CRYSTAL CLEAR TECHNOLOGY

Product Specification

T300A01X00

(REVISION 2)

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1. Table of Contents

2. Record of Revision

Rev	Date	Item	Page	Comment	Prepared	Checked
1.0	22.02.19			Initial Release	SCChong	W.Hong
2.0	07.03.19	10	25	1. Change the part number from T300A01C00 to T300A01X00 2. Add the drawing T300A01N00	SCChong	W.Hong

3. General Specification

T300A01C00 is 3.0” color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs control circuit, LED backlight and CTP (Capacitive Touch Panel). This display area contains 360(RGB) x 640 pixels and can display up to 16.7M colors. This product compliant with RoHS environmental requirement.

	Item	Specifications	Unit	Note
	Size (Diagonal)	3.0”	inch	
	Outline dimensions	42.6(W) x 74.5(H) x 3.5(T)	mm	(1)
TFT	Display type	16.7M color TFT IPS, Normally Black	-	(2)
	Viewing direction	All	O’clock	
	TFT Active area	36.72(W) x 65.28(H)	mm	
	TFT Resolution	360(RGB) x 640	-	
	Pixel size	0.102(W) x 0.102(H)	mm	
	Pixel arrangement	RGB vertical strip	-	
	TFT Driving IC	ST7701SI or Equivalent	-	
	TFT Interface mode	MIPI	-	
	Luminance	300	cd/m2	
CTP	CTP Active area	36.72(W) x 65.28(H)	mm	
	CTP Resolution	360 x 640	-	
	CTP Origin	Top-left (FPC down)	-	
	CTP Controller	ST1624	-	
	CTP Interface mode	I2C	-	
	Touch mode	5 fingers multi touch	-	
	Cover lens material	Glass	-	
	Transparency	85	%	
	Operating temperature	-20 ~ +70	°C	
	Storage temperature	-30 ~ +80	°C	

Note:
(1) FPC or Wire or Foam Tape are not included.
(2) Color tone is slightly changed by temperature and driving voltage.

4. AC/DC Characteristics (TFT)

4.1 Absolute Maximum Ratings (V_{SS} = 0V, Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Note
Power Supply Voltage	V_{DD}	-0.3	-	+4.6	V	
Input Voltage (I/O)	V_{DDIO}	-0.3	-	+4.6	V	
Backlight Forward Current	I_f	-	-	30	mA	
Storage Humidity	H_{ST}	10	-	90	%RH	(1)
Storage Temperature	T_{ST}	-30	-	+80	°C	
Operating Humidity	H_{OP}	10	-	90	%RH	(1)
Operating Temperature	T_{OP}	-20	-	+70	°C	

Note:
(1) At 25±5°C. Absolute humidity shall be less than 90%RH at +60°C.
(2) Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational sections of this specification is not implied and exposure to absolute maximum rating conditions for extended periods may affect device reliability.

4.2 Electrical Characteristics (V_{SS} = 0V, V_{DD} = 3.3V, Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Note
Power Supply Voltage	V_{DD}	2.5	-	3.6	V	
Interface Operation Voltage	V_{DDIO}	1.65	-	3.6	V	
Operation Current	I_{DD}	TBD			mA	
Low Level Input Voltage	V_{IL}	0	-	0.3V_{DDIO}	V	
High Level Input Voltage	V_{IH}	0.7V_{DDIO}	-	V_{DDIO}	V	
Low Level Output Voltage	V_{OL}	0	-	0.2V_{DDIO}	V	
High Level Output Voltage	V_{OH}	0.8V_{DDIO}	-	V_{DDIO}	V	
Differential Input High Threshold Voltage	VIT+		0	50	mV	MIPI_CLK MIPI_Data
Differential Input Low Threshold Voltage	VIT-	-50	0		mV	
Single-ended Receiver Input Operation Voltage Range	VIR	0.5		1.2	V	

Note:
(1) The recommended operating conditions refer to a range in which operation of this product is guaranteed. Accordingly, please make sure that the module is used within this range. And these current values are measured under the condition that all devices are stopped, each component is stable and logic signal is input.

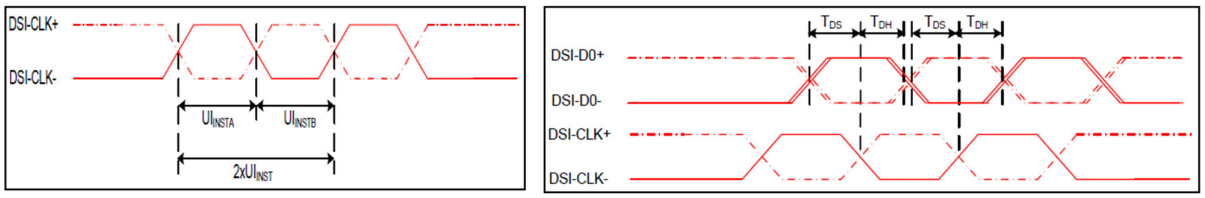
4.3 LED Backlight Specification (Ta = 25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit
LED Supply Voltage	V_f	I_f = 20mA	16.8	-	20.4	V
LED Supply Current	I_f		-	20	-	mA
Luminous Intensity	L_V	White	-	300	-	cd/m^2
Half Life Expectancy	L_L	I_f = 20mA	20000	-	-	hrs
LED Configuration	6 White LED					

Note:
(1) The LED Supply Voltage is defined by the number of LED at Ta = 25ºC and I_f = 20mA.
(2) The “Half Life Expectancy” is defined as the module brightness decrease to 50% original brightness at Ta = 25ºC and I_f = 20mA . The LED lifetime could be decreased if the operating I_f is larger than 20mA.

4.4 MIPI Interface Characteristics (VSS = 0V, VDD = 3.3V, Ta = 25°C)

4.4.1 High Speed Mode

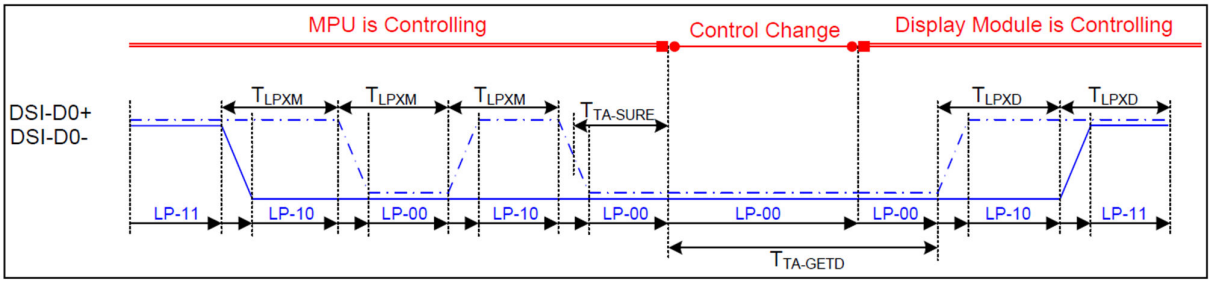


DSI Clock Channel Timing

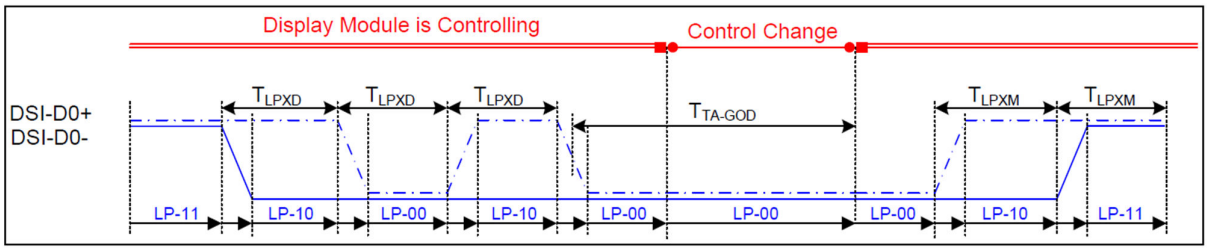
Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-CLK+/-	$2xUI_{INSTA}$	Double UI instantaneous	4	25	ns	
DSI-CLK+/-	UI_{INSTA} UI_{INSTB}	UI instantaneous halfs	2	12.5	ns	$UI = UI_{INSTA} = UI_{INSTB}$
DSI-Dn+/-	tDS	Data to clock setup time	0.15	-	UI	
DSI-Dn+/-	tDH	Data to clock hold time	0.15	-	UI	

MIPI Interface – High Speed Mode Timing Characteristics

4.4.2 Lower Power Mode



Bus Turnaround (BTA) from display module to MPU timing

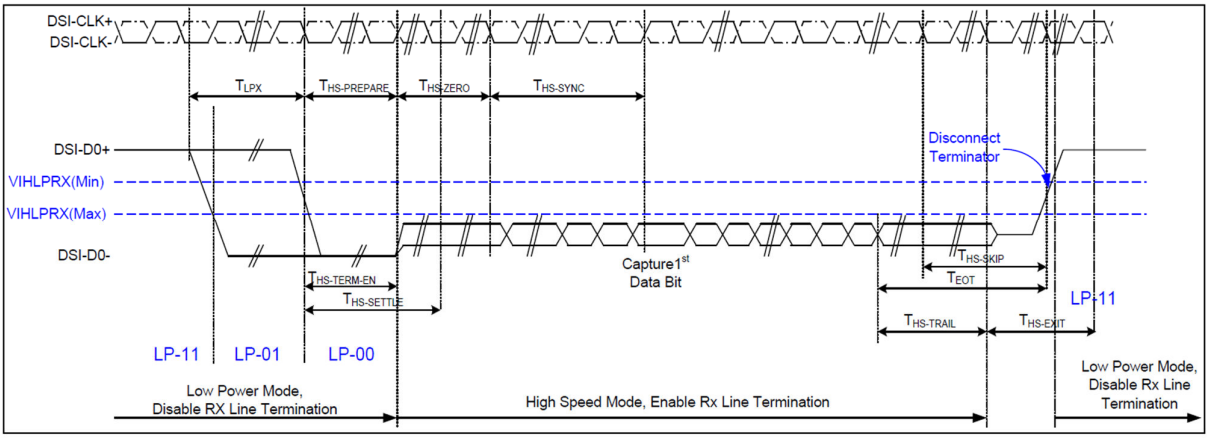


Bus Turnaround (BTA) from MPU to display module timing

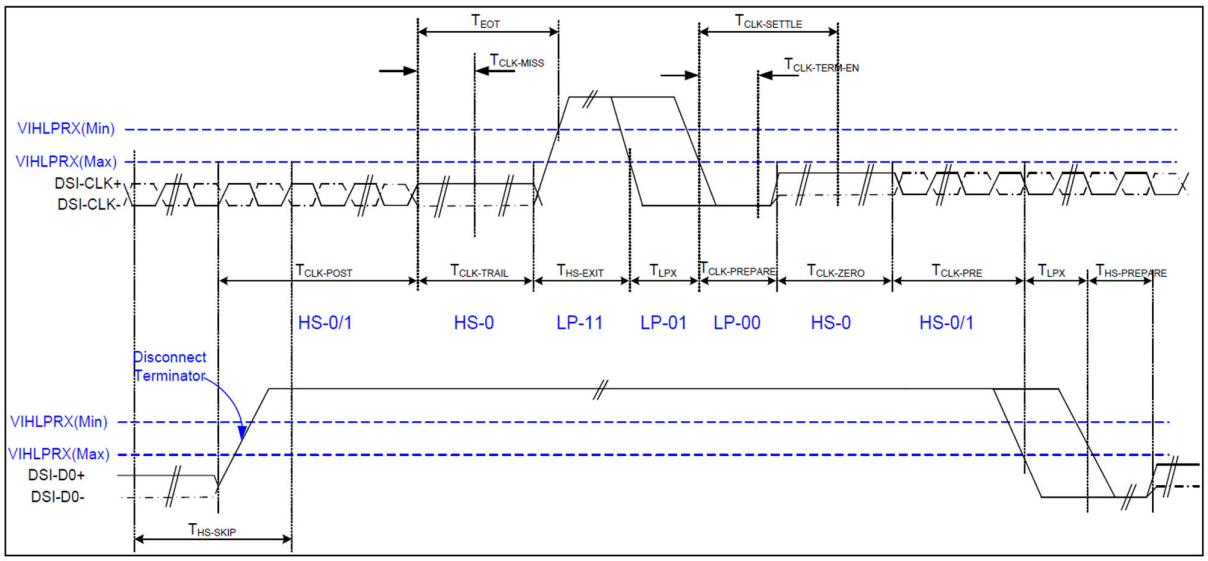
Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-D0+/-	TLPXM	Length of LP-00,LP-01, LP-10 or LP-11 periods MPU→Display Module	50	75	ns	Input
DSI-D0+/-	TLPXD	Length of LP-00,LP-01, LP-10 or LP-11 periods MPU→Display Module	50	75	ns	Output
DSI-D0+/-	TTA-SURED	Time-out before the MPU start driving	T_{LPXD}	$2xT_{LPXD}$	ns	Output
DSI-D0+/-	TTA-GETD	Time to drive LP-00 by display module	$5xT_{LPXD}$		ns	Input
DSI-D0+/-	TTA-GOD	Time to drive LP-00 after turnaround request-MPU	$4xT_{LPXD}$		ns	Output

MIPI Interface – Low Power Mode Timing Characteristics

4.4.3 DSI Bursts Mode



Data lanes – Lower Power Mode to/from High Speed Mode Timing



Clock lanes – High Speed Mode to/from Lower Power Mode Timing

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
Low Power Mode to High Speed Mode Timing						
DSI-Dn+/-	TLPX	Length of any low power state period	50	-	ns	Input
DSI-Dn+/-	THS-PREPARE	Time to drive LP-00 to prepare for HS transmission	40+4 UI	85+6 UI	ns	Input
DSI-Dn+/-	THS-TERM-EN	Time to enable data receiver line termination measured from when Dn crosses VILMAX	-	35+4 UI	ns	Input
DSI-Dn+/-	THS-PREPARE + THS-ZERO	THS-PREPARE + time to drive HS-0 before the sync sequence	140+ 10UI	-	ns	Input
High Speed Mode to Low Power Mode Timing						
DSI-Dn+/-	THS-SKIP	Time-out at display module to ignore transition period of EoT	40	55+4 UI	ns	Input
DSI-Dn+/-	THS-EXIT	Time to drive LP-11 after HS burst	100	-	ns	Input
DSI-Dn+/-	THS-TRAIL	Time to drive flipped differential state after last payload data bit of a HS transmission burst	60+4 UI	-	ns	Input

High Speed Mode to/from Low Power Mode Timing						
DSI-CLK+/-	TCLK-POS	Time that the MPU shall continue sending HS clock after the last associated data lane has transition to LP mode	60+5 2UI	-	ns	Input
DSI-CLK+/-	TCLK-TRAIL	Time to drive HS differential state after last payload clock bit of a HS transmission burst	60	-	ns	Input
DSI-CLK+/-	THS-EXIT	Time to drive LP-11 after HS burst	100	-	ns	Input
DSI-CLK+/-	TCLK-PREPARE	Time to drive LP-00 to prepare for HS transmission	38	95	ns	Input
DSI-CLK+/-	TCLK-TERM-EN	Time-out at clock lan display module to enable HS transmission	--	38	ns	Input
DSI-CLK+/-	TCLK-PREPARE + TCLK-ZERO	Minimum lead HS-0 drive period before starting clock	300	-	ns	Input
DSI-CLK+/-	TCLK-PRE	Time that the HS clock shall be driven prior to any associated data lane beginning the transition from LP to HS mode	8UI	-	ns	Input
DSI-CLK+/-	TEOT	Time form start of TCLK-TRAIL period to start of LP-11 state	-	105n s+12 UI	ns	Input

4.5 Pin Assignment Table

Pin No.	Symbol	I/O	Description	Note
1	LCD_ID	-	DUMMY	
2	GND	P	Ground	
3	LEDPWM	O	The PWM frequency output for LCD driver control	
4	GND	P	Ground	
5	Reset	I	Chip reset pin	(1)
6	VDDIO	P	Power Supply	
7	GND	P	Ground	
8	D0N	I	MIPI DSI differential data pair (DSI-D0-)	
9	NC	-	DUMMY	
10	D0P	I	MIPI DSI differential data pair (DSI-D0+)	
11	GND	P	Ground	
12	CN	I	MIPI DSI differential clock pair (DSI-CLK-)	
13	NC	-	DUMMY	
14	CP	I	MIPI DSI differential clock pair (DSI-CLK+)	
15	GND	P	Ground	
16	D1N	I	MIPI DSI differential data pair (DSI-D1-)	
17	NC	-	DUMMY	
18	D1P	I	MIPI DSI differential data pair (DSI-D1+)	
19	GND	P	Ground	
20	NC	-	DUMMY	
21	VDD	P	Power Supply	
22	TE	O	F mark signal	
23	VLED-	P	LED Backlight (Cathode)	
24	VLED+	P	LED Backlight (Anode)	
25 - 26	GND	P	Ground	

Note:
(1) RESET : Active low

5. AC/DC Characteristics (CTP)

5.1 Absolute Maximum Ratings (V_{SS} = 0V, Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Note
Power Supply Voltage	V_{CC}	-0.3	-	6.0	V	
Storage Humidity	H_{ST}	10	-	90	%RH	(1)
Storage Temperature	T_{ST}	-30	-	+80	°C	
Operating Humidity	H_{OP}	10	-	90	%RH	(1)
Operating Temperature	T_{OP}	-20	-	+70	°C	

Note:
(1) At 25±5°C. Absolute humidity shall be less than 90%RH at +60°C.
(2) Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational sections of this specification is not implied and exposure to absolute maximum rating conditions for extended periods may affect device reliability.

5.2 Electrical Characteristics (V_{SS} = 0V, V_{CC} = 3.3V, Ta = 25°C)

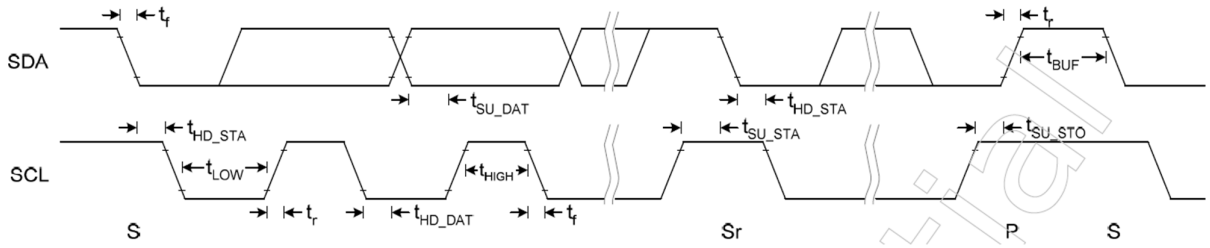
Item	Symbol	Min	Typ	Max	Unit	Note
Power Supply Voltage	V_{CC}	2.7	-	3.6	V	
Operation Current	I_{cc}	TBD			mA	
Low Level Input Voltage	V_{IL}	-	-	0.15 V_{cc}	V	
High Level Input Voltage	V_{IH}	0.85 V_{cc}	-	-	V	
Output Driving Current	IDRV	6	-	-	mA	VOH=0.8Vcc
Output Sinking Current	ISINK	10	-	-	mA	VOL=0.2Vcc
Low Voltage Reset	VLVR	-	-	2.3	V	

Note:
(1) The recommended operating conditions refer to a range in which operation of this product is guaranteed. Accordingly, please make sure that the module is used within this range. And these current values are measured under the condition that all devices are stopped, each component is stable and logic signal is input.

5.3 I2C Interface

Touch panel is used as I2C slave device, I2C slave address is 0x55, refer ST1624 datasheet for details.
There are three communication pins connected between host and CTP module which are including external interrupt IRQ, I2C pins SCL and SDA. The IRQ is active low while the touch state is calculated by CTP module and the touch information can be translated via I2C communication interface.

5.4 I2C Timing Characteristics (VSS = 0V, VCC = 3.3V,Ta = 25°C)



Symbol	Parameter	Rating			Unit
		Min.	Typ.	Max.	
f_{SCL}	SCL clock frequency	0	-	400	kHz
t_{LOW}	Low period of the SCL clock	1.3	-	-	us
t_{HIGH}	High period of the SCL clock	0.6	-	-	us
t_f	Signal falling time	-	-	300	ns
t_r	Signal rising time	-	-	300	ns
t_{SU_STA}	Set up time for a repeated START condition	0.6	-	-	us
t_{HD_STA}	Hold time (repeated) START condition. After this period, the first clock pulse is generated	0.6	-	-	us
t_{SU_DAT}	Data set up time	100	-	-	ns
t_{HD_DAT}	Data hold time	0	-	0.9	us
t_{SU_STO}	Set up time for STOP condition	0.6	-	-	us
t_{BUF}	Bus free time between a STOP and START condition	1.3	-	-	us
C_b	Capacitive load for each bus line	-	-	400	pF

5.5 Pin Assignment Table

1	RES	I	Reset	(1)
2	VCC	P	Power Supply	
3	GND	P	Ground	
4	IRQ	O	Interrupt	(2)
5	SDA	I/O	I2C Serial Data	
6	SCL	I	I2C Serial Clock	
7 – 10	NC	-	No connection	

Note:
(1) RES (CTP) : Active low
(2) IRQ (CTP) : Active low

6. Optical Characteristics

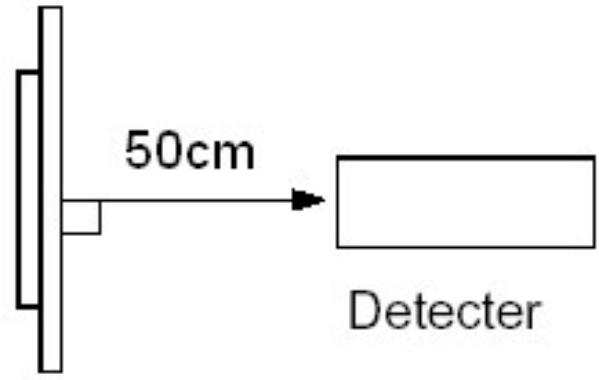
Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Brightness	Bp	θ=0° Φ=0°	200	300	400	cd/m^2	(2)
Uniformity	⊿Bp		70	80	-	%	(2)(3)
Viewing Angle	3:00	Cr≥10	-	80	-	degree	(4)
	6:00		-	80	-		
	9:00		-	80	-		
	12:00		-	80	-		
Contrast Ratio	Cr	θ=0° Φ=0° T=25°C	600	800	-	-	(5)
Response Time	Tr + Tf		-	30	45	ms	(6)
NTSC Ratio	S		54	60	-	%	(7)
CTP Transmittance	T		85	90	-	%	(8)

Note:

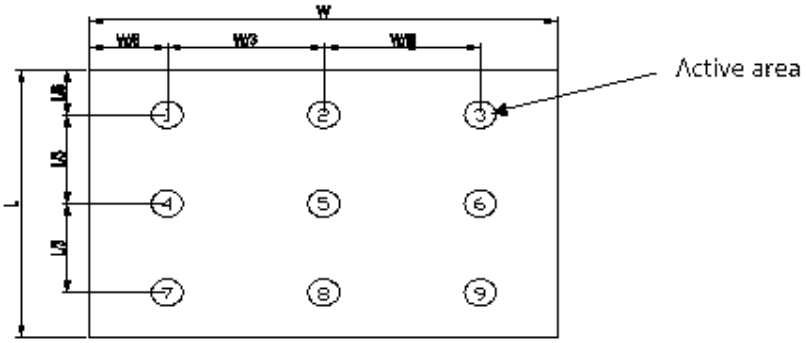
(1) The parameter is slightly changed by temperature, driving voltage and materiel.

(2) The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment BM-7(Φ5mm).
Measuring condition:
- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25°C.
- Adjust operating voltage to get optimum contrast at the center of the display.

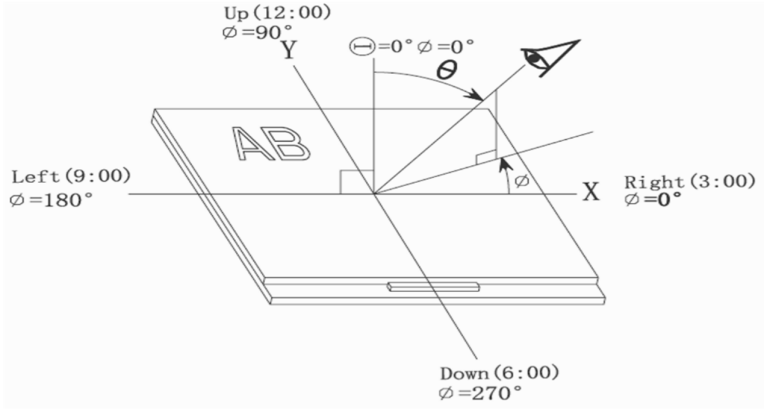
Measured value at the center point of LCD panel after more than 5 minutes while backlight turning on.
- Measurement I son TFT surface



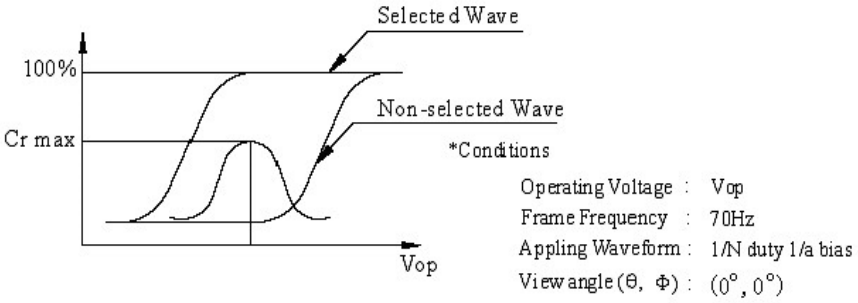
(3) The luminance uniformity is calculated by using following formula:
⊿Bp = Bp (Min.) / Bp (Max.) × 100 (%)
Bp (Max.) = Maximum brightness in 9 measured spots.
Bp (Min.) = Minimum brightness in 9 measured spots.



(4) The definition of viewing angle:
Refer to the graph below marked by *θ* and *Φ*

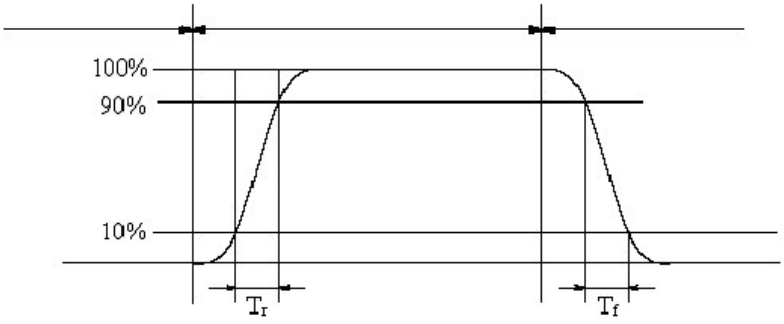


(5) Definition of contrast ratio. (Test LCD using DMS501)



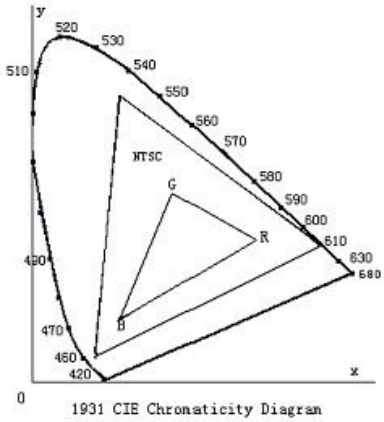
Contrast ratio (*Cr*) = $\frac{\text{Brightness of selected dots}}{\text{Brightness of non−selected dots}}$

(6) Definition of Response time. (Test LCD using DMS501):
The output signals of photo detector are measured when the input signals are changed from "black" to "white" (falling time) and from "white" to "black" (rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



The Definition of response time

(7) Definition of Color of CIE Coordinate and NTSC Ratio.



1931 CIE Chromaticity Diagram

(8) Definition of the transmittance measurements shall be made at viewing angle of θ = 0° and at the center of the touch panel by using BM-7. Transmittance shall be calculated by the difference of the luminance between a standard light source with touch panel and a standard light source without touch panel.

$$\text{Transmittance} = \frac{\text{Luminance on touch panel surface}}{\text{Luminance of standard light source}}$$

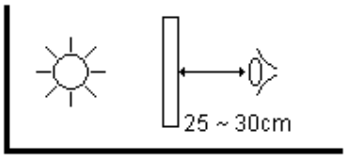
7. Reliability Test Condition

Item		Test Condition	Note
Operating	High Temperature	+70°C, 240hrs	(3)
	Low Temperature	-20°C, 240hrs	(3)
	High Temperature and High Humidity	+60°C, 90%RH, 240hrs	(3)
	Cycle	RT (0m) → -20°C (30m) → RT (5m) → +70°C (30m) → RT (5m) 50 cycles	(1)(2)(3)
Storage	High Temperature	+80°C, 240hrs	(3)
	Low Temperature	-30°C, 240hrs	(3)

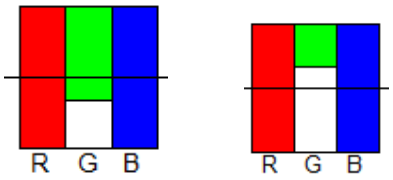
Note:
(1) RT means Room Temperature.
(2) m means minute.
(3) Before cosmetic and functional test, the product must have enough recovery time, at least 2 hours at room temperature.

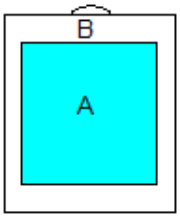
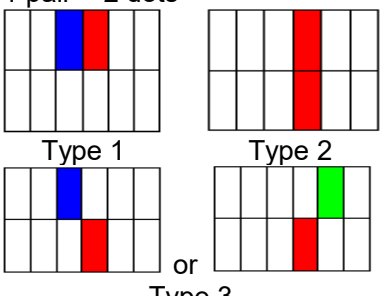
8. Inspection Criteria

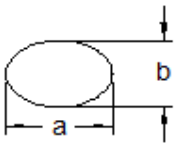
- Inspection distance: 25~30cm.
- From lamp source to product: 250 ± 100cm.
- Angle of inspection: Ambient brightness 1k-1.5k lux inspection from front view, perpendicular to the surface of product.

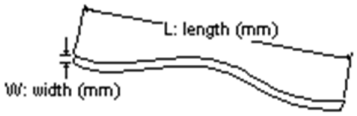
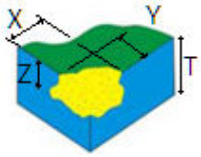
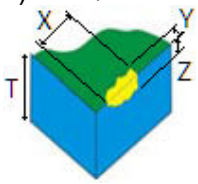


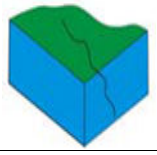
<table>
<tr><th>No</th><th>Defect</th><th>Definition of defect</th><th>Inspection Criteria</th></tr>
<tr><td rowspan="4">1</td><td>a) Definition of dot</td><td>The size of defective dot over ½ of whole is regards as one defective dot.

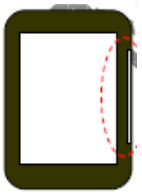
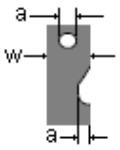
Smaller than ½ ½ Larger than
 

‘No dot defect’ (ignore) ‘1 dot defect’ (counted)</td><td>A – Viewing Area
B – Outside viewing area
 
</td></tr>
<tr><td>b) Bright Dot</td><td>Dot appear bright and unchanged in size when LCD panel is displaying black pattern.</td><td rowspan="2"><table><tr><td>Defect</td><td>A</td><td>B</td></tr><tr><td>Bright Dot</td><td>1</td><td rowspan="3">NC</td></tr><tr><td>Dark Dot</td><td>2</td></tr><tr><td>Total</td><td>3</td></tr></table>NC – Not Count</td></tr>
<tr><td>c) Dark Dot</td><td>Dot appear dark and unchanged in size when LCD panel is displaying pure color (RED, GREEN or BLUE) pattern.</td></tr>
<tr><td>d) 2 dot adjacent</td><td>1 pair = 2 dots
 
</td><td><table><tr><td>Defect</td><td>Acc. Count</td></tr><tr><td>2 Bright dot Adjacent</td><td>0</td></tr><tr><td>2 Dark dot Adjacent</td><td>1</td></tr></table></td></tr>
<tr><td>2</td><td>a) Black Spot
b) White Spot
c) Bright Spot
d) Pin Hole
e) Foreign Particle</td><td>- Black / Dark / Bright Spot is points on display which appear dark/bright and usually result from contamination.
- These defect do not vary in size intensity (contrast) when contras is varied.</td><td><table><tr><td>Defect Category</td><td>A</td><td>B</td></tr><tr><td>D < 0.10</td><td>NC</td><td rowspan="4">NC</td></tr><tr><td>0.10 ≤ D ≤ 0.15</td><td>2</td></tr><tr><td>0.15 ≤ D ≤ 0.20</td><td>1</td></tr><tr><td>D > 0.2</td><td>0</td></tr></table></td></tr>
</table>

<table>
<tr><td></td><td></td><td> 

D=(a+b)/2(mm)</td><td></td></tr>
<tr><td></td><td>a) Black Line
b) White Line
c) Particle between POL and Glass
d) Scratch on Glass</td><td> 
</td><td>
<table>
<tr><th>Defect Category</th><th>A</th><th>B</th></tr>
<tr><td>W < 0.03</td><td>NC</td><td rowspan="3">NC</td></tr>
<tr><td>0.03 ≤ W ≤ 0.05, L ≤2.0</td><td>2</td></tr>
<tr><td>W > 0.05</td><td>0</td></tr>
</table>
</td></tr>
<tr><td></td><td>a) POL Bubble
b) POL Dented</td><td></td><td>
<table>
<tr><th>Defect Category</th><th>A</th><th>B</th></tr>
<tr><td>D < 0.20</td><td>NC</td><td rowspan="4">NC</td></tr>
<tr><td>0.20 ≤ D ≤ 0.30</td><td>3</td></tr>
<tr><td>0.30 ≤ D ≤ 0.50</td><td>2</td></tr>
<tr><td>D > 0.5</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>3</td><td>Mura
(50% Grey)</td><td></td><td>Judged by Limit sample</td></tr>
<tr><td rowspan="3">4</td><td>Corner Chip</td><td></td><td>Accept if (only allowed 1):-
a) X ≤ 1.0mm
b) Y ≤ 1.0mm
c) Z ≤ 1/2T
 
</td></tr>
<tr><td>Edge Chip</td><td>- Touch sensor corner and edge chip that do not cause any damage to tracer and not visible to end-user after housing assembly.
- Lens edge and corner chip that is not visible to end-user after housing assembly.</td><td>Accept if (only allowed 1):-
a) X ≤ 1.0mm
b) Y ≤ 1.0mm
c) Z ≤ 1/2T
 

Reject – if the sensor surface edge/corner chip damage circuit and visible from front view</td></tr>
<tr><td>Glass Crack</td><td></td><td>Reject – if any crack
  </td></tr>
</table>

5	Printing Ink Light Leakage		Accept if:- Light leakage at marginal area width ≤ 0.15mm 
6	Surface Smudginess	- For those that can be cleaned, ≤20% of inspected quantity in one lot under > class 10K area; ≤10% of inspected quantity in one lot ≤ class 10K area. - For those that cannot be cleaned it is classified as foreign round shape defect.	
7	FPC Defects on Contact Pad		Accept if dent, pinhole:- a) a ≤ w/3  Reject – if open circuit / cracking / oxidation / contamination
	FPC Broken		Reject if FPC broken / extruded
	FPC Warped		Accept if FPC warped

9. Precaution

1. Handing Precautions
   a. The display panel is made of glass and polarizer. As glass is fragile. It tends to chip during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock of impact or by dropping it.
   b. If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance is in contact with your skin or clothes, wash it off using soap and water.
   c. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degrade the insulation between terminals. Scratch and dents may occur on polarizer too.
   d. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than a HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on it. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming in to contact with room temperature air.
   e. If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents.
      - Isopropyl alcohol.
      - Ethyl alcohol.
      - Do not scrub hard to avoid damaging the display surface.
   f. Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.
      - Water.
      - Ketone.
      - Aromatic solvents.
      - Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or colour fading. Avoid contact with oil and fats.
   g. Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
   h. Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
   i. Do not attempt to disassemble or process the LCD module.
   j. NC terminal should be open. Do not connect anything.
   k. If the logic circuit power is off, do not apply the input signals.
   l. Electro-Static Discharge Control. Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
      - Before removing LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential. Be sure to ground the body when handling the LCD modules.
      - Tools required for assembly, such as soldering irons, must be properly grounded. Make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screw driver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.

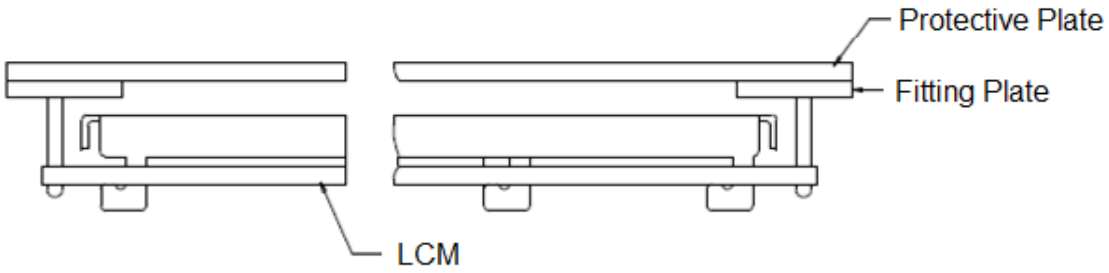
- To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work environment is not too dry. A relative humidity of 50%-60% is recommended. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.
- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

m. Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.
- Do not alter, modify or change the shape of the tab on the metal frame.
- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- Do not damage or modify the pattern writing on the printed circuit board.
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist the LCM.

2. Storage Precautions
When storing the LCD modules, the following precaution are necessary.
a. Store them in a sealed polyethylene bag. If properly sealed, there is no need for the desiccant.
b. Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C, and keep the relative humidity between 40%RH and 60%RH.
c. The polarizer surface should not come in contact with any other objects.

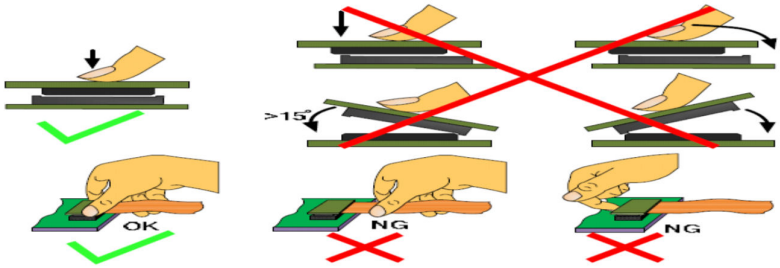
3. Others
a. Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.
b. If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.
c. To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc. Exercise care to avoid holding the following sections when handling the modules.
- Exposed area of the printed circuit board.
- Terminal electrode sections.

4. Using LCD Modules
a. Installing LCD Modules
The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.
b. Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



c. When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be 0.1mm.

d. Precaution for assemble the module with BTB connector:
Please note the position of the male and female connector position, don't assemble or assemble like the method which the following picture shows.



5. Precaution for soldering the LCM

	Manual soldering	Machine drag soldering	Machine press soldering
No RoHS Product	290°C ~350°C. Time: 3-5S.	330°C ~350°C. Speed: 4-8 mm/s.	300°C ~330°C. Time: 3-6S. Press: 0.8~1.2Mpa
RoHS Product	340°C ~370°C. Time: 3-5S.	350°C ~370°C. Time: 4-8 mm/s.	330°C ~360°C. Time: 3-6S. Press: 0.8~1.2Mpa

a. If soldering flux is used, be sure to remove any remaining flux after finishing the soldering operation (This does not apply in the case of a non-halogen type of flux). It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

b. When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.

c. When removing the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

6. Precautions for Operation

a. Viewing angle varies with the change of liquid crystal driving voltage (VLCD). Adjust VLCD to show the best contrast.

b. It is recommended to drive LCD's within the specified voltage limit since over limit will cause shorter LCD life. An electrochemical reaction due to direct current causes LCD deterioration. Avoid the use of direct current drive.

c. Response time will be extremely delayed at lower temperature compared to room operating temperature range and on the other hand, at higher temperature LCD-shows

dark colour in them. However those phenomena do not mean malfunction. The LCD will return to normal performance when ambient temperature revert to room condition.

d. If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and on.
e. A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.
f. Input logic voltage before apply analogue high voltage such as LCD driving voltage when power on. Remove analogue high voltage before logic voltage when power off the module. Input each signal after the positive/negative voltage becomes stable.
g. Please keep the temperature within the specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.

7. Safety
   a. It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
   b. If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

8. Limited Warranty

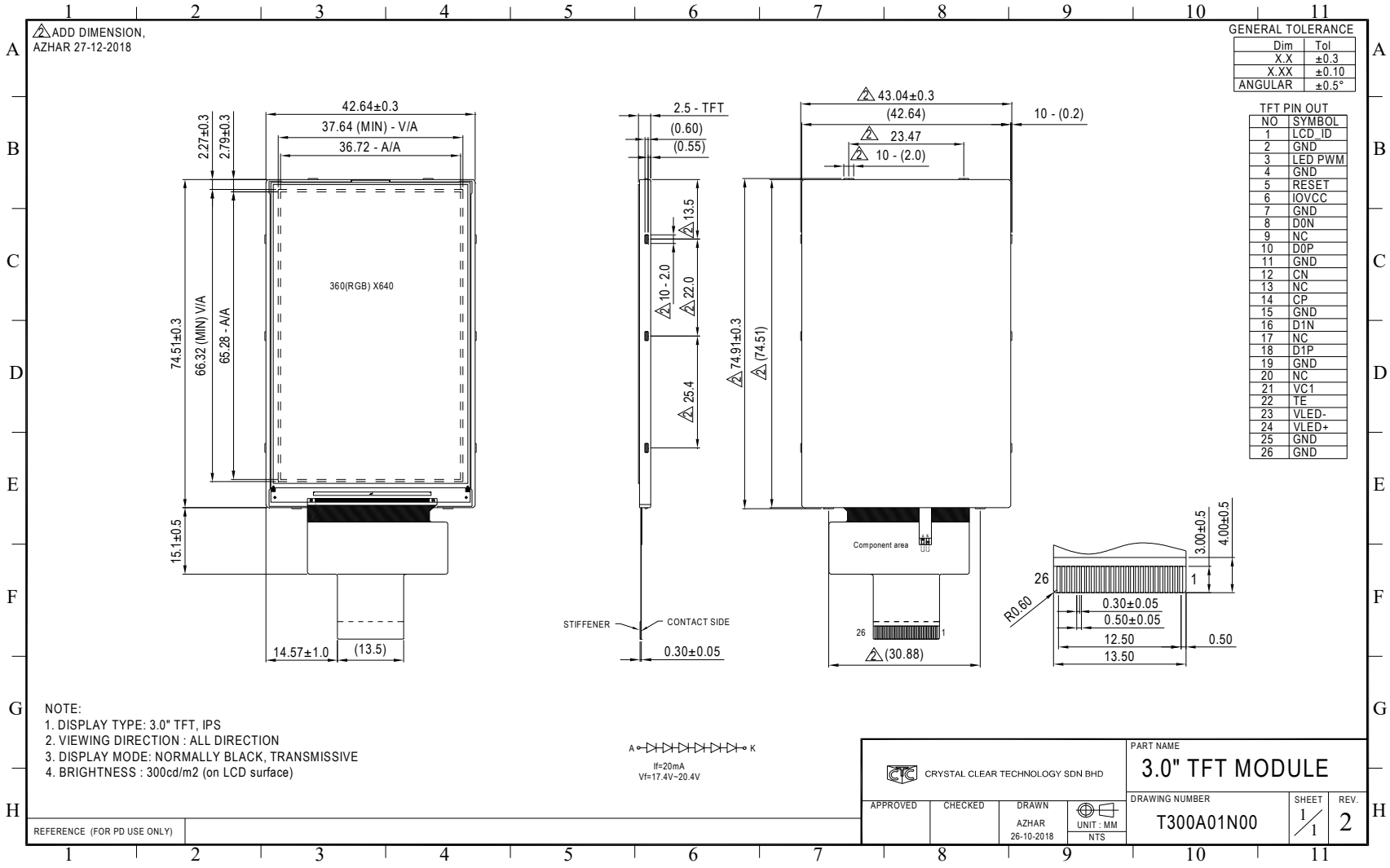
   Unless otherwise agreed between Crystal Clear Technology and customer, Crystal Clear Technology will replace or repair any of its LCD and LCM which is found to be defective electrically and visually when inspected in accordance with Crystal Clear Technology acceptance standards, for a period of one year from date of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of Crystal Clear Technology is limited to repair and/or replacement on the terms set forth above. Crystal Clear Technology will not responsible for any subsequent or consequential events.

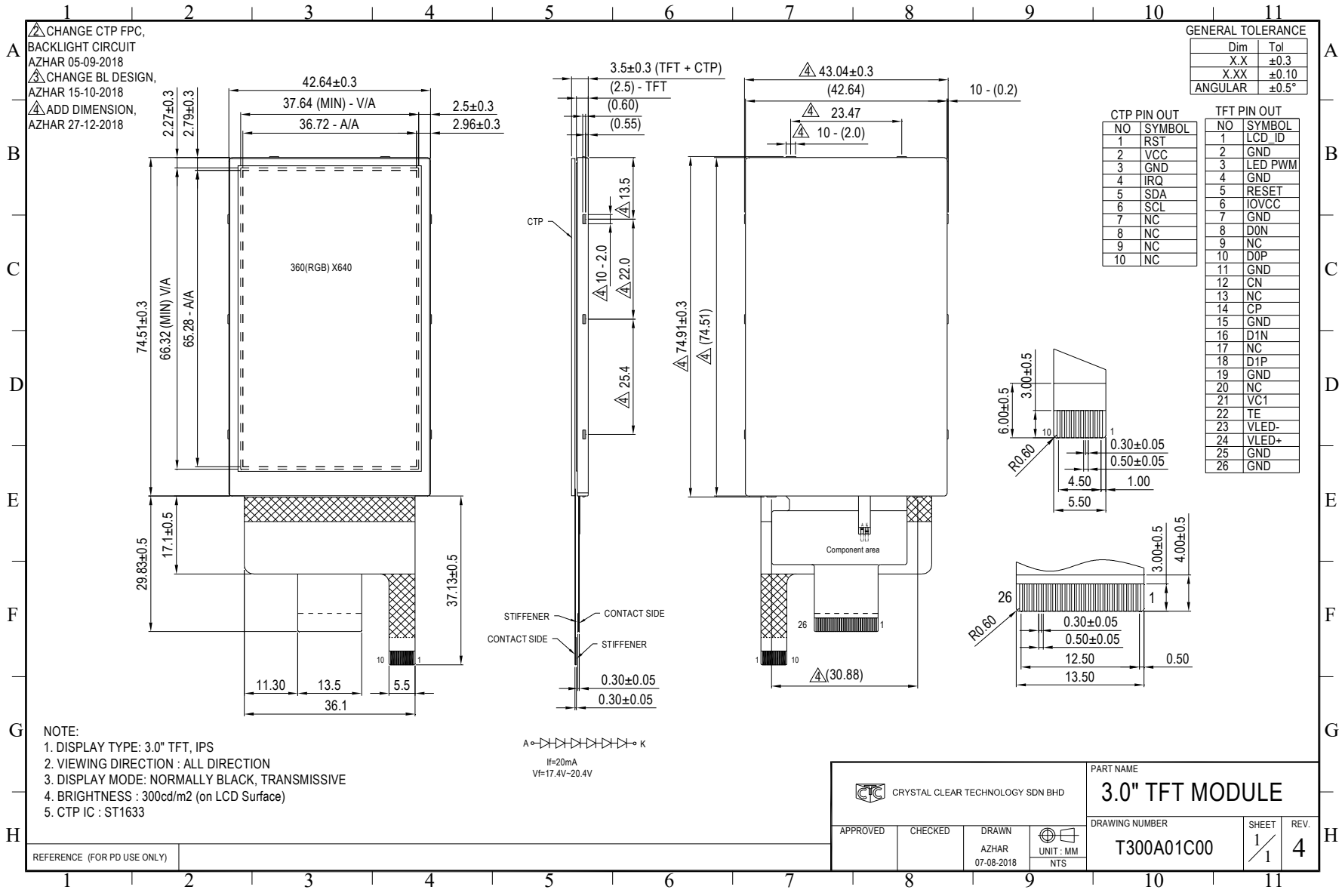
9. Return LCM under Warranty

   No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are:
   - Broken LCD glass.
   - PCB eyelet's damaged or modified.
   - PCB conductors damaged.
   - Circuit modified in any way, including addition of components.
   - PCB tampered with by grinding, engraving or painting varnish.
   - Soldering to, or modifying the bezel in any manner.

   Module repairs will be invoiced to customer upon mutual agreement. Modules must be returned with sufficient description of failure or defects. Any connectors or cable installed by customer must be removed completely without damaging the PCB eyelet's, conductors and terminals.

10. Mechanical Specification




2 CHANGE CTP FPC, BACKLIGHT CIRCUIT AZHAR 05-09-2018
3 CHANGE BL DESIGN, AZHAR 15-10-2018
4 ADD DIMENSION, AZHAR 27-12-2018
GENERAL TOLERANCE
Dim Tol
X.X ±0.3
X.XX ±0.10
ANGULAR ±0.5°
CTP PIN OUT
NO SYMBOL
1 RST
2 VCC
3 GND
4 IRQ
5 SDA
6 SCL
7 NC
8 NC
9 NC
10 NC
TFT PIN OUT
NO SYMBOL
1 LCD_ID
2 GND
3 LED PWM
4 GND
5 RESET
6 IOVCC
7 GND
8 D0N
9 NC
10 D0P
11 GND
12 CN
13 NC
14 CP
15 GND
16 D1N
17 NC
18 D1P
19 GND
20 NC
21 VC1
22 TE
23 VLED-
24 VLED+
25 GND
26 GND
42.64±0.3
37.64 (MIN) - V/A
36.72 - A/A
2.27±0.3
2.79±0.3
2.5±0.3
2.96±0.3
74.51±0.3
66.32 (MIN) V/A
65.28 - A/A
360(RGB) X640
17.1±0.5
29.83±0.5
37.13±0.5
11.30
13.5
5.5
36.1
3.5±0.3 (TFT + CTP)
(2.5) - TFT
(0.60)
(0.55)
CTP
13.5
10 - 2.0
22.0
25.4
STIFFENER
CONTACT SIDE
CONTACT SIDE
STIFFENER
0.30±0.05
0.30±0.05
43.04±0.3
(42.64)
10 - (0.2)
23.47
10 - (2.0)
74.91±0.3
(74.51)
Component area
(30.88)
6.00±0.5
3.00±0.5
R0.60
0.30±0.05
0.50±0.05
4.50
1.00
5.50
3.00±0.5
4.00±0.5
26
R0.60
0.30±0.05
0.50±0.05
12.50
0.50
13.50
A K
If=20mA
Vf=17.4V~20.4V
NOTE:
1. DISPLAY TYPE: 3.0" TFT, IPS
2. VIEWING DIRECTION : ALL DIRECTION
3. DISPLAY MODE: NORMALLY BLACK, TRANSMISSIVE
4. BRIGHTNESS : 300cd/m2 (on LCD Surface)
5. CTP IC : ST1633
REFERENCE (FOR PD USE ONLY)
CRYSTAL CLEAR TECHNOLOGY SDN BHD
PART NAME
3.0" TFT MODULE
APPROVED
CHECKED
DRAWN
AZHAR
07-08-2018
UNIT : MM
NTS
DRAWING NUMBER
T300A01C00
SHEET
1/1
REV.
4