



SPECIFICATIONS

CUSTOMER : _____

MODEL NO. : **GFTO150CA1024768V**

VERSION : **A**

DATE : **2018.01.11**

CERTIFICATION : **ROHS**

CUSTOMER SIGN : _____

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Revision Record

Data(y/m/d)	Ver.	Description	Note	page
2018.01.11	A	New		



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1. SPECIFICATIONS

GFTO150CA1024768V is 15.0" color 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 (6Bit+HFRC), 1024×768, 16.7M-color images are displayed on the 15.0" diagonal screen.

General specifications are summarized in the following table:

1.1 Features

ITEM	SPECIFICATION
Display Area(mm)	304.128(W) × 228.096(H) (15.0-inch diagonal)
Number of Pixels	1024(H) × 768(V)
Pixel Pitch(mm)	0.297(W) × 0.297(H)
Color Pixel Arrangement	RGB vertical strip
Display Mode	Normally white, TN
Number of Colors	16.7M (6Bit+HFRC)
Brightness(cd/m ²)	450 (typ.) (Center point, 100 mA)
Viewing Angle	160 /140(Typ.)
Surface Treatment	Anti-Glare, 3H
Optimum Viewing Direction	6 O'clock(Max. contrast ratio, Gray level inversion)
Power consumption(W)	8.3W (typ.)
Interface Connection	LVDS
Module Size(mm)	326.5 × 253.5 × 11.0(typ.)
Module Weight(g)	870(typ.)
Backlight Unit	LED:(white-LED)

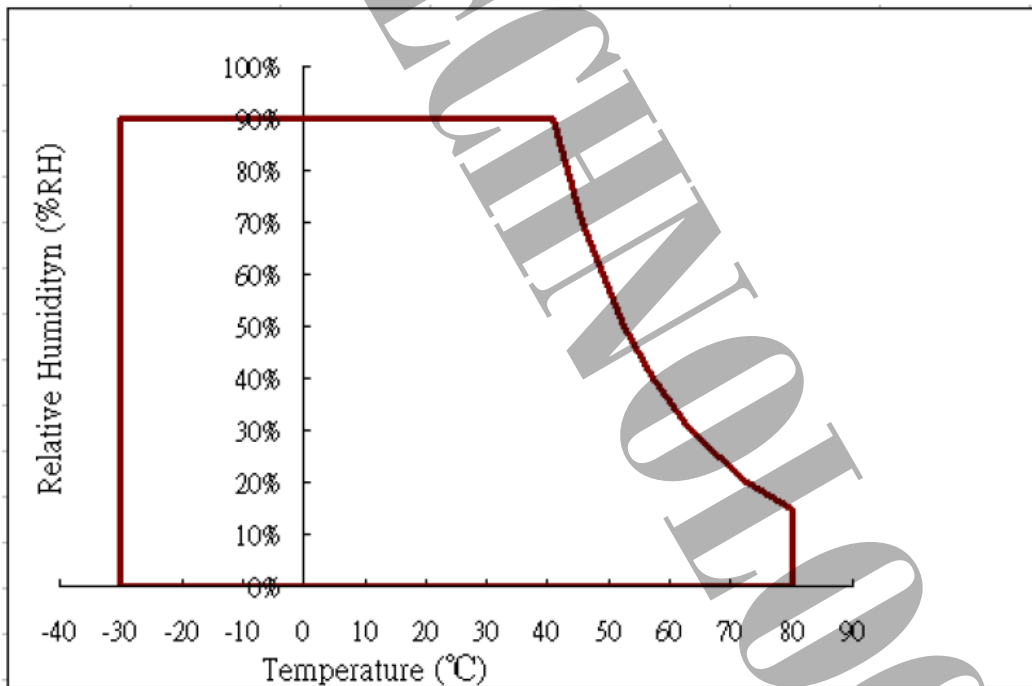


1.2 Absolute Maximum Ratings

ITEM	SYMBOL	MIN.	MAX.	UNIT	REMARK
Power Supply Voltage for LCD	VCC	0	4.0	V	
Logic Input Voltage	VI	0	4.0	V	
Backlight Power Supply Voltage	VLED	0	14	V	
Backlight ON-OFF Voltage	LED_EN	0	7	V	
Backlight Dimming Control Input Voltage	LED_PWM	0	7	V	
Operation Temperature	Top	-30	80	°C	1). 2). 3).
Storage Temperature	Tstg	-30	80	°C	1). 2). 3).

[Note]

- 1).The relative humidity and temperature range are as below sketch,90%RH Max.
- 2).The maximum wet bulb temperature $\leq 39^{\circ}\text{C}$ and without dewing.
- 3).If you use the product in an environment which over the definition of temperature and humidity too long to effect the result of eye-etching.





1.3 Electrical Characteristics

TFT LCD

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
LCD Power Voltage	VCC	3.0	3.3	3.6	V	
LCD Power Current	ICC	-	330	400	mA	*1)
LCD Rush Current	VCC_Irush			2	A	*3)
Logic Input Voltage (LVDS: IN+,IN-)	Common Voltage	$\frac{ VID }{2}$	-	$2.4 - \frac{ VID }{2}$	V	Logic Input Voltage (LVDS: IN+,IN-)
	Differential Input Voltage	VID	200	600	mV	*2)
	Threshold Voltage (HIGH)	VTH	-	100	mV	
	Threshold Voltage (LOW)	VTL	-100	-	mV	
Logic Input Voltage	VIH	0.7*DVDD	-	DVDD	V	Logic Input Voltage
	VIL	GND	-	0.3*DVDD	V	
Power consumption	P		1.09	1.44	W	
1 Data time	UI	-	tclk*1/7	-	tclk	*4)
LVDS clock to data skew	tskew	-	-	300	ps	
input data eye width	teyew	1409	-	-	ps	

【Note】

*1)TYP. specification : Gray-level test Pattern (TYP Freq. @3.3V)

MAX. specification : Black test Pattern (TYP Freq. @3.3V)



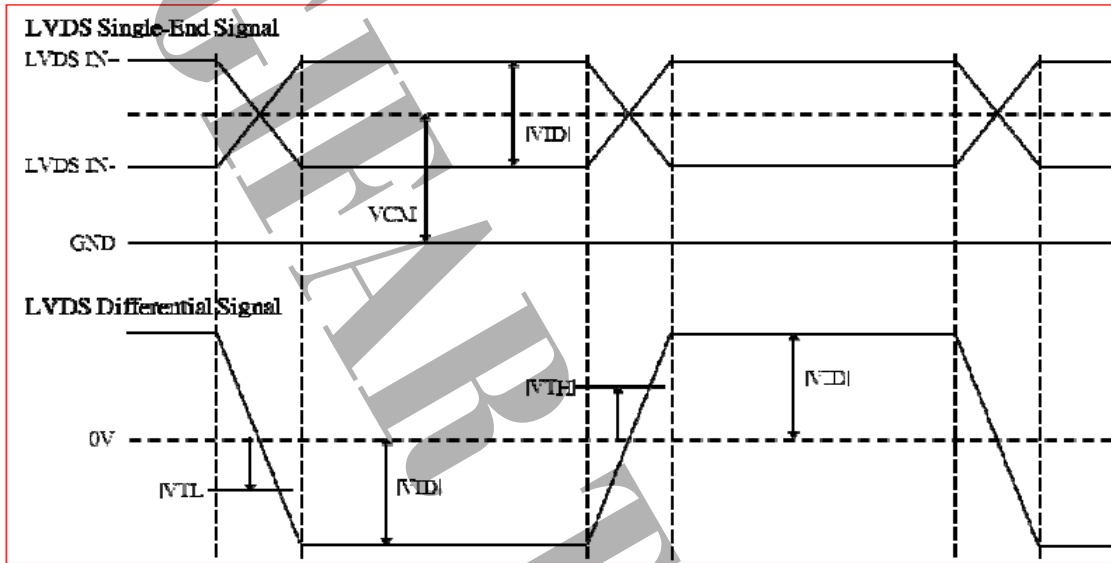
Gray-level Pattern



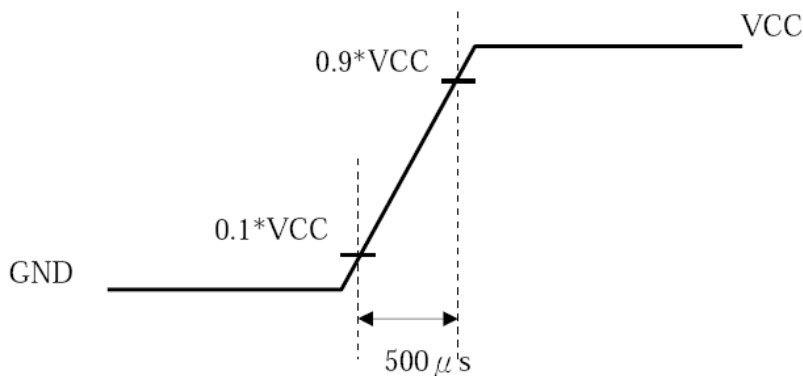
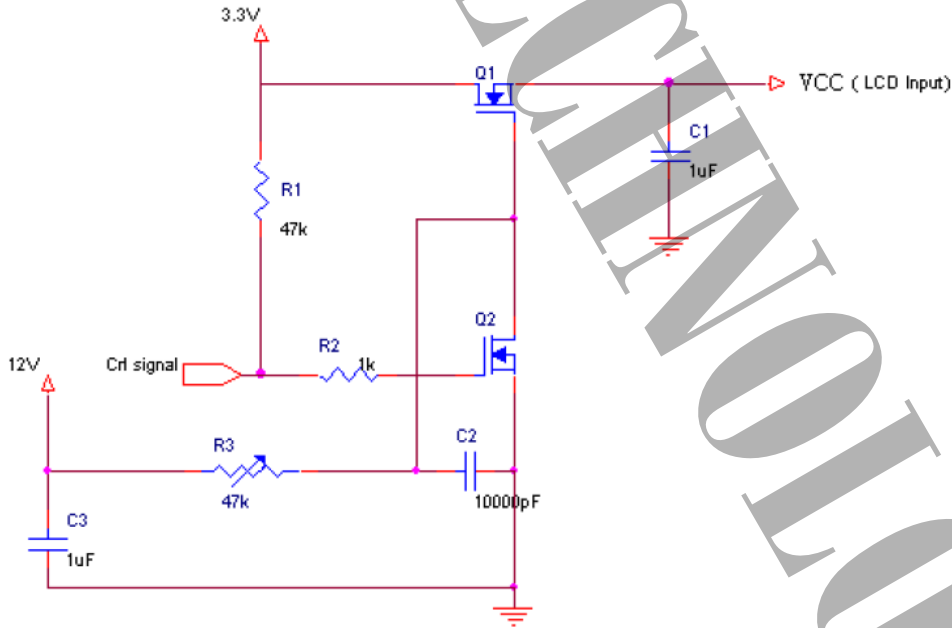
Black Pattern



*2) LVDS DC electrical characteristics



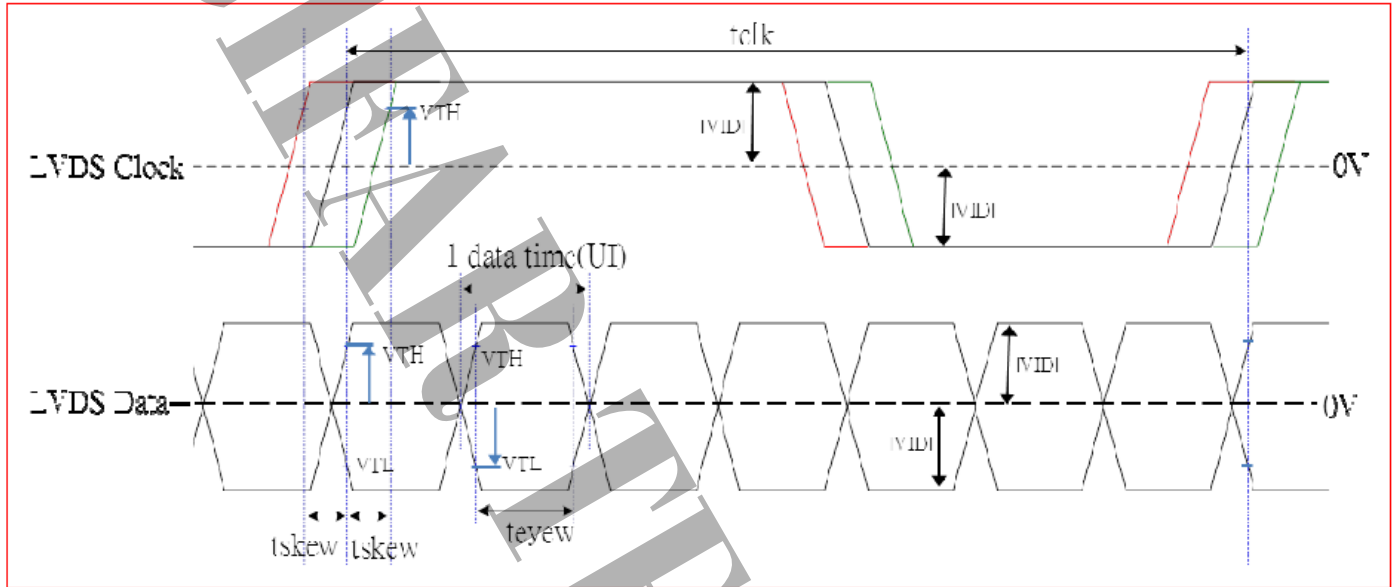
*3) Irush measure condition





*4) LVDS AC electrical characteristics

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





1.4 Optical Characteristics

Ta=25°C · VCC=3.3

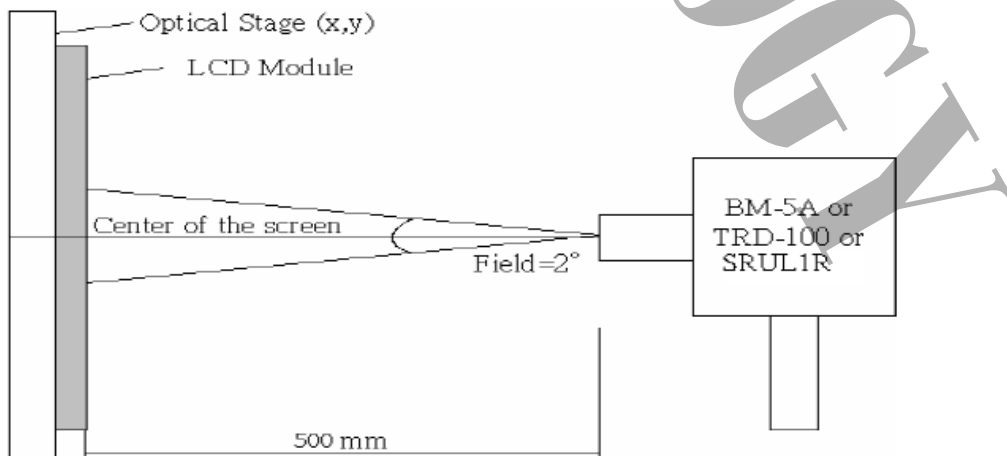
ITEM	SYMBOL	CONDITION	min	typ	max	UNIT	REMARK	
Contrast Ratio	CR	$\theta = \psi = 0^\circ$	500	700	--	--	*1) 2)	
Luminance(CEN)	L	$\theta = \psi = 0^\circ$	360	450	--	cd/m ²	*1) 3)	
9P Uniformity	ΔL	$\theta = \psi = 0^\circ$	75	80	--	%	*1) 3)	
Response Time	Tr	$\theta = \psi = 0^\circ$	--	10	15	ms	*5)	
	Tf	$\theta = \psi = 0^\circ$	--	15	20			
Crosstalk	CT	$\theta = \psi = 0^\circ$	--	--	1	%	*6)	
Viewing Angle	Horizontal	ψ	CR \geq 10	-70~70	-80~80	--	Deg.	*4)
	Vertical			θ	-60~60	-70~70	--	
Color Coordinates	White	X	$\theta = \psi = 0^\circ$	(0.263)	(0.313)	(0.363)	*3)	
		Y		(0.279)	(0.329)	(0.379)		
	Red	X		(0.585)	(0.635)	(0.685)		
		Y		(0.294)	(0.344)	(0.394)		
Green	X	(0.290)	(0.340)	(0.390)				
	Y	(0.556)	(0.606)	(0.656)				
Blue	X	(0.103)	(0.153)	(0.203)				
	Y	(0.033)	(0.083)	(0.133)				
Gamut	CG	$\theta = \psi = 0^\circ$	60	63	--	--	--	
Gamma	γ	VESA	2	2.2	2.4	--	*7)	
Image Sticking	Tis	4hrs			5	min	*8)	

[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 10 minutes and in a dark room.





2).Definition of Contrast Ratio:

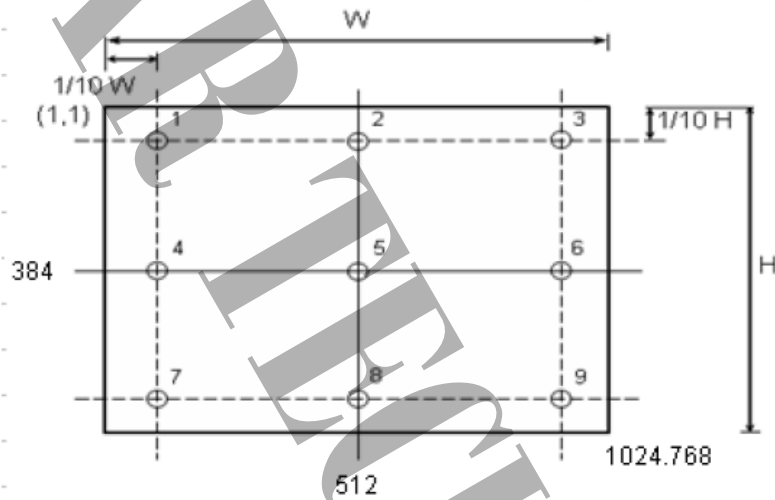
$$CR = \text{ON (White) Luminance} / \text{OFF (Black) Luminance}$$

3).Definition of Luminance and Luminance uniformity:

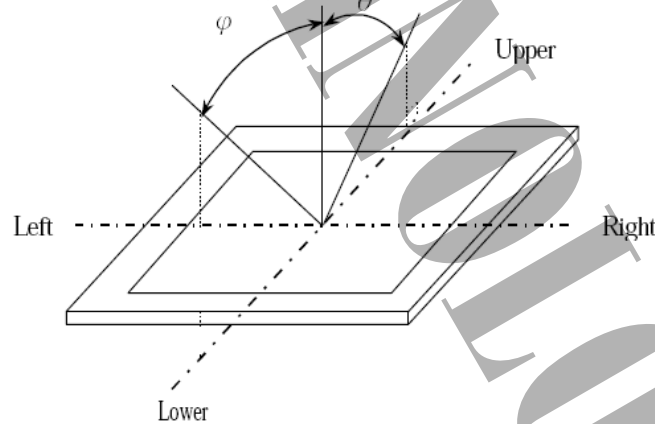
Center Luminance, &Color coordinate: measuring the luminance of the point no. 5

Average Luminance: measuring average luminance of points no.1-no.9

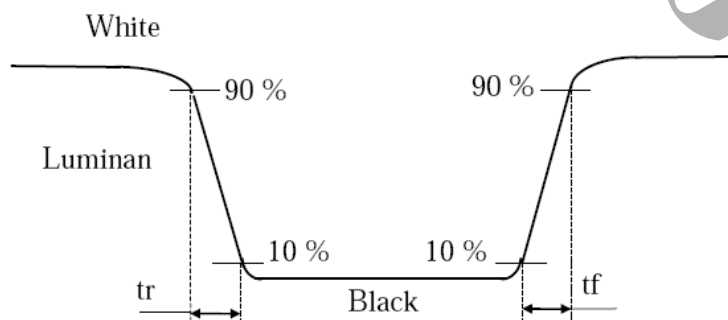
$$\text{Uniformity: } \Delta L = [L (\text{Min}) / L (\text{Max})] \times 100 \%$$



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



5) Definition of Response Time:



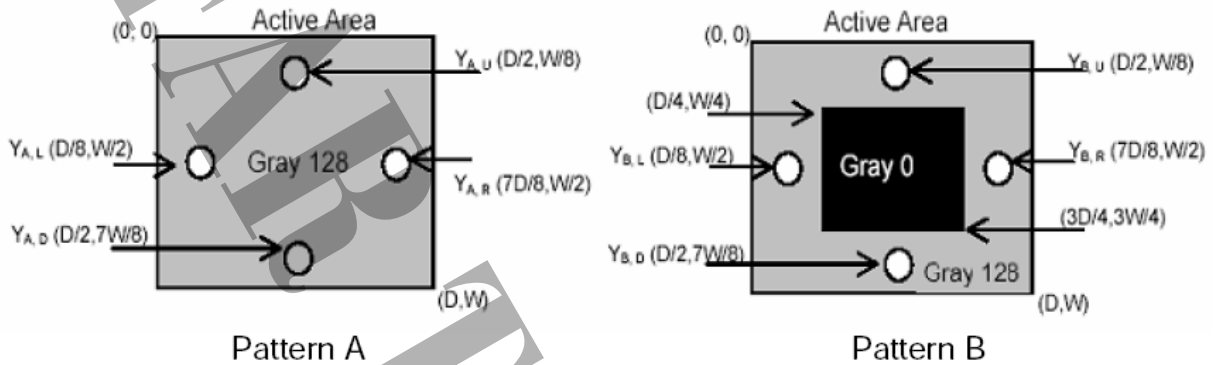


6) Definition of crosstalk:

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

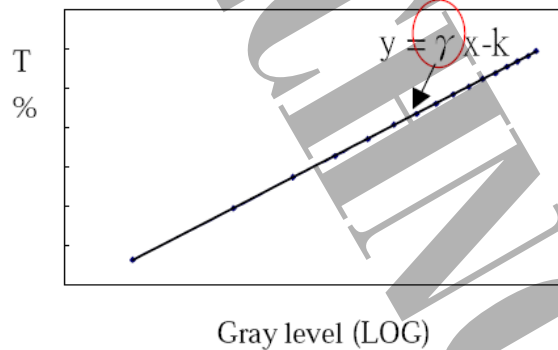
Y_A : The luminance of measured position at pattern A

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)

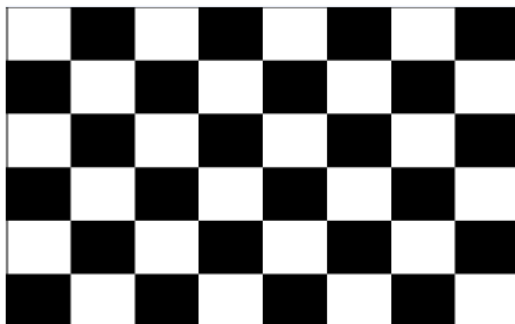


8) Image Sticking :

Condition of image sticking test: 25°C

Operation with test pattern sustained for 4hrs, then change to gray pattern immediately.

After 5 min, the Mura must be disappeared completely.



(a) Test Pattern (Chess Board Pattern)



(b) Judgment Pattern (128 Gray Pattern)



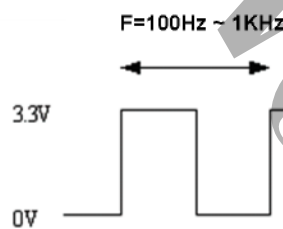
1.5. Converter Specification for Backlight

Ta = 25°C

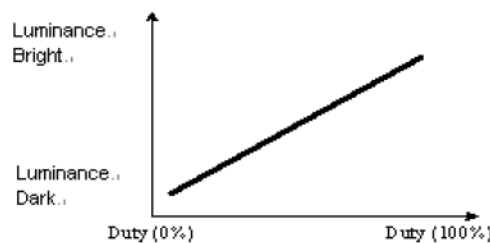
ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
LED Driver Input Voltage	VLED	10.8	12.0	13.2	V	
LED Driver Input Current	IVLED	-	600	650	mA	*1)
LED Rush Current	VLED_Irush			2	A	*3)
Dimming Control	High	2.4	--	5.5	V	Dimming Control
	Low	0		0.8		
PWM Frequency	LED_PWM	100	200	1K	Hz	*2)
Duty Ratio		5	-	100	%	
ON/OFF Control	High	2.4		5.5	V	ON/OFF Control
	Low	0		0.8		
Power Consumption (Backlight)	BLW	--	7.2	8.58	W	
LED Forward voltage (single LED)	VF	2.8	--	3.4	V	IF=100mA Ta=25°C
LED Forward current (single LED)	IF	--	100	--	mA	Ta=25°C
LIFE TIME(Backlight)		50000	70000		hr	*4)

*1) Maximum LED Driver Input Current at 10.8V Input Voltage/PWM Duty 100%.

*2) The ADJ adjust signal level is 0~3.3V , operation frequency:100Hz~1KHz .

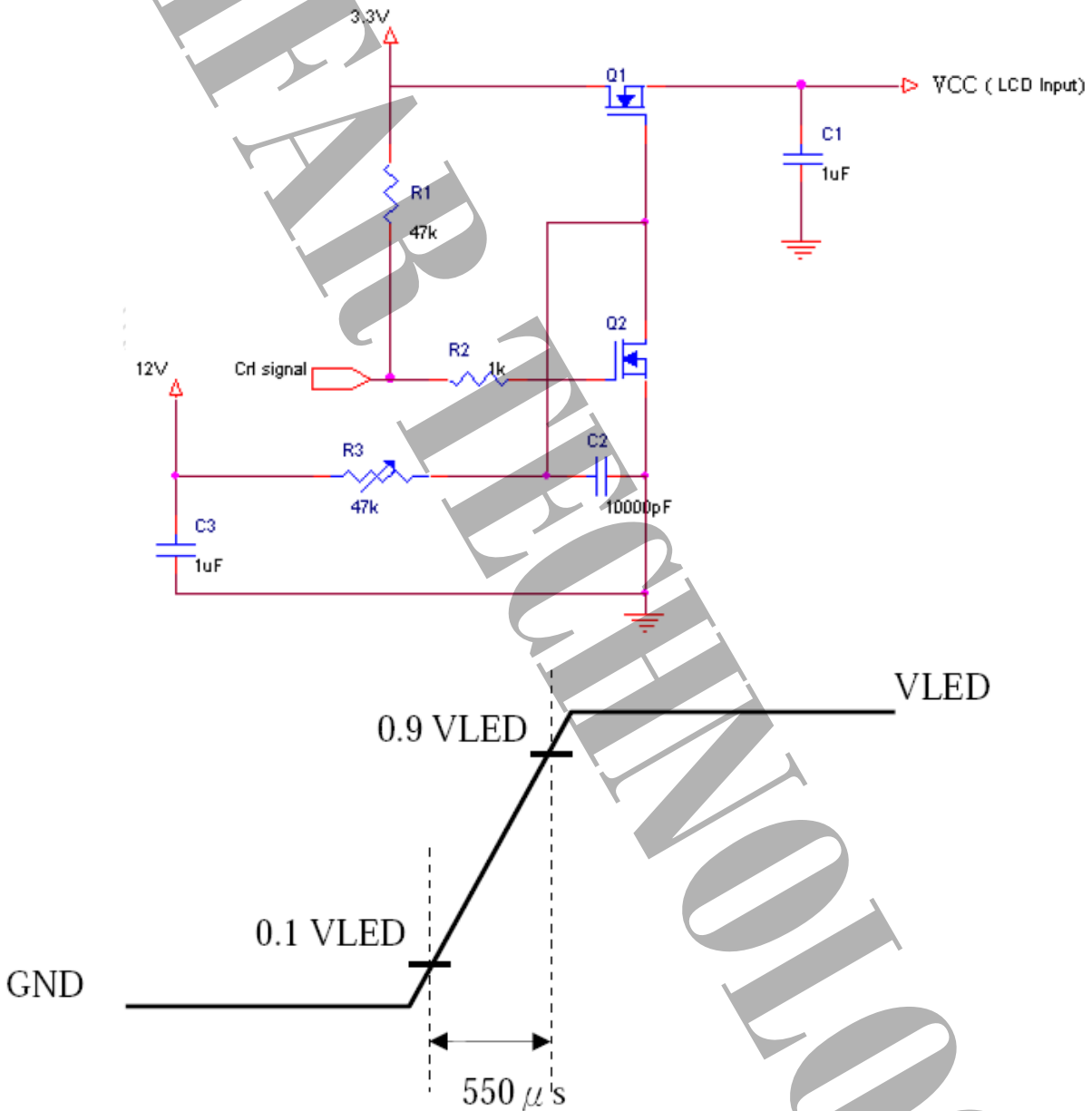


The ADJ can adjust LED BL brightness , where Duty and Luminance are in direct ratio.





*3) Irush measure condition



*4). 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=100mA.



1.6 Power and Signal sequence

Power Sequence :

$$0.50 \text{ ms} \leq T1 \leq 10 \text{ ms}$$

$$200 \text{ ms} \leq T3$$

$$10 \text{ ms} \leq T8$$

$$0.01 \text{ ms} < T2 \leq 50 \text{ ms}$$

$$10 \text{ ms} \leq T5$$

$$200 \text{ ms} \leq T9$$

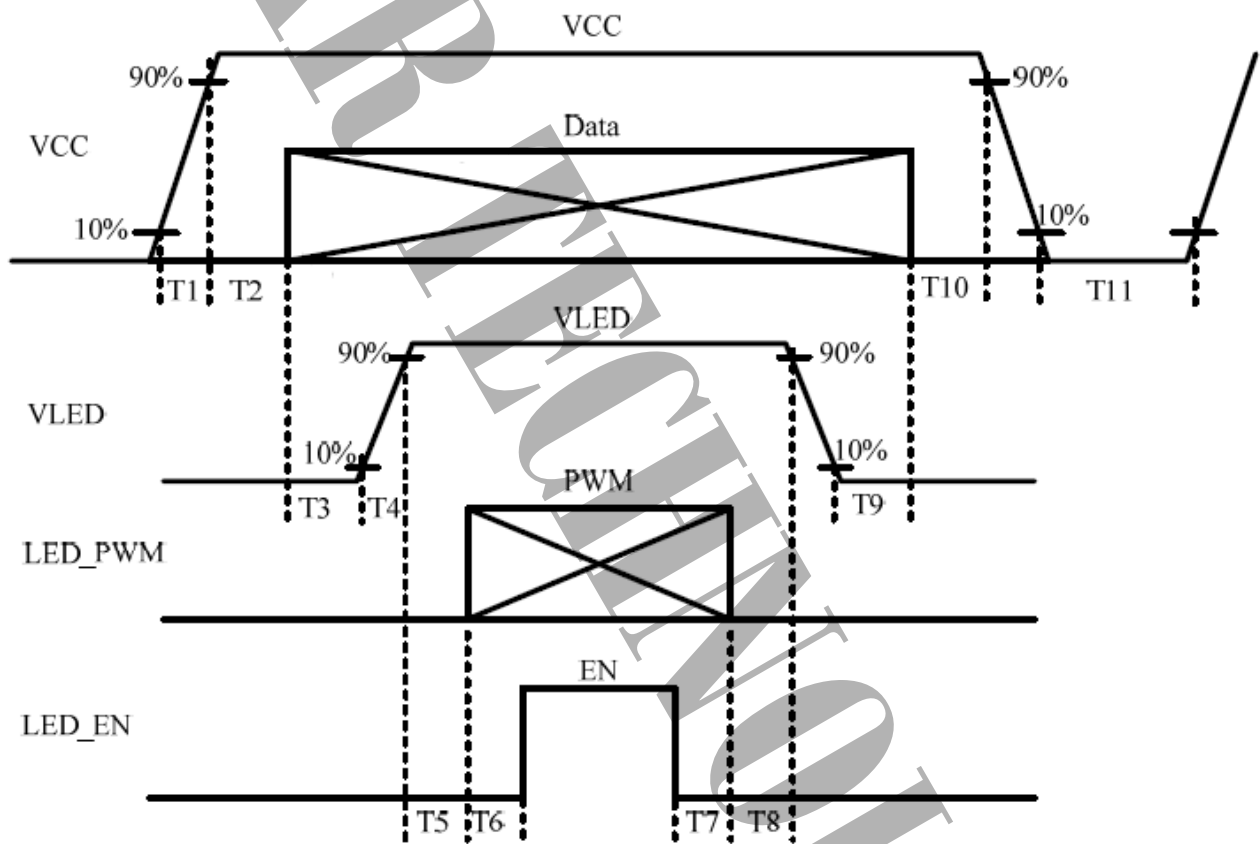
$$0.50 \text{ ms} \leq T4 \leq 10 \text{ ms}$$

$$10 \text{ ms} \leq T6$$

$$500 \text{ ms} \leq T11$$

$$0.01 \text{ ms} < T10 \leq 50 \text{ ms}$$

$$0 \text{ ms} \leq T7$$



Data NIND0 ~ NIND3 , PIND0 ~ PIND3 , NINC , PINC , DENA



2. MODULE STRUCTURE

2.1 Interface Pin Description

(1) CN1 (Data Signal and Power Supply)

Outlet connector: MSB240420HD (STM)

Plug connector: P240240 (STM) or equivalent

PIN #	SYMBOL	FUNCTION
1	VCC	+3.3V Power Supply
2	VCC	+3.3V Power Supply
3	GND	GND
4	GND	GND
5	RXIN0-	Negative LVDS Differential Data Input
6	RXIN0+	Positive LVDS Differential Data Input
7	GND	GND
8	RXIN1-	Negative LVDS Differential Data Input
9	RXIN1+	Positive LVDS Differential Data Input
10	GND	GND
11	RXIN2-	Negative LVDS Differential Data Input
12	RXIN2+	Positive LVDS Differential Data Input
13	GND	GND
14	RXCLK IN-	Negative LVDS Differential Clock Input
15	RXCLK IN+	Positive LVDS Differential Clock Input
16	GND	GND
17	RXIN3-	Negative LVDS Differential Data Input
18	RXIN3+	Positive LVDS Differential Data Input
19	NC	NC
20	SEL	Input Mode Select :6-bits(3.3V) / VESA 8-bits(GND)

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) CN2 (Backlight)

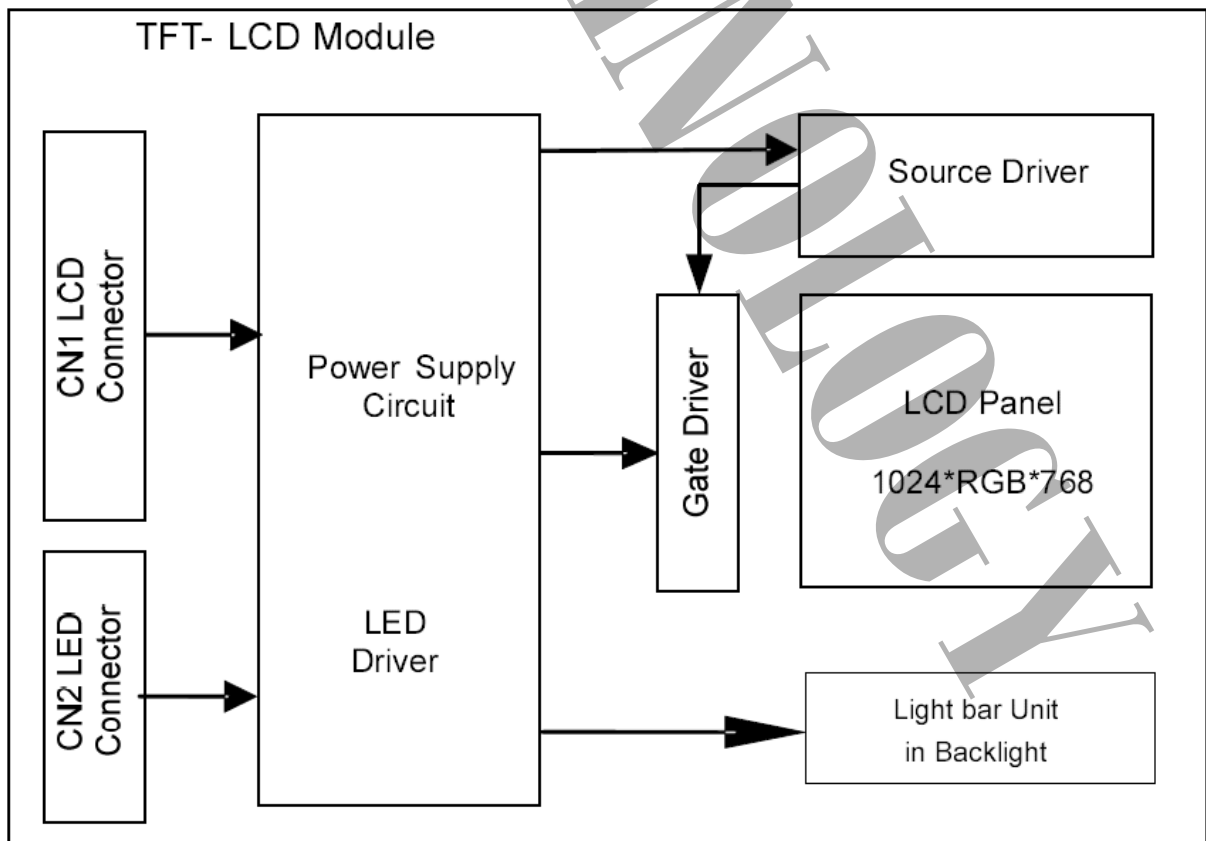
Outlet connector: 3800K-Q05N-03L (ENTERY)

Plug connector: H203K-D05N-12B(ENTERY) or equivalent

PIN #	SYMBOL	FUNCTION
1	VLED	+12V Power Supply
2	GND	GND
3	LED_EN	ON : 5V / OFF: 0V & NC (*1)
4	LED_PWM	Light Dimming Control : PWM Input for Dimming: L : 0V / H : 5V Freq : 200-2000Hz Duty : 5%-100%
5	NC	NC

*1) Enable High=2.4 to 5V, Low=0 to 0.8V or Open.

2.2 BLOCK DIAGRAM





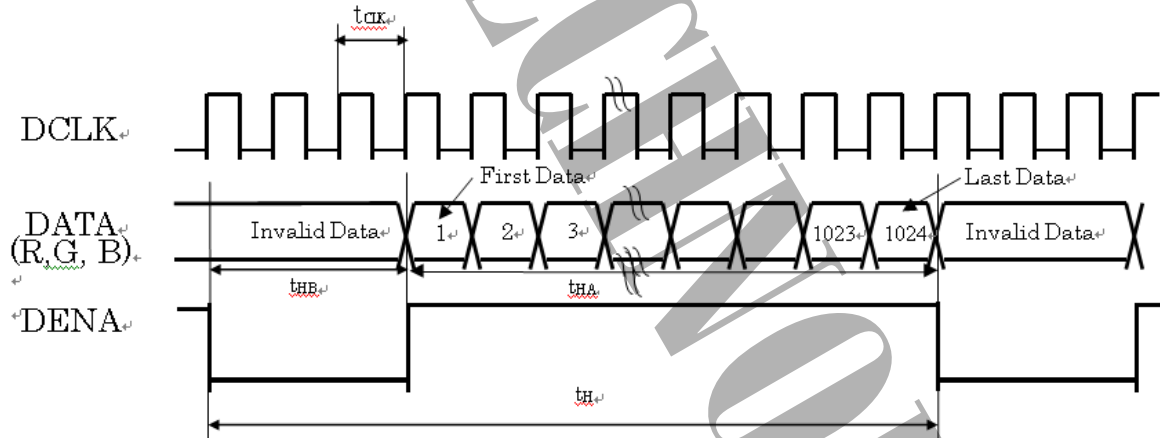
2.3. INTERFACE TIMING

(1) Timing Specifications

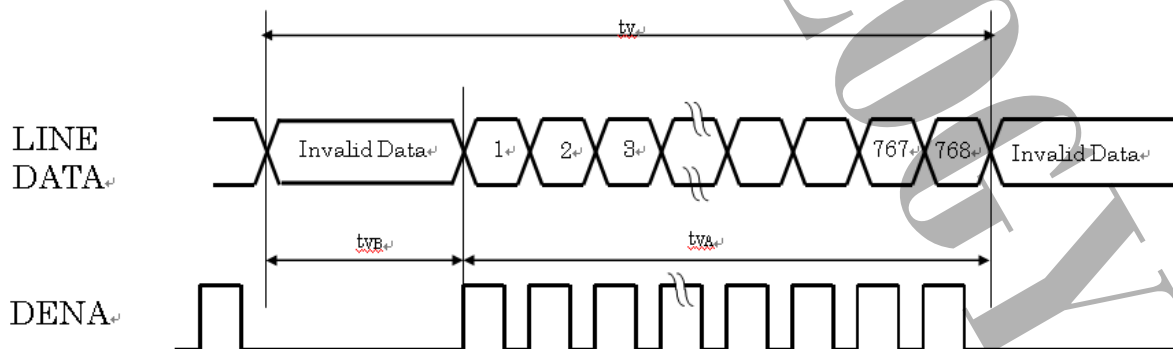
ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT		
LCD Timing	DCLK	Frequency	f_{CLK}	52.14	65	71.1	MHZ	
		Cycle	t_{CLK}	14.1	15.4	19.18	ns	
	DENA	Horizontal	Horizontal total time	t_H	1200	1344	1348	t_{CLK}
			Horizontal effective time	t_{HA}	1024			t_{CLK}
			Horizontal blank time	t_{HB}	176	320	324	t_{CLK}
		Vertical	Vertical total time	t_V	790	806	810	t_H
			Vertical effective time	t_{VA}	768			t_H
			Vertical blank time	t_{VB}	22	38	42	t_H
	Frame rate		FV	55	65	75	Hz	

(2) Timing Chart

a. Horizontal Timing

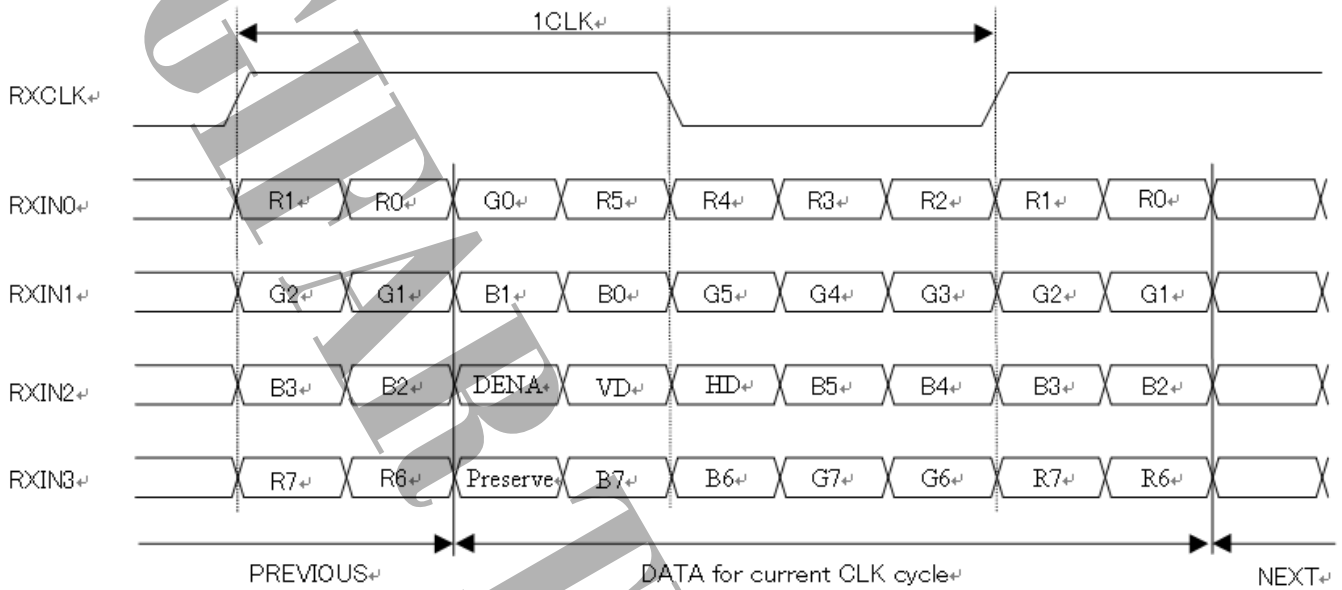


b. Vertical Timing





(3) LVDS DATA (VESA): Timing Chart





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	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	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		
	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.

3) This assignment is applied to both odd and even data.



3. RELIABILITY TEST

(1) Temperature and Humidity

TEST ITEMS	CONDITIONS
High Temperature High Humidity Operation	60°C; 90%RH; 240hrs (No condensation)
High Temperature Operation	80°C; 240hrs
High Temperature Storage	80°C; 240hrs
Low Temperature Operation	-30°C; 240hrs
Low Temperature Storage	-30°C; 240hrs
Thermal Shock	Between -30°C (1hr) ~ 80°C (1hr); 100 Cycles

(2) Shock & Vibration

ITEMS	CONDITIONS
SHOCK (NON-OPERATION)	Shock level: (150G) Waveform: half sinusoidal wave, 2ms Number of shocks: one shock input in each direction of three mutually perpendicular axes for a total of six shock inputs
VIBRATION (NON-OPERATION)	Vibration level: (1.0G) zero to peak Waveform: sinusoidal Frequency range: 10 to 300 Hz Frequency sweep rate: 0.5 octave/min Duration: one sweep from 10 to 300Hz in each of three mutually, each x,y,z axis: 30 min.

(3) ESD

POSITION	CONDITION(MDL turn off)
Connector	1. 200 pF , 0 Ω , ±200 V 2. contact mode for each pin
Module	1. 150 pF , 330 Ω , ±15K V (Air mode) , ±8K V (Contact mode) 2. Air mode, test 25 times for each test point 3. Contact mode, 25 times for each test point

(4) Judgment standard

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

Pass: Normal display image with no line defect.

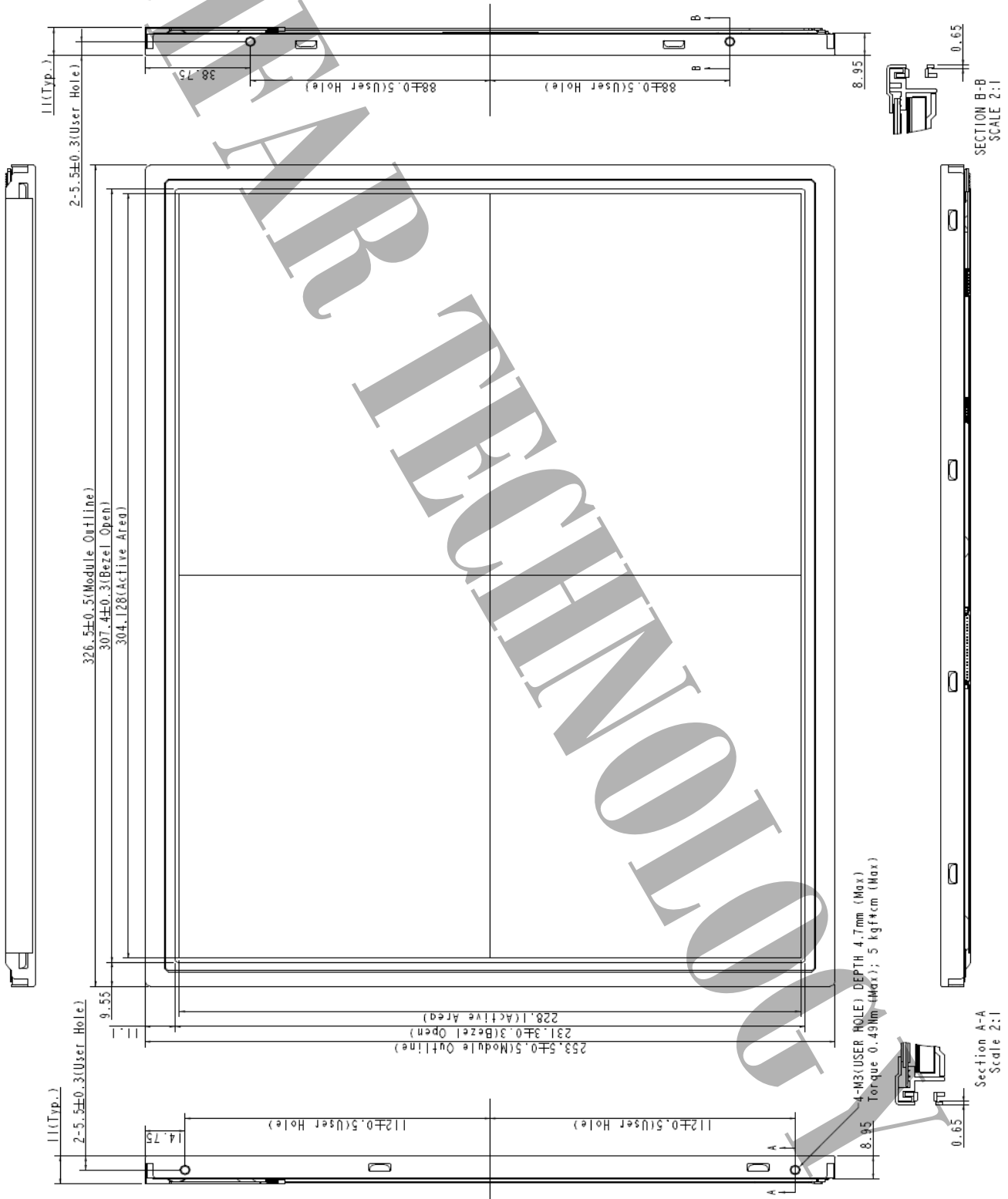
Fail: No display image or line defects



4. LCM Drawing

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

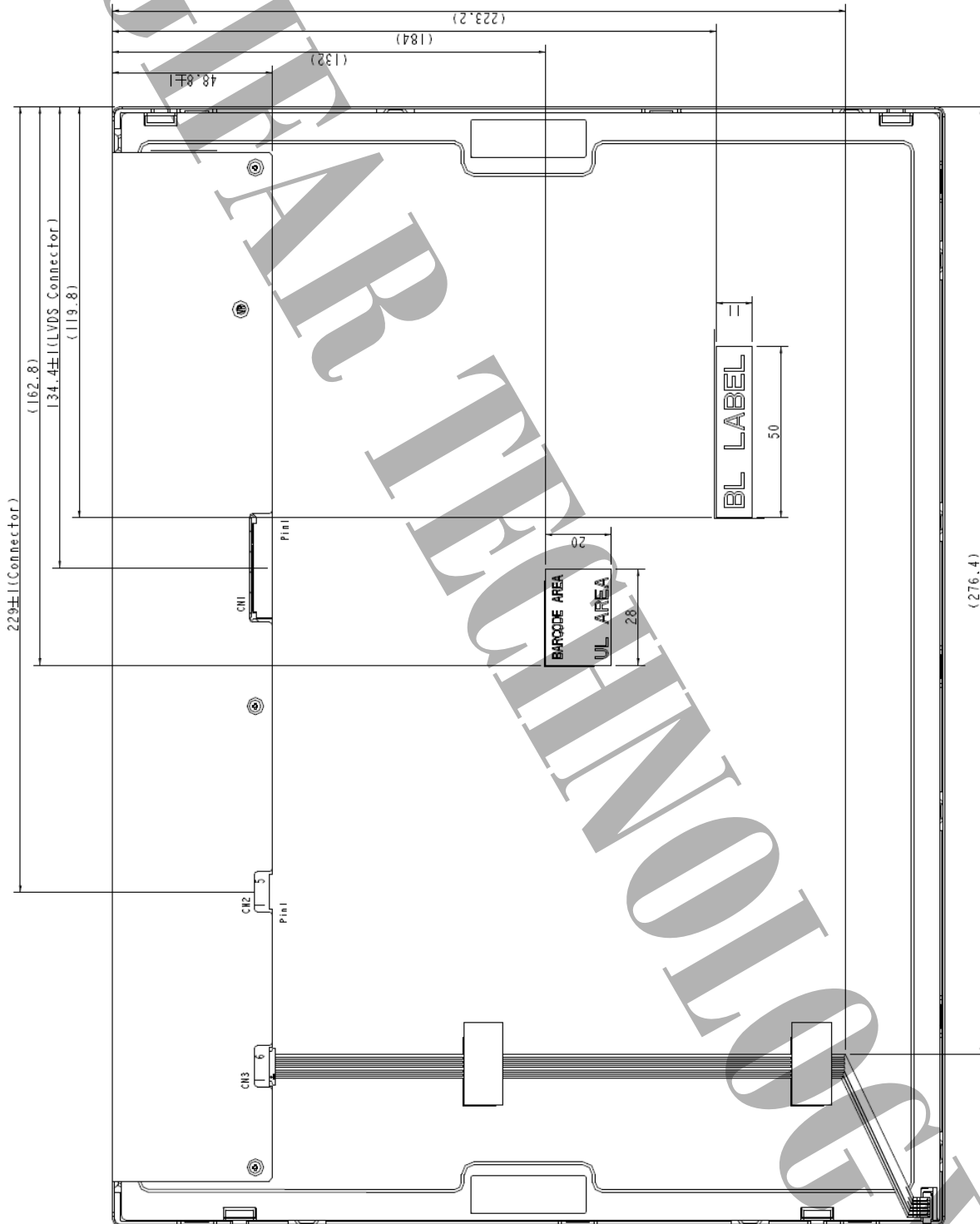
Unit: mm





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

[Unit : mm]



CN1: Connector MSB24042HD 20Pin (STM)
CN2: Connector 3800K -005N-03L

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.