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Specification of FDTC TFT-LCD module

NA19020-C962

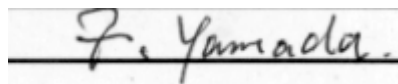
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Date : By :

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Specification No. : Tech Bes LCD – 00230

Issue Date : Oct.17, 2003

Issued by :



F. Yamada

Director

Design Dept. LCD product Div.

FUJITSU DISPLAY TECHNOLOGIES CORPORATION

Specification of TFT-LCD module

Model No. : NA19020-C962

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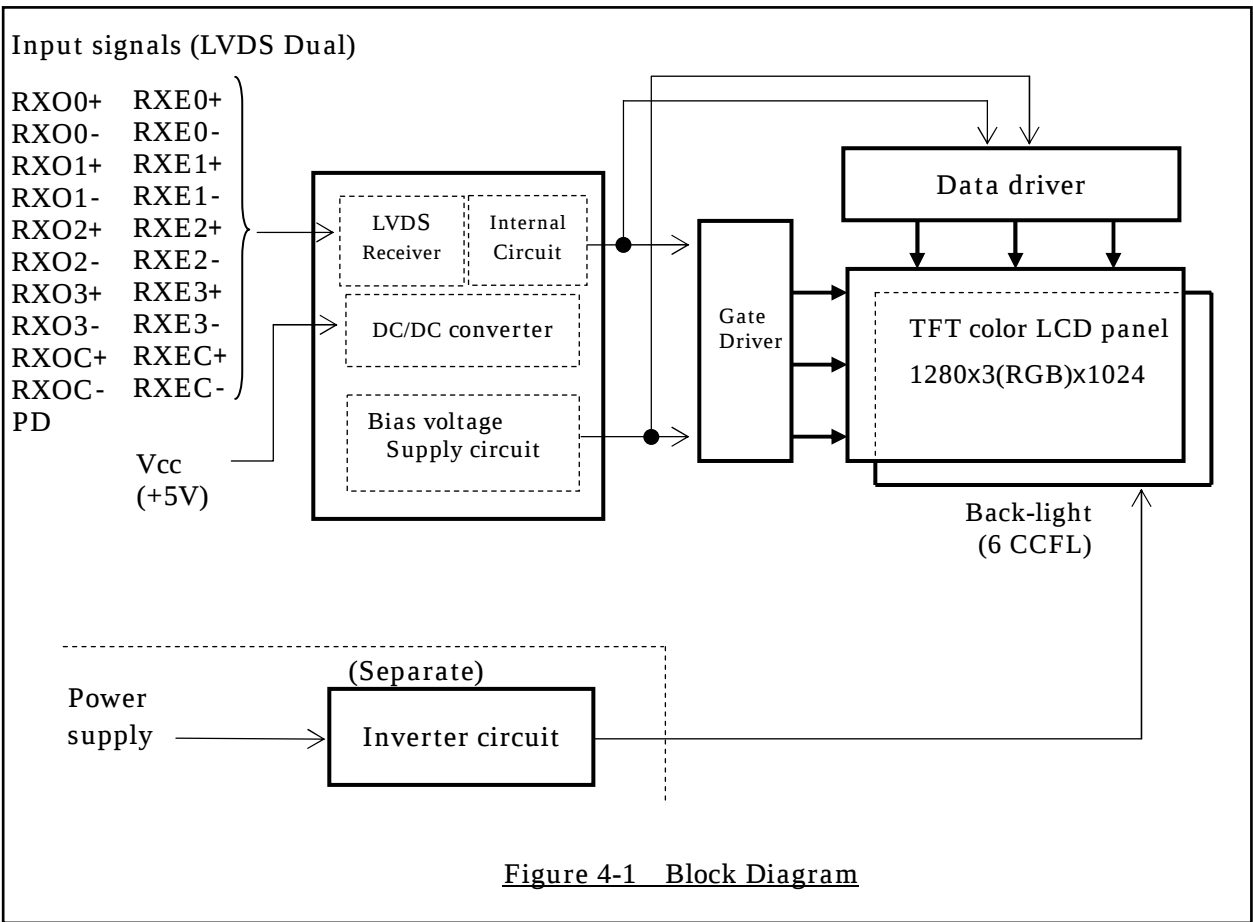


Figure 4-1 Block Diagram

5. MECHANICAL SPECIFICATIONS

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

Table 5-1 Mechanical Specifications

Item	Specifications	Unit	Remark
Dimensions	414x335x23(TYP.)	mm	Edge type back-light is used. (φ 2.6 CCFLx6) Without inverter. For details on dimensions, see dimensional outline drawing. (at page 34,35,36:Figure 19-1,2,3) Excluding inverter.
Display Resolution	(1280x3)x1024	—	
Display Dot Area	376.32x301.056	mm	
Dot Pitch	(0.098x3)x0.294	mm	
Pixel Aspect Ratio	1:1	—	
Weight	3,000 MAX	g	
FG-SG	Short circuit	—	

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6. ABSOLUTE MAXIMUM RATING

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

Table 6-1 Absolute Maximum Rating

Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Supply Voltage	V _{CC}	Ta=25°C	-0.3	—	6.0	V
Input Signal Voltage (LVDS signal, PD)	V _{IN}	Ta=25°C	-0.3	—	3.6	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 _{CC}	4.75	—	5.25	V
Ripple Voltage	V _{CC}	V _{RP}	—	0.1	V

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8. ELECTRICAL SPECIFICATIONS

Table 8-1 shows the electrical specifications of this LCD module. Figure 8-1 shows the measurement circuit. Figure 8-2(A) shows the equivalent circuit of the logic signal input area. Figure 8-2(B) shows the equivalent circuit of the supply voltage Input area.

Table 8-1 Electrical Specifications

Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit	Remark
Differential-input Voltage (Hign)	V_{IH}	$V_{CM}=+1.2V$	—	—	100	mV	
Differential-input Voltage (Low)	V_{IL}		-100	—	—	mV	
Input PD Voltage (High)	V_{IHPD}	$V_{CC}=+5.0\pm0.25V$ $V_{SS}=0V$ $DCLK=54MHz$ $T_a=25^\circ C$	2.0	—	3.3	V	
Input PD Voltage (Low)	V_{ILPD}		0	—	0.8	V	
Supply Current	I_{CC}		—	800	1,500	mA	*1
Supply Rush Current	I_{SCC}		—	—	3.5	A	*2
Supply Rush Current Duration(1.5A excess)	T_{SCC}		—	—	1	ms	
BACK LIGHT (*3)	CCFL Turn on Voltage	$f_L=50kHz, T_a=25^\circ C$	—	1,400	1,600	V_{rms}	
		$f_L=50kHz, T_a=0^\circ C$	—	—	1,600		
	Lighting Voltage	$f_L=50kHz$ $I_L=7mA$	—	750	—	V_{rms}	
	Lighting Frequency	$V_L=750V_{rms}$	40	50	60	kHz	
	Tube Current	$f_L=50kHz$ $V_L=750V_{rms}$	4	—	8	$mArms$	*3

(*1) Typical current situation : Color bar pattern. $V_{CC}=5.0V$
 Maximum current situation : White pattern. $V_{CC}=4.75V$
 Without rush current.

(*2) These items prescribe the rush current for starting internal DC/DC.
 Charging current to capacitors of V_{CC} is not prescribed.

(*3) Tube current (I_L) shows the value of the current that is consumed at one lamp.
 This LCD module has 6 lamps. Each 3 lamps are placed at upper side and lower side of the display.
 3 lamps is connected independently. Each low voltage terminals are connected with separate cable to Back-light connector.

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Measurement circuit is based on Figure 8-1.

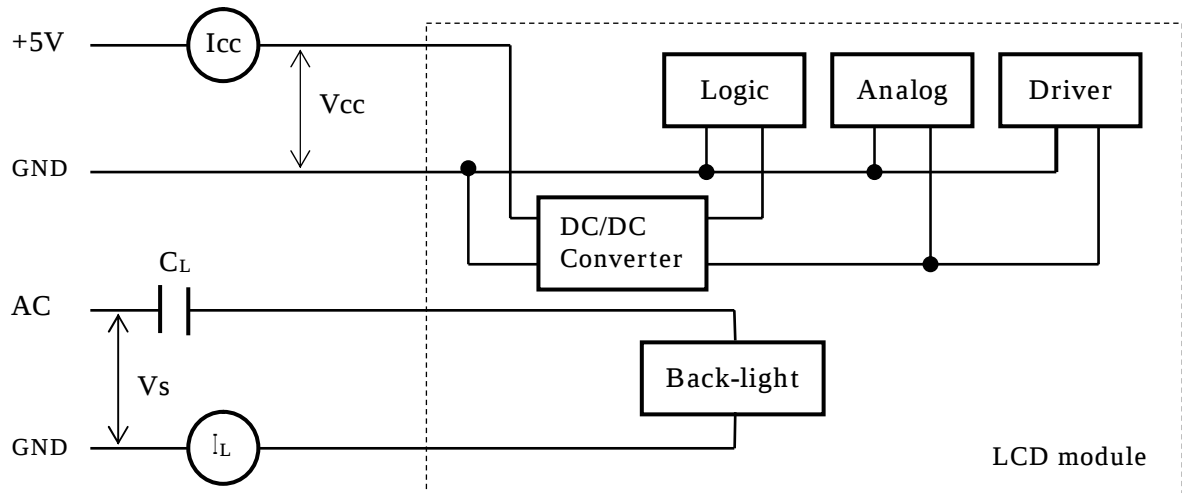
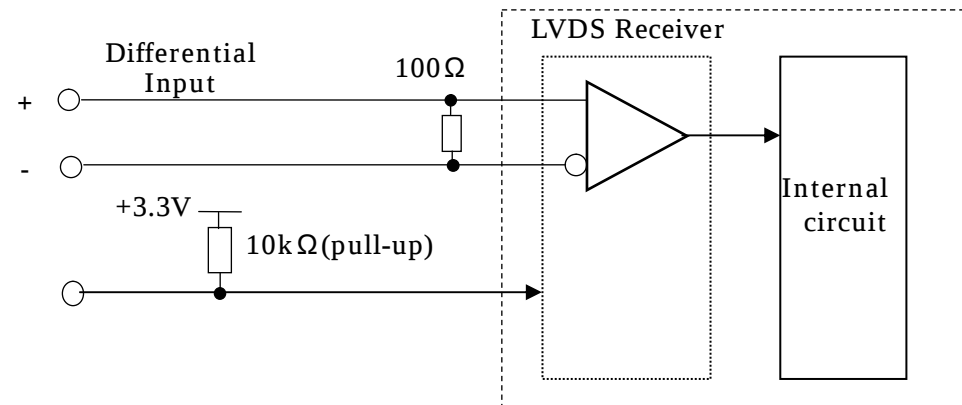


Figure 8-1 Measurement circuit

Input signals (LVDS Dual)

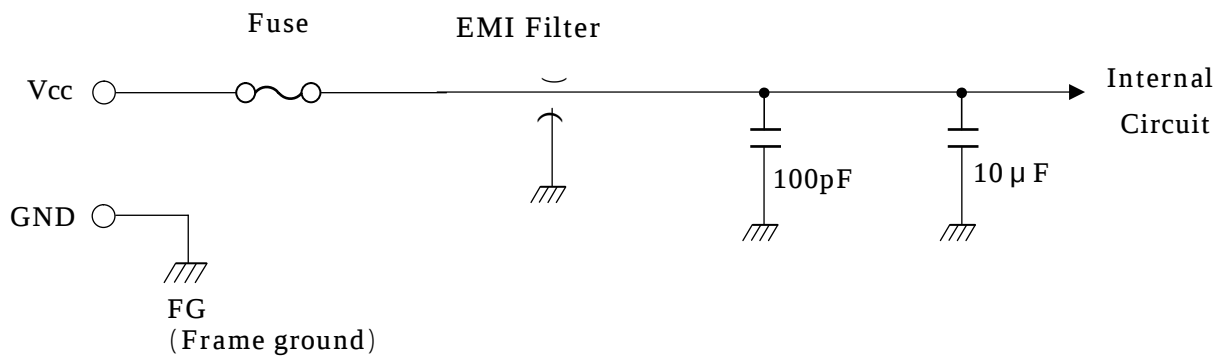
RX00+ RXE0+
RX00- RXE0-
RX01+ RXE1+
RX01- RXE1-
RX02+ RXE2+
RX02- RXE2-
RX03+ RXE3+
RX03- RXE3-
RXOC+ RXEC+
RXOC- RXEC-

PD



LVDS Receiver : DS90CF386(NS) or TH63LVDF84 (Thine)

Figure 8-2(A) Equivalent circuit of logic signal Input



Fuse : F0603C3R00FWTRM 3.0A (Kyocera Corp. or equivalent)

EMI Filter : SGM20C1E332 (Sumitomo Metal Inc. or equivalent)

Figure 8-2(B) Equivalent circuit of power supply

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 中国液晶网 LCD88.COM 9. OPTICAL SPECIFICATIONS Table 9-1 shows the optical specifications of this LCD module.																																																											
A		Table 9-1 Optical Specifications						Ta=25°C , Signal timing=Typ.																																																			
		Item		Symbol		Condition		Specifications		Unit		Remark																																															
								MIN. TYP. MAX.				Note																																															
Visual Angle		Horizontal		$\theta_{L,R}$		CR□10		$\theta_{U,D}=0^{\circ}$		85		— —		deg		(1)(2) (3)(5) (6)																																											
		Vertical		$\theta_{U,D}$				$\theta_{L,R}=0^{\circ}$		85		— —		deg																																													
		All Direction		θ						—		80 —		deg																																													
B		Contrast Ratio		CR		$\theta_{L,R,U,D}=0^{\circ}$		400		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) (5)																																											
						Ta=0°C		—		50		100		ms																																													
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																																													
C		Brightness		I		$\theta_{L,R,U,D}=0^{\circ}$ V _{CC} =5V I _L =7mA fL=50kHz R*,G*,B* Signal =All "H"		330		450		—		cd/m ²		White*1		(1)(5)																																									
		Brightness Uniformity		I				70		—		—		%				(1)(5) (7)																																									
		Chromaticity		W				x		0.249		0.313		0.343				—		(1) (5)																																							
								y		0.278		0.329		0.359				—																																									
				R G B				(x,y)		Red		(0.643, 0.351) Typ.																																															
Green		(0.296, 0.596) Typ.																																																									
Blue		(0.148, 0.127) Typ.																																																									
D		LCD Panel Type						TFT Color																																																			
		Display Mode						Normaly Black																																																			
		Wide Viewing Angle Technology						MVA																																																			
		Optimum Viewing Angle						— (symmentry)						(6)																																													
		Display Color						16,777,216 (8-bit color)																																																			
		Color of non-display area						Black																																																			
		Surface Treatment						Anti-glare (Haze value:(25%) , 2H)																																																			
(*1) Value at 15 ~ 20 minutes after lighting on. (Note) ·CS-1000 (MINOLTA Co., Ltd.) Field=1 ° , L=500mm · Back-light current = 7mA, Dark room condition(1 lux or less) Be carefull that the luminance meter, which you use, may not be able to get correct brightenss if it's no set correctly.																																																											
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Note 1) Definition of Viewing Angle (1)

Based on Figure 9-1.

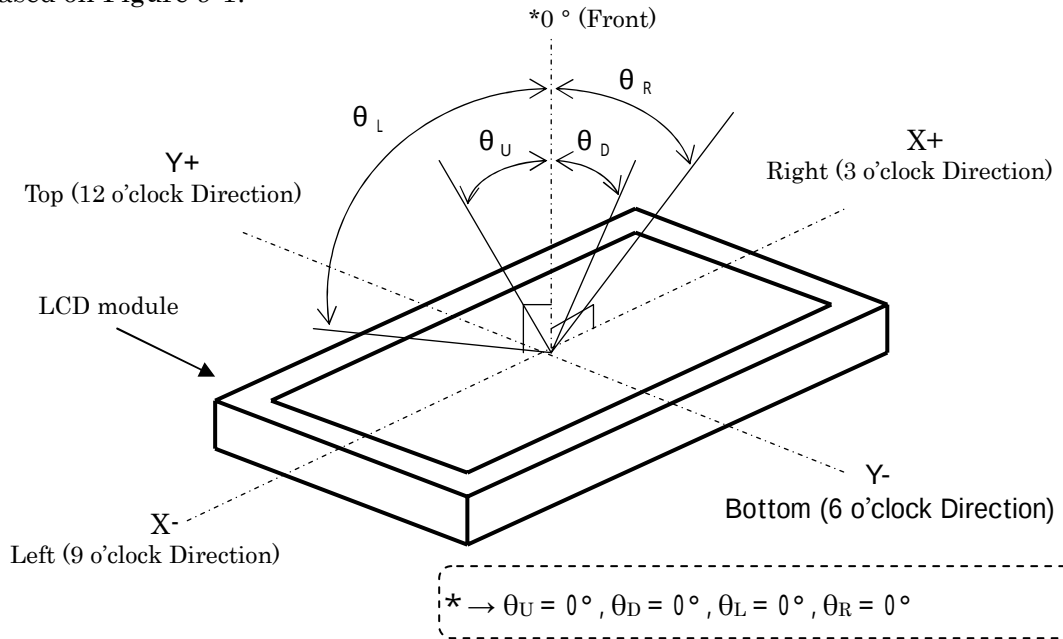


Figure 9-1 Definition of Viewing Angle (1)

Note 2) Definition of Viewing Angle (2)

Based on Figure 9-2.

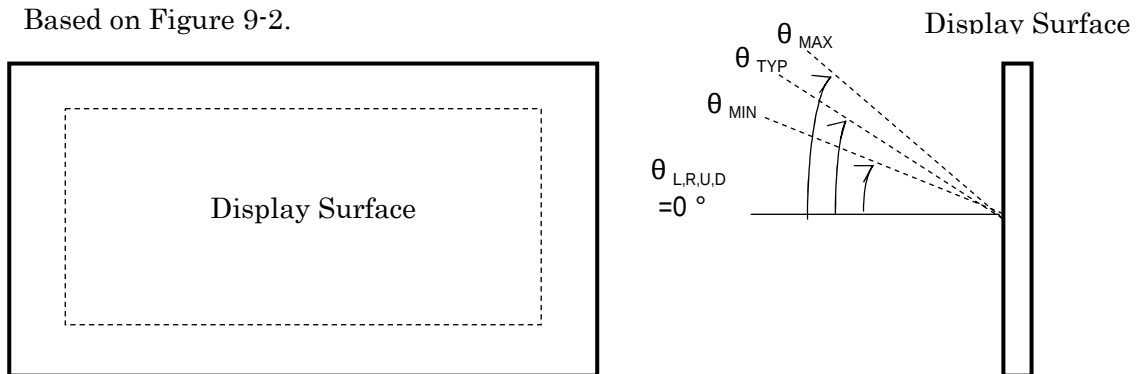


Figure 9-2 Definition of Viewing Angle (2)

Note 3) Definition of Contrast Ratio (CR)

Determined by Formula (1) based on Figure 9-3 Voltage-Brightness characteristics.

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

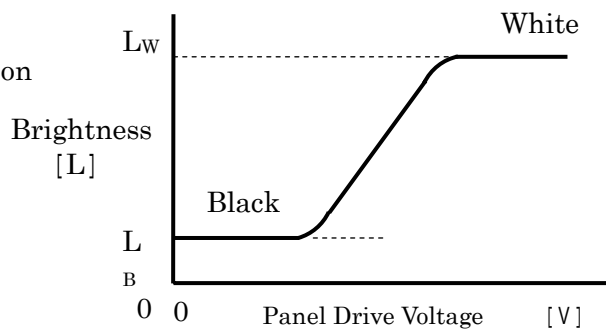


Figure 9-3 Voltage-Brightness Characteristics

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Note 4) Definition of Response Time

Based on Figure 9-4.

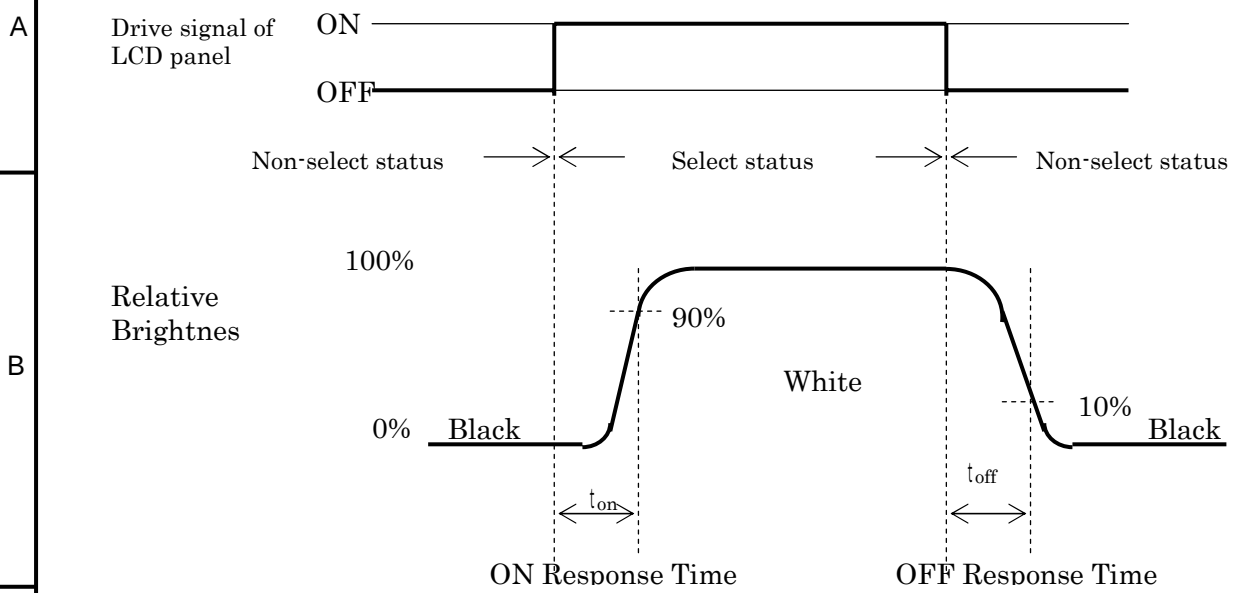


Figure 9-4 Definition of Response Time

Note 5) Contrast Ratio and Response Measurement System

Based on Figure 9-5.

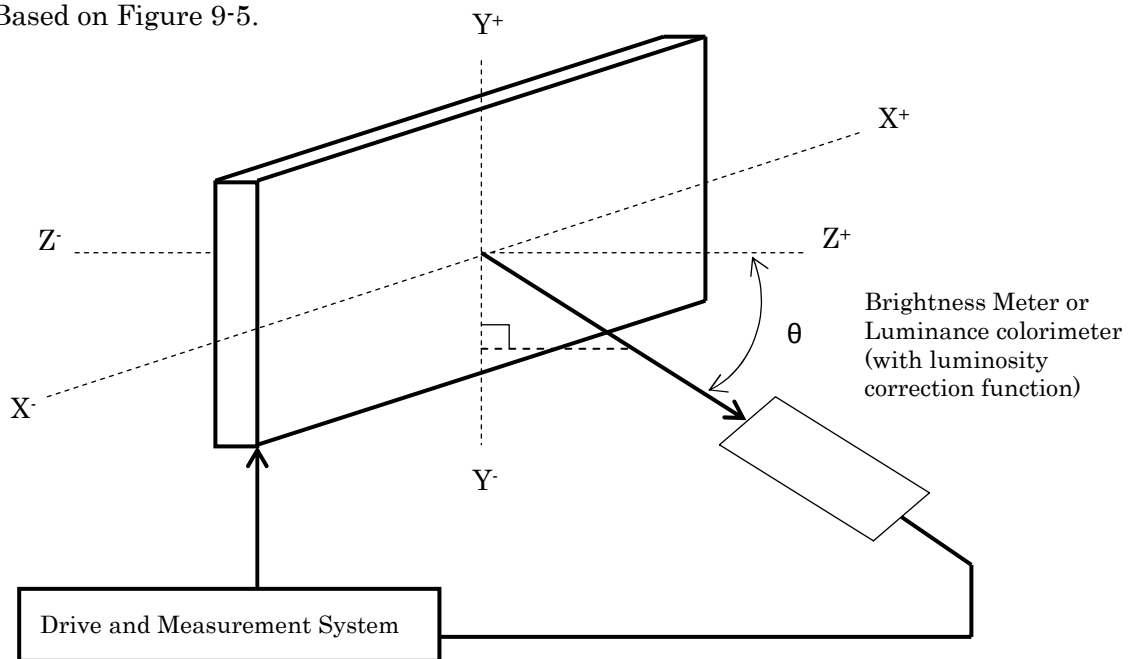


Figure 9-5 Contrast Ratio and Response Time Measurement System

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Note 6) Definition of Optimum Viewing Angle

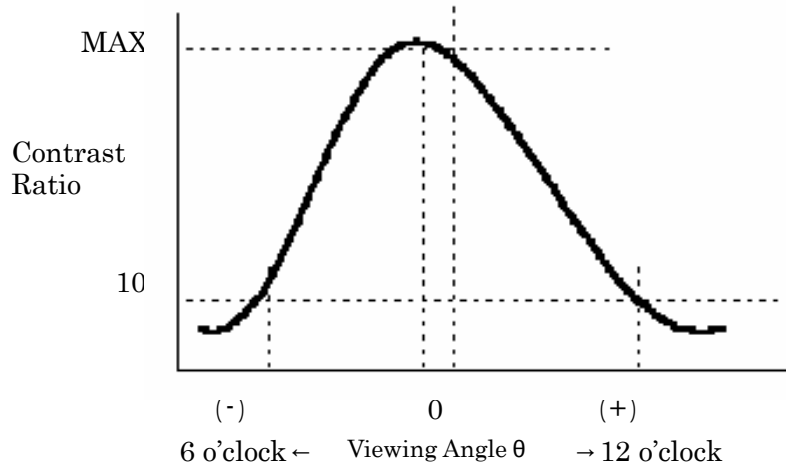


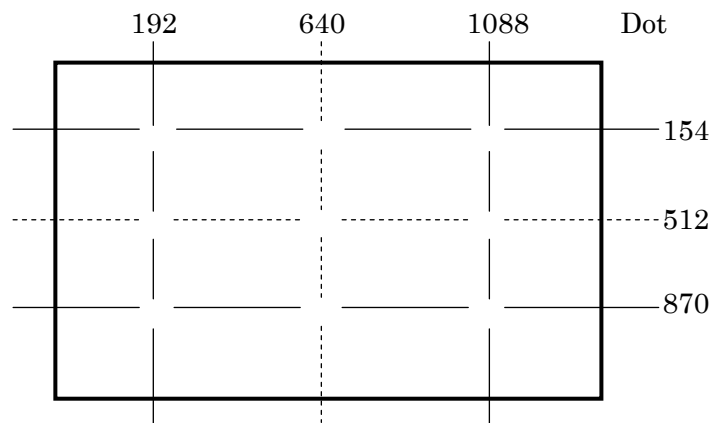
Figure 9-6 Definition of Viewing Angle

Note 7) Definition of Brightness Uniformity

Brightness uniformity is defined by the following formula.

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

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



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

Figure 9-7 Measurement Points

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10. INTERFACE SPECIFICATIONS

10-1 Signal descriptions

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

Table 10-1 Interface signals (CN1)

Pin No.	Symbol	I/O	Function
1	RxO0-	I	Negative differential input
2	RxO0+	I	Positive differential input
3	RxO1-	I	Negative differential input
4	RxO1+	I	Positive differential input
5	RxO2-	I	Negative differential input
6	RxO2+	I	Positive differential input
7	GND	—	Ground
8	RxOC-	I	Negative differential input
9	RxOC+	I	Positive differential input
10	RxO3-	I	Negative differential input
11	RxO3+	I	Positive differential input
12	RxE0-	I	Negative differential input
13	RxE0+	I	Positive differential input
14	GND	—	Ground
15	RxE1-	I	Negative differential input
16	RxE1+	I	Positive differential input
17	GND	—	Ground
18	RxE2-	I	Negative differential input
19	RxE2+	I	Positive differential input
20	RxEC-	I	Negative differential input
21	RxEC+	I	Positive differential input
22	RxE3-	I	Negative differential input
23	RxE3+	I	Positive differential input
24	GND	—	Ground
25	TST	—	Test pin *1
26	PD	I	LVDS Core Power Down
27	TST	—	Test pin *1
28	Vcc	—	+5V power supply
29	Vcc	—	+5V power supply
30	Vcc	—	+5V power supply

Connector : FI-X30S-HF (Japan Aviation Electronics)

User's connector : FI-X30M (FPC type) (Japan Aviation Electronics)

FI-X30H (Wire type)

FI-X30C (Coaxial cable type)

*1: Keep open. (Internal test use only.)

*2: When using a connector other than the recommended one, a defect in the initial stage or a problem concerning long term reliability may occur.

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10-2 LVDS Data Assignment

Table 10-2 shows the LVDS Data Assignment.

Table 10-2 LVDS Data Assignment

Input signal *1		Transmitter DS90CF383,C385		Interface connector			Receiver DS90CF386 THC63LVDF84		LCD Control input	
		pin	INPUT	System side	LCD module		pin	OUTPUT		
					pin					
LVDS Odd	RO2	51	TxIN0	Tx OUT0+	2	RxO0+	27	RxOUT0	RO2	
	RO3	52	TxIN1				29	RxOUT1	RO3	
	RO4	54	TxIN2				30	RxOUT2	RO4	
	RO5	55	TxIN3				32	RxOUT3	RO5	
	RO6	56	TxIN4	Tx OUT0-	1	RxO0-	33	RxOUT4	RO6	
	RO7	3	TxIN6				35	RxOUT6	RO7	
	GO2	4	TxIN7				37	RxOUT7	GO2	
	GO3	6	TxIN8				38	RxOUT8	GO3	
	GO4	7	TxIN9	Tx OUT1+	4	RxO1+	39	RxOUT9	GO4	
	GO5	11	TxIN12				43	RxOUT12	GO5	
	GO6	12	TxIN13				45	RxOUT13	GO6	
	GO7	14	TxIN14				46	RxOUT14	GO7	
	BO2	15	TxIN15	Tx OUT1-	3	RxO1-	47	RxOUT15	BO2	
	BO3	19	TxIN18				51	RxOUT18	BO3	
	BO4	20	TxIN19				53	RxOUT19	BO4	
	BO5	22	TxIN20				54	RxOUT20	BO5	
	BO6	23	TxIN21	Tx OUT2+	6	RxO2+	55	RxOUT21	BO6	
	BO7	24	TxIN22				1	RxOUT22	BO7	
	RSVD	27	TxIN24				3	RxOUT24	Not use	
	RSVD	28	TxIN25				5	RxOUT25	Not use	
	ENAB	30	TxIN26	Tx OUT2-	5	RxO2-	6	RxOUT26	ENAB	
	RO0	50	TxIN27				7	RxOUT27	RO0	
	RO1	2	TxIN5				34	RxOUT5	RO1	
	GO0	8	TxIN10	Tx OUT3+	11	RxO3+	41	RxOUT10	GO0	
	GO1	10	TxIN11				42	RxOUT11	GO1	
	BO0	16	TxIN16				49	RxOUT16	BO0	
	BO1	18	TxIN17				50	RxOUT17	BO1	
	RSVD	25	TxIN23	Tx OUT3-	10	RxO3-	2	RxOUT23	Not use	
		DCLK	31	TxCLK IN	TxCLK OUT+ TxCLK OUT-	9 8	RxCLK IN+ RxCLK IN-	26	RxCLK OUT	DCLK
	LVDS Even	RE2	51	TxIN0	Tx OUT0+	13	RxEO+	27	RxOUT0	RE2
RE3		52	TxIN1	29				RxOUT1	RE3	
RE4		54	TxIN2	30				RxOUT2	RE4	
RE5		55	TxIN3	32				RxOUT3	RE5	
RE6		56	TxIN4	Tx OUT0-	12	RxEO-	33	RxOUT4	RE6	
RE7		3	TxIN6				35	RxOUT6	RE7	
GE2		4	TxIN7				37	RxOUT7	GE2	
GE3		6	TxIN8				38	RxOUT8	GE3	
GE4		7	TxIN9	Tx OUT1+	16	RxE1+	39	RxOUT9	GE4	
GE5		11	TxIN12				43	RxOUT12	GE5	
GE6		12	TxIN13				45	RxOUT13	GE6	
GE7		14	TxIN14				46	RxOUT14	GE7	
BE2		15	TxIN15	Tx OUT1-	15	RxE1-	47	RxOUT15	BE2	
BE3		19	TxIN18				51	RxOUT18	BE3	
BE4		20	TxIN19				53	RxOUT19	BE4	
BE5		22	TxIN20				54	RxOUT20	BE5	
BE6		23	TxIN21	Tx OUT2+	19	RxE2+	55	RxOUT21	BE6	
BE7		24	TxIN22				1	RxOUT22	BE7	
RSVD		27	TxIN24				3	RxOUT24	Not use	
RSVD		28	TxIN25				5	RxOUT25	Not use	
RSVD		30	TxIN26	Tx OUT2-	18	RxE2-	6	RxOUT26	Not use	
RE0		50	TxIN27				7	RxOUT27	RE0	
RE1		2	TxIN5				34	RxOUT5	RE1	
GE0		8	TxIN10	Tx OUT3+	23	RxE3+	41	RxOUT10	GE0	
GE1		10	TxIN11				42	RxOUT11	GE1	
BE0		16	TxIN16				49	RxOUT16	BE0	
BE1		18	TxIN17				50	RxOUT17	BE1	
RSVD		25	TxIN23	Tx OUT3-	22	RxE3-	2	RxOUT23	Not use	
		DCLK	31	TxCLK IN	TxCLK OUT+ TxCLK OUT-	21 20	RxCLK IN+ RxCLK IN-	26	RxCLK OUT	Not use

*1 ·RSVD (reserved) pin on a transmitter should be connected with Ground.

·Input odd or even data depending on the display position of the LCD module.

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10-3 Color Data Assignment

Table 10-3 shows the Color Data Assignment.

Table 10-3 Color Data Assignment

Color	Odd Even	R Input data								G Input data								B Input data							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
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	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	0
	↓	254	1	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	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
	↑	1	0	0	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	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	↓	254	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green	255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	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
	↑	1	0	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	0	1	1	1	1	1	1	0	1
	↓	254	0	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	0	1	1	1	1	1	1	1	1

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

Larger number means brighter level.

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

Note 3) Color data consist of 8 bit red, green and blue data of odd and even number pixel data.
Total data number is 48 signals. This module is able to display 16,777,216 colors because each red, green and blue data is controlled independently.

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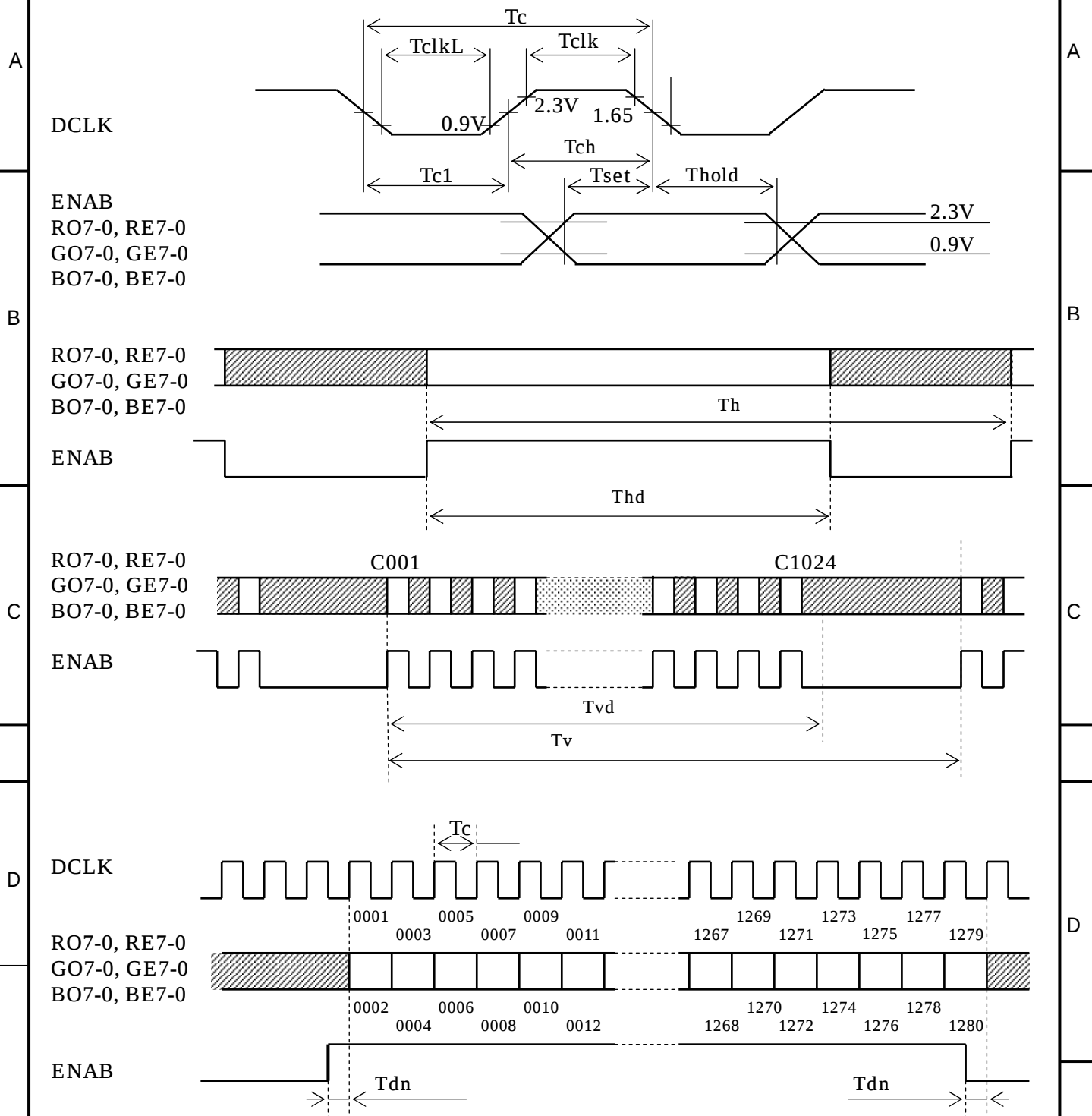


Figure 10-1 Input Signal Timing Chart

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10-4 Correspondence between Data and Display Position

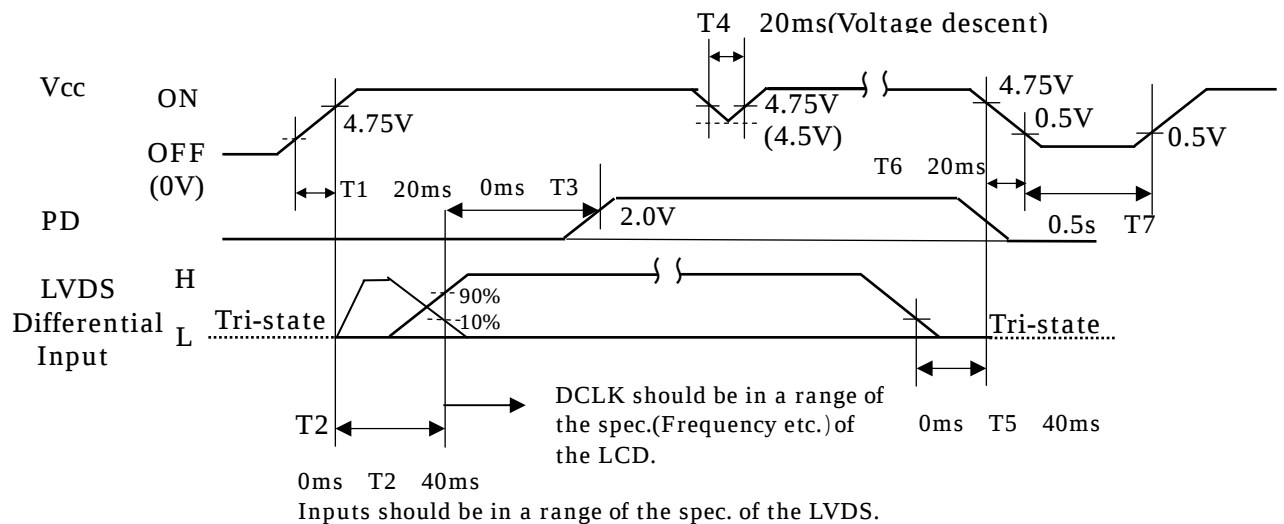
Figure 10-2 shows the Correspondence between Data and Display Position.

	S0001	S0002	S0003	S0004	S0005	S0006	S0007		S3839	S3840	
C001	RO 0001	GO 0001	BO 0001	RE 0002	GE 0002	BE 0002	RO 0003	GO 0003		GE 1280	BE 1280

Figure 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 be in the specification shown in Figure 10-3 to prevent latch-up of the driver ICs and DC driving of the LCD panel.



*Note : PD input can be set open, if it is not used.

Figure 10-3 Power Supply Sequence

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11. BACK-LIGHT SPECIFICATIONS

11-1 Pin configuration for Back-light

Table 11-1 shows the description and Pin assignment of the connectors (CN-A to D) for the Back-light of this LCD module.

Table 11-1 Pin Assignment of CN-A to CN-D

Pin No	Signal						Function	Cable color and FL tube position Front/Center/Rear
	CN-A	CN-B	CN-C	CN-D	CN-E	CN-F		
1	V _{L1}	V _{L2}	V _{L3}	V _{L4}	V _{L5}	V _{L6}	Power supply	Pink/Red/Orange
2	—	—	—	—	—	—	—	—
3	GND	GND	GND	GND	GND	GND	Ground	Blue/White/Gray

Connector : Housing : BHR-03VS-1
 Contact : SBH-001T-P0.5
 User's Connector : Post with base: SM02(8.0)B-BHS-1-TB
 Supplier : Japan Solderless Terminal Trading Company LTD. (J.S.T.)

11-2 Life

The life of the back-light is a minimum of 50,000 hours at the following conditions.

(1) Working conditions

Ambient temperature: 25 ± 5
 Tube current (I_L) : (7mA or less)

(2) Definition of life

Brightness becomes 50% or less than the minimum brightness value shown in Table 9-1.
 The lamp cannot be lit by the minimum value of the breakdown voltage(1760Vrms) shown in Table 8-1.
 Flashing.

11-3 Lamp assembly set (for replacement)

Lamp assembly set(with charge)is prepared for replacing old lamp to new one. This set consists of a upper lamp assembly and a lower lamp assembly.

Type number : FLCL-32
 Minimum order qty. unit : 20 pcs

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12. APPEARANCE SPECIFICATIONS

12-1 Appearance

No.	Item	Judgment method and standard	
1	Bright spot (high and Low)	≤ 8 dots	(Note 1)
2	Bright spot connection (high and Low)	2 dots connection ≤ 2 pair 3 dots connection ≤ 1 pair	(Note 1)
3	Total of bright spot	≤ 8 dots	
4	Dark spot	≤ 10 dots	(Note 2)
5	Dark spot connection	2 dots connection ≤ 3 pair 3 dots connection ≤ 1 pair	(Note 2)
6	Total of dark spot	≤ 10 dots	(Note 2)
7	Total of dot defect	≤ 18 dots	
8	Distance of dot defect	≥ 2 mm	
9	Black / white spot	$D \leq 0.3$	Ignore
		$0.3 < D \leq 0.6$	$N \leq 5$
		$0.6 < D \leq 0.9$	$N \leq 2$ (Distance ≥ 100 mm)
		$0.9 < D$	0
10	Mura	Ignore	

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

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

12-2-1 Zone

- Inside display dot area (376.32×301.056mm)
- 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.

12-2-2 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

12-2-3 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.
- Input signal timing should be typical value.

(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) $A < 1/3$: Not count. Only one of 4 dark 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 show the environmental specifications.

Table 13-1 Environmental specifications

Item	Condition		Remark
Temperature	Operation	0 ~ 50	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, 1octave/ 20minute, 19.6m/s ² (2G), 1.5mm max, 1hour each X, Y and Z directions.	For single module without package.
Shock	Non-operation	294m/s ² (30G), 6ms, 1time each ±X, ±Y and ±Z directions.	

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

Table 13-2 Shock resistance standard when module is packaged

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

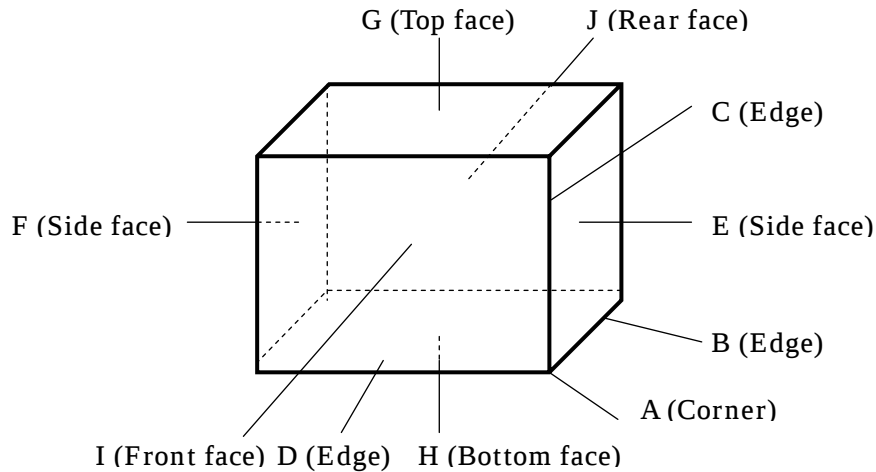


Figure 13-1 Direction to apply shock to package

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14. INDICATIONS

This module has the following indications.

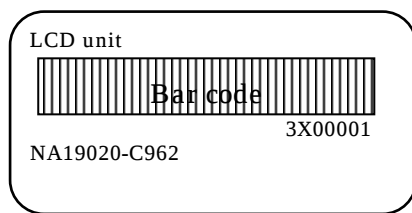
- (1) Product name : LCD unit
- (2) Model Number : NA19020-C962
- (3) Manufacturing Number : 3 X 0 0 0 0 1

Serial number
(To be reset every month on 1st.)

Manufacturing month
(Oct. = X, Nov. =Y, Dec. =Z)

Last digit of manufacturing year.

- (4) Manufacturer Country Name :
- (5) Disposal method of cold-cathode tubes. (See Figure 14-2)
- (6) Caution when changing cold-cathode tubes. (See Figure 14-3)



· 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。

· WHEN CHANGING COLD CATHODE FLUO-
RESCENT LAMPS, FOLLOW OPERATING
SPECIFICATIONS. ESPECIALLY BE CAREFUL
ABOUT THE LAMPS 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。

Figure 14-1 Product Label (Example)

Figure 14-2

Figure 14-3

15. PACKAGING

15-1 Packing specifications

- (1) 5 LCD modules/1package.
- (2) Weight:approximately 16kg/1package.
- (3) Outline dimensions: 534mm (W)x329mm (D)x 480mm (H)

15-2 Packing method

Figure 15-2 show the packing method.

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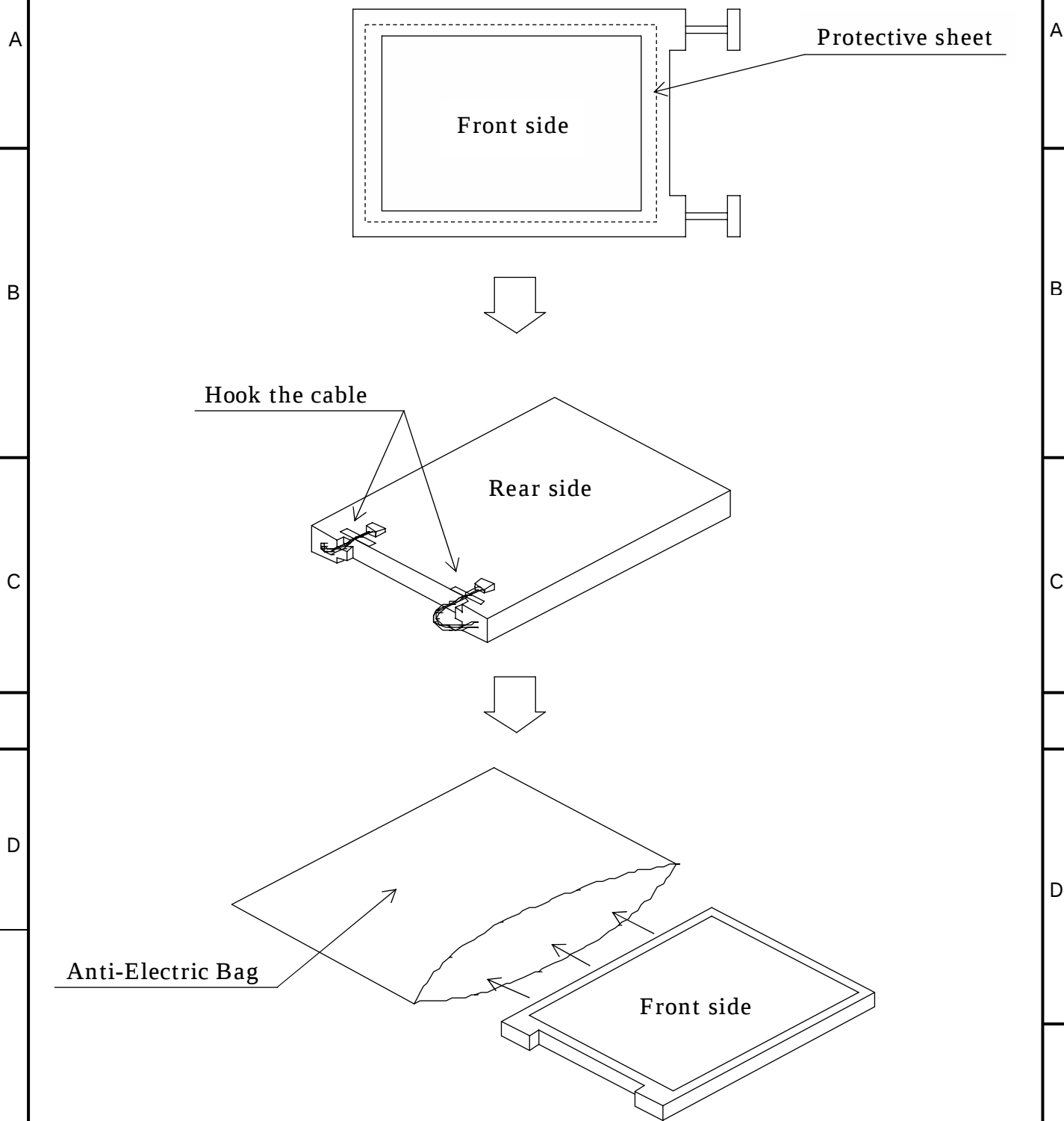


Fig.15-2 (a) Packaging Method

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						TITLE NA19020-C962								
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1 2 3 4

A

B

C

D

A

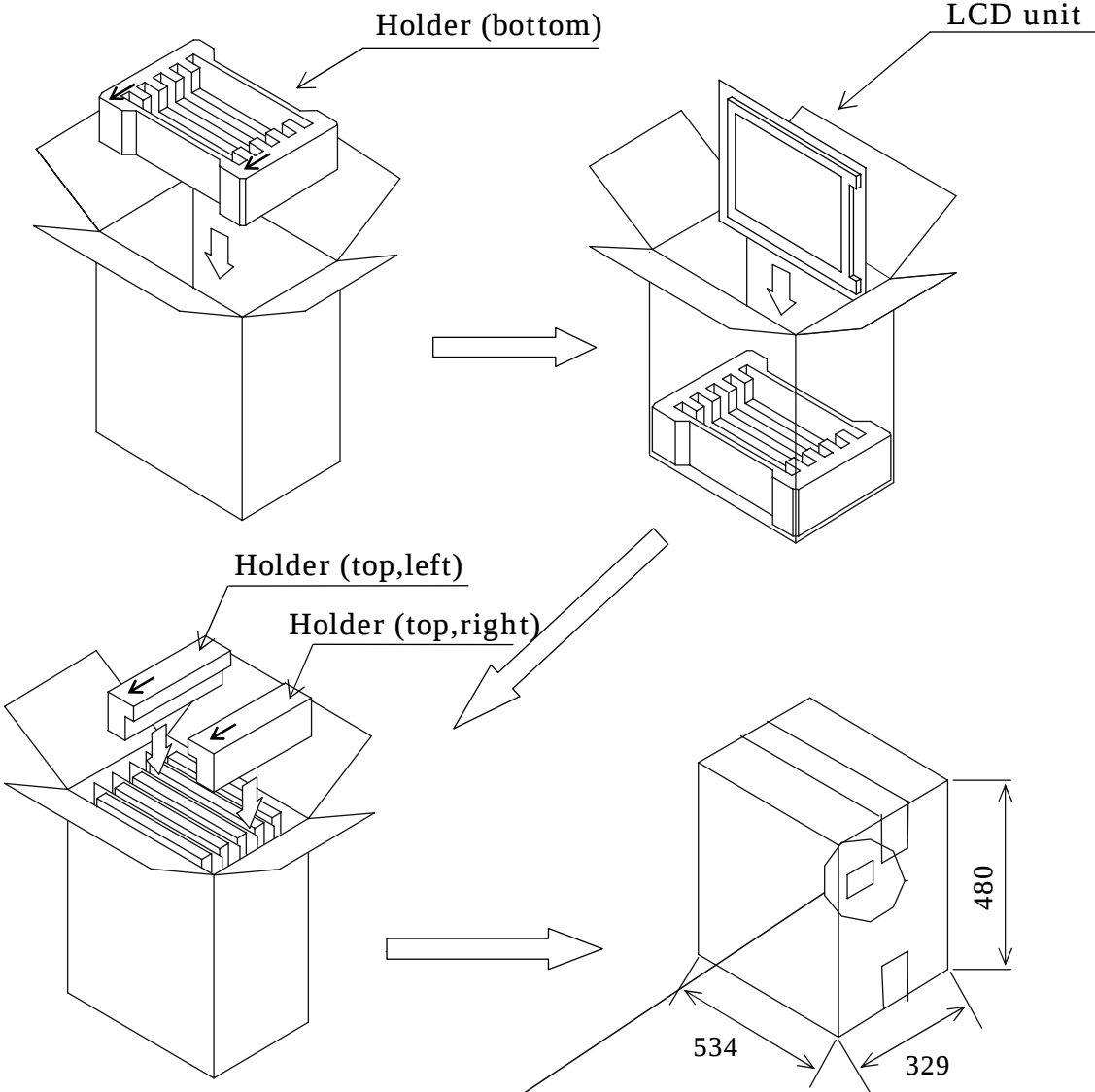
B

C

D

E

F



Label (example)

型 格 (TYPE)	NA19020-C962	数 量 (QTY.)	5
图 番 (DRWG. NO.)		版 数 (REV. NO.)	
Bar code	3X00001	Bar code	
	3X00002		
	3X00003		
	3X00004		
	3X00005		
Bar code			

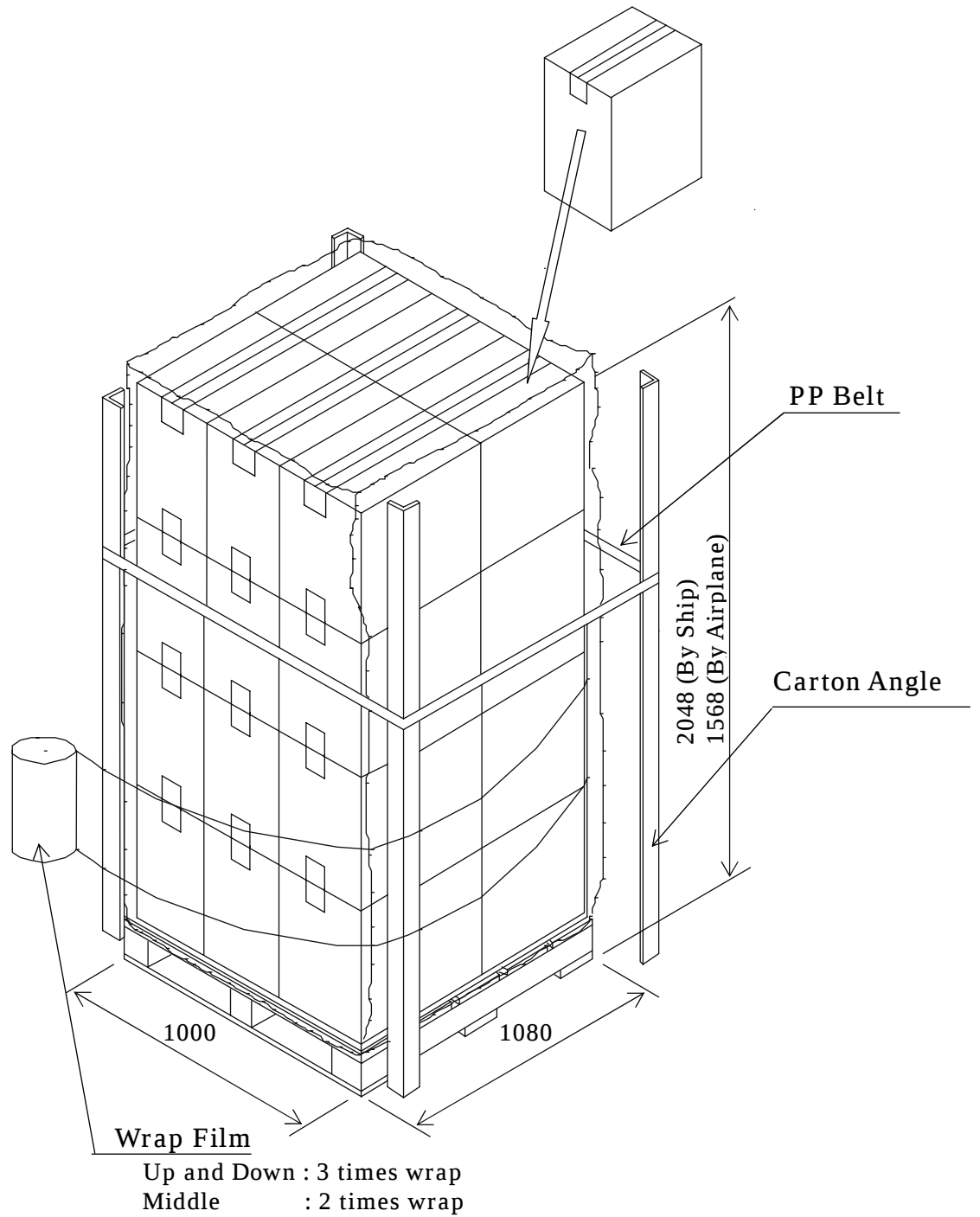
- Taping
Top : H or I method
Bottom : H method
- Top and bottom holders should be anti-electrostatic type.

Fig.15-2 (b) Packaging Method

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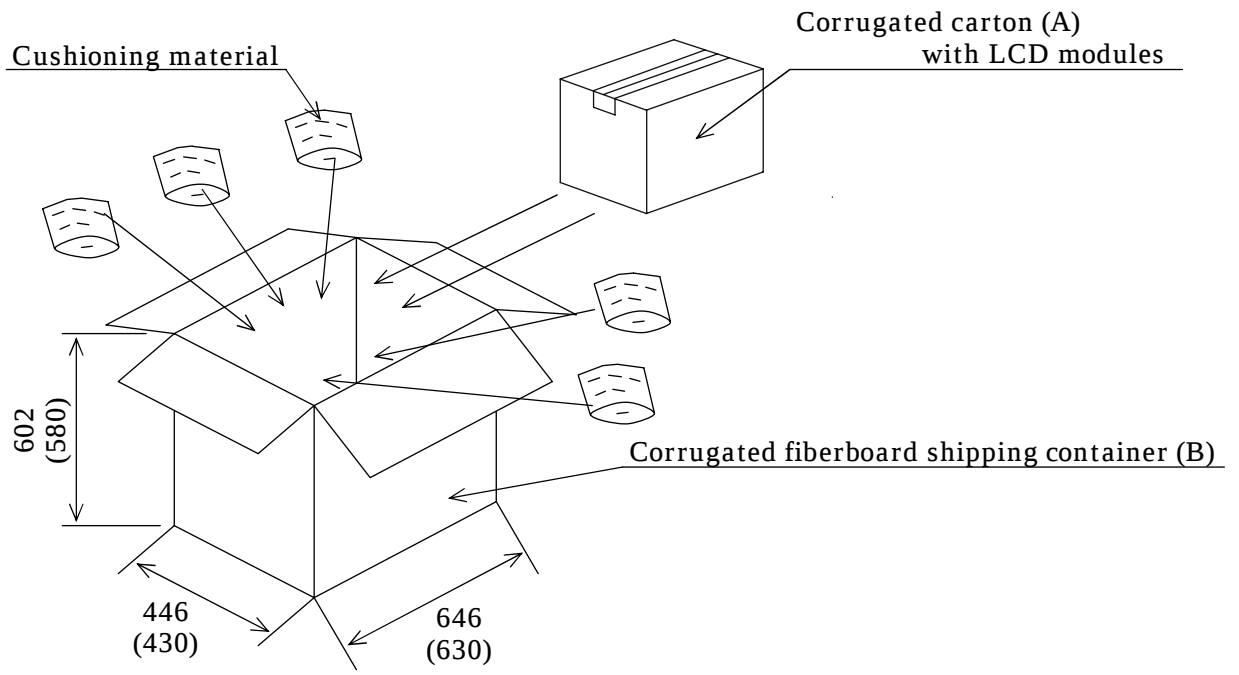


Note:1) 6 boxes × 4 layers (maximum 24 boxes) : by ship
6 boxes × 3 layers (maximum 18 boxes) : by airplane
Note:2) This drawing shows marine transportation specification.

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.

Note2) The figures in () show inside measurements of the container (B).

Figure.15-2 (d) Packing method

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(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.

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.

(3) Handling of LCD module

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.

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

Conductive foreign matter adheres to the module may cause failures.

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).

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

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.

(4) Precautions in regards of operating the LCD module

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.

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.

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The following troubles occur when the LCD module is not used under recommended temperature.

- Operation under high temperature(>50): Display colors shift to blue.
- Storage under high temperature(>60): The polarizer film deteriorates and contrast decreases.
- Operation under low temperature(< 0): The response speed decreases considerably.
- Storage under low temperature(<-20): The liquid crystal may solidify and become damaged.

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.

(5) Precautions in regards of designing module mounting

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.

Avoid twisting and bending the LCD module.

Excessive twist and bend may damage display quality and reliability.

Avoid extending the power cable between the LCD module and inverter.

This may cause the backlight to flicker or not to light.

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.

When mounting LCD module with M3 screws (x4), tighten the screws with torque below.

User hole : 50N(5kgf)

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(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 parts of the module may corrode or deteriorate.

Store the LCD module in a Fujitsu package.

At storing, Fujitsu packages can be stacked up to 3 boxes.

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

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

·Humidity : 50 ~ 60%RH

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

(7) Disposal Method**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.

Package

All the packages are made of recyclable papers except the anti-ESD bag.

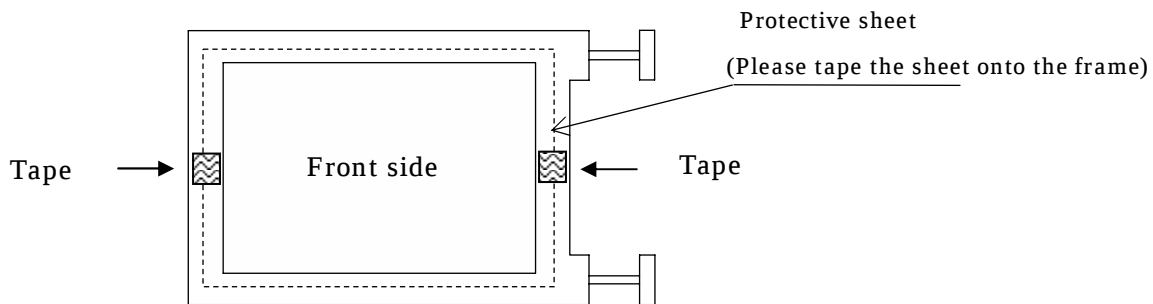
						TITLE	NA19020-C962		
						DRAW. NO.	Tech Bes LCD-00230		
								CUST.	
EDIT	DATE	DESIG.	CHECK	APPR.		DESCRIPTION	FUJITSU DISPLAY TECHNOLOGIES CORPORATION		
DESIG.			CHECK			APPR.			30 /

(8) Return method of the LCD module requested for repair or analysis of the problem

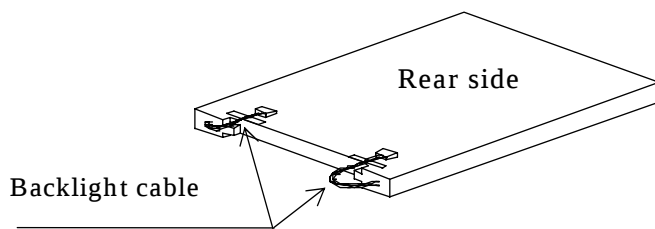
- When returning the LCD modules, adhere to the following procedures not to damage the LCD panel or the backlight cables. (Fig. 17-1(a)~(b))

When the LCD module is returned without following the specified packaging procedures, FDTTC will not take responsibility for the damages caused by the failure of the packaging method.

(1) Attach protective sheet.



(2) Hook the backlight cables.



* If the cables are not fixed, the connectors may scratch the LCD panel surface or the cables may be damaged.

(3) Put the LCD module into the anti-electrostatic bag (Please do not use torn anti-electrostatic bags)

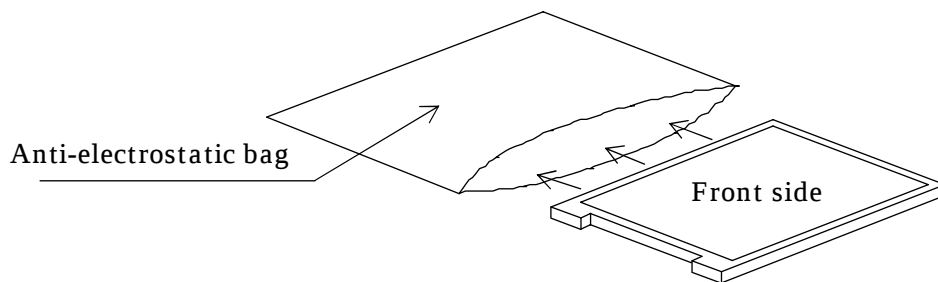


Fig. 17-1(a) Packaging method

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(4) Storage into the carton box

- When using the carton box manufactured by FDTC
(Please use carton boxes and arrowheads that are not collapsed)

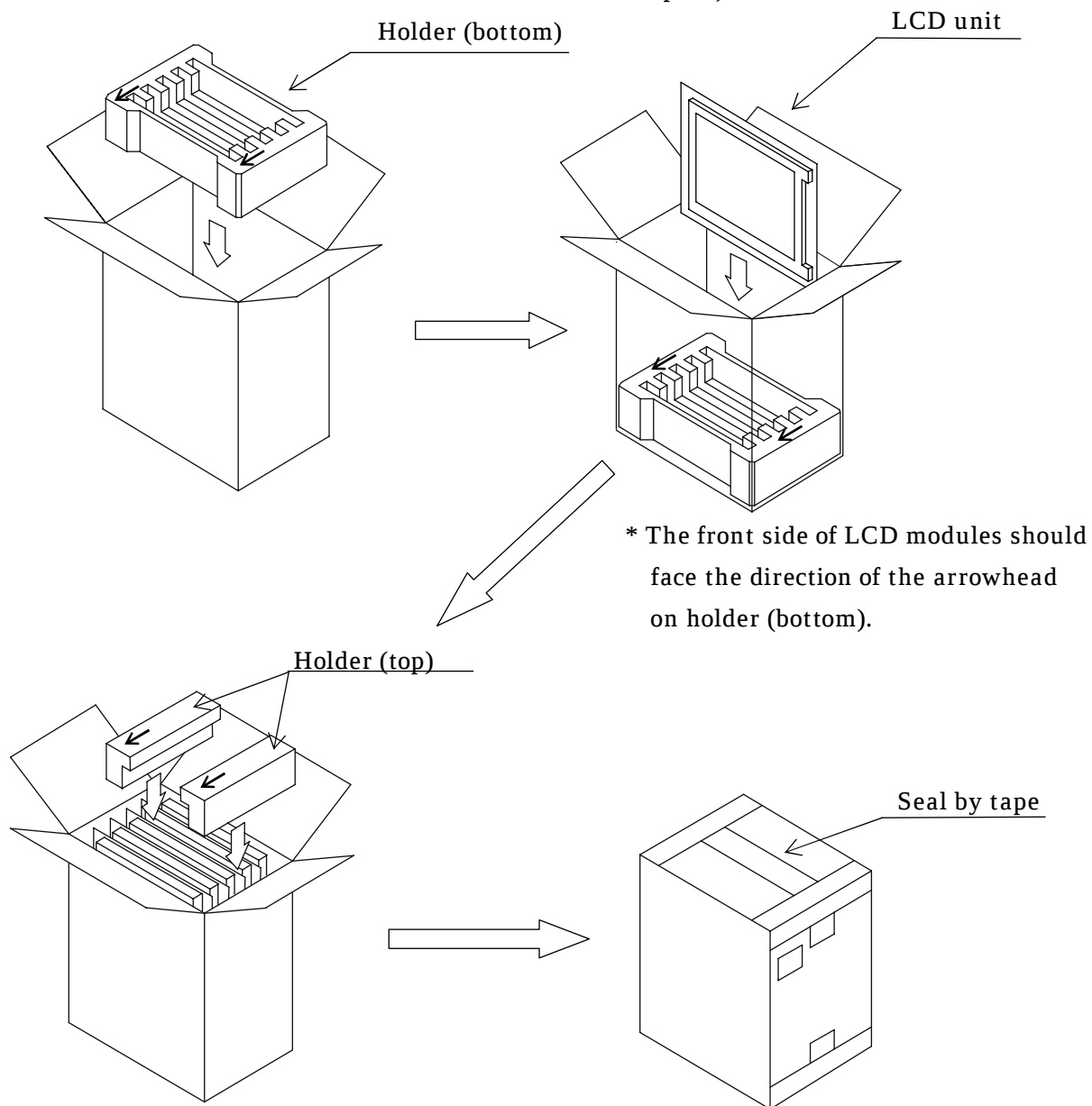


Fig. 17-1(b) Packaging method

- When not using the carton box manufactured by FDTC
Please pack the LCD modules one by one and make sure not to damage the LCD modules when transporting.

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(9) Others

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.

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.

17. 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, Fujitsu 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.

18. MISCELLANEOUS

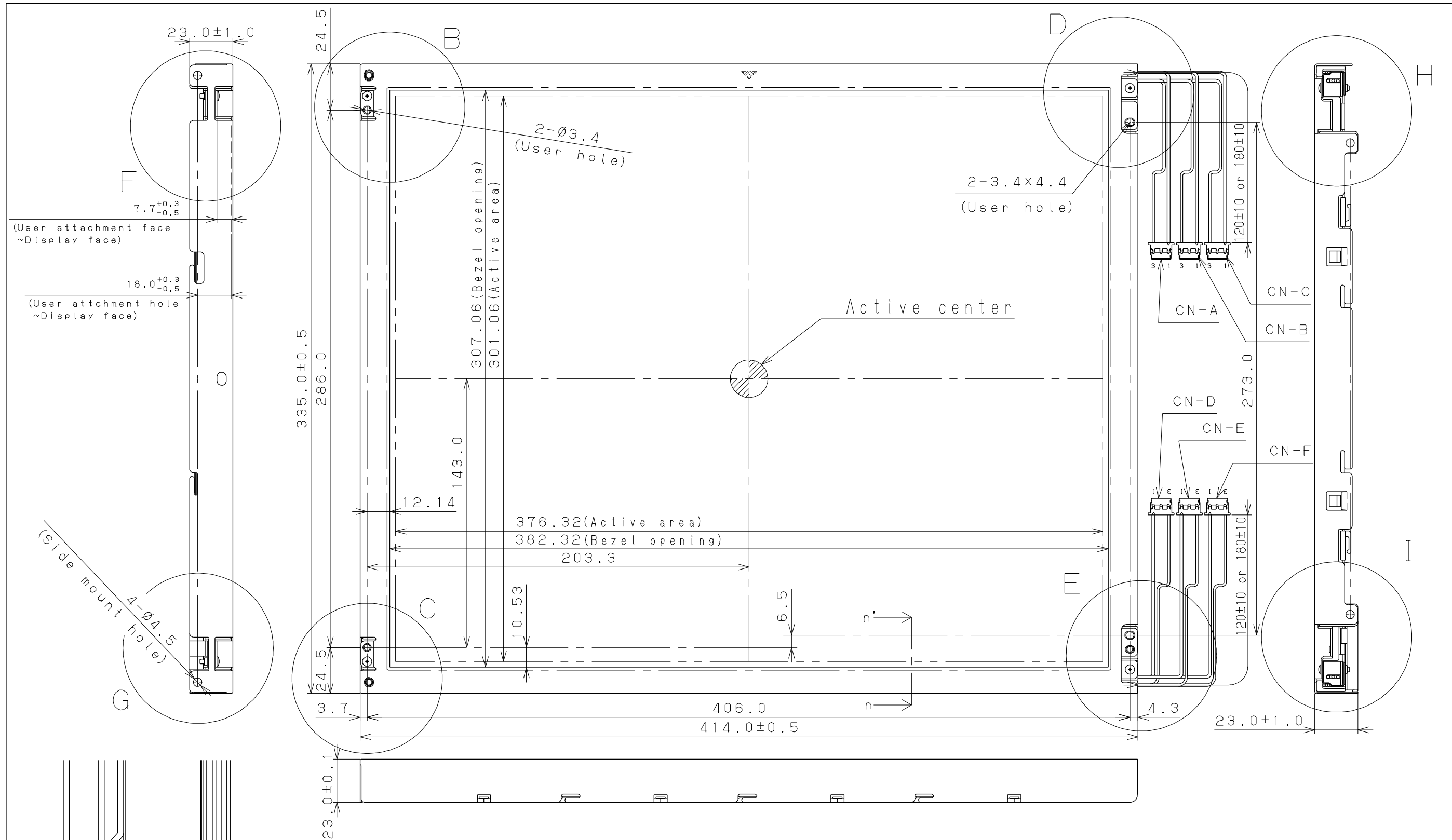
Specifications of the TFT-LCD panel and other components used in the LCD module are subject to change. Both parties shall discuss together before change.

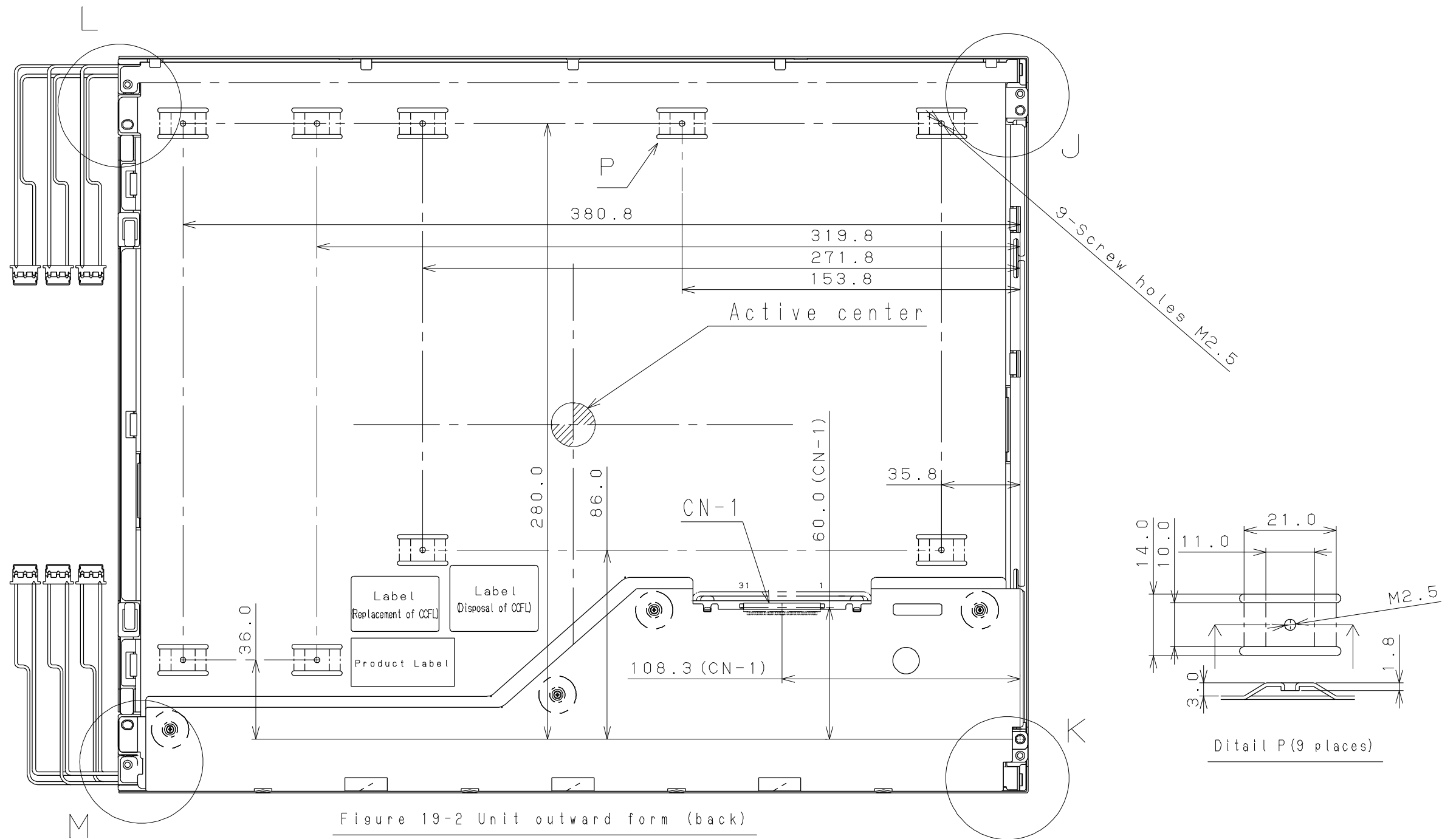
If any doubt is raised in the content of the specifications, both parties shall discuss and make best effort for the agreement.

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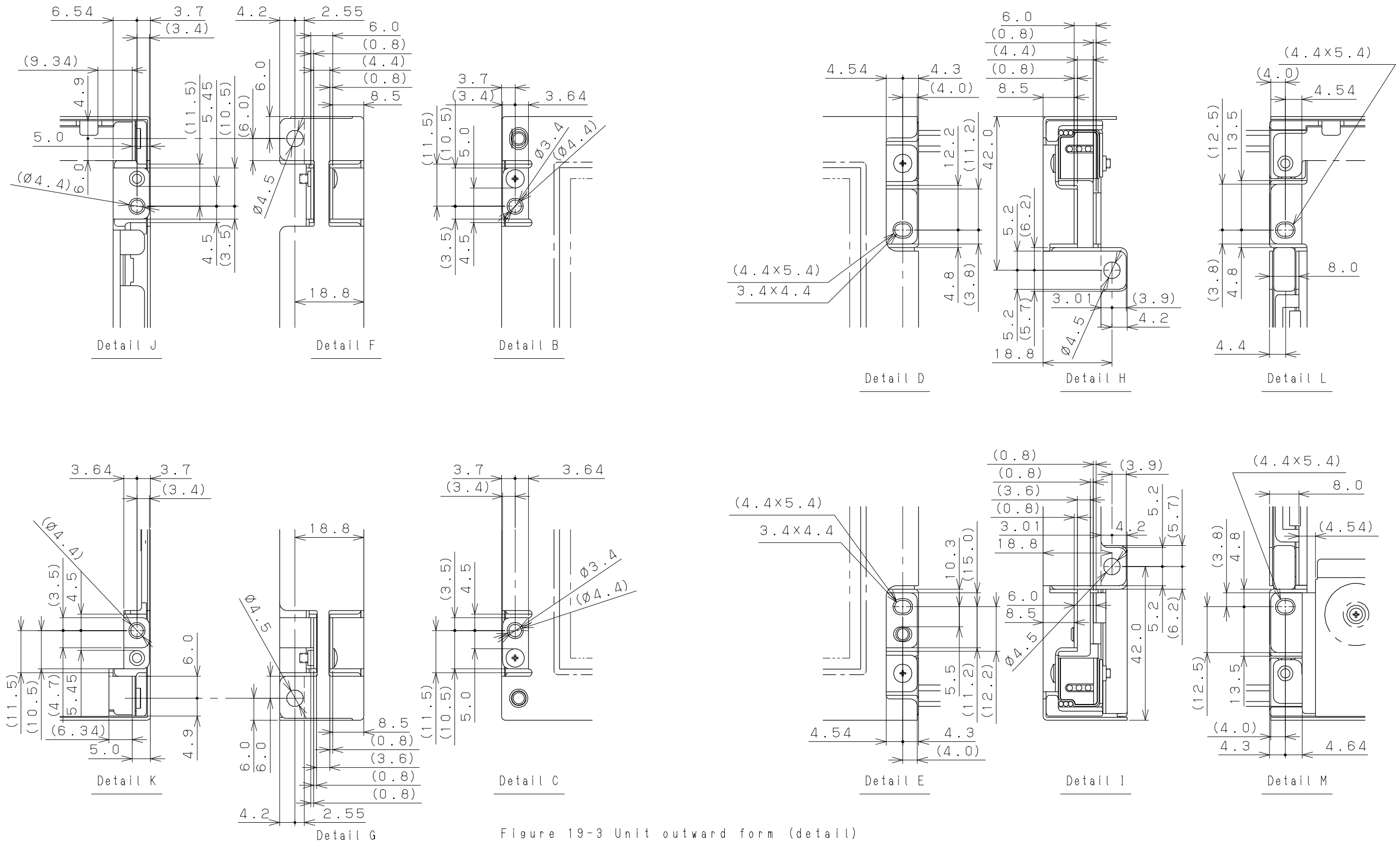




NOTE

2) The height of interface connector does not include that of a counterpart connector.

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NOTE

3) This page is referende.
(Not guarantee)

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