



Microtips

TECHNOLOGY

Model No: MTD1500AML-8

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Date	Revision No.	Summary
2017-04-21	1.0	Rev 1.0 was issued

1. Scope

This data sheet is to introduce the specification of MTD1500AML-8 active matrix TFT module. It is composed of a color TFT-LCD panel, driver ICs, TCON and a backlight unit. The 15.0" Display area contains 1024(RGB) x 768 pixels.

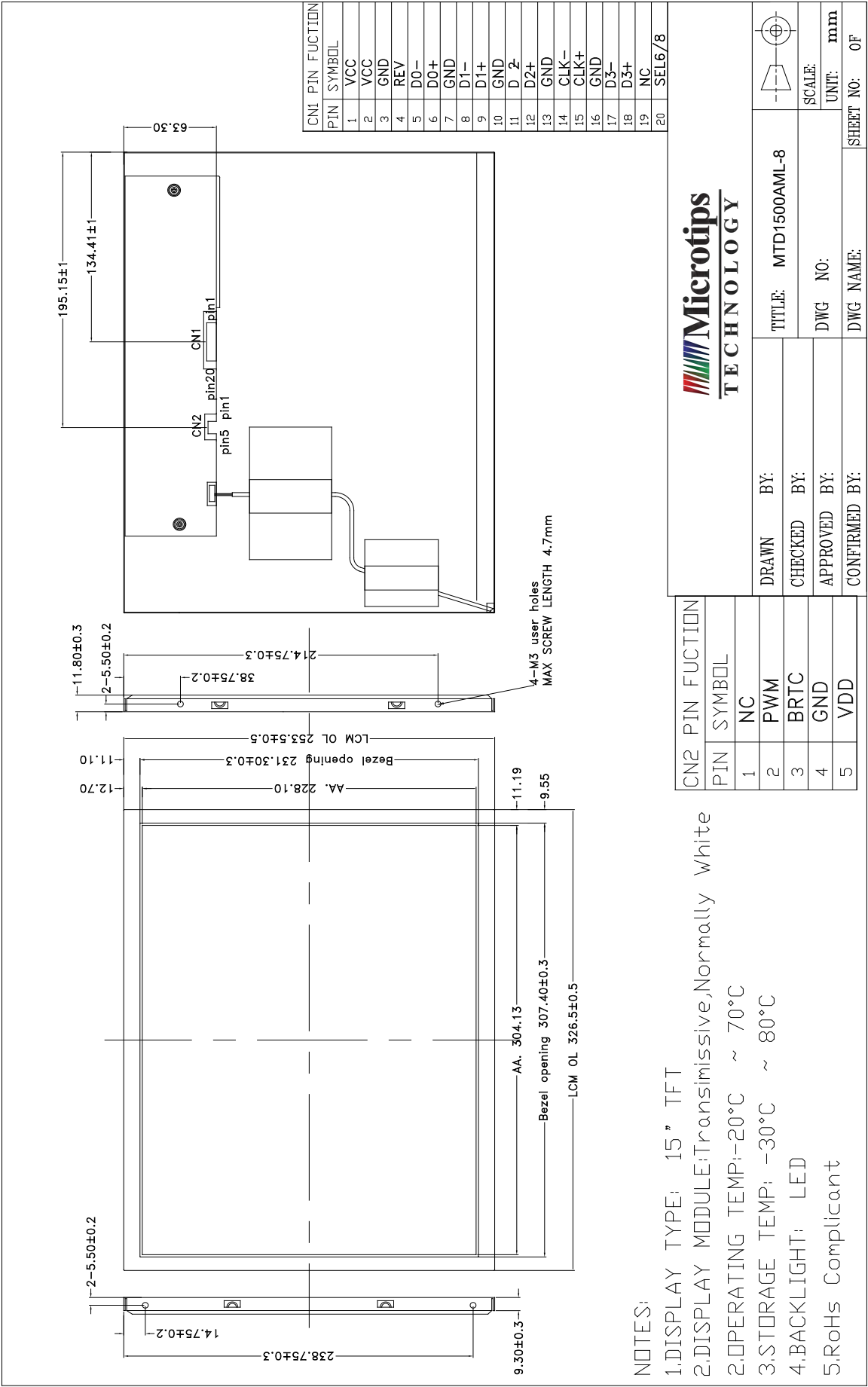
2. Application

Digital equipments which need color display, monitor, POS, video systems.

3. General Information

Item	Contents	Unit
Size	15.0	inch
Resolution	1024(RGB) x 768	/
Interface	LVDS	/
Technology type	a-Si TFT	/
Pixel pitch	0.297 x 0.297	mm
Pixel Configuration	R.G.B. Vertical Stripe	
Outline Dimension (W x H x D)	326.5 x 253.5 x 11.8	mm
Active Area	304.128 x 228.096	mm
Display Mode	Transmissive Normally White	/
Backlight Type	White-LED	/
Weight	1000	g

4. Outline Drawing



5. Interface signals

5.1 LCD PINS

CN1: Socket (Module side): 185083-20121 (P-TWO ELECTRIC TECHNOLOGY CO.,LCD.)

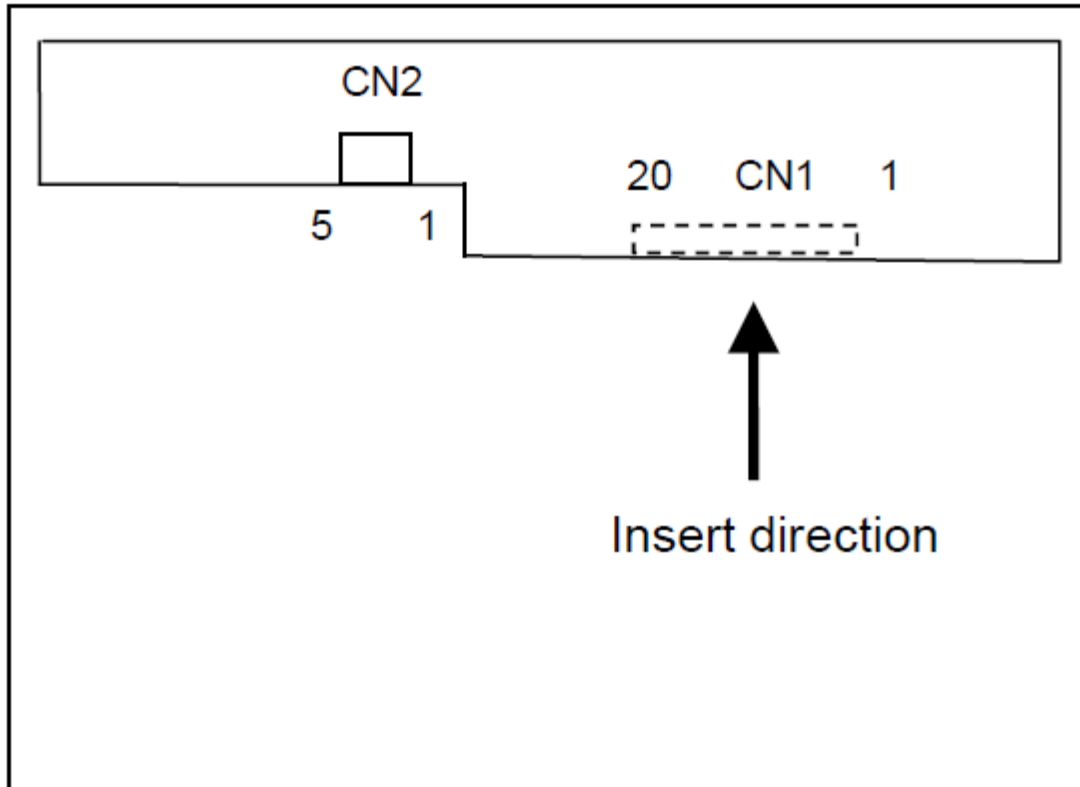
No	Symbol	Description	Remarks
1	VCC	Power Supply	
2	VCC	Power Supply	
3	GND	Power Ground	
4	REV	Selection of scan direction High: Reverse scan Low or Open: Normal scan	
5	D0-	Pixel data	R0-R5, G0
6	D0+	Pixel data	
7	GND	Power Ground	
8	D1-	Pixel data	G1-G5, B0-B1
9	D1+	Pixel data	
10	GND	Power Ground	
11	D2-	Pixel data	B2-B5, DE
12	D2+	Pixel data	
13	GND	Power Ground	
14	CLK-	Clock Signal (-)	
15	CLK+	Clock Signal (+)	
16	GND	Power Ground	
17	D3-	Pixel data	R6-R7 G6-G7 B6-B7
18	D3+	Pixel data	
19	NC	No connection	
20	SEL68	Selection of the number of colors Low: 8 bit High or Open: 6 bit	

5.2 Backlight Pins

CN2: MSB24038P5 (Produced by STM) or equivalent.

No	Symbol	Description	Remark
1	NC	No Connection	
2	PWM	PWM Luminance control	
3	BRTC	Back light ON/OFF control: 5V-On / 0V-Off	
4	GND	Ground	
5	VDD	12V	

5.3 POSITIONS OF PLUG AND SOCKET



6. Absolute maximum Ratings

6.1. Electrical Absolute max. ratings

Item	Symbol	MIN	MAX	Unit	Remark
Power Supply Voltage	VCC	-0.5	5.0	V	Ta=25°C
Input Voltage	V _{IN}	-0.5	5.0	V	Ta=25°C

6.2. Environment Conditions

Item	Symbol	MIN	MAX	Unit	Remark
Operating Temperature	TOPR	-20	70	°C	Note1
Storage Temperature	TSTG	-30	80	°C	
Relative Humidity (Note2)	RH	-	≤ 90	%	Ta ≤ 40°C
		-	≤ 85	%	40°C < Ta ≤ 50°C
		-	≤ 55	%	50°C < Ta ≤ 60°C
		-	≤ 36	%	60°C < Ta ≤ 70°C
		-	≤ 24	%	70°C < Ta ≤ 80°C
Absolute Humidity	AH	-	≤ 70	g/m ³	Ta > 50°C

Note 1: The temperature of panel display surface area should be -20°C Min and 70°C Max.

Note 2: a) Ta means the ambient temperature.

b) It is necessary to limit the relative humidity to the specified temperature range.

c) Condensation on the module is not allowed.

d) Wet-bulb temperature should be 39°C Max.(Ta > 40°C)

e) 90%RH Max.(Ta ≤ 40°C)

7. Electrical Specifications

7.1 Electrical characteristics for TFT LCD Module

GND=0V, Ta=25°C

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Power Supply Voltage		V _{CC}	3.0	3.3	3.6	V	
Power Supply Current		I _{CC}	-	550	-	mA	Note1
Power supply ripple		V _{p-p}	-	-	200	mV	Including spike noise
Permissible ripple voltage		V _{RP}	-	-	100	mV	
Differential input voltage		Vid	250	-	450	mV	
Differential input Threshold voltage for LVDS receiver	High	V _{TH}	-	-	100	mV	V _{CM} =1.25V Note2
	Low	V _T L	-100	-	-	Mv	
Input voltage width for LVDS receiver		V _i	0	-	1.90	V	
Terminating resistor		R _T	-	100	-	Ω	
Rush current		I _{rush}	--	--	1.5	A	Note 3
Terminating resistor		R _T	--	100	--	Ω	
Input voltage for MSL signals	High	V _{FH}	0.7V _{CC}	-	V _{CC}	V	
	Low	V _{FL}	0	-	0.3V _{CC}	V	

Note1: Black mode, 65MHz, at V_{CC}=3.3V.

Note2: Common mode voltage for LVDS receiver.

Note3: Measurement Conditions:

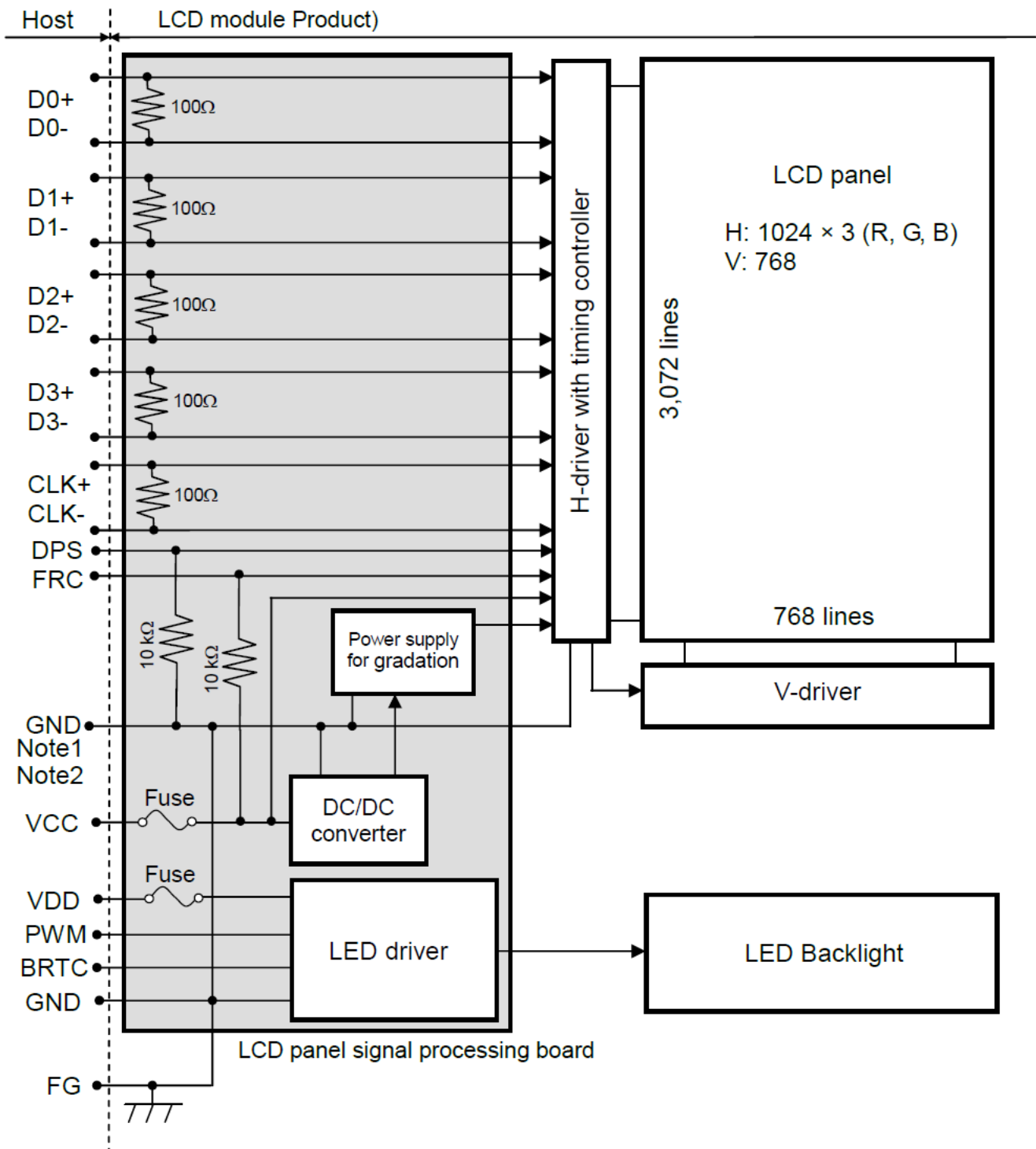
7.2 Drive for Backlight

Ta=25°C

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
Power Supply Voltage		V _{DD}	10.8	12	12.6	V	
Power Supply Current		I _{DD}	-	705	-	mA	@ Vi = 12V (Duty 100%)
Input voltage for PWM signal	High	V _{DFH1}	2.0	-	5.0	V	
	Low	V _{DFL1}	0	-	0.4	V	
Input voltage for BTRC signal	High	V _{DFH2}	2.0	-	5.0	V	
	Low	V _{DFL2}	0	-	0.4	V	
PWM Control Frequency		f _{PWM}	200	-	20K	Hz	
PWM duty		-	5	-	100	%	
LED life time		Hr	-	50000	-	Hrs	Note 1

Note1: Optical performance should be evaluated at Ta=25°C. Only If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% of initial brightness. Typical operating life time is an estimated data.

7.3 Block Diagram



Note 1: Relations between GND (Signal ground and LED driver ground) and FG (Frame ground) in the LCD module are as follows:

GND-FG	Connected
--------	-----------

Note 2: GND and FG must be connected to customer equipment's ground, and it is recommended that these grounds be connected together in customer equipment.

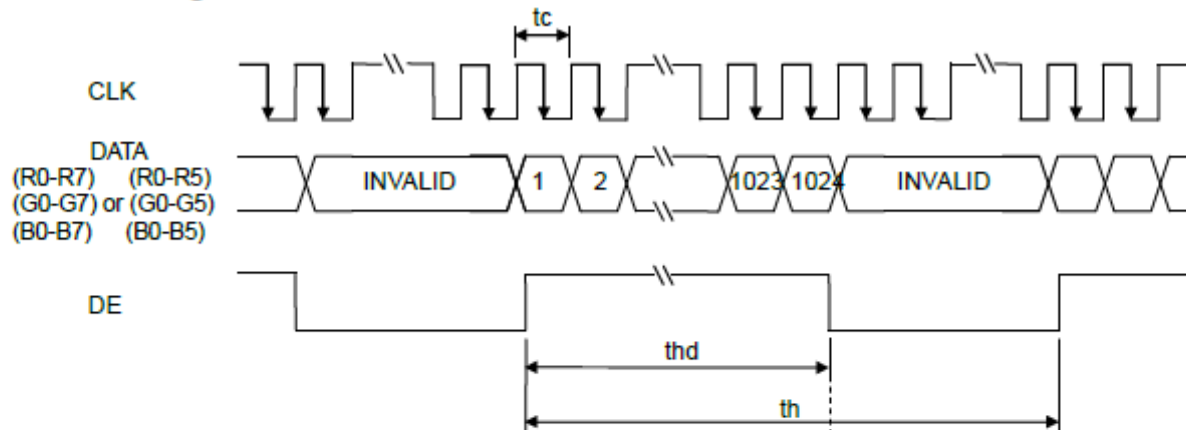
8. Command/AC Timing

8.1 TIMING CHARACTERISTICS

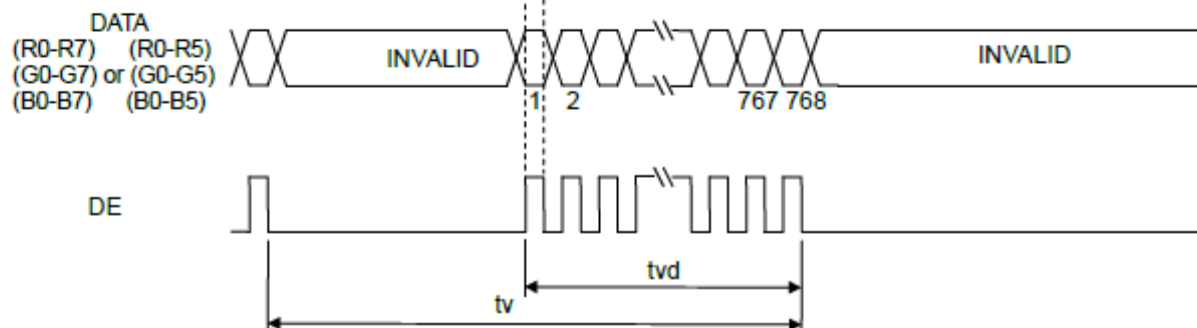
Parameter		Symbol	min.	typ.	max.	Unit	Remarks
Clock	Frequency	1/tc	52	56.88	71	MHz	17.58ns (typ)
		tc	19.23	17.58	14.08	ns	
Horizontal signals	Cycle	th	1114	1200	1400	CLK	
	Display period	thd	1024				
Vertical signals	Cycle	tv	778	790	845	H	60.0Hz(typ)
	Display period	tvd	768				

8.2 INPUT SIGNAL TIMING CHART

Horizontal timing



Vertical timing



8.3 PIXEL DATA ALIGNMENT OF DISPLAY IMAGE

The following chart is the coordinates of per pixel

D(1,1) BGR	D(1,1)	D(2,1)	D(3,1)	...	D(1024,1)
	D(1,2)	D(2,2)	D(3,2)	...	D(1024,2)
	D(1,3)	D(2,3)	D(3,3)	...	D(1024,3)
	⋮	⋮	⋮	⋮	⋮
	D(1,768)	D(2,768)	D(3,768)	...	D(1024,768)

Note: Pixel arrangement is BGR stripe when module's PCB side placed upward. It is suggested that module's PCB side should placed downward to compatible with RGB pixel arranging modules.

8.4 DISPLAY COLORS AND INPUT DATA INFORMATION

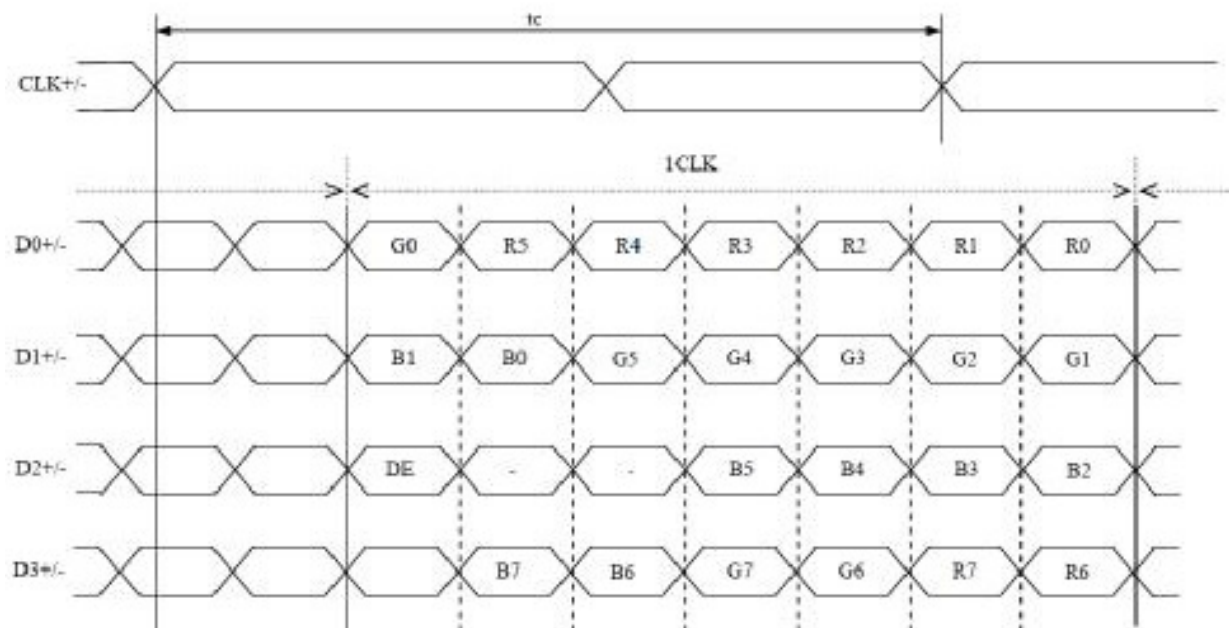
8.4.1 DISPLAY COLORS AND DATA SIGNAL

This product can display in equivalent to 16,194,277 colors in 253 scales. Also the relation between display colors and input data signals is as the following table. And it can display in equivalent to 262,144 colors in 64 scales, without data signals R7, R6, G7, G6, B7, B6 in the following table.

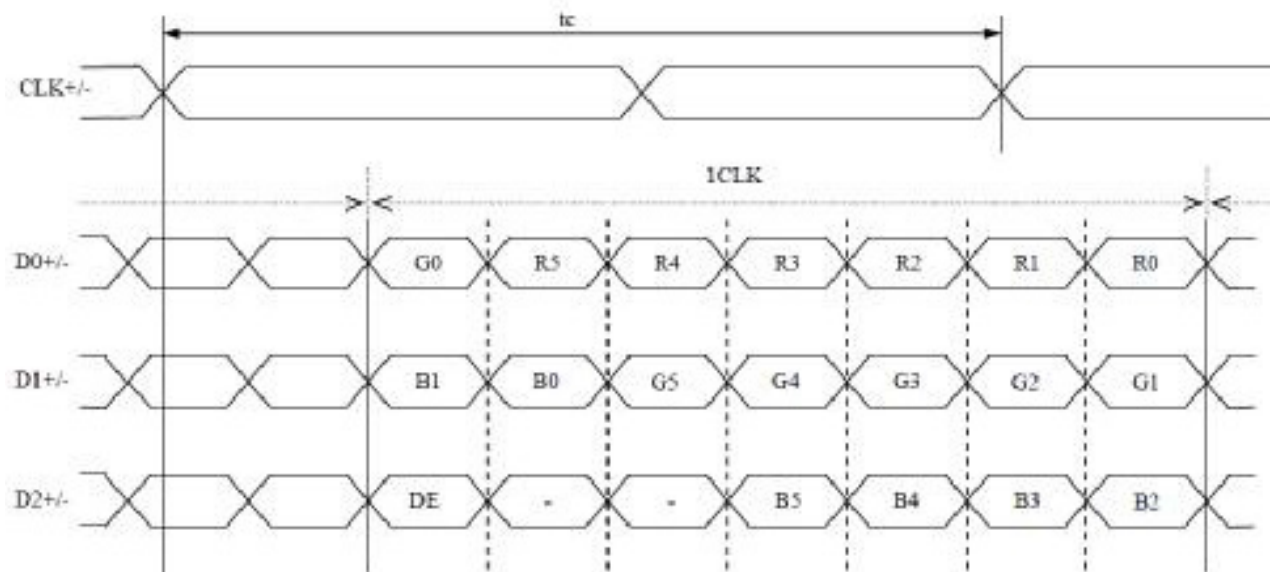
Display colors		Data signal (0: Low level, 1: High Level)																							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
BASIC COLOR	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	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
	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
	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
	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
Red grayscale	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
	Dark	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↓																								
	Bright Red	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green grayscale	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
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	↓																								
	Bright Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Blue grayscale	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
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	↓																								
	Bright Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0

8.4.2 DATA MAPPING

(1) LVDS Input data signal: 8bit

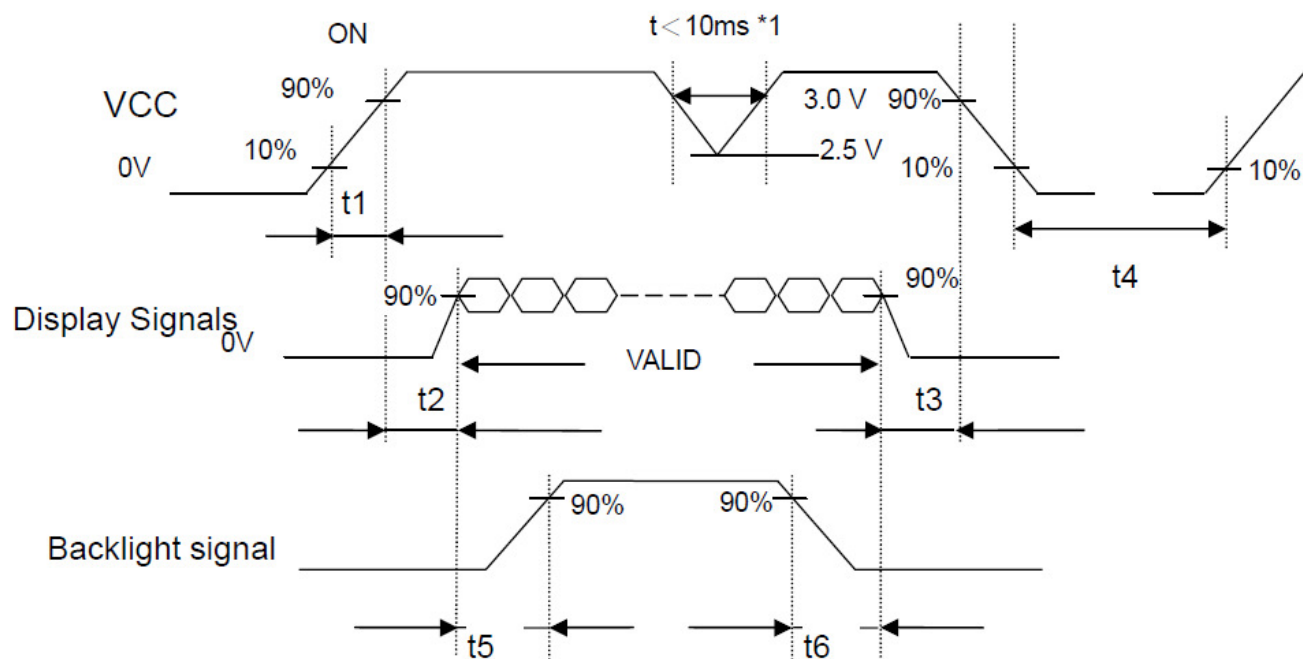


(2) LVDS Input data signal: 6bit



8.5 POWER SUPPLY VOLTAGE SEQUENCE

The sequence of backlight and power



Timing Specifications:

- t1 :0.5ms<t1 <10ms;
- t2 :0.5 ms<t2 <50ms;
- t3 :0ms<t3 <50ms;
- t4 :t4 >1000ms;
- t5 :t5 >200ms;
- t6 :t6 >200ms;

9. Optical Specification

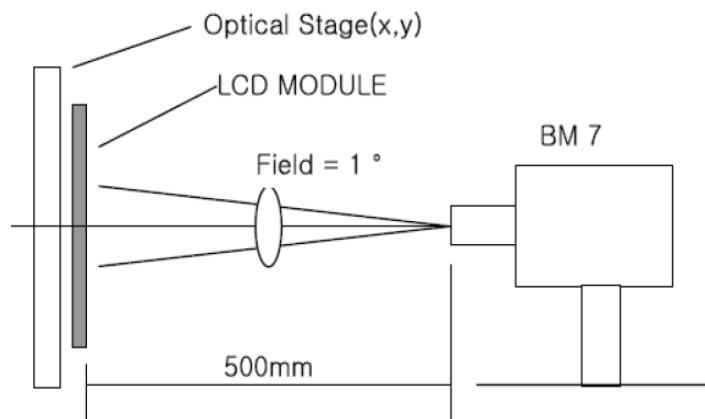
Ta=25°C

Item	Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio	CR	$\theta=0^\circ$	600	800	--		Note1 Note2
Response Time	Ton	25°C	-	8	12	ms	Note1 Note3
	Toff						
View Angles	θT	$CR \geq 10$	70	80	--	Degree	Note 4
	θB		70	80	--		
	θL		70	80	--		
	θR		70	80	--		
Chromaticity	Red	x	0.263	0.313	0.363		Note5, Note1
		y	0.279	0.329	0.379		
	Green	x	0.582	0.632	0.682		
		y	0.305	0.355	0.405		
	Blue	x	0.294	0.344	0.394		
		y	0.558	0.608	0.658		
	White	x	0.107	0.157	0.207		
		y	0.037	0.087	0.137		
Center Luminance of White	L		400	450	--	cd/m ²	Note1 Note6
White Variation		$\theta x=0^\circ$ $\theta y=0^\circ$		1.25	1.33		Note5, Note6
Uniformity	U		50	60	--	%	Note1 Note7

Note 1: Definition of optical measurement system.

Temperature = 25°C(±3°C)

LED back-light: ON, Environment brightness < 150 lx

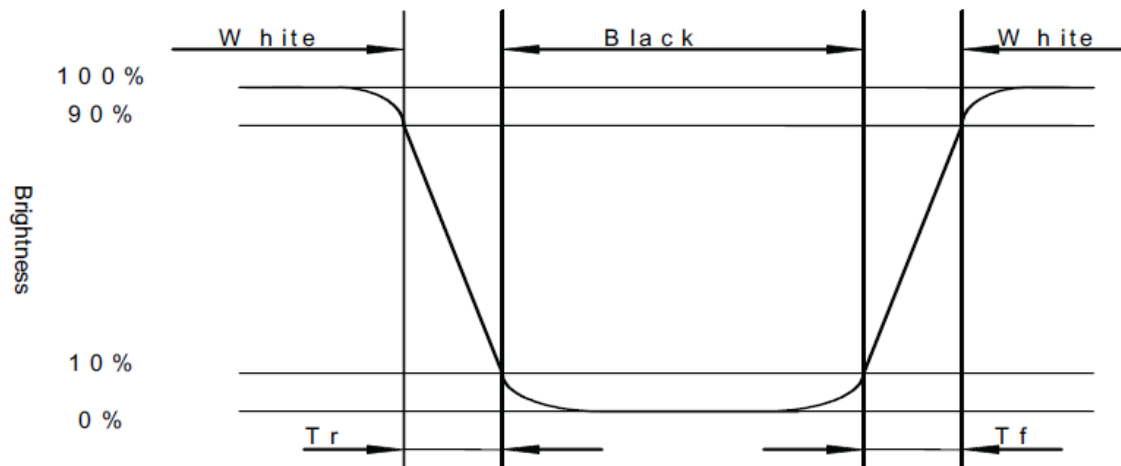


Note 2: Contrast ratio is defined as follow:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

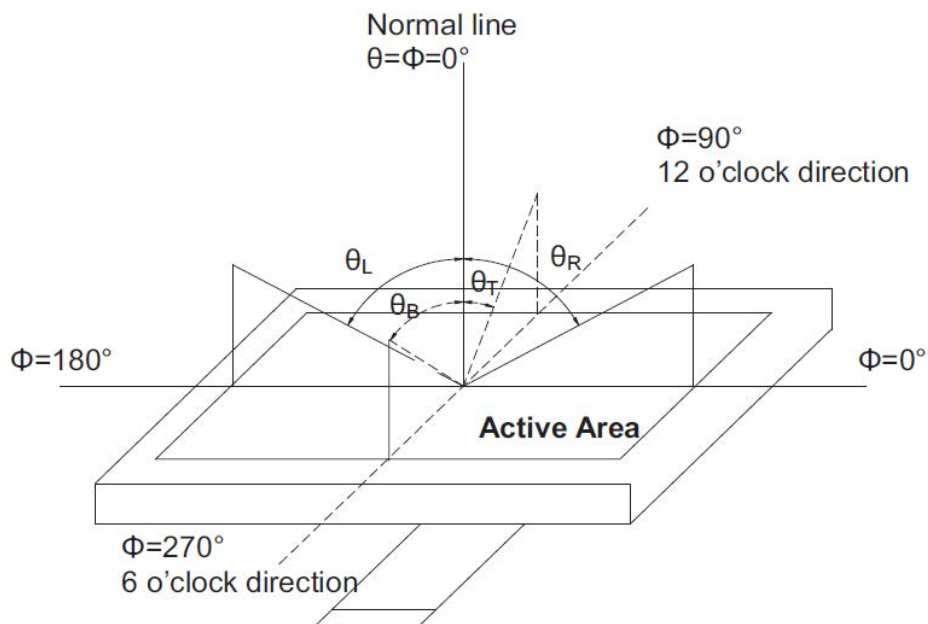
Note 3: Response time is defined as follow:

Response time is the time required for the display to transition from black to white (Rise Time, T_r) and from white to black (Decay Time, T_f).



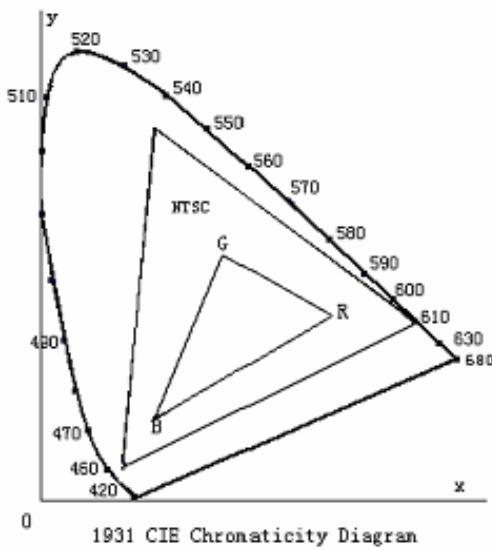
Note 4: Viewing angle range is defined as follow:

Viewing angle is measured at the center point of the LCD.



Note 5: Color chromaticity is defined as follow: (CIE1931)

Color coordinates measured at center point of LCD.



$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

Note 6: Luminance is defined as follow:

Luminance is defined as the brightness of all pixels "White" at the center of display area on optimum contrast.

Note 7: Luminance Uniformity is defined as follow:

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

$$\text{Uniformity}(U) = \frac{\text{Minimum Luminance(brightness) in 9 points}}{\text{Maximum Luminance(brightness) in 9 points}}$$

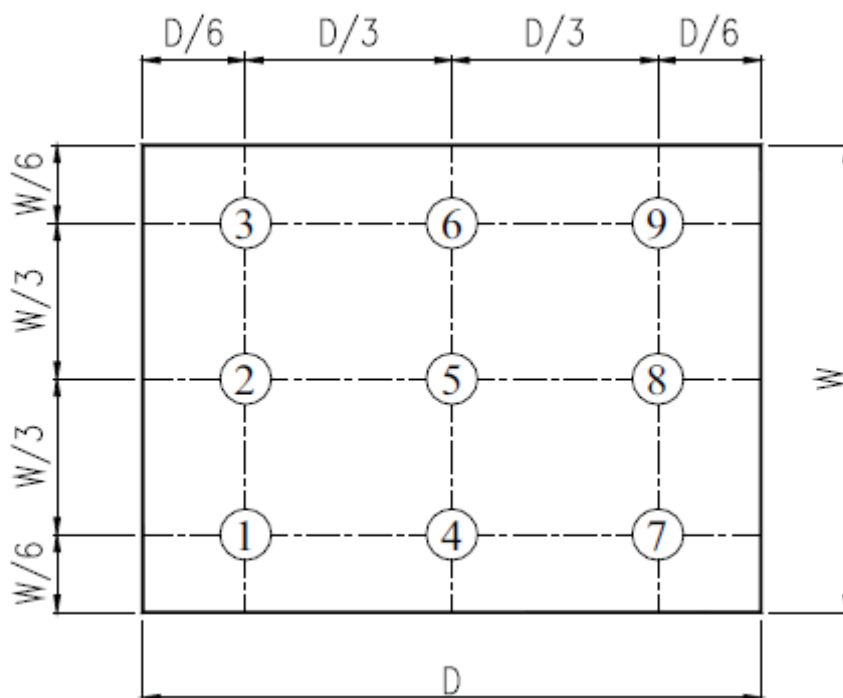


Fig. 2 Definition of uniformity

10. Environmental / Reliability Tests

No	Test Item	Condition	Judgment criteria
1	High Temp Operation	Ts=+70℃, 120hrs	Per table in below
2	Low Temp Operation	Ta=-20℃, 120hrs	Per table in below
3	High Temp Storage	Ta=+80℃, 120hrs	Per table in below
4	Low Temp Storage	Ta=-30℃, 120hrs	Per table in below
5	High Temp & High Humidity Storage	Ta=+50℃, 80% RH 120 hours	Per table in below (polarizer discoloration is excluded)
6	Thermal Shock (Non-operation)	-20℃ 30 min~+60℃ 30 min, Change time:5min, 100 Cycles	Per table in below
7	ESD (Operation)	C=150pF, R=330Ω, 5point/panel Air: ±15Kv, 9points,25times/point; Contact: ±8Kv, 9points,25times/point (Environment: 15℃~35℃, 30%~60%. 86Kpa~106Kpa)	Per table in below
8	Vibration (Non-operation)	Frequency range:5~100Hz, 11.76m/s ² 1minute/cycle X,Y,Z directions 50times each directions	Per table in below
9	Shock (Non-operation)	30G, 11ms, ±X,Y,Z directions, 3times For each direction	Per table in below
10	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	Per table in below

INSPECTION	CRITERION(after test)
Appearance	No Crack on the FPC, on the LCD Panel
Alignment of LCD Panel	No Bubbles in the LCD Panel No other Defects of Alignment in Active area
Electrical current	Within device specifications
Function / Display	No Broken Circuit, No Short Circuit or No Black line No Other Defects of Display

11. Precautions for Use of LCD Modules

11.1 Safety

The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

11.2 Handling

A. The LCD and touch panel is made of plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.

B. Do not handle the product by holding the flexible pattern portion in order to assure the reliability

C. Transparency is an important factor for the touch panel. Please wear clear finger sacks, gloves and mask to protect the touch panel from finger print or stain and also hold the portion outside the view area when handling the touch panel.

D. Provide a space so that the panel does not come into contact with other components.

E. To protect the product from external force, put a covering lens (acrylic board or similar board) and keep an appropriate gap between them.

F. Transparent electrodes may be disconnected if the panel is used under environmental conditions where dew condensation occurs.

G. Property of semiconductor devices may be affected when they are exposed to light, possibly resulting in IC malfunctions.

H. To prevent such IC malfunctions, your design and mounting layout shall be done in the way that the IC is not exposed to light in actual use.

11.3 Static Electricity

A. Ground soldering iron tips, tools and testers when they are in operation.

B. Ground your body when handling the products.

C. Power on the LCD module before applying the voltage to the input terminals.

D. Do not apply voltage which exceeds the absolute maximum rating.

E. Store the products in an anti-electrostatic bag or container.

F. Peel off the LCM protective film slowly since static electricity may be generated.

11.4 Storage

A. Store the products in a dark place at $+25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ with low humidity (40% RH to 60% RH). Don't expose to sunlight or fluorescent light.

B. Storage in a clean environment, free from dust, active gas, and solvent.

11.5 Cleaning

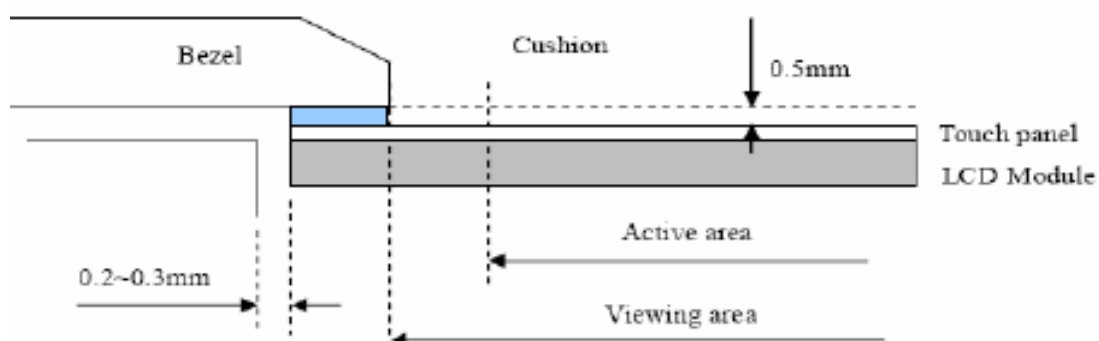
A. Do not wipe the touch panel with dry cloth, as it may cause scratch.

B. Wipe off the stain on the product by using soft cloth moistened with ethanol. Do not allow ethanol to get in between the upper film and the bottom glass. It may cause peeling issue or defective operation. Do not use any organic solvent or detergent other than ethanol.

11.6 Cautions for installing and assembling

Bezel edge must be positioned in the area between the Active area and View area. The bezel may press the touch screen and cause activation if the edge touches the active area.

A gap of approximately 0.5mm is needed between the bezel and the top electrode. It may cause unexpected activation if the gap is too narrow. There is a tolerance of 0.2 to 0.3mm for the outside dimensions of the touch panel and tail. A gap must be made to absorb the tolerance in the case and connector.



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