

Display Elektronik GmbH

# DATA SHEET

***TFT MODULE***

**DEM 480640A1 VMH-PW-N**

3,5" TFT  
(High Resolution)

Product Specification

Ver.: 4

07.03.2017

**Revision History**

<b>Revision</b>	<b>Date</b>	<b>Originator</b>	<b>Detail</b>	<b>Remarks</b>
0	24.11.2016	ZFY	Initial Release	–
1	06.12.2016	ZFY	Modify Temperature	P4
2	12.12.2016	ZFY	Add LED Lifetime Add Packaging Modify Outline	P5 P27 P28
3	23.02.2017	ZFY	Add Weight Add Current Modify Luminance Add Chromaticity	P4 P5 P6 P6
4	07.03.2017	ZFY	Modify Outline Drawing	P28

**Table of Contents**

No.	Item	Page
1.	General Description .....	4
2.	Module Parameter .....	4
3.	Absolute Maximum Ratings .....	4
4.	DC Characteristics .....	5
5.	Backlight Characteristic .....	5
5.1.	Backlight Characteristics.....	5
5.2.	Backlighting circuit .....	5
6.	Optical Characteristics .....	6
6.1.	Optical Characteristics .....	6
6.2.	Definition of Response Time .....	6
6.3.	Definition of Contrast Ratio .....	7
6.4.	Definition of Viewing Angles.....	7
6.5.	Definition of Color Appearance .....	8
6.6.	Definition of Surface Luminance, Uniformity and Transmittance.....	8
7.	Block Diagram and Power Supply .....	9
8.	Interface Pins Definition .....	10
9.	AC Characteristics .....	12
9.1.	Recommended Input Timing of SPI-3 Transmitter.....	12
9.2.	RGB Interface Timing.....	15
9.3.	Power On/Off sequenc diagram.....	17
10.	Quality Assurance .....	18
10.1	Purpose.....	18
10.2	Standard for Quality Test.....	18
10.3	Nonconforming Analysis & Disposition .....	18
10.4	Agreement Items.....	18
10.5	Standard of the Product Visual Inspection .....	19
10.6	Inspection Specification .....	19
10.7	Classification of Defects.....	24
10.8	Identification/marketing criteria .....	24
10.9	Packing .....	24
11.	Reliability Specification .....	25
12.	Precautions and Warranty .....	26
12.1	Safety .....	26
12.2	Handling .....	26
12.3	Storage .....	26
12.4	Metal Pin (Apply to Products with Metal Pins) .....	26
12.5	Operation .....	27
12.6	Static Electricity .....	27
12.7	Limited Warranty.....	27
13.	Outline Drawing .....	28

## 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 High-Brightness Backlight Unit.

## 2. Module Parameter

Features	Details	Unit
Display Size (Diagonal)	3.5"	-
LCD Type	$\alpha$ -Si TFT (MVA Mode)	-
Display Mode	Transmissive / Normally black	-
Resolution	480 x RGB x 640	Pixels
View Direction	FULL VIEW	Best Image
Module Outline	64.00 x 85.00 x 2.90 ( Note1 )	mm
Active Area	53.57 x 71.42	mm
Pixel Size	0.1116 x 0.1116	mm
Pixel Arrangement	Stripe	-
Polarizer Surface Treatment	Anti-Glare	-
Display Colors	262K	-
Interface	18-Bit-RGB-Interface + 3-Wire SPI	-
Driver IC	HX8363-A (Himax)	-
With or Without Touch Panel	No Touch	-
Operating Temperature	-20°C to +70°C	°C
Storage Temperature	-30°C to +80°C	°C
Weight	33	g

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

## 3. Absolute Maximum Ratings

$V_{SS}=0V$ ,  $T_a=25^\circ C$

Item	Symbol	Min.	Max.	Unit
Supply Voltage	Logic	-0.3	4.6	V
	Analog	-0.3	4.6	V
Storage Temperature	$T_{STG}$	-30	+80	°C
Operating Temperature	$T_{OP}$	-20	+70	°C

Note 1: If  $T_a$  below 50°C, the maximal humidity is 90%RH, if  $T_a$  over 50°C, 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	Logic	PWR_LCDIO	1.65	3.0	3.3	V
	Analog	VCC_3V0	2.5	3.0	3.3	V
Logic Low Input Voltage		V <sub>IL</sub>	0	-	0.3* PWR_LCDIO	V
Logic High Input Voltage		V <sub>IH</sub>	0.7* PWR_LCDIO	-	PWR_LCDIO	V
Logic Low Output Voltage		V <sub>OL</sub>	0	-	0.2* PWR_LCDIO	V
Logic High Output Voltage		V <sub>OH</sub>	0.8* PWR_LCDIO	-	PWR_LCDIO	V
Current Consumption All Black	Logic	I <sub>CC+ IIN</sub>	-	12	-	mA
	Analog					

5. Backlight Characteristic

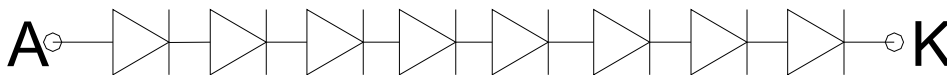
5.1. Backlight Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	V <sub>F</sub>	T <sub>a</sub> =25 °C, I <sub>F</sub> =20mA/LED	22.4	25.6	27.2	V
Forward Current	I <sub>F</sub>	T <sub>a</sub> =25 °C, V <sub>F</sub> =3.2V/LED	-	20.0	25.0	mA
Power Dissipation	P <sub>D</sub>		-	512	-	mW
Uniformity	Avg		80	-	-	%
LED Lifetime		T <sub>a</sub> =25 °C, I <sub>F</sub> =20mA/LED	20000	30000	-	Hrs
Drive Method	Constant Current					
LED Configuration	8 White LEDs in Serial					

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

The environmental conducted under ambient air flow, at T<sub>a</sub>=25±2 °C, 60%RH±5%, I<sub>F</sub>=20mA

5.2. Backlighting Circuit



6. Optical Characteristics

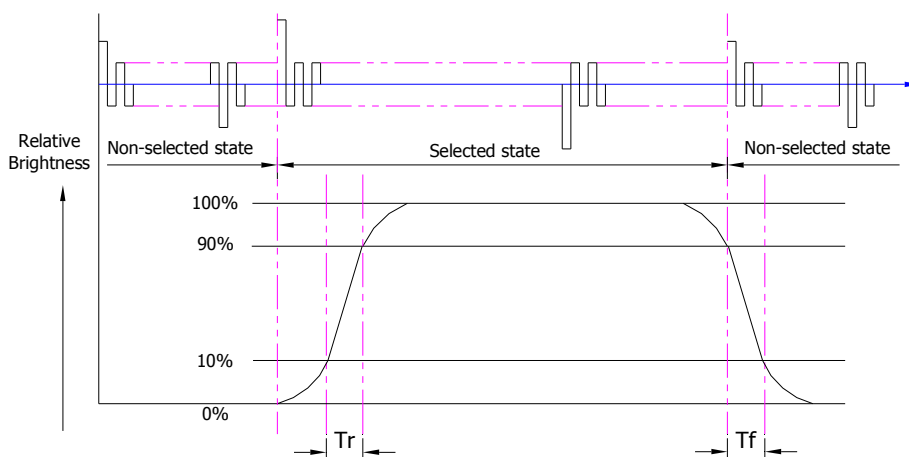
6.1. Optical Characteristics

Ta=25°C, VCC=3.0V, TN LC+ Polarizer

	Item	Symbol	Condition	Specification			Unit	
				Min.	Typ.	Max.		
Backlight On (Transmissive Mode)	Luminance on TFT( $I_f = 20\text{mA/LED}$ )	Lv	Normally viewing angle $\theta_x = \phi_y = 0^\circ$	400	500	-	cd/m <sup>2</sup>	
	Contrast Ratio(See 6.3)	CR		-	600	-		
	Response Time (See 6.2)	TR		-	30	50	ms	
		TF						
	Chromaticity Transmissive (See 6.5)	Red	XR	Center CR $\geq 10$	0.566	0.616	0.666	-
			YR		0.294	0.344	0.394	
		Green	XG		0.272	0.322	0.372	
			YG		0.580	0.630	.0680	
		Blue	XB		0.103	0.153	0.203	
			YB		0.075	0.125	0.175	
	White	XW	0.258	0.308	0.358			
		YW	0.338	0.388	0.438			
	Viewing Angle (See 6.4)	Horizon tal	$\theta_{x+}$	60	80	-	Deg.	
$\theta_{x-}$			60	80	-			
Vertical		$\phi_{y+}$	60	80	-			
		$\phi_{y-}$	60	80	-			
	NTSC Ratio(Gamut)			-	53	-	%	

6.2. Definition of Response Time

6.2.1. Normally Black Type (Negative)

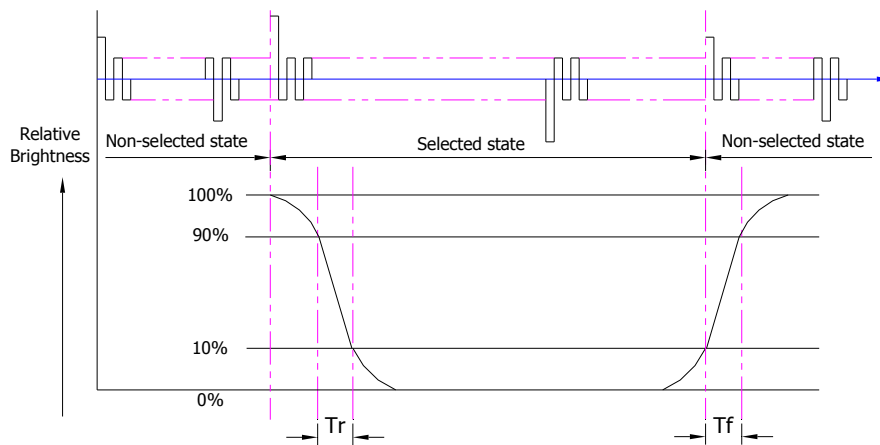


Tr is the time it takes to change form non-selected stage with relative luminance 10% to selected state with relative luminance 90%;

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 from 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

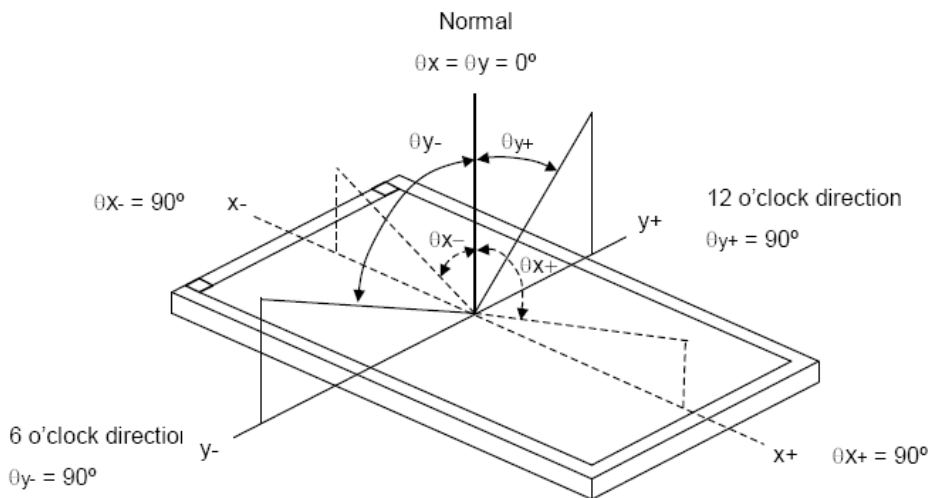
6.3. Definition of Contrast Ratio

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



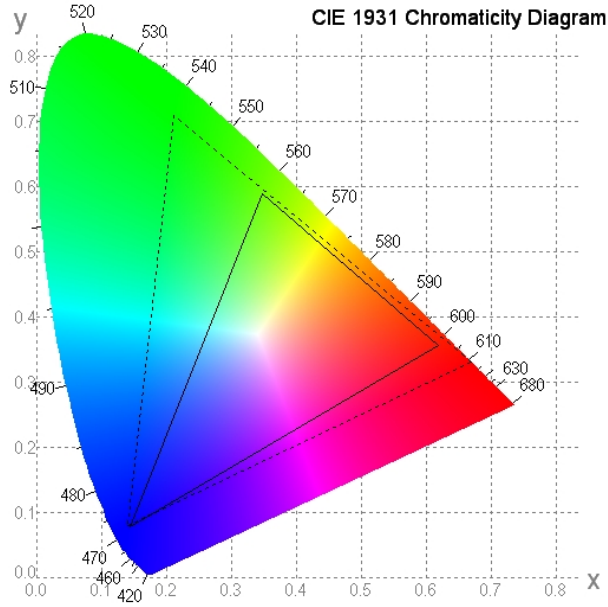
Measuring machine: LCD-5100 or EQUI

**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**

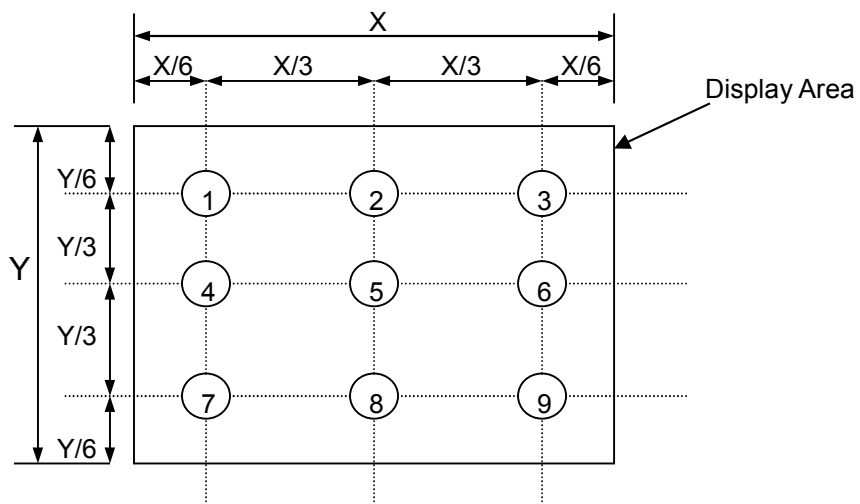
Using the transmissive mode measurement approach, measure the white screen luminance of the display panel and backlight.

6.6.1. Surface Luminance:  $L_v = \text{average} (L_{P1}:L_{P9})$

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

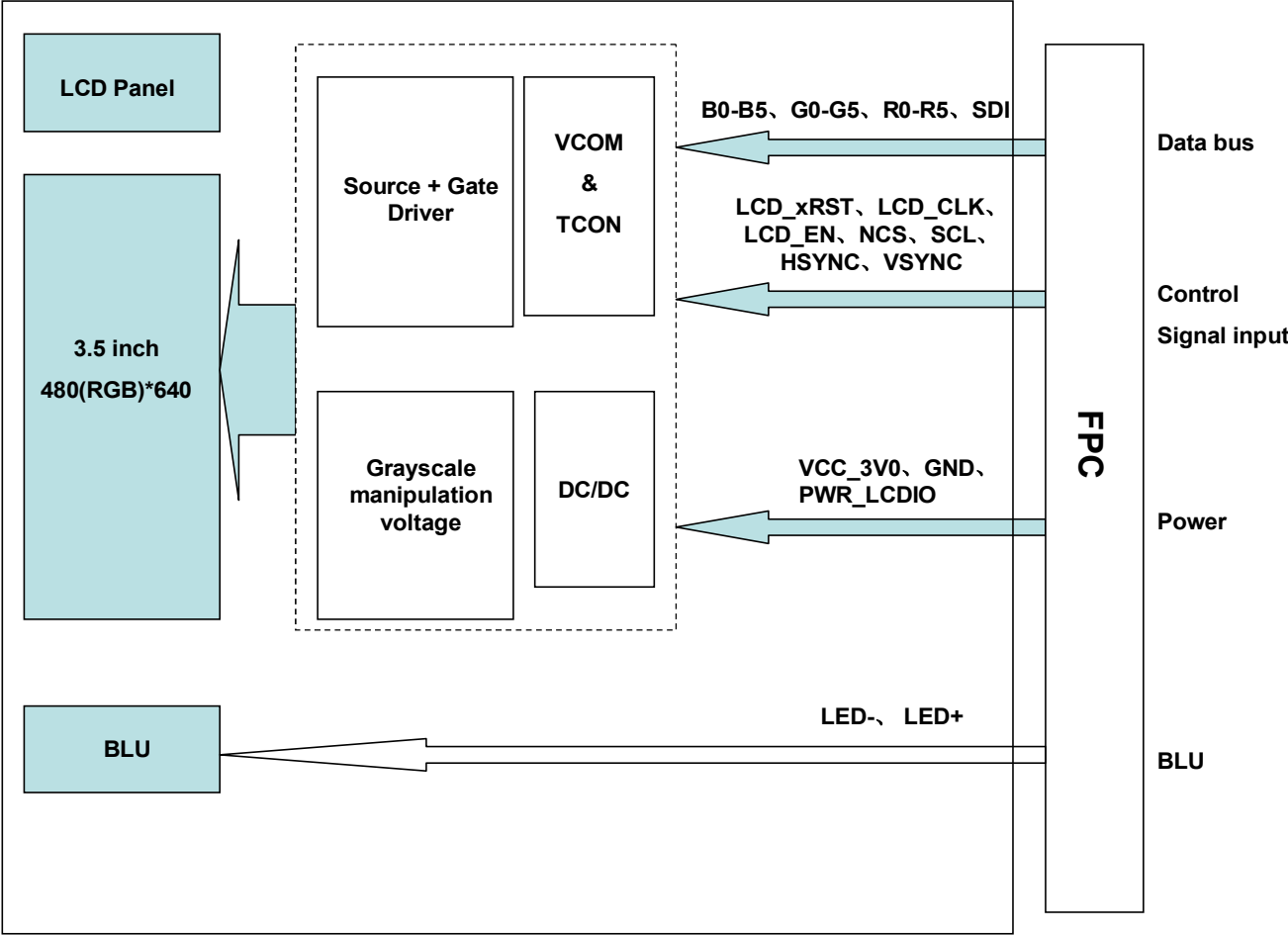
6.6.3. Transmittance =  $L_v \text{ on LCD} / L_v \text{ on Backlight} * 100\%$

Note : Measuring machine: BM-7





7. Block Diagram and Power Supply



## 8. Interface Pins Definition

No.	Symbol	Function	Remark
1	GND	Ground	
2-5	NC	No connection	
6	GND	Ground	
7-8	NC	No connection	
9	GND	Ground	
10-14	NC	No connection	
15	GND	Ground	
16	NC	No connection	
17	LCD_xRST	Reset Signal	
18-19	NC	No connection	
20	VCC_3V0	Power Supply for booster	
21	GND	Ground	
22	B0	Blue data	
23	B1	Blue data	
24	B2	Blue data	
25	B3	Blue data	
26	B4	Blue data	
27	B5	Blue data	
28	GND	Ground	
29	G0	Green data	
30	G1	Green data	
31	G2	Green data	
32	G3	Green data	
33	G4	Green data	
34	G5	Green data	
35	GND	Ground	
36	R0	Red data	
37	R1	Red data	
38	R2	Red data	
39	R3	Red data	
40	R4	Red data	
41	R5	Red data	
42	GND	Ground	
43	PWR_LCDIO	Logic Supply voltage	
44	NC	No connection	
45	GND	Ground	
46	LCD_CLK	Clock Signal	
47	GND	Ground	
48	LCD_EN	Data Enable	
49	SDO	Serial interface data output	

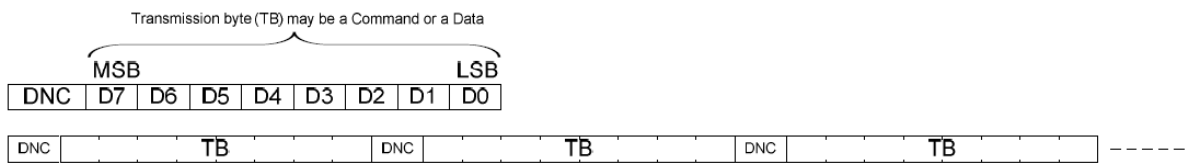
50	NCS	Chip select signal	
51	SDI	Serial interface data input	
52	NC	No connection	
53	SCL	Serial interface clock input	
54	VSYNC	Vertical sync input	
55	HSYNC	Horizontal sync input	
56-57	NC	No connection	
58	LED-	Cathode of LED	
59	LED+	Anode of LED	
60	GND	Ground	

## 9. AC Characteristics

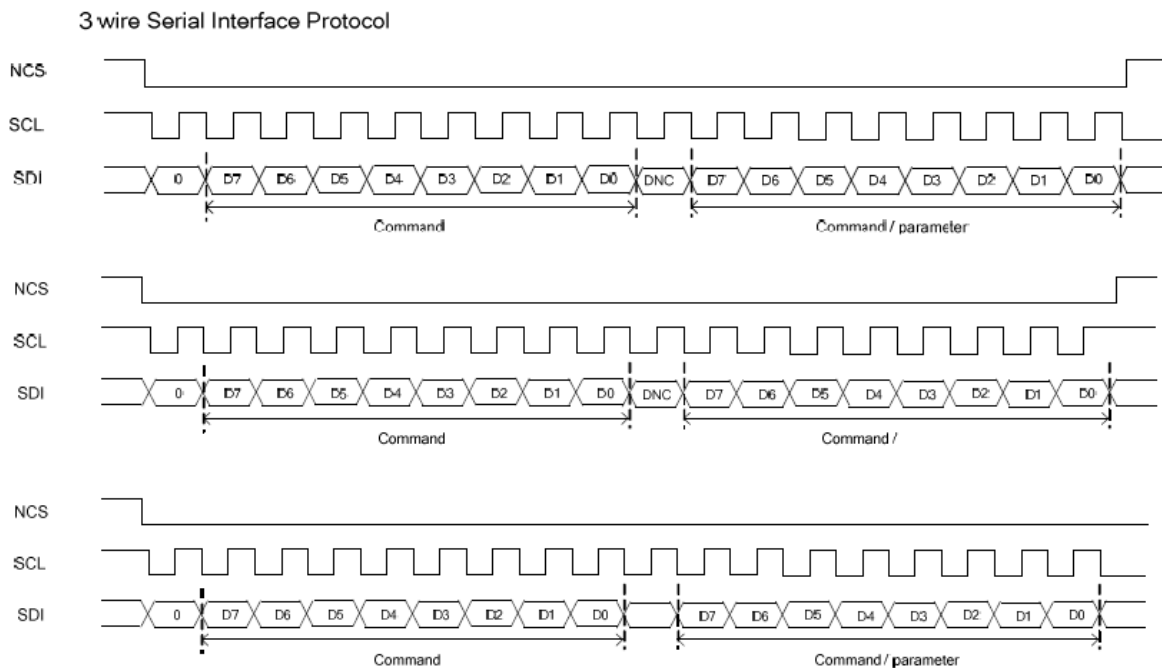
### 9.1. Recommended Input Timing of SPI-3 Transmitter

The 3-Pin serial data packet contains a control bit DNC and a transmission byte. If DNC is low, the transmission byte is command byte. If DNC is high, the transmission byte is stored to command register. The MSB is transmitted first. The serial interface is initialized when NCS is high. In this state, SCL clock pulse or SDI/SDO data have no effect. A falling edge on NCS enables the serial interface and indicates the start of data transmission.

3 wire Serial Data Stream Format



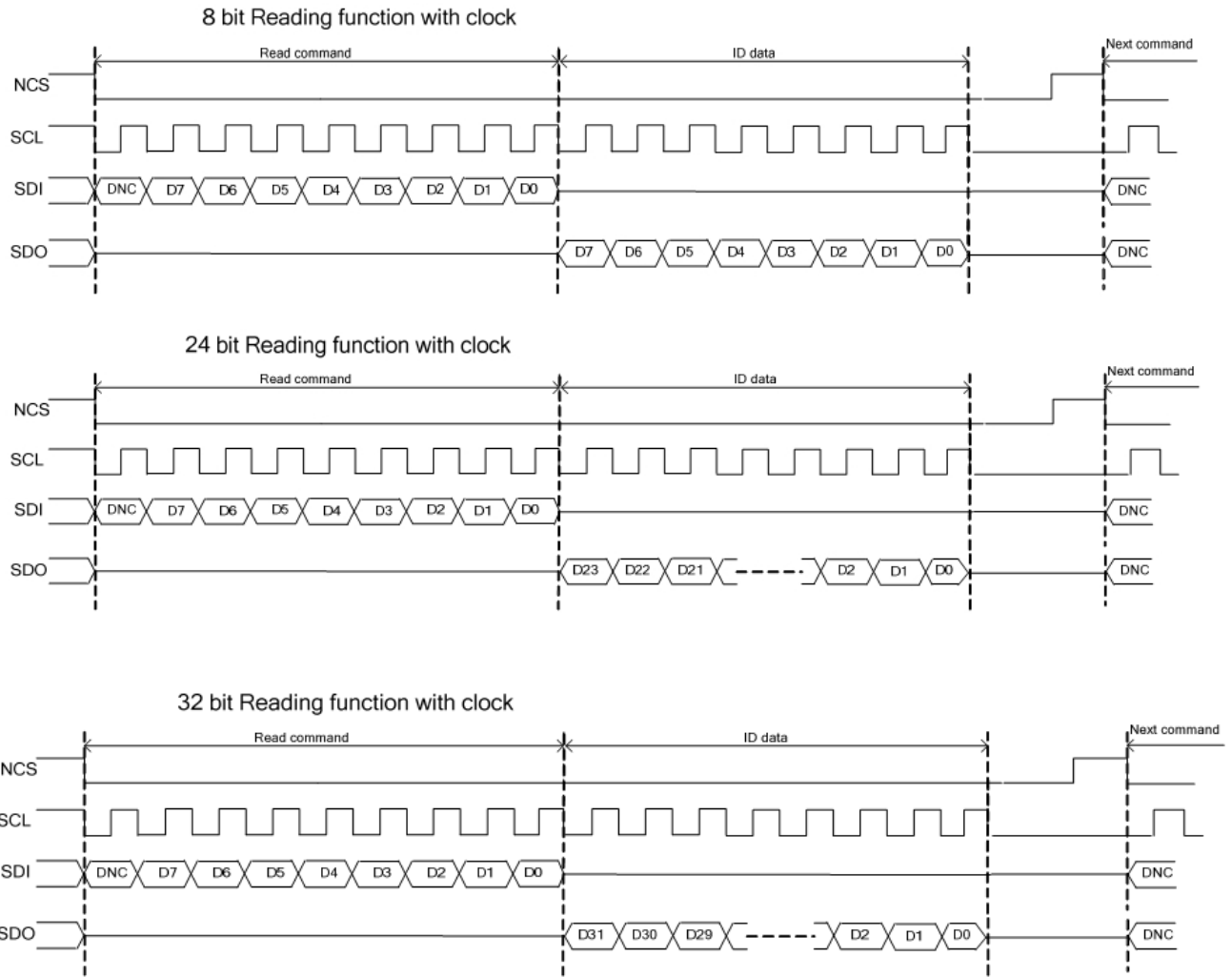
Serial Data stream, write mode



### Serial Data Read Mode

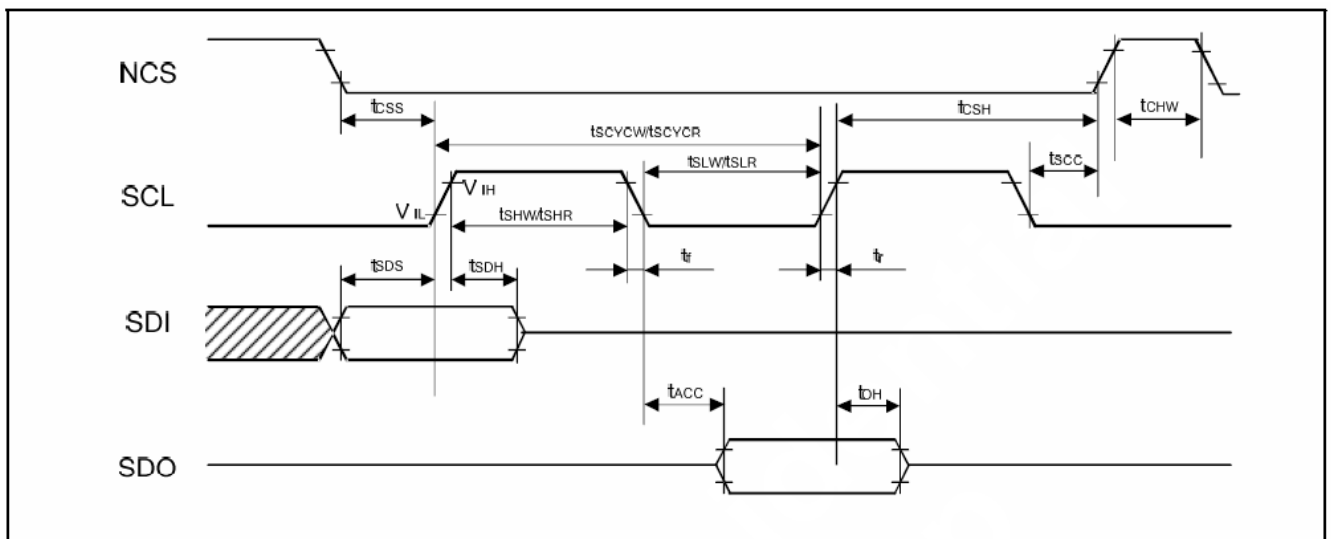
The micro controller firstly has to send a command and then the following byte is transmitted in the opposite direction. The read mode has three types of command data transmitted (8-/24- /32-bit) according command code.

3 wire Serial Interface Protocol



3 wire Serial Interface protocol, read mode

Serial Interface Characteristics (3-Pin Serial)



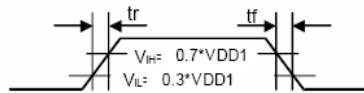
(VSSA=VSSD=0V, VDD1=1.65V to 1.95V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, T<sub>A</sub> = -30 to 70°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Serial clock cycle (Write)	t <sub>SCYCW</sub>		80	-	-	
SCL "H" pulse width (Write)	t <sub>SHW</sub>	SCL	30	-	-	ns
SCL "L" pulse width (Write)	t <sub>SLW</sub>	SCL	30	-	-	
Data setup time (Write)	t <sub>SDS</sub>	SDI	10	-	-	ns
Data hold time (Write)	t <sub>SDH</sub>	SDI	10	-	-	
Serial clock cycle (Read)	t <sub>SCYCR</sub>		150	-	-	
SCL "H" pulse width (Read)	t <sub>SHR</sub>	SCL	60	-	-	ns
SCL "L" pulse width (Read)	t <sub>SLR</sub>	SCL	60	-	-	
Access rime	t <sub>ACC</sub>	SDO For maximum C <sub>L</sub> =30pF For maximum C <sub>L</sub> =8pF	10	-	60	ns
Output disable time	t <sub>OH</sub>	SDO For maximum C <sub>L</sub> =30pF For maximum C <sub>L</sub> =8pF	15	-	100	ns
SCL to Chip select	t <sub>SCC</sub>	NCS	30	-	-	ns
NCS "H" pulse width	t <sub>CHW</sub>	NCS	60	-	-	ns
NCS-SCL time (write)	t <sub>CSS</sub>	NCS	30	-	-	ns
NCS-SCL time (write)	t <sub>CSH</sub>	NCS	30	-	-	
NCS-SCL time (Read)	t <sub>CSS</sub>	NCS	60	-	-	ns
NCS-SCL time (Read)	t <sub>CSH</sub>	NCS	65	-	-	

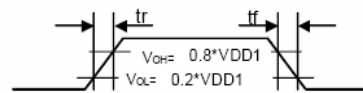
Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.

Logic high and low levels are specified as 30% and 70% of VDD1 for Input signals.

Input Signal Slope



Output Signal Slope



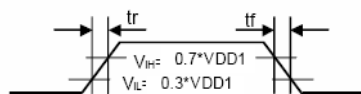
(VSSA=VSSD=0V, VDD1=1.95V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, T<sub>A</sub> = -30 to 70°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Serial clock cycle (Write)	t <sub>SCYCW</sub>		80	-	-	
SCL "H" pulse width (Write)	t <sub>SHW</sub>	SCL	30	-	-	ns
SCL "L" pulse width (Write)	t <sub>SLW</sub>	SCL	30	-	-	
Data setup time (Write)	t <sub>SDS</sub>	SDI	10	-	-	ns
Data hold time (Write)	t <sub>SDH</sub>	SDI	10	-	-	
Serial clock cycle (Read)	t <sub>SCYCR</sub>		150	-	-	
SCL "H" pulse width (Read)	t <sub>SHR</sub>	SCL	60	-	-	ns
SCL "L" pulse width (Read)	t <sub>SLR</sub>	SCL	60	-	-	
Access rime	t <sub>ACC</sub>	SDO For maximum C <sub>L</sub> =30pF For maximum C <sub>L</sub> =8pF	5	-	60	ns
Output disable time	t <sub>OH</sub>	SDO For maximum C <sub>L</sub> =30pF For maximum C <sub>L</sub> =8pF	8	-	100	ns
SCL to Chip select	t <sub>SCC</sub>	NCS	30	-	-	ns
NCS "H" pulse width	t <sub>CHW</sub>	NCS	60	-	-	ns
NCS-SCL time (write)	t <sub>CSS</sub>	NCS	30	-	-	ns
NCS-SCL time (write)	t <sub>CSH</sub>	NCS	30	-	-	
NCS-SCL time (Read)	t <sub>CSS</sub>	NCS	60	-	-	ns
NCS-SCL time (Read)	t <sub>CSH</sub>	NCS	65	-	-	

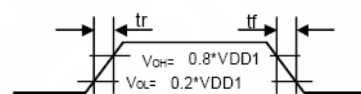
Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.

Logic high and low levels are specified as 30% and 70% of VDD1 for Input signals.

Input Signal Slope

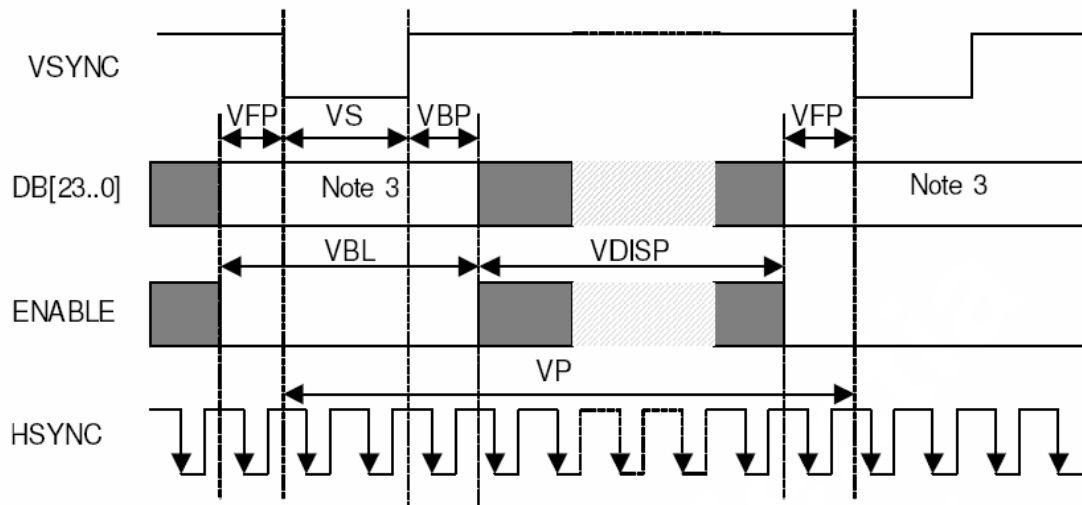


Output Signal Slope



9.2. RGB Interface Timing

Vertical Timings for RGB I/F



(Resolution=480x854, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, TA = -30 to 70°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical cycle	VP	-	860	-	864	Line
Vertical low pulse width	VS	-	2	-	4	Line
Vertical front porch	VFP	-	2	-	4	Line
Vertical back porch	VBP	-	2	-	4	Line
Vertical data start point	-	VS+VBP	4	-	8	Line
Vertical blanking period	VBL	VS+VBP+VFP	6	-	10	Line
Vertical active area	-	VDISP	-	854	-	Line
Vertical Refresh rate	VRR	-	50	-	70	Hz

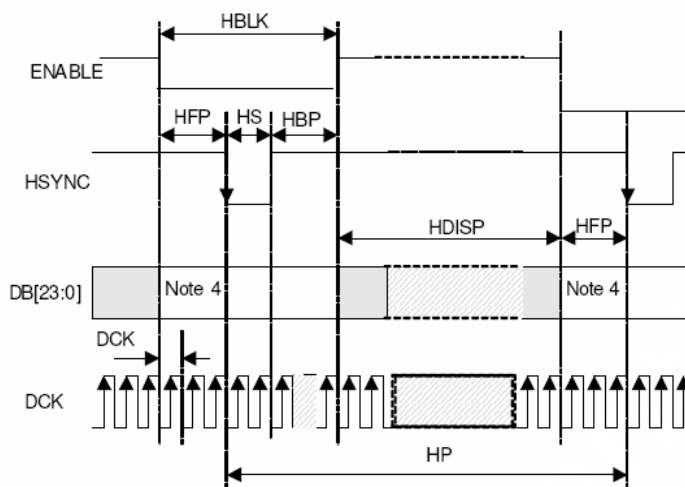
- Note: (1) Signal rise and fall times are equal to or less than 20 ns.  
 (2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.  
 (3) Data lines can be set to "High" or "Low" during blanking time – Don't care.  
 (4) VRR must keep from 50Hz to 70Hz when adjust other items.

(Resolution=480x800, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, TA = -30 to 70°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical cycle	VP	-	806	-	810	Line
Vertical low pulse width	VS	-	2	-	4	Line
Vertical front porch	VFP	-	2	-	4	Line
Vertical back porch	VBP	-	2	-	4	Line
Vertical data start point	-	VS+VBP	4	-	8	Line
Vertical blanking period	VBL	VS+VBP+VFP	6	-	10	Line
Vertical active area	-	VDISP	-	800	-	Line
Vertical Refresh rate	VRR	-	50	-	70	Hz

- Note: (1) Signal rise and fall times are equal to or less than 20 ns.  
 (2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.  
 (3) Data lines can be set to "High" or "Low" during blanking time – Don't care.  
 (4) VRR must keep from 50Hz to 70Hz when adjust other items.

Horizontal Timings for RGB I/F



(Resolution=480x854, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, T<sub>A</sub> = -30 to 70°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
HS cycle	HP	Note <sup>(3)</sup>	504	-	568	DCK
HS low pulse width	HS	-	5	-	78	DCK
Horizontal back porch	HBP	-	5	-	78	DCK
Horizontal front porch	HFP	-	5	-	78	DCK
Horizontal data start point	-	HS+HBP	19	-	83	DCK
Horizontal blanking period	HBLK	HS+HBP+HFP	24	-	88	DCK
Horizontal active area	HDISP	-	-	480	-	DCK
Pixel clock frequency When RGB I/F is running	DCK	VRR = Min. 50Hz - Max. 70Hz	21.6 29.1	-	34.3 46.2	MHz ns

- Note:** (1) Signal rise and fall times are equal to or less than 20 ns.  
 (2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.  
 (3) HP is multiples of eight DCK.  
 (4) Data lines can be set to "High" or "Low" during blanking time – Don't care.  
 (5) VRR must keep from 50Hz to 70Hz when adjust other items.

(Resolution=480x800, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, T<sub>A</sub> = -30 to 70°C)

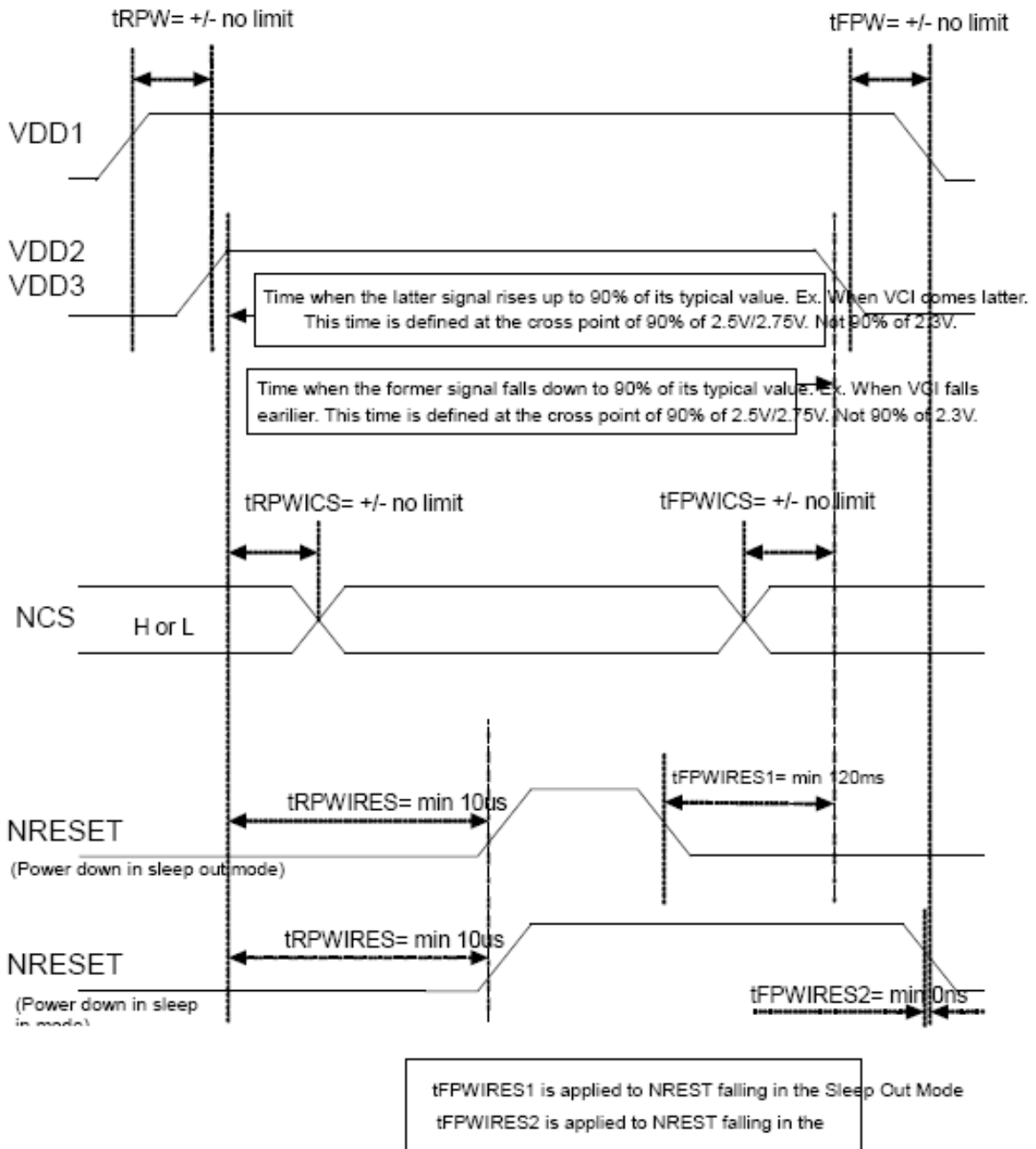
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
HS cycle	HP	Note <sup>(3)</sup>	504	-	568	DCK
HS low pulse width	HS	-	5	-	78	DCK
Horizontal back porch	HBP	-	5	-	78	DCK
Horizontal front porch	HFP	-	5	-	78	DCK
Horizontal data start point	-	HS+HBP	19	-	83	DCK
Horizontal blanking period	HBLK	HS+HBP+HFP	24	-	88	DCK
Horizontal active area	HDISP	-	-	480	-	DCK
Pixel clock frequency When RGB I/F is running	DCK	VRR = Min. 50Hz - Max. 70Hz	20.3 31	-	32.2 49.2	MHz ns

- Note:** (1) Signal rise and fall times are equal to or less than 20 ns.  
 (2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.  
 (3) HP is multiples of eight DCK.  
 (4) Data lines can be set to "High" or "Low" during blanking time – Don't care.  
 (5) VRR must keep from 50Hz to 70Hz when adjust other items.



9.3. Power On/Off sequenc diagram

If NRESET line is held low (and stable) by the host during power on, then the NRESET must be held low for minimum 10µsec after both VDD1, VDD2 and VDD3 have been applied.



Power Off Sequence

The uncontrolled power off means a situation when e.g. there is removed a battery without the controlled power off sequence. There will not be any damages for the display module or the display module will not cause any damages for the host or lines of the interface. At an uncontrolled power off the display will go blank and there will not be any visible effects within 1 second on the display (blank display) and remains blank until "Power On Sequence" powers it up.

## **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.

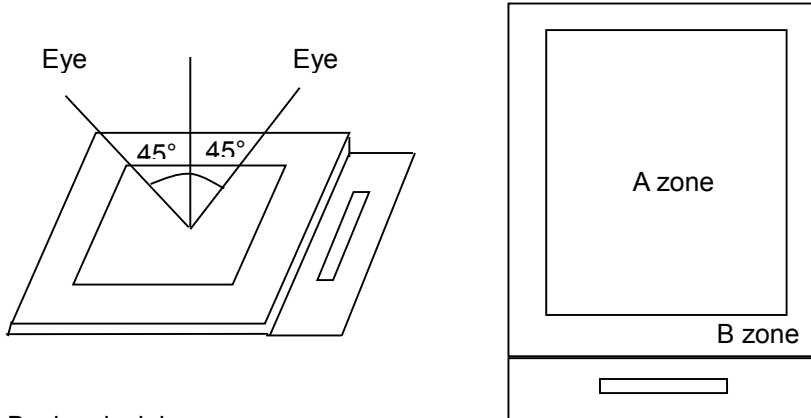
**10.5 Standard of the Product Visual Inspection**

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,



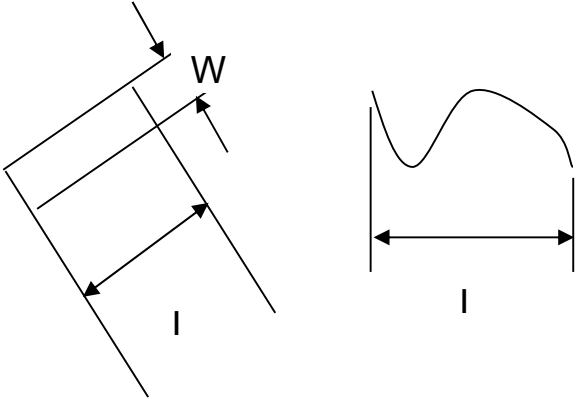
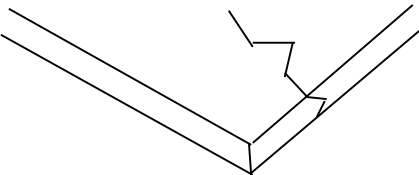
10.5.2 Basic principle:

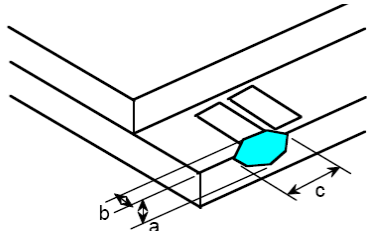
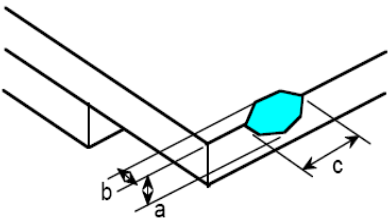
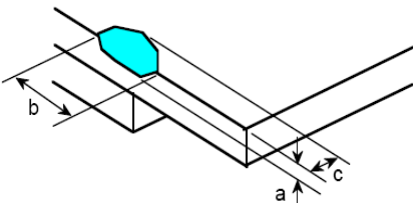
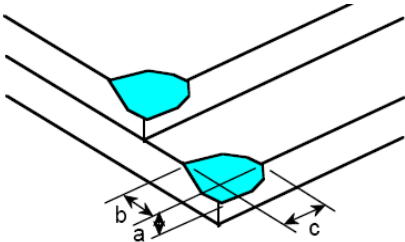
10.5.2.1 A set of sample to indicate the limit of acceptable quality level must be discussed by both us and customer when there is any dispute happened.

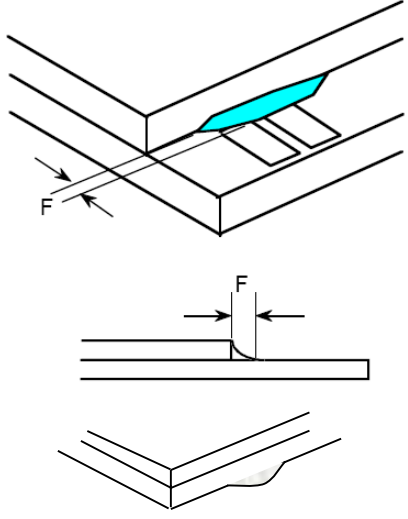
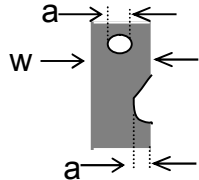
10.5.2.2 New item must be added on time when it is necessary.

**10.6 Inspection Specification**

No.	Item	Criteria (Unit: mm)																			
01	Black / White spot Foreign material (Round type) Pinholes Stain Particles inside cell. (Minor defect)	$\varphi = (a + b) / 2$	<table border="1"> <thead> <tr> <th>Size</th> <th>Area</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\varphi \leq 0.10</math></td> <td></td> <td>Ignore</td> </tr> <tr> <td><math>0.10 &lt; \varphi \leq 0.15</math></td> <td></td> <td>2</td> </tr> <tr> <td><math>0.15 &lt; \varphi \leq 0.25</math></td> <td></td> <td>1</td> </tr> <tr> <td><math>0.25 &lt; \varphi</math></td> <td></td> <td>0</td> </tr> <tr> <td>Total</td> <td></td> <td>2 no include <math>\varphi \leq 0.10</math></td> </tr> </tbody> </table>	Size	Area	Acc. Qty	$\varphi \leq 0.10$		Ignore	$0.10 < \varphi \leq 0.15$		2	$0.15 < \varphi \leq 0.25$		1	$0.25 < \varphi$		0	Total		2 no include $\varphi \leq 0.10$
			Size	Area	Acc. Qty																
$\varphi \leq 0.10$		Ignore																			
$0.10 < \varphi \leq 0.15$		2																			
$0.15 < \varphi \leq 0.25$		1																			
$0.25 < \varphi$		0																			
Total		2 no include $\varphi \leq 0.10$																			
Distance between 2 defects should more than 3mm apart.																					

02	Electrical Defect (Minor defect)	<table border="1" data-bbox="555 203 1377 421"> <tr> <th></th> <th>Display Area</th> <th>Total</th> <th rowspan="3">Note1</th> </tr> <tr> <td>Bright dot</td> <td>0</td> <td>0</td> </tr> <tr> <td>Dark dot</td> <td><math>N \leq 2</math></td> <td><math>N \leq 2</math></td> </tr> <tr> <td>Total dot</td> <td><math>N \leq 2</math></td> <td><math>N \leq 2</math></td> <td rowspan="2">Note 2</td> </tr> <tr> <td>Mura</td> <td colspan="2">Not visible through 5% ND filters.</td> </tr> </table> <p>Remark: 1. Bright dot caused by scratch and foreign object accords to item 1.</p>		Display Area	Total	Note1	Bright dot	0	0	Dark dot	$N \leq 2$	$N \leq 2$	Total dot	$N \leq 2$	$N \leq 2$	Note 2	Mura	Not visible through 5% ND filters.		
	Display Area	Total	Note1																	
Bright dot	0	0																		
Dark dot	$N \leq 2$	$N \leq 2$																		
Total dot	$N \leq 2$	$N \leq 2$	Note 2																	
Mura	Not visible through 5% ND filters.																			
02	Black and White line Scratch Foreign material (Line type) (Minor defect)	 <table border="1" data-bbox="612 1066 1240 1373"> <thead> <tr> <th>Length</th> <th>Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>/</td> <td><math>W \leq 0.03</math></td> <td>Ignore</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td>3</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.05 &lt; W \leq 0.10</math></td> <td>2</td> </tr> <tr> <td>/</td> <td><math>0.1 &lt; W</math></td> <td>0</td> </tr> <tr> <td colspan="2">Total</td> <td>3</td> </tr> </tbody> </table> <p>Distance between 2 defects should more than 3mm apart. Scratches not viewable through the back of the display are acceptable.</p>	Length	Width	Acc. Qty	/	$W \leq 0.03$	Ignore	$L \leq 2.5$	$0.03 < W \leq 0.05$	3	$L \leq 2.5$	$0.05 < W \leq 0.10$	2	/	$0.1 < W$	0	Total		3
Length	Width	Acc. Qty																		
/	$W \leq 0.03$	Ignore																		
$L \leq 2.5$	$0.03 < W \leq 0.05$	3																		
$L \leq 2.5$	$0.05 < W \leq 0.10$	2																		
/	$0.1 < W$	0																		
Total		3																		
03	Glass Crack (Minor defect)	 <p>Crack is potential to enlarge, any type is not allowed.</p>																		

<p>04</p>	<p>Glass Chipping Pad Area: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &gt; 3.0, b &lt; 1.0</math></td> <td>1</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 1.0</math></td> <td>3</td> </tr> <tr> <td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c > 3.0, b < 1.0$	1	$c < 3.0, b < 1.0$	3	$a < \text{Glass Thickness}$			
Length and Width	Acc. Qty											
$c > 3.0, b < 1.0$	1											
$c < 3.0, b < 1.0$	3											
$a < \text{Glass Thickness}$												
<p>05</p>	<p>Glass Chipping Rear of Pad Area: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &gt; 3.0, b &lt; 1.0</math></td> <td>1</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 1.0</math></td> <td>2</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 0.5</math></td> <td>4</td> </tr> <tr> <td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c > 3.0, b < 1.0$	1	$c < 3.0, b < 1.0$	2	$c < 3.0, b < 0.5$	4	$a < \text{Glass Thickness}$	
Length and Width	Acc. Qty											
$c > 3.0, b < 1.0$	1											
$c < 3.0, b < 1.0$	2											
$c < 3.0, b < 0.5$	4											
$a < \text{Glass Thickness}$												
<p>06</p>	<p>Glass Chipping Except Pad Area: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &gt; 3.0, b &lt; 1.0</math></td> <td>1</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 1.0</math></td> <td>2</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 0.5</math></td> <td>4</td> </tr> <tr> <td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c > 3.0, b < 1.0$	1	$c < 3.0, b < 1.0$	2	$c < 3.0, b < 0.5$	4	$a < \text{Glass Thickness}$	
Length and Width	Acc. Qty											
$c > 3.0, b < 1.0$	1											
$c < 3.0, b < 1.0$	2											
$c < 3.0, b < 0.5$	4											
$a < \text{Glass Thickness}$												
<p>07</p>	<p>Glass Corner Chipping: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &lt; 3.0, b &lt; 3.0</math></td> <td>Ignore</td> </tr> <tr> <td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c < 3.0, b < 3.0$	Ignore	$a < \text{Glass Thickness}$					
Length and Width	Acc. Qty											
$c < 3.0, b < 3.0$	Ignore											
$a < \text{Glass Thickness}$												

<p>08</p>	<p>Glass Burr: (Minor defect)</p> 	<table border="1" data-bbox="869 264 1340 353"> <thead> <tr> <th>Length</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>F &lt; 1.0</math></td> <td>Ignore</td> </tr> </tbody> </table> <p>Glass burr don't affect assemble and module dimension.</p>	Length	Acc. Qty	$F < 1.0$	Ignore				
Length	Acc. Qty									
$F < 1.0$	Ignore									
<p>09</p>	<p>FPC Defect: (Minor defect)</p> 	<p>9.1 Dent, pinhole width <math>a &lt; w/3</math>. (w: circuitry width.) 9.2 Open circuit is unacceptable. 9.3 No oxidation, contamination and distortion.</p>								
<p>10</p>	<p>Bubble on Polarizer (Minor defect)</p>	<table border="1" data-bbox="742 1377 1212 1556"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\varphi \leq 0.20</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.20 &lt; \varphi \leq 0.30</math></td> <td>4</td> </tr> <tr> <td><math>0.30 &lt; \varphi</math></td> <td>None</td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\varphi \leq 0.20$	Ignore	$0.20 < \varphi \leq 0.30$	4	$0.30 < \varphi$	None
Diameter	Acc. Qty									
$\varphi \leq 0.20$	Ignore									
$0.20 < \varphi \leq 0.30$	4									
$0.30 < \varphi$	None									
<p>11</p>	<p>Dent on Polarizer (Minor defect)</p>	<table border="1" data-bbox="742 1624 1212 1803"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\varphi \leq 0.20</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.20 &lt; \varphi \leq 0.30</math></td> <td>4</td> </tr> <tr> <td><math>0.30 &lt; \varphi</math></td> <td>None</td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\varphi \leq 0.20$	Ignore	$0.20 < \varphi \leq 0.30$	4	$0.30 < \varphi$	None
Diameter	Acc. Qty									
$\varphi \leq 0.20$	Ignore									
$0.20 < \varphi \leq 0.30$	4									
$0.30 < \varphi$	None									
<p>12</p>	<p>Bezel</p>	<p>12.1 No rust, distortion on the Bezel. 12.2 No visible fingerprints, stains or other contamination.</p>								

13	Touch Panel	<p>D: Diameter W: width L: length</p> <p>13.1 Spot: <math>D &lt; 0.25</math> is acceptable  <math>0.25 \leq D \leq 0.4</math></p> <p>2dots are acceptable and the distance between defects should more than 10 mm.</p> <p><math>D &gt; 0.4</math> is unacceptable</p> <p>13.2 Dent: <math>D &gt; 0.40</math> is unacceptable</p> <p>13.3 Scratch: <math>W \leq 0.03</math>, <math>L \leq 10</math> is acceptable,  <math>0.03 &lt; W \leq 0.10</math>, <math>L \leq 10</math> is acceptable</p> <p>Distance between 2 defects should more than 10 mm.  <math>W &gt; 0.10</math> is unacceptable.</p>
14	PCB	<p>14.1 No distortion or contamination on PCB terminals.</p> <p>14.2 All components on PCB must same as documented on the BOM/component layout.</p> <p>14.3 Follow IPC-A-600F.</p>
15	Soldering	Follow IPC-A-610C standard
16	Electrical Defect (Major defect)	<p>The below defects must be rejected.</p> <p>16.1 Missing vertical / horizontal segment,</p> <p>16.2 Abnormal Display.</p> <p>16.3 No function or no display.</p> <p>16.4 Current exceeds product specifications.</p> <p>16.5 LCD viewing angle defect.</p> <p>16.6 No Backlight.</p> <p>16.7 Dark Backlight.</p> <p>16.8 Touch Panel no function.</p> <p>16.9 Dark Dot –one Allowed.</p> <p>16.10 Bright Dot – one Allowed.</p> <p>Remark:</p> <p>1. A pixel defect is acceptable if one color is none functional and causes a bright dot. The display may have one case where one color is out and cause a dark dot.</p> <p>2. Bright dot caused by scratch and foreign object accords to item 1.</p>

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/marketing criteria**

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

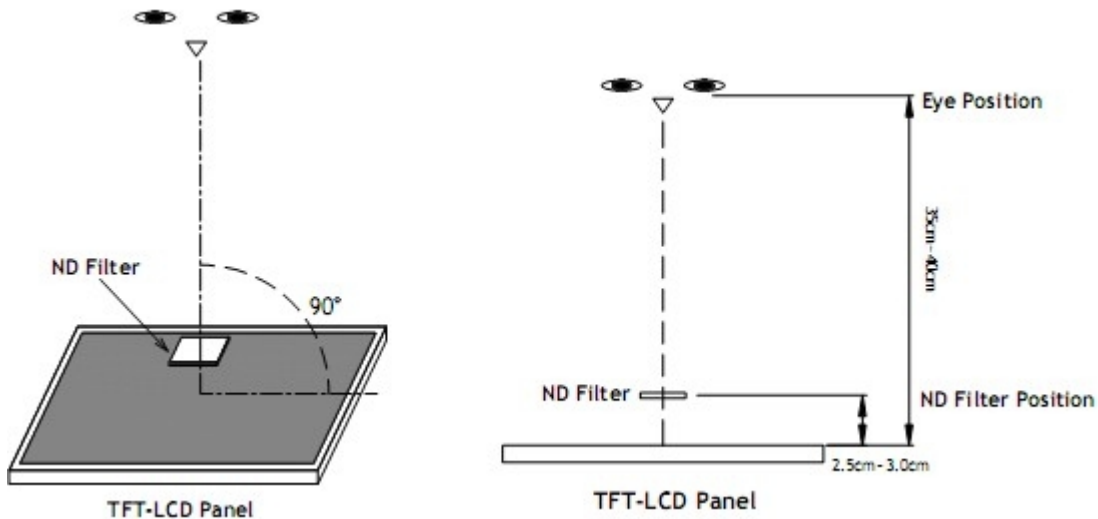
**10.9 Packing**

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	+50°C, 90%RH, 96Hrs	2	GB/T2423.3-2006
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	-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.	2	GB/T5170.14-2009
8	Electrical Static Discharge	Air: ±8kV 150pF/330 Ω 5 times Contact: ±4kV 150pF/330 Ω 5 times	2	GB/T17626.2-2006
9	Drop Test (Packaged)	Height:80 cm,1 corner, 3 edges, 6 surfaces.	2	GB/T2423.8-1995

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.

**12.4 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

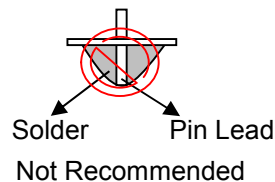
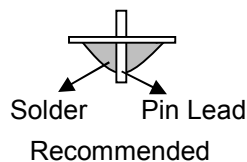
Maximum Solder Temperature: 370℃

Maximum Solder Time: 3s at the maximum temperature

Recommended Soldering Temp: 350±20℃

Typical Soldering Time: ≤3s

12.4.1.3 Solder Wetting



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℃

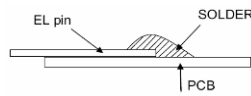
Typical Soldering Time: ≤2s

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

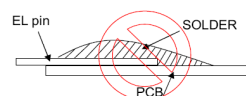
12.4.2.4 No horizontal press on the EL leads during soldering.

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

12.4.2.6 Solder Wetting

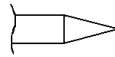


Recommended

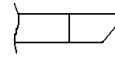


Not Recommended

12.4.2.7 The type of the solder iron:

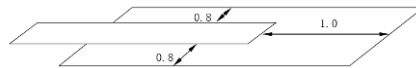


Recommended



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”.

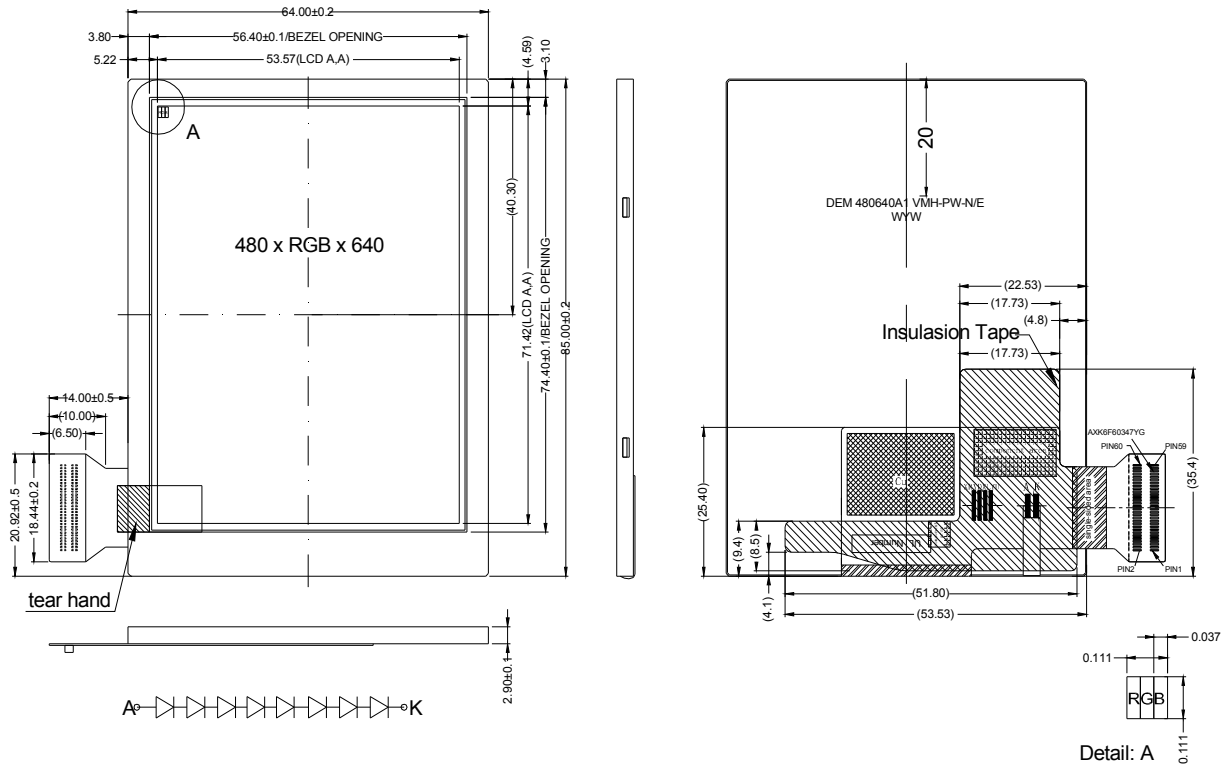
**12.6 Static Electricity**

- 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

13. Outline Drawing



Pin assignment	NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	Symbol	GND	NC (YU)	NC (XR)	NC (YD)	NC (XL)	GND	NC	NC	GND	NC	NC	NC	NC	NC	GND	NC	LCD_RST	NC	NC	VCC_3V0	GND	B0	B1	B2	B3	B4	B5	GND	G0	G1
	Symbol	G2	G3	G4	G5	GND	R0	R1	R2	R3	R4	R5	GND	PWR_LCDIO	NC	GND	LCD_CLK	GND	LCD_EN	SDO	NCS	SDI	NC	SCL	VSYNC	HSYNC	NC	NC	LED-	LED+	GND

NOTES:

1. Display Size: 3.5" TFT (MVA-MODE)
2. Viewing Direction: FULL VIEW
3. Polarizer Mode: Transmissive / Normal Black / Anti-Glare
4. Operation Temperature: -20°C to +70°C
5. Storage Temperature: -30°C to +80°C
6. Driver / Controller IC: HX8363-A (Himax)
7. Power Supply Voltage: 2.8V (typ.)
8. Backlight: White (8xLEDs) 25.6V(typ) / 20mA  
Lifetime: 30000hrs(typ)
9. ROHS must be complied