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TFT LCD

ET140FH01-HG

ACCEPTED BY :

C00

APPROVED BY	CHECKED BY	PREPARED BY



REVISION STATUS

[illegible]

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ET140FH01-HG is 14" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) Module composed of LCD Panel, driver ICs, control circuit and LED backlight. By applying 1920×1080 resolution images are displayed on the 14" diagonal screen, Display 16.7M color by R.G.B signal input.

General specifications are summarized in the following table :

ITEM	SPECIFICATION			
Panel Size	14" inch			
Display Area (mm)	308.16(H) × 173.34 (V)			
Number of Pixels	1920(H) x 1080(V)			
Pixel Pitch (mm)	0.1605(W)x 0.1605(H)			
Color Pixel Arrangement	RGB Vertical stripe			
Display Mode	Normally Black			
Number of Colors	16.7M(8bits)			
Brightness(cd/m ²)	1000nits(typ)			
Response Time (ms)	30ms(typ)			
Color Gamut	72%			
Viewing Direction	Free			
Contrast ratio	1200:1			
Interface connection	eDP interface			
Module Size(mm)		Min.	Typ.	Max
	Horizontal (H)	320.7	321	321.3
	Vertical (V)	187.4	187.7	188
	Depth (D)	7.2	7.5	7.8
Module Weight (g)	TBD			
Backlight Unit	LED			
Surface Treatment	HC 3H			



2. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Remark
Digital Supply Voltage	DVDD	-0.3	+4	V	
Logic Supply Voltage	VIN	0.3	VDD+0.3	V	
Forward Current (per LED)	If	-	90	mA	
Reverse Voltage(per LED)	VR	-	3.3	V	
Operating Ambient Temperature	T _{OP}	-20	+80	°C	
Operating Ambient Humidity	H _{OP}	60	90	% (RH)	
Storage Temperature	T _{STG}	-30	+80	°C	
Storage Humidity	H _{STG}	60	90	% (RH)	

【Note:】

- *1) If the product were used out of the operation and storage, it will have quality issue.
- *2) Ifp Conditions: Pulse Width $\leq 10\text{msec}$, Duty $\leq 1/10$
- *3) Each one of LED operation must be follow diagram of Ambient Temperature and Allowable Forward

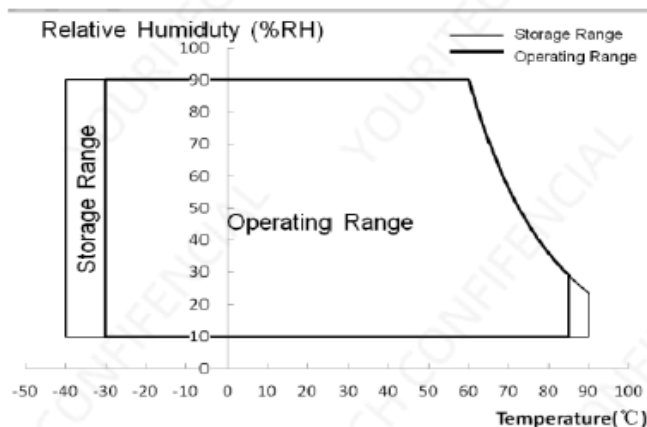


Figure 2. Operating and storage environment

- *4) If users use the product out off the environmmetal operation range (temperature and humidity), it will have visual quality concens.



3. ELECTRICAL CHARACTERISTICS

3.1 Typical Operation Conditions

Item	Symbol	Min.	TYP.	Max.	Unit	Remark
Digital Power Supply Voltage For LCD	DVDD	-	3.3	-	V	Note2
Permissible Input Ripple Voltage	VRF	-	-	500	mV	-
Power Supply Current	IDD	-	-	TBD	mA	Note1
Power Consumption	mosaic	-	-	TBD	W	Note1

Note :

1. The supply voltage is measured and specified at the interface connector of LCM. The current draw and power consumption specified is for 3.3V at 25 °C.

Mosaic 7*5 pattern

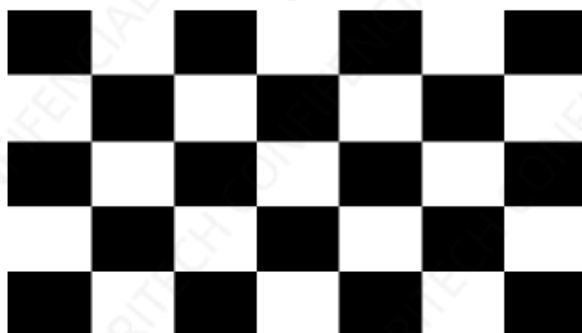


Figure 3 Power Measure Patterns

2. Measure condition (Figure 4)

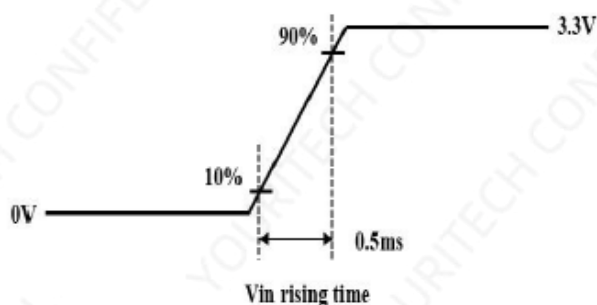
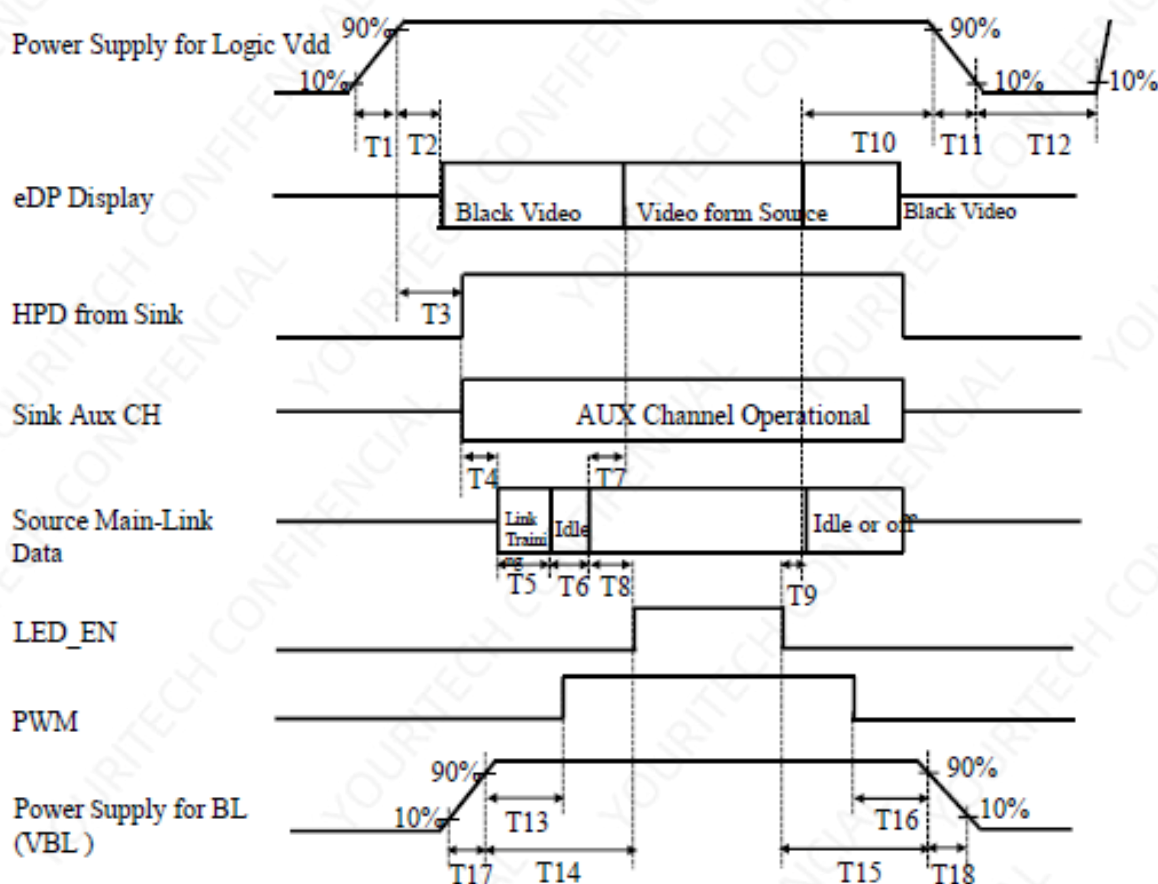


Figure 4 Inrush Measure Condition



3.2 Power Sequence

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below.



- | | | |
|---|--|---------------------------|
| ● $0.5\text{ms} \leq T1 \leq 10\text{ms}$ | ● $0\text{ms} < T10 < 500\text{ms}$ | ● $0.5\text{ms} \leq T17$ |
| ● $0\text{ms} < T2 \leq 200\text{ms}$ | ● $0.5\text{ms} \leq T11 \leq 10\text{ms}$ | ● $0.5\text{ms} \leq T18$ |
| ● $0\text{ms} < T3 \leq 200\text{ms}$ | ● $500\text{ms} \leq T12$ | |
| ● $T3+T4+T5+T6+T8 > 200\text{ms}$ | ● $0\text{ms} < T13$ | |
| ● $0\text{ms} < T7 \leq 50\text{ms}$ | ● $0\text{ms} < T14$ | |
| ● $50\text{ms} < T8$ | ● $0\text{ms} < T15$ | |
| ● $0\text{ms} < T9$ | ● $0\text{ms} < T16$ | |

Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on. Back Light must be turn on after power for logic and interface signal are valid.



3.3 Backlight

Item	Symbol	CONDITION	Min.	TYP.	Max.	Unit	Remark
LED current	IL	Ta=25°C Each serial=60mA	-	420	-	mA	
LED voltage	VL	Ta=25°C Each serial=60mA	-	27	-	V	
Power consumption	WL	Ta=25°C Each serial=60mA	-	11.34	-	W	
LED Lifetime	-	Ta=25°C Each serial=60mA	30000	-	-	Hr	

Note :

*1) LED Circuit Diagram:

*2) A: Anode(+), K: Cathode(-)

*3) Suggestion: Using the constant current control to avoid the leakage light and brightness quality issue.

*4) Definition of Led lifetime: Luminance < Initial luminance 50%.



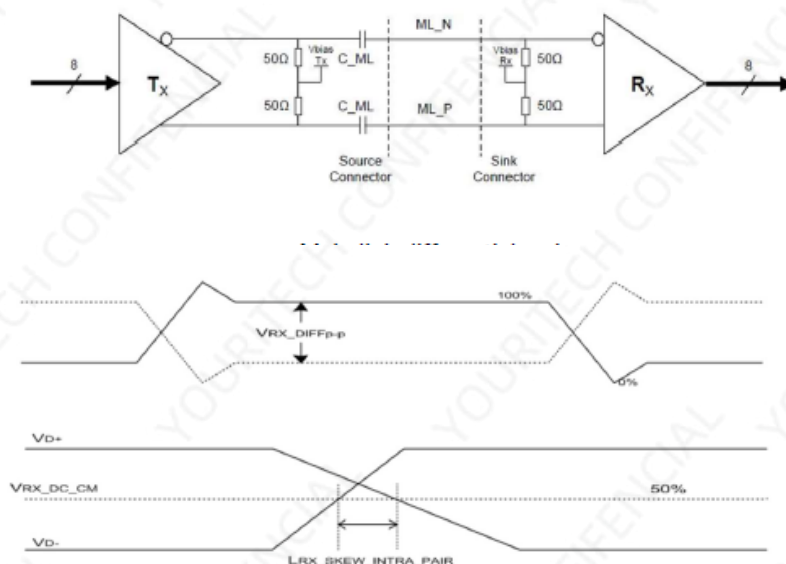
4. INTERFACE CONNECTION

Pin No.	SYMBOL	FUNCTION	Note
1	CABC_EN	NC	
2	GND	Ground	
3	DRX1N	eDP RX Channel 1 Negative	
4	DRX1P	eDP RX Channel 1 Positive	
5	GND	Ground	
6	DRX0N	eDP RX Channel 1 Negative	
7	DRX0P	eDP RX Channel 1 Positive	
8	GND	Ground	
9	DAUXP	eDP AUX CH Positive	
10	DAUXN	eDP AUX CH Negative	
11	GND	Ground	
12	VDD	Power Supply, 3.3V (typ.)	
13	VDD	Power Supply, 3.3V (typ.)	
14	BIST	NC	
15	GND	Ground	
16	GND	Ground	
17	HPD	Hot Plug Detect Output	
18	GND	Ground	
19	GND	Ground	
20	GND	Ground	
21	GND	Ground	
22	NC	NC	
23	NC	NC	
24	NC	NC	
25	NC	NC	
26	NC	NC	
27	NC	NC	
28	NC	NC	
29	NC	NC	
30	NC	NC	



5. eDP Rx Interface Timing Parameter

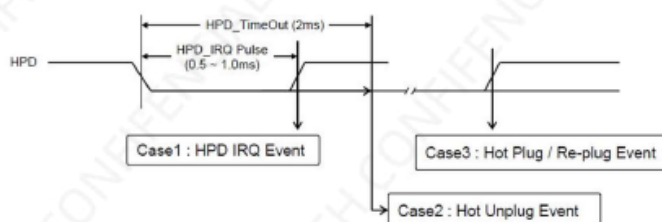
Item	Symbol	Min	Typ	Max	Unit	Remark
Spread spectrum clock (Link clock down-spreading)	ssc	-	-	2	%	
Differential peak-to-peak input voltage at package pins	VRX-DIFFp-p	100	-	1320	mV	
Rx input DC common mode voltage	VRX_DC_CM	0	-	2	V	
Differential termination resistance	RRX-DIFF	80	-	120	Ω	
Single-ended termination resistance	RRX-SE	40	-	60	Ω	
Rx short circuit current limit	IRX_SHORT	-	-	20	mA	
Intra-pair skew at Rx package pins (H BR) RX intra-pair skew tolerance at HBR	LRX_SKEW_ INTRA_PAIR	-	-	150	ps	
AC Coupling Capacitor	CSOURCE_ML	75		200	nF	Source side



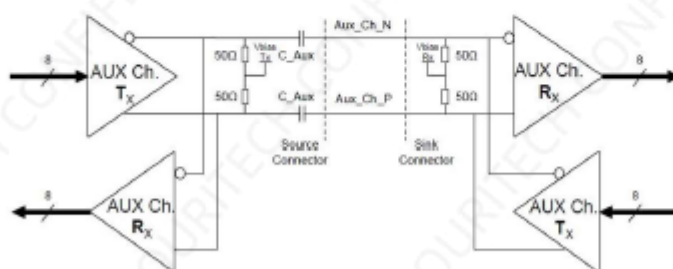
VRX-DIFFp-p & LRX_SKEW_INTRA_PAIR

<Table 8. HPD Characteristics>

Item	Symbol	Min	Typ	Max	Unit	Remark
HPD voltage	VHPD	2.25	-	2.75	V	
Hot Plug Detection Threshold	-	2.0	-	-	V	Source side Detect ing
Hot Unplug Detection Threshold	-	-	-	0.8V	V	
HPD_IRQ Pulse Width	HPD_IRQ	0.5	-	1	ms	
HPD_TimeOut	-	2.0	-	-	ms	



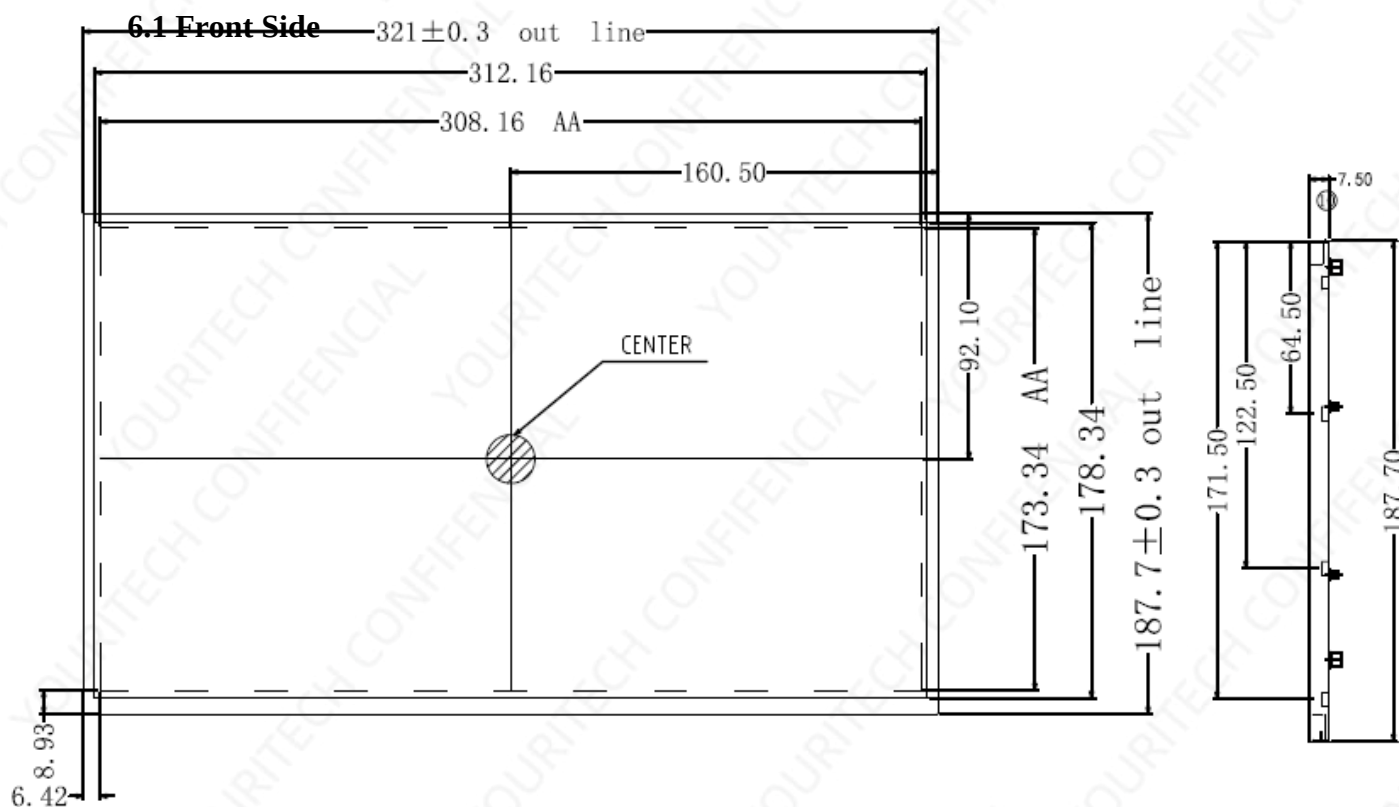
Item	Symbol	Min	Typ	Max	Unit	Remark
AUX unit interval	UIAUX	0.4	0.5	0.6	Us	
AUX peak-to-peak input differential voltage	VAUX-RX-DIFFp-p	0.29	-	1.38	V	
AUX CH termination DC resistance	RAUX-TERM	80	100	120	Ohm	
AUX DC common mode voltage	VAUX-DC-CM	0	-	2	V	
AUX turn around common mode voltage	VAUX-TURN-CM	-	-	0.3	V	
AUX short circuit current limit	IAUX-SHORT	-	-	90	mA	
AUX AC Coupling Capacitor	CSOURCE-AUX	75	-	200	nf	Source side

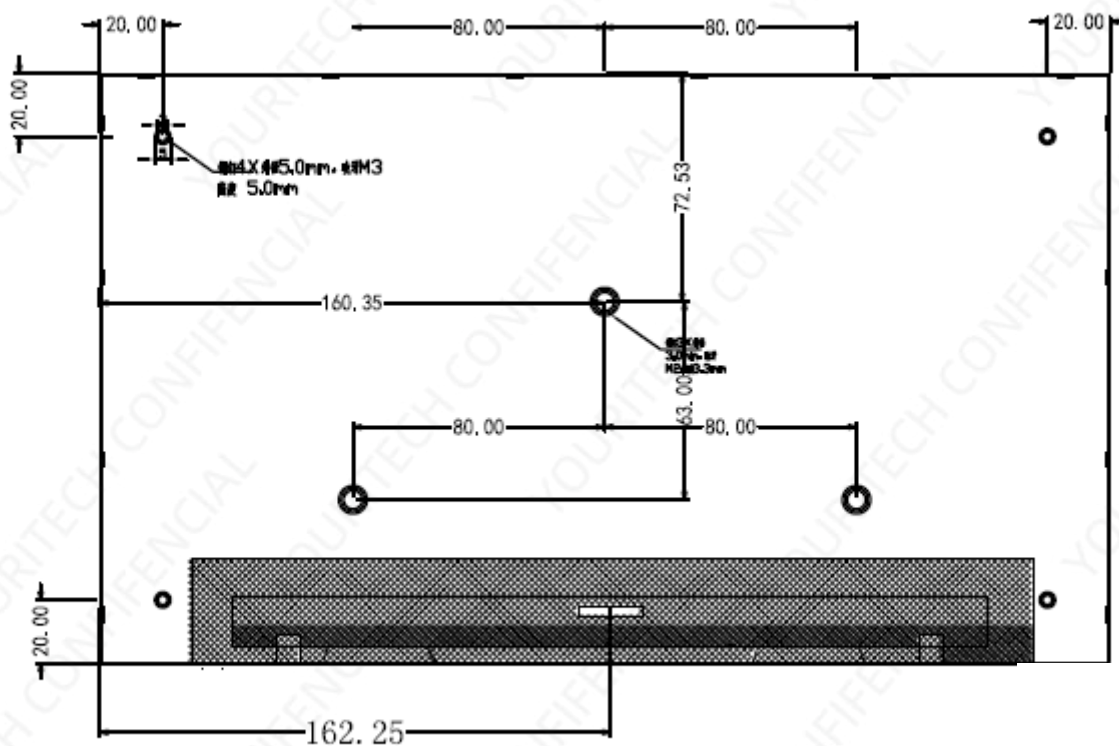


AUX differential pair



6. MECHANICAL DIMENSIONC





7. OPTICAL CHARACTERISTICS

7.1 Measurement Conditions

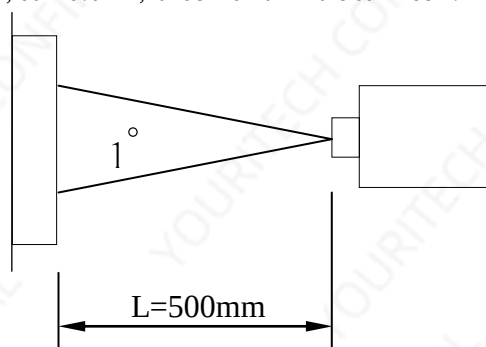
The test of Optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = $25 \pm 2^\circ\text{C}$) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0° . We refer to $\theta=0$ ($=03$) as the 3 o'clock direction (the "right"), $\theta=90$ ($=012$) as the 12 o'clock direction ("upward"), $\theta=180$ ($=09$) as the 9 o'clock direction ("left") and $\theta=270$ ($=06$) as the 6 o'clock direction ("bottom"). While scanning θ and/or Φ , the center of the measuring spot on the Display surface shall stay fixed. Optimum viewing angle direction is 6 o'clock.

7.2 Optical Specifications

$T_a = 25^\circ\text{C}$, $V_{CC} = 3.3\text{V}$

ITEM	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT	NOTE
Contrast Ratio	CR	Point-5	1000:1	1200:1			1.2.3
Luminance(CEN)	Lw	Point-5	800	1000		cd/m^2	1.3
Luminance Uniformity	L		70	80		%	1.3
Response Time (White - Black)	Tr +Tf	Point-5	-	-	30	ms	1.3.5
NTSC	-	Point-5	70	72	-	%	1.4
Viewing Angle	Vertical	Upper(θ)	-	85	-	Deg	1.4
		Down(θ)	-	85	-	Deg	1.4
	Horizontal	Left(θ)	-	85	-	Deg	1.4
		Right (θ)	-	85	-	Deg	1.4
Color Coordinate	White	Wx	0.264	0.304	0.344	-	1.3
		Wy	0.295	0.335	0.375		
	Red	Rx	0.549	0.589	0.629		
		Ry	0.301	0.341	0.381		
	Green	Gx	0.294	0.334	0.374		
		Gy	0.571	0.611	0.651		
	Blue	Bx	0.115	0.155	0.195		
		By	0.066	0.106	0.146		

Note1: Measure condition: $25^\circ\text{C} \pm 2^\circ\text{C}$, $60 \pm 10\% \text{RH}$, under 10 Lux in the dark room.BM-5A (TOPCON).



Note2: Definition of contrast ratio:

Contrast Ratio (CR)= (White) Luminance of ON $\div$ (Black) Luminance of OFF

Definition of luminance: Measure white luminance on the point 5 as figure.7-1

$\Delta L = [L(\text{MIN})/L(\text{MAX})] \times 100$

Note3: Definition of luminance: Measure white luminance on the point 5 as figure.7-1

Definition of Luminance Uniformity: Measure white luminance on the point1~9 as figure.7-1

$\Delta L = [L(\text{MIN})/L(\text{MAX})] \times 100$



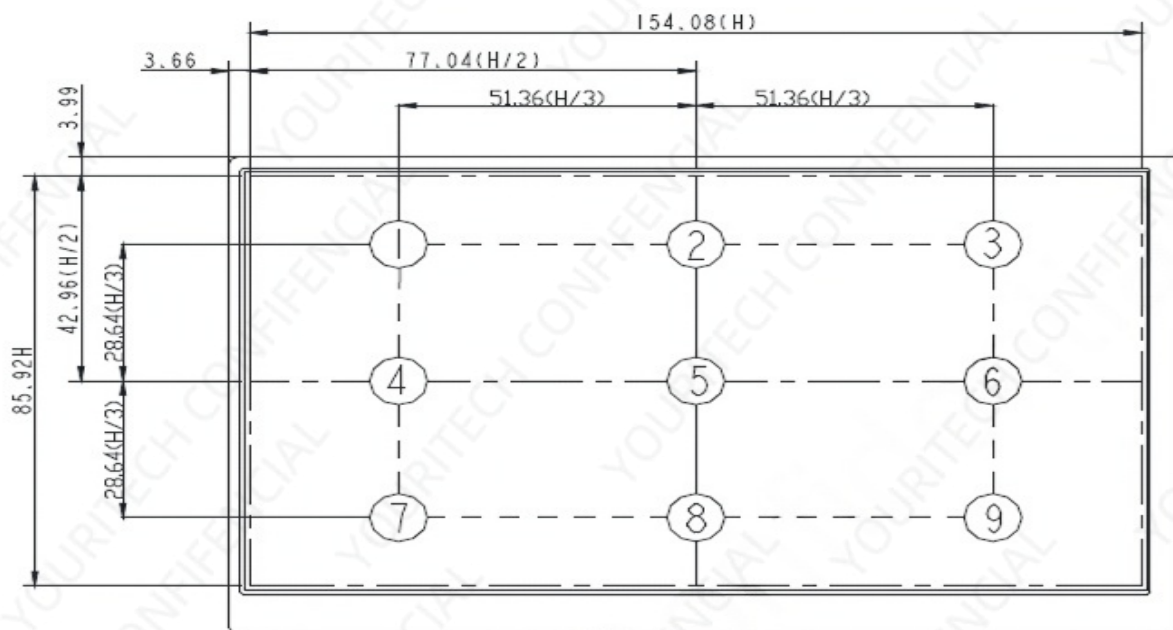


Fig.7-1 Measuring point

Note 4: Definition of Viewing Angle(θ), refer to Fig.7-2 as below:

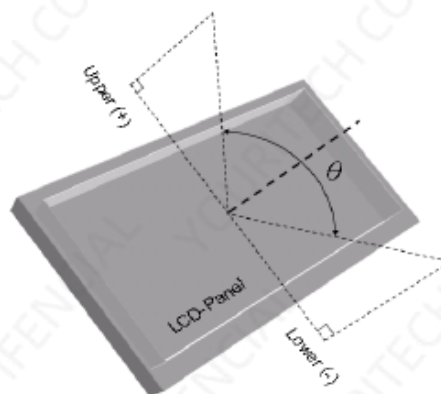
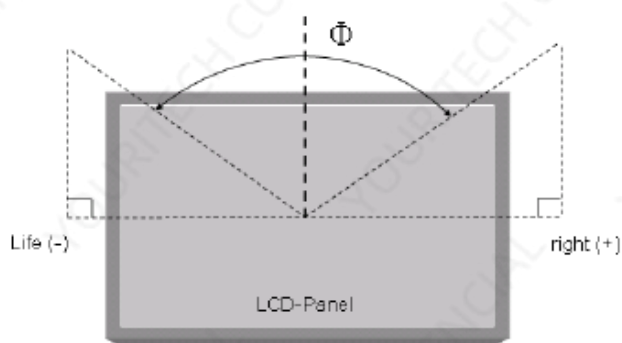


Fig.7-2 Definition of Viewing Angle

Note5: Definition of Response Time.(White-Black)

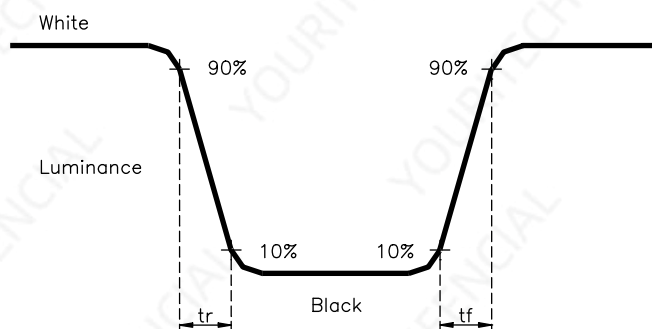


Fig.7-3 Definition of Response Time(White-Black)



8. RELIABILITY TEST ITEM

8.1 TEMPERATURE AND HUMIDITY

TEST ITEMS	CONDITIONS	NOTE
High Temperature Operation	80℃ ; 240hrs	
High Temperature Storage	80℃ ; 240hrs	
High Temperature High Humidity Operation	65℃ ; 90%RH ; 240hrs (No condensation)	
Low Temperature Operation	-20℃ ; 240hrs	
Low Temperature Storage	-30℃ ; 240hrs	
Thermal Shock	-30℃ (0.5hr)~80℃ (0.5hr); 100Cycles	Non- Operating
Image Sticking	25℃ ; 4hrs	Note 2
MTBF	30000 Hrs	

NOTE1:

All judgement of display are performed after temperature of panel return to room temperature.
Display function should be no change under normal operating condition.
Under no condensation of dew.
GTECH only guarantee the above 5 test items, and without guarantee the others.

NOTE1:

Condition of Image Sticking test: 25℃±2℃
Operation with test pattern sustained for 4 hrs, then change to mid-gray pattern immediately.
After 5 mins, the mura must be disappeared completely .

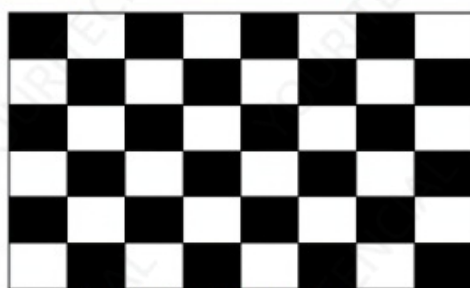
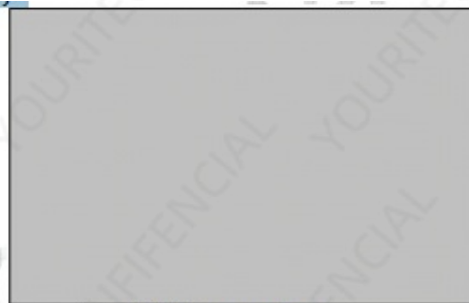


Image Sticking -pattern



Mid-Gray pattern

8.2 Shock and Vibration

ITEMS	CONDITIONS
Shock (Non-Operation)	- Shock level: 980m/s² (equal to 100G). - Waveform: 1/2 Sine wave, 6msec ±X; ±Y; ±Z; each axis 1 times
Vibration (Non-Operation)	- Frequency range: 8~33.3Hz - Stroke: 1.3mm - Vibration: sinusoidal wave, perpendicular axis (both x, z axis: 2Hrs, y axis 4Hrs). - Sweep : 2.9G, 33.3 Hz -400 Hz - Cycle: 15 min

8.3 Electrostatic Discharge

TEST ITEM	Conditions	NOTE
ESD test (operating)	Air Voltage: ±15KV Contact Voltage: ±8KV R: 330Ω C: 150pF 5 time , Surface of AA area 9 point ClassB	

Note

Class B , 有异常而可恢复, 比如闪屏, 因为整机ESD水平不仅与模组相关, 也与系统相关。此处承诺配合客户整机达到要求, 如需要进行ESD改善。



8.4 Judgment Standard

The Judgment of the above test should be made as follow:

Pass: Normal display image and no line defect.

Partial transformation of the module parts should be ignored.

Fail: No display image, function NG, or line defects.

9. WARRANTY

9.1 The period is within 12 months since the date of shipping out under normal using and storage conditions.

9.2 The warranty will be avoided in case of defect induced by customer.



10. APPEARANCE SPECIFICATION

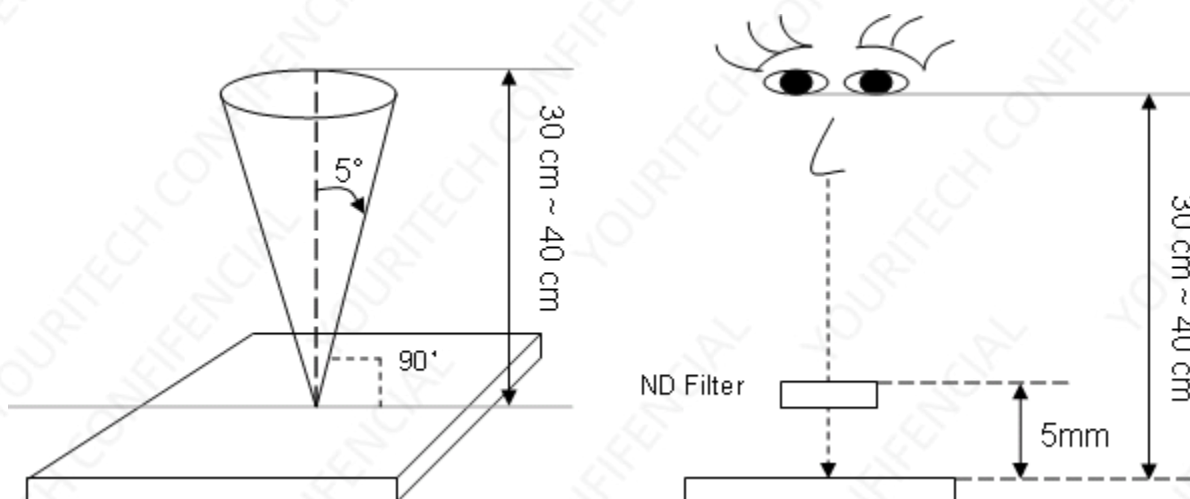
10.1.1 Inspection conditions

10.1.1.1 Inspection Distance : 35 ± 5 cm

10.1.1.2 View Angle :

(1) Inspection under operating condition: ±5

(2) Inspection under non-operating condition: ±45



10.1.2 Environment conditions :

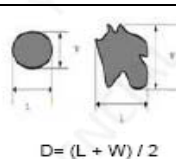
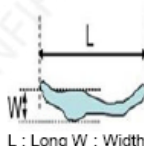
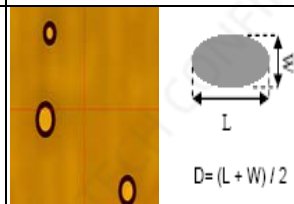
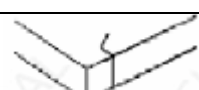
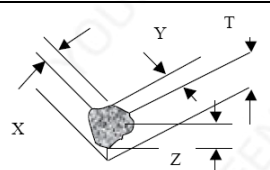
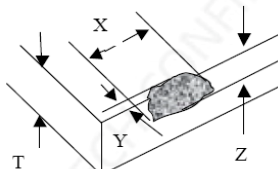
Ambient Temperature :	25±5℃
Ambient Humidity :	30~75%RH
Ambient Illumination	600~800 lux

10.2 Inspection Parameters

Appearance and Functional Inspection Criteria (D: diameter, L: length; W: width, Z: height, T: glass thickness, n: number)

Inspection item	Inspection standard			Description
No image	Prohibited			
Image abnormal	Prohibited			
Bright line	Prohibited			
Mura	It is acceptable that the defect can not be seen with 2% ND filter.			
Dot	Item	Acceptable Visible area	Total	
	Bright dot	3	6	
	Dark dot	5		
	Bright adjacent dots	1	1	
	Dark adjacent dots	2	2	



	Adjacent dots with a bright dot and a dark dot	2	2	
Foreign material in dot shape	SPEC (unit: mm)	Acceptable	 D= (L + W) / 2	
	D ≤ 0.5	Ignored		
	0.5<D ≤ 0.8, distance>5	n ≤ 5		
	D > 0.8	0		
Foreign material in line shape	SPEC(unit: mm)	Acceptable	 L : Long W : Width	
	W ≤ 0.05 and L ≤ 10	Ignored		
	0.05<W ≤ 0.1, L ≤ 10, distance >5	n ≤ 5		
	W>0.1 or L>10	0		
Contamination	It is acceptable if the dirt can be wiped.			
Inspection item	Inspection standard			Description
Scratch	SPEC (unit: mm)	Acceptable		
	W ≤ 0.05 and L ≤ 10	Ignored		
	0.05<W ≤ 0.08, L ≤ 10, distance >5	n ≤ 5		
	0.08<W ≤ 0.1, L ≤ 10, distance >5	n ≤ 3		
	W>0.1 or L>10	0		
Bubble	SPEC (unit: mm)	Acceptable	 D= (L + W) / 2	
	D ≤ 0.3	Ignored		
	Non visible area	Ignored		
	0.3<D ≤ 0.5, distance >5	n ≤ 5		
	D > 0.5	0		
Insufficient glue	SPEC (unit: mm)	Acceptable		
	Non visible area	Ignored		
	Visible area	0		
Cover & Sensor Crack	Prohibited			
Sensor angle missing & edge break	SPEC (unit: mm)	Acceptable		
	Damage circuit or effect function	0		
Cover/Sensor angle missing	SPEC (unit: mm)	Acceptable		
	X ≤ 3.0, Y ≤ 3.0, Z ≤ T	Ignored		
	X > 3.0, Y > 3.0, Z > T	0		
Cover/Sensor edge break	SPEC (unit: mm)	Acceptable		
	X ≤ 3.0, Y ≤ 3.0, Z ≤ T	Ignored		
	X > 3.0, Y > 3.0, Z > T	0		
Ink	SPEC (unit: mm)	Acceptable		
	word unclear, inverted, mistake, break line	0		
Bubble under protection film	SPEC (unit: mm)	Acceptable		
	NA			
Function	Prohibited			
If FPC was bended and the back turns to white, classify it to be NG,otherwise,classify it to be OK				



10.3 Sampling Condition

Unless otherwise agree in written, the sampling inspection shall be applied to the incoming inspection of customer.

Lot size: Quantity of shipment lot per model.

Sampling type: normal inspection, single sampling

Sampling table: ISO 2859

Inspection level: Level II

Class of defects	Definition		
	Major	AQL 0.65	It is a defect that is likely to result in failure or to reduce materially the usability of the product for the intended function.
	Minor	AQL 1.5	It is a defect that will not result in functioning problem with deviation classified.

11. QUALITY ASSURANCE

11.1 Test Condition

11.1.1 Temperature and Humidity(Ambient Temperature)

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

Humidity : $65 \pm 5\%$

11.1.2 Operation

Unless specified otherwise, test will be conducted under function state.

11.1.3 Container

Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

11.1.4 Test Frequency

In case of related to deterioration such as shock test. It will be conducted only once.

