



晶發科技股份有限公司
GI FAR TECHNOLOGY CO., LTD.

No. 81, Dongfeng St, Shulin District, 23874, New Taipei City, Taiwan, R.O.C.



SPECIFICATIONS

CUSTOMER : _____

MODEL NO. : **GFTO101BA19201200V**

VERSION : **A**

DATE : **2018.01.05**

CERTIFICATION : **ROHS**

CUSTOMER SIGN : _____

QA Approved By	Approved By	Prepared By	Prepared By

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1. OVERVIEW

This is 10.1" color (16:10) TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit and backlight. By applying 8 bit digital data, 1920×RGB (3) ×1200, 16.7M-color images are displayed on the 10.1" diagonal screen. General specifications are summarized in the following table:

ITEM	SPECIFICATION
Display Area	216.576 (H) x 135.36 (V) (mm) (10.1-inch diagonal)
Number of Pixels	1920×RGB (3) ×1200
Pixel Pitch	0.1128 (H) × 0.1128 (V) (mm)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	HFFS
Number of Colors	16,777,216
Interface Signal	LVDS
Gamut	50% (Typ)
Response Time	30ms (Typ) / 40ms (Max)
Surface Treatment	HC/AG
Viewing Angle	80° · 80° / 80° · 80° (Min) 89° · 89° / 89° · 89° (Typ.)
Brightness	700 cd/m ² (Center) (Typ)
Uniformity	9point : 75%(min)
Consumption of Power	6.5 (Max)
Module Size	229(W)×153 (H)×2.5 (D) (mm) (Typical) (w/o pcb))
Module Weight	150g (Typ.)

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.



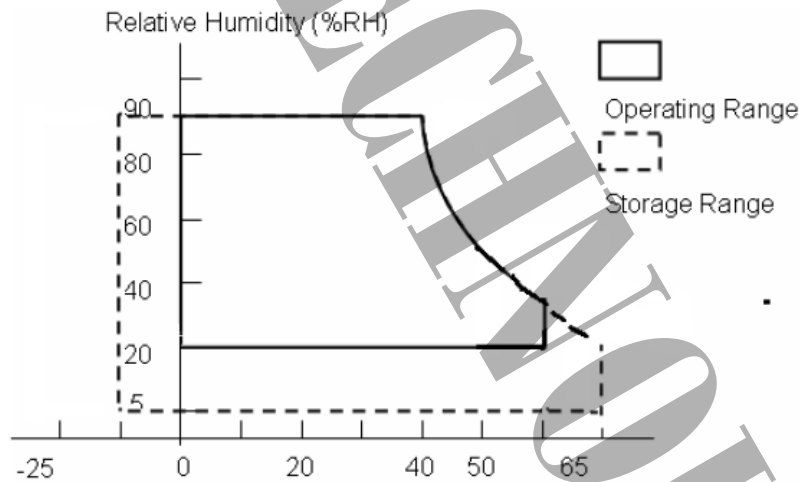
2. ABSOLUTE MAXIMUM RATINGS

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

ITEM	SYMBOL	MIN	MAX	UNIT	NOTE
LCD Power Voltage	Vin	0	4.0	V	
LED Driver Input Voltage	VBL+	0	19	V	
Operation Temperature	Top	0	50	°C	*1). *2). *3). *4)
Storage Temperature	Tstg	-25	65	°C	*1). *2). *3)

【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.





3. ELECTRICAL CHARACTERISTICS

(A) TFT LCD

TEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
LCD Power Voltage	VCC	3.0	3.3	3.6	V	*1)
LCD Power Current	ICC	-	-	333	mA	*2)
Rush Current	Irush	-	-	3	A	*3)
Logic Input Voltage (LVDS: IN+,IN-)	Common Voltage	$\frac{ VID }{2}$	-	$2.4 - \frac{ VID }{2}$	V	*4)
	Differential Input Voltage	VID	200	600	mV	*4)
	Threshold Voltage (HIGH)	VTH	-	100	mV	*4)
	Threshold Voltage (LOW)	VTL	-100	-	mV	When VCM = +1.2V
1 Data time	UI	-	tclk*1/7	-	tclk	*5)
LVDS clock to data skew	tskew	-	-	300	ps	*5)
input data eye width	teyew	1255	-	-	ps	*5)

【Note】

*1) Power Sequence :

0.01 ms < t1 ≤ 50 ms

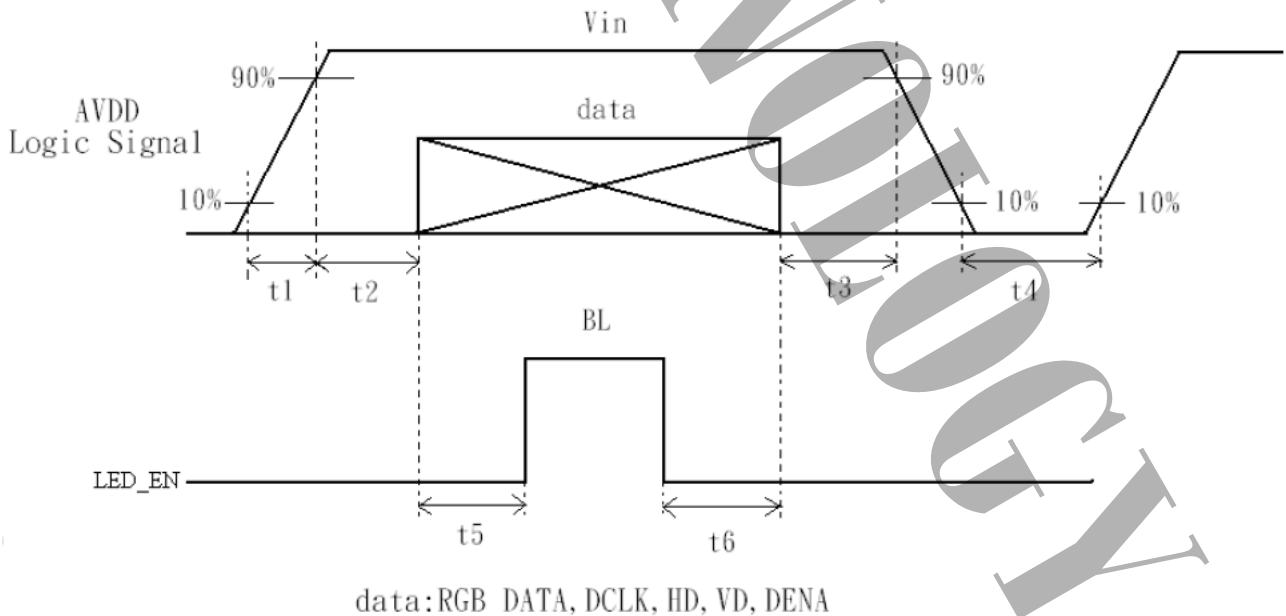
100 ms ≤ t2 ≤ 150 ms

0.01 ms < t3 ≤ 50 ms

500 ms ≤ t4

200 ms ≤ t5

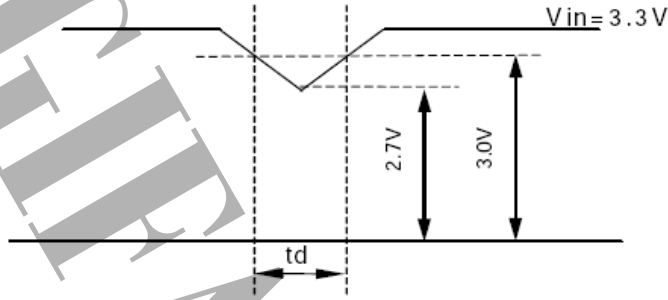
200 ms ≤ t6



Vin-dip state

(1) when $3.0V > Vin \geq 2.7V$ · $td \leq 10$ ms.

(2) when $Vin < 2.7V$ · Vin-dip condition should as the Vin-turn-off condition.

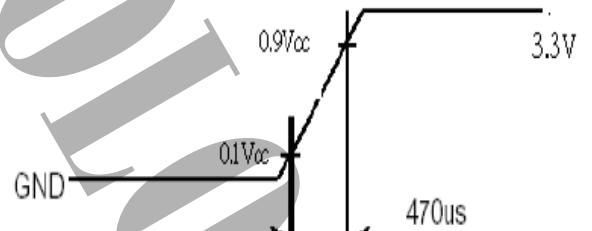
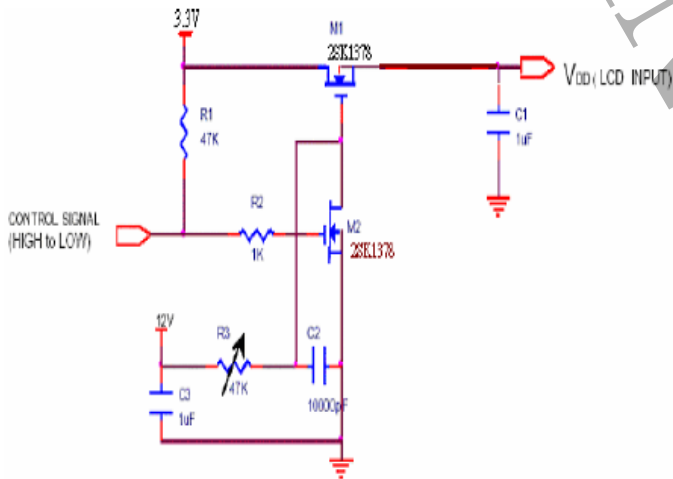


*2) Max value is White Pattern : 1200 line mode.

Circuit condition (Max) : $V_{CC} = 3.3V$, $f_V = 60Hz$, $f_H = 74.1kHz$, $f_{CLK} = 154MHz$.

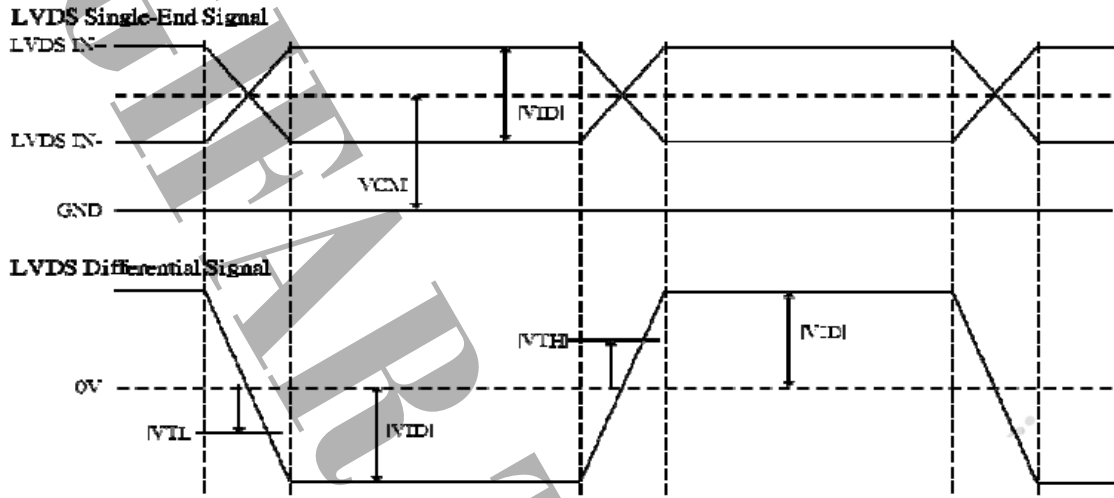


*3) Irush measure condition



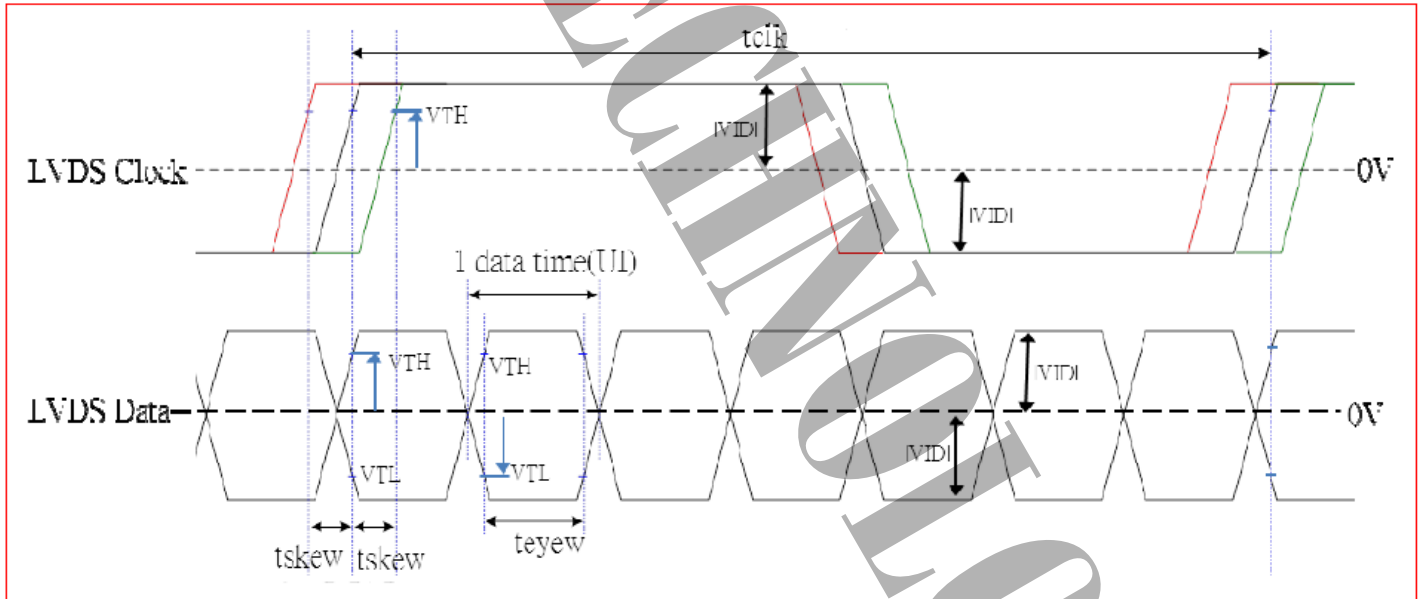


*4) LVDS DC electrical characteristics



*5) LVDS AC electrical characteristics

The following condition is based on operation frequency at Max Frequency.





(B) BACK LIGHT

(a.) ELECTRICAL CHARACTERISTICS

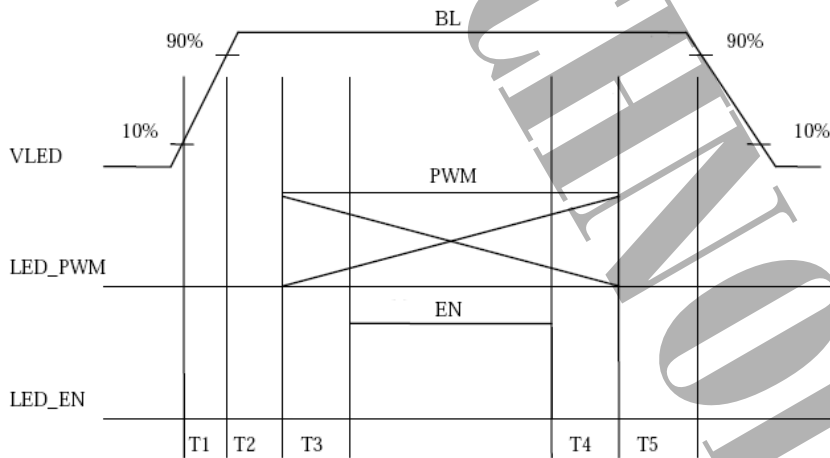
Ta=25°C

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
LED Driver Input Voltage	VLED	7.0	12	19	V	
LED Driver Input Current	I _{LED+}	-		900	mA	*1)
Forward Voltage	V _F	2.6	2.8	3.0	V	*2) I _F =20mA
Forward Current	I _F	-	20	-	mA	*2) I _F =20mA
Power Consumption	P _{LED}		4.09		W	*2)*3) I _F =20mA
PWM Frequency	PWM_BL	100	-	1000	Hz	
Duty ratio	Dim	10	-	100	%	

(b.) LED LIFE - TIME

ITEM	CONDITION	MIN	TYP	MAX	UNIT	NOTE
Life Time	I _F =20mA · Ta=25°C	15000			hrs	*4)

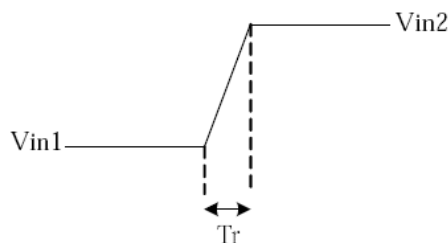
(c.) LED ON/OFF Sequence :



- 0.5ms ≤ T1 ≤ 10ms
- 10ms ≤ T2
- 10ms ≤ T3
- 0ms ≤ T4
- 10ms ≤ T5

Note:

The LED power variation spec. is defined as the following figure.

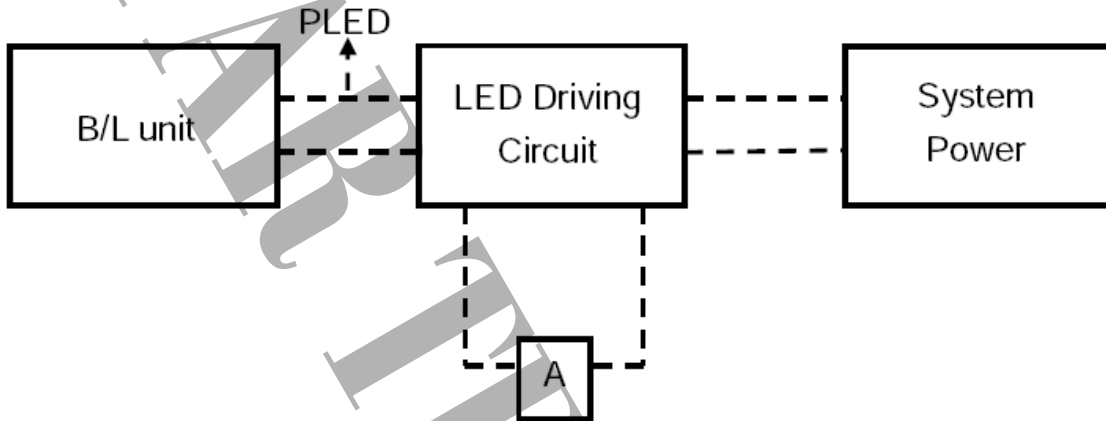




When LED input voltage is from V_{in1} up to V_{in2} , the slew rate should be less than 20 V/ms.

Slew rate = $(V_{in2} - V_{in1}) / Tr$, $V_{in2} > V_{in1}$

- *1) Maximum LED Driver Input Current at 12V Input Voltage/PWM Duty 100%.
- *2) Measure method : a. LED current is measured by utilizing a current meter as show below.
b. System power PLED is measured at input voltage 12V.



- *3) Calculator value for reference $I_F \times V_F \times N = P_{LED}$
- *4) Life time means that estimated time to 50% degradation of initial luminous intensity.



4. Connector Interface PIN & Function

CN (Interface signal)

Outlet connector: AYF334535 (PANASONIC)

**Pin No. is 45 pin define of Plug connector

Pin No.	SYMBOL	FUNCTION
1	VDD	Power Supply, 3.3V(Typical)
2	VDD	Power Supply, 3.3V(Typical)
3	VDD	Power Supply, 3.3V(Typical)
4	VDD	Power Supply, 3.3V(Typical)
5	NC(BIST)	BIST testing(L0V) : Normal display : High(2.5V) : BIST mode)
6	2-L3P	LVDS 2 data 3 (positive)
7	GND	Ground
8	2-L3N	LVDS 2 data 3 (negative)
9	GND	Ground
10	GND	Ground
11	1-L3P	LVDS 1 data 3 (positive)
12	2-LCNKP	LVDS 2 Clock (positive)
13	1-L3N	LVDS 1 data 3 (negative)
14	2-LCNKN	LVDS 2 Clock (negative)
15	GND	Ground
16	GND	Ground
17	1-LCNKP	LVDS 1 Clock (positive)
18	2-L2P	LVDS 2 data 2 (positive)
19	1-LCNKN	LVDS 1 Clock (negative)
20	2-L2N	LVDS 2 data 2 (negative)
21	GND	Ground
22	GND	Ground
23	1-L2P	LVDS 1 data 2 (positive)
24	2-L1P	LVDS 2 data 1 (positive)
25	1-L2N	LVDS 1 data 2 (negative)
26	2-L1N	LVDS 2 data 1 (negative)
27	GND	Ground
28	GND	Ground
29	1-L1P	LVDS 1 data 1 (positive)
30	2-L0P	LVDS 2 data 0 (positive)
31	1-L1N	LVDS 1 data 1 (negative)
32	2-L0N	LVDS 2 data 0 (negative)
33	GND	Ground
34	GND	Ground
35	1-L0P	LVDS 1 data 0 (positive)
36	NC	NC
37	1-L0N	LVDS 1 data 0 (negative)
38	LED_EN	LED Enable Pin. (ON : 3.3V / OFF: 0V)
39	NC	NC
40	CABC_EN	CABC Function Enable Pin.
41	LED_PWM	PWM Signal for LED Dimming Control. (+3.3V Swing)
42	VLED	LED Power Supply, 12V(Typical)
43	VLED	LED Power Supply, 12V(Typical)
44	VLED	LED Power Supply, 12V(Typical)
45	VLED	LED Power Supply, 12V(Typical)



5. INTERFACE TIMING CHART

(1) Timing Characteristic

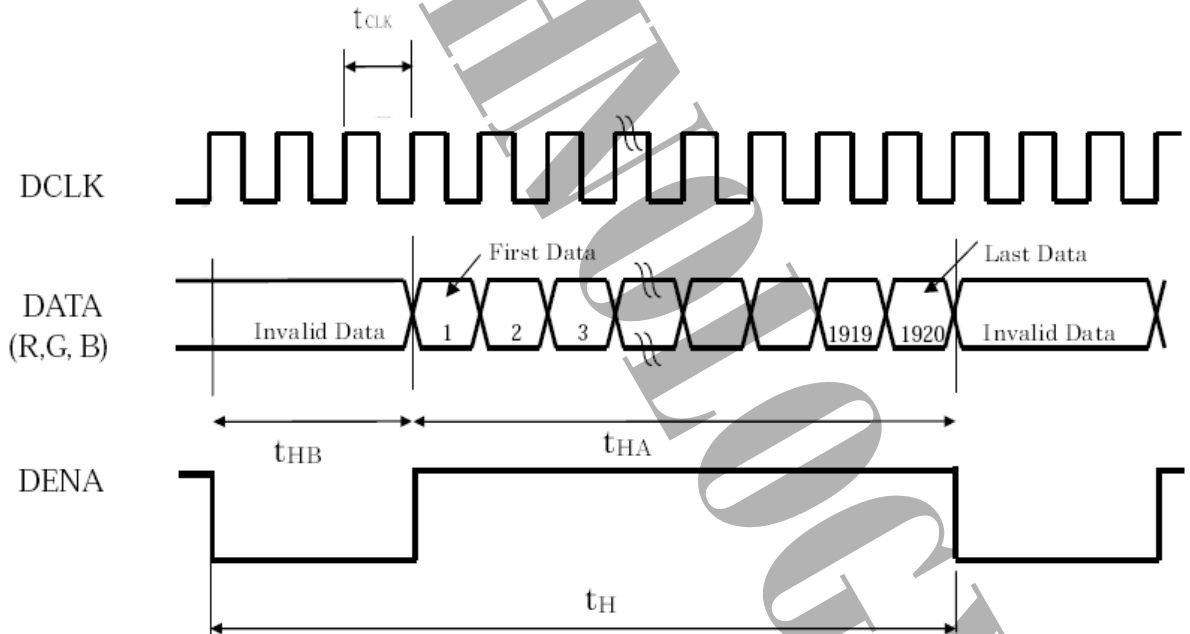
ITEM		SYMBOL	MIN	TYP	MAX	UNIT		
LCD Timing	Frame Rate		-	60	60	60	Hz	
	DCLK	Frequency	f_{CLK}	-	154	-	MHz	
		Period	t_{CLK}	-	6.5	-	ns	
	DENA	Horizontal	Horizontal total time	t_H	-	2080	-	t_{CLK}
			Horizontal Active time	t_{HA}	1920	1920	1920	t_{CLK}
			Horizontal Blank time	t_{HB}	-	160	-	t_{CLK}
		Vertical	Vertical total time	t_V	-	1235	-	t_H
			Vertical Active time	t_{VA}	1200	1200	1200	t_H
			Vertical Blank time	t_{VB}	-	35	-	t_H

【Note】

- *1) DENA (DATA ENABLE) usually is positive.
- *2) During the whole blank period, DCLK should keep input.

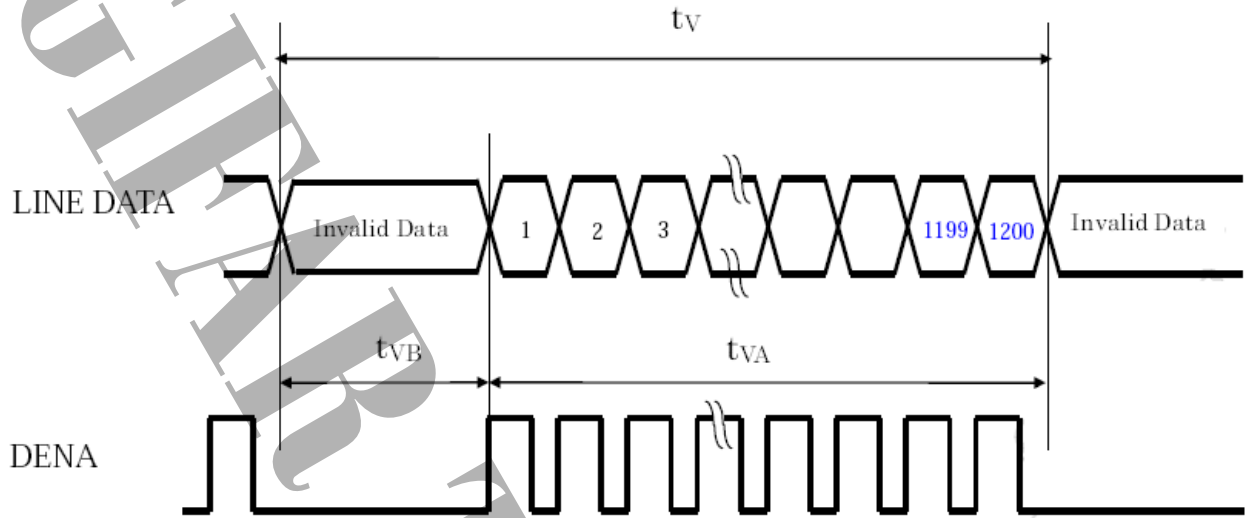
(2). Timing Chart

a. Horizontal Timing

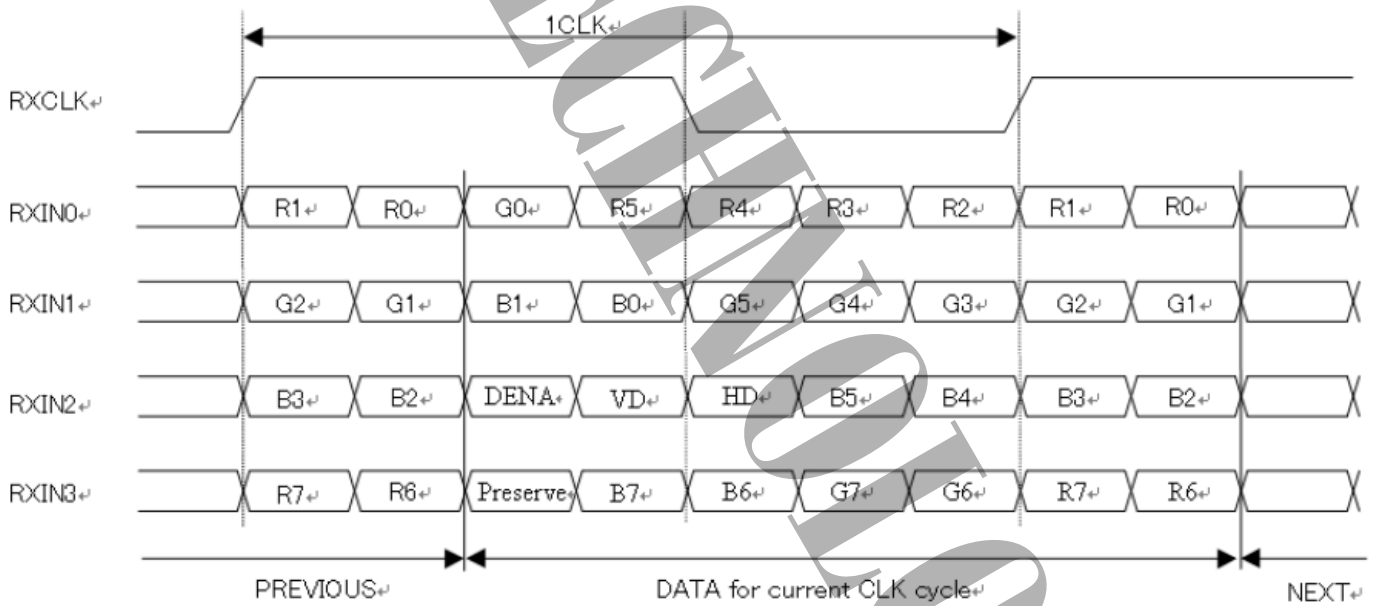




b. Vertical Timing



(3). LVDS DATA (VESA) : Timing Chart





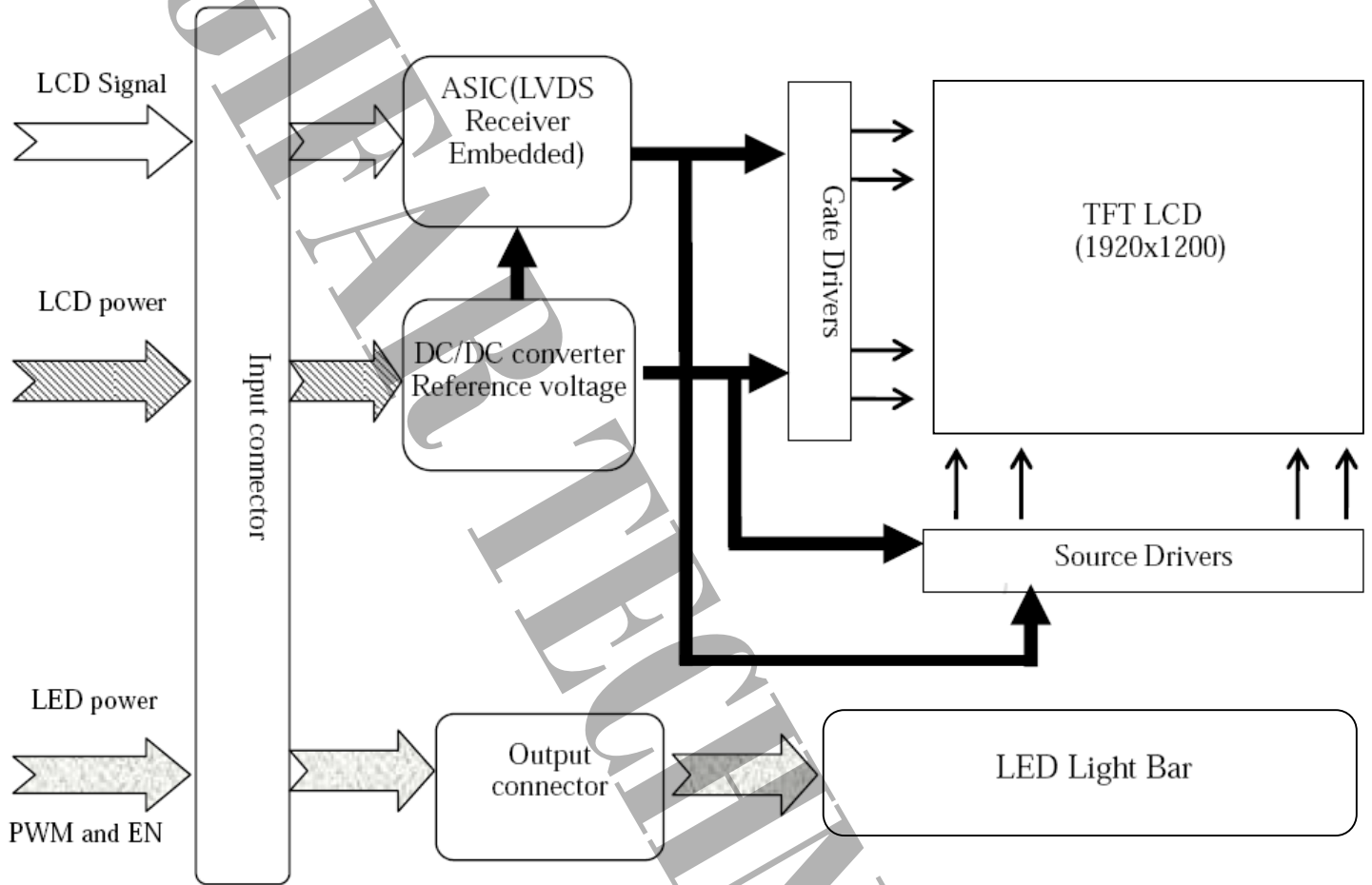
(4) DATA mapping

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	0	0	0	0	0	0	0	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	
	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	1	1	1	1	1	1	1	1	
	YELLOW	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	
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	1	0	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	0	0	0	0	0	0	0	0		
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	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		
	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	1	0		
	BLUE(254)	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	1	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.



6. BLOCK DIAGRAM



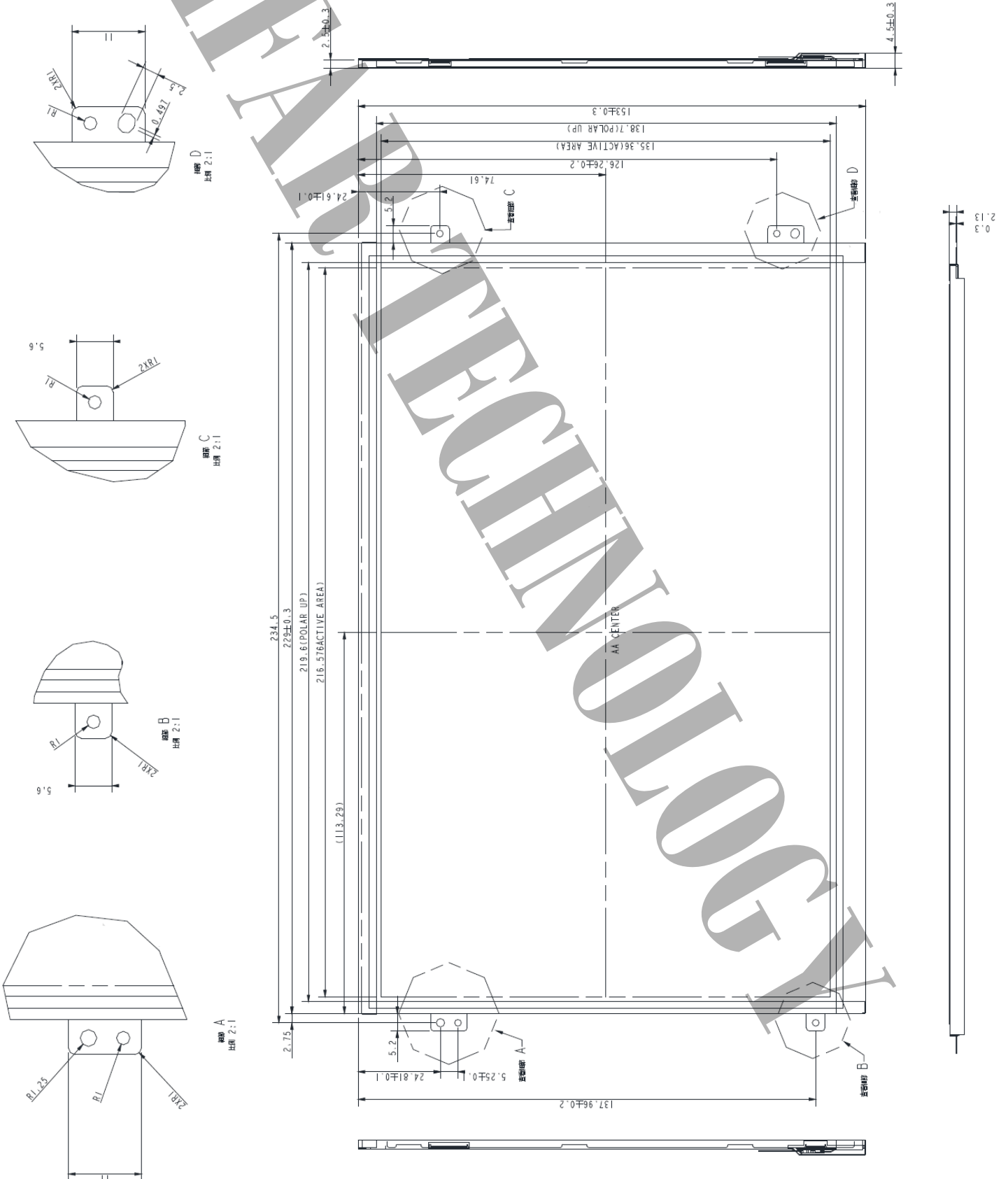


7. MECHANICAL SPECIFICATION

(1) Front side

The tolerance, not show in the figure, is ± 0.5 mm.

[Unit: mm]

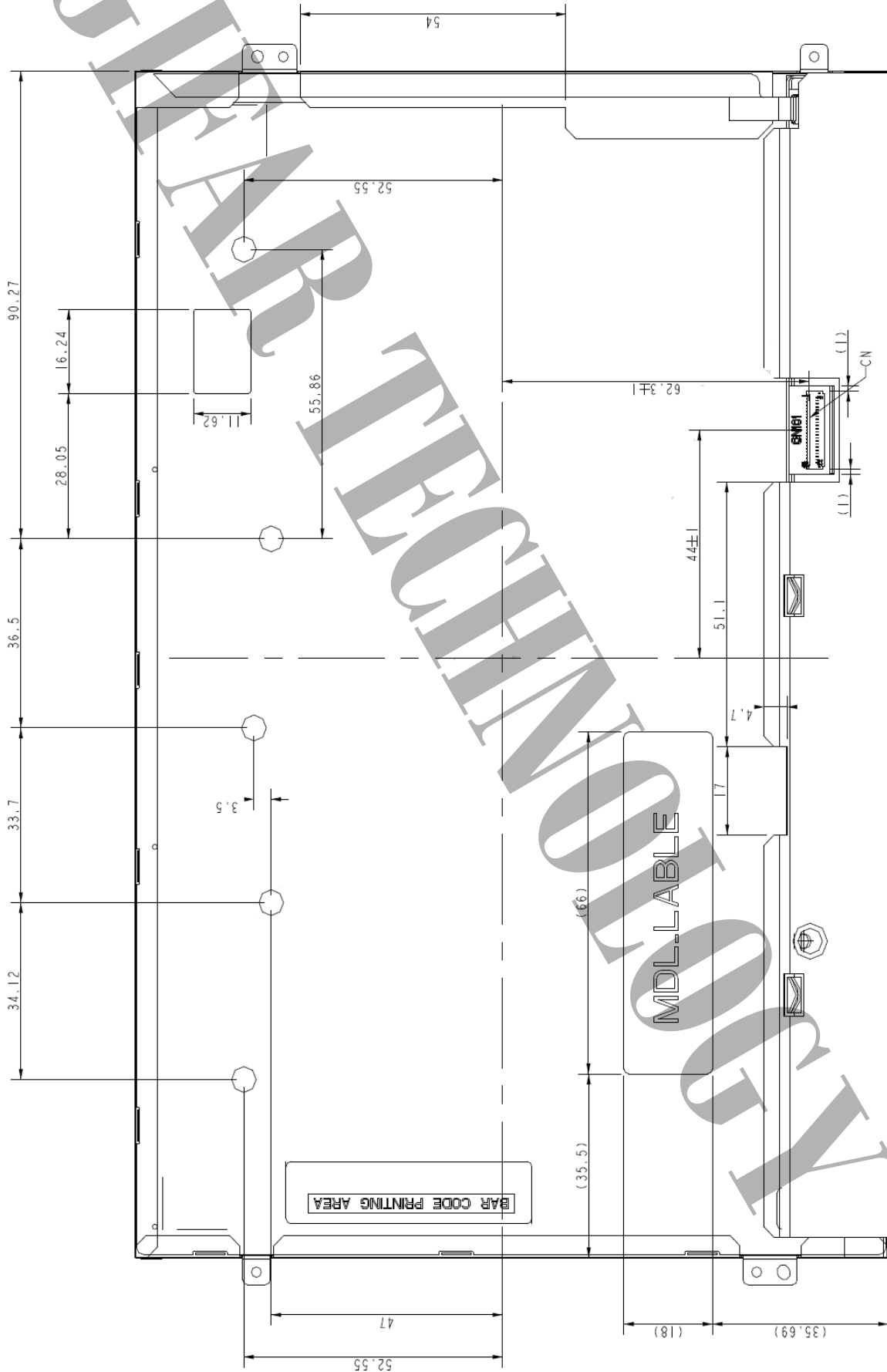




(2) Rear side

The tolerance, not show in the figure, is ± 0.5 mm.

[Unit: mm]





8. OPTICAL CHARACTERISTICS

Ta=25°C±2°C , 60±10%RH , VDD=3.3V

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	NOTE	
Contrast Ratio	CR	$\theta = \psi = 0^\circ$	600	800	--	--	*1) 2)	
Luminance (center)	L	$\theta = \psi = 0^\circ$	650	700	--	cd/m ²	*1) 3)	
Uniformity(9P)	ΔL	$\theta = \psi = 0^\circ$	75	--	--	%	*1) 3)	
Response Time	T _r	$\theta = \psi = 0^\circ$	--	30	40	ms	*5)	
	T _f							
Cross Talk	CT	$\theta = \psi = 0^\circ$	--	--	1.0	%	*6)	
View Angle	Horizontal	ψ	CR ≥ 10	80/-80	89/-89	--	°	*4)
	Vertical	θ		80/-80	89/-89	--	°	*4)
Color Coordinate	W	x	$\theta = \psi = 0^\circ$	0.281	0.311	0.341	*3)	
		y		0.327	0.357	0.387		
	R	x		(0.562)	(0.602)	(0.642)		
		y		(0.308)	(0.348)	(0.388)		
	G	x		(0.282)	(0.322)	(0.362)		
		y		(0.506)	(0.546)	(0.586)		
	B	x		(0.113)	(0.153)	(0.193)		
		y		(0.089)	(0.129)	(0.169)		
Gamut		$\theta = \psi = 0^\circ$	45	50	--	%		
Gamma	γ	GL	2.0	2.2	2.4		*7)	

Color coordinate and color gamut are measured by SRUL1R, response time is measured by TRD-100, and all the other items are measured by BM-5A (TOPCON). All these items are measured under the dark room condition (no ambient light).

Measurement Condition: IL= 20mA (each LED)

Definition of these measurement items is as follows:

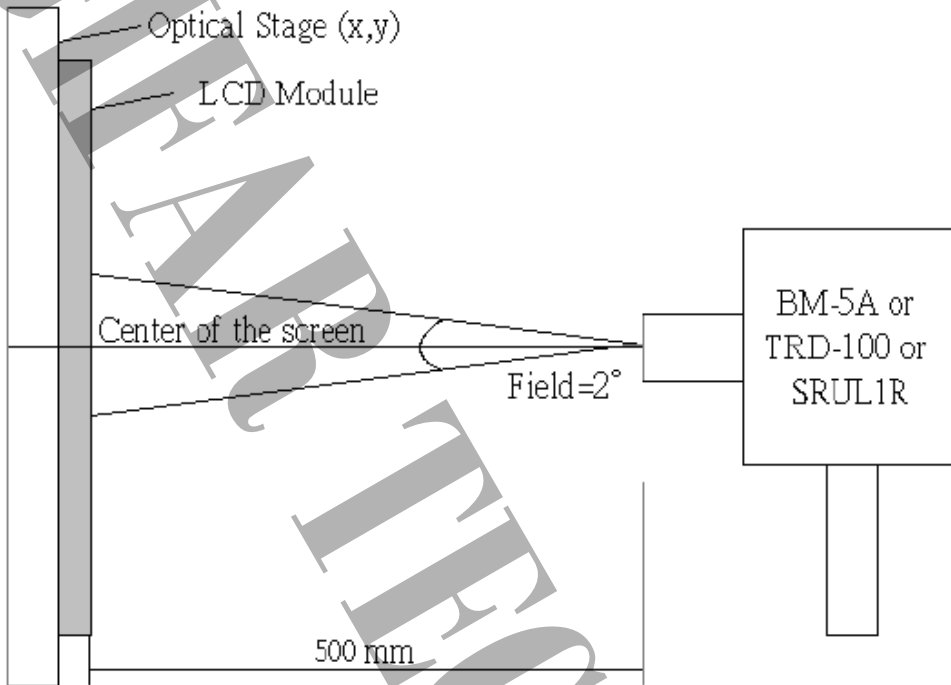
*1) Setup of Measurement Equipment

The LCD module should be turn-on to a stable luminance level to be reached. The measurement should be executed after lighting Backlight for **10** minutes and in a dark room.



***2) Definition of Contrast Ratio**

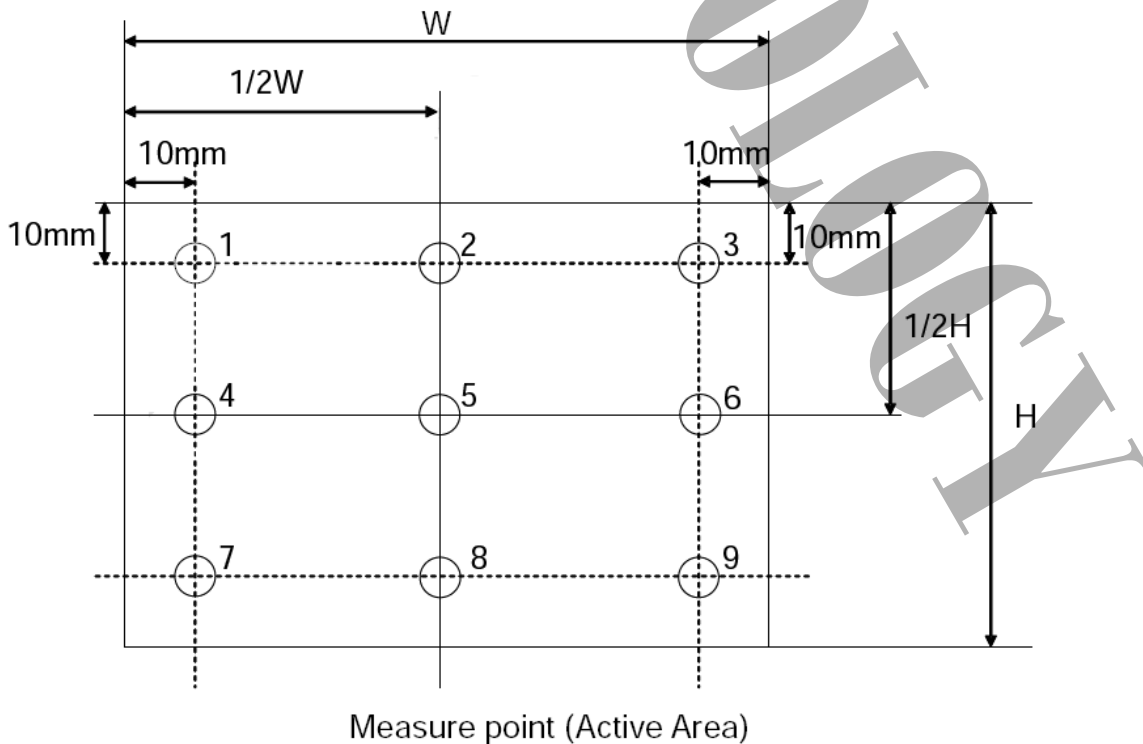
CR=ON (White) Luminance/OFF (Black) Luminance



***3) Definition of Luminance and Luminance uniformity**

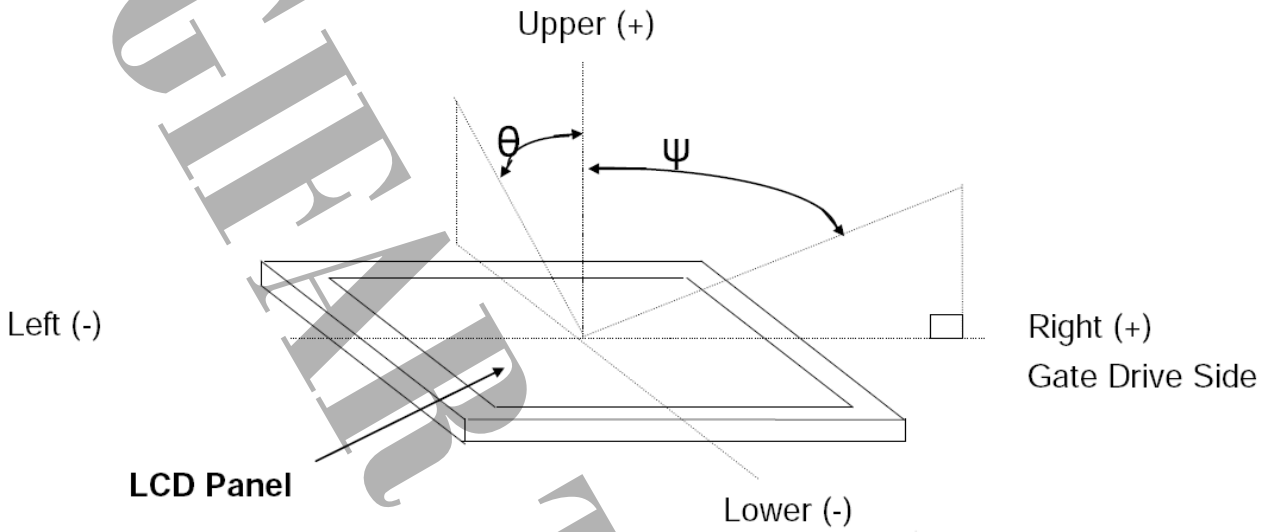
Central luminance: The white luminance is measured at the center position "5" on the screen, see Fig below.

9P Uniformity: $\Delta L = (L_{min} / L_{max}) \times 100\%$

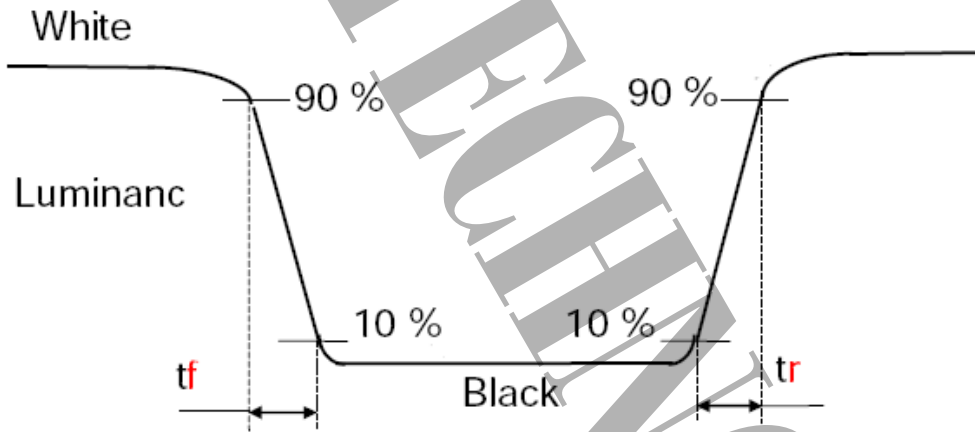




*4) Definition of view angle(θ , ψ)



*5) Definition of response time



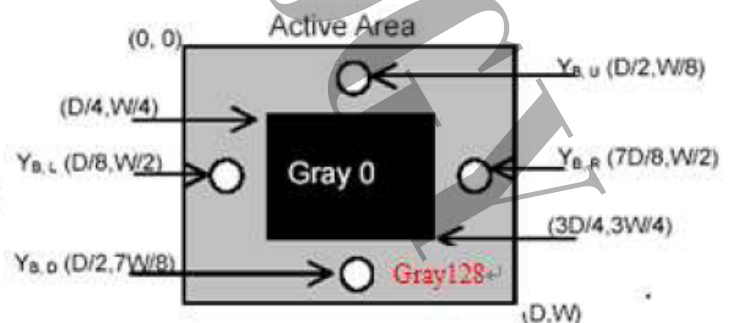
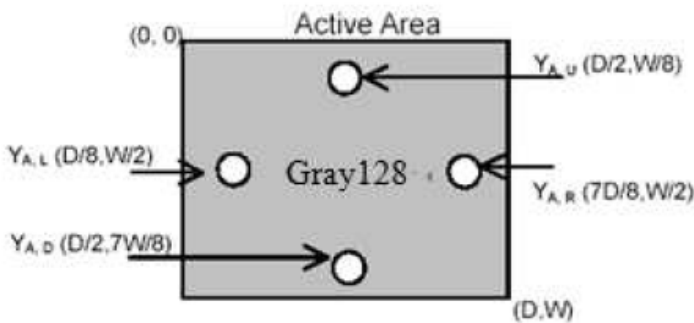
*6) Crosstalk Modulation Ratio

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

Y_A · Y_B measure position and definition

Y_A means luminance at gray level 128(exclude gray level 0 pattern)

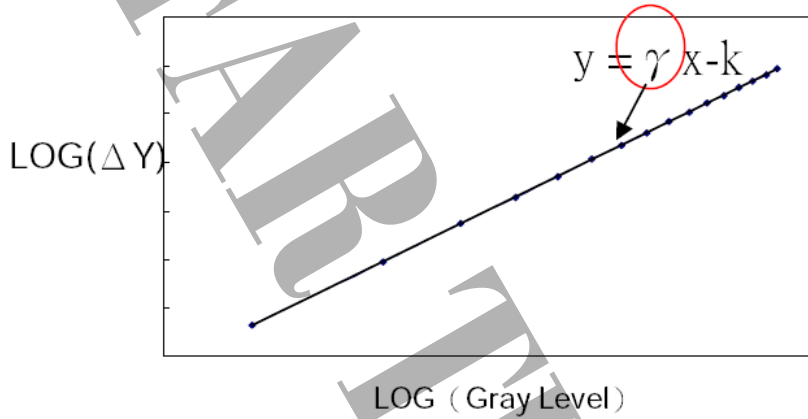
Y_B means luminance at gray level 128(include gray level 0 pattern)





***7) Definition of Gamma (VESA)**

Based on Customer Sample, take the average value as a standard center value and the variation range of gamma value caused by loop voltage error should be between +/- 0.2. the bellow figure shows how to obtain the gamma curve and γ (from gray level: 0、15、31-----239、255).





9. RELIABILITY TEST CONDITIONS

(1) Temperature and Humidity

TEST ITEMS	CONDITIONS
High Temperature Operation	50° C ; 240Hrs
High Temperature Storage	60° C ; 240Hrs
High Temperature High Humidity Operation	40° C ; 90% RH ; 240Hrs
High Temperature High Humidity Storage	50° C ; 90% RH ; 240 Hrs
Low Temperature Operation	-20° C ; 240 Hrs
Low Temperature Storage	-30° C ; 240 Hrs
Thermal Shock	-30° C (0.5 Hr) ~ 60° C (0.5 Hr), Ramp < 20° C , 27 CYCLES

(2) Shock & Vibration

TEST ITEMS	CONDITIONS
Shock (Non-Operation)	100G, 6ms, half sine wave, ± X, ± Y, ± Z 3 times each
Vibration (Non-Operation)	Frequency : 8~33.3Hz, Stoke : 1.3 mm , 33.3 Hz -400 Hz, 2.9G Vibration : sin wave, both X,Z axis: 2hrs , Y axis: 4hrs Cycle time: 15 min.

(3) ESD

TEST ITEMS	CONDITIONS
Connector Contact	200 pF, 0 Ω · ±200 V, once for each terminal
Air	150 pF, 330 Ω · ±10 kV, 5 times/point, 9 points/panel
Contact	150 pF, 330 Ω · ±6 kV, 5 times/point, 9 points/panel

(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.

10.WARRANTY

1. The period is within 12 months since the date of shipping out under normal using and storage conditions.
2. The warranty will be avoided in case of defect induced by customer.