DATA MODUL

ORTUSTECH

Specification

COM35H3R25ULC

3.5" - 240 x 320 – SPI

Spec Revision: 1.0
Revision Date: 14.03.2024

Note: This specification is subject to change without prior notice

Passion Displayed

SPECIFICATIONS № 23TLM024	Issue:Mar.15,2024

△A

Specifications for

Blanview TFT-LCD Monitor

(3.5" QVGA 240 x RGB x 320 Portrait)

Version 1.0
(Please be sure to check the specifications latest version.)

MODEL COM35H3R25ULC

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

ORTUSTECH

TOPPAN INC.
Electronics Division
Technological Development Department III

Approved by S. Eguchi

Checked by T. Matsuzaki

Prepared by M. Tojo

Version History

Ver.	Date	Page		Description
0.0	Aug.24,2023	-	-	Tentative issue
1.0	Mar.15,2024	-	-	First issue
A ×13		All		All
			Change	Company name font
		P.5		2.2 Display Method
			Change	NTSC ratio
		P.12		7.1.1 Display section
			Add	Rating
				7.1.2 Backlight section
			Correct	Rating
		P.13		7.2.1 3-wire serial interface timing characteristics
			Correct	Symbol,Rating
		P.14		7.2.2 4-wire serial interface timing characteristics
			Correct	Symbol,Rating
		P.20,21		9.1 Power ON Sequence
			Correct	Positive gamma,Negative gamma
		P.23,24		9.5 Refresh Sequence
			Correct	Positive gamma,Negative gamma
		P.27		11.1 Optical Characteristics
			Add	Center Brightness
		P.29		12.1 Defective Display and Screen Quality
			Add	Signal condition
		P.31		13. Reliability Test
			Add	number of failures /number of examinations
				Surface discharge test(Non operation)Applied voltage

Contents

1. Application

This Specification is applicable to 89.4mm (3.5 inch) Blanview TFT-LCD monitor for non-military use.

◎ TOPPAN 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 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'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'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 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 caused by stress to the LCD module shall be considered.

◎ TOPPAN 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 and Purchaser shall discuss them in good faith and seek solution.

◎ TOPPAN 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

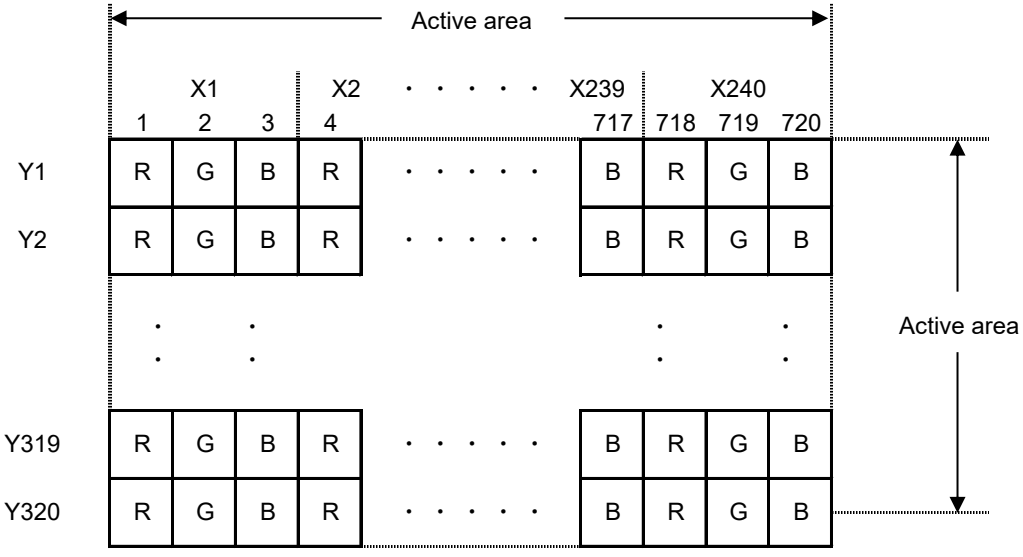
2.1 Features of the Product

- 3.5 inch diagonal display, 720 [H] x 320 [V] dots. 240RGB x 320 pixel.
- 18-bit / 262,144 colors.
- Timing generator [TG], Counter-electrode driving circuitry, Built-in power supply circuit.
- Long life & High bright white LED back-light.
- Blanview TFT-LCD, improved outdoor visibility.

	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

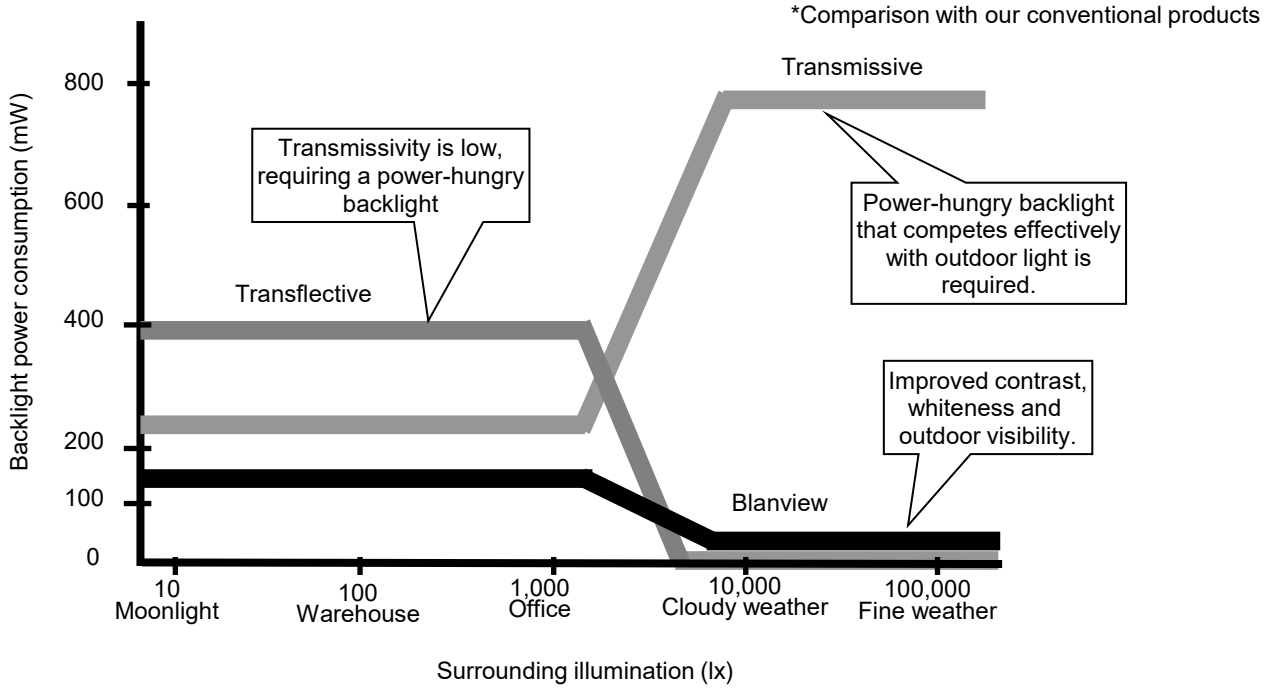
Items	Specifications	Remarks
Display type	VA type 262,144 colors Blanview, Normally Black	
Driving method	a-Si TFT Active matrix Line-scanning, Non-interlace	
Dot arrangement	RGB stripe arrangement	Refer to "Dot arrangement"
Signal input method	3-wire, 4-wire serial interface	
Backlight type	Long life & High bright white LED	
NTSC ratio	65%	



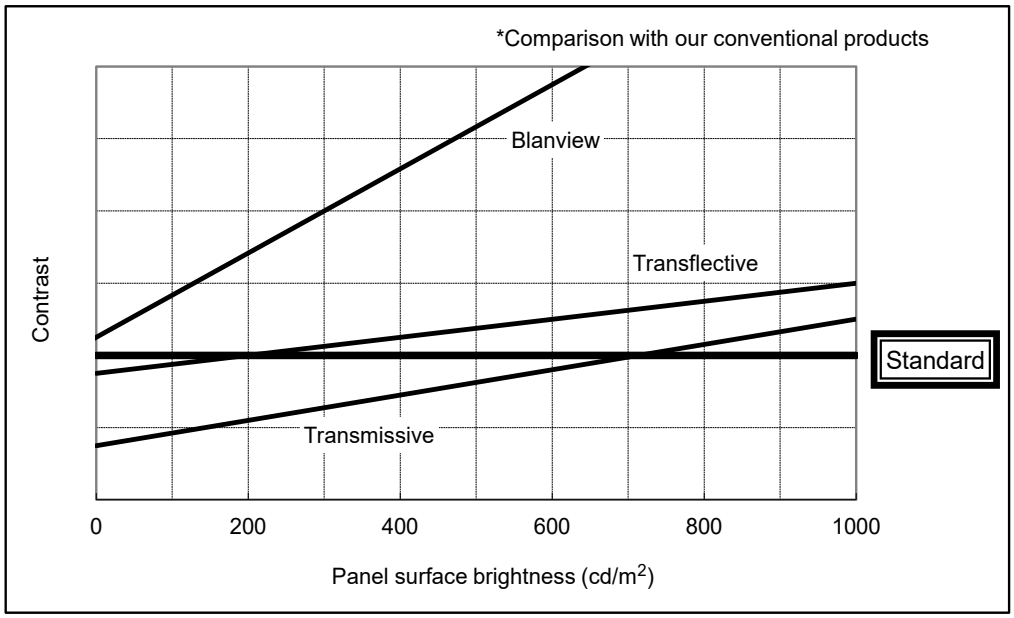
Dot arrangement (FPC cable placed left side)

<Features of Blanview>

- Backlight power consumption required to assure visibility.



- 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 criteria)



3. Dimensions and Shape

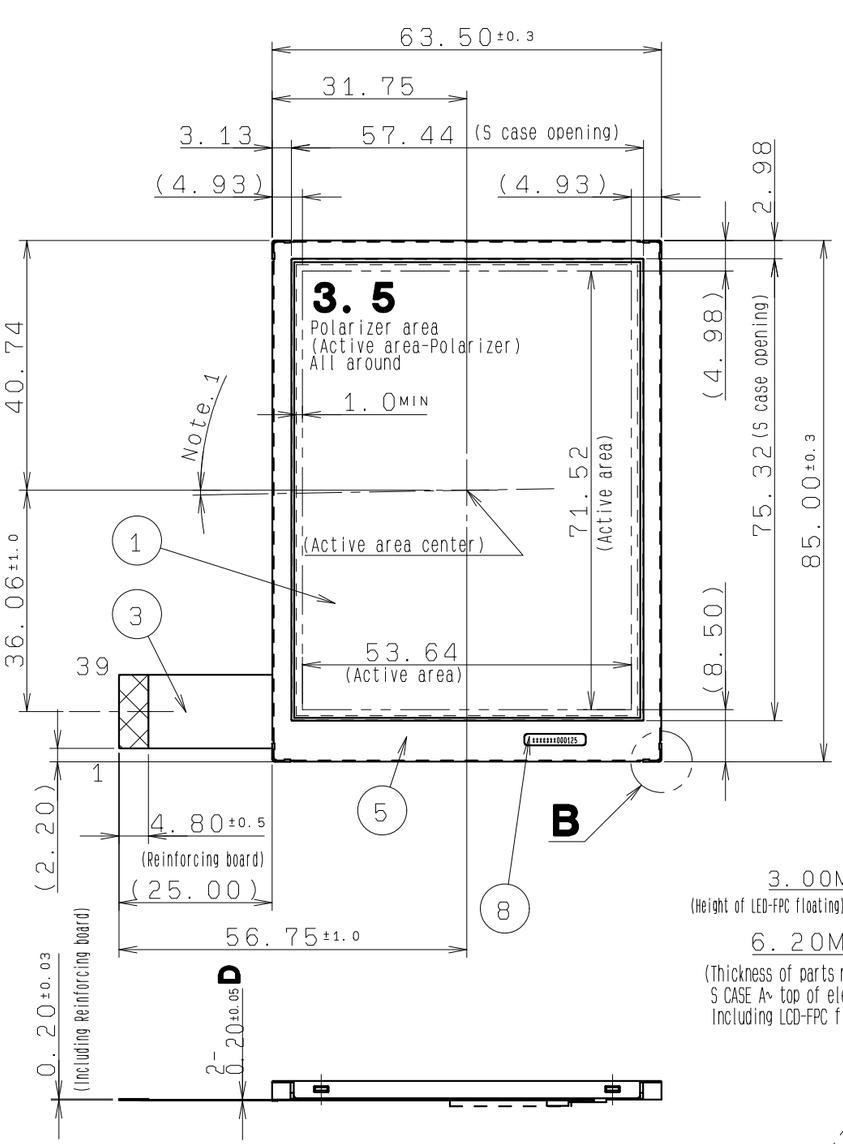
3.1 Dimensions

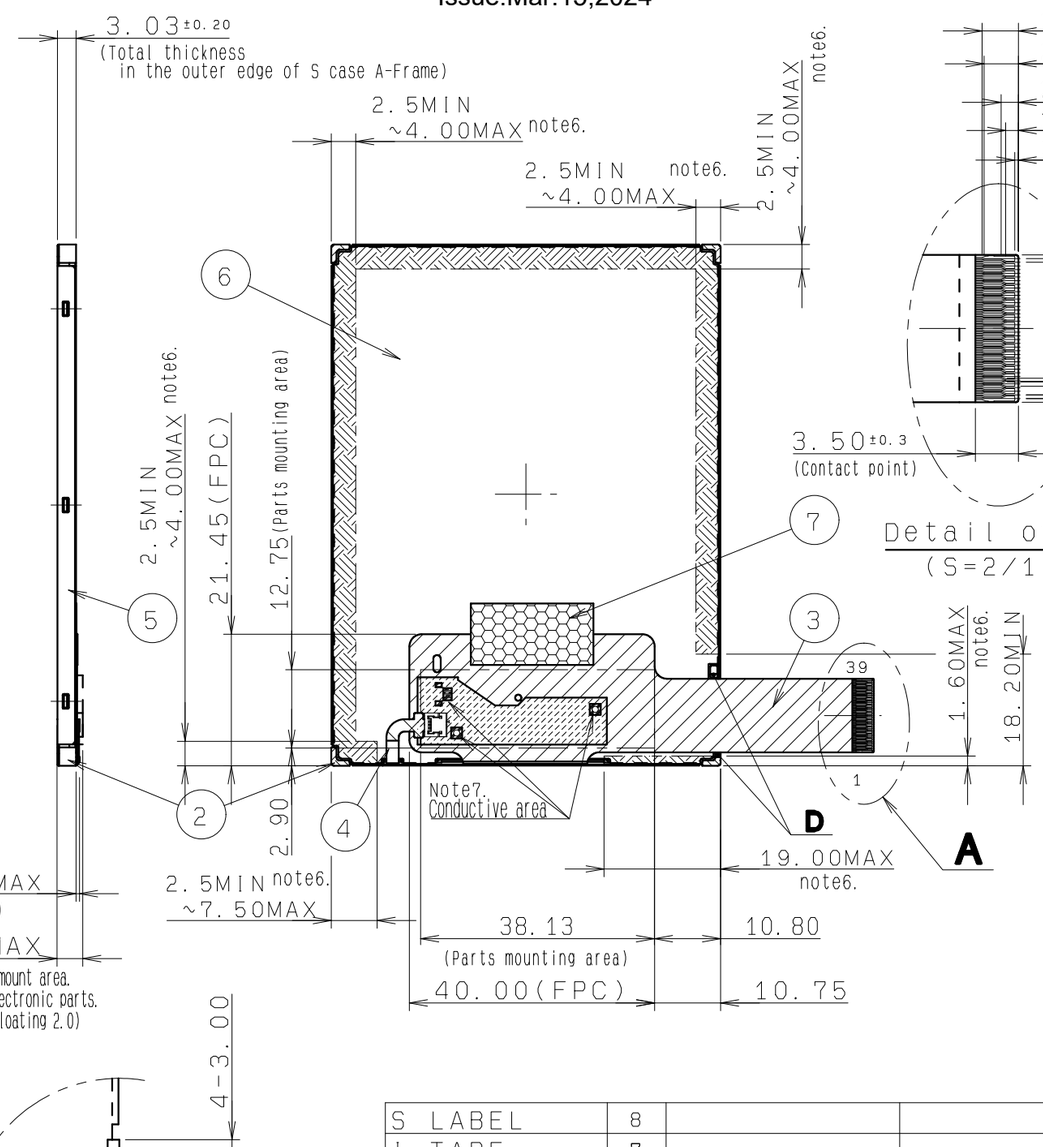
Items	Specifications	Unit	Remarks
Outline dimensions	63.5[H] × 85.0[V] × 3.03[D]	mm	exclude FPC and components on the FPC
Active area	53.64[H] × 71.52[V]	mm	89.40mm diagonal
Number of dots	720[H] × 320[V]	dot	
Dot pitch	74.5[H] × 223.5[V]	um	
Surface hardness of the polarizer	2	H	
Weight	33.0	g	Include FPC cable

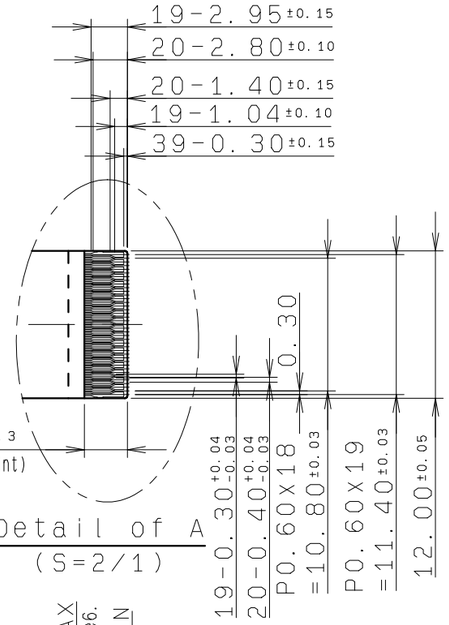
3.2 Outward Form

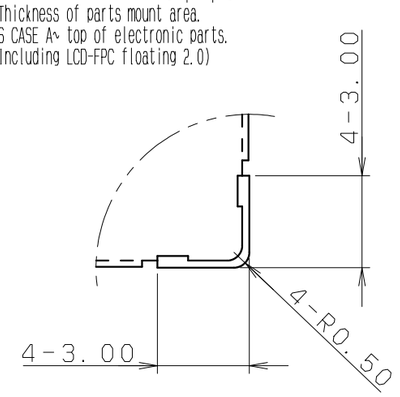
EC No.	REV. No.	REVISE	DATE (Y:M:D)	APPROVED	CHECKED	PREPARED
####			##:##:##	##	##	

(8/40)
23TLM024
Issue:Mar.15,2024









Detail of B(4 points)
(S=5/1)

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

Note 2. S label is affixed the area shown in the drawing.
The thickness of the S label will be added to that of S case's surface.

Note 3. Recommended FPC connectors
For LCD : HIROSE, part number:FH23-39S-0.3SHW(05)

Note 4. Protective film is affixed on front surface of the screen.
Location tolerance of the protective film shall be ±1.5 mm to the polarizing film.

Note 5. Refer to "12. CRITERIA JUDGMENT" about the appearance specification of a polarizer.

Note 6. In case TFT-LCD monitor is fixed to the case of your product, it's recommended that monitor is fixed in to ▨ area.

Note 7. Please avoid contact the conductor openings and electronic component with your conductor point.

PART NAME	ITEM	PART CODE	MODEL NUMBER	REMARK
S LABEL	8			(10X1.85X0.075t)
I-TAPE	7			
S CASE C	6		SUS	
S CASE A	5		SUS	
FPC B	4			Use for LED
FPC A	3			Use for LCD
FRAME	2		PC	
LCD	1		Glass substrate thickness=0.5t	

APPROVED 木下大輔	GENERAL TOLERANCE ±0.5	SCALE 1/1	UNIT mm
CHECKED 加藤真一	ISSUE (Y:M:D) 24:02:28	MODEL COM35H3R25UL*	
CHECKED	NAME	OUTLINE-D3R25	
DESIGN 井出明彦			
DRAW 井出明彦			

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DRAWING No.	REV.	SHEET	DIV.
RJD604870D301	#	/	

ASS'Y

2021.7 Electronics Division

3.3 Serial Label (S-label)

3.3.1 Display items

S-label 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	35SKC (Made in Japan) 35SLC (Made in Malaysia)		
d	Serial number			

* Example of indication of Serial label (S-label)

・Made in Japan

3L35SKC000125

means "manufactured in December 2023, 3.5 inch, SK type, C specifications, serial number 000125"

・Made in Malaysia

3L35SLC000125

means "manufactured in December 2023, 3.5 inch, SL type, C specifications, serial number 000125"

3.3.2 Location of Serial Label (S-label)

Refer to 3.2 "Outward Form".

4. Pin Assignment

No.	Symbol	Function
1	VSS	GND
2	VCI	Power supply for main circuit
3	IOVCC	Power supply for I/O circuit
4	TE	Tearing effect signal. If not used, please this pin open.
5	SDO	Serial interface output pin. If not used, please this pin open.
6	DB15	Parallel data input
7	DB14	Unused pin. Please fix to GND level.
8	DB13	
9	DB12	
10	DB11	
11	DB10	
12	DB9	
13	DB8	
14	DB7	
15	DB6	
16	DB5	
17	DB4	
18	DB3	
19	DB2	
20	DB1	
21	DB0	
22	VSS	GND
23	SDA	Serial interface data I/O.
24	RDX	Unused pin. Please fix to GND level.
25	WRX	Register selection signal (for 4-wire I/F). If not used, please fix to GND level.
26	TEST	Test pin. Please keep this pin open
27	DCX	Serial interface clock.
28	CSX	Chip selection signal （Lo：Select, Hi：Unselect）
29	RESX	Reset signal (Lo-active)
30	IM3	Interface mode setting pin. 3-wire serial Ⅰ: IM[3:0]=0101
31	IM2	4-wire serial Ⅰ: IM[3:0]=0110
32	IM1	3-wire serial Ⅱ: IM[3:0]=1101
33	IM0	4-wire serial Ⅱ: IM[3:0]=1110
34	NC	Open
35	NC	Open
36	NC	Open
37	NC	Open
38	BLH	LED drive power source. (Anode side)
39	BLL	LED drive power source. (Cathode side)

Note :

- Recommended connector : Hirose FH23 series "FH23-39S-0.3SHW(05) "
- In the circuit design, the terminal array of connector for use with terminal sequence of the "3.2 Outward Form", please be sure to check.
  If the array of the signal input to the product is different, it may cause a malfunction.
- FPC of the terminal has been decorated with gold-plated.
  Connector contact terminals is recommended the use of gold-plated products.

5. Absolute Maximum Rating

VSS=0V

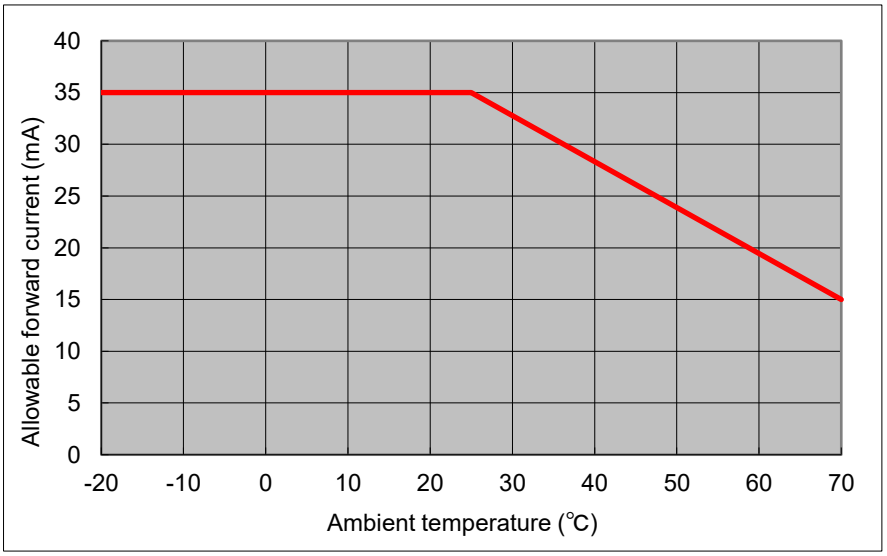
Item	Symbol	Condition	Rating		Unit	Applicable terminal
			MIN	MAX		
Supply voltage	VCI		-0.3	4.6	V	VCI
Supply voltage	IOVCC		-0.3	VCI	V	IOVCC
Input voltage for logic	VI		-0.3	IOVCC+0.3	V	SDA,RDX,WRX,DCX,CSX, RESX,IM[3:0]
LED Forward current	IL	Ta=25°C	—	35.0	mA	BLH - BLL
		Ta=70°C	—	15.0		
Storage temperature range	Tstg		-30	80	℃	
Storage atmospheric range	Hstg	40℃90%RH or less of moisture content with no condensation				

6. Recommended Operating Conditions

VSS=0V

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Supply voltage	VCI		2.8	3.3	3.6	V	VCI
Supply voltage	IOVCC		1.8	VCI	VCI	V	IOVCC
Input voltage for logic	VI		0	—	IOVCC	V	SDA,RDX,WRX,DCX,CSX, RESX,IM[3:0]
Operational temperature range	Top	*note	-20	25	70	°C	LCD Panel surface temperature
Operating humidity range	Hop	Ta≦40°C	20	—	85	%	
		Ta> 40°C	40°C85%RH or less of moisture content with no condensation				

note： The maximum value of LED Forward current "IL", do not exceed the following allowable current value.



7. Electrical Characteristics

7.1 DC Characteristics

△A 7.1.1 Display section

(Unless otherwise noted, Ta=25°C,VCI=3.3V,IOVCC=3.3V,VSS=0V)

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Input Signal Voltage	VIH		0.7×IOVCC	–	IOVCC	V	SDA,RDX,WRX,DCX,CSX
	VIL		0	–	0.3×IOVCC	V	RESX,IM[3:0]
Output Signal Voltage	VOH	IOH = -0.1mA	0.8×IOVCC	–	–	V	TE,SDO,SDA
	VOL	IOL = 0.1mA	–	–	0.2×IOVCC	V	
Operating Current	ICI	Color bar *note	–	7	14	mA	VCI
	IOICC		–	3	10	uA	IOVCC
Standby Current	ICI		–	6	30	uA	VCI
	IOICC		–	2	10	uA	IOVCC

note : CPU is not accessing the display RAM, still image display state (Color bar display)

△A 7.1.2 Backlight section

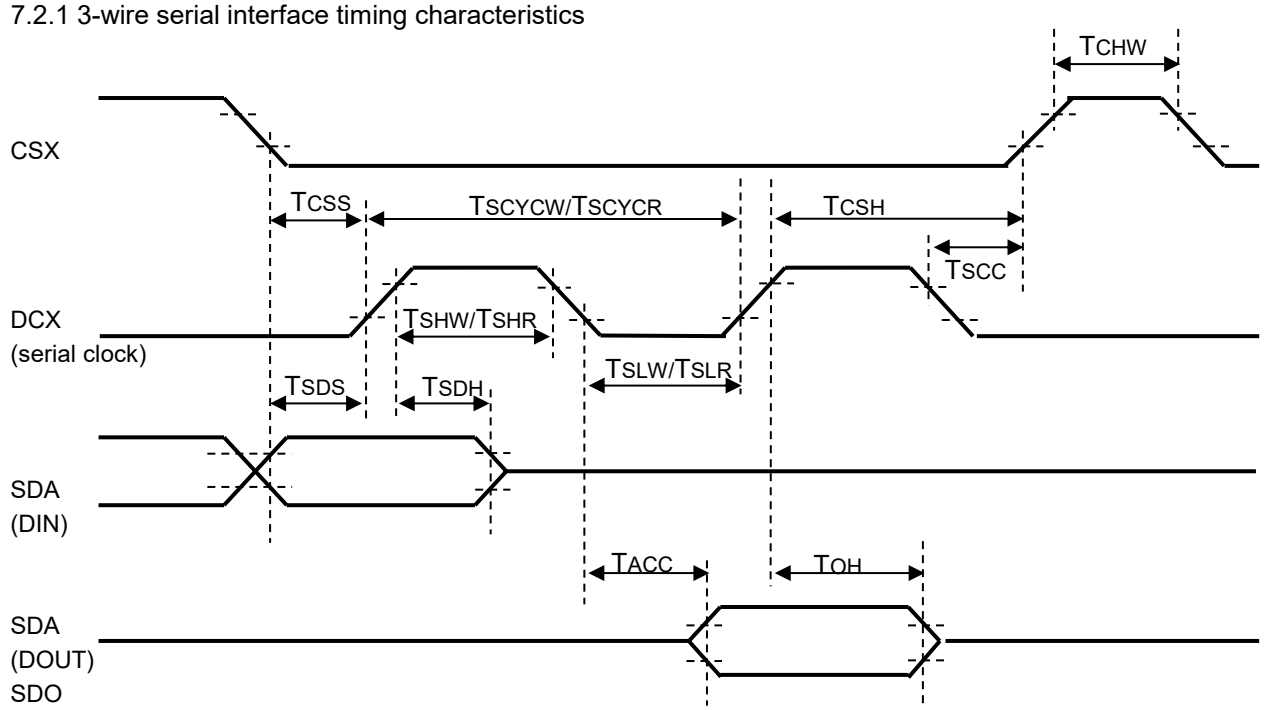
Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Forward current	IL25	Ta=25℃	–	6.5	35.0	mA	BLH - BLL
	IL70	Ta=70℃	–	–	15.0	mA	
Forward voltage	VL	Ta=25°C, IL=6.5mA	–	15.87	16.42	V	(Reference Value)
Estimated Life of LED	LL	Ta=25°C, IL=6.5mA Note	–	50,000	–	hrs	

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

7.2 AC Characteristics

7.2.1 3-wire serial interface timing characteristics



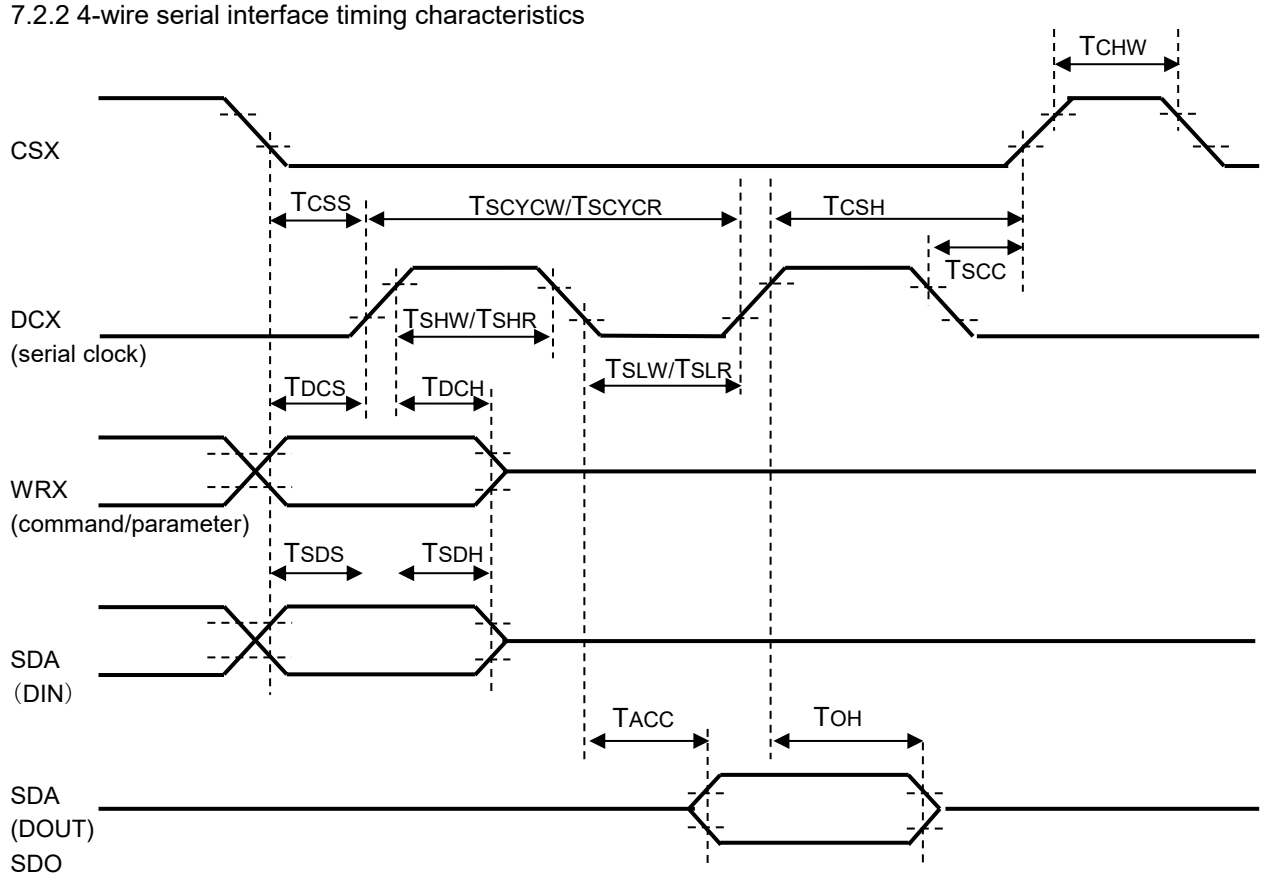
⚠

(Unless otherwise noted, Ta=25°C,VCI=3.3V,IOVCC=3.3V,VSS=0V)

Item	Symbol	Rating		Unit	
		MIN	MAX		
Chip Select Setup Time (Write)	TCSS	15		ns	CSX
Chip Select Hold Time (Write)	TCSH	15		ns	
Chip Select Setup Time (Read)	TCSS	60		ns	
Chip Select Hold Time (Read)	TSCC	65		ns	
Chip Select "H" Pulse Width (Write)	TCHW	40		ns	
Serial Clock Cycle (Write)	TSCYCW	50		ns	DCX
Serial Clock "H" Pulse Width (Write)	TSHW	7		ns	
Serial Clock "L" Pulse Width (Write)	TSLW	7		ns	
Serial Clock Cycle (Read)	TSCYCR	150		ns	
Serial Clock "H" Pulse Width (Read)	TSHR	60		ns	
Serial Clock "L" Pulse Width (Read)	TSLR	60		ns	
Data Setup Time	TSDS	7		ns	SDA
Data Hold Time	TSDH	7		ns	
Access Time	TACC	10	50	ns	SDA(DOUT)/SDO
Output disable Time	TOH	15	50	ns	
Input signal rise time	tr		15	ns	
Input signal fall time	tf		15	ns	

Note: All timing is defined as the reference to the 30-70% of IOVCC.

7.2.2 4-wire serial interface timing characteristics



A

(Unless otherwise noted, Ta=25°C,VCI=3.3V,IOVCC=3.3V,VSS=0V)

Item	Symbol	Rating		Unit	
		MIN	MAX		
Chip Select Setup Time (Write)	TCSS	15		ns	CSX
Chip Select Hold Time (Write)	TCSH	15		ns	
Chip Select Setup Time (Read)	TCSS	60		ns	
Chip Select Hold Time (Read)	TSCC	65		ns	
Chip Select "H" Pulse Width (Write)	TCHW	40		ns	
Serial Clock Cycle (Write)	TSCYCW	50		ns	DCX
Serial Clock "H" Pulse Width (Write)	TSHW	7		ns	
Serial Clock "L" Pulse Width (Write)	TSLW	7		ns	
Serial Clock Cycle (Read)	TSCYCR	150		ns	
Serial Clock "H" Pulse Width (Read)	TSHR	60		ns	
Serial Clock "L" Pulse Width (Read)	TSLR	60		ns	
D/CX Setup Time	TDCS	10		ns	WRX
D/CX Hold Time	TDCH	10		ns	
Data Setup Time	TSDS	7		ns	SDA
Data Hold Time	TSDH	7		ns	
Access Time	TACC	10	50	ns	SDA(DOUT)/SDO
Output disable Time	TOH	15	50	ns	
Input signal rise time	tr		15	ns	
Input signal fall time	tf		15	ns	

Note: All timing is defined as the reference to the 30-70% of IOVCC.

8. Interface

8.1 Interface

IM3	IM2	IM1	IM0	Interface
0	1	0	1	3-wire serial interface Ⅰ
0	1	1	0	4-wire serial interface Ⅰ
1	1	0	1	3-wire serial interface Ⅱ
1	1	1	0	4-wire serial interface Ⅱ

3-wire serial interface Ⅰ

Pin Name	Description
CSX	Chip selection signal
DCX	Clock signal
SDA	Serial input/output data

4-wire serial interface Ⅰ

Pin Name	Description
CSX	Chip selection signal
WRX	WRX=Low :Command WRX=High : Parameter
DCX	Clock signal
SDA	Serial input/output data

3-wire serial interface Ⅱ

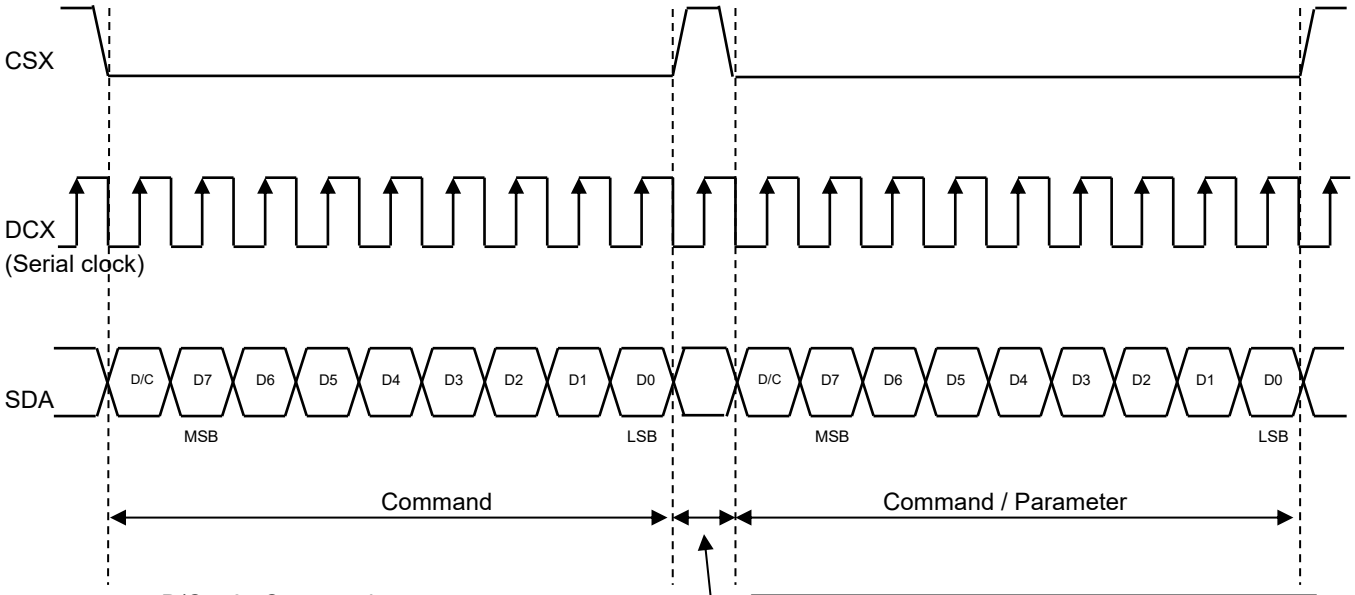
Pin Name	Description
CSX	Chip selection signal
DCX	Clock signal
SDA	Serial input data
SDO	Serial output data

4-wire serial interface Ⅱ

Pin Name	Description
CSX	Chip selection signal
WRX	WRX=Low :Command WRX=High : Parameter
DCX	Clock signal
SDA	Serial input data
SDO	Serial output data

8.2 Write protocol

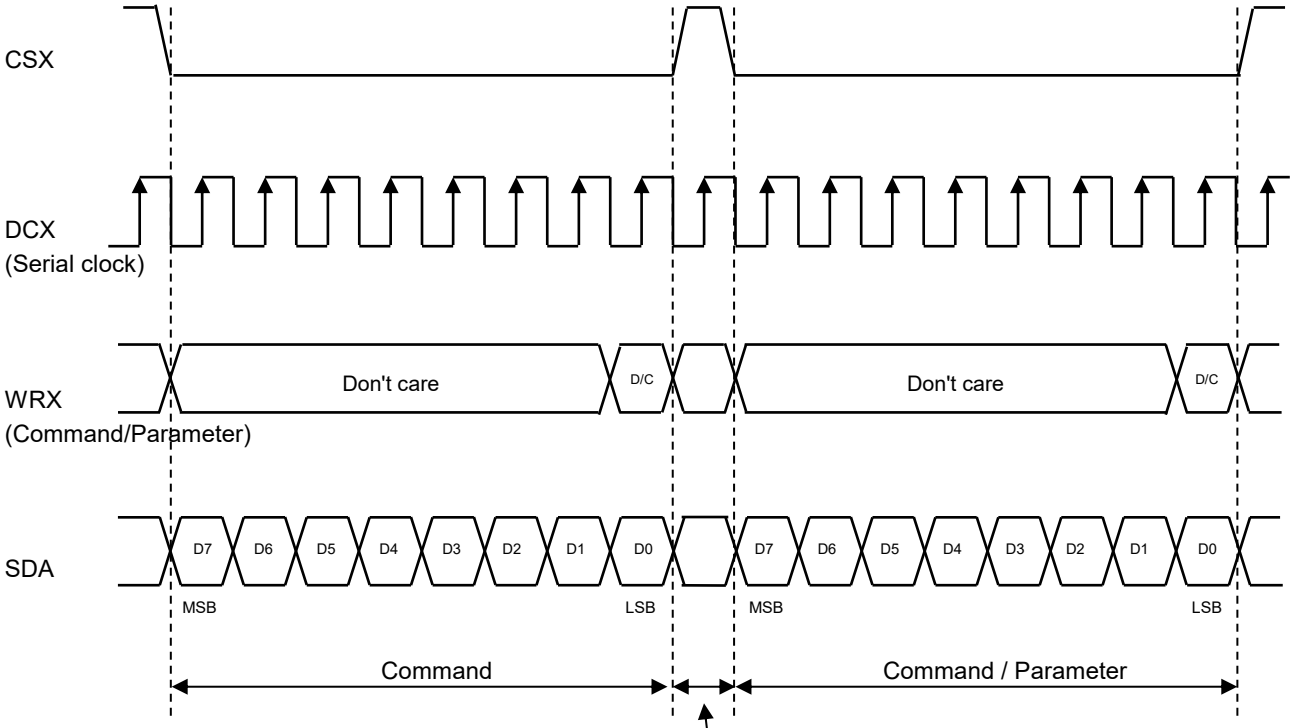
3-wire serial interface Ⅰ(IM[3:0]=0101b)
3-wire serial interface Ⅱ(IM[3:0]=1101b)



D/C = 0 : Command
D/C = 1 : Parameter

CSX can be "H" between Command and Command/Parameter, and SDA during CSX="H" is ignored.

4-wire serial interface Ⅰ(IM[3:0]=0110b)
4-wire serial interface Ⅱ(IM[3:0]=1110b)

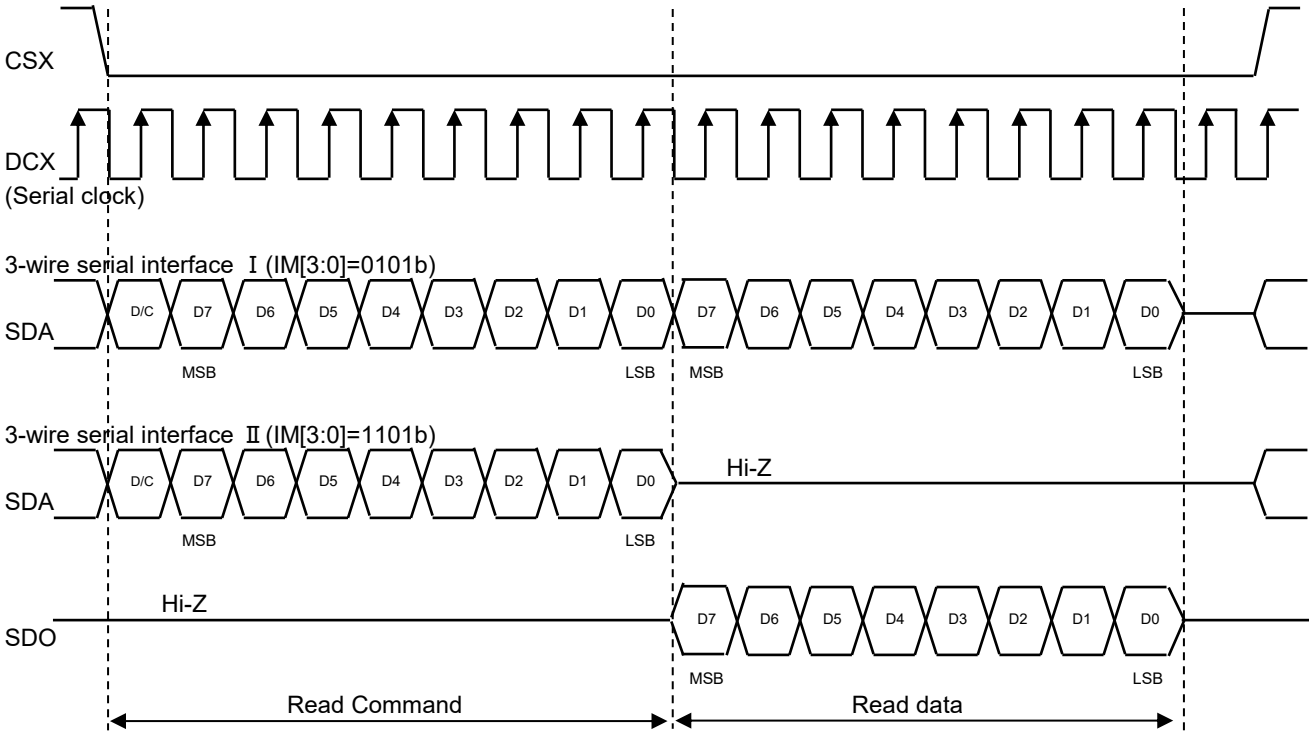


D/C = 0 : Command
D/C = 1 : Parameter

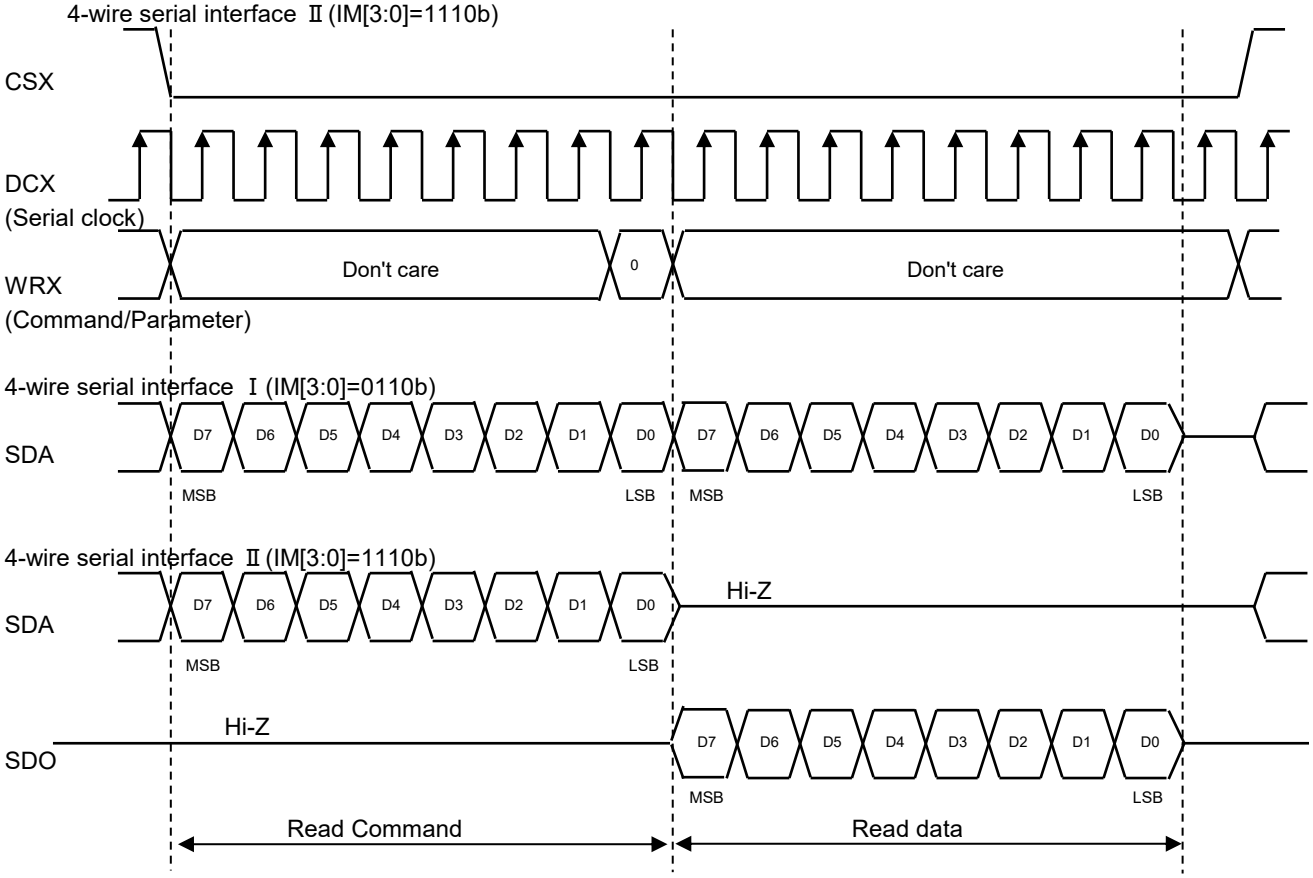
CSX can be "H" between Command and Command/Parameter, and SDA, WRX during CSX="H" is ignored.

8.3 Read protocol

3-wire serial interface Ⅰ(IM[3:0]=0101b)
3-wire serial interface Ⅱ(IM[3:0]=1101b)



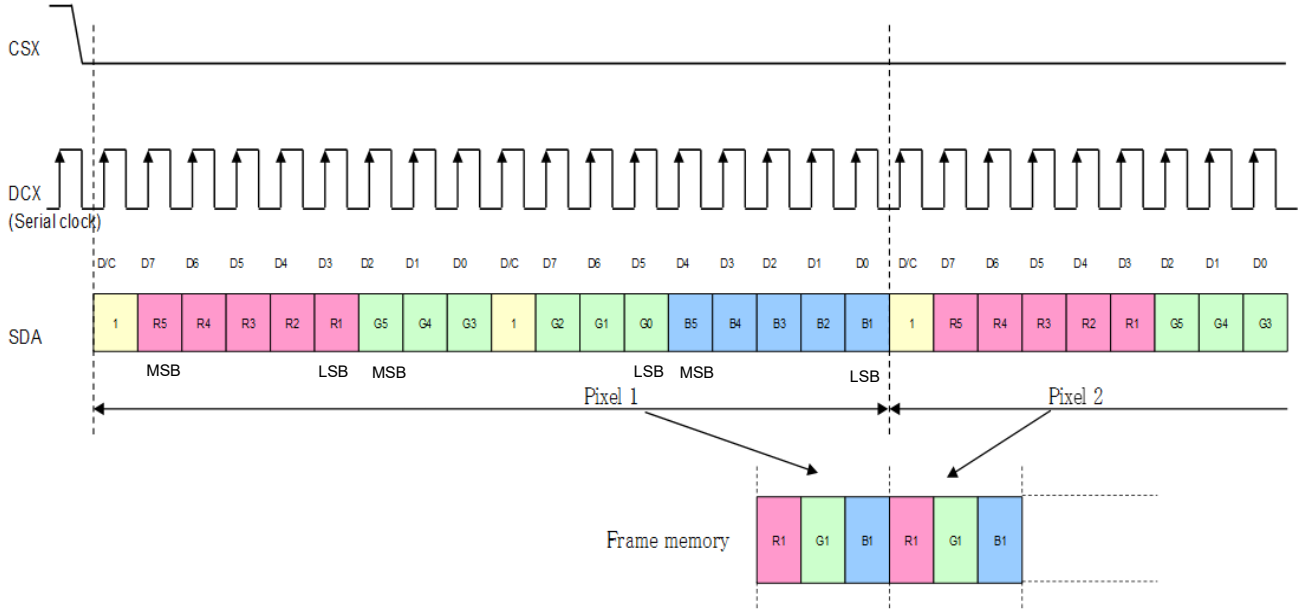
4-wire serial interface Ⅰ(IM[3:0]=0110b)
4-wire serial interface Ⅱ(IM[3:0]=1110b)



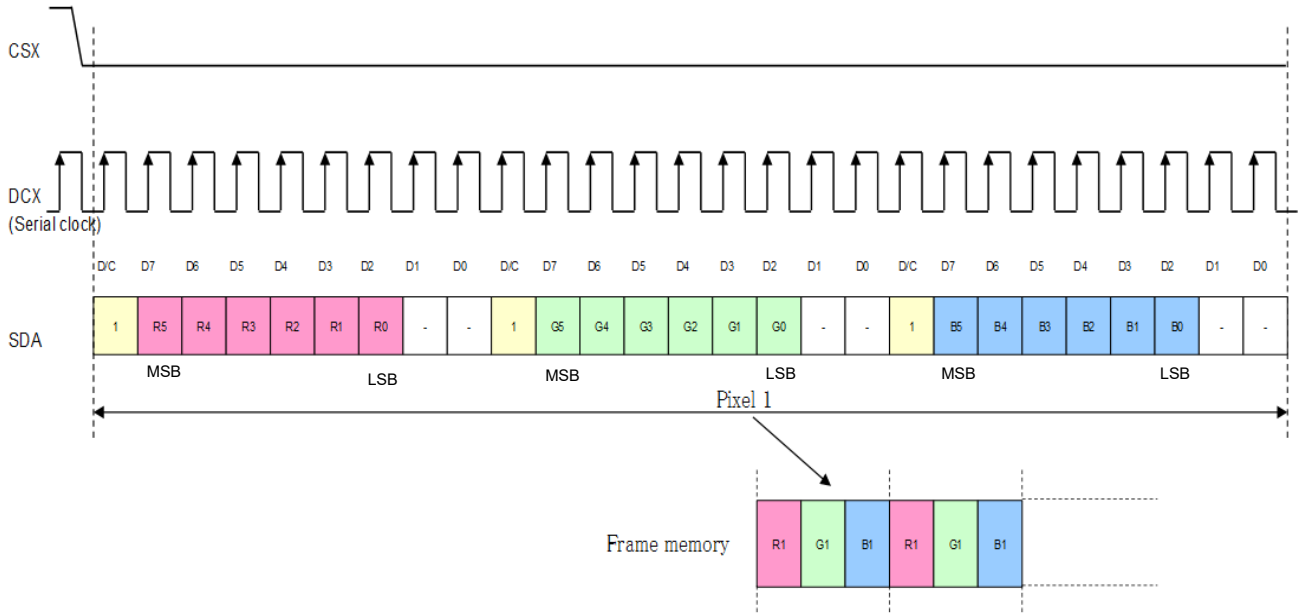
8.4 Data transfer

3-wire serial interface Ⅰ (IM[3:0]=0101b)
3-wire serial interface Ⅱ (IM[3:0]=1101b)

16bit(RGB565) 65,536 colors

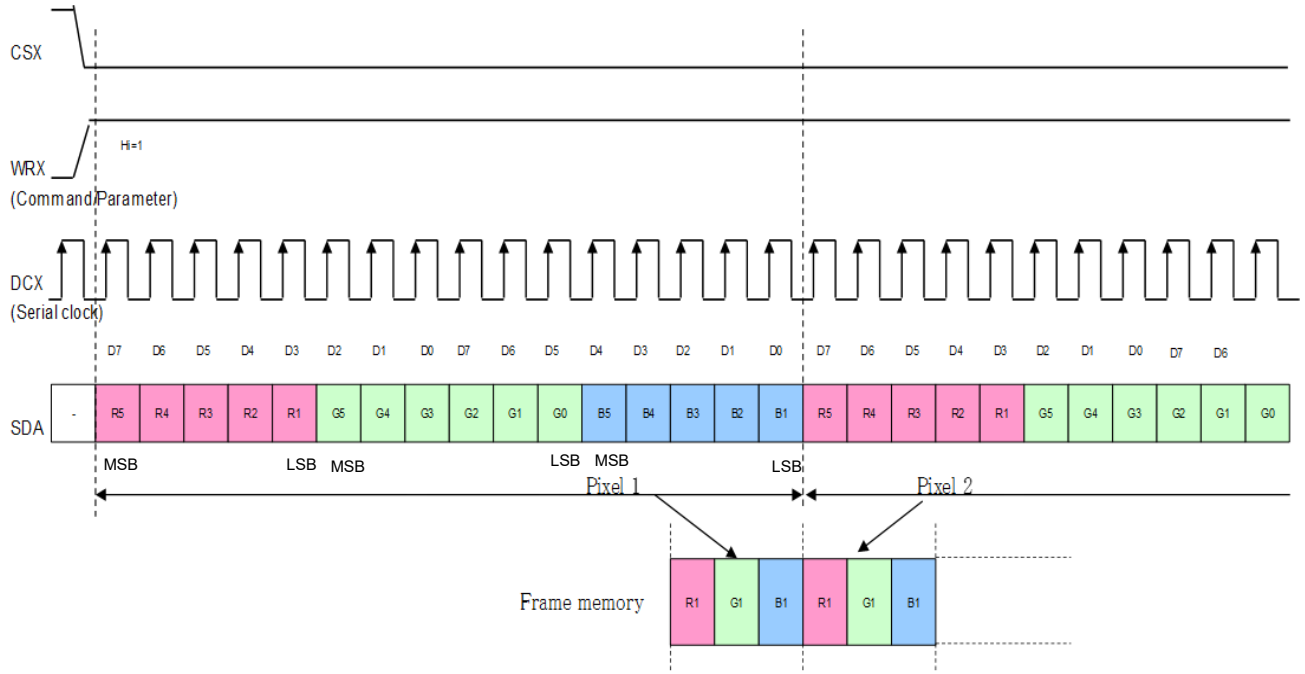


18bit(RGB666) 262,144 colors

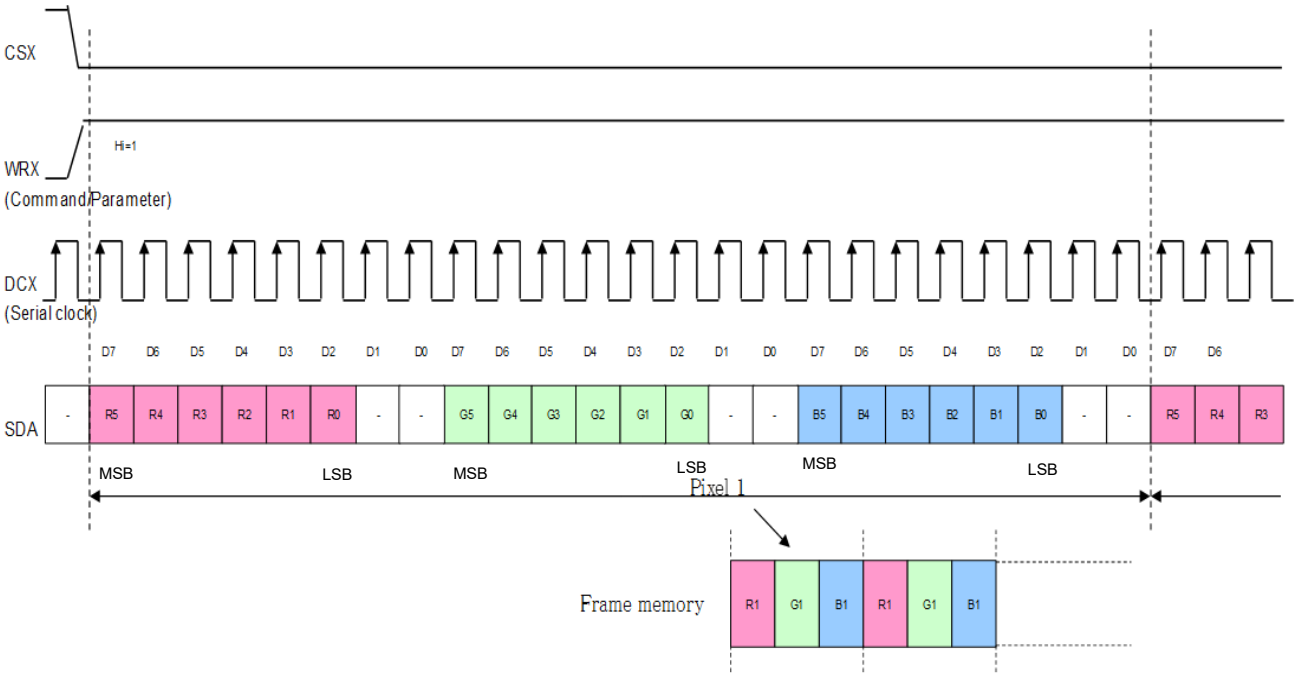


4-wire serial interface Ⅰ(IM[3:0]=0110b)
4-wire serial interface Ⅱ(IM[3:0]=1110b)

16bit(RGB565) 65,536 colors



18bit(RGB666) 262,144 colors



9. Sequence

⚠ 9.1 Power ON Sequence (1/2)

No.		D/C	D[7:0]	Remarks
	VCI/IOVCC ON			
	RESX High / RESX High → Low — RESX Low			RESX High can be omitted
	Wait 10 usec or more			
	RESX Low → High			
	Wait 120 msec or more			
1	Sleep Out	0	11 h	
	Wait 120 msec or more			
2	Memory access control	0	36 h	
	para 1	1	00 h	MX=MY=0
3	LCM Control	0	C0 h	
	para 1	1	3C h	XINV=XMV=XMX=XBGR=1
4	Pixel format	0	3A h	
	para 1	1	05 h	05h:65k,06h:262k
5	CMD2EN	0	DF h	
	para 1	1	5A h	
	para 2	1	69 h	
	para 3	1	02 h	
	para 4	1	01 h	Command2 enable
6	GATECTRL 1	0	E4 h	
	para 1	1	27 h	NL=320
	para 2	1	00 h	SCN=G0
	para 3	1	10 h	TMG=1,SM=GS=0
7	GATECTRL 2	0	B7 h	
	para 1	1	75 h	VGH=14.9,VGL=-10.4
8	VCOMS setting	0	BB h	
	para 1	1	20 h	Δv=0.9typ
9	VAP/VAN signal	0	D2 h	
	para 1	1	4C h	
10	VRH set	0	C3 h	
	para 1	1	17 h	VAP=4.7+
11	Frame rate	0	C6 h	
	para 1	1	EF h	Column inversion,60Hz
12	Power control 1	0	D0 h	
	para 1	1	A4 h	
	para 2	1	A1 h	
13	Power control 2	0	E8 h	
	para 1	1	83 h	
14	Positive gamma	0	E0 h	
	para 1	1	A0 h	
	para 2	1	09 h	
	para 3	1	0E h	
	para 4	1	0B h	
	para 5	1	0C h	
	para 6	1	16 h	
	para 7	1	2F h	
	para 8	1	33 h	
	para 9	1	3F h	
	para 10	1	27 h	
	para 11	1	16 h	
	para 12	1	13 h	
	para 13	1	12 h	
	para 14	1	20 h	

Ⓐ

(2/2)

No.		D/C	D[7:0]	Remarks
	Wait 10 msec or more			
15	Negative gamma	0	E1 h	
	para 1	1	F0 h	
	para 2	1	09 h	
	para 3	1	0F h	
	para 4	1	0C h	
	para 5	1	0C h	
	para 6	1	17 h	
	para 7	1	30 h	
	para 8	1	43 h	
	para 9	1	42 h	
	para 10	1	2A h	
	para 11	1	17 h	
	para 12	1	14 h	
	para 13	1	15 h	
	para 14	1	23 h	
	Wait 10 msec or more			
16	Equalize control	0	E9 h	
	para 1	1	08 h	
	para 2	1	08 h	
	para 3	1	00 h	
17	RGB interface control	0	B1 h	
	para 1	1	00 h	
	para 2	1	04 h	
	para 3	1	14 h	
18	RAM Control	0	B0 h	
	para 1	1	00 h	CPU interface
	para 2	1	E0 h	
19	CA SET	0	2A h	
	para 1	1	00 h	XS[15:8]
	para 2	1	00 h	XS[7:0]
	para 3	1	00 h	XE[15:8]
	para 4	1	EF h	XE[7:0]
20	RA SET	0	2B h	
	para 1	1	00 h	YS[15:8]
	para 2	1	00 h	YS[7:0]
	para 3	1	01 h	YE[15:8]
	para 4	1	3F h	YE[7:0]
21	GT ADJ	0	B8 h	
	para 1	1	2A h	
	para 2	1	2B h	
	para 3	1	14 h	
	para 4	1	F5 h	
22	Tearing Effect On	0	35 h	
	para 1	1	00 h	TEM = 0
23	RAMWR	0	2C h	
	data 1	1	**** h	write data
	data 2	1	**** h	write data
	....	...	.... h	
	data n	1	**** h	write data
	wait 10 msec or more			
24	Display ON	0	29 h	
	wait 10 msec or more			
25	Backlight ON			

9.2 Sleep IN Sequence

No.		D/C	D[7:0]	Remarks
1	Backlight OFF			
2	Display OFF	0	28 h	
	Wait 10 msec or more			
3	Sleep In	0	10 h	

9.3 Sleep OUT Sequence

No.		D/C	D[7:0]	Remarks
1	Sleep Out	0	11 h	
	Wait 120 msec or more			
2	Display ON	0	29 h	
	Wait 50 msec or more			
3	Backlight ON			

9.4 Power OFF Sequence

No.		D/C	D[7:0]	Remarks
1	Backlight OFF			
2	Display OFF	0	28 h	
	Wait 10 msec or more			
3	Sleep In	0	10 h	
	Wait 120 msec or more			
4	RESX High → Low			
5	VCI/IOVCC OFF			

A 9.5 Refresh Sequence

(1/2)

No.		D/C	D[7:0]	Remarks
1	Sleep Out	0	11 h	
	Wait 120 msec or more			
2	Memory access control	0	36 h	
	para 1	1	00 h	MX=MY=0
3	LCM Control	0	C0 h	
	para 1	1	3C h	XINV=XMV=XMX=XBGR=1
4	Pixel format	0	3A h	
	para 1	1	05 h	05h:65k,06h:262k
5	CMD2EN	0	DF h	
	para 1	1	5A h	
	para 2	1	69 h	
	para 3	1	02 h	
	para 4	1	01 h	Command2 enable
6	GATECTRL 1	0	E4 h	
	para 1	1	27 h	NL=320
	para 2	1	00 h	SCN=G0
	para 3	1	10 h	TMG=1,SM=GS=0
7	GATECTRL 2	0	B7 h	
	para 1	1	75 h	VGH=14.9,VGL=-10.4
8	VCOMS setting	0	BB h	
	para 1	1	20 h	Δv=0.9typ
9	VAP/VAN signal	0	D2 h	
	para 1	1	4C h	
10	VRH set	0	C3 h	
	para 1	1	17 h	VAP=4.7+
11	Frame rate	0	C6 h	
	para 1	1	EF h	Column inversion,60Hz
12	Power control 1	0	D0 h	
	para 1	1	A4 h	
	para 2	1	A1 h	
13	Power control 2	0	E8 h	
	para 1	1	83 h	
14	Positive gamma	0	E0 h	
	para 1	1	A0 h	
	para 2	1	09 h	
	para 3	1	0E h	
	para 4	1	0B h	
	para 5	1	0C h	
	para 6	1	16 h	
	para 7	1	2F h	
	para 8	1	33 h	
	para 9	1	3F h	
	para 10	1	27 h	
	para 11	1	16 h	
	para 12	1	13 h	
	para 13	1	12 h	
	para 14	1	20 h	

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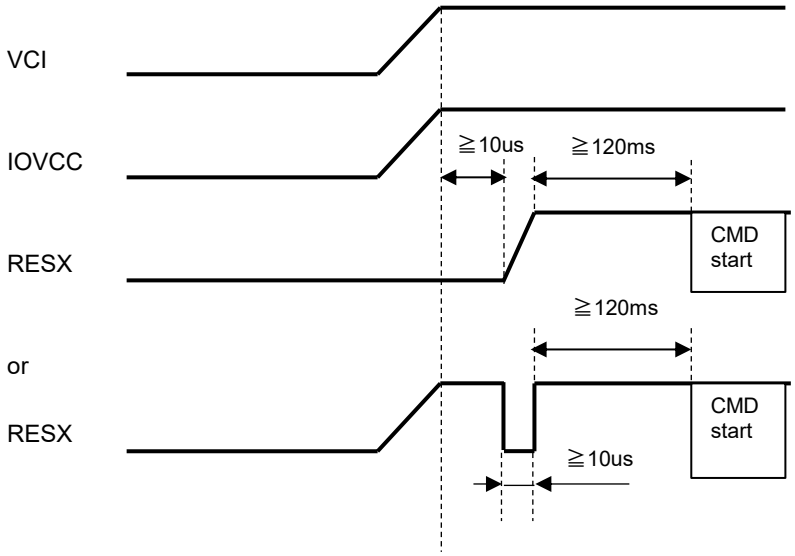
(2/2)

No.		D/C	D[7:0]	Remarks
	Wait 10 msec or more			
15	Negative gamma	0	E1 h	
	para 1	1	F0 h	
	para 2	1	09 h	
	para 3	1	0F h	
	para 4	1	0C h	
	para 5	1	0C h	
	para 6	1	17 h	
	para 7	1	30 h	
	para 8	1	43 h	
	para 9	1	42 h	
	para 10	1	2A h	
	para 11	1	17 h	
	para 12	1	14 h	
	para 13	1	15 h	
	para 14	1	23 h	
	Wait 10 msec or more			
16	Equalize control	0	E9 h	
	para 1	1	08 h	
	para 2	1	08 h	
	para 3	1	00 h	
17	RGB interface control	0	B1 h	
	para 1	1	00 h	
	para 2	1	04 h	
	para 3	1	14 h	
18	RAM Control	0	B0 h	
	para 1	1	00 h	CPU interface
	para 2	1	E0 h	
19	CA SET	0	2A h	
	para 1	1	00 h	XS[15:8]
	para 2	1	00 h	XS[7:0]
	para 3	1	00 h	XE[15:8]
	para 4	1	EF h	XE[7:0]
20	RA SET	0	2B h	
	para 1	1	00 h	YS[15:8]
	para 2	1	00 h	YS[7:0]
	para 3	1	01 h	YE[15:8]
	para 4	1	3F h	YE[7:0]
21	GT ADJ	0	B8 h	
	para 1	1	2A h	
	para 2	1	2B h	
	para 3	1	14 h	
	para 4	1	F5 h	
22	Tearing Effect On	0	35 h	
	para 1	1	00 h	TEM = 0
23	RAMWR	0	2C h	
	data 1	1	**** h	write data
	data 2	1	**** h	write data
	....	...	. . . . h	
	data n	1	**** h	write data
	wait 10 msec or more			
24	Display ON	0	29 h	
	wait 10 msec or more			

9.6 Power ON/OFF timing

Power Supply ON Sequence

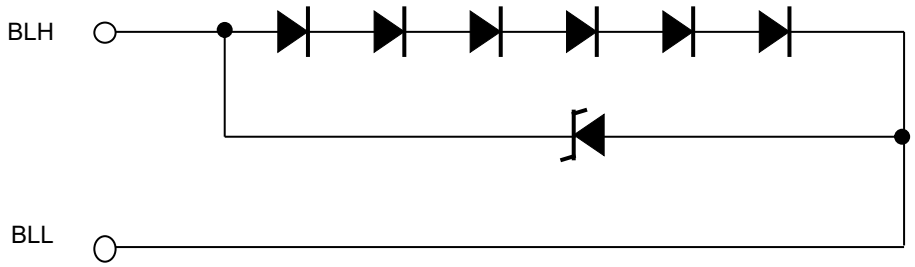
We recommend that you supplied at the same time VCI and IOVCC.
However, there is no problem even if the supply IOVCC later than VCI.
Please release the reset from at least 10us after each power supply.



Power Supply OFF Sequence

We recommend that you removed at the same time VCI and IOVCC.
However, there is no problem even if IOVCC OFF faster than VCI .

10. LED Circuit



11. Characteristics

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11.1 Optical Characteristics

(Measurement Condition)

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

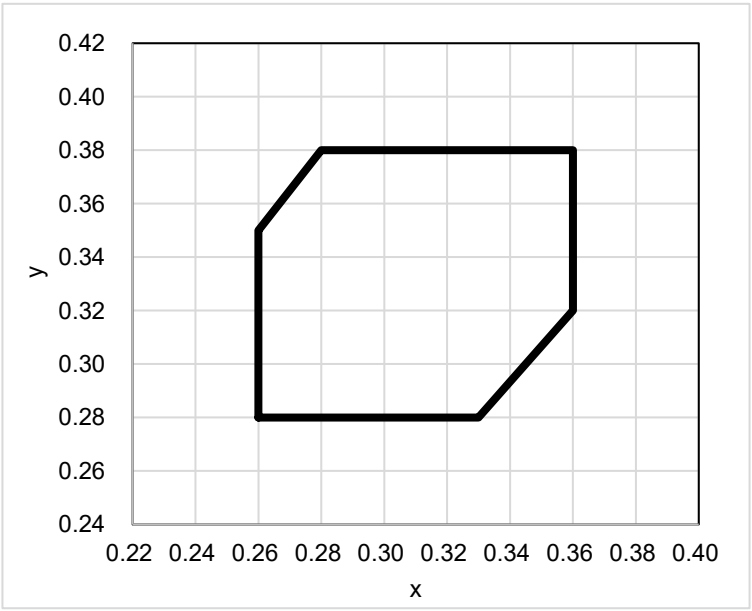
Driving condition: VCI=3.3V,IOVCC=3.3V, VSS=0V, Optimized VCOMDC

Backlight: IL= 6.5 mA

Measured temperature: Ta = 25°C

Item		Symbol	Condition	MIN	TYP	MAX	Unit	Note №	Remark
Response time	Rise time + Fall time	TON + TOFF	[Data]= 00h← → 3Fh	-	-	100	ms	1	
Contrast ratio	Backlight ON	CR	[Data]= 3Fh / 00h	480	800	-		2	
	Backlight OFF			-	3	-			
Viewing angle	Left	θL	[Data]= 3Fh / 00h	80	-	-	deg	3	
	Right	θR		80	-	-	deg		
	Up	φU		80	-	-	deg		
	Down	φD		80	-	-	deg		
White Chromaticity		x	[Data]= 3Fh	White chromaticity range				4	
		y							
Center Brightness			[Data]= 3Fh	-	900	-	cd/㎡	5	IL=20mA ∗ Reference
				175	250	-			IL=6.5mA
Brightness distribution			[Data]= 3Fh	70	-	-	%	6	
Burn-in				No noticeable burn-in image shall be observed after 2 hours of window pattern display.				7	

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



White Chromaticity Range

(White Chromaticity Range)

x	y
0.26	0.28
0.33	0.28
0.36	0.32
0.36	0.38
0.28	0.38
0.26	0.35

11.2 Temperature Characteristics

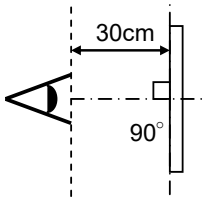
(Measurement Condition)
Measuring instruments: CS2000 (KONICA MINOLTA), LCD7200 (OTSUKA ELECTRONICS)
Driving condition: VCI=3.3V,IOVCC=3.3V, VSS=0V, Optimized VCOMDC
Backlight: IL= 6.5 mA

Item		Symbol	Specification		Remark
			Ta = -20 °C	Ta = 70 °C	
Response time	Rise time + Fall time	TON + TOFF	1000 msec or less	80 msec or less	
Contrast ratio		CR	200 or more	200 or more	Backlight ON
Display Quality			No noticeable display defect or ununiformity should be observed.		

12. Criteria of Judgment

12.1 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, 25h, 3Fh (3steps)
Observation distance: 30 cm
Illuminance: 200 to 350 lx
Backlight: IL=6.5mA



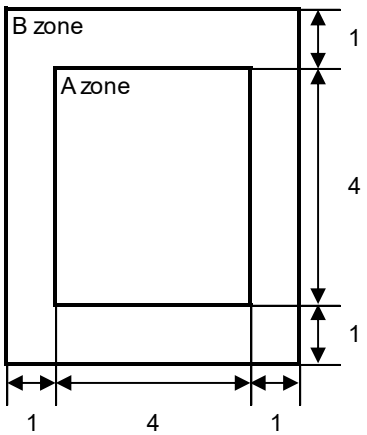
Defect item		Defect content		Criteria
Display Quality	Line defect	Black, white or color line, 3 or more neighboring defective dots		Not exists
	Dot defect	Uneven brightness on dot-by-dot base due to defective TFT or CF, or dust is counted as dot defect (brighter dot, darker dot) High bright dot: Visible through 2% ND filter at [Data]=00h Low bright dot: Visible through 5% ND filter at [Data]=00h Dark dot: Appear dark through white display at [Data]=25h		Refer to table 1
		Invisible through 5% ND filter at [Data]=00h		Acceptable
Screen Quality	Stain	Uneven brightness (white stain, black stain etc)		Invisible through 5% ND filter at Black screen. Invisible through 1% ND filter at other screen.
	Foreign particle	Point-like	0.25mm< φ	N=0
			0.20mm< φ ≦0.25mm	N≦2
			φ ≦0.20mm	Acceptable
		Liner	3.0mm < L and 0.08mm < W	N=0
			L ≦ 3.0mm or W ≦ 0.08mm	Acceptable
	Others			Use boundary sample for judgment when necessary

* φ (mm): Average diameter = (major axis + minor axis) / 2, W (mm): Width, L (mm): Length, N: Permissible number

Table1

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)

12.2 Screen and Other Appearance

Testing conditions
Observation distance: 30 cm
Illuminance: 1200 ～ 2000 lx

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

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13. 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%, 240hrs non condensing ※	0 / 3
	High temperature operation	Tp = 70°C 240hrs	0 / 3
	Low temperature operation	Tp = -20°C 240hrs	0 / 3
	High temperature & high humidity operation	Tp = 40°C, RH = 90%, 240hrs non condensing ※	0 / 3
	Thermal shock storage	-30°C ↔ 80°C (30min / 30min) 100cycles	0 / 3
	Lightfastness	Xenon Blackpanel 63±3°C non-shower 450W/㎡(300～700nm) non-operating Integral dose 800MJ/㎡	0 / 3
Mechanical environmental test	Electrostatic discharge test (Non operation)	Confirms to EIAJ ED-4701/300, C=200pF,R=0Ω,V=±200V Each 3 times of discharge on and power supply and other terminals.	0 / 3
	Surface discharge test (Non operation)	C=250pF, R=100Ω, V=±12kV Each 5 times of discharge in both polarities on the center of screen with the case grounded.	0 / 3
	Vibration test	Total amplitude 1.5mm, f=10～55Hz, X,Y,Z directions for each 2 hours	0 / 3
	Impact test	Use TOPPAN 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 / 1 packing
	Packing drop test	Drop from 75cm high. 1 time to each 6 surfaces, 3 edges, 1 corner	0 / 1 packing

Note:Ta=ambient temperature Tp=Panel temperature

※ The profile of high temperature/humidity storage and High Temperature/humidity operation
(Pure water of over 10MΩ･cm shall be used.)

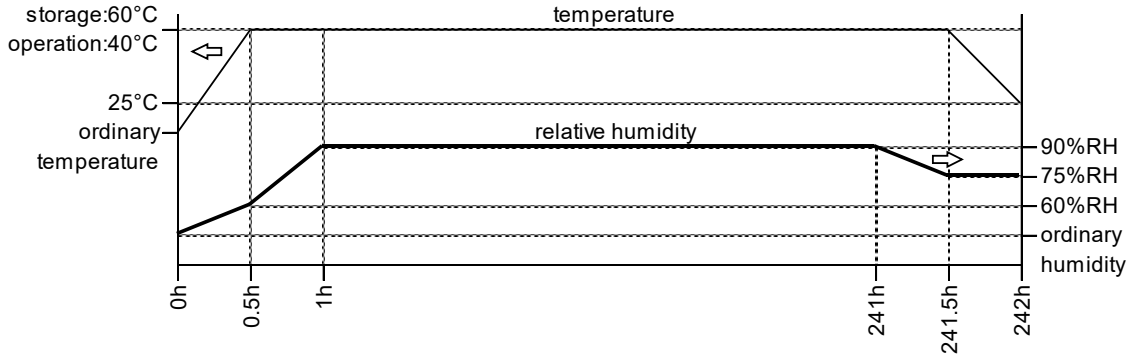
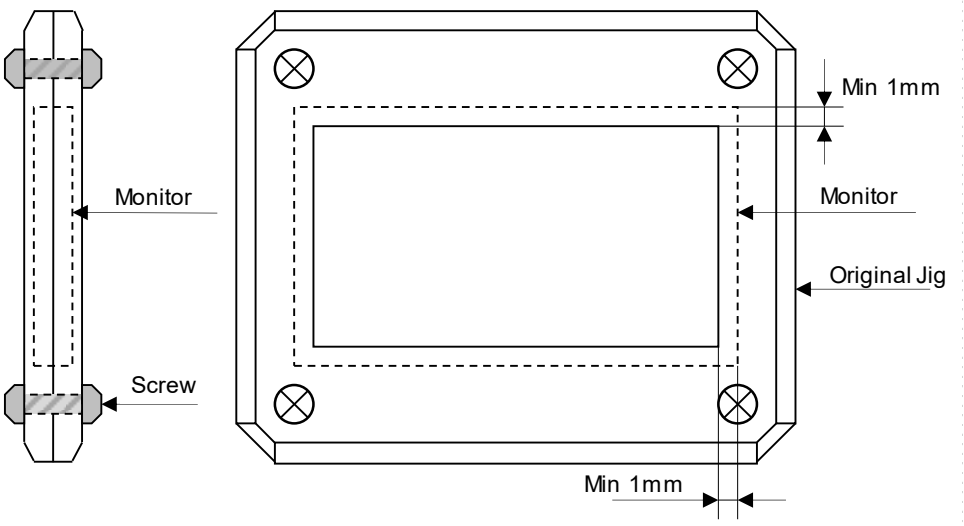


Table2. Reliability Criteria

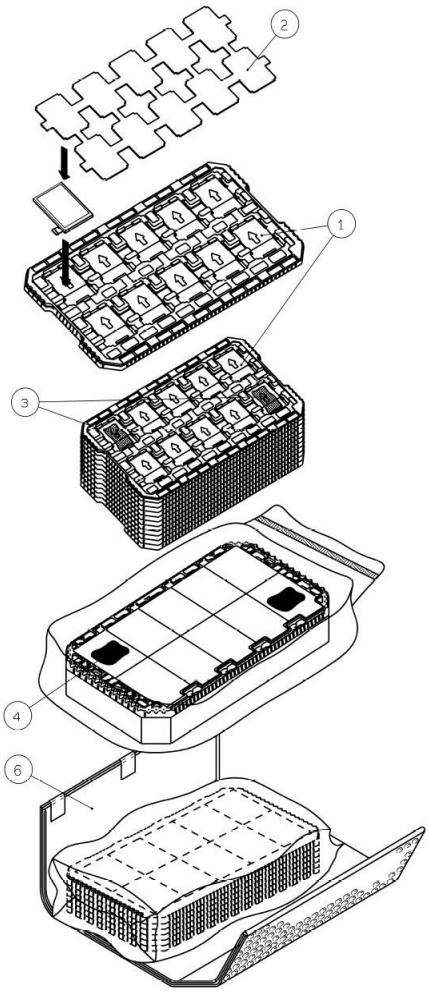
The parameters should be measured after leaving the monitor at the ordinary temperature for 24 hours or more after the test completion.

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

TOPPAN Original Jig



14. 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.
Foam sheet A are to be placed on the products in the tray.
(10 products per tray)

Step 2. Each tray is to be piled up in same orientation and the trays be in a stack of 10.
One empty tray is to be put on the top of stack of 10 trays.

Step 3. 2 packs of moisture absorbers are to be placed on the top tray as shown in the drawing.
Put piled trays into a sealing bag.

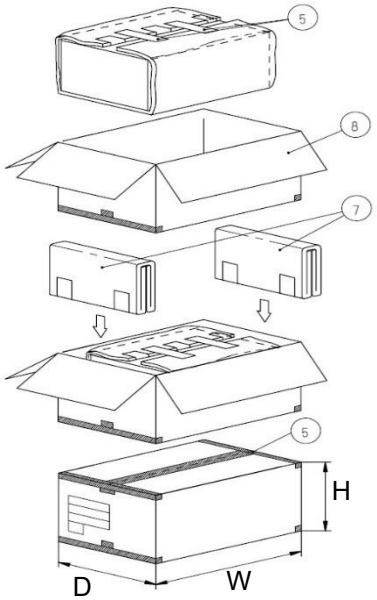
Step 4. Vacuum and seal the sealing bag with the vacuum sealing machine.

Step 5. The stack of trays in the plastic back is to be wrapped with B SHEET A.

Step 6. The wrapped trays are placed in the carton.

Step 7. B SHEET B are to be inserted into a outer carton with same orientation.
The outer carton is to be sealed in H-shape with packing tape as shown in the drawing.

Step 8. The model number, quantity of products, and shipping date are to be printed on the outer carton.
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	FOAM SHEET	Anti-static polyethylene
③	Drier	Moisture absorber
④	Sealing bag	
⑤	Packing tape	
⑥	B SHEET A	Anti-static air bubble sheet
⑦	B SHEET B	Anti-static air bubble sheet
⑧	Outer carton	Corrugated cardboard

Dimension of outer carton	
D : Approx.	(356mm)
W : Approx.	(664mm)
H : Approx.	(182mm)
Quantity of products packed in one carton:	100
Gross weight : Approx.	6.3 kg

15. Handling Instruction

15.1 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.**

15.2 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 15.5 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.

15.3 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.

15.4 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.

15.5 Precautions for Peeling off the Protective film

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

A) Work Environment

a) Humidity: 50 to 70 %RH, Temperature15 to 27˚C

b) Operators should wear conductive shoes, conductive clothes, conductive finger tips and grounded wrist-straps. Use an electrostatic neutralization blower.

c) Anti-static treatment should be implemented to work area's floor. Use a room shielded against outside dust with sticky floor mat laid at the entrance to eliminate dirt.

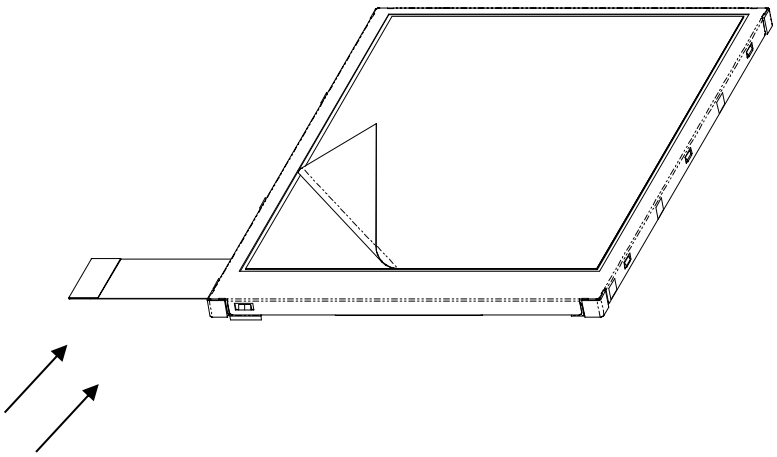
B) Work Method

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) Put an adhesive tape (Scotch tape, etc) at the lower left corner area of the protective film to prevent scratch on surface of TFT monitors.

c) Peel off the adhesive tape slowly (spending more than 2 secs to complete) by pulling it to opposite direction.



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

15.6 Warranty

TOPPAN 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.

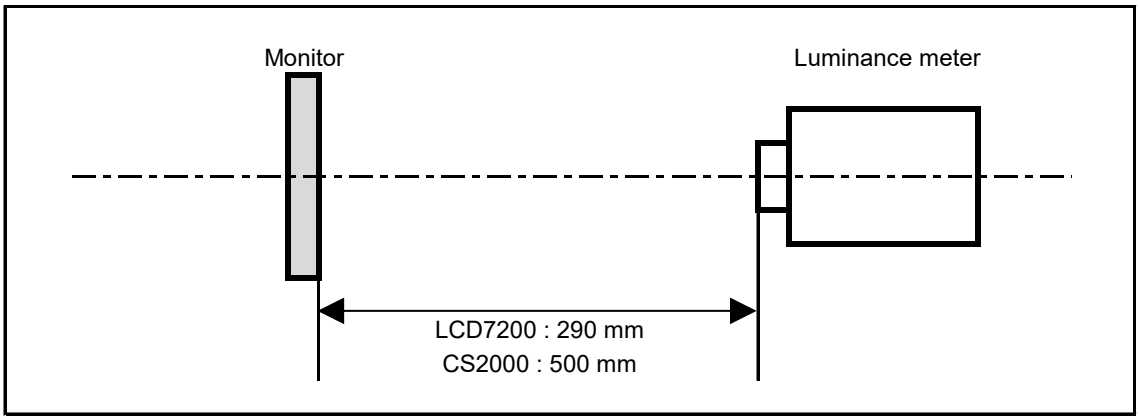
APPENDIX

Reference Method for Measuring Optical Characteristics and Performance

1. Measurement Condition

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

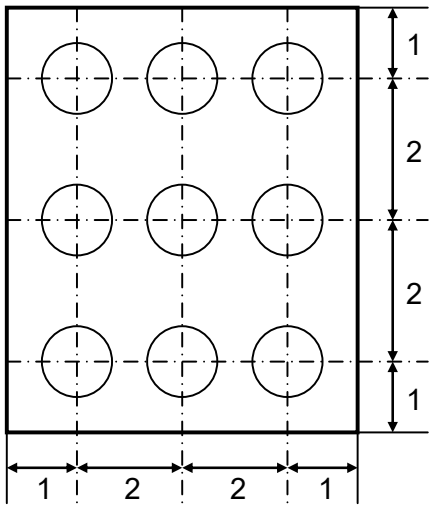
Dark box at constant temperature



*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>

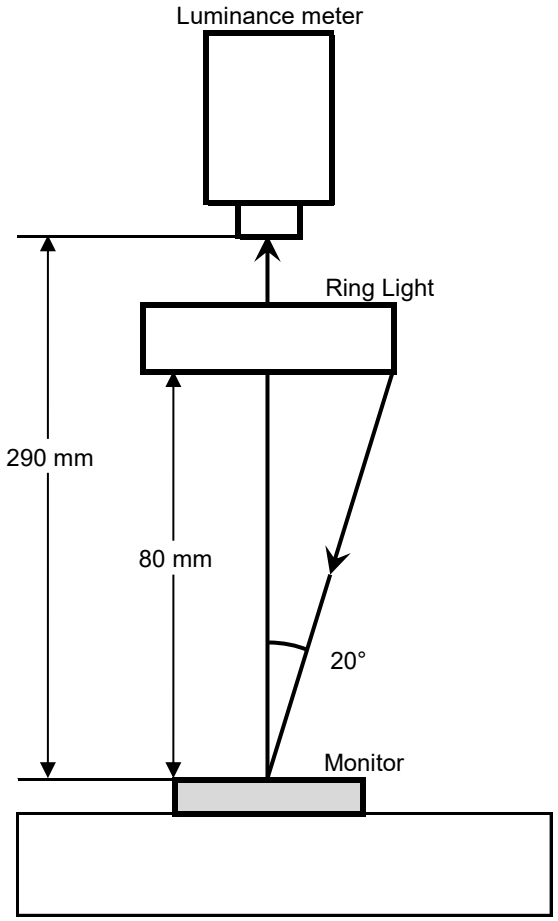


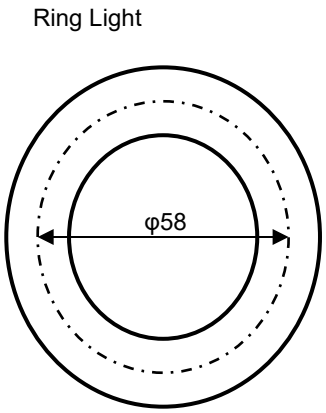
Dimensional ratio of active area

Backlight IL=6.5mA

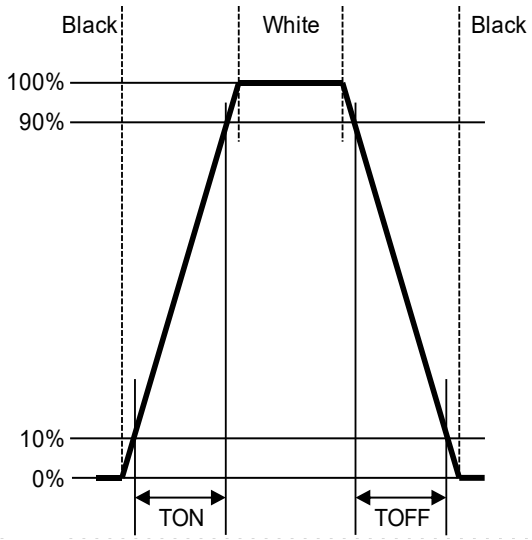
Measurement Condition (Contrast ratio Backlight OFF only)

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 unless otherwise specified



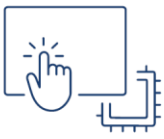


2. Test Method

Notice	Item	Test method	Measuring instrument	Remark
1	Response time	Measure output signal waveform by the luminance meter when raster of window pattern is changed from white to black and from black to white.  	LCD7200	Black display [Data]=00h White display [Data]=3Fh TON Rise time TOFF Fall time
2	Contrast ratio	Measure maximum luminance Y1([Data]=3Fh) 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: 3 mmφ(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] = 3Fh Color matching function: 2°view measurement angle: 1°	CS2000	
5	Center brightness	Measure the brightness at the center of the screen.	CS2000	
6	Brightness distribution	(Brightness distribution) = 100 x B/A % A : max. brightness of the 9 points B : min. brightness of the 9 points	CS2000	
7	Burn-in	Visually check burn-in image on the screen after 2 hours of "window display" ([Data]=00h/3Fh).		At optimized VCOMDC

DATA MODUL

Passion Displayed



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With **Hardware**, **Software** and **Services**, we realise unique display solutions that turn your ideas into reality.

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