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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, FIDTC 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

REVISION HISTORY

DOCUMENT CONTROL SECTION1

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A	1. APPLICATIONS This specification is applied to the 17.0 in. XGA-WIDE supported TFT-LCD module.								A	
	2. PRODUCT NAME AND MODEL NAME 2-1. <u>Product Name</u> : LCD Module 2-2. <u>Model Name</u> : FLC43XWC8V-02								B	
B	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.								C	
	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.								D	
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A	Input signal RxCLK - RxCLK+ Rx0 - Rx0+ Rx1 - Rx1+ Rx2 - Rx2+ Rx3 - Rx3+ Power supply +5V DC Interface circuit DC/DC converter Bias power supply circuit Gate Driver Data Driver LCD panel 1280×3(RGB)×768 (Separate) Inverter DC Back light (CCFL)					A																																																																
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C	Figure 4-1. Block Diagram					C																																																																
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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		mVp-p			
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D	(*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																																																																																	
E	(*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)																																																																																	
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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			
Fuse: KAB2402 252 NA29010(Matsuo Electric Co., Ltd.)or equivalent. EMI Filter: SGM20C1E332-2A(SUMITOMO Metal)or equivalent.			
Fig.8-2 (b) Equivalent Circuit of Power Supply			
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Add ④parts inFig.8-2(b)			
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9. OPTICAL SPECIFICATIONS Table 9-1 shows the optical specifications of this LCD module. Table 9-1. Optical Specifications Ta=25°C <table border="1"> <tr> <th colspan="2" rowspan="2">Item</th><th rowspan="2">Symbol</th><th colspan="2" rowspan="2">Condition</th><th colspan="3">Specifications</th><th>Unit</th><th colspan="2">Remark</th></tr> <tr> <th>MIN.</th><th>TYP.</th><th>MAX</th><th></th><th>Note</th></tr> <tr> <td rowspan="2">Visual Angle</td><td>Horizontal</td><td>$\theta_{L,R}$</td><td rowspan="2">$CR \geq 10$</td><td>$\theta_{U,D}=0^\circ$</td><td>85</td><td>—</td><td>—</td><td>deg</td><td></td><td>(1)(2)</td></tr> <tr> <td>Vertical</td><td>$\theta_{U,D}$</td><td>$\theta_{L,R}=0^\circ$</td><td>85</td><td>—</td><td>—</td><td>deg</td><td></td><td>(3)(5)(6)</td></tr> <tr> <td colspan="2">Contrast Ratio</td><td>CR</td><td colspan="2">$\theta_{L,R,U,D}=0^\circ$</td><td>210 350</td><td>600</td><td>—</td><td>—</td><td>White/Black</td><td>(1)(2)(3)(5)</td></tr> <tr> <td colspan="2" rowspan="2">Response Time(ON) (B → W)</td><td rowspan="2">t_{on}</td><td rowspan="2">$\theta_{L,R,U,D}=0^\circ$</td><td>Ta=25°C</td><td>—</td><td>15</td><td>30</td><td>ms</td><td></td><td>(1)(4)</td></tr> <tr> <td>Ta=0°C</td><td>—</td><td>50</td><td>100</td><td>ms</td><td></td><td>(5)</td></tr> <tr> <td colspan="2" rowspan="2">Response Time(OFF) (W → B)</td><td rowspan="2">t_{off}</td><td rowspan="2">$\theta_{L,R,U,D}=0^\circ$</td><td>Ta=25°C</td><td>—</td><td>10</td><td>25</td><td>ms</td><td></td><td></td></tr> <tr> <td>Ta=0°C</td><td>—</td><td>50</td><td>100</td><td>ms</td><td></td><td></td></tr> <tr> <td colspan="2">Brightness</td><td>I</td><td colspan="2" rowspan="4">$\theta_{L,R,U,D}=0^\circ$ V_{CC}=5V, I_L=10.5mA (at maximum brightness)</td><td>400 350</td><td>500 450</td><td>—</td><td>cd/m²</td><td rowspan="7">White*1</td><td>(1)(5)</td></tr> <tr> <td colspan="2">Brightness Uniformity</td><td>ΔI</td><td>70 75</td><td>—</td><td>—</td><td>%</td><td>(1)(5)(7)</td></tr> <tr> <td rowspan="5">Chromaticity</td><td rowspan="2">W</td><td>X</td><td>0.283</td><td>0.313</td><td>0.343</td><td>—</td><td></td></tr> <tr> <td>Y</td><td>0.299</td><td>0.329</td><td>0.359</td><td>—</td><td></td></tr> <tr> <td>R</td><td colspan="2" rowspan="3">(x, y)</td><td>Red</td><td colspan="3">0.65, 0.34 Typ.</td><td></td><td>(1)(5)</td></tr> <tr> <td>G</td><td>Green</td><td colspan="3">0.30, 0.59 Typ.</td><td></td><td></td></tr> <tr> <td>B</td><td>Blue</td><td colspan="3">0.15, 0.14 Typ.</td><td></td><td></td></tr> <tr> <td colspan="2">② γ-curve</td><td>γ</td><td colspan="2" rowspan="8"></td><td colspan="3">2.4 Typ.</td><td></td><td></td><td></td></tr> <tr> <td colspan="5">LCD Panel Type</td><td colspan="3">TFT Color</td><td></td><td></td><td></td></tr> <tr> <td colspan="5">Display Mode</td><td colspan="3">Normally Black VA</td><td></td><td></td><td></td></tr> <tr> <td colspan="5">Wide Viewing Angle Technology</td><td colspan="3">MVA-Premium</td><td></td><td></td><td></td></tr> <tr> <td colspan="5">Optimum Viewing Angle</td><td colspan="3">— (symmetry)</td><td></td><td></td><td>(6)</td></tr> <tr> <td colspan="5">Display Color</td><td colspan="3">16 million (each 6-bit+2-bit FRC)</td><td></td><td></td><td></td></tr> <tr> <td colspan="5">Color of non-display area</td><td colspan="3">Black</td><td></td><td></td><td></td></tr> <tr> <td colspan="5">Surface Treatment</td><td colspan="3">Anti-glare (Haze value:25%, 3H(at weight of 300g))</td><td></td><td></td><td></td></tr> </table> (*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). <table border="1"> <tr> <td>04</td> <td>20021205</td> <td></td> <td></td> <td></td> <td>Change value of brightness uniformity</td> <td colspan="4">FLC43XWC8V-02</td> </tr> <tr> <td>03</td> <td>20020924</td> <td></td> <td></td> <td></td> <td>Change spec. of the brightness</td> <td colspan="4"></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Min.value of contrast ratio</td> <td colspan="4"></td> </tr> <tr> <td>02</td> <td>20020807</td> <td></td> <td></td> <td></td> <td>Add γ-curve value and change</td> <td colspan="4">Tech Bes LCD-00149</td> </tr> <tr> <td>EDIT</td> <td>DATE</td> <td>DESIG.</td> <td>CHECK</td> <td>APPR.</td> <td>DESCRIPTION</td> <td colspan="4">FUJITSU DISPLAY TECHNOLOGIES CORPORATION</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td colspan="4">8 /</td> </tr> </table>										Item		Symbol	Condition		Specifications			Unit	Remark		MIN.	TYP.	MAX		Note	Visual Angle	Horizontal	$\theta_{L,R}$	$CR \geq 10$	$\theta_{U,D}=0^\circ$	85	—	—	deg		(1)(2)	Vertical	$\theta_{U,D}$	$\theta_{L,R}=0^\circ$	85	—	—	deg		(3)(5)(6)	Contrast Ratio		CR	$\theta_{L,R,U,D}=0^\circ$		210 350	600	—	—	White/Black	(1)(2)(3)(5)	Response Time(ON) (B → W)		t_{on}	$\theta_{L,R,U,D}=0^\circ$	Ta=25°C	—	15	30	ms		(1)(4)	Ta=0°C	—	50	100	ms		(5)	Response Time(OFF) (W → B)		t_{off}	$\theta_{L,R,U,D}=0^\circ$	Ta=25°C	—	10	25	ms			Ta=0°C	—	50	100	ms			Brightness		I	$\theta_{L,R,U,D}=0^\circ$ 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	—		Y	0.299	0.329	0.359	—		R	(x, y)		Red	0.65, 0.34 Typ.				(1)(5)	G	Green	0.30, 0.59 Typ.					B	Blue	0.15, 0.14 Typ.					② γ-curve		γ			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))						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				EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION	FUJITSU DISPLAY TECHNOLOGIES CORPORATION										8 /			
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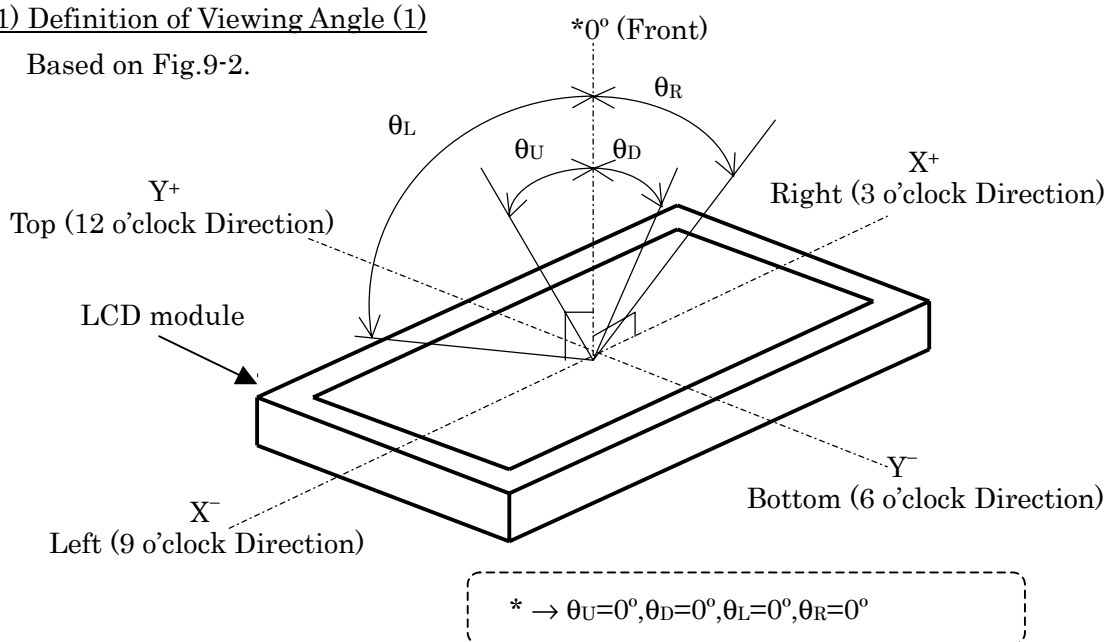
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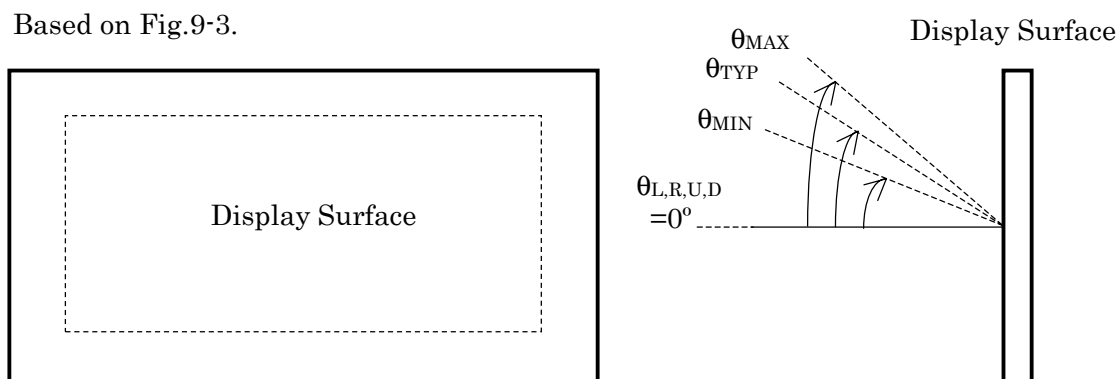
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Note 1) Definition of Viewing Angle (1)

Based on Fig.9-2.

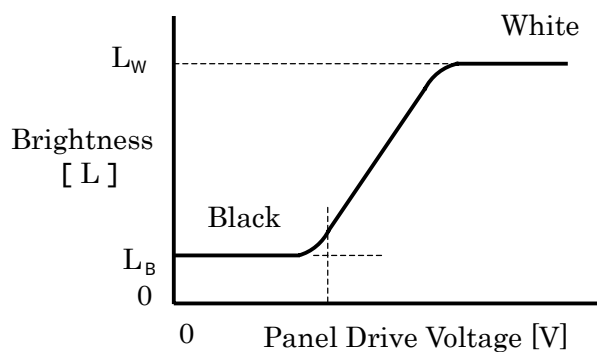
Fig.9-2. Definition of Viewing Angle (1)Note 2) Definition of Viewing Angle (2)

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.

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

Fig.9-4. Voltage-Brightness Characteristics

Note 4) Definition of Response Time

Based on Fig.9-5.

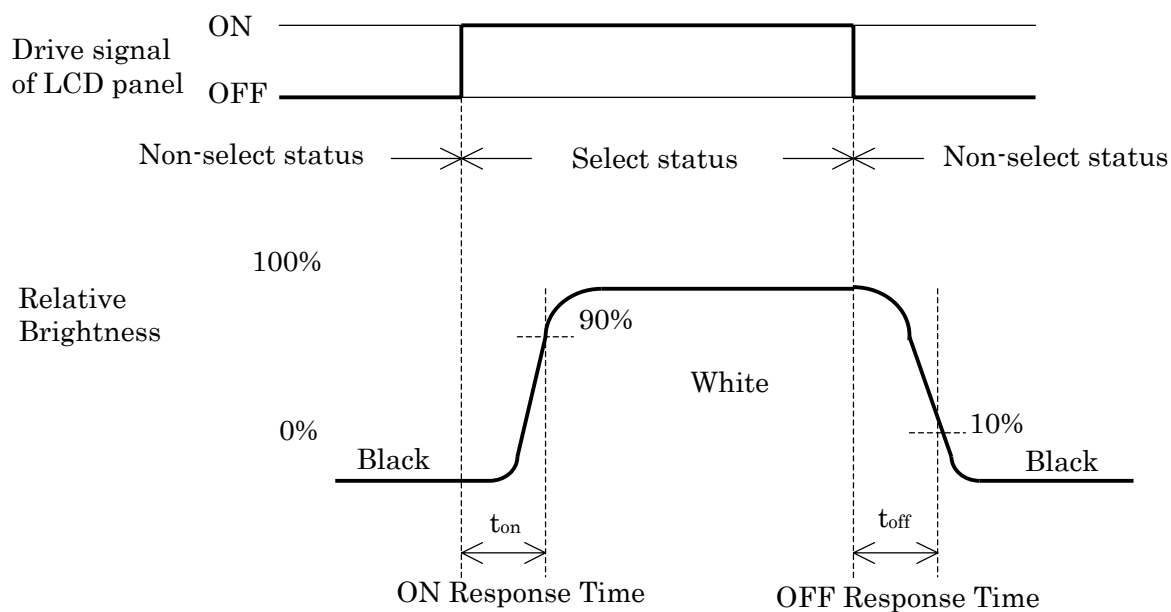


Fig.9-5. Definition of Response Time

Note 5) Contrast Ratio and Response Measurement System

Based on Fig.9-6.

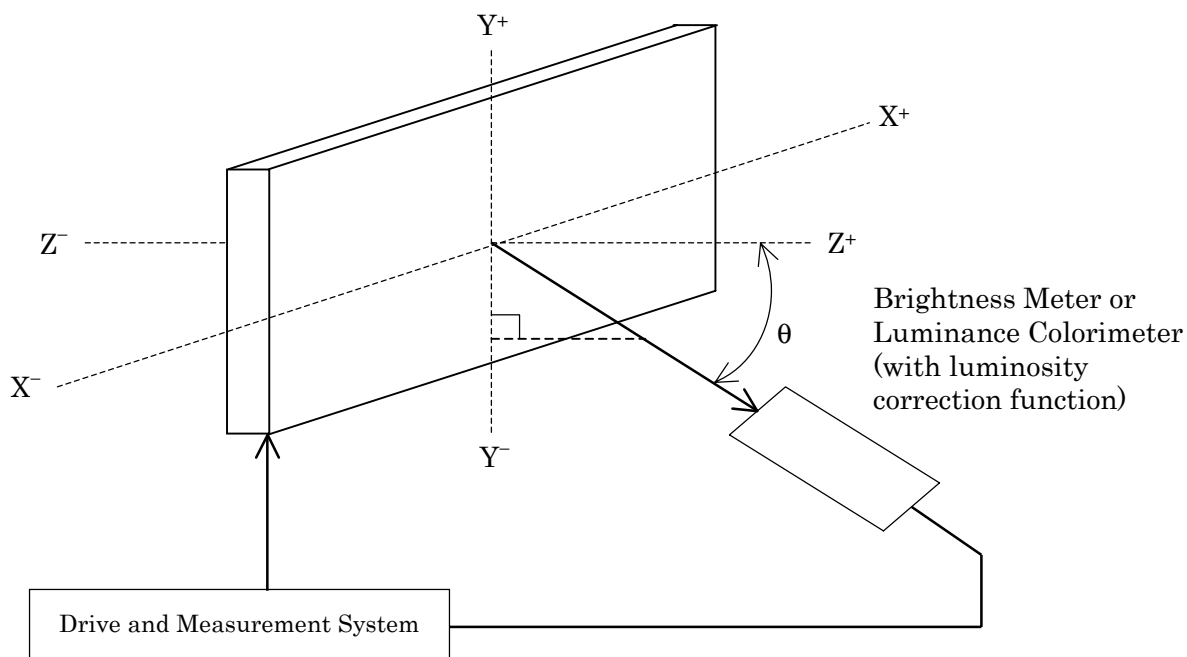


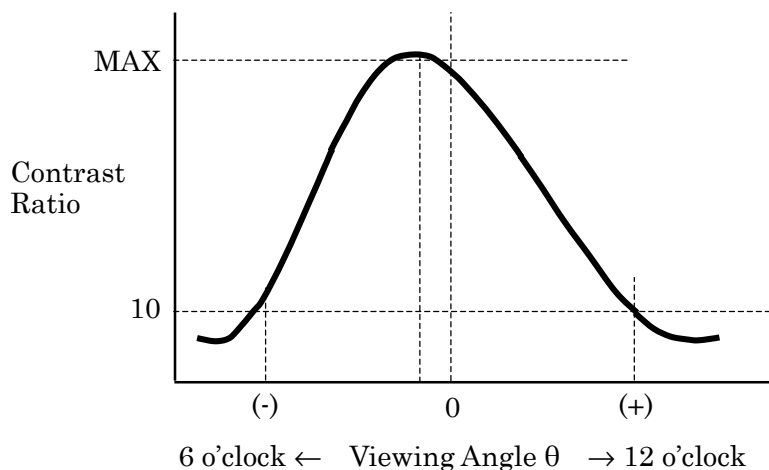
Fig.9-6. Contrast Ratio and Response Time Measurement System

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Note 6) Definition of Optimum Viewing Angle

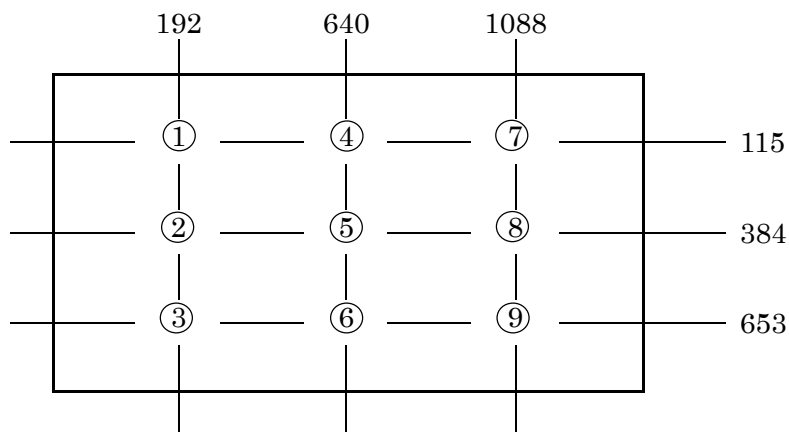
Based on Fig.9-7.

Fig.9-7. Definition of Viewing AngleNote 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.9-8.

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



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.9-8. Measurement Points

1		2		3		4																																																																																					
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10-1-1. Signal descriptions																																																																																											
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<table><tr><td>Pin No.</td><td>Symbol</td><td>I/O</td><td>Function</td></tr><tr><td>1</td><td>VDD</td><td>—</td><td>+5V Power suplv</td></tr><tr><td>2</td><td>VDD</td><td>—</td><td>+5V Power suplv</td></tr><tr><td>3</td><td>GND</td><td>—</td><td>Ground</td></tr><tr><td>4</td><td>GND</td><td>—</td><td>Ground</td></tr><tr><td>5</td><td>RX0-</td><td>I</td><td>LVDS Receiver Signal(-)</td></tr><tr><td>6</td><td>RX0+</td><td>I</td><td>LVDS Receiver Signal(+)</td></tr><tr><td>7</td><td>GND</td><td>—</td><td>Ground</td></tr><tr><td>8</td><td>RX1-</td><td>I</td><td>LVDS Receiver Signal(-)</td></tr><tr><td>9</td><td>RX1+</td><td>I</td><td>LVDS Receiver Signal(+)</td></tr><tr><td>10</td><td>GND</td><td>—</td><td>Ground</td></tr><tr><td>11</td><td>RX2-</td><td>I</td><td>LVDS Receiver Signal(-)</td></tr><tr><td>12</td><td>RX2+</td><td>I</td><td>LVDS Receiver Signal(+)</td></tr><tr><td>13</td><td>GND</td><td>—</td><td>Ground</td></tr><tr><td>14</td><td>RXCLK-</td><td>I</td><td>LVDS Receiver Clock Signal(-)</td></tr><tr><td>15</td><td>RXCLK+</td><td>I</td><td>LVDS Receiver Clock Signal(+)</td></tr><tr><td>16</td><td>GND</td><td>—</td><td>Ground</td></tr><tr><td>17</td><td>RX3-</td><td>I</td><td>LVDS Receiver Signal(-)</td></tr><tr><td>18</td><td>RX3+</td><td>I</td><td>LVDS Receiver Signal(+)</td></tr><tr><td>19</td><td>GND</td><td>—</td><td>Ground</td></tr><tr><td>20</td><td>Data Mapping Select Input</td><td>I</td><td>Low : table 10-1-2 Open or Hi : table 10-1-3</td></tr></table>								Pin No.	Symbol	I/O	Function	1	VDD	—	+5V Power suplv	2	VDD	—	+5V Power suplv	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
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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 6	RX0- RX0+	27	RxOUT0	IR0
52	TxIN1	R1				29	RxOUT1	IR1
54	TxIN2	R2				30	RxOUT2	IR2
55	TxIN3	R3				32	RxOUT3	IR3
56	TxIN4	R4				33	RxOUT4	IR4
2	TxIN5	R7	TxOUT3- TxOUT3+	17 18	RX3- RX3+	34	RxOUT5	IR7
3	TxIN6	R5	TxOUT0- TxOUT0+	5 6	RX0- RX0+	35	RxOUT6	IR5
4	TxIN7	G0				37	RxOUT7	IG0
6	TxIN8	G1	TxOUT1- TxOUT1+	8 9	RX1- RX1+	38	RxOUT8	IG1
7	TxIN9	G2				39	RxOUT9	IG2
8	TxIN10	G6	TxOUT3- TxOUT3+	17 18	RX3- RX3+	41	RxOUT10	IG6
10	TxIN11	G7				42	RxOUT11	IG7
11	TxIN12	G3	TxOUT1- TxOUT1+	8 9	RX1- RX1+	43	RxOUT12	IG3
12	TxIN13	G4				45	RxOUT13	IG4
14	TxIN14	G5				46	RxOUT14	IG5
15	TxIN15	B0				47	RxOUT15	IB0
16	TxIN16	B6	TxOUT3- TxOUT3+	17 18	RX3- RX3+	49	RxOUT16	IB6
18	TxIN17	B7				50	RxOUT17	IB7
19	TxIN18	B1	TxOUT1- TxOUT1+	8 9	RX1- RX1+	51	RxOUT18	IB1
20	TxIN19	B2	TxOUT2- TxOUT2+	11 12	RX2- RX2+	53	RxOUT19	IB2
22	TxIN20	B3				54	RxOUT20	IB3
23	TxIN21	B4				55	RxOUT21	IB4
24	TxIN22	B5				1	RxOUT22	IB5
25	TxIN23	RESERVED	TxOUT3- TxOUT3+	17 18	RX3- RX3+	2	RxOUT23	Not use
27	TxIN24	RESERVED	TxOUT2- TxOUT2+	11 12	RX2- RX2+	3	RxOUT24	Not use
28	TxIN25	RESERVED				5	RxOUT25	Not use
30	TxIN26	ENAB				6	RxOUT26	ENAB
50	TxIN27	R6	TxOUT3- TxOUT3+	17 18	RX3- RX3+	7	RxOUT27	IR6
31	TxCLKIN	DCLK	TxCLKOUT- TxCLKOUT+	14 15	RXCLK- RXCLK+	26	RxCLKOUT	DCLK

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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)

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 6	RX0- RX0+	27	RxOUT0	IR2
52	TxIN1	R3				29	RxOUT1	IR3
54	TxIN2	R4				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 6	RX0- RX0+	35	RxOUT6	IR7
4	TxIN7	G2	TxOUT0- TxOUT0+	6	RX0+	37	RxOUT7	IG2
6	TxIN8	G3	TxOUT1- TxOUT1+	8 9	RX1- RX1+	38	RxOUT8	IG3
7	TxIN9	G4	TxOUT1- TxOUT1+	9	RX1+	39	RxOUT9	IG4
8	TxIN10	G0	TxOUT3- TxOUT3+	17 18	RX3- RX3+	41	RxOUT10	IG0
10	TxIN11	G1	TxOUT3- TxOUT3+	18	RX3+	42	RxOUT11	IG1
11	TxIN12	G5	TxOUT1- TxOUT1+	8 9	RX1- RX1+	43	RxOUT12	IG5
12	TxIN13	G6				45	RxOUT13	IG6
14	TxIN14	G7				46	RxOUT14	IG7
15	TxIN15	B2				47	RxOUT15	IB2
16	TxIN16	B0	TxOUT3- TxOUT3+	17 18	RX3- RX3+	49	RxOUT16	IB0
18	TxIN17	B1	TxOUT3- TxOUT3+	18	RX3+	50	RxOUT17	IB1
19	TxIN18	B3	TxOUT1- TxOUT1+	8 9	RX1- RX1+	51	RxOUT18	IB3
20	TxIN19	B4	TxOUT2- TxOUT2+	11 12	RX2- RX2+	53	RxOUT19	IB4
22	TxIN20	B5				54	RxOUT20	IB5
23	TxIN21	B6				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	RX2+	5	RxOUT25	Not use
30	TxIN26	ENAB				6	RxOUT26	ENAB
50	TxIN27	R0	TxOUT3- TxOUT3+	17 18	RX3- RX3+	7	RxOUT27	IR0
31	TxCLKIN	DCLK	TxCLKOUT- TxCLKOUT+	14 15	RXCLK- RXCLK+	26	RxCLKOUT	DCLK

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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	fc=1/Tc *1	
	Frequency	fc	50.00	65.01	80.00④	MHz		
	Duty	Tch/Tc	45	50	55	%		
	High time	TelkH	5.0	—	—	ns		
	Low time	TelkL	5.0	—	—	ns		
	Rise time	Tclkr	—	—	5.0	ns		
	Fall time	Telkf	—	—	5.0	ns		
DCLK-Data Timing	Setup time	Tset	(4.5) 4④	—	—	ns		
	Hold time	Tthold	(6.5) 4④	—	—	ns		
Data-ENAB timing	Horizontal	Period	Th	1340	1344	(3012) 1688④	DCLK	*2,3
		Frequency	fh	46.6	48.3	55.5④	kHz	
		Display period	Thd	1280	1280	1280	DCLK	
	Vertical	Period	Tv	776	806	806④	Th	16.67ms WXGA mode *2,3
		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.

R0-7
G0-7
B0-7

R0-7
G0-7
B0-7

ENAB

R0-7
G0-7
B0-7

ENAB

DCLK

R0-7
G0-7
B0-7

ENAB

Th

Thd

C001

C768

Tvd

Tv

Tc

0001 0003 0005 1275 1277 1279
0002 0004 0006 1274 1276 1278 1280

Tdn=0clk

Tdn=0clk

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10-4. Correspondence between Data and Display Position

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

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

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.

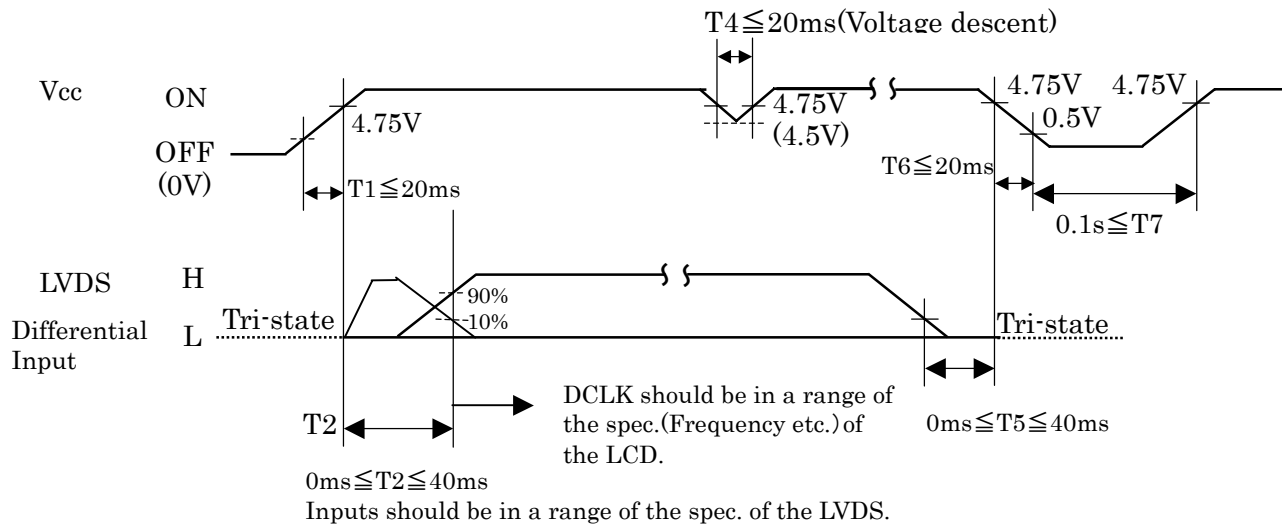


Fig.10-5. Power Supply Sequence

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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 No	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

Table11-1(b) Pin Assignment of CN-B

Pin No	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 1600Vrms.

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									
A	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 unharmed 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								
B	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) $1/3 \leq S < 2/3$: Considered as 0.5 dot. (c) $2/3 \leq S$: Considered as 1 dot. (S=Dark spot size/dot size) (Note3) Min. distance between foreign particles : 100mm								
C									
D									
E									
F									

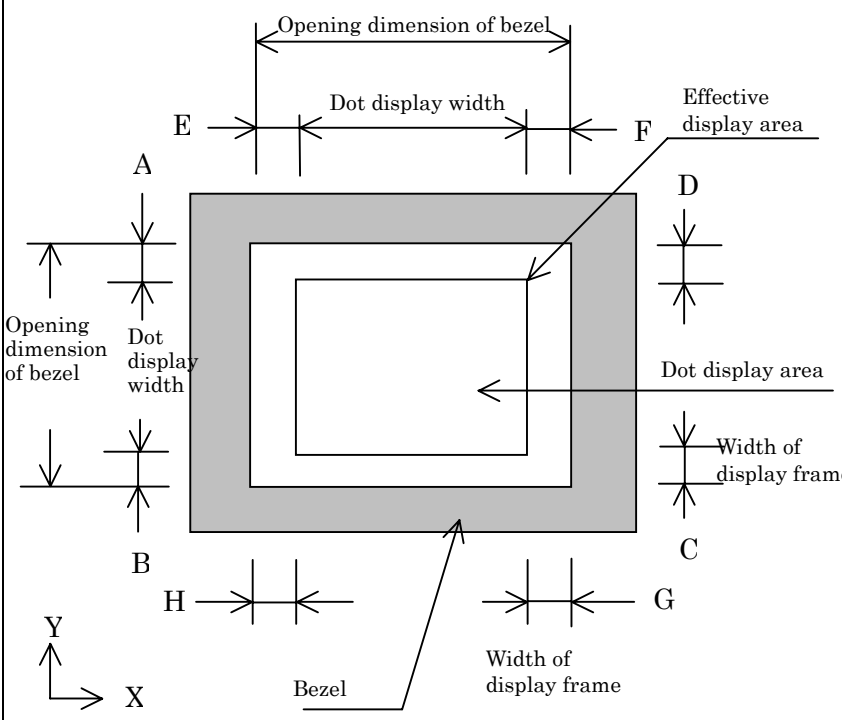
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A	No.	Item				Judgment method and standard			
	1	Bright spot (high and Low)				≤3 dots (Note 1)			
	2	Bright spot connection (high and low)				≤1 pair (Note 1) (2 dot connection in horizontal)			
	3	Total of bright spot				≤3 dots			
	4	Dark spot				≤5 dots (Note 2)			
	5	Dark spot connection				≤2 pairs (2 dot connection in horizontal) (Note 2)			
	6	Total of dark spot				≤ 5dots (Note 2)			
B	7	Total of dot defect(bright and dark)				≤ 8 dots			
	8	Distance of bright spot	high-high high			≥15mm			
C			others			≥ 5mm			
	9	Distance of dark spot				≥ 5mm			
D	10	Scratch on polarizer		W≤0.03		————		Not count	
				0.03<W≤0.05		L≤6		Not count	
						6<L≤12		≤5	
						12<L		0	
				0.05<W≤0.10		L≤0.6		Not count	
						0.6<L≤5		≤3	
						5<L		0	
				0.15<W≤0.3		W×L≤0.4		≤1	
						0.4<W×L		0	
				0.10<W		————		0	
11	Dent on polarizer		D≤0.3		Not count				
			0.3<D≤0.4		≤6				
			0.4<D		0				
12	Bubble in polarizer		D≤0.3		Not count				
			D≤0.5		Not count				
			0.5<D		0				
13	Spot (black/white) by foreign particle		D<0.5		≤5				
			0.5≤D		0				
14	Bright spot by fiber foreign particle (under the polarizer. i.e. between the polarizer and the glass) (Note 3)		D≤0.2		Not count				
			0.2<D≤0.3		≤2				
			0.3<D≤0.35		1				
			0.35<D		0				
15	Line (black /white), scratch by fiber foreign particle		W≤0.03		————		Not count		
			0.03<W≤0.05		L≤6		Not count		
					6<L≤12		≤5		
					12<L		0		
			0.05<W≤0.1		L≤0.6		Not count		
					0.6<L≤5		≤3		
					5<L		0		
0.1<W		(W+L)/2=D		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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【FLC43XWC8V-02】																																																																																																																							
Applied area										Item										Condi tion										Specification																																																																																									
Display dot area										Display location										Non-lighting										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.																																																																																									
																																																																																																																							
																														<table><thead><tr><th>Tolerance (X direction)</th><th>Tolerance (Y direction)</th></tr></thead><tbody><tr><td> E-F ≤ 1.0mm</td><td> A-B ≤ 1.0mm</td></tr><tr><td> E-H ≤ 0.7mm</td><td> A-D ≤ 0.7mm</td></tr><tr><td> F-G ≤ 0.7mm</td><td> B-C ≤ 0.7mm</td></tr><tr><td> G-H ≤ 1.0mm</td><td> C-D ≤ 1.0mm</td></tr></tbody></table>										Tolerance (X direction)	Tolerance (Y direction)	E-F ≤ 1.0mm	A-B ≤ 1.0mm	E-H ≤ 0.7mm	A-D ≤ 0.7mm	F-G ≤ 0.7mm	B-C ≤ 0.7mm	G-H ≤ 1.0mm	C-D ≤ 1.0mm																																																																						
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*The dimension of effective display area, dot display area and display frame should follow the dimensions described in each specification.																																																																																																																							
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13. ENVIRONMENTAL SPECIFICATIONS							
Table 13-1 shows the environmental specifications.							
Table 13-1. Environmental Specifications							
Item		Condition		Remark			
Temperature		Operation	0~57°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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14. INDICATIONS																																																																							
This module has the following indications.																																																																							
A	(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																																																													
B					Serial number (To be reset every month on 1st.)																																																																		
					Manufacturing month (Oct. = X, Nov. =Y, Dec. =Z)																																																																		
					Last digit of manufacturing year.																																																																		
	(5) Version number		: 01A (Example)																																																																				
			-1st 2 digits “01” means operational version.																																																																				
			-3rd alphabet means functional version.																																																																				
	(6) Country of origin		: MADE IN JAPAN																																																																				
C	(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. • 蛍光灯の交換は作業仕様書に従って行って下さい。特に蛍光灯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灯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.																																																																				
D			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) × 328(D) × 490mm(H)																																																																							
15-2. Packaging method																																																																							
Fig.15-2 (a),(b),(c),(d) show the packing method.																																																																							
<table><tr><td colspan="6"></td><td colspan="3">FLC43XWC8V-02</td></tr><tr><td colspan="6"></td><td colspan="3"></td></tr><tr><td colspan="6"></td><td colspan="2">Tech Bes LCD-00149</td><td>CUST.</td></tr><tr><td colspan="6"></td><td colspan="2"></td><td></td></tr><tr><td>EDIT</td><td>DATE</td><td>DESIG.</td><td>CHECK</td><td>APPR.</td><td colspan="4">DESCRIPTION</td></tr><tr><td colspan="2">DESIG.</td><td colspan="2"></td><td>CHECK</td><td colspan="2"></td><td>APPR.</td><td></td></tr><tr><td colspan="2">1</td><td colspan="2"></td><td></td><td colspan="2"></td><td></td><td></td></tr></table>															FLC43XWC8V-02																		Tech Bes LCD-00149		CUST.										EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION				DESIG.				CHECK			APPR.		1								
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<table><tr><td colspan="7">FUJITSU DISPLAY TECHNOLOGIES CORPORATION</td><td>24/</td></tr></table>									FUJITSU DISPLAY TECHNOLOGIES CORPORATION							24/																																																							
FUJITSU DISPLAY TECHNOLOGIES CORPORATION							24/																																																																

A

A

B

B

C

C

D

D

E

DATE	DOCUMENT CONTROL SECTION				

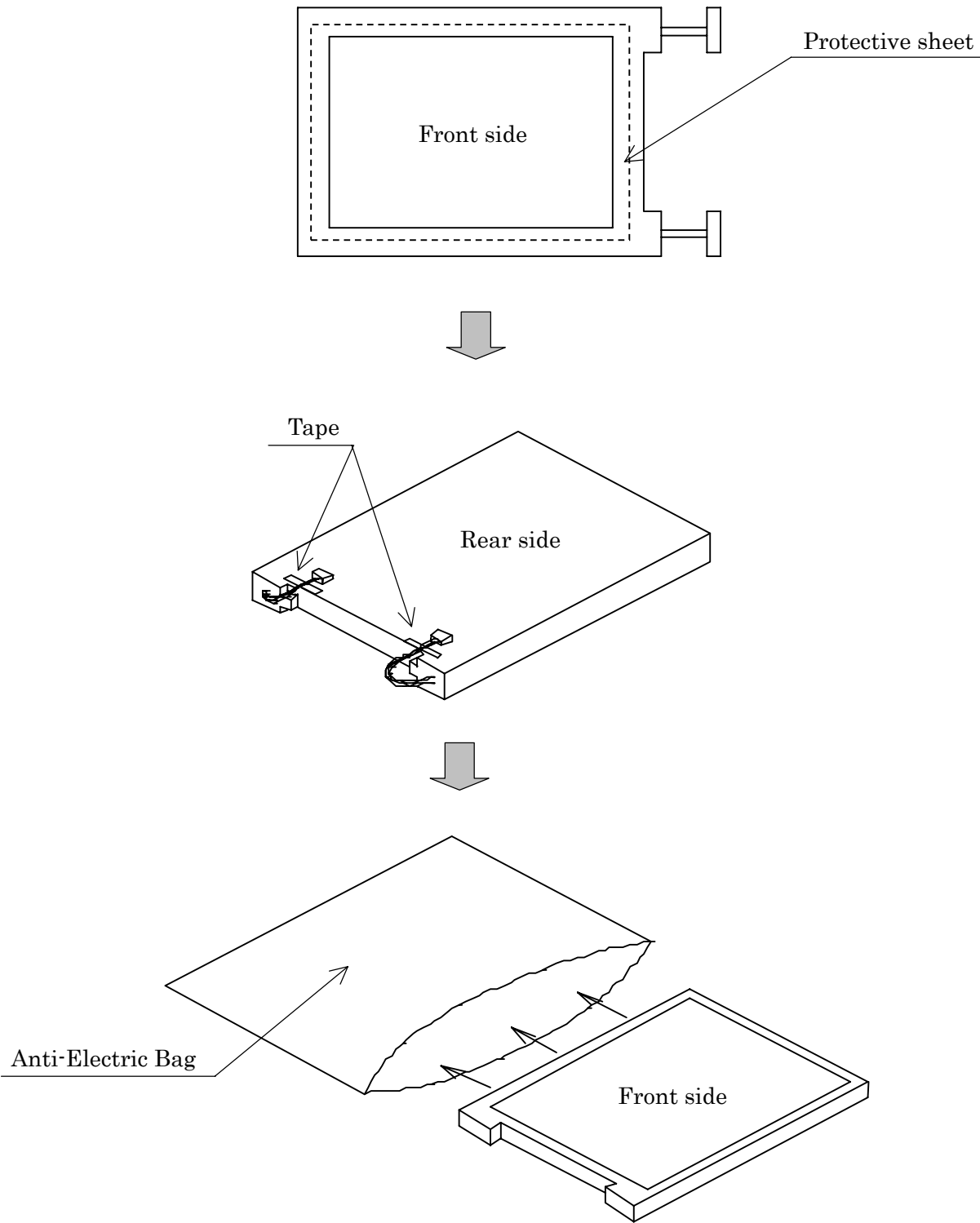


Fig.15-2(a) Packaging Method

						FLC43XWC8V-02			
						Tech Bes LCD-00149			CUST.
						FUJITSU DISPLAY TECHNOLOGIES CORPORATION			25/
EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION				
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A

Holder(bottom)

LCD unit

B

A

B

C

Holder(upper)

C

D

D

E

F

Label(example)

型 格 (TYPE)	FLC43XWC8V-02	数 量 (QTY.)	5
図 番	NA19026-C071	版 数	01A
(DRWG. NO.)		(REV. NO.)	
	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

CUST.

EDIT DATE DESIG. CHECK APPR. DESCRIPTION

FUJITSU DISPLAY TECHNOLOGIES CORPORATION

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DESIG.

CHECK

APPR.

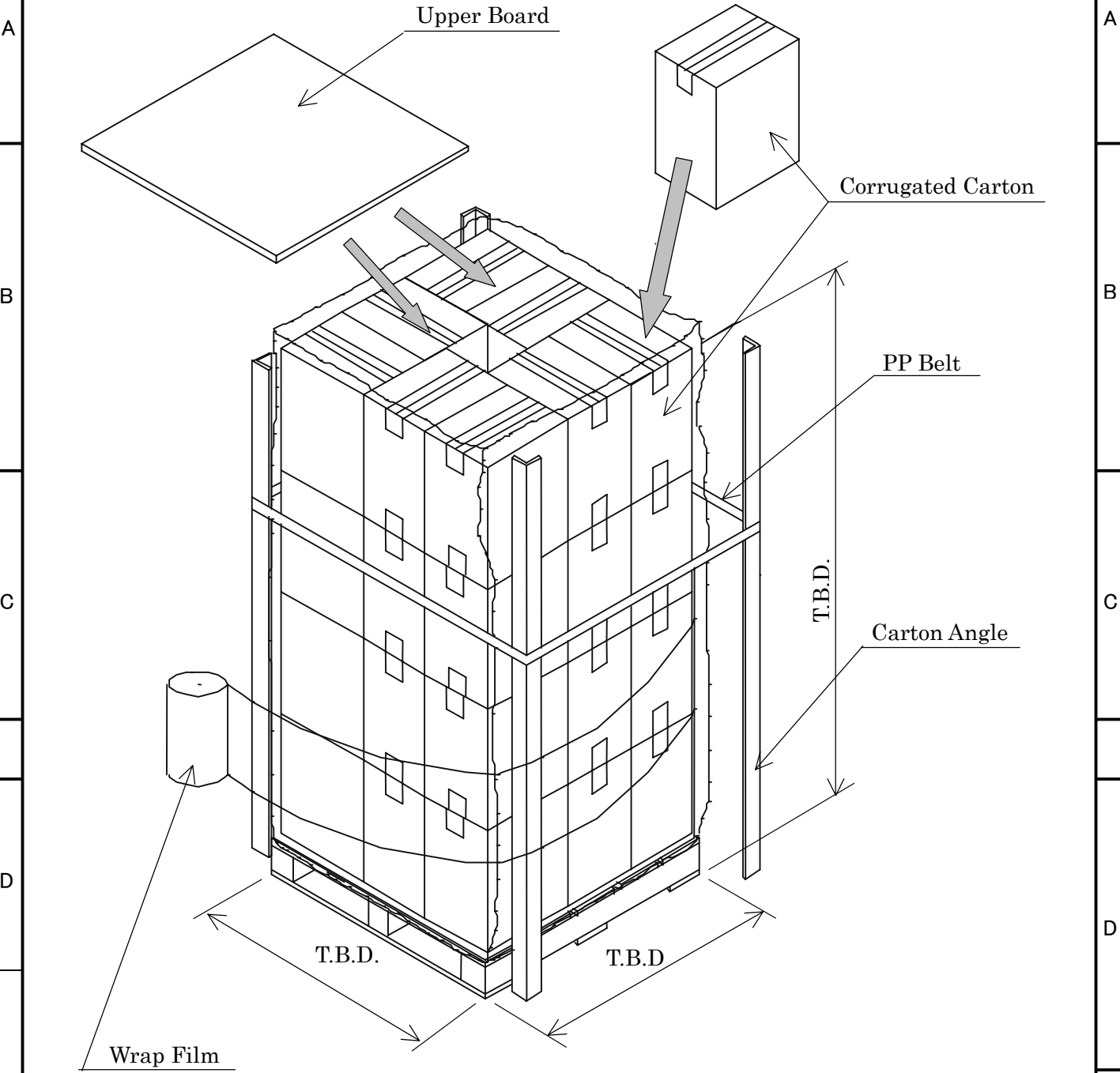
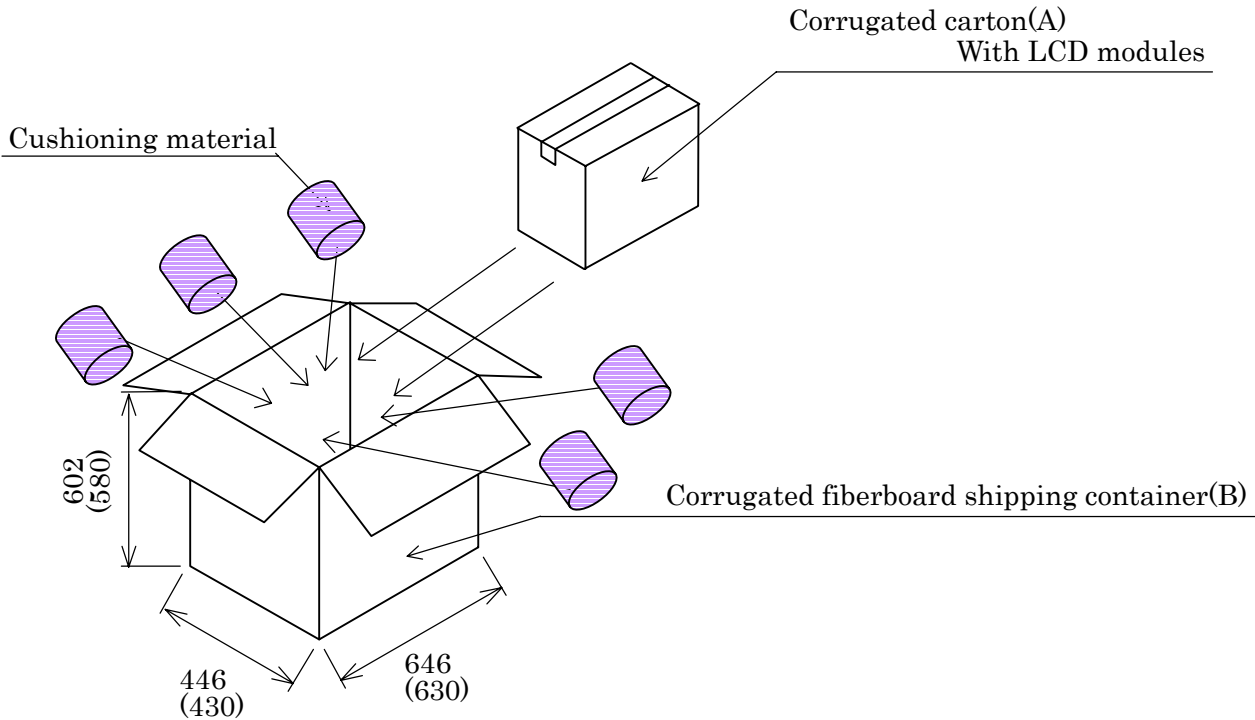


Fig.15-2(c) Packaging Method

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						Tech Bes LCD-00149			CUST.	
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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

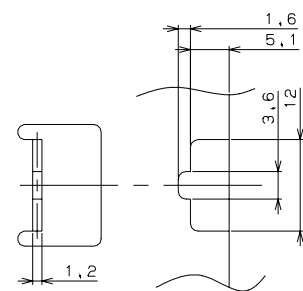
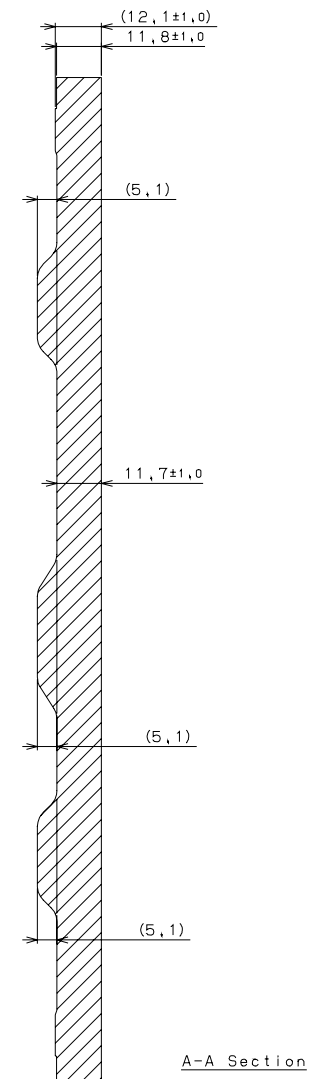
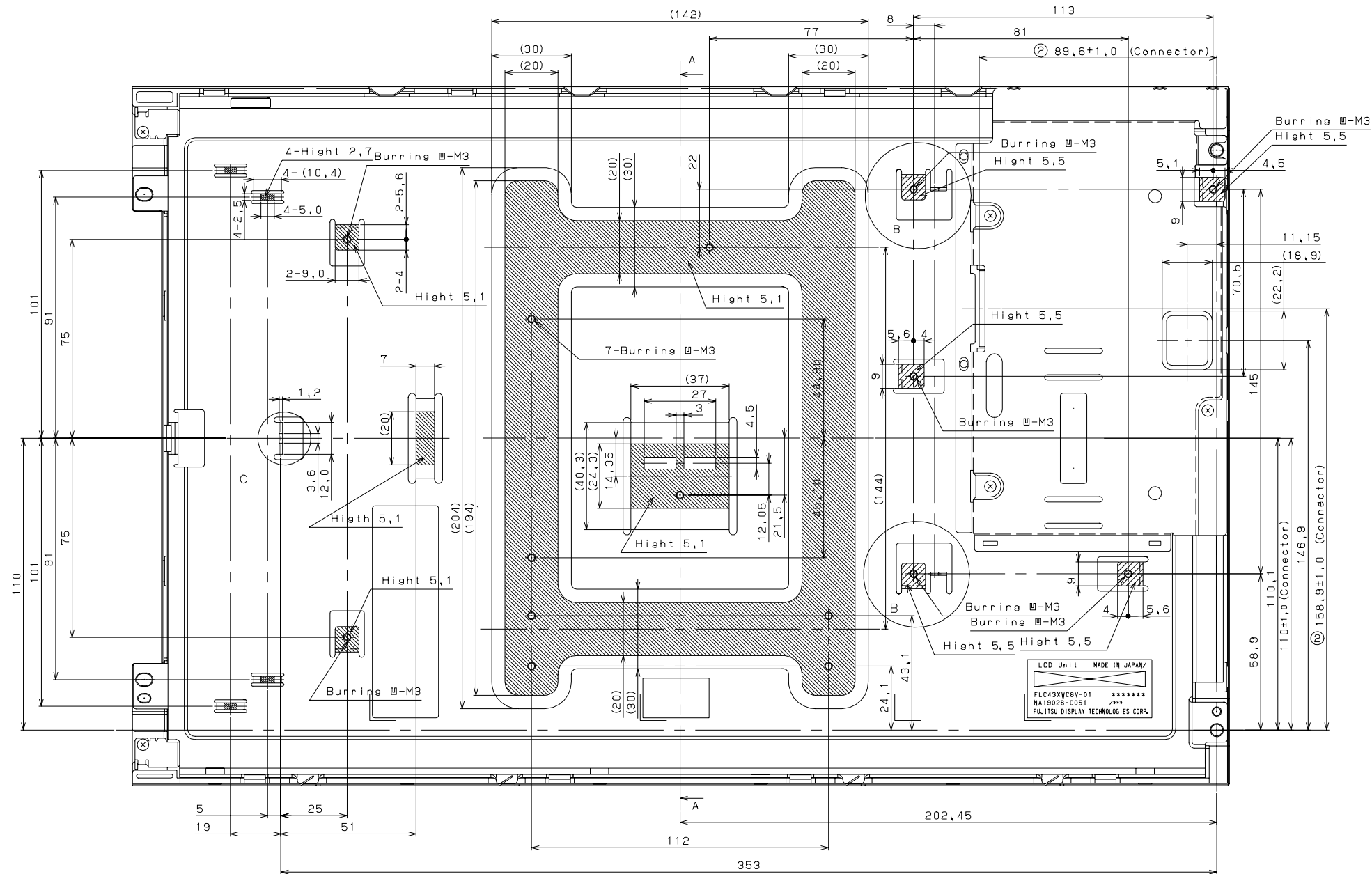
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						Tech Bes LCD-00149					CUST.
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【FLC43XWC8V-02】																													
A	16.WARRANTY The warranty period is one year after manufacturing. Products which fail during this period are repaired or replaced without charge, unless the failure is caused by user.																												
	17.PRECAUTIONS Adhere to the following precautions to properly use this LCD module.																												
B	(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.																												
C	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.)																												
D	[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.																												
E	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.																												
F						FLC43XWC8V-02																							
						Tech Bes LCD-00149			CUST.																				
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FUJITSU DISPLAY TECHNOLOGIES CORPORATION								29/																					

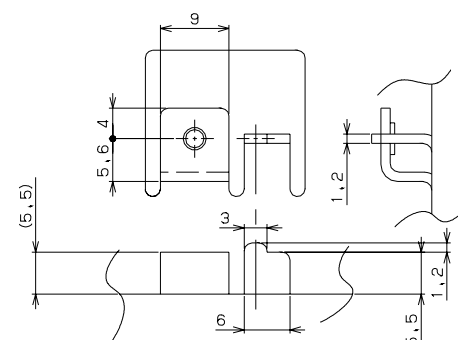
		1		2		3		4		
【FLC43XWC8V-02】										
A	(3) Handling of LCD module Do not pull the cold-cathode tube cable strongly. If the cable is pulled with the load of 2kg or more, the cable may be damaged or reliability may decrease. Assemble the module into user's system in a dust free environment. If conductive 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).									
	B	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.								
		C	(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.							
D										
	E									
F										
	DOCUMENT CONTROL SECTION									
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		FLC43XWC8V-02								
		Tech Bes LCD-00149							CUST.	
		FUJITSU DISPLAY TECHNOLOGIES CORPORATION							30/	
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$$\begin{array}{r} 33 \\ - 32 \\ \hline \end{array}$$



Detail C



Detail B

					TITLE		FLC43XWC8V-02	
04/2002/205					DRAW. NO.			
02/2002/0807					Connector position changed		Tech Bes LCD-00149	
EDIT	DATE	DESIG.	CHECK	DESCRIPTION				
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							034	034
							037	037
							033	033