To :

Specification of FUJITSU TFT-LCD module

NA19026-C661

Approval
Date :
By :

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Specification No. : Tech Bes LCD-00288

Issue Date : September 8, 2004

Issued by : K. Tanaka

K. Tanaka
Project Director
LCD Product Div.

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1 . APPLICATION

This specification applies to the 15-inch XGA TFT-LCD module.

2. PRODUCT NAME AND MODEL NUMBER

2.1.Product Name 15-inch XGA TFT-LCD Module

2.2.Model Number NA19026-C661

3. OVERVIEW

This LCD Module is a display unit that uses a liquid crystal panel with a TFT active matrix method with a display capacity of 1024x3(RGB)x768 dot and screen size of 38cm (15.0 inch). This LCD module corresponds to the LVDS 1ch interface and can display 260 thousand colors. In addition, this LCD module operates under a non-interlace mode. It has a backlight of CCFL that is built in and supplies more electric power than the exclusive inverter places externally. The power supply of this LCD module is +3.3V DC voltage.

4. CONFIGURATION

This LCD module consists of a color TFT LCD panel and a bezel where the panel driver IC is mounted into the printed substrate, a cold-cathode florescent tube backlight, and a LVDS interface PBC. These are all combined into one structure.

The inverter that supplies electric power to the backlight is configured separately from the LCD module.

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

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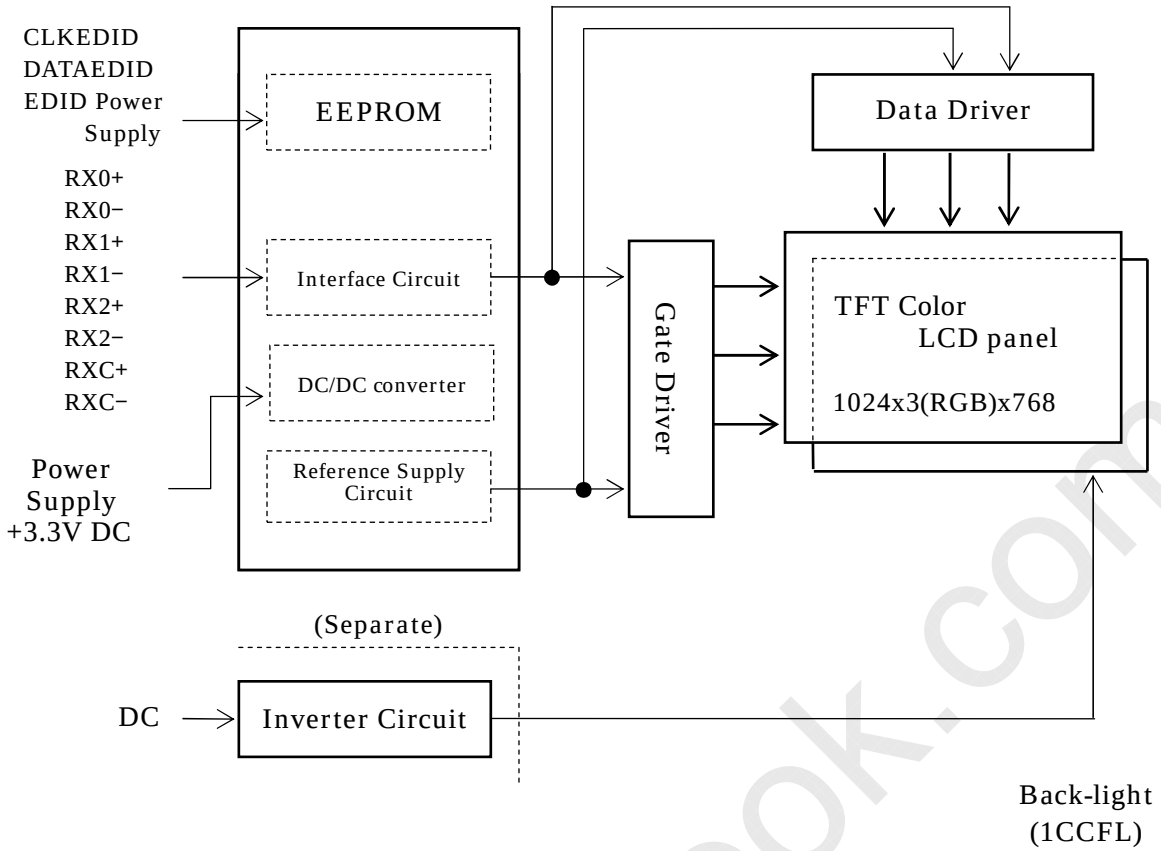

Figure 4-1 Block Diagram

5.MECHANICAL SPECIFICATIONS

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

Table 5-1 Mechanical Specifications

Item	Specifications	Unit	Remark
Dimensions	317.3×241.8×7.0 (max)	mm	Edge type back-light is used Inverter excluded For details on dimension, see dimensional outline drawing (on page 35,36)
Display Resolution	(1024×3)×768	—	
Display Dot Area (Drive range)	304.128×228.096	mm	
Dot Pitch	0.297×0.297	mm	
Pixel Aspect Ratio	1 : 1	—	
Weight	670 max	g	

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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 (3.3V)	V_{CC}	Ta=25℃	-0.3	—	4.0	V
Supply Voltage (EDID)	V_{EDID}		-0.3	—	6.25	V
Input Signal Voltage (LVDS)	V_{IN}		-0.3	—	Vcc+0.3	V
Input Signal Voltage (EDID)	V_{INED}		-0.3		V_{EDID} +0.3	V

7. RECOMMENDED OPERATIONG CONDITIONS

Table 7-1 shows the recommended operating conditions

Table 7-1 Recommended Operating Conditions

Item	Symbol	MIN.	TYP.	MAX.	UNIT
Supply Voltage (3.3V)	V_{CC}	3.0	3.3	3.6	V
Supply Voltage (EDID)	V_{EDID}	2.7	—	5.5	V
Ripple Voltage (V_{CC})	V_{RP}	—	—	100	mVp-p

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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 shows the equivalent circuit of the logic signal input area.

Table 8-1 Electrical Specifications

Item		Symbol	Condition	MIN.	TYP.	MAX.	Unit
Differential input Voltage (+)		V_{IH}	V_{cm}=+1.2V	—	—	100	mV
Differential input Voltage (−)		V_{IL}		-100	—	—	mV
Supply Current		I_{CC}	V_{CC}=+3.3V V_{SS}=0V Ta=25℃ CK=54.0MHz Frame frequency =60Hz	—	560	850	mA
Supply Rush Current		I_{SCC}		—	—	2.5	A
Supply Rush Current Duration (excess 1.2A)		T_{SCC}		—	—	2	ms
BACK LIGHT	CCFL Turn on Voltage (Note)	V_S	f_L=50kHz,Ta=25℃, C_L=22pF	—	—	1650	Vrms
			f_L=50kHz,Ta=0℃, C_L=22pF	—	—	1700	Vrms
	Lighting Voltage	V_L	f_L=50kHz,I_L=6mA	—	730	—	Vrms
	Lighting Frequency	f_L	V_L=730Vrms,I_L=6mA	40	60	80	kHz
	Recommended Lighting Frequency			50	—	60	kHz
	FL tube Current (Note2)	I_L	V_L=730Vrms f_L=50kHz	2	6	6.5	mA

Note) The CCFL turn on voltage is set under the appointed criteria and shall exceed the maximum range of the specification.

●Measurement circuit is based on Figure 8-1

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Figure 8-1 Measurement Circuit

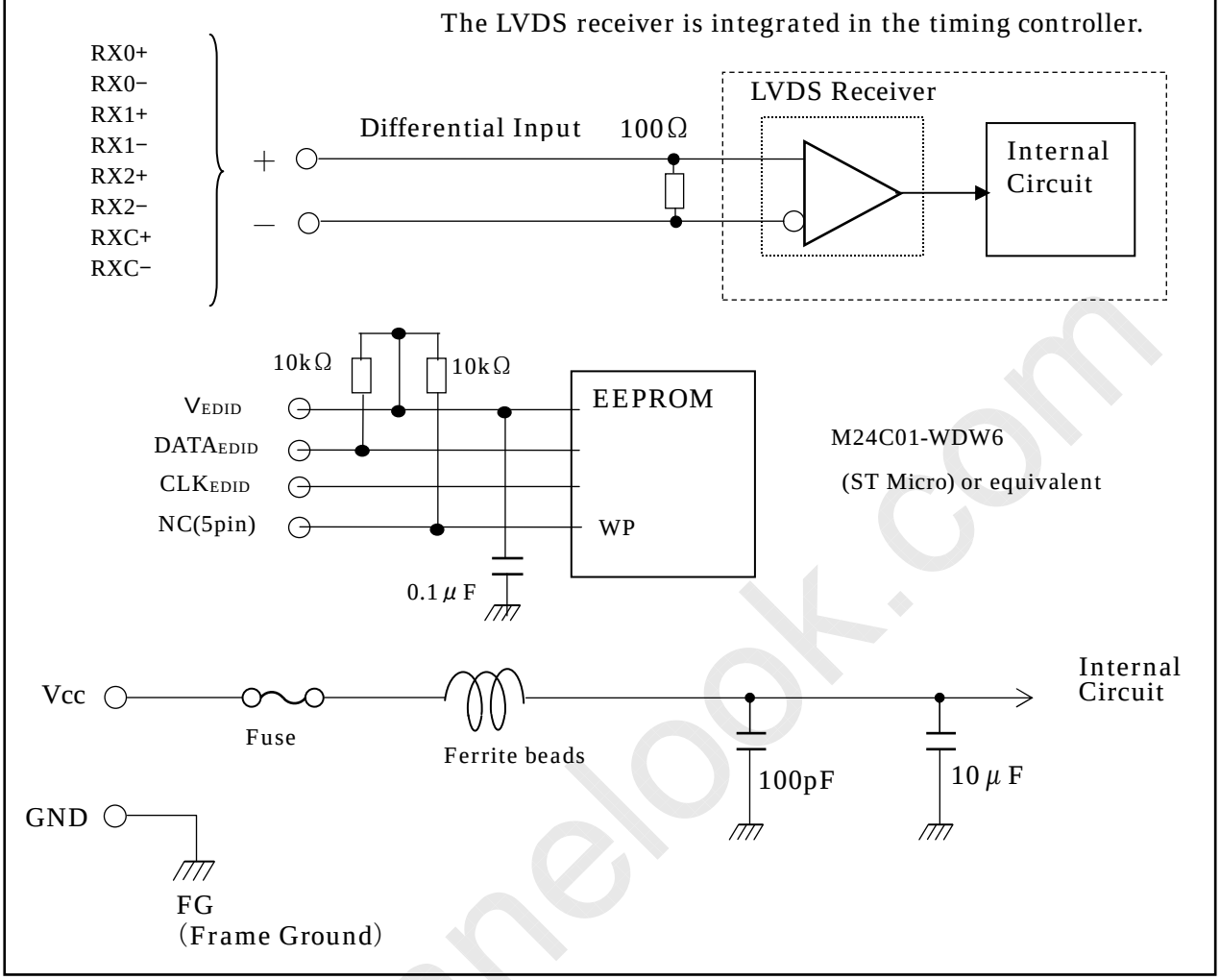

Figure 8-2 Equivalent circuit of logic signal input

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9.. OPTICAL SPECIFICATIONS

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

Table 9-1 Optical Specifications

Item	Symbol	Condition		Specification MIN.	Specification TYP.	Specification MAX.	Unit	Remark	Note
Visual Angle	$\theta_{L,R}$	CR≧10 Ta=25℃	$\theta_{U,D}=0°$	80	—	—	deg	Top Bottom	(1)(2) (3)(5) (6)
	$\theta_{U,D}$		$\theta_{L,R}=0°$	80	—	—	deg	Left Right	
Contrast Ratio	CR	$\theta_{L,R,U,D}=0°$ Ta=25℃		250	400	—	—	White／Black*1	(1)(3) (5)
Response Time (ON) (B→W)	t ON	$\theta_H=0°$ $\theta_V=0°$	Ta=25℃	—	15	30	ms		(1)(4) (5)
			Ta=0℃	—	50	100	ms		
Response time (OFF) (W→B)	t OFF	$\theta_H=0°$ $\theta_V=0°$	Ta=25℃	—	10	25	ms		
			Ta=0℃	—	50	100	ms		
Brightness	L	$\theta_H=0°$ $\theta_V=0°$ Ta=25℃ fL=50kHz If=6mA		190	300	—	cd/m²	All white display *2,3,4	(1)(5)
Brightness Uniformity	ΔL			60	—	—	%		(1)(7)
Chromaticity (White)	x			0.283	0.313	0.343	—		(1)(5)
	y			0.299	0.329	0.359	—		
Color Purity (NTSC ratio)				55	63	—	%		(1)(5)
LCD Panel Type				TFT Color					
Display Mode				Normally Black					
Wide Viewing Angle Technology				MVA					
Optimum Viewing Angle				Symmetry					
Display Color				262,144 (6 bit color)					
Color of non-display area				Black					
Surface Treatment				Glare Low reflection 2H					

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Note

*1) Brightness, Chromaticity, Contrast is measured at a spot diameter of φ2 and a distance=500mm.

*2) The value is measured 15-20 minutes after the light on.

*3) The power supply condition is VCC=3.3V,fL=50kHz,If=6mA when the optical specification is measured.

*4) The operation life of the CCFL is limited. The brightness will deteriorate over time.

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Note 1) Definition of Viewing Angle (1)

Based on Figure 9-1.

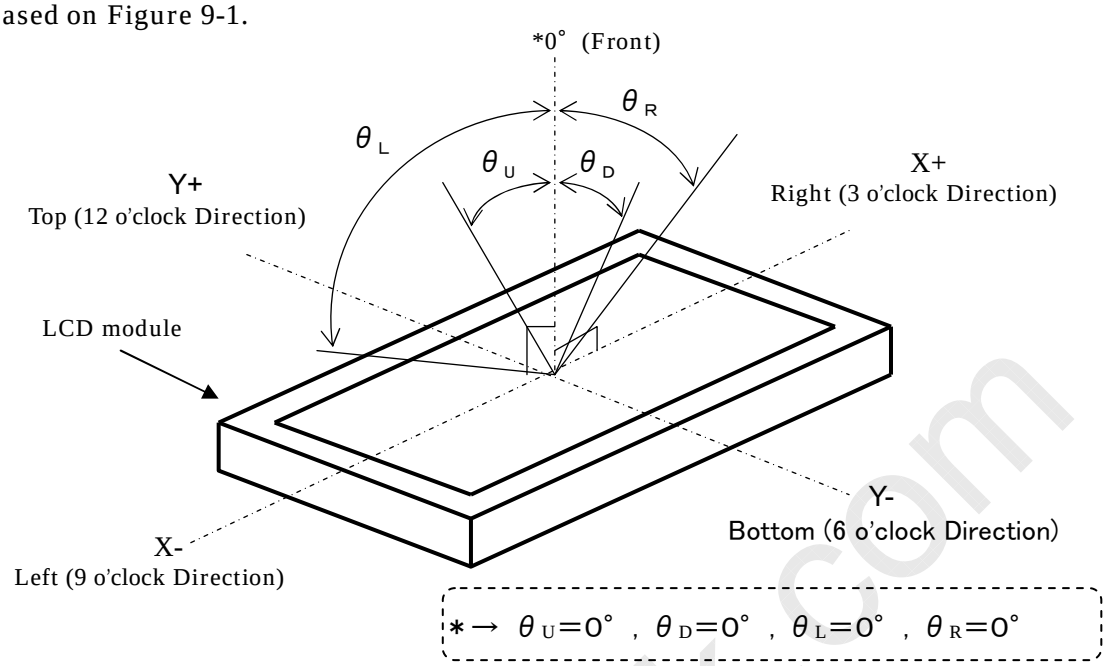

Figure 9-1 Definition of Viewing Angle (1)

Note 2) Definition of Viewing Angle (2)

Based on Figure 9-2.

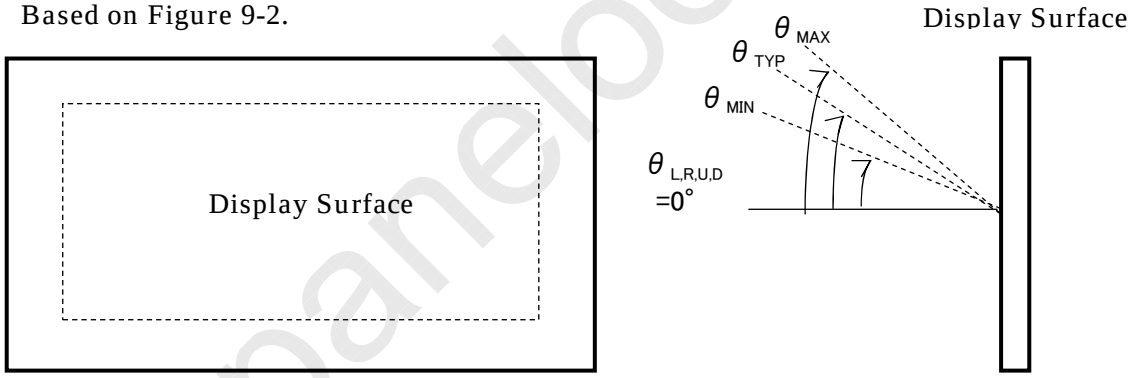

Figure 9-2 Definition of Viewing Angle (2)

Note 3) Definition of Contrast Ratio (CR)

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

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

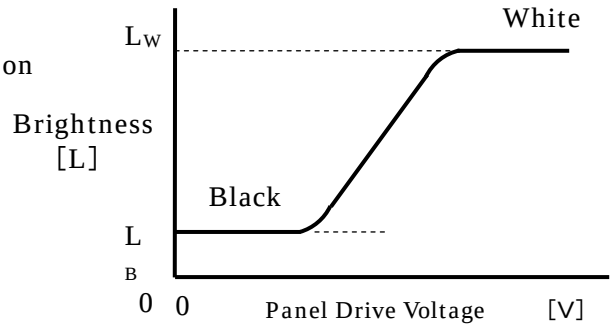

Figure 9-3 Voltage-Brightness Characteristics

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Note 4) Definition of Response Time

Based on Figure 9-4.

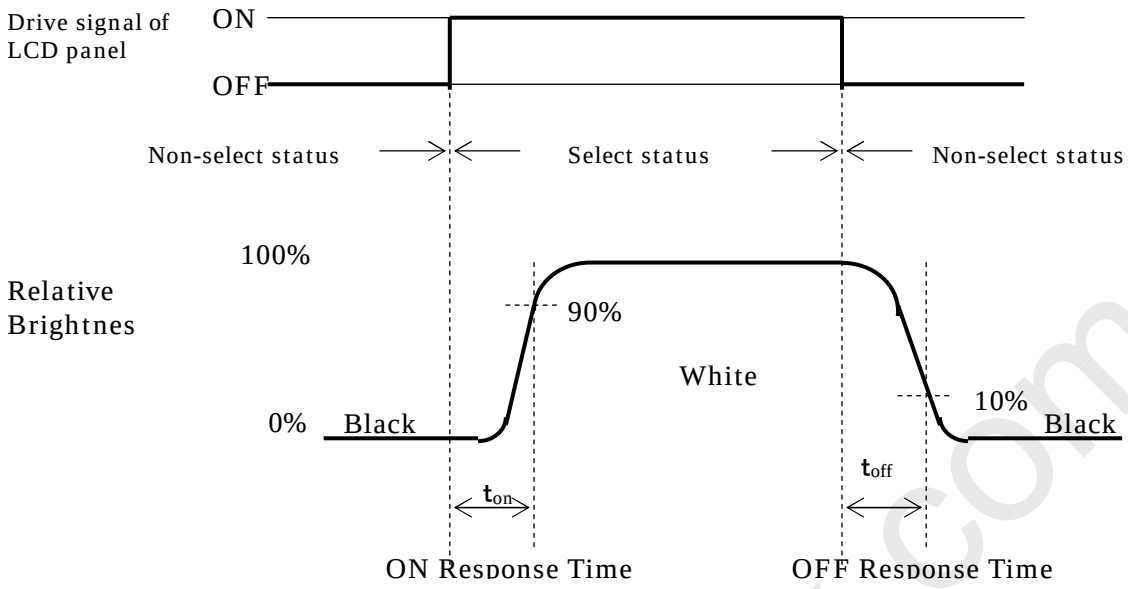

Figure 9-4 Definition of Response Time

Note 5) Contrast Ratio and Response Measurement System

Based on Figure 9-5.

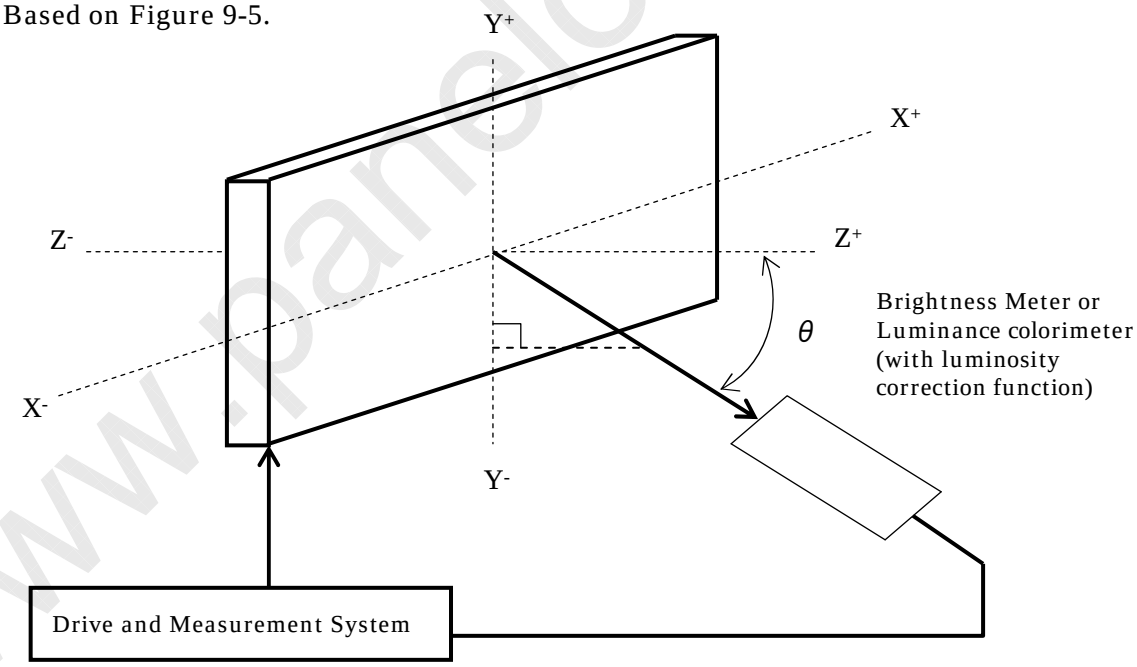

Figure 9-5 Contrast Ratio and Response Time Measurement System

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Note 6) Definition of Optimum Viewing Angle

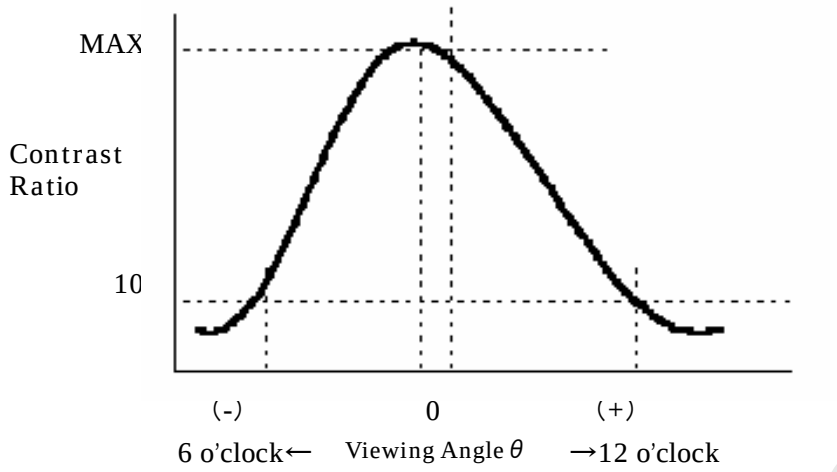


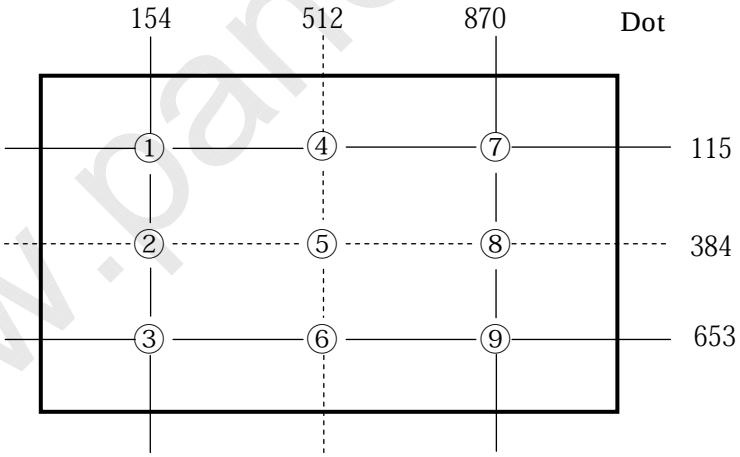
Figure 9-6 Definition of Viewing Angle

Note 7) Definition of Brightness Uniformity

The Brightness Uniformity is defined by the following formula using 9 points (①～⑨) of the brightness measuring value shown bellow.

Definitional Equation:

{(Minimum Brightness of ①～⑨)／(Maximum Brightness of ①～⑨)}×100[%]



Note) The center of each position is defined by the center spot position of the brightness meter in which the tolerance of the measurement position is ±3mm.

Figure 9-7 Measuring Points

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10. INTERFACE SPECIFICATIONS

10.1 Interface Signal Alignment

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

Table 10-1 Interface signals

Pin No.	Symbol	Function
1	VCC	+3.3V power supply
2	VCC	+3.3V power supply
3	VSS	Ground
4	VSS	Ground
5	RX0-	LVDS signal 0-
6	RX0+	LVDS signal 0+
7	VSS	Ground
8	RX1-	LVDS signal 1-
9	RX1+	LVDS signal 1+
10	VSS	Ground
11	RX2-	LVDS signal 2-
12	RX2+	LVDS signal 2+
13	VSS	Ground
14	RXC-	LVDS signal CLK-
15	RXC+	LVDS signal CLK+
16	VSS	Ground
17	V_{EDID}	DDC+3.3Vpower supply
18	NC	NC
19	CLK_{EDID}	DDC clock
20	$DATA_{EDID}$	DDC data

Connector used ：FI-SEB20P-HF13
Adapted Connector：FI-SE20M
Name of Maker ：Japan Aviation Electronics Ltd.

Note) Terminal 18 should be open.

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Table 10-2 LVDS Data Assignment

Input Signal *1	Transmitter DS90C365		Interface connector			LCD Control input
	pin	INPUT	System side	LCD module pin		
R0	44	TxIN0	Tx OUT0+	6	Rx0+	R0
R1	45	TxIN1				R1
R2	47	TxIN2				R2
R3	48	TxIN3				R3
R4	1	TxIN4	Tx OUT0-	5	Rx0-	R4
R5	3	TxIN5				R5
G0	4	TxIN6				G0
G1	6	TxIN7	Tx OUT1+	9	Rx1+	G1
G2	7	TxIN8				G2
G3	9	TxIN9				G3
G4	10	TxIN10				G4
G5	12	TxIN11	Tx OUT1-	8	Rx1-	G5
B0	13	TxIN12				B0
B1	15	TxIN13				B1
B2	16	TxIN14	Tx OUT2+	12	Rx2+	B2
B3	18	TxIN15				B3
B4	19	TxIN16				B4
B5	20	TxIN17				B5
RSVD	22	TxIN18				Not use
RSVD	23	TxIN19	Tx OUT2-	11	Rx2-	Not use
ENAB	25	TxIN20				ENAB
DCLK	26	TxCLK IN	TxCLK OUT+	15	RxC+	DCLK
			TxCLK OUT-	14	RxC-	

*1 The RSVD (reserved) pin on the transmitter should be connected to the Ground

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10.2 CORRESPONDENCE BETWEEN COLOR AND INPUT SIGNAL

Table 10-3 shows the correspondence between input signal and color

Color and Brightness Gradation			Data Signal (0:Low Level, 1:High Level)															
			R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	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
	Blue		0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Green		0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Cyan		0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Red		1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta		1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow		1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red Gradation	Black	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	1	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	⇩	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Brighter	61	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	62	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	63	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green Gradation	Black	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	1	0	0	0	0	0	0
	Darker	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	⇧		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	⇩	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Brighter	61	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	⇩	62	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green	63	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Blue Gradation	Black	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	1
	Darker	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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	Brighter	61	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	⇩	62	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue	63	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note 1) Definition of gray scale: Color (n)…"n" indicates the gray scale level.
The larger number means brighter level.

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

Note 3) There are 18 color data which consists of 6 bit of red, green and blue where they individually display 64 signals. By combining these colors, 262,144 colors can be displayed.

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10.3 INPUT SIGNAL TIMING

The input signal timing is shown in table 10-3 and figure 10-1.

Table 10-3 Timing Characteristics (Ta＝0～50℃, Vcc＝3.3±0.3V)

Item		Symbol	MIN.	TYP.	MAX.	Unit	Remark
DCLK Signal (Clock)	Period	Tc	15.15	15.38	16.67	ns	
	Frequency	1/Tc	60	65	66	MHz	*4
	Duty	Tch/Tc	45	50	55	%	
	High time	TclkH	6.0	—	—	ns	
	Low time	TclkL	6.0	—	—	ns	
DCLK-Data Timing	Setup time	Tset	3	—	—	ns	
	Hold time	Thold	5	—	—	ns	
Horizontal Signal	Horizontal period	Th	1320	1344	2046	DCLK	*1,4
	Hor. Period (1)	Th	18.0	20.68	—	μs	*4
	Hor. Display period	Thd	1024	1024	1024	DCLK	*2
Vertical Signal	Vertical Period	Tv	780	806	1023	Th	*1
	Ver. Frequency	1/Tv	55	60	65	Hz	16.67ms
	Ver. Display period	Tvd	768	768	768	Th	*2
ENAB signal	Data ENAB timing	Tdn	—	0	—	DCLK	*3

*1) • The horizontal direction of the display position is defined by the rise of the ENAB signal. Right after the signal rises, the latched data is displayed from the left edge of the screen. The vertical direction of the display position is when the ENAB signal changes from "H" to "L" and "L" is over 2048 DCLK, then the next risen ENAB signal data is displayed from the top line of the screen.

*2) • If the "H" period of the ENAB signal is less then 1024 DCLK, then black is displayed on the remaining area.
• If the ENAB signal is less than 768 Th within a frame, then the displayed data is continuously displayed from the top line of the screen continuously.

*3) • If the valid data period and the "H" period of the ENAB signal do not synchronize, then the display position is displayed as out of place.

*4) When the horizontal period is less than 1320 DCLK or 18 μs, the display quality such as unevenness and light line defect can occur.
If the DCLK frequency exceeds 66MHz, garbled data may cause flickering.
In addition, if the DCLK frequency is less than 60MHz, then unevenness may occur.

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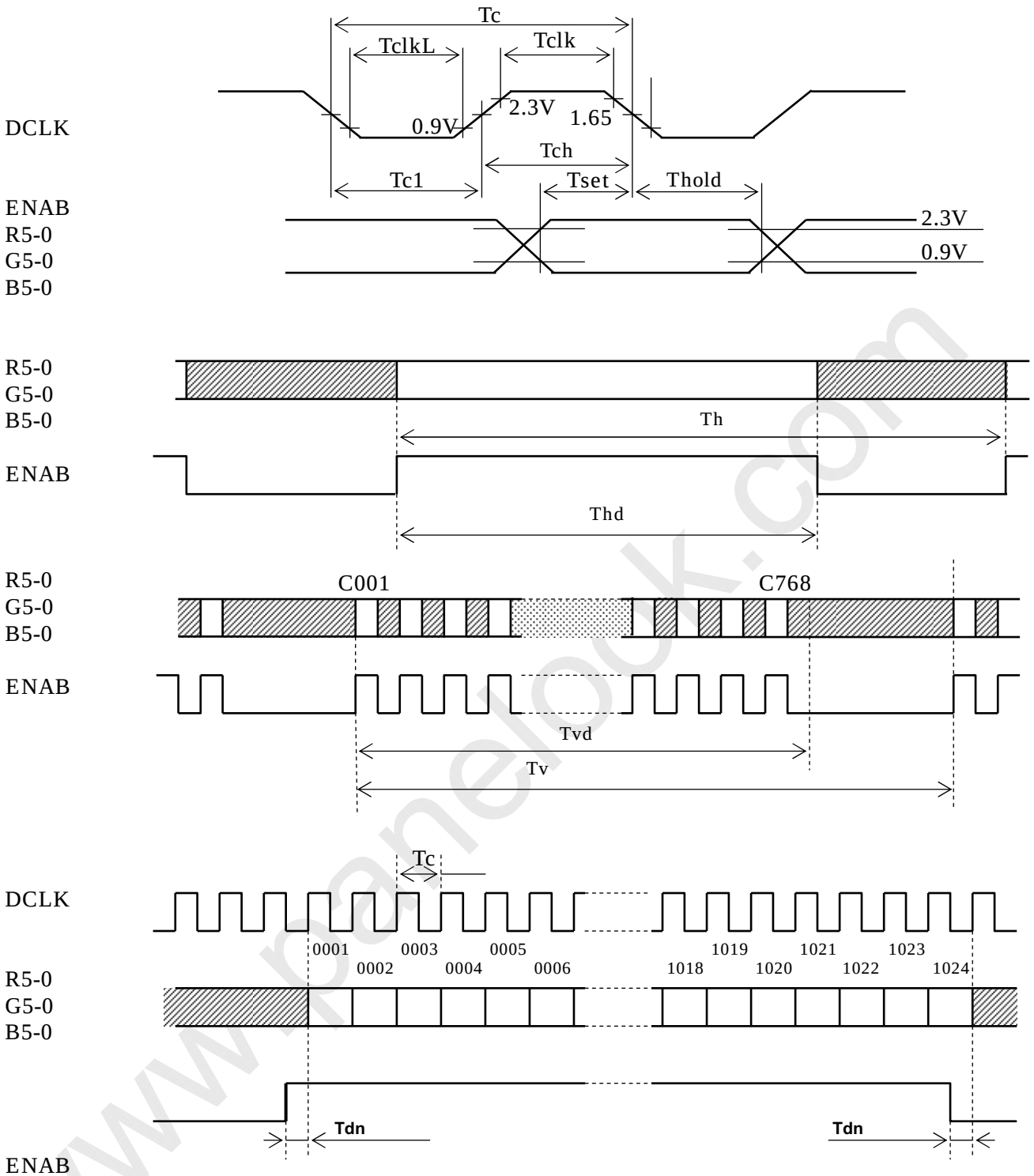

Figure 10-1 Input Signal Timing Chart

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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	S0008	----------	S3071	S3072
C001	R 0001	G 0001	B 0001	R 0002	G 0002	B 0002	R 0003	G 0003		G 1024	B 1024
C768	R 0001	G 0001	B 0001	R 0002	G 0002	B 0002	R 0003	G 0003		G 1024	B 1024

Figure 10-2 Correspondence Data and Display Position

10-5 Power Supply Sequence

Figure 10-3 defines the rise time of the power supply, voltage descent and the power supply sequence. Especially the sequence of power supply and the input signal is necessary to latch up of the driver IC and DC driving.

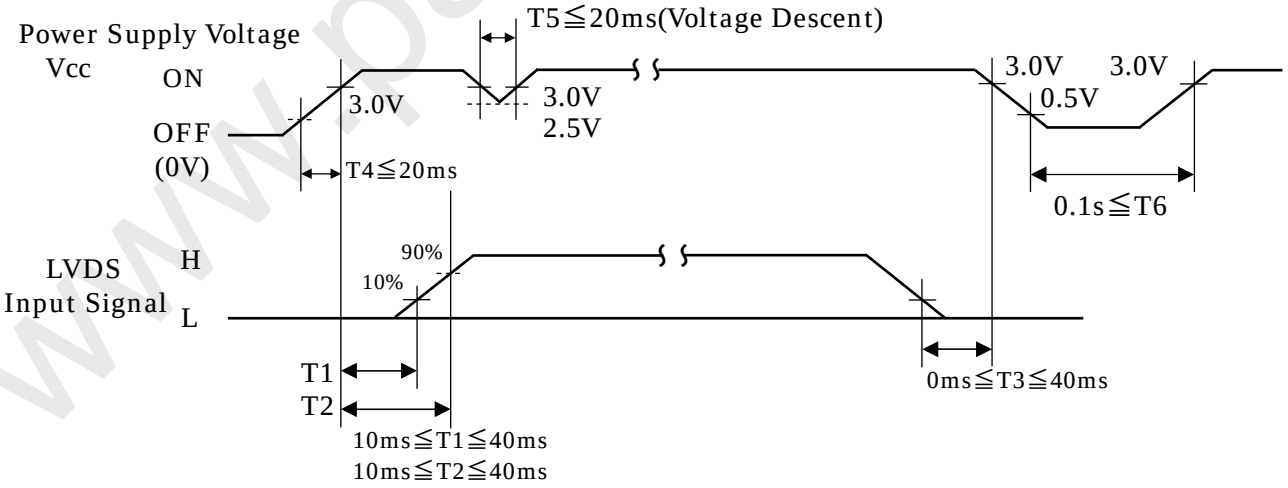

Figure 10-3 Power Supply Sequence

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10.6 EDID Signal Timing

Table 10-4 shows DC characteristics of EDID signals. Figure 10-4 shows input timing.
Table 10-5 shows AC characteristics and Table 10-6 shows the contents of EDID data.

Table 10-4 EDID DC Characteristics (Ta＝0～50℃, Vcc＝3.3±0. 3V)

Item		Symbol	MIN.	MAX.	Unit	Remarks
SCL,SDA Terminal input voltage	High voltage	VIH	0.7V_{EDID}	—	V	
	Low voltage	VIL	—	0.3V_{EDID}	V	
Hysteresis voltage		VHYS	0.05V_{EDID}	—	V	
Output voltage		VOL1 VOL2	— —	0.4 0.6	V V	I0L=3mA, V_{EDID} =2.5V I0L=6mA, V_{EDID} =2.5V
Input leak current	All input-and-output pins WP pin	Tv 1/Tv	-10 -10	10 50	μA μA	VIN=0.1V to V_{EDID},WP=VSS WP= V_{EDID}
Output leak current		Tdn	-10	10	μA	VOUT=0.1V to V_{EDID}
Terminal capacity (Input and output)		Cin,Cout	—	10	pF	VCC=5.0V Ta=25℃, Fclk=1MHz
Operating current		ICC Wr ICC Re	— —	3 1	mA mA	V_{EDID} =5.5V,SCL=400KHz V_{EDID} =5.5V,SCL=400KHz
Stillness current		ICCS	— —	30 100	μA μA	VCC=3.0V,SDA=SCL=VCC VCC=5.5V,SDA=SCL=VCC WP=VSS,A0,A1,A2=VSS

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Table 10-5 EDID AC Characteristics

Item	Symbol	Vcc=2.5V-5.5V Standard operation mode		Vcc=4.5V-5.5V High-speed operation mode		Unit	Remarks
		MIN.	MAX.	MIN.	MAX.		
Clock frequency	Fclk	—	100	—	400	kHz	
Clock high time	THIGH	4000	—	600	—	ns	
Clock low time	TLOW	4700	—	1300	—	ns	
SDA, SCL rising time	TR	—	1000	—	300	ns	
SDA, SCL falling time	TF	—	300	—	300	ns	
START hold time	THD:SDA	4000	—	600	—	ns	
START setup time	TSU:STA	4700	—	600	—	ns	
DATA input hold time	THD:DAT	0	—	0	—	ns	
DATA input setup time	STU:DAT	250	—	100	—	ns	
STOP setup time	TSU:STO	4700	—	600	—	ns	
Output decision time from a clock	TAA	100	3500	100	900	ns	
Bus free time	TBUF	4700	—	1300	—	ns	
Minimum VIH, VIL Rising time	TOF	—	250	20+0.1CB	250	ns	CB≦100pF
Spike oppression (SDA, SCL pins)	TSP	—	50	—	50	ns	
A write-in cycle time	TWR	—	10	—	10	ms	Byte and page mode
The number of times of data rewriting	—	1M	—	1M	—	cycle	25℃,Vcc=5.0V block mode

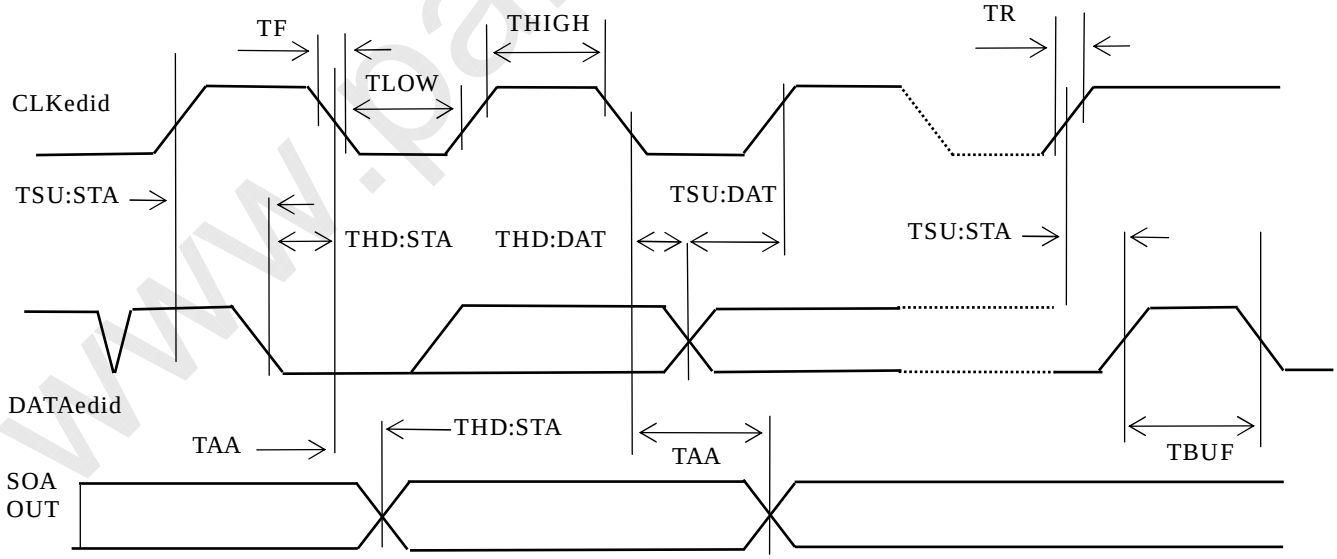

Figure 10-4 EDID signal timing

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Table 10-6 The Contents of EDID data

Address	No. Bytes	Description	Data
Header (8bytes)			
00h	1		00h
01h	1		FFh
02h	1		FFh
03h	1		FFh
04h	1		FFh
05h	1		FFh
06h	1		FFh
07h	1		00h
Vendor/Product identification (10 bytes)			
08h	2	ID Manufacturer name	1894h
0Ah	2	ID product code	****h
0Ch	1	ID serial number	**h
0Dh	1	ID serial number	**h
0Eh	1	ID serial number	**h
0Fh	1	ID serial number	**h
10h	1	Week of manufacture	**h
11h	1	Year of manufacture	**h
EDID (2bytes)			
12h	1	Version #	01h
13h	1	Revision #	03h
Basic display parameter/features (5 bytes)			
14h	1	Video input definition	80h
15h	1	Max. horizontal image size	1Eh
16h	1	Max. vertical image size	17h
17h	1	Display transfer Characteristics (Gamma)	B4h
18h	1	Feature support	08h

Address	No. Bytes	Description	Data
Color Characteristics (10bytes)			
19h	1	Red/Green Low Bits	**h
1Ah	1	Blue/White Low Bits	**h
1Bh	1	Red-x	**h
1Ch	1	Red-y	**h
1Dh	1	Green-x	**h
1Eh	1	Green-y	**h
1Fh	1	Blue-x	**h
20h	1	Blue-y	**h
21h	1	White-x	**h
22h	1	White-y	**h
Established timing (3 bytes)			
23h	1	Established Timings1	00h
24h	1	Established Timings2	00h
25h	1	Manufactures reserved timing	00h
Standard timing identification (16 bytes)			
26h	2	Standard timing Identification #1	61h 40h
28h	2	Standard timing Identification #2	01h 01h
2Ah	2	Standard timing Identification #3	01h 01h
2Ch	2	Standard timing Identification #4	01h 01h
2Eh	2	Standard timing Identification #5	01h 01h
30h	2	Standard timing Identification #6	01h 01h
32h	2	Standard timing Identification #7	01h 01h
34h	2	Standard timing Identification #8	01h 01h

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Address	No. bytes	Description	Data
Detailed timing description (72 bytes)			
Detailed timing description 1 (18 bytes)			
36h			64h
37h			19h
38h			00h
39h			40h
3Ah			41h
3Bh			00h
3Ch			25h
3Dh			30h
3Eh			00h
3Fh			00h
40h			00h
41h			00h
42h			30h
43h			E4h
44h			10h
45h			00h
46h			00h
47h			18h
Detailed timing description #2 or monitor descriptor (18 bytes)			
48h			00h
49h			00h
4Ah			00h
4Bh			10h
4Ch			00h
4Dh			00h
4Eh			00h
4Fh			00h
50h			00h
51h			00h
52h			00h
53h			00h
54h			00h
55h			00h

Address	No. bytes	Description	Data
56h			00h
57h			00h
58h			00h
59h			00h
Detailed timing description #3 or monitor Descriptor (18 bytes)			
5Ah			00h
5Bh			00h
5Ch			00h
5Dh			10h
5Eh			00h
5Fh			00h
60h			00h
61h			00h
62h			00h
63h			00h
64h			00h
65h			00h
66h			00h
67h			00h
68h			00h
69h			00h
6Ah			00h
6Bh			00h
Detailed timing description #4 or monitor descriptor (18 bytes)			
6Ch			00h
6Dh			00h
6Eh			00h
6Fh			10h
70h			00h
71h			00h
72h			00h
73h			00h
74h			00h
75h			00h
76h			00h

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Address	No. bytes	Description	Data
77h			00h
78h			00h
79h			00h
7Ah			00h
7Bh			00h
7Ch			00h
7Dh			00h
7Eh			00h
7Fh		Check Sum	**h

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11 BACK-LIGHT SPECIFICATION

11-1 Pin configuration for Back-light

Table 11-1 shows the description of the pin assignment and the types of back-light (CN-2)

Table11-1 Pin Assignment of CN-2

Pin No.	Signal	Function	Remark
1	V_H	Power supply for CCFL (High)	Cable color: Pink
2	V_L	Power supply for CCFL (Low)	Cable color: White

Used connector ： ＢＨＳＲ－０２ＶＳ－１
Applied connector ： ＳＭ０２Ｂ－ＢＨＳＳ－１
Maker ： Japanese Solderless Terminal Trading Company LTD. (J.S.T)

11-2 Life

The life duration of the LCD panel is considered to be over 50,000 hours.
The life duration of the Back Light is considered to be over 10,000 hours based on the criteria bellow.

(1)Operating condition
①Ambient temperature ： ２５±５℃
②Tube current(I_F) ： ６ｍＡ or less

(2)Definition of life
① When brightness is bellow 50% of the minimum brightness value shown in section 9, table 9-1.
② When the CCFL turn on voltage stated in section 8 of table 8-1 exceeds 1700Vrms
③ When flickering and blinking occurs based under the condition of life guarantee.

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12. Environmental Specification

Table 12-1 shows the environmental specification.

Table 12-1 Environmental Specification

Item	Specification		Remark
Temperature	Operation	0～50℃	The temperature of the LCD panel surface (display area) temperature.
	Storage	－20～60℃	
Humidity	Operation	20～85%RH	Maximum wet bulb temperature Should not exceed 29℃. No condensation
	Storage	5～85%RH	
Vibration	Operation	10-500Hz, 2G peak, 2 Hrs each in X,Y,Z direction Approx. 20 min for 1 cycle.	For single module. Test criteria is stated in (Note 1)
Shock	Non-operating	15G, 6ms, 1 time each for X,Y,Z direction	For single module. When packaging refer to (Note 2)

Note 1) The distance between the vibration table and the back surface of the LCD module should be set to 3mm when conducting a vibration test.
Note 2) The shock resisting standard when packing is shown in table 12-2 and figure 12-1.

Table 12-2 Shock resistance standard when packaging module

Contact point	Dropping height	No. of times
A, B, C, D	55cm	1 time each
E, F, G, H, I, J	60cm	

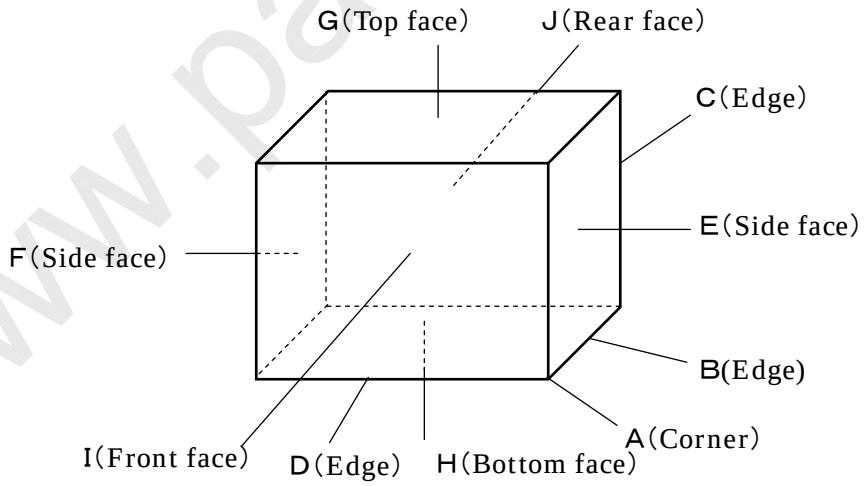

Figure 12-1 The direction of applying shock when packing

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13. Display

The module has the following indications.

(1)Product name : LCD Unit

(2)Model Number: NA19026-C661

(3) Manufacturing Number: **4900001**

- Serial number (To be reset every month on 1st.)
- Manufacturing month (Oct. = X, Nov. =Y, Dec. =Z)
- Last digit of manufacturing year.

(4)Manufacturing Country Name: MADE IN JAPAN or MADE IN TAIWAN

(5) Disposal method of cold-cathode tubes.

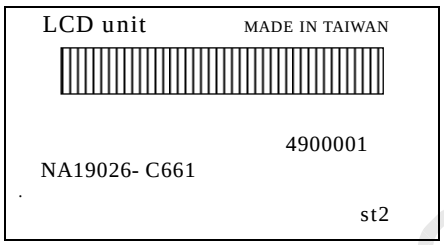

Figure 13-1 Product Label (Example)

Figure 13-2

14. PACKAGING SPECIFICATION

Packaging specification is specified separately in the packaging specification.

15. WARRENTY

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

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16. PRECAUTIONS

In order to use the LCD module properly, please abide by the following precautions.

(1)Handling of LCD panel

① Do not apply excessive mechanical shock to the LCD panel

The panel is made of glass. Excessive shock may cause damage or malfunction to the LCD panel.

② Do not press the panel surface too hard (MAX 20N/cm²)

There are 2 glass plates within the panel and they should be kept perfectly even to maintain display properties and reliability. If the panel is pressed hard, then the following problems may occur;

① Color uniformity ②Disorder of orientation of liquid crystal

Problem ① will clear as time passes. For problem ②, turn the power off and then on in order to bring the screen back to normal. However, these operations should be avoided to insure reliability.

③Do not scratch the polarizer film on the LCD panel surface

- Do not press or rub the display surface with a hard tool, tweezers, etc.
- When handling the panel, use cotton or conductive gloves so that the display surface is not soiled.
- If dust or dirt soils the display surface, use a soft cloth (deer skin) to clear the panel using the following method;

〔Dust〕 Dust the panel using a soft cloth. (Do not rub).

〔Dirt〕 Saturate clear water to a soft cloth and squeeze hard until there are no water drops, then wipe the surface lightly. Make sure water or solvents are not splashed onto the edge of the panel to prevent fluid from seeping into the panel. Do not use alcohol, detergent, ketone (acetone, etc.) and aromatics (xylene, tolune, etc.) as solvents.

- Adherence of saliva and water drops for a long period may cause partial deformation and decolorization. Clean the surface promptly using the 〔Dirt〕 method.
- Cleaners that are alkaline will damage the surface of the polarizor and should not be used
- Adherence of excessive oil is hard to clean and precaution should be taken to avoid oil adherence.

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④ Do not place or contact objects onto the LCD panel for a long period of time

There is a possibility that the components may deform and can cause the quality of the LCD panel to deteriorate.

(2)Handling of the LCD module

① Do not pull the cold-cathode tube cable with strength

If the cable is pulled in strength with more than 20N, then this can cause damage or deterioration of reliability.

② Assemble the equipment in a dust free environment

Especially conductive foreign matters can cause the module to fail.

③ Take anti-electrostatic measures when assembling the module

The LCD unit contains a CMOS-IC. The following points should be taken into consideration.

- General anti-electrostatic measures should be taken when handling instruments. (cotton or conductive gloves should be worn/grounding worker/disposal of ground on floor, operating table etc./disposal of operating tools (soldering iron, radio pliers, tweezers, etc.)etc.)
- Do not take the module out of the conductive bag until the module is assembled.
- Conduct the assembly of the module under a humid controlled environment (50%-60%RH).
  Do not handle the module under the humid of 50%RH.

④ Do not disassemble or remodel the LCD module.

Disassembly, remodel can cause the model to fail and can cause deterioration of display quality and reliability.

(3) Precautions to be made when operating the LCD module

① Please abide by the specified power supply sequence

This is necessary to prevent latch up of CMOS-IC, failure or deterioration of the display quality and reliability due to the application of DC voltage to the liquid crystal.

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② Do not input power supply, signal when condensation occurs

If voltage is applied to the panel when there is condensation on the terminal, the terminal can cause an electrochemical reaction and there is a possibility of disconnection.

Condensation occurs right after the unit has been moved from a cold environment to a warm environment in a short period of time.

③ Troubles that occur when LCD panel is not used under recommended temperature

- Operation under high temperature (Ta＞50℃)：The display color shifts to blue.
- Storage under high temperature (Ta＞60℃)： The contrast ratio decreases due to deterioration of polarizer film.
- Operation under low temperature (Ta＜ 0℃)：The response speed of the display decreases.
- Storage under low temperature(Ta＜－20℃):The liquid crystal may solidify and be damaged.

④ Control signal is to be input within a specified time after the power supply has been turned on

After turning the power supply on, if control signals (DCLK, ENAB) are not input into the timing control circuit or if the input timing is not within the specified timing、this can cause deterioration of image quality such as DC drive of liquid crystal, image sticking, decrease in contrast ratio etc.

4) Precautions in regards to mounting and designing the module

① Do not put excessive pressure onto the screen and rear side of the LCD module

Excessive pressure put on to the surface of the screen under mounting condition can cause deterioration of display quality and reliability. If excessive pressure has been put onto the back light module, brightness uniformity can occur and the reliability of the CCFL may decrease.

② Avoid twisting and bending the LCD module

Twisting and bending of the LCD module can cause damage to the display quality and reliability.

③ Do not extend the power supply cable that connects the back light and the inverter

Extension of the cable can cause the backlight to not light or flicker.

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④ Keep the power supply cable away from metal enclosures of the LCD module

The high voltage currency of the backlight drive may leak onto metal enclosures in which the desired brightness may not be assured. Therefore, when evaluating take consideration and appropriate method in wiring.

⑤ When mounting the LCD module, use a M2.0 screw (x8) in which the screw should be tightened with a torque of 20cN・m or below

⑥ Initial defect or problems with long term reliability may occur when other applied connectors are used.

(5)STORAGE METHOD

① Do not store the LCD module in an organic solvent or corrosive gas environment

- The polarizer film can discolor in an organic solvent environment.
- Various parts of the module may corrode or deteriorate in a corrosive gas environment.

② Store the LCD module in a Fujitsu package

- The LCD module within the container box is covered in anti-static bag.
- When stacking the boxes, make sure it is kept bellow 4 boxes.

③ The LCD is recommended to be stored in a humidity controlled, cool and dark place

Recommended storage environment

- Place : Dark (avoid sunlight)
- Temperature: １０～３５℃
- Humidity : ５０～６０％ＲＨ

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

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(6)DISPOSABLE METHOD

① LCD Module

- The components of this LCD module can be grouped into metal, resin, glass etc.
- Descriptions of materials or abbreviated names are listed on the plastic parts.
- The inside of the back light source of the CCFL contains mercury and should be disposed according to the local ordinance or regulations.

② Package

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

(7)Others

① If the panel breaks, do not inhale or swallow the liquid crystal

- If the liquid crystal adheres to the body or clothes, wash the liquid off immediately with soap.
- Follow regular precautions for other electric components.

② Flux residue which may be found on the printed circuit board is harmless

Fujitsu has adopted a non-wash technology for the module assembly process.

17 OTHERS

There may be changes made to the parts used in FDTC LCD panels. In those situations, a discussion will be made in advance between both parties regarding the changes that will be made to the parts.

In addition, if any doubts arise in regards to descript items in the specification, the problem shall be resolved through discussion between both parties.

FDTC panels are not designed and manufactured for the purpose of aerospace, nuclear reaction control, medical equipments that require extremely high reliability for life support. Any customers that intend to use FDTC panels for these purposes should contact and consult the design department.

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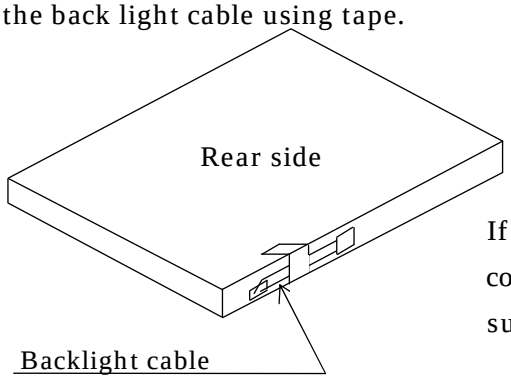
18. Return method for LCD module when requested for repair or analysis of the problem

When returning the LCD module, follow the procedure accordingly by not damaging the LCD panel or the backlight cables. (Refer to Figure 18-1,2,3,4)

It should be noted that FDTC would not take responsibility for damaged LCD modules that are returned where the reason for damage is due to failure of following the specified packaging procedure.

18-1 In case of made in Taiwan

（1）Stabilize the back light cable using tape.



If the cables are not stabilized, the connectors may scratch the LCD panel surface or it can cause damage to the cables.

（2）Put the LCD module into the anti-electrostatic bag.
(Do not use anti-electrostatic bag that are torn)

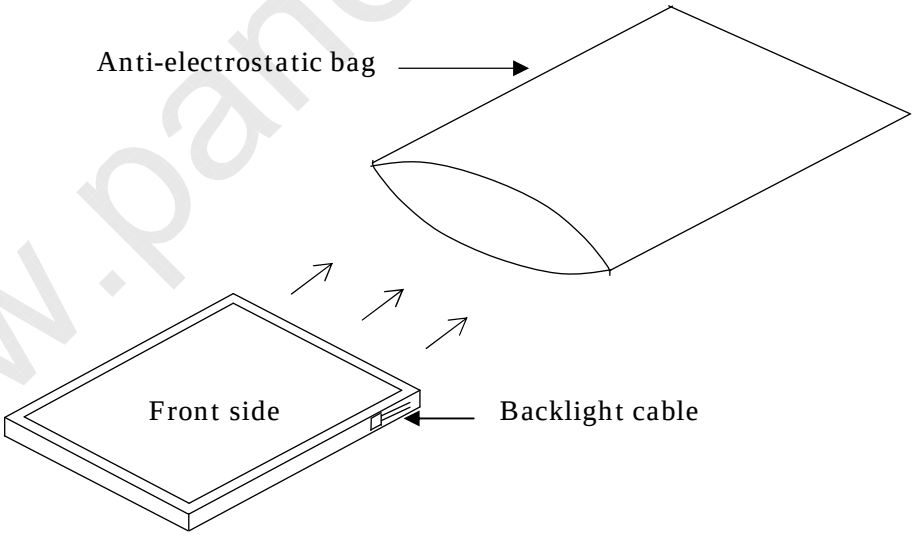


Figure 18-1 Packaging Method

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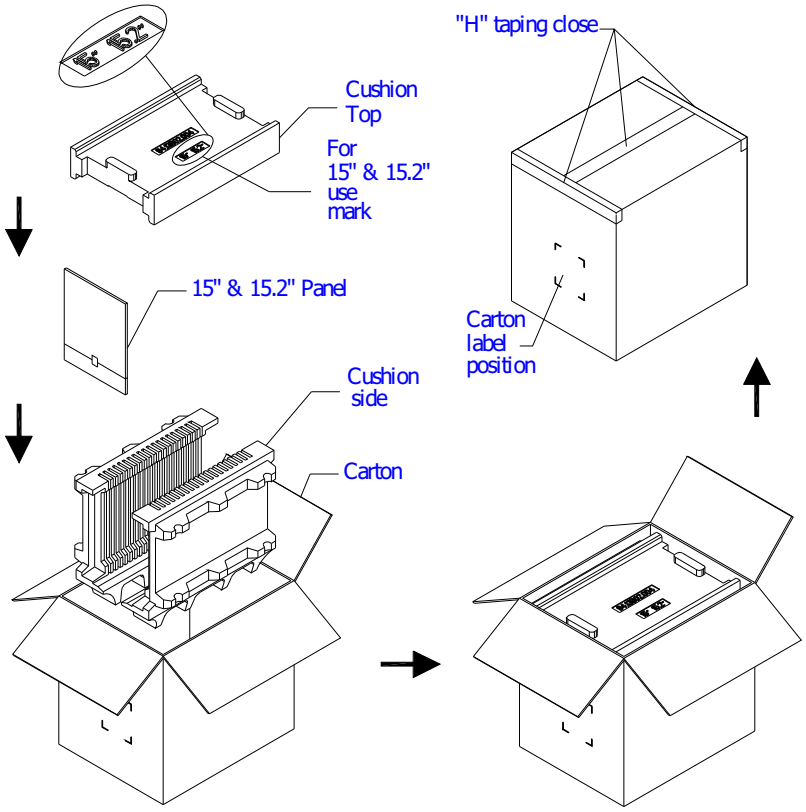
（3）Storing into a container box

- When using a carton box manufactured by FDTC

(Carton boxes and arrowheads that are not crushed should be used)



Place the front side of the LCD module in the direction of the arrow shown on the holder (top).

****Directions of arrowheads are shown on holders****

Figure 18-2 Packaging Method

- When using other methods of packaging other than specified above

Thoughtful consideration should be taken so that damage is not made to the LCD module by wrapping the module individually with an air cap. It should be noted that FDTC would not take responsibility for damages caused by failure of packaging

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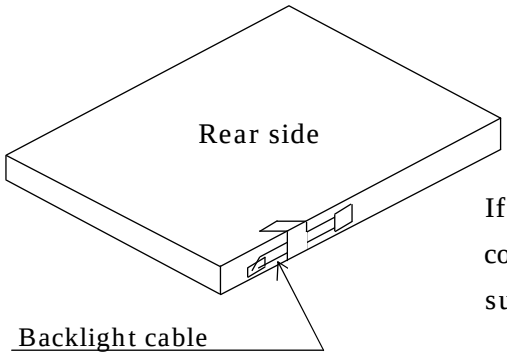
18-2 In case of made in Japan

（1） Stabilize the back light cable using tape.



If the cables are not stabilized, the connectors may scratch the LCD panel surface or it can cause damage to the cables.

（2）Put the LCD module into the anti-electrostatic bag.
(Do not use anti-electrostatic bag that are torn)

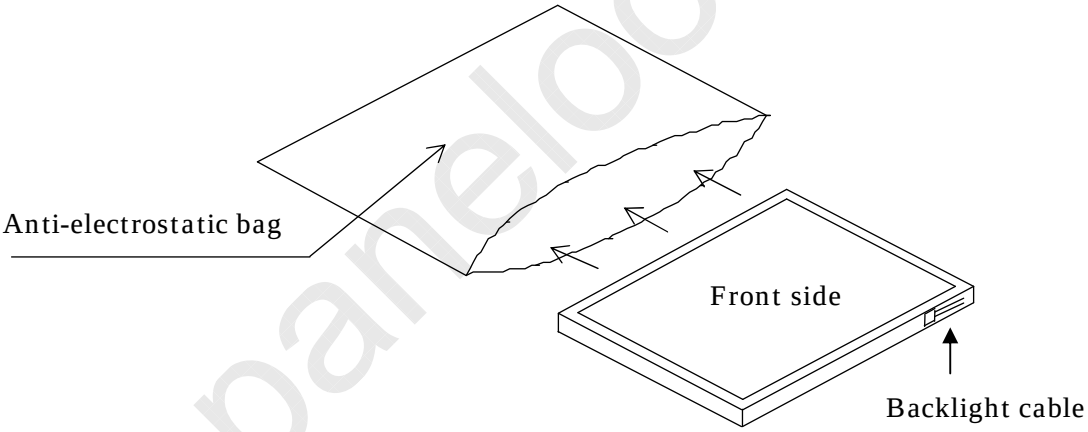


Figure 18-3 Packaging Method

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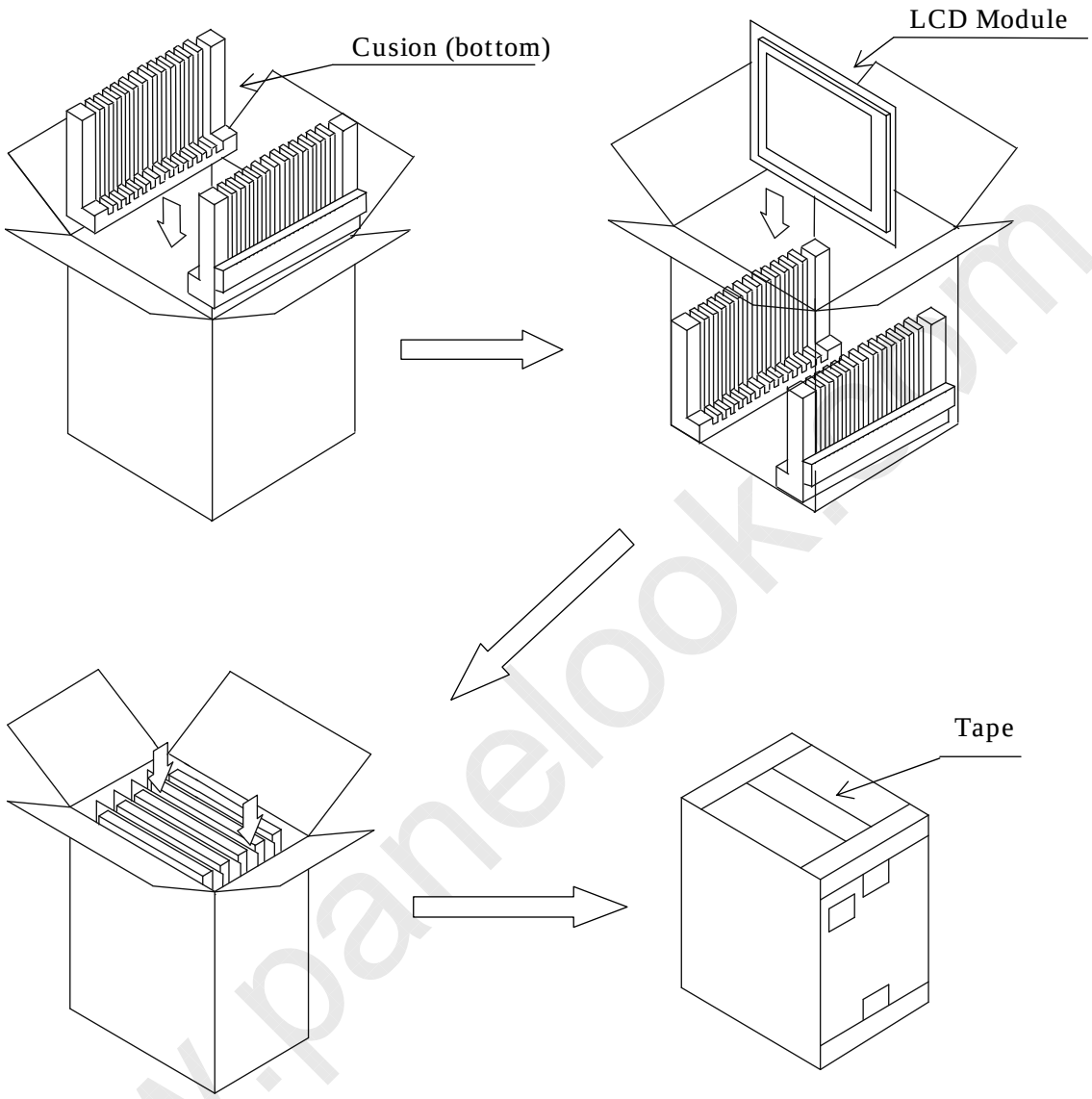
（3）Storing into a container box

- When using a carton box manufactured by FDTC

(Carton boxes and arrowheads that are not crushed should be used)



Place the front side of the LCD module in the direction of the arrow shown on the holder (top).

****Directions of arrowheads are shown on holders****

Figure 18-4 Packaging Method

- When using other methods of packaging other than specified above

Thoughtful consideration should be taken so that damage is not made to the LCD module by wrapping the module individually with an air cap. It should be noted that FDTC would not take responsibility for damages caused by failure of packaging

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