



Product Specification

Part Name: 21.5 inch TFT Module with Capacitive Touch Panel

Customer Part ID:

Topovision Part ID: TVT2150TP-IH (IPS)

Ver: B

Customer:
Approved by

From: Topovision Technology Co., Ltd.
Approved by

Notes:

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2. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by Topovision Technology Co., Ltd. for any intellectual property claims or other problems that may result from application based on the module described herein.

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1. GENERAL DESCRIPTION

1.1 OVERVIEW

The TVT2150TP-IH is a 21.5" TFT Liquid Crystal Display cell with driver ICs and a 30-pins-2ch-LVDS circuit board. The product supports 1920 x 1080 Full HD mode and can display up to 16.7M colors.

1.2 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Screen Size	21.5 inch Diagonal	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1920 x R.G.B. x 1080	pixel	-
Pixel Pitch	0.24795(H) x 0.24795(V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.7M	color	-
Transmissive Mode	Normally Black	-	-
Surface Treatment	High resolution adaptable AG, 3H hard coating, Haze : 24%	-	-
Power Consumption	Total 23.6W @ cell: 5.6 W, BL : 18W		(1)

2. MECHANICAL SPECIFICATIONS

Item	Min.	Typ.	Max.	Unit	Note
Weight	2300	2400	2600	g	
I/F connector mounting position	The mounting inclination of the connector makes the screen center within $\pm 0.5\text{mm}$ as the horizontal.				(2)

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

(2) Connector mounting position

(3) Please refer to sec.3.1 for more information of power consumption.



3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

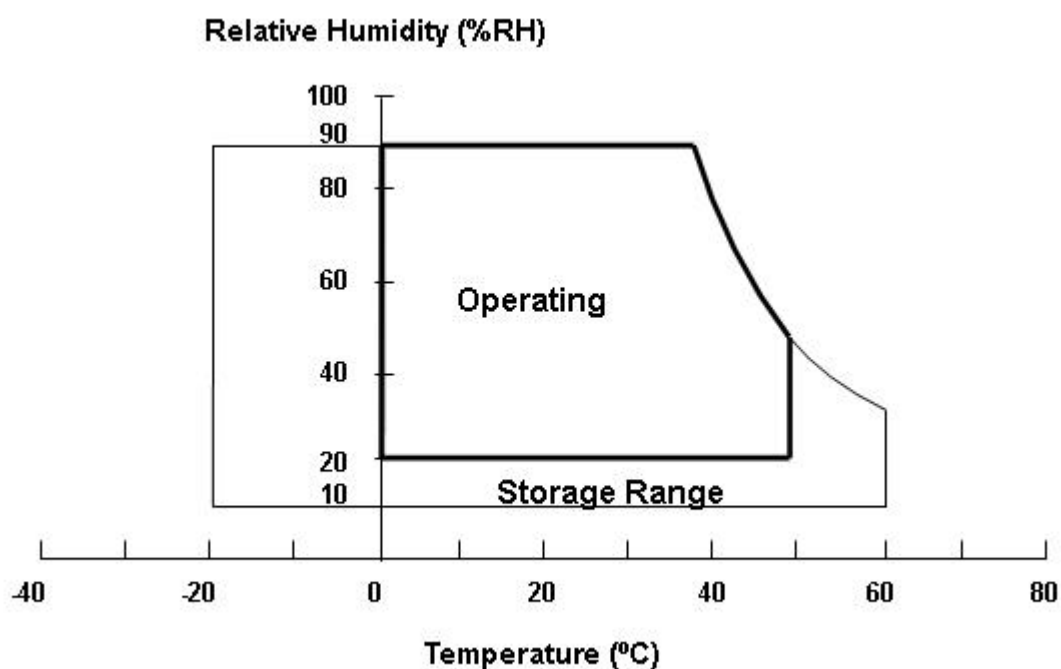
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	TST	-20	60	°C	(1)
Operating Ambient Temperature	TOP	0	50	°C	(1), (2)

Note (1)

- (a) 90 %RH Max.
- (b) Wet-bulb temperature should be 39 °C Max.
- (c) No condensation.

Note (2) The temperature of panel surface should be 0 °C min. and 60 °C max.

Panel surface temperature should be 0°C min. and 60°C max under Vcc=5.0V, Input fr =60Hz, typical LED string current, 25°C ambient temperature, and no humidity control. Any condition of ambient operating temperature, the surface of active area should be keeping not higher than 60°C.



3.2 ELECTRICAL ABSOLUTE RATINGS

3.2.1 TFT LCD OPEN CELL

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCCS	-0.3	6.0	V	(1)
Logic Input Voltage	V _{IN}	-0.3	3.6	V	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

3.3 ABSOLUTE RATINGS OF ENVIRONMENT (OPEN CELL)

High temperature or humidity may reduce the performance of panel. Please store LCD panel within the specified storage conditions.

Storage Condition: With packing.

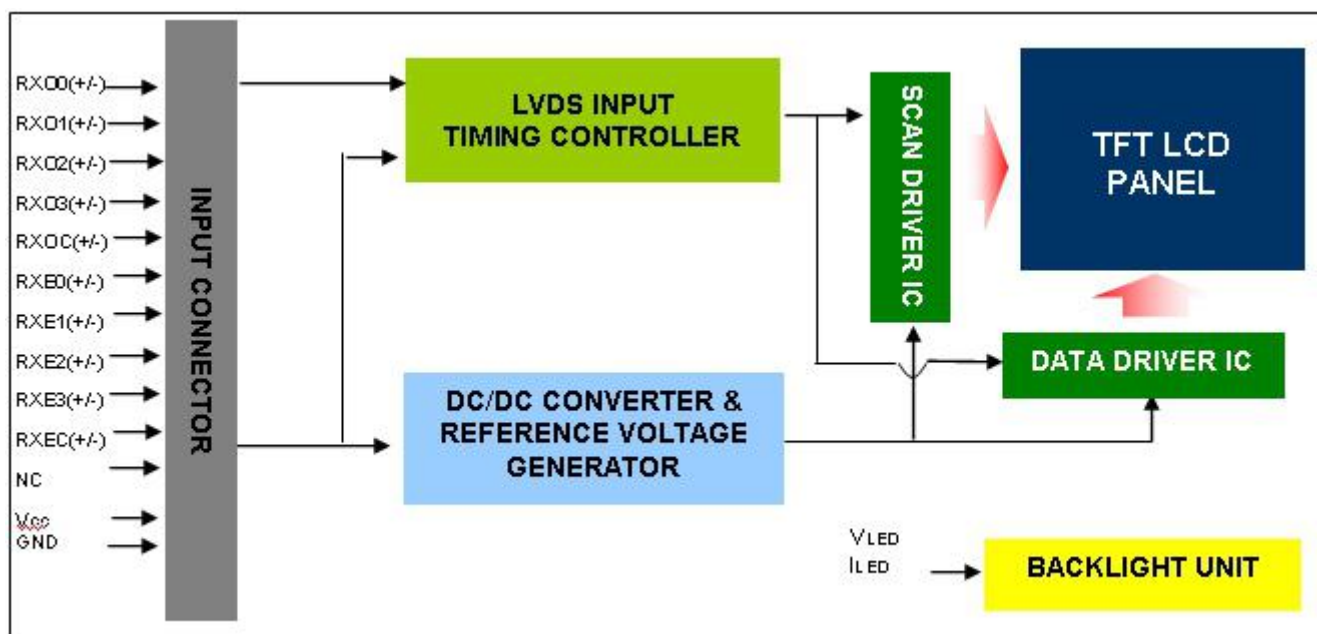
Storage temperature range: 25 ± 5 °C.

Storage humidity range: $50 \pm 10\%$ RH.

Shelf life: 30days

4. ELECTRICAL SPECIFICATIONS

4.1 FUNCTION BLOCK DIAGRAM



4.2 INTERFACE CONNECTIONS

PIN ASSIGNMENT

Pin	Name	Description
1	RXO0-	Negative LVDS differential data input. Channel O0 (odd)
2	RXO0+	Positive LVDS differential data input. Channel O0 (odd)
3	RXO1-	Negative LVDS differential data input. Channel O1 (odd)
4	RXO1+	Positive LVDS differential data input. Channel O1 (odd)
5	RXO2-	Negative LVDS differential data input. Channel O2 (odd)
6	RXO2+	Positive LVDS differential data input. Channel O2 (odd)
7	GND	Ground
8	RXOC-	Negative LVDS differential clock input. (odd)
9	RXOC+	Positive LVDS differential clock input. (odd)
10	RXO3-	Negative LVDS differential data input. Channel O3(odd)
11	RXO3+	Positive LVDS differential data input. Channel O3 (odd)
12	RXE0-	Negative LVDS differential data input. Channel E0 (even)
13	RXE0+	Positive LVDS differential data input. Channel E0 (even)
14	GND	Ground
15	RXE1-	Negative LVDS differential data input. Channel E1 (even)
16	RXE1+	Positive LVDS differential data input. Channel E1 (even)
17	GND	Ground
18	RXE2-	Negative LVDS differential data input. Channel E2 (even)
19	RXE2+	Positive LVDS differential data input. Channel E2 (even)
20	RXEC-	Negative LVDS differential clock input. (even)
21	RXEC+	Positive LVDS differential clock input. (even)
22	RXE3-	Negative LVDS differential data input. Channel E3 (even)
23	RXE3+	Positive LVDS differential data input. Channel E3 (even)
24	GND	Ground
25	NC	For LCD internal use only, Do not connect
26	SCL	I2C clock (for auto Vcom)
27	SDA	I2C data (for auto Vcom)
28	VCC	+5.0V power supply
29	VCC	+5.0V power supply
30	VCC	+5.0V power supply

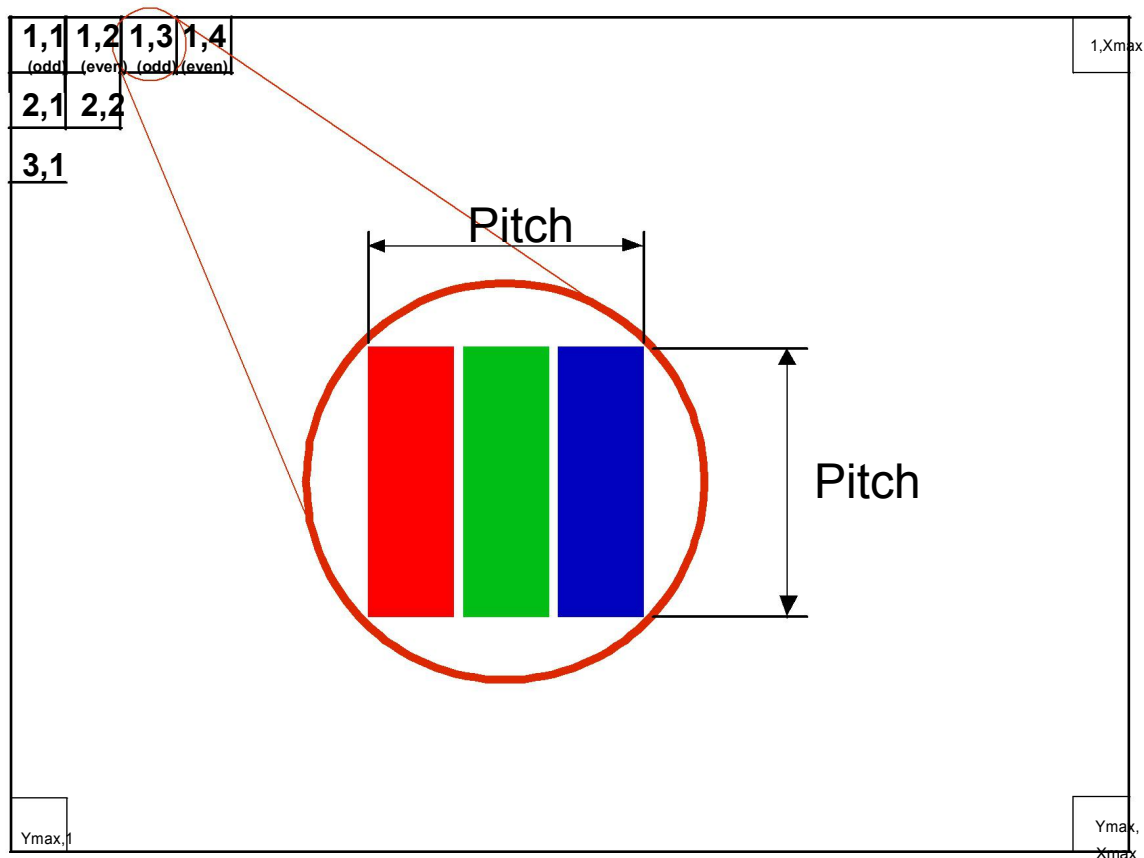
Connector Information

Item	Description
Manufacturer	P-TWO/FCN
Type part number	P-TWO:187098-30091 FCN:WF13-422-3033
User's Mating housing part number	FI-X30HL(JAE) FI-X30H(JAE)

*Notice: There would be compatible issues if not using the indicated connectors in the matching list.

Note (1) The first pixel is odd.

Note (2) Input signal of even and odd clock should be the same timing.



4.3 ELECTRICAL CHARACTERISTICS

4.3.1 LCD ELETRONICS SPECIFICATION

Parameter	Symbol	Value			Unit	Note	
		Min.	Typ.	Max.			
Power Supply Voltage	V _{CC}	4.5	5.0	5.5	V	-	
Ripple Voltage	V _{RP}			300	mV	-	
Rush Current	I _{RUSH}			3	A	(2)	
Power Supply Current	White		768	910	mA	(3)a	
	Black		720	845	mA	(3)b	
	Vertical Stripe		948	1105	mA	(3)c	
Power Consumption	PLCD		4.8	5.6	Watt	(4)	
LVDS interface	Differential Input Voltage	V _{ID}	100	-	600	mV	
	Common Input Voltage	V _{CM}	1.0	1.2	1.4	V	
	Differential Input High Threshold Voltage	V _{TH}		-	100	mV	
	Differential Input Low Threshold Voltage	V _{TL}	-100	-		mV	

Note (1) The ambient temperature is $T_a = 25 \pm 2 \text{ }^\circ\text{C}$.

Note (2) Measurement Conditions:

a. White Pattern



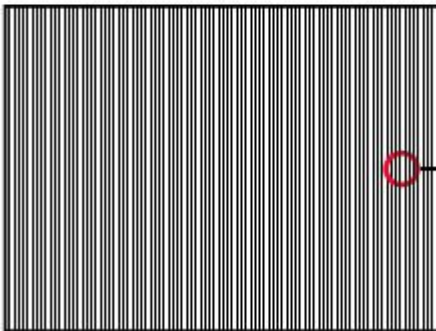
Active Area

b. Black Pattern

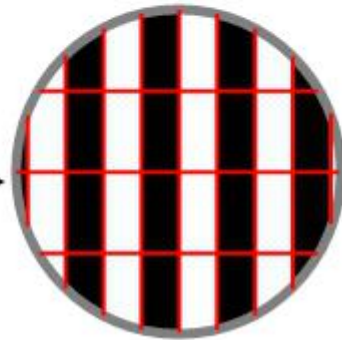


Active Area

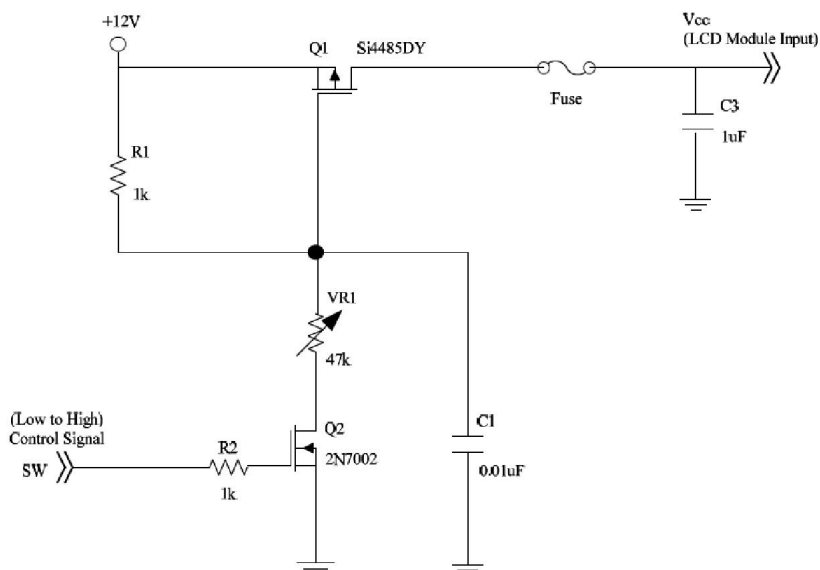
c. Vertical Stripe Pattern



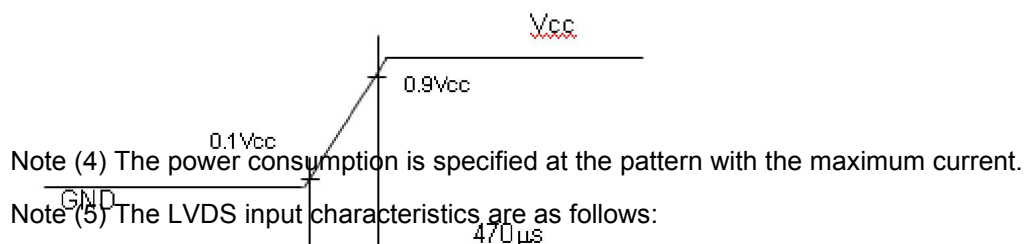
Active Area



Note (3) The specified power supply current is under the conditions at $V_{cc} = 5.0\text{ V}$, $T_a = 25 \pm 2\text{ }^\circ\text{C}$, $F_r = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

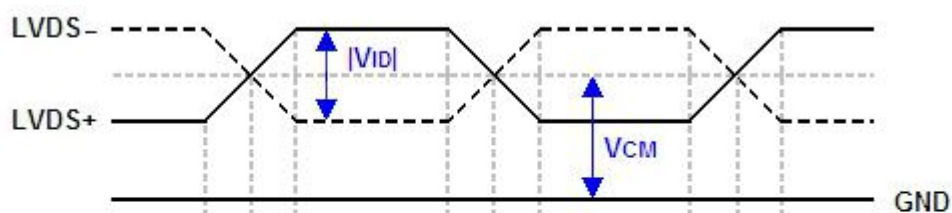


Vcc rising time is 470 μ s

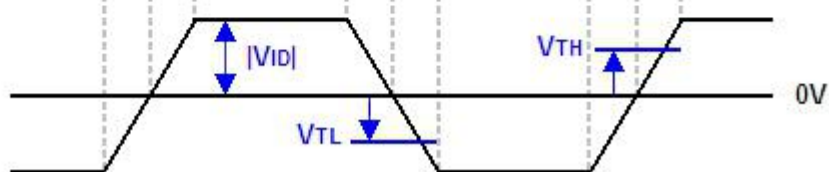


Note (5) The LVDS input characteristics are as follows:

Single-end Signals



Differential Signal



LVDS INPUT SIGNAL SPECIFICATIONS

4.4.1 LVDS DATA MAPPING TABLE

LVDS Channel O0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	OG0	OR5	OR4	OR3	OR2	OR1	OR0
LVDS Channel O1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	OB1	OB0	OG5	OG4	OG3	OG2	OG1
LVDS Channel O2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	OB5	OB4	OB3	OB2
LVDS Channel O3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	OB7	OB6	OG7	OG6	OR7	OR6
LVDS Channel E0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	EG0	ER5	ER4	ER3	ER2	ER1	ER0
LVDS Channel E1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	EB1	EB0	EG5	EG4	EG3	EG2	EG1
LVDS Channel E2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	EB5	EB4	EB3	EB2
LVDS Channel E3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	EB7	EB6	EG7	EG6	ER7	ER6

4.4.2 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Gray Scale Of Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	

Note (1) 0: Low Level Voltage, 1: High Level Voltage

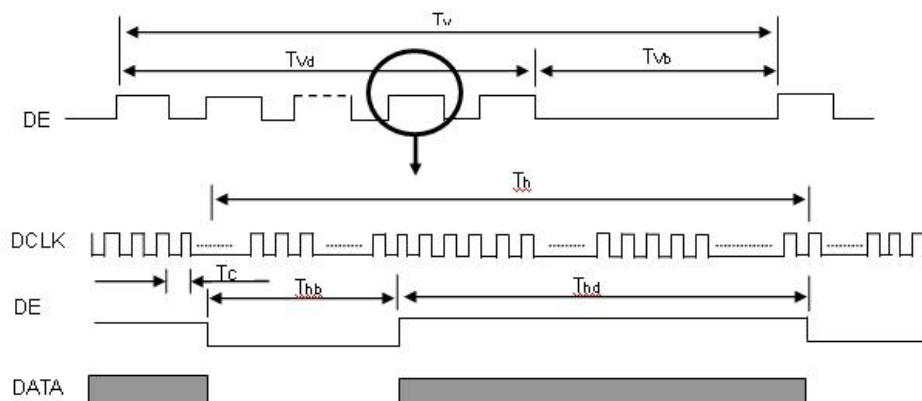
4.5 DISPLAY TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	F _c	58.54	74.25	97.98	MHz	-
	Period	T _c		13.47		ns	
	Input cycle to cycle jitter	T _{rcj}	-0.02*T _c	-	0.02*T _c	ns	(1)
	Input Clock to data skew	TLVCCS	-0.02*T _c	-	0.02*T _c	ps	(2)
	Spread spectrum modulation range	F _{clkin_mod}	0.97*F _c	-	1.03*F _c	MHz	(3)
	Spread spectrum modulation frequency	F _{SSM}	-	-	100	KHz	
Vertical Display Term	Frame Rate	Fr	50	60	75	Hz	T _v =T _v d+T _v b
	Total	T _v	1115	1125	1136	Th	-
	Active Display	T _v d	1080	1080	1080	Th	-
	Blank	T _v b	T _v -T _v d	T _v -T _v d	T _v -T _v d	Th	-
Horizontal Display Term	Total	T _h	1050	1100	1150	T _c	T _h =T _h d+T _h b
	Active Display	T _h d	960	960	960	T _c	-
	Blank	T _h b	T _h -T _h d	T _h -T _h d	T _h -T _h d	T _c	-

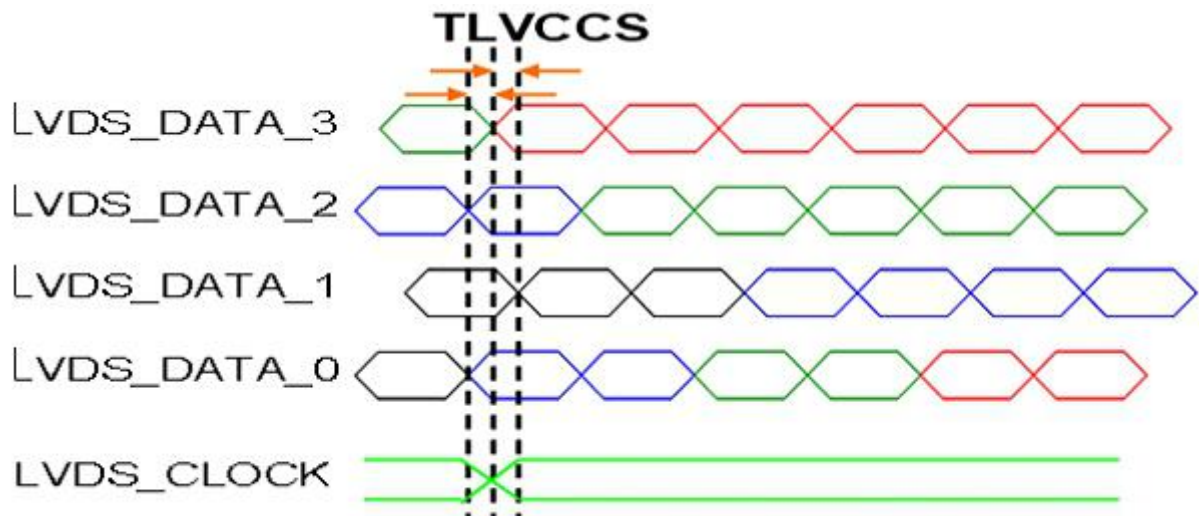
Note: Because this module is operated by DE only mode, Hsync and Vsync input signals are ignored.

INPUT SIGNAL TIMING DIAGRAM

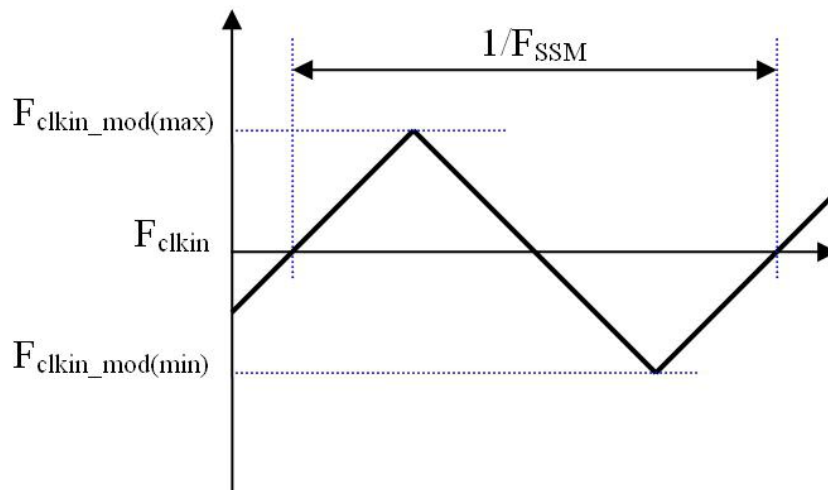


Note (1) The input clock cycle-to-cycle jitter is defined as below figures. $T_{rcj} = |T_1 - T_1|$

Note (2) Input Clock to data skew is defined as below figures.



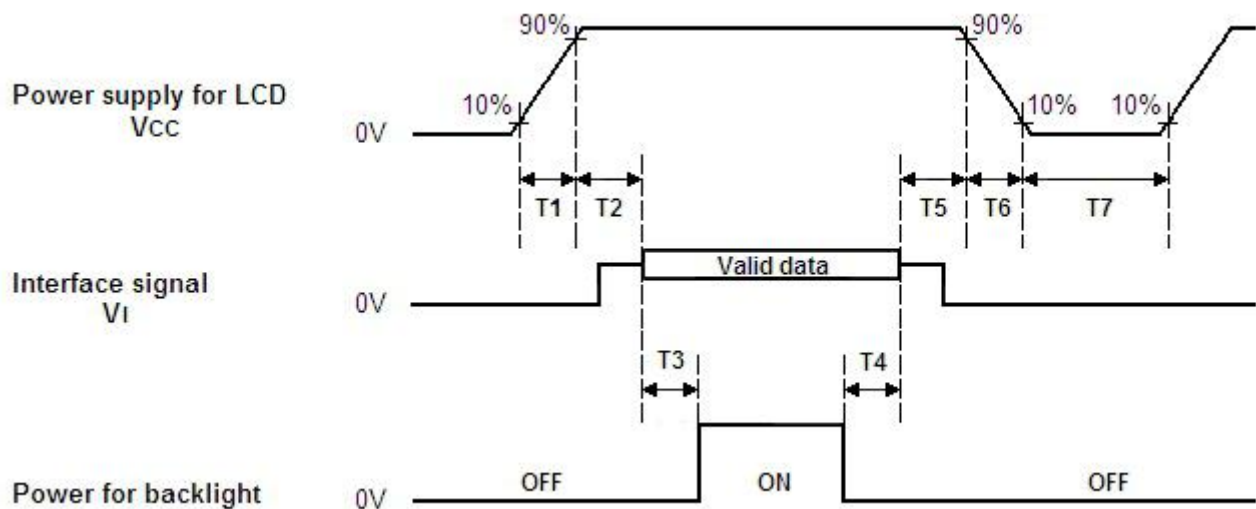
Note (3) The SSCG (Spread spectrum clock generator) is defined as below figures.



Note (4) The DCLK range at last line of V-blank should be set in 0 to Hdisplay/2

4.6 POWER ON/OFF SEQUENCE

The power sequence specifications are shown as the following table and diagram.



Timing Specifications:

Parameters	Values			Units
	Min	Typ.	Max	
T1	0.5	-	10	ms
T2	0	30	50	ms
T3	450	--	-	ms
T4	100	250	-	ms
T5	0	20	50	ms
T6	0.1	-	100	ms
T7	1000	-	-	ms

Note (1) The supply voltage of the external system for the module input should be the same as the definition of Vcc.

Note (2) When the backlight turns on before the LCD operation of the LCD turns off, the display may momentarily become abnormal screen.

Note (3) In case of VCC = off level, please keep the level of input signals on the low or keep a high impedance.

Note (4) T7 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

Note (6) INX won't take any responsibility for the products which are damaged by the customers not following the Power Sequence.

Note (7) There might be slight electronic noise when LCD is turned off (even backlight unit is also off).

To avoid this symptom, we suggest "Vcc falling timing" to follow "t6 spec".

5. OPTICAL CHARACTERISTICS

5.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	oC
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	VCC	5	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current Per Input Pin	IPIN	80 ± 1.5	mA
PWM Duty Ratio	D	100	%
LED Light Bar Test Converter	INX R373B0000U000		

5.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 5.2. The following items should be measured under the test conditions described in 5.1 and stable environment shown in Note (7).

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Color Chromaticity (CIE 1931)	Red	Rx	$\theta_x=0^\circ, \theta_y=0^\circ$ CS-2000 R=G=B=255 Gray scale	Typ - 0.03	0.635	Typ + 0.03	-	(1), (5)
		Ry			0.340			
	Green	Gx			0.315			
		Gy			0.635			
	Blue	Bx			0.155			
		By			0.050			
	White	Wx			0.313			
		Wy			0.329			
Center Transmittance	T%			4.46		%	(1), (6)	
Contrast Ratio	CR		2000	3000	-	-	(1), (3)	
Luminance	LW		-	550	-	cd		
Response Time	TR			20	25	ms	(3)	
	TF			5	10	ms	(3)	
	T _{GIG-AVE}	$\theta_x=0^\circ, \theta_y=0^\circ$	-	30	35	ms	(3)	
Viewing Angle	Horizontal	x +	CR ≥ 10	80	89	-	Deg.	(1), (2)
		x -		80	89	-		
Viewing Angle	Vertical	y +		80	89	---		
		y -		80	89	---		

Note (1) Definition of Viewing Angle ($_x, _y$):

Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

L255: Luminance of gray level 255

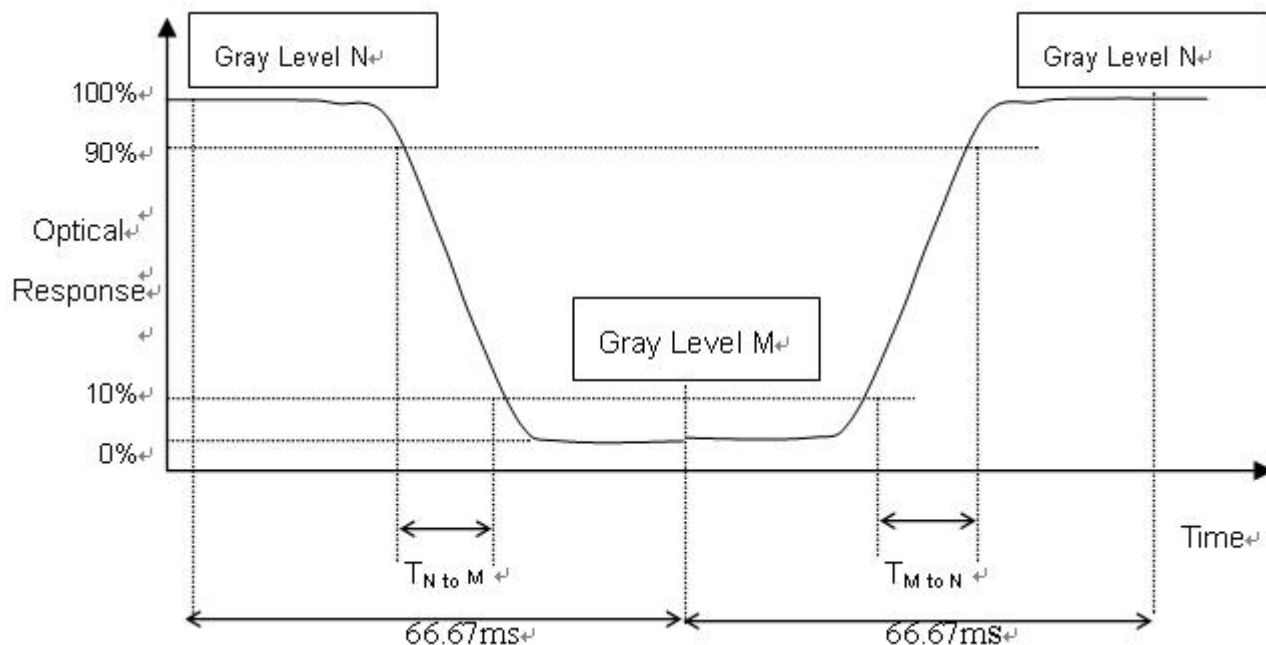
L 0: Luminance of gray level 0

CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time :

- The TR is the rising-time means the transition time from “Full-Black (gray 0)” to “Full-White (gray 255)” and the TF is the falling-time means the transition time from “Full-White (gray 255)” to “Full-Black (gray 0)” as the following figure.(Measured by TEKTRONIX TDS3054B).
- The TGtG is the response time means the transition time from “Gray N” to “Gray M” (N,M=0~255).



- T_{GIG_AVE} is the total average of the T_{GIG} data (Measured by INX GTG instrument)
- The gray (N,M) stands for the (0,31,63,~255) as the following table.
- If system use ODC (Over Driving Circuit) function, T_{GIG_AVE} may be 5ms~10ms.
- * It depends on Overshoot rate

Gray to Gray		Rising time								
		0	31	63	95	127	159	191	223	255
Falling time	0									
	31									
	63									
	95									
	127									
	159									
	191									
	223									
255										

Note (4) Definition of Luminance of White (L_c):

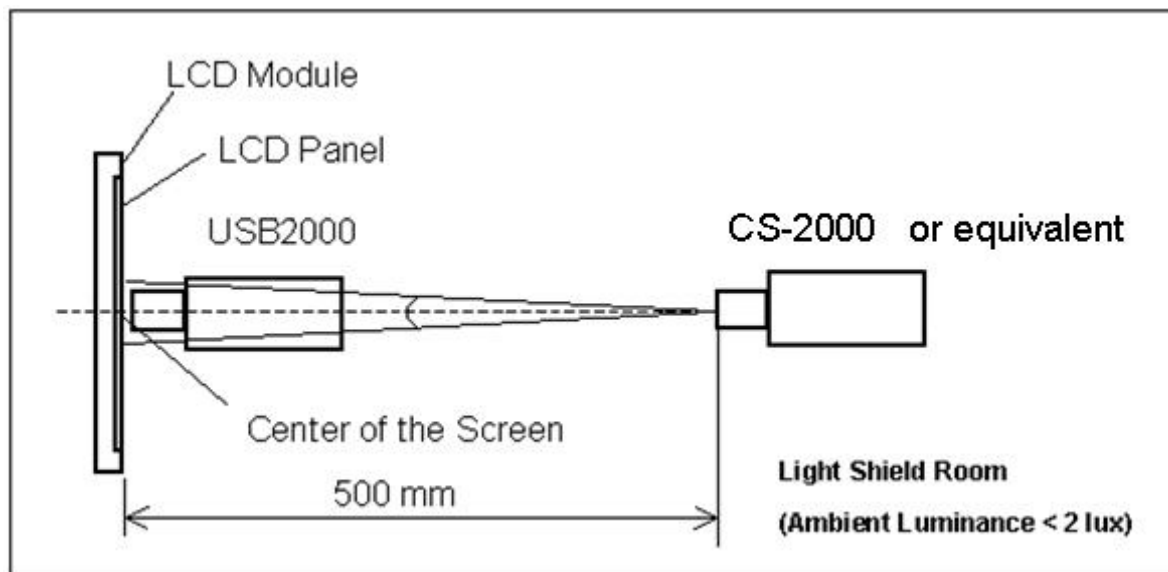
Measure the luminance of gray level 255 at center

point $L_c = L(5)$

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

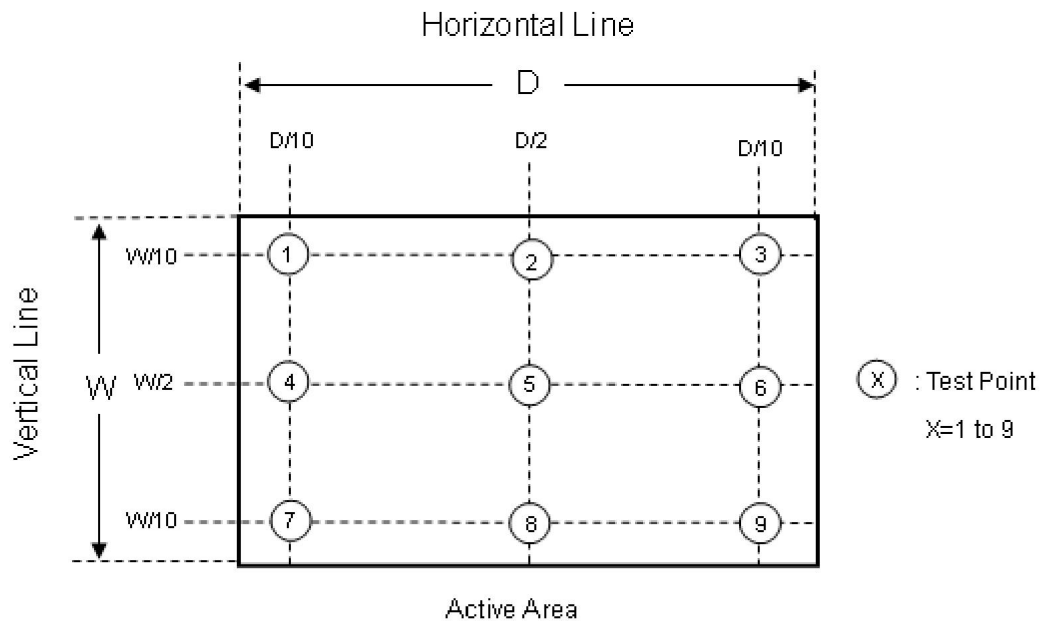
The LCD module should be stabilized at given temperature for 40 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 40 minutes in a windless room.



Note (6) Definition of White Variation ($_W$):

Measure the luminance of gray level 255 at 9 points

$_W = (\text{Minimum} [L(1) \sim L(9)] / \text{Maximum} [L(1) \sim L(9)]) * 100\%$



6. RELIABILITY TEST ITEM

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50℃, 80%RH, 240hours	(1)
High Temperature Operation (HTO)	Ta= 50℃, 240hours	
Low Temperature Operation (LTO)	Ta= 0℃, 240hours	
High Temperature Storage (HTS)	Ta= 60℃, 240hours	
Low Temperature Storage (LTS)	Ta= -20℃, 240hours	
Package Vibration Test	ISTA STANDARD 1.14Grms Random, Frequency Range: 1 ~ 200 Hz Top & Bottom: 30 minutes (+Z), 10 min (-Z), Right & Left: 10 minutes (X) Back & Forth 10 minutes (Y)	(2)
Thermal Shock Test (TST)	-20℃/30min, 60℃ / 30min, 100 cycles	(1)
On/Off Test	25℃, On/10sec, Off /10sec, 30000 cycles	
Altitude Test	Operation: 10000 ft / 24hours Non-Operation: 30000 ft / 24hours	

Note (1) The tests are done with LCD modules (M215HJJ-L30).

Note (2) The test is done with a package shown in Section 8

- (9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (10) When ambient temperature is lower than 10°C may reduce the display quality. For example, the response time will become slowly.
- (11) While touching the panel surface under the patterns with higher grey levels, a shadow or mura phenomenon would be seen. This phenomenon is totally recoverable by switching the patterns to lower grey levels. It is a product feature.

9.2 STORAGE PRECAUTIONS

- (1) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0°C to 35°C and relative humidity of less than 70%
- (2) Do not store the TFT – LCD module in direct sunlight
- (3) The module should be stored in dark place. It is prohibited to apply sunlight or fluorescent light in storing

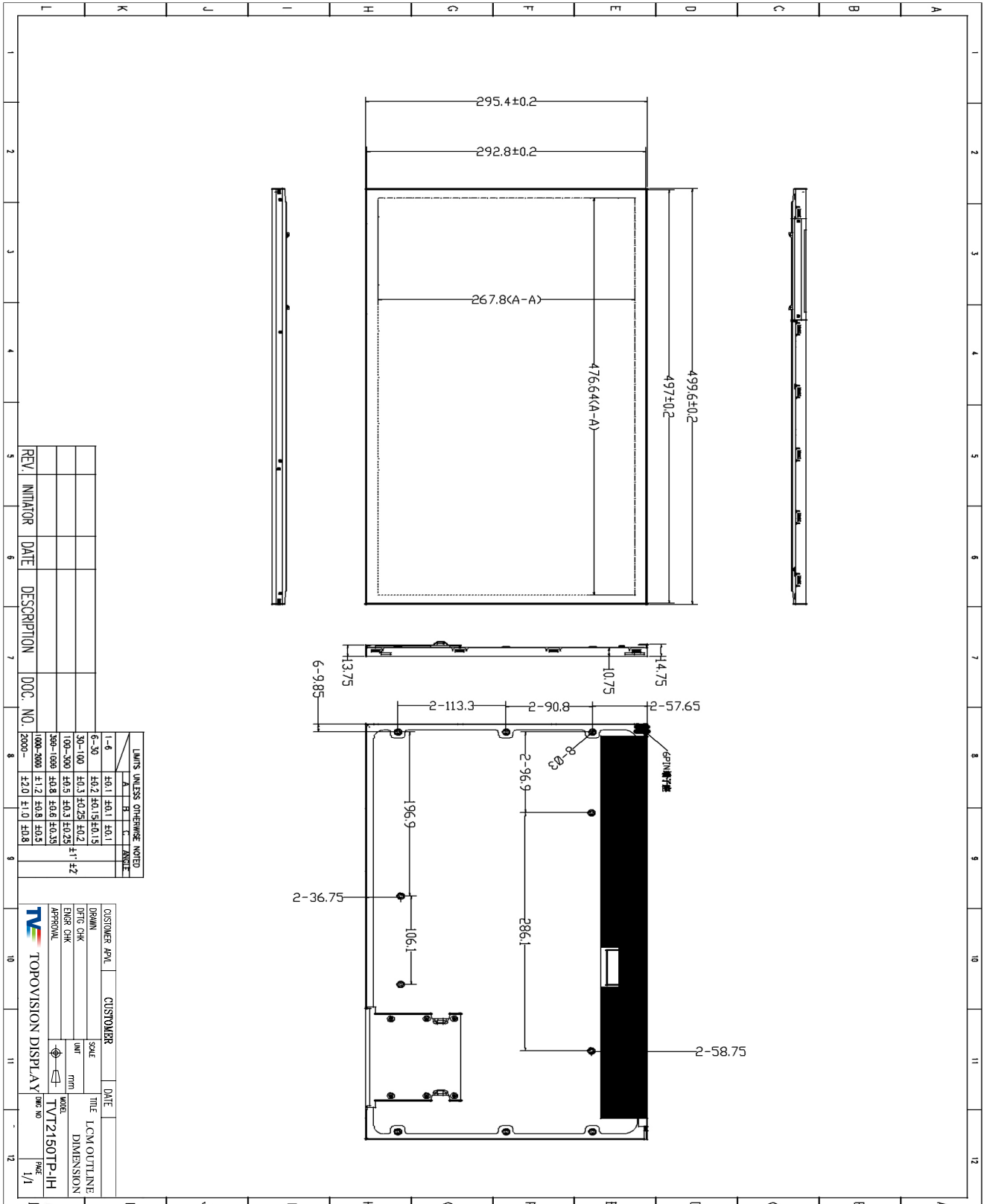
9.3 OPERATION PRECAUTIONS

- (1) The LCD product should be operated under normal condition.
Normal condition is defined as below :
Temperature : 20±15°C
Humidity: 65±20%
Display pattern : continually changing pattern(Not stationary)
- (2) If the product will be used in extreme conditions such as high temperature, high humidity, high altitude ,display pattern or operation time etc...It is strongly recommended to contact INX for application engineering advice . Otherwise, its reliability and function may not be guaranteed.

SAFETY PRECAUTIONS

- (1) 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, skin or clothes, it has to be washed away thoroughly with soap.
- (2) After the module's end of life, it is not harmful in case of normal operation and storage.

1: LCM Drawing



2. 适用

本规格承认书适用于 21.5 无边框电容触摸屏

3. 产品指定

客户产品名称: 21.5 无边框触摸屏

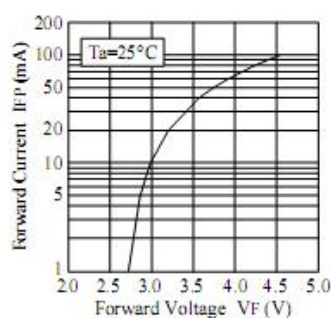
客户产品料号:

产品型号: TVT2150TP-IH

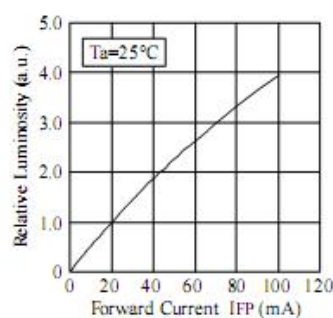
4. 光电特性

3.1. LED 光源特性图:

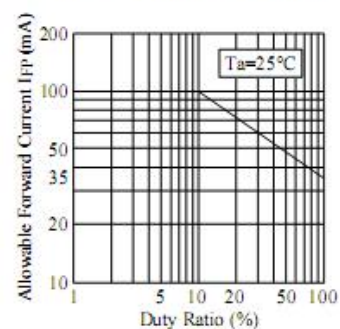
■ Forward Voltage vs. Forward Current



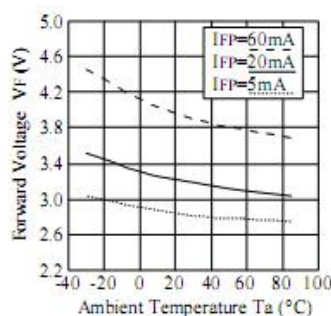
■ Forward Current vs. Relative Luminosity



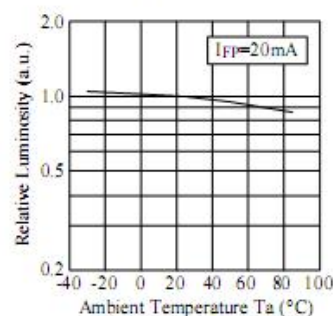
■ Duty Ratio vs. Allowable Forward Current



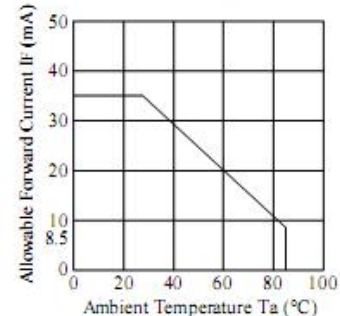
■ Ambient Temperature vs. Forward Voltage



■ Ambient Temperature vs. Relative Luminosity



■ Ambient Temperature vs. Allowable Forward Current

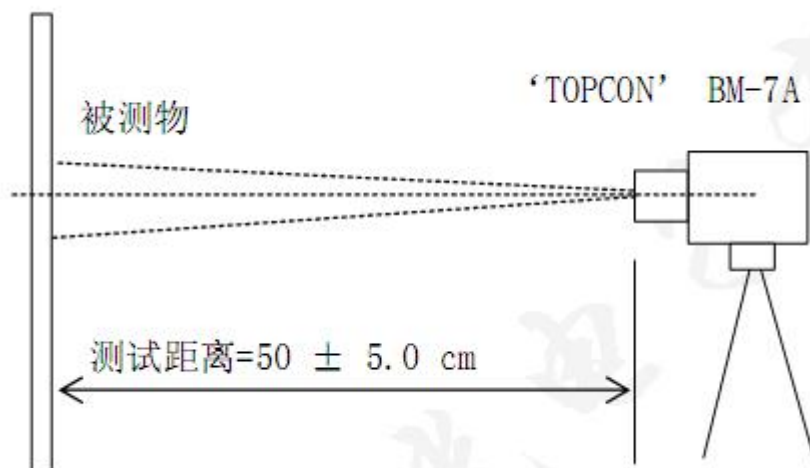


LCM 光学特性

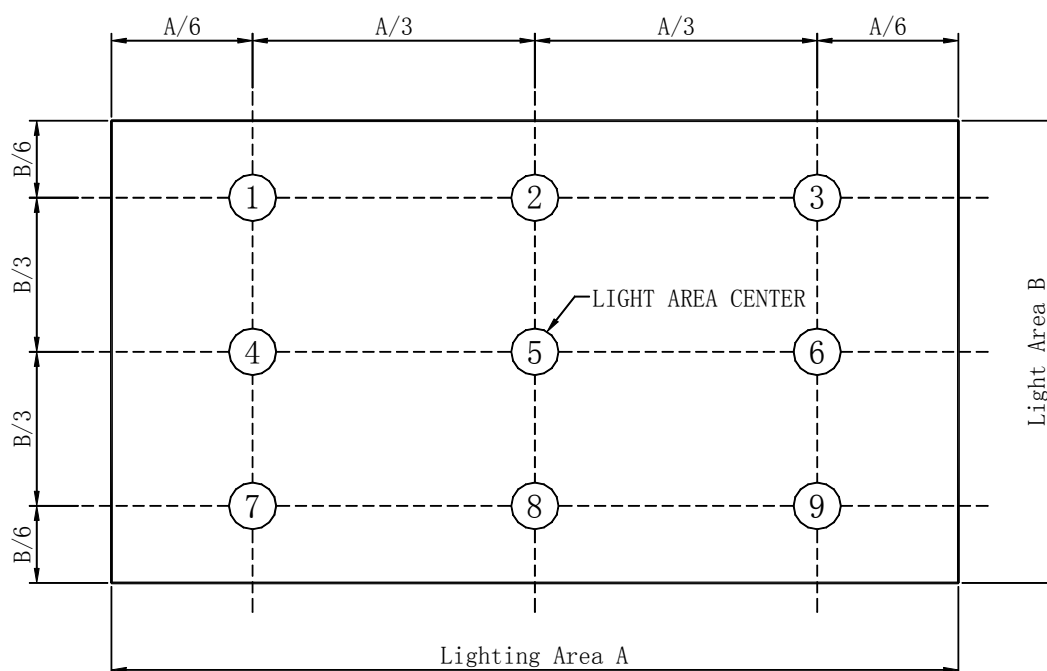
(除非特别说明, 环境温度 Ta=25°C)

NO	ITEM	VALUE			UNIT	备注	
		MIN	TYP	MAX			
1	Vf (顺电压)	57	60	66	V	IF=300MA	
2	辉度	300	350	--	cd/m ²	IF=300MA	
3	平均色度	X	0.260	--	0.32	--	IF=300MA
		Y	0.260	--	0.32	--	IF=300MA
4	均匀性	70	80	--	%	IF=300MA	

- 备注：1. 均匀性为 9 点辉度值之(最小辉度/ 最大辉度)×100%值；
 2. 因白色 LED 的波长特性，供货时无法做到每批颜色与样品一致，但能保证每批次颜色一致
 3 光学测试规定：
 4. 3.1 测试仪器及方法（如下图所示：）



4. 3.2 测试点位置图：（如下图所示：）



测试条件：

- a. 测试设备：TOPCON BM-7A
 机器误差亮度为 8%，色坐标为 0.005
- b. 观察角度：正对产品，垂直 90° ，角度误差 $\pm 2^\circ$
- c. 稳定时间：LED 背光源点亮 1 分钟后测定，CCFL 背光源点亮 5 分钟（L 型灯管 10 分钟）后测定
- d. 测试环境：环境温度为 25°C ，湿度 $60\text{RH} \pm 20\text{RH}$ ；环境亮度：暗室条件（10LUX 以下）

5. 产品寿命

周围温度 $25^{\circ}\text{C}\pm 2^{\circ}\text{C}$ 、(If=20mA/LED)之推荐使用条件下,背光源之寿命为:

试验项目	检 验 方 法	判 定
高温高湿放置试验	70°C , 90%RH/240Hrs	测试后,须放置常温,常湿 24 小时后测定。 (1) 光学特性变化在 20%以内。电压变化 $\leq \pm 5\%$ 。 (2) 外形尺寸变化仍在规格以内。 注:马口铁、镀铝锌板、镀锌板等不防锈产品,在高湿、吸潮情况下易锈,由此产生的不良不列入判定项以内
低温放置试验	-30°C /240Hrs	
高温放置试验	70°C /240 Hrs	
继续动作实验	30 秒:ON/30 秒:OFF 1000 Cycles	
寿命实验	$25\pm 2^{\circ}\text{C}$ 2500 小时	
高温高湿操作试验	60°C , 90%RH/240 Hrs	
高温操作试验	65°C /240 Hrs	
低温操作试验	-20°C /500 Hrs	
冷热冲击试验	$65^{\circ}\text{C} \rightarrow -20^{\circ}\text{C}$ (1Hr) \rightarrow (1 Hr) 100Cycles	

注:正常平均寿命为:60000 小时以上.

亮度减半平均寿命 30,000 小时以上
亮度减半保证寿命 20,000 小时以上

6. 性耐性实验

5.1 信赖性试验

5.2 包装测试(以一箱 13 片为测试单位)

测试项目	测试条件	测试结果
振动试验	1. 波形: sine wave 2. 周波数: 80Hz 3. 加速度: 1G(9.8m/sec ²) 4. 振动方向: 垂直 5. 振动时间: 1 小时	合格
落下试验	1. 落下顺序: 一角、三棱、六面的落下方式依序测试 2. 落下高度: 65cm 3. 落下次数: 各一回 4. 自由落体的重量: 11.55KG	合格
Lead 线拉伸强度	于管轴方向可抵抗 19.6N(2KG/sec) 静荷重	合格
Connector 拉伸强度	于轴方向可抵抗 9.8N(1KG/sec) 静荷重	合格
下盖螺栓孔承受扭力	1.5kgf.cm	合格

注: 一箱包装 13 片

- 外包装箱不可以有破裂现象
- 背光源本身不可有外观及内部的损坏。
- 物理特性仍需符合背光源产品个别购入规格的光学规格及电器规格。
- 尺寸仍需符合背光源产品个别购入规格的重要管