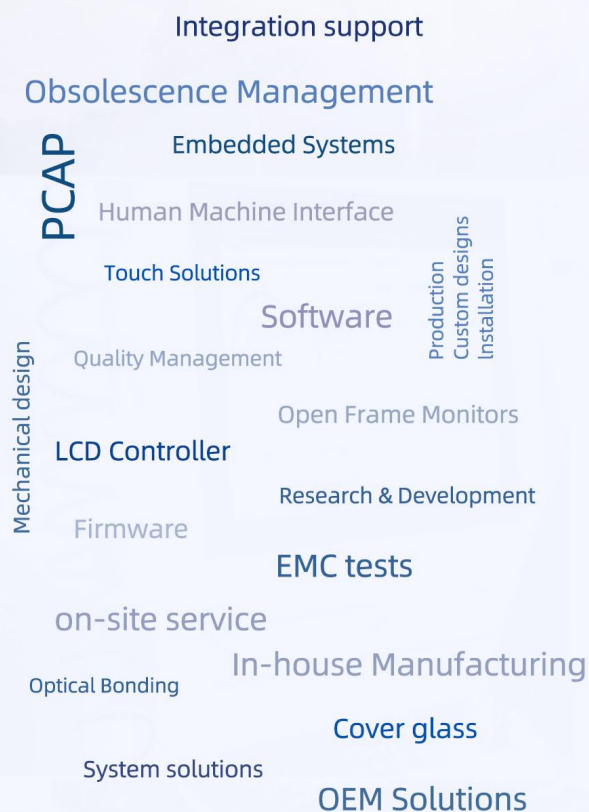


INDUSTRIAL STRENGTH... Start Your Application From YOURITECH



Specifications for

Blanview TFT-LCD Monitor

(3.2" WVGA 480 x RGB x 800 Portrait)



Sunlight readable TFT-LCD Monitor

Version 3.0

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

MODEL COM32H3P71ULC

Customer's Approval

Signature:

Name:

Section:

Title:

Date:

ORTUSTECH



TOPPAN INC.
Electronics Division
Technological Development Department IV

Approved by

Checked by

Prepared by

TOPPAN INC.

Version History

Ver.	Date	Page	Description	
0.0	Dec.21,2020	-	-	Tentative issue
1.0	May.14,2021	-	-	First issue
△ A ×6		P.7		3.1 Dimensions
			Add	Specifications
		P.35		14.1 Optical Characteristics
			Add	White Chromaticity Range
				14.2 Temperature Characteristics
			Add	Specification
		P.38		16. Reliability Test
			Add	Applied voltage (Surface discharge test)
△ B ×4	Dec.21,2023		Add	number of failures / number of examinations
		P.40		17. Packing Specifications
			Add	Packing Specifications
		P.44		18.5 Precautions for Peeling off the Protective film
			Add	Work Method
		All		All
			change	Company name
		P.1	change	Company name/Department name
△ C ×7	Feb.21,2025	P.30		12.1 DC Characteristics
			Add	Estimated Life of LED
		P.43		18.4 Storage Condition for Shipping Cartons
			Correct	Maximum piling up
		P.1		Cover
			Add	Model specification
			Change	Department name
		P.3		Contents
			Add	Item
		P.5		2.1 Features of the Product
			Change	Note
		P.6		<Features of Blanview>
			Change	Content
		P.30		12.1 DC Characteristics
			Add	Driving condion
		P.34		14.2 About Sunlight readable
			Add	Content



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1. Application

This Specification is applicable to 80.5mm (3.2 inch) Blanview TFT-LCD monitor for non-military use.

- ◎ TOPPAN INC 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 INC 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 INC'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 INC'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 INC 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/flexure or caused by stress to the LCD module shall be considered.
- ◎ TOPPAN INC 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 INC and Purchaser shall discuss them in good faith and seek solution.
- ◎ TOPPAN INC 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



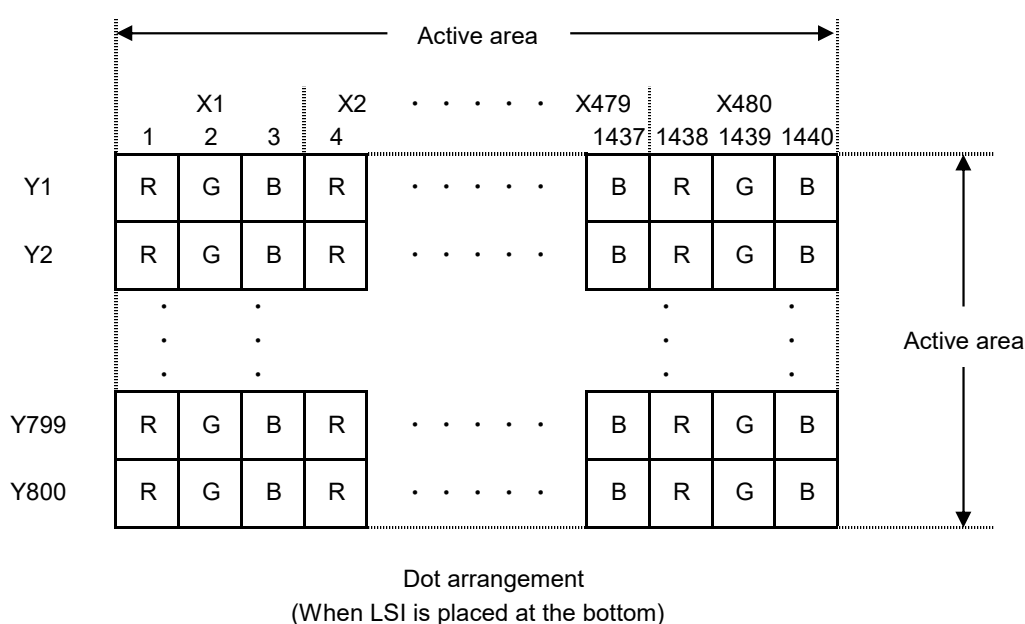
2.1 Features of the Product

- 3.2 inch diagonal display, 1,440 [H] x 800 [V] dots.
- 8-bit 16,777,216 color display capability.
- System Interface (Register setting)
- Serial Peripheral Interface (SPI)
RGB interface with 24-bit data bus (VSYNC, HSYNC, ENABLE, DOTCLK, D23-0)
- Internal booster for various voltage levels to drive LC

	Indoor		Outdoor	
	Readability	Power Efficiency (Battery Life)	Readability	Power Efficiency (Battery Life)
Transmissive	Good	Good	Average	Poor
Transflective	Average	Poor	Good	Good
Blanview	Good	Good	Excellent	Excellent

2.2 Display Method

Items	Specifications	Remarks
Display type	16,777,216 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	Register : Serial Peripheral Interface (SPI) Data : 24 bit RGB interface	
Backlight type	Long life & High bright white LED.	
NTSC ratio	35%	

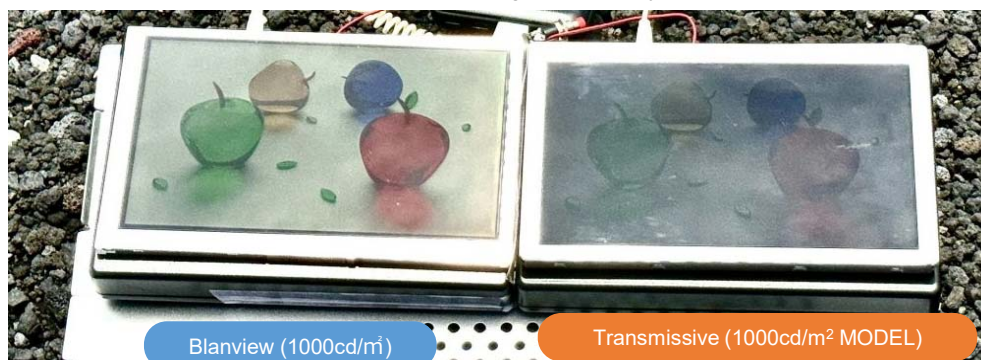


<Features of Blanview>

(A 7.0" WVGA display is shown as a typical sample)



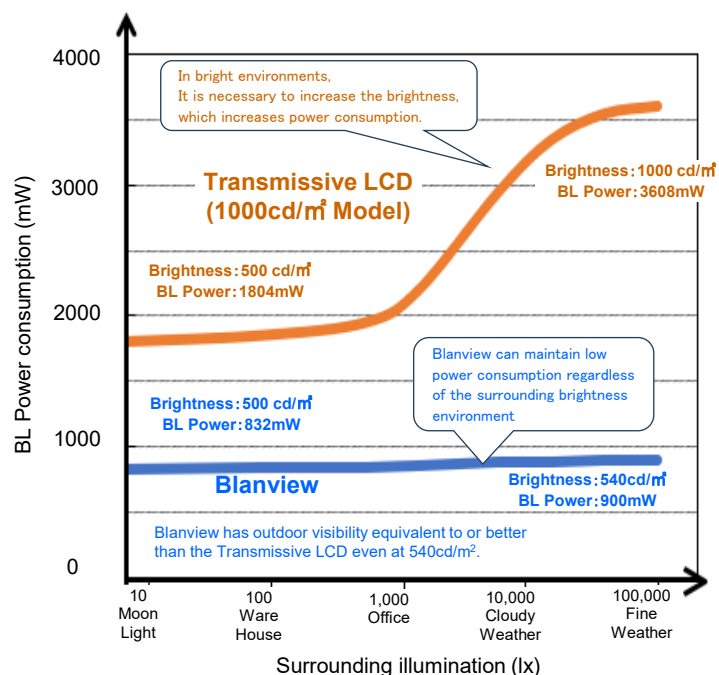
Blanview is a TFT-LCD monitor that achieves sunlight readability with low power consumption.



*Display image comparison photo outdoors (at 100,000lx)

* When compared at the same power consumption, Blanview's contrast at 100,000lx is more than two times higher than that of a transmissive LCD (1000cd/m² model). Blanview's contrast is 17.5, while that of a transmissive LCD is 7.5. Sunlight readability is Good with a contrast of 8 or higher on the TOPPAN index. (Contrast at 100,000lx is reference data.)

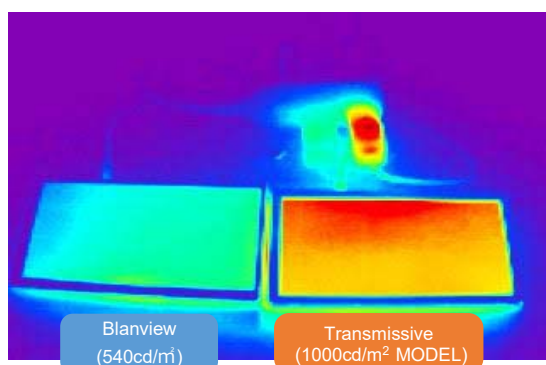
- Backlight power consumption required to assure visibility. (equivalent to 7.0"WVGA)



Sunlight Readable / BL Power comparison

	Sunlight Readable	BL Power
Transmissive LCD (1000cd/m ² Model)	Average	Poor
Blanview	Excellent	Excellent

In bright environment, other companies' products require higher brightness, which increases power consumption. However TOPPAN' Blanview can maintain low power consumption without increasing brightness (visibility is not easily affected by the environment).



*Observation image with thermograph

Transmissive LCD (1000cd/m² MODEL) consume a lot of power, which places a large load on the customer's power circuit, causing problems such as heat generation. Blanview has low power consumption, so it places a low load on the customer's power supply circuit and does not cause any harmful effects such as heat generation.

3. Dimensions and Shape

3.1 Dimensions

Items	Specifications	Unit	Remarks
Outline dimensions	46.66[H] × 78.55[V] × 1.75[D]	mm	Exclude FPC cable and parts on FPC
Active area	41.40[H] × 69.00[V]	mm	80.5mm diagonal
Number of dots	1440[H] × 800[V]	dot	
Dot pitch	28.75[H] × 86.25[V]	μm	
Surface hardness of the polarizer	3	H	Load: 2.0 N
Weight	14.7	g	Include FPC cable

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	32AKC (Made in Japan) 32ALC (Made in Malaysia)		
d	Serial number			

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

•Made in Japan

1E32AKC000125

means "manufactured in May 2021, 3.2" AK type, C specifications, serial number 000125"

•Made in Malaysia

1E32ALC000125

means "manufactured in May 2021, 3.2" AL type, C specifications, serial number 000125"

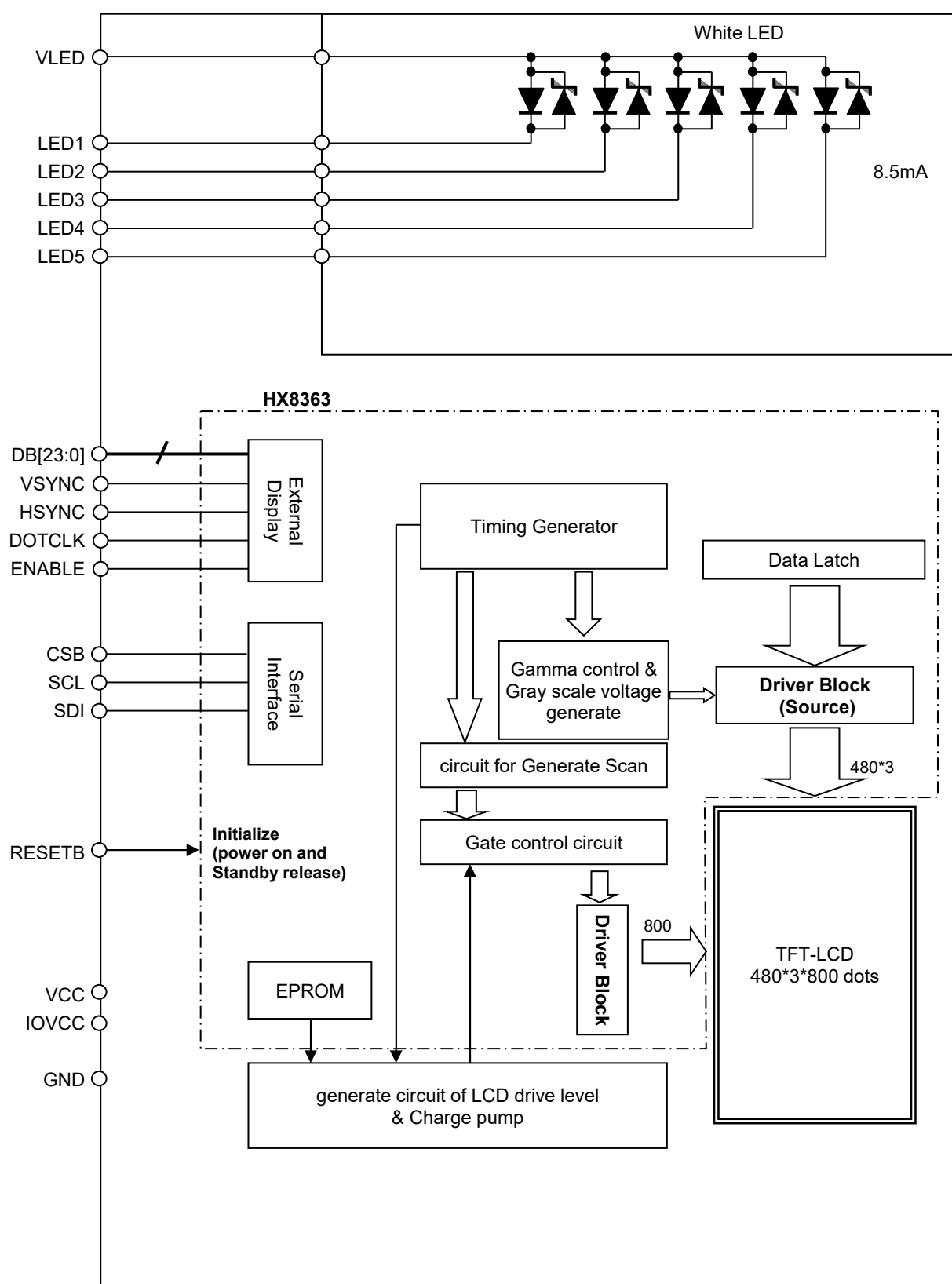
2) Location of Serial № print (S-print)

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. Block Diagram



5.FPC Terminals

№	Symbol	Details	Remark	IO
1	LED5	Backlight LED Cathode5		P
2	LED4	Backlight LED Cathode4		P
3	LED3	Backlight LED Cathode3		P
4	LED2	Backlight LED Cathode2		P
5	LED1	Backlight LED Cathode1		P
6	VLED	Power supply for Backlight LED		P
7	VLED	Power supply for Backlight LED		P
8	DB7	B_Data	MSB	I
9	DB6			I
10	DB5			I
11	DB4			I
12	DB3			I
13	DB2			I
14	DB1			I
15	DB0		LSB	I
16	DB15	G_Data	MSB	I
17	DB14			I
18	DB13			I
19	DB12			I
20	DB11			I
21	DB10			I
22	DB9			I
23	DB8		LSB	I
24	DB23	R_Data	MSB	I
25	DB22			I
26	DB21			I
27	DB20			I
28	DB19			I
29	DB18			I
30	DB17			I
31	DB16		LSB	I
32	GND	GROUND		P
33	HSYNC	HSYNC		I
34	VSYNC	VSYNC		I
35	RESETB	LCD Reset	L:Initialize Power_ON Reset is Required when Turning on the Power	I
36	DOTCLK	DOTCLK		I
37	CSB	3-Wire SPI Chip Select		I
38	SCL	3-Wire SPI clock		I
39	SDI	3-Wire SPI DATA input		I
40	ENABLE	ENABLE		I
41	IOVCC	Power		P
42	VCC	Power		P
43	VCC	Power		P
44	GND	GROUND		P

- Recommended connector: Panasonic corporation : AXE544127
- 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.

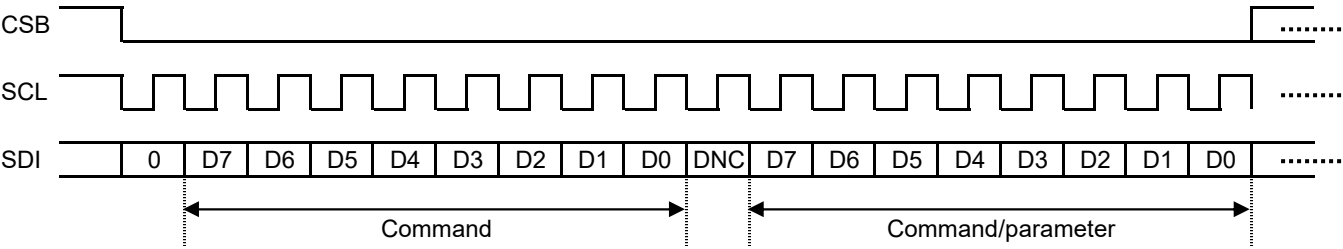
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6. Serial Data Transfer Interface

Instructions are transferred using 3 wire serial data transfer interface. The 3 wire serial bus uses chip select line (CSB), serial input data (SDI) and serial transfer clock line (SCL).

The 3 wire serial data packet is consists of control bit DNC and transmission byte. If the control bit is low, the transmission byte is command byte. If the control bit is high, the transmission byte is stored to command register. DNC should be transferred first , followed by MSB of transmission byte.

The serial interface is initialized when CSB is high, and the falling edge of CSB enables the serial interface.



7. Instruction list

(1)

(Hex)	Register	DNC	D7	D6	D5	D4	D3	D2	D1	D0
00	NOP	0	0	0	0	0	0	0	0	0
	initial recommend	-	-	-	-	-	-	-	-	-
01	SWRESET	0	0	0	0	0	0	0	0	1
	initial recommend	-	-	-	-	-	-	-	-	-
06	RDRED	0	0	0	0	0	0	1	1	0
	initial recommend	-	-	-	-	-	-	-	-	-
07	RDGREEN	0	0	0	0	0	0	1	1	1
	initial recommend	-	-	-	-	-	-	-	-	-
08	RDBLUE	0	0	0	0	0	1	0	0	0
	initial recommend	-	-	-	-	-	-	-	-	-
0A	RDDPM	0	0	0	0	0	1	0	1	0
	initial recommend	-	-	-	-	-	-	-	-	-
0B	RDDMADCTL	0	0	0	0	0	1	0	1	1
	initial recommend	-	-	-	-	-	-	-	-	-
0C	RDDCOLMOD	0	0	0	0	0	1	1	0	0
	initial recommend	-	-	-	-	-	-	-	-	-
0D	RDDIM	0	0	0	0	0	1	1	0	1
	initial recommend	-	-	-	-	-	-	-	-	-
0E	RDDSM	0	0	0	0	0	1	1	1	0
	initial recommend	-	-	-	-	-	-	-	-	-
0F	RDDSDR	0	0	0	0	0	1	1	1	1
	initial recommend	-	-	-	-	-	-	-	-	-
10	SLPIN	0	0	0	0	1	0	0	0	0
	initial recommend	-	-	-	-	-	-	-	-	-
11	SLPOUT	0	0	0	0	1	0	0	0	1
	initial recommend	-	-	-	-	-	-	-	-	-
20	INVOFF	0	0	0	1	0	0	0	0	0
	initial recommend	-	-	-	-	-	-	-	-	-
21	INVON	0	0	0	1	0	0	0	0	1
	initial recommend	-	-	-	-	-	-	-	-	-
26	GAMSET	0	0	0	1	0	0	1	1	0
	1	GC[7:0]								
28	DISPOFF	0	0	0	1	0	1	0	0	0
	initial recommend	-	-	-	-	-	-	-	-	-
29	DISPON	0	0	0	1	0	1	0	0	1
	initial recommend	-	-	-	-	-	-	-	-	-

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(3)

(Hex)	Register	DNC	D7	D6	D5	D4	D3	D2	D1	D0
B4	SETRGBIF	0	1	0	1	1	0	1	0	0
		1	-	-	-	-	NW[1:0]		-	-
	initial	-	0	0	0	0	1	0	0	0
	recommend	-	0	0	0	0	0	0	0	0
		1	SON[7:0]							
		-	0	0	0	1	0	0	1	0
	initial	-	0	0	0	0	1	0	0	0
	recommend	-	0	0	0	0	1	0	0	0
		1	SOFF[7:0]							
		-	0	1	1	1	0	0	1	0
	initial	-	0	1	0	1	0	1	1	0
	recommend	-	0	1	0	1	0	1	1	0
		1	EQS[7:0]							
		-	0	0	0	1	0	0	1	0
	initial	-	0	0	0	0	0	1	1	0
	recommend	-	0	0	0	0	0	1	1	1
		1	EQON[7:0]							
		-	0	0	0	0	0	1	1	0
	initial	-	0	0	0	0	0	0	0	1
	recommend	-	0	0	0	0	0	0	0	1
		1	GDON[7:0]							
		-	0	0	0	0	0	0	1	1
	initial	-	0	0	0	0	0	0	0	1
	recommend	-	0	0	0	0	0	0	0	1
		1	GDOFF[7:0]							
		-	0	1	1	0	0	0	0	0
	initial	-	0	1	0	0	1	1	0	0
	recommend	-	0	1	0	0	1	1	0	1
		1	GVSSP1[7:0]							
		-	0	0	0	0	0	0	1	1
	initial	-	0	0	0	0	0	0	0	1
	recommend	-	0	0	0	0	0	0	0	1
		1	GVSSP2[7:0]							
		-	0	1	0	1	1	0	1	0
	initial	-	0	1	0	0	0	0	1	0
	recommend	-	0	1	0	0	0	0	1	0
B9	SETRGBIF	0	1	0	1	1	1	0	0	1
		1	EXTC1[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	1	1	1	1	1	1	1	1
		1	EXTC2[7:0]							
		-	0	0	0	0	0	0	0	0
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	1	0	0	0	0	0	1	1
		1	EXTC3[7:0]							
		-	0	0	0	0	0	0	0	0
	initial	-	0	1	1	0	0	0	1	1
	recommend	-	0	1	1	0	0	0	1	1
C1	SETDGLUT	0	1	1	0	0	0	0	0	1
		1	-	-	-	-	-	-	-	DGC_EN
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	0	0	0	0	0	0	1
		1	D1[7:0]							
		-	0	0	0	0	0	0	0	0
	initial	-	1	1	1	0	1	1	1	1
	recommend	-	1	1	1	0	1	1	1	1
		1	D2[7:0]							
		-	0	0	0	0	1	0	0	0
	initial	-	1	1	0	1	0	1	1	1
	recommend	-	1	1	0	1	0	1	1	1
		1	D3[7:0]							
		-	0	0	0	1	0	0	0	0
	initial	-	1	0	1	1	1	1	0	1
	recommend	-	1	0	1	1	1	1	0	1
		1	D4[7:0]							
		-	0	0	0	1	1	0	0	0
	initial	-	1	0	0	1	1	0	1	0
	recommend	-	1	0	0	1	1	0	1	0

(4)

(Hex)	Register	DNC	D7	D6	D5	D4	D3	D2	D1	D0
C1	SETDGCLUT	1	D5[7:0]							
	initial	-	0	0	1	0	0	0	0	0
	recommend	-	0	1	1	1	1	0	1	0
		1	D6[7:0]							
	initial	-	0	0	1	0	1	0	0	0
	recommend	-	0	1	0	1	1	0	1	1
		1	D7[7:0]							
	initial	-	0	0	1	1	0	0	0	0
	recommend	-	0	0	1	1	1	1	0	1
		1	D8[7:0]							
	initial	-	0	0	1	1	1	0	0	0
	recommend	-	0	0	1	0	0	1	0	1
		1	D9[7:0]							
	initial	-	0	1	0	0	0	0	0	0
	recommend	-	0	0	0	0	1	0	0	1
		1	D10[7:0]							
	initial	-	0	1	0	0	1	0	0	0
	recommend	-	1	1	1	0	1	1	0	0
		1	D11[7:0]							
	initial	-	0	1	0	1	0	0	0	0
	recommend	-	1	1	0	1	0	0	1	0
		1	D12[7:0]							
	initial	-	0	1	0	1	1	0	0	0
	recommend	-	1	0	1	1	0	1	0	0
		1	D13[7:0]							
	initial	-	0	1	1	0	0	0	0	0
	recommend	-	1	0	0	1	1	0	1	0
		1	D14[7:0]							
	initial	-	0	1	1	0	1	0	0	0
	recommend	-	0	1	1	1	1	1	1	1
		1	D15[7:0]							
	initial	-	0	1	1	1	0	0	0	0
	recommend	-	0	1	1	0	0	1	0	1
		1	D16[7:0]							
	initial	-	0	1	1	1	1	0	0	0
	recommend	-	0	1	0	0	1	0	0	0
		1	D17[7:0]							
	initial	-	1	0	0	0	0	0	0	0
	recommend	-	0	0	1	0	1	1	0	1
		1	D18[7:0]							
	initial	-	1	0	0	0	1	0	0	0
	recommend	-	0	0	0	1	0	1	0	0
		1	D19[7:0]							
	initial	-	1	0	0	1	0	0	0	0
	recommend	-	1	1	1	1	0	1	1	0
		1	D20[7:0]							
	initial	-	1	0	0	1	1	0	0	0
	recommend	-	1	1	0	1	1	1	0	0
		1	D21[7:0]							
	initial	-	1	0	1	0	0	0	0	0
	recommend	-	1	1	0	0	0	0	0	1
		1	D22[7:0]							
	initial	-	1	0	1	0	1	0	0	0
	recommend	-	1	0	1	0	1	0	0	0

SETDGCLUT continues to the next page.

(5)

(Hex)	Register	DNC	D7	D6	D5	D4	D3	D2	D1	D0
C1	SETDGCLUT	1	D23[7:0]							
	initial	-	1	0	1	1	0	0	0	0
	recommend	-	1	0	0	0	1	1	0	0
		1	D24[7:0]							
	initial	-	1	0	1	1	1	0	0	0
	recommend	-	0	1	0	1	1	0	0	1
		1	D25[7:0]							
	initial	-	1	1	0	0	0	0	0	0
	recommend	-	0	0	1	1	0	1	1	0
		1	D26[7:0]							
	initial	-	1	1	0	0	1	0	0	0
	recommend	-	0	0	0	1	0	1	0	1
		1	D27[7:0]							
	initial	-	1	1	0	1	0	0	0	0
	recommend	-	1	1	1	1	0	0	1	1
		1	D28[7:0]							
	initial	-	1	1	0	1	1	0	0	0
	recommend	-	1	1	0	1	0	0	1	0
		1	D29[7:0]							
	initial	-	1	1	1	0	0	0	0	0
	recommend	-	1	0	1	1	1	0	1	1
		1	D30[7:0]							
	initial	-	1	1	1	0	1	0	0	0
	recommend	-	1	0	0	0	1	1	1	0
		1	D31[7:0]							
	initial	-	1	1	1	1	0	0	0	0
	recommend	-	0	0	0	0	1	1	1	1
		1	D32[7:0]							
	initial	-	1	1	1	1	1	0	0	0
	recommend	-	0	0	0	0	1	0	0	1
		1	D33[7:0]							
	initial	-	1	1	1	1	1	1	1	1
	recommend	-	0	0	0	0	0	0	0	0
		1	D34[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	1	1	1	1	1	1	1	1
		1	D35[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	1	1	1	1	1	1	1	1
		1	D36[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	1	1	1	0	1	0	1	0
		1	D37[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	1	0	1	0	1	0	1	0
		1	D38[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	1	0	1	0	0	1	0	1
		1	D39[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	1	0	1	0	1	0	1
		1	D40[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	1	0	1	0	0	0	0

SETDGCLUT continues to the next page.

(6)

(Hex)	Register	DNC	D7	D6	D5	D4	D3	D2	D1	D0
C1	SETDGCLUT	1	D41[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	0	0	0	0	0	0	0
		1	D42[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	0	0	0	0	0	0	0
		1	D43[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	1	1	1	0	1	0	1	0
		1	D44[7:0]							
	initial	-	0	0	0	0	1	0	0	0
	recommend	-	1	1	0	0	1	1	1	1
		1	D45[7:0]							
	initial	-	0	0	0	1	0	0	0	0
	recommend	-	1	0	1	0	1	0	0	0
		1	D46[7:0]							
	initial	-	0	0	0	1	1	0	0	0
	recommend	-	1	0	0	0	0	0	0	1
		1	D47[7:0]							
	initial	-	0	0	1	0	0	0	0	0
	recommend	-	0	1	0	1	1	1	1	1
		1	D48[7:0]							
	initial	-	0	0	1	0	1	0	0	0
	recommend	-	0	0	1	1	1	1	1	0
		1	D49[7:0]							
	initial	-	0	0	1	1	0	0	0	0
	recommend	-	0	0	1	0	0	1	0	1
		1	D50[7:0]							
	initial	-	0	0	1	1	1	0	0	0
	recommend	-	0	0	0	0	0	1	1	0
		1	D51[7:0]							
	initial	-	0	1	0	0	0	0	0	0
	recommend	-	0	0	0	0	0	0	0	0
		1	D52[7:0]							
	initial	-	0	1	0	0	1	0	0	0
	recommend	-	1	1	0	1	0	0	0	0
		1	D53[7:0]							
	initial	-	0	1	0	1	0	0	0	0
	recommend	-	1	0	1	1	0	0	1	1
		1	D54[7:0]							
	initial	-	0	1	0	1	1	0	0	0
	recommend	-	1	0	0	1	0	1	1	1
		1	D55[7:0]							
	initial	-	0	1	1	0	0	0	0	0
	recommend	-	0	1	1	1	1	1	1	1
		1	D56[7:0]							
	initial	-	0	1	1	0	1	0	0	0
	recommend	-	0	1	1	0	0	1	0	1
		1	D57[7:0]							
	initial	-	0	1	1	1	0	0	0	0
	recommend	-	0	1	0	0	1	0	1	0
		1	D58[7:0]							
	initial	-	0	1	1	1	1	0	0	0
	recommend	-	0	0	1	0	1	1	1	1

SETDGCLUT continues to the next page.

(7)

(Hex)	Register	DNC	D7	D6	D5	D4	D3	D2	D1	D0
C1	SETDGCLUT	1	D59[7:0]							
	initial	-	1	0	0	0	0	0	0	0
	recommend	-	0	0	0	1	0	1	1	0
		1	D60[7:0]							
	initial	-	1	0	0	0	1	0	0	0
	recommend	-	1	1	1	1	1	1	0	1
		1	D61[7:0]							
	initial	-	1	0	0	1	0	0	0	0
	recommend	-	0	0	0	1	0	0	0	0
		1	D62[7:0]							
	initial	-	1	0	0	1	1	0	0	0
	recommend	-	1	1	0	0	1	0	1	0
		1	D63[7:0]							
	initial	-	1	0	1	0	0	0	0	0
	recommend	-	1	0	1	0	1	1	1	1
		1	D64[7:0]							
	initial	-	1	0	1	0	1	0	0	0
	recommend	-	1	0	0	1	1	0	0	1
		1	D65[7:0]							
	initial	-	1	0	1	1	0	0	0	0
	recommend	-	0	1	1	1	0	1	0	0
		1	D66[7:0]							
	initial	-	1	0	1	1	1	0	0	0
	recommend	-	0	1	0	0	0	0	1	1
		1	D67[7:0]							
	initial	-	1	1	0	0	0	0	0	0
	recommend	-	0	0	1	0	1	1	0	0
		1	D68[7:0]							
	initial	-	1	1	0	0	1	0	0	0
	recommend	-	0	0	0	0	1	0	0	1
		1	D69[7:0]							
	initial	-	1	1	0	1	0	0	0	0
	recommend	-	1	1	1	1	0	0	0	1
		1	D70[7:0]							
	initial	-	1	1	0	1	1	0	0	0
	recommend	-	1	1	0	1	0	0	1	1
		1	D71[7:0]							
	initial	-	1	1	1	0	0	0	0	0
	recommend	-	1	1	0	0	0	0	0	1
		1	D72[7:0]							
	initial	-	1	1	1	0	1	0	0	0
	recommend	-	1	0	1	0	0	0	1	0
		1	D73[7:0]							
	initial	-	1	1	1	1	0	0	0	0
	recommend	-	0	1	1	0	1	0	1	1
		1	D74[7:0]							
	initial	-	1	1	1	1	1	0	0	0
	recommend	-	0	0	0	1	0	0	0	0
		1	D75[7:0]							
	initial	-	1	1	1	1	1	1	1	1
	recommend	-	0	0	0	0	0	0	0	0
		1	D76[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	1	1	1	1	1	1	1	1

SETDGCLUT continues to the next page.

(8)

(Hex)	Register	DNC	D7	D6	D5	D4	D3	D2	D1	D0
C1	SETDGCLUT	1	D77[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	1	1	1	1	1	1	1	1
		1	D78[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	0	1	0	1	0	1	0
		1	D79[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	1	0	1	0	1	0	1	0
		1	D80[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	1	0	0	1	0	0	0	1
		1	D81[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	1	0	1	0	1	0	1
		1	D82[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	1	0	1	0	0	0	0
		1	D83[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	0	0	0	0	0	0	0
		1	D84[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	0	0	0	0	0	0	0
		1	D85[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	0	0	0	0	0	0	0
		1	D86[7:0]							
	initial	-	0	0	0	0	1	0	0	0
	recommend	-	1	1	0	0	1	0	0	1
		1	D87[7:0]							
	initial	-	0	0	0	1	0	0	0	0
	recommend	-	1	0	0	1	1	1	0	0
		1	D88[7:0]							
	initial	-	0	0	0	1	1	0	0	0
	recommend	-	0	1	1	1	0	1	1	1
		1	D89[7:0]							
	initial	-	0	0	1	0	0	0	0	0
	recommend	-	0	1	0	1	0	0	1	1
		1	D90[7:0]							
	initial	-	0	0	1	0	1	0	0	0
	recommend	-	0	0	1	1	0	1	0	0
		1	D91[7:0]							
	initial	-	0	0	1	1	0	0	0	0
	recommend	-	0	0	0	1	1	1	0	0
		1	D92[7:0]							
	initial	-	0	0	1	1	1	0	0	0
	recommend	-	1	1	1	1	1	0	1	1
		1	D93[7:0]							
	initial	-	0	1	0	0	0	0	0	0
	recommend	-	0	0	1	0	0	0	0	0
		1	D94[7:0]							
	initial	-	0	1	0	0	1	0	0	0
	recommend	-	1	1	0	0	0	1	0	1

SETDGCLUT continues to the next page.

(9)

(Hex)	Register	DNC	D7	D6	D5	D4	D3	D2	D1	D0
C1	SETDGCLUT	1	D95[7:0]							
	initial	-	0	1	0	1	0	0	0	0
	recommend	-	1	0	1	0	1	0	1	0
		1	D96[7:0]							
	initial	-	0	1	0	1	1	0	0	0
	recommend	-	1	0	0	0	1	1	0	0
		1	D97[7:0]							
	initial	-	0	1	1	0	0	0	0	0
	recommend	-	0	1	1	1	0	0	1	1
		1	D98[7:0]							
	initial	-	0	1	1	0	1	0	0	0
	recommend	-	0	1	0	1	1	0	0	1
		1	D99[7:0]							
	initial	-	0	1	1	1	0	0	0	0
	recommend	-	0	1	0	0	0	0	0	1
		1	D100[7:0]							
	initial	-	0	1	1	1	1	0	0	0
	recommend	-	0	0	1	0	1	0	0	0
		1	D101[7:0]							
	initial	-	1	0	0	0	0	0	0	0
	recommend	-	0	0	0	1	0	0	0	0
		1	D102[7:0]							
	initial	-	1	0	0	0	1	0	0	0
	recommend	-	1	1	1	1	0	1	1	0
		1	D103[7:0]							
	initial	-	1	0	0	1	0	0	0	0
	recommend	-	1	1	0	1	1	1	0	0
		1	D104[7:0]							
	initial	-	1	0	0	1	1	0	0	0
	recommend	-	1	1	0	0	0	1	0	0
		1	D105[7:0]							
	initial	-	1	0	1	0	0	0	0	0
	recommend	-	1	0	1	0	1	0	1	0
		1	D106[7:0]							
	initial	-	1	0	1	0	1	0	0	0
	recommend	-	1	0	0	1	0	0	1	1
		1	D107[7:0]							
	initial	-	1	0	1	1	0	0	0	0
	recommend	-	0	1	1	0	1	0	1	0
		1	D108[7:0]							
	initial	-	1	0	1	1	1	0	0	0
	recommend	-	0	1	0	0	0	0	0	0
		1	D109[7:0]							
	initial	-	1	1	0	0	0	0	0	0
	recommend	-	0	0	1	0	0	1	0	1
		1	D110[7:0]							
	initial	-	1	1	0	0	1	0	0	0
	recommend	-	0	0	0	0	0	0	0	0
		1	D111[7:0]							
	initial	-	1	1	0	1	0	0	0	0
	recommend	-	1	1	1	0	1	0	0	0
		1	D112[7:0]							
	initial	-	1	1	0	1	1	0	0	0
	recommend	-	1	1	0	0	1	0	1	0

SETDGCLUT continues to the next page.

(10)

(Hex)	Register	DNC	D7	D6	D5	D4	D3	D2	D1	D0
C1	SETDGCLUT	1	D113[7:0]							
	initial	-	1	1	1	0	0	0	0	0
	recommend	-	1	0	1	1	0	1	1	1
		1	D114[7:0]							
	initial	-	1	1	1	0	1	0	0	0
	recommend	-	1	0	0	1	1	1	0	0
		1	D115[7:0]							
	initial	-	1	1	1	1	0	0	0	0
	recommend	-	0	0	0	1	1	0	1	0
		1	D116[7:0]							
	initial	-	1	1	1	1	1	0	0	0
	recommend	-	0	0	0	0	0	1	0	1
		1	D117[7:0]							
	initial	-	1	1	1	1	1	1	1	1
	recommend	-	0	0	0	0	0	0	0	0
		1	D118[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	0	1	1	1	1	1	1
		1	D119[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	1	1	1	1	1	1	1	0
		1	D120[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	0	1	0	1	0	1	0
		1	D121[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	1	0	1	0	1	0	1	0
		1	D122[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	1	0	0	1	0	1	0	1
		1	D123[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	1	0	1	0	1	0	1
		1	D124[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	1	0	1	0	0	0	0
		1	D125[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	0	0	0	0	0	0	0
		1	D126[7:0]							
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	0	0	0	0	0	0	0
CC	SETDGCLUT	0	1	1	0	0	1	1	0	0
		1	-	-	-	SM_PANEL	SS_PANEL	GS_PANEL	REV_PANEL	BGR_PANEL
	initial	-	0	0	0	0	0	0	0	0
	recommend	-	0	0	0	0	1	0	1	1

(11)

(Hex)	Register	DNC	D7	D6	D5	D4	D3	D2	D1	D0
E0	SET SIP READ INDEX	0	1	1	1	0	0	0	0	0
		1	-	-	G1_VRP0[5:0]					
	initial	-	0	0	0	0	0	1	0	1
	recommend	1	0	0	0	0	0	0	0	1
		1	G1_CGMP0[1:0]		G1_VRP1[5:0]					
	initial	-	0	0	0	1	0	0	0	1
	recommend	1	0	1	0	0	1	0	0	0
		1	G1_CGMP1[1:0]		G1_VRP2[5:0]					
	initial	-	0	0	0	1	0	1	0	1
	recommend	1	0	1	0	0	1	1	0	1
		1	G1_CGMP2[1:0]		G1_VRP3[5:0]					
	initial	-	0	0	1	0	0	1	0	0
	recommend	1	0	1	0	0	1	1	1	0
		1	G1_CGMP3[1:0]		G1_VRP4[5:0]					
	initial	-	0	0	1	0	0	1	1	1
	recommend	1	0	1	0	1	1	0	0	0
		1	G1_CGMP4		G1_VRP5[5:0]					
	initial	-	0	0	1	0	0	1	1	1
	recommend	1	1	1	1	1	0	1	1	0
		1	-	G1_PRP0[6]		G1_PKP0[4:0]				
	initial	-	0	0	0	0	0	1	1	0
	recommend	1	0	0	0	0	1	0	1	1
		1	G1_PRP0[5:4]		-	G1_PKP1[4:0]				
	initial	-	1	0	0	0	1	1	0	1
	recommend	1	0	1	0	0	1	1	1	0
		1	G1_PRP0[3:2]		-	G1_PKP2[4:0]				
	initial	-	0	0	0	1	0	0	0	1
	recommend	1	0	0	0	1	0	0	1	0
		1	G1_PRP0[1:0]		-	G1_PKP3[4:0]				
	initial	-	1	1	0	1	0	1	0	1
	recommend	-	1	1	0	1	0	1	0	1
		1	-	G1_PRP1[6]		G1_PKP4[4:0]				
	initial	-	0	0	0	1	1	0	0	1
	recommend	-	0	0	0	1	0	1	0	1
		1	G1_PRP1[5:4]		-	G1_PKP5[4:0]				
	initial	-	1	1	0	1	0	1	1	0
	recommend	-	1	0	0	1	0	1	0	1
		1	G1_PRP1[3:2]		-	G1_PKP6[4:0]				
	initial	-	1	0	0	1	0	1	1	1
	recommend	-	0	1	0	1	0	1	0	1
		1	G1_PRP1[1:0]		-	G1_PKP7[4:0]				
	initial	-	0	0	0	0	1	0	0	1
	recommend	-	1	0	0	0	1	1	1	0
		1	-			G1_PKP8[4:0]				
	initial	-	0	0	0	0	1	0	0	1
	recommend	-	0	0	0	1	0	0	0	1
		1	-			G1_VRN0[5:0]				
	initial	-	0	0	0	0	0	1	0	1
	recommend	-	0	0	0	0	0	0	0	1
		1	G1_CGMN0[1:0]		G1_VRN1[5:0]					
	initial	-	0	0	0	1	0	0	0	1
	recommend	-	0	1	0	0	1	0	0	0

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(12)

(Hex)	Register	DNC	D7	D6	D5	D4	D3	D2	D1	D0
		1	G1_CGMN1[1:0]		G1_VRN2[5:0]					
	initial	-	0	0	0	1	0	1	0	1
	recommend	-	0	1	0	0	1	1	0	1
		1	G1_CGMN2[1:0]		G1_VRN3[5:0]					
	initial	-	0	0	1	0	0	1	0	0
	recommend	-	0	1	0	1	0	1	0	1
		1	G1_CGMN3[1:0]		G1_VRN4[5:0]					
	initial	-	0	0	1	0	0	1	1	1
	recommend	-	0	1	0	1	1	1	1	1
		1	G1_CGMN5	G1_CGMN4	G1_VRN5[5:0]					
	initial	-	0	0	1	0	0	1	1	1
	recommend	-	1	1	1	1	1	1	0	1
		1	-	G1_PRN0[6]	-	G1_PKN0[4:0]				
	initial	-	0	0	0	0	0	1	1	0
	recommend	-	0	0	0	0	1	0	1	0
		1	G1_PRN0[5:4]		-	G1_PKN1[4:0]				
	initial	-	1	0	0	0	1	1	0	1
	recommend	-	0	1	0	0	1	1	1	0
		1	G1_PRN0[3:2]		-	G1_PKN2[4:0]				
	initial	-	0	0	0	1	0	0	0	1
	recommend	-	0	1	0	1	0	0	0	1
		1	G1_PRN0[1:0]		-	G1_PKN3[4:0]				
	initial	-	1	1	0	1	0	1	0	1
	recommend	-	1	1	0	1	0	0	1	1
		1	-	G1_PRN1[6]	-	G1_PKN4[4:0]				
	initial	-	0	0	0	1	0	1	1	0
	recommend	-	0	0	0	1	0	1	1	1
		1	G1_PRN1[5:4]		-	G1_PKN5[4:0]				
	initial	-	1	1	0	1	0	1	1	0
	recommend	-	1	0	0	1	0	0	0	1
		1	G1_PRN1[3:2]		-	G1_PKN6[4:0]				
	initial	-	1	0	0	1	0	1	1	1
	recommend	-	1	0	0	1	0	1	1	0
		1	G1_PRN1[1:0]		-	G1_PKN7[4:0]				
	initial	-	0	0	0	0	1	0	0	1
	recommend	-	0	1	0	0	1	1	1	0
		1	-	-	-	G1_PKN8[4:0]				
	initial	-	0	0	0	0	1	0	0	1
	recommend	-	0	0	0	1	0	0	0	1
FE	SET SPI READ INDEX	0	1	1	1	1	1	1	1	0
		1	CMD_ADD[7:0]							
FF		initial	-	-	-	-	-	-	-	-
		recommend	-	-	-	-	-	-	-	-
	SPIREAD	0	1	1	1	1	1	1	1	1
		1	CMD_DATA1[7:0]							
		initial	-	-	-	-	-	-	-	-
		recommend	-	-	-	-	-	-	-	-
		1	...							
		initial	-	-	-	-	-	-	-	-
		recommend	-	-	-	-	-	-	-	-
		1	CMD_DATAN[7:0]							
		initial	-	-	-	-	-	-	-	-
		recommend	-	-	-	-	-	-	-	-

8. Sequence

Power on sequence

№		Function	DNC	Command/Parameter
		RESETB=0		
	Wait	wait 1 msec or more		
	Power on	IOVCC, VCC on		
	Wait	wait 10 msec or more		
		RESETB=1		
	Wait	wait 10 msec or more		
	RGB signals	RGB signals start		
	Wait	wait 2 frames or more		
1	Enable extended commands	Enable extended commands	0	B9h
		Parameter 1	1	FFh
		Parameter 2	1	83h
		Parameter 3	1	63h
2	Set power	Set power	0	B1h
		Parameter 1	1	81h
		Parameter 2	1	24h
		Parameter 3	1	04h
		Parameter 4	1	02h
		Parameter 5	1	02h
		Parameter 6	1	03h
		Parameter 7	1	10h
		Parameter 8	1	10h
		Parameter 9	1	34h
		Parameter 10	1	3Ch
		Parameter 11	1	3Fh
		Parameter 12	1	3Fh
3	Sleep out	Sleep out	0	11h
	Wait	wait 5 msec or more		
4	Display inversion off	Display inversion off	0	20h
5	Memory access control	Memory access control	0	36h
		Parameter 1	1	00h
6	Interface pixel format	Interface pixel format	0	3Ah
		Parameter 1	1	70h
	Wait	wait 120 msec or more		
7	Set power	Set power	0	B1h
		Parameter 1	1	78h
		Parameter 2	1	24h
		Parameter 3	1	04h
		Parameter 4	1	02h
		Parameter 5	1	02h
		Parameter 6	1	03h
		Parameter 7	1	10h
		Parameter 8	1	10h
		Parameter 9	1	34h
		Parameter 10	1	3Ch
		Parameter 11	1	3Fh
8	Set RGB interface related register	Set RGB interface related register	0	B3h
		Parameter 1	1	01h
9	Set display waveform cycle	Set display waveform cycle	0	B4h
		Parameter 1	1	00h
		Parameter 2	1	08h
		Parameter 3	1	56h
		Parameter 4	1	07h
		Parameter 5	1	01h
		Parameter 6	1	01h
		Parameter 7	1	4Dh
		Parameter 8	1	01h
		Parameter 9	1	42h

№		Function	DNC	Command/Parameter
10	Set panel	Set panel	0	CCh
		Parameter 1	1	0Bh
11	Set gamma curve related setting	Set gamma curve related setting	0	E0h
		Parameter 1	1	01h
		Parameter 2	1	48h
		Parameter 3	1	4Dh
		Parameter 4	1	4Eh
		Parameter 5	1	58h
		Parameter 6	1	F6h
		Parameter 7	1	0Bh
		Parameter 8	1	4Eh
		Parameter 9	1	12h
		Parameter 10	1	D5h
		Parameter 11	1	15h
		Parameter 12	1	95h
		Parameter 13	1	55h
		Parameter 14	1	8Eh
		Parameter 15	1	11h
		Parameter 16	1	01h
		Parameter 17	1	48h
		Parameter 18	1	4Dh
		Parameter 19	1	55h
		Parameter 20	1	5Fh
		Parameter 21	1	FDh
		Parameter 22	1	0Ah
		Parameter 23	1	4Eh
		Parameter 24	1	51h
		Parameter 25	1	D3h
		Parameter 26	1	17h
		Parameter 27	1	95h
		Parameter 28	1	96h
		Parameter 29	1	4Eh
		Parameter 30	1	11h
	Wait	wait 5 msec or more		
12	Display on	Display on	0	29h

Power off sequence

№		Function	DNC	Command/Parameter
1	Display off	Display off	0	28h
	Wait	wait 5 msec or more		
2	Sleep in	Sleep in	0	10h
	Wait	wait 2 frames or more		
3	RGB signals	RGB signals stop		

↓
Power off

Sleep sequence

№		Function	DNC	Command/Parameter
1	Sleep in	Sleep in	0	10h
	Wait	wait 2 frames or more		
2	RGB signals	RGB signals stop		

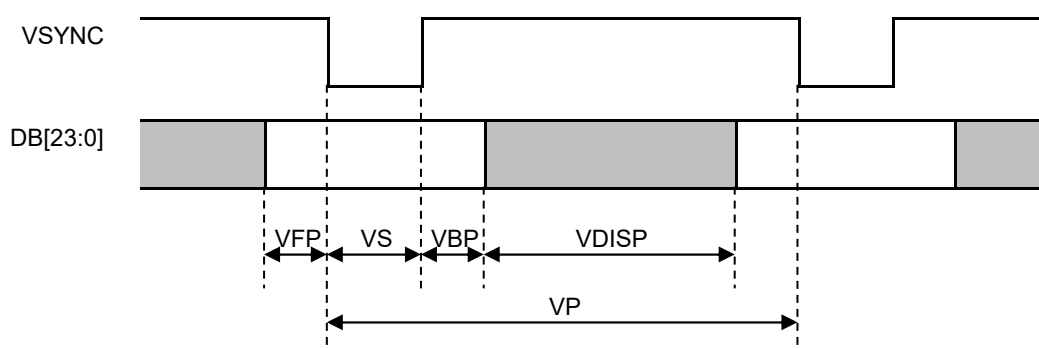
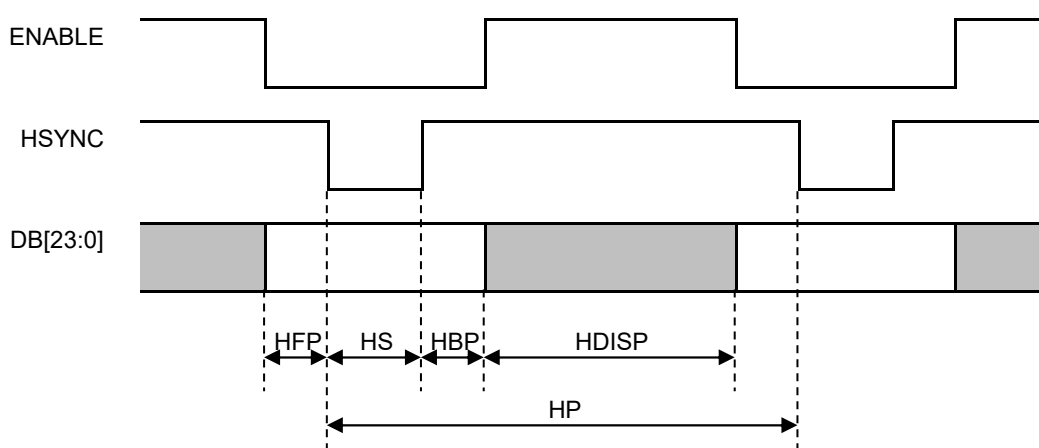
Sleep release sequence

№		Function	DNC	Command/Parameter
1	RGB signals	RGB signals start		
	Wait	wait 2 frames or more		
2	Sleep out	Sleep out	0	11h

9. RGB Interface

Recommended RGB interface timing

Item	Symbol	Recommended	Unit
Vertical cycle	VP	806	Line
Vertical low pulse width	VS	2	Line
Vertical front porch	VFP	2	Line
Vertical back porch	VBP	2	Line
Vertical active area	VDISP	800	Line
Vertical refresh rate	VRR	60	Hz
HS cycle	HP	508	DOTCLK
HS low pulse width	HS	10	DOTCLK
Horizontal back porch	HBP	10	DOTCLK
Horizontal front porch	HFP	8	DOTCLK
Horizontal active area	HDISP	480	DOTCLK
Pixel clock frequency	DCK	24.57	MHz

Vertical timingHorizontal timing

10. Absolute Maximum Rating

Item	Symbol	Condition	Rating		Unit	Terminal
			MIN	MAX		
Power supply voltage	VCC		-0.3	4.6	V	VCC
IO logic voltage	IOVCC		-0.3	4.6	V	IOVCC
Input voltage	VI		-0.3	IOVCC+0.3	V	RESETB, SDI, SCL, CSB, VSYNC, HSYNC, DOTCLK, ENABLE, DB[23:0]
LED	IL25	Ta=25°C	—	35	mA	VLED — LEDn
Forward current	IL70	Ta=70°C	—	15	mA	
Storage temperature	Tstg		-30	+80	°C	

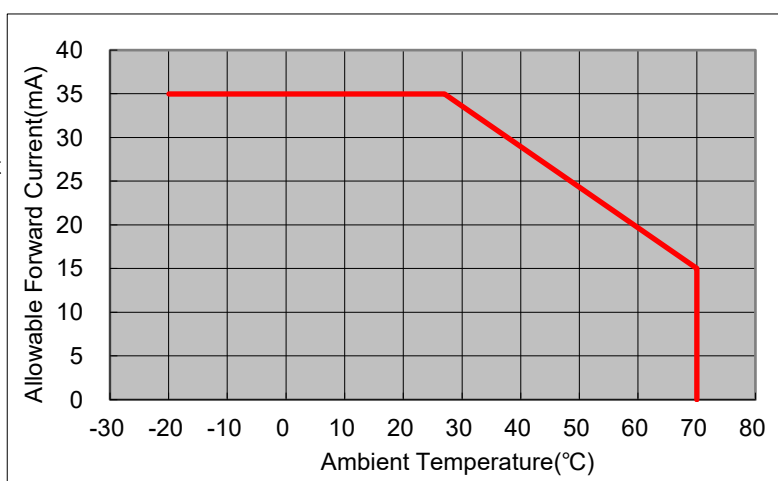
11. Recommended Operating Conditions

Item	Symbol	Rating			Unit	Terminal
		MIN	TYP	MAX		
Supply voltage	VCC	2.6	2.7	2.9	V	VCC
IO logic voltage	IOVCC	1.7	1.8	1.9	V	IOVCC (VCC ≥ IOVCC)
Operation temperature	Top	-20	+25	+70	°C	Temperature at the surface of the display
LED Ta=25 °C	IL25	—	8.5	35	mA	VLED — LEDn
Forward current Ta=70 °C	IL70	—	—	15	mA	
Forward voltage Ta=25 °C (Reference value) IL=8.5mA	VL	2.57	2.73	2.86	V	

Note1: This monitor is operatable
in this temperature range.

With regard to optical characteristics,
refer to Item 14."Characteristics".

Note 2: Acceptable Forward Current to LED is
up to 15 mA, when Ta=+70 °C.
Do not exceed Allowable Forward Current
shown on the chart right.



12. Electrical Characteristics



12.1 DC Characteristics

(Ta=25°C,VCC=2.7V, IOVCC=1.8V)

Items	Symbol	Condition	Rating			Unit	Terminal
			MIN	TYP	MAX		
High level input voltage	VIH1		0.7 IOVCC		IOVCC	V	RESETB, SDI, SCL, CSB, VSYNC, HSYNC, DOTCLK, ENABLE, DB[23:0]
Low level input voltage	VIL1		0		0.3 IOVCC	V	
Current Consumption	ICC1	VCC=2.7V,IOVCC=1.8V Still image *		12.0		mA	VCC
	ICC2	VCC=2.7V,IOVCC=1.8V stand by		10		μA	
	IOICC1	VCC=2.7V,IOVCC=1.8V Still image *		110		μA	IOVCC
	IOICC2	VCC=2.7V,IOVCC=1.8V stand by		1		μA	
Estimated Life of LED	LL	Ta=25°C, IL=8.5mA Note	—	50,000	—	hrs	

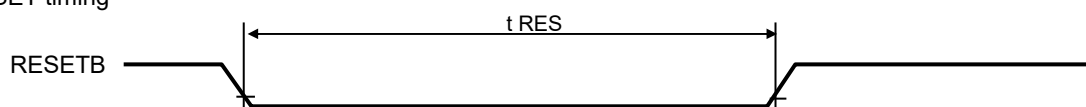
* A still image (color bar) on display, when accessing to the driver by RGB interface mode.

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

12.2 AC Characteristics

RESET timing



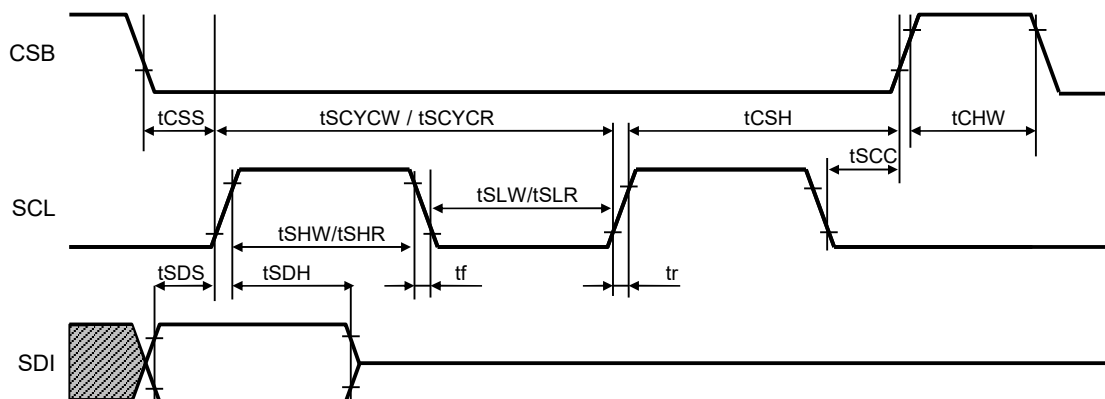
Reset low pulse width shorter than 10us do not make reset. It means undesired short pulse such as glitch, bouncing noise or electrostatic discharge do not cause irregular system reset. Please refer to the table below.

RESET timing spec

Item	Symbol	Condition	Rating			Unit
			MIN	TYP	MAX	
Reset low pulse width	tRES		10	-	-	μs

tRES Pulse	Action
Shorter than 5μs	No reset
Longer than 10μs	Reset
Between 5μs and 10μs	Not determined

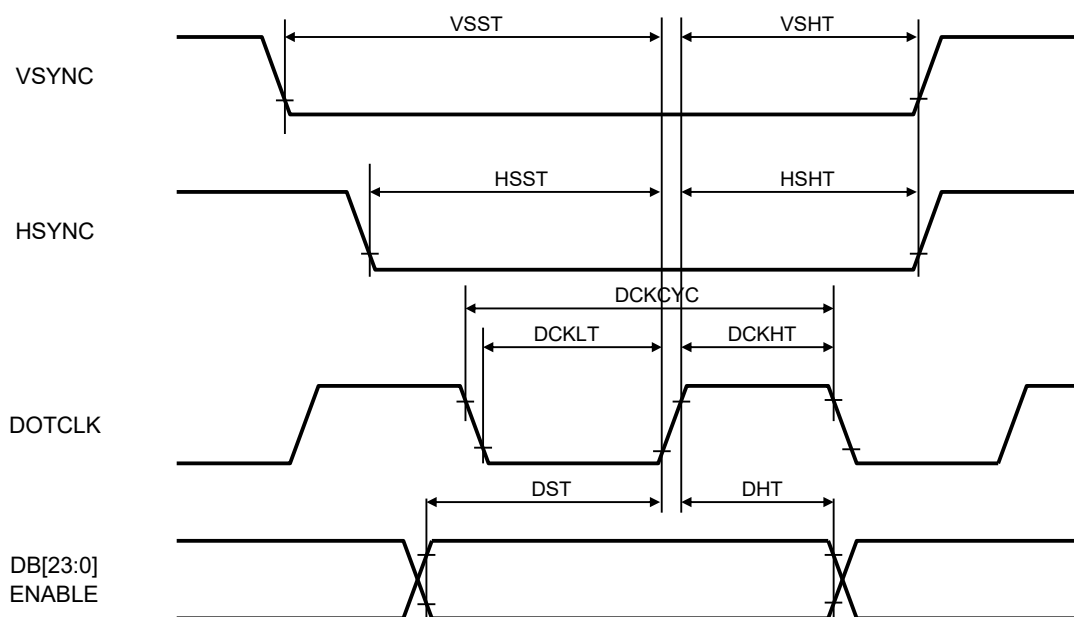
Serial Peripheral Interface(SPI)



Item	Symbol	Condition	Rating			Unit
			MIN	TYP	MAX	
Serial Clock Write Cycle	t_{SCYCW}		100		-	ns
Serial Clock Read Cycle	t_{SCYCR}		200		-	ns
Pulse Width High at Write	t_{SHW}		50		-	ns
Pulse Width High at Read	t_{SHR}		100		-	ns
Pulse Width Low at Write	t_{SLW}		50		-	ns
Pulse Width Low at Read	t_{SLR}		100		-	ns
Time between SCL ~ CSB	t_{SCC}		50		-	ns
CSB Setup Time at Write	t_{CSS}		50		-	ns
CSB Setup Time at Read	t_{CSS}		100		-	ns
CSB Hold Time at Write	t_{CSH}		50		-	ns
CSB Hold Time at Read	t_{CSH}		100		-	ns
CSB Pulse Width High	t_{CHW}		100		-	ns
SDI Setup Time	t_{SDS}		50		-	ns
SDI Hold Time	t_{SDH}		50		-	ns
Rising/Falling Time	t_r, t_f		-		10	ns

Remarks 1. All timing data is specified at 30 to 70% of VCCIO.

24 bit RGB interface



Item	Symbol	Condition	Rating			Unit
			MIN	TYP	MAX	
VSYNC Setup Time	VSST		10	-	-	ns
VSYNC Hold Time	VSHT		10	-	-	ns
HSYNC Setup Time	HSST		10	-	-	ns
HSYNC Hold Time	HSHT		10	-	-	ns
DOTCLK Clock Cycle	DCKCYC	Frame Frequency= 50 to 70 Hz	31	-	49.2	ns
DOTCLK Low Time	DCKLT		10	-	-	ns
DOTCLK High Time	DCKHT		10	-	-	ns
Data Setup Time for DB[23:0]	DST		10	-	-	ns
Data Hold Time for DB[23:0]	DHT		10	-	-	ns

Note: (1) Signal rise and fall times are equal to or less than 20 ns.

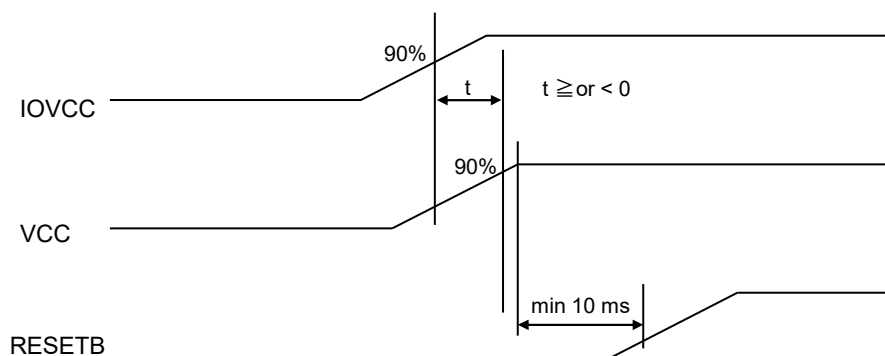
(2) Input signals are measured by 0.30 x IOVCC for low state and 0.70 x IOVCC for high state.

13. External Power on / off Sequence

13.1 External Power On sequence

VCC and IOVCC can be applied in any order.

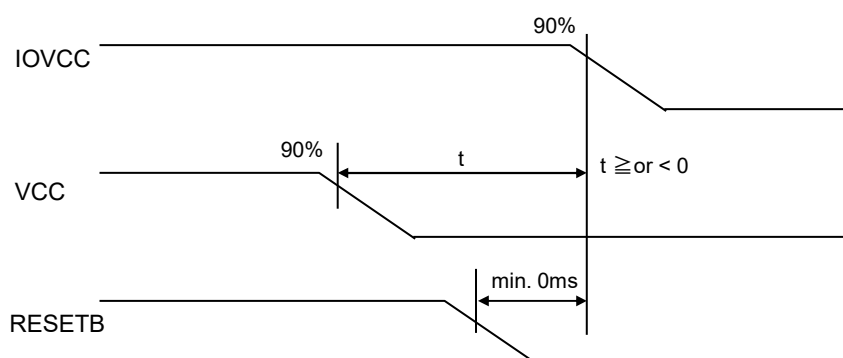
RESETB must be kept low for minimum 10 msec after both VCC and IOVCC have reached it's target voltage.



13.2 External Power Off sequence

VCC and IOVCC can be powered down in any order.

If the module is in "Sleep In" mode, IOVCC and VCC can be powered down minimum 0 msec after RESETB has been released.



14. Characteristics

14.1 Optical Characteristics

< Measurement Condition >

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

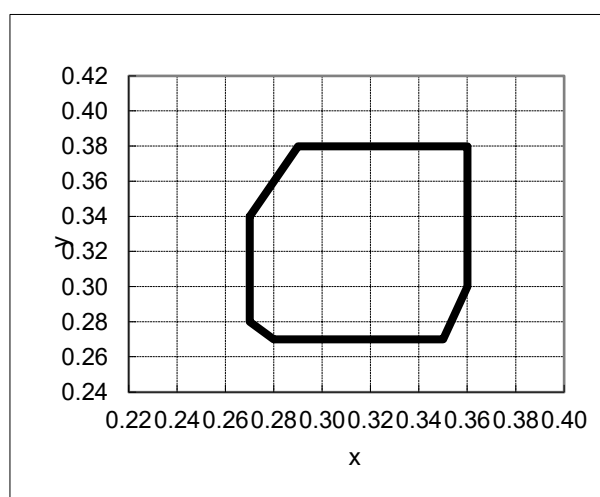
Driving condition: VCC = 2.7V, VCCIO=1.8V, Optimized VCOMDC

Backlight: IL=8.5mA

Measured temperature: Ta=25° C

Item	Symbol	Condition	MIN	TYP	MAX	Unit	Note No.	Remark
Response time	Rise time	TON [Data]=00h→FFh	—	—	40	ms	1	
	Fall time	TOFF [Data]=FFh→00h	—	—	60	ms		
Contrast ratio	Backlight ON	CR [Data]=FFh / 00h	420	700	—		2	
	Backlight OFF		—	2.4	—			
Viewing angle	Left	θL [Data]=FFh / 00h CR≥(10)	80	—	—	deg	3	
	Right		80	—	—	deg		
	Up		80	—	—	deg		
	Down		80	—	—	deg		
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]=FFh	240	380	—	cd/m ²	6	
Brightness distribution		[Data]=FFh	70	—	—	%	7	

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



【White Chromaticity Range】

x	y
0.27	0.34
0.27	0.28
0.28	0.27
0.35	0.27
0.36	0.30
0.36	0.38
0.29	0.38

White Chromaticity Range



14.2 About Sunlight readable

Item	Illuminance	Display visibility	Remarks
Sunlight readable	100,000 lx	Possible	Refer to <Features of Blanview>

14.3 Temperature Characteristics

< Measurement Condition >

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

Driving condition: VCC = 2.7V, VCCIO=1.8V, Optimized VCOMDC

Backlight: IL=8.5mA

Item			Specification		Remark
			Ta=-20°C	Ta=70°C	
Contrast ratio		CR	200 or more	200 or more	Backlight ON
Response time	Rise time	TON	400 msec or less	30 msec or less	
	Fall time	TOFF	600msec or less	50 msec or less	
Display Quality			No noticeable display defect or ununiformity should be observed.		

15. Criteria of Judgment

15.1 Defective Display and Screen Quality

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

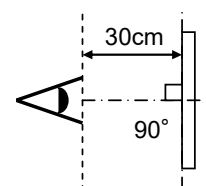
Driving Signal Raster Patter (RGB, white, black)

Signal condition [Data]:00h, 90h, FFh (3steps)

Observation distance 30 cm

Illuminance 200 to 350 lx

Backlight IL=8.5mA



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)	Refer to table 1
		High bright dot: Visible through 2% ND filter at [Data]=00h	
		Low bright dot: Visible through 5% ND filter at [Data]=00h	
Screen Quality	Stain	Dark dot: Appear dark through white display at [Data]=90h	
		Invisible through 5% ND filter at [Data]=00h	Acceptable
	Foreign particle	Uneven brightness (white stain, black stain etc)	Invisible through 5% ND filter at Black screen. Invisible through 1% ND filter at other screen.
		Point-like	
		$0.25\text{mm} < \phi$	N=0
		$0.20\text{mm} < \phi \leq 0.25\text{mm}$	$N \leq 2$
		$\phi \leq 0.20\text{mm}$	Acceptable
	Liner	$3.0\text{mm} < \text{length and } 0.08\text{mm} < \text{width}$	N=0
		$\text{length} \leq 3.0\text{mm or width} \leq 0.08\text{mm}$	Acceptable
	Others		Use boundary sample for judgment when necessary

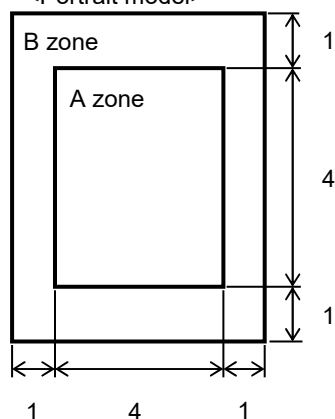
$\phi(\text{mm})$: Average diameter = (major axis + minor axis)/2

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	6	

<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)

15.2 Screen and Other Appearance

Testing conditions

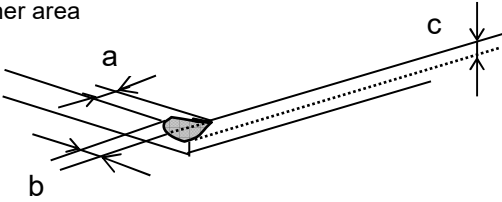
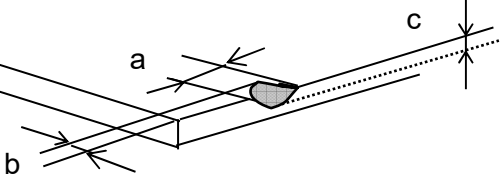
Observation distance

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	

Item	Appearance	Criteria
Glass chipping	Corner area 	Unit:mm $a \leq 3$ $b \leq 3$ $c \leq t$ (t: glass thickness) $a, b \leq 0.5$ is acceptable Maximum permissible number of chipping off on a side is 2.
	Others 	Unit:mm $a \leq 5$ $b \leq 1$ $c \leq t$ (t:glass thickness) $a, b \leq 0.5$ is acceptable Maximum permissible number of chipping off on a side is 5.
	Progressive crack	None

16. Reliability Test

Test item		Test condition	number of failures /number of examinations
Durability test	High temperature storage	Ta=80° C 240hrs	0/3
	Low temperature storage	Ta=-30° C 240hrs	0/3
	High temperature & high humidity storage	Ta=60° C, RH=90% non condensing ※	0/3
	High temperature operation	Tp=70° C 240hrs	0/3
	Low temperature operation	Tp=-20° C 240hrs	0/3
	High temp & humid operation	Tp=40° C, RH=90% non condensing ※	0/3
	Thermal shock storage	-30←→80° C(30min/30min) 100 cycles	0/3
	Lightfastness	Xenon Blackpanel 63±3°C non-shower 450W/m ² (300~700nm) non-operating Integral dose 800MJ/m ²	0/3
Mechanical environmental test	Electrostatic discharge test (Non operation)	Confirms to EIAJ ED-4701/300 C=200pF,R=0Ω,V=±200V Each 3 times of discharge on and power supply and other terminals.	0/3
	Surface discharge test (Non operation)	C=250pF, R=100Ω, V=±6kV Each 5 times of discharge in both polarities on the center of screen with the case grounded.	0/3
	Vibration test	Total amplitude 1.5mm, f=10~55Hz, X,Y,Z directions for each 2 hours	0/3
	Impact test	Use TOPPAN INC 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.	0/3
Packing test	Packing vibration-proof test	Acceleration of 19.6m/s ² with frequency of 10→55→10Hz, X,Y, Zdirection for each 30 minutes	0/1Packing
	Packing drop test	Drop from 75cm high. 1 time to each 6 surfaces, 3 edges, 1 corner	0/1Packing

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.)

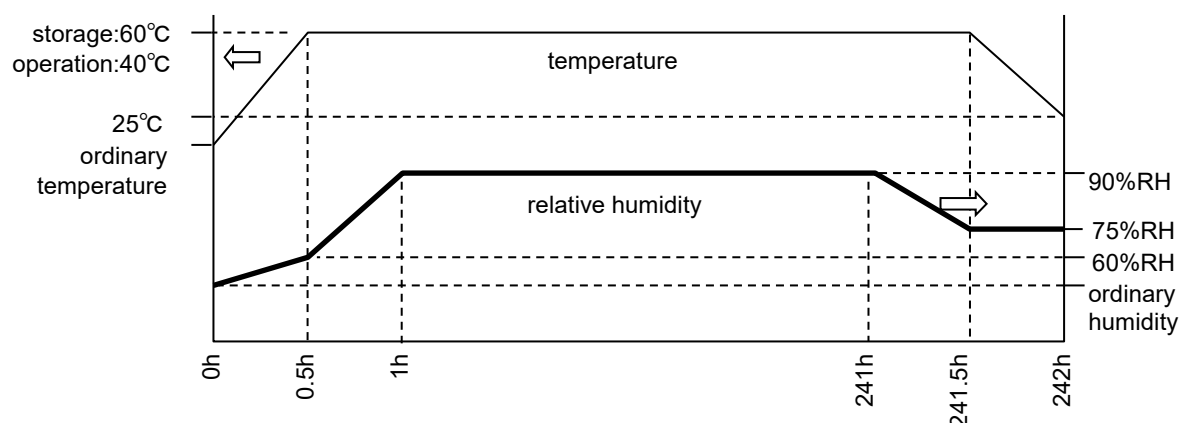
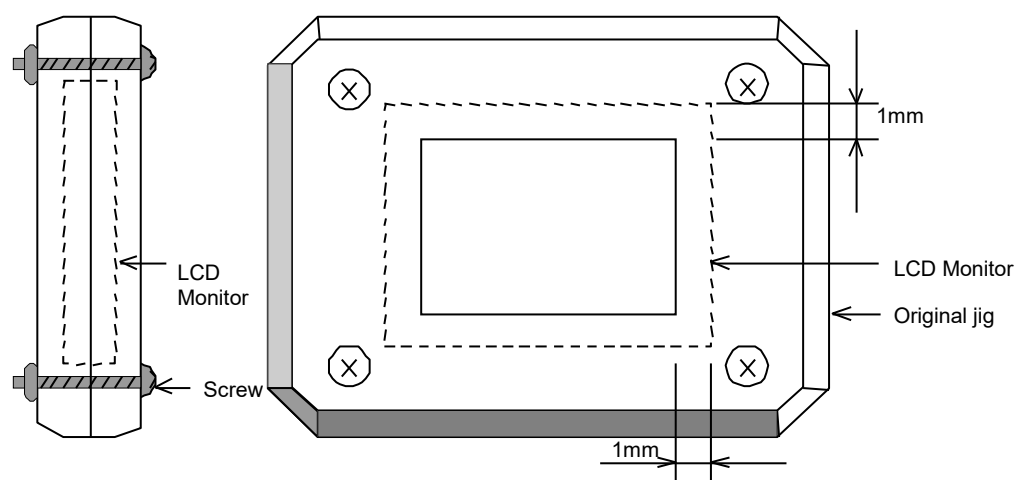


Table2.Reliability Criteria

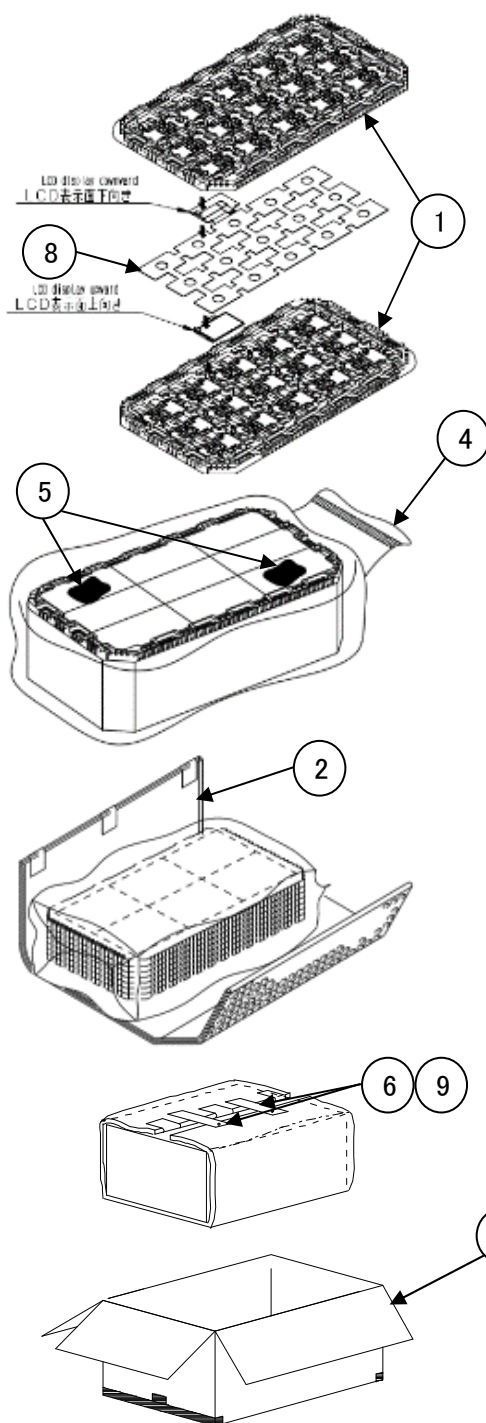
The parameters should be measured after leaving the monitor at the ordinary temperature for 24 hours or more after the test completion.

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 INC Original Jig



17. Packing Specifications



Step1. Each product is to be placed in one of the cut-outs of the tray with the display surface facing upward. (15products per tray)
Foam sheet is to be placed on the products in the tray.
Each product is to be placed in one of the cut-outs of the tray with the display surface facing downward.(30products per tray)

Step2. The trays be in a stack of 9.(Rotate 180 degrees for each step)
One empty tray is to be put on the top of stack of 9 trays.

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

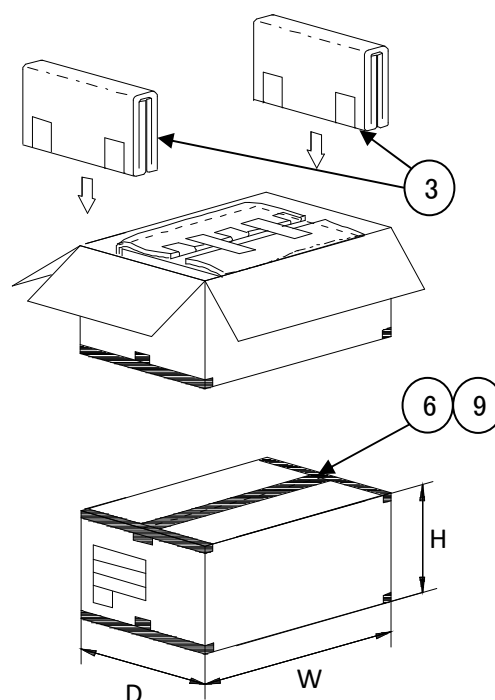
Step4. Vacuum and seal the sealing bag with the vacuum sealing machine.

Step5. Put the sealing bag in the center of the cushioning sheet.

Step6. The wrapped trays are placed in the outer carton.

Step7. Bubble cushioning sheets are to be inserted into the outer carton with same orientation. The outer carton is to be sealed in H-shape with packing tape as shown in the drawing.

Step8. The model number, quantity of products, and shipping date are to be printed on the outer carton with black ink.
If necessary, shipping labels or impression markings are to be put on the outer carton.



Remark: The return of packing materials is not required.

Packing item name		Specs., Material
①	Tray	A-PET
②	B SHEET C	Anti-static air bubble sheet
③	B SHEET D	Anti-static air bubble sheet
④	Sealing bag	
⑤	Drier	Moisture absorber
⑥	Packing tape	
⑦	Outer carton	Corrugated cardboard
⑧	FOAM SHEET	Anti-static polyethylene
⑨	Packing tape	

Dimension of outer carton	
D : Approx.	(356 mm)
W : Approx.	(664 mm)
H : Approx.	(182 mm)
Quantity of products packed in one carton:	270
Gross weight : Approx.	6.8 kg

18. Handling Instruction

18.1 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 medical 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.

18.2 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 18.5 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.
- 9) It is recommended to employ the structure of which polarizer peripheral area of LCD panel being pressed by cushioning materials, in order to prevent a cause of display brightness unevenness.
- 10) By reason of this model is made by thin glass, this model LCD is breakable.
Please apply fitting of protection LCD surface. (ex. Covered acrylic board on LCD surface)

18.3 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.

18.4 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 8 cartons (excluding the bottom)

*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 INC.

18.5 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.

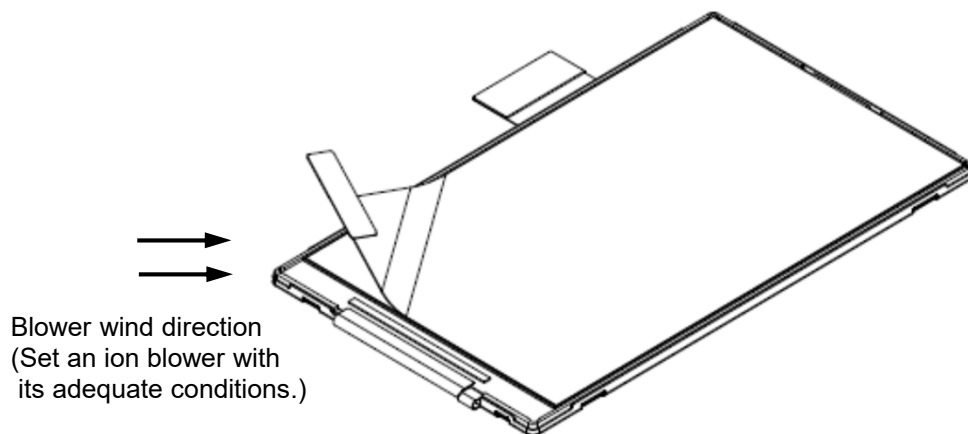
A) Work Environment

- 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 LSI is placed at the bottom.
Optimize direction of the blowing air and the distance between the TFT monitors and the electrostatic neutralization blower.
- b) Peel off the R tape slowly (spending more than 2 secs to complete)
by pulling it to opposite direction.



18.6 Warranty

TOPPAN INC 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)

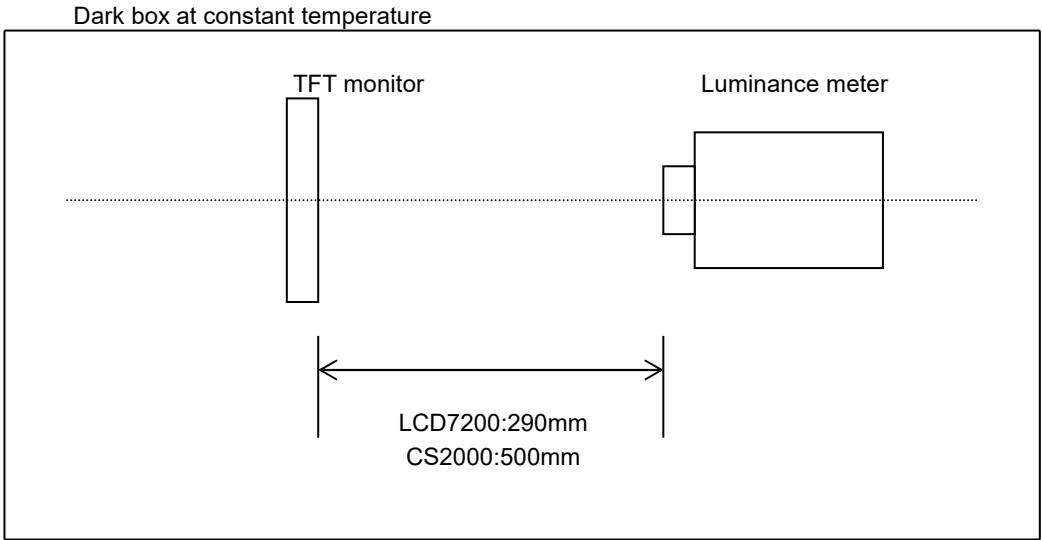
Measuring instruments: CS2000 (KONICA MINOLTA), LCD7200 (OTSUKA ELECTRONICS), EZcontrastXL88 (ELDIM)

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

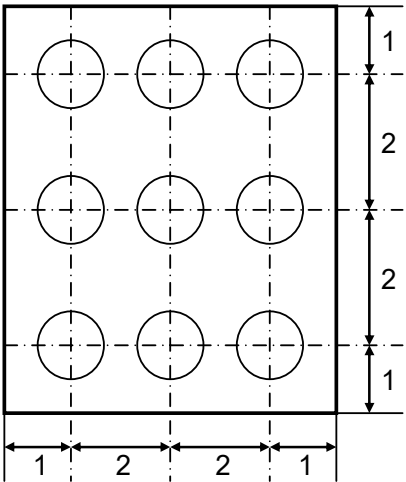


Measurement is made after 30 minutes of lighting of the backlight.

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=8.5mA

Measurement Condition (Contrast ratio Backlight OFF only)

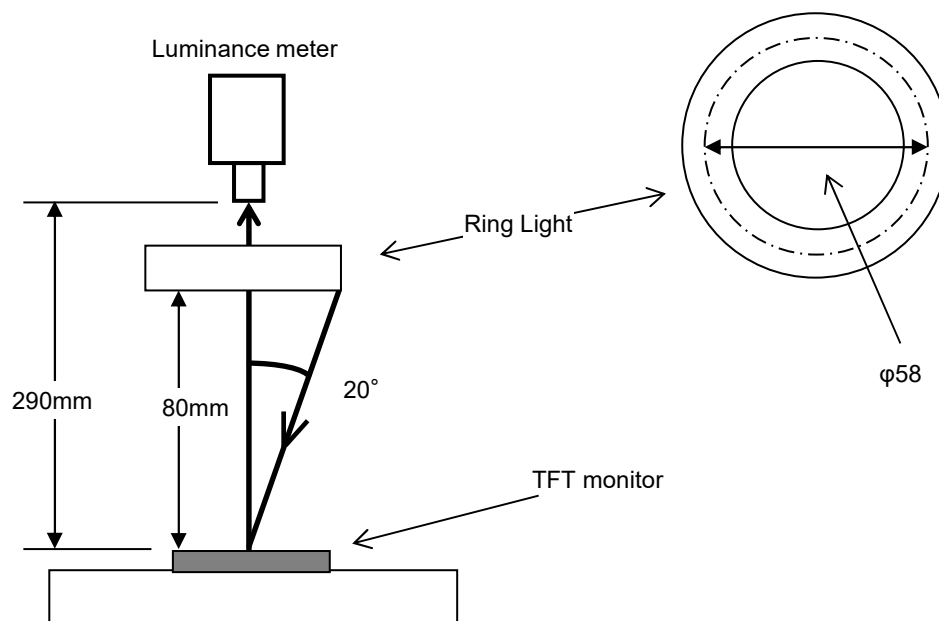
Measuring instruments: LCD7200(OTSUKA ELECTRONICS),Ring Light(40,000 lx,φ58)

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 waves with a brightness meter when the raster or window pattern is changed over 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]=00h White display [Data]=FFh TON Rise time TOFF Fall time
2	Contrast ratio	Measure maximum luminance Y1([Data]=FFh) and minimum luminance Y2([Data]=00h) 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: 7.8mmφ(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.	EZcontrastXL88	
4	White chromaticity	Measure chromaticity coordinates x and y of CIE1931 colorimetric system at [Data] = FFh Color matching function: 2°view measurement angle: 1°	CS2000	
5	Burn-in	Visually check burn-in image on the screen after 2 hours of "window display" ([Data]=00h/FFh).		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	

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