Specification

MCT024C12W240320PSL

Version History

Ver.	Date	Page		Description
1.0	Oct. 21, 2010	-	-	First issue

Contents

DOC.	DATASHEET STATEMENT

1. The following icons are absolutely designed by Midas independently in 2007-SEP. They are not in common use in the LCD industry yet but just used for marking out Midasproducts' characteristics quickly and simply without any special meaning. Midas reserves the composing right and copyright.
No one else is allowed to adopt these icons without Midas approval.

2. The ISO9001 logo used in this document is authorized by SGS (www.sgs.com). Midas had already successfully passed the strict and professional ISO9001:2000 Quality Management System Certification and got the certificate (No.: CN07/00404)

3. The technologies/techniques/crafts which denoted by the following icons are not exclusively owned by Midas, but also shared by Midas LCD strategic cooperators, however all these technologies/techniques/crafts have been finally confirmed by Midas professional engineers and QC department.

4. As the difference in test standard and test conditions, also Midas insufficient familiarity with the actual LCD using environment, all the referred information in this DATASHEET (including the icons) only have two functions:
4.1: providing quick reference when you are judging whether or not the product meets your requirements.
4.2: listing out definitely the tolerance.

SAMPLE APPROVAL document rather than consider this DATASHEET as the standard for judging whether or not the LCD meets your requirements. Once you instruct Midas to a mass-production without definite demand for providing sample before, Midas will disclaim all responsibility if the mass-production is proved not meeting with your requirements.

5. The sequence of the icons is random and doesn't indicate the importance grade.

6. Icons explanation

Midas 2006 version logo.Midas is an integrated manufacturer of flat panel display (FPD). Midas supplies TN, HTN, STN, FSTN monochrome LCD panel; COB, COG, TAB LCD module; and all kinds of LED backlight.

FAST RESPONSE TIME
This icon on the cover indicates the product is with high response speed; Otherwise not.

PROTECTION CIRCUIT
This icon on the cover indicates the product is with protection circuit; Otherwise not.

HIGH CONTRAST
This icon on the cover indicates the product is with high contrast; Otherwise not.

LONG LIFE VERSION
This icon on the cover indicates the product is long life version (over 9K hours guaranteed); Otherwise not.

WIDE VIEWING SCOPE
This icon on the cover indicates the product is with wide viewing scope; Otherwise not.

Anti UV VERSION
This icon on the cover indicates the product is against UV line. Otherwise not.

RoHS COMPLIANCE
This icon on the cover indicates the product meets ROHS requirements; Otherwise not.
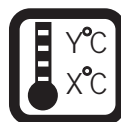
OPERATION TEMPERATURE RANGE
This icon on the cover indicates the operating temperature range (X-Y).

3TIMEs 100% QC EXAMINATION
This icon on the cover indicates the product has passed Midas thrice 100% QC. Otherwise not.

TWICE SELECTION OF LED MATERIALS
This icon on the cover indicates the LED had passed Midas twice strict selection which promises the product's identical color and brightness; Otherwise not.

VIcm = 3.0V
This icon on the cover indicates the product can work at 3.0V exactly; otherwise not.

N SERIES TECHNOLOGY (2008 developed)
New structure, new craft, new technology and new materials inside both LCD module and LCD panel to improve the "RainBow"

2. Outline Specifications

2.1 Features of the Product

- 2.4 inch diagonal display, 720 [H] x 320 [V] dots.
- 6-bit / 262,144 colors.
- 2.7V voltage single power source.
- Timing generator [TG], Counter-electrode driving circuitry, Built-in power supply circuit.
- Long life & High bright white LED back-light.
- 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.	
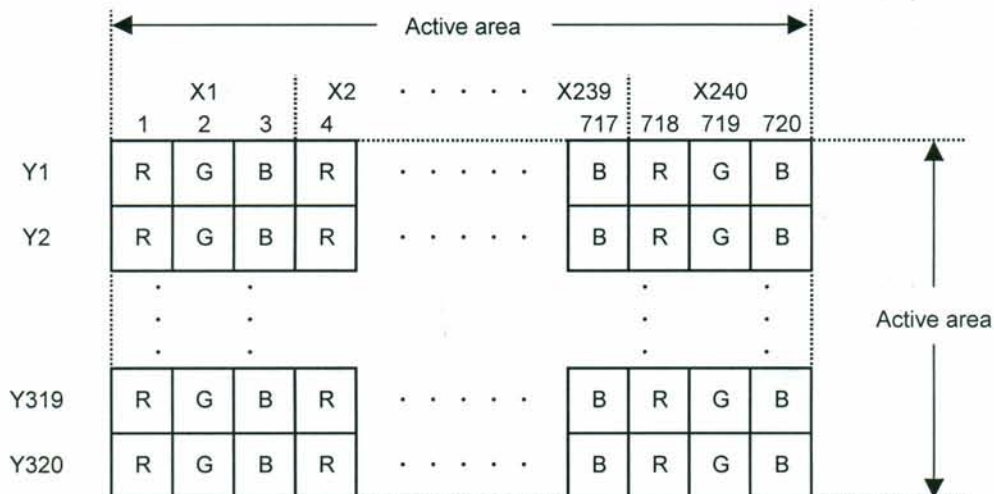
Dot arrangement (FPC cable placed leftside)

<Features of Blanview>

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

*Comparison with our conventional products
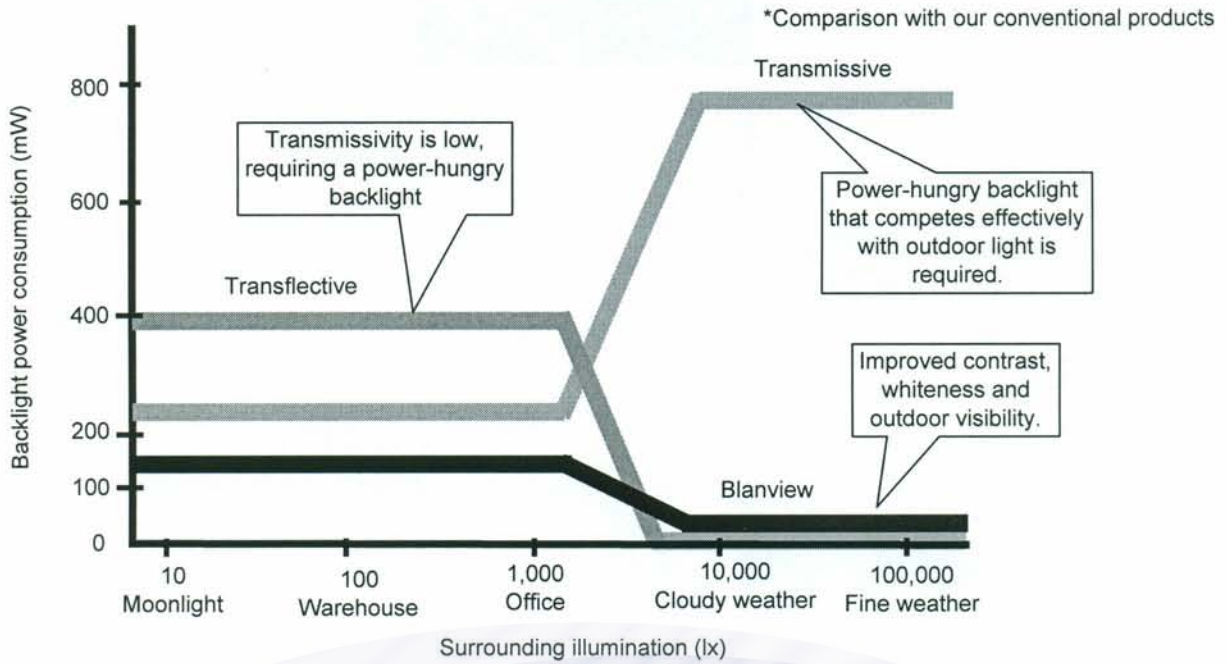
- Contrast characteristics under 100,000lx. (same condition as direct sunlight.)

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.
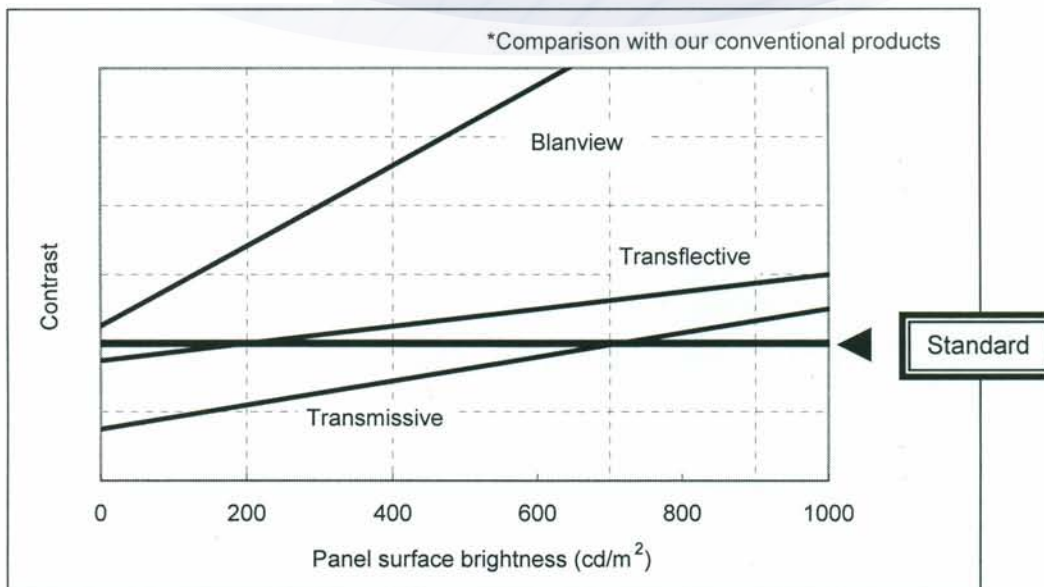
3. Dimensions and Shape

3.1 Dimensions

Items	Specifications	Unit	Remarks
Monitor outline dimensions	42.50[H] × 58.50[V] × 2.60[D]	mm	Exclude FPC cable and parts on FPC.
Active area	36.00[H] × 48.00[V]	mm	6.00cm diagonal
Number of dots	720[H] × 320[V]	dot	
Dot pitch	50.0[H] × 150.0[V]	μm	
Surface hardness of the polarizer	3	H	Load: 2.0N
Weight	13.9	g	Include FPC cable

3.2 Outward Form

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

42.50±0.2 (FRAME)
21.25±0.3 (FRAME)
0.50MIN (A.A-Pol)
0.50MIN (A.A-Pol)
(A.A-Pol)

2.4

ACTIVE center

27.00±0.3 (FRAME)
58.50±0.2 (FRAME)
48.00 (ACTIVE AREA)
36.00 (ACTIVE AREA)
0.50MIN (A.A-Pol)

NOTE.1

4.80±0.5 (Reinforcing board)

0.20±0.03 (Including Reinforcing board)

① ② ⑤

2.60±0.2 (Pol~ScaseC)
2.55±0.2 (ScaseA~C)

3.0MAX (LCD-FPC floating)
2.0MAX (LED-FPC floating)
1.4MAX
(Thickness of parts mount area.
ScaseC~electronic parts top.)
(Not including FPC floating)

Serial No. print (Inkjet)

2.30MAX
2.30MAX
000125

2.00MAX
48.42MAX
37.59
37.59MAX
48.84±1.0
18.75

Note.4
(Parts mounting area)
2.93
37.32
9.00MAX
1.30MAX
15.00±0.8
39
1

⑥ ⑦ ③ ④

A

3.50±0.3 (Contact point)
19-2.95±0.15
20-2.80±0.10
20-1.40±0.10
19-1.04±0.10
39-0.30±0.15

Detail A (S=2/1)

0.30
12.00±0.05

19-0.30±0.04
20-0.40±0.03
P0.60x18 =10.80±0.03
P0.60x19 =11.40±0.03

	8			
I-TAPE	7			
S CASE C	6			
S CASE A	5			
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 Hashizume	GENERAL TOLERANCE ±0.5	SCALE FREE(2/1)	UNIT mm
CHECKED	ISSUE (Y:M:D) 10:06:21	MODEL	
CHECKED	NAME		
DESIGN Hiranobu			
DRAW Hiranobu		DRAWING NO. RJD520988D301	REV	SHEET	DIV	PART

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

Note 2. Recommended FPC connectors
For LCD : HIROSE, part number:FH23-39S-0.3SHW(05)

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

Note 5. Refer to "11.CRITERIA OF JUDGMENT" about the appearance specification of a polarizer.

2004.2 DEVICE-TFT

3.3 Serial No. 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	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	24AQC (Made in Japan)		
		24ARC (Made in Malaysia)		
		24ASC (Made in China)		
d	Serial number			

* Example of indication of Serial No. print (S-print)
·Made in Japan

   0J24AQC000125

means "manufactured in October 2010, 2.4" AQ type, C specifications, serial number 000125"

·Made in Malaysia

   0J24ARC000125

means "manufactured in October 2010, 2.4" AR type, C specifications, serial number 000125"

·Made in China

   0J24ASC000125

means "manufactured in October 2010, 2.4" AS type, C specifications, serial number 000125"

2) Location of Serial No. 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	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	
12	D01	Display data(B)
13	D02	00h: Black
14	D03	D00:LSB D05:MSB
15	D04	Driver has internal gamma conversion.
16	D05	
17	D10	
18	D11	Display data(G)
19	D12	00h: Black
20	D13	D10:LSB D15:MSB
21	D14	Driver has internal gamma conversion.
22	D15	
23	D20	
24	D21	Display data(R)
25	D22	00h: Black
26	D23	D20:LSB D25:MSB
27	D24	Driver has internal gamma conversion.
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 make sure to check a consistency between pin assignment in "3.2 Outward Form" and
  your connector pin assignment when designing your circuit.
  Inconsistency in input signal assignment may cause a malfunction.
- Since FPC cable has gold plated terminals, gilt finish contact shoe connector is recommended.

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.
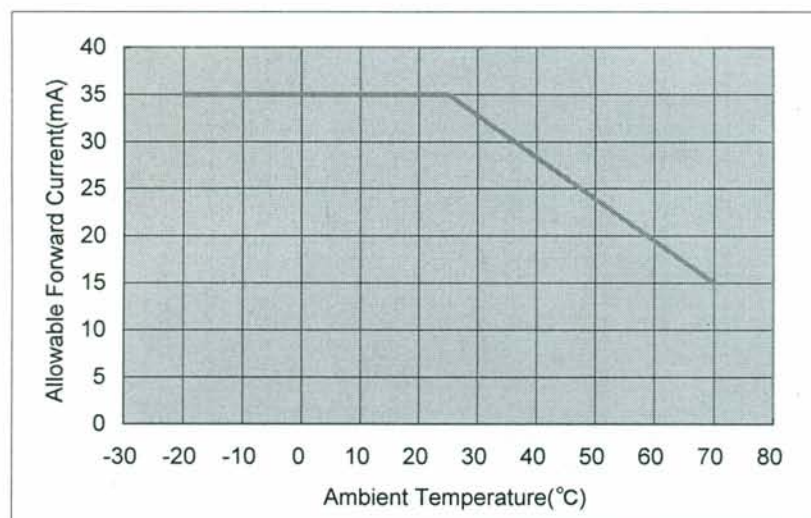
7. Characteristics

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	—	5.8	11.6	mA	VDD
Standby Current	IDDs	Other input with constant voltage	--	5.0	25	µA	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	—	6.0	6.6	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.
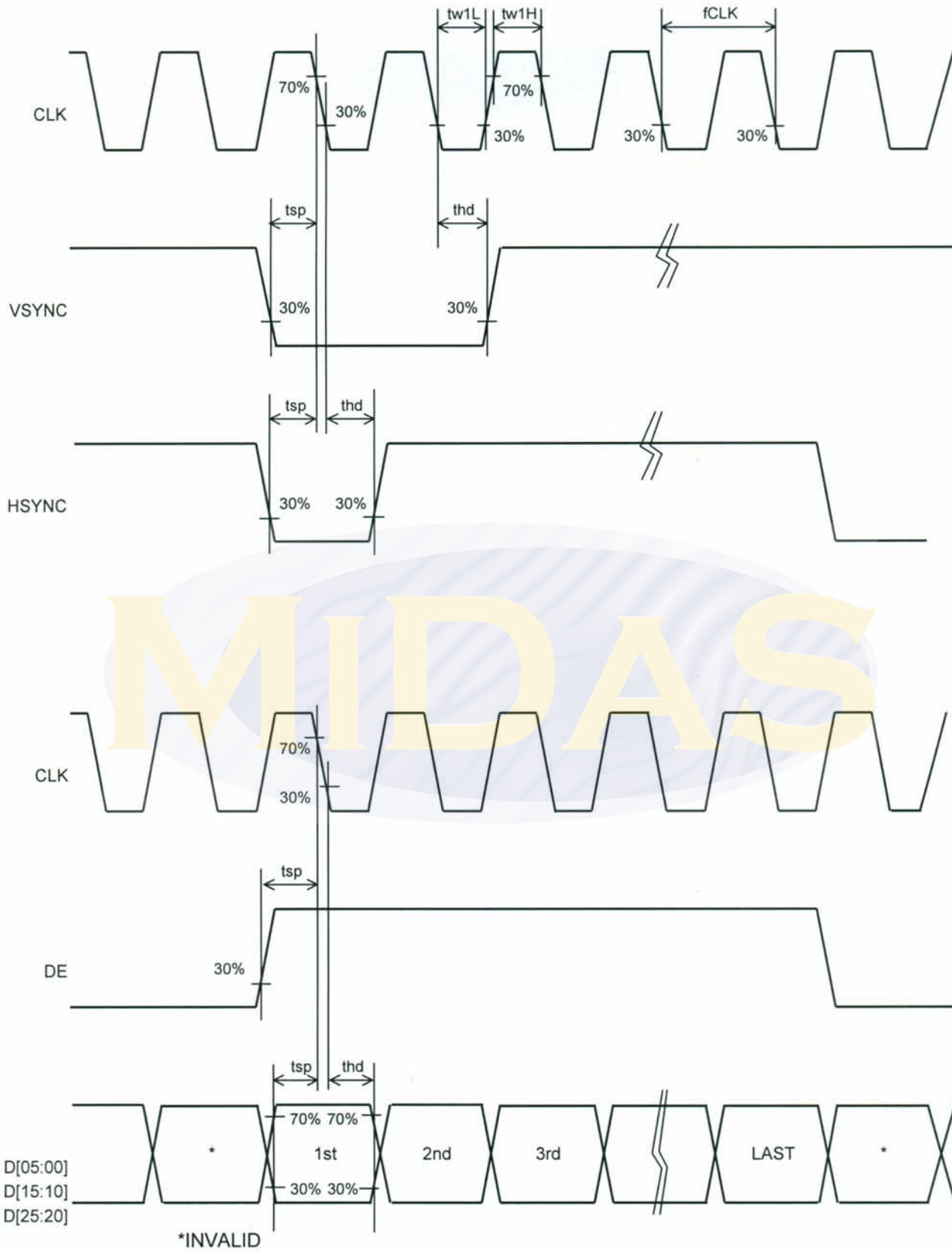
7.2 AC Characteristics

(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

*INVALID

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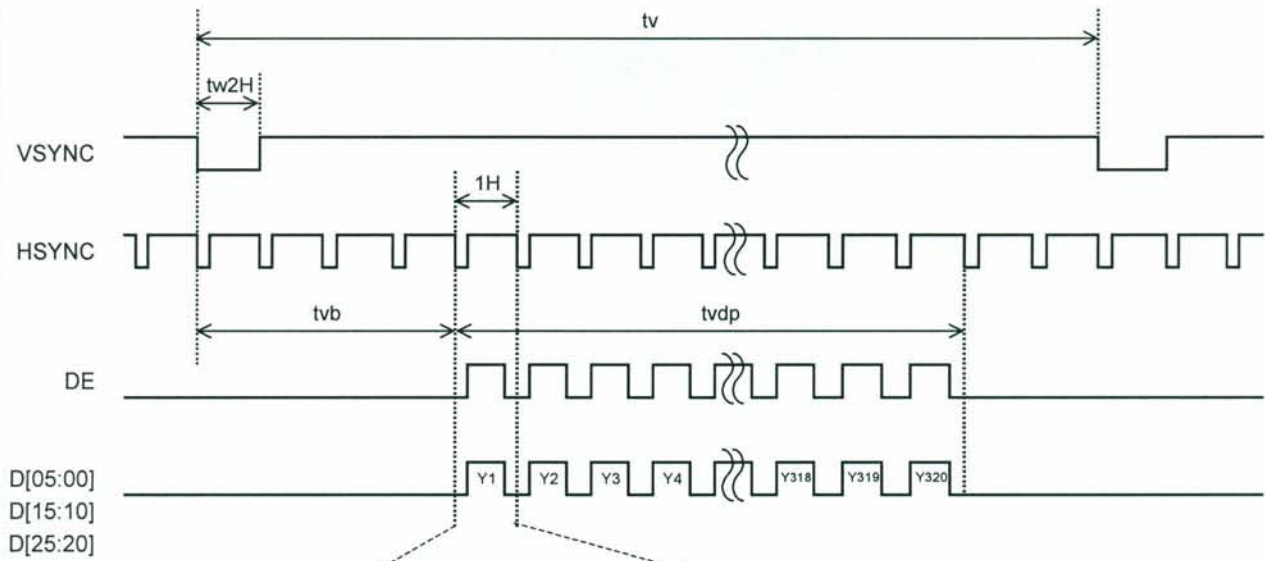
II. Horizontal Timing
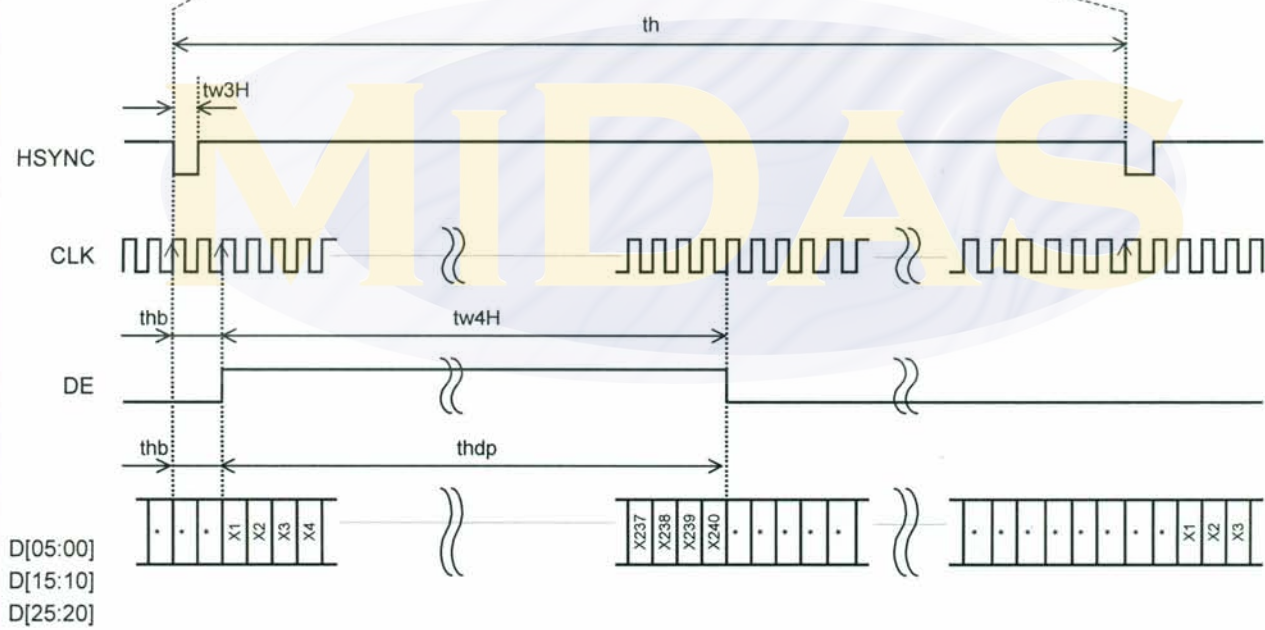
7.5 Example of Driving Timing Chart (fCLK=5.0MHz,5.6MHz,6.25MHz)

Ⅰ. Vertical Timing

325H

1H

VSYNC

1H

HSYNC

2H   320H

DE

D[05:00]   Y1   Y2   Y3   Y4   Y318 Y319 Y320
D[15:10]
D[25:20]

Ⅱ. Horizontal Timing

fCLK=5.0MHz:256CLK
fCLK=5.6MHz:287CLK
fCLK=6.25MHz:320CLK

1CLK

HSYNC

CLK

2CLK   240CLK

DE

2CLK   240CLK

D[05:00]   · · · X1 X2 X3 X4   X237 X238 X239 X240 · · · · · ·   · · · · · · · · X1 X2 X3
D[15:10]
D[25:20]
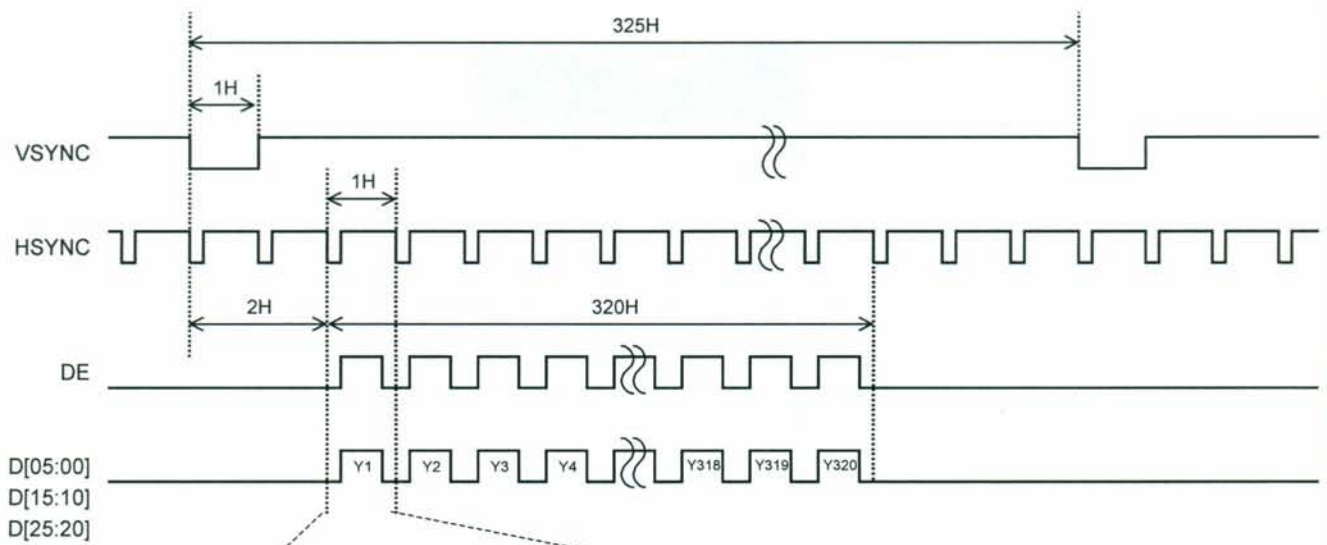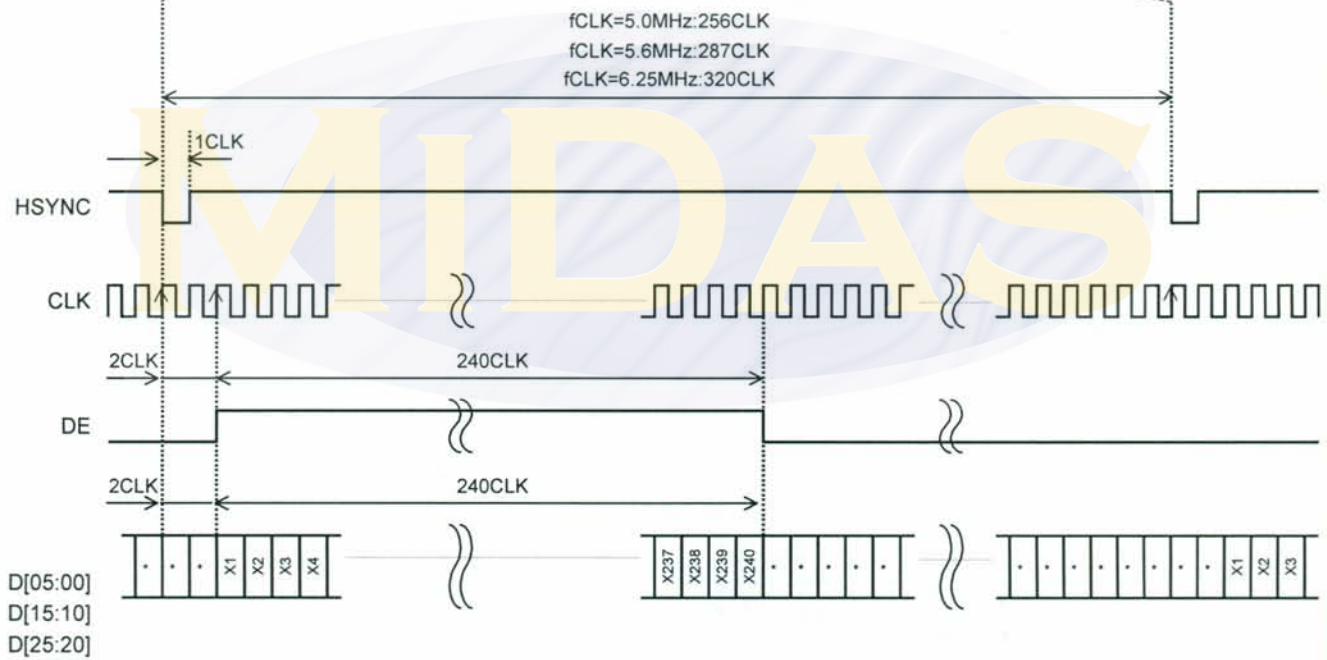
8. Description of Operation
8.1 Power ON/OFF sequence

VDD

Min 1ms*2

RESETB

STBYB

Over 20 frame *4

Min 0ms *3

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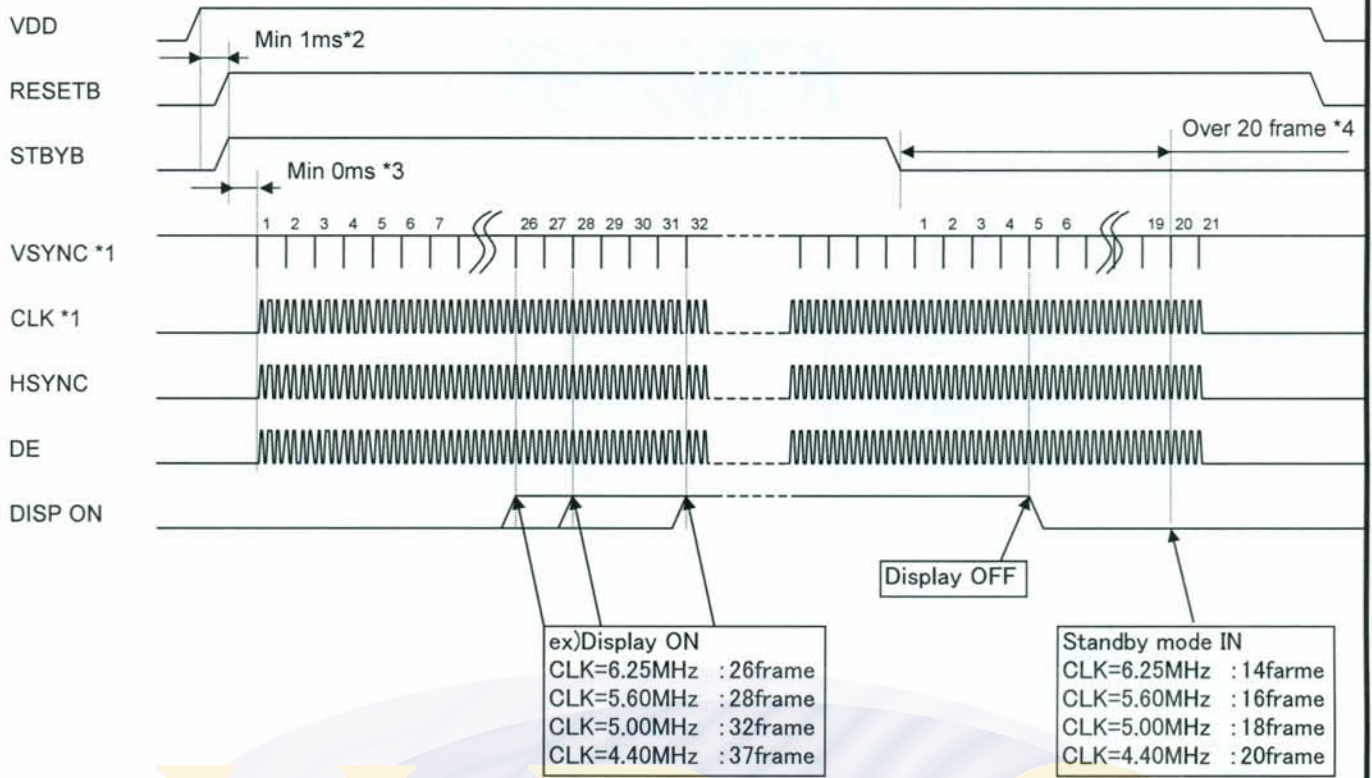
*1 DOTCLK is used for Gate aray CLK on FPC.
VSYNC is used for Gate array's inside counter.
It becomes the operation after CLK(DOTCLK),VSYNC input.

*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"
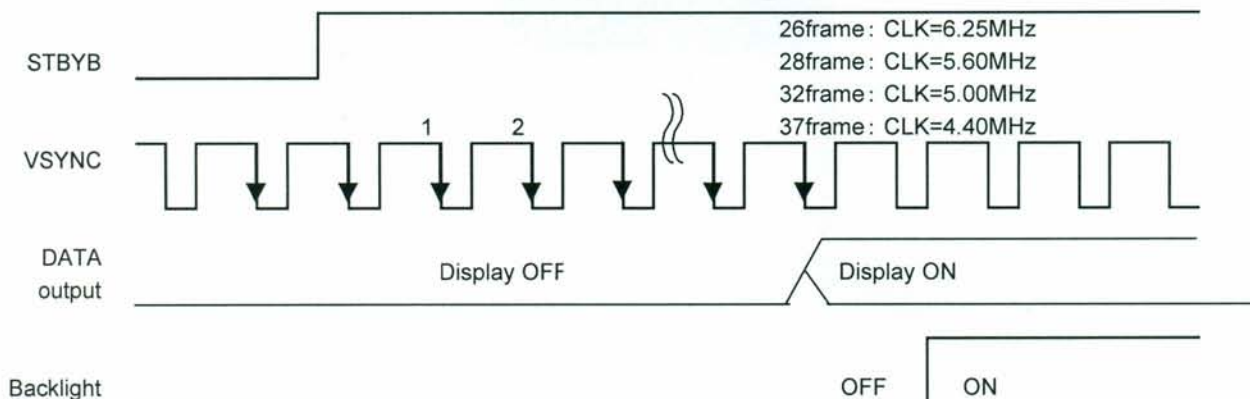But meanwhile, It is necessary to fix each signal to "H"or"L".

*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.

8.2 Display ON/OFF sequence

It explains the display sequence when display ON/OFF by the STBYB signal.
The following time will be needed according to the CLK cycle by the time the displayis begun from the standby release.

```
STBYB

                                                    26frame : CLK=6.25MHz
                                                    28frame : CLK=5.60MHz
                                                    32frame : CLK=5.00MHz
                        1      2                     37frame : CLK=4.40MHz
VSYNC

DATA
output          Display OFF                  Display ON

Backlight                                    OFF    ON
```
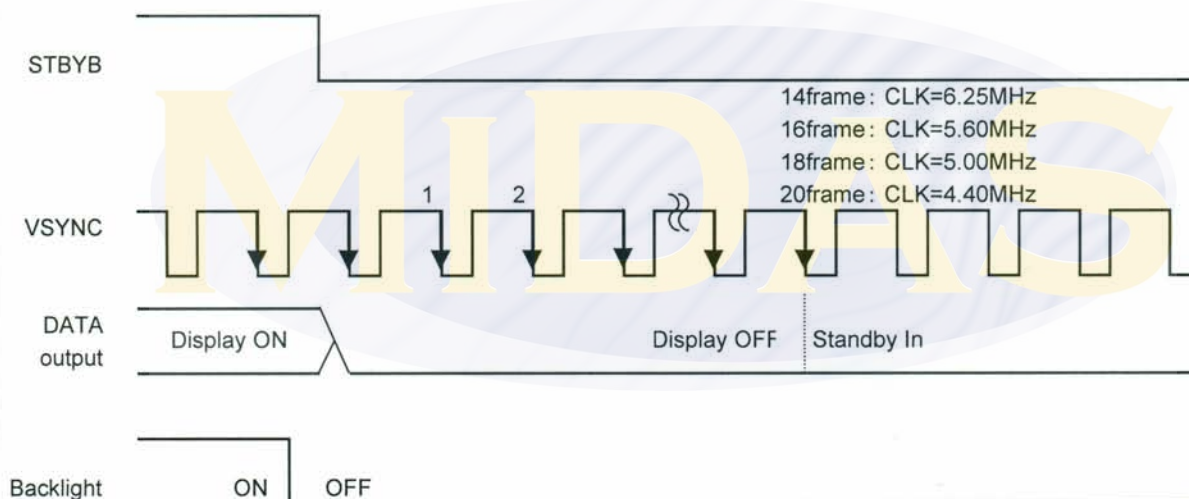
The following time will be needed according to the CLK cycle
by the time the standby sequence is ended from the standby setting.
Meanwhile, DOTCLK and the VSYNC signal should keep being supplied.
When DOTCLK and the VSYNC signal are stopped or the power supply is turned off to a regulated
frame or less, the afterimage might remain.

```
STBYB

                                                    14frame : CLK=6.25MHz
                                                    16frame : CLK=5.60MHz
                                                    18frame : CLK=5.00MHz
                        1      2                     20frame : CLK=4.40MHz
VSYNC

DATA
output     Display ON                    Display OFF   Standby In

Backlight     ON     OFF
```

8.3 Reset seqence

There is a limitation between the power supply turning on and the RESETB input.
Please defend the following conditions.

```
              90%
VDD                      |◄──T──►|
RESETB
```

T>1ms

9. LED Circuit

BLH

BLL
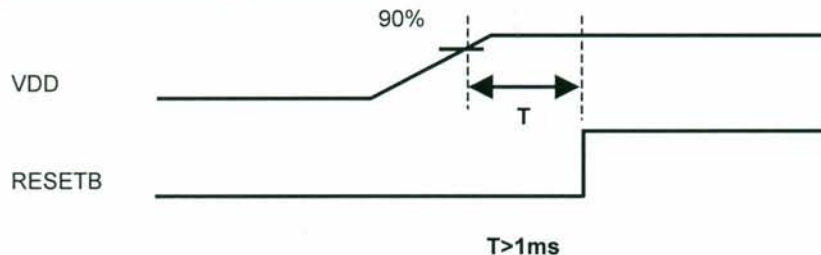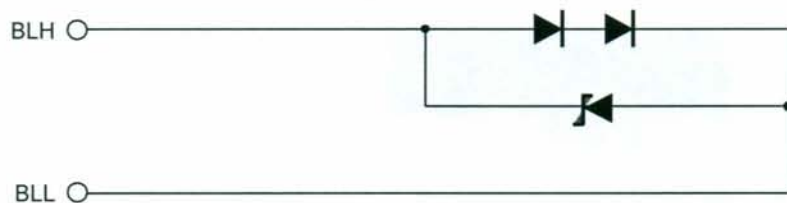
10. Characteristics

10.1 Optical Characteristics

< Measurement Condition >

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

Driving condition: VDD = 3.0V, VSS = 0V
Optimized VCOMDC
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				White V-T Curve					Reference
White Chromaticity	x		VLCD=0.7V	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	210	300	—	cd/m²	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.
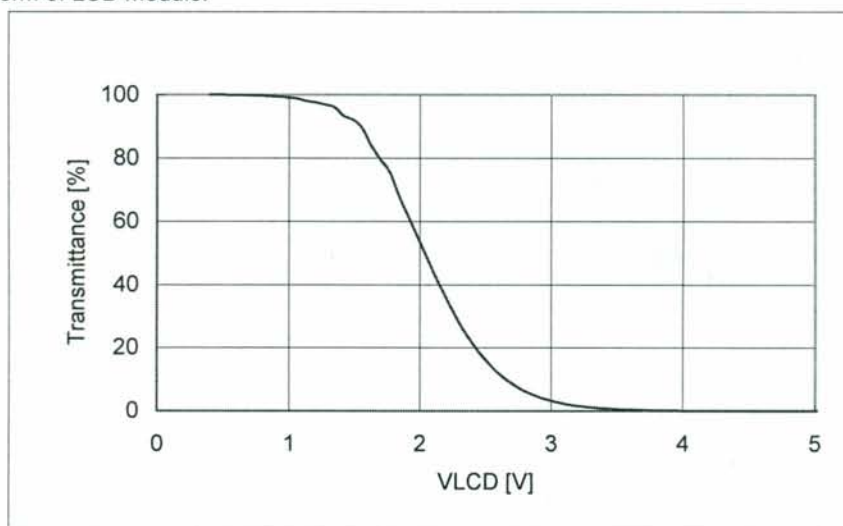
White V-T Curve
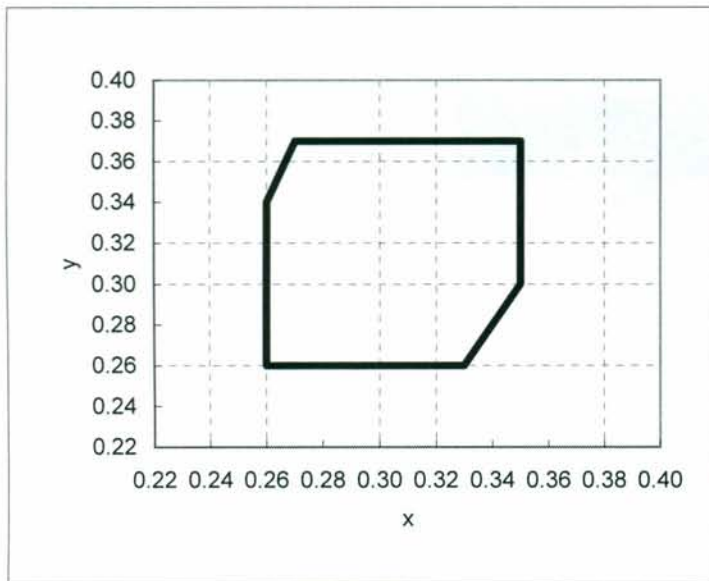
【White Chromaticity Range】

x	y
0.27	0.37
0.26	0.34
0.26	0.26
0.33	0.26
0.35	0.30
0.35	0.37

White Chromaticity Range

10.2 Temperature Characteristics

< Measurement Condition >

Measuring instruments:	CS1000(KONICA MINOLTA), LCD7000(OTSUKA ELECTRONICS)
Driving condition:	VDD = 3.0V, VSS = 0V
	Optimized VCOMDC
	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(3steps)
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
	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
	Foreign particle	Point-like	0.25mm<φ	N=0
			0.20<φ≦0.25mm	N≦2
			φ≦0.20mm	Ignored
		Liner	3.0mm<length and 0.08mm<width	N=0
			length≦3.0mm or width≦0.08mm	Ignored
	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	

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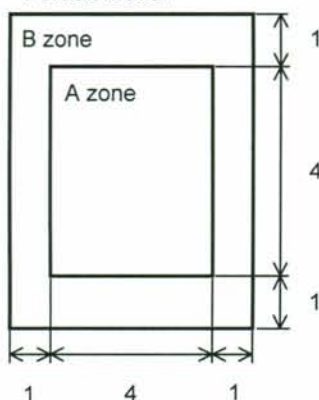
Division of A and B areas
  B area: Active area
  Dimensional ratio between A and B areas: 1: 4: 1 (Refer to the left figure)

11.2 Screen and Other Appearance

Testing conditions

Observation distance	30cm
Illuminance	1200~2000 lx

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

12. Reliability Test

Test item		Test condition	number of failures /number of examinations
Durability test	High temperature storage	Ta=80°C　　　　　　　　240H	0/3
	Low temperature storage	Ta=-30°C　　　　　　　　240H	0/3
	High temperature & high humidity storage	Ta=60°C, RH=90%　　　　240H non condensing　　　　　　　　　※	0/3
	High temperature operation	Tp=70°C　　　　　　　　240H	0/3
	Low temperature operation	Tp=-20°C　　　　　　　　240H	0/3
	High temp & humid operation	Tp=40°C, RH=90%　　　　240H non condensing　　　　　　　　　※	0/3
	Thermal shock storage	-30←→80°C(30min/30min)　　100 cycles	0/3
Mechanical environmental test	Electrostatic discharge test (Non operation)	Confirms to EIAJ ED-4701/300 C=200pF,R=0Ω,V=±200V Each 3 times of discharge on and power supply and other terminals.	0/3
	Surface discharge test (Non operation)	C=250pF, R=100Ω, V=±12kV Each 5 times of discharge in both polarities on the center of screen with the case grounded.	0/3
	Vibration test	Total amplitude 1.5mm, f=10~55Hz, X,Y,Z directions for each 2 hours	0/3
	Impact test	original jig (see next page)and make an impact with peak acceleration of 1000m/s2 for 6 msec with half sine-curve at 3 times to each X, Y, Z directions in conformance with JIS 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
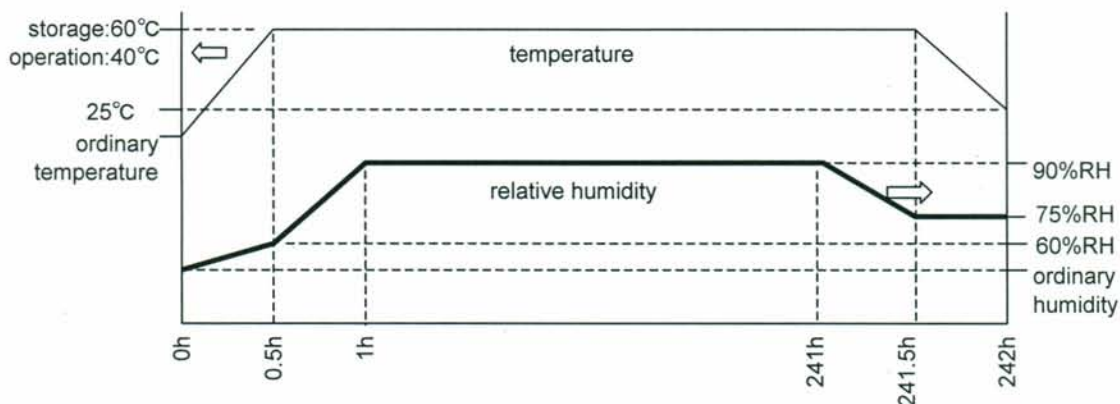(Pure water of over 10MΩ·cm shall be used.)

Table2.Reliability Criteria
　　Measure the parameters after leaving the monitor at the ordinary temperature
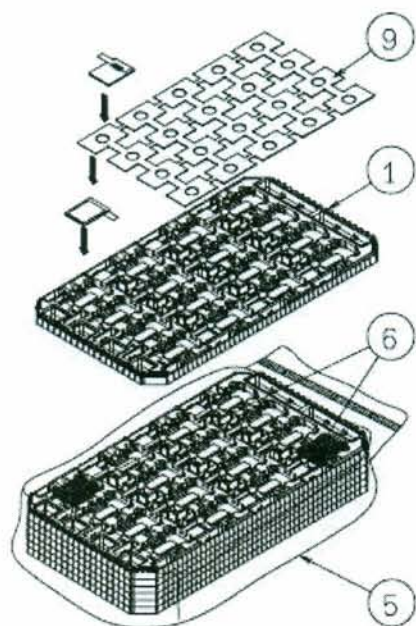　　　for 2 hours or more after the test completion.

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
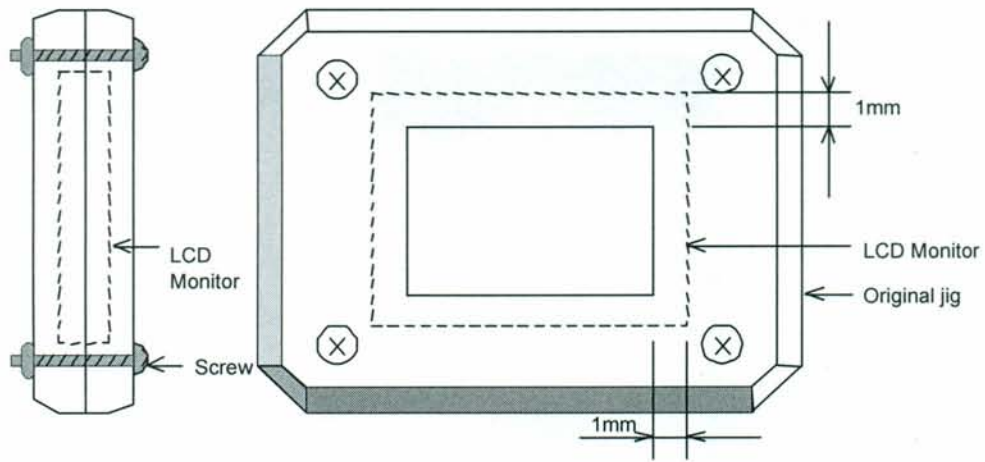
13. Packing Specifications

Step1. ・Each lower products are to be placed in one of the cut-outs of the tray
with the LCD surface facing upward, and foam-sheet is put on products.
・Upper products are to be placed with the LCD surface facing downward.

Step2. ・Trays be in a stack of 5.
・One empty tray is to be put on the top of stack of 5 packed trays.

Step3. ・2 packs of moisture absorbers are to be placed on the top tray
as shown in the drawing.
・Put piled trays into a sealing bag.

Step4. ・Vacuum and seal the sealing bag with the vacuum sealing machine.

Step5. ・The piled trays are to be wrapped with a bubble cushioning sheet.,
and to be fixed with adhesive tape.

Step6. ・A corrugated board is to be placed in the bottom of an outer carton.
・The wrapped trays are to be put on the corrugated board in the outer carton.

Step7. ・The outer carton is to be sealed in H-shape with packing tape
as shown in the drawing.
・The model number, quantity of products, and shipping date are to be
printed on the 2 opposite sides of the outer carton with black ink.
・In necessary, shipping labels or impression markings are to be
put on the outer carton.

Step8. ・The outer carton is to be inserted into a extra outer carton
with same orientation.
・The extra outer carton is to be sealed H-shape with packing tape
as shown in the drawing.

Step9. ・The model number, quantity of products, and shipping date are to be
printed on the 2 opposite sides of the extra outer carton with black ink.
・In necessary, shipping labels or impression markings are to be
put on the extra outer carton.
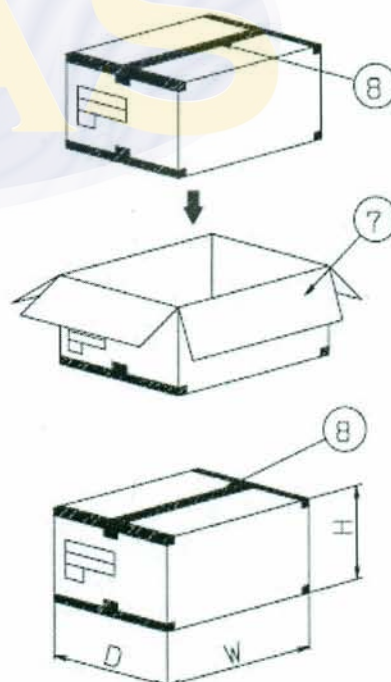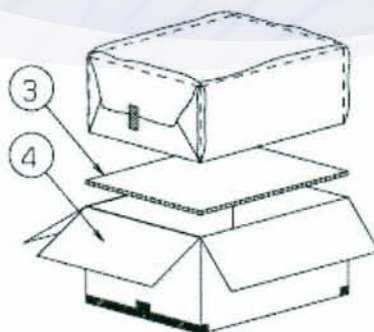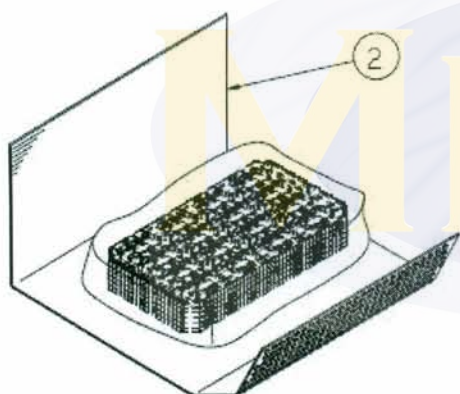
	Packing item name	Spec.,Material
①	TRAY	A-PET
②	B SHEET A	Anti-static air babble sheet
③	INNER BOARD	Corrugated cardboard
④	OUTER CARTON	Corrugated cardboard
⑤	SEALING BAG	
⑥	Drier	Moisture absorber
⑦	EXTRA OUTER CARTON	Corrugated cardboard
⑧	Packing tape	
⑧	FOAM SHEET	Anti-static polyethilene

Dimension of extra outer carton	
D : Approx.	(337mm)
W: Approx.	(618mm)
H: Approx.	(179mm)
Quantity of products packed in one carton:	200
Gross weight : Approx.	5.4Kg

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 scrap this products, follow a disposal standard of industrial waste
      that is legally valid in the community, country or territory where you reside.

(7)   Do not connect or disconnect this product while its application products is powered on.

(8)   Do not attempt to disassemble or modify this product as it is precision component.

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

(10) Since excess current protection circuit is not built in this TFT module, there is the possibility that
      LCD module or peripheral circuit become feverish and burned in case abnoramal operation is generated.
      We recommend you to add excess current protection circuit to power supply.

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

14.2 Precautions for Handling

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

2) Wear grounded wrist-straps and use electrostatic neutralization blowers to prevent static
charge and discharge when handling the TFT monitors as the LED in this TFT monitors
is damageable to electrostatic discharge.
Designate an appropriate operating area, and set equipment, tools, and machines properly
when handling this product.

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

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

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

6) Do not stain or damage the contacts of the FPC cable .
FPC cable needs to be inserted until it can reach to the end of connector slot.
During insertion, make sure to keep the cable in a horizontal position to avoid an oblique insertion.
Otherwise, it may cause poor contact or deteriorate reliability of the FPC cable.

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

3) Do not plug in or out the FPC cable while power supply is switch on.
Plug the FPC cable in and out while power supply is switched off.

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

5) Do not display a fixed image on the screen for a long time.
Use a screen-saver or other measures to avoid a fixed image displayed
on the screen for a long time. Otherwise, it may cause burn-in image
on the screen due the characteristics of liquid crystal.

14.4 Storage Condition for Shipping Cartons

Storage environment
- Temperature   0 to 40°C
- Humidity   60%RH or less
  No-condensing occurs under low temperature with high humidity condition.
- Atmosphere   No poisonous gas that can erode electronic components and/or wiring materials should be detected.
- Time period   3 months
- Unpacking   To prevent damages caused by static electricity, anti-static precautionary measures (e.g. earthing, anti-static mat) should be implemented.

- Maximum piling up   7 cartons

14.5 Precautions for Peeling off the Protective film

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

A) Work Environment
  a) Humidity: 50 to 70 %RH, Temperature15 to 27°C
  b) Operators should wear conductive shoes, conductive clothes, conductive finger tips and grounded wrist-straps. Anti-static treatment should be implemented to work area's floor.
  c) Use a room shielded against outside dust with sticky floor mat laid at the entrance to eliminate dirt.

B) Work Method
  The following procedures should taken to prevent the driver ICs from charging and discharging.
  a) Use an electrostatic neutralization blower to blow air on the TFT monitors to its lower right when 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 right 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.
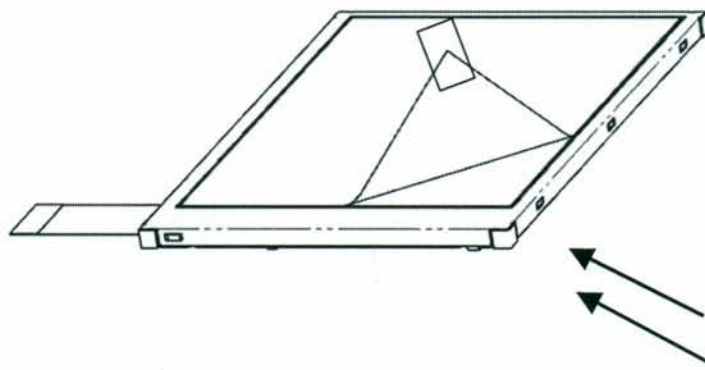
Direction of blowing air
(Optimize air direction and the distance)

APPENDIX

Reference Method for Measuring Optical Characteristics and Performance

1. Measurement Condition (Backlight ON)

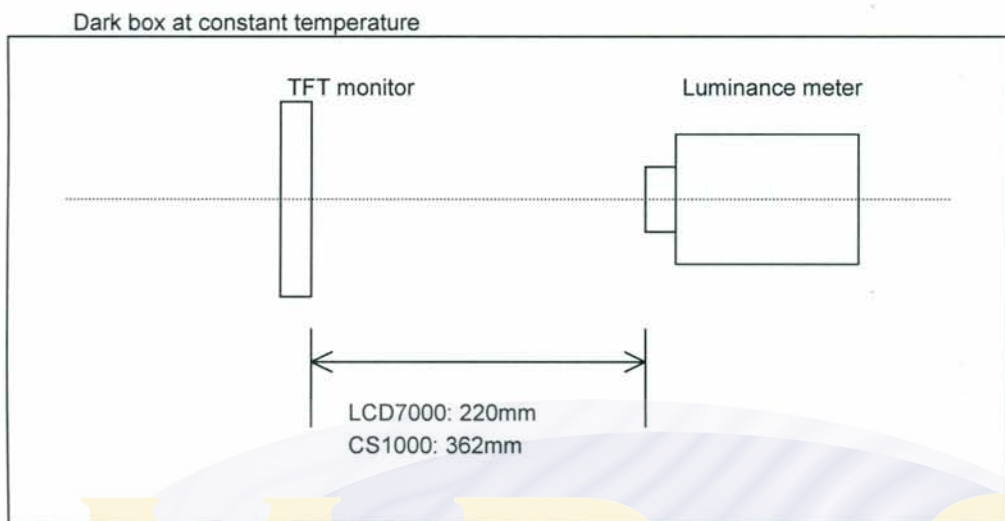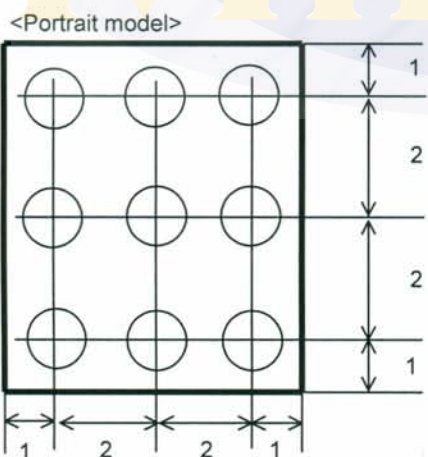|	
Measuring instruments:	CS1000 (KONICA MINOLTA), LCD7000(OTSUKA ELECTRONICS), EZcontrast160D (ELDIM)
Driving condition:	Refer to the section "Optical Characteristics"
Measured temperature:	25°C unless specified
Measurement system:	See the chart below. The luminance meter is placed on the normal line 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.

<Portrait model>

Dimensional ratio of active area

Backlight   IL=10mA
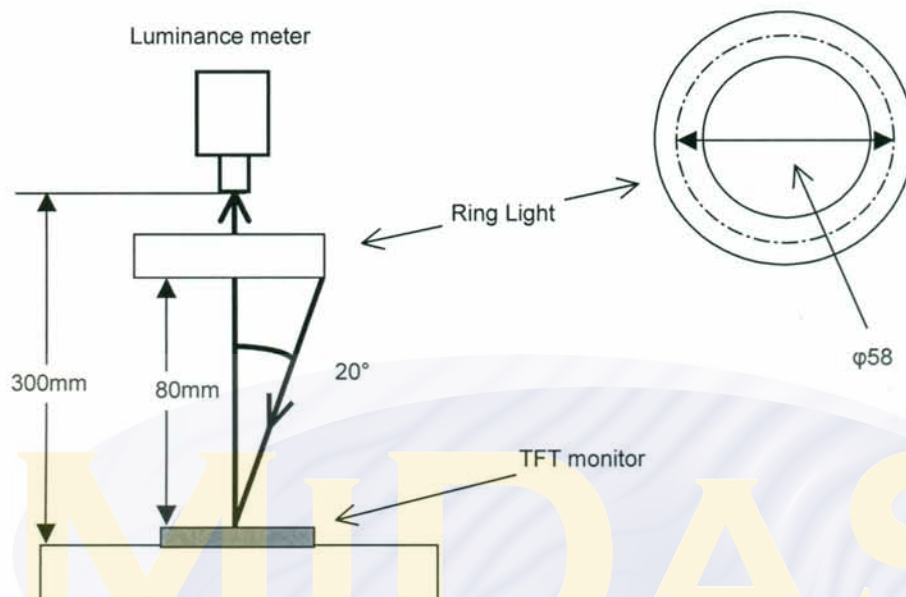
Measurement Condition (Contrast ratio Backlight OFF only)

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

300mm

80mm

20°

φ58

TFT monitor

SPECIFICATIONS No. ...

2. Test Method

Notice	Item	Test method	Measuring instrument	Remark
1	Response time	Measure output signal waveform by the luminance meter when raster of window pattern is changed from white to black and from black to white.	LCD7000	Black display 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: 8mmφ	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	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.	LCD7000	
5	White chromaticity	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 VCOMDC
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	