

# Specifications for

## TFT-LCD Monitor

Version 1.0

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

**MODEL COM65T6M13KSC**

Customer's Approval

Signature:

Name:

Section:

Title:

Date:

# ORTUSTECH

ORTUS TECHNOLOGY CO., LTD.

Approved by

M. Sugitani

Approved by

D. Mori

Checked by

C. Kimura

Prepared by

M. Ito

Ver.	Date	Page	Description
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## 1. APPLICATION

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

- ◎ ORTUS TECHNOLOGY makes no warranty or assume no liability that use of this Product and/or any information including drawings in this Specification by Purchaser is not infringing any patent or other intellectual property rights owned by third parties, and ORTUS TECHNOLOGY shall not grant to Purchaser any right to use any patent or other intellectual property rights owned by third parties. Since this Specification contains ORTUS TECHNOLOGY's confidential information and copy right, Purchaser shall use them with high degree of care to prevent any unauthorized use, disclosure, duplication, publication or dissemination of ORTUS TECHNOLOGY'S confidential information and copy right.
- ◎ If Purchaser intends to use this Products for an application which requires higher level of reliability and/or safety in functionality and/or accuracy such as transport equipment (aircraft, train, automobile, etc.), disaster-prevention/security equipment or various safety equipment, Purchaser shall consult ORTUS TECHNOLOGY on such use in advance.
- ◎ This Product shall not be used for application which requires extremely higher level of reliability and/or safety such as aerospace equipment, telecommunication equipment for trunk lines, control equipment for nuclear facilities or life-support medical equipment.
- ◎ It must be noted as a mechanical design manner, especial attention in housing design to prevent arcuaction/flexure or 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

## 2. Outline Specifications

### 2.1 Features of the Product

- 6.5" diagonal with resolution of 1,920[H]x480[V] dots.
- 6-bit 262,144 color display capability.
- 3.3V voltage[TFT-LCD module] + (12)V voltage[Backlight] is required.
- Built in Timing generator (TG)
- Long life & high brightness LED back-light and built in LED driver.
- All-in-one type monitor with lead-free mounting. (Response to 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 fig. 1
Signal input method	6-bit RGB, parallel input	
Backlight type	Long life & High bright white LED.	

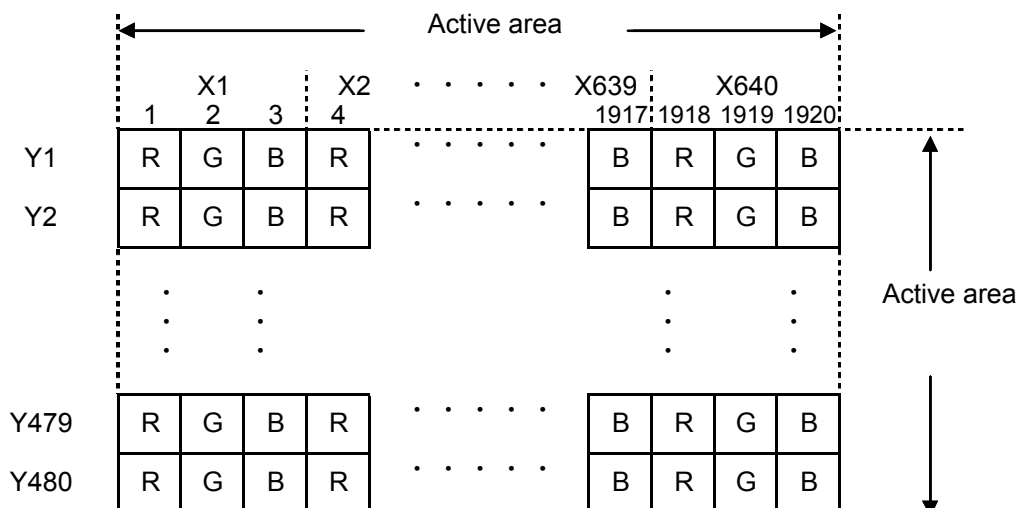


Fig 1 Dot arrangement

(When "Product Number" logo on the front case is placed at the top left)

## 3. DIMENSIONS AND SHAPE

## 3.1 Dimensions

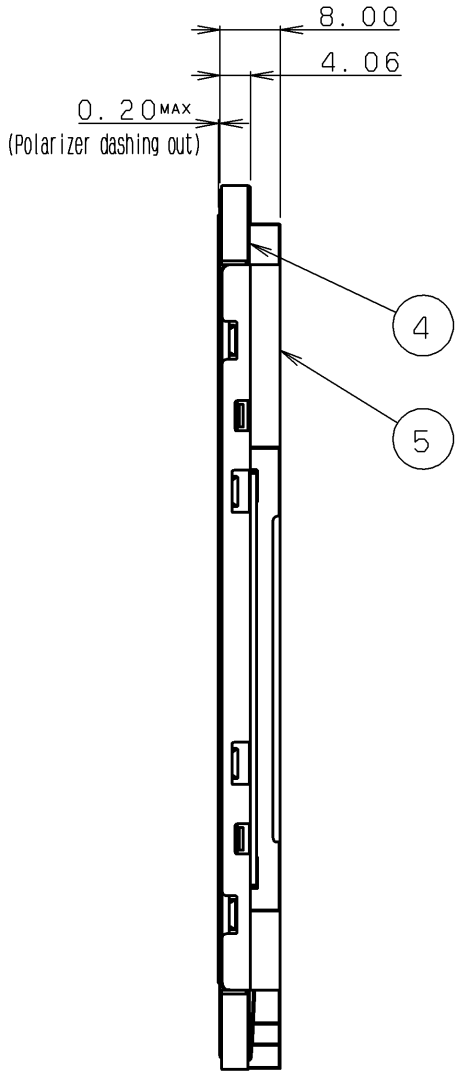
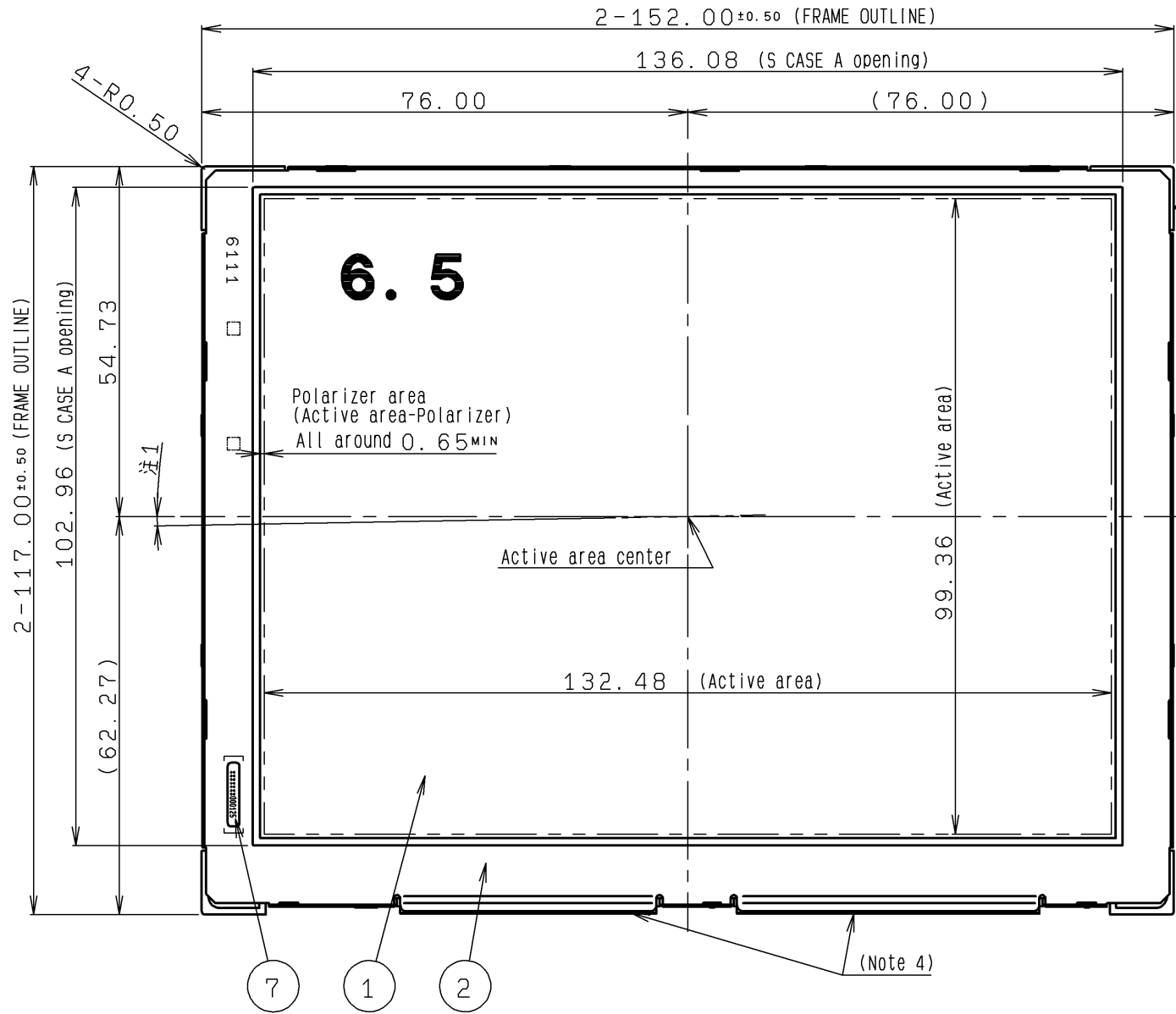
Items	Specifications	Unit	Remarks
Outline dimensions	152.00[H] × 117.00[V] × 8.00[D]	mm	
Active area	132.48[H] × 99.36[V]	mm	16.56cm diagonal
Number of dots	1,920[H] × 480[V]	dot	
Dot pitch	69.00[H] × 207.00[V]	μm	
Surface hardness of the polarizer	3	H	Load: 2.0N
Weight	160	g	

3.2 Outward Form

Front

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

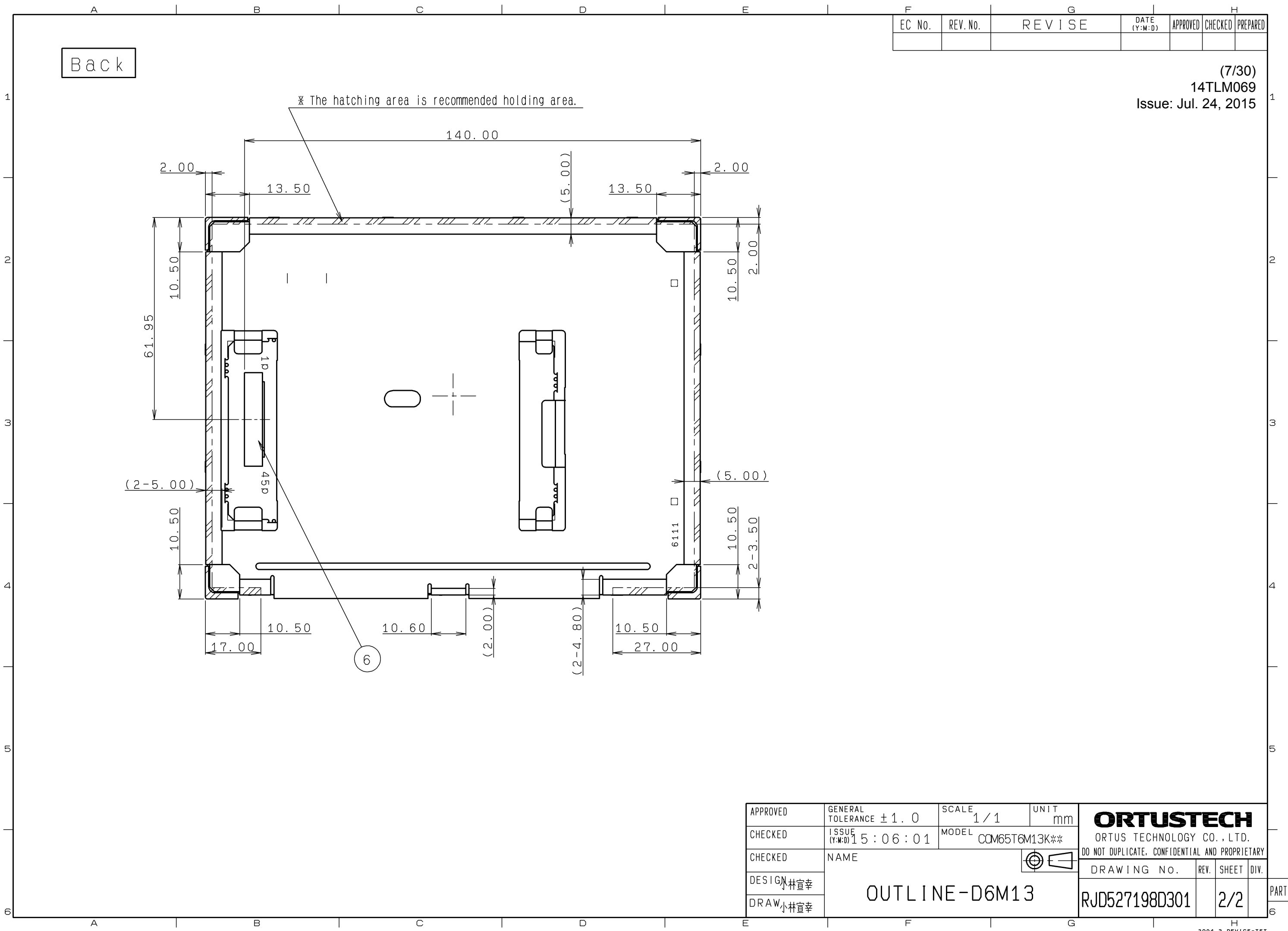
(6/30)  
14TLM069  
Issue: Jul. 24, 2015



- Note 1. Angular deviation of LCD cell from the TFT-LCD monitor's reference axis shall be less than [±50°].
- Note 2. S label is affixed the area shown in the drawing.  
The thickness of the S label will be added to that of S case's surface.
- Note 3. Protective film is affixed on front surface of the screen.  
Location tolerance of the protective film shall be ±1.5 mm to the polarizing film.
- Note 4. Exercise care not to apply any forces to the cable holder of the S case A.
- Note 5. Refer to "11.CRITERIA OF JUDGMENT" about the appearance specification of a polarizer.

	8		
S LABEL	7		(10X1.85X0.075t)
CONNECTOR	6	04 6240 045 023 846+(FFC)(Kyocera Connector Products)	pitch0.5x45pin(Lower contact)
S CASE D	5		
S CASE C	4		
FRAME	3		
S CASE A	2		
TFT-LCD PANEL	1	Glass substrate thickness=0.5t	
PART NAME	ITEM	MATERIAL GRADE	REMARK

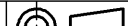
APPROVED	GENERAL TOLERANCE ±1.0	SCALE 1/1	UNIT mm	<b>ORTUSTECH</b> ORTUS TECHNOLOGY CO., LTD. DO NOT DUPLICATE. CONFIDENTIAL AND PROPRIETARY			
CHECKED	ISSUE (Y:M:D) 15:06:01	MODEL CCM65T6M13K**					
CHECKED	NAME						
DESIGN 小林宣幸	OUTLINE-D6M13			DRAWING NO.	REV.	SHEET	DIV.
DRAW 小林宣幸				RJD527198D301		1/2	PART



Back

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

(7/30)  
14TLM069  
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APPROVED	GENERAL TOLERANCE ± 1. 0	SCALE 1 / 1	UNIT mm	<b>ORTUSTECH</b> ORTUS TECHNOLOGY CO., LTD. DO NOT DUPLICATE. CONFIDENTIAL AND PROPRIETARY						
CHECKED	ISSUE (Y:M:D) 15 : 06 : 01	MODEL CCM65T6M13K**								
CHECKED	NAME			DRAWING No.				REV.	SHEET	DIV.
DESIGN 小林宣幸	OUTLINE-D6M13			RJD527198D301					2/2	
DRAW 小林宣幸										

## 3.3 SERIAL LABEL (S-LABEL)

## 1) Display Items

S-label indicates the least significant digit of manufacture year (1digit), manufacture month with below alphabet (1letter), model code (4characters or 5characters), serial number (6digits).

\* Contents of Display

\*      \*      (      or      )      \*

a      b      c      c      d

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

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

• Made in Japan

6E65ZC000125

means "manufactured in May 2016, 6.5" Z type , C specifications, serial number 000125"

• Made in Malaysia

6E65AAC000125

means "manufactured in May 2016, 6.5" AA type , C specifications, serial number 000125"

## 2) Location of Serial Label (S-label)

Refer to 3.2 "Outward Form".



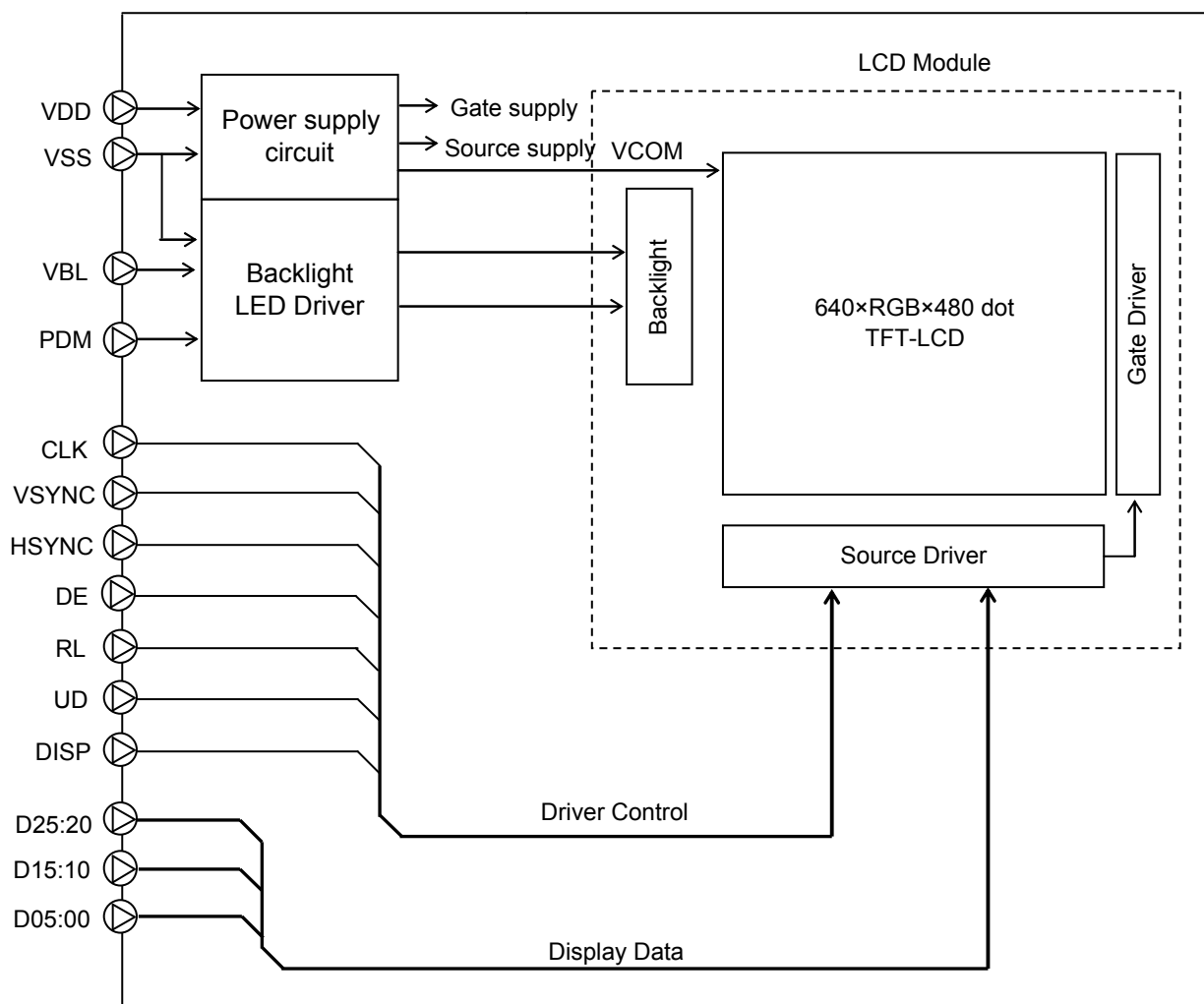
## 4. PIN ASSIGNMENT

No.	Symbol	PIN treatment	Functions
1	VSS	—	GND.
2	CLK	—	Clock signal.Latching data at the rising edge.
3	VSS	—	GND.
4	HSYNC	—	Horizontal sync signal. (Low active)
5	VSYNC	—	Vertical sync signal. (Low active)
6	VSS	—	GND.
7	TEST1	pull-down	Short to VSS
8	TEST2		Short to VSS
9	D20		Display data(B). 00h: Black D20:LSB D25:MSB
10	D21		
11	D22		
12	D23		
13	D24		
14	D25		Driver has internal gamma conversion.
15	VSS	—	GND.
16	TEST3	pull-down	Short to VSS
17	TEST4		Short to VSS
18	D10		Display data(G). 00h: Black D10:LSB D15:MSB
19	D11		
20	D12		
21	D13		
22	D14		
23	D15		Driver has internal gamma conversion.
24	VSS	—	GND.
25	TEST5	pull-down	Short to VSS
26	TEST6		Short to VSS
27	D00		Display data(R). 00h: Black D00:LSB D05:MSB
28	D01		
29	D02		
30	D03		
31	D04		
32	D05		Driver has internal gamma conversion.
33	VSS	—	GND.
34	RL	—	Horizontally Flipped (right/left) Signal. (Lo: Horizontally Flipped Display, Hi: Normal display)
35	VDD	—	Power supply input
36	VDD	—	Power supply input
37	DISP	pull-up	Display on/off control signal(Lo : display off, Hi: display on)
38	DE	pull-down	Input data effective signal. (It is effective for the period of "Hi")
39	UD	—	Vertically Flipped (up/down) Signal. (Lo: Normal display,Hi: Vertically Flipped Display)
40	VSS	—	GND.
41	VBL	—	Power supply input(Backlight)
42	VBL	—	Power supply input(Backlight)
43	PDM	—	Brightness control pulse signal (Lo:0%(Backlight off) brightness, Hi:100%)
44	VSS	—	GND
45	VSS	—	GND

- Used connector: KYOCERA CONNECTOR PRODUCTS 6240 series [04 6240 045 023 846+]
- Please refer to the section "3.2 Outward Form" for pin assignment.
- The corrosion phenomenon by the different kind metal uniting is generated according to the system requirements, and there is a possibility of becoming a loose connection.  
Please select very carefully, and design the FPC cable used.

## 5. Block Diagram

Each arrow shows signal flow.



## 6. ABSOLUTE MAXIMUM RATING

VSS=0V

Item	Symbol	Condition	Rating		Unit	Applicable terminal
			MIN	MAX		
Supply voltage	VDD	Ta=25°C	-0.3	6.0	V	VDD
Input voltage for logic	VI		-0.3	VDD+0.3	V	CLK, VSYNC, HSYNC, DE, D[25:00], RL, UD, DISP
Supply voltage for Backlight	VBL		—	14.0	V	VBL
Input voltage for Backlight	VIP		—	7.0	V	PDM
Storage temperature range	Tstg		-30	80	°C	
Storage humidity range	Hstg		Non condensing in an environmental moisture at or less than 40°C 90%RH		%	

Note: Please input the logic signal after turning on VDD.  
Do not input the logic signal while blocking VDD.

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 surge, and ambient temperature, on designing the circuit.

## 7. 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[25:00],RL,UD, DISP
Supply voltage for Backlight	VBL		10.8	12.0	13.2	V	VBL
Input voltage for Backlight	VIP		0	—	VDD	V	PDM
Operational temperature range	Top	Note1 Note2	-20	+25	+70	°C	Panel surface temperature
Operating humidity range	Hop	Ta ≤ 30°C	20	—	80	%	
		Ta > 30°C	Non condensing in an environmental moisture at or less than 30°C80%RH				

Note 1: 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.

Note 2: Allowance ON Duty of LED changes depending on the ambient temperature.

Do not exceed Allowable ON Duty shown on the chart below.

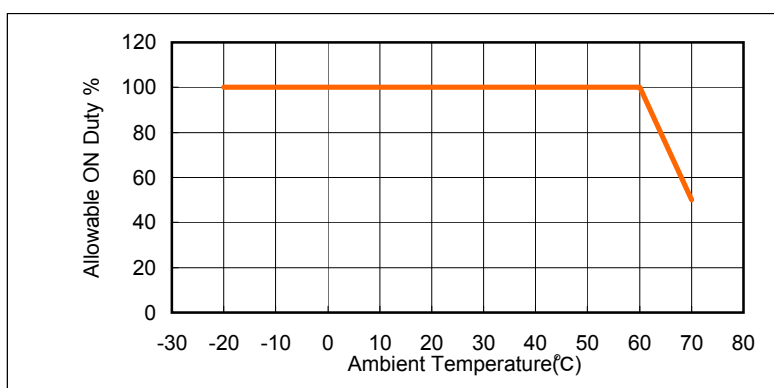


Fig. 2: Allowable ON Duty

## 8. CHARACTERISTICS

## 8.1 Electrical characteristics

## 8.1.1 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		0.7×VDD	—	VDD	V	CLK, VSYNC, HSYNC, DE, D[25:00], RL, UD, DISP
	VIL		0	—	0.3×VDD	V	
Pull down resister value	Rpd		300	450	600	kΩ	DE, D[25:00]
Pull up resister value	Rpu		300	450	600	kΩ	DISP
Current consumption	IDD	fCLK=25MHz Color bar display	—	165	330	mA	VDD

## 8.1.2 Backlight

(Unless otherwise noted, Ta=25° C, VBL=12.0V, VDD=3.3V, VSS=0V)

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Input voltage for BACKLight	VIPH		1.4	—	VDD	V	PDM
	VIPL		0	—	0.2	V	
Operating Current	IBL	Brightness control ON Duty=100%	—	106	212	mA	VBL
Estimated Life of LED	LL	Note1 Brightness control ON Duty=100%	—	(50,000)	—	hr	

Note1: Life is defined as the brightness decrease to half of its initial brightness.

This number is for reference, and not a guaranteed spec.This presumption value shows the estimated life expectancy in LED side light single purpose operation.It is different from presumption with the monitoring because the environment is different.Life is depend on environmental temperature. Especially using high temperature decreases life.

## 8.2 AC CHARACTERISTICS

## 8.2.1 Display Module

(Unless otherwise noted,  $T_a=25^{\circ}\text{C}$ ,  $V_{DD}=3.3\text{V}$ ,  $V_{SS}=0\text{V}$ )

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
CLK frequency	fCLK		—	25	27	MHz	CLK
CLK Low period	tw1L	$0.3 \times V_{DD}$ or less	14.8	—	—	ns	CLK
CLK High period	tw1H	$0.7 \times V_{DD}$ or more	14.8	—	—	ns	CLK
Setup time	tsp		10	—	—	ns	CLK, DE, D[25:00]
Hold time	thd		10	—	—	ns	HSYNC, VSYNC
VSYNC pulse width	tw2H		1	3	5	H	VSYNC
HSYNC pulse width	tw3H		5	30	—	CLK	HSYNC

## 8.2.2 Backlight

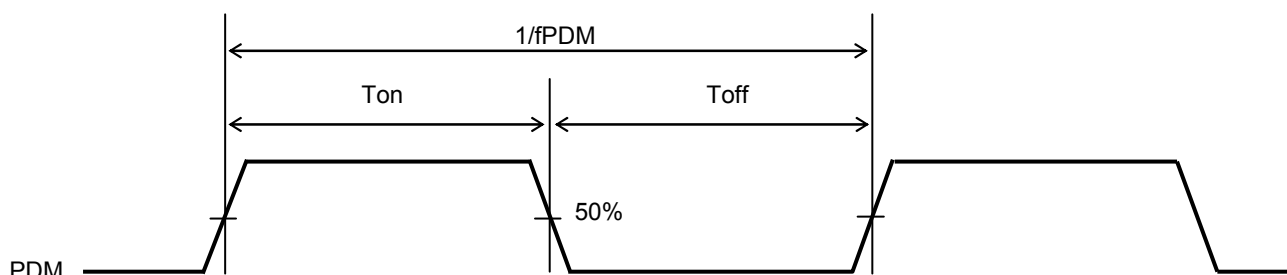
(Unless otherwise noted,  $T_a=25^{\circ}\text{C}$ ,  $V_{DD}=3.3\text{V}$ ,  $V_{BL}=12.0\text{V}$ ,  $V_{SS}=0\text{V}$ )

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
PDM frequency	fPDM		100	200	300	Hz	PDM
Backlight ON duty	ONduty	$100 \times T_{on} / (T_{on} + T_{off})$	20	—	100	%	

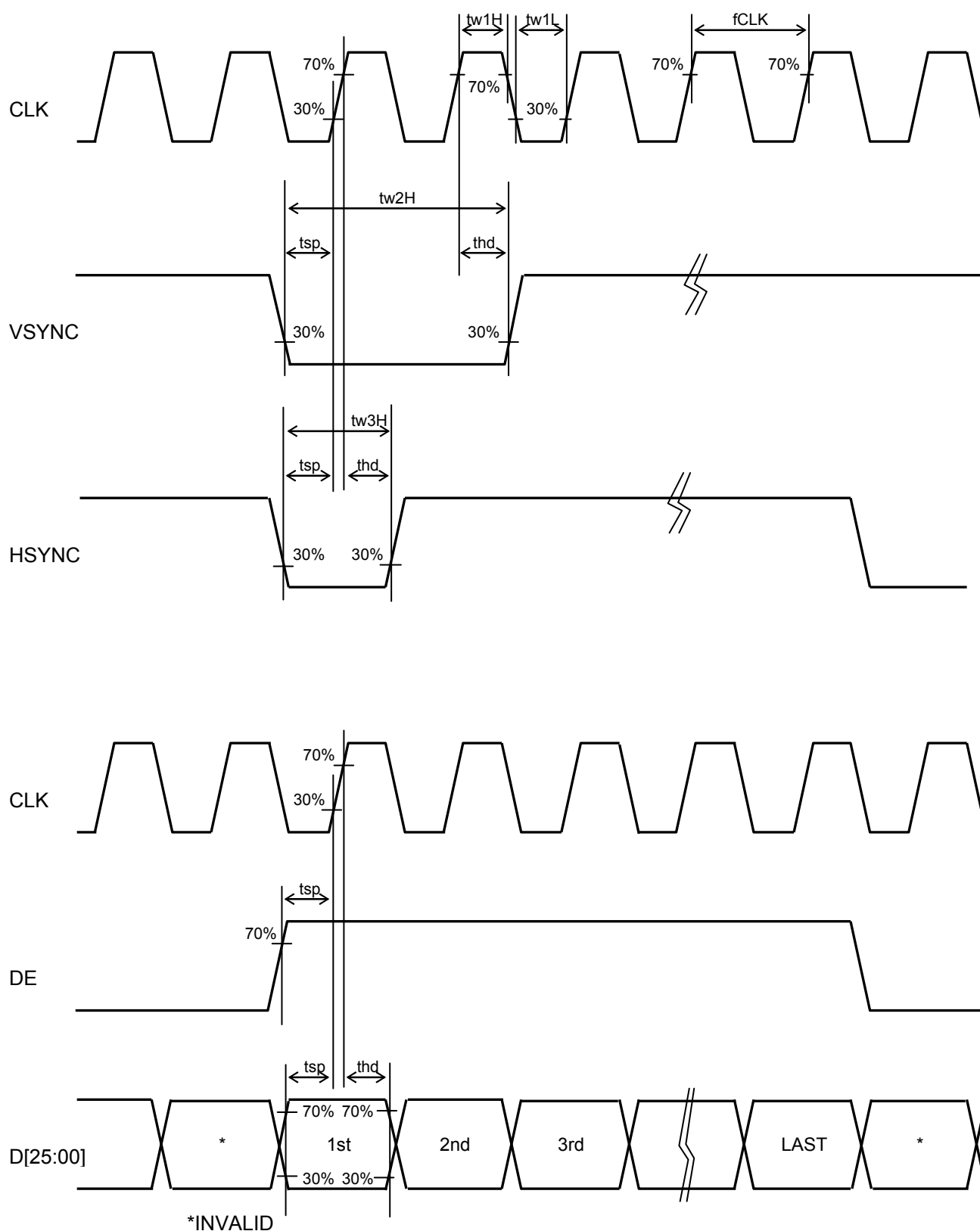
## NOTE:

The interference fringes might be generated by optical interference with the PDM frequency and the VSYNC frequency on the screen.

Please evaluate it enough in all operating temperature limits when you set the PDM frequency.



## Switching Waveform Characteristics



## 8.3 INPUT TIMING CHARACTERISTICS

Item	Symbol	Rating			Unit	Applicable terminal
		MIN	TYP	MAX		
CLK frequency	fCLK	—	25	27	MHz	CLK
VSYNC signal cycle time	tv	—	525	—	H	VSYNC,HSYNC
VSYNC frequency Note1	fVSYNC	54	60	66	Hz	VSYNC
VSYNC pulse width	tw2H	1	3	5	H	VSYNC,HSYNC
Vertical back porch	tvb	—	35	—	H	VSYNC,HSYNC,DE,D[25:00]
Vertical display period	tvdp	—	480	—	H	VSYNC,HSYNC,DE,D[25:00]
HSYNC signal cycle time	th	—	800	—	CLK	HSYNC,CLK
HSYNC pulse width	tw3H	5	30	—	CLK	HSYNC,CLK
Horizontal back porch	thb	112	—	144 Note 2	CLK	HSYNC,CLK,DE,D[25:00]
Horizontal display period	thdp	—	640	—	CLK	HSYNC,CLK,DE,D[25:00]
DE pulse width	tw4H	—	640	—	CLK	DE,CLK

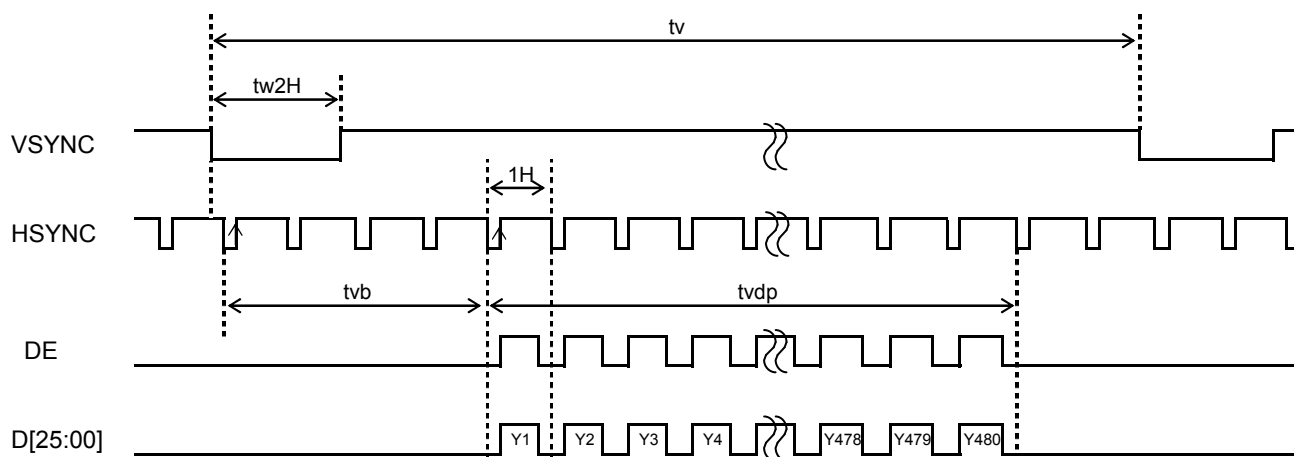
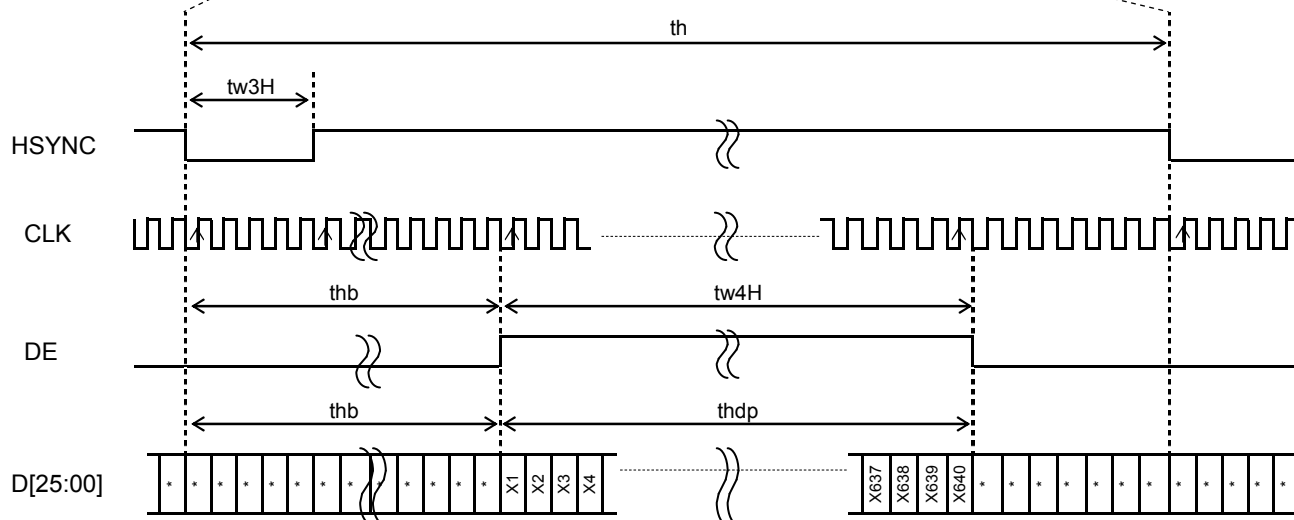
Note1: The characteristic of this item is recommended standard.

Please use it after it confirms it enough like the display fineness etc.

when it comes off from this characteristic and it is used.

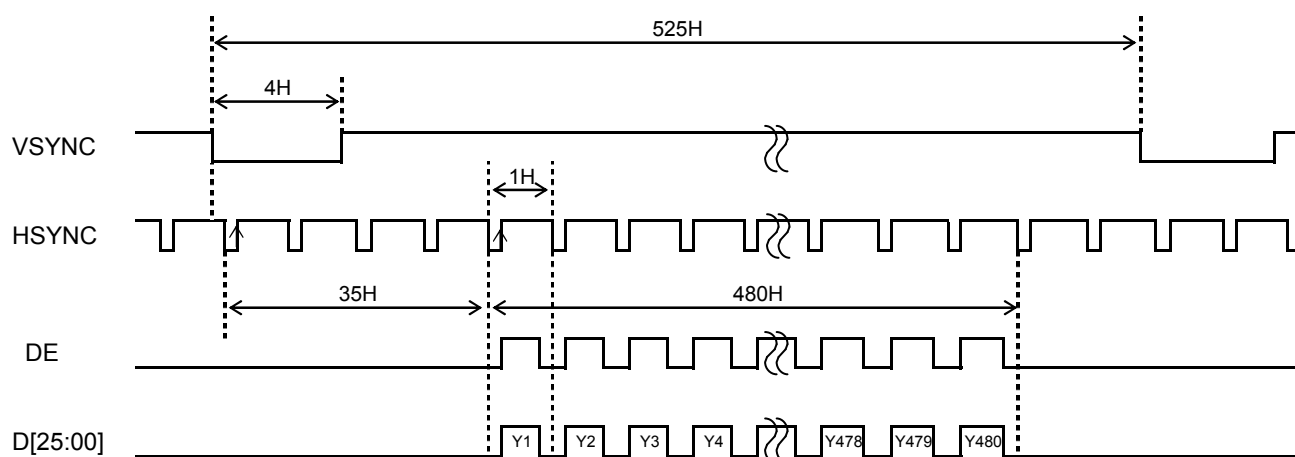
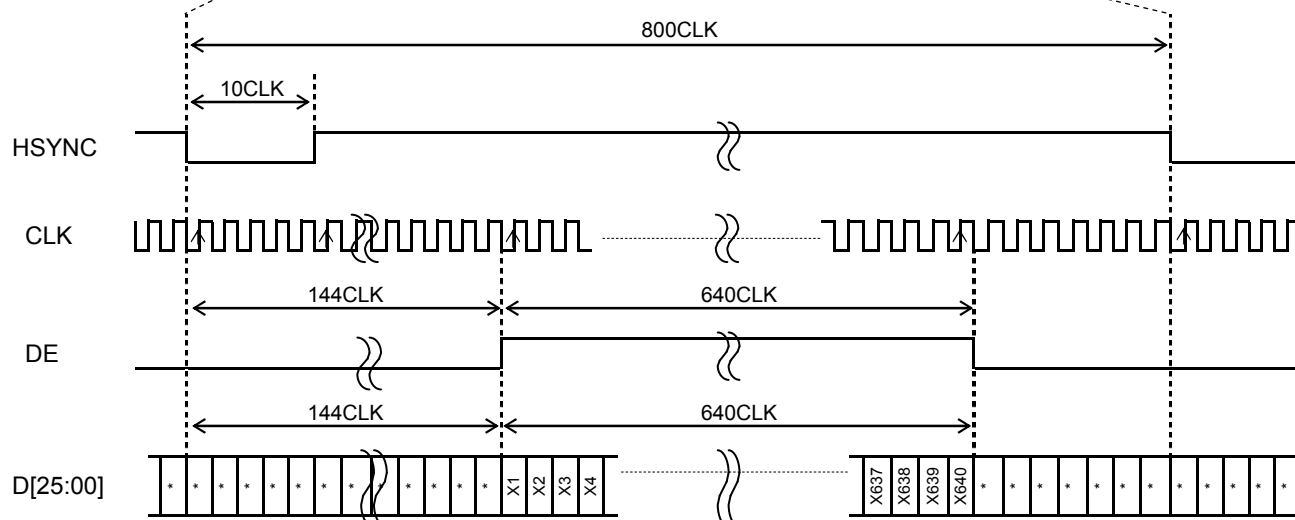
Note2: When "DE" keeps "Lo" for 144CLK or longer,start capturing data automatically from 144CLK.

## 8.4 Driving Timing Chart

**I . Vertical Timing****II . Horizontal Timing**



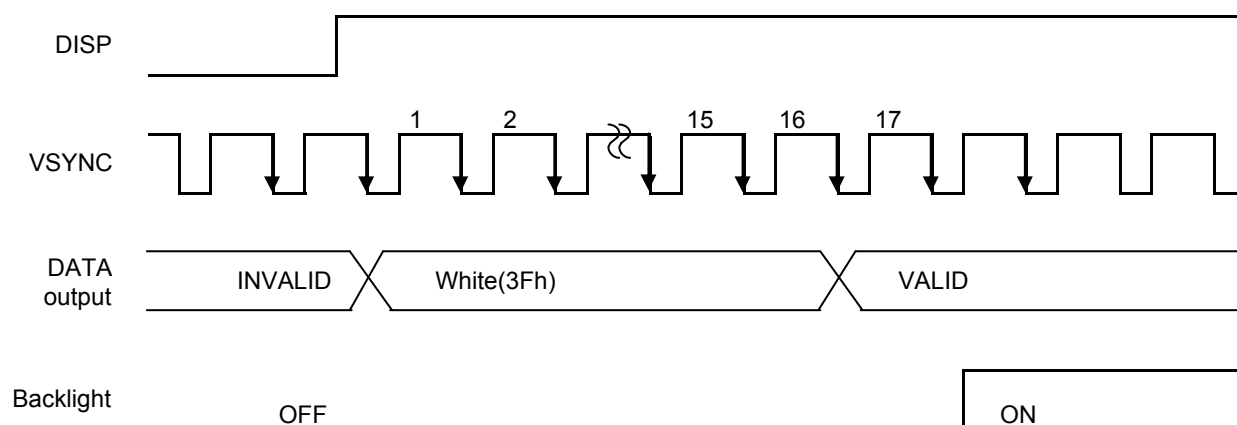
## 8.5 Example of Driving Timing Chart (fCLK=25MHz)

**I . Vertical Timing****II . Horizontal Timing**

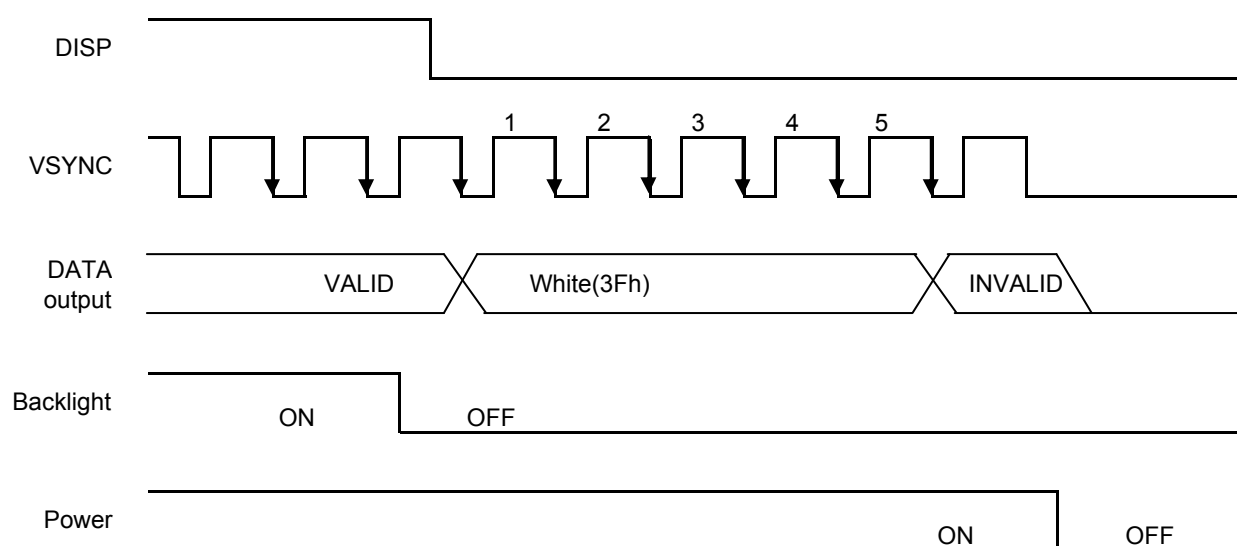
## 9. DISPLAY ON/OFF SEQUENCE

It explains the Display on/off sequence.

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



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



## 10. CHARACTERISTICS

## 10.1 Optical Characteristics

&lt; Measurement Condition &gt;

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

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

Optimized VCOMDC

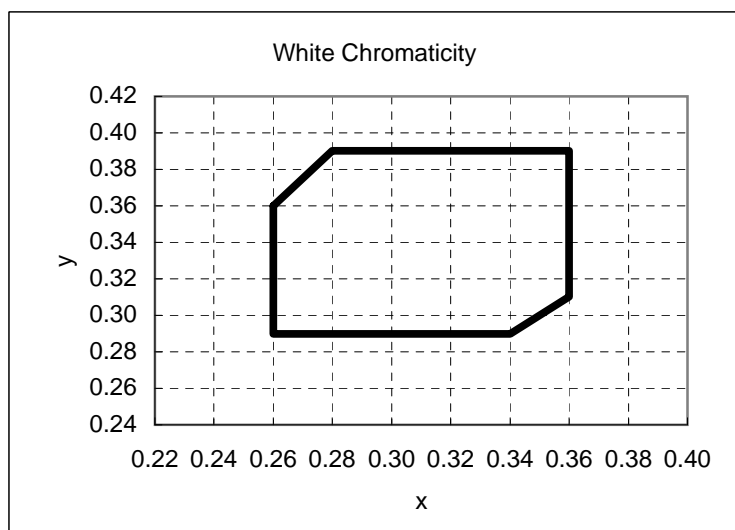
Backlight: VBL=12.0V (Brightness control ON Duty=100%)

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	240	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 shall be observed after 2 hours of window pattern display.			5		
Center brightness			[Data]=3Fh	280	400	—	cd/m <sup>2</sup>	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.



【White Chromaticity Range】

x	y
0.26	0.36
0.26	0.29
0.34	0.29
0.36	0.31
0.36	0.39
0.28	0.39

## 10.2 Temperature Characteristics

< Measurement Condition >

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

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

Optimized VCOMDC

Backlight: VBL=12.0V(Brightness control ON Duty=100%)

Item			Specification		Remark
			Ta= -20° C	Ta=70° C	
Contrast ratio		CR	40 or more	40 or more	
Response time	Rise time	TON	200 msec or less	30 msec or less	※
	Fall time	TOFF	300 msec or less	50 msec or less	※
Display Quality			No noticeable display defect or ununiformity should be observed.		Use the criteria for judgment specified in the section 11.

※ Measured in the form of LCD module.

## 11. CRITERIA OF JUDGMENT

## 11.1 Defective Display and Screen Quality

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

Driving Signal                      Raster Patter (RGB, white, black)  
 Signal condition                [Data]:3Fh,1Ch,00h(3steps)  
 Observation distance        30 cm  
 Illuminance                      200 to 350 lx  
 Backlight                        VBL=12.0V(Brightness control ON Duty=100%)

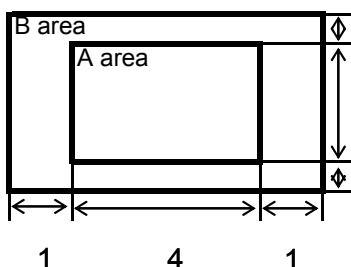
Defect item	Defect content	Criteria
Display Quality	Line defect	Black, white or color line, 3 or more neighboring defective dots
		Not exists
	Dot defect	Uneven brightness on dot-by-dot base due to defective TFT or CF, or dust is counted as dot defect (brighter dot, darker dot)
		Refer to table 1
Screen Quality		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]=1Ch
		Invisible through 5% ND filter at [Data]=00h
		ignored
	Dirt	Uneven brightness (white stain, black stain etc)
		Invisible through 1% ND filter
Screen Quality	Foreign particle	Point-like
		$0.25\text{mm} < \phi$
		$0.20\text{mm} < \phi \leq 0.25\text{mm}$
	Liner	$\phi \leq 0.20\text{mm}$
		Ignored
Screen Quality	Others	3.0mm<length, 0.08mm<width
		length $\leq$ 3.0mm, width $\leq$ 0.08mm
Screen Quality	Others	N=0
		Ignored
Screen Quality	Others	Use boundary sample for judgment when necessary

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

Permissible number: N

Table 1

Area	High bright 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	



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

## 11.2 Screen and Other Appearance

## Testing conditions

Illuminance

1200~2000 lx

Observation distance

30cm

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

## 12. RELIABILITY TEST

Test item		Test condition		number of failures /number of examinations
Durability test	High temperature storage	Ta=80°C	240hr	0/3
	Low temperature storage	Ta=-30°C	240hr	0/3
	High temperature & high humidity test	Ta=60°C, RH=90% non condensing ※1	240hr	0/3
	High temperature operation	Tp=70°C	240hr	0/3
	Low temperature operation	Tp=-20°C	240hr	0/3
	High temp & humid operation	Tp=40°C, RH=90% non condensing ※1	240hr	0/3
	Thermal shock storage	-30→80°C(30min/30min)	100 cycles	0/3
Mechanical environmental test	Electrostatic discharge test (Non operation)	Confirms to EIAJ ED-4701/300 C=200pF, R=0Ω, V=±200V Each 3 times of discharge on and power supply and other terminals.		0/3
	Surface discharge test (Non operation)	C=250pF, R=100Ω, V=±12kV Each 5 times of discharge in both polarities on the center of screen with the case grounded.		0/3
	Vibration test	Total amplitude 1.5mm, f=10 ~55Hz, X,Y,Z directions for each 2 hours		0/3
	Impact test	Use ORTUS TECHNOLOGY original jig (see next page) and make an impact with peak acceleration of 1000m/s <sup>2</sup> for 6 msec with half sine-curve at 3 times to each X, Y, Z directions in conformance with JIS 60068-2-27-2011.		0/3
Packing test	Packing vibration-proof test	Acceleration of 19.6m/s <sup>2</sup> 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

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

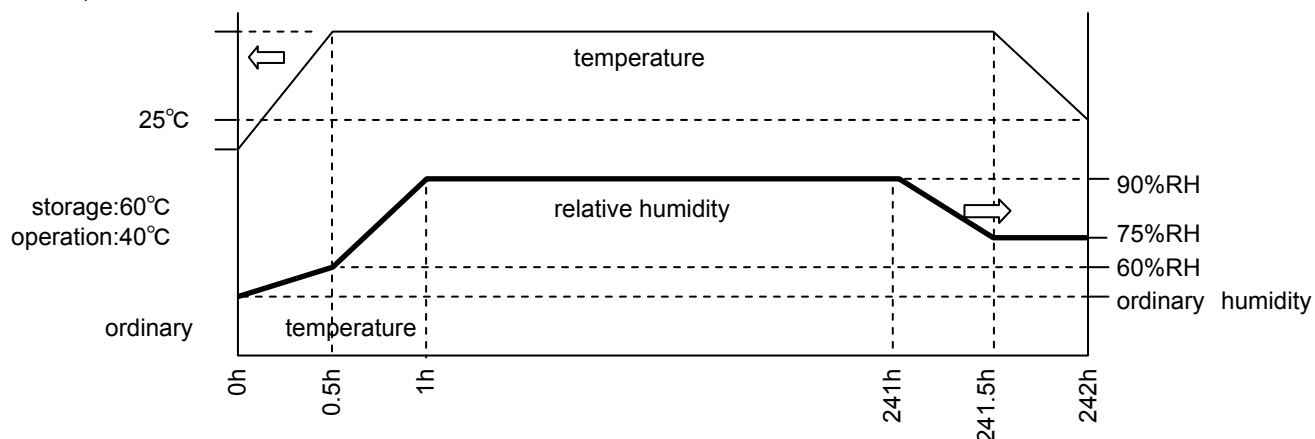
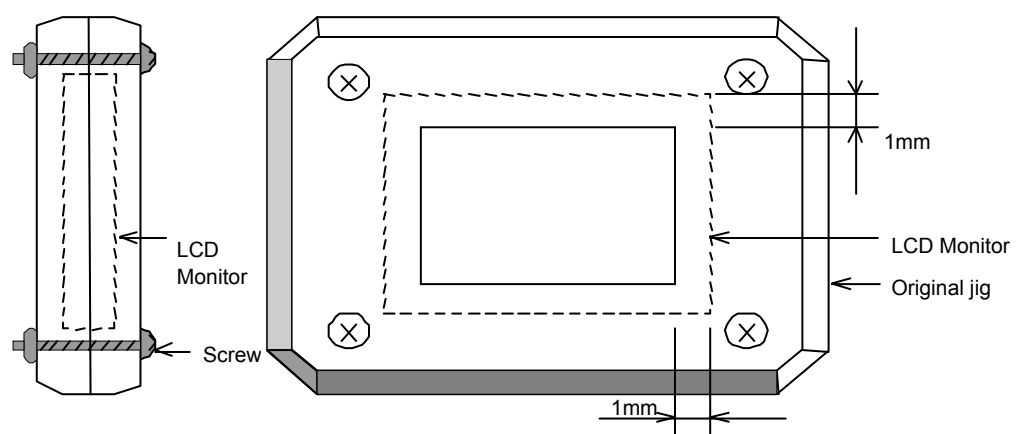


Table2.Reliability Criteria

Measure the parameters after leaving the monitor at the ordinary temperature  
for 24 hours or more after the test completion.

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

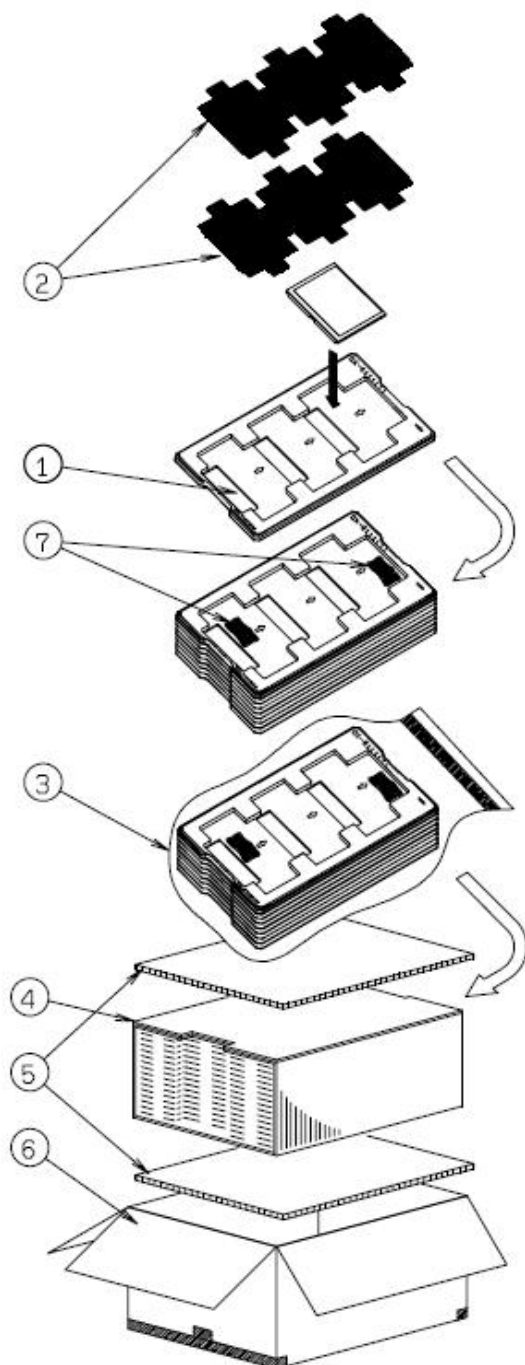
## ORTUS TECHNOLOGY Original Jig



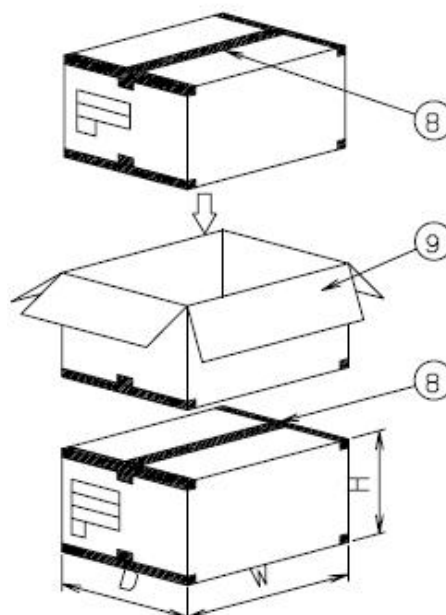


## 13. PACKING SPECIFICATIONS

(S=FREE)



- Step 1 Each product is to be placed in one of the cut-outs of the tray with the display surface facing upward.(3products per tray)  
Antistatic foam sheet is to be placed on the products in the tray.
- Step 2 Each tray needs to be same orientation respect to the tray below or above it and the trays be in a stack of 7.  
One empty tray is to be put on the top of stack of 7 trays.
- Step 3 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.
- Step 4 The stack of trays in the plastic back is to be inserted into a inner carton.
- Step 5 A corrugated board is to be placed on the top and on the bottom of the inner carton.  
The two corrugated boards and the inner carton is to be inserted into an 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.  
The extra outer carton needs to sealed with packing tape as shown in the drawing.
- Step 8 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.



Remark: The return of packing materials is not required.

Packing item name	Specs., Material
① Tray	PP
② Antistatic foam sheet	
③ Sealing bag	
④ Inner carton	Corrugated cardboard
⑤ Inner board	Corrugated cardboard
⑥ Outer carton	Corrugated cardboard
⑦ Drier	Moisture absorber
⑧ Packing tape	
⑨ Extra outer carton	Corrugated cardboard

## Dimension of extra outer carton

D : Approx.	(338mm)
W : Approx.	(549mm)
H : Approx.	(198mm)
Quantity of products packed in one carton:	3pcsx7=21pcs
Gross weight : Approx.	6.6Kg

## 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 medical 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) For protection your circuit, we recommend you to add excess current protection circuit to power supply.

**Caution**

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

#### 14.2 Precautions for Handling

- 1) Wear finger tips at incoming inspection and for handling the TFT monitors to keep display quality and keep the working area clean.  
Do not touch the surface of the polarizer as it is easily scratched.
- 2) Wear grounded wrist-straps and use electrostatic neutralization blowers to prevent static charge and discharge when handling the TFT monitors as the LED in this TFT monitors is damageable to electrostatic discharge,  
Properly set up equipment, jigs and machines, and keep working area clean and tidy for handling the TFT monitors.
- 3) Avoid strong mechanical shock including knocking, hitting or dropping to the TFT monitors for protecting their glass parts. Do not use the TFT monitors that have been experienced dropping or strong mechanical shock.
- 4) Do not use or storage the TFT monitors at high temperature and high humidity environment. Particularly, never use or storage the TFT monitors at a location where condensation builds up.
- 5) Avoid using and storing TFT monitors at a location where they are exposed to direct sunlight or ultraviolet rays to prevent the LCD panels from deterioration by ultraviolet rays.
- 6) Do not stain or damage the contacts of the connector .  
Otherwise, it may cause poor contact or deteriorate reliability of the connector.
- 7) 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.
- 8) The volume attached to the monitor is set to the optimal value at the time of shipment from our factory, so please do not change it.

#### 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 connector while power supply is switch on.  
Plug the connector 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.

#### 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 protect the TFT monitors from static damage during unpacking, keep room humidity more than 50%RH and implement effective countermeasures against static electricity such as establishing a ground (an earth) before unpacking.
- Maximum piling up 7 cartons

#### 14.5 Precautions for Peeling off the Protective film

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

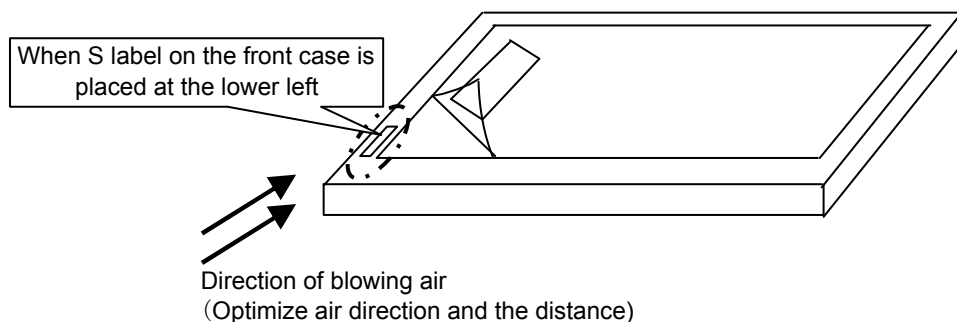
##### A) Work Environment

- a) Humidity: 50 to 70 %RH, Temperature 15 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 be 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 lower left. Optimize direction of the blowing air and the distance between the TFT monitors and the electrostatic neutralization blower.
- b) Put an adhesive tape (Scotch tape, etc) at the lower left corner area of the protective film to prevent scratch on surface of TFT monitors.
- c) Peel off the adhesive tape slowly (spending more than 2 secs to complete) by pulling it to opposite direction.



**APPENDIX**

## Reference Method for Measuring Optical Characteristics and Performance

## 1. Measurement Condition

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

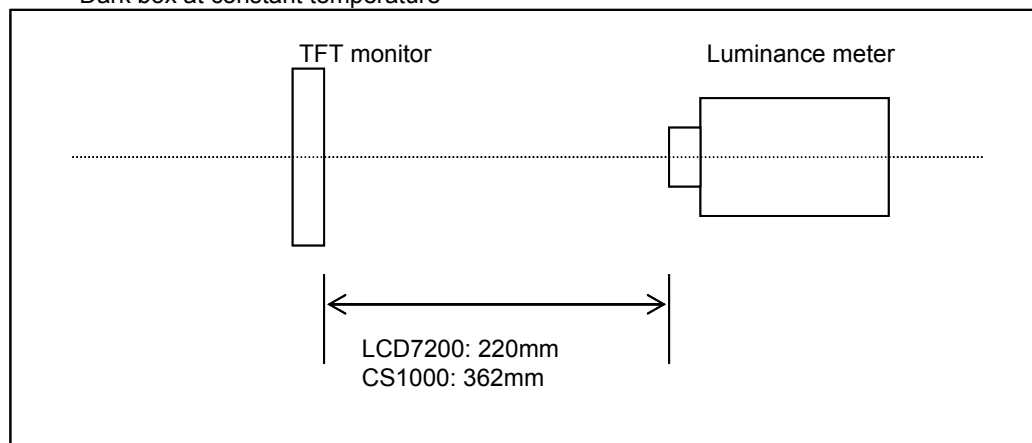
Driving condition: Refer to the section "Optical Characteristics"

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

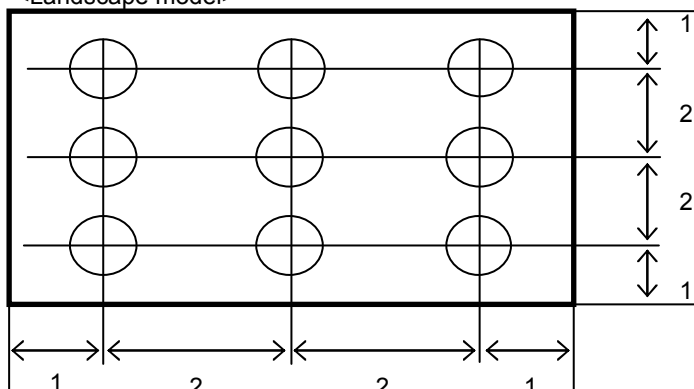
Dark box at constant temperature



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.

&lt;Landscape model&gt;



Unit: fraction

Backlight VBL=12.0V (Brightness control ON Duty=100%)

## 2. Test Method

Notice	Item	Test method	Measuring instrument	Remark
1	Response time	<p>Measure output signal waveform by the luminance meter when raster of window pattern is changed from white to black and from black to white.</p> <p>White</p> <p>100%</p> <p>90%</p> <p>10%</p> <p>0%</p> <p>Black</p> <p>TON</p> <p>TOFF</p>	LCD7200	<p>Black display [Data]=00h</p> <p>White display [Data]=3Fh</p> <p>TON</p> <p>Rise time</p> <p>TOFF</p> <p>Fall time</p>
2	Contrast ratio	<p>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.</p> <p>Contrast ratio = <math>Y1/Y2</math></p> <p>Diameter of measuring point: 8mmφ</p>	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	
5	White chromotically	<p>Measure chromaticity coordinates x and y of CIE1931 colorimetric system at [Data] = 3Fh</p> <p>Color matching faction: 2°view</p>	CS1000	
6	Burn-in	Visually check burn-in image on the screen after 2 hours of "window display" ([Data]=3Fh/00h).		At optimized VCOMDC
7	Center brightness	Measure the brightness at the center of the screen.	CS1000	
8	Brightness distribution	<p>(Brightness distribution) = <math>100 \times B/A \%</math></p> <p>A : max. brightness of the 9 points</p> <p>B : min. brightness of the 9 points</p>	CS1000	