

Specifications for TFT -LCD Monitor

MODEL : COM43T4123KTY

APPROVED BY

Signature :

Name :





Section :

Title :

Date :

CASIO®

REVISIONS

DATE	PAGE	CONTENTS	
Dec.1,2006			First issue.
Dec.20,2006	P.6 P.13 P.21 P.23	 x5  x1  x1  x1	Add W tape. Add electrical , mechanical & reliability and optical characteristics in touch panel. Change resistance mark in "12. Driving Circuit Example(module)". Change of Center brightness value in "15.1Optical characteristics".

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1.APPLICATIONS

These specifications apply to 10.9cm (4.3inch) TFT-LCD monitor products, which are intended for civilian use.

- As to the use of these products, and/or the use of the information and/or the drawings in these specifications, CASIO shall not guarantee or grant Samsung Electronics Co., Ltd. to use or exercise an industrial right, intellectual property, or any other rights of a third party. Therefore CASIO shall not be liable to infringement of rights of a third party by Samsung Electronics Co., Ltd. These specifications contain CASIO's proprietary information that is protected by the copyright. Therefore, Samsung Electronics Co., Ltd. shall treat this information with utmost care, and shall not duplicate any part of these specifications without prior permission from CASIO.
- If these products will be used in an application where a higher level of reliability and safety is needed, in terms of function and accuracy, such as transportation equipment (aircraft, train, automobile, etc.), disaster-prevention, security equipment, or various safety equipment, Samsung Electronics Co., Ltd. shall contact CASIO for technical assistance in advance.
- These products shall not be used in critical application that requires the highest level of reliability and safety, such as aerospace equipment, main lines of telecommunications equipment, control equipment for nuclear plants, or medical life-support equipment.
- CASIO shall not be liable for any damage arising from the misuse, abuse, and/or miss-operation of these products that do not meet with the operating conditions and precautions described in these specifications.
- If any issues arise as to the information provided in these specifications or any other information, CASIO will discuss them with Samsung Electronics Co., Ltd. in good faith and try to seek solutions or improvements.
- Casio shall not be obliged to burden the responsibility for destruction by static electricity broken out in your processes, such as the protection film peeling off process.
- CASIO apply these specifications, only when carried in your company Global Positioning System product. When used for the other use, since CASIO do not do, please understand a guarantee entirely.
- Complaint about non-conformance to the specifications on this document shall be notified to CASIO within six months from the date of production or three months from the date of shipment, together with return of the actual products. After the expiration date designated above, CASIO shall have the right to reject any complaint.

2.GENERAL SPECIFICATIONS

Item	Specification	Remark
Display type	TN type 16,777,216 Colors, Transmissive mode Normally white	
Driving method	a-Si TFT Active matrix Line-scanning, Non-interlace	
Dot arrangement	RGB stripe arrangement	Refer to figure 1
Input signal type	8-bit RGB, parallel input	
Backlight	High bright white LED	
Touch panel	Resistance type, transmissive analog tablet	
Viewing		

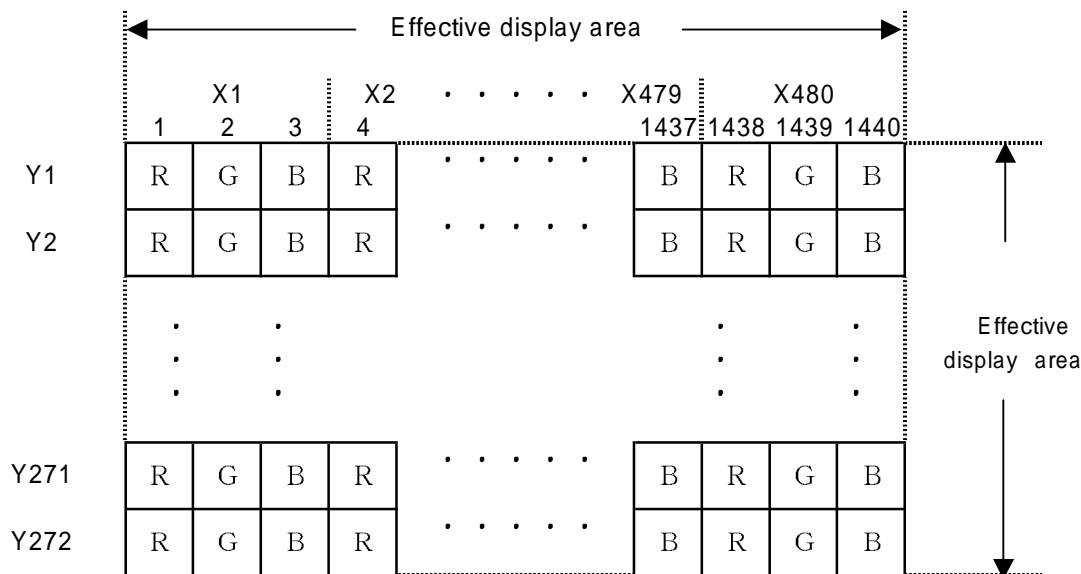
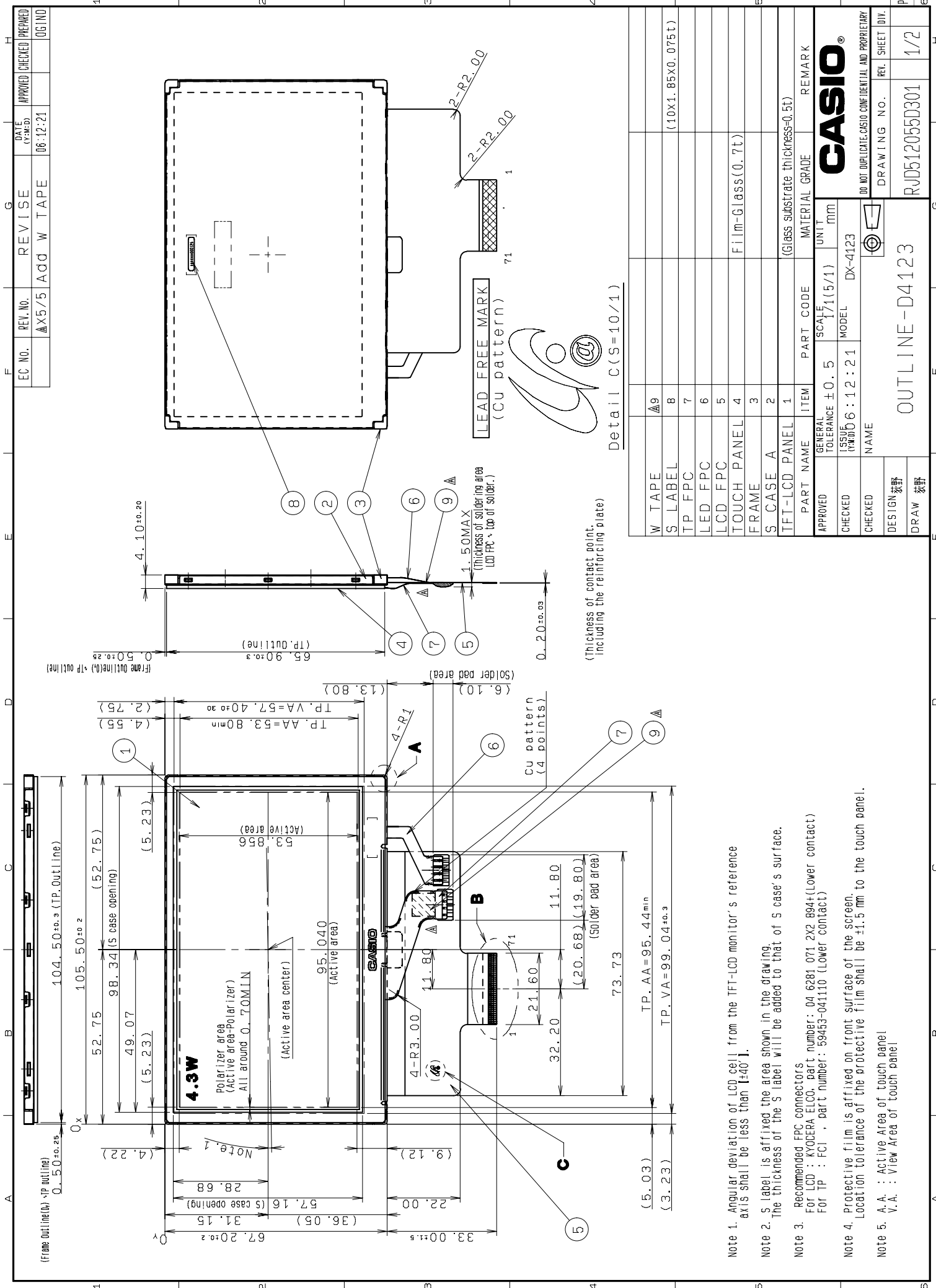


Figure-1 Dot arrangement (down for FPC)

3. DIMENSIONS AND OUTWARD FORM

3.1 Dimensions

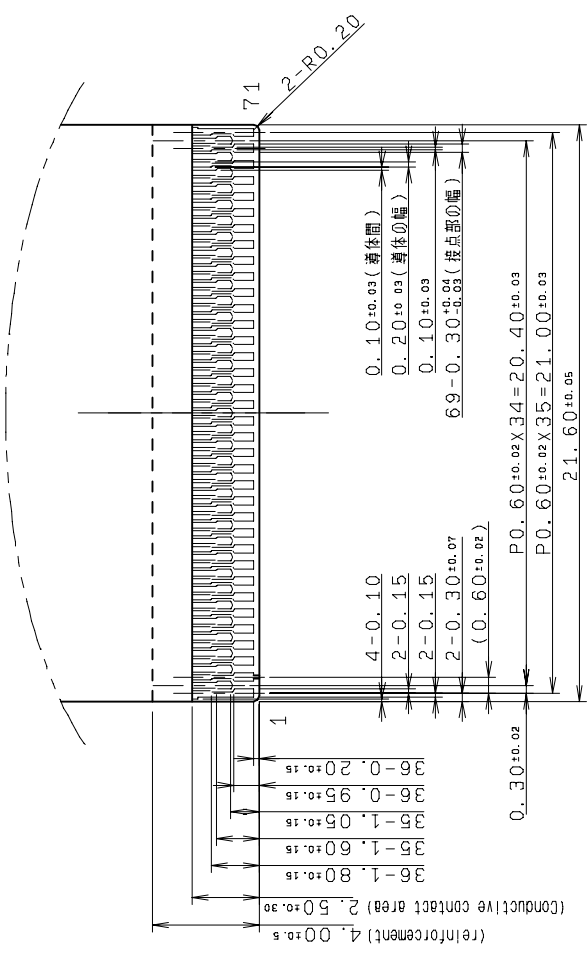
Item	Specification	Unit	Remarks
Monitor outline dimensions	105.50[H] ×67.20[V] ×4.10[D]	mm	Cable partial convex size is not included
Effective display area	95.040[H] ×53.856[V]	mm	Diagonal: 109.22mm
Number of dots	1440[H] ×272[V]	Dot	
Dot pitch	66.0[H] ×198.0[V]	μm	
Hardness of TouchPanel surface	3	H	It complies with the way of test method JIS K5400. However, the adding weight is set to 4.9N.
Weight	54.4	g	



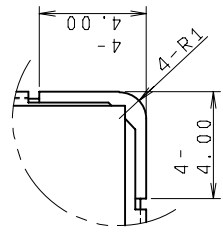
- Note 1. Angular deviation of LCD cell from the TFT-LCD monitor's reference axis shall be less than [±40]°.
- Note 2. S label is affixed the area shown in the drawing.
The thickness of the S label will be added to that of S case's surface.
- Note 3. Recommended FPC connectors
For LCD : KYOCERA ELCO, part number: D4 628J 071 2X2 894+(Lower contact)
For TP : FCI , part number: 59453-041110 (Lower Contact)
- 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 touch panel.
- Note 5. A.A : Active Area of touch panel
V.A : View Area of touch panel

EC NO.	REV. NO.	REVISE	DATE (Y/M/D)	APPROVED	CHECKED	PREPARED
	▲X0/5	Add W TAPE	06:12:21			05IND

Detail B(S=5/1)



Detail A(S=5/1)



APPROVED	GENERAL TOLERANCE ±0.5	SCALE 1/1(5/1)	UNIT mm
CHECKED	ISSUE (発行) 6:12:21	MODEL DX-4123	
CHECKED	NAME		
DESIGN 抜野			
DRAW 抜野			
	OUTLINE-D4123		
	DRAWING NO.	REV. SHEET DIV.	PART
	RJD512055D301	2/2	2/2

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3.3 SERIAL LABEL(S LABEL)

1) Contents

lot month (1digit), module model code (4digits), and serial number of the module (6digits).

* Content of Characters

* * * * * * * * * * * * *
 _ _ _ _
 a b c d

Content of Characters				
a	The unit's place of the year			
b	Production Lot (month)	Jan.-A Feb.-B Mar.-C Apr.-D	May.-E Jun.-F July.-G Aug.-H	Sept.-I Oct.-J Nov.-K Dec.-L
c	Model code	43KY(made in Japan) , 43LY(made in China)		
d	Serial Number			

* Example of SERIAL LABEL(S LABEL)

• In case of COM43T4123KTY

6J43KY500125

means Oct 2006, 4.3"K type, Y version No.000125

• In case of COM43T4123LTY

6J43LY500125

means Oct 2006, 4.3"L type, Y version No.000125

2) SERIAL LABEL(S LABEL) location

Refer to Subsection 3.2 Outward Form.

4.INTERFACE TERMINALS ASSIGNMENT

No.	Symbol	Functions
1	VSS	ground
2	AVDD	Power supply for analog circuit
3	VDD	Power supply for logic circuit.
4	VSS	ground
5	POCB	Power on clear (Low: Active)
6	DE	Horizontal sync control signal
7	VSYNC	Vertical sync signal
8	HSYNC	Horizontal sync signal
9	DISP	Display on/off control signal Lo:display off, Hi:display on
10	CLK	Clock signal for data latching and internal counter of the timing controller
11	V13	Source driver output level voltage(negative case Lo)
12	V7	Source driver output level voltage(negative case Hi)
13	V6	Source driver output level voltage(positive case Lo)
14	V0	Source driver output level voltage(positive case Hi)
15	D27	Display data(B) 00h: Black D20:LSB D27:MSB Driver has internal gamma conversion.
16	D26	
17	D25	
18	D24	
19	D23	
20	D22	
21	D21	
22	D20	
23	D17	Display data(G) 00h: Black D10:LSB D17:MSB Driver has internal gamma conversion.
24	D16	
25	D15	
26	D14	
27	D13	
28	D12	
29	D11	
30	D10	
31	D07	Display data(R) 00h: Black D00:LSB D07:MSB Driver has internal gamma conversion.
32	D06	
33	D05	
34	D04	
35	D03	
36	D02	
37	D01	
38	D00	
39	COML	Output pin of regulator for COMOUT out put L level
40	COMH	Output pin of regulator for COMOUT out put H level
41	COMDC	Adjust the amplitude Voltage level for COMOUT output
42	COMPP	Adjust the amplitude Voltage level for COMOUT output
43	VDD2	output pin of internal regulator circuit
44	VDD3	Output pin of internal reference voltage
45	OSCIN	Terminal for internal oscillation circuit
46	OSCOU	Terminal for internal oscillation circuit
47	VSS	ground

No.	Symbol	Functions
48	VDD	Power supply for logic circuit.
49	AVDD	Power supply for analog circuit
50	C5P	Connection terminal for capacitor for charge pump
51	C5M	Connection terminal for capacitor for charge pump
52	VDD4	Negative power supply
53	VGH	Positive voltage for gate driver
54	C2P	Connection terminal for capacitor for charge pump
55	C1AP	Connection terminal for capacitor for charge pump
56	C1BP	Connection terminal for capacitor for charge pump
57	C1M	Connection terminal for capacitor for charge pump
58	C2M	Connection terminal for capacitor for charge pump
59	C4P	Connection terminal for capacitor for charge pump
60	C3P	Connection terminal for capacitor for charge pump
61	C3M	Connection terminal for capacitor for charge pump
62	C4M	Connection terminal for capacitor for charge pump
63	VGL	Negative voltage for gate driver
64	COMOUT	Output signal for common electrode
65	VCOM	Input signal for common electrode
66	XL	X-axis left terminal
67	YD	Y-axis lower terminal
68	XR	X-axis right terminal
69	YU	Y-axis upper terminal
70	BLL	Backlight drive (cathode side)
71	BLH	Backlight drive (anode side)

* Recommended connector: Kyocera Elco, 6281 series (04 6281 071 2X2 829+) This terminal uses the gilding.

* Please refer to the "Outline drawing" for terminal order.

*LCD-FPC's terminal uses the gilding.

5. ABSOLUTE MAXIMUM RATINGS

VSS=0V

Item	Symbol	Condition	Rating		Unit	Applicable terminals
			MIN	MAX		
Supply voltage for logic	VDD	Ta=25°C	-0.3	6.0	V	VDD
Supply voltage for analog	AVDD	Note1	-0.3	6.0	V	AVDD
Input voltage for logic	VI		-0.3	VDD+0.3	V	POCB,DE,VSYN,HSYN,DISP,CLK,INV,CLK_REV,D[27:00]
Common electrode voltage	COMDC		0.1	AVDD-1	V	COMDC
	COMPP		0.1	AVDD-1	V	COMPP
	VCOM		-6.0	10.0	V	VCOM
LED direction current of order	IF	Ta = 25°C	—	35	mA	BLH,BLL
		Ta = 70°C	—	15		
Touch Panel Input Voltage			—	7	V	XL,XR,YU,YL
Storage temperature	Tstg		-20	80	°C	
Storage humidity Range	Hstg	Ta ≤ 40°C	20	80	%	
		Ta > 40°C	It is a thing without dew condensation blow in 40°C 80% RH of the amount of moisture.			

Note1 : Please refer to the "Power on and off sequence section of this document.

Note2 : Apply the 1KHz Sine wave. Insert 10Ω min resistor. Duration: Within 1 hour.

6.RECOMMENDED OPERATING CONDITIONS

VSS=0V

Item	Symbol	Condition	Rating			Unit	Applicable terminals	
			MIN	TYP	MAX			
Supply voltage for logic	VDD		2.7	3.0	3.6	V	VDD	
Supply voltage for analog	AVDD		4.8	5.0	5.2	V	AVDD	
Common electrode signal	Amplitude	VCOMPP	COMH-COML	2.00	—	7.80	Vp-p	COMH Note3 COML
	Center voltage Note 1	Vcom /c		0.38	2.19	4.00	V	COMDC
Output amplitude for source driver (Contrast)			0.50	—	4.50	Vp-p		
Output amplitude for source driver (Contrast)	VA1	VA1>VB1	2.50	4.50	AVDD-0.2	V	V0	
	VB1		VSS+0.2	0.20	2.50		V6	
	VA2	VA2>VB2	2.50	4.20	AVDD-0.2		V7	
	VB2		VSS+0.2	0.50	2.50		V13	
External resistance for oscillator			-	75	-	KΩ	OSCOU,OSCIN	
Operational temperature	Note2	Top	-10	+25	+70	°C	Touch Panel surface temp.	

Note 1: This range indicates the most probable range for the optimal setting for VCOMDC.

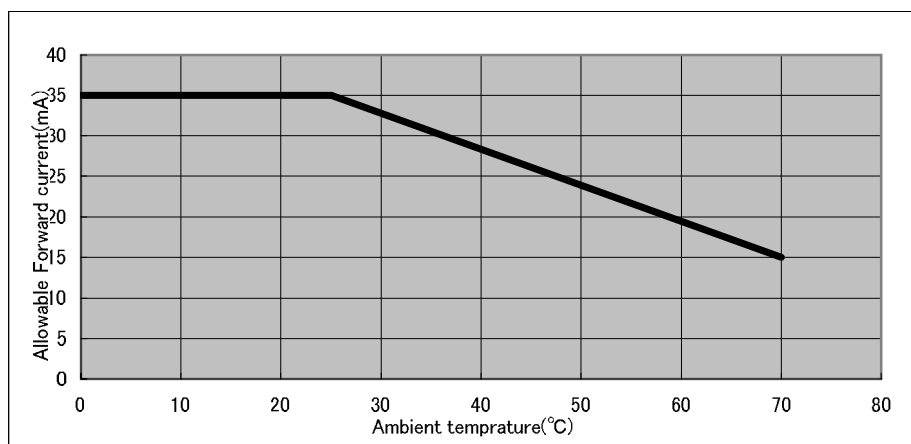
It does not mean that the optimal settings for VCOMDC for all monitors will be in this range.

VCOMDC should be optimized by viewing/using the monitor.

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.

Note 3: COMH=COMDC + COMPP,COML=COMDC - COMPP



7. Characteristics**7.1 DC Characteristics****7.1.1 Module Block**

If not specified, Ta=25°C, VDD=3.0V, AVDD=5.0V, VSS=0V

Item	Symbol	Condition	Rating			Unit	Applicable terminals
			MIN	TYP	MAX		
Input voltage for logic	VIH		0.7*VDD	—	VDD	V	POCB,DE,VSYNCHSYNC,DISP,CLK INV,CLK_REV D[27:00]
	VIL		0	—	0.3*VDD	V	
Pull up resistor value	Rpu		150	—	—	kΩ	INV,CLK_REV RESETB,DISP
Pull down resistor value	Rpu		150	—	—	kΩ	DE,D[27:00]
Current consumption	IDD	fCLK=9.00MHz	—	3.3	6.6	mA	VDD
	IAVDD	Color bar display	—	15.0	30.0	mA	AVDD

7.1.2 Backlight Block

Ta=25°C

Item	Symbol	Condition	Rating			Unit	Applicable terminals
			MIN	TYP	MAX		
Forward current	IL25	Ta=25°C	—	20.0	35.0	mA	BLH,BLL
	IL70	Ta=70°C	—	—	15.0	mA	
Forward voltage	VL	Ta=25°C, IL=20.0mA	—	32.0	35.0	V	

**7.1.3 Touch Panel****Electrial Characteristics**

Ta=25°C

Item	Symbol	Condition	Rating			Unit	Applicable terminals
			MIN	TYP	MAX		
Linearity	LE		—	—	±2.0	%	XR,XL,YU,YL
Insulation Resistance	RI	DC 25V	20	—	—	MΩ	
Terminal Resistance		X	400	—	1800	Ω	XR,XL
		Y	100	—	700		YU,YL
Rated Voltage		DC	—	—	5	V	XR,XL,YU,YL
ON/OFF Chattering		R0.8mm polyacetal pen	—	—	10	ms	XR,XL,YU,YL

Mechanical&Reliability Characteristics

Item	Rating			Unit	Note
	MIN	TYP	MAX		
Operation Force	0.05	—	1.47	N	R0.8mm Polyacetal pen or finger
Durability (Tapping life by finger)	1000000	—	—	times	Tapping at same points by silicon rubber •shape of rubber end-R8, Hardness60 ° •Load-2.45N •Frequency-3Hz
Surface hardness of Film (pencil hardness)	3	—	—	H	JIS K5400

Optical Characteristics

Item	Rating			Unit	Note
	MIN	TYP	MAX		
Transparency	80	82	—	%	JIS K7105

7.2 AC Characteristics

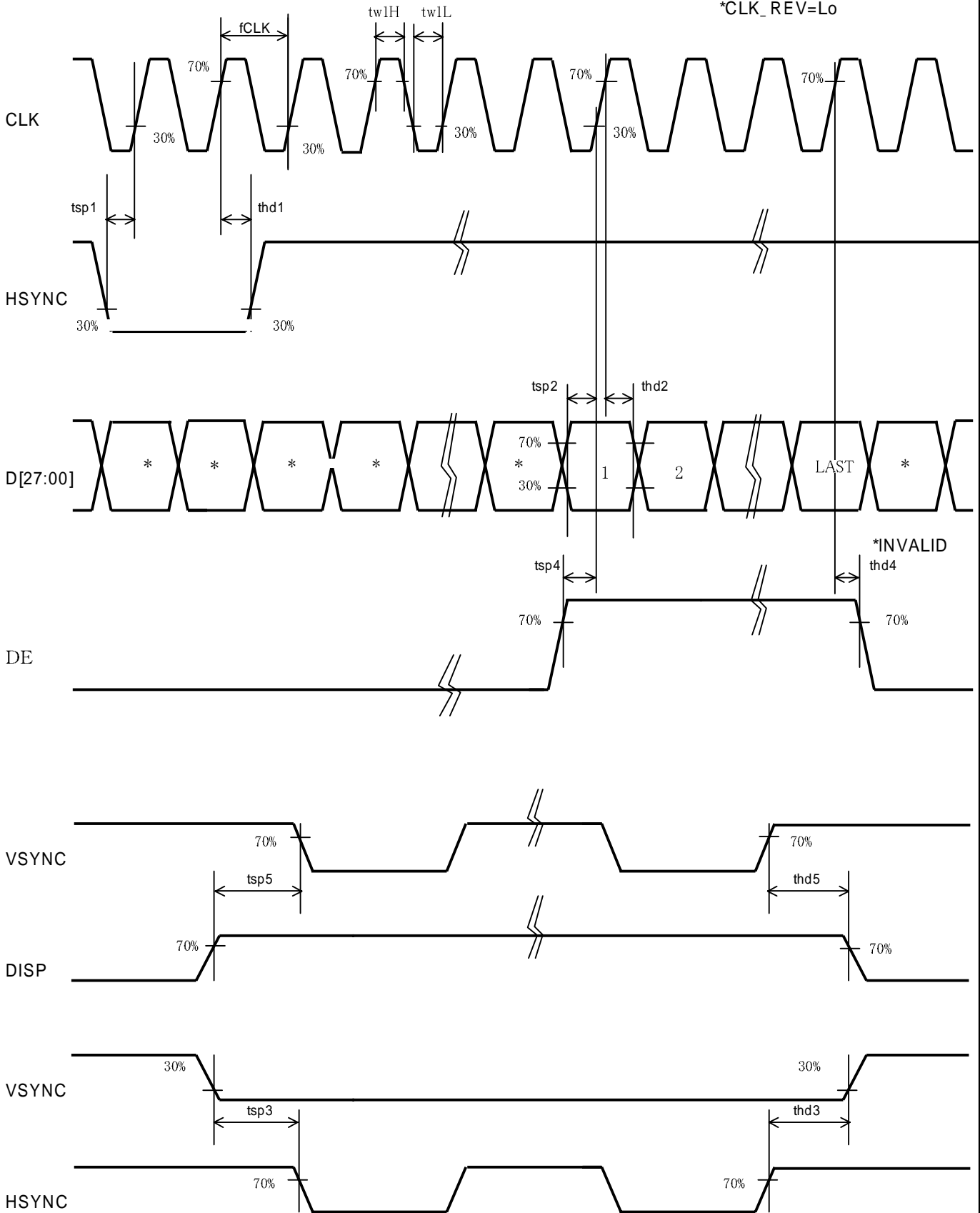
Common Item

If not specified, Ta=25°C, VDD=3.0V, AVDD=5.0V, VSS=0V

Item	Symbol	Condition	Rating			Unit	Applicable terminals
			MIN	TYP	MAX		
Clock Low period	tw1L	0.3 \times DD or shorter	26.7	—	—	ns	CLK
Clock High period	tw1H	0.7 \times DD or longer	26.7	—	—	ns	CLK
HSYNC setup time	tsp1		10	—	—	ns	HSYNC, CLK
HSYNC hold time	thd1		10	—	—	ns	HSYNC, CLK
Data setup time	tsp2		10	—	—	ns	D[27:00], CLK
Data hold time	thd2		10	—	—	ns	
VSYNC setup time1	tsp3		10	—	—	ns	VSYNC, CLK
VSYNC hold time1	thd3		10	—	—	ns	VSYNC, CLK
DE setup time	tsp4		10	—	—	ns	DE, CLK
DE hold time	thd4		10	—	—	ns	DE, CLK
DISP setup time	tsp5		10	—	—	ns	DISP, CLK
DISP hold time	thd5		10	—	—	ns	DISP, CLK
Clock frequency	fCLK		—	9.00	15	MHz	CLK

Switching Characteristics Wave Form

*CLK_REV=Lo



Note : Regulation between 50% of each signal amplitude

8. Input timing

8. 1 Input timing

If not specified, Ta=25°C, VDD=3.0V, AVDD=5.0V, VSS=0V

Item	Symbol	Rating			Unit	Applicable terminals
		MIN.	TYP.	MAX.		
HSYNC pulse width	tw2H	2	41	—	CLK	HSYNC,CLK
VSYNC pulse width	tw3H	1	10	—	H	VSYNC,HSYNC
VSYNC frequency	fVSYNC	—	59.94	—	Hz	VSYNC
HSYNC frequency	fHSYNC	—	17.14	—	KHz	HSYNC
Clock frequency	fCLK	—	9.00	15	MHz	CLK
HSYNC signal cycle time	th	—	525	—	CLK	HSYNC,CLK
Horizontal display period	thdp	—	480	—	CLK	HSYNC,CLK
Horizontal front porch	thf	2	-	—	CLK	HSYNC,CLK
Horizontal back porch	thb	2	2	—	CLK	HSYNC,CLK
VSYNC signal cycle time	tv	—	286	—	H	VSYNC,HSYNC
Vartical display period	tvdp	—	272	—	H	VSYNC,HSYNC
Vartical front porch	tvf	1	2	—	H	VSYNC,HSYNC
Vartical back porch	tvb	1	2	—	H	VSYNC,HSYNC

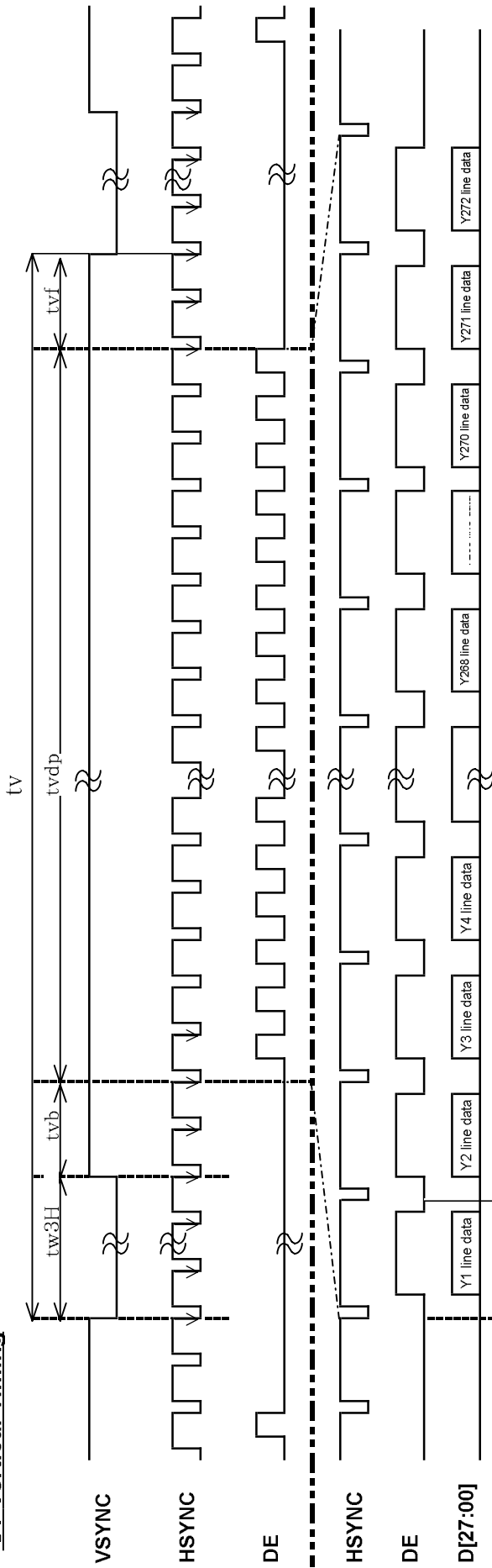
* The characteristic of this item is recommended standard.

Please use it after it confirms it enough like the display fineness etc. when it comes off from this characteristic and it is used.

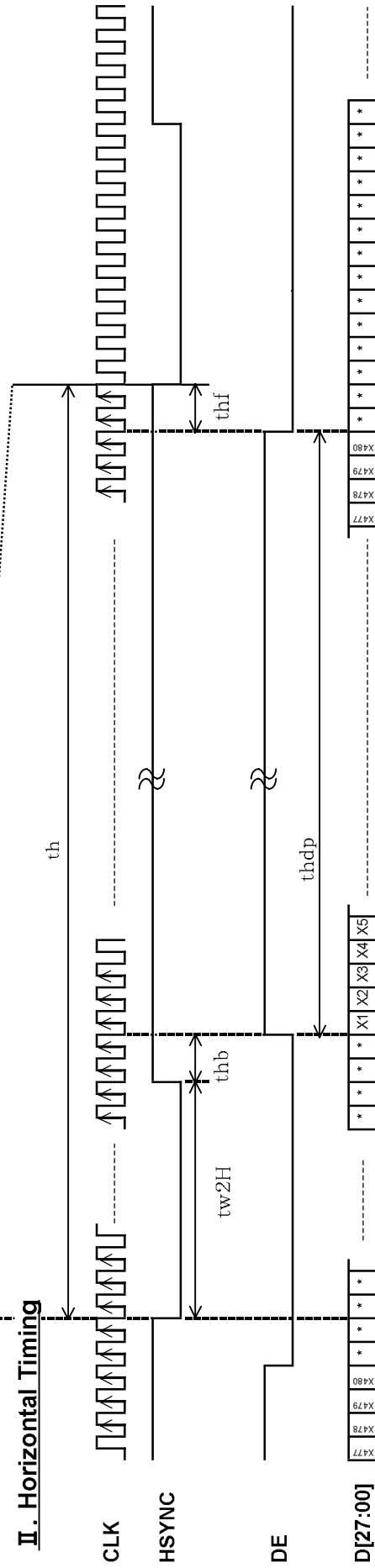
Note: ※1 thdp=480CLK, thf=2CLK, tw2H=41CLK, thb=2CLK, thf+tw2H+thb > 44

8.2 Input timing chart (In case of normal display, fCLK = 9.00MHz)

I. Vertical Timing



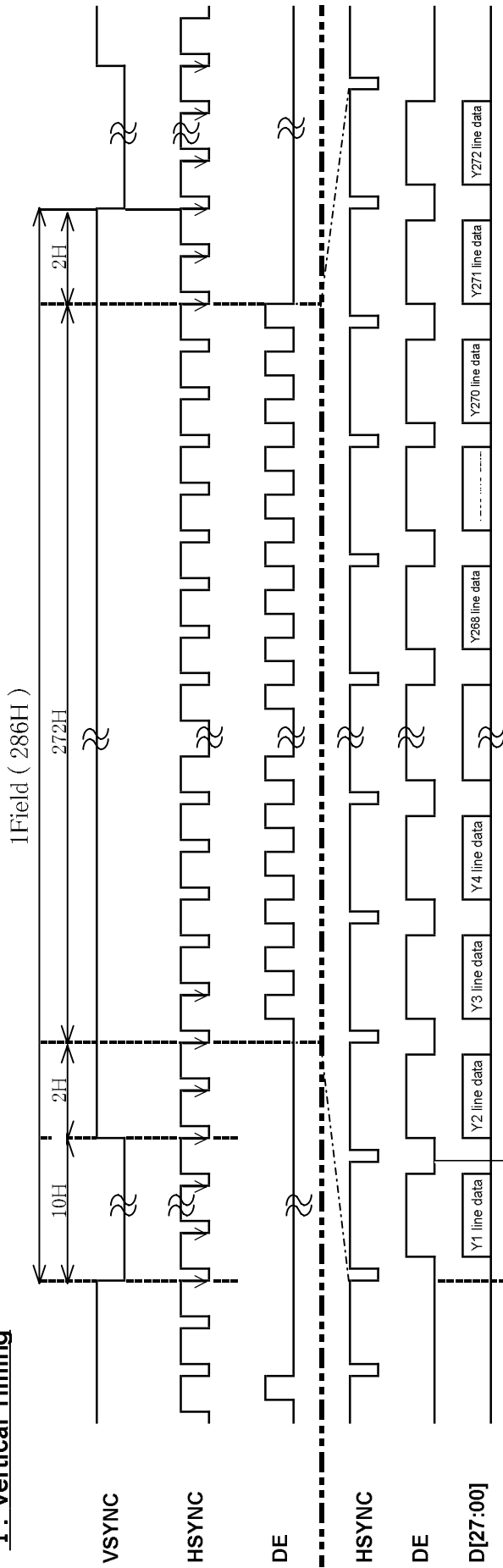
II. Horizontal Timing



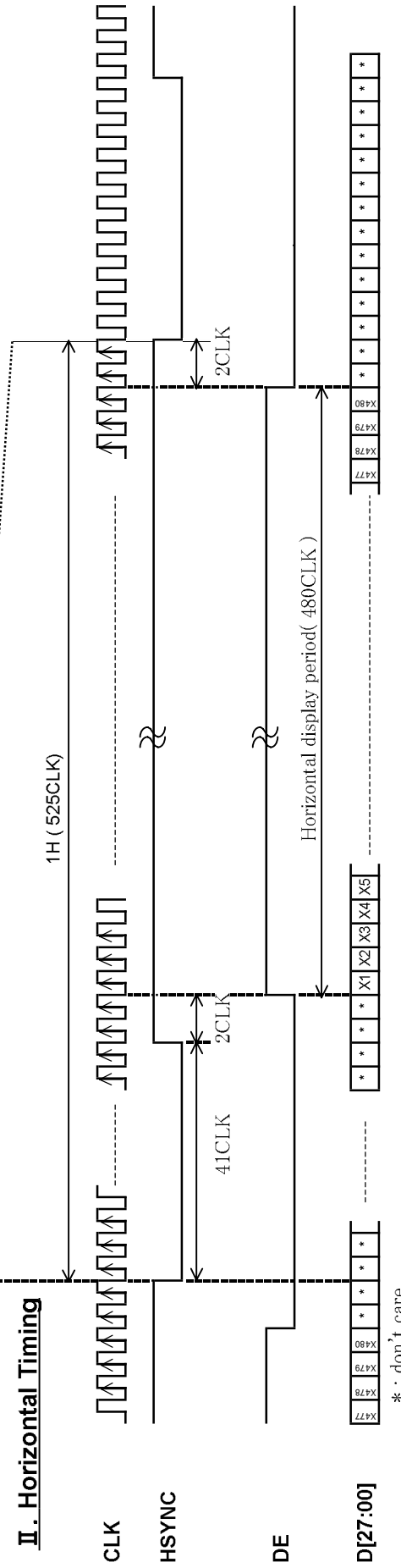
* : don't care

8.3 Input timing example (In case of normal display, fCLK = 9.00MHz)

I. Vertical Timing



II. Horizontal Timing



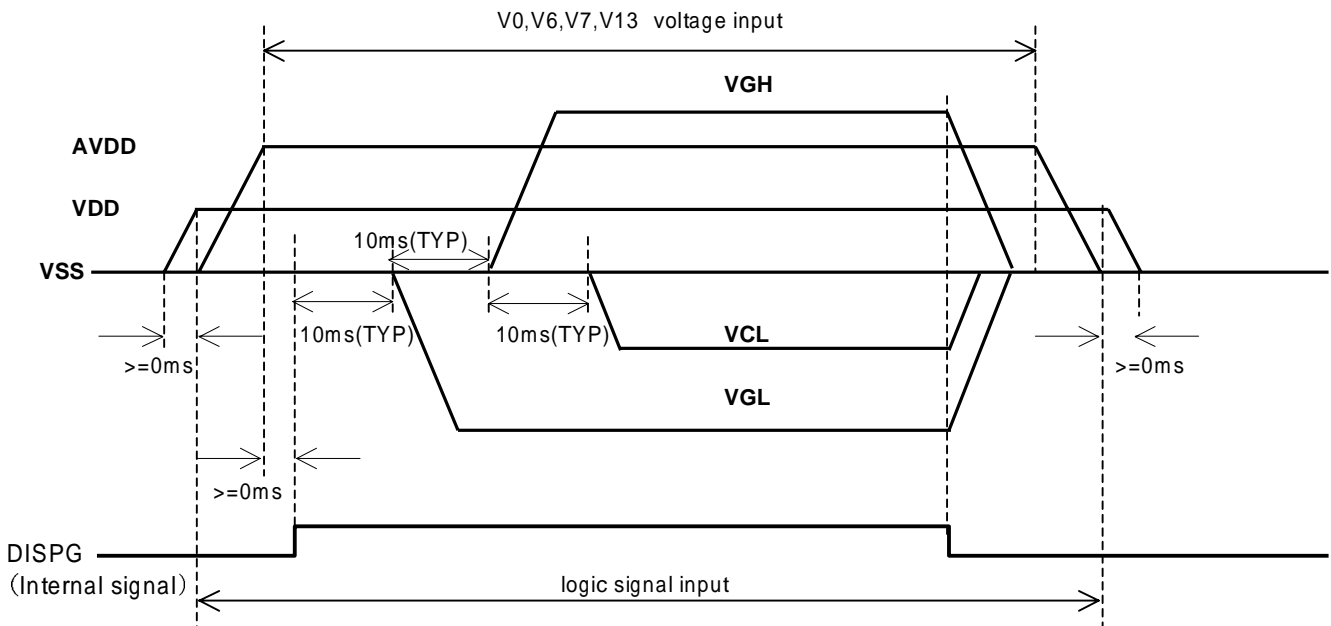
* : don't care

9. Power On/Off Sequence

The sequence of the Power On/Off and the signal input must defend the following conditions.

- Please input the logic signal after turning on VDD.
 - Please input V0, V6, V7, and the V13 voltage after turning on AVDD.
 - VGH, VCL, and VGL are generated in the module, it is not necessary to consider it for the sequence.
- Power Off sequence is assumed to be opposite of the above mentioned sequence.

Please refer Power On/Off recommended sequence is shown in the figure below.

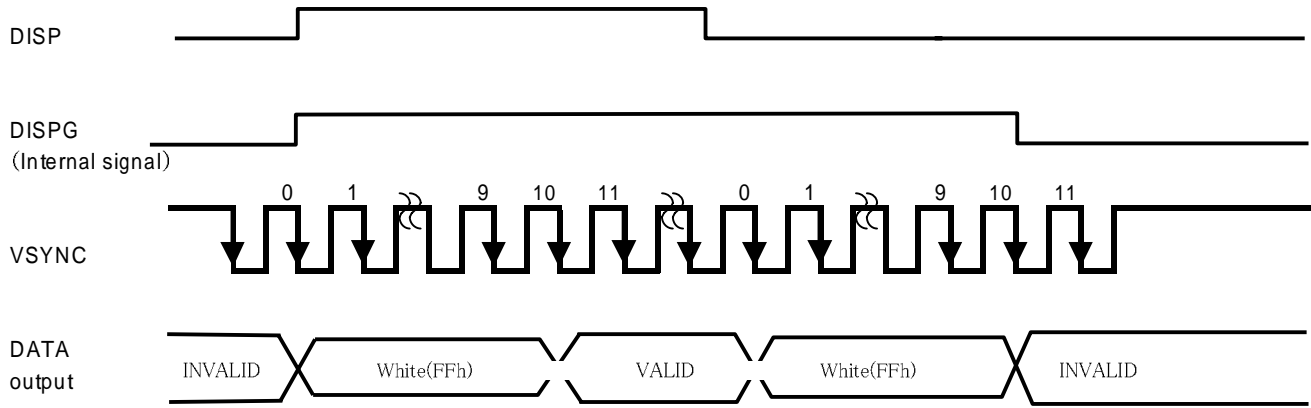


10.Display on/off Sequence

It explains the Display on/off sequence.

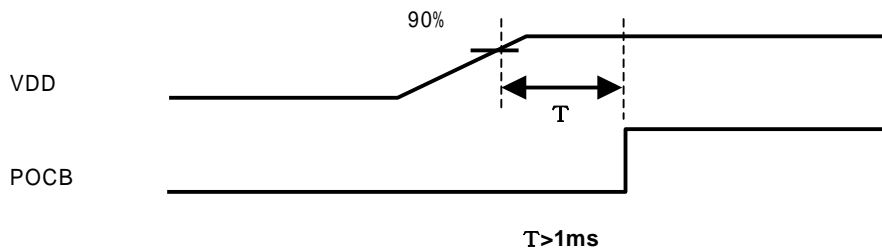
When the DISP pin is Hi, "White" data is output from rising up of the first VSYNC signal to rising up of VSYNC after 10 frames. (FFh)

Similarly, when the DISP pin is Lo, "White" data is output from rising up of the first VSYNC signal to rising up VSYNC after 10 frames. (FFh)

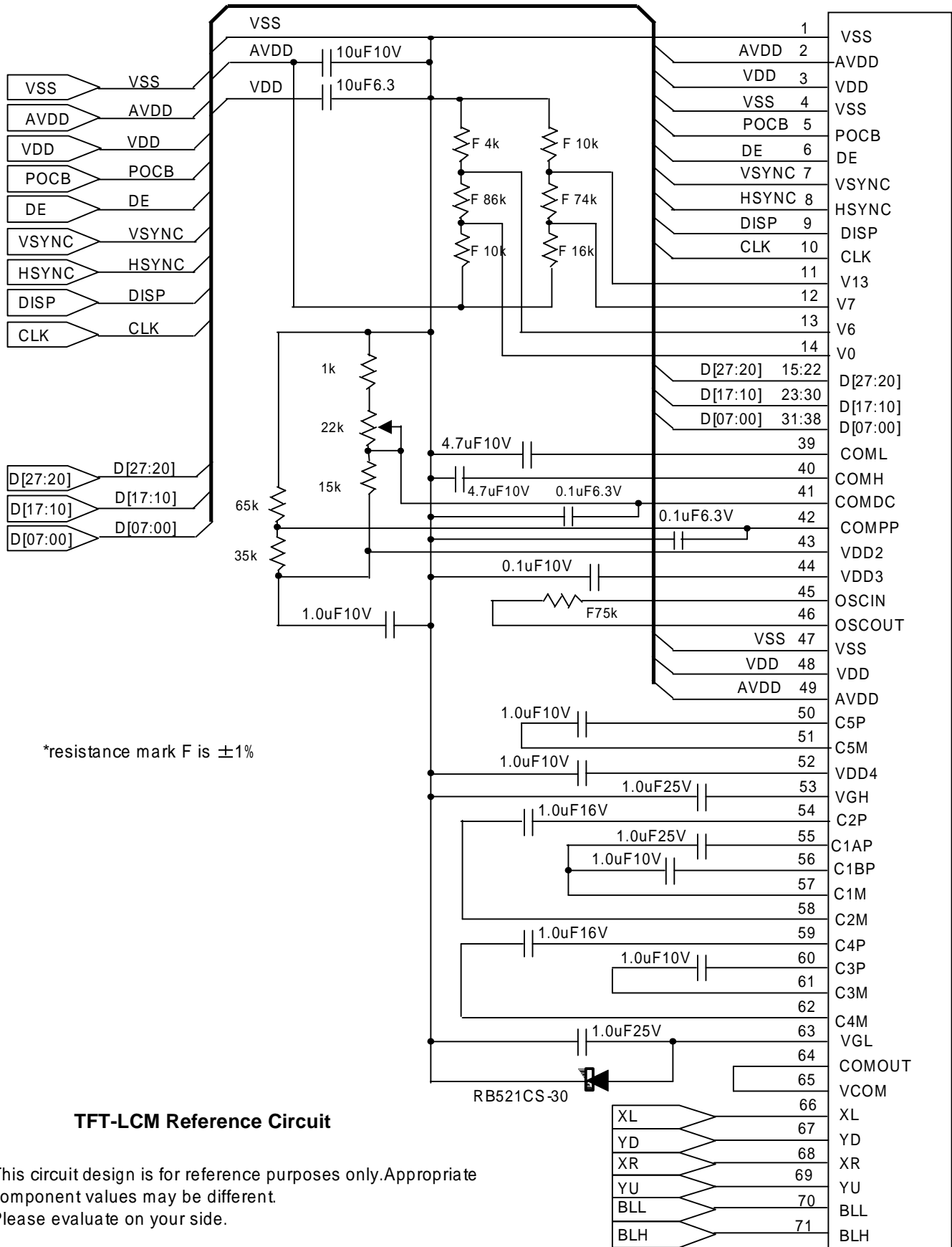


11.Power On Clear

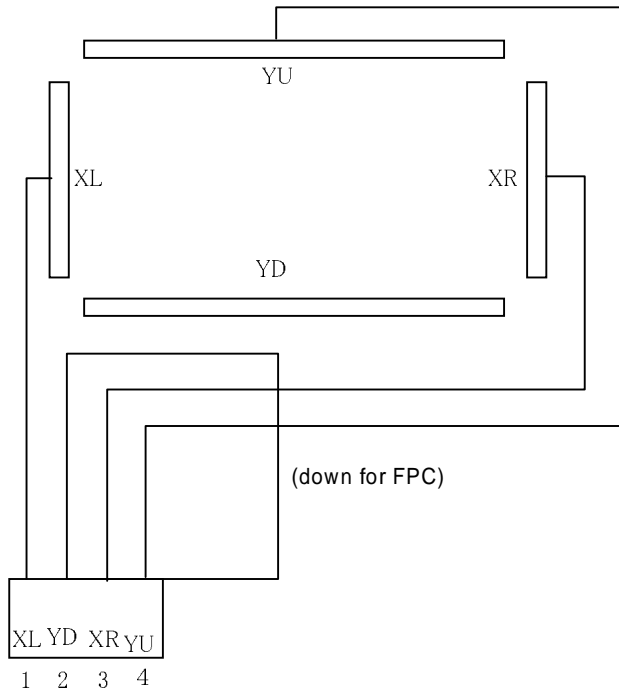
There is a limitation between Power On and POCB (power on clear) . Please defend the following conditions.



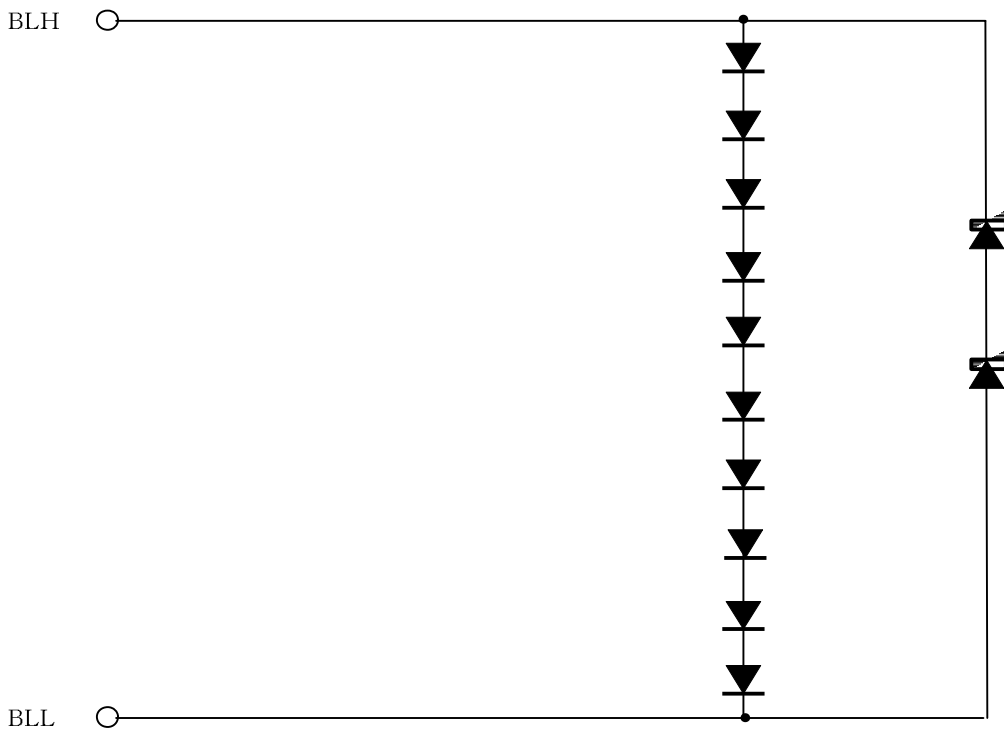
12. Driving Circuit Example(module) A



13.Touch panel circuit



14.LED circuit



15. OPTICAL CHARACTERISTICS

15.1 OPTICAL CHARACTERISTICS

Measuring condition

Measuring equipment CS1000(Konika Minolta),LCD7000(otsuka Electronics)

Driving conditions AVDD=5.0V,VDD=3.0V,VSS=0V,

Vcom/C is adjusted to an optimum value.

VLCD= | Vsigpp \pm /comp | / 2

Back light IL=20.0mA (Use Casio's measuring circuit.(refer to the appendix.))

Measuring temperature Ta=25 °C

Item	Symbol	Condition	MIN	TYP	MAX	Unit	Note #	Remarks	
Response time	Rise time	TON VLCD= 1V→5V	-	-	40	ms	1	※	
	Fall time	TOFF VLCD= 5V→1V	-	-	60	ms			
Contrast ratio	CR	VLCD= 1V/5V	60	250	-		2		
Viewing angle	Left	θ L VLCD= 1V/5V	65	80	-	deg	3	※	
	Right	θ R	65	80	-	deg			
	Up	ϕ U CR \geq 5	40	80	-	deg			
	Down	ϕ D	65	80	-	deg			
V-T Threshold voltage	V90		1.4	1.7	2.0	V	4	※	
	V50		1.8	2.1	2.4	V			
	V10		2.5	2.8	3.1	V			
White V-T characteristic			See figure 3.					Reference	
White chromatically	x	VLCD=1V	See figure 4.					5	
	y								
Maximum contrast angle	CR ϕ		-16	-8	-1	deg	6	※ Downward	
Image sticking			No image sticking shall remain after displaying the window pattern for 2 hours				7		
Center brightness		VLCD=1V	400	540	-	cd/m ²	8		
Brightness distribution		VLCD=1V	70	-	-	%	9		

* : Note1-9 Refer to the Appendix "Standed measurement method of optical characteristics for TFT-LCD monitor".

※: Note) The value are measured in module states.

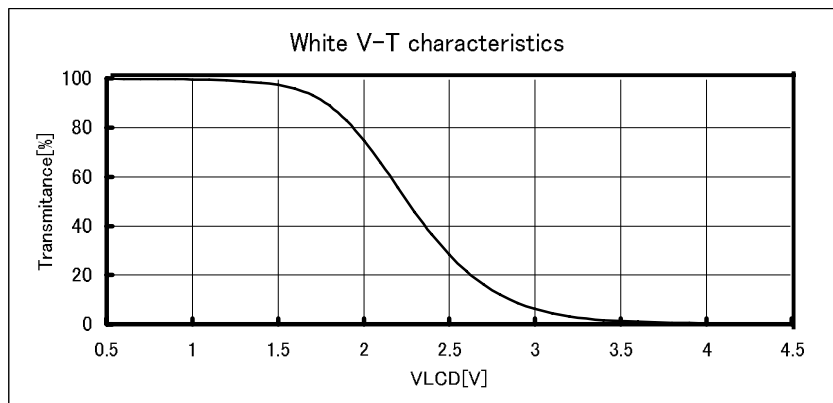
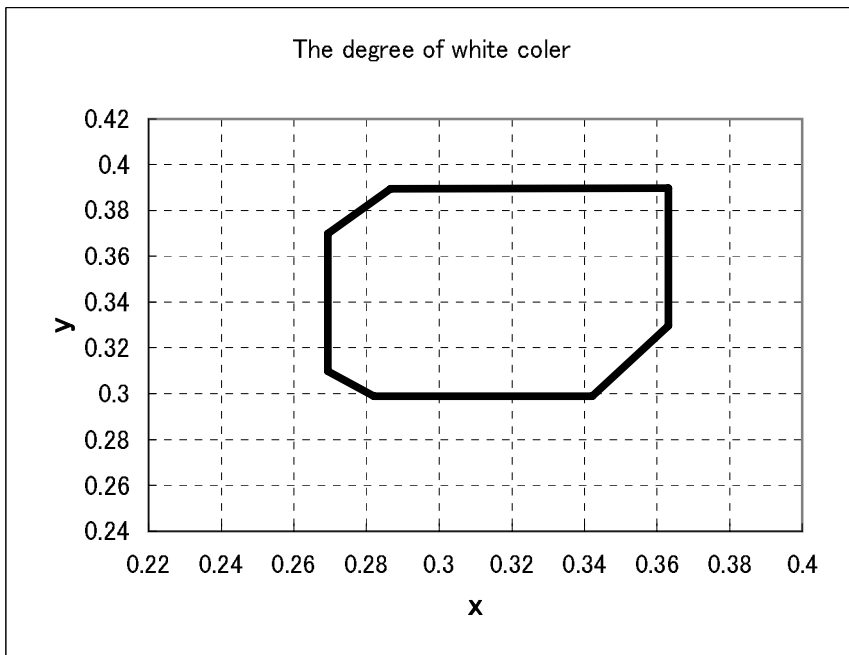


Figure 3 White V-T characteristics



【The degree of white color】

x	y
0.287	0.390
0.363	0.390
0.363	0.330
0.342	0.299
0.282	0.299
0.269	0.310
0.269	0.310

Figure 4 The degree of white color

15.2 TEMPERATURE CHARACTERISTICS

Measuring condition

Measuring equipment CS1000(Konika Minolta),LCD7000(otsuka Electronics)

Driving conditions AVDD=5.0V,VDD=3.0V,VSS=0V,

Vcom/C is adjusted to an optimum value.

VLCD= | Vsigpp ±/compp | /2

Back light IL=20.0mA (Use Casio's measuring circuit.(refer to the appendix.))

Item		Rating		Remarks
		Ta=-10 ℃	Ta=70 ℃	
Contrast ratio		40 or more	40 or more	
Response time	Rise time	Less than 200ms	Less than 30ms	
	Fall time	Less than 200ms	Less than 50ms	
Display quality		Defects and ununiformity shall be inconspicuous.		As criteria of 16

16. CRITERIA**16.1 DISPLAY APPEARANCE SPECIFICATIONS**

Testing conditions

Display monitor should be inspected with the following conditions.

Driving signal	Raster pattern(RGB signal color and white)
Signal condition	VLCD:1.5V,2.5V,5V(3steps)
Distance between display and eye	30cm
Illuminance	500 to 1500 LUX
Back light	IL=20.0mA , Use Casio's measuring circuit.(refer to the appendix.)

Item	Definition	Criteria	
Display defect	Line defect Black,white,or color line 3 or more dot defects on a strait line	None	
	Dot defect Unusual brightness of the dots unit due to defects of TFT or Cf, or dust , etc. brightness defect: Visible through 5% ND filter Dark defect Visible darker when VLCD=2.5V	Refer to Table 1.	
quality	Stain Unevenness of brightness (white stain,black stain,etc.)	Invisible through 1% ND filter	
	Foreign mater Dust between the touch panel and the LCD	Dot form	0.25mm< ϕ 0.15< ϕ ≤0.25mm ϕ ≤0.15mm
		Line form	3.0mm<length 0.08mm<width length≤3.0mm width≤0.08mm
	Display	Flaw Flaw of touch panel surface	W ≤0.02mm
0.02<W ≤0.05mm			L ≤2mm 2<L ≤5mm
0.05mm<W			ignored
Others		Due to boundary sample.	

Average of diameters=(long diameter+short diameter)/2:D(mm)

Permissible number :N

Table 1

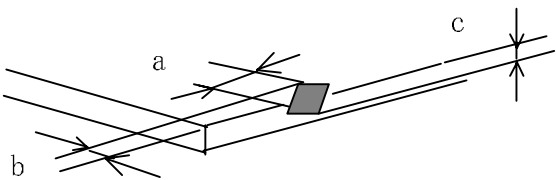
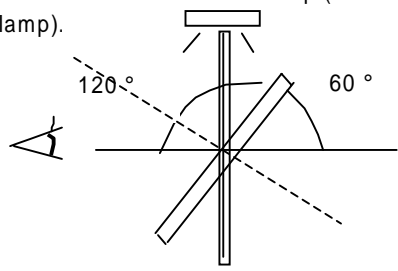
Model	Bright dot	Dark dot	Total	
COM43T4123KTY	0	3	3	Connected 2 dark defects is not allowed.

16.2 APPEARANCE CRITERIA

Testing conditions

Illuminance 500~1500Lx
 Distance between display and eye 30cm

Item	Criteria	Remarks
Polarizer Scratch Stain Bubble,dust dent	Invisible items while the monitor is turned on shall be ignored	Applied to effective display area (3.2 form screen area)
S-case	No function trouble	
Cable	No function trouble	

Item	appearance	Criteria
touch panel		$a \leq 5$ unit: (mm) $b \leq 1$ $c \leq t$ (t: Glass thick) but chipping satisfying $[a, b \leq 0.5]$ shall not be counted. Maximum allowable number on one edge is 5.
		$a \leq 2$ unit: (mm) $b \leq 2$ $c \leq t$ (t: Glass thick) Maximum allowable number is 2.
	Progressive cracks	All NG.
	Newton-ring	Interference fringe forming concentric circles. (In case of doubtful situations) Observe on the 60° from the product surface under a white fluorescent lamp (3-wavelength lamp). 
Swell	Measure the height of swell on the film surface.	$H < 0.4$ unit: (mm) (At the timing of the initial delivery)

17.RELIABILITY

Test item	Test condition	Criteria	
Endurance test	High temperature storage	Ta=80 ℃, 240H	Refer to Table 2.
	Low temperature storage	Ta= -20 ℃, 240H	Refer to Table 2.
	High temperature/ humidity storage	Ta=60 ℃, RH=90% , 240H	Functions and pictures shall have no trouble.
	High temperature operation	Tp=70 ℃, 240H	Refer to Table 2.
	Low temperature operation	Tp= -10 ℃, 240H	Refer to Table 2.
	High temperature/ humidity operation	Tp=40 ℃, RH=90% , 240H	Refer to Table 2.
	Thermal shock storage	-20←→80 ℃ (30min/30min) 100cycle	Refer to Table 2.
Mechanical test	Electrostatic discharge test (No operation)	In accordance with EIAJ ED-4701 C-111. C=200pF,R=0Ω,V= ±200V 5 times discharge between the power terminal and the other terminals.	No destruction
	Surface discharge test (No operation)	C=250pF,R=100Ω,V= ±5kV 5 times discharge at the center of the display. Shield case is connected to the Ground.	No destruction
	Vibration test	Amplitude 1.5mm, f=10 to 55Hz, 2 hours each in the X, Y, and Z directions.	Functions and pictures shall have no trouble.
	FPC tension test	Apply 3N force for 10 seconds in the direction of ±90 degrees against the FPC original direction. (It applies to FPC of LCD.)	Functions and pictures shall have no trouble.
	FPC bend test	Apply 3N force for 10 seconds in the direction of ±80 degrees against the FPC original direction. Coming and going three times. (It applies to FPC of LCD.)	Functions and pictures shall have no trouble.
Impact test	Use CASIO original jigs. Apply half-sine curve of peak acceleration 981 m/s^2 for operation time 6ms, 3 times each in X, Y, and Z directions, in accordance with JIS C 60068-2-27-1995.	Functions and pictures shall have no trouble. Refer to the below diagram.	
Packing test	Packing vibration-proof test	19.6 m/s^2 acceleration and f=10→55→10Hz, apply in each of X, Y, and Z direction for 30 minutes.	Functions and pictures shall have no trouble.
	Packing drop test	Drop the packing from 75cm height, one time each for 6-faces, 3-edges, and 1-corner.	Functions and pictures shall have no trouble.

Note : Ta = Ambient temperature Tp = Panel temperature

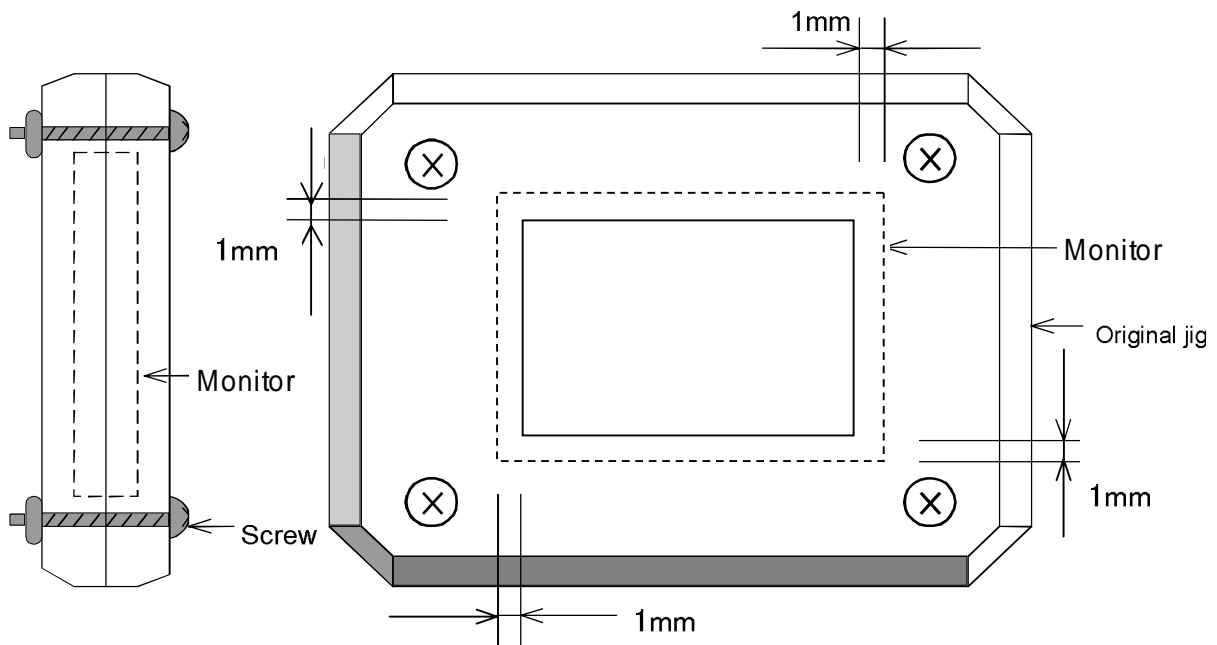
Table 2 Reliability Criteria

Measure the parameters after leaving the monitors at the room temperature for more than 2 hours from the test completion.

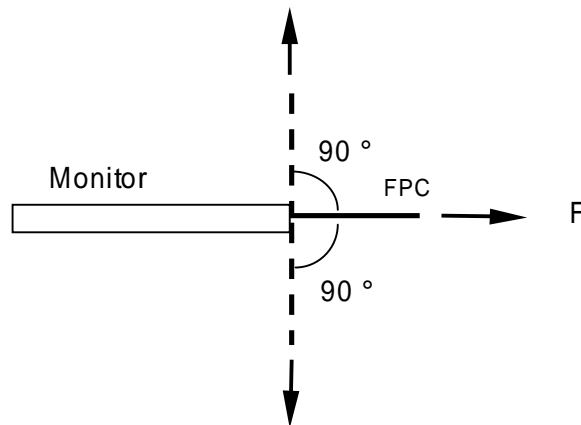
Item	Standard	Remarks
Contrast ratio	40 or more	
Response speed	MAX:TON=60msec TOFF=80msec	
Display quality	No visible abnormality shall be seen.	As criteria of 16.

Note : Reduced response time and image residual are passed over in operation under -10 ℃ to -20 ℃ temperature.

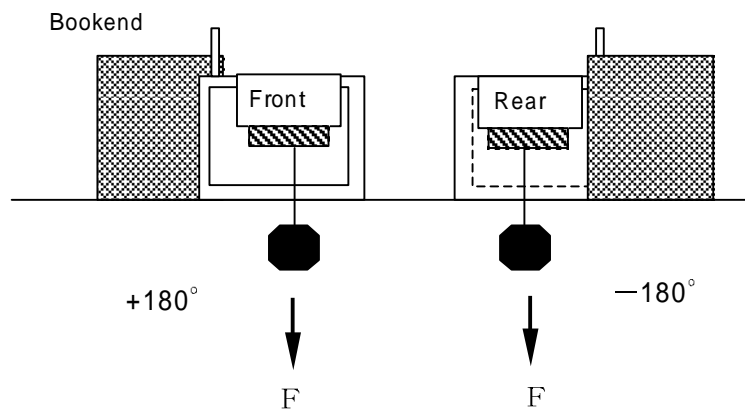
Casio original jig.



FPC tension test

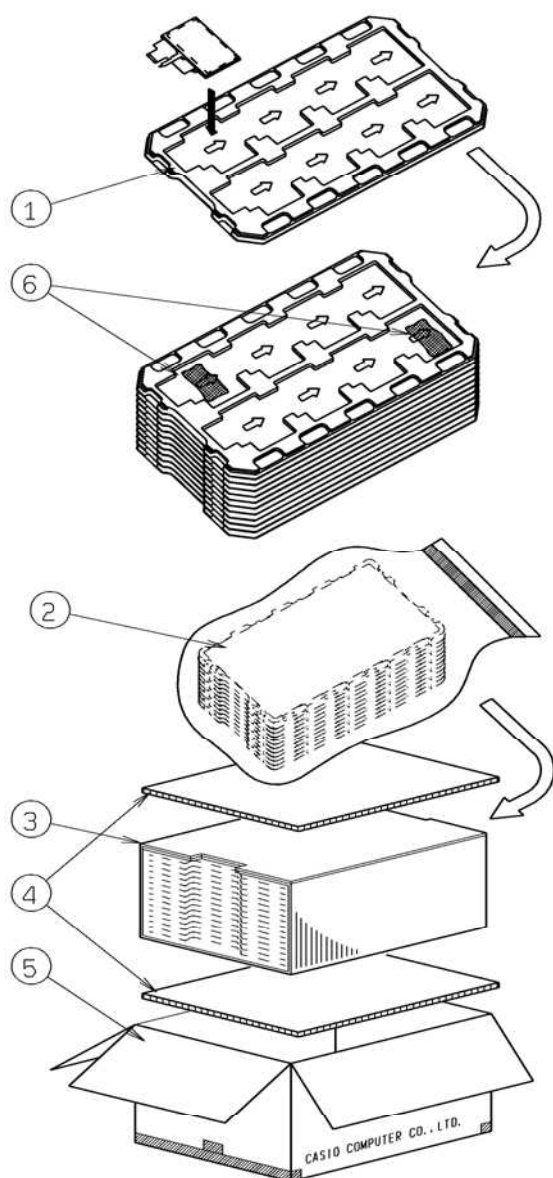


FPC bend test

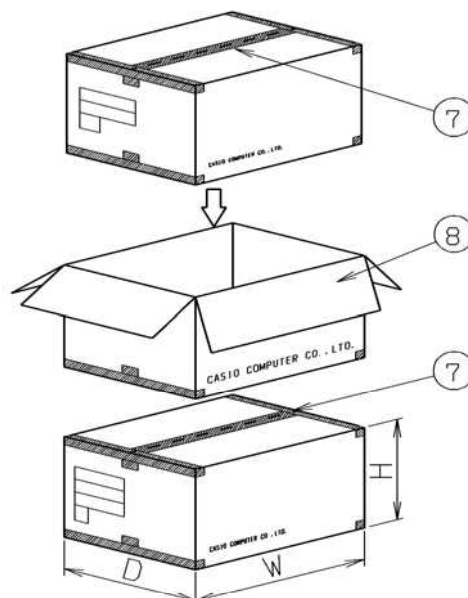


18. PACKING SPECIFICATION

(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.
(8 products per 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 10.
One empty tray is to be put on the top of stack of 10 trays.
- Step 3. 2 packs of moisture absorbers are to be placed on the top tray as shown in the drawing.
Put piled trays into a sealing bag.
Vacuum and seal the sealing bag with the vacuum sealing machine.
- Step 4. The stack of trays in the plastic back is to be inserted into a inner carton.
- Step 5. A corrugated board is to be placed on the top and on the bottom of the inner carton.
The two corrugated boards and the inner carton is to be inserted into an outer carton.
- Step 6. The outer carton needs to sealed with packing tape as shown in the drawing.
The model number, quantity of products, and shipping date are to be printed on the outer carton.
If necessary, shipping labels or impression markings are to be put on the outer carton.
- Step 7. The outer carton is to be inserted into a extra outer carton with same direction.
The extra outer carton needs to sealed with packing tape as shown in the drawing.
- Step 8. The model number, quantity of products, and shipping date are to be printed on the extra outer carton.
If necessary, shipping labels or impression markings are to be put on the extra outer carton.



Remark: The return of packing materials is not required.

	Packing item name	Specs., Material
①	Tray	PP
②	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: 80	
Gross weight : Approx. 8.0Kg	

19.HANDING PRECAUTIONS**19.1 PRECAUTIONS****Caution**

- (1) Do not make an impact on the glass, because it may break, causing possible dangers.
- (2) When the glass breaks, do not touch it directly with hands.
(You may get glass splinters in your hands or cut your skin.)
- (3) In the event that you injure yourself, receive first aid and consult a physician.
- (4) Do not put the liquid crystal in your mouth.
(In the event that the liquid crystal panel breaks, the liquid crystal inside will seep out. Although its toxicity has not been verified, you should not put the panel in your mouth.)
- (5) If the liquid crystal gets on your skin or clothing, wash it off thoroughly.
(In the event that the liquid crystal gets on your clothing or hand, wipe it off with alcohol, or carefully wash it off with soap and water. If it gets into your eyes, wash your eyes in clean running water for at least 15 minutes, then see a physician)
- (6) When disposing of this product, follow the industrial waste disposal standards existing in the country or region concerned.
- (7) Do not connect or disconnect this product while the set remains switched on.
- (8) This product has been assembled to a high degree of accuracy. Do not attempt to dismantle or modify it.

**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.

19.2 HANDLING PRECAUTIONS

- 1) Wear finger sacks when handling the modules at the incoming inspection and/or the production lines, and keep the working area very clean.
Do not touch the surface of the polarizing film because it is vulnerable.
- 2) Wear a wrist-strap and use an ion blower to avoid electrostatic discharge when handling the modules, because the LCD panel and the driver ICs are vulnerable to an electrostatic discharge.
- 3) Do not scratch or hit the module surface with a tool, and do not drop the module, because the LCD panel made of glass substrates is fragile and the polarizing film is vulnerable to frictions and mechanical impacts.
In case that the module was accidentally dropped, it must be regarded as defective, and do not use it any longer.
- 4) Do not use or store the module in a place where dew is expected.
- 5) Do not store the LCD under direct sunlight or at a place exposed to ultraviolet rays because it will cause the deterioration of the LCD.
- 6) Do not stain the cables or make them damaged, because these might cause contact defects and/or wrong effects on the reliability.
- 7) Do not bend or pull the FPC part or carry the module just by holding the FPC with fingers.
- 8) Since the protection film is stuck on the polarizing plate of a monitor's surface, please use it at the time of mounting, removing. Refer to the 19.5th clause for how to remove.
In addition, please understand that our company cannot take responsibility to faults, such as electric destruction produced on the occasion of protection film exfoliation.

19.3 OPERATING PRECAUTIONS

- 1) Do not expose the driver ICs on the module to strong lights during operation.
It may cause function failures, because the driver ICs have no light shield.
- 2) When driving the monitor, apply the input signal after the power voltage is supplied.
When turning off the power, turn off the input signal before or at the same timing of switching off the power.
- 3) Apply an optimum value of V_{com}/c when using the module.
- 4) It causes a trouble when a cable is plugged in and out under the condition that a power supply voltage is input. Plug the cable in and out after cutting off the power supply voltage.
- 5) Do not operate in the strong magnetic field. It may break a module.
- 6) Do not indicate a fixed pattern for a long time. It has the possibility that an afterimage breaks out by character of the liquid crystal. Please use a screen saver, and do not indicate a fixed pattern.

19.4 SHIPPING CARTON BOX STORAGE CONDITIONS

Environment

- Temperature 0 to 40 °C
- Relative humidity 60% or less
Shall have no dew if the temperature is low and the humidity is high.
- Atmosphere Any poisonous gases and chemical substances such as acid or alkaline, which will erode electronic components and/or wiring materials, shall not be detected in a storage room.
- Period Within approx. 3 months
- Unpacking In order to prevent the TFT modules from being damaged by static electricity during the unpacking process, adjust the relative humidity of the working room to 50% RH or higher, and take effective measures such as static electricity grounding.
- Maximum allowable quantity of piling : 10

19.5 PRECAUTIONS AT PROTECTION FILM REMOVING PROCESS

When removing the protection film from the monitor screen, static electricity may be generated, causing a function destruction or absorbing dusts. To avoid them, the following environment and working methods are recommended.

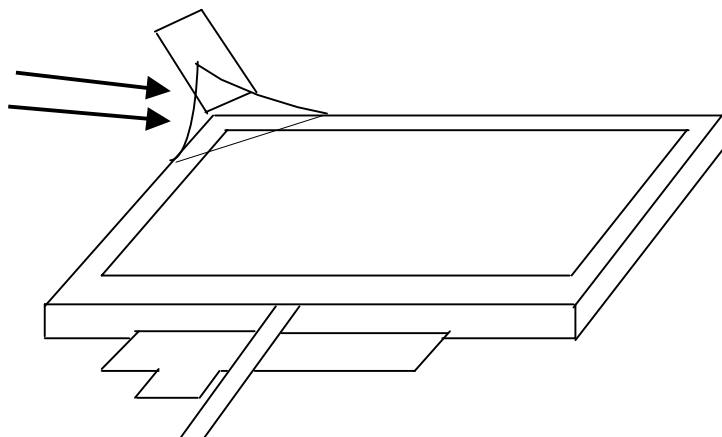
A) Working environment

- a) Keep the relative humidity at 50% to 70% and the temperature at 15 to 27 °C
- b) Workers shall wear conductive working clothes, conductive shoes, conductive finger sacks, and wrist-strap bands. The working floor shall also be conductive.
- c) The working room shall be a clean room, preventing dusts from coming in.
Setting an adhesive mat at the entrance of the room is recommended.

B) Working method

- a) Place an ion blower at an optimal distance from the monitor and set an optimal wind direction.
- b) Put an adhesive tape (Scotch tape, etc.) on the LCD protection film's corners near the ion blower to protect the polarizing film from damage.
- c) Pull the adhesive tape slowly (taking more than 2 seconds to complete) towards the operator to remove the protection film.

Blower wind direction (Set an ion blower with its adequate value.)



19.6 QUALITY ASSURANCE

Casio shall be obliged to compensate for defective products by payment at the unit price of the product or substitutes in case that the products are used and stored under the conditions specified in this document, the defect causes are attributable to Casio, and such claims are notified to Casio within one year from the day of product delivery.

Casio shall not be obliged to guarantee the product quality in case that the products are used under conditions beyond the specifications or reorganized by Samsung Electronics Co., Ltd.

19.7 OTHERS

In case of revisions of specifications, ordinarily Samsung Electronics Co., Ltd. at least one month prior to the product delivery. But in an emergent case, procedures for revision will be separately determined by consultations between Samsung Electronics Co., Ltd. and Casio.

APPENDIX

Standard Measurement Method of Optical Characteristics for TFT-LCD Monitors.

1 Testing conditions

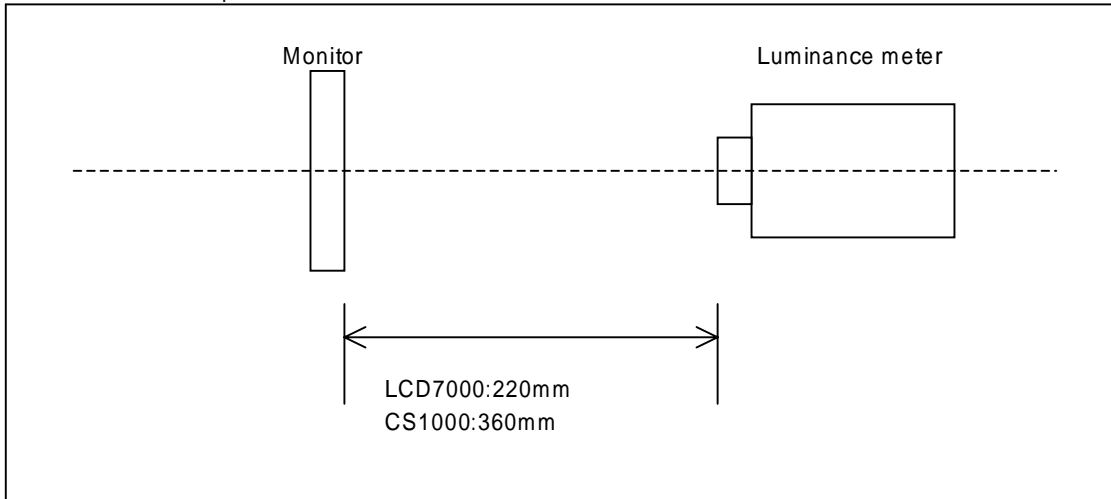
Measuring instrument: CS1000 (Konika Minolta) 、LCD7000 (Otsuka Electronics)

Measuring temperature : Unless otherwise specified, the temperature is 25 ℃

Measuring system : See the diagram below. The luminance meter is positioned on the normal line on the measuring point.

Measuring points : In usually the center point of the screen

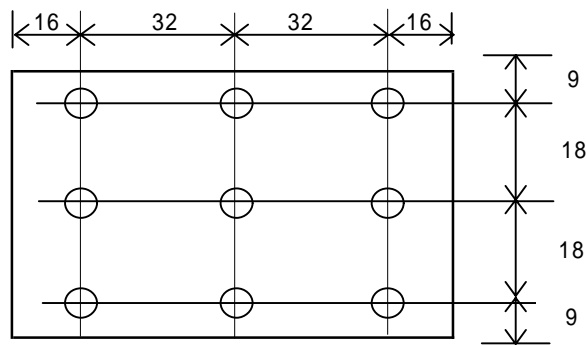
Constant temperature dark box



A measuring run should be started after allowing the back light to be lit for 30 minutes.

Measuring points : The center point of the screen

For obtaining the luminance distribution only, nine points shall be measured shown below.



Unit:mm

Backlight

IL=20.0mA

Use Casio's measuring circuit.(refer to the appendix.)

2 Testing method

Note	Item	Testing method	Measuring equipment	remarks
1	Response time	<p>Measure output signal waves with a luminance meter when the raster or window pattern is changed over from white to black and from black to white</p>	LCD7000	<p>Black VLCD=5V White VLCD=1V T ON Rise time T OFF Fall time</p>
2	Contrast ratio	<p>Put the raster or window pattern on the display. Then measure the maximum luminance $Y1$ (VLCD = 1V) and the minimum luminance $Y2$ (VLCD = 5V) at the center of the display. Contrast ratio = $Y1/Y2$ Measurement spot diameter: 8mm ϕ</p>	CS1000	
3	Viewing angle Horizontal θ Vertical ϕ	<p>Change the viewing angles step by step in up, down, left, and right direction each, and measure contrast ratio to obtain respective angle where contrast ratio becomes 5.</p>	LCD7000	
4	V-T threshold	<p>Change the VLCD by 0.1V step and measure monitor luminances. VLCD, where the luminance is 90%, 50%, and 10% of the maximum value, is defined as $V90$, $V50$, and $V10$ respectively.</p>	LCD7000	
5	White chromaticity balance	<p>Measure chromatic coordinates x and y of the CIE 1931 calorimetric system under VLCD = 1V. Color matching function is at view of 2°.</p>	CS1000	
6	Max. contrast angle	<p>Change the viewing angles step by step in up/down direction, and measure the contrast ratio at each steps to obtain angles where the contrast ratio becomes maximum.</p>	LCD7000	

Note	Item	Testing method	Measuring equipment	remarks
7	Image sticking	Confirm image stickings with eyes after displaying the window pattern (VLCD=1/5V)for 2 hours		Vcom/C is adjusted to optimum value.
8	Center luminance	Measure the luminance at the center of the screen.	CS1000	
9	Luminance distribution	(Luminance distribution) = $100 \times B/A \%$ A : max. luminance of the 9 points B : min. luminance of the 9 points	CS1000	