

# Specifications for Blanview TFT-LCD Monitor

Version 2.0

MODEL COM60H6M01DRC

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



ORTUS TECHNOLOGY CO., LTD.  
Sales Dept. Industrial Application

Approved by

T. Tamura

Checked by

\_\_\_\_\_

ORTUS TECHNOLOGY CO., LTD.  
Product Quality Assurance

Approved by

H. Konya

Checked by

E. Takabe

Prepared by

M. Ijo

## Version History

Ver.	Date	Page	Description	
1.0	Sep.9,2011	-	-	First issue
2.0	Dec. 13, 2011	P.14	Add	8.1.2 Backlight Estimated Life of LED
	 × 5	P.23	Change	11.1 Optical Characteristics Notation system: VLCD → [Data].
		P.25	Correct	Measuring item.
		P.35	Change	12.1 Defective Display and Screen Quality Notation system: VLCD → [Data].
		P.37	Correct	APPENDIX (2.Test method) Notation system: VLCD → [Data]. Measuring item. ■Cautionary instruction to handle a Touch-panel

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## 1. Application

This Specification is applicable to 15.17 cm (6.0 inch) Blanview 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

## 2. Outline Specifications

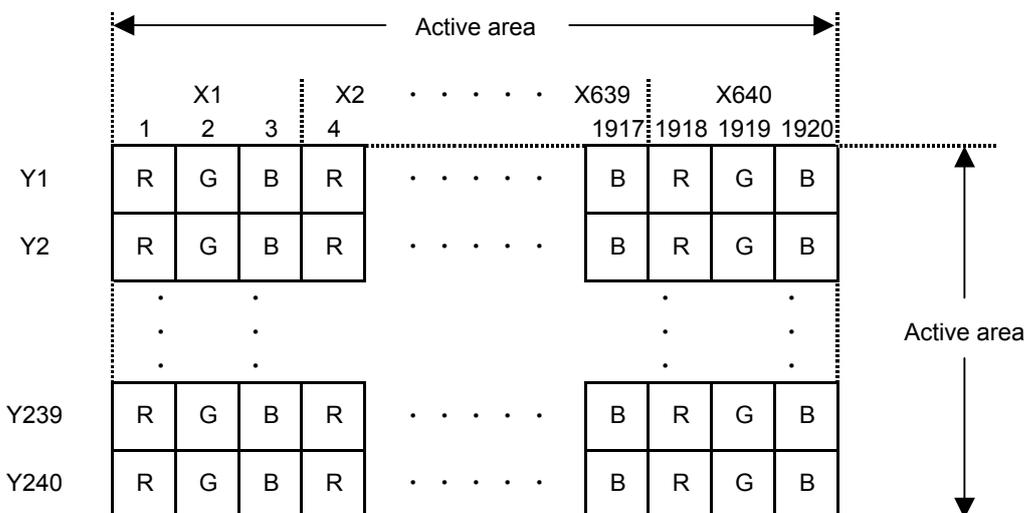
### 2.1 Features of the Product

- 6.0 inch diagonal display, 1,920 [H] x 240 [V] dots.
- 6-bit 262,144 color display capability.
- 3.3V[TFT-LCD module] + 12V[Backlight] is required.
- Built in Timing generator (TG).
- Long life & high brightness LED back-light,built in LED driver and Touch panel operation monitor.
- All-in-one type monitor with lead-free mounting(Response to RoHS Phase 3A).
- Blanview TFT-LCD, improved outdoor readability.

	Indoor		Outdoor	
	Readability	Power Efficiency (Battery Life)	Readability	Power Efficiency (Battery Life)
Transmissive	Good	Good	Fair	Poor
Transflective	Fair	Poor	Good	Good
Blanview	Good	Good	Good	Good

### 2.2 Display Method

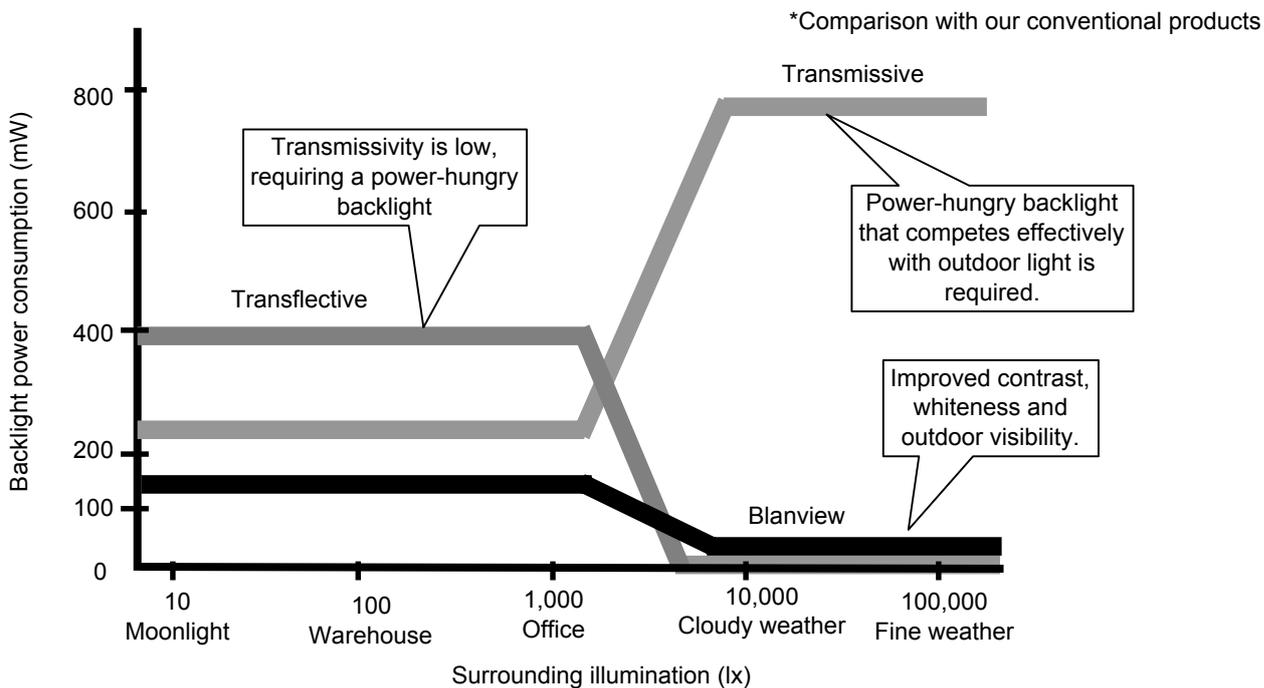
Items	Specifications	Remarks
Display type	TN type 262,144 colors. Blanview, Normally white.	
Driving method	a-Si TFT Active matrix Line-scanning, Non-interlace	
Dot arrangement	RGB stripe arrangement	Refer to "Dot arrangement"
Signal input method	6-bit RGB, parallel input.	
Backlight type	Long life & High bright white LED.	
Touch panel	Resistance type,transmissive analog tablet	Surface finishing:Clear



(When loading slot of user connector on the back is placed at the top side)

<Features of Blanview>

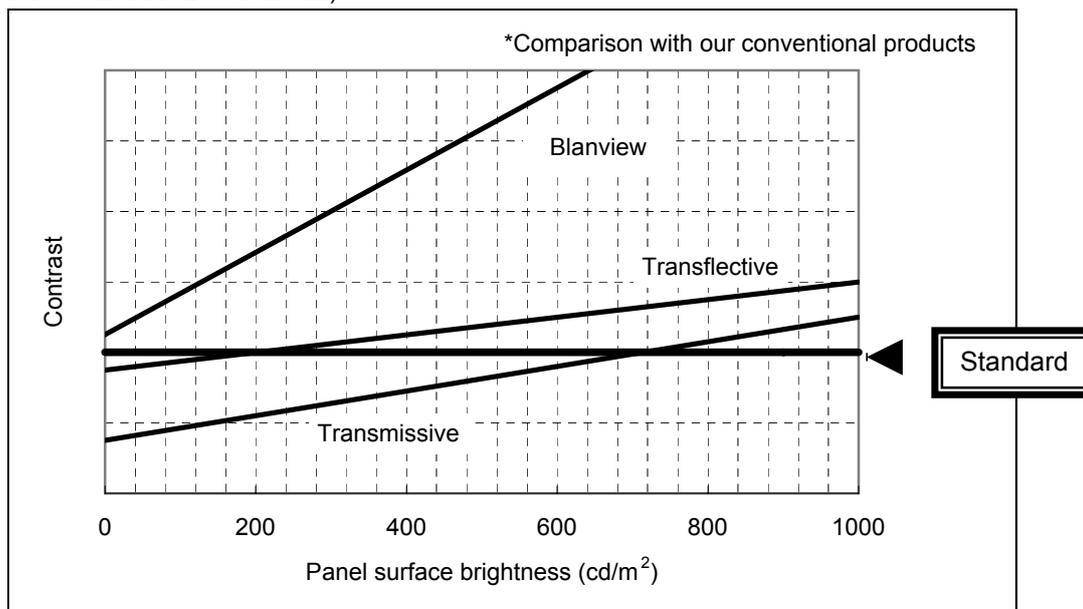
- Backlight power consumption required to assure visibility. (equivalent to 3.5"QVGA )



- Contrast characteristics under 100,000lx. (same condition as direct sunlight.)

With better contrast (higher contrast ratio), Blanview TFT-LCD has the best outdoor readability in three different types of TFT-LCD.

Below chart shows contrast value against panel surface brightness. (Horizontal: Panel surface brightness/ Vertical: Contrast value) LCD panel has enough outdoor readability above our Standard line. (ORTUS TECHNOLOGY criteria)



## 3. Dimensions and Shape

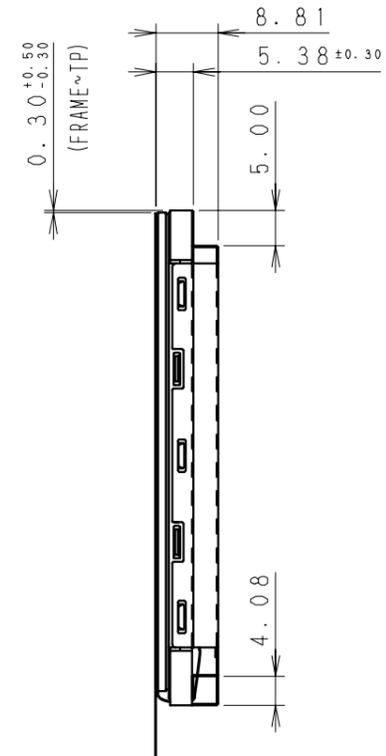
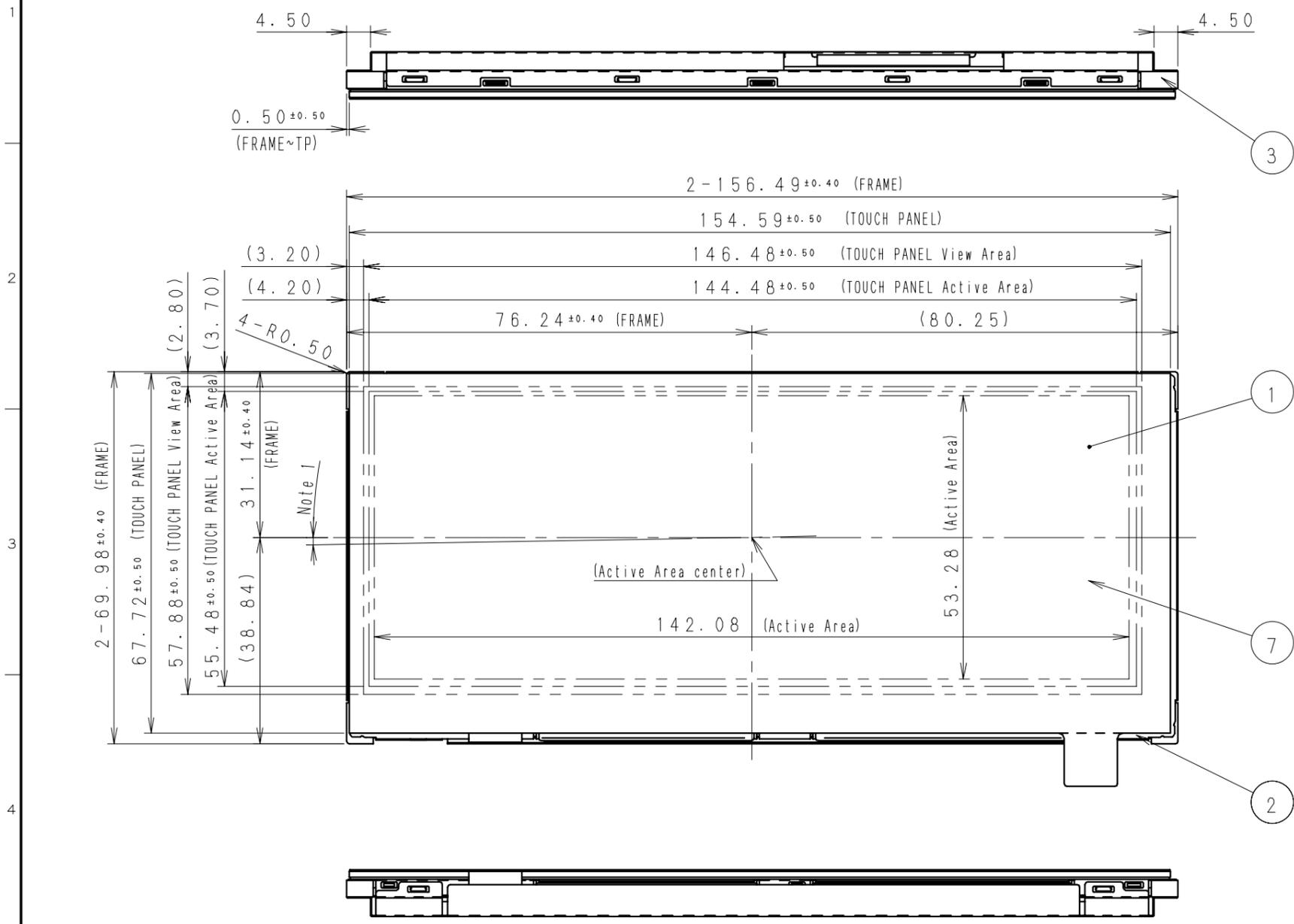
## 3.1 Dimensions

Items	Specifications	Unit	Remarks
Outline dimensions	156.49[H] × 69.98[V] × 8.81[D]	mm	
Active area	142.08[H] × 53.28[V]	mm	15.17cm diagonal
Number of dots	1,920[H] × 240[V]	dot	
Dot pitch	74[H] × 222[V]	μm	
Hardness of Touch Panel surface	3	H	Load:4.9N,Angle:45° Reference judgment standard:JIS-K5600
Weight	137	g	

EC No.	REV.No.	REVISE	DATE (Y:M:D)	APPROVED	CHECKED	PREPARED
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11TLM065  
Issue; Dec. 13, 2011

Front



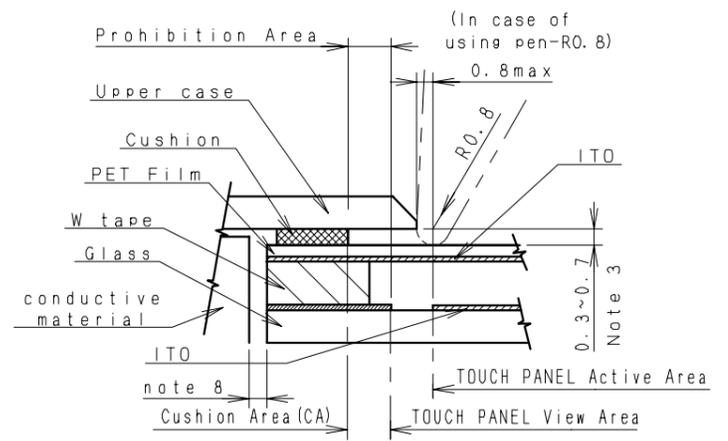
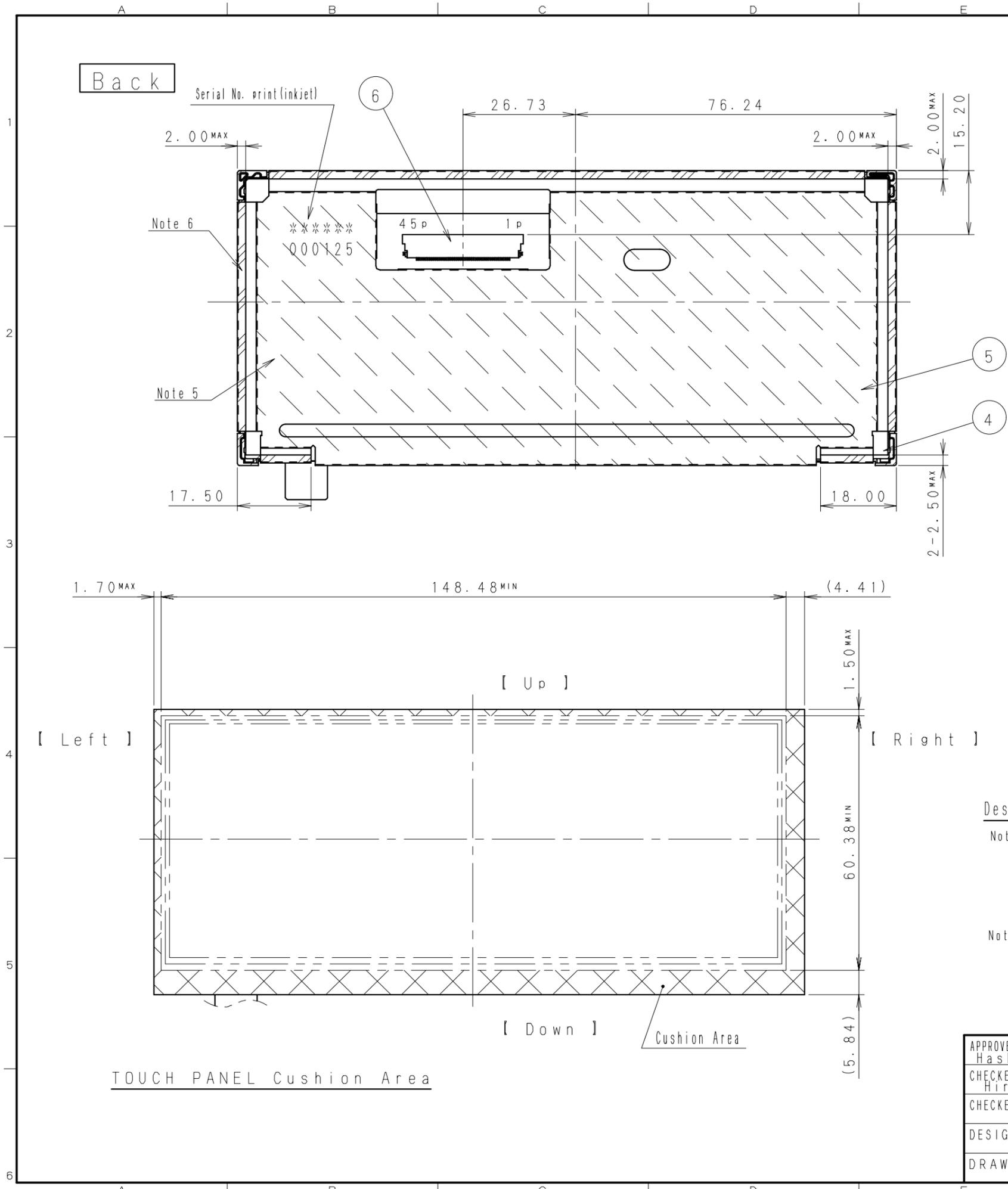
- Note 1. Angular deviation of LCD cell from the TFT-LCD monitor's reference axis shall be less than [±50'].
- Note 2. Protective film is affixed on front surface of the screen.  
Location tolerance of the protective film shall be ±3.0 mm to the TOUCH PANEL.
- Note 3. Keep a gap, for example 0.3 to 0.7mm 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 4. Linearity is guaranteed in the area surrounded by 3mm inside lines from TOUCH PANEL Active Area.
- Note 5. Exercise care not to apply any forces to the hatching area of the S case D.
- Note 6. The hatching area is recommended holding area.
- Note 7. Recommended dimensions of housing in case of using pen (R0.8) (refer to 'Example of Housing Design')
- Note 8. The end part of glass and film has conductivity.  
Please design the construction not to touch conductive material.
- Note 9. Refer to "12. CRITERIA OF JUDGMENT" about the appearance specification of a polarizer and touch panel.

TOUCH PANEL	7	Film-Glass(1.1t)	Surface finishing : Clear
CONNECTOR	6	04 6240 045 023 846+(FFC) (KYOCERA ELC0)	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 Hashizume	GENERAL TOLERANCE ± 1.0	SCALE 1/1	UNIT mm	<b>ORTUSTECH</b> ORTUS TECHNOLOGY CO., LTD. DO NOT DUPLICATE, CONFIDENTIAL AND PROPRIETARY	
CHECKED Hiranobu	ISSUE (Y:M:D) 11:08:22	MODEL COM60H6M01D**			
CHECKED	NAME			DRAWING No.	
DESIGN Ide	OUTLINE-D6M01			REV.	SHEET
DRAW Ide					1/2

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

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11TLM065  
Issue: Dec. 13, 2011



Note 7 Example of Housing Design (S=Free)

Design guidance for the Housing & the cushion

- Note 9. Upper case opening
- Please place the upper case opening to maintain the operation by a stylus pen inside the TP response area.
  - The any pressures in the area between TP response area and TP view area is prohibited.
- Note 10. Cushion design
- Please put the cushion on the upper case.
  - Do not use an adhesive tape to stick on the TP surface.
  - Please position the cushion over the cushion area to avoid a short.

APPROVED Hashizume	GENERAL TOLERANCE ± 1.0	SCALE 1/1	UNIT mm	<b>ORTUSTECH</b> ORTUS TECHNOLOGY CO., LTD. DO NOT DUPLICATE, CONFIDENTIAL AND PROPRIETARY		
CHECKED Hiranobu	ISSUE (Y:M:D) 11:08:22	MODEL COM60H6M01D**				
CHECKED	NAME			DRAWING No.		
DESIGN Ide	OUTLINE-D6M01			REV.	SHEET	DIV.
DRAW Ide				RJD522822D301	2/2	

### 3.3 Serial № print (S-print)

#### 1) Display Items

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

\* Contents of Display

*	*	*****	*****
-	-	-	-
a	b	c	d

Contents of display				
a	The least significant digit of manufacture year			
b	Manufacture month	Jan-A Feb-B Mar-C Apr-D	May-E Jun-F Jul-G Aug-H	Sep-I Oct-J Nov-K Dec-L
c	Model code	60AQ (Made in Japan) 60BQ (Made in Malaysia) 60CQ (Made in China)		
d	Serial number			

\* Example of indication of Serial No. print (S-print)

•Made in Japan

2D60AQ000125

means "manufactured in April 2012, 6.0" A type, Q specifications, serial number 000125"

•Made in Malaysia

2D60BQ000125

means "manufactured in April 2012, 6.0" B type, Q specifications, serial number 000125"

•Made in China

2D60CQ000125

means "manufactured in April 2012, 6.0" C type, Q specifications, serial number 000125"

#### 2) Location of Serial № print (S-print)

Refer to 3.2 "Outward Form".

#### 3)Others

Please note that it is likely to disappear with an organic solvent about the Serial print.

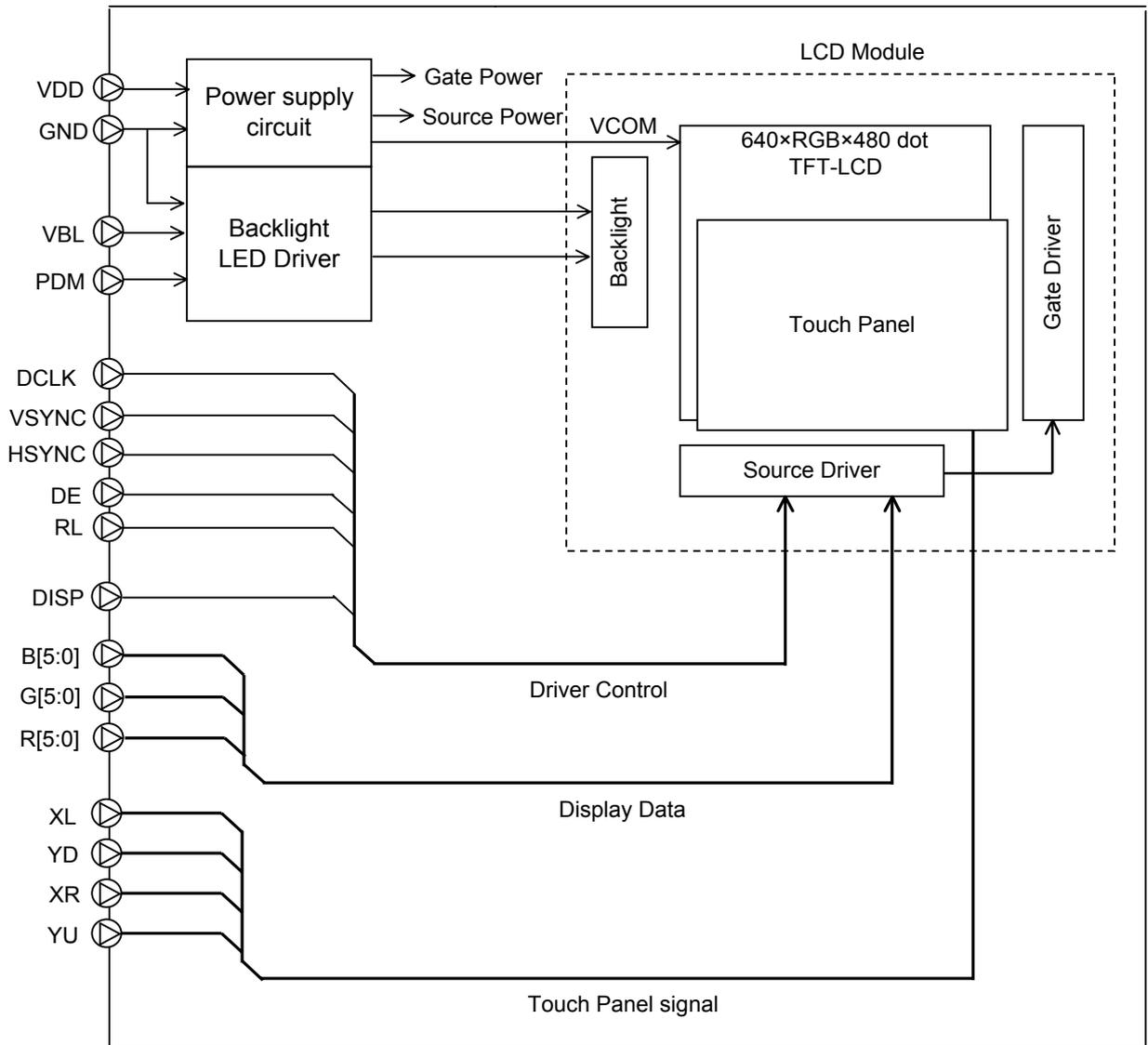
## 4. Pin Assignment

No.	Symbol	Function
1	YU	Y-axis upside terminal
2	XR	X-axis right terminal
3	YD	Y-axis downside terminal
4	XL	X-axis left terminal
5	NC	OPEN
6	GND	Ground
7	DISP	Display on/off control signal.(Lo : display off, Hi : display on)
8	DE	Input data effective signal. (It is effective for the period of "Hi")
9	VSYNC	Vertical sync signal. (Low active)
10	HSYNC	Horizontal sync signal. (Low active)
11	GND	Ground
12	DCLK	Clock signal.Latching data at the rising edge.
13	GND	Ground
14	B5	Display data(B). 00h: Black B0:LSB B5:MSB
15	B4	
16	B3	
17	B2	
18	B1	
19	B0	
20	GND	Ground
21	G5	Display data(G). 00h: Black G0:LSB G5:MSB
22	G4	
23	G3	
24	G2	
25	G1	
26	G0	
27	GND	Ground
28	R5	Display data(R). 00h: Black R0:LSB R5:MSB
29	R4	
30	R3	
31	R2	
32	R1	
33	R0	
34	GND	Ground
35	RL	Horizontally Flipped (right/left) Signal. (Lo: Horizontally Flipped Display, Hi: Normal display)
36	GND	Ground
37	GND	Ground
38	VDD	Power supply input.(+3.3V)
39	VDD	Power supply input.(+3.3V)
40	VBL	Power supply input.(Backlight) (+12V)
41	VBL	Power supply input.(Backlight) (+12V)
42	PDM	Brightness control pulse signal. (Lo:0%(Backlight off) brightness, Hi:100%)
43	GND	Ground
44	GND	Ground
45	GND	Ground

- Used connector: KYOCERA ELCO 6240 series [04 6240 045 023 846+]
- 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.
- 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

GND=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	DCLK,VSYNC,HSYNC,DE, B[5:0],G[5:0],R[5:0],RL,DISP
Supply voltage for Backlight	VBL		-0.3	14.0	V	VBL
Input voltage for Backlight	VIP		-0.3	7.0	V	PDM
Input voltage for Touch Panel	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.				

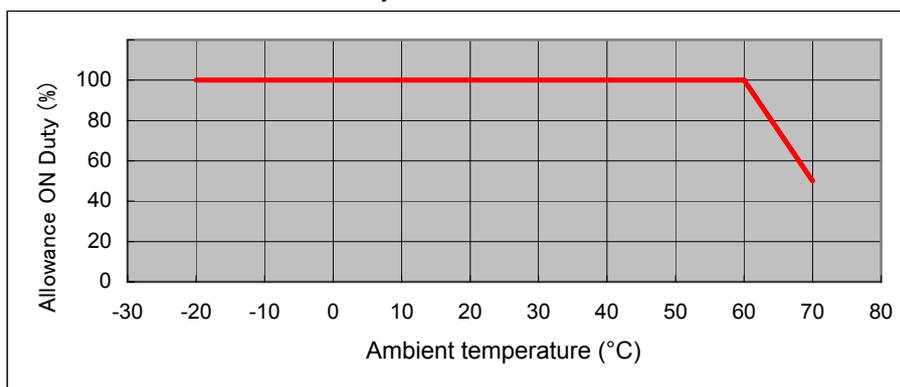
Note: Please input the logic signal after turning on VDD. Do not input the logic signal while blocking VDD. Absolute maximum ratings is parametric values , should never be exceed any value at any moment . Beyond which, it could be suffered from changes in characteristics and never be restored . Moreover, 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

GND=0V

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Supply voltage	VDD		3.0	3.3	3.6	V	VDD
Supply voltage for Backlight	VBL	VDD=3.0~ 3.6V	10.8	12.0	13.2	V	VBL
Input voltage for logic	VI		0	--	VDD	V	DCLK,VSYNC,DE, HSYNC,RL,DISP, B[5:0],G[5:0],R[5:0]
Input voltage for Backlight	VIP		0	--	VDD	V	PDM
Operating temperature range	Top	Note1,2,3	-20	25	70	°C	Touch 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.				

- 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 "11. CHARACTERISTICS".
- Note3: Allowance ON Duty of LED changes depending on the ambient temperature. Do not exceed Allowable ON Duty shown on the chart below.



## 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		0.7×VDD	--	VDD	V	DCLK, VSYNC, HSYNC, DE, B[5:0], G[5:0], R[5:0], RL, DISP
	VIL		0	--	0.3×VDD	V	
Pull down resister value	Rpd		300	450	600	kΩ	DE, B[5:0], G[5:0], R[5:0]
Pull up resister value	Rpu		300	450	600	kΩ	DISP
Current consumption	IDD	fCLK=12.5MHz Color bar display	--	120	240	mA	VDD

 8.1.2 Backlight

(Unless otherwise noted, Ta=25 °C, VDD=3.3V, VBL=12.0V, GND=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	
Pull down resister value	Rpd 2		300	500	700	kΩ	PDM
Operating Current	IBL		Brightness control ON Duty=100%	--	65	130	mA
Estimated Life of LED	LL	Note1	--	(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.

## 8.1.3 Touch Panel

Ta=25° C

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Linearity	LE	Note	-3	--	+3	%	
Insulation resistance	RI	DC 25V	20	--	--	MΩ	XR,XL-YU,YD
Terminal resistance		X	400	--	1050	Ω	XR,XL
		Y	100	--	500		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:2.45N

## 8.2 AC Characteristics

## 8.2.1 Display Module

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

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
CLK frequency	fCLK		--	12.5	15	MHz	DCLK
CLK Low period	tw1L	$0.3 \times V_{DD}$ or less	14.8	--	--	ns	DCLK
CLK High period	tw1H	$0.7 \times V_{DD}$ or more	14.8	--	--	ns	DCLK
Setup time	tsp		10	--	--	ns	DCLK, DE, B[5:0],
Hold time	thd		10	--	--	ns	G[5:0], R[5:0], HSYNC, VSYNC

## 8.2.2 Backlight

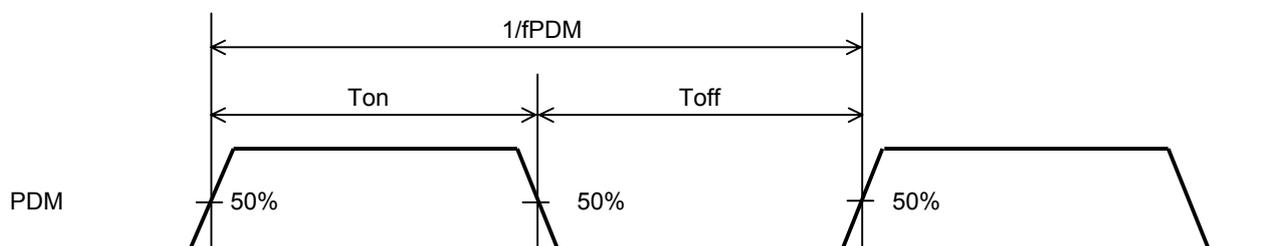
(Unless otherwise noted,  $T_a=25^\circ\text{C}$ ,  $V_{DD}=3.3\text{V}$ ,  $V_{BL}=12.0\text{V}$ ,  $GND=0\text{V}$ )

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
PDM frequency	fPDM		100	200	300	Hz	PDM
Brightness control ON Duty	ONduty	$100 \times T_{on} / (T_{on} + T_{off})$ $T_{on} > 20\mu\text{sec}$ , $T_{off} > 20\mu\text{sec}$	0	--	100	%	

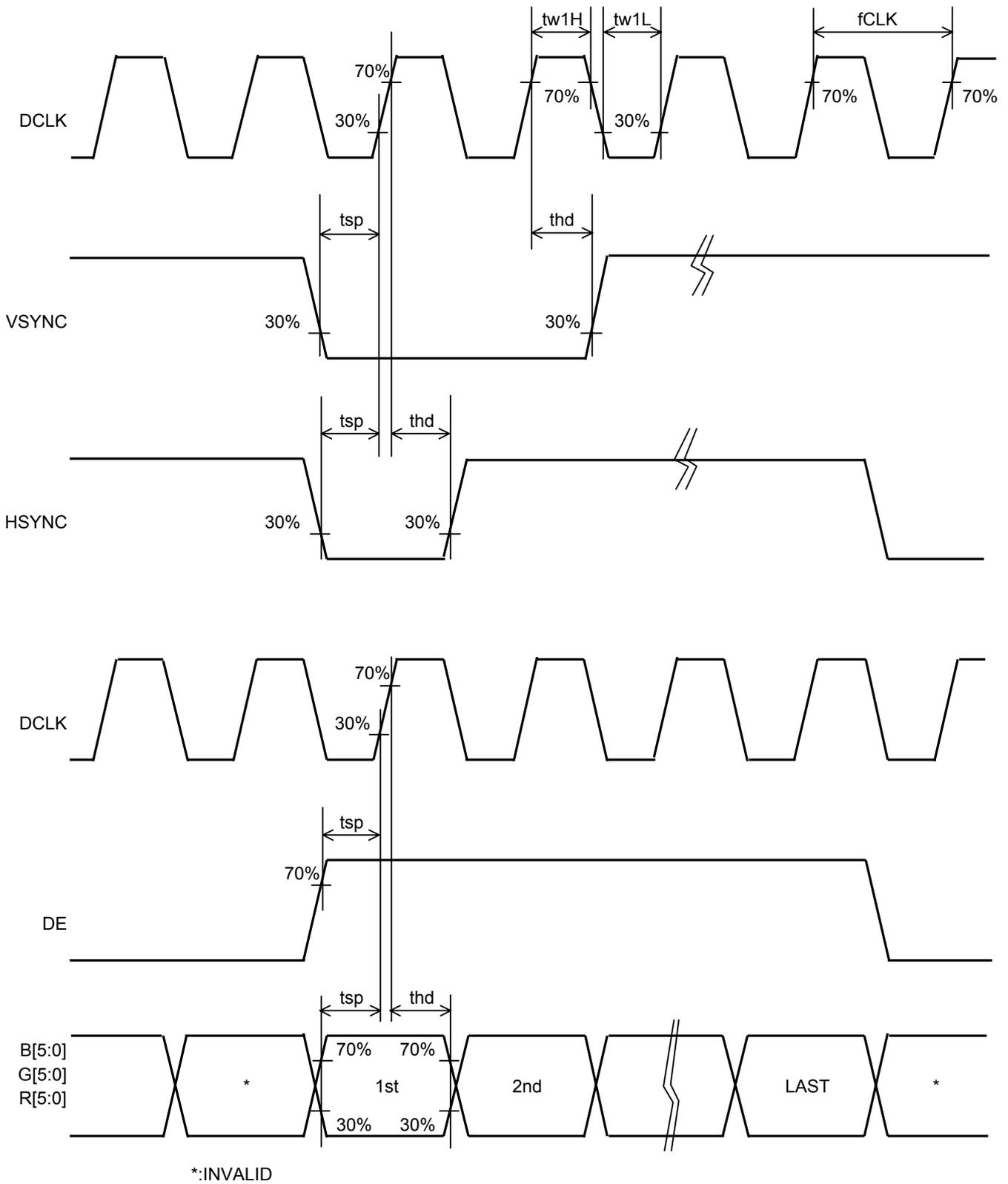
## NOTE:

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

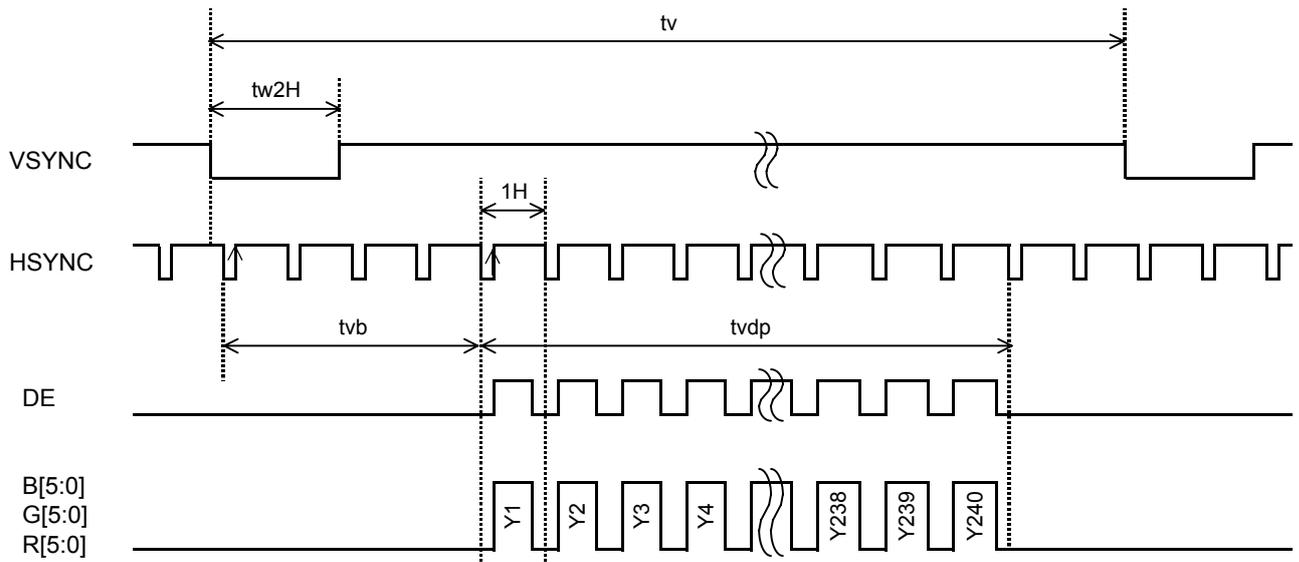


## 8.3 Input Timing Characteristics

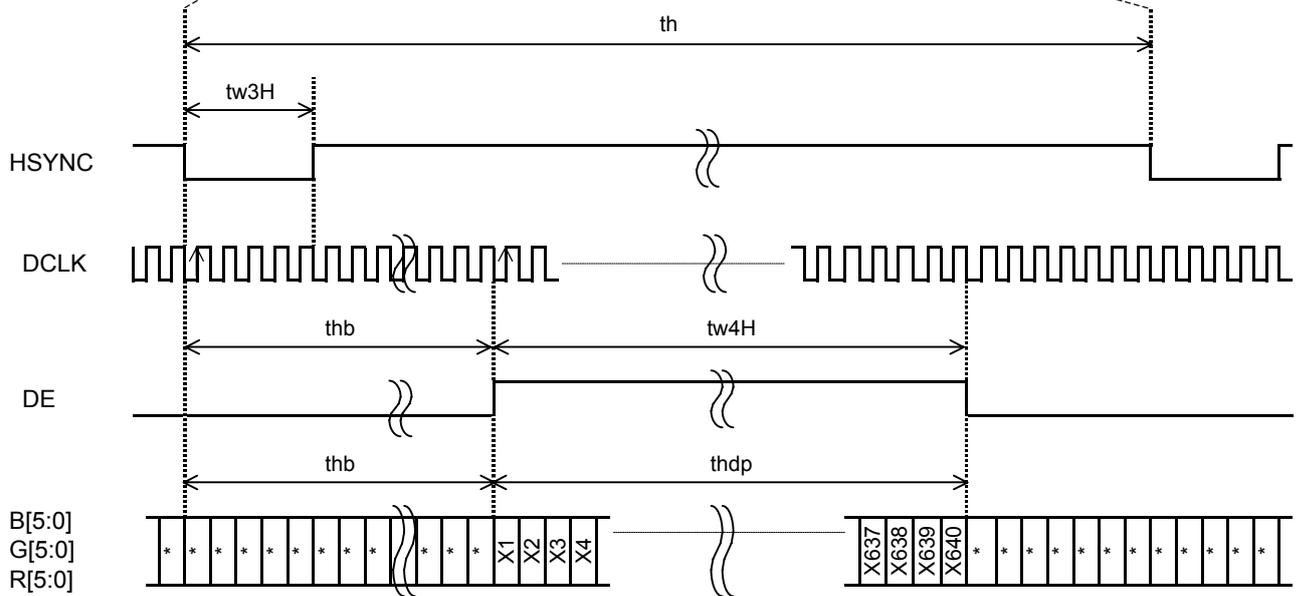
Item	Symbol	Rating			Unit	Applicable terminal
		MIN	TYP	MAX		
CLK frequency	fCLK	--	12.5	15	MHz	DCLK
VSYNC signal cycle time	tv	250	260	--	H	VSYNC,HSYNC
VSYNC frequency	fVSYNC	54	60	66	Hz	VSYNC
VSYNC pulse width	tw2H	1	3	5	H	VSYNC,HSYNC
Vertical back porch	tvb	--	10	--	H	VSYNC,HSYNC,DE,
Vertical display period	tvdp	--	240	--	H	B[5:0],G[5:0],R[5:0]
HSYNC signal cycle time	th	--	800	--	CLK	HSYNC,DCLK
HSYNC pulse width	tw3H	5	30	--	CLK	
Horizontal back porch	thb	104	120	136	CLK	HSYNC,DCLK,DE,
Horizontal display period	thdp	--	640	--	CLK	B[5:0],G[5:0],R[5:0]
DE pulse width	tw4H	--	640	--	CLK	DE,DCLK

### 8.4 Driving Timing Chart

#### -Vertical Timing

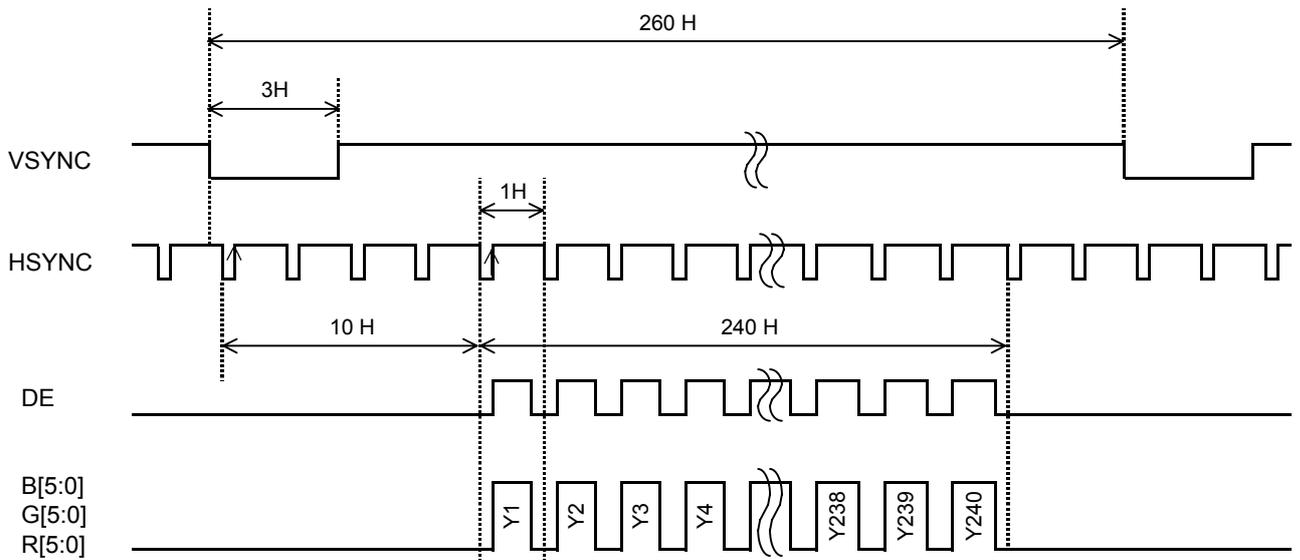


#### -Horizontal Timing

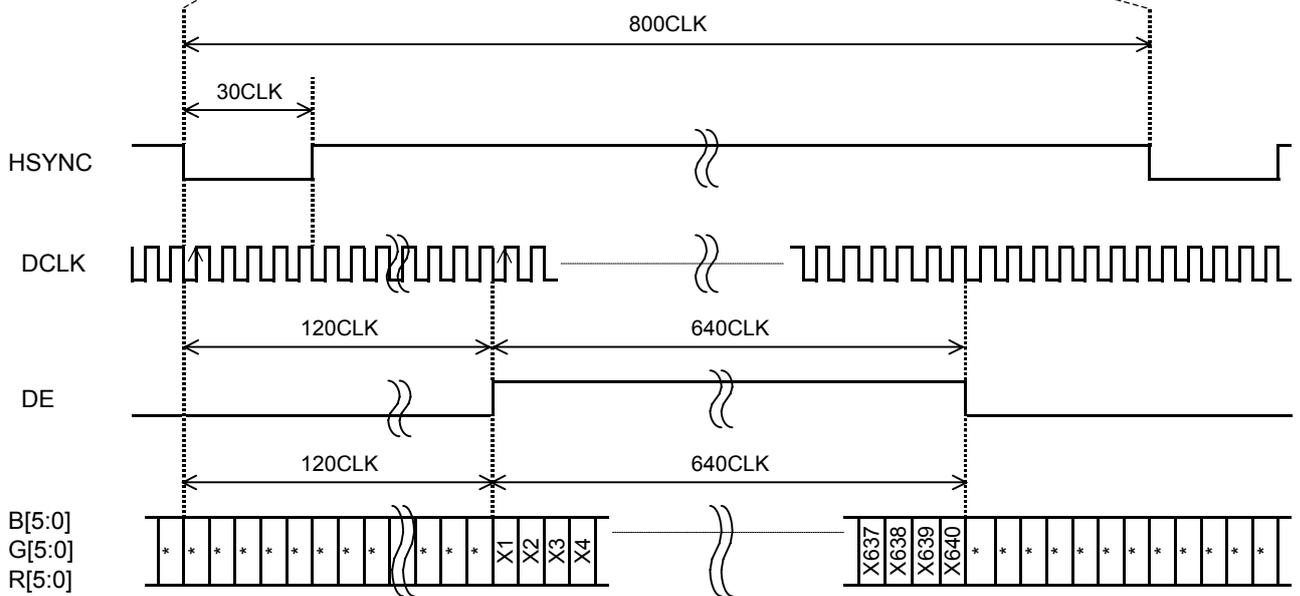


8.5 Example of Driving Timing Chart (fCLK=12.5MHz)

-Vertical Timing



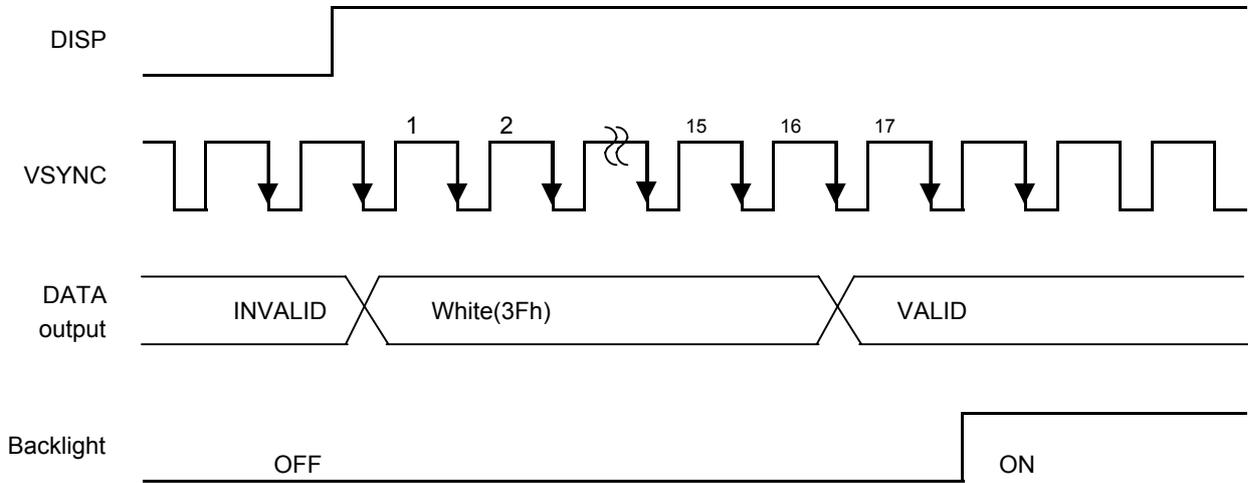
-Horizontal Timing



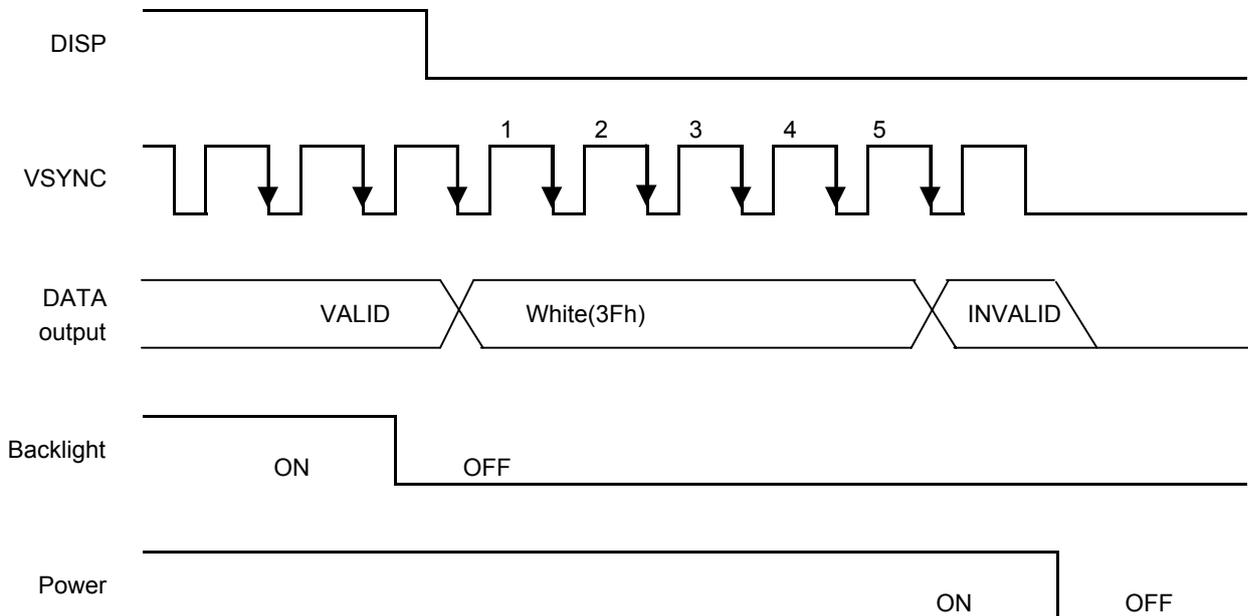
### 9. "DISP" on/off Sequence

It explains the Display on/off sequence.

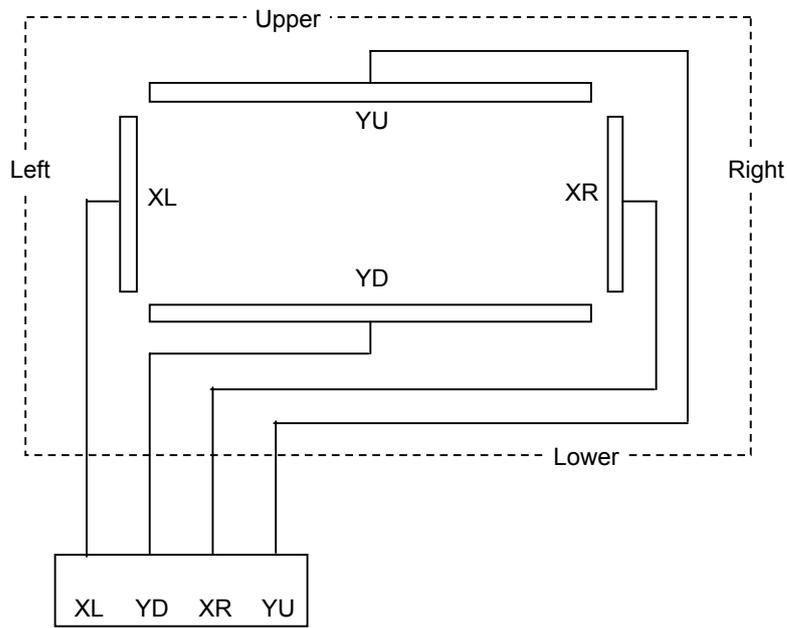
After Display on, "White" data is outputted for 16-Frames first, from the falling edge of the following VSYNC signal.



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. Touch Panel Circuit



## 11. Characteristics

## △ 11.1 Optical Characteristics

&lt; Measurement Condition &gt;

Measuring instruments: CS1000 (KONICA MINOLTA), LCD7000(OTSUKA ELECTRONICS),  
EZcontrast160D (ELDIM)Driving condition: VDD = 3.3V, VSS = 0V  
Optimized VCOMDC

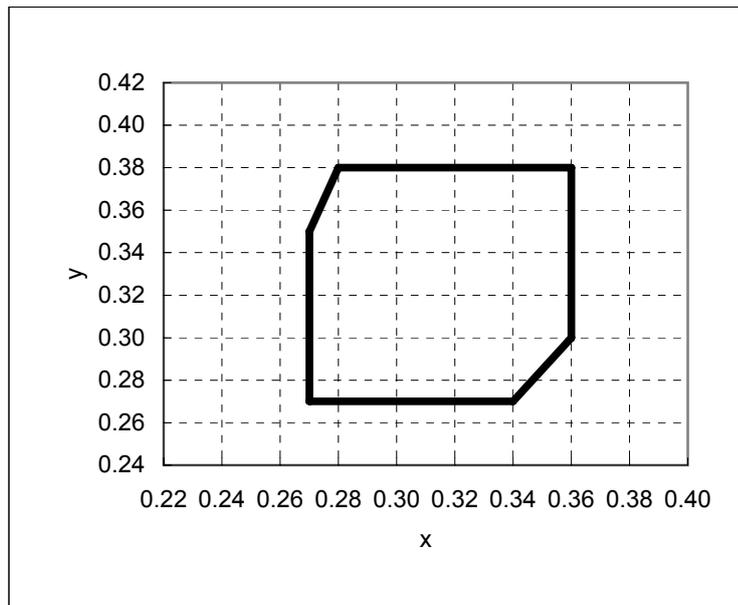
Backlight: VBL=12.0V (Brightness control ON Duty = 100%)

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	Backlight ON	CR	[Data]= 3Fh / 00h	180	300	—		2	
	Backlight OFF			—	5	—			
Viewing angle	Left	θL	[Data]= 3Fh / 00h CR ≥ 10	35	—	—	deg	3 ※	
	Right			θR	35	—	—		deg
	Up			φU	15	—	—		deg
	Down			φD	60	—	—		deg
White Chromaticity	x	[Data]=3Fh	White chromaticity range				4		
	y								
Max. Contrast angle	CRφ		-9	-2	5	deg	5	Downward ※	
Burn-in			No noticeable burn-in image should be observed after 2 hours of window pattern display.				6		
Center brightness		[Data]=3Fh	350	500	—	cd/m <sup>2</sup>	7		
Brightness distribution		[Data]=3Fh	70	—	—	%	8		

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

※Measured in the form of LCD module.



White Chromaticity Range

【White Chromaticity Range】

x	y
0.28	0.38
0.27	0.35
0.27	0.27
0.34	0.27
0.36	0.30
0.36	0.38

## 11.2 Temperature Characteristics

< Measurement Condition >

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

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

Optimized VCOMDC

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

Item			Specification		Remark
			Ta = -10°C	Ta = 70°C	
Contrast ratio		CR	40 or more	40 or more	Backlight ON
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 nonuniformity should be observed.		Use the criteria for judgment specified in the section 12.

※ Measured in the form of LCD module.

## 12. Criteria of Judgment

 12.1 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]: 3Fh, 1Ah, 00h (3 steps)  
 Observation distance 30 cm  
 Illuminance 200 to 350 lx  
 Backlight VBL=12.0V (Brightness control ON Duty=100%)

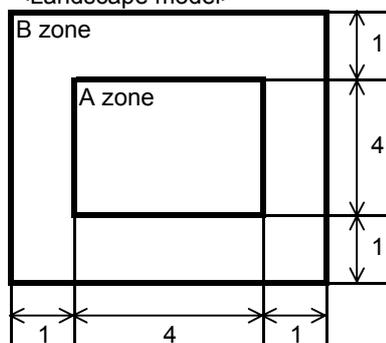
Defect item	Defect content	Criteria	
Display Quality	Line defect	Black, white or color line, 3 or more neighboring defective dots	
	Dot defect	Uneven brightness on dot-by-dot base due to defective TFT or CF, or dust is counted as dot defect (brighter dot, darker dot) High bright dot: Visible through 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]=1Ah	
Screen Quality	Dirt	Point-like uneven brightness (white stain, black stain etc)	
	Foreign particle	Point-like	$0.25\text{mm} < \varphi$
			$0.20 < \varphi \leq 0.25\text{mm}$
			$\varphi \leq 0.20\text{mm}$
	Liner	Liner	$3.0\text{mm} < \text{length and } 0.08\text{mm} < \text{width}$
			$\text{length} \leq 3.0\text{mm or width} \leq 0.08\text{mm}$
	Flaw	Flaw on the surface of the Touch panel	$0.05\text{mm} < W$
			$0.03 < W \leq 0.05\text{mm}$
			$2 < L \leq 5\text{mm}$
			$L \leq 2\text{mm}$
	$W \leq 0.03\text{mm}$		
Others		Use boundary sample for judgment when necessary	

$\varphi$ (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 Permissible distance between same color high bright dots (includes neighboring dots): 5 mm or more
B	2	4	4	6	
Total	2	4	4	7	

&lt;Landscape model&gt;



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)

## 12.2 Screen and Other Appearance

## Testing conditions

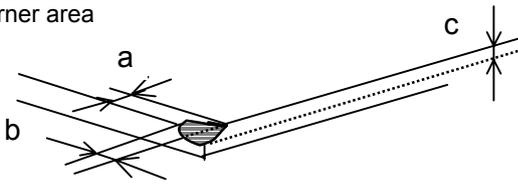
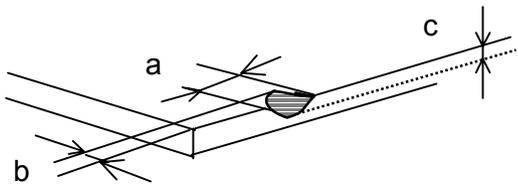
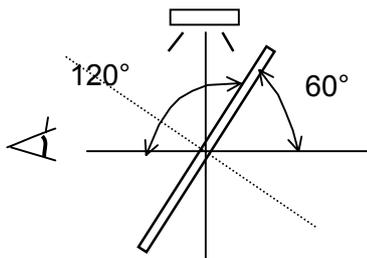
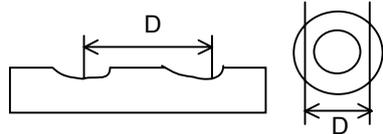
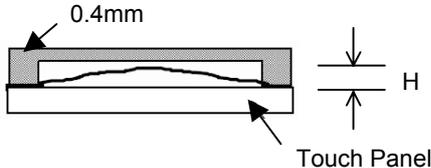
Observation distance

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	
Connector	No functional defect occurs	

Item	Appearance	Criteria
Touch Panel	Corner area 	Unit:mm $a \leq 3$ $b \leq 3$ $c \leq t$ (t: glass thickness) a,b $\leq 0.5$ is ignored $n \leq 2$
	Others 	Unit:mm $a \leq 5$ $b \leq 1$ $c \leq t$ (t:glass thickness) a,b $\leq 0.5$ is ignored Maximum permissible number of chipping off on a side is 5.
	Progressive crack	None
	Concentric interference fringe (Test method) Observe the Panel surface from 60 degrees angle to the surface under white fluorescent lamp (Triple wavelength lamp) 	Average diameter $d \leq 8\text{mm}$ is acceptable. Darkness: comply with the boundary sample
	Fisheye Film surface  (D: Average diameter of valley part)	$D \leq \varphi 0.2\text{mm}$ Ignored $\varphi 0.2 < D \leq \varphi 0.6\text{mm}$ $N \leq 2$ $\varphi 0.6\text{mm} < D$ $N=0$
Puffiness 	$H \leq 0.4\text{mm}$ is acceptable.	

## 13. 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% non condensing	240H	0/3
	High temperature operation	Tp=70°C	240H	0/3
	Low temperature operation	Tp=-20°C	240H	0/3
	High temp & humid operation	Tp=40°C, RH=90% non condensing	240H	0/3
	Thermal shock storage	-30↔80°C(30min/30min)	100 cycles	0/3
Mechanical environmental test	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 60068-2-27-1995.		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

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

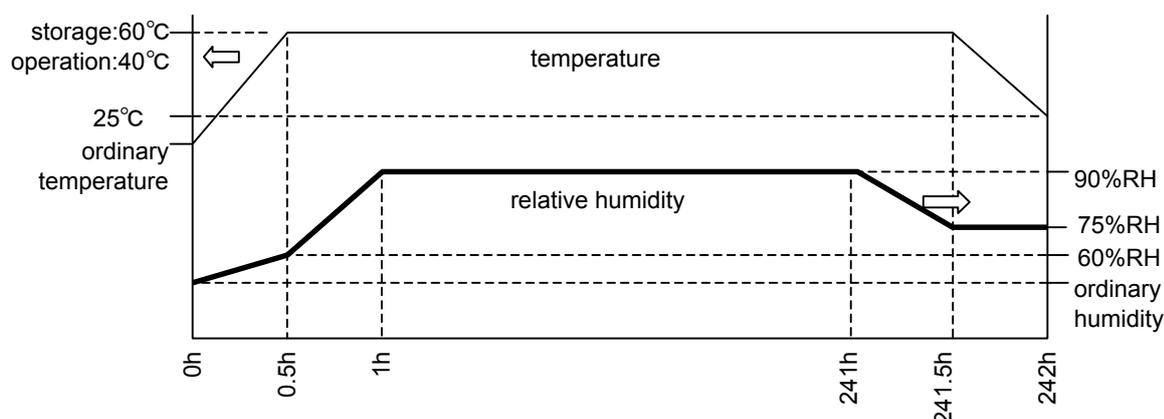
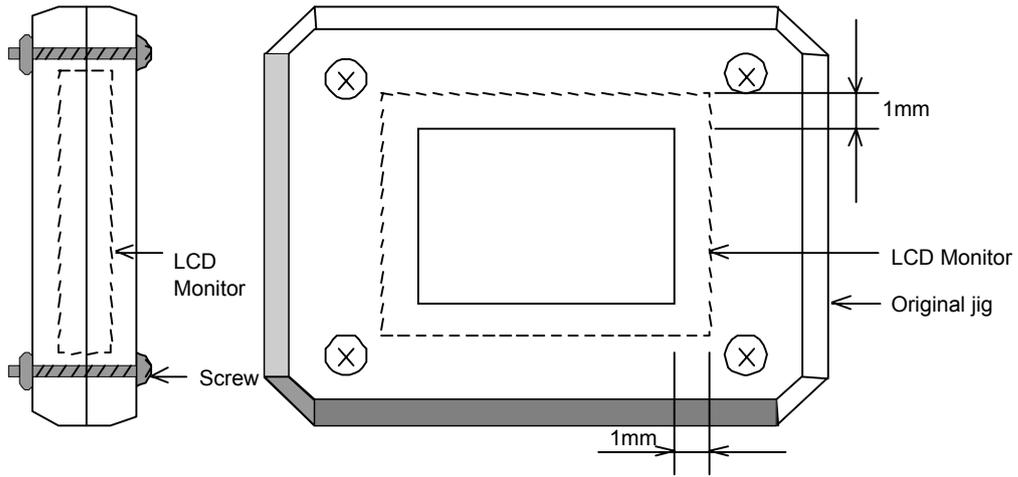


Table2.Reliability Criteria

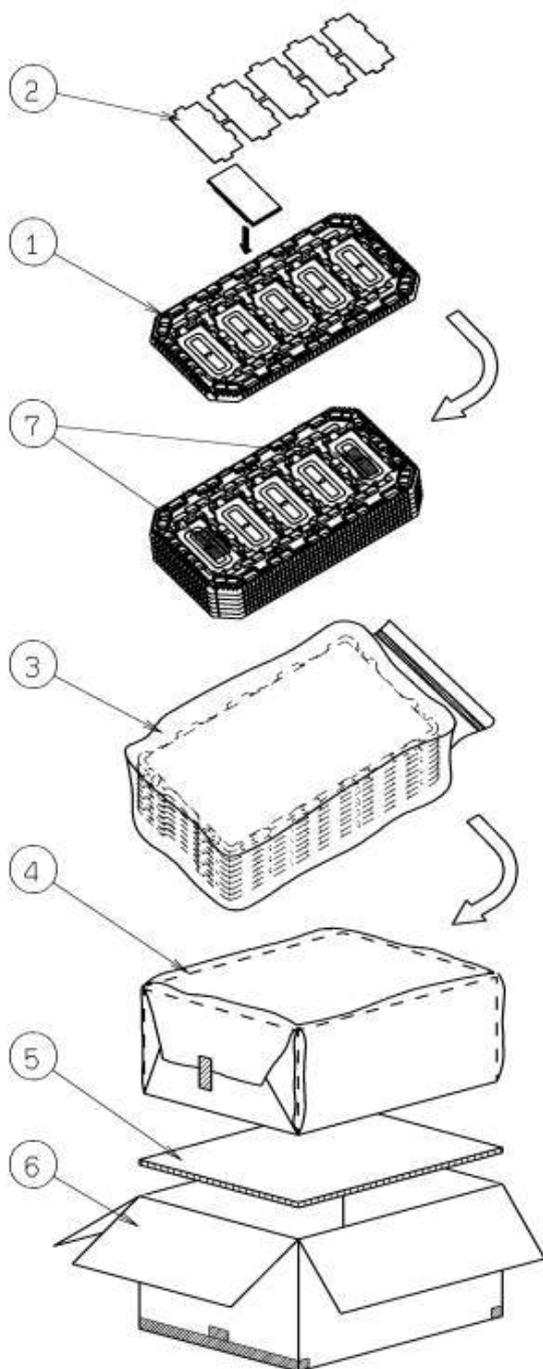
Measure the parameters after leaving the monitor at the ordinary temperature for 24 hours or more after the test completion.

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

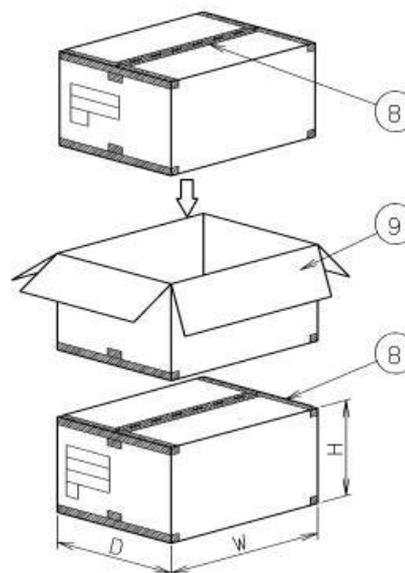
ORTUS TECHNOLOGY Original Jig



## 14. 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.(5products 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 5.  
One empty tray is to be put on the top of stack of 5 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 piled trays are to be wrapped with a bubble cushioning sheet, and to be fixed with adhesive tape.
- Step 5. The wrapped trays are to be put in the inner carton.
- Step 6. The inner carton needs to be sealed with packing tape as shown in the drawing.  
The model number, quantity of products, and shipping date are to be printed on the inner carton.  
If necessary, shipping labels or impression markings are to be put on the inner carton.
- Step 7. The inner carton is to be inserted into an extra outer carton with same direction.  
The extra outer carton needs to be 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	A-PET
②	Antistatic foam sheet	
③	SEALING BAG	
④	B SHEET A	Anti-static air bubble sheet
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.	(321mm)
W : Approx.	(594mm)
H : Approx.	(147mm)
Quantity of products packed in one carton:	5pcsx5=25pcs
Gross weight : Approx.	6.2Kg

## 15. Handling Instruction

## 15.1 Cautions for Handling LCD panels

**Caution**

- (1) Do not make an impact on the LCD panel glass because it may break and you may get injured from it.
- (2) If the glass breaks, do not touch it with bare hands.  
(Fragment of broken glass may stick you or you cut yourself on it.)
- (3) If you get injured, receive adequate first aid and consult a medial doctor.
- (4) Do not let liquid crystal get into your mouth.  
(If the LCD panel glass breaks, try not let liquid crystal get into your mouth even toxic property of liquid crystal has not been confirmed.)
- (5) If liquid crystal adheres, rinse it out thoroughly.  
(If liquid crystal adheres to your cloth or skin, wipe it off with rubbing alcohol or wash it thoroughly with soap. If liquid crystal gets into eyes, rinse it with clean water for at least 15 minutes and consult an eye doctor.)
- (6) If you scrap this products, follow a disposal standard of industrial waste that is legally valid in the community, country or territory where you reside.
- (7) Do not connect or disconnect this product while its application products is powered on.
- (8) Do not attempt to disassemble or modify this product as it is precision component.
- (9) Since excess current protection circuit is not built in this TFT module, there is the possibility that LCD module or peripheral circuit become feverish and burned in case abnormal operation is generated. We recommend you to add excess current protection circuit to power supply.
- (10) 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.

**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.**

## 15.2 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 connector .  
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 connector.
- 7) Peel off the protective film on the TFT monitors during mounting process.  
Refer to the section 15.5 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.

## 15.3 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 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.

## 15.4 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

## 15.5 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.

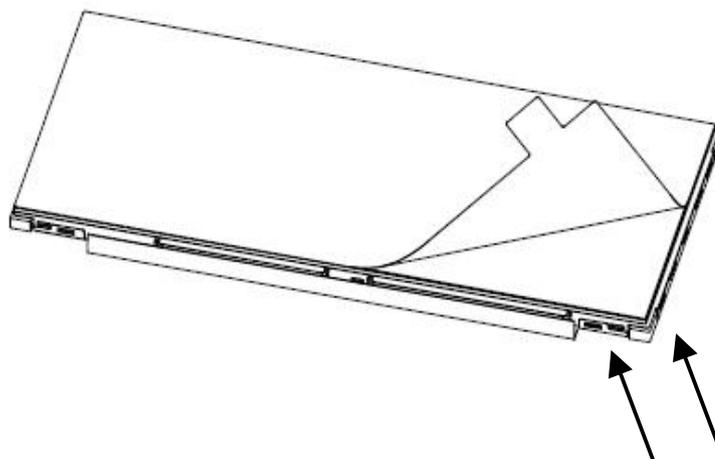
### A) Work Environment

- 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 right when tag is placed at the bottom.  
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 tag at the right side area slowly (spending more than 2 secs to complete) by pulling it to opposite direction.



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

**APPENDIX**

Reference Method for Measuring Optical Characteristics and Performance

1. Measurement Condition (Backlight ON)

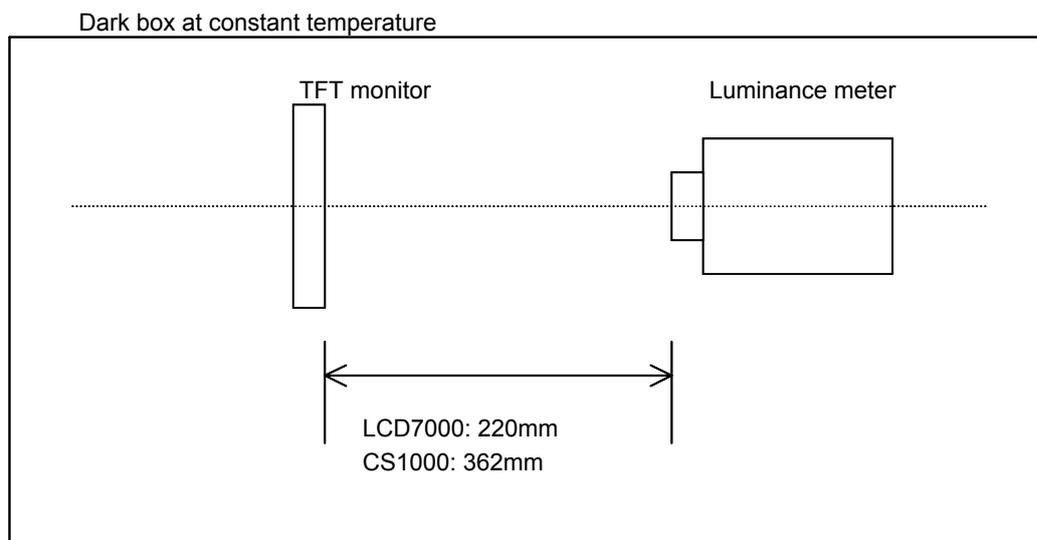
Measuring instruments: CS1000 (KONICA MINOLTA), LCD7000(OTSUKA ELECTRONICS),EZcontrast160D (ELDIM)

Driving condition: Refer to the section "Optical Characteristics"

Measured temperature: 25° C unless specified

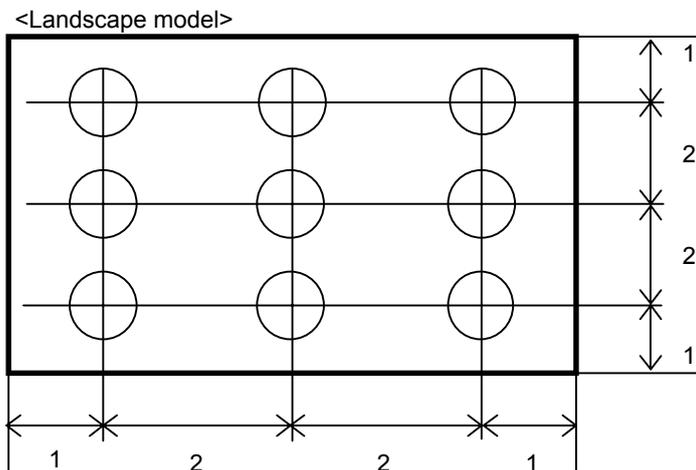
Measurement system: See the chart below. The luminance meter is placed on the normal line of measurement system.

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



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.

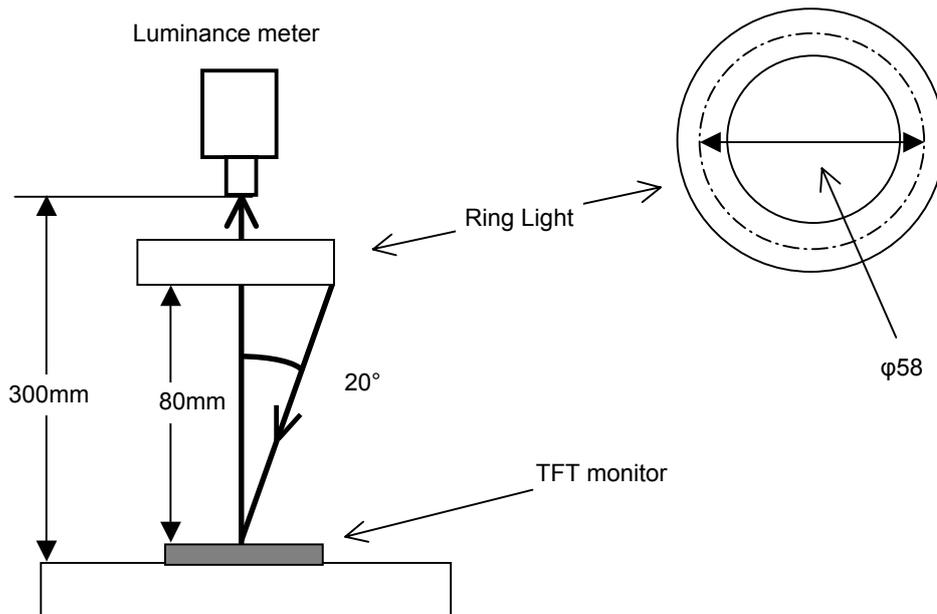


Dimensional ratio of active area

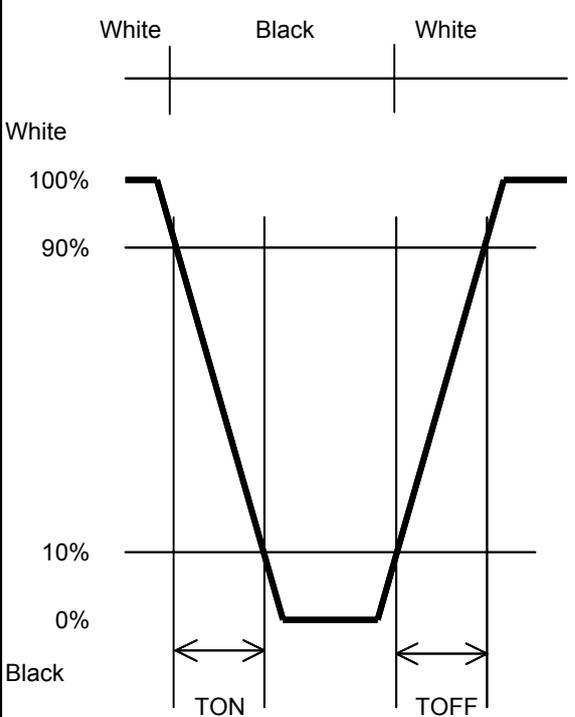
Backlight VBL=12.0V (Brightness control ON Duty=100%)

Measurement Condition (Contrast ratio Backlight OFF only)

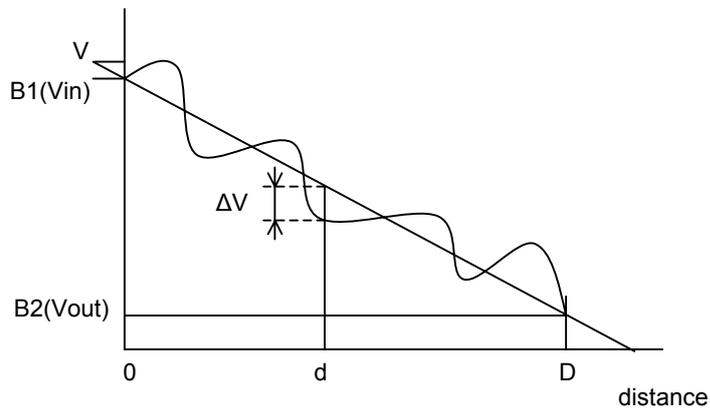
- Measuring instruments: LCD7000(OTSUKA ELECTRONICS),Ring Light(40,000 lx,φ58)
- Driving condition: Refer to the section "Optical Characteristics"
- Measured temperature: 25° C unless specified
- Measurement system: See the chart below.
- Measurement point: At the center of the screen.



## 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> 	LCD7000	<p>Black display [Data]=00h White display [Data]=3Fh TON Rise time TOFF 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 = Y1/Y2 Diameter of measuring point: 8mmφ</p>	CS1000 LCD7000	Backlight ON Backlight OFF
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	<p>Measure chromaticity coordinates x and y of CIE1931 colorimetric system at [Data] = 3Fh Color matching faction: 2°view</p>	CS1000	
5	Maximum contrast angle	Move the luminance meter vertically to the display from its normal line and measure the angles where contrast ratio reaches its highest value.	EZcontrast160D	
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) = 100 x B/A % A : max. brightness of the 9 points B : min. brightness of the 9 points</p>	CS1000	

\* Linearity Measurement of Touch Panel



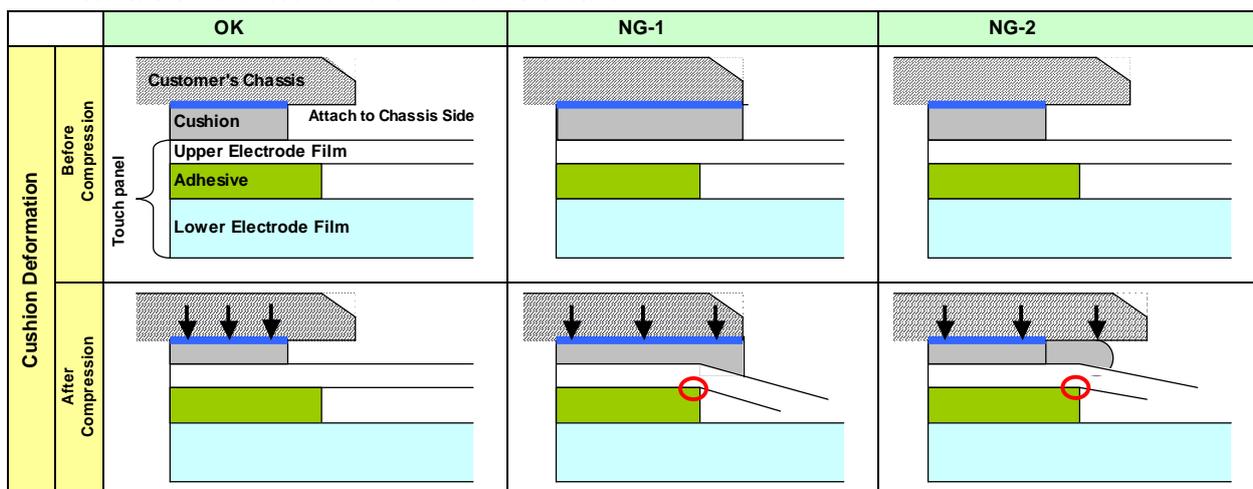
$$LE(\%) = \Delta V / (V_{in} - V_{out}) \times 100$$

$$LE_{max}(\%) = \Delta V_{max} / (V_{in} - V_{out}) \times 100$$

▲ ■ 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.

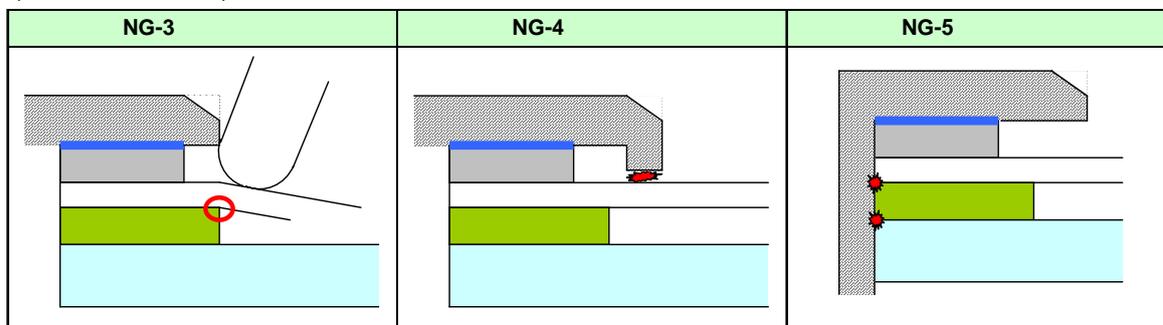


● Design Guidance of Chassis (Front Part)

- 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")



● 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.