



MODEL NO. : TS028HAARD02-00
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- Preliminary Product Specification
- Final Product Specification

Customer : _____

Approved by	Notes

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This technical specification is subjected to change without notice



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Record of Revision

Rev	Issued Date	Description
1.0	Nov,18, 2007	Preliminary release
1.1	Dec,11,2007	Modified RA conditions
1.2	Jan,14,2008	Modified RA conditions

**1 GENERAL SPECIFICATIONS**

Feature		Spec
Display Spec.	Size	2.83"
	Resolution	240(RGB) X 320
	Interface	RGB
	Color Depth	18bit
	Technology type	a-si
	Pixel pitch (mm)	0.18 x 0.18
	Display colors	262k
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment	HC, 3H
	Gray Scale Inversion Direction	12 o'clock
Mechanical Characteristics	LCM (W x H x D) (mm)	50.0x69.2x2.65
	Active Area(mm)	43.2 x 57.6
	With /Without TSP	Without TSP
	Weight (gram)	TBD.
	LED Numbers	4 LEDs serial

Note 1: Requirements on Environmental Protection: RoHS



2 INPUT/OUTPUT TERMINALS

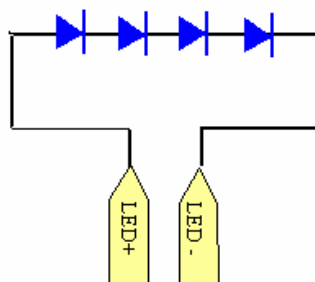
2.1 TFT LCD Panel

No	Symbol	I/O	Description	Comment
1	DENB	I	Data Enable	
2	DCK	I	Data sampling clock signal	
3	RST	I	RESET(L: Reset, H: Active)	
4	NC	-	-	
5	GND	P	Ground	
6	NC	-	-	
7	NC	-	-	
8	GND	P	Ground	
9	NC	-	-	
10	NC	-	-	
11	NC	-	-	
12	NC	-	-	
13	GND	P	Ground	
14	NC	-	-	
15	NC	-	-	
16	NC	-	-	
17	NC	-	-	
18	NC	-	-	
19	GND	P	Ground	
20	VDD	P	Power Supply of Digital	
21	VDD	P	Power Supply of Digital	
22	NC	-	-	
23	NC	-	-	
24	NC	-	-	
25	GND	P	Ground	
26	NC	-	-	
27	NC	-	-	
28	VDD	P	Power Supply of Digital	
29	DB17	I	RED data bit R5	
30	DB16	I	RED data bit R4	
31	DB15	I	RED data bit R3	
32	DB14	I	RED data bit R2	
33	DB13	I	RED data bit R1	



34	DB12	I	RED data bit R0	
35	DB11	I	RED data bit G5	
36	DB10	I	RED data bit G4	
37	DB9	I	RED data bit G3	
38	DB8	I	RED data bit G2	
39	DB7	I	RED data bit G1	
40	DB6	I	RED data bit G0	
41	DB5	I	RED data bit B5	
42	DB4	I	RED data bit B4	
43	DB3	I	RED data bit B3	
44	DB2	I	RED data bit B2	
45	DB1	I	RED data bit B1	
46	DB0	I	RED data bit B0	
47	NC	-	-	
48	SPI_CS	I	SPI Chip Select	
49	SPI_SCL	I	SPI Clock	
50	SPI_SDI	I	SPI Serial Data Input	
51	SDO	O	SPI Serial Data Output	
52	HSYNC	I	Horizontal sync signal	
53	GND	P	Ground	
54	NC	-	-	
55	NC	-	-	
56	VSYNC	I	Vertical sync signal	
57	LED+	-	High Voltage Power Supply for LED	NOTE 2-1
58	LED+	-	High Voltage Power Supply for LED	NOTE 2-1
59	LED-	-	High Voltage Power Supply for LED	NOTE 2-1
60	LED-	-	High Voltage Power Supply for LED	NOTE 2-1
61	NC	-	-	

Note 2-1: The figure below shows the connection of backlight LED.



**3. ABSOLUTE MAXIMUM RATINGS**

Ta = 25°C

Item	Symbol	MIN	MAX	Unit	Remark
Supply Voltage	VCC	-0.3	4.6	V	
Analog Supply Voltage	VCI	-0.3	4.6	V	
Input Signal Voltage	/CS,RS,/WR,/RD, /RESET, DB[0 :15]	-0.3	VCC+0.3	V	
Back Light Forward Current	ILED		25	mA	One LED
Operating Temperature	TOPR	-20	70	°C	
Storage Temperature	TSTG	-30	80	°C	



4 ELECTRICAL CHARACTERISTICS

4.1. Driving TFT LCD Panel

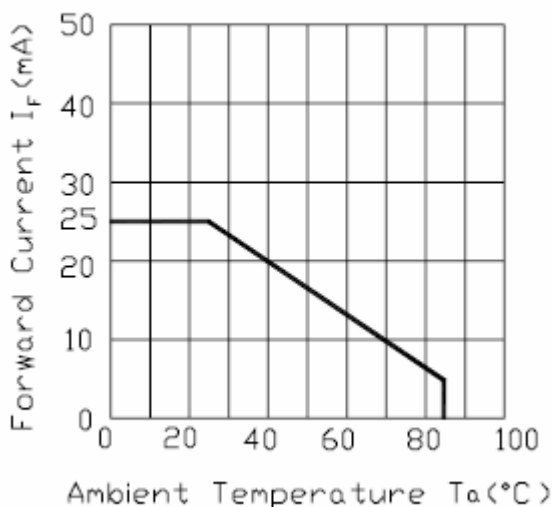
GND=0V, Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Logic Supply Voltage	VCC	2.5	2.8	3.3	V	
Analog Supply Voltage	VCI	2.5	2.8	3.3	V	
Input Signal Voltage	Low Level	V _{IL}	-0.3	0.2*VCC	V	
	High Level	V _{IH}	0.8*VCC	VCC	V	
Output Signal Voltage	Low Level	V _{IL}		0.2*VCC	V	
	High Level	V _{IH}	0.8*VCC		V	
(Panel+LSI) Power Consumption	Black Mode (60Hz)		TBD		mW	
	8 color Mode		TBD		mW	
	Sleeping Mode		TBD		mW	

4.2 Driving Backlight Ta=25°C

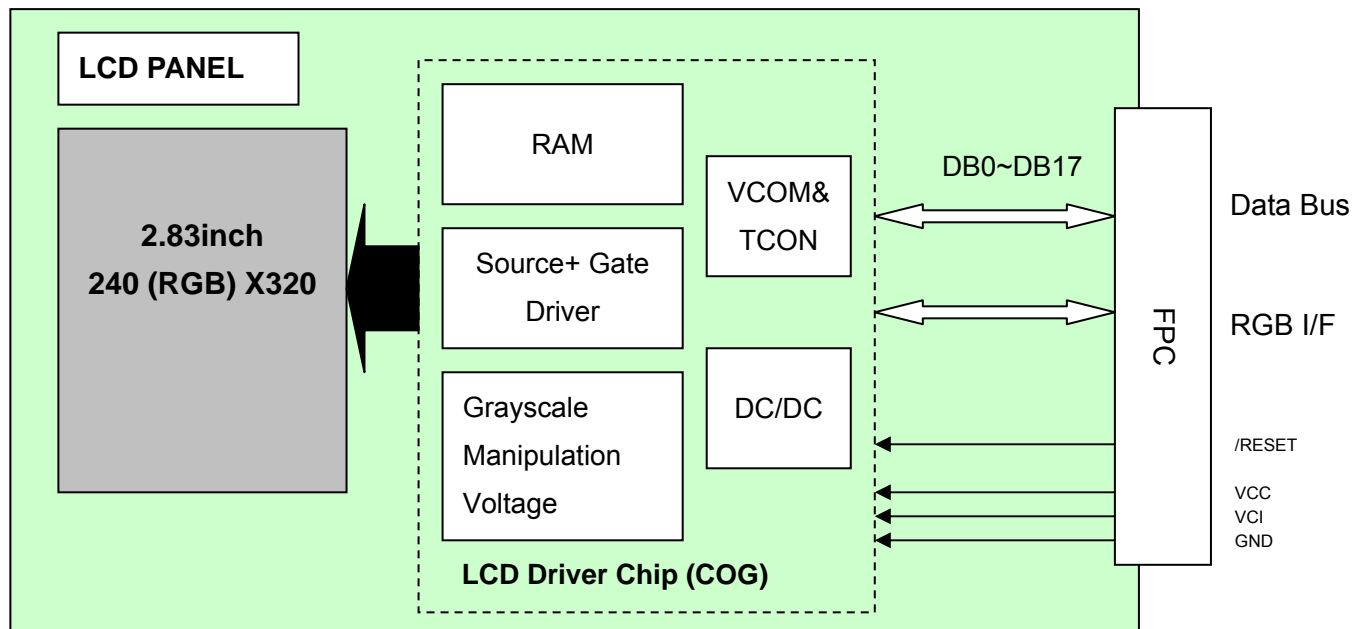
Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I _F	--	20	25	mA	
Forward Current Voltage	V _F	---	3.2	---	V	
Backlight Power Consumption	W _{BL}	--	256	--	mW	

Forward Current Derating Curve





4.3. Block Diagram





5. INTERFACE TIMING

TBD



6 OPTICAL CHARACTERISTICS

6.1 Optical Specification

Ta=25°C

Item	Symbol	Condition	Min	Typ.	Max.	Unit	Remark
View Angles	θT	$CR \geq 10$	30	40		Degree	Note 2
	θB		10	20			
	θL		30	40			
	θR		30	40			
Contrast Ratio	CR	$\theta = 0^\circ$		300			Note3
Response Time	Tr	25°C		35		ms	Note4
	Tf						
Chromaticity	White	x	Brightness is on	0.26	0.31	0.36	Note5
		y		0.28	0.33	0.38	
	RED	x			TBD		
		y			TBD		
	GREEN	x			TBD		
		y			TBD		
	BLUE	x			TBD		
		y			TBD		
Uniformity	U		75	80		%	Note6
NTSC				55		%	Note 5
Luminance (with TSP)	L		150	225		cd/m ²	Note7

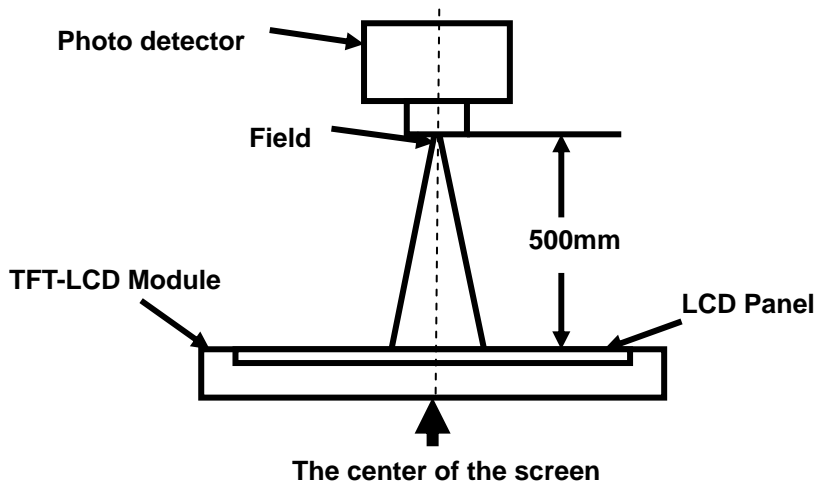
Test Conditions:

1. Vcc=2.8V $I_L = 20\text{mA}$ (Backlight current), the ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.



Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detector	Field
Contrast Ratio	SR-3	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by LCD5200.

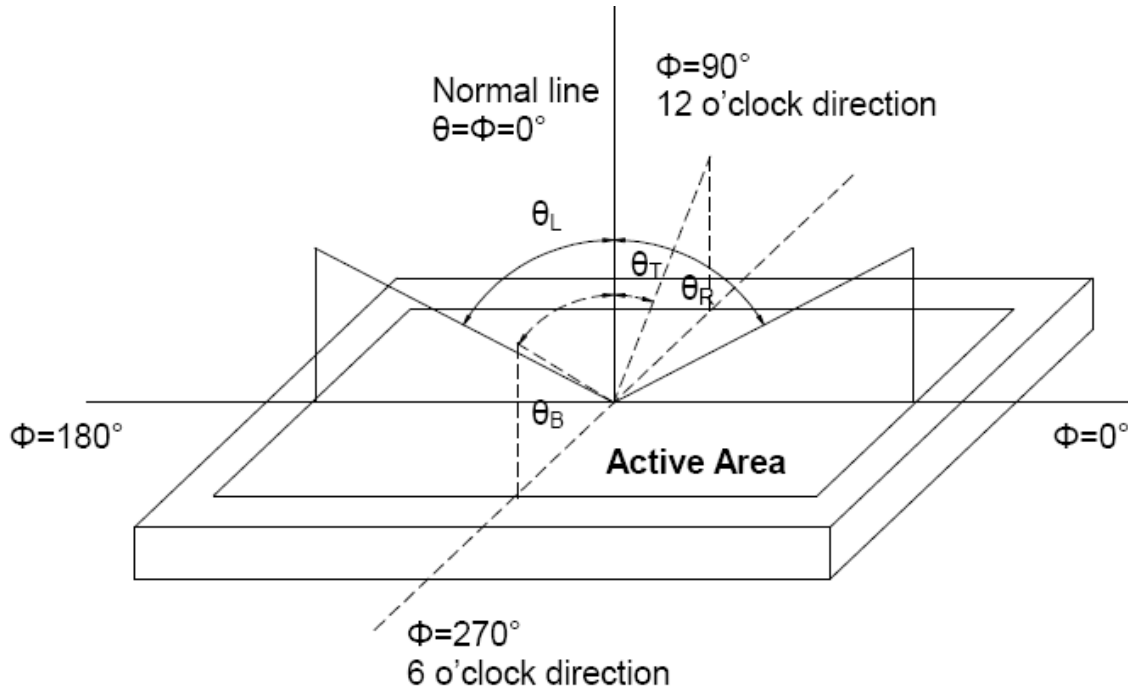


Fig. 1 Definition of viewing angle



Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

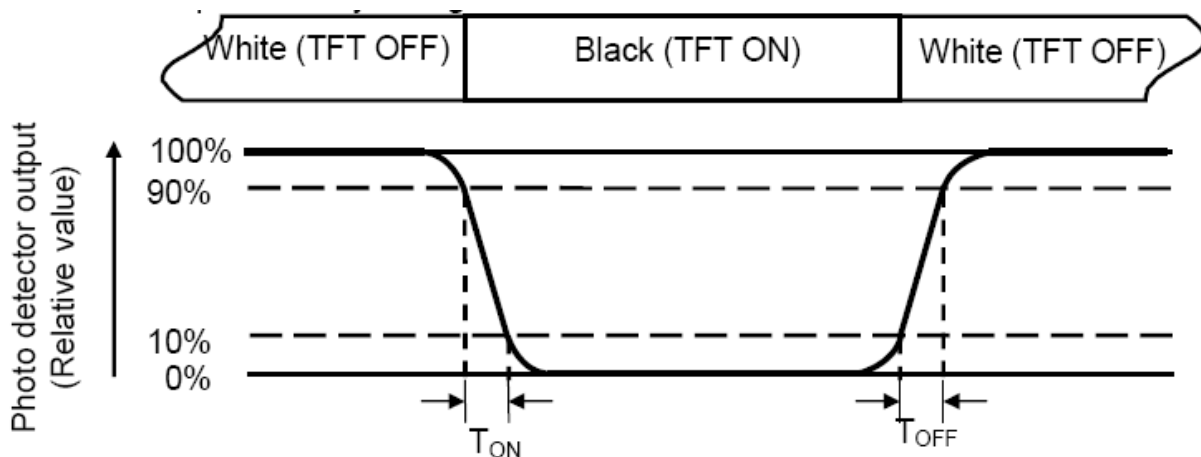
“White state “:The state is which the LCD is driven by V_{white} .

“Black state”: The state is which the LCD is driven by V_{black} .

V_{white} : To be determined V_{black} : To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.



Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity}(U) = L_{\min} / L_{\max}$$

L-----Active area length W----- Active area width

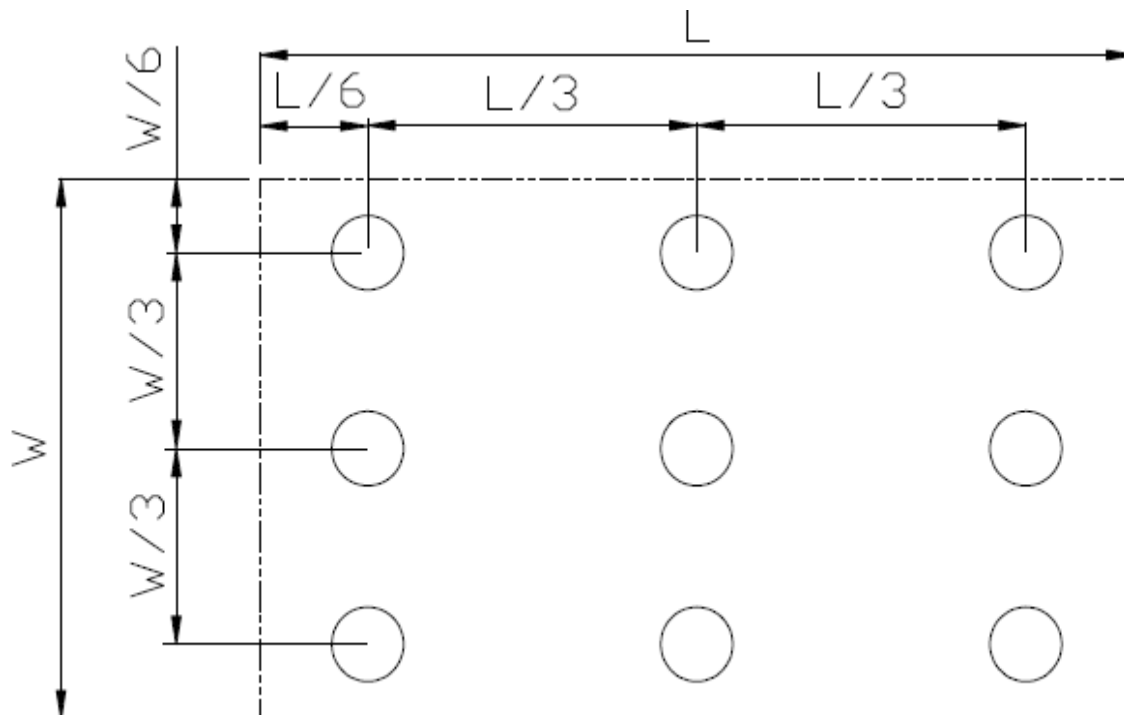


Fig. 2 Definition of uniformity

L_{max}: The measured maximum luminance of all measurement position.

L_{min}: The measured minimum luminance of all measurement position.

Note 7: Definition of Luminance :

Measure the luminance of white state at center point



5 Environmental / Reliability Tests

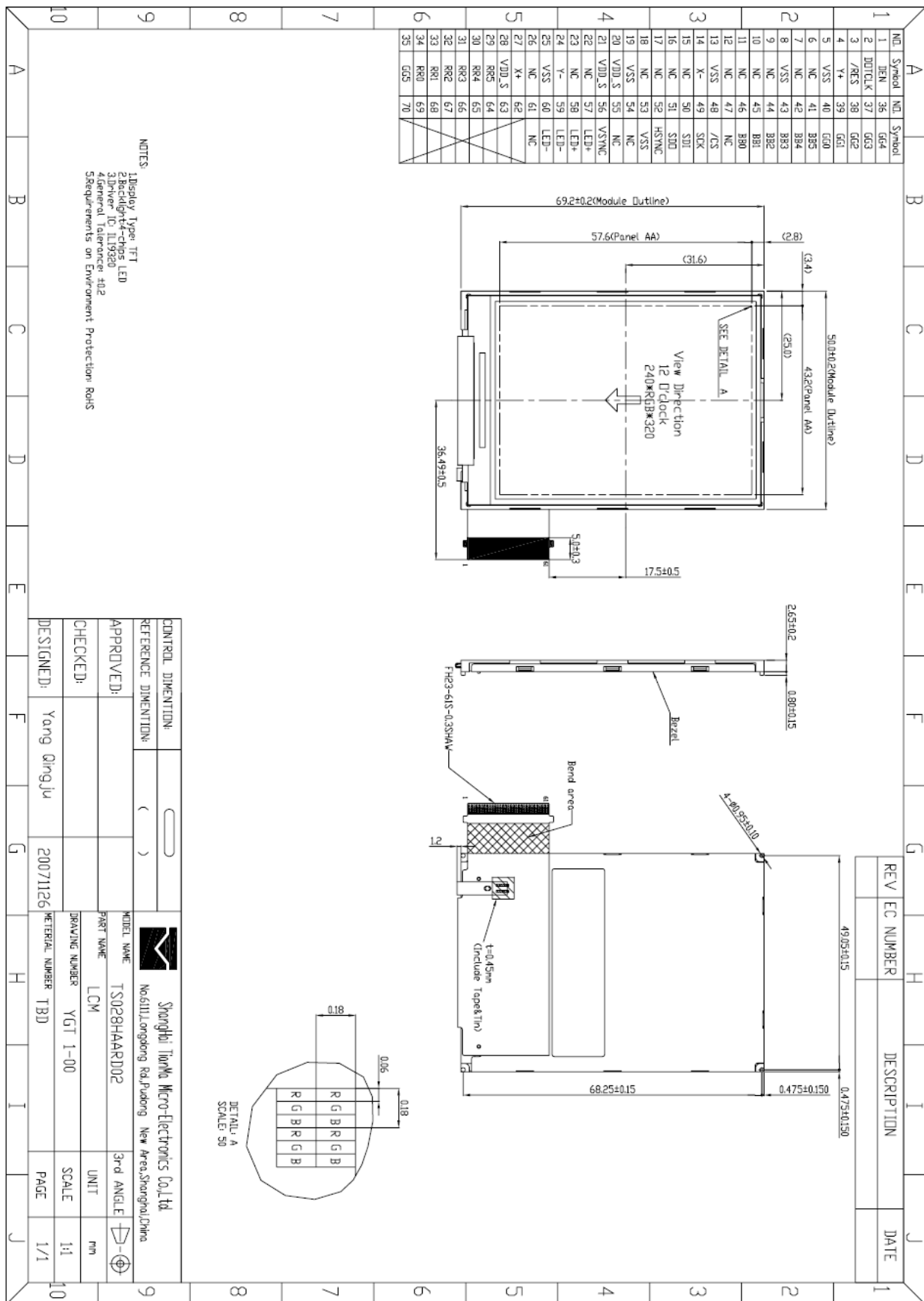
No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts=+70°C, 240hrs	Note1 IEC60068-2-2,GB2423.2—89
2	High Temperature & High Humidity storage	+60°C, 90% RH max,240 hours	IEC60068-2-3, GB/T2423.3—2006
3	Low Temperature Operation	Ta=-20°C, 240hrs	Note 2, IEC60068-2-1 GB2423.1—89
4	High Temperature Storage (non-operation)	Ta=+80°C, 240hrs	IEC60068-2-2, GB2423.2—89
5	Low Temperature Storage (non-operation)	Ta=-30°C, 240hrs	IEC60068-2-1 GB2423.1—89
6	Thermal Shock (non-operation)	-30°C 30 min~+80°C 30 min, Change time:5min, 30 Cycle	Start with cold temperature, end with high temperature IEC60068-2-14,GB2423.22—87
7	Electro Static Discharge (operation)	C=150pF, R=330Ω, 5points/panel Air:±8KV, 5times;Contact:±4KV, 5 times; (Environment: 15°C ~35°C, 30%~60%, 86Kpa~106Kpa)	IEC61000-4-2 GB/T17626.2—1998
8	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)	IEC60068-2-6 GB/T2423.10—1995
9	Shock (non-operation)	60G 6ms, ±X,±Y,±Z 3times for each di- rection	IEC60068-2-27 GB/T2423.5—1995
10	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/2423.8—1995

Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of samples.



8. MECHANICAL DRAWING





9. Packing Drawing

TBD



10. Precautions for Use of LCD Modules

10.1 Handling Precautions

10.1.1. The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

10.1.2. If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

10.1.3. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

10.1.4. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

10.1.5. If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

— Isopropyl alcohol

— Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

— Water

— Ketone

— Aromatic solvents

10.1.6. Do not attempt to disassemble the LCD Module.

10.1.7. If the logic circuit power is off, do not apply the input signals.

10.1.8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

a. Be sure to ground the body when handling the LCD Modules.

b. Tools required for assembly, such as soldering irons, must be properly ground.

c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

10.2 Storage precautions

10.2.1. When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

10.2.2. The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0°C ~ 40°C Relatively humidity: ≤80%

10.2.3. The LCD modules should be stored in the room without acid, alkali and harmful gas.

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10.3 Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.