

To : _____

Specification of FUJITSU TFT-LCD module

FLC43XWC8V-02

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-00149

Issue Date : Dec. 5, 2002

Issued by : F. Yamada

F. Yamada

Director

Products Engineering Dept.
LCD Products Div.

FUJITSU DISPLAY TECHNOLOGIES CORPORATION

【FLC43XWC8V-02】

REVISION HISTORY

A	Revision	Date	Prepared	Checked		Approved	Summary
	01A	Jul. 12, 2002	H.Takahashi			F. Yamada	1st issue
B	02B	Oct. 11, 2002	S.Sekido			F. Yamada	Change gasket location and constant number of fuse
	03B	Oct. 25, 2002	K.Yonemura			F. Yamada	Change gasket location (3 locations)
	04B	Nov. 12, 2002	S.Sekido			F. Yamada	Change gasket location (2 locations)
C							
D							
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DATE	DOCUMENT CONTROL SECTION

04	20021205	Sekido	Takahashi	Yamada	Revise p2, 6, 7, 8, 16, 21 and add p22	FLC43XWC8V-02	
03	20020924	Takahashi		Yamada	Revise p3,8,20,21	Tech Bes LCD-00149	
02	20020807	Takahashi		Yamada	Revise p4,6,8,12-13,15,17,32-33 add p14	CUST.	
EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION	FUJITSU DISPLAY TECHNOLOGIES CORPORATION	
DESIG.	20020712	Takahashi	CHECK		APPR.	Yamada	1 / 34

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04 20021205								CUST.		
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【FLC43XWC8V-02】

1. APPLICATIONS

This specification is applied to the 17.0 in. XGA-WIDE supported TFT-LCD module.

2. PRODUCT NAME AND MODEL NAME

2-1. Product Name : LCD Module

2-2. Model Name : FLC43XWC8V-02

3. OVERVIEW

This LCD module has a TFT active matrix type liquid crystal panel 1280×768 pixels, and diagonal size of 43cm (17.0-inch). This module supports 1280×768 XGA-WIDE mode (Non-interlace).

This LCD has a XGA-WIDE-capable 1ch-LVDS interface and can display 16 million colors.

By timing control signal, images are displayed on the screen at given value under specified timing.

Control signals to this LCD module are ENAB (Data enable signal), DCLK signal and RGB data signal. Data signal is transmitted with single port. (8 bit for each R, G, B)

The power supply of this LCD module is +5V DC. This module has the characteristics that apply to TCO'99.

4. CONFIGURATION

This LCD module consists of a color TFT-LCD panel that mounted with TFT driver ICs, a cold-cathode fluorescent tube back-light, a LVDS interface PCB, a structure and a bezel. And these components are integrated in a LCD module.

Cold-cathode fluorescent tube and lamp holder are replaceable.

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

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03	20020924	Add ③ (application of TCO'99)						
EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION	FUJITSU DISPLAY TECHNOLOGIES CORPORATION	SHEET	3 /
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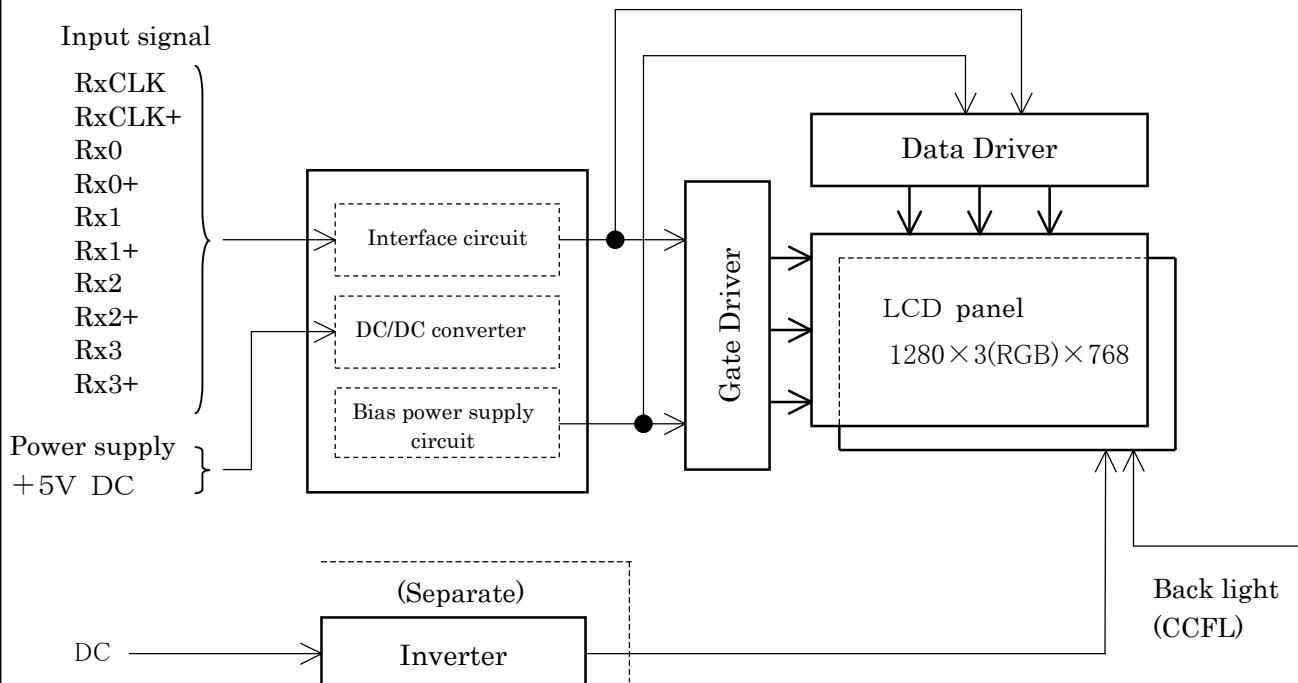


Figure 4-1. Block Diagram

5. MECHANICAL SPECIFICATIONS

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

Table 5-1. Mechanical Specifications

Item	Specifications	Unit	Remark
Dimensions	413.8×263.5×18.4(TYP.)	mm	Edge type backlight is used. (φ2.6 CCFL×4)
Display Resolution	(1280×3)×768	—	
Display Dot Area	369.6×221.76	mm	Outward Appearance is shown at page 32 and 33.
Dot Pitch	(0.09625×3)×0.28875	mm	
Aspect Ratio	1 : 1	—	
Weight	2,000 max	g	
FG-SG	Short circuit	—	

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02	20020807	Change page No. of outline drawing	FLC43XWC8V-02				
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6. ABSOLUTE MAXIMUM RATINGS

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

Table 6-1. Absolute Maximum Ratings

Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V _{CC}	- 0.3	—	6.0	V
Input Voltage	V _{IN}	- 0.3	—	V _{CC} +0.3	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	V _{CC}	4.75	5.0	5.25	V
Ripple Voltage (V _{CC})	V _{RP}	—	—	100	mV _{p-p}

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									Tech Bes LCD-00149		
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DESIG.			CHECK		APPR.				5	/	

8. ELECTRICAL SPECIFICATIONS

Table 8-1 shows the electrical specifications of this LCD module.

Table 8-1. Electrical Specifications

Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit	Remark
Supply Current	I _{CC}	V _{CC} =+5.0±0.25V V _{SS} =0V DCLK=32.498MHz	—	(600) 680(4)	(1000) 900(4)	mA	*1
"H" Level Logic Input Voltage	V _{IH}		0.7× V _{CC}	—	V _{CC} + 0.3	V	*2
"L" Level Logic Input Voltage	V _{IL}		GND	—	0.3× V _{CC}	V	*2
BACK LIGHT *3	CCFL Turn on Voltage	V _S	f _L =50kHz, Ta=25°C	—	1230	1600	Vrms
			f _L =50kHz, Ta=0°C	—	—	1600	
	Lighting Voltage	V _L	f _L =50kHz I _L =10.5mA	590	630	670	Vrms
	Lighting Frequency	f _L	V _L =580Vrms 630(4)	40	50	60	kHz
	Tube Current	I _L	f _L =50kHz V _L =580Vrms 630(4)	9.5	10.5	11.0	mArms

(*1) Typical current value is measured when gray scale (vertical 256 levels) is displayed at V_{CC}=5.0V.

Maximum current value is measured when stripes with respect to each RGB dot are displayed at V_{CC}=5.0V.
Without rush current.

(*2) Timing control circuit input voltage

(*3) Backlight specifications are valid when using a suitable inverter such as the "FLCV-15" of FDTC.

(*4) Tube current (I_L) shows the value of the current and voltage that is consumed at one lamp.
(4 tubes/unit)

This LCD module has 4 lamps. Each 2 lamps are placed at upper and lower side of the display.

2 lamps are connected in parallel. Each low voltage terminals (GND side) are bound into 1 line cable.

(See 11-1. Pin configuration for backlight)

								FLC43XWC8V-02		
04 20021205								Change the values of ④ parts		
02 20020807								Correct backlight spec.		
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Note 1) Measurement Circuit

Based on Fig.8-1.

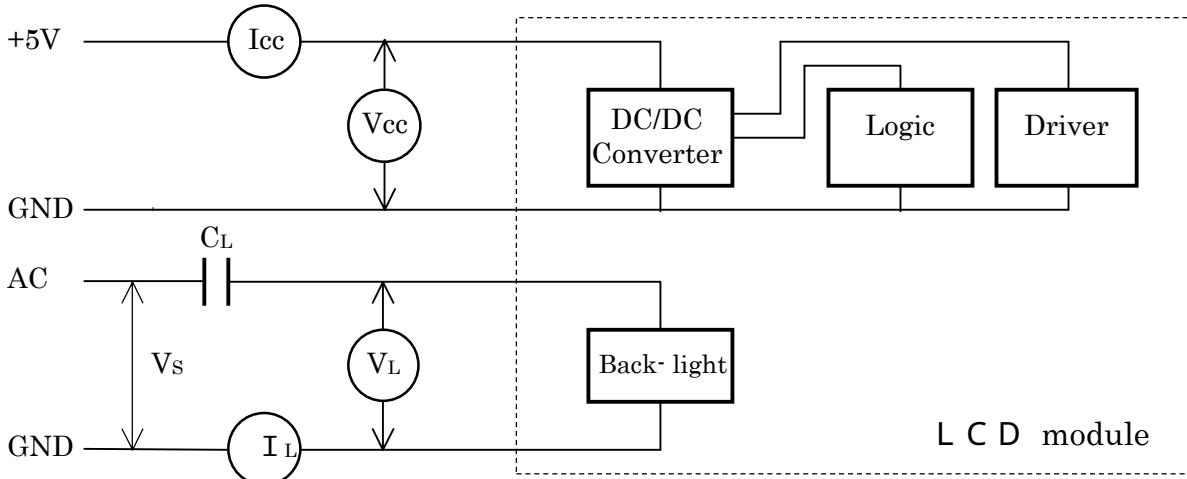


Fig.8-1. Measurement Circuit

Note 2) Equivalent Circuit

Based on Fig.8-2 (a), (b).

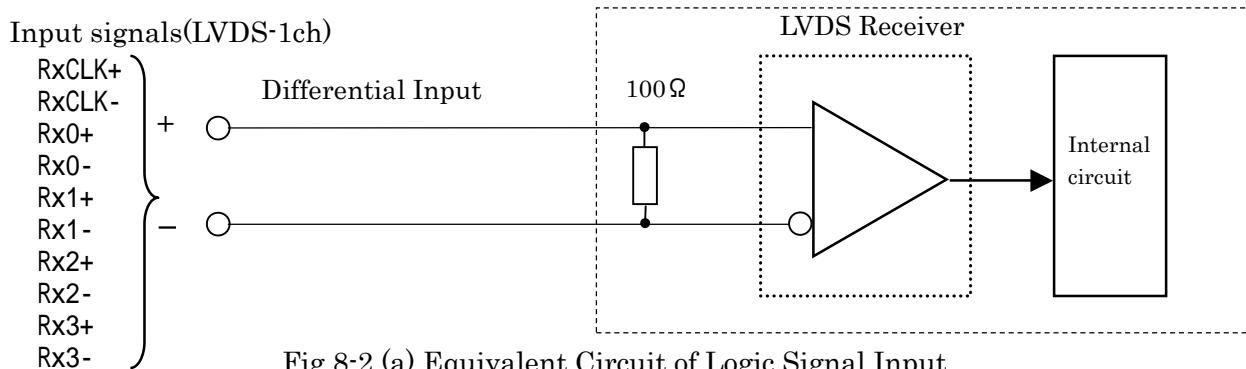


Fig.8-2 (a) Equivalent Circuit of Logic Signal Input

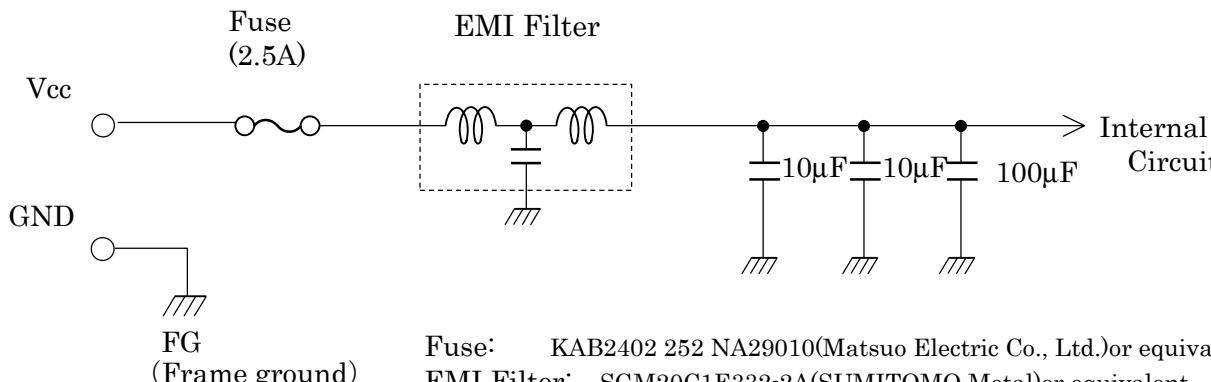


Fig 8-2 (b) Equivalent Circuit of Power Supply

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Vcc Fuse (2.5A) EMI Filter Internal Circuit

GND

FG
(Frame ground)

Fuse: KAB2402 252 NA29010(Matsuo Electric Co., Ltd.)or equivalent.
EMI Filter: SGM20C1E332-2A(SUMITOMO Metal)or equivalent.

9. OPTICAL SPECIFICATIONS

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	Note			
			MIN.	TYP.	MAX						
Visual Angle	Horizontal	θ _{L,R}	CR≥10 θ _{U,D} =0°	85	—	—	deg	(1)(2) (3)(5) (6)			
	Vertical	θ _{U,D}		85	—	—	deg				
Contrast Ratio		CR	θ _{L,R,U,D} =0°		210 350	600	—	White/ Black	(1)(2) (3)(5)		
Response Time(ON) (B W)		t _{on}	θ _{L,R, U,D} =0°	Ta=25°C Ta=0°C	— —	15 50	30 100	ms ms	(1) (4) (5)		
Response Time(OFF) (W B)		t _{off}	θ _{L,R, U,D} =0°	Ta=25°C Ta=0°C	— —	10 50	25 100	ms ms			
Brightness		I	θ _{L,R,U,D} =0° V _{CC} =5V, I _L =10.5mA (at maximum brightness)	400 350	500 450	—	cd/m ²	White *1	(1)(5)		
Brightness Uniformity		ΔI		70 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 Green Blue	0.65, 0.34 Typ. 0.30, 0.59 Typ. 0.15, 0.14 Typ.						
γ-curve				2.4 Typ.							
LCD Panel Type					TFT Color						
Display Mode					Normally Black VA						
Wide Viewing Angle Technology					MVA-Premium						
Optimum Viewing Angle					— (symmetry)			(6)			
Display Color					16 million (each 6-bit+2-bit FRC)						
Color of non-display area					Black						
Surface Treatment					Anti-glare (Haze value:25%, 3H(at weight of 300g))						

(*1) Specified value is measured in 20~30 minutes after lighting on (LCD module single).

A required value may not be achieved on condition that LCD module is built in the cabinet because of its radiation.

(Note1) •CS-1000 (MINOLTA Co., Ltd.) , BM-5A(Topcon) or equivalent luminance colorimeter should be used for the measurement.

Field=2°, L=500mm

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

04	20021205				Change value of brightness uniformity		FLC43XWC8V-02
03	20020924				Change spec. of the brightness		
					Min.value of contrast ratio		
02	20020807				Add γ-curve value and change		Tech Bes LCD-00149
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Note 1) Definition of Viewing Angle (1)

Based on Fig.9-2.

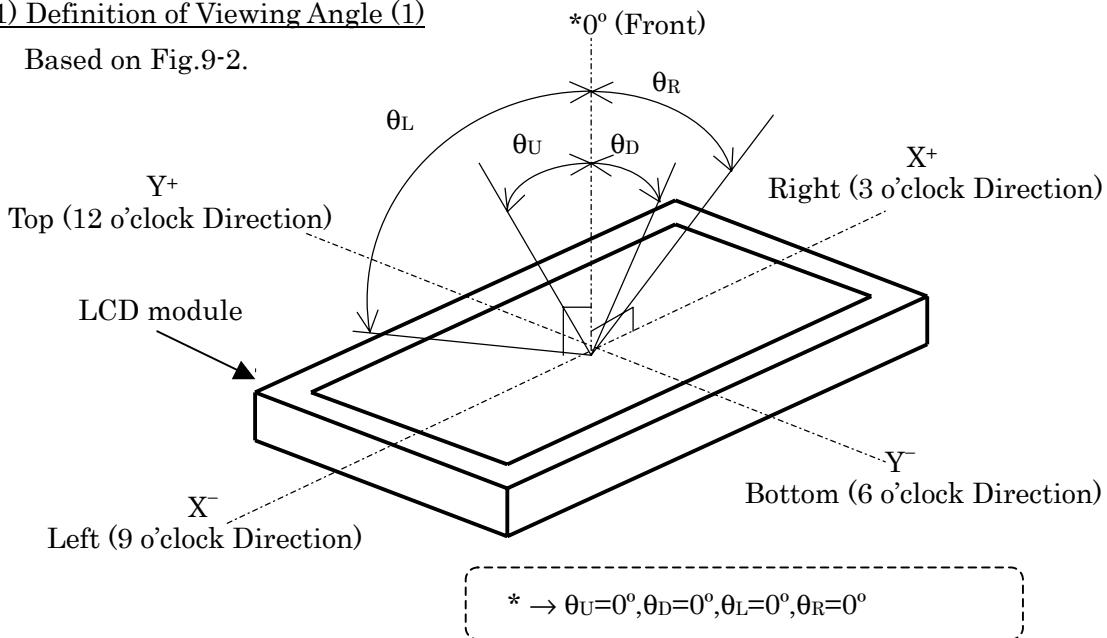


Fig.9-2. Definition of Viewing Angle (1)

Note 2) Definition of Viewing Angle (2)

Based on Fig.9-3.

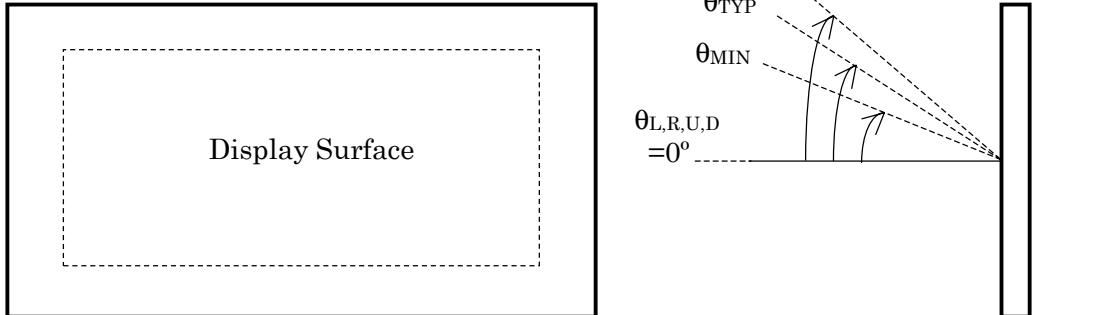


Fig.9-3. Definition of Viewing Angle (2)

Note 3) Definition of Contrast Ratio (CR)

Determined by Formula (1) based on Fig.9-4.Voltage-Brightness Characteristics.

$$= \frac{L_w \text{ (Brightness at white)}}{L_b \text{ (Brightness at black)}} \quad \dots \quad (1)$$

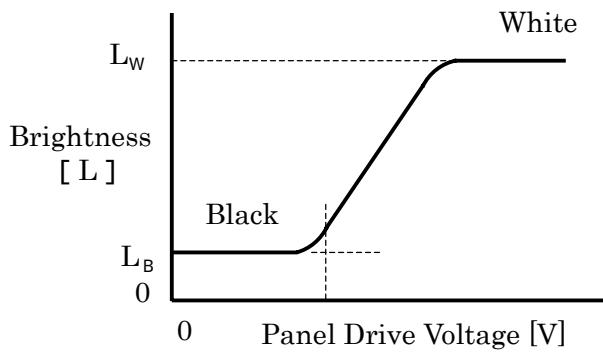


Fig.9-4. Voltage-Brightness Characteristics

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Note 4) Definition of Response Time

Based on Fig.9-5.

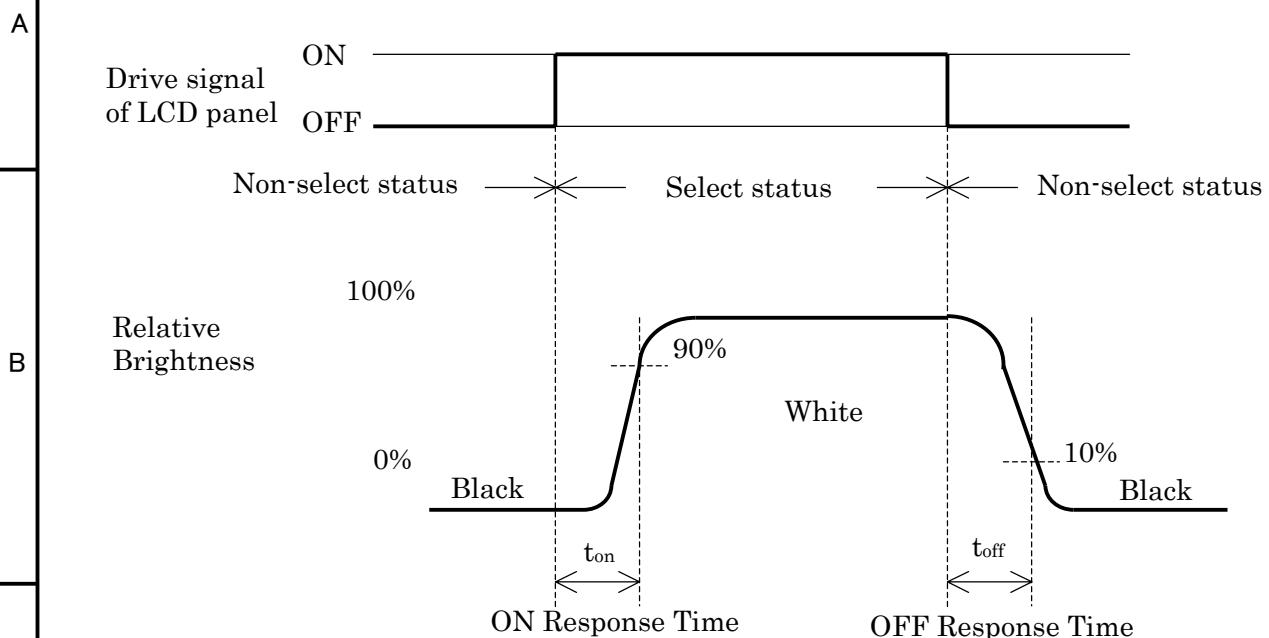


Fig.9-5. Definition of Response Time

C

Note 5) Contrast Ratio and Response Measurement System

Based on Fig.9-6.

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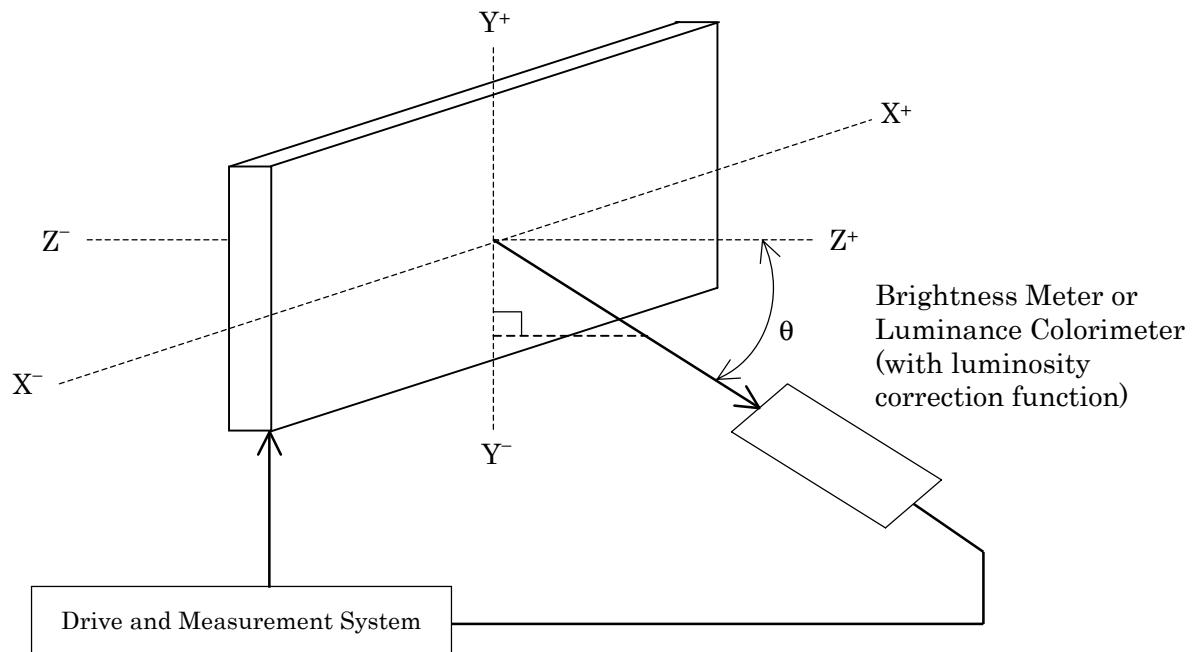


Fig.9-6. Contrast Ratio and Response Time Measurement System

FLC43XWC8V-02

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Note 6) Definition of Optimum Viewing Angle

Based on Fig.9-7.

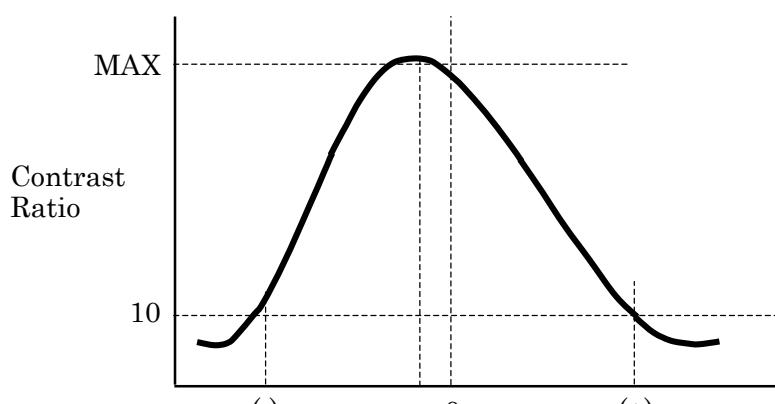


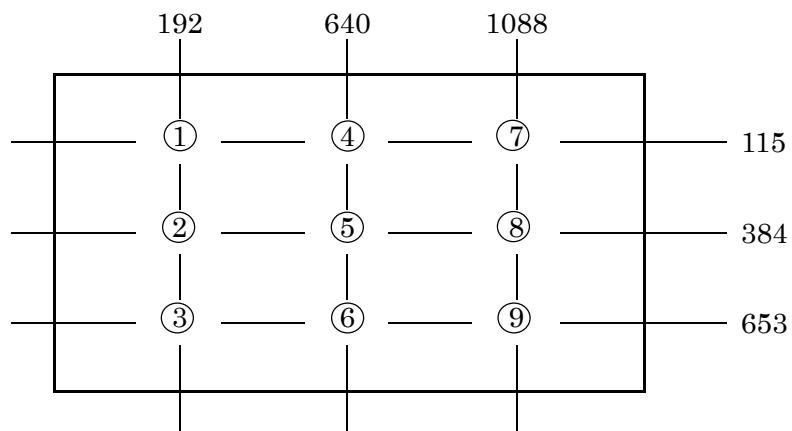
Fig.9-7. Definition of Viewing Angle

Note 7) Definition of Brightness Uniformity

Brightness uniformity is defined by the following formula.

Brightness (I1~I9) art measured at the following 9 points (① ~ ⑨) on the display area shown in Fig.9-8.

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



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.9-8. Measurement Points

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10. INTERFACE SPECIFICATIONS

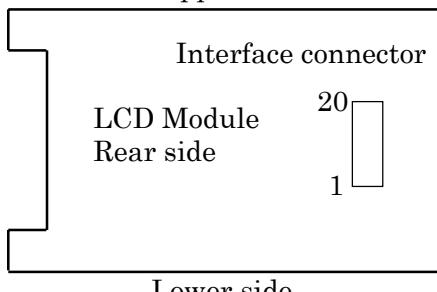
10-1-1. Signal descriptions

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

Table 10-1-1. Interface signals (CN1)

Pin No.	Symbol	I/O	Function
1	VDD	—	+5V Power supply
2	VDD	—	+5V Power supply
3	GND	—	Ground
4	GND	—	Ground
5	RX0-	I	LVDS Receiver Signal(-)
6	RX0+	I	LVDS Receiver Signal(+)
7	GND	—	Ground
8	RX1-	I	LVDS Receiver Signal(-)
9	RX1+	I	LVDS Receiver Signal(+)
10	GND	—	Ground
11	RX2-	I	LVDS Receiver Signal(-)
12	RX2+	I	LVDS Receiver Signal(+)
13	GND	—	Ground
14	RXCLK-	I	LVDS Receiver Clock Signal(-)
15	RXCLK+	I	LVDS Receiver Clock Signal(+)
16	GND	—	Ground
17	RX3-	I	LVDS Receiver Signal(-)
18	RX3+	I	LVDS Receiver Signal(+)
19	GND	—	Ground
20	Data Mapping Select Input	I	Low : table 10-1-2 Open or Hi : table 10-1-3

Upper side



Connector : D14H-20P-1.25H(HIROSE)

User's connector : DF14-20S-1.25 (HIROSE)

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10-1-2. LVDS Data Mapping 1

Table 10-1-2 shows the LVDS data mapping 1.(DataMappingSelectInput = Low)

Table 10-1-2. LVDS Data Mapping 1

Transmitter (DS90CF385)		Symbol	Interface connector			Receiver (DS90CF386)		LCD Control input	
Pin	INPUT		System side	Pin	LCD module	Pin	OUTPUT		
51	TxIN0	R0	TxOUT0– TxOUT0+	5	RX0– RX0+	27	RxOUT0	IR0	
52	TxIN1	R1				29	RxOUT1	IR1	
54	TxIN2	R2		6		30	RxOUT2	IR2	
55	TxIN3	R3				32	RxOUT3	IR3	
56	TxIN4	R4				33	RxOUT4	IR4	
2	TxIN5	R7	TxOUT3– TxOUT3+	17	RX3–	34	RxOUT5	IR7	
3	TxIN6	R5	TxOUT0– TxOUT0+	5	RX0–	35	RxOUT6	IR5	
4	TxIN7	G0		6	RX0+	37	RxOUT7	IGO	
6	TxIN8	G1	TxOUT1– TxOUT1+	8	RX1–	38	RxOUT8	IG1	
7	TxIN9	G2		9	RX1+	39	RxOUT9	IG2	
8	TxIN10	G6	TxOUT3– TxOUT3+	17	RX3–	41	RxOUT10	IG6	
10	TxIN11	G7		18	RX3+	42	RxOUT11	IG7	
11	TxIN12	G3	TxOUT1– TxOUT1+	8	RX1– RX1+	43	RxOUT12	IG3	
12	TxIN13	G4				45	RxOUT13	IG4	
14	TxIN14	G5		9		46	RxOUT14	IG5	
15	TxIN15	B0				47	RxOUT15	IB0	
16	TxIN16	B6	TxOUT3– TxOUT3+	17	RX3–	49	RxOUT16	IB6	
18	TxIN17	B7		18	RX3+	50	RxOUT17	IB7	
19	TxIN18	B1	TxOUT1– TxOUT1+	8	RX1–	51	RxOUT18	IB1	
9				9	RX1+				
20	TxIN19	B2	TxOUT2– TxOUT2+	11	RX2– RX2+	53	RxOUT19	IB2	
22	TxIN20	B3				54	RxOUT20	IB3	
23	TxIN21	B4		12		55	RxOUT21	IB4	
24	TxIN22	B5				1	RxOUT22	IB5	
25	TxIN23	RESERVED	TxOUT3– TxOUT3+	17	RX3–	2	RxOUT23	Not use	
				18	RX3+				
27	TxIN24	RESERVED	TxOUT2– TxOUT2+	11	RX2– RX2+	3	RxOUT24	Not use	
28	TxIN25	RESERVED				5	RxOUT25	Not use	
30	TxIN26	ENAB		12		6	RxOUT26	ENAB	
50	TxIN27	R6	TxOUT3– TxOUT3+	17	RX3–	7	RxOUT27	IR6	
				18	RX3+				
31	TxCLKIN	DCLK	TxCLKOUT– TxCLKOUT+	14	RXCLK–	26	RxCLKOUT	DCLK	
				15	RXCLK+				

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10-1-3. LVDS Data Mapping 2

Table 10-1-3 shows the LVDS data mapping 2.(DataMappingSelectInput = Open or Hi)

A

Table 10-1-3. LVDS Data Mapping 2

Transmitter (DS90CF385)		Symbol	Interface connector			Receiver (DS90CF386)		LCD Control input	
Pin	INPUT		System side	Pin	LCD module	Pin	OUTPUT		
51	TxIN0	R2	TxOUT0- TxOUT0+	5	RX0- RX0+	27	RxOUT0	IR2	
52	TxIN1	R3				29	RxOUT1	IR3	
54	TxIN2	R4		6		30	RxOUT2	IR4	
55	TxIN3	R5				32	RxOUT3	IR5	
56	TxIN4	R6				33	RxOUT4	IR6	
2	TxIN5	R1	TxOUT3- TxOUT3+	17 18	RX3- RX3+	34	RxOUT5	IR1	
3	TxIN6	R7	TxOUT0- TxOUT0+	5	RX0-	35	RxOUT6	IR7	
4	TxIN7	G2		6	RX0+	37	RxOUT7	IG2	
6	TxIN8	G3	TxOUT1- TxOUT1+	8	RX1-	38	RxOUT8	IG3	
7	TxIN9	G4		9	RX1+	39	RxOUT9	IG4	
8	TxIN10	G0	TxOUT3- TxOUT3+	17	RX3-	41	RxOUT10	IG0	
10	TxIN11	G1		18	RX3+	42	RxOUT11	IG1	
11	TxIN12	G5	TxOUT1- TxOUT1+	8	RX1- RX1+	43	RxOUT12	IG5	
12	TxIN13	G6				45	RxOUT13	IG6	
14	TxIN14	G7		9		46	RxOUT14	IG7	
15	TxIN15	B2				47	RxOUT15	IB2	
16	TxIN16	B0	TxOUT3- TxOUT3+	17	RX3-	49	RxOUT16	IB0	
18	TxIN17	B1		18	RX3+	50	RxOUT17	IB1	
19	TxIN18	B3	TxOUT1- TxOUT1+	8 9	RX1- RX1+	51	RxOUT18	IB3	
20	TxIN19	B4	TxOUT2- TxOUT2+	11	RX2- RX2+	53	RxOUT19	IB4	
22	TxIN20	B5				54	RxOUT20	IB5	
23	TxIN21	B6		12		55	RxOUT21	IB6	
24	TxIN22	B7				1	RxOUT22	IB7	
25	TxIN23	RESERVED	TxOUT3- TxOUT3+	17 18	RX3- RX3+	2	RxOUT23	Not use	
27	TxIN24	RESERVED	TxOUT2- TxOUT2+	11	RX2- RX2+	3	RxOUT24	Not use	
28	TxIN25	RESERVED		12		5	RxOUT25	Not use	
30	TxIN26	ENAB		6		RxOUT26	ENAB		
50	TxIN27	R0	TxOUT3- TxOUT3+	17 18	RX3- RX3+	7	RxOUT27	IRO	
31	TxCLKIN	DCLK	TxCLKOUT- TxCLKOUT+	14 15	RXCLK- RXCLK+	26	RxCLKOUT	DCLK	

DOCUMENT CONTROL SECTION

DATE

FLC43XWC8V-02

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02	20020807				Add this page	Tech Bes LCD-00149	CUST.	

10-2. Color Data Assignment

Table 10-2 shows the color data assignment.

A

Table 10-2. Color Data Assignment

B

C

D

DATE	DOCUMENT CONTROL SECTION
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Color and Brightness		Input data (0 : Low level , 1 : High level)																						
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	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	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
	Green	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	0	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
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	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
	White	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
	Darker ↑ 1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	
	: ↓ 253	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	
	Brighter ↓ 254	1	1	1	1	1	1	0	1	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
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
	Darker ↑ 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
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	Brighter ↓ 254	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0
	Green 255	0	0	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	0
	Darker ↑ 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	
	: ↓ 253	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	: :	
	Brighter ↓ 254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue 255	0	0	0	0	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) ---"n" indicates gray scale level.

The gray scale is brighter as the number is larger.

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

Note.3) By inputting 8-bit data signal for each red, green and blue, this module can display 256 gray scale independently for each color.

Therefore, the module is able to display 16 million colors. Color data are 24 lines.

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												Tech Bes LCD-00149			
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【FLC43XWC8V-02】

10-3. Input Signal Timing

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

Table 10-3. Timing Characteristics

(T=0~50°C, V_{CC}=5±0.25V)

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK signal (Clock) ②	Period	Tc	12.500④	15.382	20.000	ns	
	Frequency	fc	50.00	65.01	80.00④	MHz	fc=1/Tc *1
	Duty	Tch/Tc	45	50	55	%	
	High time	TclkH	5.0	—	—	ns	
	Low time	TclkL	5.0	—	—	ns	
	Rise time	Tclkr	—	—	5.0	ns	
	Fall time	Tclkf	—	—	5.0	ns	
DCLK-Data Timing	Setup time	Tset	(4.5)4④	—	—	ns	
	Hold time	Thold	(6.5) 4④	—	—	ns	
Data-ENAB timing	Horizontal	Period	Th	1340	1344	(3012) 1688④	DCLK
		Frequency	fh	46.6	48.3	55.5④	kHz
		Display period	Thd	1280	1280	1280	DCLK
	Vertical	Period	776	806	806④	Th	
		Frequency	1/Tv	(50)④	60	(75)④	Hz
		Display period	Tvd	768	768	768	Th
Data-ENAB timing		Tdn	0	0	0	DCLK	*4

*1) DCLK signal input must be valid while power supply is applied.

*2) Display position is specified by the ENAB signal only.

- Horizontal display position is specified by the rise of ENAB signal. The data which is latched by the falling edge of 1st DCLK right after the rise of ENAB, is displayed on the left edge of the screen.
 - Vertical display position is specified by the rise of ENAB after a “Low” level period equivalent to eight times of horizontal period. The 1st data corresponding to one horizontal line after the rise of ENAB is displayed at the top line of screen.

*3) If a period of ENAB “High” is less than 1280 DCLK or less than 768 lines, the rest of the screen displays black.

*4) The display position does not fit to the screen if a period of ENAB "High" and the effective data period do not synchronize with each other.

DOCUMENT CONTROL SECTION		FLC43XWC8V-02					
DATE						Tech Bes LCD-00149	CUST.
04	20021205				Change ④parts in Table10-3		
02	20020807				Correct values of DCLK frequency		
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1 2 3 4

【FLC43XWC8V-02】

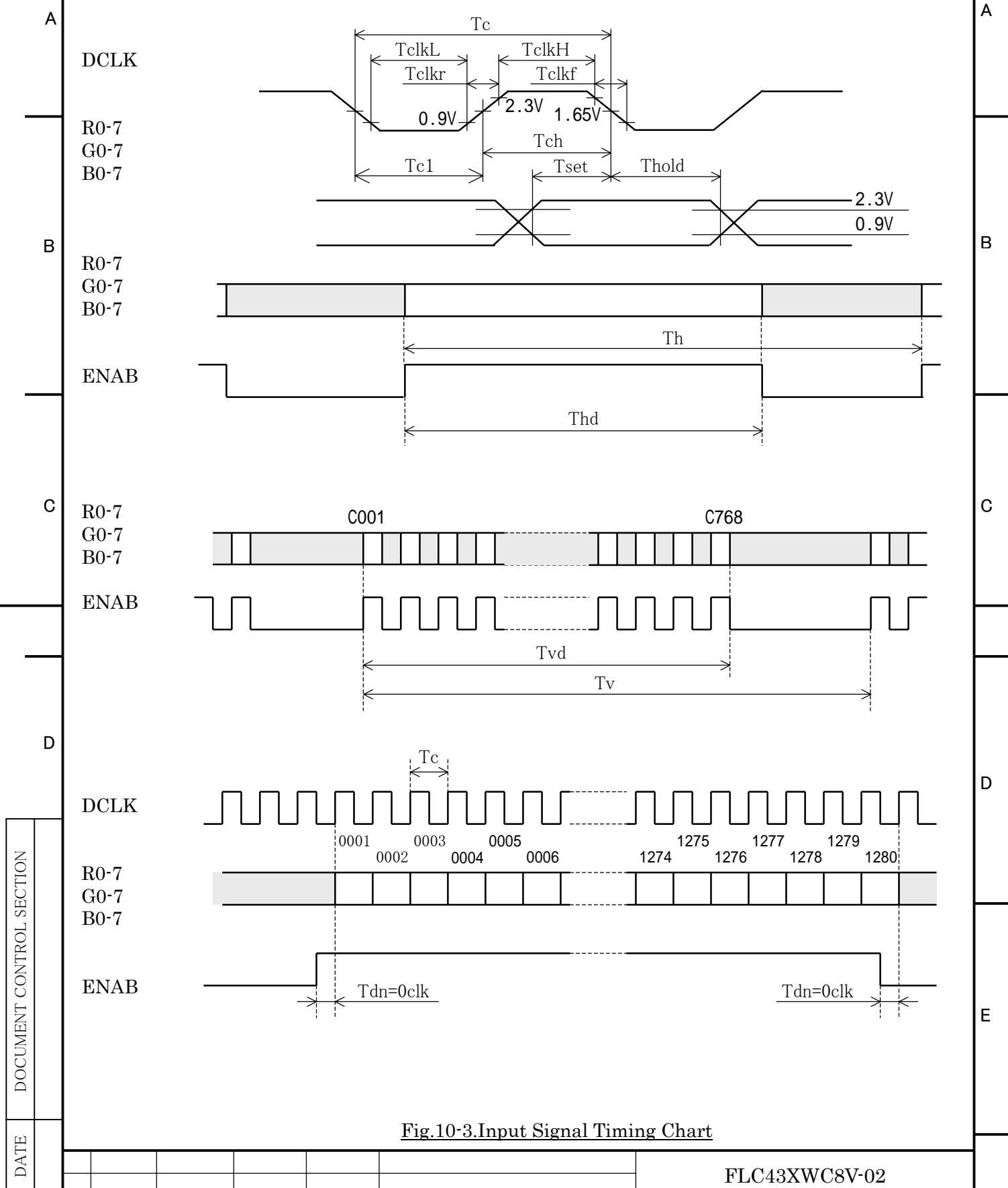


Fig.10-3.Input Signal Timing Chart

10-4. Correspondence between Data and Display Position

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

A	S0001 S0002 S0003 S0004 S0005 S0006 S0007 S0008	-----	S3839 S3840	A
C001	R 0001 G 0001 B 0001 R 0002 G 0002 B 0002 R 0003 G 0003		G 1280 B 1280	B
C768	R 0001 G 0001 B 0001 R 0002 G 0002 B 0002 R 0003 G 0003		G 1280 B 1280	C

Fig.10-4.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 be in the specification shown in Fig.10-5 to prevent latch-up of the driver ICs and DC driving of the LCD panel.

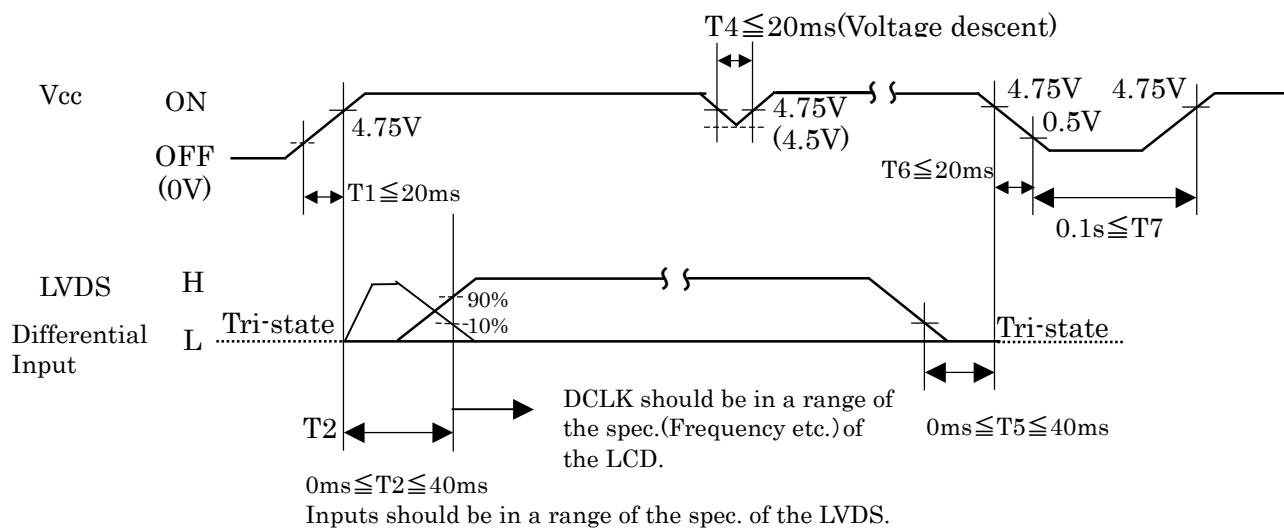


Fig.10-5. Power Supply Sequence

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11. BACKLIGHT SPECIFICATIONS

11-1. Pin Configuration for Backlight

Table 11-1(a) and 11-1(b) shows the description and pin assignment of the connectors (CN-A and B) for the Backlight of this LCD module.

Table 11-1(a) Pin Assignment of CN-A

Pin	Signal	Function	Cable color
1	V _{L1}	Power supply for CCFL 1	Red
2	V _{L2}	Power supply for CCFL 2	Red
3	NC		-
4	GND	Ground (for V _{L1} , 2)	White

Table 11-1(b) Pin Assignment of CN-B

Pin	Signal	Function	Cable color
1	V _{L3}	Power supply for CCFL 3	Red
2	V _{L4}	Power supply for CCFL 4	Red
3	NC		-
4	GND	Ground (for V _{L3} , 4)	White

Connector : Housing : BHR-04VS-1

: Contact : SBH-001T-P0.5

User's Connector : Post with base : SM04(4.0)B-BHS-1-TB

Supplier : Japan Solderless Terminal Trading Company LTD. (J.S.T.)

11-2. CCFL

Supplier : SANKEN ELECTRIC CO., LTD Part No. SD26E3850E8350B3113000

11-3. Life

The life of the backlight is a minimum of 25,000 hours at the following conditions.

(1) Working conditions

Ambient temperature : $25 \pm 5^\circ\text{C}$

Tube current(I_L) : (10.5mA or less)

(2) Definition of life

Brightness becomes 50% or below 50% of the minimum brightness value shown in Table 9-1.

The lamp cannot be lit by the breakdown voltage of 1600Vvms.

Lamp is flashing.

11-4. Lamp Assembly set (for replacement)

Lamp Assembly set (with charge) is prepared for maintenance.

This set consists of an upper lamp assembly and a lower lamp assembly.

Type number : FLCL-21

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12. APPEARANCE SPECIFICATIONS

12-1. Zone

- Inside display dot area (369.6× 221.8mm)
- Display dot area means active area.
- One pixel consists of 3 dots (red, green and blue).
- Foreign particle and scratch unharful to display image, such as the foreign particle under polarizer film but outside of the display area and scratch on metal bezel, backlight module or polarizer film out of the display area, etc., are not counted.

12-2. Bright spots

- (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

12-3. Test condition

- 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 50cm 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.
- Frame frequency should be 60Hz.

12-4. Specifications

Table 12-4 shows the appearance standard.

(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≤S<2/3 : Considered as 0.5 dot.

(C) 2/3≤S : Considered as 1 dot.

(S=Dark spot size/dot size)

(Note3) Min. distance between foreign particles : 100mm

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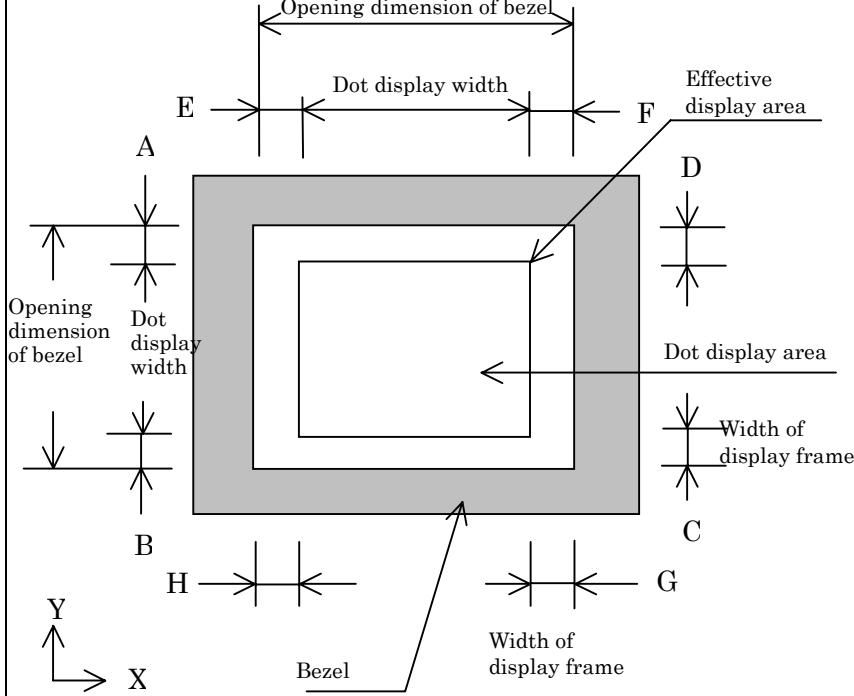
【FLC43XWC8V-02】

No.	Item	Judgment method and standard		
1	Bright spot (high and Low)	≤ 3 dots		(Note 1)
2	Bright spot connection (high and low)	≤ 1 pair (2 dot connection in horizontal)		(Note 1)
3	Total of bright spot	≤ 3 dots		
4	Dark spot	≤ 5 dots		(Note 2)
5	Dark spot connection	≤ 2 pairs (2 dot connection in horizontal)		(Note 2)
6	Total of dark spot	≤ 5 dots		(Note 2)
7	Total of dot defect(bright and dark)	≤ 8 dots		
8	Distance of bright spot	high-high high others	≥ 15 mm ≥ 5 mm	
9	Distance of dark spot		≥ 5 mm	
10	Scratch on polarizer	$W \leq 0.03$ $0.03 < W \leq 0.05$ $0.05 < W \leq 0.10$ $0.15 < W \leq 0.3$ $0.10 < W$	$-----$ $L \leq 6$ $6 < L \leq 12$ $12 < L$ $L \leq 0.6$ $0.6 < L \leq 5$ $5 < L$ $W \times L \leq 0.4$ $0.4 < W \times L$ $-----$	Not count Not count ≤ 5 0 Not count ≤ 3 0 ≤ 1 0 0
11	Dent on polarizer		$D \leq 0.3$ $0.3 < D \leq 0.4$ $0.4 < D$	Not count ≤ 6 0
12	Bubble in polarizer		$D \leq 0.3$ $D \leq 0.5$ $0.5 < D$	Not count Not count 0
13	Spot (black/white) by foreign particle		$D < 0.5$ $0.5 \leq D$	≤ 5 0
14	Bright spot by fiber foreign particle (under the polarizer. i.e. between the polarizer and the glass) (Note 3)		$D \leq 0.2$ $0.2 < D \leq 0.3$ $0.3 < D \leq 0.35$ $0.35 < D$	Not count ≤ 2 1 0
15	Line (black /white), scratch by fiber foreign particle	$W \leq 0.03$ $0.03 < W \leq 0.05$ $0.05 < W \leq 0.1$ $0.1 < W$	$-----$ $L \leq 6$ $6 < L \leq 12$ $12 < L$ $L \leq 0.6$ $0.6 < L \leq 5$ $5 < L$ $(W+L)/2 = D$	Not count Not count ≤ 5 0 Not count ≤ 3 0 Count as spot (black/white) of No.13

D:Average diameter [mm], W:Width [mm], L:Length [mm], S=(bright spot size)/(dot size)

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03 20020924				Total revision						
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Applied area	Item	Condition	Specification										
A			As for the display position in the display dot area, the variation of tolerance between window frame of the upper bezel and dot display area (right, left, up and down) is shown in the following table.										
B													
C	Display dot area	Non-lighting	 <p>The diagram illustrates the layout of the display components. The 'Bezel' is the outer frame. Inside it is the 'Effective display area'. Within the effective display area is the 'Dot display area'. The 'Dot display width' is the horizontal distance between points E and F. The 'Width of display frame' is the horizontal distance between points G and H. The 'Opening dimension of bezel' is the vertical distance between points A and B, and also between points D and C. The 'Dot display width' is also labeled as the horizontal distance between points B and C. The coordinate system shows X pointing right and Y pointing up.</p> <table border="1" data-bbox="679 1246 1377 1567"> <thead> <tr> <th>Tolerance (X direction)</th> <th>Tolerance (Y direction)</th> </tr> </thead> <tbody> <tr> <td>$E-F \leq 1.0\text{mm}$</td> <td>$A-B \leq 1.0\text{mm}$</td> </tr> <tr> <td>$E-H \leq 0.7\text{mm}$</td> <td>$A-D \leq 0.7\text{mm}$</td> </tr> <tr> <td>$F-G \leq 0.7\text{mm}$</td> <td>$B-C \leq 0.7\text{mm}$</td> </tr> <tr> <td>$G-H \leq 1.0\text{mm}$</td> <td>$C-D \leq 1.0\text{mm}$</td> </tr> </tbody> </table> <p>*The dimension of effective display area, dot display area and display frame should follow the dimensions described in each specification.</p>	Tolerance (X direction)	Tolerance (Y direction)	$ E-F \leq 1.0\text{mm}$	$ A-B \leq 1.0\text{mm}$	$ E-H \leq 0.7\text{mm}$	$ A-D \leq 0.7\text{mm}$	$ F-G \leq 0.7\text{mm}$	$ B-C \leq 0.7\text{mm}$	$ G-H \leq 1.0\text{mm}$	$ C-D \leq 1.0\text{mm}$
Tolerance (X direction)	Tolerance (Y direction)												
$ E-F \leq 1.0\text{mm}$	$ A-B \leq 1.0\text{mm}$												
$ E-H \leq 0.7\text{mm}$	$ A-D \leq 0.7\text{mm}$												
$ F-G \leq 0.7\text{mm}$	$ B-C \leq 0.7\text{mm}$												
$ G-H \leq 1.0\text{mm}$	$ C-D \leq 1.0\text{mm}$												
D													
E													
F													

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DESIG.			CHECK		APPR.		

13. ENVIRONMENTAL SPECIFICATIONS

Table 13-1 shows the environmental specifications.

Table 13-1. Environmental Specifications

Item	Condition		Remark
Temperature	Operation	0~57°C (Note1)	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	Non-operation	10~500Hz, 1 cycle/20minute, 2G, 1.5mm max, 2hour each X, Y and Z directions	For single module without package.(Note2)
Shock	Non-operation	30G, 6ms, 1time each ±X, ±Y and ±Z directions.	

Note1: Temperature on surface of LCD panel should be under 57°.

Note2: 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 ~ J	60cm	1 time

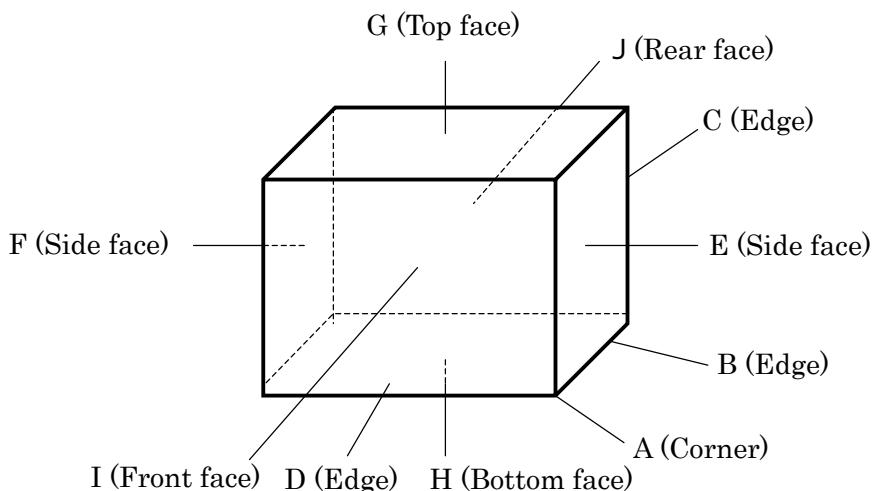


Fig.13-1. Direction to apply shock to package

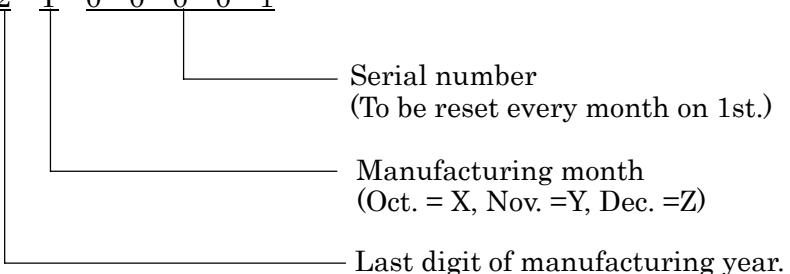
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【FLC43XWC8V-02】

14. INDICATIONS

This module has the following indications.

- (1) Product name : LCD unit
(2) Model number : FLC43XWC8V-02
(3) Product drawing number: NA19026-C071
(4) Manufacturing number : 2 Y 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 DISPLAY TECHNOLOGIES CORP.

- (8) Caution when changing cold-cathode tubes and disposal method of them. (See Fig. 14-1)

- WHEN CHANGING COLD CATHODE FLUORESCENT LAMPS, FOLLOW OPERATING SPECIFICATIONS, ESPECIALLY BE CAREFUL ABOUT THE LAMP'S SIDE-EDGE.
- 蛍光管の交換は作業仕様書に従って行って下さい。特に蛍光管ホルダ側面のエッジに気をつけて下さい。

- THIS TFT COLOR LCD CONTAINS COLD CATHODE FLUORESCENT LAMPS.
PLEASE FOLLOW LOCAL ORDINANCES OR REGULATIONS FOR ITS DISPOSAL.
- 当該液晶ディスプレイユニットには蛍光管が組み込まれていますので、
地方自治体の条例または規則に従って廃棄して下さい。

LCD unit MADE IN JAPAN

FLC43XWC8V-02 0X50015
NA19026-C071 01A
FUJITSU DISPLAY TECHNOLOGIES CORP.

Fig.14-1

Fig.14-2 Product label (example)

15. PACKAGING

Separately specified in packaging specifications.

15-1. Packaging specifications

- (1) 5 LCD modules / 1 package.
 - (2) Weight: approximately 13kg / 1 package.
 - (3) Outline dimensions : 348mm(W) x 328(D) x 490mm(H)

15-2. Packaging method

Fig.15-2 (a),(b),(c),(d) show the packing method.

【FLC43XWC8V-02】

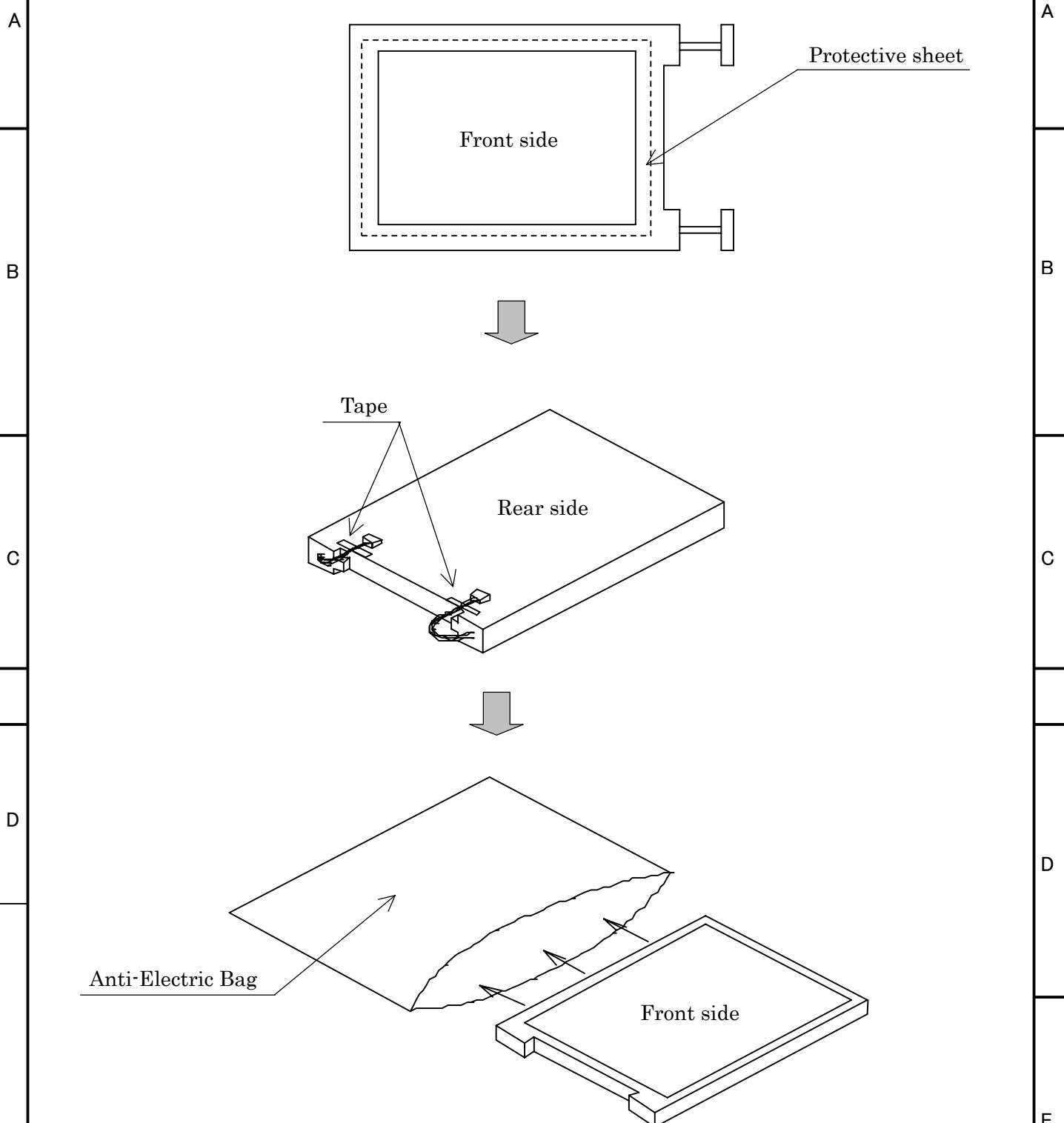
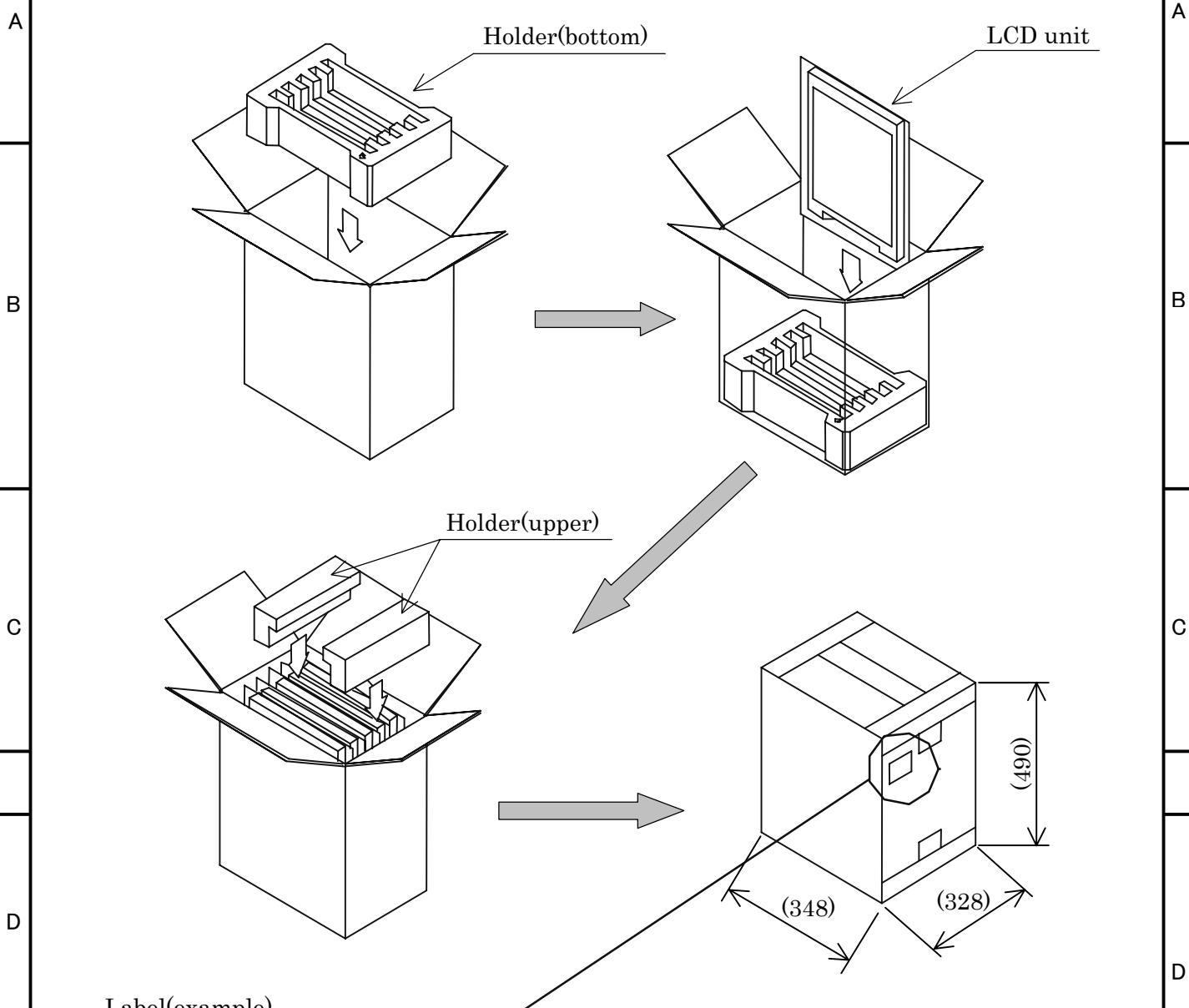


Fig.15-2(a) Packaging Method

DATE									FLC43XWC8V-02		
									Tech Bes LCD-00149		CUST.
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		DESIG.		CHECK			APPR.				25 /

【FLC43XWC8V-02】



Label(example)

型格 (TYPE)	FLC43XWC8V-02	数量 (QTY.)	5
図番 (DRWG. NO.)	NA19026-C071	版数 (REV. NO.)	01A
9X00001			
9X00002			
9X00003			
9X00004			
9X00005			
バーコード			
MADE IN JAPAN			

- Taping
 - Upper : H or I method
 - Bottom : H method
- Upper and bottom holders should be anti-electrostatic type.

Fig.15-2(b) Packaging Method

						FLC43XWC8V-02	
						Tech Bes LCD-00149	
EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION		FUJITSU DISPLAY TECHNOLOGIES CORPORATION
DESIG.			CHECK		APPR.		SH EE T 26 /
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【FLC43XWC8V-02】

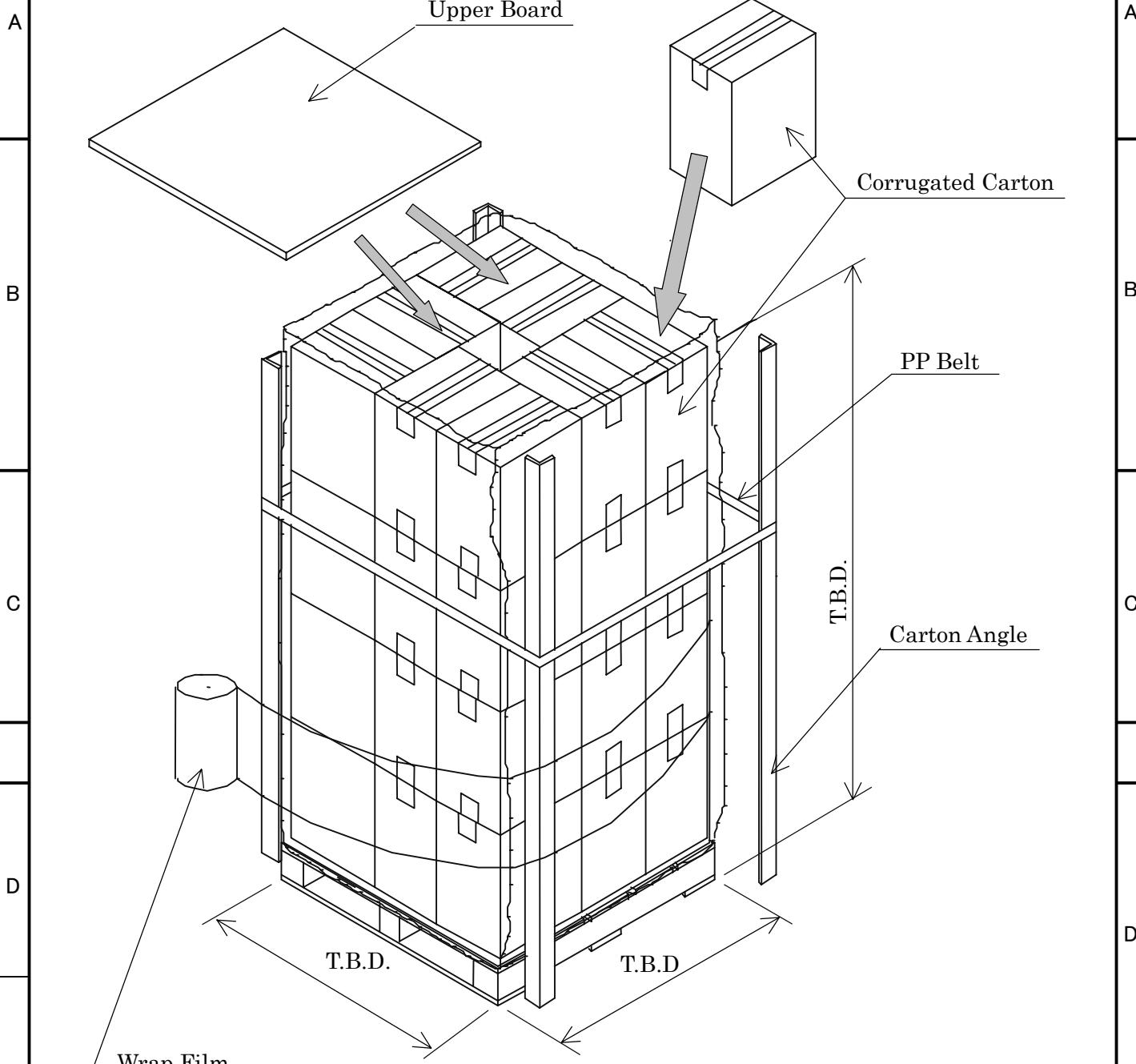
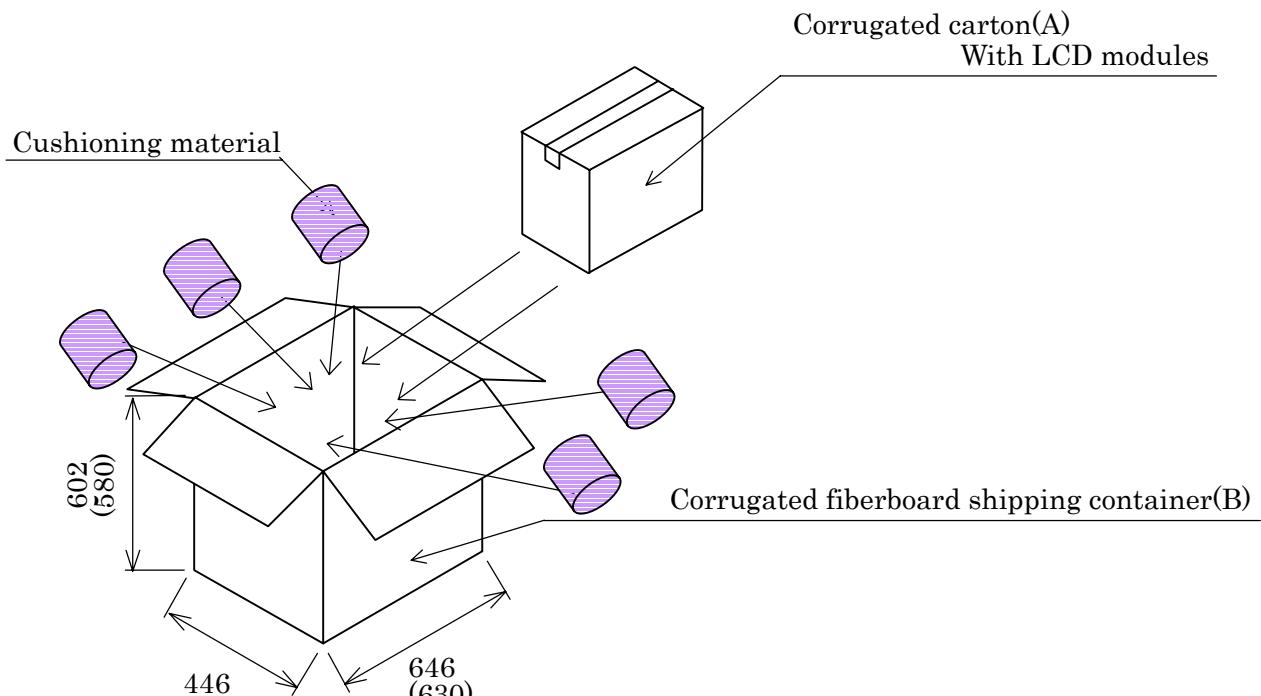


Fig.15-2(c) Packaging Method

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Note 1) The carton (A) should be placed in the middle of the container(B) with enough cushioning materials.

Figure.15-2(d) Packaging Method

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16.WARRANTY

The warranty period is one year after manufacturing. 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 properly use this LCD module.

(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

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.

Do not press hard on the LCD panel surface.

In the LCD panel, the gap between two glass plates is kept precisely and uniformly to maintain display's characteristics and reliability. If this panel is pressed hard, the following troubles occurs.

- (a) Ununiformity of color
- (b) Orientation of liquid crystal becomes disordered

Problem (a) returns to normal after a while. Problem (b) returns to normal if power is shut off once then turned on again.

However these operations should be avoided to insure reliability.

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

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

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

[Dirt] Wipe off lightly with a soft cloth after soaking in the clear water and squeezing hard out of water drops. Only if the dirt is hardly wiped off, use isopropyl alcohol or ethanol.

Be careful not to splash the water or the solvent and water penetrated between the polarizer and the LCD panel.

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

- If saliva or water drops are left for long time, it may deform partial deformation or discolored. Wipe off immediately in the same way as for dirt.
- Do not allow oil to adhere to the module, since the cleaning of oil is difficult.

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

That's because this may make some parts of the LCD module distorted and the display quality may decline.

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(3) Handling of LCD module

Do not pull the cold-cathode tube cable strongly.

If the cable is pulled with the load of 2kg or more, the cable may be damaged or reliability may decrease.

Assemble the module into user's system in a dust free environment.

If conductive foreign matter adheres to the module, failures may occur.

Take anti-static measures for assembling the module.

Since the LCD module contains CMOS-ICs, the following considerations are necessary.

- 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, pincet, etc.).
 - Do not take the module out of the conductive bag until the time when the module is assembled.
 - Assemble the module under low humidity (50%RH or less).

Do not pull the connecting cable on the rear face of the LCD module strongly.

Do not disassemble or remodel the LCD module.

If this LCD module is disassembled or remodeled, it may have some trouble, or the display quality and reliability may not be assured.

(4) Precautions for operating the LCD module

Adhere to the specified power supply sequence.

If not followed, the CMOS-IC may cause a latch-up, or the DC voltage may be applied the liquid crystal, and a failure or serious deterioration in display quality may occur.

Do not operate the LCD module when condensation is present.

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 a cold environment to a warm environment.

Trouble that occurs when the LCD module is used at not recommended temperature.

- Operation at high temperature(>60°C) :Display colors shift to blue.
 - Storage at high temperature(>60°C) :The polarizer film deteriorates and contrast decreases.
 - Operation at low temperature(<0°C) :The response speed decreases considerably.
 - Storage at low temperature (<-20°C) :The liquid crystal may solidify and become damaged.

Always input the control signals at the correct timing.

If control signals (DCLK, or 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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(5) Precautions on designing module mounting

Do not press the display surface and bottom face of the LCD module.

Display quality or reliability may be deteriorated if the installation of the LCD module is inappropriate and, as a result, excessive pressure is applied to the surface of LCD screen. Brightness uniformity or the reliability of CCFL may decrease if the pressure is applied to the backlight module.

Consider the module mounting design, so that twisting and bending do not occur to the LCD module.

Excessive twisting and bending may damage display quality and reliability.

The power cable length between the LCD module and inverter should not be extended.

Otherwise the backlight may not light or flickering may occur.

Do not make the power cable of the backlight clung to a metal plate, etc.

Backlight frequency current for backlight driving may leak to the metal and desired brightness may not be assured.

When Mounting LCD module with M4 screw(x4) should be screw up under 5.75kgf·cm torque.

(6) Storage method

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 problems may occur.

Store the LCD module in a Fujitsu package.

At storing, Fujitsu packages can be stacked up to 4 boxes.

The LCD module is in an anti-static bag. Keep the module in that status.

It is recommended that the storage environment should be humidity controlled, cool and dark.

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 or more for a long period of time, optical characteristics may deteriorate.

(7) Storage method

If the LCD panel is damaged, do not inhale or allow the liquid crystal to enter the mouth

If the liquid crystal contacts the body or cloths, wash it off with soap immediately. Follow precautions for regular electronic components.

Solder flux on the printed circuit board is harmless to the quality and reliability of LCD module.

Fujitsu is practicing non-wash technology on module assembly process.

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18. PRECAUTIONS FOR USE

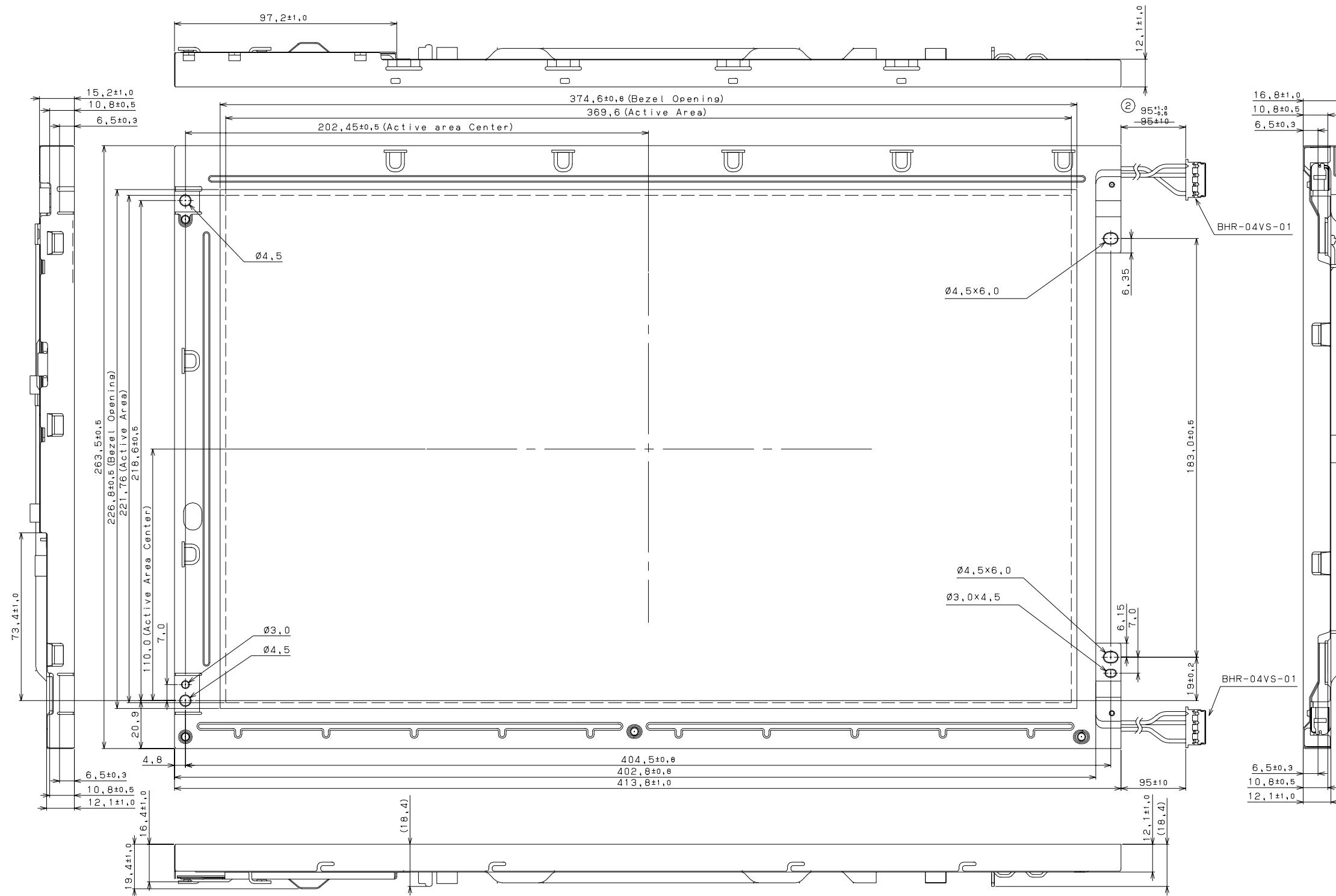
This Product is designed, developed and manufactured as contemplated for general use, including without limitation, general office use, personal use, household use, and ordinary industrial use, but is not designed, developed and manufactured as contemplated for use accompanying fatal risks or dangers 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.

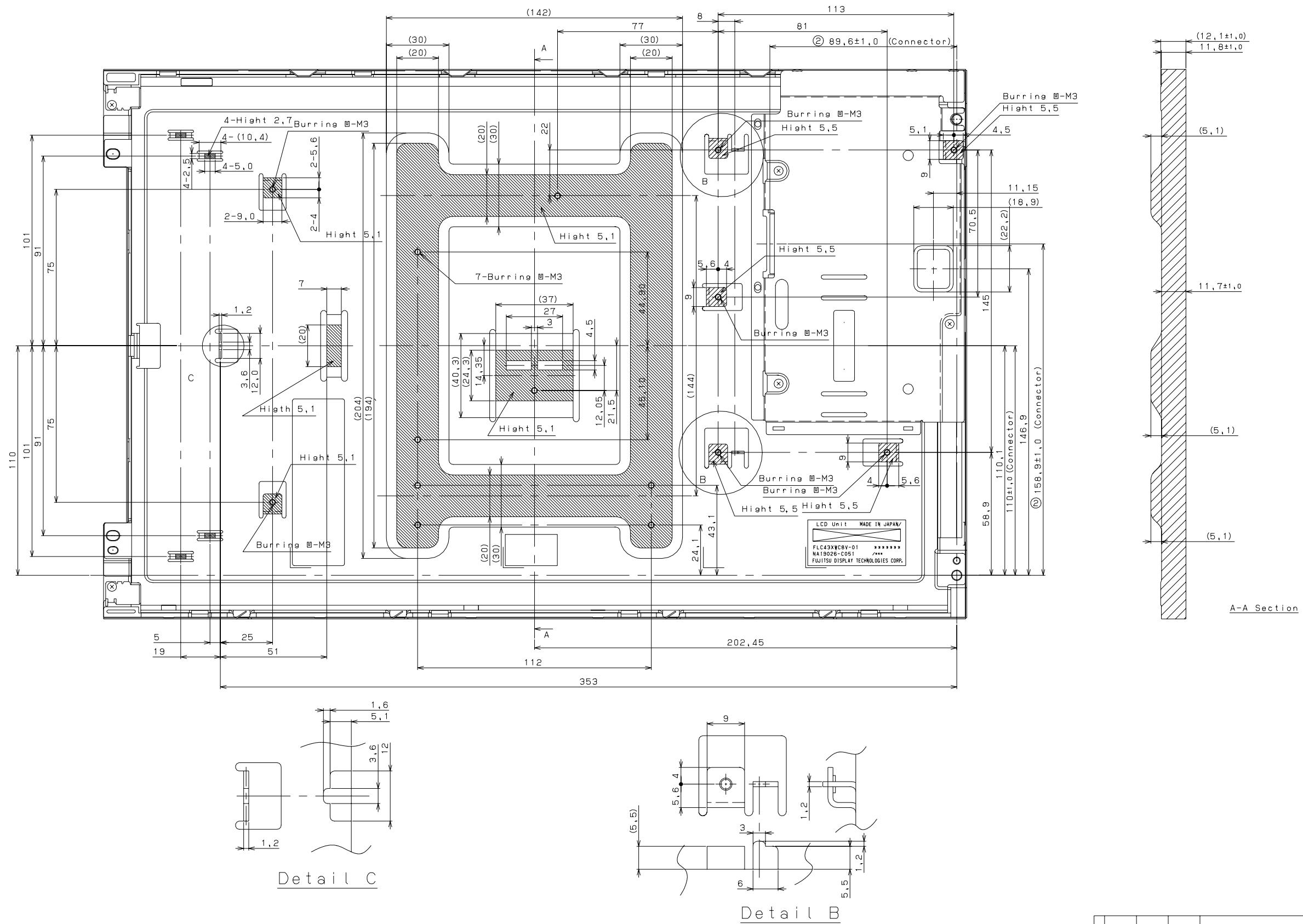
If any doubt is raised in the content of the specifications, both parties shall discuss and make best effort for the agreement.

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Front View

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