

# HITACHI

Hitachi Displays, Ltd.

Date; Aug. 25, 2003

## TECHNICAL DATA

### TX26D01VM1CAA

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RECORD OF REVISION

Date	Old Sheet No.	Summary
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## APPLICATION

<26cm (10.4 inch) VGA>

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

Note : Inverter device for Back-light is not built in and so it needs to be prepared on yourside.

- Type name : TX26D01VM1CAA
- Display Area : H211.2×V158.4 [mm]
- Display Dots : H(640×3)×V480 [dots]
- (Display Pixels) (H640×V480 pixels)
- Resolution : VGA
- Voltage of V<sub>DD</sub> : 3.3V
- Pixel Pitch : H0.330×V0.330 [mm]
- Color Pixel Arrangement : R·G·B Vertical Stripe
- Display Mode : Transmissive &  
Normally White Mode
- Color Number : 262k Colors
- Dimensions Outlines : H243.0 TYP×V181.6 TYP×t12.5 MAX. [mm]
- Weight : (530)TYP. [g]
- Interface : CMOS
- Surface Polarizing Film : Anti-Glare Polarizing Film  
(Hard Coat 3H:Pencil Hardness)
- Back-light : Two Cold Cathode Fluorescent Lamp  
(Side-Light type:Both Long Side)  
Back-light inverter is not  
contained in Module.

# 1. ABSOLUTE MAXIMUM RATINGS

## 1.1 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING		STORAGE		UNIT	NOTE
	MIN.	MAX.	MIN.	MAX.		
Ambient Temperature	-10	70	-20	70	°C	1)
Humidity	2)		2)		%RH	1)
Vibration	—	4.9 (0.5G)	—	19.6 (2G)	m/s <sup>2</sup>	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) Environmental temperature and humidity of this unit, not of system installed with this unit.

At low temperature the brightness of CFL drop and the life time of CFL become to be short.

- 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  $40^\circ\text{C}$ . without condensation

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

4) 7ms of pulse width.

## 1.2 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

### (1) TFT LIQUID CRYSTAL DISPLAY MODULE

V<sub>SS</sub>=0V

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

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

2) Discharge circuit to be connected : 200pF-250Ω, 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 metal bezel and a LCD panel.

### (2) BACK-LIGHT UNIT

GND=0V

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Lamp Current	IL	0	7.0	mArms	1)
Lamp Voltage	VL	0	1800	V <sub>rms</sub>	2)

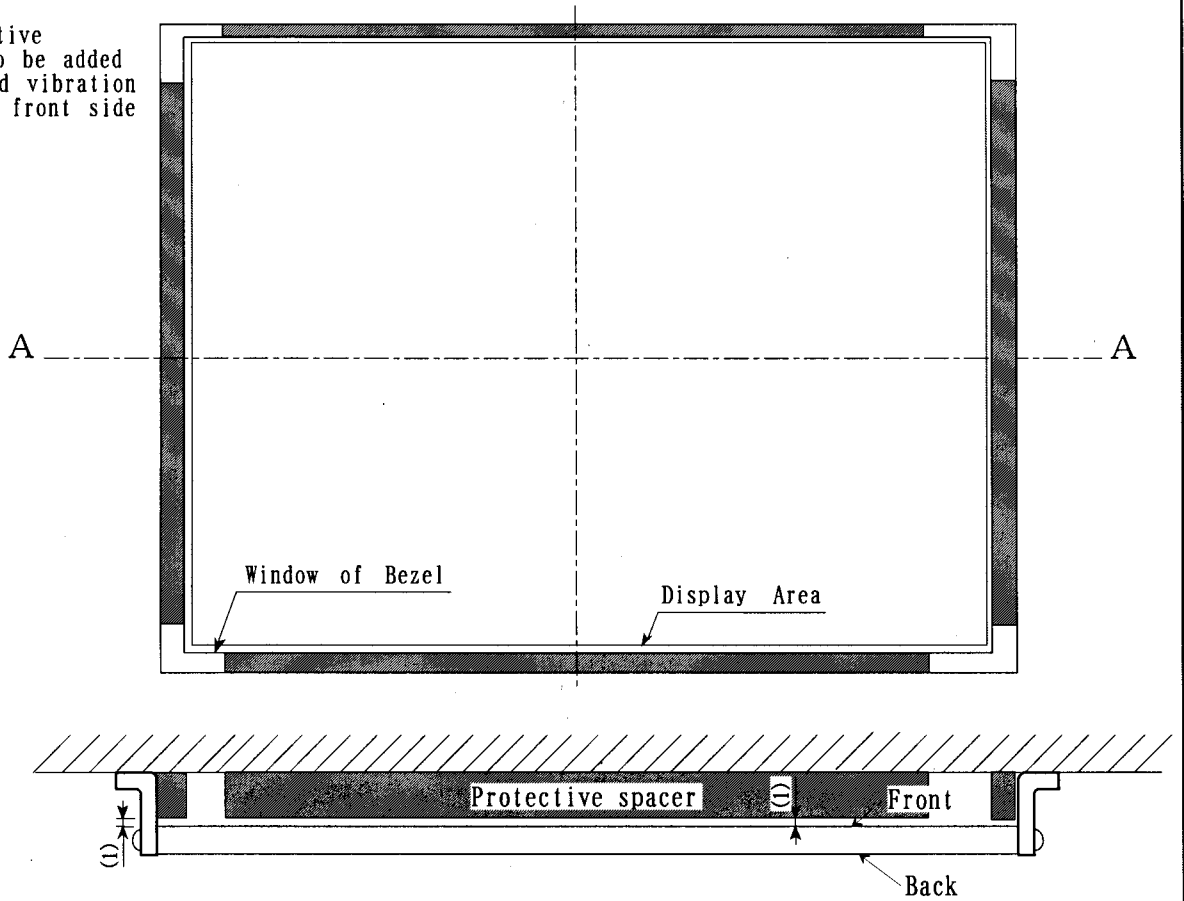
Note 1) At Lamp start-up time.

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

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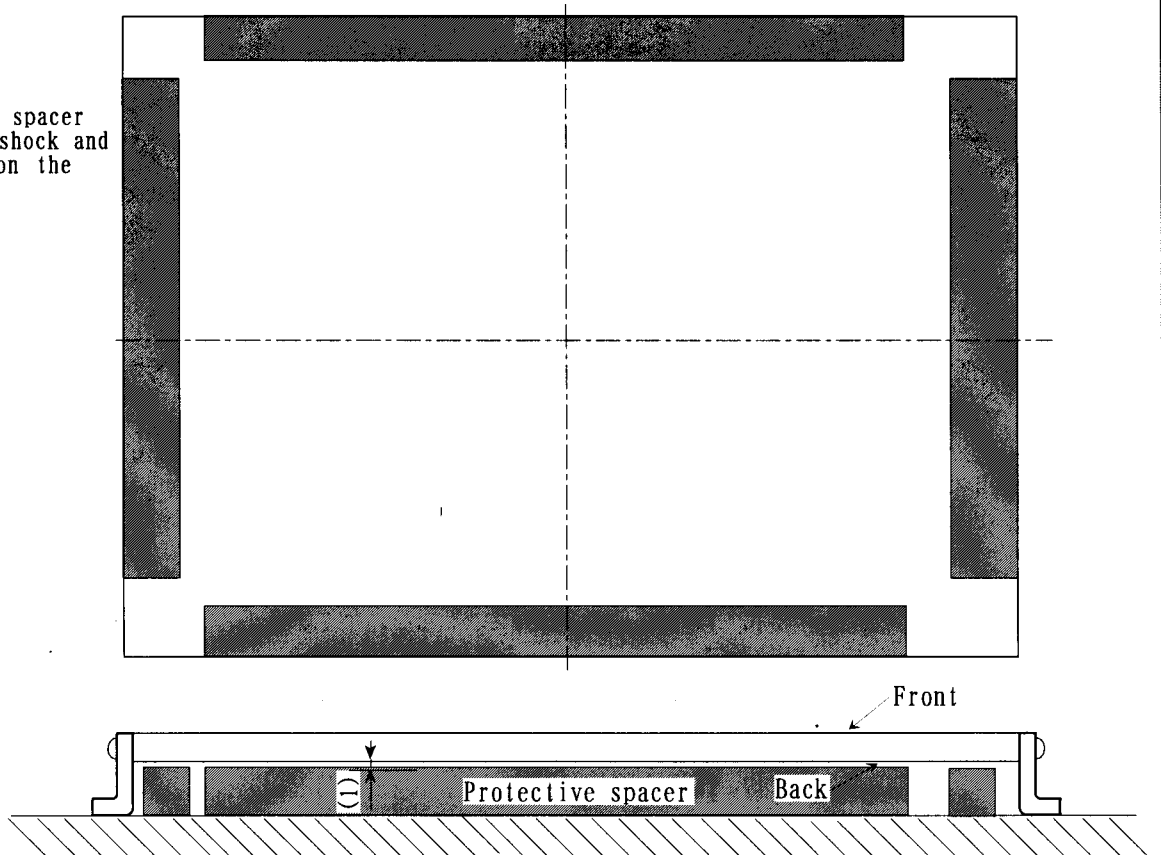
Adding protective spacer at shock & vibration test  
 Shaded area is to be supported with additional spacer.

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



Shaded area is to be supported with additional spacer.

(2) This protective spacer is to be added shock and vibration test on the back 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 15minutes' operation)

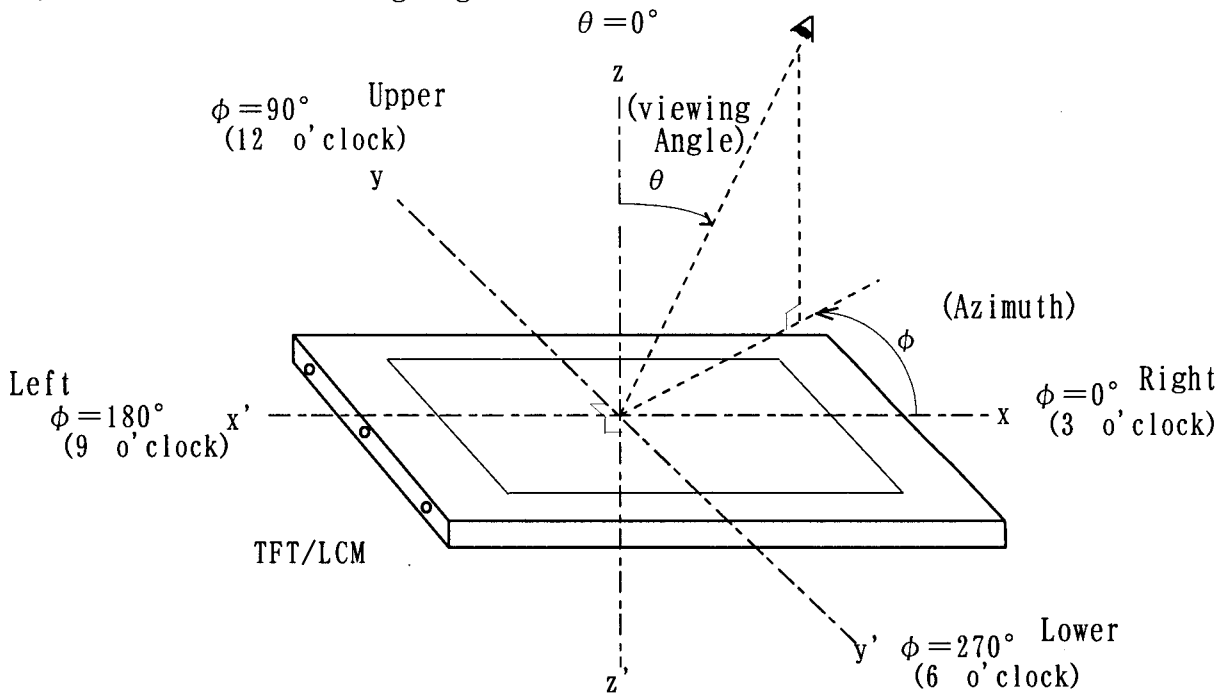
The ambient light excluding The Back-light unit is nothing.

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

Temperature of LCD=25°C, V<sub>DD</sub>=3.3V, f<sub>v</sub>=60Hz, I<sub>L</sub>=6.0mA,  
Back-Light operation Frequency=50kHz

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE	
Contrast Ratio	CR	$\theta = 0^\circ$ Note 1)	100	(300)	—	—	2)	
Response Time	RISE		tr	—	30	—	ms	3)
	FALL		tf	—	20	—		
Brightness (White)	Bwh		—	(380)	—	cd/m <sup>2</sup>		
Brightness Uniformity	Buni		60	—	—	%	4)	
Color of CIE	Red		x	—	0.58	—	—	
			y	—	0.35	—		
	Green		x	—	0.30	—		
			y	—	0.55	—		
	Blue		x	—	0.15	—		
		y	—	0.11	—			
	White	x	—	0.32	—			
		y	—	0.33	—			
Viewing Angle (CR $\geq$ 5)	x-x	$\theta x$	$\phi = 0^\circ$	—	65	—	deg	
		$\theta x'$	$\phi = 180^\circ$	—	65	—		
	y-y	$\theta y$	$\phi = 90^\circ$	—	45	—		
		$\theta y'$	$\phi = 270^\circ$	—	60	—		

Note 1) Definition of Viewing Angle



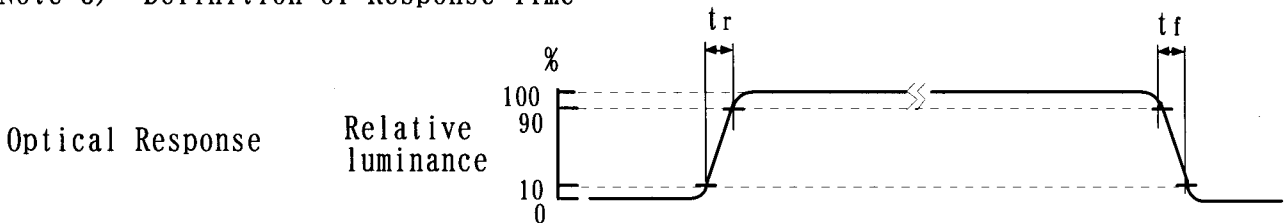
Note 2) Definition of Contrast Ratio (CR)

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

These Brightness is measured on the center of screen.

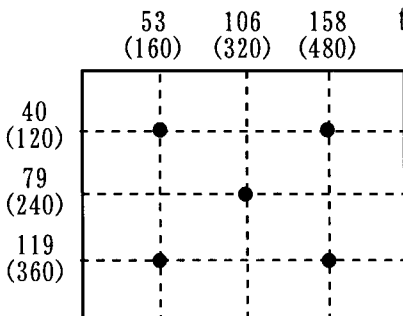
\* Measurement in the darkroom.

Note 3) Definition of Response Time



Note 4) Definition of Brightness Uniformity

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



• : measuring point

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

where, Bmax = Maximum brightness among 5 measuring points  
Bmin = Minimum brightness among 5 measuring points

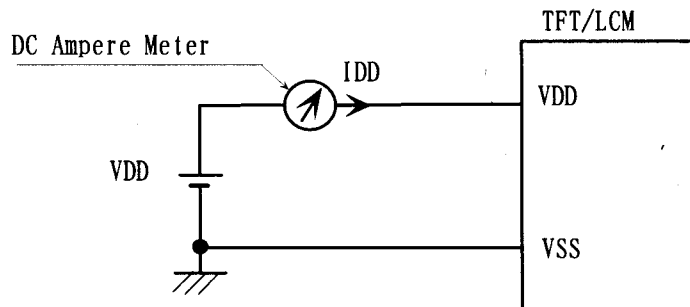
### 3. ELECTRICAL CHARACTERISTICS

#### (1) TFT LIQUID CRYSTAL DISPLAY MODULE

Ta=25°C, Vss=0V

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Power Supply Voltage	VDD	3.0	3.3	3.6	V	
Input Voltage for Logic Signal	Hi	V <sub>IH</sub>	2.0	—	VDD	mV 1)
	Lo	V <sub>IL</sub>	VSS	—	0.8	
Power Supply Current	I <sub>DD</sub>	—	250	400	mA	2), 3)
Vsync Frequency	f <sub>v</sub>	—	60	70	Hz	
Hsync Frequency	f <sub>H</sub>	—	31.6	38	kHz	
DCLK Frequency	f <sub>CLK</sub>	—	25	29	MHz	

Note 1) The specification is applicable to Display Data Signal pin, Timing Signal pin.  
 2) f<sub>v</sub>=60Hz, f<sub>CLK</sub>=25MHz, VDD=3.3V, DC Current is measured with the method as below.



Typical value is measured when displaying Black Pattern.

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

- 3) 0.63A fuse is built in the unit. Current capacity for VDD power supply should be larger than 2A, so that the fuse built in the unit(Maximum) could appropriately work in the abnormal.

#### (2) BACK-LIGHT UNIT

Ta=25°C, GND=0V

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Lamp Current	I <sub>L</sub>	(4.0)	(6.0)	6.5	mArms	1), 3)
Lamp Voltage	V <sub>L</sub>	—	(450)	—	Vrms	
Frequency	f <sub>L</sub>	50	—	70	kHz	2)
Starting Lamp Voltage	V <sub>s</sub>	Ta=25°C	(1200)	—	—	Vrms
		Ta=10°C	(1450)	—	—	

NOTE 1) Higher I<sub>L</sub> cause the short life time of CFL.

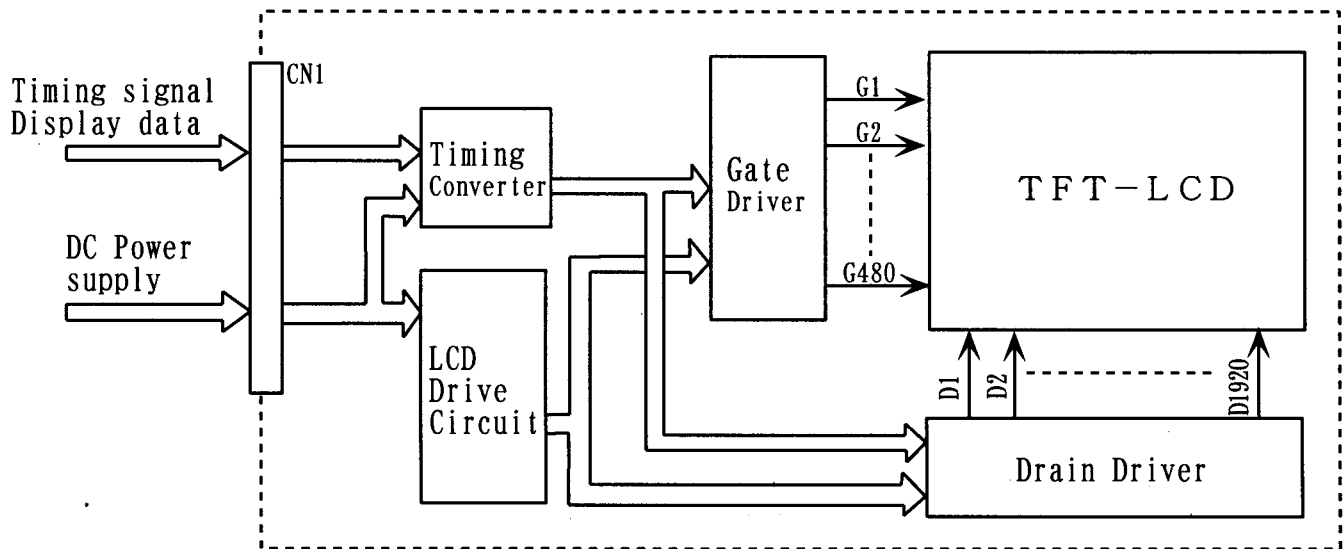
2) Lamp operation frequency may produce interference with Hsync frequency, which causes rolling or flickering screen. Therefore lamp operation frequency shall be as different as possible from Hsync frequency, to avoid interference.

3) When I<sub>L</sub> is measured, an ammeter is attached to the ground line.

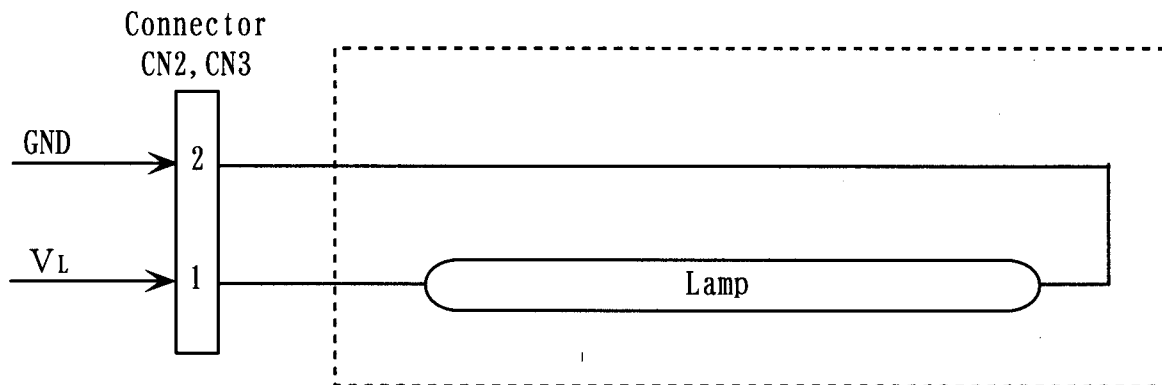


## 4. BLOCK DIAGRAM

### (1) TFT-LIQUID CRYSTAL DISPLAY MODULE



### (2) BACK-LIGHT UNIT



Color of wires CFL to CN2, CN3

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

## 5. INTERFACE PIN CONNECTION

### (1) TFT-LIQUID CRYSTAL DISPLAY MODULE

CN1 《HIROSE:DF9B-31P-1V》

Pin No.	SYMBOL	FUNCTION	NOTE
1	VSS		2)
2	DCLK	Clock Signal	
3	NC		4)
4	NC		4)
5	VSS		2)
6	R0	Red Data Signal (LSB)	
7	R1	Red Data Signal	
8	R2	Red Data Signal	
9	R3	Red Data Signal	
10	R4	Red Data Signal	
11	R5	Red Data Signal (MSB)	
12	VSS		2)
13	G0	Green Data Signal (LSB)	
14	G1	Green Data Signal	
15	G2	Green Data Signal	
16	G3	Green Data Signal	
17	G4	Green Data Signal	
18	G5	Green Data Signal (MSB)	
19	VSS		2)
20	B0	Blue Data Signal (LSB)	
21	B1	Blue Data Signal	
22	B2	Blue Data Signal	
23	B3	Blue Data Signal	
24	B4	Blue Data Signal	
25	B5	Blue Data Signal (MSB)	
26	VSS		2)
27	DTMG	Display Timing Signal	
28	VDD	Power Supply 3.3V (typical)	1)
29	VDD	Power Supply 3.3V (typical)	1)
30	TEST	TEST Pin	3)
31	NC		4)

Notes 1) All VDD pins shall be connected to +3.3V(Typ.).

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

3) Keep open. Hitachi test use only.

4) Unconnected to the module

### (2) BACK-LIGHT UNIT

CN2, CN3 《JST:BHR-02(8.0)VS-1》

Pin No.	SYMBOL	FUNCTION	NOTE
1	VL	Power Supply	
2	GND	GND (0V)	

# 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(0)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(0)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	BLUE(0)	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(62)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED(61)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	RED(2)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED(1)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(0)	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(62)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	GREEN(61)	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	1	1	1	1	0	1	0	0	0	0	0	0
	GREEN(1)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	GREEN(0)	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(62)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE(61)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	BLUE(1)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	BLUE(0)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

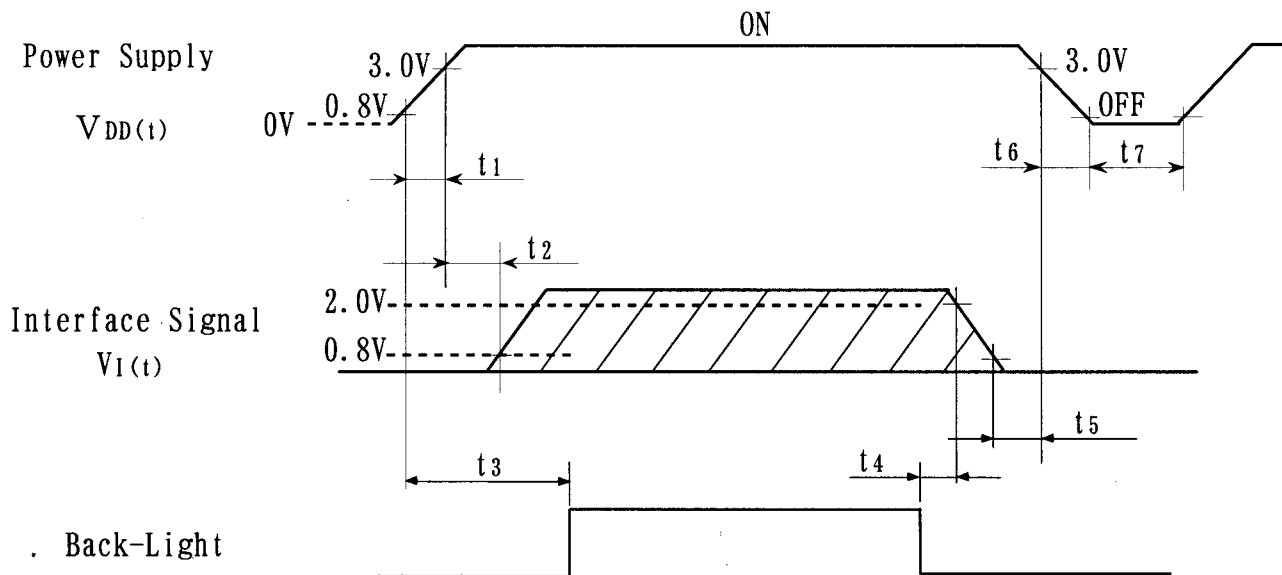
- Note 1) Definition of gray scale :  
 Color(n) --- number in parenthesis indicates gray scale level.  
 Larger number corresponds to darker level.
- 2) Data : 1:High, 0:Low



## (2) INTERFACE TIMING SPECIFICATIONS

	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Period	t <sub>CLK</sub>	34.5	40	43	ns	
	Width-Low	t <sub>WCL</sub>	12	—	—		
	Width-Hi	t <sub>WCH</sub>	12	—	—		
	Rise Time	t <sub>rCLK</sub>	—	—	25		
	Fall Time	t <sub>fCLK</sub>	—	—	25		
	Duty	D	0.45	0.5	0.55	—	D = t <sub>CLKL</sub> / t <sub>CLK</sub>
Hsync	Set up Time	t <sub>SH</sub>	5	—	—	ns	for DCLK
	Hold Time	t <sub>HH</sub>	10	—	—		
	Period	t <sub>HP</sub>	760	800	850	t <sub>CLK</sub>	
	Width-Active	t <sub>WH</sub>	5	96	—		
	Rise/Fall Time	t <sub>Hr</sub> , t <sub>Hf</sub>	—	—	30	ns	
Vsync	Set up Time	t <sub>SV</sub>	0	—	—	t <sub>CLK</sub>	for Hsync
	Hold Time	t <sub>HV</sub>	2	—	—		
	Period	t <sub>VP</sub>	515	525	609	t <sub>HP</sub>	
	Width-Active	t <sub>WV</sub>	3	—	—		
	Rise/Fall Time	t <sub>Vr</sub> , t <sub>Vf</sub>	—	—	50	ns	
DTMG	Set up Time	t <sub>SI</sub>	5	—	—	ns	for DCLK
	Hold Time	t <sub>HI</sub>	10	—	—		
	Rise/Fall Time	t <sub>Ir</sub> , t <sub>If</sub>	—	—	30	ns	
	Horizontal Back porch	t <sub>HBP</sub>	7	144	—		
	Horizontal Front porch	t <sub>HFP</sub>	—	16	—	t <sub>CLK</sub>	
	Vertical Back porch	t <sub>VBP</sub>	4	35	—	t <sub>HP</sub>	
	Vertical Front porch	t <sub>VFP</sub>	—	10	—		
DATA	Set up Time	t <sub>SD</sub>	5	—	—	ns	for DCLK
	Hold Time	t <sub>HD</sub>	10	—	—		
	Rise/Fall Time	t <sub>Dr</sub> , t <sub>Df</sub>	—	—	25	ns	

### (3) TIMING BETWEEN INTERFACE SIGNAL AND POWER SUPPLY

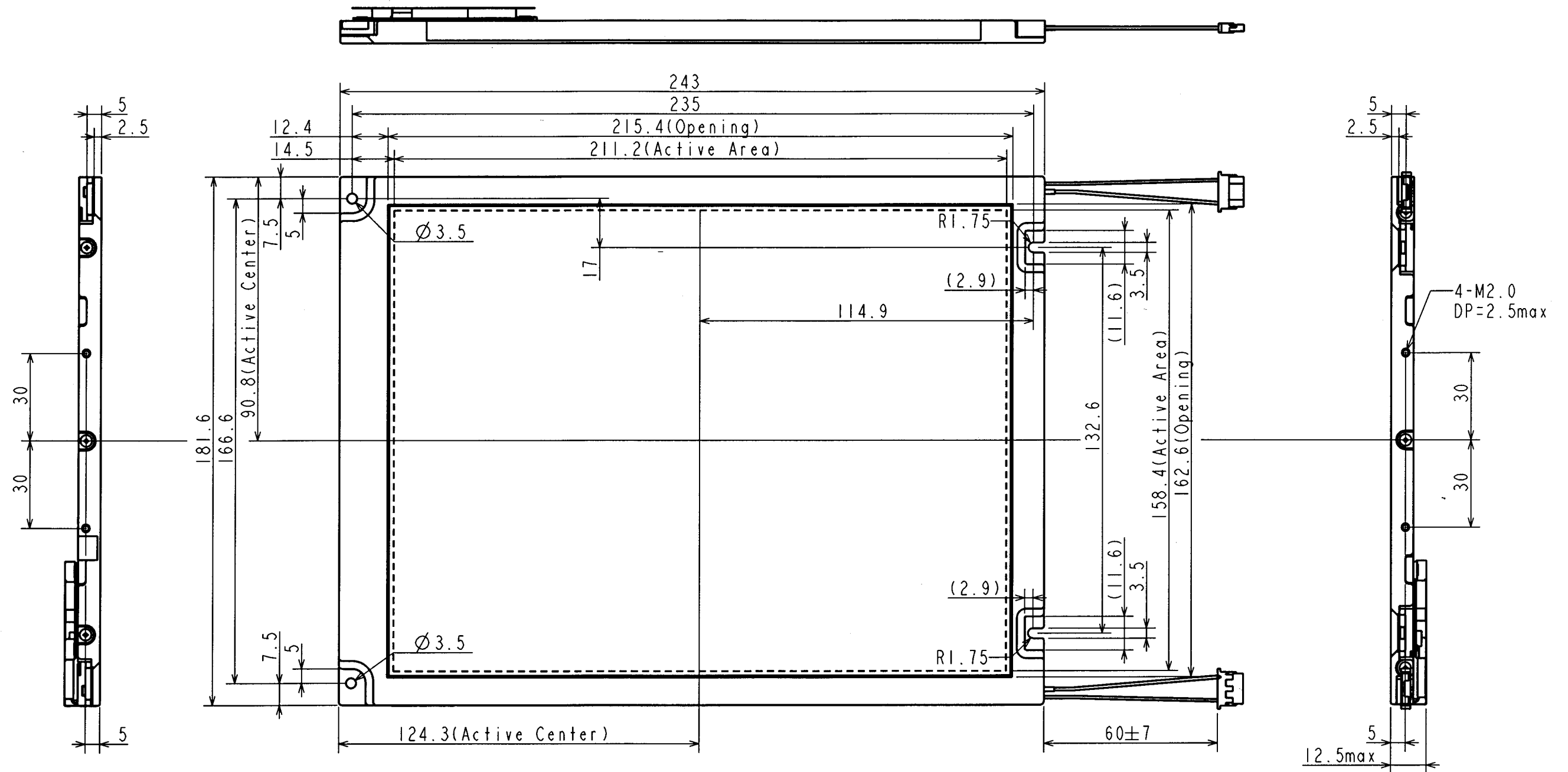


<u>POWER ON</u>		<u>POWER OFF</u>	
	$t_1 \leq 15\text{ms}$	$5\text{ms} \leq t_4$	
$0\text{ms} \leq t_2 \leq 45\text{ms}$		$0\text{ms} \leq t_5 \leq 45\text{ms}$	
$0.1\text{s} \leq t_3$		$0\text{ms} \leq t_6 \leq 20\text{ms}$	
		$0.4\text{s} \leq t_7$	

Note 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.

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

7. DIMENSIONAL OUTLINE  
Front-Side



- NOTE 1) Interface connector  
HRS:DF9B-31P-IV  
2) CFL cable connector  
JST:BHR-02(8.0)VS-IN  
3) The unspecified tolerance : ±0.5mm  
4) Holes for mounting LCD MODULE  
top mounting : 4 holes  
side mounting : 4 holes  
5) Maximum torque of the screws for mounting LCD MODULE  
0.196[N·m] (2.0[kgf·cm])  
6) The screws mounted in the side of LCD MODULE : 6 points

UNIT: mm

