To ：

Specification of FUJITSU TFT-LCD module

FLC43XWC6V-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, 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.

Specification No.： Tech Bes LCD-00087

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Issued by：

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Director
LCD Design Dep.
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LCD Group

FUJITSU LIMITED

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FLC43XWC6V-02

Tech Bes LCD-00087

CUST.

FUJITSU LIMITED

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1. APPLICATIONS

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

2. PRODUCT NAME AND MODEL NUMBER

2-1. Product Name : LCD Module

2-2. Model Name : FLC43XWC6V-02

3. OVERVIEW

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

This LCD has a digital RGB interface and can display 262,144 colors.

Timing control signal is “Data enable signal : ENAB” only. (Data enable mode)

Even and odd data are transmitted at the same timing in the interface, so data lines are 36. (R, G, B each 6 bit ×2) The signal level of this interface is +3.3V CMOS level or 5V TTL level.

The power supply of this LCD module is +5v DC single.

4. CONFIGURATION

This LCD module consists of a LCD panel, LCD driving circuit, control circuit, interface circuit and backlight unit.

The LCD panel is active matrix TFT type and Fujitsu’s unique MVA (Multi-domain Vertical Alignment) liquid crystal technology is adopted in it. The LCD driving circuit is integrated in IC chips, which are bonded on plastic wiring film (hereinafter TAB driver-IC), and the output terminals of the IC chips are connected to the LCD panel. The control circuit and the interface circuit are mounted on three kinds of printed circuit board (hereinafter PCB) and the input of the TAB driver-ICs are connected to the PCBs.

With such circuit construction, the image data received by the interface circuit is forwarded to the control circuit and the control circuit modulates the image data to LCD driving signals. The TAB driver ICs buffer the LCD driving signals and output driving voltages to the LCD panel.

These LCD parts such as the LCD panel, the TAB-ICs and the PCBs are assembled together with the backlight module in a plastic case and a metal frame.

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

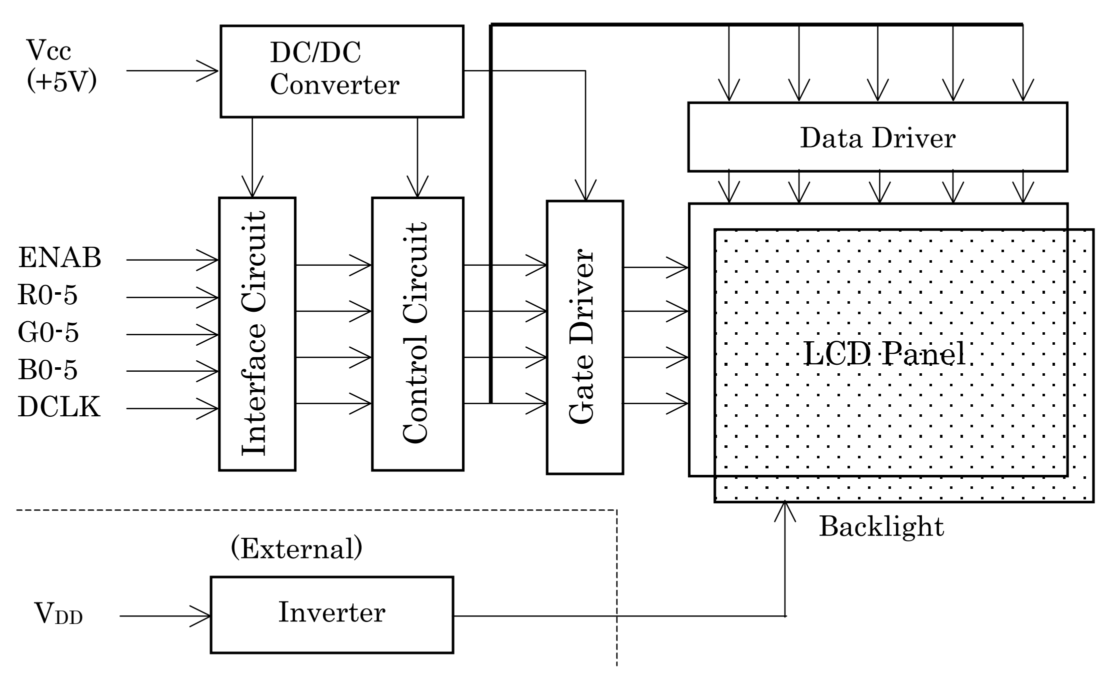

Vcc
(+5V)
DC/DC
Converter
Data Driver
ENAB
R0-5
G0-5
B0-5
DCLK
Interface Circuit
Control Circuit
Gate Driver
LCD Panel
Backlight
(External)
VDD
Inverter

Fig.4-1.Block Diagram

5. MECHANICAL SPECIFICATIONS

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

Table 5-1. Mechanical Specifications

Item	Specifications	Unit	Remark
Dimensions	413.8×263.5×19.4(TYP.) (Excluding I/F Connector and fixing parts)	mm	Edge type backlight is used. (φ2.6 CCFL×4) Outward Appearance is shown at page 30 and 31.
Display Resolution	(1280×3) ×768	—	
Display Dot Area	369.6×221.76	mm	
Dot Pitch	(0.09625×3) ×0.28875	mm	
Aspect Ratio	1 : 1	—	
Weight	2,000 max	g	
FG-SG	Short circuit	—	

6. ABSOLUTE MAXIMUM RATINGS

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

Table 6-1. Absolute Maximum Ratings

Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{CC}	Ta=25°C	-0.3	—	6.0	V
Input Voltage	V_{IN}	Ta=25°C	-0.3	—	Vcc+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 (Logic)		V_{CC}	4.75	5.0	5.25	V
Ripple Voltage	V_{CC}	V_{RP}	—	—	100	mV

8. ELECTRICAL SPECIFICATIONS

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

Table 8-1. Electrical Specifications

Item		Symbol	Condition	MIN.	TYP.	MAX.	Unit	Remark
Supply Current		I_{CC}	V_{CC}=+5.0±0.25V Vss=0V DCLK=32.505MHz	—	380	800	mA	*1
"H" Level Logic Input Voltage		V_{IH}		2.3	—	V_{CC}	V	
"L" Level Logic Input Voltage		V_{IL}		V_{SS}	—	0.9	V	
Supply Rush Current		I_{SCC}		—	5.5	7	A	*2
Supply Rush Current Duration (1A excess)		T_{SCC}		—	0.4	0.15	ms	
BACK LIGHT *3	CCFL Turn on Voltage	V_S	f_L=50kHz, Ta=25°C	—	1230	1600	Vrms	*4
			f_L=50kHz, Ta=0°C	—	—	1600		*4
	Lighting Voltage	V_L	f_L=50kHz I_L=10.5mA	590	630	670	Vrms	*4
	Lighting Frequency	f_L	V_L=580Vrms	40	50	60	kHz	
	Tube Current	I_L	f_L=50kHz V_L=580Vrms	9.5	10.5	11.0	mA	*4

(*1) Typical current value is measured when color bar pattern is displayed at Vcc=5.0V.
Maximum current value is measured when 55/63 and 63/63 gray scale pattern every 2 pixel is displayed at Vcc=4.75V.
Without rush current.

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

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

(*4) Tube current (I_L) shows the value of the current that is consumed at one lamp.
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 are bound into 1 line cable, which connected to the backlight connector.

Note 1) Measurement Circuit

Based on Fig.8-1.

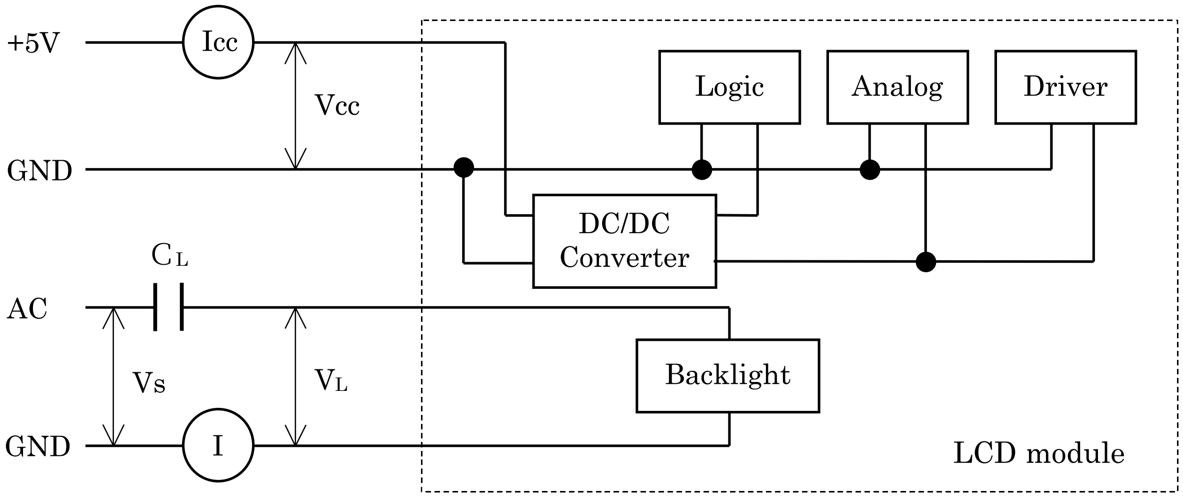

+5V
Icc
Vcc
GND
Logic
Analog
Driver
DC/DC Converter
C_L
AC
Backlight
Vs
V_L
GND
I
LCD module

Fig.8-1. Measurement Circuit

Note 2) Equivalent Circuit

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

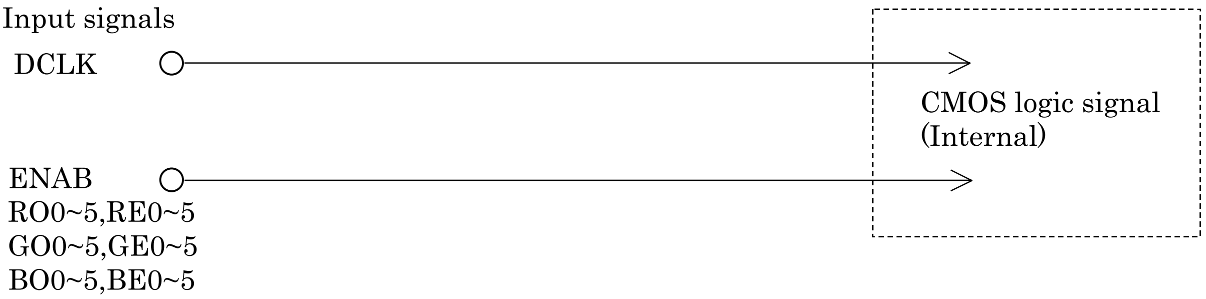
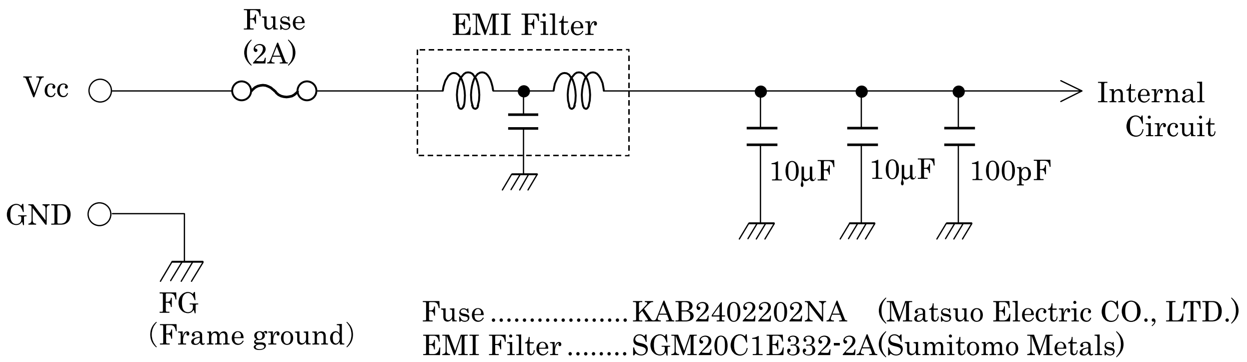

Input signals
DCLK
CMOS logic signal (Internal)
ENAB
RO0~5,RE0~5
GO0~5,GE0~5
BO0~5,BE0~5

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


Fuse (2A)
EMI Filter
Vcc
Internal Circuit
10μF
10μF
100pF
GND
FG (Frame ground)

Fuse .... KAB2402202NA (Matsuo Electric CO., LTD.)
EMI Filter .... SGM20C1E332-2A(Sumitomo Metals)

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

9. OPTICAL SPECIFICATIONS

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

Table 9-1. Optical Specifications

Ta=25°C

Item			Symbol	Condition		Specifications			Unit	Remark	
						MIN.	TYP.	MAX			Note
Visual Angle	Horizontal		$\theta_{L,R}$	CR≥10	$\theta_{U,D}$=0°	80	—	—	deg		(1)(2) (3)(5) (6)
	Vertical		$\theta_{U,D}$		$\theta_{L,R}$=0°	80	—	—	deg		
Contrast Ratio			CR	$\theta_{L,R,U,D}$=0°		210	400	—	—	White/ Black	(1)(2) (3)(5)
Response Time(ON) (B→W)			t_{on}	$\theta_{L,R,}$ $_{U,D}$=0°	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°	Ta=25°C	—	10	25	ms		
					Ta=0°C	—	50	100	ms		
Brightness			I	$\theta_{L,R,U,D}$=0° V_{CC}=5V, I_L=10.5mA (at maximum brightness)		340	400	—	cd/m²	White *1	(1)(5)
Brightness Uniformity			ΔI			70	—	—	%		(1)(5) (7)
Chromaticity	W		X			0.266	0.296	0.326	—		(1) (5)
			Y			0.276	0.306	0.336	—		
	R		(x, y)		Red	(0.640, 0.348)					
	G				Green	(0.288, 0.587)					
	B				White	(0.147, 0.142)					
LCD Panel Type						TFT Color					
Display Mode						Normally Black VA					
Wide Viewing Angle Technology						MVA					
Optimum Viewing Angle						— (symmetry)					(6)
Display Color						262,144 (6-bit color)					
Color of non-display area						Black					
Surface Treatment						Anti-glare (Haze value:25%, 3H)					

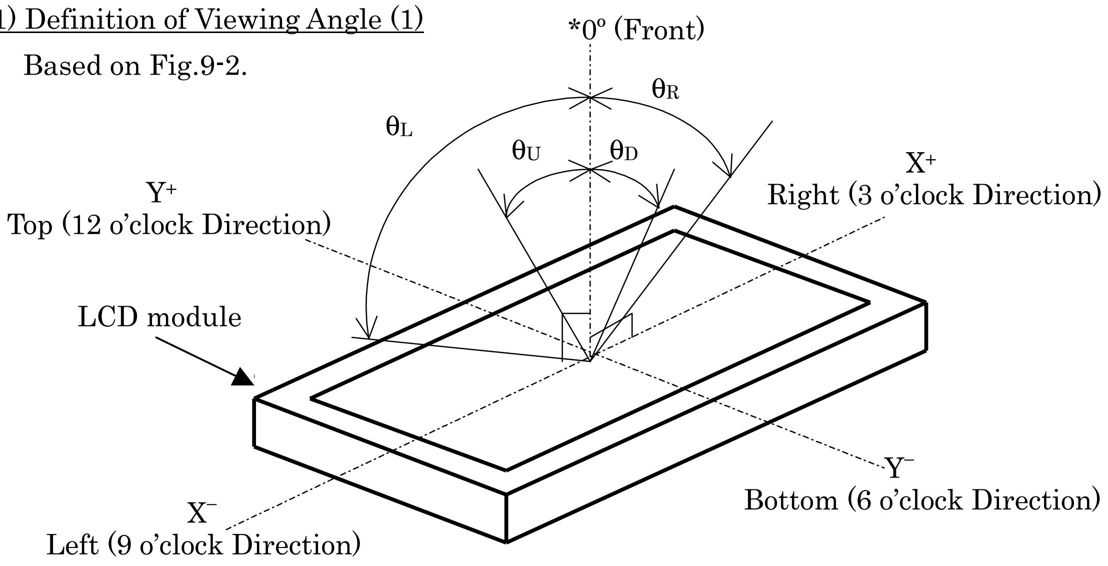
(*1) Specified value is measured in 20~30 minutes after lighting on (LCD module single).
A required value may not be achieved on condition that LCD module is built in the cabinet because of its radiation.

(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).

(Note2) ・Optical specifications are valid when using a suitable inverter such as the “FLCV-15” of Fujitsu Limited.

Note 1) Definition of Viewing Angle (1)

Based on Fig.9-2.


*0° (Front)
θR
θL
θU
θD
Y+
Top (12 o'clock Direction)
X+
Right (3 o'clock Direction)
LCD module
Y−
Bottom (6 o'clock Direction)
X−
Left (9 o'clock Direction)

* → $\theta_U=0°, \theta_D=0°, \theta_L=0°, \theta_R=0°$

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

Note 2) Definition of Viewing Angle (2)

Based on Fig.9-3.

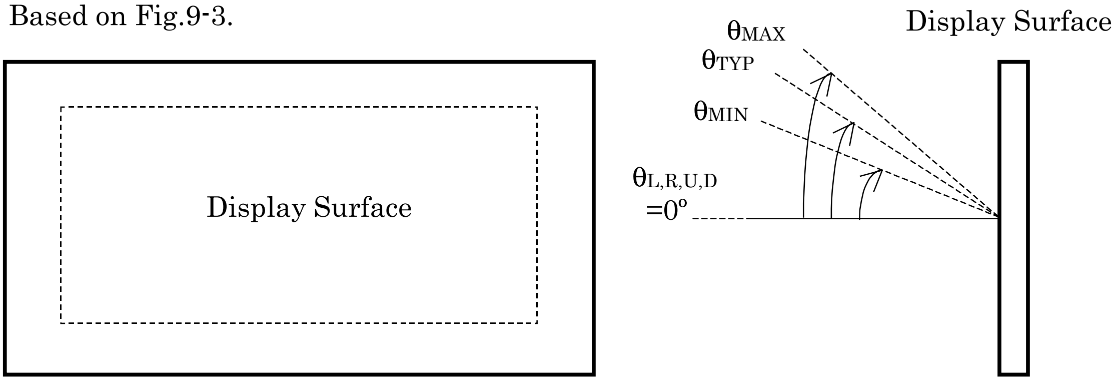

Display Surface
θMAX
θTYP
θMIN
θL,R,U,D
=0°
Display Surface

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.

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

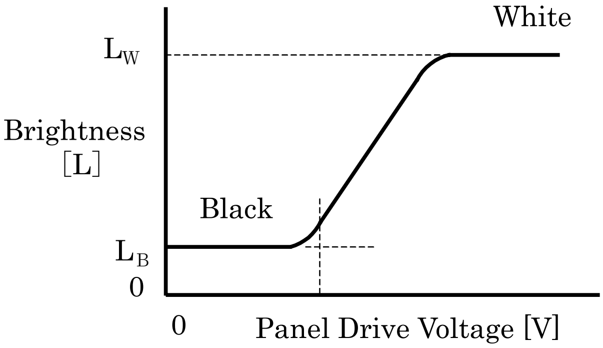


Fig.9-4. Voltage-Brightness Characteristics

Note 4) Definition of Response Time

Based on Fig.9-5.

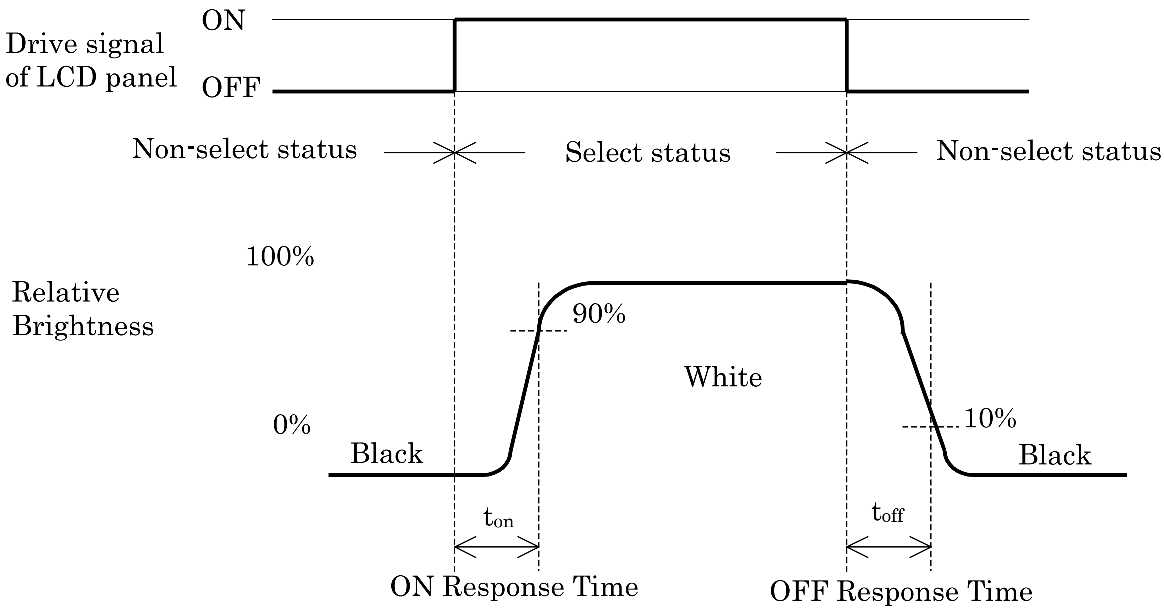

Drive signal of LCD panel
ON
OFF
Non-select status
Select status
Non-select status
100%
Relative Brightness
90%
White
0%
Black
10%
Black
t_{on}
t_{off}
ON Response Time
OFF Response Time

Fig.9-5. Definition of Response Time

Note 5) Contrast Ratio and Response Measurement System

Based on Fig.9-6.

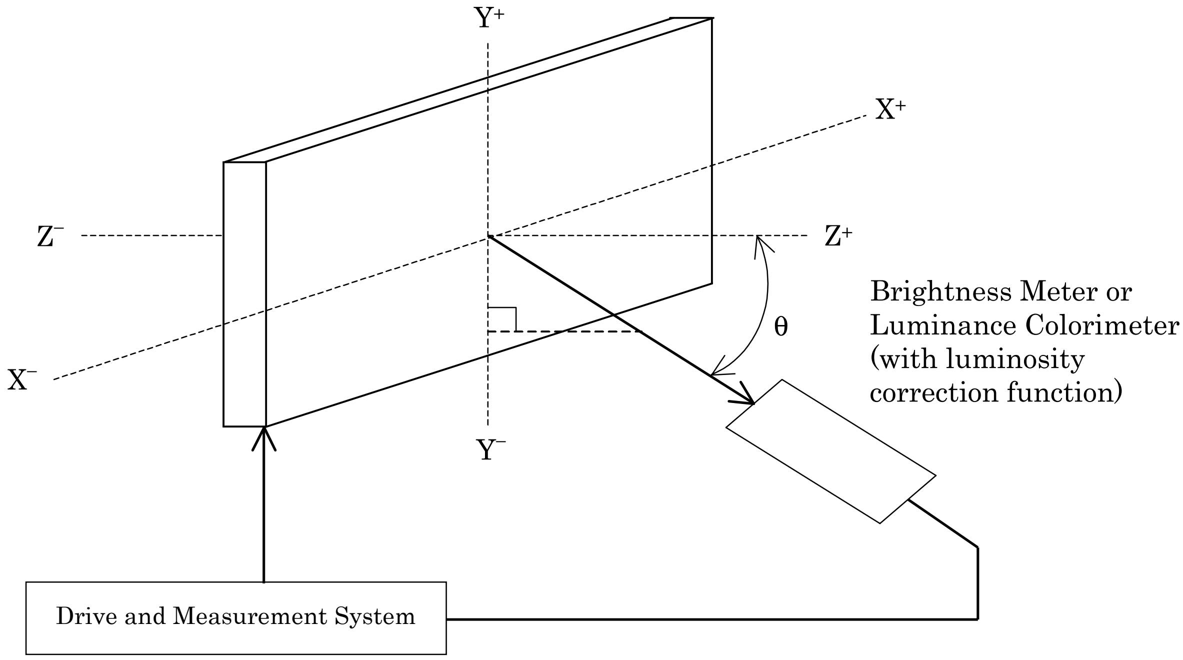

Y+
X+
Z−
Z+
θ
X−
Y−
Brightness Meter or Luminance Colorimeter (with luminosity correction function)
Drive and Measurement System

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

Note 6) Definition of Optimum Viewing Angle

Based on Fig.9-7.

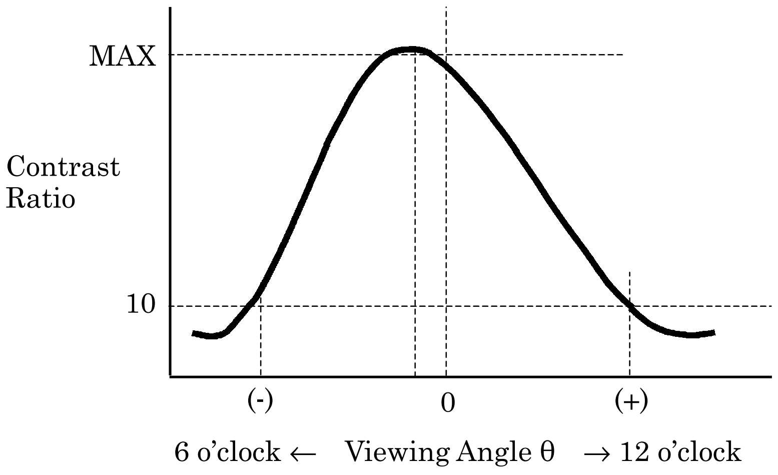
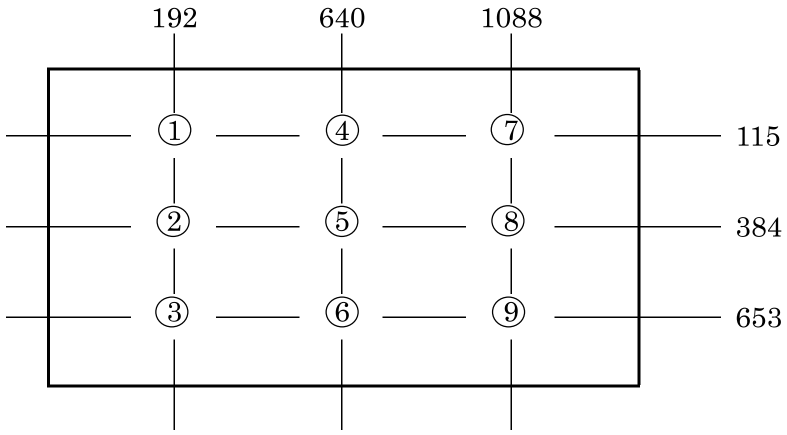


Fig.9-7. Definition of Viewing Angle

Note 7) Definition of Brightness Uniformity

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

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



Note) Each measurement point (① ~ ⑨) defines the center spot of Brightness Meter view.
The tolerance of measurement position is ±5mm.

Fig.9-8. Measurement Points

10. INTERFACE SPECIFICATIONS

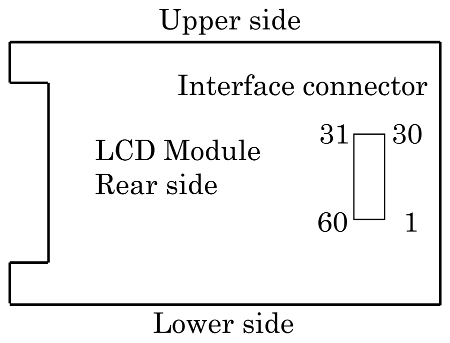
10-1. Signal descriptions

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

Table 10-1. Interface signals (CN1)

Pin No.	Symbol	I/O	Function	Pin No.	Symbol	I/O	Function
1	GND	—	Ground	31	GO1	I	Green odd data 1
2	RE0	I	Red even data 0	32	GO2	I	Green odd data 2
3	RE1	I	Red even data 1	33	GO3	I	Green odd data 3
4	RE2	I	Red even data 2	34	GO4	I	Green odd data 4
5	RE3	I	Red even data 3	35	GO5	I	Green odd data 5
6	RE4	I	Red even data 4	36	GND	—	Ground
7	RE5	I	Red even data 5	37	BO0	I	Blue odd data 0
8	GND	—	Ground	38	BO1	I	Blue odd data 1
9	GE0	I	Green even data 0	39	BO2	I	Blue odd data 2
10	GE1	I	Green even data 1	40	BO3	I	Blue odd data 3
11	GE2	I	Green even data 2	41	BO4	I	Blue odd data 4
12	GE3	I	Green even data 3	42	BO5	I	Blue odd data 5
13	GE4	I	Green even data 4	43	GND	—	Ground
14	GE5	I	Green even data 5	44	GND	—	Ground
15	GND	—	Ground	45	GND	—	Ground
16	BE0	I	Blue even data 0	46	ENAB	I	Data enable signal
17	BE1	I	Blue even data 1	47	GND	—	Ground
18	BE2	I	Blue even data 2	48	GND	—	Ground
19	BE3	I	Blue even data 3	49	DCLK	I	Dot clock signal
20	BE4	I	Blue even data 4	50	GND	—	Ground
21	BE5	I	Blue even data 5	51	GND	—	Ground
22	GND	—	Ground	52	SS	—	SS function ON/OFF (*1)
23	RO0	I	Red odd data 0	53	GND	—	Ground
24	RO1	I	Red odd data 1	54	GND	—	Ground
25	RO2	I	Red odd data 2	55	GND	—	Ground
26	RO3	I	Red odd data 3	56	GND	—	Ground
27	RO4	I	Red odd data 4	57	VDD	—	+5V Power supply
28	RO5	I	Red odd data 5	58	VDD	—	+5V Power supply
29	GND	—	Ground	59	VDD	—	+5V Power supply
30	GO0	I	Green odd data 0	60	VDD	—	+5V Power supply

(*1) SS (Spread Spectrum):SS function is ON when signal level is high or N.C..(generally set up N.C.)
SS function is OFF when signal level is low.



Connector : 52760-0600 (Molex)
User's connector : 53475-0600 (Molex)

10-2. Color Data Assignment

Table 10-2 shows the color data assignment.

Table 10-2. Color Data Assignment

Color			R Input data						G Input data						B Input data					
	Odd Even		R05 RE5	R04 RE4	R03 RE3	R02 RE2	R01 RE1	R00 RE0	G05 GE5	G04 GE4	G03 GE3	G02 GE2	G01 GE1	R00 GE0	B05 BE5	B04 BE4	B03 BE3	B02 BE2	B01 BE1	B00 BE0
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	1	1	1	1	1	1
	White		1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
Red	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
	⇧																			
	⇩																			
	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	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
	⇧																			
	⇩																			
	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	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
	⇧																			
	⇩																			
	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 gray scale level.
The gray scale is brighter as the number is larger.

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

Note.3) Color data consist of 36 bits, namely, 6-bit odd and even data for each red, green and blue.
Optional data can be set to red, green and blue independently.
Therefore, the module is able to display 262,144 colors.

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, Vcc=5±0.25V)

Item			Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK signal (Clock)		Period	Tc	30.764	30.764	40.000	ns	
		Frequency	fc	25.000	32.505	32.505	MHz	fc=1/Tc
		Duty	Tch/Tc	45	50	55	%	*1
		High time	TclkH	5.0	—	—	ns	
		Low time	TclkL	5.0	—	—	ns	
		Rise time	Tclkr	—	—	5.0	ns	
		Fall time	Tclkf	—	—	5.0	ns	
DCLK-Data Timing		Setup time	Tset	4.5	—	—	ns	
		Hold time	Thold	6.5	—	—	ns	
Data-ENAB timing	Horizontal	Period	Th	672	672	1566	DCLK	fh=1/Th
		Frequency	fh	46.6	48.3	48.3	kHz	
		Display period	Thd	640	640	640	DCLK	*2,3
	Vertical	Period	Tv	776	806	806	Th	16.67ms
		Frequency	fv	60	60	60	Hz	
		Display period	Tvd	768	768	768	Th	*2,3
	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.

- Horizontal display position is specified by the rise of ENAB signal. The data of a horizontal line, 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 640 DCLK or less than 768 lines, the rest of the screen displays black.

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

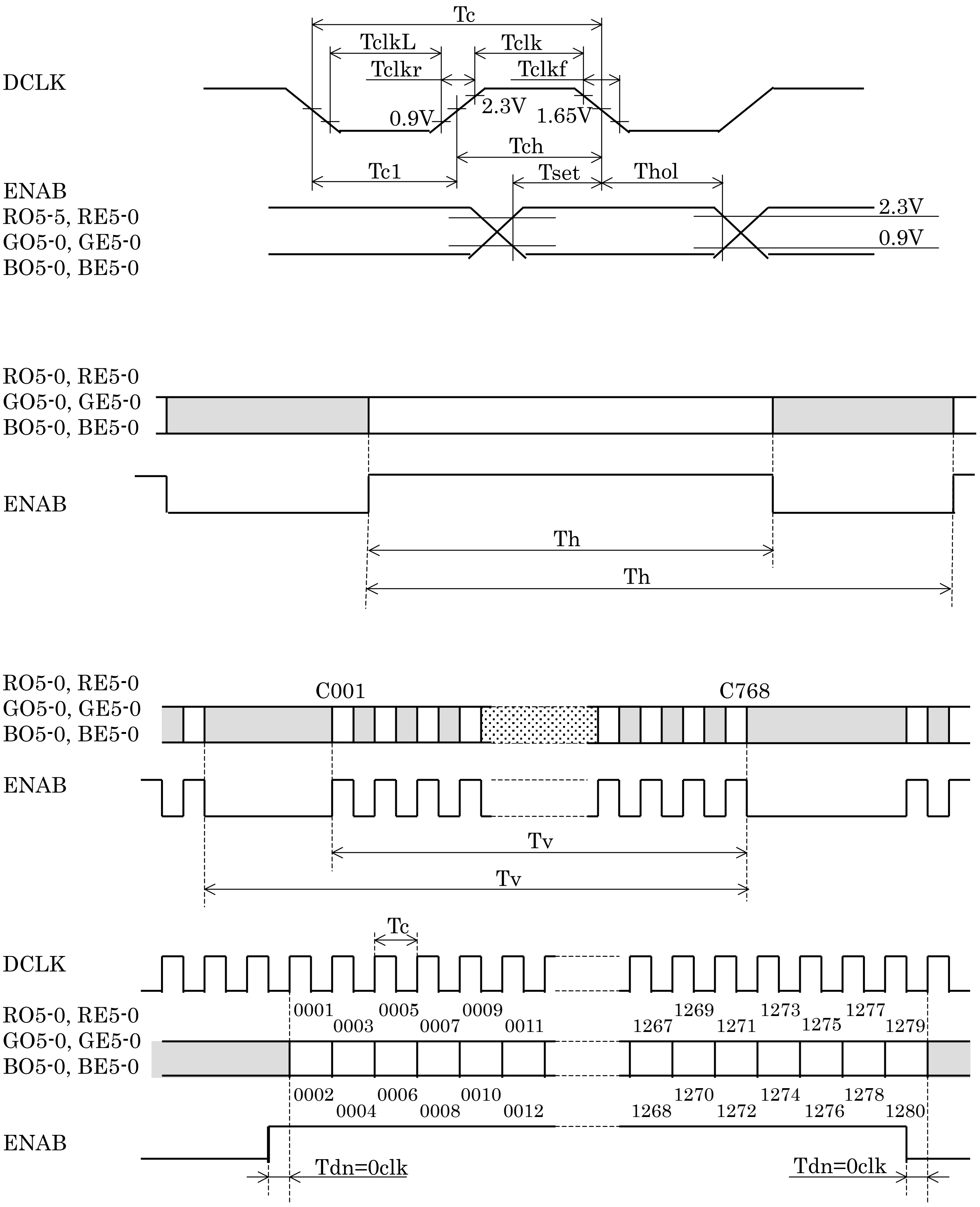

Tc
TclkL
Tclk
Tclkr
Tclkf
DCLK
0.9V
2.3V
1.65V
Tch
Tc1
Tset
Thol
ENAB
RO5-5, RE5-0
GO5-0, GE5-0
BO5-0, BE5-0
2.3V
0.9V
RO5-0, RE5-0
GO5-0, GE5-0
BO5-0, BE5-0
ENAB
Th
Th
RO5-0, RE5-0
GO5-0, GE5-0
BO5-0, BE5-0
C001
C768
ENAB
Tv
Tv
Tc
DCLK
RO5-0, RE5-0
GO5-0, GE5-0
BO5-0, BE5-0
0001
0003
0005
0007
0009
0011
1267
1269
1271
1273
1275
1277
1279
0002
0004
0006
0008
0010
0012
1268
1270
1272
1274
1276
1278
1280
ENAB
Tdn=0clk
Tdn=0clk

Fig.10-3.Input Signal Timing Chart

EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION
DESIG.		CHECK		APPR.	

FLC43XWC6V-02

Tech Bes LCD-00087

CUST.

FUJITSU LIMITED

SHEET 15／

DOCUMENT CONTROL SECTION

DATE

10-4. Correspondence between Data and Display Position

Fig.10-3 shows the Correspondence between Data and Display Position.

	S0001	S0002	S0003	S0004	S0005	S0006	S0007	S0008	------	S3071	S3072
C001	RO 0001	GO 0001	BO 0001	RE 0002	GE 0002	BE 0002	RO 0003	GO 0003		GE 1280	BE 1280
C768	RO 0001	GO 0001	BO 0001	RE 0002	GE 0002	BE 0002	RO 0003	GO 0003		GE 1280	BE 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.10-4 to prevent latch-up of the driver ICs and DC driving of the LCD panel.

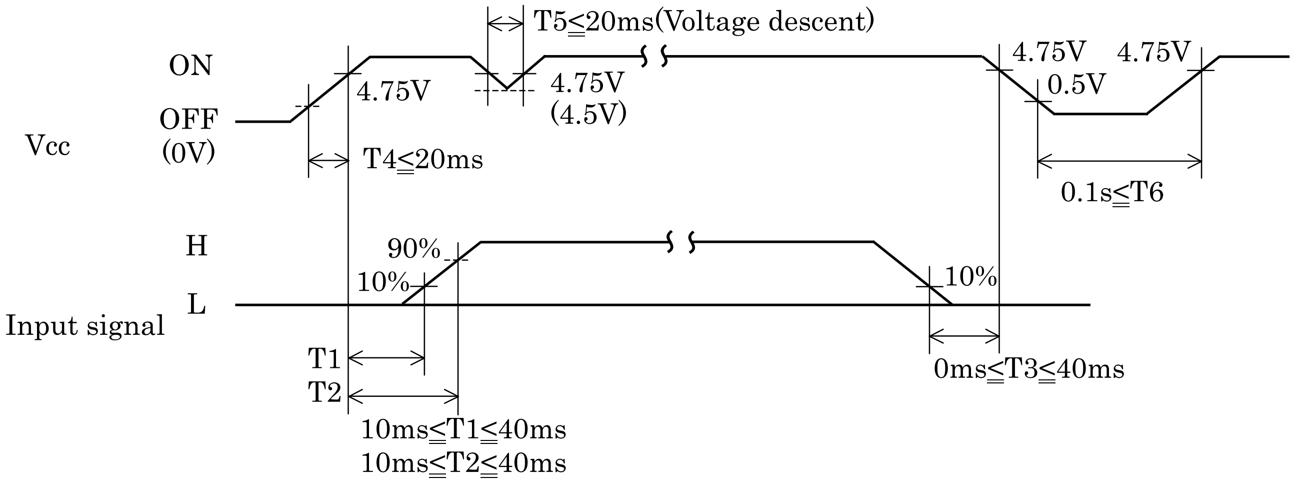

T5≦20ms(Voltage descent)
ON
OFF
(0V)
Vcc
4.75V
4.75V
(4.5V)
T4≦20ms
4.75V
4.75V
0.5V
0.1s≦T6
H
L
Input signal
90%
10%
10%
T1
T2
10ms≦T1≦40ms
10ms≦T2≦40ms
0ms≦T3≦40ms

Fig.10-5. Power Supply Sequence

11. BACKLIGHT SPECIFICATIONS

11-1. Pin Configuration for Backlight

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

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

Pin №	Signal	Function
1	V_L1	Power supply for CCFL 1
2	V_L2	Power supply for CCFL 2
3	NC	——
4	GND	Ground (for V_L1, 2)

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

Pin №	Signal	Function
1	V_L3	Power supply for CCFL 3
2	V_L4	Power supply for CCFL 4
3	NC	——
4	GND	Ground (for V_L3, 4)

Cable color (CN-A and B) : White at GND, Pink at V_L1,2,3 and 4

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

① Ambient temperature : 25±5°C

② Tube current(I_L) : (10.5mA or less)

(2) Definition of life

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

② The lamp cannot be lit by the breakdown voltage of 1600Vvms.

③ 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

12. APPEARANCE SPECIFICATIONS

12-1. Zone

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

12-2. Bright spots

(1) Bright spots by the defect of TFT.

- Visible under bias of 2% ND filter .... High bright spot R・G
- Visible under 5% but invisible under 2% ND filter ..... Low bright spot R・G・B
- Invisible under bias of 5% ND filter .... Not counted

(2) Bright spots by the light passing through tears, breaks, etc in color filter.

- Exceed size of a half dot .... High bright spot
- A half dot or less .... Not counted

(3) Bright spots by the light passing through tears, breaks, etc in chromium mask.

- Exceed 50µm .... High bright spot
- 50µm or less .... Not counted

12-3. Test condition

- Inspector must observe the LCD screen from the normal direction under the illumination by a single 20W fluorescent lamp. The distance between the LCD screen and the inspector should be a height of 50cm above the worktable.
  The vertical illuminance is 300 to 600lux (reference value).
- Bright spot should be counted under entire black screen.
- Dark spot should be counted under entire white screen.
- Frame frequency should be 60Hz.

12-4. Specifications

Table 12-4 shows the appearance standard.

(Note1) Please do not mistake a single bright spot for a bright spot connection due to Cs(supplemental capacitance) line at the center of each dot.

(Note2) If a pixel is dark partially, it connects into the number of dark spots in accordance with following rule.

(a) $S<1/3$: Not count. Only one of 4 dark connection is allowed.
(b) $1/3 \leqq S<2/3$: Considered as 0.5 dot.
(C) $2/3 \leqq S$: Considered as 1 dot.
(S=Dark spot size/dot size)

Table 12-4. Appearance specifications

No.	Item		Judgment method and standard	
1	Bright spot (high and Low)		≦10 dots (Note 1)	
2	Bright spot connection (high and low)		≦2 pair (Note 1) (2 dot connection in horizontal)	
3	Total of bright spot		≦7 dots	
4	Dark spot		≦12 dots (Note 2)	
5	Dark spot connection		≦5 pairs (Note 2) (2 dot connection in horizontal)	
6	Total of dark spot		≦12 dots (Note 2)	
7	Total of dot defect (bright and dark)		≦ 12 dots	
8	Distance of bright spot	high-hgh	≧10mm	
		others	≧ 3mm	
9	Distance of dark spot		≧ 3mm	
10	Scratch on polarizer, line shape		0.3<W≦0.5, L≦0.5	≦5
			0.5<W	0
			W<0.3	Ignore
11	Dent on polarizer, dot shape		D<0.5	≦6
12	Nick on polarizer, line shape		L<10.0	≦6
13	Black spot (Foreign circular matter)		D<0.5	≦5
			0.5≦D≦0.6	≦1
			0.6<D≦1.0	≦1
	White spot (Foreign circular matter)		D<0.5	≦5
			0.5≦D≦0.8	≦1
			0.8<D≦1.0	≦1
14	Lints, black line		W≦0.1, L<3.0	≦5
	Lints, white spot		W≦0.05, 0.1<L≦0.5	≦6
			W≦0.05, 0.5<L≦1.0	≦2

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

13. ENVIRONMENTAL SPECIFICATIONS

Table 13-1 shows the environmental specifications.

Table 13-1. Environmental Specifications

Item	Condition		Remark
Temperature	Operation	0~60°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 60°C.

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

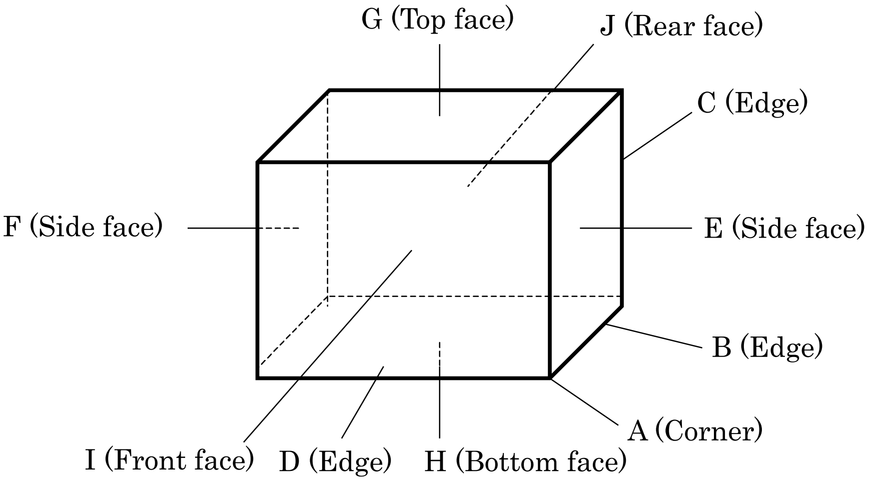


Fig.13-1. Direction to apply shock to package

14. INDICATIONS

This module has the following indications.

(1) Product name : LCD unit

(2) Model number : FLC43XWC6V-02

(3) Product drawing number: NA19020-C553

(4) Manufacturing number : 0 Y 0 0 0 0 1

- 0 0 0 0 1 — Serial number (To be reset every month on 1st.)
- Y — Manufacturing month (Oct. = X, Nov. =Y, Dec. =Z)
- 0 — Last digit of manufacturing year.

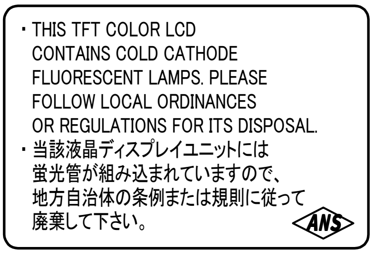
(5) Version number : 01A (Example)
-1st 2 digits “01” means operational version.
-3rd alphabet means functional version.

(6) Country of origin : MADE IN JAPAN

(7) Company name : FUJITSU LIMITED

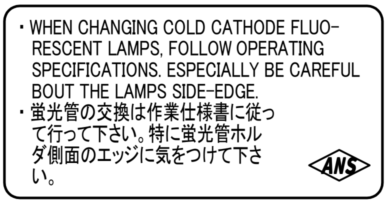
(8) Disposal method of cold-cathode tubes. (See Fig.14-1)

(9) Caution when changing cold-cathode tubes. (See Fig. 14-2)



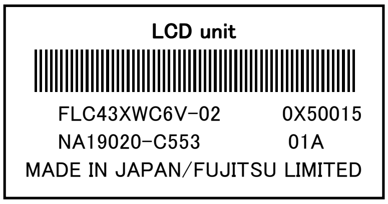
・THIS TFT COLOR LCD
CONTAINS COLD CATHODE
FLUORESCENT LAMPS. PLEASE
FOLLOW LOCAL ORDINANCES
OR REGULATIONS FOR ITS DISPOSAL.
・当該液晶ディスプレイユニットには
蛍光管が組み込まれていますので、
地方自治体の条例または規則に従って
廃棄して下さい。

Fig.14-1



・WHEN CHANGING COLD CATHODE FLUO-
RESCENT LAMPS, FOLLOW OPERATING
SPECIFICATIONS. ESPECIALLY BE CAREFUL
BOUT 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。

Fig.14-2



LCD unit
FLC43XWC6V-02 0X50015
NA19020-C553 01A
MADE IN JAPAN/FUJITSU LIMITED

Fig.14-3 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.

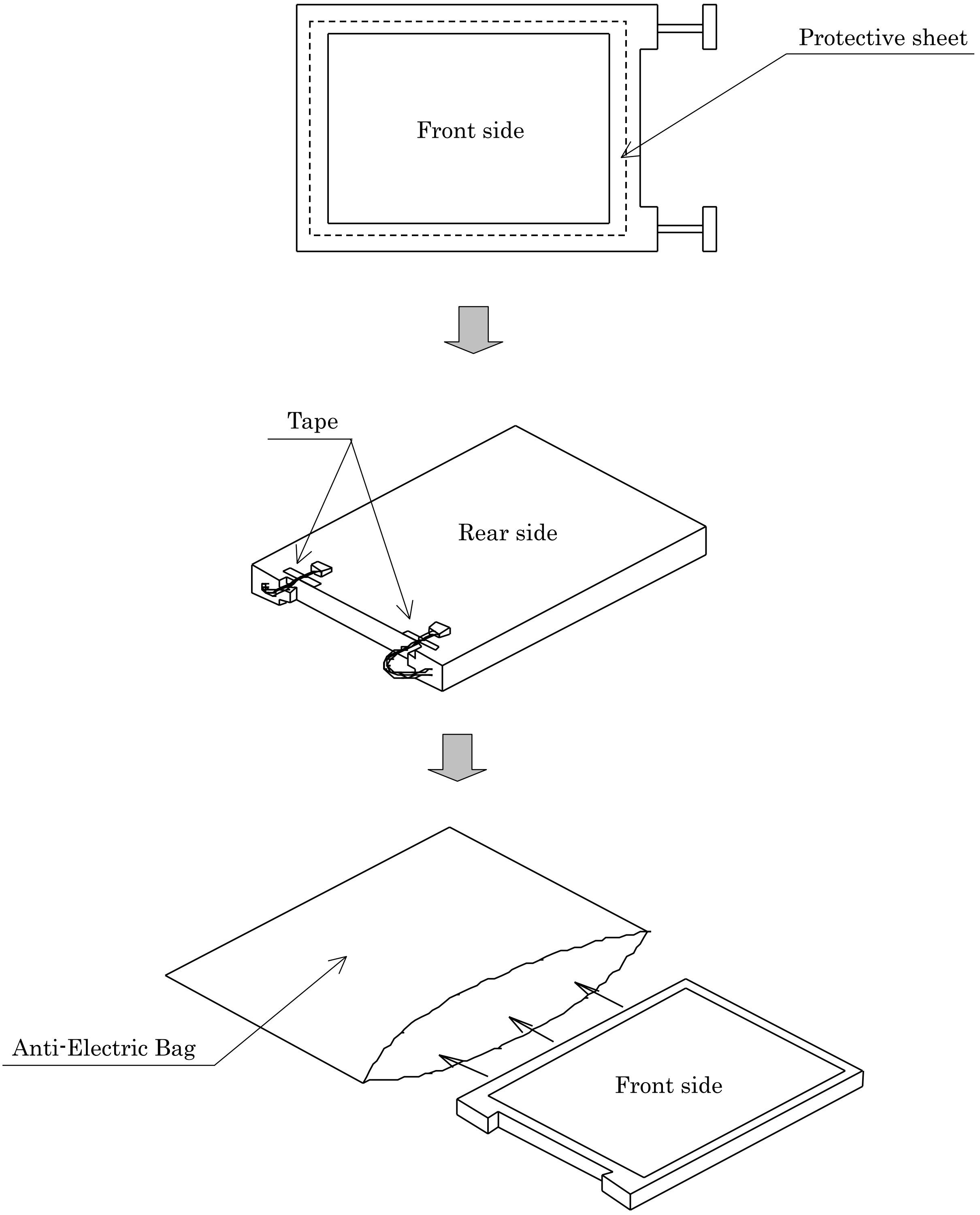
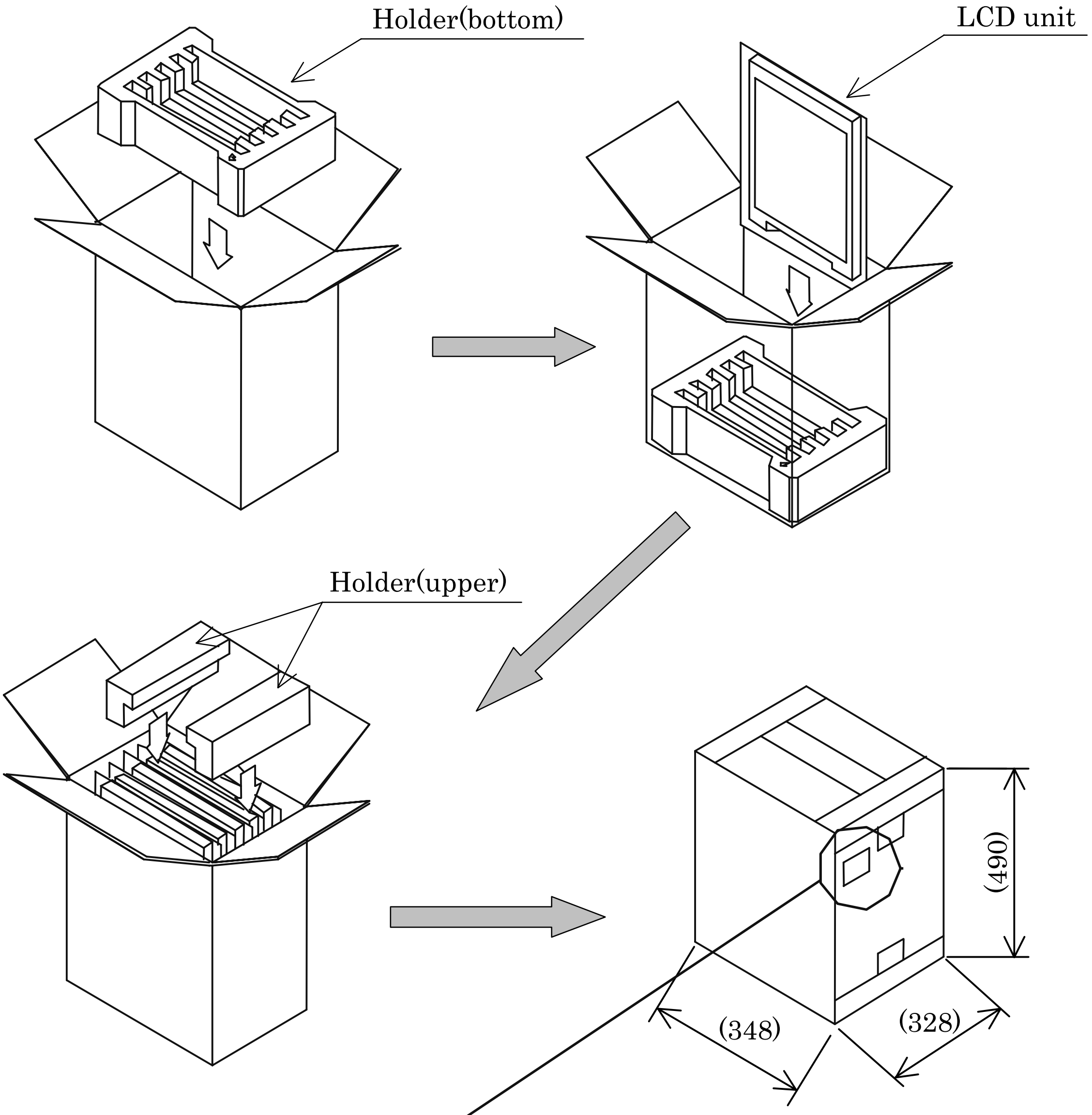

Front side
Protective sheet
Tape
Rear side
Anti-Electric Bag
Front side

Fig.15-2(a) Packaging Method



Label(example)

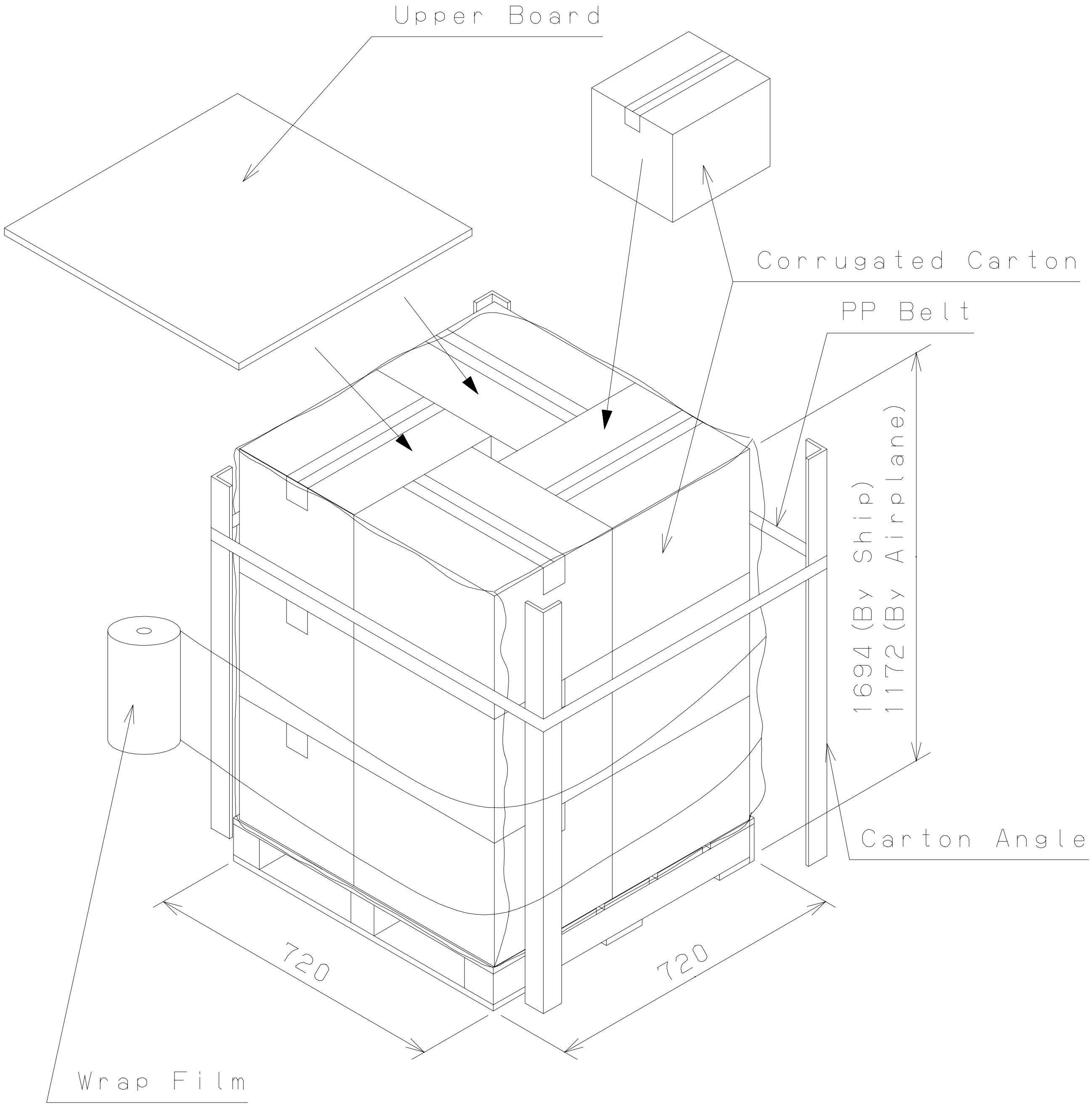
型 格 (TYPE) FLC43XWC6V-02 数 量 (QTY.) 5
図 番 NA19020-C553 版 数 01A
(DRWG. NO.) (REV. NO.)
9X00001
9X00002
9X00003
9X00004
9X00005

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

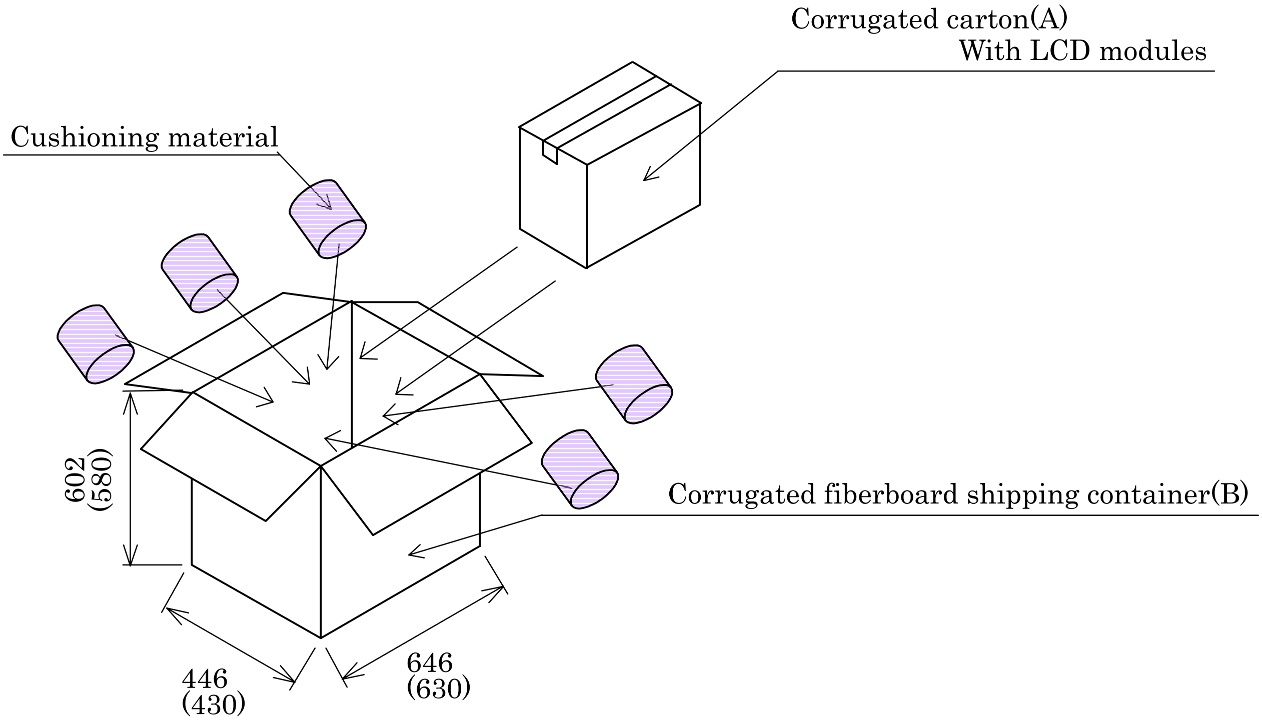

Upper Board
Corrugated Carton
PP Belt
1694 (By Ship)
1172 (By Airplane)
Carton Angle
720
720
Wrap Film

Up and Down : 3 times wrap
Middle : 2 times wrap

Note:1) 4 boxes X 3 layers (maximum 12 boxes) : by ship
4 boxes X 2 layers (maximum 8 boxes) : by airplane
Note:2) This drawing shows marine transportation specification.

Fig.15-2 (C) Packaging Method

EDIT.	DATE	DESIG.	CHECK	DESCRIPTION	TITLE FLC43XWC6V-02
DESIG.			CHECK	APPR.	DRAW. NO. Tech Bes LCD-00087
					CUST.
					SHEET 24/


Corrugated carton(A)
With LCD modules
Cushioning material
602
(580)
Corrugated fiberboard shipping container(B)
446
(430)
646
(630)

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

16.WARRANTY

The warranty period is one year after manufacturing. Products which fail during this period are repaired or replaced without charge, unless the failure is caused by user.

17.PRECAUTIONS

Adhere to the following precautions to properly use this LCD module.

(1) Fail safe design

LCD module has an inherent chance of failure. Customers must protect against injury, damage or loss from such failures by incorporating safety design measures into your facility and equipment such as redundancy, fire protection, and prevention of over-current levels and other abnormal operating conditions.

(2) Handling of LCD panel

①Do 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.

②Do 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.

③Do not scratch the polarizer film on the LCD panel surface.
・Do not press or rub the display surface with a hard tool, pincet, etc.
・For handling, use cotton or conductive gloves so that the display surface is not stained.
・For If the display surface is stained by dust or dirt, clean it as follows with a soft cloth (deer skin, etc.)

[Dust] Wipe off with a soft cloth. (do not rub.)
[Dirt] Wipe off lightly with a soft cloth after soaking in the clear water and squeezing hard out of water drops. Only if the dirt is hardly wiped off, use isopropyl alcohol or ethanol.
Be careful not to splash the water or the solvent and water penetrated between the polarizer and the LCD panel.
Do not use solvents such as ketone (acetone, etc.) and aromatics (xylene, toluene, etc.)
・If saliva or water drops are left for long time, it may deform partial deformation or discolored. Wipe off immediately in the same way as for dirt.
・Do not allow oil to adhere to the module, since the cleaning of oil is difficult.

④ 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.

(3) Handling of LCD module

①Do not pull the cold-cathode tube cable strongly.
If the cable is pulled with the loaf of 2kg or more, the cable may be damaged or reliability may decrease.

②Assemble the module into user's system in a dust free environment.
If conductive foreign matter adheres to the module, failures may occur.

③Take 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).

④Do not pull the connecting cable on the rear face of the LCD module strongly.

⑤Do not disassemble or remodel the LCD module.
If this LCD module is disassembled or remodeled, it may have some trouble, or the display quality and reliability may not be assured.

(4) Precautions for operating the LCD module

① 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.

② 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.

③ Trouble that occurs when the LCD module is used at not recommended temperature.

- Operation at high temperature(>50°C) :Display colors shift to blue.
- Storage at high temperature (>60°C) :The polarizer film deteriorates and contras 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.

④ 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.

(5) Precautions on designing module mounting

①Do not press the display surface and bottom face of the LCD module.
Display quality or reliability may be deteriorated if the installation of the LCD module is inappropriate and, as a result, excessive pressure is applied to the surface of LCD screen. Brightness uniformity or the reliability of CCFL may decrease if the pressure is applied to the backlight module.

②Consider the module mounting design, so that twisting and bending do not occur to the LCD module.
Excessive twisting and bending may damage display quality and reliability.

③The power cable length between the LCD module and inverter should not be extended.
Otherwise the backlight may not light or flickering may occur.

④Do not make the power cable of the backlight clung to a metal plate, etc.
Backlight frequency current for backlight driving may leak to the metal and desired brightness may not be assured.

⑤When Mounting LCD module with M4 screw(x4) should be screw up under 5.75kgf·cm torque.

(6) Storage method

①Do not store the LCD module in an atmosphere of organic solvent or corrosive gas.
In an organic solvent atmosphere, the polarizer film discolors and display quality deteriorates.
In a corrosive gas environment, various problems may occur.

②Store the LCD module in a Fujitsu package.
At storing, Fujitsu packages can be stacked up to 4 boxes.
The LCD module is in an anti-static bag. Keep the module in that status.

③It is recommended that the storage environment should be humidity controlled, cool and dark.

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

(7) Storage method

! ① If the LCD panel is damaged, do not inhale or allow the liquid crystal to enter the mouth
If the liquid crystal contacts the body or cloths, wash it off with soap immediately. Follow precautions for regular electronic components.

② Solder flux on the printed circuit board is harmless to the quality and reliability of LCD module.
Fujitsu is practicing non-wash technology on module assembly process.

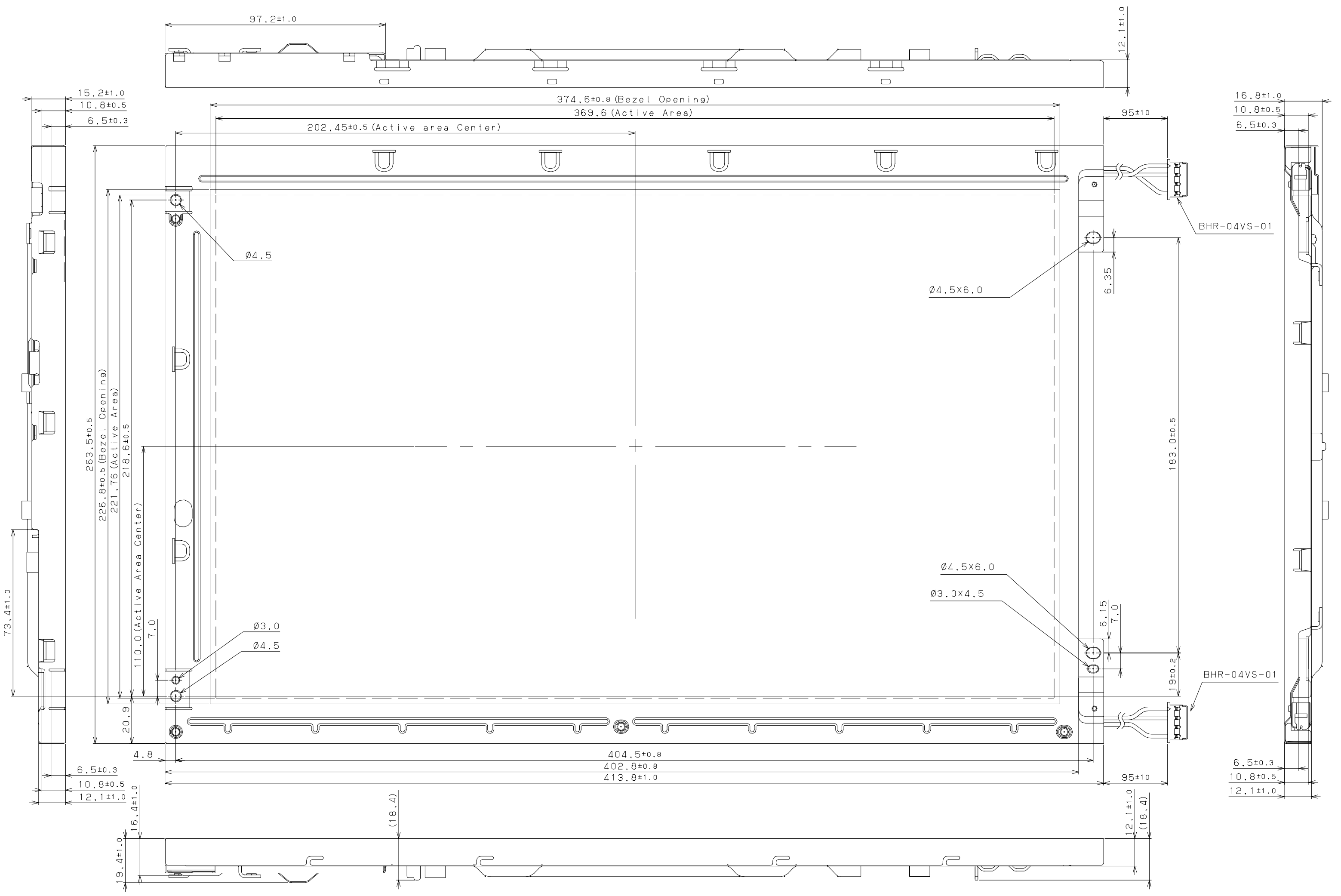
18. PRECAUTIONS FOR USE

This Product is designed, developed and manufactured as contemplated for general use, including without limitation, general office use, personal use, household use, and ordinary industrial use, but is not designed, developed and manufactured as contemplated for use accompanying fatal risks or dangers that, unless extremely high safety is secured, could lead directly to death, personal injury, severe physical damage or other loss (hereinafter "High Safety Required Use"), including without limitation, nuclear reaction control in nuclear facility, aircraft flight control, air traffic control, mass transport control, medical life support system, missile launch control in weapon system. If customer's product possibly falls under the category of High Safety Required Use, please consult with our sales representatives in charge before such use. In addition, 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.

19. MISCELLANEOUS

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

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

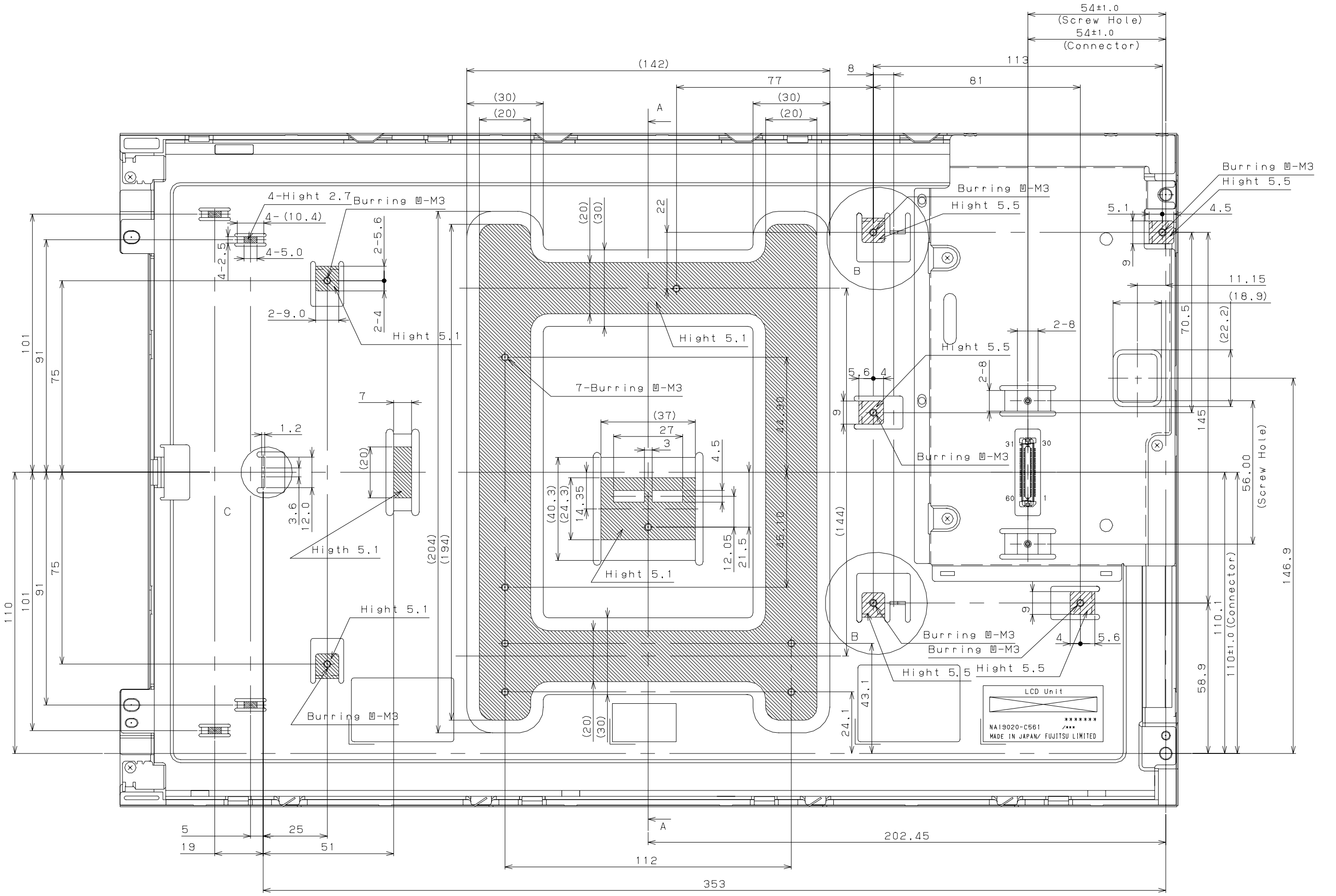

97.2±1.0
12.1±1.0
15.2±1.0
10.8±0.5
6.5±0.3
374.6±0.8 (Bezel Opening)
369.6 (Active Area)
202.45±0.5 (Active area Center)
95±10
16.8±1.0
10.8±0.5
6.5±0.3
BHR-04VS-01
Ø4.5
Ø4.5×6.0
6.35
263.5±0.5
226.8±0.5 (Bezel Opening)
221.76 (Active Area)
218.6±0.5
110.0 (Active Area Center)
183.0±0.5
73.4±1.0
7.0
Ø3.0
Ø4.5
Ø4.5×6.0
Ø3.0×4.5
6.15
7.0
19±0.2
BHR-04VS-01
20.9
4.8
404.5±0.8
402.8±0.8
413.8±1.0
95±10
6.5±0.3
10.8±0.5
12.1±1.0
6.5±0.3
10.8±0.5
12.1±1.0
16.4±1.0
(18.4)
19.4±1.0
12.1±1.0
(18.4)

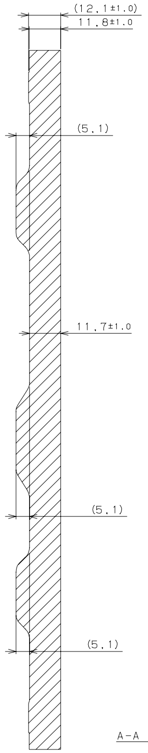
Front View

材料		処理	
名称	FLC43XWC6V-02	尺度	:
図番	Tech Bes LCD-00087	ページ	30/

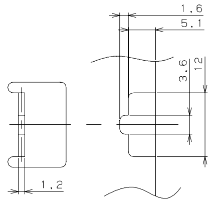
版	年月日	設計	調査	変更内容

設計　調査　承認

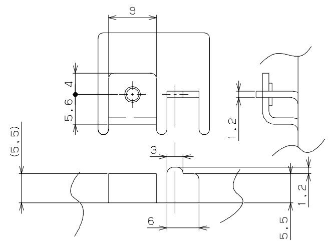

54±1.0
(Screw Hole)
54±1.0
(Connector)
(142)
113
77
8
81
(30)
(20)
A
Burring ⌀-M3
Hight 5.5
5.1
4.5
4-Hight 2.7
4-(10.4)
4-5.0
4-2.5
2-5.6
2-4
2-9.0
Hight 5.1
22
(20)
(30)
9
11.15
(18.9)
(22.2)
70.5
2-8
7-Burring ⌀-M3
(37)
27
3
4.5
44.90
45.10
(40.3)
(24.3)
14.35
12.05
21.5
1.2
3.6
12.0
(20)
7
Higth 5.1
(204)
(194)
(144)
145
56.00
(Screw Hole)
146.9
110.1
110±1.0(Connector)
58.9
43.1
24.1
101
91
75
110
C
B
5.6
4
31
30
60
1
LCD Unit
NA19020-C561
MADE IN JAPAN/ FUJITSU LIMITED
5
19
25
51
112
202.45
353


(12.1±1.0)
11.8±1.0
(5.1)
11.7±1.0
(5.1)
(5.1)

A-A Section


1.6
5.1
3.6
12
1.2

Detail C


9
4
5.6
1.2
(5.5)
3
1.2
6
5.5

Detail B

材料
処理
名称 FLC43XWC6V-02
尺度 :
図番 Tech Bes LCD-00087
版 年月日 設計 調査 変更内容
設計 調査 承認
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