Specifications for

Blanview TFT-LCD Monitor

(2.2" QVGA 240 x RGB x 320 Portrait)

Version 2.0

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

MODEL COM22H2P84ULC

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

ORTUSTECH

TOPPAN INC.
Electronics Division
Ortus Subdivision

Approved by S. Eguchi

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SPECIFICATIONS № 22TLM034	Issue:Apr.28,2023

Version History

Ver.	Date	Page	Description	
0.0	Sep.2,2022	-	-	Tentative issue
0.1	Jan.4,2023	P.18,19		10.1 Power ON Sequence
			Update	Update to Gamma 0xE0(para1~14),0xE1(para1~14).
△A ×4		P.20,21		10.2 Refresh Sequence
			Update	Update to Gamma 0xE0(para1~14),0xE1(para1~14).
1.0	Mar.31,2023	-	-	First issue
		P.13		8.1 DC Characteristics
△B ×4			Correct	Rating
		P.26		13.1 Defective Display and Screen Quality
			Correct	Signal condition
		P.28		14. Reliability Test
			Add	Test condition (Surface discharge test)
		P.33		16.4 Storage Condition for Shipping Cartons
			Correct	Maximum piling up
2.0	Apr.28,2023	P.12		6. Absolute Maximum Rating
			Correct	Condition / Rating
△C ×2		P.13		7. Recommended Operating Conditions
			Correct	Rating

SPECIFICATIONS № 22TLM034	Issue:Apr.28,2023

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1. Application

This Specification is applicable to 56.4 mm (2.2 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

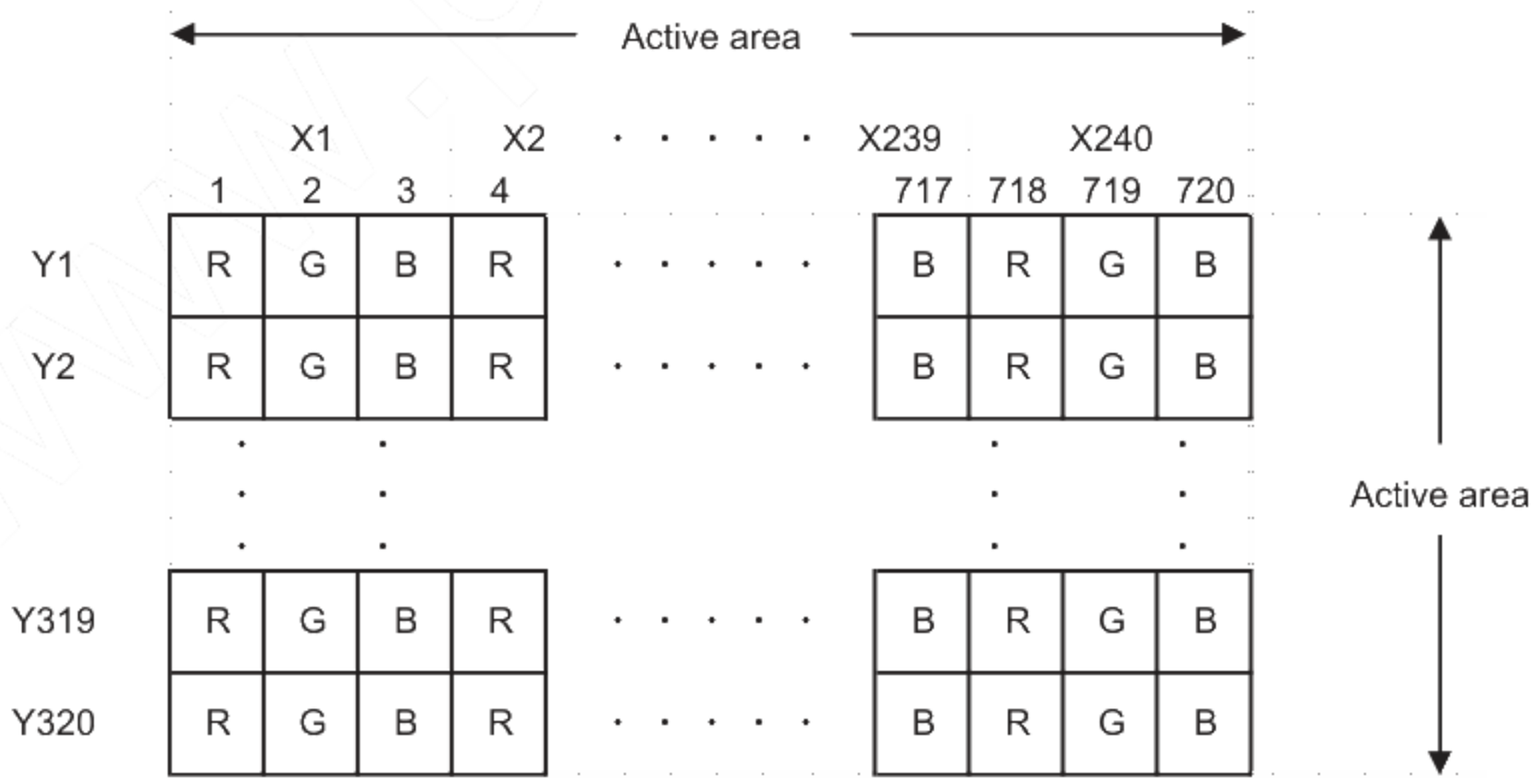
2.1 Features of the Product

- 2.2 inch diagonal display, 240 x RGB [H] x 320 [V] dots.
- 6-bit / 262,144 colors.
- Single power supply 2.8V
- Timing generator [TG], Counter-electrode driving circuitry, Built-in power supply circuit.
- High bright white LED back-light.

	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

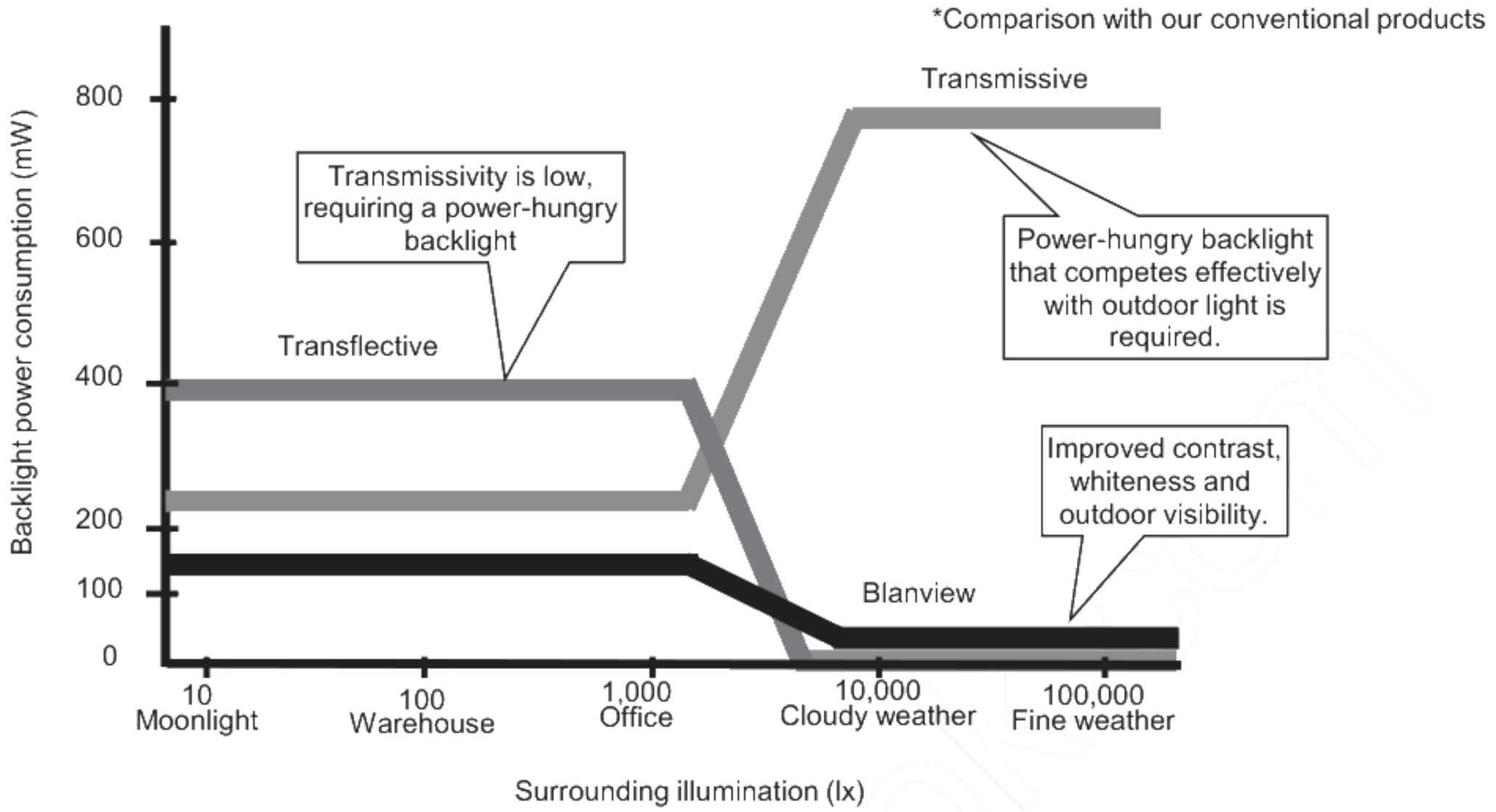
Items	Specifications	Remarks
Display type	VA 262,144 colors. Blanview, Normally black.	
Driving method	a-Si TFT Active matrix. Line-scanning, Non-interlace.	
Dot arrangement	RGB stripe arrangement.	Refer to "Dot arrangement"
Signal input method	System interface with 18 bit bus width	
Backlight	High brightness LED, side light	
NTSC ratio	35%	



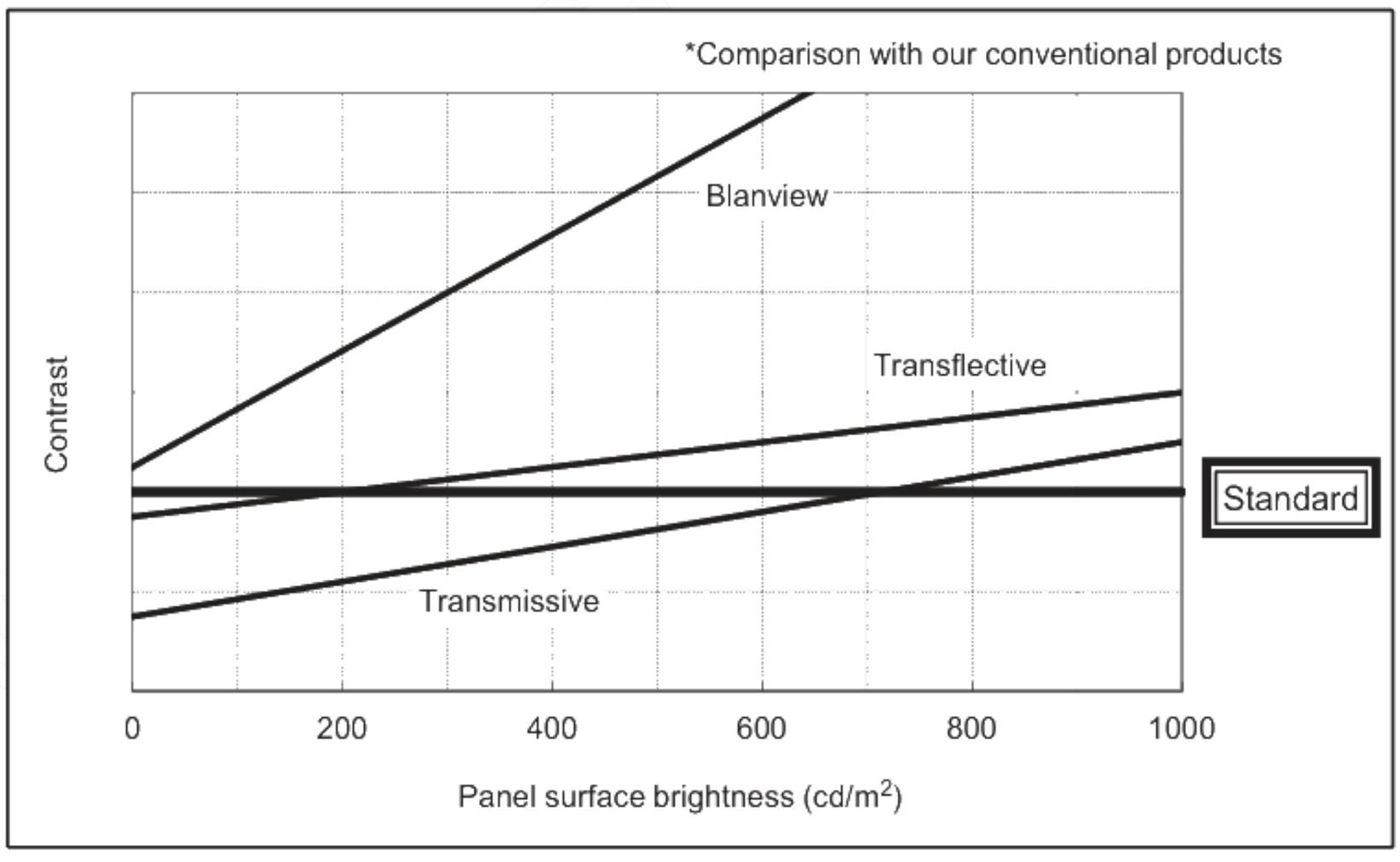
Dot arrangement (FPC cable placed right side)

<Features of Blanview>

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



- Contrast characteristics under 100,000lx.（same condition as direct sunlight.）
  With better contrast (higher contrast ratio), Blanview TFT-LCD has the best outdoor readability in three different types of TFT-LCD.
  Below chart shows contrast value against panel surface brightness. (Horizontal: Panel surface brightness/ Vertical: Contrast value) LCD panel has enough outdoor readability above our Standard line.
  (TOPPAN criteria)

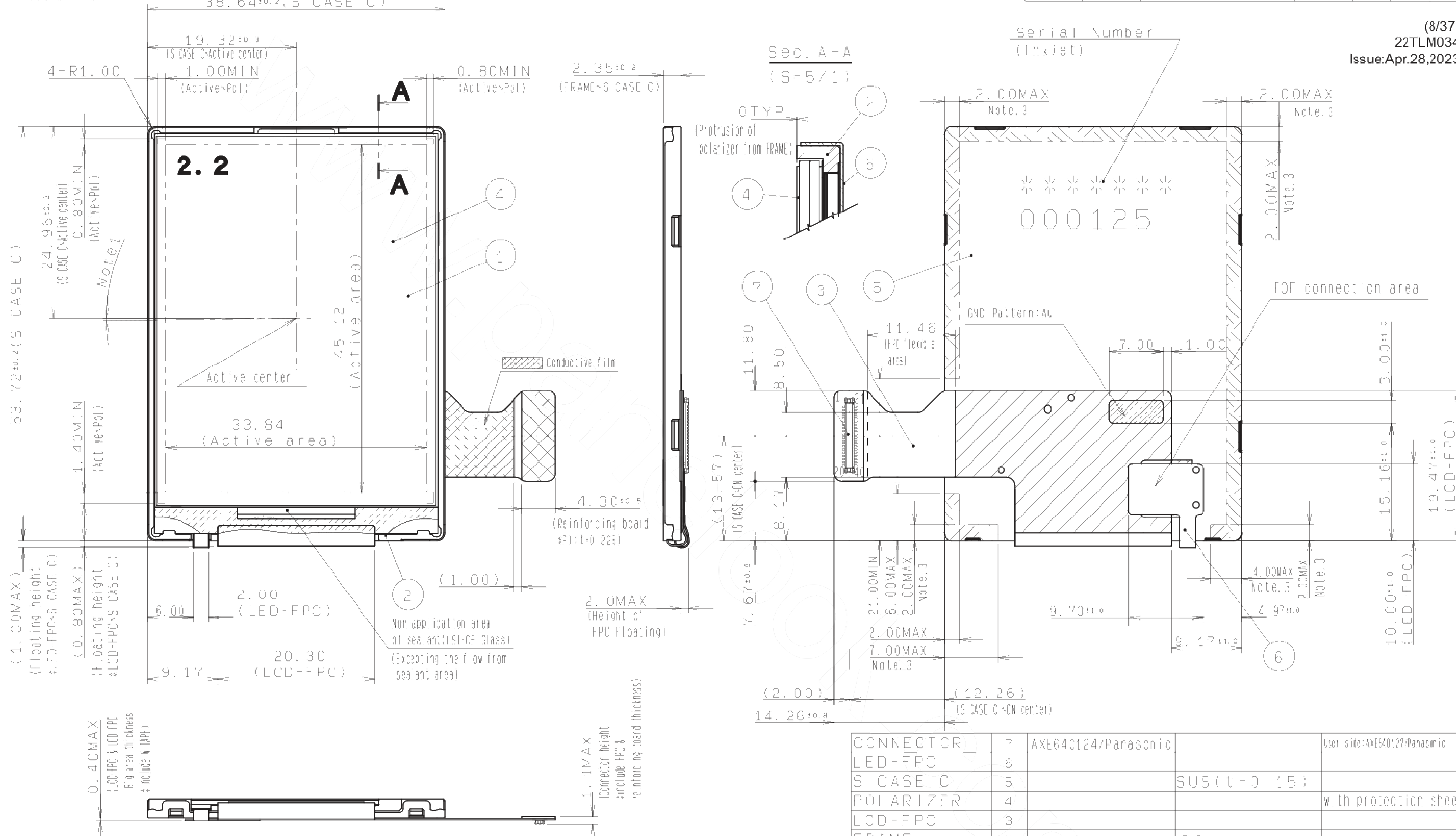


3. Dimensions and Shape

3.1 Dimensions

Items	Specifications	Unit	Remarks
Outline dimensions	38.64[H] × 53.72[V] ×2.35[D]	mm	Exclude FPC cable
Active area	33.84[H] × 45.12[V]	mm	Diagonal: 2.22inch
Number of dots	240 × RGB [H] × 320[V]	dot	
Dot pitch	47[H] × 141[V]	um	
Surface hardness of the polarizer	3	H	Load:2.0N
Weight	11	g	Include FPC cable

3.2 Outward Form



Note 1. Angular deviation of LCD coordinate from the TFT LCD monitor's reference axis shall be less than [±40'].

Note 2. 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 3. In case TFT LCD monitor is fixed to the case of your product, it's recommended that monitor is fixed in to [hatched] area.

Note 4. Do not press hard on the FOF connection area.

PART NAME	ITEM	PART CODE	MODEL NUMBER	REMARK
CONNECTOR	7	AXE640124/Panasonic		User side:AXE540127/Panasonic
LED-FPC	6			
S CASE C	5		SUS(t=0.15)	
POLARIZER	4			with protection sheet
LCD-FPC	3			
FRAME	2		PC	
TFT LCD	1		Glass substrate thickness:0.5t/0.5t	

APPROVED 木下大輔	GENERAL TOLERANCE ±0.5	SCALE 2/1	UNIT mm
CHECKED 加藤貴一	ISSUE (YY.M.D) 22:06:02	MODEL COM32H2P84U**	
CHECKED	NAME		
DESIGN 片岡明彦	OUTLINE-D2P84		
DRAW 片岡明彦			

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DRAWING No. RJD602996D301

3.3 Serial № print (S-print)

3.3.1 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	22DHC (Made in Japan) 22DJC (Made in Malaysia)		
d	Serial number			

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

・Made in Japan

2L22DHC000125

means "manufactured in December 2022, 2.2" DH type, C specifications, serial number 000125"

・Made in Malaysia

2L22DJC000125

means "manufactured in December 2022, 2.2" DJ type, C specifications, serial number 000125"

3.3.2 Location of Serial № print (S-print)

Refer to 3.2 "Outward Form".

3.3.3 Others

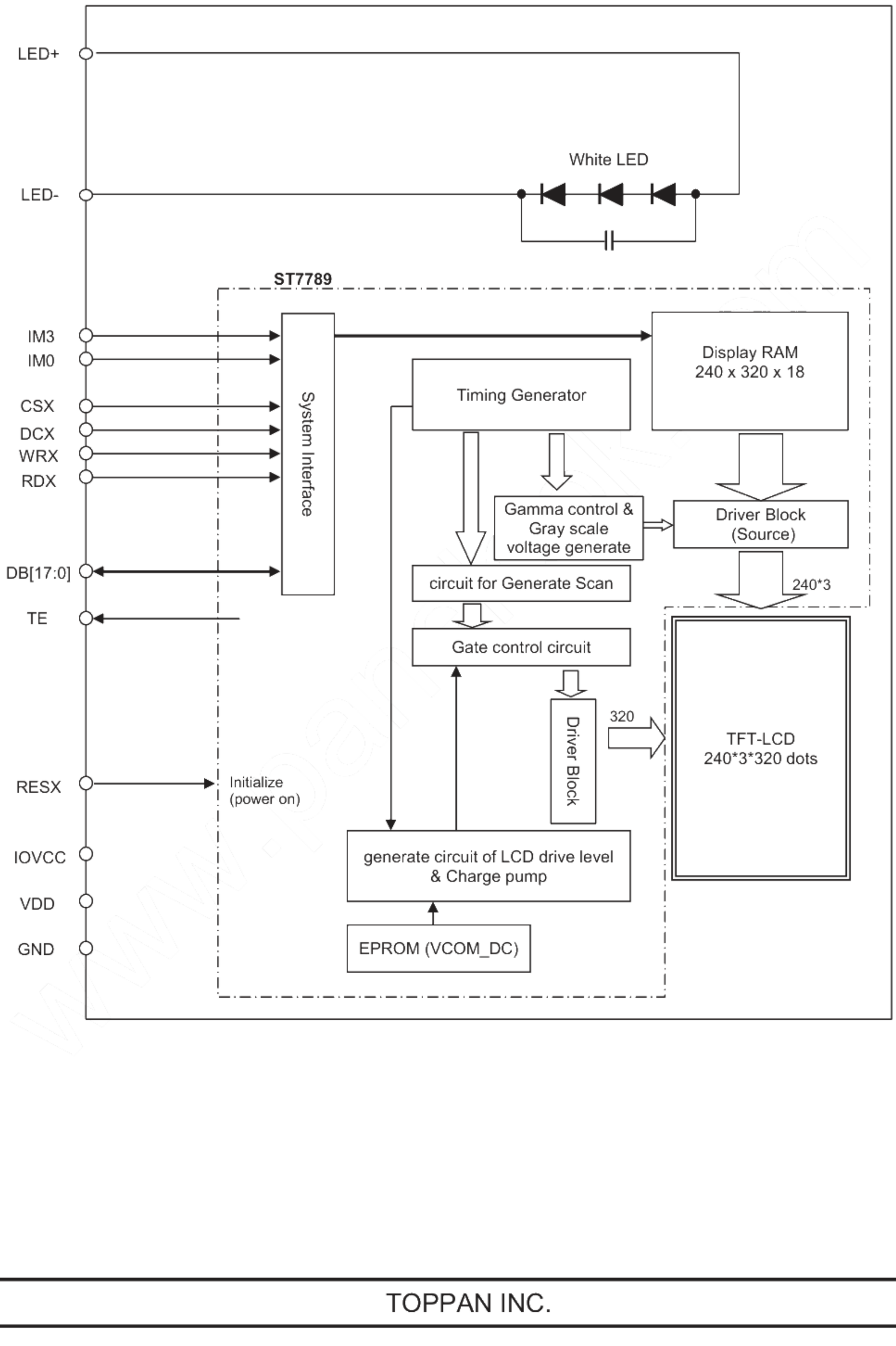
Please note that it is likely to disappear with an organic solvent about the Serial print.

4. Pin Assignment

No.	Symbol	Details	Remark	IO
1	TE	Frame Synchronizing Signal Output for LCD		O
2	LED+	LED anode		P
3	LED-	LED cathode		P
4	VDD	Power Supply for logic regulater		P
5	GND	Ground		P
6	NC	Non connection		-
7	IM0	Interface select signal		I
8	CSX	Chip select signal	L: Selected , H: Not selected	I
9	WRX	Write Signal		I
10	GND	Ground		P
11	DB1	Data Input & Output		IO
12	DB3	Data Input & Output		IO
13	DB5	Data Input & Output		IO
14	DB6	Data Input & Output		IO
15	DB8	Data Input & Output		IO
16	DB10	Data Input & Output		IO
17	GND	Ground		P
18	DB13	Data Input & Output		IO
19	DB15	Data Input & Output		IO
20	DB17	Data Input & Output		IO
21	GND	Ground		P
22	LED+	LED anode		P
23	LED-	LED cathode		P
24	IOVCC	Power Supply for interface Circuit		P
25	NC	Non connection		-
26	IM3	Interface select signal		I
27	RESX	Reset signal	L:Initialize	I
28	DCX	Select the register	L: Command , H: Parameter / Data	I
29	RDX	Read Signal		I
30	DB0	Data Input & Output		IO
31	DB2	Data Input & Output		IO
32	DB4	Data Input & Output		IO
33	GND	Ground		P
34	DB7	Data Input & Output		IO
35	DB9	Data Input & Output		IO
36	DB11	Data Input & Output		IO
37	DB12	Data Input & Output		IO
38	DB14	Data Input & Output		IO
39	DB16	Data Input & Output		IO
40	GND	Ground		P

- Recommended connector: Panasonic [AXE540127]
- 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.

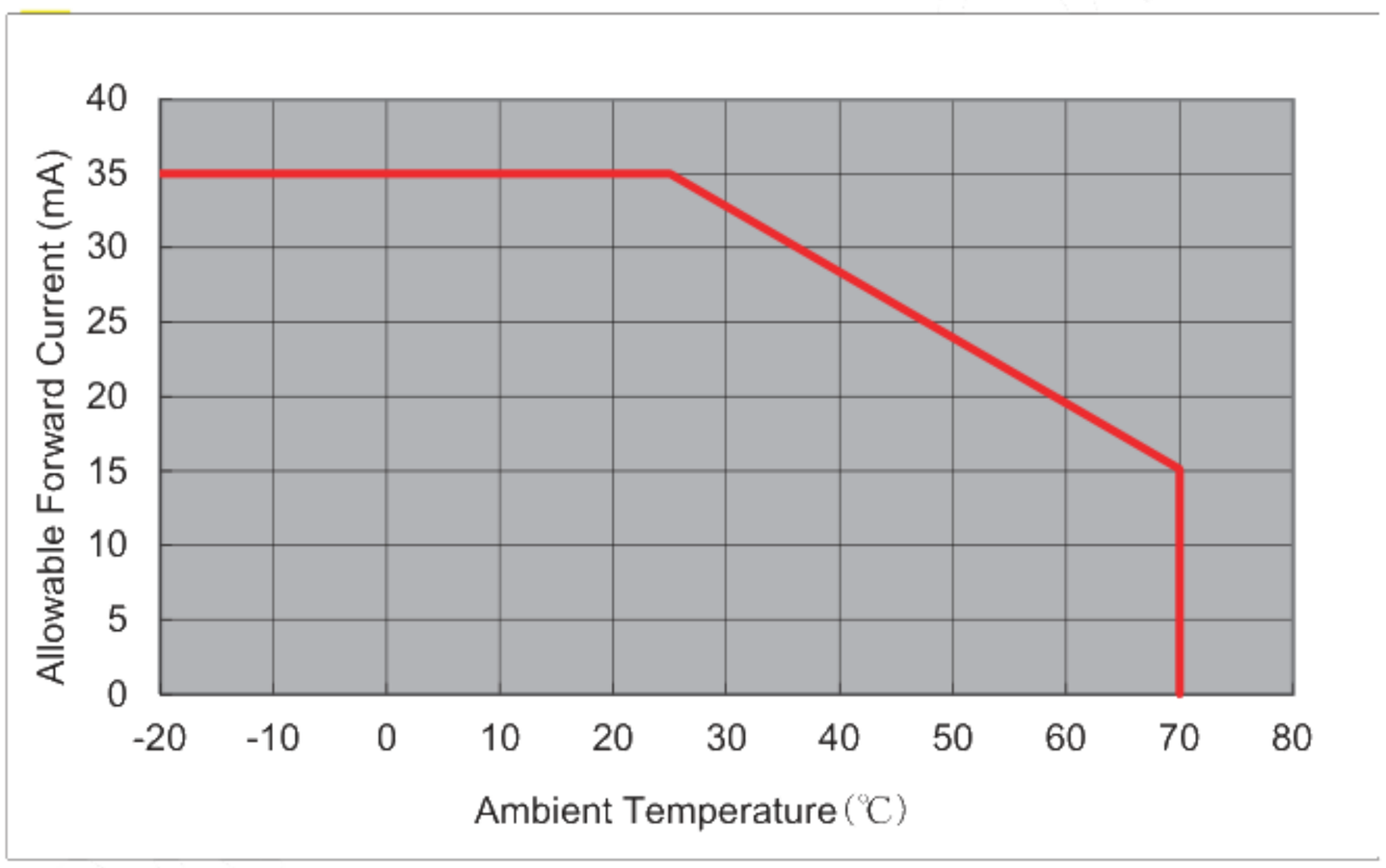
5. Block Diagram



6. Absolute Maximum Rating

Item	Symbol	Condition	Rating		Unit	Applicable terminal
			MIN	MAX		
Supply voltage	VDD		-0.3	4.6	V	VDD
Logic interface voltage	IOVCC		-0.3	VDD	V	IOVCC
Input voltage for logic	VI		-0.3	IOVCC+0.3	V	RESX,CSX,DCX,WRX, RDX,IM3,IM0,DB[17:0]
LED Forward current	IL	Ta = 25 °C	--	35	mA	LED+ - LED-
		Ta = 70 °C	--	15	mA	
Storage temperature range	Tstg		-30	80	°C	
Storage humidity range	Hstg	Non condensing in an environmental moisture at or less than 40 °C 90%RH.				

Note: Do not exceed Allowable Forward Current shown on the chart below.



△C

7. Recommended Operating Conditions

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Supply voltage	VDD	Ta=-20～70°C	2.7	2.8	3.3	V	VDD
Logic interface voltage	IOVCC		1.7	VDD	VDD	V	IOVCC
Input voltage for logic	VI		0	—	IOVCC	V	RESX,CSX,DCX,WRX, RDX,IM3,IM0,DB[17:0]
LED Forward current	IL	Ta=-20～70°C	-	5.0	15.0	mA	LED+ - LED-
LED Forward voltage	VL	Ta=25°C IL=5.0mA	7.62	8.07	8.40	V	
Operational temperature range	Top	Note1	-20	25	70	°C	Panel surface temperature
Operating humidity range	Hop	Ta≦30°C	20	—	80	%	
		Ta>30°C	Non condensing in an environmental moisture at or less than 30 °C 80%RH.				

Note1: This monitor is operatable in this temperature range. With regard to optical characteristics, refer to Item 12."Characteristics".

8. Electrical Characteristics

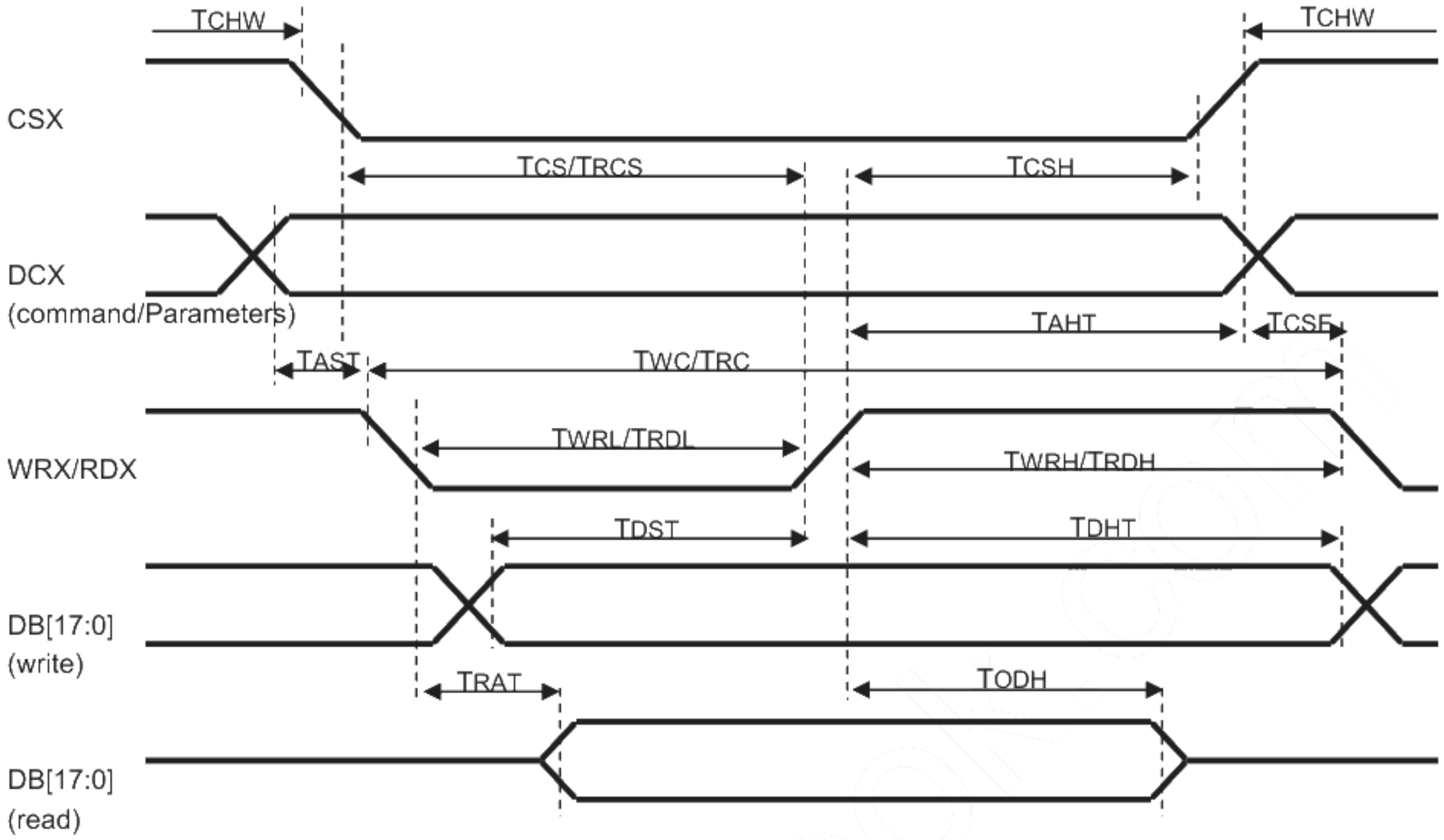
8.1 DC Characteristics

(Unless otherwise noted, Ta=25 °C,VDD=IOVCC=2.8V)

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
Input Signal Voltage	VIH	IOVCC=1.7-3.3V	0.7×IOVCC	—	IOVCC	V	RESX,CSX,DCX, WRX,RDX,IM3, IM0,DB[17:0]
	VIL		0	—	0.3×IOVCC	V	
Output Signal Voltage	VOH	IOH = -0.1mA	0.8×IOVCC	—	—	V	DB[17:0],TE
	VOL	IOL = 0.1mA	—	—	0.2×IOVCC	V	
Operating Current	IDD	Color bar display	—	7.6	13.0	mA	VDD + IOVCC
Stand-by Current	IDDS	Other input with constant voltage	—	—	40.0	μA	VDD + IOVCC

8.2 AC Characteristics

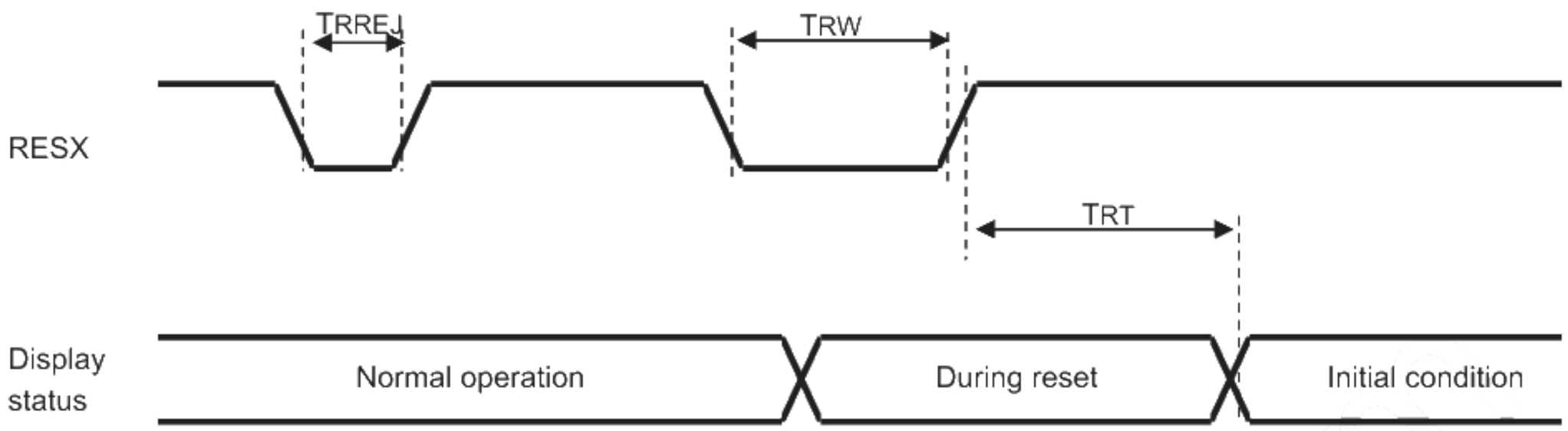
8.2.1 System I/F timing Characteristics



(Unless otherwise noted, Ta=25 °C,VDD=IOVCC=2.8V)

Item	Symbol	Rating		Unit	
		MIN	MAX		
Address setup time	TAST	0		ns	DCX
Address hold time	TAHT	10		ns	
Chip select "H" pulse width	TCHW	0		ns	CSX
Chip select setup time (write)	TCS	15		ns	
Chip select setup time (Read)	TRCS	355		ns	
Chip select wait time	TCSF	10		ns	
Chip select hold time	TCSH	10		ns	
Write cycle	TWC	66		ns	WRXRDX
Read cycle	TRC	450		ns	
WRX pulse "H" duration	TWRH	15		ns	
RDX pulse "H" duration	TRDH	90		ns	
WRX pulse "L" duration	TWRL	15		ns	
RDX pulse "L" duration	TRDL	355		ns	
Data setup time	TDST	10		ns	DB[17:0](write)
Data hold time	TDHT	10		ns	
Read data delay time	TDDR		340	ns	DB[17:0](read)
Read data hold time	TDHR	20	80	ns	
Rising / Falling time	TR / TF		15	ns	DCX,CSX,WRX,DB[17:0]

8.2.2 RESET Timing



(Unless otherwise noted, Ta=25 °C,VDD=IOVCC=2.8V)

Item	Symbol	Rating		Unit	Remarks
		MIN	MAX		
Reset Rejected Pulse width	TRREJ	-	5	us	
Reset Pulse duration	TRW	10	-	us	
Reset time	TRT	-	5	ms	during Sleep-IN mode
		-	120	ms	during Sleep-OUT mode

9. Interface

9.1 Interface Mode

The following figure illustrates the relationship between data on GRAM and display data through each interface.

a. 18bit interface (IM3=0,IM0=1,3Ah_1st=06h,B0h_2nd=E0h) 262K color

Input pins	DB17	DB16	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction	*	*	*	*	*	*	*	*	*	IB7	IB6	IB5	IB4	IB3	IB2	IB1	IB0	*
data	R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0

b. 16bit interface 1-transfer mode (IM3=0,IM0=0,3Ah_1st=05h,B0h_2nd=E0h) 65K color

Input pins	DB17	DB16	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction	*	*	*	*	*	*	*	*	*	IB7	IB6	IB5	IB4	IB3	IB2	IB1	IB0	*
data	R5/R0	R4	R3	R2	R1	G5	G4	G3	*	G2	G1	G0	B5/B0	B4	B3	B2	B1	*

c. 16bit interface 2-transfer mode -1 (IM3=0,IM0=0,3Ah_1st=06h,B0h_2nd=E3h) 262K color

Input pins		DB17	DB16	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction		*	*	*	*	*	*	*	*	*	IB7	IB6	IB5	IB4	IB3	IB2	IB1	IB0	*
data	1st	R5	R4	R3	R2	R1	R0	G5	G4	*	G3	G2	G1	G0	B5	B4	B3	B2	*
	2nd	B1	B0	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

d. 16bit interface 2-transfer mode -2 (IM3=0,IM0=0,3Ah_1st=06h,B0h_2nd=E2h)

Input pins		DB17	DB16	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction		*	*	*	*	*	*	*	*	*	IB7	IB6	IB5	IB4	IB3	IB2	IB1	IB0	*
data	1st	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	R5	R4	*
	2nd	R3	R2	R1	R0	G5	G4	G3	G2	*	G1	G0	B5	B4	B3	B2	B1	B0	*

e. 9bit interface 2-transfer mode (IM3=1,IM0=1,3Ah_1st=06h,B0h_2nd=E0h) 262K color

Input pins		DB17	DB16	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction		IB7	IB6	IB5	IB4	IB3	IB2	IB1	IB0	*	*	*	*	*	*	*	*	*	*
data	1st	R5	R4	R3	R2	R1	R0	G5	G4	G3	*	*	*	*	*	*	*	*	*
	2nd	G2	G1	G0	B5	B4	B3	B2	B1	B0	*	*	*	*	*	*	*	*	*

f. 8bit interface 2-transfer mode (IM3=1,IM0=0,3Ah_1st=05h,B0h_2nd=E0h) 65K color

Input pins		DB17	DB16	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction		IB7	IB6	IB5	IB4	IB3	IB2	IB1	IB0	*	*	*	*	*	*	*	*	*	*
data	1st	R5/R0	R4	R3	R2	R1	G5	G4	G3	*	*	*	*	*	*	*	*	*	*
	2nd	G2	G1	G0	B5/B0	B4	B3	B2	B1	*	*	*	*	*	*	*	*	*	*

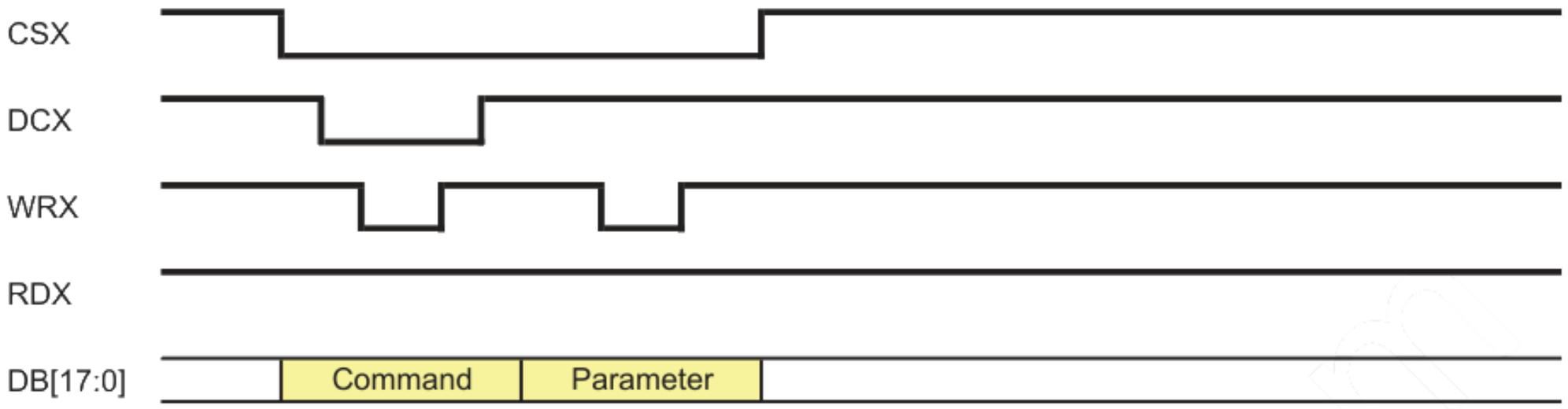
g. 8bit interface 3-transfer mode (IM3=1,IM0=0,3Ah_1st=06h,B0h_2nd=E0h) 262K color

Input pins		DB17	DB16	DB15	DB14	DB13	DB12	DB11	DB10	DB9	DB8	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Instruction		IB7	IB6	IB5	IB4	IB3	IB2	IB1	IB0	*	*	*	*	*	*	*	*	*	*
data	1st	R5	R4	R3	R2	R1	R0	*	*	*	*	*	*	*	*	*	*	*	*
	2nd	G5	G4	G3	G2	G1	G0	*	*	*	*	*	*	*	*	*	*	*	*
	3rd	B5	B4	B3	B2	B1	B0	*	*	*	*	*	*	*	*	*	*	*	*

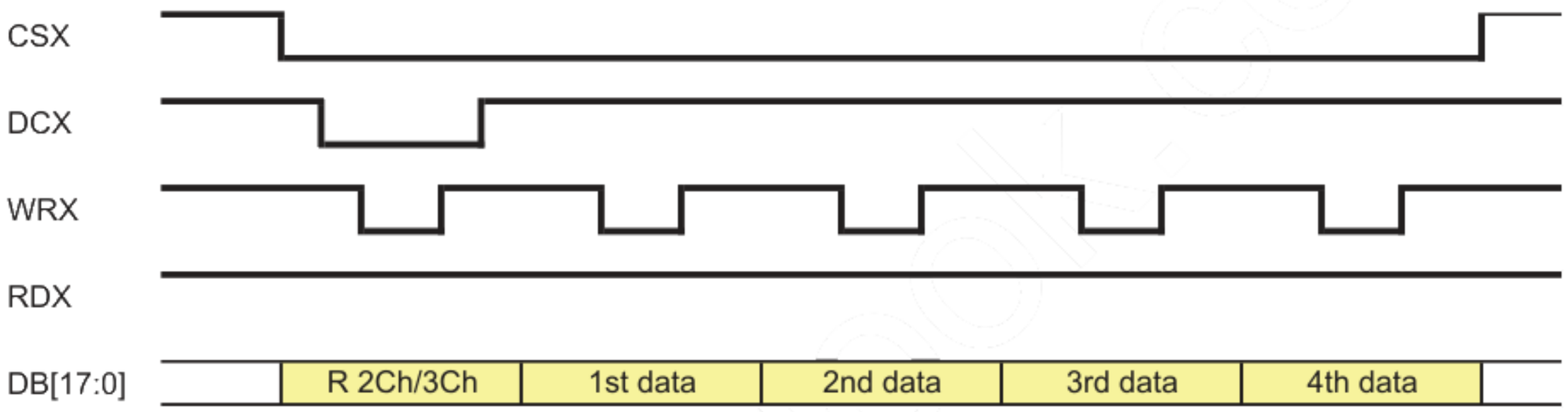
9.2 System interface timing

Send registers and data in accordance with the following transfer format.

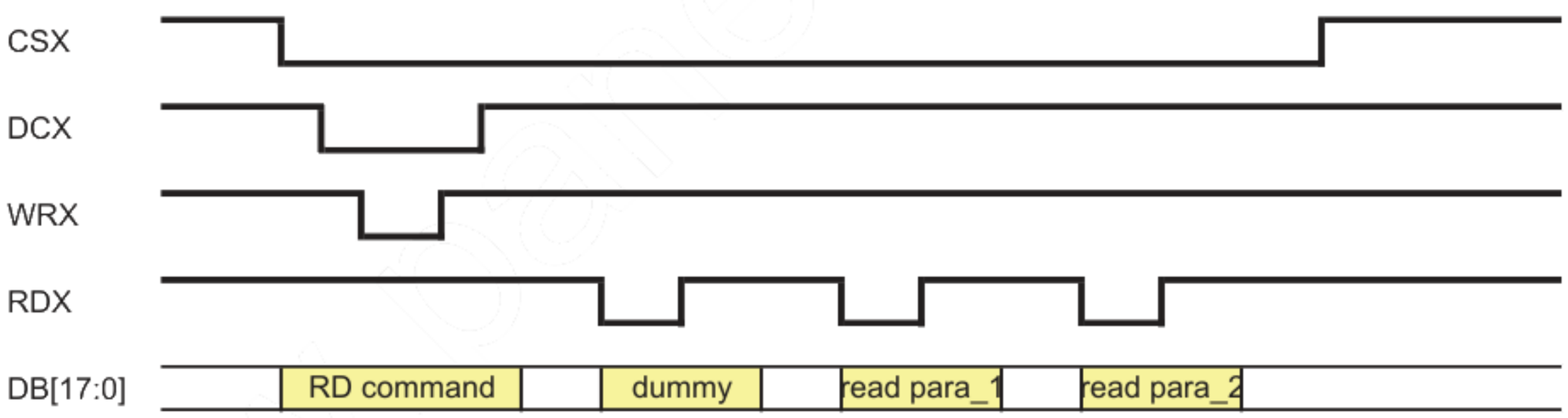
a) Write to register



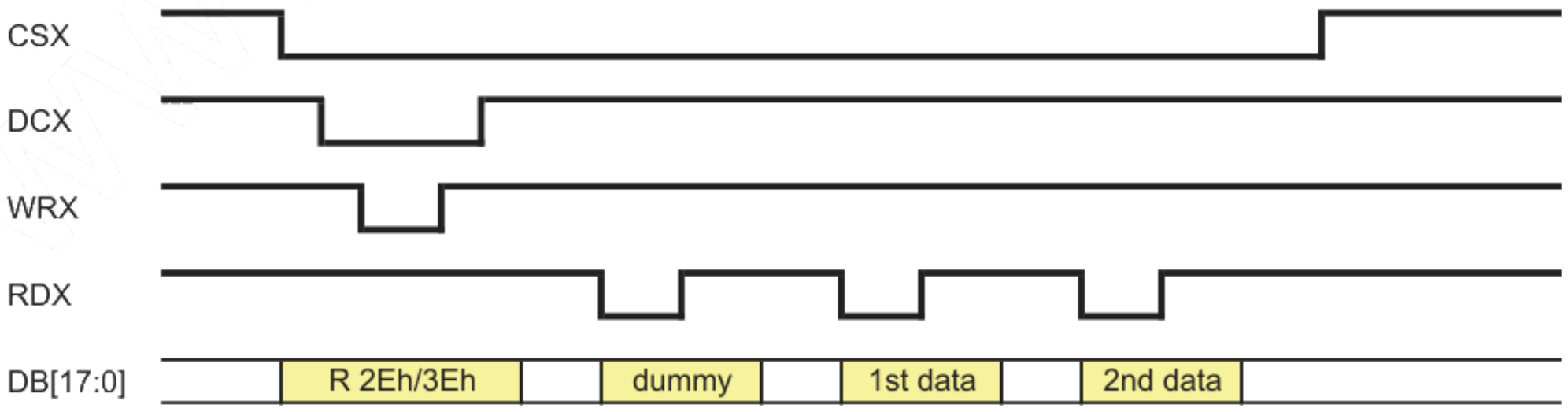
b) Write to GRAM



c) Read from register



d) Read from GRAM



10. Sequence

10.1 Power ON Sequence

(1/2)

No.			DCX	IB[7:0]	Remarks
	VDD/IOVCC ON				
	RESX High	RESX Low			(RESX High) can be omitted
	RESX High → Low				
	Wait 5 msec				
	RESX Low → High				
	Wait 120 msec				
1	Sleep Out		0	11 h	
	Wait 120 msec				
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	3h:4K,5h:65K,6h:260K
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	15 h	Δv=0.625typ
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	Positive gamma		0	E0 h	
		para 1	1	A0 h	
		para 2	1	04 h	
		para 3	1	0B h	
		para 4	1	11 h	
		para 5	1	10 h	
		para 6	1	19 h	
		para 7	1	31 h	
		para 8	1	22 h	
		para 9	1	41 h	
		para 10	1	2A h	
		para 11	1	19 h	

No.		DCX	IB[7:0]	Remarks
	para 12	1	14 h	
	para 13	1	16 h	
	para 14	1	19 h	
	Wait 10 msec			
14	Negative gamma	0	E1 h	
	para 1	1	F0 h	
	para 2	1	04 h	
	para 3	1	0B h	
	para 4	1	11 h	
	para 5	1	10 h	
	para 6	1	19 h	
	para 7	1	31 h	
	para 8	1	32 h	
	para 9	1	44 h	
	para 10	1	29 h	
	para 11	1	17 h	
	para 12	1	15 h	
	para 13	1	1B h	
	para 14	1	1E h	
	Wait 10 msec			
15	Equalize control	0	E9 h	
	para 1	1	08 h	
	para 2	1	08 h	
	para 3	1	08 h	
16	RGB interface control	0	B1 h	
	para 1	1	00 h	
	para 2	1	04 h	
	para 3	1	14 h	
17	RAM Control	0	B0 h	
	para 1	1	00 h	RM=0,DM=00:CPU interface
	para 2	1	E0 h	EPF=10b
18	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]
19	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]
20	Tearing Effect On	0	35 h	
	para 1	1	00 h	TEM = 0
21	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			
22	Display ON	0	29 h	
	wait 10 msec			
23	Backlight ON			

10.2 Refresh Sequence

To prevent false operation by static electricity and such, please refresh register setting as follows regularly.

No.		DCX	IB[7:0]	Remarks
1	Sleep Out	0	11 h	
	Wait 120 msec			
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	3h:4K,5h:65K,6h:260K
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	15 h	Δv=0.625typ
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	Positive gamma	0	E0 h	
	para 1	1	A0 h	
	para 2	1	04 h	
	para 3	1	0B h	
	para 4	1	11 h	
	para 5	1	10 h	
	para 6	1	19 h	
	para 7	1	31 h	
	para 8	1	22 h	
	para 9	1	41 h	
	para 10	1	2A h	
	para 11	1	19 h	

No.		DCX	IB[7:0]	Remarks
	para 12	1	14 h	
	para 13	1	16 h	
	para 14	1	19 h	
	Wait 10 msec			
14	Negative gamma	0	E1 h	
	para 1	1	F0 h	
	para 2	1	04 h	
	para 3	1	0B h	
	para 4	1	11 h	
	para 5	1	10 h	
	para 6	1	19 h	
	para 7	1	31 h	
	para 8	1	32 h	
	para 9	1	44 h	
	para 10	1	29 h	
	para 11	1	17 h	
	para 12	1	15 h	
	para 13	1	1B h	
	para 14	1	1E h	
	Wait 10 msec			
15	Equalize control	0	E9 h	
	para 1	1	08 h	
	para 2	1	08 h	
	para 3	1	08 h	
16	RGB interface control	0	B1 h	
	para 1	1	00 h	
	para 2	1	04 h	
	para 3	1	14 h	
17	RAM Control	0	B0 h	
	para 1	1	00 h	RM=0,DM=00:CPU interface
	para 2	1	E0 h	EPF=10b
18	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]
19	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]
20	Tearing Effect On	0	35 h	
	para 1	1	00 h	TEM = 0
21	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			
22	Display ON	0	29 h	
	wait 10 msec			
23	Backlight ON			

10.3 Sleep IN Sequence

No.		DCX	IB[7:0]	Remarks
1	Backlight OFF			
2	Display OFF	0	28 h	
	Wait 10 msec			
3	Sleep In	0	10 h	

10.4 Sleep OUT Sequence

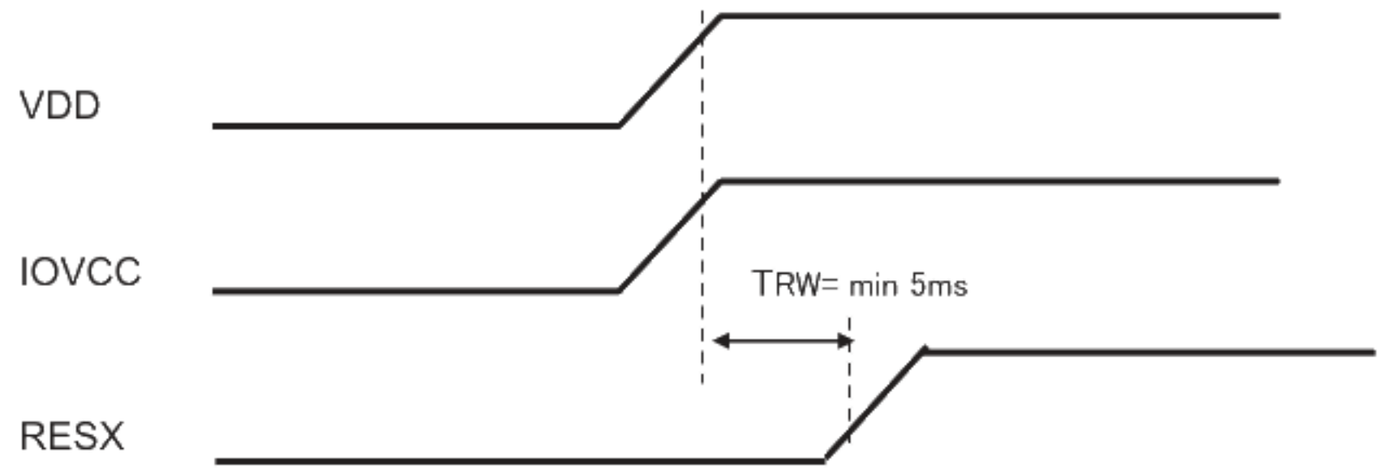
No.		DCX	IB[7:0]	Remarks
1	Sleep Out	0	11 h	
	Wait 120 msec			
2	Display ON	0	29 h	
	Wait 50 msec			
3	Backlight ON			

10.5 Power OFF Sequence

No.		DCX	IB[7:0]	Remarks
1	Backlight OFF			
2	Display OFF	0	28 h	
	Wait 10 msec			
3	Sleep In	0	10 h	
	Wait 120 msec			
4	RESX High → Low			
5	VDD/IOVCC OFF			

10.6 Power Supply ON Sequence

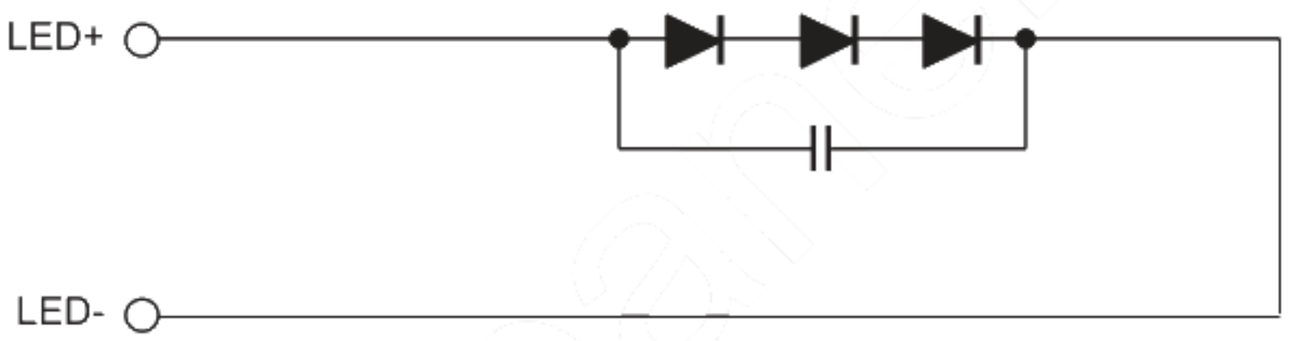
We recommend that you supplied at the same time VDD and IOVCC.
However, there is no problem even if the supply IOVCC later than VDD.
Please release the reset from at least 1ms after each power supply.



10.7 Power Supply OFF Sequence

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

11. LED Driving Circuit



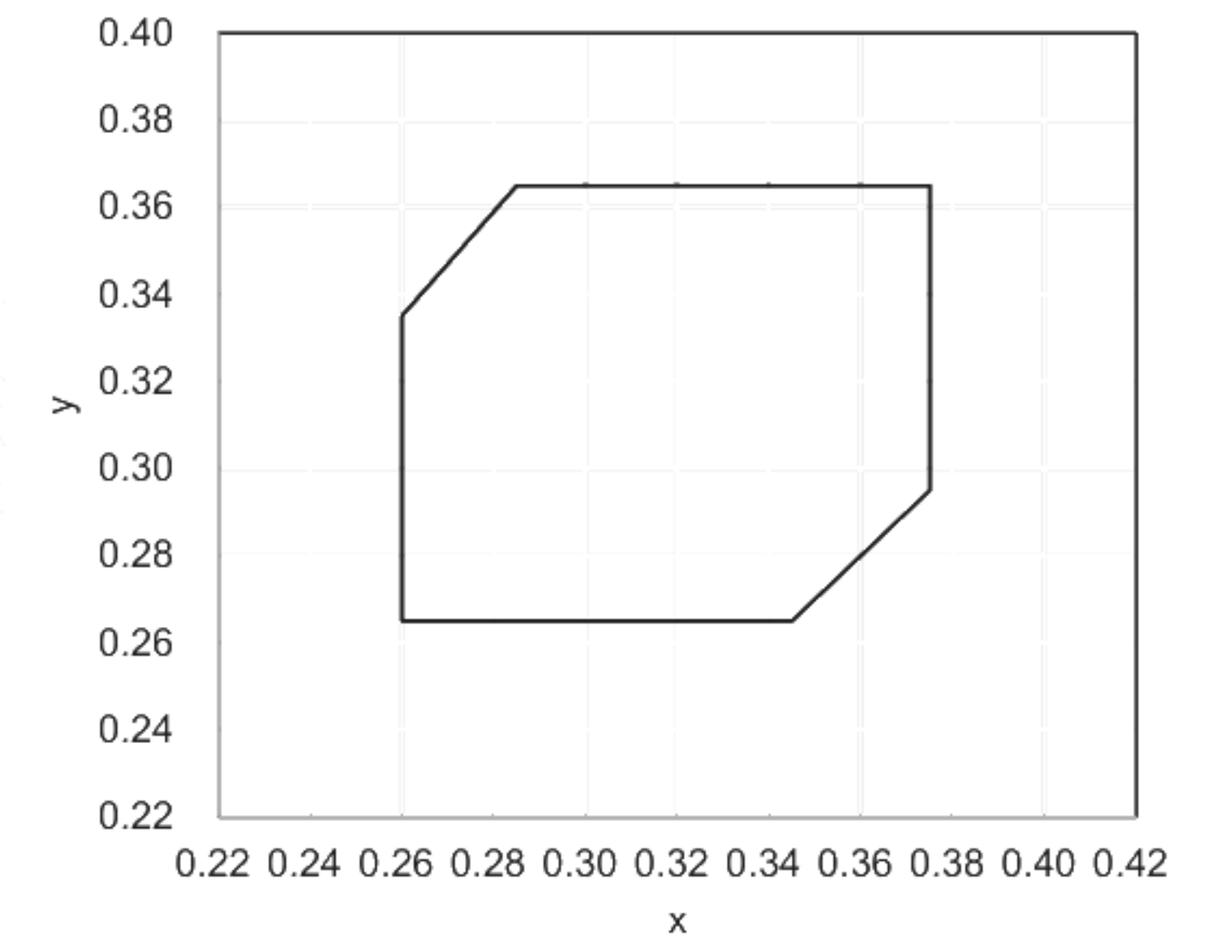
12. Characteristics

12.1 Optical Characteristics

(Measurement Condition)
Measuring instruments : CS2000 (KONICA MINOLTA), LCD7200 (OTSUKA ELECTRONICS), EZcontrastXL88 (ELDIM)
Driving condition : VDD=IOVCC=2.8V, Optimized VCOMDC
Backlight : IL=5.0 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	-	800	-		2	
	Backlight OFF			-	3.5	-			
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	280	400	-	cd/㎡	5	
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
0.260	0.265
0.345	0.265
0.375	0.295
0.375	0.365
0.285	0.365
0.260	0.335

10.2 Temperature Characteristics

(Measurement Condition)
Measuring instruments : CS2000 (KONICA MINOLTA), LCD7200 (OTSUKA ELECTRONICS)
Driving condition : VDD=IOVCC=2.8V, Optimized VCOMDC
Backlight : IL= 5.0 mA

Item		Symbol	Specification		Remark
			Ta = -20 °C	Ta = 70 °C	
Response time	Rise time + Fall time	TON + TOFF	500 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.		

12.3 Service Life Of Backlight

<Definition>
When the center luminance drops to 50% of the initial value,
the back light is considered to have reached the end of its effective service life.

Backlight : IL= 5.0 mA

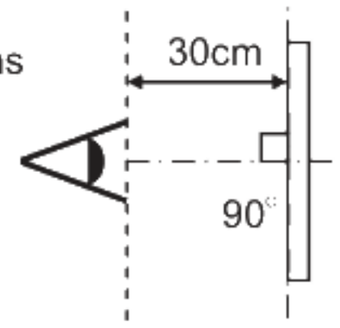
	Average life	Ambient temperature
Continuously lit	50,000 hrs	25 ± 5 °C

Average life means the period which the survival rate falls under 50%.

13. Criteria of Judgment

13.1 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=5.0mA



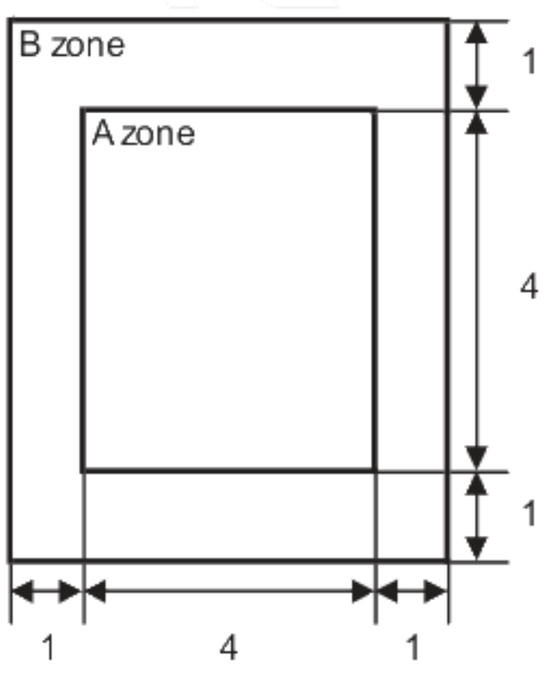
Defect item		Defect content		Criteria
Display Quality	Line defect	Black, white or color line, 3 or more neighboring defective dots		Not exists
	Dot defect	Uneven brightness on dot-by-dot base due to defective TFT or CF, or dust is counted as dot defect (brighter dot, darker dot) High bright dot: Visible 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 < length and 0.08mm < width	N=0
			length ≦ 3.0mm or width ≦ 0.08mm	Acceptable
	Others			Use boundary sample for judgment when necessary

φ(mm): Average diameter = (major axis + minor axis)/2
Permissible number: N

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>

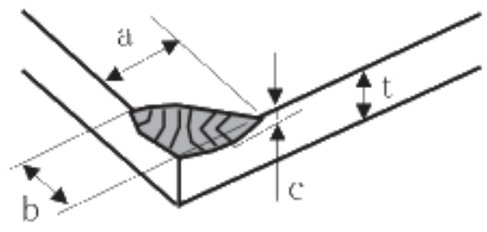
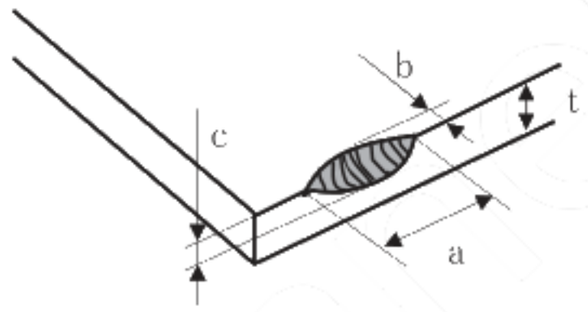


Division of A and B areas
B area: Active area
Dimensional ratio between A and B areas: 1: 4: 1
(Refer to the left figure)

13.2 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	

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

14. 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 ※	240hrs	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%, non condensing ※	240hrs	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=±8kV 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.)

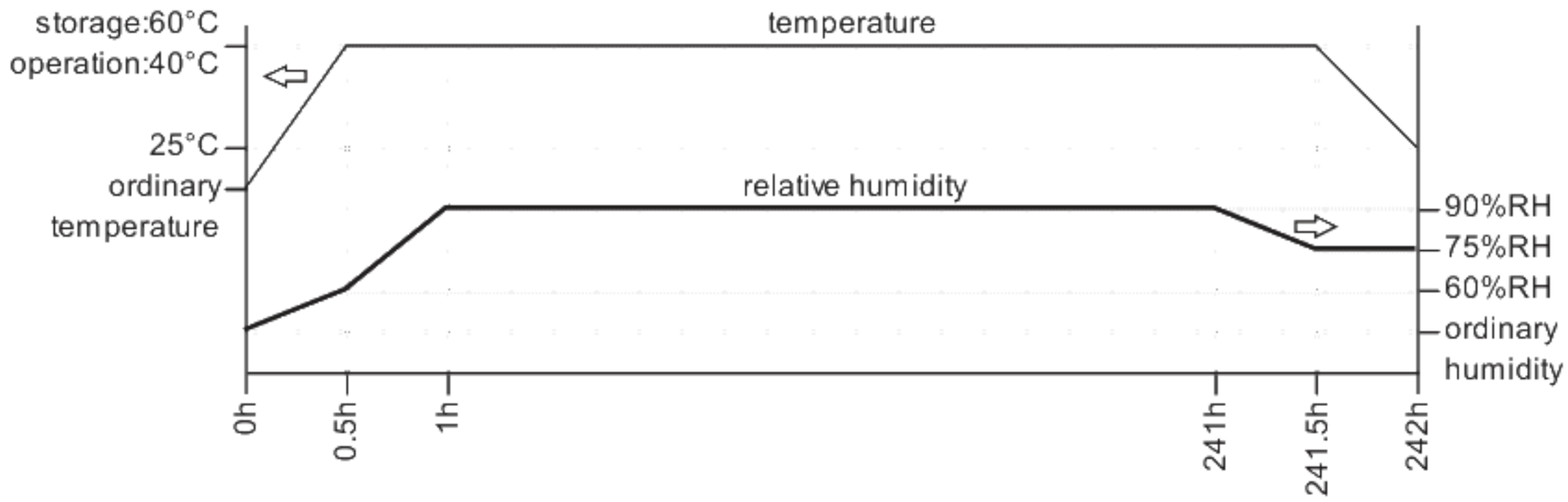
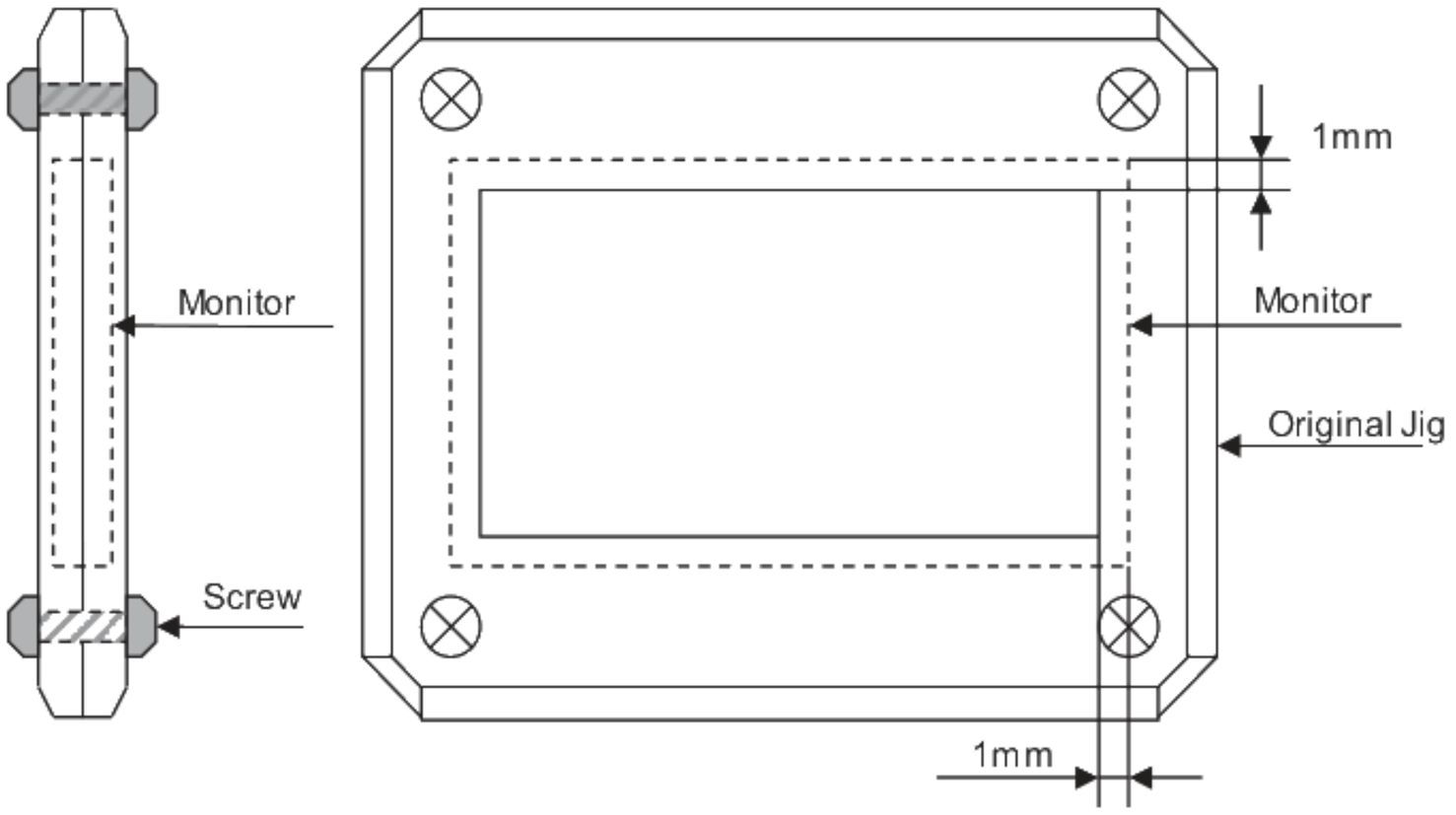


Table2. Reliability Criteria

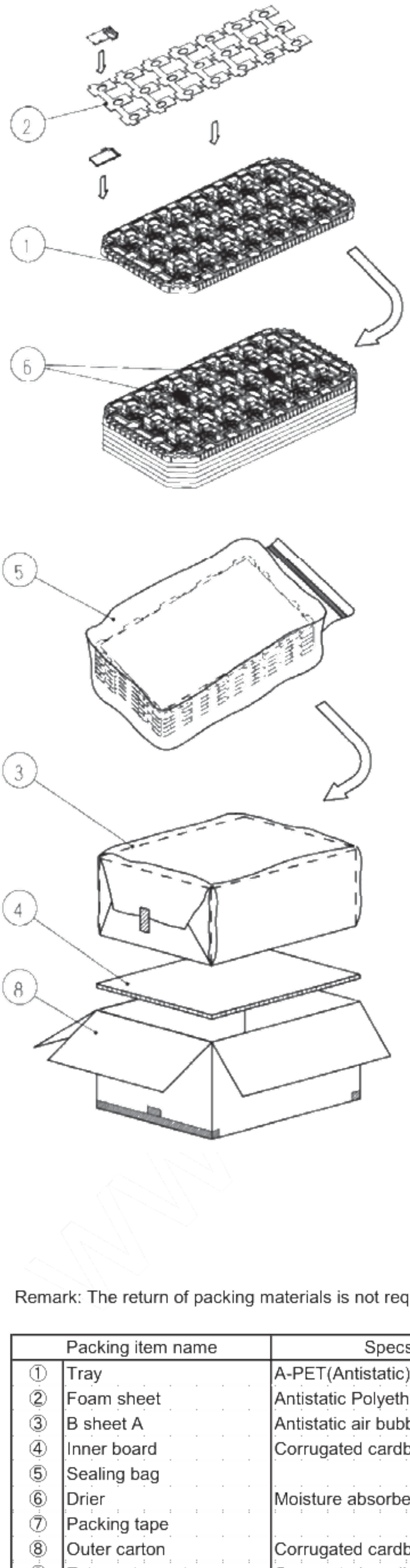
The parameters should be measured after leaving the monitor at the ordinary temperature for 24 hours or more after the test completion.

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



15. Packing Specifications



Step1. Each product is to be placed in one of the cut-outs of the tray with it's the LCD display side facing upward,and foam-sheet is put on products.(21 pieces/1 step)
Each product is to be placed on the FORM SHEET with the LCD display surface facing downward.(42 pieces/trays)

Step 2. Each tray filled with products is to be piled up in stack of 5.
One empty tray is to be put on the top of stack of 5 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 bag with the vacuum sealing machine.

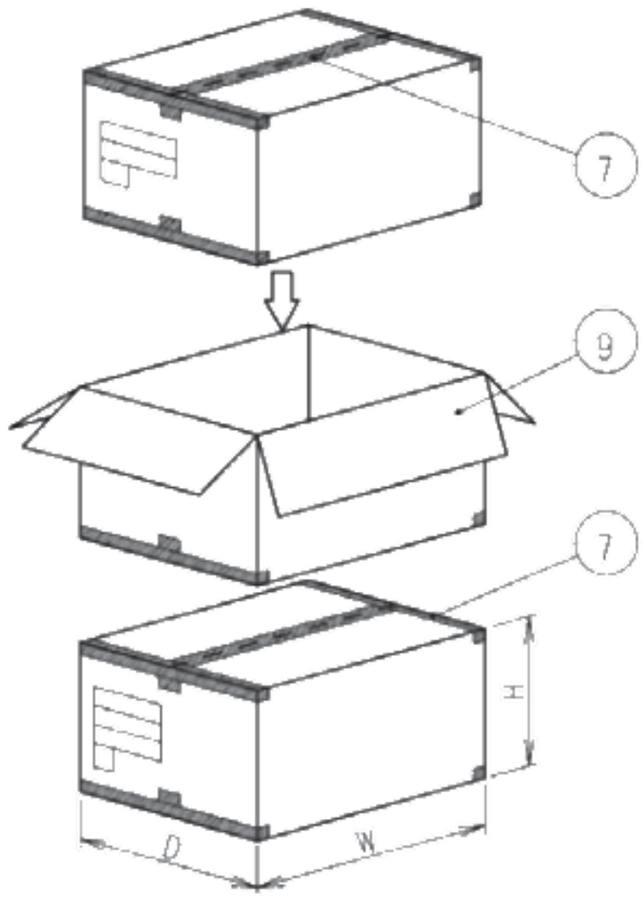
Step 5. The pilled trays are to be wrapped with a bubble cushioning sheet, and to be fixed with adhesive tape.

Step 6. A corrugated board is to be placed in the bottom of an outer carton.
The wrapped trays are to be put on the corrugated board in the outer carton.
Another corrugated board is to be placed on the top of the inserted carton box.

Step 7. The outer carton is to be sealed in H-shape with packing tape as shown in the drawing.
The model number, quantity of products, and shipping date are to be printed on the 2 opposite side of the outer carton with black ink.
If necessary, shipping labels or impression markings are to be put on the outer carton.

Step 8. The outer carton is to be inserted into a extra outer carton with same direction.
The extra outer carton needs to sealed with in H-shape with packing tape as shown in the drawing.

Step 9. The model number, quantity of products, and shipping date are to be printed on the 2 opposite sides of the extra outer carton with black ink.
If necessary, shipping labels or impression markings are to be put on the extra outer carton.



Remark: The return of packing materials is not required.

	Packing item name	Specs., Material
①	Tray	A-PET(Antistatic)
②	Foam sheet	Antistatic Polyethylene
③	B sheet A	Antistatic air bubble sheet
④	Inner board	Corrugated cardboard
⑤	Sealing bag	
⑥	Drier	Moisture absorber
⑦	Packing tape	
⑧	Outer carton	Corrugated cardboard
⑨	Extra outer carton	Corrugated cardboard

Dimension of extra outer carton	
D : Approx.	(337mm)
W : Approx.	(618mm)
H : Approx.	(179mm)
Quantity of products packed in one carton:	210
Gross weight : Approx.	5.0kg

16. Handling Instruction

16.1 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.

⚠ 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.

16.2 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 16.5 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.

16.3 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.

16.4 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.

16.5 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.

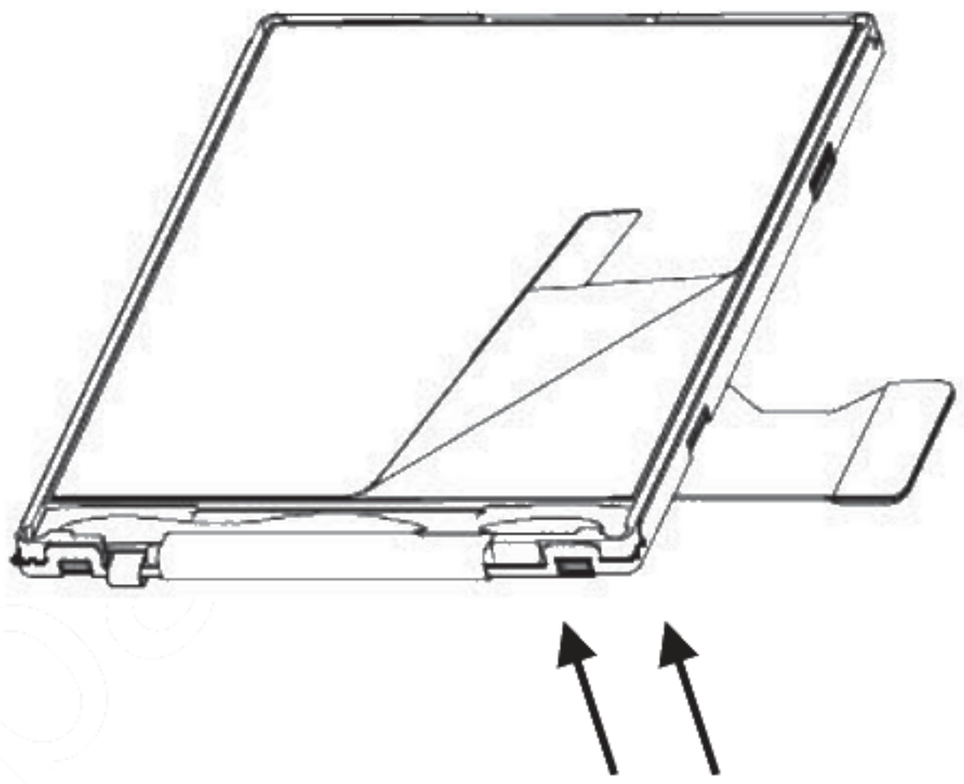
B) Work Method

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 right 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) 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.)

16.6 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.

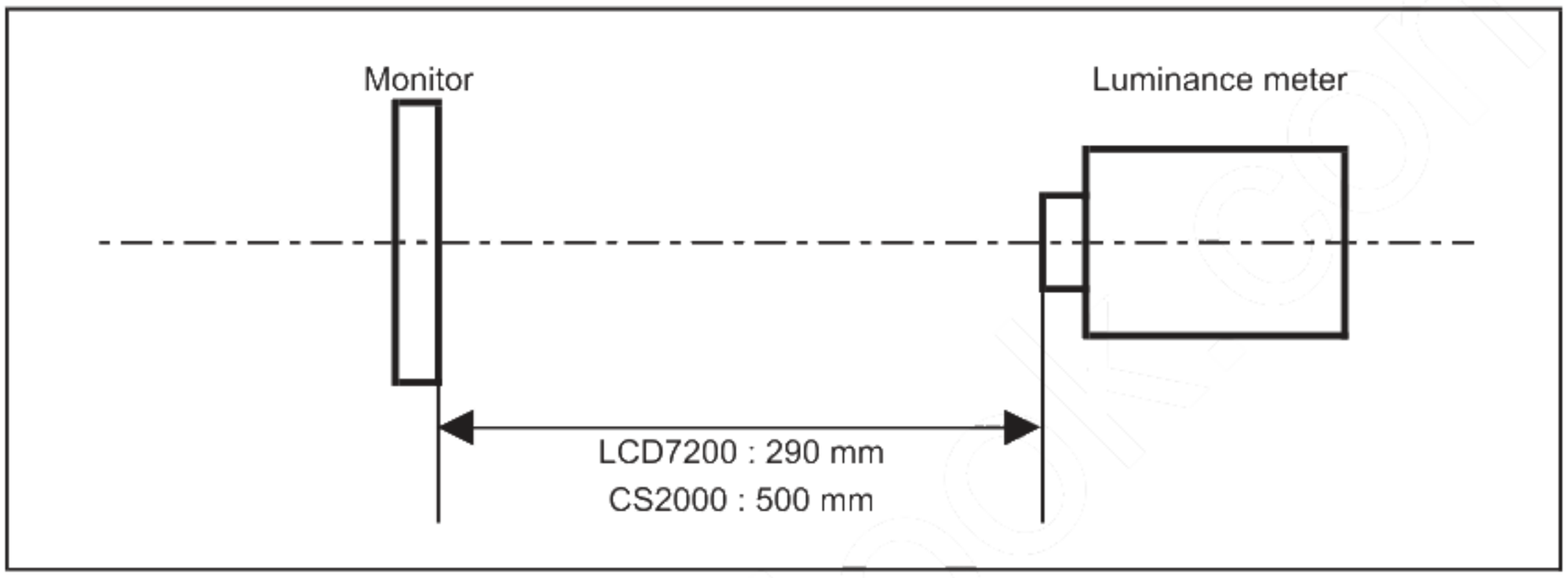
APPENDIX

Reference Method for Measuring Optical Characteristics and Performance

1. Measurement Condition (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

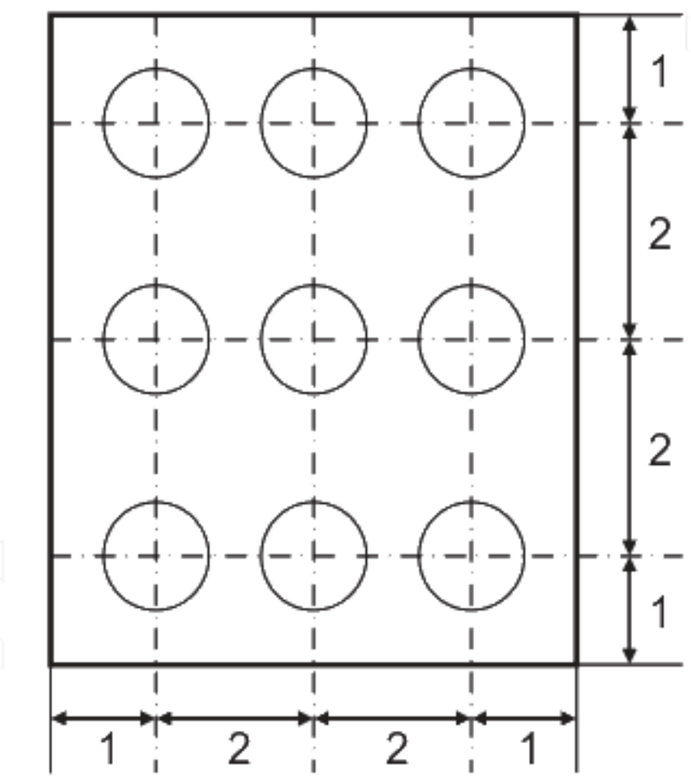
Dark box at constant temperature



*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>

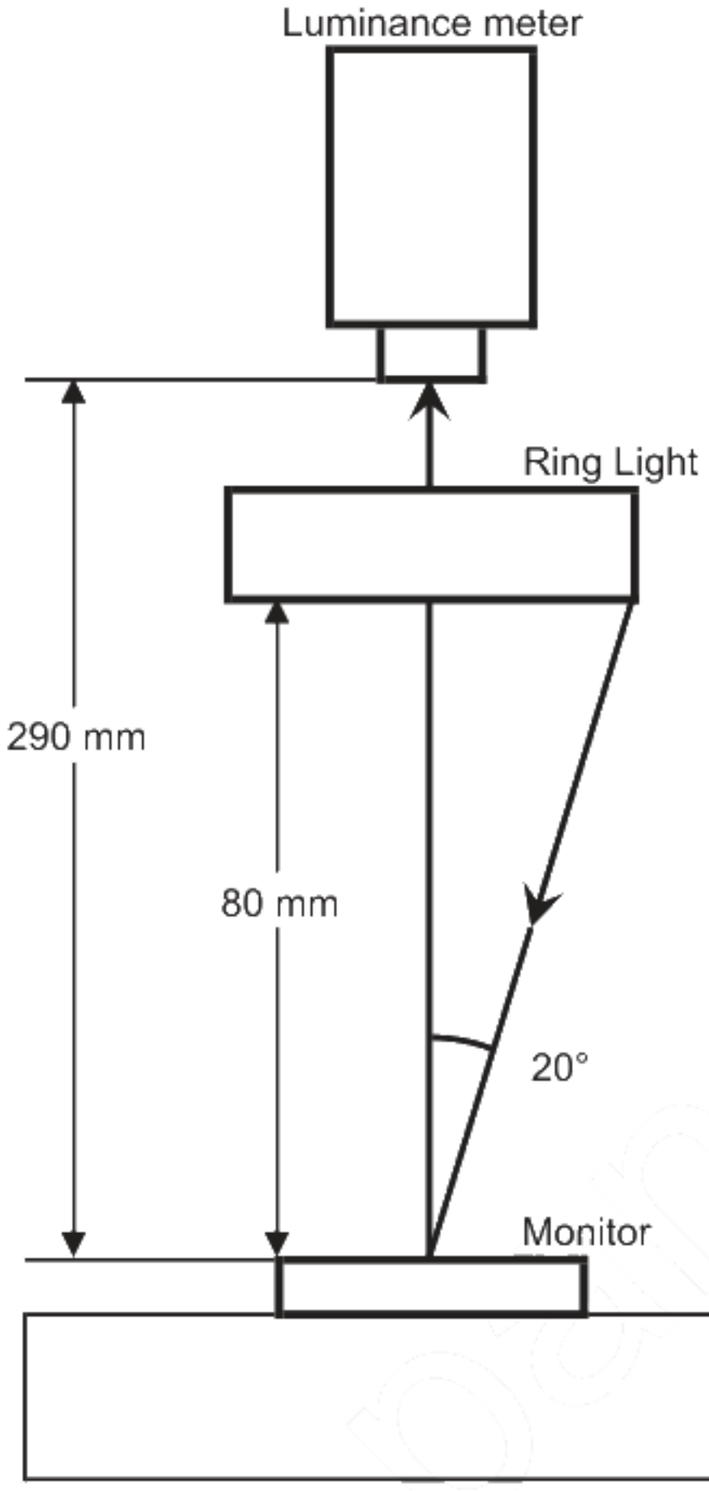


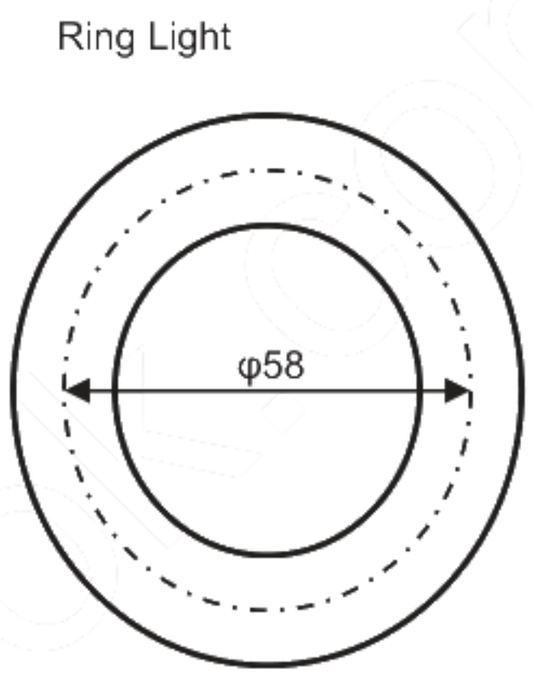
Dimensional ratio of active area

Backlight IL=5.0mA

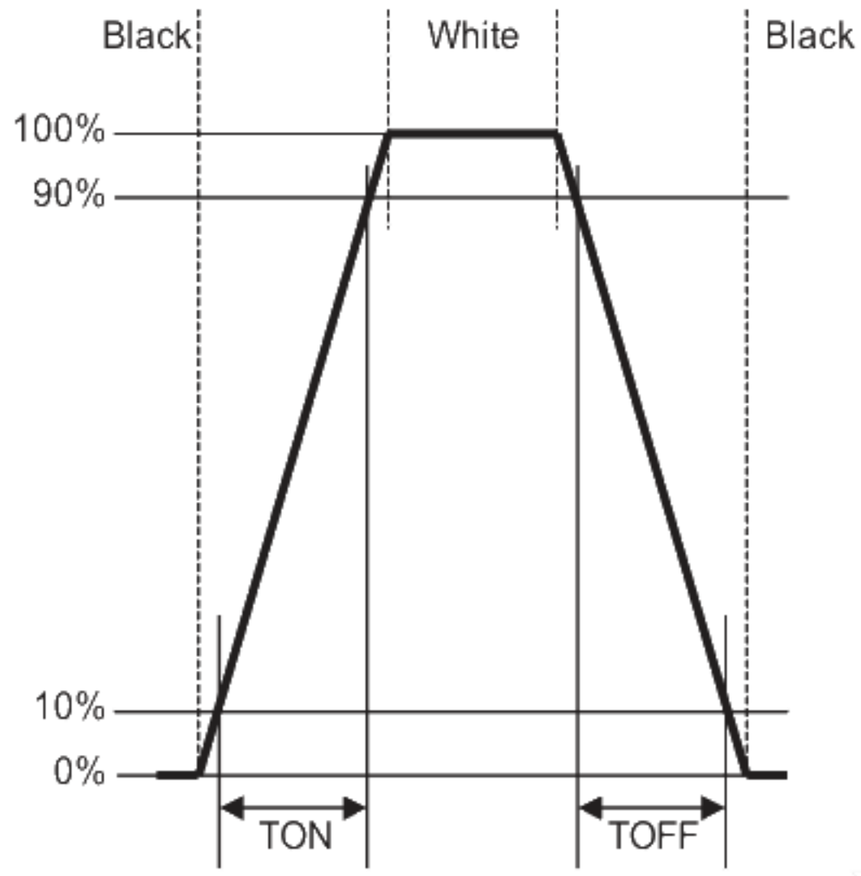
Measurement Condition (Contrast ratio Backlight OFF only)

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: 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] = 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