



SPECIFICATIONS

CUSTOMER : _____

MODEL NO. : **GFTO101AA1280720V**

VERSION : **A**

DATE : **2018.01.08**

CERTIFICATION : **ROHS**

CUSTOMER SIGN : _____

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Revision Record

Data(y/m/d)	Ver.	Description	Note	page
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1. SPECIFICATIONS

GFTO101AA1280720V is 10.1" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit and LED backlight. By applying 1280×720 images are displayed on the 10.1" diagonal screen. Display 16.7M colors by R.G.B signal input.

1.1 Features

ITEM	SPECIFICATION			
Display Area (mm)	224.64 (H) x 126.36 (V) (mm)			
Number of Pixels	1280(H) × 3(RGB) × 720(V)			
Pixel Pitch (mm)	0.1755 (H) × 0.1755 (V) (mm)			
Color Pixel Arrangement	RGB Vertical Stripe			
Display Mode	Normally Black			
Number of Colors	16.7M (6bit+2bit HiFRC)			
Brightness (cd/m ²)	400 cd/m ² (min.)/500 cd/m ² (typ.)			
Response Time (ms)	25 ms (typ.)			
Contrast Ratio	900 (typ)			
View Angle	170(H)/170(V)			
Power Consumption (W)	TBD			
Interface Connection	LVDS			
Module Size (mm)	Min	Typ	Max	
	Horizontal (H)	238.5	238.8	239.1
	Vertical (V)	147.7	148	148.3
	Depth (D) w/o FPC	5.7	6	6.3
Module Weight (g)	315 (Typ.)			
Backlight Unit	LED			
Surface Treatment	AG25%,Hardness:3H			

The LCD Products listed on this document are not suitable for use of aerospace equipment, submarine cable, and nuclear reactor control system and life support systems. If customers intend to use these LCD products for applications listed above or those not included in the "Standard" list as follows, please contact our sales in advance.

Standard : Computer, office equipment, communication equipment, test and Measurement equipment, machine tool, industrial robot, audio and visual equipment, other consumer products.



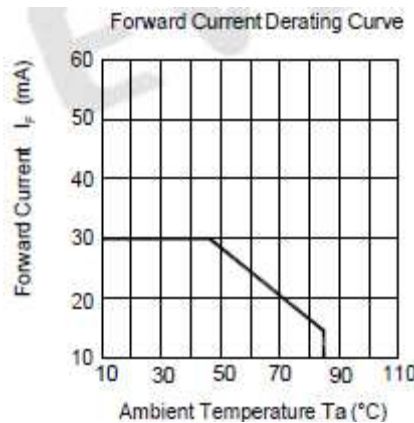
1.2 Absolute Maximum Ratings

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

ITEM	SYMBOL	MIN	MAX	UNIT	NOTE
Power Supply Voltage For LCD	DVDD	-0.3	3.96	V	
Analog Supply Voltage	AVDD	-0.5	14.85	V	
Gate On Voltage	VGH	-0.3	40	V	
Gate Off Voltage	VGL	-20	0.3	V	
Gate On-Gate Off Voltage	VGH-VGL	-0.3	40	V	
Operation Temperature	Top	-20	70	°C	*1).*2).*3).*4).
Storage Temperature	Tstg	-30	80	°C	*1).*2).*3)
Forward Current(per LED)	If	-	30	mA	
Pulse Forward Current(per LED)	Ifp	-	100	mA	*5).

【Note】

- *1) The relative temperature and humidity range are as below sketch, 90%RH Max. ($T_a \leq 40^\circ\text{C}$)
- *2) The maximum wet bulb temperature $\leq 39^\circ\text{C}$ ($T_a > 40^\circ\text{C}$) and without dewing.
- *3) 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.
- *4) If you operate LCD in normal temperature range, the center surface of panel should be under 50°C .
- *5) : Ifp Conditions : Pulse Width $\leq 10\text{msec}$: Duty $\leq 1/10$
- *6) : Operating must under the condition as below drawing.



(Ambient Temperature /Allowable Forward Current) Each LED)



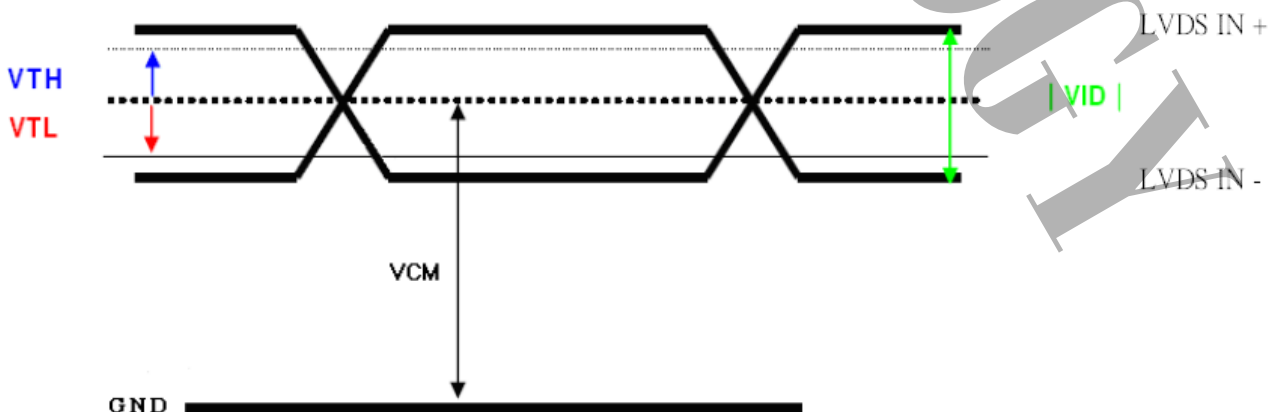
1.3 Electrical Characteristics

TFT LCD

Ta=25°C

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Digital Power Supply Voltage For LCD	DVDD	3	3.3	3.6	V	
Logic Input Voltage (LVDS:IN+,IN-)	VCM	$\frac{ VID }{2}$	-	$2.4 - \frac{ VID }{2}$	V	Note1
	VID	200	-	600	mV	Note1
	VTH	-	-	100	mV	VCM=1.2V
	VTL	-100	-	-	mV	Note1
Analog Power Supply Voltage	AVDD	12.8	13.0	13.2	V	
Gate On Power Supply Voltage	VGH	23	24	25	V	
Gate Off Power Supply Voltage	VGL	-6.6	-6	-5.4	V	
Logic Input Voltage	VIH	0.7*DVDD	-	DVDD	V	
	VIL	GND	-	0.3*DVDD	V	
Gamma Voltage	V1		12.14		V	Note3
	V2		11.60		V	
	V3		9.73		V	
	V4		9.00		V	
	V5		8.39		V	
	V6		6.93		V	
	V7		6.88		V	
	V8		5.88		V	
	V9		5.71		V	
	V10		4.25		V	
	V11		3.64		V	
	V12		2.87		V	
	V13		1.00		V	
	V14		0.34		V	

【Note1】 LVDS signal





TFT-LCD Current Consumption

Item	Symbol	Condition	Min.	Typ.	Max.	Unit.	Note.
Gate on Current	IVGH	VGH = 24V	-	0.5	1	mA	【 Note1】
Gate off Current	IVGL	VGL = -6V	-	0.5	1	mA	【 Note1】
Digital Current	IDVDD	DVDD = 3.3V	-	36	50	mA	【 Note1】
Analog Current	IAVDD	AVDD = 13V	-	36	60	mA	【 Note1】
Total Power Consumption	PC		-	602	990	mW	【 Note1】

【Note1】 Typical: Under 256 gray pattern
Maximum: Under White pattern



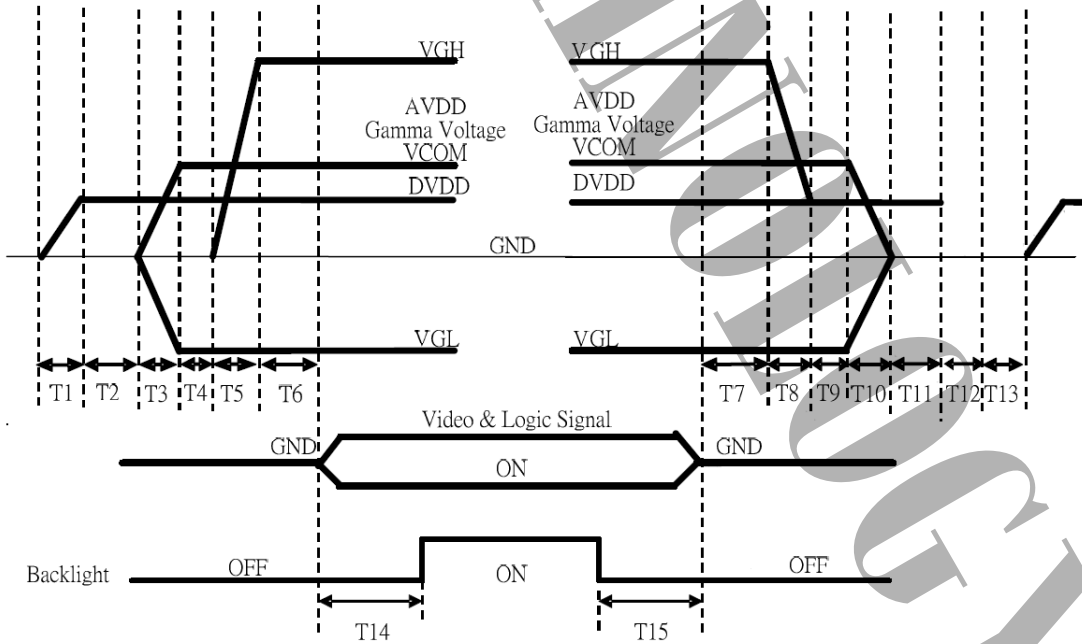
256 gray pattern



White Pattern

Power and Signal sequence

Power On : DVDD → AVDD/VGL → VGH → Video & Logic Signal → Backlight
Power Off : Backlight → Video & Logic Signal → VGH → AVDD/VGL → DVDD



0.5ms < T1 < 10ms
T2 > 0ms
0 < T3 < 10ms
T4 > 0ms
0 < T5 < 10ms
0 < T6 < 10ms
T14 > 200ms

T7 > 0ms
0 < T8 < 10ms
T9 > 0ms
0 < T10 < 10ms
T11 > 0ms
0 < T12 < 10ms
T13 > 200ms
T15 > 200ms

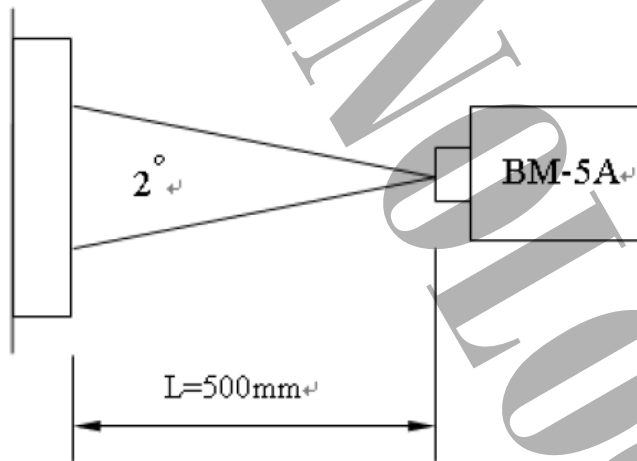


1.4 Optical Characteristics

Ta=25°C, Vcc=3.3V

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	REMARK
Contrast Ratio	CR	Point-5	600	900		--	*1) 2)
Luminance	Lw	Point-5	400	500		cd/m2	*1) 3)
Luminance Uniformity	ΔL		70	80		%	*1) 4)
Response Time (White - Black)	Tr+ Tf	Point-5		25	35	ms	*6)
NTSC	--	Point-5	65	70		%	*1) 3)
Viewing Angle	Left	Point-5 CR \geq 10	75	85			*1)*2)*5)
	Right		75	85			*1)*2)*5)
	Upper		75	85			*1)*2)*5)
	Lower		75	85			*1)*2)*5)
Color Coordinate	White	Wx Wy	(0.267) (0.284)	(0.307) (0.324)	(0.347) (0.364)		*1)
	Red	Rx Ry	TBD	TBD	TBD		
	Green	Gx Gy	TBD	TBD	TBD		
	Blue	Bx By	TBD	TBD	TBD		

*1) Measure condition : 25°C ± 2°C , 60 ± 10% RH , under 1 Lux in the dark room. BM-5A (TOPCON) , viewing angle 2° . IL=260 mA (Backlight current) , measurement after lighting on 10 minutes.



*2) Definition of contrast ratio :

Measure the point-5 as figure 8-1

$$\text{Contrast Ratio (CR)} = (\text{White}) \text{ Luminance of ON} \div (\text{Black}) \text{ Luminance of OFF}$$

*3) Definition of luminance :

Measure white luminance on the points-5 as figure 8-1

*4) Definition of Luminance Uniformity :

Measure white luminance on the point 1~9 as figure 8-1

$$\Delta L = [L(\text{MIN})/L(\text{MAX})] \times 100$$

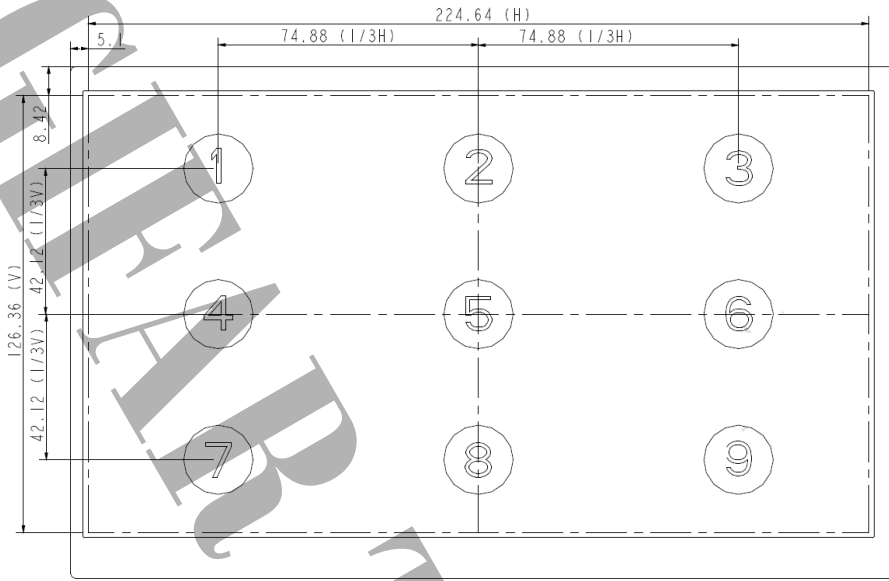
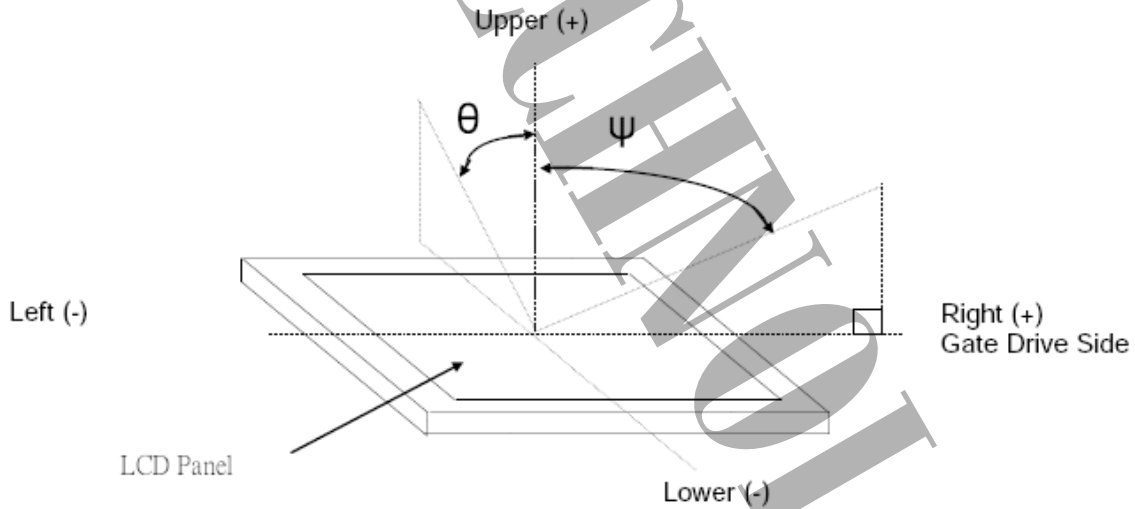
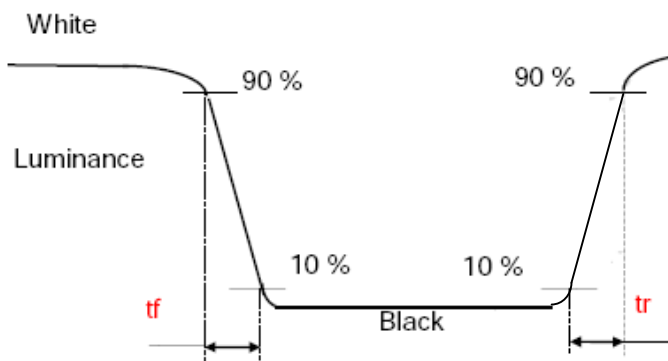


figure.7-1 Measuring point

*5) Definition of view angle(θ · ψ)



*6) Definition of response time

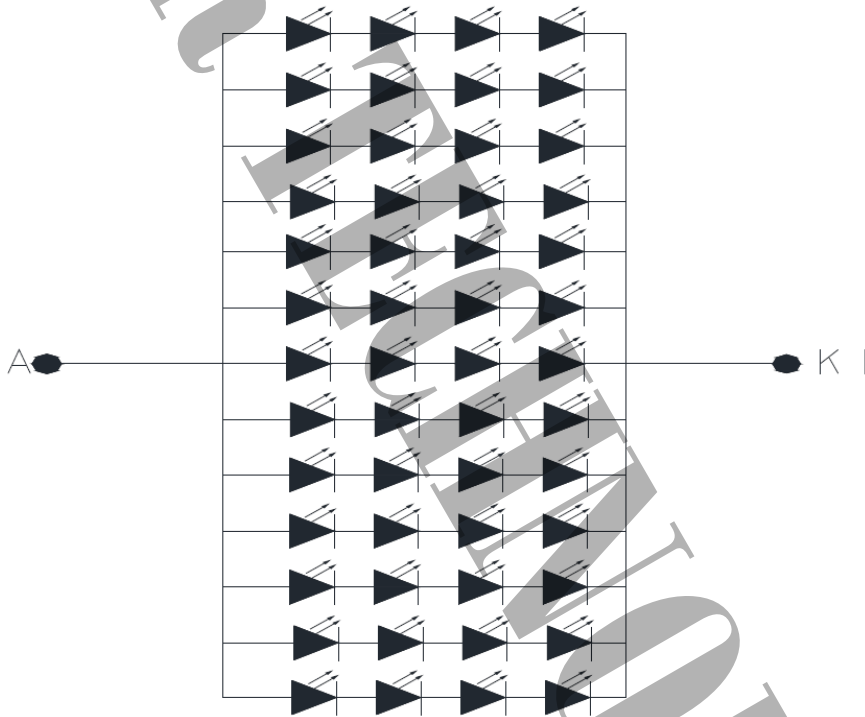




1.5 Backlight Characteristics

Ta=25°C

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	Note
LED current	IL	Ta=25°C, Each serial=20mA	--	260	--	mA	(1)(2)(3)
LED voltage	VL	Ta=25°C, Each serial=20mA	11.8	13	14.2	V	(1)(2)(3)
Power consumption	WL	Ta=25°C, Each serial=20mA	--	3.38	--	W	(1)(2)
LED Life Time	N/A	Ta=25°C, IF=20mA	--	30000	--	Hour	(4)



Remarks :

*1)LED Circuit Diagram

*2) A : Anode(+) , K : Cathode(-)

*3) LED control must use the constant current control to avoid the leakage light and brightness quality issue.

*4) Definition of the LED life : Luminance will decay less than 30%



2. MODULE STRUCTURE

2.1 Interface Pin Description

CN1 (Input Signal)

Connector : FH52-60S-0.5SH (HRS)

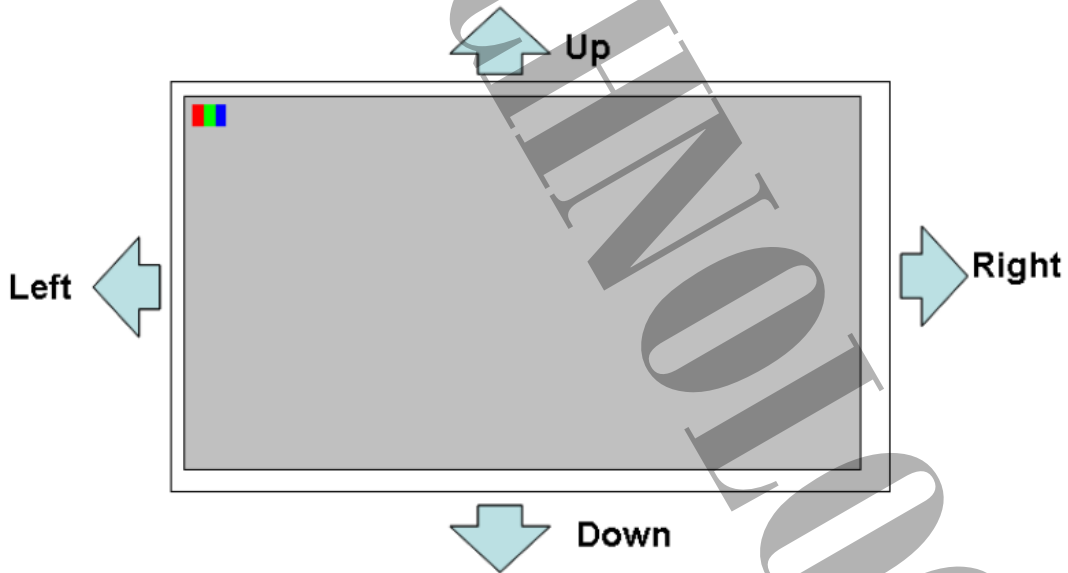
Pin NO.	Symbol	Description	Note
1	GND	Analog ground	
2	AVDD	Analog power	
3	DVDD	Digital power	
4	GND	Digital ground	
5	NC	Not connect	
6	DVDD	Digital power	
7	GND	Digital ground	
8	V14	Gamma correction voltage reference	
9	V13	Gamma correction voltage reference	
10	V12	Gamma correction voltage reference	
11	V11	Gamma correction voltage reference	
12	V10	Gamma correction voltage reference	
13	V9	Gamma correction voltage reference	
14	V8	Gamma correction voltage reference	
15	GND	Digital ground	
16	DVDD	LVDS power	
17	GND	Digital ground	
18	PIND3	Positive LVDS differential data input	
19	NIND3	Negative LVDS differential data input	
20	GND	Digital ground	
21	PINC	Positive LVDS differential clock input	
22	NINC	Negative LVDS differential clock input	
23	GND	Digital ground	
24	PIND2	Positive LVDS differential data input	
25	NIND2	Negative LVDS differential data input	
26	GND	Digital ground	
27	PIND1	Positive LVDS differential data input	
28	NIND1	Negative LVDS differential data input	
29	GND	Digital ground	
30	PIND0	Positive LVDS differential data input	
31	NIND0	Negative LVDS differential data input	
32	GND	Digital ground	
33	GND	LVDS ground	
34	GRB	Global reset pin. Active low to enter reset state. Suggest to connecting with an RC reset circuit for stability. Normally pull high. (R=10KΩ · C=1 μF)	
35	STBYB	Standby mode. STBYB=" 1" , normal operation STBYB=" 0" , timing control, source driver will turn off, all output are high-Z	
36	SHLR	Left or right display control	Note 1
37	DVDD	Digital power	
38	UPDN	Up / down display control	Note 1
39	GND	Analog ground	
40	AVDD	Analog power	
41	NC	Not connect	
42	DITH	Dithering function enable control. DITHER = "1" , Enable internal dithering function DITHER = "0" , Disable internal dithering function	Note 2
43	GND	Digital ground	
44	DVDD	Digital Power	
45	GND	Digital ground	
46	V7	Gamma correction voltage reference	
47	V6	Gamma correction voltage reference	



48	V5	Gamma correction voltage reference	
49	V4	Gamma correction voltage reference	
50	V3	Gamma correction voltage reference	
51	V2	Gamma correction voltage reference	
52	V1	Gamma correction voltage reference	
53	GND	Digital ground	
54	DVDD	Digital power	
55	SELB	6bit/8bit mode select, SELB = "0", LVDS input data is 8bits SELB = "1", LVDS input data is 6bits	Note 2
56	VGH	Positive power for TFT	
57	DVDD	Digital power for Gate IC	
58	VGL	Negative power for TFT	
59	GND	Digital ground for Gate IC	
60	NC	Not connect	

Note 1 : UPDN and SHLR control function

SHLR	UPDN	Data shifting
DVDD	GND	Left → Right · Up → Down(default)
GND	GND	Right → Left · Up → Down
DVDD	DVDD	Left → Right · Down → Up
GND	DVDD	Right → Left · Down → Up





Note 2: if LVDS input data is 6bits, SELB must be set to High
if LVDS input data is 8bits, SELB must be set to Low

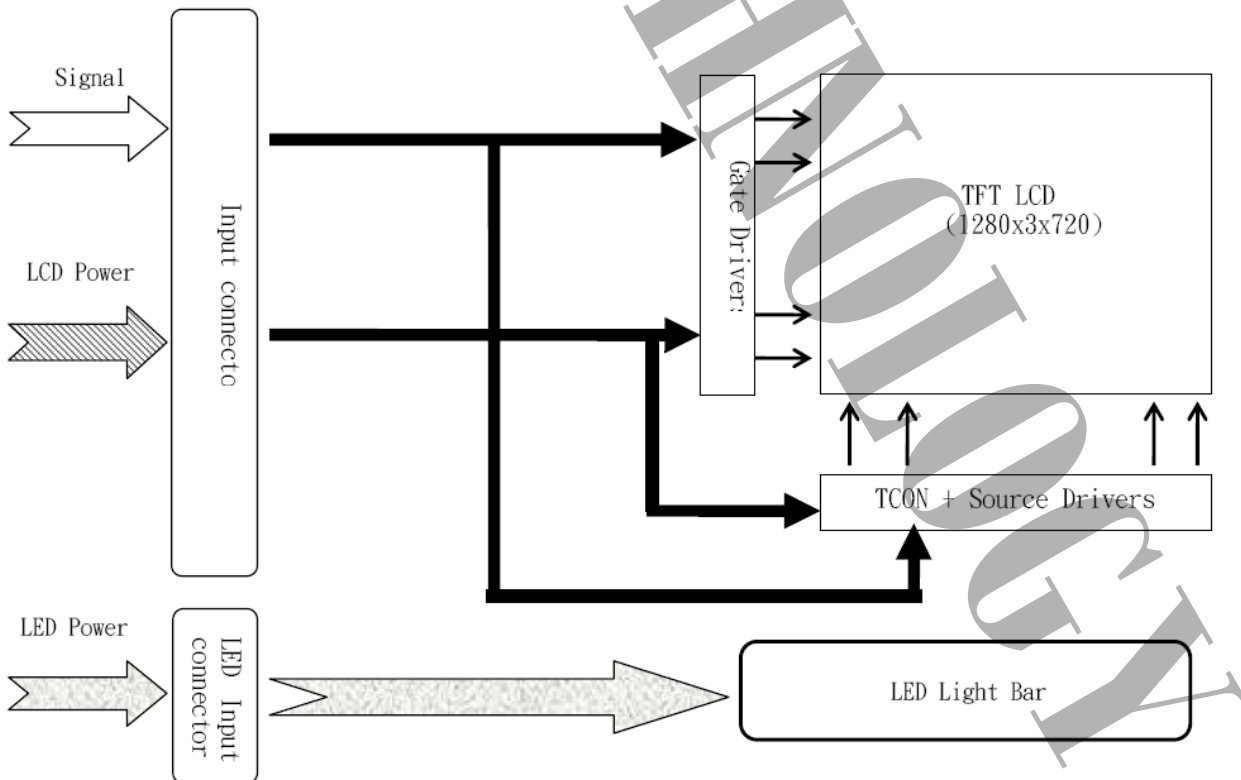
DITH and SELB control function

DITH	SELB	FUNCTION
0	1	Colors (262K)
0	0	Colors (262K)
1	1	Colors (262K)
1	0	16.7M (6bit+2bit HiFRC)

CN2(BLU connector)

Pin No.	SYMBOL	FUNCTION
1	A	Anode
2	K1	Cathode 1

2.2. BLOCK DIAGRAM





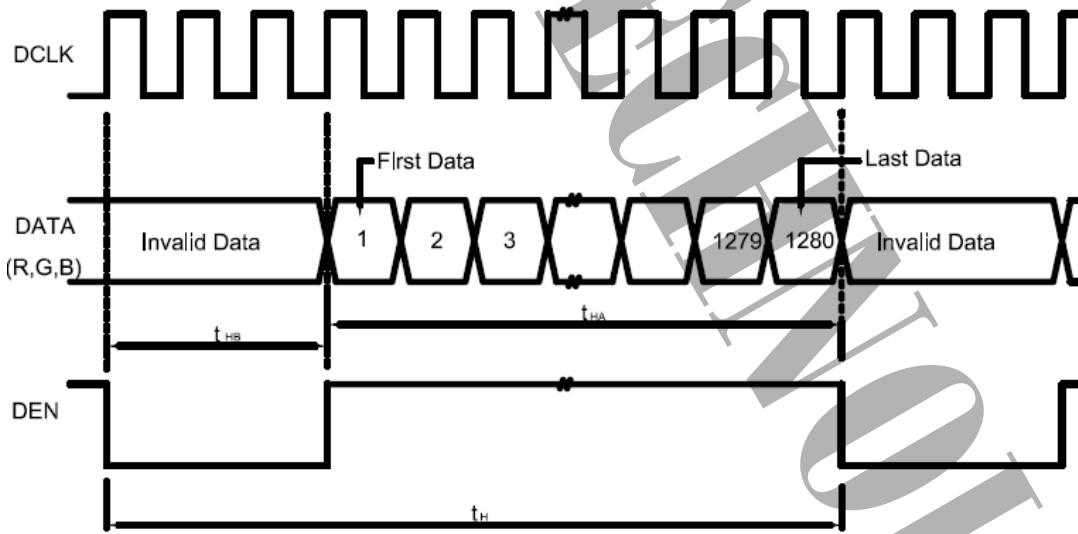
2.3. Timing Characteristics of Input Signals

Ta=25°C

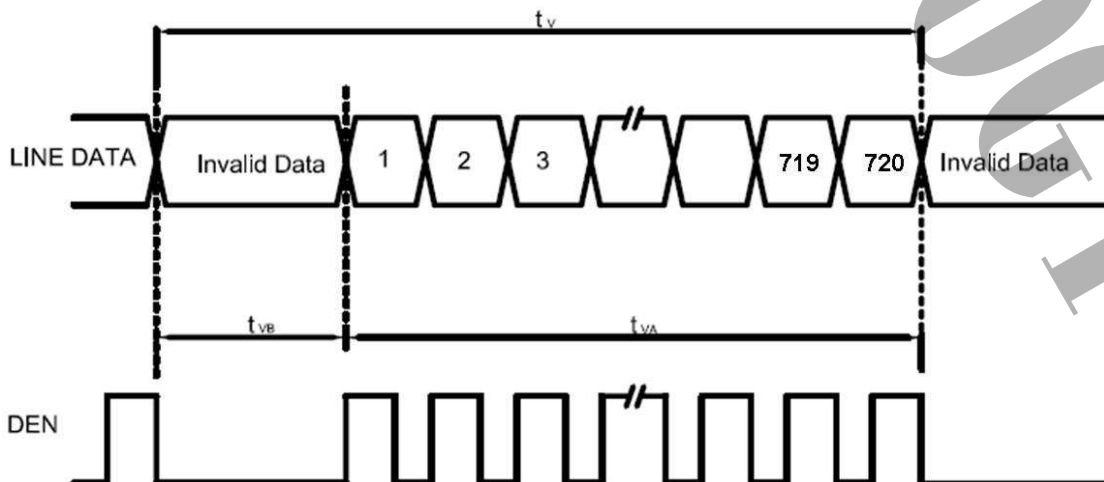
Item	Symbol	Min.	Typ.	Max.	Unit		
LVDS input signal sequence	CLK Frequency	1/tclk	60	65.5	71.3	MHz	
LCD input signal sequence (Input LVDS Transmitter)	Horizontal	Horizontal total Time	t _H	1370	1440	1500	tCLK
		Horizontal effective Time	t _{HA}	1280			tCLK
		Horizontal Blank Time	t _{HB}	90	160	220	tCLK
	Vertical	Vertical total Time	t _V	730	758	792	t _H
		Vertical effective Time	t _{VA}	720			t _H
		Vertical Blank Time	t _{VB}	10	38	72	t _H

2.3.1 Timing Sequence(Timing Chart)

Horizontal Timing Sequence



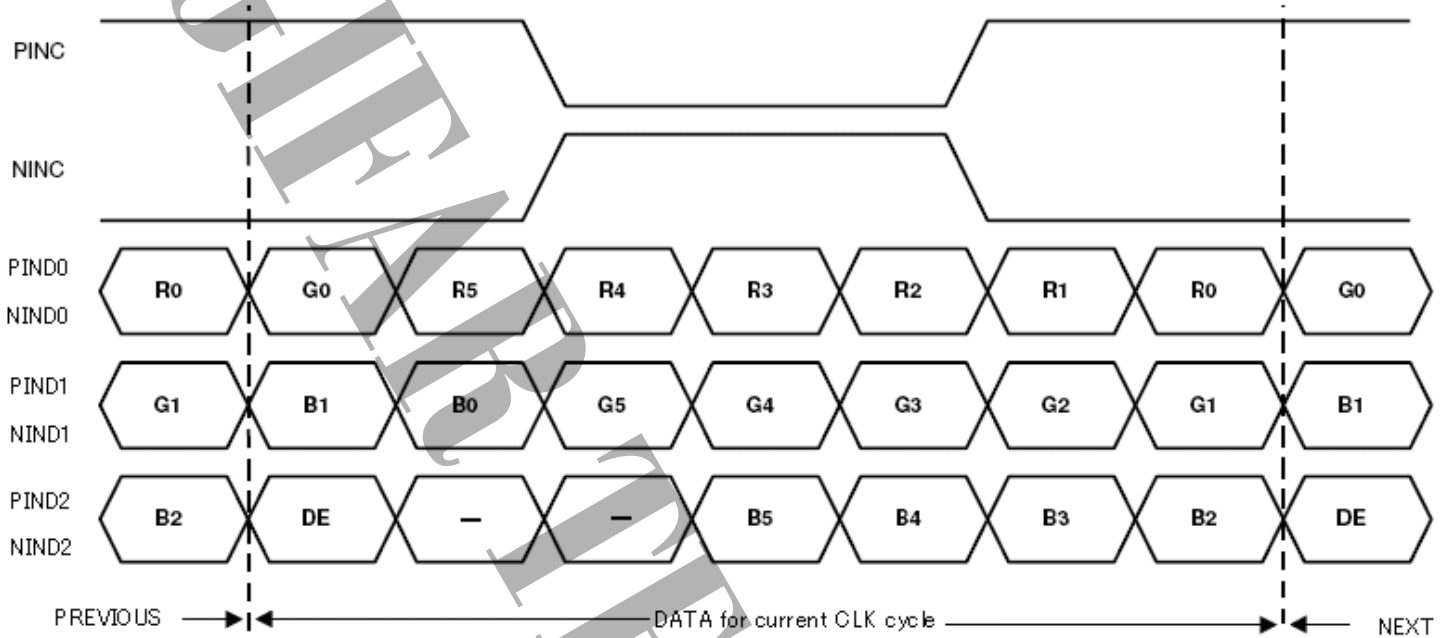
Vertical Timing Sequence



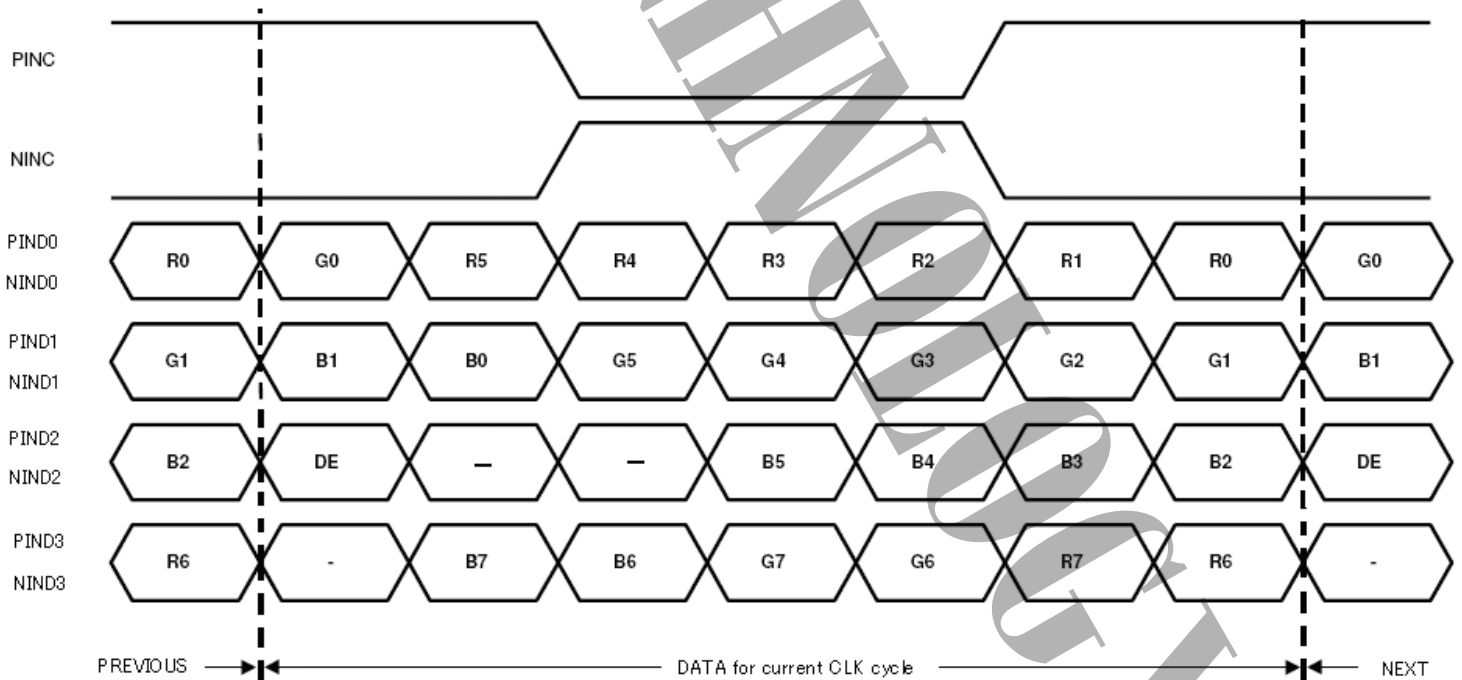


2.3.2 LVDS Input Data Mapping

6 Bit LVDS input



8 Bit LVDS input





2.4 Color Data Reference

COLOR	INPUT DATA	R DATA								G DATA								B DATA							
		R7 MSB	R6	R5	R4	R3	R2	R1	R0 LSB	G7 MSB	G6	G5	G4	G3	G2	G1	G0 LSB	B7 MSB	B6	B5	B4	B3	B2	B1	B0 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	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	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(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	
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	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	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(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	
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	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	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	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	



3. RELIABILITY TEST

3.1 Temperature and Humidity

TEST ITEMS	CONDITIONS	NOTE
High Temperature Operation	70°C, 240hrs	
High Temperature Storage	80°C, 240hrs	
High Temperature High Humidity Operation	60°C, 90%RH, 240Hrs	No condensation
Low Temperature Operation	-20°C, 240hrs	
Low Temperature Storage	-30°C, 240hrs	
Thermal Shock	-30°C(0.5hr) <-> 80°C(0.5hr) 200 cycles	
Image Sticking	25°C ; 2hrs	Note 1

【Note 1】 :

Condition of Image Sticking test : 25°C ± 2°C

Operation with test pattern sustained for 2 hrs, then change to gray pattern immediately.

After 5 mins, the mura must be disappeared completely .

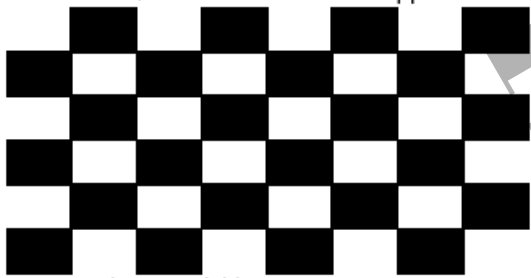


Image sticking pattern



mid-gray pattern

3.2. Shock and Vibration

TEST ITEMS	CONDITIONS
Shock (Non-Operation)	Shock level: 980m/s ² (equal to 100G). Waveform: half sinusoidal wave, 6ms. Number of shocks: +X · +Y · +Z · each axis 3 times.
Vibration (Non-Operation)	Frequency range: 8~33.3Hz Stoke : 1.3 mm Vibration: sinusoidal wave, perpendicular axis(both x, z axis: 2hrs , y axis: 4hrs). Sweep: 2.9G, 33.3 Hz -400 Hz Cycle time: 15 min

3.3 Electrostatic Discharge

TEST ITEMS	CONDITIONS	NOTE
ESD	150pF · 330Ω · ±8kV & ±15kV air & contact test	1
	200pF · 0Ω · ±200V contact test	2

Note: Measure

1: LCD glass and metal bezel

2: IF connector pins

3.4 Judgment Standard

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

Pass : Normal display image and no line defect.

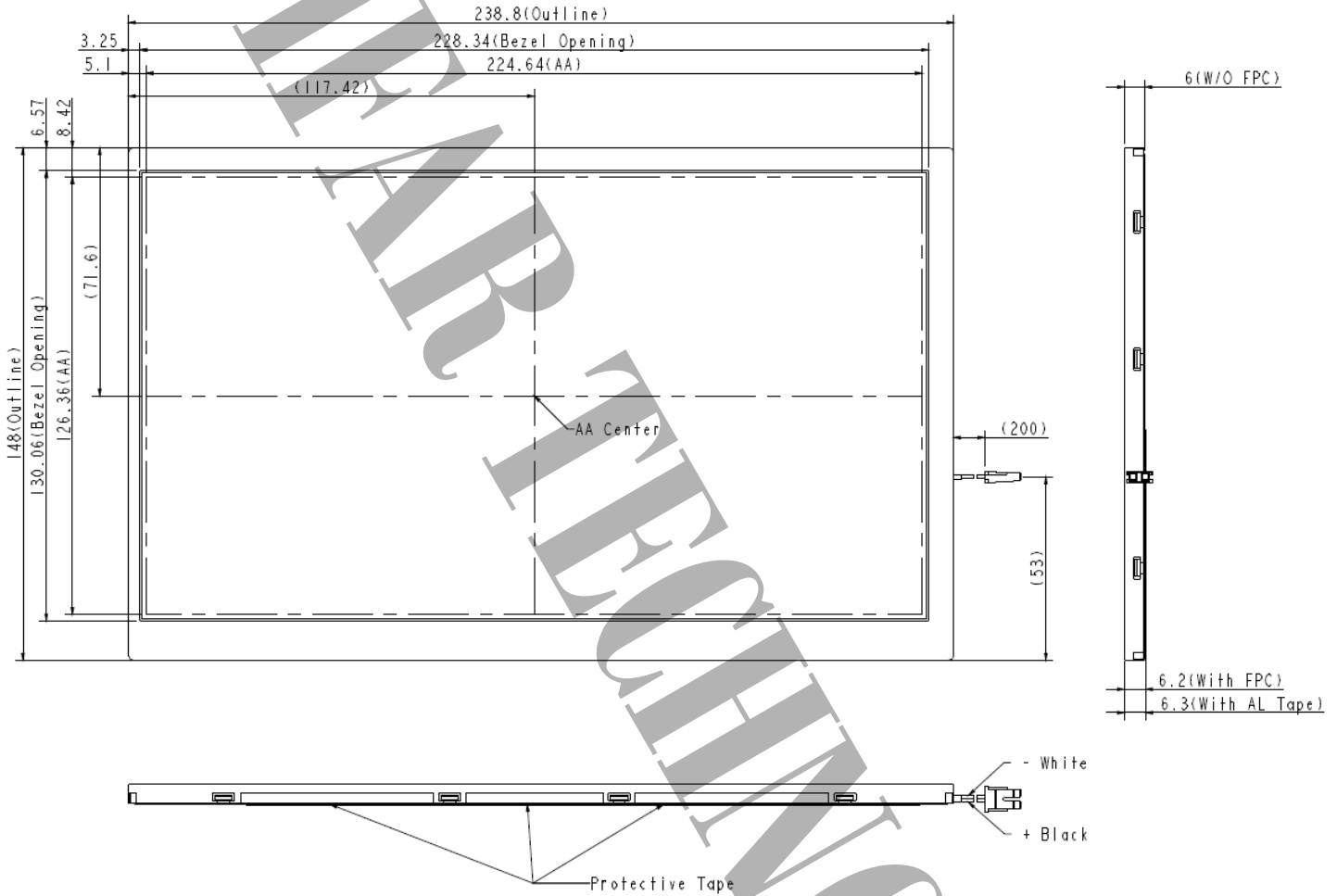
Fail : No display image, function NG, or line defects.



4. LCM Drawing

4.1 Front Side

[Unit : mm]

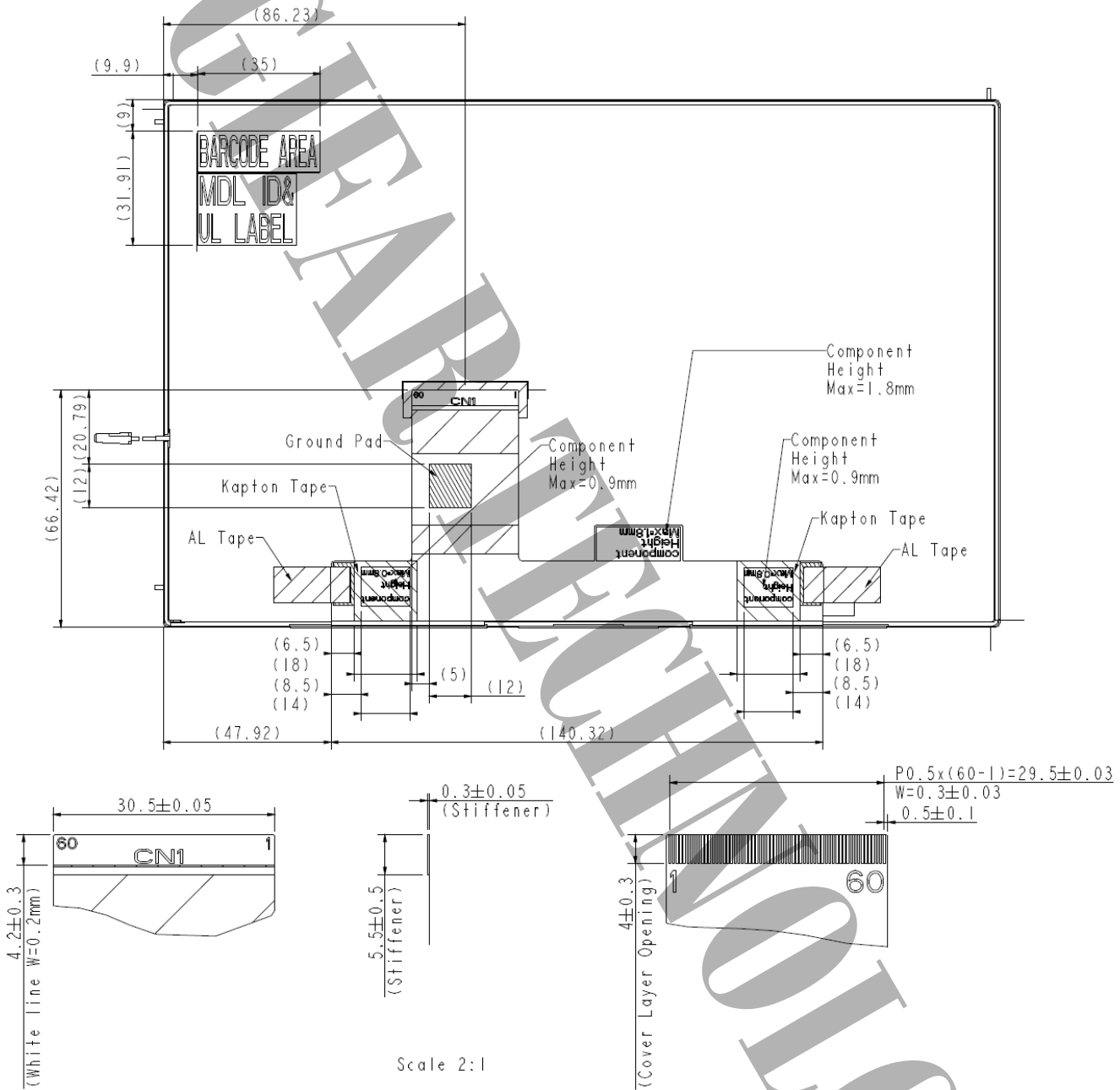


Tolerance is $\pm 0.3\text{mm}$ unless noted (Unit : mm)



4.2 Rear Side

[Unit : mm]



Note:

1. General tolerance = ±0.3mm
2. CNI suggested connector (60pin):
HRS FH52-10S-0.5SH
3. CN2 suggested connector (2pin):
JST BHSR-02VS-1

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.