

SPECIFICATION
FOR
LCM Module

MODULE No:	KD070FHFID015
CUSTOMER:	

STARTEK	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
APPROVED BY		



Revision History

Date	Rev. No.	Page	Summary
2018.07.23	V1.0	ALL	FIRST ISSUE

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	常备库存 Stock For Sale	长期供货 Long Time supply	支持小量 NO MOQ	品种齐全 In Full Range

1. Basic Specifications

* Description

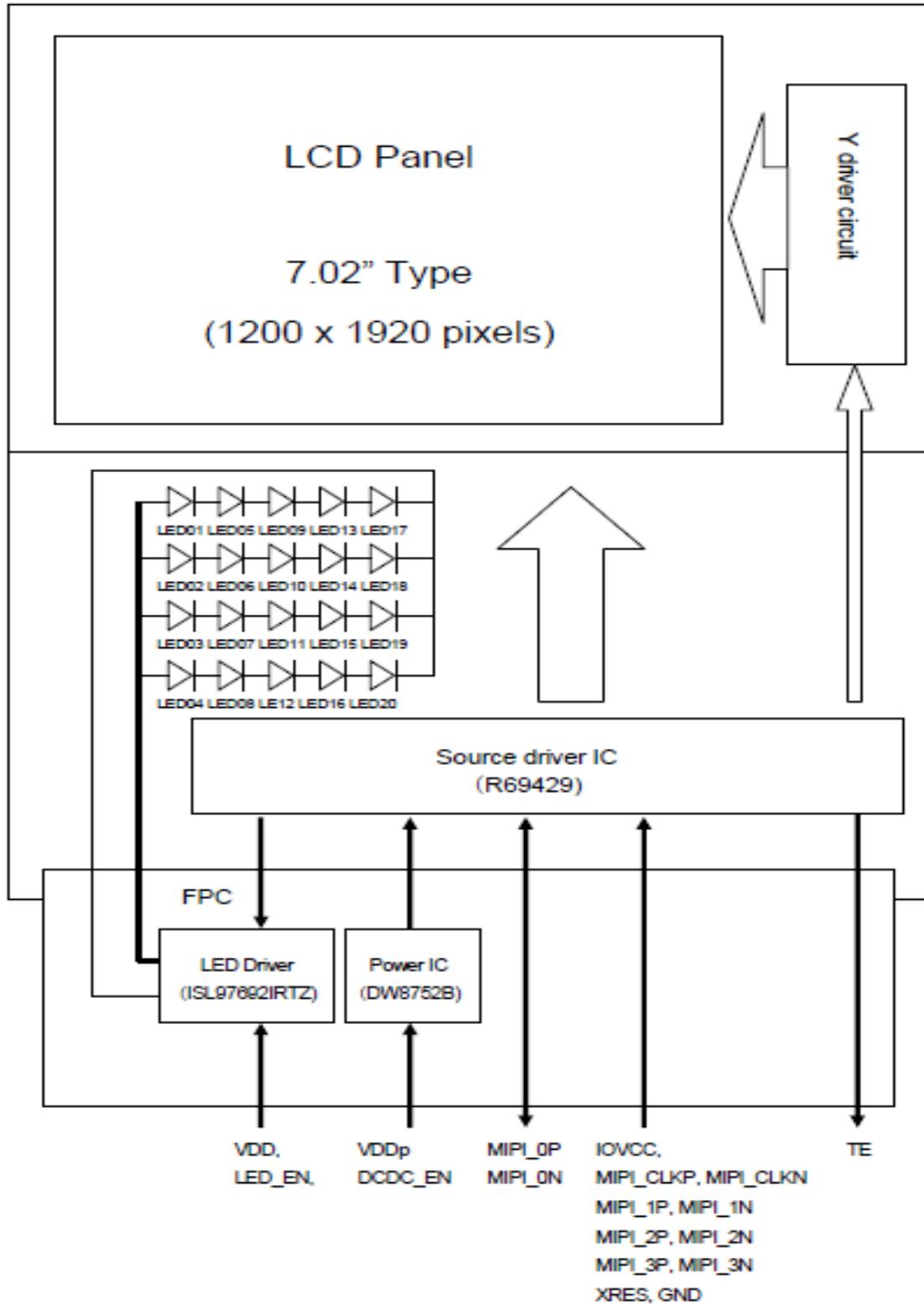
This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This module is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 7.0" TFT-LCD contains 1200x1920 pixels, and can display up to 16.7M colors.

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	94.5(H)*151.2(V) (7.0 inch)	mm	
Driver element	TFT active matrix	-	
Display colors	16.7M	colors	
Number of pixels	1200(RGB)*1920	dots	
Pixel arrangement	RGB vertical stripe	-	
Pixel pitch	0.07875(H)*0.07875(V)	mm	
Viewing angle	Free	o'clock	
Controller IC	R69429	-	
LCM Interface	4 LANE MIPI	-	
Display mode	Transmissive /Normally Black	-	
Operating temperature	-10~+60	°C	
Storage temperature	-30~+70	°C	

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	-	98.70	-	mm	
	Vertical(V)	-	160.80	-	mm	
	Depth(D)	-	1.98	-	mm	
Weight		-	TBD	-	g	

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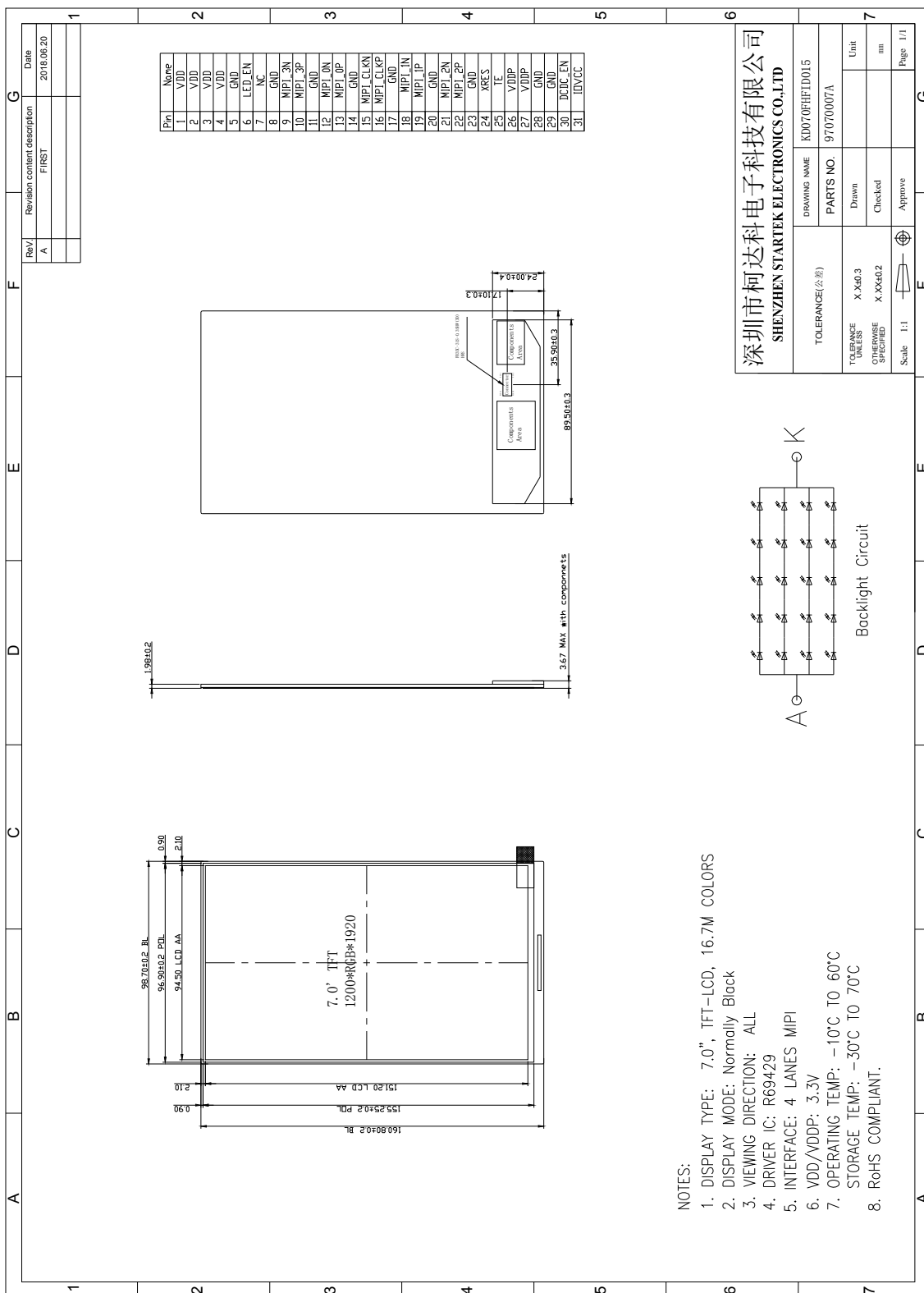
2. Block Diagram



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3. Outline dimension



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4. Input terminal Pin Assignment

Connector on FPC :FH35C-31S-0.3HW(50) (HIROSE)

NO.	SYMBOL	DISCRIPTION	I/O
1	VDD	LED power supply (3-5V)	P
2	VDD	LED power supply (3-5V)	P
3	VDD	LED power supply (3-5V)	P
4	VDD	LED power supply (3-5V)	P
5	GND	Ground.	P
6	LED_EN	LED backlight enable, High active	I
7	NC		
8	GND	Ground.	P
9	MIPI_3N	MIPI data 3 negative signal	I/O
10	MIPI_3P	MIPI data 3 positive signal	I/O
11	GND		P
12	MIPI_0N	MIPI data 0 negative signal	I/O
13	MIPI_0P	MIPI data 0 positive signal	I/O
14	GND	Ground.	P
15	MIPI_CLKN	MIPI CLK negative signal	I/O
16	MIPI_CLKP	MIPI CLK positive signal	I/O
17	GND	Ground.	P
18	MIPI_1N	MIPI data 1 negative signal	I/O
19	MIPI_1P	MIPI data 1 positive signal	I/O
20	GND	Ground.	P
21	MIPI_2N	MIPI data 2 negative signal	I/O
22	MIPI_2P	MIPI data 2 positive signal	I/O
23	GND	Ground.	P
24	XRES	Reset, Low active	I
25	TE		O
26	VDDp	Power IC supply (3-5V)	P
27	VDDp	Power IC supply (3-5V)	P
28	GND	Ground.	P
29	GND	Ground.	P
30	DCDC_EN	Power IC supply enable, High active	I
31	IOVCC	Power supply for LCM (1.8 +/- 0.1V)	P

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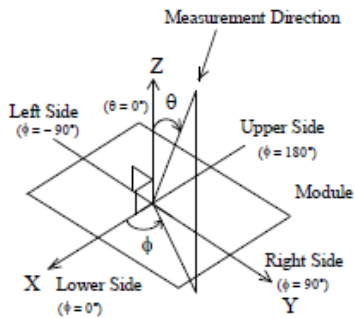
5. LCD Optical Characteristics

5.1 Optical specification

Item	Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio	CR	$\Theta=0$ Normal viewing angle	700	1100	--		
Uniformity	S(%)		--	71.5	--	%	
Color Filter Chromacity	White	W_x	0.27	0.31	0.35		
		W_y	0.29	0.33	0.37		
	Red	R_x	0.60	0.64	0.68		
		R_y	0.29	0.33	0.37		
	Green	G_x	0.27	0.31	0.35		
		G_y	0.57	0.61	0.65		
	Blue	B_x	0.11	0.15	0.19		
		B_y	0.01	0.05	0.09		
Viewing angle	Hor.	Θ_L	CR>10	80	-	--	1) 2)
		Θ_R		80	-	--	
	Ver.	Θ_U		80	-	--	
		Θ_D		80	-	--	
Option View Direction	Free						

Note 1) The definition of the Viewing Angle is as figure.

Note 2) The definition of the Viewing cone is as figure 2. Refer to Limit sample to judge it is evaluated by the pattern from customer.



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6. Electrical Characteristics

6.1 Absolute Maximum Rating

Item ¹⁾	Symbol	Min.	Max.	Unit	Remark
Power supply voltage (Analog)	VDD-GND	-0.3	6.0	V	
	VDDp-GND	-0.3	6.0	V	
Power supply voltage (Logic)	IOVCC	-0.3	4.6	V	
Input signal voltage (RES)	V _I	-0.3	IOVCC+0.3	V	XRES
Input signal voltage (DSI)	V _{I(DSI)}	-0.3	1.8	V	
Input signal voltage (LED)	V _{I(LED)}	-0.3	6.0	V	LED_EN
Input signal voltage (PWR)	V _{I(PWR)}	-0.3	5.5	V	DCDC_EN
Operating temperature	T _{OP}	-10	+60	°C	²⁾
Storage temperature	T _{STG}	-30	+70	°C	²⁾

Note 1) The absolute maximum ratings are the values that must not be exceeded at any time for this product. It is not allowed for any of these ratings to be exceeded. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed. Therefore, when designing a system incorporating the module, make sure that adequate attentions be paid to the variations in the supply voltages, the characteristics of parts that are connected, surges in the input and output lines, and the ambient temperatures.

Note 2) Should be no condensation.

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6.2 Recommended Operating Conditions for Driving LCD

(Ta=25°C)

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply voltage for Analog		VDD	3.0	-	5.0	V	
		VDDp	3.0	-	5.0	V	
Power supply voltage for Logic		IOVCC	1.70	1.80	1.90	V	
Input signal voltage (RES)		V _{IL}	0	-	0.3*IOVCC	V	XRES
		V _{IH}	0.7*IOVCC	-	IOVCC	V	
Output signal voltage (TE)		V _{OL}	0	-	0.2*IOVCC	V	TE
		V _{OH}	0.8*IOVCC	-	IOVCC	V	
Input signal voltage (DSI)	Low level	V _{IL(DSI)}	-50	-	550	mV	Low Power Receiver
	High level	V _{IH(DSI)}	880	-	1350	mV	
	Input voltage	V _{CMRX}	70	-	330	mV	High Speed Receiver
	Differential input low threshold	V _{IDTL}	-70	-	-	mV	
	Differential input high threshold	V _{IDTH}	-	-	70	mV	
Input signal voltage (LED)		V _{IL(PWR)}	1.5	-	VDD	V	LED_EN
		V _{IH(PWR)}	0	-	0.5	V	
Input signal voltage (PWR)		V _{IL(LED)}	1.4	-	VDDp	V	DCDC_EN
		V _{IH(LED)}	0	-	0.4	V	

Note 1) The recommended operating conditions refers to a range in which operation of this product is guaranteed. Should this range is exceeded, the operation cannot be guaranteed even if the values may be within the absolute maximum ratings. Accordingly, please make sure that the module is used within this range.

6.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 20 chips LED

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I _F	160	180	--	mA	
LCM Luminance	LV	350	450	--	cd/m ²	Note3
LED life time	Hr	--	50000	--	Hour	Note1,2
Uniformity	Avg	80	--	--	%	Note3

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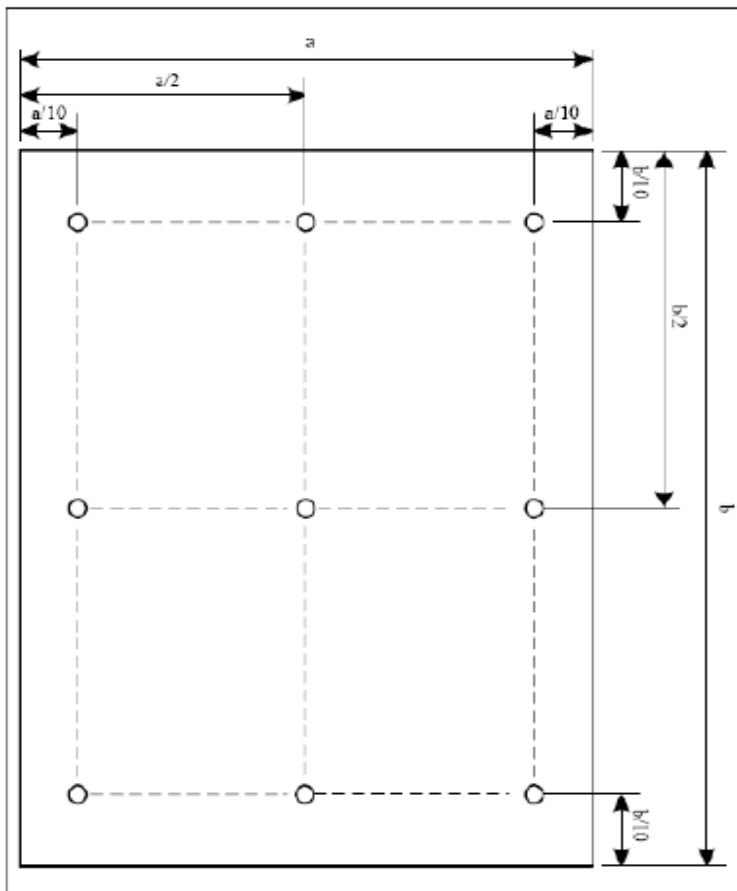
Note1: LED life time (Hr) can be defined as the time in which it continues to operate under the condition:

$T_a=25\pm 3\text{ }^\circ\text{C}$, 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

$T_a=25\text{ }^\circ\text{C}$ and $I_L=180\text{mA}$. The LED lifetime could be decreased if operating I_L is larger than 180mA. The constant current driving method is suggested.

Note (3) Luminance Uniformity of these 9 points is defined as below:



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

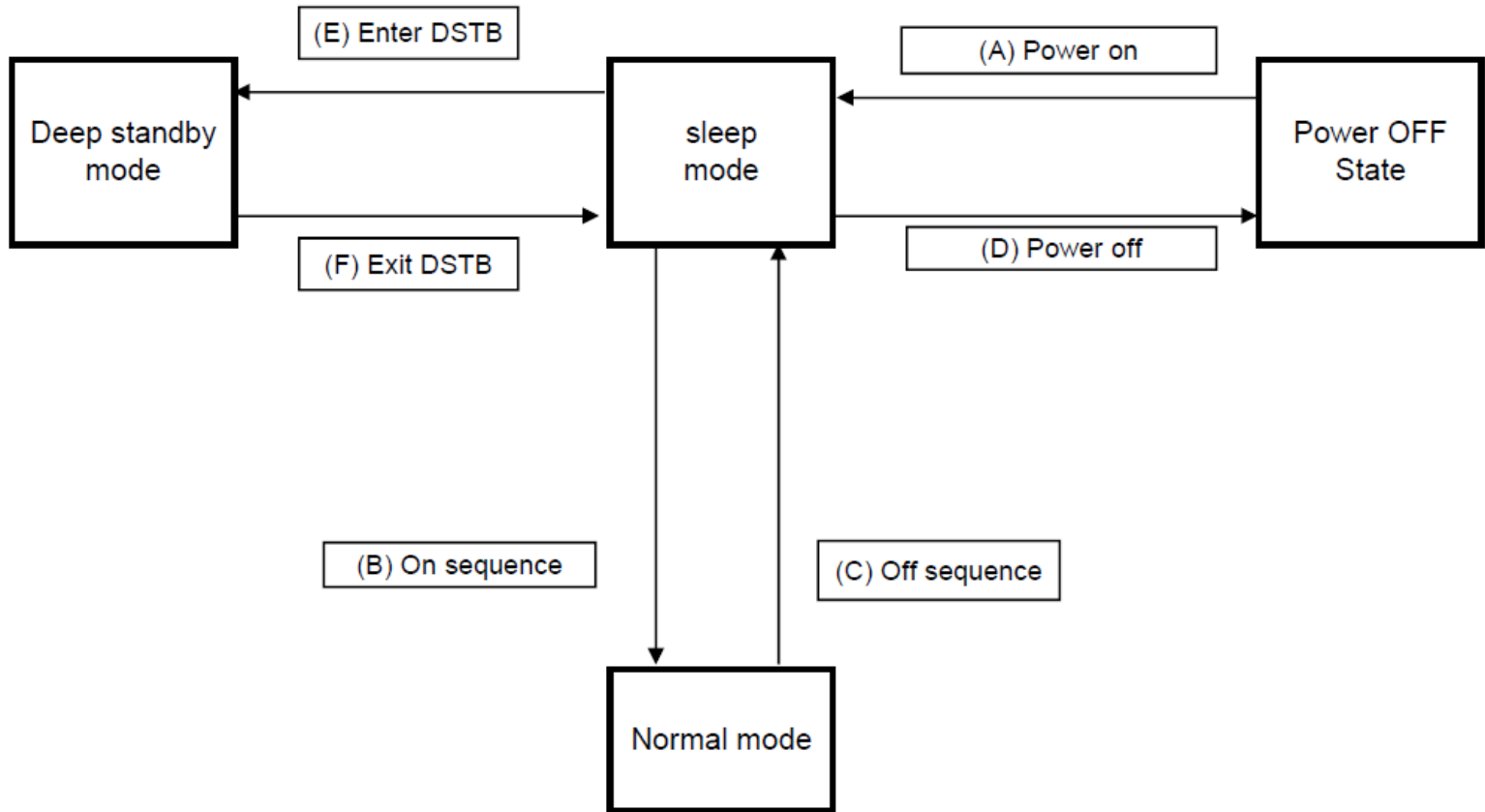
$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$

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7. Command sequence



7.1 Status Flow

(1200RGBx1920, R69429, MIPI 4lane)



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7.2 Sequence
(A) Power on

sequence	DataTyp (hex)	index (hex)	parameters # (hex)	description	comment
<div style="background-color: #f4a460; padding: 5px; border: 1px solid black; display: inline-block;">POWER OFF STATE</div>					
					
PWR supply on				IOVcc on	DSI input should be at GND level while IOVcc off.
wait 5ms					
PWR supply on				Vddp(VSP,VSN PWR) on	
wait 3ms					
DCDC_EN L->H				DCDC_EN L->H (VSP,VSN on)	
wait 20ms					
RESET L->H				RESET L->H	
wait 10ms					
DCDC_EN H->L				DCDC_EN H->L (VSP,VSN off)	(*1)Can skip "DCDC_EN H->L" in case of going to normal mode without staying sleep status.
wait 20ms					
					
<div style="background-color: #f4a460; padding: 5px; border: 1px solid black; display: inline-block;">SLEEP MODE</div>					

(B) On sequence

sequence	Data Type (hex)	index (hex)	parameters # (hex)	description	comment
SLEEP MODE					
↓					
DCDC_EN L->H				DCDC_EN L->H (VSP,VSN on)	
wait 20ms					
command	05	01	-	soft reset	
wait 5ms					
command	23	B0	1 00	MCAP	
command	29	B3	1 04 2 08 3 00 4 22 5 00	Interface setting	
command	29	B4	1 0C	Interface ID setting	
command	29	B6	1 3A 2 D3	DSI control	
command	15	51	1 E6	write display brightness	
command	15	53	1 2C	write control display	
command	15	3A	1 77	set pixel format	
command	39	2A	1 00 2 00 3 04 4 AF	set column address	
command	39	2B	1 00 2 00 3 07 4 7F	set page address	
send image	39	2C/3C		write memory / write memory continue	
command	05	11	-	exit sleep mode	
wait 120ms					
command	05	29	-	set display on	
wait min 0ms					
LED_EN L->H				LED_EN L->H	
↓					
NORMAL MODE					

(C) Off sequence

sequence	DataTyp (hex)	index (hex)	parameters # (hex)	description	comment
NORMAL MODE					
↓					
command	05	28	-	-	set display off
wait 20ms					
command	05	10	-	-	enter sleep mode
wait 80ms					
DCDC_EN H->L					DCDC_EN H->L (VSP,VSN off)
wait 20ms					
↓					
SLEEP MODE					

(D) Power Off

sequence	DataTyp (hex)	index (hex)	parameters # (hex)	description	comment
SLEEP MODE					
↓					
RESET H->L					
PWR supply off				IOVcc off	DSI input should be at GND level while IOVcc off.
↓					
POWER OFF STATE					

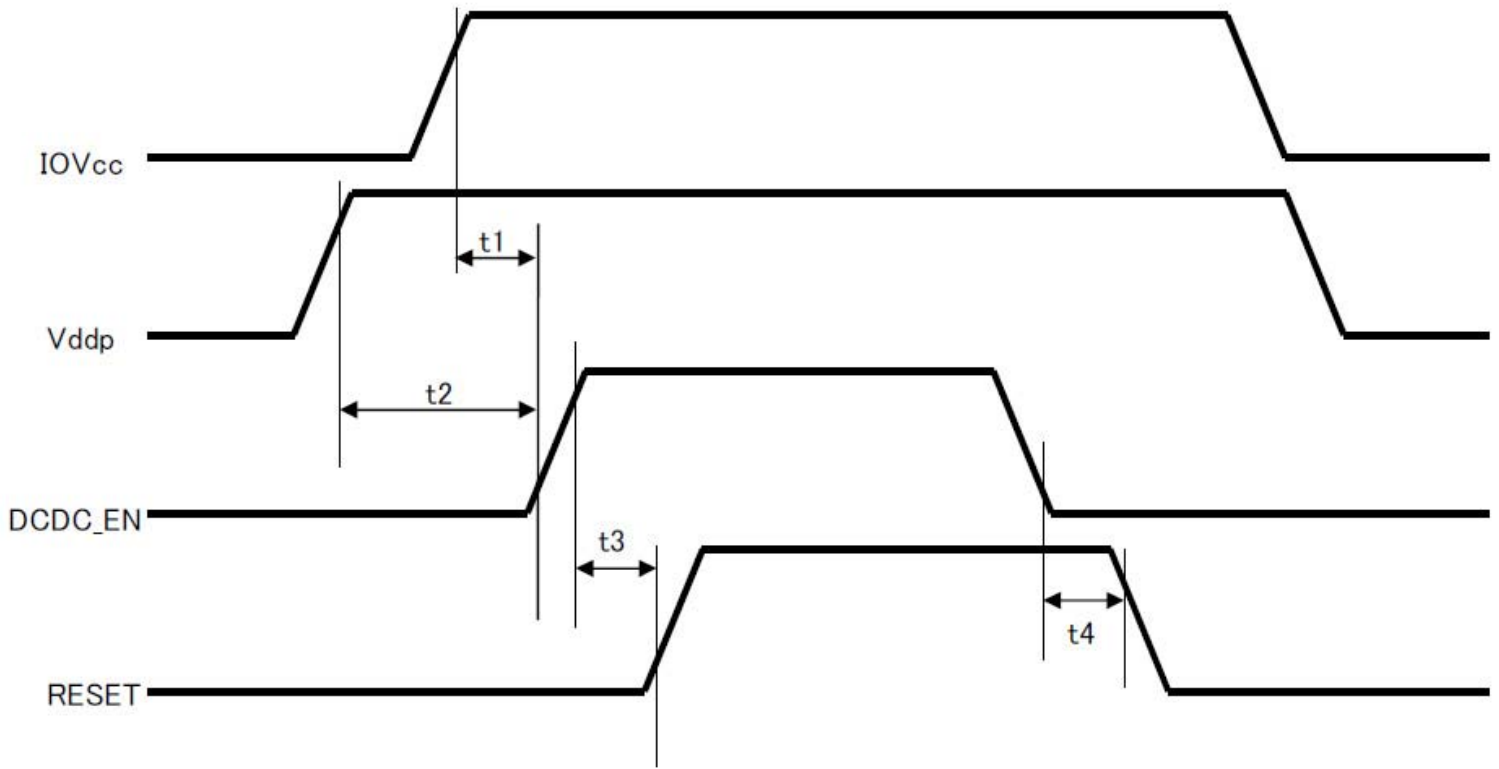
(E) Enter DSTB

sequence	DataTyp (hex)	index (hex)	parameters # (hex)	description	comment
SLEEP MODE					
↓					
command	23	B0	1	00	MCAP
command	23	B1	1	01	DSTB=1
↓					
DSTB MODE					

(F) Exit DSTB

sequence	DataTyp (hex)	index (hex)	parameters # (hex)	description	comment
<div style="border: 1px solid black; background-color: #f4a460; padding: 5px; display: inline-block; margin-bottom: 10px;">DSTB MODE</div> <div style="text-align: center;">↓</div>					
RESET H -> L					
wait 10ms					
PWR supply on				Vddp(VSP,VSN PWR) on	
wait 3ms					
DCDC_EN L->H				DCDC_EN L->H (VSP,VSN on)	
wait 20ms					
RESET L->H				RESET L->H	
wait 10ms					
DCDC_EN H->L				DCDC_EN H->L (VSP,VSN off)	(*1)Can skip "DCDC_EN H->L" in case of going to normal mode without staying sleep status.
wait 20ms					
<div style="text-align: center;">↓</div> <div style="border: 1px solid black; background-color: #f4a460; padding: 5px; display: inline-block; margin-top: 10px;">SLEEP MODE</div>					

7.3 Power Supply Sequence



Item	Symbol	Unit	Min	Typ	Max
IOVCC on to DCDC_EN on time	t1	ms	1	3	-
VDDP on to DCDC_EN on time	t2	ms	1	3	-
DCDC_EN on to REST on time	t3	ms	12	20	-
DCDC_EN off to REST off time	t4	ms	15	20	-

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.

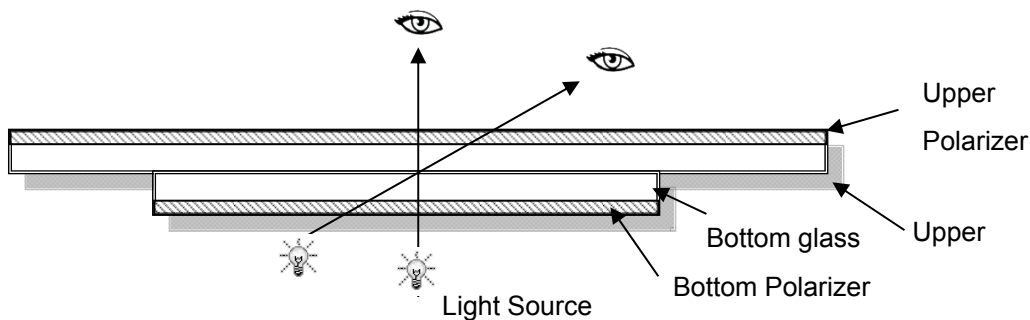
Temperature : $25\pm 5^{\circ}\text{C}$

Humidity : $65\%\pm 10\%RH$

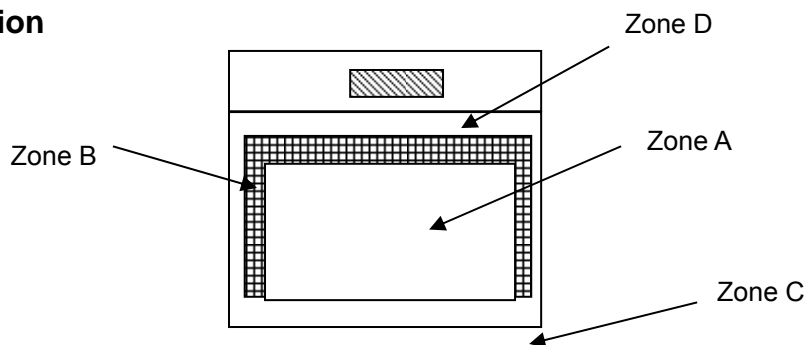
Viewing Angle : Normal viewing Angle.

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 Cover (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

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8.1.3 Sampling Plan

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

AQL:

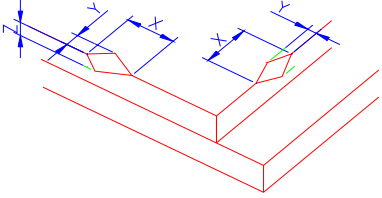
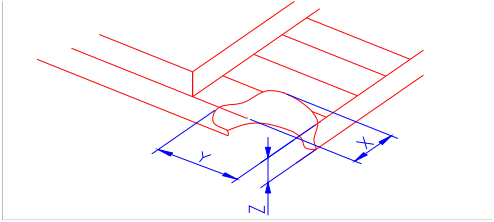
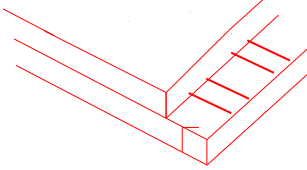
Major defect	Minor defect
0.65	1.5

LCD: Liquid Crystal Display , TP: Touch Panel , 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. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Spot Line defect	Light dot , Dim spot , Polarizer Bubble ; Polarizer accidented spot.	
6	Soldering appearance	Good soldering , Peeling off is not allowed.	
7	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

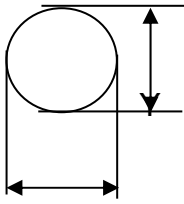
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8.1.4 Criteria (Visual)

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 border="1" data-bbox="756 667 1455 817"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0mm</td> <td><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="815 1122 1394 1223"> <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



X

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

① light dot (LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain)

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.10$	Ignore		
$0.10 < \Phi \leq 0.25$	4(distance $\geq 10\text{mm}$)		
$0.25 < \Phi \leq 0.35$	3		
$\Phi > 0.4$	0		

② Dim spot (LCD/TP/Polarizer dim dot, light leakage, dark spot)

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.1$	Ignore		
$0.10 < \Phi \leq 0.25$	4(distance $\geq 10\text{mm}$)		
$0.25 < \Phi \leq 0.35$	3		
$\Phi > 0.4$	0		

③ Polarizer accidented spot

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		
$0.3 < \Phi \leq 0.5$	3(distance $\geq 10\text{mm}$)		
$\Phi > 0.5$	1		

④ Pixel bad points (light dot, Dim dot, color dot)

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.15$	Ignore		
$0.2 < \Phi \leq 0.3$	2(distance $\geq 10\text{mm}$)		
$\Phi > 0.4$	1		

⑤ Polarizer Bubble

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		
$0.3 < \Phi \leq 0.4$	4(distance $\geq 10\text{ m}$)		
$0.4 < \Phi \leq 0.5$	3		

$\Phi > 0.5$

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常备库存
Stock For Sale

长期供货
Long Time supply

支持小量
NO MOQ

品种齐全
In Full Range

3.0	Line defect (LCD/TP /Polarizer backlight black/white line, scratch, stain)	Width(mm)	Length(m)	Acceptable Qty		
				A	B	C
		$\Phi \leq 0.05$	Ignore	Ignore		
		$0.05 < W \leq 0.06$	$L \leq 4.0$	N \leq 3		
		$0.07 < W \leq 0.08$	$L \leq 3.0$	N \leq 2		
	$0.08 < W$	Define as spot defect				
4.0	Electronic Components SMT	Not allow missing parts, solderless connection, cold solder joint, mismatch, The positive and negative polarity opposite				
5.0	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.				
6.0	LCD Mura	By 5% ND filter invisible.				

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	TP no function	Not allowed

9. Reliability Test Result

Item	Condition	Inspection after test
High Temperature Operating	60°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	-10°C, 96HR	
High Temperature Storage	70°C, 96HR	
Low Temperature Storage	-30°C, 96HR	
High Temperature & High	+50°C, 90% RH ,96 hours.	
Thermal Shock (Non-operation)	-40°C,30 min ↔ 90°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 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)	

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.

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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 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.

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11. Packing

----TBD----

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