



88X2242

Integrated Quad-port Multi-speed
Ethernet Transceiver with Electronic
Dispersion Compensation
Technology

Datasheet – Public

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88X2242

Integrated Quad-port Multi-speed Ethernet Transceiver with Electronic Dispersion Compensation Technology

Datasheet – Public

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PRODUCT OVERVIEW

The Marvell® 88X2242 transceiver is a fully integrated single chip solution providing end-to-end data transmission over fiber-optic networks as well as Twinax copper links. It is a 4-port device that performs all physical layer functions associated with 10GBASE-R, and 1000BASE-X. In addition the device supports 1 port of XAUI, and 40GBASE-R4.

The Electronic Dispersion Compensation (EDC) engine delivers high-speed bi-directional point-to-point full-duplex data transmission at 10.3 Gbps per port over a variety of media. The performance of the engine can be reduced to save power in fiber-optic applications that does not require EDC.

The line side interface supports 4 ports of 10GBASE-R, 1000BASE-X, and 1 port of 40GBASE-R4. The line side interface also supports Clause 73 AP Auto-Negotiation.

The host side interface supports 4 ports of 10GBASE-R, RXAUI, 1000BASE-X, and 2 ports of 40GBASE-R4, and XAUI. Any port from the host side can be attached to any port on the line side as long as the speeds match.

Internal registers can be accessed via an MDIO/MDC serial management interface which is compliant with the IEEE 802.3 specification (Clause 45). The MDC frequency supported is up to 25 MHz. The 88X2242 is manufactured in a 19 mm x 19 mm 324-pin FCBGA package.

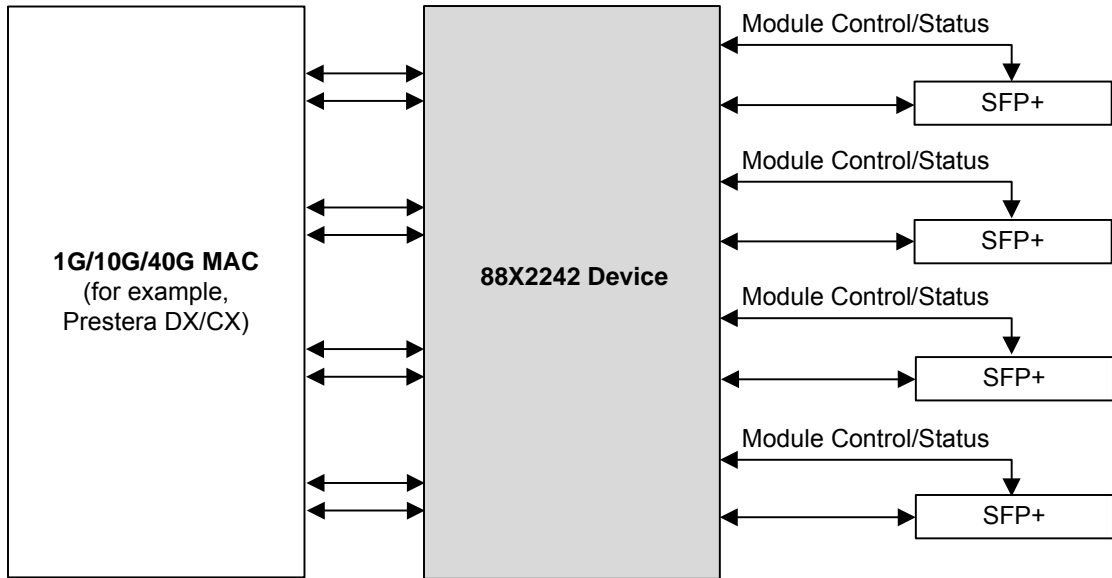
Features

- 40GBASE-R4 (KR4 and CR4), 10GBASE-R, and 1000BASE-X support on the line interface
- EDC meets SFF-8431 requirements (SFP+MSA)
- MMF compensation exceeding 220m of OM1, OM2, and OM3 fibers
- SFF 8431 requirements are supported
- SMF CD/PMD compensation exceeding 80km
- 40GBASE-R4, 10GBASE-R, RXAUI, XAUI, 1000BASE-X support on the host interface
- Transmitter adjustable signal level and pre-emphasis
- IEEE 802.3 local/remote fault monitoring at SFP/SFP+ interface
- Built-in generators and checkers
- Programmable inversion on all differential signals
- Power saving modes
- Global multi-status interrupt pin
- Per-port TWSI for SFP IDPROM access (NOTE: SSCL clock stretching is not supported)
- Near and far-end loopbacks
- Supports IEEE-1149.1 and 1149.6 JTAG

Applications

- High-density line card SFP+ interfacing
- SFP+ modules, 10GSFP+Cu direct attach cables
- 1G SFP modules
- Switch to switch bridging

Figure 1: 88X2242 Application Diagram



MAC Interface

- 4 Port – 1000BASE-X
- 4 Port – 10GBASE-R
- 4 Port – RXAUI
- 2 Port – 40GBASE-R4
- 2 Port – XAUI

Media Interface

- 4 Port – 1000BASE-X
- 4 Port – 10GBASE-R
- 1 Port – 40GBASE-R4

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1

General Device Description

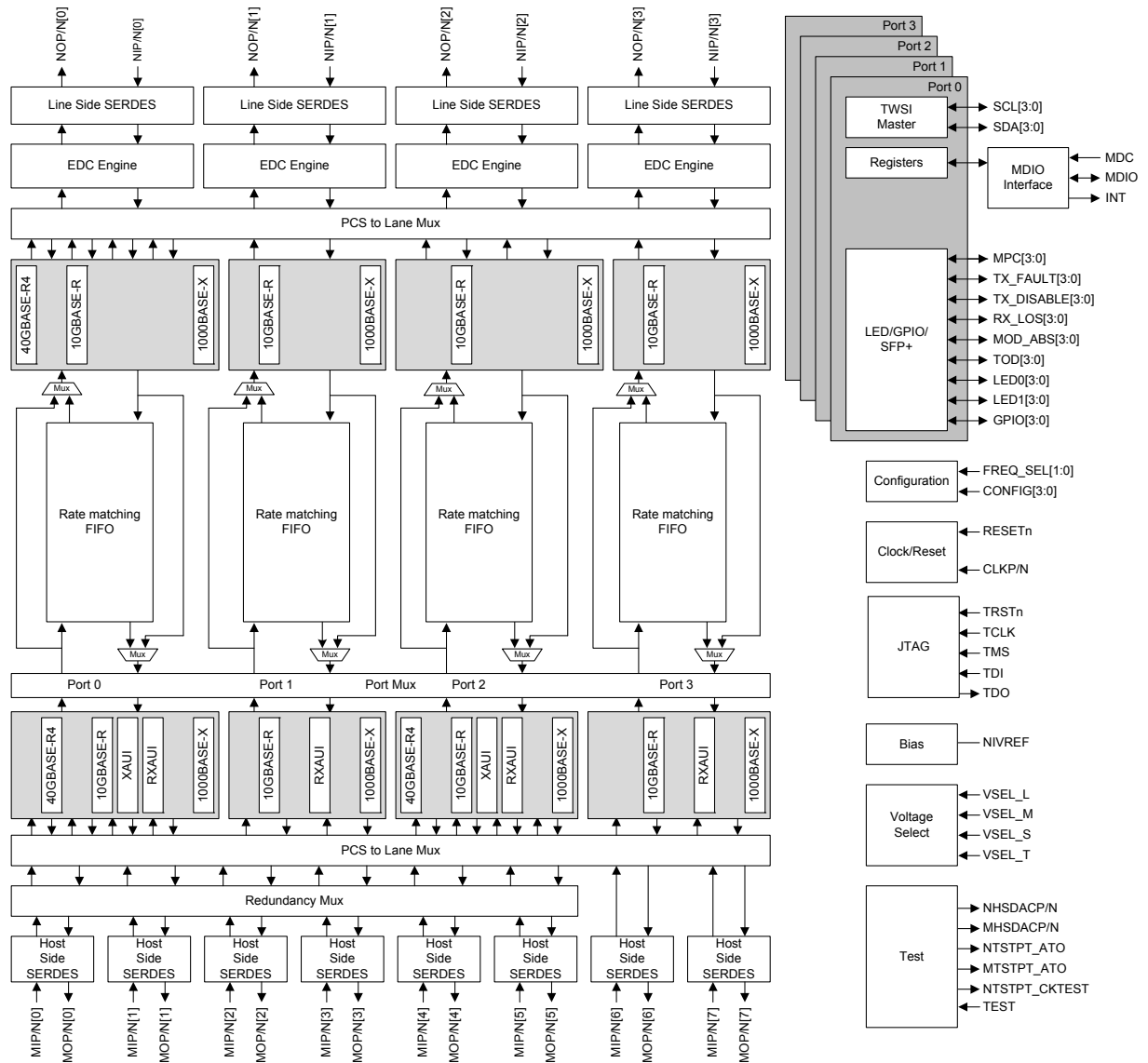
The line side and host side support various modes of operation for end-to-end data transmission over multi-mode fiber, single mode fiber, and Twinax copper cables. The DSP engine overcomes the impairments of the fiber cable, optical front end, and electrical interconnect.

Registers can be accessed by the host through standard clause 45 MDC/MDIO.

The device operates from a 1.0V digital core voltage and a 1.5V analog voltage. The digital I/O signals can operate at 1.5V, 1.8V, 2.5V, and 3.3V.

[Figure 2](#) shows a block diagram of the 88X2242 device.

Figure 2: 88X2242 Device Functional Block Diagram



2

Signal Description

This section includes information on the following topics:

- [Section 2.1, 88X2242 BGA Package](#)
- [Section 2.2, Pin Description](#)
- [Section 2.3, 88X2242 Pin Assignments](#)
- [Section 2.4, 88X2242 Device Pin Assignment List](#)

2.1 88X2242 BGA Package

**Note**

Due to the large number of pins, the FCBGA package is depicted graphically over 2 facing pages. For pin 1 location, see [Figure 52 on page 281](#).

Figure 3: 88X2242 BGA Package, (Top Left View)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
|---|---------|-----------|-------------|-------------|----------|------------|----------|---------------|------------|---|
| A | VSS | LED0[3] | VSS | WAN_CLKP | WAN_CLKN | NHSDACP | AVSS_N | NOP[0] | AVSS_N | A |
| B | LED1[3] | CONFIG[3] | TOD[3] | AVSS_N | AVSS_N | NHSDACN | AVSS_N | NON[0] | AVSS_N | B |
| C | LED1[2] | CONFIG[2] | TOD[2] | AVSS_N | AVSS_N | AVSS_N | NIP[0] | AVSS_N | NIP[1] | C |
| D | LED0[2] | VSS | GPIO[3] | VSEL_L | VDDOL | AVDD15_N | NIN[0] | AVDD15_N | NIN[1] | D |
| E | LED1[1] | CONFIG[1] | GPIO[2] | TOD[1] | VSSOL | NTSTPT_ATO | AVSS_N | AVDD15_N | AVSS_N | E |
| F | LED0[1] | CONFIG[0] | GPIO[1] | TOD[0] | VDDOL | VSS | NIVREF | NTSTPT_CKTEST | AVDD11_N | F |
| G | LED1[0] | VSS | GPIO[0] | VSSOL | VSSOL | DVDD | VSS | DVDD | VSS | G |
| H | LED0[0] | TDO | TRSTn | VDDOL | VDDOL | VSS | DVDD | VSS | DVDD | H |
| J | TDI | TCK | TMS | VSSOL | VSSOL | DVDD | VSS | DVDD | VSS | J |
| K | RCLK0 | RCLK1 | TEST | VSEL_T | VDDOT | VSS | DVDD | VSS | DVDD | K |
| L | VSS | RESETn | FREQ_SEL[0] | FREQ_SEL[1] | VSSOT | VSSOT | VSS | DVDD | VSS | L |
| M | CLKP | DNC | DNC | DNC | DVDD | VSS | DVDD | VSS | DVDD | M |
| N | CLKN | AVDD10_M | AVDD10_M | AVDD10_M | AVSS_M | AVDD10_M | AVDD10_M | AVDD10_M | MTSTPT_ATO | N |
| P | AVSS_M | AVDD15_M | AVSS_M | AVDD15_M | AVSS_M | AVDD15_M | AVSS_M | AVDD15_M | AVSS_M | P |
| R | MIP[0] | AVDD15_M | MIP[1] | AVDD15_M | MIP[2] | AVDD15_M | MIP[3] | AVDD15_M | AVSS_M | R |
| T | MIN[0] | AVSS_M | MIN[1] | AVSS_M | MIN[2] | AVSS_M | MIN[3] | AVSS_M | AVSS_M | T |
| U | AVSS_M | MOP[0] | AVSS_M | MOP[1] | AVSS_M | MOP[2] | AVSS_M | MOP[3] | AVSS_M | U |
| V | AVSS_M | MON[0] | AVSS_M | MON[1] | AVSS_M | MON[2] | AVSS_M | MON[3] | AVSS_M | V |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |

Figure 4: 88X2242 BGA Package, (Top Right View)

| | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | |
|---|----------|----------|----------|----------|----------|-------------|---------------|---------------|----------|---|
| A | NOP[1] | AVSS_N | NOP[2] | AVSS_N | NOP[3] | AVSS_N | LOS[3] | MOD_ABS[3] | VSS | A |
| B | NON[1] | AVSS_N | NON[2] | AVSS_N | NON[3] | AVSS_N | MPC[3] | TX_DISABLE[3] | SCL[3] | B |
| C | AVSS_N | NIP[2] | AVSS_N | NIP[3] | AVSS_N | VDDOS | LOS[2] | TX_FAULT[3] | SDA[3] | C |
| D | AVDD15_N | NIN[2] | AVDD15_N | NIN[3] | AVDD15_N | MPC[2] | VSSOS | MOD_ABS[2] | SCL[2] | D |
| E | AVDD15_N | AVSS_N | AVDD15_N | AVSS_N | AVDD15_N | VDDOS | VSEL_S | TX_DISABLE[2] | SDA[2] | E |
| F | AVDD11_N | AVDD11_N | AVDD11_N | AVDD11_N | VSS | LOS[1] | VSSOS | TX_FAULT[2] | SCL[1] | F |
| G | DVDD | VSS | DVDD | VSS | DVDD | VDDOS | MPC[1] | MOD_ABS[1] | SDA[1] | G |
| H | VSS | DVDD | VSS | DVDD | VSS | LOS[0] | VSSOS | TX_DISABLE[1] | SCL[0] | H |
| J | DVDD | VSS | DVDD | VSS | DVDD | MOD_ABS[0] | MPC[0] | TX_FAULT[1] | SDA[0] | J |
| K | VSS | DVDD | VSS | DVDD | VSS | TX_FAULT[0] | TX_DISABLE[0] | INTn | MDC | K |
| L | DVDD | VSS | DVDD | VSS | DVDD | VSSOM | VDDOM | VSEL_M | MDIO | L |
| M | VSS | DVDD | VSS | DVDD | VSS | DVDD | VSS | VSS | VSS | M |
| N | MHSDACN | MHSDACP | AVDD10_M | AVDD10_M | AVDD10_M | AVSS_M | AVDD10_M | AVDD10_M | AVDD10_M | N |
| P | AVSS_M | AVDD15_M | AVSS_M | AVDD15_M | AVSS_M | AVDD15_M | AVSS_M | AVDD15_M | AVSS_M | P |
| R | AVSS_M | AVDD15_M | MIP[4] | AVDD15_M | MIP[5] | AVDD15_M | MIP[6] | AVDD15_M | MIP[7] | R |
| T | AVSS_M | AVSS_M | MIN[4] | AVSS_M | MIN[5] | AVSS_M | MIN[6] | AVSS_M | MIN[7] | T |
| U | AVSS_M | MOP[4] | AVSS_M | MOP[5] | AVSS_M | MOP[6] | AVSS_M | MOP[7] | AVSS_M | U |
| V | AVSS_M | MON[4] | AVSS_M | MON[5] | AVSS_M | MON[6] | AVSS_M | MON[7] | AVSS_M | V |
| | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | |

2.2 Pin Description

Table 1: Pin Type Definitions

| Pin Type | Definition |
|----------|-------------------|
| A | Analog |
| D | Open drain output |
| DNC | Do Not Connect |
| G | Ground |
| I | Input only |
| I/O | Input and output |
| O | Output only |
| P | Power |

2.3 88X2242 Pin Assignments

Table 2: Line Side Interface

| Package Pin # | Pin Name | Pin Type | Description |
|-------------------------|--------------------------------------|---------------|---------------------|
| C13 C11 C9 C7 | NIP[3] NIP[2] NIP[1] NIP[0] | Analog Input | SFI Input Positive |
| D13 D11 D9 D7 | NIN[3] NIN[2] NIN[1] NIN[0] | Analog Input | SFI Input Negative |
| A14 A12 A10 A8 | NOP[3] NOP[2] NOP[1] NOP[0] | Analog Output | SFI Output Positive |
| B14 B12 B10 B8 | NON[3] NON[2] NON[1] NON[0] | Analog Output | SFI Output Negative |

Table 3: Host Side Interface

| Package Pin # | Pin Name | Pin Type | Description |
|--|--|---------------|---------------------|
| R18 R16 R14 R12 R7 R5 R3 R1 | MIP[7] MIP[6] MIP[5] MIP[4] MIP[3] MIP[2] MIP[1] MIP[0] | Analog Input | XFI Input Positive |
| T18 T16 T14 T12 T7 T5 T3 T1 | MIN[7] MIN[6] MIN[5] MIN[4] MIN[3] MIN[2] MIN[1] MIN[0] | Analog Input | XFI Input Negative |
| U17 U15 U13 U11 U8 U6 U4 U2 | MOP[7] MOP[6] MOP[5] MOP[4] MOP[3] MOP[2] MOP[1] MOP[0] | Analog Output | XFI Output Positive |
| V17 V15 V13 V11 V8 V6 V4 V2 | MON[7] MON[6] MON[5] MON[4] MON[3] MON[2] MON[1] MON[0] | Analog Output | XFI Output Negative |

Table 4: Clocking and Reference

| Package Pin # | Pin Name | Pin Type | Description |
|---------------|----------|----------------|--|
| M1 | CLKP | Analog Input | Reference Clock Positive and Negative. REF_CLK is 156.25 MHz. See Section 7.8, Reference Clock, on page 275 for details. |
| N1 | CLKN | Analog Input | |
| A4 | WAN_CLKP | Analog Input | Reserved. For test purposes only. Terminate both pins using 50 Ω to ground. |
| A5 | WAN_CLKN | Analog Input | |
| F7 | NIVREF | Analog Output | Resistor Reference. External 3.65 k Ω \pm 1% resistor connection to VSS is required for this pin. |
| K1 | RCLK0 | Digital Output | Reserved. For test purposes only. Leave floating. |
| K2 | RCLK1 | Digital Output | Reserved. For test purposes only. Leave floating. |

Table 5: Configuration and Reset

| Package Pin # | Pin Name | Pin Type | Description |
|----------------------|--|---------------|--|
| D4 | VSEL_L | Analog Input | VDDOL Voltage Select 0 - VDDOL = 2.5V/3.3V 1 - VDDOL = 1.2V/1.8V |
| L17 | VSEL_M | Analog Input | VDDOM Voltage Select 0 - VDDOM = 2.5V/3.3V 1 - VDDOM = 1.2V/1.8V |
| E16 | VSEL_S | Analog Input | VDDOS Voltage Select 0 - VDDOS = 2.5V/3.3V 1 - VDDOS = 1.2V/1.8V |
| K4 | VSEL_T | Analog Input | VDDOT Voltage Select 0 - VDDOT = 2.5V/3.3V 1 - VDDOT = 1.2V/1.8V |
| B2 C2 E2 F2 | CONFIG[3] CONFIG[2] CONFIG[1] CONFIG[0] | Digital Input | Hardware Configuration |
| L4 L3 | FREQ_SEL[1] FREQ_SEL[0] | Digital Input | CLKP/N Frequency 00 = 156.25 MHz 01 = Reserved 10 = Reserved 11 = Reserved |
| L2 | RESETn | Digital Input | Hardware Reset, 0 = Reset |

Table 6: Management Interface

| Package Pin # | Pin Name | Pin Type | Description |
|---------------|----------|----------------------|---|
| K18 | MDC | Digital Input | Management Interface Clock |
| L18 | MDIO | Digital Input/Output | Management Interface Data Bi-directional management interface data transferred synchronously to the MDC. This pin requires a pull-up resistor in a range from 1.5k to 10 kΩ. |
| K17 | INTn | Digital Output | Interrupt |

Table 7: SFP+, GPIO, LED

| Package Pin # | Pin Name | Pin Type | Description |
|--------------------------|--------------------------------------|----------------------|-----------------------------------|
| B16 D15 G16 J16 | MPC[3] MPC[2] MPC[1] MPC[0] | Digital Input/Output | Managed Power Control, LED2, GPIO |
| B3 C3 E4 F4 | TOD[3] TOD[2] TOD[1] TOD[0] | Digital Input/Output | TOD, LED3, GPIO |

Table 7: SFP+, GPIO, LED (Continued)

| Package Pin # | Pin Name | Pin Type | Description |
|--------------------------|--|----------------------|---------------------------------------|
| B17 E17 H17 K16 | TX_DISABLE[3] TX_DISABLE[2] TX_DISABLE[1] TX_DISABLE[0] | Digital Input/Output | SFP Transmit Disable, LED4, GPIO |
| A17 D17 G17 J15 | MOD_ABS[3] MOD_ABS[2] MOD_ABS[1] MOD_ABS[0] | Digital Input/Output | SFP Module Attached, GPIO |
| C17 F17 J17 K15 | TX_FAULT[3] TX_FAULT[2] TX_FAULT[1] TX_FAULT[0] | Digital Input/Output | SFP Transmit Fault, GPIO |
| A16 C16 F15 H15 | LOS[3] LOS[2] LOS[1] LOS[0] | Digital Input/Output | SFP Loss Of Signal, GPIO |
| B18 D18 F18 H18 | SCL[3] SCL[2] SCL[1] SCL[0] | Digital Input/Output | Two Wire Serial Interface Clock, GPIO |
| C18 E18 G18 J18 | SDA[3] SDA[2] SDA[1] SDA[0] | Digital Input/Output | Two Wire Serial Interface Data, GPIO |
| D3 E3 F3 G3 | GPIO[3] GPIO[2] GPIO[1] GPIO[0] | Digital Input/Output | GPIO |
| A2 D1 F1 H1 | LED0[3] LED0[2] LED0[1] LED0[0] | Digital Input/Output | LED0, GPIO |
| B1 C1 E1 G1 | LED1[3] LED1[2] LED1[1] LED1[0] | Digital Input/Output | LED1, GPIO |

Table 8: JTAG

| Package Pin # | Pin Name | Pin Type | Description |
|---------------|----------|----------------|-------------------|
| J1 | TDI | Digital Input | JTAG Test In |
| H2 | TDO | Digital Output | JTAG Test Out |
| J3 | TMS | Digital Input | JTAG Test Control |

Table 8: JTAG (Continued)

| Package Pin # | Pin Name | Pin Type | Description |
|---------------|----------|---------------|---|
| J2 | TCK | Digital Input | JTAG Test Clock |
| H3 | TRSTn | Digital Input | JTAG Test Reset For normal operation, TRSTn should be pulled low with a 4.7 kΩ pull-down resistor. |

Table 9: Test

| Package Pin # | Pin Name | Pin Type | Description |
|---------------|---------------|---------------|---|
| K3 | TEST | Digital Input | Test Enable, 1 = Test For normal operation, TEST pin should be connected to ground. |
| A6 | NHSDACP | Analog Output | Analog AC Test Positive Port N For normal operation, NHSDACP must be left unconnected. |
| B6 | NHSDACN | Analog Output | Analog AC Test Negative Port N For normal operation, NHSDACN must be left unconnected. |
| N11 | MHSDACP | Analog Output | Analog AC Test Positive Port M For normal operation, MHSDACP must be left unconnected. |
| N10 | MHSDACN | Analog Output | Analog AC Test Negative Port M For normal operation, MHSDACN must be left unconnected. |
| E6 | NTSTPT_ATO | Analog Output | Analog DC Test Point Port N For normal operation, NTSTPT_ATO must be left unconnected. |
| N9 | MTSTPT_ATO | Analog Output | Analog DC Test Point Port M For normal operation, MTSTPT_ATO must be left unconnected. |
| F8 | NTSTPT_CKTEST | Analog Output | Analog Clock Test Point Port N For normal operation, NTSTPT_CKTEST must be left unconnected. |

Table 10: Power and Ground

| Package Pin # | Pin Name | Pin Type | Description |
|--|----------|---------------|-------------------------|
| G6 G8 G10 G12 G14 H7 H9 H11 H13 J6 J8 J10 J12 J14 K7 K9 K11 K13 L8 L10 L12 L14 M5 M7 M9 M11 M13 M15 | DVDD | Digital Power | 1.0V Digital Core Power |
| P2 P4 P6 P8 P11 P13 P15 P17 R2 R4 R6 R8 R11 R13 R15 R17 | AVDD15_M | Analog Power | 1.5V Analog Core Power |

Table 10: Power and Ground (Continued)

| Package Pin # | Pin Name | Pin Type | Description |
|--|----------|--------------|--|
| D6 D8 D10 D12 D14 E8 E10 E12 E14 | AVDD15_N | Analog Power | 1.5V Analog Core Power |
| N2 N3 N4 N6 N7 N8 N12 N13 N14 N16 N17 N18 | AVDD10_M | Analog Power | 1.0V Analog Core Power |
| F9 F10 F11 F12 F13 | AVDD11_N | Analog Power | 1.1V Analog Core Power |
| D5 F5 H4 H5 | VDDOL | I/O Power | I/O Power: CONFIG[4:0], TOD[3:0], GPIO[3:0], LED0[3:0], LED1[3:0] |
| I16 | VDDOM | I/O Power | I/O Power: MDC, MDIO |
| C15 E15 G15 | VDDOS | I/O Power | I/O Power: LOS[3:0], MOD_ABS[3:0], MPC[3:0], SCL[3:0], SDA[3:0], TX_DISABLE[3:0], TX_FAULT[3:0], INTn, |
| K5 | VDDOT | I/O Power | I/O Power: RESETn, TEST, TDI, TDO, TMS, TCK, TRSTn, FREQ_SEL[1:0] |

Table 10: Power and Ground (Continued)

| Package Pin # | Pin Name | Pin Type | Description |
|--|----------|----------|-------------|
| A7 A9 A11 A13 A15 B4 B5 B7 B9 B11 B13 B15 C4 C5 C6 C8 C10 C12 C14 E7 E9 E11 E13 | AVSS_N | Ground | Ground |
| N5 N15 P1 P3 P5 P7 P9 P10 P12 P14 P16 P18 R9 R10 T2 T4 T6 T8 T9 T10 T11 T13 T15 T17 U1 U3 U5 U7 U9 | AVSS_M | Ground | Ground |

Table 10: Power and Ground (Continued)

| Package Pin # | Pin Name | Pin Type | Description |
|--|----------------|----------|-------------|
| U10 U12 U14 U16 U18 V1 V3 V5 V7 V9 V10 V12 V14 V16 V18 | AVSS_M (cont.) | Ground | Ground |
| E5 G4 G5 J4 J5 | VSSOL | Ground | Ground |
| L15 | VSSOM | Ground | Ground |
| D16 F16 H16 | VSSOS | Ground | Ground |

Table 10: Power and Ground (Continued)

| Package Pin # | Pin Name | Pin Type | Description |
|--|----------|----------|-------------|
| L5 L6 | VSSOT | Ground | Ground |
| A1 A3 A18 D2 F6 F14 G2 G7 G9 G11 G13 H6 H8 H10 H12 H14 J7 J9 J11 J13 K6 K8 K10 K12 K14 L1 L7 L9 L11 L13 M6 M8 M10 M12 M14 M16 M17 M18 | VSS | Ground | Ground |

Table 11: No Connect

| Package Pin # | Pin Name | Pin Type | Description |
|----------------|----------|----------|--------------------------------|
| M2 M3 M4 | DNC | DNC | Do not connect. Keep floating. |

2.4 88X2242 Device Pin Assignment List

Table 12: 88X2242 Pin List—Alphabetical by Signal Name

| Pin Number | Pin Name | Pin Number | Pin Name |
|------------|----------|------------|----------|
| N2 | AVDD10_M | R15 | AVDD15_M |
| N3 | AVDD10_M | R17 | AVDD15_M |
| N4 | AVDD10_M | D6 | AVDD15_N |
| N6 | AVDD10_M | D8 | AVDD15_N |
| N7 | AVDD10_M | D10 | AVDD15_N |
| N8 | AVDD10_M | D12 | AVDD15_N |
| N12 | AVDD10_M | D14 | AVDD15_N |
| N13 | AVDD10_M | E8 | AVDD15_N |
| N14 | AVDD10_M | E10 | AVDD15_N |
| N16 | AVDD10_M | E12 | AVDD15_N |
| N17 | AVDD10_M | E14 | AVDD15_N |
| N18 | AVDD10_M | N5 | AVSS_M |
| F9 | AVDD11_N | N15 | AVSS_M |
| F10 | AVDD11_N | P1 | AVSS_M |
| F11 | AVDD11_N | P3 | AVSS_M |
| F12 | AVDD11_N | P5 | AVSS_M |
| F13 | AVDD11_N | P7 | AVSS_M |
| P2 | AVDD15_M | P9 | AVSS_M |
| P4 | AVDD15_M | P10 | AVSS_M |
| P6 | AVDD15_M | P12 | AVSS_M |
| P8 | AVDD15_M | P14 | AVSS_M |
| P11 | AVDD15_M | P16 | AVSS_M |
| P13 | AVDD15_M | P18 | AVSS_M |
| P15 | AVDD15_M | R9 | AVSS_M |
| P17 | AVDD15_M | R10 | AVSS_M |
| R2 | AVDD15_M | T2 | AVSS_M |
| R4 | AVDD15_M | T4 | AVSS_M |
| R6 | AVDD15_M | T6 | AVSS_M |
| R8 | AVDD15_M | T8 | AVSS_M |
| R11 | AVDD15_M | T9 | AVSS_M |
| R13 | AVDD15_M | T10 | AVSS_M |

Table 12: 88X2242 Pin List—Alphabetical by Signal Name (Continued)

| Pin Number | Pin Name | Pin Number | Pin Name |
|------------|----------|------------|-----------|
| T11 | AVSS_M | B11 | AVSS_N |
| T13 | AVSS_M | B13 | AVSS_N |
| T15 | AVSS_M | B15 | AVSS_N |
| T17 | AVSS_M | C4 | AVSS_N |
| U1 | AVSS_M | C5 | AVSS_N |
| U3 | AVSS_M | C6 | AVSS_N |
| U5 | AVSS_M | C8 | AVSS_N |
| U7 | AVSS_M | C10 | AVSS_N |
| U9 | AVSS_M | C12 | AVSS_N |
| U10 | AVSS_M | C14 | AVSS_N |
| U12 | AVSS_M | E7 | AVSS_N |
| U14 | AVSS_M | E9 | AVSS_N |
| U16 | AVSS_M | E11 | AVSS_N |
| U18 | AVSS_M | E13 | AVSS_N |
| V1 | AVSS_M | N1 | CLKN |
| V3 | AVSS_M | M1 | CLKP |
| V5 | AVSS_M | F2 | CONFIG[0] |
| V7 | AVSS_M | E2 | CONFIG[1] |
| V9 | AVSS_M | C2 | CONFIG[2] |
| V10 | AVSS_M | B2 | CONFIG[3] |
| V12 | AVSS_M | M2 | DNC |
| V14 | AVSS_M | M3 | DNC |
| V16 | AVSS_M | M4 | DNC |
| V18 | AVSS_M | G6 | DVDD |
| A7 | AVSS_N | G8 | DVDD |
| A9 | AVSS_N | G10 | DVDD |
| A11 | AVSS_N | G12 | DVDD |
| A13 | AVSS_N | G14 | DVDD |
| A15 | AVSS_N | H7 | DVDD |
| B4 | AVSS_N | H9 | DVDD |
| B5 | AVSS_N | H11 | DVDD |
| B7 | AVSS_N | H13 | DVDD |
| B9 | AVSS_N | J6 | DVDD |

Table 12: 88X2242 Pin List—Alphabetical by Signal Name (Continued)

| Pin Number | Pin Name | Pin Number | Pin Name |
|------------|-------------|------------|------------|
| J8 | DVDD | H15 | LOS[0] |
| J10 | DVDD | F15 | LOS[1] |
| J12 | DVDD | C16 | LOS[2] |
| J14 | DVDD | A16 | LOS[3] |
| K7 | DVDD | K18 | MDC |
| K9 | DVDD | L18 | MDIO |
| K11 | DVDD | N10 | MHSDACN |
| K13 | DVDD | N11 | MHSDACP |
| L8 | DVDD | T1 | MIN[0] |
| L10 | DVDD | T3 | MIN[1] |
| L12 | DVDD | T5 | MIN[2] |
| L14 | DVDD | T7 | MIN[3] |
| M5 | DVDD | T12 | MIN[4] |
| M7 | DVDD | T14 | MIN[5] |
| M9 | DVDD | T16 | MIN[6] |
| M11 | DVDD | T18 | MIN[7] |
| M13 | DVDD | R1 | MIP[0] |
| M15 | DVDD | R3 | MIP[1] |
| L3 | FREQ_SEL[0] | R5 | MIP[2] |
| L4 | FREQ_SEL[1] | R7 | MIP[3] |
| G3 | GPIO[0] | R12 | MIP[4] |
| F3 | GPIO[1] | R14 | MIP[5] |
| E3 | GPIO[2] | R16 | MIP[6] |
| D3 | GPIO[3] | R18 | MIP[7] |
| K17 | INTn | J15 | MOD_ABS[0] |
| H1 | LED0[0] | G17 | MOD_ABS[1] |
| F1 | LED0[1] | D17 | MOD_ABS[2] |
| D1 | LED0[2] | A17 | MOD_ABS[3] |
| A2 | LED0[3] | V2 | MON[0] |
| G1 | LED1[0] | V4 | MON[1] |
| E1 | LED1[1] | V6 | MON[2] |
| C1 | LED1[2] | V8 | MON[3] |
| B1 | LED1[3] | V11 | MON[4] |

Table 12: 88X2242 Pin List—Alphabetical by Signal Name (Continued)

| Pin Number | Pin Name | Pin Number | Pin Name |
|------------|------------|------------|---------------|
| V13 | MON[5] | A12 | NOP[2] |
| V15 | MON[6] | A14 | NOP[3] |
| V17 | MON[7] | E6 | NTSTPT_ATO |
| U2 | MOP[0] | F8 | NTSTPT_CKTEST |
| U4 | MOP[1] | K1 | RCLK0 |
| U6 | MOP[2] | K2 | RCLK1 |
| U8 | MOP[3] | L2 | RESETn |
| U11 | MOP[4] | H18 | SCL[0] |
| U13 | MOP[5] | F18 | SCL[1] |
| U15 | MOP[6] | D18 | SCL[2] |
| U17 | MOP[7] | B18 | SCL[3] |
| J16 | MPC[0] | J18 | SDA[0] |
| G16 | MPC[1] | G18 | SDA[1] |
| D15 | MPC[2] | E18 | SDA[2] |
| B16 | MPC[3] | C18 | SDA[3] |
| N9 | MTSTPT_ATO | J2 | TCK |
| B6 | NHSDACN | J1 | TDI |
| A6 | NHSDACP | H2 | TDO |
| D7 | NIN[0] | K3 | TEST |
| D9 | NIN[1] | J3 | TMS |
| D11 | NIN[2] | F4 | TOD[0] |
| D13 | NIN[3] | E4 | TOD[1] |
| C7 | NIP[0] | C3 | TOD[2] |
| C9 | NIP[1] | B3 | TOD[3] |
| C11 | NIP[2] | H3 | TRSTn |
| C13 | NIP[3] | K16 | TX_DISABLE[0] |
| F7 | NIVREF | H17 | TX_DISABLE[1] |
| B8 | NON[0] | E17 | TX_DISABLE[2] |
| B10 | NON[1] | B17 | TX_DISABLE[3] |
| B12 | NON[2] | K15 | TX_FAULT[0] |
| B14 | NON[3] | J17 | TX_FAULT[1] |
| A8 | NOP[0] | F17 | TX_FAULT[2] |
| A10 | NOP[1] | C17 | TX_FAULT[3] |

Table 12: 88X2242 Pin List—Alphabetical by Signal Name (Continued)

| Pin Number | Pin Name | Pin Number | Pin Name |
|------------|----------|------------|----------|
| D5 | VDDOL | K6 | VSS |
| F5 | VDDOL | K8 | VSS |
| H4 | VDDOL | K10 | VSS |
| H5 | VDDOL | K12 | VSS |
| L16 | VDDOM | K14 | VSS |
| C15 | VDDOS | L1 | VSS |
| E15 | VDDOS | L7 | VSS |
| G15 | VDDOS | L9 | VSS |
| K5 | VDDOT | L11 | VSS |
| D4 | VSEL_L | L13 | VSS |
| L17 | VSEL_M | M6 | VSS |
| E16 | VSEL_S | M8 | VSS |
| K4 | VSEL_T | M10 | VSS |
| A1 | VSS | M12 | VSS |
| A3 | VSS | M14 | VSS |
| A18 | VSS | M16 | VSS |
| D2 | VSS | M17 | VSS |
| F6 | VSS | M18 | VSS |
| F14 | VSS | E5 | VSSOL |
| G2 | VSS | G4 | VSSOL |
| G7 | VSS | G5 | VSSOL |
| G9 | VSS | J4 | VSSOL |
| G11 | VSS | J5 | VSSOL |
| G13 | VSS | L15 | VSSOM |
| H6 | VSS | D16 | VSSOS |
| H8 | VSS | F16 | VSSOS |
| H10 | VSS | H16 | VSSOS |
| H12 | VSS | L5 | VSSOT |
| H14 | VSS | L6 | VSSOT |
| J7 | VSS | A5 | WAN_CLKN |
| J9 | VSS | A4 | WAN_CLKP |
| J11 | VSS | | |
| J13 | VSS | | |

3

Chip Level Functional Description

This section includes information on the following topics:

- [Section 3.1, Datapath](#)
- [Section 3.2, Resets](#)
- [Section 3.3, Hardware Configuration](#)
- [Section 3.4, MDC/MDIO Register Access](#)
- [Section 3.5, GPIO and SFP+](#)
- [Section 3.6, LED](#)
- [Section 3.7, EEPROM Bridging and Polling](#)
- [Section 3.8, Interrupt](#)
- [Section 3.9, Power Management](#)
- [Section 3.10, IEEE1149.1 and 1149.6 Controller](#)
- [Section 3.11, Reference Clock](#)
- [Section 3.12, Power Supplies](#)

This section describes the chip level functionality. [Section 4, Line Side Description, on page 87](#) and [Section 5, Host Side Description, on page 97](#) describe the individual units in more detail.

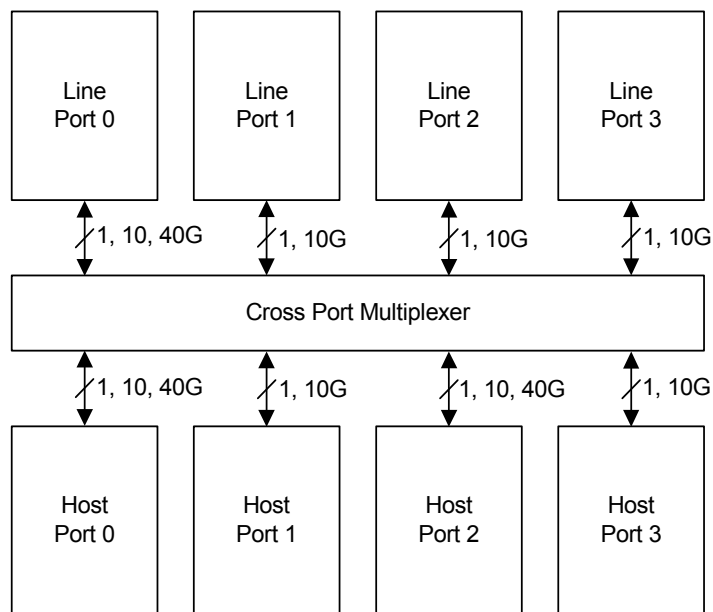
3.1 Datapath

[Figure 5](#) illustrates the datapath of both devices. This section examines the multiplexing in more detail.

3.1.1 Cross Port Multiplexing

Although the device supports multiple different PCS with the various PCS attached to 1 or more physical lanes, the device can be fundamentally viewed as 4 ports on the line side and 4 ports on the host side. Any of the 4 ports on the line side can be attached to any of the 4 ports on the host side by programming the cross port multiplexer. Note that the association between the line and host side can be independently programmed for ingress and egress paths and need not be the same for both directions. It is also possible for data received on one port of the line (host) side to be transmitted out on more than 1 port of the host (line) side.

Figure 5: Cross Port Multiplexing



The attached ports must run at the same speed (though the PCS types can be different). All speeds are not supported on all ports. It is the user's responsibility to ensure that the cross port multiplexing is set correctly.

Registers 31.F400 bits 3:0, 7:4, 11:8, and 15:12 control which port on the host side attaches to ports 0, 1, 2, and 3 of the line side port transmitter, respectively.

- 0000 = power down the line side port transmitter
- 0001 = output idles on the line side port transmitter
- 1000 = attach to host side port 0
- 1001 = attach to host side port 1
- 1010 = attach to host side port 2
- 1011 = attach to host side port 3

Registers 31.F401 bits 3:0, 7:4, 11:8, and 15:12 control which port on the line side attaches to ports 0, 1, 2, and 3 of the host side port transmitter, respectively.

- 0000 = power down the host side port transmitter
- 0001 = output idles on the host side port transmitter
- 1000 = attach to line side port 0
- 1001 = attach to line side port 1
- 1010 = attach to line side port 2
- 1011 = attach to line side port 3

Registers 31.F400 and 31.F401 are global registers and can be accessed from Port 0 PHYAD.

3.1.2 PCS Operational Mode and Lane Attachment

Each port supports multiple PCS. Not all PCS are supported by all ports. Only 1 PCS can be enabled at a time for a given port, but different PCS can be selected among the different ports.

Since some PCS requires more lanes to operate than others, it is possible that conflicts can exist (for example, Port 0 in XAUI mode conflicting with the other 3 ports). In case of conflict, the lower numbered port will have the higher priority over the higher numbered port. The PCS on the port with the lower priority that has conflict will be automatically powered down.

Register 31.F002.14:8 and 31.F002.6:0 selects the PCS type for the line and host side respectively. Not all PCS type are available for each port. Table 13 lists out which PCS is available for each port. Table 14 and Table 15 list the pin mappings for PCS modes for the line and host interfaces. Table 16 and Table 17 list the valid 7 bit setting for registers 31.F002.14:8 and 31.F002.6:0.

Table 13: PCS Availability by Port

| PCS Type | Line Side Port N | | | | Host Side Port M | | | |
|------------|------------------|----|----|----|------------------|----|----|----|
| | N0 | N1 | N2 | N3 | M0 | M1 | M2 | M3 |
| 40GBASE-R4 | X | | | | X | | X | |
| 10GBASE-R | X | X | X | X | X | X | X | X |
| XAUI | | | | | X | | X | |
| RXAUI | | | | | X | X | X | X |
| 1000BASE-X | X | X | X | X | X | X | X | X |

Table 14: Pin Mapping for PCS Modes - Line Interface

| | Name | # | Name | # | Name | # | Name | # |
|-----------|-------------------|----|-------------------|-----|-------------------|-----|-------------------|-----|
| | Lane 0 Pin | | Lane 1 Pin | | Lane 2 Pin | | Lane 3 Pin | |
| Rx | NIP[0] | C7 | NIP[1] | C9 | NIP[2] | C11 | NIP[3] | C13 |
| | NIN[0] | D7 | NIN[1] | D9 | NIN[2] | D11 | NIN[3] | D13 |
| Tx | NOP[0] | A8 | NOP[1] | A10 | NOP[2] | A12 | NOP[3] | A14 |
| | NON[0] | B8 | NON[1] | B10 | NON[2] | B12 | NON[3] | B14 |
| PCS Modes | 10GBASE-R Port 0 | | 10GBASE-R Port 1 | | 10GBASE-R Port 2 | | 10GBASE-R Port 3 | |
| | 1000BASE-X Port 0 | | 1000BASE-X Port 1 | | 1000BASE-X Port 2 | | 1000BASE-X Port 3 | |
| | 40GBASE-R4 Port 0 | | | | | | | |

Table 15: Pin Mapping for PCS Modes - Host Interface

| | Name | # | Name | # | Name | # | Name | # |
|----|------------|----|------------|----|------------|----|------------|----|
| | Lane 0 Pin | | Lane 1 Pin | | Lane 2 Pin | | Lane 3 Pin | |
| Rx | MIP[0] | R1 | MIP[1] | R3 | MIP[2] | R5 | MIP[3] | R7 |
| | MIN[0] | T1 | MIN[1] | T3 | MIN[2] | T5 | MIN[3] | T7 |

Table 15: Pin Mapping for PCS Modes - Host Interface (Continued)

| | Name | # | Name | # | Name | # | Name | # | | |
|------------------|--|-----|----------------------|-----|--|---------------------|----------------------|-----|--|--|
| Tx | MOP[0] | U2 | MOP[1] | U4 | MOP[2] | U6 | MOP[3] | U8 | | |
| | MON[0] | V2 | MON[1] | V4 | MON[2] | V6 | MON[3] | V8 | | |
| PCS Modes | 10GBASE-R lane attachment mapping is based on 31.0xF402.9 | | | | | | | | | |
| | 10GBASE-R Port 0 | | 10GBASE-R Port 1(1) | | 10GBASE-R Port 1(0) | | 10GBASE-R Port 3(1) | | | |
| | 1000BASE-X lane attachment mapping is based on 31.0xF402.8 | | | | | | | | | |
| | — | | 1000BASE-X Port 1(1) | | 1000BASE-X Port 1(0) 1000BASE-X Port 2(1) | | 1000BASE-X Port 3(1) | | | |
| | RXAUI lane attachment mapping is based on 31.0xF402.11 | | | | | | | | | |
| | RXAUI Port 0 | | | | RXAUI Port 1(0) RXAUI Port 2(1) | | | | | |
| | XAUI Port 0 | | | | | | | | | |
| | 40GBASE-R4 Port 0 | | | | | | | | | |
| | Lane 4 Pin | | Lane 5 Pin | | Lane 6 Pin | | Lane 7 Pin | | | |
| Rx | MIP[4] | R12 | MIP[5] | R14 | MIP[6] | R16 | MIP[7] | R18 | | |
| | MIN[4] | T12 | MIN[5] | T14 | MIN[6] | T16 | MIN[7] | T18 | | |
| Tx | MOP[4] | U11 | MOP[5] | U13 | MOP[6] | U15 | MOP[7] | U17 | | |
| | MON[4] | V11 | MON[5] | V13 | MON[6] | V15 | MON[7] | V17 | | |
| PCS Modes | 10GBASE-R lane attachment mapping is based on 31.0xF402.9 | | | | | | | | | |
| | 10GBASE-R Port 2(0) | | | | | 10GBASE-R Port 3(0) | | | | |
| | RXAUI lane attachment mapping is based on 31.0xF402.11 | | | | | | | | | |
| | RXAUI Port 2 | | | | RXAUI Port 3 | | | | | |
| | XAUI Port 2 | | | | | | | | | |
| | 40GBASE-R4 Port 2 | | | | | | | | | |

Table 16: Valid Settings - Line Side

| 31.F002.14:8 | PCS | Auto-Negotiation |
|--------------|----------------|------------------|
| 1110000 | 40GBASE-R4 | N/A |
| 1110001 | 10GBASE-R | N/A |
| 1111010 | 1000BASE-X | Off |
| 1111011 | | On |
| 1111100 | SGMII (System) | Off |
| 1111101 | | On |
| 1111110 | SGMII (Media) | Off |
| 1111111 | | On |

Table 17: Valid Settings - Host Side

| 31.F002.6:0 | PCS | Auto-Negotiation |
|-------------|------------|------------------|
| 1110000 | 40GBASE-R4 | N/A |
| 1110001 | 10GBASE-R | N/A |

Table 17: Valid Settings - Host Side (Continued)

| 31.F002.6:0 | PCS | Auto-Negotiation |
|-------------|----------------|------------------|
| 1110010 | RXAUI | N/A |
| 1110011 | XAUI | N/A |
| 1110111 | Reserved | N/A |
| 1111010 | 1000BASE-X | Off |
| 1111011 | | On |
| 1111100 | SGMII (System) | Off |
| 1111101 | | On |
| 1111110 | SGMII (Media) | Off |
| 1111111 | | On |

Although the various lanes can support multiple speeds, there are limitations on which speed combinations can be supported across the various lanes simultaneously.

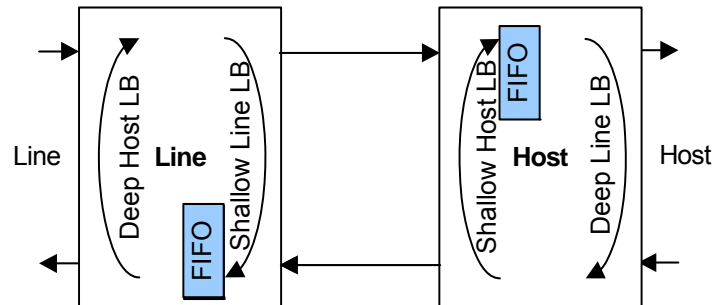
3.1.3 Loopback and Bypass

Figure 6 illustrates the possible loopback and bypass paths. Note that the cross port multiplexing is not shown in Figure 6.

For information, see the following sections:

- Line side loopbacks—[Section 4.3, Loopback](#)
- Host side loopbacks—[Section 5.3, Loopback](#)

Figure 6: 88X2242 Device Data Path



3.1.4 Frequency Compensation FIFOs

There are FIFOs in the PCS blocks to compensate the frequency offset between the host and line. The FIFO positions are illustrated in Figure 6. The FIFO depth can be set via register 3.F00C.15:14 for the Line side and register 4.F00C.15:14 for the Host side.

3.1.5 Host Side Lane Attachment

There are 8 physical lanes on the host side. All 8 physical lanes (Physical Lane 0-7) are mapped to 8 logical lanes (Logical Lane M0-7).

The 1000BASE-X and 10GBASE-R may be attached to different logical lanes to facilitate connection to various different legacy switches. Register 31.F402 bits 11, 9, and 8 control which lanes attach to which PCS.

Table 18 shows which PCS are available and which lane attachments are possible.

Table 18: Host Side Line Muxing

| Register | Function | Setting |
|------------|-----------------------|--|
| 31.F402.11 | RXAUI Attachment | 0 = Ports 0, 2 attached to logical lanes 0/1, 4/5 1 = Ports 0, 2 attached to logical lanes 0/1, 2/3 |
| 31.F402.9 | 10BASE-R Attachment | 0 = Ports 0, 1, 2, 3 attached to logical lanes 0, 2, 4, 6 1 = Ports 0, 1, 2, 3 attached to logical lanes 0, 1, 2, 3 |
| 31.F402.8 | 1000BASE-X Attachment | 0 = Ports 0, 1, 2, 3 attached to logical lanes 0, 2, 4, 6 1 = Ports 0, 1, 2, 3 attached to logical lanes 0, 1, 2, 3 |

Table 19: Physical Lane to PCS Mapping

| Port | Lane | | | | | | | Comment |
|--------|------------|----------------|----------------|----------------|----------------|---|----------------|---------------------------------------|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | |
| Port 0 | 40GBASE-R4 | | | | | | | |
| | XAUI | | | | | | | |
| | RXAUI | | | | | | | |
| | 10GBASE-R | | | | | | | |
| | 1000BASE-X | | | | | | | |
| Port 1 | RXAUI | | | | | | | |
| | | 10GBASE-R (1) | 10GBASE-R (0) | | | | | 31.F402.9 0 = Lane 2 1 = Lane 1 |
| | | 1000BASE-X (1) | 1000BASE-X (0) | | | | | 31.F402.8 0 = Lane 2 1 = Lane 1 |
| Port 2 | 40GBASE-R4 | | | | | | | |
| | XAUI | | | | | | | |
| | RXAUI (1) | | | RXAUI (0) | | | | Force to |
| | | | 10GBASE-R (1) | | 10GBASE-R (0) | | | 31.F402.9 0 = Lane 4 1 = Lane 2 |
| | | | 1000BASE-X (1) | | 1000BASE-X (0) | | | 31.F402.8 0 = Lane 4 1 = Lane 2 |
| Port 3 | RXAUI | | | | | | | |
| | | | | 10GBASE-R (1) | | | 10GBASE-R (0) | 31.F402.9 0 = Lane 6 1 = Lane 3 |
| | | | | 1000BASE-X (1) | | | 1000BASE-X (0) | 31.F402.8 0 = Lane 6 1 = Lane 3 |

3.1.6 Polarity Inversion

The polarity of each lane can be independently inverted.

Registers 31.F406 bit 0 to 7 controls the polarity of MOP/N[0] to MOP/N[7] respectively.

Registers 31.F406 bit 8 to 15 controls the polarity of MIP/N[0] to MIP/N[7] respectively.

Registers 31.F407 bit 0 to 3 controls the polarity of NOP/N[0] to NOP/N[3] respectively.

Registers 31.F407 bit 8 to 11 controls the polarity of NIP/N[0] to NIP/N[3] respectively.

0 = Normal polarity
1 = Reverse polarity

3.2 Resets

A hardware reset (RESETn) resets the entire chip and initializes all the registers to their hardware reset default.

A software reset has a similar effect on the affected units as a hardware reset except all 'Retain' type of registers hold their value, and any previously written values in the 'Update' registers take effect.

To assert a host/line side port reset, set:

- 31.F003.15 to 1 for line side of the port
- 31.F003.7 to 1 for host side of the port

Refer to [Section 4.5, Power Management, on page 92](#) for the line side PCS and PMA resets and [Section 5.5, Power Management, on page 100](#) for the host side PCS and PMA resets.

To assert a global chip-level soft reset, set:

- 31.0xF404.15
- 31.0xF404.14

3.3 Hardware Configuration

After de-assertion of RESETn, the 88X2242 device will be hardware configured.

The 88X2242 device is configured through the CONFIG[3:0] pins.

Each CONFIG[3:0] pin is used to configure 2 bits. The 2-bit value is set depending on what is connected to the CONFIG pins soon after de-assertion of hardware reset. The 2-bit mapping is shown in [Table 20](#).

Table 20: Two Bit Mapping

| Pin | Bit 1,0 |
|---------|---------|
| VSS | 00 |
| LED0[0] | 01 |
| LED1[0] | 10 |
| VDDO | 11 |

The 2 bits for the CONFIG pin is mapped as shown in [Table 21](#).

Table 21: Configuration Mapping

| Pin | CONFIG Bit1 | CONFIG Bit 0 |
|-----------|-------------|--------------|
| CONFIG[0] | Must be 0 | Must be 0 |
| CONFIG[1] | PHYAD[3] | PHYAD[2] |

Table 21: Configuration Mapping (Continued)

| Pin | CONFIG Bit1 | CONFIG Bit 0 |
|-----------|----------------------|----------------------|
| CONFIG[2] | PDSTATE | PHYAD[4] |
| CONFIG[3] | Reserved Tie to 0 | Reserved Tie to 0 |

Each bit in the configuration is defined as shown in [Table 22](#).

Table 22: Configuration Definition

| Bits | Definition | Register Affected |
|------------|--|---|
| PHYAD[4:0] | PHY Address for port 0. Port n address is (PHYAD[4:2], 0,0) + n | None |
| PDSTATE | 0 = Start In Power Up State 1 = Start In Power Down State | 31.F400.15:0 31.F401.15:0 31.F403.7:0 |

The `FREQ_SEL[1:0]` must be set to 00. All other settings are reserved.

3.4 MDC/MDIO Register Access

The management interface provides access to the internal registers via the MDC and MDIO pins and is compliant with IEEE 802.3 clause 45. MDC is the management data clock input and, it can run from DC to a maximum rate of 25 MHz. At high, MDIO fanouts the maximum rate may be decreased depending on the output loading. MDIO is the management data input/output and is a bi-directional signal that runs synchronously to MDC.

The MDIO does not require a pull-up resistor. If another open-drain device driving MDIO requires a pull-up resistor, it should drive or be pulled up to the same voltage value as the DVDDIO rail.

PHY address is configured during the hardware reset sequence. For more information on how to configure PHY addresses, see [Section 3.3, Hardware Configuration, on page 49](#).

Typical read and write operations on the management interface are shown in [Figure 7](#) and [Figure 8](#). All the required serial management registers are implemented as well as several optional registers. A description of the registers can be found in [Section 6, Register Description, on page 104](#).

Figure 7: Typical MDC/MDIO Read Operation

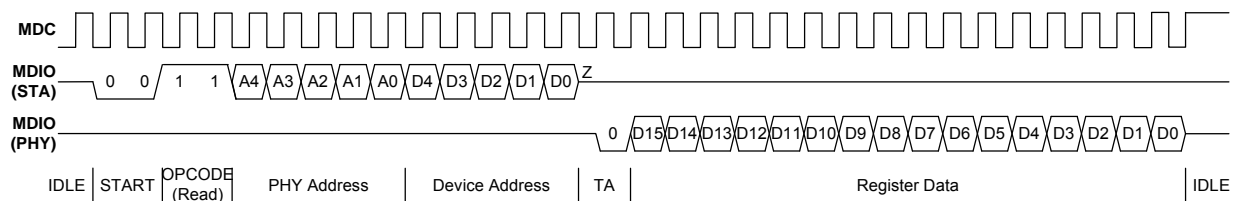
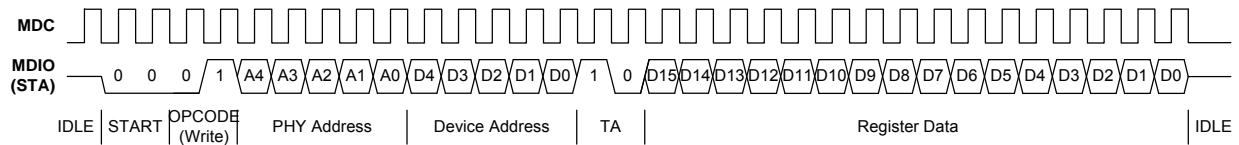


Figure 8: Typical MDC/MDIO Write Operation



3.4.1 Clause 45 MDIO Framing

The MDIO interface frame structure is compatible with Clause 22 such that the 2 management interfaces can co-exist on the same MDIO bus.

The extensions for Clause 45 MDIO indirect register accesses are specified in [Table 23](#).

Table 23: Extensions for Management Frame Format for Indirect Access

| Frame | PRE | ST | OP | PHYAD | DEVADR | TA | ADDRESS/DATA | Idle |
|----------------|-------|----|----|-------|--------|----|------------------|------|
| Address | 1...1 | 00 | 00 | PPPPP | DDDDD | 10 | AAAAAAAAAAAAAAAA | Z |
| Write | 1...1 | 00 | 01 | PPPPP | DDDDD | 10 | DDDDDDDDDDDDDDDD | Z |
| Read | 1...1 | 00 | 11 | PPPPP | DDDDD | Z0 | DDDDDDDDDDDDDDDD | Z |
| Read Increment | 1...1 | 00 | 10 | PPPPP | DDDDD | Z0 | DDDDDDDDDDDDDDDD | Z |

The MDIO implements a 16-bit address register that stores the address of the register to be accessed. For an address cycle, it contains the address of the register to be accessed on the next cycle. For read, write, post-read-increment-address cycles, the field contains the data for the register. At power up and reset, the contents of the register are undefined.

Write, read, and post-read-increment-address frames access the address register, though write and read frames do not modify the contents of the address register.

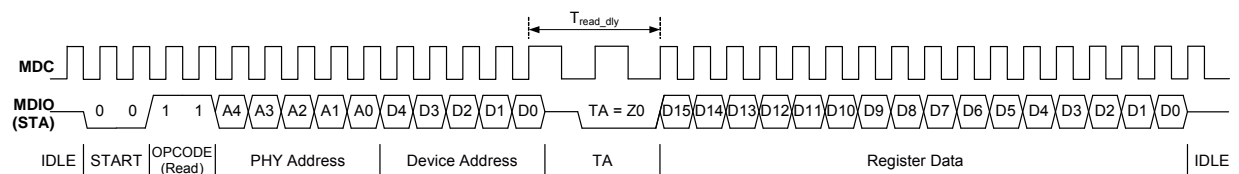
3.4.2 High-Speed MDC/MDIO Management Interface Protocol

In addition to supporting the typical MDC/MDIO protocol, the device has the capability to run MDC as fast as 40 MHz. Write operation can operate normally at this speed; however, for read operation, the MDC clock cycle must be slowed down for the TA period as shown in the [Figure 9](#).

During read operations, the MDC clock must slow down so that the PHY has enough time to fetch the data. There are 2 scenarios. In 1 scenario, the MDIO has exclusive access to the internal register bus.

For timing details, see [Table 407 on page 262](#).

Figure 9: 40 MHz MDC/MDIO Read Operation



3.5 GPIO and SFP+

The GPIO, LED, and TWSI functions share the same set of signal pins. Each pin can be individually programmed to operate in 1 of the 3 functions. The GPIO and TWSI functions can be combined to form the SFP+ digital interface. The pin mapping is summarized in [Table 24](#).

Table 24: GPIO, LED, and TWSI Signal Mapping

| Signal | GPIO | LED | TWSI | SFP+ | Default Mode |
|------------|----------------|-------------|------------------|------------------------|------------------|
| MOD_ABS | MOD_ABS | | | Module Attached | GPIO Input |
| TX_FAULT | TX_FAULT | | | Transmit Fault | GPIO Input |
| RX_LOS | RX_LOS | | | Receive Loss of Signal | GPIO Input |
| GPIO | GPIO | | | | GPIO Input |
| LED0 | GPIO[4] | LED0 | | | LED Function |
| LED1 | GPIO[5] | LED1 | | | LED Function |
| MPC | GPIO[6] | MPC | | Module Power | GPIO Output Low |
| TOD | GPIO[7] | TOD | | | GPIO Input |
| TX_DISABLE | GPIO[8] | TX_DISABLED | | Transmit Disable | GPIO Output High |
| SDA | GPIO[10] | | TWSI Serial Data | TWSI Serial Data | TWSI |
| SCL | GPIO[11] | | TWSI Clock | TWSI Clock | TWSI |
| | Bit 9 not used | | | | |

The GPIO function enables the pins listed in [Table 24](#) to function as GPIO ports. Each pin can operate bi-directionally and can be individually configured. When operating as an output, these pins operate as open drain.

3.5.1 Enabling GPIO Functionality

The TX_DISABLED, TOD, MPC, LED1, and LED0 pins operates in the LED mode unless register 31.F016.4:3 is set to 01, and 31.F014.11, 31.F014.7, 31.F015.15, 31.F015.11, 31.F015.7, 31.F015.3 respectively are set to 1. Once set to 1, the LED pins can be controlled via the GPIO registers.

The SCL and SDA pins operate in the TWSI mode unless register 31.F016.15 and 31.F016.11 respectively are set to 1. Once set to 1, the SCL and SDA pins can be controlled via the GPIO registers.

The GPIO, RX_LOS, TX_FAULT, and MOD_ABS pins can always be controlled via the GPIO registers.

3.5.2 Controlling and Sensing

Register 31.F013 controls whether the GPIO pins are inputs or outputs. Each pin can be individually controlled.

Register 31.F012 allows the pins to be controlled and sensed.

When configured as input, a read to register 31.F012 will return the real-time sampled state of the pin at the time of the read. A write will write the output register but has no immediate effect on the pin since the pin is configured to be an input. The input is sampled once every 38.4 ns.

When configured as output, a read to register 31.F012 returns the value in the output register. A write writes the output register which in turn drives the state of the pin.

Table 25: GPIO Data

| Register | Function | Setting | Mode |
|------------|------------------|---|------|
| 31.F012.11 | SCL Data | This bit has no effect unless register 31.F016.15 = 1. When 31.F013.11 = 0, a read to this register will reflect the state of the SCL pin, and a write will write the output register but will have no effect on the SCL pin. When 31.F013.11 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and will drive the state of the SCL pin. | R/W |
| 31.F012.10 | SDA Data | This bit has no effect unless register 31.F016.11 = 1. When 31.F013.10 = 0, a read to this register will reflect the state of the SDA pin, and a write will write the output register but will have no effect on the SDA pin. When 31.F013.10 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and will drive the state of the SDA pin. | R/W |
| 31.F012.8 | TX_DISABLED Data | This bit has no effect unless register 31.F016.3 = 1. When 31.F013.8 = 0, a read to this register will reflect the state of the TX_DISABLED pin, and a write will write the output register but will have no effect on the TX_DISABLED pin. When 31.F013.8 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and will drive the state of the TX_DISABLED pin. | R/W |
| 31.F012.7 | TOD Data | This bit has no effect unless register 31.F015.15 = 1. When 31.F013.7 = 0, a read to this register will reflect the state of the TOD pin, and a write will write the output register but will have no effect on the TOD pin. When 31.F013.7 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and will drive the state of the TOD pin. | R/W |
| 31.F012.6 | MPC Data | This bit has no effect unless register 31.F015.11 = 1. When 31.F013.6 = 0, a read to this register will reflect the state of the MPC pin, and a write will write the output register but will have no effect on the MPC pin. When 31.F013.6 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and will drive the state of the MPC pin. | R/W |
| 31.F012.5 | LED1 Data | This bit has no effect unless register 31.F015.7 = 1. When 31.F013.5 = 0, a read to this register will reflect the state of the LED1 pin, and a write will write the output register but will have no effect on the LED1 pin. When 31.F013.5 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and will drive the state of the LED1 pin. | R/W |
| 31.F012.4 | LED0 Data | This bit has no effect unless register 31.F015.3 = 1. When 31.F013.4 = 0, a read to this register will reflect the state of the LED0 pin, and a write will write the output register but will have no effect on the LED0 pin. When 31.F013.4 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and will drive the state of the LED0 pin. | R/W |

Table 25: GPIO Data (Continued)

| Register | Function | Setting | Mode |
|-----------|---------------|---|------|
| 31.F012.3 | GPIO Data | When 31.F013.9 = 0, a read to this register will reflect the state of the GPIO pin, and a write will write the output register but will have no effect on the GPIO pin. When 31.F013.9 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and will drive the state of the GPIO pin. | R/W |
| 31.F012.2 | RX_LOS Data | When 31.F013.2 = 0, a read to this register will reflect the state of the RX_LOS pin, and a write will write the output register but will have no effect on the RX_LOS pin. When 31.F013.2 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and will drive the state of the RX_LOS pin. | R/W |
| 31.F012.1 | TX_FAULT Data | When 31.F013.1 = 0, a read to this register will reflect the state of the TX_FAULT pin, and a write will write the output register but will have no effect on the TX_FAULT pin. When 31.F013.1 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and will drive the state of the TX_FAULT pin. | R/W |
| 31.F012.0 | MOD_ABS Data | When 31.F013.0 = 0, a read to this register will reflect the state of the MOD_ABS pin, and a write will write the output register but will have no effect on the MOD_ABS pin. When 31.F013.0 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and will drive the state of the MOD_ABS pin. | R/W |

Table 26: GPIO Tristate Control

| Register | Function | Setting | Mode |
|------------|---------------------------|---|------|
| 31.F013.11 | SCL Output Enable | This bit has no effect unless register 31.F016.15 = 1. 0 = Input, 1 = Output | R/W |
| 31.F013.10 | SDA Output Enable | This bit has no effect unless register 31.F016.11 = 1. 0 = Input, 1 = Output | R/W |
| 31.F013.8 | TX_DISABLED Output Enable | This bit has no effect unless register 31.F016.3 = 1. 0 = Input, 1 = Output | R/W |
| 31.F013.7 | TOD Output Enable | This bit has no effect unless register 31.F015.15 = 1. 0 = Input, 1 = Output | R/W |
| 31.F013.6 | MPC Output Enable | This bit has no effect unless register 31.F015.11 = 1. 0 = Input, 1 = Output | R/W |
| 31.F013.5 | LED1 Output Enable | This bit has no effect unless register 31.F015.7 = 1. 0 = Input, 1 = Output | R/W |
| 31.F013.4 | LED0 Output Enable | This bit has no effect unless register 31.F015.3 = 1. 0 = Input, 1 = Output | R/W |
| 31.F013.3 | GPIO Output Enable | 0 = Input, 1 = Output | R/W |
| 31.F013.2 | RX_LOS Output Enable | 0 = Input, 1 = Output | R/W |
| 31.F013.1 | TX_FAULT Output Enable | 0 = Input, 1 = Output | R/W |
| 31.F013.0 | MOD_ABS Output Enable | 0 = Input, 1 = Output | R/W |

3.5.3 GPIO Interrupts

When the pins are configured as input, several types of interrupt events can be generated. Registers 31.F014, 31.F015, and 31.F016 allow each pin to be configured to generate interrupt on 1 of 5 types of events:

- Low Level
- High Level
- High to Low Transition
- Low to High Transition
- Transitions on Either Edge

The interrupt generation can also be disabled.

When an interrupt event is generated, it is latched high in register 31.F011. The register bits will remain high until read.

The INT pin can be asserted when interrupt events occur. Register 31.F010 sets the interrupt enable. Registers 31.F010 and 31.F011 are bitwise AND together. If the result is non-zero, the INT pin will assert.

If any of the following occur, no new interrupt events will be generated and reported in register 31.F011 for that particular pin:

- When a pin is set to output
- When TX_DISABLED, TOD, MPC, LED1, and LED0 are set to LED function instead of GPIO function
- When SCL and SDA are set to TWSI function instead of GPIO function

If a previous interrupt event occurred but is not read, the register will retain its value until read. In other words, if an interrupt event occurred while the pin is configured as an input, the interrupt status bit will be set. If subsequently the pin is set to an output, the interrupt status bit will remain set until it is read.

When changing a pin from output to input, an edge triggered event will not be generated on the transition. For example, if the pin is configured as an output and is driven low and there is a pull-up attached to the pin. Once the pin is configured as an input (to tri-state the pin), there will be a low to high transition. This low to high transition will not trigger an edge event. Subsequent transitions with the pin configured as input will trigger edge events.

See [Table 27](#), [Table 28](#), and [Table 29](#) for information on GPIO interrupt enable, status, and type.

Table 27: GPIO Interrupt Enable

| Register | Function | Setting | Mode |
|------------|------------------------------|-------------------------|------|
| 31.F010.11 | SCL Interrupt Enable | 0 = Disable, 1 = Enable | R/W |
| 31.F010.10 | SDA Interrupt Enable | 0 = Disable, 1 = Enable | R/W |
| 31.F010.8 | TX_DISABLED Interrupt Enable | 0 = Disable, 1 = Enable | R/W |
| 31.F010.7 | TOD Interrupt Enable | 0 = Disable, 1 = Enable | R/W |
| 31.F010.6 | MPC Interrupt Enable | 0 = Disable, 1 = Enable | R/W |
| 31.F010.5 | LED1 Interrupt Enable | 0 = Disable, 1 = Enable | R/W |
| 31.F010.4 | LED0 Interrupt Enable | 0 = Disable, 1 = Enable | R/W |
| 31.F010.3 | GPIO Interrupt Enable | 0 = Disable, 1 = Enable | R/W |
| 31.F010.2 | RX_LOS Interrupt Enable | 0 = Disable, 1 = Enable | R/W |
| 31.F010.1 | TX_FAULT Interrupt Enable | 0 = Disable, 1 = Enable | R/W |
| 31.F010.0 | MOD_ABS Interrupt Enable | 0 = Disable, 1 = Enable | R/W |

Table 28: GPIO Interrupt Status

| Register | Function | Setting | Mode |
|------------|------------------------------|---|--------|
| 31.F011.11 | SCL Interrupt Status | This bit is not valid unless register 31.F016.15 = 1 and 31.F013.11 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred | RO, LH |
| 31.F011.10 | SDA Interrupt Status | This bit is not valid unless register 31.F016.11 = 1 and 31.F013.10 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred | RO, LH |
| 31.F011.8 | TX_DISABLED Interrupt Status | This bit is not valid unless register 31.F016.3 = 1 and 31.F013.8 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred | RO, LH |
| 31.F011.7 | TOD Interrupt Status | This bit is not valid unless register 31.F015.15 = 1 and 31.F013.7 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred | RO, LH |
| 31.F011.6 | MPC Interrupt Status | This bit is not valid unless register 31.F015.11 = 1 and 31.F013.6 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred | RO, LH |
| 31.F011.5 | LED1 Interrupt Status | This bit is not valid unless register 31.F015.7 = 1 and 31.F013.5 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred | RO, LH |
| 31.F011.4 | LED0 Interrupt Status | This bit is not valid unless register 31.F015.3 = 1 and 31.F013.4 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred | RO, LH |
| 31.F011.3 | GPIO Interrupt Status | This bit is not valid unless register 31.F013.3 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred | RO, LH |
| 31.F011.2 | RX_LOS Interrupt Status | This bit is not valid unless register 31.F013.2 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred | RO, LH |
| 31.F011.1 | TX_FAULT Interrupt Status | This bit is not valid unless register 31.F013.1 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred | RO, LH |
| 31.F011.0 | MOD_ABS Interrupt Status | This bit is not valid unless register 31.F013.0 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred | RO, LH |

Table 29: GPIO Interrupt Type

| Register | Function | Setting | Mode |
|---------------|-------------------|---|------|
| 31.F014.14:12 | GPIO Select | Interrupt is effective only when 31.F013.3 = 0. 000 = No Interrupt 001 = Reserved 010 = Interrupt on Low Level 011 = Interrupt on High Level 100 = Interrupt on High to Low 101 = Interrupt on Low to High 110 = Reserved 111 = Interrupt on Low to High or High to Low | R/W |
| 31.F014.11 | RX_LOS Function | 0 = RX_LOS is used as Signal Detect Function. 1 = RX_LOS is used for GPIO Function. | R/W |
| 31.F014.10:8 | RX_LOS Select | Interrupt is effective only when 31.F013.2 = 0. Same as 31.F014.14:12 | R/W |
| 31.F014.7 | TX_FAULT Function | 0 = TX_FAULT status indicated by 1.0008.11. 1 = TX_FAULT is used for GPIO Function. | R/W |
| 31.F014.6:4 | TX_FAULT Select | Interrupt is effective only when 31.F013.1 = 0. Same as 31.F014.14:12 | R/W |
| 31.F014.2:0 | MOD_ABS Select | Interrupt is effective only when 31.F013.0 = 0. Same as 31.F014.14:12 | R/W |
| 31.F015.15 | TOD Function | 0 = TOD is used for LED Function. 1 = TOD is used for GPIO Function. | R/W |
| 31.F015.14:12 | TOD Select | Interrupt is effective only when 31.F013.7 = 0. Same as 31.F014.14:12 | R/W |
| 31.F015.11 | MPC Function | 0 = MPC is used for LED Function. 1 = MPC is used for GPIO Function. | R/W |
| 31.F015.10:8 | MPC Select | Interrupt is effective only when 31.F013.6 = 0. Same as 31.F014.14:12 | R/W |
| 31.F015.7 | LED1 Function | 0 = LED1 is used for LED Function. 1 = LED1 is used for GPIO Function. | R/W |
| 31.F015.6:4 | LED1 Select | Interrupt is effective only when 31.F013.5 = 0. Same as 31.F014.14:12 | R/W |
| 31.F015.3 | LED0 Function | 0 = LED0 is used for LED Function. 1 = LED0 is used for GPIO Function. | R/W |
| 31.F015.2:0 | LED0 Select | Interrupt is effective only when 31.F013.4 = 0. Same as 31.F014.14:12 | R/W |
| 31.F016.15 | SCL Function | 0 = SCL is used for TWI Function. 1 = SCL is used for GPIO Function. | R/W |
| 31.F016.14:12 | SCL Select | Interrupt is effective only when 31.F013.11 = 0. Same as 31.F014.14:12 | R/W |
| 31.F016.11 | SDA Function | 0 = SDA is used for TWI Function. 1 = SDA is used for GPIO Function. | R/W |
| 31.F016.10:8 | SDA Select | Interrupt is effective only when 31.F013.10 = 0. Same as 31.F014.14:12 | R/W |

Table 29: GPIO Interrupt Type (Continued)

| Register | Function | Setting | Mode |
|-------------|----------------------|--|------|
| 31.F016.4:3 | TX_DISABLED Function | 00 = TX_DISABLED is used for LED Function. 01 = TX_DISABLED is used for GPIO Function. 10 = TX_DISABLED controlled by 1.0009.4:0 | R/W |
| 31.F016.2:0 | TX_DISABLED Select | Interrupt is effective only when 31.F013.8 = 0. Same as 31.F014.14:12 | R/W |

3.5.4 SFP Behavior

The behavior of TX_DISABLED, RX_LOS, and TX_FAULT pins can be set to interact with the IEEE defined registers and PCS.

3.5.4.1 TX_DISABLE

When register 31.F016.4:3 of a port is set to 10, the TX_DISABLE has the following behavior.

The TX_DISABLE pin is configured as an output and writing to registers 31.F010.8, 31.F012.8, and 31.F013.8 has no effect.

If the PCS of port N is configured to 1000BASE-X, or 10GBASE-R then

- TX_DISABLE[N] pin is set high when port N register 1.0009.0 is set to 1 or 1.0009.1 is set to 1. Otherwise TX_DISABLE[N] pin is set low.

If the PCS of port 0 is configured to XAUI, or 40GBASE-R4 then

- TX_DISABLE[0] pin is set high when port 0 register 1.0009.0 is set to 1 or 1.0009.1 is set to 1. Otherwise TX_DISABLE[0] pin is set low.
- TX_DISABLE[1] pin is set high when port 0 register 1.0009.0 is set to 1 or 1.0009.2 is set to 1. Otherwise TX_DISABLE[1] pin is set low.
- TX_DISABLE[2] pin is set high when port 0 register 1.0009.0 is set to 1 or 1.0009.3 is set to 1. Otherwise TX_DISABLE[2] pin is set low.
- TX_DISABLE[3] pin is set high when port 0 register 1.0009.0 is set to 1 or 1.0009.4 is set to 1. Otherwise TX_DISABLE[3] pin is set low.

Note that the PCS transmit path is also disabled when the transmit disable bits are set in register 1.0009.

3.5.4.2 RX_LOS

When 31.F014.11 is set to 0 the RX_LOS pin is configured as an input and writing to register 31.F013.2 has no effect. The RX_LOS is used in conjunction with the receiver status of the lane to determine signal detect. Both the RX_LOS and the receiver must detect a signal for signal detect to be up. When 31.F014.11 = 1, then RX_LOS is not used to determine signal detect and only the receiver status of the lane is used to determine signal detect status.

Port N register 31.F012.2 will report the state of RX_LOS[N], and 31.F011.2 will report the interrupt status of RX_LOS[N] regardless of the setting of register 31.F014.11.

When register 31.F014.11 of a port is set to 0, the RX_LOS has the following behavior that is dependent on the PCS.

If the PCS of port N is configured to 1000BASE-X, or 10GBASE-R then

- RX_LOS[N] pin is used for lane 0 signal detect, and port N register 1.000A.0 and 1.000A.1 reflects the signal detect status.

If the PCS of port 0 is configured to XAU1, or 40GBASE-R4 then

- RX_LOS[0] pin is used for lane 0 signal detect, and port 0 register 1.000A.1 reflects the signal detect status.
- RX_LOS[1] pin is used for lane 1 signal detect, and port 0 register 1.000A.2 reflects the signal detect status.
- RX_LOS[2] pin is used for lane 2 signal detect, and port 0 register 1.000A.3 reflects the signal detect status.
- RX_LOS[3] pin is used for lane 3 signal detect, and port 0 register 1.000A.4 reflects the signal detect status.
- Port 0 register 1.000A.0 is set to 1 whenever all four bits of 1.000A.4:1 are set to 1.

3.5.4.3 TX_FAULT

When 31.F014.7 is set to 0, the TX_FAULT pin is configured as an input and writing to register 31.F013.1 has no effect. The TX_FAULT pin is used to determine the state of the transmit fault register 1.0008.11. When 31.F014.7 = 1, then register 1.0008.11 is always set to 0.

Port N register 31.F012.1 will report the state of TX_FAULT[N], and 31.F011.1 will report the interrupt status of TX_FAULT[N] regardless of the setting of register 31.F014.7.

When register 31.F014.7 of a port is set to 0, the TX_FAULT has the following behavior that is dependent on the PCS.

If the PCS of port N is configured to 1000BASE-X, or 10GBASE-R then

- Port N register 1.0008.11 is set to 1 when TX_FAULT[N] is high. Otherwise register 1.0008.11 is set to 0.

If the PCS of port 0 is configured to XAU1, or 40GBASE-R4 then

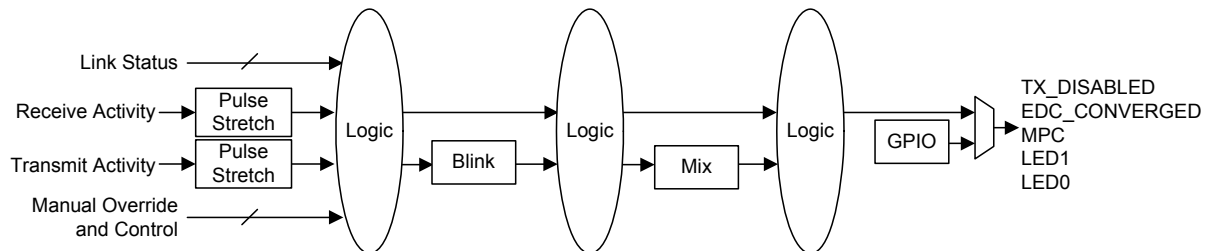
- Port 0 register 1.0008.11 is set to 1 when any of the TX_FAULT[3:0] is high. Otherwise register 1.0008.11 is set to 0.

3.6 LED

The TX_DISABLED, TOD, MPC, LED1, and LED0 pins can be used to drive LED pins. Registers 31.F020 through 31.F027 control the operation of the LED pins. TX_DISABLED, TOD, MPC, LED1, and LED0 will operate per this section unless the pin is used for GPIO purposes (see [Section 3.5, GPIO and SFP+](#), on page 52).

[Figure 10](#) shows the general chaining of function for the LEDs. The various functions are described in the following sections. All LED pins are open drain outputs.

Figure 10: LED Chain



3.6.1 LED Polarity

There are a variety of ways to hook up the LEDs. Some examples are shown in Figure 11. In order to make things more flexible registers 31.F020.1:0, 31.F021.1:0, 31.F022.1:0, 31.F023.1:0, and 31.F024.1:0 specify the output polarity for the LED function. The lower bit of each pair specifies the on (active) state of the LED, either high or low. The upper bit of each pair specifies whether the off state of the LED should be driven to the opposite level of the on state or Hi-Z.

Figure 11: Various LED Hookup Configurations

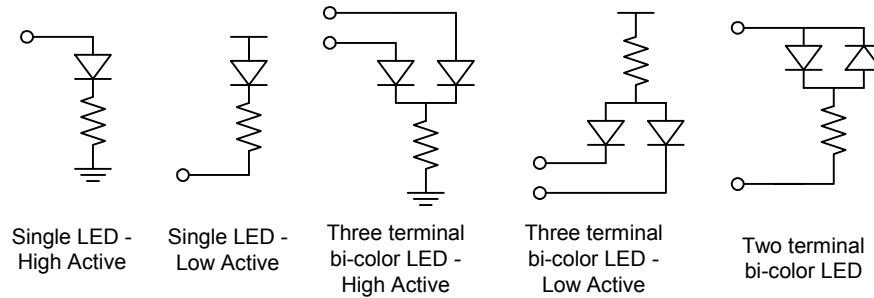


Table 30: LED Polarity

| Register | LED Function | Definition |
|-------------|--------------|---|
| 31.F020.1:0 | LED0 | 00 = On - drive LED0 low, Off - drive LED0 high 01 = On - drive LED0 high, Off - drive LED0 low 10 = On - drive LED0 low, Off - tristate LED0 11 = On - drive LED0 high, Off - tristate LED0 |
| 31.F021.1:0 | LED1 | 00 = On - drive LED1 low, Off - drive LED1 high 01 = On - drive LED1 high, Off - drive LED1 low 10 = On - drive LED1 low, Off - tristate LED1 11 = On - drive LED1 high, Off - tristate LED1 |
| 31.F022.1:0 | MPC | 00 = On - drive MPC low, Off - drive MPC high 01 = On - drive MPC high, Off - drive MPC low 10 = On - drive MPC low, Off - tristate MPC 11 = On - drive MPC high, Off - tristate MPC |
| 31.F023.1:0 | TOD | 00 = On - drive TOD low, Off - drive TOD high 01 = On - drive TOD high, Off - drive TOD low 10 = On - drive TOD low, Off - tristate TOD 11 = On - drive TOD high, Off - tristate TOD |
| 31.F024.1:0 | TX_DISABLED | 00 = On - drive TX_DISABLED low, Off - drive TX_DISABLED high 01 = On - drive TX_DISABLED high, Off - drive TX_DISABLED low 10 = On - drive TX_DISABLED low, Off - tristate TX_DISABLED 11 = On - drive TX_DISABLED high, Off - tristate TX_DISABLED |

3.6.2 Pulse Stretching and Blinking

Register 31.F027.14:12 specifies the pulse stretching duration of a particular activity. Only the transmit activity, receive activity, and (transmit or receive) activity are stretched. All other statuses are not stretched since they are static in nature and no stretching is required.

Some status will require blinking instead of a solid on. Register 31.F027.10:8 and 31.F027.6:4 specifies the 2 blink rates. Note that the pulse stretching is applied first, and the blinking will reflect the duration of the stretched pulse.

Registers 31.F020.2, 31.F021.2, 31.F022.2, 31.F023.2, and 31.F024.2 select which of the 2 blink rates to use for LED0, LED1, MPC, TOD, and TX_DISABLED respectively.

0 = Select Blink Rate 1

1 = Select Blink Rate 2

The stretched/blinked output will then be mixed if needed (see [Section 3.6.3, Bi-Color LED Mixing, on page 61](#)). For information on pulse stretching and blinking, see [Table 31](#).

Table 31: Pulse Stretching and Blinking

| Register | LED Function | Definition |
|---------------|------------------------|--|
| 31.F027.14:12 | Pulse stretch duration | 000 = No pulse stretching 001 = 20 ms to 40 ms 010 = 40 ms to 81 ms 011 = 81 ms to 161 ms 100 = 161 ms to 322 ms 101 = 322 ms to 644 ms 110 = 644 ms to 1.3s 111 = 1.3s to 2.6s |
| 31.F027.10:8 | Blink Rate 2 | 000 = 40 ms 001 = 81 ms 010 = 161 ms 011 = 322 ms 100 = 644 ms 101 = 1.3s 110 = 2.6s 111 = 5.2s |
| 31.F027.6:4 | Blink Rate 1 | 000 = 40 ms 001 = 81 ms 010 = 161 ms 011 = 322 ms 100 = 644 ms 101 = 1.3s 110 = 2.6s 111 = 5.2s |

3.6.3 Bi-Color LED Mixing

In the dual LED modes, the mixing function allows the 2 colors of the LED to be mixed to form a third color. Register 31.F026.7:4 control the amount to mix in the TOD and LED1 pins. Register 31.F026.3:0 controls the amount to mix in the MPC and LED0 pins. The mixing is determined by the percentage of time the LED is on during the active state. The percentage is selectable in 12.5% increments.

Note that there are 2 types of bi-color LEDs: 3 terminal type, and 2 terminal type. For example, the third and fourth LED block from the left in [Figure 11](#) illustrate 3 terminal types, and the one on the far right in [Figure 11](#) illustrate the 2 terminal type. In the 3 terminal type both of the LEDs can be turned on at the same time. Hence the sum of the percentage specified by 31.F026.7:4 and 31.F026.3:0 can exceed 100%. However, in the 2 terminal type, the sum should never exceed 100% since only 1 LED can be turned on at any given time.

The mixing only applies when register 31.F020.11:8 or 31.F022.11:8 are set to 101x. There is no mixing in single LED modes.

Table 32: Bi-Color LED Mixing

| Register | LED Function | Definition |
|-------------|--------------------------|---|
| 31.F026.7:4 | TOD, LED1 mix percentage | 0000 = 0% 0001 = 12.5% . . 0111 = 87.5% 1000 = 100% 1001 to 1111 = Reserved |
| 31.F026.3:0 | MPC, LED0 mix percentage | 0000 = 0% 0001 = 12.5%, . . . 0111 = 87.5% 1000 = 100% 1001 to 1111 = Reserved |

3.6.4 Modes of Operation

The LED pins relay various statuses of the PHY so that they can be displayed by the LEDs.

The statuses that the LEDs display is defined by registers 31.F020 to 31.F025 as shown in [Table 33](#). For each LED, if the condition selected by bits 11:8 is true, the LED will blink. If the condition selected by bits 7:4 is true, the LED will be solid on. If both selected conditions are true, the blink will take precedence.

Table 33: LED Display

| Register | LED Function | Definition |
|--------------|---------------------|--|
| 31.F020.11:8 | LED0 Blink Behavior | Blink Behavior has higher priority. 0000 = Solid Off 0001 = System Side Transmit or Receive Activity 0010 = System Side Transmit Activity 0011 = System Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = System Side Link 0111 = Solid On 1000 = Reserved 1001 = Reserved 1010 = Blink Mix 1011 = Solid Mix 11xx = Reserved |
| 31.F020.7:4 | LED0 Solid Behavior | Blink Behavior has higher priority. 0000 = Solid Off 0001 = System Side Transmit or Receive Activity 0010 = System Side Transmit Activity 0011 = System Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = System Side Link 0111 = Solid On 1xxx = Reserved |

Table 33: LED Display (Continued)

| Register | LED Function | Definition |
|--------------|---------------------|--|
| 31.F021.11:8 | LED1 Blink Behavior | Blink Behavior has higher priority. This register ignored if 31.F020.11:10 = 10 (Dual Mode). 0000 = Solid Off 0001 = Line Side Transmit or Receive Activity 0010 = Line Side Transmit Activity 0011 = Line Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = Line Side Link 0111 = Solid On 1xxx = Reserved |
| 31.F021.7:4 | LED1 Solid Behavior | Blink Behavior has higher priority. This register ignored if 31.F020.11:10 = 10 (Dual Mode). 0000 = Solid Off 0001 = Line Side Transmit or Receive Activity 0010 = Line Side Transmit Activity 0011 = Line Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = Line Side Link 0111 = Solid On 1xxx = Reserved |
| 31.F022.11:8 | MPC Blink Behavior | Blink Behavior has higher priority. 0000 = Solid Off 0001 = System Side Transmit or Receive Activity 0010 = System Side Transmit Activity 0011 = System Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = System Side Link 0111 = Solid On 1000 = Reserved 1001 = Reserved 1010 = Blink Mix 1011 = Solid Mix 11xx = Reserved |
| 31.F022.7:4 | MPC Solid Behavior | Blink Behavior has higher priority. 0000 = Solid Off 0001 = System Side Transmit or Receive Activity 0010 = System Side Transmit Activity 0011 = System Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = System Side Link 0111 = Solid On 1xxx = Reserved |

Table 33: LED Display (Continued)

| Register | LED Function | Definition |
|--------------|----------------------------|--|
| 31.F023.11:8 | TOD Blink Behavior | Blink Behavior has higher priority. This register ignored if 31.F022.11:10 = 10 (Dual Mode). 0000 = Solid Off 0001 = Line Side Transmit or Receive Activity 0010 = Line Side Transmit Activity 0011 = Line Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = Line Side Link 0111 = Solid On 1xxx = Reserved |
| 31.F023.7:4 | TOD Solid Behavior | Blink Behavior has higher priority. This register ignored if 31.F022.11:10 = 10 (Dual Mode). 0000 = Solid Off 0001 = Line Side Transmit or Receive Activity 0010 = Line Side Transmit Activity 0011 = Line Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = Line Side Link 0111 = Solid On 1xxx = Reserved |
| 31.F024.11:8 | TX_DISABLED Blink Behavior | Blink Behavior has higher priority. 0000 = Solid Off 0001 = System Side Transmit or Receive Activity 0010 = System Side Transmit Activity 0011 = System Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = System Side Link 0111 = Solid On 11xx = Reserved |
| 31.F024.7:4 | TX_DISABLED Solid Behavior | Blink Behavior has higher priority. 0000 = Solid Off 0001 = Transmit or Receive Activity 0010 = Transmit Activity 0011 = Receive Activity 0100 = Reserved 0101 = Reserved 0110 = Link 0111 = Solid On 1xxx = Reserved |

3.7

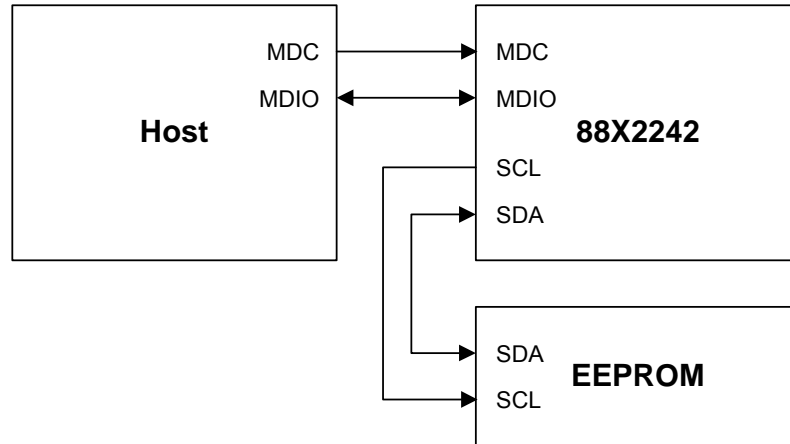
EEPROM Bridging and Polling

The 88X2242 device supports the ability to cache the contents of the EEPROM into an onboard RAM for faster read access. The device has the ability to periodically read the EEPROM and refresh the RAM. The 88X2242 device can also act as a bridge so that the EEPROM or other devices can be accessed via the MDC/MDIO interface of the PHY.

The EEPROM or external device is attached to the Two-wire Serial Interface (TWSI) via the SCL and SDA pins.

Register 1.8000.10 can be set to 1 to force the TWSI to reset.

Figure 12: MDC/MDIO Bridging



3.7.1 Bridging Function

The bridging function allows the contents of the EEPROM to be accessed directly via the MDC/MDIO. The access is through a series of reads and writes to the PHY register. Note that the access is not limited to the EEPROM but also to any device that is attached to the TWSI.

Since other devices may be connected to the TWSI where the slave address is not necessarily 1010xxx, there is a hook to access the TWSI device directly from the MDIO. Registers 1.8001, 1.8002, and 1.8003 give direct access between the MDIO and the TWSI.

Table 34: EEPROM Address Register

| Register | Function | Setting | Mode |
|-------------|---------------|---|------|
| 1.8001.15:9 | Slave Address | Slave Address | R/W |
| 1.8001.8 | Read/Write | <p>A write to 1.8001 will initiate a read or write command on the TWSI if the TWSI is free; otherwise, the read or write command will be ignored.</p> <p>Make sure register 1.8002.10:8 is not equal to 010 (command in progress) prior to writing this register</p> <p>A read to 1.8001 will not trigger any action. Register 1.8003.7:0 must be set to the value to be written prior to issuing a write command.</p> <p>1 = Read, 0 = Write</p> | R/W |
| 1.8001.7:0 | Byte Address | Byte Address | R/W |

Table 35: EEPROM Read Data Register and EEPROM/RAM Status Register

| Register | Function | Setting | Mode |
|-------------|---|--|--------|
| 1.8002.12 | Cache ECC Single Bit Corrected Interrupt Status | 0 = No single bit correction in ECC cache detected 1 = Single bit correction in ECC cache detected | RO, LH |
| 1.8002.11 | Cache ECC Uncorrectable Bit Interrupt Status | 0 = No uncorrectable bit in ECC cache detected 1 = Uncorrectable bit in ECC cache detected | RO, LH |
| 1.8002.10:8 | TWSI Status | <p>Register 1.8002.10:8 is the status in response to setting to writing register 1.8001.</p> <p>Register 1.8002.10:8 will remain at 010 until the command is completed. Once the command is completed, the status 001, 011, 100, 101, or 111 will remain until register 1.8002 is read. The register will clear on read.</p> <p>If a new command is issued by writing register 1.8001 without reading register 1.8002 for a previous command, the status of the previous command will be lost.</p> <p>If a command initiated by writing register 1.8001 is still in progress and a second command is issued, the status 1.8002.10:8 will reflect the first command.</p> <p>The second command is ignored but register 1.8002.10:8 will not be set to 111.</p> <p>Command Done - No Error is set when the TWSI slave properly responds with ACK.</p> <p>In the case of a write command with automatic read back, a Command Done - No Error status will be returned even if the read back data does not match the written data or if the TWSI slave does not respond with ACK during the read back.</p> <p>Register 1.8002.7:0 is valid only when register 1.8002.10:8 is set to 001.</p> <p>000 = Ready 001 = Command Done - No Error 010 = Command in Progress 011 = Write done but read back failed 100 = Reserved 101 = Command Failed 110 = Reserved 111 = two-wire interface Busy, Command Ignored</p> | RO, LH |
| 1.8002.7:0 | Read Data | <p>Read Data</p> <p>Register 1.8002.7:0 is valid only when register 1.8002.10:8 is set to 001.</p> | RO |

Table 36: EEPROM Write Data Register and EEPROM/RAM Control Register

| Register | Function | Setting | Mode |
|--------------|---------------------------------|--|------|
| 1.8003.15:12 | Write Time | 0000 = EEPROM takes 0 ms to write 0001 = 1.05 ms 1110 = 14.68 ms 1111 = 15.73 ms | R/W |
| 1.8003.9 | Automatic read back after write | If read back is enabled, then data will always be read back after a write. The read data is stored in register 1.8002.7:0 1 = Read back, 0 = no read back | R/W |
| 1.8003.7:0 | Write Data | Write Data | R/W |

3.7.1.1 Read from TWSI Slave Device to the MDIO

When a read operation to the TWSI is required, the slave address and byte address is written to register 1.8001.15:9 and 1.8001.7:0 respectively with register 1.8001.8 set to 1 indicating read. Once register 1.8001 is written, a read operation on the TWSI commences only if the TWSI is free; otherwise, a read operation on the TWSI is never issued. The byte that is read is stored in register 1.8002.7:0. The status of the read operation is stored in register 1.8002.10:8.

While the read operation is pending register 1.8002.10:8 is set to 010. Once the read operation is completed and the TWSI slave sends all acknowledges register 1.8002.10:8 is set to 001 indicating the read operation completed without error. A 101 is returned if the read command is aborted when the TWSI slave does not acknowledge properly. A 111 is returned if the TWSI is busy when register 1.8001 was written.

Note that other than the 010 setting (command in progress) a read to 1.8002 will cause bits 10:8 to clear to 000.

3.7.1.2 Write from MDIO into the TWSI Slave Device

Write commands into the EEPROM are always available through the MDIO. If write access should be disabled, the EEPROM itself should be configured to ignore write commands from the 88X2242 device.

When a write operation to the TWSI is required, the byte data should first be written into 1.8003.7:0. The slave address and byte address is written to register 1.8001.15:9 and 1.8001.7:0 respectively with register 1.8001.8 set to 0 indicating write. Once register 1.8001 is written a write operation to the TWSI commences. If the read back bit is set in register 1.8003.9 then a read operation to the same address is performed after the write. The byte that is read is stored in register 1.8002.7:0. The status of the write operation is stored in register 1.8002.10:8.

While the write operation is pending register 1.8002.10:8 is set to 010. Once the write operation is completed and, optionally, the read back command and the TWSI slave sends all acknowledges, register 1.8002.10:8 is set to 001 indicating the write operation completed without error. A 011 is returned if the write operation is successfully completed but the read back command is aborted. A 101 is returned if the write command is aborted when the TWSI slave does not acknowledge properly. A 111 is returned if the TWSI is busy when register 1.8001 was written. Note that other than the 010 setting (command in progress) a read to 1.8002 will cause bits 10:8 to clear to 000.

Since it may take some time for the write to take effect in the external device, the 88X2242 device should wait for some amount of time as programmed in register 1.8003.15:12 after the write operation before issuing a read back command.

3.7.2 EEPROM Caching into RAM

The contents of the EEPROM or other device on the TWSI can be cached into on-chip memory. There are 2 segments of 128 bytes that can be cached. The first 128 byte segment is referred to as the A0 page, and the second 128 byte segment is referred to as the secondary page.

Table 37, Table 38, and Table 39 list all the caching and polling registers. The A0 page always has a slave address of 1010000 and always reads the lower 128 bytes of the device. The A0 page control registers are located in 1.8000.1:0, the status registers located in 1.8000.3:2 and 1.8000.9, and the 128 bytes are stored in 1.8007 to 1.8086 bits 7:0.

The secondary page has similar registers located in 1.8000.12:11, 1.8000.14:13, 1.8000.15, and 1.8087 to 1.8106 bits 7:0 respectively. The only exception for the secondary page is that the slave address is not fixed and can be specified in 1.8004.7:1, and 18004.0 specifies whether the upper or lower 128 bytes of the device is read.

The caching sequence is not triggered at the de-assertion of hardware reset. Instead, the EEPROM is read, and RAM is loaded every time the MOD_ABS pin makes a high to low transition. The caching sequence takes place after a delay specified by register 1.8004.15:13. The A0 page is cached on MOD_ABS high to low transition only if 1.8000.1:0 is set to 01 or 10. The secondary page is similarly cached only if 1.8000.12:11 is set to 01 or 10. If caching is enabled for both pages, then page A0 is always loaded first.

Note that if the TWSI is active for any reason when the MOD_ABS pin is triggered, the caching sequence will be deferred until the TWSI is inactive. If the TWSI is in the middle of a caching sequence initiated by the user (see below) the current caching sequence will be aborted after the completion of the active TWSI transaction and a new caching sequence is then started.

Either or both RAM caches are periodically updated if register 1.8000.1:0 and/or 1.8000.12:11 are set to 10. The update period is specified by register 1.8004.10:9. If both caches are to be updated the A0 page gets updated first. The polling will continue until it is disabled via registers 1.8000.1:0 or 1.8000.12:11. Alternatively, if the MOD_ABS pin goes high, the polling will stop immediately after the TWSI transaction completes.

The contents of the EEPROM can be reloaded into RAM by writing register 1.8000.1:0 and/or 1.8000.12:11 to 11. These bits are self-clearing. If both 1.8000.1:0 and 1.8000.12:11 are set to 11 concurrently, the A0 page will be serviced first and, upon completion, 1.8000.1:0 will be cleared and then the secondary page will be serviced. Manual loading can be initiated regardless of the state of the MOD_ABS pin. The result of the reload can be read via register 1.8000.3:2, 1.8000.9 or 1.8000.14:13, 1.8000.15.

All single byte read/write commands are deferred when initiated in the middle of an RAM update cycle.

Once the caching sequence is completed, the status register in 1.8000.3:2 or 1.8000.14:13 will be updated. Registers 1.8000.3:2 and 18000.14:13 are clear on read registers. After reading, the bits clear to 00. The status registers are updated according to the following priority.

If the entire 128 bytes have been updated successfully at least once since the last read to register 1.8000, then the status bits will be set to 01.

If all attempts to read the entire 128 bytes have failed since the last read to register 1.8000, then the status bits will be set to 11. A fail is defined to have occurred if any of the 128 byte reads return error.

If the circuit is in the middle of the first attempt to update the 128 bytes since the last read to register 1.8000, then the status will return 10.

If the circuit never made an attempt to update the 128 byte registers since the last read to register 1.8000, then the status will return 00.

Whenever MOD_ABS pin transitions from 0 to 1 or whenever software or hardware reset is asserted, then 1.8000.9 and 1.8000.15 are set to 0s. If 1 successful caching sequence completes, then 1.8000.9 or 1.8000.15 will be set to a 1 and remains set until MOD_ABS transitions from 0 to 1 or until a software or hardware reset is issued. Once the status bit is set to 1, it will remain set even if subsequent updates are not successful.

The maximum size EEPROM for each segment that can be handled is 128 bytes. The expected device type and device page selection in the slave address of the EEPROM is 1010000 for the A0 page. Any other value will result in the EEPROM not being read. Note that other pages can be read by setting registers 1.8004.7:1 and 1.8004.0.

The RAM can be access via reading registers 1.8007 to 1.8086 bits 7:0 for the A0 page and 1.8087 to 1.8106 bits 7:0 for the secondary page.

The RAM is protected by an Error Correction Circuit (ECC) that generates 2 status signals, 1 to indicate a single bit error has been corrected and another to indicate uncorrectable bit errors. These 2 signals are used to generate interrupts. Registers 1.8004.12:11 are the interrupt enable bits and 1.8002.12:11 are the interrupt status bits. The interrupt status bits latch high when the status bits assert. The bits clear on read.

Table 37: Caching and Polling Control and Status Register

| Register | Function | Setting | Mode |
|--------------|-------------------------------|---|---------|
| 1.8000.15 | Cache Valid Secondary Page | 0 = Registers 1.8087 to 1.8106 invalid 1 = Registers 1.8087 to 1.8106 valid This bit is set to 1 if at least 1 successful cache update is completed since hardware, software reset, or MOD0 transitions from 0 to 1. Use register 1.8000.14:13 for latest status. | RO |
| 1.8000.14:13 | Command Status Secondary Page | 00 = Cache not updated since last read 01 = Contents in cache updated at least once since last read 10 = Cache is currently loading since last read 11 = All caching attempts since last read failed This register clears on read. Register 1.8000.15 indicates whether the content of the cache is valid from any updates in the past. | RO, SC |
| 1.8000.12:11 | Cache Setting Secondary Page | 00 = No automatic caching 01 = Cache once at module plugin 10 = Cache at module plugin and periodically poll 11 = Manual cache refresh The page cached is selected by register 1.8004.7:0 | R/W |
| 1.8000.10 | TWSI Reset | 0 = Normal operation 1 = Force TWSI circuit to reset | R/W, SC |
| 1.8000.9 | Cache Valid Page A0 | 0 = Registers 1.8007 to 1.8086 invalid 1 = Registers 1.8007 to 1.8086 valid This bit is set to 1 if at least 1 successful cache update is completed since hardware, software reset, or MOD0 transitions from 0 to 1. Use register 1.8000.14:13 for latest status. | RO |

Table 37: Caching and Polling Control and Status Register (Continued)

| Register | Function | Setting | Mode |
|------------|------------------------|--|--------|
| 1.8000.3:2 | Command Status Page A0 | 00 = Cache not updated since last read 01 = Contents in cache updated at least once since last read 10 = Cache is currently loading since last read 11 = All caching attempts since last read failed This register clears on read. Register 1.8000.9 indicates whether the content of the cache is valid from any updates in the past. | RO, SC |
| 1.8000.1:0 | Cache Setting Page A0 | 00 = No automatic caching 01 = Cache once at module plugin 10 = Cache at module plugin and periodically poll 11 = Manual cache refresh Page A0 lower 128 bytes are cached. | R/W |

Table 38: Caching and Polling Register

| Register | Function | Setting | Mode |
|--------------|---|---|------|
| 1.8004.15:13 | Auto Caching Delay | 000 = No delay 001 = 0.25 Second 010 = 0.5 Second 011 = 1 Second 100 = 2 Seconds 101 = 4 Seconds 110 = 8 Seconds 111 = Auto Caching Disabled | R/W |
| 1.8004.12 | Cache ECC Single Bit Corrected Interrupt Enable | 0 = Interrupt disabled 1 = Interrupt enabled | R/W |
| 1.8004.11 | Cache ECC Uncorrectable Bit Interrupt Enable | 0 = Interrupt disabled 1 = Interrupt enabled | R/W |
| 1.8004.10:9 | Page Reload Frequency | 00 = 250 ms 01 = 500 ms 10 = 1 second 11 = 2 seconds | R/W |
| 1.8004.7:1 | Secondary Page | Seven bit slave address to use when loading 1.8087 to 1.8106. | R/W |
| 1.8004.0 | Secondary Page Register Address MSB | 0 = Lower 128 bytes of secondary page should be loaded 1 = Upper 128 bytes of secondary page should be loaded | R/W |

Table 39: Cache Registers

| Register | Function | Setting | Mode |
|--------------------|----------------------------|---------------------------------|------|
| 1.8007 to 8086.7:0 | Page A0 EEPROM Byte | Byte (REGAD - 0x8007) Of EEPROM | RO |
| 1.8087 to 8106.7:0 | Secondary Page EEPROM Byte | Byte (REGAD - 0x8087) Of EEPROM | RO |



Note

EEPROM caching is supported only for applications that do not require clock stretching.

3.8 Interrupt

Various functional units in the device can generate interrupt on the INTn pin. INTn is pulled low when an enabled interrupt is active.

The interrupt status is reported upwards via 3 levels:

- First level (information purposes only)—Reports which port is generating an active interrupt
- Second level—Reports which function in the port is generating the interrupt
- Third level—Interrupt registers report the actual interrupt status

The third level interrupt status and the corresponding enables are described in the register sections for each function, and in the interrupt tree diagrams below. The polarity of the interrupt can be controlled by Register 31.F421.

Table 40: First Level Interrupt Status

| Register | Function | Setting |
|-----------|--------------------------|--|
| 31.F420.7 | Port M3 Interrupt Status | 0 = No Interrupt 1 = Active Interrupt |
| 31.F420.6 | Port M2 Interrupt Status | 0 = No Interrupt 1 = Active Interrupt |
| 31.F420.5 | Port M1 Interrupt Status | 0 = No Interrupt 1 = Active Interrupt |
| 31.F420.4 | Port M0 Interrupt Status | 0 = No Interrupt 1 = Active Interrupt |
| 31.F420.3 | Port N3 Interrupt Status | 0 = No Interrupt 1 = Active Interrupt |
| 31.F420.2 | Port N2 Interrupt Status | 0 = No Interrupt 1 = Active Interrupt |
| 31.F420.1 | Port N1 Interrupt Status | 0 = No Interrupt 1 = Active Interrupt |
| 31.F420.0 | Port N0 Interrupt Status | 0 = No Interrupt 1 = Active Interrupt |

Table 41: Second Level Interrupt Status

| Register | Function | Setting | Section Reference |
|-----------|---------------------------|--|---|
| 31.F040.3 | GPIO Interrupt | 0 = No Interrupt 1 = Active Interrupt | Section 3.5.3, GPIO Interrupts, on page 55 |
| 31.F040.2 | System Side PCS Interrupt | 0 = No Interrupt 1 = Active Interrupt | Section 5.6, Traffic Generation and Checking, on page 100 |
| 31.F040.0 | Line Side PCS Interrupt | 0 = No Interrupt 1 = Active Interrupt | Section 4.7, PRBS and Pattern Generators, on page 94 |

Table 42: Interrupt Polarity Control

| Register | Function | Setting |
|-------------|----------------------------|---|
| 31.F421.2:1 | Interrupt Polarity | 00 = Active - drive INT low, Inactive - drive INT high 01 = Active - drive INT high, Inactive - drive INT low 10 = Active - drive INT low, Inactive - tristate INT 11 = Active - drive INT high, Inactive - tristate INT |
| 31.F421.0 | Force Interrupt Pin Active | 0 = Normal operation 1 = Force interrupt pin active |

Figure 13: Chip level Interrupt Generation Diagram

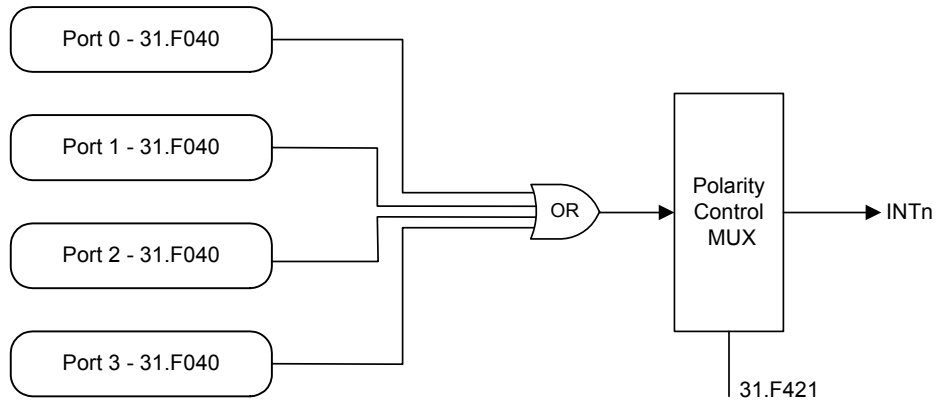


Figure 14: Chip level Interrupt Port Location (First Level)

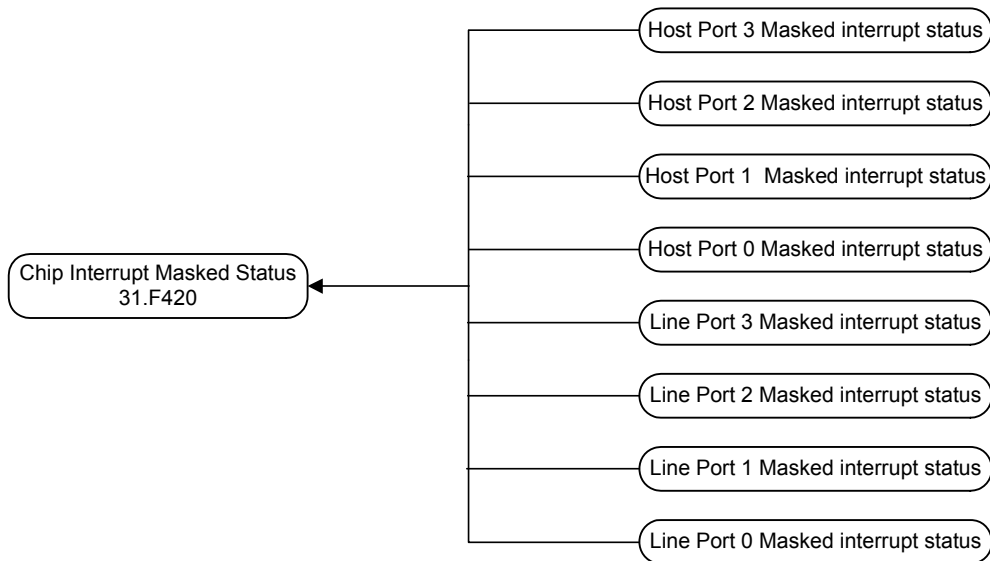


Figure 15: Per Port Interrupt Function Source (Second Level)

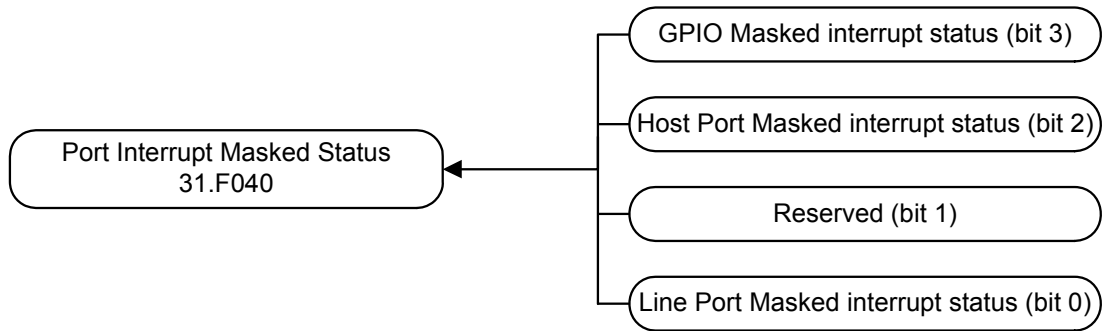


Figure 16: Interrupt Source - GPIO Interrupt Masked Status (Third Level)

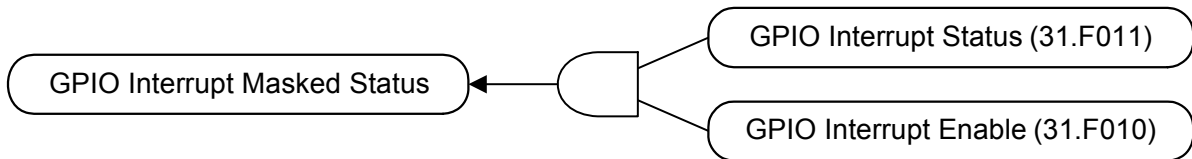


Figure 17: Interrupt Source - Host Port Interrupt Masked Status (Third Level)

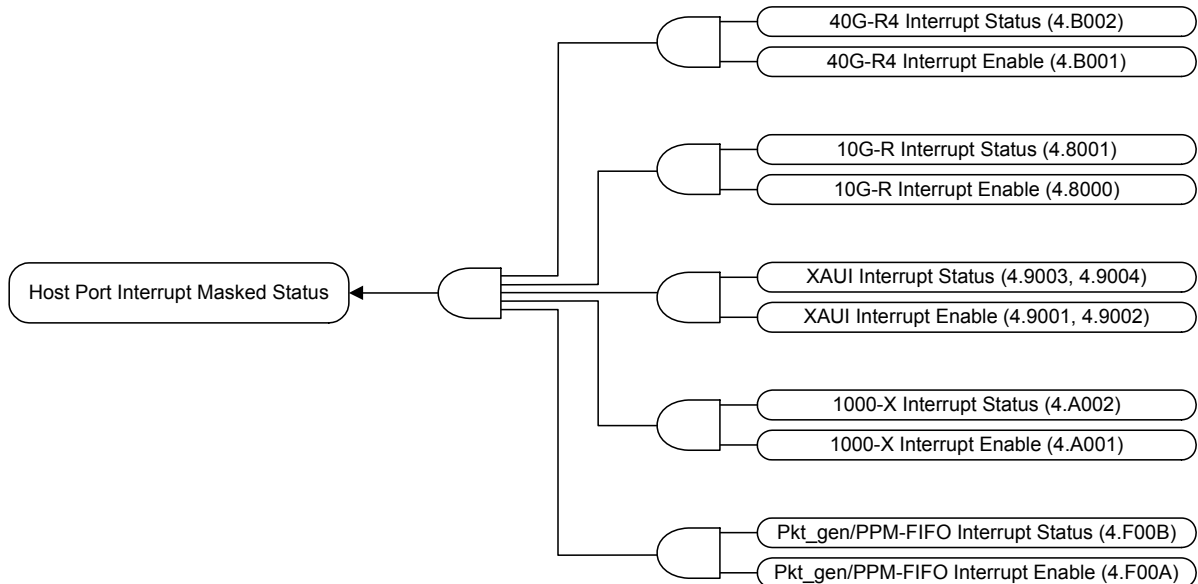


Figure 18: Interrupt Source - Line Port Interrupt Masked Status (Third Level)

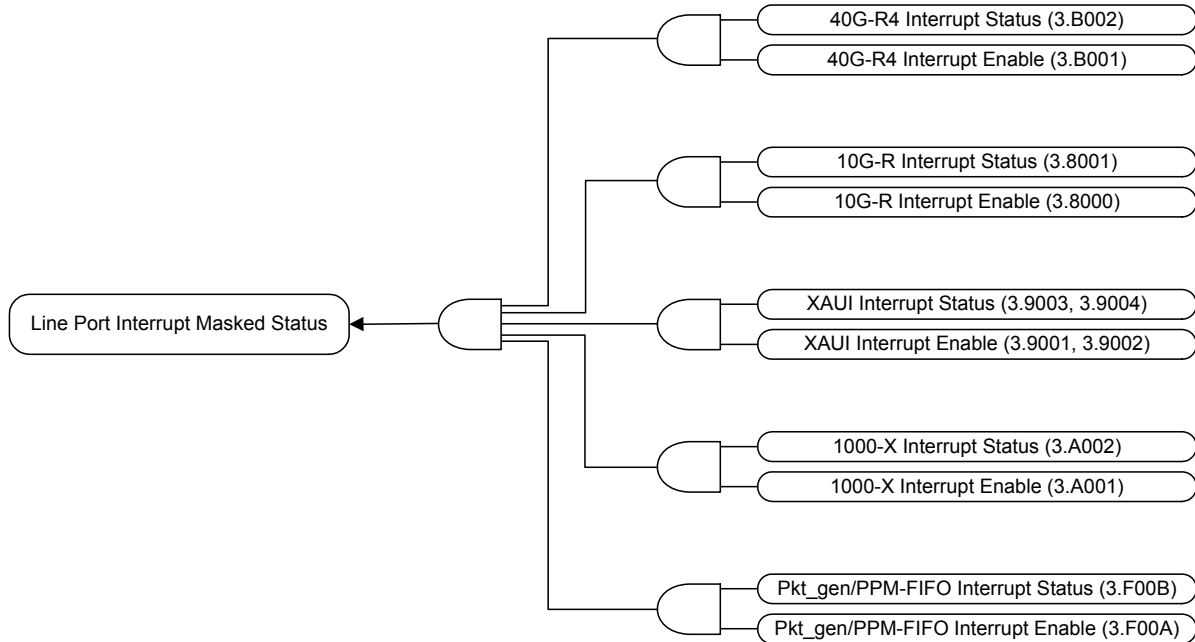
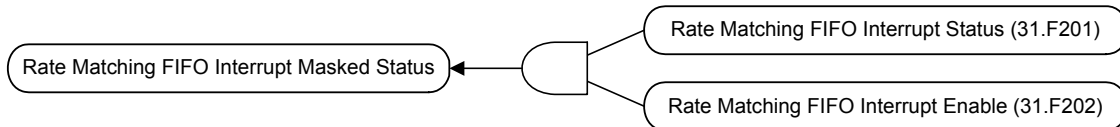


Figure 19: Interrupt Source - Rate Matching FIFO Interrupt Masked Status (Third Level)



3.9 Power Management

The chip can be globally set to be in the power down state after hardware reset. For information on how See [Section 3.3, Hardware Configuration, on page 49](#) on how to configure the device in the power down state.

The Line and Host can be manually powered down as described in [Section 4.5, Power Management, on page 92](#) and [Section 5.5, Power Management, on page 100](#) respectively.

They can also be powered up and down via a single write to register 31.F403.7:0. Note that there are many registers that can be used to power down various blocks (for example, 31.F403.7:0 registers in [Section 4.5, Power Management, on page 92](#) and [Section 5.5, Power Management, on page 100](#)). All registers associated with a block must be powered for it to be active.

3.10 IEEE1149.1 and 1149.6 Controller

The IEEE 1149.1 standard defines a test access port and boundary-scan architecture for digital integrated circuits and for the digital portions of mixed analog/digital integrated circuits. The IEEE 1149.6 standard defines a test access port and boundary-scan architecture for AC coupled signals.

This standard provides a solution for testing assembled printed circuit boards and other products based on highly complex digital integrated circuits and high-density surface-mounting assembly techniques.

The 88X2242 device implements the instructions shown in [Table 43](#). Upon reset, ID_CODE instruction is selected. The instruction opcodes are shown in [Table 43](#).

Table 43: TAP Controller Opcodes

| Instruction | OpCode |
|----------------|-----------|
| EXTEST | 0000_0000 |
| SAMPLE/PRELOAD | 0000_0001 |
| CLAMP | 0000_0010 |
| HIGH-Z | 0000_0011 |
| ID_CODE | 0000_0100 |
| EXTEST_PULSE | 0000_0101 |
| EXTEST_TRAIN | 0000_0110 |
| AC_EXTEST | 0000_0111 |
| PROG_HYST | 0000_1000 |
| BYPASS | 1111_1111 |

The 88X2242 device reserves 5 pins called the Test Access Port (TAP) to provide test access: Test Mode Select Input (TMS), Test Clock Input (TCK), Test Data Input (TDI), and Test Data Output (TDO), and Test Reset Input (TRSTn). To ensure race-free operation all input and output data is synchronous with the test clock (TCK). TAP input signals (TMS and TDI) are clocked into the test logic on the rising edge of TCK while output signal (TDO) is clocked on the falling edge. For additional details, refer to the IEEE 1149.1 Boundary Scan Architecture document.

3.10.1 BYPASS Instruction

The BYPASS instruction uses the bypass register. This register contains a single shift-register stage and is used to provide a minimum length serial path between the TDI and TDO pins of the 88X2242 device when test operation is not required. This arrangement allows rapid movement of test data to and from other testable devices in the system.

3.10.2 SAMPLE/PRELOAD Instruction

The SAMPLE/PRELOAD instruction enables scanning of the boundary-scan register without causing interference to the normal operation of the 88X2242 device. Two functions are performed when this instruction is selected: sample and preload.

Sample allows a snapshot to be taken of the data flowing from the system pins to the on-chip test logic or vice versa, without interfering with normal operation. The snapshot is taken on the rising edge of TCK in the Capture-DR controller state, and the data can be viewed by shifting through the component's TDO output.

While sampling and shifting data out through TDO for observation, preload enables an initial data pattern to be shifted in through TDI and to be placed at the latched parallel output of the boundary-scan register cells that are connected to system output pins. This step ensures that known data is driven through the system output pins upon entering the extest instruction. Without preload, indeterminate data would be driven until the first scan sequence is complete. The shifting of data for the sample and preload phases can occur simultaneously. While data capture is being shifted out, the preload data can be shifted in.

The boundary scan register for MIN[7] is closest to TDO.

Table 44 lists the boundary scan order where:

TDI → INTn → ... → MIN[7] → TDO

Table 44: Boundary Scan Chain Order

| Order | Ball | Type |
|-------|---------------|---------------|
| 1 | MIN[7] | AC Input |
| 2 | MIP[7] | AC Input |
| 3 | MOP[7]/MON[7] | AC Output |
| 4 | MOP[7]/MON[7] | AC/DC Select |
| 5 | MIN[3] | AC Input |
| 6 | MIP[3] | AC Input |
| 7 | MOP[3]/MON[3] | AC Output |
| 8 | MOP[3]/MON[3] | AC/DC Select |
| 9 | NIN[3] | AC Input |
| 10 | NIP[3] | AC Input |
| 11 | NOP[3]/NON[3] | AC Output |
| 12 | NOP[3]/NON[3] | AC/DC Select |
| 13 | LED0[3] | Input |
| 14 | LED0[3] | Output |
| 15 | LED0[3] | Output Enable |
| 16 | LED1[3] | Input |
| 17 | LED1[3] | Output |
| 18 | LED1[3] | Output Enable |
| 19 | MPC[3] | Input |
| 20 | MPC[3] | Output |
| 21 | MPC[3] | Output Enable |
| 22 | TOD[3] | Input |
| 23 | TOD[3] | Output |
| 24 | TOD[3] | Output Enable |
| 25 | TX_DISABLE[3] | Input |
| 26 | TX_DISABLE[3] | Output |
| 27 | TX_DISABLE[3] | Output Enable |
| 28 | MOD_ABS[3] | Input |
| 29 | MOD_ABS[3] | Output |
| 30 | MOD_ABS[3] | Output Enable |
| 31 | TX_FAULT[3] | Input |

Table 44: Boundary Scan Chain Order (Continued)

| Order | Ball | Type |
|-------|---------------|---------------|
| 32 | TX_FAULT[3] | Output |
| 33 | TX_FAULT[3] | Output Enable |
| 34 | LOS[3] | Input |
| 35 | LOS[3] | Output |
| 36 | LOS[3] | Output Enable |
| 37 | GPIO[3] | Input |
| 38 | GPIO[3] | Output |
| 39 | GPIO[3] | Output Enable |
| 40 | SCL[3] | Input |
| 41 | SCL[3] | Output |
| 42 | SCL[3] | Output Enable |
| 43 | SDA[3] | Input |
| 44 | SDA[3] | Output |
| 45 | SDA[3] | Output Enable |
| 46 | MIN[6] | AC Input |
| 47 | MIP[6] | AC Input |
| 48 | MOP[6]/MON[6] | AC Output |
| 49 | MOP[6]/MON[6] | AC/DC Select |
| 50 | MIN[2] | AC Input |
| 51 | MIP[2] | AC Input |
| 52 | MOP[2]/MON[2] | AC Output |
| 53 | MOP[2]/MON[2] | AC/DC Select |
| 54 | NIN[2] | AC Input |
| 55 | NIP[2] | AC Input |
| 56 | NOP[2]/NON[2] | AC Output |
| 57 | NOP[2]/NON[2] | AC/DC Select |
| 58 | LED0[2] | Input |
| 59 | LED0[2] | Output |
| 60 | LED0[2] | Output Enable |
| 61 | LED1[2] | Input |
| 62 | LED1[2] | Output |
| 63 | LED1[2] | Output Enable |
| 64 | MPC[2] | Input |
| 65 | MPC[2] | Output |
| 66 | MPC[2] | Output Enable |
| 67 | TOD[2] | Input |
| 68 | TOD[2] | Output |
| 69 | TOD[2] | Output Enable |
| 70 | TX_DISABLE[2] | Input |
| 71 | TX_DISABLE[2] | Output |

Table 44: Boundary Scan Chain Order (Continued)

| Order | Ball | Type |
|-------|---------------|---------------|
| 72 | TX_DISABLE[2] | Output Enable |
| 73 | MOD_ABS[2] | Input |
| 74 | MOD_ABS[2] | Output |
| 75 | MOD_ABS[2] | Output Enable |
| 76 | TX_FAULT[2] | Input |
| 77 | TX_FAULT[2] | Output |
| 78 | TX_FAULT[2] | Output Enable |
| 79 | LOS[2] | Input |
| 80 | LOS[2] | Output |
| 81 | LOS[2] | Output Enable |
| 82 | GPIO[2] | Input |
| 83 | GPIO[2] | Output |
| 84 | GPIO[2] | Output Enable |
| 85 | SCL[2] | Input |
| 86 | SCL[2] | Output |
| 87 | SCL[2] | Output Enable |
| 88 | SDA[2] | Input |
| 89 | SDA[2] | Output |
| 90 | SDA[2] | Output Enable |
| 91 | MIN[5] | AC Input |
| 92 | MIP[5] | AC Input |
| 93 | MOP[5]/MON[5] | AC Output |
| 94 | MOP[5]/MON[5] | AC/DC Select |
| 95 | MIN[1] | AC Input |
| 96 | MIP[1] | AC Input |
| 97 | MOP[1]/MON[1] | AC Output |
| 98 | MOP[1]/MON[1] | AC/DC Select |
| 99 | NIN[1] | AC Input |
| 100 | NIP[1] | AC Input |
| 101 | NOP[1]/NON[1] | AC Output |
| 102 | NOP[1]/NON[1] | AC/DC Select |
| 103 | LED0[1] | Input |
| 104 | LED0[1] | Output |
| 105 | LED0[1] | Output Enable |
| 106 | LED1[1] | Input |
| 107 | LED1[1] | Output |
| 108 | LED1[1] | Output Enable |
| 109 | MPC[1] | Input |
| 110 | MPC[1] | Output |
| 111 | MPC[1] | Output Enable |

Table 44: Boundary Scan Chain Order (Continued)

| Order | Ball | Type |
|-------|---------------|---------------|
| 112 | TOD[1] | Input |
| 113 | TOD[1] | Output |
| 114 | TOD[1] | Output Enable |
| 115 | TX_DISABLE[1] | Input |
| 116 | TX_DISABLE[1] | Output |
| 117 | TX_DISABLE[1] | Output Enable |
| 118 | MOD_ABS[1] | Input |
| 119 | MOD_ABS[1] | Output |
| 120 | MOD_ABS[1] | Output Enable |
| 121 | TX_FAULT[1] | Input |
| 122 | TX_FAULT[1] | Output |
| 123 | TX_FAULT[1] | Output Enable |
| 124 | LOS[1] | Input |
| 125 | LOS[1] | Output |
| 126 | LOS[1] | Output Enable |
| 127 | GPIO[1] | Input |
| 128 | GPIO[1] | Output |
| 129 | GPIO[1] | Output Enable |
| 130 | SCL[1] | Input |
| 131 | SCL[1] | Output |
| 132 | SCL[1] | Output Enable |
| 133 | SDA[1] | Input |
| 134 | SDA[1] | Output |
| 135 | SDA[1] | Output Enable |
| 136 | MIN[4] | AC Input |
| 137 | MIP[4] | AC Input |
| 138 | MOP[4]/MON[4] | AC Output |
| 139 | MOP[4]/MON[4] | AC/DC Select |
| 140 | MIN[0] | AC Input |
| 141 | MIP[0] | AC Input |
| 142 | MOP[0]/MON[0] | AC Output |
| 143 | MOP[0]/MON[0] | AC/DC Select |
| 144 | NIN[0] | AC Input |
| 145 | NIP[0] | AC Input |
| 146 | NOP[0]/NON[0] | AC Output |
| 147 | NOP[0]/NON[0] | AC/DC Select |
| 148 | LED0[0] | Input |
| 149 | LED0[0] | Output |
| 150 | LED0[0] | Output Enable |
| 151 | LED1[0] | Input |

Table 44: Boundary Scan Chain Order (Continued)

| Order | Ball | Type |
|-------|---------------|---------------|
| 152 | LED1[0] | Output |
| 153 | LED1[0] | Output Enable |
| 154 | MPC[0] | Input |
| 155 | MPC[0] | Output |
| 156 | MPC[0] | Output Enable |
| 157 | TOD[0] | Input |
| 158 | TOD[0] | Output |
| 159 | TOD[0] | Output Enable |
| 160 | TX_DISABLE[0] | Input |
| 161 | TX_DISABLE[0] | Output |
| 162 | TX_DISABLE[0] | Output Enable |
| 163 | MOD_ABS[0] | Input |
| 164 | MOD_ABS[0] | Output |
| 165 | MOD_ABS[0] | Output Enable |
| 166 | TX_FAULT[0] | Input |
| 167 | TX_FAULT[0] | Output |
| 168 | TX_FAULT[0] | Output Enable |
| 169 | LOS[0] | Input |
| 170 | LOS[0] | Output |
| 171 | LOS[0] | Output Enable |
| 172 | GPIO[0] | Input |
| 173 | GPIO[0] | Output |
| 174 | GPIO[0] | Output Enable |
| 175 | SCL[0] | Input |
| 176 | SCL[0] | Output |
| 177 | SCL[0] | Output Enable |
| 178 | SDA[0] | Input |
| 179 | SDA[0] | Output |
| 180 | SDA[0] | Output Enable |
| 181 | CONFIG[0] | Input |
| 182 | CONFIG[1] | Input |
| 183 | CONFIG[2] | Input |
| 184 | CONFIG[3] | Input |
| 185 | RCLK0 | Output |
| 186 | RCLK0 | Output Enable |
| 187 | RCLK1 | Output |
| 188 | RCLK1 | Output Enable |
| 189 | FREQ_SEL[0] | Input |
| 190 | FREQ_SEL[1] | Input |
| 191 | RESETn | Input |

Table 44: Boundary Scan Chain Order (Continued)

| Order | Ball | Type |
|-------|------|---------------|
| 192 | MDC | Input |
| 193 | MDIO | Input |
| 194 | MDIO | Output |
| 195 | MDIO | Output Enable |
| 196 | INTn | Output |
| 197 | INTn | Output Enable |

3.10.3 EXTEST Instruction

The EXTEST instruction enables circuitry external to the 88X2242 device (typically the board interconnections) to be tested. Prior to executing the EXTEST instruction, the first test stimulus to be applied is shifted into the boundary-scan registers using the sample/preload instruction. Thus, when the change to the extest instruction takes place, known data is driven immediately from the 88X2242 to its external connections. Note that the SERDES output pins will be driven to static levels. The positive and negative legs of the SERDES output pins are controlled via a single boundary scan cell. The positive leg outputs the level specified by the boundary scan cell while the negative leg outputs the opposite level.

3.10.4 CLAMP Instruction

The CLAMP instruction enables the state of the signals driven from component pins to be determined from the boundary-scan register while the bypass register is selected as the serial path between TDI and TDO. The signals driven from the component pins do not change while the clamp instruction is selected.

3.10.5 HIGH-Z Instruction

The HIGH-Z instruction places all of the digital component system logic outputs in an inactive high-impedance drive state. In this state, an in-circuit test system may drive signals onto the connections normally driven by a component output without incurring the risk of damage to the component.



Note

The SERDES outputs cannot be tri-stated.

3.10.6 ID CODE Instruction

The ID CODE contains the manufacturer identity, part and version.

Table 45: ID CODE Instruction

| Version | Part Number | Manufacturer Identity | Bit |
|--------------|------------------|-----------------------|-------|
| Bit 31 to 28 | Bit 27 to 12 | Bit 11 to 1 | Bit 0 |
| 0000 | 0000000000110001 | 00111101001 | 1 |

3.10.7 EXTEST_PULSE Instruction

When the AC/DC select is set to DC, the EXTEST_PULSE instruction has the same behavior as the EXTEST instruction.

When the AC/DC select is set to AC, the EXTEST_PULSE instruction has the same behavior as the EXTEST instruction except for the behavior of the SERDES output pins.

As in the EXTEST instruction, the test stimulus must first be shifted into the boundary-scan registers. Upon the execution of the EXTEST_PULSE instruction the SERDES positive output pins output the level specified by the test stimulus and SERDES negative output pins output the opposite level.

However, if the TAP controller enters into the Run-Test/Idle state the SERDES positive output pins output the inverted level specified by the test stimulus and SERDES negative output pins output the opposite level.

When the TAP controller exits the Run-Test/Idle state, the SERDES positive output pins again output the level specified by the test stimulus and SERDES negative output pins output the opposite level.

3.10.8 EXTEST_TRAIN Instruction

When the AC/DC select is set to DC, the EXTEST_TRAIN instruction has the same behavior as the EXTEST instruction.

When the AC/DC select is set to AC, the EXTEST_TRAIN instruction has the same behavior as the EXTEST instruction except for the behavior of the SERDES output pins.

As in the EXTEST instruction, the test stimulus must first be shifted into the boundary-scan registers. Upon execution of the EXTEST_PULSE instruction, the SERDES positive output pins output the level specified by the test stimulus and SERDES negative output pins output the opposite level.

However, if the TAP controller enters into the Run-Test/Idle state, the SERDES output pins will toggle between inverted and non-inverted levels on the falling edge of TCK. This toggling will continue for as long as the TAP controller remains in the Run-Test/Idle state.

When the TAP controller exits the Run-Test/Idle state, the SERDES positive output pins again output the level specified by the test stimulus and SERDES negative output pins output the opposite level.

3.10.9 AC-JTAG Fault Detection

The fault detection across AC coupled connections can be detected with a combination of (DC) EXTEST and any one of the AC JTAG commands. The AC coupled connection is shown in [Figure 20](#). The fault signature is shown in [Table 46](#).

- Column 1 lists the fault type.
- Columns 2 to 5 list the behavior when both the transmitter and receiver are running the EXTEST_TRAIN and EXTEST_PULSE commands.
 - Column 2 shows the expected value captured by the boundary scan cell that is connected to the test receiver, which is connected to the positive input when a negative differential pulse is transmitted.
 - Column 3 is the same as column 2 except for the negative input.
 - Columns 4 and 5 are similar to columns 2 and 3 except a positive differential pulse is transmitted.
- Columns 6 to 9 is similar to columns 2 to 5 except both the transmitter and receiver are running the (DC) EXTEST command.

While it is not possible to identify precisely which fault is occurring based on the fault signature, the signature to the no fault condition is unique when the (DC) EXTEST command is run with at least 1 of the EXTEST_TRAIN, or EXTEST_PULSE commands. Note that running only AC JTAG commands is not sufficient since the no fault condition signature is not distinguishable from the Tx to Rx short (see shaded cells in Table 46).

Figure 20: AC Coupled Connection

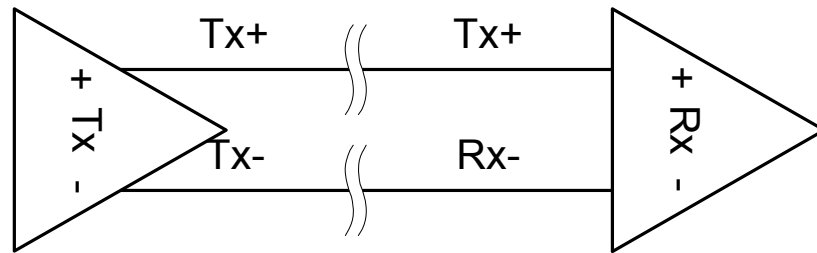


Table 46 provides details about the positive/negative legs for AC testing samples and (DC) EXTEST samples. In Table 46, the positive leg column is identified as +, and the negative leg column is identified as –.

Table 46: AC Coupled Connection Fault Signature

| DC Coupled Fault | AC Testing Sample 0 | | AC Testing Sample 1 | | (DC) EXTEST Sample 0 | | (DC) EXTEST Sample 1 | |
|---------------------|---------------------|----------|---------------------|----------|----------------------|---|----------------------|---|
| | + | - | + | - | + | - | + | - |
| Tx+ Open | 0 | X | 0 | X | 1 | X | 1 | X |
| Tx- Open | X | 0 | X | 0 | X | 1 | X | 1 |
| Rx+ Open | 0 | X | 0 | X | 1 | X | 1 | X |
| Rx- Open | X | 0 | X | 0 | X | 1 | X | 1 |
| Tx+ short to power | 0/Note 2 | X | 0/Note 2 | X | 1 | X | 1 | X |
| Tx- short to power | X | 0/Note 2 | X | 0/Note 2 | X | 1 | X | 1 |
| Rx+ short to power | 0/Note 2 | X | 0/Note 2 | X | 1 | X | 1 | X |
| Rx- short to power | X | 0/Note 2 | X | 0/Note 2 | X | 1 | X | 1 |
| Tx+ short to ground | 0 | X | 0 | X | 1 | X | 1 | X |
| Tx- short to ground | X | 0 | X | 0 | X | 1 | X | 1 |
| Rx+ short to ground | 0 | X | 0 | X | 0 | X | 0 | X |
| Rx- short to ground | X | 0 | X | 0 | X | 0 | X | 0 |
| Tx+ short to Tx- | Note 1 | Note 1 | Note 1 | Note 1 | 1 | 1 | 1 | 1 |
| Rx+ short to Rx- | Note 1 | Note 1 | Note 1 | Note 1 | 1 | 1 | 1 | 1 |
| Tx+ short to Rx- | X | 0 | X | 1 | X | 0 | X | 1 |
| Tx- short to Rx+ | 1 | X | 0 | X | 1 | X | 0 | X |

NOTES:

1. Short on positive and negative leg can have several behavior on the test receiver. If both drivers cancel each other out then output on both legs is 0. If one driver dominates the other then both legs are either both 1 or both 0. In any case, the result is that both legs will have same value.
2. A solid short to power is assumed. If the short has high inductance then a pulse may still be sent at the receiver and will be mistaken as a good connection.

Table 46: AC Coupled Connection Fault Signature (Continued)

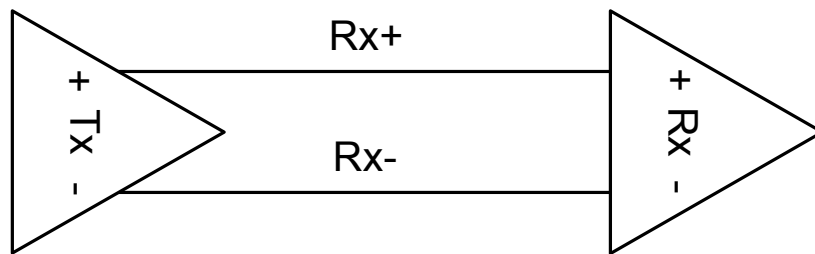
| DC Coupled Fault | AC Testing Sample 0 | | AC Testing Sample 1 | | (DC) EXTEST Sample 0 | | (DC) EXTEST Sample 1 | |
|------------------|---------------------|---|---------------------|---|----------------------|---|----------------------|---|
| | + | - | + | - | + | - | + | - |
| Tx+ short to Rx+ | 0 | X | 1 | X | 0 | X | 1 | X |
| Tx- short to Rx- | X | 1 | X | 0 | X | 1 | X | 0 |
| No Fault | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |

NOTES:

- Short on positive and negative leg can have several behavior on the test receiver. If both drivers cancel each other out then output on both legs is 0. If one driver dominates the other then both legs are either both 1 or both 0. In any case, the result is that both legs will have same value.
- A solid short to power is assumed. If the short has high inductance then a pulse may still be sent at the receiver and will be mistaken as a good connection.

The fault detection across DC coupled connections can be detected with any one of the AC JTAG or (DC) EXTEST commands. The DC coupled connection is shown in [Figure 21](#). The fault signature is shown in [Table 47](#).

Figure 21: DC Coupled Connection



In [Table 47](#), the positive leg column is identified as +, and the negative leg column is identified as -.

Table 47: DC Coupled Connection Fault Signature

| DC Coupled Fault | AC Testing Sample 0 | | AC Testing Sample 1 | | (DC) EXTEST Sample 0 | | (DC) EXTEST Sample 1 | |
|---------------------|---------------------|----------|---------------------|----------|----------------------|---|----------------------|---|
| | + | - | + | - | + | - | + | - |
| Rx+ Open | 0 | X | 0 | X | 1 | X | 1 | X |
| Rx- Open | X | 0 | X | 0 | X | 1 | X | 1 |
| Rx+ short to power | 0/Note 2 | X | 0/Note 2 | X | 1 | X | 1 | X |
| Rx- short to power | X | 0/Note 2 | X | 0/Note 2 | X | 1 | X | 1 |
| Rx+ short to ground | 0 | X | 0 | X | 0 | X | 0 | X |
| Rx- short to ground | X | 0 | X | 0 | X | 0 | X | 0 |

NOTES:

- Short on positive and negative leg can have several behaviors on the test receiver. If both drivers cancel each other out then output on both legs is 0. If one driver dominates the other then both legs are either both 1 or both 0. In any case, the result is that both legs will have same value.
- A solid short to power is assumed. If the short has high inductance then a pulse may still be sent at the receiver and will be mistaken as a good connection.

Table 47: DC Coupled Connection Fault Signature (Continued)

| DC Coupled Fault | AC Testing Sample 0 | | AC Testing Sample 1 | | (DC) EXTEST Sample 0 | | (DC) EXTEST Sample 1 | |
|------------------|---------------------|--------|---------------------|--------|----------------------|--------|----------------------|--------|
| | + | - | + | - | + | - | + | - |
| Rx+ short to Rx- | Note 1 | Note 1 | Note 1 | Note 1 | Note 1 | Note 1 | Note 1 | Note 1 |
| No Fault | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 |

NOTES:

1. Short on positive and negative leg can have several behaviors on the test receiver. If both drivers cancel each other out then output on both legs is 0. If one driver dominates the other then both legs are either both 1 or both 0. In any case, the result is that both legs will have same value.
2. A solid short to power is assumed. If the short has high inductance then a pulse may still be sent at the receiver and will be mistaken as a good connection.

3.11 Reference Clock

An external oscillator provides a reference for the on-board transmit Phase Lock Loop (PLL) and clock generation block that provides internal clocks for both the transmit and receive data paths. The clock input pins are CLKP/CLKN.

CLKP/CLKN runs on a 156.25 MHz differential clock. The FREQ_SEL[1:0] should be set to 00.

3.12 Power Supplies

The 88X2242 device requires 3 power supplies: 1.5V (analog), 1.1V (analog), and 1.0V (digital).

If 1.2V, 1.8V, 2.5V, or 3.3V I/Os are required, then additional supplies will be required.

3.12.1 AVDD15

AVDD15_N and AVDD15_M are the 1.5V analog supplies.

3.12.2 AVDD11

AVDD11_N is the 1.1V analog supply.

3.12.3 AVDD10

AVDD10_M is the 1.0V analog supply.

3.12.4 DVDD

DVDD is the core logic 1.0V digital supply.

3.12.5 VDDO

There are 4 separate VDDO segments (VDDOT, VDDOS, VDDOL, and VDDOM). Each segment can be independently set to 1 for the following voltages: 1.2V, 1.5V, 1.8V, 2.5V, or 3.3V. Each VDDO segment has a corresponding voltage select configuration pin (VSEL_T, VSEL_S, VSEL_L, and VSEL_M). [Table 48](#) lists the signals under each of the VDDO segments.

If the VDDO* segment is set to 1.2V, 1.5V, or 1.8V, then its corresponding VSEL_* should be tied to VDDO*.

If the VDDO* segment is set to 2.5V, or 3.3V, then its corresponding VSEL_* should tied to VSS.

The input pins are not high voltage tolerant. For example, if VDDOT is tied to 2.5V, then RESETn should not be driven to 3.3V.

Table 48: Signal Power Segment

| Power Segment | VDDOT | VDDOS | VDDOL | VDDOM |
|----------------|---------------|-----------------|-------------|--------|
| Voltage Select | VSEL_T | VSEL_S | VSEL_L | VSEL_M |
| Signals | FREQ_SEL[1:0] | LOS[3:0] | CONFIG[3:0] | INTn |
| | RESETn | MOD_ABS[3:0] | TOD[3:0] | MDC |
| | TCK | MPC[3:0] | GPIO[3:0] | MDIO |
| | TDI | SCL[3:0] | LED0[3:0] | |
| | TDO | SDA[3:0] | LED1[3:0] | |
| | TEST | TX_DISABLE[3:0] | | |
| | TMS | TX_FAULT[3:0] | | |
| | TRST | | | |

4 Line Side Description

This section includes information on the following topics:

- [Section 4.1, Media Electrical Interface](#)
- [Section 4.2, PCS](#)
- [Section 4.3, Loopback](#)
- [Section 4.4, Synchronization FIFO](#)
- [Section 4.5, Power Management](#)
- [Section 4.6, Traffic Generation and Checking](#)
- [Section 4.7, PRBS and Pattern Generators](#)
- [Section 4.8, Interrupt](#)

The line side interface is comprised of 4 differential input lanes NIP[3:0] / NIN[3:0] and 4 differential output lanes NOP[3:0] / NON[3:0]. They can operate over multi-mode fiber, single mode fiber, and Twinax copper cables. The DSP engine overcomes the impairments of the fiber cable, optical front end, and electrical interconnect. In this document, each set of input / output lanes is referred to as lane N0, N1, N2, and N3.

These lanes can be arranged to form 4-ports of 1000BASE-X, 10GBASE-R, and 1-port of 40GBASE-R4.

4.1 Media Electrical Interface

The input and output buffers of the SERDES interface are internally terminated by 50Ω impedance (100Ω differential). No external terminations are required.

The SERDES transmitter uses a 3 tap (1 pre-tap and 1 post-tap) FIR filter that is implemented for the purpose of channel equalization. The FIR tap values can be manually adjusted to optimize the transmit eye over a particular channel.

The SERDES receiver contains a DSP based Electronic Dispersion Compensation engine to perform clock and data recovery that significantly exceed the receiver performance specified by the 10GBASE-LRM standard. Advanced algorithms enables operation over multi-mode fiber.

The Electronic Dispersion Compensation can be disabled when not needed to trade performance vs. power and latency.

4.2 PCS

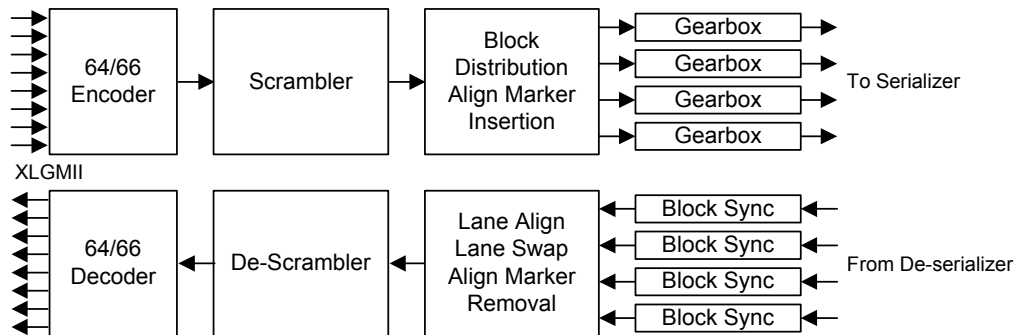
Each port supports a multiple number of different PCS. [Section 3.1.2, PCS Operational Mode and Lane Attachment, on page 44](#) describes how to configure each port for the various PCS. This section focuses on the PCS itself.

4.2.1 40GBASE-R4

The 40GBASE-R4 PCS is available only on port 0. Lanes N0 to N3 correspond to lanes 0 to 3 of the PCS. It is enabled by setting register 31.F002.14:8 to 0x70.

The 40GBASE-R4 PCS operates according to Clause 82 and 83 of the IEEE 802.3ba specification. The PCS uses a 64B/66B coding and scrambling to improve the transmission characteristics of the serial data and ease clock recovery at the receiver. The data stream is distributed across 4 lanes. The alignment markers allows the lanes to be aligned and lanes to be swapped at the receiver. The synchronization headers for 64B/66B code enable the receiver to achieve block alignment on the receive data. For further details refer to the IEEE 802.3ba specification.

Figure 22: 40GBASE-R4 PCS

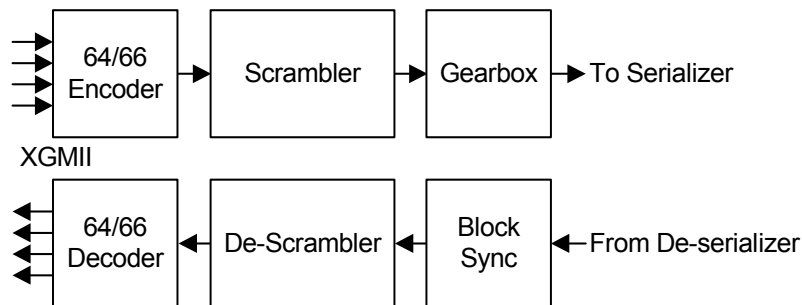


4.2.2 10GBASE-R

The 10GBASE-R PCS is available on all ports. Lanes N0 through N3 are used by port 0 through 3 respectively. It is enabled by setting register 31.F002.14:8 to 0x71.

The 10GBASE-R PCS operates according to Clause 49 of the IEEE 802.3ae specification. The PCS uses a 64B/66B coding and scrambling to improve the transmission characteristics of the serial data and ease clock recovery at the receiver. The synchronization headers for 64B/66B code enable the receiver to achieve block alignment on the receive data. For further details refer to the IEEE 802.3 specification.

Figure 23: 10GBASE-R PCS



4.2.3 1000BASE-X

The 1000BASE-X PCS is available on all ports. Lanes N0 through N3 are used by port 0 through 3 respectively. There are several modes of 1000BASE-X. It is enabled by setting register 31.F002.14:8 to 1 for the following values.

- 0x7A = 1000BASE-X, 1000BASE-X Auto-Negotiation off

- 0x7B = 1000BASE-X, 1000BASE-X Auto-Negotiation on
- 0x7C = SGMII (system), SGMII Auto-Negotiation off
- 0x7D = SGMII (system), SGMII Auto-Negotiation on
- 0x7E = SGMII (media), SGMII Auto-Negotiation off
- 0x7F = SGMII (media), SGMII Auto-Negotiation on

4.2.3.1 PCS

The 1000BASE-X PCS operates according to Clause 36 of the IEEE 802.3 specification. The PCS uses a 8/10 bit coding for DC line balancing. For further details refer to the IEEE 802.3 specification.

The SGMII protocol is also supported over 1000BASE-X. The SGMII allows 10 Mbps, 100 Mbps, and 1000 Mbps throughput over 1000BASE-X line coding.

When SGMII Auto-Negotiation is turned off (3.2000.12 = 0) the speed setting is programmed via register 3.2000 bits 13 and 6. Link is established when the underlying 1000BASE-X establishes link.

When SGMII Auto-Negotiation is turned on (3.2000.12 = 1) and the SGMII is set to the media side the speed setting is programmed via register 3.2000 bits 13 and 6. This speed capability is advertised and Auto-Negotiations have to complete prior to link being established.

When SGMII Auto-Negotiation is turned on (3.2000.12 = 1) and the SGMII is set to the system side the speed setting is determined by the Auto-Negotiation speed advertised by the link partner. Auto-Negotiations must be complete prior to link being established.

Although register 31.F002.14:8 can set the Auto-Negotiation to be on or off, that setting can be overridden by writing register 3.2000.12.

The SGMII mode is intended to be operated in pairs. In general the port on the line side will be set to SGMII system while the attached port on the host side set to SGMII media, though it is possible to reverse this. If SGMII Auto-Negotiation is turned on, the Auto-Negotiation results on the SGMII system on the line side will be passed to the SGMII media on the host side which will in turn advertise the results.

4.2.3.2 1000BASE-X Auto-Negotiation

1000BASE-X Auto-Negotiation is defined in Clause 37 of the IEEE 802.3 specification. It is used to auto-negotiate duplex and flow control over fiber cable. Registers 3.2000, 3.2004, 3.2005, 3.2006, 3.2007, 3.2008, and 3.200F are used to enable AN, advertise capabilities, determine link partner's capabilities, show AN status, and show the duplex mode of operation respectively.

The device supports Next Page option for 1000BASE-X Auto-Negotiation. Register 3.2007 of the fiber pages is used to transmit Next Pages, and register 3.2008 of the fiber pages is used to store the received Next Pages. The Next Page exchange occurs with software intervention. The user must set Register 3.2004.15 to enable fiber Next Page exchange. Each Next Page received in the registers should be read before a new Next Page to be transmitted is loaded in Register 3.2007.

If the PHY enables 1000BASE-X Auto-Negotiation and the link partner does not, the link cannot be established. The device implements an Auto-Negotiation bypass mode. For more details, see [Section 4.2.3.4, Auto-Negotiation Bypass Mode, on page 90](#).

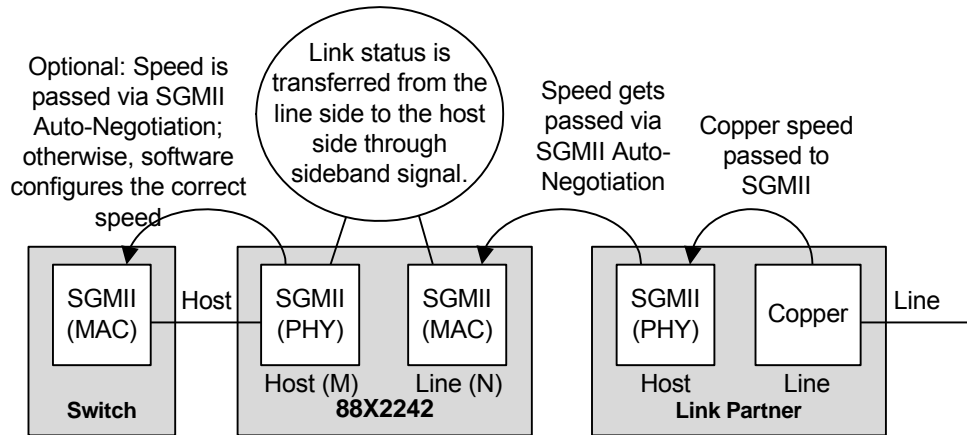
4.2.3.3 SGMII Auto-Negotiation

SGMII is a de-facto standard designed by Cisco. SGMII uses 1000BASE-X coding to send data as well as Auto-Negotiation information between the PHY and the MAC. However, the contents of the SGMII Auto-Negotiation are different than the 1000BASE-X Auto-Negotiation. See the "Cisco SGMII Specification" and the "MAC Interfaces and Auto-Negotiation" application note for further details.

The device supports SGMII with and without Auto-Negotiation. Auto-Negotiation can be enabled or disabled by writing to Register 3.2000.12 followed by a soft reset. If SGMII Auto-Negotiation is disabled, the MAC interface link, speed, and duplex status (determined by the media side) cannot be conveyed to the MAC from the PHY. The user must program the MAC with this information in some other way (for example, by reading PHY registers for link, speed, and duplex status).

The SGMII Auto-Negotiation information flow is shown in [Figure 24](#).

Figure 24: SGMII Auto-Negotiation Information Flow



4.2.3.4 Auto-Negotiation Bypass Mode

If the MAC or the PHY implements the Auto-Negotiation function and the link partner does not, two-way communication is not possible unless Auto-Negotiation is manually disabled and both sides are configured to work in the same operational modes. To solve this problem, the device implements the SGMII Auto-Negotiation Bypass Mode. When entering the state "Ability_Detect", a bypass timer begins to count down from an initial value of approximately 200 ms. If the device receives idles during that 200 ms, the device will interpret that the other side is "alive" but cannot send configuration codes to perform Auto-Negotiation. After the 200 ms timeframe, the state machine will move to a new state called "Bypass_Link_Up" in which the device assumes a link-up status and the operational mode is set to the value listed under the Comments column of [Table 49](#).

Table 49: SGMII Auto-Negotiation Modes

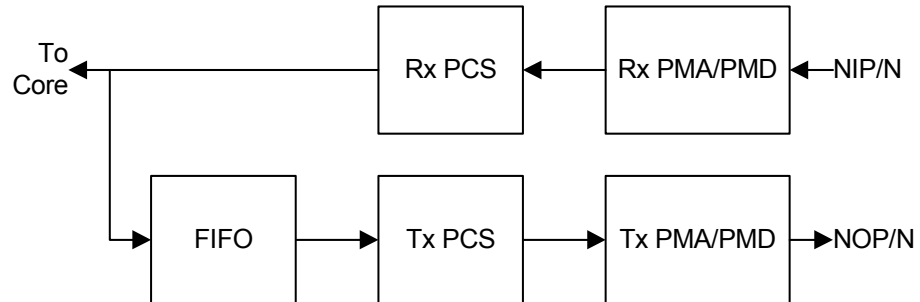
| Reg. 3.2000.12 | Reg. 3.A000.13 | Comments |
|----------------|----------------|--|
| 0 | X | No Auto-Negotiation. User responsible for determining speed, link, and duplex status by reading PHY registers. |
| 1 | 0 | Normal SGMII Auto-Negotiation. Speed, link, and duplex status automatically communicated to the MAC during Auto-Negotiation. |
| 1 | 1 | MAC Auto-Negotiation enabled. Normal operation. |
| | | MAC Auto-Negotiation disabled. After 200 ms the PHY will disable Auto-Negotiation and link based on idles. |

4.3 Loopback

The line side SERDES support 2 loopback paths.

If register 3.F003.12 = 1 then data from the line will loopback to the line as shown in [Figure 25](#).

Figure 25: Shallow Line Loopback



Registers 2.0000.14, 3.0000.14, 3.1000.14, 3.2000.14, and 3.3000.14 are physically the same bit. If any of these bits are set to 1 then data from the core will loopback to the core as shown in [Figure 26](#) and [Figure 27](#). If register 3.F003.6 = 0 then the egress path will not be blocked as shown in [Figure 26](#). If register 3.F003.6 = 1 then the egress path will be blocked as shown in [Figure 27](#).

Figure 26: Deep Host Loopback, No Egress Blocking

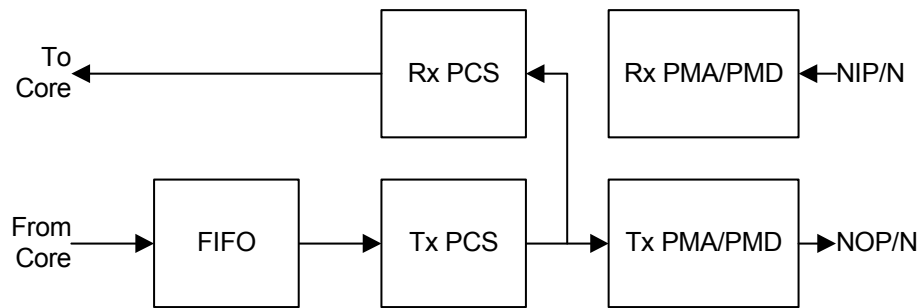
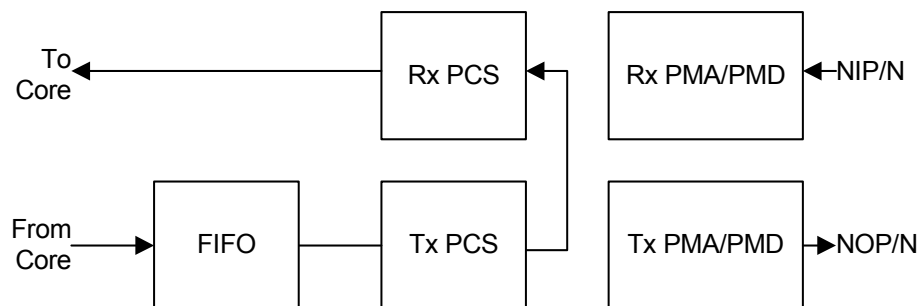


Figure 27: Deep Host Loopback, Egress Blocking



4.4 Synchronization FIFO

Each port has a transmit synchronizing FIFOs to reconcile frequency differences between the clocks of the internal bus and the clock used to transmit data onto the media interface. The depth of the FIFO can be programmed by setting Register 3.F00C.15:14.

The FIFO depths can be increased in length to support longer frames. The device has settings for maximum frame sizes of 10K, 20K, 40K, and 80K bytes with up to ± 100 ppm clock jitter in 10 Gbps operation and 10K, 15K, 20K, and 25K bytes with up to ± 100 ppm clock jitter in 1 Gbps operation. The deeper the FIFO depth, the higher the latency will be.

The FIFO overflow/underflow status is reported in Register 3.F00B.1:0.

4.5 Power Management

The 88X2242 device will automatically power down unused circuits. The media side can be forced into a power down state by setting 1.0000.11, 2.0000.11, 3.0000.11, 3.1000.11, 3.2000.11, or 3.3000.11 to 1. Note that these power down registers are physically the same bit even though they reside in different locations. Port level register, 31.F003.14 can also be used to power down the media side. Since 31.0xF003.14 is physically a separate register bit, setting this bit won't be reflected into PCS power down bits mentioned above, but will override them.

To soft reset the media side set registers 1.0000.15, 2.0000.15, 3.0000.15, 3.1000.15, 3.2000.15, 3.3000.15, or 7.0000.15 to 1. Register 31.F003.15 can also be used to soft reset the media side. Note that these software reset registers are physically the same bit even though they reside in different locations.

4.6 Traffic Generation and Checking

This section describes the Generator/Checker functions. All counters are 48 bits long. If Register 3.F010.14 is set to 1, the counters clear on read. If Register 3.F010.14 is set to 0, the counters will keep counting until 3.F010.6 is set to 1 to clear the contents.

4.6.1 Packet Generator

A packet generator enables the device to generate traffic onto the media without the need to receive data from the host.

Register 3.F010.1 enables the internal packet generator.

Register 3.F016 specifies the number of bytes in the packet that is to be generated. This count includes the frame bytes but does not include the 4 byte CRC (unless it is appended - Register 3.F011.3 = 0), the terminate symbol, nor the 8 preamble bytes. If the register is set to 0x0000 then the length will be randomly selected between 64 to 1518 bytes. If the register is set to 0x0001 then the length will be randomly selected to be between 64 to 0x0FFF bytes, 0x0002 then 64 to 0x1FFF bytes, 0x0003 then 64 to 0x3FFF bytes, 0x0004 then 64 to 0x7FFF bytes, 0x0005 then 64 to 0xFFFF bytes. If 0x0008 to 0xFFFF then the number of bytes transmitted is fixed from 8 to 0xFFFF.

Register 3.F017 specifies the number of packets to burst. 0x0000 means stop generation, 0xFFFF means continuously generate packets, 0x0001 to 0xFFFFE means send a burst of 1 to 0xFFFFE packets.

Register 3.F018 specifies the gap between packets. Each increment in the value increases the idle time by 4 bytes. 3.F018.14:0 specifies the upper limit of the gap. If 3.F018.15 is 0 then the lower limit for IPG is also specified by 3.F018.14:0. Otherwise a random gap between 1 x 4 bytes to 3.F018.14:0 x 4 bytes will be used. For the purposes of counting IPG all lanes must be idle for it to be counted as an IPG. In other words if the terminate symbol is in the XGMII word then it does not count towards the IPG.

Register 3.F012 and 3.F013 specifies the initial value of the payload or the fixed value of the payload. The 4 bytes in this register corresponds to the first 4 bytes of the frame. Register 3.F011.7:4 specifies the behavior of the payload.

When 3.F011.7:4 = 000x then registers 3.F012 and 3.F013 are used as the payload repeatedly.

When 3.F011.7:4 = 0010 then registers 3.F012 and 3.F013 are used as the payload repeatedly but every other XGMII word should be inverted. That is, a payload of 034EA675 will result in a sequence of 034EA675, FCB1598A, 034EA675, FCB1598A,

When 3.F011.7:4 = 0011 then registers 3.F012 and 3.F013 are used as the payload repeatedly but inverted every second XGMII word. That is, a payload of 034EA675 will result in a sequence of 034EA675, 034EA675, FCB1598A, FCB1598A, 034EA675, 034EA675, FCB1598A, FCB1598A,

When 3.F011.7:4 = 0100 then registers 3.F012 and 3.F013 are used as the initial value and each byte subsequently bitwise left shifted. That is, a payload of 034EA675 will result in a sequence of 034EA675, 069C4DEA, 0C399AD5, 187235AB,

When 3.F011.7:4 = 0101 then registers 3.F012 and 3.F013 are used as the initial value and each byte subsequently bitwise right shifted.

When 3.F011.7:4 = 0110 then registers 3.F012 and 3.F013 are used as the initial value and the 32 bits subsequently bitwise left shifted. That is, a payload of C34EA675 will result in a sequence of C34EA675, 869D4CEB, 0D3A99D7, 1A7533AE,

When 3.F011.7:4 = 0111 then registers 3.F012 and 3.F013 are used as the initial value and the 32 bits subsequently bitwise right shifted.

When 3.F011.7:4 = 1000 then registers 3.F012 and 3.F013 are used as the initial value and subsequently byte-wise incremented. That is, a payload of FFFE0055 will result in a sequence of FFFE0055, 00FF0156, 01000257, 02010358,

When 3.F011.7:4 = 1001 then registers 3.F012 and 3.F013 are used as the initial value and subsequently byte-wise decremented.

When 3.F011.7:4 = 1010 then registers 3.F012 and 3.F013 are ignored and a pseudo random payload is generated. All 4 bytes are the same value for each cycle.

When 3.F011.7:4 = 1011 then registers 3.F012 and 3.F013 are ignored and a pseudo random payload is generated. All 4 bytes are randomly generated for each cycle.

At the start of each packet registers 3.F012 and 3.F013 should be used to reset the initial values to ensure that the pattern in the packet is the same when repeated over and over many times. The only time that the pattern in the packet will be different is when pseudo random generation is selected.

For each packet generated the 48 bit counter in 3.F01B, 3.F01C, and 3.F01D is incremented by 1.

For each byte generated the 48 bit counter in 3.F01E, 3.F01F, and 3.F020 is incremented by 1. Preamble bytes are not counted but CRC bytes are counted.

Register 3.F011.3 controls whether the CRC is generated or not.

4.6.2 Checker

The CRC checker is enabled by setting Register 3.F010.0 to 1.

If Register 3.F010.2 = 0, the checker will wait until the start of frame delimiter (SFD) is detected to detect the frame boundary.

If Register 3.F010.2 = 1, the checker will assume the first 8 bytes of the packet is the preamble and the frame starts at the ninth byte of the packet.

There are 3 sets of 48-bit counters for the checker.

- Registers 3.F021, 3.F022, 3.F023 is the receive packet counter.

- Register 3.F027, 3.F028, and 3.F029 is the receive packet error counter.
- Register 3.F024, 3.F025, and 3.F026 is the receive byte counter.

The receive packet counter counts the number of packets received regardless of whether there is a CRC error. The receive packet error counter increments once per packet with a CRC error. The byte counter counts the number of bytes in the frame including the CRC. The preamble bytes are not counted.

4.7 PRBS and Pattern Generators

The device supports various IEEE defined and proprietary PRBS generators and checkers, and transmit waveform pattern generators. Only 1 generator/checker may be enabled at a time per lane. Unpredictable results may occur if multiple generators are enabled simultaneously.

4.7.1 General PRBS Generators and Checkers

Each lane has its own general PRBS generator and checker. Port 0 registers controls lane 0, port 1 controls lane 1, port 2 controls lane 2, and port 3 controls lane 3.

Register 3.F030 controls the generator and checker. Setting register 3.F030.5 to 1 enables the generator, and setting register 3.F030.4 to 1 enables the checker. If either of these bits is set to 1, the general PRBS generator and checker overrides the PCS specific generators and checkers.

Register 3.F030.3:0 controls the pattern that is generated and checked. There is no checker for the high frequency, low frequency, mixed frequency, and square wave patterns as there are waveforms to check the transmitter performance.

0000 = IEEE 49.2.8 - PRBS 31

0001 = PRBS 7

0010 = PRBS 9 IEEE 83.7

0011 = PRBS 23

0100 = PRBS 31 Inverted

0101 = PRBS 7 Inverted

1000 = PRBS 15

1001 = PRBS 15 Inverted

0110 = PRBS 9 Inverted

0111 = PRBS 23 Inverted

1100 = High frequency pattern

1101 = Low frequency pattern

1110 = Mixed frequency pattern

1111 = Square Wave pattern

All counters are 48 bits long. If register 3.F030.13 is set to 1 then the counters will clear on read. If register 3.F030.13 is set to 0 then the counters will keep counting until register 3.F030.6 is set to 1 to clear the contents. If register 3.F030.7 is set to 0, then the PRBS counters will not start to count until the checker first locks onto the incoming PRBS data. If register 3.F030.7 is set to 1 then the PRBS checker will start counting errors without first locking to the incoming PRBS data. Register 3.F030.8 indicates whether the PRBS checker has locked.

All 48-bit counters are formed by 3 16-bit registers. The lowest addressed register is the least significant 16 bits and the highest addressed register is the most significant 16 bits of the counter. When the least significant register is read, the 2 upper registers are updated and frozen so that the 3 register read is atomic. Note that it is not necessary to read the upper registers. However, upon subsequent reads of the least significant register, the values of the upper registers from the previous reads are lost. In order to get the correct upper register value the least significant register must be read first.

Register 3.F031, 3.F032, and 3.F033 is the transmit bit counter. Register 3.F034, 3.F035, and 3.F036 is the receive bit counter. Register 3.F037, 3.F038, and 3.F039 is the receive bit error counter.

4.7.2 40GBASE-R4 Specific Generators and Checkers

Register 3.302A.7 is used to enable generation of scramble idle code.

4.7.3 10GBASE-R Specific Generators and Checkers

Registers 3.002A.4 and 3.002A.5 when set to 1 enables the PRBS31 generator and checker respectively. Register 3.002A.3 and 3.002A.2 when set to 1 enables the transmit and receive test patterns respectively. Register 3.002A.1 selects the test pattern. The error counter is in register 3.002B.15:0 and clears on read.

4.7.4 XAUI Specific Generators and Checkers

Register 3.9010.2:0 can select any of the 5 jitter patterns specified by IEEE 802.3.

000 = Jitter 48A.1 (high freq)

001 = Jitter 48A.2 (low freq)

010 = Jitter 48A.3 (mix freq)

100 = Jitter 48A.4 (CRPAT)

101 = Jitter 48A.5 (CJPAT)

The transmit jitter pattern is enabled by setting 3.9010.4 to 1.

The 48A.1, 48A.2, and 48A.3 transmit patterns can also be enabled by setting register 3.1019.2 to 1 and selecting the pattern via register 3.1019.1:0.

There is a checker to check the CRPAT and CJPAT patterns. This is enabled by setting 3.9010.5 to 1.

Register 3.9011 and 3.9012 forms a 32 bit counter that increments once for every CRPAT or CJPAT packet transmitted. Register 3.9013 and 3.9014 forms a 32 bit counter that increments once for every CRPAT or CJPAT packet received. Register 3.9015 and 3.9016 forms a 32 bit counter that increments once for every CRPAT or CJPAT packet received with error.

The lower addressed register is the least significant 16 bits and the higher addressed register is the most significant 16 bits of the counter. When the least significant register is read, the upper register is updated and frozen so that the 2 register read is atomic. The counters can be cleared only by setting register 3.9010.7 to 1.

4.8 Interrupt

The Line PCS supports several interrupts. The interrupt enable, interrupt status, and real time status are shown in [Table 50](#).

The INTn interrupt pin will be active if any of the events enabled in the interrupt enable register occurs. If an interrupt event corresponding to a disabled interrupt enable bit occurs, the corresponding interrupt status bit will be set even though the event does not activate the INTn pin. The interrupts are cleared after a read to the interrupt status register.

Table 50: Interrupt Registers

| Type | Interrupt Enable | Interrupt Status | Real Time Status |
|------------|------------------|------------------|------------------|
| 10GBASE-R | 3.8000 | 3.8001 | 3.8002 |
| 1000BASE-X | 3.A001 | 3.A002 | 3.A003 |
| 40GBASE-R4 | 3.B001 | 3.B002 | 3.B003 |
| Misc | 3.F00A | 3.F00B | |

5 Host Side Description

This section includes information on the following topics:

- [Section 5.1, Host Electrical Interface](#)
- [Section 5.2, PCS](#)
- [Section 5.3, Loopback](#)
- [Section 5.4, Synchronizing FIFO](#)
- [Section 5.5, Power Management](#)
- [Section 5.6, Traffic Generation and Checking](#)
- [Section 5.7, PRBS and Pattern Generators](#)
- [Section 5.8, Interrupt](#)

The host side interface is comprised of 8 differential input lanes MIP[7:0] / MIN[7:0] and 4 differential output lanes MOP[7:0] / MON[7:0]. They are designed to operate over short backplanes to the host device. In this document, each set of input / output lanes is referred to as lane M0, M1, M2, M3, M4, M5, M6, and M7.

These lanes can be arranged to form 4-ports of 1000BASE-X, 10GBASE-R, and RXAUI, 2-ports of XAUI, and 40GBASE-R4.

The host side can also be configured to support redundant switches as described in [Section 3.1.5, Host Side Lane Attachment, on page 46](#). In the redundant operation only 4 functional lanes are supported; hence, the lanes can be arranged to support 4-ports of 1000BASE-X and 10GBASE-R, 2-ports RXAUI, 1 port of XAUI, and 40GBASE-R4.

5.1 Host Electrical Interface

The input and output buffers of the SERDES interface are internally terminated by 50Ω impedance (100Ω differential). No external terminations are required.

The SERDES transmitter uses a 3 tap (1 pre-tap and 1 post-tap) FIR filter that is implemented for the purpose of channel equalization. The FIR tap can be manually adjusted to optimize the transmit eye over a particular channel.

The receiver performs clock and data recovery and de-serializes the data.

5.2 PCS

Each port supports a multiple number of different PCS. [Section 3.1.2, PCS Operational Mode and Lane Attachment, on page 44](#) describes how to configure each port for the various PCS. This section focuses on the PCS itself.

5.2.1 40GBASE-R4

The 40GBASE-R4 PCS is available only on ports 0 and 2. Lanes M0 to M3 are used by port 0 and correspond to lanes 0 to 3. Lanes M4 to M7 are used by port 2 and correspond to lanes 0 to 3. These lanes are enabled by setting register 31.F002.6:0 to 0x70.

In all other respects, the 40GBASE-R4 functionality is identical to [Section 4.2.1, 40GBASE-R4, on page 87](#) except the DEVAD is 4 instead of 3.

5.2.2 10GBASE-R

The 10GBASE-R PCS is available on all ports. It is enabled by setting register 31.F002.6:0 to 0x71.

If register 31.F402.9 is set to 1, then lanes M0 through M3 are used by port 0 through 3 respectively.

If register 31.F402.9 is set to 0, then lanes M0, M2, M4, M6 are used by port 0 through 3 respectively.

In all other respects, the 10GBASE-R functionality is identical to [Section 4.2.2, 10GBASE-R, on page 88](#) except the DEVAD is 4 instead of 3.

5.2.3 XAUI

The XAUI PCS is available only on ports 0 and 2. It is enabled by setting register 31.F002.6:0 to 0x73.

Normally, lanes M0 to M3 are used by port 0 and correspond to lanes 0 to 3, and lanes M4 to M7 are used by port 2 and correspond to lanes 4 to 7. However, if register 4.9000.7 is set to 1, then the lane order will be reversed with lanes M3 to M0 used by port 0 and corresponding to lanes 0 to 3, and lanes M7 to M4 are by port 2 and corresponding to lanes 4 to 7. The reverse lane order configuration only applies to the PCS. Access for all PMA registers is not lane reversed.

In all other respects, XAUI functionality is identical to [Section 4.2.3, 1000BASE-X, on page 88](#) except the DEVAD is 4 instead of 3.

5.2.4 1000BASE-X

The 1000BASE-X PCS is available on all ports. There are several modes of 1000BASE-X.

It is enabled by setting register 31.F002.6:0 to 1 of the following values.

- 0x7A = 1000BASE-X, 1000BASE-X Auto-Negotiation off
- 0x7B = 1000BASE-X, 1000BASE-X Auto-Negotiation on
- 0x7C = SGMII (system), SGMII Auto-Negotiation off
- 0x7D = SGMII (system), SGMII Auto-Negotiation on
- 0x7E = SGMII (media), SGMII Auto-Negotiation off
- 0x7F = SGMII (media), SGMII Auto-Negotiation on

If register 31.F402.8 is set to 1, then lanes M0 through M3 are used by port 0 through 3 respectively.

If register 31.F402.8 is set to 0, then lanes M0, M2, M4, M6 are used by port 0 through 3 respectively.

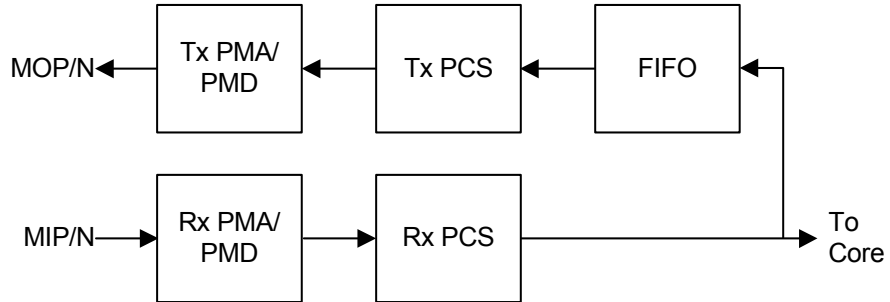
In all other respects, the 1000BASE-X functionality is identical to [Section 4.2.3, 1000BASE-X, on page 88](#) except the DEVAD is 4 instead of 3.

5.3 Loopback

The host side SERDES supports 2 loopback paths.

If register 4.F003.12 = 1, then data from the host will loopback to the host as shown in [Figure 28](#).

Figure 28: Shallow Host Loopback



Registers 4.0000.14, 4.1000.14, 4.2000.14, and 4.3000.14 are physically the same bit. If any of these bits are set to 1, then data from the core will loopback to the core as shown in [Figure 29](#) and [Figure 30](#). If register 4.F003.6 = 0, then the ingress path will not be blocked as shown in [Figure 29](#). If register 4.F003.6 = 1, then the ingress path will be blocked as shown in [Figure 30](#).

Figure 29: Deep Line Loopback, No Ingress Blocking

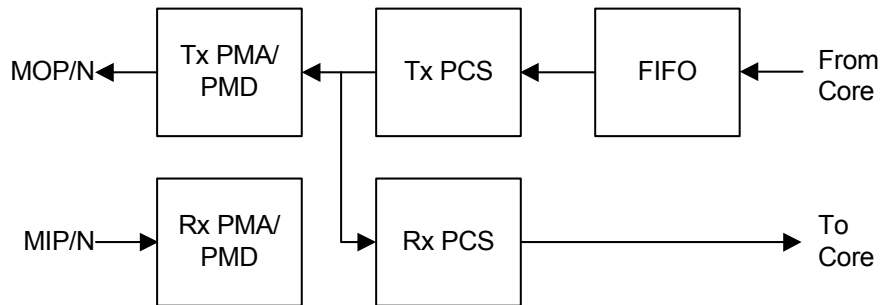
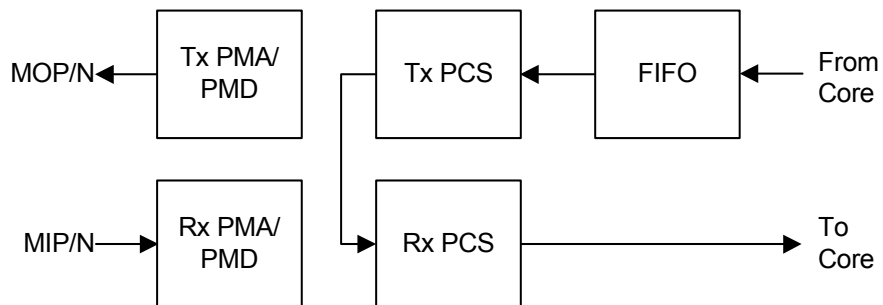


Figure 30: Deep Line Loopback, Ingress Blocking



5.4 Synchronizing FIFO

Each port has a transmit synchronizing FIFOs to reconcile frequency differences between the internal bus clocks and the clock used to transmit data onto the host interface. The depth of the FIFO can be programmed by setting register 4.F00C.15:14.

The FIFO depths can be increased in length to support longer frames. The device has settings for maximum frame sizes of:

- 10 KBs, 20 KBs, 40 KBs, and 80 KBs with up to ± 100 ppm clock jitter in 10 Gbps operation and
- 10 KBs, 15 KBs, 20 KBs, and 25 KBs with up to ± 100 ppm clock jitter in 1 Gbps operation

The deeper the FIFO depth, the higher the latency will be.

The FIFO overflow/underflow status is reported in register 4.F00B.1:0.

5.5 Power Management

The 88X2242 device will automatically power down unused circuits. The host side can be forced into a power down state by setting 4.0000.11, 4.1000.11, 4.2000.11, or 4.3000.11 to 1. Register 31.0xF003.6 can also be used to power down the host side port. Note that these power down registers are physically the same bit even though they reside in different locations. Since 31.0xF003.6 is physically a separate register bit, setting this bit won't be reflected into PCS power down bits mentioned above but will override them.

To soft reset only the host side, set registers 4.0000.15, 4.1000.15, 4.2000.15, or 4.3000.15. Register 31.F003.7 can also be used to soft reset the host side. Note that these software reset registers are physically the same bit even though they reside in different locations.

5.6 Traffic Generation and Checking

This section describes the generator and checker functions. All counters are 48 bits long. If register 4.F010.14 is set to 1, the counters clear on read. If register 4.F010.14 is set to 0, the counters will keep counting until 4.F010.6 is set to 1 to clear the contents.

5.6.1 Packet Generator

A packet generator enables the device to generate traffic onto the host without the need to receive data from the media.

Register 4.F010.1 enables the internal packet generator.

Register 4.F016 specifies the number of bytes in the packet that is to be generated. This count includes the frame bytes but does not include the 4 byte CRC (unless it is appended - register 4.F011.3 = 0), the terminate symbol, nor the 8 preamble bytes. The length depends upon the register setting:

- If the register is set to 0x0000, then the length will be randomly selected between 64 to 1518 bytes.
- If the register is set to 0x0001, then the length will be randomly selected to be between 64 to 0x0FFF bytes.
- If the register is set to 0x0002, then the length will be 64 to 0x1FFF bytes,
- If the register is set to 0x0003, then the length will be 64 to 0x3FFF bytes,
- If the register is set to 0x0004, then the length will be 64 to 0x7FFF bytes,
- If the register is set to 0x0005, then the length will be 64 to 0xFFFF bytes.
- If the register is set to 0x0008 to 0xFFFF, then the number of bytes transmitted is fixed from 8 to 0xFFFF.

Register 4.F017 specifies the number of packets to burst. 0x0000 means stop generation, 0xFFFF means continuously generate packets, 0x0001 to 0xFFFFE means send a burst of 1 to 0xFFFFE packets.

Register 4.F018 specifies the gap between packets. Each increment in the value increases the idle time by 4 bytes. 4.F018.14:0 specifies the upper limit of the gap. If 4.F018.15 is 0, then the lower limit for IPG is also specified by 4.F018.14:0; otherwise, a random gap between 1 x 4 bytes to 4.F018.14:0 x 4 bytes will be used. For the purposes of counting IPG, all lanes must be idle for it to be counted as an IPG. In other words, if the terminate symbol is in the XGMII word, then it does not count towards the IPG.

Register 4.F012 and 4.F013 specifies the initial value of the payload or the fixed value of the payload. The 4 bytes in this register corresponds to the first 4 bytes of the frame. Register 4.F011.7:4 specifies the behavior of the payload.

When 4.F011.7:4 = 000x, then registers 4.F012 and 4.F013 are used as the payload repeatedly.

When 4.F011.7:4 = 0010, then registers 4.F012 and 4.F013 are used as the payload repeatedly, but every other XGMII word should be inverted. That is, a payload of 034EA675 will result in a sequence of 034EA675, FCB1598A, 034EA675, FCB1598A,

When 4.F011.7:4 = 0011, then registers 4.F012 and 4.F013 are used as the payload repeatedly but inverted every second XGMII word. That is, a payload of 034EA675 will result in a sequence of 034EA675, 034EA675, FCB1598A, FCB1598A, 034EA675, 034EA675, FCB1598A, FCB1598A,

When 4.F011.7:4 = 0100, then registers 4.F012 and 4.F013 are used as the initial value, and each subsequent byte is shifted left bitwise. That is, a payload of 034EA675 will result in a sequence of 034EA675, 069C4DEA, 0C399AD5, 187235AB,

When 4.F011.7:4 = 0101, then registers 4.F012 and 4.F013 are used as the initial value, and each subsequent byte is shifted right bitwise.

When 4.F011.7:4 = 0110, then registers 4.F012 and 4.F013 are used as the initial value, and the subsequent 32 bits are shifted left bitwise. That is, a payload of C34EA675 will result in a sequence of C34EA675, 869D4CEB, 0D3A99D7, 1A7533AE,

When 4.F011.7:4 = 0111, then registers 4.F012 and 4.F013 are used as the initial value, and the subsequent 32 bits are shifted right bitwise.

When 4.F011.7:4 = 1000, then registers 4.F012 and 4.F013 are used as the initial value and are subsequently bitwise incremented. That is, a payload of FFFE0055 will result in a sequence of FFFE0055, 00FF0156, 01000257, 02010358,

When 4.F011.7:4 = 1001, registers 4.F012 and 4.F013 are used as the initial value and are subsequently bitwise decremented.

When 4.F011.7:4 = 1000, registers 4.F012 and 4.F013 are ignored, and a pseudo random payload is generated. All 4 bytes are the same value for each cycle.

When 4.F011.7:4 = 1001, registers 4.F012 and 4.F013 are ignored, and a pseudo random payload is generated. All 4 bytes are randomly generated for each cycle.

At the start of each packet, registers 4.F012 and 4.F013 should be used to reset the initial values to ensure that the pattern in the packet is the same when repeated many times. The only time that the pattern in the packet will be different is when pseudo random generation is selected.

The following 48-bit counters are incremented by 1:

- For each packet generated, 4.F01B, 4.F01C, and 4.F01D
- For each byte generated, 4.F01E, 4.F01F, and 4.F020

Preamble bytes are not counted but CRC bytes are counted.

Register 4.F011.3 controls whether the CRC is generated or not.

5.6.2 Checker

The CRC checker is enabled by setting register 4.F010.0 to 1.

If register 4.F010.2 = 0, the checker will wait until the SFD is detected to detect the frame boundary.

If register 4.F010.2 = 1, the checker will assume the first 8 bytes of the packet is the preamble, and the frame starts at the ninth byte of the packet.

There are 3 sets of 48-bit counters for the checker:

- Receive packet counter
 - Registers 4.F021, 4.F022, 4.F023
 - Counts the number of packets received regardless of whether there is a CRC error
- Receive packet error counter
 - Registers 4.F027, 4.F028, and 4.F029
 - Increments once per packet with a CRC error
- Receive byte counter
 - Registers 4.F024, 4.F025, and 4.F026
 - Counts the number of bytes in the frame including the CRC (note that preamble bytes are not counted)

5.7 PRBS and Pattern Generators

The device supports various IEEE-defined and proprietary PRBS generators and checkers, and transmit waveform pattern generators. Only 1 generator/checker per lane may be enabled simultaneously.



Caution

If multiple generators are enabled simultaneously, unpredictable results may occur.

5.7.1 General PRBS Generators and Checkers

Each lane has its own general PRBS generator and checker:

- Port 0 registers control lanes 0 and 4
- Port 1 registers control lanes 1 and 5
- Port 2 registers control lanes 2 and 6
- Port 3 registers control lanes 3 and 7

For lanes 0 to 3, the functionality is identical to [Section 4.7.1, General PRBS Generators and Checkers, on page 94](#) except the DEVAD is 4 instead of 3.

For lanes 4 to 7, the function of registers 4.F040 to 4.F049 is identical to registers 4.F030 to 4.F039 except the registers control a different lane.

5.7.2 40GBASE-R4-Specific Generators and Checkers

The functionality is identical to [Section 4.7.2, 40GBASE-R4 Specific Generators and Checkers, on page 95](#) except the DEVAD is 4 instead of 3.

5.7.3 10GBASE-R-Specific Generators and Checkers

The functionality is identical to [Section 4.7.3, 10GBASE-R Specific Generators and Checkers, on page 95](#) except the DEVAD is 4 instead of 3.

5.7.4 XAUI-Specific Generators and Checkers

The functionality is identical to [Section 4.7.4, XAUI Specific Generators and Checkers, on page 95](#) except the DEVAD is 4 instead of 3.

5.8 Interrupt

The Host PCS supports several interrupts. [Table 51](#) shows the interrupt enable, interrupt status, and real time status.

The INTn interrupt pin will be active if any of the events enabled in the interrupt enable register occurs. If an interrupt event corresponding to a disabled interrupt enable bit occurs, the corresponding interrupt status bit will be set even though the event does not activate the INTn pin. The interrupts are cleared after a read to the interrupt status register.

Table 51: Interrupt Registers

| Type | Interrupt | | Real-Time Status |
|---------------|-------------------|-------------------|------------------|
| | Enable | Status | |
| 10GBASE-R | 4.8000 | 4.8001 | 4.8002 |
| XAUI RXAUI | 4.9001, 3.9002 | 4.9003, 4.9004 | 4.9006 |
| 1000BASE-X | 4.A001 | 4.A002 | 4.A003 |
| 40GBASE-R4 | 4.B001 | 4.B002 | 4.B003 |
| Misc | 4.F00A | 4.F00B | |

6.1 Chip Level Registers

The registers in this section are accessible through any of the 4 PHY addresses.

Table 52: Chip Level Registers - Register Map

| Register Name | Register Address | Table and Page |
|--|----------------------------|------------------|
| Transmitter Source N | Device 31, Register 0xF400 | Table 53, p. 105 |
| Transmitter Source M | Device 31, Register 0xF401 | Table 54, p. 106 |
| Host Side Lane Muxing | Device 31, Register 0xF402 | Table 55, p. 107 |
| Chip Global Reset And Misc | Device 31, Register 0xF404 | Table 56, p. 107 |
| Host SERDES Lane Polarity Inversion | Device 31, Register 0xF406 | Table 57, p. 107 |
| Line SERDES Lane Polarity Inversion | Device 31, Register 0xF407 | Table 58, p. 108 |
| Recovered Clock and PCS_HW Reset Control | Device 31, Register 0xF408 | Table 59, p. 109 |
| Global Interrupt Status | Device 31, Register 0xF420 | Table 60, p. 109 |
| Global Interrupt Control | Device 31, Register 0xF421 | Table 61, p. 110 |

**Table 53: Transmitter Source N
Device 31, Register 0xF400**

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------|------|-----------|--------|--|
| 15:12 | N3 Source | R/W | See Desc. | Retain | 0000 = Output Powered Down 0001 = Output Idles 1000 = M0 1001 = M1 1010 = M2 1011 = M3 Else = Reserved On hardware reset will default to 0000 if PDOWN = 1 else 1011. |
| 11:8 | N2 Source | R/W | See Desc. | Retain | 0000 = Output Powered Down 0001 = Output Idles 1000 = M0 1001 = M1 1010 = M2 1011 = M3 Else = Reserved On hardware reset will default to 0000 if PDOWN = 1 else 1010. |
| 7:4 | N1 Source | R/W | See Desc. | Retain | 0000 = Output Powered Down 0001 = Output Idles 1000 = M0 1001 = M1 1010 = M2 1011 = M3 Else = Reserved On hardware reset will default to 0000 if PDOWN = 1 else 1001. |

Table 53: Transmitter Source N (Continued)
 Device 31, Register 0xF400

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------|------|-----------|--------|--|
| 3:0 | N0 Source | R/W | See Desc. | Retain | 0000 = Output Powered Down 0001 = Output Idles 1000 = M0 1001 = M1 1010 = M2 1011 = M3 Else = Reserved On hardware reset will default to 0000 if PDOWN = 1 else 1000. |

Table 54: Transmitter Source M
 Device 31, Register 0xF401

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------|------|-----------|--------|--|
| 15:12 | M3 Source | R/W | See Desc. | Retain | 0000 = Output Powered Down 0001 = Output Idles 1000 = N0 1001 = N1 1010 = N2 1011 = N3 Else = Reserved On hardware reset will default to 0000 if PDOWN = 1 else 1011. |
| 11:8 | M2 Source | R/W | See Desc. | Retain | 0000 = Output Powered Down 0001 = Output Idles 1000 = N0 1001 = N1 1010 = N2 1011 = N3 Else = Reserved On hardware reset will default to 0000 if PDOWN = 1 else 1010. |
| 7:4 | M1 Source | R/W | See Desc. | Retain | 0000 = Output Powered Down 0001 = Output Idles 1000 = N0 1001 = N1 1010 = N2 1011 = N3 Else = Reserved On hardware reset will default to 0000 if PDOWN = 1 else 1001. |
| 3:0 | M0 Source | R/W | See Desc. | Retain | 0000 = Output Powered Down 0001 = Output Idles 1000 = N0 1001 = N1 1010 = N2 1011 = N3 Else = Reserved On hardware reset will default to 0000 if PDOWN = 1 else 1000. |

Table 55: Host Side Lane Muxing
Device 31, Register 0xF402

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------|------|--------|--------|--|
| 15:12 | Reserved | R/W | 0x0 | Update | Set to 0 |
| 11 | RXAUI Attachment | R/W | 0x0 | Update | 0 = Ports 0, 2 attached to logical lanes 0/1, 4/5 1 = Ports 0, 2 attached to logical lanes 0/1, 2/3 |
| 10 | Reserved | R/W | 0x0 | Update | Set to 0 |
| 9 | 10BASE-R Attachment | R/W | 0x0 | Update | 0 = Ports 0, 1, 2, 3 attached to logical lanes 0, 2, 4, 6 1 = Ports 0, 1, 2, 3 attached to logical lanes 0, 1, 2, 3 |
| 8 | 1000BASE-X Attachment | R/W | 0x0 | Update | 0 = Ports 0, 1, 2, 3 attached to logical lanes 0, 2, 4, 6 1 = Ports 0, 1, 2, 3 attached to logical lanes 0, 1, 2, 3 |
| 7:0 | Reserved | R/W | 0x00 | Update | Set to 0 |

Table 56: Chip Global Reset And Misc
Device 31, Register 0xF404

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------------|-------|--------|--------|--|
| 15 | Global Software Reset | W, SC | 0x0 | 0x0 | 1 = Soft reset asserted for the whole chip |
| 14 | Global Hardware Reset | W, SC | 0x0 | 0x0 | 1 = Hard reset asserted for the whole chip |
| 13:9 | Reserved | RO | 0x00 | 0x00 | 0 |
| 8 | Disable Fragment Packet Control | R/W | 0x0 | 0x0 | 1 = Disable fragment packet control |
| 7:0 | Reserved | RO | 0x00 | 0x00 | Writing to this field is forbidden |

Table 57: Host SERDES Lane Polarity Inversion
Device 31, Register 0xF406

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------|------|--------|--------|------------------------|
| 15 | Invert Lane 7 Input Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 14 | Invert Lane 6 Input Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 13 | Invert Lane 5 Input Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 12 | Invert Lane 4 Input Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 11 | Invert Lane 3 Input Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 10 | Invert Lane 2 Input Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 9 | Invert Lane 1 Input Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |

Table 57: Host SERDES Lane Polarity Inversion (Continued)
Device 31, Register 0xF406

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------------------|------|--------|--------|------------------------|
| 8 | Invert Lane 0 Input Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 7 | Invert Lane 7 Output Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 6 | Invert Lane 6 Output Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 5 | Invert Lane 5 Output Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 4 | Invert Lane 4 Output Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 3 | Invert Lane 3 Output Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 2 | Invert Lane 2 Output Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 1 | Invert Lane 1 Output Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 0 | Invert Lane 0 Output Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |

Table 58: Line SERDES Lane Polarity Inversion
Device 31, Register 0xF407

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-------------------------------|------|--------|--------|------------------------|
| 15:12 | Reserved | R/W | 0x0 | Retain | Set to 0s. |
| 11 | Invert Lane 3 Input Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 10 | Invert Lane 2 Input Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 9 | Invert Lane 1 Input Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 8 | Invert Lane 0 Input Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 7:4 | Reserved | R/W | 0x0 | Retain | Set to 0s. |
| 3 | Invert Lane 3 Output Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 2 | Invert Lane 2 Output Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |
| 1 | Invert Lane 1 Output Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |

Table 58: Line SERDES Lane Polarity Inversion (Continued)
Device 31, Register 0xF407

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------------------|------|--------|--------|------------------------|
| 0 | Invert Lane 0 Output Polarity | R/W | 0x0 | Retain | 0 = Normal, 1 = Invert |

Table 59: Recovered Clock and PCS_HW Reset Control
Device 31, Register 0xF408

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------|------|--------|--------|--|
| 15:7 | Reserved | RO | 0x0 | 0x0 | Set to 0. |
| 6:4 | RCLK1 Control | R/W | 0x0 | Retain | 000 = Low 100 = Output lane 0 recovered clock divided by 64 101 = Output lane 1 recovered clock divided by 64 110 = Output lane 2 recovered clock divided by 64 111 = Output lane 3 recovered clock divided by 64 Else = Reserved |
| 3 | Reserved | R/W | 0x0 | Retain | Set to 0. |
| 2:0 | RCLK0 Control | R/W | 0x0 | Retain | 000 = Low 100 = Output lane 0 recovered clock divided by 64 101 = Output lane 1 recovered clock divided by 64 110 = Output lane 2 recovered clock divided by 64 111 = Output lane 3 recovered clock divided by 64 Else = Reserved |

Table 60: Global Interrupt Status
Device 31, Register 0xF420

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------|------|--------|--------|--|
| 15:8 | Reserved | RO | 0x00 | Retain | 0 |
| 7 | M3 Interrupt Status | RO | 0x0 | Retain | 0 = No Interrupt 1 = Active Interrupt |
| 6 | M2 Interrupt Status | RO | 0x0 | Retain | 0 = No Interrupt 1 = Active Interrupt |
| 5 | M1 Interrupt Status | RO | 0x0 | Retain | 0 = No Interrupt 1 = Active Interrupt |
| 4 | M0 Interrupt Status | RO | 0x0 | Retain | 0 = No Interrupt 1 = Active Interrupt |
| 3 | N3 Interrupt Status | RO | 0x0 | Retain | 0 = No Interrupt 1 = Active Interrupt |
| 2 | N2 Interrupt Status | RO | 0x0 | Retain | 0 = No Interrupt 1 = Active Interrupt |
| 1 | N1 Interrupt Status | RO | 0x0 | Retain | 0 = No Interrupt 1 = Active Interrupt |
| 0 | N0 Interrupt Status | RO | 0x0 | Retain | 0 = No Interrupt 1 = Active Interrupt |

Table 61: Global Interrupt Control
Device 31, Register 0xF421

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|---|
| 15 | SPEED_UP_TI_TIMERS | R/W | 0x0 | Retain | When set, accelerates cunit timer |
| 14:3 | Reserved | RO | 0x000 | Retain | Set to 0s. |
| 2:1 | Interrupt Polarity | R/W | 0x2 | Retain | 00 = Active - drive INT low, Inactive - drive INT high 01 = Active - drive INT high, Inactive - drive INT low 10 = Active - drive INT low, Inactive - tristate INT 11 = Active - drive INT high, Inactive - tristate INT |
| 0 | Force Interrupt Pin Active | R/W | 0x0 | Retain | 0 = Normal operation 1 = Force interrupt pin active |

6.2 Port Level Registers

The registers in this section apply to all ports.

Table 62: Port Level Registers - Register Map

| Register Name | Register Address | Table and Page |
|---|-----------------------------------|----------------------------------|
| Two Wire Interface Caching Control/Status Register | Device 1, Register 0x8000 | Table 63, p. 112 |
| Two Wire Interface Memory Address Register | Device 1, Register 0x8001 | Table 64, p. 113 |
| Two Wire Interface Memory Read Data and Status Register | Device 1, Register 0x8002 | Table 65, p. 113 |
| Two Wire Interface Memory Write Data and Control Register | Device 1, Register 0x8003 | Table 66, p. 114 |
| Two Wire Interface Caching Delay | Device 1, Register 0x8004 | Table 67, p. 115 |
| EEPROM Cache Page A0 | Device 1, Register 0x8007 to 8086 | Table 68, p. 115 |
| EEPROM Cache Page A2 | Device 1, Register 0x8087 to 8106 | Table 69, p. 115 |
| Per Lane Clocking Configuration | Device 31, Register 0xF001 | Table 70, p. 116 |
| Port PCS Configuration | Device 31, Register 0xF002 | Table 71, p. 116 |
| Port Reset and Power Down | Device 31, Register 0xF003 | Table 72, p. 117 |
| GPIO Interrupt Enable | Device 31, Register 0xF010 | Table 73, p. 117 |
| GPIO Interrupt Status | Device 31, Register 0xF011 | Table 74, p. 118 |
| GPIO Data | Device 31, Register 0xF012 | Table 75, p. 119 |
| GPIO Tristate Control | Device 31, Register 0xF013 | Table 76, p. 121 |
| GPIO Interrupt Type 1 | Device 31, Register 0xF014 | Table 77, p. 122 |
| GPIO Interrupt Type 2 | Device 31, Register 0xF015 | Table 78, p. 123 |
| GPIO Interrupt Type 3 | Device 31, Register 0xF016 | Table 79, p. 124 |
| Heartbeat Counter | Device 31, Register 0xF01F | Table 80, p. 125 |
| LED0 Control | Device 31, Register 0xF020 | Table 81, p. 125 |
| LED1 Control | Device 31, Register 0xF021 | Table 82, p. 126 |
| MPC Control | Device 31, Register 0xF022 | Table 83, p. 127 |
| DSP_LOCK Control | Device 31, Register 0xF023 | Table 84, p. 128 |
| TX_DISABLED Control | Device 31, Register 0xF024 | Table 85, p. 128 |
| LED Mixing Control | Device 31, Register 0xF026 | Table 86, p. 129 |
| LED Timer Control | Device 31, Register 0xF027 | Table 87, p. 130 |
| Port Interrupt Status | Device 31, Register 0xF040 | Table 88, p. 130 |

Table 63: Two Wire Interface Caching Control/Status Register
Device 1, Register 0x8000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-------------------------------|---------|--------|--------|---|
| 15 | Cache Valid Secondary Page | RO | 0x0 | 0x0 | 0 = Registers 1.8087 to 1.8106 invalid 1 = Registers 1.8087 to 1.8106 valid This bit is set to 1 if at least one successful cache update is completed since hardware, software reset, or MOD0 transitions from 0 to 1. Use register 1.8000.14:13 for latest status. |
| 14:13 | Command Status Secondary Page | RO, SC | 0x0 | 0x0 | 00 = Cache not updated since last read 01 = Contents in cache updated at least once since last read 10 = Cache is currently loading since last read 11 = All caching attempts since last read failed This register clears on read. Register 1.8000.15 indicates whether the content of the cache is valid from any updates in the past. |
| 12:11 | Cache Setting Secondary Page | R/W, SC | 0x0 | Retain | 00 = No automatic caching 01 = Cache once at module plugin 10 = Cache at module plugin and periodically poll 11 = Manual cache refresh The page cached is selected by register 1.8004.7:0 This register will self clear when set to 11. |
| 10 | TWSI Reset | R/W, SC | 0x0 | 0x0 | 0 = Normal operation 1 = Force TWSI circuit to reset |
| 9 | Cache Valid Page A0 | RO | 0x0 | 0x0 | 0 = Registers 1.8007 to 1.8086 invalid 1 = Registers 1.8007 to 1.8086 valid This bit is set to 1 if at least one successful cache update is completed since hardware, software reset, or MOD0 transitions from 0 to 1. Use register 1.8000.14:13 for latest status. |
| 8:6 | Reserved | RO | 0x0 | 0x0 | 000 |
| 5 | EEPROM Read/Write | RO | 0x0 | 0x0 | 0 = Read. Writing from internal memory to EEPROM is not supported. Use registers 1.8001 and 1.8002 to write registers one by one if needed. |
| 4 | Reserved | RO | 0x0 | 0x0 | 0 |
| 3:2 | Command Status Page A0 | RO, SC | 0x0 | 0x0 | 00 = Cache not updated since last read 01 = Contents in cache updated at least once since last read 10 = Cache is currently loading since last read 11 = All caching attempts since last read failed This register clears on read. Register 1.8000.9 indicates whether the content of the cache is valid from any updates in the past. |

Table 63: Two Wire Interface Caching Control/Status Register (Continued)
Device 1, Register 0x8000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|---------|--------|--------|---|
| 1:0 | Cache Setting Page A0 | R/W, SC | 0x1 | Retain | 00 = No automatic caching 01 = Cache once at module plugin 10 = Cache at module plugin and periodically poll 11 = Manual cache refresh Page A0 lower 128 bytes are cached. This register will self clear when set to 11. |

Table 64: Two Wire Interface Memory Address Register
Device 1, Register 0x8001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------|------|--------|--------|---|
| 15:9 | Slave Address | R/W | 0x50 | Retain | Slave Address |
| 8 | Read/Write | R/W | 0x1 | Retain | A write to 1.8001 will initiate a read or write command on the two-wire interface if the two-wire interface is free, otherwise the read or write command will be ignored. Make sure register 1.8002.10:8 is not equal to 010 (command in progress) prior to writing register 1.8001. A read to 1.8001 will not trigger any action. Register 1.8003.7:0 must be set to the value to be written prior to issuing a write command. 1 = Read 0 = Write |
| 7:0 | Byte Address | R/W | 0x00 | Retain | Byte Address |

Table 65: Two Wire Interface Memory Read Data and Status Register
Device 1, Register 0x8002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---|--------|--------|--------|---|
| 15:13 | Reserved | RO | 0x0 | 0x0 | 0000 |
| 12 | Cache ECC Single Bit Corrected Interrupt Status | RO, LH | 0x0 | 0x0 | 0 = No single bit correction in ECC cache detected 1 = Single bit correction in ECC cache detected |
| 11 | Cache ECC Uncorrectable Bit Interrupt Status | RO, LH | 0x0 | 0x0 | 0 = No uncorrectable bit in ECC cache detected 1 = Uncorrectable bit in ECC cache detected |

Table 65: Two Wire Interface Memory Read Data and Status Register (Continued)
 Device 1, Register 0x8002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------|--------|--------|--------|--|
| 10:8 | TWSI Status | RO, LH | 0x0 | 0x0 | <p>Register 1.8002.10:8 is the status in response to setting to writing register 1.8001.</p> <p>Register 1.8002.10:8 will remain at 010 until the command is completed. Once the command is completed the status 001, 011, 100, 101, or 111 will remain until register 1.8002 is read. The register will clear on read.</p> <p>If a new command is issued by writing register 1.8001 without reading register 1.8002 for a previous command, the status of the previous command will be lost.</p> <p>If a command initiated by writing register 1.8001 is still in progress and a second command is issued, the status register 1.8002.10:8 will reflect the first command. The second command is ignored but register 1.8002.10:8 will not be set to 111.</p> <p>Command Done - No Error is set when the TWSI slave properly responds with ACK.</p> <p>In the case of a write command with automatic read back a Command Done - No Error status will be returned even if the read back data does not match the written data or if the TWSI slave does not respond with ACK during the read back.</p> <p>Register 1.8002.7:0 is valid only when register 1.8002.10:8 is set to 001.</p> <p>000 = Ready 001 = Command Done - No Error 010 = Command in Progress 011 = Write done but readback failed 100 = Reserved 101 = Command Failed 110 = Reserved 111 = Two-wire interface Busy, Command Ignored</p> |
| 7:0 | Read Data | RO | 0x00 | 0x00 | <p>Read Data</p> <p>Register 1.8002.7:0 is valid only when register 1.8002.10:8 is set to 001.</p> |

Table 66: Two Wire Interface Memory Write Data and Control Register
 Device 1, Register 0x8003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---------------------------------|------|--------|--------|--|
| 15:12 | Write Time | R/W | 0xA | Retain | <p>0000 = EEPROM takes 0ms to write 0001 = 1.05 ms 1110 = 14.68 ms 1111 = 15.73 ms</p> |
| 11:10 | Reserved | R/W | 0x0 | 0x0 | Set to 0. |
| 9 | Automatic Read Back After Write | R/W | 0x0 | Retain | <p>If read back is enabled then data will always be read back after a write. The read data is stored in register 1.8002.7:0 1 = Read back, 0 = No read back</p> |
| 8 | Reserved | R/W | 0x0 | 0x0 | Set to 0. |

Table 66: Two Wire Interface Memory Write Data and Control Register (Continued)
Device 1, Register 0x8003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------|------|--------|--------|-------------|
| 7:0 | Write Data | R/W | 0x00 | Retain | Write Data. |

Table 67: Two Wire Interface Caching Delay
Device 1, Register 0x8004

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---|------|--------|--------|---|
| 15:13 | Auto Caching Delay | R/W | 0x3 | Retain | 000 = No delay 001 = 0.25 Second 010 = 0.5 Second 011 = 1 Second 100 = 2 Seconds 101 = 4 Seconds 110 = 8 Seconds 111 = Auto Caching Disabled |
| 12 | Cache ECC Single Bit Corrected Interrupt Enable | R/W | 0x0 | Retain | 0 = Interrupt disabled 1 = Interrupt enabled |
| 11 | Cache ECC Uncorrectable Bit Interrupt Enable | R/W | 0x0 | Retain | 0 = Interrupt disabled 1 = Interrupt enabled |
| 10:9 | Page Reload Frequency | R/W | 0x1 | Retain | 00 = 250 ms 01 = 500 ms 10 = 1 second 11 = 2 seconds |
| 8 | Reserved | R/W | 0x0 | Retain | Set to 0 |
| 7:1 | Secondary Page | R/W | 0x51 | Retain | Seven bit slave address to use when loading 1.8087 to 1.8106. |
| 0 | Secondary Page Register Address MSB | R/W | 0x0 | Retain | 0 = Lower 128 bytes of secondary page should be loaded 1 = Upper 128 bytes of secondary page should be loaded |

Table 68: EEPROM Cache Page A0
Device 1, Register 0x8007 to 8086

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------|------|--------|--------|---------------------------------|
| 15:8 | Reserved | RO | 0x00 | 0x00 | 0 |
| 7:0 | EEPROM Byte | RO | -- | -- | Byte (REGAD - 0x8007) Of EEPROM |

Table 69: EEPROM Cache Page A2
Device 1, Register 0x8087 to 8106

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------|------|--------|--------|---------------------------------|
| 15:8 | Reserved | RO | 0x00 | 0x00 | 0 |
| 7:0 | EEPROM Byte | RO | -- | -- | Byte (REGAD - 0x8087) Of EEPROM |

Table 70: Per Lane Clocking Configuration
 Device 31, Register 0xF001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------------|------|--------|--------|--|
| 15:10 | Reserved | R/W | 0x00 | Update | Set to 0 |
| 9:8 | Line Side Transmit Clocking | R/W | 0x0 | Update | 00 = Local reference clock 01 = Host side recovered clock 10 = Line side recovered clock |
| 1:0 | Host Side Transmit Clocking | R/W | 0x0 | Update | 00 = Local reference clock 01 = Host side recovered clock 10 = Line side recovered clock |

Table 71: Port PCS Configuration
 Device 31, Register 0xF002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------|------|--------|--------|---|
| 15 | Reserved | R/W | 0x0 | Retain | Set to 0. |
| 14:8 | Line Side PCS Select | R/W | 0x71 | Update | PCS Select Bits 14:12 must set 111 then bits 3:0 has the following meaning (Not all PCS available in all ports) 0000 = 40GBASE-R4 0001 = 10GBASE-R 0010 = Reserved 0011 = Reserved 0100 = Reserved 0101 = Reserved 0110 = Reserved 0111 = Reserved 1000 = Reserved 1001 = Reserved 1010 = 1000BASE-X, 1000BASE_X autoneg off 1011 = 1000BASE-X, 1000BASE_X autoneg on 1100 = SGMII (MAC), SGMII autoneg off 1101 = SGMII (MAC), SGMII autoneg on 1110 = SGMII (Line), SGMII autoneg off 1111 = SGMII (Line), SGMII autoneg on Changes to this register will not take effect unless 31.F002.15 is issued. |
| 7 | Reserved | R/W | 0x0 | Retain | Set to 0. |

Table 71: Port PCS Configuration (Continued)
Device 31, Register 0xF002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------|------|--------|--------|---|
| 6:0 | Host Side PCS Select | R/W | 0x71 | Update | <p>PCS Select Bits 6:4 must set 111 then bits 3:0 has the following meaning (Not all PCS available in all ports) 0000 = 40GBASE-R4 0001 = 10GBASE-R 0010 = RXAUI 0011 = XAUI 0100 = Reserved 0101 = Reserved 0110 = Reserved 0111 = Reserved 1000 = Reserved 1001 = Reserved 1010 = 1000BASE-X, 1000BASE_X autoneg off 1011 = 1000BASE-X, 1000BASE_X autoneg on 1100 = SGMII (MAC), SGMII autoneg off 1101 = SGMII (MAC), SGMII autoneg on 1110 = SGMII (Line), SGMII autoneg off 1111 = SGMII (Line), SGMII autoneg on</p> <p>Changes to this register will not take effect unless 31.F002.15 is issued.</p> |

Table 72: Port Reset and Power Down
Device 31, Register 0xF003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------------|---------|--------|--------|-----------------------------------|
| 15 | Line Side Software Reset | R/W, SC | 0x0 | Update | 0 = Normal Operation 1 = Reset |
| 14 | Line Side Power Down | R/W | 0x0 | Retain | 0 = Power Up 1 = Power Down |
| 13:8 | Reserved | R/W | 0x00 | Retain | Set to 0s. |
| 7 | Host Side Software Reset | R/W, SC | 0x0 | Update | 0 = Normal Operation 1 = Reset |
| 6 | Host Side Power Down | R/W | 0x0 | Retain | 0 = Power Up 1 = Power Down |
| 5:0 | Reserved | R/W | 0x00 | Retain | Set to 0s. |

Table 73: GPIO Interrupt Enable
Device 31, Register 0xF010

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|----------------------|------|--------|--------|---------------------------|
| 15:12 | Reserved | R/W | 0x0 | Retain | Set to 0s. |
| 11 | SCL Interrupt Enable | R/W | 0x0 | Retain | 0 = Disable 1 = Enable |

Table 73: GPIO Interrupt Enable (Continued)
Device 31, Register 0xF010

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|---------------------------|
| 10 | SDA Interrupt Enable | R/W | 0x0 | Retain | 0 = Disable 1 = Enable |
| 9 | Reserved | R/W | 0x0 | Retain | Set to 0s. |
| 8 | TX_DISABLE Interrupt Enable | R/W | 0x0 | Retain | 0 = Disable 1 = Enable |
| 7 | DSP_LOCK Interrupt Enable | R/W | 0x0 | Retain | 0 = Disable 1 = Enable |
| 6 | MPC Interrupt Enable | R/W | 0x0 | Retain | 0 = Disable 1 = Enable |
| 5 | LED1 Interrupt Enable | R/W | 0x0 | Retain | 0 = Disable 1 = Enable |
| 4 | LED0 Interrupt Enable | R/W | 0x0 | Retain | 0 = Disable 1 = Enable |
| 3 | GPIO Interrupt Enable | R/W | 0x0 | Retain | 0 = Disable 1 = Enable |
| 2 | RX_LOS Interrupt Enable | R/W | 0x0 | Retain | 0 = Disable 1 = Enable |
| 1 | TX_FAULT Interrupt Enable | R/W | 0x0 | Retain | 0 = Disable 1 = Enable |
| 0 | MOD_ABS Interrupt Enable | R/W | 0x0 | Retain | 0 = Disable 1 = Enable |

Table 74: GPIO Interrupt Status
Device 31, Register 0xF011

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------------|--------|--------|--------|---|
| 15:12 | Reserved | RO | 0x0 | Retain | Set to 0s. |
| 11 | SCL Interrupt Status | RO, LH | 0x0 | Retain | This bit is not valid unless register 31.F016.15 = 1 and 31.F013.11 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred |
| 10 | SDA Interrupt Status | RO, LH | 0x0 | Retain | This bit is not valid unless register 31.F016.11 = 1 and 31.F013.10 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred |
| 9 | Reserved | RO | 0x0 | Retain | 0 |
| 8 | TX_DISABLE Interrupt Status | RO, LH | 0x0 | Retain | This bit is not valid unless register 31.F016.3 = 1 and 31.F013.8 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred |

Table 74: GPIO Interrupt Status (Continued)
Device 31, Register 0xF011

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------|--------|--------|--------|--|
| 7 | DSP_LOCK Interrupt Status | RO, LH | 0x0 | Retain | This bit is not valid unless register 31.F015.15 = 1 and 31.F013.7 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred |
| 6 | MPC Interrupt Status | RO, LH | 0x0 | Retain | This bit is not valid unless register 31.F015.11 = 1 and 31.F013.6 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred |
| 5 | LED1 Interrupt Status | RO, LH | 0x0 | Retain | This bit is not valid unless register 31.F015.7 = 1 and 31.F013.5 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred |
| 4 | LED0 Interrupt Status | RO, LH | 0x0 | Retain | This bit is not valid unless register 31.F015.3 = 1 and 31.F013.4 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred |
| 3 | GPIO Interrupt Status | RO, LH | 0x0 | Retain | This bit is not valid unless register 31.F013.3 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred |
| 2 | RX_LOS Interrupt Status | RO, LH | 0x0 | Retain | This bit is not valid unless register 31.F013.2 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred |
| 1 | TX_FAULT Interrupt Status | RO, LH | 0x0 | Retain | This bit is not valid unless register 31.F013.1 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred |
| 0 | MOD_ABS Interrupt Status | RO, LH | 0x0 | Retain | This bit is not valid unless register 31.F013.0 = 0. 0 = No Interrupt Occurred 1 = Interrupt Occurred |

Table 75: GPIO Data
Device 31, Register 0xF012

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|----------|------|--------|--------|---|
| 15:12 | Reserved | RO | 0x0 | Retain | Set to 0s. |
| 11 | SCL Data | R/W | 0x0 | Retain | This bit has no effect unless register 31.F016.15 = 1. When 31.F013.11 = 0 a read to this register will reflect the state of the SCL pin, and a write will write the output register but have no effect on the SCL pin. When 31.F013.11 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and drive the state of the SCL pin. |

Table 75: GPIO Data (Continued)
Device 31, Register 0xF012

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------|------|--------|--------|--|
| 10 | SDA Data | R/W | 0x0 | Retain | This bit has no effect unless register 31.F016.11 = 1. When 31.F013.10 = 0 a read to this register will reflect the state of the SDA pin, and a write will write the output register but have no effect on the SDA pin. When 31.F013.10 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and drive the state of the SDA pin. |
| 9 | Reserved | RO | 0x0 | Retain | |
| 8 | TX_DISABLED Data | R/W | 0x1 | Retain | This bit has no effect unless register 31.F016.3 = 1. When 31.F013.8 = 0 a read to this register will reflect the state of the TX_DISABLED pin, and a write will write the output register but have no effect on the TX_DISABLED pin. When 31.F013.8 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and drive the state of the TX_DISABLED pin. |
| 7 | DSP_LOCK Data | R/W | 0x0 | Retain | This bit has no effect unless register 31.F015.15 = 1. When 31.F013.7 = 0 a read to this register will reflect the state of the DSP_LOCK pin, and a write will write the output register but have no effect on the DSP_LOCK pin. When 31.F013.7 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and drive the state of the DSP_LOCK pin. |
| 6 | MPC Data | R/W | 0x0 | Retain | This bit has no effect unless register 31.F015.11 = 1. When 31.F013.6 = 0 a read to this register will reflect the state of the MPC pin, and a write will write the output register but have no effect on the MPC pin. When 31.F013.6 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and drive the state of the MPC pin. |
| 5 | LED1 Data | R/W | 0x0 | Retain | This bit has no effect unless register 31.F015.7 = 1. When 31.F013.5 = 0 a read to this register will reflect the state of the LED1 pin, and a write will write the output register but have no effect on the LED1 pin. When 31.F013.5 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and drive the state of the LED1 pin. |
| 4 | LED0 Data | R/W | 0x0 | Retain | This bit has no effect unless register 31.F015.3 = 1. When 31.F013.4 = 0 a read to this register will reflect the state of the LED0 pin, and a write will write the output register but have no effect on the LED0 pin. When 31.F013.4 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and drive the state of the LED0 pin. |

Table 75: GPIO Data (Continued)
Device 31, Register 0xF012

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------|------|--------|--------|--|
| 3 | GPIO Data | R/W | 0x0 | Retain | When 31.F013.3 = 0 a read to this register will reflect the state of the GPIO pin, and a write will write the output register but have no effect on the GPIO pin. When 31.F013.3 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and drive the state of the GPIO pin. |
| 2 | RX_LOS Data | R/W | 0x0 | Retain | When 31.F013.2 = 0 a read to this register will reflect the state of the RX_LOS pin, and a write will write the output register but have no effect on the RX_LOS pin. When 31.F013.2 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and drive the state of the RX_LOS pin. |
| 1 | TX_FAULT Data | R/W | 0x0 | Retain | When 31.F013.1 = 0 a read to this register will reflect the state of the TX_FAULT pin, and a write will write the output register but have no effect on the TX_FAULT pin. When 31.F013.1 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and drive the state of the TX_FAULT pin. |
| 0 | MOD_ABS Data | R/W | 0x0 | Retain | When 31.F013.0 = 0 a read to this register will reflect the state of the MOD_ABS pin, and a write will write the output register but have no effect on the MOD_ABS pin. When 31.F013.0 = 1 a read to this register will reflect the state of the output register, and a write will write the output register and drive the state of the MOD_ABS pin. |

Table 76: GPIO Tristate Control
Device 31, Register 0xF013

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--------------------------|------|--------|--------|---|
| 15:12 | Reserved | RO | 0x0 | Retain | Set to 0s. |
| 11 | SCL Output Enable | R/W | 0x1 | Retain | This bit has no effect unless register 31.F016.15 = 1. 0 = Input 1 = Output |
| 10 | SDA Output Enable | R/W | 0x1 | Retain | This bit has no effect unless register 31.F016.11 = 1. 0 = Input 1 = Output |
| 9 | Reserved | R/W | 0x1 | Retain | Set to 0. |
| 8 | TX_DISABLE Output Enable | R/W | 0x1 | Retain | This bit has no effect unless register 31.F016.3 = 1. 0 = Input 1 = Output |
| 7 | DSP_LOCK Output Enable | R/W | 0x1 | Retain | This bit has no effect unless register 31.F015.15 = 1. 0 = Input 1 = Output |
| 6 | MPC Output Enable | R/W | 0x1 | Retain | This bit has no effect unless register 31.F015.11 = 1. 0 = Input 1 = Output |

Table 76: GPIO Tristate Control (Continued)
 Device 31, Register 0xF013

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|--|
| 5 | LED1 Output Enable | R/W | 0x1 | Retain | This bit has no effect unless register 31.F015.7 = 1. 0 = Input 1 = Output |
| 4 | LED0 Output Enable | R/W | 0x1 | Retain | This bit has no effect unless register 31.F015.3 = 1. 0 = Input 1 = Output |
| 3 | GPIO Output Enable | R/W | 0x0 | Retain | 0 = Input 1 = Output |
| 2 | RX_LOS Output Enable | R/W | 0x0 | Retain | 0 = Input 1 = Output |
| 1 | TX_FAULT Output Enable | R/W | 0x0 | Retain | 0 = Input 1 = Output |
| 0 | MOD_ABS Output Enable | R/W | 0x0 | Retain | 0 = Input 1 = Output |

Table 77: GPIO Interrupt Type 1
 Device 31, Register 0xF014

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-------------------|------|--------|--------|---|
| 15 | Reserved | RO | 0x0 | Retain | Set to 0. |
| 14:12 | GPIO Select | R/W | 0x0 | Retain | Interrupt is effective only when 31.F013.3 = 0. 000 = No Interrupt 001 = Reserved 010 = Interrupt on Low Level 011 = Interrupt on High Level 100 = Interrupt on High to Low 101 = Interrupt on Low to High 110 = Reserved 111 = Interrupt on Low to High or High to Low |
| 11 | RX_LOS Function | R/W | 0x1 | Retain | 0 = RX_LOS is used as signal detect 1 = RX_LOS is used for GPIO Function. |
| 10:8 | RX_LOS Select | R/W | 0x0 | Retain | Interrupt is effective only when 31.F013.2 = 0. 000 = No Interrupt 001 = Reserved 010 = Interrupt on Low Level 011 = Interrupt on High Level 100 = Interrupt on High to Low 101 = Interrupt on Low to High 110 = Reserved 111 = Interrupt on Low to High or High to Low |
| 7 | TX_FAULT Function | R/W | 0x1 | Retain | 0 = TX_FAULT is status is indicated by 1.0008.11. 1 = TX_FAULT is used for GPIO Function. |

Table 77: GPIO Interrupt Type 1 (Continued)
Device 31, Register 0xF014

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------|------|--------|--------|---|
| 6:4 | TX_FAULT Select | R/W | 0x0 | Retain | Interrupt is effective only when 31.F013.1 = 0. 000 = No Interrupt 001 = Reserved 010 = Interrupt on Low Level 011 = Interrupt on High Level 100 = Interrupt on High to Low 101 = Interrupt on Low to High 110 = Reserved 111 = Interrupt on Low to High or High to Low |
| 3 | Reserved | RO | 0x0 | Retain | Set to 0. |
| 2:0 | MOD_ABS Select | R/W | 0x0 | Retain | Interrupt is effective only when 31.F013.0 = 0. 000 = No Interrupt 001 = Reserved 010 = Interrupt on Low Level 011 = Interrupt on High Level 100 = Interrupt on High to Low 101 = Interrupt on Low to High 110 = Reserved 111 = Interrupt on Low to High or High to Low |

Table 78: GPIO Interrupt Type 2
Device 31, Register 0xF015

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-------------------|------|--------|--------|---|
| 15 | DSP_LOCK Function | R/W | 0x0 | Retain | 0 = DSP_LOCK is used for LED Function. 1 = DSP_LOCK is used for GPIO Function. |
| 14:12 | DSP_LOCK Select | R/W | 0x0 | Retain | Interrupt is effective only when 31.F013.7 = 0. 000 = No Interrupt 001 = Reserved 010 = Interrupt on Low Level 011 = Interrupt on High Level 100 = Interrupt on High to Low 101 = Interrupt on Low to High 110 = Reserved 111 = Interrupt on Low to High or High to Low |
| 11 | MPC Function | R/W | 0x1 | Retain | 0 = MPC is used for LED Function. 1 = MPC is used for GPIO Function. |
| 10:8 | MPC Select | R/W | 0x0 | Retain | Interrupt is effective only when 31.F013.6 = 0. 000 = No Interrupt 001 = Reserved 010 = Interrupt on Low Level 011 = Interrupt on High Level 100 = Interrupt on High to Low 101 = Interrupt on Low to High 110 = Reserved 111 = Interrupt on Low to High or High to Low |
| 7 | LED1 Function | R/W | 0x0 | Retain | 0 = LED1 is used for LED Function. 1 = LED1 is used for GPIO Function. |

Table 78: GPIO Interrupt Type 2 (Continued)
Device 31, Register 0xF015

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------|------|--------|--------|---|
| 6:4 | LED1 Select | R/W | 0x0 | Retain | Interrupt is effective only when 31.F013.5 = 0. 000 = No Interrupt 001 = Reserved 010 = Interrupt on Low Level 011 = Interrupt on High Level 100 = Interrupt on High to Low 101 = Interrupt on Low to High 110 = Reserved 111 = Interrupt on Low to High or High to Low |
| 3 | LED0 Function | R/W | 0x0 | Retain | 0 = LED0 is used for LED Function. 1 = LED0 is used for GPIO Function. |
| 2:0 | LED0 Select | R/W | 0x0 | Retain | Interrupt is effective only when 31.F013.4 = 0. 000 = No Interrupt 001 = Reserved 010 = Interrupt on Low Level 011 = Interrupt on High Level 100 = Interrupt on High to Low 101 = Interrupt on Low to High 110 = Reserved 111 = Interrupt on Low to High or High to Low |

Table 79: GPIO Interrupt Type 3
Device 31, Register 0xF016

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--------------|------|--------|--------|--|
| 15 | SCL Function | R/W | 0x0 | Retain | 0 = SCL is used for TWSI Function. 1 = SCL is used for GPIO Function. |
| 14:12 | SCL Select | R/W | 0x0 | Retain | Interrupt is effective only when 31.F013.11 = 0. 000 = No Interrupt 001 = Reserved 010 = Interrupt on Low Level 011 = Interrupt on High Level 100 = Interrupt on High to Low 101 = Interrupt on Low to High 110 = Reserved 111 = Interrupt on Low to High or High to Low |
| 11 | SDA Function | R/W | 0x0 | Retain | 0 = SDA is used for TWSI Function. 1 = SDA is used for GPIO Function. |
| 10:8 | SDA Select | R/W | 0x0 | Retain | Interrupt is effective only when 31.F013.10 = 0. 000 = No Interrupt 001 = Reserved 010 = Interrupt on Low Level 011 = Interrupt on High Level 100 = Interrupt on High to Low 101 = Interrupt on Low to High 110 = Reserved 111 = Interrupt on Low to High or High to Low |
| 7:5 | Reserved | R/W | 0x0 | Retain | Set to 0 |

Table 79: GPIO Interrupt Type 3 (Continued)
Device 31, Register 0xF016

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------|------|--------|--------|---|
| 4:3 | TX_DISABLE Function | R/W | 0x1 | Retain | 00 = TX_DISABLE is used for LED Function. 01 = TX_DISABLE is used for GPIO Function. 10 = TX_DISABLE is controlled by 1.0009.0. |
| 2:0 | TX_DISABLE Select | R/W | 0x0 | Retain | Interrupt is effective only when 31.F013.8 = 0. 000 = No Interrupt 001 = Reserved 010 = Interrupt on Low Level 011 = Interrupt on High Level 100 = Interrupt on High to Low 101 = Interrupt on Low to High 110 = Reserved 111 = Interrupt on Low to High or High to Low |

Table 80: Heartbeat Counter
Device 31, Register 0xF01F

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------|---------|--------|--------|---|
| 15 | Heartbeat Counter Control | R/W | 0x0 | Retain | 0 = bits 14:0 clear on read and saturates at 0x7FFF 1 = bits 14:0 does not clear on read and will rollover |
| 14:0 | Heartbeat Counter | R/W, SC | 0x0000 | 0x0000 | A write to this register will set the count value. Indicates the number of seconds that elapsed. The counter will self clear if bit 15 is set to 0. |

Table 81: LED0 Control
Device 31, Register 0xF020

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---------------------|------|--------|--------|--|
| 15:12 | Reserved | RO | 0x0 | Retain | Set to 0s. |
| 11:8 | LED0 Blink Behavior | R/W | 0x1 | Retain | Blink Behavior has higher priority. 0000 = Solid Off 0001 = System Side Transmit or Receive Activity 0010 = System Side Transmit Activity 0011 = System Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = System Side Link 0111 = Solid On 1000 = Reserved 1001 = Reserved 1010 = Blink Mix 1011 = Solid Mix 11xx = Reserved |

Table 81: LED0 Control (Continued)
 Device 31, Register 0xF020

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|--|
| 7:4 | LED0 Solid Behavior | R/W | 0x6 | Retain | Blink Behavior has higher priority. 0000 = Solid Off 0001 = System Side Transmit or Receive Activity 0010 = System Side Transmit Activity 0011 = System Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = System Side Link 0111 = Solid On 1xxx = Reserved |
| 3 | Reserved | R/W | 0x0 | Retain | Set to 0 |
| 2 | LED0 Blink Rate Select | R/W | 0x0 | Retain | 0 = Select Blink Rate 1 1 = Select Blink Rate 2 |
| 1:0 | LED0 Polarity | R/W | 0x0 | Retain | 00 = On - drive LED0 low, Off - drive LED0 high 01 = On - drive LED0 high, Off - drive LED0 low 10 = On - drive LED0 low, Off - tristate LED0 11 = On - drive LED0 high, Off - tristate LED0 |

Table 82: LED1 Control
 Device 31, Register 0xF021

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---------------------|------|--------|--------|--|
| 15:12 | Reserved | RO | 0x0 | Retain | Set to 0s. |
| 11:8 | LED1 Blink Behavior | R/W | 0x1 | Retain | Blink Behavior has higher priority. This register ignored if 31.F020.11:10 = 10 (Dual Mode). 0000 = Solid Off 0001 = Line Side Transmit or Receive Activity 0010 = Line Side Transmit Activity 0011 = Line Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = Line Side Link 0111 = Solid On 1xxx = Reserved |
| 7:4 | LED1 Solid Behavior | R/W | 0x6 | Retain | Blink Behavior has higher priority. This register ignored if 31.F020.11:10 = 10 (Dual Mode). 0000 = Solid Off 0001 = Line Side Transmit or Receive Activity 0010 = Line Side Transmit Activity 0011 = Line Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = Line Side Link 0111 = Solid On 1xxx = Reserved |
| 3 | Reserved | RO | 0x0 | Retain | Set to 0 |

Table 82: LED1 Control (Continued)
Device 31, Register 0xF021

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|---|
| 2 | LED1 Blink Rate Select | R/W | 0x0 | Retain | This register ignored if 31.F020.11:10 = 10 (Dual Mode). 0 = Select Blink Rate 1 1 = Select Blink Rate 2 |
| 1:0 | LED1 Polarity | R/W | 0x0 | Retain | 00 = On - drive LED1 low, Off - drive LED1 high 01 = On - drive LED1 high, Off - drive LED1 low 10 = On - drive LED1 low, Off - tristate LED1 11 = On - drive LED1 high, Off - tristate LED1 |

Table 83: MPC Control
Device 31, Register 0xF022

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------|------|--------|--------|--|
| 15:12 | Reserved | RO | 0x0 | Retain | Set to 0s. |
| 11:8 | MPC Blink Behavior | R/W | 0x0 | Retain | Blink Behavior has higher priority. 0000 = Solid Off 0001 = System Side Transmit or Receive Activity 0010 = System Side Transmit Activity 0011 = System Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = System Side Link 0111 = Solid On 1000 = Reserved 1001 = Reserved 1010 = Blink Mix 1011 = Solid Mix 11xx = Reserved |
| 7:4 | MPC Solid Behavior | R/W | 0x0 | Retain | Blink Behavior has higher priority. 0000 = Solid Off 0001 = System Side Transmit or Receive Activity 0010 = System Side Transmit Activity 0011 = System Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = System Side Link 0111 = Solid On 1xxx = Reserved |
| 3 | Reserved | RO | 0x0 | Retain | Set to 0 |
| 2 | MPC Blink Rate Select | R/W | 0x0 | Retain | 0 = Select Blink Rate 1 1 = Select Blink Rate 2 |
| 1:0 | MPC Polarity | R/W | 0x0 | Retain | 00 = On - drive MPC low, Off - drive MPC high 01 = On - drive MPC high, Off - drive MPC low 10 = On - drive MPC low, Off - tristate MPC 11 = On - drive MPC high, Off - tristate MPC |

Table 84: DSP_LOCK Control
Device 31, Register 0xF023

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|----------------------------|------|--------|--------|--|
| 15:12 | Reserved | RO | 0x0 | Retain | Set to 0s. |
| 11:8 | DSP_LOCK Blink Behavior | R/W | 0x0 | Retain | Blink Behavior has higher priority. This register ignored if 31.F022.11:10 = 10 (Dual Mode). 0000 = Solid Off 0001 = Line Side Transmit or Receive Activity 0010 = Line Side Transmit Activity 0011 = Line Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = Line Side Link 0111 = Solid On 1xxx = Reserved |
| 7:4 | DSP_LOCK Solid Behavior | R/W | 0x4 | Retain | Blink Behavior has higher priority. This register ignored if 31.F022.11:10 = 10 (Dual Mode). 0000 = Solid Off 0001 = Line Side Transmit or Receive Activity 0010 = Line Side Transmit Activity 0011 = Line Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = Line Side Link 0111 = Solid On 1xxx = Reserved |
| 3 | Reserved | RO | 0x0 | Retain | Set to 0 |
| 2 | DSP_LOCK Blink Rate Select | R/W | 0x0 | Retain | This register ignored if 31.F022.11:10 = 10 (Dual Mode). 0 = Select Blink Rate 1 1 = Select Blink Rate 2 |
| 1:0 | DSP_LOCK Polarity | R/W | 0x0 | Retain | 00 = On - drive DSP_LOCK low, Off - drive DSP_LOCK high 01 = On - drive DSP_LOCK high, Off - drive DSP_LOCK low 10 = On - drive DSP_LOCK low, Off - tristate DSP_LOCK 11 = On - drive DSP_LOCK high, Off - tristate DSP_LOCK |

Table 85: TX_DISABLED Control
Device 31, Register 0xF024

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|----------|------|--------|--------|-------------|
| 15:12 | Reserved | R/W | 0x0 | Retain | Set to 0s. |

Table 85: TX_DISABLED Control (Continued)
Device 31, Register 0xF024

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------------------|------|--------|--------|--|
| 11:8 | TX_DISABLED Blink Behavior | R/W | 0x0 | Retain | Blink Behavior has higher priority. 0000 = Solid Off 0001 = System Side Transmit or Receive Activity 0010 = System Side Transmit Activity 0011 = System Side Receive Activity 0100 = Reserved 0101 = Reserved 0110 = System Side Link 0111 = Solid On 11xx = Reserved |
| 7:4 | TX_DISABLED Solid Behavior | R/W | 0x0 | Retain | Blink Behavior has higher priority. 0000 = Solid Off 0001 = Transmit or Receive Activity 0010 = Transmit Activity 0011 = Receive Activity 0100 = Reserved 0101 = Reserved 0110 = Link 0111 = Solid On 1xxx = Reserved |
| 3 | Reserved | RO | 0x0 | Retain | Set to 0 |
| 2 | TX_DISABLED Blink Rate Select | R/W | 0x0 | Retain | 0 = Select Blink Rate 1 1 = Select Blink Rate 2 |
| 1:0 | TX_DISABLED Polarity | R/W | 0x0 | Retain | 00 = On - drive TX_DISABLED low, Off - drive TX_DISABLED high 01 = On - drive TX_DISABLED high, Off - drive TX_DISABLED low 10 = On - drive TX_DISABLED low, Off - tristate TX_DISABLED 11 = On - drive TX_DISABLED high, Off - tristate TX_DISABLED |

Table 86: LED Mixing Control
Device 31, Register 0xF026

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------------------|------|--------|--------|--|
| 15:8 | Reserved | RO | 0x00 | Retain | Set to 0s. |
| 7:4 | DSP_LOCK, LED1 Mix Percentage | R/W | 0x4 | Retain | When using 2 terminal bi-color LEDs the mixing percentage should not be set greater than 50%. 0000 = 0%, 0001 = 12.5%,..., 0111 = 87.5%, 1000 = 100% 1001 to 1111 = Reserved |
| 3:0 | MPC, LED0 Mix Percentage | R/W | 0x4 | Retain | When using 2 terminal bi-color LEDs the mixing percentage should not be set greater than 50%. 0000 = 0%, 0001 = 12.5%,..., 0111 = 87.5%, 1000 = 100% 1001 to 1111 = Reserved |

Table 87: LED Timer Control
Device 31, Register 0xF027

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|------------------------|------|--------|--------|---|
| 15 | Reserved | RO | 0x0 | Retain | Set to 0. |
| 14:12 | Pulse Stretch Duration | R/W | 0x4 | Retain | 000 = no pulse stretching 001 = 20 ms to 40 ms 010 = 40 ms to 81 ms 011 = 81 ms to 161 ms 100 = 161 ms to 322 ms 101 = 322 ms to 644 ms 110 = 644 ms to 1.3 s 111 = 1.3 s to 2.6 s |
| 11 | Reserved | RO | 0x0 | Retain | Set to 0. |
| 10:8 | Blink Rate 2 | R/W | 0x5 | Retain | 000 = 40 ms 001 = 81 ms 010 = 161 ms 011 = 322 ms 100 = 644 ms 101 = 1.3s 110 = 2.6 s 111 = 5.2 s |
| 7 | Reserved | RO | 0x0 | Retain | Set to 0. |
| 6:4 | Blink Rate 1 | R/W | 0x1 | Retain | 000 = 40 ms 001 = 81 ms 010 = 161 ms 011 = 322 ms 100 = 644 ms 101 = 1.3s 110 = 2.6 s 111 = 5.2 s |
| 3:0 | Reserved | RO | 0x0 | Retain | Set to 0. |

Table 88: Port Interrupt Status
Device 31, Register 0xF040

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------|------|--------|--------|--|
| 15:6 | Reserved | RO | 0x000 | Retain | 0 |
| 3 | GPIO Interrupt | RO | 0x0 | Retain | 0 = No Interrupt 1 = Active Interrupt |
| 2 | System Side PCS Interrupt | RO | 0x0 | Retain | 0 = No Interrupt 1 = Active Interrupt |
| 1 | Reserved | RO | 0x0 | Retain | 0 |
| 0 | Line Side PCS Interrupt | RO | 0x0 | Retain | 0 = No Interrupt 1 = Active Interrupt |

6.3 SFI Registers

6.3.1 SFI PMA

The registers in this section apply to all ports. However, descriptions for Lanes 1, 2, and 3 may not be applicable depending on the PCS setting.

Table 89: SFI PMA Registers - Register Map

| Register Name | Register Address | Table and Page |
|------------------------------|---------------------------|-------------------|
| PMA/PMD Control 1 | Device 1, Register 0x0000 | Table 90, p. 131 |
| PMA/PMD Status 1 | Device 1, Register 0x0001 | Table 91, p. 132 |
| PMA/PMD Device Identifier 1 | Device 1, Register 0x0002 | Table 92, p. 132 |
| PMA/PMD Device Identifier 2 | Device 1, Register 0x0003 | Table 93, p. 133 |
| PMA/PMD Speed Ability | Device 1, Register 0x0004 | Table 94, p. 133 |
| PMA/PMD Devices In Package 1 | Device 1, Register 0x0005 | Table 95, p. 133 |
| PMA/PMD Devices In Package 2 | Device 1, Register 0x0006 | Table 96, p. 134 |
| 10G PMA/PMD Control 2 | Device 1, Register 0x0007 | Table 97, p. 134 |
| PMA/PMD Status 2 | Device 1, Register 0x0008 | Table 98, p. 135 |
| PMD Transmit Disable | Device 1, Register 0x0009 | Table 99, p. 135 |
| PMD Receive Signal Detect | Device 1, Register 0x000A | Table 100, p. 136 |
| PMA/PMD Extended Ability | Device 1, Register 0x000B | Table 101, p. 136 |
| 40G PMA/PMD Extended Ability | Device 1, Register 0x000D | Table 102, p. 137 |
| PMA/PMD Package Identifier 1 | Device 1, Register 0x000E | Table 103, p. 137 |
| PMA/PMD Package Identifier 2 | Device 1, Register 0x000F | Table 104, p. 138 |
| BASE-R PMD Control Register | Device 1, Register 0x0096 | Table 105, p. 138 |
| BASE-R PMD Status Register | Device 1, Register 0x0097 | Table 106, p. 138 |
| Test Pattern Ability | Device 1, Register 0x05DC | Table 107, p. 139 |
| PRBS Pattern Testing Control | Device 1, Register 0x05DD | Table 108, p. 139 |
| Square Wave Testing Control | Device 1, Register 0x05E6 | Table 109, p. 140 |
| PRBS Rx Error Counter Lane 0 | Device 1, Register 0x06A4 | Table 110, p. 140 |
| PRBS Rx Error Counter Lane 1 | Device 1, Register 0x06A5 | Table 111, p. 141 |
| PRBS Rx Error Counter Lane 2 | Device 1, Register 0x06A6 | Table 112, p. 141 |
| PRBS Rx Error Counter Lane 3 | Device 1, Register 0x06A7 | Table 113, p. 141 |

**Table 90: PMA/PMD Control 1
Device 1, Register 0x0000**

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|---------|--------|--------|--|
| 15 | Software Reset | R/W, SC | 0x0 | 0x0 | 1 = Reset 0 = Normal This register will soft reset all PCS/PMA and associated registers of this interface. |
| 14 | Reserved | RO | 0x0 | 0x0 | Set to 0 |
| 13 | Speed Select | RO | 0x1 | 0x1 | This bit is ignored and is always set to 1 |

Table 90: PMA/PMD Control 1 (Continued)
Device 1, Register 0x0000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------|------|-----------|--------|---|
| 12 | Reserved | RO | 0x0 | 0x0 | Set to 0 |
| 11 | Low Power | R/W | See Desc. | Retain | 1 = Power Down 0 = Normal This register will power down all PCS/PMA of this interface. Initial power state is a function of hardware configuration. |
| 10:7 | Reserved | RO | 0x0 | 0x0 | Set to 0s |
| 6 | Speed Select | RO | 0x1 | 0x1 | This bit is ignored and is always set to 1 |
| 5:2 | Speed Select | RO | 0x0 | 0x0 | This register is ignored. Speed is automatically set based on the mode selected in register 31.F002 |
| 1 | PMA Remote Loopback | R/W | 0x0 | 0x0 | 0 = Disable PMA remote loopback. Writing this register has no effect. |
| 0 | PMA Local Loopback | R/W | 0x0 | 0x0 | 0 = Disable PMA local loopback. 1 = PMA shall loopback transmit data on the received path. |

Table 91: PMA/PMD Status 1
Device 1, Register 0x0001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------|--------|--------|--------|--|
| 15:8 | Reserved | RO | 0x00 | 0x00 | 00000000 |
| 7 | Fault | RO | 0x0 | 0x0 | 1 = Fault condition 0 = No fault condition Bit 1.0001.7 = 1.0008.11 OR 1.0008.10 |
| 6:3 | Reserved | RO | 0x0 | 0x0 | 0000 |
| 2 | Receive Link Status | RO, LL | 0x0 | 0x0 | 1 = PMA/PMD link up 0 = PMA/PMD link down Bit 1.0001.2 is the inverse of 1.0008.10 |
| 1 | Low Power Ability | RO | 0x1 | 0x1 | 1 = PMA/PMD supports low power |
| 0 | Reserved | RO | 0x0 | 0x0 | 0 |

Table 92: PMA/PMD Device Identifier 1
Device 1, Register 0x0002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---|------|--------|--------|---|
| 15:0 | Organizationally Unique Identifier Bit 3:18 | RO | 0x0141 | 0x0141 | 0000000101000001 Marvell OUI is 0x005043 |

Table 93: PMA/PMD Device Identifier 2
Device 1, Register 0x0003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--|------|-----------|-----------|--|
| 15:10 | Organizationally Unique Identifier Bit 19:24 | RO | 0x03 | 0x03 | 000011 |
| 9:4 | Model Number | RO | 0x31 | 0x31 | 110001 |
| 3:0 | Revision Number | RO | See Desc. | See Desc. | Rev Number Contact Marvell® FAEs for information on the device revision number. |

Table 94: PMA/PMD Speed Ability
Device 1, Register 0x0004

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-------------------|------|--------|--------|--|
| 15:10 | Reserved | RO | 0x00 | 0x00 | 000000 |
| 9 | 100G Capable | RO | 0x0 | 0x0 | 0 = PMA/PMD is not capable of operating at 100 Gbps |
| 8 | 40G Capable | RO | 0x1 | 0x1 | 1 = PMA/PMD is capable of operating at 40 Gbps |
| 7 | Reserved | RO | 0x0 | 0x0 | 0 |
| 6 | 10M Capable | RO | 0x0 | 0x0 | 1 = PMA/PMD is capable of operating at 10 Mbps |
| 5 | 100M Capable | RO | 0x0 | 0x0 | 1 = PMA/PMD is capable of operating at 100 Mbps |
| 4 | 1000M Capable | RO | 0x1 | 0x1 | 1 = PMA/PMD is capable of operating at 1000 Mbps |
| 3 | Reserved | RO | 0x0 | 0x0 | 0 |
| 2 | 10PASS-TS Capable | RO | 0x0 | 0x0 | 0 = PMA/PMD is not capable of operating as 10PASS-TS |
| 1 | 2BASE-TL Capable | RO | 0x0 | 0x0 | 0 = PMA/PMD is not capable of operating as 2BASE-TL |
| 0 | 10G Capable | RO | 0x1 | 0x1 | 1 = PMA/PMD is capable of operating at 10 Gbps |

Table 95: PMA/PMD Devices In Package 1
Device 1, Register 0x0005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-------------------|------|--------|--------|--|
| 15:12 | Reserved | RO | 0x0 | 0x0 | 00000 |
| 11 | Separated PMA (4) | RO | 0x0 | 0x0 | 1 = Separated PMA (4) present in package 0 = Separated PMA (4) not present in package |
| 10 | Separated PMA (3) | RO | 0x0 | 0x0 | 1 = Separated PMA (3) present in package 0 = Separated PMA (3) not present in package |
| 9 | Separated PMA (2) | RO | 0x0 | 0x0 | 1 = Separated PMA (2) present in package 0 = Separated PMA (2) not present in package |
| 8 | Separated PMA (1) | RO | 0x0 | 0x0 | 1 = Separated PMA (1) present in package 0 = Separated PMA (1) not present in package |

Table 95: PMA/PMD Devices In Package 1 (Continued)
 Device 1, Register 0x0005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|--|
| 7 | Auto-Negotiation Present | RO | 0x1 | 0x1 | 1 = Auto-negotiation present in package 0 = Auto-negotiation not present in package |
| 6 | TC Present | RO | 0x0 | 0x0 | 1 = TC present in package 0 = TC not present in package |
| 5 | DTE XS Present | RO | 0x0 | 0x0 | 1 = DTE XS present in package 0 = DTE XS not present in package |
| 4 | PHY XS Present | RO | 0x1 | 0x1 | 1 = PHY XS present in package 0 = PHY XS not present in package |
| 3 | PCS Present | RO | 0x1 | 0x1 | 1 = PCS present in package 0 = PCS not present in package |
| 2 | Reserved | RO | 0x1 | 0x1 | Reserved Do not write any value other than the HW Rst value. |
| 1 | PMD/PMA Present | RO | 0x1 | 0x1 | 1 = PMA/PMD present in package 0 = PMA/PMD not present in package |
| 0 | Clause 22 Registers Present | RO | 0x0 | 0x0 | 1 = Clause 22 registers present in package 0 = Clause 22 registers not present in package |

Table 96: PMA/PMD Devices In Package 2
 Device 1, Register 0x0006

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------------|------|--------|--------|--|
| 15 | Marvell Specific Device 2 Present | RO | 0x1 | 0x1 | 1 = Marvell specific device 2 present 0 = Marvell specific device 2 not present |
| 14 | Marvell Specific Device 1 Present | RO | 0x1 | 0x1 | 1 = Marvell specific device 1 present 0 = Marvell specific device 1 not present |
| 13 | Clause 22 Extension Present | RO | 0x0 | 0x0 | 1 = Clause 22 extension present 0 = Clause 22 extension not present |
| 12:0 | Reserved | RO | 0x0000 | 0x0000 | 0 |

Table 97: 10G PMA/PMD Control 2
 Device 1, Register 0x0007

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|---|
| 15:6 | Reserved | RO | 0x000 | 0x000 | Set to 0s. |
| 5:0 | PMA/PMD Type Selection | RO | 0x00 | 0x00 | This register is ignored. PMA is automatically set based on the mode selected in register 31.F002. PMD is based on the external optics used. |

Table 98: PMA/PMD Status 2
Device 1, Register 0x0008

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|------------------------------|--------|--------|--------|--|
| 15:14 | Device Present | RO | 0x2 | 0x2 | 10 = Device responding to this address |
| 13 | Transmit Fault Ability | RO | 0x1 | 0x1 | 1 = PMA/PMD has ability to detect a fault condition on the transmit path 0 = PMA/PMD does not have ability to detect a fault condition on the transmit path |
| 12 | Receive Fault Ability | RO | 0x1 | 0x1 | 1 = PMA/PMD has ability to detect a fault condition on the receive path 0 = PMA/PMD does not have ability to detect a fault condition on the receive path |
| 11 | Transmit Fault | RO, LH | 0x0 | 0x0 | 1 = Fault condition on transmit path 0 = No fault condition on transmit path |
| 10 | Receive Fault | RO, LH | 0x0 | 0x0 | 1 = Fault condition on receive path 0 = No fault condition on receive path |
| 9 | Extended Abilities | RO | 0x1 | 0x1 | 1 = PMA/PMD has extended abilities listed in register 1.000B |
| 8 | PMD Transmit Disable Ability | RO | 0x1 | 0x1 | 1 = PMD has the ability to disable the transmit path 0 = PMD does not have the ability to disable the transmit path |
| 7 | 10GBASE-SR Ability | RO | 0x1 | 0x1 | 1 = Able 0 = Not able |
| 6 | 10GBASE-LR Ability | RO | 0x1 | 0x1 | 1 = Able 0 = Not able |
| 5 | 10GBASE-ER Ability | RO | 0x1 | 0x1 | 1 = Able 0 = Not able |
| 4 | 10GBASE-LX4 Ability | RO | 0x1 | 0x1 | 1 = Able 0 = Not able |
| 3 | 10GBASE-SW Ability | RO | 0x1 | 0x1 | 1 = Able 0 = Not able |
| 2 | 10GBASE-LW Ability | RO | 0x1 | 0x1 | 1 = Able 0 = Not able |
| 1 | 10GBASE-EW Ability | RO | 0x1 | 0x1 | 1 = Able 0 = Not able |
| 0 | PMA Local Loopback Ability | RO | 0x1 | 0x1 | 1 = Able 0 = Not able |

Table 99: PMD Transmit Disable
Device 1, Register 0x0009

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------|------|--------|--------|---|
| 15:5 | Reserved | RO | 0x000 | 0x000 | Set to 00000000000 Software reset is defined to be 1.0000.15 only. |

Table 99: PMD Transmit Disable (Continued)
Device 1, Register 0x0009

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|---|
| 4 | PMD Transmit Disable Lane 3 | R/W | 0x0 | 0x0 | 0 = Enable transmitter 1 = Disable transmitter This register is ignored if the PCS does not require lane 3. |
| 3 | PMD Transmit Disable Lane 2 | R/W | 0x0 | 0x0 | 0 = Enable transmitter 1 = Disable transmitter This register is ignored if the PCS does not require lane 2. |
| 2 | PMD Transmit Disable Lane 1 | R/W | 0x0 | 0x0 | 0 = Enable transmitter 1 = Disable transmitter This register is ignored if the PCS does not require lane 1. |
| 1 | PMD Transmit Disable Lane 0 | R/W | 0x0 | 0x0 | 0 = Enable transmitter 1 = Disable transmitter |
| 0 | Global PMD Transmit Disable | R/W | 0x0 | 0x0 | 0 = Enable transmitter 1 = Disable transmitter |

Table 100: PMD Receive Signal Detect
Device 1, Register 0x000A

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--|------|--------|--------|---|
| 15:5 | Reserved | RO | 0x000 | 0x000 | 0 |
| 4 | PMD Receive Signal Detect Disable Lane 3 | RO | 0x0 | 0x0 | 1 = Signal detected on receive 0 = Signal not detected on receive This register should be ignored if the PCS does not require lane 3. |
| 3 | PMD Receive Signal Detect Disable Lane 2 | RO | 0x0 | 0x0 | 1 = Signal detected on receive 0 = Signal not detected on receive This register should be ignored if the PCS does not require lane 2. |
| 2 | PMD Receive Signal Detect Disable Lane 1 | RO | 0x0 | 0x0 | 1 = Signal detected on receive 0 = Signal not detected on receive This register should be ignored if the PCS does not require lane 1. |
| 1 | PMD Receive Signal Detect Disable Lane 0 | RO | 0x0 | 0x0 | 1 = Signal detected on receive 0 = Signal not detected on receive |
| 0 | Global PMD Receive Signal Detect | RO | 0x0 | 0x0 | 1 = Signal detected on receive 0 = Signal not detected on receive |

Table 101: PMA/PMD Extended Ability
Device 1, Register 0x000B

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|----------|------|--------|--------|-------------|
| 15:11 | Reserved | RO | 0x00 | 0x00 | 0 |

Table 101: PMA/PMD Extended Ability (Continued)
Device 1, Register 0x000B

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|---|
| 10 | 40G/100G Extended Abilities | RO | 0x1 | 0x1 | 1 = PMA/PMD has 40G/100G extended abilities listed in register 1.000C |
| 9 | Reserved | RO | 0x0 | 0x0 | 0 |
| 8 | 10BASE-T | RO | 0x0 | 0x0 | 0 = PMA/PMD is not able to perform 10BASE-T |
| 7 | 100BASE-TX | RO | 0x0 | 0x0 | 0 = PMA/PMD is not able to perform 100BASE-TX |
| 6 | 1000BASE-KX | RO | 0x1 | 0x1 | 1 = PMA/PMD is able to perform 1000BASE-KX |
| 5 | 1000BASE-T | RO | 0x0 | 0x0 | 0 = PMA/PMD is not able to perform 1000BASE-T |
| 4 | 10GBASE-KR | RO | 0x1 | 0x1 | 1 = PMA/PMD is able to perform 10GBASE-KR |
| 3 | 10GBASE-KX4 | RO | 0x1 | 0x1 | 1 = PMA/PMD is able to perform 10GBASE-KX4 |
| 2 | 10GBASE-T | RO | 0x0 | 0x0 | 1 = PMA/PMD is able to perform 10GBASE-T |
| 1 | 10GBASE-LRM | RO | 0x0 | 0x0 | 0 = PMA/PMD is not able to perform 10GBASE-LRM |
| 0 | 10GBASE-CX4 | RO | 0x1 | 0x1 | 1 = PMA/PMD is able to perform 10GBASE-CX4 |

Table 102: 40G PMA/PMD Extended Ability
Device 1, Register 0x000D

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|---|
| 15 | PMA Remote loopback ability | RO | 0x0 | 0x0 | 1 = PMA has the ability to perform a remote loopback function 0 = PMA doesn't have the ability to perform a remote loopback function |
| 14:4 | Reserved | RO | 0x000 | 0x000 | 0 |
| 3 | 40GBASE-LR4 | RO | 0x1 | 0x1 | 1 = PMA/PMD is able to perform 40GBASE-LR4 |
| 2 | 40GBASE-SR4 | RO | 0x1 | 0x1 | 1 = PMA/PMD is able to perform 40GBASE-SR4 |
| 0 | 40GBASE-KR4 | RO | 0x1 | 0x1 | 1 = PMA/PMD is able to perform 40GBASE-KR4 |

Table 103: PMA/PMD Package Identifier 1
Device 1, Register 0x000E

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---|------|--------|--------|---|
| 15:0 | Organizationally Unique Identifier Bit 3:18 | RO | 0x0141 | 0x0141 | 0000000101000001 Marvell OUI is 0x005043 |

Table 104: PMA/PMD Package Identifier 2
Device 1, Register 0x000F

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--|------|-----------|-----------|--|
| 15:10 | Organizationally Unique Identifier Bit 19:24 | RO | 0x03 | 0x03 | 000011 |
| 9:4 | Model Number | RO | 0x31 | 0x31 | 110001 |
| 3:0 | Revision Number | RO | See Desc. | See Desc. | Rev Number Contact Marvell® FAEs for information on the device revision number. |

Table 105: BASE-R PMD Control Register
Device 1, Register 0x0096

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------|---------|--------|--------|---|
| 15:2 | Reserved | RO | 0x0000 | 0x0000 | 0000 |
| 1 | Training Enable | R/W | 0x0 | Retain | 1 = Enable BASE-R start-up protocol 0 = Disable BASE-R start-up protocol |
| 0 | Restart Training | R/W, SC | 0x0 | Retain | 1 = Reset BASE-R start-up protocol 0 = Normal operation |

Table 106: BASE-R PMD Status Register
Device 1, Register 0x0097

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15 | Training Failure 3 | RO | 0x0 | Retain | 1 = Training failure has been detected for lane 3 0 = Training failure has not been detected for lane 3 |
| 14 | Start-Up Protocol Status 3 | RO | 0x0 | Retain | 1 = Start-up protocol in progress for lane 3 0 = Start-up protocol complete for lane 3 |
| 13 | Frame Lock 3 | RO | 0x0 | Retain | 1 = Training frame delineation detected for lane 3 0 = Training frame delineation not detected for lane 3 |
| 12 | Receiver Status 3 | RO | 0x0 | Retain | 1 = Receiver trained and ready to receive data for lane 3 0 = Receiver training for lane 3 |
| 11 | Training Failure 2 | RO | 0x0 | Retain | 1 = Training failure has been detected for lane 2 0 = Training failure has not been detected for lane 2 |
| 10 | Start-Up Protocol Status 2 | RO | 0x0 | Retain | 1 = Start-up protocol in progress for lane 2 0 = Start-up protocol complete for lane 2 |
| 9 | Frame Lock 2 | RO | 0x0 | Retain | 1 = Training frame delineation detected for lane 2 0 = Training frame delineation not detected for lane 2 |
| 8 | Receiver Status 2 | RO | 0x0 | Retain | 1 = Receiver trained and ready to receive data for lane 2 0 = Receiver training for lane 2 |
| 7 | Training Failure 1 | RO | 0x0 | Retain | 1 = Training failure has been detected for lane 1 0 = Training failure has not been detected for lane 1 |

Table 106: BASE-R PMD Status Register (Continued)
Device 1, Register 0x0097

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 6 | Start-Up Protocol Status 1 | RO | 0x0 | Retain | 1 = Start-up protocol in progress for lane 1 0 = Start-up protocol complete for lane 1 |
| 5 | Frame Lock 1 | RO | 0x0 | Retain | 1 = Training frame delineation detected for lane 1 0 = Training frame delineation not detected for lane 1 |
| 4 | Receiver Status 1 | RO | 0x0 | Retain | 1 = Receiver trained and ready to receive data for lane 1 0 = Receiver training for lane 1 |
| 3 | Training Failure 0 | RO | 0x0 | Retain | 1 = Training failure has been detected for lane 0 0 = Training failure has not been detected for lane 0 |
| 2 | Start-Up Protocol Status 0 | RO | 0x0 | Retain | 1 = Start-up protocol in progress for lane 0 0 = Start-up protocol complete for lane 0 |
| 1 | Frame Lock 0 | RO | 0x0 | Retain | 1 = Training frame delineation detected for lane 0 0 = Training frame delineation not detected for lane 0 |
| 0 | Receiver Status 0 | RO | 0x0 | Retain | 1 = Receiver trained and ready to receive data for lane 0 0 = Receiver training for lane 0 |

Table 107: Test Pattern Ability
Device 1, Register 0x05DC

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------------|------|--------|--------|--|
| 15:13 | Reserved | RO | 0x0 | 0x0 | 0 |
| 12 | Square wave test ability | RO | 0x1 | 0x1 | 1 = Square wave testing supported 0 = Square waver testing not supported |
| 11:6 | Reserved | RO | 0x00 | 0x00 | 0 |
| 5 | PRBS9 Tx generator Ability | RO | 0x1 | 0x1 | 1 = PRBS9 Tx direction pattern generation supported 0 = PRBS9 Tx direction pattern generation not supported |
| 4 | PRBS9 Rx generator Ability | RO | 0x0 | 0x0 | 1 = PRBS9 Rx direction pattern generation supported 0 = PRBS9 Rx direction pattern generation not supported |
| 3 | PRBS31 Tx generator Ability | RO | 0x1 | 0x1 | 1 = PRBS31 Tx direction pattern generation supported 0 = PRBS31 Tx direction pattern generation not supported |
| 2 | PRBS31 Tx checker Ability | RO | 0x0 | 0x0 | 1 = PRBS31 Tx direction pattern checker supported 0 = PRBS31 Tx direction pattern checker not supported |
| 1 | PRBS31 Rx generator Ability | RO | 0x0 | 0x0 | 1 = PRBS31 Rx direction pattern generation supported 0 = PRBS31 Rx direction pattern generation not supported |
| 0 | PRBS31 Rx checker Ability | RO | 0x1 | 0x1 | 1 = PRBS31 Rx direction pattern checker supported 0 = PRBS31 Rx direction pattern checker not supported |

Table 108: PRBS Pattern Testing Control
Device 1, Register 0x05DD

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------|------|--------|--------|-------------|
| 15:8 | Reserved | RO | 0x00 | 0x00 | 0 |

Table 108: PRBS Pattern Testing Control (Continued)
Device 1, Register 0x05DD

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|------|--------|--------|---|
| 7 | PRBS31 Pattern Enable | R/W | 0x0 | 0x0 | 1 = Enable PRBS31 test-pattern 0 = Disable PRBS31 test-pattern |
| 6 | PRBS9 Pattern Enable | R/W | 0x0 | 0x0 | 1 = Enable PRBS9 test-pattern 0 = Disable PRBS9 test-pattern |
| 5:4 | Reserved | RO | 0x0 | 0x0 | 0 |
| 3 | Tx generator Enable | R/W | 0x0 | 0x0 | 1 = Enable Tx direction test-pattern generator 0 = Disable Tx direction test-pattern generator |
| 2 | Tx checker Enable | RO | 0x0 | 0x0 | 1 = Enable Tx direction test-pattern checker 0 = Disable Tx direction test-pattern checker |
| 1 | Rx generator Enable | RO | 0x0 | 0x0 | 1 = Enable Rx direction test-pattern generator 0 = Disable Rx direction test-pattern generator |
| 0 | Rx checker Enable | R/W | 0x0 | 0x0 | 1 = Enable Rx direction test-pattern checker 0 = Disable Rx direction test-pattern checker |

Table 109: Square Wave Testing Control
Device 1, Register 0x05E6

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------|------|--------|--------|---|
| 15:4 | Reserved | RO | 0x000 | 0x000 | 0 |
| 3 | Lane 3 SW enable | R/W | 0x0 | 0x0 | 1 = Enable square wave on lane 3 0 = Disable square wave on lane 3 |
| 2 | Lane 2 SW enable | R/W | 0x0 | 0x0 | 1 = Enable square wave on lane 2 0 = Disable square wave on lane 2 |
| 1 | Lane 1 SW enable | R/W | 0x0 | 0x0 | 1 = Enable square wave on lane 1 0 = Disable square wave on lane 1 |
| 0 | Lane 0 SW enable | R/W | 0x0 | 0x0 | 1 = Enable square wave on lane 0 0 = Disable square wave on lane 0 |

Table 110: PRBS Rx Error Counter Lane 0
Device 1, Register 0x06A4

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------|------|--------|--------|--|
| 15:0 | Error Count [15:0] | RO | 0x0 | 0x0 | Increments by 1 for every bit error received per lane. This register clears on read and held at all ones in case of overflow. |

Table 111: PRBS Rx Error Counter Lane 1
Device 1, Register 0x06A5

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------|------|--------|--------|---|
| 15:0 | Error Count [15:0] | RO | 0x0 | 0x0 | Increments by 1 for every bit error received per lane. This register clears on read and held at all ones in case of overflow. |

Table 112: PRBS Rx Error Counter Lane 2
Device 1, Register 0x06A6

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------|------|--------|--------|---|
| 15:0 | Error Count [15:0] | RO | 0x0 | 0x0 | Increments by 1 for every bit error received per lane. This register clears on read and held at all ones in case of overflow. |

Table 113: PRBS Rx Error Counter Lane 3
Device 1, Register 0x06A7

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------|------|--------|--------|---|
| 15:0 | Error Count [15:0] | RO | 0x0 | 0x0 | Increments by 1 for every bit error received per lane. This register clears on read and held at all ones in case of overflow. |

6.3.2 SFI 10GBASE-R PCS

The registers in this section apply to all ports.

Table 114: SFI 10GBASE-R PCS Registers - Register Map

| Register Name | Register Address | Table and Page |
|--|---------------------------|-------------------|
| 10GBASE-R PCS Control 1 | Device 3, Register 0x0000 | Table 115, p. 142 |
| 10GBASE-R PCS Status 1 | Device 3, Register 0x0001 | Table 116, p. 143 |
| PCS Device Identifier 1 | Device 3, Register 0x0002 | Table 117, p. 144 |
| PCS Device Identifier 2 | Device 3, Register 0x0003 | Table 118, p. 144 |
| PCS Speed Ability | Device 3, Register 0x0004 | Table 119, p. 144 |
| PCS Devices In Package 1 | Device 3, Register 0x0005 | Table 120, p. 144 |
| PCS Devices In Package 2 | Device 3, Register 0x0006 | Table 121, p. 145 |
| PCS Control 2 | Device 3, Register 0x0007 | Table 122, p. 145 |
| 10GBASE-R PCS Status 2 | Device 3, Register 0x0008 | Table 123, p. 145 |
| PCS Package Identifier 1 | Device 3, Register 0x000E | Table 124, p. 146 |
| PCS Package Identifier 2 | Device 3, Register 0x000F | Table 125, p. 146 |
| PCS EEE Capability Register | Device 3, Register 0x0014 | Table 126, p. 147 |
| BASE-R PCS Status 1 | Device 3, Register 0x0020 | Table 127, p. 147 |
| BASE-R PCS Status 2 | Device 3, Register 0x0021 | Table 128, p. 147 |
| 10GBASE-R PCS Test Pattern Seed A 0 | Device 3, Register 0x0022 | Table 129, p. 148 |
| 10GBASE-R PCS Test Pattern Seed A 1 | Device 3, Register 0x0023 | Table 130, p. 148 |
| 10GBASE-R PCS Test Pattern Seed A 2 | Device 3, Register 0x0024 | Table 131, p. 148 |
| 10GBASE-R PCS Test Pattern Seed A 3 | Device 3, Register 0x0025 | Table 132, p. 148 |
| 10GBASE-R PCS Test Pattern Seed B 0 | Device 3, Register 0x0026 | Table 133, p. 148 |
| 10GBASE-R PCS Test Pattern Seed B 1 | Device 3, Register 0x0027 | Table 134, p. 148 |
| 10GBASE-R PCS Test Pattern Seed B 2 | Device 3, Register 0x0028 | Table 135, p. 148 |
| 10GBASE-R PCS Test Pattern Seed B 3 | Device 3, Register 0x0029 | Table 136, p. 149 |
| BASE-R PCS Test Pattern Control | Device 3, Register 0x002A | Table 137, p. 149 |
| 10GBASE-R PCS Test Pattern Error Counter | Device 3, Register 0x002B | Table 138, p. 149 |
| 10GBASE-R Interrupt Enable Register | Device 3, Register 0x8000 | Table 139, p. 149 |
| 10GBASE-R Interrupt Status Register | Device 3, Register 0x8001 | Table 140, p. 150 |
| 10GBASE-R PCS Real Time Status Register | Device 3, Register 0x8002 | Table 141, p. 150 |

Table 115: 10GBASE-R PCS Control 1
 Device 3, Register 0x0000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|---------|--------|--------|--|
| 15 | Software Reset | R/W, SC | 0x0 | 0x0 | 1 = Reset 0 = Normal This register will soft reset all PCS/PMA and associated registers of this interface. |
| 14 | Loopback | R/W | 0x0 | 0x0 | 1 = Loopback 0 = Normal |

Table 115: 10GBASE-R PCS Control 1 (Continued)
Device 3, Register 0x0000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------|------|-----------|--------|--|
| 13 | Speed Select | RO | 0x1 | 0x1 | 1 = Bits 5:2 select speed. |
| 12 | Reserved | RO | 0x0 | 0x0 | 0 |
| 11 | Low Power | R/W | See Desc. | Retain | 1 = Power Down 0 = Normal This register will power down all PCS/PMA of this interface. Initial power state is a function of hardware configuration. |
| 10 | Clock Stoppable | R/W | 0x0 | 0x0 | 1 = Clock stoppable during LPI 0 = Clock not stoppable |
| 9:7 | Reserved | RO | 0x0 | 0x0 | 000 |
| 6 | Speed Select | RO | 0x1 | 0x1 | 1 = Bits 5:2 select speed. |
| 5:2 | Speed Select | RO | 0x0 | 0x0 | This register is ignored. Speed is automatically set based on the mode selected in register 31.F002 |
| 1:0 | Reserved | RO | 0x0 | 0x0 | 00 |

Table 116: 10GBASE-R PCS Status 1
Device 3, Register 0x0001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------|--------|--------|--------|--|
| 15:12 | Reserved | RO | 0x0 | 0x0 | 00000000 |
| 11 | TX LP Idle Received | RO/LH | 0x0 | 0x0 | 1 = Tx PCS has received LP Idle 0 = LP Idle not received |
| 10 | Rx LP Idle Received | RO/LH | 0x0 | 0x0 | 1 = Rx PCS has received LP Idle 0 = LP Idle not received |
| 9 | Tx LP Idle Indication | RO | 0x0 | 0x0 | 1 = Tx PCS is currently receiving LP Idle 0 = Tx PCS is not currently receiving LP Idle |
| 8 | Rx LP Idle Indication | RO | 0x0 | 0x0 | 1 = Rx PCS is currently receiving LP Idle 0 = Rx PCS is not currently receiving LP Idle |
| 7 | Fault | RO | 0x0 | 0x0 | 1 = Fault condition 0 = No fault condition |
| 6 | Clock Stop Capable | RO | 0x0 | 0x0 | 0 = Clock not stoppable |
| 5:3 | Reserved | RO | 0x0 | 0x0 | 000 |
| 2 | Link Status | RO, LL | 0x0 | 0x0 | 1 = PCS link up 0 = PCS link down |
| 1 | Low Power Ability | RO | 0x1 | 0x1 | 1 = PCS Supports Low Power |
| 0 | Reserved | RO | 0x0 | 0x0 | 0 |

Table 117: PCS Device Identifier 1
 Device 3, Register 0x0002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---|------|--------|--------|---|
| 15:0 | Organizationally Unique Identifier Bit 3:18 | RO | 0x0141 | 0x0141 | 0000000101000001 Marvell OUI is 0x005043 |

Table 118: PCS Device Identifier 2
 Device 3, Register 0x0003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--|------|-----------|-----------|--|
| 15:10 | Organizationally Unique Identifier Bit 19:24 | RO | 0x03 | 0x03 | 000011 |
| 9:4 | Model Number | RO | 0x31 | 0x31 | 110001 |
| 3:0 | Revision Number | RO | See Desc. | See Desc. | Rev Number Contact Marvell® FAEs for information on the device revision number. |

Table 119: PCS Speed Ability
 Device 3, Register 0x0004

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15:4 | Reserved | RO | 0x000 | 0x000 | 0 |
| 3 | 100G Capable | RO | 0x0 | 0x0 | 0 = Not capable of operating at 100 Gbps |
| 2 | 40G Capable | RO | 0x1 | 0x1 | 1 = Capable of operating at 40 Gbps |
| 1 | 10PASS-TS/2BASE-TL Capable | RO | 0x0 | 0x0 | 0 = Not capable of operating as the 10P/2B PCS |
| 0 | 10G Capable | RO | 0x1 | 0x1 | 1 = Capable of operating at 10Gbps |

Table 120: PCS Devices In Package 1
 Device 3, Register 0x0005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--------------------------|------|--------|--------|--|
| 15:11 | Reserved | RO | 0x00 | 0x00 | 00000 |
| 10 | Separated PMA (3) | RO | 0x0 | 0x0 | 1 = Separated PMA (3) present in package 0 = Separated PMA (3) not present in package |
| 9 | Separated PMA (2) | RO | 0x0 | 0x0 | 1 = Separated PMA (2) present in package 0 = Separated PMA (2) not present in package |
| 8 | Separated PMA (1) | RO | 0x0 | 0x0 | 1 = Separated PMA (1) present in package 0 = Separated PMA (1) not present in package |
| 7 | Auto-Negotiation Present | RO | 0x1 | 0x1 | 1 = Auto-negotiation present in package 0 = Auto-negotiation not present in package |

Table 120: PCS Devices In Package 1 (Continued)
Device 3, Register 0x0005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|--|
| 6 | TC Present | RO | 0x0 | 0x0 | 1 = TC present in package 0 = TC not present in package |
| 5 | DTE XS Present | RO | 0x0 | 0x0 | 1 = DTE XS present in package 0 = DTE XS not present in package |
| 4 | PHY XS Present | RO | 0x1 | 0x1 | 1 = PHY XS present in package 0 = PHY XS not present in package |
| 3 | PCS Present | RO | 0x1 | 0x1 | 1 = PCS present in package 0 = PCS not present in package |
| 2 | Reserved | RO | 0x1 | 0x1 | Reserved Do not write any value other than the HW Rst value. |
| 1 | PMD/PMA Present | RO | 0x1 | 0x1 | 1 = PMA/PMD present in package 0 = PMA/PMD not present in package |
| 0 | Clause 22 Registers Present | RO | 0x0 | 0x0 | 1 = Clause 22 registers present in package 0 = Clause 22 registers not present in package |

Table 121: PCS Devices In Package 2
Device 3, Register 0x0006

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------------|------|--------|--------|--|
| 15 | Marvell Specific Device 2 Present | RO | 0x1 | 0x1 | 1 = Marvell specific device 2 present 0 = Marvell specific device 2 not present |
| 14 | Marvell Specific Device 1 Present | RO | 0x1 | 0x1 | 1 = Marvell specific device 1 present 0 = Marvell specific device 1 not present |
| 13 | Clause 22 Extension Present | RO | 0x0 | 0x0 | 1 = Clause 22 extension present 0 = Clause 22 extension not present |
| 12:0 | Reserved | RO | 0x0000 | 0x0000 | 0 |

Table 122: PCS Control 2
Device 3, Register 0x0007

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------|------|--------|--------|--|
| 15:3 | Reserved | RO | 0x0000 | 0x0000 | 0 |
| 2:0 | PCS Type Selection | RO | 0x0 | 0x0 | This register is ignored. PCS is automatically set based on the mode selected in register 31.F002 |

Table 123: 10GBASE-R PCS Status 2
Device 3, Register 0x0008

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|----------------|------|--------|--------|--|
| 15:14 | Device Present | RO | 0x2 | 0x2 | 10 = Device responding to this address |

Table 123: 10GBASE-R PCS Status 2 (Continued)
 Device 3, Register 0x0008

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--------------------|--------|--------|--------|--|
| 13:12 | Reserved | RO | 0x0 | 0x0 | 00 |
| 11 | Transmit Fault | RO, LH | 0x0 | 0x0 | 1 = Fault on transmit path, 0 = No fault |
| 10 | Receive Fault | RO, LH | 0x0 | 0x0 | 1 = Fault on receive path, 0 = No fault |
| 9:6 | Reserved | RO | 0x0 | 0x0 | 0000000 |
| 5 | 100GBASE-R Capable | RO | 0x0 | 0x0 | 1 = PCS is able to support 100GBASE-R PCS types 0 = PCS is not able to support 100GBASE-R PCS types |
| 4 | 40GBASE-R Capable | RO | 0x1 | 0x1 | 1 = PCS is able to support 40GBASE-R PCS types 0 = PCS is not able to support 40GBASE-R PCS types |
| 3 | 10GBASE-T Capable | RO | 0x0 | 0x0 | 1 = PCS is able to support 10GBASE-T PCS types 0 = PCS is not able to support 10GBASE-T PCS types |
| 2 | Reserved | RO | 0x1 | 0x1 | Reserved Do not write any value other than the HW Rst value. |
| 1 | 10GBASE-X Capable | RO | 0x1 | 0x1 | 1 = PCS is able to support 10GBASE-X PCS types 0 = PCS is not able to support 10GBASE-X PCS types |
| 0 | 10GBASE-R Capable | RO | 0x1 | 0x1 | 1 = PCS is able to support 10GBASE-R PCS types 0 = PCS is not able to support 10GBASE-R PCS types |

Table 124: PCS Package Identifier 1
 Device 3, Register 0x000E

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--|------|--------|--------|---|
| 15:0 | Organizationally Unique Identifier Bit 3:18 | RO | 0x0141 | 0x0141 | 0000000101000001 Marvell OUI is 0x005043 |

Table 125: PCS Package Identifier 2
 Device 3, Register 0x000F

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---|------|-----------|-----------|--|
| 15:10 | Organizationally Unique Identifier Bit 19:24 | RO | 0x03 | 0x03 | 000011 |
| 9:4 | Model Number | RO | 0x31 | 0x31 | 110001 |
| 3:0 | Revision Number | RO | See Desc. | See Desc. | Rev Number Contact Marvell® FAEs for information on the device revision number. |

Table 126: PCS EEE Capability Register
Device 3, Register 0x0014

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------|------|--------|--------|--------------------------------------|
| 15:7 | Reserved | RO | 0x000 | 0x000 | 0 |
| 6 | 10GBASE-KR EEE | RO | 0x0 | 0x0 | 1 = EEE is supported for 10GBASE-KR |
| 5 | 10GBASE-KX4 EEE | RO | 0x0 | 0x0 | 1 = EEE is supported for 10GBASE-KX4 |
| 4 | 1000BASE-KX EEE | RO | 0x0 | 0x0 | 1 = EEE is supported for 1000BASE-KX |
| 3:0 | Reserved | RO | 0x0 | 0x0 | 0 |

Table 127: BASE-R PCS Status 1
Device 3, Register 0x0020

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------------------|------|--------|--------|--|
| 15:13 | Reserved | RO | 0x0 | 0x0 | 0 |
| 12 | 10GBASE-R Receive Link Status | RO | 0x0 | 0x0 | 1 = 10G BASE-R PCS receive link up 0 = 10G BASE-R PCS receive link down |
| 11:4 | Reserved | RO | 0x00 | 0x00 | 0 |
| 3 | PRBS9 Pattern Testing Ability | RO | 0x1 | 0x1 | 1 = PCS is able to support PRBS9 pattern testing 0 = PCS is not able to support PRBS9 pattern testing |
| 2 | PRBS31 Pattern Testing Ability | RO | 0x1 | 0x1 | 1 = PCS is able to support PRBS31 pattern testing 0 = PCS is not able to support PRBS31 pattern testing |
| 1 | 10GBASE-R PCS High Bit Error Rate | RO | 0x0 | 0x0 | 1 = 10G BASE-R PCS reporting high BER 0 = 10G BASE-R PCS not reporting high BER |
| 0 | 10GBASE-R PCS Block Lock | RO | 0x0 | 0x0 | 1 = 10G BASE-R PCS locked to received block 0 = 10G BASE-R PCS not locked |

Table 128: BASE-R PCS Status 2
Device 3, Register 0x0021

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|--------|--------|--------|---|
| 15 | Latched Block Lock | RO, LL | 0x0 | 0x0 | 1 = PCS Has Block Lock 0 = PCS Does Not Have Block Lock |
| 14 | Latched High Bit Error Rate | RO, LH | 0x0 | 0x0 | 1 = PCS Has Reported High BER 0 = PCS Has Not Reported High BER |
| 13:8 | Bit Error Rate Counter | RO | 0x00 | 0x00 | Bit Error Rate Counter Counter clears on read. Counter will peg at all 1s. |
| 7:0 | Errored Blocks Counter | RO | 0x00 | 0x00 | Errored Blocks Counter Counter clears on read. Counter will peg at all 1s. |

Table 129: 10GBASE-R PCS Test Pattern Seed A 0
 Device 3, Register 0x0022

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|------|--------|--------|----------------------------------|
| 15:0 | Test Pattern Seed A 0 | R/W | 0x0000 | 0x0000 | Test Pattern Seed A bits 0 to 15 |

Table 130: 10GBASE-R PCS Test Pattern Seed A 1
 Device 3, Register 0x0023

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|------|--------|--------|-----------------------------------|
| 15:0 | Test Pattern Seed A 1 | R/W | 0x0000 | 0x0000 | Test Pattern Seed A bits 16 to 31 |

Table 131: 10GBASE-R PCS Test Pattern Seed A 2
 Device 3, Register 0x0024

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|------|--------|--------|-----------------------------------|
| 15:0 | Test Pattern Seed A 2 | R/W | 0x0000 | 0x0000 | Test Pattern Seed A bits 32 to 47 |

Table 132: 10GBASE-R PCS Test Pattern Seed A 3
 Device 3, Register 0x0025

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------|------|--------|--------|-----------------------------------|
| 15:10 | Reserved | RO | 0x00 | 0x00 | 000000 |
| 9:0 | Test Pattern Seed A 3 | R/W | 0x0000 | 0x0000 | Test Pattern Seed A bits 48 to 57 |

Table 133: 10GBASE-R PCS Test Pattern Seed B 0
 Device 3, Register 0x0026

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|------|--------|--------|----------------------------------|
| 15:0 | Test Pattern Seed B 0 | R/W | 0x0000 | 0x0000 | Test Pattern Seed B bits 0 to 15 |

Table 134: 10GBASE-R PCS Test Pattern Seed B 1
 Device 3, Register 0x0027

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|------|--------|--------|-----------------------------------|
| 15:0 | Test Pattern Seed B 1 | R/W | 0x0000 | 0x0000 | Test Pattern Seed B bits 16 to 31 |

Table 135: 10GBASE-R PCS Test Pattern Seed B 2
 Device 3, Register 0x0028

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|------|--------|--------|-----------------------------------|
| 15:0 | Test Pattern Seed B 2 | R/W | 0x0000 | 0x0000 | Test Pattern Seed B bits 32 to 47 |

Table 136: 10GBASE-R PCS Test Pattern Seed B 3
Device 3, Register 0x0029

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------|------|--------|--------|-----------------------------------|
| 15:10 | Reserved | RO | 0x00 | 0x00 | 000000 |
| 9:0 | Test Pattern Seed B 3 | R/W | 0x000 | 0x000 | Test Pattern Seed B bits 48 to 57 |

Table 137: BASE-R PCS Test Pattern Control
Device 3, Register 0x002A

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------------------------|------|--------|--------|---|
| 15:7 | Reserved | RO | 0x000 | 0x000 | 0 |
| 6 | PRBS9 Transmit Test Pattern Enable | R/W | 0x0 | 0x0 | 1 = Enable On Transmit Path 0 = Disable On Transmit Path |
| 5 | PRBS31 Receive Test Pattern Enable | R/W | 0x0 | 0x0 | 1 = Enable On Receive Path 0 = Disable On Receive Path |
| 4 | PRBS31 Transmit Test Pattern Enable | R/W | 0x0 | 0x0 | 1 = Enable On Transmit Path 0 = Disable On Transmit Path |
| 3 | Transmit Test Pattern Enable | R/W | 0x0 | 0x0 | 1 = Enable 0 = Disable |
| 2 | Receive Test Pattern Enable | R/W | 0x0 | 0x0 | 1 = Enable 0 = Disable |
| 1 | Test Pattern Select | R/W | 0x0 | 0x0 | 1 = Square Wave 0 = Pseudo Random |
| 0 | Data Pattern Select | R/W | 0x0 | 0x0 | 1 = Zeros Data Pattern 0 = LF Data Pattern |

Table 138: 10GBASE-R PCS Test Pattern Error Counter
Device 3, Register 0x002B

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15:0 | Test Pattern Error Counter | RO | 0x0000 | 0x0000 | Test Pattern Error Counter Counter clears on read. Counter will peg at all 1s. In Pseudo-random test mode, it counts block errors. In PRBS31 test mode it counts bit errors at the PRBS31 pattern checker output. |

Table 139: 10GBASE-R Interrupt Enable Register
Device 3, Register 0x8000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--|------|--------|--------|---|
| 15:12 | Reserved | R/W | 0x0 | Retain | Set to 0 |
| 11 | Local Fault Transmitted Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |

Table 139: 10GBASE-R Interrupt Enable Register (Continued)
 Device 3, Register 0x8000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------------------|------|--------|--------|---|
| 10 | Local Fault Received Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 9:4 | Reserved | R/W | 0x00 | Retain | Set to 0 |
| 3 | Reserved | R/W | 0x0 | Retain | Set to 0 |
| 2 | Link status change Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 1 | High BER Change Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 0 | Block Lock Change Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |

Table 140: 10GBASE-R Interrupt Status Register
 Device 3, Register 0x8001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------------------|-------|--------|--------|--|
| 15:12 | Reserved | RO,LH | 0x0 | 0x0 | Set to 0 |
| 11 | Local Fault Transmitted Interrupt | RO,LH | 0x0 | 0x0 | 1 = Local fault transmitted 0 = No local fault transmitter |
| 10 | Local Fault Received Interrupt | RO,LH | 0x0 | 0x0 | 1 = Local fault received 0 = No local fault received |
| 9:4 | Reserved | RO,LH | 0x00 | 0x00 | Set to 0 |
| 3 | Reserved | RO,LH | 0x0 | 0x0 | Set to 0 |
| 2 | Link status change Detected | RO,LH | 0x0 | 0x0 | 1 = Link status changed detected 0 = Link status changed not detected |
| 1 | High BER Change Interrupt | RO,LH | 0x0 | 0x0 | 1 = Change detected 0 = No Change |
| 0 | Block Lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1 = Change detected 0 = No Change |

Table 141: 10GBASE-R PCS Real Time Status Register
 Device 3, Register 0x8002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--------------------------------|------|--------|--------|---|
| 15:12 | Reserved | RO | 0x0 | 0x0 | Set to 0 |
| 11 | Local Fault Transmitted Status | RO | 0x0 | 0x0 | 1 = Local fault transmitted 0 = No local fault transmitted |
| 10 | Local Fault Received Status | RO | 0x0 | 0x0 | 1 = Local fault received 0 = No local fault received |
| 9:5 | Reserved | RO | 0x00 | 0x00 | Set to 0 |

Table 141: 10GBASE-R PCS Real Time Status Register (Continued)
Device 3, Register 0x8002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------------|------|--------|--------|--|
| 4 | Jit_0_lock | RO | 0x0 | 0x0 | 1 = JIT 0 lock achieved |
| 3 | Jit_lf_lock | RO | 0x0 | 0x0 | 1 = JIT local fault lock achieved |
| 2 | Link Status | RO | 0x0 | 0x0 | 1 = 10GBASE-R link achieved 0 = No link |
| 1 | High BER Status | RO | 0x0 | 0x0 | 1 = High BER 0 = No high BER |
| 0 | Lane 3 Block Lock Status | RO | 0x0 | 0x0 | 1 = Block lock achieved 0 = No block lock |

6.3.3 Line Side 1000BASE-X, SGMII PCS

The registers in this section apply to all ports.

Table 142: Line Side 1000BASE-X, SGMII PCS Registers - Register Map

| Register Name | Register Address | Table and Page |
|---|---------------------------|-----------------------------------|
| 1000BASE-X/SGMII Control Register | Device 3, Register 0x2000 | Table 143, p. 152 |
| 1000BASE-X/SGMII Status Register | Device 3, Register 0x2001 | Table 144, p. 153 |
| PHY Identifier | Device 3, Register 0x2002 | Table 145, p. 154 |
| PHY Identifier | Device 3, Register 0x2003 | Table 146, p. 154 |
| 1000BASE-X Auto-Negotiation Advertisement Register | Device 3, Register 0x2004 | Table 147, p. 155 |
| SGMII (Media side) Auto-Negotiation Advertisement Register | Device 3, Register 0x2004 | Table 148, p. 156 |
| SGMII (System side) Auto-Negotiation Advertisement Register | Device 3, Register 0x2004 | Table 149, p. 156 |
| 1000BASE-X Link Partner Ability Register | Device 3, Register 0x2005 | Table 150, p. 157 |
| SGMII (Media side) Link Partner Ability Register | Device 3, Register 0x2005 | Table 151, p. 158 |
| SGMII (System side) Link Partner Ability Register | Device 3, Register 0x2005 | Table 152, p. 158 |
| 1000BASE-X Auto-Negotiation Expansion Register | Device 3, Register 0x2006 | Table 153, p. 159 |
| 1000BASE-X Next Page Transmit Register | Device 3, Register 0x2007 | Table 154, p. 159 |
| 1000BASE-X Link Partner Next Page Register | Device 3, Register 0x2008 | Table 155, p. 160 |
| Extended Status Register | Device 3, Register 0x200F | Table 156, p. 160 |
| 1000BASE-X Timer Mode Select Register | Device 3, Register 0xA000 | Table 157, p. 161 |
| 1000BASE-X Interrupt Enable Register | Device 3, Register 0xA001 | Table 158, p. 161 |
| 1000BASE-X Interrupt Status Register | Device 3, Register 0xA002 | Table 159, p. 162 |
| 1000ASE-X PHY Specific Status Register | Device 3, Register 0xA003 | Table 160, p. 162 |

Table 143: 1000BASE-X/SGMII Control Register
 Device 3, Register 0x2000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------------|---------|-----------|--------|---|
| 15 | Reset | R/W, SC | 0x0 | 0x0 | 1 = Reset 0 = Normal This register will soft reset all PCS/PMA and associated registers of this interface. |
| 14 | Loopback | R/W | See Desc. | Retain | 1 = Loopback 0 = Normal |
| 13 | SGMII Speed (LSB) | R/W | See Desc. | Retain | This register is used to control SGMII speed only. (bit 6, bit 13) 00 = 10 Mbps, 01 = 100 Mbps, 10 = 1000 Mbps |
| 12 | 1000BASE-X Auto-Negotiation Enable | R/W | See Desc. | Retain | If the value of this bit is Changed, the link will be broken and 1000BASE-X Auto-Negotiation restarted (bit 3.2000.9 is set to 1). 1 = Enable Auto-Negotiation Process 0 = Disable Auto-Negotiation Process |

Table 143: 1000BASE-X/SGMII Control Register (Continued)
Device 3, Register 0x2000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------------------|---------|-----------|--------|--|
| 11 | Power Down | R/W | See Desc. | Retain | 1 = Power Down 0 = Normal This register will power down all PCS/PMA of this interface. Initial power state is a function of hardware configuration. |
| 10 | Isolate | RO | 0x0 | 0x0 | The core bus is embedded hence this function is not supported |
| 9 | Restart 1000BASE-X Negotiation | R/W, SC | 0x1 | SC | Auto-Negotiation automatically restarts after hardware reset, software reset (3.2000.15) or Change in auto-negotiation enable (3.2000.12) regardless of whether or not the restart bit (3.2000.9) is set. The bit is set when Auto-negotiation is Enabled or Disabled in 3.2000.12. 1 = Restart Auto-Negotiation Process 0 = Normal operation |
| 8 | Duplex Mode | RO | 0x1 | Retain | Writing this bit has no effect since only full-duplex mode is supported. 1 = Full-duplex 0 = Half-Duplex |
| 7 | Collision Test | R/W | 0x0 | 0x0 | No effect since half-duplex not supported. 1 = Enable COL signal test 0 = Disable COL signal test |
| 6 | SGMII Speed Selection (MSB) | R/W | See Desc. | Retain | This register is used to control SGMII speed only. (bit 6, bit 13) 00 = 10 Mbps, 01 = 100 Mbps, 10 = 1000 Mbps |
| 5:0 | Reserved | RO | 0x00 | 0x00 | Always 0. |

Table 144: 1000BASE-X/SGMII Status Register
Device 3, Register 0x2001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|--|
| 15 | 100BASE-T4 | RO | 0x0 | 0x0 | 0 = PHY not able to perform 100BASE-T4 |
| 14 | 100BASE-X Full-Duplex | RO | 0x0 | 0x0 | 0 = PHY not able to perform full-duplex 100BASE-X |
| 13 | 100BASE-X Half-Duplex | RO | 0x0 | 0x0 | 0 = PHY not able to perform half-duplex 100BASE-X |
| 12 | 10 Mbps Full-Duplex | RO | 0x0 | 0x0 | 0 = PHY not able to perform full-duplex 10BASE-T |
| 11 | 10 Mbps Half-Duplex | RO | 0x0 | 0x0 | 0 = PHY not able to perform half-duplex 10BASE-T |
| 10 | 100BASE-T2 Full-Duplex | RO | 0x0 | 0x0 | 0 = PHY not able to perform full-duplex |
| 9 | 100BASE-T2 Half-Duplex | RO | 0x0 | 0x0 | 0 = PHY not able to perform half-duplex |
| 8 | Extended Status | RO | 0x1 | 0x1 | 1 = Extended status information in Register 3.200F |

Table 144: 1000BASE-X/SGMII Status Register (Continued)
Device 3, Register 0x2001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------------------------|-------|-----------|-----------|---|
| 7 | Reserved | RO | 0x0 | 0x0 | Must always be 0. |
| 6 | MF Preamble Suppression | RO | 0x1 | 0x1 | 1 = PHY accepts management frames with preamble suppressed |
| 5 | 1000BASE-X Auto-Negotiation Complete | RO | 0x0 | 0x0 | 1 = Auto-Negotiation process complete 0 = Auto-Negotiation process not complete Bit is not set when link is up due of Fiber Auto-negotiation Bypass or if Auto-negotiation is disabled. |
| 4 | 1000BASE-X Remote Fault | RO,LH | 0x0 | 0x0 | 1 = Remote fault condition detected 0 = Remote fault condition not detected This bit is always 0 in SGMII modes. |
| 3 | Auto-Negotiation Ability | RO | See Desc. | See Desc. | If register 3.F002.6= 1, then this bit is always 1, otherwise this bit is 0. 1 = PHY able to perform Auto-Negotiation 0 = PHY not able to perform Auto-Negotiation |
| 2 | 1000BASE-X Link Status | RO,LL | 0x0 | 0x0 | This register bit indicates when link was lost since the last read. For the current link status, read this register back-to-back. 1 = Link is up 0 = Link is down |
| 1 | Reserved | RO,LH | Always 0 | Always 0 | Must be 0 |
| 0 | Extended Capability | RO | Always 1 | Always 1 | 1 = Extended register capabilities |

Table 145: PHY Identifier
Device 3, Register 0x2002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---|------|--------|--------|---|
| 15:0 | Organizationally Unique Identifier Bit 3:18 | RO | 0x0141 | 0x0141 | 0000000101000001 Marvell OUI is 0x005043 |

Table 146: PHY Identifier
Device 3, Register 0x2003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--|------|-----------|-----------|--|
| 15:10 | Organizationally Unique Identifier Bit 19:24 | RO | 0x03 | 0x03 | 000011 |
| 9:4 | Model Number | RO | 0x31 | 0x31 | 110001 |
| 3:0 | Revision Number | RO | See Desc. | See Desc. | Rev Number Contact Marvell® FAEs for information on the device revision number. |

Table 147: 1000BASE-X Auto-Negotiation Advertisement Register
Device 3, Register 0x2004

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------------------|------|------------|------------|---|
| 15 | Next Page | R/W | 0x0 | Retain | A write to this register bit does not take effect until any one of the following occurs: Software reset is asserted (Register 3.2000.15) Restart Auto-Negotiation is asserted (Register 3.2000.9) Power down (Register 3.2000.11) transitions from power down to normal operation Link goes down 1 = Advertise 0 = Not advertised |
| 14 | Reserved | RO | Always 0 | Always 0 | 0 |
| 13:12 | Remote Fault 2/ Remote Fault 1 | R/W | 0x0 | Retain | A write to this register bit does not take effect until any one of the following also occurs: Software reset is asserted (Register 3.2000.15) Re-start Auto-Negotiation is asserted (Register 3.2000.9) Power down (Register 3.2000.11) transitions from power down to normal operation Link goes down Device has no ability to detect remote fault. 00 = No error, link OK (default) 01 = Link Failure 10 = Offline 11 = Auto-Negotiation Error |
| 11:9 | Reserved | RO | Always 000 | Always 000 | 0 |
| 8:7 | Pause | R/W | 0x0 | Retain | A write to this register bit does not take effect until any one of the following also occurs: Software reset is asserted (Register 3.2000.15) Re-start Auto-Negotiation is asserted (Register 3.2000.9) Power down (Register 3.2000.11) transitions from power down to normal operation Link goes down 00 = No PAUSE 01 = Symmetric PAUSE 10 = Asymmetric PAUSE toward link partner 11 = Both Symmetric PAUSE and Asymmetric PAUSE toward local device. |
| 6 | 1000BASE-X Half-Duplex | RO | 0x0 | Retain | 1 = Advertise 0 = Not advertised |
| 5 | 1000BASE-X Full-Duplex | RO | 0x1 | Retain | 1 = Advertise 0 = Not advertised |

Table 147: 1000BASE-X Auto-Negotiation Advertisement Register (Continued)
 Device 3, Register 0x2004

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------|------|--------|--------|---|
| 4:0 | Reserved | R/W | 0x00 | 0x00 | <p>A write to this register bit does not take effect until any one of the following also occurs: Software reset is asserted (Register 3.2000.15)</p> <p>Re-start Auto-Negotiation is asserted (Register 3.2000.9) Power down (Register 3.2000.11) transitions from power down to normal operation Link goes down</p> <p>Reserved bit is R/W to allow for forward compatibility with future IEEE standards.</p> |

Table 148: SGMII (Media side) Auto-Negotiation Advertisement Register
 Device 3, Register 0x2004

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|----------------|------|--------|--------|---|
| 15 | Link Status | RO | 0x0 | 0x0 | 0 = Link is not up on the attached interface 1 = Link is up on the attached interface |
| 14 | Reserved | RO | 0x0 | 0x0 | 0 |
| 13 | Reserved | RO | 0x0 | 0x0 | 0 |
| 12 | Duplex Status | RO | 0x0 | 0x0 | 0 = Interface Resolved to half-duplex 1 = Interface Resolved to full-duplex |
| 11:10 | Speed[1:0] | RO | 0x0 | 0x0 | 00 = Interface speed is 10 Mbps 01 = Interface speed is 100 Mbps 10 = Interface speed is 1000 Mbps 11 = Reserved |
| 9 | Transmit Pause | RO | 0x0 | 0x0 | 0 = Disabled 1 = Enabled |
| 8 | Receive Pause | RO | 0x0 | 0x0 | 0 = Disabled 1 = Enabled |
| 7 | Fiber/Copper | RO | 0x0 | 0x0 | 0 = Copper media 1 = Fiber media |
| 6:0 | Reserved | RO | 0x01 | 0x01 | Always set to 0000001 as per the SGMII Specification |

Table 149: SGMII (System side) Auto-Negotiation Advertisement Register
 Device 3, Register 0x2004

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------|------|--------|--------|---------------------------------------|
| 15:0 | Reserved | RO | 0x0001 | 0x0001 | Per SGMII Specification Always 0x0001 |

**Table 150: 1000BASE-X Link Partner Ability Register
Device 3, Register 0x2005**

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------------------|------|--------|--------|--|
| 15 | Next Page | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bit 15 1 = Link partner capable of next page 0 = Link partner not capable of next page |
| 14 | Acknowledge | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Acknowledge Received Code Word Bit 14 1 = Link partner received link code word 0 = Link partner has not received link code word |
| 13:12 | Remote Fault 2/ Remote Fault 1 | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bit 13:12 00 = No error, link OK (default) 01 = Link Failure 10 = Offline 11 = Auto-Negotiation Error |
| 11:9 | Reserved | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bit 11:9 |
| 8:7 | Asymmetric Pause | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bit 8:7 00 = No PAUSE 01 = Symmetric PAUSE 10 = Asymmetric PAUSE toward link partner 11 = Both Symmetric PAUSE and Asymmetric PAUSE toward local device. |
| 6 | 1000BASE-X Half-Duplex | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word bit 6 1 = Link partner capable of 1000BASE-X half-duplex. 0 = Link partner not capable of 1000BASE-X half-duplex. |
| 5 | 1000BASE-X Full-Duplex | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word bit 5 1 = Link partner capable of 1000BASE-X full-duplex. 0 = Link partner not capable of 1000BASE-X full-duplex. |
| 4:0 | Reserved | RO | 0x00 | 0x00 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bits 4:0 Must be 0 |

Table 151: SGMII (Media side) Link Partner Ability Register
 Device 3, Register 0x2005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------|------|--------|--------|---|
| 15 | Reserved | RO | 0x0 | 0x0 | Must be 0 |
| 14 | Acknowledge | RO | 0x0 | 0x0 | Acknowledge Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bit 14 1 = Link partner received link code word 0 = Link partner has not received link code word |
| 13:0 | Reserved | RO | 0x0000 | 0x0000 | Received Code Word Bits 13:0 Must receive 00_0000_0000_0001 per SGMII spec |

Table 152: SGMII (System side) Link Partner Ability Register
 Device 3, Register 0x2005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------|------|--------|--------|--|
| 15 | Link | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bit 15 1 = Copper Link is up on the link partner 0 = Copper Link is not up on the link partner |
| 14 | Acknowledge | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Acknowledge Received Code Word Bit 14 1 = Link partner received link code word 0 = Link partner has not received link code word |
| 13 | Reserved | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bit 13 Must be 0 |
| 12 | Duplex Status | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bit 12 1 = Copper Interface on the Link Partner is capable of full-duplex 0 = Copper Interface on the link partner is capable of half-duplex |
| 11:10 | Speed Status | RO | 0x0 | 0x0 | Register bits are cleared when link goes down and loaded when a base page is received Received Code Word Bit 11:10 00 = 10 Mbps 01 = 100 Mbps 10 = 1000 Mbps 11 = reserved |
| 9 | Transmit Pause Status | RO | 0x0 | 0x0 | This bit is non-zero only if the link partner supports enhanced SGMII Auto-Negotiation. Received Code Word Bit 9 0 = Disabled, 1 = Enabled |

Table 152: SGMII (System side) Link Partner Ability Register (Continued)
Device 3, Register 0x2005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------|------|--------|--------|--|
| 8 | Receive Pause Status | RO | 0x0 | 0x0 | This bit is non-zero only if the link partner supports enhanced SGMII Auto-Negotiation. Received Code Word Bit 8 0 = Disabled, 1 = Enabled |
| 7 | Fiber/Copper Status | RO | 0x0 | 0x0 | This bit is non-zero only if the link partner supports enhanced SGMII Auto-Negotiation. Received Code Word Bit 7 0 = Copper media, 1 = Fiber media |
| 6:0 | Reserved | RO | 0x00 | 0x00 | Register bits are cleared when link goes down and loaded when a base page is received Received Code Word Bits 6:0 Must be 0000001 |

Table 153: 1000BASE-X Auto-Negotiation Expansion Register
Device 3, Register 0x2006

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------------|--------|--------|--------|--|
| 15:4 | Reserved | RO | 0x000 | 0x000 | Reserved. Must be 000000000000. |
| 3 | Link Partner Next Page Able | RO | 0x0 | 0x0 | In SGMII mode this bit is always 0. In 1000BASE-X mode register 3.2006.3 is set when a base page is received and the received link control word has bit 15 set to 1. The bit is cleared when link goes down. 1 = Link Partner is Next Page able 0 = Link Partner is not Next Page able |
| 2 | Local Next Page Able | RO | 0x1 | 0x1 | 1 = Local Device is Next Page able |
| 1 | Page Received | RO, LH | 0x0 | 0x0 | Register 3.2006.1 is set when a valid page is received. 1 = A New Page has been received 0 = A New Page has not been received |
| 0 | Link Partner Auto-Negotiation Able | RO | 0x0 | 0x0 | This bit is set when there is sync status, the fiber receiver has received 3 non-zero matching valid configuration code groups and Auto-negotiation is enabled in register 3.2000.12 1 = Link Partner is Auto-Negotiation able 0 = Link Partner is not Auto-Negotiation able |

Table 154: 1000BASE-X Next Page Transmit Register
Device 3, Register 0x2007

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------|------|--------|--------|--|
| 15 | Next Page | R/W | 0x0 | 0x0 | A write to register 7 implicitly sets a variable in the Auto-Negotiation state machine indicating that the next page has been loaded. Register 7 only has effect in the 1000BASE-X mode. Transmit Code Word Bit 15 |

Table 154: 1000BASE-X Next Page Transmit Register (Continued)
Device 3, Register 0x2007

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------------------|------|--------|--------|---|
| 14 | Reserved | RO | 0x0 | 0x0 | Transmit Code Word Bit 14 |
| 13 | Message Page Mode | R/W | 0x1 | 0x1 | Transmit Code Word Bit 13 |
| 12 | Acknowledge2 | R/W | 0x0 | 0x0 | Transmit Code Word Bit 12 |
| 11 | Toggle | RO | 0x0 | 0x0 | Transmit Code Word Bit 11. This bit is internally set to the opposite value each time a page is received |
| 10:0 | Message/ Unformatted Field | R/W | 0x001 | 0x001 | Transmit Code Word Bit 10:0 |

Table 155: 1000BASE-X Link Partner Next Page Register
Device 3, Register 0x2008

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------------------|------|--------|--------|--|
| 15 | Next Page | RO | 0x0 | 0x0 | Register 8 only has effect in the 1000BASE-X mode. The register is loaded only when a next page is received from the link partner. It is cleared each time the link goes down. Received Code Word Bit 15 |
| 14 | Acknowledge | RO | 0x0 | 0x0 | Received Code Word Bit 14 |
| 13 | Message Page | RO | 0x0 | 0x0 | Received Code Word Bit 13 |
| 12 | Acknowledge2 | RO | 0x0 | 0x0 | Received Code Word Bit 12 |
| 11 | Toggle | RO | 0x0 | 0x0 | Received Code Word Bit 11 |
| 10:0 | Message/ Unformatted Field | RO | 0x000 | 0x000 | Received Code Word Bit 10:0 |

Table 156: Extended Status Register
Device 3, Register 0x200F

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------|------|--------|--------|--|
| 15 | 1000BASE-X Full-Duplex | RO | 0x1 | 0x1 | 1 = 1000 BASE-X full-duplex capable 0 = Not 1000 BASE-X full-duplex capable |
| 14 | 1000BASE-X Half-Duplex | RO | 0x0 | 0x0 | 1 = 1000 BASE-X half-duplex capable 0 = Not 1000 BASE-X half-duplex capable |
| 13 | 1000BASE-T Full-Duplex | RO | 0x0 | 0x0 | 0 = Not 1000 BASE-T full-duplex capable |
| 12 | 1000BASE-T Half-Duplex | RO | 0x0 | 0x0 | 0 = Not 1000 BASE-T half-duplex capable |
| 11:0 | Reserved | RO | 0x000 | 0x000 | 000000000000 |

Table 157: 1000BASE-X Timer Mode Select Register
Device 3, Register 0xA000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---|------|--------|--------|---|
| 15:14 | SGMII Autoneg Timer Select | R/W | 0x0 | Retain | Selects link_timer value in SGMII mode 00 = 1.6 ms 01 = 0.5 us 10 = 1 us 11 = 2 us |
| 13 | Serial Interface Auto-Negotiation Bypass Enable | R/W | 0x1 | Retain | Changes to this bit are disruptive to the normal operation; hence, any Changes to these registers must be followed by software reset to take effect. 1 = Bypass Allowed 0 = No Bypass Allowed |
| 12:2 | Reserved | RO | 0x000 | 0x000 | |
| 1 | Reserved | R/W | 0x0 | Retain | Reserved |
| 0 | Noise Filter | R/W | 0x0 | Retain | When set, noise filter is enabled. |

Table 158: 1000BASE-X Interrupt Enable Register
Device 3, Register 0xA001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---|------|--------|--------|---|
| 15 | Reserved | R/W | 0x0 | Retain | Set to 0 |
| 14 | Speed Changed Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 13 | Duplex Changed Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 12 | Page Received Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 11 | Auto-Negotiation Completed Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 10 | Link Up to Link Down Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 9 | Link Down to Link Up Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 8 | Symbol Error Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 7 | False Carrier Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 6:0 | Reserved | R/W | 0x00 | Retain | Set to 0s |

Table 159: 1000BASE-X Interrupt Status Register
Device 3, Register 0xA002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------------------|-------|--------|--------|--|
| 15 | Reserved | RO | 0x0 | 0x0 | 0 |
| 14 | Speed Changed | RO,LH | 0x0 | 0x0 | 1 = Speed changed 0 = Speed not changed |
| 13 | Duplex Changed | RO,LH | 0x0 | 0x0 | 1 = Duplex changed 0 = Duplex not changed |
| 12 | Page Received | RO,LH | 0x0 | 0x0 | 1 = Page received 0 = Page not received |
| 11 | Auto-Negotiation Completed | RO,LH | 0x0 | 0x0 | 1 = Auto-Negotiation completed 0 = Auto-Negotiation not completed |
| 10 | Link Up to Link Down Detected | RO,LH | 0x0 | 0x0 | 1 = Link up to link down detected 0 = Link up to link down not detected |
| 9 | Link Down to Link Up Detected | RO,LH | 0x0 | 0x0 | 1 = Link down to link up detected 0 = Link down to link up not detected |
| 8 | Symbol Error | RO,LH | 0x0 | 0x0 | 1 = Symbol error 0 = No symbol error |
| 7 | False Carrier | RO,LH | 0x0 | 0x0 | 1 = False carrier 0 = No false carrier |
| 6:0 | Reserved | RO | 0x00 | 0x00 | 0000000 |

Table 160: 1000ASE-X PHY Specific Status Register
Device 3, Register 0xA003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---------------------------|--------|--------|--------|--|
| 15:14 | Speed | RO | 0x0 | 0x0 | These status bits are valid only after resolved bit 3.A003.11 = 1. The resolved bit is set when Auto-Negotiation is completed or Auto-Negotiation is disabled. 11 = Reserved 10 = 1000 Mbps 01 = 100 Mbps 00 = 10 Mbps |
| 13 | Duplex | RO | 0x0 | 0x0 | This status bit is valid only after resolved bit 3.A003.11 = 1. The resolved bit is set when Auto-Negotiation is completed or Auto-Negotiation is disabled. 1 = Full-duplex 0 = Half-duplex |
| 12 | Page Received | RO, LH | 0x0 | 0x0 | 1 = Page received 0 = Page not received |
| 11 | Speed and Duplex Resolved | RO | 0x0 | 0x0 | When Auto-Negotiation is not enabled this bit is always 1. 1 = Resolved 0 = Not resolved |
| 10 | Link (real time) | RO | 0x0 | 0x0 | 1 = Link up 0 = Link down |

Table 160: 1000ASE-X PHY Specific Status Register (Continued)
Device 3, Register 0xA003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|---|
| 9:6 | Reserved | RO | 0x0 | 0x0 | 0 |
| 5 | Sync Status | RO | 0x0 | 0x0 | 1 = Sync 0 = No Sync |
| 4 | Energy Detect Status | RO | 0x1 | 0x1 | 1 = No energy detected 0 = Energy Detected |
| 3 | Transmit Pause Enabled | RO | 0x0 | 0x0 | This is a reflection of the MAC pause resolution. This bit is for information purposes and is not used by the device. This status bit is valid only after resolved bit 3.A003.11 = 1. The resolved bit is set when Auto-Negotiation is completed or Auto-Negotiation is disabled. 1 = Transmit pause enabled 0 = Transmit pause disable |
| 2 | Receive Pause Enabled | RO | 0x0 | 0x0 | This is a reflection of the MAC pause resolution. This bit is for information purposes and is not used by the device. This status bit is valid only after resolved bit 3.A003.11 = 1. The resolved bit is set when Auto-Negotiation is completed or Auto-Negotiation is disabled. 1 = Receive pause enabled 0 = Receive pause disabled |
| 1:0 | Reserved | RO | 0x0 | 0x0 | 00 |

6.3.4 SFI 40GBASE-R4 PCS

The registers in this section apply to port 0 for 40GBASE-R4 only.

Table 161: SFI 40GBASE-R4 Registers - Register Map

| Register Name | Register Address | Table and Page |
|---|---------------------------|-------------------|
| 40GBASE-R4 PCS Control 1 | Device 3, Register 0x3000 | Table 162, p. 164 |
| 40GBASE-R4 PCS Status 1 | Device 3, Register 0x3001 | Table 163, p. 165 |
| PCS Device Identifier 1 | Device 3, Register 0x3002 | Table 164, p. 166 |
| PCS Device Identifier 2 | Device 3, Register 0x3003 | Table 165, p. 166 |
| PCS Speed Ability | Device 3, Register 0x3004 | Table 166, p. 166 |
| PCS Devices In Package 1 | Device 3, Register 0x3005 | Table 167, p. 166 |
| PCS Devices In Package 2 | Device 3, Register 0x3006 | Table 168, p. 167 |
| PCS Control 2 | Device 3, Register 0x3007 | Table 169, p. 167 |
| 40GBASE-R4 PCS Status 2 | Device 3, Register 0x3008 | Table 170, p. 167 |
| PCS Package Identifier 1 | Device 3, Register 0x300E | Table 171, p. 168 |
| PCS Package Identifier 2 | Device 3, Register 0x300F | Table 172, p. 168 |
| BASE-R Status1 Register | Device 3, Register 0x3020 | Table 173, p. 169 |
| BASE-R PCS Status 2 | Device 3, Register 0x3021 | Table 174, p. 169 |
| 40GBASE-R PCS Test Pattern Control | Device 3, Register 0x302A | Table 175, p. 169 |
| 40GBASE-R PCS Test Pattern Error Counter | Device 3, Register 0x302B | Table 176, p. 170 |
| 40GBASE-R PCS BER High Order Counter | Device 3, Register 0x302C | Table 177, p. 170 |
| 40GBASE-R PCS Errored Blocks High Order Counter | Device 3, Register 0x302D | Table 178, p. 170 |
| Multi-lane BASE-R PCS Alignment Status 1 | Device 3, Register 0x3032 | Table 179, p. 170 |
| Multi-lane BASE-R PCS Alignment Status 2 | Device 3, Register 0x3034 | Table 180, p. 171 |
| BIP Error Counter Lanes 0 Register | Device 3, Register 0x30C8 | Table 181, p. 171 |
| BIP Error Counter Lanes 1 Register | Device 3, Register 0x30C9 | Table 182, p. 171 |
| BIP Error Counter Lanes 2 Register | Device 3, Register 0x30CA | Table 183, p. 172 |
| BIP Error Counter Lanes 3 Register | Device 3, Register 0x30CB | Table 184, p. 172 |
| Lanes 0 Mapping Register | Device 3, Register 0x3190 | Table 185, p. 172 |
| Lanes 1 Mapping Register | Device 3, Register 0x3191 | Table 186, p. 172 |
| Lanes 2 Mapping Register | Device 3, Register 0x3192 | Table 187, p. 172 |
| Lanes 3 Mapping Register | Device 3, Register 0x3193 | Table 188, p. 172 |
| 40GBASE-R4 Interrupt enable Register | Device 3, Register 0xB001 | Table 189, p. 173 |
| 40GBASE-R4 Interrupt Status Register | Device 3, Register 0xB002 | Table 190, p. 174 |
| 40GBASE-R4 PCS Real Time Status Register | Device 3, Register 0xB003 | Table 191, p. 175 |

Table 162: 40GBASE-R4 PCS Control 1
Device 3, Register 0x3000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|---------|--------|--------|--|
| 15 | Software Reset | R/W, SC | 0x0 | 0x0 | 1 = Reset 0 = Normal This register will soft reset all PCS/PMA and associated registers of this interface. |

Table 162: 40GBASE-R4 PCS Control 1 (Continued)
Device 3, Register 0x3000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------|------|-----------|--------|--|
| 14 | Loopback | R/W | 0x0 | 0x0 | 1 = Loopback 0 = Normal |
| 13 | Speed Select | RO | 0x1 | 0x1 | 1 = Bits 5:2 select speed. |
| 12 | Reserved | RO | 0x0 | 0x0 | Set to 0 |
| 11 | Low Power | R/W | See Desc. | Retain | 1 = Power Down 0 = Normal This register will power down all PCS/PMA of this interface. Initial power state is a function of hardware configuration. |
| 10 | Clock Stoppable | R/W | 0x0 | 0x0 | 1 = Clock stoppable during LPI 0 = Clock not stoppable |
| 9:7 | Reserved | RO | 0x0 | 0x0 | 000 |
| 6 | Speed Select | RO | 0x1 | 0x1 | 1 = Bits 5:2 select speed. |
| 5:2 | Speed Select | RO | 0x3 | 0x3 | This register is ignored. Speed is automatically set based on the mode selected in register 31.F002 |
| 1:0 | Reserved | RO | 0x0 | 0x0 | Set to 0s |

Table 163: 40GBASE-R4 PCS Status 1
Device 3, Register 0x3001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------|--------|--------|--------|--|
| 15:12 | Reserved | RO | 0x0 | 0x0 | 00000000 |
| 11 | TX LP Idle Received | RO/LH | 0x0 | 0x0 | 1 = Tx PCS has received LP Idle 0 = LP Idle not received |
| 10 | Rx LP Idle Received | RO/LH | 0x0 | 0x0 | 1 = Rx PCS has received LP Idle 0 = LP Idle not received |
| 9 | Tx LP Idle Indication | RO | 0x0 | 0x0 | 1 = Tx PCS is currently receiving LP Idle 0 = Tx PCS is not currently receiving LP Idle |
| 8 | Rx LP Idle Indication | RO | 0x0 | 0x0 | 1 = Rx PCS is currently receiving LP Idle 0 = Rx PCS is not currently receiving LP Idle |
| 7 | Fault | RO | 0x0 | 0x0 | 1 = Transmit or Receive fault condition 0 = No fault condition |
| 6 | Clock Stop Capable | RO | 0x0 | 0x0 | 0 = Clock not stoppable |
| 5:3 | Reserved | RO | 0x0 | 0x0 | 000 |
| 2 | Link Status | RO, LL | 0x0 | 0x0 | 1 = PCS link up 0 = PCS link down |
| 1 | Low Power Ability | RO | 0x1 | 0x1 | 1 = PCS supports low power |
| 0 | Reserved | RO | 0x0 | 0x0 | 0 |

Table 164: PCS Device Identifier 1
Device 3, Register 0x3002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---|------|--------|--------|---|
| 15:0 | Organizationally Unique Identifier Bit 3:18 | RO | 0x0141 | 0x0141 | 0000000101000001 Marvell OUI is 0x005043 |

Table 165: PCS Device Identifier 2
Device 3, Register 0x3003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--|------|-----------|-----------|--|
| 15:10 | Organizationally Unique Identifier Bit 19:24 | RO | 0x03 | 0x03 | 000011 |
| 9:4 | Model Number | RO | 0x31 | 0x31 | 110001 |
| 3:0 | Revision Number | RO | See Desc. | See Desc. | Rev Number Contact Marvell® FAEs for information on the device revision number. |

Table 166: PCS Speed Ability
Device 3, Register 0x3004

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15:4 | Reserved | RO | 0x000 | 0x000 | 0 |
| 3 | 100G Capable | RO | 0x0 | 0x0 | 0 = Not capable of operating at 100Gbps |
| 2 | 40G Capable | RO | 0x1 | 0x1 | 1 = Capable of operating at 40Gbps |
| 1 | 10PASS-TS/2BASE-TL Capable | RO | 0x0 | 0x0 | 0 = Not capable of operating as the 10P/2B PCS |
| 0 | 10G Capable | RO | 0x1 | 0x1 | 1 = Capable of operating at 10Gbps |

Table 167: PCS Devices In Package 1
Device 3, Register 0x3005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------------|------|--------|--------|--|
| 15:8 | Reserved | RO | 0x00 | 0x00 | 00000 |
| 10 | Separated PMA (3) | RO | 0x0 | 0x0 | 1 = Separated PMA (3) present in package 0 = Separated PMA (3) not present in package |
| 9 | Separated PMA (2) | RO | 0x0 | 0x0 | 1 = Separated PMA (2) present in package 0 = Separated PMA (2) not present in package |
| 8 | Separated PMA (1) | RO | 0x0 | 0x0 | 1 = Separated PMA (1) present in package 0 = Separated PMA (1) not present in package |
| 7 | Auto-Negotiation Present | RO | 0x1 | 0x1 | 1 = Auto-negotiation present in package 0 = Auto-negotiation not present in package |

Table 167: PCS Devices In Package 1 (Continued)
Device 3, Register 0x3005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|--|
| 6 | TC Present | RO | 0x0 | 0x0 | 1 = TC present in package 0 = TC not present in package |
| 5 | DTE XS Present | RO | 0x0 | 0x0 | 1 = DTE XS present in package 0 = DTE XS not present in package |
| 4 | PHY XS Present | RO | 0x1 | 0x1 | 1 = PHY XS present in package 0 = PHY XS not present in package |
| 3 | PCS Present | RO | 0x1 | 0x1 | 1 = PCS present in package 0 = PCS not present in package |
| 2 | Reserved | RO | 0x1 | 0x1 | Reserved Do not write any value other than the HW Rst value. |
| 1 | PMD/PMA Present | RO | 0x1 | 0x1 | 1 = PMA/PMD present in package 0 = PMA/PMD not present in package |
| 0 | Clause 22 Registers Present | RO | 0x0 | 0x0 | 1 = Clause 22 registers present in package 0 = Clause 22 registers not present in package |

Table 168: PCS Devices In Package 2
Device 3, Register 0x3006

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------------|------|--------|--------|--|
| 15 | Marvell Specific Device 2 Present | RO | 0x1 | 0x1 | 1 = Marvell specific device 2 present 0 = Marvell specific device 2 not present |
| 14 | Marvell Specific Device 1 Present | RO | 0x1 | 0x1 | 1 = Marvell specific device 1 present 0 = Marvell specific device 1 not present |
| 13 | Clause 22 Extension Present | RO | 0x0 | 0x0 | 1 = Clause 22 extension present 0 = Clause 22 extension not present |
| 12:0 | Reserved | RO | 0x0000 | 0x0000 | 0 |

Table 169: PCS Control 2
Device 3, Register 0x3007

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------|------|--------|--------|--|
| 15:3 | Reserved | RO | 0x0000 | 0x0000 | 0 |
| 2:0 | PCS Type | RO | 0x4 | 0x4 | This register is ignored. PCS is automatically set based on the mode selected in register 31.F002 |

Table 170: 40GBASE-R4 PCS Status 2
Device 3, Register 0x3008

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|----------------|------|--------|--------|--|
| 15:14 | Device Present | RO | 0x2 | 0x2 | 10 = Device responding to this address |

Table 170: 40GBASE-R4 PCS Status 2 (Continued)
 Device 3, Register 0x3008

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--------------------|--------|--------|--------|--|
| 13:12 | Reserved | RO | 0x0 | 0x0 | 00 |
| 11 | Transmit Fault | RO, LH | 0x0 | 0x0 | 1 = Fault on transmit path, 0 = No fault |
| 10 | Receive Fault | RO, LH | 0x0 | 0x0 | 1 = Fault on receive path, 0 = No fault |
| 9:6 | Reserved | RO | 0x0 | 0x0 | 0000000 |
| 5 | 100GBASE-R Capable | RO | 0x0 | 0x0 | 1 = PCS is able to support 100GBASE-R PCS types 0 = PCS is not able to support 100GBASE-R PCS types |
| 4 | 40GBASE-R Capable | RO | 0x1 | 0x1 | 1 = PCS is able to support 40GBASE-R PCS types 0 = PCS is not able to support 40GBASE-R PCS types |
| 3 | 10GBASE-T Capable | RO | 0x0 | 0x0 | 1 = PCS is able to support 10GBASE-T PCS types 0 = PCS is not able to support 10GBASE-T PCS types |
| 2 | Reserved | RO | 0x0 | 0x0 | Reserved |
| 1 | 10GBASE-X Capable | RO | 0x1 | 0x1 | 1 = PCS is able to support 10GBASE-X PCS types 0 = PCS is not able to support 10GBASE-X PCS types |
| 0 | 10GBASE-R Capable | RO | 0x1 | 0x1 | 1 = PCS is able to support 10GBASE-R PCS types 0 = PCS is not able to support 10GBASE-R PCS types |

Table 171: PCS Package Identifier 1
 Device 3, Register 0x300E

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--|------|--------|--------|---|
| 15:0 | Organizationally Unique Identifier Bit 3:18 | RO | 0x0141 | 0x0141 | 0000000101000001 Marvell OUI is 0x005043 |

Table 172: PCS Package Identifier 2
 Device 3, Register 0x300F

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---|------|-----------|-----------|--|
| 15:10 | Organizationally Unique Identifier Bit 19:24 | RO | 0x03 | 0x03 | 000011 |
| 9:4 | Model Number | RO | 0x31 | 0x31 | 110001 |
| 3:0 | Revision Number | RO | See Desc. | See Desc. | Rev Number Contact Marvell® FAEs for information on the device revision number. |

Table 173: BASE-R Status1 Register
Device 3, Register 0x3020

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-------------------------------|------|--------|--------|--|
| 15:13 | Reserved | RO | 0x0 | 0x0 | 0 |
| 12 | 40G Rx Link Status | RO | 0x0 | 0x0 | 1 = 40GBASE-R PCS receive link up 0 = 40GBASE-R PCS receive link down |
| 11:4 | Reserved | RO | 0x00 | 0x00 | 0 |
| 3 | 10GBASE-R PRBS9 Test Ability | RO | 0x1 | 0x1 | 1 = PCS is able to support PRBS9 pattern testing 0 = PCS is not able to support PRBS9 pattern testing |
| 2 | 10GBASE-R PRBS31 Test Ability | RO | 0x1 | 0x1 | 1 = PCS is able to support PRBS31 pattern testing 0 = PCS is not able to support PRBS31 pattern testing |
| 1 | 40G PCS High BER | RO | 0x0 | 0x0 | 1 = 40GBASE-R PCS reporting high BER 0 = 40GBASE-R PCS not reporting high BER |
| 0 | 40G PCSR Block Lck | RO | 0x0 | 0x0 | 1 = 40GBASE-R PCS locked to received block 0 = 40GBASE-R PCS not locked |

Table 174: BASE-R PCS Status 2
Device 3, Register 0x3021

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|--------|--------|--------|---|
| 15 | Latched Block Lock | RO, LL | 0x0 | 0x0 | 1 = PCS Has Block Lock 0 = PCS Does Not Have Block Lock |
| 14 | Latched High Bit Error Rate | RO, LH | 0x0 | 0x0 | 1 = PCS Has Reported High BER 0 = PCS Has Not Reported High BER |
| 13:8 | Bit Error Rate Counter | RO | 0x00 | 0x00 | Bit Error Rate Counter Counter clears on read. Counter will peg at all 1s. |
| 7:0 | Errored Blocks | RO | 0x00 | 0x00 | Errored Blocks Counter Counter clears on read. Counter will peg at all 1s. |

Table 175: 40GBASE-R PCS Test Pattern Control
Device 3, Register 0x302A

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------------------------|------|--------|--------|---|
| 15:8 | Reserved | RO | 0x00 | 0x00 | 0 |
| 7 | Scramble_idle Test Pattern Enable | R/W | 0x0 | 0x0 | 1 = Enable On Transmit Path 0 = Disable On Transmit Path |
| 6 | PRBS9 Transmit Test Pattern Enable | RO | 0x0 | 0x0 | Write to this bit is ignored |
| 5 | PRBS31 Receive Test Pattern Enable | RO | 0x0 | 0x0 | Write to this bit is ignored |
| 4 | PRBS31 Transmit Test Pattern Enable | RO | 0x0 | 0x0 | Write to this bit is ignored. |

Table 175: 40GBASE-R PCS Test Pattern Control (Continued)
 Device 3, Register 0x302A

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------|------|--------|--------|-------------------------------|
| 3 | Transmit Test Pattern Enable | RO | 0x0 | 0x0 | Write to this bit is ignored. |
| 2 | Receive Test Pattern Enable | RO | 0x0 | 0x0 | Write to this bit is ignored. |
| 1 | Test Pattern Select | RO | 0x0 | 0x0 | Write to this bit is ignored. |
| 0 | Data Pattern Select | RO | 0x0 | 0x0 | Write to this bit is ignored. |

Table 176: 40GBASE-R PCS Test Pattern Error Counter
 Device 3, Register 0x302B

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|---|
| 15:0 | Test Pattern Error Counter | RO | 0x0000 | 0x0000 | Test Pattern Error Counter Counter clears on read. Counter will peg at all 1s. |

Table 177: 40GBASE-R PCS BER High Order Counter
 Device 3, Register 0x302C

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|--|
| 15:0 | BER High Order | RO | 0x0000 | 0x0000 | Bits 21:6 of 22-bit BER counter. Register 3.3021 should be read first. Counter clears on read of 3.3021. 22-bit Counter will peg at all 1s. |

Table 178: 40GBASE-R PCS Errored Blocks High Order Counter
 Device 3, Register 0x302D

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15 | High Order Counter Present | RO | 0x1 | 0x1 | 1 = High order counter is present |
| 14 | Reserved | RO | 0x0 | 0x0 | Test Pattern Error Counter Counter clears on read. Counter will peg at all 1s. |
| 13:0 | Errored Blocks High Order | RO | 0x0000 | 0x0000 | Bits 21:8 of 22-bits Errored Blocks Counter. Register 3.3021 should be read first. Counter clears on read of 3.3021. 22-bit Counter will peg at all 1s. |

Table 179: Multi-lane BASE-R PCS Alignment Status 1
 Device 3, Register 0x3032

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---------------------------|------|--------|--------|--|
| 15:13 | Reserved | RO | 0x0 | 0x0 | |
| 12 | PCS Lane Alignment Status | RO | 0x0 | 0x0 | 1 = PCS receive lanes locked and aligned 0 = PCS receive lanes not locked and aligned |
| 11:4 | Reserved | RO | 0x00 | 0x00 | |

Table 179: Multi-lane BASE-R PCS Alignment Status 1 (Continued)
Device 3, Register 0x3032

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------|------|--------|--------|--|
| 3 | Lane 3 Block Lock | RO | 0x0 | 0x0 | 1 = Lane 3 is locked 0 = Lane 3 is not locked |
| 2 | Lane 2 Block Lock | RO | 0x0 | 0x0 | 1 = Lane 2 is locked 0 = Lane 2 is not locked |
| 1 | Lane 1 Block Lock | RO | 0x0 | 0x0 | 1 = Lane 1 is locked 0 = Lane 1 is not locked |
| 0 | Lane 0 Block Lock | RO | 0x0 | 0x0 | 1 = Lane 0 is locked 0 = Lane 0 is not locked |

Table 180: Multi-lane BASE-R PCS Alignment Status 2
Device 3, Register 0x3034

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|--|
| 15:4 | Reserved | RO | 0x000 | 0x000 | |
| 3 | Lane 3 Aligned | RO | 0x0 | 0x0 | 1 = Lane 3 alignment marker is locked 0 = Lane 3 alignment marker is not locked |
| 2 | Lane 2 Aligned | RO | 0x0 | 0x0 | 1 = Lane 2 alignment marker is locked 0 = Lane 2 alignment marker is not locked |
| 1 | Lane 1 Aligned | RO | 0x0 | 0x0 | 1 = Lane 1 alignment marker is locked 0 = Lane 1 alignment marker is not locked |
| 0 | Lane 0 Aligned | RO | 0x0 | 0x0 | 1 = Lane 0 alignment marker is locked 0 = Lane 0 alignment marker is not locked |

Table 181: BIP Error Counter Lanes 0 Register
Device 3, Register 0x30C8

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------|------|--------|--------|---|
| 15:0 | Lane 0 Bip Err Count | RO | 0x0000 | 0x0000 | Lane 0 BIP Error Counter Counter clears on read. Counter will peg at all 1s. |

Table 182: BIP Error Counter Lanes 1 Register
Device 3, Register 0x30C9

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------|------|--------|--------|---|
| 15:0 | Lane 1 Bip Err Count | RO | 0x0000 | 0x0000 | Lane 1 BIP Error Counter Counter clears on read. Counter will peg at all 1s. |

Table 183: BIP Error Counter Lanes 2 Register
 Device 3, Register 0x30CA

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------|------|--------|--------|---|
| 15:0 | Lane 2 Bip Err Count | RO | 0x0000 | 0x0000 | Lane 2 BIP Error Counter Counter clears on read. Counter will peg at all 1s. |

Table 184: BIP Error Counter Lanes 3 Register
 Device 3, Register 0x30CB

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------|------|--------|--------|---|
| 15:0 | Lane 3 Bip Err Count | RO | 0x0000 | 0x0000 | Lane 3 BIP Error Counter Counter clears on read. Counter will peg at all 1s. |

Table 185: Lanes 0 Mapping Register
 Device 3, Register 0x3190

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|--|
| 15:6 | Reserved | RO | 0x000 | 0x000 | |
| 5:0 | Lane 0 Mapping | RO | 0x00 | 0x00 | PCS lane received in service interface lane 0. The content is valid when lane 0 aligned bit (3.3034.0) is set to one, and invalid otherwise. |

Table 186: Lanes 1 Mapping Register
 Device 3, Register 0x3191

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|--|
| 15:6 | Reserved | RO | 0x000 | 0x000 | |
| 5:0 | Lane 1 Mapping | RO | 0x00 | 0x00 | PCS lane received in service interface lane 1. The content is valid when lane 1 aligned bit (3.3034.1) is set to one, and invalid otherwise. |

Table 187: Lanes 2 Mapping Register
 Device 3, Register 0x3192

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|--|
| 15:6 | Reserved | RO | 0x000 | 0x000 | |
| 5:0 | Lane 2 Mapping | RO | 0x00 | 0x00 | PCS lane received in service interface lane 2. The content is valid when lane 2 aligned bit (3.3034.2) is set to one, and invalid otherwise. |

Table 188: Lanes 3 Mapping Register
 Device 3, Register 0x3193

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------|------|--------|--------|-------------|
| 15:6 | Reserved | RO | 0x000 | 0x000 | |

Table 188: Lanes 3 Mapping Register (Continued)
Device 3, Register 0x3193

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|--|
| 5:0 | Lane 3 Mapping | RO | 0x00 | 0x00 | PCS lane received in service interface lane 3. The content is valid when lane 3 aligned bit (3.3034.3) is set to one, and invalid otherwise. |

Table 189: 40GBASE-R4 Interrupt enable Register
Device 3, Register 0xB001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--|------|--------|--------|---|
| 15 | Lane 3 AM_lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 14 | Lane 2 AM_lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 13 | Lane 1 AM_lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 12 | Lane 0 AM_lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 11 | Local Fault Transmitted Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 10 | Local Fault Received Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 9 | Lane_alignment change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 8 | Tx_Lane_cnt_err Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 7 | JIT 0 Lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 6 | JIT Local-Fault Lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 5 | Link Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 4 | High BER Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 3 | Lane 3 Block Lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |

Table 189: 40GBASE-R4 Interrupt enable Register (Continued)
 Device 3, Register 0xB001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---|------|--------|--------|---|
| 2 | Lane 2 Block Lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 1 | Lane 1 Block Lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 0 | Lane 0 Block Lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |

Table 190: 40GBASE-R4 Interrupt Status Register
 Device 3, Register 0xB002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--|-------|--------|--------|---|
| 15 | Lane 3 AM_lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 14 | Lane 2 AM_lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 13 | Lane 1 AM_lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 12 | Lane 0 AM_lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 11 | Local Fault Transmitted Interrupt | RO,LH | 0x0 | 0x0 | 1 = Local fault transmitted 0 = No local fault transmitter |
| 10 | Local Fault Received Interrupt | RO,LH | 0x0 | 0x0 | 1 = Local fault received 0 = No local fault received |
| 9 | Lane_Alignment change Interrupt Enable | RO,LH | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 8 | Tx_Lane_cnt_err Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 7 | JIT 0 Lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 6 | JIT Local-Fault Lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 5 | Link Change Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 4 | High BER Change Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 3 | Lane 3 Block Lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |

Table 190: 40GBASE-R4 Interrupt Status Register (Continued)
Device 3, Register 0xB002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------------|-------|--------|--------|-------------------------------------|
| 2 | Lane 2 Block Lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 1 | Lane 1 Block Lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 0 | Lane 0 Block Lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |

Table 191: 40GBASE-R4 PCS Real Time Status Register
Device 3, Register 0xB003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------------------|------|--------|--------|--|
| 15 | Lane 3 AM_lock Status | RO | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 14 | Lane 2 AM_lock Status | RO | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 13 | Lane 1 AM_lock Status | RO | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 12 | Lane 0 AM_lock Status | RO | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 11 | Local Fault Transmitted Status | RO | 0x0 | 0x0 | 1 = Local fault transmitted 0 = No local fault transmitted |
| 10 | Local Fault Received Status | RO | 0x0 | 0x0 | 1 = Local fault received 0 = No local fault received |
| 9 | Lane_Alignment Status | RO | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 8 | TX_LANE_CNT_ERR Status | RO | 0x0 | 0x0 | 1= TX Blk dist lane cnt error. If this is set, 40GBASE-R4 won't behave as desired. 0 = No error |
| 7 | JIT 0 Lock Status | RO | 0x0 | 0x0 | 1 =JIT 0 lock achieved 0 = No JIT 0 lock |
| 6 | JIT Local-Fault Lock Status | RO | 0x0 | 0x0 | 1 =JIT local fault lock achieved 0 = No local fault lock |
| 5 | Link Status | RO | 0x0 | 0x0 | 1 = 40GBASE-R link achieved 0 = No link |
| 4 | High BER Status | RO | 0x0 | 0x0 | 1 = High BER 0 = No high BER |
| 3 | Lane 3 Block Lock Status | RO | 0x0 | 0x0 | 1 = Block lock achieved 0 = No block lock |
| 2 | Lane 2 Block Lock Status | RO | 0x0 | 0x0 | 1 = Block lock achieved 0 = No block lock |

Table 191: 40GBASE-R4 PCS Real Time Status Register (Continued)
 Device 3, Register 0xB003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------------|------|--------|--------|--|
| 1 | Lane 1 Block Lock Status | RO | 0x0 | 0x0 | 1 = Block lock achieved 0 = No block lock |
| 0 | Lane 0 Block Lock Status | RO | 0x0 | 0x0 | 1 = Block lock achieved 0 = No block lock |

6.3.5 SFI Common Registers

The registers in this section apply to all ports.

Table 192: SFI Common Registers - Register Map

| Register Name | Register Address | Table and Page |
|---------------------------------------|---------------------------|-------------------|
| SERDES Control Register 1 | Device 3, Register 0xF003 | Table 193, p. 178 |
| FIFO and CRC Interrupt Enable | Device 3, Register 0xF00A | Table 194, p. 178 |
| FIFO and CRC Interrupt Status | Device 3, Register 0xF00B | Table 195, p. 178 |
| PPM FIFO Control 1 | Device 3, Register 0xF00C | Table 196, p. 179 |
| Packet Generation Control 1 | Device 3, Register 0xF010 | Table 197, p. 179 |
| Packet Generation Control 2 | Device 3, Register 0xF011 | Table 198, p. 180 |
| Initial Payload 0-1/Packet Generation | Device 3, Register 0xF012 | Table 199, p. 180 |
| Initial Payload 2-3/Packet Generation | Device 3, Register 0xF013 | Table 200, p. 180 |
| Packet Generation Length | Device 3, Register 0xF016 | Table 201, p. 180 |
| Packet Generation Burst Sequence | Device 3, Register 0xF017 | Table 202, p. 181 |
| Packet Generation IPG | Device 3, Register 0xF018 | Table 203, p. 181 |
| Transmit Packet Counter [15:0] | Device 3, Register 0xF01B | Table 204, p. 181 |
| Transmit Packet Counter [31:16] | Device 3, Register 0xF01C | Table 205, p. 181 |
| Transmit Packet Counter [47:32] | Device 3, Register 0xF01D | Table 206, p. 181 |
| Transmit Byte Counter [15:0] | Device 3, Register 0xF01E | Table 207, p. 182 |
| Transmit Byte Counter [31:16] | Device 3, Register 0xF01F | Table 208, p. 182 |
| Transmit Byte Counter [47:32] | Device 3, Register 0xF020 | Table 209, p. 182 |
| Receive Packet Counter [15:0] | Device 3, Register 0xF021 | Table 210, p. 182 |
| Receive Packet Counter [31:16] | Device 3, Register 0xF022 | Table 211, p. 183 |
| Receive Packet Counter [47:32] | Device 3, Register 0xF023 | Table 212, p. 183 |
| Receive Byte Count [15:0] | Device 3, Register 0xF024 | Table 213, p. 183 |
| Receive Byte Count [31:16] | Device 3, Register 0xF025 | Table 214, p. 183 |
| Receive Byte Count [47:32] | Device 3, Register 0xF026 | Table 215, p. 184 |
| Receive Packet Error Count [15:0] | Device 3, Register 0xF027 | Table 216, p. 184 |
| Receive Packet Error Count [31:16] | Device 3, Register 0xF028 | Table 217, p. 184 |
| Receive Packet Error Count [47:32] | Device 3, Register 0xF029 | Table 218, p. 184 |
| PRBS Control | Device 3, Register 0xF030 | Table 219, p. 184 |
| PRBS Symbol Tx Counter [15:0] | Device 3, Register 0xF031 | Table 220, p. 185 |
| PRBS Symbol Tx Counter [31:16] | Device 3, Register 0xF032 | Table 221, p. 186 |
| PRBS Symbol Tx Counter [47:32] | Device 3, Register 0xF033 | Table 222, p. 186 |
| PRBS Symbol Rx Counter [15:0] | Device 3, Register 0xF034 | Table 223, p. 186 |
| PRBS Symbol Rx Counter [31:16] | Device 3, Register 0xF035 | Table 224, p. 186 |
| PRBS Symbol Rx Counter [47:32] | Device 3, Register 0xF036 | Table 225, p. 187 |
| PRBS Error Count [15:0] | Device 3, Register 0xF037 | Table 226, p. 187 |
| PRBS Error Count [31:16] | Device 3, Register 0xF038 | Table 227, p. 187 |
| PRBS Error Count [47:32] | Device 3, Register 0xF039 | Table 228, p. 187 |

Table 192: SFI Common Registers - Register Map (Continued)

| Register Name | Register Address | Table and Page |
|-----------------------------------|---------------------------|-----------------------------------|
| PRBS Elapse Timer | Device 3, Register 0xF03A | Table 229, p. 188 |
| Power Management TX state control | Device 3, Register 0xF074 | Table 230, p. 188 |

**Table 193: SERDES Control Register 1
 Device 3, Register 0xF003**

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|----------------------------|------|--------|--------|--|
| 15:14 | Reserved | RO | 0x0 | 0x0 | Set to 0s |
| 13 | Reserved | R/W | 0x0 | Retain | 0 |
| 12 | Line Loopback | R/W | 0x0 | 0x0 | 1 = Enable Loopback 0 = Normal Operation |
| 11 | Reserved | RO | 0x0 | 0x0 | 0 |
| 10 | Force Link Good | R/W | 0x0 | Retain | If link is forced to be good, the link state machine is bypassed and the link is always up. 1 = Force link good 0 = Normal operation |
| 9 | Reserved | RO | 0x0 | 0x0 | 0 |
| 8 | Receiver Power Down | R/W | 0x0 | Retain | 1 = Receiver Powered Down 0 = Receiver Can Power Up |
| 7 | Force Signal Detect | R/W | 0x0 | Retain | 1 = Force signal detect to be good 0 = Normal Operation |
| 6 | Block Transmit On Loopback | R/W | 0x0 | Retain | 0 = Do not block egress path 1 = Block egress path |
| 5:0 | Reserved | R/W | 0x00 | Retain | Set to 0s. |

**Table 194: FIFO and CRC Interrupt Enable
 Device 3, Register 0xF00A**

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------------|------|--------|--------|---|
| 15:3 | Reserved | R/W | 0x0000 | Retain | Set to 0 |
| 2 | CRC Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 1 | FIFO Overflow Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 0 | FIFO Underflow Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |

**Table 195: FIFO and CRC Interrupt Status
 Device 3, Register 0xF00B**

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------|------|--------|--------|-------------|
| 15:3 | Reserved | RO | 0x0000 | 0x0000 | 0 |

Table 195: FIFO and CRC Interrupt Status (Continued)
Device 3, Register 0xF00B

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|-------|--------|--------|---|
| 2 | CRC Interrupt Status | RO,LH | 0x0 | 0x0 | This interrupt will be set only if the packet checker is enabled. 1 = CRC Error detected 0 = CRC error not detected |
| 1 | FIFO Overflow Status | RO,LH | 0x0 | 0x0 | 1 = FIFO overflow occurred 0 = FIFO overflow did not occur |
| 0 | FIFO Underflow Status | RO,LH | 0x0 | 0x0 | 1 = FIFO underflow occurred 0 = FIFO underflow did not occur |

Table 196: PPM FIFO Control 1
Device 3, Register 0xF00C

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|----------------|------|--------|--------|---|
| 15:14 | PPM FIFO Depth | R/W | 0x0 | 0x0 | PPM FIFO depth selection Default setting varies based on the PCS mode. 10GBASE-R, XAUI, RXAUI: 01 40GBASE-R4: 11 Else: 00 |
| 13:0 | Reserved | RO | 0x0000 | 0x0000 | Set to 0s |

Table 197: Packet Generation Control 1
Device 3, Register 0xF010

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------|---------|--------|--------|---|
| 15 | Read Clear | R/W | 0x0 | Retain | 1 = Enable clear on read 0 = Use 3.F010.6 to clear counters |
| 14:7 | Reserved | R/W | 0x00 | 0x00 | Set to 0s. |
| 6 | Pkt-Gen/Chk Counter Reset | R/W, SC | 0x0 | 0x0 | This bit self clears after counters are cleared. 1 = Clear counters 0 = Normal Operation |
| 5:3 | Reserved | RO | 0x0 | 0x0 | 0000 |
| 2 | Use SFD in Checker | R/W | 0x0 | 0x0 | 0 = Look for SFD before starting CRC checking 1 = Start CRC checking after the first 8 bytes in packet |
| 1 | Transmit Test Pattern Enable | R/W | 0x0 | 0x0 | 1 = Pkt generator enable 0 = Disable |
| 0 | Receive Test Pattern Enable | R/W | 0x0 | 0x0 | 1 = Pkt checker enable 0 = Disable |

Table 198: Packet Generation Control 2
 Device 3, Register 0xF011

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------------|------|--------|--------|---|
| 15:8 | Reserved | RO | 0x00 | Retain | Set to 0s |
| 7:4 | Internal Packet Generation Control | R/W | 0x0 | Retain | 000x = No Mask 0010 = Invert every other word 0011 = 2 no invert, 2 invert 0100 = Left shift byte 0101 = Right shift byte 0110 = Left shift word 0111 = Right shift word 1000 = Increment byte 1001 = decrement byte 1010 = Pseudo random byte 1011 = Pseudo random word 11xx = reserved |
| 3 | CRC Generation | R/W | 0x0 | Retain | 0 = On 1 = Off |
| 2:0 | Reserved | RO | 0x0 | Retain | Set to 0s |

Table 199: Initial Payload 0-1/Packet Generation
 Device 3, Register 0xF012

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------|------|--------|--------|----------------------------------|
| 15:8 | Byte 1 | R/W | 0x00 | Retain | Initial payload value for byte 1 |
| 7:0 | Byte 0 | R/W | 0x00 | Retain | Initial payload value for byte 0 |

Table 200: Initial Payload 2-3/Packet Generation
 Device 3, Register 0xF013

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------|------|--------|--------|----------------------------------|
| 15:8 | Byte 3 | R/W | 0x00 | Retain | Initial payload value for byte 1 |
| 7:0 | Byte 2 | R/W | 0x00 | Retain | Initial payload value for byte 0 |

Table 201: Packet Generation Length
 Device 3, Register 0xF016

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------------|------|--------|--------|--|
| 15:0 | Number Of Bytes In Frame | R/W | 0x0000 | Retain | 0000 = Random length between 64 bytes to 1518 bytes 0001 = Random length between 64 bytes to 0x0FFF bytes 0002 = Random length between 64 bytes to 0x1FFF bytes 0003 = Random length between 64 bytes to 0x3FFF bytes 0004 = Random length between 64 bytes to 0x7FFF bytes 0005 = Random length between 64 bytes to 0xFFFF bytes 0006 to 0007 = Undefined 0008 to FFFF = Length in number of bytes |

Table 202: Packet Generation Burst Sequence
Device 3, Register 0xF017

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------|------|--------|--------|---|
| 15:0 | Number Of Packets To Send | R/W | 0x0000 | Retain | 0000 = Stop generation 0001 to FFFE = Number of packets to send FFFF = Continuous |

Table 203: Packet Generation IPG
Device 3, Register 0xF018

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------|------|--------|--------|---|
| 15 | Random IPG | R/W | 0x0 | Retain | 0 = Fixed IPG per bits 14:0 1 = Random IPG from 5 bytes to value specified per bits 14:0 |
| 14:0 | IPG Duration | R/W | 0x0002 | Retain | Each bit equals 4 bytes of idle |

Table 204: Transmit Packet Counter [15:0]
Device 3, Register 0xF01B

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|------|--------|--------|--|
| 15:0 | Transmit Count [15:0] | RO | 0x0000 | 0x0000 | Counts the total number of packets transmitted. If 3.F010.14 = 0 then register does not clear on read. Cleared only when register 3.F010.6 transitions from 0 to 1. If 3.F010.14 = 1 then register clear on read. |

Table 205: Transmit Packet Counter [31:16]
Device 3, Register 0xF01C

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|---|
| 15:0 | Transmit Count [31:16] | RO | 0x0000 | 0x0000 | If 3.F010.14 = 0 then register does not clear on read. Cleared only when register 3.F010.6 transitions from 0 to 1. If 3.F010.14 = 1 then register clear on read. Must read register 3.F01B first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 206: Transmit Packet Counter [47:32]
Device 3, Register 0xF01D

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|---|
| 15:0 | Transmit Count [47:32] | RO | 0x0000 | 0x0000 | If 3.F010.14 = 0 then register does not clear on read. Cleared only when register 3.F010.6 transitions from 0 to 1. If 3.F010.14 = 1 then register clear on read. Must read register 3.F01B first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 207: Transmit Byte Counter [15:0]
Device 3, Register 0xF01E

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15:0 | Transmit Byte Count [15:0] | RO | 0x0000 | 0x0000 | Counts the total number of bytes in frame (including preamble) transmitted. If 3.F010.14 = 0 then register does not clear on read. Cleared only when register 3.F010.6 transitions from 0 to 1. If 3.F010.14 = 1 then register clear on read. |

Table 208: Transmit Byte Counter [31:16]
Device 3, Register 0xF01F

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|---|
| 15:0 | Transmit Byte Count [13:16] | RO | 0x0000 | 0x0000 | If 3.F010.14 = 0 then register does not clear on read. Cleared only when register 3.F010.6 transitions from 0 to 1. If 3.F010.14 = 1 then register clear on read. Must read register 3.F01E first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 209: Transmit Byte Counter [47:32]
Device 3, Register 0xF020

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|---|
| 15:0 | Transmit Byte Count [47:32] | RO | 0x0000 | 0x0000 | If 3.F010.14 = 0 then register does not clear on read. Cleared only when register 3.F010.6 transitions from 0 to 1. If 3.F010.14 = 1 then register clear on read. Must read register 3.F01E first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 210: Receive Packet Counter [15:0]
Device 3, Register 0xF021

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------|------|--------|--------|---|
| 15:0 | Receive Count [15:0] | RO | 0x0000 | 0x0000 | Counts the total number of packets received. If 3.F010.14 = 0 then register does not clear on read. Cleared only when register 3.F010.6 transitions from 0 to 1. If 3.F010.14 = 1 then register clear on read. |

Table 211: Receive Packet Counter [31:16]
Device 3, Register 0xF022

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|------|--------|--------|--|
| 15:0 | Receive Count [31:16] | RO | 0x0000 | 0x0000 | If 3.F010.14 = 0 then register does not clear on read. Cleared only when register 3.F010.6 transitions from 0 to 1. If 3.F010.14 = 1 then register clear on read. Must read register 3.F021 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 212: Receive Packet Counter [47:32]
Device 3, Register 0xF023

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|------|--------|--------|--|
| 15:0 | Receive Count [47:32] | RO | 0x0000 | 0x0000 | If 3.F010.14 = 0 then register does not clear on read. Cleared only when register 3.F010.6 transitions from 0 to 1. If 3.F010.14 = 1 then register clear on read. Must read register 3.F021 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 213: Receive Byte Count [15:0]
Device 3, Register 0xF024

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------|------|--------|--------|--|
| 15:0 | Byte Count [15:0] | RO | 0x0000 | 0x0000 | Counts the total number of bytes in frame (including preamble) received. If 3.F010.14 = 0 then register does not clear on read. Cleared only when register 3.F010.6 transitions from 0 to 1. If 3.F010.14 = 1 then register clear on read. |

Table 214: Receive Byte Count [31:16]
Device 3, Register 0xF025

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------|------|--------|--------|--|
| 15:0 | Byte Count [31:16] | RO | 0x0000 | 0x0000 | If 3.F010.14 = 0 then register does not clear on read. Cleared only when register 3.F010.6 transitions from 0 to 1. If 3.F010.14 = 1 then register clear on read. Must read register 3.F024 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 215: Receive Byte Count [47:32]
Device 3, Register 0xF026

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------|------|--------|--------|--|
| 15:0 | Byte Count [47:32] | RO | 0x0000 | 0x0000 | If 3.F010.14 = 0 then register does not clear on read. Cleared only when register 3.F010.6 transitions from 0 to 1. If 3.F010.14 = 1 then register clear on read. Must read register 3.F024 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 216: Receive Packet Error Count [15:0]
Device 3, Register 0xF027

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------|------|--------|--------|--|
| 15:0 | Packet Error Count [15:0] | RO | 0x0000 | 0x0000 | Counts the number of packets with CRC Error received. If 3.F010.14 = 0 then register does not clear on read. Cleared only when register 3.F010.6 transitions from 0 to 1. If 3.F010.14 = 1 then register clear on read. |

Table 217: Receive Packet Error Count [31:16]
Device 3, Register 0xF028

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|---|
| 15:0 | Packet Error Count [31:16] | RO | 0x0000 | 0x0000 | If 3.F010.14 = 0 then register does not clear on read. Cleared only when register 3.F010.6 transitions from 0 to 1. If 3.F010.14 = 1 then register clear on read. Must read register 3.F027 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 218: Receive Packet Error Count [47:32]
Device 3, Register 0xF029

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15:0 | Packet Error Count [47:32] | RO | 0x0000 | 0x0000 | If 3.F010.14 = 0 then register does not clear on read. Cleared only when register 3.F010.6 transitions from 0 to 1. If 3.F010.14 = 1 then register clear on read. Must read register 3.F027 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 219: PRBS Control
Device 3, Register 0xF030

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------|------|--------|--------|--|
| 15 | Reserved | R/W | 0x0 | 0x0 | Set to 0s. |
| 14 | BER_mode_en | R/W | 0x1 | Retain | 0 = Legacy mode of error count accumulation 1 = BER mode enabled for error accumulation. This is used for average Bit Error Rate (BER) calculation. |

Table 219: PRBS Control (Continued)
Device 3, Register 0xF030

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------|---------|--------|--------|--|
| 13 | Read Clear | R/W | 0x0 | Retain | 1 = Enable clear on read 0 = Use 3.F030.6 to clear counters |
| 12:9 | Reserved | R/W | 0x0 | 0x0 | Set to 0s. |
| 8 | PRBS Lock | RO | 0x0 | 0x0 | 1 = PRBS locked 0 = PRBS not locked |
| 7 | Immediate Error Count Enable | R/W | 0x0 | 0x0 | 1 = Count PRBS errors before locking 0 = Wait until PRBS locks before counting |
| 6 | PRBS Counter Reset | R/W, SC | 0x0 | 0x0 | This bit self clears after counters are cleared. 1 = Clear counters 0 = Normal Operation |
| 5 | Transmit Test Pattern Enable | R/W | 0x0 | 0x0 | Test enabled only if the appropriate mode is selected. 1 = Enable 0 = Disable |
| 4 | Receive Test Pattern Enable | R/W | 0x0 | 0x0 | Test enabled only if the appropriate mode is selected. Note that there is no receive checking done for IEEE 48.A.1, 48.A.2, and 48.A.3. 1 = Enable, 0 = Disable |
| 3:0 | | R/W | 0x0 | 0x0 | 0000 = IEEE 49.2.8 - PRBS 31 0001 = PRBS 7 0010 = PRBS 9 IEEE 83.7 0011 = PRBS 23 0100 = PRBS 31 Inverted 0101 = PRBS 7 Inverted 1000 = PRBS 15 1001 = PRBS 15 Inverted 0110 = PRBS 9 Inverted 0111 = PRBS 23 Inverted 1100 = High frequency pattern 1101 = Low frequency pattern 1110 = Mixed frequency pattern 1111 = Square Wave pattern |

Table 220: PRBS Symbol Tx Counter [15:0]
Device 3, Register 0xF031

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|------|--------|--------|--|
| 15:0 | Transmit Count [15:0] | RO | 0x0000 | 0x0000 | Increments by 1 for every bit transmitted per lane. If 3.F030.13 = 0 then register does not clear on read. Cleared only when register 3.F030.6 transitions from 0 to 1. If 3.F030.13 = 1 then register clear on read. |

Table 221: PRBS Symbol Tx Counter [31:16]
Device 3, Register 0xF032

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|--|
| 15:0 | Transmit Count [31:16] | RO | 0x0000 | 0x0000 | If 3.F030.13 = 0 then register does not clear on read. Cleared only when register 3.F030.6 transitions from 0 to 1. If 3.F030.13 = 1 then register clear on read. Must read register 3.F031 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 222: PRBS Symbol Tx Counter [47:32]
Device 3, Register 0xF033

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|--|
| 15:0 | Transmit Count [47:32] | RO | 0x0000 | 0x0000 | If 3.F030.13 = 0 then register does not clear on read. Cleared only when register 3.F030.6 transitions from 0 to 1. If 3.F030.13 = 1 then register clear on read. Must read register 3.F031 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 223: PRBS Symbol Rx Counter [15:0]
Device 3, Register 0xF034

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------|------|--------|--------|--|
| 15:0 | Receive Count [15:0] | RO | 0x0000 | 0x0000 | Increments by 1 for every bit received per lane. If 3.F030.13 = 0 then register does not clear on read. Cleared only when register 3.F030.6 transitions from 0 to 1. If 3.F030.13 = 1 then register clear on read. |

Table 224: PRBS Symbol Rx Counter [31:16]
Device 3, Register 0xF035

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|--|
| 15:0 | Receive Error Count [31:16] | RO | 0x0000 | 0x0000 | If 3.F030.13 = 0 then register does not clear on read. Cleared only when register 3.F030.6 transitions from 0 to 1. If 3.F030.13 = 1 then register clear on read. Must read register 3.F034 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 225: PRBS Symbol Rx Counter [47:32]
Device 3, Register 0xF036

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|--|
| 15:0 | Receive Error Count [47:32] | RO | 0x0000 | 0x0000 | If 3.F030.13 = 0 then register does not clear on read. Cleared only when register 3.F030.6 transitions from 0 to 1. If 3.F030.13 = 1 then register clear on read. Must read register 3.F034 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 226: PRBS Error Count [15:0]
Device 3, Register 0xF037

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------|------|--------|--------|---|
| 15:0 | Lane 0 Error Count [15:0] | RO | 0x0000 | 0x0000 | Increments by 1 for every bit error received per lane. If 3.F030.13 = 0 then register does not clear on read. Cleared only when register 3.F030.6 transitions from 0 to 1. If 3.F030.13 = 1 then register clear on read. |

Table 227: PRBS Error Count [31:16]
Device 3, Register 0xF038

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15:0 | Lane 0 Error Count [31:16] | RO | 0x0000 | 0x0000 | If 3.F030.13 = 0 then register does not clear on read. Cleared only when register 3.F030.6 transitions from 0 to 1. If 3.F030.13 = 1 then register clear on read. Must read register 3.F037 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 228: PRBS Error Count [47:32]
Device 3, Register 0xF039

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15:0 | Lane 0 Error Count [47:32] | RO | 0x0000 | 0x0000 | If 3.F030.13 = 0 then register does not clear on read. Cleared only when register 3.F030.6 transitions from 0 to 1. If 3.F030.13 = 1 then register clear on read. Must read register 3.F037 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 229: PRBS Elapse Timer
 Device 3, Register 0xF03A

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------|------|--------|--------|--|
| 15:0 | Elapse Timer Count [15:0] | RO | 0x0000 | 0x0000 | Increments by 1 for every 2 second. Valid only if 3.F030.14 = 1 If 3.F030.13 = 0 then register does not clear on read, but cleared only when register 3.F030.6 transitions from 0 to 1. If 3.F030.13 = 1 then register clear on read. Must read register 3.F037 first in order to update this register. |

Table 230: Power Management TX state control
 Device 3, Register 0xF074

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------|------|--------|--------|--------------------------------------|
| 15:14 | Reserved | RO | 0x0 | 0x0 | Writing to this section is forbidden |
| 13 | RG_EN_RST_DSP_S | R/W | 0x1 | Retain | 0=Disable 1 = Enable |
| 12:0 | Reserved | RO | 0x0000 | 0x0000 | Writing to this section is forbidden |

6.3.6 SFI SERDES Registers

By default LDSP tries to automatically train the link partner for the best transmitter settings. The transmitter comes up with default settings which can be read back from registers in [Table 232](#) to [Table 239](#). If manual forcing of transmitter amplitude/pre/post emphasis is desired, it can be achieved by writing to the same registers. Here register address 1E.B116.15 should be read as 0x1E.0xB116 and so on.

Table 231: SFI SERDES Registers - Register Map

| Register Name | Register Address | Table and Page |
|---|----------------------|-----------------------------------|
| SFI Transmitter Lane 0 Settings | Register 0x1E.0xB116 | Table 232, p. 189 |
| SFI Transmitter Lane 0 Settings | Register 0x1E.0xB117 | Table 233, p. 189 |
| SFI Transmitter Lane 1 Settings | Register 0x1E.0xB316 | Table 234, p. 190 |
| SFI Transmitter Lane 1 Settings | Register 0x1E.0xB317 | Table 235, p. 190 |
| SFI Transmitter Lane 2 Settings | Register 0x1E.0xB516 | Table 236, p. 190 |
| SFI Transmitter Lane 2 Settings | Register 0x1E.0xB517 | Table 237, p. 190 |
| SFI Transmitter Lane 3 Settings | Register 0x1E.0xB716 | Table 238, p. 191 |
| SFI Transmitter Lane 3 Settings | Register 0x1E.0xB717 | Table 239, p. 191 |

Table 232: SFI Transmitter Lane 0 Settings
Register 0x1E.0xB116

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|---|
| 15 | Force Enable | R/W | 0x0 | Retain | Force enable for bit 14:0 and next register bit 15:0 0 = This register and next register are read back values 1 = This register and next register are forced values |
| 14 | Spare | R/W | 0x0 | Retain | |
| 13:8 | Pre-cursor tap | R/W | 0x0 | Retain | n0[5:0] |
| 7:6 | Spares | R/W | 0x0 | Retain | |
| 5:0 | Main tap | R/W | 0x0 | Retain | n1[5:0] |

Table 233: SFI Transmitter Lane 0 Settings
Register 0x1E.0xB117

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------|------|--------|--------|-------------|
| 15:14 | Spares | R/W | 0x0 | Retain | |
| 13:8 | Post Cursor Tap | R/W | 0x0 | Retain | n2[5:0] |
| 7:6 | Spares | R/W | 0x0 | Retain | |
| 5:0 | Remaining Tap | R/W | 0x0 | Retain | nrst[5:0] |

Table 234: SFI Transmitter Lane 1 Settings
 Register 0x1E.0xB316

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|---|
| 15 | Force Enable | R/W | 0x0 | Retain | Force enable for bit 14:0 and next register bit 15:0 0 = This register and next register are read back values 1 = This register and next register are forced values |
| 14 | Spare | R/W | 0x0 | Retain | |
| 13:8 | Pre-cursor tap | R/W | 0x0 | Retain | n0[5:0] |
| 7:6 | Spares | R/W | 0x0 | Retain | |
| 5:0 | Main tap | R/W | 0x0 | Retain | n1[5:0] |

Table 235: SFI Transmitter Lane 1 Settings
 Register 0x1E.0xB317

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------|------|--------|--------|-------------|
| 15:14 | Spares | R/W | 0x0 | Retain | |
| 13:8 | Post Cursor Tap | R/W | 0x0 | Retain | n2[5:0] |
| 7:6 | Spares | R/W | 0x0 | Retain | |
| 5:0 | Remaining Tap | R/W | 0x0 | Retain | nrst[5:0] |

Table 236: SFI Transmitter Lane 2 Settings
 Register 0x1E.0xB516

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|---|
| 15 | Force Enable | R/W | 0x0 | Retain | Force enable for bit 14:0 and next register bit 15:0 0 = This register and next register are read back values 1 = This register and next register are forced values |
| 14 | Spare | R/W | 0x0 | Retain | |
| 13:8 | Pre-cursor tap | R/W | 0x0 | Retain | n0[5:0] |
| 7:6 | Spares | R/W | 0x0 | Retain | |
| 5:0 | Main tap | R/W | 0x0 | Retain | n1[5:0] |

Table 237: SFI Transmitter Lane 2 Settings
 Register 0x1E.0xB517

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------|------|--------|--------|-------------|
| 15:14 | Spares | R/W | 0x0 | Retain | |
| 13:8 | Post Cursor Tap | R/W | 0x0 | Retain | n2[5:0] |
| 7:6 | Spares | R/W | 0x0 | Retain | |
| 5:0 | Remaining Tap | R/W | 0x0 | Retain | nrst[5:0] |

Table 238: SFI Transmitter Lane 3 Settings
Register 0x1E.0xB716

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|---|
| 15 | Force Enable | R/W | 0x0 | Retain | Force enable for bit 14:0 and next register bit 15:0 0 = This register and next register are read back values 1 = This register and next register are forced values |
| 14 | Spare | R/W | 0x0 | Retain | |
| 13:8 | Pre-cursor tap | R/W | 0x0 | Retain | n0[5:0] |
| 7:6 | Spares | R/W | 0x0 | Retain | |
| 5:0 | Main tap | R/W | 0x0 | Retain | n1[5:0] |

Table 239: SFI Transmitter Lane 3 Settings
Register 0x1E.0xB717

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------|------|--------|--------|-------------|
| 15:14 | Spares | R/W | 0x0 | Retain | |
| 13:8 | Post Cursor Tap | R/W | 0x0 | Retain | N2[5:0] |
| 7:6 | Spares | R/W | 0x0 | Retain | |
| 5:0 | Remaining Tap | R/W | 0x0 | Retain | NRST[5:0] |

6.4 XFI Registers

6.4.1 XFI 10GBASE-R PCS

The registers in this section apply to all ports.

Table 240: XFI 10GBASE-R PCS Registers - Register Map

| Register Name | Register Address | Table and Page |
|--|---------------------------|-------------------|
| 10GBASE-R PCS Control 1 | Device 4, Register 0x0000 | Table 241, p. 192 |
| 10GBASE-R PCS Status 1 | Device 4, Register 0x0001 | Table 242, p. 193 |
| PCS Device Identifier 1 | Device 4, Register 0x0002 | Table 243, p. 193 |
| PCS Device Identifier 2 | Device 4, Register 0x0003 | Table 244, p. 194 |
| PCS Speed Ability | Device 4, Register 0x0004 | Table 245, p. 194 |
| PCS Devices In Package 1 | Device 4, Register 0x0005 | Table 246, p. 194 |
| PCS Devices In Package 2 | Device 4, Register 0x0006 | Table 247, p. 195 |
| PCS Control 2 | Device 4, Register 0x0007 | Table 248, p. 195 |
| 10GBASE-R PCS Status 2 | Device 4, Register 0x0008 | Table 249, p. 195 |
| PCS Package Identifier 1 | Device 4, Register 0x000E | Table 250, p. 196 |
| PCS Package Identifier 2 | Device 4, Register 0x000F | Table 251, p. 196 |
| PCS EEE Capability Register | Device 4, Register 0x0014 | Table 252, p. 196 |
| BASE-R PCS Status 1 | Device 4, Register 0x0020 | Table 253, p. 197 |
| BASE-R PCS Status 2 | Device 4, Register 0x0021 | Table 254, p. 197 |
| 10GBASE-R PCS Test Pattern Error Counter | Device 4, Register 0x002B | Table 255, p. 197 |
| 10GBASE-R Interrupt Enable Register | Device 4, Register 0x8000 | Table 256, p. 197 |
| 10GBASE-R Interrupt Status Register | Device 4, Register 0x8001 | Table 257, p. 198 |
| 10GBASE-R PCS Real Time Status Register | Device 4, Register 0x8002 | Table 258, p. 198 |

Table 241: 10GBASE-R PCS Control 1
Device 4, Register 0x0000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|---------|-----------|--------|--|
| 15 | Software Reset | R/W, SC | 0x0 | 0x0 | 1 = Reset 0 = Normal This register will soft reset all PCS/PMA and associated registers of this interface. |
| 14 | Loopback | R/W | 0x0 | 0x0 | 1 = Loopback 0 = Normal |
| 13 | Speed Select | RO | 0x1 | 0x1 | 1 = Bits 5:2 select speed. |
| 12 | Reserved | RO | 0x0 | 0x0 | 0 |
| 11 | Low Power | R/W | See Desc. | Retain | 1 = Power Down 0 = Normal This register will power down all PCS/PMA of this interface. Initial power state is a function of hardware configuration. |

Table 241: 10GBASE-R PCS Control 1 (Continued)
Device 4, Register 0x0000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------|------|--------|--------|--|
| 10 | Clock Stoppable | R/W | 0x0 | 0x0 | 1 = Clock stoppable during LPI 0 = Clock not stoppable |
| 9:7 | Reserved | RO | 0x0 | 0x0 | 000 |
| 6 | Speed Select | RO | 0x1 | 0x1 | 1 = Bits 5:2 select speed. |
| 5:2 | Speed Select | RO | 0x0 | 0x0 | This register is ignored. Speed is automatically set based on the mode selected in register 31.F002 |
| 1:0 | Reserved | RO | 0x0 | 0x0 | 00 |

Table 242: 10GBASE-R PCS Status 1
Device 4, Register 0x0001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------|--------|--------|--------|--|
| 15:12 | Reserved | RO | 0x0 | 0x0 | 00000000 |
| 11 | TX LP Idle Received | RO/LH | 0x0 | 0x0 | 1 = Tx PCS has received LP Idle 0 = LP Idle not received |
| 10 | Rx LP Idle Received | RO/LH | 0x0 | 0x0 | 1 = Rx PCS has received LP Idle 0 = LP Idle not received |
| 9 | Tx LP Idle Indication | RO | 0x0 | 0x0 | 1 = Tx PCS is currently receiving LP Idle 0 = Tx PCS is not currently receiving LP Idle |
| 8 | Rx LP Idle Indication | RO | 0x0 | 0x0 | 1 = Rx PCS is currently receiving LP Idle 0 = Rx PCS is not currently receiving LP Idle |
| 7 | Fault | RO | 0x0 | 0x0 | 1 = Fault condition 0 = No fault condition |
| 6 | Clock Stop Capable | RO | 0x0 | 0x0 | 0 = Clock not stoppable |
| 5:3 | Reserved | RO | 0x0 | 0x0 | 000 |
| 2 | Link Status | RO, LL | 0x0 | 0x0 | 1 = PCS link up 0 = PCS link down |
| 1 | Low Power Ability | RO | 0x1 | 0x1 | 1 = PCS Supports Low Power |
| 0 | Reserved | RO | 0x0 | 0x0 | 0 |

Table 243: PCS Device Identifier 1
Device 4, Register 0x0002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---|------|--------|--------|---|
| 15:0 | Organizationally Unique Identifier Bit 3:18 | RO | 0x0141 | 0x0141 | 0000000101000001 Marvell OUI is 0x005043 |

Table 244: PCS Device Identifier 2
 Device 4, Register 0x0003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--|------|-----------|-----------|--|
| 15:10 | Organizationally Unique Identifier Bit 19:24 | RO | 0x03 | 0x03 | 000011 |
| 9:4 | Model Number | RO | 0x31 | 0x31 | 110001 |
| 3:0 | Revision Number | RO | See Desc. | See Desc. | Rev Number Contact Marvell® FAEs for information on the device revision number. |

Table 245: PCS Speed Ability
 Device 4, Register 0x0004

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15:4 | Reserved | RO | 0x000 | 0x000 | 0 |
| 3 | 100G Capable | RO | 0x0 | 0x0 | 0 = Not capable of operating at 100Gbps |
| 2 | 40G Capable | RO | 0x1 | 0x1 | 1 = Capable of operating at 40Gbps |
| 1 | 10PASS-TS/2BASE-TL Capable | RO | 0x0 | 0x0 | 0 = Not capable of operating as the 10P/2B PCS |
| 0 | 10G Capable | RO | 0x1 | 0x1 | 1 = Capable of operating at 10Gbps |

Table 246: PCS Devices In Package 1
 Device 4, Register 0x0005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--------------------------|------|--------|--------|--|
| 15:11 | Reserved | RO | 0x00 | 0x00 | 00000 |
| 10 | Separated PMA (3) | RO | 0x0 | 0x0 | 1 = Separated PMA (3) present in package 0 = Separated PMA (3) not present in package |
| 9 | Separated PMA (2) | RO | 0x0 | 0x0 | 1 = Separated PMA (2) present in package 0 = Separated PMA (2) not present in package |
| 8 | Separated PMA (1) | RO | 0x0 | 0x0 | 1 = Separated PMA (1) present in package 0 = Separated PMA (1) not present in package |
| 7 | Auto-Negotiation Present | RO | 0x1 | 0x1 | 1 = Auto-negotiation present in package 0 = Auto-negotiation not present in package |
| 6 | TC Present | RO | 0x0 | 0x0 | 1 = TC present in package 0 = TC not present in package |
| 5 | DTE XS Present | RO | 0x0 | 0x0 | 1 = DTE XS present in package 0 = DTE XS not present in package |
| 4 | PHY XS Present | RO | 0x1 | 0x1 | 1 = PHY XS present in package 0 = PHY XS not present in package |
| 3 | PCS Present | RO | 0x1 | 0x1 | 1 = PCS present in package 0 = PCS not present in package |

Table 246: PCS Devices In Package 1 (Continued)
Device 4, Register 0x0005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|--|
| 2 | Reserved | RO | 0x1 | 0x1 | Reserved Do not write any value other than the HW Rst value. |
| 1 | PMD/PMA Present | RO | 0x1 | 0x1 | 1 = PMA/PMD present in package 0 = PMA/PMD not present in package |
| 0 | Clause 22 Registers Present | RO | 0x0 | 0x0 | 1 = Clause 22 registers present in package 0 = Clause 22 registers not present in package |

Table 247: PCS Devices In Package 2
Device 4, Register 0x0006

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------------|------|--------|--------|--|
| 15 | Marvell Specific Device 2 Present | RO | 0x1 | 0x1 | 1 = Marvell specific device 2 present 0 = Marvell specific device 2 not present |
| 14 | Marvell Specific Device 1 Present | RO | 0x1 | 0x1 | 1 = Marvell specific device 1 present 0 = Marvell specific device 1 not present |
| 13 | Clause 22 Extension Present | RO | 0x0 | 0x0 | 1 = Clause 22 extension present 0 = Clause 22 extension not present |
| 12:0 | Reserved | RO | 0x0000 | 0x0000 | 0 |

Table 248: PCS Control 2
Device 4, Register 0x0007

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------|------|--------|--------|--|
| 15:3 | Reserved | RO | 0x0000 | 0x0000 | 0 |
| 2:0 | PCS Type Selection | RO | 0x0 | 0x0 | This register is ignored. PCS is automatically set based on the mode selected in register 31.F002 |

Table 249: 10GBASE-R PCS Status 2
Device 4, Register 0x0008

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--------------------|--------|--------|--------|--|
| 15:14 | Device Present | RO | 0x2 | 0x2 | 10 = Device responding to this address |
| 13:12 | Reserved | RO | 0x0 | 0x0 | 00 |
| 11 | Transmit Fault | RO, LH | 0x0 | 0x0 | 1 = Fault on transmit path, 0 = No fault |
| 10 | Receive Fault | RO, LH | 0x0 | 0x0 | 1 = Fault on receive path, 0 = No fault |
| 9:6 | Reserved | RO | 0x0 | 0x0 | 0000000 |
| 5 | 100GBASE-R Capable | RO | 0x0 | 0x0 | 1 = PCS is able to support 100GBASE-R PCS types 0 = PCS is not able to support 100GBASE-R PCS types |

Table 249: 10GBASE-R PCS Status 2 (Continued)
 Device 4, Register 0x0008

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------|------|--------|--------|--|
| 4 | 40GBASE-R Capable | RO | 0x1 | 0x1 | 1 = PCS is able to support 40GBASE-R PCS types 0 = PCS is not able to support 40GBASE-R PCS types |
| 3 | 10GBASE-T Capable | RO | 0x0 | 0x0 | 1 = PCS is able to support 10GBASE-T PCS types 0 = PCS is not able to support 10GBASE-T PCS types |
| 2 | Reserved | RO | 0x1 | 0x1 | Reserved Do not write any value other than the HW Rst value. |
| 1 | 10GBASE-X Capable | RO | 0x1 | 0x1 | 1 = PCS is able to support 10GBASE-X PCS types 0 = PCS is not able to support 10GBASE-X PCS types |
| 0 | 10GBASE-R Capable | RO | 0x1 | 0x1 | 1 = PCS is able to support 10GBASE-R PCS types 0 = PCS is not able to support 10GBASE-R PCS types |

Table 250: PCS Package Identifier 1
 Device 4, Register 0x000E

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---|------|--------|--------|---|
| 15:0 | Organizationally Unique Identifier Bit 3:18 | RO | 0x0141 | 0x0141 | 0000000101000001 Marvell OUI is 0x005043 |

Table 251: PCS Package Identifier 2
 Device 4, Register 0x000F

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--|------|-----------|-----------|--|
| 15:10 | Organizationally Unique Identifier Bit 19:24 | RO | 0x03 | 0x03 | 000011 |
| 9:4 | Model Number | RO | 0x31 | 0x31 | 110001 |
| 3:0 | Revision Number | RO | See Desc. | See Desc. | Rev Number Contact Marvell® FAEs for information on the device revision number. |

Table 252: PCS EEE Capability Register
 Device 4, Register 0x0014

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------|------|--------|--------|--------------------------------------|
| 15:7 | Reserved | RO | 0x000 | 0x000 | 0 |
| 6 | 10GBASE-KR EEE | RO | 0x0 | 0x0 | 1 = EEE is supported for 10GBASE-KR |
| 5 | 10GBASE-KX4 EEE | RO | 0x0 | 0x0 | 1 = EEE is supported for 10GBASE-KX4 |
| 4 | 1000BASE-KX EEE | RO | 0x0 | 0x0 | 1 = EEE is supported for 1000BASE-KX |
| 3:0 | Reserved | RO | 0x0 | 0x0 | 0 |

Table 253: BASE-R PCS Status 1
Device 4, Register 0x0020

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------------------|------|--------|--------|--|
| 15:13 | Reserved | RO | 0x0 | 0x0 | 0 |
| 12 | 10GBASE-R Receive Link Status | RO | 0x0 | 0x0 | 1 = 10G BASE-R PCS receive link up 0 = 10G BASE-R PCS receive link down |
| 11:4 | Reserved | RO | 0x00 | 0x00 | 0 |
| 3 | PRBS9 Pattern Testing Ability | RO | 0x1 | 0x1 | 1 = PCS is able to support PRBS9 pattern testing 0 = PCS is not able to support PRBS9 pattern testing |
| 2 | PRBS31 Pattern Testing Ability | RO | 0x1 | 0x1 | 1 = PCS is able to support PRBS31 pattern testing 0 = PCS is not able to support PRBS31 pattern testing |
| 1 | 10GBASE-R PCS High Bit Error Rate | RO | 0x0 | 0x0 | 1 = 10G BASE-R PCS reporting high BER 0 = 10G BASE-R PCS not reporting high BER |
| 0 | 10GBASE-R PCS Block Lock | RO | 0x0 | 0x0 | 1 = 10G BASE-R PCS locked to received block 0 = 10G BASE-R PCS not locked |

Table 254: BASE-R PCS Status 2
Device 4, Register 0x0021

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|--------|--------|--------|---|
| 15 | Latched Block Lock | RO, LL | 0x0 | 0x0 | 1 = PCS Has Block Lock 0 = PCS Does Not Have Block Lock |
| 14 | Latched High Bit Error Rate | RO, LH | 0x0 | 0x0 | 1 = PCS Has Reported High BER 0 = PCS Has Not Reported High BER |
| 13:8 | Bit Error Rate Counter | RO | 0x00 | 0x00 | Bit Error Rate Counter Counter clears on read. Counter will peg at all 1s. |
| 7:0 | Errored Blocks Counter | RO | 0x00 | 0x00 | Errored Blocks Counter Counter clears on read. Counter will peg at all 1s. |

Table 255: 10GBASE-R PCS Test Pattern Error Counter
Device 4, Register 0x002B

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15:0 | Test Pattern Error Counter | RO | 0x0000 | 0x0000 | Test Pattern Error Counter Counter clears on read. Counter will peg at all 1s. In Pseudo-random test mode, it counts block errors. In PRBS31 test mode it counts bit errors at the PRBS31 pattern checker output. |

Table 256: 10GBASE-R Interrupt Enable Register
Device 4, Register 0x8000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|----------|------|--------|--------|-------------|
| 15:12 | Reserved | R/W | 0x0 | Retain | Set to 0 |

Table 256: 10GBASE-R Interrupt Enable Register (Continued)
Device 4, Register 0x8000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--|------|--------|--------|---|
| 11 | Local Fault Transmitted Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 10 | Local Fault Received Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 9:4 | Reserved | R/W | 0x00 | Retain | Set to 0 |
| 3 | Reserved | R/W | 0x0 | Retain | Set to 0 |
| 2 | Link status change Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 1 | High BER Change Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 0 | Block Lock Change Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |

Table 257: 10GBASE-R Interrupt Status Register
Device 4, Register 0x8001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------------------|-------|--------|--------|--|
| 15:12 | Reserved | RO,LH | 0x0 | 0x0 | Set to 0 |
| 11 | Local Fault Transmitted Interrupt | RO,LH | 0x0 | 0x0 | 1 = Local fault transmitted 0 = No local fault transmitter |
| 10 | Local Fault Received Interrupt | RO,LH | 0x0 | 0x0 | 1 = Local fault received 0 = No local fault received |
| 9:4 | Reserved | RO,LH | 0x00 | 0x00 | Set to 0 |
| 3 | Reserved | RO,LH | 0x0 | 0x0 | Set to 0 |
| 2 | Link status change Detected | RO,LH | 0x0 | 0x0 | 1 = Link status changed detected 0 = Link status changed not detected |
| 1 | High BER Change Interrupt | RO,LH | 0x0 | 0x0 | 1 = Change detected 0 = No Change |
| 0 | Block Lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1 = Change detected 0 = No Change |

Table 258: 10GBASE-R PCS Real Time Status Register
Device 4, Register 0x8002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--------------------------------|------|--------|--------|---|
| 15:12 | Reserved | RO | 0x0 | 0x0 | Set to 0 |
| 11 | Local Fault Transmitted Status | RO | 0x0 | 0x0 | 1 = Local fault transmitted 0 = No local fault transmitted |

Table 258: 10GBASE-R PCS Real Time Status Register (Continued)
Device 4, Register 0x8002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|---|
| 10 | Local Fault Received Status | RO | 0x0 | 0x0 | 1 = Local fault received 0 = No local fault received |
| 9:5 | Reserved | RO | 0x00 | 0x00 | Set to 0 |
| 4 | Jit_0_lock | RO | 0x0 | 0x0 | 1 = JIT 0 lock achieved |
| 3 | Jit_lf_lock | RO | 0x0 | 0x0 | 1 = JIT local fault lock achieved |
| 2 | Link Status | RO | 0x0 | 0x0 | 1 = 10GBASE-R link achieved 0 = No link |
| 1 | High BER Status | RO | 0x0 | 0x0 | 1 = High BER 0 = No high BER |
| 0 | Lane 3 Block Lock Status | RO | 0x0 | 0x0 | 1 = Block lock achieved 0 = No block lock |

6.4.2 XFI XAUI, RXAUI PCS

The registers in this section applies to ports 0 and 2 for XAUI, RXAUI PCS and ports 1 and 3 for RXAUI only.

Table 259: XFI XAUI, RXAUI PCS Registers - Register Map

| Register Name | Register Address | Table and Page |
|---|---------------------------|-----------------------------------|
| XAUI PCS Control 1 | Device 4, Register 0x1000 | Table 260, p. 200 |
| XAUI PCS Status 1 | Device 4, Register 0x1001 | Table 261, p. 201 |
| PCS Device Identifier 1 | Device 4, Register 0x1002 | Table 262, p. 202 |
| PCS Device Identifier 2 | Device 4, Register 0x1003 | Table 263, p. 202 |
| PCS Speed Ability | Device 4, Register 0x1004 | Table 264, p. 202 |
| PCS Devices In Package 1 | Device 4, Register 0x1005 | Table 265, p. 202 |
| PCS Devices In Package 2 | Device 4, Register 0x1006 | Table 266, p. 203 |
| PCS Control 2 | Device 4, Register 0x1007 | Table 267, p. 203 |
| XAUI PCS Status 2 | Device 4, Register 0x1008 | Table 268, p. 203 |
| PCS Package Identifier 1 | Device 4, Register 0x100E | Table 269, p. 204 |
| PCS Package Identifier 2 | Device 4, Register 0x100F | Table 270, p. 204 |
| PCS EEE Capability Register | Device 4, Register 0x1014 | Table 271, p. 205 |
| 10GBASE-X Lane Status | Device 4, Register 0x1018 | Table 272, p. 205 |
| 10GBASE-X Test Control Register | Device 4, Register 0x1019 | Table 273, p. 205 |
| XAUI Control | Device 4, Register 0x9000 | Table 274, p. 206 |
| XAUI Interrupt Enable 1 | Device 4, Register 0x9001 | Table 275, p. 206 |
| XAUI Interrupt Enable 2 | Device 4, Register 0x9002 | Table 276, p. 207 |
| XAUI Interrupt Status 1 | Device 4, Register 0x9003 | Table 277, p. 207 |
| XAUI Interrupt Status 2 | Device 4, Register 0x9004 | Table 278, p. 208 |
| XAUI Real Time Status Register 2 | Device 4, Register 0x9006 | Table 279, p. 208 |
| XAUI Random Sequence Control | Device 4, Register 0x9010 | Table 280, p. 209 |
| XAUI Jitter Packet Transmit Counter LSB | Device 4, Register 0x9011 | Table 281, p. 209 |
| XAUI Jitter Packet Transmit Counter MSB | Device 4, Register 0x9012 | Table 282, p. 209 |
| XAUI Jitter Packet Received Counter LSB | Device 4, Register 0x9013 | Table 283, p. 210 |
| XAUI Jitter Packet Received Counter MSB | Device 4, Register 0x9014 | Table 284, p. 210 |
| XAUI Jitter Pattern Error Counter LSB | Device 4, Register 0x9015 | Table 285, p. 210 |
| XAUI Jitter Pattern Error Counter MSB | Device 4, Register 0x9016 | Table 286, p. 210 |

Table 260: XAUI PCS Control 1
Device 4, Register 0x1000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|---------|--------|--------|--|
| 15 | Software Reset | R/W, SC | 0x0 | 0x0 | 1 = Reset 0 = Normal This register will soft reset all PCS/PMA and associated registers of this interface. |
| 14 | Loopback | R/W | 0x0 | 0x0 | 1 = Loopback 0 = Normal |

Table 260: XAUI PCS Control 1 (Continued)
Device 4, Register 0x1000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------|------|-----------|--------|--|
| 13 | Speed Select | RO | 0x1 | 0x1 | 1 = Bits 5:2 select speed. |
| 12 | Reserved | RO | 0x0 | 0x0 | 0 |
| 11 | Low Power | R/W | See Desc. | Retain | 1 = Power Down 0 = Normal This register will power down all PCS/PMA of this interface. Initial power state is a function of hardware configuration. |
| 10 | Clock Stoppable | R/W | 0x0 | 0x0 | 1 = Clock stoppable during LPI 0 = Clock not stoppable |
| 9:7 | Reserved | RO | 0x0 | 0x0 | 000 |
| 6 | Speed Select | RO | 0x1 | 0x1 | 1 = Bits 5:2 select speed. |
| 5:2 | Speed Select | RO | 0x0 | 0x0 | This register is ignored. Speed is automatically set based on the mode selected in register 31.F002 |
| 1:0 | Reserved | RO | 0x0 | 0x0 | 00 |

Table 261: XAUI PCS Status 1
Device 4, Register 0x1001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------|--------|--------|--------|--|
| 15:12 | Reserved | RO | 0x0 | 0x0 | 00000000 |
| 11 | TX LP Idle Received | RO/LH | 0x0 | 0x0 | 1 = Tx PCS has received LP Idle 0 = LP Idle not received |
| 10 | Rx LP Idle Received | RO/LH | 0x0 | 0x0 | 1 = Rx PCS has received LP Idle 0 = LP Idle not received |
| 9 | Tx LP Idle Indication | RO | 0x0 | 0x0 | 1 = Tx PCS is currently receiving LP Idle 0 = Tx PCS is not currently receiving LP Idle |
| 8 | Rx LP Idle Indication | RO | 0x0 | 0x0 | 1 = Rx PCS is currently receiving LP Idle 0 = Rx PCS is not currently receiving LP Idle |
| 7 | Fault | RO | 0x0 | 0x0 | 1 = Fault condition 0 = No fault condition |
| 6 | Clock Stop Capable | RO | 0x0 | 0x0 | 0 = Clock not stoppable |
| 5:3 | Reserved | RO | 0x0 | 0x0 | 000 |
| 2 | Link Status | RO, LL | 0x0 | 0x0 | 1 = PCS link up 0 = PCS link down |
| 1 | Low Power Ability | RO | 0x1 | 0x1 | 1 = PCS supports low power |
| 0 | Reserved | RO | 0x0 | 0x0 | 0 |

Table 262: PCS Device Identifier 1
Device 4, Register 0x1002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---|------|--------|--------|---|
| 15:0 | Organizationally Unique Identifier Bit 3:18 | RO | 0x0141 | 0x0141 | 0000000101000001 Marvell OUI is 0x005043 |

Table 263: PCS Device Identifier 2
Device 4, Register 0x1003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--|------|-----------|-----------|--|
| 15:10 | Organizationally Unique Identifier Bit 19:24 | RO | 0x03 | 0x03 | 000011 |
| 9:4 | Model Number | RO | 0x31 | 0x31 | 110001 |
| 3:0 | Revision Number | RO | See Desc. | See Desc. | Rev Number Contact Marvell® FAEs for information on the device revision number. |

Table 264: PCS Speed Ability
Device 4, Register 0x1004

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15:9 | Reserved | RO | 0x00 | 0x00 | 0 |
| 8 | 100G Capable | RO | 0x0 | 0x0 | 0 = Not capable of operating at 100 Gbps |
| 7 | 40G Capable | RO | 0x1 | 0x1 | 1 = Capable of operating at 40 Gbps |
| 6:2 | Reserved | RO | 0x00 | 0x00 | 0 |
| 1 | 10PASS-TS/2BASE-TL Capable | RO | 0x0 | 0x0 | 0 = Not capable of operating as the 10P/2B PCS |
| 0 | 10G Capable | RO | 0x1 | 0x1 | 1 = Capable of operating at 10G |

Table 265: PCS Devices In Package 1
Device 4, Register 0x1005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--------------------------|------|--------|--------|--|
| 15:11 | Reserved | RO | 0x00 | 0x00 | 00000 |
| 10 | Separated PMA (3) | RO | 0x0 | 0x0 | 1 = Separated PMA (3) present in package 0 = Separated PMA (3) not present in package |
| 9 | Separated PMA (2) | RO | 0x0 | 0x0 | 1 = Separated PMA (2) present in package 0 = Separated PMA (2) not present in package |
| 8 | Separated PMA (1) | RO | 0x0 | 0x0 | 1 = Separated PMA (1) present in package 0 = Separated PMA (1) not present in package |
| 7 | Auto-Negotiation Present | RO | 0x1 | 0x1 | 1 = Auto-negotiation present in package 0 = Auto-negotiation not present in package |

Table 265: PCS Devices In Package 1 (Continued)
Device 4, Register 0x1005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|--|
| 6 | TC Present | RO | 0x0 | 0x0 | 1 = TC present in package 0 = TC not present in package |
| 5 | DTE XS Present | RO | 0x0 | 0x0 | 1 = DTE XS present in package 0 = DTE XS not present in package |
| 4 | PHY XS Present | RO | 0x1 | 0x1 | 1 = PHY XS present in package 0 = PHY XS not present in package |
| 3 | PCS Present | RO | 0x1 | 0x1 | 1 = PCS present in package 0 = PCS not present in package |
| 2 | Reserved | RO | 0x1 | 0x1 | Reserved Do not write any value other than the HW Rst value. |
| 1 | PMD/PMA Present | RO | 0x1 | 0x1 | 1 = PMA/PMD present in package 0 = PMA/PMD not present in package |
| 0 | Clause 22 Registers Present | RO | 0x0 | 0x0 | 1 = Clause 22 registers present in package 0 = Clause 22 registers not present in package |

Table 266: PCS Devices In Package 2
Device 4, Register 0x1006

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------------|------|--------|--------|--|
| 15 | Marvell Specific Device 2 Present | RO | 0x1 | 0x1 | 1 = Marvell specific device 2 present 0 = Marvell specific device 2 not present |
| 14 | Marvell Specific Device 1 Present | RO | 0x1 | 0x1 | 1 = Marvell specific device 1 present 0 = Marvell specific device 1 not present |
| 13 | Clause 22 Extension Present | RO | 0x0 | 0x0 | 1 = Clause 22 extension present 0 = Clause 22 extension not present |
| 12:0 | Reserved | RO | 0x0000 | 0x0000 | 0 |

Table 267: PCS Control 2
Device 4, Register 0x1007

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------|------|--------|--------|--|
| 15:3 | Reserved | RO | 0x0000 | 0x0000 | 0 |
| 2:0 | PCS Type Selection | RO | 0x1 | 0x1 | This register is ignored. PCS is automatically set based on the mode selected in register 31.F002 |

Table 268: XAUI PCS Status 2
Device 4, Register 0x1008

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|----------------|------|--------|--------|--|
| 15:14 | Device Present | RO | 0x2 | 0x2 | 10 = Device responding to this address |

Table 268: XAUI PCS Status 2 (Continued)
Device 4, Register 0x1008

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--------------------|--------|--------|--------|--|
| 13:12 | Reserved | RO | 0x0 | 0x0 | 00 |
| 11 | Transmit Fault | RO, LH | 0x0 | 0x0 | 1 = Fault on transmit path, 0 = No fault |
| 10 | Receive Fault | RO, LH | 0x0 | 0x0 | 1 = Fault on receive path, 0 = No fault |
| 9:6 | Reserved | RO | 0x0 | 0x0 | 0000000 |
| 5 | 100GBASE-R Capable | RO | 0x0 | 0x0 | 1 = PCS is able to support 100GBASE-R PCS types 0 = PCS is not able to support 100GBASE-R PCS types |
| 4 | 40GBASE-R Capable | RO | 0x1 | 0x1 | 1 = PCS is able to support 40GBASE-R PCS types 0 = PCS is not able to support 40GBASE-R PCS types |
| 3 | 10GBASE-T Capable | RO | 0x0 | 0x0 | 1 = PCS is able to support 10GBASE-T PCS types 0 = PCS is not able to support 10GBASE-T PCS types |
| 2 | Reserved | RO | 0x0 | 0x0 | Reserved |
| 1 | 10GBASE-X Capable | RO | 0x1 | 0x1 | 1 = PCS is able to support 10GBASE-X PCS types 0 = PCS is not able to support 10GBASE-X PCS types |
| 0 | 10GBASE-R Capable | RO | 0x1 | 0x1 | 1 = PCS is able to support 10GBASE-R PCS types 0 = PCS is not able to support 10GBASE-R PCS types |

Table 269: PCS Package Identifier 1
Device 4, Register 0x100E

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--|------|--------|--------|---|
| 15:0 | Organizationally Unique Identifier Bit 3:18 | RO | 0x0141 | 0x0141 | 0000000101000001 Marvell OUI is 0x005043 |

Table 270: PCS Package Identifier 2
Device 4, Register 0x100F

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---|------|-----------|-----------|--|
| 15:10 | Organizationally Unique Identifier Bit 19:24 | RO | 0x03 | 0x03 | 000011 |
| 9:4 | Model Number | RO | 0x31 | 0x31 | 110001 |
| 3:0 | Revision Number | RO | See Desc. | See Desc. | Rev Number Contact Marvell® FAEs for information on the device revision number. |

Table 271: PCS EEE Capability Register
Device 4, Register 0x1014

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------|------|--------|--------|--------------------------------------|
| 15:7 | Reserved | RO | 0x000 | 0x000 | 0 |
| 6 | 10GBASE-KR EEE | RO | 0x0 | 0x0 | 1 = EEE is supported for 10GBASE-KR |
| 5 | 10GBASE-KX4 EEE | RO | 0x0 | 0x0 | 1 = EEE is supported for 10GBASE-KX4 |
| 4 | 1000BASE-KX EEE | RO | 0x0 | 0x0 | 1 = EEE is supported for 1000BASE-KX |
| 3:0 | Reserved | RO | 0x0 | 0x0 | 0 |

Table 272: 10GBASE-X Lane Status
Device 4, Register 0x1018

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---------------------------|------|--------|--------|--|
| 15:13 | Reserved | RO | 0x0 | 0x0 | 000 |
| 12 | Lane Alignment Status | RO | 0x0 | 0x0 | 1 = Rx Lanes Aligned 0 = Rx Lanes Not Aligned |
| 11 | Pattern Testing Ability | RO | 0x1 | 0x1 | 1 = Is Able To Generate Test Patterns |
| 10 | PHY XGXS Loopback Ability | RO | 0x1 | 0x1 | 1 = Has Ability To Perform Loopback Function |
| 9:4 | Reserved | RO | 0x00 | 0x00 | 000000 |
| 3 | Lane 3 Sync | RO | 0x0 | 0x0 | 1 = Lane 3 is synchronized 0 = Lane 3 is not synchronized |
| 2 | Lane 2 Sync | RO | 0x0 | 0x0 | 1 = Lane 2 is synchronized 0 = Lane 2 is not synchronized |
| 1 | Lane 1 Sync | RO | 0x0 | 0x0 | 1 = Lane 1 is synchronized 0 = Lane 1 is not synchronized |
| 0 | Lane 0 Sync | RO | 0x0 | 0x0 | 1 = Lane 0 is synchronized 0 = Lane 0 is not synchronized |

Table 273: 10GBASE-X Test Control Register
Device 4, Register 0x1019

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------|------|--------|--------|---|
| 15:3 | Reserved | RO | 0x0000 | 0x0000 | 0 |
| 2 | Transmit Test Pattern Enable | R/W | 0x0 | 0x0 | 1 = Transmit test pattern enable 0 = Transmit test pattern not enabled Jitter 48A.1, 48A.2, and 48A.3 can also be generated by setting register 4.9010.2:0 If both 4.1019.2 and 4.9010.4 are asserted, the setting in 4.1019.1:0 takes priority. |

Table 273: 10GBASE-X Test Control Register (Continued)
Device 4, Register 0x1019

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------|------|--------|--------|--|
| 1:0 | Test Pattern Select | R/W | 0x0 | 0x0 | 00 = High frequency test pattern 01 = Low frequency test pattern 10 = Mixed frequency test pattern 11 = Reserved See Desc. in 4.1019.2 |

Table 274: XAUI Control
Device 4, Register 0x9000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------------------|------|--------|--------|--|
| 15:8 | Reserved | RO | 0x00 | Retain | 0 |
| 7 | XAUI Lane Reverse Enable | R/W | 0x0 | Retain | 1 = Lane reverse enable 0 = Lane reverse disable |
| 6 | Signal Detect Override Value | R/W | 0x0 | Retain | Signal detect override value when bit 5 is set to 1. |
| 5 | Signal Detect Override Enable | R/W | 0x0 | Retain | 1 = Override enable 0 = Override disable |
| 4:2 | Reserved | RO | 0x0 | Retain | 0 |
| 1 | X2 Disparity Enable. | R/W | 0x0 | Retain | There are two methods to interleave the lanes in RXAUI mode. The Disparity Calculation Is Different. 1 = Interleave two 8-bit stream first and then apply 8/10 encoding 0 = Apply 8/10 encoding first and then interleave at the 10 bit level. |
| 0 | LPI Codeword Enable | R/W | 0x0 | Retain | 1 = Low Power Idle codeword support enabled 0 = LPI support disabled |

Table 275: XAUI Interrupt Enable 1
Device 4, Register 0x9001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------------------|------|--------|--------|---|
| 15:4 | Reserved | R/W | 0x000 | Retain | Set to 0. |
| 3 | Link Up to Link Down Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 2 | Link Down to Link Up Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 1:0 | Reserved | R/W | 0x0 | 0x0 | 0 |

Table 276: XAUI Interrupt Enable 2
Device 4, Register 0x9002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---|------|--------|--------|---|
| 15:10 | Reserved | RO | 0x00 | Retain | 0 |
| 9 | Fault Line To Core Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 8 | Fault Core To Line Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 7 | Lane 3 Energy Detect Changed Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 6 | Lane 2 Energy Detect Changed Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 5 | Lane 1 Energy Detect Changed Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 4 | Lane 0 Energy Detect Changed Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 3 | Lane 3 Sync Change Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 2 | Lane 2 Sync Change Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 1 | Lane 1 Sync Change Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 0 | Lane 0 Sync Change Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |

Table 277: XAUI Interrupt Status 1
Device 4, Register 0x9003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------------------|-------|--------|--------|--|
| 15:4 | Reserved | RO | 0x000 | 0x000 | 0 |
| 3 | Link Up to Link Down Detected | RO,LH | 0x0 | 0x0 | 1 = Link up to link down detected 0 = Link up to link down not detected |
| 2 | Link Down to Link Up Detected | RO,LH | 0x0 | 0x0 | 1 = Link down to link up detected 0 = Link down to link up not detected |
| 1:0 | Reserved | RO | 0x0 | 0x0 | 0 |

Table 278: XAUI Interrupt Status 2
Device 4, Register 0x9004

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--|--------|--------|--------|-------------------------------------|
| 15:10 | Reserved | RO | 0x00 | 0x00 | 0 |
| 9 | Fault Line To Core Interrupt | RO, LH | 0x0 | 0x0 | 1 = Fault occurred 0 = No fault |
| 8 | Fault Core To Line Interrupt | RO, LH | 0x0 | 0x0 | 1 = Fault occurred 0 = No fault |
| 7 | Lane 3 Energy Detect Changed Interrupt | RO, LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 6 | Lane 2 Energy Detect Changed Interrupt | RO, LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 5 | Lane 1 Energy Detect Changed Interrupt | RO, LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 4 | Lane 0 Energy Detect Changed Interrupt | RO, LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 3 | Lane 3 Sync Change Interrupt | RO, LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 2 | Lane 2 Sync Change Interrupt | RO, LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 1 | Lane 1 Sync Change Interrupt | RO, LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 0 | Lane 0 Sync Change Interrupt | RO, LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |

Table 279: XAUI Real Time Status Register 2
Device 4, Register 0x9006

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|---|
| 15:8 | Reserved | RO | 0x00 | 0x00 | 0 |
| 7 | Lane 3 Energy Detect Status | RO | 0x0 | 0x0 | 1 = Energy detected 0 = No Energy Detected |
| 6 | Lane 2 Energy Detect Status | RO | 0x0 | 0x0 | 1 = Energy detected 0 = No Energy Detected |
| 5 | Lane 1 Energy Detect Status | RO | 0x0 | 0x0 | 1 = Energy detected 0 = No Energy Detected |
| 4 | Lane 0 Energy Detect Status | RO | 0x0 | 0x0 | 1 = Energy detected 0 = No Energy Detected |
| 3 | Lane 3 Sync Status | RO | 0x0 | 0x0 | 1 = Sync 0 = No Sync |
| 2 | Lane 2 Sync Status | RO | 0x0 | 0x0 | 1 = Sync 0 = No Sync |

Table 279: XAUI Real Time Status Register 2 (Continued)
Device 4, Register 0x9006

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------|------|--------|--------|-------------------------|
| 1 | Lane 1 Sync Status | RO | 0x0 | 0x0 | 1 = Sync 0 = No Sync |
| 0 | Lane 0 Sync Status | RO | 0x0 | 0x0 | 1 = Sync 0 = No Sync |

Table 280: XAUI Random Sequence Control
Device 4, Register 0x9010

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------------|---------|--------|--------|--|
| 15:8 | Reserved | RO | 0x00 | Retain | Set to 0 |
| 7 | Counter Reset | R/W, SC | 0x0 | Retain | This bit self clears after counters are cleared. 1 = Clear counter 0 = Normal operation |
| 6 | Reserved | RO | 0x0 | Retain | Set to 0 |
| 5 | Jitter Receive Checking Enable | R/W | 0x0 | Retain | 1 = Jitter Test Receive Enable |
| 4 | Jitter Transmit Generation Enable | R/W | 0x0 | Retain | 1 = Jitter Test Transmit Enable Jitter 48A.1, 48A.2, and 48A.3 can also be generated by setting register 4.1019.1:0 If both 4.1019.2 and 4.9010.4 are asserted the setting in 4.1019.1:0 takes priority. |
| 3 | Reserved | RO | 0x0 | Retain | Set to 0. |
| 2:0 | Jitter Test Select | R/W | 0x0 | Retain | 000 = Jitter 48A.1 (high freq) 001 = Jitter 48A.2 (low freq) 010 = Jitter 48A.3 (mix freq) 100 = Jitter 48A.4 (CRPAT) 101 = Jitter 48A.5 (CJPAT) Else = reserved |

Table 281: XAUI Jitter Packet Transmit Counter LSB
Device 4, Register 0x9011

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------|------|--------|--------|--|
| 15:0 | Error Count LSB | RO | 0x0000 | Retain | Register does not clear on read. Cleared only when register 4.9010.7 is set to 1. |

Table 282: XAUI Jitter Packet Transmit Counter MSB
Device 4, Register 0x9012

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------|------|--------|--------|---|
| 15:0 | Error Count MSB | RO | 0x0000 | Retain | Register does not clear on read. Cleared only when register 4.9010.7 is set to 1. Must read register 4.9011 first in order to update register 4.9012. This insures the 32 bit read is atomic. |

Table 283: XAUI Jitter Packet Received Counter LSB
 Device 4, Register 0x9013

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------|------|--------|--------|--|
| 15:0 | Error Count LSB | RO | 0x0000 | Retain | Register does not clear on read. Cleared only when register 4.9010.7 is set to 1. |

Table 284: XAUI Jitter Packet Received Counter MSB
 Device 4, Register 0x9014

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------|------|--------|--------|---|
| 15:0 | Error Count MSB | RO | 0x0000 | Retain | Register does not clear on read. Cleared only when register 4.9010.7 is set to 1. Must read register 4.9013 first in order to update register 4.9014. This insures the 32 bit read is atomic. |

Table 285: XAUI Jitter Pattern Error Counter LSB
 Device 4, Register 0x9015

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------|------|--------|--------|---|
| 15:0 | Error Count LSB | RO | 0x0000 | Retain | Register does not clear on read. Cleared only when register 4.9010.7 is set to 1 |

Table 286: XAUI Jitter Pattern Error Counter MSB
 Device 4, Register 0x9016

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------|------|--------|--------|---|
| 15:0 | Error Count MSB | RO | 0x0000 | Retain | Register does not clear on read. Cleared only when register 4.9010.7 is set to 1. Must read register 4.9015 first in order to update register 4.9016. This insures the 32 bit read is atomic. |

6.4.3 Host Side 1000BASE-X, SGMII PCS

The registers in this section apply to all ports.

Table 287: Host Side 1000BASE-X, SGMII PCS Registers - Register Map

| Register Name | Register Address | Table and Page |
|---|---------------------------|-----------------------------------|
| 1000BASE-X/SGMII Control Register | Device 4, Register 0x2000 | Table 288, p. 211 |
| 1000BASE-X/SGMII Status Register | Device 4, Register 0x2001 | Table 289, p. 212 |
| PHY Identifier | Device 4, Register 0x2002 | Table 290, p. 213 |
| PHY Identifier | Device 4, Register 0x2003 | Table 291, p. 213 |
| 1000BASE-X Auto-Negotiation Advertisement Register | Device 4, Register 0x2004 | Table 292, p. 214 |
| SGMII (Media side) Auto-Negotiation Advertisement Register | Device 4, Register 0x2004 | Table 293, p. 215 |
| SGMII (System side) Auto-Negotiation Advertisement Register | Device 4, Register 0x2004 | Table 294, p. 215 |
| 1000BASE-X Link Partner Ability Register | Device 4, Register 0x2005 | Table 295, p. 216 |
| SGMII (Media side) Link Partner Ability Register | Device 4, Register 0x2005 | Table 296, p. 217 |
| SGMII (System side) Link Partner Ability Register | Device 4, Register 0x2005 | Table 297, p. 217 |
| 1000BASE-X Auto-Negotiation Expansion Register | Device 4, Register 0x2006 | Table 298, p. 218 |
| 1000BASE-X Next Page Transmit Register | Device 4, Register 0x2007 | Table 299, p. 219 |
| 1000BASE-X Link Partner Next Page Register | Device 4, Register 0x2008 | Table 300, p. 219 |
| Extended Status Register | Device 4, Register 0x200F | Table 301, p. 219 |
| 1000BASE-X Timer Mode Select Register | Device 4, Register 0xA000 | Table 302, p. 220 |
| 1000BASE-X Interrupt Enable Register | Device 4, Register 0xA001 | Table 303, p. 220 |
| 1000BASE-X Interrupt Status Register | Device 4, Register 0xA002 | Table 304, p. 221 |
| 1000ASE-X PHY Specific Status Register | Device 4, Register 0xA003 | Table 305, p. 221 |

Table 288: 1000BASE-X/SGMII Control Register
Device 4, Register 0x2000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------------|---------|-----------|--------|---|
| 15 | Reset | R/W, SC | 0x0 | 0x0 | 1 = Reset 0 = Normal This register will soft reset all PCS/PMA and associated registers of this interface. |
| 14 | Loopback | R/W | See Desc. | Retain | 1 = Loopback 0 = Normal |
| 13 | SGMII Speed (LSB) | R/W | See Desc. | Retain | This register is used to control SGMII speed only. (bit 6, bit 13) 00 = 10 Mbps 01 = 100 Mbps 10 = 1000 Mbps |
| 12 | 1000BASE-X Auto-Negotiation Enable | R/W | See Desc. | Retain | If the value of this bit is Changed, the link will be broken and 1000BASE-X Auto-Negotiation restarted (bit 4.2000.9 is set to 1). 1 = Enable Auto-Negotiation Process 0 = Disable Auto-Negotiation Process |

Table 288: 1000BASE-X/SGMII Control Register (Continued)
Device 4, Register 0x2000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------------------|---------|-----------|--------|--|
| 11 | Power Down | R/W | See Desc. | Retain | 1 = Power Down 0 = Normal This register will power down all PCS/PMA of this interface. Initial power state is a function of hardware configuration. |
| 10 | Isolate | RO | 0x0 | 0x0 | The core bus is embedded hence this function is not supported |
| 9 | Restart 1000BASE-X Negotiation | R/W, SC | 0x1 | SC | Auto-Negotiation automatically restarts after hardware reset, software reset (4.2000.15) or Change in auto-negotiation enable (4.2000.12) regardless of whether or not the restart bit (4.2000.9) is set. The bit is set when Auto-negotiation is Enabled or Disabled in 4.2000.12. 1 = Restart Auto-Negotiation Process 0 = Normal operation |
| 8 | Duplex Mode | RO | 0x1 | Retain | Writing this bit has no effect since only full-duplex mode is supported. 1 = Full-duplex 0 = Half-Duplex |
| 7 | Collision Test | R/W | 0x0 | 0x0 | No effect since half-duplex not supported. 1 = Enable COL signal test 0 = Disable COL signal test |
| 6 | SGMII Speed Selection (MSB) | R/W | See Desc. | Retain | This register is used to control SGMII speed only. (bit 6, bit 13) 00 = 10 Mbps 01 = 100 Mbps 10 = 1000 Mbps |
| 5:0 | Reserved | RO | 0x00 | 0x00 | Always 0. |

Table 289: 1000BASE-X/SGMII Status Register
Device 4, Register 0x2001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|---|
| 15 | 100BASE-T4 | RO | 0x0 | 0x0 | 0 = PHY not able to perform 100BASE-T4 |
| 14 | 100BASE-X Full-Duplex | RO | 0x0 | 0x0 | 0 = PHY not able to perform full-duplex 100BASE-X |
| 13 | 100BASE-X Half-Duplex | RO | 0x0 | 0x0 | 0 = PHY not able to perform half-duplex 100BASE-X |
| 12 | 10 Mbps Full-Duplex | RO | 0x0 | 0x0 | 0 = PHY not able to perform full-duplex 10BASE-T |
| 11 | 10 Mbps Half-Duplex | RO | 0x0 | 0x0 | 0 = PHY not able to perform half-duplex 10BASE-T |
| 10 | 100BASE-T2 Full-Duplex | RO | 0x0 | 0x0 | 0 = PHY not able to perform full-duplex |
| 9 | 100BASE-T2 Half-Duplex | RO | 0x0 | 0x0 | 0 = PHY not able to perform half-duplex |

Table 289: 1000BASE-X/SGMII Status Register (Continued)
Device 4, Register 0x2001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------------------------|-------|-----------|-----------|---|
| 8 | Extended Status | RO | 0x1 | 0x1 | 1 = Extended status information in Register 4.200F |
| 7 | Reserved | RO | 0x0 | 0x0 | Must always be 0. |
| 6 | MF Preamble Suppression | RO | 0x1 | 0x1 | 1 = PHY accepts management frames with preamble suppressed |
| 5 | 1000BASE-X Auto-Negotiation Complete | RO | 0x0 | 0x0 | 1 = Auto-Negotiation process complete 0 = Auto-Negotiation process not complete Bit is not set when link is up due of Fiber Auto-negotiation Bypass or if Auto-negotiation is disabled. |
| 4 | 1000BASE-X Remote Fault | RO,LH | 0x0 | 0x0 | 1 = Remote fault condition detected 0 = Remote fault condition not detected This bit is always 0 in SGMII modes. |
| 3 | Auto-Negotiation Ability | RO | See Desc. | See Desc. | If register 4.F002.6= 1, then this bit is always 1, otherwise this bit is 0. 1 = PHY able to perform Auto-Negotiation 0 = PHY not able to perform Auto-Negotiation |
| 2 | 1000BASE-X Link Status | RO,LL | 0x0 | 0x0 | This register bit indicates when link was lost since the last read. For the current link status, read this register back-to-back. 1 = Link is up 0 = Link is down |
| 1 | Reserved | RO,LH | Always 0 | Always 0 | Must be 0 |
| 0 | Extended Capability | RO | Always 1 | Always 1 | 1 = Extended register capabilities |

Table 290: PHY Identifier
Device 4, Register 0x2002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---|------|--------|--------|---|
| 15:0 | Organizationally Unique Identifier Bit 3:18 | RO | 0x0141 | 0x0141 | 0000000101000001 Marvell OUI is 0x005043 |

Table 291: PHY Identifier
Device 4, Register 0x2003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--|------|-----------|-----------|--|
| 15:10 | Organizationally Unique Identifier Bit 19:24 | RO | 0x03 | 0x03 | 000011 |
| 9:4 | Model Number | RO | 0x31 | 0x31 | 110001 |
| 3:0 | Revision Number | RO | See Desc. | See Desc. | Rev Number Contact Marvell® FAEs for information on the device revision number. |

Table 292: 1000BASE-X Auto-Negotiation Advertisement Register
 Device 4, Register 0x2004

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|----------------------------------|------|------------|------------|---|
| 15 | Next Page | R/W | 0x0 | Retain | A write to this register bit does not take effect until any one of the following occurs: Software reset is asserted (Register 4.2000.15) Restart Auto-Negotiation is asserted (Register 4.2000.9) Power down (Register 4.2000.11) transitions from power down to normal operation Link goes down 1 = Advertise 0 = Not advertised |
| 14 | Reserved | RO | Always 0 | Always 0 | 0 |
| 13:12 | Remote Fault 2/ RemoteFault 1 | R/W | 0x0 | Retain | A write to this register bit does not take effect until any one of the following also occurs: Software reset is asserted (Register 4.2000.15) Re-start Auto-Negotiation is asserted (Register 4.2000.9) Power down (Register 4.2000.11) transitions from power down to normal operation Link goes down Device has no ability to detect remote fault. 00 = No error, link OK (default) 01 = Link Failure 10 = Offline 11 = Auto-Negotiation Error |
| 11:9 | Reserved | RO | Always 000 | Always 000 | 0 |
| 8:7 | Pause | R/W | 0x0 | Retain | A write to this register bit does not take effect until any one of the following also occurs: Software reset is asserted (Register 4.2000.15) Re-start Auto-Negotiation is asserted (Register 4.2000.9) Power down (Register 4.2000.11) transitions from power down to normal operation Link goes down 00 = No PAUSE 01 = Symmetric PAUSE 10 = Asymmetric PAUSE toward link partner 11 = Both Symmetric PAUSE and Asymmetric PAUSE toward local device. |
| 6 | 1000BASE-X Half-Duplex | RO | 0x0 | Retain | 1 = Advertise 0 = Not advertised |
| 5 | 1000BASE-X Full-Duplex | RO | 0x1 | Retain | 1 = Advertise 0 = Not advertised |

Table 292: 1000BASE-X Auto-Negotiation Advertisement Register (Continued)
Device 4, Register 0x2004

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------|------|--------|--------|--|
| 4:0 | Reserved | R/W | 0x00 | 0x00 | A write to this register bit does not take effect until any one of the following also occurs: Software reset is asserted (Register 4.2000.15) Re-start Auto-Negotiation is asserted (Register 4.2000.9) Power down (Register 4.2000.11) transitions from power down to normal operation Link goes down Reserved bit is R/W to allow for forward compatibility with future IEEE standards. |

Table 293: SGMII (Media side) Auto-Negotiation Advertisement Register
Device 4, Register 0x2004

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|----------------|------|--------|--------|---|
| 15 | Link Status | RO | 0x0 | 0x0 | 0 = Link is not up on the attached interface 1 = Link is up on the attached interface |
| 14 | Reserved | RO | 0x0 | 0x0 | 0 |
| 13 | Reserved | RO | 0x0 | 0x0 | 0 |
| 12 | Duplex Status | RO | 0x0 | 0x0 | 0 = Interface Resolved to half-duplex 1 = Interface Resolved to full-duplex |
| 11:10 | Speed[1:0] | RO | 0x0 | 0x0 | 00 = Interface speed is 10 Mbps 01 = Interface speed is 100 Mbps 10 = Interface speed is 1000 Mbps 11 = Reserved |
| 9 | Transmit Pause | RO | 0x0 | 0x0 | 0 = Disabled, 1 = Enabled |
| 8 | Receive Pause | RO | 0x0 | 0x0 | 0 = Disabled, 1 = Enabled |
| 7 | Fiber/Copper | RO | 0x0 | 0x0 | 0 = Copper media, 1 = Fiber media |
| 6:0 | Reserved | RO | 0x01 | 0x01 | Always set to 0000001 as per the SGMII Specification |

Table 294: SGMII (System side) Auto-Negotiation Advertisement Register
Device 4, Register 0x2004

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------|------|--------|--------|---------------------------------------|
| 15:0 | Reserved | RO | 0x0001 | 0x0001 | Per SGMII Specification Always 0x0001 |

Table 295: 1000BASE-X Link Partner Ability Register
 Device 4, Register 0x2005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------------------|------|--------|--------|--|
| 15 | Next Page | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bit 15 1 = Link partner capable of next page 0 = Link partner not capable of next page |
| 14 | Acknowledge | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Acknowledge Received Code Word Bit 14 1 = Link partner received link code word 0 = Link partner has not received link code word |
| 13:12 | Remote Fault 2/ Remote Fault 1 | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bit 13:12 00 = No error, link OK (default) 01 = Link Failure 10 = Offline 11 = Auto-Negotiation Error |
| 11:9 | Reserved | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bit 11:9 |
| 8:7 | Asymmetric Pause | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bit 8:7 00 = No PAUSE 01 = Symmetric PAUSE 10 = Asymmetric PAUSE toward link partner 11 = Both Symmetric PAUSE and Asymmetric PAUSE toward local device. |
| 6 | 1000BASE-X Half-Duplex | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word bit 6 1 = Link partner capable of 1000BASE-X half-duplex. 0 = Link partner not capable of 1000BASE-X half-duplex. |
| 5 | 1000BASE-X Full-Duplex | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word bit 5 1 = Link partner capable of 1000BASE-X full-duplex. 0 = Link partner not capable of 1000BASE-X full-duplex. |
| 4:0 | Reserved | RO | 0x00 | 0x00 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bits 4:0 Must be 0 |

Table 296: SGMII (Media side) Link Partner Ability Register
Device 4, Register 0x2005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------|------|--------|--------|---|
| 15 | Reserved | RO | 0x0 | 0x0 | Must be 0 |
| 14 | Acknowledge | RO | 0x0 | 0x0 | Acknowledge Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bit 14 1 = Link partner received link code word 0 = Link partner has not received link code word |
| 13:0 | Reserved | RO | 0x0000 | 0x0000 | Received Code Word Bits 13:0 Must receive 00_0000_0000_0001 per SGMII spec |

Table 297: SGMII (System side) Link Partner Ability Register
Device 4, Register 0x2005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---------------|------|--------|--------|--|
| 15 | Link | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bit 15 1 = Copper Link is up on the link partner 0 = Copper Link is not up on the link partner |
| 14 | Acknowledge | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Acknowledge Received Code Word Bit 14 1 = Link partner received link code word 0 = Link partner has not received link code word |
| 13 | Reserved | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bit 13 Must be 0 |
| 12 | Duplex Status | RO | 0x0 | 0x0 | Register bit is cleared when link goes down and loaded when a base page is received Received Code Word Bit 12 1 = Copper Interface on the Link Partner is capable of full-duplex 0 = Copper Interface on the link partner is capable of half-duplex |
| 11:10 | Speed Status | RO | 0x0 | 0x0 | Register bits are cleared when link goes down and loaded when a base page is received Received Code Word Bit 11:10 00 = 10 Mbps 01 = 100 Mbps 10 = 1000 Mbps 11 = reserved |

Table 297: SGMII (System side) Link Partner Ability Register (Continued)
 Device 4, Register 0x2005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|------|--------|--------|--|
| 9 | Transmit Pause Status | RO | 0x0 | 0x0 | This bit is non-zero only if the link partner supports enhanced SGMII Auto-Negotiation. Received Code Word Bit 9 0 = Disabled 1 = Enabled |
| 8 | Receive Pause Status | RO | 0x0 | 0x0 | This bit is non-zero only if the link partner supports enhanced SGMII Auto Negotiation. Received Code Word Bit 8 0 = Disabled, 1 = Enabled |
| 7 | Fiber/Copper Status | RO | 0x0 | 0x0 | This bit is non-zero only if the link partner supports enhanced SGMII Auto-Negotiation. Received Code Word Bit 7 0 = Copper media, 1 = Fiber media |
| 6:0 | Reserved | RO | 0x00 | 0x00 | Register bits are cleared when link goes down and loaded when a base page is received Received Code Word Bits 6:0 Must be 0000001 |

Table 298: 1000BASE-X Auto-Negotiation Expansion Register
 Device 4, Register 0x2006

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------------|--------|--------|--------|--|
| 15:4 | Reserved | RO | 0x000 | 0x000 | Reserved. Must be 00000000000. |
| 3 | Link Partner Next Page Able | RO | 0x0 | 0x0 | In SGMII mode this bit is always 0. In 1000BASE-X mode register 4.2006.3 is set when a base page is received and the received link control word has bit 15 set to 1. The bit is cleared when link goes down. 1 = Link Partner is Next Page able 0 = Link Partner is not Next Page able |
| 2 | Local Next Page Able | RO | 0x1 | 0x1 | 1 = Local Device is Next Page able |
| 1 | Page Received | RO, LH | 0x0 | 0x0 | Register 4.2006.1 is set when a valid page is received. 1 = A New Page has been received 0 = A New Page has not been received |
| 0 | Link Partner Auto-Negotiation Able | RO | 0x0 | 0x0 | This bit is set when there is sync status, the fiber receiver has received 3 non-zero matching valid configuration code groups and Auto-negotiation is enabled in register 4.2000.12 1 = Link Partner is Auto-Negotiation able 0 = Link Partner is not Auto-Negotiation able |

Table 299: 1000BASE-X Next Page Transmit Register
Device 4, Register 0x2007

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------------------|------|--------|--------|--|
| 15 | Next Page | R/W | 0x0 | 0x0 | A write to register 7 implicitly sets a variable in the Auto-Negotiation state machine indicating that the next page has been loaded. Register 7 only has effect in the 1000BASE-X mode. Transmit Code Word Bit 15 |
| 14 | Reserved | RO | 0x0 | 0x0 | Transmit Code Word Bit 14 |
| 13 | Message Page Mode | R/W | 0x1 | 0x1 | Transmit Code Word Bit 13 |
| 12 | Acknowledge2 | R/W | 0x0 | 0x0 | Transmit Code Word Bit 12 |
| 11 | Toggle | RO | 0x0 | 0x0 | Transmit Code Word Bit 11. This bit is internally set to the opposite value each time a page is received |
| 10:0 | Message/ Unformatted Field | R/W | 0x001 | 0x001 | Transmit Code Word Bit 10:0 |

Table 300: 1000BASE-X Link Partner Next Page Register
Device 4, Register 0x2008

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------------------|------|--------|--------|--|
| 15 | Next Page | RO | 0x0 | 0x0 | Register 8 only has effect in the 1000BASE-X mode. The register is loaded only when a next page is received from the link partner. It is cleared each time the link goes down. Received Code Word Bit 15 |
| 14 | Acknowledge | RO | 0x0 | 0x0 | Received Code Word Bit 14 |
| 13 | Message Page | RO | 0x0 | 0x0 | Received Code Word Bit 13 |
| 12 | Acknowledge2 | RO | 0x0 | 0x0 | Received Code Word Bit 12 |
| 11 | Toggle | RO | 0x0 | 0x0 | Received Code Word Bit 11 |
| 10:0 | Message/ Unformatted Field | RO | 0x000 | 0x000 | Received Code Word Bit 10:0 |

Table 301: Extended Status Register
Device 4, Register 0x200F

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------|------|--------|--------|--|
| 15 | 1000BASE-X Full-Duplex | RO | 0x1 | 0x1 | 1 = 1000 BASE-X full duplex capable 0 = Not 1000 BASE-X full duplex capable |
| 14 | 1000BASE-X Half-Duplex | RO | 0x0 | 0x0 | 1 = 1000 BASE-X half-duplex capable 0 = Not 1000 BASE-X half-duplex capable |
| 13 | 1000BASE-T Full-Duplex | RO | 0x0 | 0x0 | 0 = Not 1000 BASE-T full-duplex capable |

Table 301: Extended Status Register (Continued)
Device 4, Register 0x200F

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|---|
| 12 | 1000BASE-T Half-Duplex | RO | 0x0 | 0x0 | 0 = Not 1000 BASE-T half-duplex capable |
| 11:0 | Reserved | RO | 0x000 | 0x000 | 000000000000 |

Table 302: 1000BASE-X Timer Mode Select Register
Device 4, Register 0xA000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---|------|--------|--------|---|
| 15:14 | SGMII Autoneg Timer Select | R/W | 0x0 | Retain | Selects link_timer value in SGMII mode 00 = 1.6 ms 01 = 0.5 us 10 = 1 us 11 = 2 us |
| 13 | Serial Interface Auto-Negotiation Bypass Enable | R/W | 0x1 | Retain | Changes to this bit are disruptive to the normal operation; hence, any Changes to these registers must be followed by software reset to take effect. 1 = Bypass Allowed 0 = No Bypass Allowed |
| 12:2 | Reserved | RO | 0x000 | 0x000 | |
| 1 | Reserved | R/W | 0x0 | Retain | Reserved |
| 0 | Noise Filter | R/W | 0x0 | Retain | When set, noise filter is enabled. |

Table 303: 1000BASE-X Interrupt Enable Register
Device 4, Register 0xA001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---|------|--------|--------|---|
| 15 | Reserved | R/W | 0x0 | Retain | Set to 0 |
| 14 | Speed Changed Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 13 | Duplex Changed Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 12 | Page Received Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 11 | Auto-Negotiation Completed Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 10 | Link Up to Link Down Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 9 | Link Down to Link Up Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 8 | Symbol Error Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |

Table 303: 1000BASE-X Interrupt Enable Register (Continued)
Device 4, Register 0xA001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------------------|------|--------|--------|---|
| 7 | False Carrier Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 6:0 | Reserved | R/W | 0x00 | Retain | Set to 0s |

Table 304: 1000BASE-X Interrupt Status Register
Device 4, Register 0xA002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------------------|-------|--------|--------|--|
| 15 | Reserved | RO | 0x0 | 0x0 | 0 |
| 14 | Speed Changed | RO,LH | 0x0 | 0x0 | 1 = Speed changed 0 = Speed not changed |
| 13 | Duplex Changed | RO,LH | 0x0 | 0x0 | 1 = Duplex changed 0 = Duplex not changed |
| 12 | Page Received | RO,LH | 0x0 | 0x0 | 1 = Page received 0 = Page not received |
| 11 | Auto-Negotiation Completed | RO,LH | 0x0 | 0x0 | 1 = Auto-Negotiation completed 0 = Auto-Negotiation not completed |
| 10 | Link Up to Link Down Detected | RO,LH | 0x0 | 0x0 | 1 = Link up to link down detected 0 = Link up to link down not detected |
| 9 | Link Down to Link Up Detected | RO,LH | 0x0 | 0x0 | 1 = Link down to link up detected 0 = Link down to link up not detected |
| 8 | Symbol Error | RO,LH | 0x0 | 0x0 | 1 = Symbol error 0 = No symbol error |
| 7 | False Carrier | RO,LH | 0x0 | 0x0 | 1 = False carrier 0 = No false carrier |
| 6:0 | Reserved | RO | 0x00 | 0x00 | 0000000 |

Table 305: 1000BASE-X PHY Specific Status Register
Device 4, Register 0xA003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-------|------|--------|--------|--|
| 15:14 | Speed | RO | 0x0 | 0x0 | These status bits are valid only after resolved bit 4.A003.11 = 1. The resolved bit is set when Auto-Negotiation is completed or Auto-Negotiation is disabled. 11 = Reserved 10 = 1000 Mbps 01 = 100 Mbps 00 = 10 Mbps |

Table 305: 1000ASE-X PHY Specific Status Register (Continued)
 Device 4, Register 0xA003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------|--------|--------|--------|---|
| 13 | Duplex | RO | 0x0 | 0x0 | This status bit is valid only after resolved bit 4.A003.11 = 1. The resolved bit is set when Auto-Negotiation is completed or Auto-Negotiation is disabled. 1 = Full-duplex 0 = Half-duplex |
| 12 | Page Received | RO, LH | 0x0 | 0x0 | 1 = Page received 0 = Page not received |
| 11 | Speed and Duplex Resolved | RO | 0x0 | 0x0 | When Auto-Negotiation is not enabled this bit is always 1. 1 = Resolved 0 = Not resolved |
| 10 | Link (real time) | RO | 0x0 | 0x0 | 1 = Link up 0 = Link down |
| 9:6 | Reserved | RO | 0x0 | 0x0 | 0 |
| 5 | sync status | RO | 0x0 | 0x0 | 1 = Sync 0 = No Sync |
| 4 | Energy Detect Status | RO | 0x1 | 0x1 | 1 = No energy detected 0 = Energy Detected |
| 3 | Transmit Pause Enabled | RO | 0x0 | 0x0 | This is a reflection of the MAC pause resolution. This bit is for information purposes and is not used by the device. This status bit is valid only after resolved bit 4.A003.11 = 1. The resolved bit is set when Auto-Negotiation is completed or Auto-Negotiation is disabled. 1 = Transmit pause enabled 0 = Transmit pause disable |
| 2 | Receive Pause Enabled | RO | 0x0 | 0x0 | This is a reflection of the MAC pause resolution. This bit is for information purposes and is not used by the device. This status bit is valid only after resolved bit 4.A003.11 = 1. The resolved bit is set when Auto-Negotiation is completed or Auto-Negotiation is disabled. 1 = Receive pause enabled 0 = Receive pause disabled |
| 1:0 | Reserved | RO | 0x0 | 0x0 | 00 |

6.4.4 XFI 40GBASE-R4

The registers in this section apply to Port 0 for 40GBASE-R4 only.

Table 306: XFI 40GBASE-R4 - Register Map

| Register Name | Register Address | Table and Page |
|---|---------------------------|-------------------|
| 40GBASE-R4 PCS Control 1 | Device 4, Register 0x3000 | Table 307, p. 223 |
| 40GBASE-R4 PCS Status 1 | Device 4, Register 0x3001 | Table 308, p. 224 |
| PCS Device Identifier 1 | Device 4, Register 0x3002 | Table 309, p. 225 |
| PCS Device Identifier 2 | Device 4, Register 0x3003 | Table 310, p. 225 |
| PCS Speed Ability | Device 4, Register 0x3004 | Table 311, p. 225 |
| PCS Devices In Package 1 | Device 4, Register 0x3005 | Table 312, p. 225 |
| PCS Devices In Package 2 | Device 4, Register 0x3006 | Table 313, p. 226 |
| PCS Control 2 | Device 4, Register 0x3007 | Table 314, p. 226 |
| 40GBASE-R4 PCS Status 2 | Device 4, Register 0x3008 | Table 315, p. 226 |
| PCS Package Identifier 1 | Device 4, Register 0x300E | Table 316, p. 227 |
| PCS Package Identifier 2 | Device 4, Register 0x300F | Table 317, p. 227 |
| BASE-R Status1 Register | Device 4, Register 0x3020 | Table 318, p. 228 |
| BASE-R PCS Status 2 | Device 4, Register 0x3021 | Table 319, p. 228 |
| 40GBASE-R PCS Test Pattern Control | Device 4, Register 0x302A | Table 320, p. 228 |
| 40GBASE-R PCS Test Pattern Error Counter | Device 4, Register 0x302B | Table 321, p. 229 |
| 40GBASE-R PCS BER High Order Counter | Device 4, Register 0x302C | Table 322, p. 229 |
| 40GBASE-R PCS Errored Blocks High Order Counter | Device 4, Register 0x302D | Table 323, p. 229 |
| Multi-lane BASE-R PCS Alignment Status 1 | Device 4, Register 0x3032 | Table 324, p. 229 |
| Multi-lane BASE-R PCS Alignment Status 2 | Device 4, Register 0x3034 | Table 325, p. 230 |
| BIP Error Counter Lanes 0 Register | Device 4, Register 0x30C8 | Table 326, p. 230 |
| BIP Error Counter Lanes 1 Register | Device 4, Register 0x30C9 | Table 327, p. 230 |
| BIP Error Counter Lanes 2 Register | Device 4, Register 0x30CA | Table 328, p. 231 |
| BIP Error Counter Lanes 3 Register | Device 4, Register 0x30CB | Table 329, p. 231 |
| Lanes 0 Mapping Register | Device 4, Register 0x3190 | Table 330, p. 231 |
| Lanes 1 Mapping Register | Device 4, Register 0x3191 | Table 331, p. 231 |
| Lanes 2 Mapping Register | Device 4, Register 0x3192 | Table 332, p. 231 |
| Lanes 3 Mapping Register | Device 4, Register 0x3193 | Table 333, p. 231 |
| 40GBASE-R4 Interrupt enable Register | Device 4, Register 0xB001 | Table 334, p. 232 |
| 40GBASE-R4 Interrupt Status Register | Device 4, Register 0xB002 | Table 335, p. 233 |
| 40GBASE-R4 PCS Real Time Status Register | Device 4, Register 0xB003 | Table 336, p. 234 |

Table 307: 40GBASE-R4 PCS Control 1
Device 4, Register 0x3000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|---------|--------|--------|--|
| 15 | Software Reset | R/W, SC | 0x0 | 0x0 | 1 = Reset 0 = Normal This register will soft reset all PCS/PMA and associated registers of this interface. |

Table 307: 40GBASE-R4 PCS Control 1 (Continued)
 Device 4, Register 0x3000

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------|------|-----------|--------|--|
| 14 | Loopback | R/W | 0x0 | 0x0 | 1 = Loopback 0 = Normal |
| 13 | Speed Select | RO | 0x1 | 0x1 | 1 = Bits 5:2 select speed. |
| 12 | Reserved | RO | 0x0 | 0x0 | Set to 0 |
| 11 | Low Power | R/W | See Desc. | Retain | 1 = Power Down 0 = Normal This register will power down all PCS/PMA of this interface. Initial power state is a function of hardware configuration. |
| 10 | Clock Stoppable | R/W | 0x0 | 0x0 | 1 = Clock stoppable during LPI 0 = Clock not stoppable |
| 9:7 | Reserved | RO | 0x0 | 0x0 | 000 |
| 6 | Speed Select | RO | 0x1 | 0x1 | 1 = Bits 5:2 select speed. |
| 5:2 | Speed Select | RO | 0x3 | 0x3 | This register is ignored. Speed is automatically set based on the mode selected in register 31.F002 |
| 1:0 | Reserved | RO | 0x0 | 0x0 | Set to 0s |

Table 308: 40GBASE-R4 PCS Status 1
 Device 4, Register 0x3001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------------|--------|--------|--------|--|
| 15:12 | Reserved | RO | 0x0 | 0x0 | 00000000 |
| 11 | TX LP Idle Received | RO/LH | 0x0 | 0x0 | 1 = Tx PCS has received LP Idle 0 = LP Idle not received |
| 10 | Rx LP Idle Received | RO/LH | 0x0 | 0x0 | 1 = Rx PCS has received LP Idle 0 = LP Idle not received |
| 9 | Tx LP Idle Indication | RO | 0x0 | 0x0 | 1 = Tx PCS is currently receiving LP Idle 0 = Tx PCS is not currently receiving LP Idle |
| 8 | Rx LP Idle Indication | RO | 0x0 | 0x0 | 1 = Rx PCS is currently receiving LP Idle 0 = Rx PCS is not currently receiving LP Idle |
| 7 | Fault | RO | 0x0 | 0x0 | 1 = Transmit or Receive fault condition 0 = No fault condition |
| 6 | Clock Stop Capable | RO | 0x0 | 0x0 | 0 = Clock not stoppable |
| 5:3 | Reserved | RO | 0x0 | 0x0 | 000 |
| 2 | Link Status | RO, LL | 0x0 | 0x0 | 1 = PCS link up 0 = PCS link down |
| 1 | Low Power Ability | RO | 0x1 | 0x1 | 1 = PCS supports low power |
| 0 | Reserved | RO | 0x0 | 0x0 | 0 |

Table 309: PCS Device Identifier 1
Device 4, Register 0x3002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--|------|--------|--------|---|
| 15:0 | Organizationally Unique Identifier Bit 3:18 | RO | 0x0141 | 0x0141 | 0000000101000001 Marvell OUI is 0x005043 |

Table 310: PCS Device Identifier 2
Device 4, Register 0x3003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---|------|-----------|-----------|--|
| 15:10 | Organizationally Unique Identifier Bit 19:24 | RO | 0x03 | 0x03 | 000011 |
| 9:4 | Model Number | RO | 0x31 | 0x31 | 110001 |
| 3:0 | Revision Number | RO | See Desc. | See Desc. | Rev Number Contact Marvell® FAEs for information on the device revision number. |

Table 311: PCS Speed Ability
Device 4, Register 0x3004

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15:4 | Reserved | RO | 0x000 | 0x000 | 0 |
| 3 | 100G Capable | RO | 0x0 | 0x0 | 0 = Not capable of operating at 100Gbps |
| 2 | 40G Capable | RO | 0x1 | 0x1 | 1 = Capable of operating at 40Gbps |
| 1 | 10PASS-TS/2BASE-TL Capable | RO | 0x0 | 0x0 | 0 = Not capable of operating as the 10P/2B PCS |
| 0 | 10G Capable | RO | 0x1 | 0x1 | 1 = Capable of operating at 10Gbps |

Table 312: PCS Devices In Package 1
Device 4, Register 0x3005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------------|------|--------|--------|--|
| 15:8 | Reserved | RO | 0x00 | 0x00 | 00000 |
| 10 | Separated PMA (3) | RO | 0x0 | 0x0 | 1 = Separated PMA (3) present in package 0 = Separated PMA (3) not present in package |
| 9 | Separated PMA (2) | RO | 0x0 | 0x0 | 1 = Separated PMA (2) present in package 0 = Separated PMA (2) not present in package |
| 8 | Separated PMA (1) | RO | 0x0 | 0x0 | 1 = Separated PMA (1) present in package 0 = Separated PMA (1) not present in package |
| 7 | Auto-Negotiation Present | RO | 0x1 | 0x1 | 1 = Auto-negotiation present in package 0 = Auto-negotiation not present in package |

Table 312: PCS Devices In Package 1 (Continued)
 Device 4, Register 0x3005

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|--|
| 6 | TC Present | RO | 0x0 | 0x0 | 1 = TC present in package 0 = TC not present in package |
| 5 | DTE XS Present | RO | 0x0 | 0x0 | 1 = DTE XS present in package 0 = DTE XS not present in package |
| 4 | PHY XS Present | RO | 0x1 | 0x1 | 1 = PHY XS present in package 0 = PHY XS not present in package |
| 3 | PCS Present | RO | 0x1 | 0x1 | 1 = PCS present in package 0 = PCS not present in package |
| 2 | Reserved | RO | 0x1 | 0x1 | Reserved Do not write any value other than the HW Rst value. |
| 1 | PMD/PMA Present | RO | 0x1 | 0x1 | 1 = PMA/PMD present in package 0 = PMA/PMD not present in package |
| 0 | Clause 22 Registers Present | RO | 0x0 | 0x0 | 1 = Clause 22 registers present in package 0 = Clause 22 registers not present in package |

Table 313: PCS Devices In Package 2
 Device 4, Register 0x3006

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------------|------|--------|--------|--|
| 15 | Marvell Specific Device 2 Present | RO | 0x1 | 0x1 | 1 = Marvell specific device 2 present 0 = Marvell specific device 2 not present |
| 14 | Marvell Specific Device 1 Present | RO | 0x1 | 0x1 | 1 = Marvell specific device 1 present 0 = Marvell specific device 1 not present |
| 13 | Clause 22 Extension Present | RO | 0x0 | 0x0 | 1 = Clause 22 extension present 0 = Clause 22 extension not present |
| 12:0 | Reserved | RO | 0x0000 | 0x0000 | 0 |

Table 314: PCS Control 2
 Device 4, Register 0x3007

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------|------|--------|--------|--|
| 15:3 | Reserved | RO | 0x0000 | 0x0000 | 0 |
| 2:0 | PCS Type | RO | 0x4 | 0x4 | This register is ignored. PCS is automatically set based on the mode selected in register 31.F002 |

Table 315: 40GBASE-R4 PCS Status 2
 Device 4, Register 0x3008

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|----------------|------|--------|--------|--|
| 15:14 | Device Present | RO | 0x2 | 0x2 | 10 = Device responding to this address |

Table 315: 40GBASE-R4 PCS Status 2 (Continued)
Device 4, Register 0x3008

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|--------------------|--------|--------|--------|--|
| 13:12 | Reserved | RO | 0x0 | 0x0 | 00 |
| 11 | Transmit Fault | RO, LH | 0x0 | 0x0 | 1 = Fault on transmit path, 0 = No fault |
| 10 | Receive Fault | RO, LH | 0x0 | 0x0 | 1 = Fault on receive path, 0 = No fault |
| 9:6 | Reserved | RO | 0x0 | 0x0 | 0000000 |
| 5 | 100GBASE-R Capable | RO | 0x0 | 0x0 | 1 = PCS is able to support 100GBASE-R PCS types 0 = PCS is not able to support 100GBASE-R PCS types |
| 4 | 40GBASE-R Capable | RO | 0x1 | 0x1 | 1 = PCS is able to support 40GBASE-R PCS types 0 = PCS is not able to support 40GBASE-R PCS types |
| 3 | 10GBASE-T Capable | RO | 0x0 | 0x0 | 1 = PCS is able to support 10GBASE-T PCS types 0 = PCS is not able to support 10GBASE-T PCS types |
| 2 | Reserved | RO | 0x0 | 0x0 | Reserved |
| 1 | 10GBASE-X Capable | RO | 0x1 | 0x1 | 1 = PCS is able to support 10GBASE-X PCS types 0 = PCS is not able to support 10GBASE-X PCS types |
| 0 | 10GBASE-R Capable | RO | 0x1 | 0x1 | 1 = PCS is able to support 10GBASE-R PCS types 0 = PCS is not able to support 10GBASE-R PCS types |

Table 316: PCS Package Identifier 1
Device 4, Register 0x300E

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--|------|--------|--------|---|
| 15:0 | Organizationally Unique Identifier Bit 3:18 | RO | 0x0141 | 0x0141 | 0000000101000001 Marvell OUI is 0x005043 |

Table 317: PCS Package Identifier 2
Device 4, Register 0x300F

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---|------|-----------|-----------|--|
| 15:10 | Organizationally Unique Identifier Bit 19:24 | RO | 0x03 | 0x03 | 000011 |
| 9:4 | Model Number | RO | 0x31 | 0x31 | 110001 |
| 3:0 | Revision Number | RO | See Desc. | See Desc. | Rev Number Contact Marvell® FAEs for information on the device revision number. |

Table 318: BASE-R Status1 Register
 Device 4, Register 0x3020

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-------------------------------|------|--------|--------|--|
| 15:13 | Reserved | RO | 0x0 | 0x0 | 0 |
| 12 | 40G Rx Link Status | RO | 0x0 | 0x0 | 1 = 40GBASE-R PCS receive link up 0 = 40GBASE-R PCS receive link down |
| 11:4 | Reserved | RO | 0x00 | 0x00 | 0 |
| 3 | 10GBASE-R PRBS9 Test Ability | RO | 0x1 | 0x1 | 1 = PCS is able to support PRBS9 pattern testing 0 = PCS is not able to support PRBS9 pattern testing |
| 2 | 10GBASE-R PRBS31 Test Ability | RO | 0x1 | 0x1 | 1 = PCS is able to support PRBS31 pattern testing 0 = PCS is not able to support PRBS31 pattern testing |
| 1 | 40G PCS High BER | RO | 0x0 | 0x0 | 1 = 40GBASE-R PCS reporting high BER 0 = 40GBASE-R PCS not reporting high BER |
| 0 | 40G PCSR Block Lck | RO | 0x0 | 0x0 | 1 = 40GBASE-R PCS locked to received block 0 = 40GBASE-R PCS not locked |

Table 319: BASE-R PCS Status 2
 Device 4, Register 0x3021

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|--------|--------|--------|---|
| 15 | Latched Block Lock | RO, LL | 0x0 | 0x0 | 1 = PCS Has Block Lock 0 = PCS Does Not Have Block Lock |
| 14 | Latched High Bit Error Rate | RO, LH | 0x0 | 0x0 | 1 = PCS Has Reported High BER 0 = PCS Has Not Reported High BER |
| 13:8 | Bit Error Rate Counter | RO | 0x00 | 0x00 | Bit Error Rate Counter Counter clears on read. Counter will peg at all 1s. |
| 7:0 | Errored Blocks | RO | 0x00 | 0x00 | Errored Blocks Counter Counter clears on read. Counter will peg at all 1s. |

Table 320: 40GBASE-R PCS Test Pattern Control
 Device 4, Register 0x302A

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------------------------|------|--------|--------|---|
| 15:8 | Reserved | RO | 0x00 | 0x00 | 0 |
| 7 | Scramble_idle Test Pattern Enable | R/W | 0x0 | 0x0 | 1 = Enable On Transmit Path 0 = Disable On Transmit Path |
| 6 | PRBS9 Transmit Test Pattern Enable | RO | 0x0 | 0x0 | Write to this bit is ignored |
| 5 | PRBS31 Receive Test Pattern Enable | RO | 0x0 | 0x0 | Write to this bit is ignored |
| 4 | PRBS31 Transmit Test Pattern Enable | RO | 0x0 | 0x0 | Write to this bit is ignored |

Table 320: 40GBASE-R PCS Test Pattern Control (Continued)
Device 4, Register 0x302A

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------|------|--------|--------|------------------------------|
| 3 | Transmit Test Pattern Enable | RO | 0x0 | 0x0 | Write to this bit is ignored |
| 2 | Receive Test Pattern Enable | RO | 0x0 | 0x0 | Write to this bit is ignored |
| 1 | Test Pattern Select | RO | 0x0 | 0x0 | Write to this bit is ignored |
| 0 | Data Pattern Select | RO | 0x0 | 0x0 | Write to this bit is ignored |

Table 321: 40GBASE-R PCS Test Pattern Error Counter
Device 4, Register 0x302B

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|---|
| 15:0 | Test Pattern Error Counter | RO | 0x0000 | 0x0000 | Test Pattern Error Counter Counter clears on read. Counter will peg at all 1s. |

Table 322: 40GBASE-R PCS BER High Order Counter
Device 4, Register 0x302C

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|--|
| 15:0 | BER High Order | RO | 0x0000 | 0x0000 | Bits 21:6 of 22-bit BER counter. Register 4.3021 should be read first. Counter clears on read of 4.3021. 22-bit Counter will peg at all 1s. |

Table 323: 40GBASE-R PCS Errored Blocks High Order Counter
Device 4, Register 0x302D

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15 | High order counter present | RO | 0x1 | 0x1 | 1 = High order counter is present |
| 14 | Reserved | RO | 0x0 | 0x0 | Test Pattern Error Counter Counter clears on read. Counter will peg at all 1s. |
| 13:0 | Errored blocks high order | RO | 0x0000 | 0x0000 | Bits 21:8 of 22-bits Errored Blocks Counter. Register 4.3021 should be read first. Counter clears on read of 4.3021. 22-bit Counter will peg at all 1s. |

Table 324: Multi-lane BASE-R PCS Alignment Status 1
Device 4, Register 0x3032

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|---------------------------|------|--------|--------|--|
| 15:13 | Reserved | RO | 0x0 | 0x0 | |
| 12 | PCS Lane Alignment Status | RO | 0x0 | 0x0 | 1 = PCS receive lanes locked and aligned 0 = PCS receive lanes not locked and aligned |
| 11:4 | Reserved | RO | 0x00 | 0x00 | |

Table 324: Multi-lane BASE-R PCS Alignment Status 1 (Continued)
Device 4, Register 0x3032

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------|------|--------|--------|--|
| 3 | Lane 3 Block Lock | RO | 0x0 | 0x0 | 1 = Lane 3 is locked 0 = Lane 3 is not locked |
| 2 | Lane 2 Block Lock | RO | 0x0 | 0x0 | 1 = Lane 2 is locked 0 = Lane 2 is not locked |
| 1 | Lane 1 Block Lock | RO | 0x0 | 0x0 | 1 = Lane 1 is locked 0 = Lane 1 is not locked |
| 0 | Lane 0 Block Lock | RO | 0x0 | 0x0 | 1 = Lane 0 is locked 0 = Lane 0 is not locked |

Table 325: Multi-lane BASE-R PCS Alignment Status 2
Device 4, Register 0x3034

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|--|
| 15:4 | Reserved | RO | 0x000 | 0x000 | |
| 3 | Lane 3 Aligned | RO | 0x0 | 0x0 | 1 = Lane 3 alignment marker is locked 0 = Lane 3 alignment marker is not locked |
| 2 | Lane 2 Aligned | RO | 0x0 | 0x0 | 1 = Lane 2 alignment marker is locked 0 = Lane 2 alignment marker is not locked |
| 1 | Lane 1 Aligned | RO | 0x0 | 0x0 | 1 = Lane 1 alignment marker is locked 0 = Lane 1 alignment marker is not locked |
| 0 | Lane 0 Aligned | RO | 0x0 | 0x0 | 1 = Lane 0 alignment marker is locked 0 = Lane 0 alignment marker is not locked |

Table 326: BIP Error Counter Lanes 0 Register
Device 4, Register 0x30C8

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------|------|--------|--------|---|
| 15:0 | Lane 0 Bip Err Count | RO | 0x0000 | 0x0000 | Lane 0 BIP Error Counter Counter clears on read. Counter will peg at all 1s. |

Table 327: BIP Error Counter Lanes 1 Register
Device 4, Register 0x30C9

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------|------|--------|--------|---|
| 15:0 | Lane 1 Bip Err Count | RO | 0x0000 | 0x0000 | Lane 1 BIP Error Counter Counter clears on read. Counter will peg at all 1s. |

Table 328: BIP Error Counter Lanes 2 Register
Device 4, Register 0x30CA

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------|------|--------|--------|---|
| 15:0 | Lane 2 Bip Err Count | RO | 0x0000 | 0x0000 | Lane 2 BIP Error Counter Counter clears on read. Counter will peg at all 1s. |

Table 329: BIP Error Counter Lanes 3 Register
Device 4, Register 0x30CB

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------|------|--------|--------|---|
| 15:0 | Lane 3 Bip Err Count | RO | 0x0000 | 0x0000 | Lane 3 BIP Error Counter Counter clears on read. Counter will peg at all 1s. |

Table 330: Lanes 0 Mapping Register
Device 4, Register 0x3190

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|--|
| 15:6 | Reserved | RO | 0x000 | 0x000 | |
| 5:0 | Lane 0 mapping | RO | 0x00 | 0x00 | PCS lane received in service interface lane 0. The content is valid when lane 0 aligned bit (4.3034.0) is set to one, and invalid otherwise. |

Table 331: Lanes 1 Mapping Register
Device 4, Register 0x3191

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|--|
| 15:6 | Reserved | RO | 0x000 | 0x000 | |
| 5:0 | Lane 1 mapping | RO | 0x00 | 0x00 | PCS lane received in service interface lane 1. The content is valid when lane 1 aligned bit (4.3034.1) is set to one, and invalid otherwise. |

Table 332: Lanes 2 Mapping Register
Device 4, Register 0x3192

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|--|
| 15:6 | Reserved | RO | 0x000 | 0x000 | |
| 5:0 | Lane 2 mapping | RO | 0x00 | 0x00 | PCS lane received in service interface lane 2. The content is valid when lane 2 aligned bit (4.3034.2) is set to one, and invalid otherwise. |

Table 333: Lanes 3 Mapping Register
Device 4, Register 0x3193

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------|------|--------|--------|-------------|
| 15:6 | Reserved | RO | 0x000 | 0x000 | |

Table 333: Lanes 3 Mapping Register (Continued)
Device 4, Register 0x3193

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|--|
| 5:0 | Lane 3 mapping | RO | 0x00 | 0x00 | PCS lane received in service interface lane 3. The content is valid when lane 3 aligned bit (4.3034.3) is set to one, and invalid otherwise. |

Table 334: 40GBASE-R4 Interrupt enable Register
Device 4, Register 0xB001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--|------|--------|--------|---|
| 15 | Lane 3 AM_lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 14 | Lane 2 AM_lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 13 | Lane 1 AM_lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 12 | Lane 0 AM_lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 11 | Local Fault Transmitted Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 10 | Local Fault Received Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 9 | Lane_alignment change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 8 | Tx_Lane_cnt_err Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 7 | JIT 0 Lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 6 | JIT Local-Fault Lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 5 | Link Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 4 | High BER Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 3 | Lane 3 Block Lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |

Table 334: 40GBASE-R4 Interrupt enable Register (Continued)
Device 4, Register 0xB001

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---|------|--------|--------|---|
| 2 | Lane 2 Block Lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 1 | Lane 1 Block Lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 0 | Lane 0 Block Lock Change Interrupt Enable | R/W | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |

Table 335: 40GBASE-R4 Interrupt Status Register
Device 4, Register 0xB002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--|-------|--------|--------|---|
| 15 | Lane 3 AM_lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 14 | Lane 2 AM_lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 13 | Lane 1 AM_lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 12 | Lane 0 AM_lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 11 | Local Fault Transmitted Interrupt | RO,LH | 0x0 | 0x0 | 1 = Local fault transmitted 0 = No local fault transmitter |
| 10 | Local Fault Received Interrupt | RO,LH | 0x0 | 0x0 | 1 = Local fault received 0 = No local fault received |
| 9 | Lane_alignment change Interrupt Enable | RO,LH | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 8 | Tx_Lane_cnt_err Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 7 | JIT 0 Lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 6 | JIT Local-Fault Lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 5 | Link Change Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 4 | High BER Change Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 3 | Lane 3 Block Lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |

Table 335: 40GBASE-R4 Interrupt Status Register (Continued)
 Device 4, Register 0xB002

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------------|-------|--------|--------|-------------------------------------|
| 2 | Lane 2 Block Lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 1 | Lane 1 Block Lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |
| 0 | Lane 0 Block Lock Change Interrupt | RO,LH | 0x0 | 0x0 | 1= Change detected 0 = No Change |

Table 336: 40GBASE-R4 PCS Real Time Status Register
 Device 4, Register 0xB003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------------------|------|--------|--------|--|
| 15 | Lane 3 AM_lock status | RO | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 14 | Lane 2 AM_lock status | RO | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 13 | Lane 1 AM_lock status | RO | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 12 | Lane 0 AM_lock status | RO | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 11 | Local Fault Transmitted Status | RO | 0x0 | 0x0 | 1 = Local fault transmitted 0 = No local fault transmitted |
| 10 | Local Fault Received Status | RO | 0x0 | 0x0 | 1 = Local fault received 0 = No local fault received |
| 9 | Lane_alignment status | RO | 0x0 | 0x0 | 1 = Interrupt enable 0 = Interrupt disable |
| 8 | Tx_Lane_cnt_err Status | RO | 0x0 | 0x0 | 1= TX Blk dist lane cnt error. If this is set, 40GBASE-R4 won't behave as desired. 0 = No error |
| 7 | JIT 0 Lock Status | RO | 0x0 | 0x0 | 1 =JIT 0 lock achieved 0 = No JIT 0 lock |
| 6 | JIT Local-Fault Lock Status | RO | 0x0 | 0x0 | 1 =JIT local fault lock achieved 0 = No local fault lock |
| 5 | Link Status | RO | 0x0 | 0x0 | 1 = 40GBASE-R link achieved 0 = No link |
| 4 | High BER Status | RO | 0x0 | 0x0 | 1 = High BER 0 = No high BER |
| 3 | Lane 3 Block Lock Status | RO | 0x0 | 0x0 | 1 = Block lock achieved 0 = No block lock |
| 2 | Lane 2 Block Lock Status | RO | 0x0 | 0x0 | 1 = Block lock achieved 0 = No block lock |

Table 336: 40GBASE-R4 PCS Real Time Status Register (Continued)
Device 4, Register 0xB003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------------|------|--------|--------|--|
| 1 | Lane 1 Block Lock Status | RO | 0x0 | 0x0 | 1 = Block lock achieved 0 = No block lock |
| 0 | Lane 0 Block Lock Status | RO | 0x0 | 0x0 | 1 = Block lock achieved 0 = No block lock |

6.4.5 XFI Common Registers

The registers in this section apply to all ports.

Table 337: XFI Common Registers - Register Map

| Register Name | Register Address | Table and Page |
|---------------------------------------|---------------------------|-------------------|
| SERDES Control Register 1 | Device 4, Register 0xF003 | Table 338, p. 237 |
| Repeater mode Phase_FIFO Status | Device 4, Register 0xF008 | Table 339, p. 238 |
| FIFO and CRC Interrupt Enable | Device 4, Register 0xF00A | Table 340, p. 238 |
| FIFO and CRC Interrupt Status | Device 4, Register 0xF00B | Table 341, p. 238 |
| PPM FIFO Control 1 | Device 4, Register 0xF00C | Table 342, p. 239 |
| Packet Generation Control 1 | Device 4, Register 0xF010 | Table 343, p. 239 |
| Packet Generation Control 2 | Device 4, Register 0xF011 | Table 344, p. 239 |
| Initial Payload 0-1/Packet Generation | Device 4, Register 0xF012 | Table 345, p. 240 |
| Initial Payload 2-3/Packet Generation | Device 4, Register 0xF013 | Table 346, p. 240 |
| Packet Generation Length | Device 4, Register 0xF016 | Table 347, p. 240 |
| Packet Generation Burst Sequence | Device 4, Register 0xF017 | Table 348, p. 240 |
| Packet Generation IPG | Device 4, Register 0xF018 | Table 349, p. 240 |
| Transmit Packet Counter [15:0] | Device 4, Register 0xF01B | Table 350, p. 241 |
| Transmit Packet Counter [31:16] | Device 4, Register 0xF01C | Table 351, p. 241 |
| Transmit Packet Counter [47:32] | Device 4, Register 0xF01D | Table 352, p. 241 |
| Transmit Byte Counter [15:0] | Device 4, Register 0xF01E | Table 353, p. 241 |
| Transmit Byte Counter [31:16] | Device 4, Register 0xF01F | Table 354, p. 242 |
| Transmit Byte Counter [47:32] | Device 4, Register 0xF020 | Table 355, p. 242 |
| Receive Packet Counter [15:0] | Device 4, Register 0xF021 | Table 356, p. 242 |
| Receive Packet Counter [31:16] | Device 4, Register 0xF022 | Table 357, p. 242 |
| Receive Packet Counter [47:32] | Device 4, Register 0xF023 | Table 358, p. 243 |
| Receive Byte Count [15:0] | Device 4, Register 0xF024 | Table 359, p. 243 |
| Receive Byte Count [31:16] | Device 4, Register 0xF025 | Table 360, p. 243 |
| Receive Byte Count [47:32] | Device 4, Register 0xF026 | Table 361, p. 243 |
| Receive Packet Error Count [15:0] | Device 4, Register 0xF027 | Table 362, p. 244 |
| Receive Packet Error Count [31:16] | Device 4, Register 0xF028 | Table 363, p. 244 |
| Receive Packet Error Count [47:32] | Device 4, Register 0xF029 | Table 364, p. 244 |
| PRBS 0 Control | Device 4, Register 0xF030 | Table 365, p. 244 |
| PRBS 0 Symbol Tx Counter [15:0] | Device 4, Register 0xF031 | Table 366, p. 245 |
| PRBS 0 Symbol Tx Counter [31:16] | Device 4, Register 0xF032 | Table 367, p. 245 |
| PRBS 0 Symbol Tx Counter [47:32] | Device 4, Register 0xF033 | Table 368, p. 246 |
| PRBS 0 Symbol Rx Counter [15:0] | Device 4, Register 0xF034 | Table 369, p. 246 |
| PRBS 0 Symbol Rx Counter [31:16] | Device 4, Register 0xF035 | Table 370, p. 246 |
| PRBS 0 Symbol Rx Counter [47:32] | Device 4, Register 0xF036 | Table 371, p. 246 |
| PRBS 0 Error Count [15:0] | Device 4, Register 0xF037 | Table 372, p. 247 |
| PRBS 0 Error Count [31:16] | Device 4, Register 0xF038 | Table 373, p. 247 |
| PRBS 0 Error Count [47:32] | Device 4, Register 0xF039 | Table 374, p. 247 |

Table 337: XFI Common Registers - Register Map (Continued)

| Register Name | Register Address | Table and Page |
|-----------------------------------|---------------------------|-------------------|
| PRBS 0 Elapse Timer | Device 4, Register 0xF03A | Table 375, p. 247 |
| PRBS 1 Control | Device 4, Register 0xF040 | Table 376, p. 247 |
| PRBS 1 Symbol Tx Counter [15:0] | Device 4, Register 0xF041 | Table 377, p. 249 |
| PRBS 1 Symbol Tx Counter [31:16] | Device 4, Register 0xF042 | Table 378, p. 249 |
| PRBS 1 Symbol Tx Counter [47:32] | Device 4, Register 0xF043 | Table 379, p. 249 |
| PRBS 1 Symbol Rx Counter [15:0] | Device 4, Register 0xF044 | Table 380, p. 249 |
| PRBS 1 Symbol Rx Counter [31:16] | Device 4, Register 0xF045 | Table 381, p. 250 |
| PRBS 1 Symbol Rx Counter [47:32] | Device 4, Register 0xF046 | Table 382, p. 250 |
| PRBS 1 Error Count [15:0] | Device 4, Register 0xF047 | Table 383, p. 250 |
| PRBS 1 Error Count [31:16] | Device 4, Register 0xF048 | Table 384, p. 250 |
| PRBS 1 Error Count [47:32] | Device 4, Register 0xF049 | Table 385, p. 251 |
| PRBS 1 Elapse Timer | Device 4, Register 0xF04A | Table 386, p. 251 |
| Power Management TX state control | Device 4, Register 0xF074 | Table 387, p. 251 |

Table 338: SERDES Control Register 1
Device 4, Register 0xF003

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|----------------------------|------|--------|--------|---|
| 15:14 | Reserved | RO | 0x0 | 0x0 | Set to 0s |
| 13 | Ftygr_1byte_ipg | R/W | 0x0 | Retain | 1 = In Ftygkr mode PPM_FIFO will do ppm adjustments maintaining up to a min of one byte of IPG (Just the /T/). 0 = PPM_FIFO will do ppm adjustments maintaining up to a min of 5 bytes of IPG(/ T I I I I /) |
| 12 | Host Loopback | R/W | 0x0 | 0x0 | 1 = Enable Loopback 0 = Normal Operation |
| 11 | Reserved | RO | 0x0 | 0x0 | 0 |
| 10 | Force Link Good | R/W | 0x0 | Retain | If link is forced to be good, the link state machine is bypassed and the link is always up. 1 = Force link good 0 = Normal operation |
| 9 | Reserved | RO | 0x0 | 0x0 | 0 |
| 8 | Receiver Power Down | R/W | 0x0 | Retain | 1 = Receiver Powered Down 0 = Receiver Can Power Up |
| 7 | Force Signal Detect | R/W | 0x0 | Retain | 1 = Force signal detect to be good 0 = Normal Operation |
| 6 | Block Transmit On Loopback | R/W | 0x0 | Retain | 0 = Do not block ingress path 1 = Block ingress path |
| 5:0 | Reserved | R/W | 0x00 | Retain | Set to 0s. |

Table 339: Repeater mode Phase_FIFO Status
Device 4, Register 0xF008

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------------|-------|--------|--------|---|
| 15:3 | Reserved | RO | 0x0000 | 0x0000 | Set to 0 |
| 2 | Repxg-X phase_FIFO error | RO,LH | 0x0 | 0x0 | This bit is latched HIGH whenever Repxg-X phase_FIFO empty or full flag is asserted. Cleared on read. |
| 1 | Repxg-R phase_FIFO full | RO,LH | 0x0 | 0x0 | This bit is latched HIGH whenever Repxg-R phase_FIFO full flag is asserted. Cleared on read. |
| 0 | Repxg-R phase_FIFO empty | RO,LH | 0x0 | 0x0 | This bit is latched HIGH whenever Repxg-R phase_FIFO empty flag is asserted. Cleared on read. |

Table 340: FIFO and CRC Interrupt Enable
Device 4, Register 0xF00A

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------------|------|--------|--------|---|
| 15:3 | Reserved | R/W | 0x0000 | Retain | Set to 0 |
| 2 | CRC Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 1 | FIFO Overflow Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |
| 0 | FIFO Underflow Interrupt Enable | R/W | 0x0 | Retain | 1 = Interrupt enable 0 = Interrupt disable |

Table 341: FIFO and CRC Interrupt Status
Device 4, Register 0xF00B

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|-------|--------|--------|---|
| 15:3 | Reserved | RO | 0x0000 | 0x0000 | 0 |
| 2 | CRC Interrupt Status | RO,LH | 0x0 | 0x0 | This interrupt will be set only if the packet checker is enabled. 1 = CRC Error detected 0 = CRC error not detected |
| 1 | FIFO Overflow Status | RO,LH | 0x0 | 0x0 | 1 = FIFO overflow occurred 0 = FIFO overflow did not occur |
| 0 | FIFO Underflow Status | RO,LH | 0x0 | 0x0 | 1 = FIFO underflow occurred 0 = FIFO underflow did not occur |

Table 342: PPM FIFO Control 1
Device 4, Register 0xF00C

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|----------------|------|--------|--------|---|
| 15:14 | PPM FIFO Depth | R/W | 0x0 | 0x0 | PPM FIFO depth selection Default setting varies based on the PCS mode. 10GBASE-R, XAU1, RXAU1: 01 40GBASE-R4: 11 Else: 00 |
| 13:0 | Reserved | RO | 0x0000 | 0x0000 | Set to 0s |

Table 343: Packet Generation Control 1
Device 4, Register 0xF010

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------|---------|--------|--------|---|
| 15 | Read Clear | R/W | 0x0 | Retain | 1 = Enable clear on read 0 = Use 4.F010.6 to clear counters |
| 14:7 | Reserved | R/W | 0x00 | 0x00 | Set to 0s. |
| 6 | Pkt-Gen/Chk Counter Reset | R/W, SC | 0x0 | 0x0 | This bit self clears after counters are cleared. 1 = Clear counters, 0 = Normal Operation |
| 5:3 | Reserved | RO | 0x0 | 0x0 | 0000 |
| 2 | Use SFD in Checker | R/W | 0x0 | 0x0 | 0 = Look for SFD before starting CRC checking 1 = Start CRC checking after the first 8 bytes in packet |
| 1 | Transmit Test Pattern Enable | R/W | 0x0 | 0x0 | 1 = Pkt generator enable, 0 = Disable |
| 0 | Receive Test Pattern Enable | R/W | 0x0 | 0x0 | 1 = Pkt checker enable, 0 = Disable |

Table 344: Packet Generation Control 2
Device 4, Register 0xF011

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------------|------|--------|--------|---|
| 15:8 | Reserved | RO | 0x00 | Retain | Set to 0s |
| 7:4 | Internal Packet Generation Control | R/W | 0x0 | Retain | 000x = No Mask 0010 = Invert every other word 0011 = 2 no invert, 2 invert 0100 = Left shift byte 0101 = Right shift byte 0110 = Left shift word 0111 = Right shift word 1000 = Increment byte 1001 = decrement byte 1010 = Pseudo random byte 1011 = Pseudo random word 11xx = reserved |
| 3 | CRC Generation | R/W | 0x0 | Retain | 0 = On, 1 = off |
| 2:0 | Reserved | RO | 0x0 | Retain | Set to 0s |

Table 345: Initial Payload 0-1/Packet Generation
Device 4, Register 0xF012

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------|------|--------|--------|----------------------------------|
| 15:8 | Byte 1 | R/W | 0x00 | Retain | Initial payload value for byte 1 |
| 7:0 | Byte 0 | R/W | 0x00 | Retain | Initial payload value for byte 0 |

Table 346: Initial Payload 2-3/Packet Generation
Device 4, Register 0xF013

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------|------|--------|--------|----------------------------------|
| 15:8 | Byte 3 | R/W | 0x00 | Retain | Initial payload value for byte 1 |
| 7:0 | Byte 2 | R/W | 0x00 | Retain | Initial payload value for byte 0 |

Table 347: Packet Generation Length
Device 4, Register 0xF016

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------------|------|--------|--------|--|
| 15:0 | Number Of Bytes In Frame | R/W | 0x0000 | Retain | 0000 = Random length between 64 bytes to 1518 bytes 0001 = Random length between 64 bytes to 0x0FFF bytes 0002 = Random length between 64 bytes to 0x1FFF bytes 0003 = Random length between 64 bytes to 0x3FFF bytes 0004 = Random length between 64 bytes to 0x7FFF bytes 0005 = Random length between 64 bytes to 0xFFFF bytes 0006 to 0007 = Undefined 0008 to FFFF = Length in number of bytes |

Table 348: Packet Generation Burst Sequence
Device 4, Register 0xF017

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------|------|--------|--------|---|
| 15:0 | Number Of Packets To Send | R/W | 0x0000 | Retain | 0000 = Stop generation 0001 to FFFE = Number of packets to send FFFF = Continuous |

Table 349: Packet Generation IPG
Device 4, Register 0xF018

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------|------|--------|--------|---|
| 15 | Random IPG | R/W | 0x0 | Retain | 0 = Fixed IPG per bits 14:0 1 = Random IPG from 5 bytes to value specified per bits 14:0 |
| 14:0 | IPG Duration | R/W | 0x0002 | Retain | Each bit equals 4 bytes of idle |

Table 350: Transmit Packet Counter [15:0]
Device 4, Register 0xF01B

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|------|--------|--------|--|
| 15:0 | Transmit Count [15:0] | RO | 0x0000 | 0x0000 | Counts the total number of packets transmitted. If 4.F010.14 = 0 then register does not clear on read. Cleared only when register 4.F010.6 transitions from 0 to 1. If 4.F010.14 = 1 then register clear on read. |

Table 351: Transmit Packet Counter [31:16]
Device 4, Register 0xF01C

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|---|
| 15:0 | Transmit Count [31:16] | RO | 0x0000 | 0x0000 | If 4.F010.14 = 0 then register does not clear on read. Cleared only when register 4.F010.6 transitions from 0 to 1. If 4.F010.14 = 1 then register clear on read. Must read register 4.F01B first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 352: Transmit Packet Counter [47:32]
Device 4, Register 0xF01D

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|---|
| 15:0 | Transmit Count [47:32] | RO | 0x0000 | 0x0000 | If 4.F010.14 = 0 then register does not clear on read. Cleared only when register 4.F010.6 transitions from 0 to 1. If 4.F010.14 = 1 then register clear on read. Must read register 4.F01B first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 353: Transmit Byte Counter [15:0]
Device 4, Register 0xF01E

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15:0 | Transmit Byte Count [15:0] | RO | 0x0000 | 0x0000 | Counts the total number of bytes in frame (including preamble) transmitted. If 4.F010.14 = 0 then register does not clear on read. Cleared only when register 4.F010.6 transitions from 0 to 1. If 4.F010.14 = 1 then register clear on read. |

Table 354: Transmit Byte Counter [31:16]
Device 4, Register 0xF01F

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|--|
| 15:0 | Transmit Byte Count [13:16] | RO | 0x0000 | 0x0000 | If 4.F010.14 = 0 then register does not clear on read. Cleared only when register 4.F010.6 transitions from 0 to 1. If 4.F010.14 = 1 then register clear on read. Must read register 4.F01E first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 355: Transmit Byte Counter [47:32]
Device 4, Register 0xF020

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|--|
| 15:0 | Transmit Byte Count [47:32] | RO | 0x0000 | 0x0000 | If 4.F010.14 = 0 then register does not clear on read. Cleared only when register 4.F010.6 transitions from 0 to 1. If 4.F010.14 = 1 then register clear on read. Must read register 4.F01E first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 356: Receive Packet Counter [15:0]
Device 4, Register 0xF021

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------|------|--------|--------|--|
| 15:0 | Receive Count [15:0] | RO | 0x0000 | 0x0000 | Counts the total number of packets received. If 4.F010.14 = 0 then register does not clear on read. Cleared only when register 4.F010.6 transitions from 0 to 1. If 4.F010.14 = 1 then register clear on read. |

Table 357: Receive Packet Counter [31:16]
Device 4, Register 0xF022

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|------|--------|--------|--|
| 15:0 | Receive Count [31:16] | RO | 0x0000 | 0x0000 | If 4.F010.14 = 0 then register does not clear on read. Cleared only when register 4.F010.6 transitions from 0 to 1. If 4.F010.14 = 1 then register clear on read. Must read register 4.F021 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 358: Receive Packet Counter [47:32]
Device 4, Register 0xF023

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|------|--------|--------|--|
| 15:0 | Receive Count [47:32] | RO | 0x0000 | 0x0000 | If 4.F010.14 = 0 then register does not clear on read. Cleared only when register 4.F010.6 transitions from 0 to 1. If 4.F010.14 = 1 then register clear on read. Must read register 4.F021 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 359: Receive Byte Count [15:0]
Device 4, Register 0xF024

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-------------------|------|--------|--------|--|
| 15:0 | Byte Count [15:0] | RO | 0x0000 | 0x0000 | Counts the total number of bytes in frame (including preamble) received. If 4.F010.14 = 0 then register does not clear on read. Cleared only when register 4.F010.6 transitions from 0 to 1. If 4.F010.14 = 1 then register clear on read. |

Table 360: Receive Byte Count [31:16]
Device 4, Register 0xF025

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------|------|--------|--------|--|
| 15:0 | Byte Count [31:16] | RO | 0x0000 | 0x0000 | If 4.F010.14 = 0 then register does not clear on read. Cleared only when register 4.F010.6 transitions from 0 to 1. If 4.F010.14 = 1 then register clear on read. Must read register 4.F024 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 361: Receive Byte Count [47:32]
Device 4, Register 0xF026

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|--------------------|------|--------|--------|--|
| 15:0 | Byte Count [47:32] | RO | 0x0000 | 0x0000 | If 4.F010.14 = 0 then register does not clear on read. Cleared only when register 4.F010.6 transitions from 0 to 1. If 4.F010.14 = 1 then register clear on read. Must read register 4.F024 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 362: Receive Packet Error Count [15:0]
Device 4, Register 0xF027

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------|------|--------|--------|---|
| 15:0 | Packet Error Count [15:0] | RO | 0x0000 | 0x0000 | Counts the number of packets with CRC Error received. If 4.F010.14 = 0 then register does not clear on read. Cleared only when register 4.F010.6 transitions from 0 to 1. If 4.F010.14 = 1 then register clear on read. |

Table 363: Receive Packet Error Count [31:16]
Device 4, Register 0xF028

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15:0 | Packet Error Count [31:16] | RO | 0x0000 | 0x0000 | If 4.F010.14 = 0 then register does not clear on read. Cleared only when register 4.F010.6 transitions from 0 to 1. If 4.F010.14 = 1 then register clear on read. Must read register 4.F027 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 364: Receive Packet Error Count [47:32]
Device 4, Register 0xF029

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15:0 | Packet Error Count [47:32] | RO | 0x0000 | 0x0000 | If 4.F010.14 = 0 then register does not clear on read. Cleared only when register 4.F010.6 transitions from 0 to 1. If 4.F010.14 = 1 then register clear on read. Must read register 4.F027 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 365: PRBS 0 Control
Device 4, Register 0xF030

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------|---------|--------|--------|--|
| 15 | Reserved | R/W | 0x0 | 0x0 | Set to 0s. |
| 14 | BER_mode_en | R/W | 0x1 | Retain | 0 = Legacy mode of error count accumulation 1 = BER mode enabled for error accumulation. This is used for average Bit Error Rate (BER) calculation. |
| 13 | Read Clear | R/W | 0x0 | Retain | 1 = Enable clear on read 0 = Use 4.F030.6 to clear counters |
| 12:9 | Reserved | R/W | 0x0 | 0x0 | Set to 0s. |
| 8 | PRBS Lock | RO | 0x0 | 0x0 | 1 = PRBS locked, 0 = PRBS not locked |
| 7 | Immediate Error Count Enable | R/W | 0x0 | 0x0 | 1 = Count PRBS errors before locking 0 = Wait until PRBS locks before counting |
| 6 | PRBS Counter Reset | R/W, SC | 0x0 | 0x0 | This bit self clears after counters are cleared. 1 = Clear counters, 0 = Normal Operation |

Table 365: PRBS 0 Control (Continued)
Device 4, Register 0xF030

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------|------|--------|--------|--|
| 5 | Transmit Test Pattern Enable | R/W | 0x0 | 0x0 | Test enabled only if the appropriate mode is selected. 1 = Enable 0 = Disable |
| 4 | Receive Test Pattern Enable | R/W | 0x0 | 0x0 | Test enabled only if the appropriate mode is selected. Note that there is no receive checking done for IEEE 48.A.1, 48.A.2, and 48.A.3. 1 = Enable 0 = Disable |
| 3:0 | | R/W | 0x0 | 0x0 | 0000 = IEEE 49.2.8 - PRBS 31 0001 = PRBS 7 0010 = PRBS 9 IEEE 83.7 0011 = PRBS 23 0100 = PRBS 31 Inverted 0101 = PRBS 7 Inverted 1000 = PRBS 15 1001 = PRBS 15 Inverted 0110 = PRBS 9 Inverted 0111 = PRBS 23 Inverted 1100 = High frequency pattern 1101 = Low frequency pattern 1110 = Mixed frequency pattern 1111 = Square Wave pattern |

Table 366: PRBS 0 Symbol Tx Counter [15:0]
Device 4, Register 0xF031

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|------|--------|--------|--|
| 15:0 | Transmit Count [15:0] | RO | 0x0000 | 0x0000 | Increments by 1 for every bit transmitted per lane. If 4.F030.13 = 0 then register does not clear on read. Cleared only when register 4.F030.6 transitions from 0 to 1. If 4.F030.13 = 1 then register clear on read. |

Table 367: PRBS 0 Symbol Tx Counter [31:16]
Device 4, Register 0xF032

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|---|
| 15:0 | Transmit Count [31:16] | RO | 0x0000 | 0x0000 | If 4.F030.13 = 0 then register does not clear on read. Cleared only when register 4.F030.6 transitions from 0 to 1. If 4.F030.13 = 1 then register clear on read. Must read register 4.F031 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 368: PRBS 0 Symbol Tx Counter [47:32]
Device 4, Register 0xF033

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|--|
| 15:0 | Transmit Count [47:32] | RO | 0x0000 | 0x0000 | If 4.F030.13 = 0 then register does not clear on read. Cleared only when register 4.F030.6 transitions from 0 to 1. If 4.F030.13 = 1 then register clear on read. Must read register 4.F031 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 369: PRBS 0 Symbol Rx Counter [15:0]
Device 4, Register 0xF034

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------|------|--------|--------|--|
| 15:0 | Receive Count [15:0] | RO | 0x0000 | 0x0000 | Increments by 1 for every bit received per lane. If 4.F030.13 = 0 then register does not clear on read. Cleared only when register 4.F030.6 transitions from 0 to 1. If 4.F030.13 = 1 then register clear on read. |

Table 370: PRBS 0 Symbol Rx Counter [31:16]
Device 4, Register 0xF035

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|--|
| 15:0 | Receive Error Count [31:16] | RO | 0x0000 | 0x0000 | If 4.F030.13 = 0 then register does not clear on read. Cleared only when register 4.F030.6 transitions from 0 to 1. If 4.F030.13 = 1 then register clear on read. Must read register 4.F034 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 371: PRBS 0 Symbol Rx Counter [47:32]
Device 4, Register 0xF036

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|--|
| 15:0 | Receive Error Count [47:32] | RO | 0x0000 | 0x0000 | If 4.F030.13 = 0 then register does not clear on read. Cleared only when register 4.F030.6 transitions from 0 to 1. If 4.F030.13 = 1 then register clear on read. Must read register 4.F034 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 372: PRBS 0 Error Count [15:0]
Device 4, Register 0xF037

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------|------|--------|--------|---|
| 15:0 | Lane 0 Error Count [15:0] | RO | 0x0000 | 0x0000 | Increments by 1 for every bit error received per lane. If 4.F030.13 = 0 then register does not clear on read. Cleared only when register 4.F030.6 transitions from 0 to 1. If 4.F030.13 = 1 then register clear on read. |

Table 373: PRBS 0 Error Count [31:16]
Device 4, Register 0xF038

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|---|
| 15:0 | Lane 0 Error Count [31:16] | RO | 0x0000 | 0x0000 | If 4.F030.13 = 0 then register does not clear on read. Cleared only when register 4.F030.6 transitions from 0 to 1. If 4.F030.13 = 1 then register clear on read. Must read register 4.F037 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 374: PRBS 0 Error Count [47:32]
Device 4, Register 0xF039

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|---|
| 15:0 | Lane 0 Error Count [47:32] | RO | 0x0000 | 0x0000 | If 4.F030.13 = 0 then register does not clear on read. Cleared only when register 4.F030.6 transitions from 0 to 1. If 4.F030.13 = 1 then register clear on read. Must read register 4.F037 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 375: PRBS 0 Elapse Timer
Device 4, Register 0xF03A

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------|------|--------|--------|--|
| 15:0 | Elapse Timer Count [15:0] | RO | 0x0000 | 0x0000 | Increments by 1 for every 2 second. Valid only if 4.F030.14 = 1 If 4.F030.13 = 0 then register does not clear on read, but cleared only when register 4.F030.6 transitions from 0 to 1. If 4.F030.13 = 1 then register clear on read. Must read register 4.F037 first in order to update this register. |

Table 376: PRBS 1 Control
Device 4, Register 0xF040

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------|------|--------|--------|-------------|
| 15 | Reserved | R/W | 0x0 | 0x0 | Set to 0s. |

Table 376: PRBS 1 Control (Continued)
Device 4, Register 0xF040

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------------|---------|--------|--------|--|
| 14 | BER_mode_en | R/W | 0x1 | 0x1 | 0 = Legacy mode of error count accumulation 1 = BER mode enabled for error accumulation. This is used for average Bit Error Rate (BER) calculation. |
| 13 | Read Clear | R/W | 0x0 | Retain | 1 = Enable clear on read 0 = Use 4.F040.6 to clear counters |
| 12:9 | Reserved | R/W | 0x0 | 0x0 | Set to 0s. |
| 8 | PRBS Lock | RO | 0x0 | 0x0 | 1 = PRBS locked 0 = PRBS not locked |
| 7 | Immediate Error Count Enable | R/W | 0x0 | 0x0 | 1 = Count PRBS errors before locking 0 = Wait until PRBS locks before counting |
| 6 | PRBS Counter Reset | R/W, SC | 0x0 | 0x0 | This bit self clears after counters are cleared. 1 = Clear counters 0 = Normal Operation |
| 5 | Transmit Test Pattern Enable | R/W | 0x0 | 0x0 | Test enabled only if the appropriate mode is selected. 1 = Enable 0 = Disable |
| 4 | Receive Test Pattern Enable | R/W | 0x0 | 0x0 | Test enabled only if the appropriate mode is selected. Note that there is no receive checking done for IEEE 48.A.1, 48.A.2, and 48.A.3. 1 = Enable 0 = Disable |
| 3:0 | | R/W | 0x0 | 0x0 | 0000 = IEEE 49.2.8 - PRBS 31 0001 = PRBS 7 0010 = PRBS 9 IEEE 83.7 0011 = PRBS 23 0100 = PRBS 31 Inverted 0101 = PRBS 7 Inverted 1000 = PRBS 15 1001 = PRBS 15 Inverted 0110 = PRBS 9 Inverted 0111 = PRBS 23 Inverted 1100 = High frequency pattern 1101 = Low frequency pattern 1110 = Mixed frequency pattern 1111 = Square Wave pattern |



Note

This selection is valid in any SERDES speed.

Table 377: PRBS 1 Symbol Tx Counter [15:0]
Device 4, Register 0xF041

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------|------|--------|--------|---|
| 15:0 | Transmit Count [15:0] | RO | 0x0000 | 0x0000 | Increments by 1 for every bit transmitted per lane. If 4.F040.13 = 0 then register does not clear on read. Cleared only when register 4.F040.6 transitions from 0 to 1. If 4.F040.13 = 1 then register clear on read. |

Table 378: PRBS 1 Symbol Tx Counter [31:16]
Device 4, Register 0xF042

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|---|
| 15:0 | Transmit Count [31:16] | RO | 0x0000 | 0x0000 | If 4.F040.13 = 0 then register does not clear on read. Cleared only when register 4.F040.6 transitions from 0 to 1. If 4.F040.13 = 1 then register clear on read. Must read register 4.F031 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 379: PRBS 1 Symbol Tx Counter [47:32]
Device 4, Register 0xF043

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|------------------------|------|--------|--------|---|
| 15:0 | Transmit Count [47:32] | RO | 0x0000 | 0x0000 | If 4.F040.13 = 0 then register does not clear on read. Cleared only when register 4.F040.6 transitions from 0 to 1. If 4.F040.13 = 1 then register clear on read. Must read register 4.F031 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 380: PRBS 1 Symbol Rx Counter [15:0]
Device 4, Register 0xF044

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------|------|--------|--------|---|
| 15:0 | Receive Count [15:0] | RO | 0x0000 | 0x0000 | Increments by 1 for every bit received per lane. If 4.F040.13 = 0 then register does not clear on read. Cleared only when register 4.F040.6 transitions from 0 to 1. If 4.F040.13 = 1 then register clear on read. |

Table 381: PRBS 1 Symbol Rx Counter [31:16]
 Device 4, Register 0xF045

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|--|
| 15:0 | Receive Error Count [31:16] | RO | 0x0000 | 0x0000 | If 4.F040.13 = 0 then register does not clear on read. Cleared only when register 4.F040.6 transitions from 0 to 1. If 4.F040.13 = 1 then register clear on read. Must read register 4.F034 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 382: PRBS 1 Symbol Rx Counter [47:32]
 Device 4, Register 0xF046

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|-----------------------------|------|--------|--------|--|
| 15:0 | Receive Error Count [47:32] | RO | 0x0000 | 0x0000 | If 4.F040.13 = 0 then register does not clear on read. Cleared only when register 4.F040.6 transitions from 0 to 1. If 4.F040.13 = 1 then register clear on read. Must read register 4.F034 first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 383: PRBS 1 Error Count [15:0]
 Device 4, Register 0xF047

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------|------|--------|--------|--|
| 15:0 | Lane 1 Error Count [15:0] | RO | 0x0000 | 0x0000 | Increments by 1 for every bit error received per lane. If 4.F040.13 = 0 then register does not clear on read. Cleared only when register 4.F040.6 transitions from 0 to 1. If 4.F040.13 = 1 then register clear on read. |

Table 384: PRBS 1 Error Count [31:16]
 Device 4, Register 0xF048

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15:0 | Lane 1 Error Count [31:16] | RO | 0x0000 | 0x0000 | If 4.F040.13 = 0 then register does not clear on read. Cleared only when register 4.F040.6 transitions from 0 to 1. If 4.F040.13 = 1 then register clear on read. Must read register 4.F03A first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 385: PRBS 1 Error Count [47:32]
Device 4, Register 0xF049

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------------------|------|--------|--------|--|
| 15:0 | Lane 1 Error Count [47:32] | RO | 0x0000 | 0x0000 | If 4.F040.13 = 0 then register does not clear on read. Cleared only when register 4.F040.6 transitions from 0 to 1. If 4.F040.13 = 1 then register clear on read. Must read register 4.F03A first in order to update this register. This ensures that the 48 bit read is atomic. |

Table 386: PRBS 1 Elapse Timer
Device 4, Register 0xF04A

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|---------------------------|------|--------|--------|--|
| 15:0 | Elapse Timer Count [15:0] | RO | 0x0000 | 0x0000 | Increments by 1 for every 2 second. Valid only if 4.F040.14 = 1 If 4.F040.13 = 0 then register does not clear on read, but cleared only when register 4.F030.6 transitions from 0 to 1. If 4.F040.13 = 1 then register clear on read. Must read register 4.F047 first in order to update this register. |

Table 387: Power Management TX state control
Device 4, Register 0xF074

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------|------|--------|--------|--------------------------------------|
| 15:14 | Reserved | RO | 0x0 | 0x0 | Writing to this section is forbidden |
| 13 | Rg_en_rst_dsp_s | R/W | 0x1 | Retain | 0=Disable 1 = Enable |
| 12:0 | Reserved | RO | 0x0000 | 0x0000 | Writing to this section is forbidden |

6.4.6 XFI SERDES Registers

The transmitter comes up with default settings which can be read back from registers in [Table 389](#) to [Table 396](#). If manual forcing of transmitter amplitude/pre/post emphasis is desired, it can be achieved by writing to the same registers. Here register address 1E.80E6 should be read as 0x1E.0x80E6 and so on.

Table 388: XFI SERDES Registers - Register Map

| Register Name | Register Address | Table and Page |
|---|----------------------|-----------------------------------|
| XFI Transmitter Lane 0 Settings | Register 0x1E.0x80E6 | Table 389, p. 252 |
| XFI Transmitter Lane 0 Settings | Register 0x1E.0x80E7 | Table 390, p. 252 |
| XFI Transmitter Lane 1 Settings | Register 0x1E.0x82E6 | Table 391, p. 253 |
| XFI Transmitter Lane 1 Settings | Register 0x1E.0x82E7 | Table 392, p. 253 |
| XFI Transmitter Lane 2 Settings | Register 0x1E.0x84E6 | Table 393, p. 253 |
| XFI Transmitter Lane 2 Settings | Register 0x1E.0x84E7 | Table 394, p. 253 |
| XFI Transmitter Lane 3 Settings | Register 0x1E.0x86E6 | Table 395, p. 254 |
| XFI Transmitter Lane 3 Settings | Register 0x1E.0x86E7 | Table 396, p. 254 |

**Table 389: XFI Transmitter Lane 0 Settings
Register 0x1E.0x80E6**

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|---|
| 15 | Force Enable | R/W | 0x0 | Retain | Force enable for bit 14:0 and next register bit 15:0 0 = This register and next register are read back values 1 = This register and next register are forced values |
| 14 | Spare | R/W | 0x0 | Retain | |
| 13:8 | Pre-cursor tap | R/W | 0x0 | Retain | n0[5:0] |
| 7:6 | Spares | R/W | 0x0 | Retain | |
| 5:0 | Main tap | R/W | 0x0 | Retain | n1[5:0] |

**Table 390: XFI Transmitter Lane 0 Settings
Register 0x1E.0x80E7**

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------|------|--------|--------|-------------|
| 15:14 | Spares | R/W | 0x0 | Retain | |
| 13:8 | Post Cursor Tap | R/W | 0x0 | Retain | n2[5:0] |
| 7:6 | Spares | R/W | 0x0 | Retain | |
| 5:0 | Remaining Tap | R/W | 0x0 | Retain | nrst[5:0] |

Table 391: XFI Transmitter Lane 1 Settings
Register 0x1E.0x82E6

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|---|
| 15 | Force Enable | R/W | 0x0 | Retain | Force enable for bit 14:0 and next register bit 15:0 0 = This register and next register are read back values 1 = This register and next register are forced values |
| 14 | Spare | R/W | 0x0 | Retain | |
| 13:8 | Pre-cursor tap | R/W | 0x0 | Retain | n0[5:0] |
| 7:6 | Spares | R/W | 0x0 | Retain | |
| 5:0 | Main tap | R/W | 0x0 | Retain | n1[5:0] |

Table 392: XFI Transmitter Lane 1 Settings
Register 0x1E.0x82E7

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------|------|--------|--------|-------------|
| 15:14 | Spares | R/W | 0x0 | Retain | |
| 13:8 | Post Cursor Tap | R/W | 0x0 | Retain | n2[5:0] |
| 7:6 | Spares | R/W | 0x0 | Retain | |
| 5:0 | Remaining Tap | R/W | 0x0 | Retain | nrst[5:0] |

Table 393: XFI Transmitter Lane 2 Settings
Register 0x1E.0x84E6

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|---|
| 15 | Force Enable | R/W | 0x0 | Retain | Force enable for bit 14:0 and next register bit 15:0 0 = This register and next register are read back values 1 = This register and next register are forced values |
| 14 | Spare | R/W | 0x0 | Retain | |
| 13:8 | Pre-cursor tap | R/W | 0x0 | Retain | n0[5:0] |
| 7:6 | Spares | R/W | 0x0 | Retain | |
| 5:0 | Main tap | R/W | 0x0 | Retain | n1[5:0] |

Table 394: XFI Transmitter Lane 2 Settings
Register 0x1E.0x84E7

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------|------|--------|--------|-------------|
| 15:14 | Spares | R/W | 0x0 | Retain | |
| 13:8 | Post Cursor Tap | R/W | 0x0 | Retain | n2[5:0] |
| 7:6 | Spares | R/W | 0x0 | Retain | |
| 5:0 | Remaining Tap | R/W | 0x0 | Retain | nrst[5:0] |

Table 395: XFI Transmitter Lane 3 Settings
 Register 0x1E.0x86E6

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|------|----------------|------|--------|--------|---|
| 15 | Force Enable | R/W | 0x0 | Retain | Force enable for bit 14:0 and next register bit 15:0 0 = This register and next register are read back values 1 = This register and next register are forced values |
| 14 | Spare | R/W | 0x0 | Retain | |
| 13:8 | Pre-cursor tap | R/W | 0x0 | Retain | n0[5:0] |
| 7:6 | Spares | R/W | 0x0 | Retain | |
| 5:0 | Main tap | R/W | 0x0 | Retain | n1[5:0] |

Table 396: XFI Transmitter Lane 3 Settings
 Register 0x1E.0x86E7

| Bits | Field | Mode | HW Rst | SW Rst | Description |
|-------|-----------------|------|--------|--------|-------------|
| 15:14 | Spares | R/W | 0x0 | Retain | |
| 13:8 | Post Cursor Tap | R/W | 0x0 | Retain | n2[5:0] |
| 7:6 | Spares | R/W | 0x0 | Retain | |
| 5:0 | Remaining Tap | R/W | 0x0 | Retain | nrst[5:0] |

7 Electrical Specifications

This section includes information on the following topics:

- [Section 7.1, Absolute Maximum Ratings](#)
- [Section 7.2, Recommended Operating Conditions](#)
- [Section 7.3, Package Thermal Information](#)
- [Section 7.4, Current Consumption](#)
- [Section 7.5, Digital I/O Electrical Specifications](#)
- [Section 7.6, XFI](#)
- [Section 7.7, SFI](#)
- [Section 7.8, Reference Clock](#)
- [Section 7.9, Latency](#)

7.1 Absolute Maximum Ratings

Table 397: Absolute Maximum Ratings¹

Stresses above those listed in Absolute Maximum Ratings may cause permanent device failure. Functionality at or above these limits is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.

| Symbol | Parameter | Min | Typ | Max | Units |
|----------------------|--|------|-----|--|-------|
| V _{DDA15} | Power Supply Voltage on AVDD15_N and AVDD15_M with respect to VSS | -0.5 | | 1.8 | V |
| V _{DDA11} | Power Supply Voltage on AVDD11_N with respect to VSS | -0.5 | | 1.5 | V |
| V _{DDA10} | Power Supply Voltage on AVDD10_M with respect to VSS | -0.5 | | 1.5 | V |
| V _{DD} | Power Supply Voltage on DVDD with respect to VSS | -0.5 | | 1.5 | V |
| V _{DDO} | Power Supply Voltage on VDDOT, VDDOS, VDDOL, and VDDOM with respect to VSS | -0.5 | | 3.6 | V |
| V _{PIN} | Voltage applied to any digital input pin | -0.5 | | 5.0 or V _{DDO} + 0.7, whichever is less | V |
| T _{STORAGE} | Storage temperature | -55 | | +125 ² | °C |

1. On power-up, no special power supply sequencing is required.
2. 125 °C is only used as bake temperature for not more than 24 hours. Long term storage (e.g weeks or longer) should be kept at 85 °C or lower.

7.2 Recommended Operating Conditions

Table 398: Recommended Operating Conditions

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|---------------------------------|--|---------------------------------------|-------|---------------------|------------------|-------|
| V _{DDA15} ¹ | AVDD15_M supply | For AVDD15_M | 1.425 | 1.5 | 1.575 | V |
| V _{DDA11} ¹ | AVDD11_N supply | For AVDD11_N | 1.045 | 1.1 | 1.155 | V |
| V _{DDA10} ¹ | AVDD10_M supply | For AVDD10_M | 0.95 | 1.0 | 1.05 | V |
| V _{DD} | DVDD supply | For DVDD at 1.0V | 0.95 | 1.0 | 1.05 | V |
| V _{DDO} | VDDOT, VDDOS, VDDOL, and VDDOM supply | For VDDO at 1.2V | 1.14 | 1.2 | 1.26 | V |
| | | For VDDO at 1.5V | 1.425 | 1.5 | 1.575 | V |
| | | For VDDO at 1.8V | 1.71 | 1.8 | 1.89 | V |
| | | For VDDO at 2.5V | 2.375 | 2.5 | 2.625 | V |
| | | For VDDO at 3.3V | 3.13 | 3.3 | 3.47 | V |
| RSET | Internal bias reference | Resistor connected to V _{SS} | | 3650 ± 1% tolerance | | Ω |
| T _A | Commercial Ambient operating temperature | | 0 | | 70 ² | °C |
| T _J | Maximum junction temperature | | | | 125 ³ | °C |

1. Maximum noise allowed on supplies is 20 mV peak-peak.
2. Commercial operating temperatures are typically below 70 °C, e.g, 45 °C ~55 °C. The 70 °C max is Marvell specification limit
3. Refer to white paper on TJ Thermal Calculations for more information.

7.3 Package Thermal Information

7.3.1 Thermal Conditions for 324-Pin FCBGA Package

Table 399: Thermal Conditions for 324-pin FCBGA Package

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|---------------|---|---|-----|------|-----|-------|
| θ_{JA} | Thermal resistance ¹ - junction to ambient for the 324-Pin, FCBGA package $\theta_{JA} = (T_J - T_A) / P$ P = Total power dissipation | JEDEC 3 in. x 4.5 in. 4-layer PCB with no air flow | | 11.7 | | °C/W |
| | | JEDEC 3 in. x 4.5 in. 4-layer PCB with 1 meter/sec air flow | | 10.0 | | °C/W |
| | | JEDEC 3 in. x 4.5 in. 4-layer PCB with 2 meter/sec air flow | | 9.2 | | °C/W |
| | | JEDEC 3 in. x 4.5 in. 4-layer PCB with 3 meter/sec air flow | | 8.7 | | °C/W |
| Ψ_{JT} | Thermal characteristic parameter ^a - junction to top center of the 324-Pin, FCBGA package $\Psi_{JT} = (T_J - T_{top}) / P$ P = Total power dissipation, T_{top} : Temperature on the top center of the package. | JEDEC 3 in. x 4.5 in. 4-layer PCB with no air flow | | 0.4 | | °C/W |
| | | JEDEC 3 in. x 4.5 in. 4-layer PCB with 1 meter/sec air flow | | 0.4 | | °C/W |
| | | JEDEC 3 in. x 4.5 in. 4-layer PCB with 2 meter/sec air flow | | 0.4 | | °C/W |
| | | JEDEC 3 in. x 4.5 in. 4-layer PCB with 3 meter/sec air flow | | 0.4 | | °C/W |
| θ_{JC} | Thermal resistance ^a - junction to case for the 324-Pin, FCBGA package $\theta_{JC} = (T_J - T_C) / P_{top}$ P_{top} = Power dissipation from the top of the package | JEDEC with no air flow | | 0.6 | | °C/W |
| θ_{JB} | Thermal resistance ^a - junction to board for the 324-Pin, FCBGA package $\theta_{JB} = (T_J - T_B) / P_{bottom}$ P_{bottom} = Power dissipation from the bottom of the package to the PCB surface. | JEDEC with no air flow | | 3.1 | | °C/W |

1. Refer to white paper on TJ Thermal Calculations for more information.

7.4 Current Consumption



Current consumption numbers are estimates at this time and are subject to change.

The current consumption is broken down by each power supply. The total current consumption for each power supply is calculated by summing the various components in the tables below. The total chip power consumption is calculated as follows:

$$I_{\text{supply_Total}} = I_{\text{supply_Base}} + \sum_{N=0}^3 I_{\text{supply_PCS}}(\text{port } N) + \sum_{N=0}^3 I_{\text{supply_MS}}(\text{port } N)$$

$I_{\text{supply_PCS}}$ = Current consumption for the PCS selected. 0 mA if the port is turned off.

$I_{\text{supply_DSP}}$ = Incremental current consumption when the Electronic Dispersion Compensation DSP Engine is enabled, otherwise 0 mA.

Supply is one of AVDD15, AVDD11, AVDD10, and DVDD.

The current consumption numbers for $I_{\text{supply_PCS}}$ and $I_{\text{supply_MS}}$ are per port.

The current consumption numbers for $I_{\text{supply_DSP}}$ is per active lane on the line side.

Table 400: Base Current Consumption (Per Chip)

| Symbol | Parameter | Pins | Condition | Min | Typ | Max | Units |
|---------------------------|---------------------|----------------------|------------------------|-----|-----|------|-------|
| $I_{\text{AVDD15_Base}}$ | 1.5V analog supply | AVDD15_M AVDD15_N | All ports powered down | | 80 | 90 | mA |
| $I_{\text{AVDD11_Base}}$ | 1.1V analog supply | AVDD11_N | All ports powered down | | 20 | 140 | mA |
| $I_{\text{AVDD10_Base}}$ | 1.0V analog supply | AVDD10_M | All ports powered down | | 110 | 230 | mA |
| $I_{\text{DVDD_Base}}$ | 1.0V digital supply | DVDD | All ports powered down | | 640 | 3380 | mA |

Table 401: AVDD15 Current Consumption by Mode (Per Port)

| Symbol | Parameter | Pins | Condition (host, line) | Min | Typ | Max | Units |
|-------------------------|--------------------|----------------------|-----------------------------|-----|------|------|-------|
| I _{AVDD15_PCS} | 1.5V analog supply | AVDD15_M AVDD15_N | 1000BASE-X, 1000BASE-X | | 340 | 390 | mA |
| | | | 10GBASE-R, 10GBASE-R | | 470 | 520 | mA |
| | | | XAUI, 10GBASE-R | | 1130 | 1240 | mA |
| | | | RXAUI, 10GBASE-R | | 680 | 740 | mA |
| | | | 40GBASE-R4, 40GBASE-R4 | | 1890 | 2140 | mA |
| | | | Dual 1000BASE-X, 1000BASE-X | | 540 | 600 | mA |
| | | | Dual 10GBASE-R, 10GBASE-R | | 700 | 790 | mA |
| | | | 1000BASE-X, Dual 1000BASE-X | | 480 | 570 | mA |
| | | | 10GBASE-R, Dual 10GBASE-R | | 710 | 770 | mA |

Table 402: AVDD11 Current Consumption by Mode (Per Port)

| Symbol | Parameter | Pins | Condition (host, line) | Min | Typ | Max | Units |
|-------------------------|--------------------|----------|-----------------------------|-----|-----|-----|-------|
| I _{AVDD11_PCS} | 1.1V analog supply | AVDD11_N | 1000BASE-X, 1000BASE-X | | 100 | 110 | mA |
| | | | 10GBASE-R, 10GBASE-R | | 140 | 150 | mA |
| | | | XAUI, 10GBASE-R | | 130 | 160 | mA |
| | | | RXAUI, 10GBASE-R | | 130 | 140 | mA |
| | | | 40GBASE-R4, 40GBASE-R4 | | 520 | 560 | mA |
| | | | Dual 1000BASE-X, 1000BASE-X | | 100 | 110 | mA |
| | | | Dual 10GBASE-R, 10GBASE-R | | 130 | 140 | mA |
| | | | 1000BASE-X, Dual 1000BASE-X | | 200 | 220 | mA |
| | | | 10GBASE-R, Dual 10GBASE-R | | 260 | 270 | mA |

Table 403: AVDD10 Current Consumption by Mode (Per Port)

| Symbol | Parameter | Pins | Condition (host, line) | Min | Typ | Max | Units |
|-------------------------|--------------------|----------|-----------------------------|-----|-----|-----|-------|
| I _{AVDD10_PCS} | 1.0V analog supply | AVDD10_M | 1000BASE-X, 1000BASE-X | | 20 | 20 | mA |
| | | | 10GBASE-R, 10GBASE-R | | 30 | 40 | mA |
| | | | XAUI, 10GBASE-R | | 80 | 80 | mA |
| | | | RXAUI, 10GBASE-R | | 40 | 40 | mA |
| | | | 40GBASE-R4, 40GBASE-R4 | | 160 | 160 | mA |
| | | | Dual 1000BASE-X, 1000BASE-X | | 30 | 30 | mA |
| | | | Dual 10GBASE-R, 10GBASE-R | | 80 | 80 | mA |
| | | | 1000BASE-X, Dual 1000BASE-X | | 20 | 20 | mA |
| | | | 10GBASE-R, Dual 10GBASE-R | | 40 | 40 | mA |

Table 404: DVDD Current Consumption by Mode (Per Port)

| Symbol | Parameter | Pins | Condition (host, line) | Min | Typ | Max | Units |
|---------------------------|---------------------|------|-----------------------------|-----|------|------|-------|
| I _{DVDD_PCS} | 1.0V digital supply | DVDD | 1000BASE-X, 1000BASE-X | | 40 | 50 | mA |
| | | | 10GBASE-R, 10GBASE-R | | 470 | 640 | mA |
| | | | XAU1, 10GBASE-R | | 520 | 620 | mA |
| | | | RXAU1, 10GBASE-R | | 500 | 570 | mA |
| | | | 40GBASE-R4, 40GBASE-R4 | | 1950 | 2410 | mA |
| | | | Dual 1000BASE-X, 1000BASE-X | | 70 | 80 | mA |
| | | | Dual 10GBASE-R, 10GBASE-R | | 520 | 800 | mA |
| | | | 1000BASE-X, Dual 1000BASE-X | | 50 | 170 | mA |
| 10GBASE-R, Dual 10GBASE-R | | 870 | 1010 | mA | | | |

7.5 Digital I/O Electrical Specifications

7.5.1 DC Operating Conditions

Table 405: DC Operating Conditions

All digital I/O are on one of four supply rails – VDDOT, VDDOS, VDDOL, and VDDOM. Each supply rail can be independently programmed to operate at 1.2V, 1.5V, 1.8V, 2.5V, and 3.3V. See section [Section 3.12.4, DVDD, on page 85](#) for more details.
 (Over full range of values listed in the Recommended Operating Conditions unless otherwise specified)

| Symbol | Parameter | Pins | Condition | Min | Typ | Max | Units |
|------------------|---------------------------|--------------------------------|-------------|-------------|-----|-------------|-------|
| VIH | Input high voltage | All digital inputs | VDDO = 3.3V | 2.0 | | VDDO + 0.6V | V |
| | | | VDDO = 2.5V | 1.75 | | VDDO + 0.6V | V |
| | | | VDDO = 1.8V | 1.26 | | VDDO + 0.6V | V |
| | | | VDDO = 1.5V | 1.05 | | VDDO + 0.6V | V |
| | | | VDDO = 1.2V | 0.84 | | VDDO + 0.6V | V |
| VIL | Input low voltage | All digital inputs | VDDO = 3.3V | -0.3 | | 0.8 | V |
| | | | VDDO = 2.5V | -0.3 | | 0.75 | V |
| | | | VDDO = 1.8V | -0.3 | | 0.54 | V |
| | | | VDDO = 1.5V | -0.3 | | 0.45 | V |
| | | | VDDO = 1.2V | -0.3 | | 0.36 | V |
| VOH | High level output voltage | All digital outputs | IOH = -4 mA | VDDO - 0.4V | | | V |
| VOL | Low level output voltage | All digital outputs | IOL = 4 mA | | | 0.4 | V |
| I _{ILK} | Input leakage current | With internal pull-up resistor | | | | 10 -50 | uA |
| | | All others without resistor | | | | 10 | uA |
| CIN | Input capacitance | All pins | | | | 5 | pF |

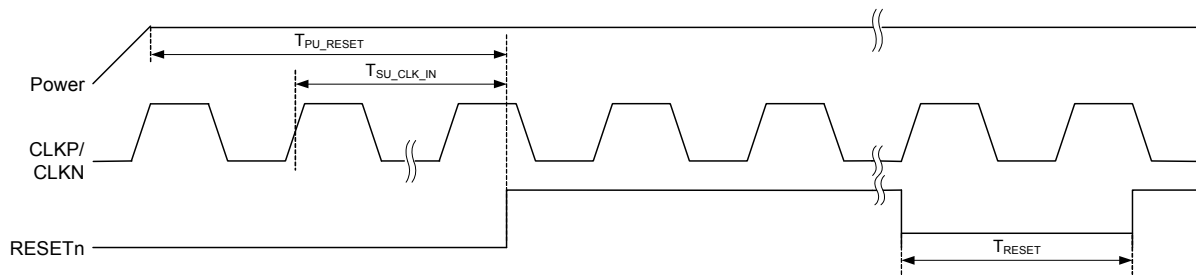
7.5.2 Reset Timing

Table 406: Reset Timing

(Over full range of values listed in the Recommended Operating Conditions unless otherwise specified)

| Symbol | Parameter | Min | Typ | Max | Units |
|-------------------|--|-----|-----|-----|-------|
| T_{PU_RESET} | Valid power to RESET de-assertion | 10 | | | ms |
| $T_{SU_CLK_IN}$ | Number of valid CLKP/CLKN cycles prior to RESET de-assertion | 50 | | | clks |
| T_{RESET} | Minimum reset pulse width during normal operation | 10 | | | ms |

Figure 32: Reset Timing



7.5.3 MDC/MDIO Management Interface Timing

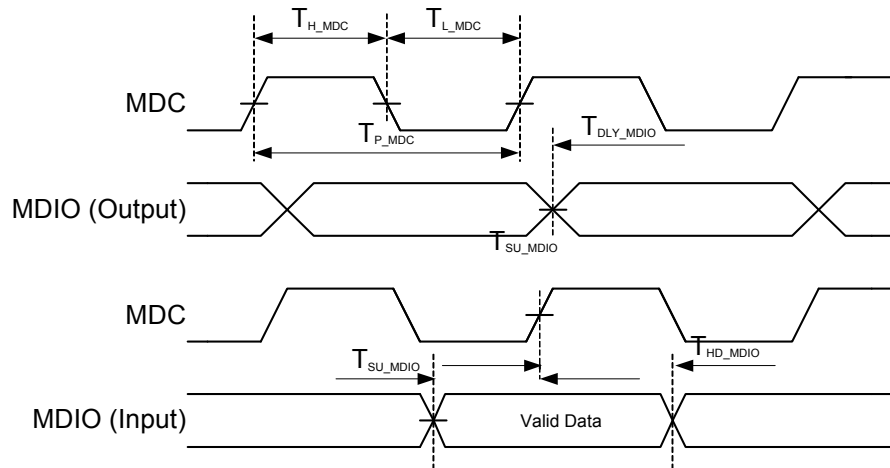
Table 407: MDC/MDIO Management Interface Timing

(Over full range of values listed in the Recommended Operating Conditions unless otherwise specified)

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|-----------------|--|----------------------------|---------------------|-----|-----|-------|
| T_{DLY_MDIO} | MDC to MDIO (Output) Delay Time | 25 pf load on MDIO | 3.5 ns + half cycle | | 19 | ns |
| T_{SU_MDIO} | MDIO (Input) to MDC Setup Time | | 6.5 | | | ns |
| T_{HD_MDIO} | MDIO (Input) to MDC Hold Time | | 0.5 | | | ns |
| T_{P_MDC} | MDC Period | Subject to T_{READ_DLY} | 25 ¹ | | | ns |
| T_{H_MDC} | MDC High | | 12 | | | ns |
| T_{L_MDC} | MDC Low | | 12 | | | ns |
| T_{READ_DLY} | Two MDC Period during Read Turnaround. For details, see Section 3.4.2, High-Speed MDC/MDIO Management Interface Protocol , on page 51. | | 80 | | | ns |

1. T_{P_MDC} is minimum of 25 ns for 40 MHz MDC clock support with stretched TA, but 40 ns (25 MHz) with standard TA as per IEEE specification. MDC of 40 MHz is supported only with VDDO supply of 1.8V and above. For lower VDDO, MDC frequency of up to 25 MHz is supported.

Figure 33: MDC/MDIO Management Interface



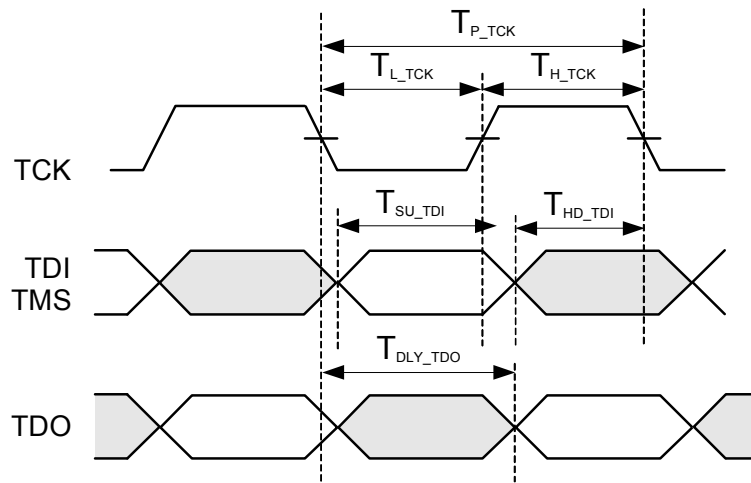
7.5.4 JTAG Timing

Table 408: JTAG Timing

(Over full range of values listed in the Recommended Operating Conditions unless otherwise specified)

| Symbol | Parameter | Min | Typ | Max | Units |
|----------------|----------------------------|-----|-----|-----|-------|
| T_{P_TCK} | TCK Period | 60 | | | ns |
| T_{H_TCK} | TCK High | 12 | | | ns |
| T_{L_TCK} | TCK Low | 12 | | | ns |
| T_{SU_TDI} | TDI, TMS to TCK Setup Time | 10 | | | ns |
| T_{HD_TDI} | TDI, TMS to TCK Hold Time | 10 | | | ns |
| T_{DLY_TDO} | TCK to TDO Delay | 0 | | 15 | ns |

Figure 34: JTAG Timing



7.5.5 Two-wire Serial Interface (Master) Timing

Table 409: Two-wire Serial Interface (Master) Timing

(Over full range of values listed in the Recommended Operating Conditions unless otherwise specified)

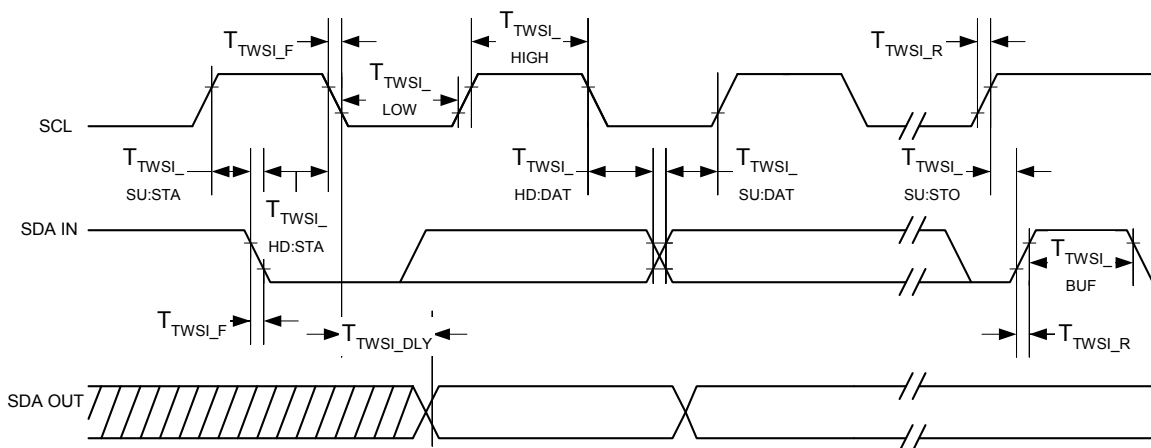
| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|--------------------|---|-----------|------|-----|------|-------|
| F_{TWSI_SCL} | SSCL Clock Frequency | 100 kHz | 100 | | 400 | kHz |
| T_{TWSI_NS} | Noise Suppression Time at SSDA Inputs | 100 kHz | | | 80 | ns |
| T_{TWSI_R} | SSCL/SSDA Rise time | 100 kHz | | | 1000 | ns |
| T_{TWSI_F} | SSCL/SSDA Fall Time | 100 kHz | | | 300 | ns |
| T_{TWSI_HIGH} | Clock High Period | 100 kHz | 4000 | | | ns |
| T_{TWSI_LOW} | Clock Low Period | 100 kHz | 4700 | | | ns |
| $T_{TWSI_SU:STA}$ | Start Condition Setup Time (for a Repeated Start Condition) | 100 kHz | 4700 | | | ns |
| $T_{TWSI_HD:STA}$ | Start Condition Hold Time | 100 kHz | 4000 | | | ns |
| $T_{TWSI_SU:STO}$ | Stop Condition Setup Time | 100 kHz | 4000 | | | ns |
| $T_{TWSI_SU:DAT}$ | Data in Setup Time | 100 kHz | 250 | | | ns |
| $T_{TWSI_HD:DAT}$ | Data in Hold Time | 100 kHz | 300 | | | ns |
| T_{TWSI_BUF} | Bus Free Time | 100 kHz | 4700 | | | ns |
| T_{TWSI_DLY} | SSCL Low to SSDA Data Out Valid | 100 kHz | 40 | | 200 | ns |



Note

SSCL clock stretching is not supported.

Figure 35: TWSI Master Timing

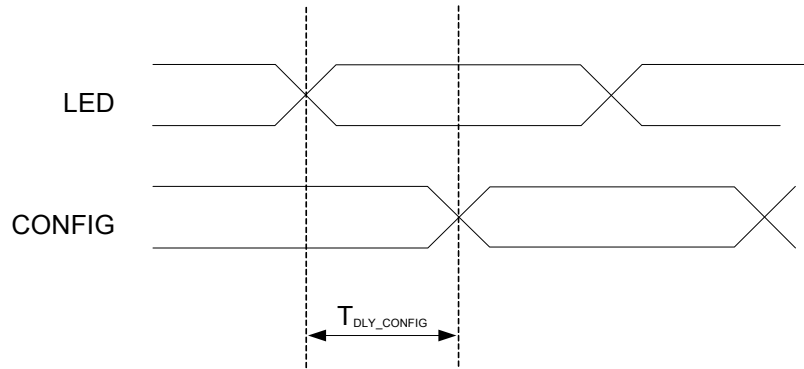


7.5.6 LED to CONFIG Timing

Table 410: LED to CONFIG Timing

| Symbol | Parameter | Min | Typ | Max | Units |
|-------------------|---------------------|-----|-----|-----|-------|
| T_{DLY_CONFIG} | LED to CONFIG Delay | 0 | | 25 | ns |

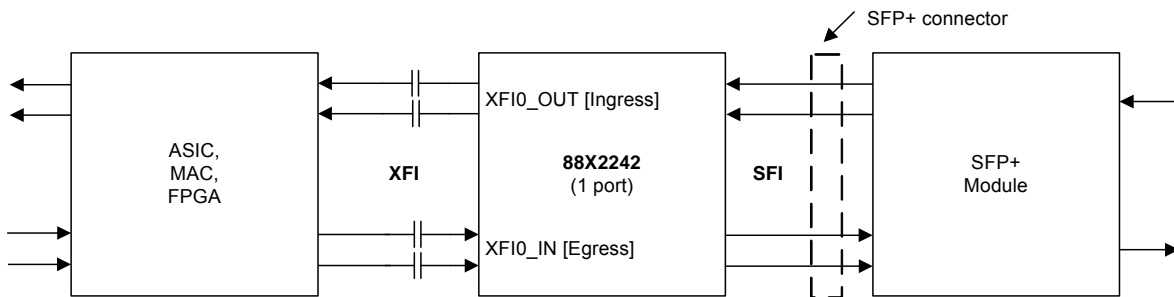
Figure 36: LED to CONFIG Timing



7.6 XFI

7.6.1 XFI Application Reference Model

Figure 37: XFI Application Reference Model



The high-speed 10G serial electrical module interface includes XFI0_OUTP/N and XFI0_INP/N pins. All high-speed SFI I/Os should be AC-coupled.

7.6.2 XFI Output (XFI[3:0]_OUT) Specifications

The specifications shown in [Table 411](#) and [Table 412](#) are at 10.3125G at the output of the chip measured with a minimal loss channel terminated into $2 \times 50\Omega$ through AC coupling.

Table 411: XFI[3:0]_OUT Electrical Specifications

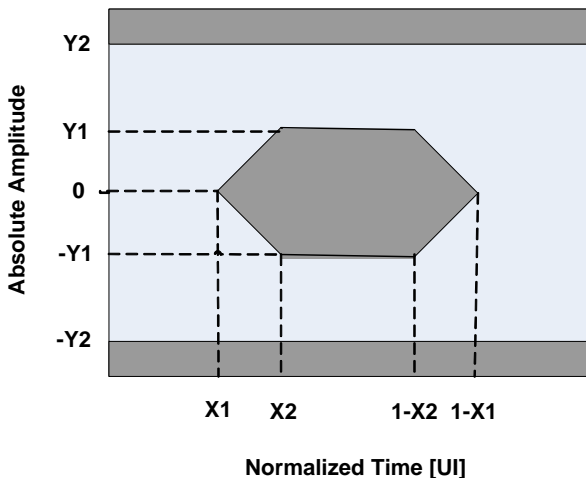
| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|------------------|--|---------------------------|-------------------|-----|-------------------|----------|
| V_{diff} | Differential Output Voltage | | Note ¹ | | Note ¹ | |
| ΔZ_M | Termination Mismatch | See INF-8077i section 3.6 | | | 5 | % |
| | Output AC Common Mode Voltage | See INF-8077i section 3.6 | | | 15 | mV (RMS) |
| t_{RH}, t_{FH} | Output Rise and Fall times [20% to 80%] | Note ² | 24 | | | ps |
| SDD22 | Differential Output Reflection Coefficient | 0.05 - 0.1 GHz | 20 | | | dB |
| | | 0.1 - 7.5 GHz | 10 | | | |
| SCC22 | Common Mode Output Reflection Coefficient | 0.1 - 15 GHz | 6 | | | dB |

1. Differential output voltage shall meet the Y1 and Y2 eye mask values in [Table 412](#)
2. The eye mask limits the maximum output rise and fall times.

Table 412: XFI[3:0]_OUT Jitter Specifications

| Symbol | Parameter | Condition | Min | Typ | Max | Units | |
|--------|----------------------|---------------------------|-----|-----|------|-----------|----|
| DJ | Deterministic Jitter | See INF-8077i section 3.6 | | | 0.15 | UI_{pp} | |
| TJ | Total Jitter | | | | 0.30 | UI_{pp} | |
| X1 | Eye Mask | See INF-8077i section 3.6 | | | 0.15 | UI | |
| X2 | | | | | 0.40 | UI | |
| Y1 | | | 180 | | | mV | |
| Y2 | | | | | | 385 | mV |
| | | | | | | | |
| | | | | | | | |

Figure 38: XFI[3:0]_OUT Differential Output Compliance Mask



7.6.3 XFI[3:0]_OUT 1GE Specifications

All voltage and jitter specifications at 1.25G are identical to the specifications at 10.3125G. Jitter and mask parameters scale with data rate (same UI values).

7.6.4 XFI Receiver (XFI[3:0]_IN) Input Specifications

The specifications shown in [Table 413](#) and [Table 414](#) are at 10.3125G at the input of the chip measured with a minimal loss channel from a test equipment of $2 \times 50\Omega$ impedance through AC coupling.



Note

XFI receiver specifications are generally based on datacom applications for FC-PI-3, point D. Point D sinusoidal jitter tolerance specifications account for the peaking impairments of a CDR in an XFP module. However, the 88X2242 device's receiver is located at the same point in a system where FC-PI-3 defines a module to be, which is point B. Since there is no CDR in this path, the sinusoidal jitter tolerance requirements for point B are used.

Table 413: XFI[3:0]_IN Electrical Specifications

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|--|---|----------------|-----|-----|-----|-------------------|
| Input AC Common Mode Voltage Tolerance | See FC-PI-3 section D.5.2 | | | | 15 | mV _{rms} |
| SDD11 | Differential Input Reflection Coefficient | 0.05 - 0.1 GHz | 20 | | | dB |
| | | 0.1 - 7.5 GHz | 10 | | | |
| SCC11 | | 0.1 - 15 GHz | 6 | | | dB |
| SCD11 | Differential to Common Mode Conversion | 0.1 - 15 GHz | 12 | | | dB |

Table 414: XFI[3:0]_IN Jitter and Mask Specifications

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|--------|-----------------------------|---------------------------|-----|-----|------------------|-------|
| TJ | Total Jitter | See INF-8077i section 3.6 | | | 0.65 | UI |
| | Total non-EQJ Jitter | | | | 0.45 | UI |
| SJ | Sinusoidal Jitter Tolerance | | | | See ¹ | |
| X1 | Eye Mask | | | | 0.325 | |
| Y1 | Eye Mask | | 55 | | | |
| Y2 | Eye Mask | | | | 525 | |

1. Sinusoidal jitter tolerance for datacom is given in [Figure 40 on page 268](#).

Figure 39: XFI[3:0]_OUT Differential Channel Input Compliance Mask

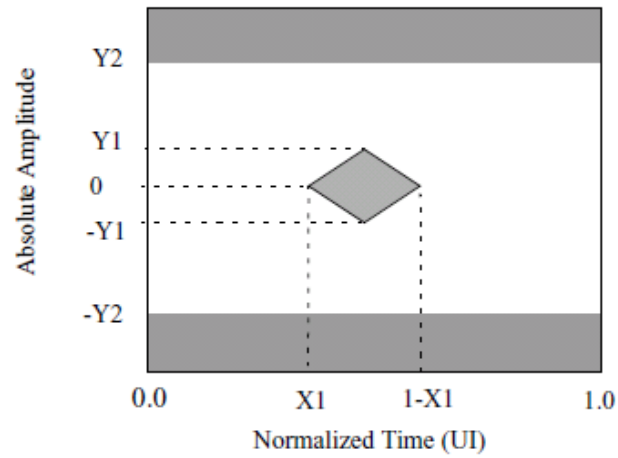
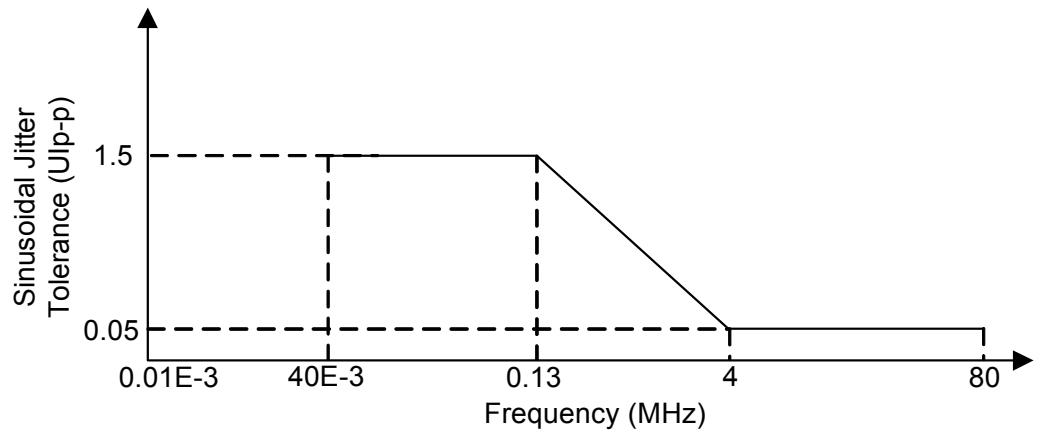


Figure 40: XFI[3:0]_IN Sinusoidal Jitter Tolerance Template at 10.3125G



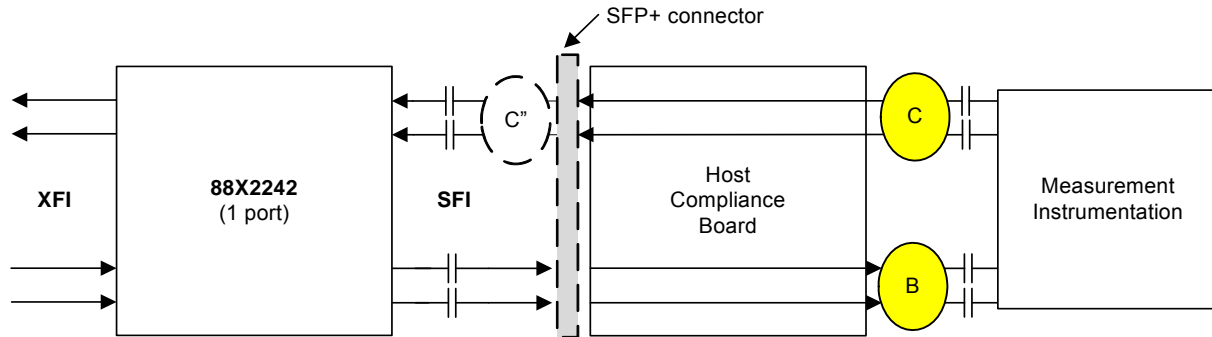
7.6.5 XFI[3:0]_IN 1GE Specifications

All voltage and jitter specifications at 1.25G are identical to the specifications at 10.3125G, except that the maximum input voltage swing that can be tolerated is 850 mV pk-pk. Jitter parameters scale with data rate (same UI values). Sinusoidal jitter tolerance frequencies scale with data rate.

7.7 SFI

7.7.1 SFI Specification Reference Model

Figure 41: SFI Specification Reference Model



The high-speed 10G serial electrical module interface includes SFI0_OUTP/N and SFI0_INP/N pins. All high-speed SFI I/Os should be AC-coupled.

The SFI adheres to the electrical specifications for both limiting and linear interfaces defined in the SFF-8431 Specifications for Enhanced Small Form Factor Pluggable Module “SFP+”. For definitions for test points C”, B, and C, see SFF-8431.

7.7.2 SFI[3:0]_OUT

The full set of 10G parameters and test conditions for output specifications at Test Point B are described in SFF8431 section 3.5.1 and section E.2 for a host channel which applies to the recommendations in Annex A of SFF-8431.

Table 415: SFI[3:0]_OUT Output Electrical Specifications at B

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|--------------|-----------------------------------|--------------------------------------|------|-----|------------------|---------------------|
| S_{EOVR} | Single Ended Output Voltage Range | | -0.3 | | 4.0 | V |
| ΔZ_M | Termination Mismatch | See SFF-8431 section D.16, Figure 55 | | | 5 | % |
| | Output AC Common Mode Voltage | See SFF-8431, D.15 | | | 15 | mV _(RMS) |
| SDD22 | Differential Output S-parameter | 0.01 - 2 GHz | | | -12 | dB |
| | | 2 - 11.1 GHz | | | See ¹ | |
| SCC22 | Common Mode Output S-parameter | 0.01 - 2.5 GHz | | | See ² | dB |
| | | 2.5 - 11.1 GHz | | | -3 | |

1. Reflection coefficient given by equation $SDD22(dB) < -6.68 + 12.1 \times \log_{10}(f/5.5)$, with f in GHz.

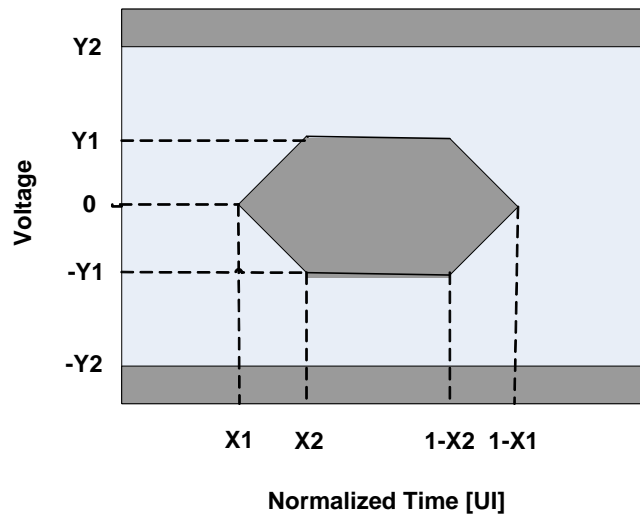
2. Reflection coefficient given by equation $SCC22(dB) < -7 + 1.6 \times f$, with f in GHz.

Table 416: SFI[3:0]_OUT Output Jitter and Eye Mask Specifications at B

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|------------|---|---|-----|------|-------|-------------------|
| T_r, T_f | Crosstalk Source Rise/Fall Time (20% - 80%) | See ¹ SFF-8431, D.6 | | 34 | | ps |
| | Crosstalk Source Amplitude (p-p differential) | See ¹ SFF-8431, D.7 | | 1000 | | mV |
| T_r, T_f | Signal Rise/Fall time (20% - 80%) | See SFF-8431, D.6 | 34 | | | ps |
| TJ | Total Jitter | See SFF-8431, D.5 | | | 0.28 | UI _{pp} |
| DDJ | Data Dependent Jitter | See SFF-8431, D.3 | | | 0.1 | UI _{pp} |
| DDPWS | Data Dependent Pulse Width Shrinkage | | | | 0.055 | UI _{pp} |
| UJ | Uncorrelated Jitter | See SFF-8431, D.4 | | | 0.023 | UI _{rms} |
| Q_{sq} | Transmitter Q_{sq} | See SFF-8431, D8 | 50 | | | |
| Eye Mask | X1 | Mask hit ratio of 5×10^{-5} see SFF-8431, D.2, Figure 42 | | | 0.12 | UI |
| | X2 | | | | 0.33 | UI |
| | Y1 | | 95 | mV | | |
| | Y2 | | 350 | mV | | |
| VMA | Voltage Modulation Amplitude | See SFF-8431, D.7 | 300 | | | mV _{pp} |
| TWDPc | Output TWDP | See ^{2, 3} | | | 10.7 | dBe |

1. Measured at C" with Host Compliance Board and Module Compliance Board pair, see SFF-8431 [Figure 42](#).
2. Electrical output measured with LRM 14 taps FFE and 5 taps DFE Equalizer with PRBS9 for copper direct attached stressor, see SFF-8431 Appendix G.
3. The stressor for TWDPc is given in SFF-8431 Table 34 and is included in the code in SFF-8431 Appendix G.

Figure 42: SFI[3:0]_OUT Output Mask for 10.3125 Gbps Operation



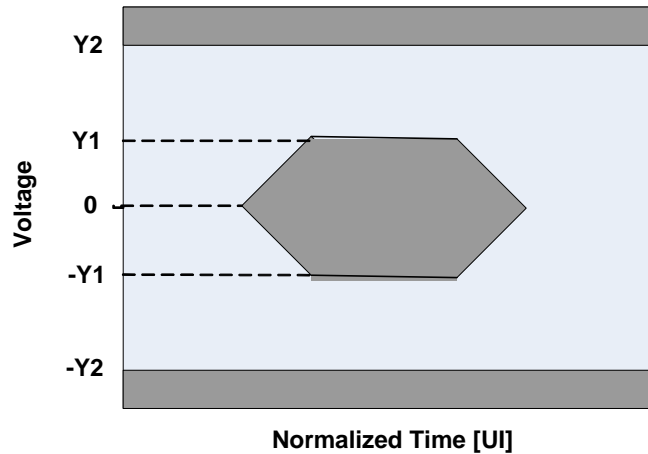
7.7.3 SFI[3:0]_OUT 1GE Specifications

Specifications for 1.25 Gbps are per SFP-8431 section F.2 for the B point and assume the same channel recommendation as in SFF-8431 Annex A. 1G jitter specs at B are per IEEE 802.3 clause 38.5, TP1.

Table 417: SFI[3:0]_OUT Requirements to Support 1.25 Gbps Mode

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|-----------|-----------------------------|--|-----|-----|------|-------|
| V_{out} | SFI Output VMA Differential | | 500 | | | mV |
| DJ | Deterministic Jitter | Assumes the channel recommendations in SFF-8431 Annex A. | | | 0.1 | UI |
| TJ | Total Jitter | | | | 0.24 | UI |
| Eye Mask | Y1 | See SFF-8431, D.2 and Figure 43 | 150 | | | mV |
| | Y2 | | 500 | | | mV |

Figure 43: SFI[3:0]_OUT Output Mask for 1.25 Gbps Operation



7.7.4 SFI[3:0]_IN

The full set of 10G parameters and test conditions for Test Point C are described in SFF-8431 sections 3.5.2 and E.3 with channels per the SFP channel specs SFF-8431 section A. This includes both linear and limiting.

Table 418: SFI[3:0]_IN Input Electrical Specifications at C

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|--------|--|------------------------------------|------|-----|-----|------------|
| | Single Ended Input Voltage | Referenced to V_{eeR} | -0.3 | | 4.0 | V |
| | Input AC Common Mode Voltage Tolerance | See ¹ and SFF-8431 D.15 | 7.5 | | | mV_{rms} |
| | Damage Threshold (p-p differential) | See ¹ | 2000 | | | mV |

Table 418: SFI[3:0]_IN Input Electrical Specifications at C (Continued)

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|--------|--|-----------------|-----|-----|------------------|-------|
| SDD11 | Differential Input S-parameter | 0.01 to 2 GHz | | | -12 | dB |
| | | 2 to 11.1 GHz | | | See ² | |
| SCD11 | Reflected Differential to Common Mode Conversion | 0.1 to 11.1 GHz | | | -10 | dB |

1. Measured at C” with the Module Compliance Board.
2. Reflection Coefficient given by equation $SDD11(dB) < -6.68 + 12.1 \times \log_{10}(f/5.5)$, with f in GHz.

Table 419: SFI[3:0]_IN Supporting Limiting Module Input Compliance Test Signal Calibrated at C”

| Symbol | Parameter | Condition | Min | Target | Max | Units |
|---------------------------------|--|---|-----|--------|-----|-------------------|
| T _r , T _f | Crosstalk Source Rise/Fall time (20%-80%) | SFF-8431, D.6 | | 34 | | ps |
| | Crosstalk Source Amplitude (p-p differential) | See ¹ | | 700 | | mV |
| | AC Common Mode Voltage | See ² and SFF-8431, D.15 | | | 7.5 | mV _{rms} |
| J2 | 99% Jitter | See ³ and SFF-8431, D.5, D.11 | | 0.42 | | UI _{pp} |
| TJ | Total Jitter | BER 1×10^{-12} , See SFF-8431 D.5, D11 | | 0.70 | | UI _{pp} |
| DDPWS | Pulse Width Shrinkage Jitter | See ⁴ and SFF-8431, D.3 | | 0.3 | | UI _{pp} |
| X1 | Eye Mask | Mask hit ratio of 1×10^{-12} , see SFF-8431 D.2, D11 and Figure 44 | | 0.35 | | UI |
| Y1 | Eye Mask Amplitude Sensitivity ^{5, 8} | | | 150 | | mV |
| Y2 | Eye Mask Amplitude Overload ^{6, 7, 8} | | | 425 | | mV |

1. Measured at B” with host Compliance Board and Module Compliance Board pair, see SFF-8431 Figure 16.
2. The tester is not expected to generate this common mode voltage however its output must not exceed this value.
3. Includes sinusoidal jitter, per SFF-8431 figure 21, when measured with the reference PLL specified by the relevant IEEE standard.
4. In practice the test implementer may trade DDPWS with other pulse width shrinkage from the sinusoidal interferer.
5. Eye mask amplitude sensitivity tests the host receiver with the minimum eye opening expected at the input within the constraint set by Y2.
6. Eye mask amplitude overload test the host receiver tolerance to the largest peak signal levels expected at the input within the constraint set by Y1.
7. It is not expected that module Rx output will exhibit both maximum peak level and minimum eye opening.
8. Sensitivity and overload are tested separately, see SFF-8431 D.11.

Figure 44: SFI[3:0]_IN Input Compliance Mask at C” Supporting Limiting Module

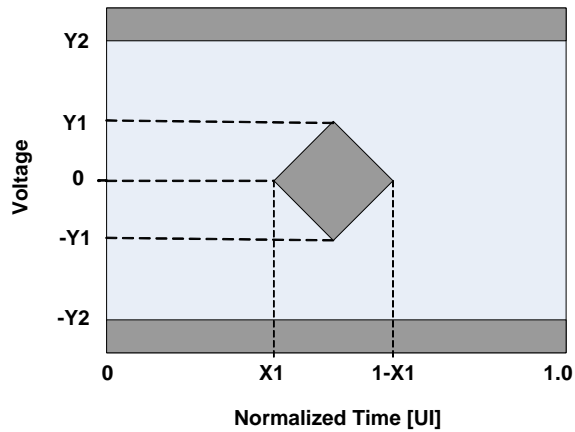


Table 420: SFI[3:0]_IN Linear Passive Copper Module Compliance Test Signal Calibrated at C”

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|------------|---|-------------------------------------|-----|-----|-----|-------------------|
| T_r, T_f | Crosstalk Source Rise/Fall time (20%-80%) | See ¹ , SFF-8431, D.6 | | 34 | | ps |
| | Crosstalk Source Amplitude (p-p differential) | See ¹ | | 700 | | mV |
| | AC Common Mode Voltage | See ² and SFF-8431, D.15 | | | 7.5 | mV _{rms} |
| VMA | Differential Voltage Modulation Amplitude | For LRM see ³ | 180 | | 600 | mV |
| | Differential Voltage Modulation Amplitude | For SR and LR see ³ | 150 | | 600 | mV |

1. Measured at B” with host Compliance Board and Module Compliance Board pair, see SFF-8431 Figure 16.
2. The tester is not expected to generate this common mode voltage however its output must not exceed this value.
3. Peak levels of received signals in service may exceed their VMA due to overshoot of the far end transmitter and/or the module receiver.

Table 421: SFI[3:0]_IN Linear Optical Module Compliance Test Signal Calibrated at C”

| Symbol | Applications | Compliance Stress Test Conditions, see ¹ and ² SFF-8431 D.13 | Target WDP (dBo) | Target RN, (rms) | | WDPI (dBo) |
|--------|--------------|--|-------------------------------|------------------|--------|------------|
| | | | | m | b | |
| WDP | LRM | High WDP & precursor stressor | Approx. 5.1, see ³ | 0.014 | 0.0477 | 4.1 |
| | | High WDP & split symmetric stressor | 5.4 | 8 | | 3.9 |
| | | High WDP & post cursor stressor | Approx. 5.2, see ³ | | | 4.2 |
| | | Low WDP & precursor stressor | Approx. 4.7, see ⁴ | | | 4.1 |
| | | Low WDP & split symmetric stressor | Approx 4.7, see ⁴ | | | 3.9 |
| | | Low WDP & post cursor stressor | Approx. 4.8, see ³ | | | 4.2 |
| | LR | Low WDP | Approx. 2.6, see ⁴ | -0.02 | 0.096 | 1.9 |

1. Target WDP is calibrated with a reference receiver with 14 T/2 spaced FFE taps and 5 T spaced DFE taps.
2. Target RN rms values are given by the following equation: $RN=m \times (WDP-WDPI)+b$, where WDP is the actual value of the tester, and WDPI values are based on wave shapes expected at TP3.
3. The filter bandwidth in the TP3 to electrical adaptor in SFF-8431 figure 52 is set to produce 5.4 dBo for WDP for the split-symmetrical TP3 stressor. The same filter is to be used for high WDP pre-cursor LRM stressors – their approximate target WDP values are given only for guidance. WDP is to be measured for each stressor, and target RN is determined by the relevant equation in note 2.
4. The filter bandwidth in TP3 to electrical adaptor in SFF-8431 Figure 52 is set to 7.5 GHz for all three LRM low WDP conditions and for LR condition. The approximate target WDP values are given for guidance. WDP is to be measured for each stressor, and target RN is determined by relevant equation in note 2.

For LR, the SFP+ linear host shall operate with sinusoidal jitter given by Figure 12 in SFF-8431, while the stress conditions given in Table 421 are applied. For LRM, the host shall operate with sinusoidal jitter as defined in IEEE802.3 clause 68, with the other stressors and noises in SFF-8431, Figure 52 turned off, including those in the TP3 tester.

Table 422: SFI[3:0]_IN Linear Passive Copper Compliance Test Signal Calibrated at C”

| Symbol | Parameter | Condition | Min | Typ Target | Max | Units |
|-----------------|--|--------------------------------------|-----|------------|------|-------------------|
| WDPc | Waveform Distortion Penalty of the ISI Generator | See ^{1, 2} | | 9.3 | | dBe |
| Q _{sq} | Transmitter Q _{sq} | See ^{3, 4} | | 63.1 | | |
| N _o | Post channel fixed noise source | See ⁵ | | 2.14 | | mV _{rms} |
| VMA | Differential Voltage Modulation Amplitude | See ³ | | 180 | | mV |
| | Differential Peak-Peak Voltage Overload | | | 700 | | mV |
| | Input AC Common Mode Voltage | See ⁶ and SFF-8431 D.15.2 | | | 13.5 | mV _{rms} |

1. Copper stressor as defined in SFF-8431 table 36. WDPc is measured with reference receiver with 14 FFE tabs and with 5 DFE taps, see SFF-8431 Appendix G.
2. WDPc for the stress is smaller than the transmitter TWDPc due the VMA loss in the host stressor.
3. Square patterns with eight ONEs and eight ZEROs.

4. $Q_{sq} = 1/RN$ if the one level and zero level noises are identical and see SFF-8431 D.8. Q_{sq} is calibrated at the output of the MCB in a 12 GHz bandwidth with the ISI of the channel model in SFF-8431 figure 61 disabled. The source for N_o should be disabled during this calibration.
5. N_o is the rms voltage measured over one symbol period at the output of the MCB in a 12 GHz bandwidth. The source for Q_{sq} should be disabled during this calibration.
6. AC common mode target value is achieved by adjusting relative delay of the P and N signals.

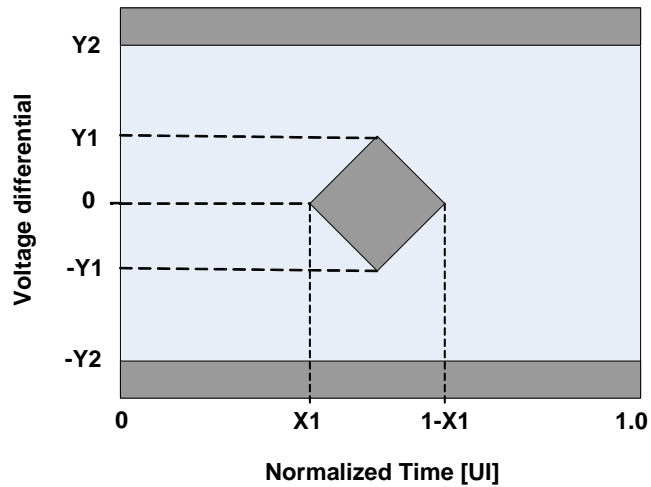
7.7.5 SFI[3:0]_IN 1GE Specifications

1G voltage and jitter specifications are given in [Table 423](#) and [Figure 45](#). 1G jitter specs at C are per IEEE 802.3 clause 38.5, TP4.

Table 423: SFI[3:0]_IN Input Specifications at 1.25 Gbps at Point C

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|----------|----------------------------|--|-----|-----|------|-------|
| V_{IN} | SFI Input VMA Differential | | 370 | | | mV |
| DJ | DJ Jitter | Assumes channel recommendations in SFF-8431 Annex A. | | | 0.46 | UI |
| TJ | Total Jitter | | | | 0.75 | UI |
| Eye Mask | Y1 | See SFF-8431 D.2 and Figure 45 | 125 | | | mV |
| | Y2 | | 600 | | | mV |

Figure 45: SFI0_IN Input Mask for 1.25 Gbps Operation



7.8 Reference Clock

Table 424: Reference Clock

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|------------|-----------------|------------------------|----------|--------|----------|-------|
| Fclk | Frequency | REF_CLK is 156.25 MHz. | -100 ppm | 156.25 | +100 ppm | MHz |
| t_r, t_f | Rise, fall time | 20%-80% of swing | 0.3 | 0.5 | 0.8 | ns |
| V_{ppd} | Amplitude | Differential pk-pk | 0.4 | 0.8 | 1.6 | V |

Table 424: Reference Clock (Continued)

| Symbol | Parameter | Condition | Min | Typ | Max | Units |
|--------|----------------------|----------------------------|------|------|--------------|----------|
| Vin | Input Voltage Limits | Single-ended | 0.0 | | AVDD15 | V |
| Tduty | Duty cycle | | 0.45 | 0.5 | 0.55 | |
| Tjit | Jitter | Integrated from 1-30 MHz | | | 0.5 | ps, rms |
| Zin | Input Impedance | Differential | 90 | 100 | 110 | Ω |
| Vicm | Input CM | CLK can be DC coupled | 0.1 | 0.85 | AVDD15 - 0.1 | V |
| SDD11 | Input Return Loss | Differential, 100 Ω | | | -12 | db |

Figure 46: Reference Clock Input Waveform

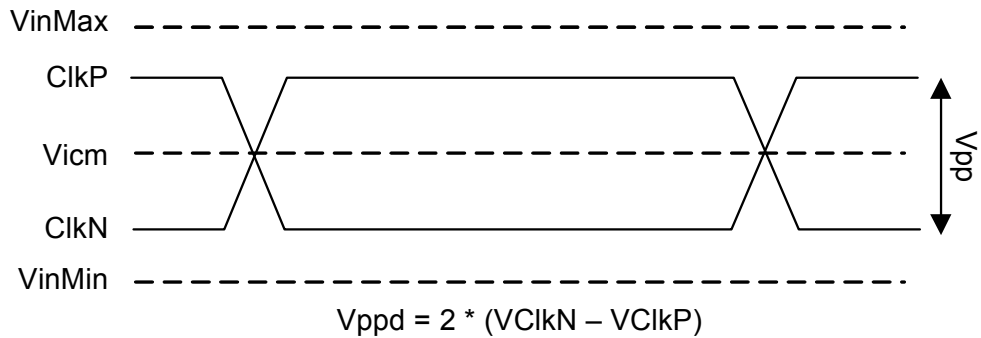
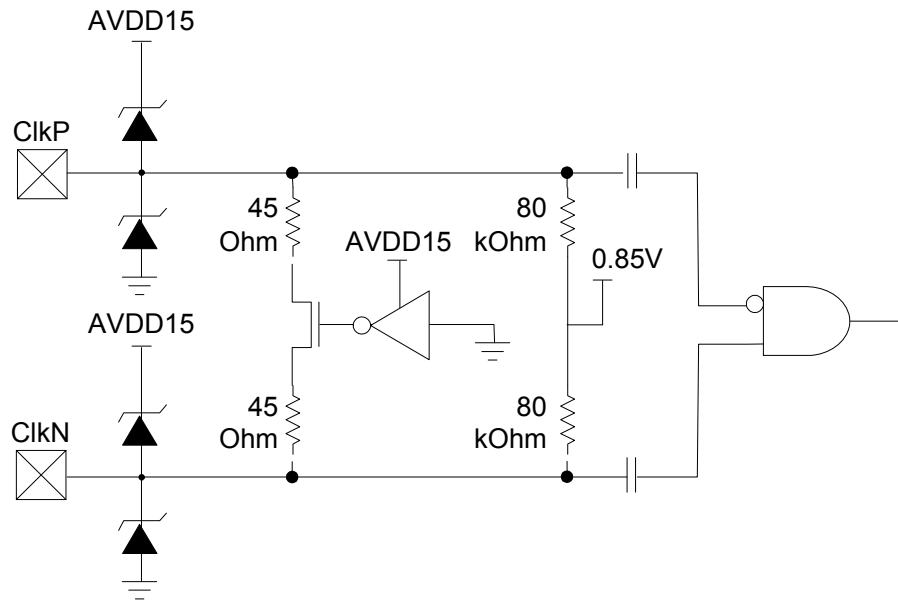


Figure 47: Simplified Reference Clock Input Schematics



7.9 Latency

The latency is calculated from the tables below by summing the various components.

$$\text{Total Egress Latency} = T_{\text{EGRESS}} + T_{\text{FEC_TX}}$$

$$\text{Total Ingress Latency} = T_{\text{INGRESS}} + T_{\text{SF1_DSP}} + T_{\text{FEC_RX}}$$

$$\text{Total Egress Latency} = T_{\text{EGRESS}}$$

$$\text{Total Ingress Latency} = T_{\text{INGRESS}}$$

T_{EGRESS} and T_{INGRESS} are based on the datapath selected.

Table 425: Egress Latency

| Symbol | Parameter | Condition (host, line) | Min | Typ | Max | Units |
|---------------------|---------------------|------------------------|-----|-----|-----|-------|
| T_{EGRESS} | Egress Path Latency | 1000BASE-X, 1000BASE-X | 451 | | 473 | ns |
| | | 10GBASE-R, 10GBASE-R | 160 | | 171 | ns |
| | | XAU1, 10GBASE-R | 243 | | 268 | ns |
| | | RXAU1, 10GBASE-R | 206 | | 227 | ns |
| | | 40GBASE-R4, 40GBASE-R4 | 353 | | 362 | ns |

Table 426: Ingress Latency

| Symbol | Parameter | Condition (host, line) | Min | Typ | Max | Units |
|----------------------|----------------------|------------------------|-----|-----|-----|-------|
| T_{INGRESS} | Ingress Path Latency | 1000BASE-X, 1000BASE-X | 451 | | 473 | ns |
| | | 10GBASE-R, 10GBASE-R | 160 | | 171 | ns |
| | | XAU1, 10GBASE-R | 184 | | 227 | ns |
| | | RXAU1, 10GBASE-R | 161 | | 169 | ns |
| | | 40GBASE-R4, 40GBASE-R4 | 353 | | 362 | ns |

Table 427: Electronic Dispersion Compensation DSP Latency

| Symbol | Parameter | Condition (host, line) | Min | Typ | Max | Units |
|-----------------------|-------------------------|------------------------|-----|-----|-----|-------|
| $T_{\text{SF1_DSP}}$ | Incremental EDC Latency | 10GBASE-R | | | | ns |

Table 428: FEC Latency

| Symbol | Parameter | Condition (host, line) | Min | Typ | Max | Units |
|----------------------|----------------------|--------------------------|-----|-----|-----|-------|
| $T_{\text{FEC_TX}}$ | Transmit FEC Latency | 10GBASE-R and 40GBASE-R4 | | | 13 | ns |
| $T_{\text{FEC_RX}}$ | Receive FEC Latency | 10GBASE-R and 40GBASE-R4 | | | 269 | ns |

8 Mechanical Drawings

Figure 48: 324-Pin FCBGA Package Mechanical Drawings - Top View

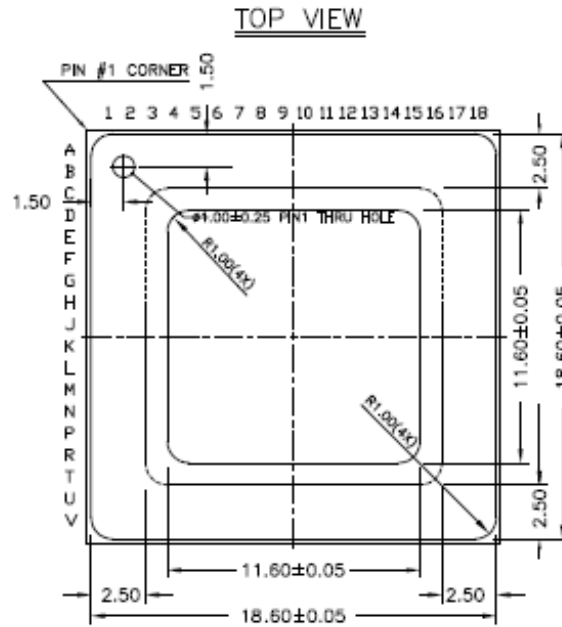


Figure 49: 324-Pin FCBGA Package Mechanical Drawings - Side View

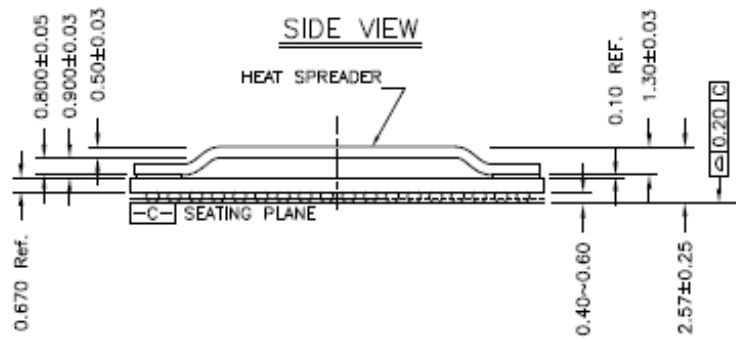
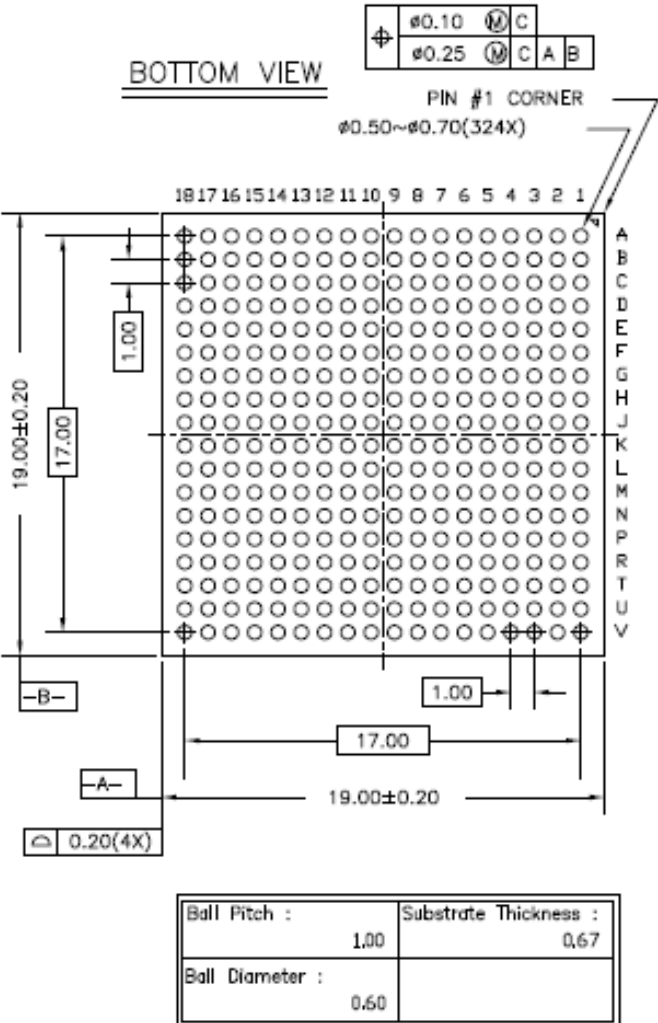


Figure 50: 324-Pin FCBGA Package Mechanical Drawings - Bottom View



9 Part Order Numbering/Package Marking

This section includes information on the following topics:

- [Section 9.1, Part Order Numbering](#)
- [Section 9.2, Package Marking](#)

9.1 Part Order Numbering

Figure 51 shows the part order numbering scheme for the 88X2242 device. Refer to Marvell Field Application Engineers (FAEs) or representatives for further information when ordering parts.

Figure 51: Sample Part Number

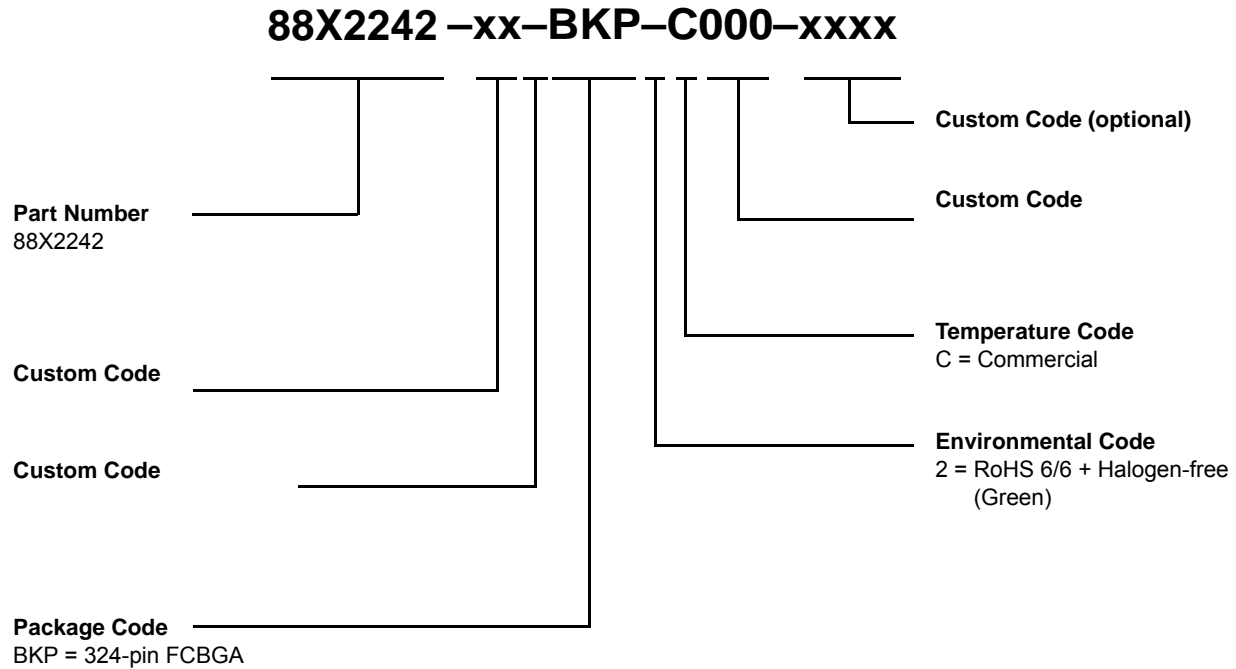


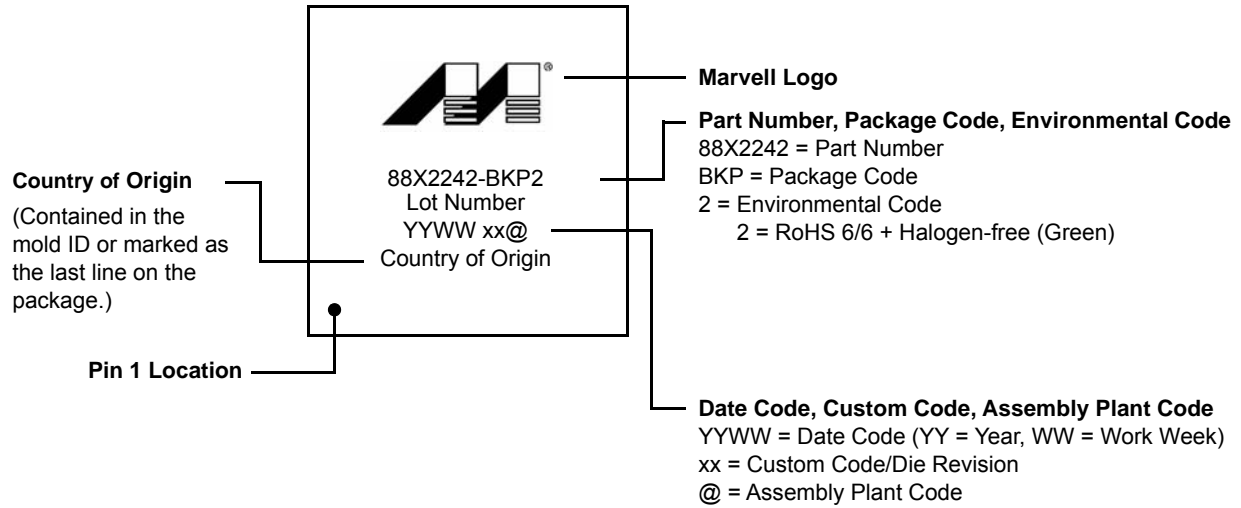
Table 429: 88X2242 Device Part Order Options

| Package Type | Part Order Number |
|-------------------|--|
| Commercial | |
| 324-pin FCBGA | 88X2242-xx-BKP2C000 (Commercial, Green, RoHS 6/6 + Halogen-free compliant package) |

9.2 Package Marking

Figure 52 shows a sample Commercial package marking and pin 1 location for the 88X2242.

Figure 52: Commercial Package Marking and Pin 1 Location



Note: The above drawing is not drawn to scale. Location of markings is approximate.

A Acronyms and Abbreviations

| | |
|-------|------------------------------------|
| API | Application Programming Interface |
| ECC | Error Correction Circuit |
| EDC | Electronic Dispersion Compensation |
| FAE | Field Application Engineer |
| MDIO | Management Data Input/Output |
| PCS | |
| PLL | Phase Lock Loop |
| SFD | Start of Frame Delimiter |
| TAP | Test Access Port |
| TCK | Test Clock Input |
| TDI | Test Data Input |
| TDO | Test Data Output |
| TMS | Test Mode Select |
| TRSTn | Test Reset Input |
| TWSI | Two-Wire Serial Interface |

B Revision History

Table 430: Revision History

| Revision | Date | Section | Detail |
|--------------------------------------|--|--|---|
| Rev. B | May 16, 2018 | All applicable | Cosmetic enhancements |
| | | Chip Level Functional Description | Figure 18: Interrupt Source - Line Port Interrupt Masked Status (Third Level): updated |
| | | Register Description | Table 95: PMA/PMD Devices In Package 1: updated bit [2] |
| | | | Table 120: PCS Devices In Package 1: updated bit [2] |
| | | | Table 167: PCS Devices In Package 1: updated bit [2] |
| | | | Table 246: PCS Devices in Package 1: updated bit [2] |
| | | | Table 265: PCS Devices In Package 1: updated bit [2] |
| | | Table 312: PCS Devices In Package 1: updated bit [2] | |
| | | Mechanical Drawings | Separated Figure 46: 324-Pin FCBGA Package Mechanical Drawings - Top View into Figure 48: 324-Pin FCBGA Package Mechanical Drawings - Top View and Figure 49: 324-Pin FCBGA Package Mechanical Drawings - Side View |
| Part Order Numbering/Package Marking | Changed "HFCBGA" to "FCBGA" in Figure 51: Sample Part Number and Table 429 88X2242 Device Part Order Options | | |
| Acronyms and Abbreviations | New appendix added | | |
| Rev. A | March 9, 2018 | All applicable | Initial release |



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