To :

Specification of FUJITSU TFT-LCD module

FLC38XGC6V-06

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-00050

Issue Date : Oct. 30, 2001

Issued by : 

T. Naka
Director
LCD Design Dep.
LCD Technology Div.
LCD Group

FUJITSU LIMITED

REVISION HISTORY

Revision	Date	Prepared	Checked		Approved	Summary
01A	Sep.26,2000	M.Miyahara	M.Fukuhara		T.Naka	1st issue
~~02B~~	~~Jul.06,2001~~	M.Miyahara	M.Fukuhara	T.Minemura	T.Naka	~~Change connection method to ACF, Color Filter, and position of Gasket. Apply to NA19020-C281.~~
02B	Oct.30,2001	M.Miyahara	M.Fukuhara	T.Minemura	T.Naka	Add ACF to connection method, change Color Filter. Apply to NA19020-C281 only.

DOCUMENT CONTROL SECTION

DATE

EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION
05	20011030	Miyahara	Fukuhara	Minemura	Revised p1,31
04	20010706	Miyahara	Fukuhara	Minemura	Revised p2,8,27,29-32
03	20010109	Miyahara		Fukuhara	Revised p22,24
02	20001117	Miyahara		Fukuhara	Revised p3
DESIG.	20000926	Miyahara	CHECK		APPR. Fukuhara

FLC38XGC6V-06

Tech Bes LCD-00050

CUST.

FUJITSU LIMITED

SHEET 1 /

TABLE OF CONTENTS

DOCUMENT CONTROL SECTION

DATE

EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION
04	20010706				Add 18.,19.

DESIG. CHECK APPR.

FLC38XGC6V-06

Tech Bes LCD-00050 CUST.

FUJITSU LIMITED SHEET 2 /

1. APPLICATIONS

This specification is applied to the 15.0 in. XGA supported TFT-LCD module.

2. PRODUCT NAME AND MODEL NUMBER

2-1. Product Name : LCD Module

2-2. Model Name : FLC38XGC6V-06

② 3. OVERVIEW

This LCD module has a TFT active matrix type liquid crystal panel 1024×768 pixels, and diagonal size of 38cm (15.0-inch). This module supports 1024×768 XGA 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.
This module has the characteristics for applying TCO'99.

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.

DOCUMENT CONTROL SECTION

DATE

EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION
02	20001117				Correct 3.OVERVIEW

DESIG. CHECK APPR.

FLC38XGC6V-06

Tech Bes LCD-00050 CUST.

FUJITSU LIMITED SHEET 3 /

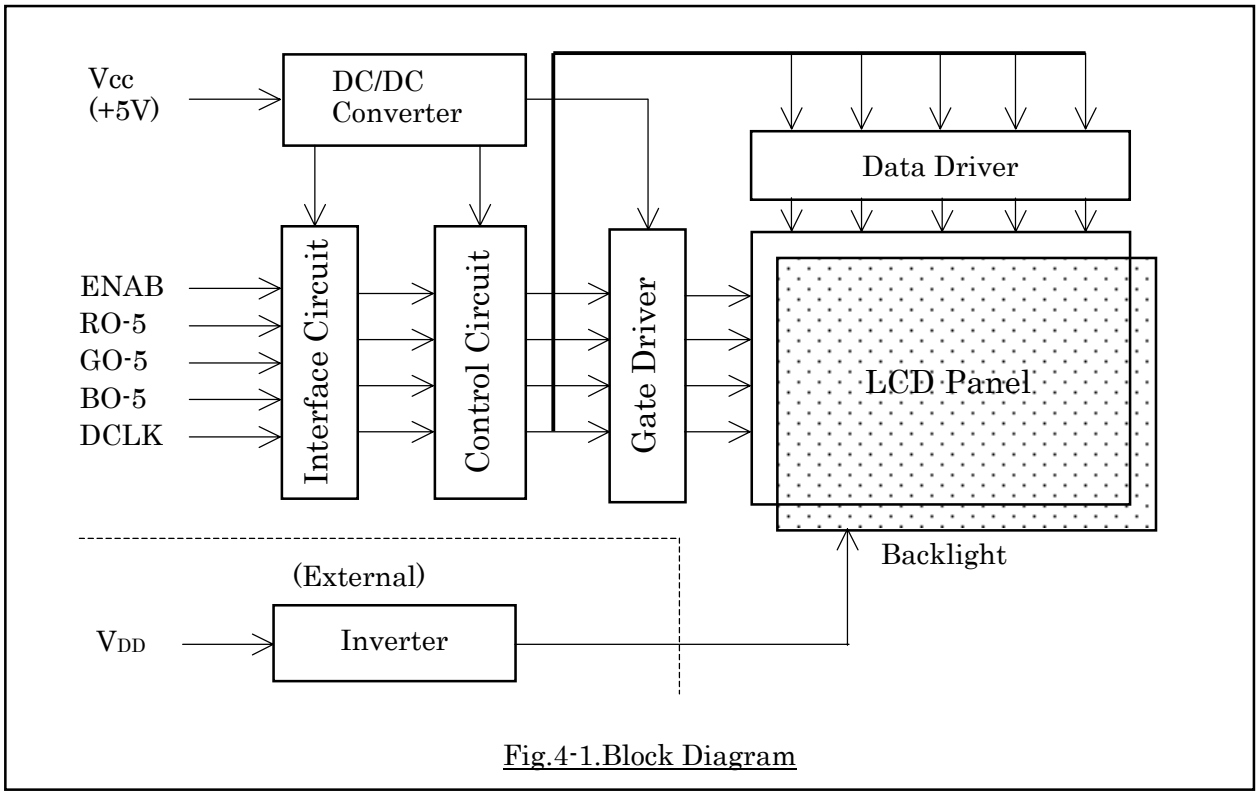


Fig.4-1.Block Diagram

5. MECHANICAL SPECIFICATIONS

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

Table 5-1. Mechanical Specifications

Item	Specifications	Unit	Remark
Dimensions	347.3×263.5×15.8(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	(1024×3) ×768	—	
Display Dot Area	304.1×228.1	mm	
Dot Pitch	(0.099×3) ×0.297	mm	
Aspect Ratio	1 : 1	—	
Weight	1,500 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=25ºC	-0.3	—	6.0	V
Input Voltage	V_{IN}	Ta=25ºC	-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	
Leak Current (Logic Input)		I_{IL}		-5	—	+5	μA	
Supply Rush Current		I_{SCC}		—	—	5.5	A	*2
Supply Rush Current Duration (1A excess)		T_{SCC}		—	—	0.4	ms	
Contrast Regulation VR		R_{VR}		0	—	100	kΩ	
BACK LIGHT	CCFL Turn on Voltage	V_S	f_L=50kHz, Ta=25ºC	—	1324	1500	Vrms	
			f_L=50kHz, Ta=0ºC	—	1324	1500		
	Lighting Voltage	V_L	f_L=50kHz I_L=7mA	550	580	610	Vrms	
	Lighting Frequency	f_L	V_L=580Vrms	40	50	60	kHz	
*4	Tube Current	I_L	f_L=50kHz V_L=580Vrms	6	7	8	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-07" 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.

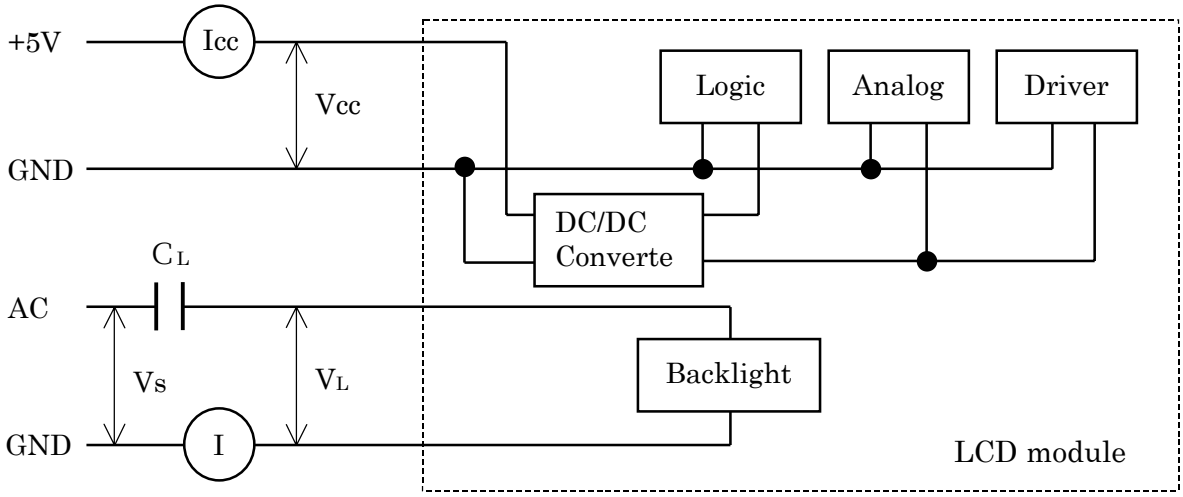
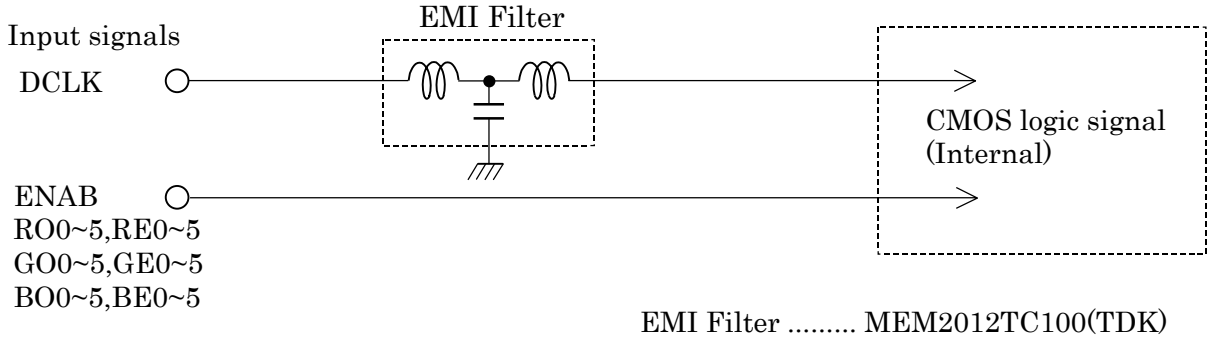


Fig.8-1. Measurement Circuit

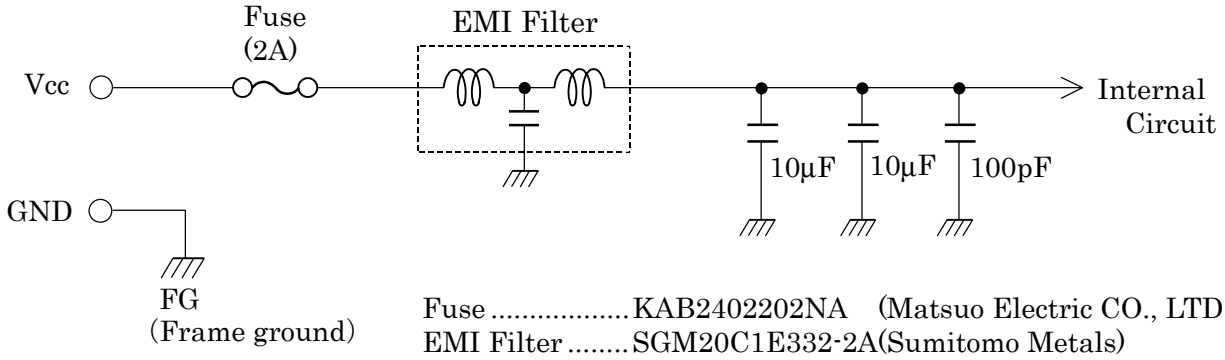
Note 2) Equivalent Circuit

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



EMI Filter ..... MEM2012TC100(TDK)

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



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

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

DOCUMENT CONTROL SECTION

DATE

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

FLC38XGC6V-06

Tech Bes LCD-00050 CUST.

FUJITSU LIMITED SHEET 7 /

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 MIN.	Specifications TYP.	Specifications MAX	Unit	Remark	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=7mA (at maximum brightness)		200	250	—	cd/m²	White *1	(1)(5)
Brightness Uniformity		ΔI			80	—	—	%		(1)(5)(7)
Chromaticity	W	X			0.283	0.313	0.343	—		(1)(5)
		Y			0.299	0.329	0.359	—		
	R	(x, y)		Red	④ (0.646, 0.350) TYP.					
	G			Green	④ (0.310, 0.593) TYP.					
	B			White	④ (0.153, 0.152) TYP.					
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%, 2H)					

(*1) Value at 15~20 minutes after lighting on.

(Note) ・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).

DOCUMENT CONTROL SECTION

DATE

EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION
04	20010706				Revised chromaticity of R, G, B

DESIG. CHECK APPR.

FLC38XGC6V-06

Tech Bes LCD-00050 CUST.

FUJITSU LIMITED SHEET 8 /

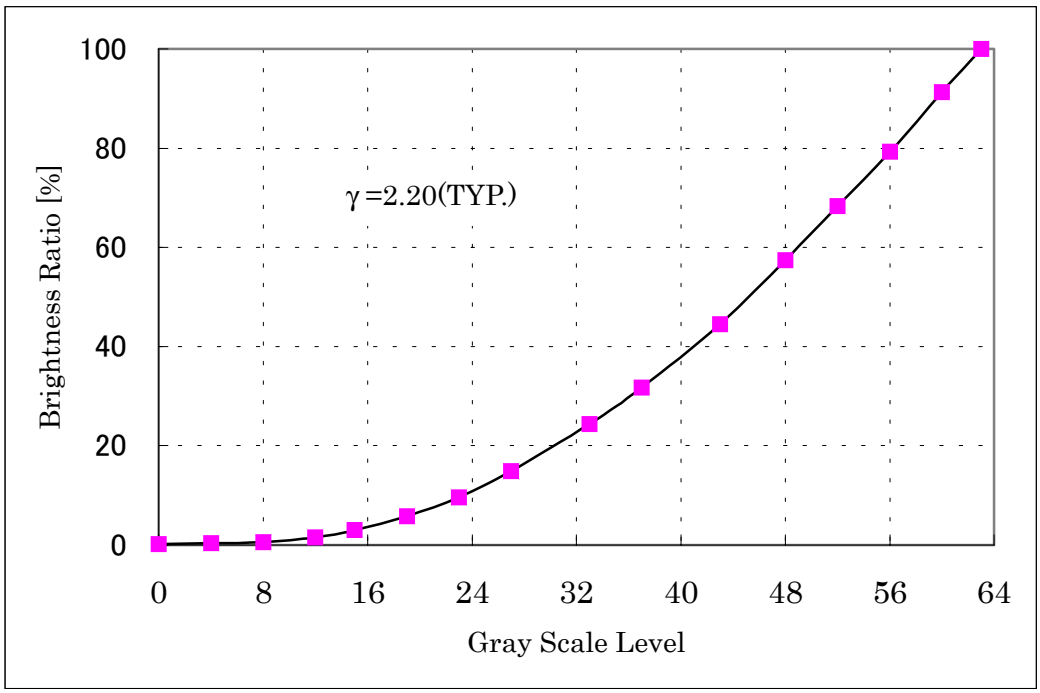


Fig.9-1. γ -Curve (Reference Value)

Note 1) Definition of Viewing Angle (1)

Based on Fig.9-2.

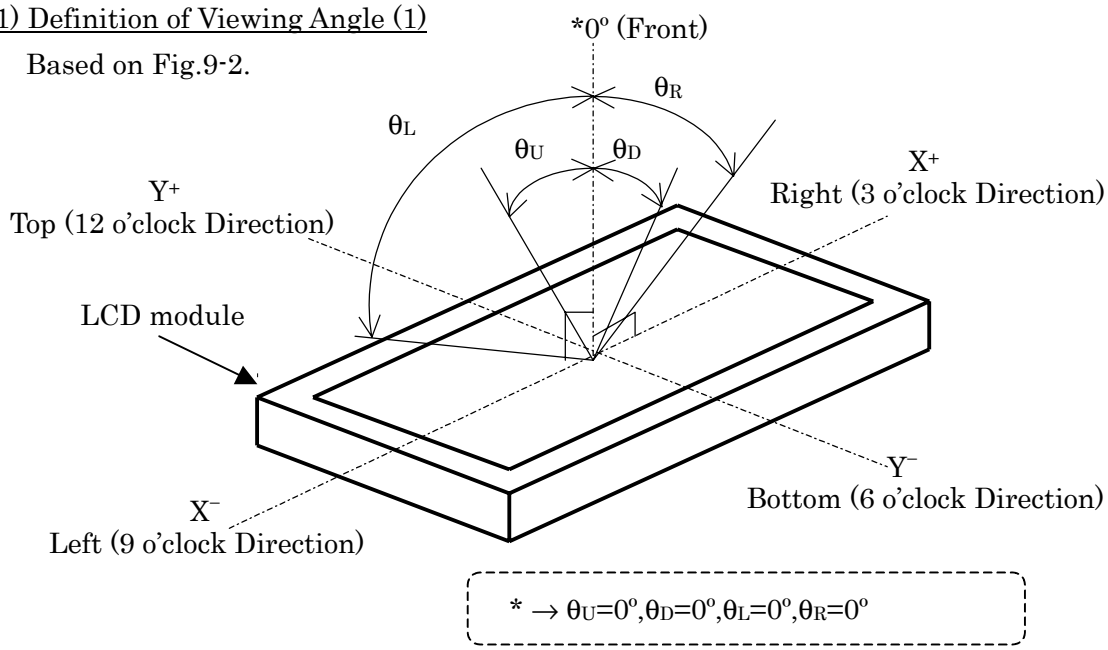


Fig.9-2. Definition of Viewing Angle (1)

Note 2) Definition of Viewing Angle (2)

Based on Fig.9-3.

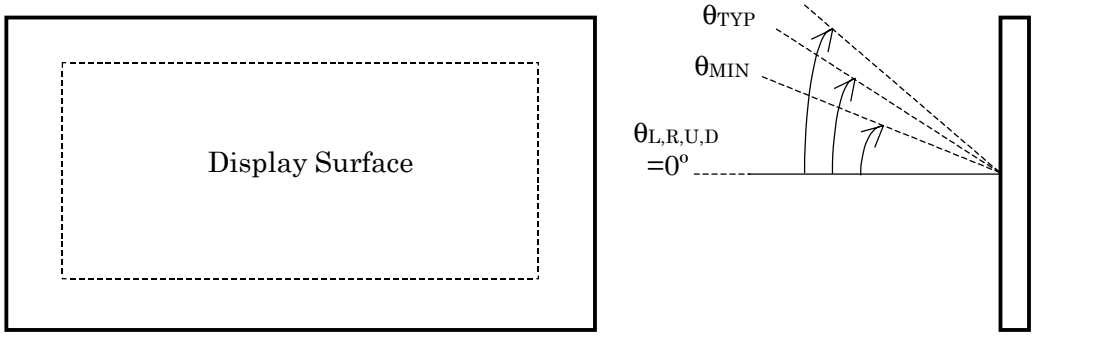


Fig.9-3. Definition of Viewing Angle (2)

Note 3) Definition of Contrast Ratio (CR)

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

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

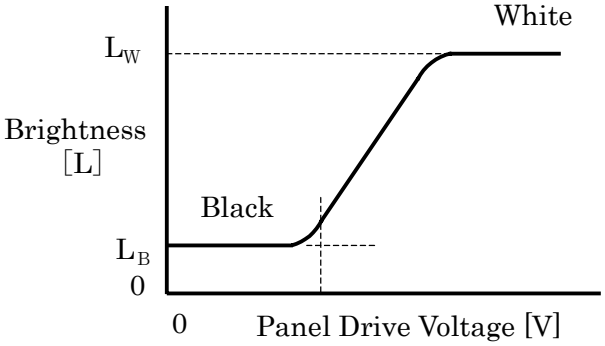


Fig.9-4. Voltage-Brightness Characteristics

DOCUMENT CONTROL SECTION

DATE

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

FLC38XGC6V-06

Tech Bes LCD-00050

CUST.

FUJITSU LIMITED

SHEET 10/

Note 4) Definition of Response Time

Based on Fig.9-5.

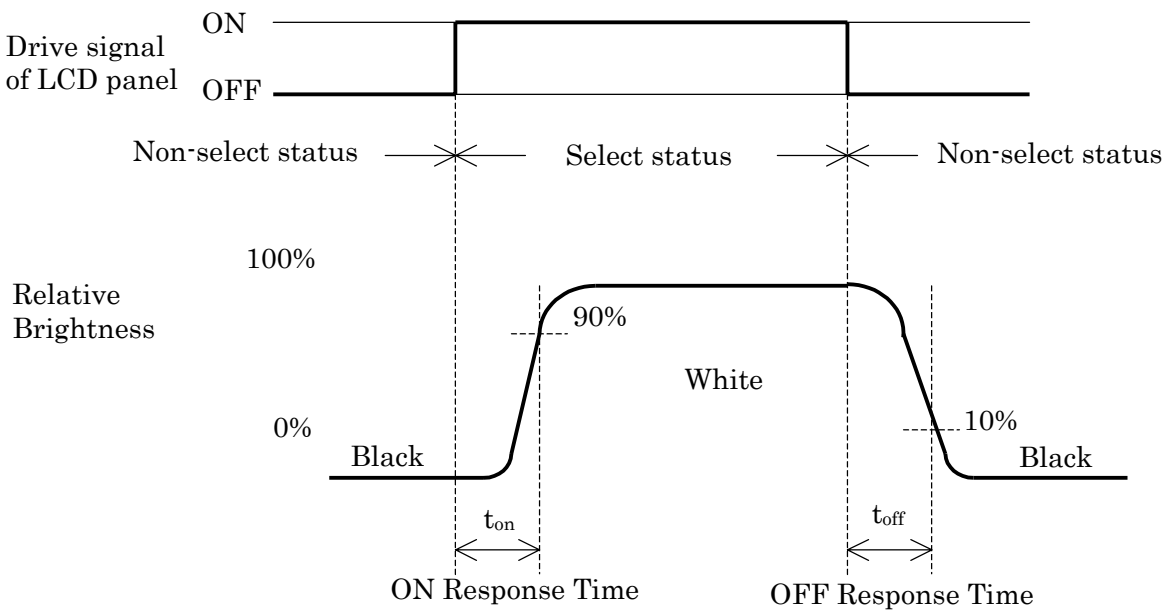


Fig.9-5. Definition of Response Time

Note 5) Contrast Ratio and Response Measurement System

Based on Fig.9-6.

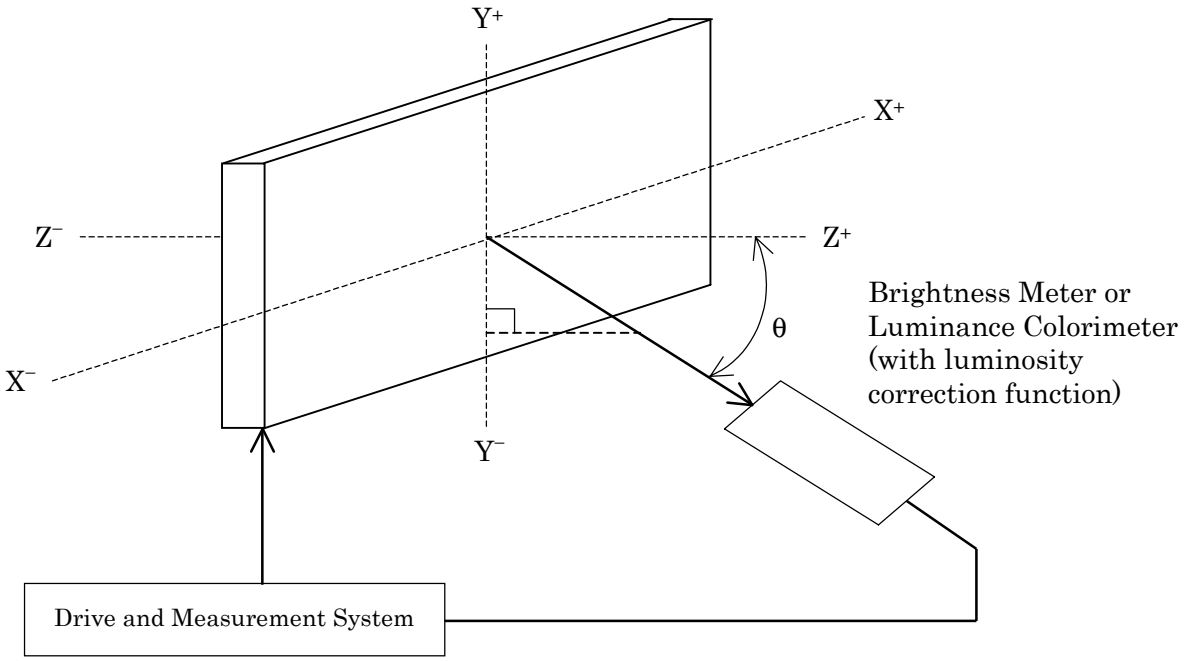


Fig.9-6. Contrast Ratio and Response Time Measurement System

Note 6) Definition of Optimum Viewing Angle

Based on Fig.9-7.

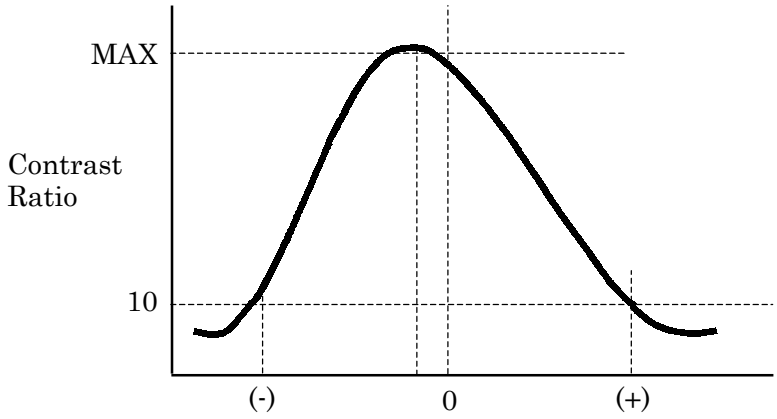


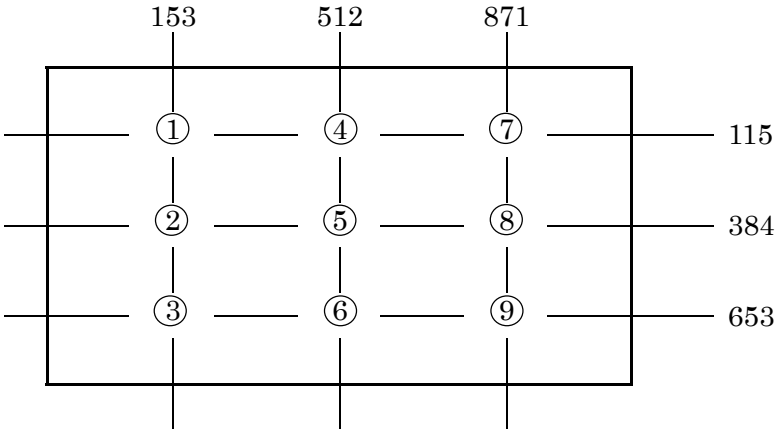
Fig.9-7. Definition of Viewing Angle

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

DOCUMENT CONTROL SECTION

DATE

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

FLC38XGC6V-06

Tech Bes LCD-00050

CUST.

FUJITSU LIMITED

10. INTERFACE SPECIFICATIONS

10-1. Signal descriptions

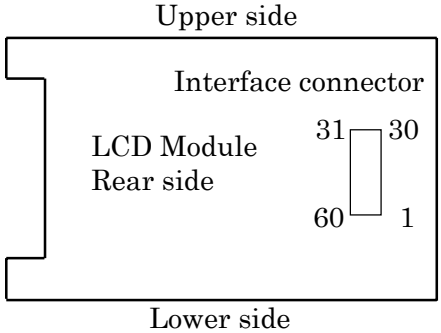
Table 10-1 shows the description and configuration of Interface signals (CN1).

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	PULL	I	(*2)
15	GND	—	Ground	45	PULL	I	(*2)
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	N.C.	—	—
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.

(*2).Connect it to GND for the protection of internal circuit.



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

DOCUMENT CONTROL SECTION

DATE

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

FLC38XGC6V-06

Tech Bes LCD-00050

CUST.

FUJITSU LIMITED

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	G00 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=0~50ºC, Vcc=5±0.25V)

Item			Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK signal (Clock)		Period	Tc	25.000	30.764	40.000	ns	
		Frequency	fc	25.000	32.505	40.000	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	40MHz
		Hold time	Thold	6.5	—	—	ns	40MHz
Data-ENAB timing	Horizontal	Period	Th	565	672	1566	DCLK	fh=1/Th
		Frequency	fh	38.6	48	60	kHz	
		Display period	Thd	—	512	—	DCLK	*2,3
	Vertical	Period	Tv	772	806	868	Th	16.67ms
		Frequency	fv	50	60	75	Hz	
		Display period	Tvd	—	768	—	Th	*2,3
	Data-ENAB timing		—	—	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 512 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.

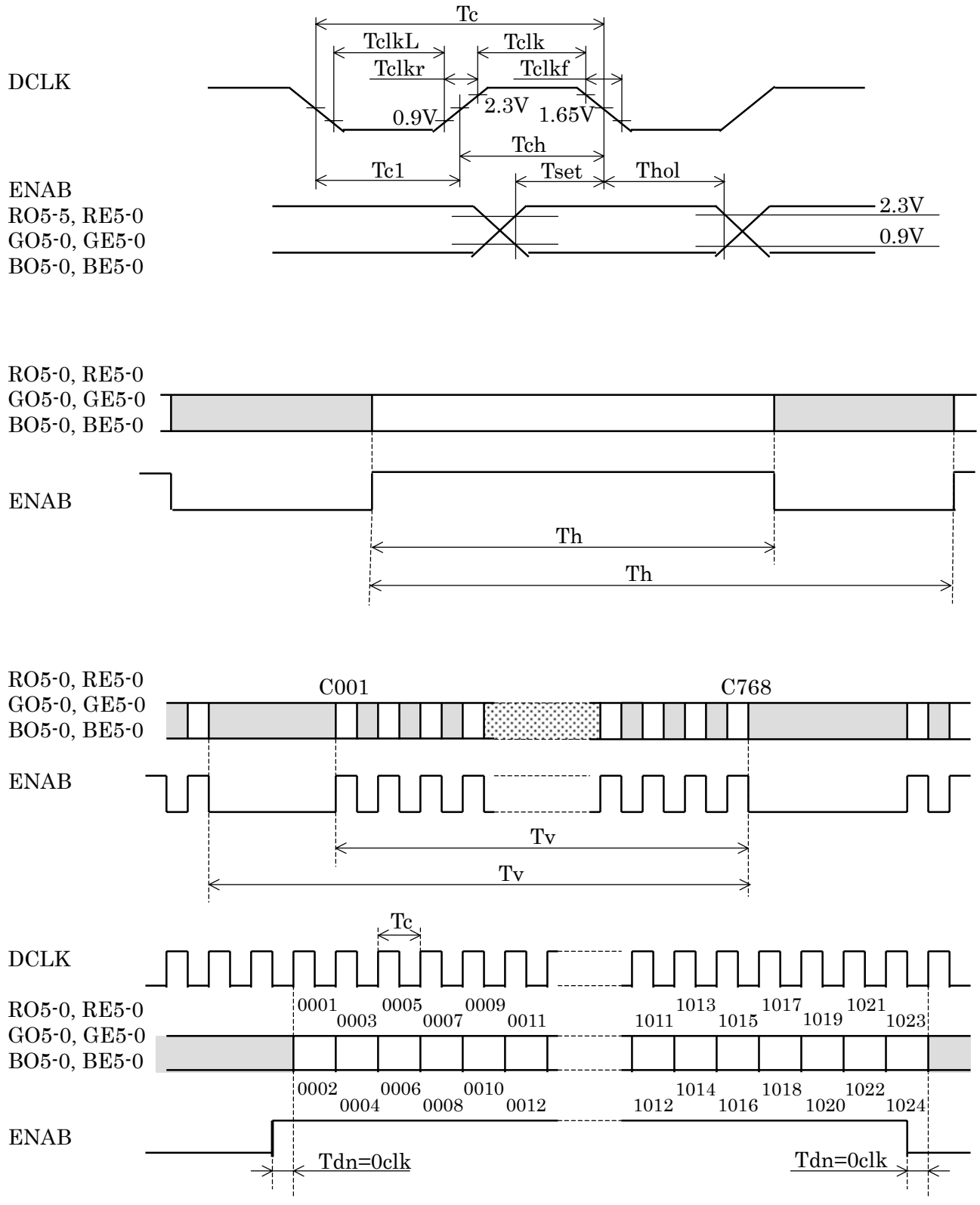


Fig.10-3.Input Signal Timing Chart

DOCUMENT CONTROL SECTION

DATE

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

FLC38XGC6V-06

Tech Bes LCD-00050

CUST.

FUJITSU LIMITED

SHEET 16/

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 1024	BE 1024
C768	RO 0001	GO 0001	BO 0001	RE 0002	GE 0002	BE 0002	RO 0003	GO 0003		GE 1024	BE 1024

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.

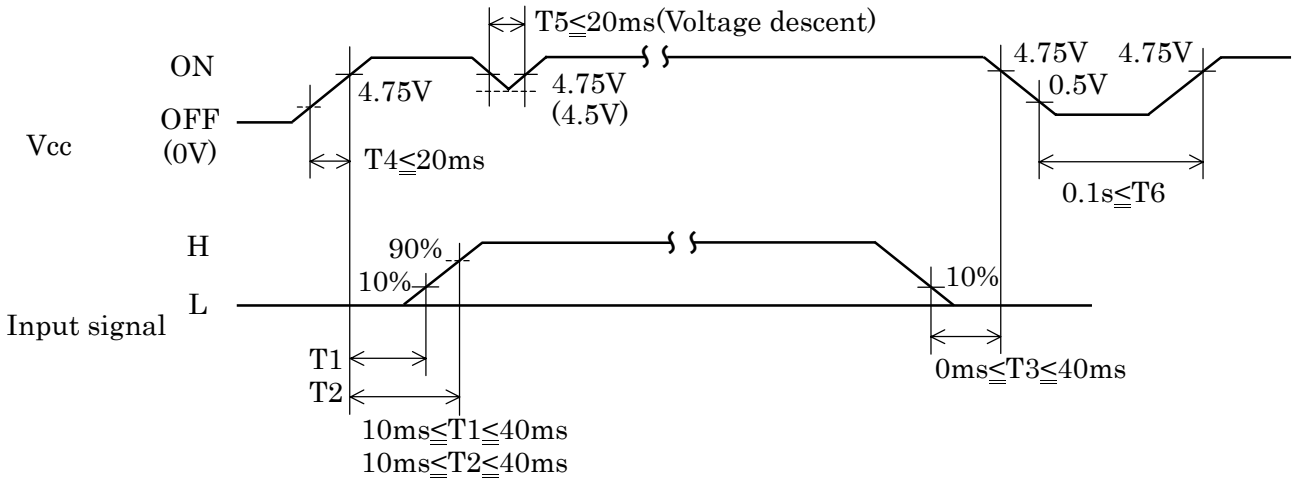


Fig.10-5. Power Supply Sequence

DOCUMENT CONTROL SECTION

DATE

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

FLC38XGC6V-06

Tech Bes LCD-00050

CUST.

FUJITSU LIMITED

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. KFN8319F315296Z

11-3. Life

The life of the backlight is a minimum of 50,000 hours at the following conditions.

(1) Working conditions
① Ambient temperature : 25±5°C
② Tube current(I_L) : (7mA 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 1500Vvms.
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-16S (for upper and lower)

12. APPEARANCE SPECIFICATIONS

12-1. Zone

- Inside display dot area (304.1× 228.1mm)
- 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)		≦3 dots (Note 1)		
2	Bright spot connection (high and low)		≦1 pair (Note 1) (2 dot connection in horizontal only)		
3	Total of bright spot		≦3 dots		
4	Dark spot		≦6 dots (Note 2)		
5	Dark spot connection		≦3 pairs (Note 2) (2 dot connection in horizontal only)		
6	Total of dark spot		≦6 dots (Note 2)		
7	Total of dot defect (bright and dark)		≦ 6 dots		
8	Distance of bright spot	high-hgh	≧15mm		
		others	≧ 5mm		
9	Distance of dark spot		≧ 5mm		
10	Scratch on polarizer, line shape		W≦0.03	————	Ignore
			0.03<W≦0.05	L≦6	Ignore
				6<L≦12	≦3
				12<L	0
			0.05<W≦0.15	L≦0.6	Ignore
				0.6<L≦5	≦2
				5<L	0
			0.15<W≦0.3	W×L≦0.4	≦1
				0.4<W×L	0
			0.3<W	————	0
11	Dent on polarizer, dot shape		D≦0.2		Ignore
			0.2<D≦0.4		≦4
			0.4<D		0
12	Bubble in polarizer		D≦0.4		≦4
			0.4<D		0
13	Black white spot (Foreign circular matter)		D≦0.5		≦4
			0.5<D		0
14	Light leakage by foreign articles		S<1/3	1dot	Ignore
				Consecutive 2~3 dots	≦3
				Consecutive 4~5 dots	≦2
				Consecutive 6 dots	0
			1/3≦S<2/3		Dot defect +0.5
			2/3≦S		Dot defect +1
15	Lints, black/white line		W≦0.03	————	Ignore
			0.03<W≦0.05	L≦6	Ignore
				6<L≦12	≦3
				12<L	0
			0.05<W≦0.1	L≦0.6	Ignore
				0.6<L≦5	≦2
				5<L	0
			0.1<W	(W+L)/2=D	Conform to No.13

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

DOCUMENT CONTROL SECTION

DATE

EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION

DESIG. CHECK APPR.

FLC38XGC6V-06

Tech Bes LCD-00050

CUST.

FUJITSU LIMITED

13. ENVIRONMENTAL SPECIFICATIONS

Table 13-1 shows the environmental specifications.

Table 13-1. Environmental Specifications

Item	Condition		Remark
Temperature	Operation	0~50ºC	Temperature on surface of LCD panel (display area.)
	Storage	-20~60ºC	
Humidity	Operation	20~85%RH	Maximum wet-bulb temperature should not exceed 29ºC. 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.
Shock	Non-operation	50G, 6ms, 1time each ±X, ±Y and ±Z directions.	

NOTE: 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

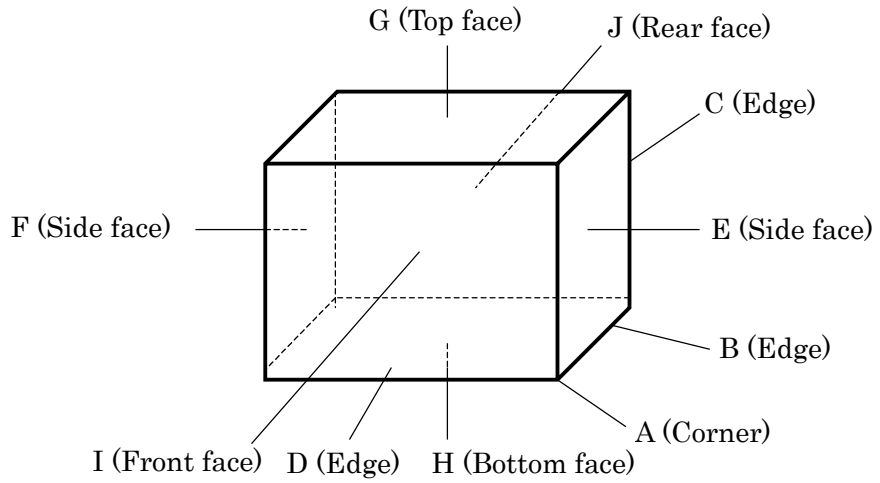


Fig.13-1. Direction to apply shock to package

14. INDICATIONS

This module has the following indications.

(1) Product name : LCD unit

(2) Model number : FLC38XGC6V-06

(3) Product drawing number: NA19020-C281 or NA19020-C291

(4) Manufacturing number : 8 Y 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.

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

(6) Country of origin : MADE IN JAPAN (NA19020-C281)
MADE IN TAIWAN(NA19020-C291)

(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)

Fig.14-1

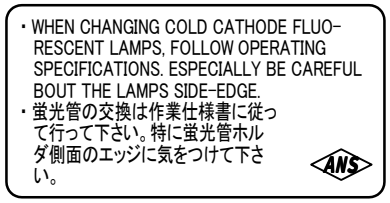


Fig.14-2

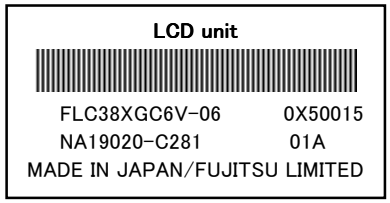


Fig.14-3 Product label (example)

15. PACKAGING

Separately specified in packaging specifications.

15-1. Packaging specifications

(1) 5 LCD modules / 1 package.

(2) Weight: approximately 10kg / 1 package.

(3) Outline dimensions : 353mm (W)×268mm (D) ×462mm (H)

15-2. Packaging method

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

DOCUMENT CONTROL SECTION

DATE

EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION
03	20010109				Correct 15-1(3)

DESIG. CHECK APPR.

FLC38XGC6V-06

Tech Bes LCD-00050 CUST.

FUJITSU LIMITED SHEET 22/

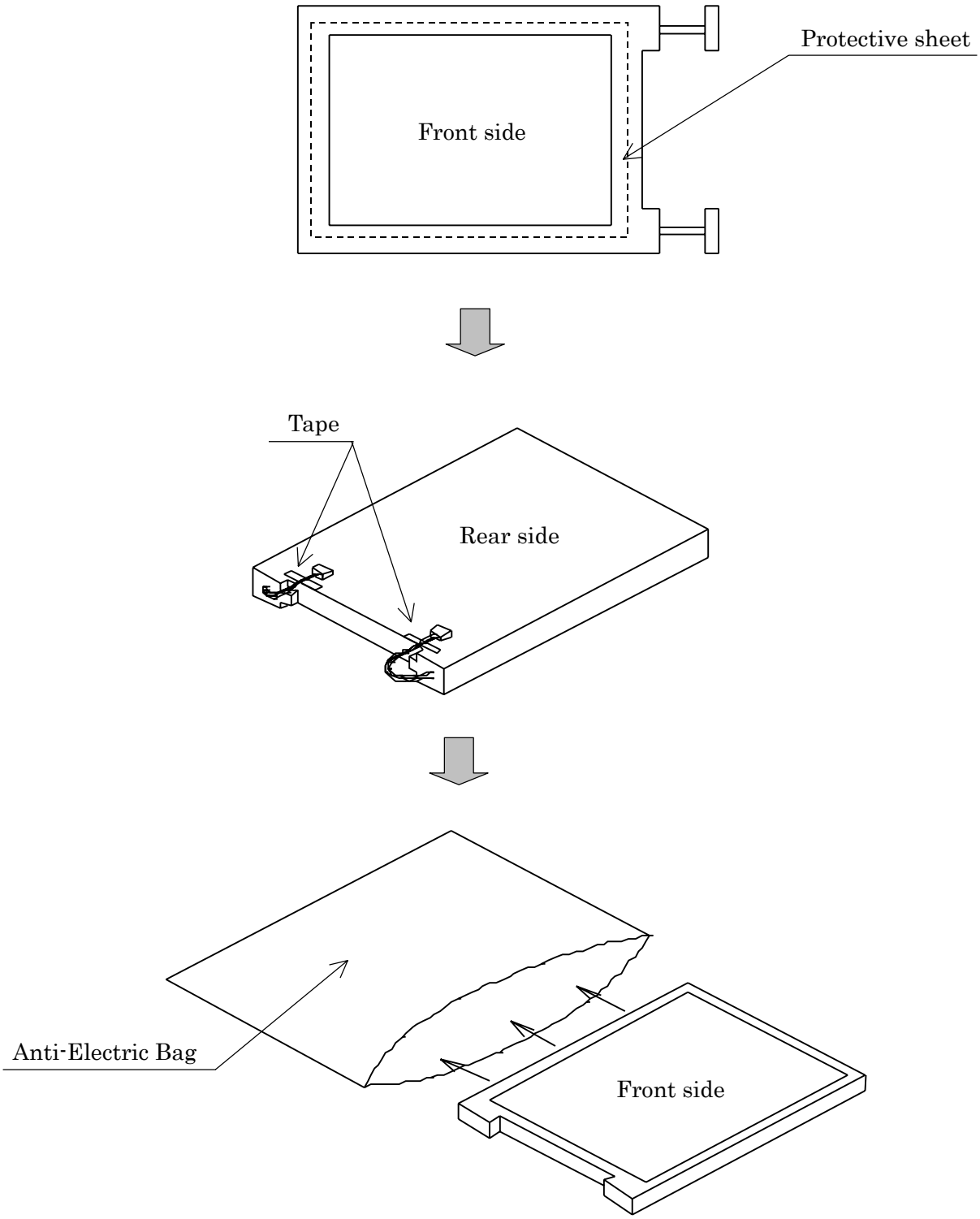
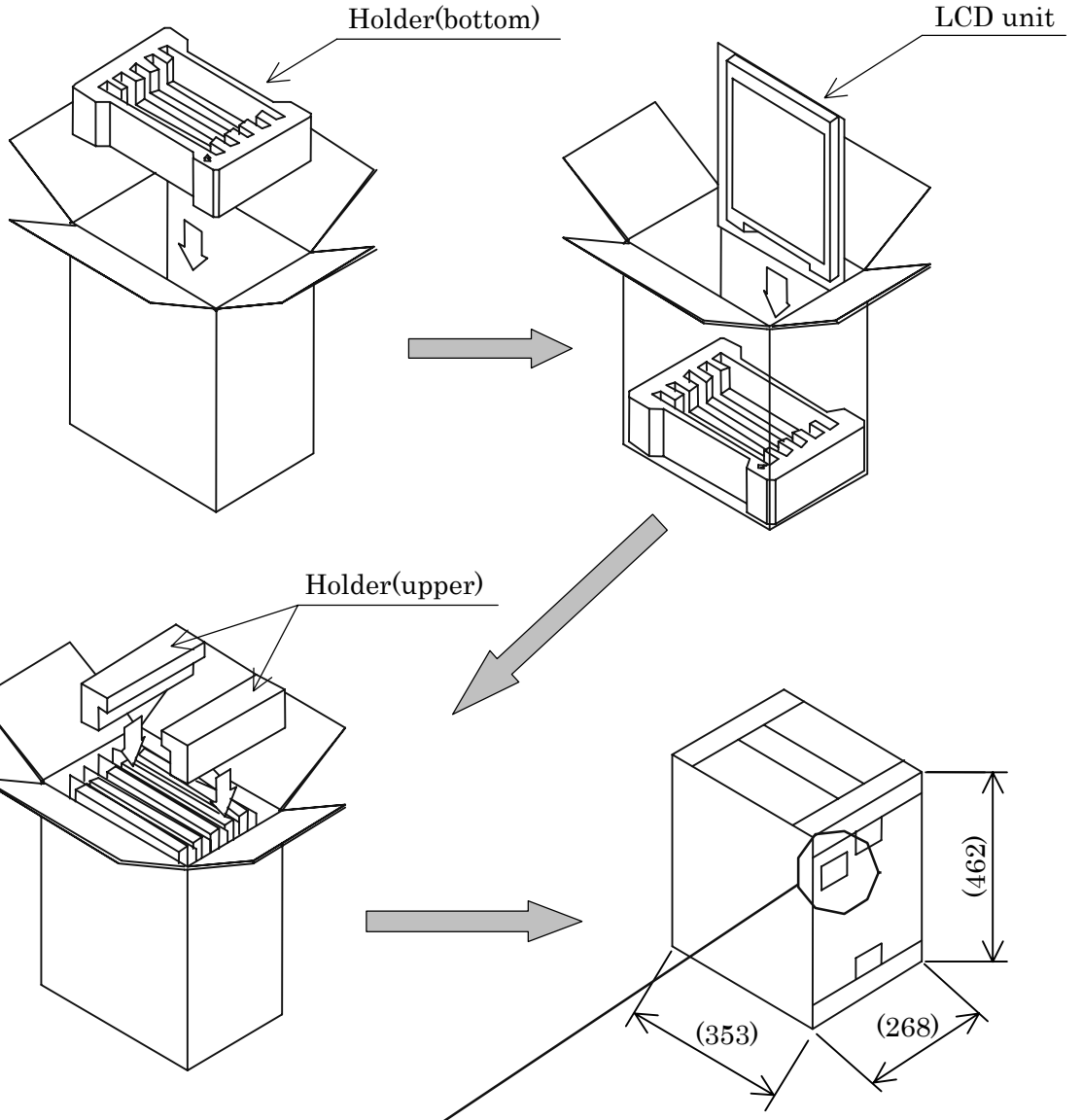


Fig.15-2(a) Packaging Method



Label(example)

型 格 (TYPE)	FLC38XGC6V-06	数 量 (QTY.)	5
図 番 (DRWG. NO.)	NA19020-C281	版 数 (REV. NO.)	01A

9X00001
9X00002
9X00003
9X00004
9X00005

バーコード

MADE IN JAPAN

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

Fig.15-2(b) Packaging Method

DOCUMENT CONTROL SECTION

DATE

EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION
03	20010109				Correct package size

DESIG. CHECK APPR.

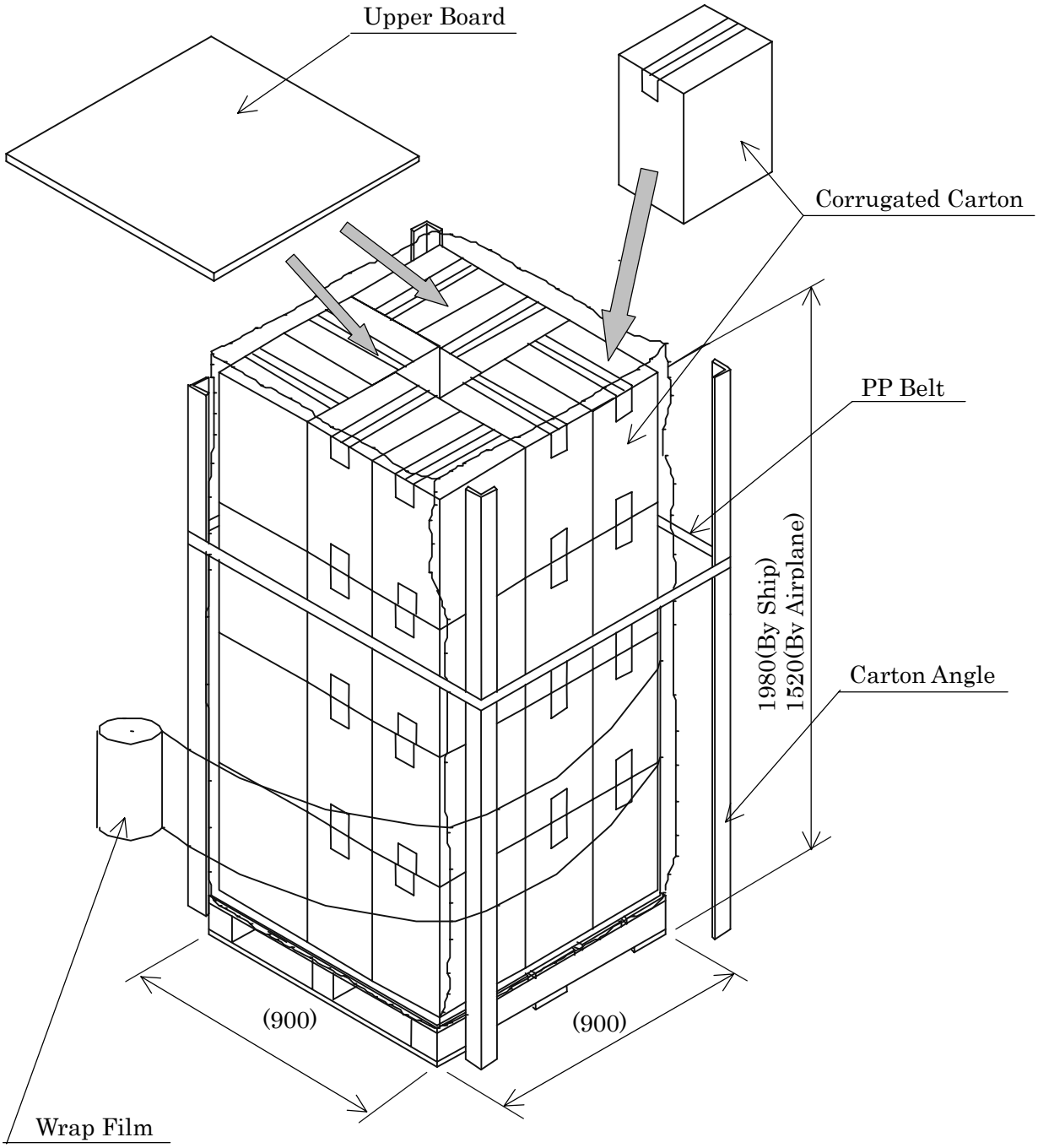
FLC38XGC6V-06

Tech Bes LCD-00050

CUST.

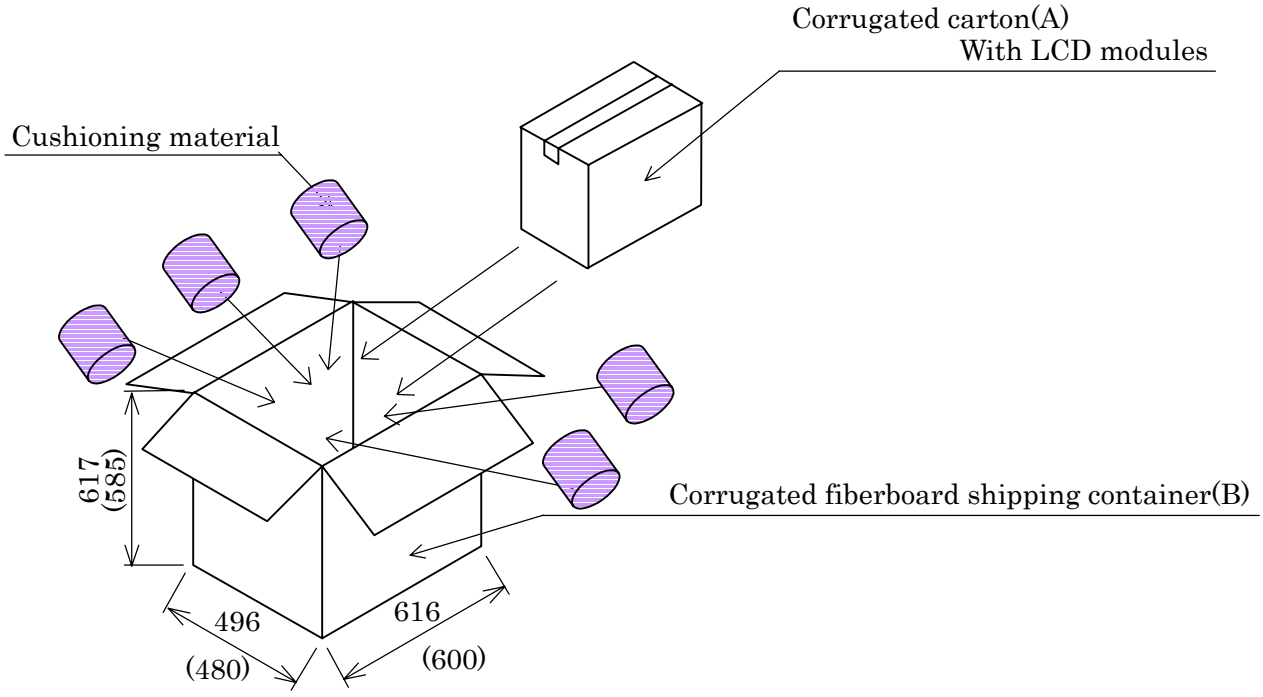
FUJITSU LIMITED

SHEET 24/



Note:1) 8 boxes×4 layers (maximum 32 boxes) : by ship
8 boxes×3 layers (maximum 24 boxes) : by airplane
Note:2) This drawing shows marine transportation specification.

Fig.15-2(c) Packaging Method



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

Note 2) The figures in ( ) show inside measurements of the container(B).

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.

④ **(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(>50ºC) :Display colors shift to blue.
- Storage at high temperature(>60ºC) :The polarizer film deteriorates and contras decreases.
- Operation at low temperature(<0ºC) :The response speed decreases considerably.
- Storage at low temperature (<-20ºC) :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.

DOCUMENT CONTROL SECTION

DATE

EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION

DESIG. CHECK APPR.

FLC38XGC6V-06

Tech Bes LCD-00050 CUST.

FUJITSU LIMITED SHEET 28/

(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 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 : 10~35ºC
- 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.

④ **(7) Others**

! ①If 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.

②Solder 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.

DOCUMENT CONTROL SECTION

DATE

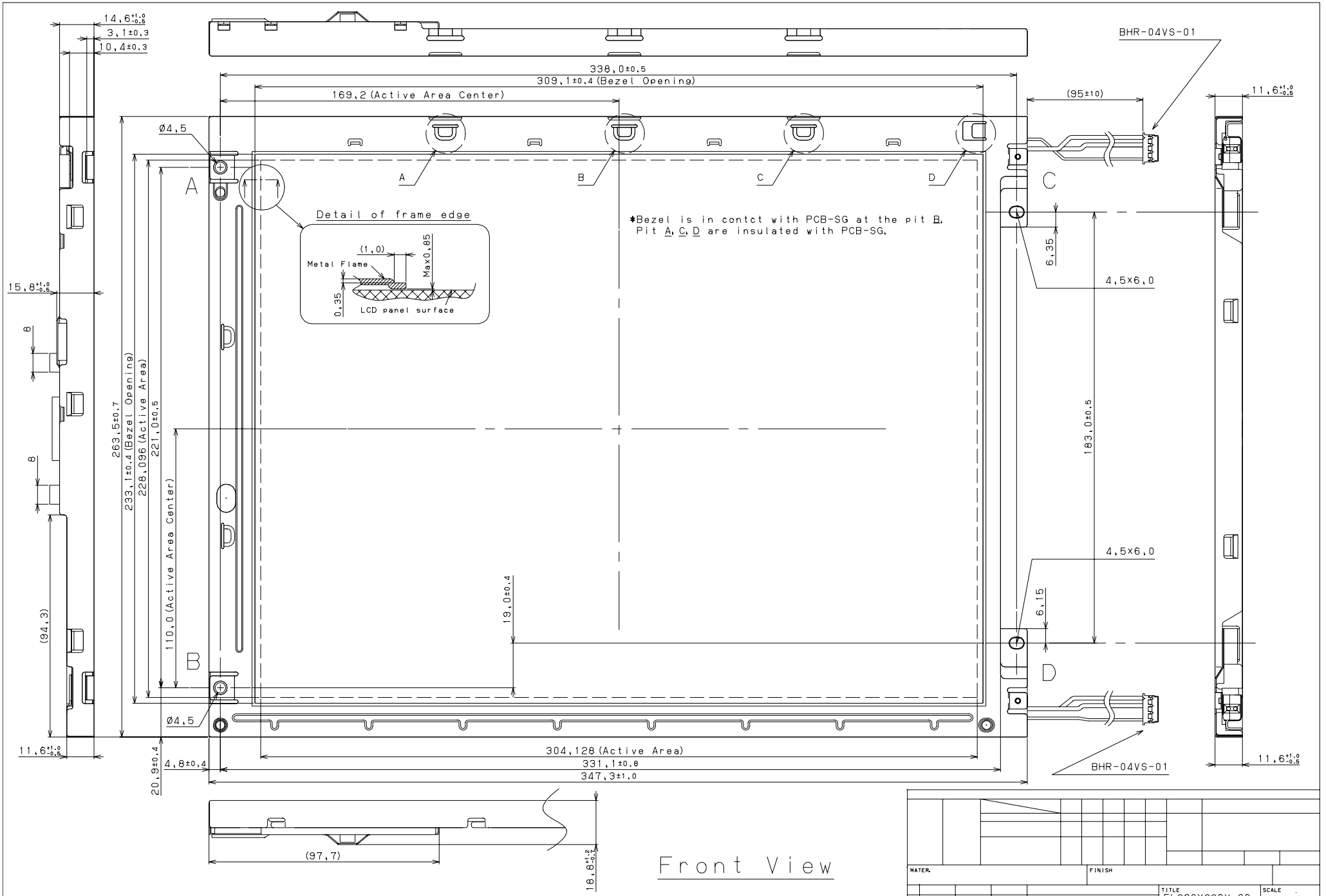
						FLC38XGC6V-06	
						Tech Bes LCD-00050	CUST.
04	20010706				Revised 17(7)		
EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION	FUJITSU LIMITED	SHEET 29/
DESIG.			CHECK		APPR.		

④ 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.

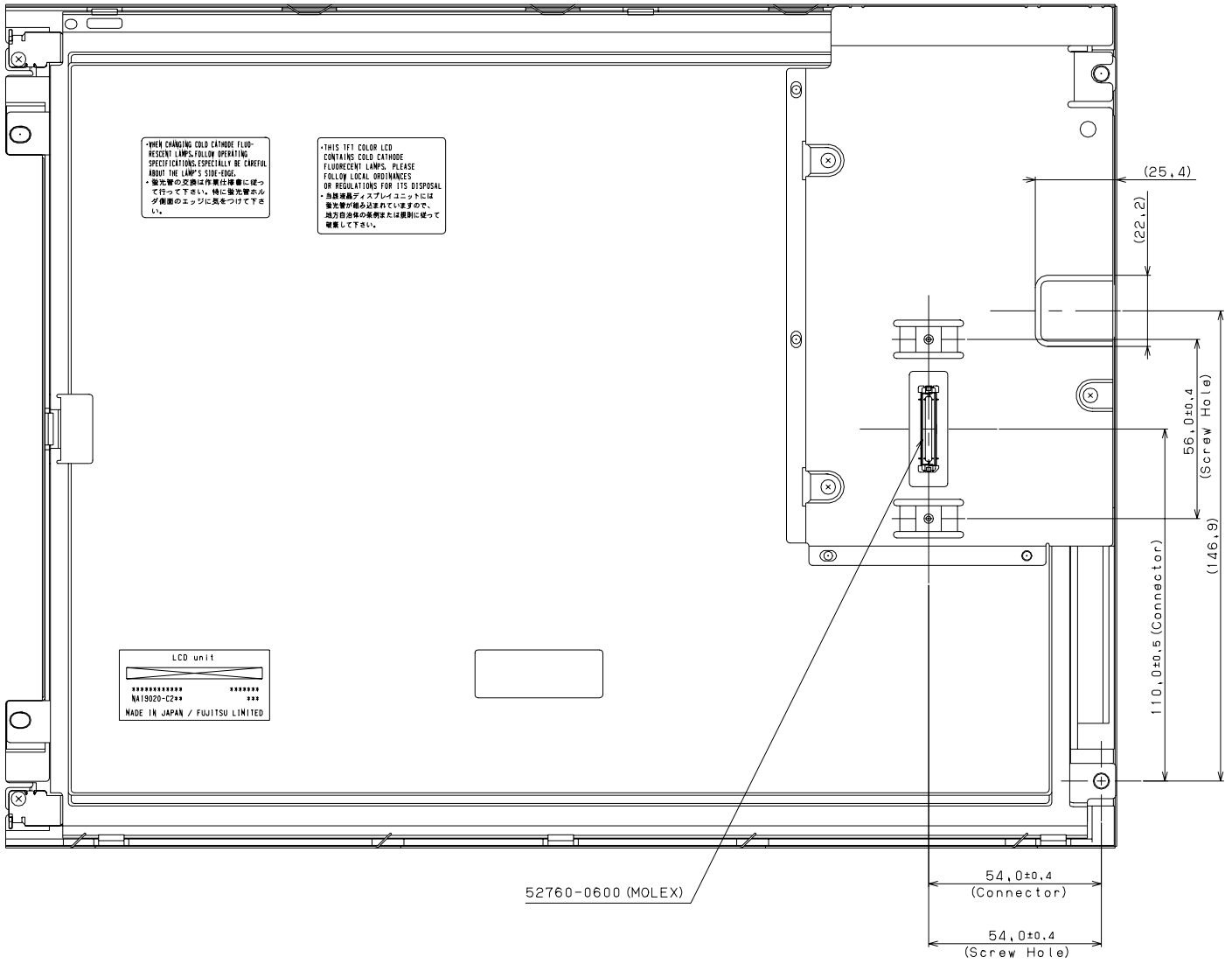
④ 19. Miscellaneous

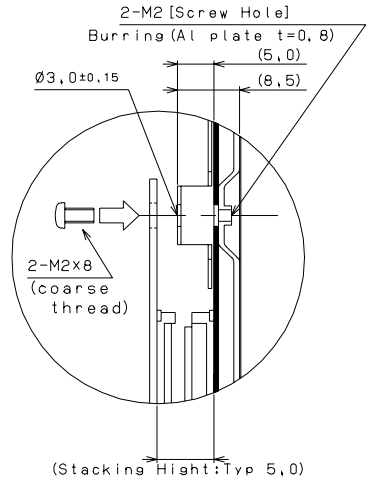
Specifications of the TFT-LCD panel and other components used in the LCD module are subject to change. Both parties shall discuss together before change.
If any doubt is raised in the content of the specifications, both parties shall discuss and make best effort for the agreement.



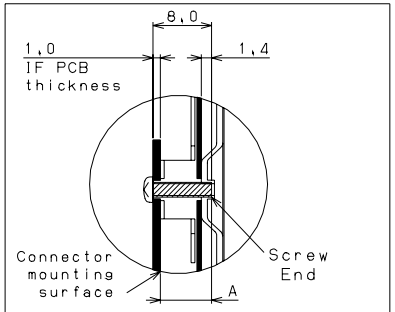
Front View

MATER.				FINISH			
						TITLE FLC38XGC6V-06	SCALE :
05	20011030			Revised gasket posiion(same as of A)		DRAW. NO. Tech Bes LCD-00050	
04	20010706			Revised gasket position and page number			
EDIT.	DATE	DESIG.	CHECK	DESCRIPTION			SHEET 31/
DESIG.			CHECK		APPR.		





IF Detail



If the thickness of IF PCB is 1,0mm, the length of engagement is 1,4mm with a screw which thread length is 8mm,

※Please adjust thread length or washer thickness so that dimension "A" will be 7~7,8mm,

Rear View

MATER.				FINISH			
						TITLE FLC38XGC6V-06	SCALE :
						DRAW. NO. Tech Bes LCD-00050	
04	20010706			Revised page number			
EDIT.	DATE	DESIG.	CHECK	DESCRIPTION			SHEET 32/32
DESIG.			CHECK		APPR.		