

Display Elektronik GmbH

# DATA SHEET

TFT MODULE

DEM 2560720A VMH-PW-N

14,5" TFT

Product Specification

Version: 0

26.12.2024



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**\* Description**

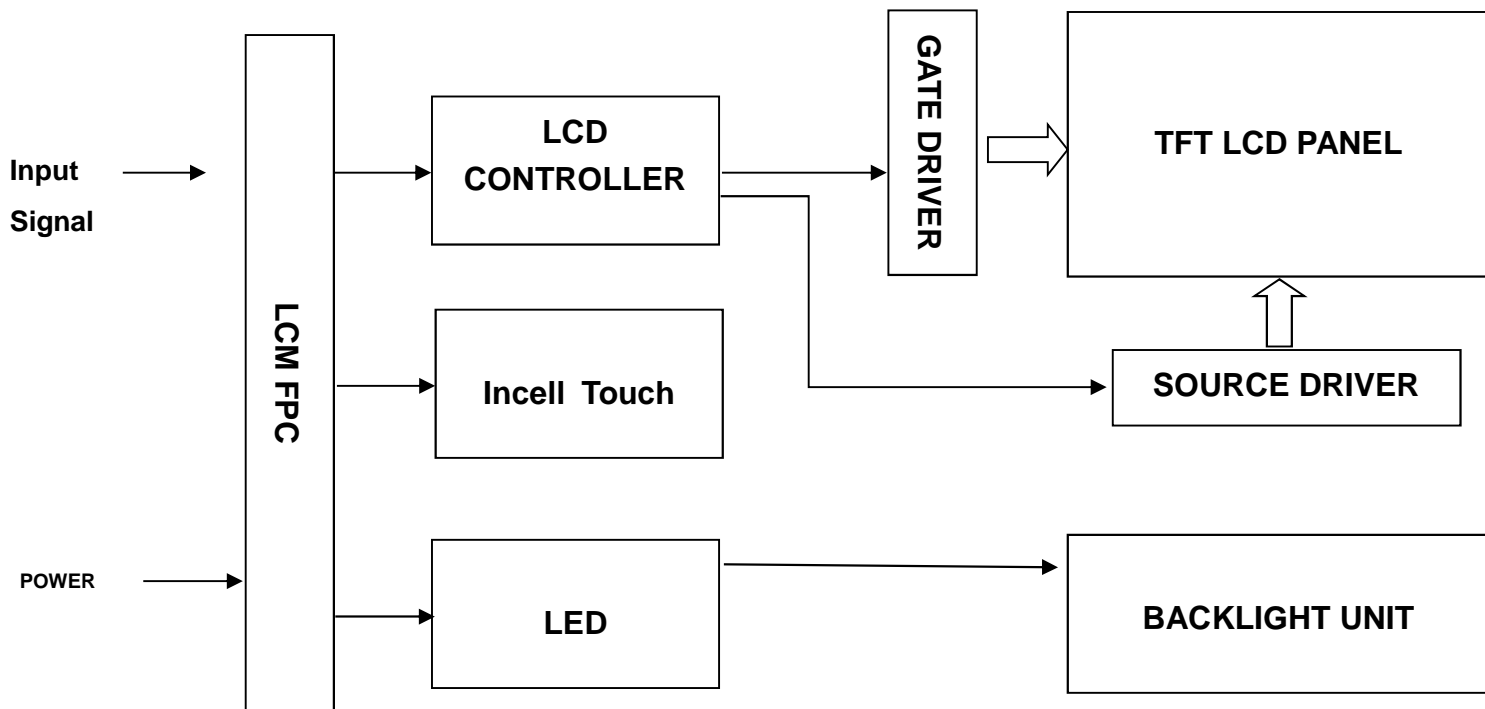
This is a LTPS & transmissive type Thin Film Transistor Liquid crystal Display (TFT-LCD) with iT P (in cell Touch panel) technology. This model is composed of a TFT-LCD, a driver, FPC (flexible printed circuit) and PCB (Printed Circuit Board), and a backlight unit with a capacitive touch sensor. TCON (timing controller) is also embedded in source driver.

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	355.50(H) × 100.00(V)(14.5 inch)	mm	-
Driver element	TFT active matrix	-	-
Display colors	16.7M	colors	-
Number of pixels	2560(RGB)*720	dots	-
TFT Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.0462RGB(H)x0.1386(V)	mm	-
Viewing angle	ALL	o'clock	-
LCM Interface	2-Port LVDS	-	-
Display mode	Normally Black (AHVA)	-	-
Operating temperature	-20~+70	°C	-
Storage temperature	-25~+80	°C	-

**\* Mechanical Information**

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	-	363.5	-	mm	-
	Vertical(V)	-	113.5	-	mm	-
	Depth(D)	-	6.0	-	mm	-
Weight		-	TBD	-	g	-

### 1. Block Diagram

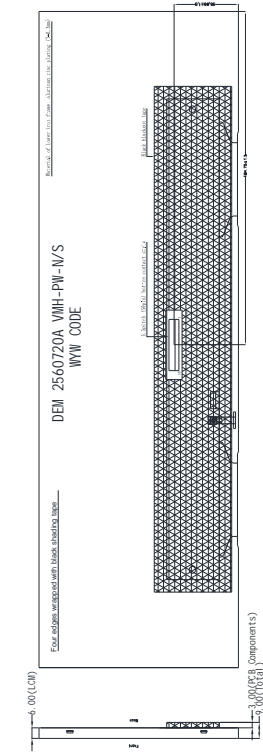


Outline dimension

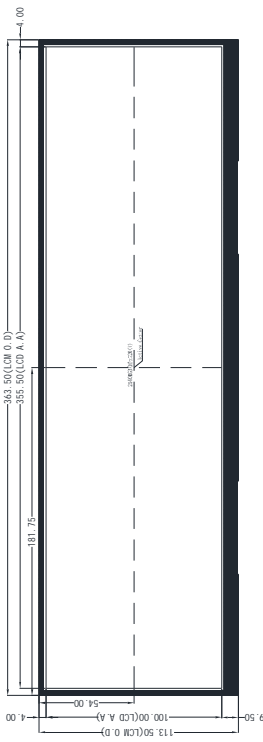
Interface definition

Pin	Name
1	GND
2	HP-INT
3	HP-SDA
4	HP-PCSEL
6	GND
7	HVR
8	GND
9	AD-
10	AD+
12	A1+
13	A1+
14	GND
15	A2-
16	A2+
17	GND
18	ACT-K+
19	ACT-K+
20	GND
21	A3-
22	A3+
23	GND
24	EO-
25	EO+
26	GND
27	E1-
28	E1+
29	GND
30	E2-
31	E2+
32	GND
33	E3-K+
44	E3-K+
35	GND
36	E3-
37	E3+
38	GND
39	STBYA
40	STBYA
41	GND
42	STBYB
43	BIST
44	RESET
45	LED-A
47	LED-K
48	LED-K
49	LED-K
50	LED-K

Bottom View



Side View



Front View



B/L Circuit (9 series and 6 parallel)

- NOTE:
1. DISPLAY TYPE: 14.5", TFT-LCD, 16.7M COLORS
  2. DISPLAY MODE: NORMALLY BLACK/IPS
  3. VIEWING DIRECTION: AHVA
  4. LCM Interface: 2-Port LVDS
  5. VDD: 3.3V (TYP.)
  6. OPERATING TEMP: -20° C TO 70° C  
STORAGE TEMP: -25° C TO 80° C
  7. BACK LIGHT: LED WHITE, 54 LED, 360mA, 27±0.3V
  8. RoHS COMPLIANT.

**3. Input terminal Pin Assignment**

NO.	SYMBOL	DISCRIPTION	I/O
1	GND	Power Ground	P
2	TP_INT	Touch I2C interrupt	O
3	TP_SDA	Touch I2C data	I
4	TP_SCL	Touch I2C clock	I
5	TP_RESET	Touch part reset pin	I
6	GND	Power Ground	P
7	HVR	Horizontally and Vertically Inverted	I
8	GND	Power Ground	P
9	A0-	LVDS Data differential signal input pin (A0-)	I
10	A0+	LVDS Data differential signal input pin (A0+)	I
11	GND	Power Ground	P
12	A1-	LVDS Data differential signal input pin (A1-)	I
13	A1+	LVDS Data differential signal input pin (A1+)	I
14	GND	Power Ground	P
15	A2-	LVDS Data differential signal input pin (A2-)	I
16	A2+	LVDS Data differential signal input pin (A2+)	I
17	GND	Power Ground	P
18	ACLK-	LVDS Data differential signal input pin(Negative)	I
19	ACLK+	LVDS Data differential signal input pin (Positive)	I
20	GND	Power Ground	P
21	A3-	LVDS Data differential signal input pin (A3-)	I
22	A3+	LVDS Data differential signal input pin (A3+)	I
23	GND	Power Ground	P
24	E0-	LVDS Data differential signal input pin (E0-)	I
25	E0+	LVDS Data differential signal input pin (E0+)	I
26	GND	Power Ground	P
27	E1-	LVDS Data differential signal input pin (E1-)	I
28	E1+	LVDS Data differential signal input pin (E1+)	I

29	GND	Power Ground	P
30	E2-	LVDS Data differential signal input pin (E2-)	I
31	E2+	LVDS Data differential signal input pin (E2+)	I
32	GND	Power Ground	P
33	ECLK-	LVDS Data differential signal input pin(Negative)	I
34	ECLK+	LVDS Data differential signal input pin (Positive)	I
35	GND	Power Ground	P
36	E3-	LVDS Data differential signal input pin (E3-)	I
37	E3+	LVDS Data differential signal input pin (E3+)	I
38	GND	Power Ground	P
39	3V3(650MA)	Power supply for the analog circuit	P
40	3V3(650MA)	LCD logic and driver power(3.3V)	P
41	GND	Power Ground	P
42	STBYB	Standby mode setting pin.active low	I
43	BIST	Enable built-in self test (BIST) function	I
44	RESET	Global reset pin	I
45	LED_A	B Power for LED backlight (Anode)	P
46	LED_A	Power for LED backlight (Anode)	P
47	LED_K	Power for LED backlight (Cathode)	P
48	LED_K	Power for LED backlight (Cathode)	P
49	LED_K	Power for LED backlight (Cathode)	P
50	LED_K	Power for LED backlight (Cathode)	P



4.LCD Optical Characteristics

Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response Time	Rise Fall	Tr+Tf	$\theta = 0^\circ, T_a = 25^\circ\text{C}$	-	-	20	ms	Note 3
		Tr+Tf	$\theta = 0^\circ, T_a = -20^\circ\text{C}$	-	-	150	ms	
		Tr+Tf	$\theta = 0^\circ, T_a = -30^\circ\text{C}$	-	-	400	ms	
Contrast ratio		CR	$\theta = 0^\circ$	1200	1500	-		Note 5, 6, 7
Viewing Angle	Top	CR $\square$ 10	$\theta = 0^\circ$	-	89	-	deg.	Note 8, 9
	Bottom				89			
	Left				89			
	Right				89			
Brightness		YL	$\theta = 0^\circ$	700	800	-	cd/m2	Note 1,2,10
White Chromaticity		Wx	$\theta = 0^\circ$	(0.263)	(0.293)	(0.323)		Note 9
		Wy	$\theta = 0^\circ$	(0.290)	(0.320)	(0.350)		
White Chromaticity		Wx	$\theta = 0^\circ$	(0.288)	(0.293)	(0.298)		
		Wy	$\theta = 0^\circ$	(0.315)	(0.320)	(0.325)		
Red Chromaticity		Rx	$\theta = 0^\circ$	(0.610)	(0.640)	(0.670)		
		Ry	$\theta = 0^\circ$	(0.300)	(0.330)	(0.360)		
Green Chromaticity		Gx	$\theta = 0^\circ$	(0.270)	(0.300)	(0.330)		
		Gy	$\theta = 0^\circ$	(0.570)	(0.600)	(0.630)		
Blue Chromaticity		Bx	$\theta = 0^\circ$	(0.112)	(0.150)	(0.180)		
		By	$\theta = 0^\circ$	(0.030)	(0.060)	(0.090)		
Color Gamut		NTSC	$\theta = 0^\circ$	-	70.8	-	%	
Uniformity White			9-point, $\theta = 0^\circ$	80	-	-	%	Note 11
Uniformity Black			9-point, $\theta = 0^\circ$	50	-	-	%	Note 11
Reflectance		SCI	$\theta = 0^\circ, T_a = 25^\circ\text{C}$			2	%	Note 4, 12

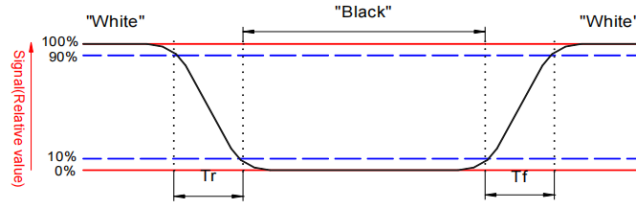
Note 1: Measurement should be performed in the dark room, optical ambient temperature =25°C, and backlight current I<sub>L</sub>=360 mA

Note 2: To be measured on the center area of panel with a field angle of 1°by [Instrument-System goniometer system](#)

DMS-series, after 10 minutes operation and warm up 30 minutes.

Note 3: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from “black” to “white”(rising time) and from “white” to “black”(falling time), respectively.



Note 4: Data for reference only, will not measure during ORT(Ongoing Reliability Test).

Note 5: From liquid crystal characteristics, response time will become slower and the color of panel will become darker when ambient temperature is below 25°C.

Note 6: Contrast ratio is calculated with the following formula.

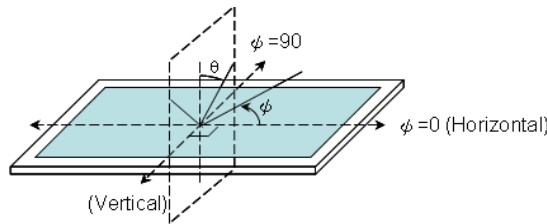
$$\text{Contrast ratio} = \frac{\text{Photo detector output when LCD is at "White" state}}{\text{Photo detector output when LCD is at "Black" state}}$$

Note 7: White : RGB data = “11111111”

Black : RGB data = “00000000”

100% transmission is defined as the transmission of LCD panel when all the input terminals of Module are electrically opened.

Note 8: Definition of viewing angle: refer to figure as below.

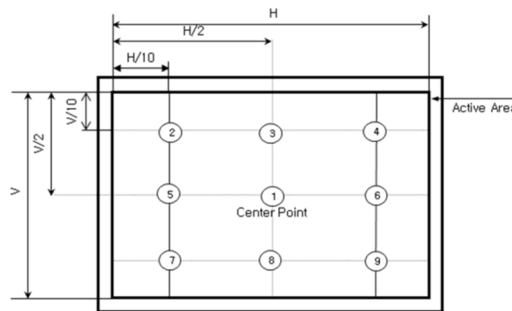


Note 9: The viewing angles are measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

If user finds panel that is out of color range, AUO will proceed to RMA ( Return Material Authorisation ) Process to exchange panel piece by piece without the failure rate counting.

Note 10: Brightness is measured at the center of the display with white pattern in 80mA driving current Note 11: Luminance Uniformity is defined as following within the 9 measurements (L1~L9),

Luminance Uniformity(%) =Minimum luminance(brightness)/Maximum luminance(brightness)



Note 12: Measured by Konica Minolta CM-2600d, SCI method. Illuminant: D65, Observer: CIE 1964/10°, Illumination system: d/8 (diffuse illumination, 8-degree viewing )

5.TFT Electrical Characteristics

5.1 Absolute Maximum Rating (Ta=25 VSS=0V)

Parameter	Symbol	Min.	Max.	Unit	Note
Logic Supply Voltage	V <sub>CC</sub>	-0.3	3.5	V	
Logic Input Signal Voltage	V <sub>Signal</sub>	-0.3	V <sub>CC</sub>	V	
BL Supply Voltage	V <sub>LED</sub>	-0.3	24	V	
Operating Temperature	T <sub>gs</sub>	-20	70	°C	
Storage Temperature	T <sub>a</sub>	-25	80	°C	

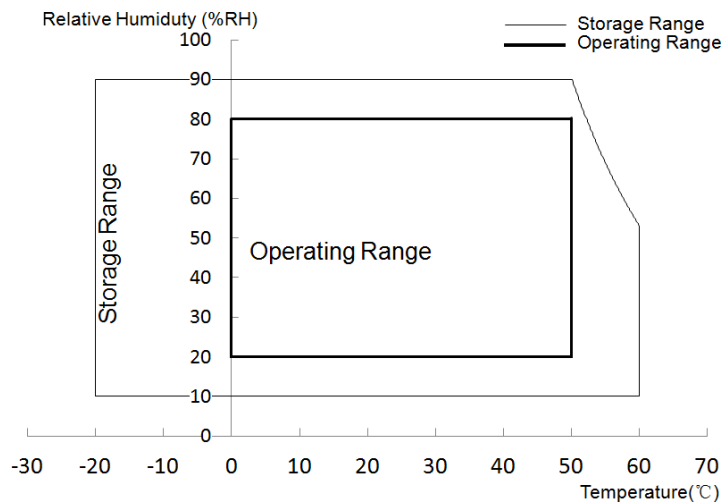
Note (1) All the parameters specified in the table are absolute maximum rating values that may cause faulty operation or unrecoverable damage, if exceeded. It is recommended to follow the typical value.

Note (2) All the contents of electro-optical specifications and display fineness are guaranteed under Normal Conditions. All the display fineness should be inspected under normal conditions. Normal conditions are defined as follow:

Temperature: 25°, Humidity: 55± 10%RH.

Note (3) Unpredictable results may occur when it was used in extreme conditions. Ta= Ambient Temperature, Tgs= Glass Surface Temperature. All the display fineness should be inspected under normal conditions.

Note (4) Temperature and relative humidity range are shown in the figure below. Wet bulb temperature should be lower than 46°, and no condensation of water. Besides, protect the module from static electricity.



## 5.2 DC Electrical Characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit	Note
<i>System Power Supply</i>							
LCD Drive Voltage (Logic)		V <sub>CC</sub>	3.0	3.3	3.6	V	(1),(2)
Logic Power	32*32 mosaic Pattern	P <sub>VCC</sub>	-	0.6	0.75	W	(1),(2) (3)
LCD Self Test	VIH	V <sub>BIST</sub>	3.0	-	3.6	V	(1),(2),(9)
	VIL		0	-	0.5	V	
Rush Current		I <sub>rush</sub>	-	-	1.5	A	(1),(4)
Allowable Logic/LCD Drive Ripple Voltage		V <sub>VCC-RP</sub>	-	-	200	mV	(1)
<i>LED Power Supply</i>							
LED Driver Input Voltage		V <sub>LED</sub>	5	12	21	V	(1),(2)
LED Power Consumption		P <sub>LED</sub>	-	-	5.14	W	(1),(5)
LED Forward Voltage		V <sub>F</sub>	2.7	2.85	3.0	V	(1),(2)
LED Forward Current		I <sub>F</sub>	-	22	-	mA	
PWM Signal Voltage	VIH	V <sub>PWM</sub>	3.0	-	3.6	V	
	VIL		0	-	0.5		
LED Enable Voltage	VIH	V <sub>LED_E</sub> N	3.0	-	3.6	V	(1),(2)
	VIL		0	-	0.5		
Input PWM Frequency		F <sub>PWM</sub>	200	-	2,000	Hz	(1),(2),(7)
Duty Ratio		PWM	1	-	100	%	(1),(8)
LED Life Time		LT	15,000	-	-	Hours	(1),(9)

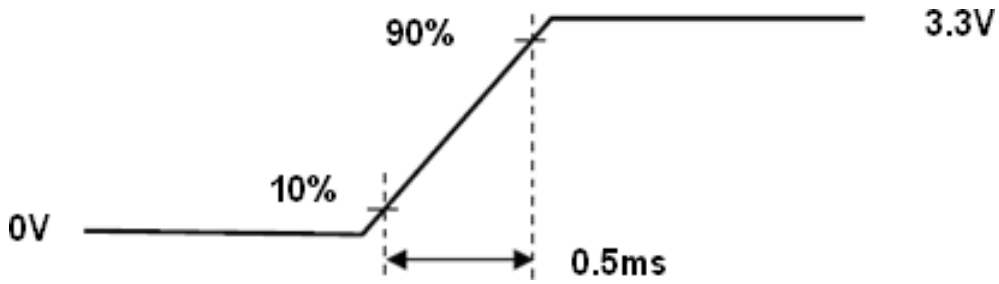
Note (1) All of the specifications are guaranteed under normal conditions. Normal conditions are defined as follow:  
Temperature: 25℃, Humidity: 55± 10%RH.

Note (2) All of the absolute maximum ratings specified in the table, if exceeded, may cause faulty operation or unrecoverable damage. It is recommended to follow the typical value.

Note (3) The specified VCC current and power consumption are measured under the VCC = 3.3 V, FV = 60 Hz condition and 32\*32 Mosaic Pattern.

Note (4) The figures below is the measuring condition of VCC Rush current can be measured when TRUSH is 0.5 ms.

Note (5) The power consumption of LED Driver are under the VLED : typ=12V ,Dimming of Max luminance .

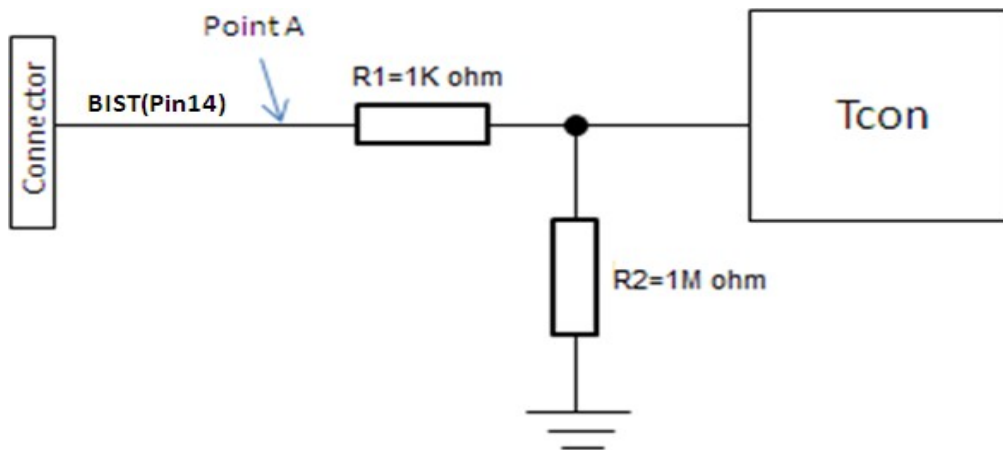


Note (6) Although acceptable range as defined, the dimming ratio is not effective at all conditions. The PWM frequency should be fixed and stable for more consistent luminance control at any specific level desired.

Note (7) The operation of LED Driver below minimum dimming ratio may cause flickering or reliability issue.

Note (8) The life time is determined as the sum of the lighting time till the luminance of LCD at the typical LED current reducing to 50% of the minimum value under normal operating condition.

Note (9) Because of the special operating voltage of Tcon, we design a resistor divider to meet TCON specification; If you want to enable BIST mode, please ensure that the voltage of BIST pin is 3.0V ~3.6V on Point A, especially when NB system is connecting with panel.



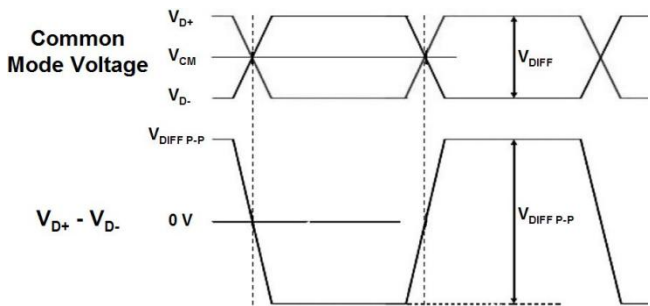
## 4. INTERFACE Characteristic

### 6.1 Signal Electrical Characteristics

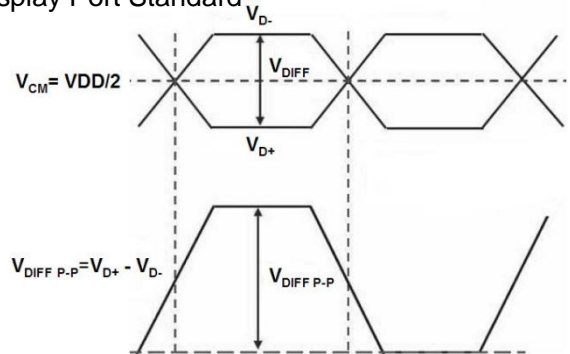
Parameter	Description	Min.	Typ.	Max.	Unit
$V_{CM}$	Differential Common Mode Voltage	0	-	2	V
$V_{DIFF P-P}$ Level	Differential Peak to Peak Voltage Level1 at TP4	0.12	-	-	V

Note (1) Input signals shall be low or Hi- resistance state when VCC is off

Note (2) It is recommended to refer the specifications of VESA Display Port Standard



Display Port Main Link Signal



Display Port AUX\_CH Signal

Parameter	Description	Min.	Typ.	Max.	Unit
$V_{CM}$	Differential Common Mode Voltage when receiving	0	-	1.2	V
$V_{DIFF P-P}$	Differential Peak to Peak Voltage at TP3	0.14	-	1.36	V

Note: Follow as VESA display port standard

Parameter	Description	Min.	Typ.	Max.	Unit
$V_{HPD}$	HPD Voltage	2.25	-	3.60	V

Note: Follow as VESA display port standard

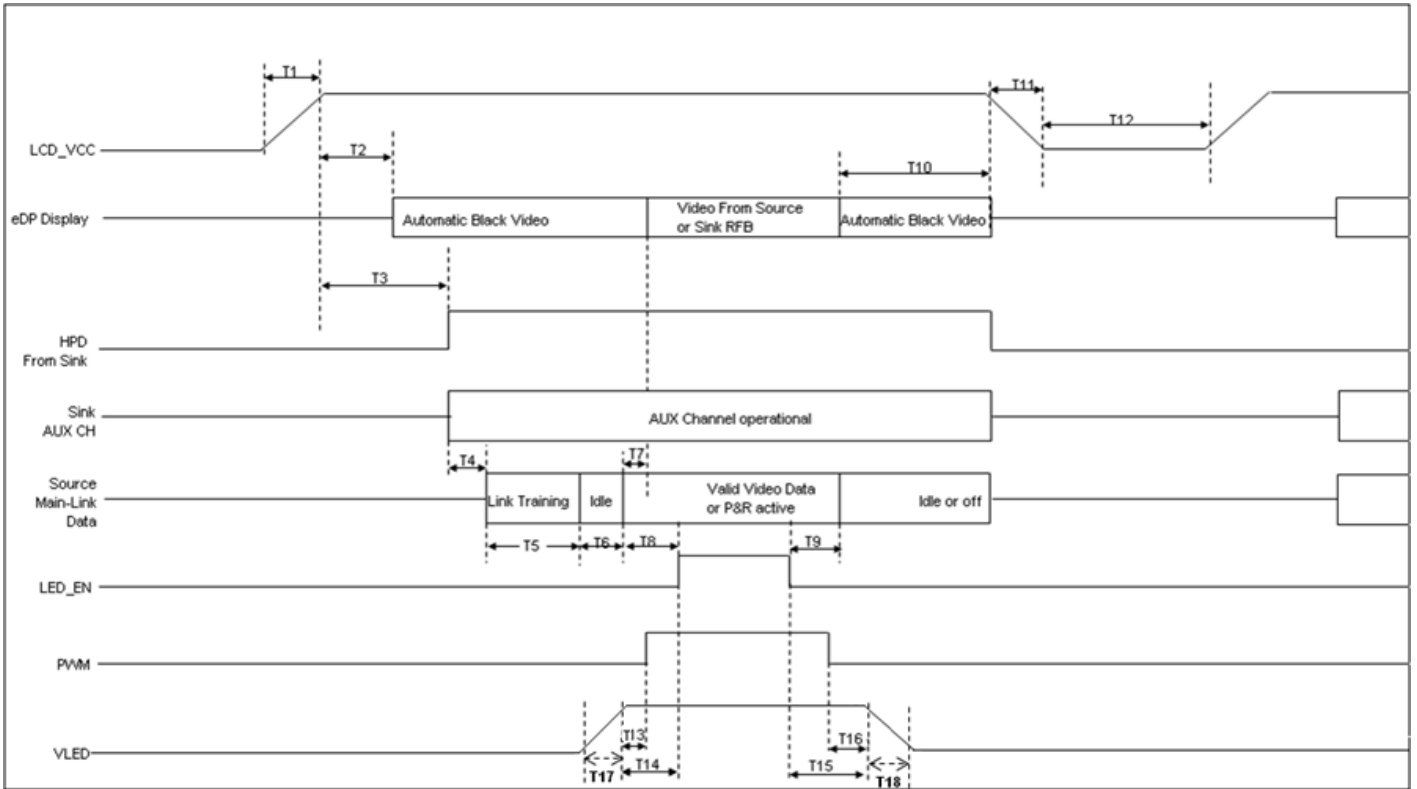
### 6.2 Interface Timings

Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock Frequency	Fclk	-	138.8	-	MHz
H Total Time	HT	-	2,080	-	Clocks
H Active Time	HA	1,920			Clocks
HSYNC Blanking	THBLANK	-	160	-	Clocks
V Total Time	VT	-	1,112	-	Lines
V Active Time	VA	1,080			Lines
VSYNC Blanking	TVBLANK	-	32	-	Lines
Frame Rate	FV	-	60	-	Hz

Note (1) All reliabilities are specified for timing specification based on refresh rate of 60Hz

6.3 Power ON/OFF Sequence

1. Interface signals are also shown in the chart. Signals from any system shall be Hi- resistance state or low level when VCC voltage is off.
2. When system first start up, should keep the VCC high time longer than 200ms, otherwise may cause image sticking when VCC drop off.



Parameter	Symbol	Unit	Min.	Typ.	Max.
LCD_VCC Rise Time (10% to 90%)	T1	ms	0.5	-	(10
Delay from LCD_VCC to automatic Black Video generation	T2	ms	0	-	200
Delay from LCD_VCC to HPD high	T3	ms	0	-	200
Delay from HPD high to link training initialization	T4	ms	-	-	-
Link training duration	T5	ms	-	-	-
Link idle	T6	ms	-	-	-
Delay from valid video data from Source to video on display	T7	ms	0	-	50
Delay from valid video data from Source to backlight enable	T8	ms	200	-	-
Delay from backlight disable to end of valid video data	T9	ms	10	-	-
Delay from end of valid video data from Source to VCC off	T10	ms	0	-	500
LCD_VCC fall time (90% to 10%)	T11	ms	0.5	-	10
VCC off time	T12	ms	500	-	-
Delay from VLED to PWM	T13	ms	0	-	-
Delay from VLED to backlight enable	T14	ms	0	-	-
Delay from backlight disable to VLED off	T15	ms	0	-	-
Delay from PWM off to VLED off	T16	ms	0	-	-
VLED Rise Time(10% to 90%)	T17	ms	0.5	-	10
VLED fall time (90% to 10%)	T18	ms	0.5	-	-



### 7. LCD Module Out-Going Quality Level

#### 7.1 VISUAL & FUNCTION INSPECTION STANDARD

##### 7.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

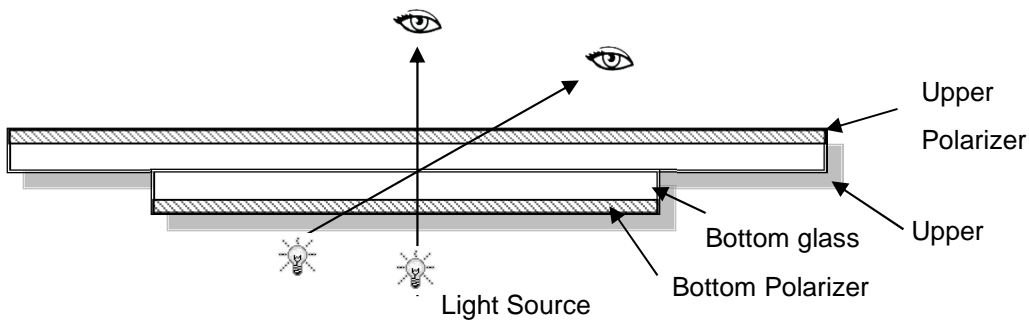
Temperature : 25±5°C

Humidity : 65%±10%RH

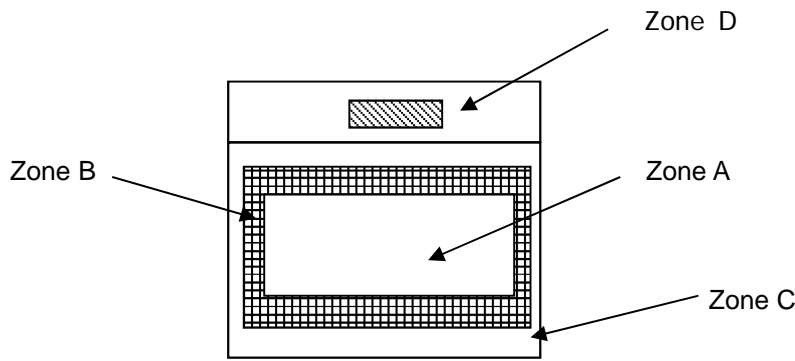
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



##### 7.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Zone D : IC Bonding Area

Note:As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer

**7.1.3 Sampling Plan**

According to GB/T 2828-2003 ; , normal inspection, Class II

AQL:

Major defect	Minor defect
0.65	1.5

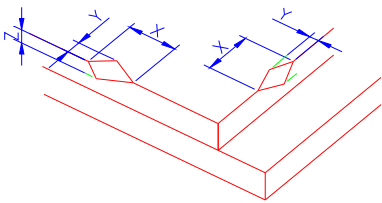
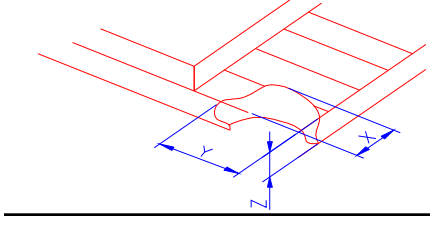
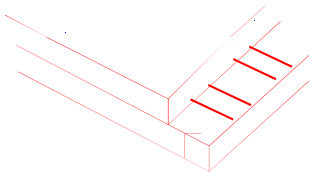
LCD: Liquid Crystal Display , LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. etc...	Major
2	Missing	Missing components and etc...	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed, deformation and etc...	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Spot/Line defect	Light dot, Dim spot, (Note1) Polarizer Air Bubble, Polarizer accidented spot and etc...	
6	Soldering appearance	Good soldering , Peeling off is not allowed and etc...	
7	LCD/Polarizer	Black/White spot/line, scratch, crack, etc.	

**Note1:** a) Light dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

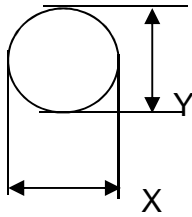
b) Dim dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

7.1.4 Criteria (Visual)

Number	Items	Criteria(mm)						
1.0 LCD Crack/Broken NOTE: X: Length Y: Width Z: Height L: Length of ITO, T: Height of LCD	(1) The edge of LCD broken	 <table border="1" data-bbox="751 611 1453 759"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0mm</td> <td>&lt;Inner border line of the seal</td> <td>≤T</td> </tr> </tbody> </table>	X	Y	Z	≤3.0mm	<Inner border line of the seal	≤T
	X	Y	Z					
	≤3.0mm	<Inner border line of the seal	≤T					
(2)LCD corner broken	 <table border="1" data-bbox="831 1068 1374 1167"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0mm</td> <td>≤L</td> <td>≤T</td> </tr> </tbody> </table>	X	Y	Z	≤3.0mm	≤L	≤T	
X	Y	Z						
≤3.0mm	≤L	≤T						
(3) LCD crack	 <p style="text-align: center;">Crack Not allowed</p>							

2.0

Spot defect



$$\Phi = (X + Y) / 2$$

① light dot ( black/white spot , pinhole, stain, etc. )

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.15$	Ignore		
$0.15 < \Phi \leq 0.25$	3(distance $\geq 10$ mm)		
$0.25 < \Phi \leq 0.4$	2(distance $\geq 10$ mm)		
$\Phi > 0.4$	0		

② Dim spot ( light leakage, dent, dark spot, etc )


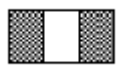
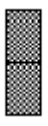
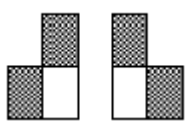
Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.15$	Ignore		
$0.15 < \Phi \leq 0.25$	3( distance $\geq 10$ mm)		
$0.25 < \Phi \leq 0.4$	2( distance $\geq 10$ mm)		
$\Phi > 0.4$	0		


③ Polarizer accidented spot

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		
$0.2 < \Phi \leq 0.5$	2( distance $\geq 10$ mm)		
$\Phi > 0.5$	0		

④ Polarizer Bubble

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		
$0.2 < \Phi \leq 0.4$	2(distance $\geq 10$ mm)		
$0.4 < \Phi \leq 0.5$	1		
$\Phi > 0.5$	0		

3.0	LCD Pixel defect	<p>Pixel bad points</p> <table border="1" data-bbox="534 248 1492 996"> <thead> <tr> <th data-bbox="534 248 726 302">Item</th> <th data-bbox="726 248 1241 302">Zone A</th> <th data-bbox="1241 248 1492 302">Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td data-bbox="534 302 726 465" rowspan="3">Bright dot</td> <td data-bbox="726 302 1241 360">Random</td> <td data-bbox="1241 302 1492 360">N≤2</td> </tr> <tr> <td data-bbox="726 360 1241 418">2 dots adjacent</td> <td data-bbox="1241 360 1492 418">N≤0</td> </tr> <tr> <td data-bbox="726 418 1241 465">3 dots adjacent</td> <td data-bbox="1241 418 1492 465">N≤0</td> </tr> <tr> <td data-bbox="534 465 726 629" rowspan="3">Dark dot</td> <td data-bbox="726 465 1241 524">Random</td> <td data-bbox="1241 465 1492 524">N≤3</td> </tr> <tr> <td data-bbox="726 524 1241 582">2 dots adjacent</td> <td data-bbox="1241 524 1492 582">N≤0</td> </tr> <tr> <td data-bbox="726 582 1241 629">3 dots adjacent</td> <td data-bbox="1241 582 1492 629">N≤0</td> </tr> <tr> <td data-bbox="534 629 726 943">Distance</td> <td data-bbox="726 629 1241 943">                     1. Minimum Distance Between Bright dots.                      2. Minimum Distance Between dark dots                      3. Minimum Distance Between dark and bright dot.                 </td> <td data-bbox="1241 629 1492 943">5mm</td> </tr> <tr> <td colspan="2" data-bbox="534 943 1241 996">Total bright and dark dot</td> <td data-bbox="1241 943 1492 996">N≤4</td> </tr> </tbody> </table> <p data-bbox="534 1010 614 1041">Note:</p> <p data-bbox="534 1064 1476 1153">A) Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.</p> <p data-bbox="534 1176 1436 1265">B) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.</p> <p data-bbox="534 1310 1029 1355">C) 2 dot adjacent = 1 pair = 2 dots</p> <p data-bbox="534 1366 646 1400">Picture:</p> <div data-bbox="662 1444 742 1512" style="display: inline-block; text-align: center;">  </div> <div data-bbox="582 1556 790 1601" style="display: inline-block; text-align: center;">2 dot adjacent</div> <div data-bbox="1069 1444 1189 1512" style="display: inline-block; text-align: center;">  </div> <div data-bbox="1021 1556 1236 1601" style="display: inline-block; text-align: center;">2 dot adjacent</div> <div data-bbox="670 1612 718 1736" style="display: inline-block; text-align: center;">  </div> <div data-bbox="534 1747 869 1792" style="display: inline-block; text-align: center;">2 dot adjacent (vertical)</div> <div data-bbox="1077 1612 1268 1736" style="display: inline-block; text-align: center;">  </div> <div data-bbox="1013 1747 1316 1792" style="display: inline-block; text-align: center;">2 dot adjacent (slant)</div>	Item	Zone A	Acceptable Qty	Bright dot	Random	N≤2	2 dots adjacent	N≤0	3 dots adjacent	N≤0	Dark dot	Random	N≤3	2 dots adjacent	N≤0	3 dots adjacent	N≤0	Distance	1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot.	5mm	Total bright and dark dot		N≤4
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Total bright and dark dot		N≤4																							

4.0	Line defect (LCD /Polarizer backlight black/white line, scratch, stain)  W: width, L : length  N : Count	<table border="1"> <thead> <tr> <th rowspan="2">Width(mm)</th> <th rowspan="2">Length(m m)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.05</math></td> <td>Ignore</td> <td colspan="3">Ignore</td> </tr> <tr> <td><math>0.05 &lt; W \leq 0.06</math></td> <td><math>L \leq 5.0</math></td> <td colspan="3"><math>N \leq 3</math></td> </tr> <tr> <td><math>0.06 &lt; W \leq 0.08</math></td> <td><math>L \leq 4.0</math></td> <td colspan="3"><math>N \leq 2</math></td> </tr> <tr> <td><math>W &gt; 0.08</math></td> <td colspan="4">Define as spot defect</td> </tr> </tbody> </table>	Width(mm)	Length(m m)	Acceptable Qty			A	B	C	$\Phi \leq 0.05$	Ignore	Ignore			$0.05 < W \leq 0.06$	$L \leq 5.0$	$N \leq 3$			$0.06 < W \leq 0.08$	$L \leq 4.0$	$N \leq 2$			$W > 0.08$	Define as spot defect			
		Width(mm)			Length(m m)	Acceptable Qty																								
			A	B		C																								
		$\Phi \leq 0.05$	Ignore	Ignore																										
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$0.06 < W \leq 0.08$	$L \leq 4.0$	$N \leq 2$																												
$W > 0.08$	Define as spot defect																													
5.0	Electronic Components SMT.	Not allow missing parts, solderless connection, cold solder joint, mismatch, The positive and negative polarity opposite																												
6.0	Display color & Brightness.	1. Color: Measuring the color coordinates, The measurement standard according to the datasheet or samples. 2. Brightness: Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples.																												
7.0	LCD Mura/Waving/ Hot spot	Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary.																												

Criteria ( functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed

## 8. Reliability Test Result

Remark:

Item	Condition	Inspection after test
High Temperature Operating	70°C,96H	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value.
Low Temperature Operating	-20°C, 96HR	
High Temperature Storage	80°C, 96HR	
Low Temperature Storage	-25°C, 96HR	
High Temperature & High Humidity Operating	+60°C, 90% RH ,96 hours.	
Thermal Shock (Non-operation)	0°C,30 min ↔ +60°C,30 min, Change time:5min 20CYC.	
ESD test	C=150pF, R=330,5points/panel Air:±15KV, 5times; Contact:±8KV, 5 times; (Environment: 15°C~35°C, 30%~60%).	
Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition).	
Box Drop Test	1 Corner 3 Edges 6 faces,80cm(MEDIUM BOX)	

- 1.The test samples should be applied to only one test item.
- 2.Sample size for each test item is 5~10pcs.
- 3.For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.
- 4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
- 5.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.
6. The color fading mura of polarizing filter should not care.

## **9. Cautions and Handling Precautions**

### **9.1 Handling and Operating the Module**

(1) When the module is assembled, it should be attached to the system firmly.

Do not warp or twist the module during assembly work.

(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.

(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.

(4) Do not allow drops of water or chemicals to remain on the display surface.

If you have the droplets for a long time, staining and discoloration may occur.

(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.

Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static; it may cause damage to the CMOS ICs.

(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(10) Do not disassemble the module.

(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(12) Pins of I/F connector shall not be touched directly with bare hands.

(13) Do not connect, disconnect the module in the "Power ON" condition.

(14) Power supply should always be turned on/off by the item 6.1 Power On Sequence & 6.2 Power Off Sequence

### **9.2 Storage and Transportation.**

(1) Do not leave the panel in high temperature, and high humidity for a long time.

It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%

(2) Do not store the TFT-LCD module in direct sunlight.

(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.

(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.

In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.

(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.