
	<input type="checkbox"/> Preliminary Specification <input checked="" type="checkbox"/> Product Specification	
	Standard Product	Part Number: TM080JDHP95-00 Version: 1.1

SPECIFICATION

Tianma Part Number: TM080JDHP95-00
Description: 8.0” HD Normally Black

	Department	Name	Signature
Tianma	Integrate Project Manager	Jon	
	Project Management	Bill_Hu	
Customer			

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Revision History

Version	Page	Revision Items	Name	Date
V0.1	All	First Release.	Ray Wen	2016-2-25
V0.2	P17	Update the Optical Characteristics	Ray Wen	2016-3-29
V 0.3	P26	Update the Appendix	Ray Wen	2016-4-27
V 0.4	P22	Update Drawing	Ray Wen	2016-4-28
V 0.5	P6	Update the Pin Assignment	Ray Wen	2016-7-19
V 0.6	P17	Update the white Chromaticity	Ray Wen	2016-8-03
V 0.7	P7,P11,P24	Update : 1. Scan direction Description 2. De-Rating Curve 3. Product Inspection Criteria.	Bill Hu	2016-10-20
V 0.8	P6,P17	Update : 1. Description of Pin8,Pin9,P10 2. The Color Chromaticity of Wy	Bill Hu	2016-12-30
V 1.0	P24	Update : 1. Dark /Bright spots Inspection Criteria. 2. Change to Product specification from Preliminary Specification. 3. Power ON/OFF Sequence and note.	Bill Hu	2017-3-18
V 1.1	P5,P6,P7,P10,P11,P14,P19,P21	Update some typing error.	Bill Hu	2017-4-5



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1. Precautions for Use of LCD Modules

1.1 Handling Precautions

- 1.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 1.1.2 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.
- 1.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 1.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle the polarizer carefully.
- 1.1.5 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
- 1.1.6 Do not attempt to disassemble the LCD Module.
- 1.1.7 If the logic circuit power is off, do not apply the input signals.
- 1.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - 1.1.8.1 Be sure to ground the body when handling the LCD Modules.
 - 1.1.8.2 Tools required for assembly, such as soldering irons, must be properly grounded.
 - 1.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - 1.1.8.4 The LCD Module is covered with a film to protect the display surface. Be carefully and slowly when peeling off this protective film since static electricity may be generated.

1.2 Storage precautions

- 1.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.
- 1.2.2 The LCD modules should be stored under the storage temperature range. the recommend condition is: Temperature : 0℃ ~ 40℃, Relatively humidity: ≤80%, and no more than 1 year..
- 1.2.3 The LCD modules should be stored in the room without acid, alkali and sulfur compound harmful gas, etc.

1.3 Transportation Precautions

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

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2. Features

This is 8.0-inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) module. It is composed of a 8.0 inch TFT-LCD panel, LCD Driver IC with T-con integrated, FPC and a backlight unit.

This is 8.0-inch TFT-LCD Normally Black SFT technology module, which is designed for Automotive, and other high reliability electronic products required high performance flat panel displays. It is designed for Touch Panel by air-gap bonding, instead of optical bonding by OCR. Requirements on Environmental Protection of this 8.0 inch module are Following *RoHS*.

3. General Specifications


Feature		Spec	Remark
Display Spec.	Size	8.0 inch	
	Resolution	1280(RGB) x 720	
	Interface	One-port LVDS 24 bits VESA	
	Color Depth	16.7 M	
	Technology Type	a-Si	
	Pixel Pitch (mm)	0.138 x 0.138	
	Pixel Configuration	R.G.B. Vertical Stripe	
	Display Mode	Normally Black SFT technology	
	Surface Treatment (LCD Upper Polarizer)	HC	
	Gray Scale Inversion Direction	No gray inversion.	
	Viewing Direction	Landscape Mode Optimized	
	LCM (W x H x D) (mm)	192.8x116.9x6.4	Note 2
	Polarizer Sunglass Compatible	Yes	
Mechanical Characteristics	Active Area(mm)	176.64 x 99.36	
	With /Without Touch Panel	Touch panel not included	
	Weight (g)	Max. 196g (typ.)	Note 3
	LED Configuration	3 parallels 7 serials	

Table 3.1 General TFT Specifications

Note 1: Requirements on Environmental Protection: RoHS.

Note 2: The height dimension does not include the length of FPC.

Note 3: LCM weight tolerance: $\pm 10\%$.

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4. Input/output Terminals

4.1 CN1 pin assignment

Recommended Mating Connector type: FH28D-30S-0.5SH (Hirose)


No	Symbol	I/O	Description	Remark
1	NC	N	MUST be non-connection.	
2	VDD	P	Power supply 3.3V(Typ)	
3	VDD	P	Power supply 3.3V(Typ)	
4	GND	P	Power Ground	
5	RESET	I	Global reset signal	
6	STBYB	I	Standby mode control signal	
7	GND	P	Power Ground	
8	SDA	I/O	Only for Tianma OTP use, Not connect	
9	SCL	I	Only for Tianma OTP use, Not connect	
10	CSB	I	Only for Tianma OTP use, Not connect	
11	GND	P	Power Ground	
12	TB	I	Vertical shift direction (gate output) selection	
13	RL	I	Horizontal shift direction (source output) selection	
14	GND	P	Power Ground	
15	LV0N	I	Negative LVDS Differential data input(0)	
16	LV0P	I	Positive LVDS Differential data input(0)	
17	GND	P	Power Ground	
18	LV1N	I	Negative LVDS Differential data input(1)	
19	LV1P	I	Positive LVDS Differential data input(1)	
20	GND	P	Power Ground	
21	LV2N	I	Negative LVDS Differential data input(2)	
22	LV2P	I	Positive LVDS Differential data input(2)	
23	GND	P	Power Ground	
24	CLKN	I	Negative LVDS Differential clock input	
25	CLKP	I	Positive LVDS Differential clock input	
26	GND	P	Power Ground	
27	LV3N	I	Negative LVDS Differential data input(3)	
28	LV3P	I	Positive LVDS Differential data input(3)	
29	GND	P	Power Ground	
30	VDDOTP	P	Power input for OTP programming, Not connect	

Table 4.1.1 Pin assignment for TFT interface

Note1: All of GND pins should be connected to system ground.

Note2: I/O definition.

I---Input, O---Output, P--- Power/Ground, N--- No connection

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Note3:

Scan Control Input		Scanning Direction
TB	RL	
L	H	Bottom →Top, Left →Right
H	L	Top →Bottom, Right →Left
H	H	Top →Bottom, Left →Right
L	L	Bottom →Top, Right →Left

Table 4.1.2 Scan direction Description

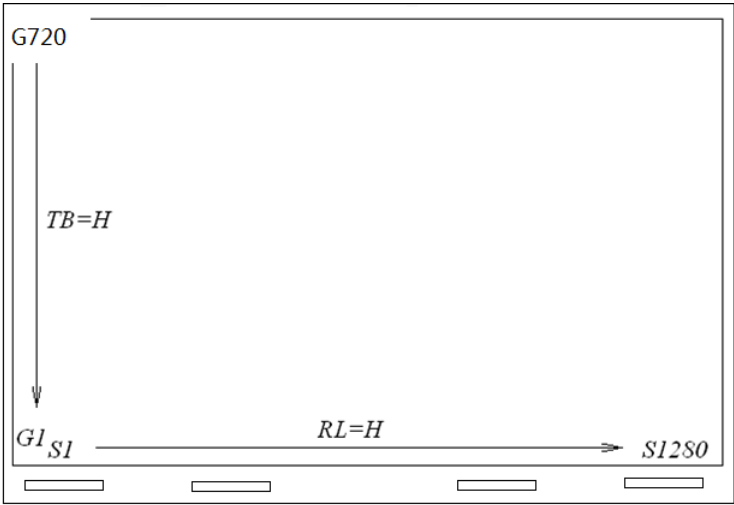



Figure 4.1.1 Scan direction Description

4.2 CN2 pin assignment (Backlight interface)

Recommended Mating Connector type: FH28-10S-0.5SH Hirose

PIN NO.	Symbol
1	A1
2	A2
3	A3
4	NC
5	NTC+
6	NTC-
7	NC
8	C3
9	C2
10	C1

Table 4.2.1 Pin assignment for backlight interface

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5. Absolute Maximum Ratings

GND=0V, Ta = 25°C


Item	Symbol	Min	Max	Unit	Remark
Power supply voltage	VDD	-0.3	3.96	V	Note2
Analog supply voltage	AVDDP	-0.3	6.5	V	Internal DCDC
Analog supply voltage	AVDDN	-6.5	0.3	V	
Gate on voltage	VGH	-0.3	VGL+40	V	
Gate off voltage	VGL	-25	+0.3	V	
Gate voltage range	VGH-VGL	12	40	V	
Digital I/O signal input	Vio	-0.3	VDD+0.3	V	
Back Light Forward Current	If	-	150	mA	Per chain
Operating Temperature	Top	-30	85	°C	Note1, 3
Storage Temperature	Tst	-40	85	°C	

Table 5.1.1 Absolute maximum rating

Note1: The temperature is the surface temperature of module

Note2: If the voltage exceeds its absolute maximum ratings, the LCM maybe damaged. In addition, if the LCM is operated with the absolute maximum ratings for a long time, its reliability drops.

Note3: Functional operation should be restricted under normal ambient temperature.

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6. Electrical Characteristics

6.1 DC Characteristics for Panel Driving


GND=0V

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Supply Voltage	VDD	3.0	3.3	3.6	V	
Power consumption	Ivdd	-	266.5	400	mA	VDD=3.3V, white pattern, DCLK=63.7MHz , fv=60Hz Note 1
In-rush current	Ivdd-rush	-	-	1	A	VDD=3.3V Note 1
Control Signal	Vh	0.7*VDD	-	VDD	V	T=25℃
	VI	0	-	0.3*VDD	V	T=25℃
Allowable VDD ripple	VDD-ripple	-	-	100	mV	
Differential Input High Voltage(threshold)	Vth	-	-	0.1	V	Note2
Differential Input Low Voltage(threshold)	Vtl	-0.1	-	-	V	
Magnitude Differential Input Voltage	V _{id}	0.2	-	0.6	V	
Common Mode Voltage	V _{cm}	1	1.2	1.8- V _{id} /2	V	
Spread Spectrum Clocking Ratio	SSCR	50	-	200	KHz	

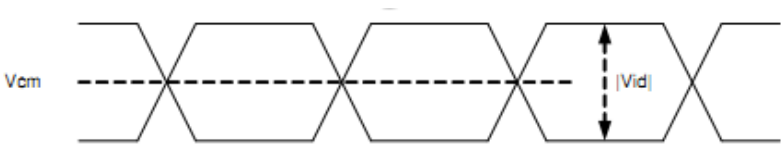
Table 6.1.1 LCD module electrical characteristics

Note1: For different LCM, the value may have a bit of difference.

Note2: Refers to the LVDS waveform below

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Single-ended:
CLKP
CLKN
LV[3:0]P
LV[3:0]N



Differential:
CLKP-CLKN
LV[3:0]P
LV[3:0]N

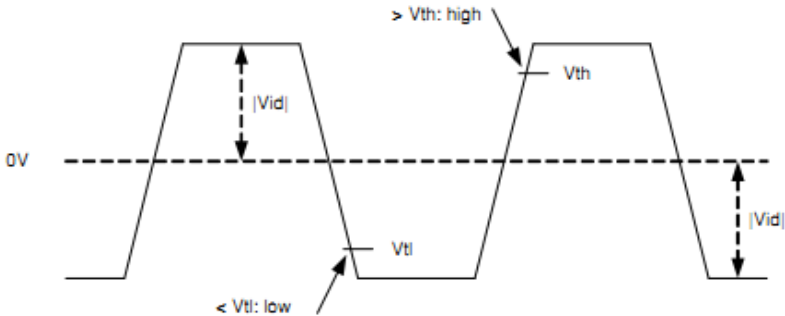


Figure 6.1.1 LVDS waveform


Parameter	Symbol	Min.	Spec. Typ.	Max.	Unit	Condition
Modulation Frequency	SSC _{MF}	-	-	200	Khz	LVDS clock frequency centered at 80MHz.
		-	-	150	Khz	LVDS clock frequency centered at 60MHz.
		-	-	100	Khz	LVDS clock frequency centered at 40MHz.
		-	-	50	Khz	LVDS clock frequency centered at 20MHz.
Modulation Rate	SSC _{MR}	-	-	±5	%	LVDS clock frequency + SSC _{MR} is in the range of 10~85MHz.

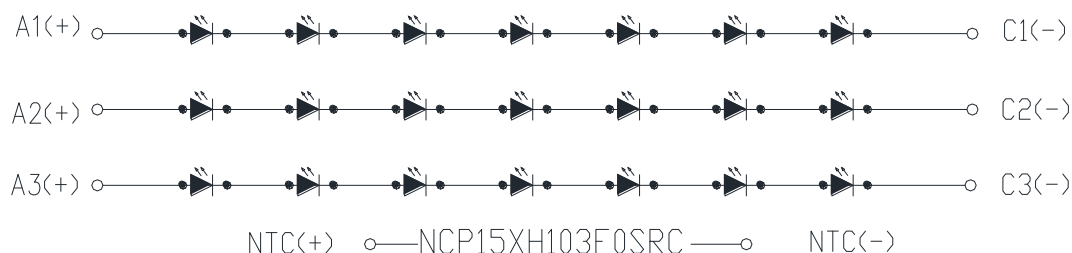
Table 6.1.2 SSC limitation of LVDS interface

6.2 DC Characteristics for Backlight Driving

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I _{BL}	-	95	98	mA	Note1
Forward Voltage	V _{BL}	18.9	21.7	23.8	V	
LED Life Time	-	30000	-	-	Hrs	Note2
Backlight Power Consumption	-	5.4	6.2	6.8	W	95mA/ Channel

Table 6.2.1 LED backlight characteristics

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6.2.2 Backlight dirving curcuit figure

Note 1: I_{BL} is defined for one channel LED, There are total three LED channels in back light unit Under LCM operating, and the stable forward current should be inputted.

Note 2: It is estimation result based on LED supplier data. Optical performance should be evaluated at $T_a=25^{\circ}\text{C}$ only. Operating life means brightness goes down to 50% of original brightness.

Note 3: it is suggested Customer to make sure the LCM module in the system is well heat dissipation. When operating at high temperature, keep panel surface temperature under 85°C or obey the de-rating curve as curve 6.2.3.

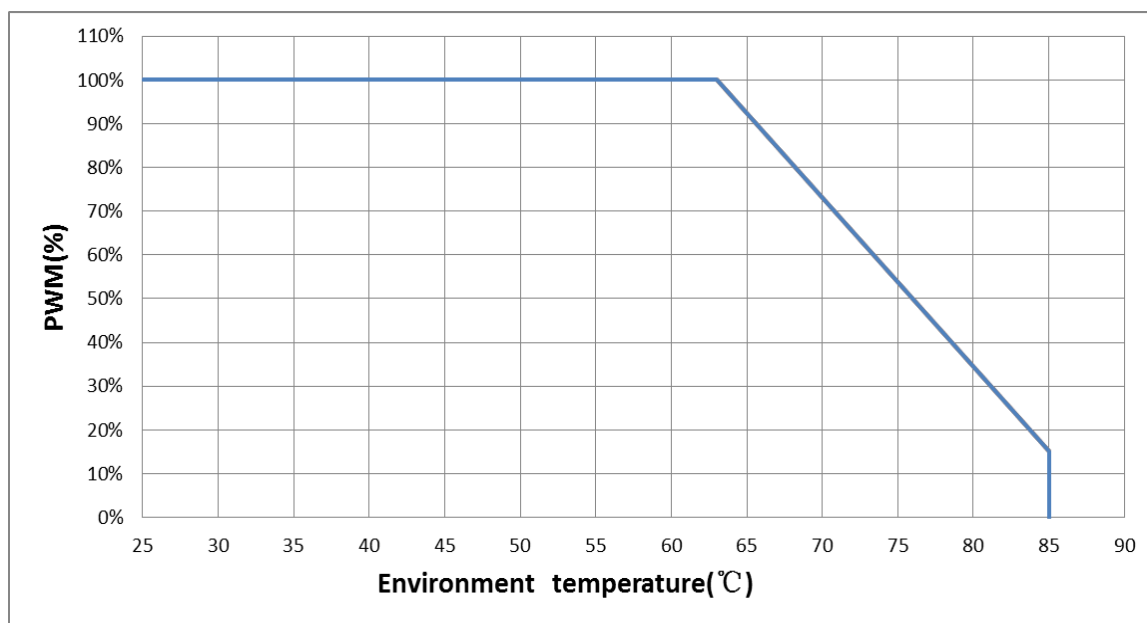


Figure 6.2.3 Backlight Current De-Rating Curve

6.3 Recommended Power ON/OFF Sequence

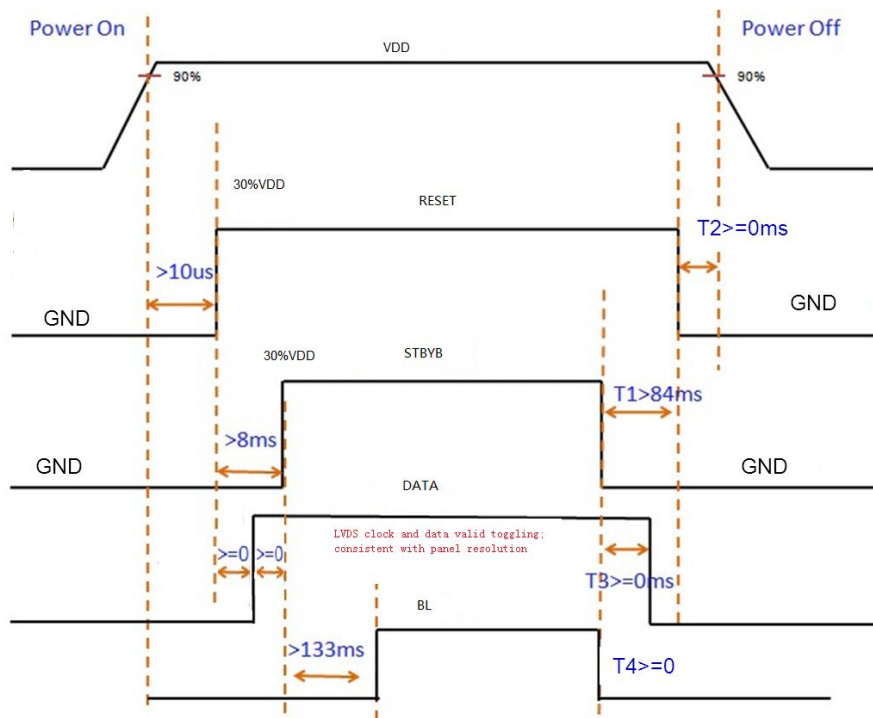



Figure 6.3.1 Power on/off Sequence

Note1: The low level of these signals and analog powers are GND level.

Note2: All of power and signals should be kept GND level before power on.
IF there are remaining voltages on them, LCD might become abnormal.

Note3: BL is the voltage applied to backlight, and it will stay low level before display stability; and it need to be turned off before STBYB off, refer to T4 in above figure.

Note4: DATA stands for LVDS signals. The valid LVDS signals (clock pair and data pairs in toggling state) should be consistent with panel solution and timing specification.

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6.4 LCD Block Diagram

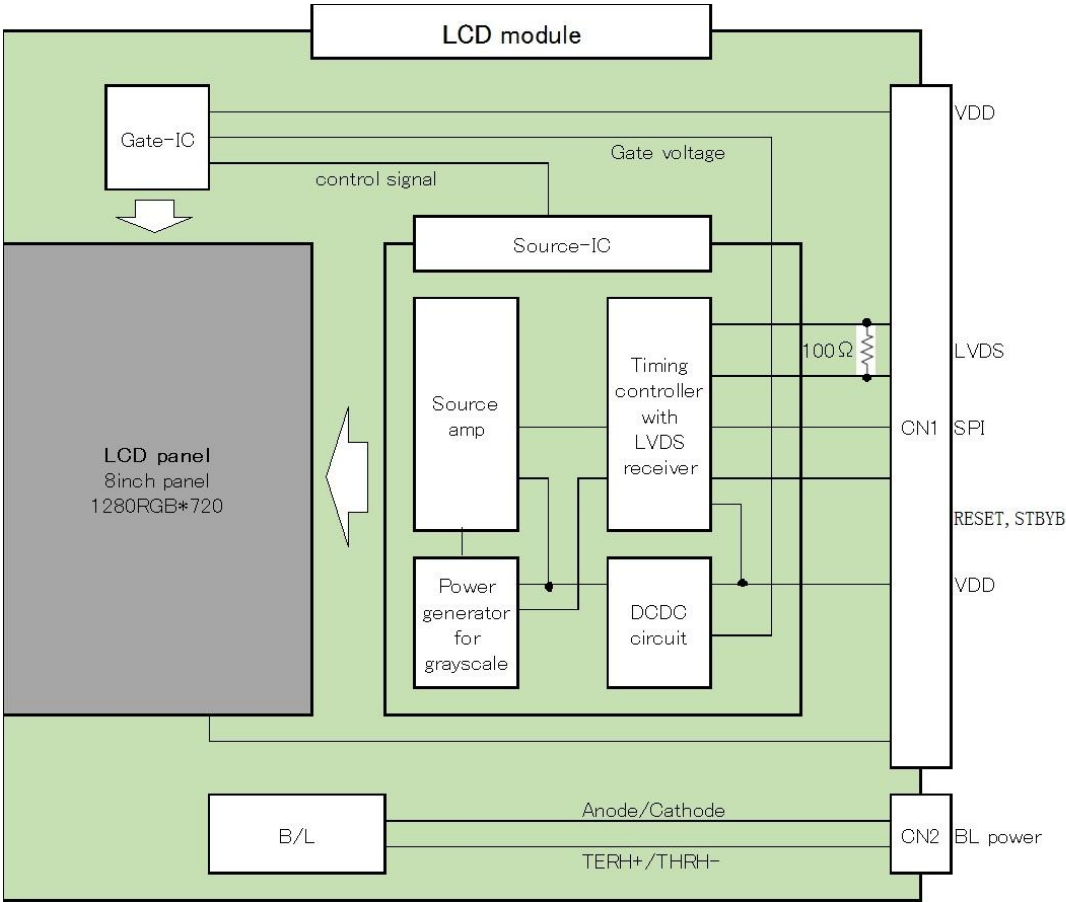


Figure 6.4.1 LCD Block Diagram

7. Timing Characteristics

7.1 Input timing

Parameter	Symbol	Unit	Min.	Typ.	Max.	Remarks
Clock Frequency	f_{dck}	MHz		63.7		Note1
H Total Time	T_{hp}	clocks	1336	1340	1472	
H Active Time	HA	clocks		1280		
H Blank	T_{hfp}	clocks	56	60	192	
V Total Time	T_{vp}	lines	730	792	864	
V Active Time	VA	lines		720		
V Blank	T_{vfp}	lines	10	72	144	
V Frequency	f_v	Hz	-	60	-	

Table 7.1.1. LVDS input timing parameters

Note1 : Need to modify the value of the relative registers.

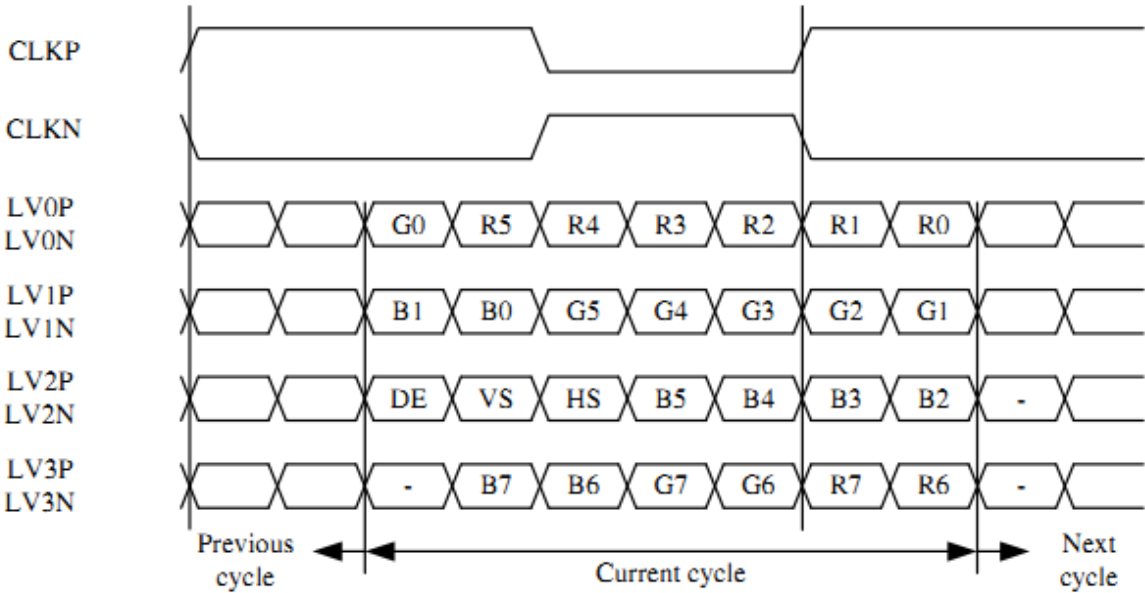


Figure 7.1.1. LVDS,8-bit,VESA format

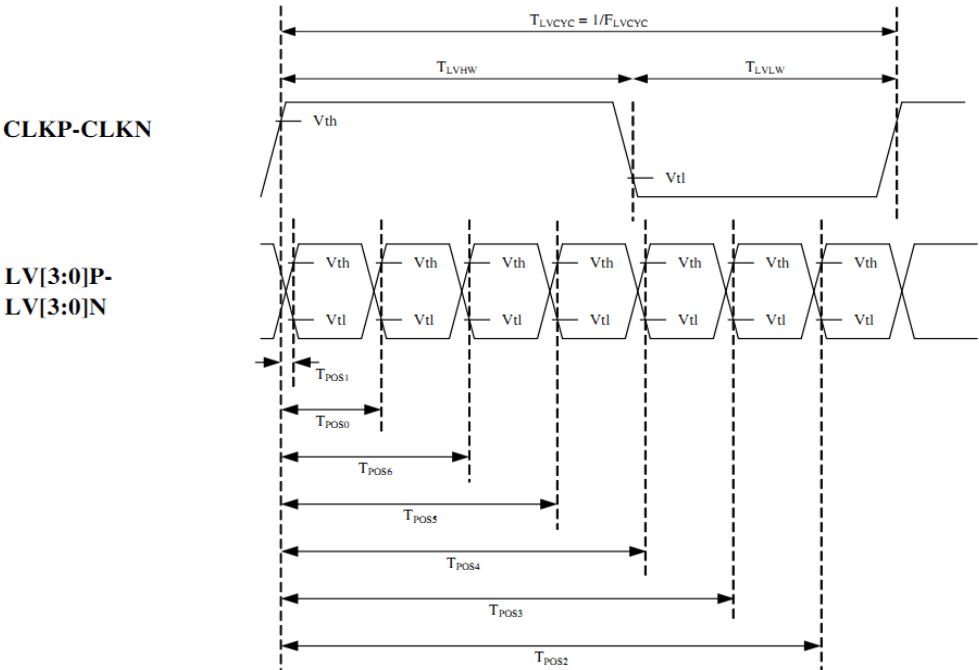
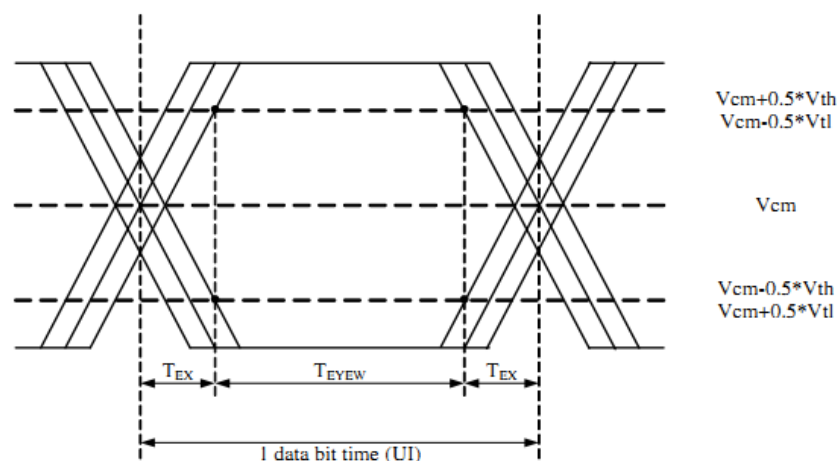


Figure 7.1.2. LVDS input timing

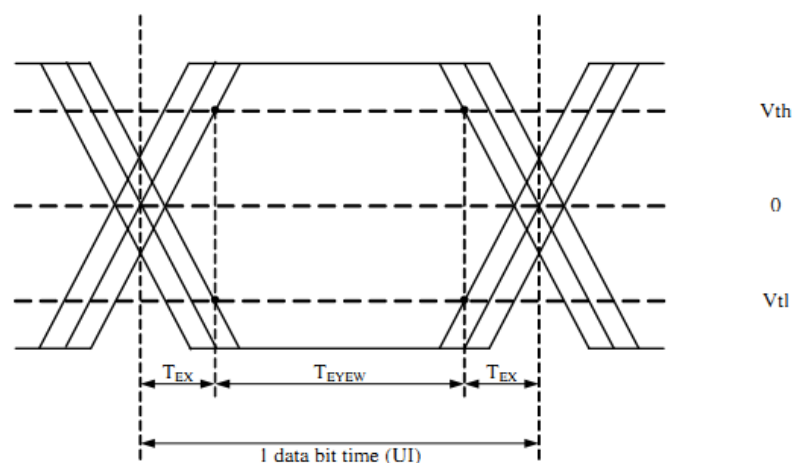
Single-ended:

**LV[3:0]P,
LV[3:0]N**




Differential:

LV[3:0]P-LV[3:0]N



Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Clock frequency	FLVCYC	10	-	85	MHz
Clock period	TLVCYC	11.76	-	100	nsec
1 data bit time	UI	-	1/7	-	TLVCYC
Position 1	TPOS1	-0.2	0	0.2	UI
Position 0	TPOS0	0.8	1	1.2	UI
Position 6	TPOS6	1.8	2	2.2	UI
Position 5	TPOS5	2.8	3	3.2	UI
Position 4	TPOS4	3.8	4	4.2	UI
Position 3	TPOS3	4.8	5	5.2	UI
Position 2	TPOS2	5.8	6	6.2	UI
Input eye width	TEYEW	0.6	-	-	UI
Input eye border	TEX	-	-	0.2	UI
LVDS wake up time	TENLVD S	-	-	150	μs

Table 7.1.2. LVDS input timing parameters

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8. Optical Characteristics

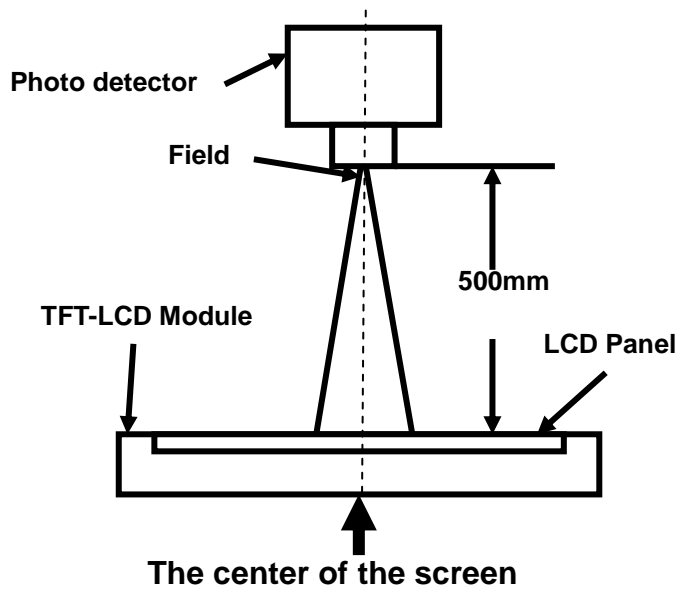
Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		U	CR≥10	80	88	--	Degree	--
		D		80	88	--		
		L		80	88	--		
		R		80	88	--		
Contrast Ratio		CR	⊥,25℃	600:1	900:1	--		Note3 Note6
			⊥,85℃	50% value of 25℃				
Response Time		Ton+Toff	25℃	--	35	40	ms	Note4
			-20℃	--	250	400		
			-30℃	--	550	700		
Chromaticity	White	x	Backlight is on	0.260	0.300	0.340		Note5
		y		0.290	0.330	0.370		
	Red	x		0.610	0.640	0.670		
		y		0.282	0.312	0.342		
	Green	x		0.276	0.306	0.336		
		y		0.601	0.631	0.661		
	Blue	x		0.128	0.158	0.188		
		y		0.044	0.074	0.104		
Uniformity		White	--	75	80	--	%	Note1 Note7
NTSC			⊥	70	73	--	%	Note5
Luminance		L	--	600	800	--	cd/m ²	Note1 Note9
Flicker		dB	50%Gray pattern	--	--	-20	--	Center of Display.
Gamma		γ	--	1.6	2.2	2.8	--	VESA standard Perpendicular

Test Conditions:

1. $I_F = 95\text{mA} \times 3\text{chains} = 285\text{mA}$, the panel surface temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.

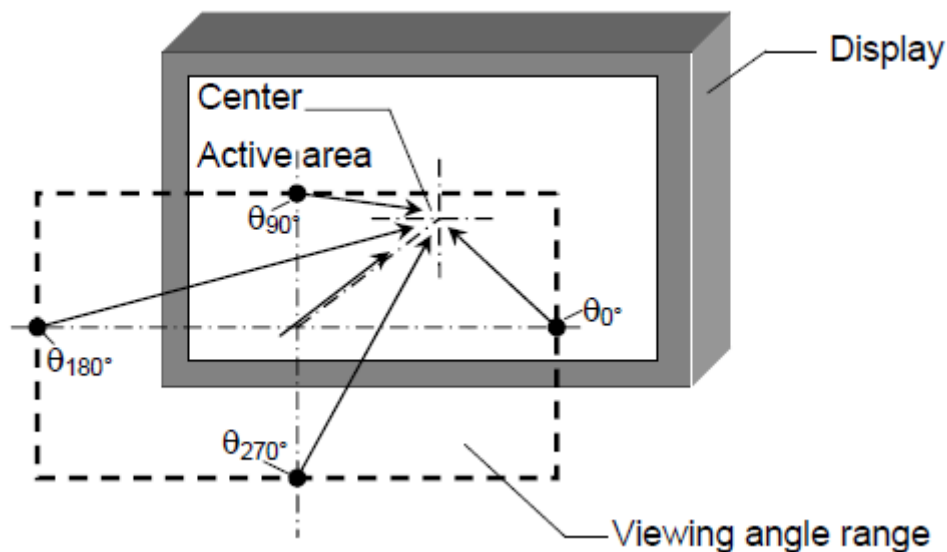
Note 1: Definition of optical measurement system.

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-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	DMS 803	3mm
Reflectivity	CM-3600	

Note 2: Definition of viewing angle range and measurement system




FPC at θ_{270°

Note 3: Definition of the contrast ratio

“White state”: The state is that the LCD should be driven by V_{white} .

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

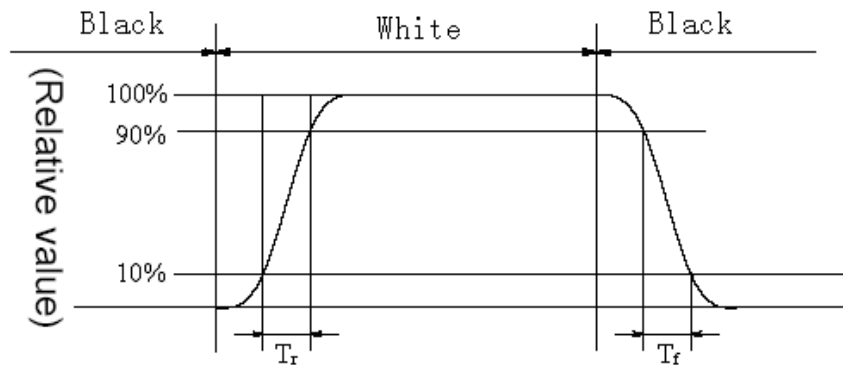
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

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Note 4: Definition for Response time

$T_{on} + T_{off}$

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 10% to 90%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 90% to 10%. Refer to below.



Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

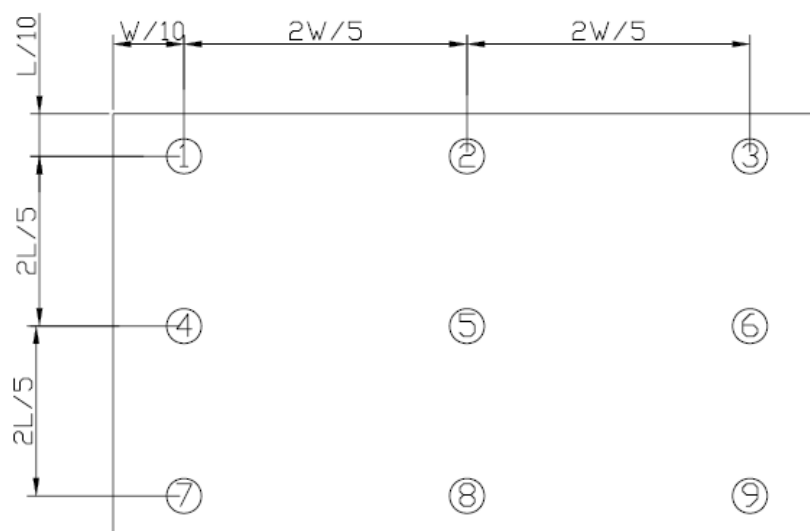
Note 6: Contrast ratio against temperature

CR defines the allowed contrast reduction at the defined temperature based on the CR at room temperature. For example: $CR = (CR@25^{\circ}C - CR@-30^{\circ}C) / CR@25^{\circ}C \times 100\%$


Note 7: Luminance homogeneity

The luminance uniformity is calculated by using following formula.

$$\text{Luminance uniformity (Lu)} = \frac{\text{Minimum luminance from ① to ⑨}}{\text{Maximum luminance from ① to ⑨}}$$



Note 8: Definition of Luminance:


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Measure the luminance of white state at center point.

9. Reliability Test

9.1 Content of Reliability Test

No	Test Item	Test condition	Criterion
1	High Temperature Storage	85℃ 240H RH≤45% Restore 2H at 25℃ non-operation	Note 1 IEC 60 068 - 2 - 2Bb
2	Low Temperature Storage	-40℃±3℃ 240H Restore 2H at 25℃ non-operation	Note 1 IEC 60 068 - 2 - 1Ab
3	High Temperature Operation	85℃±2℃ 240H RH≤45% Restore 2H at 25℃ operation	Note 1 IEC 60 068 - 2 - 2Bb Note 7
4	Low Temperature Operation	-30℃±3℃ 240H Restore 2H at 25℃ operation	Note 1 IEC 60 068 - 2 - 1Ab
5	High Temperature & Humidity Operation	60℃±2℃, 90±2%RH 240H operation	Note 1 IEC 60 068 - 2 - 3Ca
6	Thermal Shock	-40℃→ change→+85℃ 30min 30s 30min 100cycle non-operation	Note 1 IEC 60 068 - 2 - 14Nb
7	Vibration Test	Frequency: 8 - 33.3 Hz, Total amplitude: 1.3mm Frequency: 33.3 - 400 Hz, Acceleration: 29.4 m/s ² sweep time: 15 minutes 2 hours each for X and Z directions, 4 hours for Y direction (total 8 hours) Non-operation	Note 2 IEC 60 068 - 2 - 6Fc
8	Shock Test	60 x 9.8m/s ² , t=6ms, XYZ directions, Half sin curve, [non-operating],each directions 2 times	Note 2 IEC 60 068 - 2 - 27Ea
9	ESD	Air discharge: C=150pF±10%,R=330Ω±10%, 5 point/panel Air: +/-15KV, 5times	GB/T17626 (IEC61000) / ISO10605

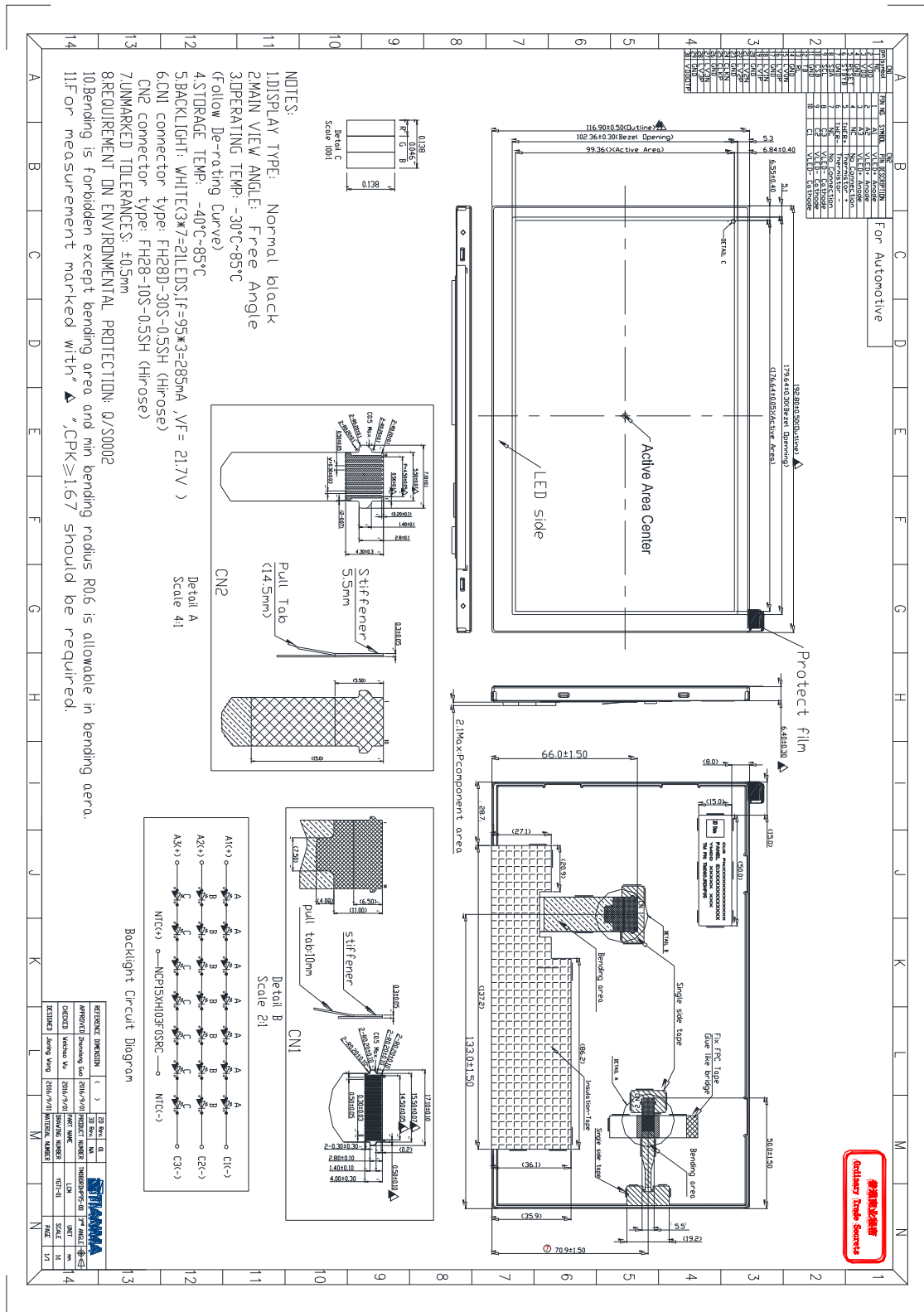
	<input type="checkbox"/> Preliminary Specification <input checked="" type="checkbox"/> Product Specification	
	Standard Product	Part Number: TM080JDHP95-00 Version: 1.1


		Contact discharge: $C=150\text{pF}\pm 10\%$, $R=330\Omega\pm 10\%$, 5 point/panel Contact: $\pm 8\text{KV}$, 5times	GB/T17626 (IEC61000) / ISO10605
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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:
 - Air bubble in the LCD
 - Seal leak
 - Non-display
 - Missing segments
 - Glass crack
- Each test item applies for a test sample only once, The test sample can not be used again in any other test item.
- For Damp Proof Test, Pure water (Resistance $> 10\text{M}\Omega$) should be used.
- In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
- In the test of High Temperature Operation and High Temperature & Humidity Operation. The operation temperature is the surface temperature of module
- We will consult with our customers, if appearing problems during the reliability test.
- LED forward current should follow the De-rating curve.

10. Mechanical Drawing



	<input type="checkbox"/> Preliminary Specification <input checked="" type="checkbox"/> Product Specification	
	Standard Product	Part Number: TM080JDHP95-00 Version: 1.1

11. Product Inspection Criteria

11.1 Inspection Conditions

11.1.1 Ambient conditions:

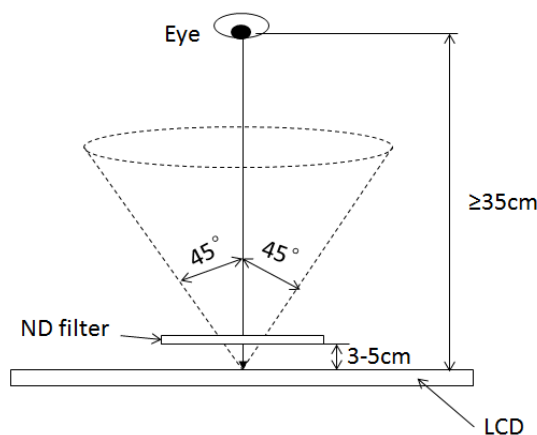
- Temperature: Room temperature $25\pm 5^{\circ}\text{C}$
- Humidity: $(60\pm 10)\% \text{RH}$
- Illumination (the surface of LCD)
 - backlight-on 100-300Lux
 - backlight-off 800-1200lux

11.1.2 Viewing distance

The distance between the LCD and the inspector's eyes shall be 35cm or more.

11.1.3 Viewing Angle

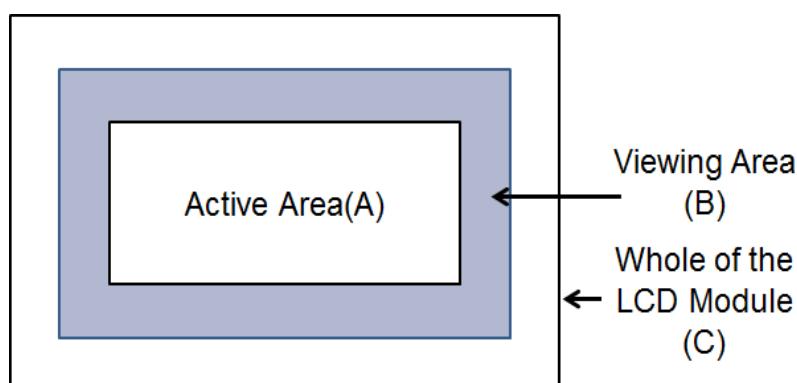
U/D: $45^{\circ}/45^{\circ}$, L/R: $45^{\circ}/45^{\circ}$



11.1.4 Light-on condition

The current of the Backlight should refer to the recommended typical value in this specification.


11.1.5 Definition of LCD zone (with front bezel)



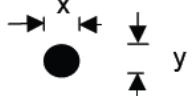
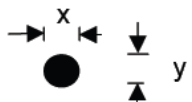
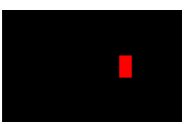
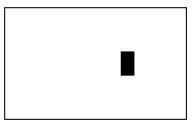
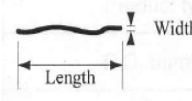
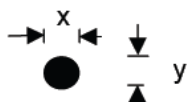

A-zone: The inside of the Active Area (as defined on the product drawing)

B-zone: The inside of the Viewing Area which is between A-zone and the metal frame (defined on the product drawing if no up metal frame)

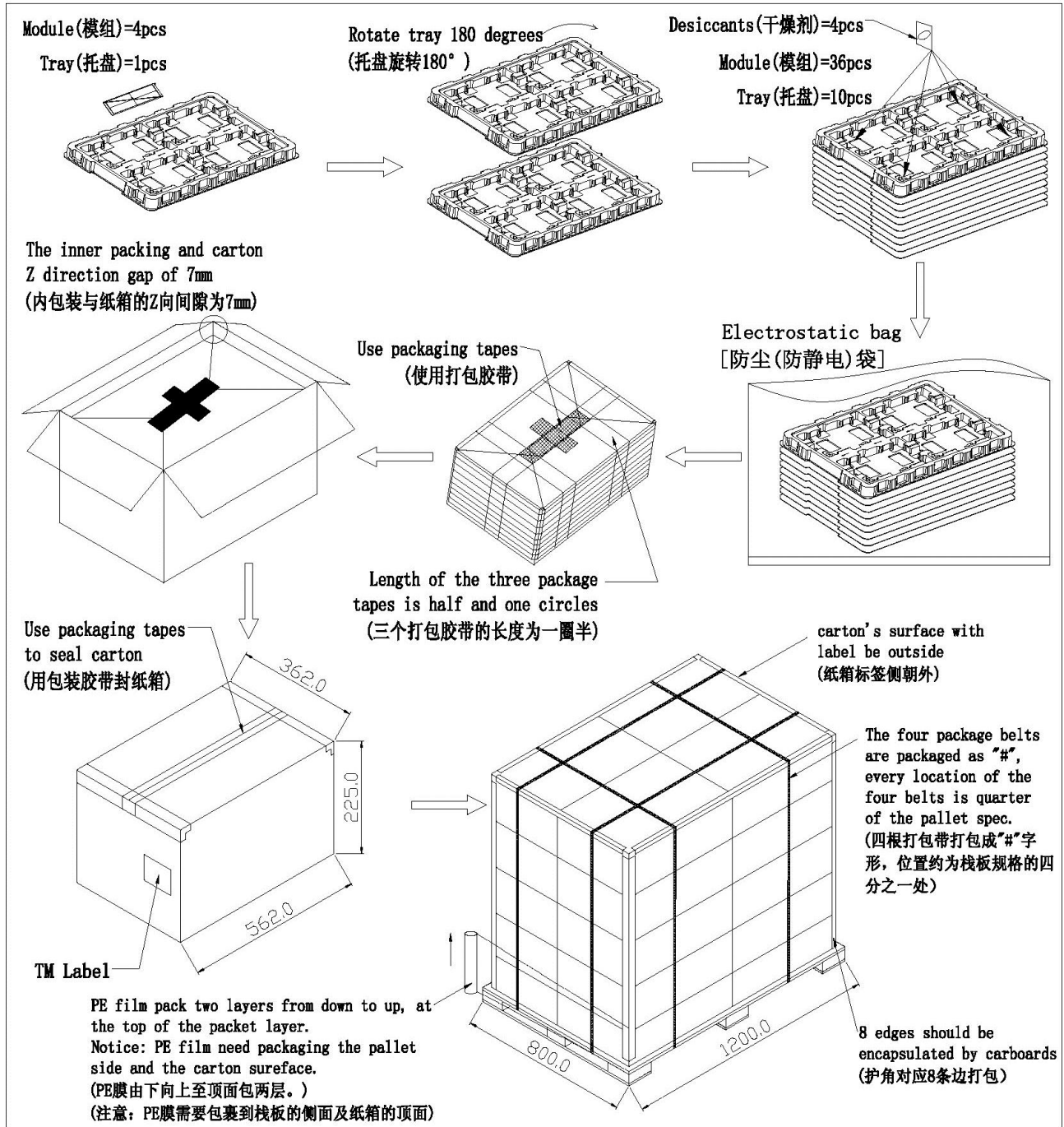
C-zone: Whole of the LCD Module except the zone A and B. (Including FPC& Metal Frame & backside of the LCD Module)


	<input type="checkbox"/> Preliminary Specification <input checked="" type="checkbox"/> Product Specification		
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11.2 Cosmetic Inspection Criteria

Inspection Item	Inspection Standards	Acceptable Qty.	Applied Zone	Inspection Mode	Note
Bright spots	$\varphi \leq 0.15$	Ignore	A	Backlight-on	$\varphi = (x+y) / 2$ 
	$0.15 < \varphi \leq 0.3\text{mm}$	3			
	$0.3 < \varphi$	None			
Dark spots	$\varphi \leq 0.2$	Ignore	A	Backlight-on	$\varphi = (x+y) / 2$ 
	$0.2 < \varphi \leq 0.4$	3			
	$0.4 < \varphi$	None			
Bright pixel dot	1 sub-pixel, Visible through ND2%	None	A	Backlight -on	
Dark pixel dot	1 sub-pixel	3 (distance ≥ 5 mm)	A	Backlight -on	
Lints & Scratches	$W \leq 0.03$ and $L \leq 3.0$ $0.03 < W \leq 0.05$ and $L \leq 3.0$ $0.05 < W$ or $L > 3.0$	Ignore 2 None	A\B	Backlight -on Backlight -off	
Polarizer Dent/Bubble	$\varphi \leq 0.2$ $0.2 < \varphi \leq 0.4$ $0.40 < \varphi$	Ignore 3 None	A\B	Backlight -on Backlight -off	$\varphi = (x+y) / 2$ 
Mura	Visible through ND2% at full black pattern	None	A	Backlight -on	
Dirty/Dust	Those wiped out easily are acceptable		A\B	Backlight -off	\
Cover Shield	The rust on the side and cross section of bezel can be ignored. It does not affect function/operation of LCM.		A\B	Backlight -off	

12. Packing Instruction




	<input type="checkbox"/> Preliminary Specification <input checked="" type="checkbox"/> Product Specification	
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13. Appendix

13.1 The relationship of temperature and resistance for NTC:

TEMP (deg.C)	Resistance (kohm)	TEMP (deg.C)	Resistance (kohm)	TEMP (deg.C)	Resistance (kohm)	TEMP (deg.C)	Resistance (kohm)
-40.000	195.652	2.000	24.988	44.000	5.086	86.000	1.413
-39.000	184.917	3.000	23.951	45.000	4.917	87.000	1.375
-38.000	174.845	4.000	22.963	46.000	4.754	88.000	1.338
-37.000	165.391	5.000	22.021	47.000	4.597	89.000	1.303
-36.000	156.513	6.000	21.123	48.000	4.446	90.000	1.268
-35.000	148.171	7.000	20.267	49.000	4.301	91.000	1.234
-34.000	140.330	8.000	19.450	50.000	4.161	92.000	1.202
-33.000	132.958	9.000	18.670	51.000	4.026	93.000	1.170
-32.000	126.022	10.000	17.926	52.000	3.896	94.000	1.139
-31.000	119.494	11.000	17.214	53.000	3.771	95.000	1.110
-30.000	113.347	12.000	16.534	54.000	3.651	96.000	1.081
-29.000	107.565	13.000	15.886	55.000	3.535	97.000	1.053
-28.000	102.116	14.000	15.266	56.000	3.423	98.000	1.026
-27.000	96.978	15.000	14.674	57.000	3.315	99.000	0.999
-26.000	92.132	16.000	14.108	58.000	3.211	100.000	0.974
-25.000	87.559	17.000	13.566	59.000	3.111	101.000	0.949
-24.000	83.242	18.000	13.049	60.000	3.014	102.000	0.925
-23.000	79.166	19.000	12.554	61.000	2.922	103.000	0.902
-22.000	75.316	20.000	12.081	62.000	2.834	104.000	0.880
-21.000	71.677	21.000	11.628	63.000	2.748	105.000	0.858
-20.000	68.237	22.000	11.195	64.000	2.666	106.000	0.837
-19.000	64.991	23.000	10.780	65.000	2.586	107.000	0.816
-18.000	61.919	24.000	10.382	66.000	2.509	108.000	0.796
-17.000	59.011	25.000	10.000	67.000	2.435	109.000	0.777
-16.000	56.258	26.000	9.634	68.000	2.364	110.000	0.758
-15.000	53.650	27.000	9.284	69.000	2.294	111.000	0.740
-14.000	51.178	28.000	8.947	70.000	2.228	112.000	0.722
-13.000	48.835	29.000	8.624	71.000	2.163	113.000	0.705
-12.000	46.613	30.000	8.315	72.000	2.100	114.000	0.688
-11.000	44.506	31.000	8.018	73.000	2.040	115.000	0.672
-10.000	42.506	32.000	7.734	74.000	1.981	116.000	0.656
-9.000	40.600	33.000	7.461	75.000	1.925	117.000	0.640
-8.000	38.791	34.000	7.199	76.000	1.870	118.000	0.625
-7.000	37.073	35.000	6.948	77.000	1.817	119.000	0.611
-6.000	35.442	36.000	6.707	78.000	1.766	120.000	0.596
-5.000	33.892	37.000	6.475	79.000	1.716	121.000	0.583
-4.000	32.420	38.000	6.253	80.000	1.669	122.000	0.569
-3.000	31.020	39.000	6.039	81.000	1.622	123.000	0.556

	<input type="checkbox"/> Preliminary Specification <input checked="" type="checkbox"/> Product Specification		
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-2.000	29.689	40.000	5.834	82.000	1.578	124.000	0.544
-1.000	28.423	41.000	5.636	83.000	1.535	125.000	0.531
0.000	27.219	42.000	5.445	84.000	1.493		
1.000	26.076	43.000	5.262	85.000	1.452		