SPECIFICATIONS № 12TLM062	Issue: Aug. 22, 2012

Specifications for

TFT-LCD Monitor

Version 1.0

MODEL   COM43T4M81ZTC

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

ORTUSTECH

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ORTUS TECHNOLOGY CO.,LTD.

SPECIFICATIONS № 12TLM062	Issue: Aug. 22, 2012

Version History

Ver.	Date	Page		Description
1.0	Aug. 22, 2012	-	-	First issue

ORTUS TECHNOLOGY CO.,LTD.

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Contents

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1. Application

This Specification is applicable to 10.9cm (4.3 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.

◎ 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

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2. Outline Specifications

2.1 Features of the Product

- 4.3 inch diagonal display, 1,440 [H] x 272 [V] dots.
- 8-bit 16,777,216 color display capability.
- Single power supply operation of 3.3V.
- Built in Timing generator (TG), Counter-electrode driving circuitry and power supply circuit.
- High bright white LED back-light and Touch panel operation monitor.

2.2 Display Method

Items	Specifications	Remarks
Display type	TN type 16,777,216 colors. 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	8-bit RGB, parallel input.	
Backlight type	High bright white LED.	
Touch panel	Resistance type,transmissive analog tablet	
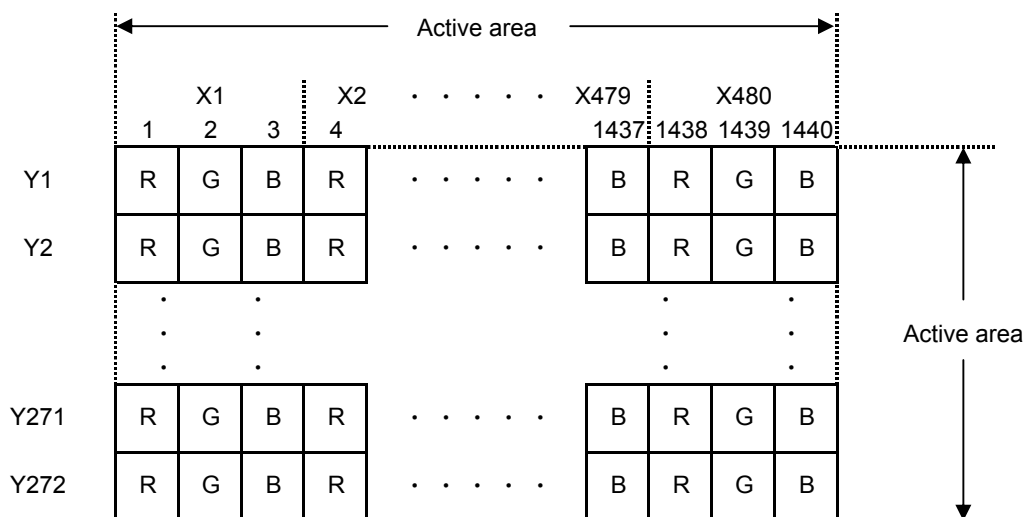
Dot arrangement (FPC cable placed downside)

3. Dimensions and Shape

3.1 Dimensions

Items	Specifications	Unit	Remarks
Outline dimensions	105.50[H] × 67.20[V] × 6.35[D]	mm	Exclude FPC cable.
Active area	95.040[H] × 53.856[V]	mm	10.9cm diagonal.
Number of dots	1,440[H] × 272[V]	dot	
Dot pitch	66.0[H] × 198.0[V]	μm	
Hardness of 　　　Touch Panel surface	3	H	Load:4.9N,Angle:45° Reference judgment standard:JIS-K5600
Weight	72.5	g	Include FPC cable.

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

3.2 Outward Form

4-R0.5

4.3W

104.50±0.3 (TP outline)
0.50±0.25 (FRAME-TP outline)
105.50±0.2
(52.75)
52.75
(5.23)
(5.23)

Polarizer area(Active area-Polarizer)
All around 0.70min

(Active area center)

67.20±0.2
(31.15)
36.05
46.73

Note. 1

53.856(Active area)
95.040 (Active area)
(4.22)
(9.12)
TP. AA=55.50min
TP. VA=57.30min
7.50max (TP outline-TP.AA)
6.60max (TP outline-TP.VA)

24.50

Insulation tape

23.00
22.71
14.50

1
45

TP. AA=96.7min
TP. VA=98.50min
3.90max(TP outline-TP.AA)
3.00max(TP outline-TP.VA)

6.35±0.2
5.20 (FRAME-S CASE A)
1.00 (TP)
65.90±0.3 (TP outline)
0.80±0.25 (FRAME-TP outline)

1.50max
(Thickness of soldering area
LCD FPC - top of solder)

0.30±0.05
(Thickness of contact point,
including the reinforcing plate)

Note.8 2.50min~4.00max
Note.8 2.50min~4.00max
Note.8 1.80min~3.00max
Note.8 1.50min~7.50max

************125
****57********

12.74
5.00

Bending area

Notes:

Note. 1 Angular deviation of LCD cell from the TFT-LCD monitor's reference axis shall be less than [±40′].
Note. 2 B label is affixed the area shown in the drawing.
The thickness of the B label will be added to that of S case's surface.
Note. 3 Recommended FPC connectors
For LCD : HIROSE/FH12A-45S-0.5SH(55)(Upper contact)
FPC pin assignment differs from a position of Datum Pin of recommended FPC connector.
Please notice the difference when designing your circuit with much care.
Note. 4 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. 5 Keep a gap, for example 0.3 to 0.7mm between the bezel edge and TP surface
to avoid the bezel edge from making contacting with the TP surface
that may cause a "false touch" with the bottom layer.
Note. 6 Recomended dimension of case window frame when pen in point R0.8 is used.
Refer to the example of housing design.
Note. 7 Linearity is guaranteed in the area surrounded by 3mm inside lines from TP.AA.
Note. 8 In case TFT-LCD monitor is fixed to the case of your product, it's recommended that monitor is fixed in to ▨▨ area.
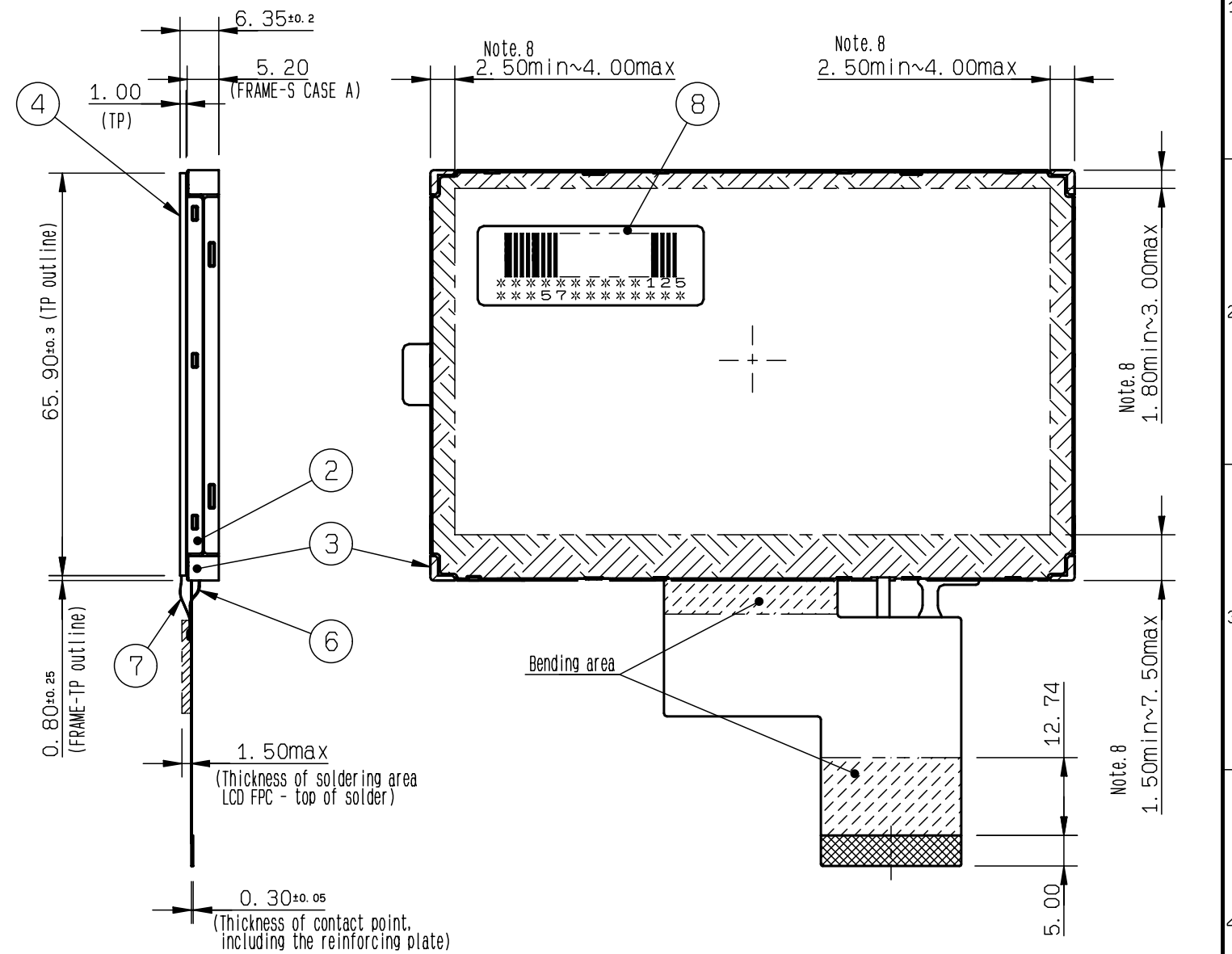Note. 9 TP : TOUCHPANEL
Note.10 TP. AA : Active Area of touch panel
TP. VA : View Area of touch panel
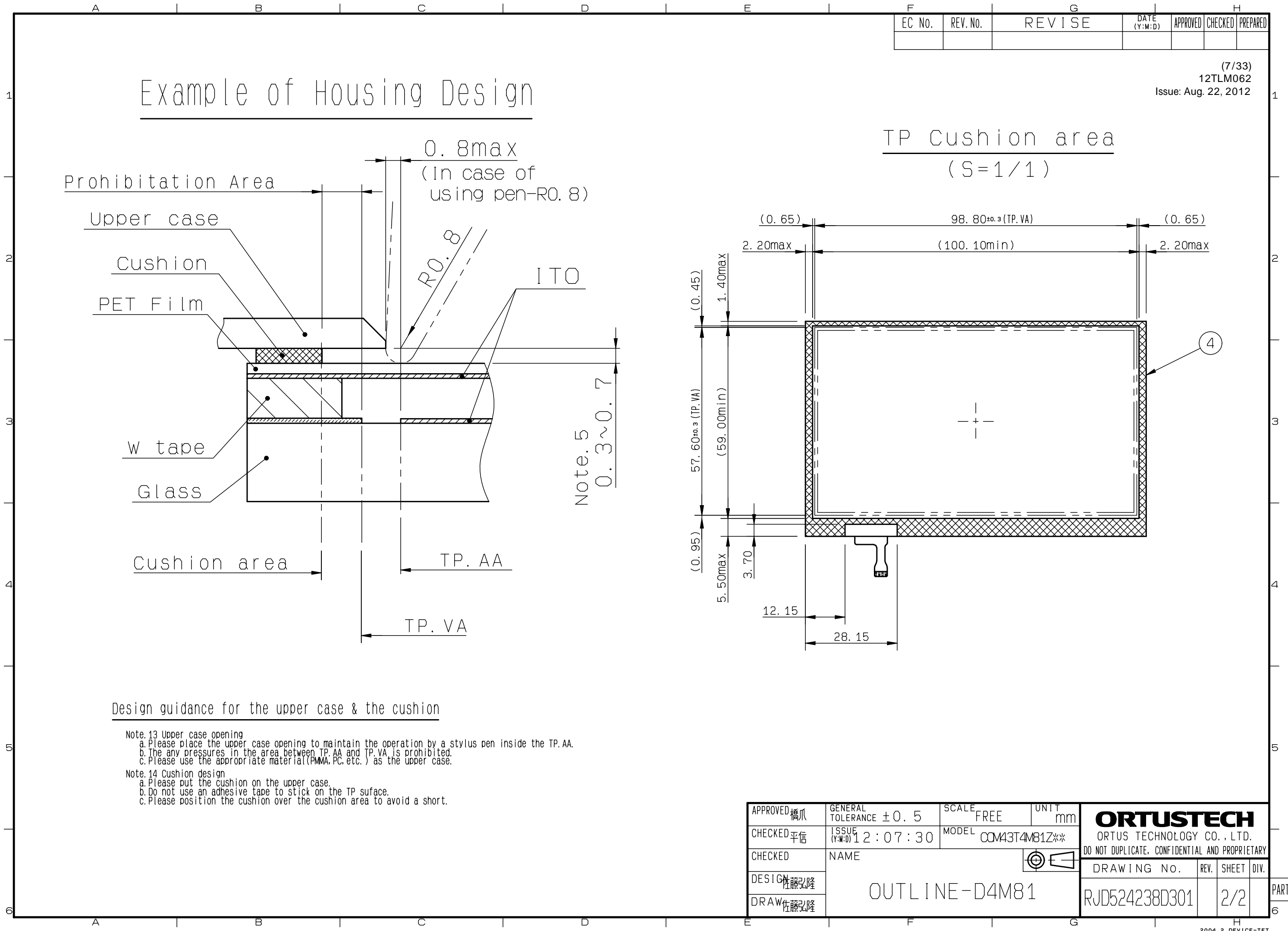Note.11 Refer to "4.PIN ASIGNMENT" about the pin No. of TOUCHPANEL.
Note.12 Refer to "11.CRITERIA OF JUDGMENT" about the appearance specification of a polarizer.

PART NAME	Part No.	Spec. No., Standard	Material	Remarks
	10			
	9			
B LABEL	8			(37X13X0.075t)
TP FPC	7			
LED FPC	6			
LCD FPC	5			
TOUCH PANEL	4		Film-Glass	
FRAME	3			
S CASE A	2			
TFT-LCD PANEL	1		Glass substrate thickness=0.5t	

APPROVED 橋爪	GENERAL TOLERANCE ±0.5	SCALE 1/1	UNIT mm	**ORTUSTECH**
CHECKED 平信	ISSUE (Y:M:D) 12:07:30	MODEL COM43T4M81Z**		ORTUS TECHNOLOGY CO., LTD.
CHECKED	NAME			DO NOT DUPLICATE, CONFIDENTIAL AND PROPRIETARY
DESIGN 佐藤弘隆				DRAWING NO.	REV.	SHEET	DIV.
DRAW 佐藤弘隆	OUTLINE-D4M81			RJD524238D301		1/2	PART

2004. 2 DEVICE-TFT

Example of Housing Design

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

Prohibition Area

Upper case

Cushion

PET Film

R0.8

ITO

Note.5
0.3~0.7

W tape

Glass

Cushion area

TP.AA

TP.VA

TP Cushion area
(S=1/1)

(0.65)　　98.80±0.3(TP.VA)　　(0.65)

2.20max　　(100.10min)　　2.20max

(0.45)　1.40max

57.60±0.3(TP.VA)　(59.00min)

(0.95)

5.50max　3.70

④

12.15

28.15
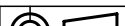
Design guidance for the upper case & the cushion

Note.13 Upper case opening
  a.Please place the upper case opening to maintain the operation by a stylus pen inside the TP.AA.
  b.The any pressures in the area between TP.AA and TP.VA is prohibited.
  c.Please use the appropriate material(PMMA,PC.etc.) as the upper case.

Note.14 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 橋爪	GENERAL TOLERANCE ±0.5	SCALE FREE	UNIT mm	**ORTUSTECH**
CHECKED 平信	ISSUE (Y:M:D) 12:07:30	MODEL COM43T4M81Z**		ORTUS TECHNOLOGY CO.,LTD.
CHECKED	NAME			DO NOT DUPLICATE, CONFIDENTIAL AND PROPRIETARY
DESIGN 佐藤弘隆	OUTLINE-D4M81			DRAWING NO. / REV. / SHEET / DIV.
DRAW 佐藤弘隆				RJD524238D301 / / 2/2 / PART

2004.2 DEVICE-TFT

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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
* * * 4 3 * * * * * * * *
```
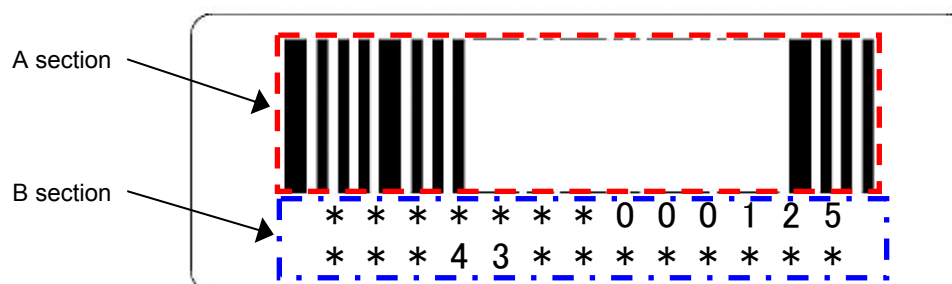
Details of B section
 Upper culumn: It indicates The least significant digit of manufacture year (1 digit),
  manufacture month with below alphabet (1letter), model code (5characters),
  serial number (6digits).

```
  *      *      *****    ******
  ‾      ‾      ‾‾‾‾‾    ‾‾‾‾‾‾
  a      b        c        d
```

	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	43DEC (Made in Japan)					
		43DFC (Made in Malaysia)					
		43DGC (Made in China)					
d	Serial number						

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

　2L43DEC000125

means "manufactured in December 2012, 4.3" DE type,
C specifications, serial number 000125"

・Made in Malaysia

　2L43DFC000125

means "manufactured in December 2012, 4.3" DF type,
C specifications, serial number 000125"

・Made in China

　2L43DGC000125

means "manufactured in December 2012, 4.3" DG type,
C specifications, serial number 000125"

　　Lower culumn: Model (13characters)

2) Location of Bar code 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

No.	Symbol	Function
1	VSS	GND.
2	VSS	GND.
3	VDD	Power supply.
4	VDD	Power supply.

5	D00	Display data(R).
		  00h: Black
		      D00:LSB D07:MSB
		
		  Driver has internal gamma conversion.

6	D01	
7	D02	
8	D03	
9	D04	
10	D05	
11	D06	
12	D07	

13	D10	Display data(G).
		  00h: Black
		      D10:LSB D17:MSB
		
		  Driver has internal gamma conversion.

14	D11	
15	D12	
16	D13	
17	D14	
18	D15	
19	D16	
20	D17	

21	D20	Display data(B).
		  00h: Black
		      D20:LSB D27:MSB
		
		  Driver has internal gamma conversion.

22	D21	
23	D22	
24	D23	
25	D24	
26	D25	
27	D26	
28	D27	
29	VSS	GND.
30	CLK	Clock signal.Latching data at the falling edge.
31	STBYB	Standby signal input. (Hi:Normal operation, Lo:Standby operation)
32	HSYNC	Horizontal sync signal input. (Low active)
33	VSYNC	Vertical sync signal input. (Low active)
34	DE	Input data effective signal. (It is effective for the period of "Hi")
35	NC	OPEN.
36	VSS	GND.
37	YU	Y-axis upside terminal
38	XL	X-axis left terminal
39	YD	Y-axis downside terminal
40	XR	X-axis right terminal
41	VSS	GND.
42	BLL	Backlight drive (cathode side)
43	BLH	Backlight drive (anode side)
44	LR	Right/Left Display reverse(Hi:normal display, Low:inversion display)
45	UD	Up/Down Display reverse(Hi:normal display, Low:inversion display)

- Recommended connector: HIROSE ELECTRIC FH12 series [FH12A-45S-0.5SH(55)]
- Please make sure to check a consistency between pin assignment in "3.2 Outward Form" and
  your connector pin assignment when designing your circuit.
  Inconsistency in input signal assignment may cause a malfunction.
- Since FPC cable has gold plated terminals, gilt finish contact shoe connector is recommended.

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5. Absolute Maximum Rating

VSS=0V

Item	Symbol	Condition	Rating		Unit	Applicable terminal
			MIN	MAX		
Supply voltage	VDD	Ta=25°C	-0.3	5.0	V	VDD
Input voltage for logic	VI		-0.3	VDD+0.3	V	CLK,VSYNC,HSYNC,DE D[27:20],D[17:10],D[07:00], STBYB,LR,UD
LED direction current	IL	Ta=25°C	--	70	mA	BLH - BLL
Touch Panel input voltage	VIT		--	7.0	V	XR,XL,YU,YD
Storage temperature range	Tstg		-30	80	°C	
Storage humidity range	Hstg	Non condensing in an environmental moisture at or less than 40°C90%RH.				

6. Recommended Operating Conditions

VSS=0V

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Supply voltage	VDD		3.0	3.3	3.6	V	VDD
Input voltage for logic	VI	VDD=3.0~ 3.6V	0	--	VDD	V	CLK,VSYNC,HSYNC, DE,D[27:20],D[17:10], D[07:00],STBYB,LR,UD
Operating temperatur range	Top	Note 1,2	-20	25	70	°C	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: This monitor is operatable in this temperature range. With regard to optical characteristics, refer to Item "10. CHARACTERISTICS".

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7. Characteristics

7.1 DC Characteristics

7.1.1 Display Module

(Unless otherwise noted, Ta=25°C,VDD=3.3V,VSS=0V)

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Input voltage for logic	VIH	VDD=3.0~3.6V	0.7×VDD	--	VDD	V	CLK,VSYNC,HSYNC, DE,D[27:20],D[17:10],
	VIL		0	--	0.3×VDD	V	D[07:00],STBYB LR,UD
Pull down resister value	Rpd		--	200	--	kΩ	DE,D[27:20],D[17:10], D[07:00]
Pull up resister value	Rpu		--	200	--	kΩ	VSYNC,HSYNC, STBYB,LR,UD
Current consumption	IDD	fCLK=9MHz Color bar display	--	17	34	mA	VDD
Standby Current	IDDs	Other input with constant voltage	--	100	200	µA	

7.1.2 Backlight

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Forward current	IL25	Ta=25°C	--	35	70	mA	BLH - BLL
Forward voltage	VL	Ta=25°C, IL=35mA	--	14.25	16.25	V	
Estimated Life of LED	LL	Ta=25°C, IL=35mA Note	--	70,000	--	hr	

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.

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7.1.3 Touch Panel

Ta=25°C

Item	Symbol	Condition	Rating MIN	Rating TYP	Rating MAX	Unit	Applicable terminal
Linearity	LE	Note	-1.5	--	1.5	%	
Insulation resistance	RI	DC 25V	20	--	--	MΩ	XR,XL-YU,YD
Terminal resistance		X	200	--	1200	Ω	XR,XL
		Y	100	--	600		YU,YD
Rated voltage		DC	--	5.0	7.0	V	XR,XL,YU,YD
on/off chattering		R0.8mm Polyacetal pen.	--	--	10	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".
　　　Load:(2.45)N

Mechanical Characteristics

Item	Rating MIN	Rating TYP	Rating MAX	Unit	Remark
Detectable activation force	0.05	--	1.20	N	R0.8mm Polyacetal pen or finger. Resistance between X and Y axis must be equal or lower than 2KΩ.
Keystroke durability	1,000,000	--	--	times	key the same part by silicon rubber. (Touch panel Active area only) -Rubber tip part: R8mm -Load: 2.45N　　　-Speed: 2times/second

7.2 AC Characteristics

(Unless otherwise noted, Ta=25°C,VDD=3.3V,VSS=0V)

Item	Symbol	Condition	Rating MIN	Rating TYP	Rating MAX	Unit	Applicable terminal
CLK frequency	fCLK		5.0	9.0	12.0	MHz	CLK
CLK rising time	tr	10%→90%	--	--	9	ns	
CLK falling time	tf	90%→10%	--	--	9	ns	
CLK Low period	tw1L	0.3×VDD or less.	0.4/fCLK	--	0.6/fCLK	ns	
CLK High period	tw1H	0.7×VDD or more.	0.4/fCLK	--	0.6/fCLK	ns	
Setup time	tsp		12.0	--	--	ns	CLK,VSYNC,HSYNC,
Hold time	thd		12.0	--	--	ns	DE,D[27:20],D[17:10], D[07:00]

Switching Waveform Characteristics

*:INVALID

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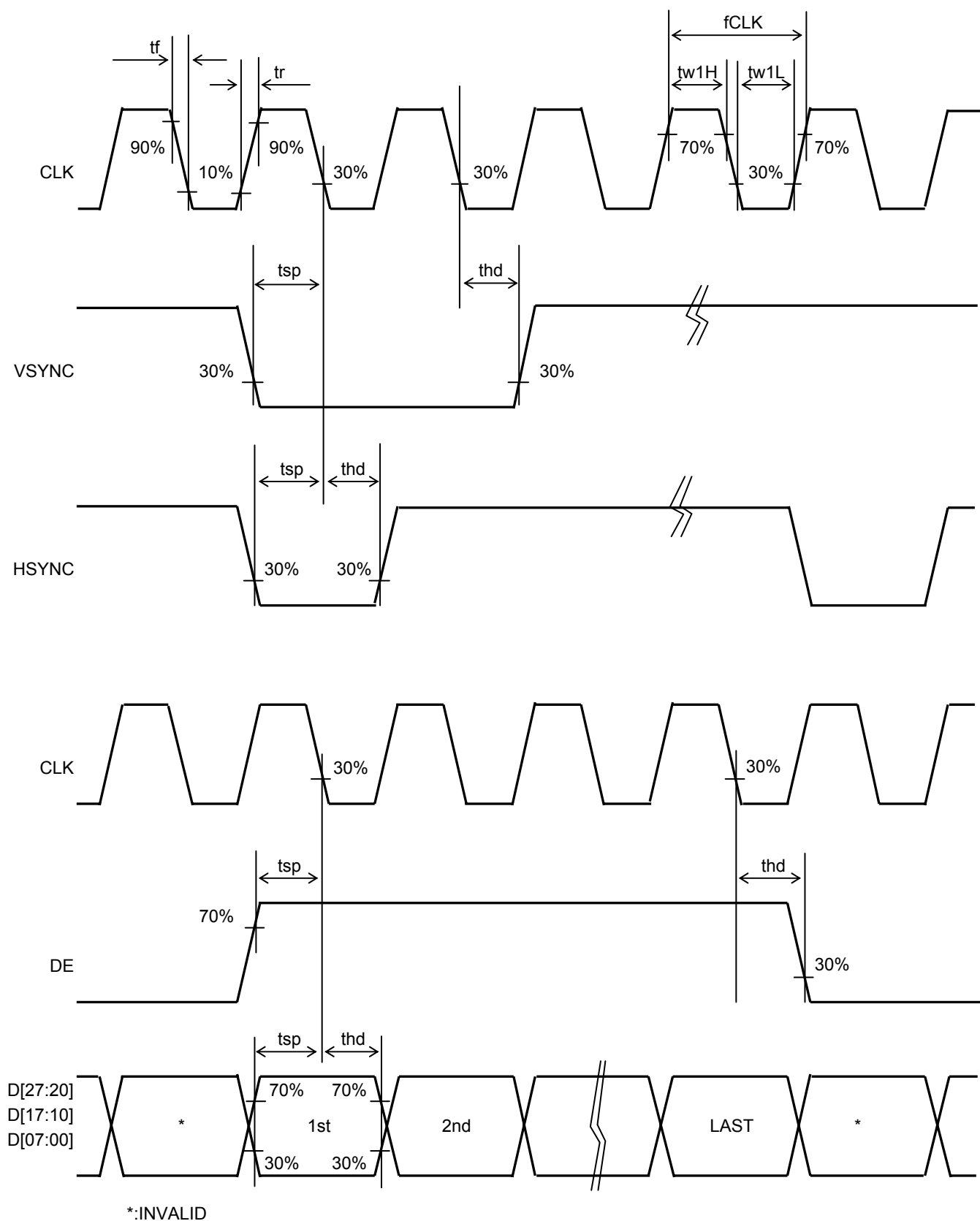
7.3 Input Timing Characteristics

(Unless otherwise noted, Ta=25°C,VDD=3.3V,VSS=0V)

Item	Symbol	Rating			Unit	Applicable terminal
		MIN	TYP	MAX		
VSYNC frequency Note	fVSYNC	54	60	66	Hz	VSYNC
VSYNC signal cycle time	tv	277	288	400	H	VSYNC,HSYNC
VSYNC pulse width	tw2H	1	--	--	H	
Vertical back porch	tvb	3	8	31	H	
Vertical front porch	tvf	2	8	93	H	
Vertical display period	tvdp	--	272	--	H	VSYNC,HSYNC,DE,D[27:20], D[17:10],D[07:00]
HSYNC frequency	fHSYNC	15.38	16.67	18.18	Khz	HSYNC
HSYNC signal cycle time	th	520	525	800	CLK	HSYNC,CLK
HSYNC pulse width	tw3H	1	--	--	CLK	
Horizontal back porch	thb	36	40	255	CLK	HSYNC,DE,CLK
Horizontal front porch	thf	4	5	65	CLK	
Horizontal display period	thdp	--	480	--	CLK	DE,D[27:20],D[17:10],D[07:00], CLK
DE pulse width	tw4H	--	480	--	CLK	DE,CLK

Note: 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.

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7.4 Driving Timing Chart

-Vertical Timing
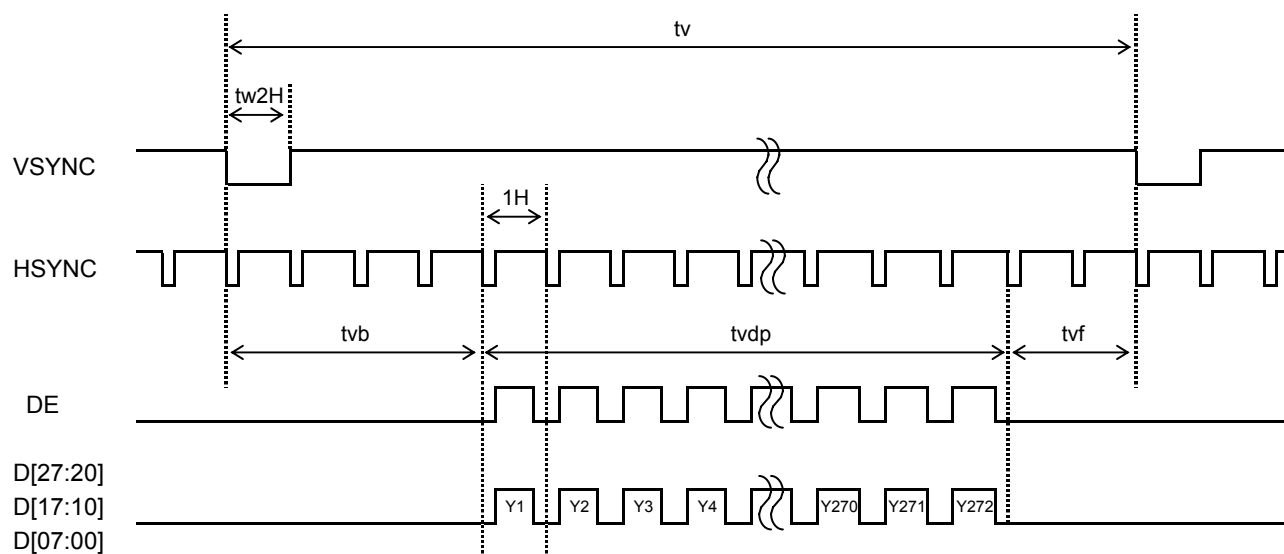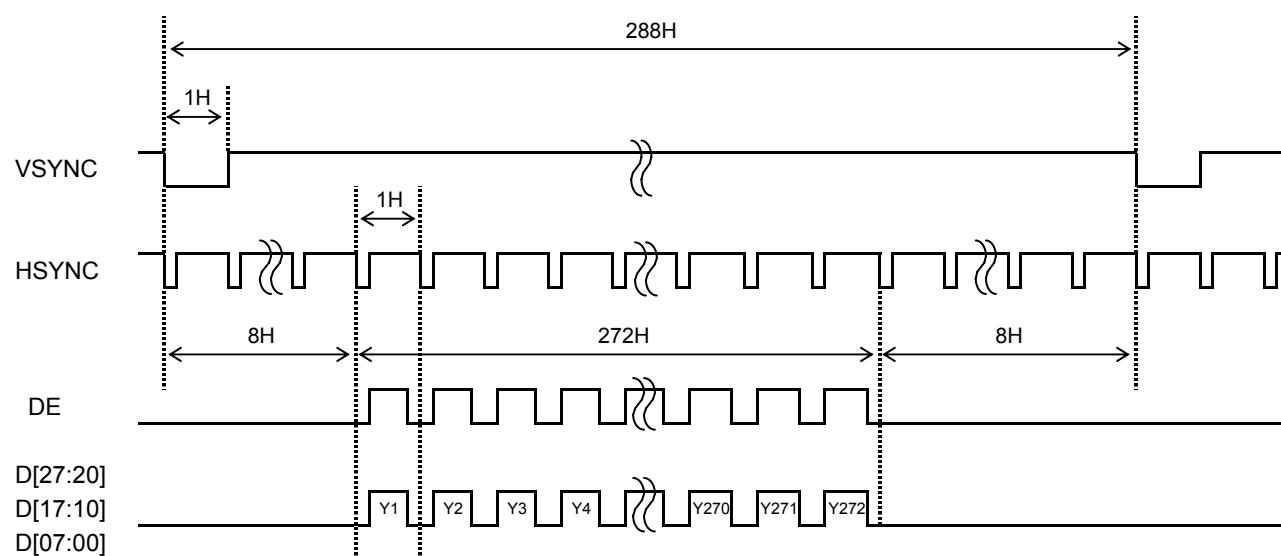

-Horizontal Timing
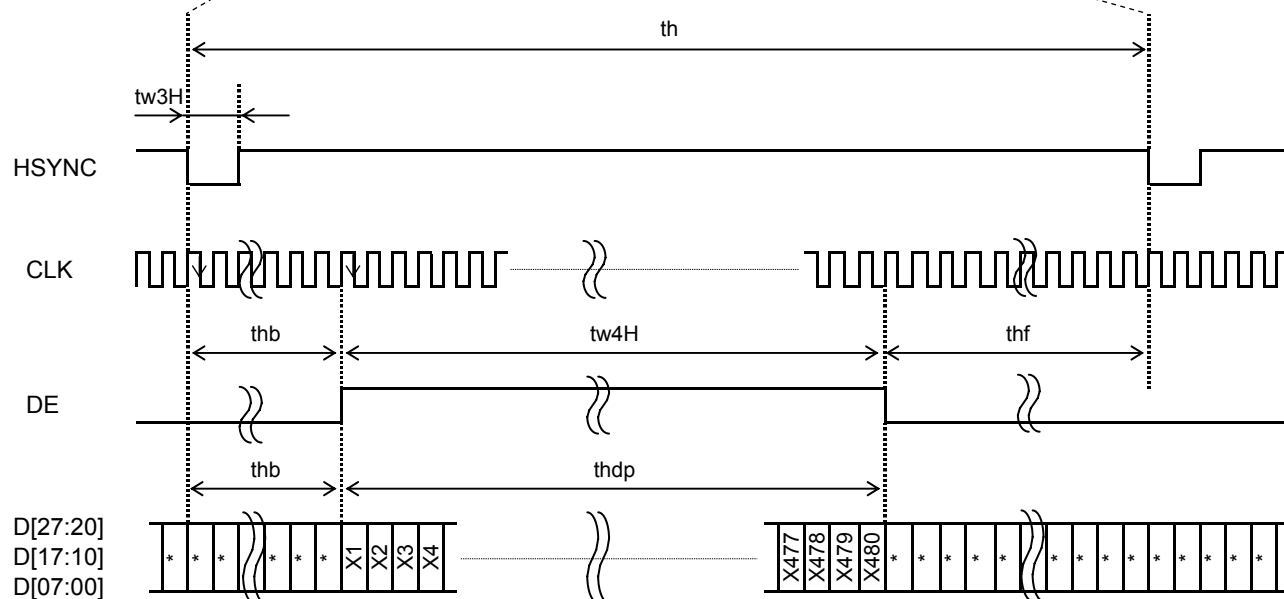
7.5 Example of Driving Timing Chart (fCLK=9.0MHz)

-Vertical Timing

288H

1H

VSYNC

1H

HSYNC

8H   272H   8H

DE

D[27:20]
D[17:10]   Y1 Y2 Y3 Y4   Y270 Y271 Y272
D[07:00]

-Horizontal Timing

525CLK

2CLK

HSYNC

CLK

40CLK   480CLK   5CLK

DE

40CLK   480CLK

D[27:20]
D[17:10]   * * * * * * * * * * * * X1 X2 X3 X4   X477 X478 X479 X480 * * * * * * * * * * * *
D[07:00]
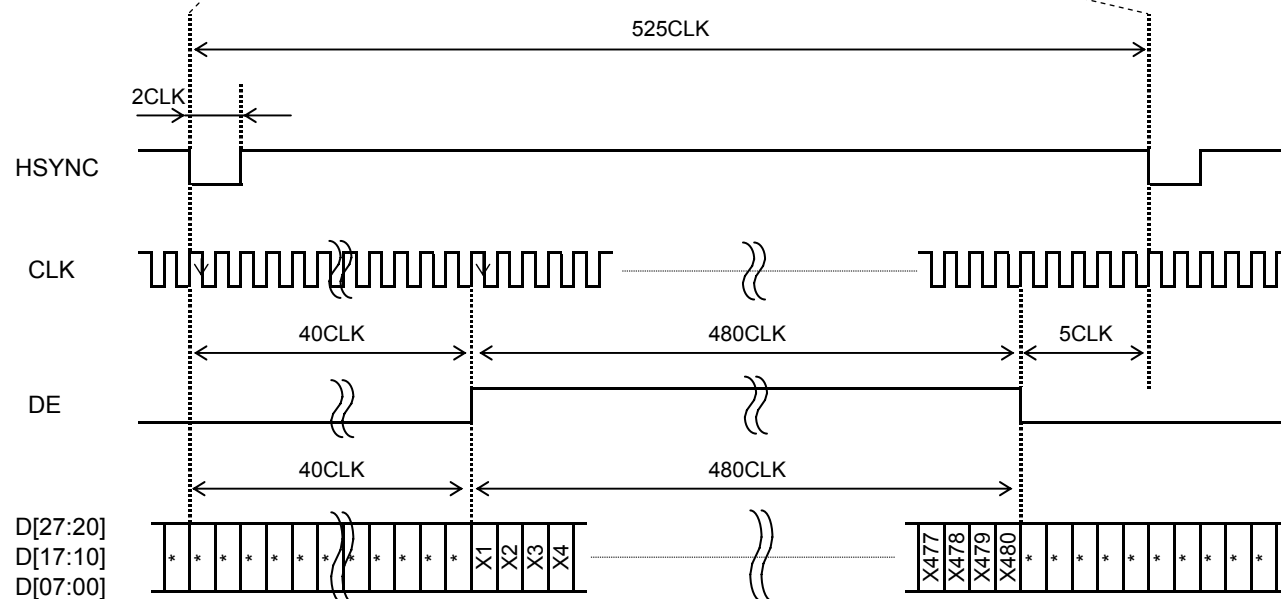
8. Description of Sequence

The outline of "Power ON/OFF Sequence" and "Standby ON/OFF Sequence" is shown below.
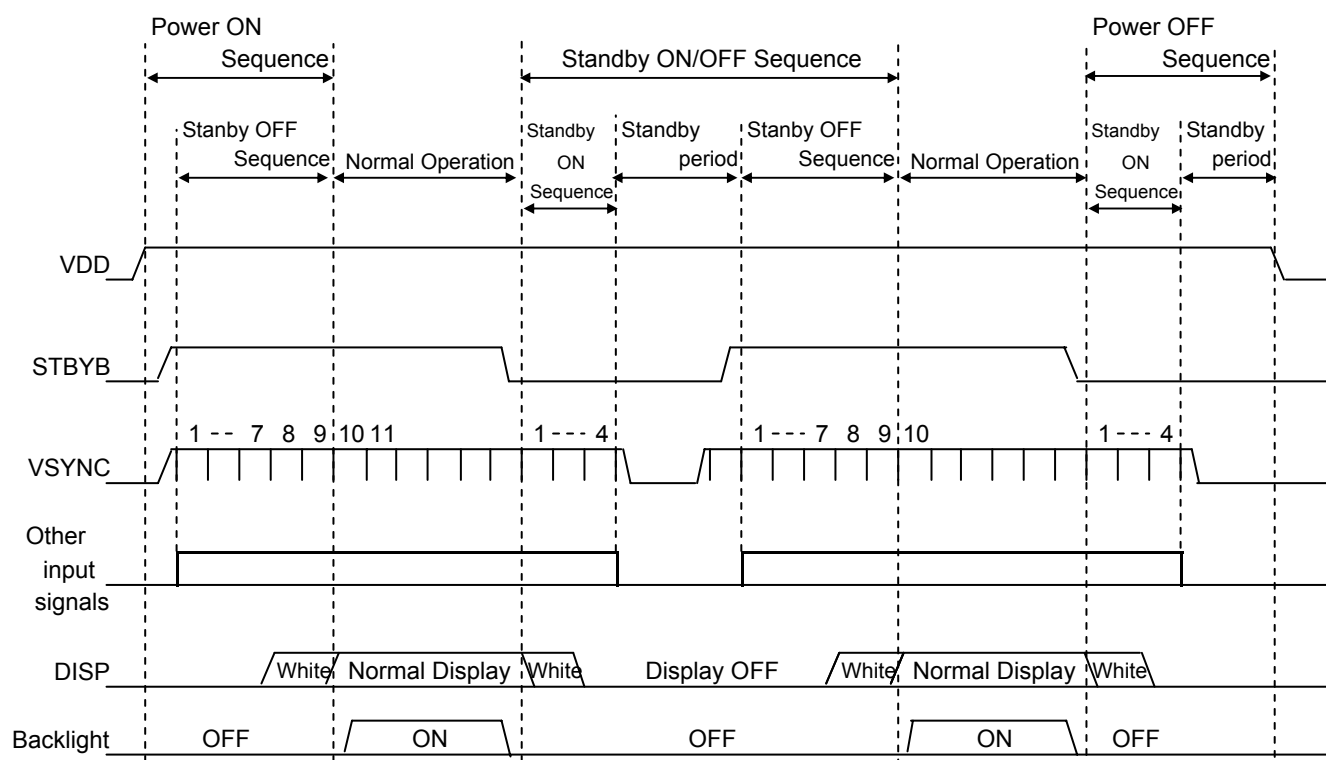
8.1 Power ON/OFF Sequence

The sequence of the Power On/Off and the signal input must defend the following conditions.
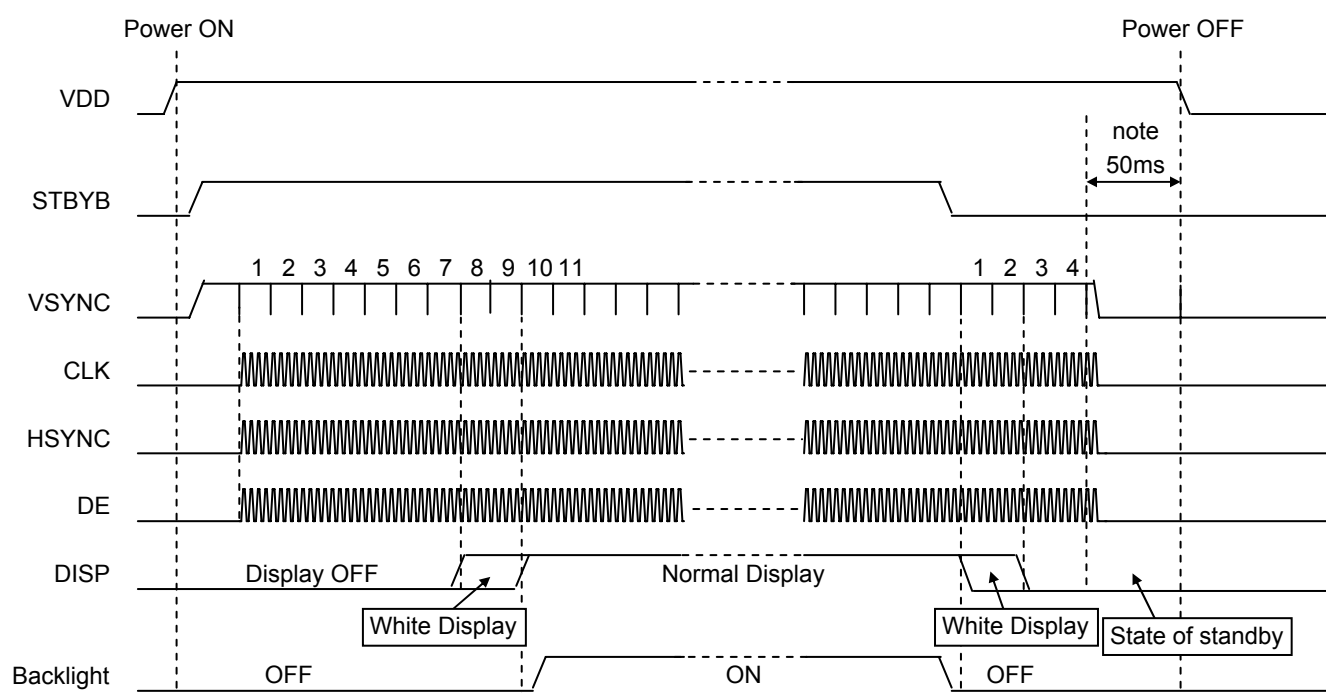
Note: For Power OFF,please turn off VDD since 50msec after the standby state shifts.
       When CLK and the VSYNC signal are stopped or the power supply is turned off to a regulated
       frame or less, the afterimage might remain.

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8.2 Stanby ON/OFF Sequence

It explains Standby ON/OFF sequence by the STBYB signal.

The following time will be needed by the shift in the state of the standby from the standby setting according to the STBYB signal.
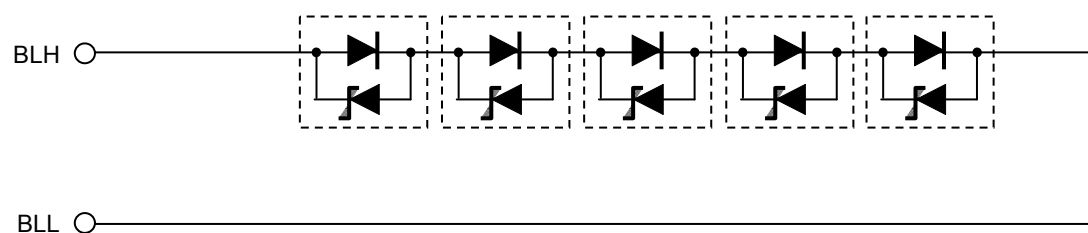Meanwhile, VSYNC signal and the CLK signal should keep being supplied.

STBYB

VSYNC   1   2   3   4

DATA output: Normal Display | White Display | Display OFF | State of standby

Backlight: ON | OFF
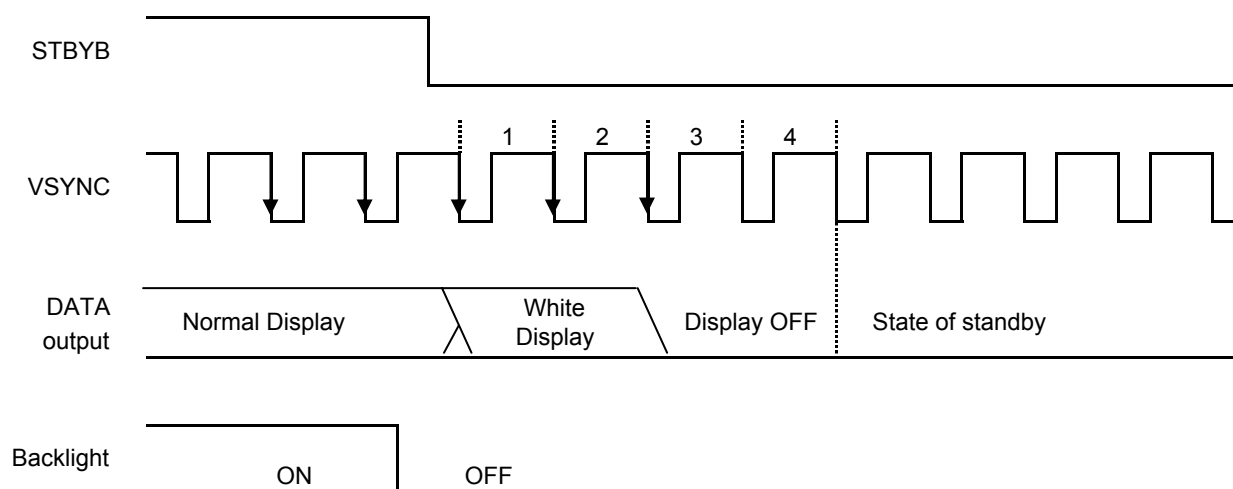
Similarly, the time of nine frames will be needed by the time a usual display is begun from the standby release by the STBYB signal.
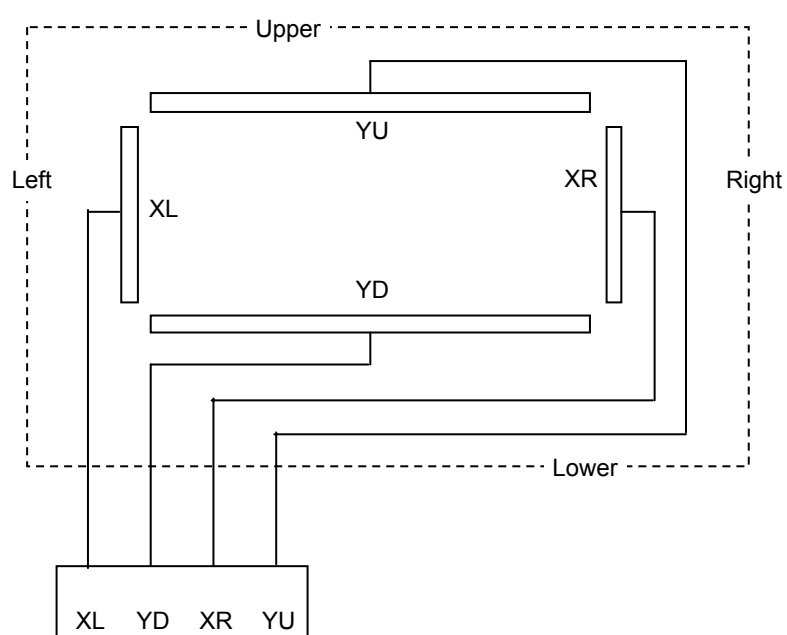Please begin outputting in the 8th frame on the Display Data.

STBYB

VSYNC   1   2   7   8   9   10

DATA output: State of standby | White Display | Normal Display

Backlight: OFF | ON

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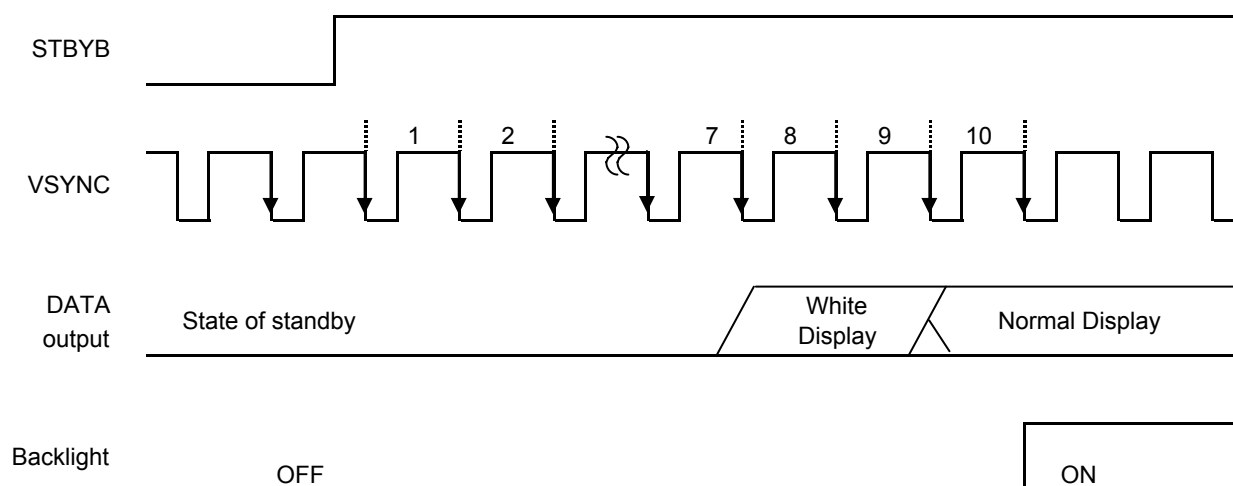
9. Circuit

9.1 LED Circuit

9.2 Touch Panel Circuit

10. Characteristics

10.1 Optical Characteristics

< Measurement Condition >

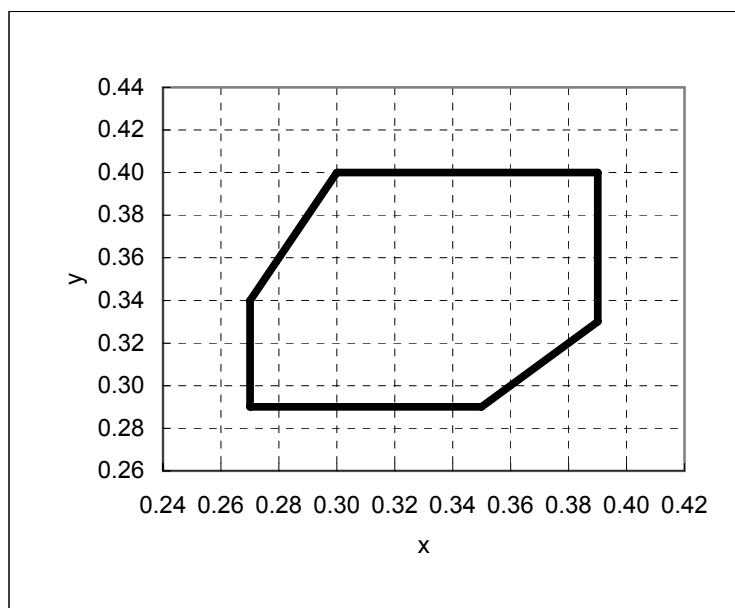|	
Measuring instruments:	CS1000（KONICA MINOLTA）, LCD7000(OTSUKA ELECTRONICS）, EZcontrast160D（ELDIM）
Driving condition:	VDD = 3.3V, VSS = 0V Optimized VCOMDC
Backlight:	IL=35mA
Measured temperature:	Ta=25°C

Item		Symbol	Condition	MIN	TYP	MAX	Unit	Note No.	Remark
Response time	Rise time	TON	[Data]= 00h→FFh	—	—	40	ms	1	※
	Fall time	TOFF	[Data]= FFh→00h	—	—	60	ms		
Contrast ratio		CR	[Data]= FFh / 00h	240	400	—		2	
Viewing angle	Left	θL	[Data]= 00h / FFh CR≧10	80	—	—	deg	3	※
	Right	θR		80	—	—	deg		
	Up	φU		80	—	—	deg		
	Down	φD		80	—	—	deg		
White Chromaticity		x	[Data]= FFh	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]=FFh	250	360	—	cd/m^2	6	
Brightness distribution			[Data]=FFh	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
0.30	0.40
0.27	0.34
0.27	0.29
0.35	0.29
0.39	0.33
0.39	0.40

White Chromaticity Range

10.2 Temperature Characteristics

< Measurement Condition >
Measuring instruments: CS1000（KONICA MINOLTA）, LCD7000(OTSUKA ELECTRONICS）
Driving condition: VDD = 3.3V, VSS = 0V
Optimized VCOMDC
Backlight: IL=35mA

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 in monochrome, white, black)
Signal condition [Data] = FFh, 70h, 00h (3steps)
Observation distance 30 cm
Illuminance 200 to 350 lx
Backlight IL=35mA

| 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]=70h			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	0.25mm<φ		N=0
			0.20<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	Flaw on the surface of the Touch panel	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
	Others				Use boundary sample for judgment when necessary

φ(mm): Average diameter = (major axis + minor axis)/2

Table 1 Permissible number: N

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	

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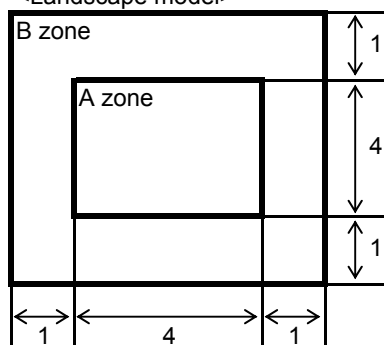
Division of A and B areas
    B area: Active area
    Dimensional ratio between A and B areas: 1: 4: 1 (Refer to the left figure)

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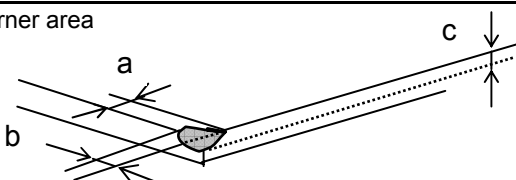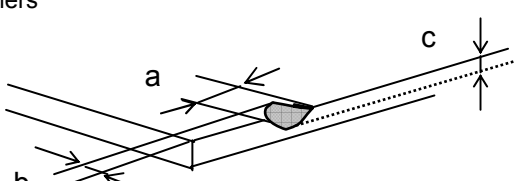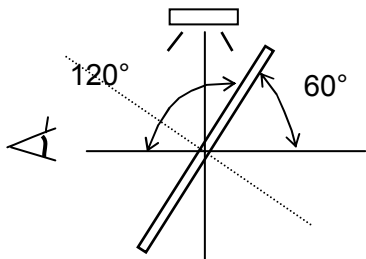
Observation distance	30cm	
Illuminance	1200～2000 lx	

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 n≦2
		Others 	Unit:mm a≦5 b≦1 c≦t　　　　(t:glass thickness) a,b≦0.5 is ignored Maximum permissible number of chipping off on a side is 5.
		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.

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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 ※	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% 240H non condensing ※	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
	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. Reciprocate it 3 times.	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
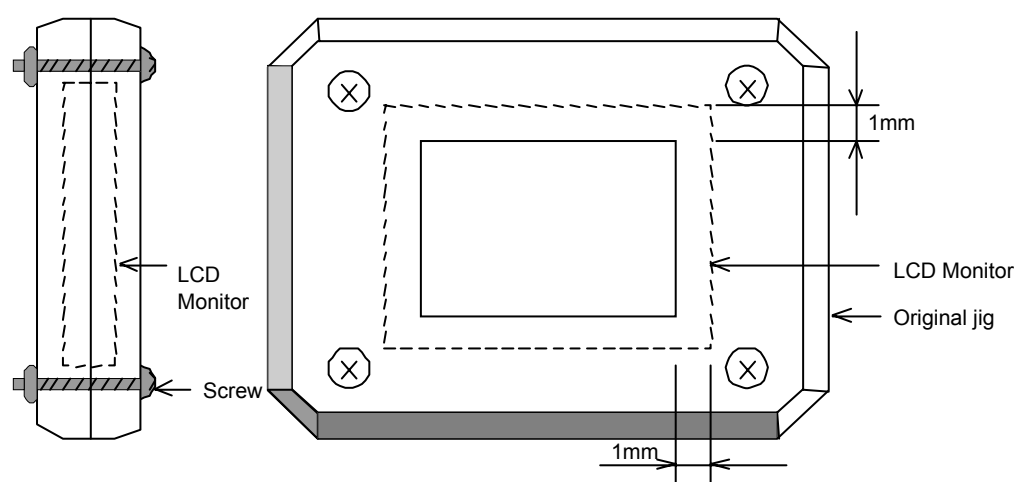(Pure water of over 10MΩ·cm shall be used.）

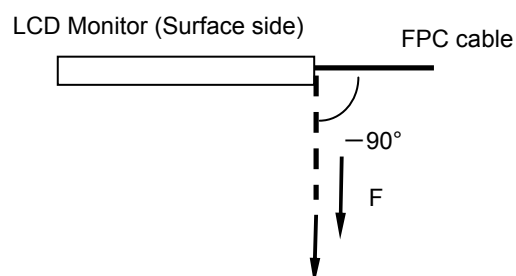SPECIFICATIONS № 12TLM062 | Issue: Aug. 22, 2012
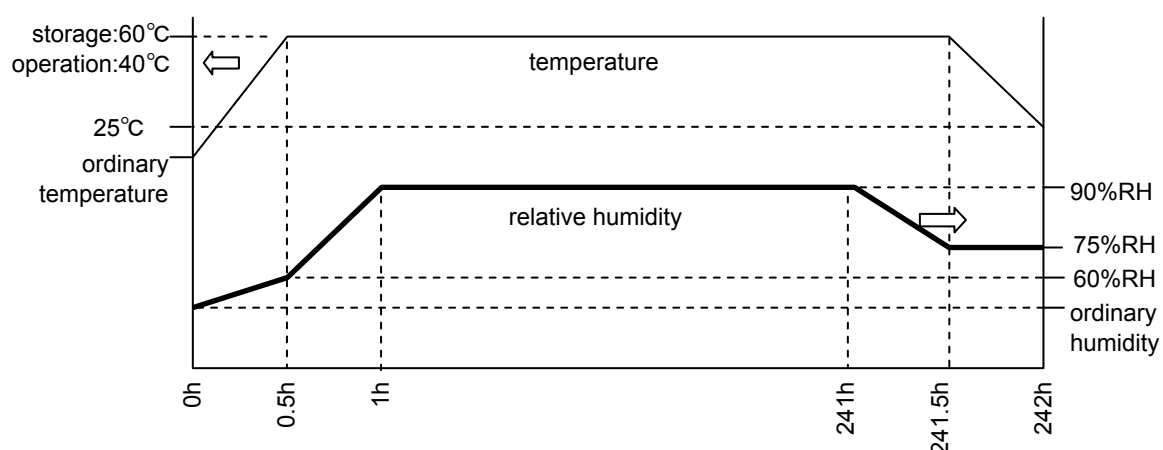
Table2.Reliability Criteria
The parameters should be measured after leaving the monitor at the ordinary temperature for 24 hours
or more after the test completion.

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

ORTUS TECHNOLOGY Original Jig

LCD Monitor

Screw

1mm

LCD Monitor

Original jig

1mm

Tension Test Method for FPC cable

LCD Monitor (Surface side)

FPC cable

－90°

F

Bend Test Method for FPC cable

FPC cable

F

－180°

LCD Monitor (Surface side)

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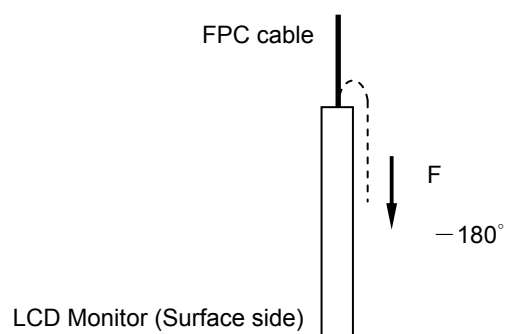
13. Packing Specifications
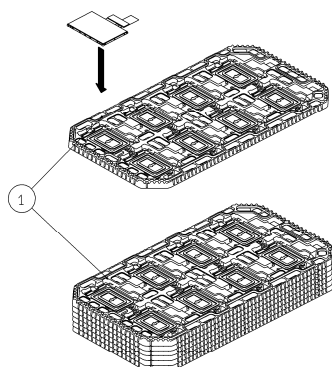
Step 1. Each product is to be placed in one of the cut-outs of the tray with
the display surface facing upward.(8products per tray)

Step 2. Each tray filled with the products is to be piled up in the stack of 5 trays.
One empty tray is to be put on the top of the stack of 5 trays.
Each tray including top empty tray needs to be piled up same direction with
respect to the tray below and above it.

Step 3. Two 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.

Step 4. The piled trays are to be wrapped with a bubble cushioning sheet,
and to be fixed with adhesive tape.
The side is to be folded as shown in figure.

Step 5. A corrugated board is to be placed in the bottom of the inner carton.
The wrapped trays are to be put on the corrugated board in the outer carton.

Step 6. 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.

Step 7. The outer carton is to be inserted into a extra outer carton with same direction.

Step 8. 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 two opposites of the extra outer carton with black ink.
If necessary, shipping labels or impression markings are to be put on the extra outer carton.
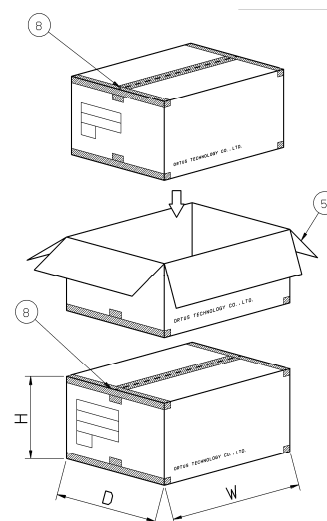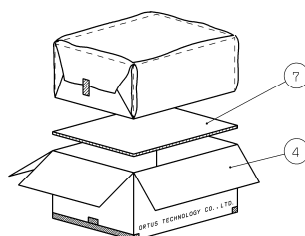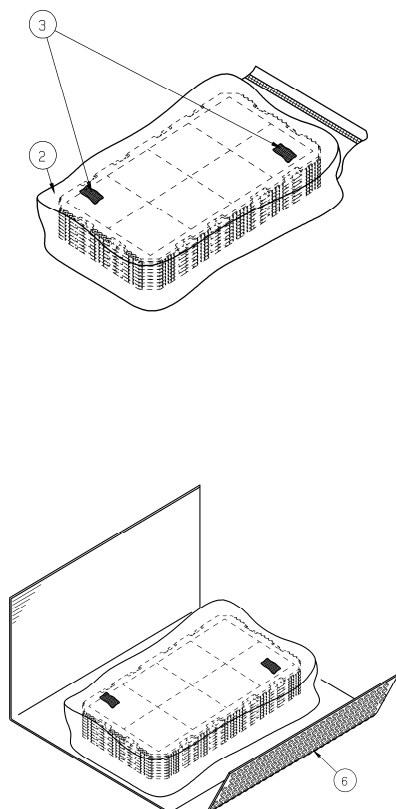
Remark: The return of packing materials is not required.

	Packing item name	Specs., Material
①	Tray	A-PET
②	Sealing bag	Polypropylene
③	Drier	Moisture absorber
④	Inner carton	Corrugated cardboard
⑤	Outer carton	Corrugated cardboard
⑥	Bubble cushioning sheet	Air cap
⑦	Inner board	Corrugated cardboard
⑧	Packing tape	

Dimension of extra outer carton	
D: Approx.	(337mm)
W: Approx.	(618mm)
H: Approx.	(179mm)
Quantity of products packed in one carton.	40
Gross weight : Approx.	5.4 kg

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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 abnoramal 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.**

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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) When turning off the power, turn off the input signal before or at the same timing of switching off the power.

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
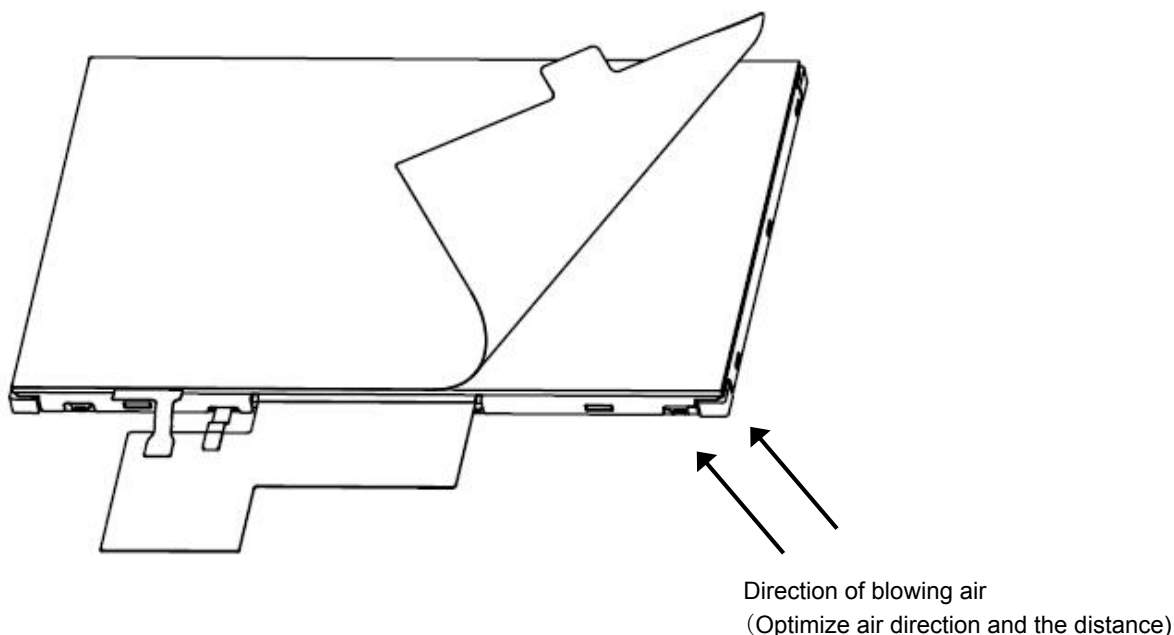static damage or adhesion of dust when peeling off the protective films.

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 right when FPC 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 tab 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）, LCD7000(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

LCD7000: 220mm
CS1000: 362mm
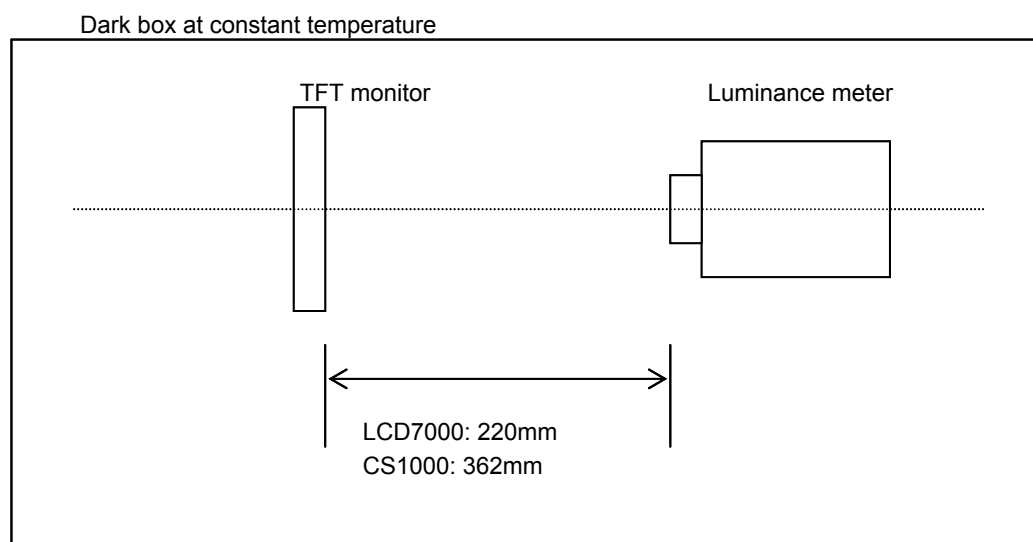
Measurement is made after 30 minutes of lighting of the backlight.
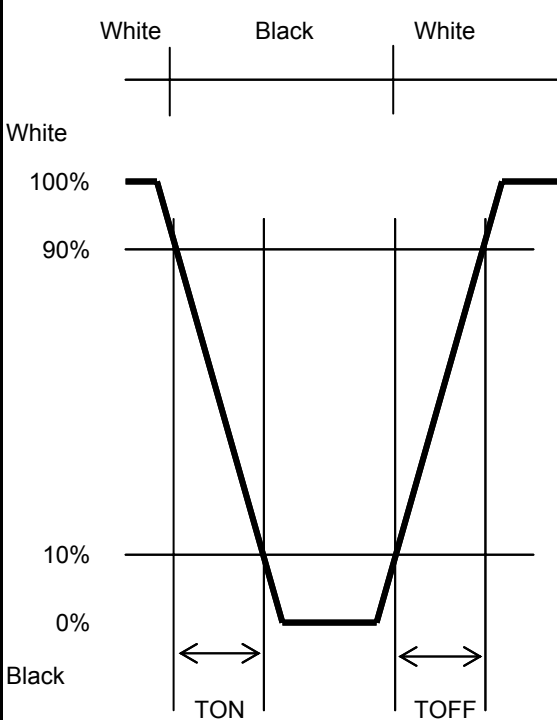
Measurement point: At the center point of the screen
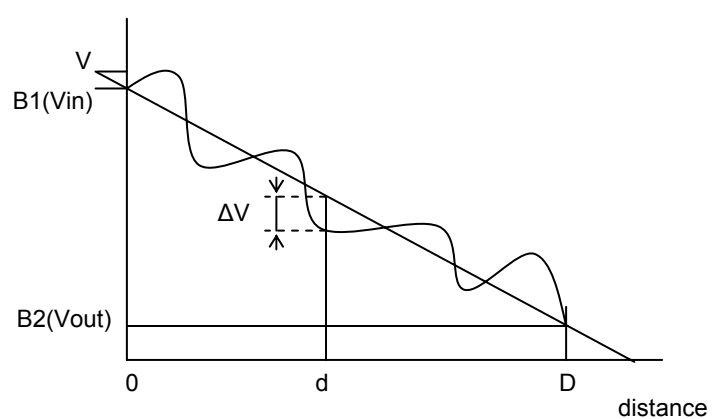   Brightness distribution: 9 points shown in the following drawing.

<Landscape model>

1

2

2

1

1   2   2   1
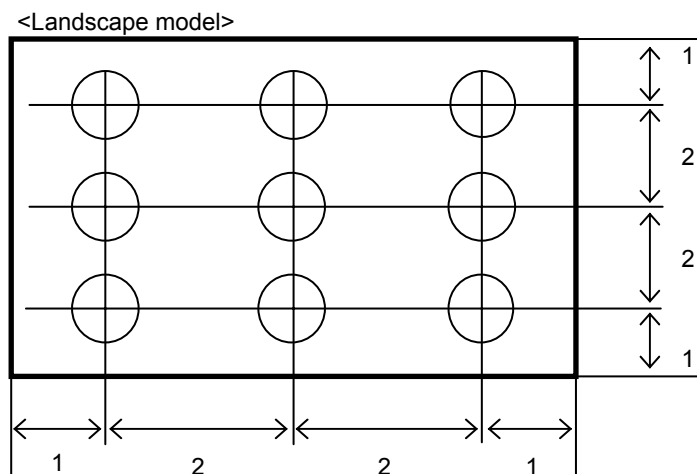
Dimensional ratio of active area

Backlight   IL=35mA

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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.
		
			LCD7000	Black display [Data]=00h
				White display [Data]=FFh
				TON
				   Rise time
				
				TOFF
				   Fall time

2	Contrast ratio	Measure maximum luminance Y1([Data]=FFh) 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] = FFh Color matching faction: 2°view	CS1000	
5	Burn-in	Visually check burn-in image on the screen after 2 hours of "window display" ([Data]=FFh/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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■ Cautionary instruction to handle a Touch-panel

● Cushion (between Touch Panel Chassis) Design
   1) A cushion is required to be placed between Touch Panel and customer's chassis and there is a designated area
      to attach it. Attachment at area inside Input Prohibition Area must be forbidden.
      If cushion was located inside Input Prohibition Area, Upper Electrode may be push constantly
      and which may cause the electrode breakage at the position falling on the edge of adhesive;
      it eventually results in Touch Panel malfunction in the future.   (Please see "NG-1")
   2) Be attention to the cushion material you use.   In the case that too soft cushion was used,
      the cushion may protrude into Prohibition Area by being push strongly; which may result in the electrode breakage.
      Eventually there is a chance that the electrode breakage leads to the malfunction of Touch Panel in the future.
      (Please see "NG-2")
   3) Cushion is required to be attached at the side of Customer's chassis.
      Attaching a cushion at the side of Upper Electrode Film has a chance to deform the film and
   lead to the malfunction of Touch Panel in the future.

		OK	NG-1	NG-2
Cushion Deformation	Before Compression	Customer's Chassis / Cushion / Attach to Chassis Side / Touch panel / Upper Electrode Film / Adhesive / Lower Electrode Film		
	After Compression			
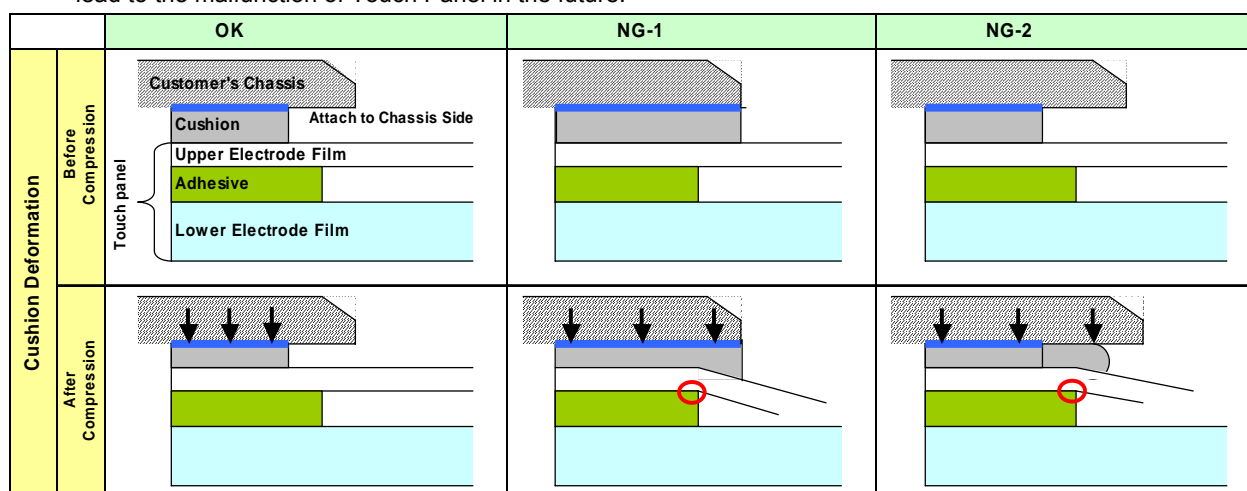
● Design Guidance of Chassis (Front Part)
   4) Be attention to stay Input Prohibition Area away from touching and/or drawing by a stylus pens in order to
      avoid the electrode breakage and potential malfunction of Touch Panel.   (Please see "NG-3")
      We recommend customers to design chassis (front case) being able to protect Input Prohibition Area.
   5) Clearance between customer's chassis and Touch Panel surface is certainly required in order to avoid
      erroneous input caused by a collision of the edge of chassis.   (Please see "NG-4")
      A clearance of 0.3 to 0.7mm is recommended.
● Design Guidance of Chassis (Side Part)
   6) Upper Electrode and Lower Electrode fall on the edge of Touch Panel outline.
      Redundant design having enough clearance to avoid electric short with chassis is highly recommended.
      (Please see "NG-5")

NG-3	NG-4	NG-5
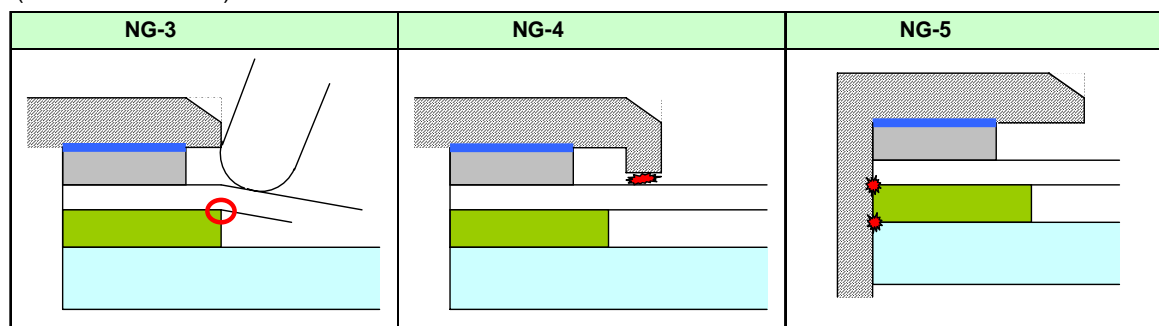
● Example of Recommended Chassis Design
     Refer to "3.2 Outward Form".
● As a terminal resistance has individual specificity, calibration to align the displaying and
   the sensing position one each is mandatory before use.

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