

HITACHI

Hitachi Displays, Ltd.

Date: Nov. 06, 2006

For Messrs. Hitachi Europe Ltd.
CUSTOMER'S ACCEPTANCE SPECIFICATIONS

TX38D55VM1AAA

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Please return 1 copy with your signature on this page for approval.

Accepted by : _____

Proposed by : H. KAWAMURA

Date : _____

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RECORD OF REVISION

Date	Old Sheet No.	Summary
	New Sheet No.	
Nov.06,2006	3284PS 2603- TX38D55VM1AAA-1 Page 3-1/2	Title was changed. APPLICATIONS → DESCRIPTION
	3284PS 2603- TX38D55VM1AAA-2 Page 3-1/2	
	3284PS 2604- TX38D55VM1AAA-1 Page 4-1/3	1.1 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS STORAGE Ambient Temperature was changed. MIN. : -20 → -30
	3284PS 2604- TX38D55VM1AAA-2 Page 4-1/3	
	3284PS 2606- TX38D55VM1AAA-1 Page 6-1/2	1. Hsync and Vsync spec. was changed DTMG spec. Vertical Frequency → Frame Cycle Frequency Horizontal Frequency → Line Cycle Frequency DCLK Frequency: MIN. MHz → MIN. 60 MHz 2. Note 3) was changed. Module fuse spec.: 1.0A → 0.8A Current source fuse spec.: 2.5A → 2.0A
	3284PS 2606- TX38D55VM1AAA-2 Page 6-1/2	
	3284PS 2608- TX38D55VM1AAA-1 Page 8-3/4	LVDS Input Signal were changed. Vsync → NA Hsync → NA
	3284PS 2608- TX38D55VM1AAA-2 Page 8-3/4	
	3284PS 2603- TX38D55VM1AAA-1 Page 3-2/2	Title was changed. Others → Caution
	3284PS 2603- TX38D55VM1AAA-2 Page 3-2/2	
Nov.06,2006	3284PS 2604- TX38D55VM1AAA-2 Page 4-2/3	1.3 Connection between System Ground and Metal frame. The spelling mistake is corrected. couned → connected
	3284PS 2604- TX38D55VM1AAA-3 Page 4-2/3	

RECORD OF REVISION

Date	Old Sheet No.	Summary
	New Sheet No.	
	3284PS 2606- TX38D55VM1AAA-2 Page 6-1/2	Misprint correction. MIN. MIN. IDD : 58 → -
	3284PS 2606- TX38D55VM1AAA-3 Page 6-1/2	
	3284PS 2611- TX38D55VM1AAA-2 Page 11-1/2	8.1 LOT MARK The Optional mark is deleted. 8.3 Location of lot mark Item correction 7. External Dimensional → 7. DIMENSIONAL OUTLINE
	3284PS 2611- TX38D55VM1AAA-3 Page 11-1/2	
	3284PS 2612- TX38D55VM1AAA-2 Page 12-3/3	• No.8 Note 8) → 9) • Added No.10 • Correcting Note 9)
	3284PS 2612- TX38D55VM1AAA-3 Page 12-3/3	

DESCRIPTION

This specification is applied to the following TFT Liquid Crystal Display Module with Back-light unit.

General Specifications

- Type name : TX38D55VM1AAA
- Display Area : H304.1×V228.1 [mm]
- Display Pixels : H1024×V768 pixels
(Display Dots) (H(1024×3)×V768 [dots])
- Power Supply Voltage : 3.3 V
- Pixel Pitch : H0.297×V0.297 [mm]
- Color Pixel Arrangement : R·G·B Vertical Stripe
- Display Mode : Transmissive &
Normally White Mode
- Color Number : 262k Colors
- Viewing Direction : 12 O'clock (Note1)
- Dimensions Outlines : H330.0 typ. ×V260.0 typ. ×t17.0 typ. [mm]
- Weight : 1300 typ. [g]
- Interface : 1ch-LVDS / Receiver (Note2)
- Surface Polarizing Film : Glare Polarizing Film
(Hard Coat 3H : Pencil Hardness)
- Back-light : Four Cold Cathode Fluorescent Lamp
(Side-Light type : Upper and Lower)
Back-light inverter is not
contained in Module.

Note1) Viewing Direction : Less inversion of gray scale.

2) LVDS : Low Voltage Differential Signaling.

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• Caution :

- (1) This product is supposed to be used in the air-conditioned room where sunshine does not directly come in.
- (2) Please do not use this product to such application as needs high reliability and safety. in function. (Ex. Medical Equipment, Life Support System, and Safe for Property etc.)
- (3) There might be some change in the Product and Specs without notice.
Please confirm them beforehand when you need maintenance parts.
- (4) In case of Failure due to HITACHI's Responsibility, it could be repaired or replaced for free within guarantee.
Failure due to Customer's responsibility (including Customers' repair by themselves) could not be repaired and replaced even within guarantee.
- (5) The content of these sheet might be changed for some improvement without notice.
Please be advised with Sales to make sure when you design equipment using this product.
- (6) Please contact with Sales if there is any question in regard to these sheet.

1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING		STORAGE		UNIT	NOTE
	MIN.	MAX.	MIN.	MAX.		
Ambient Temperature	-20	70	-30	70	℃	1)
Humidity	2)		2)		%RH	1)
Vibration	—	4.9 (0.5G)	—	19.6 (2G)	m/s ²	3)
Shock	—	29.4 (3G)	—	490 (50G)		4)
Corrosive Gas	NOT ACCEPTABLE		NOT ACCEPTABLE		—	
Illuminance at LCD surface	—	50,000	—	50,000	lx	

Note 1) Temperature and Humidity should be applied to the glass surface of a TFT module, not of system installed with this unit.
Operating temperature means functional temperature without regard to optical performance.

Life characteristic is specified at 25 ± 5 degree.

At low temperature the brightness of CFL drop and the life time of CFL become to be short. (especially below 0 degree)

Storage at low temp : 48hr max.

2) Ambient temp. $T_a \leq 40^\circ\text{C}$: 85%RH MAX. without condensation
 $T_a > 40^\circ\text{C}$: Absolute humidity must be lower than the saturated vapor of 85%RH at 40°C . without condensation

3) Vibration frequency : 20~50Hz. (Except resonance frequency)

4) 3ms, X·Y·Z·Z'.

1.2 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

(1) TFT LIQUID CRYSTAL DISPLAY MODULE

VSS=0V

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Power Supply Voltage	VDD	0	4.0	V	
Input Voltage for logic	VI	-0.2	VDD+0.2	V	1)
Electrostatic Durability	VESD0	± 100		V	2), 3)
	VESD1	± 8		kV	4), 5)

Note 1) It is applied to pixel data signal and clock signal.

2) Electric discharge constant 200 pF-0 Ω , 25 $^{\circ}$ C-70%RH.

3) The I/F Connector pins are subjected.

4) Electric discharge constant 200 pF-250 Ω , 25 $^{\circ}$ C-70%RH.

5) The Surface of Metal bezel and LCD are subjected.

(2) BACK-LIGHT UNIT

GND=0V

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Lamp Current	IL	0	7	mA _{rms}	1)
Lamp Voltage	VL	0	1500	V _{rms}	2)

Note 1) At Lamp start-up time.

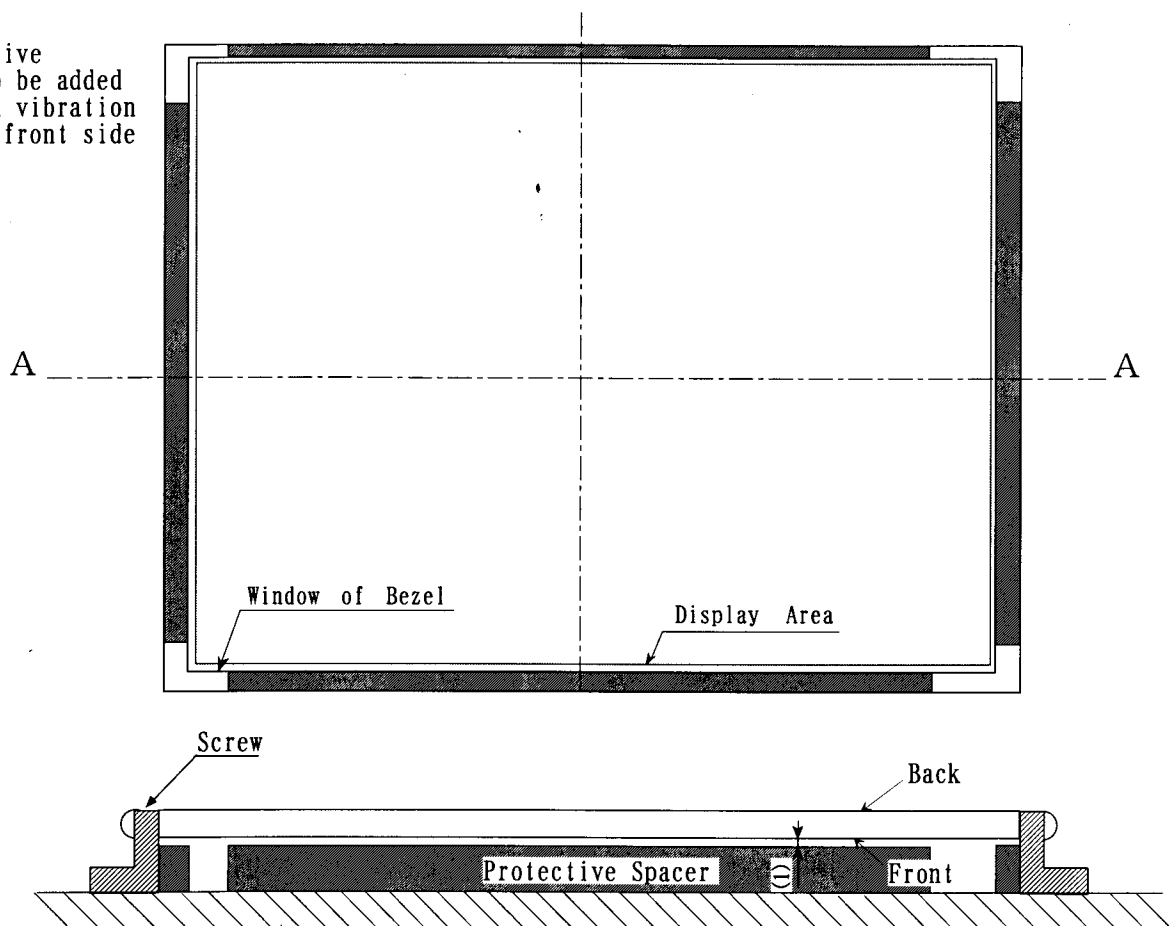
2) The specification is applicable to connector pins of Back-Light unit.

1.3 Connection between System Ground and Metal frame.

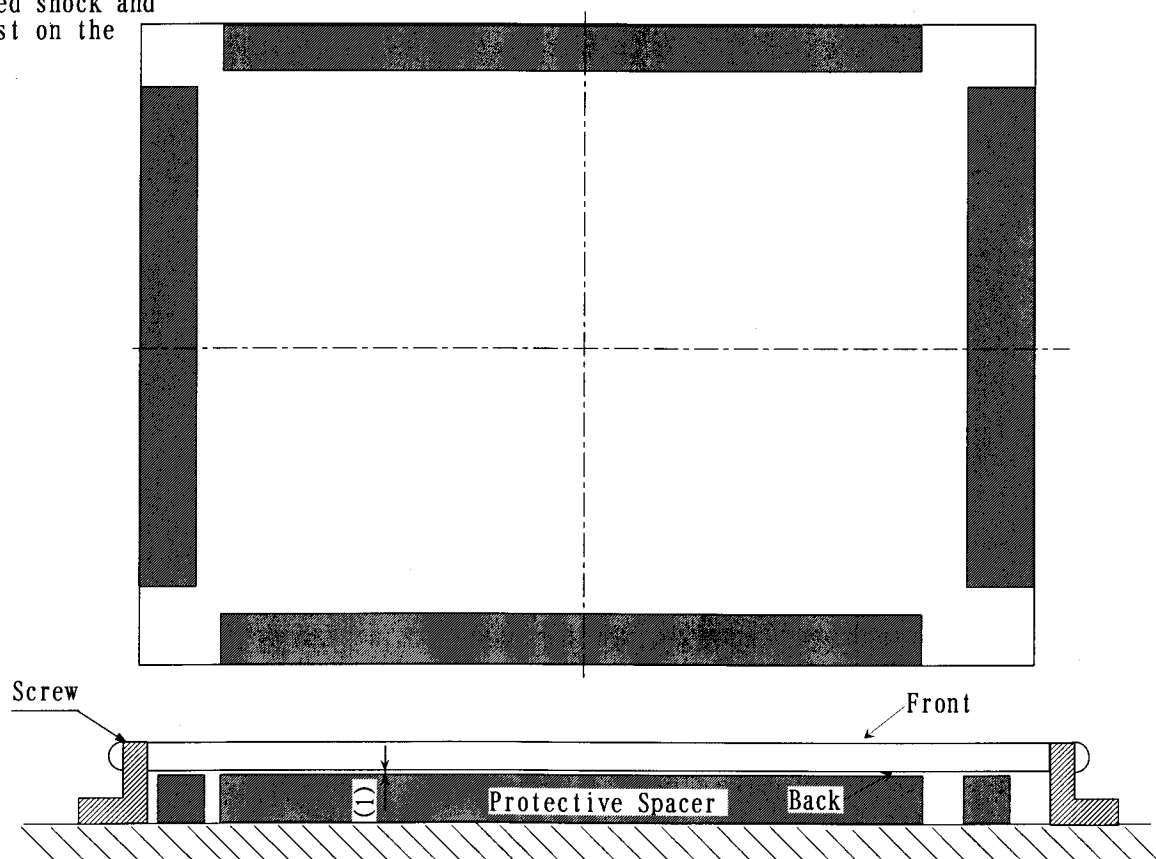
Metal frame of the module should be grounded with Customer's system ground in case that protection film is being peeled off while operating the module. Unless you connected between metal frame and System Ground. Machine's system happen to shut down due to the influence of electrostatic discharge caused by peeling off the protection film.

Protective spacer

- (1) This protective spacer is to be added at shock and vibration test on the front side



- (2) This protective spacer is to be added shock and vibration test on the other side



2. OPTICAL CHARACTERISTICS

The following items are measured on the conditions that this unit operation (TFT panel and Back-light) and measuring systems are stable. (more than 30minutes' operation)

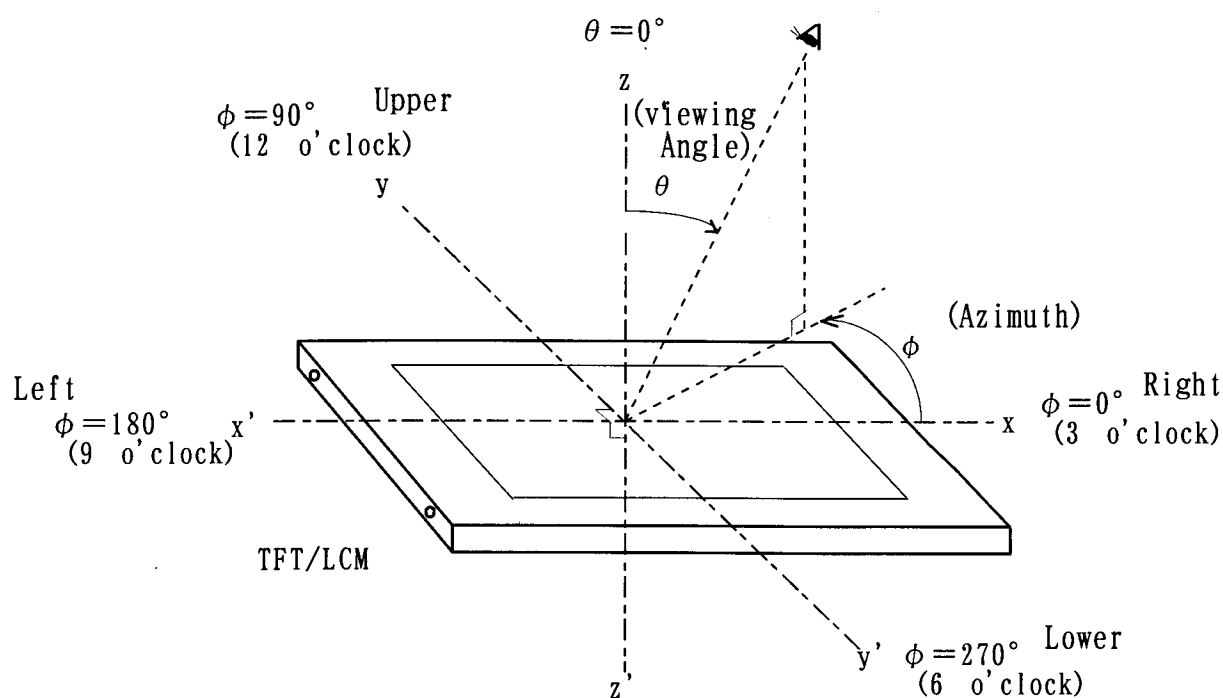
The ambient light excluding The Back-light unit is nothing.

- Measuring equipment : TOPCON BM-7, Prichard 1980A, or equivalent
- Measuring point : Active area center

Temperature of LCD= $25\pm 3^{\circ}\text{C}$, $V_{DD}=3.3\text{V}$, $f_v=60\text{Hz}$, $f_L=50\text{kHz}$, $I_L=6\text{mA}_{rms}$

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Contrast Ratio		CR	$\theta = 0^{\circ}$ Note 1)	200	500	—	—	2)
Response Time	RISE	tr		—	20	—	ms	3)
	FALL	tf		—	10	—		
Brightness (White)		Bwh		—	350	—	cd/m ²	
Color of CIE	Red	x		0.58	0.63	0.68	—	
		y		0.29	0.34	0.39		
	Green	x		0.25	0.30	0.35		
		y		0.55	0.60	0.65		
	Blue	x		0.09	0.14	0.19		
		y		0.04	0.09	0.14		
	White	x		0.27	0.32	0.37		
		y		0.28	0.33	0.38		
Viewing Angle (CR≥10)	x-x	θ x	$\phi = 0^{\circ}$	—	60	—	deg	1)
		θ x'	$\phi = 180^{\circ}$	—	60	—		
	y-y	θ y	$\phi = 90^{\circ}$	—	45	—		
		θ y'	$\phi = 270^{\circ}$	—	50	—		

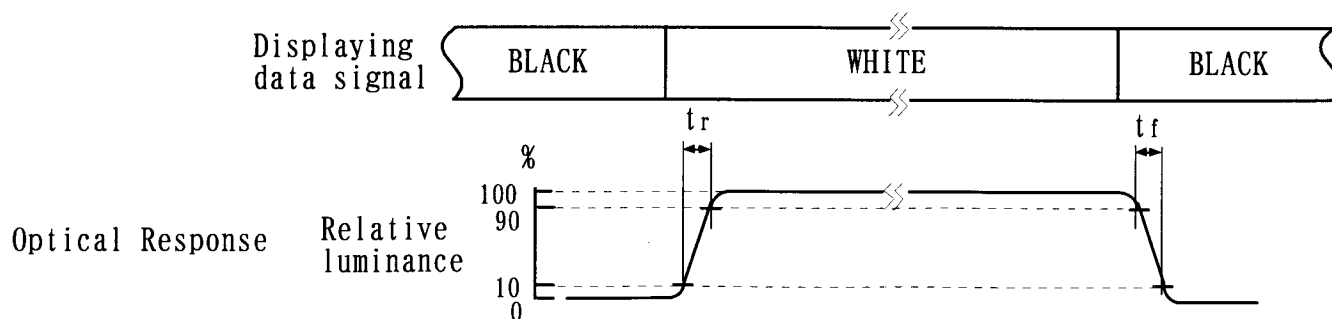
Note 1) Definition of Viewing Angle



Note 2) Definition of Contrast Ratio (CR)

$$CR = \frac{\text{Brightness when displaying White raster}}{\text{Brightness when displaying Black raster}}$$

Note 3) Definition of Response Time



3. ELECTRICAL CHARACTERISTICS

(1) TFT LIQUID CRYSTAL DISPLAY MODULE

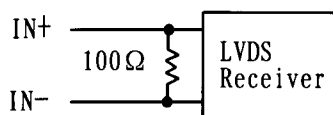
Ta=25°C, Vss=0V

ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Power Supply Voltage		V _{DD}	3.0	3.3	3.6	V	
Differential Input Voltage for LVDS Receiver Threshold	Hi	V _{IH}	—	—	+100	mV	1)
	Lo	V _{IL}	-100	—	—		
Power Supply Current		I _{DD}	—	0.4	0.65	A	2), 3)
Frame Cycle Frequency		f _v	—	60	—	Hz	4), 5)
Line Cycle Frequency		f _H	—	48.3	—	kHz	4)
DCLK Frequency		f _{CLK}	60	65	68	MHz	4)

Note 1) VCM=+1.25V

VCM is common mode voltage of LVDS transmitter/receiver.

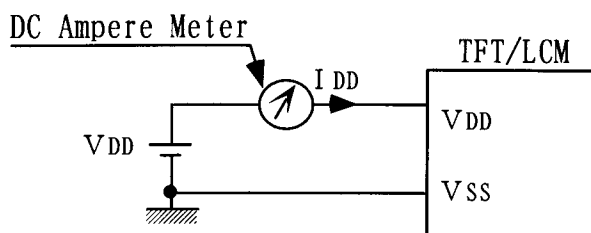
The input terminal of LVDS transmitter is terminated with 100Ω.



2) f_v=60Hz, f_{CLK}=65MHz, V_{DD}=3.3V, DC Current.

Typical value is measured when displaying vertical 64 gray scale.

Maximum is measured when displaying Vertical-stripe (Black-Gray 7).



3) As this module contains 0.8A fuse, prepare current source that is enough for cutting current fuse when a trouble happens. (larger than 2.0A.)

4) For LVDS Transmitter Input

5) Vertical Frequency is encouraged to be used by 60Hz.

The flicker level changes by the gap of the vertical frequency.

(2) BACK-LIGHT UNIT

Ta=25°C, GND=0V

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Lamp Current	IL	3.0	6.0	6.5	mArms	1), 2)
Lamp Voltage	VL	—	620	—	Vrms	7)
Frequency	fL	40	—	70	kHz	3)
Starting Lamp Voltage	Vs	1170	—	—	Vrms	Ta=25°C 4), 5)
		1370	—	—		Ta=-10°C 4), 5)

Note 1) IL is Current of GND side.

2) Higher IL cause the short life time of CFL.

3) Lamp frequency may produce interference with Hsync frequency, causing beat or flicker on the display.

4) Starting Lamp Voltage should be more than Vs(Min).

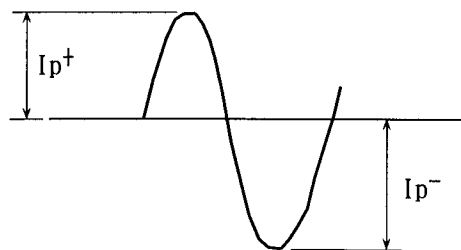
5) Invertor open output voltage please makes the design which 1 seconds or more can be continued at least. When it is below that, there are times when the lamp dose not light up.

6) Quality of the invertor produces big effect on illumination efficiency and life of back light. When it arranges the invertor, that back light and flicker etc. the illumination malfunction of back light does not occur, we request verification. In addition, as for verification as much as possible we recommend that it executes when it is close to the apparatus. In addition, as for the invertor, overvoltage, use you ask those which have the safe protection circuit such as the overcurrent inspection circuit and the discharge corrugated inspection circuit.

7) IL=6mArms

8) Distribution difference of lamp surface temperature should be less than 5°C.

9) When the lighting wave form of the invertor is asymmentry, the inclination of mercury is generated. Therefore, please adjust the unbalance ($|Ip^+ - Ip^-| / Irms \times 100\%$) of the lighting current wave form to 10% or less, and adjust the wave high rate (Ip^+ (or Ip^-) / $Irms$) to 1.2~1.63.



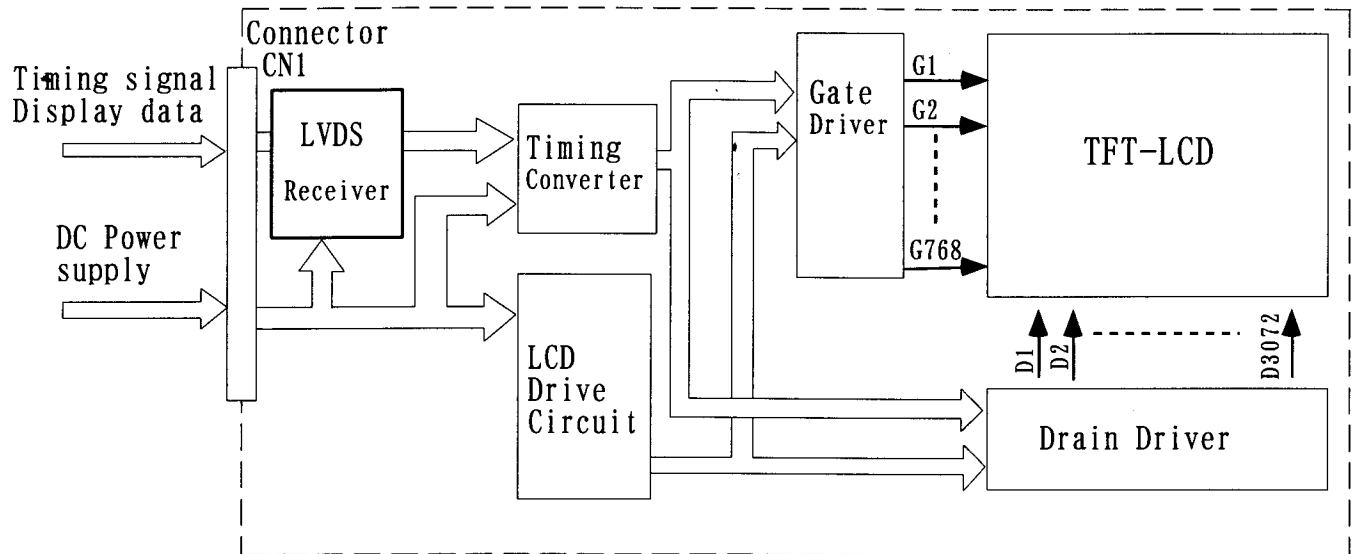
Invertor current wave form.

10) Recommendation invertor : HITACHI LIGHTING, Ltd.

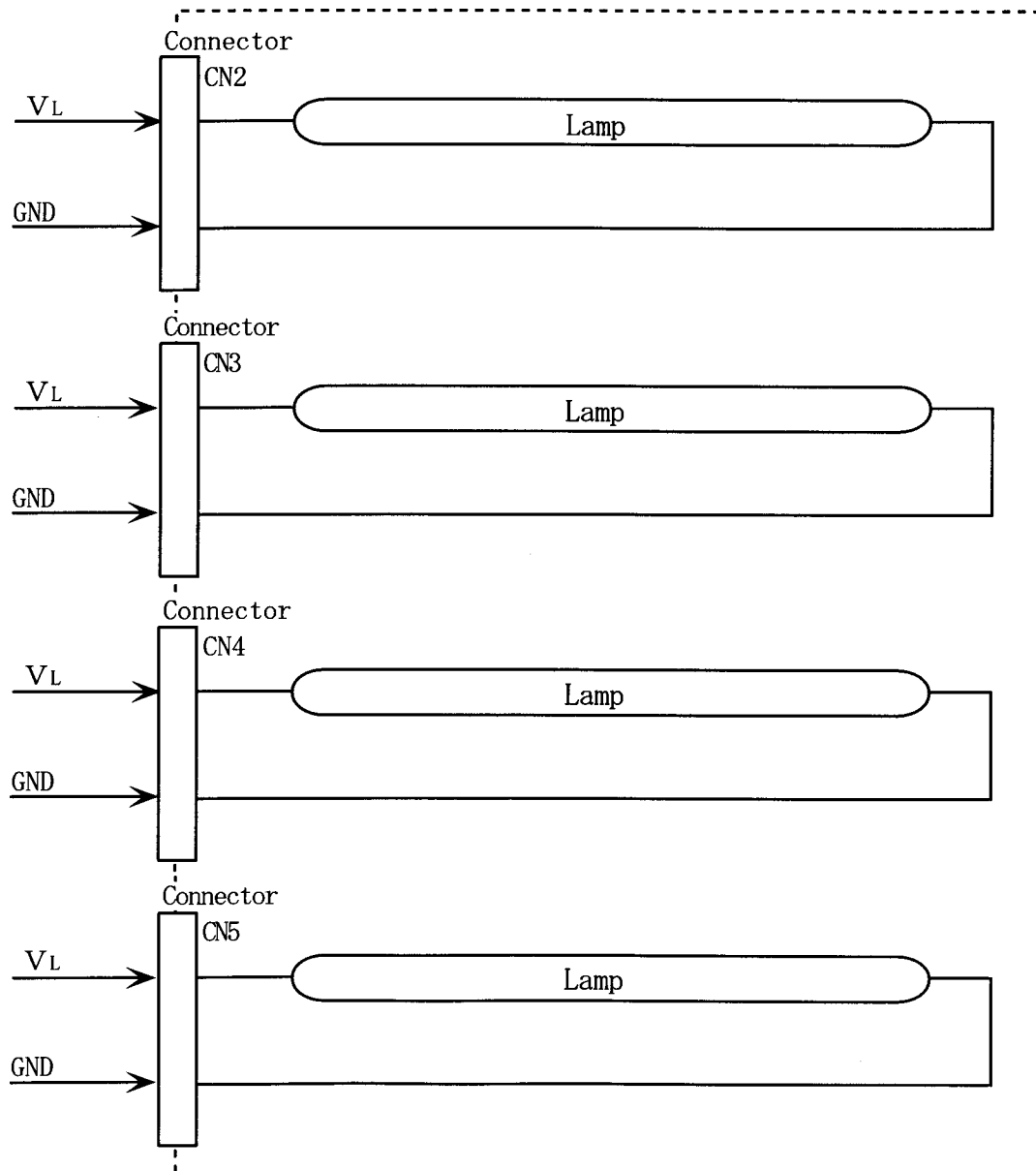
Type name : INVC759 suitable item

4. BLOCK DIAGRAM

(1) TFT LIQUID CRYSTAL DISPLAY MODULE



(2) BACK-LIGHT UNIT



5. INTERFACE PIN CONNECTION

(1) TFT LIQUID CRYSTAL DISPLAY MODULE

CN1 《JAE FI-SEB20P-HF13E》

Pin No.	SYMBOL	FUNCTION	NOTE
1	VDD	Power Suply (3.3V)	2)
2			
3	VSS	Ground (0V)	1)
4			
5	IN0-	Pixel Data	
6	IN0+		
7	VSS	Ground (0V)	1)
8	IN1-	Pixel Data	
9	IN1+		
10	VSS	Ground (0V)	1)
11	IN2-	Pixel Data	
12	IN2+		
13	VSS	Ground (0V)	1)
14	CLK IN-	Clock	
15	CLK IN+		
16	VSS	Ground (0V)	1)
17			
18			
19			
20			

Note 1) All VSS pins should be connected to GND(0V).

Metal bezel is connected internally to VSS.

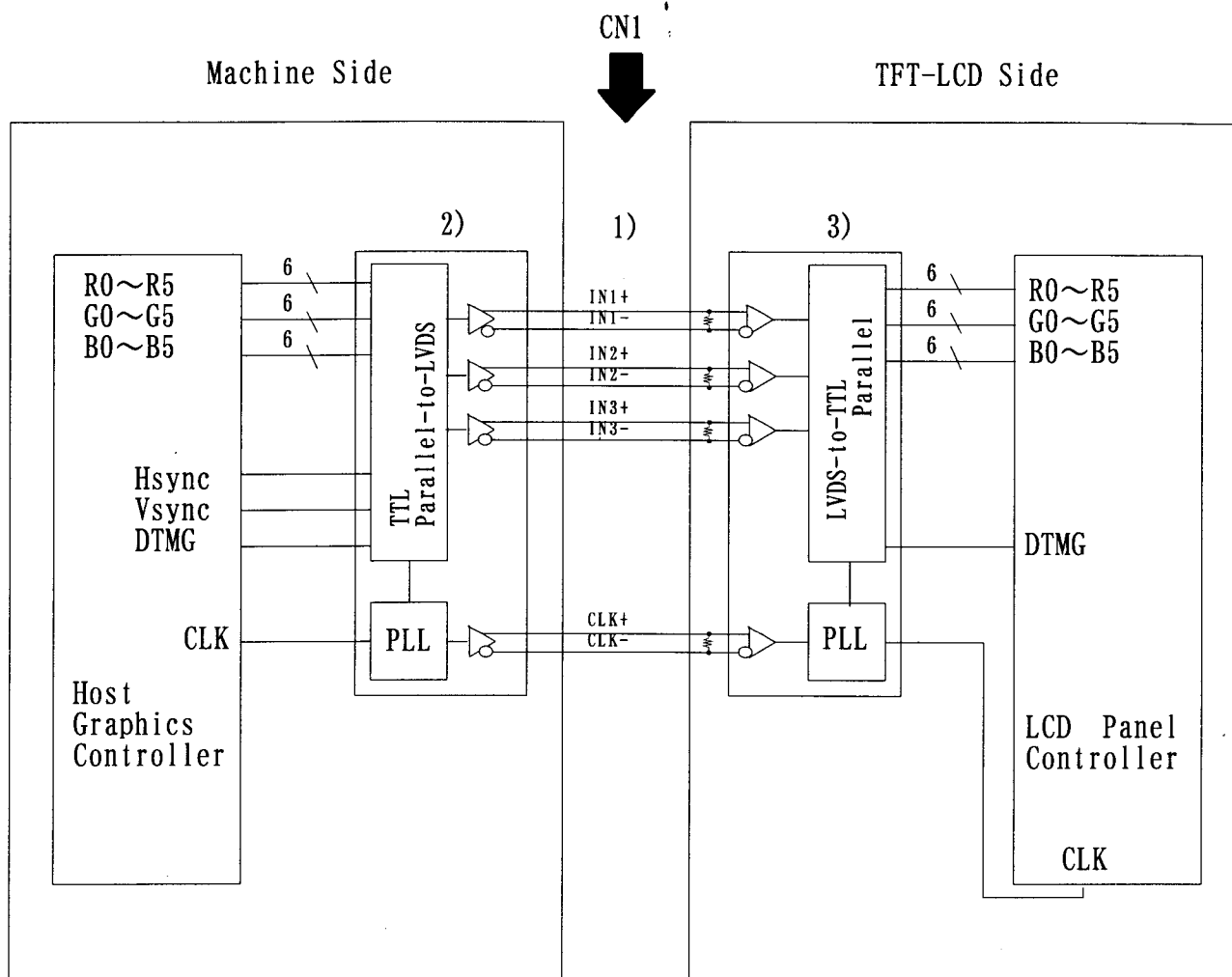
2) All VDD pins should be connected to +3.3V.

(2) BACK-LIGHT UNIT

CN2, CN3, CN4, CN5 《JST BHSR-02VS-1》

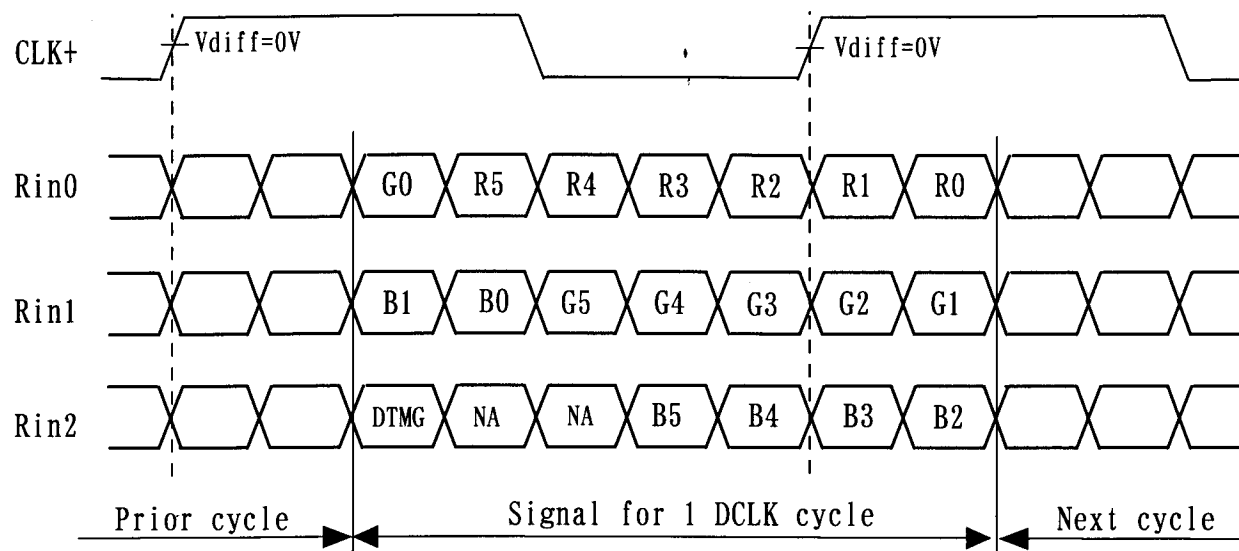
Pin No	SYMBOL	DESCRIPTION	Refelence
1	VL	Power Supply	
2	GND	GND (0V)	

LVDS INTERFACE



- NOTE:
- 1) LVDS cable impedance should be 100 ohms per signal line when each 2-lines(+,-) is used in differential mode.
 - 2) Transmitter Made by Thine : THC63LVDM63A equivalent. Transmitter is not contained in Module.
 - 3) Receiver : with built-in TCON IC.

L V D S Input Signal



NA: Not Available

	INPUT SIGNAL	Transmitter	Interface connector (CN1)	
			Main body	TFT-LCD
L V D S	R0	IN0 (44)	OUT0+	IN0+
	R1	IN1 (45)		
	R2	IN2 (47)		
	R3	IN3 (48)		
	R4	IN4 (1)	OUT0-	IN0-
	R5	IN5 (3)		
	G0	IN6 (4)		
	G1	IN7 (6)		
	G2	IN8 (7)	OUT1+	IN1+
	G3	IN9 (9)		
	G4	IN10 (10)		
	G5	IN11 (12)		
	B0	IN12 (13)	OUT1-	IN1-
	B1	IN13 (15)		
	B2	IN14 (16)		
	B3	IN15 (18)		
	B4	IN16 (19)	OUT2+	IN2+
	B5	IN17 (20)		
	HSYNC	IN18 (22)		
	USYNC	IN19 (23)		
	DTMG	IN20 (25)	OUT2-	IN2-
	DCLK	CLK IN (26)		
			CLK OUT+	CLK IN+
			CLK OUT-	CLK IN-

NOTE : The () value of the transmitter show IC pin No.
when made of thine THC63LVDM63A is used.

RELATIONSHIP BETWEEN DISPLAYED COLOR AND INPUT DATA

INPUT DATA COLOR		R DATA						G DATA						B DATA					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	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
	RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	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
RED	BLACK	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	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
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	RED(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	BLACK	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	1	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
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	GREEN(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	GREEN(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	GREEN(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
BLUE	BLACK	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	1
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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	BLUE(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	BLUE(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

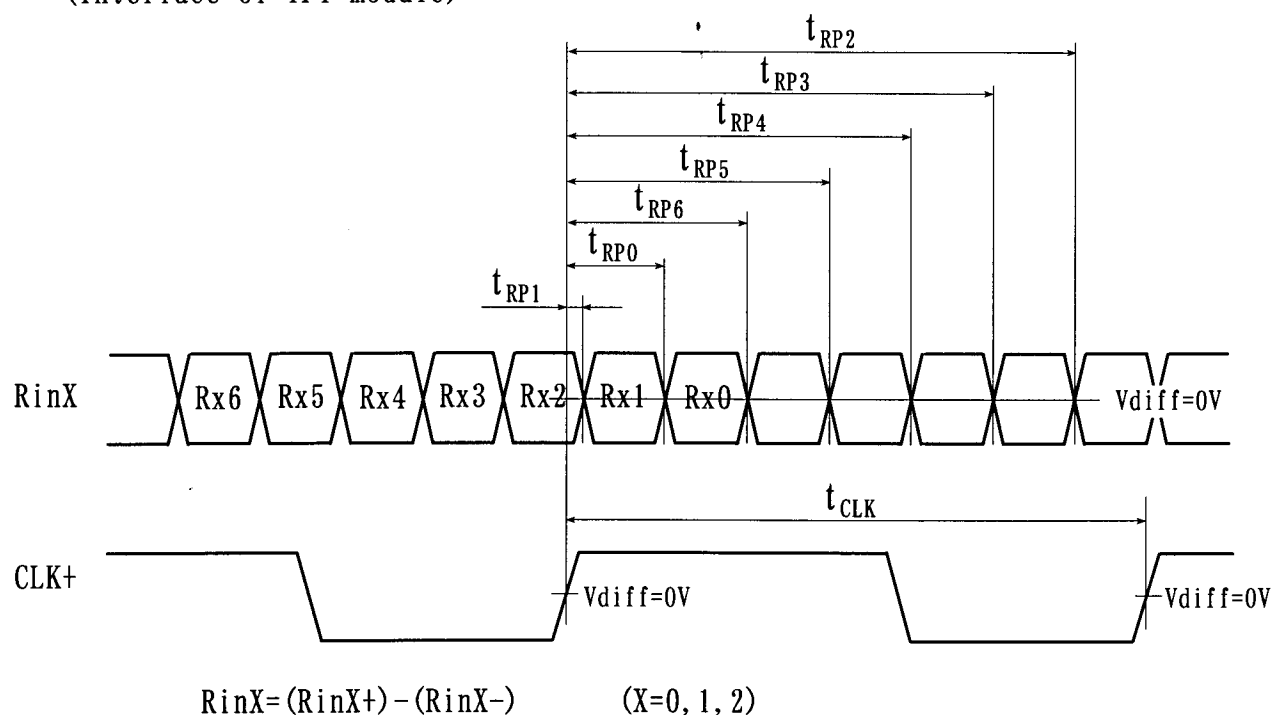
Note 1) Definition of gray scale :

Color(n) --- number in parenthesis indicates gray scale level.
Larger number corresponds to brighter level.

2) Data Signal : 1:High, 0:Low

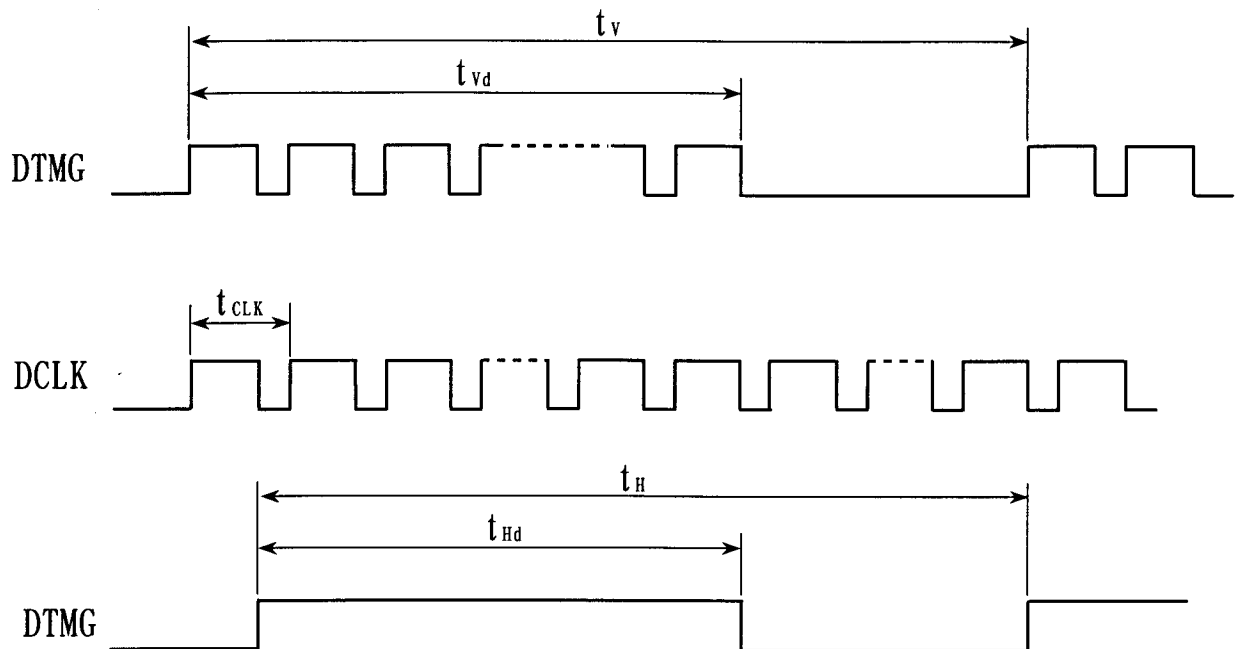
6. Interface timing

(1) LVDS receiver timing (Interface of TFT module)



ITEM		SIMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
DCLK	FREQUENCY	$1/t_{CLK}$	60	65	68	MHz	
R_{inX} ($X=0, 1, 2$)	0 data position	t_{RP0}	$\frac{1}{7}t_{CLK}-0.49$	$\frac{1}{7}t_{CLK}$	$\frac{1}{7}t_{CLK}+0.49$	ns	
	1st data position	t_{RP1}	-0.49	0	+0.49		
	2nd data position	t_{RP2}	$\frac{6}{7}t_{CLK}-0.49$	$\frac{6}{7}t_{CLK}$	$\frac{6}{7}t_{CLK}+0.49$		
	3rd data position	t_{RP3}	$\frac{5}{7}t_{CLK}-0.49$	$\frac{5}{7}t_{CLK}$	$\frac{5}{7}t_{CLK}+0.49$		
	4th data position	t_{RP4}	$\frac{4}{7}t_{CLK}-0.49$	$\frac{4}{7}t_{CLK}$	$\frac{4}{7}t_{CLK}+0.49$		
	5th data position	t_{RP5}	$\frac{3}{7}t_{CLK}-0.49$	$\frac{3}{7}t_{CLK}$	$\frac{3}{7}t_{CLK}+0.49$		
	6th data position	t_{RP6}	$\frac{2}{7}t_{CLK}-0.49$	$\frac{2}{7}t_{CLK}$	$\frac{2}{7}t_{CLK}+0.49$		

(2) timing converter timing
(Input timing for transmitter)



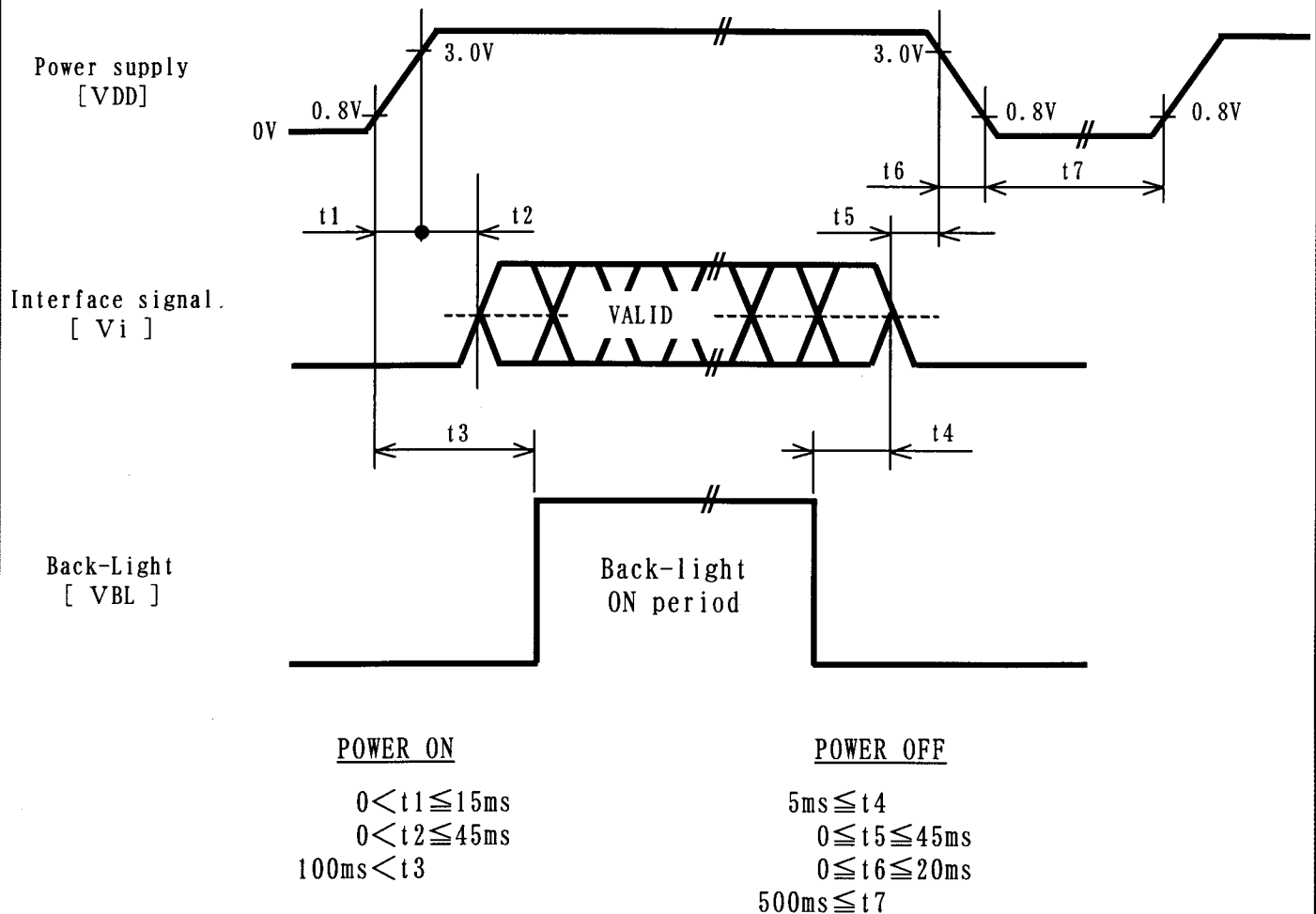
The timings except mentioned above are referred to the specifications of your transmitter.

Item		Symbol	Min.	Typ.	Max.	Unit
DCLK	Cycle time	t_{CLK}	14.8	15.4	—	ns
DTMG	Line cycle time	t_H	1180	1344	2400	t_{CLK}
	Line width-Active	t_{Hd}	1024	1024	1024	
	Frame cycle time 1)	t_v	771	806	1000	l_{line}
	V width-Active	t_{Vd}	768	768	768	

NOTE 1) It counts by a typical value of line cycle time.

(3)TIMING BETWEEN INTERFACE SIGNAL AND POWER SUPPLY

Power Supply, Input Signal and Backlight Voltage ON/OFF/REENTRY should comply with the following sequence.

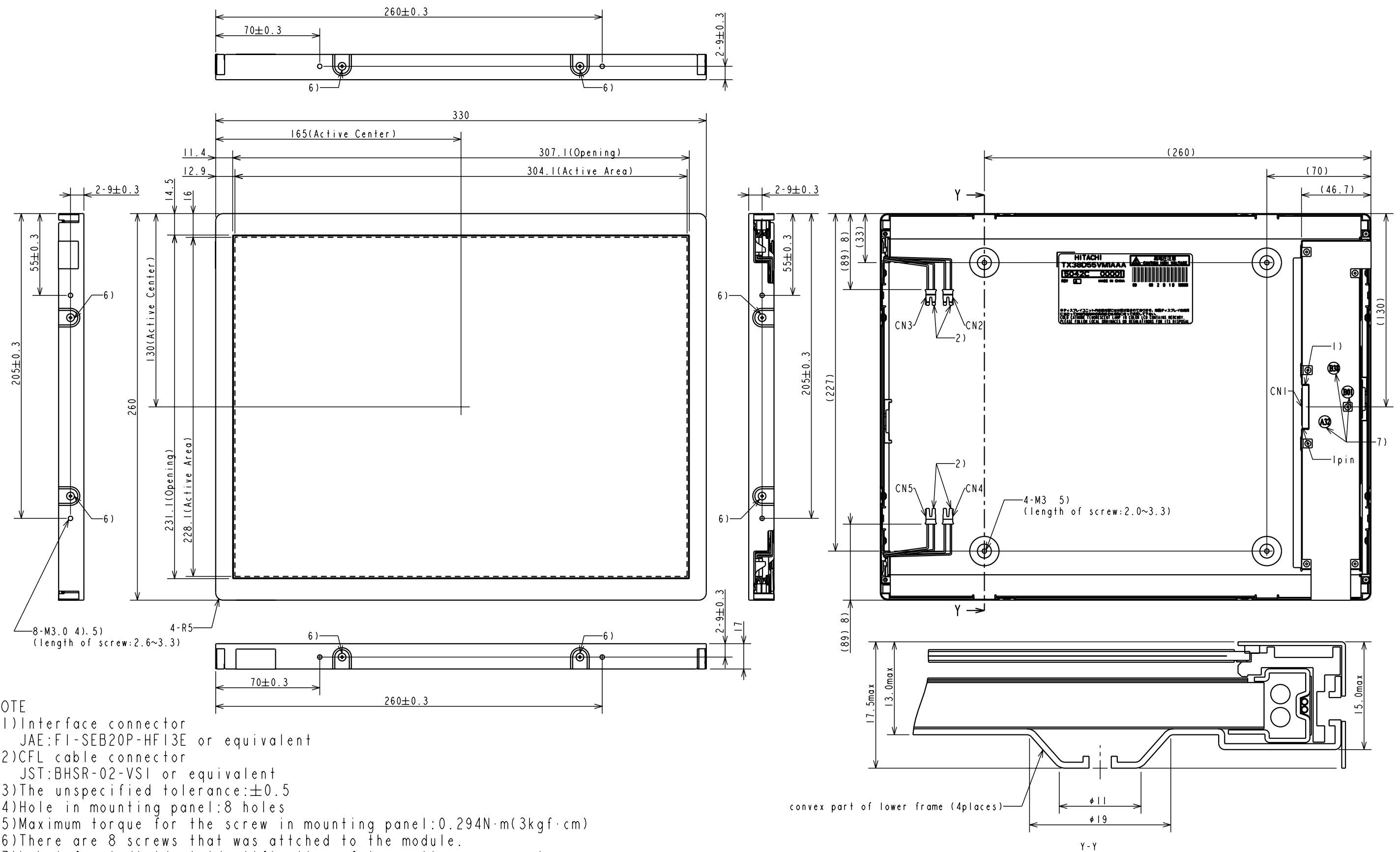


Note(1) In order to prevent electronic parts from destruction caused by latch-up, please input signal after Power Supply Voltage ON. In addition, please turn off signals before Power Supply Voltage OFF.

(2) In order to prevent from function error due to residual charge, please reenter Power Supply Voltage after time stipulated with t7.

(3) Please turn on Backlight after signals fix and turn off before signals down, otherwise noise appears in the display. The noise cause no problem with display performance in case of timing sequence comply with the spec.

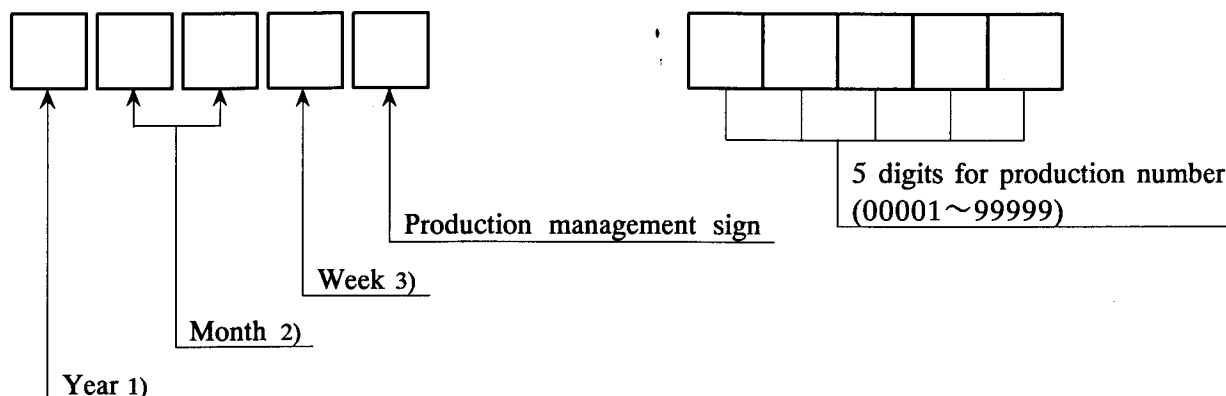
7. DIMENSIONAL OUTLINE



UNIT : mm

8. DESIGNATION OF LOT MARK

8.1 LOT MARK



Notes

1)

Year	Mark
2006	6
2007	7
2008	8
2009	9
2010	0

2)

Month	Mark	Month	Mark
1	01	7	07
2	02	8	08
3	03	9	09
4	04	10	10
5	05	11	11
6	06	12	12

3)

Week(Days)	Mark
1~7	1
8~14	2
15~21	3
22~28	4
29~31	5

8.2 Revision (REV.) control

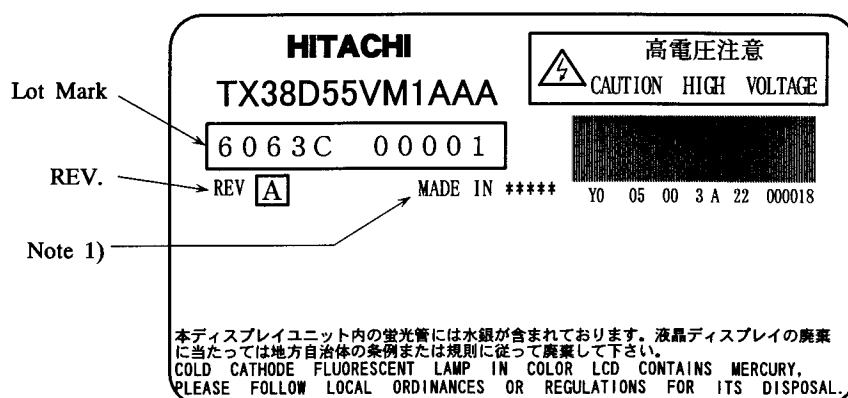
REV. is the column for manufacturing convenience. A-Z except I and O may be written on this column.

8.3 Location of lot mark

Lot mark is printed on a label. The label is on the metallic bezel as shown in

7. DIMENSIONAL OUTLINE

The style of character will be changed without notice.



Note 1) Indication of place of origin
(***** section)

CHINA
JAPAN
TAIWAN

8.4 EX. indication of place of origin

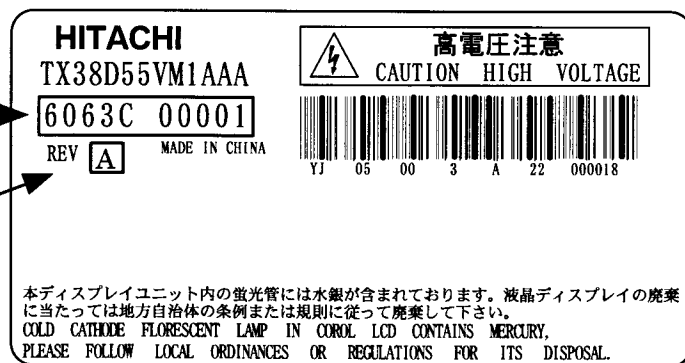
Label is attached on the back side of module.

The items mentioned change without notice.

8.4.1 Made in CHINA

Lot No. &
Production Control No.

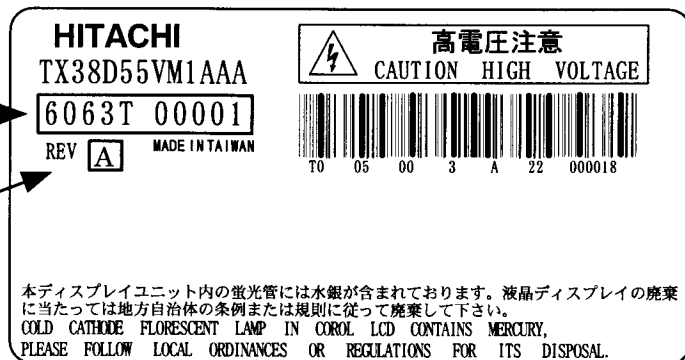
Revision



8.4.2 Made in TAIWAN

Lot No. &
Production Control No.

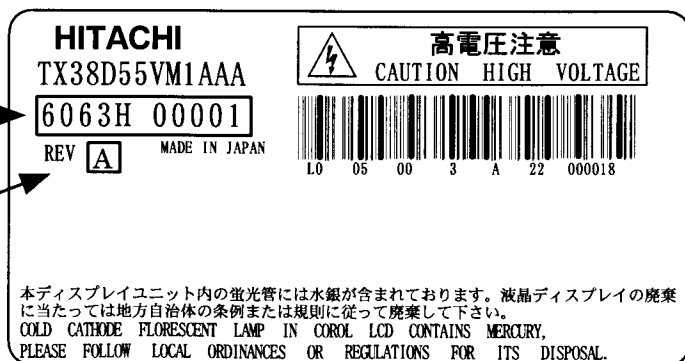
Revision



8.4.3 Made in JAPAN

Lot No. &
Production Control No.

Revision

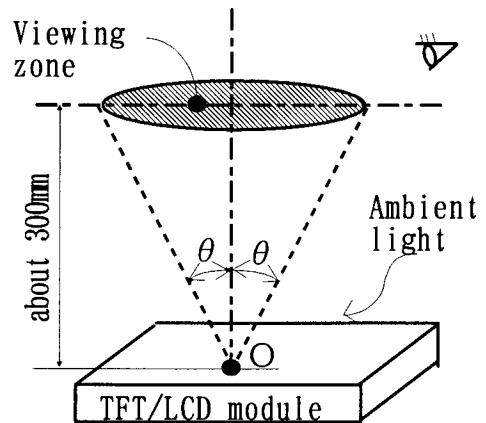


9. COSMETIC SPECIFICATIONS

9.1 CONDITIONS FOR COSMETIC INSPECTION

(1) Viewing zone

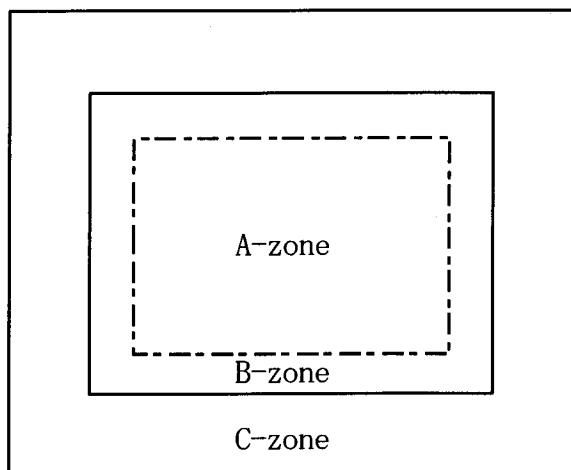
- i) The figure shows the correspondence between eyes (of inspector) and TFT/LCD module.
 - $\theta \leq 15^\circ$ when non-operating inspection
 - $\theta \leq 5^\circ$ when operating inspection
- ii) Inspection should be executed only from front side, and only A-zone. Cosmetic of B-zone and C-zone are ignored.
(refer to 9.2 DEFINITION OF ZONE)



(2) Environmental

- i) Temperature : 25°C
When operating inspection, surface temperature of LCD panel is 25°C.
 - ii) Ambient light : More than 2000 [lx] and non-directive.
 - iii) Back-light : When non-operating inspection, Back-light should be off.
- (3) Operating inspection
Operating inspection should be done with 8 color mode (without gray scale).

9.2 DEFINITION OF ZONE



- A-zone : Display area (pixel area).
- B-zone : Area between A-zone and C-zone.
- C-zone : Metal bezel area.
(Include I/F connector)

9.3 COSMETIC SPECIFICATIONS

- When displaying condition is not stable (ex. at turn on or off), the following specifications are not applied.

	No.	Item			Max.acceptable number A-zone	Unit	Note
Operating inspection	1	Dot defect	Sparkle mode	1-dot	5	pcs	1),2),4)
				2-dots	2	units	1),2),5)
				3-dots	0		
				4-dots	0		
				Density	2	pcs/ ϕ 15mm	1),2),6)
				Total	5	pcs	1),2)
			Black mode	1-dot	10	pcs	1),3),4)
				2-dots	5	units	1),3),5)
				3-dots	0		
				4-dots	0		
				Density	3	pcs/ ϕ 5mm	1),3),7)
				Total	10	pcs	1),3)
			Total			15	pcs
	2	Line defect			Serious one is not allowed.	-	-
	3	Uneven brightness					
	4	Stain inclusion [Line shape W:width (mm) L:length (mm)]	W≤0.06	L:Ignore	Ignore	pcs	8)
			W>0.06	L>1.0	By Dot shape		
				L≤1.0	Ignore		
	5	Stain inclusion [Dot shape D:ave. dia. (mm)]	D≤0.45		Ignore	pcs	8)
			D≤0.7		5		
D>0.7			0				
6	Scratch on polarizer [Line shape W:width (mm) L:length (mm)]	W≤0.01	L:Ignore	Ignore	pcs	9)	
		W≤0.02	L≤40	10			
			L>40	0			
		W≤0.04	L≤20	10			
			L>20	0			
		W>0.8	-	0			
7	Scratch on polarizer [Dot shape D:ave. dia. (mm)]	D≤0.45		Ignore	pcs	9)	
		D≤0.7		10			
		D>0.7		0			

	No.	Item	Max. acceptable number A-zone	Unit	Note
Non- operating inspection	8	Bubbles, peeling in polarizer [D:ave. dia. (mm)]	$D \leq 1.0$	Ignore	pcs 9)
			$D \leq 2.0$	10	
			$D > 2.0$	0	
	9	Wrinkles on Polarizer	Serious one is not allowed.	-	-
	10	Burr of Polarizer edge	$L \leq 1.0$	Ignore	pcs -
			$L > 1.0$	0	

Note 1) Dot defect : defect area $> 1/2$ dot

2) Sparkle mode : brightness of dot is more than 30% at black. (visible to eye)

3) Black mode : brightness of dot is less than 70% at white. (visible to eye)

4) 1 dot : defect dot is isolated, not attached to other defect dot.

5) N dots : N defect dots are consecutive. (N means the number of defects dots)

6) Sparkle mode density : number of defect dots inside 15mm ϕ .

7) Black mode density : number of defect dots inside 5mm ϕ .

8) Those stains which can be wiped out easily are acceptable.

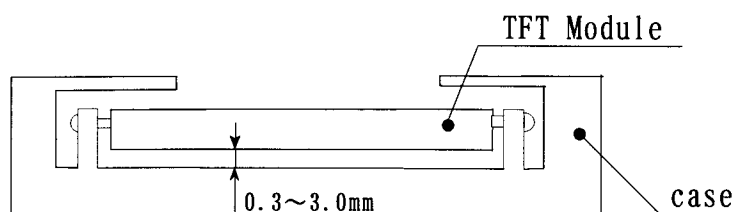
9) Polarizer area inside of A-zone is applied, and B/C-zone is not applied.

10. PRECAUTIONS

Please pay attention to the followings when you use this TFT/LCD module with Back-light unit.

10.1 MOUNTING PRECAUTION

- (1) You must mount Module using mounting holes arranged in 8 corners tightly.
- (2) You should consider the mounting structure so that uneven force (ex. twisted stress) is not applied to Module.
And the case which Module is mounted should have sufficient strength so that external force is not transmitted directly to Module.
- (3) To improve the strength of module against the mechanical shock the space between module and the case should be 0.3~3.0mm.



- (4) You should adopt radiation structure to satisfy the temperature specification.
- (5) Acetic acid type and chloline type materials for the cover case are not desirable because the former generate corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- (6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub by dustclothes with chemical treatment.
Do not touch the surface of polarizer with bare hand or greasy close.
(Some cosmetics are detrimental to the polarizer.)
- (7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials chamois soaked petroleum benzin.
IPA(Iso-Propyl Alcohol) is recommended for cleaning the adhesives used to attach front /rear polarizers. Do not use acetone, toluen and alcohol because they cause chemical damage to the polarizer.
- (8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (9) Do not open the case because inside circuits have not sufficient strength.
- (10) Use fingerstalls of soft gloves in order to keep clean display quality, when you handle the device for incoming inspection and assembly.
- (11) Do not pull or do not fold the CFL cable.

10.2 OPERATING PRECAUTION

- (1) Response time depends on the temperature. (In lower temperature, it becomes longer).
And also Transmittance and Color depend on the temperature.
- (2) Brightness depends on the temperature. (In lower temperature, it becomes lower).
And in lower temperature, response time (required time that brightness is stable after turn on) becomes longer.
- (3) Optical characteristics (eg. luminance, uniformity, color coordinate etc.) gradually change by operating condition, especially low temperature change faster, because LCD module has Cold Cathode Fluorescent Lamp.
- (4) Be careful for condensation at sudden temperature change.
Condensation make damage to polarizer or electrical contact part.
And after fading condensation, smear or spot will occur.
- (5) When fixed patterns are displayed at long times, afterimage is likely to occur.
- (6) The Module have high frequency circuit. If you need to shield the electromagnetic noise, please do in yours.
- (7) When Back-light unit is operating, it sounds.
If you need to shield the noise, please do in yours.
- (8) Please connect the Back-light connector to the inverter circuit directly.
The long cable between CFL and the inverter may cause the brightness drop of CFL and may cause the rise of starting lamp Voltage(Vs).
In addition, it causes CFL life to shorten.
- (9) Do not connect or remove the module from main system with power applied.

10.3 ELECTROSTATIC DISCHARGE CONTROL

- (1) Since Module is composed with electronic circuit, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through list band etc.. And don't touch I/F pin directly.
- (2) When the polarizer protection film is peeled off,
electrostatic discharge occurs. Please peel it off slowly.

10.4 PRECAUTION FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

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10.5 Precaution to strage

When modules for replacement are stored for a long time, following precautions should be taken care of :

- (1) For preventing the liquid crystal deterioration with the ultraviolet ray, please retain when by all means it is inserted in the Hitachi shipping box.
- (2) When it cannot retain in the Hitachi shipping box, Modules should be stored in a dark place.
It is prohibited to apply sunlight or fluorescent light during storage.
- (3) The surface of polarizers should not come in contact with any other object. It is recommended that modules should be stored in the Hitachi shipping box.
- (4) Modules should be at 5 to 35 at normal humidity (60%RH or less).
- (5) Please follow to the environmental condition of statement in the page 4-1/3 of CAS excluding the long term strage.

10.6 HANDLING PRECAUTIONS FOR PROTECTIVE FILM

- (1) When the protective film is peeled off, static electricity is generated between the film and the polarizer.
This film should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- (2) The protective film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protective film against the polarizer during the time you peel off the film, the glue is apt to remain more on the polarizer. So please carefully peel off the protective film without rubbing it against the polarizer.
- (3) When the Module with protective film attached is stored for long time, sometimes there remains a very small amount of glue, still on the polarizer after the protective film is peeled off.
Please refrain from storing the Module at the high temperature and high humidity for glue is apt to remain in these condition.
- (4) The Glue may be taken for the Modules failure, but you can remove the Glue easily.
When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with IPA (Iso-Propyl Alcohol).

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10.7 SAFETY

- (1) If Module is broken, be careful to handle not to injure. (TFT/LCD and Lamp are made of glass.)
Please wash hands sufficiently when you touch the liquid crystal coming out from broken LCDs.
- (2) As Back-light unit has high voltage circuit internal, do not open the case and do not insert foreign materials in the case.

10.8 Environmental protection

- (1) The LCD Modules include Cold Cathode Fluorescent Lamp(CFL).
CFL contains a small amount of mercury. Please follow local ordinances or regulations for disposal.
- (2) Printed circuits board used in a module contain small amount of lead below RoHS regulation value.
Please follow local ordinance or regulations for its disposal.