Specifications for

TFT-LCD Monitor

Version 1.0
(Please be sure to check the specifications latest version.)

MODEL   COM70T7M18ZTC

Customer's Approval
Signature:
Name:
Section:
Title:
Date:

ORTUSTECH

ORTUS TECHNOLOGY CO., LTD.

Approved by

Approved by

Checked by

Prepared by

ORTUS TECHNOLOGY CO.,LTD.

| | SPECIFICATIONS № 15TLM010 | | Issue: Feb. 18, 2015 |

Version History

Ver.	Date	Page		Description
1.0	Feb. 18, 2015	-	-	First issue

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Contents

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1. Application

This Specification is applicable to 17.8cm (7.0 inch) TFT-LCD 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.

◎ It must be noted as an mechaniacl design manner, especial attention in housing design to prevent
   arcuation/flexureor caused by stress to the LCD module shall be considered.

◎ 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.

◎ ORTUS TECHNOLOGY is not responsible for any nonconformities and defects
   that are not specified in this specifications.

◎ 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

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2. Outline Specifications

2.1 Features of the Product

- 7.0 inch diagonal display, 2,400 [H] x 480 [V] dots.
- 6-bit 262,144 color display capability.
- 3.3V is required.
- Built in Timing generator (TG).
- High brightness LED back-light,built in Touch panel operation monitor. .
- All-in-one type monitor with lead-free mounting(Response to RoHS Phase 3A).

2.2 Display Method

Items	Specifications	Remarks
Display type	TN type 262,144 colors. Transmissive type, Normally white	
Driving method	a-Si TFT Active matrix Line-scanning, Non-interlace	
Dot arrangement	RGB stripe arrangement	Refer to "Dot arrangement"
Signal input method	6-bit RGB, parallel input.	
Backlight type	High bright white LED.	
Touch panel	Resistance type,transmissive analog tablet	Surface finishing:Clear
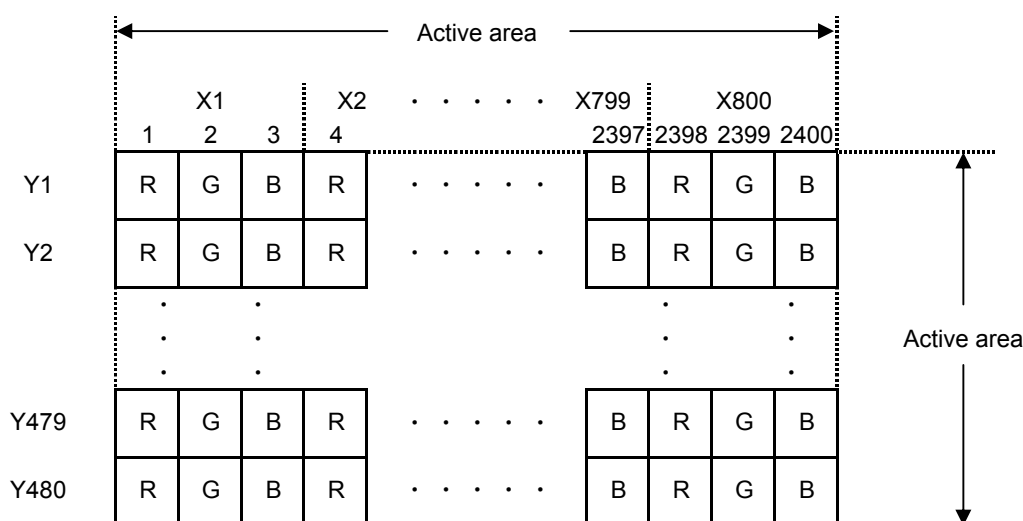
Dot arrangement
(When "FPC" is placed at the right-bottom)

3. Dimensions and Shape

3.1 Dimensions

Items	Specifications	Unit	Remarks
Outline dimensions	165.00[H] × 105.80[V] × 4.51[D]	mm	Exclude FPC and components on the FPC
Active area	152.40[H] × 91.44[V]	mm	17.8cm diagonal
Number of dots	2,400[H] × 480[V]	dot	
Dot pitch	63.5[H] × 190.5[V]	μm	
Surface hardness of Touch Panel	3	H	Load:4.9N,Angle:45° Reference judgment standard:JIS-K5600
Weight	170	g	

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3.2 Outward Form

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

165.00 (S CASE A)
163.20 (TOUCH PANEL)
154.40 (TOUCH PANEL View Area)
155.25 (Opening of S CASE A)
152.40 (LCD, TOUCH PANEL Active Area)
(0.90)
(3.30)
(2.87)
(4.30)
(8.30)
80.50 (S CASE A)
(84.50)

7.0 WVGA

Up
Left   Right
Active area center
Down

(2.93)
(2.50)
(3.93)
105.80 (S CASE A)
103.00 (TOUCH PANEL)
93.44 (TOUCH PANEL View Area)
94.30 (Opening of S CASE A)
91.44 (LCD, TOUCH PANEL Active Area)
49.65 (S CASE A)
(56.15)
(3-97.03)
(10.43)
(4.40)

Single layer
22.00
Component Area height t=1.5MAX

Note 4

10.00±1.00 (Reinforcing plate)
15.00
10.00
5.00±0.50 (Reinforcing plate)
36.15
5.00±0.50 (Reinforcing plate)
(40.30)
(115.25)
(152.60)

(4.51)
3.35±0.30

0.20±0.03 (LED FPC)
0.30±0.05 (LCD FPC)
0.30±0.05 (TP FPC)

3.20±0.30
1.68±0.30
1.48±0.30
(4.37)
(1.00) Sealant
(97.03)

※ The hatching area is recommended holding area.

(82.50)
1.50±0.30
Sticking area of S LABEL
COM70T7M18Z**   *000125
(52.90)

(FPC bent area)

6 1
CN2
B

1 40
CN1
A

4 1
CN3
C

CN2
No.	Signal
1	LED1
2	VLED1
3	LED2
4	VLED2
5	LED3
6	VLED3

CN1
No.	Signal	No.	Signal
1	GND	21	G5
2	GND	22	G4
3	NC	23	G3
4	VDD	24	GND
5	VDD	25	G2
6	VDD	26	G1
7	LR	27	G0
8	NC	28	GND
9	DE	29	R5
10	HSYNC	30	R4
11	VSYNC	31	R3
12	GND	32	GND
13	B5	33	R2
14	B4	34	R1
15	B3	35	R0
16	GND	36	GND
17	B2	37	GND
18	B1	38	DCLK
19	B0	39	UD
20	GND	40	GND

2.80±0.05
2.60±0.30
3.80±0.30
3.80±0.10

0.35±0.03
0.50±0.10
0.50±0.10
P0.50±0.05×39=19.50±0.05
20.50±0.07
1

Detail A (S=5/1)

4-R0.20
2-R0.20
1.20±0.30
0.70±0.10
6
0.30±0.03
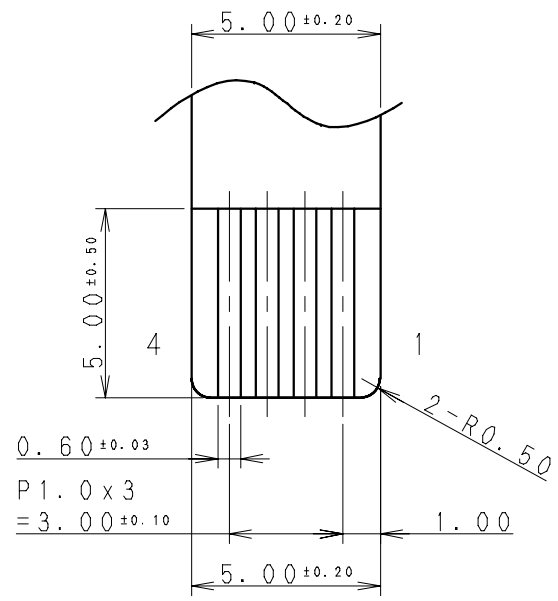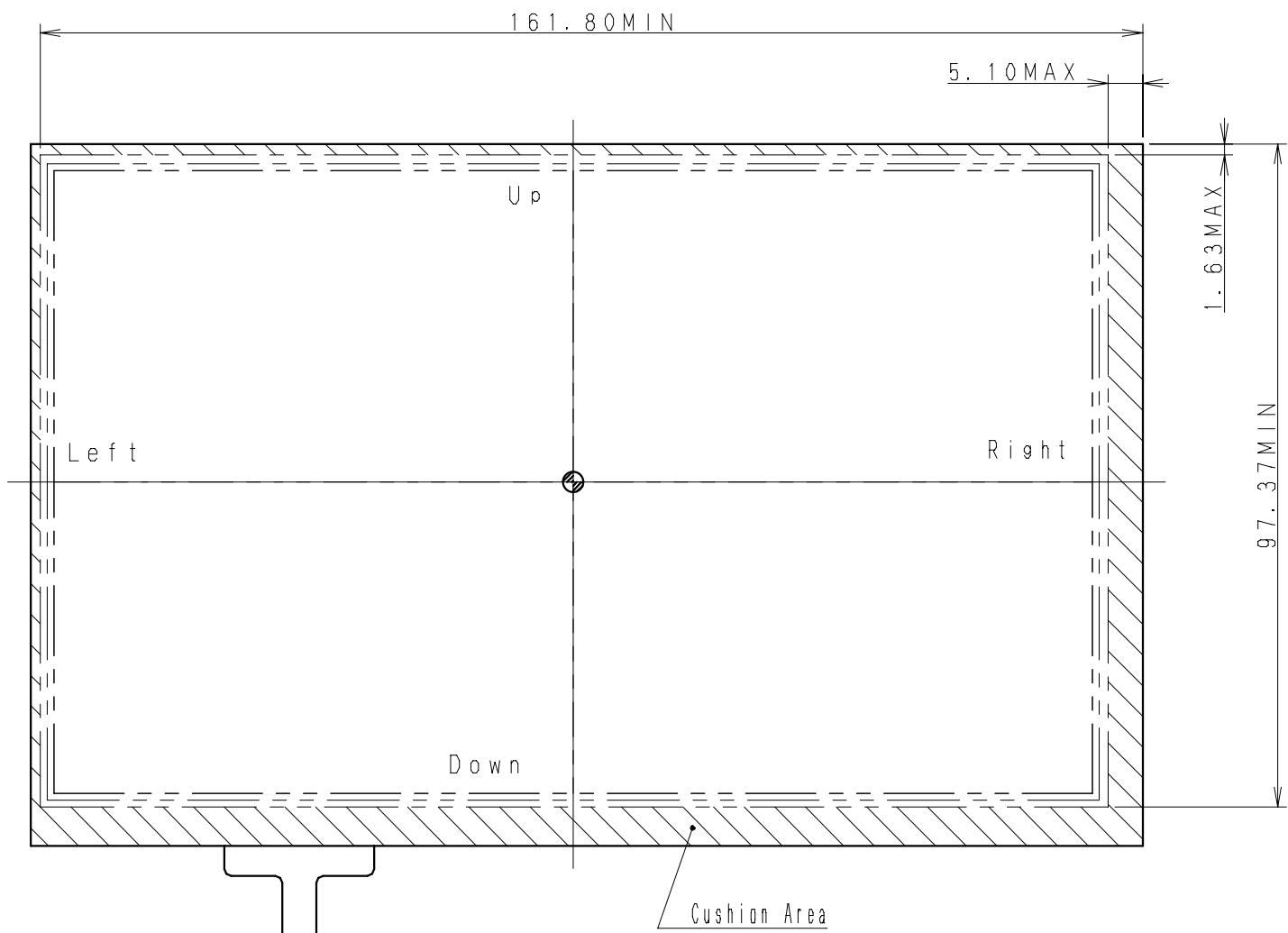0.50
P0.5×5 =2.50±0.05
3.50±0.05

Detail B (S=5/1)

Note 1. 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 2. Protective film is affixed on front surface of the screen.
        Location tolerance of the protective film shall be ±3.0 mm to the TOUCH PANEL.
Note 3. Recommended FPC connectors
        For LCD FPC : HIROSE.
               part number: FH12-40S-0.5SH(Lower contact)
        For LED FPC : KYOCERA Connector Products.
               part number: 04 6277 006 001 883+(Dual-sided contact)
        For TP FPC : KYOCERA Connector Products.
               part number: 04 6227 004 100 829+(Dual-sided contact)
Note 4. Exercise care not to apply any forces to the cable holder of the S case A.
Note 5. Linearity is guaranteed in the area surrounded by 3mm inside lines from TOUCH PANEL Active Area.
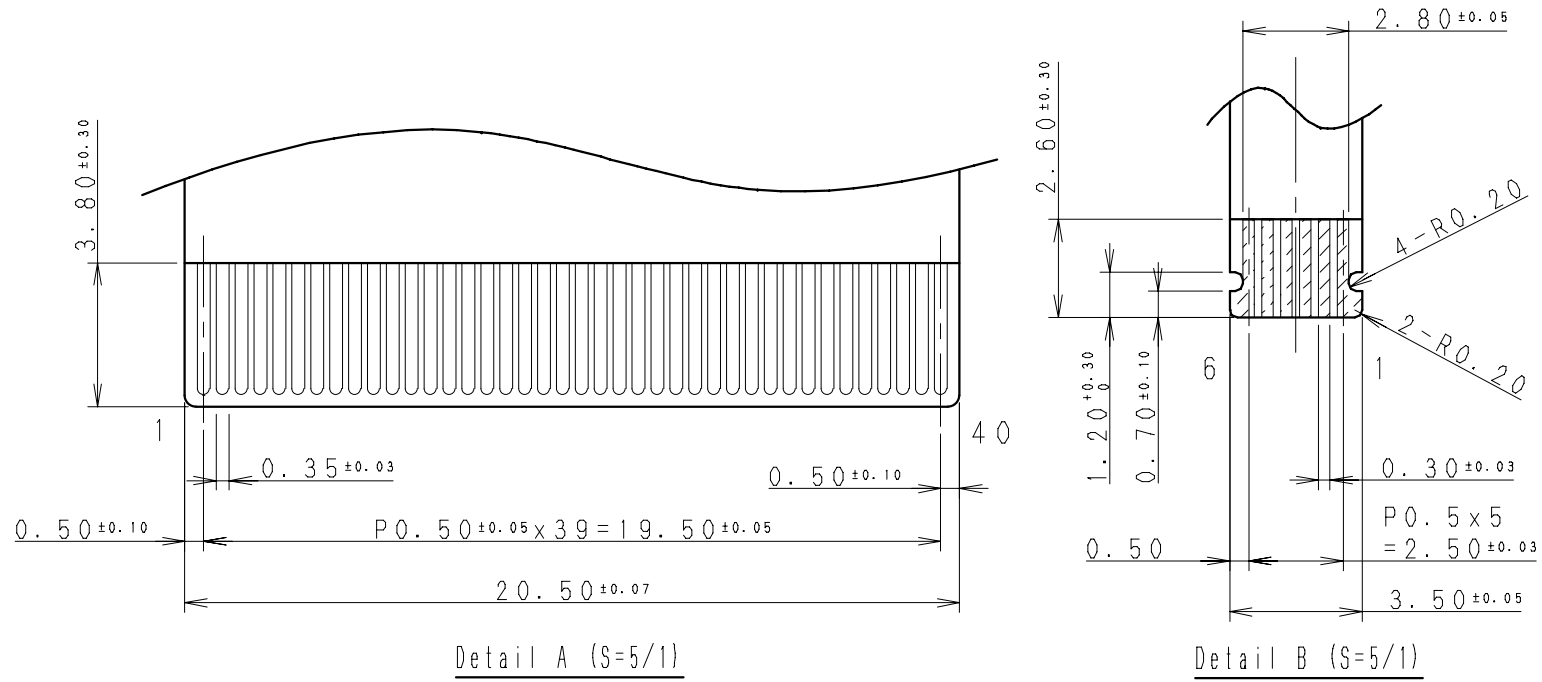
PART NAME	ITEM	MATERIAL GRADE	REMARK
S LABEL	9	Barcode(CODE39)	(37×13×0.075t)
TOUCH PANEL FPC	8		
LED FPC	7		
LCD FPC	6		
TOUCH PANEL	5	Film-Glass(0.7t)	Surface finishing : Anti-Glare
S CASE C	4		
FRAME	3		
S CASE A	2		
TFT-LCD PANEL	1	Glass substrate thickness=0.5t	

APPROVED	GENERAL TOLERANCE ±0.5	SCALE 1/1 (5/1)	UNIT mm	ORTUSTECH
CHECKED	ISSUE 2015:01:30	MODEL COM70T7M18Z**		ORTUS TECHNOLOGY CO., LTD.
CHECKED	NAME			DO NOT DUPLICATE. CONFIDENTIAL AND PROPRIETARY
DESIGN 荻野				DRAWING No. REV. SHEET DIV.
DRAW 荻野		OUTLINE-D7M18		RJD526625D201 1/2

EC No.	REV.No.	R E V I S E	DATE (Y:M:D)	APPROVED	CHECKED	PREPARED

161.80MIN

5.10MAX

1.63MAX

97.37MIN

Up

Left

Right

Down

Cushion Area

TOUCH PANEL Cushion Area

5.00±0.20

5.0±0.50

0.60±0.03

P1.0x3 =3.00±0.10

5.00±0.20

1.00

2-R0.50

4   1

Detail C (S=5/1)

CN3

Pin No.	Assignment
1	XL
2	YD
3	XR
4	YU

Up

Left   Right

YU

XL   XR

YD

Down
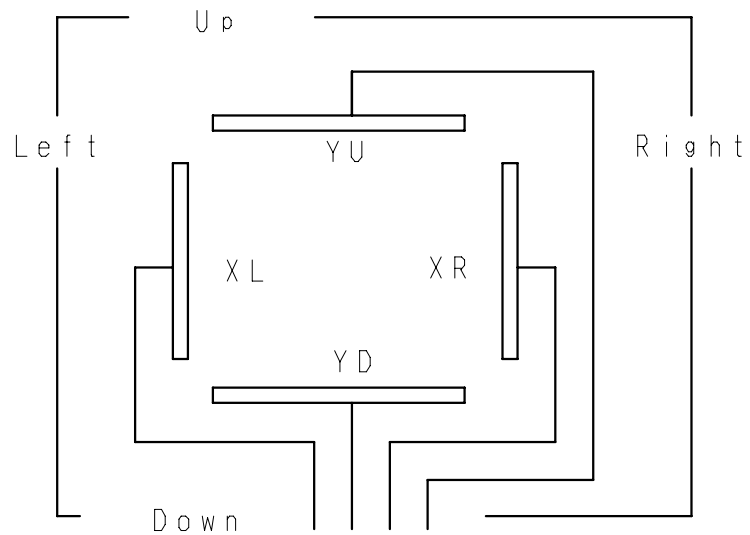
1 - X L
2 - Y D
3 - X R
4 - Y U

Circuit diagram

Prohibition Area

Upper case

Note 9
Cushion

PET Film

W tape

Glass

ITO

Cushion Area (CA)

0.8max
(In case of using pen-R0.8)

R0.8

ITO

0.3~0.7
Note 6

TP-A.A.

TP-V.A.
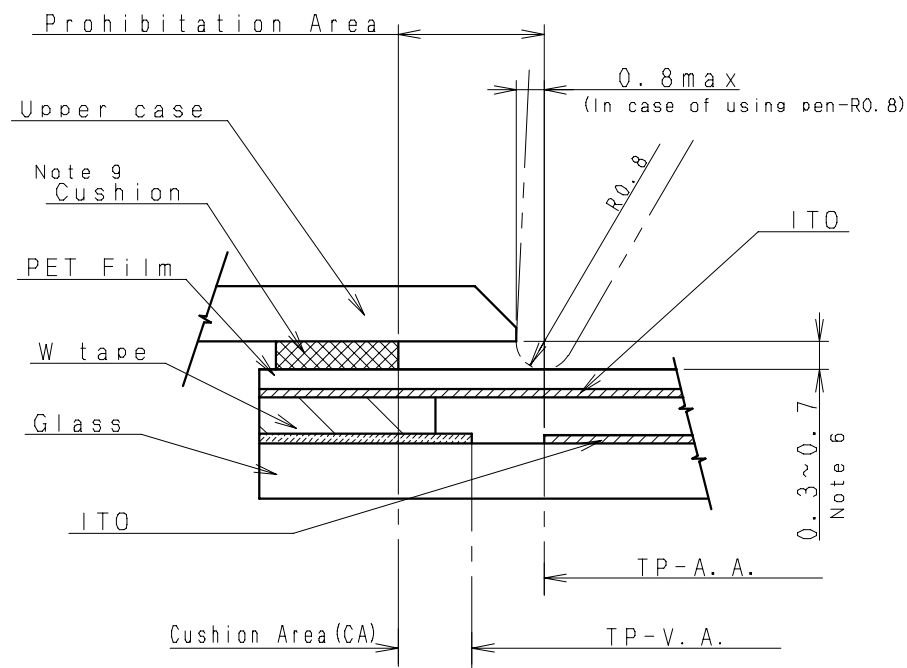
Example of Housing Design
(S=Free)

Design guidance for the Housing & the cushion

Note 6. Keep a gap, for example 0.3 to 0.7mm between the bezel edge and touch panel surface
to avoid the bezel edge from making contacting with the touch panel surface
that may cause a 'false touch' with the bottom layer.
Note 7. Recommended dimensions of housing in case of using pen (R0.8)
(refer to 'Example of Housing Design')
Note 8. Upper case opening
a.Please place the upper case opening to maintain the operation
by a stylus pen inside the TP response area.
b.The any pressures in the area between TP response area and TP viewing area
is prohibited.
Note 9. Cushion design
a.Please put the cushion on the upper case.
b.Do not use an adhesive tape to stick on the TP suface.
c.Please position the cushion over the cushion area to avoid a short.

APPROVED	GENERAL TOLERANCE ±0.5	SCALE 1/1 (5/1)	UNIT mm	**ORTUSTECH**
CHECKED	ISSUE (Y:M:D) '15 :01:30	MODEL COM70T7M18Z**		ORTUS TECHNOLOGY CO.,LTD.
CHECKED	NAME			DO NOT DUPLICATE, CONFIDENTIAL AND PROPRIETARY
DESIGN 荻野			DRAWING No.	REV.	SHEET	DIV.
DRAW 荻野	OUTLINE-D7M18		RJD526625D201		2/2	

2004.2 DEVICE-TFT

3.3 SERIAL LABEL (S-LABEL)

1) Display Items
    A section : Bar code
    B section : Combination of a character

A section →

B section →

```
* * * * * 0 0 0 1 2 5
C O M 7 0 T 7 M 1 8 Z T C
```
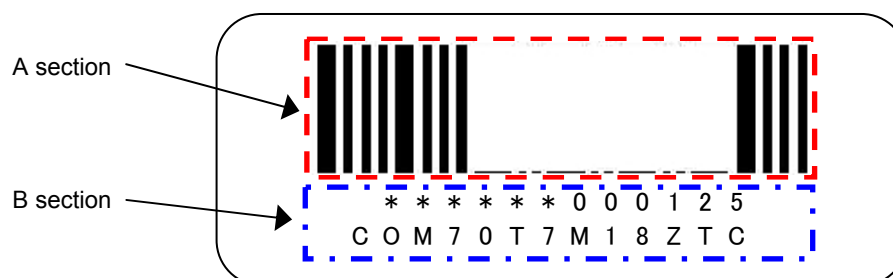
Details of B section
    Upper culumn: It indicates The least significant digit of manufacture year (1 digit),
                 manufacture month with below alphabet (1letter), model code (5characters),
                 serial number (6digits).

$$\underset{a}{\underline{*}} \quad \underset{b}{\underline{*}} \quad \underset{c}{\underline{****}} \quad \underset{d}{\underline{******}}$$

	Contents of display						
a	The least significant digit of manufacture year						
b	Manufacture month	Jan-A	Mar-C	May-E	Jul-G	Sep-I	Nov-K
		Feb-B	Apr-D	Jun-F	Aug-H	Oct-J	Dec-L
c	Model code	70NC (Made in Japan)					
		70PC (Made in Malaysia)					
d	Serial number						

    * Example of indication of Serial label (S-label)
    ・Made in Japan

       5J70NC000125

means "manufactured in October 2015, 7.0" N type,
C specifications, serial number 000125"

    ・Made in Malaysia

       5J70PC000125

means "manufactured in October 2015, 7.0" P type,
C specifications, serial number 000125"

    Lower culumn: Model (13characters)

2) Location of Serial Label (S-label)
    Refer to 3.2 "Outward Form".

2) Others
    Bar code readablity is excluded from quality assurance coverage.

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4. Pin Assignment

4.1 Display Module Part

No.	Symbol	Function
1	GND	GND.
2	GND	GND.
3	NC	No connection
4	VDD	Power supply input.
5	VDD	Power supply input.
6	VDD	Power supply input.
7	LR	Horizontally Flipped (right/left) Signal. (Lo: Horizontally Flipped Display, Hi: Normal display)
8	NC	No connection
9	DE	Input data effective signal. (positive polarity) Input GND level when "SYNC mode".
10	HSYNC	Horizontal sync signal input.(negative polarity) Input GND level when "DE mode".
11	VSYNC	Vertical sync signal input.(negative polarity) Input GND level when "DE mode".
12	GND	GND.
13	B5	Display data input for Blue 5(MSB).
14	B4	Display data input for Blue 4.
15	B3	Display data input for Blue 3.
16	GND	GND.
17	B2	Display data input for Blue 2.
18	B1	Display data input for Blue 1.
19	B0	Display data input for Blue 0(LSB).
20	GND	GND.
21	G5	Display data input for Green 5(MSB).
22	G4	Display data input for Green 4.
23	G3	Display data input for Green 3.
24	GND	GND.
25	G2	Display data input for Green 2.
26	G1	Display data input for Green 1.
27	G0	Display data input for Green 0(LSB).
28	GND	GND.
29	R5	Display data input for Red 5(MSB).
30	R4	Display data input for Red 4.
31	R3	Display data input for Red 3.
32	GND	GND.
33	R2	Display data input for Red 2.
34	R1	Display data input for Red 1.
35	R0	Display data input for Red 0(LSB).
36	GND	GND.
37	GND	GND.
38	DCLK	Clock signal.Latching data at the falling edge.
39	UD	Vertically Flipped (up/down) Signal. (Lo: Normal display,Hi: Vertically Flipped Display)
40	GND	GND.

- Recommended connector　　: HIROSE　FH 12 series [FH12-40S-0.5SH]
- Please refer to the section "3.2 Outward Form" for pin terminal order.

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4.2 Backlight Part

No.	Symbol	Function
1	LED 1	LED 1 cathode side.
2	VLED 1	LED 1 anode side.
3	LED 2	LED 2 cathode side.
4	VLED 2	LED 2 anode side.
5	LED 3	LED 3 cathode side.
6	VLED 3	LED 3 anode side.

- Recommended connector: KYOCERA Connector Products 6277 series [04 6277 006 001 883+]
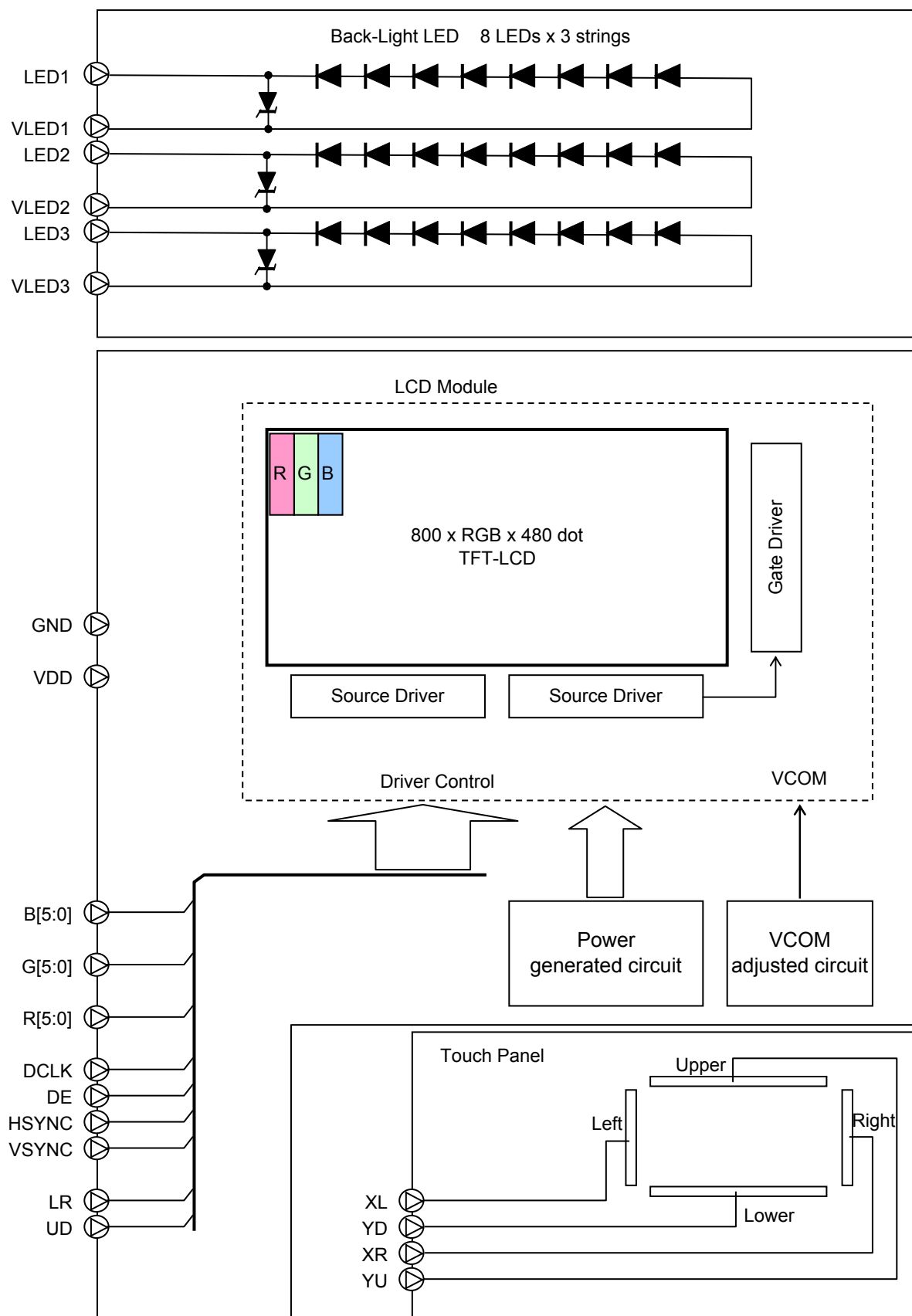- Please refer to the section "3.2 Outward Form" for pin terminal order.

4.3 Touch Panel Part

No.	Symbol	Function
1	XL	X-axis left terminal
2	YD	Y-axis downside terminal
3	XR	X-axis right terminal
4	YU	Y-axis upside terminal

- Recommended connector: KYOCERA Connector Products 6227 series [04 6227 004 100 829+]
- Please refer to the section "3.2 Outward Form" for pin terminal order.

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5. Block Diagram

Each arrow shows signal flow.

Back-Light LED   8 LEDs x 3 strings

LED1
VLED1
LED2
VLED2
LED3
VLED3

LCD Module

R G B

800 x RGB x 480 dot
TFT-LCD

Gate Driver

GND
VDD

Source Driver

Source Driver

Driver Control

VCOM

B[5:0]
G[5:0]
R[5:0]
DCLK
DE
HSYNC
VSYNC
LR
UD

Power
generated circuit

VCOM
adjusted circuit

Touch Panel

Upper

Left

Right

Lower

XL
YD
XR
YU

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6. Absolute Maximum Rating

GND=0V

Item	Symbol	Rating MIN	Rating MAX	Unit	Applicable terminal
Supply voltage	VDD	-0.3	6.0	V	VDD
Input voltage for logic	VI	-0.3	VDD+0.3	V	B[5:0],G[5:0],R[5:0],DCLK, DE,HSYNC,VSYNC,LR,UD
LED forward current	IL	--	35 (note)	mA	VLED1-LED1,VLED2-LED2 VLED3-LED3
Input voltage for Touch Panel	VIT	--	7.0	V	XR,XL,YU,YD
Storage temperature range	Tstg	-30	80	°C	

Absolute maximum ratings is parametric values , should never be exceed any value at any moment.
Beyond which, it could be suffered from changes in characteristics and never be restored .
Moreover, it could even be suffered from permanent destruction.
Therefore, please note enough the fluctuation of input voltage, the characteristics of connected parts,
I/O signal line serge, and ambient temperature, on designing the circuit.
Please refer to the figure below allowable current characteristic - Ta of the LED.
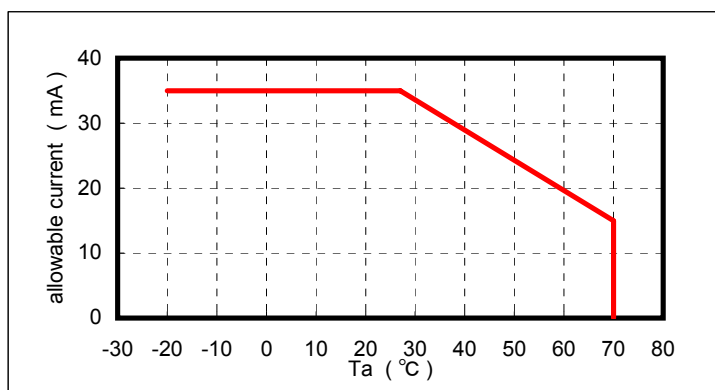
7. Recommended Operating Conditions

GND=0V

Item	Symbol	Condition	Rating MIN	Rating TYP	Rating MAX	Unit	Applicable terminal
Supply voltage	VDD		3.0	3.3	3.6	V	VDD
Input voltage for logic	VI	VDD= 3.0~3.6V	0	--	VDD	V	B[5:0],G[5:0], R[5:0],DCLK, DE,HSYNC, VSYNC,LR,UD
Operating temperature range	Top	Note1,2	-20	25	70	°C	Touch Panel surface temperature
Operating humidity range	Hop	Ta≦40°C	20	--	85	%	
		Ta>40°C	Non condensing in an environmental moisture at or less than 40°C85%RH.				

Note1: The temperature within the display will increase due to the heat radiated from the back light while in operation.
Necessary measures have to be taken in the product design to make sure that the display has proper ventilation
so that temperature on any surface of this display should not exceed 70°C.
Note2: This monitor is operatable in this temperature range. With regard to optical characteristics,
refer to Item "10. CHARACTERISTICS".

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8. Characteristics

8.1 DC Characteristics

8.1.1 Display Module
(Unless otherwise noted, Ta=25°C,VDD=3.3V,GND=0V)

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Input voltage for logic	VIH		0.8×VDD	--	VDD	V	B[5:0],G[5:0], R[5:0],DCLK,DE, HSYNC,VSYNC, LR,UD
	VIL		0	--	0.2×VDD	V	
Current consumption	IDD	Fcph=33.26MHz/Tv=60Hz Color bar display	--	118	236	mA	VDD

8.1.2 Backlight

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Forward current	IL	Ta=25°C	--	20	35	mA	VLED1-LED1, VLED2-LED2, VLED3-LED3
Forward voltage	VL	Ta=25°C, IL= 20 mA	--	22.4	24.0	V	
Estimated Life of LED	LL	Ta=25°C, IL= 20 mA Note	--	20,000	--	hrs	

Note: - 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.

8.1.3 Touch Panel
Ta=25°C

Item	Condition	Rating			Unit	Applicable terminal
		MIN	TYP	MAX		
Linearity	Note	-1.5	--	1.5	%	
Insulation resistance	DC 25V	10	--	--	MΩ	XR,XL-YU,YD
Terminal resistance	X	450	--	1500	Ω	XR,XL
	Y	70	--	1000	Ω	YU,YD
Rated voltage	DC	--	5.0	7.0	V	XR,XL,YU,YD
on/off chattering	R0.8mm Polyacetal pen.	--	--	20	ms	

Note: -Please refer to "3.2 Outward Form" for the range of the guarantee.
-Linearity Measurement:Refer to the APPENDIX of "Reference Method for Measuring Optical Characteristics".
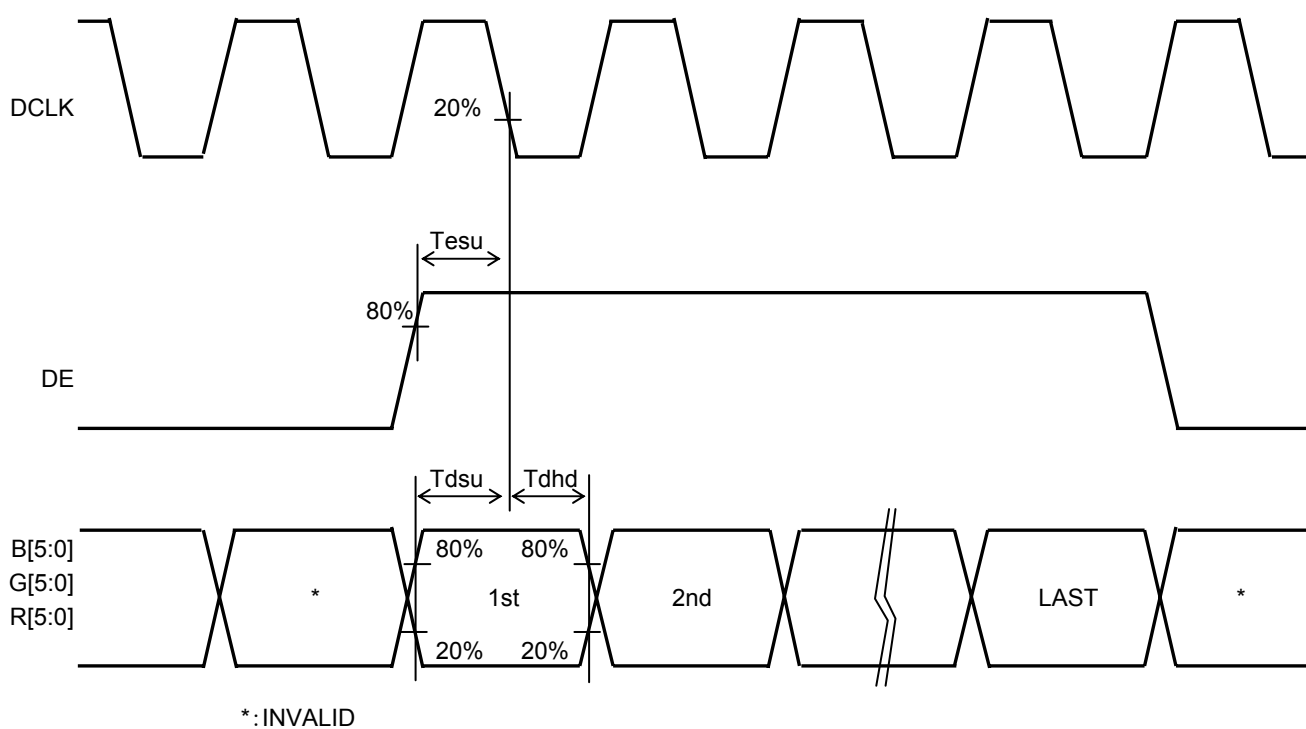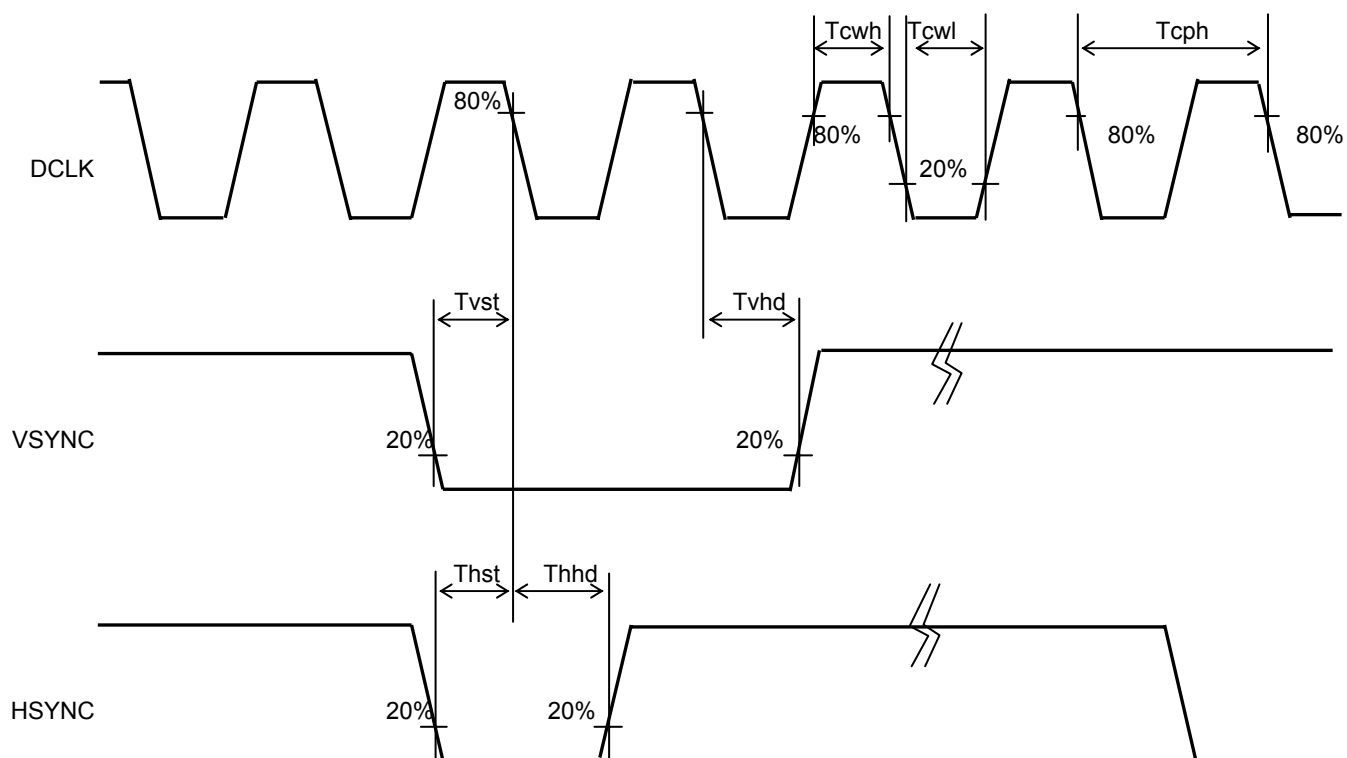
Mechanical Characteristics

Item	Rating			Unit	Remark
	MIN	TYP	MAX		
Detectable activation force	--	--	80	gf	R0.8mm Polyacetal pen or finger.
Keystroke durability	1,000,000	--	--	times	key the same part by silicon rubber. (Touch panel Active area only) -Rubber tip part: R8mm -Load: 200gf -speed: 3times/second

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8.2 AC Characteristics

(Ta=25°C,VDD=3.3V,GND=0V)

Item	Symbol	Rating			Unit
		MIN	TYP	MAX	
CLK pulse duty	Tcwh	40	50	60	%
HS setup time	Thst	6	--	--	ns
HS hold time	Thhd	6	--	--	ns
VS setup time	Tvst	6	--	--	ns
VS hold time	Tvhd	6	--	--	ns
Data setup time	Tdsu	6	--	--	ns
Data hold time	Tdhd	6	--	--	ns
DE setup time	Tesu	6	--	--	ns

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Switching Waveform Characteristics

| Tcwh | Tcwl | Tcph |

DCLK

80% 80% 80% 80% 80% 20%

Tvst Tvhd

VSYNC

20% 20%

Thst Thhd

HSYNC

20% 20%

DCLK

20%

Tesu

80%

DE

Tdsu Tdhd

B[5:0]
G[5:0]
R[5:0]

* 1st 2nd LAST *

80% 80%

20% 20%

*：INVALID

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8.3 Input Timing Characteristics

< Sync mode >

Ta=25℃,VDD=3.3V,GND=0V

Item	Symbol	Rating			Unit
		MIN	TYP	MAX	
CLK frequency	F_{CPH}	29.40	33.26	36.59	MHz
CLK period	T_{CPH}	27.32	30.06	34.01	ns
Frame frequency (Note)	F_V	54	60	66	Hz
HS period	T_H	1018	1056	-	T_{CPH}
HS pulse width	T_{WH}	1	128	-	T_{CPH}
HS-first horizontal data time	T_{HS}	216			T_{CPH}
HS Active Time	T_{HA}	800			T_{CPH}
VS period	T_V	517	525	-	T_H
VS pulse width	T_{WV}	1	2	-	T_H
VS-DE time	T_{VS}	35			T_H
VS Active Time	T_{VA}	480			T_H

Note: This is recommended spec to get high quality picture on display.
It is customer's risk to use out of this frequency.

< DE mode >

Ta=25℃,VDD=3.3V,GND=0V

Item	Symbol	Rating			Unit
		MIN	TYP	MAX	
CLK frequency	F_{CPH}	29.40	33.26	36.59	MHz
CLK period	T_{CPH}	27.32	30.06	34.01	ns
Frame frequency (Note)	F_V	54	60	66	Hz
DE period	T_H	1000	1056	1200	T_{CPH}
DE pulse width	T_{DEH}	800			T_{CPH}
DE frame blanking	T_{DEB}	10	45	110	T_H
DE frame width	T_{DEVA}	480			T_H

Note: This is recommended spec to get high quality picture on display.
It is customer's risk to use out of this frequency.

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8.4 Driving Timing Chart

< SYNC mode >

-Vertical Timing

-Horizontal Timing

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< DE mode >

-Vertical Timing

-Horizontal Timing

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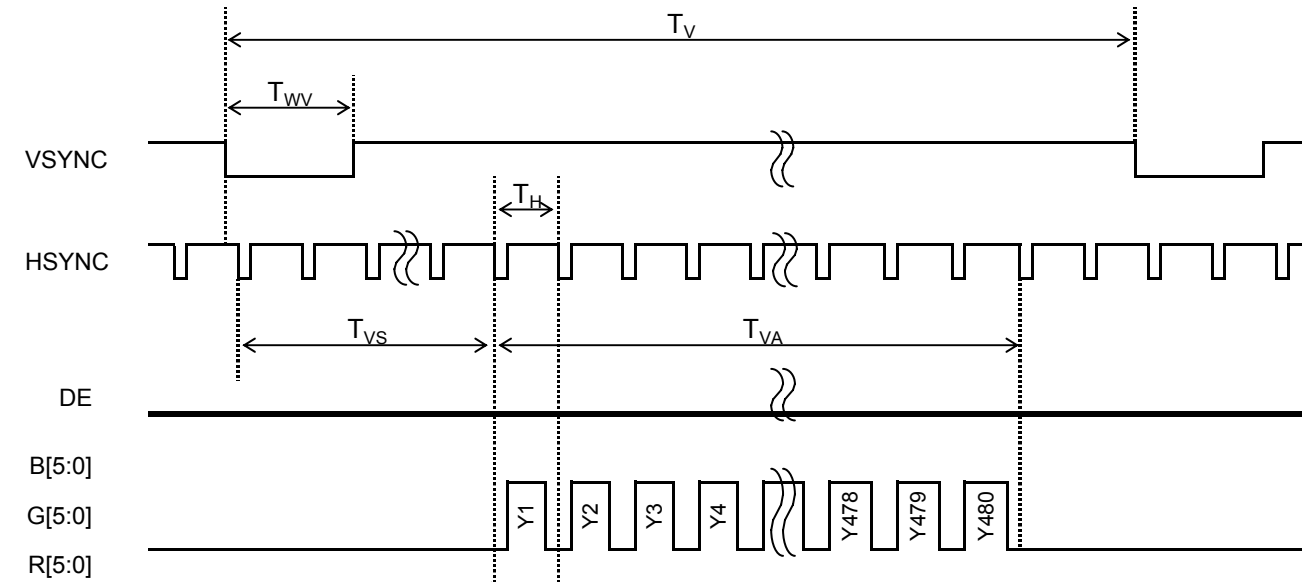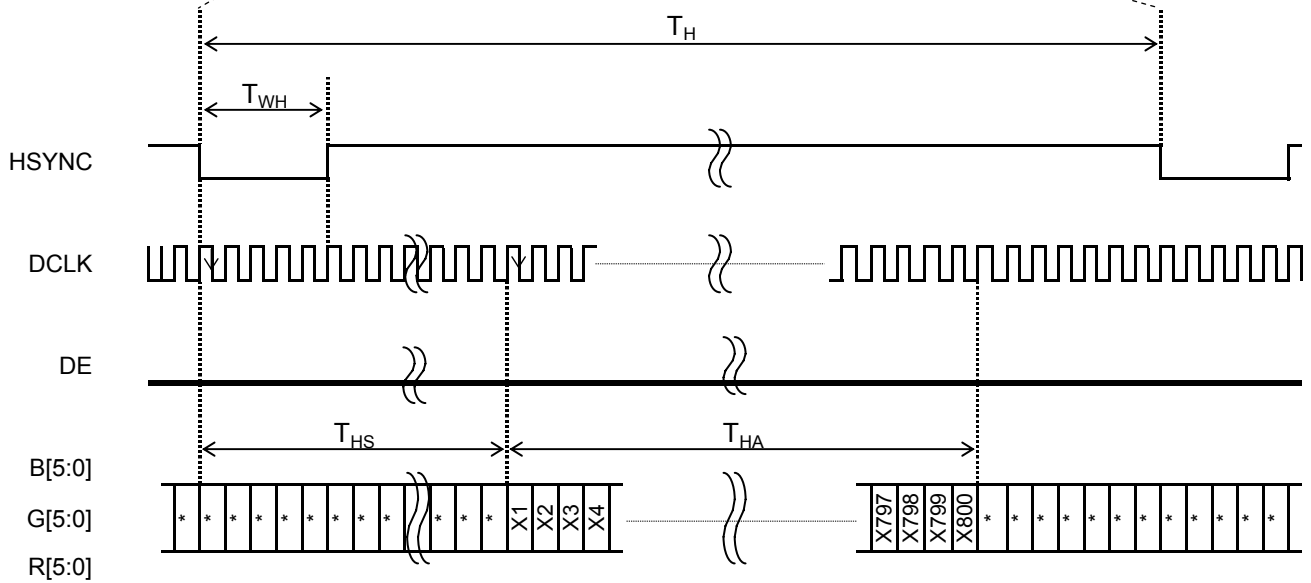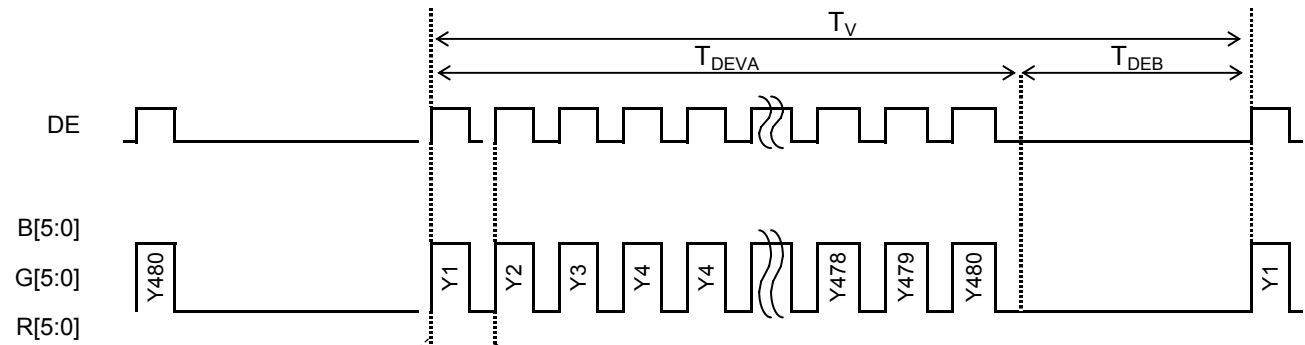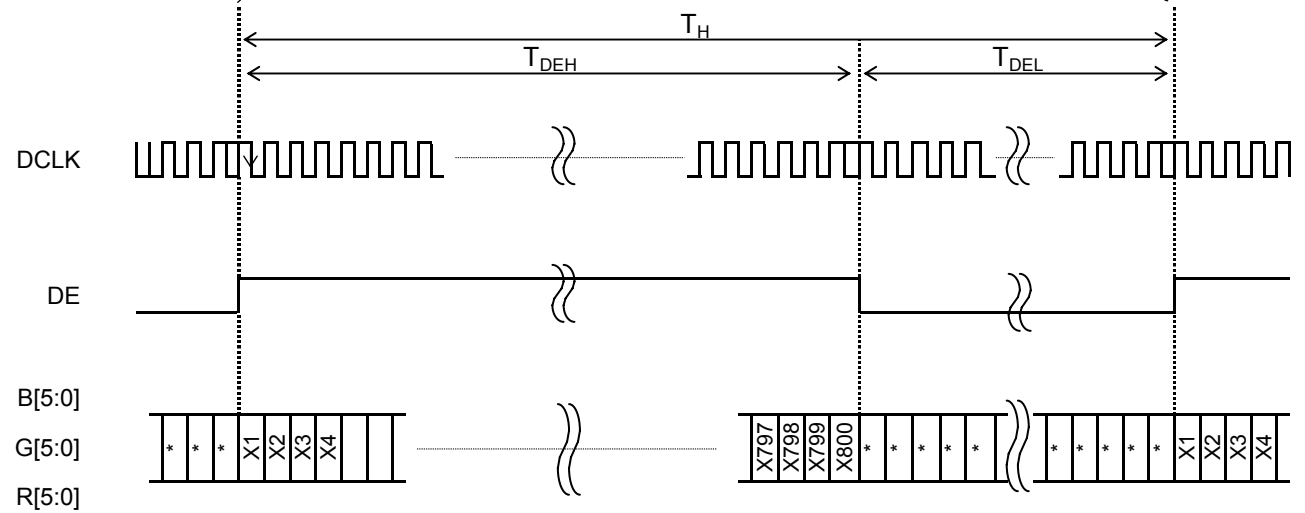
8.5. Input Data vs Display color

DISPLAY		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
								INPUT DATA SIGNAL											
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	GREEN	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	CYAN	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	RED	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	MAGENTA	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
GRAY SCALE OF RED	BLACK	0	0	0	0	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
	dark	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑			↑						↑						↑			
	↓			↓						↓						↓			
	light	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	↓	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	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
	dark	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	↑			↑						↑						↑			
	↓			↓						↓						↓			
	light	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	↓	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	GREEN	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	↑			↑						↑						↑			
	↓			↓						↓						↓			
	light	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	↓	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
GRAY SCALE OF WHITE	BLACK	0	0	0	0	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	1
	dark	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0
	↑			↑						↑						↑			
	↓			↓						↓						↓			
	light	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1
	↓	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

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9. Power on/off Sequence
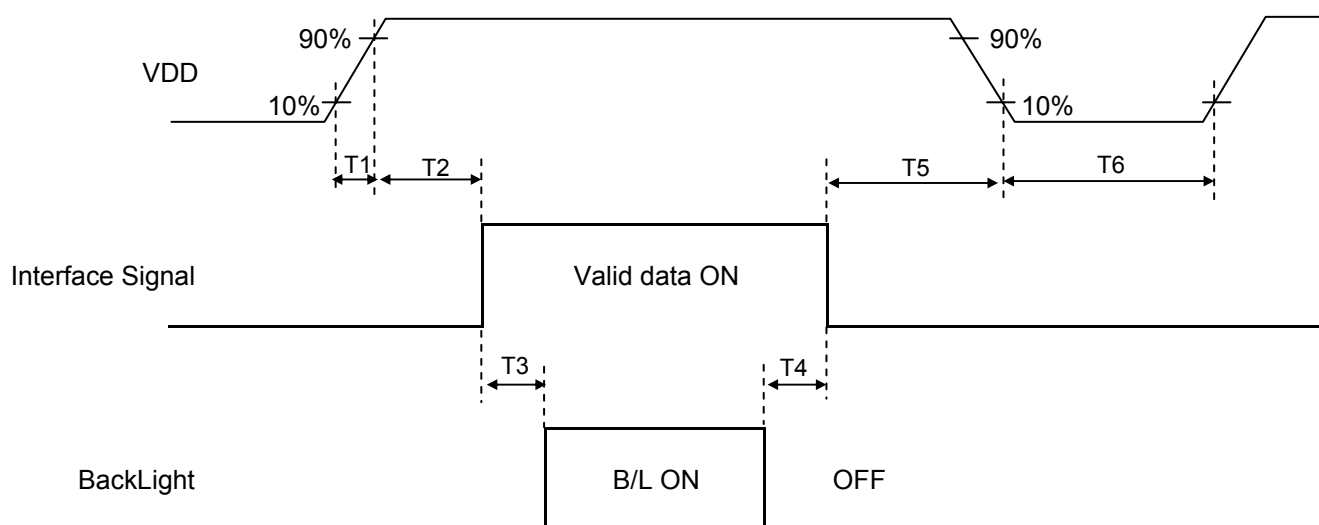
Item	Rating			Unit
	Min	TYP	MAX	
T1	0.1	--	2	ms
T2	0	60	100	ms
T3	200	--	--	ms
T4	200	--	--	ms
T5	1	--	100	ms
T6	1000	--	--	ms

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10. Characteristics

10.1 Optical Characteristics

< Measurement Condition >

Measuring instruments: CS1000（KONICA MINOLTA）, LCD7200(OTSUKA ELECTRONICS）,
                        EZcontrast160D（ELDIM）
Driving condition: VDD = 3.3V, GND = 0V
                        Optimized VCOMDC
Backlight: IL=20.0mA
Measured temperature: Ta=25°C

Item		Symbol	Condition	MIN	TYP	MAX	Unit	Note No.	Remark
Response time	Rise time	TON	[Data]= 3Fh → 00h	—	—	40	ms	1	※
	Fall time	TOFF	[Data]= 00h → 3Fh	—	—	60	ms		
Contrast ratio		CR	[Data]= 3Fh / 00h	250	400	—		2	
Viewing angle	Left	θL	[Data]= 3Fh / 00h CR≧10	—	80	—	deg	3	※
	Right	θR		—	80	—	deg		
	Up	φU		—	80	—	deg		
	Down	φD		—	80	—	deg		
White Chromaticity		x	[Data]=3Fh	White chromaticity range				4	
		y							
Burn-in				No noticeable burn-in image should be observed after 2 hours of window pattern display.				5	
Center brightness			[Data]=3Fh	290	430	—	cd/m²	6	
Brightness distribution			[Data]=3Fh	70	—	—	%	7	

* Note number 1 to 7: Refer to the APPENDIX of "Reference Method for Measuring Optical Characteristics".
※ Measured in the form of LCD module.

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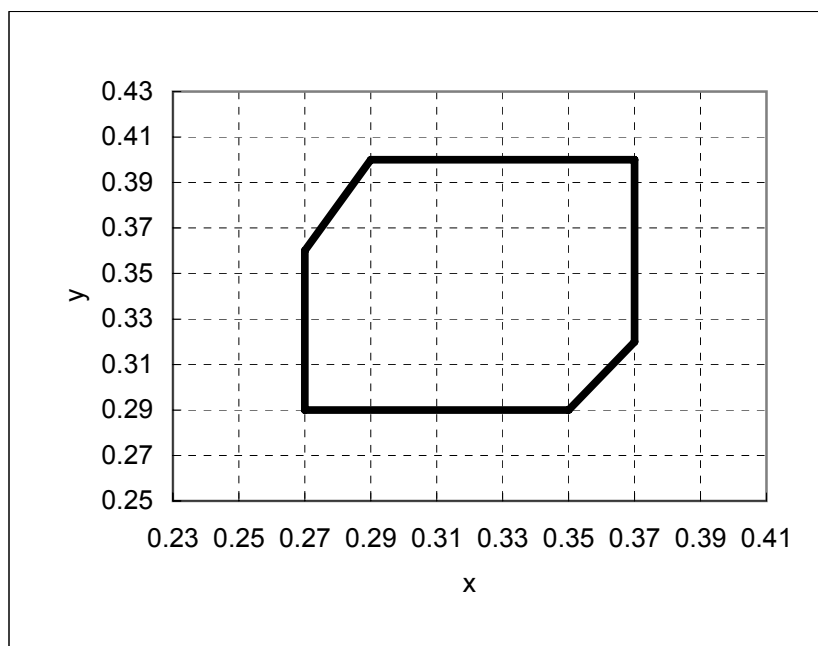
【White Chromaticity Range】

x	y
0.27	0.36
0.27	0.29
0.35	0.29
0.37	0.32
0.37	0.40
0.29	0.40

White Chromaticity Range

10.2 Temperature Characteristics

< Measurement Condition >
Measuring instruments: CS1000（KONICA MINOLTA）, LCD7200(OTSUKA ELECTRONICS）
Driving condition: VDD = 3.3V, GND = 0V
Optimized VCOMDC
Backlight: IL=20.0mA

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.

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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 , white, black)
Signal condition   [Data]= 00h, 23h, 3Fh (3steps)
Observation distance   30 cm
Illuminance   200 to 350 lx
Backlight   IL=20.0mA

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 [Data]=00h Low bright dot: Visible through 5% ND filter at [Data]=00h Dark dot: Appear dark through white display at [Data]=23h		Refer to table 1
		Invisible through 5% ND filter at [Data]=00h		ignored
Screen Quality	Dirt	Uneven brightness (white stain, black stain etc)		Invisible through 1% ND filter
	Foreign particle	Point-like	0.25mm< φ	N=0
			0.20mm< φ ≦0.25mm	N≦2
			φ ≦0.20mm	Ignored
		Liner	3.0mm<length and 0.08mm<width	N=0
			length≦3.0mm or width≦0.08mm	Ignored
	Others			Use boundary sample for judgment when necessary

φ(mm): Average diameter = (major axis + minor axis)/2
L (mm): Length
W (mm): Width
N: Permissible number

Table 1

Area	High bright dot	Low bright dot	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	Two connecting bright/dark point count as one.

<Landscape model>
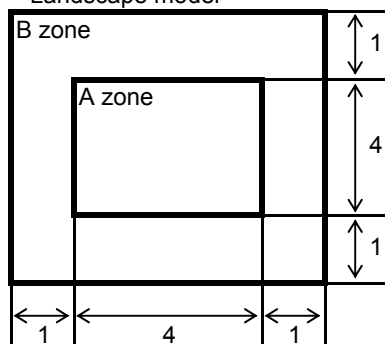
Division of A and B areas
   B area: Active area
   Dimensional ratio between A and B areas: 1: 4: 1 (Refer to the left figure)

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11.2 Screen and Other Appearance
Testing conditions
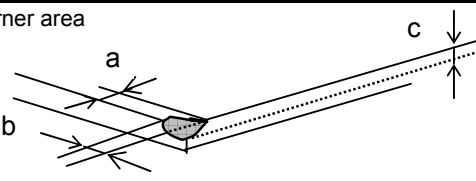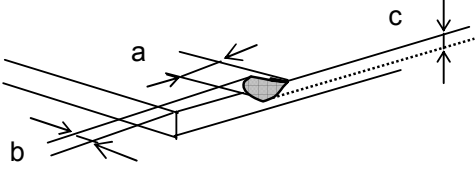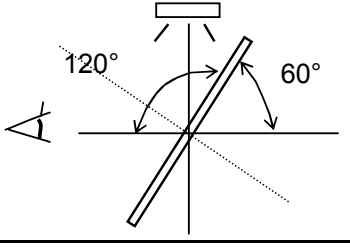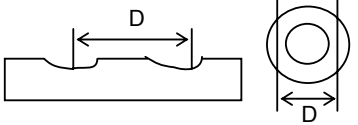
Observation distance	30cm
Illuminance	1200～2000 lx

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

Item		Appearance	Criteria
Touch Panel	Glass chipping	Corner area 	Unit:mm a≦3 b≦3 c≦t (t: glass thickness) a,b≦0.5 is ignored
		Others 	Unit:mm a≦5 b≦3 c≦t (t:glass thickness) a,b≦0.5 is ignored
		Progressive crack	None
	Interference fringe	Concentric interference fringe （Test method） Observe the Panel surface from 60 degrees angle to the surface under white fluorescent lamp (Triple band fluorescent lamp) 	Size: 1/3 or less of Active area. Darkness: comply with the boundary sample
	Fisheye Film surface	 (D: Average diameter of valley part)	D ≦φ0.3mm Ignored φ0.3mm< D ≦φ0.4mm N≦3 φ0.4mm< D ≦φ0.5mm N≦2 φ0.5mm< D N=0
	Foreign particle	Point-like	0.25mm< φ	N=0
			0.20mm< φ ≦0.25mm	N≦2
			φ ≦0.20mm	Ignored
		Liner	3.0mm<length and 0.08mm<width	N=0
			length≦3.0mm or width≦0.08mm	Ignored
	Flaw	0.05mm<W		Conform to the criteria of point-like foreign particles.
		0.03<W≦0.05mm	2<L≦5mm	N≦5
			L≦2mm	Ignored
		W≦0.03mm		Ignored

φ(mm): Average diameter = (major axis + minor axis)/2
Permissible number: N
L (mm): Length   W (mm): Width

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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 storage	Ta=60°C, RH=90% 240H non condensing ※	TBD
	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% 240H non condensing ※	0 / 3
	Thermal shock storage	-30←→80°C(30min/30min) 100 cycles	0 / 3
Mechanical environmental test	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
	Impact test	Use ORTUS TECHNOLOGY original jig (see next page)and make an impact with peak acceleration of 1000m/s2 for 6 msec with half sine-curve at 3 times to each X, Y, Z directions in conformance with JIS C 60068-2-27-2011.	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.）
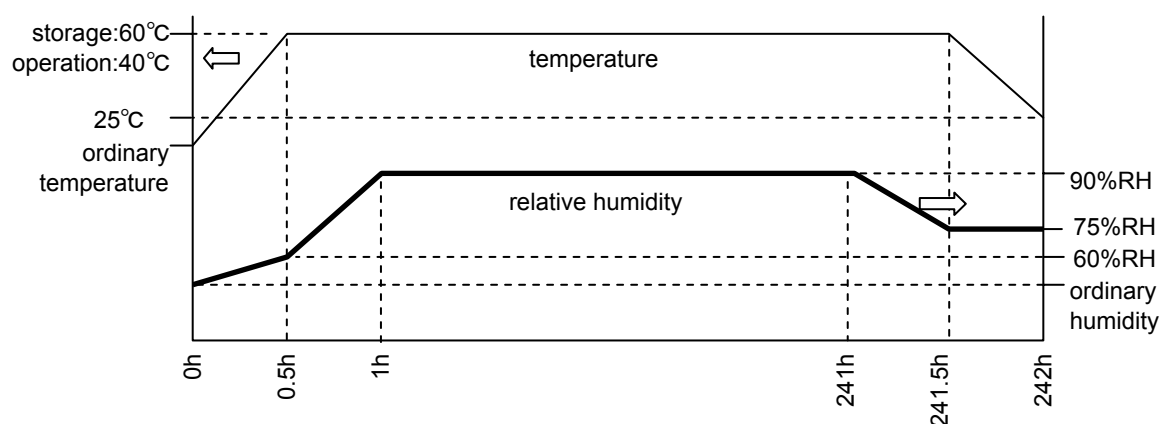
Table2.Reliability Criteria
The parameters should be measured after leaving the monitor at the ordinary temperature for 24 hours or more after the test completion.

item	Standard	Remarks
Display quality	No visible abnormality shall be seen.	
Contrast ratio	40 or more	

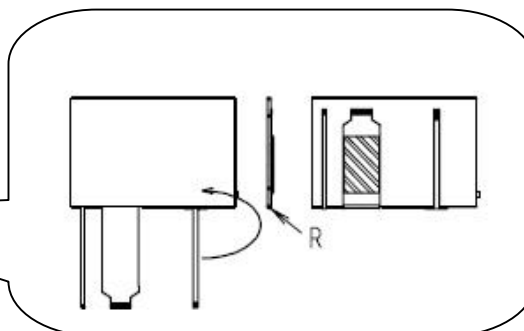ORTUS TECHNOLOGY CO.,LTD.

ORTUS TECHNOLOGY Original Jig
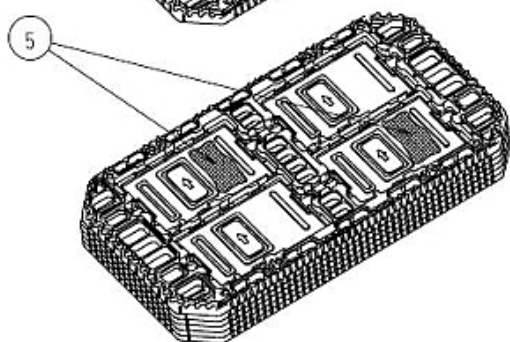

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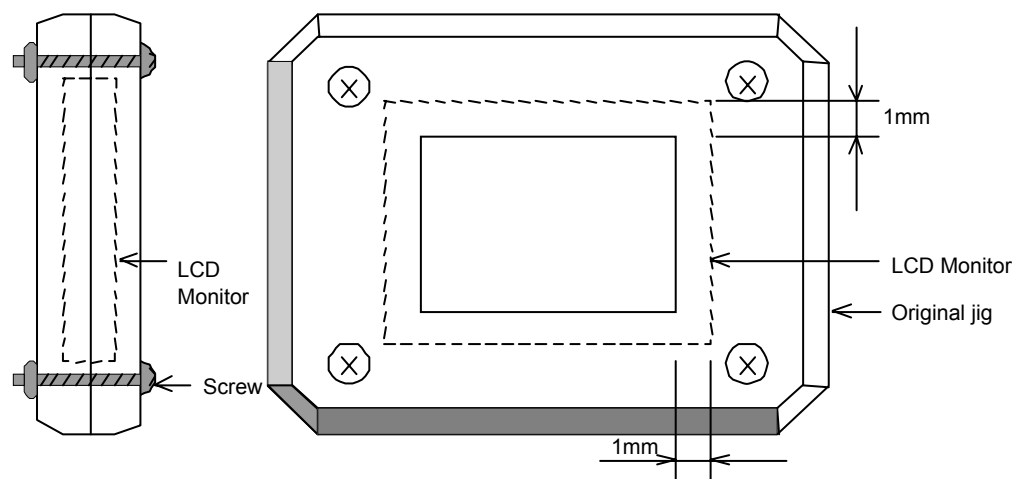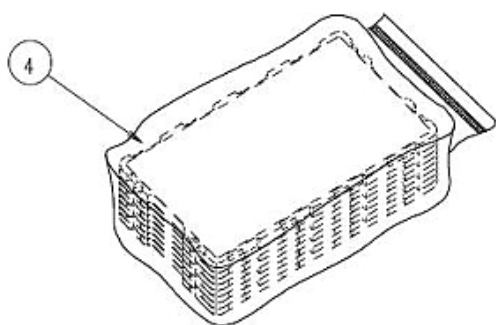
13. Packing Specifications
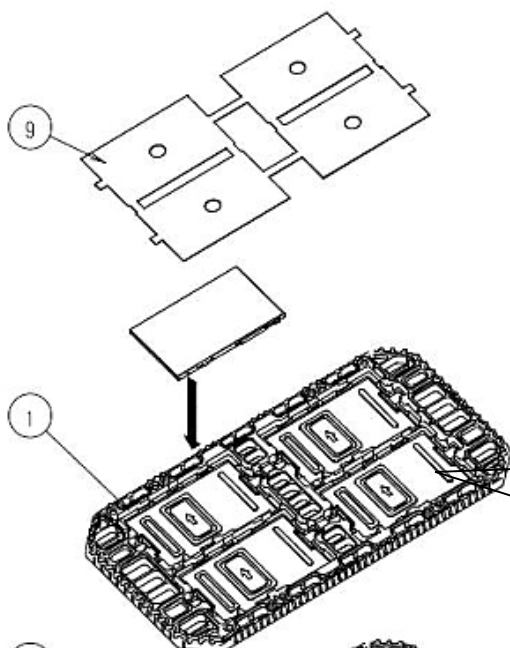
Step1) Each product is to be placed in one of the cut-outs of the tray
with its the display surface facing upward, and
Foam sheet is put on products. (4 products / tray)

LCD-FPC and LED-FPC, Touch panel-FPC are bent. (Rear side)

Step2) Each tray filled with products is to be piled up in stack of 5.
One empty tray is to be put on the top of stack of 5 trays.

Step3) 2 packs of moisture absorbers are to be placed on the top tray
as shown in the drawing.
Put piled trays into a sealing bag.
Vacuum and seal the sealing bag with the vacuum sealing machine.
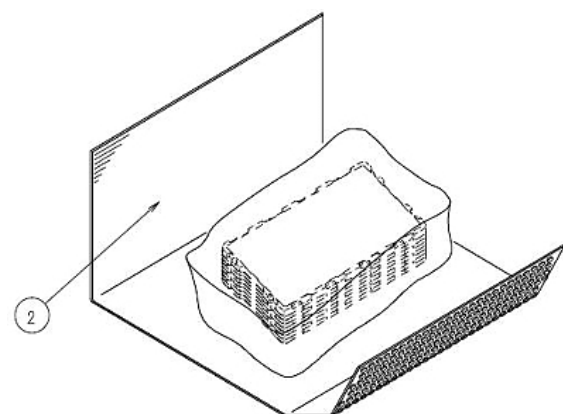
Step4) The pilled trays are to be wrapped with a bubble cushioning sheet,
and to be fixed with adhesive tape.

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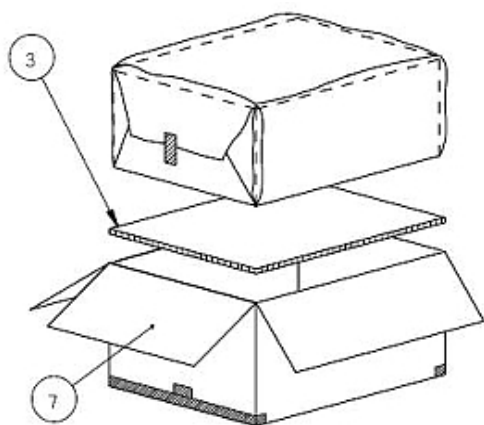
Step5) A corrugated board is to be placed in the bottom of an outer carton.
The wrapped trays are to be put on the corrugated board
in the outer carton.
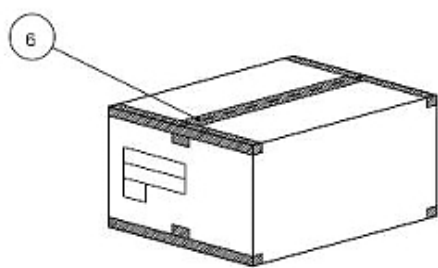
Step6) The outer carton needs to sealed with packing tape
as shown in the drawing.
The model number, quantity of products, and shipping date are
to be printed on the outer carton.
If necessary, shipping labels or impression markings are
to be put on the outer carton.
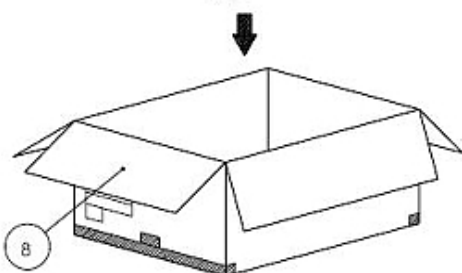
Step7) The outer carton is to be inserted into a extra outer carton
with same direction.
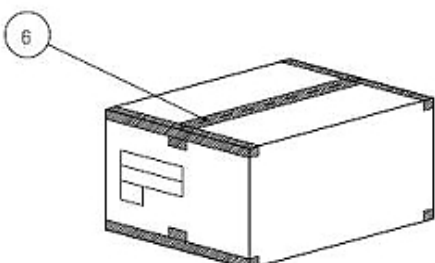
Step8) The extra outer carton needs to sealed with packing tape
as shown in the drawing.
The model number, quantity of products, and shipping date are
to be printed on the extra outer carton.
If necessary, shipping labels or impression markings are
to be put on the extra outer carton.

	Packing item name	Specs., Material
①	Tray	A-PET
②	B SHEET A	Anti-static air bubble sheet
③	Inner board	Corrugated cardboard
④	Sealing bag	
⑤	Drier	Moisture absorber
⑥	Packing tape	
⑦	Outer carton	Corrugated cardboard
⑧	Extra outer carton	Corrugated cardboard
⑨	Foam sheet	Anti-static polyethylene

Dimension of extra outer carton	
D : Approx.	(337mm)
W : Approx.	(618mm)
H : Aapprox.	(179mm)
Quantity of products packed in one carton :	20
Gross weight : Approx.	6.7kg

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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)   If a part of soldering part has been exposed, and avoid contact (short-circuit)
       with a metallic part of the case etc. about FPC of this model, please.
       Please insulate it with the insulating tape etc. if necessary.
       The defective operation is caused, and there is a possibility to generation
       of heat and the ignition.

(10)   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.

(11)   The end part of glass and film of touch panel has conductivity, and avoid contact (short-circuit)
       with electroconductive case etc.. There is a possibility of setting up a defective touch panel,
       and insulate it for the case suppression (cushion etc.) if necessary, please.

(12)   The devices on the FPC are damageable to electrostatic discharge,
       because the terminals of the devices are exposed.
       Wear grounded wrist-straps and use electrostatic neutralization blowers to prevent static
       charge and discharge when handling the TFT monitors.
       Designate an appropriate operating area, and set equipment, tools, and machines properly
       when handling this product.

⚠   **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 monitor 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.
Designate an appropriate operating area, and set equipment, tools, and machines properly
when handling this product.

  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)   Since this TFT monitors are not equipped with light shielding for the driver IC,
do not expose the driver IC to strong lights during operation as it may cause functional failures.

  2)   In case of powering up or powering off this LCD module,
be sure to comply the sequence as instructed in this specification.

  3)   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.

  4)   Do not operate the TFT monitors in the strong magnetic field. It may break the TFT monitors.

  5)   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.

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14.4 Storage Condition for Shipping Cartons

Storage environment
- ・ Temperature   0 to 40°C
- ・ Humidity   60%RH or less
  No-condensing occurs under low temperature with high humidity condition.
- ・ Atmosphere   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.
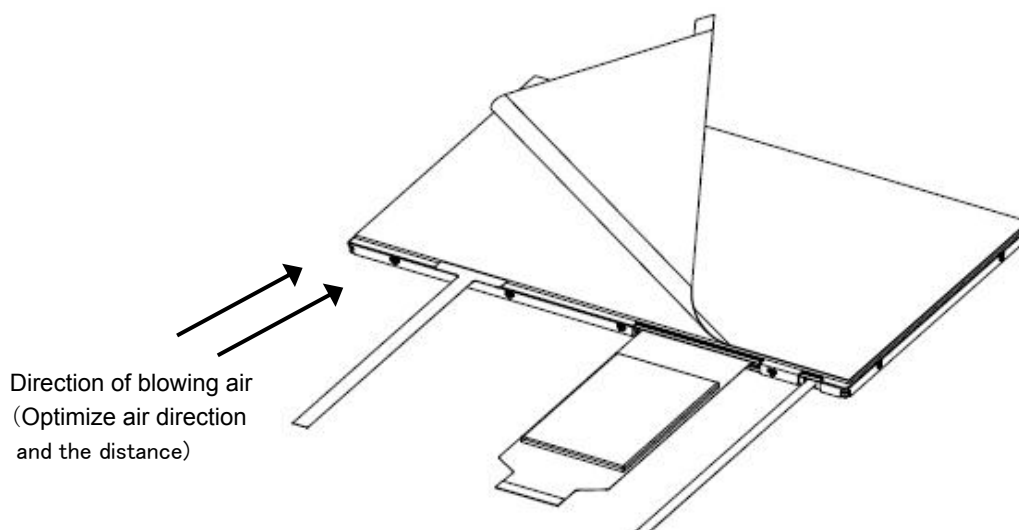
A) Work Environment
a) Humidity: 50 to 70 %RH, Temperature15 to 27°C
b) Operators should wear conductive shoes, conductive clothes, conductive finger tips and grounded wrist-straps. Anti-static treatment should be implemented to work area's floor.
c) Use a room shielded against outside dust with sticky 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 "S LABEL" on the front case is placed at the bottom. Optimize direction of the blowing air and the distance between the TFT monitors and the electrostatic neutralization blower.
b) Peel off the R 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）

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APPENDIX

Reference Method for Measuring Optical Characteristics and Performance

1. Measurement Condition

Measuring instruments: CS1000（KONICA MINOLTA）, LCD7200(OTSUKA ELECTRONICS）,EZcontrast160D（ELDIM）

Driving condition: Refer to the section "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

Dark box at constant temperature

TFT monitor   Luminance meter

LCD7200: 220mm
CS1000: 362mm
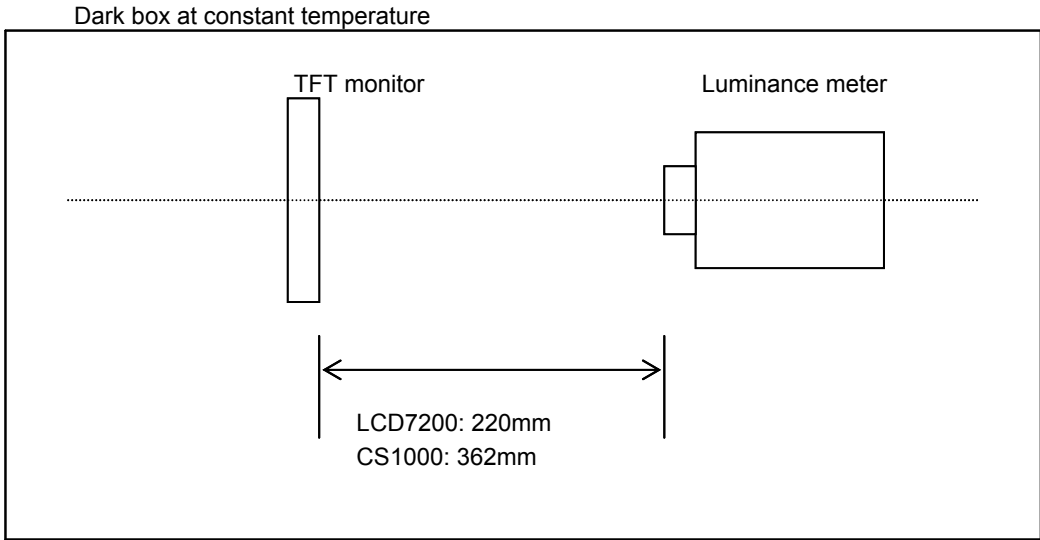
Measurement is made after 30 minutes of lighting of the backlight.

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

<Landscape model>

1
2
2
1

1   2   2   1
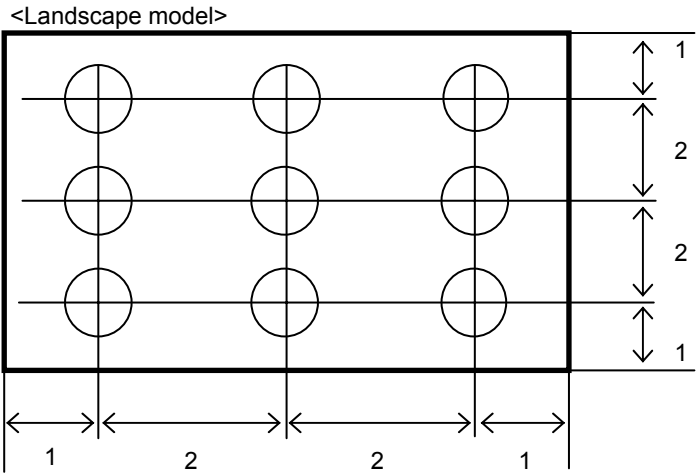
Dimensional ratio of active area

Backlight   IL=20.0mA

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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.
		
		White Black White
		
		White
		100%
		90%
		10%
		0%
		Black
		TON TOFF
			LCD7200	Black display [Data]=00h
				White display [Data]=3Fh
				TON
				  Rise time
				
				TOFF
				  Fall time

2	Contrast ratio	Measure maximum luminance Y1([Data]=3Fh) and minimum luminance Y2([Data]=00h) 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	White chromaticity	Measure chromaticity coordinates x and y of CIE1931 colorimetric system at [Data] = 3Fh Color matching function: 2°view	CS1000	
5	Burn-in	Visually check burn-in image on the screen after 2 hours of "window display" ([Data]=3Fh/00h).		At optimized VCOMDC
6	Center brightness	Measure the brightness at the center of the screen.	CS1000	
7	Brightness distribution	(Brightness distribution) = 100 x B/A % A : max. brightness of the 9 points B : min. brightness of the 9 points	CS1000	

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* Linearity Measurement of Touch Panel
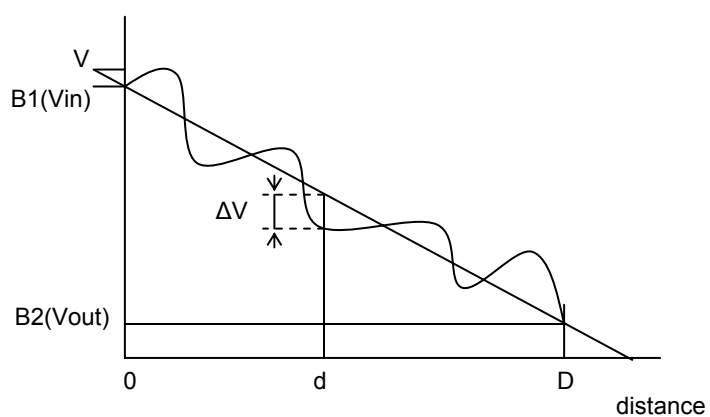
$$LE(\%) = \Delta V / (Vin - Vout) \times 100$$

$$LEmax(\%) = \Delta Vmax / (Vin - Vout) \times 100$$

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