

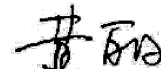
PRODUCT SPECIFICATION

CDTECH Model: **S035HQ93ES**

CUSTOMER Model: **-**

Description: **3.5" TFT-LCD Module**

Version: **1.0**

CDTECH	PREPARED BY	CHECKED BY	APPROVED BY
SIGNATURE			
DATE	2023.3.1	2023.3.1	2023.3.1

CUSTOMER APPROVAL	SIGNATURE	DATE



Record of Revisions

[illegible]



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1. General Specifications

1.1 LCM General Information

Item	Specification	Unit
LCD Size	3.5	inch
Number of Pixels	320 (H) RGB x 240 (V)	pixels
Display Mode	Normally Black	-
Viewing Direction	Free	o' clock
Interface	RGB	-
Display Colors	16.7M	colors
Outline Dimension	76.90 (H) x 63.90 (V) x 3.26 (D)	mm
Active Area	70.08 (H) x 52.56 (V)	mm
Pixel Pitch	0.219 (H) x 0.219 (V)	mm
Driver IC	ST7272A	-
Operation Temperature	-30~85	°C
Storage Temperature	-30~85	°C

Note1:Requirements on environmental protection RoHS compliant.

2. Absolute Maximum Ratings

Item	Symbol	MIN.	MAX.	Unit	Note
Analog Supply voltage	VDD	-0.3	5.0	V	Note 1

Note 1:Permanent damage may occur to the LCD module if beyond this specification.

Functional operation should be restricted to the conditions described under normal operating conditions.

3. Electrical Characteristics

3.1 Recommended Operating Condition for TFT LCD

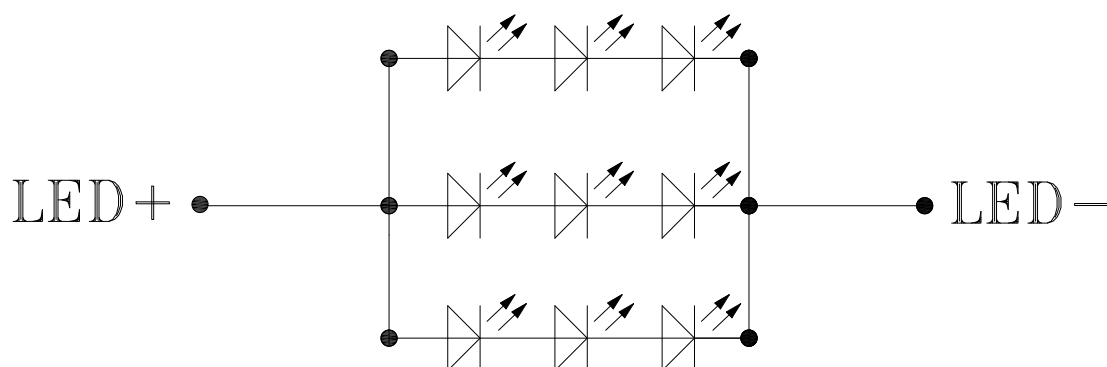
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Analog Supply voltage	VDD	3.0	3.3	3.6	V	
Analog supply current	I _{VDD}	-	TBD	-	mA	VDD=3.3V
Logic input voltage	V _{IH}	0.7*VDD	-	VDD	V	
	V _{IL}	GND	-	0.3*VDD	V	

3.2 Recommended Driving Condition for Backlight

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Driving Current	I _F	-	60	-	mA	
Driving Voltage	V _F	8.1	-	10.2	V	
Power consumption	W _{BL}	0.486	-	0.612	W	
LED Life-Time	N/A	-	50,000	-	Hours	Ta=25°C Note 1

Note 1: LED lifetime is defined as the module brightness decay 50% of original brightness at Ta=25 degree, typical current.

Note 2: LED circuit :



4. Interface Pin Assignment

4.1 LCM Pin Assignment

Recommended connector: FH12-54S-0.5SH manufactured by HIROSE

No.	Symbol	Description
1	VBL-	Power for LED backlight (Cathode)
2	VBL-	Power for LED backlight (Cathode)
3	VBL+	Power for LED backlight (Anode)
4	VBL+	Power for LED backlight (Anode)
5	Y1	Touch panel up side (NC)
6	X1	Touch panel right side (NC)
7	NC	No connection
8	RESET	Global reset pin
9	NC	No connection
10	NC	No connection
11	NC	No connection
12-19	B0-B7	Data bus
20-27	G0-G7	Data bus
28-35	R0-R7	Data bus
36	HSYNS	Horizontal sync input. Negative polarity
37	VSYN	Vertical sync input. Negative polarity
38	DOTCLK	Dot-clock signal and oscillator source
39	NC	No connection
40	NC	No connection
41	VDD	Power supply
42	VDD	Power supply
43	Y2	Touch panel bottom side (NC)
44	X2	Touch panel left side (NC)
45	NC	No connection
46	NC	No connection
47	NC	No connection
48	NC	No connection
49	NC	No connection
50	NC	No connection
51	NC	No connection
52	DEN	Display enable signal
53	GND	Ground
54	GND	Ground

5. Interface Characteristics

5.1 AC Electrical Characteristics

Test Condition: (VDD=VDDP=3.3V, VDDA=5.0V, GND=GNDA=GNDP=0V, TA= 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
System Operation Timing						
VDD power source slew time	T _{POR}			1000	us	From 0V to 90% VDD
RSTB active pulse width	T _{RSTB}	40			us	VDD = 3.3V
Input Output Timing						
CLKIN clock time	T _{clk}	33.3/125	-	-	ns	Please refer to timing table(p.32)
HSD to CLKIN	T _{hc}	-	-	1	CLKIN	
HSD width	T _{hwh}	1	-	-	CLKIN	
VSD width	T _{vwh}	1	-	-	Th	
HSD period time	T _h	60	63.56	67	us	
VSD setup time	T _{vst}	8	-	-	ns	
VSD hold time	T _{vhd}	10	-	-	ns	
HSD setup time	T _{hst}	8	-	-	ns	
HSD hold time	T _{hhd}	10	-	-	ns	
Data set-up time	T _{dsu}	8	-	-	ns	DIN[23:0] to CLKIN
Data hold time	T _{dhd}	10	-	-	ns	DIN[23:0] to CLKIN
DEN setup time	T _{esd}	12	-	-	ns	DEN to CLKIN
Time that VSD to 1 st line data input	T _{vs}	2	13	127	Th	@CCIR601 / 8bit RGB HV mode Control by HDLY[6:0] setting T _{vs} = HDLY[6:0]
Time that CCIR_V to 1 st line data input	T _{vs}	12	20	28	Th	@CCIR656 NTSC mode Control by HDLY[6:0] setting T _{vs} = HDLY[6:0]
Time that CCIR_V to 1 st line data input	T _{vs} 17 25 33 Th					@CCIR656 PAL mode Control by HDLY[6:0] setting T _{vs} = HDLY[6:0]
Time that VSD to 1 st line data input	T _{vs}	2	13	127	Th	@24bit RGB HV mode Control by HDLY[6:0] setting T _{vs} = HDLY[6:0]
Source output stable time 1	T _{st}	-	25	30	us	96% final, CL=30pF, RL=2K
Gate output stable time	T _{gst}	-	500	1000	ns	96% final, CL=40pF
VCOMOUT output stable time	T _{cst}	-	4	8	us	96% final, CL=33nF, RL=100ohm
3-wire serial communication AC timing						
Serial clock	T _{spck}	320	-	-	ns	
SPCK pulse duty		40	50	60	%	T _{ckh} / T _{spck}
Serial data setup time	T _{isu}	120	-	-	ns	
Serial data hold time	T _{ihd}	120	-	-	ns	
Serial clock high/low	T _{ckh/l}	120	-	-	ns	
Chip select distinguish	T _{cd}	1	-	-	us	
SPENB to VSD	T _{cv}	1	-	-	us	
SPENB input setup time	T _{eck}	150	-	-	ns	
SPENB input hold time	T _{cke}	150	-	-	ns	

5.2 DC Electrical Characteristics

Recommended Operating Range

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Supply Voltage	VDD	3.0	3.3	3.6	V	
IO Supply Voltage	VDDI	3.0	-	3.6	V	
Charge Pump Supply Voltage	PVDD	3.0	3.3	3.6	V	

DC Characteristics for Digital Circuit

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Logic-High Input Voltage	V _{ih}	0.7VDDI	-	VDDI	V	
Logic-Low Input Voltage	V _{il}	DGND	-	0.3VDDI	V	
Logic-High Output Voltage	V _{oh}	VDDI-0.4	-	VDDI	V	
Logic-Low Output Voltage	V _{ol}	DGND	-	DGND+0.4	V	

DC Characteristics for Analog Circuit

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Positive High-Voltage Power	V _{GH}	13	15	16.5	V	No Load@ FR=60Hz
Negative High-Voltage Power	V _{GL}	-7	-10	-11	V	
Output Voltage Deviation	V _{od}	-	±35	±45	mV	
Standby Current	I _{sc}	-		50	uA	
Operation Current	I _{oc}	-	20		mA	

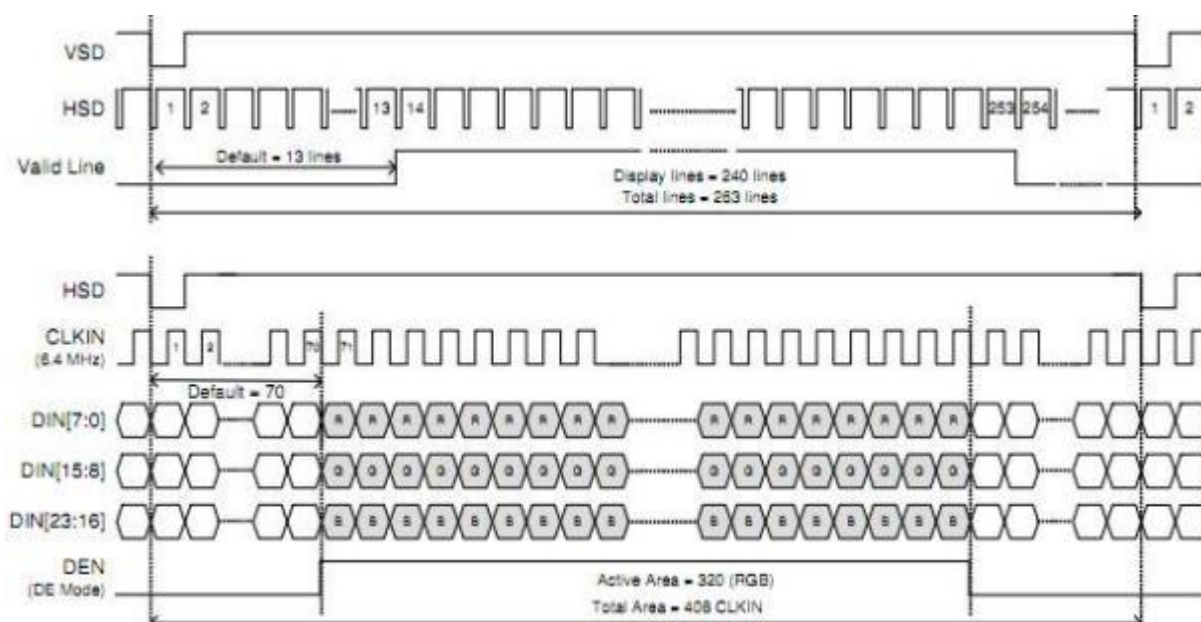
5.3 Bit RGB Mode

Parallel 24-bit RGB Input Timing (PVDD=VDD=VDDI= 3.3V, AGND= 0V, TA=25°C)

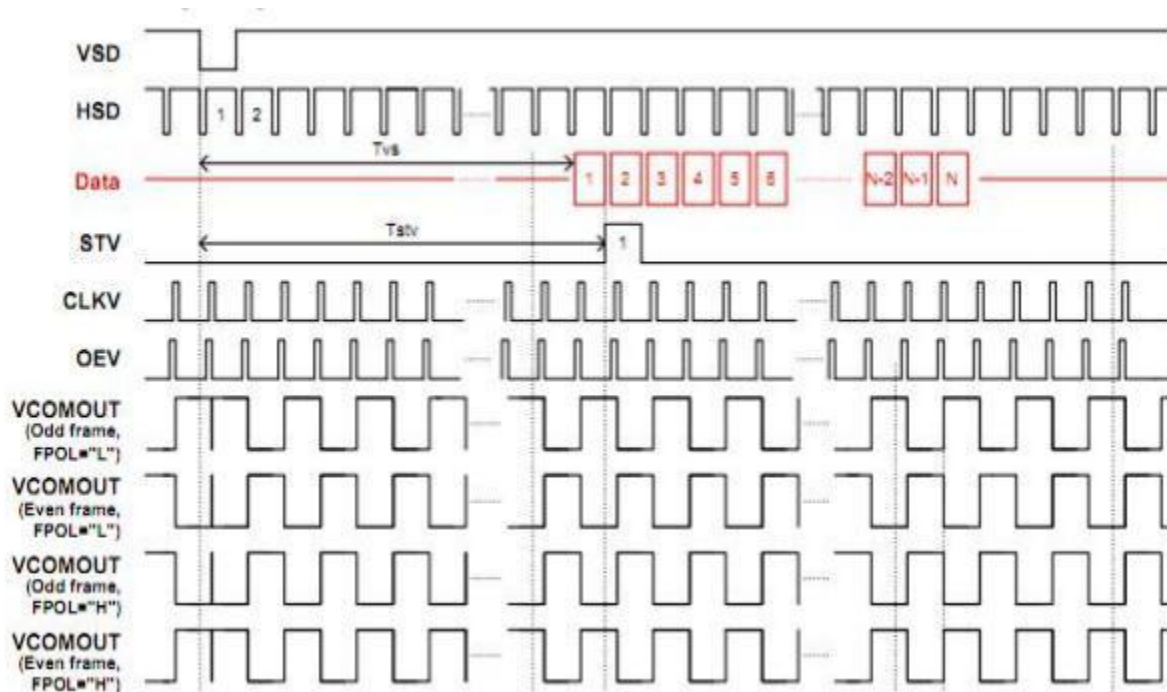
Parallel 24-bit RGB Input Timing Table						
Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK Frequency	Fclk	5	6	8	MHz	
DCLK Period	Tclk	125	167	200	ns	
HSYNC	Period Time	Th	325	371	438	DCLK
	Display Period	Thdisp		320		DCLK
	Back Porch	Thbp	3	43	43	DCLK SYNC mode back porch control by H_BLANKING[7:0] setting Thbp= H_BLANKING[7:0]
	Front Porch	Thfp	2	8	75	DCLK
	Pulse Width	Thw	2	4	43	DCLK
VSYNC	Period Time	Tv	244	260	289	HSYNC
	Display Period	Tvdisp		240		HSYNC
	Back Porch	Tvbp	2	12	12	HSYNC SYNC mode back porch control by V_BLANKING[7:0] setting Tvbp= V_BLANKING[7:0]
	Front Porch	Tvfp	2	8	37	HSYNC
	Pulse Width	Tvw	2	4	12	HSYNC

Note: It is necessary to keep Tvbp =12 and Thbp =43 in sync mode. DE mode is unnecessary to keep it.

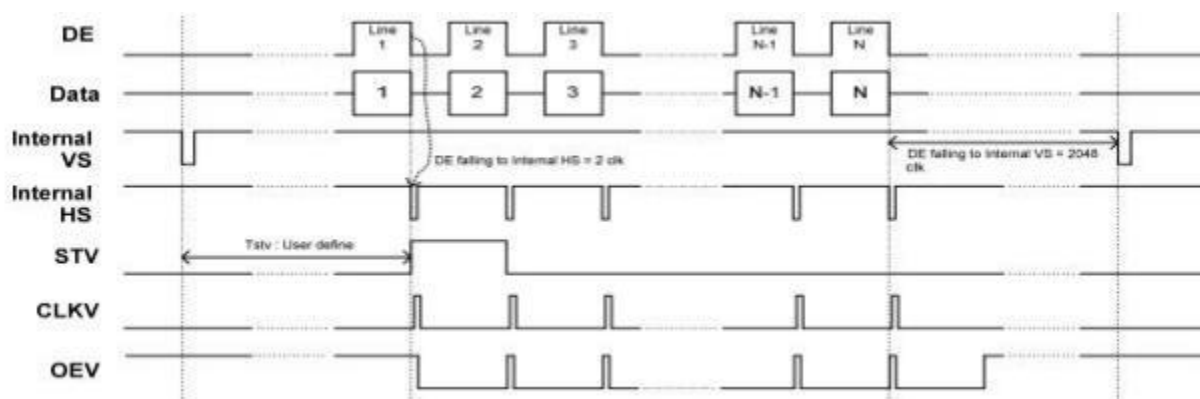
5.4 Input Data Timing



5.5 Vertical Timing Diagram (HV Mode)



5.6 Vertical Timing Diagram (DE Mode)

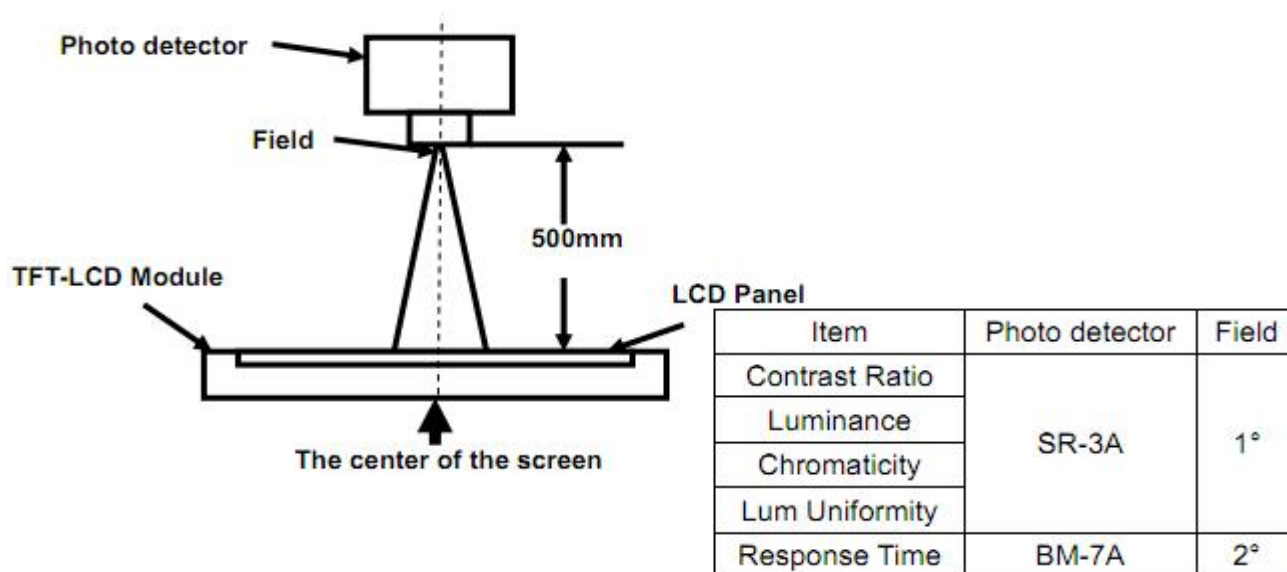


6. Optical Specifications

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR≥10) B/L ON	θ_T	$\Phi=90^\circ$ (12 o'clock)	70	80	-	deg	Note2
	θ_B	$\Phi=270^\circ$ (6 o'clock)	70	80	-	deg	Note2
	θ_L	$\Phi=180^\circ$ (9 o'clock)	70	80	-	deg	Note2
	θ_R	$\Phi=0^\circ$ (3 o'clock)	70	80	-	deg	Note2
Response Time	T_{ON}	Normal $\theta=\Phi=0^\circ$	-	15	20	msec	Note4
	T_{OFF}		-	15	20	msec	Note4
Contrast Ratio	CR		640	800	-	-	Note1 Note3
Color Chromaticity	W_X		0.267	0.317	0.367	-	Note1 Note5
	W_Y		0.289	0.339	0.389	-	Note1 Note5
Luminance	L		800	1000	-	cd/m ²	Note1 Note7
Luminance Uniformity	Y_U		75	80	-	%	Note1 Note6
NTSC	-		55	60	-	%	-

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.



Note 2: Definition of viewing angle range and measurement system

Viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).

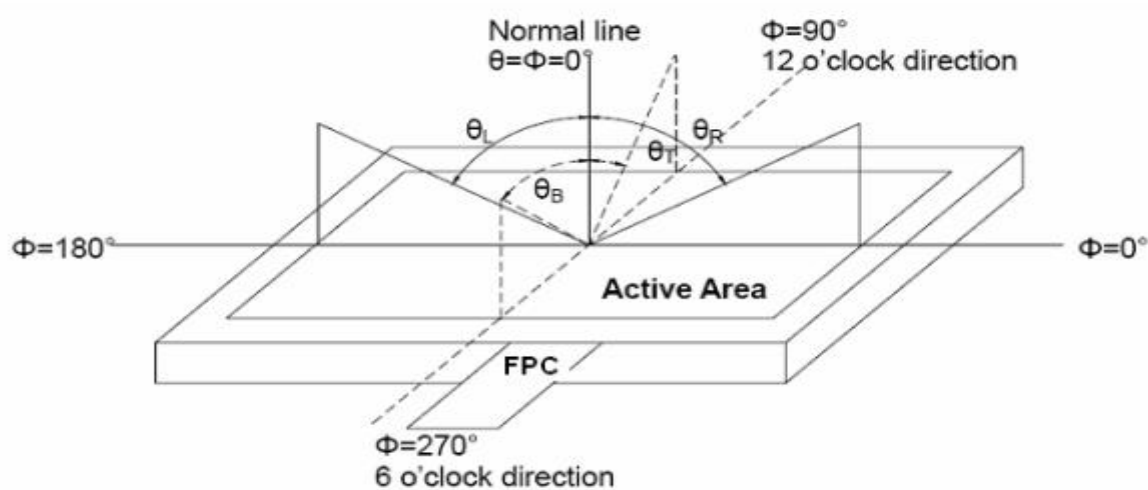


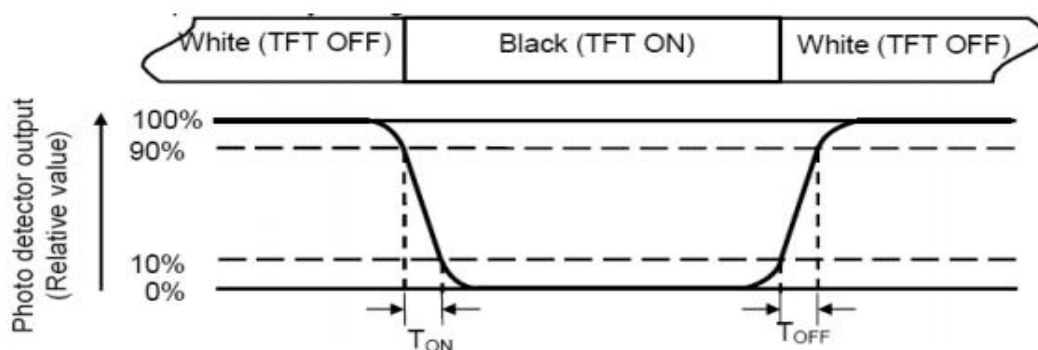
Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

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

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 (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) 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

The luminance uniformity in surface luminance is determined by measuring luminance at each test position 1 through n, and then dividing the maximum luminance of n points luminance by minimum luminance of n points luminance. For more information see FIG.2.

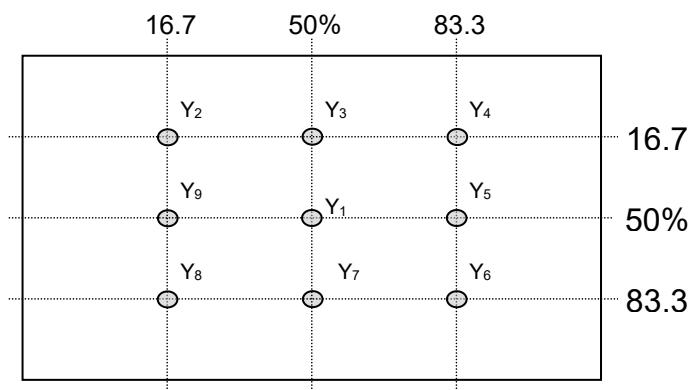


Fig. 2 Definition of points

Note 7: Definition of Luminance (Refer Fig. 2)

Surface luminance is the luminance with all pixels displaying white.

L_v = Average Surface Luminance with all white pixels($P_1, P_2, P_3, \dots, P_n$).

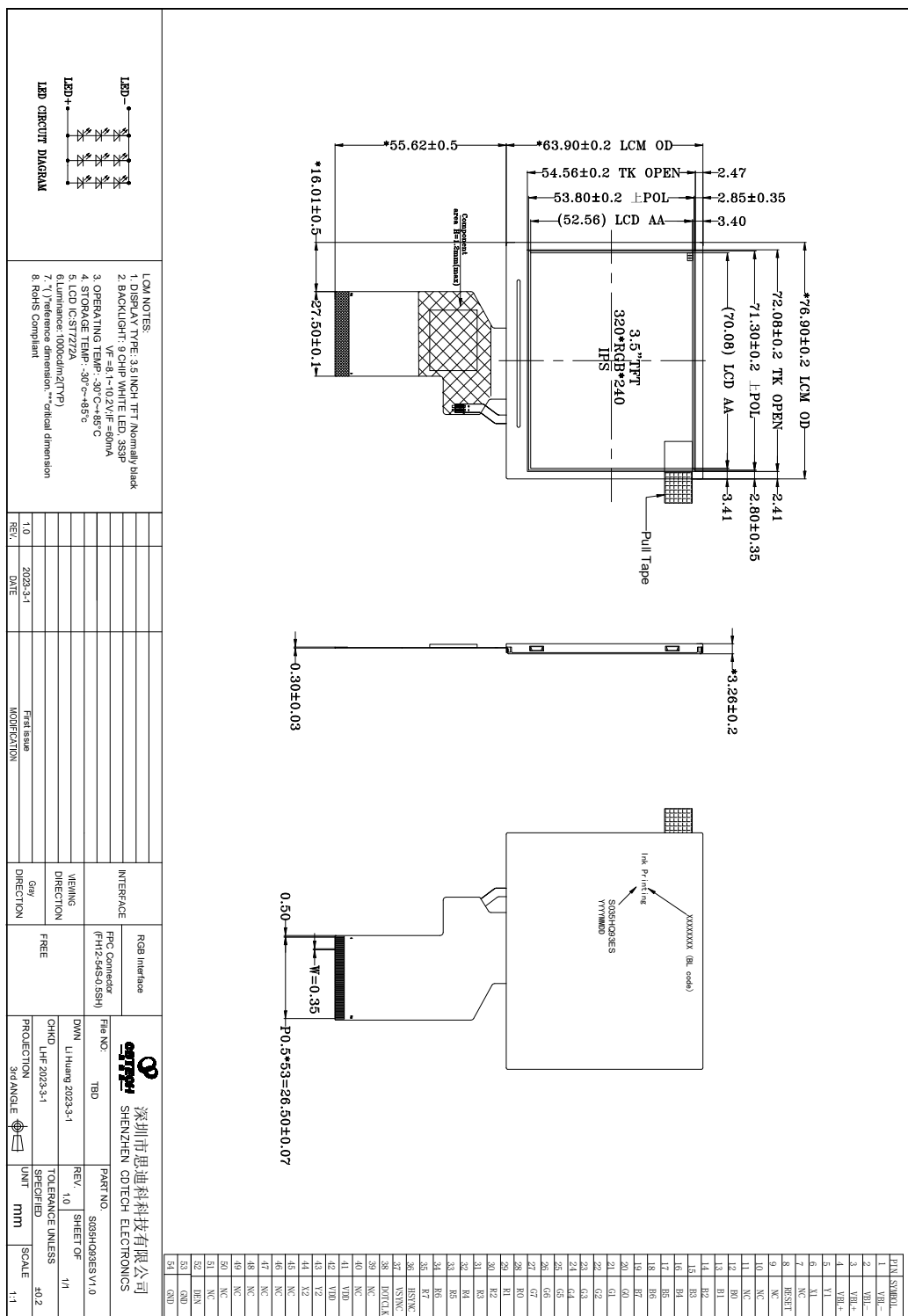
7. Reliability Test Items

Test Item	Test Conditions
High Temperature Storage	Ta= +85℃ 96hrs
Low Temperature Storage	Ta= -30℃ 96hrs
High Temperature Operation	Ta= +85℃ 96hrs
Low Temperature Operation	Ta= -30℃ 96hrs
High Temperature and Humidity Storage	Ta= +60℃, 90% RH 96hrs
Thermal Shock (Non-operation)	-30℃/30 min ~ +85℃/30 min for 20 cycles Start with cold temperature end with high temperature
Electro Static Discharge	Contact = ± 4 kV, class B Air = ± 8 kV, class B R=330Ω,C=150pF
Vibration	Sweep: 10Hz~55Hz~10Hz Stroke: 1.5mm 2 hrs for each direction of X .Y. Z.
Mechanical Shock	60G 6ms,±X,±Y,±Z 3 times for each direction
Package Drop Test	Height: 60 cm 1 corner, 3 edges, 6 surfaces

Notes: The test result shall be evaluated after the sample has been left at room temperature and humidity for 2 hours without load. No condensation shall be accepted. The sample will not be accepted if appear these defects:

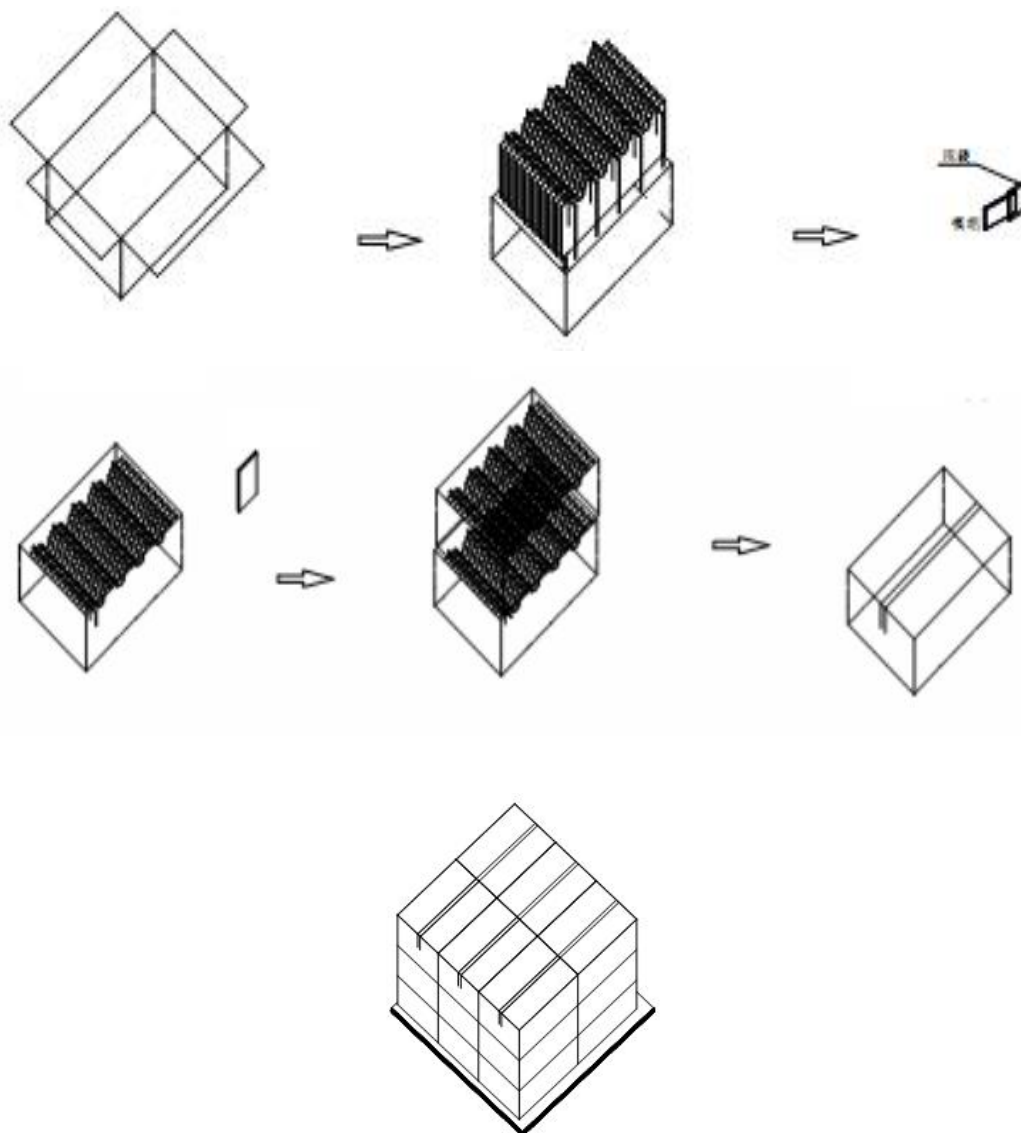
- 1). Air bubble in the LCD
- 2). Seal leak or Glass crack
- 3). Non display or abnormal display
- 4). Brightness reduction >50%

8. Mechanical Drawing



9. Packing

Packing Method



Steps:

1. Put module into tray cavity
2. Tray stacking
3. Put 1 cardboard under the tray stack and 1 cardboard above
4. Fix the cardboard to the tray stack with adhesive tape
5. Put the tray stack into carton
6. Carton sealing with adhesive tape

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
- Ketene
- 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.

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

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

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

10.1.8.4. 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℃ ~40℃ Relatively humidity: ≤80%

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

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.