Display Elektronik GmbH

DATA SHEET

TFT- MODULE

DEM 640480H VMH-PW-N

5,7” IPS TFT

Product Specification Ver.: 1

31.05.2024

Revision History

Revision	Date	Originator	Detail	Remarks
0	27.05.2024	LL	Initial Release	-
1	31.05.2024	DFG	Modify Module Parameter Add Chromaticity Transmissive Modify Outline Drawing(B)	P4 P6 P29

Table of Contents

1. General Description

The specification is a transmissive type color active matrix liquid crystal display (LCD) which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT-LCD panel, driver ICs and a backlight unit.

2. Module Parameter

Features	Details	Unit
Display Size (Diagonal)	5.7”	-
LCD Type	IPS TFT	-
Display Mode	Normal Black/Transmissive	-
Resolution	640 x RGB x 480	Pixels
View Direction	Full View	Best Image
Module Outline	127.00 x 98.43 x 5.90 (Note1)	mm
Active Area	115.20 x 86.40	mm
Pixel Size	0.180 x 0.180	mm
Pixel Arrangement	RGB Vertical Stripe	-
Display Colors	16.7 Million	-
Driver IC	JD9168S	-
Interface	MIPI (DSI) LVDS 24-bit&18-bitRGB	-
With or Without Touch Panel	Without	-
Operating Temperature	-20°C to +70°C	ºC
Storage Temperature	-30°C to +80°C	ºC
Weight	90	g

Note 1: Exclusive hooks, posts, FFC/FPC tail etc.

3. Absolute Maximum Ratings

GND=0V, Ta=25ºC

Item	Symbol	Min.	Max.	Unit
Supply Voltage	IOVCC	-0.3	6.3	V
	AVDD	-0.3	6.3	V
	AVEE	-0.3	-6.3	V
Storage temperature	T_{STG}	-30	80	ºC
Operating temperature	T_{OP}	-20	70	ºC

Note 1: If Ta below 50ºC, the maximal humidity is 90%RH, if Ta over 50ºC, absolute humidity should be less than 60%RH.

Note 2: The response time will be extremely slow when the operating temperature is around -10°C, and the back ground will become darker at high temperature operating.

4. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	IOVCC	2.5	3.3	3.3	V
	AVDD	4.5	5.5	6.0	V
	AVEE	-4.5	-5.5	-6.0	V
Logic Low Input Voltage	V_{IL}	GND	-	0.3*IOVCC	V
Logic High Input Voltage	V_{IH}	0.7*IOVCC	-	IOVCC	V
Output low Voltage	V_{OL}	GND	-	GND+0.4	V
Output high Voltage	V_{OH}	IOVCC-0.4	-	IOVCC	V
Current Consumption All White	I_{CC}	-	75	-	mA

5. Backlight Characteristics

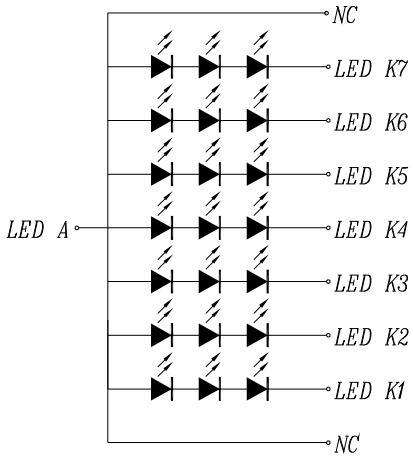
5.1. Backlight Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Backlight Voltage	V_{LED}	Ta=25 ºC, I_F=20mA/LED	8.1	**9**	9.9	V
Backlight Current	I_{LED}	Ta=25 ºC, V_F=3.0V/LED	-	140	-	mA
Power Dissipation	P_D		-	1260	-	mW
Uniformity	Avg		-	80	-	%
LED Lifetime (+25°C)	-		-	30000	-	Hrs
Drive Method	Constant Current					
LED Configuration	21 White LEDs (3 LEDs in one string and 7 groups in parallel)					

Note1：LED lifetime defined as follows: The final brightness is at 50% of original brightness.

The environmental conducted under ambient air flow, at Ta=25°C ± 2ºC, 60%RH ± 5%, I_F=20mA/LED.

5.2. Backlighting Circuit



3*7=21EA If=140mA

6. Optical Characteristics

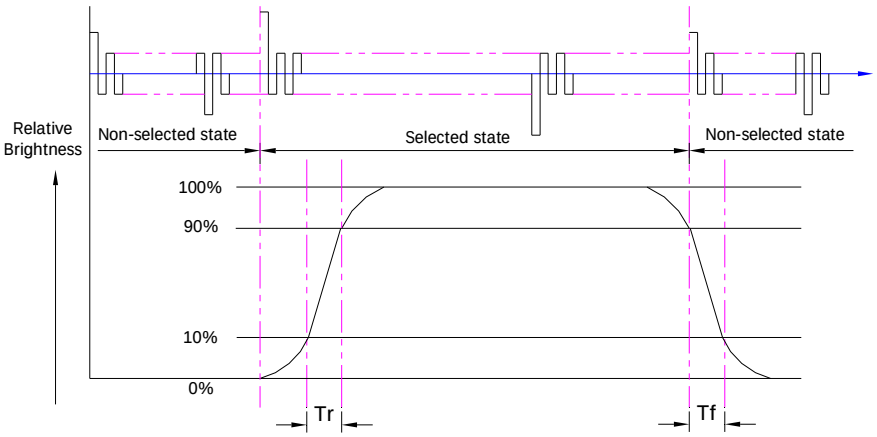
6.1. Optical Characteristics

Ta=25ºC, IOVCC=3.3V

	Item		Symbol	Condition	Specification			Unit
					Min.	Typ.	Max.	
Backlight On (Transmissive Mode)	Luminance on TFT(I_f =20mA/LED)		Lv	Normally viewing angle $\theta_X = \varphi_Y = 0^o$	488	610	-	cd/m²
	Contrast Ratio(See 6.3)		CR		1000	1200	-	-
	Response Time (See 6.2)		T_R+T_F		-	30	35	ms
	Chromaticity Transmissive (See 6.5)	Red	X_R	-	0.606	0.656	0.706	-
			Y_R		0.271	0.321	0.371	-
		Green	X_G		0.271	0.321	0.371	-
			Y_G		0.567	0.617	0.667	-
		Blue	X_B		0.070	0.120	0.170	-
			Y_B		0.076	0.126	0.176	-
		White	X_W		0.261	0.311	0.361	-
			Y_W		0.332	0.382	0.432	-
	Viewing Angle (See 6.4)	Horizontal	θ_{X+}	Center CR≥10	75	80	-	Deg.
			θ_{X-}		75	80	-	
		Vertical	φ_{Y+}		75	80	-	
			φ_{Y-}		75	80	-	
	NSTC			Θ=0 °	55	60	-	%

6.2. Definition of Response Time

6.2.1. Normally Black Type (Negative)

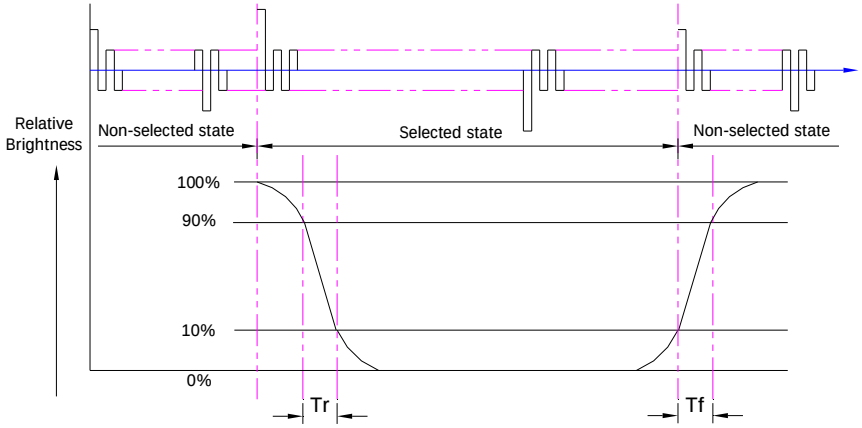


Tr is the time it takes to change form non-selected stage with relative luminance 10% to selected state with relative luminance 90%;

Tf is the time it takes to change from selected state with relative luminance 90% to non-selected state with relative luminance 10%

Note: Measuring machine: LCD-5100

6.2.2. Normally White Type (Positive)



Tr is the time it takes to change form non-selected stage with relative luminance 90% to selected state with relative luminance 10%;

Tf is the time it takes to change from selected state with relative luminance 10% to non-selected state with relative luminance 90%;

Note: Measuring machine: LCD-5100 or EQUI

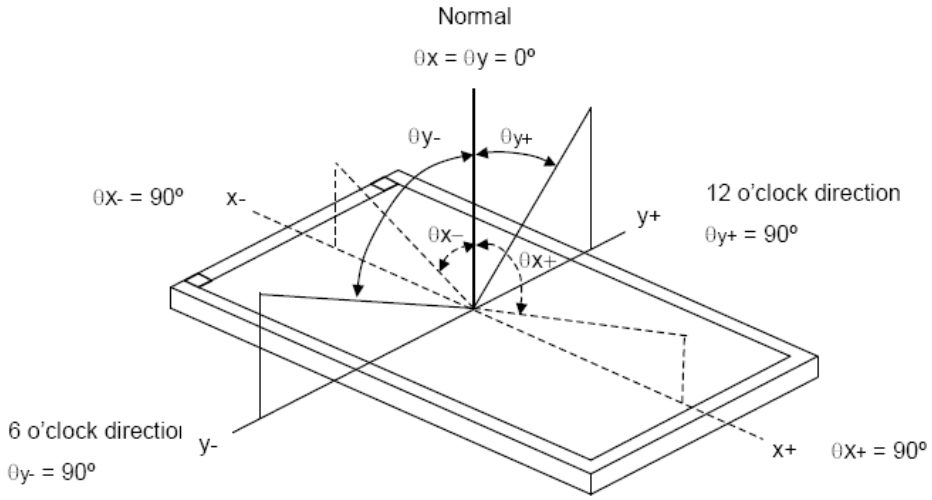
6.3. Definition of Contrast Ratio

Contrast is measured perpendicular to display surface in reflective and transmissive mode. The measurement condition is:

Measuring Equipment	Eldim or Equivalent
Measuring Point Diameter	3mm//1mm
Measuring Point Location	Active Area centre point
Test pattern	A: All Pixels white
	B: All Pixel black
Contrast setting	Maximum

Definitions: CR (Contrast) = Luminance of White Pixel / Luminance of Black Pixel

6.4. Definition of Viewing Angles



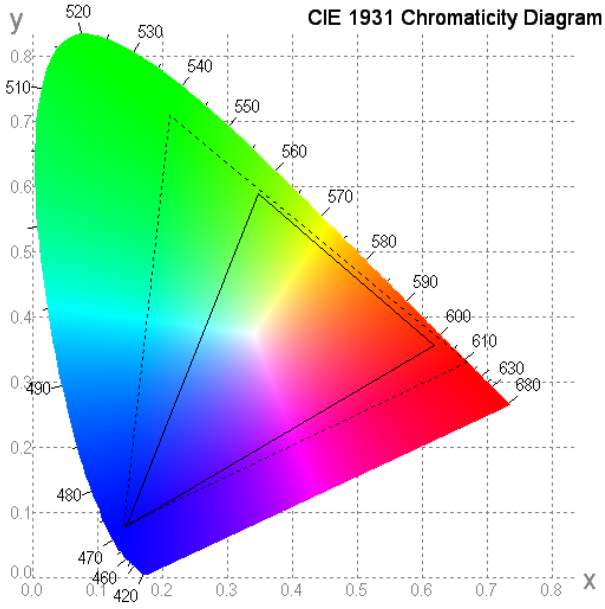
Measuring machine: LCD-5100 or EQUI

6.5. Definition of Color Appearance

R,G,B and W are defined by (x, y) on the IE chromaticity diagram

NTSC=area of RGB triangle/area of NTSC triangleX100%

Measuring picture: Red, Green, Blue and White (Measuring machine: BM-7)



6.6. Definition of Surface Luminance, Uniformity and Transmittance

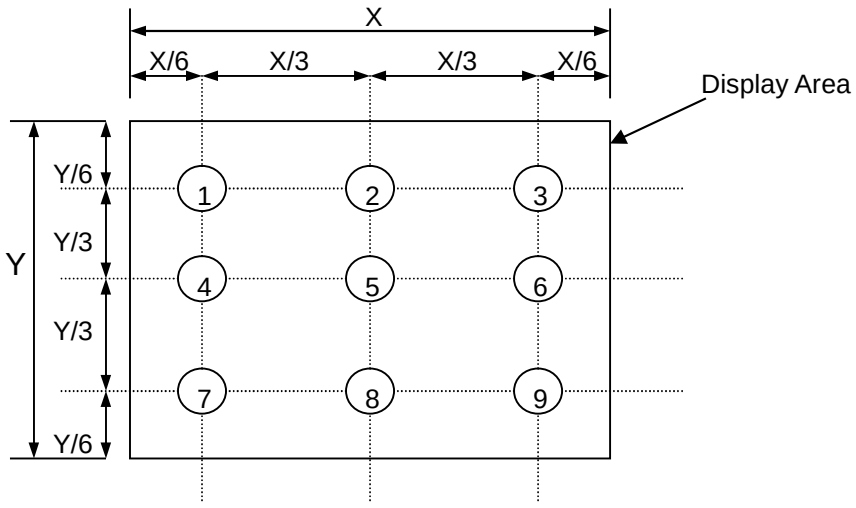
Using the transmissive mode measurement approach, measure the white screen luminance of the display panel and backlight.

6.6.1. Surface Luminance: L_V = average (L_{P1}:L_{P9})

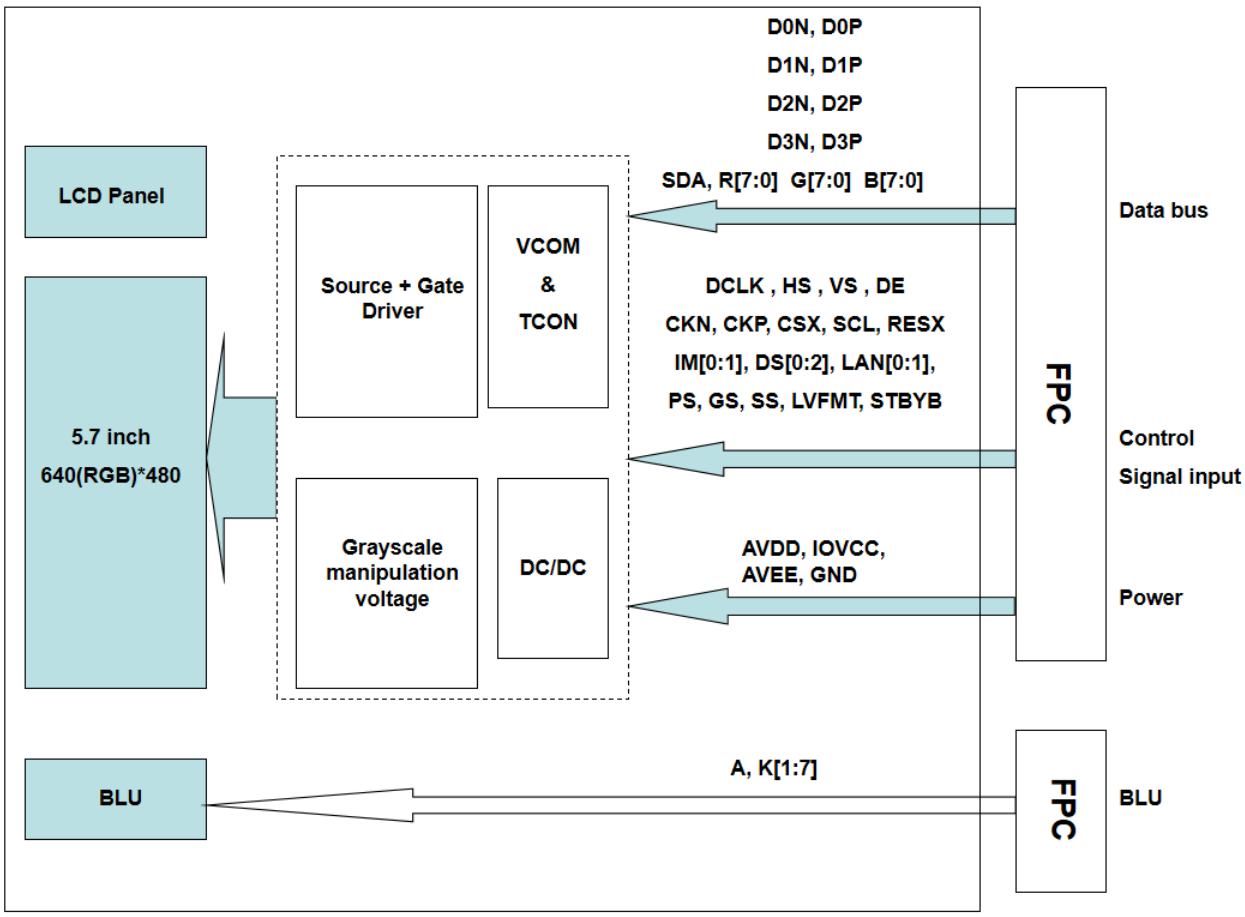
6.6.2. Uniformity = Minimal (L_{P1}:L_{P9}) / Maximal (L_{P1}:L_{P9}) * 100%

6.6.3. Transmittance = L_V on LCD / L_V on Backlight * 100%

Note: Measuring machine: BM-7



7. Block Diagram and Power Supply



8. Interface Pins Definition

<table>
<tr><th>No.</th><th>Symbol</th><th>Function</th></tr>
<tr><td>1</td><td>SDA</td><td>Serial communication data input and output</td></tr>
<tr><td>2</td><td>CSX</td><td>Serial communication chip selection</td></tr>
<tr><td>3</td><td>SCL</td><td>Serial communication clock input</td></tr>
<tr><td>4</td><td>RESX</td><td>Reset pin</td></tr>
<tr><td>5</td><td>B0</td><td>Blue data</td></tr>
<tr><td>6</td><td>B1</td><td>Blue data</td></tr>
<tr><td>7</td><td>B2</td><td>Blue data</td></tr>
<tr><td>8</td><td>B3</td><td>Blue data</td></tr>
<tr><td>9</td><td>B4</td><td>Blue data</td></tr>
<tr><td>10</td><td>B5</td><td>Blue data</td></tr>
<tr><td>11</td><td>B6</td><td>Blue data</td></tr>
<tr><td>12</td><td>B7</td><td>Blue data</td></tr>
<tr><td>13</td><td>G0</td><td>Green data</td></tr>
<tr><td>14</td><td>G1</td><td>Green data</td></tr>
<tr><td>15</td><td>G2</td><td>Green data</td></tr>
<tr><td>16</td><td>G3</td><td>Green data</td></tr>
<tr><td>17</td><td>G4</td><td>Green data</td></tr>
<tr><td>18</td><td>G5</td><td>Green data</td></tr>
<tr><td>19</td><td>G6</td><td>Green data</td></tr>
<tr><td>20</td><td>G7</td><td>Green data</td></tr>
<tr><td>21</td><td>R0</td><td>Red data</td></tr>
<tr><td>22</td><td>R1</td><td>Red data</td></tr>
<tr><td>23</td><td>R2</td><td>Red data</td></tr>
<tr><td>24</td><td>R3</td><td>Red data</td></tr>
<tr><td>25</td><td>R4</td><td>Red data</td></tr>
<tr><td>26</td><td>R5</td><td>Red data</td></tr>
<tr><td>27</td><td>R6</td><td>Red data</td></tr>
<tr><td>28</td><td>R7</td><td>Red data</td></tr>
<tr><td>29</td><td>GS</td><td>Gate driver scan direction on panel module
<table><tr><th>GS</th><th>Direction</th></tr><tr><td>0</td><td>G[1, 2, 3 → … → 1024]</td></tr><tr><td>1</td><td>G[1024, 1023, 1022 → … → 1]</td></tr></table></td></tr>
<tr><td>30</td><td>SS</td><td>Source driver scan direction on panel module.
<table><tr><th>SS</th><th>Direction</th></tr><tr><td>0</td><td>S[1, 2, 3 → → 1536]</td></tr><tr><td>1</td><td>S[1536, 1535, 1534 → → 1]</td></tr></table></td></tr>
<tr><td>31</td><td>LAN0</td><td>Select the lane mode as listed below:
<table><tr><th>LANSEL[1:0]</th><th>DSI IF</th><th>LVDS IF</th></tr></table></td></tr>
</table>

<table>
<tr><td>32</td><td>LAN1</td><td></td></tr>
<tr><td>33</td><td>LVFMT</td><td>Data format select for LVDS mode.
<table><tr><th>LVFMT</th><th>Format</th></tr><tr><td>0</td><td>VESA</td></tr><tr><td>1</td><td>JEIDA</td></tr></table></td></tr>
<tr><td>34</td><td>STBYB</td><td>Standby mode.
<table><tr><th>STBYB</th><th>IC Status</th></tr><tr><td>0</td><td>Standby Mode</td></tr><tr><td>1</td><td>Normal Mode</td></tr></table></td></tr>
<tr><td>35</td><td>IM1</td><td rowspan="2">Select the interface mode as listed below:
<table><tr><th colspan="2">IM[1:0]</th><th>Interface</th></tr><tr><td>0</td><td>0</td><td>DSI</td></tr><tr><td>0</td><td>1</td><td>LVDS</td></tr><tr><td>1</td><td>0</td><td>RGB</td></tr><tr><td>1</td><td>1</td><td>Not used</td></tr></table>RGB IF data format (RGB565 / RGB666 / RGB888) is selected by DCS command (0x3A).</td></tr>
<tr><td>36</td><td>IM0</td></tr>
<tr><td>37</td><td>DCLK</td><td>Sample clock</td></tr>
<tr><td>38</td><td>DE</td><td>Data Input Enable</td></tr>
<tr><td>39</td><td>VS</td><td>Vertical Sync Input</td></tr>
<tr><td>40</td><td>HS</td><td>Horizontal Sync Input</td></tr>
</table>

<table>
<tr><td>41</td><td>DS2</td><td rowspan="4">Select for DSI data lane sequence and polarity.
<table>
<tr><th>PSWAP</th><th>DSWAP[2:0]</th><th>D0N</th><th>D0P</th><th>D1N</th><th>D1P</th><th>CKN</th><th>CKP</th><th>D2N</th><th>D2P</th><th>D3N</th><th>D3P</th></tr>
<tr><td>0</td><td>000</td><td>D2-</td><td>D2+</td><td>D1-</td><td>D1+</td><td>CLK-</td><td>CLK+</td><td>D0-</td><td>D0+</td><td>D3-</td><td>D3+</td></tr>
<tr><td>0</td><td>001</td><td>D2-</td><td>D2+</td><td>D0-</td><td>D0+</td><td>CLK-</td><td>CLK+</td><td>D1-</td><td>D1+</td><td>D3-</td><td>D3+</td></tr>
<tr><td>0</td><td>010</td><td>D3-</td><td>D3+</td><td>D1-</td><td>D1+</td><td>CLK-</td><td>CLK+</td><td>D0-</td><td>D0+</td><td>D2-</td><td>D2+</td></tr>
<tr><td>0</td><td>011</td><td>D3-</td><td>D3+</td><td>D0-</td><td>D0+</td><td>CLK-</td><td>CLK+</td><td>D1-</td><td>D1+</td><td>D2-</td><td>D2+</td></tr>
<tr><td>0</td><td>100</td><td>D3-</td><td>D3+</td><td>D2-</td><td>D2+</td><td>CLK-</td><td>CLK+</td><td>D1-</td><td>D1+</td><td>D0-</td><td>D0+</td></tr>
<tr><td>0</td><td>101</td><td>D3-</td><td>D3+</td><td>D1-</td><td>D1+</td><td>CLK-</td><td>CLK+</td><td>D2-</td><td>D2+</td><td>D0-</td><td>D0+</td></tr>
<tr><td>0</td><td>110</td><td>D0-</td><td>D0+</td><td>D2-</td><td>D2+</td><td>CLK-</td><td>CLK+</td><td>D1-</td><td>D1+</td><td>D3-</td><td>D3+</td></tr>
<tr><td>0</td><td>111</td><td>D0-</td><td>D0+</td><td>D1-</td><td>D1+</td><td>CLK-</td><td>CLK+</td><td>D2-</td><td>D2+</td><td>D3-</td><td>D3+</td></tr>
<tr><td>1</td><td>000</td><td>D2+</td><td>D2-</td><td>D1+</td><td>D1-</td><td>CLK+</td><td>CLK-</td><td>D0+</td><td>D0-</td><td>D3+</td><td>D3-</td></tr>
<tr><td>1</td><td>001</td><td>D2+</td><td>D2-</td><td>D0+</td><td>D0-</td><td>CLK+</td><td>CLK-</td><td>D1+</td><td>D1-</td><td>D3+</td><td>D3-</td></tr>
<tr><td>1</td><td>010</td><td>D3+</td><td>D3-</td><td>D1+</td><td>D1-</td><td>CLK+</td><td>CLK-</td><td>D0+</td><td>D0-</td><td>D2+</td><td>D2-</td></tr>
<tr><td>1</td><td>011</td><td>D3+</td><td>D3-</td><td>D0+</td><td>D0-</td><td>CLK+</td><td>CLK-</td><td>D1+</td><td>D1-</td><td>D2+</td><td>D2-</td></tr>
<tr><td>1</td><td>100</td><td>D3+</td><td>D3-</td><td>D2+</td><td>D2-</td><td>CLK+</td><td>CLK-</td><td>D1+</td><td>D1-</td><td>D0+</td><td>D0-</td></tr>
<tr><td>1</td><td>101</td><td>D3+</td><td>D3-</td><td>D1+</td><td>D1-</td><td>CLK+</td><td>CLK-</td><td>D2+</td><td>D2-</td><td>D0+</td><td>D0-</td></tr>
<tr><td>1</td><td>110</td><td>D0+</td><td>D0-</td><td>D2+</td><td>D2-</td><td>CLK+</td><td>CLK-</td><td>D1+</td><td>D1-</td><td>D3+</td><td>D3-</td></tr>
<tr><td>1</td><td>111</td><td>D0+</td><td>D0-</td><td>D1+</td><td>D1-</td><td>CLK+</td><td>CLK-</td><td>D2+</td><td>D2-</td><td>D3+</td><td>D3-</td></tr>
</table>
</td></tr>
<tr><td>42</td><td>DS1</td></tr>
<tr><td>43</td><td>DS0</td></tr>
<tr><td>44</td><td>PS</td></tr>
<tr><td></td><td></td><td>Select for LVDS data lane sequence and polarity.
<table>
<tr><th>PSWAP</th><th>DSWAP[2:0]</th><th>D0N</th><th>D0P</th><th>D1N</th><th>D1P</th><th>CKN</th><th>CKP</th><th>D2N</th><th>D2P</th><th>D3N</th><th>D3P</th></tr>
<tr><td>0</td><td>000</td><td>D3-</td><td>D3+</td><td>D2-</td><td>D2+</td><td>CLK-</td><td>CLK+</td><td>D1-</td><td>D1+</td><td>D0-</td><td>D0+</td></tr>
<tr><td>0</td><td>001</td><td>D3-</td><td>D3+</td><td>CLK-</td><td>CLK+</td><td>D2-</td><td>D2+</td><td>D1-</td><td>D1+</td><td>D0-</td><td>D0+</td></tr>
<tr><td>0</td><td>010</td><td>D0-</td><td>D0+</td><td>D1-</td><td>D1+</td><td>CLK-</td><td>CLK+</td><td>D2-</td><td>D2+</td><td>D3-</td><td>D3+</td></tr>
<tr><td>0</td><td>011</td><td>D0-</td><td>D0+</td><td>D1-</td><td>D1+</td><td>D2-</td><td>D2+</td><td>CLK-</td><td>CLK+</td><td>D3-</td><td>D3+</td></tr>
<tr><td>0</td><td>100</td><td>CLK-</td><td>CLK+</td><td>D0-</td><td>D0+</td><td>D1-</td><td>D1+</td><td>D2-</td><td>D2+</td><td>D3-</td><td>D3+</td></tr>
<tr><td>0</td><td>101</td><td>CLK-</td><td>CLK+</td><td>D3-</td><td>D3+</td><td>D2-</td><td>D2+</td><td>D1-</td><td>D1+</td><td>D0-</td><td>D0+</td></tr>
<tr><td>0</td><td>110</td><td>D3-</td><td>D3+</td><td>D2-</td><td>D2+</td><td>D1-</td><td>D1+</td><td>D0-</td><td>D0+</td><td>CLK-</td><td>CLK+</td></tr>
<tr><td>0</td><td>111</td><td>D0-</td><td>D0+</td><td>D1-</td><td>D1+</td><td>D2-</td><td>D2+</td><td>D3-</td><td>D3+</td><td>CLK-</td><td>CLK+</td></tr>
<tr><td>1</td><td>000</td><td>D3+</td><td>D3-</td><td>D2+</td><td>D2-</td><td>CLK+</td><td>CLK-</td><td>D1+</td><td>D1-</td><td>D0+</td><td>D0-</td></tr>
<tr><td>1</td><td>001</td><td>D3+</td><td>D3-</td><td>CLK+</td><td>CLK-</td><td>D2+</td><td>D2-</td><td>D1+</td><td>D1-</td><td>D0+</td><td>D0-</td></tr>
<tr><td>1</td><td>010</td><td>D0+</td><td>D0-</td><td>D1+</td><td>D1-</td><td>CLK+</td><td>CLK-</td><td>D2+</td><td>D2-</td><td>D3+</td><td>D3-</td></tr>
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<tr><td>1</td><td>100</td><td>CLK+</td><td>CLK-</td><td>D0+</td><td>D0-</td><td>D1+</td><td>D1-</td><td>D2+</td><td>D2-</td><td>D3+</td><td>D3-</td></tr>
<tr><td>1</td><td>101</td><td>CLK+</td><td>CLK-</td><td>D3+</td><td>D3-</td><td>D2+</td><td>D2-</td><td>D1+</td><td>D1-</td><td>D0+</td><td>D0-</td></tr>
<tr><td>1</td><td>110</td><td>D3+</td><td>D3-</td><td>D2+</td><td>D2-</td><td>D1+</td><td>D1-</td><td>D0+</td><td>D0-</td><td>CLK+</td><td>CLK-</td></tr>
<tr><td>1</td><td>111</td><td>D0+</td><td>D0-</td><td>D1+</td><td>D1-</td><td>D2+</td><td>D2-</td><td>D3+</td><td>D3-</td><td>CLK+</td><td>CLK-</td></tr>
</table>
</td></tr>
<tr><td>45</td><td>GND</td><td>Ground</td></tr>
<tr><td>46</td><td>D0N</td><td>Data differential signal input pins</td></tr>
<tr><td>47</td><td>D0P</td><td>Data differential signal input pins</td></tr>
<tr><td>48</td><td>D1N</td><td>Data differential signal input pins</td></tr>
<tr><td>49</td><td>D1P</td><td>Data differential signal input pins</td></tr>
<tr><td>50</td><td>CKN</td><td>CLOCK differential signal input pins</td></tr>
<tr><td>51</td><td>CKP</td><td>CLOCK differential signal input pins</td></tr>
<tr><td>52</td><td>D2N</td><td>Data differential signal input pins</td></tr>
<tr><td>53</td><td>D2P</td><td>Data differential signal input pins</td></tr>
<tr><td>54</td><td>D3N</td><td>Data differential signal input pins</td></tr>
<tr><td>55</td><td>D3P</td><td>Data differential signal input pins</td></tr>
<tr><td>56</td><td>IOVCC</td><td>power supply</td></tr>
<tr><td>57</td><td>AVDD</td><td>Input positive power from system/ external power IC</td></tr>
<tr><td>58</td><td>AVEE</td><td>Input negative power from system/ external power IC</td></tr>
</table>

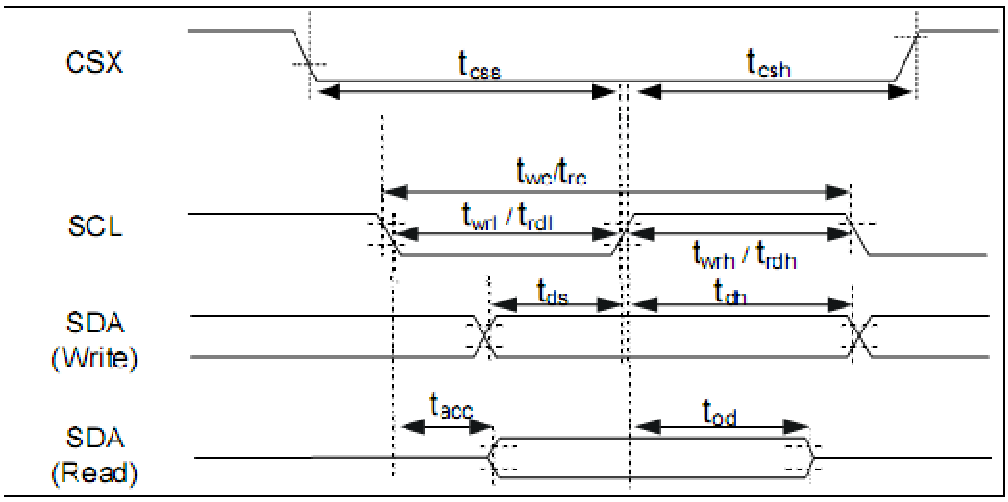
59	VPP	External High voltage pin is used in OTP program mode, the power is operate at 7.8V.If not used, let them open
60	GND	Ground

BACKLIGHT UNIT PIN:

No.	Symbol	Function
1	NC	No connection
2	A	LED Anode
3	K1	LED Cathode
4	K2	LED Cathode
5	K3	LED Cathode
6	K4	LED Cathode
7	K5	LED Cathode
8	K6	LED Cathode
9	K7	LED Cathode
10	NC	No connection

9. AC Characteristics

9.1. 3-Wire SPI Interface Timing



SPI interface AC characteristics

(T_A=25°C, IOVCC=3.3V, VCI=3.3V)

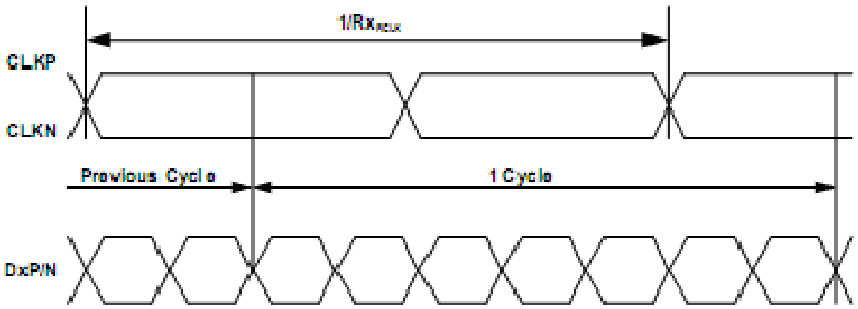
Signal	Symbol	Parameter	Min.	Max.	Unit	Description
CSX	t_{css} t_{csh}	Chip select setup time (Write) Chip select setup time (Read)	40 40	- -	ns	-
SCL (Write)	t_{wrc} t_{wrh} t_{wrl}	Write cycle Control pulse "H" duration Control pulse "L" duration	100 40 40	- - -	ns	-
SCL (Read)	t_{rc} t_{rdh} t_{rdl}	Read cycle Control pulse "H" duration Control pulse "L" duration	150 60 60	- - -	ns	-
SDA (Write)	t_{ds} t_{dh}	Data setup time Data hold time	30 30	- -	ns	Note(1)
SDA (Read)	t_{acc} t_{od}	Read access time Output disable time	- 10	35 50	ns	

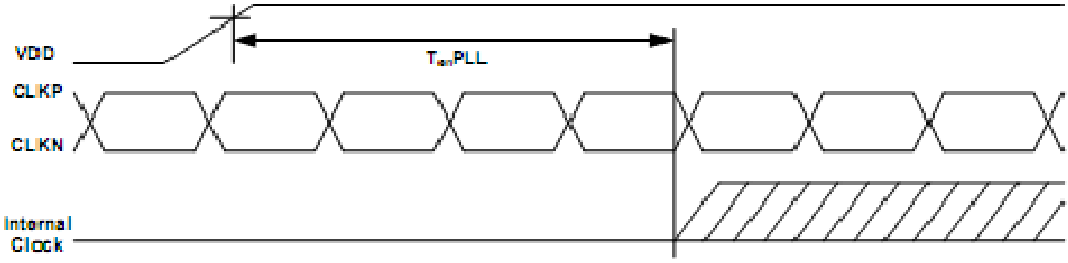
Note: (1) For maximum CL=30pF, for minimum CL=8pF.
(2) The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
(3) Logic high and low levels are specified as 30% and 70% of IOVCC for input signals.

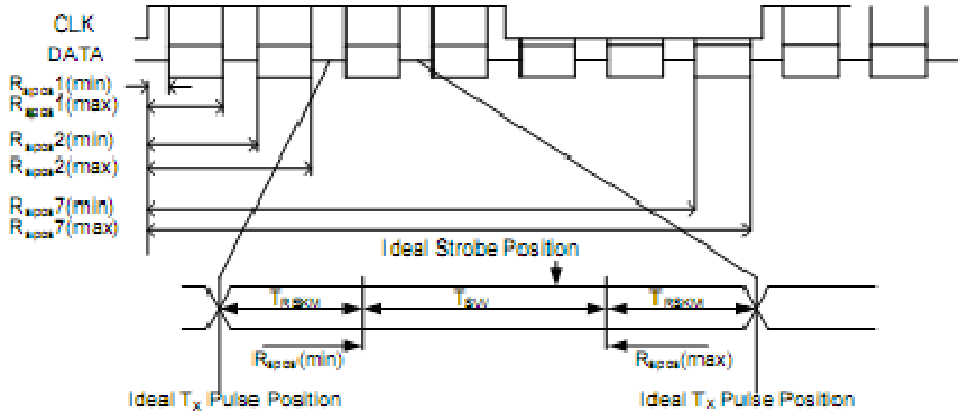
SPI interface AC characteristics

9.2. LVDS Interface

9.2.1. LVDS Electronic Characteristic







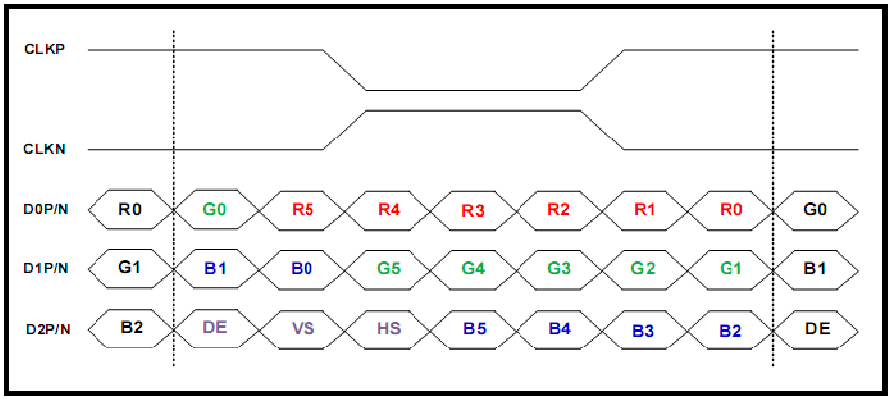
T_{SW}: Strobe width (Internal data sampling window)
R_{POS} : Receiver strobe position
T_{RSKM} : Receiver strobe margin

LVDS AC characteristics

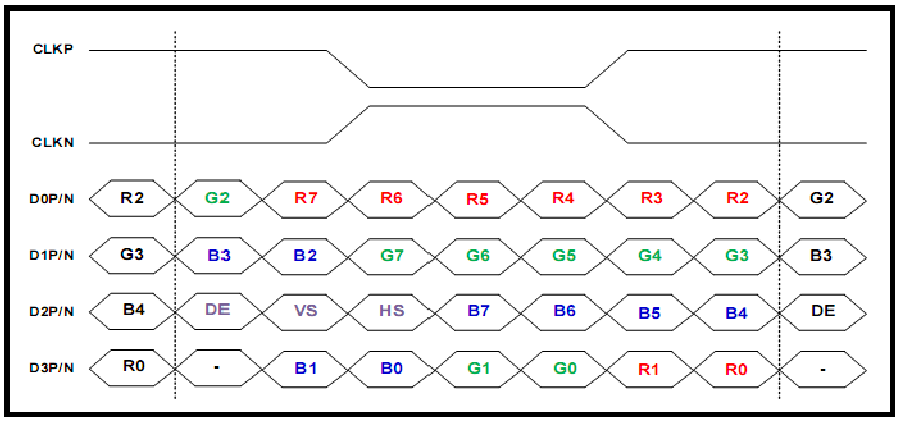
Signal	Symbol	Min.	Typ	Max.	Unit	Description
Clock frequency	RxF_{CLK}	30	-	75	MHz	-
Input data skew margin	T_{RSKM}	500	-	-	ps	|VID| = 200mV RxVCM = 1.2V @RxF_{CLK}=75MHz
Clock high time	T_{LVCH}	-	4/(7x RxF_{CLK})	-	ns	-
Clock low time	T_{LVCL}	-	3/(7xRxF_{CLK})	-	ns	-
PLL wake-up time	T_{wn}PLL	-	-	150	us	-

LVDS AC characteristics

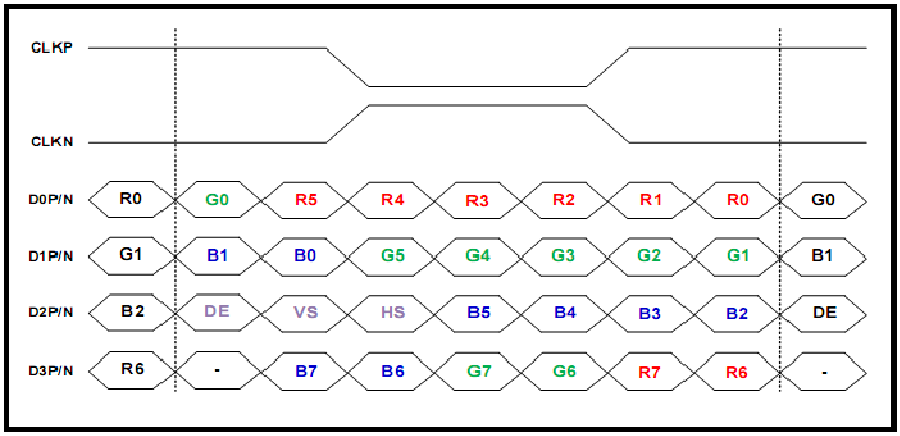
9.2.2. LVDS Data Format



6-bit LVDS input (IM[1:0]=01, LANSEL[1:0]=10, LVFMT=Don't care)



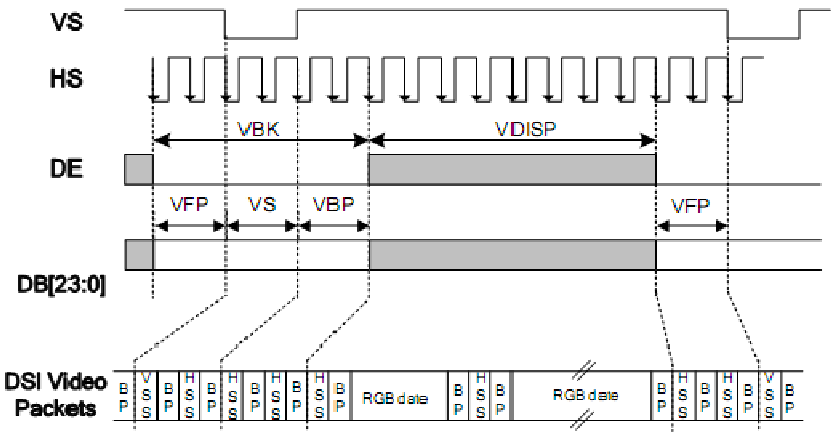
8-bit LVDS input (IM[1:0]=01, LANSEL[1:0]=11, LVFMT=1(JEIDA))



8-bit LVDS input (IM[1:0]=01, LANSEL[1:0]=11, LVFMT=0(VESA))

9.3. RGB Interface Timing

Vertical Timings



Vertical Timings for DPI/F

Resolution=800x480 (T_A=25°C, IOVCC=3.3V, VCI=3.3V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical low pulse width	VS	-	2	-	Note(1)	Line
Vertical front porch	VFP	-	2	-	-	Line
Vertical back porch	VBP	-	2	-	Note(1)	Line
Vertical blanking period	VBK	VS+VBP+VFP	6	-	-	Line
Vertical active area	-	VDISP	-	480	-	Line
Vertical Refresh rate	VRR	-	-	60	-	Hz

Note: The VS and VBP pulse width are related to GIP start pulse and GIP clock pulse timing. The GIP start pulse and GIP clock pulse must be set at corresponding position for LCD normal display.

Horizontal Timings

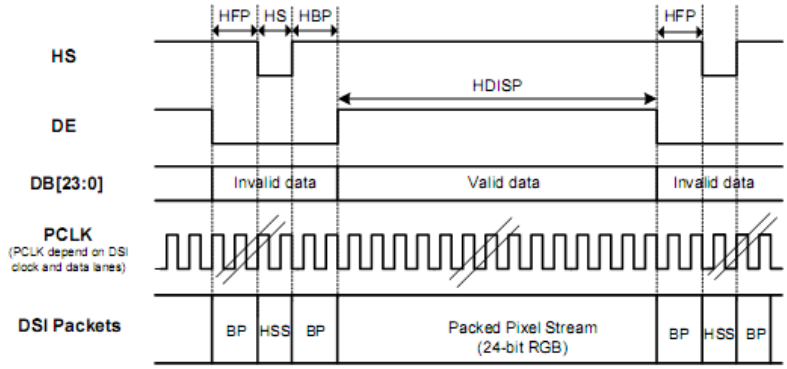


Figure 11.13: Horizontal Timing for DSI Video mode I/F

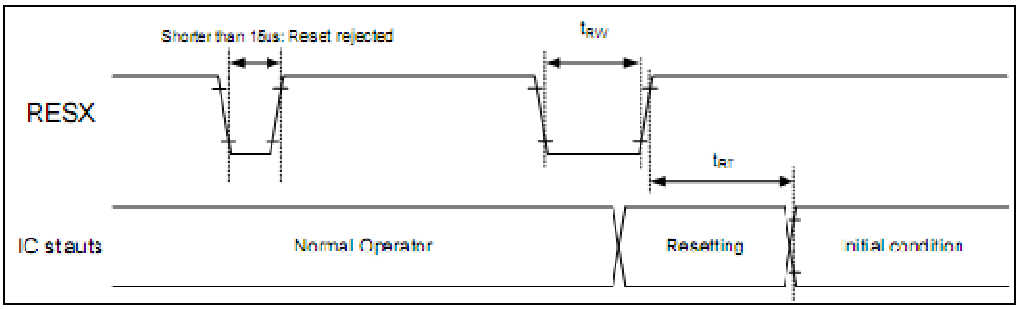
RGB Resolution=800x480 (T_A=25°C, VCCH=IOVCC=3.3V, VCI=3.3V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
HS low pulse width	HS	-	100			ns
Horizontal back porch	HBP	-	100			ns
Horizontal front porch	HFP	-	400			ns
Horizontal blanking period	HBLK	HS+HBP+HFP		900(1)		ns
Horizontal active area	HDISP	640 pixels	-	12(2)	-	us

Note:

1. Below time limitation will apply in all DSI speed range.
   (1) HS+HBP >= 500ns.
   (2) HFP >= 400ns.
2. Base on frame rate = 60HZ,
   (1) VS=2, VBP=2 and VFP=2.

9.4. Reset Timing



Reset input timings

Symbol	Parameter	Related pins	Min.	Max.	Unit
t_{RW}	Reset "L" pulse width(2)	RESX	20	-	µs
t_{RT}	Reset complete time(3)	-	-	5(5)	ms
		-	-	120(6) (7) (8)	ms

Note:

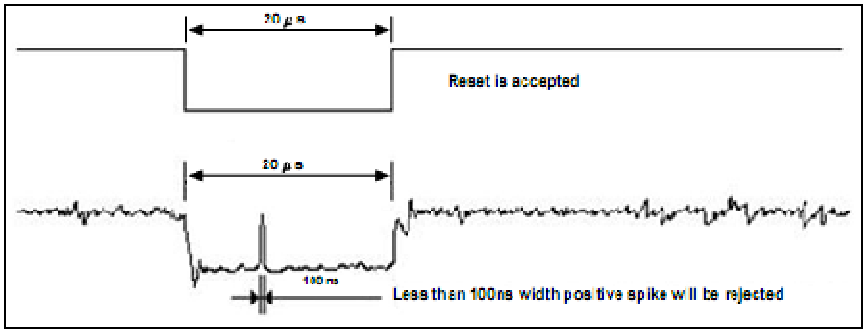
(1) The reset complete time also required time for loading ID bytes from OTP to registers. This loading is done every time when there is HW reset complete time (t_{RT}) within 5 ms after a rising edge of RESX.

(2) Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below.

RESX Pulse	Action
Shorter than 15 µs	Reset Rejected
Longer than 20 µs	Reset
Between 15 µs and 20 µs	Reset Start

(3) During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode) and then returns to Default condition for H/W reset.

(4) Spike Rejection also applies during a valid reset pulse as shown below:



Reset timings

(5) When Reset is applied during Sleep In Mode.

(6) When Reset is applied during Sleep Out Mode.

(7) It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

(8) After Sleep Out command, it is necessary to wait 120msec then send RESX.

10. Quality Assurance

10.1. Purpose

This standard for Quality Assurance assures the quality of LCD module products supplied to customer.

10.2. Standard for Quality Test

10.2.1. Sampling Plan:

GB2828.1-2012

Single sampling, general inspection level II

10.2.2. Sampling Criteria:

Visual inspection: AQL 1.5.

Electrical functional: AQL 0.65.

10.2.3. Reliability Test:

Detailed requirement refer to Reliability Test Specification.

10.3. Nonconforming Analysis & Disposition

10.3.1. Nonconforming analysis:

10.3.1.1. Customer should provide overall information of non-conforming sample for their complaints.

10.3.1.2. After receipt of detailed information from customer, the analysis of nonconforming parts usually should be finished in one week.

10.3.1.3. If cannot finish the analysis on time, customer will be notified with the progress status.

10.3.2. Disposition of nonconforming:

10.3.2.1. Non-conforming product over PPM level will be replaced.

10.3.2.2. The cause of non-conformance will be analyzed. Corrective action will be discussed and implemented.

10.4. Agreement Items

Shall negotiate with customer if the following situation occurs:

10.4.1. There is any discrepancy in standard of quality assurance.

10.4.2. Additional requirement to be added in product specification.

10.4.3. Any other special problem.

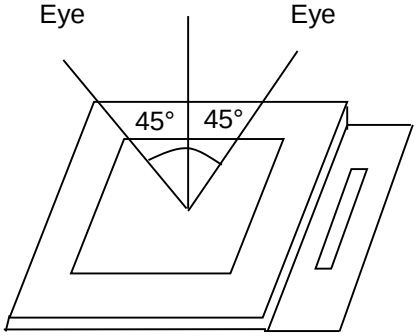
10.5. Standard of the Product Visual Inspection

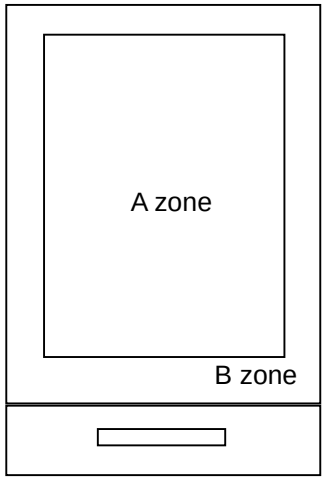
10.5.1. Appearance inspection:

10.5.1.1. The inspection must be under illumination about 1000 – 1500 lx, and the distance of view must be at 30cm ± 2cm .

10.5.1.2. The viewing angle should be 45° from the vertical line without reflection light or follows customer's viewing angle specifications.

10.5.1.3. Definition of area: A Zone: Active Area, B Zone: Viewing Area,



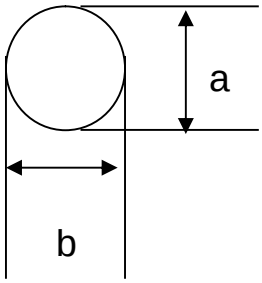


10.5.2. Basic principle:

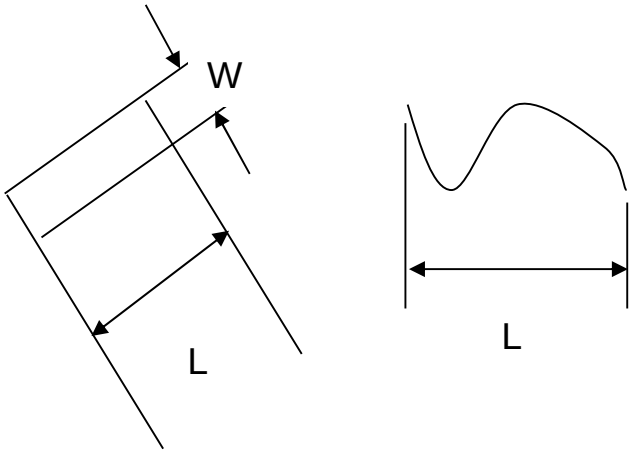
10.5.2.1. A set of sample to indicate the limit of acceptable quality level must be discussed by both us and customer when there is any dispute happened.

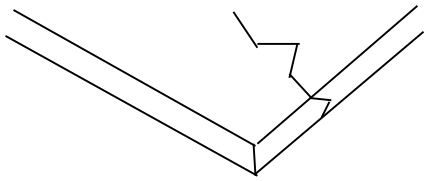
10.5.2.2. New item must be added on time when it is necessary.

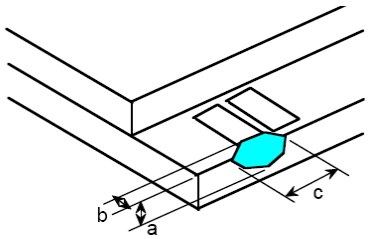
10.6. Inspection Specification

<table>
<tr><th>No.</th><th>Item</th><th>Criteria (Unit: mm)</th></tr>
<tr><td>01</td><td>Black / White spot
Foreign material (Round type)
Pinholes
Stain
Particles inside cell. (Minor defect)</td><td>


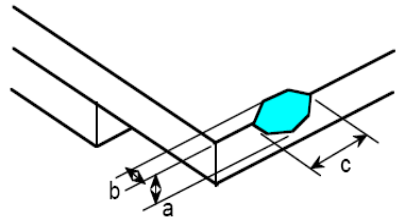
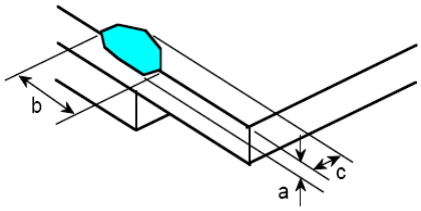
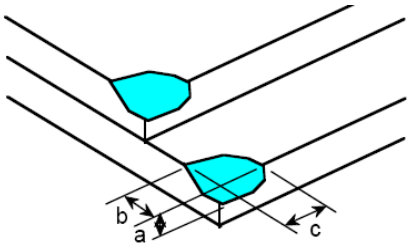
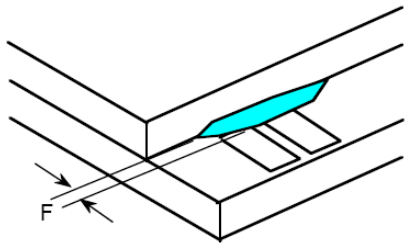
<table>
<tr><th>Size \ Area</th><th>Acc. Qty</th></tr>
<tr><td>φ≤0.20</td><td>Ignore</td></tr>
<tr><td>0.20<φ≤0.50</td><td>N≤3</td></tr>
<tr><td>0.50<φ</td><td>0</td></tr>
</table>
φ= (a + b) /2
Distance between 2 defects should more than 5mm apart.
</td></tr>
<tr><td>02</td><td>Electrical Defect
(Minor defect)</td><td>
<table>
<tr><td rowspan="2">Bright dot</td><td>Display Area</td><td>Total</td><td rowspan="4">Note1</td></tr>
<tr><td>N⩽2</td><td>N⩽2</td></tr>
<tr><td>Dark dot</td><td>N⩽4</td><td>N⩽4</td></tr>
<tr><td>Total dot</td><td>N⩽4</td><td>N⩽4</td></tr>
<tr><td>Mura</td><td colspan="2">Not visible through 5% ND filters.</td><td>Note 2</td></tr>
</table>
Remark:
1. Bright dot caused by scratch and foreign object accords to item 1.
</td></tr>
</table>

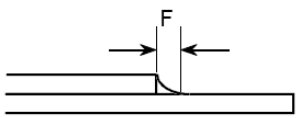
<table>
<tr>
<td>03</td>
<td>Black and White line
Scratch
Foreign material
(Line type)
(Minor defect)</td>
<td>


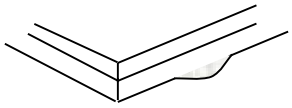
<table>
<tr><th>Length</th><th>Width</th><th>Acc. Qty</th></tr>
<tr><td>/</td><td>W ≦ 0.1</td><td>Ignore</td></tr>
<tr><td>L ≦ 2.5</td><td>0.1 ＜ W ≦ 0.2</td><td>3</td></tr>
<tr><td>L＞2.5</td><td>0.2 ＜ W</td><td>0</td></tr>
<tr><td colspan="2">Total</td><td>3</td></tr>
</table>
Distance between 2 defects should more than 3mm apart. Scratches not viewable through the back of the display are acceptable.
</td>
</tr>
<tr>
<td>04</td>
<td>Glass Crack
(Minor defect)</td>
<td>

Crack is potential to enlarge, any type is not allowed.
</td>
</tr>
</table>

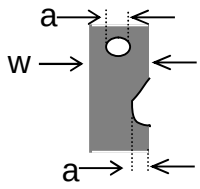
<table>
<tr>
<td>05</td>
<td>Glass Chipping Pad Area:
(Minor defect)


</td>
<td>
<table>
<tr><th>Length and Width</th><th>Acc. Qty</th></tr>
<tr><td>c > 3.0, b< 1.0</td><td>1</td></tr>
<tr><td>c< 3.0, b< 1.0</td><td>3</td></tr>
<tr><td colspan="2">a<Glass Thickness</td></tr>
</table>
</td>
</tr>
</table>

<table>
<tr>
<td>06</td>
<td>Glass Chipping Rear of Pad Area:
(Minor defect)
 
</td>
<td><table>
<tr><th>Length and Width</th><th>Acc. Qty</th></tr>
<tr><td>c > 3.0, b< 1.0</td><td>1</td></tr>
<tr><td>c< 3.0, b< 1.0</td><td>2</td></tr>
<tr><td>c< 3.0, b< 0.5</td><td>4</td></tr>
<tr><td colspan="2">a<Glass Thickness</td></tr>
</table></td>
</tr>
<tr>
<td>07</td>
<td>Glass Chipping Except Pad Area:
(Minor defect)
 
</td>
<td><table>
<tr><th>Length and Width</th><th>Acc. Qty</th></tr>
<tr><td>c > 3.0, b< 1.0</td><td>1</td></tr>
<tr><td>c< 3.0, b< 1.0</td><td>2</td></tr>
<tr><td>c< 3.0, b< 0.5</td><td>4</td></tr>
<tr><td colspan="2">a<Glass Thickness</td></tr>
</table></td>
</tr>
<tr>
<td>08</td>
<td>Glass Corner Chipping:
(Minor defect)
 
</td>
<td><table>
<tr><th>Length and Width</th><th>Acc. Qty</th></tr>
<tr><td>c < 3.0, b< 3.0</td><td>Ignore</td></tr>
<tr><td colspan="2">a<Glass Thickness</td></tr>
</table></td>
</tr>
<tr>
<td>09</td>
<td>Glass Burr:
(Minor defect)
 

  </td>
<td><table>
<tr><th>Length</th><th>Acc. Qty</th></tr>
<tr><td>F < 1.0</td><td>Ignore</td></tr>
</table>
Glass burr don’t affect assemble and module dimension.</td>
</tr>
</table>

<table>
<tr><td>10</td><td>FPC Defect:
(Minor defect)
 
</td><td>10.1 Dent, pinhole width a<w/3.
(w: circuitry width.)
10.2 Open circuit is unacceptable.
10.3 No oxidation, contamination and distortion.</td></tr>
<tr><td>11</td><td>Bubble on Polarizer
(Minor defect)</td><td colspan="2"><table><tr><th>Diameter</th><th>Acc. Qty</th></tr><tr><td>φ≤0.30</td><td>Ignore</td></tr><tr><td>0.30 <φ≤0.50</td><td>N≤2</td></tr><tr><td>0.50 < φ</td><td>N=0</td></tr></table></td></tr>
<tr><td>12</td><td>Dent on Polarizer
(Minor defect)</td><td colspan="2"><table><tr><th>Diameter</th><th>Acc. Qty</th></tr><tr><td>φ≤0.25</td><td>Ignore</td></tr><tr><td>0.25 <φ≤0.50</td><td>N≤4</td></tr><tr><td>0.50 < φ</td><td>None</td></tr></table></td></tr>
<tr><td>13</td><td>Bezel</td><td colspan="2">13.1 No rust, distortion on the Bezel.
13.2 No visible fingerprints, stains or other contamination.</td></tr>
<tr><td>14</td><td>PCB</td><td colspan="2">14.1 No distortion or contamination on PCB terminals.
14.2 All components on PCB must same as documented on the BOM/component layout.
14.3 Follow IPC-A-600F.</td></tr>
<tr><td>15</td><td>Soldering</td><td colspan="2">Follow IPC-A-610C standard</td></tr>
<tr><td>16</td><td>Electrical Defect
(Major defect)</td><td colspan="2">The below defects must be rejected.
16.1 Missing vertical / horizontal segment,
16.2 Abnormal Display.
16.3 No function or no display.
16.4 Current exceeds product specifications.
16.5 LCD viewing angle defect.
16.6 No Backlight.
16.7 Dark Backlight.
16.8 Touch Panel no function.</td></tr>
</table>

Remark: LCD Panel Broken shall be rejected. Defect out of LCD viewing area is acceptable.

10.7. Classification of Defects

10.7.1. Visual defects (Except no / wrong label) are treated as minor defect and electrical defect is major.

10.7.2. Two minor defects are equal to one major in lot sampling inspection.

10.8. Identification/marking criteria

Any unit with illegible / wrong /double or no marking/ label shall be rejected.

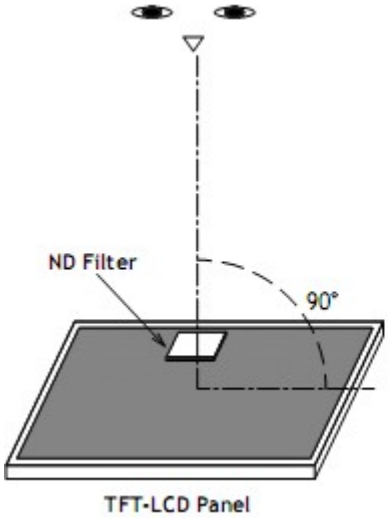
10.9. Packing

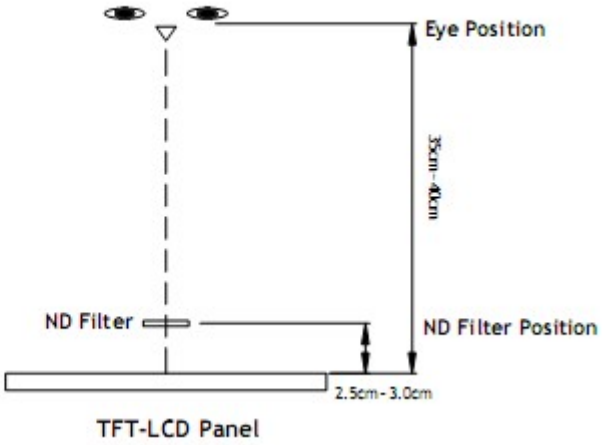
10.9.1. There should be no damage of the outside carton box, each packaging box should have one identical label.

10.9.2. Modules inside package box should have compliant mark.

10.9.3. All direct package materials shall offer ESD protection.

Note1: Bright dot is defined as the defective area of the dot is larger than 50% of one sub-pixel area.





Bright dot: The bright dot size defect at black display pattern. It can be recognized by 2% transparency of filter when the distance between eyes and panel is 350mm ± 50mm.

Dark dot: Cyan, Magenta or Yellow dot size defect at white display pattern. It can be recognized by 5% transparency of filter when the distance between eyes and panel is 350mm ± 50mm.

Note2: Mura on display which appears darker / brighter against background brightness on parts of display area.

11. Reliability Specification

No	Item	Condition	Quantity	Criteria
1	High Temperature Operating	+70°C, 96Hrs	2	GB/T2423.2 -2008
2	Low Temperature Operating	-20°C, 96Hrs	2	GB/T2423.1 -2008
3	High Humidity Storage	+50°C, 90%RH, 96Hrs	2	GB/T2423.3 -2016
4	High Temperature Storage	+80°C, 96Hrs	2	GB/T2423.2 -2008
5	Low Temperature Storage	-30°C, 96Hrs	2	GB/T2423.1 -2008
6	Thermal Cycling Test Storage	-20°C, 60min ~ +70°C, 60min, 20 cycles.	2	GB/T2423.22 -2012
7	Packing vibration	Frequency range:10Hz~50Hz Acceleration of gravity: 5G X, Y, Z 30 min for each direction.	-	GB/T5170.14 -2009
8	Electrical Static Discharge	Air: ± 4kV 150pF/330Ω 5 times Contact: ± 2kV 150pF/330Ω 5 times	2	GB/T17626.2 -2018
9	Drop Test (Packaged)	Height:80 cm,1 corner, 3 edges, 6 surfaces.	-	GB/T2423.7-2018

Note1. No defection cosmetic and operational function allowable.

Note2. Total current Consumption should be below double of initial value

12. Precautions and Warranty

12.1. Safety

12.1.1. The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

12.1.2. Since the liquid crystal cells are made of glass, do not apply strong impact on them. Handle with care.

12.2. Handling

12.2.1. Reverse and use within ratings in order to keep performance and prevent damage.

12.2.2. Do not wipe the polarizer with dry cloth, as it might cause scratch. If the surface of the LCD needs to be cleaned, wipe it swiftly with cotton or other soft cloth soaked with petroleum IPA, do not use other chemicals.

12.3. Storage

12.3.1. Do not store the LCD module beyond the specified temperature ranges.

12.3.2. Strong light exposure causes degradation of polarizer and color filter.

12.4. Metal Pin (Apply to Products with Metal Pins)

12.4.1. Pins of LCD and Backlight

12.4.1.1. Solder tip can touch and press on the tip of Pin LEAD during the soldering

12.4.1.2. Recommended Soldering Conditions

Solder Type: Sn96.3~94-Ag3.3~4.3-Cu0.4~1.1

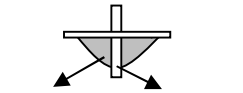
Maximum Solder Temperature: 370℃

Maximum Solder Time: 3s at the maximum temperature

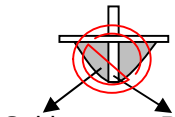
Recommended Soldering Temp: 350±20℃

Typical Soldering Time: ≤3s

12.4.1.3. Solder Wetting



Recommended



Not Recommended

12.4.2. Pins of EL

12.4.2.1. Solder tip can touch and press on the tip of EL leads during soldering.

12.4.2.2. No Solder Paste on the soldering pad on the motherboard is recommended.

12.4.2.3. Recommended Soldering Conditions

Solder type: Nippon Alimit Leadfree SR-34, size 0.5mm

Recommended Solder Temperature: 270～290℃

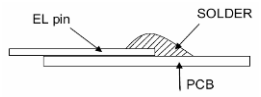
Typical Soldering Time: ≤2s

Minimum solder distance from EL lamp (body):2.0mm

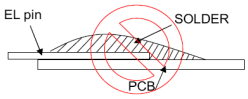
12.4.2.4. No horizontal press on the EL leads during soldering.

12.4.2.5. 180° bend EL leads three times is not allowed.

12.4.2.6. Solder Wetting

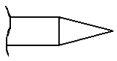


Recommended

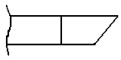


Not Recommended

12.4.2.7. The type of the solder iron:

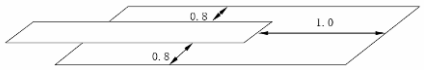


Recommended



Not Recommended

12.4.2.8. Solder Pad



12.5. Operation

12.5.1. Do not drive LCD with DC voltage

12.5.2. Response time will increase below lower temperature

12.5.3. Display may change color with different temperature

12.5.4. Mechanical disturbance during operation, such as pressing on the display area, may cause the segments to appear “fractured”.

12.5.5. Do not connect or disconnect the LCM to or from the system when power is on.

12.5.6. Never use the LCM under abnormal condition of high temperature and high humidity.

12.5.7. Module has high frequency circuits. Sufficient suppression to the electromagnetic interface shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

12.5.8. Do not display the fixed pattern for long time（we suggest the time not longer than one hour）because it will develop image sticking due to the TFT structure.

12.6. Static Electricity

12.6.1. CMOS LSIs are equipped in this unit, so care must be taken to avoid the electro-static charge, by ground human body, etc.

12.6.2. The normal static prevention measures should be observed for work clothes and benches.

12.6.3. The module should be kept into anti-static bags or other containers resistant to static for storage.

12.7. Limited Warranty

12.7.1. Our warranty liability is limited to repair and/or replacement. We will not be responsible for any consequential loss.

12.7.2. If possible, we suggest customer to use up all modules in six months. If the module storage time over twelve months, we suggest that recheck it before the module be used.

12.7.3. After the product shipped, any product quality issues must be feedback within three months, otherwise, we will not be responsible for the subsequent or consequential events.

13. Outline Drawings