TFT MODULE SPECIFICATION

RVT70HSMFWN00

IPS MIPI 7.0" LCD TFT DATASHEET

Rev.1.0
2021-08-02

ITEM	CONTENTS	UNIT
LCD Type	TFT/Transmissive/Normally Black/IPS	/
Size	7.0	Inch
Viewing Direction	Free	/
Outside Dimensions (W x H x D)	181.60 x 100.60 x 6.23	mm
Active Area (W x H)	154.21 x 85.92	mm
Pixel Pitch (W x H)	0.1506 x 0.1432	mm
Resolution	1024 (RGB) x 600	/
Brightness	1000	cd/m^2
LCD Interface Type	MIPI	/
Color Depth	16.7 M	/
Pixel Arrangement	RGB Vertical Stripe	/
LCD Driver	EK79007AD3+EK73217BCGA	/
With/Without Touch	Without Touch Panel	/
Weight	180	g

Note 1: RoHS3 compliant

Note 2: LCM weight tolerance: ± 5%.

1. REVISION RECORD

REV NO.	REV DATE	CONTENTS	REMARKS
1.0	2021-08-02	Initial Release	

2. CONTENTS

3. MODULE CLASSIFICATION INFORMATION

RV	T	70	H	S	M	F	W	N	00
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.

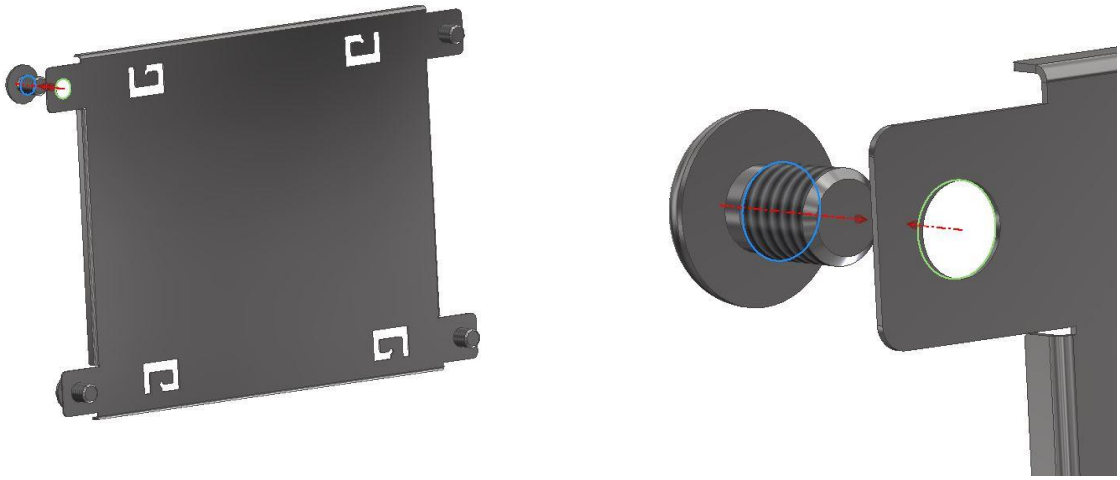
NO.	PARAMETER	SYMBOL
1.	BRAND	RV – Riverdi
2.	PRODUCT TYPE	T – TFT Standard
3.	DISPLAY SIZE	70 – 7.0”
4.	MODEL SERIAL NO.	H – High Brightness, IPS
5.	RESOLUTION	S – 1024 x 600 px
6.	INTERFACE	M – MIPI
7.	FRAME	F – With Mounting Metal Frame
8.	BACKLIGHT TYPE	W – LED White
9.	TOUCH PANEL	N – Without Touch Panel
10.	VERSION	00 – (00-99)

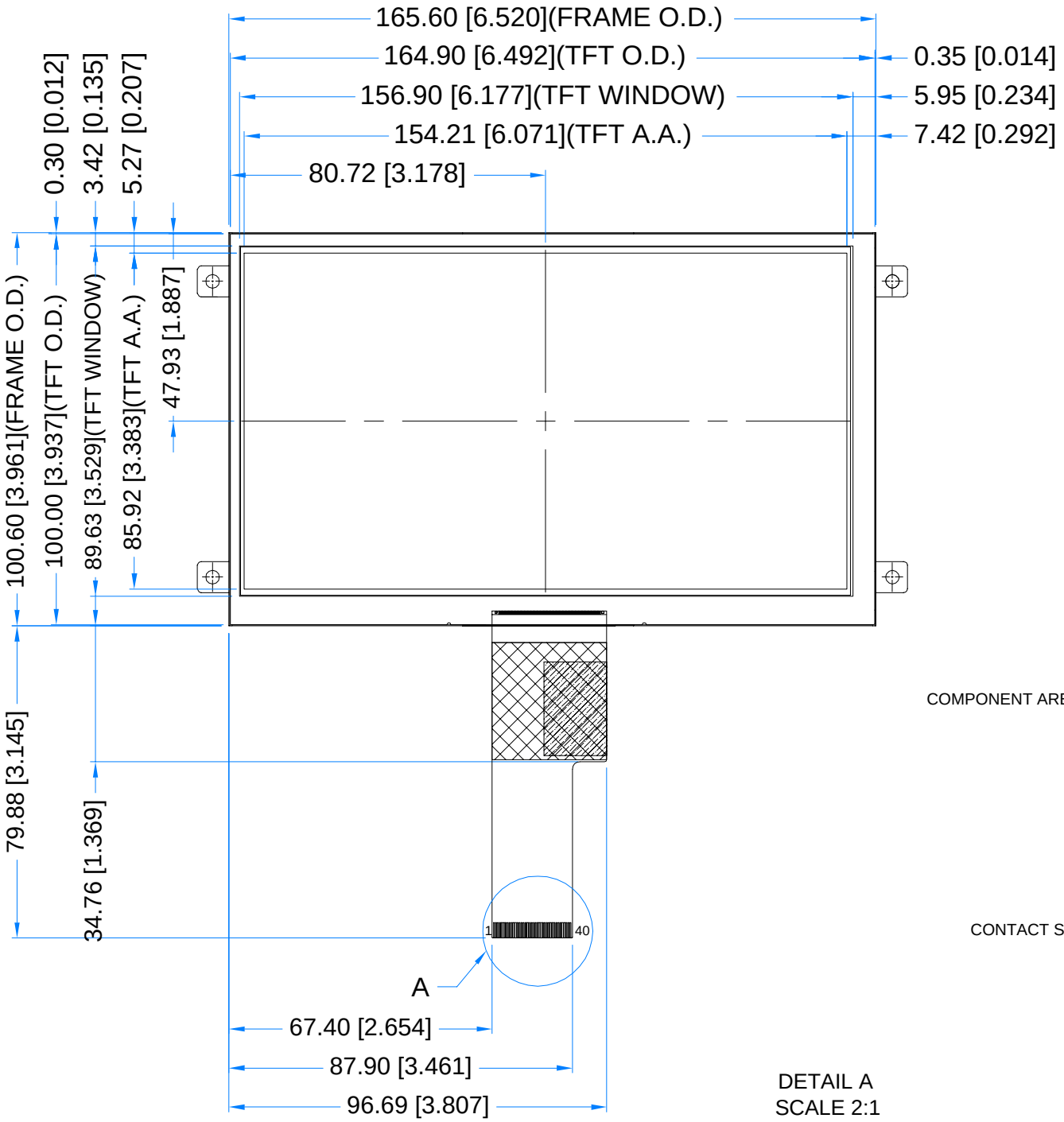
4. ASSEMBLY GUIDE

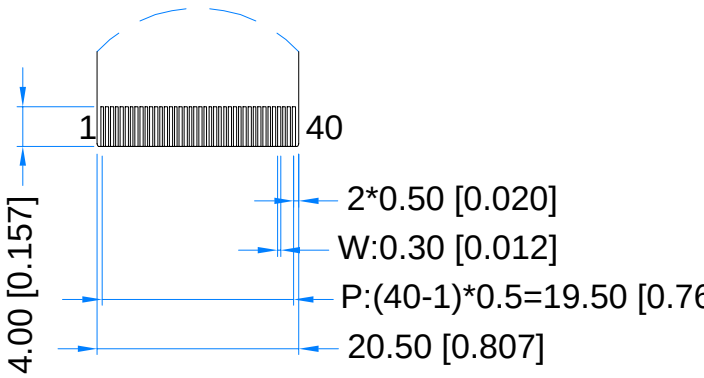
4.1 Mounting frame

For dimensions 3.5”, 4.3”, 5.0”, 7.0”and 10.1” the product with mounting frame version is available. Thanks to the four catches attached to the side, frame provides strong assembly to the surface by mounting element (like the screw, see Figure 1). The frames are specially designed to fit Riverdi products perfectly. The diameter of the mounting hole is 3.5mm.

Figure 1. Mounting frame







TFT NOTES:

1. LCD TYPE: TRANSMISSIVE, NORMALLY BLACK,IPS
2. RESOLUTION: 1024x600
3. VIEWING ANGLE: FREE
4. IC CONTROLLER:EK79007AD3+EK73217BCGA
5. OPERATING VOLTAGE: 3.3V
6. INTERFACE: MIPI
7. BACKLIGHT: 27 LEDS WHITE, Vf = 9.6V, If = 270mA

GENERAL NOTES:

1. MODULE SURFACE LUMINANCE: 1000 cd/m^2
2. MOUNTING METAL FRAME THICKNESS: 0.30 mm
3. OPERATING TEMPERATURE: -20°C ~ 70°C
4. STORAGE TEMPERATURE: -30°C ~ 80°C
5. WITHOUT INDIVIDUAL TOLERANCE: ±0.3mm
6. RoHS3 COMPLIANT

6. ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN	MAX	UNIT
Power for Circuit Driving	VDD	-0.3	+4.6	V
Operating Temperature	T_{OP}	-20	70	°C
Storage Temperature	T_{ST}	-30	80	°C
Storage Humidity (@ 25 ± 5°C)	H_{ST}	10	-	% RH
Operating Ambient Humidity (@ 25 ± 5°C)	H_{OP}	10	-	% RH

Note. The above are maximum values. If exceeded, they may cause permanent damage to the unit.

7. ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Supply Voltage for Module	VDD	2.6	3.3	3.6	V
Digital Power Current	IDD	-	30	45	mA
Logic Input Signal Voltage	VIH	0.7VDD	-	VDD	V
	VIL	0	-	0.3VDD	V

8. BACKLIGHT ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Backlight Driving Voltage	VF	9.0	9.6	10.2	V
Backlight Driving Current	IF	-	270	315	mA
Backlight Power Consumption	WBL	-	2592	-	mW
Lifetime	-	-	50,000	-	

Note. Operating life means the period in which the LED brightness goes down to 50% of the initial brightness. Typical operating lifetime is the estimated parameter.

9. ELECTRO-OPTICAL CHARACTERISTICS

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25 ℃. The values specified are at an approximate distance 500mm from the LCD surface at a viewing angle of Φ and θ equal to 0°.

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	RMK	NOTE
Response Time	Tr+Tf	θ=0° ⌀=0° Ta=25 °C	-	35	-	ms	FIG 2.	4
Contrast Ratio	Cr		-	800	-	---	FIG 3.	1
Luminance Uniformity	δ WHITE		-	75	-	%	FIG 3.	3
Surface Luminance	Lv		-	1000	-	cd/m2	FIG 3.	2
Viewing Angle Range	θ	⌀ = 90°	-	85	-	deg	FIG 4.	6
		⌀ = 270°	-	85	-	deg	FIG 4.	
		⌀ = 0°	-	85	-	deg	FIG 4.	
		⌀ = 180°	-	85	-	deg	FIG 4.	
CIE (x, y) Chromaticity	Rx	θ=0° ⌀=0° Ta=25 °C	0.578	0.618	0.658	-	FIG 3.	5
	Ry		0.489	0.329	0.369	-		
	Gx		0.376	0.416	0.456	-		
	Gy		0.493	0.533	0.573	-		
	Bx		0.071	0.111	0.151	-		
	By		0.108	0.148	0.188	-		
	Wx		0.270	0.310	0.350	-		
	Wy		0.290	0.330	0.370	-		

Note 1. Contrast Ratio (CR) is defined mathematically as below, for more information see Figure 3.

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Average Surface Luminance with all black pixels (P1, P2, P3, P4, P5)}}$$

Note 2. Surface luminance is the LCD surface from the surface with all pixels displaying white. For more information see Figure 3.

Lv = Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)

Note 3. The uniformity in surface luminance δ WHITE is determined by measuring luminance at each test position 1 through 5, and then dividing the minimum luminance of 5 points luminance by maximum luminance of 5 points luminance. For more information see Figure 3.

$$\delta \text{ WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Maximum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}$$

Note 4. Response time is the time required for the display to transition from white to black (Rise Time, Tr) and from black to white (Decay Time, Tf). For additional information see Figure 2. The test equipment is Autronic-Melchers's ConoScope series.

Note 5. CIE (x, y) chromaticity, the x, y value is determined by measuring luminance at each test position 1 through 5, and then make average value.

Note 6. Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to LCD surface. For more information see Figure 4.

Note 7. For viewing angle and response time testing, the testing data is based on Autronic-Melchers's ConoScope series. Instruments for Contrast Ratio, Surface Luminance, Luminance Uniformity, CIE the test data is based on TOPCON's BM-5 photo detector.

Figure 2. The definition of response time

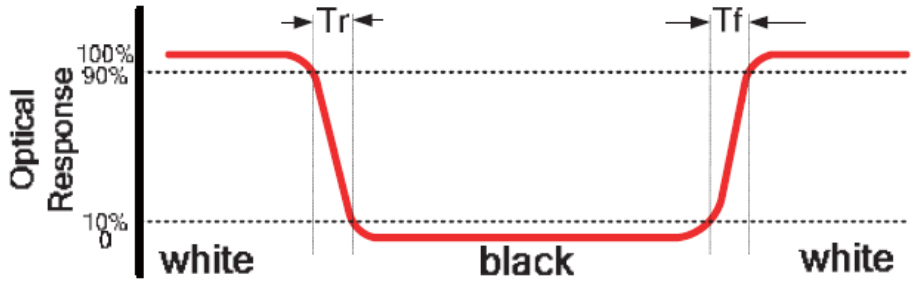
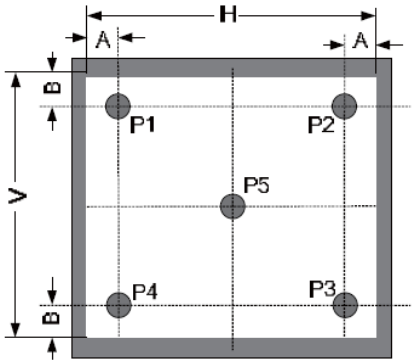


Figure 3. Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE (x, y) chromaticity



A: 5mm

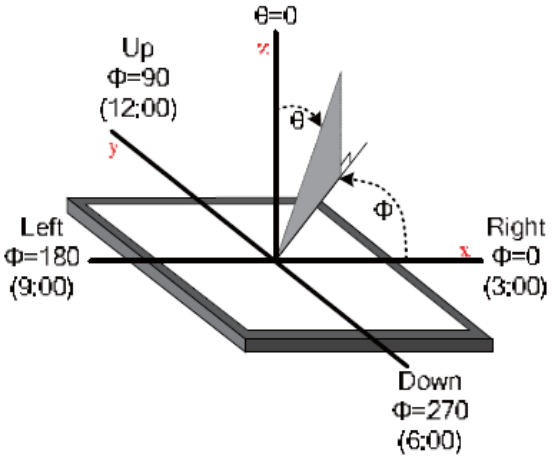
B: 5mm

H, V: Active Area

Light spot size Ø=5mm, 500mm distance from the LCD surface to detector lens.

Measurement instrument is TOPCON'S luminance meter BM-5

Figure 4. The definition of viewing angle



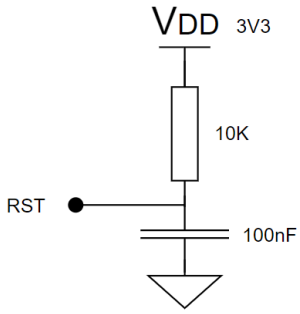
10. INTERFACE DESCRIPTION

10.1 TFT assignment

PIN NO.	SYMBOL	I/O	DESCRIPTION	NOTE
1	NC	-	No connection	
2	VDD	P	Power supply 3.3V	
3	VDD	P	Power supply 3.3V	
4	NC	-	No connection	
5	RESET	I	Global reset pin. Active low to enter reset state.	NOTE 1
6	STBYB	I	Internally pull-up, STBYB=1, normal operation. STBYB=0, timing control, source driver will turn off	
7	GND	P	Ground	
8	D0N	I/O	Negative MIPI differential data input	
9	D0P	I/O	Positive MIPI differential data input	
10	GND	P	Ground	
11	D1N	I/O	Negative MIPI differential data input	
12	D1P	I/O	Positive MIPI differential data input	
13	GND	P	Ground	
14	D2N	I/O	Negative MIPI differential data input	
15	D2P	I/O	Positive MIPI differential data input	
16	GND	P	Ground	
17	DCLKN	I/O	Negative MIPI differential clock input	
18	DCLKP	I/O	Positive MIPI differential clock input	
19	GND	P	Ground	
20	D3N	I/O	Negative MIPI differential data input	
21	D3P	I/O	Positive MIPI differential data input	
22	GND	P	Ground	
23	NC	-	No connection	
24	NC	-	No connection	
25	GND	P	Ground	
26	NC	-	No connection	
27	NC	-	No connection	
28	NC	-	No connection	
29	NC	-	No connection	
30	GND	P	Ground	
31	LED-	P	LED Cathode	
32	LED-	P	LED Cathode	
33	L/R	I	Left/Right display control, internally pull-up	Note 2
34	U/D	I	Up/Down display control, internally pull down	
35	NC	-	No connection	
36	NC	-	No connection	
37	NC	-	No connection	
38	NC	-	No connection	
39	LED+	P	LED Anode	
40	LED+	P	LED Anode	

I: input, O: output, P: Power

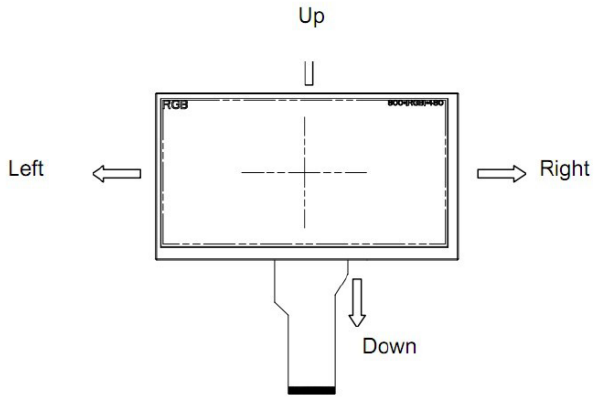
Note 1: Recommended Reset circuit:



Note 2: U/D (Pin 34) is internally pull-down, and R/L (Pin 33) is internally pull-up. The default scanning direction is up to down, left to right.

SETTING OF SCAN CONTROL INPUT		SCANNING DIRECTION
U/D	L/R	
GND	VDD	Up to down, left to right
VDD	GND	Down to up, right to left
GND	GND	Up to down, right to left
VDD	VDD	Down to up, left to right

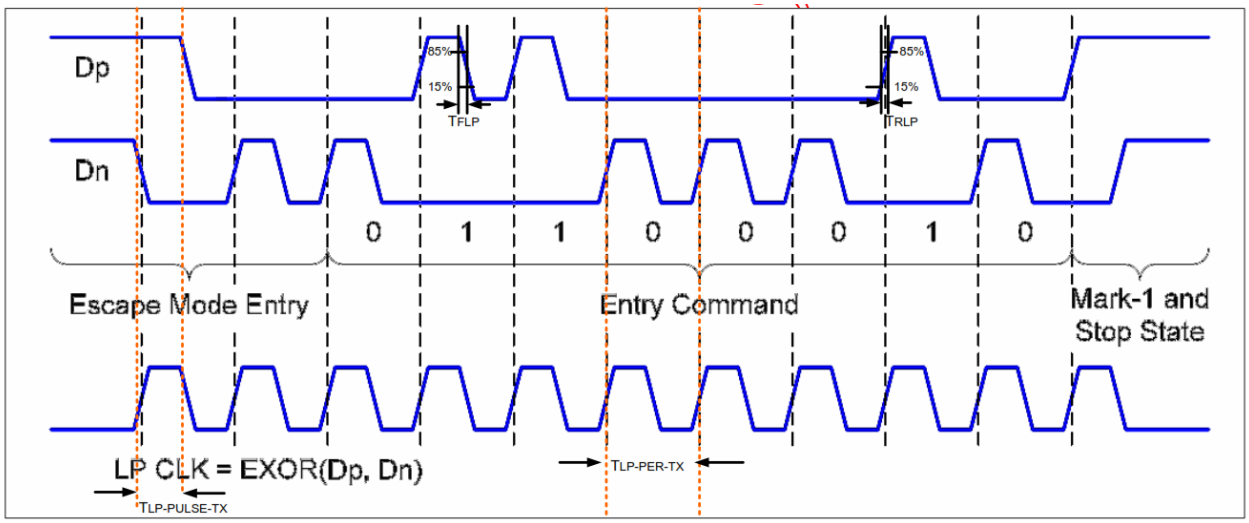
Definition of scanning direction, refer to the figure as below:



11. TIMING CHARACTERISTICS

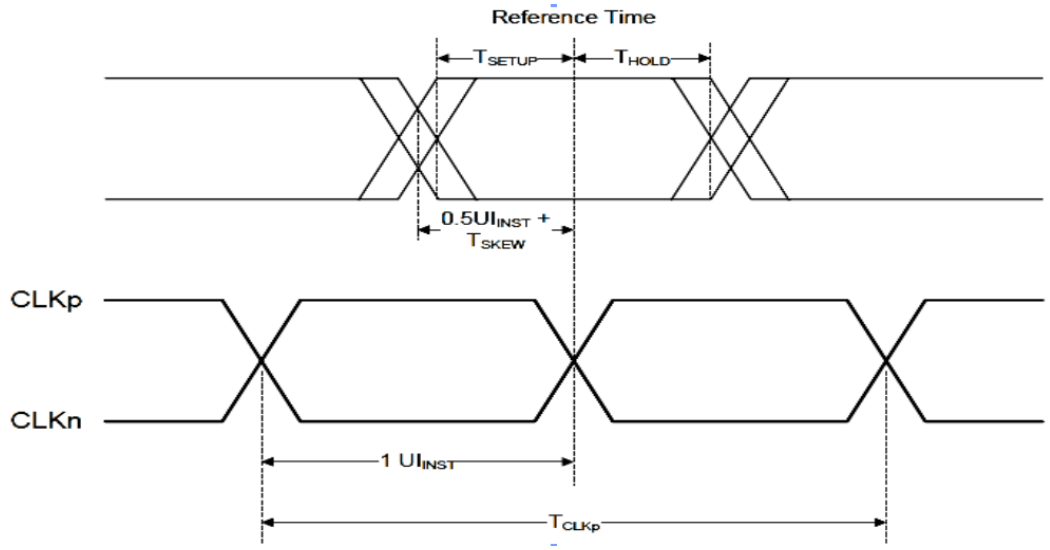
11.1 Low power transmitter AC characteristic

PARAMETER		SYMBOL	MIN	TYP	MAX	UNIT
15%~85% rising time and falling time		T_{RLP}/T_{FLP}	-	-	25	ns
30%~85% rising time and falling time		T_{REOT}	-	-	35	
Pulse width of LP exclusive -OR clock	First LP EXOR clock pulse after STOP state or LAST pulse before stop state	$T_{LP-PULSE-TX}$	40	-	-	
	All other pulses		20	-	-	
Period of the LP EXOR clock		$T_{LP-PER-TX}$	90	-	-	mV/ns
Slew Rate @CLOAD =0pF		$\delta V / \delta t_{SR}$	30	-	500	
Slew Rate @CLOAD =5pF			30	-	200	
Slew Rate @CLOAD =20pF			30	-	150	
Slew Rate @CLOAD =70pF			30	-	100	
Load Capacitance		T_{RLP}	-	-	70	pF



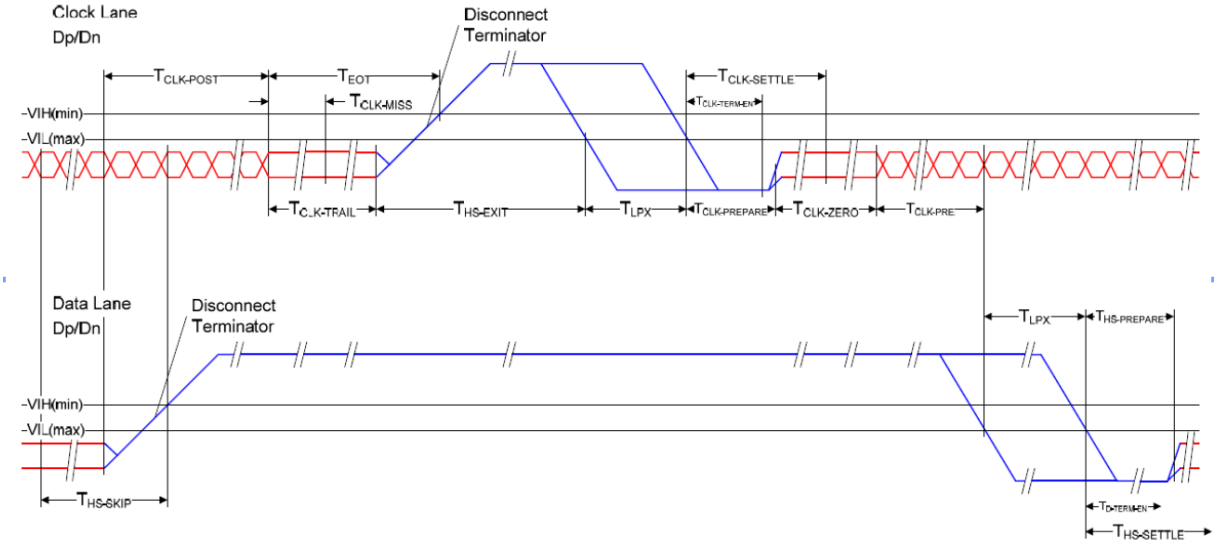
11.2 High speed transmission

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
UI instantaneous	UI_{INST}	2	-	12.5	ns
Data to Clock Skew (measured at transmitter)	$T_{SKEW(TX)}$	-0.15	-	0.15	UI_{INST}
Data to Clock Setup time (Measured at receiver)	$T_{SETUP(RX)}$	0.15	-	-	
Data to Clock Hold time (Measured at receiver)	$T_{HOLD(RX)}$	0.15	-		
20%~80% rising time and falling time	T_R,T_F	150	-	-	ps
		-	-	0.3	UI_{INST}

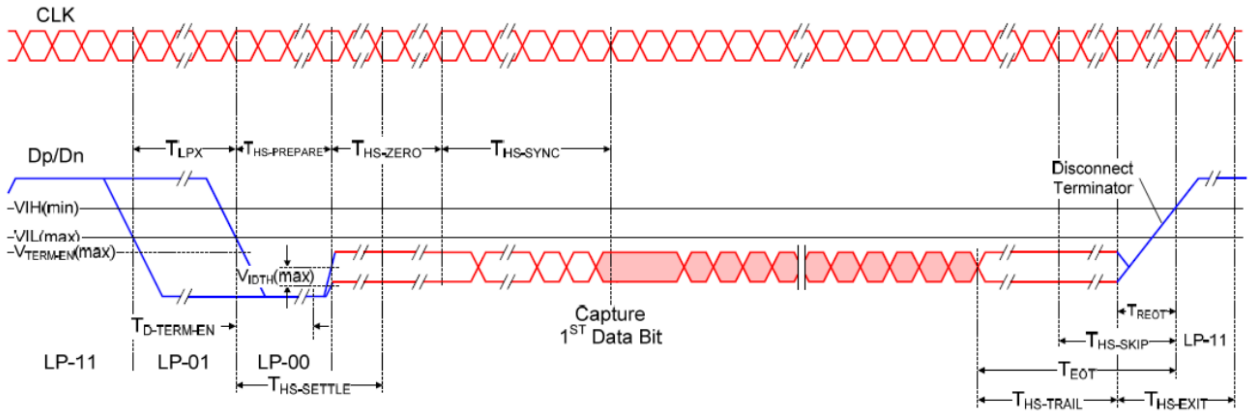


11.3 High speed clock transmission

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Time that the transmitter shall continue sending HS clock after the last associated Data Lane has transitioned to LP mode	$T_{CLK-POST}$	60+52UI	-	-	ns
Detection time that the clock has stopped toggling	$T_{CLK-MISS}$	-	-	60	
Time to drive LP-00 to prepare for HS clock transmission	$T_{CLK-PREPARE}$	38	-	95	
Minimum lead HS-0 drive period before starting clock	$T_{CLK-PREPARE+}$ $T_{CLK-ZERO}$	300	-	-	
Time to enable Clock Lane receiver line termination measured from when Dn cross $V_{IL,MAX}$	$T_{HS-TERM-EN}$	-	-	38	
Minimum time that the HS clock must be prior to any associated data lane beginning the transmission from LP to HS mode	$T_{CLK-PRE}$	8	-	-	UI
Time to drive HS differential state after last payload clock bit of a HS transmission burst	$T_{CLK-TRAIL}$	60	-	-	ns



11.4 High speed data transmission in bursts



12. INITIALIZATION CODE

```
DCS_Short_Write_NP(0x01); //Software Reset
Delay (120);
Generic_Short_Write_1P(0x87,0x5A);
 //Other commands will not work if this command is nor written
Generic_Short_Write_1P(0xB2,0x70); //Set Channels   2LANE:0x50; 3LANE:0x60; 4LANE:0x70
Generic_Short_Write_1P(0x80,0x4B); //Set Gamma voltage
Generic_Short_Write_1P(0x81,0xFF); //Set Gamma voltage
Generic_Short_Write_1P(0x82,0x1A); //Set Gamma voltage
Generic_Short_Write_1P(0x83,0x88); //Set Gamma voltage
Generic_Short_Write_1P(0x84,0x8F); //Set Gamma voltage
Generic_Short_Write_1P(0x85,0x35); //Set Gamma voltage
Generic_Short_Write_1P(0x86,0xB0); //Set Gamma voltage
DCS_Short_Write_NP(0x11); //Exit Sleep Mode
Delay (120);
DCS_Short_Write_NP(0x29); //Display on; 0x28 is display off
Delay (20);
```

13. INSPECTION

Standard acceptance/rejection criteria for TFT module

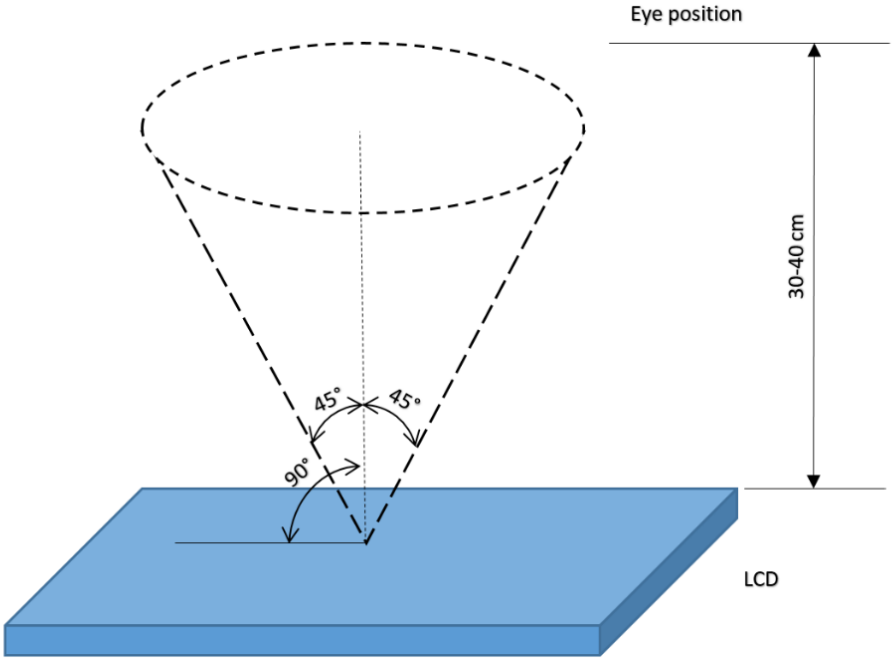
13.1 Inspection condition

Ambient conditions:

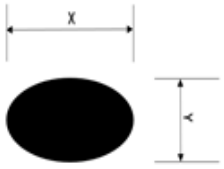
- Temperature: 25 ± 2°C
- Humidity: (60 ± 10) %RH
- Illumination: Single fluorescent lamp non-directive (300 to 700 lux)

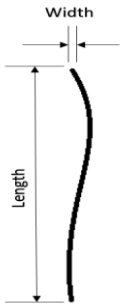
Viewing distance: 35 ± 5cm between inspector bare eye and LCD.

Viewing Angle: U/D: 45°/45°, L/R: 45°/45°



13.2 Inspection standard

<table>
<tr><th>ITEM</th><th colspan="4">CRITERION</th></tr>
<tr><td rowspan="6">Black spots, white spots, light leakage, Foreign Particle (round Type)</td><td rowspan="6"> 

D=(x+y)/2
Spot's density: 10 mm</td><td colspan="3">Size = 7”</td></tr>
<tr><td>Average Diameter</td><td colspan="2">Qualified Qty</td></tr>
<tr><td>D ≤ 0.2 mm</td><td colspan="2">Ignored</td></tr>
<tr><td>0.2 mm < D ≤ 0.3 mm</td><td colspan="2">N≤3</td></tr>
<tr><td>0.5mm < D</td><td colspan="2">Not allowed</td></tr>
<tr><td>0.5mm < D</td><td colspan="2"></td></tr>
<tr><td rowspan="5">LCD black spots, white spots, light leakage (line Type)</td><td rowspan="5"> 
</td><td colspan="3">Size = 7”</td></tr>
<tr><td>Length</td><td>Width</td><td>Qualified Qty</td></tr>
<tr><td>-</td><td>W ≤ 0.05</td><td>Ignored</td></tr>
<tr><td>L ≤ 5.0</td><td>0.05 < W ≤ 0.1</td><td>3</td></tr>
<tr><td>5.0 < L</td><td>0.1 < W</td><td>Not allowed</td></tr>
<tr><td rowspan="5">Bright/Dark Dots</td><td colspan="4">Size = 7”</td></tr>
<tr><td colspan="2">Item</td><td colspan="2">Qualified Qty</td></tr>
<tr><td colspan="2">Bright dots</td><td colspan="2">N≤2</td></tr>
<tr><td colspan="2">Dark dots</td><td colspan="2">N≤3</td></tr>
<tr><td colspan="2">Total bright and dark dots</td><td colspan="2">N≤4</td></tr>
<tr><td rowspan="6">Clear spots</td><td colspan="4">Size = 7”</td></tr>
<tr><td colspan="2">Average Diameter</td><td colspan="2">Qualified Qty</td></tr>
<tr><td colspan="2">D < 0.2 mm</td><td colspan="2">Ignored</td></tr>
<tr><td colspan="2">0.2 mm < D < 0.3 mm</td><td colspan="2">4</td></tr>
<tr><td colspan="2">0.3 mm < D < 0.5 mm</td><td colspan="2">2</td></tr>
<tr><td colspan="2">0.5 mm < D</td><td colspan="2">0</td></tr>
<tr><td rowspan="5">Polarizer bubbles</td><td colspan="4">Size = 7”</td></tr>
<tr><td colspan="2">Average Diameter</td><td colspan="2">Qualified Qty</td></tr>
<tr><td colspan="2">D ≤ 0.2 mm</td><td colspan="2">Ignored</td></tr>
<tr><td colspan="2">0.2 mm < D ≤ 0.5 mm</td><td colspan="2">4</td></tr>
<tr><td colspan="2">0.5 mm < D</td><td colspan="2">0</td></tr>
<tr><td rowspan="5">Touch panel spot</td><td colspan="4">Size ≥ 5"</td></tr>
<tr><td colspan="2">Average Diameter</td><td colspan="2">Qualified Qty</td></tr>
<tr><td colspan="2">D < 0.25 mm</td><td colspan="2">Ignored</td></tr>
<tr><td colspan="2">0.25 mm < D < 0.5 mm</td><td colspan="2">4</td></tr>
<tr><td colspan="2">0.5 mm < D</td><td colspan="2">0</td></tr>
<tr><td rowspan="4">Touch panel White line Scratch</td><td colspan="4">Size ≥ 5”</td></tr>
<tr><td>Length</td><td>Width</td><td colspan="2">Qualified Qty</td></tr>
<tr><td>-</td><td>W < 0.03</td><td colspan="2">Ignored</td></tr>
<tr><td>L < 5.0</td><td>0.03 < W < 0.05</td><td colspan="2">2</td></tr>
<tr><td>-</td><td>0.05 < W</td><td colspan="2">0</td></tr>
</table>

14. RELIABILITY TEST

NO.	TEST ITEM	TEST CONDITION
1	High Temperature Storage	80°C/120 hours
2	Low Temperature Storage	-30°C/120 hours
3	High Temperature Operating	70 °C /120 hours
4	Low Temperature Operating	-20°C/120 hours
5	High Temperature and High Humidity	Humidity 40℃, 90%RH, 120Hrs
6	Thermal Cycling Test (No operation)	-20℃ for 30min, 70℃ for 30 min. 100 cycles. Then test at room temperature after 1 hour
7	Vibration Test	Frequency: 10 ÷ 55 Hz. Stroke: 1.5 mm. Sweep: 10Hz ÷ 55Hz ÷ 10 Hz. 2 hours for each direction of X, Y, Z (Total 6 hours)
8	Package Drop Test	Height: 60 cm 1 corner, 3 edges, 6 surfaces
9	ESD Test	Air: ±2 kV, Human Body Mode, 100 pF /1500 Ω

Note 1. Sample quantity for each test item is 5 ÷ 10 pcs.
Note 2. Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

15. LEGAL INFORMATION

Riverdi grants the guarantee for the proper operation of the goods for a period of 12 months from the date of possession of the goods. If in a consequence of this guaranteed execution the customer has received the defects-free item as replacement for the defective item, the effectiveness period of this guarantee shall start anew from the moment the customer receives the defects-free item.

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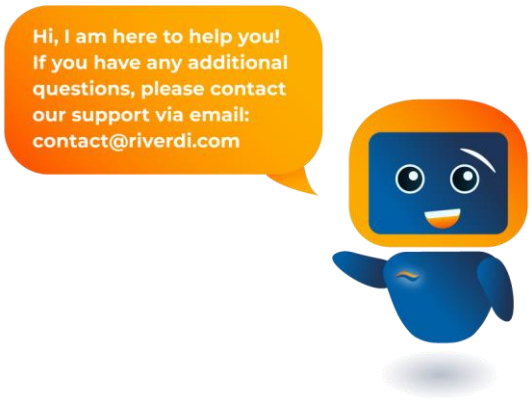

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