



OUR GLOBAL
COMPETENCE
CENTRES

 APOLLO DISPLAY
TECHNOLOGIES



 DISTEC



 DISPLAY
TECHNOLOGY



Datasheet

Ortustech

COM43H4N90ULC

OR-20-037

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

Specifications for

Blanview TFT-LCD Monitor (TENTATIVE) **(4.3" WVGA 480 x RGB x 800 Portrait)**

Version 0.0

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

MODEL COM43H4N90ULC

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



TOPPAN PRINTING CO.,LTD.
Electronics Division
Ortus Subdivision

Approved by

Checked by

Prepared by

Contents

1. Application	.....	4
2. Outline Specifications		
2.1 Features of the Product	.....	5
2.2 Display Method	.....	5
3. Dimensions and Shape		
3.1 Dimensions	.....	7
3.2 Outward Form	.....	8
3.3 Serial № print (S-print)	.....	9
4. Pin Assignment	.....	10
5. Block Diagram	.....	11
6. Absolute Maximum Rating	.....	12
7. Recommended Operating Conditions	.....	12
8. Electrical Characteristics		
8.1 DC Characteristics	.....	13
8.2 AC Characteristics	.....	14
8.3 Input Timing Characteristics	.....	16
8.4 Driving Timing Chart	.....	17
8.5 Example of Driving Timing Chart	.....	18
9. Power ON/OFF sequence	.....	19
10. Characteristics		
10.1 Optical Characteristics	.....	20
10.2 Temperature Characteristics	.....	21
11. Criteria of Judgment		
11.1 Defective Display and Screen Quality	.....	22
11.2 Screen and Other Appearance	.....	23
12. Reliability Test	.....	24
13. Packing Specifications	.....	26
14. Handling Instruction		
14.1 Cautions for Handling LCD panels	.....	27
14.2 Precautions for Handling	.....	28
14.3 Precautions for Operation	.....	28
14.4 Storage Condition for Shipping Cartons	.....	29
14.5 Precautions for Peeling off the Protective film	.....	30
14.6 Warranty	.....	30
APPENDIX	.....	31

1. Application

This Specification is applicable to 108.5 mm (4.3 inch) Blanview TFT-LCD monitor for non-military use.

- ◎ TOPPAN PRINTING 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 TOPPAN PRINTING shall not grant to Purchaser any right to use any patent or other intellectual property rights owned by third parties. Since this Specification contains TOPPAN PRINTING'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 TOPPAN PRINTING'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 TOPPAN PRINTING 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.
- ◎ TOPPAN PRINTING 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, TOPPAN PRINTING and Purchaser shall discuss them in good faith and seek solution.
- ◎ TOPPAN PRINTING 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(2.0) 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
Bis(2-ethylhexyl)phthalate series(DEHP series)	1000
Butyl benzyl phthalate series(BBP series)	1000
Dibutyl phthalate series(DBP series)	1000
Diisobutyl phthalate series(DIBP series)	1000

2. Outline Specifications

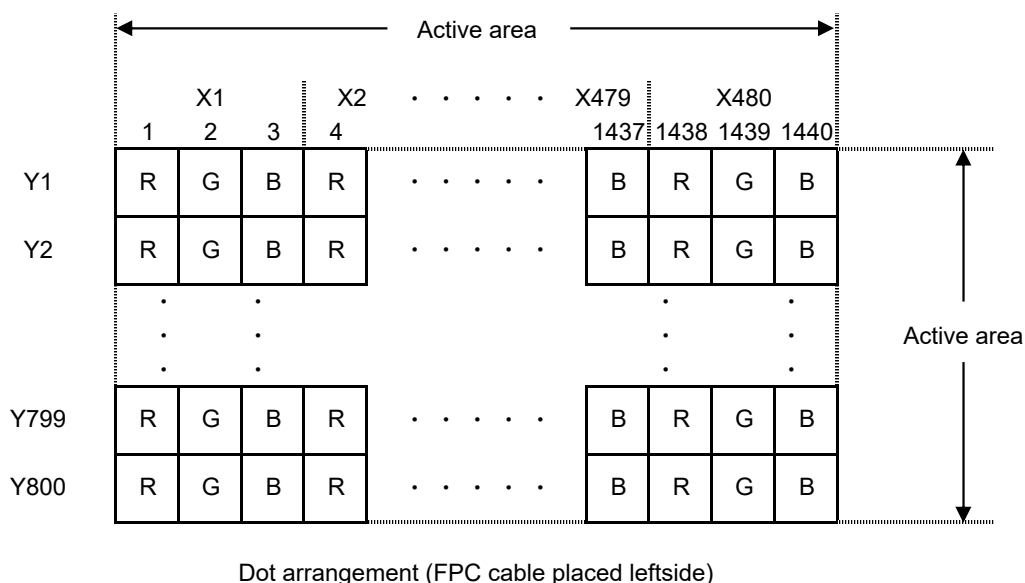
2.1 Features of the Product

- 4.3 inch diagonal display, 1440 [H] x 800 [V] dots.
- 6-bit / 262,144 colors.
- Timing generator [TG], Counter-electrode driving circuitry, Built-in power supply circuit.
- Power save (Standby) mode capable.
- 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

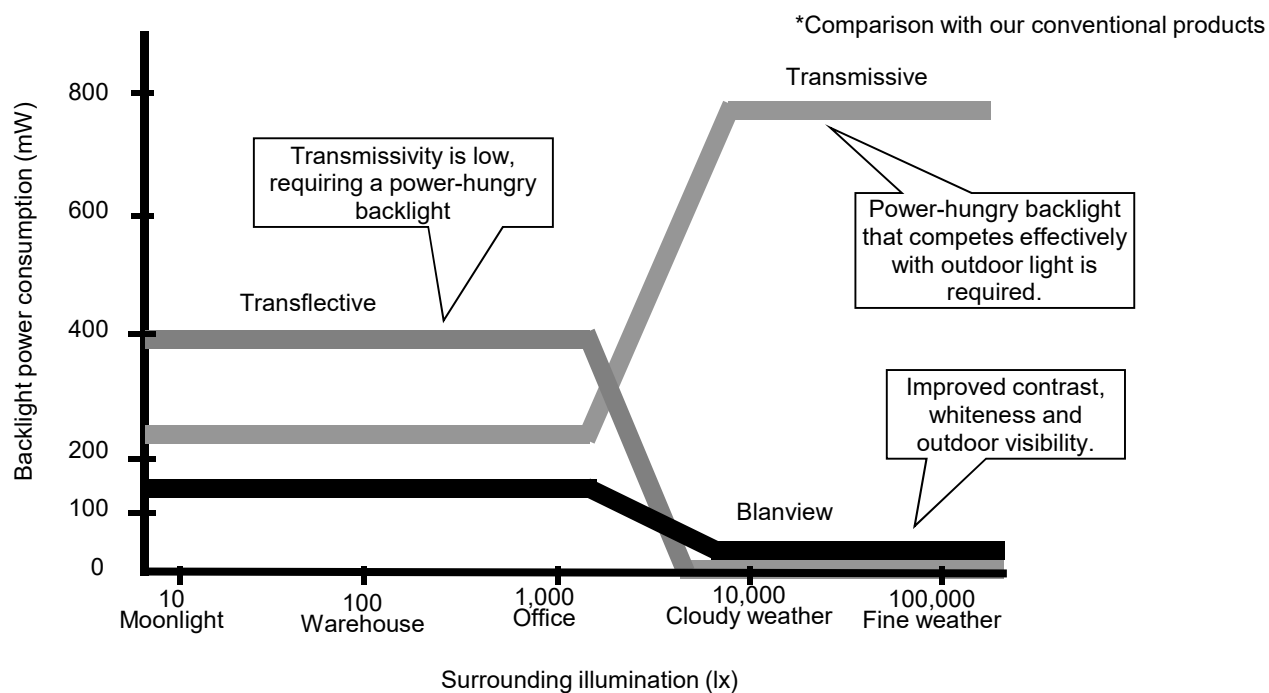
2.2 Display Method

Items	Specifications	Remarks
Display type	262,144 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	6-bit RGB,parallel input.	
Backlight type	Long life & High bright white LED.	
NTSC ratio	35%	



<Features of Blanview>

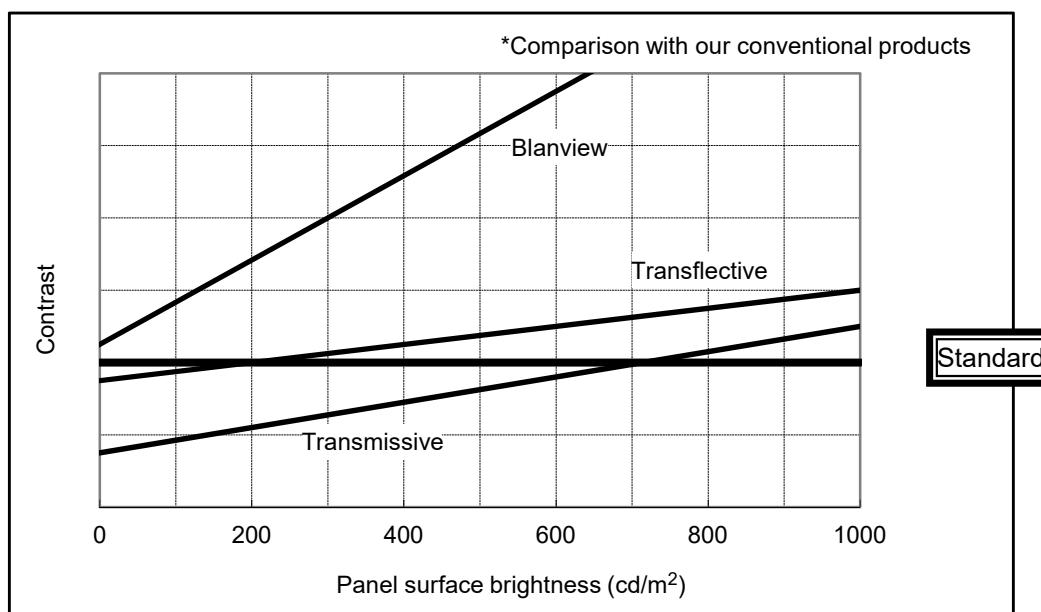
- Backlight power consumption required to assure visibility. (equivalent to 3.5"QVGA)



- 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. (TOPPAN PRINTING criteria)



3. Dimensions and Shape

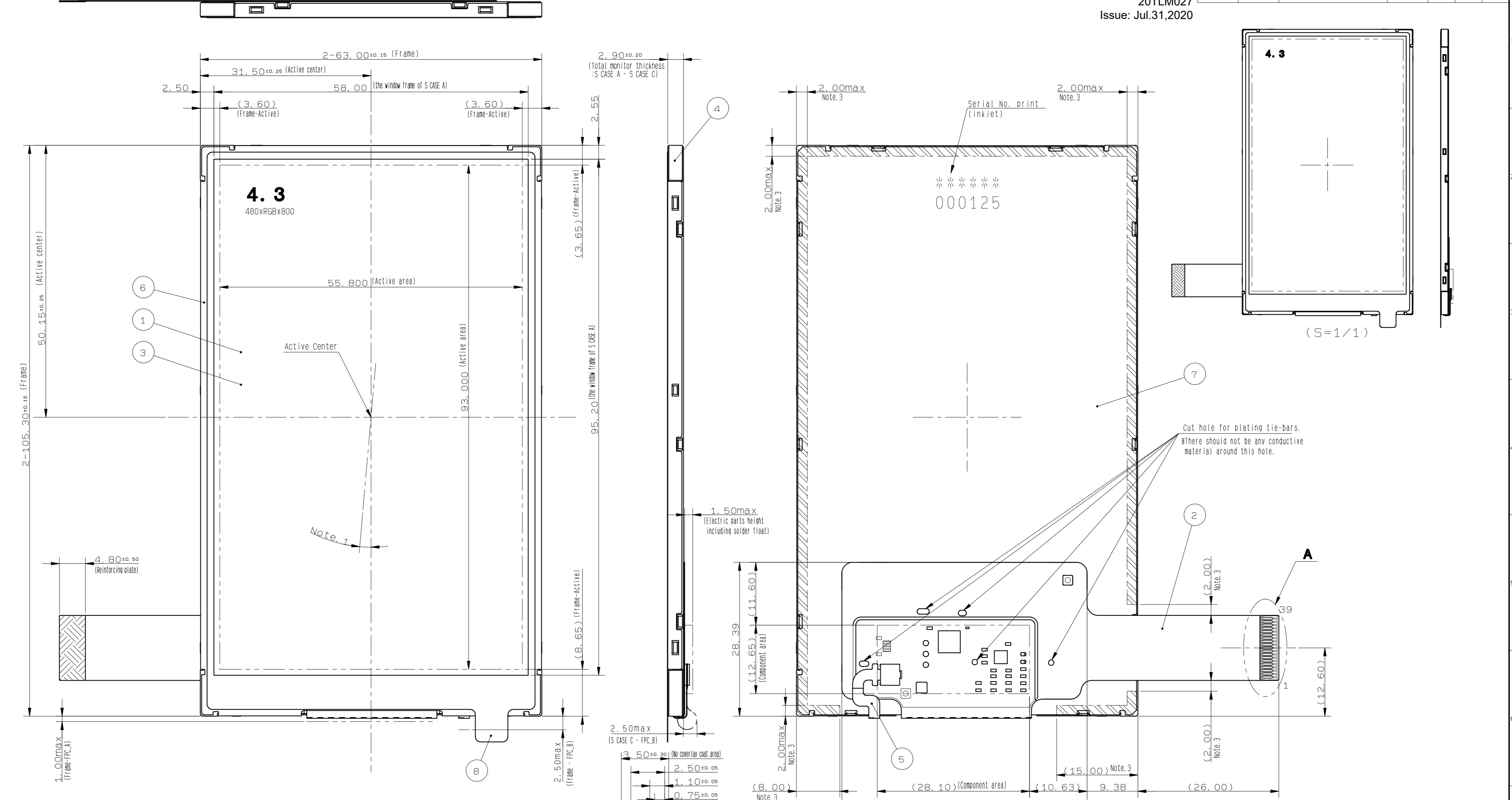
3.1 Dimensions

Items	Specifications	Unit	Remarks
Outline dimensions	63.0[H] × 105.3[V] × 2.9[D]	mm	Exclude FPC cable and parts on FPC.
Active area	55.8[H] × 93.0[V]	mm	108.5 mm diagonal
Number of dots	1440[H] × 800[V]	dot	
Dot pitch	38.75[H] × 116.25[V]	μm	
Surface hardness of the polarizer	2	H	Load:2.0N
Weight	39.6	g	Include FPC cable

3.2 Outward Form

(8/33)
20TLM027
Issue: Jul.31,2020

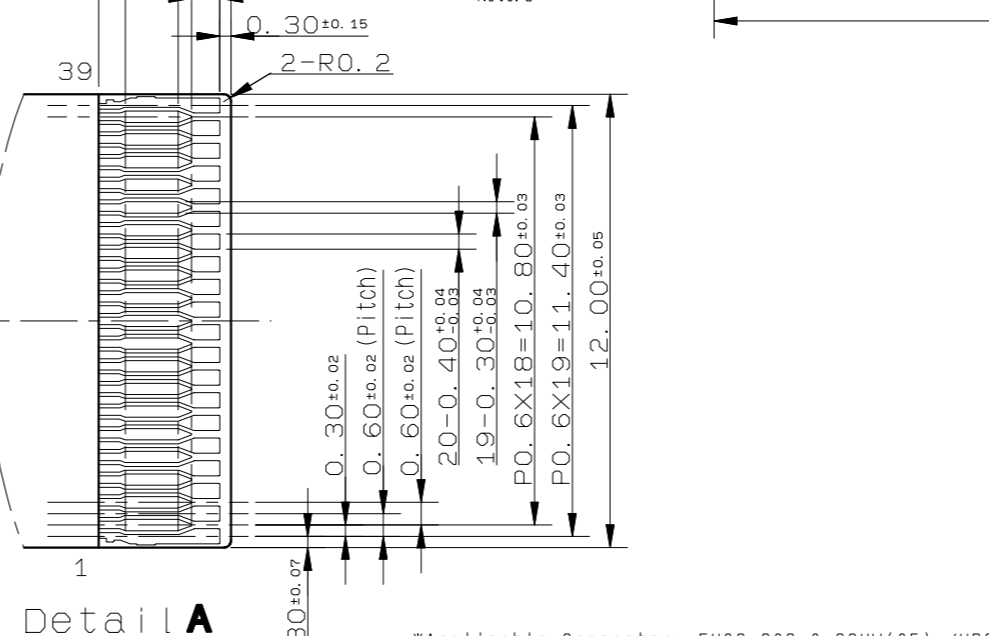
EC No.	REV. No.	REVISE	DATE (Y:M:D)	APPROVED	CHECKED	PREPARED



Note 1. Angular deviation of LCD cell from the TFT-LCD monitor's reference axis shall be less than $\pm 40'$.

2. Recommended FPC connectors
For LCD : HIROSE ELECTRIC CO.,LTD., part number:FH23-39S-0.35HW(05)

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



P FILM	9			
S CASE C	7		SUS (t=0.20)	
S CASE A	6		SUS (t=0.20)	
FPC B	5			Use of LED
Frame	4		PC	
Polarizer	3			
FPC A	2			Use of LCD
TFT-LCD	1		Glass thickness=0.50±0.50t	
PART NAME	ITEM	PART CODE	MODEL NUMBER	REMARK
APPROVED	尾木	GENERAL TOLERANCE ±0.5	SCALE 2/1(1/1)	UNIT mm
CHECKED	加藤貴一	ISSUE (Y:M:D) 20:07:02	MODEL COM43H4N90**	
CHECKED	NAME			
DESIGN	中山			
DRAW	井出			
OUTLINE-D4N90				
DRAWING No.		REV.	SHEET	DIV.
RJD600547D201		#	/	ASSY

3.3 Serial № print (S-print)

1) Display Items

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

* Contents of Display

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

Contents of display				
a	The least significant digit of manufacture year			
b	Manufacture month	Jan-A Feb-B Mar-C Apr-D	May-E Jun-F Jul-G Aug-H	Sep-I Oct-J Nov-K Dec-L
c	Model code	43FMC (Made in Japan) 43FNC (Made in Malaysia)		
d	Serial number			

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

•Made in Japan

0L43FMC000125

means "manufactured in December 2020, 4.3" FM type, C specifications, serial number 000125"

•Made in Malaysia

0L43FNC000125

means "manufactured in December 2020, 4.3" FM type, C specifications, serial number 000125"

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

Refer to 3.2 "Outward Form".

3)Others

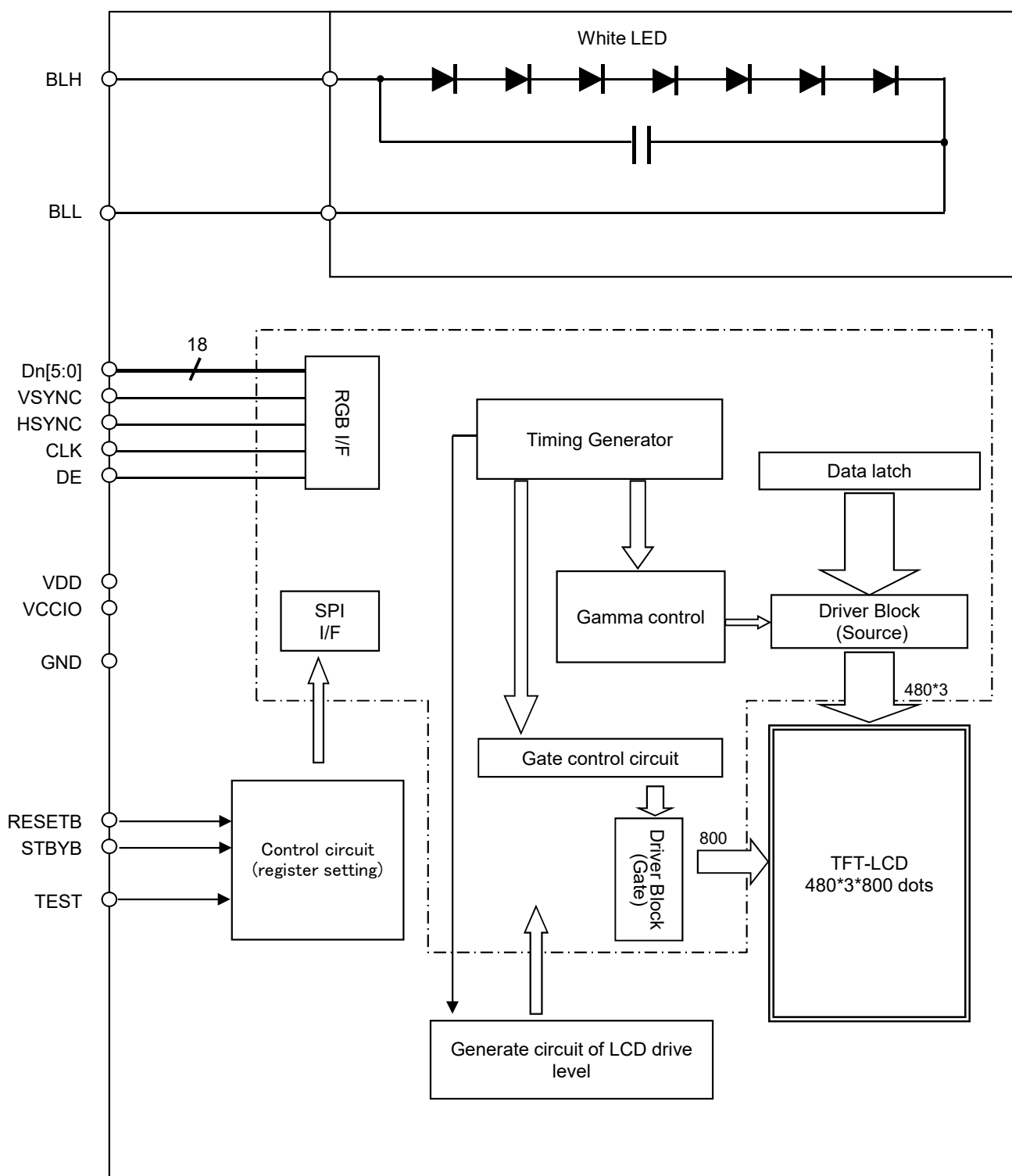
Please note that it is likely to disappear with an organic solvent about the Serial print.

4. Pin Assignment

No.	Symbol	Function
1	VSS	Ground
2	VSS	Ground
3	VDD	Power supply input.
4	VCCIO	Logic Interface Power supply input.
5	VSS	Ground
6	RESETB	System reset signal input.(Lo: active)
7	HSYNC	Horizontal sync signal input. (Negative polarity)
8	VSYNC	Vertical sync signal input.(Negative polarity)
9	CLK	Clock input for display. (Data Input on the falling edge)
10	VSS	Ground
11	D00	Display data input for (B). 00h for black display D00:LSB D05:MSB Driver IC carries out gamma conversion internally.
12	D01	
13	D02	
14	D03	
15	D04	
16	D05	
17	D10	Display data input for (G). 00h for black display D10:LSB D15:MSB Driver IC carries out gamma conversion internally.
18	D11	
19	D12	
20	D13	
21	D14	
22	D15	
23	D20	Display data input for (R). 00h for black display D20:LSB D25:MSB Driver IC carries out gamma conversion internally.
24	D21	
25	D22	
26	D23	
27	D24	
28	D25	
29	VSS	Ground
30	DE	Input data effective signal. (It is effective for the period of "H")
31	STBYB	Standby signal (Lo:Standby operation,Hi:Normal operation)
32	TEST1	Connect to Ground.
33	NC	OPEN
34	NC	OPEN
35	NC	OPEN
36	NC	OPEN
37	TEST2	Connect to Ground.
38	BLH	LED drive power source. (Anode side)
39	BLL	LED drive power source. (Cathode side)

- Recommended connector: HIROSE ELECTRIC FH23 series [FH23-39S-0.3SHW(05)]
- Please 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. Block Diagram



6. 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
Logic interface voltage	VCCIO		-0.3	VDD	V	VCCIO
Input voltage for logic	VI		-0.3	VCCIO+0.3	V	CLK,VSYNC,HSYNC,DE D[05:00],D[15:10] D[25:20],STBYB,RESETB
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.				

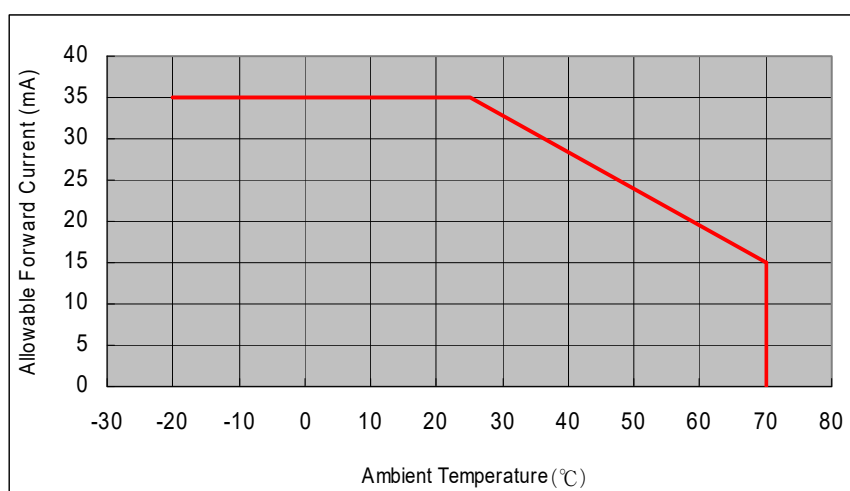
7. Recommended Operating Conditions

VSS=0V

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Supply voltage	VDD		2.7	3.0	3.6	V	VDD
Logic interface voltage	VCCIO		1.7	1.8	VDD	V	VCCIO
Input voltage for logic	VI		0	--	VCCIO	V	CLK,VSYNC,HSYNC,DE D[05:00],D[15:10] D[25:20],STBYB,RESETB
Operational temperature range	Top	Note1,2	-20	+25	+70	° C	Panel surface temperature
Operating humidity range	Hop	Ta<=40 °C	20	—	85	%	
		Ta>40 °C	Non condensing in an environmental moisture at or less than 40 °C 85%RH.				

Note1: 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.



8. Electrical Characteristics

8.1 DC Characteristics

8.1.1 Display Module

(Unless otherwise noted, Ta=25 °C, VDD=3.0V, VCCIO=1.8V, VSS=0V)

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Input Signal Voltage	VIH	VCCIO=1.7-3.6	0.7×VCCIO	--	VCCIO	V	CLK, VSYNC, HSYNC, DE, D[05:00], D[15:10], D[25:20], STBYB, RESETB
	VIL		0	--	0.3×VCCIO	V	
Operating Current	IDD	fCLK=25MHz	--	(8.5)	(17.0)	mA	VDD
	ICCIO	Color bar display	--	(0.6)	(1.2)	mA	VCCIO
Stand-by Current	IDDS	Other input with constant voltage	--	(5.0)	(15.0)	μA	VDD
	ICCIOS		--	--	(1.0)	μA		VCCIO

8.1.2 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 (Reference Value)	VL	Ta=25 °C IL=10.0mA	--	19.6	20.3	V	
Estimated Life of LED	LL	Ta=25 °C IL=10.0mA Note	--	(50,000)	--	hrs	

Note: - 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.

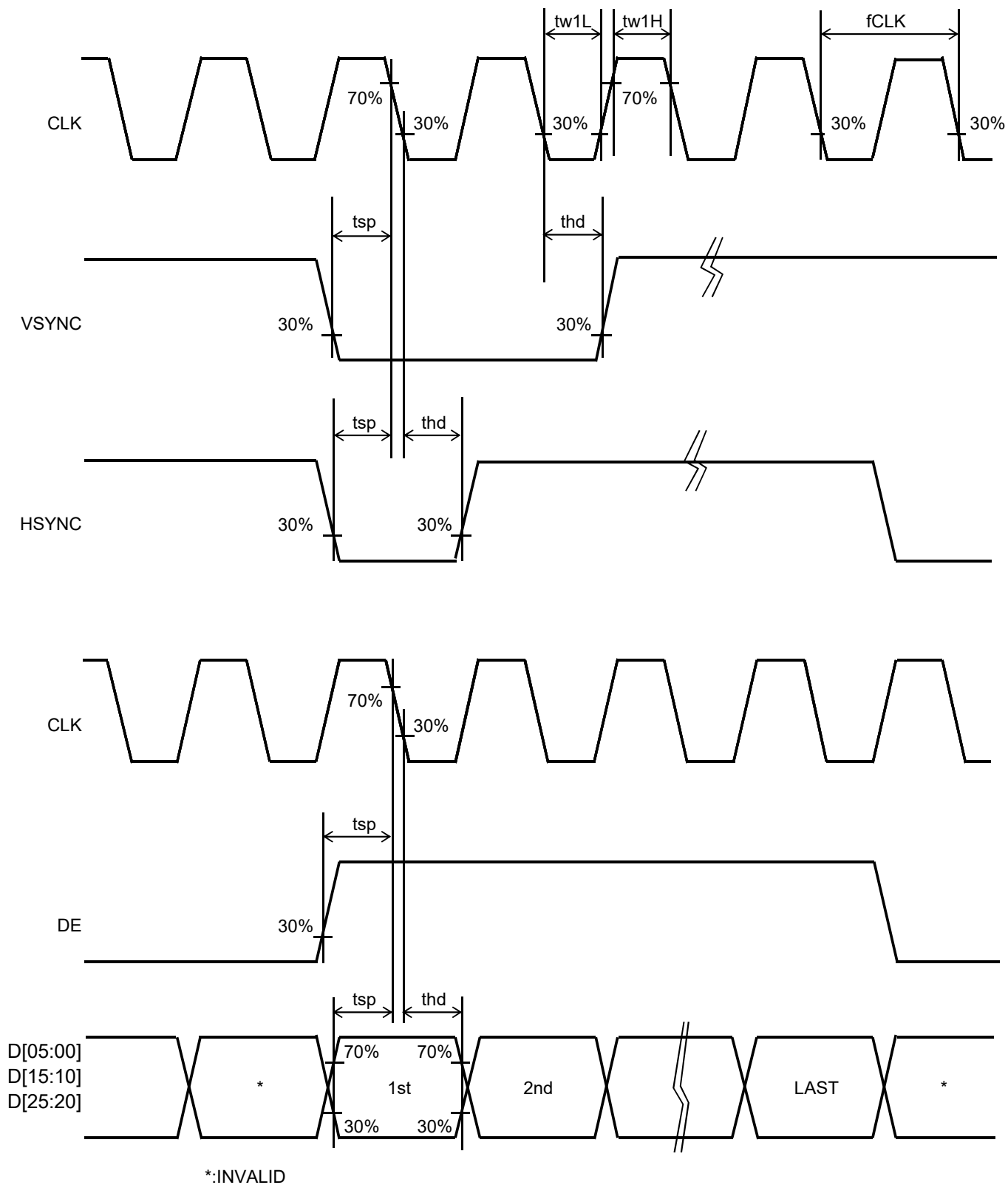
- Estimated lifetime could vary on a different temperature and usually higher temperature could reduce the life significantly.

8.2 AC Characteristics

(Unless otherwise noted, $T_a=25^{\circ}\text{C}$, $V_{DD}=3.0\text{V}$, $V_{CCIO}=1.8\text{V}$, $V_{SS}=0\text{V}$)

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
CLK frequency	fCLK		22	25	28	MHz	CLK
CLK Low period	tw1L	$0.3 \times V_{CCIO}$ or less	10	--	--	ns	
CLK High period	tw1H	$0.7 \times V_{CCIO}$ or more	10	--	--	ns	
Setup time	tsp		10	--	--	ns	CLK, VSYNC, HSYNC, DE,
Hold time	thd		10	--	--	ns	D[05:00], D[15:10] D[25:20]

Switching Waveform Characteristics



8.3 Input Timing Characteristics

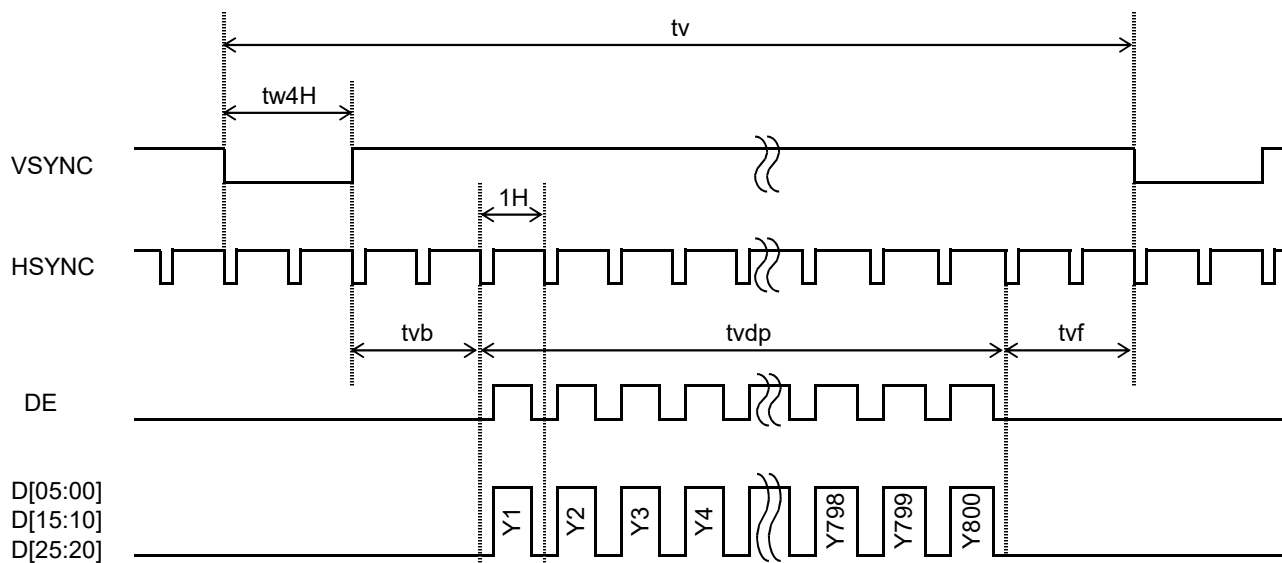
Item	Symbol	Rating			Unit	Applicable terminal
		MIN	TYP	MAX		
CLK Frequency	fCLK	22	25	28	MHz	CLK
VSYNC Frequency	Note1 fVSYNC	54	60	66	Hz	VSYNC
VSYNC Cycle	tv	806	809	810	H	VSYNC,HSYNC
VSYNC Pulse Width	tw4H	2	3	4	H	
Vertical Back Porch	tvb	2	3	4	H	VSYNC,HSYNC,DE, D[05:00],D[15:10],D[25:20]
Vertical Front Porch	tvf	2	3	4	H	
Vertical Display Period	tvdP	--	800	--	H	
HSYNC frequency	Note2 fHSYNC	43.6	48.5	50	kHz	HSYNC
HSYNC Cycle	th	504	515	568	CLK	CLK,HSYNC
HSYNC Pulse Width	tw5H	5	10	78	CLK	
Horizontal Back Porch	thb	5	15	78	CLK	CLK,HSYNC,DE, D[05:00],D[15:10],D[25:20]
Horizontal Front Porch	thf	5	10	78	CLK	
Horizontal data start Point	tw5H+thb	19	--	83	CLK	
Horizontal Blanking Period	tw5H+thb+thf	24	--	88	CLK	
DE Pulse Width	tw6H	--	480	--	CLK	CLK,DE
Horizontal Display Period	thdp	--	480	--	CLK	CLK,DE, D[05:00],D[15:10],D[25:20]

Note1: This is recommended spec to get high quality picture on display. It is customer's risk to use out of this frequency.

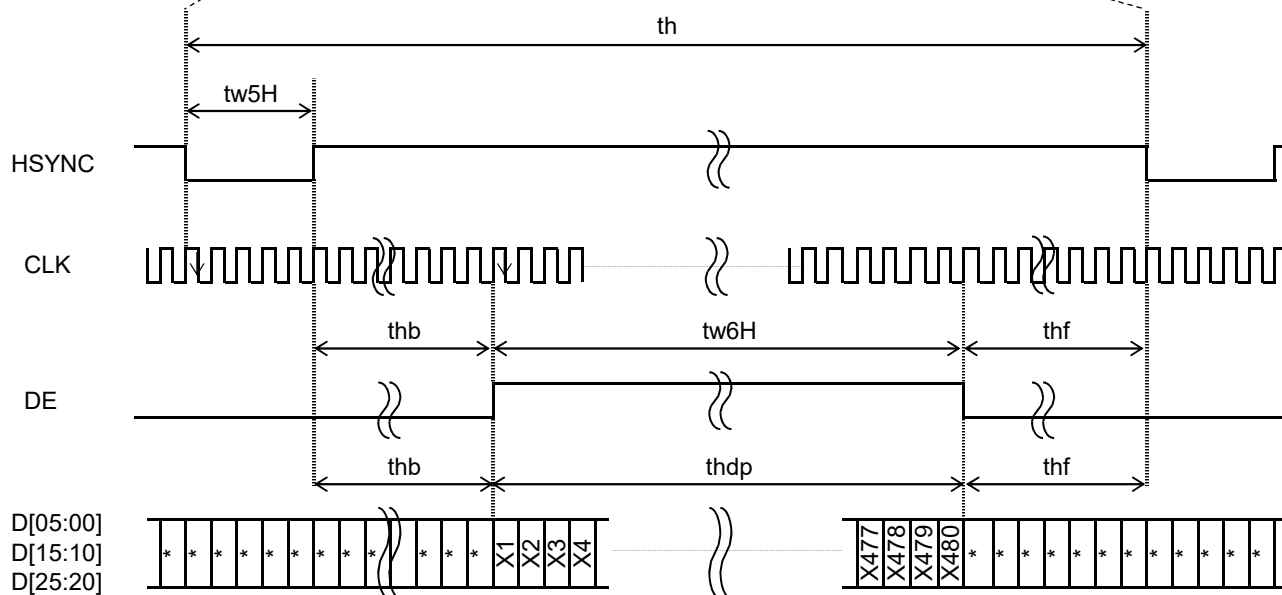
Note2: Keep "Hsync frequency" within design range.

8.4 Driving Timing Chart

-Vertical Timing

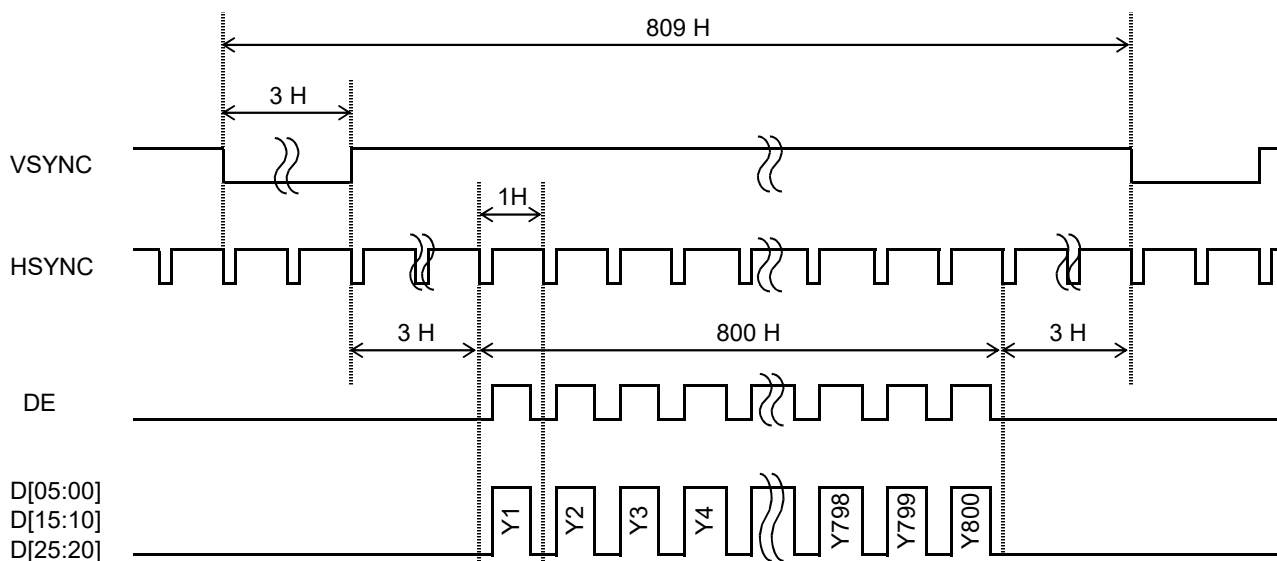


-Horizontal Timing

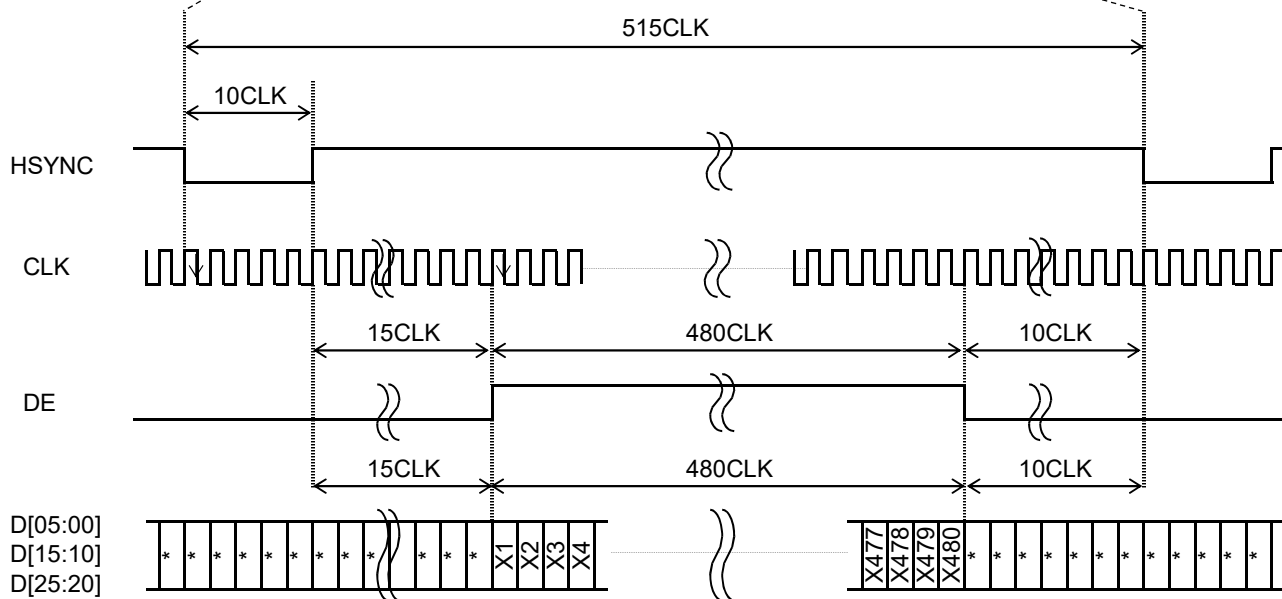


8.5 Example of Driving Timing Chart

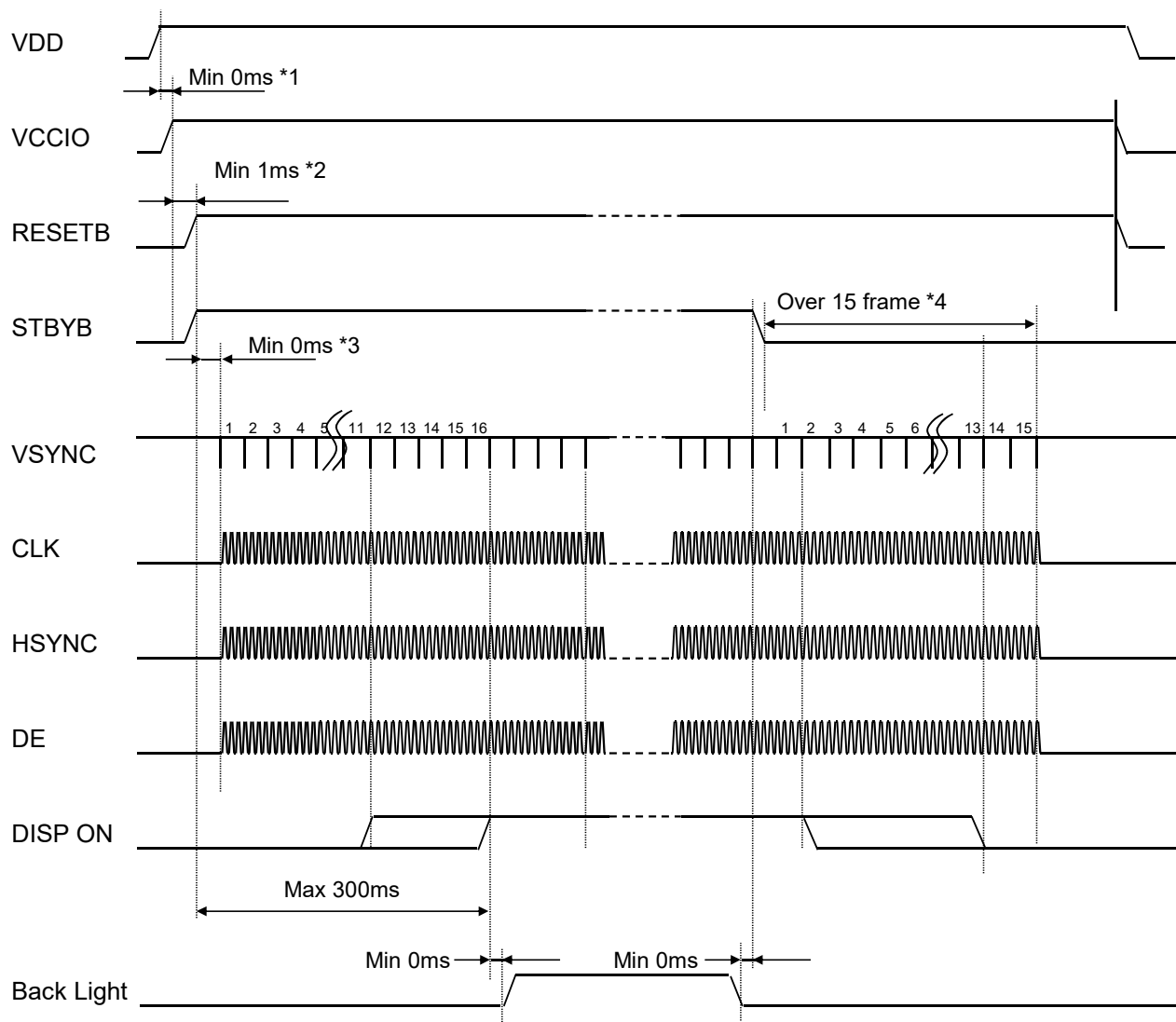
-Vertical Timing



-Horizontal Timing



9 Power ON/OFF sequence



*1 Please start up VDD and VCCIO at the same time or in order of VDD --> VCCIO.

*2 After the power supply, Please execute RESETB.

*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 for 15 frames or more from STBYB "L" to
turning off the power supply without leaving the afterimage.

10. Characteristics

10.1 Optical Characteristics

< Measurement Condition >

Measuring instruments: CS2000 (KONICA MINOLTA), LCD7200(OTSUKA ELECTRONICS),EZcontrastXL88 (ELDIM)

Driving condition: VDD=3.0V,VCCIO=1.8V

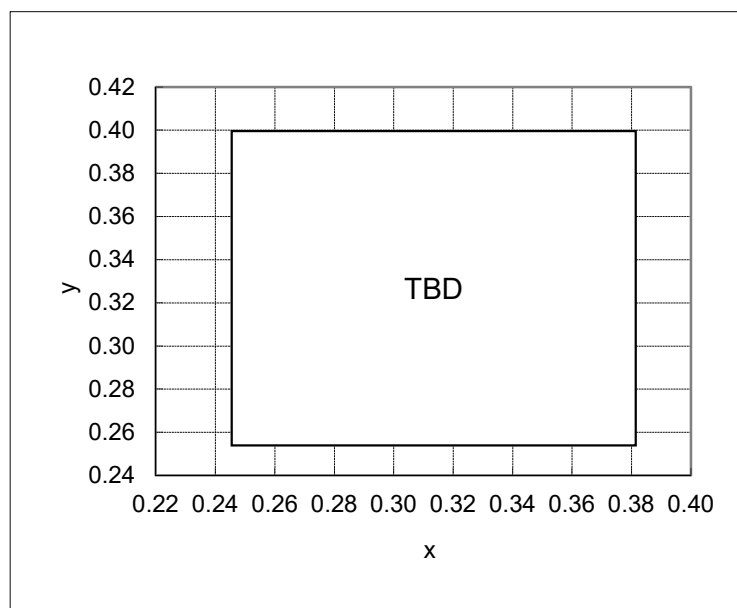
Optimized VCOMDC

Backlight: IL=(10.0)mA

Measured temperature: Ta=25° C

Item	Symbol	Condition	MIN	TYP	MAX	Unit	Note No.	Remark
Response time	Rise time	TON	[Data]= (00)h→(3F)h	—	—	(40)	ms	1 ※
	Fall time	TOFF	[Data]= (3F)h→(00)h	—	—	(60)	ms	
Contrast ratio	Backlight ON	CR	[Data]= (3F)h / (00)h	(TBD)	(600)	—	2	
	Backlight OFF			—	(TBD)	—		
Viewing angle	Left	θL	[Data]= (3F)h / (00)h CR ≥ (10)	-	(80)	—	3	※
	Right	θR		-	(80)	—		
	Up	φU		-	(80)	—		
	Down	φD		-	(80)	—		
White Chromaticity	x		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]=(3F)h	(280)	(400)	—	cd/m ²	6	
Brightness distribution		[Data]=(3F)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
TBD	TBD

10.2 Temperature Characteristics

< Measurement Condition >

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

Driving condition: VDD=3.0V, VCCIO=1.8V

Optimized VCOMDC

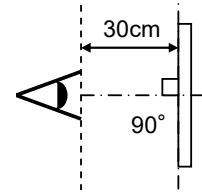
Backlight: IL=(10.0)mA

Item			Specification		Remark
			Ta=(-10)°C	Ta=70 °C	
Contrast ratio		CR	(200) or more	(200) 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.		

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, white, black)
Signal condition	[Data]:(00)h, (25)h, (3F)h (3steps)
Observation distance	30 cm
Illuminance	200 to 350 lx
Backlight	IL=(10.0)mA



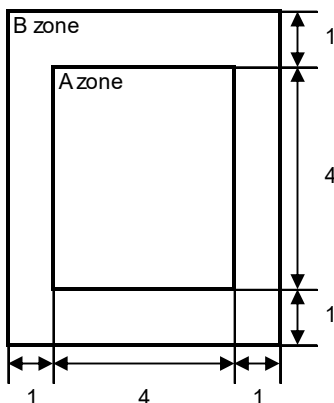
Defect item	Defect content		Criteria	
Display Quality	Line defect	Black, white or color line, 3 or more neighboring defective dots	Not exists	
	Dot defect	Uneven brightness on dot-by-dot base due to defective TFT or CF, or dust is counted as dot defect (brighter dot, darker dot) High bright dot: Visible 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]=(25)h Invisible through 5% ND filter at [Data]=(00)h	Refer to table 1 Acceptable	
		Stain	Uneven brightness (white stain, black stain etc)	Invisible through 5% ND filter at Black screen. Invisible through 1% ND filter at other screen.
Screen Quality	Foreign particle	Point-like	0.25mm ϕ 0.20mm $\phi \leq 0.25\text{mm}$ $\phi \leq 0.20\text{mm}</math>$	N=0 N ≤ 2 Acceptable
		Liner	3.0mm length and 0.08mm width length ≤ 3.0mm or width ≤ 0.08mm	N=0 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
B	2	4	4	6	Permissible distance between same color high bright dots (includes neighboring dots): 5 mm or more
Total	2	4	4	7	

<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	Ignore invisible defect when the backlight is on.	Applicable area: Active area only (Refer to the section 3.2 "Outward form")
	Stain		
	Dirt		
	Bubble		
	Dust		
Dent			
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	240hrs	TBD
	Low temperature storage	Ta=-30° C	240hrs	TBD
	High temperature & high humidity storage	Ta=60° C, RH=90% non condensing	240hrs	TBD
	High temperature operation	Tp=70° C	240hrs	TBD
	Low temperature operation	Tp=-20° C	240hrs	TBD
	High temp & humid operation	Tp=40° C, RH=90% non condensing	240hrs	TBD
	Thermal shock storage	(-30)←→80° C(30min/30min)	100cycles	TBD
	Lightfastness	Xenon Blackpanel 63±3° C non-shower 450W/m ² (300~700nm) non-operating		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
	Vibration test	Total amplitude 1.5mm, f=10~55Hz, X,Y,Z directions for each 2 hours		TBD
	Impact test	Use TOPPAN PRINTING original jig (see next page)and make an impact with peak acceleration of 1000m/s ² for 6 msec with half sine-curve at 3 times to each X, Y, Z directions in conformance with JIS 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.)

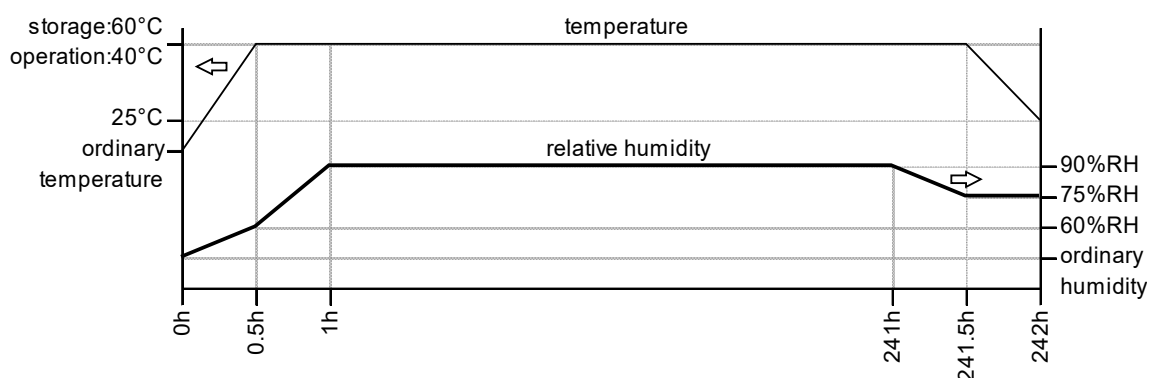
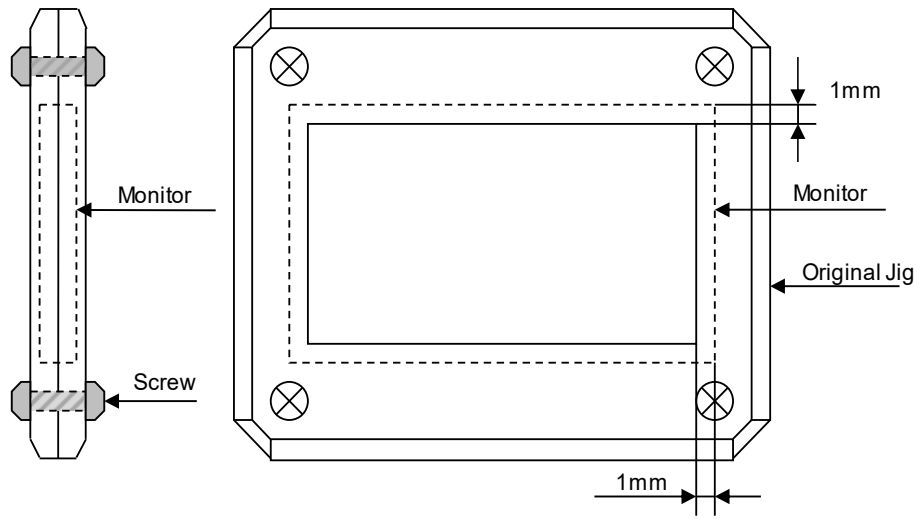


Table2.Reliability Criteria

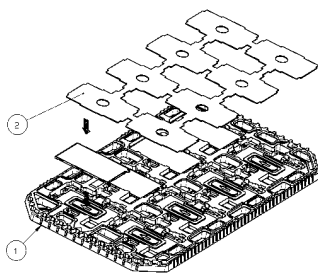
The parameters should be measured after leaving the monitor at the ordinary temperature for 24 hours or more after the test completion.

item	Standard	Remarks
Display quality	No visible abnormality shall be seen. (Except for unevenness by Pol deterioration.)	
Contrast ratio	200 or more	Backlight ON

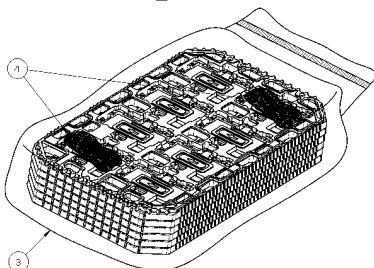
TOPPAN PRINTING Original Jig



13. Packing Specifications

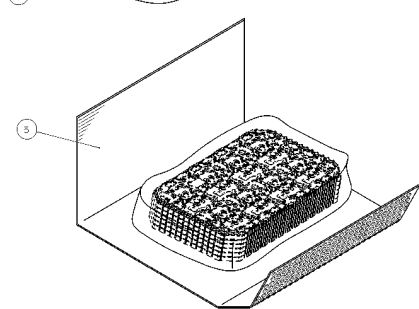


Step 1. Each product is to be placed in one of the cut-outs of the tray with the display surface facing upward.(8products per tray)
Foam sheet is to be placed on the products in the tray.



Step 2. Each tray filled with the products is to be piled up in the stack of 5 trays.
One empty tray is to be put on the top of the stack of 5 trays.
Each tray including top empty tray needs to be piled up same direction with respect to the tray below and above it.

Step 3. Two packs of moisture absorbers are to be placed on the top tray as shown in the drawing.
Put piled trays into a sealing bag.
Vacuum and seal the sealing bag with the vacuum sealing machine.



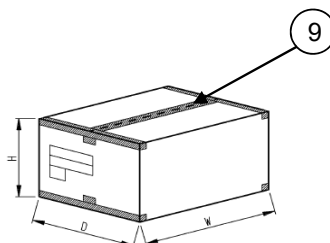
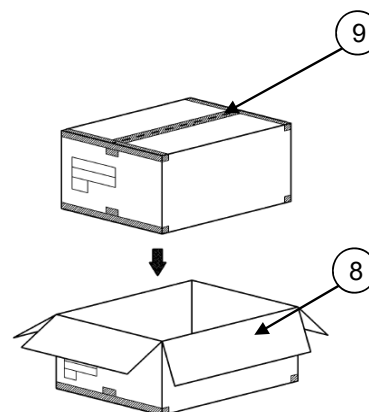
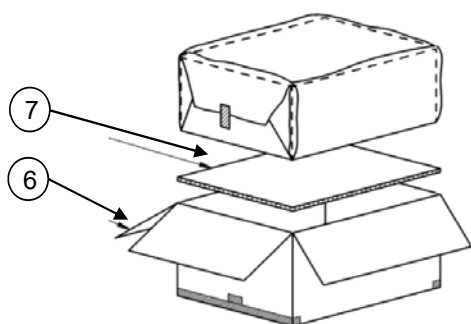
Step 4. The piled trays are to be wrapped with a bubble cushioning sheet, and to be fixed with adhesive tape.
The side is to be folded as shown in figure.

Step 5. A corrugated board is to be placed in the bottom of the inner carton.
The wrapped trays are to be put on the corrugated board in the outer carton.

Step 6. The wrapped trays are to be put on the corrugated board in the outer carton.
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.

Step 8. The extra 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 two opposites of the extra outer carton with black ink.
If necessary, shipping labels or impression markings are to be put on the extra outer carton.



Remark: The return of packing materials is not required.

Packing item name	Specs., Material
① Tray	A-PET
② Antistatic foam sheet	Polyethylene foam
③ Sealing bag	Polypropylene
④ Drier	Moisture absorber
⑤ Bubble cushioning sheet A	Air cap
⑥ Inner carton	Corrugated cardboard
⑦ Inner board	Corrugated cardboard
⑧ Outer carton	Corrugated cardboard
⑨ Packing tape	

Dimension of extra outer carton	
D : Approx	(337mm)
W : Approx.	(618mm)
H : Approx.	(179mm)
Quantity of products packed in one carton :	40
Gross weight : Approx.	4.4kg

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 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.

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) 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.

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 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 7 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 TOPPAN PRINTING.

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.

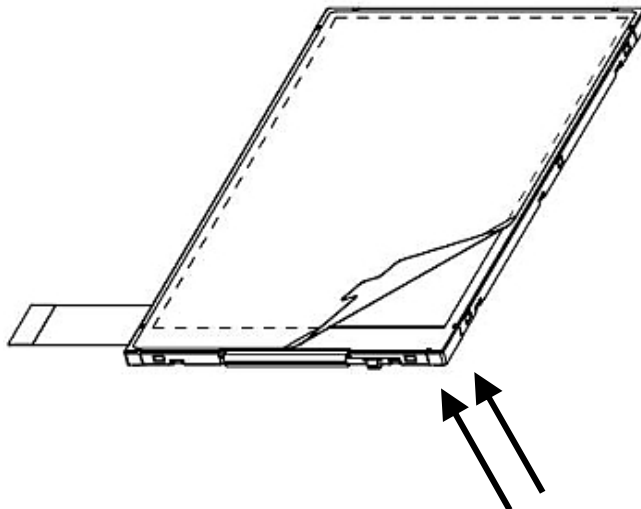
A) Work Environment

- a) Humidity: 50 to 70 %RH, Temperature 15 to 27 ° C
- b) Operators should wear conductive shoes, conductive clothes, conductive finger tips and grounded wrist-straps.
Use an electrostatic neutralization blower.
Anti-static treatment should be implemented to work area's floor.
- c) Use a room shielded against outside dust with sticky floor mat laid at the entrance to eliminate dirt.

B) Work Method

The following procedures should taken to prevent the driver ICs from charging and discharging.

- a) Use an electrostatic neutralization blower to blow air on the TFT monitors to its lower left when FPC is placed at the left.
Optimize direction of the blowing air and the distance between the TFT monitors and the electrostatic neutralization blower.
- b) Peel off the tab slowly (spending more than 2 secs to complete)
by pulling it to opposite direction.



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

14.6 Warranty

TOPPAN PRINTING 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)

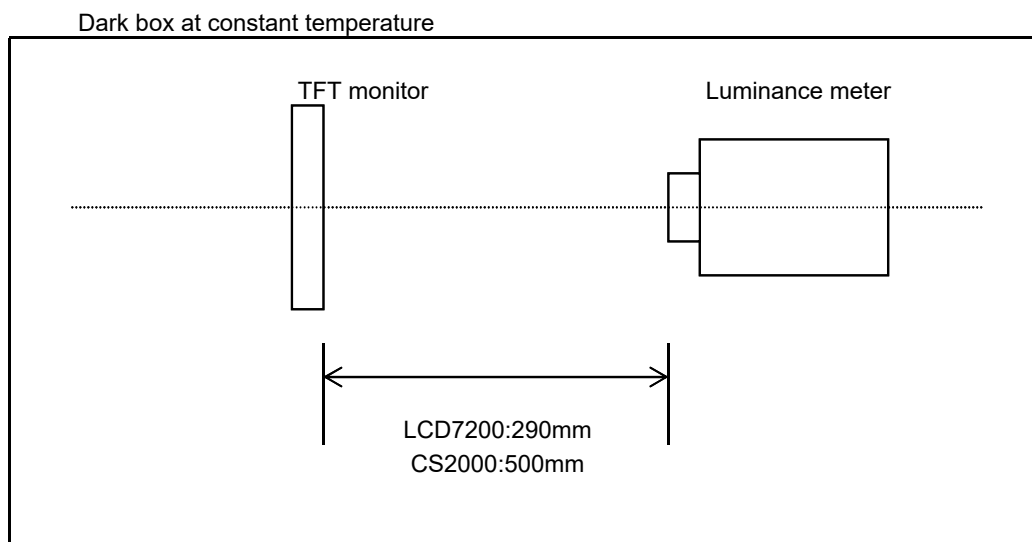
Measuring instruments: CS2000 (KONICA MINOLTA), LCD7200 (OTSUKA ELECTRONICS), EZcontrastXL88 (ELDIM)

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

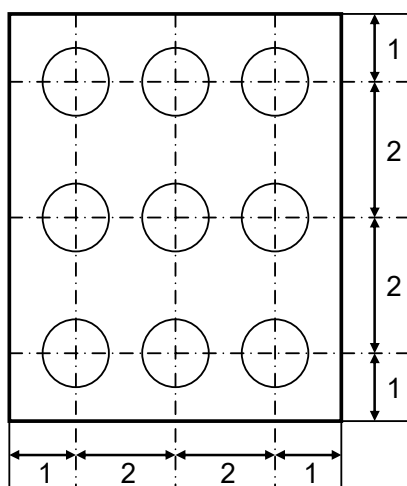


Measurement is made after 30 minutes of lighting of the backlight.

Measurement point: At the center point of the screen

Brightness distribution: 9 points shown in the following drawing.

<Portrait model>

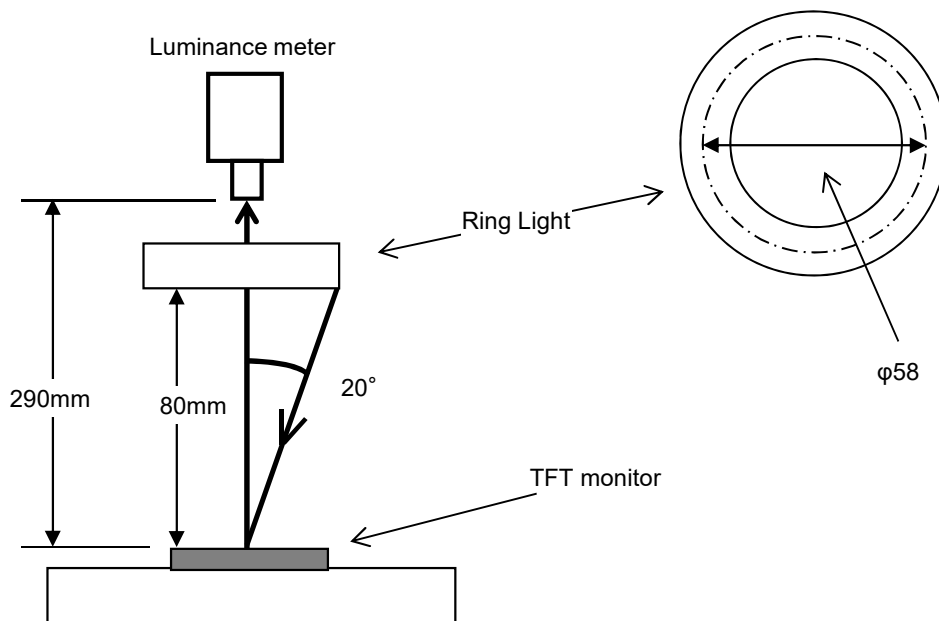


Dimensional ratio of active area

Backlight IL=(10.0)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	<p>Measure output signal waveform by the luminance meter when raster of window pattern is changed from white to black and from black to white.</p> <p style="text-align: center;">Black White Black</p> <p>White brightness</p> <p>100%</p> <p>90%</p> <p>10%</p> <p>0%</p> <p>Black brightness</p> <p>TON</p> <p>TOFF</p>	LCD7200	Black display [Data]=(00)h White display [Data]=(3F)h TON Rise time TOFF Fall time
2	Contrast ratio	<p>Measure maximum luminance Y1([Data]=(3F)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.</p> <p style="text-align: center;">Contrast ratio = Y1/Y2</p> <p style="text-align: center;">Diameter of measuring point: 7.8mmφ(CS2000)</p> <p style="text-align: center;">Diameter of measuring point: 3mmφ(LCD7200)</p>	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).	EZcontrastXL88	
4	White chromaticity	<p>Measure chromaticity coordinates x and y of CIE1931 colorimetric system at [Data] = (3F)h</p> <p style="text-align: center;">Color matching function: 2°view</p> <p style="text-align: center;">measurement angle: 1°</p>	CS2000	
5	Burn-in	Visually check burn-in image on the screen after 2 hours of "window display" ([Data]=(00)h/(3F)h).		At optimized VCOMDC
6	Center brightness	Measure the brightness at the center of the screen.	CS2000	
7	Brightness distribution	<p>(Brightness distribution) = 100 x B/A %</p> <p>A : max. brightness of the 9 points</p> <p>B : min. brightness of the 9 points</p>	CS2000	

Our company network supports you worldwide with offices in Germany, Austria, Switzerland, the UK and the USA. For more information please contact:

Headquarters

Germany



FORTEC Elektronik AG

Augsburger Str. 2b
82110 Germering

Phone: +49 89 894450-0
E-Mail: info@fortecag.de
Internet: www.fortecag.de

Fortec Group Members

Austria



Distec GmbH Office Vienna

Nuschinggasse 12
1230 Wien

Phone: +43 1 8673492-0
E-Mail: info@distec.de
Internet: www.distec.de

Germany



Distec GmbH

Augsburger Str. 2b
82110 Germering

Phone: +49 89 894363-0
E-Mail: info@distec.de
Internet: www.distec.de

Switzerland



ALTRAC AG

Bahnhofstraße 3
5436 Würenlos

Phone: +41 44 7446111
E-Mail: info@altrac.ch
Internet: www.altrac.ch

United Kingdom



Display Technology Ltd.

Osprey House, 1 Osprey Court
Hichingbrooke Business Park
Huntingdon, Cambridgeshire, PE29 6FN

Phone: +44 1480 411600
E-Mail: info@displaytechnology.co.uk
Internet: www.displaytechnology.co.uk

USA



Apollo Display Technologies, Corp.

87 Raynor Avenue,
Unit 1 Ronkonkoma,
NY 11779

Phone: +1 631 5804360
E-Mail: info@apolloDisplays.com
Internet: www.apolloDisplays.com