HITACHI

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TECHNICAL DATA

SPECIFICATIONS OF 15.0" TFT-LCD MODULE

TFTMD38140CBA

CONTENTS

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: TFTMD38140CBA

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	LVDS 1-channel	
Back-Light	4 pcs. of CFL	
	(Edge Light 2 pcs. at each top and bottom side)	
External Dimensions	H 350× V 265× t 19	(mm)
Weight	Max. 1700	(g)

Note   LVDS : Low Voltage Differential Signaling
        CFL : Cathode Fluorescent Lamp

1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

Item	Operation		Non-operation		Unit	Note
	Min.	Max.	Min.	Max.		
Temperature	5	45	-20	60	℃	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			
Illumination at LCD Surface	—	50,000	—	50,000	lx	

Notes 1) "Temperature" and "Humidity" shall be at glass surface of a Super TFT-LCD Module, not in the system installed with the Module. Operation shall be at the temperature below 60℃ at rear surface center. The brightness of a CFL in the Back-Light unit drops at lower temperature. Besides, the life of the CFL gets shorter at lower temperature.
  2) Ta≦40 ℃ --- ・Humidity shall be less than 85 % RH Max. .
     ・Non condensation
   Ta＞40 ℃ --- ・Absolute humidity shall be lower than the saturated vapor of the 85 % RH at 40 ℃.
     ・Dew is prohibited.
  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) SUPER TFT-LCD MODULE
VSS=0V

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage for logic	VDD	0	6	V	
Input signal Voltage for logic	VI	-0.3	3.3 +0.3	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℃ - 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 metal bezel and a LCD panel.

(2) BACK-LIGHT UNIT
GND=0V

Item	Symbol	Min.	Max.	Unit	Note
Lamp Current	IL	-	13.5	mArms	1)
Lamp Voltage	VL	-	2000	Vrms	2)

Notes 1) The specification shall be applied to each CFL unit. (A CFL unit consists of two pieces of CFLs.)
  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 the 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 : Pritchard 1980A, or equivalent

Temperature of LCD = 25 ℃, VDD = 5.0 V, fV = 60 Hz, IL= 12.0mA

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR		150	300	—		2)
Response Time	Fall	ton		—	25	40	ms	3)
	Rise	toff		—	25	40	ms	3)
Brightness (White)		Bwh		160	200	—	cd/m2	
Brightness Uniformity		Buni		70	—	—	%	4)
Color Position on CIE	Red	x	θ =0℃ 1)	0.59	0.62	0.65	—	Gray scale =255th level (Maximum)
		y		0.31	0.34	0.37		
	Green	x		0.26	0.29	0.32		
		y		0.57	0.60	0.63		
	Blue	x		0.12	0.15	0.18		
		y		0.08	0.11	0.14		
	White	x		0.28	0.31	0.34		
		y		0.31	0.34	0.37		
Variation of Color Position on CIE	Red	Δx	θ =+50° ϕ =0° , 90° 180° , 270° 1)	—	—	0.05	—	Gray scale =255th level (Maximum) 5)
		Δy		—	—	0.05		
	Green	Δx		—	—	0.05		
		Δy		—	—	0.05		
	Blue	Δx		—	—	0.05		
		Δy		—	—	0.05		
	White	Δx		—	—	0.05		
		Δy		—	—	0.05		
Contrast Ratio at 80°		CR80°	θ =+80° ϕ =0° , 90° 180° , 270°	20	—	—	—	

Notes   1) Definition of Viewing Angle

$\theta = 0°$

Z

(Viewing Angle)

θ

eye

$\phi = 90°$ Y

(12 o'clock)

$\phi = 180°$ X'

(9 o'clock)

ϕ (Azimuth)

$\phi = 0°$

X (3 o'clock)

TFT – LCD Module

Z'   Y'

$\phi = 270°$

(6 o'clock)

2) Definition of Contrast Ratio(CR):

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

3) Definition of Response Time

Displaying data signal

| BLACK | WHITE | BLACK |

ton   toff

%
100
90

Optical Response
(Luminance)

10
0

4) Definition of Brightness Uniformity

Display Area

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

% 90

Display Area

50

10

(1) (2) (3)
(4) (5) (6)
(7) (8) (9)

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

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

(Display Pattern) Gray scale=255th level

90
50   %
10

• :measuring point

5) Variation of color position on CIE is defined as difference between colors
at $\theta = 0°$ and at $\theta = 50°$ & $\phi = 0°$, $90°$, $180°$, $270°$.

3. ELECTRICAL CHARACTERISTICS

3.1 SUPER TFT-LCD MODULE
Ta=25℃, VSS=0V

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	VDD	4.5	5	5.5	V	
Power Supply Current	IDD	—	660	900	mA	1), 2)
VSYNC Frequency	fV	—	60	75	Hz	
HSYNC Frequency	fH	—	48.4	60.24	kHz	
DCLK Frequency	fCLK	—	65	80	MHz	
Input Signals	VI	—	—	—	V	3)

Notes   1) DC current at fV=60Hz, fCLK=65 MHz, VDD=5.0V, and All white screen

DC Ampere Meter

TFT -LCD Module

VDD

VSS
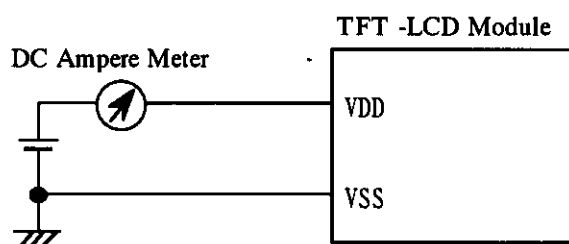
2)Current fuse is built in the module 1.6A.
Current capability of the power supply for VDD shall be larger than 3.2A.

3) Characteristics of the input signals are to conform to the LVDS-data-sheets.
(transmitter : THC63LVDM83A (LVDS83A),   receiver :THC63LVDF84A by THine Microsystems, Inc.)

3.2 BACK-LIGHT UNIT
Ta=25℃

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp Current	IL	6.5	—	13.0	mArms	1), 4)
Lamp Voltage	VL	—	600	—	Vrms	5)
Frequency	fL	40	—	60	kHz	2)
Starting Lamp Voltage	VS	1500	—	1950	Vrms	3)

Notes
1) Longer IL causes the shorter life of a lamp CFL.
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.
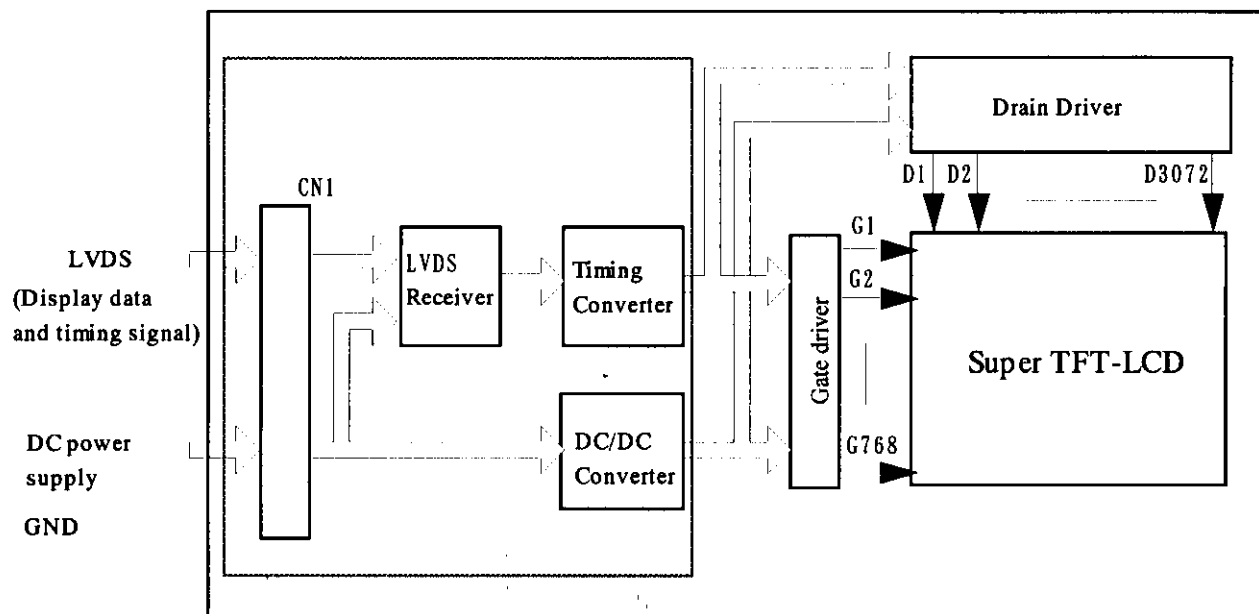3) Ta = 0 ℃
4) The specification shall be applied to each CFL unit. (A CFL unit consists of two pieces of CFL.)
5) Recommended inverter for the back-light unit:
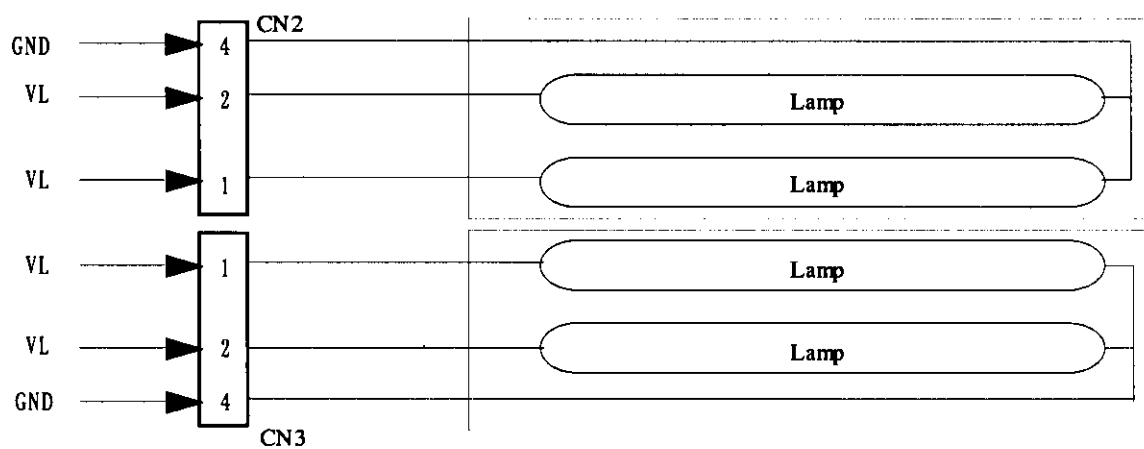   MODEL: PH - BLC51 by HITACHI MEDIA ELECTRONICS

4. BLOCK DIAGRAM
4.1 TFT-LCD MODULE

4.2 BACK-LIGHT UNIT

Reflector is not connect.

Color of wires from CFL to CN2 and CN3

4   (GND) : White
1, 2   (VL)   : Pink

5. INTERFACE PIN CONNECTION

5.1 TFT-LCD MODULE

CN1 : FI-SE20P-HF (JAE)   Mating connector : FI-SE20M (JAE)

Pin No.	Symbol	Description	Note
1	VDD	Power Supply (typ.+5V)	1)
2	VDD		
3	VSS	GND (0V)	2)
4	VSS		
5	Rx0-	Pixel Data	3)
6	Rx0+		
7	VSS	GND (0V)	2)
8	Rx1-	Pixel Data	3)
9	Rx1+		
10	VSS	GND (0V)	2)
11	Rx2-	Pixel Data	3)
12	Rx2+		
13	VSS	GND (0V)	2)
14	CLK-	Pixel Clock	3)
15	CLK+		
16	VSS	GND (0V)	2)
17	Rx3-	Pixel Data	3)
18	Rx3+		
19	VSS	GND (0V)	2)
20	VDD	Power Supply (typ.+5V)	1)

Notes   1) All VDD pins shall be connected to +5.0V(Typ.).
2) All VSS pins shall be grounded. Metal bezel is internally connected to VSS.
3) Rx n+ and Rx n- (n=1,2,3) should be wired by twist-pairs or side-by-side FPC patterns, respectively.

5.2 BACK-LIGHT UNIT

CN2, CN3 : BHR-04VS-1 (J.S.T.)
Mating connector : SM03(7-D1)B-BHS-1 (J.S.T.)

Pin No.	Symbol	Description	Note
1	VL	Power Supply	
2	VL	Power Supply	
3	NC	No connection	
4	GND	GND(0V)	

5.3 BLOCK DIAGRAM OF INTERFACE
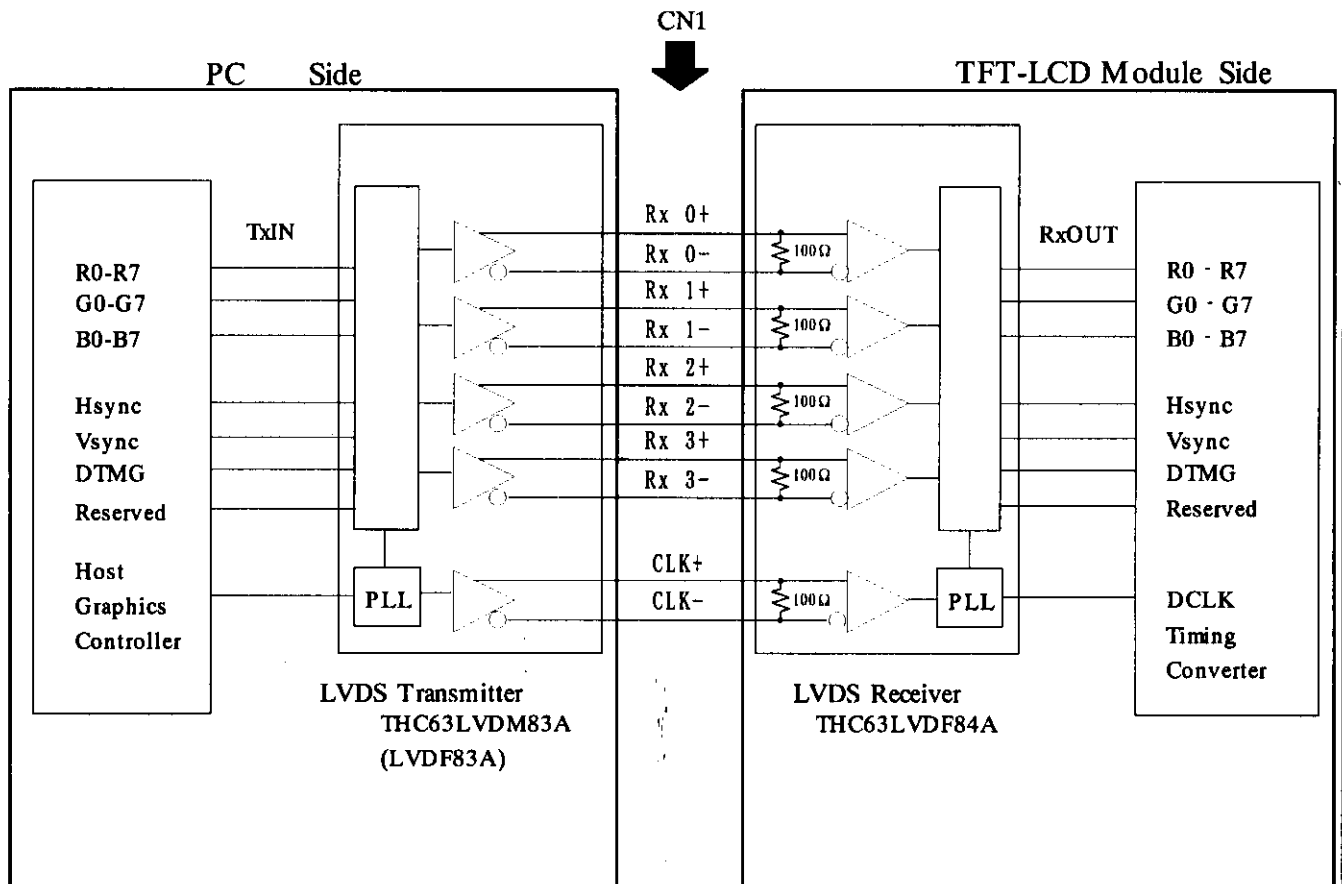
R0~R7	: Pixel R Data
G0~G7	: Pixel G Data
B0~B7	: Pixel B Data
HSYNC	: Horizontal synchronization signal
VSYNC	: Vertical synchronization signal
DTMG	: Display timing signal

Notes   1) The system must have the transmitter to drive the module.

2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line when it is used differentially.

3) Reserved pins on the transmitter shall be connected with VSS.

5.4 LVDS INTERFACE

|	SIGNAL	TRANSMITTER THC63LVDM83A		INTERFACE CONNECTOR		RECEIVER THC63LVDF84A		TFT CONTROL INPUT
		PIN	INPUT	PC	TFT-LCD	PIN	OUTPUT	
	R2	51	Tx IN0			27	Rx OUT0	R2
	R3	52	Tx IN1			29	Rx OUT1	R3
	R4	54	Tx IN2	TA OUT0+	Rx 0+	30	Rx OUT2	R4
	R5	55	Tx IN3			32	Rx OUT3	R5
	R6	56	Tx IN4			33	Rx OUT4	R6
	R7	3	Tx IN6	TA OUT0-	Rx 0-	35	Rx OUT6	R7
	G2	4	Tx IN7			37	Rx OUT7	G2
	G3	6	Tx IN8			38	Rx OUT8	G3
	G4	7	Tx IN9			39	Rx OUT9	G4
	G5	11	Tx IN12	TA OUT1+	Rx 1+	43	Rx OUT12	G5
	G6	12	Tx IN13			45	Rx OUT13	G6
	G7	14	Tx IN14			46	Rx OUT14	G7
	B2	15	Tx IN15	TA OUT1-	Rx 1-	47	Rx OUT15	B2
24bit	B3	19	Tx IN18			51	Rx OUT18	B3
	B4	20	Tx IN19			53	Rx OUT19	B4
	B5	22	Tx IN20			54	Rx OUT20	B5
	B6	23	Tx IN21	TA OUT2+	Rx 2+	55	Rx OUT21	B6
	B7	24	Tx IN22			1	Rx OUT22	B7
	HSYNC	27	Tx IN24			3	Rx OUT24	HSYNC
	VSYNC	28	Tx IN25	TA OUT2-	Rx 2-	5	Rx OUT25	VSYNC
	DTMG	30	Tx IN26			6	Rx OUT26	DTMG
	R0	50	Tx IN27			7	Rx OUT27	R0
	R1	2	Tx IN5			34	Rx OUT5	R1
	G0	8	Tx IN10	TA OUT3+	Rx 3+	41	Rx OUT10	G0
	G1	10	Tx IN11			42	Rx OUT11	G1
	B0	16	Tx IN16			49	Rx OUT16	B0
	B1	18	Tx IN17	TA OUT3-	Rx 3-	50	Rx OUT17	B1
	RSVD 1)	25	Tx IN23			2	Rx OUT23	not connect
	DCLK	31	TxCLK IN	TxCLK OUT+ TxCLK OUT-	RxCLK IN+ RxCLK IN-	26	RxCLK OUT	DCLK

R0~R7 : Pixel R Data (7 ; MSB, 0 ; LSB)
G0~G7 : Pixel G Data (7 ; MSB, 0 ; LSB)
B0~B7 : Pixel B Data (7 ; MSB, 0 ; LSB)
HSYNC : Horizontal synchronization signal
VSYNC : Vertical synchronization signal
DTMG : Display timing signal

Notes 1) RSVD(reserved) pins on the transmitter shall be connected with VSS.

5.5 CORRESPONDENCE BETWEEN INPUT DATA AND SCREEN IMAGE

(1, 1)

R　G　B
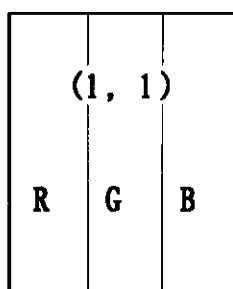
pixel ： R0～R7 :R data
G0～G7 :G data
B0～B7 :B data

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

DCLK

R0～R7
G0～G7   INVALID ✕ 1, 1 ✕ 1, 2 ✕ 1, 1023 ✕ 1, 1024 ✕ INVALID ✕ 2, 1 ✕ 2, 2 ✕
B0～B7

DTMG
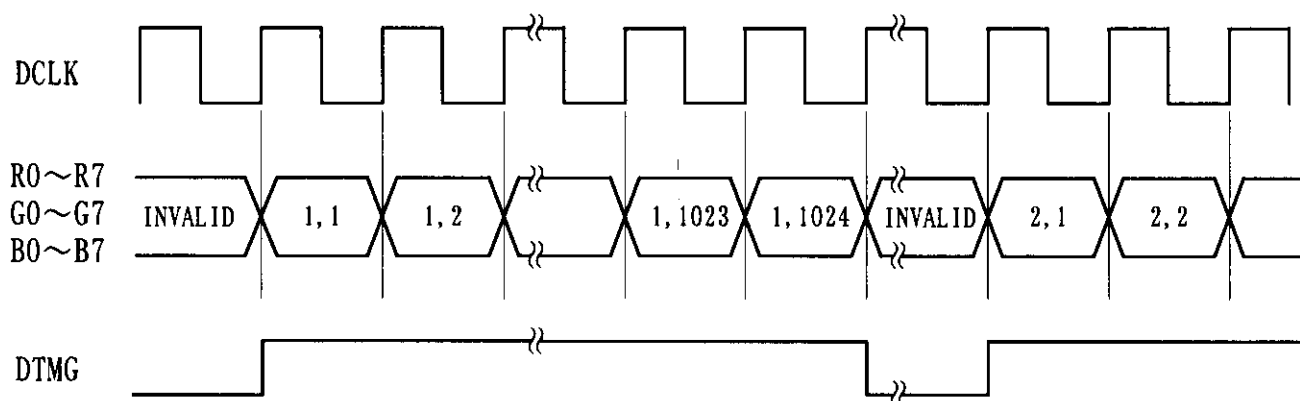
5.5 RELATIONSHIP BETWEEN DISPLAYED COLOR AND INPUT DATA

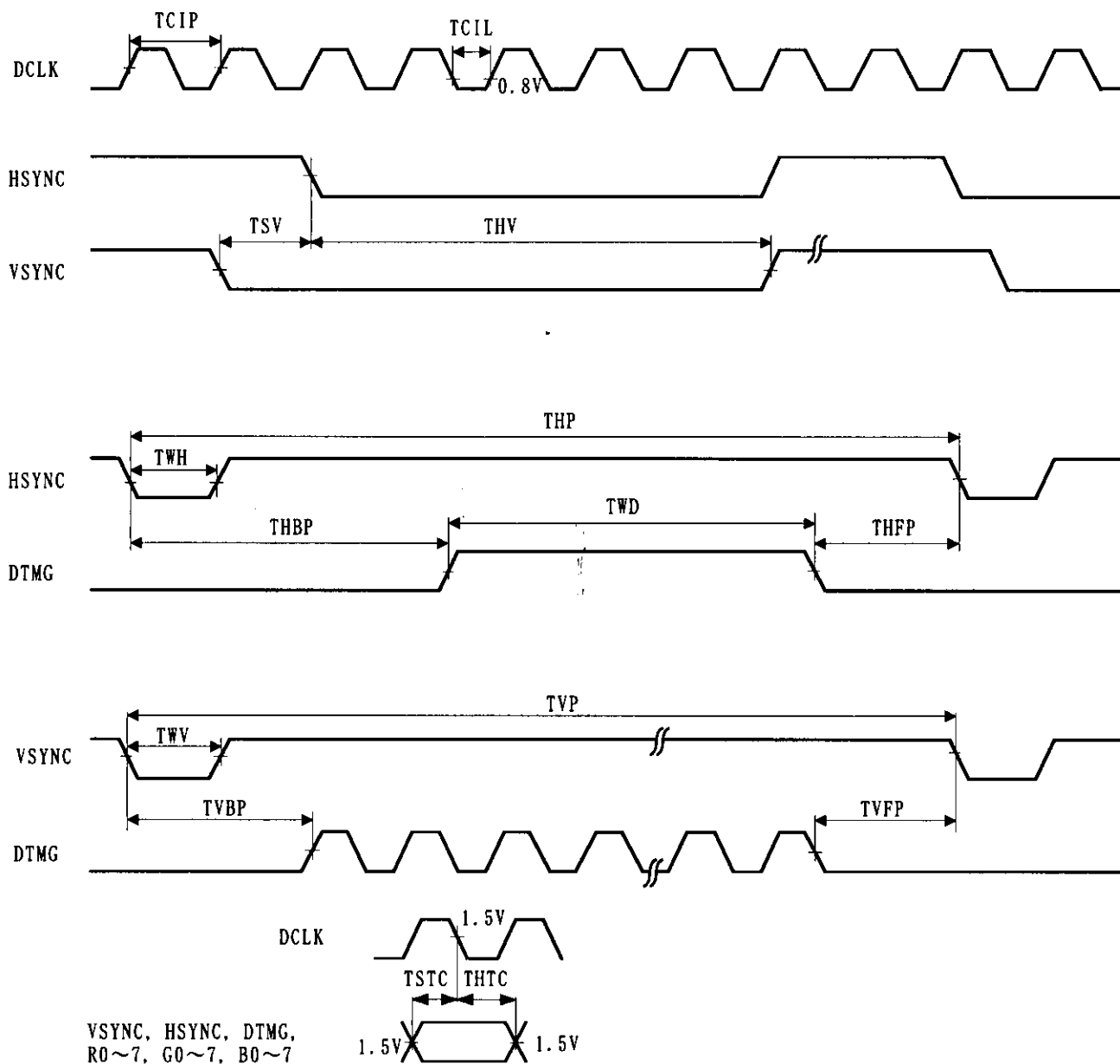| Color	Input	Red Data								Green Data								Blue Data							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
		MSB							LSB	MSB							LSB	MSB							LSB
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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

DCLK — TCIP, TCIL, 0.8V

HSYNC

VSYNC — TSV, THV

HSYNC — THP, TWH, THBP, TWD, THFP

DTMG

VSYNC — TVP, TWV, TVBP, TVFP

DTMG

DCLK — 1.5V, TSTC, THTC

VSYNC, HSYNC, DTMG, R0~7, G0~7, B0~7 — 1.5V, 1.5V

Notes   1) Reference level for each timing signal is 1.5V unless it is stated on the chart , high level voltage(VIH) and low level voltage(VIL) are defined as follows:

$V_{IH} \geqq 2.0\,V$ $V_{IL} \leqq 0.8\,V$

The above definition conforms the timing of DCLK to other signals to the specifications of LVDS transmitter (THC63LVDM83A / by THine Microsystems, Inc.).

2) HSYNC, VSYNC timing is specified in negative polarity.

6.2 INTERFACE TIMING SPECIFICATIONS

Item		Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Period	TCIP	12.5	—	—	ns	
	Duty	D	0.35	0.5	0.65		D=TCIL/TCIP
HSYNC	Period	THP	1072	—	2500	TCIP	
	Width-Active	TWH	8	—	240	TCIP	
VSYNC	Set up Time	TSV	0	—	—	TCIP	to HSYNC
	Hold Time	THV	2	—	—	TCIP	
	Period	TVP	772	—	1000	THP	
	Width-Active	TWV	1	—	120	THP	
DTMG	Horizontal Back porch	THBP	48	—	510	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	1024	—	—	TCIP	
COMMON	Set up Time	TSTC	5	—	3)	ns	
	Hold Time	THTC	3	—	3)	ns	

Notes
1) THBP+THFP≦714 TCIP.
2) TVBP+TVFP≦253 THP.
3) TSTC and THTC conforms to the specifications of LVDS transmitter.
   It is preferable to check the specifications of LVDS transmitter in your system.
4) fV = 1／TVP ≦ 75Hz (Refer to 3. ELECTRICAL CHARACTERISTICS)
5) fH = 1／THP ≦ 60.24kHz (Refer to 3. ELECTRICAL CHARACTERISTICS)

6.3 TIMING BETWEEN INTERFACE SIGNAL AND POWER SUPPLY
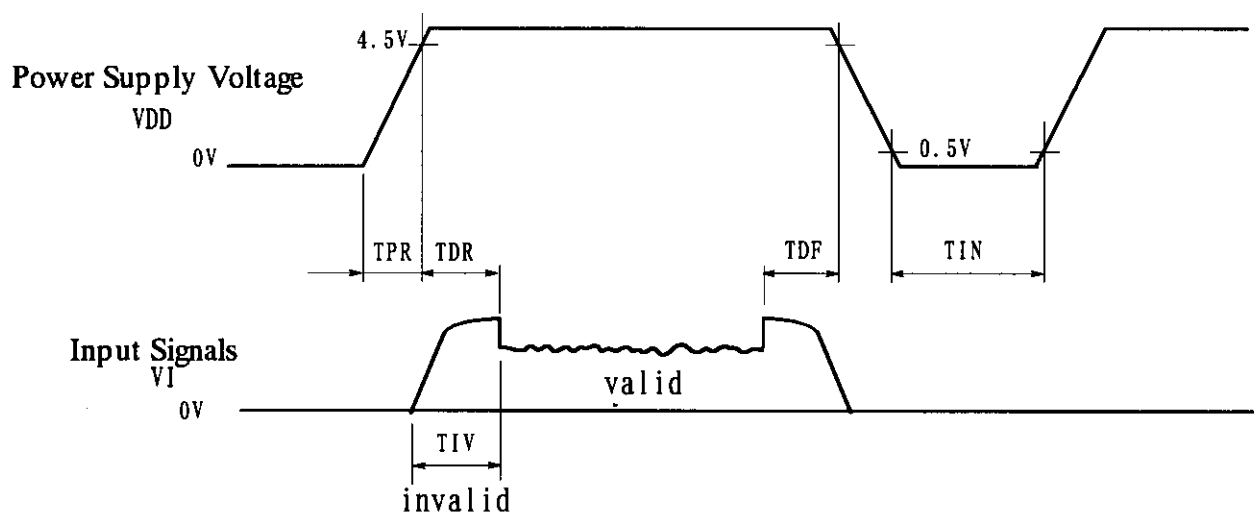
Timing of power supply voltage and input signals shall be specified as the followings.

$$0ms \leqq TPR \leqq 20ms$$
$$0ms \leqq TDR \leqq 20ms$$
$$0ms \leqq TDF \leqq 50ms$$
$$TIN \geqq 200ms$$
$$TIV \leqq 3ms$$

7. DIMENSIONAL OUTLINE
(1)FRONT SIDE
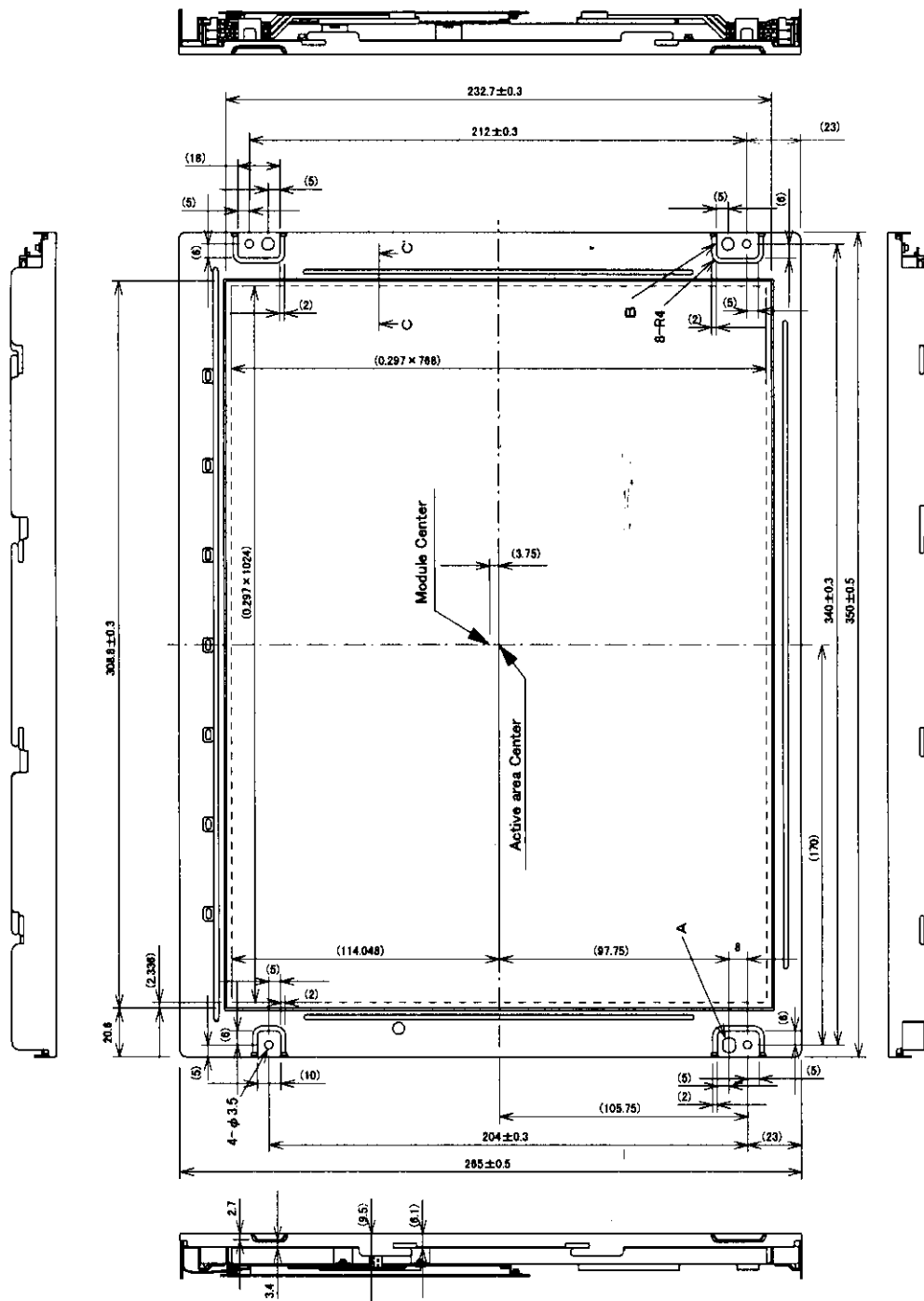
notes 1)Dimension in parenthesis are reference value.
2)Tolerance not specified is ±0.5mm.
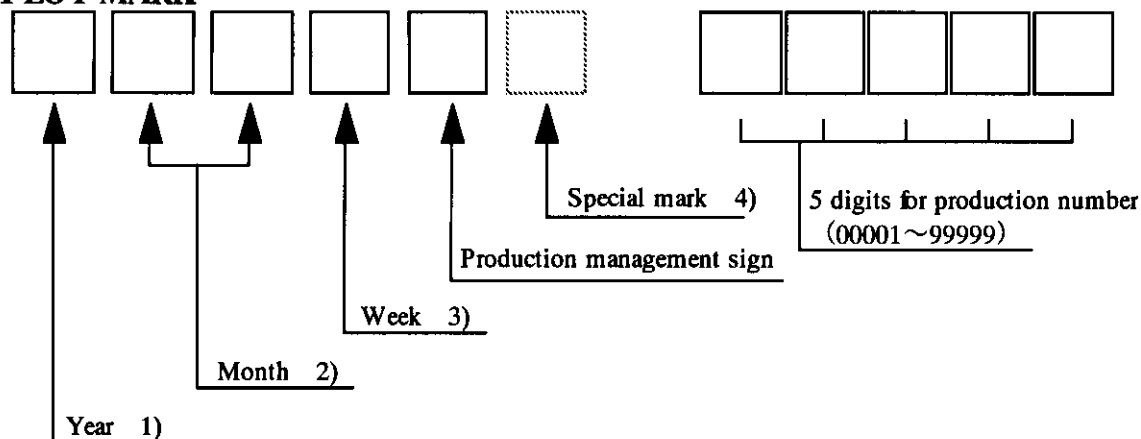3)Measure the values with 9.8×10^4Pa(1.0kgf/cm2).

Unit:mm
Scale:NTS

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Unit:mm
Scale:NTS

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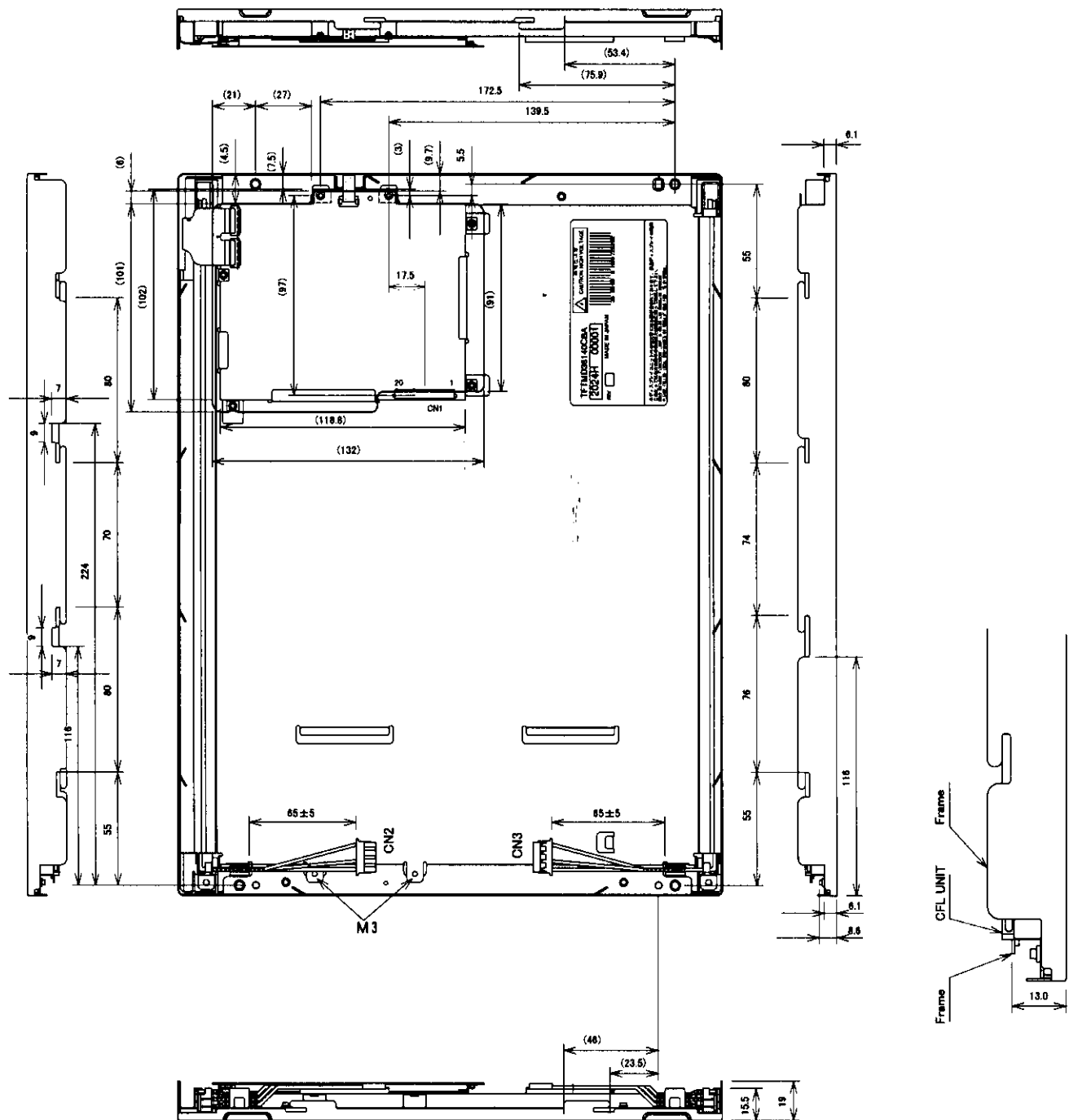
8. DESIGNATION OF LOT MARK

8.1 LOT MARK

[Lot mark diagram showing boxes with arrows pointing to:]
- Special mark 4)
- 5 digits for production number (00001～99999)
- Production management sign
- Week 3)
- Month 2)
- Year 1)

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) The special mark may be added by manufacturing accordingly to production number.

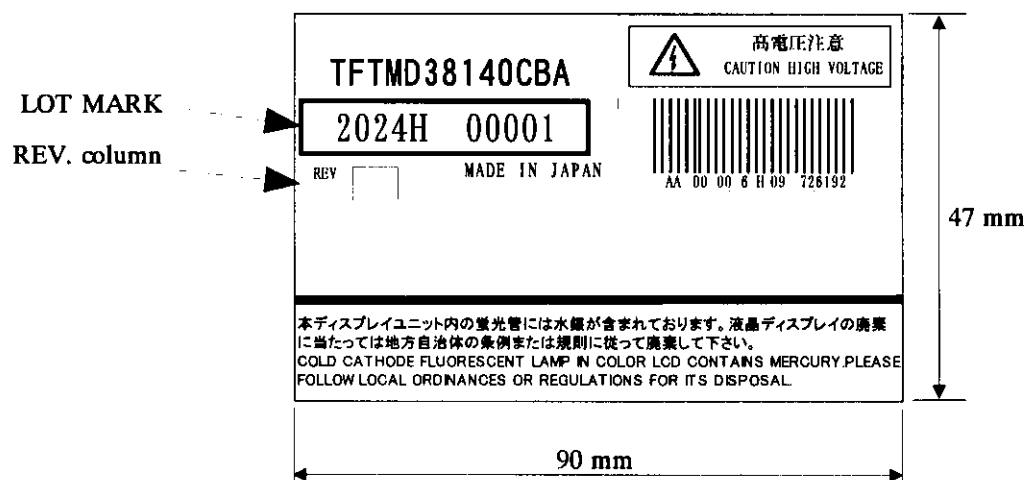## 8.2 REVISION(REV.) CONTROL

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 metal bezel as shown in the drawing at Section 7.
The style of character may be changed without notice.

LOT MARK

REV. column

[Label drawing:]
TFTMD38140CBA
高電圧注意
CAUTION HIGH VOLTAGE
2024H 00001
REV [ ]   MADE IN JAPAN
AA 00 00 6 H 09 726192

本ディスプレイユニット内の蛍光管には水銀が含まれております。液晶ディスプレイの廃棄
に当たっては地方自治体の条例または規則に従って廃棄して下さい。
COLD CATHODE FLUORESCENT LAMP IN COLOR LCD CONTAINS MERCURY.PLEASE
FOLLOW LOCAL ORDINANCES OR REGULATIONS FOR ITS DISPOSAL.

47 mm

90 mm

| Displays, Hitachi, Ltd. | Date | Sep.06,2002 | Sheet No. | 3284STD - 0935 - 1 | Page 11-1/1 |

10. PRECAUTIONS

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

10.1 PRECAUTIONS IN MOUNTING MODULE

(1) Please do not give a stress on the module which cause damage on the metal, plastic, and LCD glass.

(2) The module should be appropriately handled by both hands. Please never hold top and bottom side of the module by just one hand.

(3) The module should be mounted into the enclosure by each mounting hole on the corner.

(4) Please ensure the module not be stressed in being mounted.

(5) Then the module should be placed around 1mm from inside of the enclosure as shown in Fig. 1.
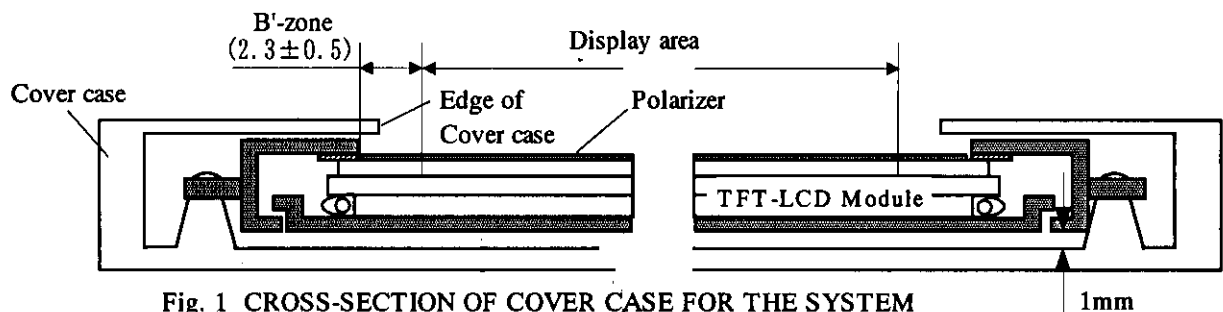
Fig. 1 CROSS-SECTION OF COVER CASE FOR THE SYSTEM

(6) The edge of the front plastic window should be within the B'-zone shown in Fig.1 by more than 1 mm from the metal frame window of the module.

(7) It is preferable to place a transparent plate on the display area in order to protect the polarizer and LCD glass.
The plate should be placed away from the surface of the module.

(8) Please do not use acetic acid & chlorine type materials for enclosure & other components surrounding the module since these materials give rise to the gas at high temperature which degrade the polarizer and cause open circuit at the module electrical circuit due to electro-chemical reaction.

(9) Polarizer is easily scratched and should be carefully handled then. Please do not touch, push, and rub the polarizer by hard materials such as glass, tweezers and others harder than HB pencil lead. Also, please do not touch it by bare-hand.

(10) In case of cleaning the polarizer, please wipe it with absorbent cotton, chamois or other soft materials absorbing Normal-Hexane recommended as cleaning chemicals.

(11) Saliva and water drop should be immediately wiped off since they degrade the polarizer.

(12) Please do not disassemble and modify the module yourselves since it may malfunction.

(13) Metal frame should not be touched with bare-hand and dirty gloves since it my be degraded.

(14) The module rear side should not be touched with metal in being mounted.

(15) Please do not pull and hold the lamp cable.

(16) Interface cable shall be installed with an appropriate procedure.

10.2 PRECAUTIONS IN OPERATION OF MODULE

(1) The module is heated by the backlight in operation. The module needs to be appropriately being cooled in order to avoid brightness reduction so that the ambient temperature would be within the specifications.

(2) Spike noise from the power supply may cause functional error and damage the module.
Overshooting & undershooting of VDD voltage should be within +/- 200 mV under the maximum rating.
(3) Optical performance of the TFT-LCD changes by the temperature. (Response time gets longer at lower temperature.)
(4) Lamp start-up time also gets longer at lower temperature.
(5) In case that environmental temperature suddenly changes, it may cause the condensation and dew on the module.
Please be careful so that the condensation would not happen since it cause the degrade of optical performance and mal-function.
(6) Image sticking may happen after the same pattern being displayed for long time but it will disappear soon.
Please do not display the same pattern for long time so as not to bring about image sticking.
(7) Please ensure the countermeasures for electro-magnetic interference which affect the electrical circuit of the module.
Grounding & shielding method is effective to reduce the radiation.
(8) Acoustic noise may happen in the backlight operation. If necessary, please take appropriate countermeasures.
(9) In case the lamp cable is made longer, it may cause brightness drop and degrade lamp start-up.
It is preferable to connect it directly to CFL inverter.
(10) Please do not connect and remove the module while a main system is powered on.
(11) Grounding the metal of the module is preferable to prevent the video from flickering and rolling.
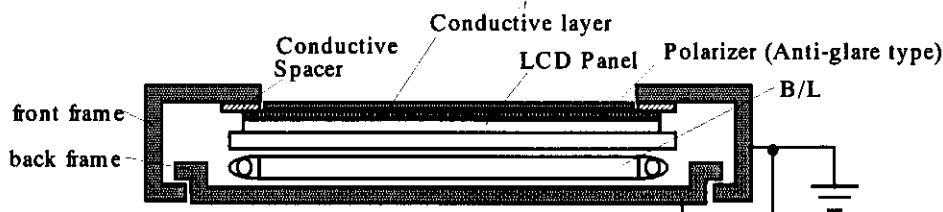
10.3 ELECTRO-STATIC DISCHARGE CONTROL

(1) The module is easily damaged when it suffers from electro-static discharge over the specification.
Please take care about the control such as grounding human body in handing the module. Also, please do not touch the connector with bare-hand.
(2) Protection film on polarizer should be slowly removed so that electro-static discharge could be reduced.

10.4 PRECAUTIONS FOR LIGHT EXPOSURE

(1) Please do not expose the module against the intensive light which is likely to degrade the polarizer & color filter.

10.5 PRECAUTIONS IN STORAGE OF MODULE

In case of long term storage of the module, the followings should be taken care about.
(1) The module should be stored in a dark with appropriate humidity (60 % RH or below) at 0 to 35 ℃.
(2) Nothing should contact on the polarizer while the module being stored. It is preferable to store the modules in the packaging of the shipment.

10.6 PRECAUTIONS IN HANDLING PROTECTION FILM

(1) The protection film on polarizer should be slowly removed with wrist band grounded so as to reduce electro-static discharge. Ionized air blow is also effective.

(2) In case the polarizer is rubbed by the protection film while being removed, the adhesive on the film may remain on the polarizer. Then, please be careful not to rub the polarizer while removing the protection film.

(3) Please take care about the storage condition in case of remaining the protection film on the polarizer.
The adhesive on the film may move onto the polarizer at high temperature & high humidity.

(4) The adhesive remaining on the polarizer should be wiped off with absorbent cotton absorbing Normal Hexane.

10.7 PRECAUTIONS TO REPLACING BACK LIGHT UNITS (CFL)

(1) As shown in the dimensional outline of the module in page 10, back light is replaceable.

(2) The replacing backlight unit consists of a pair of CFL assembly / A for bottom and CFL assembly / B for top.
Because of no marking on each assembly, please make sure direction of projected portion of cable holder in the CFL assemblies when they are inserted.

(3) During the procedures, all power supplies not only to the module but also to the inverter shall be switched off.

(4) Replacing work shall be started after the inverter and the CFL become sufficiently cool.

(5) Special care shall be taken to the display area in order not to damage its surface.

(6) The CFL shall not be touched with bare hands to protect its surface from stains.

(7) It is recommended to use clean soft gloves and hold a cable holder of the CFL assembly during the replacing work in order to protect not only the display area of the module and the surface of CFL but also a serviceman himself.

(8) CFL assembly shall be pulled off slowly and straight without twisting or rotating. When it is inserted, the same care shall be taken.

10.8 SAFETY

(1) The module is unit which consists of LCD glass and backlight. In case of being dropped and mechanically shocked, it may be cracked. Please take care about the cracked glass. In addition, hands should be washed if you touch the liquid material from the broken LCD.

(2) Electrically conductive materials should be never put into the module. Backlight unit generates especially high voltage and you should take care about it.

10.9 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.

10.10 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.

10.11 OTHERS

(1) Electrical components which does not affect the module electrical performance may be changed without notice because of availability, etc.