ISL71026MEVAL1Z

User's Manual: Evaluation Board

High Reliability Space

Rev 0.00   May 2017

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ISL71026MEVAL1Z

Evaluation Board User Guide

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1. Overview

The ISL71026M is a 3.3V CAN transceiver that is compatible with the ISO11898-2 standard for use in Controller Area Network (CAN) serial communication systems. The transceiver performs transmit and receive functions between the CAN controller and the CAN differential bus. It can transmit and receive at bus speeds of up to 1Mbps. It was specifically designed to operate in harsh environments such as space.

The ISL71026MEVAL1Z board was designed to provide a quick and easy method for evaluating the ISL71026M 3.3V CAN transceiver. This device is a unique IC. Using this evaluation board properly requires a thorough knowledge of the operation of the IC. Refer to the ISL71026M datasheet for an understanding of the functions and features of the device.

A picture of the ISL71026MEVAL1Z evaluation board is shown in Figure 5.1 on page 11. The ISL71026MVZ 14 Ld TSSOP IC is soldered onto the evaluation board. It is located in the upper center of the board and is designated as U1.

The transceiver performs transmit and receive functions between the CAN controller and the CAN differential bus. It can transmit and receive at bus speeds of up to 1Mbps. It is designed to operate over a common-mode range of -7V to +12V with a maximum of 120 nodes. The device is capable of withstanding ±20V on the CANH and CANL bus pins.

The part has various configurations of operation. The evaluation board contains standard jumpers, BNC connector, banana connectors, cable connector, and load resistors to allow the user to easily interface with the IC to evaluate its functions, features, and performance.

This user guide will guide the user through the process of configuring and using the evaluation board to evaluate the ISL71026M device.

Figure 1.1 shows the block diagram/pin-out for the part.

1.1 Ordering Information

Part Number	Description
ISL71026MEVAL1Z	ISL71026M Evaluation Board

1.2 Key Features

- D-SUB 9-pin male connector for connection to another CAN evaluation board.
- 60Ω resistor across the differential signal lines to evaluate propagation delay, rise/fall time, and skew parameters.
- Convenient test points and connections for test equipment.
- Jumpers to select between the three rise/fall settings or tie RS high to enter low power listen state.
- Banana jacks for power, ground, and voltage common-mode (VCM) connections.

1.3 Related Literature

- For a full list of related documents, visit our website
  - ISL71026M product page

1.4   Specifications

The evaluation board has been configured and optimized for the following conditions:

• V_{CC} = 3V to 3.6V

• Data rate: ≤1Mbps

• CAN bus termination resistance of 60Ω across the CANH and CANL differential signal lines
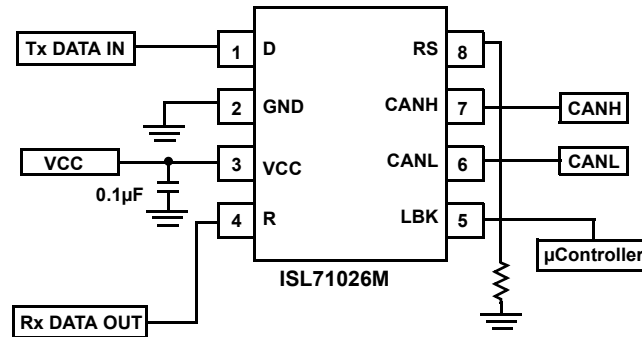
• Board temperature: +25°C

Figure 1.1   ISL71026MEVAL1Z Block Diagram

2.   Functional Description

The ISL71026MEVAL1Z evaluation board provides easy access to the pins of the ISL71026M IC and convenient connectors/test points for connecting test equipment. The schematic, bill of materials, and top silkscreen for the board are available in "PCB Layout Guidelines" on page 11.

"Typical Performance Curves" on page 15 shows performance data taken using the ISL71026MEVAL1Z evaluation board and basic lab equipment.

In the following sections, we will discuss using the evaluation board.

2.1   Basic Layout of Evaluation Board

The basic layout of the evaluation board is described in the following sections. For more information, see "Board Layout" on page 14 or the actual ISL71026MEVAL1Z evaluation board.

Located in the upper center of the board is the IS71026MVZ transceiver IC (U1). The evaluation board has a pin 1 dot, to show how the IC should be oriented onto the evaluation board. The IC pin 1 indicator dot needs to be aligned with the evaluation board pin 1 dot indicator. The board comes with the IC soldered onto the board.

Power for the IC is located at the left side of the board through banana jacks labeled VCC and GND. A DC voltage source of 3.3V must be connected between VCC and GND to power the part. Test points TP13 (VCC) and TP2 (GND) are available to measure the VCC voltage to the part.

Access to the D input to the transceiver is at the BNC connector labeled D at the upper right corner of the evaluation board. You would connect the digital source of the CAN digital test pattern at this connector.

Access to the R output of the transceiver is at the test point labeled TP4 located at the top center of the evaluation board. There is a through hole labeled R that could have a wire soldered to it, if you want to feed the digital output into a CAN controller board.

Control of the RS pin is through jumpers J5, J6, J7, and J8 located at middle left side of the evaluation board. Only one of these jumper locations should have a jumper installed at any one time. Putting the jumper at J5 will put the transceiver in the listen mode. Putting the jumper at J6 will put the transceiver driver in the slow speed mode, at J7 in the medium speed mode, and at J8 in the fast speed mode. Note: J4 and R3 are not populated. They can be used to put a mechanical potentiometer at the RS pin.

Access to the differential pins (CANH and CANL) are through the test points TP7 and TP8 or through the BNC connectors labeled CANH and CANL (not populated) or through the D-SUB 9 pin male connector J1, located at the bottom of the board. Use the J1 connector to connect two evaluation boards together for evaluating the performance of two boards communicating with each other over various length cables. The CANH and CANL BNCs can be used to apply voltages to the differential pins to evaluate the receiver of the transceiver.

The board comes populated with a 60Ω resistor (R9) installed across the CANH and CANL lines. Many performance tests for the transceiver such as propagation delay, rise time, fall time, and skew are done with a 60Ω resistor. In a normal CAN system the bus is terminated at both ends with a 120Ω resistor, which gives a differential loading of 60Ω.

See the board schematic ("Schematic" on page 12) for the reference designators of the jumpers, resistors and connectors associated with each I/O.

2.2   Power Supply

The ISL71026M IC requires a DC power supply in the range of 3.0V to 3.6V for proper operation.

The power supply is connected at banana jacks VCC and GND. The power supply should be capable of delivering 100mA of current.

2.3   Evaluation Board Logic Control

The ISL71026M IC has three logic control input pins; the D (pin 1), RS (pin 8), and LBK (pin 5).

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2.3.1   D Pin

The D pin is the digital input to the driver of the transceiver. A digital bit pattern is applied at this pin. A logic 1 on the D pin puts the CANH and CANL differential pins in the recessive state. A logic 0 on the D pin, puts the CANH and CANL differential pins in the dominant state.

The logic 1 V_{IH} level is from 2.0V to 5.5V with a VCC supply voltage of 3.0V to 3.6V. The logic 0 V_{IL} level is from 0.8V to 0V.

2.3.2   RS Pin

The output driver has three distinct speed selections that may be chosen by using a resistor from the RS pin to GND. Connecting the RS pin directly to GND (Jumper at J6) results in output switching times that are the fastest, limited only by the drive capability of the output stage. RS = 10kΩ (Jumper at J7) provides for a typical slew rate of 8V/μs and RS = 50kΩ (Jumpter at J8) provides for a typical slew rate of 4V/μs.

Putting a high logic level to the RS pin (Jumper at J5) places the transceiver in a low current listen mode.

2.3.3   LBK Pin

When a high level is applied to the LBK pin, the device enters the loop-back state. The transceiver CANH and CANL pins are disconnected from the bus. The driver and receiver circuitry of the transceiver remains active to allow for diagnostic testing of the node. Installing a jumper at position 1 to 2 on jumper J9 of the evaluation board will connect the LBK pin to VCC putting the part in loop-back state. Removing the jumper will put the part back into normal operation. LBK pin of the transceiver has an internal pull-down.

2.4   Test Points

The board has various test points for ease of connecting probes to make measurements. The test points available are described in Table 2.1.

Table 2.1   Test Points

Designator	Description
TP1	Ground test point
TP2	Ground test point
TP3	D input test point
TP4	R output test point
TP5	LBK pin test point
TP6	RS pin test point
TP7	CANH pin test point
TP8	CANL pin test point
TP9	Ground test point
TP10	Not populated - VCM test point
TP11	Ground test point
TP12	Not populated - R output test point
TP13	VCC test point

2.5   Board Component Definitions

| Designator	Description
U1	ISL71026M TSSOP IC
VCC	VCC power supply connection (nominal 3.3V_{DC})
GND	Ground connection
J1	9-pin male D-SUB connector (used to connect to another CAN evaluation board)
J4	Not populated - jumper on RS pin to connect mechanical potentiometer
J5	Jumper on the RS pin to connect it to VCC (a jumper installed at this location will put the transceiver in listen mode).
J6	Jumper on the RS pin to connect the RS pin to ground through a 50kΩ resistor (jumper installed at this location will put the transceiver in slow speed mode).
J7	Jumper on the RS pin to connect the RS pin to ground through a 10kΩ resistor (jumper installed at this location will put the transceiver in medium speed mode).
J8	Jumper on the RS pin to connect the RS pin to ground (jumper installed at this location will put the transceiver in high speed mode).
J9	Three pin jumper on the LBK pin. Install jumper in upper position (1 to 2) to connect the LBK pin to VCC to put the part in loop-back mode. Remove jumper or put the jumper in the lower position (2 to 3) to connect LBK pin to ground for normal operation.
J10	Jumper, location is not populated. It needs to be populated if you are going to use the BNC connector labeled CANH.
J11	Jumper, location is not populated. It needs to be populated if you are going to use the BNC connector labeled CANL.
D	BNC connector. Provides access to the D pin of the transceiver.
CANH	BNC connector, location is not populated. Provides access to the CANH pin for special receiver testing and fault testing.
CANL	BNC connector, location is not populated. Provides access to the CANL pin for special receiver testing and fault testing.
VCM	Banana jack for testing with various common mode voltages (-7V to +12V). For CM testing, R12 and R13 should be populated with 330Ω resistors and TP10 populated to measure VCM voltage.
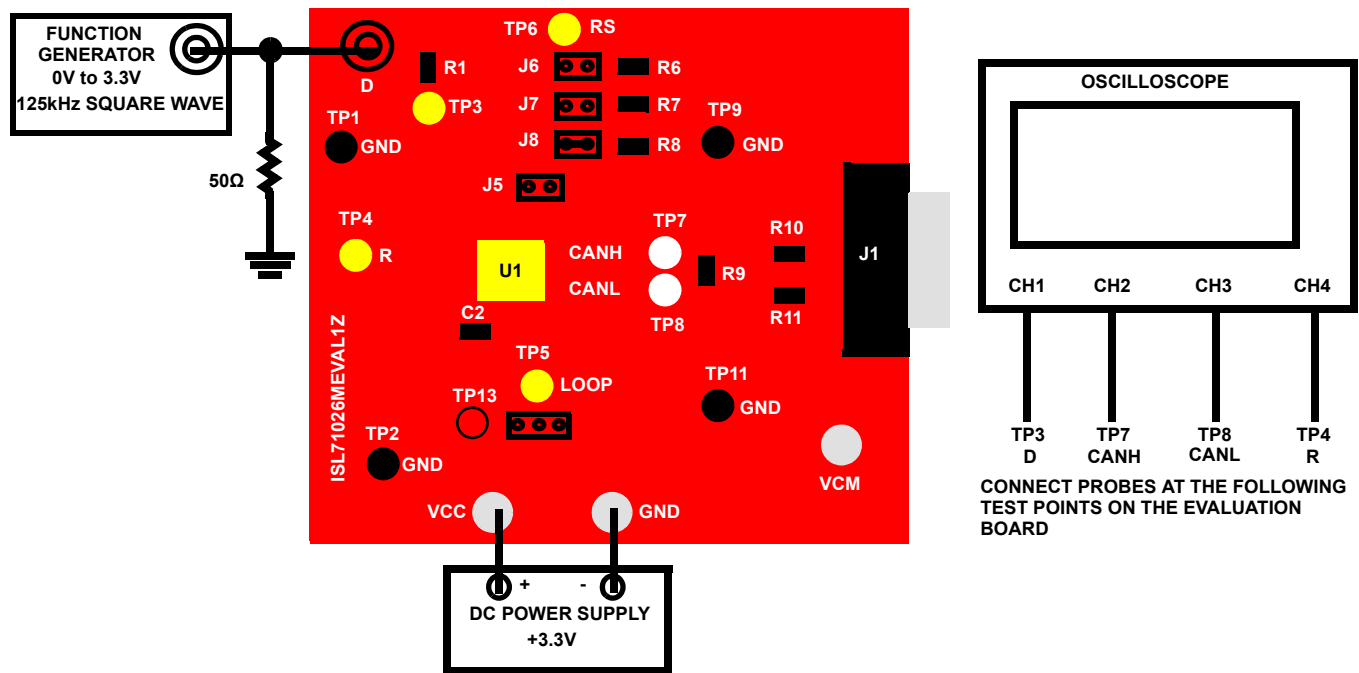
Figure 2.1   Basic Evaluation Test Setup Block Diagram (Measuring Propagation Delay, Skew, and Rise/Fall Time)

3. Using the Board to Measure Propagation Delay, Skew, and Rise/Fall Time

Refer to Figure 2.1 on page 6.

3.1 Lab Equipment

The equipment, external supplies, and signal sources needed to operate the board:

• 3.3V DC power supply

• Function/signal generator (HP 8112A pulse generator or equivalent)

• Four channel oscilloscope (Tektronix TDS5140 digital oscilloscope or equivalent)

3.2 Initial Board Setup Procedure

(1) Attach the main evaluation board to the DC power supply to the banana jacks labeled VCC and GND as shown in Figure 2.1 on page 6. Positive terminal at VCC and negative terminal at GND. The supply should be capable of delivering 3.0V to 3.6V and 100mA of current. Set the supply voltage to 3.3V.

(2) Configure the board for high speed mode by installing a jumper at J8. No jumpers should be installed at J5, J6, J7, and J9.

(3) Connect the oscilloscope to the evaluation board as indicated in Figure 2.1 on page 6.

    (a) Connect the Channel 1 probe to the D pin by connecting the oscilloscope probe at TP3 on the evaluation board and the probe ground at TP1.

    (b) Connect the Channel 2 probe to the CANH differential pin by connecting the oscilloscope probe at TP7 on the evaluation board and the probe ground at TP9.

    (c) Connect the Channel 3 probe to the CANL differential pin by connecting the oscilloscope probe at TP8 on the evaluation board and the probe ground at TP11.

    (d) Connect the Channel 4 probe to the R pin by connecting the oscilloscope probe at TP4 on the evaluation board and the probe ground at TP2.

(4) Connect the function/signal generator at the BNC connector labeled D on the evaluation board as shown in Figure 2.1 on page 6. Set the generator to output a 125kHz square wave, 0V to 3.3V amplitude, 50% duty cycle with a t_{rise} = t_{fall} ≤6ns. Disable the generator output.

(5) Verify that a 60Ω resistor is installed at location R9 on the evaluation board.

3.3 Calculating V$_{DIFF}$ and Taking Measurements

(1) Set the oscilloscope to 2.0µs/division.

(2) Set channel CH1 of the oscilloscope to 5V/division.

(3) Set CH2, CH3, and CH4 of the oscilloscope to 2V/division.

(4) Using the math function of the oscilloscope, set the math 1 selection to measure CH2 - CH3 and display the M1 trace on the oscilloscope screen.
M1 = CH2 - CH3 = V_{DIFF} = VOD = CANH - CANL.

(5) Use the "Measure" menu on the oscilloscope to set up the following four measurements:

    • LOW to HIGH propagation delay (t_{PLH}) to measure the time from the 50% point of the falling edge of CH1 (D pin) to the 900mV point on the rising edge of the M1 trace (V_{DIFF}).

    • HIGH to LOW propagation delay (t_{PHL}) to measure the time from the 50% point of the rising edge of CH1 (D pin) to the 500mV point on the falling edge of M1 trace (V_{DIFF}).

    • Output rise time (t_r) to measure the 10% to 90% time of the rise edge of the M1 trace (V_{DIFF}).

    • Output fall time (t_f) to measure the 90% to 10% time of the falling edge of the M1 trace (V_{DIFF}).

(6) Ensure that a jumper is installed at J8 (selects fast driver edges by connecting the RS pin to ground) and no jumpers are installed at J5, J6, J7, and J9.

(7) Enable the function generator. The scope plots should look like the ones shown in Figure 4.1 on page 9.

(8) In fast speed mode (RS = 0V):
- t_{PLH} should be around 75ns and no greater than 150ns.

- t_{PHL} should be around 80ns and no greater than 155ns.

- t_{rise} should be around 55ns and no less than 20ns or greater than 100ns.

- t_{fall} should be around 25ns and no less than 10ns or greater than 75ns.

(9) Move the jumper from J8 to J7 (selects medium driver edges by connecting the RS pin to ground through a 10kΩ resistor). Note: No jumpers should be installed at J5, J6, J8, and J9.

(10) The scope plot should look like the ones in <u>Figure 4.2 on page 9</u>.

(11) In medium speed mode (RS = 10kΩ):
- t_{PLH} should be around 520ns and no greater than 850ns.

- t_{PHL} should be around 460ns and no greater than 800ns.

- t_r should be around 400ns and no less than 200ns or greater than 780ns.

- t_f should be around 300ns and no less than 175ns or greater than 500ns.

(12) Move the jumper from J7 to J6 (selects slow driver edges by connecting the RS pin to ground through a 50kΩ resistor). Note: No jumpers should be installed at J5, J7, J8, and J9.

(13) The scope plot should look like the ones in <u>Figure 4.3 on page 10</u>.

(14) In slow speed mode (RS = 50kΩ):
- t_{PLH} should be around 850ns and no greater than 1400ns.

- t_{PHL} should be around 725ns and no greater than 1300ns.

- t_r should be around 700ns and no less than 400ns or greater than 1400ns.

- t_f should be around 650ns and no less than 300ns or greater than 1000ns.
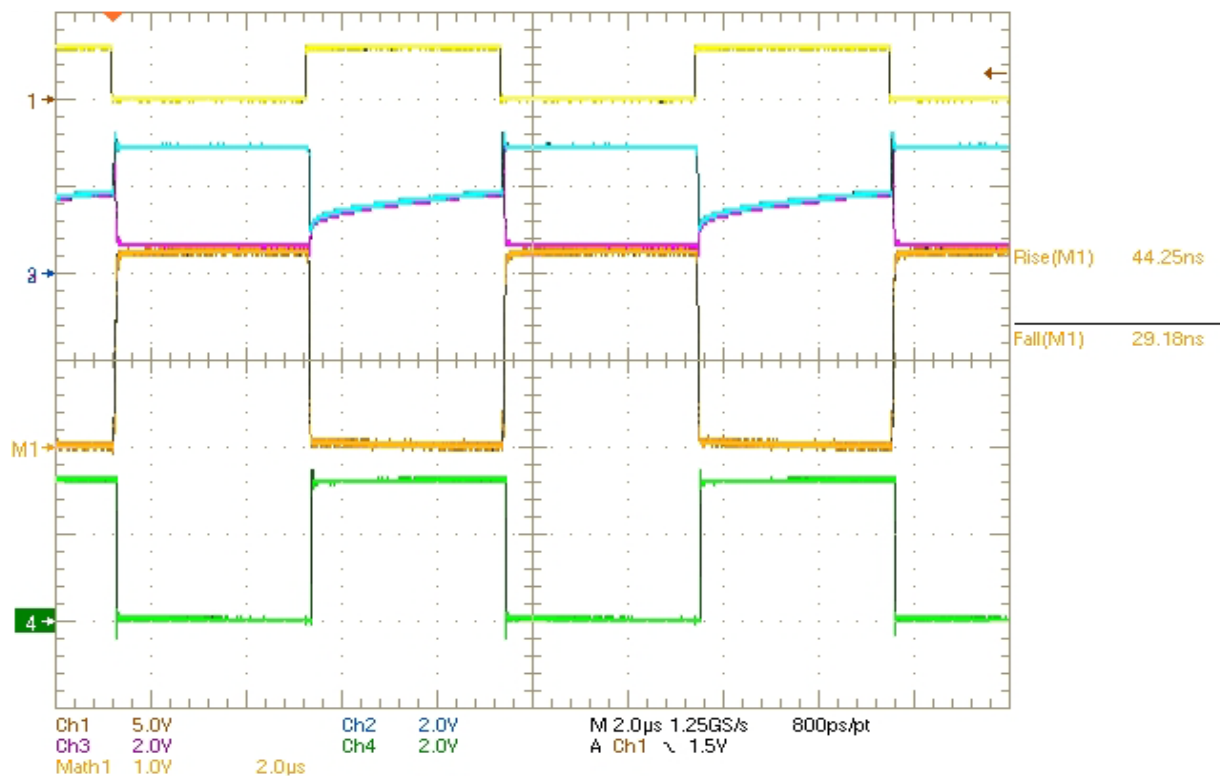
4. Waveforms

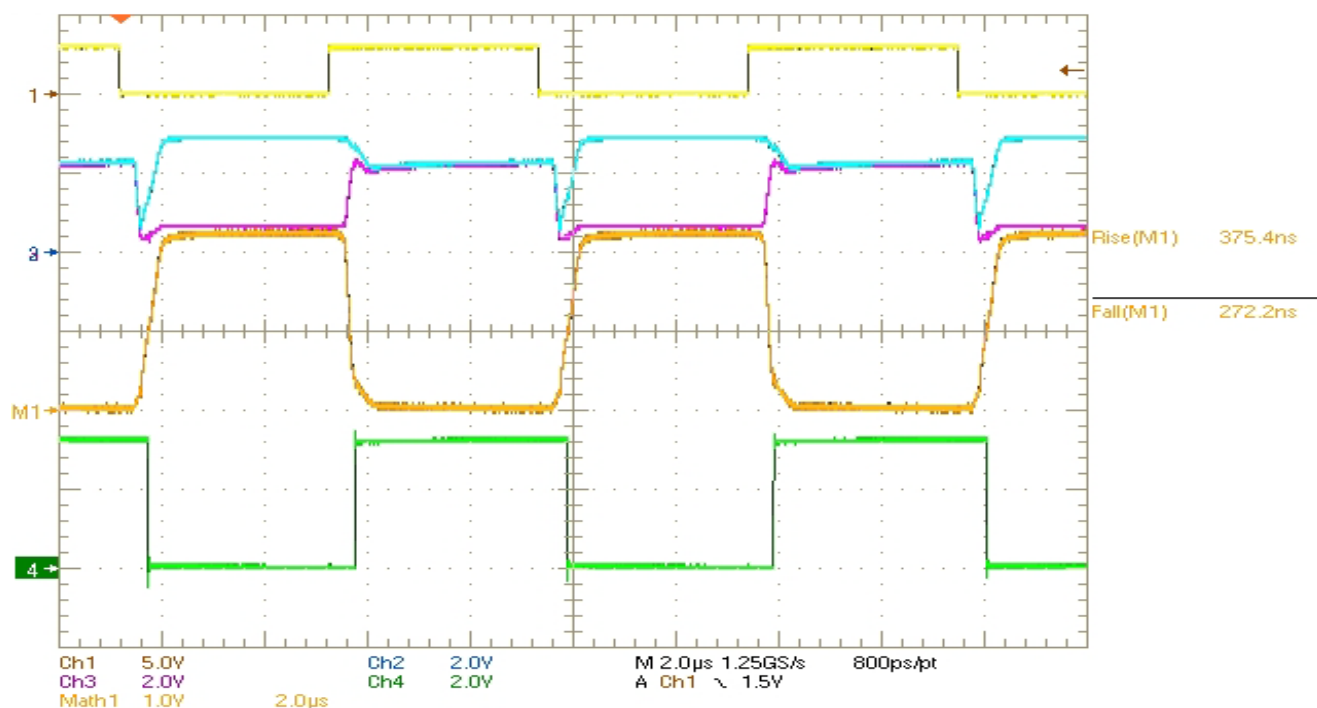**Figure 4.1   Oscilloscope Plot (Fast Speed) Waveforms and Measurements**

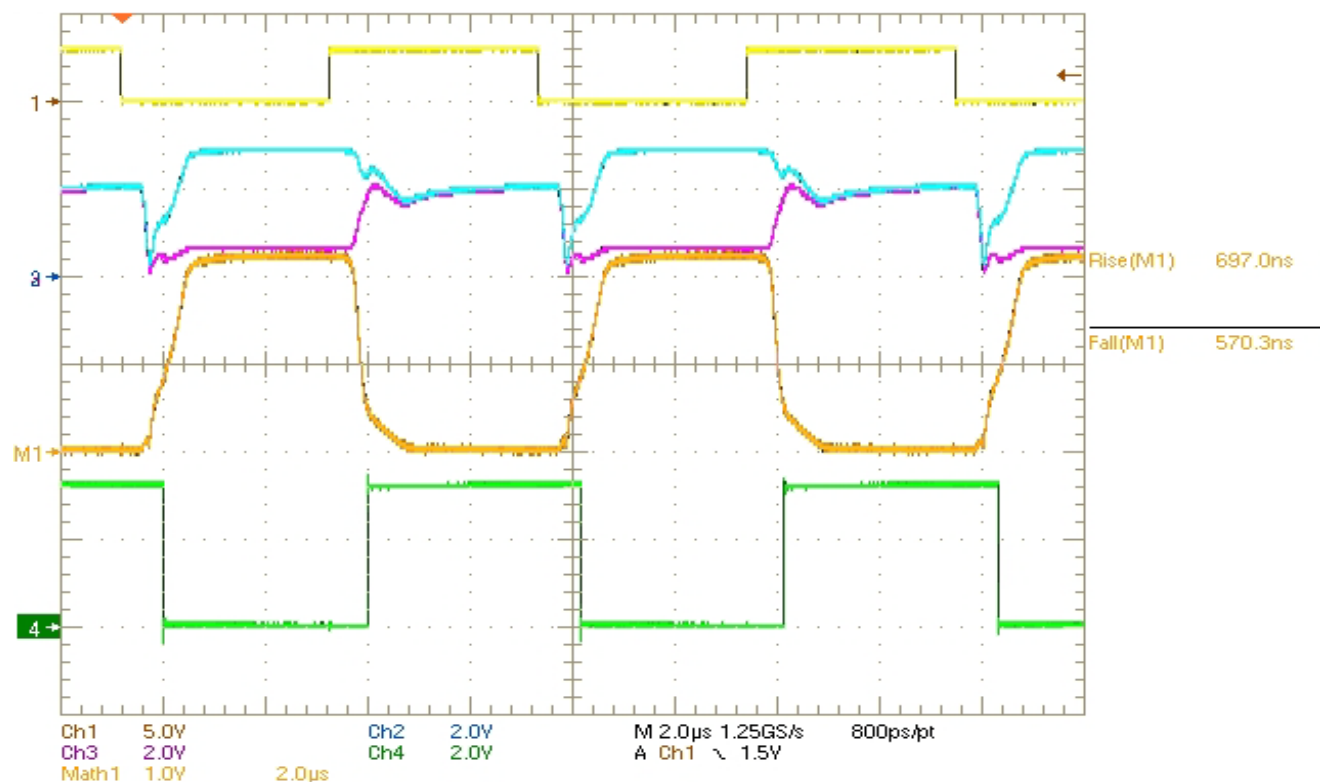**Figure 4.2   Oscilloscope Plot (Medium Speed) Waveforms and Measurements**

Figure 4.3   Oscilloscope Plot (Slow Speed) Waveforms and Measurements

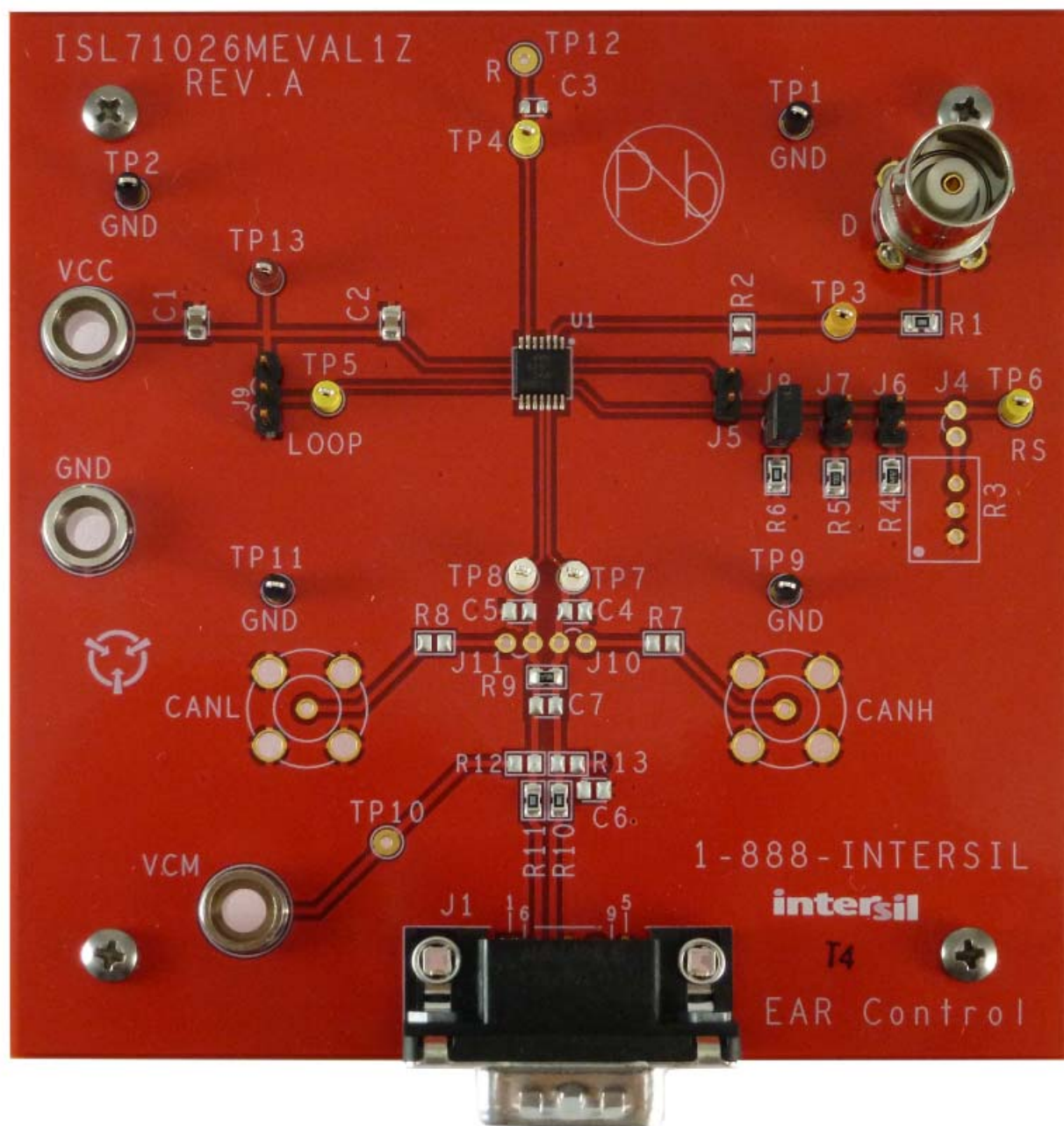# 5.   PCB Layout Guidelines

5.1   Evaluation Board

Figure 5.1   ISL71026MEVAL1Z Evaluation Board

5.2 Schematic

Figure 5.2   ISL71026MEVAL1Z Circuit Schematic

5.3   Bill of Materials

Qty	Units	Reference Designator	Description	Mfr	Manufacturer Part Number
1	ea.	SEE LABEL - RENAME BOARD	PWB-PCB, ISL71026MEVAL1Z, Rev A, ROHS	Imagineering Inc	ISL71026MEVAL1ZREVAPCB
1	ea.	C2	CAP, SMD, 0805, 0.1µF, 50V, 10%, X7R, ROHS	KEMET	C0805C104K5RACTU
1	ea.	C1	CAP, SMD, 0805, 10µF, 25V, 10%, X5R, ROHS	TDK	C2012X5R1E106K
1	ea.	D	CONN - BNC, RECEPTACLE, TH, 4 POST, 50Ω, GOLDCONTACT, ROHS	Amphenol	31-5329-52RFX
1	ea.	TP13	CONN - MINI TEST PT, VERTICAL, RED, ROHS	Keystone	5000
4	ea.	TP1, TP2, TP9, TP11	CONN - MINI TEST PT, VERTICAL, BLK, ROHS	Keystone	5001
2	ea.	TP7, TP8	CONN-MINI TEST PT, VERTICAL, WHITE, ROHS	Keystone	5002
4	ea.	TP3, TP4, TP5, TP6	CONN-MINI TEST PT, VERTICAL, YEL, ROHS	Keystone	5004
1	ea.	J1	9 PIN MALE RIGHT ANGLE D-SUB CONNECTOR	TE Connectivity / AMP	5788792-1
3	ea.	GND, VCC, VCM	CONN - JACK, MINI BANANA, 0.175 PLUG, NICKEL/BRASS, ROHS	Keystone	575-4
1	ea.	U1	CAN BUS PART, 14Ld, TSSOP	Intersil	ISL71026MVZ
1	ea.	J9	CONN - HEADER, 1X3, BREAKAWY 1X36, 2.54mm, ROHS	BERG/FCI	68000-236HLF
4	ea.	J5, J6, J7, J8	CONN - HEADER, 1X2, RETENTIVE, 2.54mm, 0.230X0.120, ROHS	BERG/FCI	69190-202HLF
0	ea.	R2, R7, R8, R12, R13	RESISTOR, SMD, 0805, DNP, TF, ROHS	-	-
4	ea.	R1, R6, R10, R11	RES, SMD, 0805, 0Ω, 1/8W, TF, ROHS	Yageo	RC0805JR-070RL
1	ea.	R5	RES, SMD, 0805, 10kΩ, 1/8W, 1%, TF, ROHS	Venkel	CR0805-8W-1002FT (PbFREE)
1	ea.	R4	RES, SMD, 0805, 49.9kΩ, 1/8W, 1%, TF, ROHS	Panasonic	ERJ-6ENF4992V
1	ea.	R9	RES, SMD, 0805, 60.4Ω, 1/8W, 1%, TF, ROHS	Panasonic	ERJ-6ENF60R4V
4	ea.	Four Corners	SCREW, 4-40X1/4in, PAN, SS, PHILLIPS	-	-
4	ea.	Four Corners	STANDOFF, 4-40X3/4in, F/F, HEX, ALUMINUM, ROHS	Keystone	2204 (.250 OD)
1	ea.	Place assy in bag	BAG, STATIC, 6X8, ZIP LOC, ROHS	ULINE	S-2262
0	ea.	TP10, TP12	CONN - MINI TEST POINT, VERTICAL, ROHS	Keystone	5004
0	ea.	C3, C4, C5, C6, C7	DO NOT POPULATE OR PURCHASE		
0	ea.	J4, J10, J11	DO NOT POPULATE OR PURCHASE		
0	ea.	R3	DO NOT POPULATE OR PURCHASE		
0	ea.	CANH, CANL	DO NOT POPULATE OR PURCHASE		
1	ea.	AFFIX TO BACK OF PCB	LABEL - DATE CODE_LINE 1: YRWK/REV#, LINE 2: BOM NAME	Intersil	LABEL-DATE CODE

5.4   Board Layout
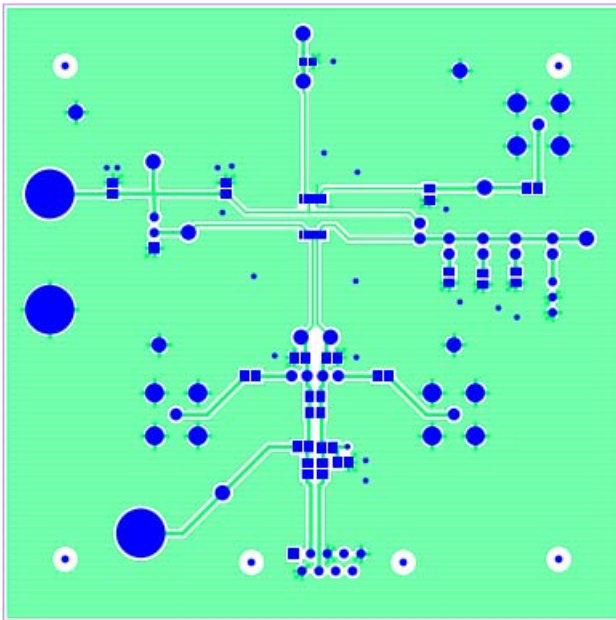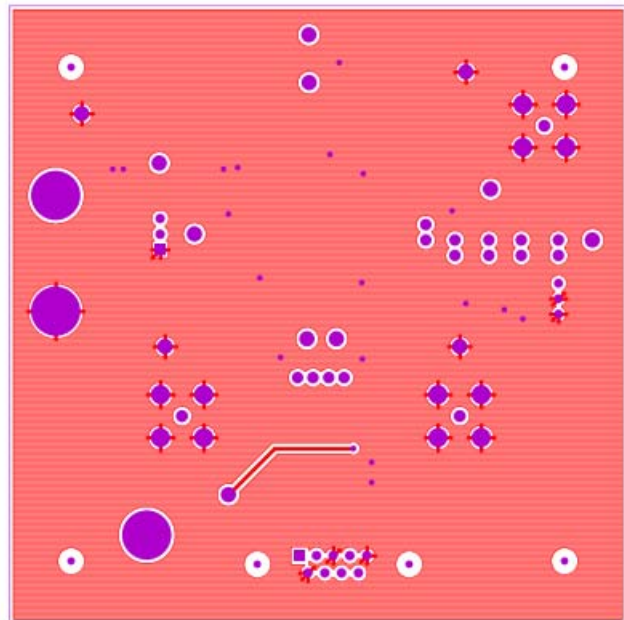

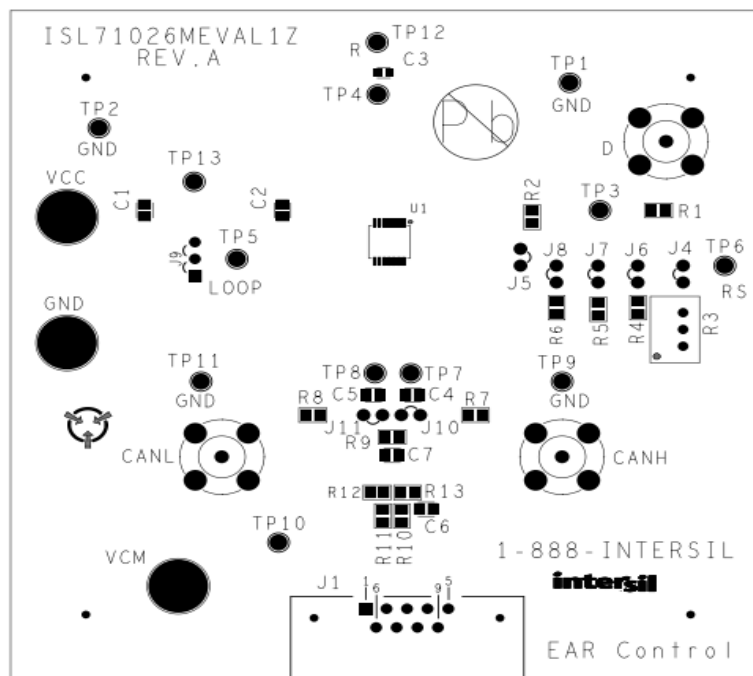**Figure 5.3   Top Layer**

Figure 5.4   Bottom Layer

Figure 5.5   Top Layer Silk Screen

6.   Typical Performance Curves

Unless noted: VCC = 3.3V, D = 125kHz, Square Wave, 0 to VCC, 50% Duty Cycle, $t_r = t_f \leq 6ns$, $T_A = +25°C$
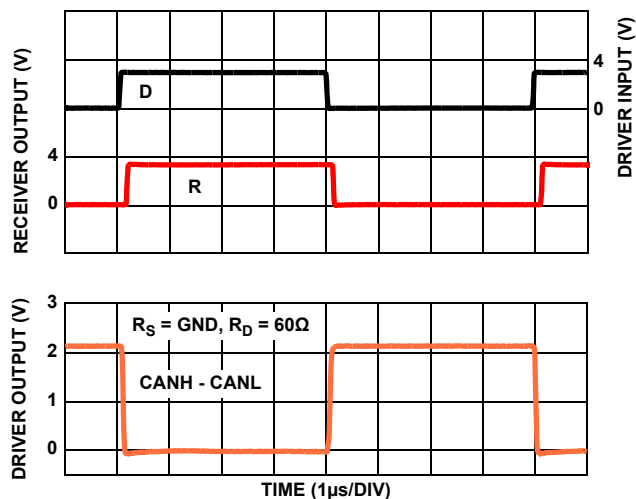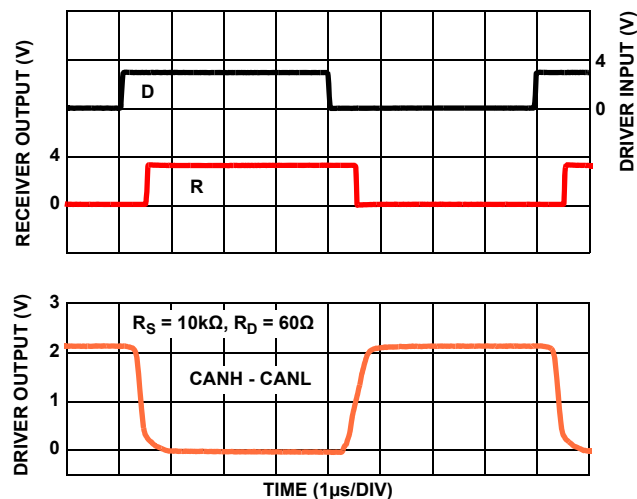

Figure 6.1   Fast Driver and Receiver Waveforms

Figure 6.2   Medium Driver and Receiver Waveforms
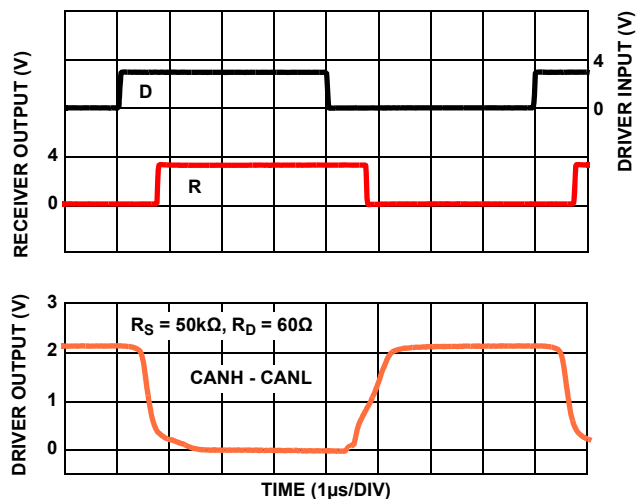

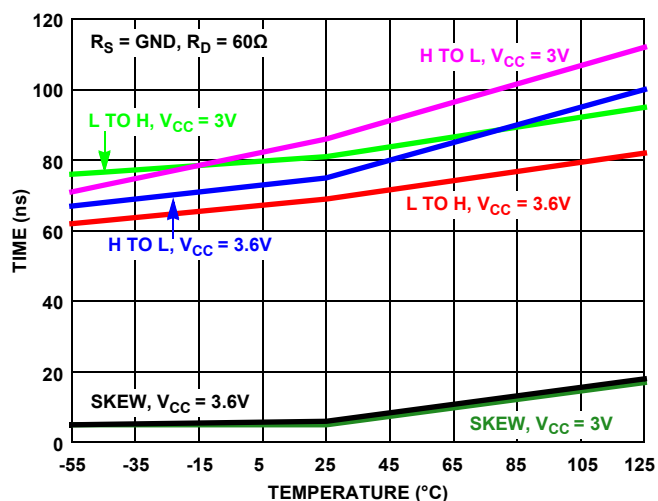**Figure 6.3   Slow Driver and Receiver Waveforms**

Figure 6.4   Transmitter Propagation Delay and Skew vs Temperature at Fast Speed
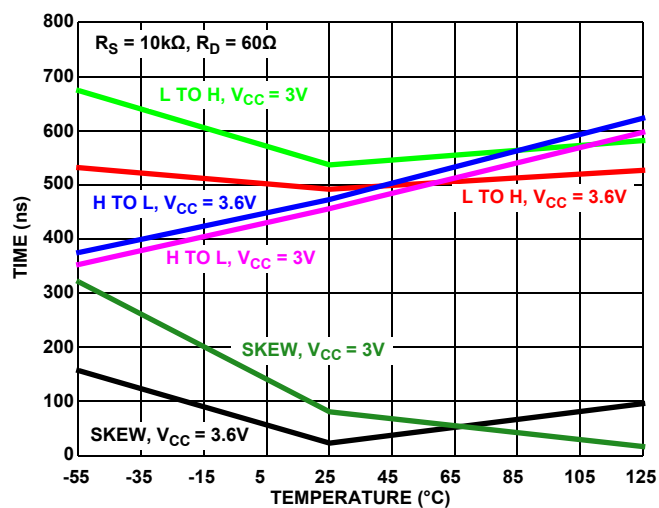
Figure 6.5   Transmitter Propagation Delay and Skew vs Temperature at Medium Speed
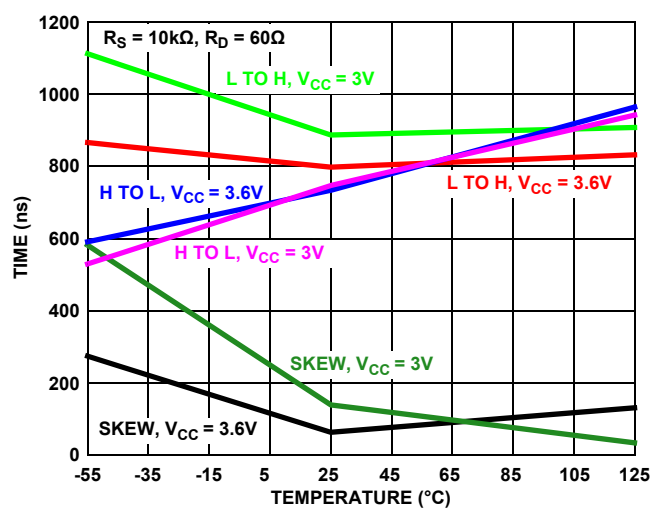

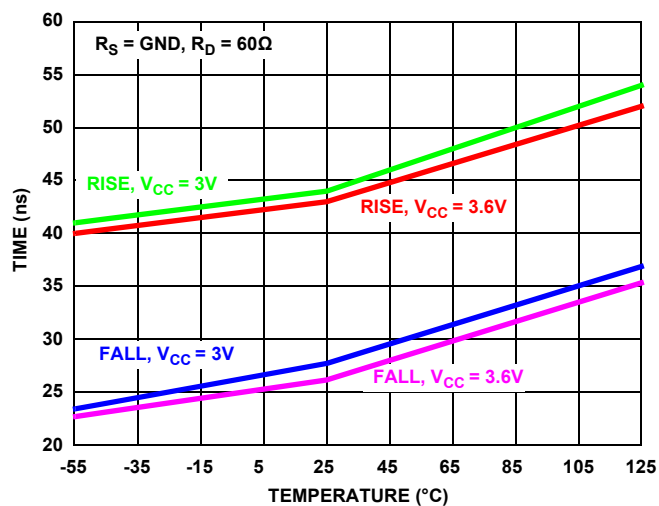Figure 6.6   Transmitter Propagation Delay and Skew vs Temperature at Slow Speed

Figure 6.7   Transmitter Rise and Fall Times vs Temperature at Fast Speed
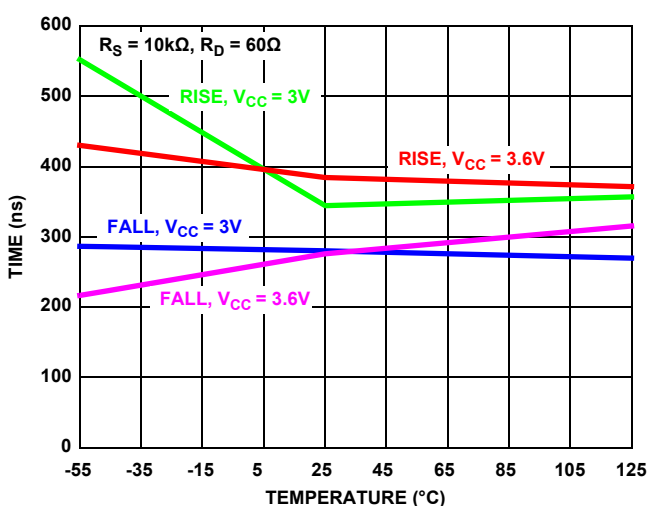

Figure 6.8   Transmitter Rise and Fall Times vs Temperature at Medium Speed

7.   Revision History

Rev.	Date	Page	Description
			Summary
0.00	May 3, 2017	—	Initial release

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(Rev.1.0 Mar 2020)

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В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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