To　:　_____

TENTATIVE

Specification of FUJITSU TFT-LCD module

FLC26XGC6R

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, FDTC 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-00185

Issue Date　　　:　Jan. 31, 2003

Issued by :　　　　　F.Yamada

FUJITSU DISPLAY TECHNOLOGIES CORPORATION

TENTATIVE

REVISION HISTORY

Revision	Date	Prepared	Checked		Approved	Summary
01A	Jan. 31, 2003	S.Hayashimoto			F.Yamada	1st issue

DOCUMENT CONTROL SECTION

DATE

TITLE							
						FLC26XGC6R	
						DRAW. NO. Tech Bes LCD-00185	CUST.
EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION	FUJITSU DISPLAY TECHNOLOGIES CORPORATION	1/31
DESIG.	20030131	S.Hayashimoto	CHECK		APPR. F.Yamada		

1

TENTATIVE

TABLE OF CONTENTS

DOCUMENT CONTROL SECTION

DATE

					TITLE		
EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION	FUJITSU DISPLAY TECHNOLOGIES	
DESIG.			CHECK		APPR.	CORPORATION	

TITLE **FLC26XGC6R**

DRAW. NO. **Tech Bes LCD-00185**

CUST.

2/

TENTATIVE

1. APPLICATION

This specification is applied to the 10.4-inch XGA supported TFT-LCD module.

2 PRODUCT NAME AND MODEL NAME

2–1   Product Name   :   LCD Module

2–2   Model Name   :

3. OVERVIEW

This LCD module has a TFT active matrix type liquid crystal panel 1024x RGB 768 pixels, and diagonal size of 26cm. This LCD has a RGB interface for XGA and can display 262,144 colors under non-interlaced mode.

This LCD module can display under the bright light very clearly, also can display plainly in the dark place due to the front light.

It has built-in edge type front-light with 1CCFL which is driven by external inverter for this front-light.

The power supply of this LCD module is +3.3V DC   . (It is not included with the power source for front light and Digitizer unit.)

The timing control signal consists of data-ENAB signal only. It is possible to display freely within regulation.

The interface uses   interface. This LCD module installs the digitizer unit of electromagnetic induction tablet device.

4. CONFIGURATION

This LCD module consists of a reflected color TFT-LCD panel on which TFT driver ICs are mounted, a bezel, a CCFL front-light, digitizer unit for tablet device, and LVDS interface PCB.
The inverter for the front-light is not included.
Figure 4-1 shows a block diagram of this LCD module.

DOCUMENT CONTROL SECTION

DATE

TITLE		
	FLC26XGC6R	
DRAW. NO.		CUST.
Tech Bes LCD-00185		

EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION	FUJITSU DISPLAY TECHNOLOGIES	3/
DESIG.			CHECK		APPR.	CORPORATION	

TENTATIVE

Digitizer
Control signal

Control signal
(LVDS Input)
  IN0±
  IN1±
  IN2±
  CLKIN±

Power supply

Digitizer controller
interface circuit.

LVDS circuit
Interface circuit

/   converter

Bias supply

Gate Driver

Color TFT-LCD Pannel
1024×3(RGB)×768

Front Light
CCFL

Digitizer
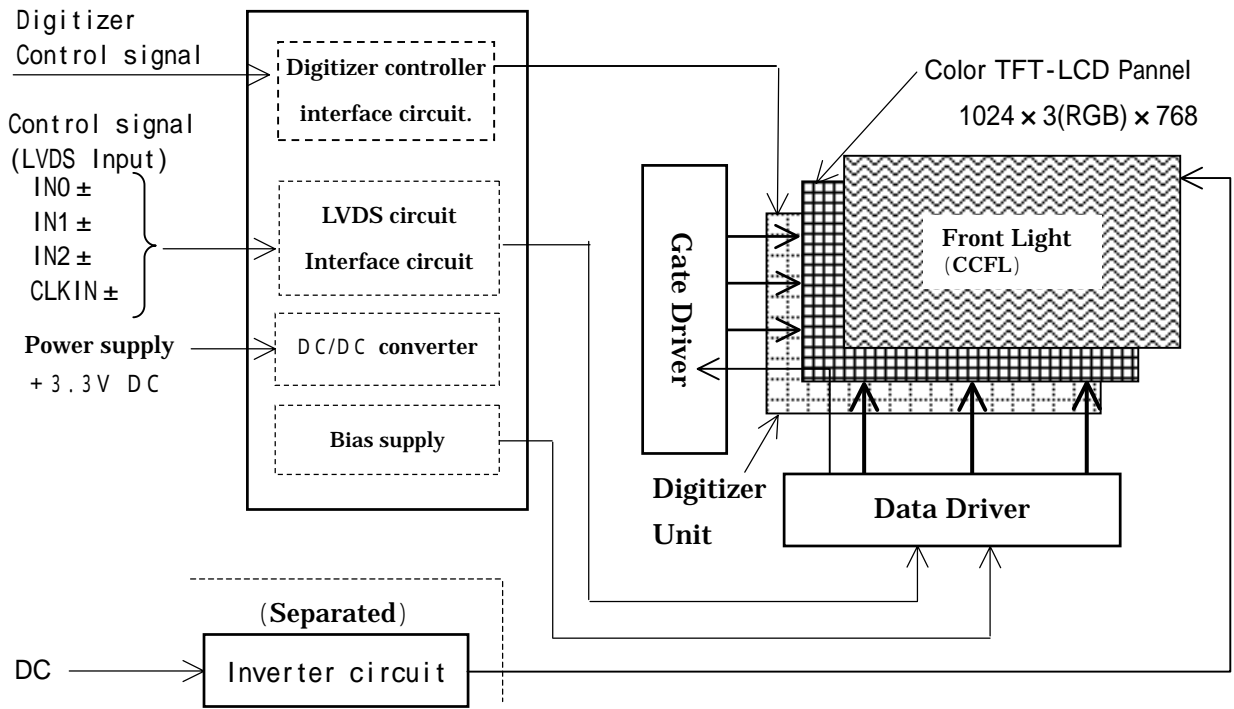Unit

Data Driver

Separated

DC

Inverter circuit

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	235.6 x 173.2 x 6.8	mm	Edge type front-light is used. (1.8 CCFLx1)
Display Resolution	(1024 x 3) x 768	—	Without inverter.
Display Dot Area	210.432 x 157.824	mm	For details on dimensions,
Dot Pitch	(0.0685x3)x0.2055	mm	see dimensional outline drawing. (at page 32,33,34:Figure 19-1,2,3)
Aspect Ratio	1:1	—	
Weight	330 MAX		
FG SG	Short	—	

DOCUMENT CONTROL SECTION

DATE

TENTATIVE

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=25ºC	–0.3	—	4.0	V
Input Signal Voltage(LVDS)	V_{IN}		–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	V_{CC}	3.0	3.3	3.6	V
Ripple Voltage (Vcc)	RP			100	mV

DOCUMENT CONTROL SECTION

DATE

	TITLE			
		FLC26XGC6R		
	DRAW. NO.			CUST.
	Tech Bes LCD-00185			

| EDIT | DATE | DESIG. | CHECK | APPR. | DESCRIPTION | FUJITSU DISPLAY TECHNOLOGIES | 5/ |
| DESIG. | | | CHECK | | APPR. | CORPORATION | |

| 1 | 2 | 3 | 4 |

TENTATIVE

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 (+)		IH	cm=+1.2V			100	mV
Differential-input Voltage ( )		IL		100			mV
Supply Current		CC	V_{CC}=+3.3V V_{SS}=0V Ta=25 CK=65MHz Frame frequency =60Hz		195	325	mA
Supply Rush Current		sCC				1.7	A
Supply Rush Current Duration (excess 1.2A)		sCC				1	ms
FRONT LIGHT	CCFL Turn on Voltage	S	f_L=65kHz,Ta=25 C_L=22pF		1100	1200	Vrms
			f_L=65kHz,Ta=0			1200	Vrms
	Lighting Voltage	L	f_L=65kHz,I_L=5mArms		630		Vrms
	Lighting Frequency	L	V_L=630Vrms, I_L=5mA	50	65	80	kHz
	Recommended Lighting Frequency						kHz
	Tube Current	L	V_L=630Vrms f_L=65kHz	4.0	5.0	6.0	mArms

Measurement circuit is based on Figure 8-1.
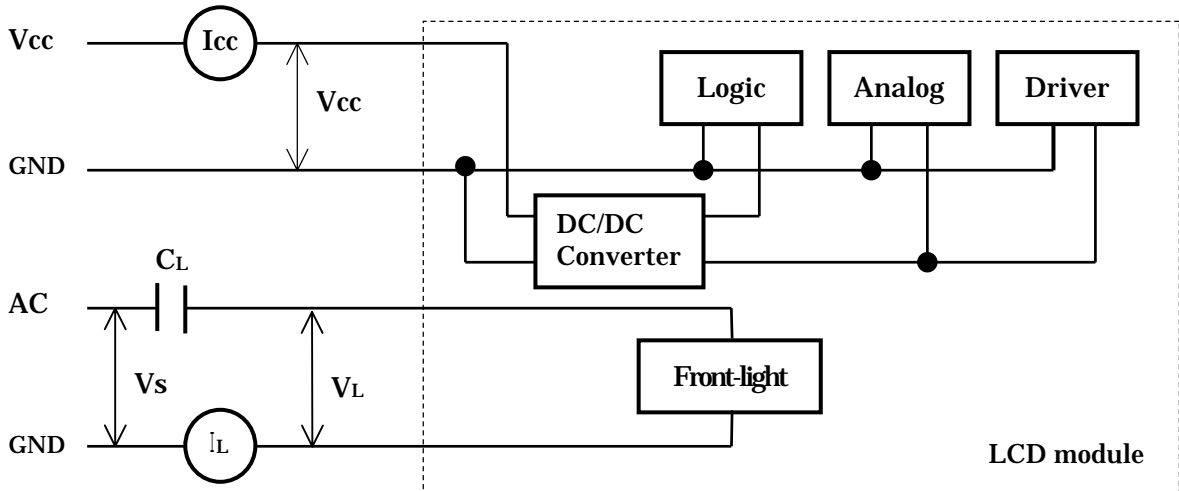
Figure 8-1   Measurement circuit

DOCUMENT CONTROL SECTION

DATE

| TITLE | | FLC26XGC6R |
| DRAW. NO. | Tech Bes LCD-00185 | CUST. |

| EDIT | DATE | DESIG. | CHECK | APPR. | DESCRIPTION | FUJITSU DISPLAY TECHNOLOGIES CORPORATION | 6/ |
| DESIG. | | | CHECK | | APPR. | | |

TENTATIVE

DS90CR583(National Semiconductor) or equivalent

IN0
IN1
IN2
CLKIN

IN0
IN1
IN2
CLKIN

Differential Input   100

LVDS receiver | Internal circuit

Fuse   Beads

1.0A

Vcc   Internal circuit

$100pF$ $4.7\mu F \times 2$

0

GND

$1\mu F \times 2$ $0.1\mu F \times 10$

FG
Frame ground

Fuse……………..KAB3202102NA29 1.0A

(Matsuo Electric Co., LTD.) or equivalent

Beads…………..MPZ2012 S331A T000 (TDK Co., LTD.)
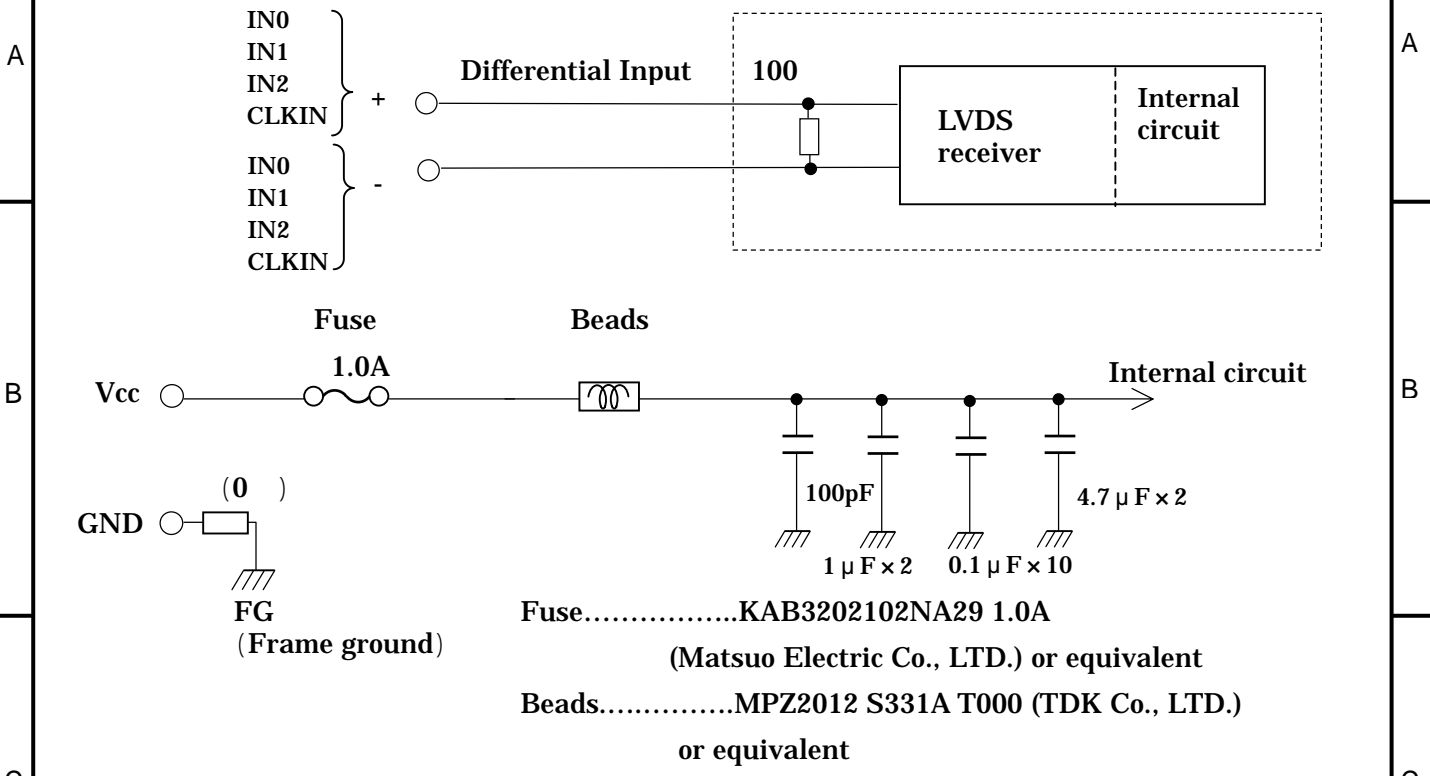
or equivalent

Figure 8-2 Equivalent circuit of logic signal input

DOCUMENT CONTROL SECTION

DATE

TITLE

FLC26XGC6R

DRAW. NO.
Tech Bes LCD-00185

CUST.

| EDIT | DATE | DESIG. | CHECK | APPR. | DESCRIPTION | FUJITSU DISPLAY TECHNOLOGIES CORPORATION | 7/ |
| DESIG. | | | CHECK | | APPR. | | |

1

TENTATIVE

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	Front Light	Note
Horizontal Visual Angle		CR	θ = 0°	55			deg		4,6,8,10
				45					1,2,6,7,8,10
Vertical Visual Angle			θ = 0°	55					4,6,8,10
				70					1,2,6,7,8,10
				55				OFF	4,6,8,10
				40				ON	1,2,6,7,8,10
Contrast Ratio		0° φS 25°		(30)	40				3,6
		0°		(16)	18				1,2,6,8,10
Response Time (ON) B→W		φ=0°	Ta=25		15	30		ON	1,2,6,9,10
			Ta=0		50	100			
Response Time (OFF) W→B		φ=0°	Ta=25		10	25			
			Ta=0		50	100			
Reflectivity	R	0° φS 25°		(13)	15				3,6
Brightness	I			(30)	35		cd/m²		1,2,6
Brightness Uniformity				65					1,2,6,12
Chromaticity W		φ=0° V=3.3V, I=5mArms			(0.32)			OFF	5
				(0.283)	0.313	(0.343)		ON	1,2,6
					(0.35)			OFF	5
				(0.299)	0.329	(0.359)		ON	1,2,6
Chromaticity R,G,B — R								OFF	5
				0.45 0.31 Typ.				ON	1,2,6
G								OFF	5
				0.32 0.41 Typ.				ON	1,2,6
B								OFF	5
				0.21 0.24 Typ.				ON	1,2,6
LCD Panel Type		Color							
Display Mode		Normally Black							
Pannel Technology		- R							
Optimum Viewing Angle		none						OFF	11
		Top (12 o' clock Direction)						ON	
Display Color		6- bit color							
Surface Treatment		None (Front- Light Prism surface)							

Specified value is measured in 15 20 minutes after lighting on.
All items without "Brightness Uniformity" are measured at the center of display board.

DOCUMENT CONTROL SECTION

DATE

TITLE   FLC26XGC6R

DRAW. NO.   Tech Bes LCD-00185

CUST.

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

FUJITSU DISPLAY TECHNOLOGIES CORPORATION

8 /
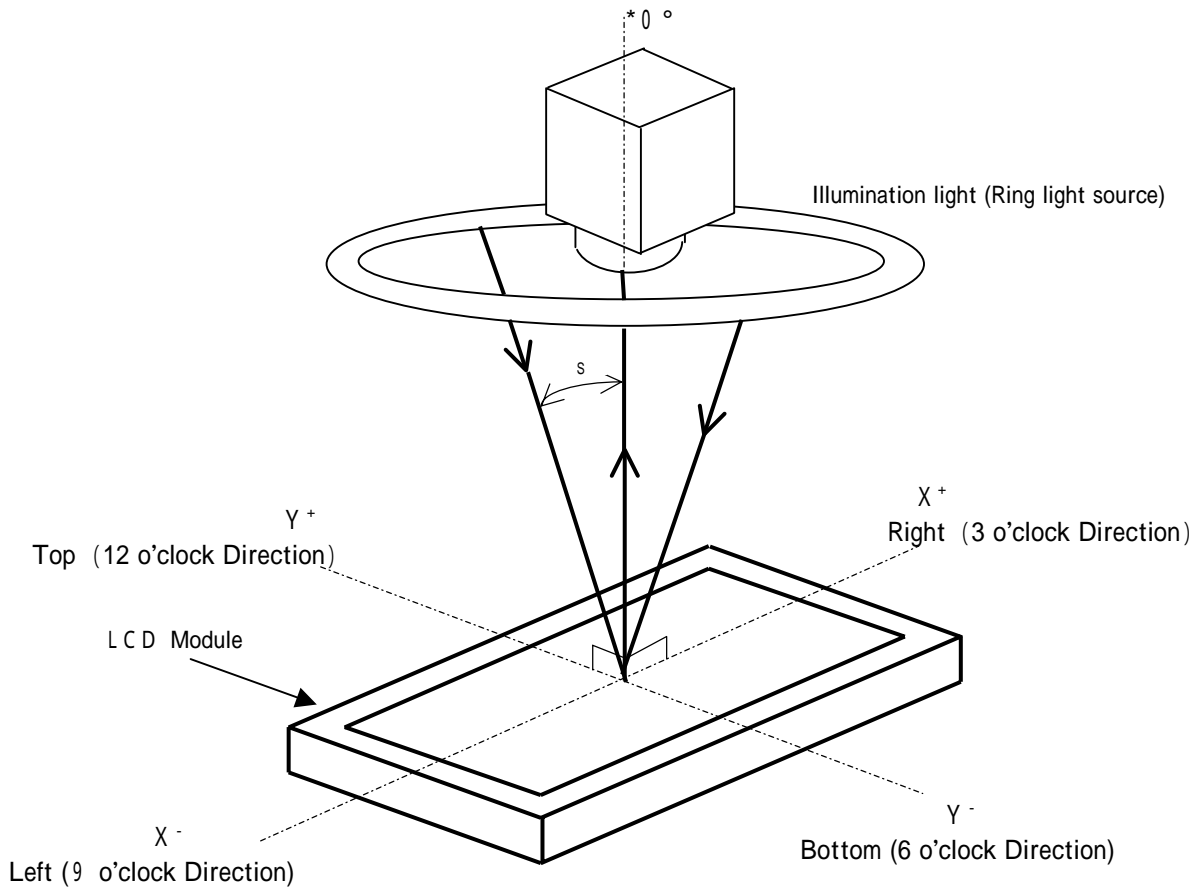
Note 1)   Brightness is measured by CS-1000 MINOLTA Co., LTD. , BM-5A TOPCON Co., LTD. ,or equivalent.
    Field   °   Interval   500

Note 2)   This LCD module's specifications of Visual Angle, Contrast Ratio, Brightness, Brightness Uniformity, and Chromaticity are measured in the dark condition (under 1lu).

Note 3)   **Definition of reflectivity**

All-directional Ring **light irradiation**
It is measured by CM-512m3 **MINOLTA Co., LTD.** or equivalent.

Illumination light (Ring light source)

s

Top   12 o'clock Direction

Right   3 o'clock Direction

Module

Left (o'clock Direction)

Bottom (6 o'clock Direction)

Note 4) Measuring method of reflective viewing angle
It is measured by LCD-7000
(OTSUKA ELECTRONICS CO., LTD)

Note 5) Measuring Method of Chromaticity at reflection
All-directional diffusion irradiation
It is measured by CM-2022(MINOLTA CO., LTD).

Lens

Lens

Light
Source

LCD Module

Light
D$_{65}$

LCD Module
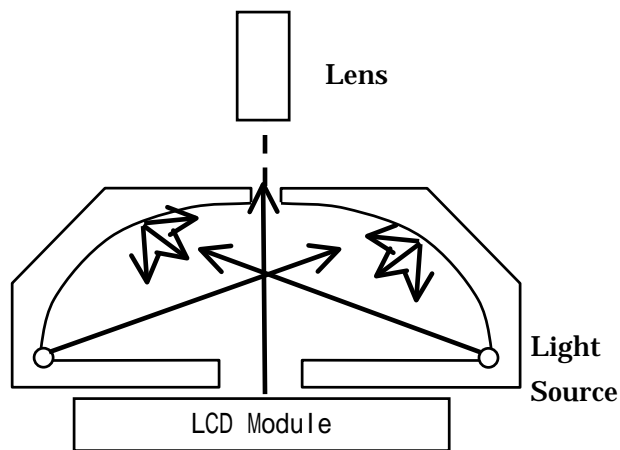
Note 6) Definition of Viewing Angle (1)
Based on Figure 9-2.

*0° (Front)

Y+
Top (12 o'clock Direction)

U

X+
Right (3 o'clock Direction)

LCD module

Y-
Bottom (6 o'clock Direction)

X-
Left (9 o'clock Direction)

U   °   D   °   L   °   R   °

Figure 9-2   Definition of Viewing Angle (1)
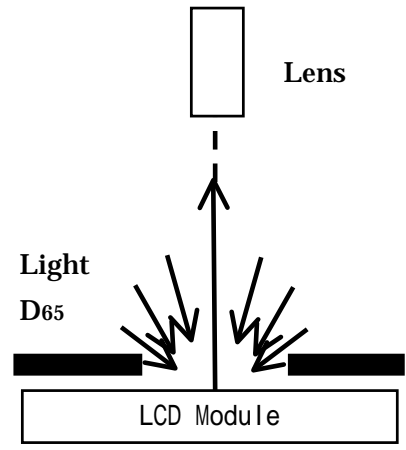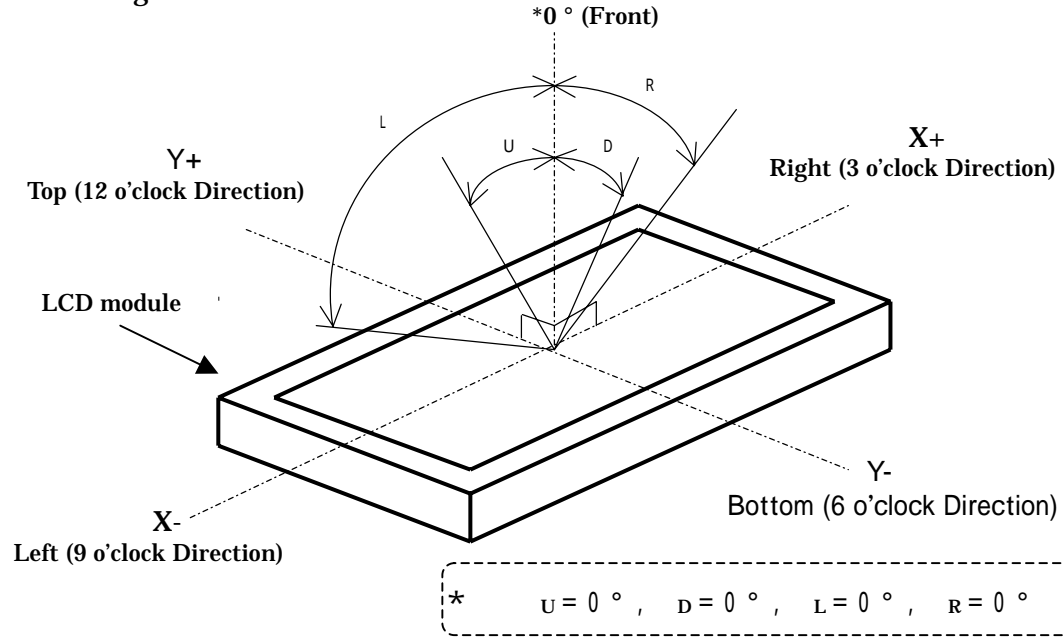
DOCUMENT CONTROL SECTION

DATE

TITLE
FLC26XGC6R

DRAW. NO.
Tech Bes LCD-00185

CUST.

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

FUJITSU DISPLAY TECHNOLOGIES
CORPORATION

10/

TENTATIVE

Note 7) Definition of Viewing Angle (2)

Based on Figure 9-3.

Display Surface

Display Surface
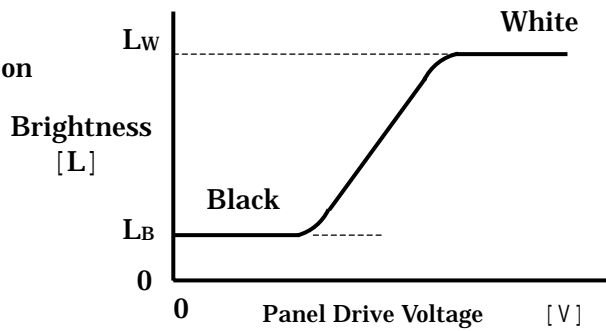
MAX

TYP

MN

L,R,U,D

=0°
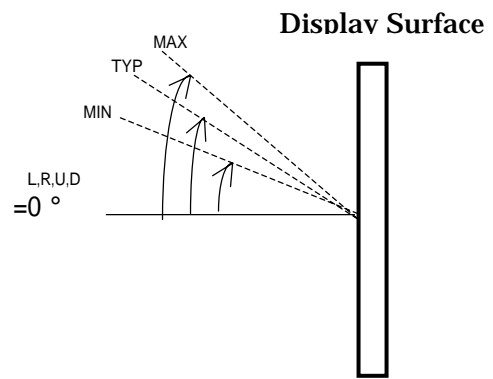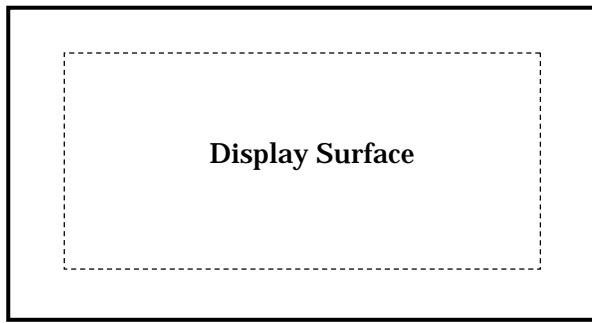
Figure 9-3   Definition of Viewing Angle (2)

Note 8) Definition of Contrast Ratio (CR)

Determined by Formula (1) based on Figure 9-4 Voltage-Brightness characteristics.

$$= \frac{W \text{ (Brightness at white)}}{\text{(Brightness at black)}} \quad ......(1)$$

Brightness L

White

L_W

Black

L_B

0

0   Panel Drive Voltage

Figure 9-4   Voltage-Brightness Characteristics

Note 9) Definition of Response Time

Based on Figure 9-5.

Drive signal of

LCD panel

ON

OFF

Non-select status   Select status   Non-select status

Relative Brightnes

100%

90%

White

Black

10%

Black

0%

on

off

ON Response time   OFF Response Time
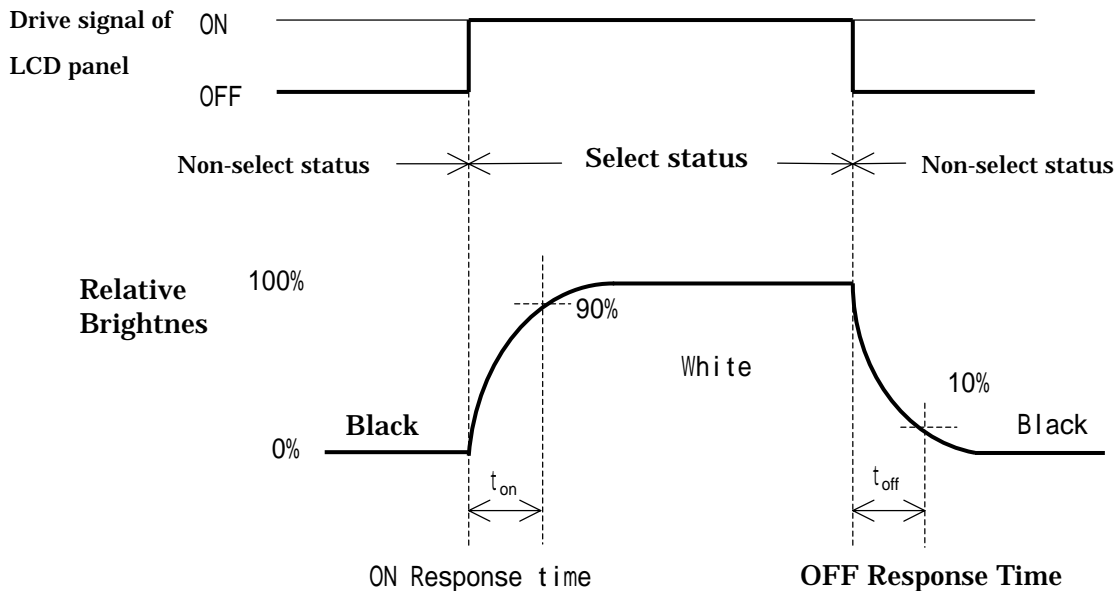
Figure 9-5   Definition of Response Time

DOCUMENT CONTROL SECTION

DATE

						TITLE	
						FLC26XGC6R	
						DRAW. NO.	CUST.
						Tech Bes LCD-00185	
EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION	FUJITSU DISPLAY TECHNOLOGIES CORPORATION	11/
DESIG.			CHECK		APPR.		

1　　　　　　2　　　　　　3　　　　　　4

TENTATIVE

A

<u>Note 10) Contrast Ratio and Response Measurement System</u>

Based on Figure 9-6.

Y^+

X^+

Z^-　　　　　　　　　　　　　　　Z^+

X^-

Y^-

**Brightness Meter or
Luminance colorimeter
(with luminosity
correction function)**

B

Drive and Measurement System
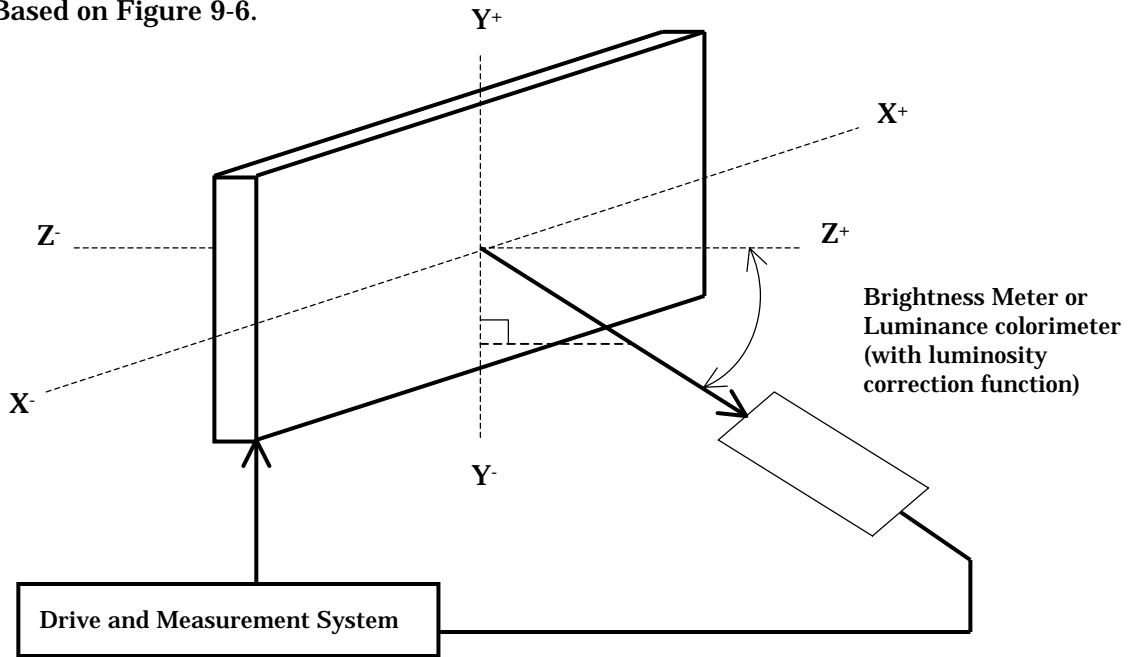
Figure 9-6　Contrast Ratio and Response Time Measurement System

C

<u>Note 11) Definition of Optimum Viewing Angle</u>

D

MAX

**Contrast
Ratio**

10

-　　　　　0　　　　　+

6 o'clock　　**Viewing Angle**　　**12 o'clock**
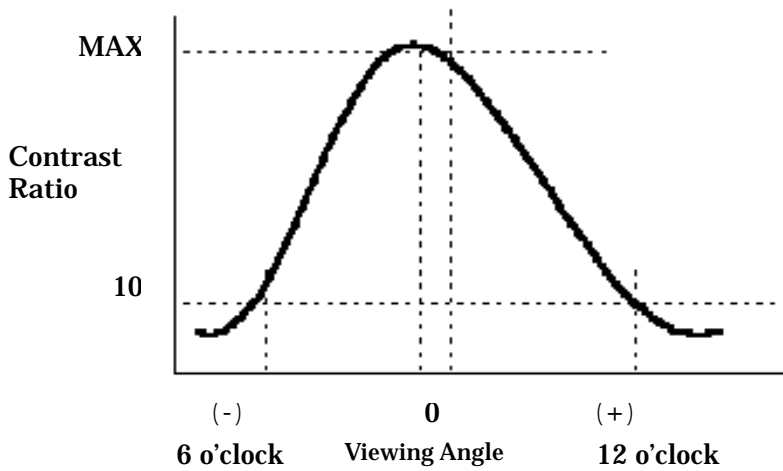
Figure 9-7　Definition of Viewing Angle

E

|				TITLE	
				FLC26XGC6R	
				DRAW. NO.	CUST.
				Tech Bes LCD-00185	
EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION	FUJITSU DISPLAY TECHNOLOGIES CORPORATION	**12/**
DESIG.			CHECK		APPR.		

F

TENTATIVE

A

Note 12) Definition of Brightness Uniformity

Brightness uniformity is defined by the following formula.
Brightness art measured at the following 9 points (   ) on the display area
that is shown in Figure 9-8.

Brightness Uniformity   Min. Brightness   Max. Brightness   ×

153   512   871   Dot

115

384

653

B

C
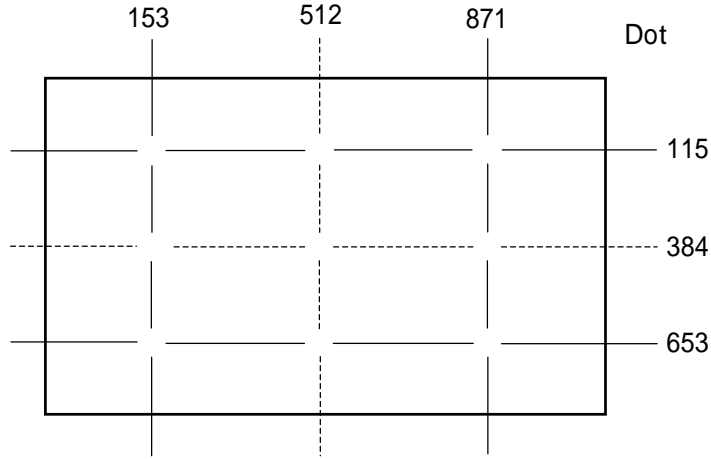
Note) Each measurement point (   ) defines the center spot of view of Brightness Meter.
The tolerance of measurement position is± 3mm.

Figure 9-8   Measurement Points

10. INTERFACE SPECIFICATIONS

CN-2

CN-3   14

1

1
14   CN-1
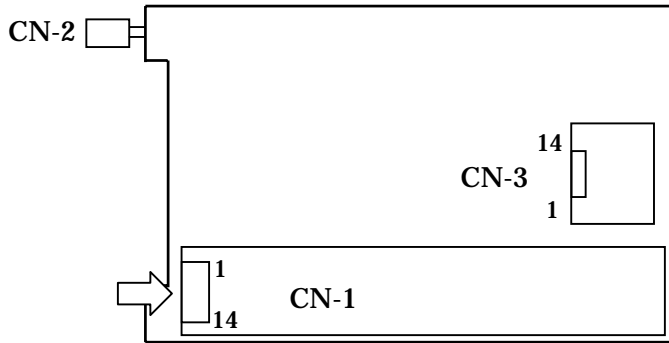
CN-1   LCD interface
CN-2   Power source of front light
CN-3   Digitizer unit Interface

It shows from backside.

D

E

DOCUMENT CONTROL SECTION

DATE

						TITLE	
						FLC26XGC6R	
						DRAW. NO.	CUST.
						Tech Bes LCD-00185	
EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION	FUJITSU DISPLAY TECHNOLOGIES	13/
DESIG.			CHECK		APPR.	CORPORATION	

TENTATIVE

10-1 Signal Descriptions and Data assignment of LCD
Table 10-1 shows the Signal Description of LCD (CN1).
Table 10-2 shows the LVDS Data Assignment.

Table 10-1 Interface signals (CN1)

Pin No.	Symbol	Function
1	VCC	3.3V power supply
2	VCC	3.3V power supply
3	VSS	GND
4	VSS	GND
5		LVDS signal
6		LVDS signal
7		LVDS signal 1
8		LVDS signal
9		LVDS signal
10		LVDS signal
11		LVDS signal CLKIN
12		LVDS signal CLKIN
13		GND
14		GND

Connector   :
Conformed Connector :
Producer   :   HIROSE ELECTRIC CO., LTD.

DOCUMENT CONTROL SECTION

DATE

TITLE
FLC26XGC6R

DRAW. NO.
Tech Bes LCD-00185

CUST.

EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION	FUJITSU DISPLAY TECHNOLOGIES	
DESIG.			CHECK		APPR.	CORPORATION	14/

TENTATIVE

Table 10-2　LVDS Data Assignment

| Graphic Controller Input Signal | Transmitter pin assignment | | | | | | | LCD connector pin assignment |
| | Input from Graphic Contoller | | | | Output to LCD module | | | |
	Pin No.	SN75LVDS84 (TI)	DS90CR563 (NS)		Pin No.	SN75LVDS84 (TI)	DS90CR563 (NS)	
Red 0　(LSB)	44	D0	TxIN0		41	Y1M	TxOUT0	5 (IN0　)
Red 1	45	D1	TxIN1					
Red 2	47	D2	TxIN2					
Red 3	48	D3	TxIN3					
Red 4	1	D4	TxIN4		40	Y2P	TxOUT0	6 (IN0　)
Red 5　(MSB)	3	D5	TxIN5					
Green 0(LSB)	4	D6	TxIN6					
Green 1	6	D7	TxIN7		39	Y2M	TxOUT1	7 (IN1　)
Green 2	7	D8	TxIN8					
Green 3	9	D9	TxIN9					
Green 4	10	D10	TxIN10					
Green 5(MSB)	12	D11	TxIN11		38	Y1P	TxOUT1	8 (IN1　)
Blue 0　(LSB)	13	D12	TxIN12					
Blue 1	15	D13	TxIN13					
Blue 2	16	D14	TxIN14		35	Y3M	TxOUT2	9 (IN2　)
Blue 3	18	D15	TxIN15					
Blue 4	19	D16	TxIN16					
Blue 5 (MSB)	20	D17	TxIN17		34	Y3P	TxOUT2	10 (IN2　)
HRSVD	22	D18	TxIN18					
VRSVD	23	D19	TxIN19					
ENAB	25	D20	TxIN20					
CK	26	CLKIN	TxCLK IN		33	CLKOUTM	TxCLK OUT	11 (CLKIN　)
					32	CLKOUTP	TxCLK OUT	12 (CLKIN　)

DOCUMENT CONTROL SECTION

DATE

EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION		TITLE　FLC26XGC6R	
DESIG.			CHECK			APPR.	DRAW. NO.　Tech Bes LCD-00185	CUST.

FUJITSU DISPLAY TECHNOLOGIES CORPORATION　15/

TENTATIVE

10-2 Digitizer Unit Interface (CN-3)

Table 10-3 shows the Digitizer Unit Interface Data Assignment.

Table 10-3 Digitizer Unit Interface Data Assignment

Pin	NAME	IN/OUT	FUNCTION
1	GND		Ground
2	PWS1	OUT	Auxiliary Port1
3	PWS2	OUT	Auxiliary Port2
4	PWS3	OUT	Auxiliary Port3
5	PWS4	OUT	Auxiliary Port4
6	PDCT	OUT	Pen Detect Signal
7	DSR	IN	Data Set Ready Signal
8	CTS	IN	Clear To Send Signal
9	TxD	OUT	Serial Data Output Signal
10	RxD	IN	Serial Data Input Signal
11	SLP	IN	Sleep Signal
12	RES	IN	Reset
13	Vcc		Power Supply (3.3 Volt)
14	GND		Ground

Connector on SU-001: DF19L-14P-1H / HIROSE ELECTRIC CO., LTD
Mating Connector (Corresponding Connector)
: DF19L-14S-1C / HIROSE ELECTRIC CO., LTD

TxD   Serial Data Output Signal
          To be connected to Host's RxD
RxD   Serial Data Input Signal
          To be connected to Host's TxD
CTS   Clear To Send Signal
          To be connected to Host's RTS for Plug & Play
DSR   Data Set Ready Signal
          To be connected to Host's DTR for Plug & Play
PCDT   Pen Detect output Signal
          This is set "HIGH" while Pen Device detects pen or eraser.
          Leave this open if Host does not use.
SLP   Sleep Input Signal
          When set "High", Pen Device stops and goes into sleep mode
          Keep this "Low" if sleep mode is not needed.
RES   Reset
          Pen Device stops operating when RES is set "LOW".
          Input "system power on reset" signal.
PWS1:4   Auxiliary Port
          Leave this pen.

				TITLE	FLC26XGC6R
				DRAW. NO. Tech Bes LCD-00185	CUST.
EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION
DESIG.			CHECK		APPR.

FUJITSU DISPLAY TECHNOLOGIES CORPORATION

16/

DOCUMENT CONTROL SECTION

DATE

| 1 | 2 | 3 | 4 |

TENTATIVE

10-3　Color Data Assignment

Table 10-4 shows the Color Data Assignment.

Table 10-4　Color Data Assignment

Color/ Brightness		Input Data　　　level　　　level																	
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Color	Black Blue Green Cyan Red Magenta Yellow White																		
Red	Black　　　0 ⇧　　　　1 Darker　　2 ⇧ ⇩ Brighter　61 ⇩　　　　62 Red　　　63																		
Green	Black　　　0 ⇧　　　　1 Darker　　2 ⇧ ⇩ Brighter　61 ⇩　　　　62 Green　　63																		
Blue	Black　　　0 ⇧　　　　1 Darker　　2 ⇧ ⇩ Brighter　61 ⇩　　　　62 Blue　　　63																		

Note.1) Definition of gray scale:Color (n)…"n" indicates gray scale level.
　　　　Larger number means brighter level.
Note.2) Data;　1:High, 0:Low

Note 3) Color data consist of 6 bit red, green and blue data of odd and even number pixel data.
　　　　Total data number is 36 signals. This module is able to display 262,144 colors because
　　　　each red, green and blue data is controlled independently.

					TITLE
					FLC26XGC6R

DOCUMENT CONTROL SECTION

DATE

| EDIT | DATE | DESIG. | CHECK | APPR. | DESCRIPTION | DRAW. NO.　Tech Bes LCD-00185 | CUST. |
| DESIG. | | | CHECK | | APPR. | FUJITSU DISPLAY TECHNOLOGIES CORPORATION | 17/ |

| 1 | 2 | 3 | 4 |

TENTATIVE

10-4 Input Signal Timing

Table 10-5 and Figure 10-3 shows the Input Signal Timing at LVDS transmitter.

Table 10-5   Timing Characteristics   (Ta=0~50°C, Vcc=3.3±0.3V)

Item		Symbol	MIN.	TYP.	MAX.	Unit	Remark
DCLK signal (Clock)	Period	Tc	15.15	15.38	28.5	ns	
	Frequency	fc	35	65	66	MHz	=1/
	Duty	Tch/Tc	45	50	55		*1
	High Time	TclkH	6			ns	
	Low Time	TclkL	6			ns	
	Rise Time	Tclkr			5.0	ns	
	Fall Time	Tclkf			5.0	ns	
DCLK-Data Timing	Setup time	Tset	3.0			ns	(65MHz)
	Hold time	Thold	7.0			ns	(65MHz)
Horizontal signal	Period	Th	1320	1344	1566	DCLK	
	Frequency	fh	38.6	48	60	kHz	
	Display period	Thd	1024	1024	1024	DCLK	*2
Vertical signal	Period	Tv	772	806	868	Th	16.67ms
	Frequency	fv	59.998	59.998	59.998	Hz	
	Display period	Tvd		768		Th	*2
ENAB signal	Data-ENAB timing	Tdn		0		DCLK	*3

*1)•Clock must be input while the power is on.

*2)•Horizontal display position is specified by the rise of ENAB signal only.
   The data latched at falling edge of DCLK after rise of ENAB is displayed at the left edge of the display area.
   •Vertical display position is specified by the rise of "L" ENAB after "H" level continuation over 2 Horizon Period.
   The data latched at the rise of ENAB is displayed at the top line of the display area.

*3) •If High Time ENAB does not synchronize with the effective data period, the display position does not fit to the display area.

DOCUMENT CONTROL SECTION

DATE

TITLE

FLC26XGC6R

DRAW. NO.

Tech Bes LCD-00185

CUST.

| EDIT | DATE | DESIG. | CHECK | APPR. | DESCRIPTION | FUJITSU DISPLAY TECHNOLOGIES CORPORATION | **18/** |
| DESIG. | | | CHECK | | APPR. | | |

TENTATIVE

CK

$V_{IH}(MIN) : 0.7Vcc(V)$
$V_{IL}(MAX) : 0.3Vcc(V)$
Center of input signal $0.5Vcc$

ENAB
R0-R5
G0-G5
B0-B5

VALID
DATA

$V_{IH}(MIN) : 0.7Vcc(V)$
$V_{IL}(MAX) : 0.3Vcc(V)$

CK

$0.5Vcc$
Duty(A, B) : 50± 5%

R0-R5
G0-G5
B0-B5

ENAB

Thd
Th

R0-R5
G0-G5
B0-B5

C001

C768

ENAB

Tvd
Tv

DCLK

0001   0003   0005   1019   1021   1023

R0-R5
G0-G5
B0-B5

0002   0004   0006   1018   1020   1022   1024

ENAB

Tdn=0clk   Tdn=0clk

Figure 10-3   Input Signal Timing Chart

DATE

					TITLE	**FLC26XGC6R**	
					DRAW. NO.	**Tech Bes LCD-00185**	CUST.
EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION	FUJITSU DISPLAY TECHNOLOGIES CORPORATION	**19/**
DESIG.			CHECK			APPR.	

TENTATIVE

10-5   Correspondence between Data and Display Position

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

	S0001	S0002	S0003	S0004	S0005	S0006	S0007			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

Figure 10-4   Correspondence Data and Display Position

10-6   Power Supply Sequence

The sequence of input signals and On/Off of the power supply of this LCD module should be in the specification shown in Figure 10-5 to prevent latch-up of the driver ICs and DC driving of the LCD panel.

Vcc
ON   T5 20ns   Voltage descent
OFF (0V)   0.3V   3.0V   3.0V   2.4V   0.3V   0.3V
0 T1 0ns
500ns T7

8ns T4

CK
ENAB
RO-R5
GO-G5
BO-B5
H   0.7Vcc   0.3Vcc
L   0 T2   0 T6 30ns
T3 20ns
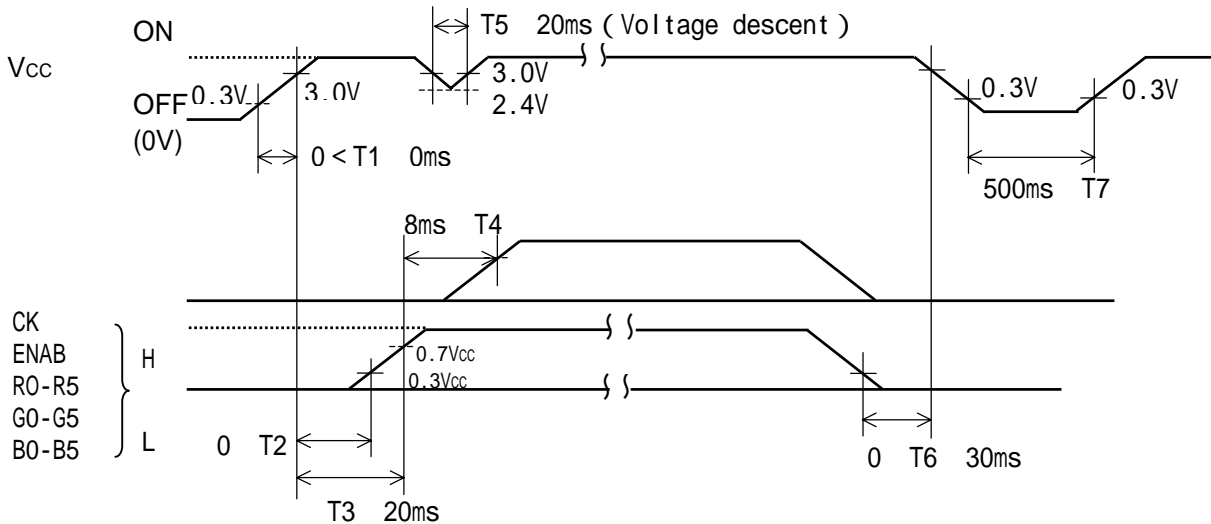
Note) Power supply sequence is defined by input signal toward LVDS-IC (TRANSMITTER).

Figure 10-5   Power Supply Sequence

DOCUMENT CONTROL SECTION

DATE

TITLE	**FLC26XGC6R**

DRAW. NO. **Tech Bes LCD-00185**   CUST.

EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION	FUJITSU DISPLAY TECHNOLOGIES CORPORATION	20/
DESIG.			CHECK		APPR.		

10-7 Shut Down Time

Figure 10-6 shows the specification of shut down time.

If this specification is out of regulation, the last screen before shut down might be afterimage.
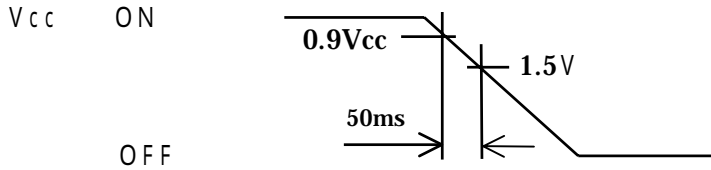

0.9Vcc

1.5

50ms

Figure 10-6 Shut down time

11. FRONT-LIGHT SPECIFICATIONS

11-1 Pin configuration for Front-light (CN-2)

Table 11-1 shows the description and Pin assignment of the connectors
(CN-2) for the Front-light of this LCD module.

Table 11-1 Pin Assignment of CN-2

Pin	Signal	Function
1	V_L	Power supply for CCFL
2	GND	GROUND

Connector   :   Housing   :   BHSR-02VS-1
User's Connector :   Post with base: SM02B-BHSS-1
Supplier   :   Japan Solderless Terminal Trading Company LTD. (J.S.T.)

11-2 CCFL Specification

Supplier   :   Sanken Electric Co., Ltd.
Catalog Number   :   NA19026-5401

11-3 Life

The life of the front-light is a minimum of 10,000 hours at the following conditions.

(1) Working conditions

Ambient temperature 25 ± 5
Tube current (I_L)   5.0mA or less

(2) Definition of life

Brightness becomes 50% or less than the minimum brightness value shown in Table 9-1.
Turn-on voltage becomes over 1500Vrms shown in Table 8-1.
Flashing.

DOCUMENT CONTROL SECTION

DATE

| TITLE | FLC26XGC6R |
| DRAW. NO. | Tech Bes LCD-00185 | CUST. |

| EDIT | DATE | DESIG. | CHECK | APPR. | DESCRIPTION | FUJITSU DISPLAY TECHNOLOGIES | 21/ |
| DESIG. | | | CHECK | | APPR. | CORPORATION | |

TENTATIVE

12. APPEARANCE SPECIFICATIONS (Tentative)

12-1　Zone (Tentative)

· Inside display dot area (210.432×157.824mm)
· 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, frontlight module or polarizer film out of the display area, etc., are not counted.

12-2　Bright spots (Tentative)

(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 (Tentative)

· 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 35cm 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.
· The test is performed when frame frequency is 60Hz.

12-4　Specification (Tentative)

Figure 12-1 shows the specification.

(Note1) Please do not mistake a single bright spot for a bright spot connection due to Cs(supplemental capacitance) line at the center of each dot.
(Note2) If a pixel is dark partially, it connects into the number of dark spots in accordance with following rule.
(a) $S<1/3$ 　　　: Not count. Only one of 4 dark connection is allowed.
(b) $1/3 \leq S < 2/3$ 　: Considered as 0.5 dot.
(c) $2/3 \leq S$ 　　　: Considered as 1 dot.

(S=Dark spot size/dot size)

DOCUMENT CONTROL SECTION

DATE

TITLE　　FLC26XGC6R

DRAW. NO.　Tech Bes LCD-00185

CUST.

| EDIT | DATE | DESIG. | CHECK | APPR. | DESCRIPTION | FUJITSU DISPLAY TECHNOLOGIES CORPORATION | 22／ |
| DESIG. | | | CHECK | | APPR. | | |

TENTATIVE

Figure 12-1　Appearance (Tentative)

No.	Item		Judgment method and standard
1	Bright spot (high and Low)		T.B.D
2	Bright spot connection (high and low)		
3	Total of bright spot		
4	Dark spot		
5	Dark spot connection		
6	Total of dark spot		
7	Total of dot defect (bright and dark)		
8	Distance of bright spot	high-hgh	
		others	
9	Distance of dark spot		
10	Scratch on polarizer, line shape		
11	Dent on polarizer, dot shape		
12	Bubble in polarizer		
13	Black white spot (Foreign circular matter)		
14	Light leakage by foreign articles		
15	Lints, black/white line by foreign articles		

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

DOCUMENT CONTROL SECTION

DATE

TITLE		
	FLC26XGC6R	
DRAW. NO.		CUST.
Tech Bes LCD-00185		

EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION	FUJITSU DISPLAY TECHNOLOGIES CORPORATION	23/
DESIG.			CHECK		APPR.		

TENTATIVE

13. ENVIRONMENTAL SPECIFICATIONS

Table 13-1 show the environmental specifications.

Table 13-1　Environmental specifications

Item		Condition	Remark
Temperature	Operation	0~50℃	Temperature on surface of LCD panel (display area.)
	Storage	−20~60℃	
Humidity	Operation	20~85　RH	Maximum wet-bulb temperature should not exceed 29℃. No condensation.
	Storage	5~85%RH	
Vibration	Operation	10~500Hz, Sweep / 20minute, 2G, 2 hours for each X, Y and Z directions.	For single module without package.
Shock	Non-operation	15G, 6ms, 1time each ±X, ±Y and ±Z directions.	

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

Table 13-2　Shock resistance standard when module is packaged

Dropping location	Dropping height	Count
A　J	60cm	1 time

G (Top face)　　J (Rear face)

C (Edge)

F (Side face)

E (Side face)

B (Edge)

A (Corner)
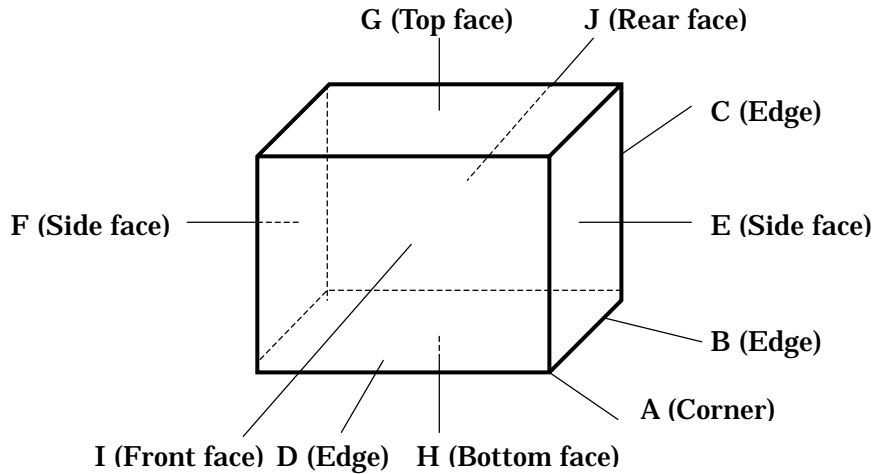
I (Front face)　D (Edge)　H (Bottom face)

Figure 13-1　Direction to apply shock to package
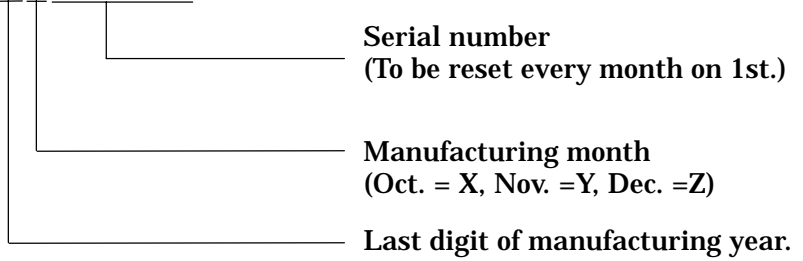
DOCUMENT CONTROL SECTION

DATE

TITLE

FLC26XGC6R

DRAW. NO.

Tech Bes LCD-00185

CUST.

| EDIT | DATE | DESIG. | CHECK | APPR. | DESCRIPTION | FUJITSU DISPLAY TECHNOLOGIES CORPORATION | 24 / |
| DESIG. | | | CHECK | | APPR. | | |

| TENTATIVE |

14. INDICATIONS

This module has the following indications.

(1)　Product name　　　　　　:　LCD

(2)　Model Number　　　　　　:　FLC26XGC6R

(3)　Product Drawing Number :　NA19026-C451

(4)　Manufacturing Number　:　**2 5 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)　Manufacturer Country Name :　MADE IN JAPAN

(7)　Company Name　　　　　　:　FUJITSU DISPLAY TECHNOLOGIES CORP.

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

THIS TFT COLOR LCD
CONTAINS COLD CATHODE
FLUORESCENT LAMPS. PLEASE
FOLLOWLOCAL ORDINANCES
OR REGULATIONS FOR ITS DISPOSAL.

Figure 14-2

LCD unit　　　　　MADE IN JAPAN

CP******-**　　　　0X50015
NA19026-C451　　　01A
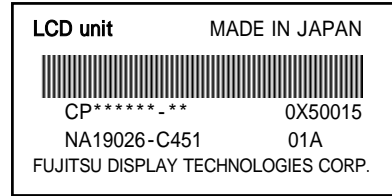FUJITSU DISPLAY TECHNOLOGIES CORP.

Figure 14-1 Product Label (Example)

15. PACKAGING

Packaging spec. is specified separately in the packaging specification.
*This spec. is based on FDTC's original oversea packing specification against dropping damage.

DOCUMENT CONTROL SECTION

DATE

| TITLE | FLC26XGC6R |

DRAW. NO.　**Tech Bes LCD-00185**　CUST.

| EDIT | DATE | DESIG. | CHECK | APPR. | DESCRIPTION | FUJITSU DISPLAY TECHNOLOGIES CORPORATION | 25 / |
| DESIG. | | | CHECK | | APPR. | | |

TENTATIVE

16.WARRANTY

The warranty period is one year after shipping. 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 use this LCD module properly.

(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

LCD panel is mounted rear side of LCD module.

Do not apply any strong mechanical shock to the LCD module.
Since the LCD panel is made of glass, excessive shock may damage the panel or cause a malfunction.

Do not press hard on the rear side of LCD module.
In the LCD panel, the gap between two glass plates is kept perfectly even to maintain display properties and reliability. The hard pressure on the LCD panel may cause the following problems.
Ununiformity of color
Disorder of orientation of liquid crystal
Problem returns to normal condition after a while. Problem returns to normal condition by turning the power off and turning on again.
However these operations should be avoided to insure reliability.

Precaution for not damaging the front light
Since the surface of front light consists of the fine prism form, dent and dirt soil may cause deterioration of display quality.
!*Do not touch the display surface.*
On handling, please put on conductive gloves, and don't touch the screen.

Do not place or contact objects on the display surface.
This may make some parts of the LCD module distorted and the quality of display may deteriorate.

(3) Handling of LCD module

Do not pull the cold-cathode tube cable strongly.
If the cable is pulled with the strength of 2kgf or more, the cable may be damaged or may lose reliability.

DOCUMENT CONTROL SECTION

DATE

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

TITLE FLC26XGC6R

DRAW. NO. Tech Bes LCD-00185

CUST.

FUJITSU DISPLAY TECHNOLOGIES CORPORATION

26/

TENTATIVE

Assemble the module into user's system in a dust free environment.
Visible dirt between the protective board and LCD module may cause deterioration in display quality.
Conductive foreign matter adheres to the module may cause failures.

Take anti-electrostatic measures for assembling the module.

Since the LCD module contains CMOS-ICs, the following points should be observed.

For assembling the module, operator should be grounded and wear cotton or conductive gloves.

Floor of work area and work table to assemble the LCD module should be covered with electrostatic shielding in order to discharge static electricity via an earth wire.

If necessary, ground operation tools (soldering iron, radio pliers, tweezers, etc.).

Do not take the module out of the conductive bag until the module is assembled.

Do not assemble the module under low humidity (50%RH or less).

Do not disassemble or remodel the LCD module.
Disassembly or remodeling of the LCD module may result in malfunctions or deterioration in the display quality and reliability.

(4) Precautions in regards of operating the LCD module

Adhere to the specified power supply sequence.
If not followed, the CMOS-IC may cause a latch-up, or DC voltage may be applied to the liquid crystal, which cause a failure or serious deterioration in display quality.

Do not operate the LCD module when condensation occurs.
If the LCD module is operated when condensation is on the terminals of the LCD panel, the terminals cause electrochemical reaction, and may reach disconnection. Condensation easily occurs especially when the module is moved from cold environment to warm environment.

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

Operation under high temperature(>50): Display colors shift to blue.

Storage under high temperature(>60): The polarizer film deteriorates and contrast decreases.

Operation under low temperature(< 0): The response speed decreases considerably.

Storage under low temperature(<-20): The liquid crystal may solidify and become damaged.

Be sure to input the control signals at the correct timing.
If control signals (DCLK, ENAB) are not input, or if the timing is out of the specified timing, DC voltage may be applied to the liquid crystal and, as a result, cause image sticking or deterioration of contrast.

The Strong Moire Stripe will be appeared on Special Pattern.
The strong moiré stripe will be appeared on horizontal stripe display.

A   B   C   D   E   F

DOCUMENT CONTROL SECTION

DATE

						TITLE	FLC26XGC6R

DRAW. NO.

Tech Bes LCD-00185

CUST.

| EDIT | DATE | DESIG. | CHECK | APPR. | DESCRIPTION | FUJITSU DISPLAY TECHNOLOGIES | 27 / |
| DESIG. | | | CHECK | | APPR. | CORPORATION | |

1

(5) Precautions in regards of designing module mounting

Excessive force should not be applied to the screen or the rear side of the LCD module.
Excessive pressure on the screen caused by the installation of the LCD module may deteriorate display quality and reliability.
Since panel at the rare side of this LCD module is made from glass, brightness uniformity and the reliability of CCFT may decrease if the pressure is applied to the frontlight module.

Avoid twisting and bending the LCD module.
Excessive twist and bend may damage display quality and reliability.

Avoid extending the power cable between the LCD module and inverter.
This may cause the frontlight to flicker or not to light.

Keep the frontlight cable apart from the metal enclosure of the LCD module.
When frequency current for frontlight driving leak to the metal enclosure, the desired brightness may not be assured.

Take countermeasure against electromagnetic interference of digitizer unit.
The noise, which is occurred from transfer and inductance for power supply, affects electromagnetic induction sensor module. It is recommended to use the transfer and inductance that don't leak out magnetic flux. Please don't mount magnetic flux of transfer and coil right angled to sensor board.
Mount the protect board on display screen.
The surface of frontlight is prism form Make the circumstance that the surface cannot be touched.

(6) Storage method

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

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

The LCD module is recommended to be stored in humidity controlled, cool and dark locations.
Recommended storage environment
　　Place　　　　　: Dark (avoid direct sunlight)
　　Temperature　: 10　35
　　Humidity　　　: 50　60%RH

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

(7) Disposal Method

LCD module
The components of this LCD module can be grouped into metal, resin, glass and so on. As the frontlight contains CCFL which includes mercury, it must be disposed according to the local ordinance or regulations.

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

DOCUMENT CONTROL SECTION

DATE

EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION	TITLE	FLC26XGC6R	
DESIG.			CHECK		APPR.	DRAW. NO. Tech Bes LCD-00185	CUST.	

FUJITSU DISPLAY TECHNOLOGIES CORPORATION

28 /

(8) Others

If the LCD panel is damaged, do not inhale and do not swallow the liquid crystal.

If the liquid crystal adhere to the body or cloths, wash it off with soap immediately.

Follow regular precautions for electronic components.

Flux residue on the printed circuit board is harmless to the quality and reliability of LCD module.

FDTC has adopted 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, FDTC 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.
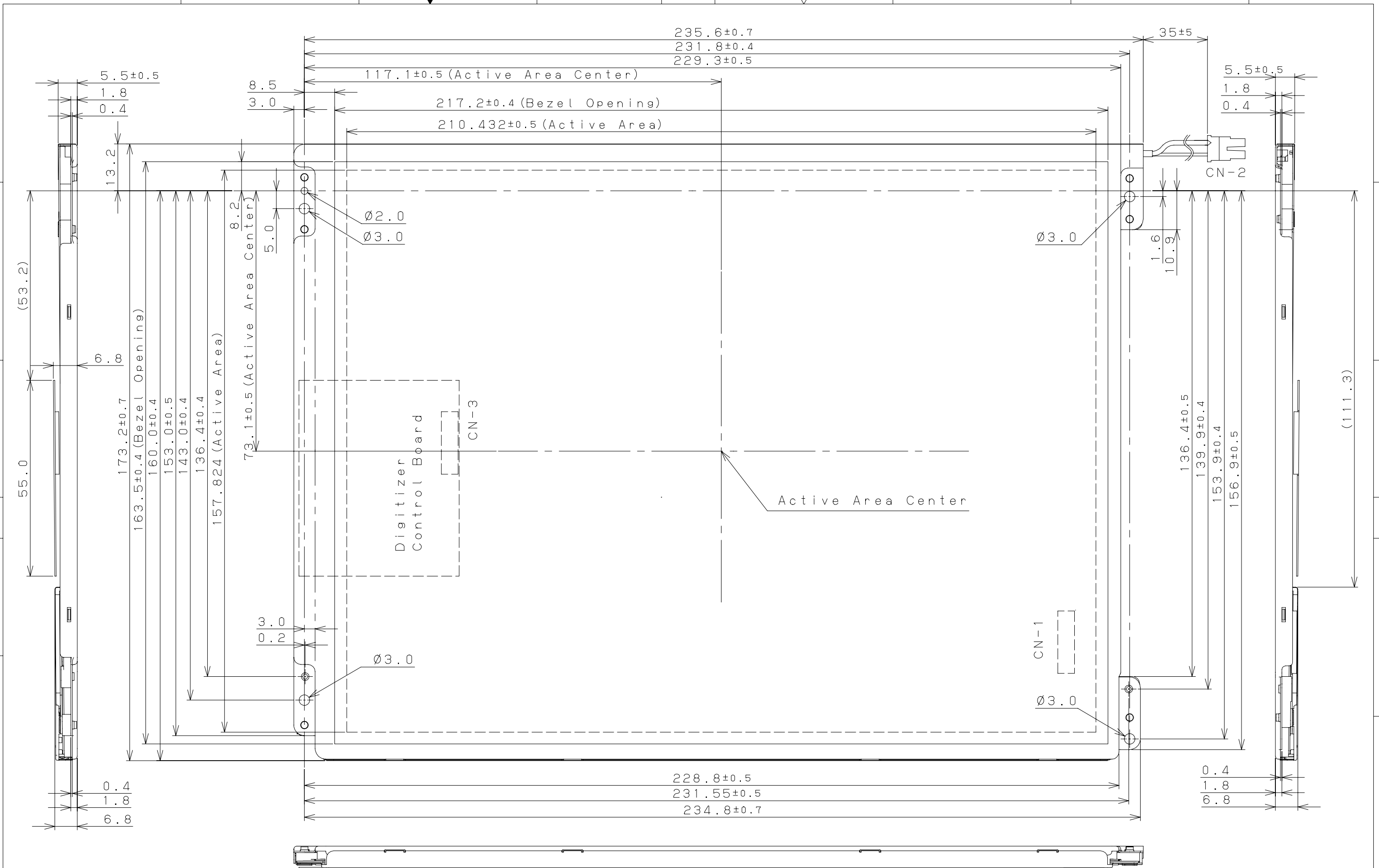
19. MISCELLANEOUS

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.

DOCUMENT CONTROL SECTION

DATE

						TITLE	F L C 2 6 X G C 6 R
EDIT	DATE	DESIG.	CHECK	APPR.	DESCRIPTION	DRAW. NO. Tech Bes LCD-00185	CUST.
DESIG.		CHECK		APPR.		FUJITSU DISPLAY TECHNOLOGIES CORPORATION	29 /

1

Front View

TENTATIVE

TITLE	FLC26XGC6R	
DRAW. NO. Tech Bes LCD-00185		CUST.
EDIT.	DATE	DESIG.	CHECK	DESCRIPTION	FUJITSU DISPLAY TECHNOLOGIES CORPORATION	30/
DESIG.			CHECK		APPR.	

93.04 FDNC-3901-3

216.6±1.0

43.2±1.0

70.8±1.0

126.75±1.0

CN-2

Digitizer
Sensor Board

Digitizer
Control Board

CN-3

CN-1

(43.7)

DOCUMENT CONTROL SECTION

DATE

TENTATIVE

Rear View

		TITLE	FLC26XGC6R	
		DRAW. NO.	Tech Bes LCD-00185	CUST.
EDIT.	DATE	DESIG.	CHECK	DESCRIPTION
DESIG.			CHECK	APPR.

FUJITSU DISPLAY TECHNOLOGIES
CORPORATION

Sheet 31 / 31

93.04 FDNC-3901-3