Display Elektronik GmbH

DATA SHEET

TFT MODULE

DEM 320480C VMH-PW-N

3,5" TFT

Product Specification   Ver.: 3

22.07.2022

Revision History

Revision	Date	Originator	Detail	Remarks
0	10.05.2022	MHI	Initial Release	
1	13.05.2022	MHI	Modify Details	
2	16.05.2022	MHI	Modify Details	
3	22.07.2022	MH	Modify Item 5.1 and Item 7.1	

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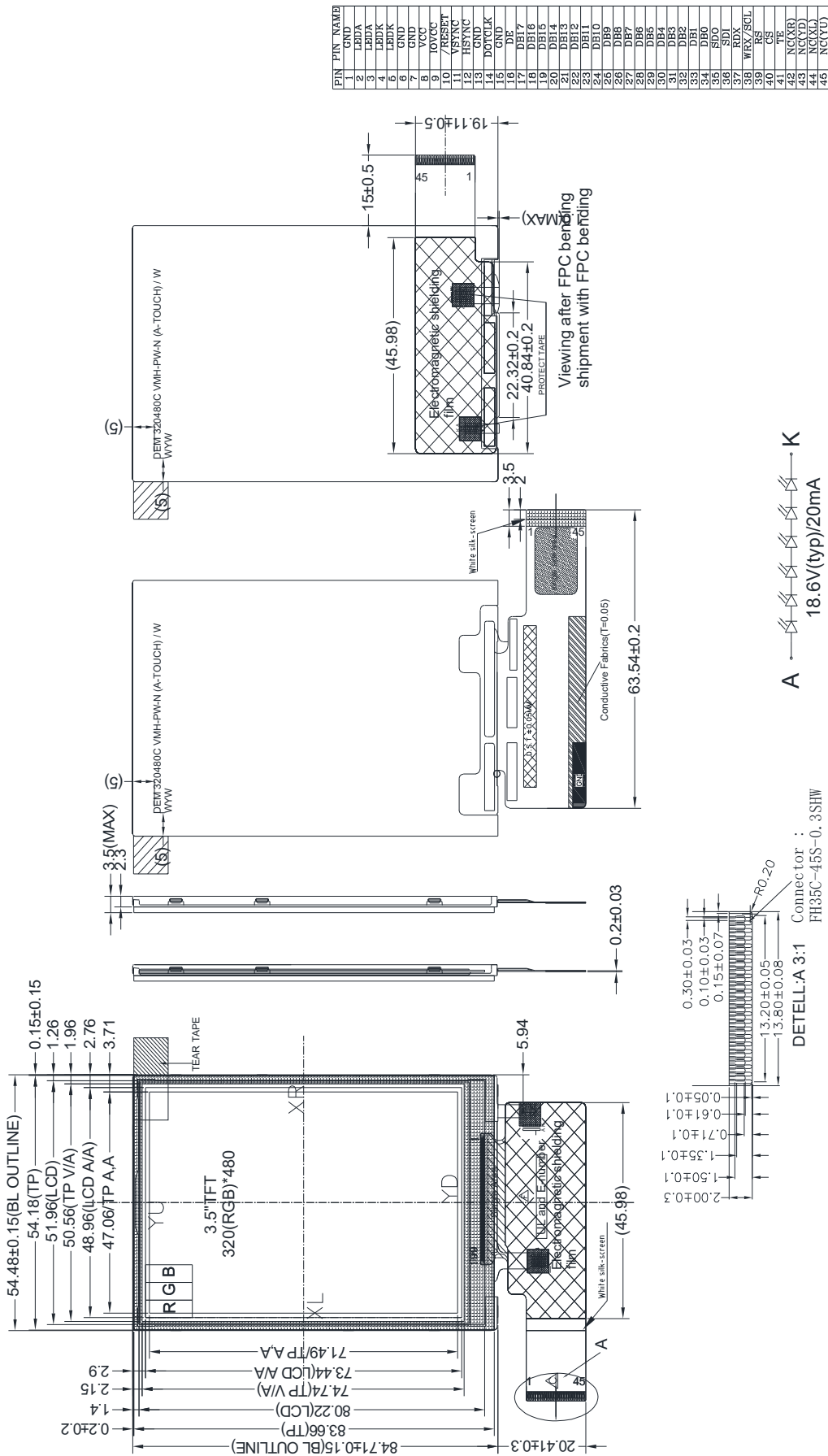
1.   General Description

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)	3.5"	-
LCD Type	IPS TFT	-
Display Mode	Transmissive /Normally black	-
Resolution	320RGB x 480	Pixels
View Direction	FULL view	Best Image
Module Outline	54.48(H) x 84.71(V) x 2.20 (T) (Note1)	mm
Active Area	48.96 (H) x73.44(V)	mm
Pixel Pitch	0.153(H) x 0.153(V)	mm
Pixel Arrangement	RGB Vertical Stripe	-
Display Colors	262K	-
Interface	RGB + 3SPI（default）	-
Driver IC	ILI9488	-
With or Without Touch Panel	Without	-
Operating Temperature	-20～70	ºC
Storage Temperature	-30～80	ºC
Weight	20	g

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

2.1 Outline drawing

PIN	PIN NAME
1	GND
2	LEDA
3	LEDA
4	LEDK
5	LEDK
6	GND
7	VCC
8	IOVCC
9	/RESET
10	VSYNC
11	HSYNC
12	GND
13	DOTCLK
14	GND
15	DE
16	DB17
17	DB16
18	DB15
19	DB14
20	DB13
21	DB12
22	DB11
23	DB10
24	DB9
25	DB8
26	DB7
27	DB6
28	DB5
29	DB4
30	DB3
31	DB2
32	DB1
33	DB0
34	SDO
35	SDI
36	RDX
37	WRX/SCL
38	RS
39	CS
40	TE
41	NC(XR)
42	NC(YD)
43	NC(XL)
44	NC(YU)

19.11±0.5

15±0.5

45　1

(MAX)

Viewing after FPC bending
shipment with FPC bending

(45.98)

Electromagnetic shielding film

22.32±0.2
40.84±0.2
PROTECT TAPE

3.5
2

DEM 320480C VMH-PW-N (A-TOUCH) / W
WYW

(S)

(S)

White silk-screen

Conductive Fabrics(T=0.05)

63.54±0.2

0.5 T±0.05MAX

GND

A 〜〜〜〜〜 K
18.6V(typ)/20mA

3.5(MAX)
2.3

0.2±0.03

5.94

R0.20

Connector：
FH35C-45S-0.3SHW

DETELL:A 3:1

0.30±0.03
0.10±0.03
0.15±0.07
13.20±0.05
13.80±0.08
0.05±0.1
0.61±0.1
0.71±0.1
1.35±0.1
1.50±0.1
2.00±0.3

TEAR TAPE

0.15±0.15
1.26
1.96
2.76
3.71

54.48±0.15(BL OUTLINE)
54.18(TP)
51.96(LCD)
50.56(TP V/A)
48.96(LCD A/A)
47.06/TP A.A

3.5"TFT
320(RGB)*480

R G B

XR
YU
MD
XL

TP and FP number

Electromagnetic shielding film

White silk-screen

(45.98)

A

45

71.49/TP A.A
73.44(LCD A/A)
74.74(TP V/A)
80.22(LCD)
83.66(TP)
84.71±0.15(BL OUTLINE)

2.9
2.15
1.4
0.2±0.2

20.41±0.3

3. Absolute Maximum Ratings

GND =0V, Ta=25ºC

Item	Symbol	Min.	Max.	Unit
Power supply voltage	VCC	-0.3	4.6	V
	IOVCC	-0.3	4.6	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		VCC	2.5	2.8	3.3	V
		IOVCC	1.65	1.8	3.3	V
Logic Low input voltage		V_{IL}	-0.3	-	0.3*IOVCC	V
Logic High input voltage		V_{IH}	0.7*IOVCC	-	IOVCC	V
Logic Low output voltage		V_{OL}	0	-	0.2*IOVCC	V
Logic High output voltage		V_{OH}	0.8*IOVCC	-	IOVCC	V
Current Consumption All white	Logic	I_{CC+} I_{IN}	-	(20)		mA
	Analog					

5. Backlight Characteristic

5.1. Backlight Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V_F	Ta=25 ºC, I_F=20mA/LED	16.8	18.6	20.4	V
Forward Current	I_F	Ta=25 ºC, V_F=3.2V/LED	-	20	-	mA
Power Dissipation	P_D	-	-	372	-	mW
Uniformity	Avg	-	-	80	-	%
LED Lifetime (25°C)	-		-	30,000	-	Hrs
Drive Method	Constant current					
LED Configuration	6 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 Ta=25°C±2ºC, 60%RH±5%, I_F=20mA/LED.

5.2. Backlighting Circuit

6. Touch Screen Panel Specifications

Without TP

7. Optical Characteristics

7.1. Optical Characteristics

Ta=25ºC, VCC=2.8V

	Item		Symbol	Condition	Specification			Unit
					Min.	**Typ.**	**Max.**	
Backlight On (Transmissive Mode)	Luminance on TFT(I_f =20mA/LED)		Lv		280	360	-	cd/m²
	Contrast ratio(See 7.3)		CR	Normally viewing angle $\theta_X = \varphi_Y = 0º$		700	-	
	Response time (See 7.2)		T_R		-	30	-	ms
			T_F					
	Chromacity Transmissive (See 7.5)	White	X_W		0.29	0.34	0.39	-
			Y_W		0.34	0.39	0.44	-
	Viewing Angle (See 7.4)	Horizontal	θ_X+	Center CR≥10	65	80	-	Deg.
			θ_X-		65	80	-	
		Vertical	φ_Y+		65	80	-	
			φ_Y-		65	80	-	
	NTSC Ratio(Gamut)		-	-	-	69	-	%

7.2. Definition of Response Time

7.2.1.   Normally Black Type (Negative)
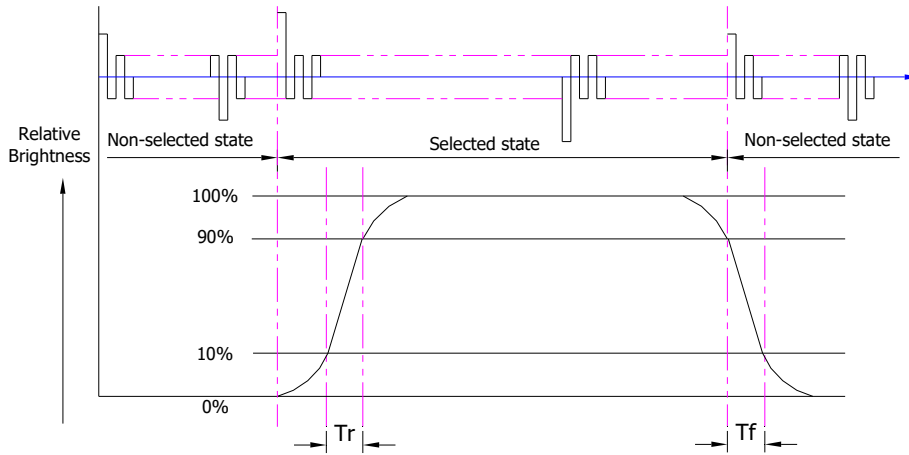
Tr is the time it takes to change form non-selected stage with relative luminance 10% to selected state with relative luminance 90%;

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

7.2.2.   Normally White Type (Positive)
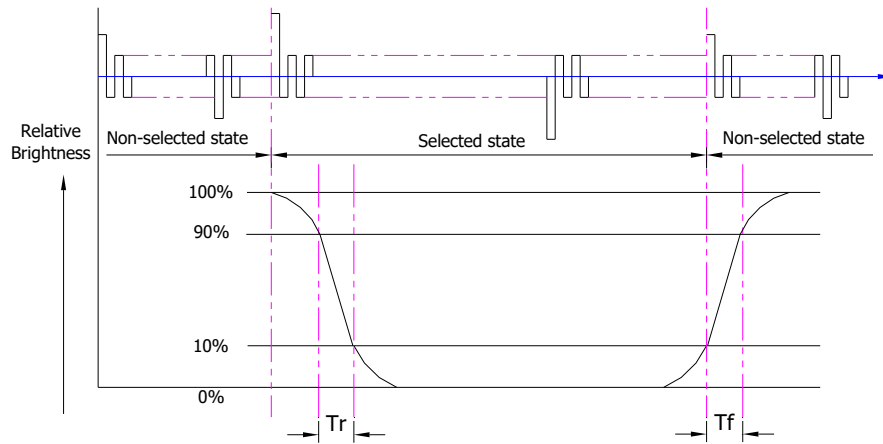
Tr is the time it takes to change form non-selected stage with relative luminance 90% to selected state with relative luminance 10%;

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

7.3. 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

7.4. Definition of Viewing Angles
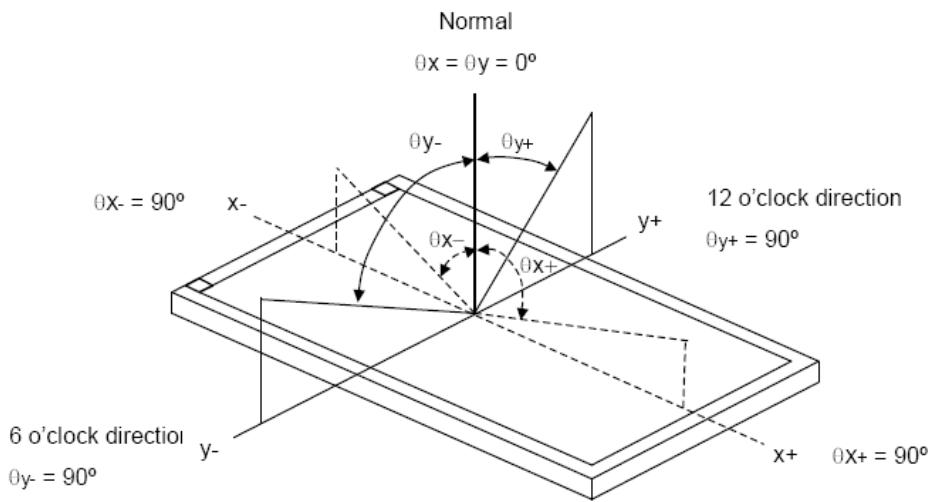
Measuring machine: LCD-5100 or EQUI

7.5. 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)
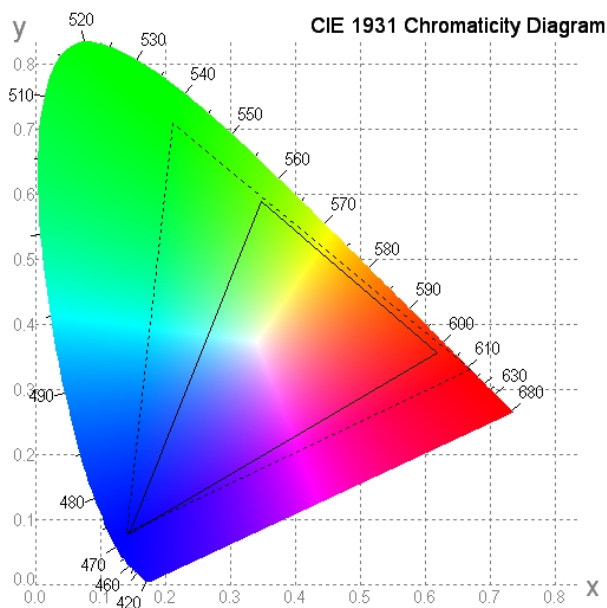
7.6. Definition of Surface Luminance, Uniformity and Transmittance

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

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

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

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

Note: Measuring machine: BM-7
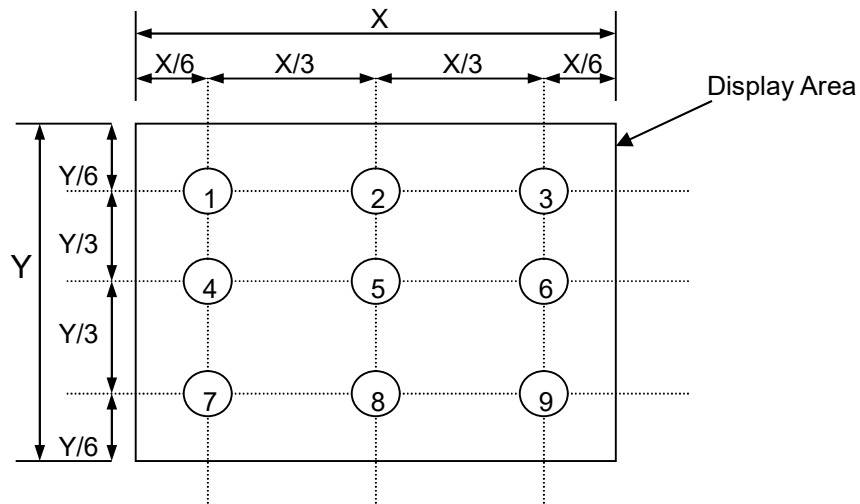
8.   Block Diagram and Power Supply
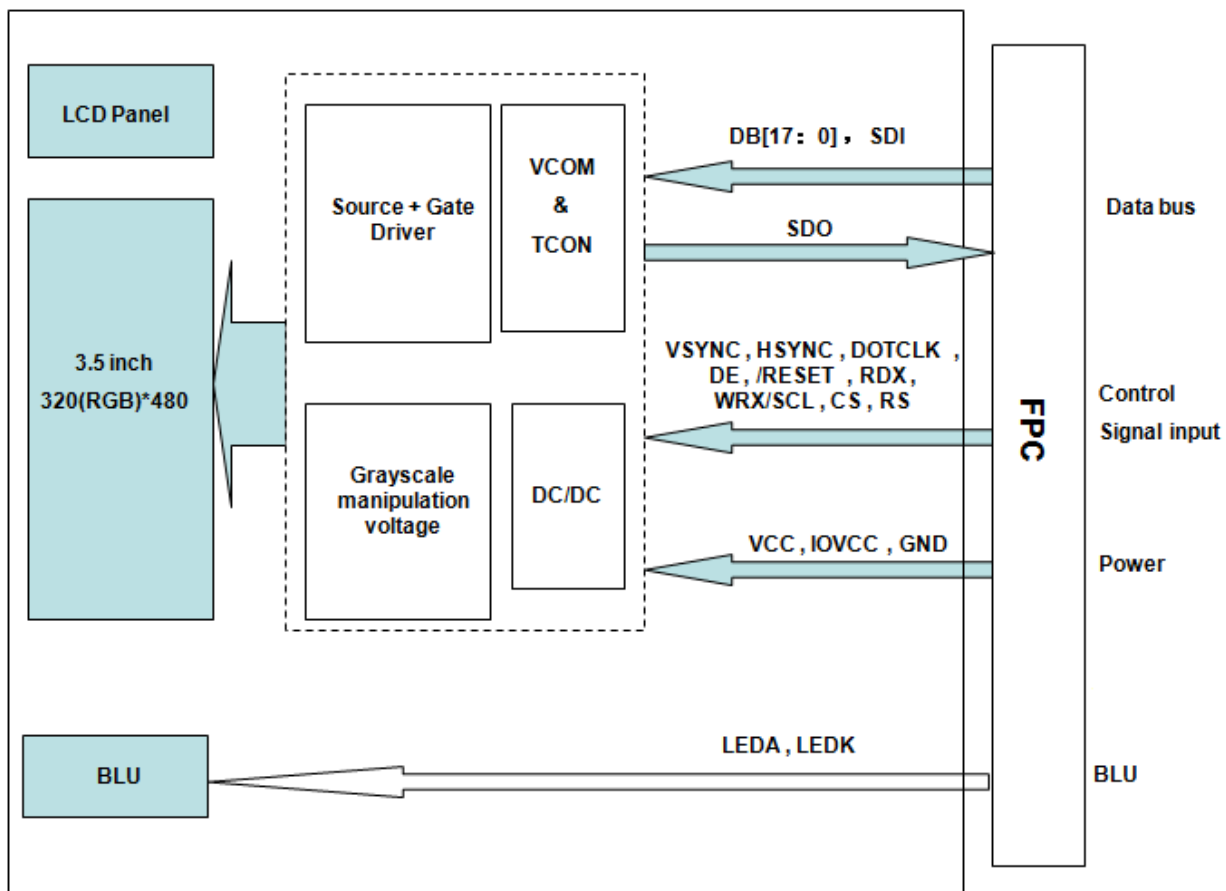
9. Interface Pins Definition

Connector type : FH35C-45S-0.3SHW

No.	Symbol	Function
1	GND	Power Ground
2	LEDA	Anode for back light driver voltage
3	LEDA	Anode for back light driver voltage
4	LEDK	Cathode for back light driver voltage
5	LEDK	Cathode for back light driver voltage
6	GND	Power Ground
7	GND	Power Ground
8	VCC	Power supply
9	IOVCC	Power supply
10	/RESET	Reset input pin. Signal is active low.
11	VSYNC	Vertical Sync Signal
12	HSYNC	Horizontal Sync Signal
13	GND	Power Ground
14	DOTCLK	Pixel clock signal
15	GND	Power Ground
16	DE	Data Enable signal.
17	DB17	Data bus
18	DB16	Data bus
19	DB15	Data bus
20	DB14	Data bus
21	DB13	Data bus
22	DB12	Data bus
23	DB11	Data bus
24	DB10	Data bus
25	DB9	Data bus
26	DB8	Data bus
27	DB7	Data bus
28	DB6	Data bus
29	DB5	Data bus
30	DB4	Data bus
31	DB3	Data bus
32	DB2	Data bus
33	DB1	Data bus
34	DB0	Data bus
35	SDO	Serial data output
36	SDI	Serial data input pin.
37	RDX	LCD driver read enable
38	WRX/SCL	DBI Type B:WRX pin, serves as a write signal DBI Type C:SCL pin as Serial Clock when operates in the serial interface
39	RS	Command/Display data selection signal

40	CS	Chip select signal
41	TE	Tearing effect output pin
42	NC/XR	NC
43	NC/YD	NC
44	NC/XL	NC
45	NC/YU	NC

10. AC Characteristics

1）3-SPI Serial Data Transfer Interface Characteristics
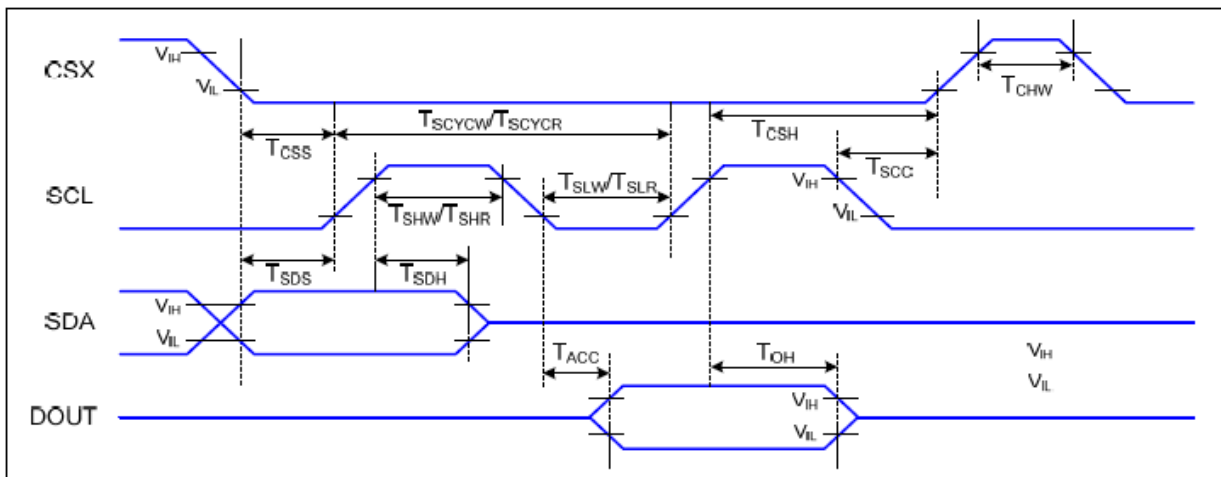
Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	
	T_{SHW}	SCL "H" pulse width (Write)	15		ns	
	T_{SLW}	SCL "L" pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

2）RGB Interface Characteristics
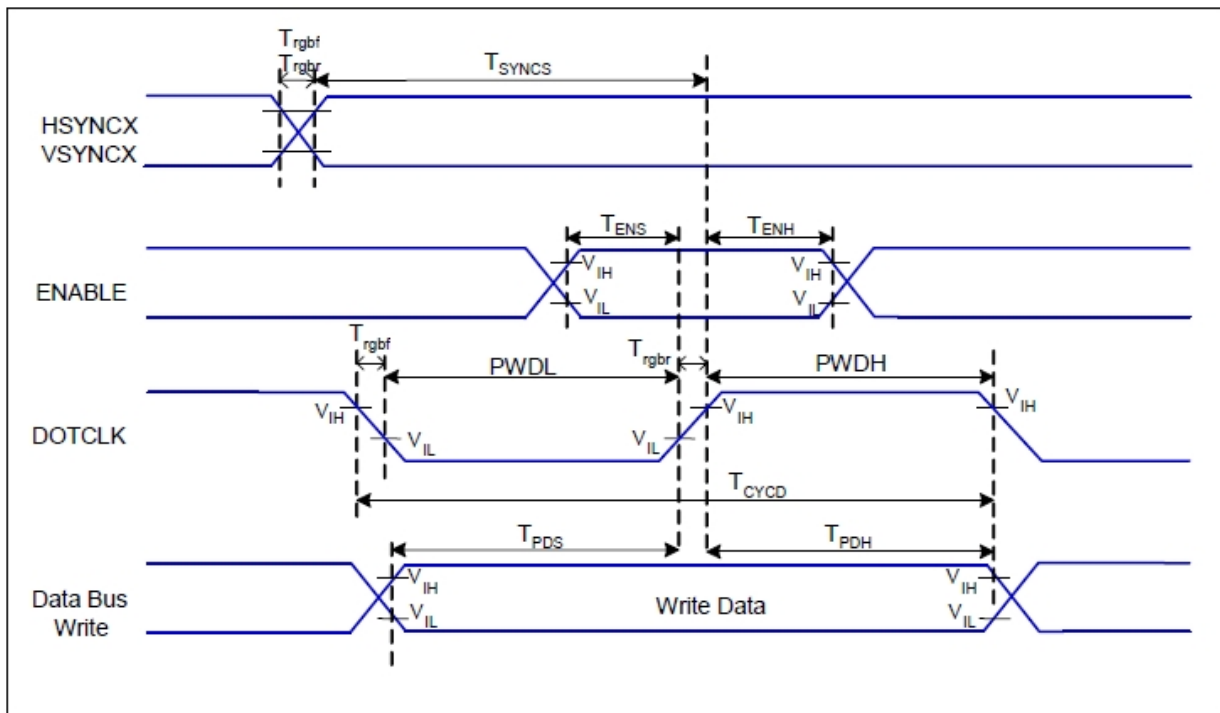
Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	T$_{SYNCS}$	VSYNC, HSYNC Setup Time	15	-	ns	
ENABLE	T$_{ENS}$	Enable Setup Time	15	-	ns	
	T$_{ENH}$	Enable Hold Time	15	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	30	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	30	-	ns	
	T$_{CYCD}$	DOTCLK Cycle Time	66	-	ns	
	Trghr, Trghf	DOTCLK Rise/Fall time	-	15	ns	
DB	T$_{PDS}$	PD Data Setup Time	15	-	ns	
	T$_{PDH}$	PD Data Hold Time	15	-	ns	

11. Quality Assurance

11.1. Purpose

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

11.2. Standard for Quality Test

11.2.1.　Sampling Plan:

GB2828.1-2012

Single sampling, general inspection level II

11.2.2.　Sampling Criteria:

Visual inspection: AQL 1.5.

Electrical functional: AQL 0.65.

11.2.3.　Reliability Test:

Detailed requirement refer to Reliability Test Specification.

11.3. Nonconforming Analysis & Disposition

11.3.1.　Nonconforming analysis:

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

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

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

11.3.2.　Disposition of nonconforming:

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

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

11.4. Agreement Items

Shall negotiate with customer if the following situation occurs:

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

11.4.2.　Additional requirement to be added in product specification.

11.4.3.　Any other special problem.

11.5. Standard of the Product Visual Inspection

11.5.1.　Appearance inspection:

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

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

11.5.1.3. Definition of area: A Zone: Active Area, B Zone: Viewing Area,
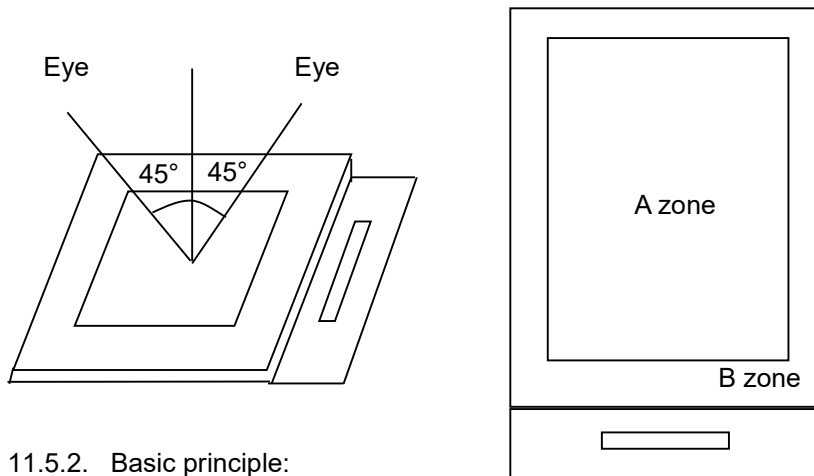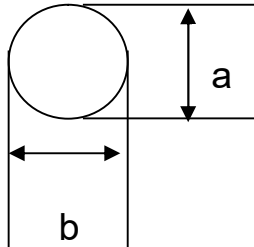
11.5.2. Basic principle:
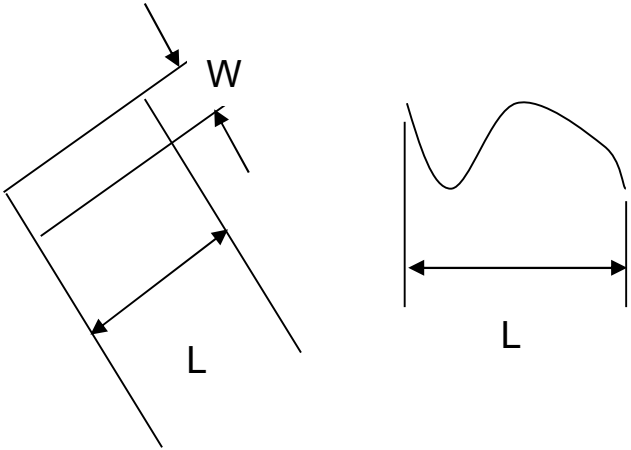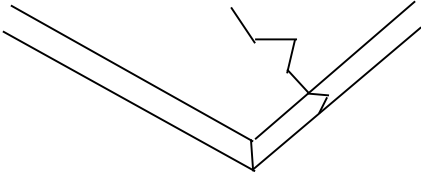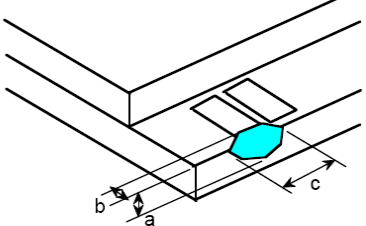
11.5.2.1. A set of sample to indicate the limit of acceptable quality level must be discussed by both us and customer when there is any dispute happened.
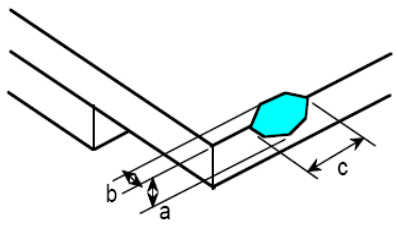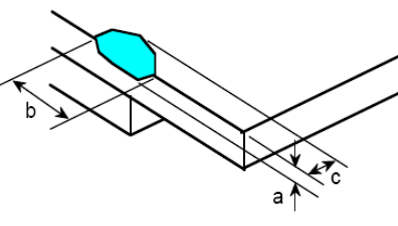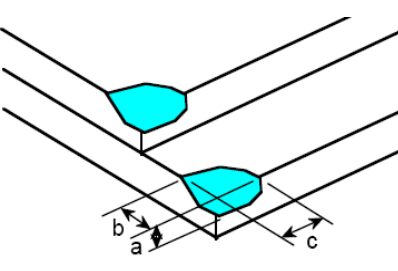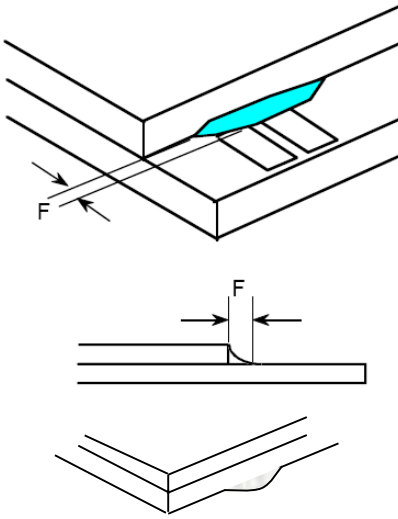
11.5.2.2. New item must be added on time when it is necessary.
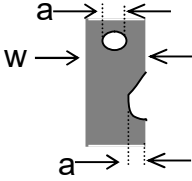
11.6. Inspection Specification

No.	Item	Criteria (Unit: mm)		
01	Black / White spot Foreign material (Round type) Pinholes Stain Particles inside cell. (Minor defect)	 $\varphi = (a + b)/2$ Distance between 2 defects should more than 3mm apart.	**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 $\varphi \leq 0.10$
02	Electrical Defect (Minor defect)			

	Display Area	Total	
Bright dot	0	0	Note1
Dark dot	$N \leq 2$	$N \leq 2$	
Total dot	$N \leq 2$	$N \leq 2$	
Mura	Not visible through 5% ND filters.		Note 2

Remark:
1. Bright dot caused by scratch and foreign object accords to item 1.

03	Black and White line Scratch Foreign material (Line type) (Minor defect)	W ... L ... L	

Length	Width	Acc. Qty
/	W ≦ 0.03	Ignore
L ≦ 2.5	0.03 ＜ W ≦ 0.05	3
L ≦ 2.5	0.05 ＜ W ≦ 0.10	2
/	0.1 ＜ W	0
Total		3

Distance between 2 defects should more than 3mm apart. Scratches not viewable through the back of the display are acceptable.

04	Glass Crack (Minor defect)

Crack is potential to enlarge, any type is not allowed.

05	Glass Chipping Pad Area: (Minor defect)

Length and Width	Acc. Qty
c > 3.0, b< 1.0	1
c< 3.0, b< 1.0	3
a<Glass Thickness	

06	Glass　Chipping Rear of Pad Area: (Minor defect) 		
		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<Glass Thickness	

07	Glass　Chipping Except Pad Area: (Minor defect) 		
		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<Glass Thickness	

08	Glass Corner Chipping: (Minor defect) 		
		Length and Width	**Acc. Qty**
		c < 3.0, b< 3.0	Ignore
		a<Glass Thickness	

09	Glass Burr: (Minor defect) 		
		Length	**Acc. Qty**
		F < 1.0	Ignore
		Glass burr don't affect assemble and module dimension.		

10	FPC Defect: (Minor defect) 	10.1 Dent, pinhole width a<w/3. (w: circuitry width.) 10.2 Open circuit is unacceptable. 10.3 No oxidation, contamination and distortion.

11	Bubble on Polarizer (Minor defect)		Diameter	Acc. Qty
			φ≤0.20	Ignore
			0.20 <φ≤0.30	4
			0.30 <φ≤0.50	1
			0.50 < φ	None

12	Dent on Polarizer (Minor defect)		Diameter	Acc. Qty
			φ≤0.20	Ignore
			0.20 <φ≤0.30	4
			0.30 <φ≤0.50	1
			0.50 < φ	None

13	Bezel	13.1 No rust, distortion on the Bezel. 13.2 No visible fingerprints, stains or other contamination.

14	Touch Panel	D: Diameter W: width L: length
		14.1 Spot: D<0.25 is acceptable
		        0.25≤D≤0.4
		2dots are acceptable and the distance between defects should more than 10 mm.
		        D>0.4 is unacceptable
		14.2 Dent: D>0.40 is unacceptable
		14.3 Scratch: W≤0.03, L≤10 is acceptable,
		        0.03<W≤0.10, L≤10 is acceptable
		Distance between 2 defects should more than 10 mm.
		        W>0.10 is unacceptable.

15	PCB	15.1 No distortion or contamination on PCB terminals. 15.2 All components on PCB must same as documented on the BOM/component layout. 15.3 Follow IPC-A-600F.

16	Soldering	Follow IPC-A-610C standard

17	Electrical Defect (Major defect)	The below defects must be rejected. 17.1 Missing vertical / horizontal segment,

		17.2 Abnormal Display.
		17.3 No function or no display.
		17.4 Current exceeds product specifications.
		17.5 LCD viewing angle defect.
		17.6 No Backlight.
		17.7 Dark Backlight.
		17.8 Touch Panel no function.

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

11.7. Classification of Defects

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

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

11.8. Identification/marking criteria

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

11.9. Packing

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

11.9.2. Modules inside package box should have compliant mark.

11.9.3. 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.
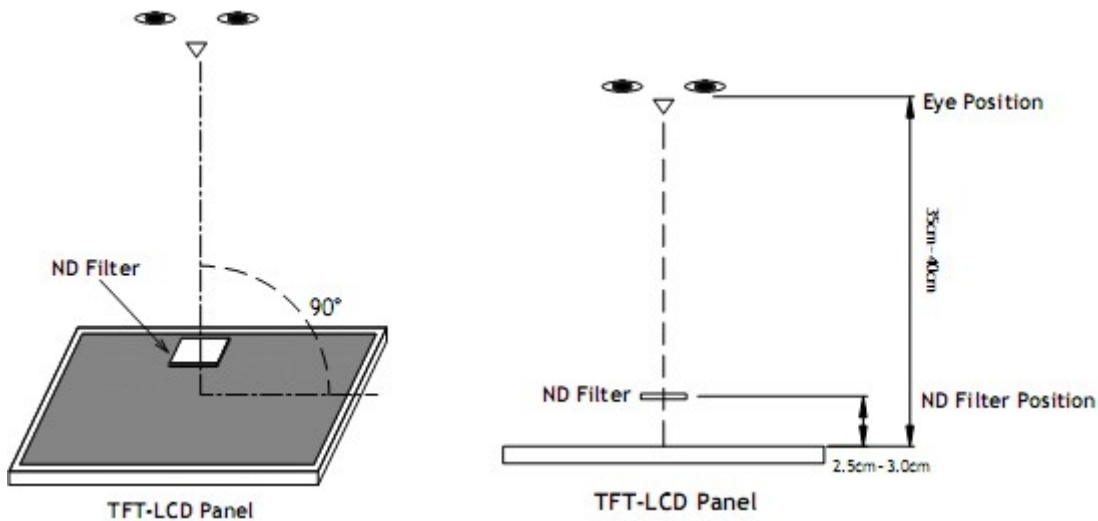
Bright dot: The bright dot size defect at black display pattern. It can be recognized by 2% transparency of filter when the distance between eyes and panel is 350mm±50mm.

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.

12. 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 -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	-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:±4KV 150pF/330Ω 5 times	2	GB/T17626.2 -2018
		Contact:±2KV 150pF/330Ω 5 times		
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

13. Precautions and Warranty

13.1. Safety

13.1.1. 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.

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

13.2. Handling

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

13.2.2. 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.

13.3. Storage

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

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

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

13.4.1. Pins of LCD and Backlight

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

    13.4.1.2. Recommended Soldering Conditions

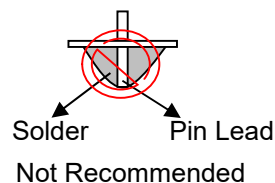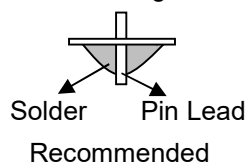   Solder Type: Sn96.3~94-Ag3.3~4.3-Cu0.4~1.1

        Maximum Solder Temperature: 370℃

        Maximum Solder Time: 3s at the maximum temperature

        Recommended Soldering Temp: 350±20℃

        Typical Soldering Time: ≤3s

    13.4.1.3. Solder Wetting

| Solder | Pin Lead | Solder | Pin Lead |
| Recommended | | Not Recommended | |

13.4.2. Pins of EL

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

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

    13.4.2.3. Recommended Soldering Conditions

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

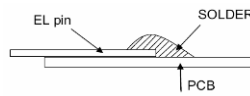   Recommended Solder Temperature: 270～290℃

        Typical Soldering Time: ≤2s

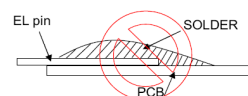   Minimum solder distance from EL lamp (body):2.0mm

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

    13.4.2.5. 180° bend EL leads three times is not allowed.
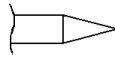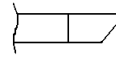
13.4.2.6. Solder Wetting

Recommended   Not Recommended
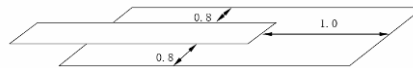
13.4.2.7. The type of the solder iron:

Recommended   Not Recommended

13.4.2.8. Solder Pad

13.5. Operation

13.5.1. Do not drive LCD with DC voltage

13.5.2. Response time will increase below lower temperature

13.5.3. Display may change color with different temperature

13.5.4. Mechanical disturbance during operation, such as pressing on the display area, may cause the segments to appear "fractured".

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

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

13.5.7. 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.

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

13.6. Static Electricity

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

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

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

13.7. Limited Warranty

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

13.7.2. 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.

13.7.3. 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.