Specification

Part Number:	MCT027A12W240320PSL
Version:	
Date:	

Revision

No.	Date	Description	Item	Page

Revision History

Ver.	Date	Page	Description
1.0	Nov.6,2008		First issue
2.0	Dec.26,2008 △ ×22	P.1	Addition:"TFT-LCD Monitor"→"Sunlight View TFT-LCD Monitor"
		P.3	Change:Contents number
		P.4,5,6	Addition:Sunlight View characteristics
		P.8	3.2 Outward Form
			Addition:Add note and recommended fixed area.
		P.21	10.1 Optical Characteristics
			Addition:Contrast ratio(Backlight OFF)
		P.22	10.2 Temperature Characteristics
			Addition:Contrast ratio remark "Backlight ON"
		P.23	11.1 Defective Display and Screen Quality
			Change:Foreign particle"0.08mm<width,Point foreign particle standard applied." →"3.0mm<length and 0.08mm<width,N=0"
			Change:Foreign particle"length≦3.0mm, width≦0.08mm" →"length≦3.0mm or width≦0.08mm"
		P.25	12. RELIABILITY TEST
			Addition:Contrast ratio remark "Backlight ON"
		P.29	14.2 Precautions for Handling
			Addition:"The FPC cable is a design very weak to the bend and the pull as it is fixed with the tape."
		P.31,32,33	Addition:Sunlight View characteristic

Contents

1. APPLICATION

This Specification is applicable to 6.84cm（2.7 inch）Ù˘ } |ã @ÁXã¸ ÁTFT-LCD back-light monitor for non-military use.

◎ Midas Components 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 Midas Components shall not grant to Purchaser any right to use
   any patent or other intellectual property rights owned by third parties. Since this Specification contains Midas Components
   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 Midas Components
    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 Midas Components 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.

◎ Midas Components 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,
    Midas Components and Purchaser shall discuss them in good faith and seek solution.

◎ Midas Components 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

- 2.7" diagonal with resolution of 720[H]x320[V] dots.
- 6-bit 262,144 color display capability.
- Single power supply operation of 3V.
- Built in Timing generator (TG)
- Long life & High bright white LED back-light.
- Å˘}|ã@ÁẌã̧ TFT-LCD, improved outdoor readability.

Indoor		Outdoor	
Readability	Power Efficiency (Battery Life)	Readability	Power Efficiency (Battery Life)
Good	Good	Fair	Poor
r	Poor	Good	Good
Good	Good	Good	Good

2.2 Display Method

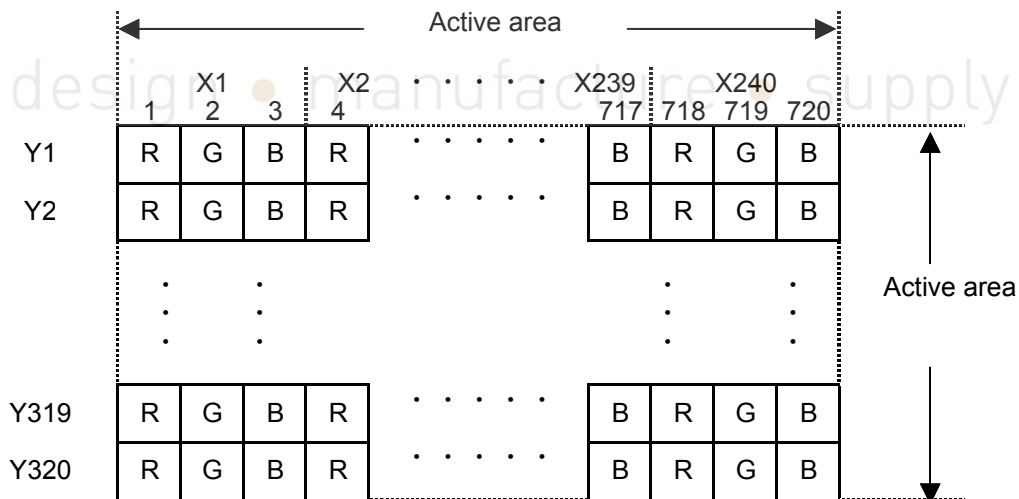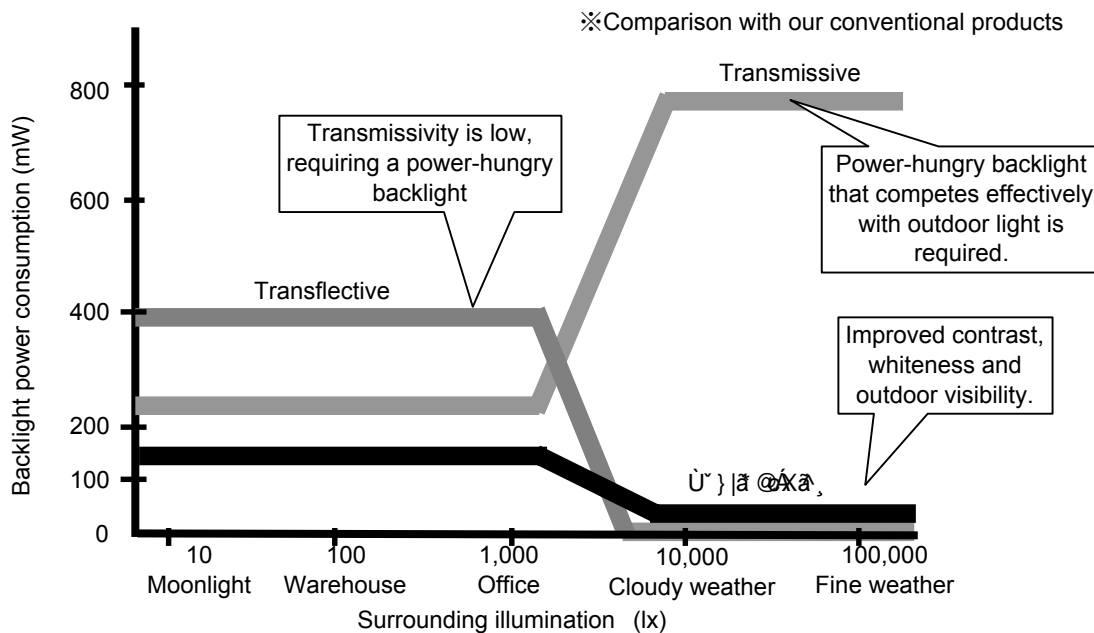| Items	Specifications	Remarks
Display type	TN type 262,144 Colors. Ù˘}|ã@ÁẌã̧, Normally white.	
Driving method	a-Si TFT Active matrix Line-scanning, Non-interlace	
Dot arrangement	RGB stripe arrangement	Refer to Fig. 1
Input signal type	6-bit RGB, parallel input.	
Backlight	Long life & High bright white LED.	

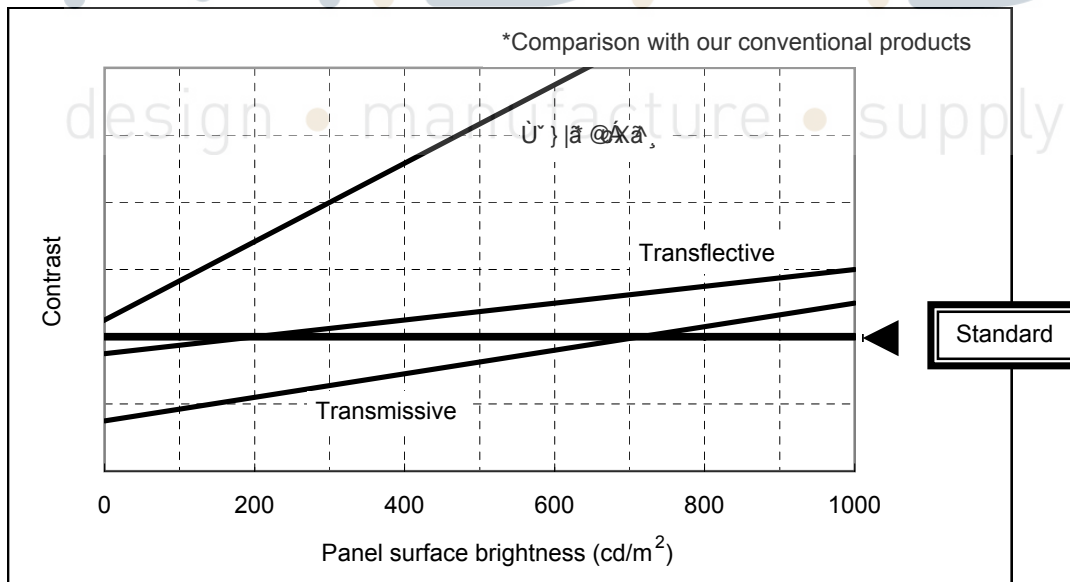Fig. 1: Dot arrangement
(FPC cable placed left)

Features of Ù˘}|ã @ǿXã¸

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

※Comparison with our conventional products

Transmissive

Transmissivity is low, requiring a power-hungry backlight

Power-hungry backlight that competes effectively with outdoor light is required.

Transflective

Improved contrast, whiteness and outdoor visibility.

Ù˘}|ã @ǿXã¸

(Backlight power consumption (mW) vs Surrounding illumination (lx))

800 | 600 | 400 | 200 | 100 | 0

10 Moonlight — 100 Warehouse — 1,000 Office — 10,000 Cloudy weather — 100,000 Fine weather

Surrounding illumination (lx)

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

With better contrast (hgher contrast ratio), Ù˘}|ã @ǿXã¸ 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.

*Comparison with our conventional products

Ù˘}|ã @ǿXã¸

Transflective

Standard

Transmissive

Contrast (vertical) vs Panel surface brightness (cd/m^2) (horizontal)

0 | 200 | 400 | 600 | 800 | 1000

Panel surface brightness (cd/m^2)

3. DIMENSIONS AND SHAPE

3.1 Dimensions

Items	Specifications	Unit	Remarks
Monitor outline dimensions	47.00[H] × 66.00[V] × 2.89[D]	mm	Exclude FPC cable and parts on FPC.
Active area	41.04[H] × 54.72[V]	mm	6.84cm diagonal
Number of dots	720[H] × 320[V]	dot	
Dot pitch	57.0[H] × 171.0[V]	μ m	
Surface hardness of the polarizer	3	H	Load: 2.0N
Weight	19.0	g	Include FPC cable

3.2 Outward Form

08TLM081

Issue:Apr.1,2010

EC No.	REV.No.	REVISE	DATE (Y:M:D)	APPROVED	CHECKED	PREPARED
RD080431	⚠X9	Add note. Add recommended fixed area.	08:12:26	K.Hashizume	J.Hiranobu	Ogino

47.00±0.2(FRAME)

23.50±0.3 (FRAME)

0.50Min. (A.A-Pol)

0.50Min. (A.A-Pol)

0.50Min. (A.A-Pol)

0.50Min. (A.A-Pol)

2.7

ACTIVE Center

30.99±0.3 (FRAME)

54.72(ACTIVE AREA)

41.04 (ACTIVE AREA)

66.00±0.2(FRAME)

26.33±1.0

Note.1

39

4.80±0.5 (Reinforcing board)

2M90

(33.25)

56.75±1.0

0.20±0.03 (Including Reinforcing board)

2.92±0.15 (FRAME-Pol)

2.89±0.25 (FRAME-S CASE A)

2.55MIN ~3.85MAX Note.5

2.55MIN ~3.55MAX Note.5

2.55MIN ~3.55MAX Note.5

2.55MIN ~3.55MAX Note.5

[ ]

11.55 (Parts mounting area)

⚠14.00MIN Note.5

(21.93:FPC)

4.58

⚠11.00MAX Note.5

38.18 (Parts mounting area)

40.00(FPC)

2.50

⚠23.00MIN Note.5

⚠1.60MAX Note.5

2.0MAX (LCD-FPC floating)

3.0MAX (LED-FPC floating)

1.2MAX (Thickness of parts mount area. FPC rear~electronic parts top.) (Not including FPC floating)

3.50±0.3 (Contact point)

19-2.95±0.15

20-2.80±0.10

20-1.40±0.15

19-1.04±0.10

39-0.30±0.15

0.30

Detail of A (S=2/1)

39

1

19-0.30±0.04/-0.03

20-0.40±0.04/-0.03

P0.60x18 =10.80±0.03

P0.60x19 =11.40±0.03

12.00±0.05

A

S LABEL	8			t=0.075
I-TAPE	7			t=0.05
S CASE C	6		SUS304	
S CASE A	5		SUS304	
LED-FPC	4			
LCD-FPC	3			
FRAME	2		PC	
LCD	1		Glass substrate thickness=0.5t	
PART NAME	ITEM	PART CODE	MATERIAL GRADE	REMARK

APPROVED K.Hashizume	GENERAL TOLERANCE ±0.5	SCALE FREE(2/1)	UNIT mm
CHECKED J.Hiranobu	ISSUE (Y:M:D) 08:07:25	MODEL	
CHECKED	NAME		
DESIGN A.OGINO		DRAWING NO.	REV. SHEET DIV.
DRAW A.OGINO		RJD516961D301	PART

Note 1. Angular deviation of LCD cell from the TFT-LCD monitor's reference axis shall be less than [±40′].

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. Recommended FPC connectors For LCD : HIROSE. part number:FH23-39S-0.3SHW(05)

Note 4. 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 5. In case TFT-LCD monitor is fixed to the case of your product, it's recommended that monitor is fixed in to ▨ area.

Note 6. Refer to "11. CRITERIA OF JUDGMENT" about the appearance specification of a polarizer.

2004.2 DEVICE-TFT

3.3 Serial Label (S-Label)

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

* 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	27BTC (Made in Japan) 27BVC (Made in Malaysia) 27BYC (Made in China)		
d	Serial number			

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

> 9E27BTC000125

means "manufactured in May 2009, model 27BT, C specifications, serial number 000125"

・Made in Malaysia

> 9E27BVC000125

means "manufactured in May 2009, model 27BV, C specifications, serial number 000125"

・Made in China

> 9E27BYC000125

means "manufactured in May 2009, model 27BY, C specifications, serial number 000125"

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

4. PIN ASSIGNMENT

No.	Symbol	Functions
1	VSS	Ground
2	VSS	Ground
3	VDD	Power supply
4	VDD	Power supply
5	VSS	Ground
6	RESETB	Reset signal. When RESETB is Lo, an internal reset is performed.
7	HSYNC	Horizontal sync signal input. (Low active)
8	VSYNC	Vertical sync signal input. (Low active)
9	CLK	Clock signal for data latching and internal counter of the timing controller
10	VSS	Ground

11	D00	Display data(B)
		    00h: Black
		        D00：LSB D05：MSB
		    Driver has internal gamma conversion.

12	D01	
13	D02	
14	D03	
15	D04	
16	D05	

17	D10	Display data(G)
		    00h: Black
		        D10：LSB D15：MSB
		    Driver has internal gamma conversion.

18	D11	
19	D12	
20	D13	
21	D14	
22	D15	

23	D20	Display data(R)
		    00h: Black
		        D20：LSB D25：MSB
		    Driver has internal gamma conversion.

24	D21	
25	D22	
26	D23	
27	D24	
28	D25	
29	VSS	Ground
30	DE	Input data effective signal. (It is effective for the period of "H")
31	STBYB	Standby signal (Lo:Standby operation,Hi:Normal operation)
32	TEST1	Connect to Ground.
33	NC	Open
34	NC	Open
35	NC	Open
36	NC	Open
37	TEST2	Connect to Ground.
38	BLH	LED drive power source (Anode side)
39	BLL	LED drive power source (Cathode side)

- Recommended connector: HIROSE ELECTRIC FH23 series [FH23-39S-0.3SHW(05)]
- Please refer to the section "3.2 Outward Form" for pin assignment.
- Since FPC cable has gold plated terminals, gilt finish contact shoe connector is recommended.

5. ABSOLUTE MAXIMUM RATING

VSS=0V

Item	Symbol	Condition	Rating		Unit	Applicable terminal
			MIN	MAX		
Supply voltage	VDD	Ta=25°C	-0.3	4.6	V	VDD
Input voltage for logic	VI		-0.3	VDD+0.3	V	CLK,VSYNC,HSYNC,DE D[05:00],D[15:10],D[25:20] STBYB,RESETB TEST1,TEST2
LED forward current	IL	Ta = 25°C	—	35	mA	BLH - BLL
		Ta = 70°C	—	15		
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	Ta=25°C	2.7	3.0	3.6	V	VDD
Input voltage for logic	VI		0	—	VDD	V	CLK,VSYNC,HSYNC DE,D[05:00] D[15:10],D[25:20] STBYB,RESETB TEST1,TEST2
Operational temperature range Note 1	Top	Note 2	-20	+25	+70	°C	Surface of panel
Operating humidity range	Hop	Ta ≦ 30°C	20	—	80	%	
		Ta > 30°C	Non condensing in an environmental moisture at or less than 30°C80%RH.				

Note 1: This monitor is operatable in this temperature range. With regard to optical characteristics,
        refer to Item "10. CHARACTERISTICS".
Note 2: Acceptable Forward Current to LED is up to 15mA, when Ta=+70°C.
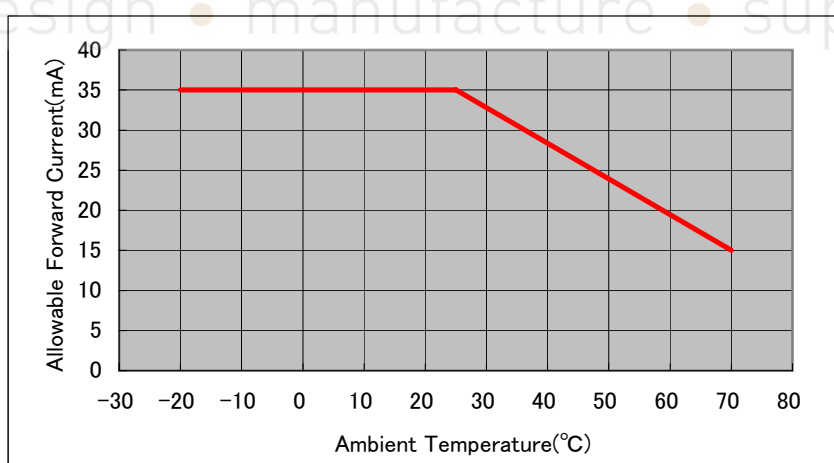   Do not exceed Allowable Forward Current shown on the chart below.

Fig. 2: Allowable Forward Current

7. CHARACTERISTICS

7.1 DC Characteristics
7.1.1 Display Module

(Unless otherwise noted, Ta=25°C,VDD=3.0V,VSS=0V)

Item	Symbol	Condition	Rating			Unit	Applicable terminals
			MIN	TYP	MAX		
Input voltage for logic	VIH		0.7×VDD	—	VDD	V	CLK,VSYNC,HSYNC DE,STBYB,RESETB
	VIL		0	—	0.3×VDD	V	D[05:00],D[15:10],D[25:20] TEST1,TEST2
Operating Current	IDD	fCLK=6.25MHz Color bar display	—	8.0	16.0	mA	VDD

7.1.2 Backlight

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Forward current	IL25	Ta=25°C	—	10.0	35.0	mA	BLH - BLL
	IL70	Ta=70°C	—	—	15.0	mA	
Forward voltage	VL	Ta=25°C, IL=10.0mA	—	9.0	9.9	V	
Estimated Life of LED	LL	Ta=25°C, IL=10.0mA Note1	—	(50,000)	—	hr	

Note1: - The lifetime of the LED is defined as a period till the brightness of the LED decreases to the half of its initial value.
- This figure is given as a reference purpose only, and not as a guarantee.
- This figure is estimated for an LED operating alone. As the performance of an LED may differ when assembled as a monitor together with a TFT panel due to different environmental temperature.
- Estimated lifetime could vary on a different temperature and usually higher temperature could reduce the life significantly.
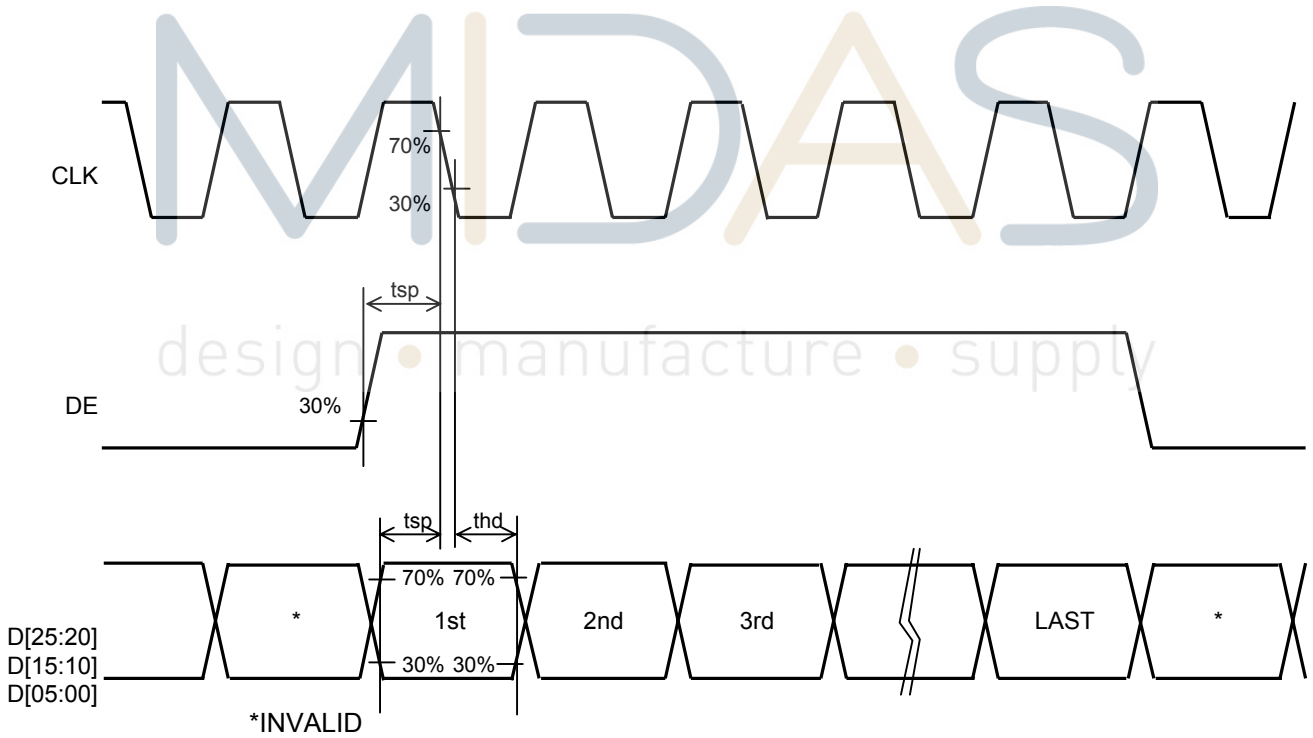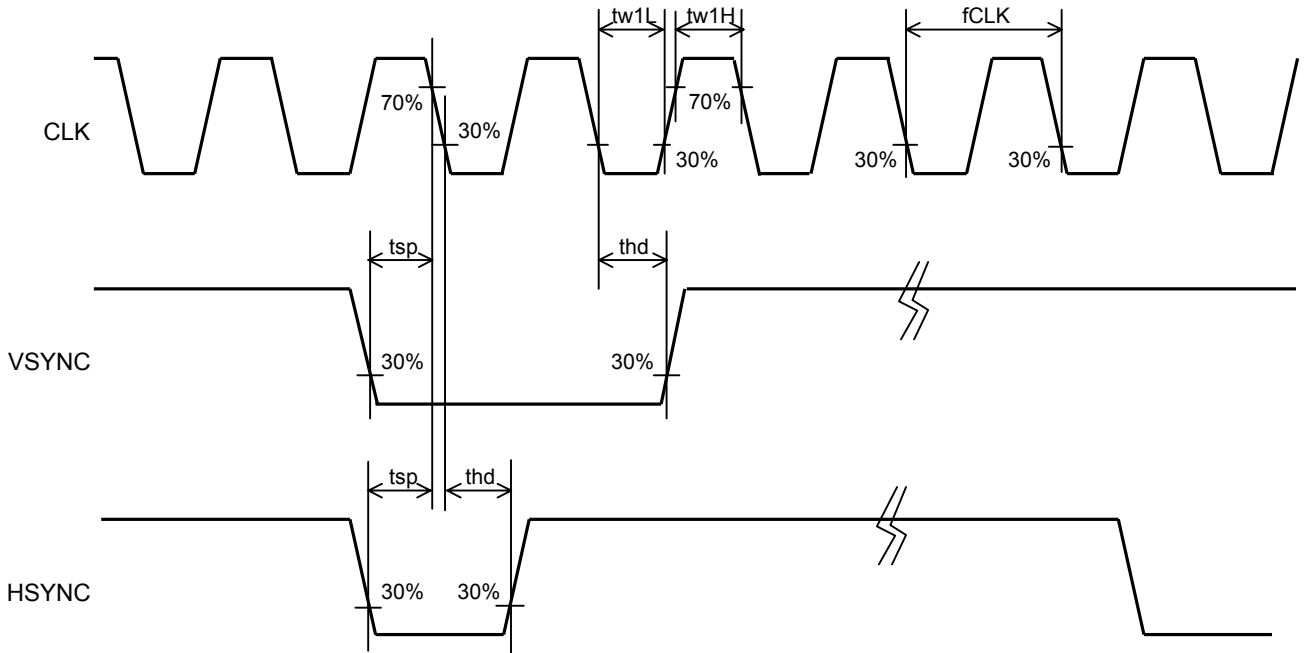
7.2 AC Characteristics

(Unless otherwise noted, Ta=25°C,VDD=3.0V,VSS=0V)

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Clock frequency	fCLK		4.4	5.6	7.0	MHz	CLK
Clock Low period	tw1L	0.3×VDD or less	15	—	—	ns	CLK
Clock High period	tw1H	0.7×VDD or more	15	—	—	ns	CLK
INPUT setup time	tsp		15	—	—	ns	CLK,VSYNC,HSYNC D[05:00],D[15:10]
INPUT hold time	thd		15	—	—	ns	D[25:20],DE

Switching Waveform Characteristics

7.3 Input Timing

(Unless otherwise noted, Ta=25°C,VDD=3.0V,VSS=0V)

Item	Symbol	Rating			Unit	Applicable terminals
		MIN	TYP	MAX		
CLK frequency	fCLK	4.4	5.6	7.0	MHz	CLK
VSYNC frequency Note1	fVSYNC	54	60	66	Hz	VSYNC
VSYNC signal cycle time	tv	324	325	348	H	VSYNC,HSYNC
VSYNC pulse width	tw2H	1	—	—	H	VSYNC,HSYNC
Vartical back porch	tvb	2	—	14	H	VSYNC,HSYNC,DE D[05:00],D[15:10],D[25:20]
Vartical display period	tvdp	—	320	—	H	VSYNC,HSYNC,DE D[05:00],D[15:10],D[25:20]
HSYNC frequency	fHSYNC	—	19.5	—	kHz	HSYNC
HSYNC signal cycle time	th	—	287	402	CLK	HSYNC,CLK
HSYNC pulse width	tw3H	1	—	—	CLK	HSYNC,CLK
Horizontal back porch	thb	2	—	14	CLK	CLK,HSYNC,DE D[05:00],D[15:10],D[25:20]
DE pulse width	tw4H	—	240	—	CLK	DE,CLK
Horizontal display period	thdp	—	240	—	CLK	CLK D[05:00],D[15:10],D[25:20]

Note 1: The characteristic of this item is recommended standard.
Please use it after it confirms it enough like the display fineness etc.
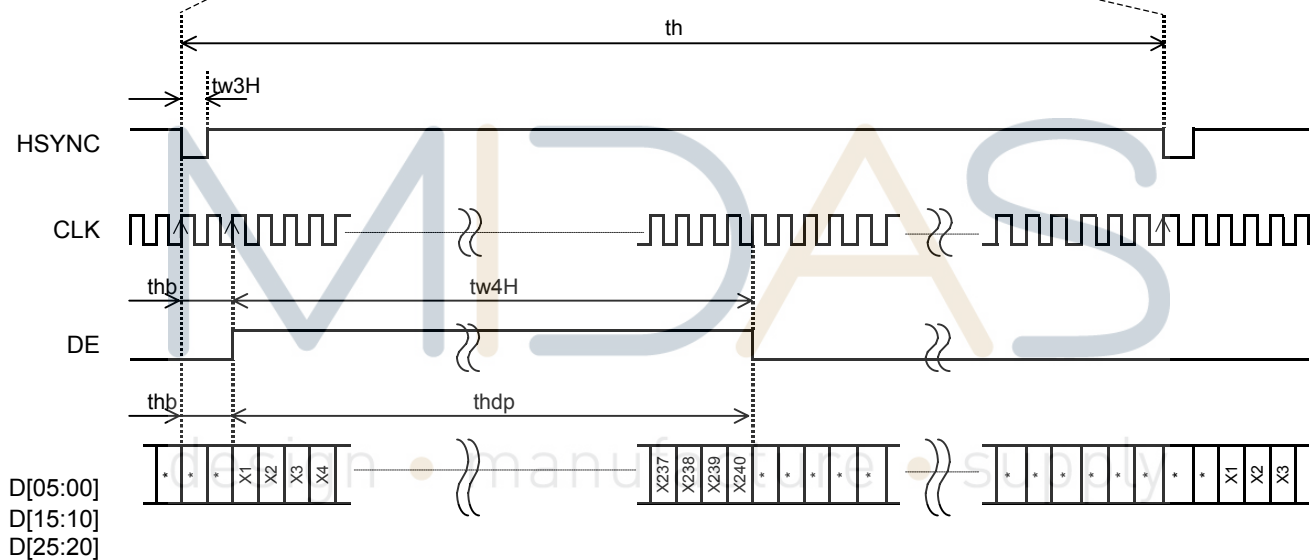when it comes off from this characteristic and it is used.
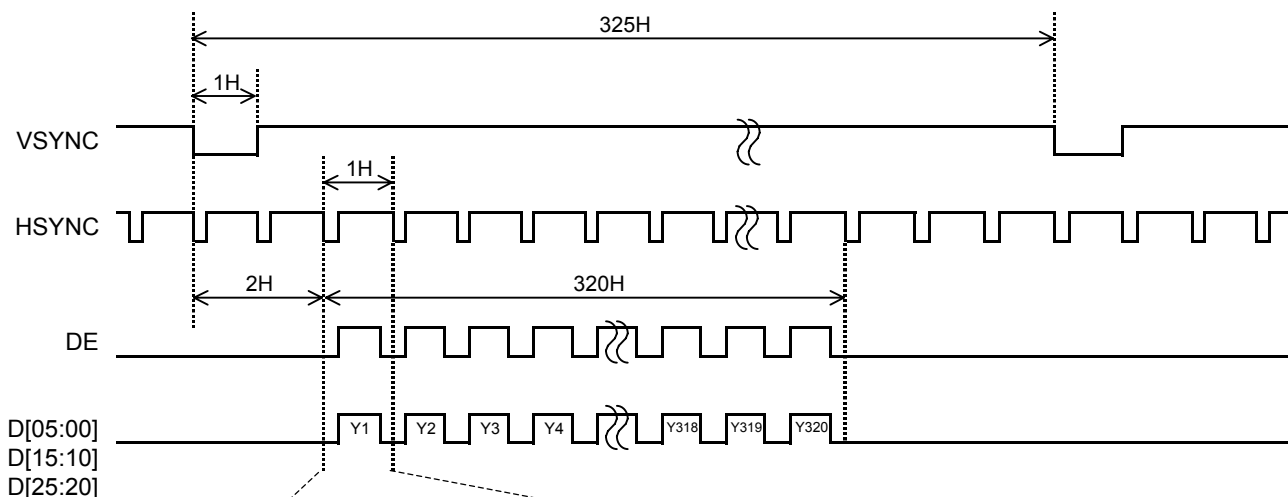
7.4 Driving Timing Chart
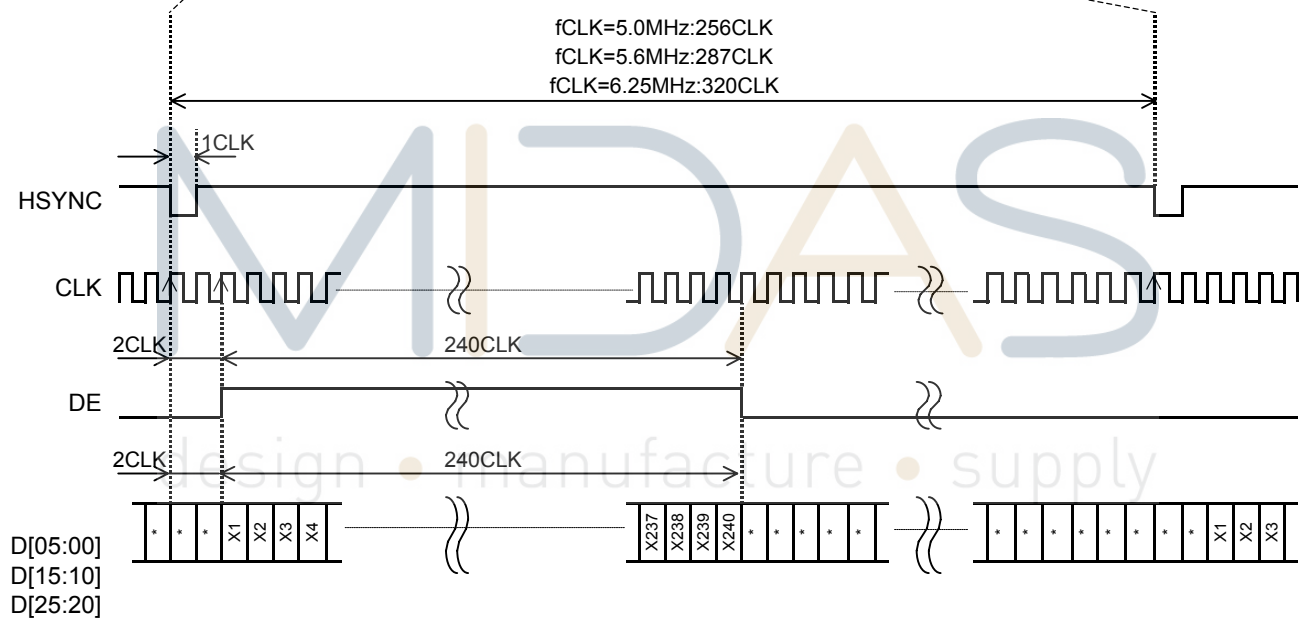Ⅰ. Vertical Timing
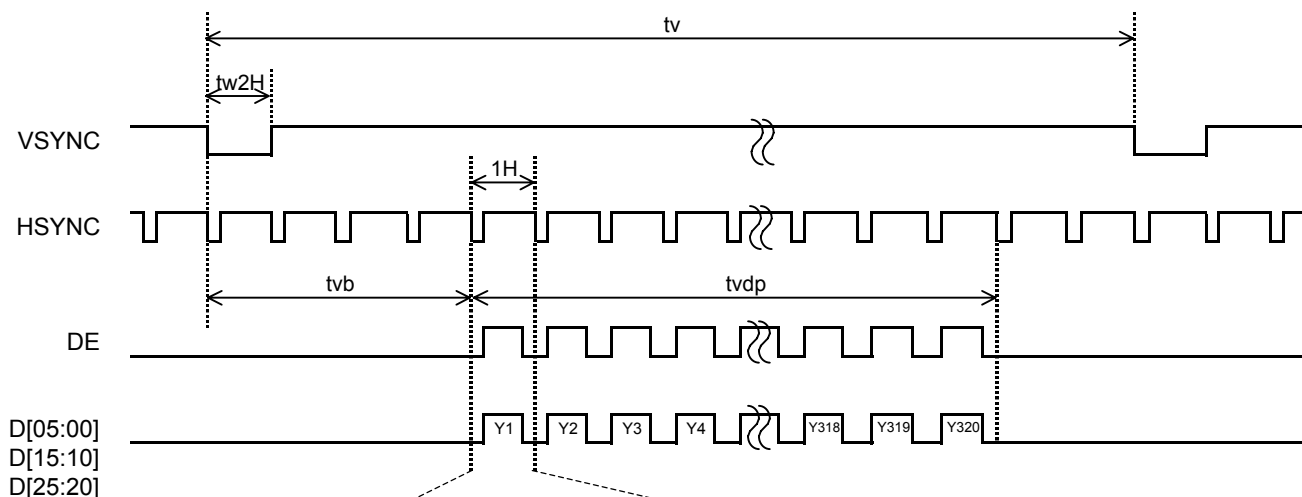
Ⅱ. Horizontal Timing

7.5 Example of Driving Timing Chart (fCLK=5.0MHz,5.6MHz,6.25MHz)
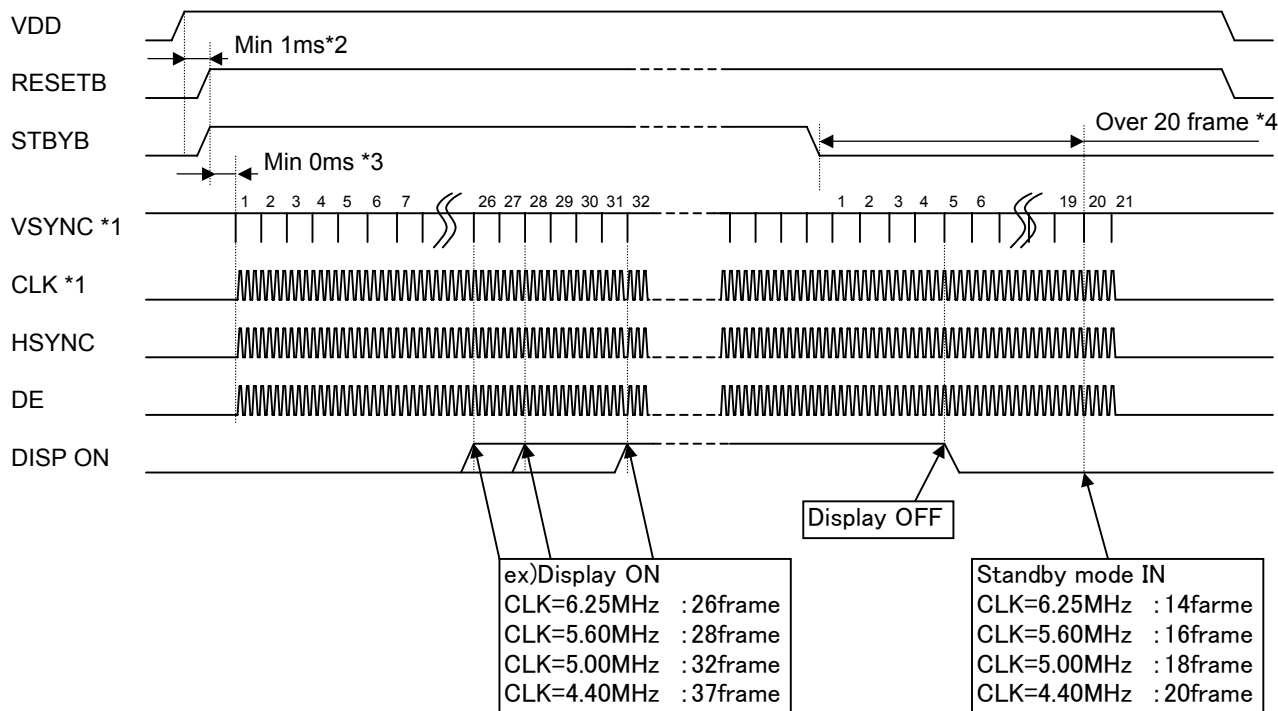
Ⅰ. Vertical Timing

Ⅱ. Horizontal Timing

8. DESCRIPTION OF OPERATION
8.1 Power ON/OFF sequence

VDD

RESETB — Min 1ms*2

STBYB — Min 0ms *3 — Over 20 frame *4

VSYNC *1 — 1 2 3 4 5 6 7 ⟨⟨ 26 27 28 29 30 31 32 — 1 2 3 4 5 6 ⟨⟨ 19 20 21

CLK *1

HSYNC

DE

DISP ON — Display OFF

ex)Display ON
CLK=6.25MHz : 26frame
CLK=5.60MHz : 28frame
CLK=5.00MHz : 32frame
CLK=4.40MHz : 37frame

Standby mode IN
CLK=6.25MHz : 14farme
CLK=5.60MHz : 16frame
CLK=5.00MHz : 18frame
CLK=4.40MHz : 20frame

*1 DOTCLK is used for Gate aray CLK on FPC.
    VSYNC is used for Gate array's inside counter.
    It becomes the operation after CLK(DOTCLK),VSYNC input.

*2 After the power suplly,Please excute RESETB.(8.3 Reset sequence Reference)

*3 There is no regulations at time until each signal is supplied from RESETB"H"
    But meanwhile, It is necessary to fix each signal to "H"or"L".

*4 It is necessary to supply VSYNC and CLK(DOTCLK) for 20 frames or less from STBYB "L" to
    turning off the power supply without leaving the afterimage.

9．LED CIRCUIT

```
BLH ○───────┬────────▶|──────────▶|──────────▶|──────┐
             │                                         │
             └─────────────────────|◀──────────────────┤
                                                        │
BLL ○───────────────────────────────────────────────┘
```

10. CHARACTERISTICS

10.1 Optical Characteristics

< Measurement Condition >

Measuring instruments:	CS1000（KONICA MINOLTA）, LCD7000(OTSUKA ELECTRONICS）, EZcontrast160D(ELDIM)
Driving condition:	VDD = 3.0V, VSS = 0V
	Optimized Vcom/c
	VLCD=｜Vsigpp±Vcompp｜/2
Backlight:	IL=10mA
Measured temperature:	Ta ＝ 25°C

Item		Symbol	Condition	MIN	TYP	MAX	Unit	Note No.	Remark
Response time	Rise time	TON	VLCD= 0.7V→5.0V	—	—	40	ms	1	※
	Fall time	TOFF	VLCD= 5.0V→0.7V	—	—	60	ms		
Contrast ratio	Backlight ON	CR	VLCD= 0.7V/5.0V	240	400	—		2	
	Backlight OFF			—	8.5	—			
Viewing angle	Left	θL	VLCD= 0.7V/5.0V CR≧10	80	—	—	deg	3	※
	Right	θR		80	—	—	deg		
	Up	ϕU		80	—	—	deg		
	Down	ϕD		80	—	—	deg		
V-T threshold voltage		V90		1.3	1.6	1.9	V	4	※
		V50		1.8	2.1	2.4	V		
		V10		2.4	2.7	3.0	V		
White V-T Curve				Refer to Fig. 3: White V-T Curve					Reference
White Chromaticity		x	VLCD=0.7V	Fig. 4: White chromaticity range				5	
		y							
Burn-in				No noticeable burn-in image should be observed after 2 hours of window pattern display.				6	
Center brightness			VLCD=0.7V	280	400	—	cd/m^2	7	
Brightness distribution			VLCD=0.7V	70	—	—	%	8	

* Note number 1 to 8: Refer to the APPENDIX of "Reference Method for Measuring Optical Characteristics".
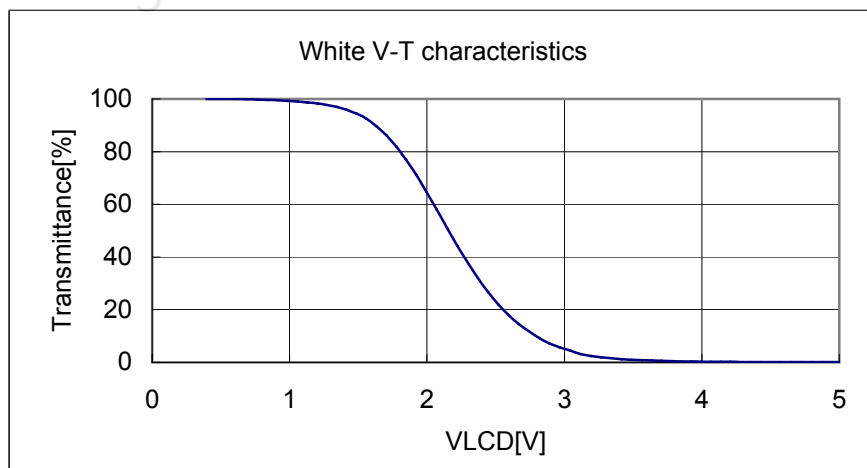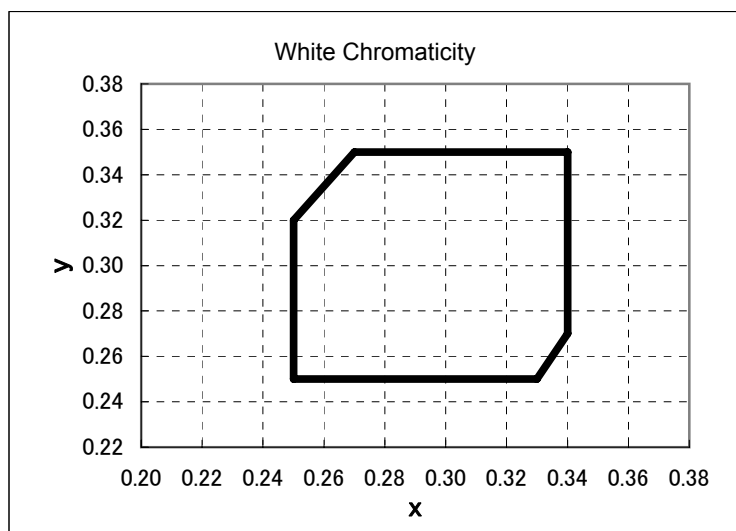
※ Measured in the form of LCD module.

Fig. 3: White V-T Curve

White Chromaticity

Fig. 4: White Chromaticity Range

【White Chromaticity Range】

x	y
0.25	0.32
0.25	0.25
0.33	0.25
0.34	0.27
0.34	0.35
0.27	0.35

10.2 Temperature Characteristics

< Measurement Condition >
Measuring instruments: CS1000（KONICA MINOLTA）, LCD7000(OTSUKA ELECTRONICS）
Driving condition: VDD = 3.0V, VSS = 0V
                          Optimized Vcom/c
                          VLCD=│Vsigpp±Vcompp│/2
Backlight: IL=10mA

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 ununiformity should be observed.		Use the criteria for judgment specified in the section 11.

※ Measured in the form of LCD module.

11. CRITERIA OF JUDGMENT

11.1 Defective Display and Screen Quality

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

Driving Signal	Raster Patter (RGB in monochrome, white, black)
Signal condition	VLCD : 0.7V, 2.1V, 5.0V (3 steps)
Observation distance	30 cm
Illuminance	200 to 350 lx
Backlight	IL=10mA

Defect item		Defect content	Criteria
Display Quality	Line defect	Black, white or color line, 3 or more neighboring defective dots	Not exists
Display Quality	Dot defect	Uneven brightness on dot-by-dot base due to defective TFT or CF, or dust is counted as dot defect (brighter dot, darker dot) High bright dot: Visible through 2% ND filter at VLCD=5.0V Low bright dot: Visible through 5% ND filter at VLCD=5.0V Dark dot: Appear dark through white display at VLCD=2.1V	Refer to table 1
Screen Quality	Dirt	Point-like uneven brightness (white stain, black stain etc)	Invisible through 1% ND filter
Screen Quality	Foreign particle — Point-like	0.25mm< ϕ	N=0
Screen Quality	Foreign particle — Point-like	0.20< ϕ ≦0.25mm	N≦2
Screen Quality	Foreign particle — Point-like	ϕ ≦0.20mm	Ignored
Screen Quality	Foreign particle — Liner	3.0mm<length and 0.08mm<width	N=0
Screen Quality	Foreign particle — Liner	length≦3.0mm or width≦0.08mm	Ignored
Screen Quality	Others		Use boundary sample for judgment when necessary

φ(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	5	Permissible distance between same color high bright dots (includes neighboring dots): 5 mm or more
Total	2	4	4	5	
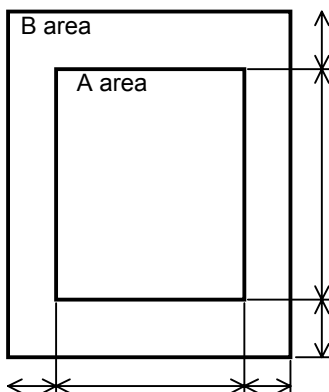
Division of A and B areas
B area: Active area
Dimensional ratio between A and B areas: 1: 4: 1 (Refer to the left figure)

11.2 Screen and Other Appearance

Testing conditions

Illuminance	1200～2000 lx
Observation distance	30cm

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	

12. RELIABILITY TEST

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

Note:Ta=ambient temperature　　Tp=Panel temperature

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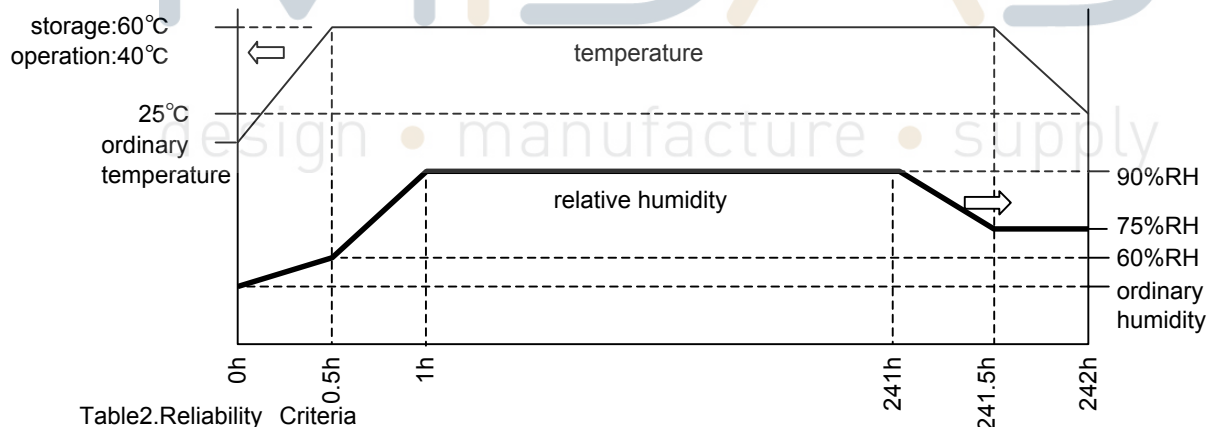(Pure water of over 10MΩ·cm shall be used.）

Table2.Reliability Criteria

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

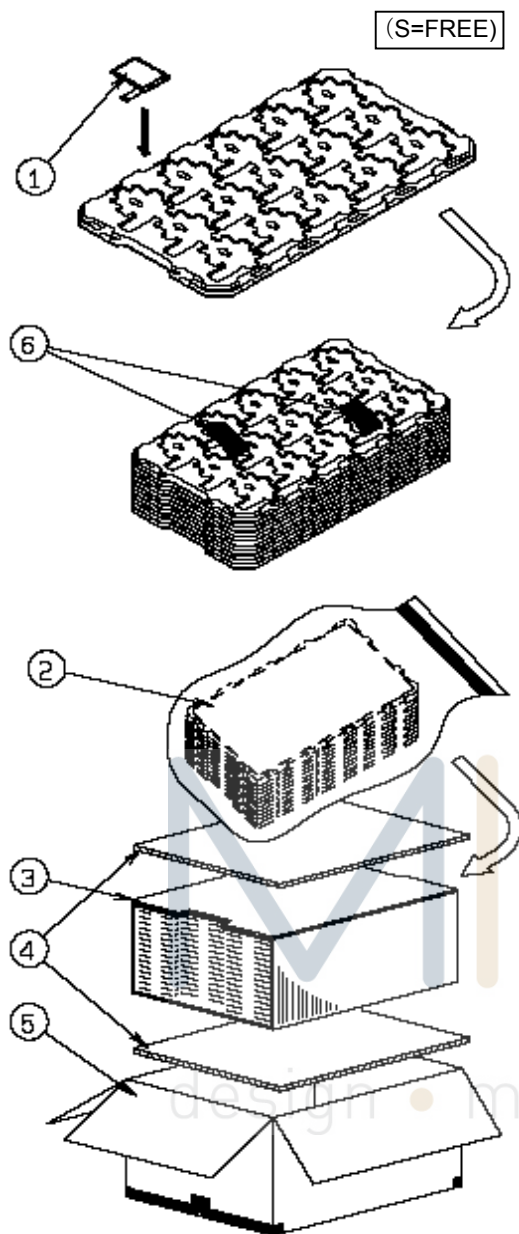| item	Standard	Remarks
Display quality	No visible abnormality shall be seen.	As criteria of 11 "CRITERIA OF JUDGMENT".
Contrast ratio	40 or more	Backlight ON

Original Jig

LCD
Monitor

Screw

1mm

LCD Monitor

Original jig

1mm
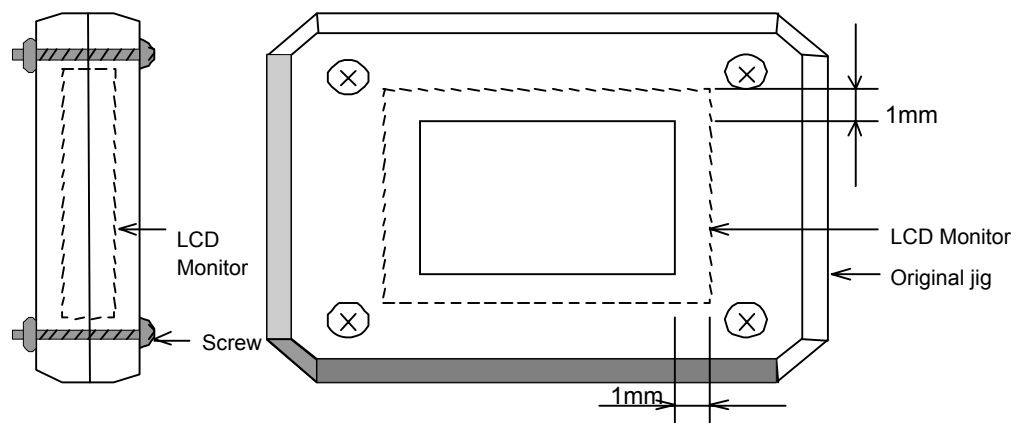
13. PACKING SPECIFICATIONS

(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.
(15products per tray)

Step 2. Each tray is to be piled up in same orientation and the trays be in a stack of 10.
One empty tray is to be put on the top of stack of 10 trays.

Step 3. 2 packs of moisture absobers 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.
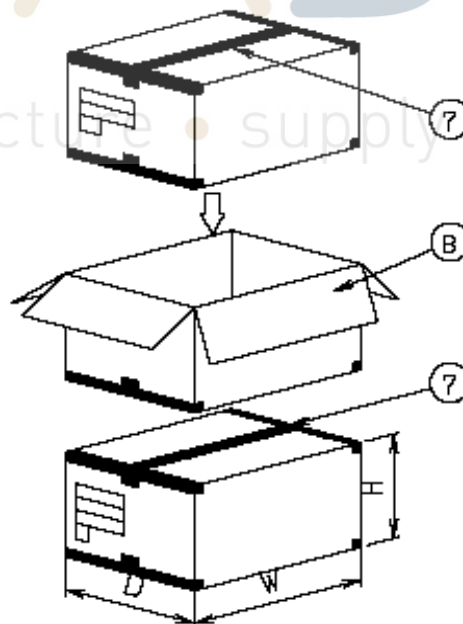
Remark: The return of packing materials is not required.

	Packing item name	Specs., Material
①	Tray	PP
②	Sealing bag	
③	Inner carton	Corrugated cardboard
④	Inner board	Corrugated cardboard
⑤	Outer carton	Corrugated cardboard
⑥	Drier	Moisture absorber
⑦	Packing tape	
⑧	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:	150
Gross weight : Approx.	6.4kg

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 scrape 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) 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.

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

14.2 Precautions for Handling

1)   Wear finger tips at incoming inspection and for handling the TFT monitors to keep
display quality and keep the working area clean.
Do not touch the surface of the polarizer as it is easily scratched.

2)   Wear grounded wrist-straps and use electrostatic neutralization blowers to prevent static
charge and discharge when handling the TFT monitors as the LED in this TFT monitors
is damageable to electrostatic discharge,
Properly set up equipment, jigs and machines, and keep working area clean and tidy
for handling the TFT monitors.

3)   Avoid strong mechanical shock including knocking, hitting or dropping to the TFT monitors
for protecting their glass parts. Do not use the TFT monitors that have been experienced
dropping or strong mechanical shock.

4)   Do not use or storage the TFT monitors at high temperature and high humidity environment.
Particularly, never use or storage the TFT monitors at a location where condensation builds up.

5)   Avoid using and storing TFT monitors at a location where they are exposed to direct
sunlight or ultraviolet rays to prevent the LCD panels from deterioration by ultraviolet rays.

6)   Do not stain or damage the contacts of the FPC cable .
Otherwise, it may cause poor contact or deteriorate reliability of the FPC cable.

7)   The FPC cable is a design very weak to the bend and the pull as it is fixed with the tape.
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 driving the monitor,refer to "8.1 Power ON/OFF sequence".
When turning off the power,turn off the input signal before or at the same timing ofswitching 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.

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, Temperature15˚C to 27˚C
- b) Operators should wear conductive shoes, conductive clothes, conductive finger tips and grounded wrist-straps. Anti-static treatment should be implemented to work area's floor.
- c) Use a room shielded against outside dust with sticky floor mat laid at the entrance to eliminate dirt.

B) Work Method
The following procedures should taken to prevent the driver ICs from charging and discharging.
- a) Use an electrostatic neutralization blower to blow air on the TFT monitors to its lower left when the LCD-FPC cable is facing to the leftside.
  Optimize direction of the blowing air and the distance between the TFT monitors and the electrostatic neutralization blower.
- b) Put an adhesive tape (Scotch tape, etc) at the lower left corner area of the protective film to prevent scratch on surface of TFT monitors.
- c) Peel off the adhesive tape slowly (spending more than 2 secs to complete) by pulling it to opposite direction.
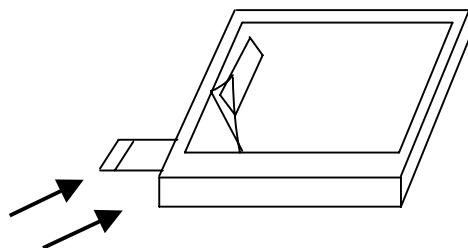
Direction of blowing air
（Optimize air direction and the distance）

APPENDIX
 Reference Method for Measuring Optical Characteristics and Performance
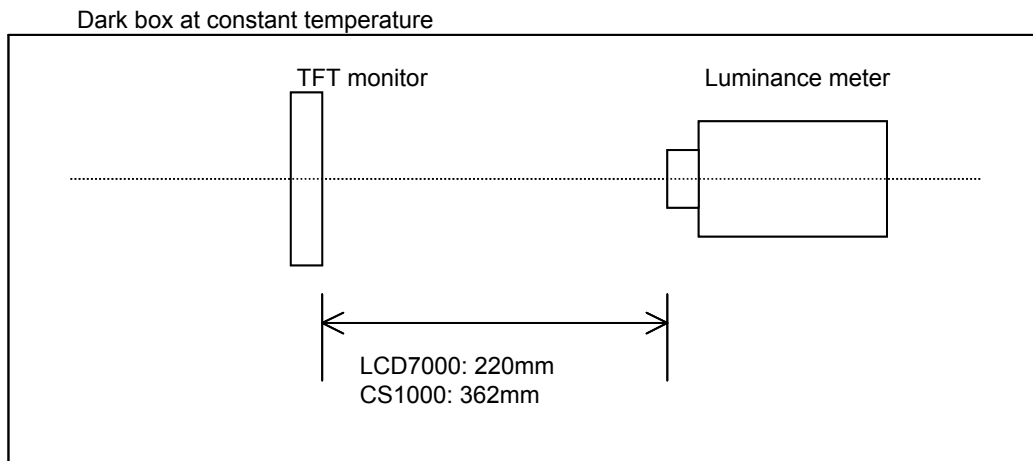
1. Measurement Condition (Backlight ON)
Measuring instruments: CS1000(KONICA MINOLTA), LCD7000(OTSUKA ELECTRONICS), EZcontrast160D(ELDIM)
Driving condition: Refer to the section "Optical Characteristics"
Measured temperature: 25°C unless specified
Measurement system: See the chart below. The luminance meter is placed on the normal line of
                        measurement system.
Measurement point: At the center of the screen unless otherwise specified

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.

1
2
2
1

1   2   2   1
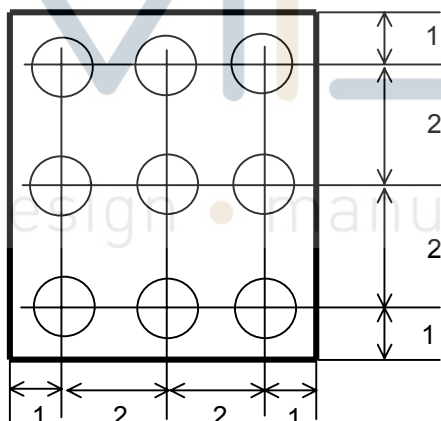
Backlight IL = 10mA

Dimensional ratio of active area

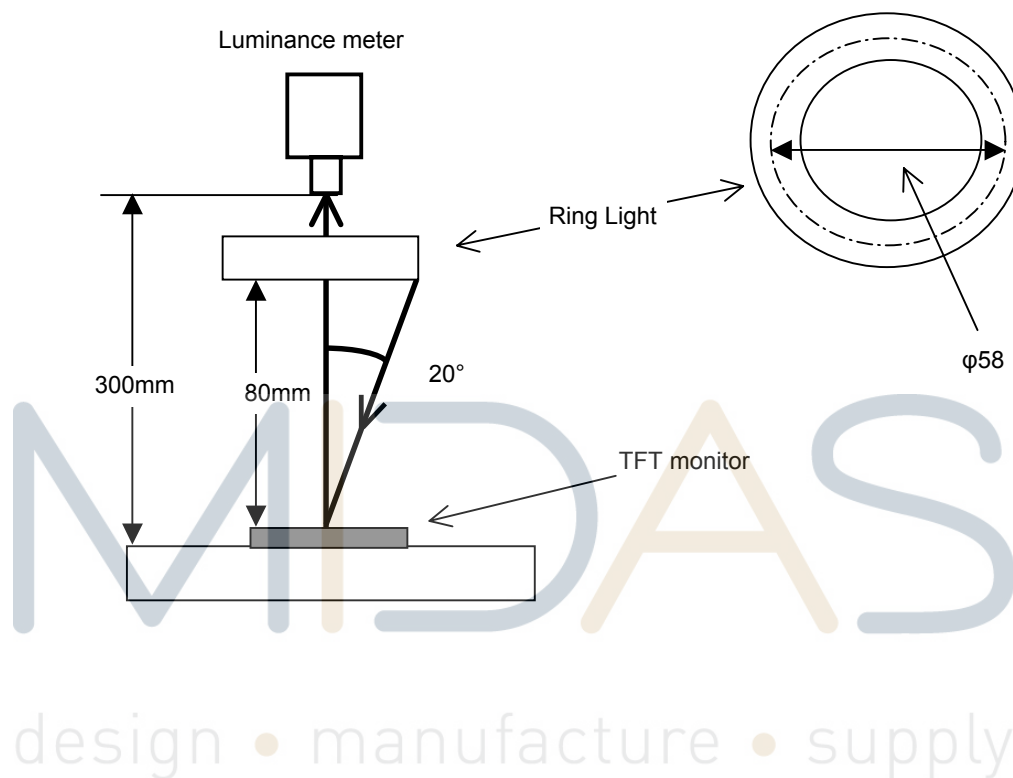Measurement Condition (Contrast ratio Backlight OFF only)
Measuring instruments: LCD7000(OTSUKA ELECTRONICS),Ring Light(40,000 lx,φ58)
Driving condition: Refer to the section "Optical Characteristics"
Measured temperature: 25°C unless specified
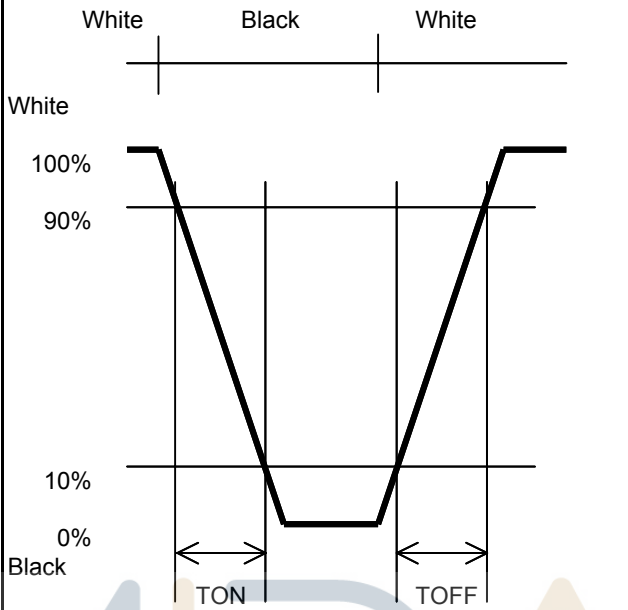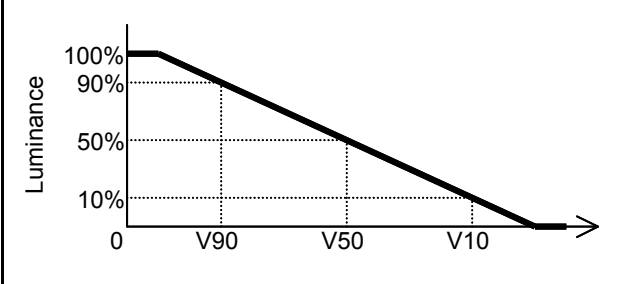Measurement system: See the chart below.
Measurement point: At the center of the screen.

Luminance meter

Ring Light

φ58

300mm

80mm

20°

TFT monitor

2. Test Method

Notice	Item	Test method	Measuring instrument	Remark

1	Response time	Measure output signal waveform by the luminance meter when raster of window pattern is changed from white to black and from black to white.
		
		White Black White
		
		White
		100%
		90%
		10%
		0%
		Black
		TON TOFF
			LCD7000	Black display
				   VLCD=5.0V
				White display
				   VLCD=0.7V
				TON
				   Rise time
				TOFF
				   Fall time

2	Contrast ratio	Measure maximum luminance Y1(VLCD=0.7V) and minimum luminance Y2(VLCD=5.0V) 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: 8mm ϕ
			CS1000
			LCD7000	

3	Viewing angle Horizontal θ Vertical ϕ	Move the luminance meter from right to left and up and down and determine the angles where contrast ratio is 10.	EZcontrast160D	
4	V-T threshold value	Change VLCD by 0.1V step and plot the points where the luminance is 90% as V90, 50% as V50 and 10% as V10 of maximum luminance. Luminance 100% 90% 50% 10% 0 V90 V50 V10	LCD7000	
5	White chromatically	Measure chromaticity coordinates x and y of CIE1931 colorimetric system at VLCD = 0.7V Color matching faction: 2°view	CS1000	

Notice	Item	Test method	Measuring instrument	Remark
6	Burn-in	Visually check burn-in image on the screen after 2 hours of "window display" (VLCD=0.7V/5.0V).		At optimized Vcom/C
7	Center brightness	Measure the brightness at the center of the screen.	CS1000	
8	Brightness distribution	(Brightness distribution) = 100 x B/A % A : max. brightness of the 9 points B : min. brightness of the 9 points	CS1000	