

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

## Specification of FUJITSU TFT-LCD module

<b>FLC59UXC8V-02</b>
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Approval
Date :
By :

Specification No. : Tech Bes LCD-00021

Issue Date : May. 10, 2000

Issued by :

\_\_\_\_\_  
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Director  
LCD Design Dep.  
LCD Technology Div.  
LCD Group

**FUJITSU LIMITED**

【FLC59UXC8V-02】

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REVISION HISTORY

A

A

Revision	Date	Prepared	Checked		Approved	Summary
01A	May.10,2000					1st issue

B

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C

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### 1. APPLICATIONS

This specification is applied to the 23.1-inch (59 cm) UXGA supported TFT-LCD module.

### 2. PRODUCT NAME AND MODEL NUMBER

2-1 Product Name : LCD Module

2-2 Model Name : FLC59UXC8V-02

2-3 Product Drawing Number : NA19020-C453

### 3. OVERVIEW

This LCD module has a 23.1-inch (59 cm) TFT active-matrix liquid crystal panel that has 1600x1200 pixels.

This LCD module has a LDI digital 8-bit RGB Interface and supports 16,777,216 colors.

This LCD module has a control signal ENAB (data enable) for controlling both horizontal and vertical position of video data without Hsync or Vsync.

The power supplies of this LCD module are +5V DC (for the driving circuit) and +12V DC (for the backlight).

### 4. CONFIGURATION

This LCD module mainly consists of a color TFT-LCD panel, TFT driver ICs mounted on TCP, RGB interface printed circuit board, cold-cathode tube back-light and bezel.

The inverter for the backlight is mounted on the rear of the LCD module.

Fig.4-1 shows the block diagram of this LCD module.

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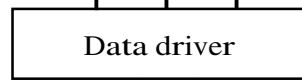
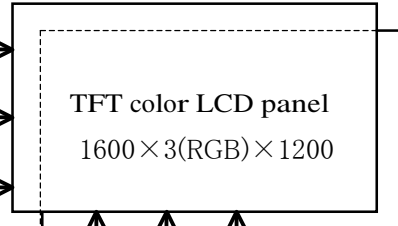
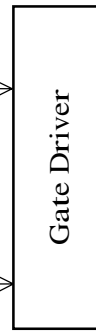
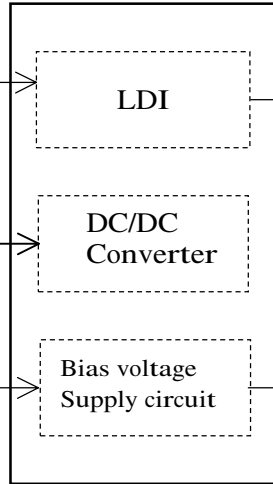
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Input signals

RXINCLK±  
RXINO±  
RXINI±  
RXIN2±

+5V DC

+12V DC



Back light

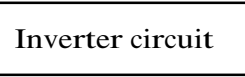


Fig.4-1 Block Diagram

### 5. MECHANICAL SPECIFICATIONS

Table 5-1 shows the mechanical specifications of this LCD module.

Table 5-1 Mechanical Specifications

Item	Specifications	Unit	Remark
Dimensions	530.0×432.8×(32.5)(TYP.) (Excluding I/F Connector and fixing parts)	mm	For details on dimensions, see dimensional outline drawing. ( see page 26,27,28 )
Display Resolution	(1600×RGB)×1200	—	
Display Dot Area	470.4×352.8	mm	
Dot Pitch	(0.098×RGB)×0.294	mm	
Aspect Ratio	1:1	—	
Weight	5,500 max	g	
FG-SG	Short circuit	—	

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## 6. ABSOLUTE MAXIMUM RATINGS

Table 6-1 shows the absolute maximum ratings of this LCD module.

Table 6-1 Absolute Maximum Ratings

Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Supply Voltage	V <sub>CC</sub>	Ta=25°C	-0.3	—	6.0	V
	V <sub>INV</sub>	Ta=25°C	-0.3	—	14	V
Input Voltage	V <sub>IN</sub>	Ta=25°C	-0.3	—	5.5	V
Control Voltage	V <sub>CNT</sub>	Ta=25°C	-0.3	—	V <sub>INV</sub>	V
Brightness Control Voltage	V <sub>VR1~4</sub>	Ta=25°C	0	—	4.0	V

## 7. RECOMMENDED OPERATING CONDITIONS

Table 7-1 shows the recommended operating conditions of this LCD module.

Table 7-1 Recommended Operating Conditions

Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage(Logic)	V <sub>CC</sub>	4.75	5.0	5.25	V
Supply Voltage(Inverter)	V <sub>INV</sub>	10.8	12.0	13.2	V
Ripple Voltage	V <sub>CC</sub>	V <sub>RP1</sub>	—	—	50 mV

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## 8. ELECTRICAL SPECIFICATIONS

Table 8-1 shows the electrical specifications of this LCD module. Figure 8-2 shows the equivalent circuit of the logic signal input. Figure 8-3 shows the equivalent circuit of the supply voltage input.

Table 8-1 Electrical Specification (LDI interface)

Item	Symbol	Condition	MIN.	TYP.	MAX	Unit	Remark
LDI	Differential-input Voltage	$V_{ID}$	(250)	(345)	(450)	mV	
	Supply Current	$I_{CC}$	—	(T.B.D)	(T.B.D)	mA	*1
	Supply Rush Current	$I_{SCC}$	—	—	(T.B.D)	A	*2
	Supply Rush Current Duration(1A excess)	$T_{SCC}$	—	—	(T.B.D)	ms	
BACK LIGHT	Supply Current	$I_{INV}$	—	(2.5)	(T.B.D)	A	
	Brightness Control Voltage	$V_{VR1\sim4}$	0		3.5	V	
	Lighting Frequency	$f$	—	(60)	—	KHz	
	Lighting Fix Voltage	$V_{ent}$	0	—	0.8	V	
	Non-Lighting Fix Voltage	$V_{ent}$	2.1	—	$V_{INV}$	V	

(\*1) Typical current value is measured when color-bar-pattern is displayed at  $V_{CC}=5.0V$ .

Maximum current value is measured when every 2 pixel-checked pattern is displayed at  $V_{CC}=4.75V$ .

Rush current is not included in this value.

(\*2) These items prescribe the rush current of internal DC/DC.

Current value for charging capacitors inside the module is not prescribed.

(\*3) The current capacities of power supply for inverter should be more than twice as much as the supply current( $I_{INV}$ ), otherwise the protective circuit of inverter(fuse)might not work.

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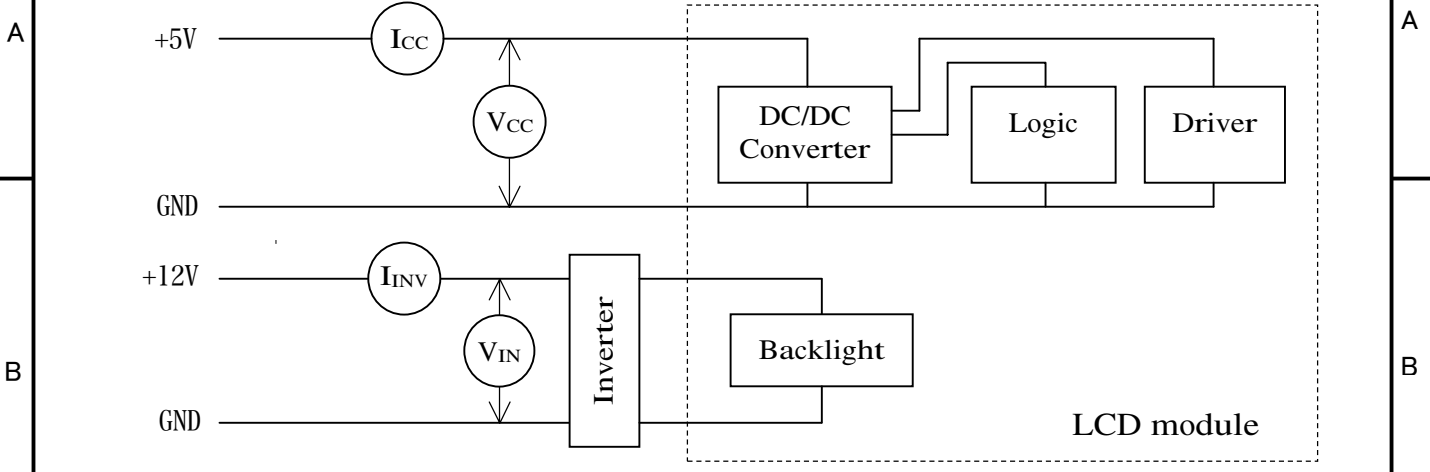


Fig.8-1 Measurement Circuit

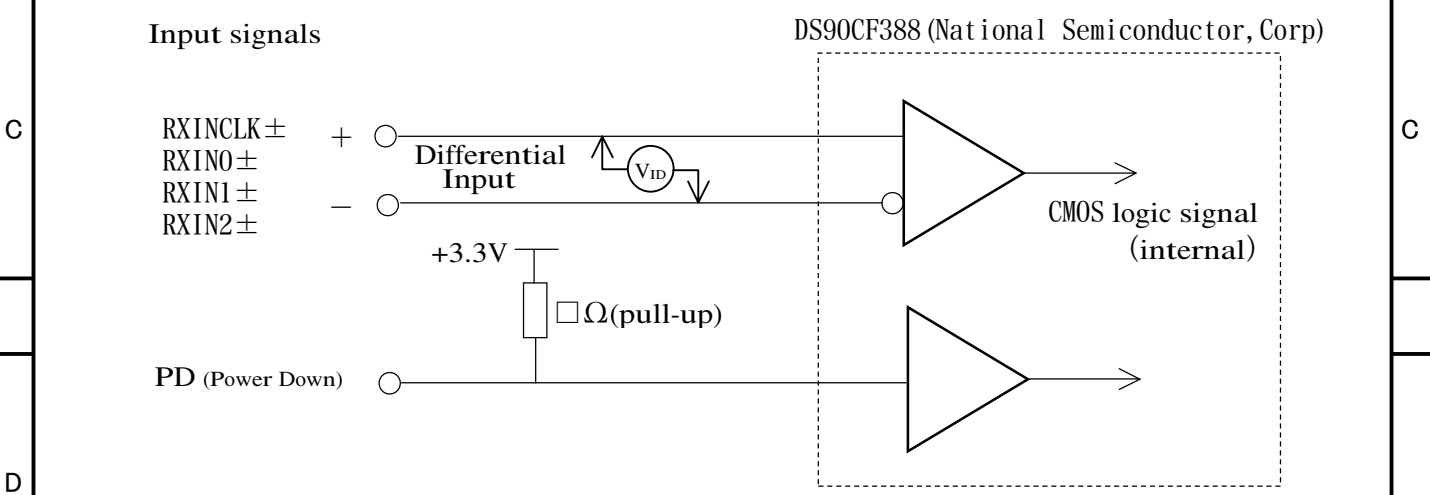


Fig.8-2 Equivalent circuit of logic signal Input

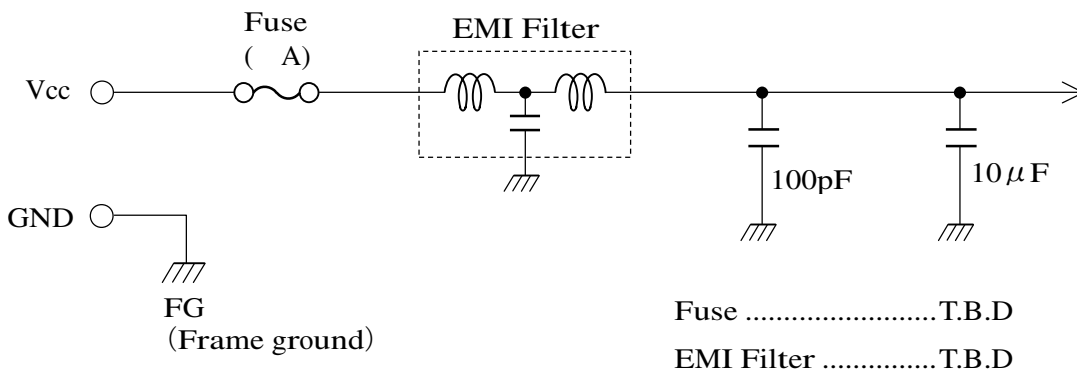


Fig.8-3 Equivalent Circuit of Power Supply

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## 9. OPTICAL SPECIFICATIONS

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

Table 9-1 Optical specifications

Ta=25°C

Item	Symbol	Condition	Specifications			Unit	Remark			
			MIN.	TYP.	MAX.			Note		
Visual Angle	Horizontal	$\theta_{L,R}$	$CR \geq 10$	$\theta_{U,D}=0^\circ$	80	—	—	°	(1)(2) (3)(5) (6)	
	Vertical	$\theta_{U,D}$		$\theta_{L,R}=0^\circ$	80	—	—	°		
Contrast Ratio	CR	$\theta_{L,R,U,D}=0^\circ$ ( $R_{VR}=\square k\Omega$ )		210	400	—	—	White/ Black	(1)(2) (3)(5)	
Response Time(ON) (B→W)	$t_{on}$	$\theta_{L,R,U,D}=0^\circ$	Ta=25°C	—	10	25	ms		(1) (4) (5)	
			Ta=0°C	—	50	100	ms			
Response Time(OFF) (W→B)	$t_{off}$	$\theta_{L,R,U,D}=0^\circ$	Ta=25°C	—	15	30	ms			
			Ta=0°C	—	50	100	ms			
Brightness	I	$\theta_{L,R,U,D}=0^\circ$ $V_{CC}=5V$ (at maximum brightness)		200	250	—	cd/m <sup>2</sup>	White *1	(1)(5)	
Brightness Uniformity	$\Delta I$			75	—	—	%		(1)(5)(7)	
Chromaticity	W		x		0.283	0.313	0.343	—		(1) (5)
			y		0.299	0.329	0.359	—		
	R G B	(x,y)	Red	(0.610, 0.340) TYP.						
			Green	(0.300, 0.570) TYP.						
			Blue	(0.150, 0.130) TYP.						
LCD Panel Type				TFT Color						
Display Mode				Normally Black VA						
Wide Viewing Angle Technology				MVA						
Optimum Viewing Angle				— (symmetry)					(6)	
Display Color				16,777,216 (8-bit color)						
Color of non-display area				Black						
Surface Treatment				T.B.D						

(\*1) Value at 15~20 minutes after lighting on.

(Note1)

- CS-1000 (MINOLTA Co., Ltd.), or equivalent luminance colorimeter should be used for themeasurement.

Field=2° , L=500mm

- The specified value of viewing angle, contrast, brightness, brightness uniformity and chromaticity are measured under the dark room condition (1lux or less).

(Note2)

- $R_{VR}=\square k\Omega$ , if any condition is not specified.

- The characteristics of  $R_{VR}=\square k\Omega$  is equal to that of  $R_{VR}=\infty$ .

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**Note 1) Definition of Viewing Angle (1)**  
Based on Fig.9-1.

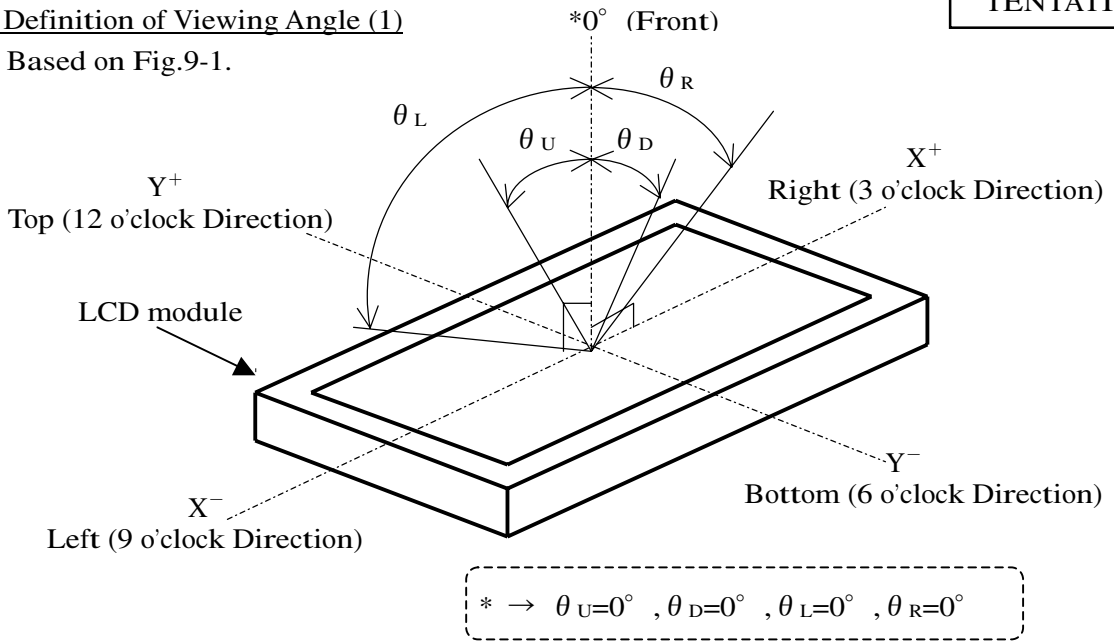


Fig.9-1 Definition of Viewing Angle (1)

**Note 2) Definition of Viewing Angle (2)**  
Based on Fig.9-2.

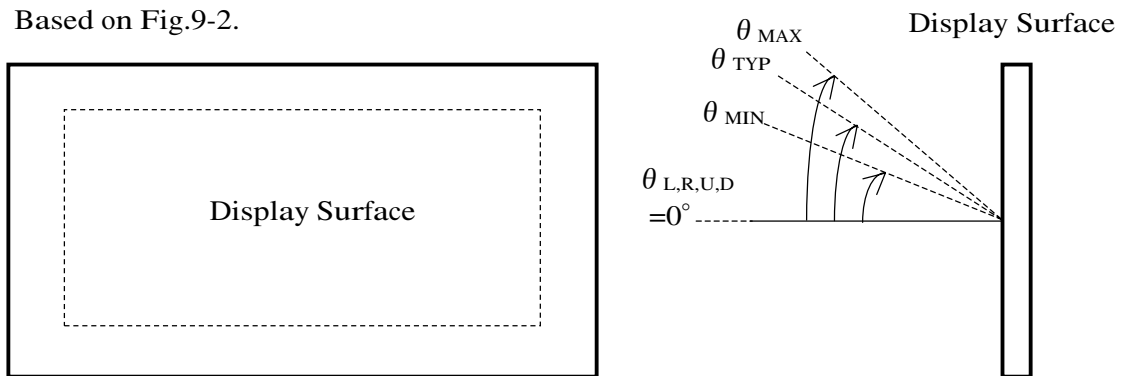


Fig.9-2 Definition of Viewing Angle (2)

**Note 3) Definition of Contrast Ratio (CR)**  
Determined by Formula (1) based on Fig. 9-3 Voltage-Brightness characteristics.

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

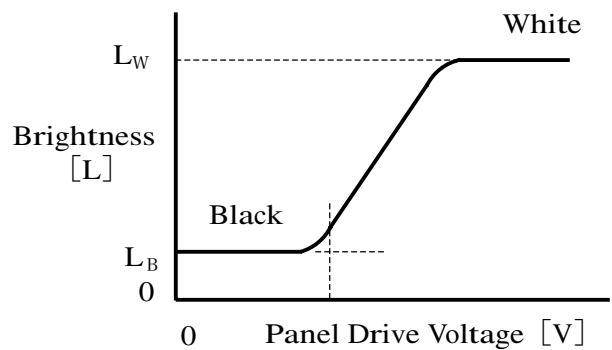


Fig.9-3 Voltage-Brightness Characteristics

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Note 4) Definition of Response Time

Based on Fig.9-4.

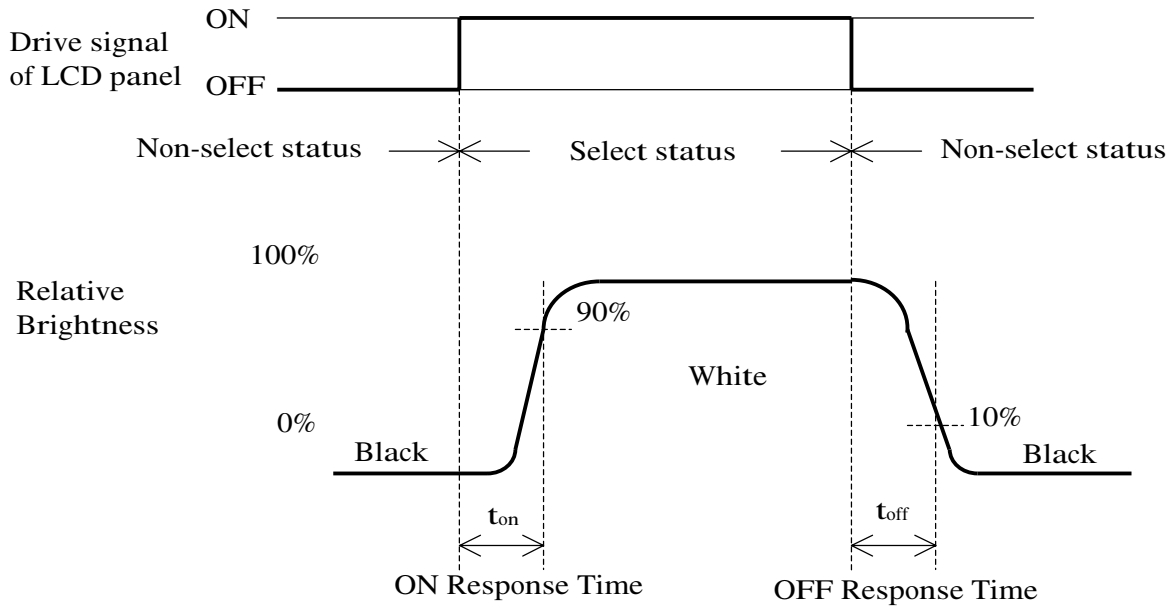


Fig.9-4 Definition of Response Time

Note 5) Contrast Ratio and Response Measurement System

Based on Fig.9-5.

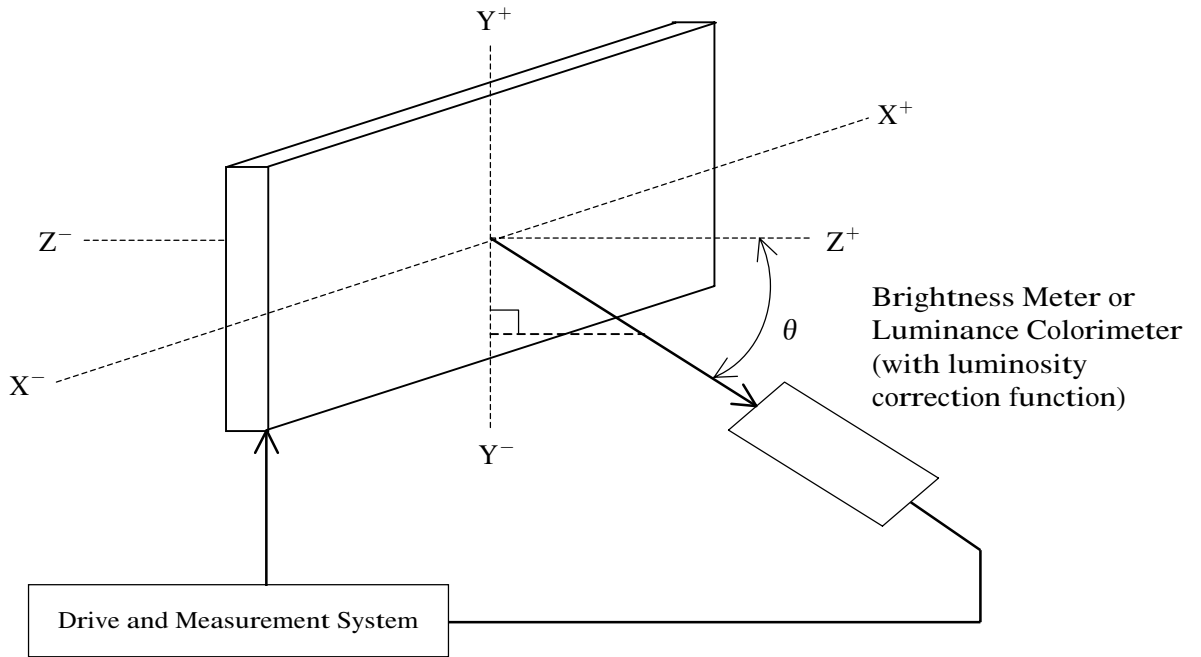


Fig.9-5 Contrast Ratio and Response Time Measurement System

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Note 6) Definition of Optimum Viewing Angle

Based on Fig.9-6.

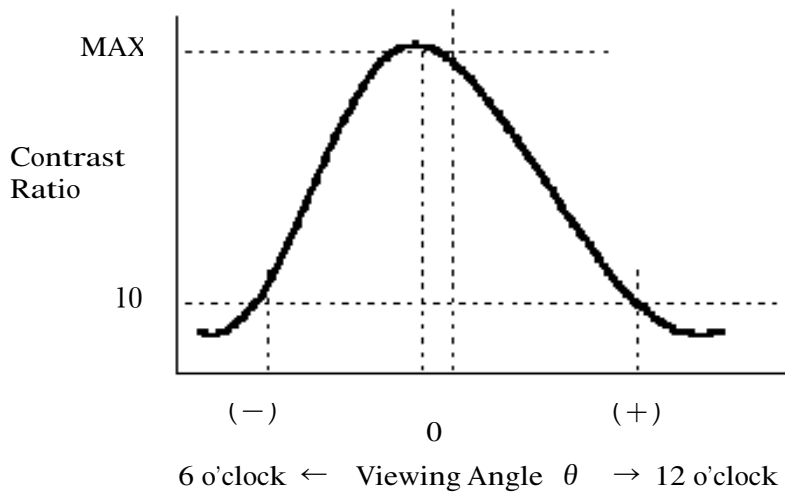


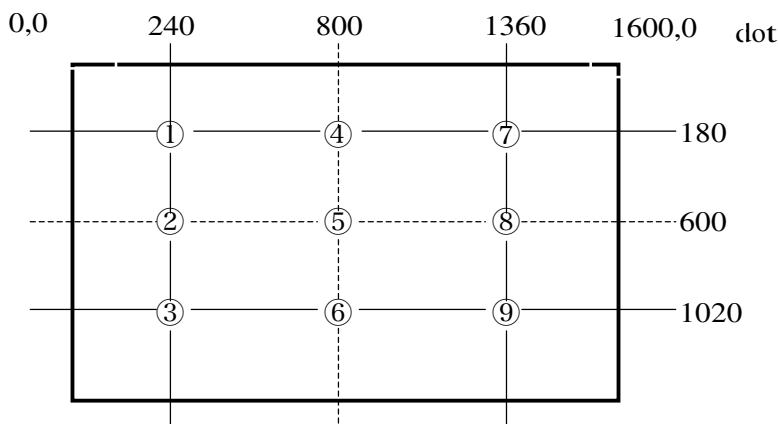
Fig.9-6 Definition of Viewing Angle

Note 7) Definition of Brightness Uniformity

Brightness uniformity is defined by the following formula.

Brightness (I1~I9) are measured at the following 9 points (①~⑨) on the display area shown in Fig.9-7.

$$\text{Brightness Uniformity } (\Delta L) = \frac{|\text{Min. In I}|}{|\text{Max. In I}|} \times 100 (\%), n=1 \text{ to } 9$$



Note) Each measurement point (①~⑨) defines the center spot of Brightness Meter view.  
The tolerance of measurement position is  $\pm 3\text{mm}$ .

Fig.9-7 Measurement Points

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10. INTERFACE SPECIFICATIONS

10-1. Signal descriptions

Table 10-1 shows the description and configuration of the interface signals (CN1).

Table 10-1 Interface signals (CN1)

Pin No.	Symbol	I/O	Function
1	Vcc	—	+5V power supply
2	Vcc	—	+5V power supply
3	Vcc	—	+5V power supply
4	Vcc	—	+5V power supply
5	GND	—	Ground
6	GND	—	Ground
7	GND	—	Ground
8	GND	—	Ground
9	GMCH	—	Gamma Control (High)
10	GMCL	—	Gamma Control (Low)
11	A0M	I	Negative differential input
12	A0P	I	Positive differential input
13	A1M	I	Negative differential input
14	A1P	I	Positive differential input
15	A2M	I	Negative differential input
16	A2P	I	Positive differential input
17	CLKM	I	Negative differential input
18	CLKP	I	Positive differential input
19	A3M	I	Negative differential input
20	A3P	I	Positive differential input
21	A4M	I	Negative differential input
22	A4P	I	Positive differential input
23	A5M	I	Negative differential input
24	A5P	I	Positive differential input
25	A6M	I	Negative differential input
26	A6P	I	Positive differential input
27	A7M	I	Negative differential input
28	A7P	I	Positive differential input
29	PD	I	LVDS Core PowerDown
30	LVDSGND	—	LVDS Ground
31	LVDSGND	—	LVDS Ground

Connector : FI-WE31P-HF (Japan Aviation Electronics)

User's connector : FI-W31M, FI-C3-A3-15000 (Contact)(Japan Aviation Electronics)

Note1) N.C terminal should keep open.

Note2) Inputted signals adhere to 「LVDS Display Interface (LDI) TFT Data Mapping for Interoperability with FPD-Link」(National Semiconductor).

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10-2. Color Data Assignment

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Table 10-2 shows the color data assignment.

Table 10-2 Color Data Assignment

Color		Data signal (0: Low level, 1: High level)																								
		Odd	R07	R06	R05	R04	R03	R02	R01	R00	G07	G06	G05	G04	G03	G02	G01	G00	B07	B06	B05	B04	B03	B02	B01	B00
		Even	RE7	RE6	RE5	RE4	RE3	RE2	RE1	RE0	GE7	GE6	GE5	GE4	GE3	GE2	GE1	GE0	BE7	BE6	BE5	BE4	BE3	BE2	BE1	BE0
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
	Blue		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	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
	Red		1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	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	
	↑	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Darker	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	↑	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	Brighter	253	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	↓	254	1	1	1	1	1	1	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	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		
	↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0		
	Darker	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0			
	↑	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	↓	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	Brighter	253	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0			
	↓	254	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0			
	Green	255	0	0	0	0	0	0	0	1	1	1	1	1	1	1	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		
	↑	1	0	0	0	0	0	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	0	0	0	0	0	1	0		
	↑	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	↓	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	Brighter	253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1		
	↓	254	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	1	1	1	1	1	1	1	1		

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

The gray scale is brighter as the number is larger.

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

Note.3) Color data consist of 48 bits, namely, 8-bit odd and even data for each red, green and blue.

Optional data can be set to red, green and blue independently.

Therefore, the module is able to display 16,777,216 colors.

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**10-3. Input Signal Timing**

Table 10-3 and Fig.10-1 shows the input signal timing.

**Table 10-3 Timing Characteristics**

(T=0~50°C, Vcc=5±0.25V)

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK signal (Clock)	Period	Tc	(11.765)	12.345	(18.181)	ns	
	Frequency	1/Tc	(55)	81.000	(85)	MHz	
	Duty	Tch/Tc	(45)	50	(55)	%	
	High time	TclkH	(3.5)	—	—	ns	
	Low time	TclkL	(3.5)	—	—	ns	
	Rise time	Telkr	—	—	(4)	ns	
	Fall time	Telkf	—	—	(4)	ns	
DCLK-Data Timing	Setup time	Tset	(3)	—	—	ns	
	Hold time	Thold	(2)	—	—	ns	
ENAB signal	Horizontal Period	Th	(920)	1080	(T.B.D)	DCLK	
		Th	(T.B.D)	13.3	(16.6)	μs	
	Hor. Display period Blanking	Thd	800	800	800	DCLK	*2
		—	(120)	280	Th-800	DCLK	
	Vertical Period	Tv	(1220)	1250	(T.B.D)	Th	
		Vertical Frequency	1/Tv	(50)	60	(T.B.D)	Hz
	Ver. Display period Blanking	Tvd	1200	1200	1200	Th	*2
		—	(20)	50	Tv-1200	Th	
Data-ENAB timing	Tdn	—	0	—	DCLK	*3	

\*1) •The rise timing of ENAB specifies horizontal display position. The data latched at falling edge of DCLK after the rise of ENAB is displayed at the left edge of the screen.

•The first ENAB pulse after its remaining at “Low” level for the period equivalent to four times of Hsync period specifies vertical display position. The data latched during the first ENAB pulse is displayed at the top line of the screen.

\*2) •If ENAB remains at “High” level for the period of less than 800 DCLK or the number of ENAB pulse in a frame period becomes less than 1200, the rest of the screen stays black.

\*3) •The display position does not fit to the screen if the ENAB period and the effective data period do not synchronize with each other.

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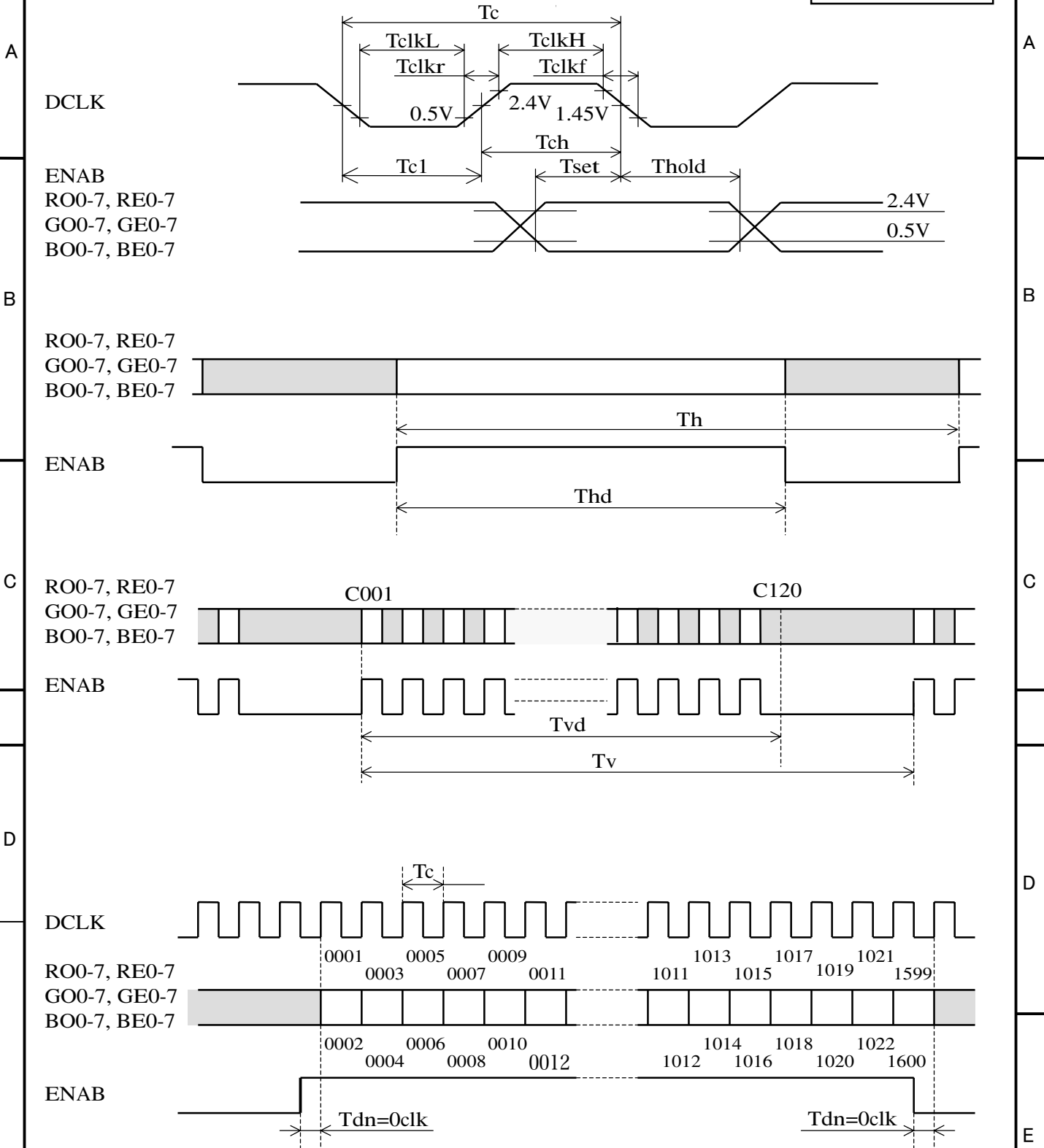


Fig.10-1 Input Signal Timing Chart

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10-4. Correspondence between Data and Display Position

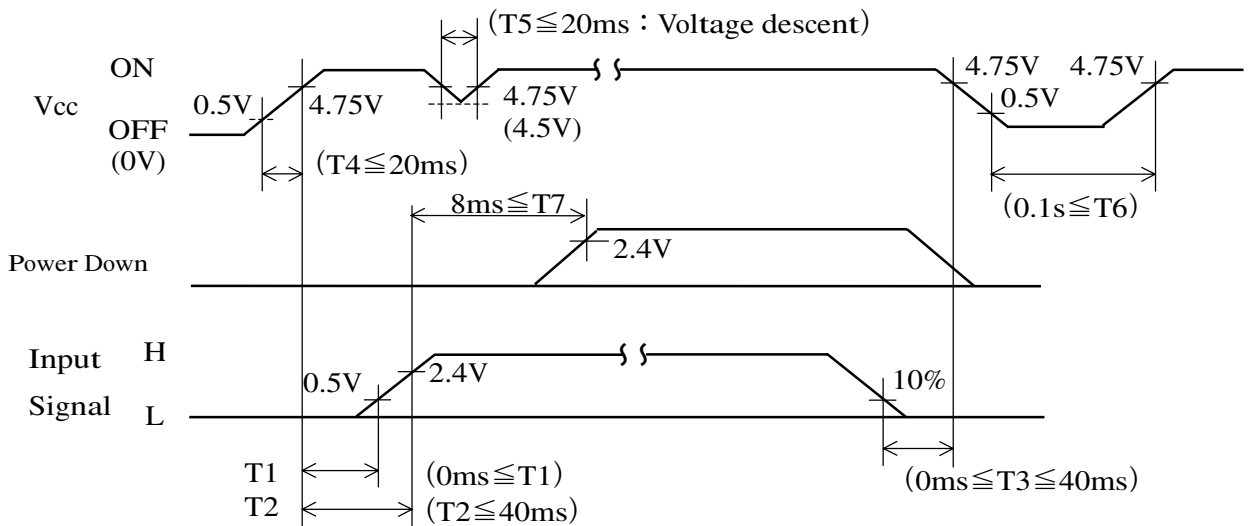
Fig.10-2 shows the Correspondence between Data and Display Position.

	S0001	S0002	S0003	S0004	S0005	S0006	S0007	S0008	-----	S4799	S4800
C100	RO 0001	GO 0001	BO 0001	RE 0002	GE 0002	BE 0002	RO 0003	GO 0003		GE 1600	BE 1600
C1200	RO 0001	GO 0001	BO 0001	RE 0002	GE 0002	BE 0002	RO 0003	GO 0003		GE 1600	BE 1600

Fig.10-2 Correspondence Data and Display Position

10-5. Power Supply Sequence

The sequence of input signals and On/Off of the power supply of this LCD module should keep the specification shown in Fig.10-3 to prevent latch-up of the driver ICs and DC driving of the LCD panel.



Note: Power Supply Sequence is defined by the signal inputted to LDI-IC(TRANSMITTER).

Fig.10-3 Power Supply Sequence

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### 11.BACKLIGHT SPECIFICATIONS

#### A 11-1.Pin configuration for Backlight

Table11-1 Pin Assignment of CN-3,4

Pin No.	Signal	Function
1	V <sub>VR1</sub>	N.C
2	V <sub>VR2</sub>	N.C
3	V <sub>VR3</sub>	N.C
4	V <sub>VR4</sub>	Brightness Control(White)
5	GND	Ground
6	V <sub>cnt</sub>	Lighting Control
7	V <sub>INV</sub>	Power Supply
8	V <sub>INV</sub>	Power Supply
9	V <sub>INV</sub>	Power Supply
10	V <sub>INV</sub>	Power Supply
11	GND	Ground(High Voltage)
12	GND	Ground(High Voltage)

Connector : 53261-1490

User's Connector : 51021-1400

Supplier : Molex-Japan Co.Ltd.

Note) N.C terminal should keep open.

#### D 11-2.Life

The life of the backlight is a minimum of 50,000 hours at the following conditions.

##### (1)Working conditions

- ① Ambient temperature : 25 ± 5°C
- ② Brightness Control(V<sub>VR1</sub>~4) : 0V

##### (2)Definition of life

- ①Brightness becomes under 50% of the minimum brightness value shown in Table 9-1.
- ②The lamp becomes not lighting on.
- ③Lamp becomes flashing.

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### 12. APPEARANCE SPECIFICATIONS

#### 12-1.Appearance

Length:

L [mm]

Width:

W [mm]

Allowable number of pieces: N, Average diameter: D [mm]

No.	Item		Judgement method and standard		Remarks
1	Foreign particle	Black particle	0.5 > D	N ≤ T.B.D	Recognized in the cell with lighting
		Fiber	3.0 > L	N ≤ T.B.D	
2	Scratch	Scratch on polarizer film	10.0 > L	N ≤ T.B.D	
3	Nick	Nick on polarizer film	0.5 > D	N ≤ T.B.D	

#### Note

- Foreign particle and scratch that do not effect display image, such as foreign particle between glass and polarizer film out of the display area, scratch on metal bezel, backlight module or polarizer film out of the display area are not counted.
- These items are applied to the defects in the cell when backlight is on, and defects on the surface of the polarizer film at the display area.
- Must be observed the LCD screen from the normal direction unless specified. The distance between the LCD screen and the observing position should be 35cm or more. One 20W fluorescent lamp is used at 50cm above the work table. At this time, the illuminance at the vertical direction to the fluorescent lamp is 300 to 600 lux (reference value).

#### 12-2.Dot defects (Bright spots, Dark spots)

##### 12-2-1.Area to be inspected

- Inside display dot area (470.4 X 352.8mm)
- Display dot area means active area.
- One pixel consists of 3 dots (red, green and blue).

##### 12-2-2.Bright spots definition

- Bright spots are classified as follows. (based on brightness samples)
  - Visible through 2% ND filter .....High-bright spot ( R,G )
  - Visible through 5% but invisible through 2% ND filter ..... Low-bright spot( R,G,B )
  - Invisible through 5% ND filter .....Not counted
- Tears, breaks, etc in color filter visible by the light passing through.
  - Bigger than a half dot..... High bright spot
  - A half dot or smaller .....Not counted
- Tears, breaks, etc in black matrix visible by the light passing through.
  - Diameter above 50 μ m ..... High-bright spot
  - Diameter of 50 μ m or smaller.....Not counted

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A

A

12-2-3. Number of bright spot standard

Item	Entire Screen	
Brightness classification	High-bright spots	High and Low-bright spots
Number of defects	T.B.D	T.B.D

B

B

NOTES :

1. Display should be all black when bright spots are counted.
2. Number of high-bright spots of green (G) is up to T.B.D.
3. Number of two low-bright spot connections is up to T.B.D.
4. Number of three bright spot connections and two high-bright spot connections is T.B.D.
5. Number of high-bright spot and low-bright spot connections is up to T.B.D.

12-2-4. Distance between Bright spots

- High-bright spots R and G.....T.B.D mm or more
  - High-bright spots and low-bright spot .....T.B.D mm or more
- (Not applied to two-bright-spot connections allowed in NOTES of 12-2-3)

C

C

12-2-5. Number of Dark spots standard

Item	Entire Screen
Number of defects	T.B.D
Number of two dark spot connections	T.B.D
Number of three dark spot connections	T.B.D

D

D

NOTES :

1. Display should be all white when dark spot is counted.
2. Distance between defects is T.B.D mm or more.
3. If dark spot size is smaller than one dot, convert with following rule and sum up.
  - (a)  $A < 1/3$  : Not counted.  
(Under T.B.D of 4 dark spot-connection is allowed.)
  - (b)  $1/3 \leq A < 2/3$  : Considered as 0.5 dot.
  - (c)  $2/3 \leq A$  : Considered as 1 dot.  
(A= Dark spot size/dot size)

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### 13. ENVIRONMENTAL SPECIFICATIONS

Table 13-1 shows 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	10~500 Hz, 1 cycle/20minute, 9.8m/s <sup>2</sup> , 1.5 mm max, 2 hour each X, Y and Z directions	For single module without package.
Shock	Non-operation	147m/s <sup>2</sup> , 6ms, 1time each ±X, ±Y and ±Z directions.	

NOTE : Table 13-2 and Fig.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 ~ D	55cm	1 time
E ~ J	65cm	1 time

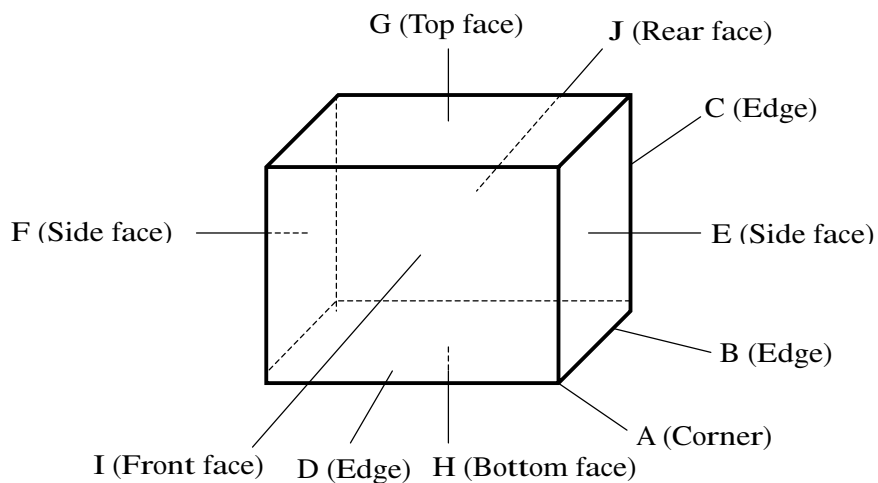


Fig.13-1. Direction to apply shock to package

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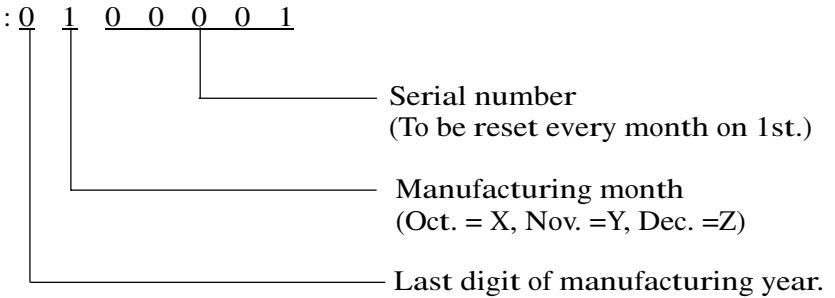
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### 14. INDICATIONS

This module has the following indications.

- (1) Product name : LCD unit
- (2) Model number : FLC59UXC8V-02
- (3) Product drawing number : NA19020-C453
- (4) Manufacturing number : 0 1 0 0 0 0 1



- (5) Version number : 01A(Example)  
 -1st 2 digits "01" means operational version.  
 -3rd alphabet means functional version.
- (6) Country of origin : MADE IN JAPAN
- (7) Company name : FUJITSU LIMITED
- (8) Disposal method of cold-cathode tubes. (See Fig.14-1)
- (9) Caution when changing cold-cathode tubes. (See Fig.14-2)



Fig.14-1

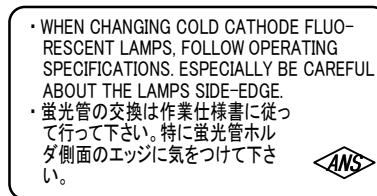


Fig.14-2

### 15. PACKAGING

#### 15-1. Packaging specifications

- (1) LCD modules / 1 package.
- (2) Weight: approximately ( ) kg / 1 package.
- (3) Outline dimensions: ( ) mm (W) × ( ) mm (D) × ( ) mm (H)

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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) Handling of LCD panel**

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

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 LCD panel surface.**

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 Do not scratch the polarizer film on the LCD panel surface.**

- Do not press or rub the display surface with a hard tool, tweezers, etc.
- For handling, use cotton or conductive gloves so that the display surface is not soiled.
- If dust or dirt soils the display surface, clean it as follows with a soft cloth (deerskin, etc.)

[Dust] Wipe off with a soft cloth. (do not rub.)

[Dirt] Apply clear water to a soft cloth and squeeze hard out of water drops, then lightly wipe off the specified parts. Only if the dirt is hardly wiped off, use isopropyl alcohol or ethanol.

Be careful not to splash the water or the solvents on the edge of polarizer and in the LCD unit.

The polarizer possibly exfoliates due to the solvent and water penetrated between the polarizer and the LCD panel.

Do not use unspecified solvent such as ketone (acetone, etc.) and aromatics (xylene, toluene, etc.)

(Caution) Be careful not to allow the water or solvent to enter the module.

- If saliva or water drops are left for a long period of time, the part may become deformed or discolored.

Wipe off immediately in the same way as for dirt.

- Do not allow oil to adhere to the module since excessive oil is hard to clean.

**④ Do not place or contact objects on the display surface for a long period of time.**

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

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(2) Handling of LCD module

- ① **Do not pull the cold-cathode tube cable strongly.**  
If the cable is pulled with the strength of 2kg or more, the cable may be damaged or may lose reliability.
- ② **Assemble the module into user's system in a dust free environment.**  
Conductive foreign matter adheres to the module may cause failures.
- ③ **Take anti-electrostatic measures for assembling the module.**  
Since the LCD module contains CMOS-ICs, the following points should be observed.
  - For assembling the module, operator should be grounded and wear cotton or conductive gloves.
  - Floor of work area and work table to assemble the LCD module should be covered with electrostatic shielding in order to discharge static electricity via an earth wire.
  - If necessary, ground operation tools (soldering iron, radio pliers, tweezers, etc.).
  - Do not take the module out of the conductive bag until the module is assembled.
  - Do not assemble the module under low humidity (50%RH or less).
- ④ **Do not pull the connecting cable on the rear face of the LCD module strongly.**
- ⑤ **Do not disassemble or remodel the LCD module.**  
Disassembly or remodeling of the LCD module may result in malfunctions or deterioration of the display quality and reliability.

(3) Precautions in regards of operating the LCD module

- ① **Adhere to the specified power supply sequence.**  
If not followed, the CMOS-IC may cause a latch-up, or DC voltage may be applied to the liquid crystal, which cause a failure or serious deterioration in display quality.
- ② **Do not operate the LCD module when condensation occurs.**  
If the LCD module is operated when condensation is on the terminals of the LCD panel, the terminals cause electrochemical reaction, and may reach disconnection. Condensation easily occurs especially when the module is moved from cold environment to warm environment.
- ③ **The following troubles occur when the LCD module is not used under recommended temperature.**
  - Operation under high temperature(>50°C) : Display colors shift to blue.
  - Storage under high temperature (>60°C) : The polarizer film deteriorates and contrast decreases.
  - Operation under low temperature (< 0°C) : The response speed decreases considerably.
  - Storage under low temperature (<-20°C) : The liquid crystal may solidify and become damaged.
- ④ **Be sure to input the control signals at the correct timing.**  
If control signals (DCLK, ENAB) are not input, or if the timing is out of the specified timing, DC voltage may be applied to the liquid crystal and, as a result, cause image sticking or deterioration of contrast.

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(4) 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.  
Brightness uniformity and the reliability of CCFL may decrease if the pressure is applied to the backlight 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 backlight to flicker or not to light.
- ④ **Keep the backlight cable apart from the metal enclosure of the LCD module.**  
When frequency current for backlight driving leak to the metal enclosure, the desired brightness may not be assured.
- ⑤ **When Mounting LCD module with M4 screws (x4), tighten the screws with torque below 4.5kgf.**

(5) 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 Fujitsu package.**  
At storing, Fujitsu packages can be stacked up to    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.

(6) Disposal Method

- ① **LCD module**  
The components of this LCD module can be grouped into metal, resin, glass and so on.  
As the backlight 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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(7) 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.**  
 Fujitsu has adopted non-wash technology on module assembly process.

**18. OTHERS**

Specifications of the TFT-LCD panel and other components used in this LCD module are subject to change. Both parties shall discuss together and make the best effort to reach agreement in case of the rising of any doubt to the contents of the specifications.

This LCD module is not designed for the purpose where high reliability is required, such as for aero-space equipment, control system of nuclear power and medical life-support equipment.

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A

A

B

B

C

C

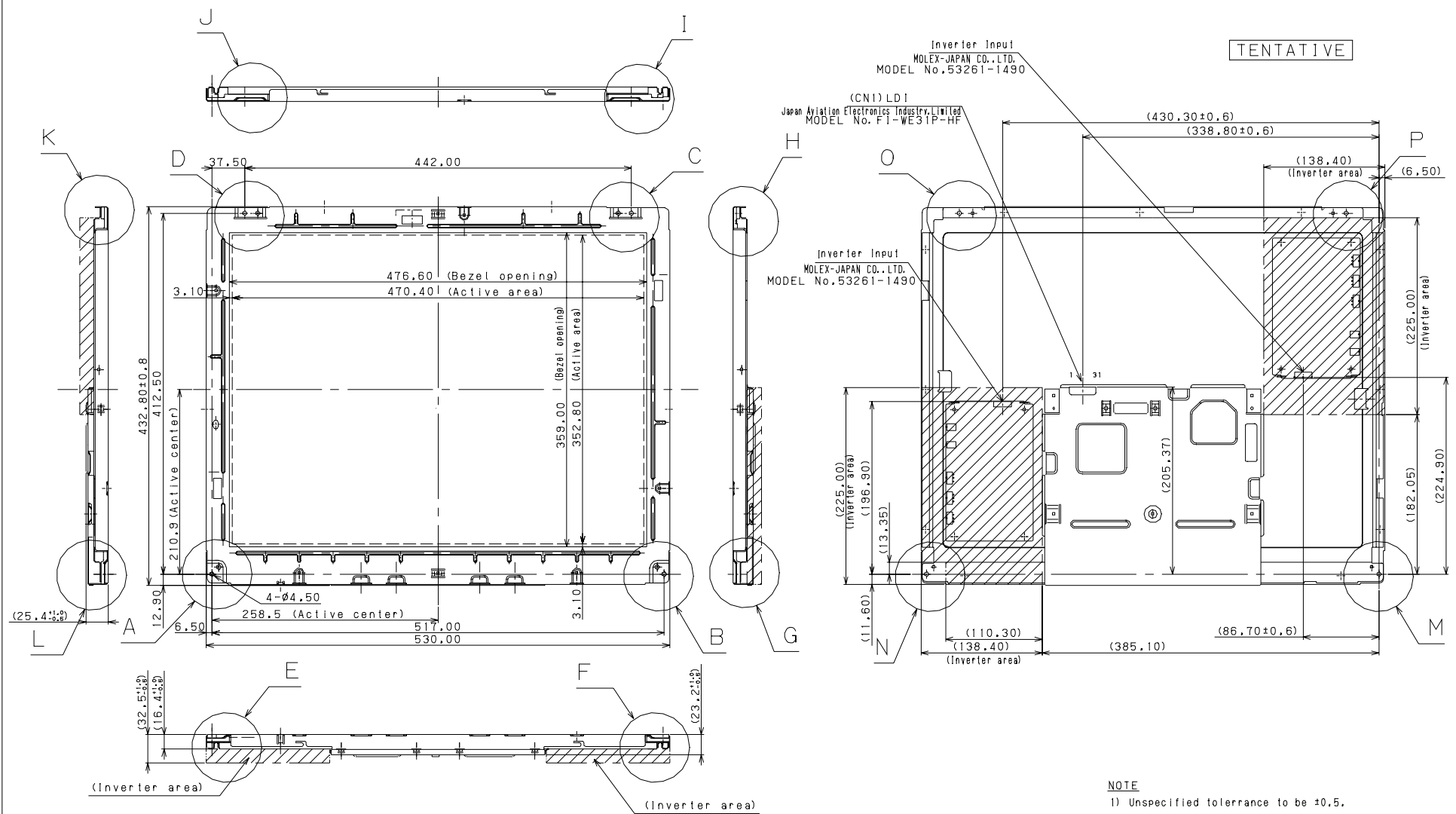
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E

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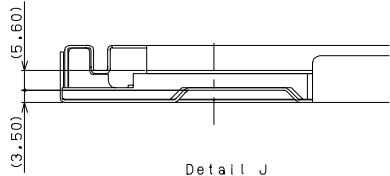
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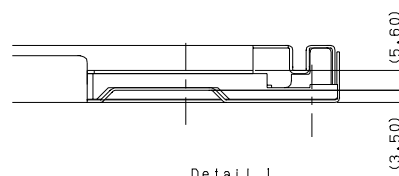
NOTE  
1) Unspecified tolerance to be ±0.5.

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				DRAW. NO.			
				Tech Bes LCD-00021			
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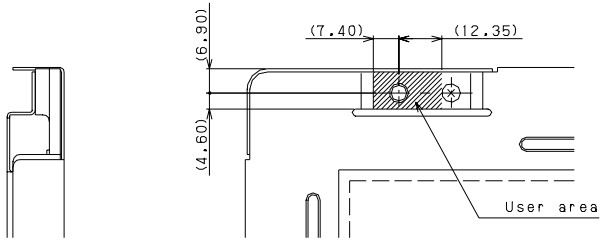
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Detail J

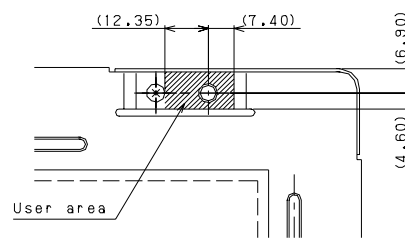


Detail I

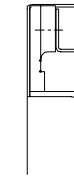


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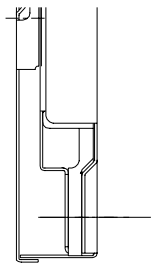
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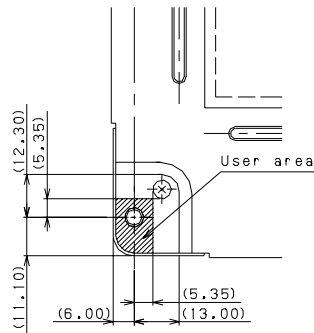
Detail C



Detail H

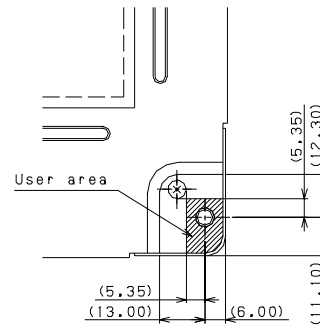


Detail L

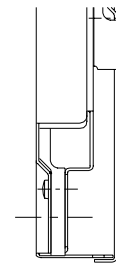


Detail A

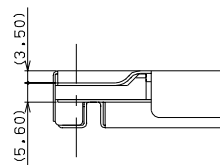
3.5 (+.3) Surface of Bezel  
2.3 (+0.7) Surface of Polarizer



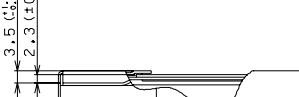
Detail B



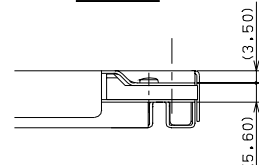
Detail G



Detail E (1)



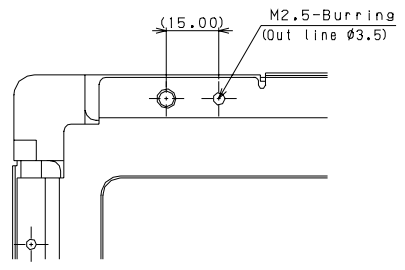
Detail E (2)



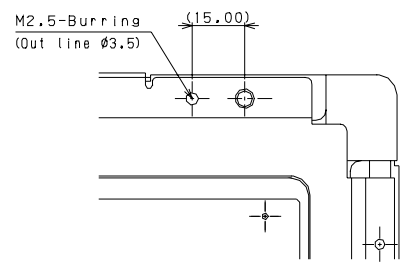
Detail F

MATER.		FINISH		TITLE		SCALE	
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EDT.	DATE	DESIG.	CHECK	DESCRIPTION			
DESIG.		CHECK		APPR.		27/	

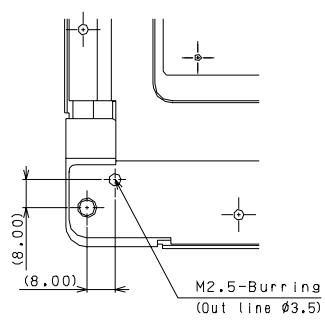
TENTATIVE



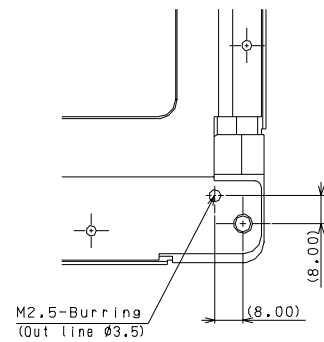
Detail Q



Detail P



Detail N



Detail M

MATER.		FINISH		TITLE		SCALE	
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EDIT.	DATE	DESIG.	CHECK	DESCRIPTION		APPR.	
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