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LC74900

CMOS IC

Silicon gate LCD PROCESSOR LSI for small size display

Overview

LC74900 is a highly integrated multi-purpose LCD Panel (up to WVGA) controller processing analog and digital video signal.

It contains A/D converter, video decoder, De-interlacer/Scaler, and picture improvement.

Features

(1) Video Input/Output

- Analog input: 4ch CVBS (NTSC, PAL, and SECAM) with 1ch 10bit A/D converter
- Digital input: 24bit RGB and YCbCr, 16bit YCbCr (4:2:2), and 8bit YC (BT.656)
- Digital output: 8bit video decoder output (BT.656)

(2) YC separation video decoder

- Adaptive 3line comb filter, automatic gain and chrominance control

(3) De-interlacer and Scaler

- Horizontal and vertical programmable scaler separately, and supports panels up to WVGA resolutions

(4) Picture Improvements

- CDEX (Color Depth Expander): high quality expansion for low-resolution graphics
- Dynamic gamma correction: picture adapted automatic luminance control
- Sharpness control, LTI and CTI: peaking enhancement without glares
- Color exciter: 6 phases RGBYMC gain control separately

(5) Panel interface

- 24bit RGB output and 18bit RGB output with dithering process
- Pulse Width Modulation for automatic LED backlight control
- Timing controller for LCD driver with horizontal or vertical reversing signals
- Pin swapping : replace output pin assignment of the RGB channel or bit

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(6) On Screen Display

- Built-in OSD controller with integrated font ROM, which contains 501 fonts, and font RAM, which contains 8 fonts
- Character Numbers displayed on the screen: 24 characters by 8 rows, 24 characters by 10 rows, or 32 characters by 8 rows
- Character Size: 16 pixels wide by 20 pixels high
- Character Colors: 8 font colors for each character, 8 back colors for each character, and 8 font border colors for each row
- Inverting font colors and back colors each character, Blinking fonts each character, and Fringing each row
- Pin assignment for an optional external OSD controller: 24bit, 18bit, 12bit, and 6bit RGB

(7) EEPROM booting

- Quick boot from an external EEPROM in power on sequence before starting a system controller
- Waiting timer between data transfers
- Verifying boot datas
- EEPROM Size: Up to 512K bits with I²C or SPI interface

(8) Parallel data outputs, panel interface and video decoder output

- Reentering video decoder outputs, which are processed by an external graphic engine as digital inputs

(9) System Controller Interface

- SPI (Max 1Mbit/s) or I²C bus (100Kbit/s or 400Kbit/s)

LSI Specification

- Supply voltage: 1.5V (core), 3.3V (IO)
- Maximum operation frequency: 60MHz (video processing)
- Package: 120pin TQFP

Applications

- For mediam or small size LCD Panel
- Automobile use: car TV, portable navigation, etc.
- Home use: Photo Frame, Portable DVD, Door Phone, etc.

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Specifications

Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$, $DV_{SS} = 0\text{V}$, $ADC0AV_{SS} = 0\text{V}$, $ADC1AV_{SS} = 0\text{V}$, $PLLAV_{SS} = 0\text{V}$, $XV_{SS} = 0\text{V}$

Parameter	Symbol	Conditions	Ratings	unit
Maximum supply voltage (I/O)	DV_{DD33} XV_{DD33} DV_{DD3318}		-0.3 to +3.96	V
Maximum supply voltage (Analog)	$ADC0AV_{DD33}$ $ADC1AV_{DD33}$ $PLLAV_{DD33}$		-0.3 to +3.96	V
Maximum supply voltage (Core)	DV_{DD15}		-0.3 to +1.8	V
Digital input voltage	V_I		-0.3 to $DV_{DD33}+0.3$	V
	V_I (5V Tolerant)		-0.3 to $DV_{DD3318}+0.3$	
Digital output voltage	V_O		-0.3 to $DV_{DD33}+0.3$	V
			-0.3 to $DV_{DD3318}+0.3$	
Maximum allowable loss	$P_d \text{ max}$	$T_a = 85^\circ\text{C}$, With evaluation board*	0.7	W
Operating temperature	T_{opr}		-40 to +85	$^\circ\text{C}$
Storage temperature	T_{stg}		-55 to +125	$^\circ\text{C}$

*: Board size: 150mm × 150mm × 1.6mm, FR-4, 6layers

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Allowable Operation Ranges at $T_a = -40$ to $+85^\circ\text{C}$, $DV_{SS} = 0\text{V}$, $ADC0AV_{SS} = 0\text{V}$, $ADC1AV_{SS} = 0\text{V}$, $PLLAV_{SS} = 0\text{V}$, $XV_{SS} = 0\text{V}$

Parameter	Symbol	Conditions	min	typ	max	unit
Supply voltage (I/O)	DV_{DD33} XV_{DD33}		3.15	3.3	3.45	V
	DV_{DD3318}		3.15	3.3	3.45	V
				1.7	1.8	1.9
Supply voltage (Analog)	$ADC0AV_{DD33}$ $ADC1AV_{DD33}$ $PLLAV_{DD33}$		3.15	3.3	3.45	V
Supply voltage (Core)	DV_{DD15}		1.4	1.5	1.6	V
Input voltage range	V_{IN}		0		DV_{DD33} DV_{DD3318}	V
Input voltage range (5V Tolerant)	V_{IN5}		0		5.5	V

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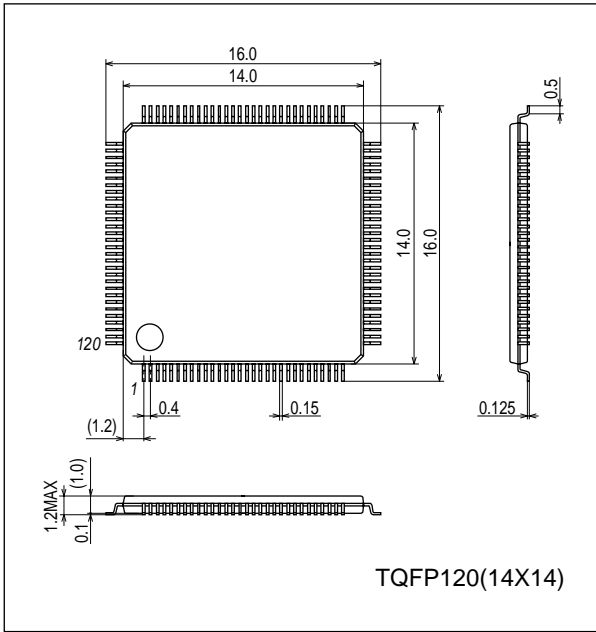
DC Characteristics at $T_a = -40$ to $+85^\circ\text{C}$, $DV_{SS} = 0\text{V}$, $ADC0AV_{SS} = 0\text{V}$, $ADC1AV_{SS} = 0\text{V}$, $PLLAV_{SS} = 0\text{V}$, $XV_{SS} = 0\text{V}$, $DV_{DD33} = 3.15\text{V}$ to 3.45V , $DV_{DD3318} = 3.15\text{V}$ to 3.45V or 1.7V to 1.9V , $DV_{DD15} = 1.42\text{V}$ to 1.58V , $XV_{DD33} = 3.15\text{V}$ to 3.45V , $ADC0AV_{DD} = 3.15\text{V}$ to 3.45V , $ADC1AV_{DD} = 3.15\text{V}$ to 3.45V , $PLLAV_{DD} = 3.15\text{V}$ to 3.45V

Parameter	Symbol	Conditions	min	typ	max	unit
Input high-level voltage	V_{IH}	CMOS level inputs	$0.7DV_{DD33}$ $0.7DV_{DD3318}$			V
		CMOS level Schmitt inputs	$0.7DV_{DD33}$			V
Input low-level voltage	V_{IL}	CMOS level inputs	0		$0.3DV_{DD33}$ $0.3DV_{DD3318}$	V
		CMOS level Schmitt inputs	0		$0.3DV_{DD33}$	V
Input high-level current	I_{IH}	$V_I = DV_{DD33}$				μA
		$V_I = DV_{DD3318}$				μA
Input low-level current	I_{IL}	$V_I = DV_{SS}$				μA
Output high-level voltage	V_{OH}	Type B: $I_{OH} = -4\text{mA}$ Type G: $I_{OH} = -6\text{mA}$	$DV_{DD33}-0.6$			V
		$DV_{DD3318} = 3.15\text{V}$ to 3.45V Type J: $I_{OH} = -4\text{mA}$ Type K: $I_{OH} = -6\text{mA}$	$DV_{DD3318}-0.6$			V
		$DV_{DD3318} = 1.7\text{V}$ to 1.9V Type J: $I_{OH} = -3\text{mA}$ Type K: $I_{OH} = -5\text{mA}$	$DV_{DD3318}-0.4$			V
Output low-level voltage	V_{OL}	CMOS			0.4	V
Output leakage current	I_{OZ}	When in high-impedance output mode	-10		10	μA
Operating current drain	I_{DDOP}	Output open, tck = 9MHz, 10steps $T_a = 25^\circ\text{C}$, $DV_{DD33} = 3.3\text{V}$, $DV_{DD3318} = 3.3\text{V}$, $XV_{DD} = 3.3\text{V}$, $DV_{DD15} = 1.5\text{V}$, $ADC0AV_{DD} = 3.3\text{V}$, $ADC1AV_{DD} = 3.3\text{V}$, $PLLAV_{DD} = 3.3\text{V}$		95		mA
		Output open, tck = 33MHz, 10steps $T_a = 25^\circ\text{C}$, $DV_{DD33} = 3.3\text{V}$, $DV_{DD3318} = 3.3\text{V}$, $XV_{DD} = 3.3\text{V}$, $DV_{DD15} = 1.5\text{V}$, $ADC0AV_{DD} = 3.3\text{V}$, $ADC1AV_{DD} = 3.3\text{V}$, $PLLAV_{DD} = 3.3\text{V}$		139		mA
Static current drain	I_{DDST}	Output open, tck: stop $V_I = DV_{SS}$, $T_a = 25^\circ\text{C}$, $DV_{DD33} = 3.3\text{V}$, $DV_{DD3318} = 1.8\text{V}$, $XV_{DD} = 3.3\text{V}$, $DV_{DD15} = 1.5\text{V}$, $ADC0AV_{DD} = 3.3\text{V}$, $ADC1AV_{DD} = 3.3\text{V}$, $PLLAV_{DD} = 3.3\text{V}$		34		μA

Package Dimensions

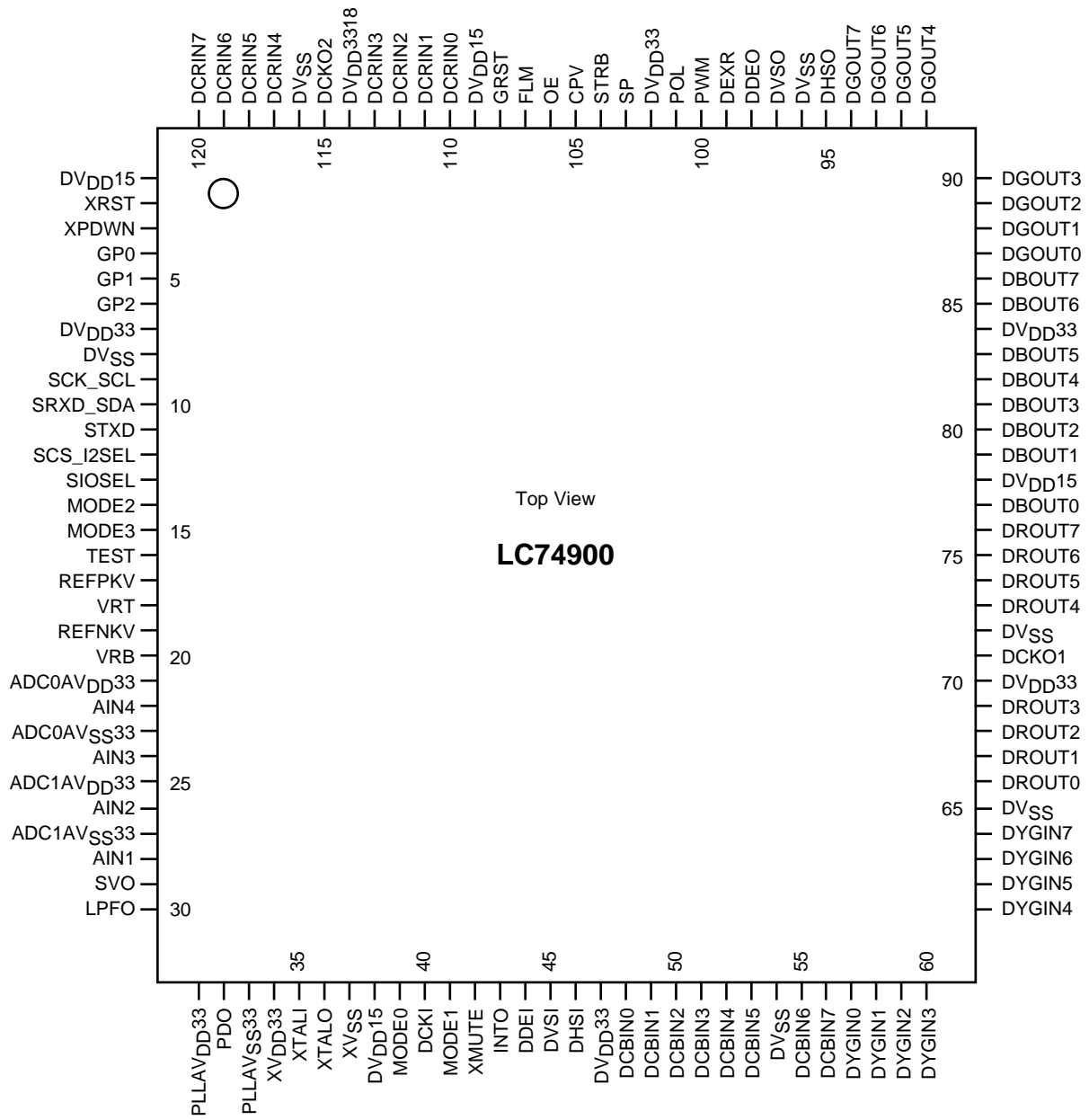
unit : mm (typ)

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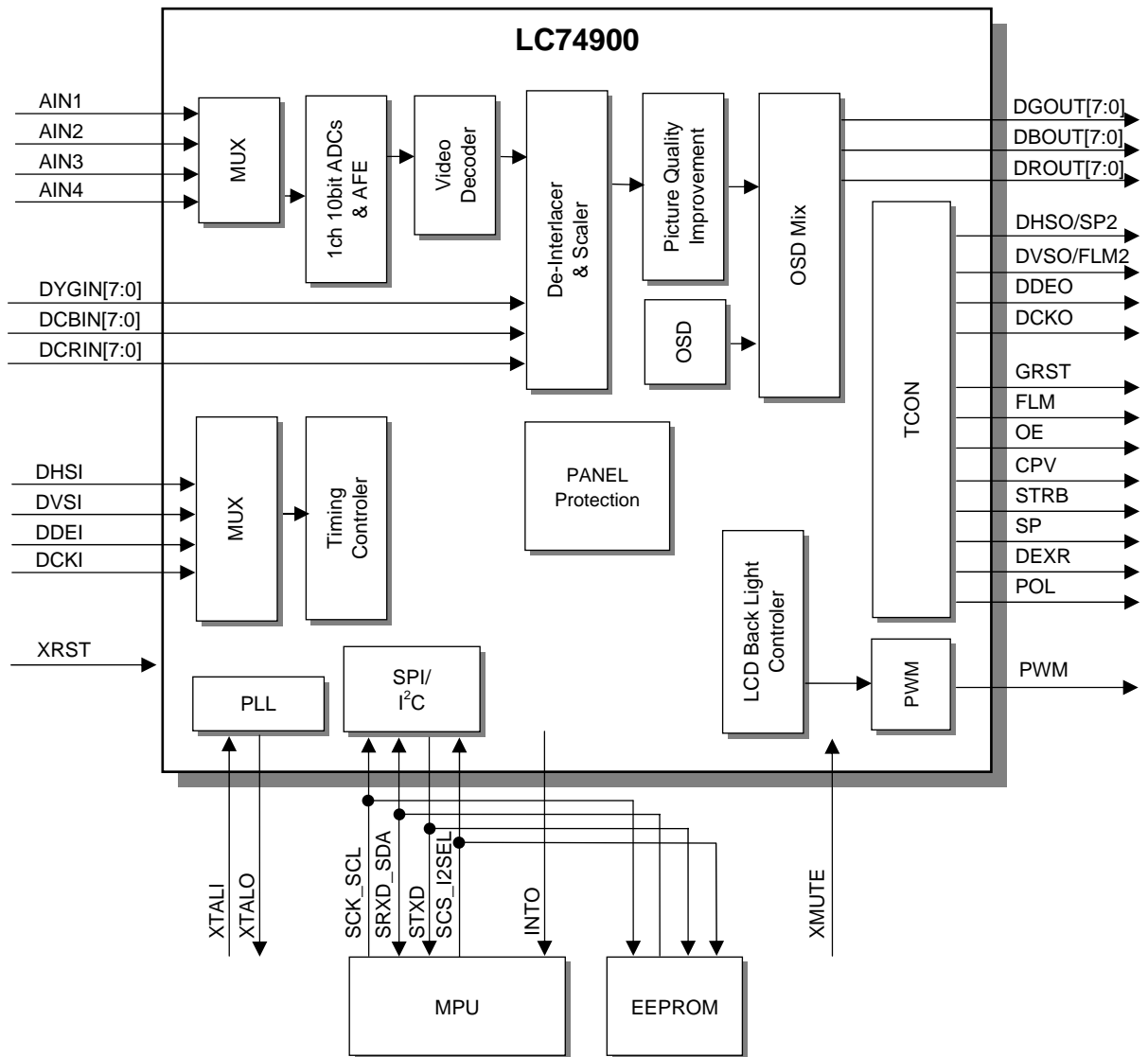
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Pin Assignment



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Block Diagram



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Pin Functions

Pin No.	Pin symbol	I/O format		Connected to		Digital IO power supply	Remarks
		I/O	Format				
1	DV _{DD} 15	P	-	Core voltage	Digital		Power supply for core (1.5V)
2	XRST	I	A	CMOS	Digital	DV _{DD} 33	Reset pin (active at a low voltage level)
3	XPDWN	I	A	CMOS	Digital	DV _{DD} 33	Fixed at a high voltage level
4	GP0	I/O	B	CMOS	Digital	DV _{DD} 33	Input: Digital input/OSD enable (pull down if not used) Output: Global port/Video decoder Vsync
5	GP1	I/O	B	CMOS	Digital	DV _{DD} 33	Input: Digital input/OSD halftone (pull down if not used) Output: Global Port/Video DecoderHsync
6	GP2	I/O	B	CMOS	Digital	DV _{DD} 33	Global port output
7	DV _{DD} 33	P	-	IO voltage	Digital		Power supply for IO (3.3V)
8	DV _{SS}	P	-	GND	Digital		GND for digital
9	SCK_SCL	I/O	C	CMOS	Digital	DV _{DD} 33	I ² C: I ² C Clock inout, SPI: Clock input
10	SRXD_SDA	I/O	C	CMOS	Digital	DV _{DD} 33	I ² C: data inout, SPI: data input
11	STXD	I/O	B	CMOS	Digital	DV _{DD} 33	SPI: data output
12	SCS_I2SEL	I	A	CMOS	Digital	DV _{DD} 33	I ² C: Select I ² C slave address, SPI: Chip select
13	SIOSEL	I	D	CMOS	Digital	DV _{DD} 33	Select CPU I/F, "L": I ² C, "H": SPI
14	MODE2	I	D	CMOS	Digital	DV _{DD} 33	Operation mode control
15	MODE3	I	D	CMOS	Digital	DV _{DD} 33	Operation mode control
16	TEST	I	D	CMOS	Digital	DV _{DD} 33	For production test (Fixed at a low voltage level)
17	REFPKV	I	E		Analog		Top reference level Buffer-AMP input for ADC
18	VRT	I	E		Analog		Top reference level for ADC
19	REFNKV	I	E		Analog		Bottom reference level Buffer-AMP input for ADC
20	VRB	I	E		Analog		Bottom reference level for ADC
21	ADC0AV _{DD} 33	P	-	Analog voltage	Analog		Power supply for ADC (3.3V)
22	AIN4	I	E		Analog		CVBS input 4
23	ADC0AV _{SS} 33	P	-	GND	Analog		GND for ADC
24	AIN3	I	E		Analog		CVBS input 3
25	ADC1AV _{DD} 33	P	-	Analog voltage	Analog		Power supply for ADC (3.3V)
26	AIN2	I	E		Analog		CVBS input 2
27	ADC1AV _{SS} 33	P	-	GND	Analog		GND for ADC
28	AIN1	I	E		Analog		CVBS input 1
29	SVO	O	E		Analog		AFE output
30	LPFO	O	E		Analog		External AGC control level
31	PLLAV _{DD} 33	P	-	Analog voltage	Analog		Power supply for PLL (3.3V)
32	PDO	O	-		Analog		Test port for PLL (Open)
33	PLLAV _{SS} 33	P	-	GND	Analog		GND for PLL
34	XV _{DD} 33	P	-	IO voltage	Digital		Power supply for 27MHz X'tal (3.3V)
35	XTALI	I	F	CMOS	Digital	XV _{DD} 33	27MHz X'tal input
36	XTALO	O	F	CMOS	Digital	XV _{DD} 33	27MHz X'tal output
37	XV _{SS}	P	-	GND	Digital		GND for 27MHz X'tal
38	DV _{DD} 15	P	-	Core voltage	Digital		Power supply for core (1.5V)
39	MODE0	I	D	CMOS	Digital	DV _{DD} 33	Operation mode control
40	DCKI	I	D	CMOS	Digital	DV _{DD} 33	Digital video clock
41	MODE1	I	D	CMOS	Digital	DV _{DD} 33	Operation mode control
42	XMUTE	I	A	CMOS	Digital	DV _{DD} 33	Mute control (active at a low voltage level)
43	INTO	I/O	B	CMOS	Digital	DV _{DD} 33	Interrupt output
44	DDEI	I	D	CMOS	Digital	DV _{DD} 33	Digital video enable/OSD enable
45	DVSI	I	D	CMOS	Digital	DV _{DD} 33	Digital video Vsync/OSD half tone
46	DHSI	I	D	CMOS	Digital	DV _{DD} 33	Digital video Hsync
47	DV _{DD} 33	P	-	IO voltage	Digital		Power supply for IO (3.3V)
48	DCBIN0	I	D	CMOS	Digital	DV _{DD} 33	Digital video input/OSD input (pull down if not used)
49	DCBIN1	I	D	CMOS	Digital	DV _{DD} 33	Digital video input/OSD input (pull down if not used)
50	DCBIN2	I	D	CMOS	Digital	DV _{DD} 33	Digital video input/OSD input (pull down if not used)

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Pin No.	Pin symbol	I/O format		Connected to		Digital IO power supply	Remarks
		I/O	Format				
51	DCBIN3	I	D	CMOS	Digital	DV _{DD33}	Digital video input/OSD input (pull down if not used)
52	DCBIN4	I	D	CMOS	Digital	DV _{DD33}	Digital video input/OSD input (pull down if not used)
53	DCBIN5	I	D	CMOS	Digital	DV _{DD33}	Digital video input/OSD input (pull down if not used)
54	DV _{SS}	P		GND	Digital		GND for digital
55	DCBIN6	I	D	CMOS	Digital	DV _{DD33}	Digital video input/OSD input (pull down if not used)
56	DCBIN7	I	D	CMOS	Digital	DV _{DD33}	Digital video input/OSD input (pull down if not used)
57	DYGIN0	I	D	CMOS	Digital	DV _{DD33}	Digital video input/OSD input (pull down if not used)
58	DYGIN1	I	D	CMOS	Digital	DV _{DD33}	Digital video input/OSD input (pull down if not used)
59	DYGIN2	I	D	CMOS	Digital	DV _{DD33}	Digital video input/OSD input (pull down if not used)
60	DYGIN3	I	D	CMOS	Digital	DV _{DD33}	Digital video input/OSD input (pull down if not used)
61	DYGIN4	I	D	CMOS	Digital	DV _{DD33}	Digital video input/OSD input (pull down if not used)
62	DYGIN5	I	D	CMOS	Digital	DV _{DD33}	Digital video input/OSD input (pull down if not used))
63	DYGIN6	I	D	CMOS	Digital	DV _{DD33}	Digital video input/OSD input (pull down if not used)
64	DYGIN7	I	D	CMOS	Digital	DV _{DD33}	Digital video input/OSD input (pull down if not used)
65	DV _{SS}	P		GND	Digital		GND for digital
66	DROUT0	I/O	B	CMOS	Digital	DV _{DD33}	Panel R output (LSB) (input port in test mode)
67	DROUT1	I/O	B	CMOS	Digital	DV _{DD33}	Panel R output (input port in test mode)
68	DROUT2	I/O	B	CMOS	Digital	DV _{DD33}	Panel R output (input port in test mode)
69	DROUT3	I/O	B	CMOS	Digital	DV _{DD33}	Panel R output (input port in test mode)
70	DV _{DD33}	P		IO voltage	Digital		Power supply for IO (3.3V)
71	DCKO1	O	G	CMOS	Digital	DV _{DD33}	Panel clock output
72	DV _{SS}	P		GND	Digital		GND for digital
73	DROUT4	I/O	B	CMOS	Digital	DV _{DD33}	Panel R output (input port in test mode)
74	DROUT5	I/O	B	CMOS	Digital	DV _{DD33}	Panel R output (input port in test mode)
75	DROUT6	I/O	B	CMOS	Digital	DV _{DD33}	Panel R output (input port in test mode)
76	DROUT7	I/O	B	CMOS	Digital	DV _{DD33}	Panel R output (MSB) (input port in test mode)
77	DBOUT0	I/O	B	CMOS	Digital	DV _{DD33}	Panel B output (LSB) (input port in test mode)
78	DV _{DD15}	P		Core voltage	Digital		Power supply for core (1.5V)
79	DBOUT1	I/O	B	CMOS	Digital	DV _{DD33}	Panel B output (input port in test mode)
80	DBOUT2	I/O	B	CMOS	Digital	DV _{DD33}	Panel B output (input port in test mode)
81	DBOUT3	I/O	B	CMOS	Digital	DV _{DD33}	Panel B output (input port in test mode)
82	DBOUT4	I/O	B	CMOS	Digital	DV _{DD33}	Panel B output (input port in test mode)
83	DBOUT5	I/O	B	CMOS	Digital	DV _{DD33}	Panel B output (input port in test mode)
84	DV _{DD33}	P		IO voltage	Digital		Power supply for IO (3.3V)
85	DBOUT6	I/O	B	CMOS	Digital	DV _{DD33}	Panel B output (input port in test mode)
86	DBOUT7	I/O	B	CMOS	Digital	DV _{DD33}	Panel B output (MSB) (input port in test mode)
87	DGOUT0	I/O	B	CMOS	Digital	DV _{DD33}	Panel G output (LSB) (input port in test mode)
88	DGOUT1	I/O	B	CMOS	Digital	DV _{DD33}	Panel G output (input port in test mode)
89	DGOUT2	I/O	B	CMOS	Digital	DV _{DD33}	Panel G output (input port in test mode)
90	DGOUT3	I/O	B	CMOS	Digital	DV _{DD33}	Panel G output (input port in test mode)
91	DGOUT4	I/O	B	CMOS	Digital	DV _{DD33}	Panel G output (input port in test mode)
92	DGOUT5	I/O	B	CMOS	Digital	DV _{DD33}	Panel G output (input port in test mode)
93	DGOUT6	I/O	B	CMOS	Digital	DV _{DD33}	Panel G output (input port in test mode)
94	DGOUT7	I/O	B	CMOS	Digital	DV _{DD33}	Panel G output (MSB) (input port in test mode)
95	DHSO	I/O	B	CMOS	Digital	DV _{DD33}	Panel Hsync/Start pulse for source driver/ Video decoder Vsync output (input port in test mode)
96	DV _{SS}	P		GND	Digital		GND for digital
97	DVSO	I/O	B	CMOS	Digital	DV _{DD33}	Panel Vsync/Start pulse for gate driver/ Video decoder Vsync output (input port in test mode)
98	DDEO	I/O	B	CMOS	Digital	DV _{DD33}	Panel enable output (input port in test mode)
99	DEXR	I/O	B	CMOS	Digital	DV _{DD33}	Invert control signal for DTR/ Video decoder output 1[7](BT.656) (input port in test mode)

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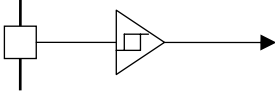
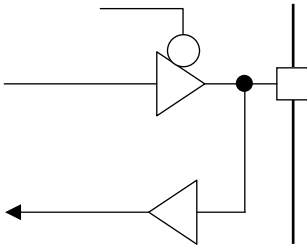
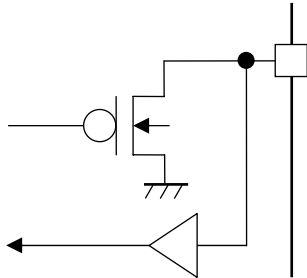
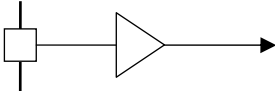

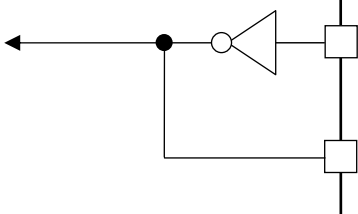
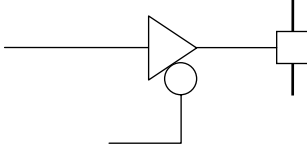
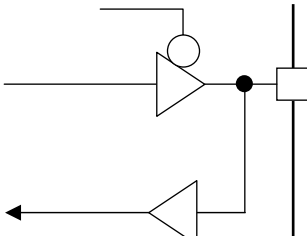
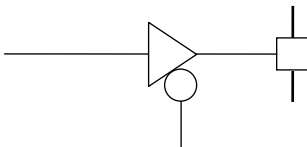
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Pin No.	Pin symbol	I/O format		Connected to		Digital IO power supply	Remarks
		I/O	Format				
100	PWM	I/O	B	CMOS	Digital	DV _{DD} 33	Pulse width modulation (input port in test mode)
101	POL	I/O	B	CMOS	Digital	DV _{DD} 33	Polarity control for source driver/ Video decoder output 1[6] (BT.656) (input port in test mode)
102	DV _{DD} 33	P		IO voltage	Digital		Power supply for IO (3.3V)
103	SP	I/O	B	CMOS	Digital	DV _{DD} 33	Start pulse for source driver/ Video decoder output 1[5] (BT.656) (input port in test mode)
104	STRB	I/O	B	CMOS	Digital	DV _{DD} 33	Data stroboscope for source driver/ Video decoder output 1[4] (BT.656) (input port in test mode)
105	CPV	I/O	B	CMOS	Digital	DV _{DD} 33	Clock for gate driver/ Video decoder output 1[3] (BT.656) (input port in test mode)
106	OE	I/O	B	CMOS	Digital	DV _{DD} 33	Output enable for gate driver/ Video decoder output 1[2] (BT.656) (input port in test mode)
107	FLM	I/O	B	CMOS	Digital	DV _{DD} 33	Start pulse for gate driver/ Video decoder output 1[1] (BT.656) (input port in test mode)
108	GRST	I/O	B	CMOS	Digital	DV _{DD} 33	Reset for gate driver/ Video decoder output 1[0] (BT.656) (input port in test mode)
109	DV _{DD} 15	P		Core voltage	Digital		Power supply for core (1.5V)
110	DCRIN0	I/O	H	CMOS	Digital	DV _{DD} 3318	Input: Digital video input/OSD input (pull down if not used) Output: Video decoder output 2[0] (BT.656)
111	DCRIN1	I/O	H	CMOS	Digital	DV _{DD} 3318	Input: Digital video input/OSD input (pull down if not used) Output: Video decoder output 2[1] (BT.656)
112	DCRIN2	I/O	H	CMOS	Digital	DV _{DD} 3318	Input: Digital video input/OSD input (pull down if not used) Output: Video decoder output 2[2] (BT.656)
113	DCRIN3	I/O	H	CMOS	Digital	DV _{DD} 3318	Input: Digital video input/OSD input (pull down if not used) Output: Video decoder output 2[3] (BT.656)
114	DV _{DD} 3318	P	-	IO voltage	Digital		Power supply for IO (3.3V/1.8V)
115	DCKO2	O	J	CMOS	Digital	DV _{DD} 3318	Video decoder clock output
116	DV _{SS}	P	-	GND	Digital		GND for digital
117	DCRIN4	I/O	H	CMOS	Digital	DV _{DD} 3318	Input: Digital video input/OSD input (pull down if not used) Output: Video decoder output 2[4] (BT.656)
118	DCRIN5	I/O	H	CMOS	Digital	DV _{DD} 3318	Input: Digital video input/OSD input (pull down if not used) Output: Video decoder output 2[5] (BT.656)
119	DCRIN6	I/O	H	CMOS	Digital	DV _{DD} 3318	Input: Digital video input/OSD input (pull down if not used) Output: Video decoder output 2[6] (BT.656)
120	DCRIN7	I/O	H	CMOS	Digital	DV _{DD} 3318	Input: Digital video input/OSD input (pull down if not used) Output: Video decoder output 2[7] (BT.656)

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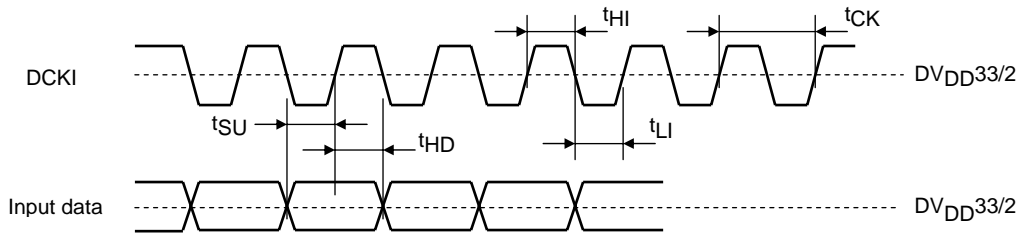
Pin Type

I/O type	Function	Equivalent circuit	Applicable pins
A	Schmitt trigger CMOS input		XRST, XPDWN, SCS_I2SEL, XMUTE
B	8mA 3-STATE drive CMOS I/O		GP0, GP1, GP2, STXD, INTO, DROUT0, DROUT1, DROUT2, DROUT3, DROUT4, DROUT5, DROUT6, DROUT7, DBOUT0, DBOUT1, DBOUT2, DBOUT3, DBOUT4, DBOUT5, DBOUT6, DBOUT7, DGOUT0, DGOUT1, DGOUT2, DGOUT3, DGOUT4, DGOUT5, DGOUT6, DGOUT7 DVSO, DHSO, DDEO, DEXR, PWM, POL, SP, STRB, CPV, OE, FLM, GRST
C	8mA OpenDrain output CMOS input*		SCK_SCL, SRXD_SDA
D	CMOS input		SIOSEL, MODE2, MODE3, TEST, MODE0, DCKI, MODE1, DDEI, DVSI, DHSI, DCBIN0, DCBIN1, DCBIN2, DCBIN3, DCBIN4, DCBIN5, DCBIN6, DCBIN7, DYGIN0, DYGIN1, DYGIN2, DYGIN3, DYGIN4, DYGIN5, DYGIN6, DYGIN7
E	Analog I/O		REFPKV, VRT, REFNKV, VRB, AIN4, AIN3, AIN2, AIN1, SVO, LPFO
F	Oscillator circuit I/O		XTALI, XTALO
G	12mA 3-STATE drive CMOS output		DCKO1
H	3.3V: 8mA 1.8V: 3mA 3-STATE drive CMOS I/O		DCRIN0, DCRIN1, DCRIN2, DCRIN3, DCRIN4, DCRIN5, DCRIN6, DCRIN7
J	3.3V: 12mA 1.8V: 5mA 3-STATE drive CMOS output		DCKO2

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I/O Data Timing

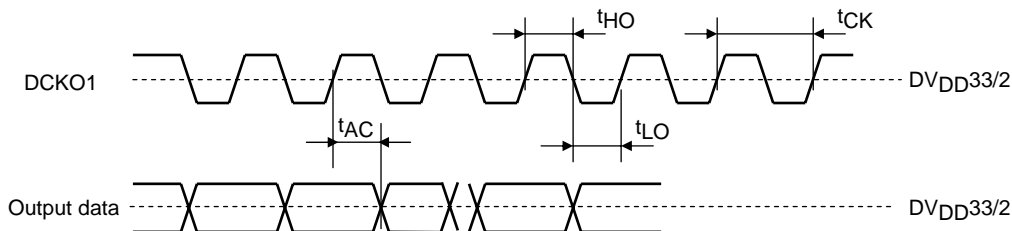
(1) Input data timing



Pin name	Parameter	Symbol	min	typ	max	unit
DCKI	Clock cycle	t_{CK}	16.7			ns
	Duty			50		%
DCRIN*, DYGIN*, DCBIN*, DVSI, DHSI, DDEI	Input data setup time ($DV_{DD33} = 3.15V$ to $3.45V$) ($DV_{DD3318} = 3.15V$ to $3.45V$)	t_{SU}	3			ns
	Input data hold time ($DV_{DD33} = 3.15V$ to $3.45V$) ($DV_{DD3318} = 3.15V$ to $3.45V$)	t_{HD}	2			ns

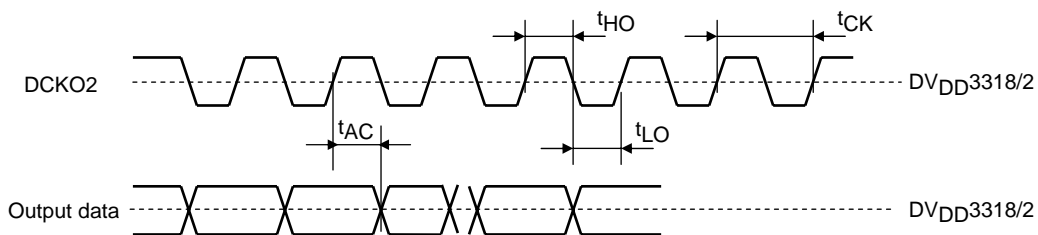
* The recommended duty ratio of input clock is 50%

(2) Output data timing



Pin name	Parameter	Symbol	min	typ	max	unit
DCKO1	Clock cycle	t_{CK}	16.7			ns
	Duty			50		%
DROUT*, DGOUT*, DBOUT* DVSO, DHSO, DDEO, DEXR, POL, SP, STRB, CPV, OE, FLM, GRST	Output data delay time $DV_{DD33} = 3.15V$ to $3.45V$	t_{AC}	-3		3	ns

* DCKO1 output is not inverted. Output capacitance: 15pF



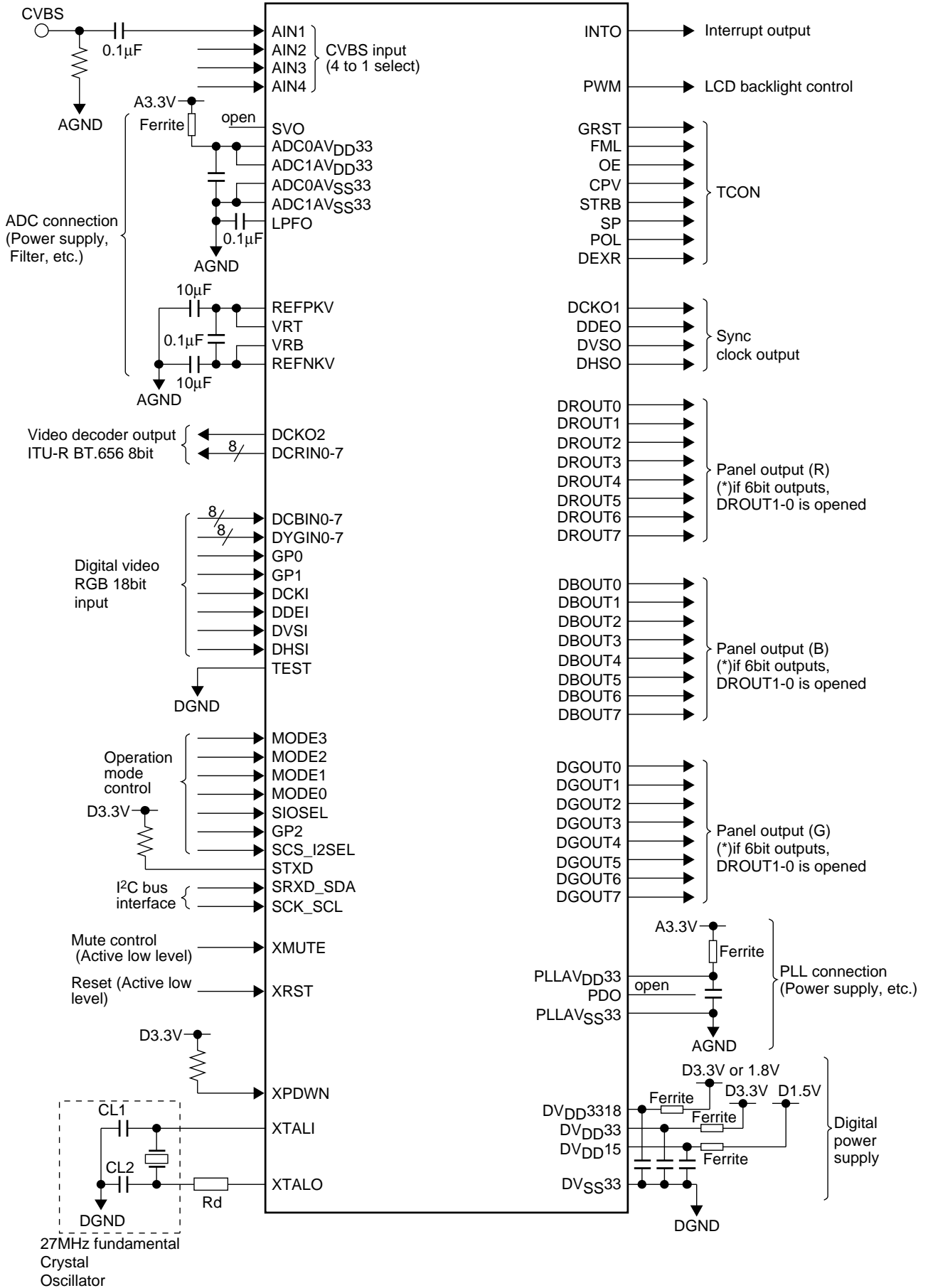
Pin name	Parameter	Symbol	min	typ	max	unit
DCKO2	Clock cycle	t_{CK}	37			ns
	Duty			50		%
DCRIN*, DEXR, POL, SP STRB, CPV, OE, FLM, GRST, GP0, GP1, DVSO, DHSO	Output data delay time $DV_{DD3318} = 3.15V$ to $3.45V$ $DV_{DD33} = 3.15V$ to $3.45V$	t_{AC}	-3		3	ns
DCRIN*	Output data delay time $DV_{DD3318} = 1.7V$ to $1.9V$	t_{AC}	-6		6	ns

* DCKO1 output is not inverted. Output capacitance: 15pF

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Connection Example of Parallel Output Mode (Panel/Video Decoder)

* For details, see Application Note.



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