

Specifications for TFT-LCD Monitor

Version 3.0

MODEL COM65T6112KLC

Customer's Approval

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Revision History

Ver.	Date	Page	Description
1.0	Nov.27,2008		First issue
2.0	Apr.1,2010 △ A	All	Change It is a company name change from CASIO COMPUTER CO., LTD. to ORTUS TECHNOLOGY CO., LTD.
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1. APPLICATION

This Specification is applicable to 16.56cm (6.5 inch) TFT-LCD back-light monitor for non-military use.

- ◎ ORTUS TECHNOLOGY makes no warranty or assume no liability that use of this Product and/or any information including drawings in this Specification by Purchaser is not infringing any patent or other intellectual property rights owned by third parties, and ORTUS TECHNOLOGY shall not grant to Purchaser any right to use any patent or other intellectual property rights owned by third parties. Since this Specification contains ORTUS TECHNOLOGY'S confidential information and copy right, Purchaser shall use them with high degree of care to prevent any unauthorized use, disclosure, duplication, publication or dissemination of ORTUS TECHNOLOGY'S confidential information and copy right.
- ◎ If Purchaser intends to use this Products for an application which requires higher level of reliability and/or safety in functionality and/or accuracy such as transport equipment (aircraft, train automobile etc.), disaster-prevention/security equipment or various safety equipment, Purchaser shall consult ORTUS TECHNOLOGY on such use in advance.
- ◎ This Product shall not be used for application which requires extremely higher level of reliability and/or safety such as aerospace equipment, telecommunication equipment for trunk lines, control equipment for nuclear facilities or life-support medical equipment.
- ◎ ORTUS TECHNOLOGY assumes no liability for any damage resulting from misuse, abuse, and/or miss-operation of the Product deviating from the operating conditions and precautions described in the Specification.
- ◎ If any issue arises as to information provided in this Specification or any other information, ORTUS TECHNOLOGY and Purchaser shall discuss them in good faith and seek solution.
- ◎ ORTUS TECHNOLOGY assumes no liability for defects such as electrostatic discharge failure occurred during peeling off the protective film or Purchaser's assembly process.
- ◎ This Product is compatible for RoHS directive.

Object substance	Maximum content [ppm]
Cadmium and its compound	100
Hexavalent Chromium Compound	1000
Lead & Lead compound	1000
Mercury & Mercury compound	1000
Polybrominated biphenyl series (PBB series)	1000
Polybrominated biphenyl ether series (PBDE series)	1000

2. Outline Specifications

2.1 Features of the Product

- 6.5" diagonal with resolution of 1,920[H]x480[V] dots.
- 6-bit 262,144 color display capability.
- Built in Timing generator (TG)
- Long life & High brightness white LED back-light

2.2 Display Method

Items	Specifications	Remarks
Display type	TN type 262,144 Colors. Transmissive mode, Normally white.	
Driving method	a-Si TFT Active matrix. Line-scanning, Non-interlace.	
Dot arrangement	RGB stripe arrangement.	Refer to fig. 1
Signal input method	6-bit RGB, parallel input.	
Backlight type	Long life & High bright white LED.	

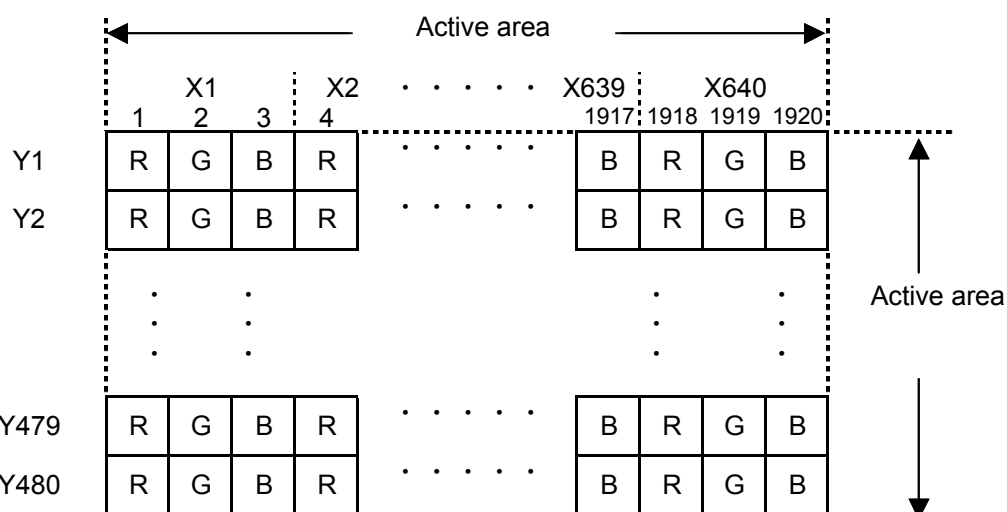


Fig 1 Dot arrangement
(FPC cable placed down)

3. DIMENSIONS AND SHAPE

3.1 Dimensions

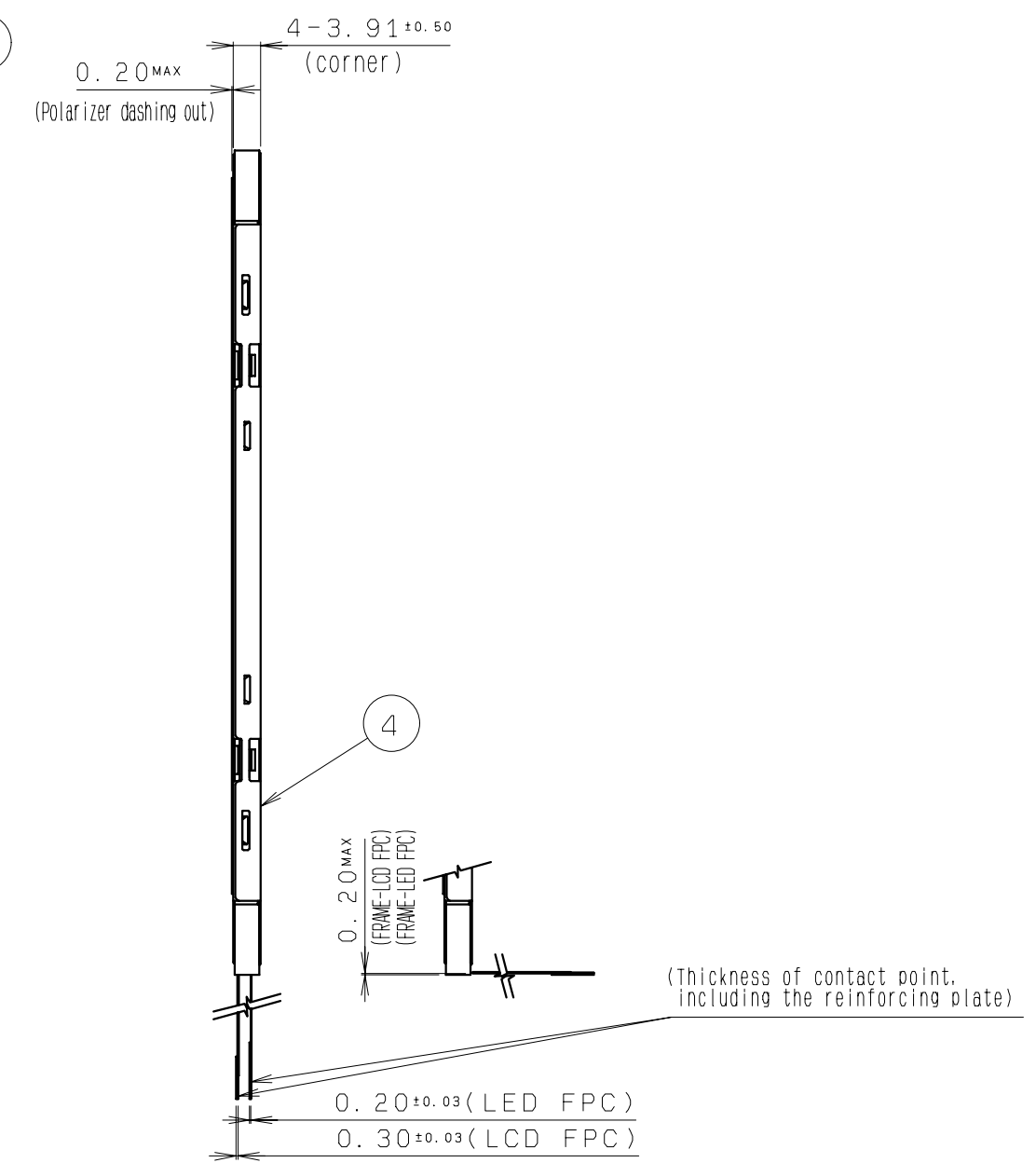
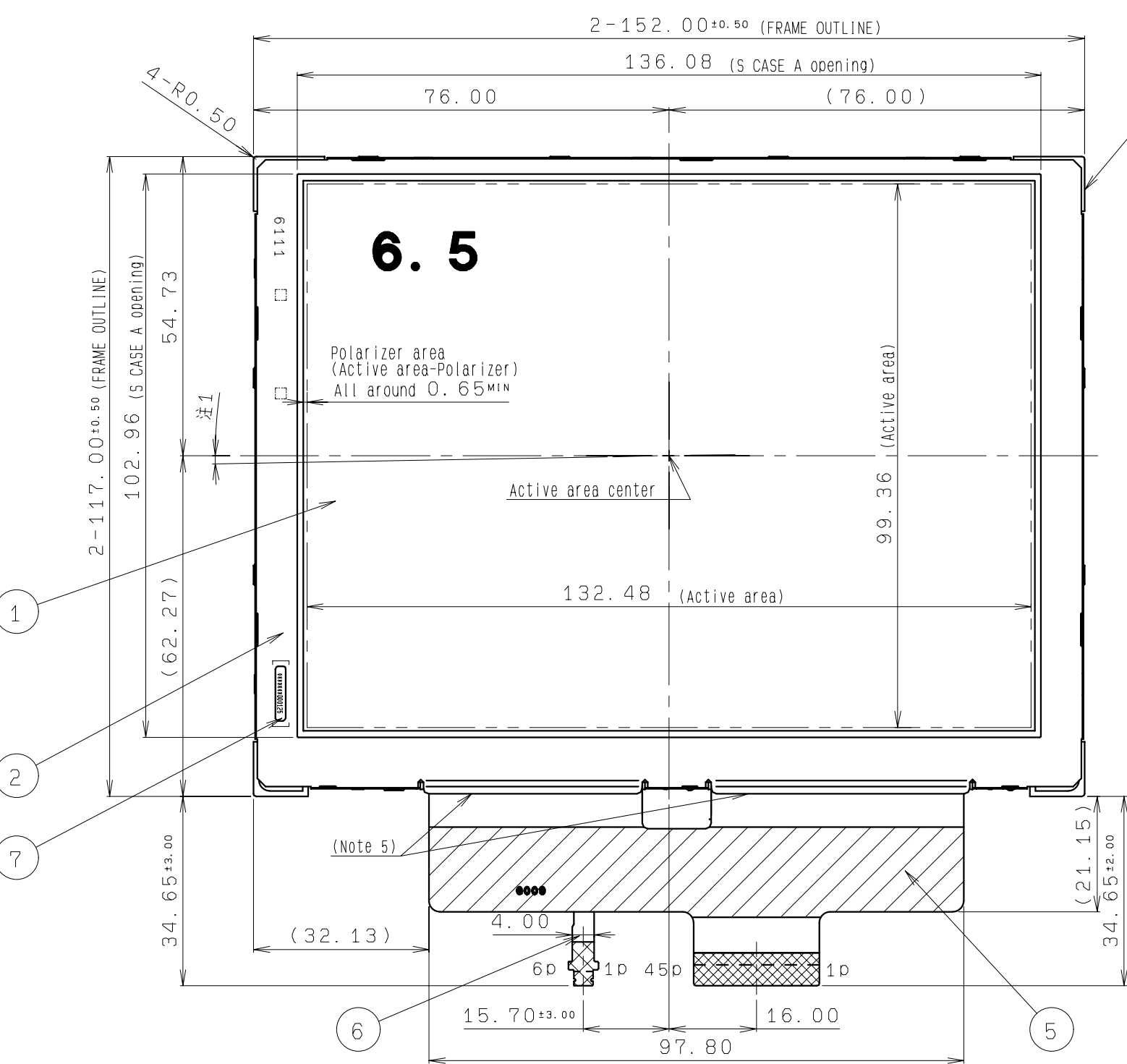
Items	Specifications	Unit	Remarks
Outline dimensions	152.00[H] × 117.00[V] × 3.91[D]	mm	Exclude FPC cable
Active area	132.48[H] × 99.36[V]	mm	16.56cm diagonal
Number of dots	1920[H] × 480[V]	dot	
Dot pitch	69.0[H] × 207.0[V]	μm	
Surface hardness of the polarizer	3	H	Load: 2.0N
Weight	121	g	Include FPC cable

3.2 Outward Form

EC No.	REV. No.	REVISE	DATE (Y:M:D)	APPROVED	CHECKED	PREPARED

(6/33)
08TLM062
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Front



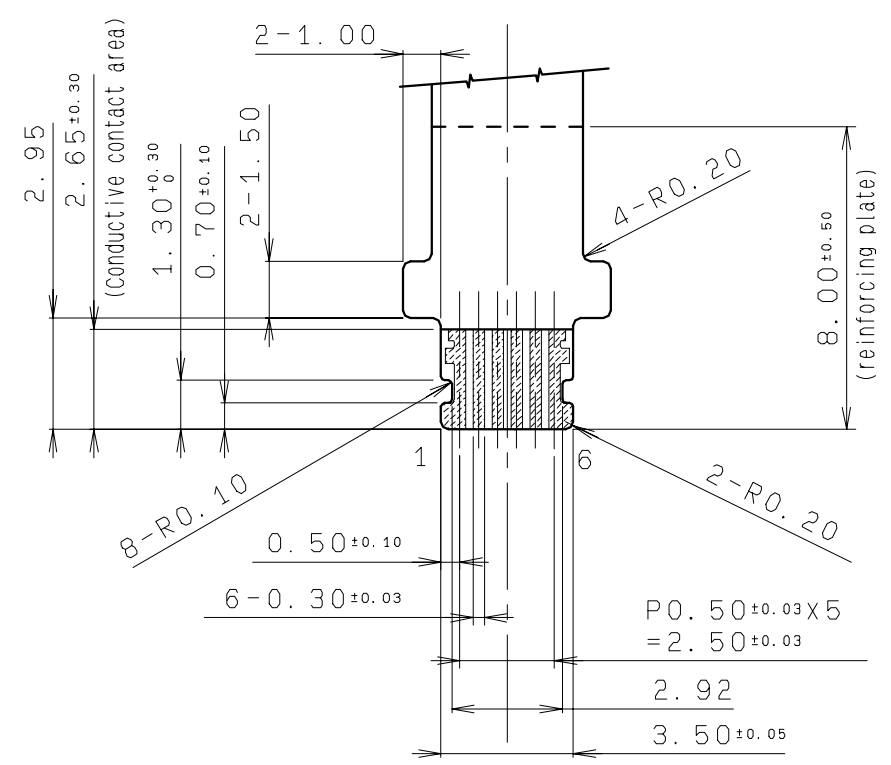
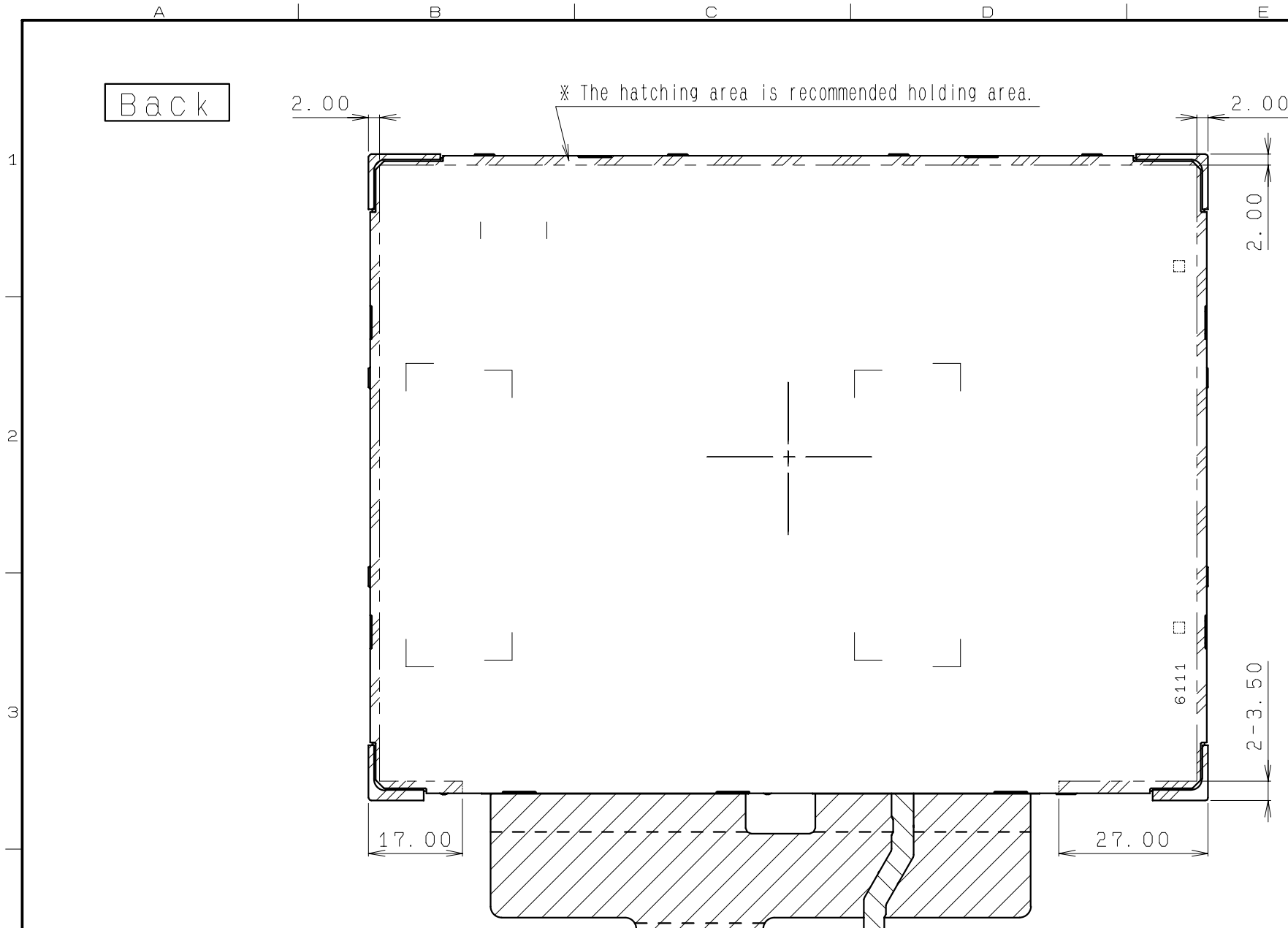
- Note 1. Angular deviation of LCD cell from the TFT-LCD monitor's reference axis shall be less than $[\pm 50']$.
- Note 2. S label is affixed the area shown in the drawing. The thickness of the S label will be added to that of S case's surface.
- Note 3. Protective film is affixed on front surface of the screen. Location tolerance of the protective film shall be ± 1.5 mm to the polarizing film.
- Note 4. Recommended FPC connectors
For LCD : KYOCERA ELCO, part number: 04 6240 045 023 846+(Lower contact)
For LED : KYOCERA ELCO, part number: 04 6277 006 001 883+(Lower contact)
- Note 5. Exercise care not to apply any forces to the cable holder of the S case A.
- Note 6. Refer to "11.CRITERIA OF JUDGMENT" about the appearance specification of a polarizer.

S LABEL	7		(10X1.85X0.075t)
LED FPC	6		
LCD FPC	5		
S CASE C	4		
FRAME	3		
S CASE A	2		
TFT-LCD PANEL	1	Glass substrate thickness=0.5t	
PART NAME	ITEM	MATERIAL GRADE	REMARK

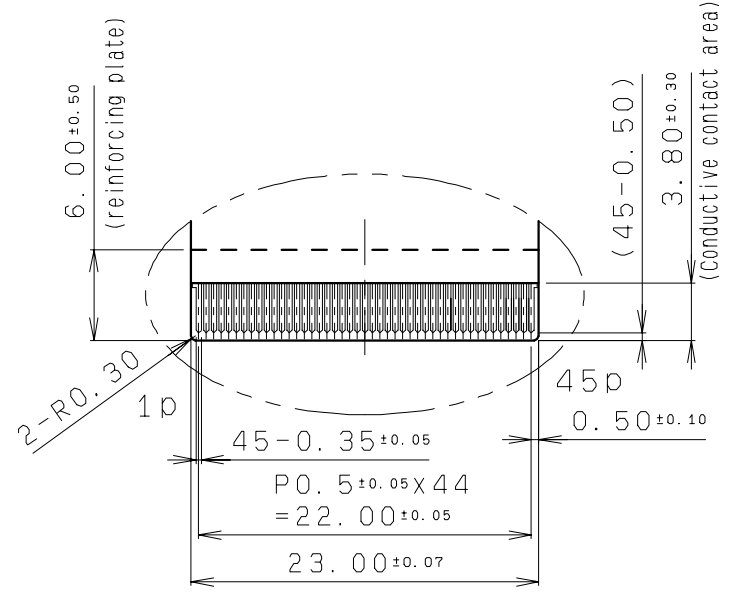
APPROVED Hashizume	GENERAL TOLERANCE ± 1.0	SCALE 1/1(2/1,5/1)	UNIT mm	ORTUSTECH ORTUS TECHNOLOGY CO., LTD. DO NOT DUPLICATE, CONFIDENTIAL AND PROPRIETARY
CHECKED Hiranobu	ISSUE (Y:M:D) 08:06:09	MODEL COM65T6112KLC		
CHECKED	NAME			DRAWING No.
DESIGN Ide	OUTLINE-D6112			REV.
DRAW Ide				SHEET
				DIV.
				RJD516772D301
				1/2

EC No.	REV. No.	REVISE	DATE (Y:M:D)	APPROVED	CHECKED	PREPARED

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08TLM062
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Detail B (S=5/1)



Detail A (S=2/1)

APPROVED Hashizume	GENERAL TOLERANCE ± 1.0	SCALE 1/1(2/1, 5/1)	UNIT mm
CHECKED Hiranobu	ISSUE (Y:M:D) 08:06:09	MODEL COM65T6112KLC	
CHECKED	NAME		
DESIGN Ide			
DRAW Ide			

OUTLINE-D6112

ORTUSTECH ORTUS TECHNOLOGY CO., LTD.			
DO NOT DUPLICATE, CONFIDENTIAL AND PROPRIETARY			
DRAWING No.	REV.	SHEET	DIV.
RJD516772D301		2/2	

3.3 SERIAL LABEL (S-LABEL)

1) Display Items

S-label indicates the least significant digit of manufacture year (1digit), manufacture month with below alphabet (1letter), model code (4characters), serial number (6digits).

* Contents of Display

* * **** *****
 _ _ _ _
 a b c d

Contents of display				
a	The least significant digit of manufacture year			
b	Manufacture month	Jan-A Feb-B Mar-C Apr-D	May-E Jun-F Jul-G Aug-H	Sep-I Oct-J Nov-K Dec-L
c	Model code	65CC (Made in Japan) 65FC (Made in Malaysia) 65JC (Made in China)		
d	Serial number			

* Example of indication of Serial label (S-label)

•Made in Japan

9E65CC000125

means "manufactured in May 2009, model 65C, C specifications, serial number 000125"

•Made in Malaysia

9E65FC000125

means "manufactured in May 2009, model 65F, C specifications, serial number 000125"

•Made in China

9E65JC000125

means "manufactured in May 2009, model 65J, C specifications, serial number 000125"

2) Location of Serial Label (S-label)

Refer to 3.2 "Outward Form".

4. PIN ASSIGNMENT

4.1 Display Module Part

No.	Symbol	PIN treatment	Functions
1	VSS	—	GND.
2	VGL	—	Negative voltage for gate driver.
3	VDD	—	Power supply for logic circuit.
4	VGH	—	Positive voltage for gate driver.
5	AVDD	—	Power supply for analog circuit.
6	V10	—	Source driver output level voltage. (negative case)
7	V6	—	Source driver output level voltage. (negative case)
8	V5	—	Source driver output level voltage. (positive case)
9	V1	—	Source driver output level voltage. (positive case)
10	POCB	pull-up	Power on clear. (Low: Active)
11	DISP	pull-up	Display on/off control signal(Lo : display off, Hi : display on)
12	RL	—	Horizontally Flipped (right/left) Signal. (Lo: Horizontally Flipped Display, Hi: Normal display)
13	UD	—	Vertically Flipped (up/down) Signal. (Lo: Normal display, Hi: Vertically Flipped Display)
14	VSS	—	GND.
15	VDD	—	Power supply for logic circuit.
16	DE	pull-down	Input data effective signal. (It is effective for the period of "Hi")
17	HSYNC	—	Horizontal sync signal. (Low active)
18	VSYNC	—	Vertical sync signal. (Low active)
19	CLK	—	Clock signal. Latching data at the rising edge.
20	TEST5	pull-down	Short to VSS
21	TEST6		Short to VSS
22	D00		Display data(R). 00h: Black D00: LSB D05: MSB Driver has internal gamma conversion.
23	D01		
24	D02		
25	D03		
26	D04		
27	D05		
28	TEST3	pull-down	Short to VSS
29	TEST4		Short to VSS
30	D10		Display data(G). 00h: Black D10: LSB D15: MSB Driver has internal gamma conversion.
31	D11		
32	D12		
33	D13		
34	D14		
35	D15		
36	TRST1	pull-down	Short to VSS
37	TEST2		Short to VSS
38	D20		Display data(B). 00h: Black D20: LSB D25: MSB Driver has internal gamma conversion.
39	D21		
40	D22		
41	D23		
42	D24		
43	D25		
44	VCOM	—	Input signal for common electrode.
45	VSS	—	GND.

* Recommended connector: Kyocera Elco, 6240 series (04 6240 045 023 846+)

* FPC's terminal uses the gilding.

* Please refer to the "3.2 Outward Form" for terminal order.

4.2 Backlight Part

No.	Symbol	Functions
1	BLH1	Backlight drive 1 (anode side)
2	BLL1	Backlight drive 1 (cathode side)
3	BLH2	Backlight drive 2 (anode side)
4	BLL2	Backlight drive 2 (cathode side)
5	BLH3	Backlight drive 3 (anode side)
6	BLL3	Backlight drive 3 (cathode side)

* Recommended connector: Kyocera Elco, 6277 series (04 6277 006 001 883+)

* FPC's terminal uses the gilding.

* Please refer to the "3.2 Outward Form" for terminal order.

5. ABSOLUTE MAXIMUM RATING

VSS=0V

Item	Symbol	Condition	Rating		Unit	Applicable terminals
			MIN	MAX		
Supply voltage for logic	VDD	Ta=25° C Note 1	-0.3	7.0	V	VDD
Supply voltage for analog1	AVDD		-0.3	13.5	V	AVDD
Supply voltage for analog2	VGH		-0.3	42.0	V	VGH
Supply voltage for analog3	VGL		VGH-42.0	0.3	V	VGL
Supply voltage for analog4	Vy		-0.3	AVDD-0.1	V	V1,V5,V6,V10 Note 2
Input voltage for logic	VI		-0.3	VDD+0.3	V	CLK,VSYNC,HSYNC,DE, D[25:00],RL,UD,TEST1~6, DISP,POCB
Common electrode voltage	VCOM		-0.3	10.0	V	VCOM
LED direction current of order	IL	Ta = 25° C	—	35	mA	BLH1 - BLL1,BLH2 - BLL2 BLH3 - BLL3
		Ta = 70° C	—	15		
Storage temperature	Tstg		-30	80	°C	
Storage humidity range	Hstg		Non condensing in an environmental moisture at or less than 40° C90%RH		%	

Note 1: Please refer to the "Power on/off sequence" section of this document.

Note 2: AVDD>V1>V5>V6>V10>VSS.

6. RECOMMENDED OPERATING CONDITIONS

VSS=0V

Item	Symbol	Condition	Rating			Unit	Applicable terminals
			MIN	TYP	MAX		
Supply voltage for logic	VDD	Ta=25° C	3.0	3.3	3.6	V	VDD
Supply voltage for analog1	AVDD		11.0	12.0	13.0	V	AVDD
Supply voltage for analog2	VGH		20.0	21.0	22.0	V	VGH
Supply voltage for analog3	VGL		-8.0	-7.0	-6.0	V	VGL
Common electrode voltage Note 1	VCOM		4.2	4.7	5.2	V	VCOM
Contrast range	V1		10.3	10.6	10.9	V	V1
	V5	6.6	6.9	7.2	V	V5	
	V6	5.4	5.7	6.0	V	V6	
	V10	0.7	0.8	0.9	V	V10	
Operational temperature	Top	Note2	-20	+25	70	°C	Note 3
Operating humidity range	Hop	Ta ≤ 30° C	20	-	80	%	
		Ta > 30° C	Non condensing in an environmental moisture at or less than 30° C80%RH.				

Note 1: This range indicates the most probable range for the optimal setting for VCOM. It does not mean that the optimal settings for VCOM for all monitors will be in this range. VCOM should be optimized by viewing/using the monitor.

Note 2: This monitor is operable in this temperature range. With regard to optical characteristics, refer to Item 10."CHARACTERISTICS".

Note 3: Acceptable Forward Current to LED is up to 15mA, when Ta=+70° C. Do not exceed Allowable Forward Current shown on the chart below.

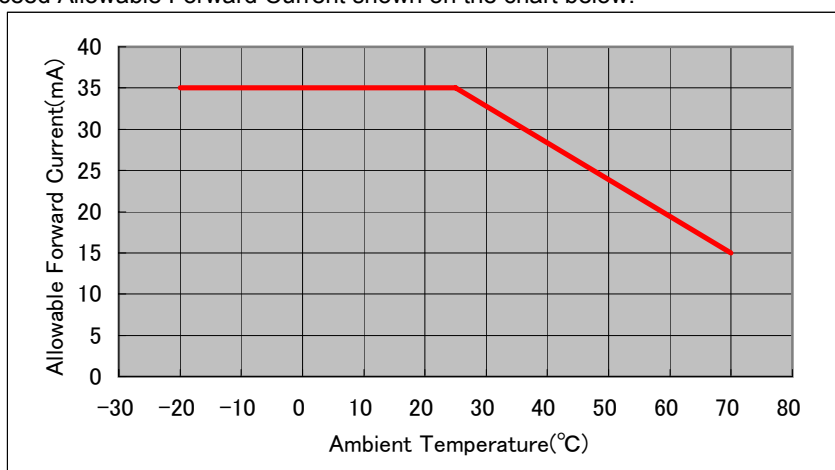


Fig 2 Allowable Forward Current

7. CHARACTERISTICS

7.1 DC characteristics

7.1.1 Display Module

If not specified, Ta=25°C, VDD=3.3V, VSS=0V

Item	Symbol	Condition	Rating			Unit	Applicable terminals
			MIN	TYP	MAX		
Input voltage for logic	VIH		0.7×VDD	—	VDD	V	CLK, VSYNC, HSYNC, DE, D[25:00], RL, UD
	VIL		0	—	0.3×VDD	V	DISP, POCB
Pull up resistor value	Rpu		300	450	600	kΩ	POCB, DISP
Pull down resistor value	Rpd		300	450	600	kΩ	DE, D[25:00], TEST1~6
Current consumption	IDD	fCLK=25MHz Color bar display	—	7.0	14.0	mA	VDD
	IAVDD	VDD=3.3V AVDD=12.0V	—	14.0	28.0	mA	AVDD
	IGH	VGH=21.0V VGL=-7.0V	—	120	240	μA	VGH
	IGL		-240	-120	—	μA	VGL

7.1.2 Backlight

Item	Symbol	Condition	Rating			Unit	Applicable terminals
			MIN	TYP	MAX		
Forward current	IL25	Ta=25°C	—	20.0	35.0	mA	BLH1 - BLL1
	IL70	Ta=70°C	—	—	15.0	mA	BLH2 - BLL2
Forward voltage	VL	Ta=25°C, IL=20.0mA	—	28.8	31.5	V	BLH3 - BLL3
Estimated Life of LED	LL	Ta=25°C, IL=20.0mA Note1	—	(50,000)	—	hr	

Note1: - The lifetime of the LED is defined as a period till the brightness of the LED decreases to the half of its initial value.

- This figure is given as a reference purpose only, and not as a guarantee.
- This figure is estimated for an LED operating alone.

As the performance of an LED may differ when assembled as a monitor together with a TFT panel due to different environmental temperature.

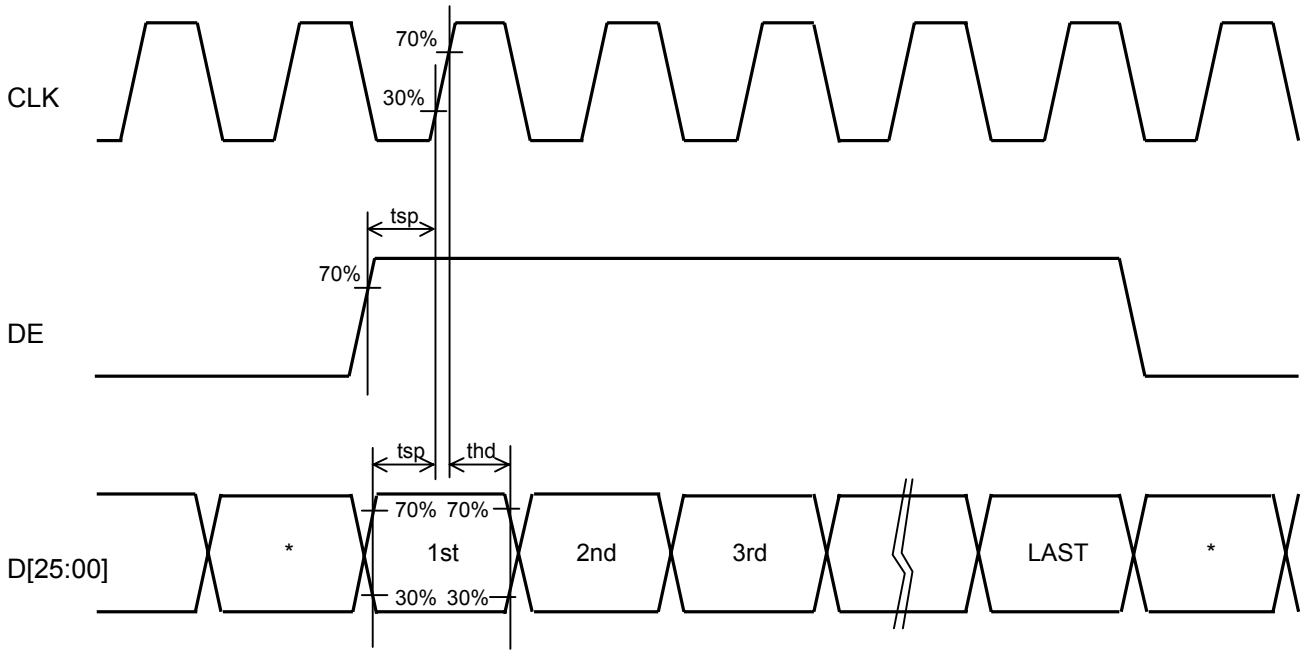
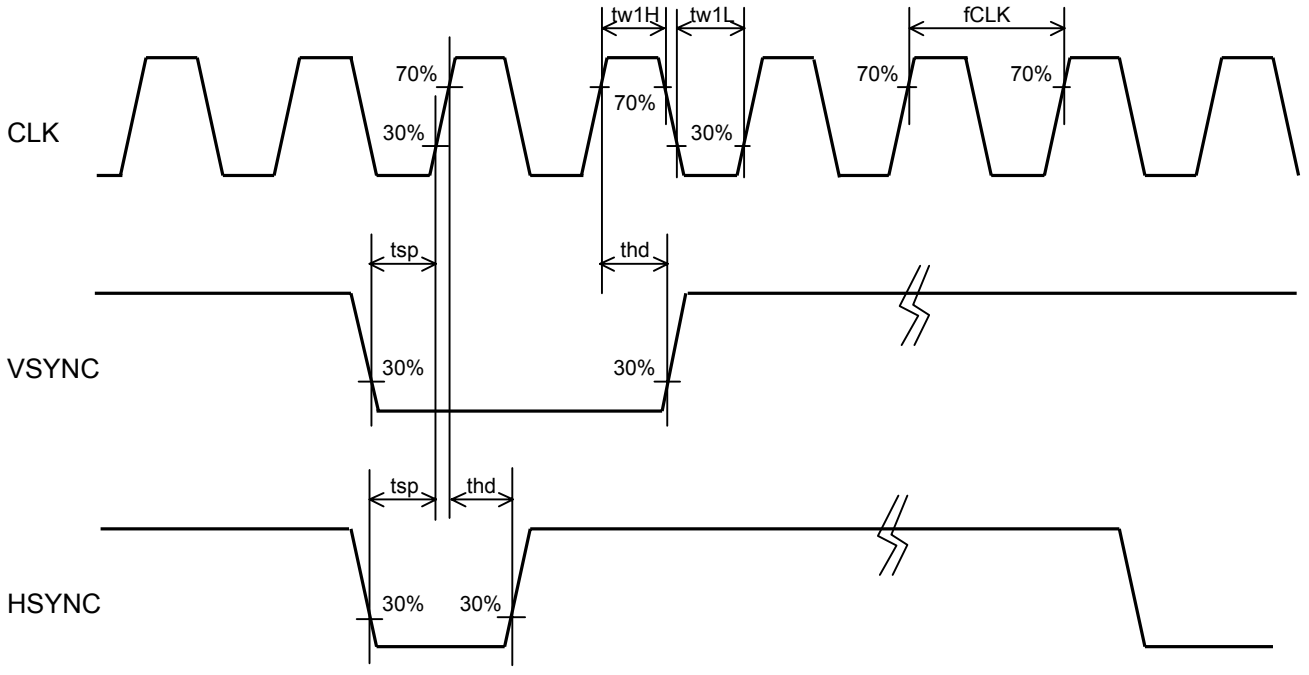
- Estimated lifetime could vary on a different temperature and usually higher temperature could reduce the life significantly.

7.2 AC Characteristics

If not specified, Ta=25°C, VDD=3.3V, VSS=0V

Item	Symbol	Condition	Rating			Unit	Applicable terminals
			MIN	TYP	MAX		
Clock frequency	fCLK		—	25	27	MHz	CLK
Clock Low period	tw1L	0.3×VDD or less	14.8	—	—	ns	CLK
Clock High period	tw1H	0.7×VDD or more	14.8	—	—	ns	CLK
INPUT setup time	tsp		10	—	—	ns	CLK, DE, D[25:00]
INPUT hold time	thd		10	—	—	ns	HSYNC, VSYNC

Switching Characteristics Wave Form



* INVALID

7.3 INPUT TIMING

Item	Symbol	Rating			Unit	Applicable terminals
		MIN	TYP	MAX		
CLK frequency	fCLK	—	25	27	MHz	CLK
VSYNC signal cycle time	tv	—	525	—	H	VSYNC,HSYNC
VSYNC frequency Note1	fVSYNC	54	60	66	Hz	VSYNC
VSYNC pulse width	tw2H	1	3	5	H	VSYNC,HSYNC
Vertical back porch	tvb	—	35	—	H	VSYNC,HSYNC,DE,D[25:00]
Vertical display period	tvdp	—	480	—	H	VSYNC,HSYNC,DE,D[25:00]
HSYNC signal cycle time	th	—	800	—	CLK	HSYNC,CLK
HSYNC pulse width	tw3H	5	30	—	CLK	HSYNC,CLK
Horizontal back porch	thb	112	—	144	CLK	HSYNC,CLK,DE,D[25:00]
Horizontal display period	thdp	—	640	—	CLK	HSYNC,CLK,DE,D[25:00]
DE pulse width	tw4H	—	640	—	CLK	DE,CLK

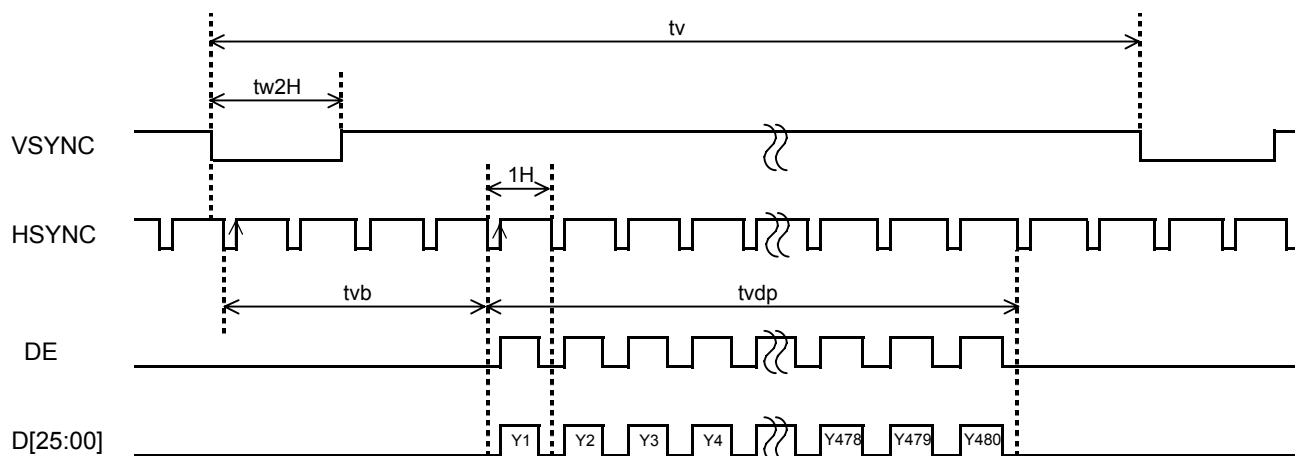
Note 1: The characteristic of this item is recommended standard.

Please use it after it confirms it enough like the display fineness etc.
when it comes off from this characteristic and it is used.

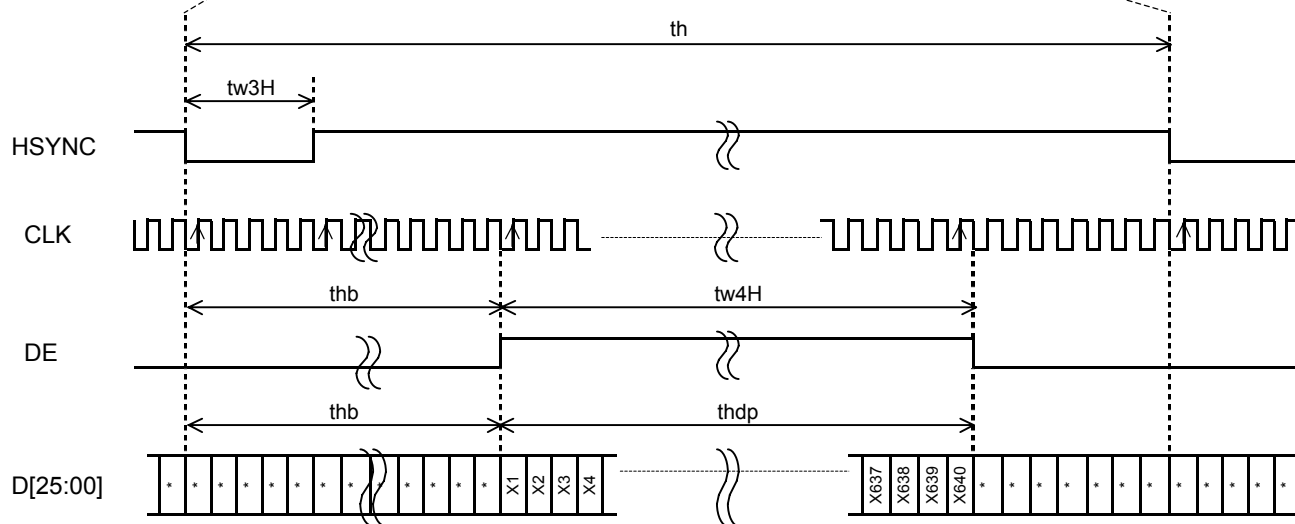
Note 2: When "DE" keeps "Lo" for 144CLK or longer,start capturing data automatically from 144CLK.

7.4 Driving Timing Chart

I. Vertical Timing

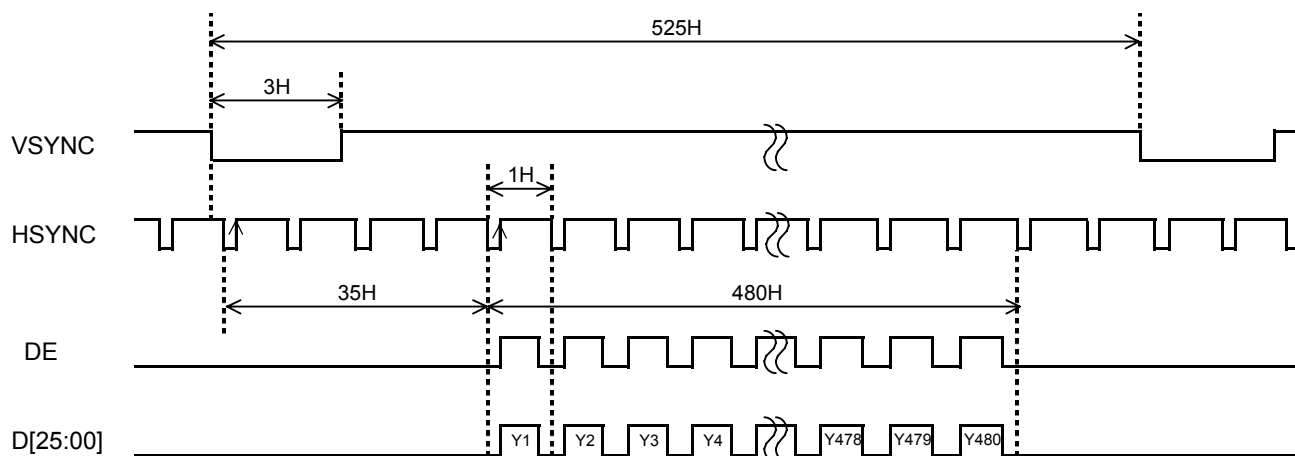


II. Horizontal Timing

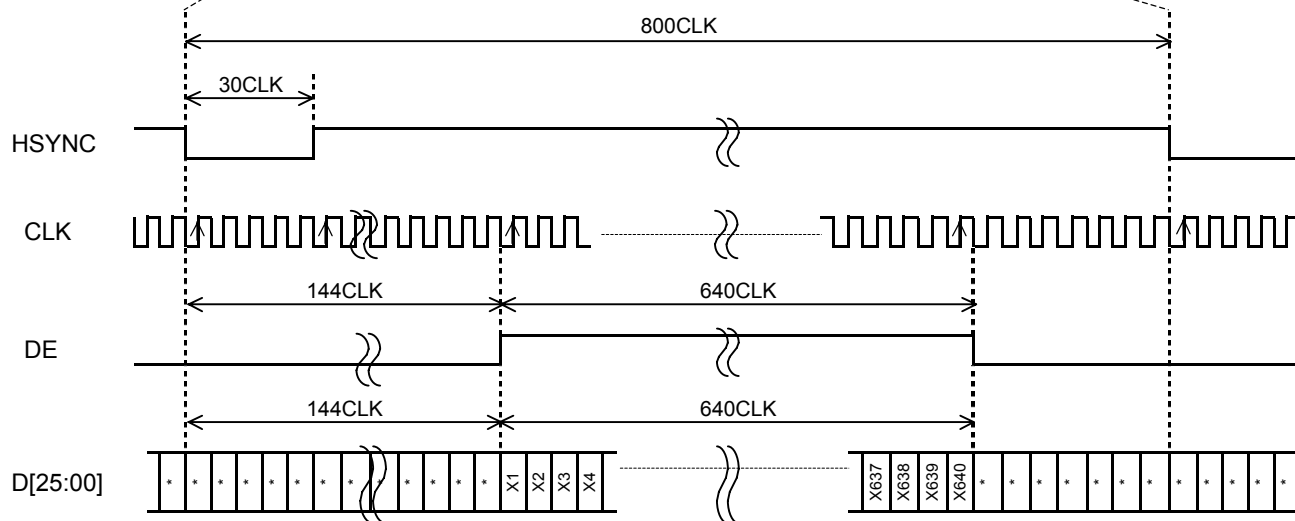


7.5 Example of Driving Timing Chart (fCLK=25MHz)

I. Vertical Timing



II. Horizontal Timing



8. Description of Operation

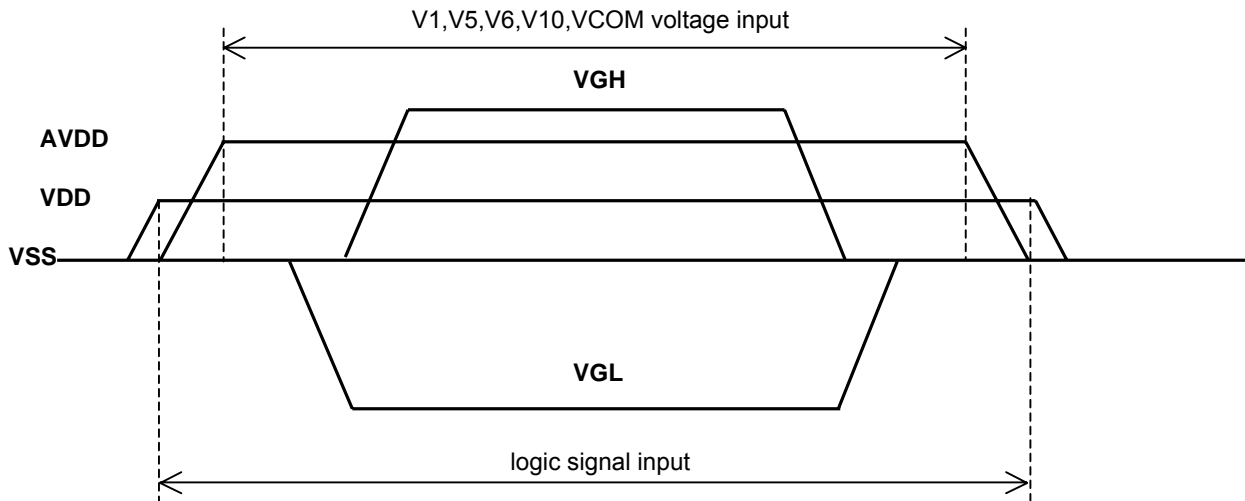
8.1 Power On/Off Sequence

The sequence of the Power On/Off and the signal input must defend the following conditions.

- Please input the logic signal after turning on VDD.
- Please input AVDD after turning on VDD or at the same time.
- Please input V1, V5, V6, V10 and VCOM voltage after turning on AVDD.
- Please input VGL after turning on VDD.
- Please input VGH after turning on VGL.

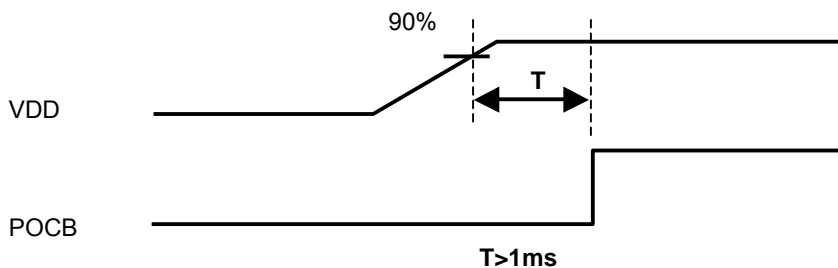
Power Off sequence is assumed to be opposite of the above mentioned sequence.

Please refer Power On/Off recommended sequence is shown in the figure below.



8.2 Power On Clear

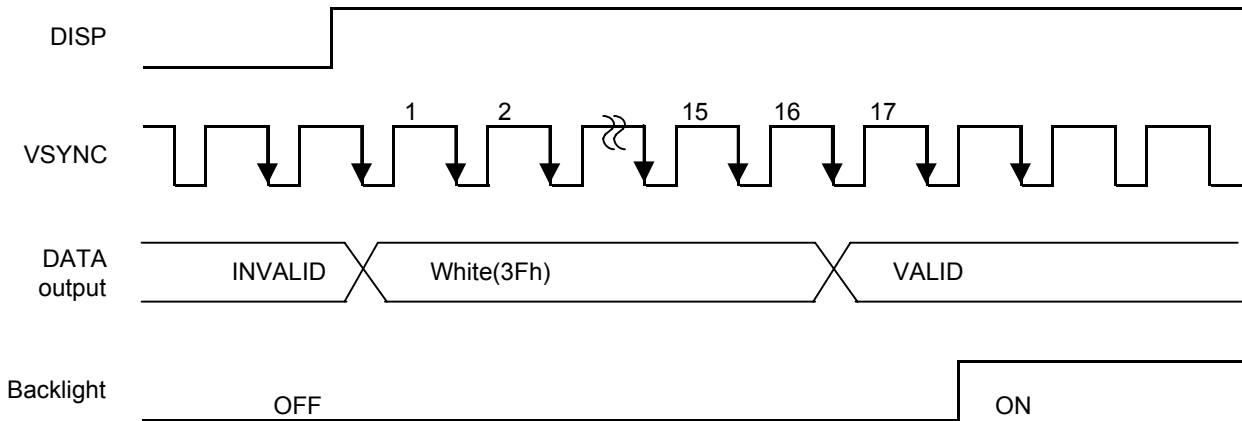
There is a limitation between Power On and POCB (power on clear). Please defend the following conditions.



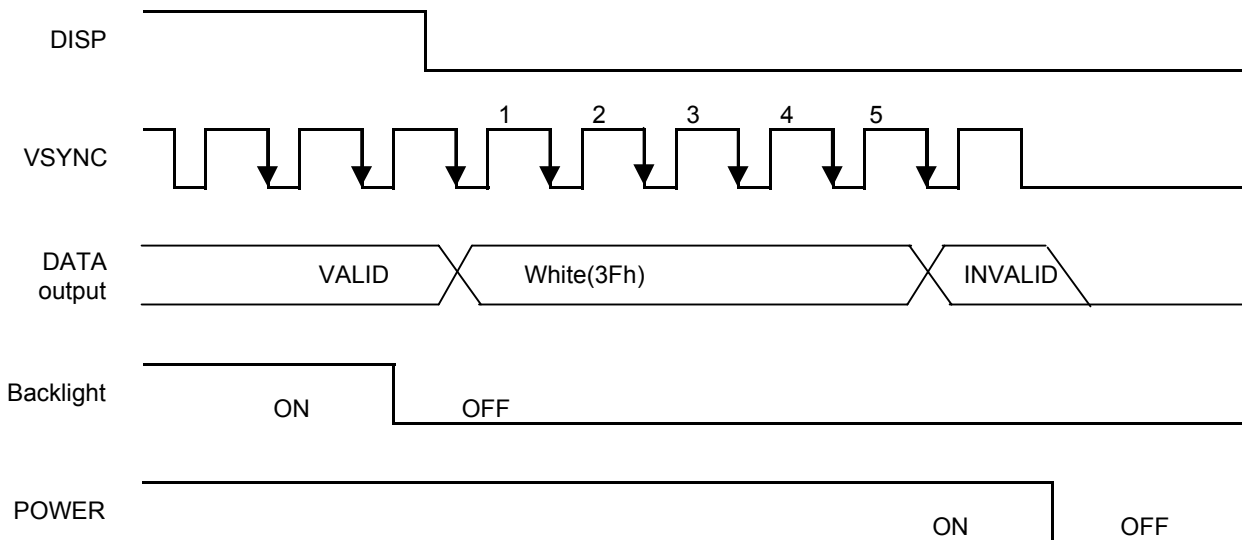
8.3 Display on/off Sequence

It explains the Display on/off sequence.

After Display on, "White" data(3Fh) is outputted for 16-Frames first, from the falling edge of the following VSYNC signal.



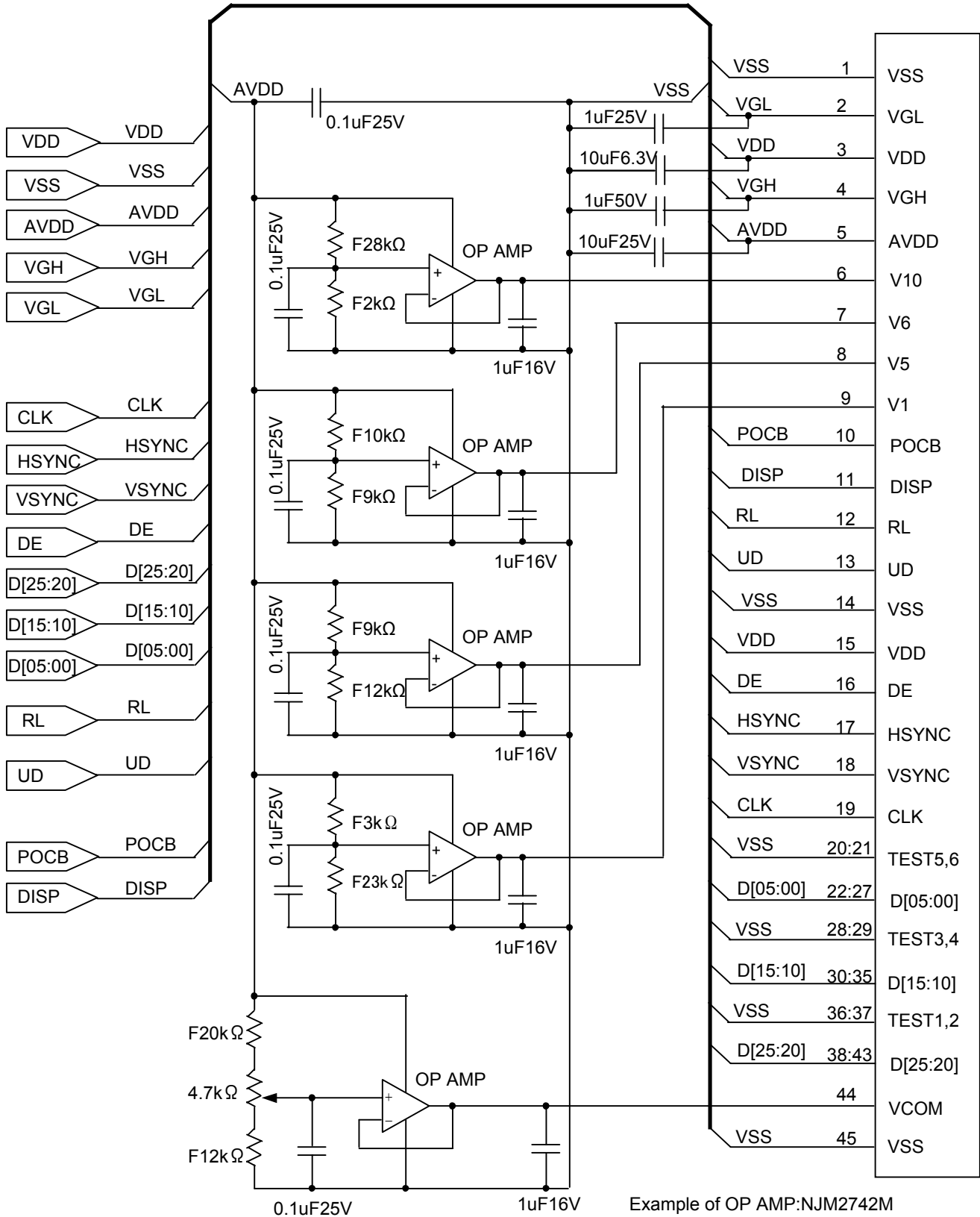
After Display off, "White" data(3Fh) is outputted for 5-Frames first, from the falling edge of the following VSYNC signal. Please turn off the power supply promptly after OFF of "DISP".



B

9. CIRCUIT

9.1 Driving Circuit Example (AVDD=12.0V)

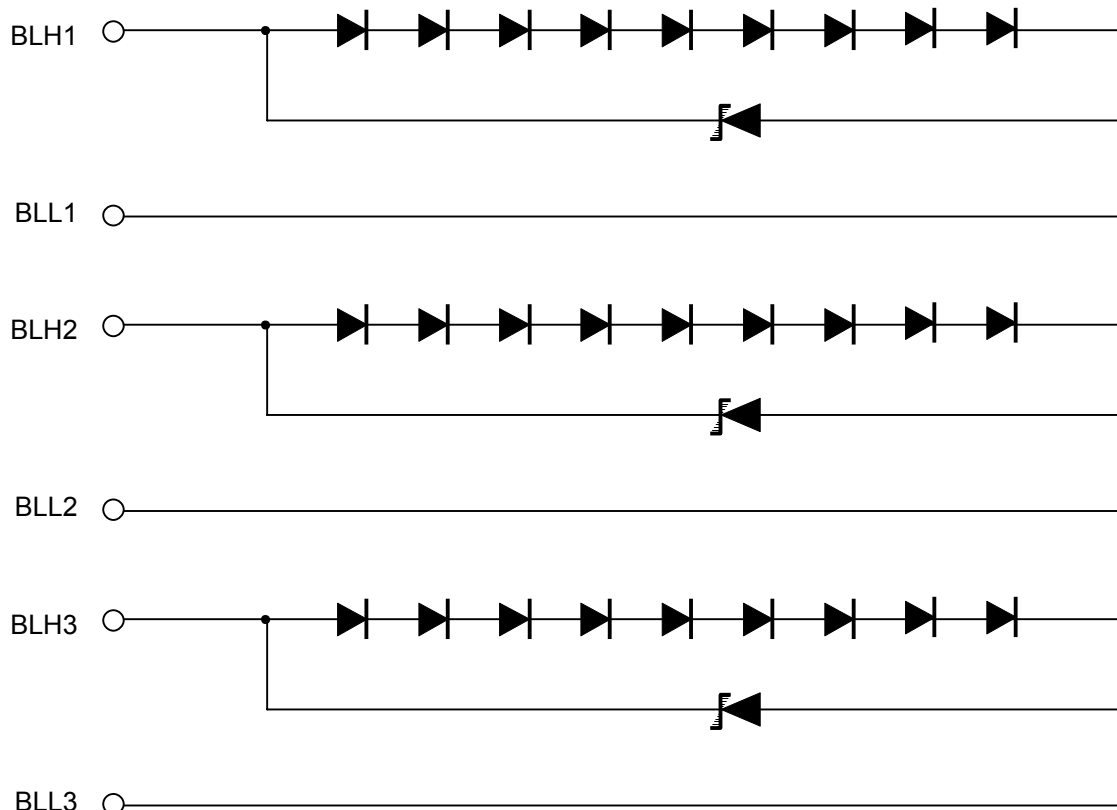


Example of OP AMP: NJM2742M

TFT LCD MODULE REFERENCE CIRCUIT

This circuit design is for reference purposes only. Appropriate component values may be different. Please evaluate on your side.

9.3 LED Circuit



10. CHARACTERISTICS



10.1 Optical Characteristics

< Measurement Condition >

Measuring instruments: CS1000 (KONICA MINOLTA), LCD7000 (OTSUKA ELECTRONICS), EZcontrast160D (ELDIM)

Driving condition: VDD = 3.3V, VSS = 0V
Optimized VCOMDC
VLCD = Vsigpp/2

Backlight: IL = 20mA

Measured temperature: Ta = 25°C

Item	Symbol	Condition	MIN	TYP	MAX	Unit	Note No.	Remark	
Response time	Rise time	TON VLCD=0.6V→4.9V	—	—	40	ms	1	※	
	Fall time	TOFF VLCD=4.9V→0.6V	—	—	60	ms			
Contrast ratio	CR	VLCD=0.6V/4.9V	240	400	—		2		
Viewing angle	Left	θL θR φU φD VLCD=0.6V/4.9V CR ≥ 10	80	—	—	deg	3	※	
	Right		80	—	—	deg			
	Up		80	—	—	deg			
	Down		80	—	—	deg			
V-T threshold voltage	V90		1.1	1.4	1.7	V	4	※	
	V50		1.6	1.9	2.2	V			
	V10		2.2	2.5	2.8	V			
White V-T Curve			Refer to Fig. 3: White V-T Curve					Reference	
White Chromaticity	x	VLCD=0.6V	Fig. 4: White chromaticity range					5	
	y								
Burn-in			No noticeable burn-in image should be observed after 0.5 hours of window pattern display.				6		
Brightness at the screen center		VLCD=0.6V	280	400	—	cd/m ²	7		
Brightness distribution		VLCD=0.6V	70	—	—	%	8		

* Note number 1 to 8: Refer to the APPENDIX of "Reference Method for Measuring Optical Characteristics".

※ Measured in the form of LCD module.

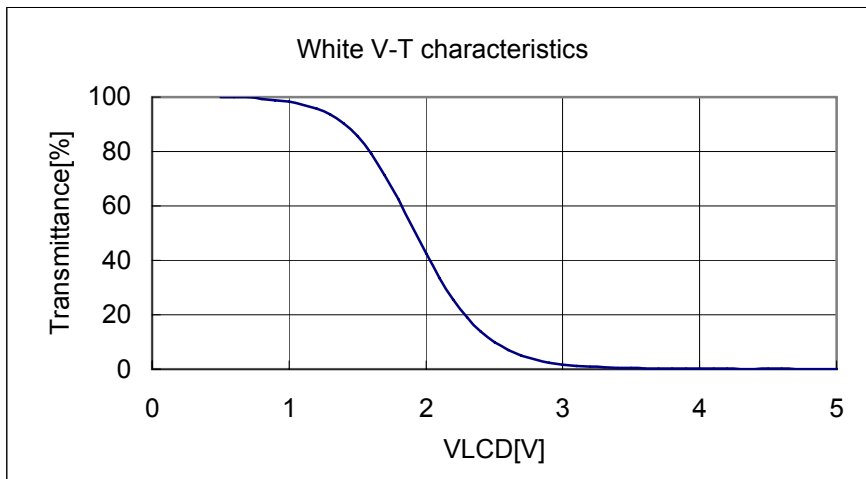


Fig 3 White V-T Curve

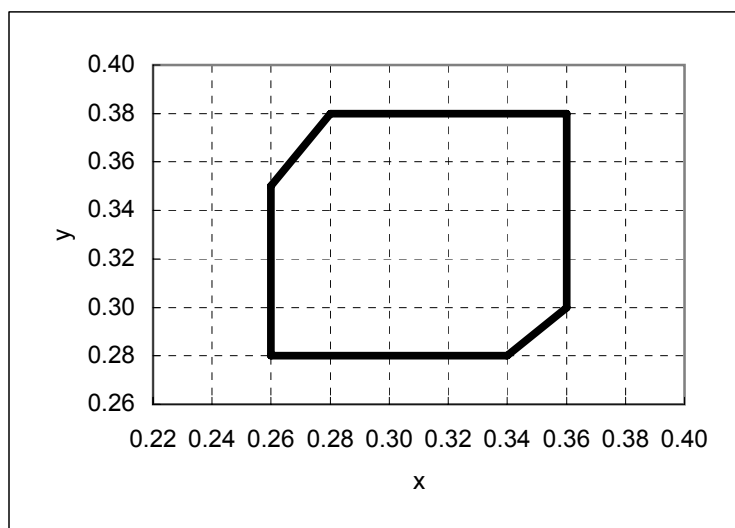


Fig. 4: White Chromaticity Range

【White Chromaticity Range】

x	y
0.26	0.35
0.26	0.28
0.34	0.28
0.36	0.30
0.36	0.38
0.28	0.38

△ 10.2 Temperature Characteristics

< Measurement Condition >

Measuring instruments: CS1000 (KONICA MINOLTA), LCD7000 (OTSUKA ELECTRONICS)

Driving condition: VDD = 3.3V, VSS = 0V

Optimized VCOMDC

VLCD = Vsigpp/2

Backlight: IL=20mA

Item		Specification		Remark	
		Ta = -10°C	Ta = 70°C		
Contrast ratio	CR	40 or more	40 or more		
Response time	Rise time	TON	200 msec or less	30 msec or less	※
	Fall time	TOFF	300 msec or less	50 msec or less	※
Display Quality		No noticeable display defect or ununiformity should be observed.		Use the criteria for judgment specified in the section 11.	

※ Measured in the form of LCD module.

11. CRITERIA OF JUDGMENT

11.1 Defective Display and Screen Quality

Test Condition: Observed TFT-LCD monitor from front during operation with the following conditions

Driving Signal	Raster Patter (RGB in monochrome, white, black)
Signal condition	VLCD:0.6V,2.1V,4.9V(3steps)
Observation distance	30 cm
Illuminance	200 to 350 lx
Backlight	IL = 20 mA

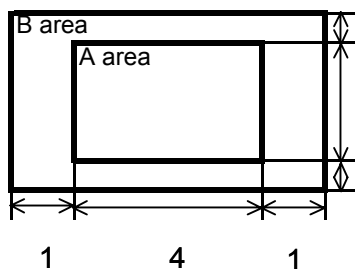
Defect item		Defect content	Criteria	
Display Quality	Line defect	Black, white or color line, 3 or more neighboring defective dots	Not exists	
	Dot defect	Uneven brightness on dot-by-dot base due to defective TFT or CF, or dust is counted as dot defect (brighter dot, darker dot) High bright dot: Visible through 2% ND filter at VLCD=4.9V Low bright dot: Visible through 5% ND filter at VLCD=4.9V Dark dot: Appear dark through white display at VLCD=2.1V	Refer to table 1	
Screen Quality	Dirt	Point-like uneven brightness (white stain, black stain etc)	Invisible through 1% ND filter	
	Foreign particle	Point-like	$0.25\text{mm} < \phi$	N=0
			$0.20 < \phi \leq 0.25\text{mm}$	$N \leq 2$
			$\phi \leq 0.20\text{mm}$	Ignored
	Liner	$3.0\text{mm} < \text{length}, 0.08\text{mm} < \text{width}$	N=0	
$\text{length} \leq 3.0\text{mm}, \text{width} \leq 0.08\text{mm}$		Ignored		
Others		Use boundary sample for judgment when necessary		

$\phi(\text{mm})$: Average diameter = (major axis + minor axis)/2

Permissible number: N

Table 1

Area	High bright	Low bright	Dark dot	Total	Criteria
A	0	2	2	3	Permissible distance between same color bright dots (includes neighboring dots): 3 mm or more
B	2	4	4	6	Permissible distance between same color high bright dots (includes neighboring dots): 5 mm or more
Total	2	4	4	7	



1 Division of A and B areas

B area: Active area

4 Dimensional ratio between A and B areas: 1: 4: 1 (Refer to the left figure)

1

11.2 Screen & Other Appearance

Testing conditions

Illuminance 1200~2000 lx
 Observation distance 30cm

Item		Criteria	Remark
Polarizer	Flaw	Ignore invisible defect when the backlight is on.	Applicable area: Active area only (Refer to the section 3.2 "Outward form")
	Stain		
	Bubble		
	Dust		
	Dent		
	S-case	No functional defect occurs	
	FPC cable	No functional defect occurs	

12. RELIABILITY TEST

Test item		Test condition		number of failures /number of examinations
Durability test	High temperature storage	Ta=80°C	240H	0/3
	Low temperature storage	Ta=-30°C	240H	0/3
	High temperature & high humidity test	Ta=60°C, RH=90% non condensing	240H	0/3
	High temperature operation	Tp=70°C	240H	0/3
	Low temperature operation	Tp=-20°C	240H	0/3
	High temp & humid operation	Tp=40°C, RH=90% non condensing	240H	0/3
	Thermal shock storage	-30←→80°C(30min/30min)	100 cycles	0/3
Mechanical environmental test	Electrostatic discharge test (Non operation)	Confirms to EIAJ ED-4701/300 C=200pF, R=0Ω, V=±200V Each 3 times of discharge on and power supply and other terminals.		0/3
	Surface discharge test (Non operation)	C=250pF, R=100Ω, V=±12kV Each 5 times of discharge in both polarities on the center of screen with the case grounded.		0/3
	Vibration test	Total amplitude 1.5mm, f=10~55Hz, X,Y,Z directions for each 2 hours		0/3
	FPC tension test	Pull the FPC with the force of 3N for 10 sec. in the direction +/- 90-degree to its original direction.		0/3
	FPC bend test	Pull the FPC with the force of 3N for 10 sec. in the direction +/-180-degree to its original direction. Repeat it 3 times.		0/3
	Impact test	Use ORTUS TECHNOLOGY original jig (see next page) and make an impact with peak acceleration of 1000m/s ² for 6 msec with half sine-curve at 3 times to each X, Y, Z directions in conformance with JIS 60068-2-27-1995.		0/3
Packing test	Packing vibration-proof test	Acceleration of 19.6m/s ² with frequency of 10→55→10Hz, X,Y, Zdirection for each 30 minutes		0/1 Packing
	Packing drop test	Drop from 75cm high. 1 time to each 6 surfaces, 3 edges, 1 corner		0/1 Packing

Note: Ta=ambient temperature Tp=Panel temperature

※ The profile of high temperature/humidity storage and High Temperature/humidity operation
(Pure water of over 10MΩ·cm shall be used.)

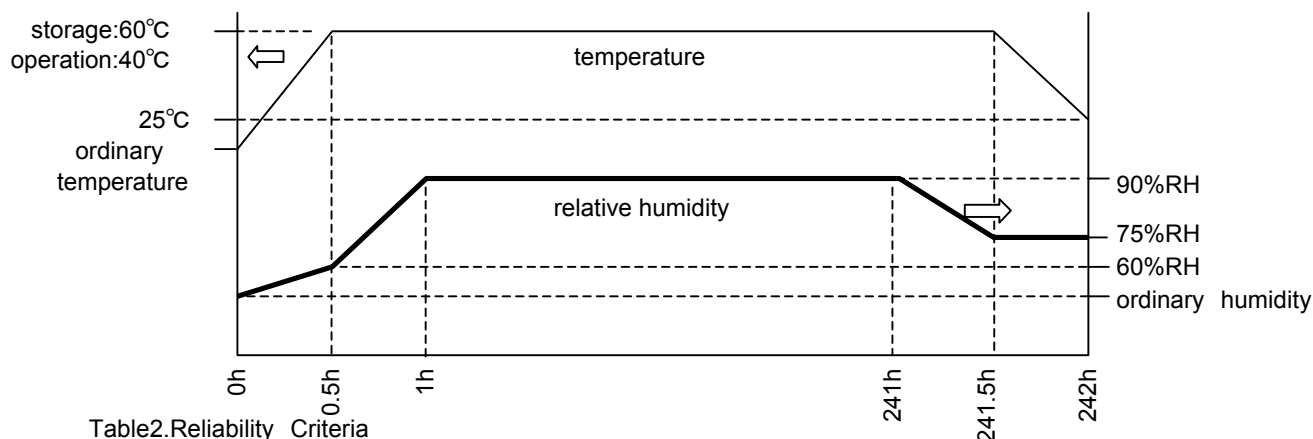
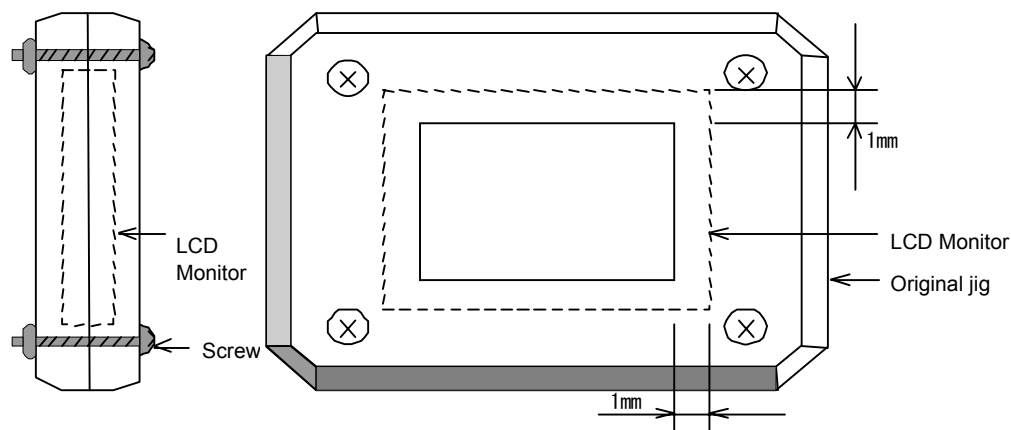


Table2.Reliability Criteria

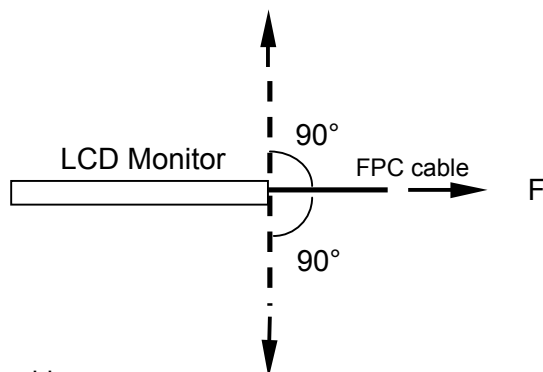
Measure the parameters after leaving the monitor at the ordinary temperature
for 2 hours or more after the test completion.

item	Standard	Remarks
Display quality	No visible abnormality shall be seen.	As criteria of 11"CRITERIA OF JUDGMENT".
Contrast ratio	40 or more	

ORTUS TECHNOLOGY Original Jig

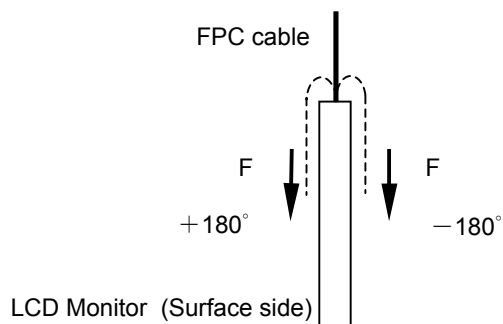


Tension Test Method for FPC cable



Bend Test Method for FPC cable

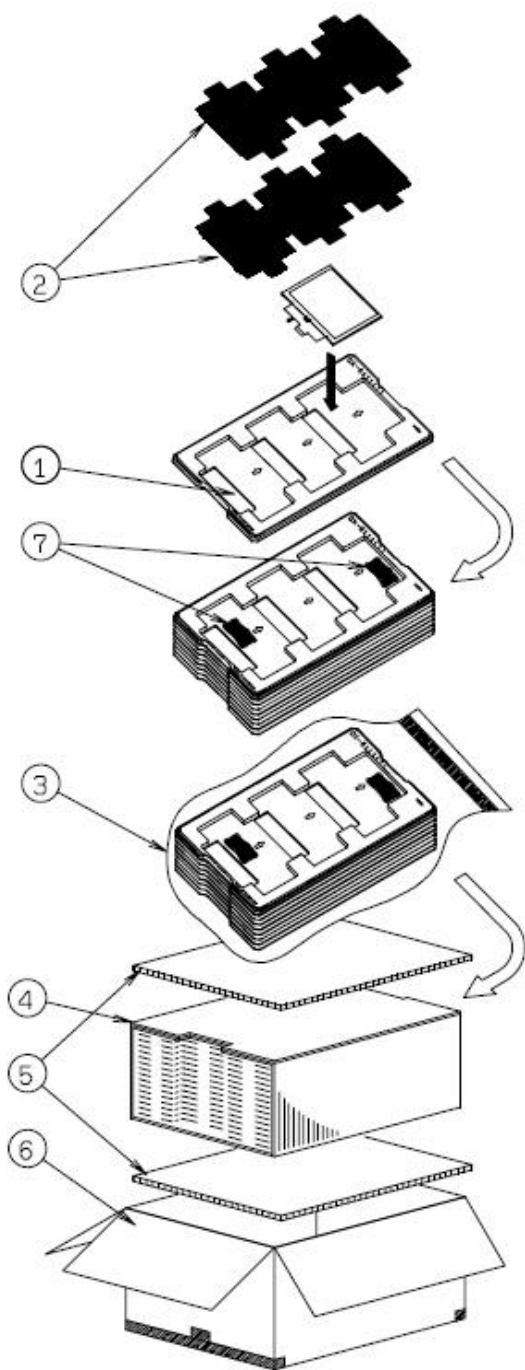
$\triangle B$



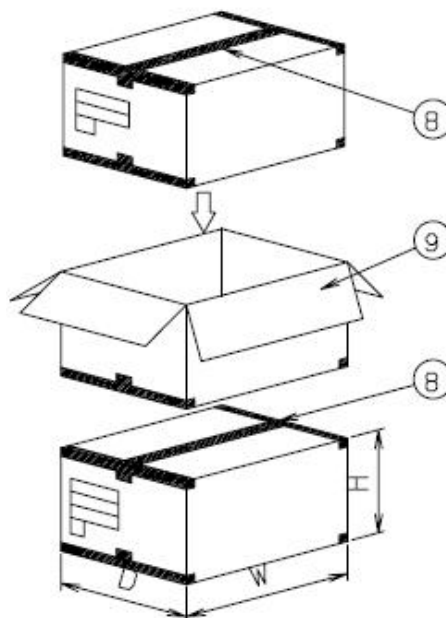
13. PACKING SPECIFICATIONS

B

(S=FREE)



- Step 1 Each product is to be placed in one of the cut-outs of the tray with the display surface facing upward.(3products per tray)
Foam sheet is to be placed on the products in the tray.
Each tray needs to be same orientation respect to the tray
- Step 2 below or above it and the trays be in a stack of 7.
One empty tray is to be put on the top of stack of 7 trays.
2 packs of moisture absorbers are to be placed on the top
- Step 3 tray as shown in the drawing.
Put piled trays into a sealing bag.
Vacuum and seal the sealing bag with the vacuum sealing machine.
The stack of trays in the plastic back is to be inserted into a
- Step 4 inner carton.
A corrugated board is to be placed on the top and on the
- Step 5 bottom of the inner carton.
The two corrugated boards and the inner carton is to be inserted into an outer carton.
The outer carton needs to sealed with packing tape as shown
- Step 6 in the drawing.
The model number, quantity of products, and shipping date are to be printed on the outer carton.
If necessary, shipping labels or impression markings are to be put on the outer carton.
The outer carton is to be inserted into a extra outer carton
- Step 7 with same direction.
The extra outer carton needs to sealed with packing tape as shown in the drawing.
The model number, quantity of products, and shipping date
- Step 8 are to be printed on the extra outer carton.
If necessary, shipping labels or impression markings are to be put on the extra outer carton.



Remark: The return of packing materials is not required.

	Packing item name	Specs., Material
①	TRAY	PP
②	FOAM SHEET	Anti-static polyethylene
③	SEALING BAG	
④	INNER BOARD	Corrugated cardboard
⑤	INNER CARTON	Corrugated cardboard
⑥	OUTER CARTON	Corrugated cardboard
⑦	Drier	Moisture absorber
⑧	Packing tape	
⑨	EXTRA OUTER CARTON	Corrugated cardboard

Dimension of extra outer carton	
D : Approx.	(338mm)
W : Approx.	(549mm)
H : Approx.	(198mm)
Quantity of products packed in one carton:	3pcsx7=21pcs
Gross weight : Approx.	5.8Kg

14. HANDLING INSTRUCTION

14.1 Cautions for Handling LCD panels


**Caution**

- (1) Do not make an impact on the LCD panel glass because it may break and you may get injured from it.
- (2) If the glass breaks, do not touch it with bare hands.
(Fragment of broken glass may stick you or you cut yourself on it.)
- (3) If you get injured, receive adequate first aid and consult a medial doctor.
- (4) Do not let liquid crystal get into your mouth.
(If the LCD panel glass breaks, try not let liquid crystal get into your mouth even toxic property of liquid crystal has not been confirmed.)
- (5) If liquid crystal adheres, rinse it out thoroughly.
(If liquid crystal adheres to your cloth or skin, wipe it off with rubbing alcohol or wash it thoroughly with soap. If liquid crystal gets into eyes, rinse it with clean water for at least 15 minutes and consult an eye doctor.)
- (6) If you scrap this products, follow a disposal standard of industrial waste that is legally valid in the community, country or territory where you reside.
- (7) Do not connect or disconnect this product while its application products is powered on.
- (8) Do not attempt to disassemble or modify this product as it is precision component.
- (9) Since excess current protection circuit is not built in this TFT module, there is the possibility that LCD module or peripheral circuit become feverish and burned in case abnormal operation is generated. We recommend you to add excess current protection circuit to power supply.


**Caution**

This mark is used to indicate a precaution or an instruction which, if not correctly observed, may result in bodily injury, or material damages alone.

14.2 Precautions for Handling

- 1) Wear finger tips at incoming inspection and for handling the TFT monitors to keep display quality and keep the working area clean.
Do not touch the surface of the polarizer as it is easily scratched.
- 2) Wear grounded wrist-straps and use electrostatic neutralization blowers to prevent static charge and discharge when handling the TFT monitors as the LED in this TFT monitors is damageable to electrostatic discharge,
Properly set up equipment, jigs and machines, and keep working area clean and tidy for handling the TFT monitors.
- 3) Avoid strong mechanical shock including knocking, hitting or dropping to the TFT monitors for protecting their glass parts. Do not use the TFT monitors that have been experienced dropping or strong mechanical shock.
- 4) Do not use or storage the TFT monitors at high temperature and high humidity environment. Particularly, never use or storage the TFT monitors at a location where condensation builds up.
- 5) Avoid using and storing TFT monitors at a location where they are exposed to direct sunlight or ultraviolet rays to prevent the LCD panels from deterioration by ultraviolet rays.
-  6) Do not stain or damage the contacts of the FPC cable .
FPC cable needs to be inserted until it can reach to the end of connector slot.
During insertion, make sure to keep the cable in a horizontal position to avoid an oblique insertion.
Otherwise, it may cause poor contact or deteriorate reliability of the FPC cable.
- 7) Do not bend or pull the FPC cable or carry the TFT monitor by holding the FPC cable.
- 8) Peel off the protective film on the TFT monitors during mounting process.
Refer to the section 14.5 on how to peel off the protective film.
We are not responsible for electrostatic discharge failures or other defects occur when peeling off the protective film.

14.3 Precautions for Operation

- 1) Do not expose the driver IC to strong lights during operation as it may cause functional failures.
- 2) When driving the monitor, refer to "8.1 Power On/Off Sequence".
When turning off the power, turn off the input signal before or at the same timing of switching off the power.
-  3) Optimize VCOMDC within recommended operating conditions.
* When VCOMDC is not an optimal value, flicker and image sticking will be occurred.
- 4) Do not plug in or out the FPC cable while power supply is switch on.
Plug the FPC cable in and out while power supply is switched off.
- 5) Do not operate the TFT monitors in the strong magnetic field. It may break the TFT monitors.
- 6) Do not display a fixed image on the screen for a long time.
Use a screen-saver or other measures to avoid a fixed image displayed on the screen for a long time. Otherwise, it may cause burn-in image on the screen due the characteristics of liquid crystal.

14.4 Storage Condition for Shipping Cartons

Storage environment

- Temperature 0 to 40° C
- Humidity 60%RH or less
- Atmosphere No-condensing occurs under low temperature with high humidity condition. No poisonous gas that can erode electronic components and/or wiring materials should be detected.
- Time period 3 months
- Unpacking To prevent damages caused by static electricity, anti-static precautionary measures (e.g. earthing, anti-static mat) should be implemented.
- Maximum piling up 7 cartons



14.5 Precautions for Peeling off the Protective film

The followings work environment and work method are recommended to prevent the TFT monitors from static damage or adhesion of dust when peeling off the protective films.

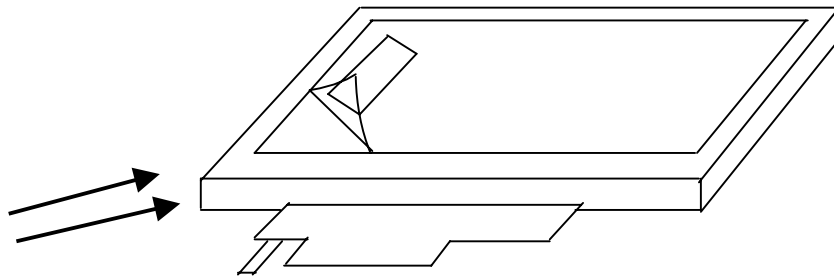
A) Work Environment

- a) Humidity: 50 to 70 %RH, Temperature 15° C to 27° C
- b) Operators should wear conductive shoes, conductive clothes, conductive finger tips and grounded wrist-straps. Anti-static treatment should be implemented to work area's floor.
- c) Use a room shielded against outside dust with sticky floor mat laid at the entrance to eliminate dirt.

B) Work Method

The following procedures should taken to prevent the driver ICs from charging and discharging.

- a) Use an electrostatic neutralization blower to blow air on the TFT monitors to its lower left when the FPC cable is facing to the downside. Optimize direction of the blowing air and the distance between the TFT monitors and the electrostatic neutralization blower.
- b) Put an adhesive tape (Scotch tape, etc) at the lower left corner area of the protective film to prevent scratch on surface of TFT monitors.
- c) Peel off the adhesive tape slowly (spending more than 2 secs to complete) by pulling it to opposite direction.



Direction of blowing air
(Optimize air direction and the distance)

APPENDIX

Reference Method for Measuring Optical Characteristics and Performance

1. Measurement Condition

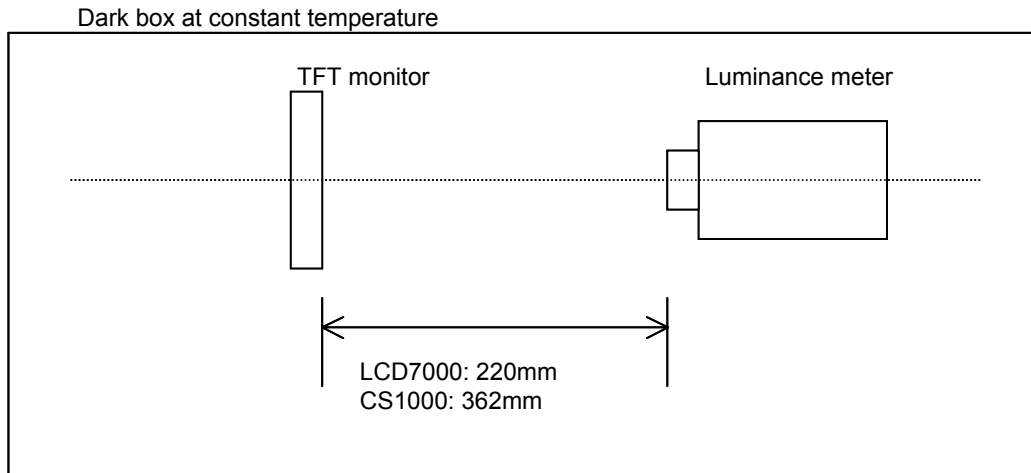
Measuring instruments: CS1000(KONICA MINOLTA) , LCD7000(OTSUKA ELECTRONICS) ,EZcontrast160D(ELDIM)

Driving condition: Refer to the section 10.1 "Optical Characteristics"

Measured temperature: 25° C unless specified

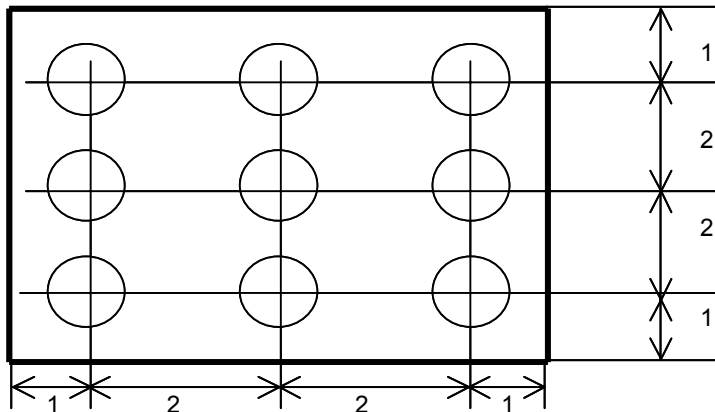
Measurement system: See the chart below. The luminance meter is placed on the normal line of measurement system.

Measurement point: At the center of the screen unless otherwise specified



Measurement is made after 30 minutes of lighting of the backlight.

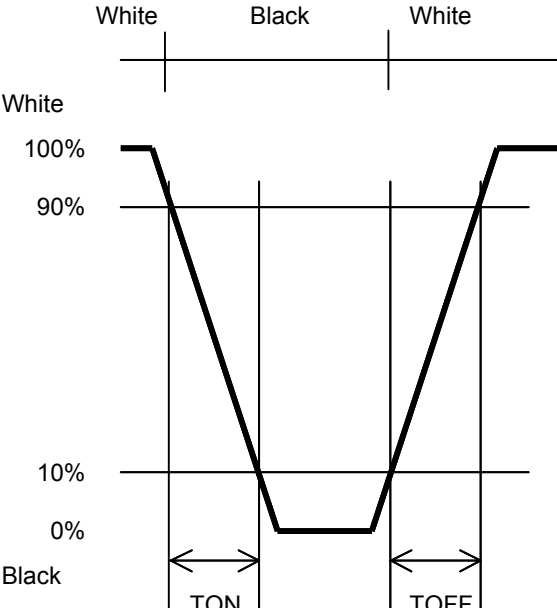
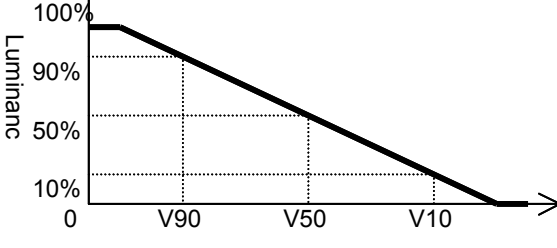
Measurement point: At the center point of the screen
Brightness distribution: 9 points shown in the following drawing.



Backlight IL = 20mA

Unit: fraction

2. Test Method

Notice	Item	Test method	Measuring instrument	Remark
1	Response time	Measure output signal waveform by the luminance meter when raster of window pattern is changed from white to black and from black to white. 	LCD7000	Black display VLCD=4.9V White display VLCD=0.6V TON Rise time TOFF Fall time
2	Contrast ratio	Measure maximum luminance Y1(VLCD=0.6V) and minimum luminance Y2(VLCD=4.9V) at the center of the screen by displaying raster or window pattern. Then calculate the ratio between these two values. Contrast ratio = Y1/Y2 Diameter of measuring point: 8mmφ	CS1000	
3	Viewing angle Horizontalθ Verticalφ	Move the luminance meter from right to left and up and down and determine the angles where contrast ratio is 10.	EZcontrast160D	
4	V-T threshold value	Change VLCD by 0.0.6V step and plot the points where the luminance is 90% as V90, 50% as V50 and 10% as V10 of maximum luminance. 	LCD7000	
5	White chromotically	Measure chromaticity coordinates x and y of CIE1931 colorimetric system at VLCD = 0.6V Color matching faction: 2°view	CS1000	

Notice	Item	Test method	Measuring instrument	Remark
△ B	6	Burn-in	Visually check burn-in image on the screen after 0.5 hours of "window display" (VLCD=0.6V/4.9V).	At optimized VCOMDC
	7	Center brightness	Measure the brightness at the center of the screen.	CS1000
	8	Brightness distribution	(Brightness distribution) = 100 x B/A % A : max. brightness of the 9 points B : min. brightness of the 9 points	CS1000