

To : \_\_\_\_\_

TENTATIVE

## Specification of FUJITSU TFT-LCD module

FLC26XGC6R

Approval

Date :

By :

This Product is designed, developed and manufactured as contemplated for general use, including without limitation, general office use, personal use, household use, and ordinary industrial use, but is not designed, developed and manufactured as contemplated for use accompanying fatal risks or dangers that, unless extremely high safety is secured, could lead directly to death, personal injury, severe physical damage or other loss (hereinafter "High Safety Required Use"), including without limitation, nuclear reaction control in nuclear facility, aircraft flight control, air traffic control, mass transport control, medical life support system, missile launch control in weapon system. If customer's product possibly falls under the category of High Safety Required Use, please consult with our sales representatives in charge before such use. In addition, FDTC shall not be liable against the customer and/or any third party for any claims or damages arising in connection with the High Safety Required Use of the Product without permission.

Specification No. : Tech Bes LCD-00185

Issue Date : Jan. 31, 2003

Issued by : F.Yamada

FUJITSU DISPLAY TECHNOLOGIES CORPORATION

## REVISION HISTORY

EDATE \_\_\_\_\_1

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**1. APPLICATION**

This specification is applied to the 10.4-inch XGA supported TFT-LCD module.

**2. PRODUCT NAME AND MODEL NAME**

2-1 Product Name : LCD Module

2-2 Model Name : **FLC26XGC6R**

**3. OVERVIEW**

This LCD module has a TFT active matrix type liquid crystal panel 1024x 3 (RGB) x768 pixels, and diagonal size of 26cm. This LCD has a RGB interface for XGA and can display 262,144 colors under non-interlaced mode.

This LCD module can display under the bright light very clearly, also can display plainly in the dark place due to the front light.

It has built-in edge type front-light with 1CCFL which is driven by external inverter for this front-light.

The power supply of this LCD module is +3.3V DC voltage (It is not included with the power source for front light and Digitizer unit.)

The timing control signal consists of data-ENAB signal only. It is possible to display freely within regulation.

The interface uses LVDS interface. This LCD module installs the digitizer unit of electromagnetic induction tablet device.

**4. CONFIGURATION**

This LCD module consists of a reflected color TFT-LCD panel on which TFT driver ICs are mounted, a bezel, a CCFL front-light, digitizer unit for tablet device, and LVDS interface PCB.

The inverter for the front-light is not included.

Figure 4-1 shows a block diagram of this LCD module.

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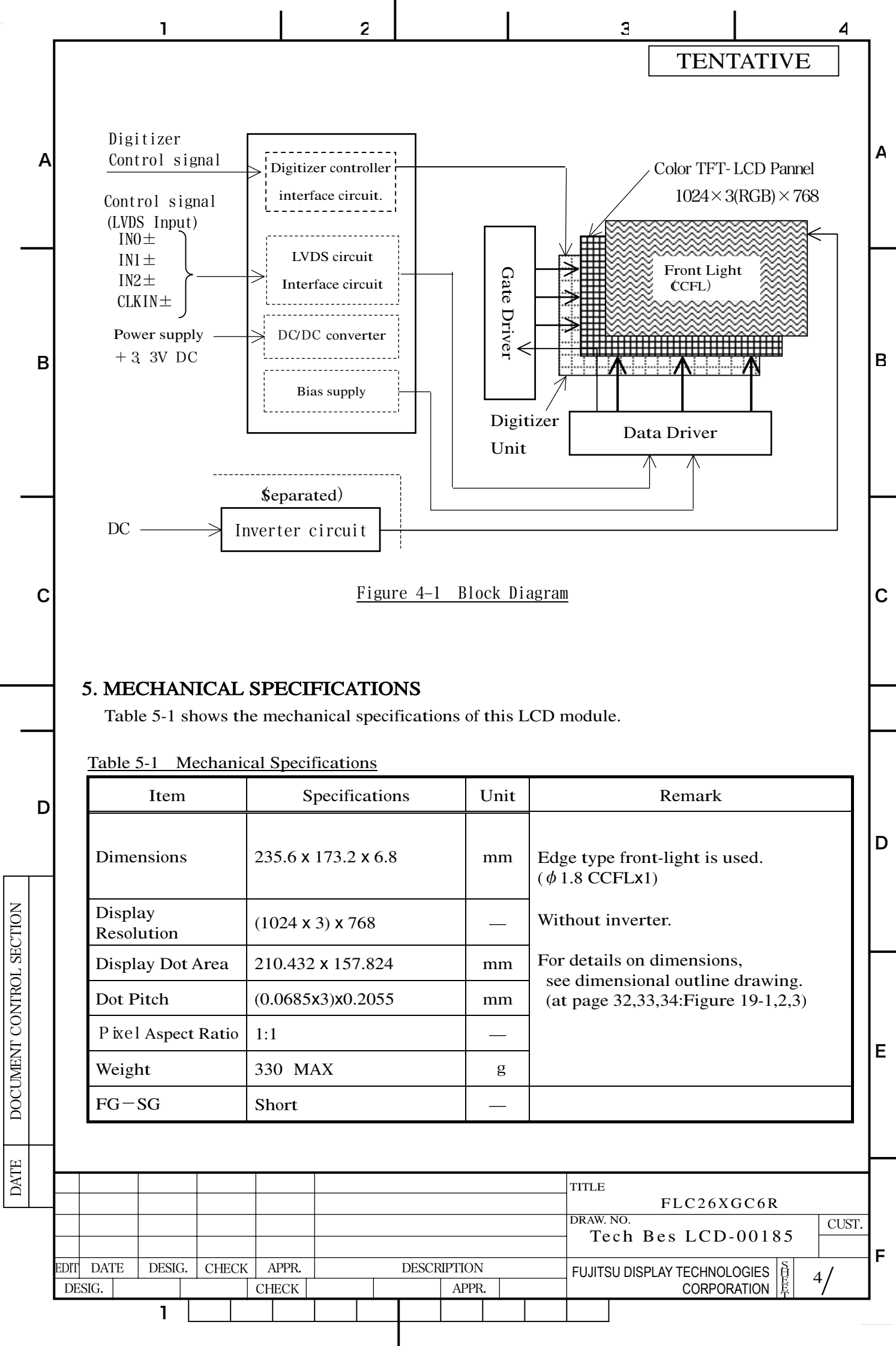




Table 8-1 shows the electrical specifications of this LCD module. Figure 8-1 shows the measurement circuit. Figure 8-2 shows the equivalent circuit of the logic signal input area.

Item		Symbol	Condition	MIN.	TYP.	MAX.	Unit
Differential-input Voltage (+)		$V_{IH}$	$V_{cm}=+1.2V$	—	—	100	mV
Differential-input Voltage (—)		$V_{IL}$		—100	—	—	mV
Supply Current		$I_{CC}$	$V_{CC}=+3.3V$ $V_{SS}=0V$ $T_a=25^{\circ}C$ $CK=65MHz$ Frame frequency $=60Hz$	—	195	325	mA
Supply Rush Current		$I_{SCC}$		—	—	1.7	A
Supply Rush Current Duration (excess 1.2A)		$T_{SCC}$		—	—	1	ms
FRONT LIGHT	CCFL Turn on Voltage	$V_S$	$f_L=65kHz, T_a=25^{\circ}C$ $C_L=22pF$	—	1100	1200	Vrms
			$f_L=65kHz, T_a=0^{\circ}C$	—	—	1200	Vrms
	Lighting Voltage	$V_L$	$f_L=65kHz, I_L=5mA_{rms}$	—	630	—	Vrms
	Lighting Frequency	$f_L$	$V_L=630V_{rms},$ $I_L=5mA$	50	65	80	kHz
	Recommended Lighting Frequency			—	—	—	kHz
	Tube Current	$I_L$	$V_L=630V_{rms}$ $f_L=65kHz$	4.0	5.0	6.0	mA <sub>rms</sub>

The diagram illustrates the power and signal connections for the LCD module. It is divided into two main sections by a vertical dashed line. On the left, the power source is defined by a Vcc supply (represented by a circle with Icc) and a GND reference. An AC source is also shown, connected to a load capacitor (CL) and a load resistor (represented by a circle with I), with voltages Vs and VL indicated. On the right, the LCD module components are shown: a DC/DC Converter, Logic, Analog, and Driver blocks. The DC/DC Converter is connected to the Vcc and GND lines. The Logic, Analog, and Driver blocks are connected to the output of the DC/DC Converter and the GND line. The Front-light block is connected to the AC source and the GND line. The label 'LCD module' is positioned at the bottom right of the diagram.

Figure 8-1 Measurement circuit

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DS90CR583(National Semiconductor) or equivalent

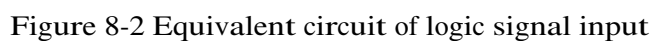


Figure 8-2 Equivalent circuit of logic signal input

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## 9. OPTICAL SPECIFICATIONS

Table 9-1 shows the optical specifications of this LCD module.

Table 9- 1    Optical Specifications

Item		Symbol	Condition		Specification			Unit	Front Light	Note		
					MIN.	TYP.	MAX.					
Horizontal Visual Angle		$\theta_{L,R}$	$\theta_{U,D}=0^{\circ}$	55	—	—	deg	OFF	4,6,8,10			
				45	—	—		ON	1,2,6,7,8,10			
Vertical Visual Angle		$\theta_U$	$\theta_{L,R}=0^{\circ}$	55	—	—		OFF	4,6,8,10			
				70	—	—		ON	1,2,6,7,8,10			
		$\theta_D$		55	—	—		OFF	4,6,8,10			
				40	—	—		ON	1,2,6,7,8,10			
Contrast Ratio		CR	$\theta_{L,R,U,D}=0^{\circ}$ $\theta_S=25^{\circ}$		(30)	40	—	—	OFF	3,6		
			$\theta_{L,R,U,D}=0^{\circ}$		(16)	18	—	—	ON	1,2,6,8,10		
Response Time (ON) (B→W)		$t_{on}$	$\theta_{L,R,U,D}=0^{\circ}$	Ta=25°C	—	15	30	m s	ON	1,2,6,9,10		
			$\theta_{L,R,U,D}=0^{\circ}$	Ta=0°C	—	50	100	m s				
Response Time (OFF) (W→B)		$t_{off}$	$\theta_{L,R,U,D}=0^{\circ}$	Ta=25°C	—	10	25	m s			ON	1,2,6,9,10
			$\theta_{L,R,U,D}=0^{\circ}$	Ta=0°C	—	50	100	m s				
Reflectivity		R	$\theta_{L,R,U,D}=0^{\circ}$ $\theta_S=25^{\circ}$		(13)	15	—	%	OFF	3,6		
Brightness		I	$\theta_{L,R,U,D}=0^{\circ}$ $V_{CC}=3.3V$ , $I_L=5mA$		(30)	35	—	cd/m <sup>2</sup>	ON	1,2,6		
Brightness Uniformity		$\Delta I$			65	—	—	%	ON	1,2,6,12		
Chromaticity	W	x			—	(0.32)	—	—	OFF	5		
					(0.283)	0.313	(0.343)	—	ON	1,2,6		
	y	—			(0.35)	—	—	OFF	5			
		(0.299)			0.329	(0.359)	—	ON	1,2,6			
	R G B	x, y	R	—					OFF	5		
				$\Phi.45, 0.31)$ Typ.					ON	1,2,6		
			G	—					OFF	5		
				$\Phi.32, 0.41)$ Typ.					ON	1,2,6		
B	—					OFF	5					
	$\Phi.21, 0.24)$ Typ.					ON	1,2,6					
LCD Panel Type					TFT Color							
Display Mode					Normally Black VA							
Panel Technology					MVA- R							
Optimum Viewing Angle					none			OFF	11			
					Top (12 o' clock Direction)			ON				
Display Color					262, 144 6-bit color)							
Surface Treatment					None (Front- Light Prism surface)							

\*Specified value is measured in 15~20 minutes after lighting on.

•All items without “Brightness Uniformity” are measured at the center of display board.

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Note 1) Brightness is measured by CS-1000 (MINOLTA Co., LTD.), BM-5A (TOPCON Co., LTD.), or equivalent.

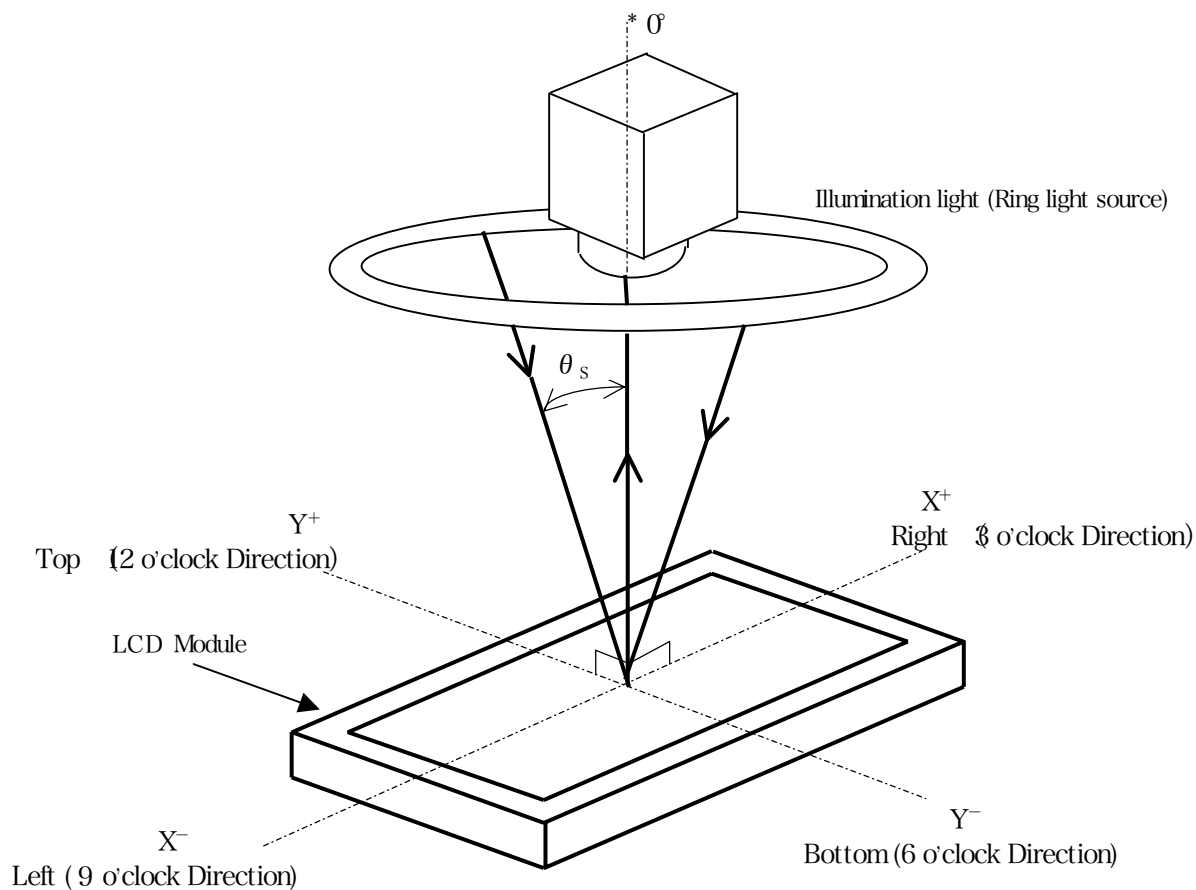
Field= 2° , Interval=500mm

**A** Note 2) This LCD module's specifications of Visual Angle, Contrast Ratio, Brightness, Brightness Uniformity, and Chromaticity are measured in the dark condition (under 1lux).

### Note 3) Definition of reflectivity

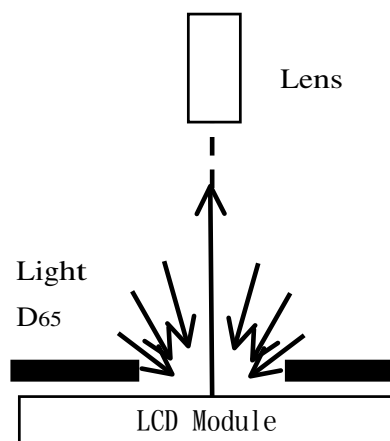
### All-directional Ring light irradiation

It is measured by CM-512m3 (MINOLTA Co., LTD.) or equivalent.

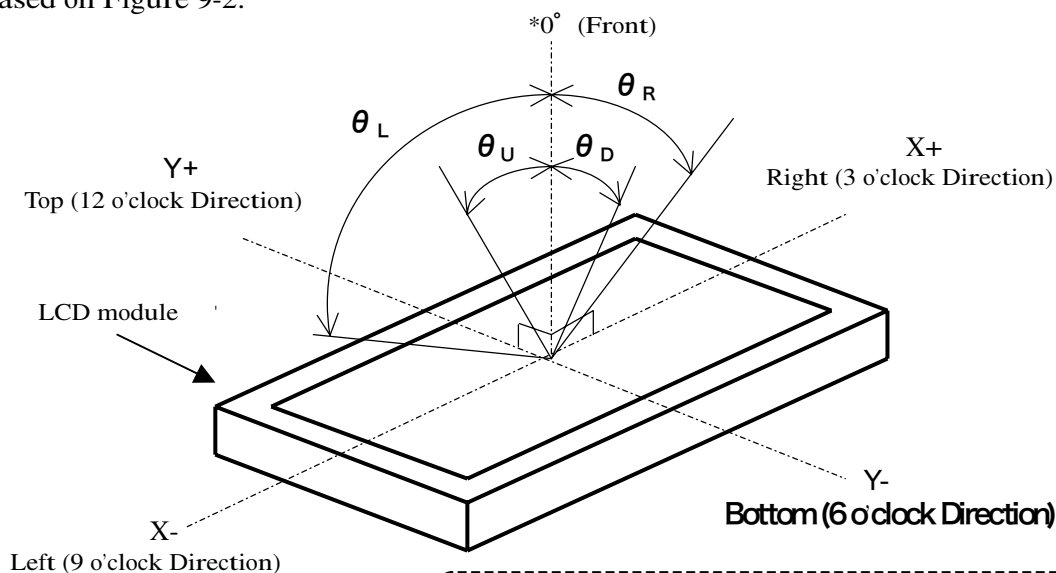


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It is measured by CM- 2022(MINOLTA CO., LTD).



Based on Figure 9-2.

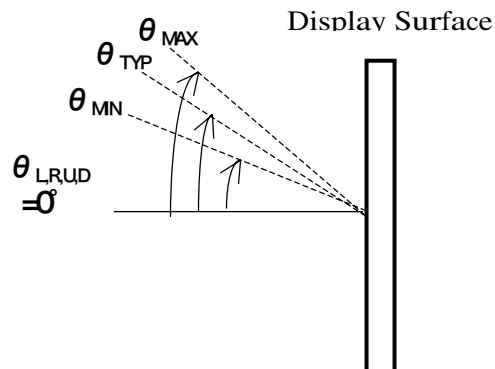
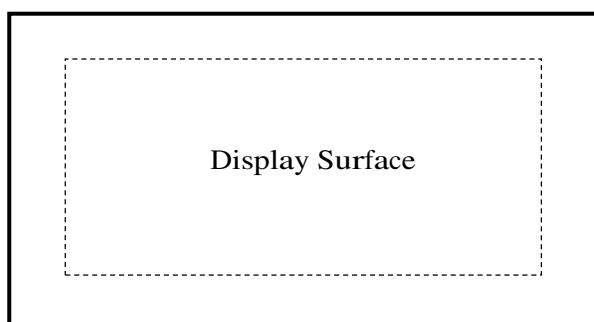

$$[* \rightarrow \theta_U = 0^\circ, \theta_D = 0^\circ, \theta_L = 0^\circ, \theta_R = 0^\circ$$

**Figure 9-2 Definition of Viewing Angle (1)**

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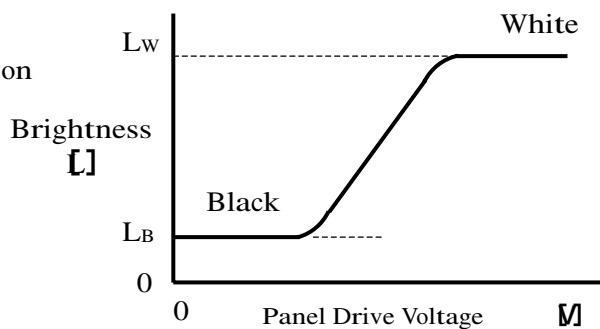
Note 7) Definition of Viewing Angle (2)

Based on Figure 9-3.

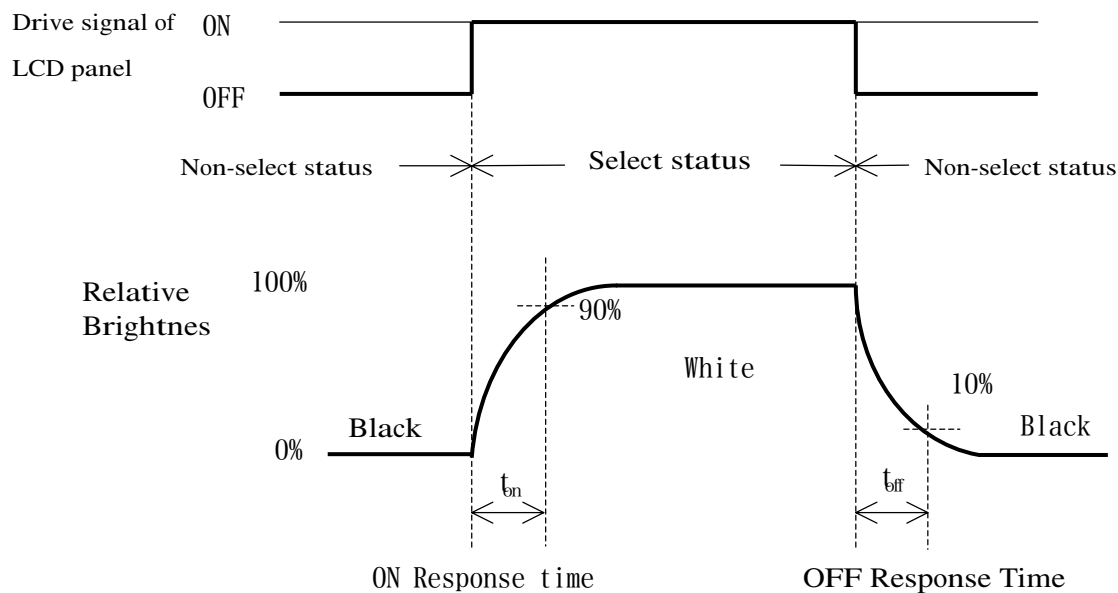
Figure 9-3 Definition of Viewing Angle (2)Note 8) Definition of Contrast Ratio (CR)

Determined by Formula (1) based on Figure 9-4 Voltage-Brightness characteristics.

$$= \frac{L_W \text{ (Brightness at white)}}{L_B \text{ (Brightness at black)}} \cdots \cdots (1)$$

Figure 9-4 Voltage-Brightness CharacteristicsNote 9) Definition of Response Time

Based on Figure 9-5.

Figure 9-5 Definition of Response Time

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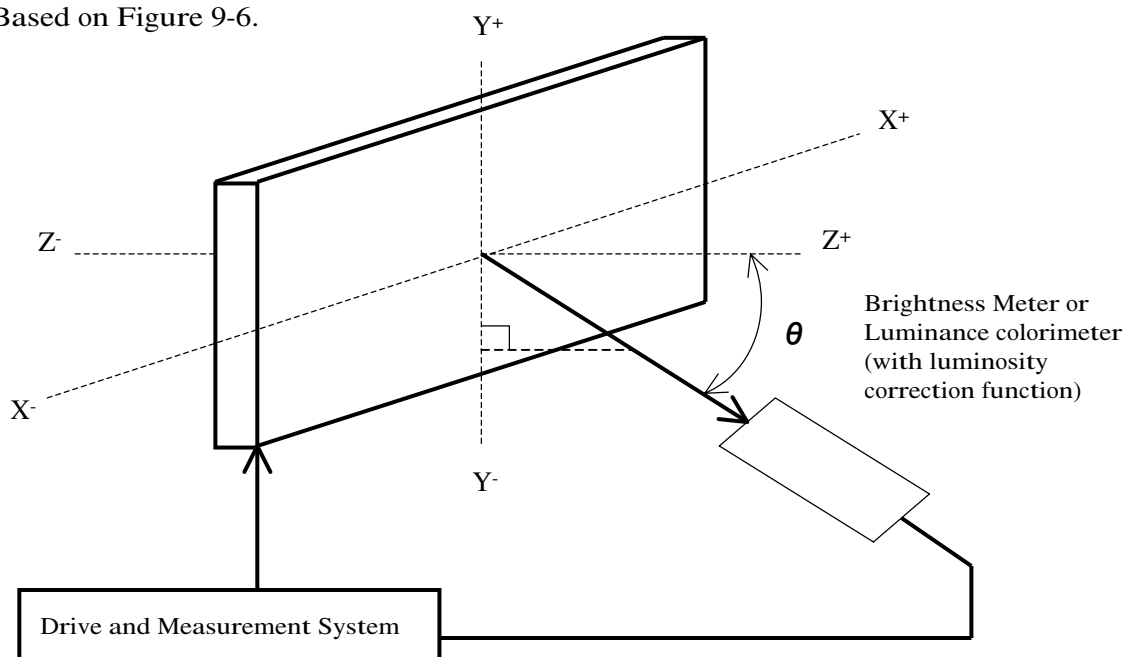
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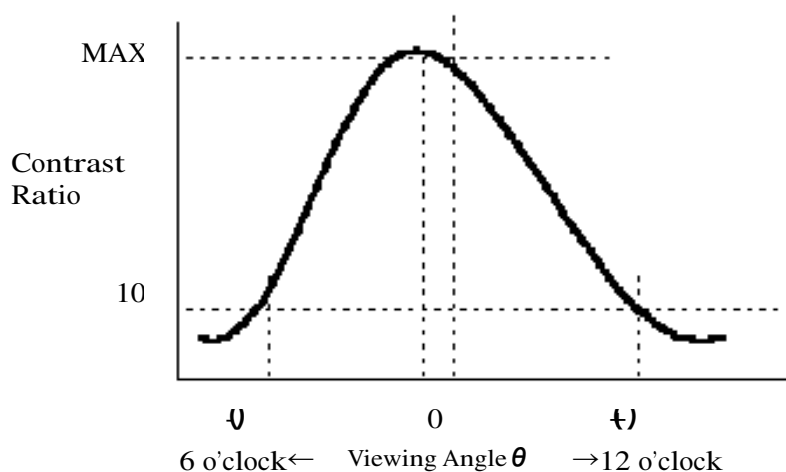
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Based on Figure 9-6.



**Figure 9-6 Contrast Ratio and Response Time Measurement System**

### Note 11) Definition of Optimum Viewing Angle



### Figure 9-7 Definition of Viewing Angle

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Table 10-2 shows the LVDS Data Assignment.

Pin No.	Symbol	Function
1	VCC	+3.3V power supply
2	VCC	+3.3V power supply
3	VSS	GND
4	VSS	GND
5	N0−	LVDS signal N0−
6	N0+	LVDS signal N0+
7	N1−	LVDS signal N1−
8	N1+	LVDS signal N1+
9	N2−	LVDS signal N2−
10	N2+	LVDS signal N2+
11	CLK N−	LVDS signal CLKIN−
12	CLK N+	LVDS signal CLKIN+
13	VSS	GND
14	VSS	GND

Connector : DF19L- 14P- 1H  
 Conformed Connector : DF19G- 14S- 1C  
 Producer : HIROSE ELECTRIC CO., LTD.

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Table 10-2 LVDS Data Assignment

Graphic Controller Input Signal	Transmitter pin assignment						LCD connector pin assignment	
	Input from Graphic Contoller				Output to LCD module			
	Pin No.	SN75LVDS84 (TI)	DS90CR563 (NS)		Pin No.	SN75LVDS84 (TI)		DS90CR563 (NS)
Red 0 (LSB)	44	D0	TxIN0	]	41	Y1M	TxOUT0−	5 (IN0−)
Red 1	45	D1	TxIN1					
Red 2	47	D2	TxIN2					
Red 3	48	D3	TxIN3					
Red 4	1	D4	TxIN4		40	Y2P	TxOUT0+	6 (IN0+)
Red 5 (MSB)	3	D5	TxIN5					
Green 0(LSB)	4	D6	TxIN6					
Green 1	6	D7	TxIN7	]	39	Y2M	TxOUT1 −	7 (IN1 −)
Green 2	7	D8	TxIN8					
Green 3	9	D9	TxIN9					
Green 4	10	D10	TxIN10					
Green 5(MSB)	12	D11	TxIN11		38	Y1P	TxOUT1+	8 (IN1 +)
Blue 0 (LSB)	13	D12	TxIN12					
Blue 1	15	D13	TxIN13					
Blue 2	16	D14	TxIN14	]	35	Y3M	TxOUT2−	9 (IN2 −)
Blue 3	18	D15	TxIN15					
Blue 4	19	D16	TxIN16					
Blue 5 (MSB)	20	D17	TxIN17					
HRSVD	22	D18	TxIN18		34	Y3P	TxOUT2+	10 (IN2+)
VRSVD	23	D19	TxIN19					
ENAB	25	D20	TxIN20					
CK	26	CLKIN	TxCLK IN	]	33	CLKOUTM	TxCLK OUT−	11 (CLKIN−)
					32	CLKOUTP	TxCLK OUT+	12 (CLKIN+)

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10-2 Digitizer Unit Interface (CN-3)

Table 10-3 shows the Digitizer Unit Interface Data Assignment.

Table 10-3 Digitizer Unit Interface Data Assignment

Pin	NAME	IN/OUT	FUNCTION
1	GND		Ground
2	PWS1	OUT	Auxiliary Port1
3	PWS2	OUT	Auxiliary Port2
4	PWS3	OUT	Auxiliary Port3
5	PWS4	OUT	Auxiliary Port4
6	PDCT	OUT	Pen Detect Signal
7	DSR	IN	Data Set Ready Signal
8	CTS	IN	Clear To Send Signal
9	TxD	OUT	Serial Data Output Signal
10	RxD	IN	Serial Data Input Signal
11	SLP	IN	Sleep Signal
12	RES	IN	Reset
13	Vcc		Power Supply (3.3 Volt)
14	GND		Ground

- Connector on SU-001: DF19L-14P-1H / HIROSE ELECTRIC CO., LTD
- Mating Connector (Corresponding Connector)  
: DF19L-14S-1C / HIROSE ELECTRIC CO., LTD

TxD	Serial Data Output Signal To be connected to Host's RxD
RxD	Serial Data Input Signal To be connected to Host's TxD
CTS	Clear To Send Signal To be connected to Host's RTS for Plug & Play
DSR	Data Set Ready Signal To be connected to Host's DTR for Plug & Play
PCDT	Pen Detect output Signal This is set "HIGH" while Pen Device detects pen or eraser. Leave this open if Host does not use.
SLP	Sleep Input Signal When set "High", Pen Device stops and goes into sleep mode Keep this "Low" if sleep mode is not needed.
RES	Reset Pen Device stops operating when RES is set "LOW". Input "system power on reset" signal.
PWS1:4	Auxiliary Port Leave this pen.

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## 10-3 Color Data Assignment

Table 10-4 shows the Color Data Assignment.

Table 10-4 Color Data Assignment

Color/ Brightness			Input Data (0:Low level, 1:High level)																
			R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	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
	↑	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	↑	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	↓	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Brighter	61	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0
	↓	62	1	1	1	1	1	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	
Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Darker	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	↑	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	Brighter	61	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0
	↓	62	0	0	0	0	0	0	1	1	1	1	1	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	
Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Darker	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	↑	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	↓	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Brighter	61	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	↓	62	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	1	1	1	1	1	1	

Note.1) Definition of gray scale:Color (n)···"n" indicates gray scale level.

Larger number means brighter level.

Note.2) Data; 1:High, 0:Low

Note 3) Color data consist of 6 bit red, green and blue data of odd and even number pixel data.

Total data number is 36 signals. This module is able to display 262,144 colors because each red, green and blue data is controlled independently.

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**10-4 Input Signal Timing**

Table 10-5 and Figure 10-3 shows the Input Signal Timing at LVDS transmitter.

**Table 10-5 Timing Characteristics**

(Ta=0~50°C, Vcc=3.3±0.3V)

Item		Symbol	MIN.	TYP.	MAX.	Unit	Remark
DCLK signal (Clock)	Period	Tc	15.15	15.38	28.5	ns	$f_c=1/T_c$ * 1
	Frequency	fc	35	65	66	MHz	
	Duty	Tch/Tc	45	50	55	%	
	High Time	TclkH	6	—	—	ns	
	Low Time	TclkL	6	—	—	ns	
	Rise Time	Tclkr	—	—	5.0	ns	
	Fall Time	Tclkf	—	—	5.0	ns	
DCLK- Data Timing	Setup time	Tset	3.0	—	—	ns	(65MHz)
	Hold time	Thold	7.0	—	—	ns	(65MHz)
Horizontal signal	Period	Th	1320	1344	1566	DCLK	* 2
	Frequency	fh	38.6	48	60	kHz	
	Display period	Thd	1024	1024	1024	DCLK	
Vertical signal	Period	Tv	772	806	868	Th	16.67ms
	Frequency	fv	59.998	59.998	59.998	Hz	* 2
	Display period	Tvd	—	768	—	Th	
ENAB signal	Data- ENAB timing	Tdn	—	0	—	DCLK	* 3

\*1)•Clock must be input while the power is on.

\*2)•Horizontal display position is specified by the rise of ENAB signal only.

The data latched at falling edge of DCLK after rise of ENAB is displayed at the left edge of the display area.

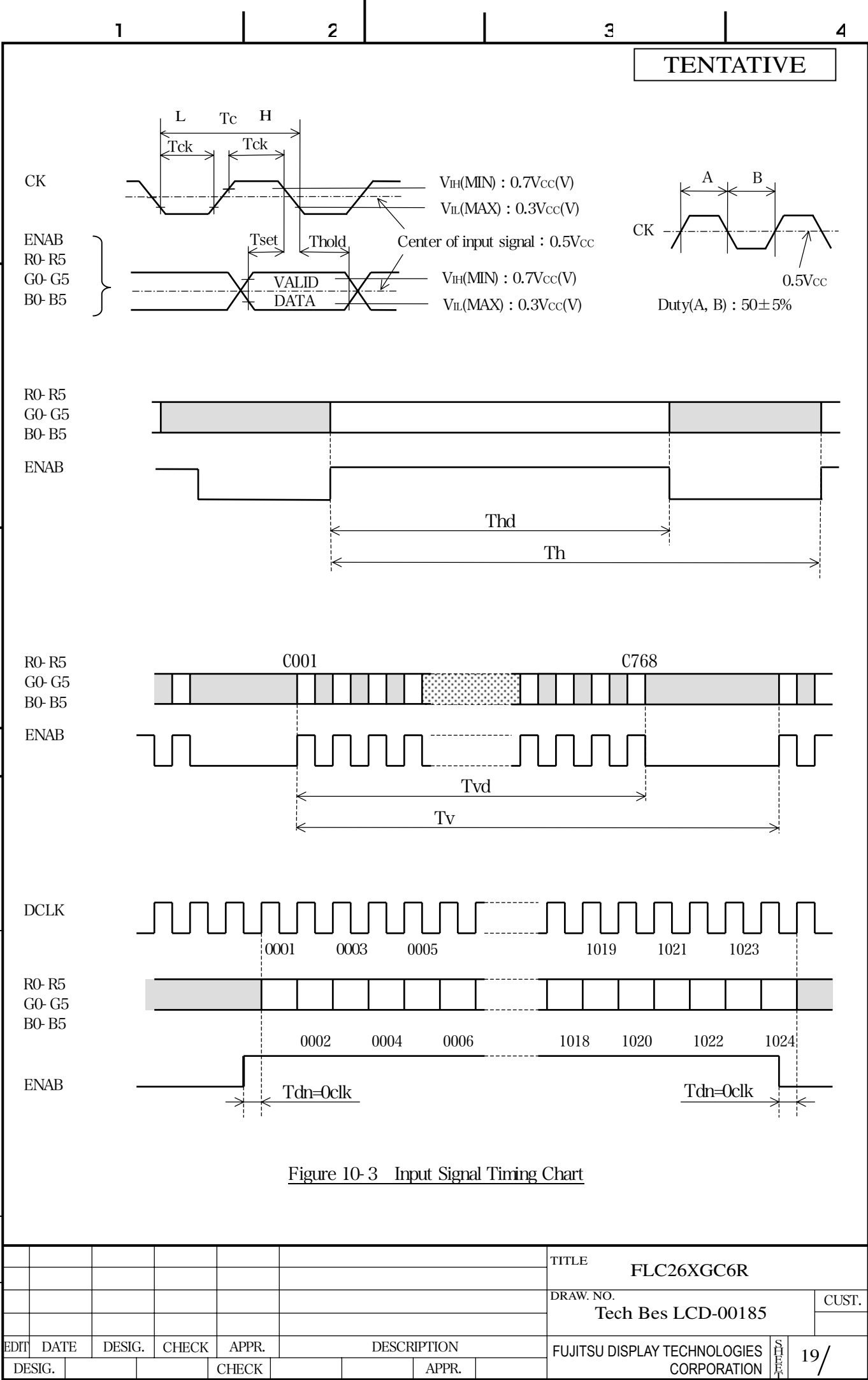
•Vertical display position is specified by the rise of “L” ENAB after “H” level continuation over 2 Horizon Period  
The data latched at the rise of ENAB is displayed at the top line of the display area.

\*3) •If High Time ENAB does not synchronize with the effective data period, the display position does not fit to the display area.

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10-5 Correspondence between Data and Display Position

Figure 10-4 shows the Correspondence between Data and Display Position.

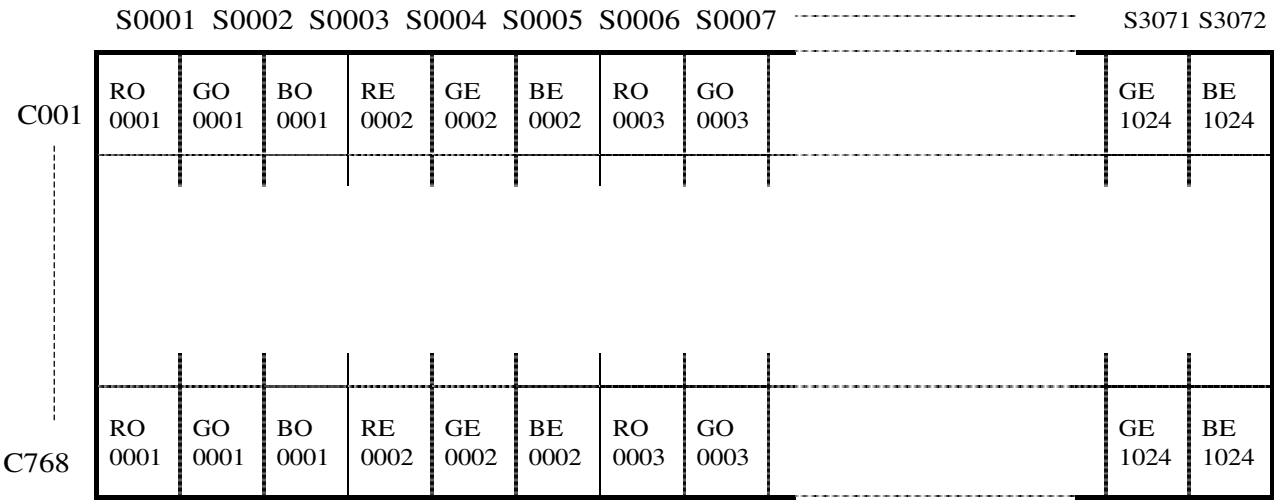
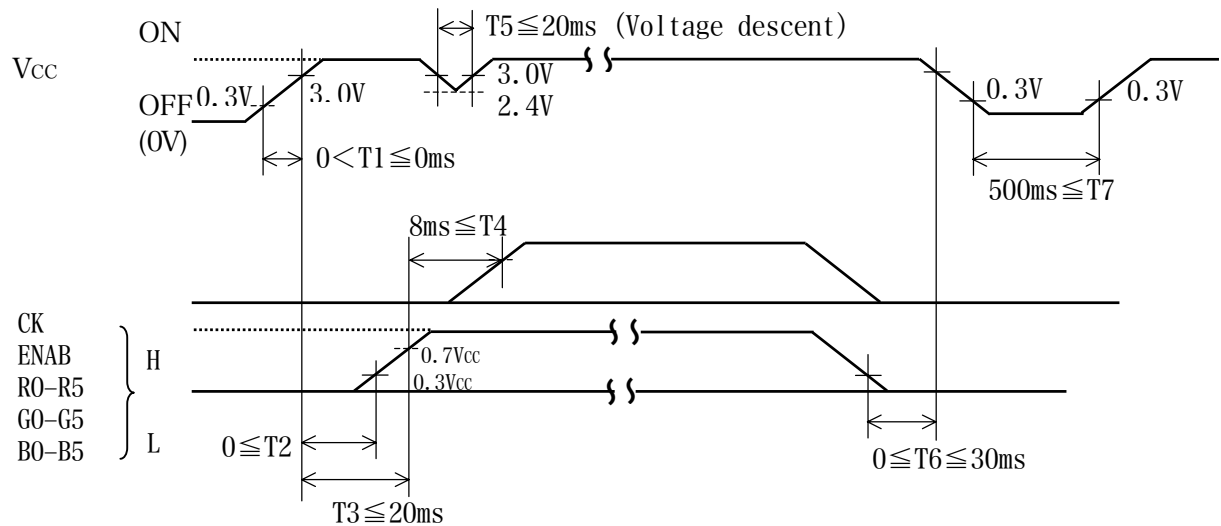


Figure 10-4 Correspondence Data and Display Position

10-6 Power Supply Sequence

The sequence of input signals and On/Off of the power supply of this LCD module should be in the specification shown in Figure 10-5 to prevent latch-up of the driver ICs and DC driving of the LCD panel.



Note) Power supply sequence is defined by input signal toward LVDS- IC(TRANSMITTER).

Figure 10-5 Power Supply Sequence

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### 10-7 Shut Down Time

Figure 10-6 shows the specification of shut down time.

If this specification is out of regulation, the last screen before shut down might be afterimage.

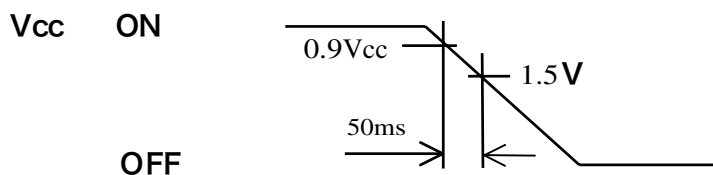


Figure 10-6 Shut down time

## 11. FRONT-LIGHT SPECIFICATIONS

### 11-1 Pin configuration for Front-light (CN-2)

Table 11-1 shows the description and Pin assignment of the connectors (CN-2) for the Front-light of this LCD module.

Table 11-1 Pin Assignment of CN-2

Pin No.	Signal	Function
1	VL	Power supply for CCFL
2	GND	GROUND

Connector : Housing : BHSR-02VS-1  
User's Connector : Post with base: SM02B-BHSS-1  
Supplier : Japan Solderless Terminal Trading Company LTD. (J.S.T.)

### 11-2 CCFL Specification

Supplier : Sanken Electric Co., Ltd.  
Catalog Number : NA19026-5401

### 11-3 Life

The life of the front-light is a minimum of 10,000 hours at the following conditions.

#### (1) Working conditions

- ①Ambient temperature :  $25 \pm 5^{\circ}\text{C}$
- ②Tube current (IL) : 5.0mA or less

#### (2) Definition of life

- ①Brightness becomes 50% or less than the minimum brightness value shown in Table 9-1.
- ②Turn-on voltage becomes over 1500Vrms shown in Table 8-1.
- ③Flashing.

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## 12. APPEARANCE SPECIFICATIONS (Tentative)

- Inside display dot area (210.432×157.824mm)
- Display dot area means active area.
- One pixel consists of 3 dots (red, green and blue).
- Foreign particle and scratch unharmed to display image, such as the foreign particle under polarizer film but outside of the display area and scratch on metal bezel, frontlight module or polarizer film out of the display area, etc., are not counted.

(1) Bright spots by the defect of TFT.

- |   |                       |
|---|-----------------------|
| · Visible under bias of 2% ND filter.....                 | High bright spot R•G  |
| · Visible under 5% but invisible under 2% ND filter ..... | Low bright spot R•G•B |
| · Invisible under bias of 5% ND filter.....               | Not counted           |

- (2) Bright spots by the light passing through tears, breaks, etc in color filter.

- |                                  |                  |
|----------------------------------|------------------|
| · Exceed size of a half dot..... | High bright spot |
| · A half dot or less .....       | Not counted      |

- (3) Bright spots by the light passing through tears, breaks, etc in chromium mask.

- |                      |                  |
|----------------------|------------------|
| · Exceed 50µm .....  | High bright spot |
| · 50µm or less ..... | Not counted      |

- Inspector must observe the LCD screen from the normal direction under the illumination by a single 20W fluorescent lamp. The distance between the LCD screen and the inspector should be a height of 35cm above the worktable.  
The vertical illuminance is 300 to 600lux (reference value).
- Bright spot should be counted under entire black screen.
- Dark spot should be counted under entire white screen.
- The test is performed when frame frequency is 60Hz.

Figure 12-1 shows the specification.

(Note1) Please do not mistake a single bright spot for a bright spot connection due to Cs(supplemental capacitance) line at the center of each dot.

(Note2) If a pixel is dark partially, it connects into the number of dark spots in accordance with following rule.

- (a)  $S < 1/3$  : Not count. Only one of 4 dark connection is allowed.  
 (b)  $1/3 \leq S < 2/3$  : Considered as 0.5 dot.  
 (c)  $2/3 \leq S$  : Considered as 1 dot.

(S=Dark spot size/dot size)

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<div><p>(Note2) If a pixel is dark partially, it connects into the number of dark spots in accordance with following rule.</p><p>(a) <math>S &lt; 1/3</math> : Not count. Only one of 4 dark connection is allowed.</p><p>(b) <math>1/3 \leq S &lt; 2/3</math> : Considered as 0.5 dot.</p><p>(c) <math>2/3 \leq S</math> : Considered as 1 dot.</p><p>(S=Dark spot size/dot size)</p></div>																
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Figure 12-1 Appearance (Tentative)

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### 13. ENVIRONMENTAL SPECIFICATIONS

Table 13-1 show the environmental specifications.

Table 13-1 Environmental specifications

Item	Condition		Remark
Temperature	Operation	0~50°C	Temperature on surface of LCD panel (display area.)
	Storage	-20~60°C	
Humidity	Operation	20~85%RH	Maximum wet-bulb temperature should not exceed 29°C. No condensation.
	Storage	5~85%RH	
Vibration	Operation	10~500Hz, Sweep / 20minute, 2G, 2 hours for each X, Y and Z directions.	For single module without package.
Shock	Non-operation	15G, 6ms, 1time each $\pm X$ , $\pm Y$ and $\pm Z$ directions.	

NOTE : Table 13-2 and Figure 13-1 show the shock resistance standard when module is packaged.

Table 13-2 Shock resistance standard when module is packaged

Dropping location	Dropping height	Count
A~J	60cm	1 time

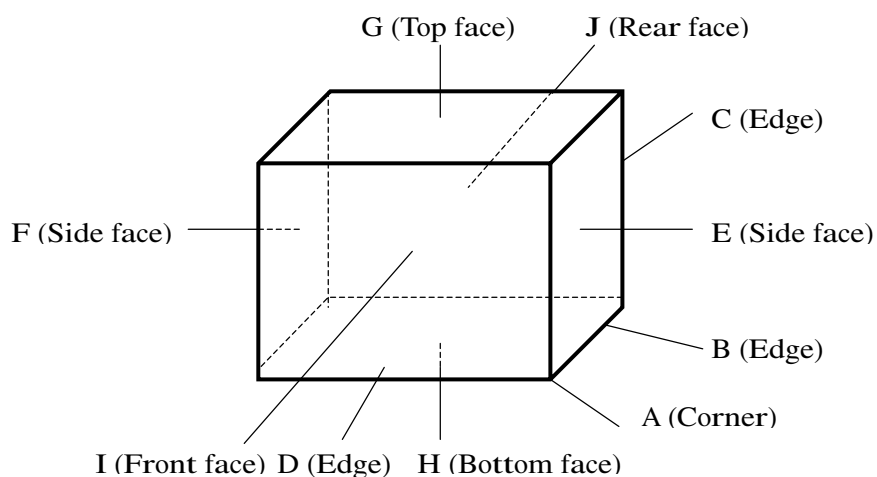


Figure 13-1 Direction to apply shock to package

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**16.WARRANTY**

The warranty period is one year after shipping. Products which fail during this period are repaired or replaced without charge, unless the failure is caused by user.

**17.PRECAUTIONS**

Adhere to the following precautions to use this LCD module properly.

**(1) Fail safe design**

LCD module has an inherent chance of failure. Customers must protect against injury, damage or loss from such failures by incorporating safety design measures into your facility and equipment such as redundancy, fire protection, and prevention of over-current levels and other abnormal operating conditions.

**(2) Handling of LCD panel**

LCD panel is mounted rear side of LCD module.

**① Do not apply any strong mechanical shock to the LCD module.**

Since the LCD panel is made of glass, excessive shock may damage the panel or cause a malfunction.

**② Do not press hard on the rear side of LCD module.**

In the LCD panel, the gap between two glass plates is kept perfectly even to maintain display properties and reliability. The hard pressure on the LCD panel may cause the following problems.

① Ununiformity of color

② Disorder of orientation of liquid crystal

Problem ① returns to normal condition after a while. Problem ② returns to normal condition by turning the power off and turning on again.

However these operations should be avoided to insure reliability.

**③ Precaution for not damaging the front light**

Since the surface of front light consists of the fine prism form, dent and dirt soil may cause deterioration of display quality.

**!Do not touch the display surface.**

On handling, please put on conductive gloves, and don't touch the screen.

**④ Do not place or contact objects on the display surface.**

This may make some parts of the LCD module distorted and the quality of display may deteriorate.

**(3) Handling of LCD module****① Do not pull the cold-cathode tube cable strongly.**

If the cable is pulled with the strength of 2kgf or more, the cable may be damaged or may lose reliability.

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## (5) Precautions in regards of designing module mounting

- ① **Excessive force should not be applied to the screen or the rear side of the LCD module.**  
Excessive pressure on the screen caused by the installation of the LCD module may deteriorate display quality and reliability.  
Since panel at the rare side of this LCD module is made from glass, brightness uniformity and the reliability of CCFT may decrease if the pressure is applied to the frontlight module.
- ② **Avoid twisting and bending the LCD module.**  
Excessive twist and bend may damage display quality and reliability.
- ③ **Avoid extending the power cable between the LCD module and inverter.**  
This may cause the frontlight to flicker or not to light.
- ④ **Keep the frontlight cable apart from the metal enclosure of the LCD module.**  
When frequency current for frontlight driving leak to the metal enclosure, the desired brightness may not be assured.
- ⑤ **Take countermeasure against electromagnetic interference of digitizer unit.**  
The noise, which is occurred from transfer and inductance for power supply, affects electromagnetic induction sensor module. **It is recommended to use the transfer and inductance that don't leak out magnetic flux. Please don't mount magnetic flux of transfer and coil right angled to sensor board**
- ⑥ **Mount the protect board on display screen.**  
The surface of frontlight is prism form. Make the circumstance that the surface cannot be touched.

## (6) Storage method

- ① **Do not store the LCD module in an atmosphere of organic solvent or corrosive gas.**  
In an organic solvent atmosphere, the polarizer film discolors and display quality deteriorates.  
In a corrosive gas environment, various parts of the module may corrode or deteriorate.
- ② **Store the LCD module in a FDTC package.**  
At storing, FDTC packages can be stacked up to 4 boxes.  
The LCD module is in an anti-static bag. Keep the module in that status.
- ③ **The LCD module is recommended to be stored in humidity controlled, cool and dark locations.**  
Recommended storage environment  
 ♣Place : Dark (avoid direct sunlight)  
 ♣Temperature : 10~35°C  
 ♣Humidity : 50~60%RH

Note) If the module is left in an environment of 60°C and above for a long period of time, optical characteristics may deteriorate.

## (7) Disposal Method

- ① **LCD module**  
The components of this LCD module can be grouped into metal, resin, glass and so on. As the frontlight contains CCFL which includes mercury, it must be disposed according to the local ordinance or regulations.
- ② **Package**  
All the packages are made of recyclable papers except the anti-ESD bag.

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## (8) Others

- ① If the LCD panel is damaged, do not inhale and do not swallow the liquid crystal.

If the liquid crystal adhere to the body or cloths, wash it off with soap immediately.

Follow regular precautions for electronic components.

- ② Flux residue on the printed circuit board is harmless to the quality and reliability of LCD module.

FDTC has adopted non-wash technology on module assembly process.

## 18. PRECAUTIONS FOR USE

This Product is designed, developed and manufactured as contemplated for general use, including without limitation, general office use, personal use, household use, and ordinary industrial use, but is not designed, developed and manufactured as contemplated for use accompanying fatal risks or dangers that, unless extremely high safety is secured, could lead directly to death, personal injury, severe physical damage or other loss (hereinafter "High Safety Required Use"), including without limitation, nuclear reaction control in nuclear facility, aircraft flight control, air traffic control, mass transport control, medical life support system, missile launch control in weapon system. If customer's product possibly falls under the category of High Safety Required Use, please consult with our sales representatives in charge before such use. In addition, FDTC shall not be liable against the customer and/or any third party for any claims or damages arising in connection with the High Safety Required Use of the Product without permission.

## 19. MISCELLANEOUS

Specifications of the TFT-LCD panel and other components used in the LCD module are subject to change. Both parties shall discuss together before change.

If any doubt is raised in the content of the specifications, both parties shall discuss and make best effort for the agreement.

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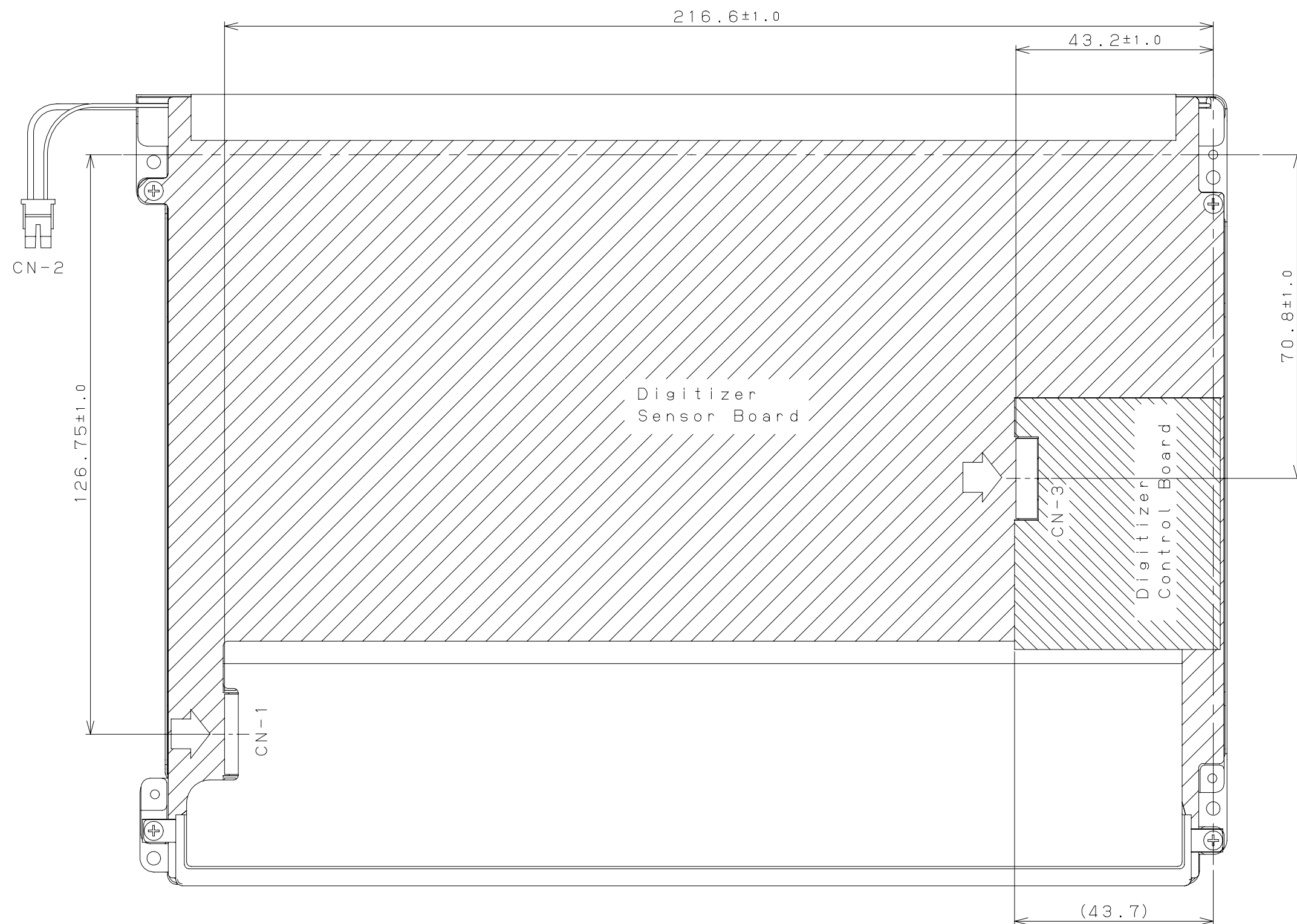
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Front View

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