SPECIFICATIONS № 16TLM034	Issue: Oct. 6, 2016

This product is under development and specifications are subject to change.

Specifications for

Blanview TFT-LCD Monitor (TENTATIVE)

(5.0" WVGA 800 x RGB x 480 Landscape)

Version 0.0

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

MODEL COM50H5N01ULC

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

ORTUSTECH

ORTUS TECHNOLOGY CO., LTD.

Approved by

Checked by

Prepared by

Contents

1. Application

This Specification is applicable to 127.3mm (5.0 inch) Blanview TFT-LCD monitor for non-military use.

◎ ORTUS TECHNOLOGY makes no warranty or assume no liability that use of this Product and/or any information including drawings in this Specification by Purchaser is not infringing any patent or other intellectual property rights owned by third parties, and ORTUS TECHNOLOGY shall not grant to Purchaser any right to use any patent or other intellectual property rights owned by third parties. Since this Specification contains ORTUS TECHNOLOGY's confidential information and copy right, Purchaser shall use them with high degree of care to prevent any unauthorized use, disclosure, duplication, publication or dissemination of ORTUS TECHNOLOGY'S confidential information and copy right.

◎ If Purchaser intends to use this Products for an application which requires higher level of reliability and/or safety in functionality and/or accuracy such as transport equipment (aircraft, train, automobile, etc.), disaster-prevention/security equipment or various safety equipment, Purchaser shall consult ORTUS TECHNOLOGY on such use in advance.

◎ This Product shall not be used for application which requires extremely higher level of reliability and/or safety such as aerospace equipment, telecommunication equipment for trunk lines, control equipment for nuclear facilities or life-support medical equipment.

◎ It must be noted as an mechanical design manner, especial attention in housing design to prevent arcuation/flexureor caused by stress to the LCD module shall be considered.

◎ ORTUS TECHNOLOGY assumes no liability for any damage resulting from misuse, abuse, and/or miss-operation of the Product deviating from the operating conditions and precautions described in the Specification.

◎ It shall be mutually conferred if nonconforming defect which result from unspecified cause in this specification arises.

◎ If any issue arises as to information provided in this Specification or any other information, ORTUS TECHNOLOGY and Purchaser shall discuss them in good faith and seek solution.

◎ ORTUS TECHNOLOGY assumes no liability for defects such as electrostatic discharge failure occurred during peeling off the protective film or Purchaser's assembly process.

◎ This Product is compatible for RoHS directive.

Object substance	Maximum content [ppm]
Cadmium and its compound	100
Hexavalent Chromium Compound	1000
Lead & Lead compound	1000
Mercury & Mercury compound	1000
Polybrominated biphenyl series（PBB series）	1000
Polybrominated biphenyl ether series（PBDE series）	1000

2. Outline Specifications

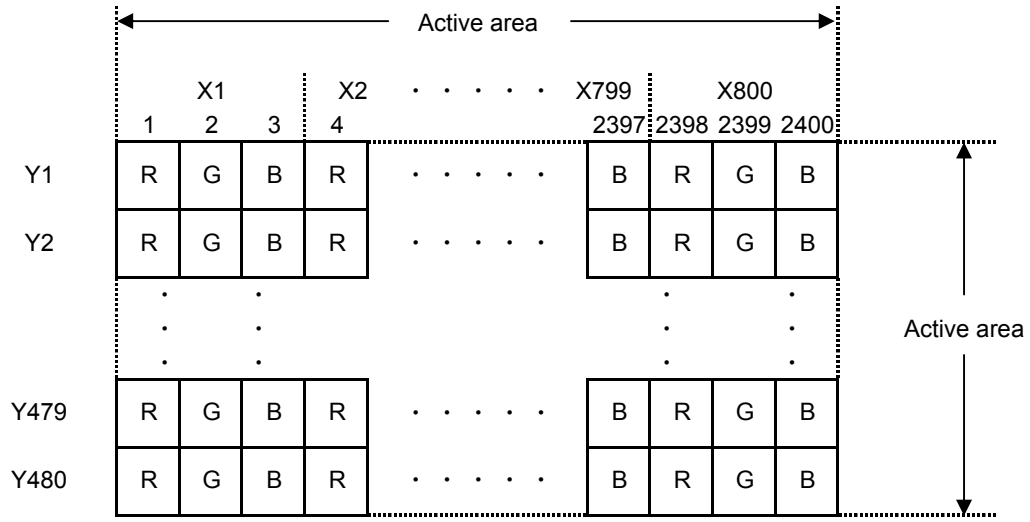
2.1 Features of the Product

- 5.0 inch diagonal display, 800 x RGB [H] x 480 [V] dots.
- 16.7 M colors (8-bit) / 262 K colors (6-bit).
- 3.3V 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

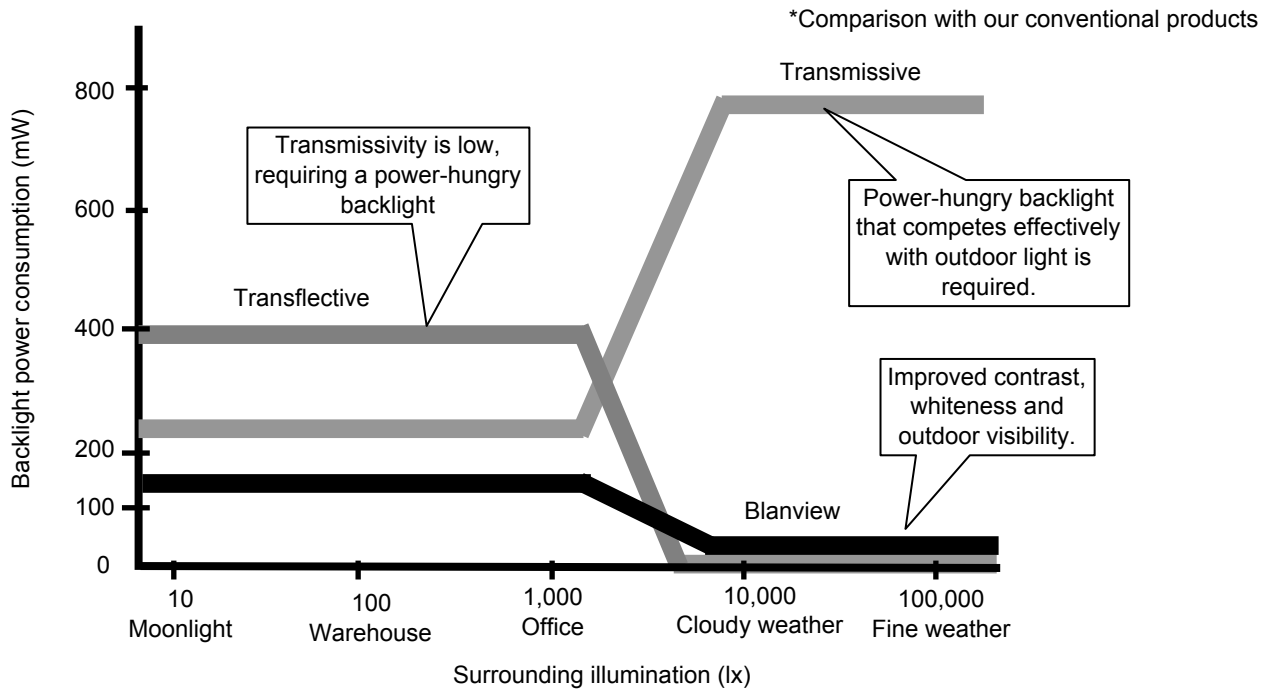
Items	Specifications	Remarks
Display type	16.7 M colors. / 262 K colors. Blanview, Normally black.	
Driving method	a-Si TFT Active matrix. Line-scanning, Non-interlace.	
Dot arrangement	RGB stripe arrangement.	Refer to "Dot arrangement"
Signal input method	8-bit / 6-bit LVDS interface (VESA format)	
Backlight type	High bright white LED.	
NTSC ratio	50%	



Dot arrangement (FPC cable placed down side)

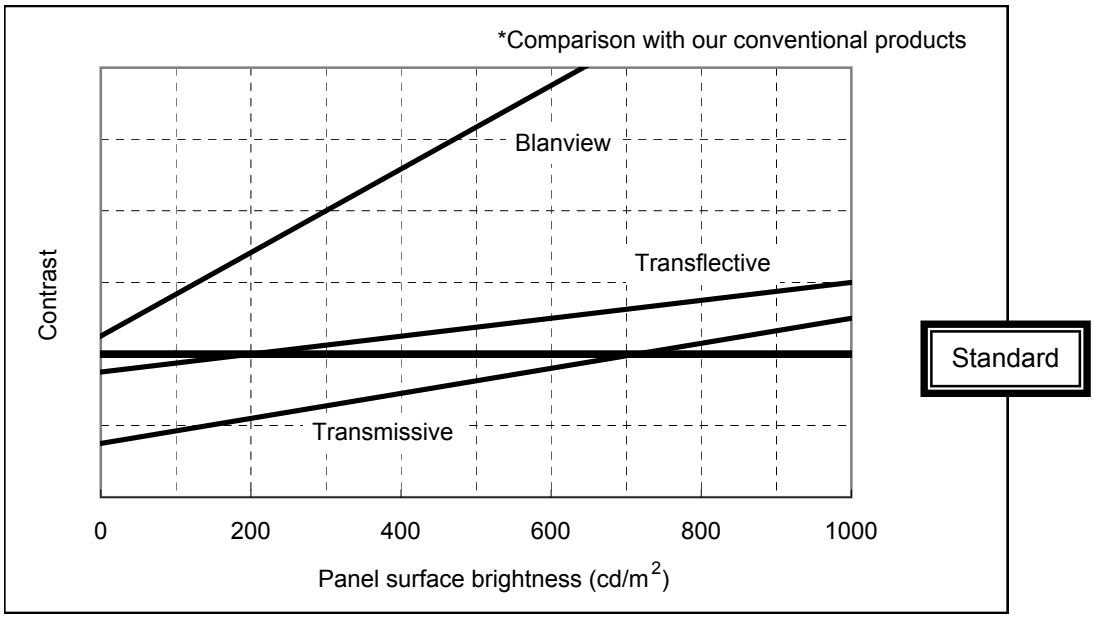
<Features of Blanview>

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



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

With better contrast (higher contrast ratio), Blanview TFT-LCD has the best outdoor readability in three different types of TFT-LCD.
Below chart shows contrast value against panel surface brightness. (Horizontal: Panel surface brightness/ Vertical: Contrast value) LCD panel has enough outdoor readability above our Standard line.
(ORTUS TECHNOLOGY criteria)



3. Dimensions and Outward Form

3.1 Dimensions

Items	Specifications	Unit	Remarks
Outline dimensions	124.00[H] × 80.82[V] ×6.18[D]	mm	Exclude FPC cable and parts on FPC.
Active area	109.20[H] × 65.52[V]	mm	127.3mm diagonal
Number of dots	2400[H] × 480[V]	dot	
Dot pitch	45.5[H] × 136.5[V]	um	
Surface hardness of the polarizer	(3)	H	2N
Weight	TBD	g	Include FPC cable

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

3.2 Outward Form

16TLM034

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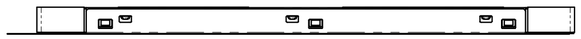
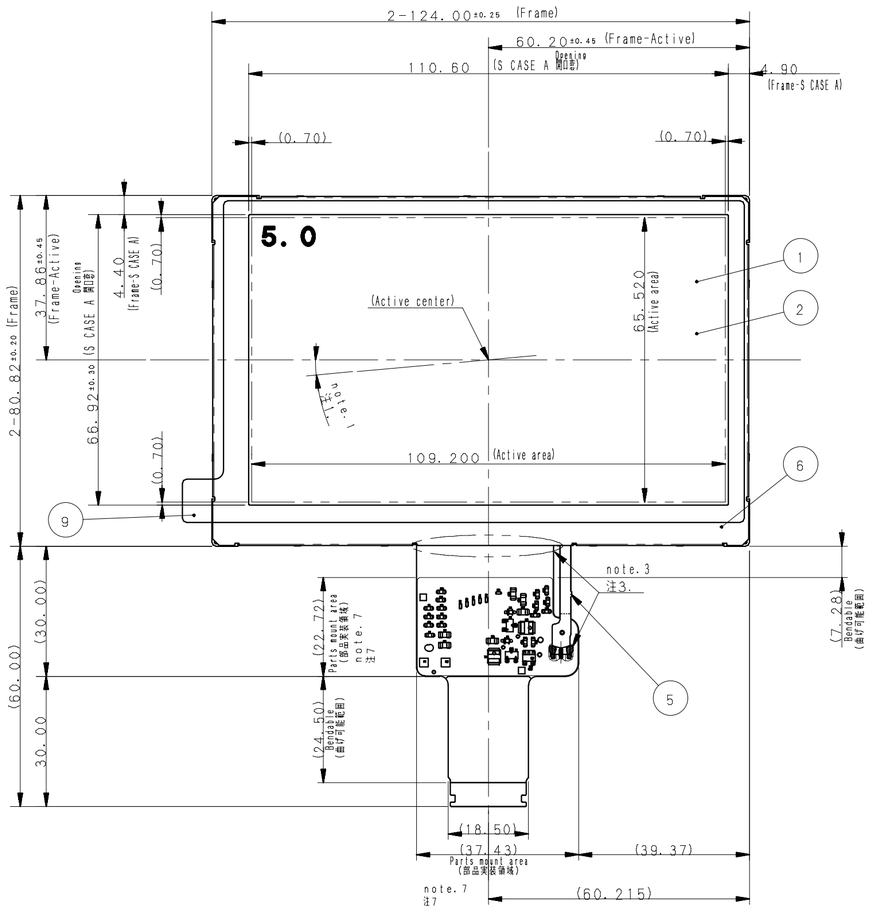
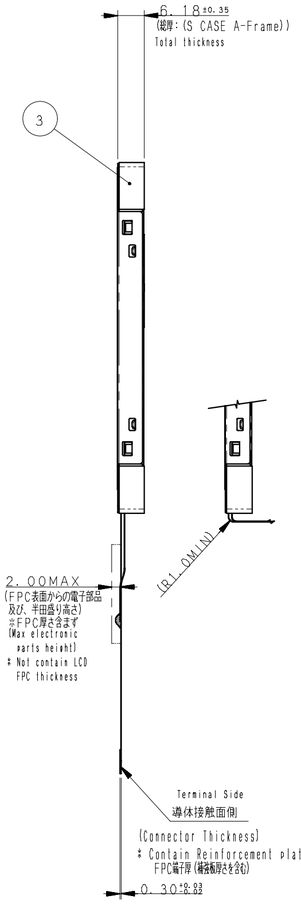
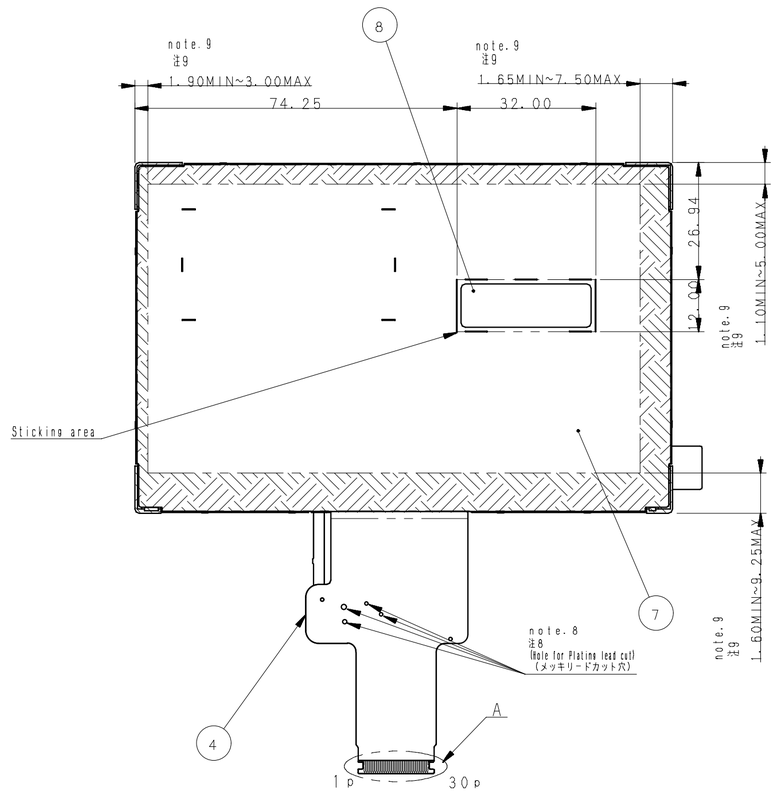








Angular deviation of LCD cell from the TFT-LCD monitor's reference note axis shall be less than【±50'】.
注1．TFT-LCD PANELの角度ズレは、モニター基準軸に対し【±50′】以下とする。

Protective film is affixed on front surface of the screen.
Protective film is not protrude from the outline of the monitor.
2．保護膜が表面側に貼られる。
保護膜はモニター外形からはみ出さないものとする。

Don't stress to FPC bonding area & the solder area.
3．FPCの圧着部及び半田接続部には負荷の掛からないようご注意願います。

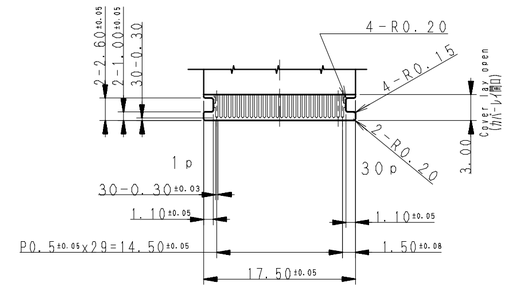
Recommended FPC connectors
: IRISO/IMSA-9699S-30A-GFN1(Lower contact)
4．FPCの推奨コネクターの規格を下記に示す。
イリソ電子工業 ：9699 series (IMSA-9699S-30A-GFN1(下接点))

A LABEL is affixed the area as shown in the drawing.
The thickness of SERIAL LABEL will be added to that of part's(S CASE C's) surface.
5．LABELが図示の位置に貼り付けされます。
Sラベル厚さ分貼付け面から(S CASE Cから)凸となります。

Burrs direction of S CASE is outward. (Burrs size is less than 0.03mm.)
6．S CASEのバリ方向は外側になります。(MAX0.03mm)

Don't touch any conductive material to conductive area.
7．導体開口部は導体部品との接触を避けてください。

Don't touch any conductive material to plating cut area.
8．メッキリードカット位置は導体部品との接触を避けてください。
In case TFT-LCD monitor is fixed to the case of your product, it's recommended that monitor is fixed in te [▨] area.
9．モニタは [▨] 範囲内で固定することを推奨いたします。



DETAIL A (S=2/1) note.4 注4

	10			
Protective film	9			
LABEL	8		For BL unit	(30×10×0.080t)
S CASE C	7		SUS (t=0.20)	
S CASE A	6		SUS (t=0.15)	
FPC B	5			Use of LED
FPC A	4		Au/Ni plating Au/Niメッキ	Use of LCD
Frame	3		PC	
Polarizer	2			
TFT-LCD PANEL	1		Glass thickness=0.50+0.50t	
PART NAME	ITEM	PART CODE	MODEL NUMBER	REMARK

APPROVED 敷地	GENERAL TOLERANCE ±0.5	SCALE 1/1	UNIT mm
CHECKED	ISSUE (Y:M:D) 16:08:19	MODEL COM50H5N01U**	
CHECKED 木下	NAME		
DESIGN 小林宣幸	OUTLINE-D5N01		
DRAW 小林宣幸			

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DRAWING No.	REV.	SHEET	DIV.
SJD511611D201			

ASSY

3.3 SERIAL LABEL (S-LABEL)

TBD

4. Pin Assignment

No.	Symbol	Function	I/O
1	BLH	LED drive power source. (Anode side)	P
2	BLL2	LED drive power source . (Cathode side 2)	P
3	BLL1	LED drive power source . (Cathode side 1)	P
4	GND	Ground	P
5	VDD	Power supply input.	P
6	VDD	Power supply input.	P
7	CSB	Chip select input for serial communication. (Low: active. Handling of unused pins: Connect to VDD)	I
8	SCL	Clock input for serial communication.(Handling of unused pins: Connect to GND)	I
9	SDA	Data input for serial communication.(Handling of unused pins: Connect to GND)	I/O
10	NC	No connection	-
11	UL/DR	Up & Left / Down & Right switching terminal (Low : DR , High or NC : UL)	I
12	IM	6 / 8 bit (based on VESA) switching terminal (Low : 6bit , High or NC : 8bit)	I
13	STBYB	Standby signal (Low:Standby operation,High:Normal operation)	I
14	GND	Ground	P
15	R0-	LVDS DATA0(-)	I
16	R0+	LVDS DATA0(+)	I
17	GND	Ground	P
18	R1-	LVDS DATA1(-)	I
19	R1+	LVDS DATA1(+)	I
20	GND	Ground	P
21	CLK-	LVDS CLK(-)	I
22	CLK+	LVDS CLK(+)	I
23	GND	Ground	P
24	R2-	LVDS DATA2(-)	I
25	R2+	LVDS DATA2(+)	I
26	GND	Ground	P
27	R3-	LVDS DATA3(-)	I
28	R3+	LVDS DATA3(+)	I
29	GND	Ground	P
30	NC	No connection	-

- Recommended connector : IRISO ELECTRONICS 9699 series [IMSA-9699S-30A-GFN1]
- 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

GND=0V

Item	Symbol	Condition	Rating		Unit	Applicable terminal
			MIN	MAX		
Supply voltage	VDD		-0.3	3.9	V	VDD
Input voltage for logic	VI		-0.3	VDD+0.3	V	UL/DR , IM , SCL , CSB , SDA , STBYB
Forward current	IL		--	TBD	mA	BLH-BLL1/BLL2
Storage temperature range	Tstg		-40	95	℃	

6. Recommended Operating Conditions

GND=0V

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Supply voltage	VDD		3.0	3.3	3.6	V	VDD
Input voltage for logic	VI		0	--	VDD	V	UL/DR , IM , SCL , CSB , SDA , STBYB
Operational temperature range	Top	Note1	-30	+25	+85	℃	Panel surface temperature

Note1: This monitor is operatable in this temperature range. With regard to optical characteristics, refer to Item 9."CHARACTERISTICS".

7. Electrical Characteristics

7.1 DC Characteristics

(Unless otherwise noted, Ta=25 ℃,VDD=3.3V,GND=0V)

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
High Level Input Voltage	VIH		0.7VDD	—	VDD	V	UL/DR,IM, SCL,CSB,SDA, STBYB
Low Level Input Voltage	VIL		0	—	0.3VDD	V	
High Level Output Voltage	VOH	IOH=-400uA	VDD-0.4	—	VDD	V	SDA
Low Level Output Voltage	VOL	IOL=400uA	0	—	0.4	V	
Pull up/down resistor	RI		200	350	850	kΩ	Pull down SCL , SDA
			200	350	850	kΩ	Pull up : IM , CSB , STBYB
			100	175	425	kΩ	Pull up : UL/DR
Operating Current	IDD	Color Bar fclk = 27.2 MHz	T.B.D.	T.B.D.	T.B.D.	mA	VDD

(BackLight)

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Forward current	IL	Ta=25 ℃	--	(34.0)	TBD	mA	BLH - BLL1 / BLL2
Forward voltage	VL	Ta=25 ℃ IL=(34.0) mA Note1	--	(14.3)	TBD	V	
Estimated Life of LED	LL	Ta=25 ℃ IL=(34.0) mA Note2	--	(100000)	--	hrs	

Note1: - Reference value

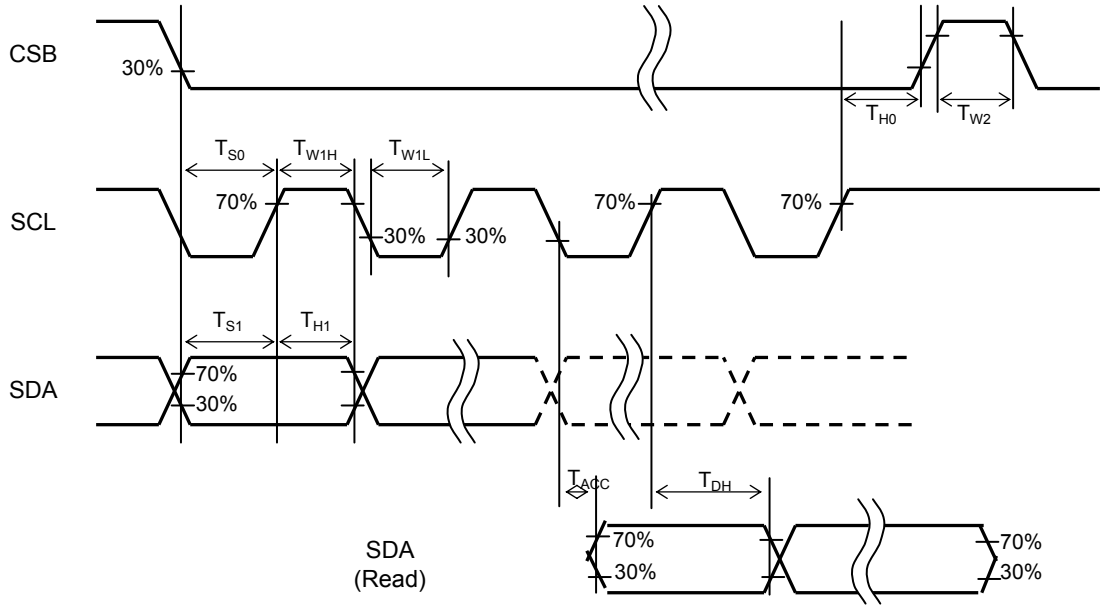
Note2: - The lifetime of the LED is defined as a period till the brightness of the LED decreases to the half of its initial value.
- This figure is given as a reference purpose only, and not as a guarantee.
- This figure is estimated for an LED operating alone.
  As the performance of an LED may differ 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 3-wire Serial interface

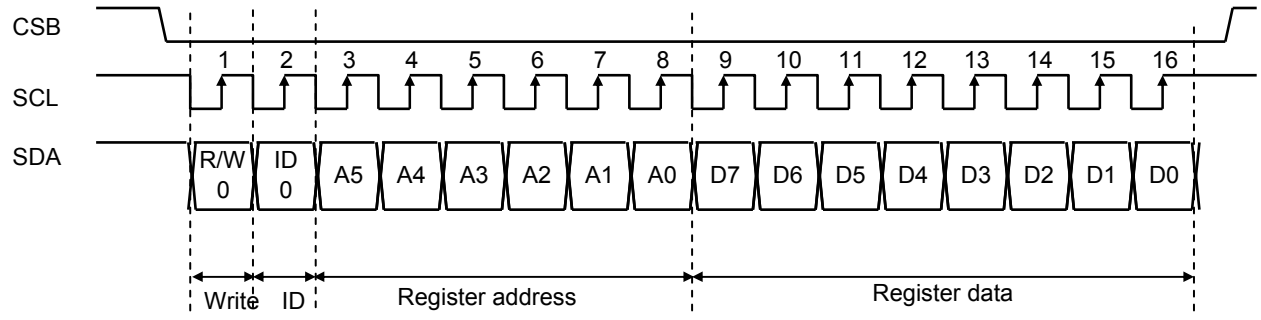
AC Characteristics

(Unless otherwise noted, Ta=25 ℃,VDD=3.3V,GND=0V)

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Serial clock cycle	fSCL		-	-	6.7	MHz	SCL
Clock duty ratio	-		40	50	60	%	
SCL High pulse width	T_{W1H}		75	--	--	ns	
SCL Low pulse width	T_{W1L}		75	--	--	ns	
CSB pulse width	T_{W2}		1	--	--	μs	CSB
CSB setup time	T_{S0}	CSB to SCL	60	--	--	ns	SCL、CSB、SDA
SDA setup time	T_{S1}	SDA to SCL	60	--	--	ns	
CSB hold time	T_{H0}	CSB to SCL	60	--	--	ns	
SDA hold time	T_{H1}	SDA to SCL	60	--	--	ns	
Output access time	T_{ACC}	SCL↓ to SDO	(5)	--	(50)	ns	Read :
Output hold time	T_{DH}	SCL↑ to SDO	(5)	--	(50)	ns	SCL、CSB、SDA



Write timing



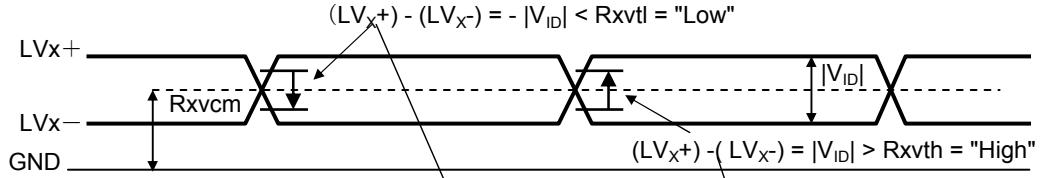
7.3 LVDS interface

7.3.1 LVDS DC Characteristics

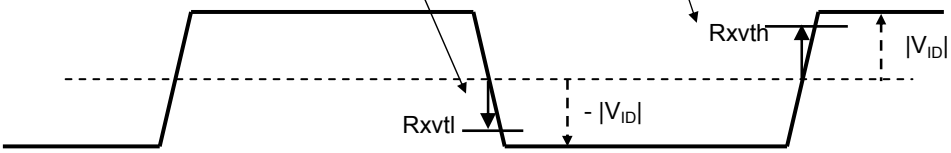
(Unless otherwise noted, Ta=25 ℃,VDD=3.3V,GND=0V)

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Differential input high threshold voltage	Rxvth	R_{XVCM}=1.2V	-	-	0.1	V	CLK+、CLK- R0+、R0-、R1+、R1- R2+、R2-、R3+、R3-
Differential input low threshold voltage	Rxvtl		-0.1	-	-	V	
Differential input common Mode voltage	Rxvcm		1.0	1.2	1.4	V	
Differential input voltage	$\|V_{ID}\|$		0.2	-	0.6	V	
Differential input leakage current	RV_{leak}		-10	—	＋10	μA	

Single end signals



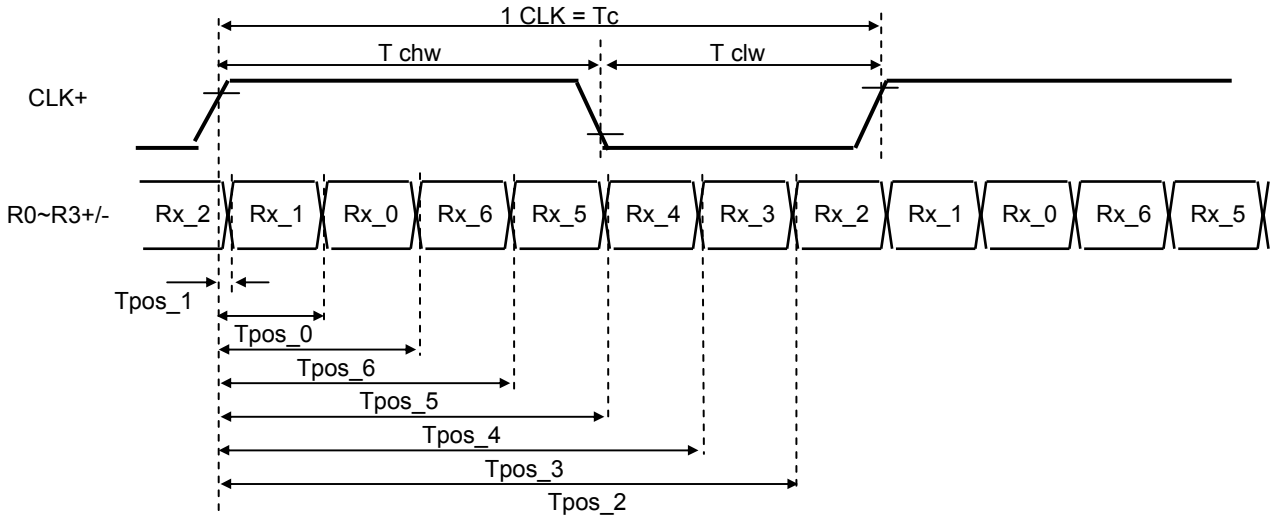
Differential signals

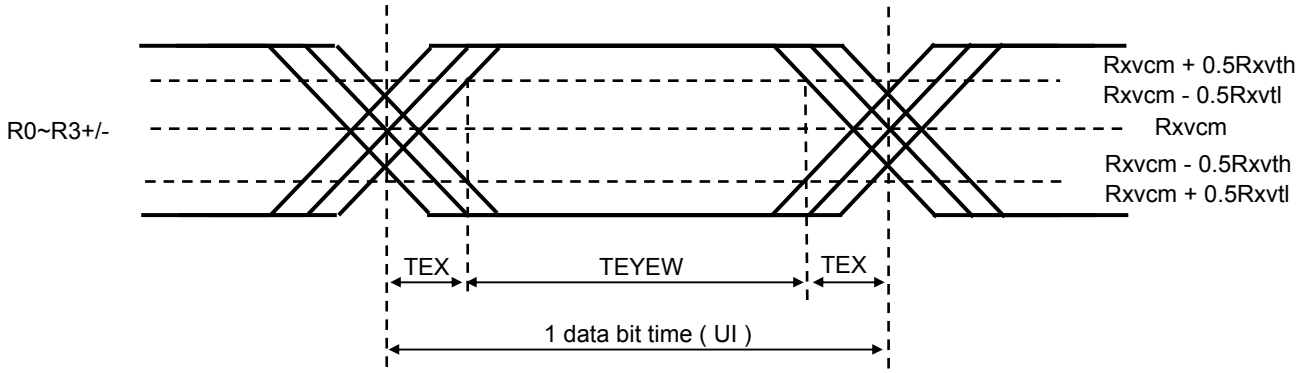


7.3.2 LVDS AC Characteristics

(Unless otherwise noted, Ta=25 ℃,VDD=3.3V,GND=0V)

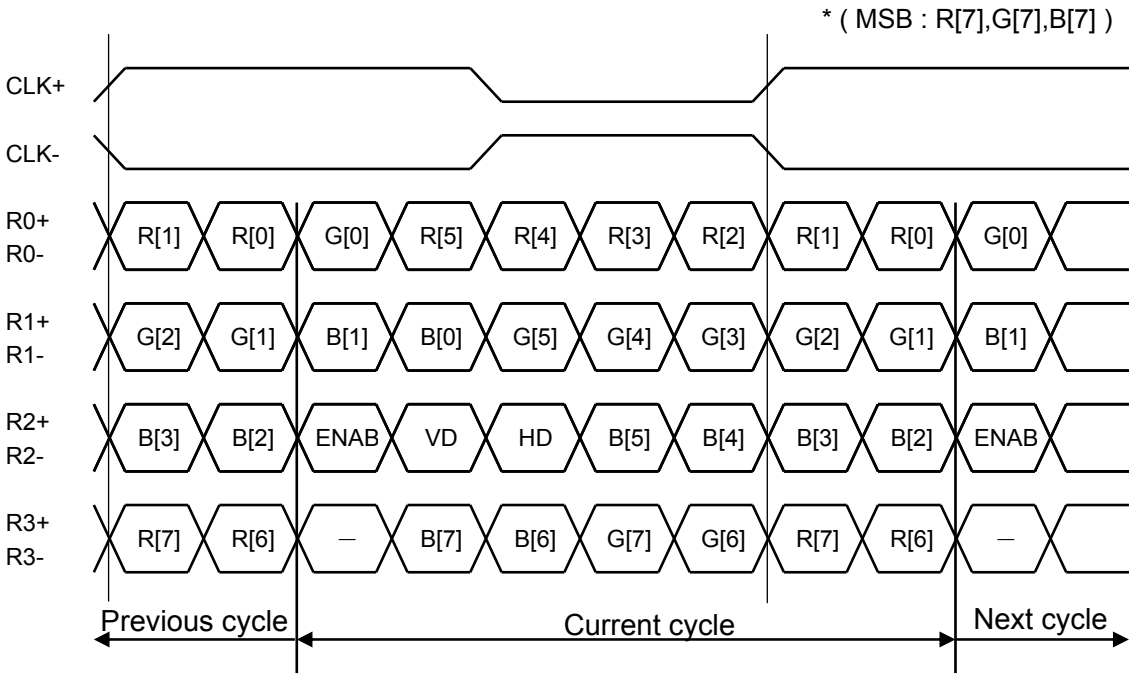
Item	Symbol	Rating			Unit	
		MIN	TYP	MAX		
CLK Frequency	f clk	25.2	27.2	30.5	MHz	
Clock period	Tc	32.8	36.8	39.7	ns	
1 data bit time	UI	-	1/7	-	Tc	
CLK High level Width	T chw	2.9	4	4.1	UI	
CLK Low level Width	T clw	2.9	3	4.1	UI	
Position 1	Tpos_1	-0.2	0	0.2	UI	
Position 0	Tpos_0	0.8	1	1.2	UI	
Position 6	Tpos_6	1.8	2	2.2	UI	
Position 5	Tpos_5	2.8	3	3.2	UI	
Position 4	Tpos_4	3.8	4	4.2	UI	
Position 3	Tpos_3	4.8	5	5.2	UI	
Position 2	Tpos_2	5.8	6	6.2	UI	
Reciever Strobe Position 7	TEYEW	0.6	-	-	UI	
Reciever Strobe Position 8	TEX	-	-	0.2	UI	



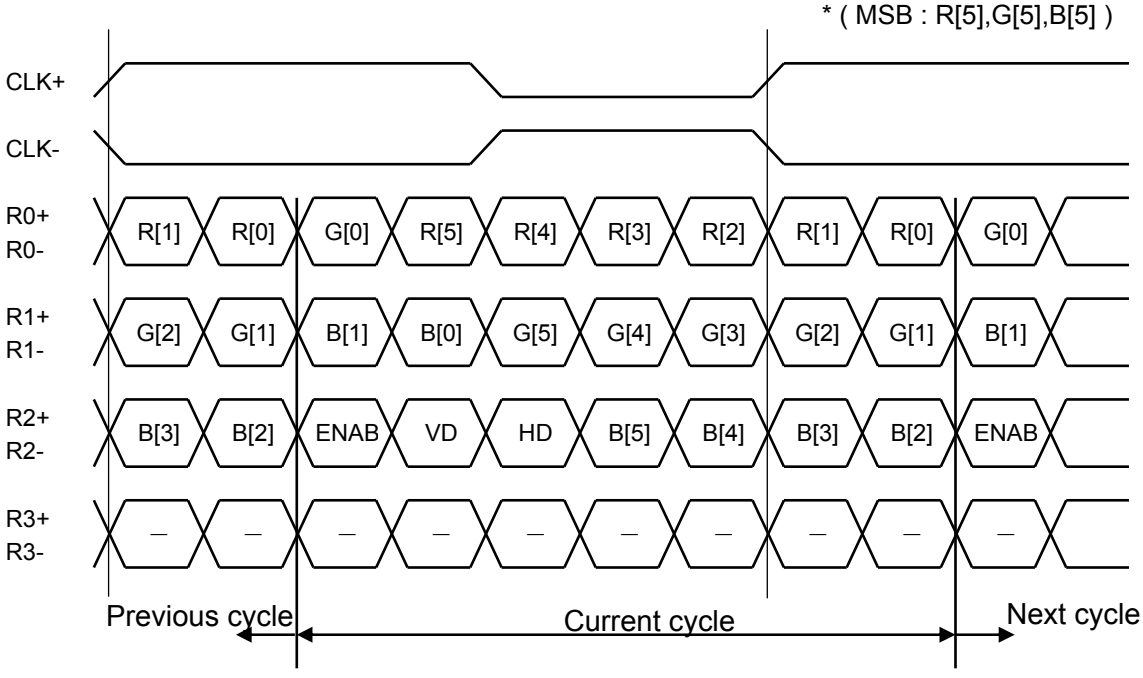


7.3.3 LVDS Data Format

VESA Format 8bit



VESA Format 6bit

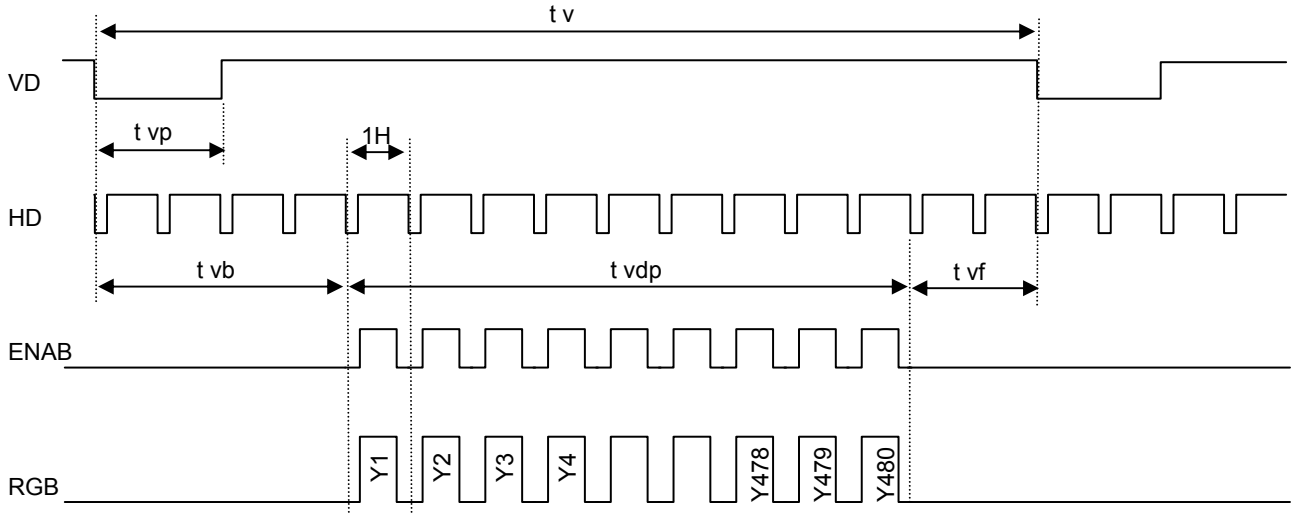


7.4 Input timing

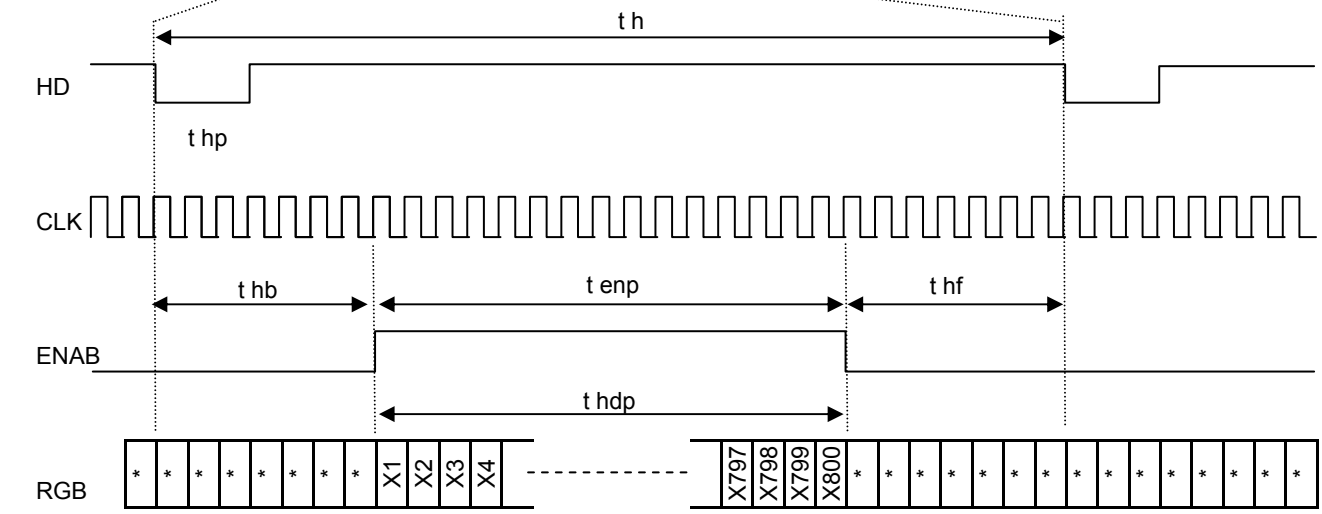
Item	Symbol	Rating			Unit	Signal (*)
		MIN	TYP	MAX		
CLK frequency	fCLK	25.2	27.2	30.5	MHz	CLK
VD frequency	fVD		60		Hz	VD
1 vertical field	tv	490	528	552	H	
VD pulse width	tvp	1	2	66	H	
VD back porch	tvb	5	10	67	H	VD,HD,ENAB
VD front porch	tvf	5	38	67	H	R[7:0],G[7:0],B[7:0]
Vertical valid data	tvdp		480		H	
HD frequency	fHD		28.8		kHz	HD
1 horizontal field	th	856	860	920	CLK	
HD pulse width	thp	1	2	100	CLK	
HD back porch	thb	5	16	101	CLK	CLK,HD,ENAB
HD front porch	thf	19	44	115	CLK	R[7:0],G[7:0],B[7:0]
ENAB pulse width	tenp		800		CLK	
Horizontal valid data	thdp		800		CLK	

(*) Input terminals are (R0+/- , R1+/- , R2+/- , R3+/- , CLK+/-).

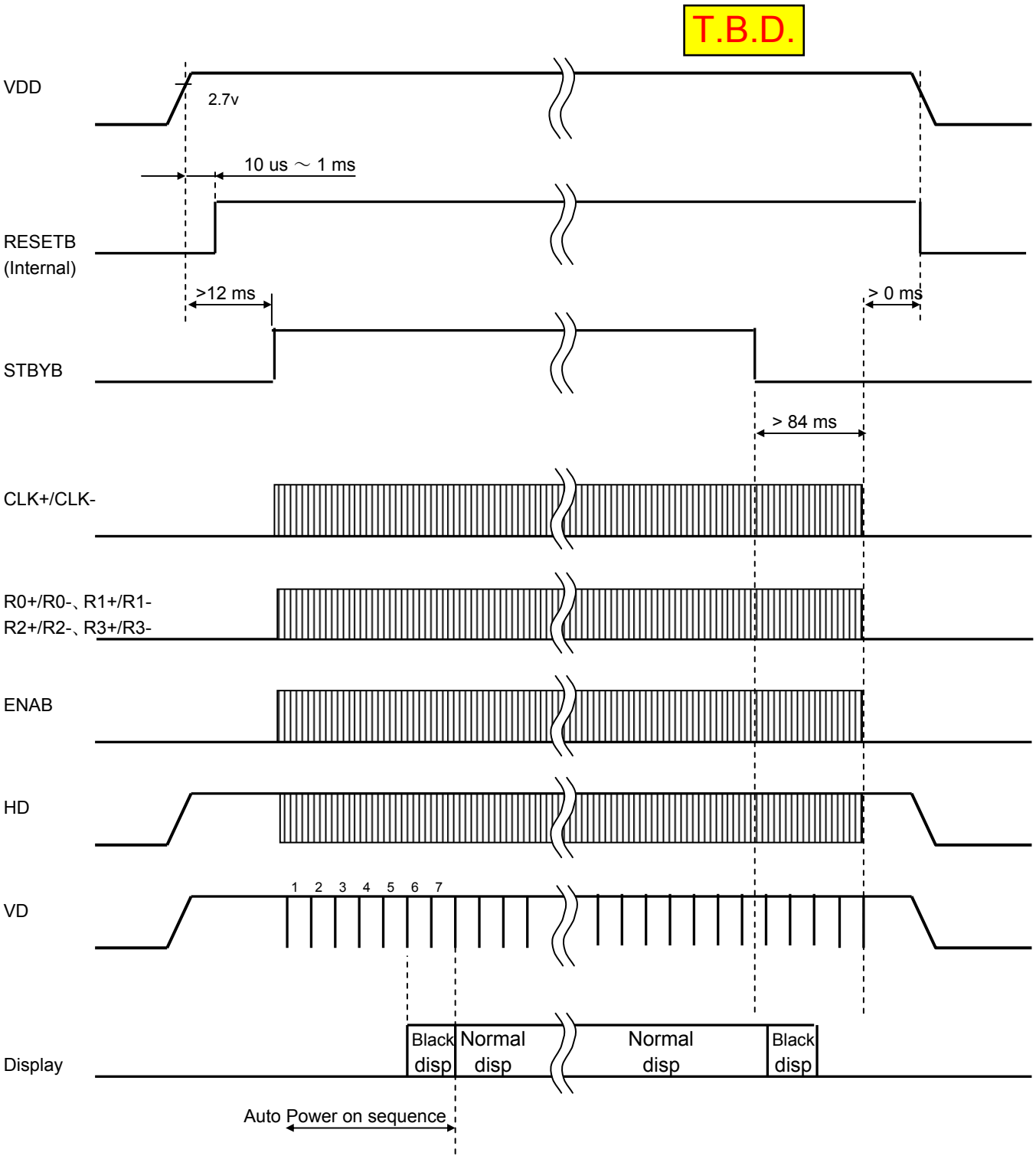
<Vertical timing>



<Horizontal timing>

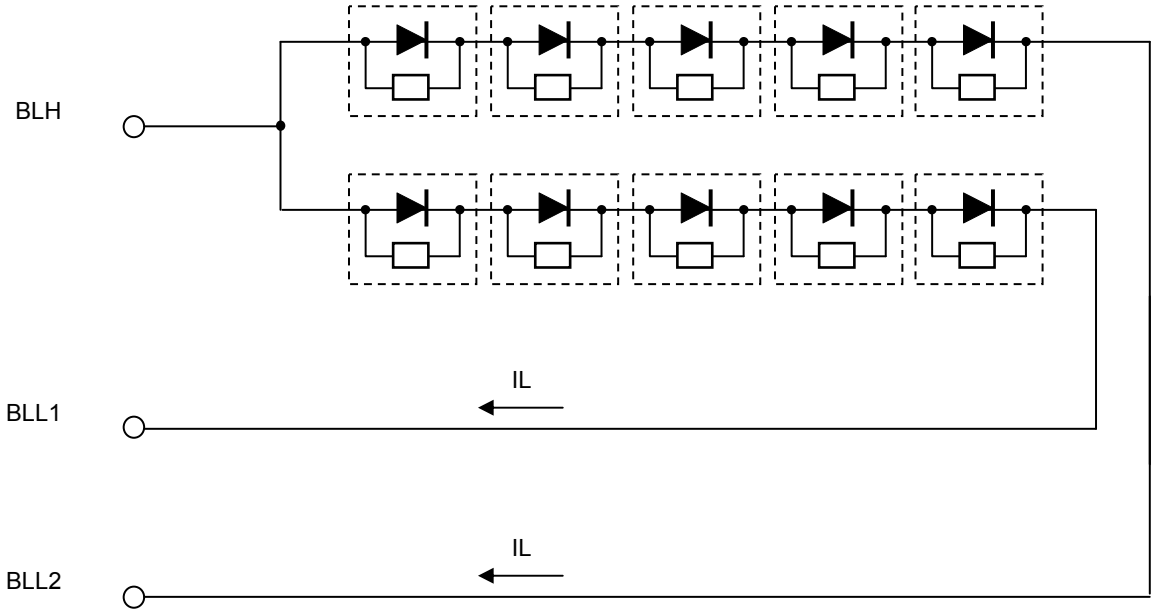


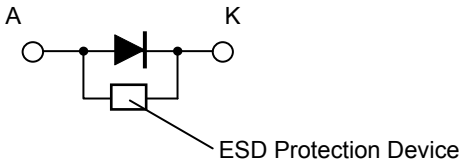
7.5 Power ON/OFF sequencs



Note: ENAB, HD and VD are included in the R2 + / R2- terminals.

8. LED Circuit





9. Characteristics

9.1 Optical Characteristics

< Measurement Condition >

Measuring instruments: CS2000（KONICA MINOLTA）, LCD7200(OTSUKA ELECTRONICS）, EZcontrast160D（ELDIM）

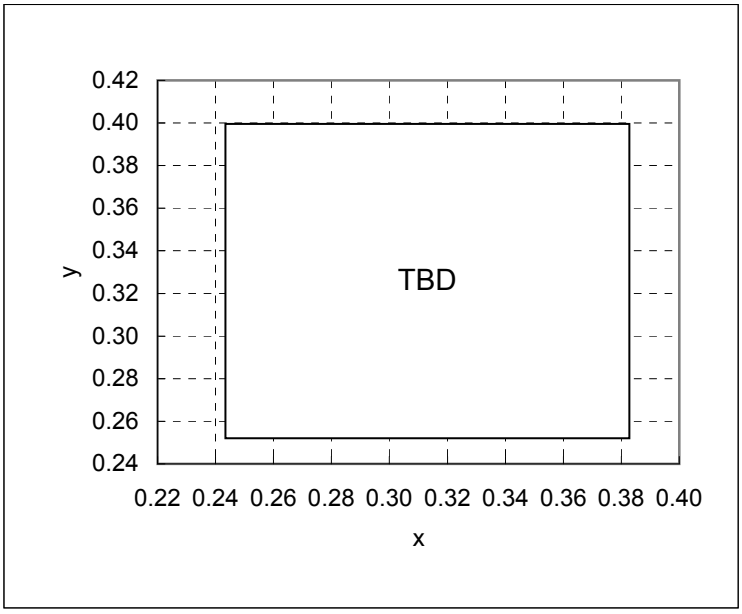
Driving condition: VDD = 3.3V, VSS = 0V
Optimized VCOMDC

Backlight: IL=(34.0)mA

Measured temperature: Ta=25° C

Item		Symbol	Condition	MIN	TYP	MAX	Unit	Note No.	Remark
Response time	Rise time	TON	[Data]= (00)h→(FF)h	—	—	(60)	ms	1	
	Fall time	TOFF	[Data]= (FF)h→(00)h	—	—	(40)	ms		
Contrast ratio	Backlight ON	CR	[Data]= (FF)h / (00)h	(540)	(900)	—		2	
	Backlight OFF			—	(TBD)	—			
Viewing angle	Left	θL	[Data]= (FF)h / (00)h CR≧(10)	(80)	—	—	deg	3	
	Right	θR		(80)	—	—	deg		
	Up	φU		(80)	—	—	deg		
	Down	φD		(80)	—	—	deg		
White Chromaticity		x	[Data]=(FF)h	White chromaticity range				4	
		y							
Burn-in				No noticeable burn-in image shall be observed after (2) hours of window pattern display.				5	
Center brightness			[Data]=(FF)h	TBD	(400)	—	cd/m^2	6	
Brightness distribution			[Data]=(FF)h	(70)	—	—	%	7	

* Note number 1 to 7: Refer to the APPENDIX of "Reference Method for Measuring Optical Characteristics".



White Chromaticity Range

【White Chromaticity Range】

x	y
TBD	TBD
TBD	TBD
TBD	TBD
TBD	TBD
TBD	TBD
TBD	TBD
TBD	TBD

9.2 Temperature Characteristics

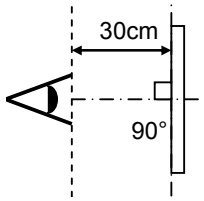
< Measurement Condition >
Measuring instruments: CS2000（KONICA MINOLTA）, LCD7200(OTSUKA ELECTRONICS）
Driving condition: VDD = 3.3V, VSS = 0V
Optimized VCOMDC
Backlight: IL=(34.0)mA

Item			Specification		Remark
			Ta＝-20°C	Ta＝70°C	
Contrast ratio		CR	TBD	TBD	Backlight ON
Response time	Rise time	TON	TBD	TBD	
	Fall time	TOFF	TBD	TBD	
Display Quality			No noticeable display defect or ununiformity should be observed.		

10. Criteria of Judgment

10.1 Defective Display and Screen Quality

Test Condition:	Observed TFT-LCD monitor from front during operation with the following conditions
Driving Signal	Raster Patter (RGB, white, black)
Signal condition	[Data]:(00)h, (TBD)h, (FF)h (3steps)
Observation distance	30 cm
Illuminance	200 to 350 lx
Backlight	IL=(34.0)mA



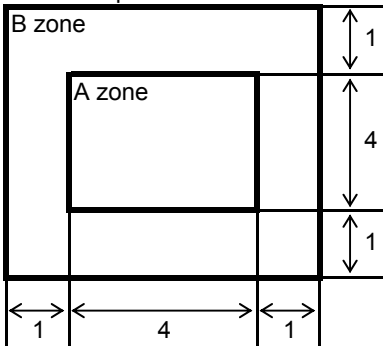
Defect item		Defect content		Criteria
Display Quality	Line defect	Black, white or color line, 3 or more neighboring defective dots		Not exists
	Dot defect	Uneven brightness on dot-by-dot base due to defective TFT or CF, or dust is counted as dot defect (brighter dot, darker dot) High bright dot: Visible through 2% ND filter at [Data]=(00)h Low bright dot: Visible through 5% ND filter at [Data]=(00)h Dark dot: Appear dark through white display at [Data]=(TBD)h		Refer to table 1
		Invisible through 5% ND filter at [Data]=(00)h		Acceptable
Screen Quality	Dirt	Uneven brightness (white stain, black stain etc)		Invisible through 5% ND filter at Black screen. Invisible through 1% ND filter at other screen.
	Foreign particle	Point-like	0.25mm< φ	N=0
			0.20mm< φ ≦0.25mm	N≦3
			φ ≦0.20mm	Acceptable
		Liner	3.0mm<length and 0.08mm<width	N=0
			length≦3.0mm or width≦0.08mm	Acceptable
	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 Permissible distance between same color high bright dots (includes neighboring dots): 5 mm or more
B	2	4	4	6	
Total	2	4	4	7	

<Landscape 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)

10.2 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	

11. Reliability Test

Test item		Test condition	number of failures /number of examinations
Durability test	High temperature storage	Ta=95°C (240)hr	TBD
	Low temperature storage	Ta=-40°C (240)hr	TBD
	High temperature & high humidity storage	Ta=60°C, RH=90% (240)hr non condensing ※	TBD
	High temperature operation	Tp=85°C (240)hr	TBD
	Low temperature operation	Tp=-30°C (240)hr	TBD
	High temp & humid operation	Tp=40°C, RH=90% (240)hr non condensing ※	TBD
	Thermal shock storage	-40←→95°C(30min/30min) (100) cycles	TBD
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.	TBD
	Surface discharge test (Non operation)	C=250pF, R=100Ω, V=±(TBD)kV Each 5 times of discharge in both polarities on the center of screen with the case grounded.	TBD
	FPC tension test	Pull the FPC with the force of 3N for 10 sec. in the direction - 90-degree to its original direction.	TBD
	FPC bend test	Pull the FPC with the force of 3N for 10 sec. in the direction -180-degree to its original direction. Reciprocate it 3 times.	TBD
	Vibration test	Total amplitude 1.5mm, f=10～55Hz, X,Y,Z directions for each 2 hours	TBD
	Impact test	Use ORTUS TECHNOLOGY 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 C 60068-2-27-2011.	TBD
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	TBD
	Packing drop test	Drop from 75cm high. 1 time to each 6 surfaces, 3 edges, 1 corner	TBD

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.)

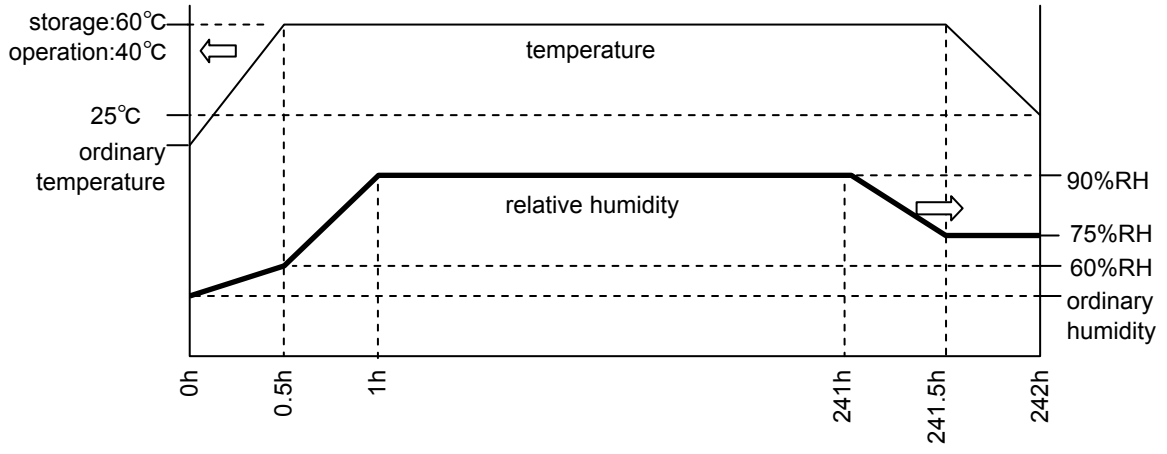
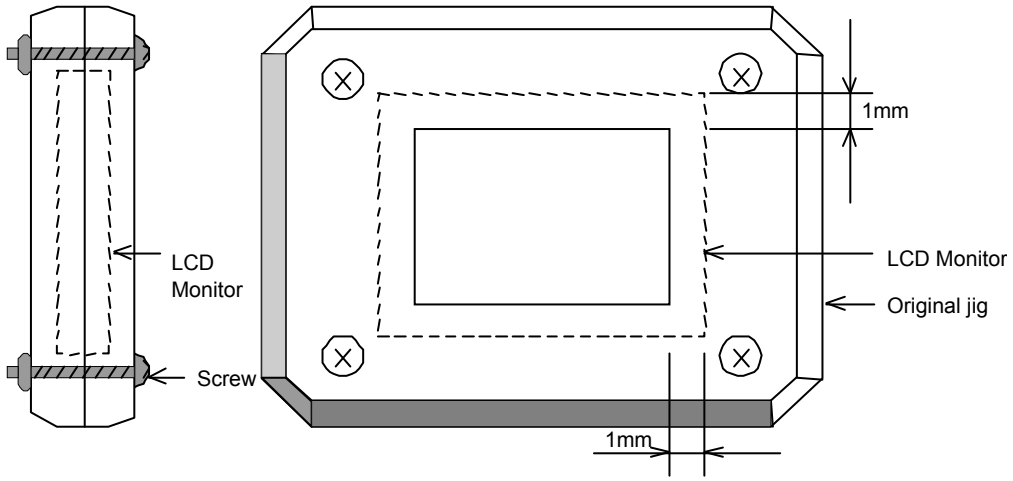


Table2.Reliability Criteria

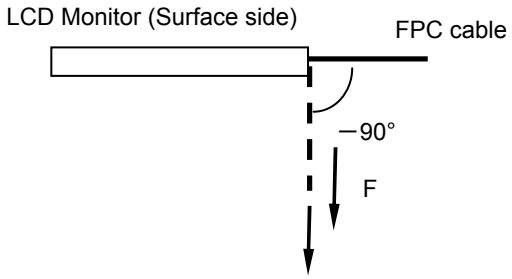
The parameters should be measured after leaving the monitor at the ordinary temperature for 24 hours or more after the test completion.

item	Standard	Remarks
Display quality	No visible abnormality shall be seen. (Except for unevenness by Pol deterioration.)	
Contrast ratio	100 or more	Backlight ON

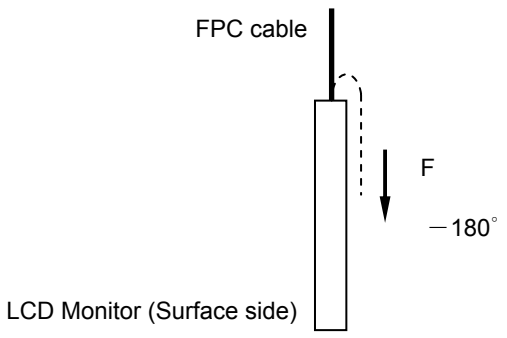
ORTUS TECHNOLOGY Original Jig



Tension Test Method for FPC cable



Bend Test Method for FPC cable



12. Packing Specifications

TBD

13. Handling Instruction

13.1 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 abnormal operation is generated.
We recommend you to add excess current protection circuit to power supply.

(11) The devices on the FPC are damageable to electrostatic discharge, because the terminals of the devices are exposed.
Wear grounded wrist-straps and use electrostatic neutralization blowers to prevent static charge and discharge when handling the TFT monitors.
Designate an appropriate operating area, and set equipment, tools, and machines properly when handling this product.

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.

13.2 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.

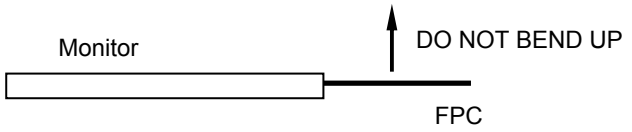
3) Avoid strong mechanical shock including knocking, hitting or dropping to the TFT monitors for protecting their glass parts. Do not use the TFT monitors that have been experienced dropping or strong mechanical shock.

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) Do not bend or pull the FPC cable or carry the TFT monitor by holding the FPC cable.
Especially, it will cause mechanical damage or critical defect if FPC is pull up or bent up to short of display.



8) Peel off the protective film on the TFT monitors during mounting process.
Refer to the section 13.5 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.

13.3 Precautions for Operation

1) Since this TFT monitors are not equipped with light shielding for the driver IC, do not expose the driver IC to strong lights during operation as it may cause functional failures.

2) In case of powering up or powering off this LCD module, be sure to comply the sequence as instructed in this specification.

3) Do not plug in or out the 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.

13.4 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: 1 year
- Unpacking: To prevent damages caused by static electricity, anti-static precautionary measures (e.g. earthing, anti-static mat) should be implemented.
  After unpack, keep product in the appropriate condition, otherwise bubble seal of Protective film may be printed on Polarizer.
- Maximum piling up: (TBD) cartons

*Conditions to storage after unpacking

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: 1 year (Shelf life)
- Others: Keep/ store away from direct sunlight
  Storage goods on original tray made by ORTUS.

13.5 Precautions for Peeling off the Protective film

TBD

13.6 Warranty

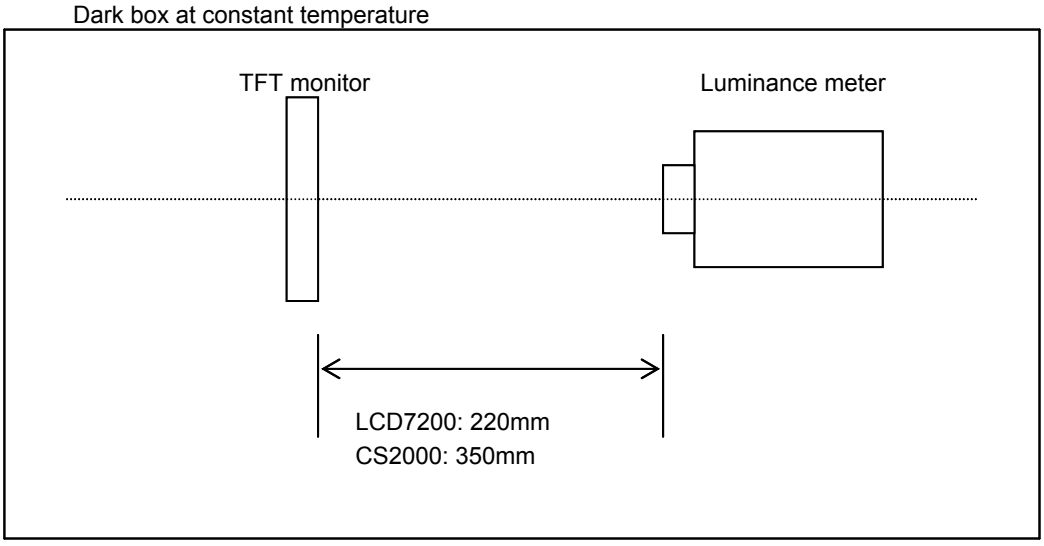
ORTUS is only liable to defective goods which is stored and used under the condition complying with this specifications and returned within 1 (one) year.
Warranty caused by manufacturing defect shall be conducted by replacement of goods or refundment at unit price.

APPENDIX

Reference Method for Measuring Optical Characteristics and Performance

1. Measurement Condition (Backlight ON)

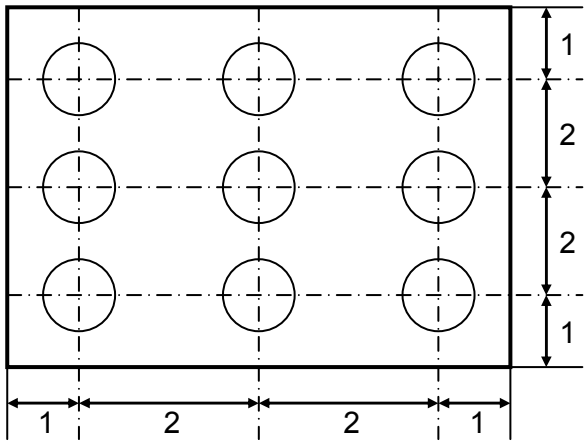
Measuring instruments: CS2000（KONICA MINOLTA）, LCD7200(OTSUKA ELECTRONICS）,EZcontrast160D（ELDIM）
Driving condition: Refer to the section "Optical Characteristics"
Measured temperature: 25˚C unless specified
Measurement system: See the chart below. The luminance meter is placed on the normal line of measurement system.
Measurement point: At the center of the screen unless otherwise specified



Measurement is made after 30 minutes of lighting of the backlight.

Measurement point: At the center point of the screen
Brightness distribution: 9 points shown in the following drawing.

<Landscape model>

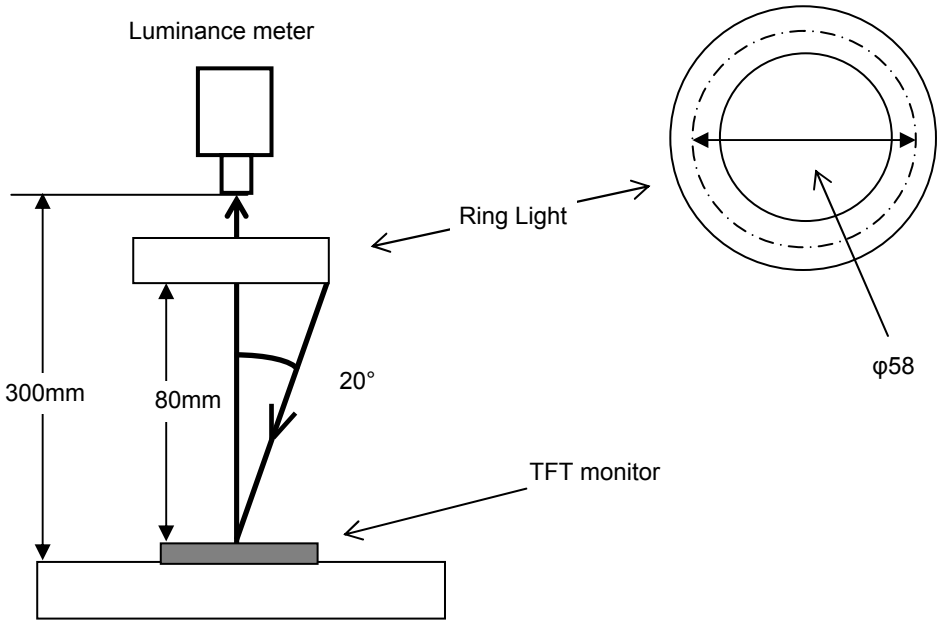


Dimensional ratio of active area

Backlight IL=(34.0)mA

Measurement Condition (Contrast ratio Backlight OFF only)

Measuring instruments:	LCD7200(OTSUKA ELECTRONICS),Ring Light(40,000 lx,φ58)
Driving condition:	Refer to the section "Optical Characteristics"
Measured temperature:	25˚C unless specified
Measurement system:	See the chart below.
Measurement point:	At the center of the screen.



2. Test Method

Notice	Item	Test method	Measuring instrument	Remark
1	Response time	Measure output signal waveform by the luminance meter when raster of window pattern is changed from white to black and from black to white. Black White Black White brightness 100% 90% 10% 0% Black brightness TON TOFF	LCD7200	Black display [Data]=(00)h White display [Data]=(FF)h TON Rise time TOFF Fall time
2	Contrast ratio	Measure maximum luminance Y1([Data]=(FF)h) and minimum luminance Y2([Data]=(00)h) 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: 1mmφ(CS2000) Diameter of measuring point: 3mmφ(LCD7200)	CS2000 LCD7200	Backlight ON Backlight OFF
3	Viewing angle Horizontalθ Verticalφ	Move the luminance meter from right to left and up and down and determine the angles where contrast ratio is (10).	EZcontrast160D	
4	White chromaticity	Measure chromaticity coordinates x and y of CIE1931 colorimetric system at [Data] = (FF)h Color matching function: 2°view	CS2000	
5	Burn-in	Visually check burn-in image on the screen after 2 hours of "window display" ([Data]=(00)h/(FF)h).		At optimized VCOMDC
6	Center brightness	Measure the brightness at the center of the screen.	CS2000	
7	Brightness distribution	(Brightness distribution) = 100 x B/A % A : max. brightness of the 9 points B : min. brightness of the 9 points	CS2000	