

TECHNICAL DATA

SPECIFICATIONS OF 15.0" TFT-LCD MODULE

TFTMD38170CBA

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Notes :

1. The information contained herein is tentative and may be changed without prior notices.
2. Please contact Hitachi before proceeding to the design of your product.

DESCRIPTION

The specifications are applied to the following SUPER TFT-LCD Modules.

Note : Inverter device for Back-Light is not built in the module.

Type Name : TFTMD38170CBA

General Specifications

Effective Display Area	H 304.128 × V 228.096	(mm)
Resolution	XGA	
Number of Pixels	H 1024 × V 768	(pixels)
Pixel Pitch	H 0.297 × V 0.297	(mm)
Color Pixel Arrangement	R·G·B Vertical Stripe	
Display Mode	Transmissive Mode, Normally Black Mode	
Top polarizer Type	Anti-glare	
Number of Colors	16,777,216	(colors)
Viewing Angle Range	Super Wide version (Horizontal & Vertical : 160° at each direction , on the condition of Contrast Ratio ≥ 20)	
Input Signal	C-MOS IF	
Back-Light	6 pcs. of CFL	
External Dimensions	H 350 × V 265 × t 25	(mm)
Weight	Typ. 1200	(g)

Note CFL : Cathode Fluorescent Lamp

1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

Item	Operating		Non-operation		Unit	Note
	Min.	Max.	Min.	Max.		
Temperature	5	45	-20	60	°C	1)
Humidity	2)		2)		%RH	1)
Vibration	-	4.9 (0.5G)	-	19.6 (2G)	m/s2	3)
Shock	-	29.4 (3G)	-	294 (30G)	m/s2	4)
Corrosive Gas	Not Acceptable		Not Acceptable			
Illuminance of LCD Surface	-	50,000	-	50,000	lx	

Notes 1) "Temperature" and "Humidity" shall be at glass surface of Super TFT-LCD Module, not in the system installed with the Module. Operation shall be at the temperature below 60°C at the rear surface center. The brightness of CFL in the back-light unit drops at lower temperature. Besides, the life of the CFL gets shorter at lower temperature.

2) $T_a \leq 40^\circ\text{C}$ --- • Humidity shall be less than 85 % RH Max. .
• Non condensation.

$T_a > 40^\circ\text{C}$ --- • Absolute humidity shall be lower than the moisture of the 85 % RH at 40 °C.
• Non condensation.

3) Frequency of the vibration shall be between 20 Hz and 50 Hz. (except resonance point)

4) Pulse width of the shock shall be 7 ms.

1.2 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

1.2.1 SUPER TFT-LCD MODULE

VSS=0V

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VDD	0	6	V	
Input signal Voltage	VI	-0.3	3.3+0.5	V	1)
Electrostatic Durability	VESD0	± 100		V	2), 3)
	VESD1	± 8		kV	2), 4)

Notes 1) The specification shall be applied to pixel data signal and clock signal.

2) Discharge circuit to be connected : 200 pF - 250 Ω , Environmental : 25°C - 70 % RH

3) The specification shall be applied to I/F connector pins.

4) The specification shall be applied to the surface of both a metallic bezel and a LCD panel.

1.2.2 BACK-LIGHT UNIT

GND=0V

Item	Symbol	Min.	Max.	Unit	Note
Lamp Current	IL	-	7	mA _{rms}	1)
Lamp Voltage	VL	-	2000	V _{rms}	2)

Notes 1) The specification shall be applied to each CCFL.

2) The specification shall be applied at connector pins for back-light units at start-up.

2. OPTICAL CHARACTERISTICS

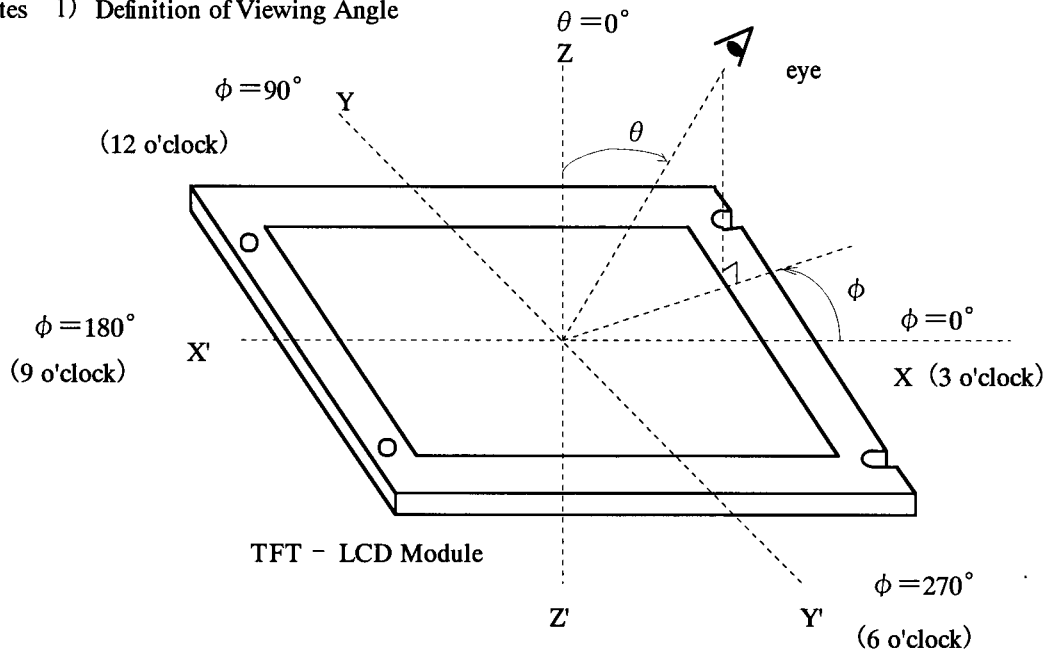
The following optical characteristics shall be measured during operation of unit (SUPER TFT-LCD module and Back-Light) on the condition the measuring systems operation are stable. It takes about 30 minutes. The measured point shall be at the center of the LCD unless any specified. The ambient light excluding light from the backlight unit of the module shall be prohibited.

• Measuring equipment : TOPCON BM-5, BM-7, Pritchard 1980A, or equivalent

Temperature of LCD = 25 °C, VDD = 5.0 V, fV = 60 Hz, IL= 6.5mA

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR		300	400	-		2)
Response Time	Fall	ton		-	15	40	ms	3)
	Rise	toff		-	20	40	ms	3)
Brightness (White)		Bwh		-	(350)	-	cd/m2	
Brightness Uniformity		Buni		70	-	-	%	4)
Color Position on CIE	Red	x	$\theta = 0^{\circ}$ 1)	0.57	0.60	0.63	-	Gray scale =255th level
		y		0.30	0.33	0.36		
	Green	x		0.25	0.28	0.31		
		y		0.54	0.57	0.60		
	Blue	x		0.11	0.14	0.17		
		y		0.07	0.10	0.13		
	White	x		0.25	0.28	0.31		
		y		0.26	0.29	0.32		
Variation of Color Position on CIE	Red	Δx	$\theta = +50^{\circ}$ $\phi = 0^{\circ}$, 90° 180° , 270° 1)	-	-	0.04	-	Gray scale =255th level 5)
		Δy		-	-	0.04		
	Green	Δx		-	-	0.04		
		Δy		-	-	0.04		
	Blue	Δx		-	-	0.04		
		Δy		-	-	0.04		
	White	Δx		-	-	0.04		
		Δy		-	-	0.04		
Contrast Ratio at 80°		CR80°	$\theta = +80^{\circ}$ $\phi = 0^{\circ}$, 90° 180° , 270°	20	-	-	-	

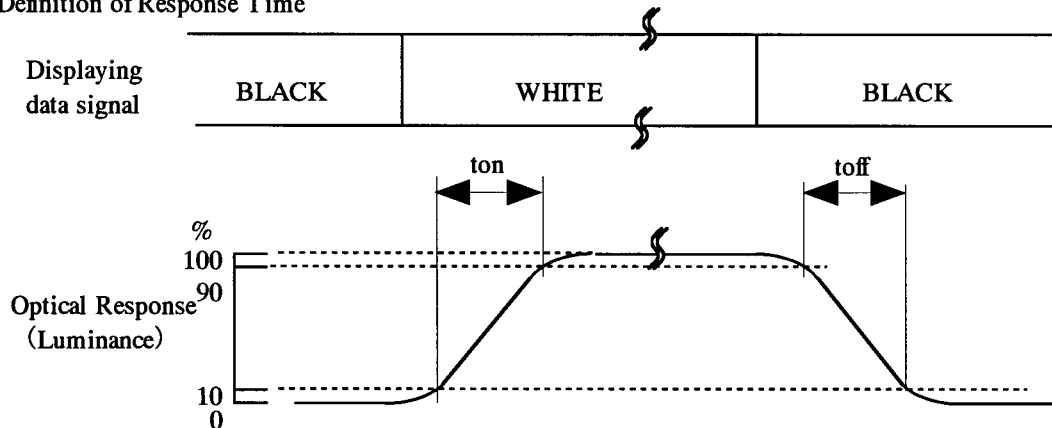
Notes 1) Definition of Viewing Angle



2) Definition of Contrast Ratio(CR):

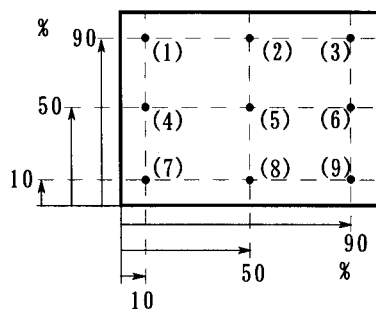
$$CR = \frac{\text{(Luminance at displaying WHITE)}}{\text{(Luminance at displaying BLACK)}}$$

3) Definition of Response Time



4) Definition of Brightness Uniformity

The brightness uniformity (Buni) is defined as the following equation.



$$Buni = \frac{Bmin}{Bmax} \times 100$$

where, Bmax = Maximum brightness among 9 measuring points
Bmin = Minimum brightness among 9 measuring points

(Display Pattern) Gray scale=255th level

• : measuring point

5) Variation of color position on CIE is defined as difference between colors

at $\theta = 0^\circ$ and at $\theta = 50^\circ$ & $\phi = 0^\circ, 90^\circ, 180^\circ, 270^\circ$.

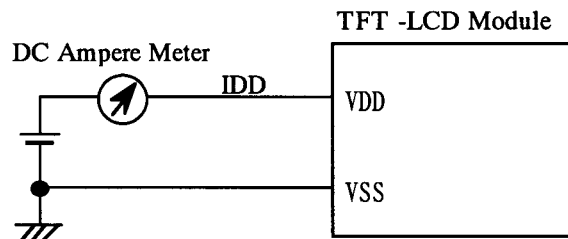
3. ELECTRICAL CHARACTERISTICS

3.1 SUPER TFT-LCD MODULE

Ta=25°C, VSS=0V

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	VDD	4.5	5	5.5	V	
Power Supply Current	IDD	-	720	950	mA	1),2)
VSYNC Frequency	fV	-	60	-	Hz	
HSYNC Frequency	fH	-	48.4	-	kHz	
DCLK Frequency	fCLK	-	32.5	-	MHz	
Input Signal of Low level	ViL	-	-	0.8	V	
Input Signals of High level	ViH	2.0	-	-	V	

Notes 1) DC current at fV=60Hz, fCLK=32.5 MHz, VDD=5.0V and displaying white pattern (Gray scale =255th)



2) Current fuse is built in the module 1.6A.

Current capability of the power supply for VDD shall be larger than 3.2A.

3.2 BACK-LIGHT UNIT

Ta=25°C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp Current	IL	-	6.5	7.0	mA _{rms}	1), 4)
Lamp Voltage	VL	-	600	-	V _{rms}	
Frequency	fL	40	-	60	kHz	2)
Starting Lamp Voltage	VS	1400	-	-	V _{rms}	3)

Notes

1) Higher IL causes the shorter life of a lamp CCFL.

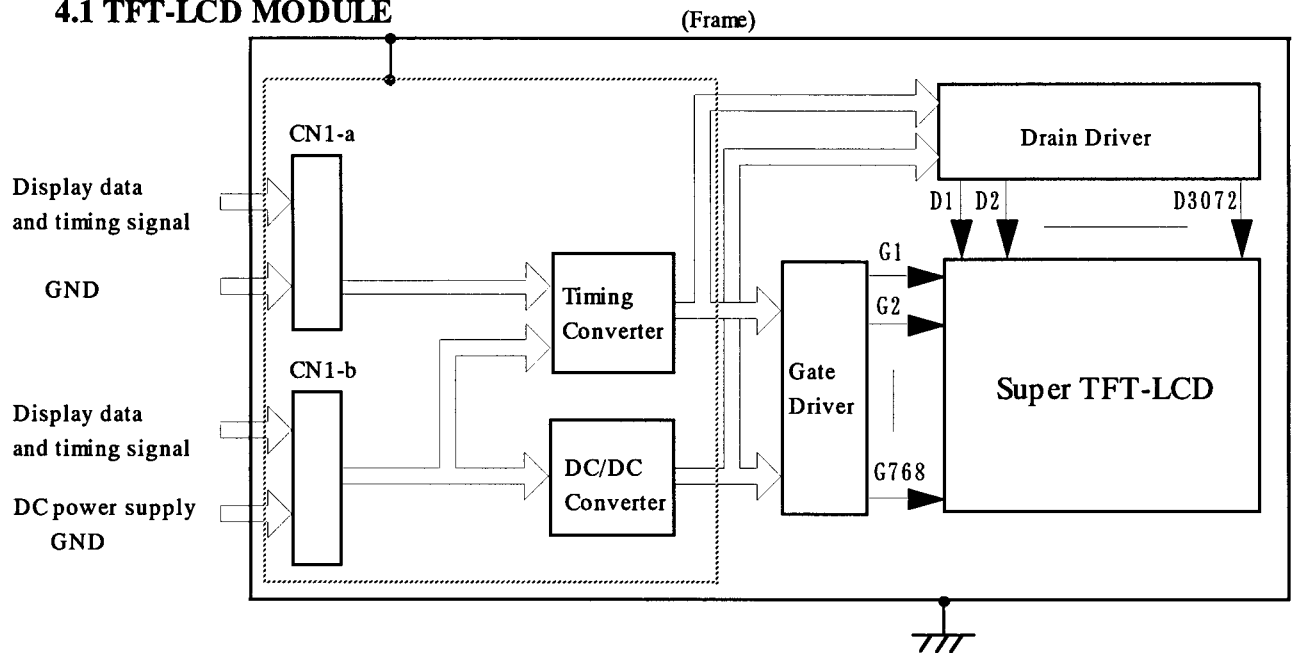
2) Frequency of power supply for a CFL may cause interference with HSYNC frequency and causes beat or flicker on the display. Therefore, lamp frequency shall be as different as possible from HSYNC frequency in order to avoid the interference.

3) Ta = 5 °C

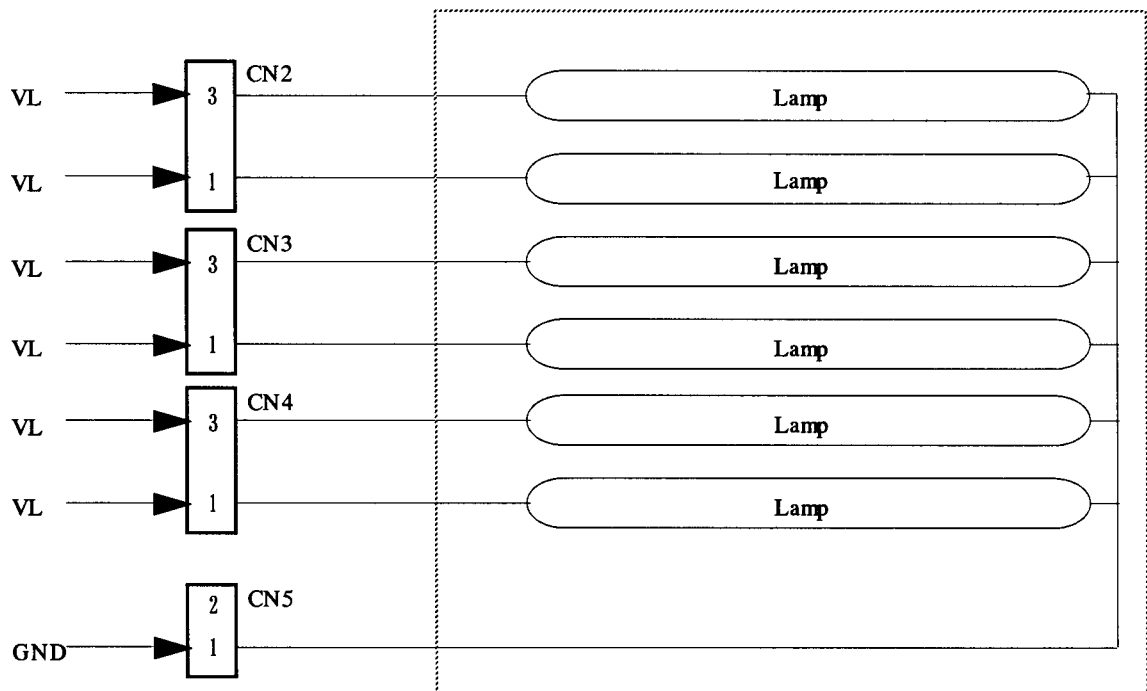
4) The specification shall be applied to each CCFL at GND line. (Back-Light unit consists of 6 pieces of CCFL.)

4. BLOCK DIAGRAM

4.1 TFT-LCD MODULE



4.2 BACK-LIGHT UNIT



5. INTERFACE PIN CONNECTION

5.1 TFT-LCD MODULE

CN1-a : IL-FHR-F40S-HF (JAE)

Pin No.	Symbol	Description	Note
1	FACE	(open)	1)
2	GND	GND(0V)	2)
3	RB7	Second Pixel R Data(MSB)	
4	RB6	Second Pixel R Data	
5	RB5	Second Pixel R Data	
6	RB4	Second Pixel R Data	
7	GND	GND(0V)	2)
8	RB3	Second Pixel R Data	
9	RB2	Second Pixel R Data	
10	RB1	Second Pixel R Data	
11	RB0	Second Pixel R Data(LSB)	
12	GND	GND(0V)	2)
13	GB7	Second Pixel G Data(MSB)	
14	GB6	Second Pixel G Data	
15	GB5	Second Pixel G Data	
16	GB4	Second Pixel G Data	
17	GND	GND(0V)	2)
18	GB3	Second Pixel G Data	
19	GB2	Second Pixel G Data	
20	GB1	Second Pixel G Data	
21	GB0	Second Pixel G Data(LSB)	
22	GND	GND(0V)	2)
23	BB7	Second Pixel B Data(MSB)	
24	BB6	Second Pixel B Data	
25	BB5	Second Pixel B Data	
26	BB4	Second Pixel B Data	
27	GND	GND(0V)	2)
28	BB3	Second Pixel B Data	
29	BB2	Second Pixel B Data	
30	BB1	Second Pixel B Data	
31	BB0	Second Pixel B Data(LSB)	
32	GND	GND(0V)	2)
33	Vsync	Vertical Synchronization	
34	Hsync	Horizontal Synchronization	
35	DTMG	Display Timing	
36	DCLK	Dot Clock	
37	GND	GND(0V)	2)
38	GND		
39	GND		
40	GND		

CN1-b : IL-FHR-F40S-HF (JAE)

Pin No.	Symbol	Description	Note
41	GND	GND(0V)	2)
42	GND		
43	RA7	First Pixel R Data(MSB)	
44	RA6	First Pixel R Data	
45	RA5	First Pixel R Data	
46	RA4	First Pixel R Data	
47	GND	GND(0V)	2)
48	RA3	First Pixel R Data	
49	RA2	First Pixel R Data	
50	RA1	First Pixel R Data	
51	RA0	First Pixel R Data(LSB)	
52	GND	GND(0V)	2)
53	GA7	First Pixel G Data(MSB)	
54	GA6	First Pixel G Data	
55	GA5	First Pixel G Data	
56	GA4	First Pixel G Data	
57	GND	GND(0V)	2)
58	GA3	First Pixel G Data	
59	GA2	First Pixel G Data	
60	GA1	First Pixel G Data	
61	GA0	First Pixel G Data(LSB)	
62	GND	GND(0V)	2)
63	BA7	First Pixel B Data(MSB)	
64	BA6	First Pixel B Data	
65	BA5	First Pixel B Data	
66	BA4	First Pixel B Data	
67	GND	GND(0V)	2)
68	BA3	First Pixel B Data	
69	BA2	First Pixel B Data	
70	BA1	First Pixel B Data	
71	BA0	First Pixel B Data(LSB)	
72	GND	GND(0V)	2)
73	VDD	Power Supply +5V	
74	VDD		
75	VDD		
76	VDD		
77	PIX	(open)	1)
78	GND	GND(0V)	2)
79	GND		
80	TEST	(open)	1)

Notes 1) No connection.

2) All VSS pins shall be grounded. Metal bezel is internally connected to VSS.

5.2 BACK-LIGHT UNIT

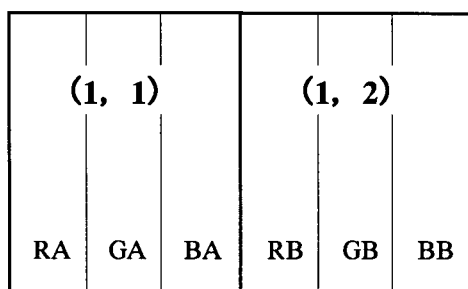
CN2, CN3, CN4 : BHR-03VS-1 (J.S.T.) Matching connector: SM02(8.0)B-BHS-1 (J.S.T.)

Pin No.	Symbol	Description	Note
1	VL	Power Supply	
2	NC	No connection	
3	VL	Power Supply	

CN5 : ZHR-02 (J.S.T.) Matching connector: S2B-ZR-SM3A-TF (J.S.T.)

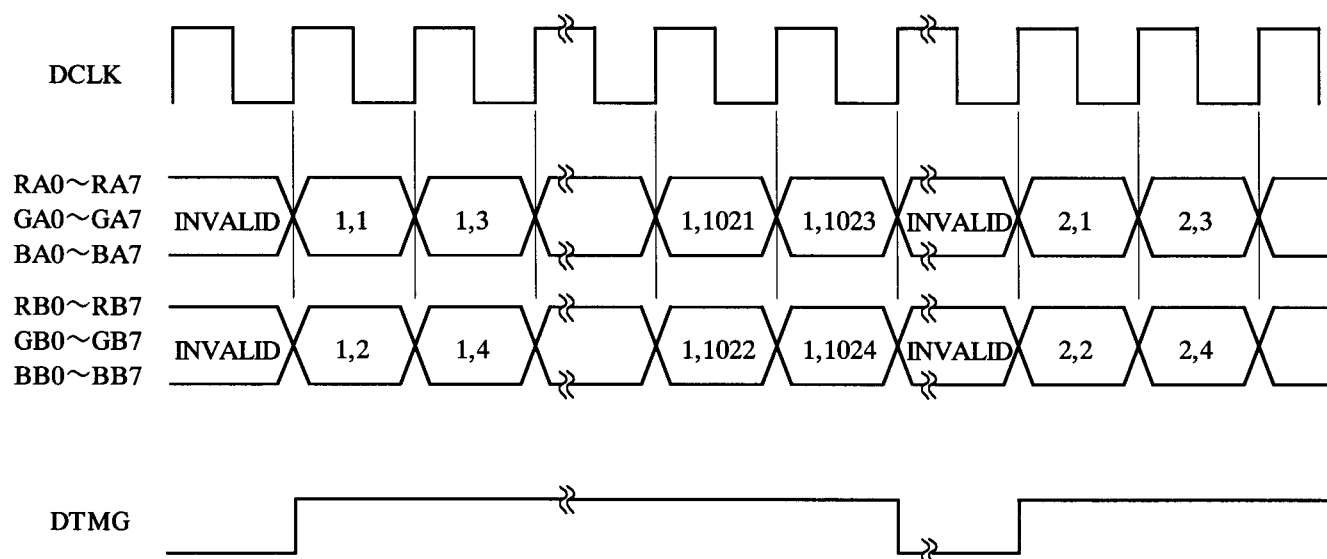
Pin No.	Symbol	Description	Note
1	GND	GND	
2	NC	No connection	

5.3 CORRESPONDENCE BETWEEN INPUT DATA AND SCREEN IMAGE



RA0~RA7 : First Pixel Red Data
 RB0~RB7 : Second Pixel Red Data
 GA0~GA7 : First Pixel Green Data
 GB0~GB7 : Second Pixel Green Data
 BA0~BA7 : First Pixel Blue Data
 BB0~BB7 : Second Pixel Blue Data

1,1	1,2	1,3	_____	1,1024
2,1	2,2	2,3	_____	2,1024
3,1	3,2	3,3	_____	3,1024
⋮	⋮	⋮		⋮
768,1	768,2	768,3	_____	768,1024



5.4 RELATIONS BETWEEN DISPLAYED COLOR AND INPUT DATA

Input Color		Red Data								Green Data								Blue 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							
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	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	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	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	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	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	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	1
Red	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 (1)	0	0	0	0	0	0	0	1	0	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	0
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	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	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	0
Green	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
	Green(1)	0	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	0
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	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	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	0
Blue	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
	Blue(1)	0	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	0
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	Blue(254)	0	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	0	1	1	1	1	1	1	1	1

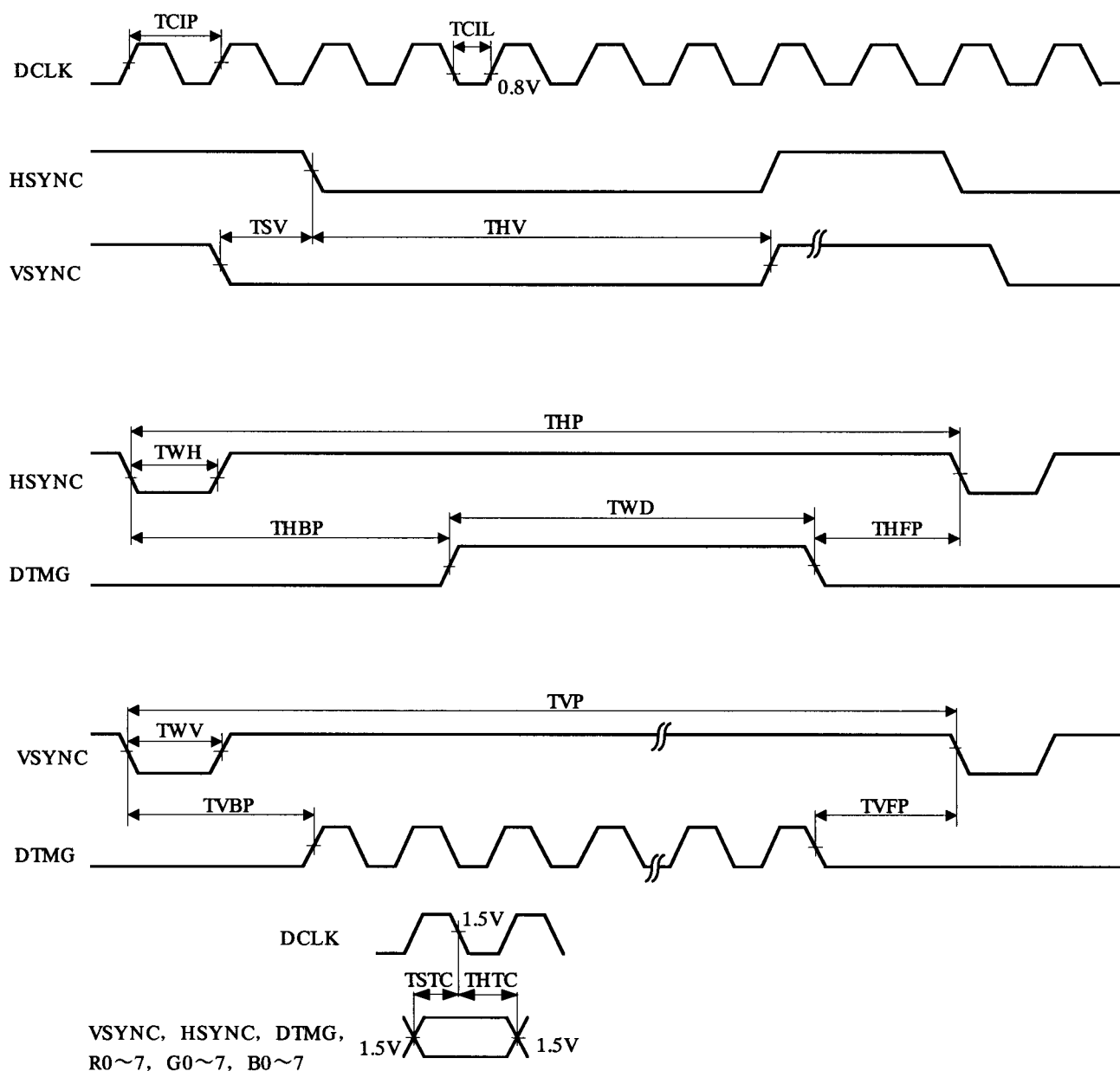
Notes 1) Definition of gray scale:

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

2) Data: 1:High, 0:Low

6. INTERFACE TIMING

6.1 TIMING CHART



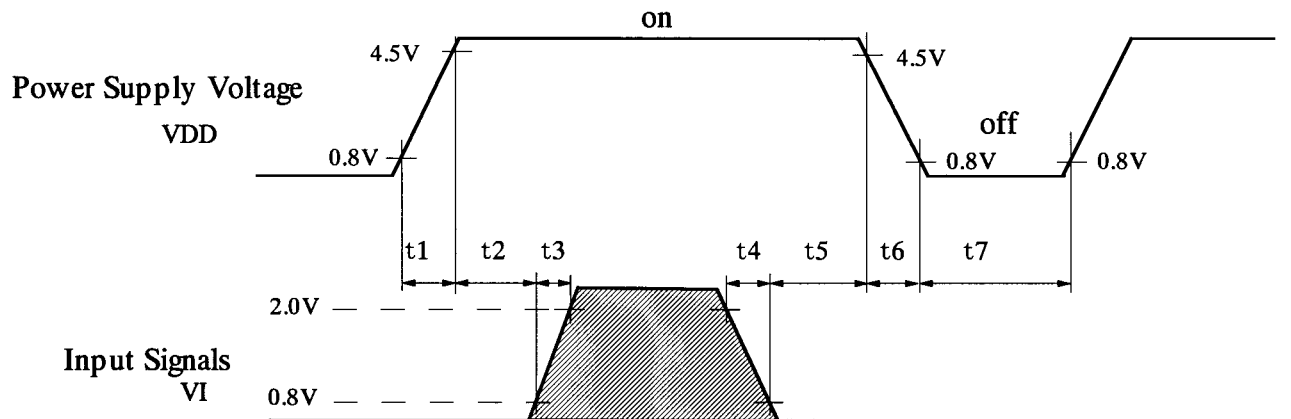
- Notes
- 1) Reference level for each timing signals is 1.5V unless it is stated on the chart, high level voltage(V_{IH}) and low level voltage(V_{IL}) are defined as follows:
 $V_{IH} \geq 2.0V$ $V_{IL} \leq 0.8V$
 - 2) HSYNC, VSYNC is specified in negative polarity.

6.2 INTERFACE TIMING SPECIFICATIONS

	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Period	TCIP	25.0	-	-	ns	
	Duty	D	0.35	0.5	0.65		D=TCIL/TCIP
HSYNC	Period	THP	532	-	1250	TCIP	
	Width-Active	TWH	8	-	240	TCIP	
VSYNC	Set up Time	TSV	0	-	-	TCIP	to HSYNC
	Hold Time	THV	2	-	-	TCIP	
	Period	TVP	772	-	850	THP	
	Width-Active	TWV	1	-	120	THP	
DTMG	Horizontal Back porch	THBP	20	-	255	TCIP	
	Horizontal Front Porch	THFP	0	-	1)	TCIP	
	Vertical Back Porch	TVBP	3	-	2)	THP	
	Vertical Front porch	TVFP	0	-	2)	THP	
	Width-Active	TWD	512	-	-	TCIP	
COMMON	Set up Time	TSTC	4	-	-	ns	
	Hold Time	THTC	2	-	-	ns	

- Notes
- 1) $THBP + THFP \leq 357 \text{ TCIP}$.
 - 2) $TVBP + TVFP \leq 253 \text{ THP}$.
 - 3) $f_V = 1/TVP \leq 60\text{Hz}$ (Refer to the electrical characteristics, see page 6-1/1)
 - 4) $f_H = 1/THP \leq 48.4\text{kHz}$ (Refer to the electrical characteristics, see page 6-1/1)

6.3 TIMING BETWEEN INTERFACE SIGNAL AND POWER SUPPLY



$$\begin{aligned}
 t_1 &\leq 40\text{ms} & 0\text{ms} < t_4 &\leq 3\text{ms} \\
 0\text{ms} < t_2 &\leq 50\text{ms} & 0\text{ms} < t_5 &\leq 50\text{ms} \\
 0\text{ms} < t_3 &\leq 3\text{ms} & 0\text{ms} < t_6 &\leq 1\text{s} \\
 & & t_7 &\geq 0.2\text{s}
 \end{aligned}$$

Power ON OFF

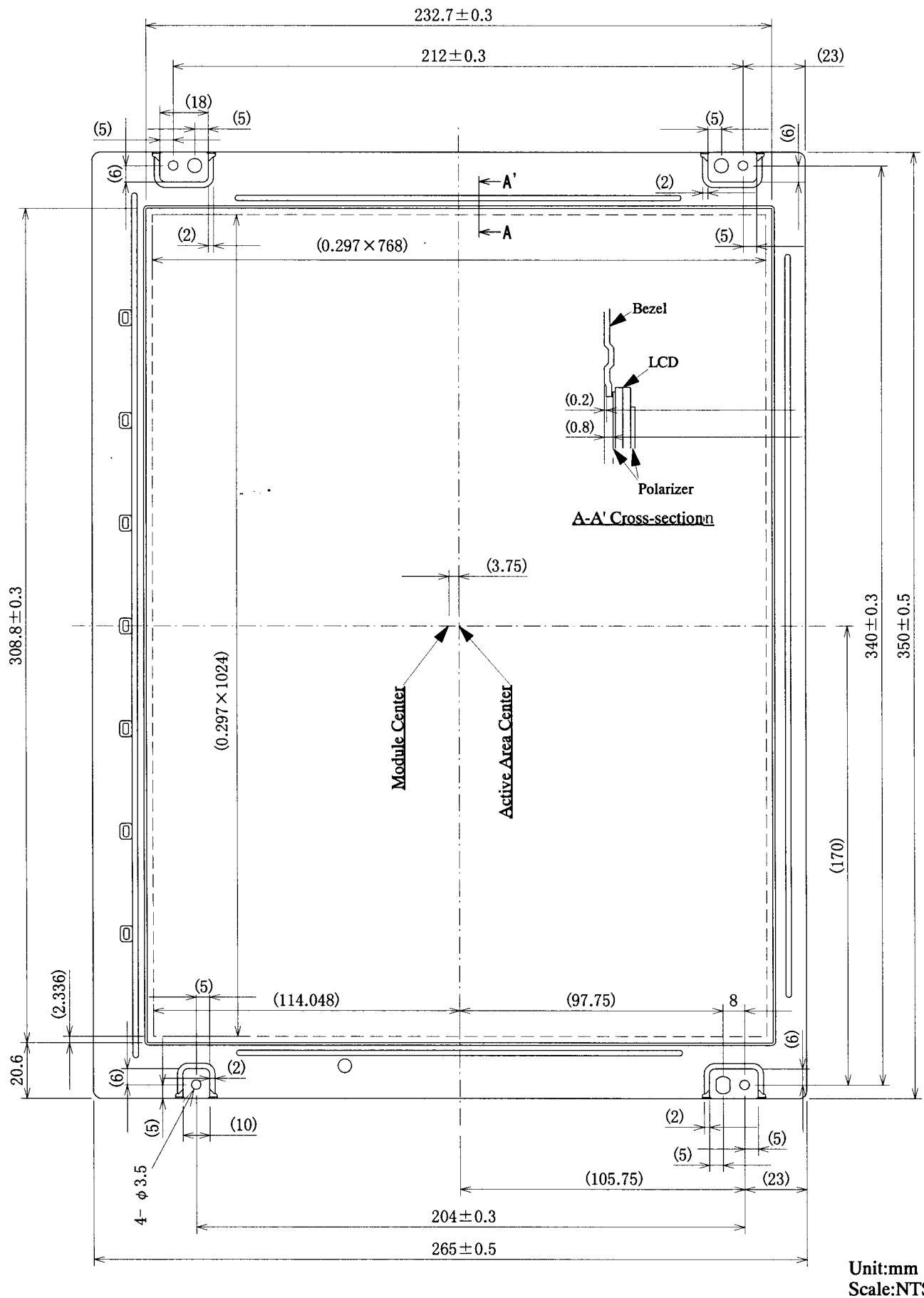
Notes 1) Set $0\text{V} \leq V_I(t) \leq V_{DD}(t)$.

Here, $V_I(t)$, $V_{DD}(t)$ indicate the transitive state of V_I , V_{DD} when power supply is turned ON or OFF.

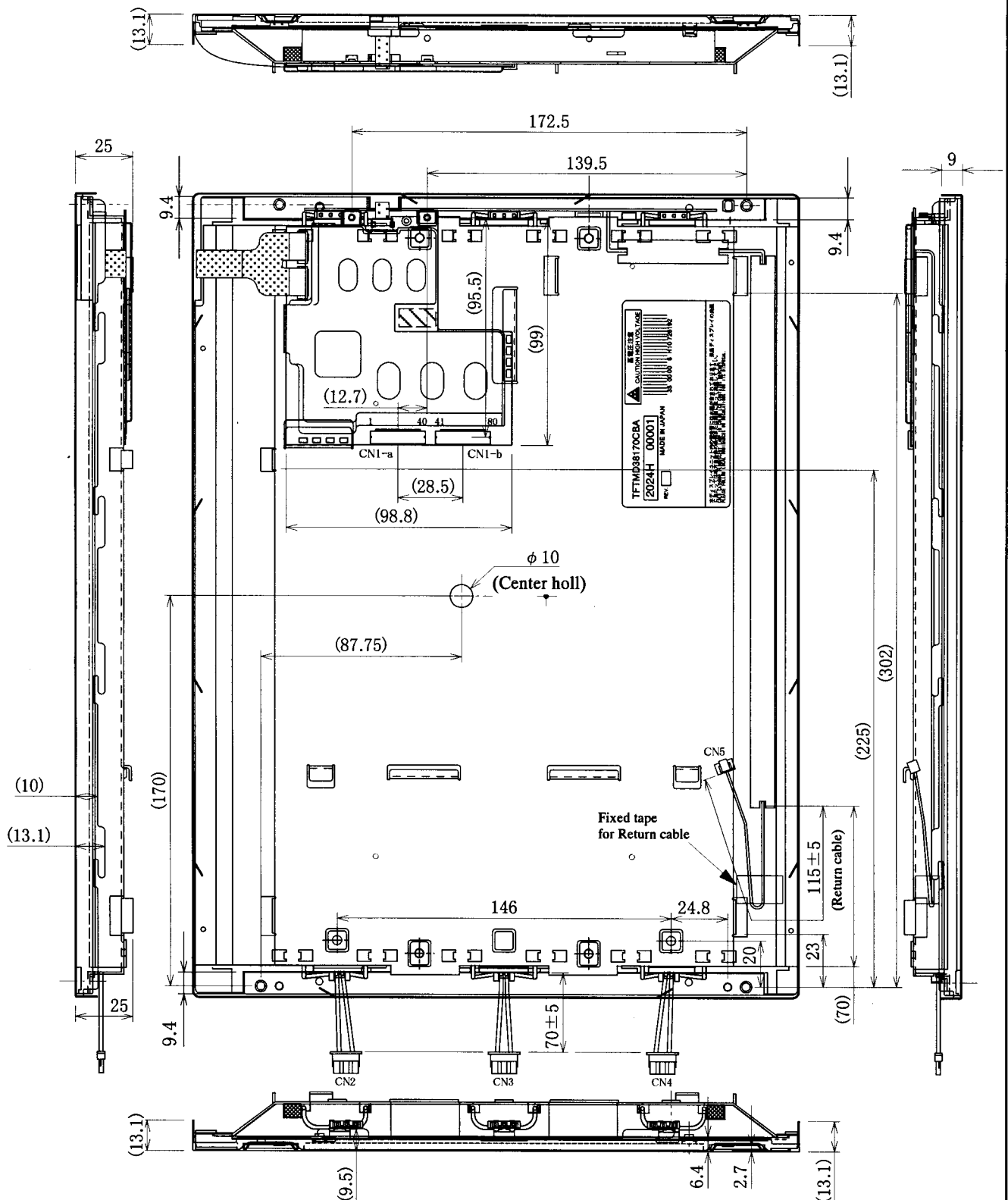
2) Do not keep interface signal high-impedance when power on.

7. DIMENSIONAL OUTLINE

(1) FRONT SIDE



(2) BACK SIDE

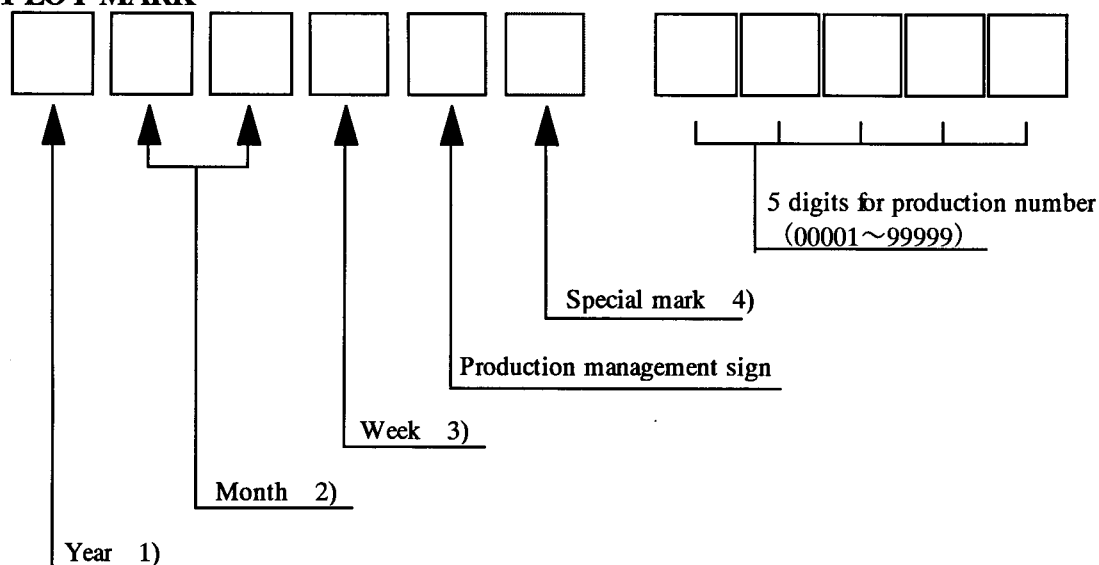


NOTE 1) Dimension in parenthesis are reference value.
2) Tolerance not specified is $\pm 0.5\text{mm}$
3) Measure the values with $9.8 \times 10^4 \text{pa}$ (1.0kgf/cm^2)

Unit:mm
Scale:NTS

8. DESIGNATION OF LOT MARK

8.1 LOT MARK



Notes

1)

Year	Mark
2002	2
2003	3
2004	4
2005	5
2006	6

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

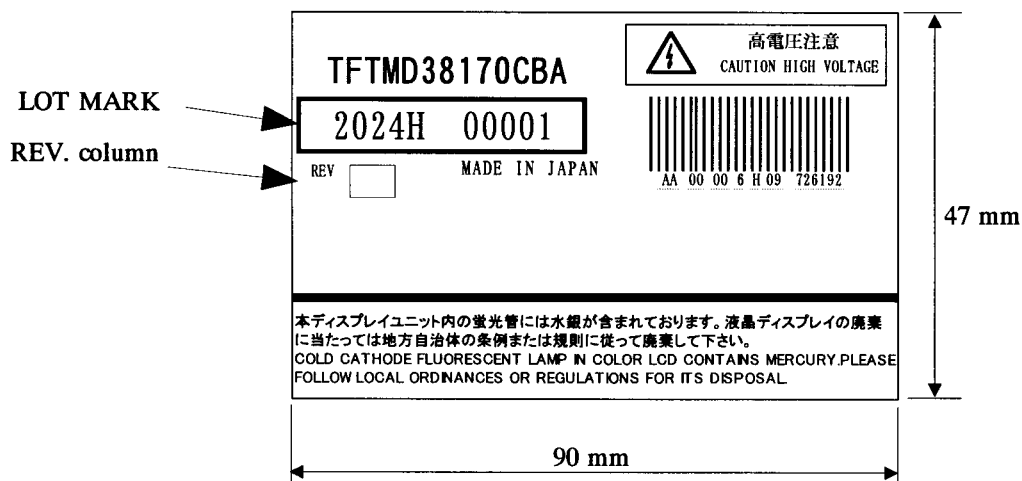
4) It is the mark that was opened up by production person to take correspondence with production number.

8.2 REVISION(REV.) CONTROL

REV. column is the column for the 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.

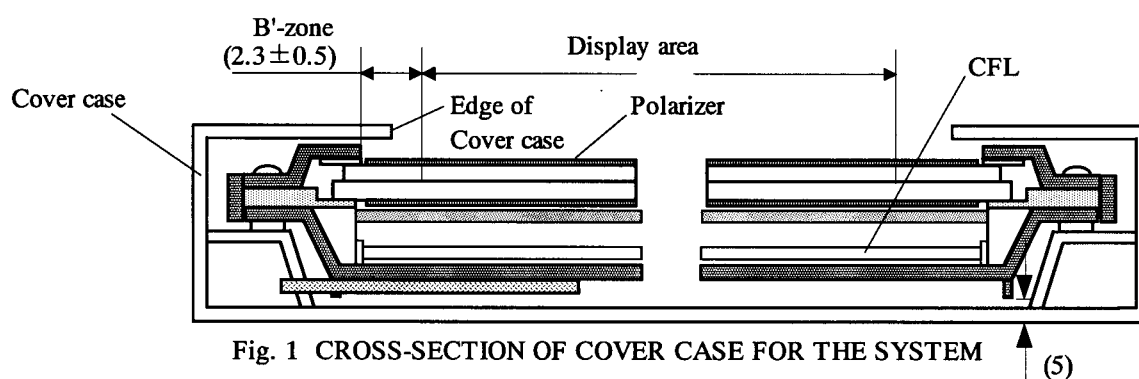


10. PRECAUTIONS

Please take care about the followings in handling the TFT Module.

10.1 PRECAUTIONS TO MOUNTING

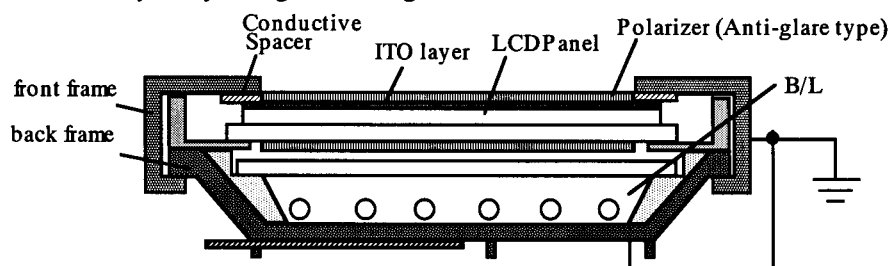
- (1) Since the module is thin and heavy, applying strong force to a part of the module may cause partial deformation of frame or mold, and cause damage to the display.
- (2) The module shall gently and firmly be held by both hands. Never hold the longer side of the module by just one hand in order to avoid any internal damage. Never drop or hit the module. Never make any pressure on the display surface.
- (3) The module shall be installed with mounting holes at each corner of the module with an appropriate torque, 0.6N·m or less should be recommended.
- (4) Uneven force such as twisted stress shall not be applied to the module when the module is mounted on the cover case. And, the cover case must have sufficient strength so that external force can not be transmitted directly to the module.
- (5) The space between the edge side of the back of the module and the cover case shall be 5.0mm or more, in order to suppress bending potential of the module. (See Fig. 1)



- (6) The edge of the cover case shall be located more than 1 mm from the edge of the module front frame.
- (7) When a transparent protective plate will be added on the displaying area of the module in order to protect polarizer and SUPER TFT-LCD cell, the transparent protective plate shall have sufficient strength so that the plate can not touch the module by external force.
- (8) Materials with acetic acid type or choline type shall not be used for the cover case as well as other parts and boards near the module. Because, gases from the materials at higher temperature are corrosive and attack the module. Acetic acid type attacks the polarizer. Choline type attacks electric circuits due to electro-chemical reaction.
- (9) The polarizer on the TFT-LCD cell shall carefully be handled due to its softness, and shall not be touched, pushed or rubbed with glass, tweezers or anything harder than HB pencil lead. The surface of the polarizer shall not be touched and rubbed with bare hand, greasy clothes or dusty clothes with chemical treatment. (Some cosmetics are detrimental to the polarizer.)
- (10) The surface of the polarizer shall be gently wiped with absorbent cotton, chamois or other soft materials slightly contained petroleum benzene when the surface becomes dirty.
- (11) Normal-Hexane as cleaning chemicals is recommended in order to clean the adhesives which fix front / rear polarizers on the SUPER TFT-LCD cell. Other cleaning chemicals such as acetone, toluene and alcohol shall not be used to the adhesives because they cause chemical damage to the polarizer.
- (12) Saliva or water drops shall be immediately wiped off. Otherwise, the portion of the polarizer may be deformed and its color may be faded.
- (13) The module shall not be opened or modified. Otherwise, it may cause malfunctions.
- (14) Metallic bezel of the module shall not be handled with bare hand or dirty gloves. Otherwise, color of the metallic frame may become dirty during its storage. It is recommended to use both clean soft gloves and clean finger stalls when the module is handled at incoming inspection process and production (assembly) process.
- (15) The cable for lamp(CFL) shall not be pull or held. Interface cable shall be installed with an appropriate procedure.

10.2 PRECAUTIONS TO OPERATION

- (1) The ambient temperature near the operated module shall be satisfied with the absolute maximum ratings. Unless it meets the specifications, sufficient cooling system shall be adopted to the cover case.
- (2) The spike noise causes the mis-operation of the module. The level of the spike noise shall be as follows :
 $-200\text{ mV} \leq \text{over- and under- shoot of VDD} \leq +200\text{ mV}$
VDD including over- and under- shoot shall be satisfied with the absolute maximum ratings.
- (3) Optical response time, luminance and chromaticity depend on the temperature of the SUPER TFT-LCD cell. It would be realized that the response time becomes longer at lower temperature operation. Besides, it would also be realized that the time to saturate luminance of the lamp(CFL) becomes longer at lower temperature operation.
- (4) Sudden temperature change may cause dew on and/or in the module. Dew makes damage to polarizer and/or electrical contacting portion. And dew causes fading of displayed quality such as smear, spot and soon.
- (5) Fixed patterns displayed on the module for a long time may cause after-image. It will be recovered sooner or later.
- (6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the radiation.
- (7) Noise may hear when a back-light unit is operated. If necessary, sufficient suppression shall be done by system manufacturers.
- (8) The cable between the back-light connector and its inverter power supply shall be a minimized length and be connected directly. The longer cable between the back-light and the inverter may cause lower luminance of lamp(CFL) and may require higher starting lamp voltage (VS).
- (9) The module shall not be connected or disconnected while a main system is still on.
- (10) To avoid after image, it is recommended not to display a still image for a long time, and not to apply any direct current as display data to the LCD. Especially, display data shall be carefully checked at the output of data processing circuits in the I/F board, such as frame rate control.
- (11) The glass surface is coated with a conductive layer (ITO layer) as shown in the figure. This layer is electrically connected to the front metal frame through the conductive spacer. Both of the front and back metal frames should be electrically connected to your system ground using the mountain holes.



10.3 ELECTROSTATIC DISCHARGE CONTROL

- (1) Since the module consists of SUPER TFT-LCD cell and electronic circuits with CMOS-ICs, which are very weak to electrostatic discharge, persons who are handling the module shall be grounded through adequate methods such as list band. Pins of I/F connector shall not be touched directly with bare hands.
- (2) Protection film for polarizer on the module shall be slowly peeled off just before the use so that the electrostatic charge can be minimized.

10.4 PRECAUTIONS TO STRONG LIGHT EXPOSURE

- (1) The module shall not be exposed under strong light. Otherwise, characteristics of the polarizer and color filter in the module may be degraded.

10.5 PRECAUTIONS TO STORAGE

When the module for replacement are stored for long time, following precautions shall be taken care of:

- (1) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the storage. The module shall be stored at 5 to 35 °C at normal humidity (60 % RH or less).
- (2) The surface of the polarizer shall not come in contact with any other object. It is recommended that the module shall be stored in the same shipping container that Hitachi used.

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10.6 PRECAUTIONS TO HANDLING PROTECTION FILM

- (1) The protection film for polarizer shall be peeled off slowly and carefully by persons who are electrically grounded with adequate methods such as list band. Besides, ionized air shall be blown over during the peeling action. Dusts on the polarizer shall be blown off by an ionized nitrogen gun and so on.
- (2) The protection film shall be peeling off without rubbing it to the polarizer. Because, if the film is rubbed together with the polarizer, since the film is attached to the polarizer with a small amount of adhesive, the adhesive may remain on the polarizer.
- (3) The module with protection film shall be stored at the conditions explained in (1) of 10.5. However, if the storing time is too long, the adhesive may remain on the polarizer even after the protection film is slowly peeled off. If the module is stored at higher temperature and/or higher humidity, the adhesive may remain more on the polarizer. The remained adhesive may causes non-uniformity.
- (4) The adhesive can be removed easily with Normal-Hexane. The remained adhesive or its vestige on the polarizer shall be wiped off with absorbent cotton or other soft materials such as chamois slightly contained Normal-Hexane.

10.7 SAFETY

- (1) Since SUPER TFT-LCD cell and lamp(CFL) are made of glass, handling to the broken module shall be taken care sufficiently in order not to be injured. Hands touched the liquid crystal from the broken cell shall be washed sufficiently.
- (2) Electrically conductive wire shall not be inserted in the CFL units. Because, the unit has a high voltage circuit internally.
- (3) The CFL inverter should be designed to prevent continuous over current and overvoltage what happen due to any backlight trouble.
Please check the operation of your inverter safety protection circuit under abnormal condition with your actual complete set.

10.8 ECOLOGY

- (1) The lamp of backlight has a little mercury. Please handle it appropriately in case of disposal.
- (2) Flex cable and Printed Wire Board have a little lead. Then, please handle them appropriately in case of disposal.

10.9 USE RESTRICTIONS AND LIMITATIONS

- (1) This product is not authorized for use in life support devices or systems, military applications, or other applications which pose a significant risk of personal injury. Therefore, the product shall not be used for such purposes.
- (2) In no event shall Hitachi, Ltd., be liable for any incidental, indirect, or consequential damages in connection with the installation or use of this product, even if informed of the possibility thereof in advance. These limitations apply to all causes of action in the aggregate, including without limitation breach of contract, breach of warranty, negligence, strict liability, misrepresentation and other torts.

10.10 OTHERS

- (1) Electrical components which may not affect electrical performance are subjective to change without notice because of their availability etc.