



SPECIFICATIONS

CUSTOMER : _____

MODEL NO. : **GFTO276AA1920360V**

VERSION : **A**

DATE : **2018.01.12**

CERTIFICATION : **ROHS**

CUSTOMER SIGN : _____

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Revision Record

Data(y/m/d)	Ver.	Description	Note	page
2018.01.12	A	New		



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1. SPECIFICATIONS

GFTO276AA1920360V is 27.6" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit and backlight. By applying 6bits+Hi-FRC digital data, 1920×360, 16.7M-color images are displayed on the 27.6" diagonal screen. Input power voltage is 5.0V for LCD driving. Converter for backlight is included in this module.

General specifications are summarized in the following table:

1.1 Features

ITEM	SPECIFICATION
Display Area(mm)	688.896 (H) × 129.168 (V) (27.6-inch diagonal)
Number of Pixels	1920 (H) × 360(V)
Pixel Pitch(mm)	0.3588 (H) × 0.3588 (V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	Normally black, FFS
Number of Colors	16.7M(6bits+Hi-FRC)
Brightness(cd/m ²)	1000cd/m ² (Typ.)(center, 130mA)
Viewing Angle(H/V)	170/170 (Typ.)
Surface Treatment	Anti-glare, 3H
Power consumption(W)	1W(Typ.)
Module Size(mm)	725.1 (W) × 166.7 (H) × 18(D) (Typ.)
Interface Connection	LVDS
Module Weight(g)	2064 Typ
Backlight Unit	LED (White-LED)



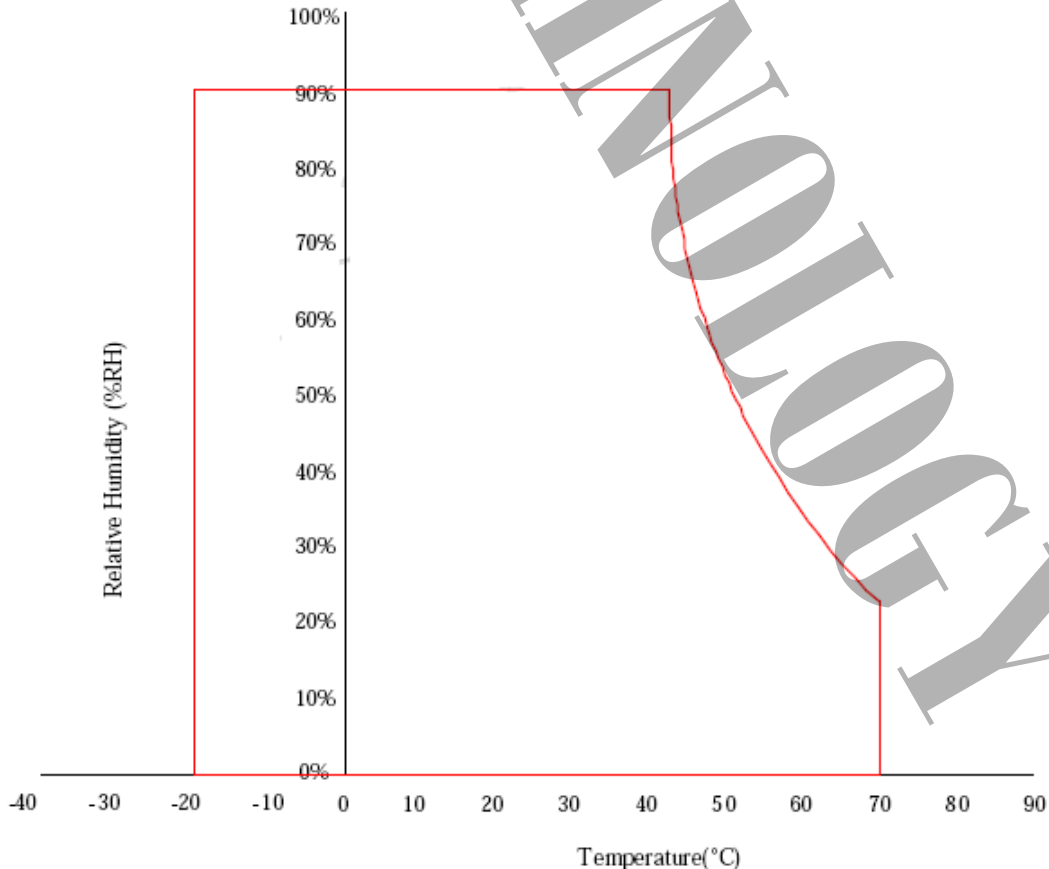
1.2 Absolute Maximum Ratings

The following are maximum values which, if exceeded, may cause faulty operation or damage to the unit.

ITEM	SYMBOL	MIN.	MAX.	UNIT	REMARK
Power Supply Voltage for LCD	VCC	0	6	V	
LED Forward voltage	VF	2.9	3.5	V	1). 2)
LED Forward current	IF	-	200	mA	
Operation Temperature	Top	-20	70	°C	3). 4). 5).
Storage Temperature	Tstg	-30	80	°C	3). 4). 5).

[Note]

- 1). Product life-time relate to LED, please operate production follow statement at page 8 "(2)back light" .
- 2). When LED current over the definition of operating current ,product life-time will decay rapidly or operate unusual.
- 3). The relative temperature and humidity range are as below sketch, 90%RHMax.(Ta ≤ 40 °C).
- 4). The maximum wet bulb temperature ≤ 39°C (Ta > 40°C) and without dewing.
- 5). If product in environment which over the definition of the relative temperature and humidity out of range too long, it will affect visual of LCD.





1.3 Electrical Characteristics

TFT LCD

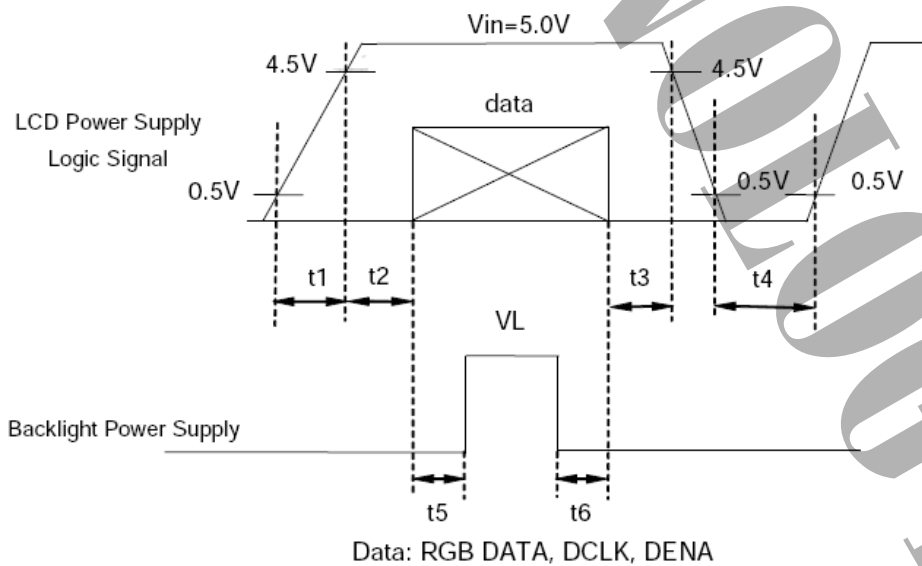
Ta=25°C

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	REMARK	
Power Supply Voltage for LCD	VCC	4.5	5.0	5.5	V	*1)	
Power Supply Current for LCD	ICC	--	200	310	mA	*2)	
Differential Resistance	Zm	90	100	110	Ω		
LVDS: IN+ · IN-	The same motion input Voltage	VCM	0.7		1.6	V	*3)
	Differential input Voltage	VID	200	350	600	mV	
	High electric potential threshold voltage	VTH	-	-	100	mV	
	Low electric potential threshold voltage	VTL	-100	-	-	mV	
LCD Irush Current	Irush	-	-	4	A	*5)	
Power consumption	P	-	1	1.4	W	*2)	
1 Data time	UI	-	tclk*1/7	-	tclk	*4)	
LVDS clock to data skew	tskew	-	-	300	ps		
input data eye width	teyew	1265	-	-	ps		

[Note]

*1)Power · data sequence

$0.50ms \leq t1 \leq 10ms$ $t4 \geq 1 \text{ sec}$
 $0.01ms < t2 \leq 50ms$ $t5 \geq 200ms$
 $0.01ms < t3 \leq 50ms$ $t6 \geq 200ms$

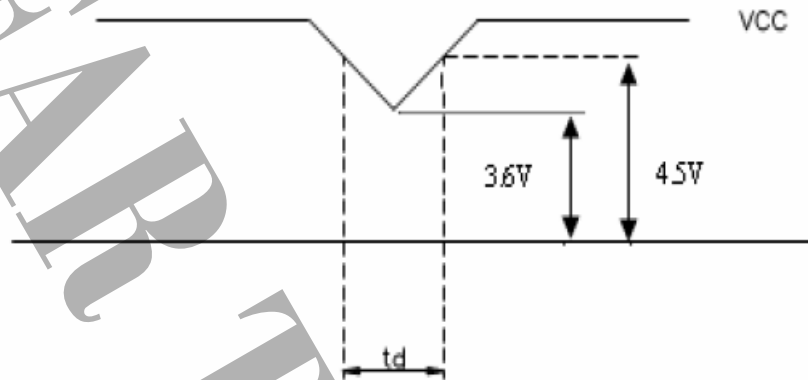




VCC-dip conditions:

(1) When $3.6V \leq V_{cc}(\min) < 4.5V$: $t_d \leq 10$ ms

(2) When $V_{cc} < 3.6$ V, VCC-dip conditions should also follow the VCC-turn-on conditions.



*2). TYP. specification : Gray-level test Pattern (TYP Freq. @5.0V)

MAX. specification : White test Pattern (TYP Freq. @5.0V)

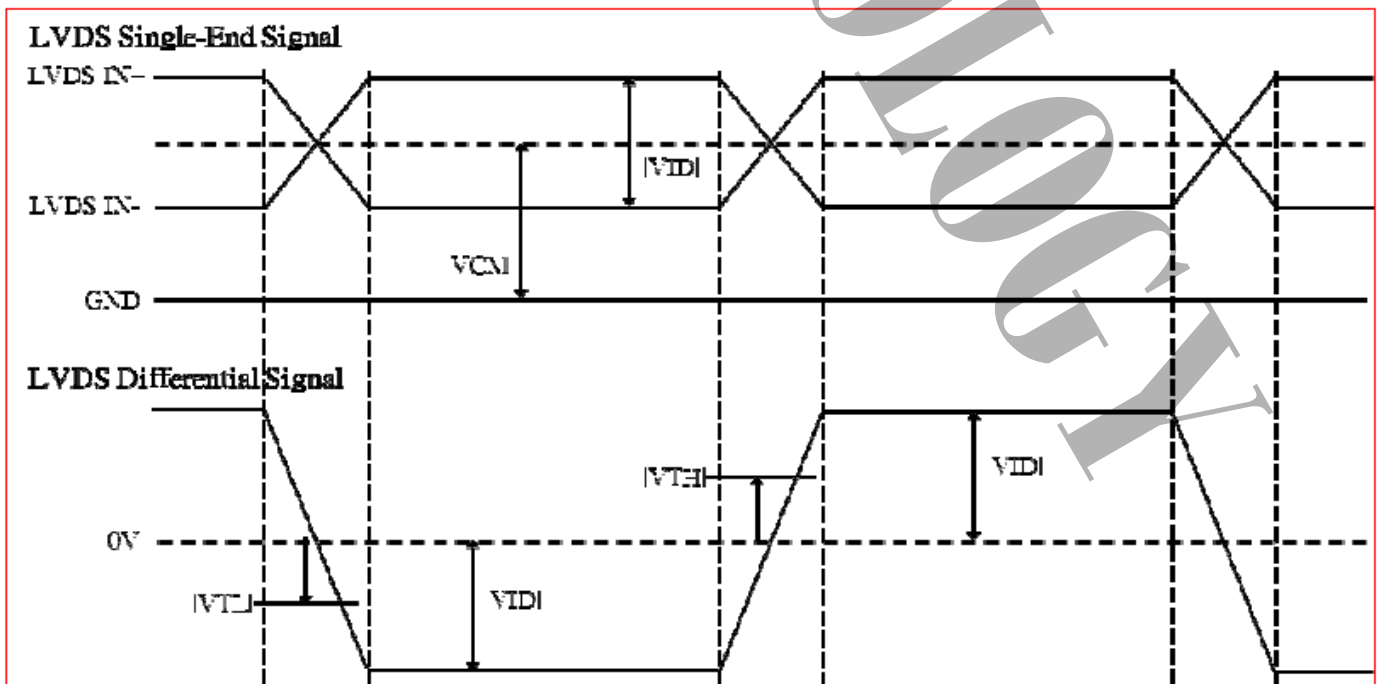
The current is root mean square value (RMS)

Gray-level Pattern

White Pattern



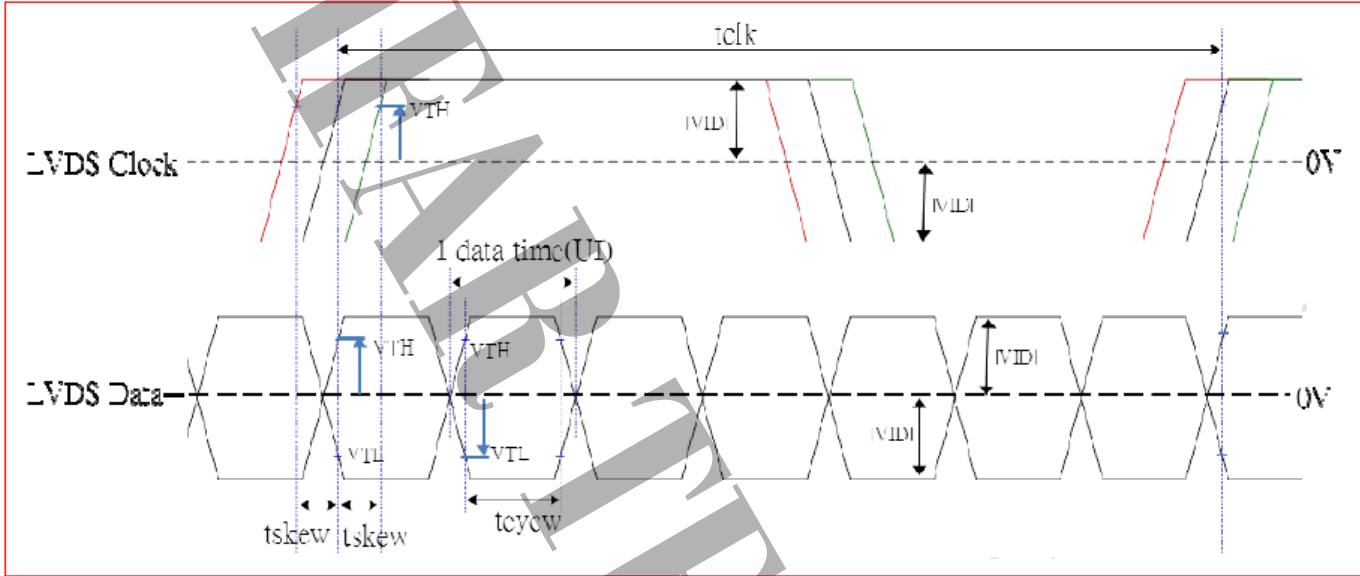
*3) LVDS DC electrical characteristics



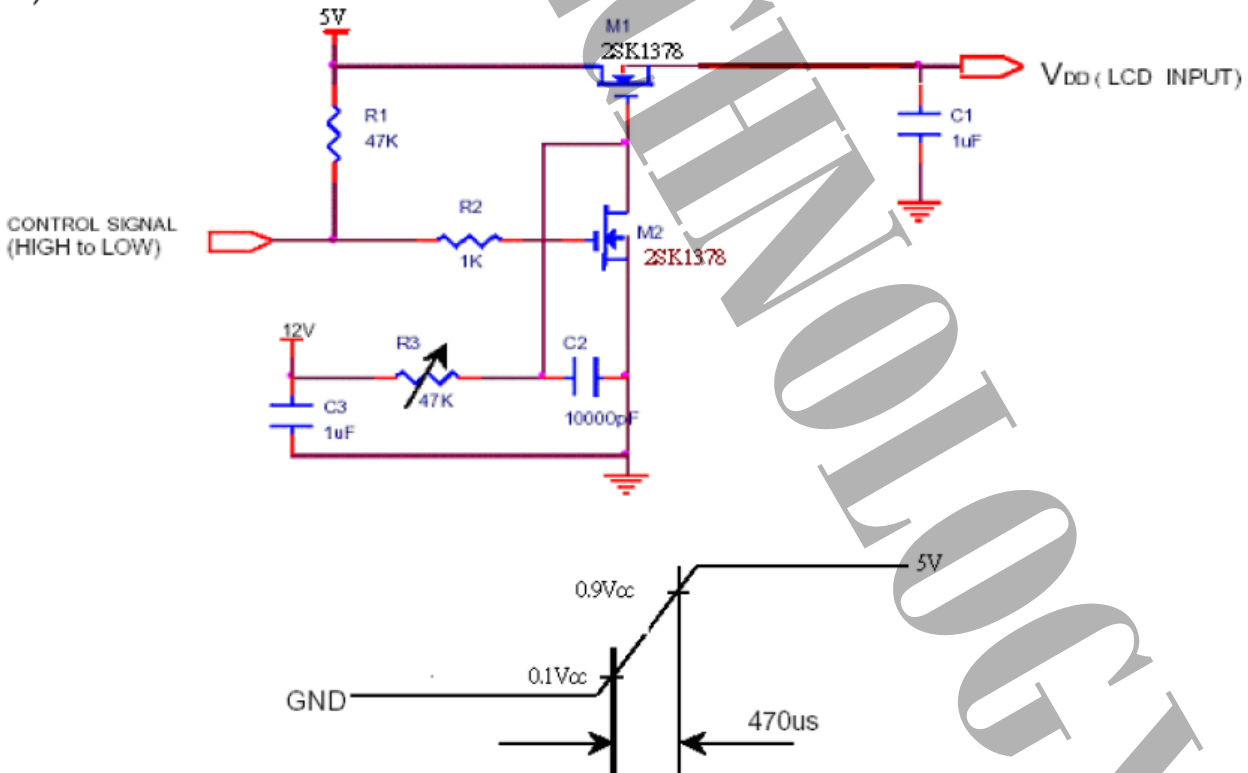


*4) LVDS AC electrical characteristics

Differential LVDS signal : The following condition is base on operation frequency at 76.59MHz



*5). Irush Measurement Condition





1.4 Optical Characteristics

Ta=25°C · VCC=5.0V

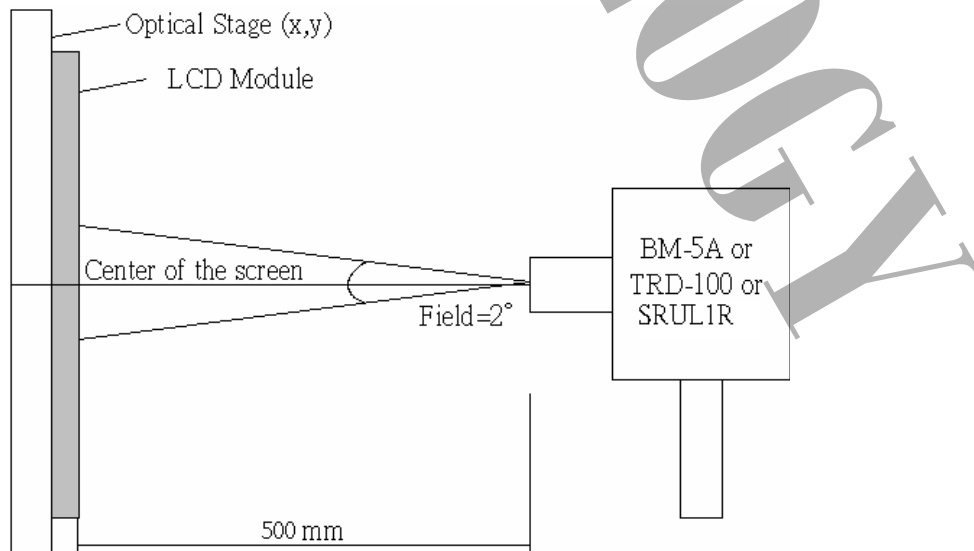
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK	
Contrast (CEN)	CR	$\theta=\psi=0^\circ$	800	1000	--	--	*1) 2)	
Luminance (CEN)	L	$\theta=\psi=0^\circ$	800	1000	--	cd/m ²	*1) 3)	
9P Uniformity	ΔL	$\theta=\psi=0^\circ$	75	80	--	%	*1) 3)	
Response Time	Tr+Tf	$\theta=\psi=0^\circ$	--	25	35	ms	*5)	
Cross talk	CT	$\theta=\psi=0^\circ$	--	--	2	%	*6)	
View angle	Horizontal 	ψ	$CR \geq 10$	75/-75	85/-85	--	Deg.	*4)
	Vertical	θ		75/-75	85/-85	--	Deg.	
Color Coordinates	White	x	$\theta=\psi=0^\circ$	(0.263)	(0.313)	(0.363)	Color Coordinates	*3)
		y		(0.279)	(0.329)	(0.379)		
	Red	x		(0.589)	(0.639)	(0.689)		
		y		(0.285)	(0.335)	(0.385)		
	Green	x		(0.256)	(0.306)	(0.356)		
		y		(0.566)	(0.616)	(0.666)		
	Blue	x		(0.105)	(0.155)	(0.205)		
		y		(0.008)	(0.058)	(0.108)		
Gamut	CG	$\theta=\psi=0^\circ$	68	72	--	%		
Gamma	γ	VESA	2.0	2.2	2.4	--	*7)	

[Note]

Definition of these measurement items is as follows:

1) Setup of Measurement Equipment

The LCD module should be turn-on to a stable luminance level to be reached. The measurement should be executed after lighting Backlight for 20 minutes and in a dark room.





2). Definition of Contrast Ratio:

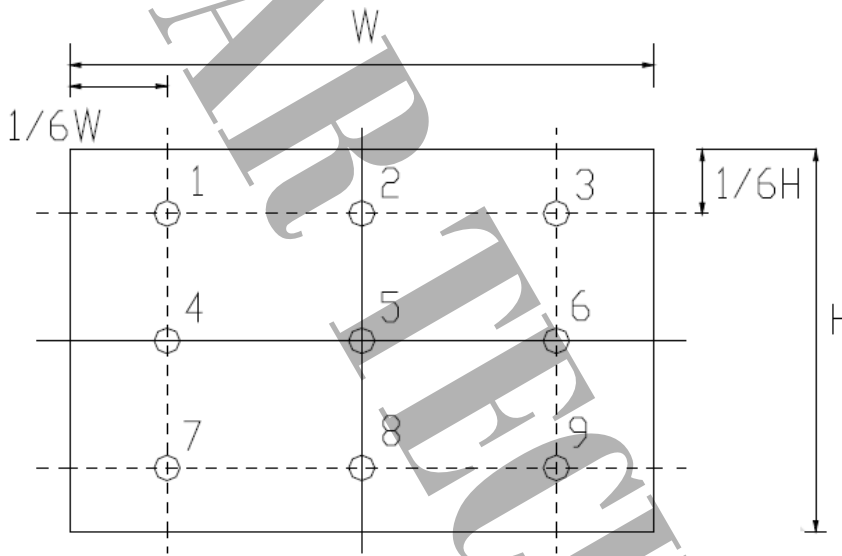
$$CR = \text{ON (White) Luminance} / \text{OFF (Black) Luminance}$$

3) Definition of Luminance and Luminance uniformity

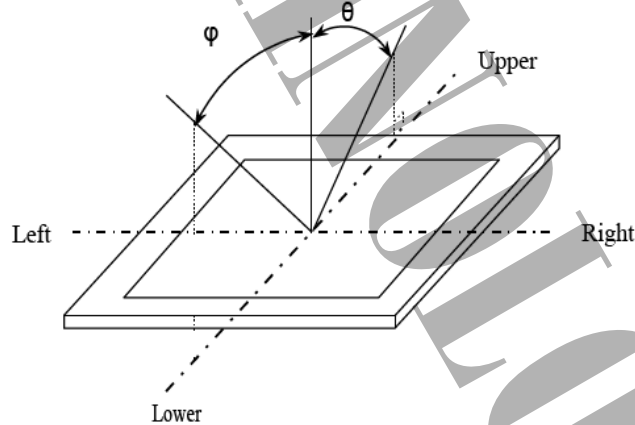
Central luminance: The white luminance is measured at the center position "5" on the screen, see Fig.1 below. And the measure time is 30 min after discharged.

9P Luminance (AVG): The white luminance is measured at measuring points 1 to 9, see Fig.1 below.

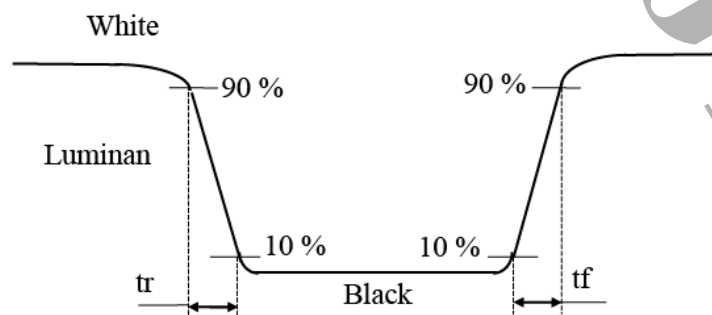
$$9P \text{ Uniformity: } \Delta L = (L_{\text{MIN}} / L_{\text{MAX}}) \times 100\%$$



4). Definition of Viewing Angle (θ, ψ):



5) Definition of Response Time:



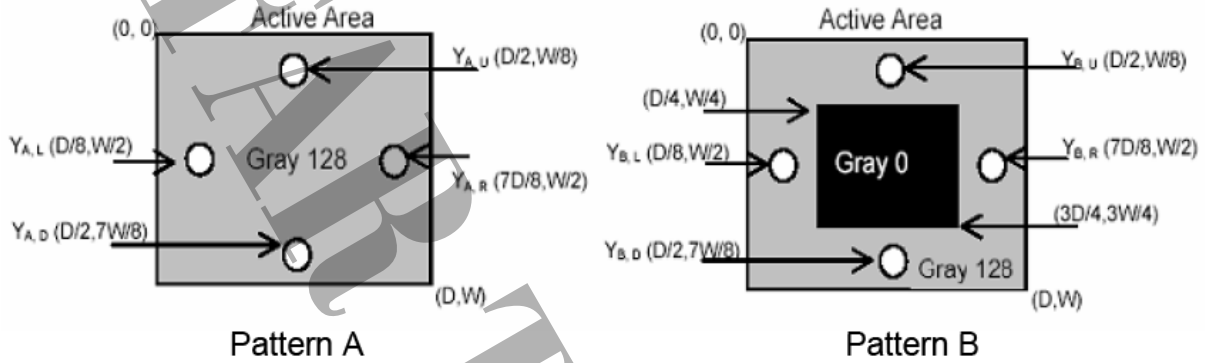


6) Definition of crosstalk:

$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Y_A : The luminance of measured position at pattern A

Y_B : The luminance of measured position at pattern B with Gray level 0



7) Definition of Gamma (γ), follow VESA standard sampling every 16 gray level (0,16,32,.....224,240,255)



1.5. Backlight

1. Electrical specification

Ta=25°C (Ta: ambient temperature)

Symbol	Parameter	Min	TYP	MAX	UNIT	REMARK
V _F	LED Operation Voltage (for reference)	26.1	28.8	31.5	V	Per serial LED
I _F	LED Operation Current	-	130	-	mA	Per LED
P _{out}	BLU Power	-	29.952	-	W	

2. CN2

Type Part Number	A1256H00-6P-HF(ZHIJI) or compatible
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Pin	Name	Description
1	A1	Vin 28.8V
2	A1	Vin 28.8V
3	K1	String 9 PcsLED , feedback 130mA
4	K2	String 9 PcsLED , feedback 130mA
5	K3	String 9 PcsLED , feedback 130mA
6	K4	String 9 PcsLED , feedback 130mA

CN3

Type Part Number	A1256H00-6P-HF(ZHIJI) or compatible
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Pin	Name	Description
1	A1	Vin 28.8V
2	A1	Vin 28.8V
3	K1	String 9 PcsLED , feedback 130mA
4	K2	String 9 PcsLED , feedback 130mA
5	K3	String 9 PcsLED , feedback 130mA
6	K4	String 9 PcsLED , feedback 130mA

3. life time

ITEM	min	typ	max	UNIT	REMARK
LIFE TIME	50000	70000	--	hrs	*1

*1). Definition of the LED life time: Luminance (L) under 50% of the initial value. LED life time is restricted under normal condition, ambient temperature=25°C and LED operation forward current=130mA.



2. MODULE STRUCTURE

2.1 Interface Pin Description

CN1 (Input signal)

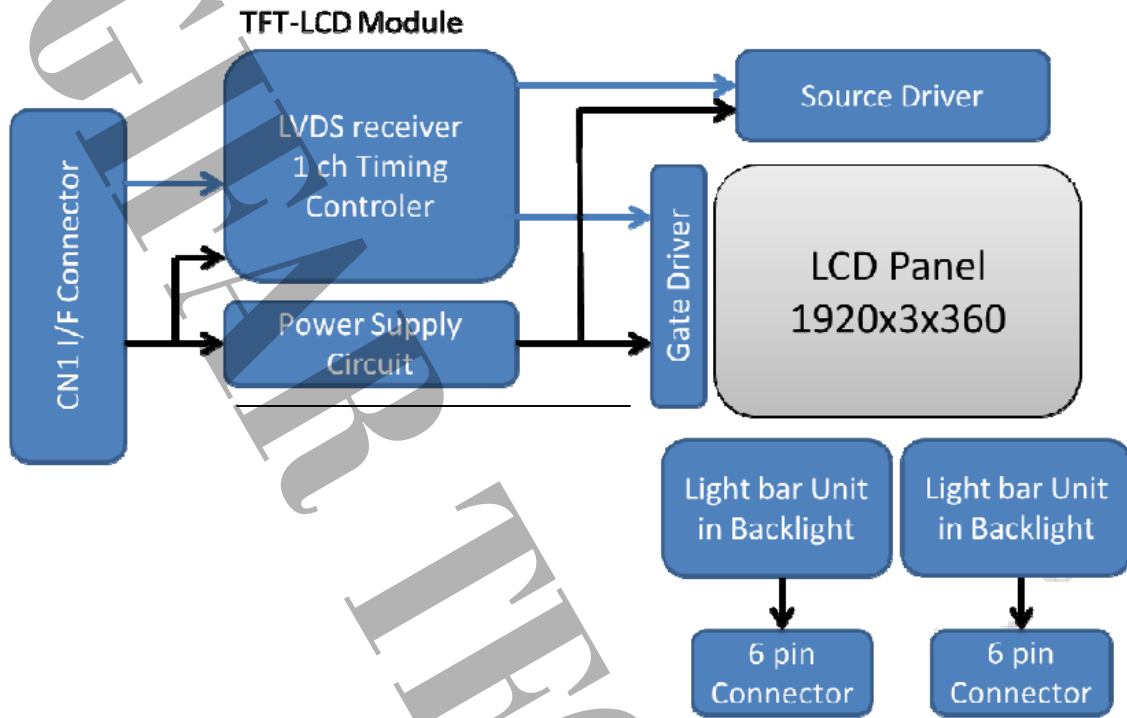
Used connector: MSBKT2407P30HB (SIN-SHENG) or equivalent or equivalent (093G30-01001A-M4 (starconn))

PIN NO.	SYMOBL	FUNCTION
1	RX0-	LVDS Signal(-)—channel 0
2	RX0+	LVDS Signal(+)—channel 0
3	RX1-	LVDS Signal(-)—channel 1
4	RX1+	LVDS Signal(+)—channel 1
5	RX2-	LVDS Signal(-)—channel 2
6	RX2+	LVDS Signal(+)—channel 2
7	GND	ground
8	RXC-	LVDS Clock Signal(-)
9	RXC+	LVDS Clock Signal(+)
10	RX3-	LVDS Signal(-)—channel 3
11	RX3+	LVDS Signal(+)—channel 3
12	NC	NC (Please let it floating for test only)
13	NC	NC (Please let it floating for test only)
14	GND	ground
15	NC	NC (Please let it floating for test only)
16	NC	NC (Please let it floating for test only)
17	GND	ground
18	NC	NC (Please let it floating for test only)
19	NC	NC (Please let it floating for test only)
20	NC	NC (Please let it floating for test only)
21	NC	NC (Please let it floating for test only)
22	NC	NC (Please let it floating for test only)
23	NC	NC (Please let it floating for test only)
24	GND	ground
25	GND	ground
26	GND	ground
27	NC	NC (Please let it floating for test only)
28	VCC	Power supply input voltage(5.0 V)
29	VCC	Power supply input voltage(5.0 V)
30	VCC	Power supply input voltage(5.0 V)

- 1) Please keep the NC Pin and don't connect it to GND or other signals.
- 2) GND Pin must connect to the ground, don't let it be a vacant pin.



2.2 BLOCK DIAGRAM





2.3. INPUT SIGNAL

Timing Specification

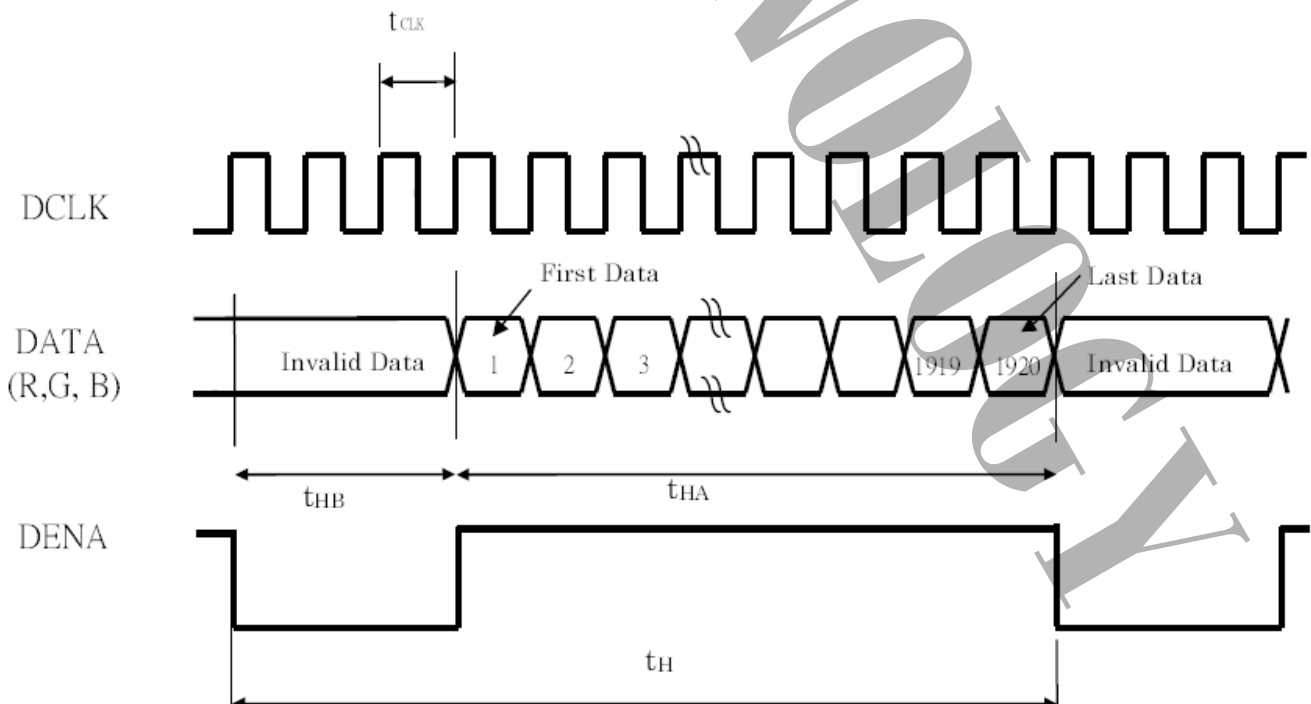
		ITEM	SYMBOL	MIN	TYP	MAX	UNIT
LCD Timing	DCLK	Frequency	f_{CLK}	38.11	51.52	76.59	MHz
		Period	t_{CLK}	13.06	19.41	26.24	ns
	DATA Enable DENA	Horizontal Active Time	t_{HA}	1920			t_{CLK}
		Horizontal Blank Time	t_{HB}	140	200	300	t_{CLK}
		Horizontal Total Time	t_H	2060	2120	2220	t_{CLK}
		Vertical Active Time	t_{VA}	360			t_H
		Vertical Blank Time	t_{VB}	10	45	100	t_H
		Vertical Total Time	t_V	370	405	460	t_H
		Vertical Frame Rate	F_r	50	60	75	Hz

[Note]

- *1) DENA (data enable) usually is positive
- *2) DCLK still inputs during blanking
- *3) DE mode only
- *4) It maybe cause flicker at 50Hz.

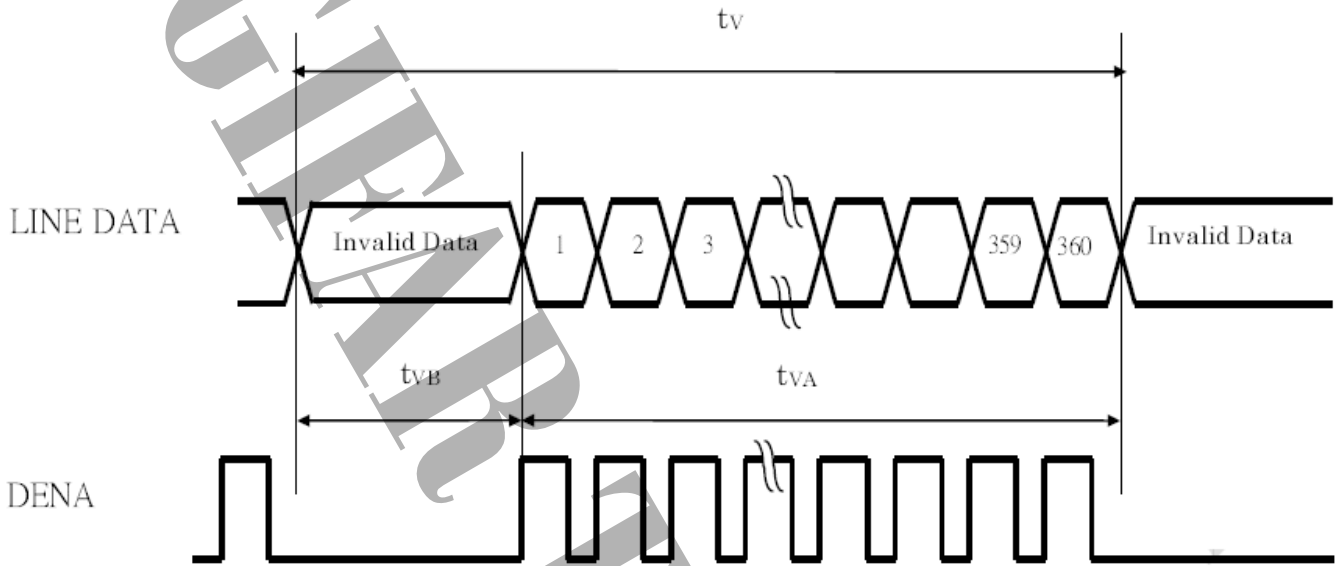
Timing Sequence (Timing chart)

Horizontal Timing Sequence



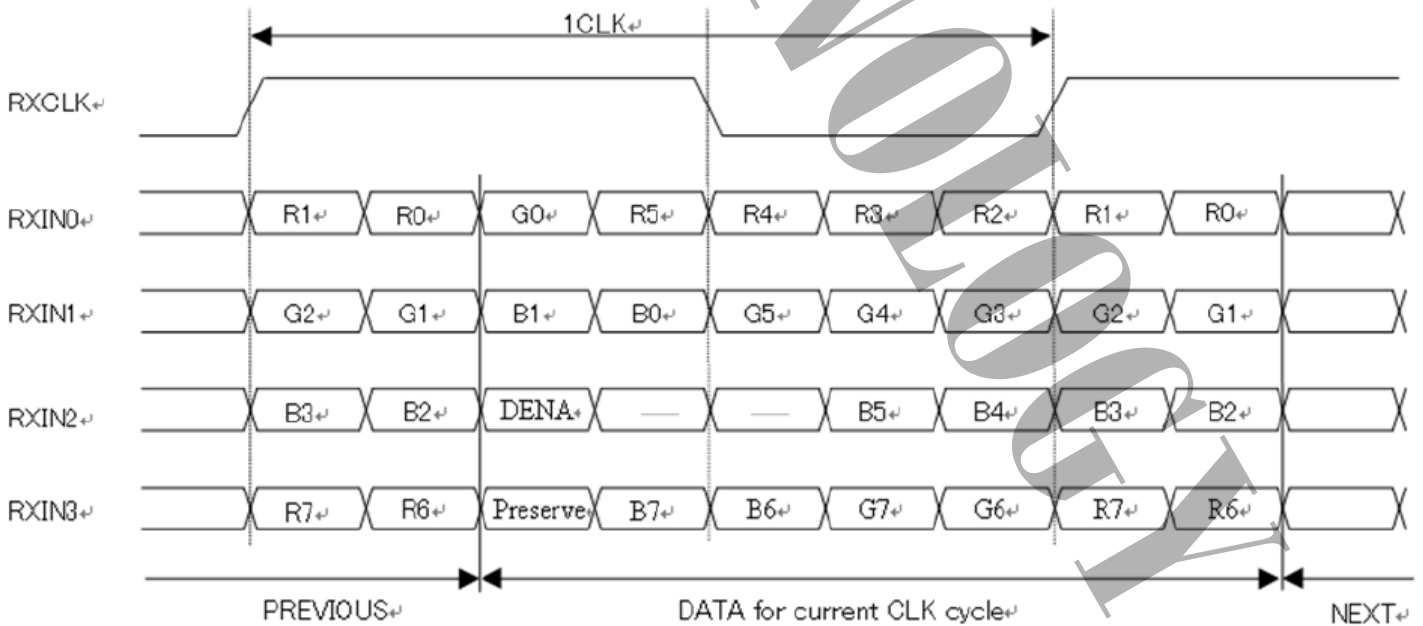


Vertical Timing Sequence



LVDS Input Data mapping

For 6Bit+Hi-FRC (VESA)





2.4 Color Data Reference

COLOR	INPUT DATA	R DATA								G DATA								B DATA							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
		MSB						LSB	MSB							LSB	MSB								LSB
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	
	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	
	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	
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	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	
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
RED	RED(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		
	RED(2)	0	0	0	0	0	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		
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	GREEN	GREEN(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	1	0	0	0	0	0	0	0		
GREEN(2)		0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	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		
GREEN(255)		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0		
BLUE		BLUE(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	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		
	BLUE(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1		
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1		

[Note] 1) Definition of gray scale: Color (n): n indicates gray scale level; higher n means brighter level.

2) Data: 1-High, 0-Low.

3).Color Data Distribution

D(1,1)	D(2,1)	..	D(X,1)	..	D(1919,1)	D(1920,1)
D(1,2)	D(2,2)	..	D(X,2)	..	D(1919,2)	D(1920,2)
..	..	+	..	+
D(1,Y)	D(2,Y)	..	D(X,Y)	..	D(1919,Y)	D(1920,Y)
..	..	+	..	+
D(1,359)	D(2, 359)	..	D(X, 359)	..	D(1919, 359)	D(1920, 359)
D(1, 360)	D(2, 360)	..	D(X, 360)	..	D(1919, 360)	D(1920,360)



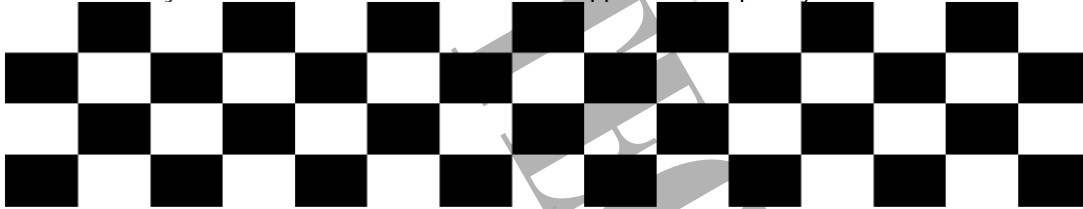
3. RELIABILITY TEST

3.1. Temperature and humidity

TEST ITEMS	CONDITIONS	NOTE
HIGH TEMPERATURE HIGH HUMIDITY OPERATION	40°C; 95%RH; 240h	No condensation
HIGH TEMPERATURE OPERATION	70°C; 240h	
HIGH TEMPERATURE STORAGE	80°C; 240h	
LOW TEMPERATURE OPERATION	-20°C; 240h	
LOW TEMPERATURE STORAGE	-30°C; 240h	
THERMAL SHOCK	BETWEEN -20 °C (0.5hr)~70 °C (0.5hr); 50 CYCLES	
IMAGE STICKING	25°C : 2h	Note 1

Note 1: Conition of Image Sticking test : 25°C±2°C

Operation with test pattern sustained for 2 hrs, then change to Mid-gray pattern immediately. After 5 mins, the mura must be disappeared completely.



(a) Test Pattern(chess board pattern)



(b) Mid-Gray Pattern

3.2. Shock and Vibration

TEST ITEMS	CONDITIONS
SHOCK (NON-OPERATION)	50G, 20ms, Each ±X,±Y,±Z axis is 1 times (Total is 6 times)
VIBRATION (NON-OPERATION)	1.5G, 10-200-10Hz, 3 axis, 30min/axis

3.3 Electrostatic Discharge

POSITION	CONDITION(MDL turn off)
ESD (power off)	MM Connector · 200pF, 0 , ±200V · once for each terminal
	1. 150 pF · 330 Ω , ±8 kv/±15 kv, 25 times/point, 4 points/panel(air) 2. 150 pF · 330 Ω , ±8 kv/±15 kv, 25 times/point(contact)

3.4 Judgment standard

The judgment of the above test should be made as follow:

Pass: Normal display image with no obvious non-uniformity and no line defect. Partial transformation of the module parts should be ignored.

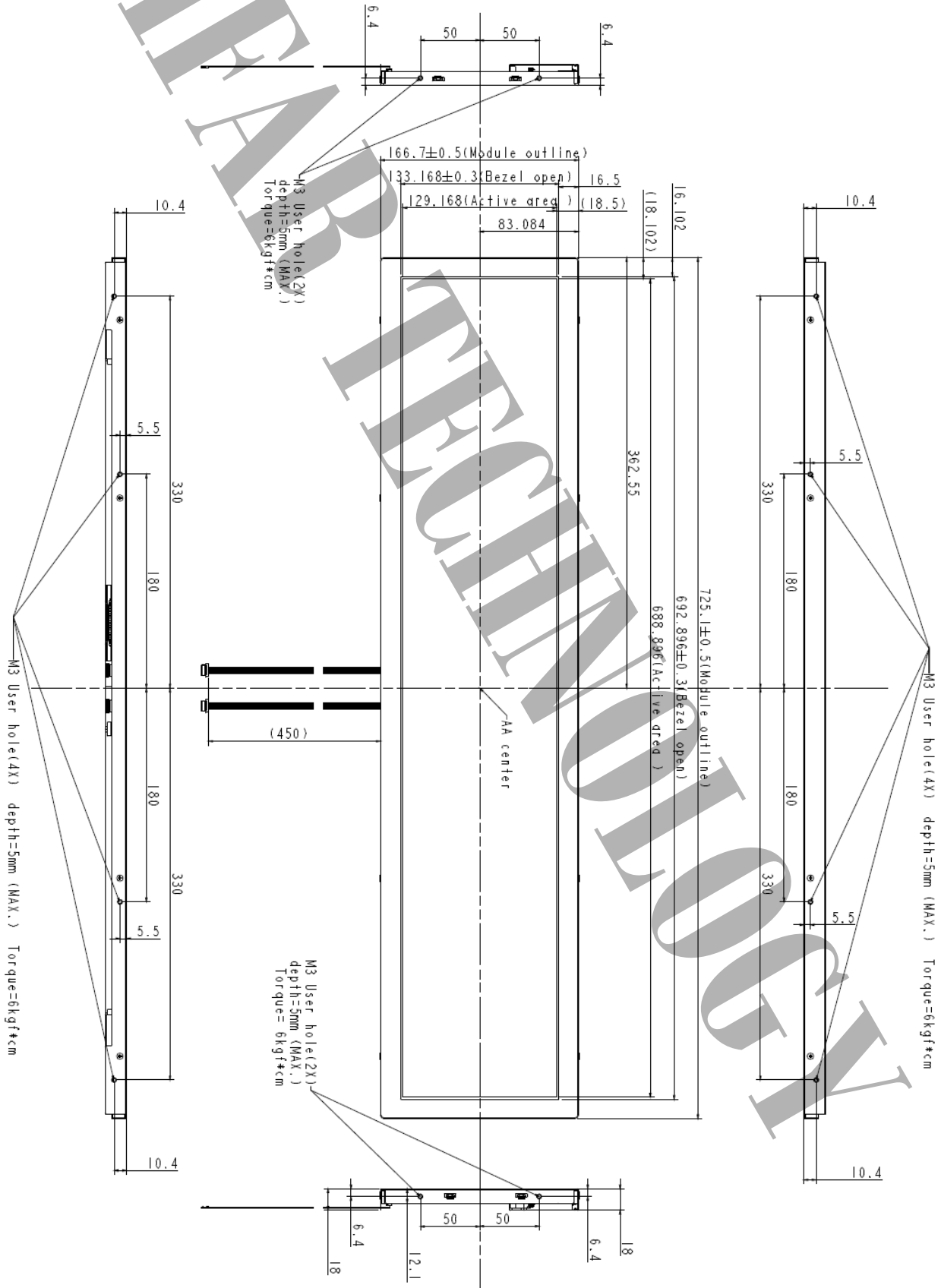
Fail: No display image, obvious non-uniformity, or line defects.



4. LCM Drawing

4.1 Front side (Tolerance is $\pm 0.5\text{mm}$ unless noted)

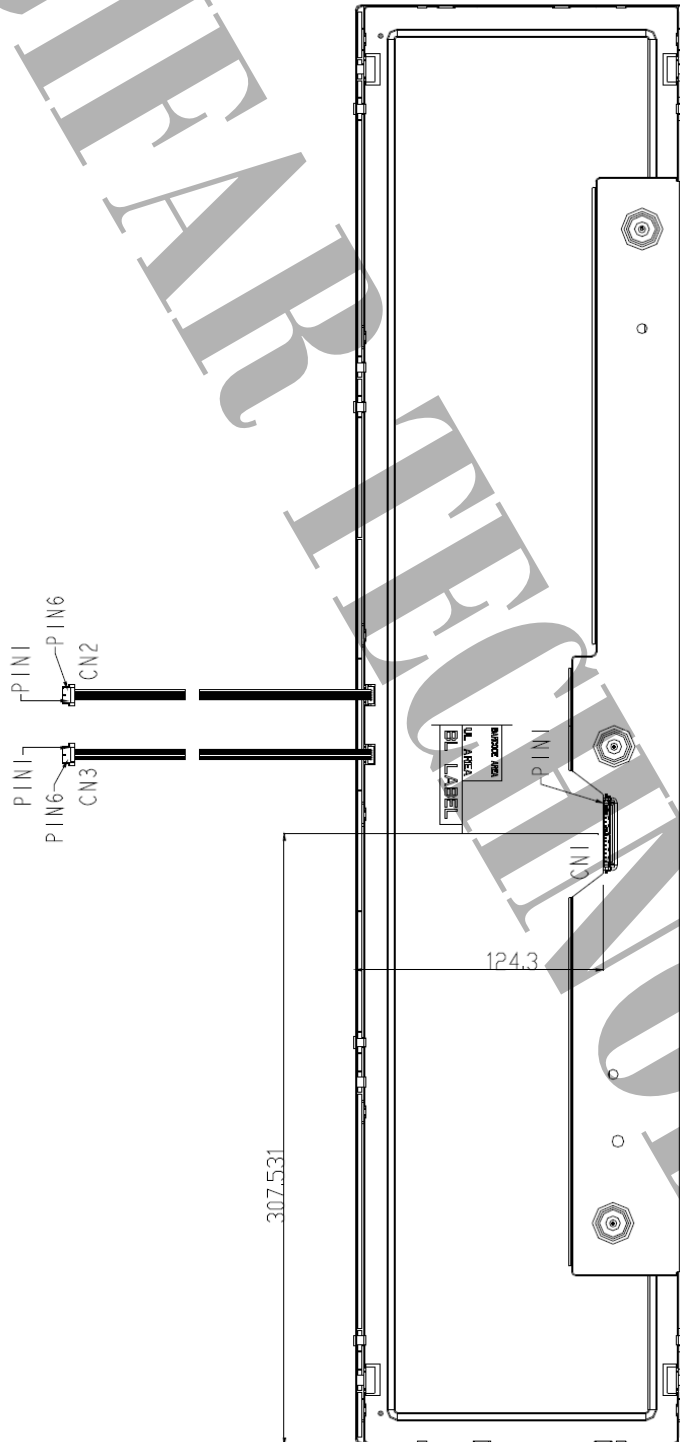
Unit: mm





4.2 Rear Side(Tolerance is $\pm 0.5\text{mm}$ unless noted)

[Unit : mm]



5. WARRANTY

5.1 The period is within 12 months since the date of shipping out under normal using and storage conditions.

5.2 The warranty will be avoided in case of defect induced by customer.