

Display Elektronik GmbH

DATA SHEET

TFT MODULE

**DEM 240320U VMH-PW-N
(A-TOUCH)**

1,77" TFT + RTP

Version: 0

29.09.2025

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*** Description**

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This module is composed of a transmissive type TFT-LCD Panel, driver circuit, 4 wires resistance touch screen back-light unit.

The resolution of a 1.77" TFT-LCD contains 240x320 pixels, and can display up to 65k/262k colors.

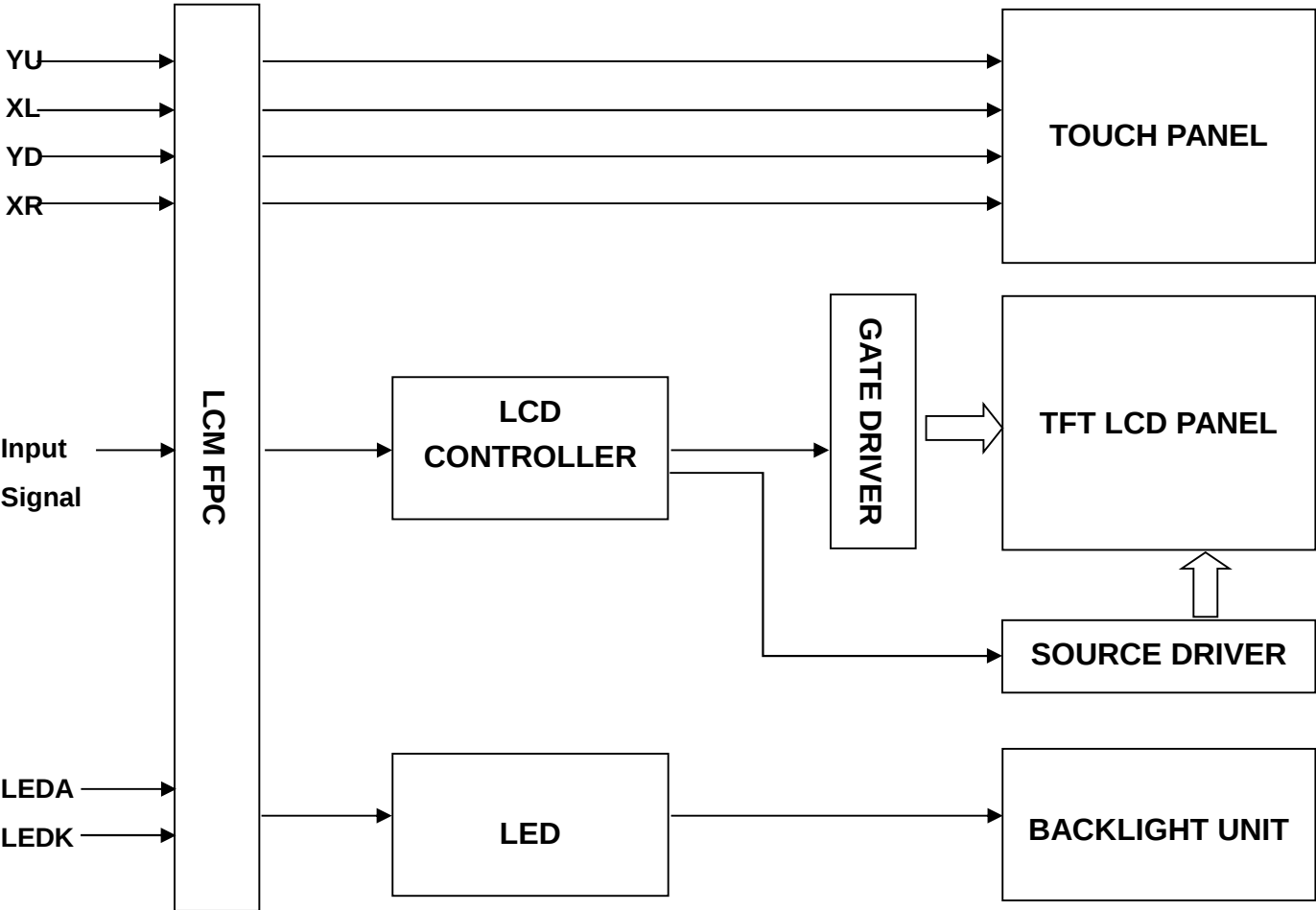
*** Features**

General Information Items	Specification	Unit	Note
	Main Panel		
Display Area(AA)	26.64 x 35.52 (1.77 Inch)	mm	-
Driver Element	TFT Active Matrix	-	-
Display Colors	65k/262k	Colors	-
Number of Pixels	240 x RGB x 320	Dots	-
Pixel Arrangement	RGB Vertical Stripe	-	-
Pixel Pitch	0.111 x 0.111	mm	-
Viewing Angle	ALL	o'clock	-
Controller IC	ST7789V (Sitronix)	-	-
Display Mode	IPS, Transmissive / Normally Black	-	-
LCM Interface	8/9/16/18-Bit-MCU 3/4SPI+16/18-Bit-RGB 3-line/4-line Serial Interface	-	-
Operating Temperature	-20°C to +70°C	°C	-
Storage Temperature	-30°C to +80°C	°C	-
Module Bonding Technology	Air-Gap bonding between LCM and RTP	-	-

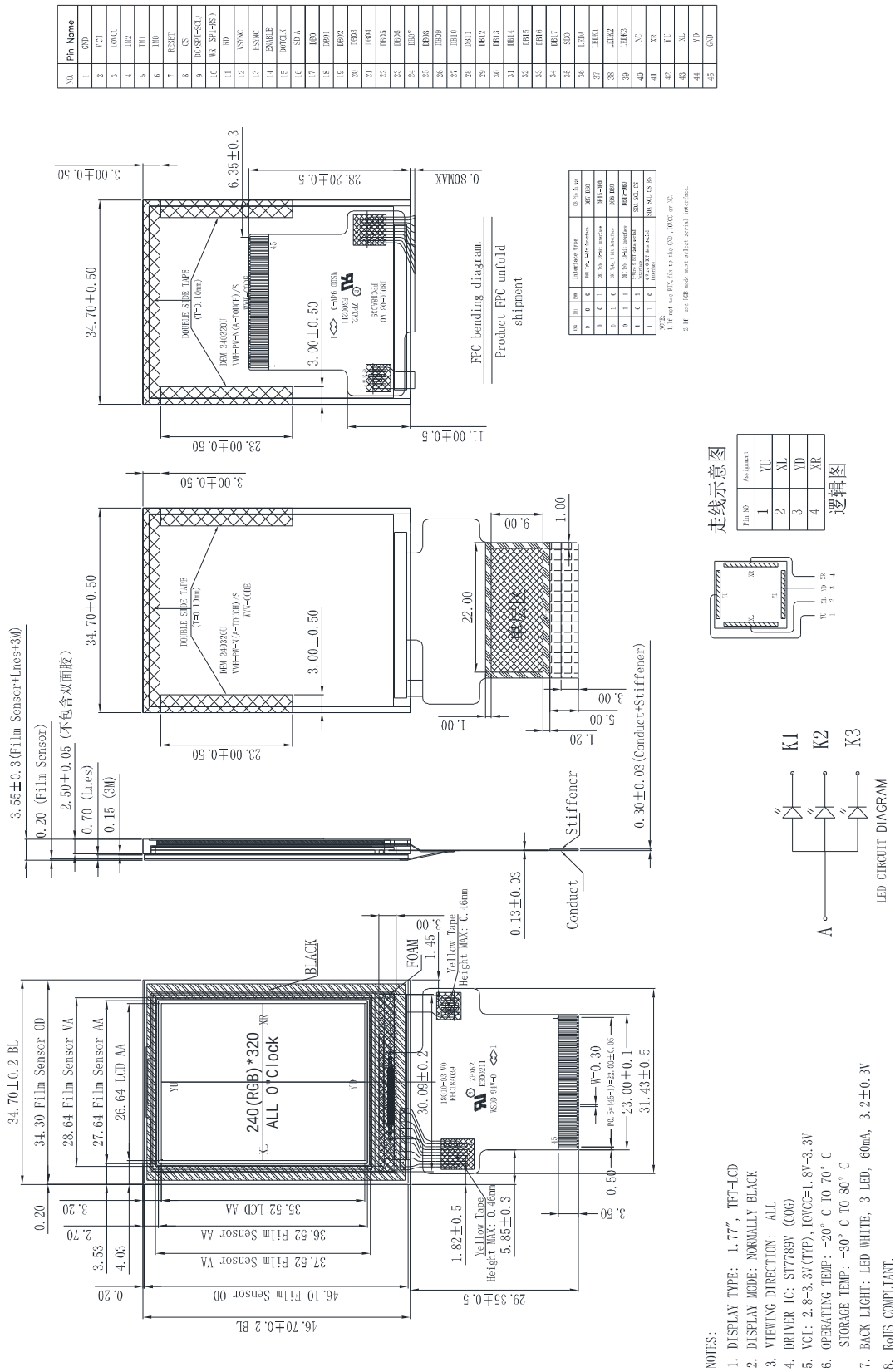
*** Mechanical Information**

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	-	34.70	-	mm	-
	Vertical(V)	-	46.70	-	mm	-
	Depth(D)	-	3.55	-	mm	-
Weight		-	t.b.d.	-	g	-

1. Block Diagram



2. Outline Dimension



3. Input Terminal Pin Assignment

NO.	SYMBOL	DISCRIPTION	I/O
1	GND	Ground.	P
2	VCI/VCC	Supply voltage (3.3V).	P
3	IOVCC	Supply voltage (1.65-3.3V).	P
4	IM2	Interface selecting signal.	I
5	IM1		I
6	IM0		I
7	RESET	This signal will reset the device and must be applied to properly initialize the chip.	I
8	CS	Chip select input pin ("Low" enable). fix this pin at IOVCC or GND when not in use.	I
9	DC(SPI-SCL)	- Display data/command selection pin in parallel interface. - This pin is used to be serial interface clock. DC='1': display data or parameter. DC='0': command data. - If not used, please fix this pin at IOVCC or DGND.	I
10	WR(SPI-RS)	- Write enable in MCU parallel interface. - Display data/command selection pin in 4-line serial interface. - Second Data lane in 2 data lane serial interface. - If not used, please fix this pin at IOVCC or DGND.	I
11	RD	Serves as a read signal and MCU read data at the rising edge. fix this pin at IOVCC or GND when not in use.	I
12	VSYNC	Frame synchronous signal. Low active. Connect to I GND when DPI is not selected.	I
13	HSYNC	Line synchronous signal. Low active. Connect to GND when DPI is not selected.	I
14	ENABLE	Data enable signal in DPI operation. Low: Select (Accessible) High: Not select (Inaccessible) Connect to GND when DPI is not selected.	I
15	DOTCLK	Pixel clock signal. The data input timing is set on the rising edge. Connect to GND when DPI is not selected.	I

DEM 240320U VMH-PW-N(A-TOUCH) *Product Specification*

16	SDA	Serial data input/output pin in DBI Type C operation.	I
17~34	DB0~DB17	Data bus. Connect to GND when is not used.	P
35	SDO	This pin is enabled when SDOE=1 and DBI Type C is used. With this setting, SDA can be used as an input pin and SDO pin can be used as an output pin without bidirectional bus to execute serial communication. If not used please open.	O
36	LEDA	Anode pin of backlight.	P
37	LEDK1	Cathode pin of backlight.	P
38	LEDK2	Cathode pin of backlight.	P
39	LEDK3	Cathode pin of backlight.	P
40	NC	NC	-
41	XR	Touch panel Right Glass Terminal	A/D
42	YU	Touch panel Top Film Terminal	A/D
43	XL	Touch panel Left Glass Terminal	A/D
44	YD	Touch panel Bottom Film Terminal	A/D
45	GND	Ground.	P

4. LCD Optical Characteristics

4.1 Optical Specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	$\Theta=0$ Normal viewing angle	500	600	--	--	(1)(2)
Response Time	Rising	T _R		--	20	45	msec	(1)(3)
	Falling	T _F		--	35	50		
Color Gamut		S(%)	--	48	52.5	--	%	C-light
Color Filter Chromaticity	White	W _X	--	0.280	0.320	0.360	--	(1)(4) CA-310
		W _Y	--	0.324	0.364	0.404		
	Red	R _X	--	0.579	0.599	0.619		
		R _Y	--	0.342	0.362	0.382		
	Green	G _X	--	0.324	0.344	0.364		
		G _Y	--	0.579	0.599	0.619		
	Blue	B _X	--	0.140	0.160	0.180		
		B _Y	--	0.098	0.118	0.138		
Viewing Angle	Hor.	Θ_L	CR>10	60	85	--	--	(1)(4)
		Θ_R		60	85	--		
	Ver.	Θ_U		60	85	--		
		Θ_D		60	85	--		
Option View Direction		ALL						--

*The data comes from the LCD specification.

Measuring Condition

Measuring surrounding: dark room

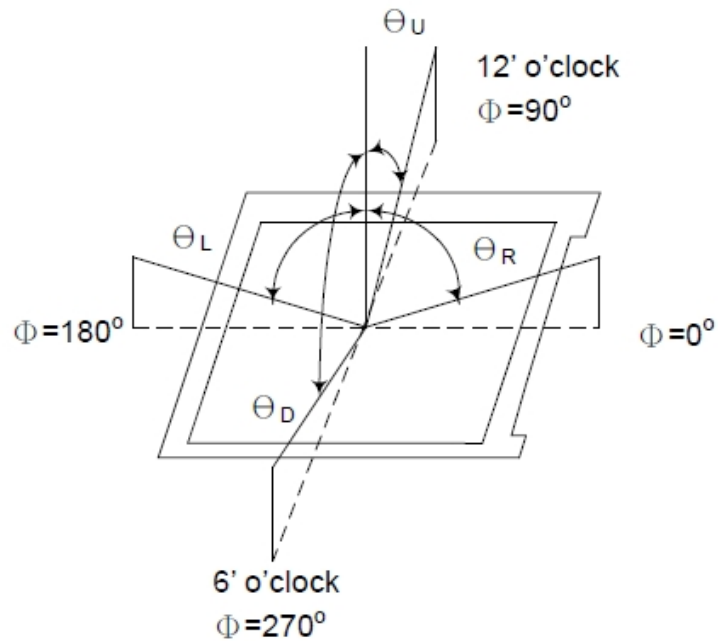
Ambient temperature: 25°C±2°C

15min. warm-up time

Measuring Equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

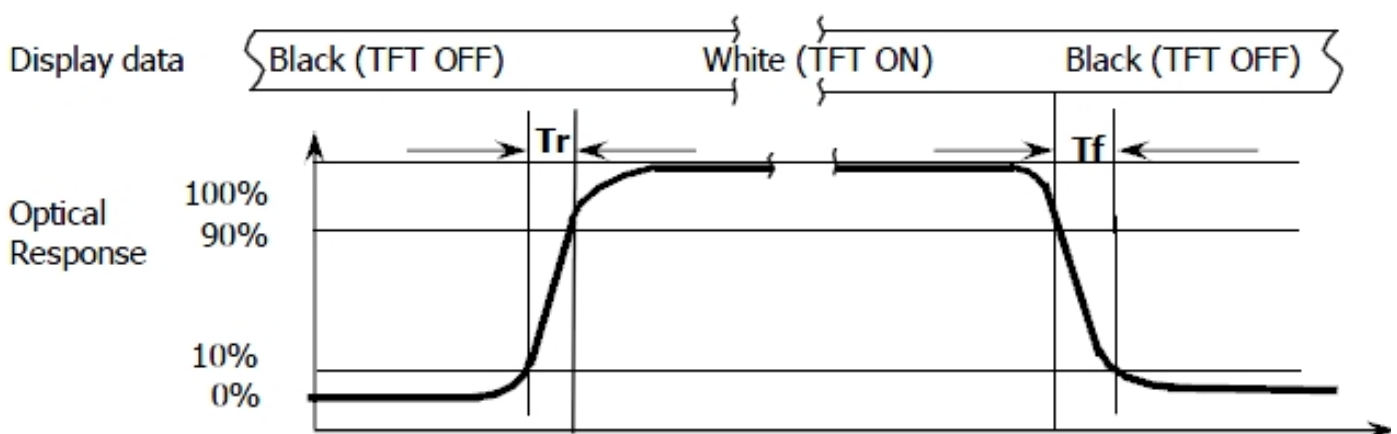
Note (1): Definition of Viewing Angle:



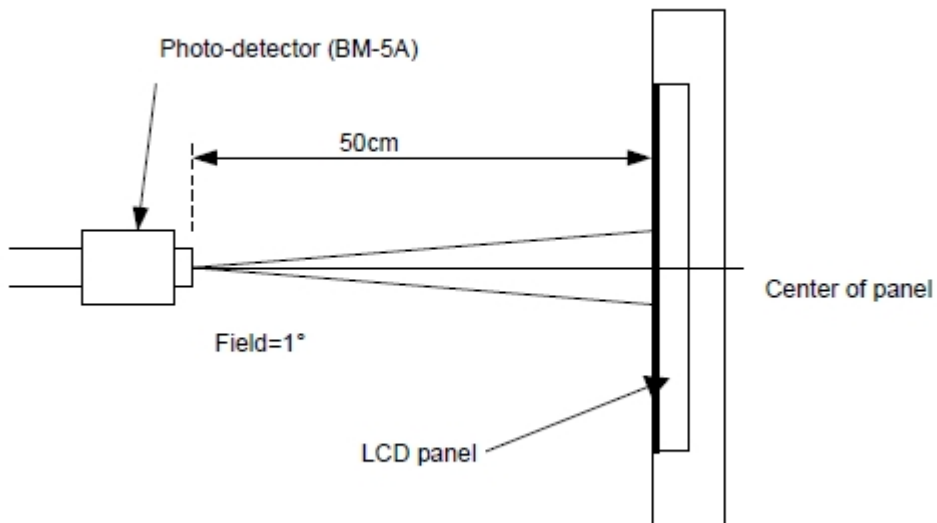
Note (2): Definition of Contrast Ratio (CR): measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3): Response Time:



Note (4): Definition of optical measurement setup



5. Electrical Characteristics

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

Characteristics	Symbol	Min.	Max.	Unit
Digital Supply Voltage	VCI	-0.3	4.6	V
Digital Interface Supply Voltage	IOVCC	-0.3	4.6	V
Operating Temperature	T _{OP}	-20	+70	°C
Storage Temperature	T _{ST}	-30	+80	°C

NOTE: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit
Digital Supply Voltage	VCI	2.4	2.8	3.3	V
Digital Interface Supply Voltage	IOVCC	1.65	1.8	3.3	V
Normal Mode Current Consumption	IDD	--	6.5	13	mA
Level Input Voltage	V _{IH}	0.7IOVCC	-	IOVCC	V
	V _{IL}	GND	-	0.3IOVCC	V
Level Output Voltage	V _{OH}	0.8IOVCC	-	IOVCC	V
	V _{OL}	GND	-	0.2IOVCC	V

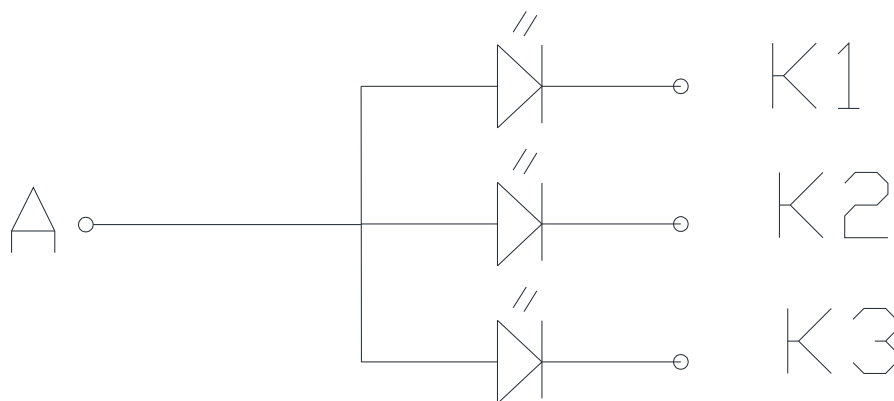
5.3 LED Backlight Characteristics

The Backlight system is edge-lighting type with 3 chips White LED

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I_F	45	60	--	mA	--
Forward Voltage	V_F	2.8	3.2	3.4	V	--
LCM Luminance	L_v	250	300	--	cd/m ²	Note3
LED Lifetime	Hr	50000	--	--	Hour	Note1,2
Uniformity	AVg	80	--	--	%	Note3

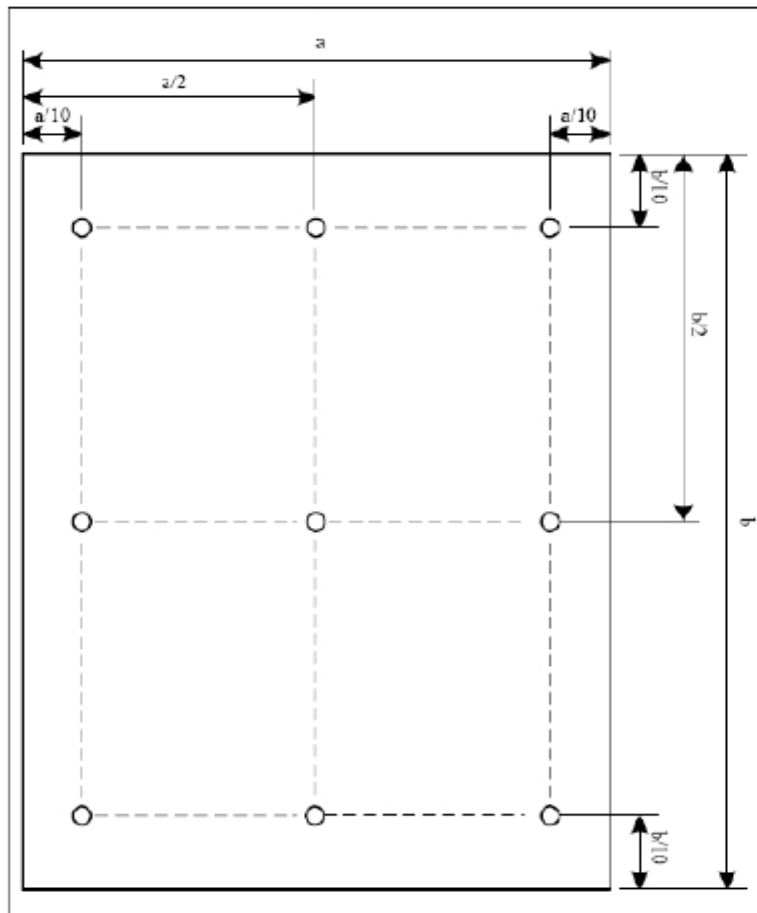
Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: $T_a=25^{\circ}\text{C}\pm 3^{\circ}\text{C}$, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at $T_a=25^{\circ}\text{C}$ and $I_L=60\text{mA}$. The LED lifetime could be decreased if operating I_L is larger than 60mA. The constant current driving method is suggested.



LED CIRCUIT DIAGRAM

NOTE 3: Luminance Uniformity of these 9 points is defined as below:



$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$

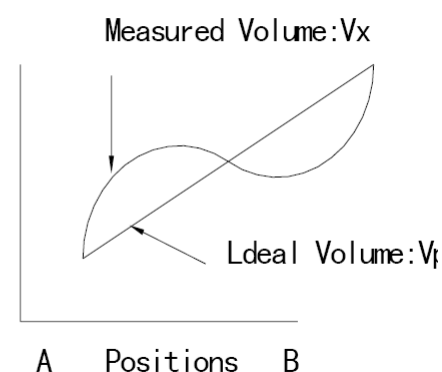
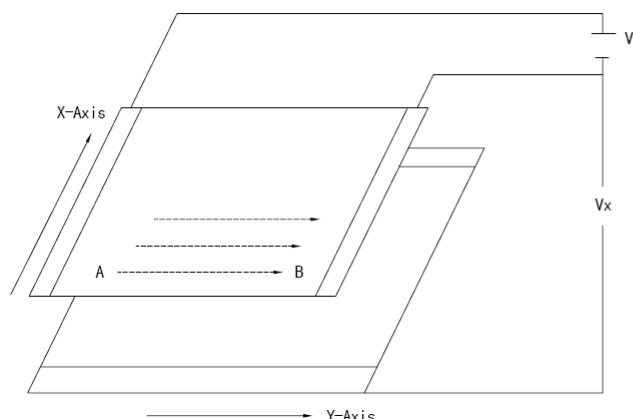
6. TP Feature

6.1 Conditions of Use and Storage

Item	Value(condition)	Note
Temperature Range upon Operation	Humidity: 20%~90% non dew, condensation -20°C~70°C	In a simple substance
Temperature Range upon Storage	Humidity: 20%~90% non dew, condensation -30°C~80°C	In a simple substance

6.2 Electrical Property

Item	Value	Note
Maximum Voltage	DC5V	-
Resistance between Terminals	X direction[Film side]: 200-600Ω	-
	Y direction [Glass side]: 300-900Ω	
Insulation Resistance	DC 25V 20MΩ or above	Connect X+~X- and Y+~Y- apply 25VDC between X and Y for perform measurements
Chattering	10msec or below	-
Rating	Voltage is DC 5 Volt	-



6.3 Mechanical Property

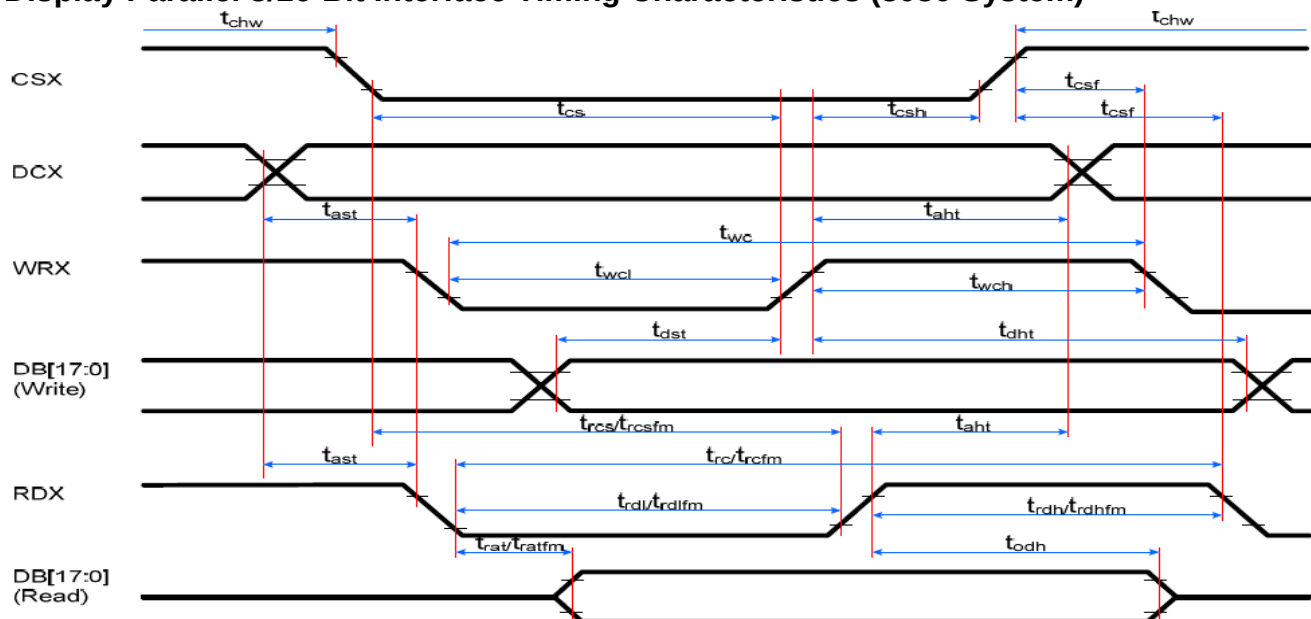
Item	Performance		Note
Input method	Used of an exclusive Pen or Finger		
Load upon Operation	Exclusive Pen	60-100g or below	Operation and measurement with a pen must be carried out under the following tip conditions: Stylus pen material: POM(ployacetal) Tip : Diameter 3.0mm, SR 0.8 mm
	Finger	60-100g or below	Operations and measurement methods simulated for a finger must be carried out under the following tip conditions. Material: Silicon Rubber (Hardness : 30°Hs) Tip: Diameter 12.0mm, SR 12.5mm
Surface Hardness	Pencil Hardness : 3H or above		It complies with the way of test method JIS K5400.

6.4 Optical Property

Item	Performance	Note
Total Light Transmittance	80% or above	JIS K7105
Haze	5% or below	JIS K7136
Film Specification	Matte type with hard coated surface	-

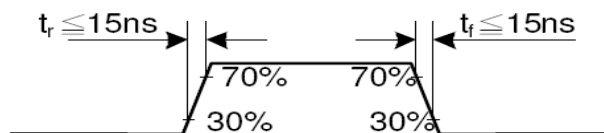
7. AC Characteristic

7.1 Display Parallel 8/16-Bit Interface Timing Characteristics (8080 System)

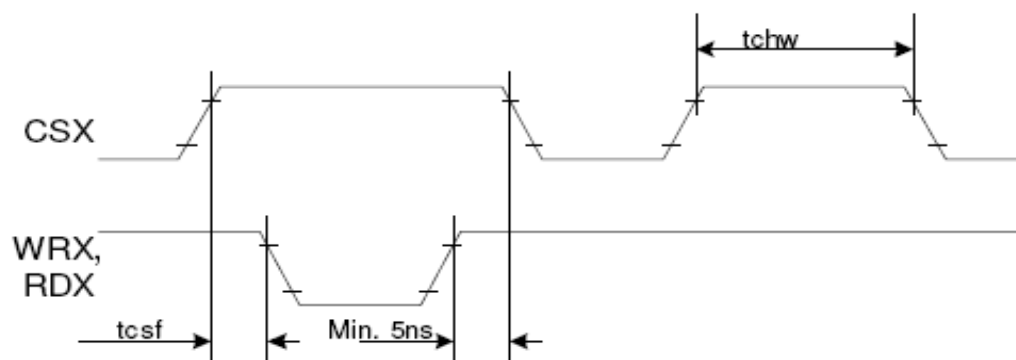


Signal	Symbol	Parameter	min	max	Unit	Description
DCX	t _{ast}	Address setup time	0	-	ns	
	t _{ah}	Address hold time (Write/Read)	10	-	ns	
CSX	t _{chw}	CSX "H" pulse width	0	-	ns	
	t _{cs}	Chip Select setup time (Write)	15	-	ns	
	t _{rcs}	Chip Select setup time (Read ID)	45	-	ns	
	t _{rcsfm}	Chip Select setup time (Read FM)	355	-	ns	
	t _{csf}	Chip Select Wait time (Write/Read)	10	-	ns	
WRX	t _{wc}	Write cycle	66	-	ns	
	t _{wrh}	Write Control pulse H duration	15	-	ns	
	t _{wrl}	Write Control pulse L duration	15	-	ns	
RDX (FM)	t _{rcfm}	Read Cycle (FM)	450	-	ns	
	t _{rdhfm}	Read Control H duration (FM)	90	-	ns	
	t _{rdlfm}	Read Control L duration (FM)	355	-	ns	
RDX (ID)	t _{rc}	Read cycle (ID)	160	-	ns	
	t _{rdh}	Read Control pulse H duration	90	-	ns	
	t _{rdl}	Read Control pulse L duration	45	-	ns	
D[17:0], D[15:0], D[8:0], D[7:0]	t _{dst}	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	t _{dht}	Write data hold time	10	-	ns	
	t _{rat}	Read access time	-	40	ns	
	t _{ratfm}	Read access time	-	340	ns	
	t _{rod}	Read output disable time	20	80	ns	

Note: $T_a = -30$ to 70°C , $IOVCC=1.65\text{V}$ to 2.8V , $VCI=2.6\text{V}$ to 3.3V , $GND=0\text{V}$

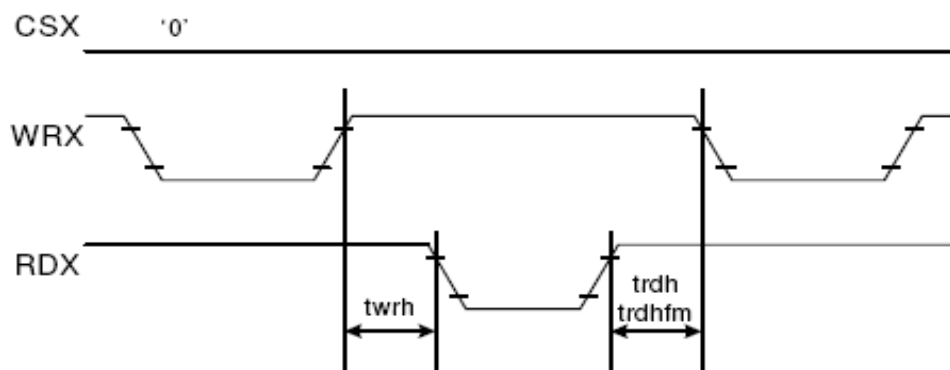


CSX timings :



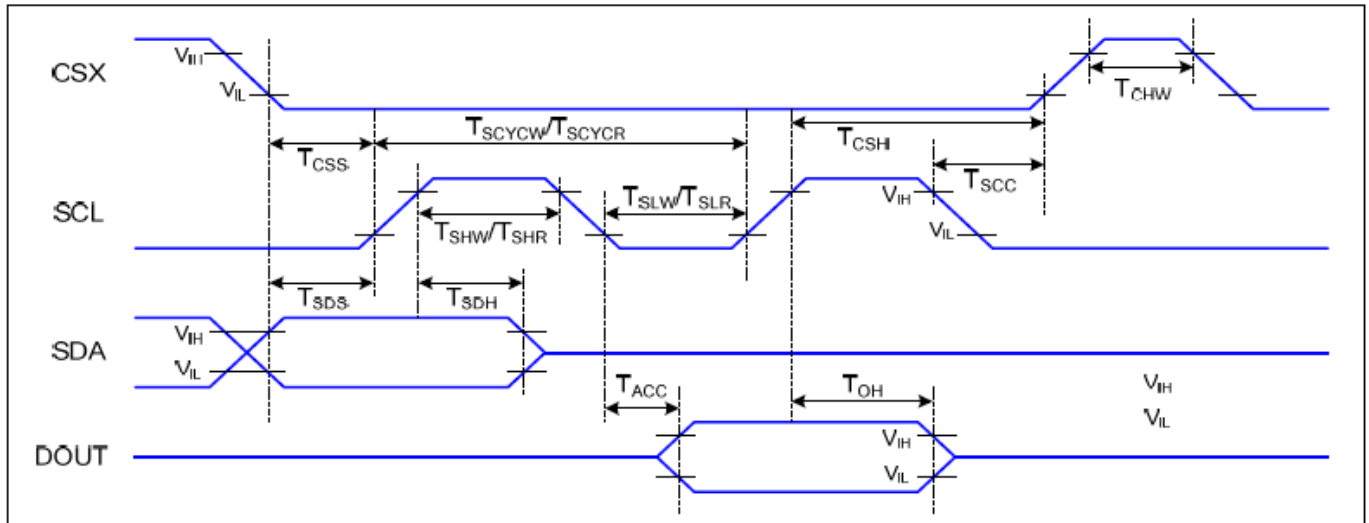
Note: Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

Write to read or read to write timings:



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

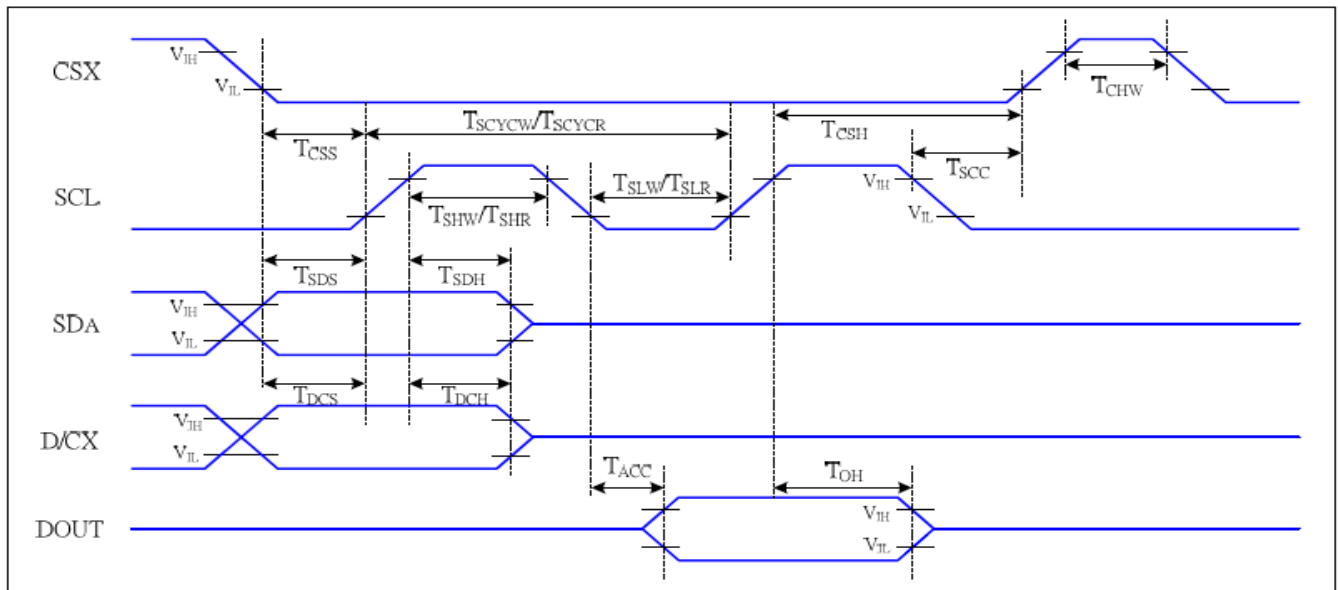
7.2 Display Serial Interface Timing Characteristics (3-Line SPI System)



$V_{DDI}=1.65$ to $3.3V$, $V_{DD}=2.4$ to $3.3V$, $AGND=DGND=0V$, $T_a=-30$ to $70\text{ }^{\circ}\text{C}$

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 $CL=8pF$

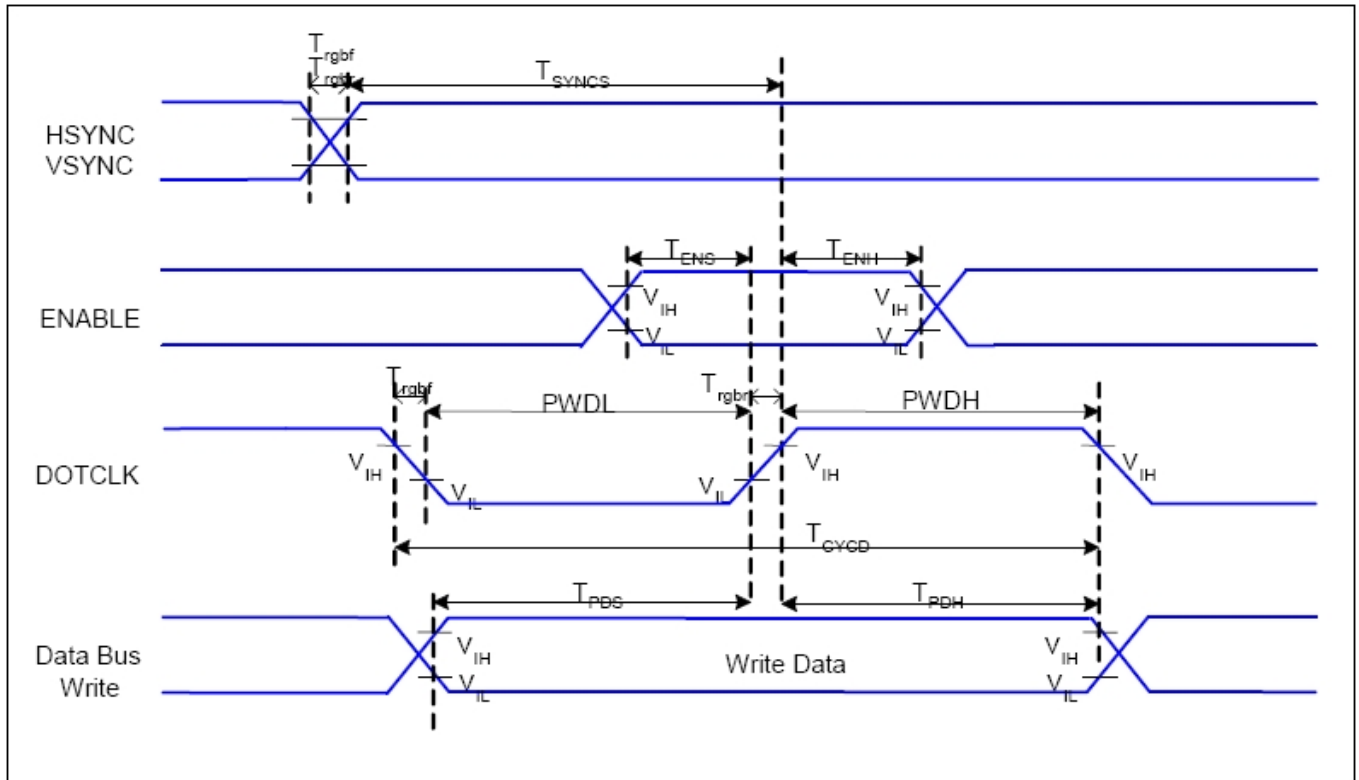
7.3 Display Serial Interface Timing Characteristics (4-Line SPI System)



$V_{DDI}=1.65$ to $3.3V$, $V_{DD}=2.4$ to $3.3V$, $AGND=DGND=0V$, $T_a=-30$ to 70 °C

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	-write command & data ram
	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	-read command & data ram
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
D/CX	T_{DCS}	D/CX setup time	10		ns	
	T_{DCH}	D/CX hold time	10		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

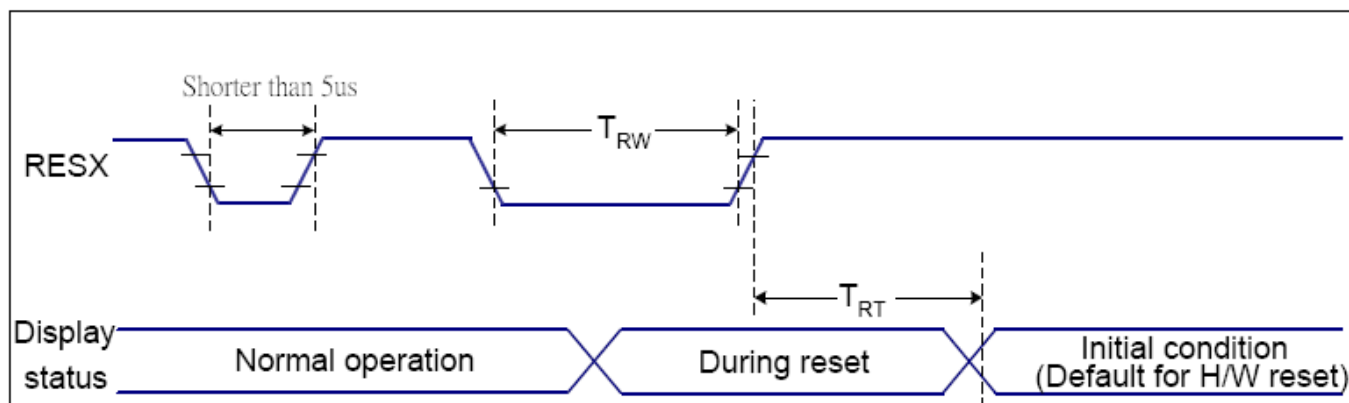
7.4 Parallel RGB Interface Timing Characteristics



$V_{DDI}=1.65$ to $3.3V$, $V_{DD}=2.4$ to $3.3V$, $AGND=DGND=0V$, $T_a=-30 \sim 70^{\circ}C$

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	T_{SYNCS}	VSYSNC, HSYNC Setup Time	30	-	ns	
ENABLE	T_{ENS}	Enable Setup Time	25	-	ns	
	T_{ENH}	Enable Hold Time	25	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	60	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	60	-	ns	
	T_{CYCD}	DOTCLK Cycle Time	120	-	ns	
	T_{rghr} , T_{rghf}	DOTCLK Rise/Fall time	-	20	ns	
DB	T_{PDS}	PD Data Setup Time	50	-	ns	
	T_{PDH}	PD Data Hold Time	50	-	ns	

7.5 Reset Timing Characteristics



$V_{DDI}=1.65$ to $3.3V$, $V_{DD}=2.4$ to $3.3V$, $AGND=DGND=0V$, $T_a=-30 \sim 70^{\circ}C$

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120 (Note 1, 6, 7)	ms

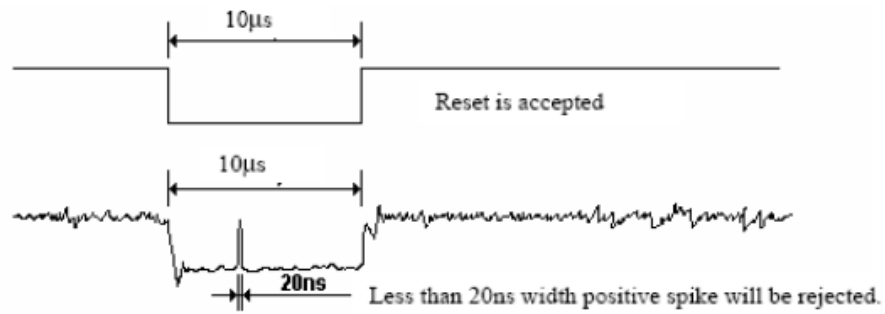
Notes:

1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (t_{RT}) within 5 ms after a rising edge of RESX.
2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9us	Reset starts

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

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



5. When Reset applied during Sleep In Mode.

6. When Reset applied during Sleep Out Mode.

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

8. LCD Module Out-Going Quality Level

8.1 VISUAL & FUNCTION INSPECTION STANDARD

8.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

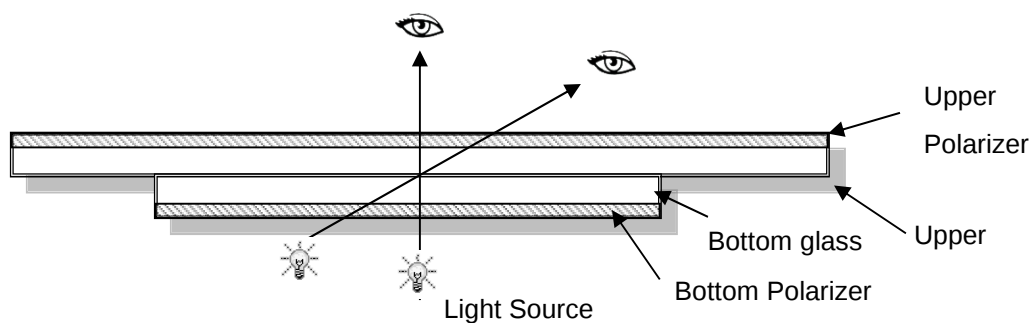
Temperature: $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$

Humidity: $65\% \pm 10\% \text{RH}$

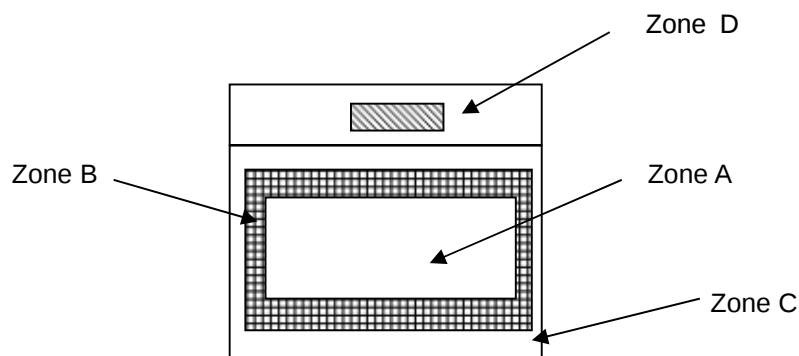
Viewing Angle: Normal Viewing Angle.

Illumination: Single fluorescent Lamp (300 to 700Lux)

Viewing Distance: 30-50cm



8.1.2 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 cannot 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

8.1.3 Sampling Plan

According to GB/T 2828-2003; Normal Inspection, Class II

AQL:

Major Defect	Minor Defect
0.65	1.5

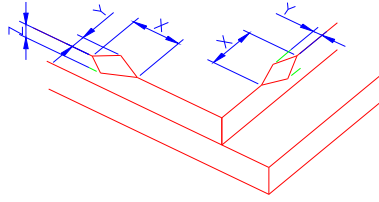
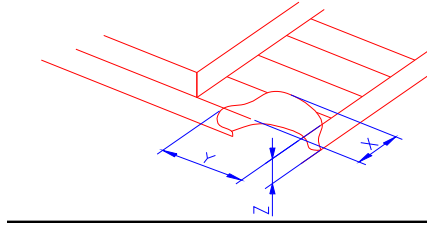
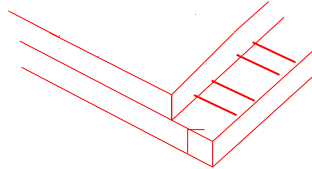
LCD: Liquid Crystal Display LCM: Liquid Crystal Module, RTP: Resistance Touch Panel

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/RTP	Black/White spot/line, scratch, crack, etc.	

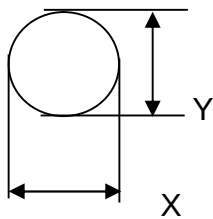
Note1: a) Light dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

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

8.1.4 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><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></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><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table>	X	Y	Z	≤3.0mm	≤L	≤T	
X	Y	Z						
≤3.0mm	≤L	≤T						
(3) LCD crack	 Crack Not allowed							

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	Ignore	
$0.15 < \Phi \leq 0.25$	3(distance $\geq 6\text{mm}$)		
$0.25 < \Phi \leq 0.4$	2(distance $\geq 6\text{mm}$)		
$\Phi > 0.4$	0		

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

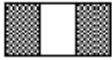
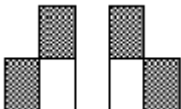
Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.15$	Ignore	Ignore	
$0.15 < \Phi \leq 0.25$	3(distance $\geq 6\text{mm}$)		
$0.25 < \Phi \leq 0.4$	2(distance $\geq 6\text{mm}$)		
$\Phi > 0.4$	0		

③ Polarizer accidented spot

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		Ignore
$0.2 < \Phi \leq 0.5$	2(distance $\geq 6\text{mm}$)		
$\Phi > 0.5$	0		

④Polarizer Bubble

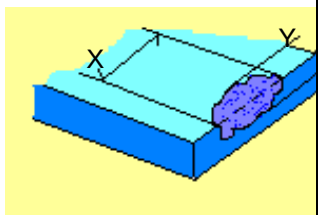
Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		Ignore
$0.2 < \Phi \leq 0.4$	3(distance $\geq 6\text{mm}$)		
$\Phi > 0.4$	0		

3.0	LCD Pixel defect	Pixel bad points																							
		<table> <tr> <th>Item</th><th>Zone A</th><th>Acceptable Qty</th></tr> <tr> <td rowspan="3">Bright dot</td><td>Random</td><td>$N \leq 2$</td></tr> <tr> <td>2 dots adjacent</td><td>$N \leq 0$</td></tr> <tr> <td>3 dots adjacent</td><td>$N \leq 0$</td></tr> <tr> <td rowspan="3">Dark dot</td><td>Random</td><td>$N \leq 2$</td></tr> <tr> <td>2 dots adjacent</td><td>$N \leq 0$</td></tr> <tr> <td>3 dots adjacent</td><td>$N \leq 0$</td></tr> <tr> <td>Distance</td><td> 1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot. </td><td>5mm</td></tr> <tr> <td colspan="2">Total bright and dark dot</td><td>$N \leq 4$</td></tr> </table>	Item	Zone A	Acceptable Qty	Bright dot	Random	$N \leq 2$	2 dots adjacent	$N \leq 0$	3 dots adjacent	$N \leq 0$	Dark dot	Random	$N \leq 2$	2 dots adjacent	$N \leq 0$	3 dots adjacent	$N \leq 0$	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		$N \leq 4$
Item	Zone A	Acceptable Qty																							
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	3 dots adjacent	$N \leq 0$																							
Dark dot	Random	$N \leq 2$																							
	2 dots adjacent	$N \leq 0$																							
	3 dots adjacent	$N \leq 0$																							
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		$N \leq 4$																							
		Note: A) Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern. B) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture. C) 2 dot adjacent = 1 pair = 2 dots Picture:  2 dot adjacent  2 dot adjacent (vertical)  2 dot adjacent  2 dot adjacent (slant)																							

4.0	Line defect (LCD /Polarizer backlight black/white line, scratch, stain)	<table border="1"> <tr> <th rowspan="2">Width(mm)</th> <th rowspan="2">Length(m)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> <tr> <td>$\Phi \leq 0.03$</td> <td>Ignore</td> <td colspan="2">Ignore</td> <td rowspan="3">Ignore</td> </tr> <tr> <td>$0.03 < W \leq 0.04$</td> <td>$L \leq 3.0$</td> <td colspan="2">$N \leq 2$</td> </tr> <tr> <td>$0.04 < W \leq 0.05$</td> <td>$L \leq 2.0$</td> <td colspan="2">$N \leq 1$</td> </tr> <tr> <td>$W > 0.05$</td> <td colspan="4">Define as spot defect</td> </tr> </table>				Width(mm)	Length(m)	Acceptable Qty			A	B	C	$\Phi \leq 0.03$	Ignore	Ignore		Ignore	$0.03 < W \leq 0.04$	$L \leq 3.0$	$N \leq 2$		$0.04 < W \leq 0.05$	$L \leq 2.0$	$N \leq 1$		$W > 0.05$	Define as spot defect			
	Width(mm)	Length(m)	Acceptable Qty																												
			A	B	C																										
	$\Phi \leq 0.03$	Ignore	Ignore		Ignore																										
	$0.03 < W \leq 0.04$	$L \leq 3.0$	$N \leq 2$																												
	$0.04 < W \leq 0.05$	$L \leq 2.0$	$N \leq 1$																												
$W > 0.05$	Define as spot defect																														
 W: width, L : length																															
N : Count																															
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.																													

8.0	RTP Related	RTP film bubble/ accidented spot	<table><tr><th rowspan="2">Size Φ(mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>0.1<Φ≤0.25</td><td colspan="2">0 (distance>5mm)</td></tr><tr><td>0.25<Φ≤0.35</td><td colspan="2">2 (distance>5mm)</td></tr><tr><td>Φ>0.35</td><td colspan="2">0</td></tr></table>				Size Φ(mm)	Acceptable Qty			A	B	C	Φ≤0.1	Ignore		Ignore	0.1<Φ≤0.25	0 (distance>5mm)		0.25<Φ≤0.35	2 (distance>5mm)		Φ>0.35	0						
			Size Φ(mm)	Acceptable Qty																											
				A	B	C																									
			Φ≤0.1	Ignore		Ignore																									
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			0.25<Φ≤0.35	2 (distance>5mm)																											
		Φ>0.35	0																												
		RTP film scratch	<table><tr><th rowspan="2">Width(mm)</th><th rowspan="2">Length</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>Φ≤0.03</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>0.03<W≤0.04</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr><tr><td>0.04<W≤0.05</td><td>L≤2.0</td><td colspan="2">N≤1</td></tr><tr><td>0.05<W</td><td colspan="3">Define as spot defect</td></tr></table>				Width(mm)	Length	Acceptable Qty			A	B	C	Φ≤0.03	Ignore	Ignore		Ignore	0.03<W≤0.04	L≤3.0	N≤2		0.04<W≤0.05	L≤2.0	N≤1		0.05<W	Define as spot defect		
			Width(mm)	Length	Acceptable Qty																										
					A	B	C																								
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0.03<W≤0.04	L≤3.0		N≤2																												
0.04<W≤0.05	L≤2.0	N≤1																													
0.05<W	Define as spot defect																														

		Assembly deflection	beyond the edge of backlight ≤0.2mm					
		Bulge (undulation included)	The ITO film plumped below 0.40mm, it's ok. 					
		Newton Ring	Newton Ring area>1/3 TP area NG Newton Ring area≤1/3 TP area OK					
		RTP corner broken X : length Y : width Z : height	<table border="1"><thead><tr><th>X</th><th>Y</th><th>Z</th></tr></thead><tbody><tr><td>X≤3mm</td><td>Y≤3mm</td><td>Z<COVER thickness</td></tr></tbody></table> * *Circuitry broken is not allowed.	X	Y	Z	X≤3mm	Y≤3mm
X	Y	Z						
X≤3mm	Y≤3mm	Z<COVER thickness						

		RTP edge broken	X	Y	Z	
		X : length	$X \leq 4\text{mm}$	$Y \leq 2\text{mm}$	$Z < \text{COVER thickness}$	
		Y : width				
		Z : height	* Circuitry broken is not allowed.			

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
5	RTP no function	Not allowed

9. Reliability Test Result

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, 96h	
High Temperature Storage	+80°C, 96h	
Low Temperature Storage	-30°C, 96h	
High Temperature & High Humidity Operating	+60°C, 90% RH, 96h	
Thermal Shock (Non-Operation)	-10°C, 30 min ↔ +60°C, 30 min, Change time:5min 20CYC.	
ESD Test	C=150pF, R=330, 5points/panel Air:±8kV, 5times; Contact:±6kV, 5 times (Environment: 15°C~35°C, 30%~60%)	
Vibration (Non-Operation)	Frequency range: 10~55Hz, Stroke: 1.5mm Sweep: 10Hz~55Hz~10Hz 2h for each direction of X.Y.Z. (6 hours for total) (Package condition).	
Box Drop Test	1 Corner 3 Edges 6 faces,80cm	

Remark:

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.

10. Cautions and Handling Precautions

10.1 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.

10.2 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°C 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.