



Specification

COM35H3R07ULC

3.5" - 640 x 960 - MIPI

Spec Revision: 3.0 Revision Date: 29.01.2025

Note: This specification is subject to change without prior notice

Specifications for

Blanview TFT-LCD Monitor

(3.5" DVGA 640 x RGB x 960 Portrait)
Sunlight readable TFT-LCD Monitor

Version 3.0

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

MODEL COM35H3R07ULC

Signature :
Name :
Section :
Title:
Date :

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	Electronics Division

Technological Development Department IV

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Issue:Jan.29,2025

Version History

Ver.	Date	Page		Description
0.0	Oct.5,2022	_	-	Tentative issue
0.1	Dec.23,2022	P.7		3.1 Dimensions
			Add	Weight
Δ		P.13		7.1.3 Backlight
<u>/A\</u> ×6			Change	Forward current
			Add	Forward voltage
		P.24		12.1 Optical Characteristics
			Change	Backlight current
		P.25		12.2 Temperature Characteristics
			Change	Backlight current
		P.26		13.1 Defective Display and Screen Quality
			Change	Backlight current
		P.35		APPENDIX(1.Measurement Condition (Backlight ON))
			Change	Backlight current
1.0	Apr.12,2023	-	-	First issue
		P.12		7.1.1 Display Module
_			Add	Rating
<u>/B</u> \ _{×9}		P.13		7.1.3 Backlight
			Add	Rating
		P.24		12.1 Optical Characteristics
			Add	Specification
		P.25		12.2 Temperature Characteristics
			Add	Specification
		P.26		13.1 Defective Display and Screen Quality
			Add	Signal condition
		P.28		14. Reliability Test
			Add	number of failures / number of examinations
		P.30		15. Packing Specifications
			Add	Packing Specifications
		P.33		16.4 Storage Condition for Shipping Cartons
			Add	Maximum piling up
		P.34		16.5 Precautions for Peeling off the Protective film
			Add	Work Method
2.0	Feb.7,2024	All		All
1 .			Change	Company name font
∕C\ ×3		P.1		Cover
			Change	Department name
		P.17		7.2.4 Reset input timing
			Correct	Error correct
3.0	Jan.29,2025	P.1		Cover
1 ,			Add	Model specification
<u></u>			Change	Department name
		P.3		Contents
			Add	Item
		P.5		2.1 Features of the Product
			Change	Note
		P.6		<features blanview="" of=""></features>
			Change	Content
		P.24		12.2 About Sunlight readable
			Add	Content
	•		•	•



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1. Application

This Specification is applicable to 87.9 mm (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

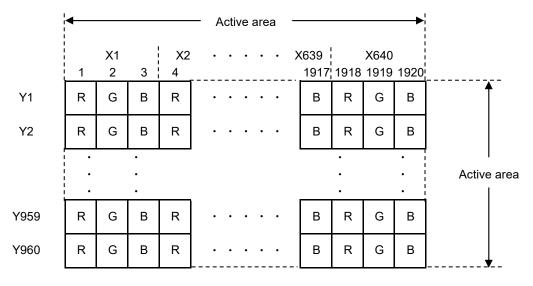
- 3.5 inch diagonal display, 640 x RGB [H] x 960 [V] dots.
- 24bitRGB (8-8-8 Format) / 16.7 Million colors.
- MIPI DSI as high-speed interface. Video mode only.
- Timing generator [TG], Counter-electrode driving circuitry, Built-in power supply circuit.
- Various display controls and functional selection.
- Blanview TFT-LCD, improved outdoor readability.
 - * MIPI : Mobile Industrial Processor Interface , DSI : Display Serial Interface

	Ind	Out	door	
	Readability Power Efficiency (Battery Life)		Readability	Power Efficiency (Battery Life)
Transmissive	Good	Good	Average	Poor
Transflective	Average	Poor	Good	Good
Blanview	Good	Good	Excellent	Excellent

2.2 Display Method

Items	Specifications	Remarks
Display type	VA 16.7 Million 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	MIPI DSI 4-lanes : 4 data lanes and 1 clock lane	in foot note 1
Backlight type	Long life & High bright white LED.	
NTSC Ratio	50%	

Foot note1: when use MIPI DSI 2-lanes, Please contact Toppan.



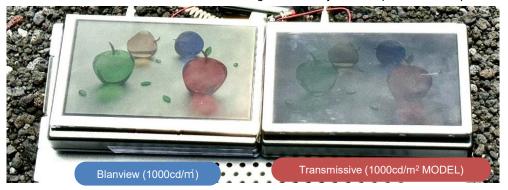
Dot arrangement (FPC cable placed low)

/D\

<Features of Blanview>

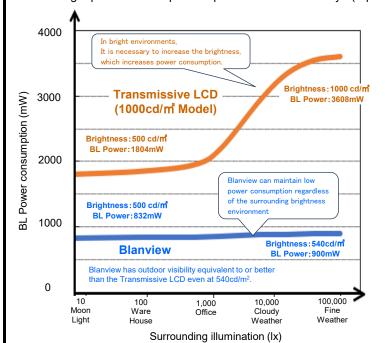
(A 7.0" WVGA display is shown as a typical sample)

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



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

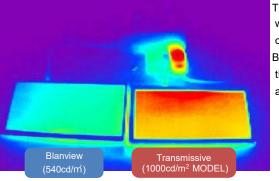
- * When compared at the same power consumption, Blanview's contrast at 100,000lx is more than two times higher than that of a transmissive LCD (1000cd/m² model). Blanview's contrast is 17.5, while that of a transmissive LCD is 7.5. Sunlight readability is Good with a contrast of 8 or higher on the TOPPAN index. (Contrast at 100,000lx is reference data.)
- Backlight power consumption required to assure visibility. (equivalent to 7.0"WVGA)



Sunlight Readable / BL Power comparison

	Sunlight Readable	BL Power	
Transmissive LCD (1000cd/㎡ Model)	Average	Poor	
Blanview	Excellent	Excellent	

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



*Observation image with thermograph

Transmissive LCD (1000cd/m² MODEL) consume a lot of power, which places a large load on the customer's power circuit, causing problems such as heat generation.

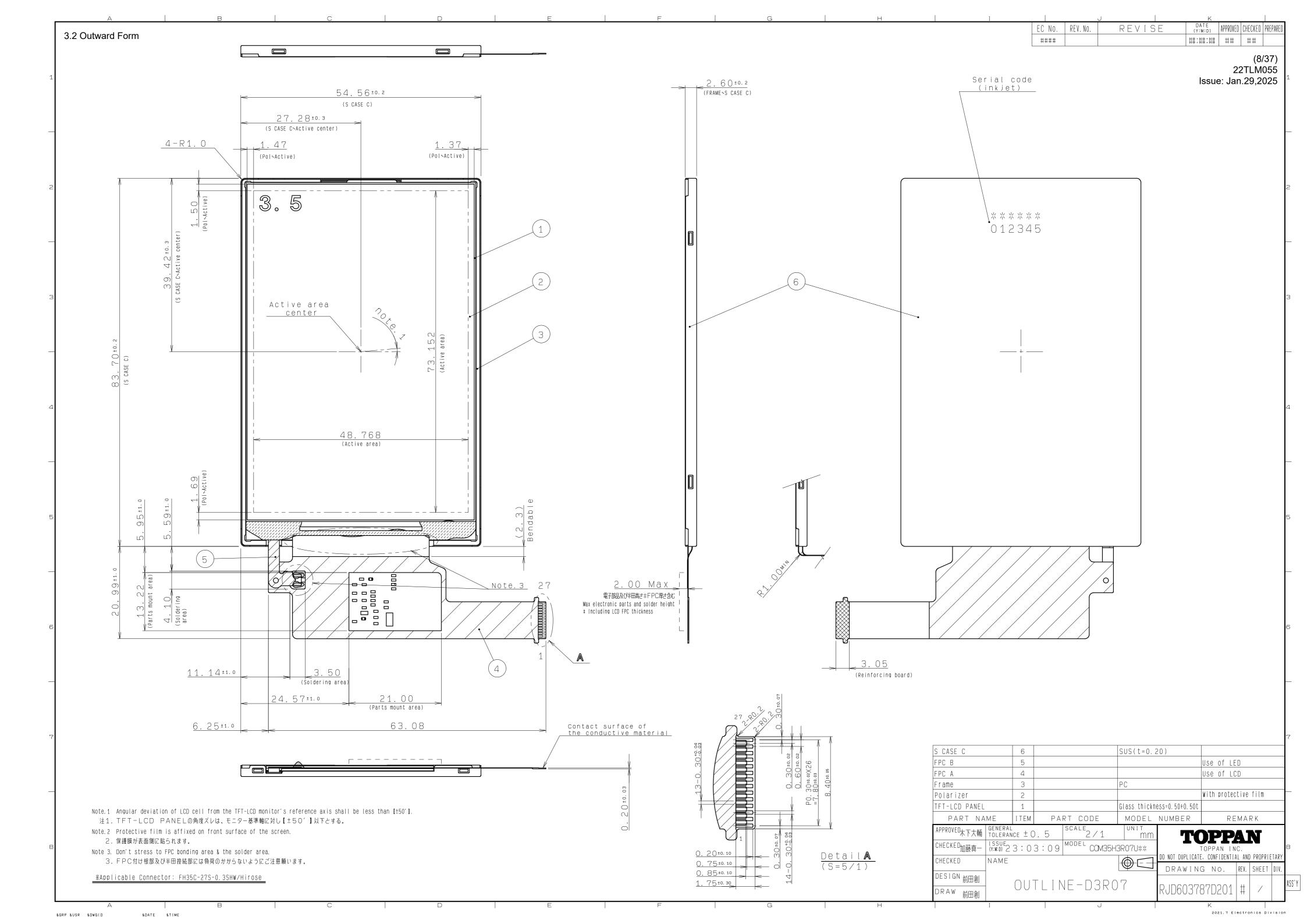
Blanview has low power consumption, so it places a low load on the customer's power supply circuit and does not cause any harmful effects such as heat generation.

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3. Dimensions and Shape

3.1 Dimensions

Items	Specifications	Unit	Remarks
Outline dimensions	54.56 [H] × 83.70 [V] ×2.60 [D]	mm	Exclude FPC cable
Active area	48.768 [H] × 73.152 [V]	mm	87.92mm diagonal
Number of dots	1920[H] × 960[V]	dot	
Dot pitch	25.4[H] × 76.2[V]	um	
Surface hardness of the polarizer	2	Н	Load: 4.9N
Weight	26.0	g	



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

*	*	****	*****
_	_		
а	b	С	d

	Contents of display				
а	The least significant d	ligit of manufacture yea	r		
b	Manufacture month	Jan-A	May-E	Sep-I	
		Feb-B	Jun-F	Oct-J	
		Mar-C	Jul-G	Nov-K	
		Apr-D	Aug-H	Dec-L	
С	Model code	35RNC (Made in Jap	oan)		
		35RPC (Made in Malaysia)			
d	Serial number				

- * Example of indication of Serial № print (S-print)
- · Made in Japan

2L35RNC000125

means "manufactured in December 2022, 3.5" RN type, C specifications, serial number 000125"

· Made in Malaysia

2L35RPC000125

means "manufactured in December 2022, 3.5" RP 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	Ю
1	VSS	Ground		Р
2	NC	Non connection		-
3	LED+	Backlight LED Anode		Р
4	NC	Non connection		-
5	LED-	Backlight LED Cathode		Р
6	VCC	Analog Power Supply	VCC = 2.9V (TYP)	Р
7	VSS	Ground		Р
8	IOVCC	DSI and I/O Power Supply	IOVCC = 1.8V (TYP)	Р
8	RESX	LCD Reset	L:Initialize , Power_ON Reset is Required when Turning on the Power	I
10	VSS	Ground		Р
11	TEST OUT	TEST Signal output	Test Pin. Please Open this pin	0
12	VSS	Ground		Р
13	D3P	MIPI-DSI Data differential signal pin (Data lane 3)		_
14	D3N	MIPI-DSI Data differential signal pin (Data lane 3)		I
15	VSS	Ground		Р
16	D2P	MIPI-DSI Data differential signal pin (Data lane 2)		_
17	D2N	MIPI-DSI Data differential signal pin (Data lane 2)		I
18	VSS	Ground		Р
19	СР	MIPI-DSI Clock differential signal pin		I
20	CN	MIPI-DSI Clock differential signal pin		I
21	VSS	Ground		Р
22	D1P	MIPI-DSI Data differential signal pin (Data lane 1)		I
23	D1N	MIPI-DSI Data differential signal pin (Data lane 1)		I
24	VSS	Ground		Р
25	D0P	MIPI-DSI Data differential signal pin (Data lane 0)		Ю
26	D0N	MIPI-DSI Data differential signal pin (Data lane 0)		Ю
27	VSS	Ground		Р

- Recommended connector: (FH35C-27S-0.3SHW(50)/HIROSE ELECTRIC)
- Please make sure to check a consistency between pin assignment in "3.2 Outward Form" and your connector pin assignment when designing your circuit.

 Inconsistency in input signal assignment may cause a malfunction.
- Since FPC cable has gold plated terminals, gilt finish contact shoe connector is recommended.

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5. Absolute Maximum Rating

VSS=0V

Item	Symbol	Condition	Ra	ting	Unit	Applicable terminal
			MIN	MAX		
Supply voltage	VCC	Ta=25 °C	-0.3	3.6	V	VCC
DSI and I/O Power Supply voltage	IOVCC		-0.3	3.6	V	IOVCC
Input voltage for logic	VI		-0.3	IOVCC+0.3	V	RESX
DSI Input voltage	VDSIIN		-0.3	2.0	V	D0P/N D2P/N D1P/N D3P/N CP/N
LED forward current	IL	Ta = 25 °C	-	35	mA	LED+ - LED-
		Ta = 70 °C	-	15		
Storage temperature range	Tstg		-30	80	°C	
Storage humidity range	Hstg	Non condensing moisture at or les				

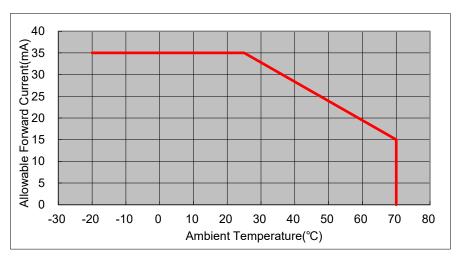
6. Recommended Operating Conditions

VSS=0V

Item	Symbol	Condition		Rating		Unit	Applicable terminal
			MIN	TYP	MAX		
Supply voltage	VCC		2.7	2.9	3.0	V	VCC
DSI and I/O Power Supply voltage	IOVCC		1.7	1.8	2.0	V	IOVCC
Input voltage for logic	VI		0	-	IOVCC	V	RESX
DSI Input voltage	VDSIIN		-0.15	-	1.45	V	D0P/N D2P/N D1P/N D3P/N CP/N
Operational temperature range	Тор	Note1,2	-20	25	70	°C	Panel surface temperature
Operating humidity range		Ta<=40 °C	20	-	85	%	
	Нор	Ta>40 °C		nsing in nental mois 0 °C 85%RI			

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

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



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7. Electrical Characteristics

7.1 DC Characteristics

7.1.1 Display Module

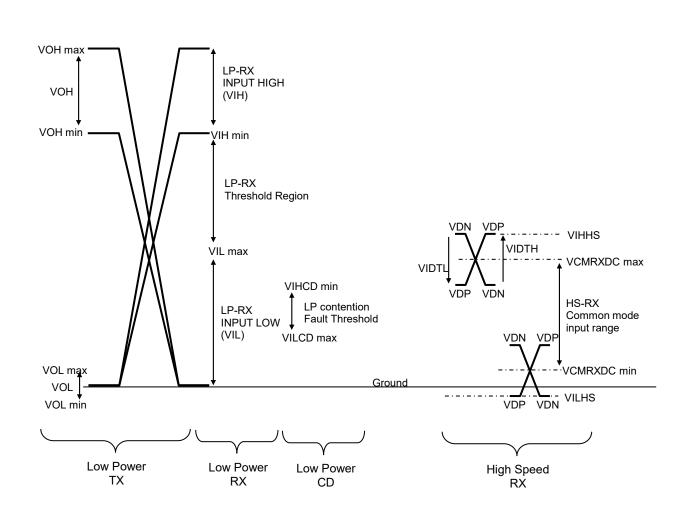
(Unless otherwise noted, Ta=25 °C,VCC=2.9V,IOVCC=1.8V,VSS=0V)

			(0, = 0, = 0,							
Item	Symbol	Condition		Rating		Unit	Applicable			
			MIN	TYP	MAX		terminal			
Input Signal	VIH	IOVCC=1.7-2.0V	0.7×IOVCC	-	IOVCC	V	RESX			
Voltage	VIL		0	-	0.3×IOVCC	V				
Operating	ICC	Still Image*	-	22	44	mA	VCC			
Current	ICCIO		-	17.5	35	mA	IOVCC			
Sleep_mode	ICCS	Clock/Data=LP11	-	50	100	uA	VCC			
Current	ICCIOS	Sleep_mode	_	75	200	uA	IOVCC			

^{*} A still image (color bar) on display, when accessing to the driver by MIPI DSI 4Lanes, 24-bit(RGB888).

7.1.2 MIPI DSI Interface

	Item	Symbol	Condition		Rating		Unit	Note
		-		MIN	TYP	MAX		
HS-RX	Differential input high threshold	VIDTH		-	-	70	mV	
	Differential input low threshold	VIDTL		-70	-	-	mV	
	Single-ended input high voltage	VIHHS		-	-	460	mV	
	Single-ended input low voltage	VILHS		-40	-	-	mV	
	Common-mode voltage HS receive mode	VCMRXDC		70	-	330	mV	
	Differential input impedance	ZID		80	100	125	Ohm	
LP-RX	Logic 1 input voltage	VIH		880	-	-	mV	
	Logic 0 input voltage	VIL		-	-	550	mV	
LP-TX	Thevenin output low level	VOL		-50	-	50	mV	
	Thevenin output high level	VOH		1.1	1.2	1.3	V	
	Output impedance of LP transmitter	ZOLP		110	-	-	Ohm	
CD-RX	Logic 1 contention threshold	VIHCD		450	-	-	mV	
	Logic 0 contention threshold	VILCD		-	-	200	mV	



The signal levels for the LP and HS.

7.1.3 Backlight

Item	Symbol	Condition		Rating		Unit	Applicable terminal
			MIN	TYP	MAX		
Forward current	IL25	Ta=25 °C		10	35	mA	LED+ - LED-
	IL70	Ta=70 °C			15	mA	
Forward voltage	VL	Ta=25 ℃	15.02 *	16.15 *	16.68 *	V	
(*Reference only)		IL=10.0mA					
Estimated Life	LL	Ta=25 ℃		50,000		hrs	
of LED		IL=10.0mA					
		Note					

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 HS-RX Specifications

AC-SPEC is the value in 24-bit (RGB888) mode. (Unless otherwise noted, Ta=25 °C,VCC=2.9V,IOVCC=1.8V,VSS=0V)

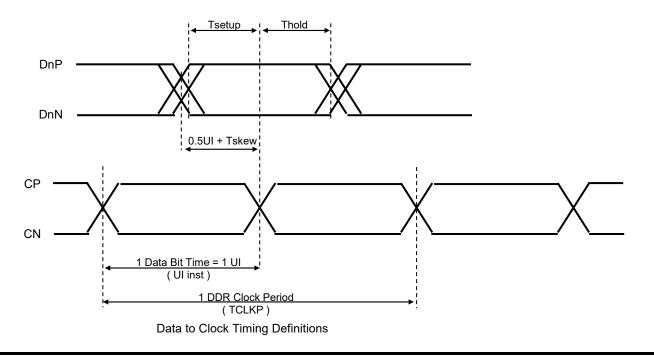
Item	Symbol	Condition		Rating		Unit	Applicable terminal
			MIN	TYP	MAX]	
DSICLK Frequency	f DSICLK	RGB888	40	-	250	MHz	CP/N
DSICLK Cycle time	TCLKP	(Packet	4.0	-	25.0	ns	
DSI Data Transfer Rate	UI	data type=3Eh)	2.0	-	12.5	ns	D0P/N,D1P/N
	t DSIR		80	-	500	Mbps	D2P/N,D3P/N
Data to Clock Setup Time	Tsetup		0.15	-	-	UI	D0P/N,D1P/N
Clock to Data Hold Time	Thold		0.15	-	-	UI	D2P/N,D3P/N
							CP/N

AC-SPEC is the value in 18-bit (RGB666) mode. (Unless otherwise noted, Ta=25 °C,VCC=2.9V,IOVCC=1.8V,VSS=0V)

710 01 20 10 110 Value	יון זום טונ (ויני	Booo) mede. (ei	HOOD CHICK	noo notoa, i	u 20 0, v	JO 2.0 V	1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0
Item	Symbol	Condition		Rating		Unit	Applicable terminal
			MIN	TYP	MAX		
DSICLK Frequency	f DSICLK	RGB666	40	-	170	MHz	CP/N
DSICLK Cycle time	TCLKP	(Packet	4.0	-	25.0	ns	
DSI Data Transfer Rate	UI	data type=1Eh)	2.0	-	12.5	ns	D0P/N,D1P/N
	t DSIR		80	-	340	Mbps	D2P/N,D3P/N
Data to Clock Setup Time	Tsetup		0.15	-	-	UI	D0P/N,D1P/N
Clock to Data Hold Time	Thold		0.15	-	-	UI	D2P/N,D3P/N
							CP/N

AC-SPEC is the value in 16-bit (RGB565) mode. (Unless otherwise noted, Ta=25 °C,VCC=2.9V,IOVCC=1.8V,VSS=0V)

Item	Symbol	Condition		Rating		Unit	Applicable terminal
			MIN	TYP	MAX		
DSICLK Frequency	f DSICLK	RGB565	40	-	150	MHz	CP/N
DSICLK Cycle time	TCLKP	(Packet	4.0	-	25.0	ns	
DSI Data Transfer Rate	UI	data type=0Eh)	2.0	-	12.5	ns	D0P/N,D1P/N
	t DSIR		80	-	300	Mbps	D2P/N,D3P/N
Data to Clock Setup Time	Tsetup		0.15	-	-	UI	D0P/N,D1P/N
Clock to Data Hold Time	Thold		0.15	-	-	UI	D2P/N,D3P/N
							CP/N



7.2.2 LP-TX Specifications

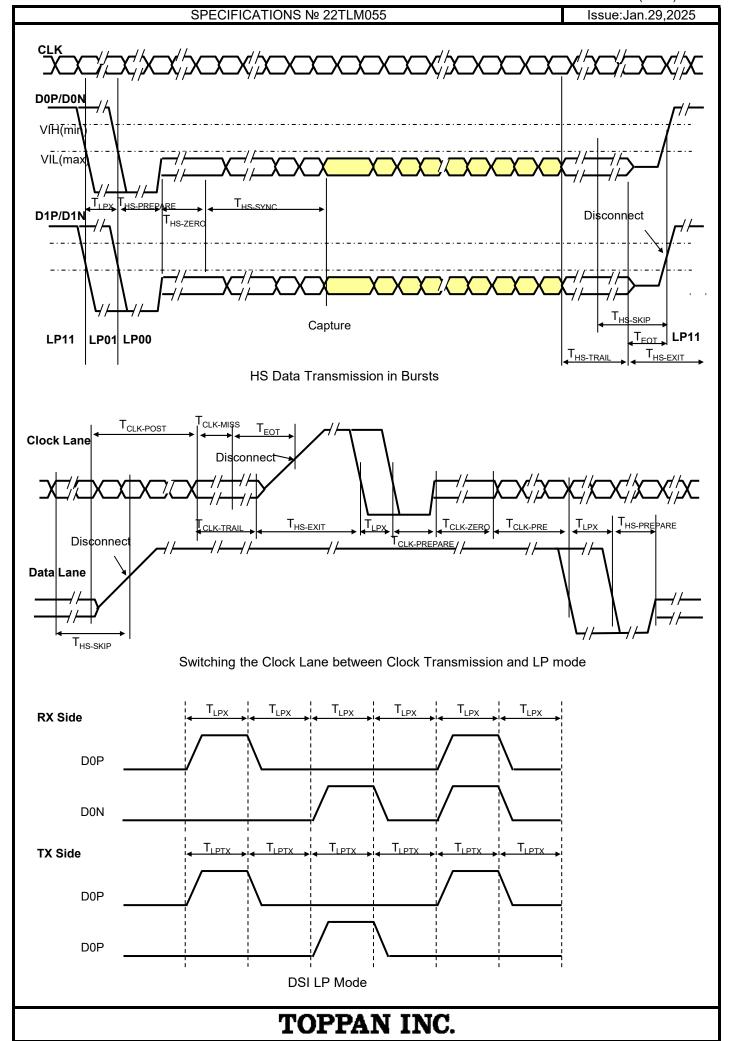
(Unless otherwise noted, Ta=25 °C,VCC=2.9V,IOVCC=1.8V,VSS=0V)

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
15% - 85% rise time	TRLP		-	-	25	ns	D0P/N
85% - 15% fall time	TFLP		-	-	25	ns	
Slew rate	ΔV / ⊿tSR	Cload = 70pF	-	-	150	mV/ns	

7.2.3 RX/TX Specifications

(Unless otherwise noted, Ta=25°C,VCC=2.9V,IOVCC=1.8V,VSS=0V)

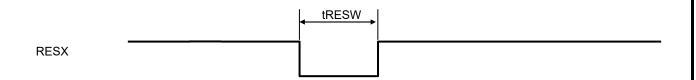
Item	Description	l	Rating	•	Unit
		MIN	TYP	MAX	
T _{HS-PREPARE}	Time to drive LP00 to prepare for HS transmission	40 ns + 4UI	-	85 ns + 6UI	
T _{HS-PREPARE} + T _{HS-ZERO}	T _{HS-PREPARE} + Time to drive HS0 before the SYNC sequence	145 ns +10UI	-	-	
T _{HS-TRAIL}	Time to drive flipped differential state after last payload data bit of a HS transmission burst	max(n*8UI,60 ns+n*4UI)	-	-	
T _{HS-EXIT}	Time to drive LP11 after HS burst	100	-	-	ns
T _{TA-GO}	Time to drive LP00 after Turnaround Request		4*T _{LPTX}		
T _{TA-SURE}	Time out before new TX side starts driving	TLPTX	-	2*T _{LPTX}	
T _{TA-GET}	Time to drive LP00 by new TX		5*T _{LPTX}		
T_LPX	Length of any Low Power state period	50	-	-	ns
Ratio T _{LPX}	Ratio of T _{LPX} (MASTER)/T _{LPX} (SLAVE) between Master and Slave side	2/3	-	3/2	
T _{CLK-POST}	Time that the transmitter shall continue sending HS clock after the last associated Data Lane has transitioned to LP mode	60 ns + 52UI	-	-	
T _{CLK-PREPARE} + T _{CLK-ZERO}	T _{CLK-PREPARE} +time for lead HS-0 drive period before starting Clock	300	-	-	ns
T _{CLK-PRE}	Time that the HS clock shall be driven prior to any associated Data Lane beginning the transition from LP to HS mode	8	-	-	UI
T _{CLK-PREPARE}	Time to drive LP-00 to prepare for HS clock transmission	38	-	95	ns
T _{CLK-TRAIL}	Time to drive HS differential state after last payload clock bit of a HS transmission burst	60	-	-	ns
T _{EOT}	Time from start of THS-TRAIL period to start of LP- 11 state	-	-	105 ns + n*12UI	
T _{LPTX1}	Length of Low-Power TX state period in case of using DSI clock	-	n*DSITX	-	UI
T _{LPTX2}	Length of Low-Power TX state period in case of using internal OSC clock	-	1/fosc	-	ns



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7.2.4 Reset input timing

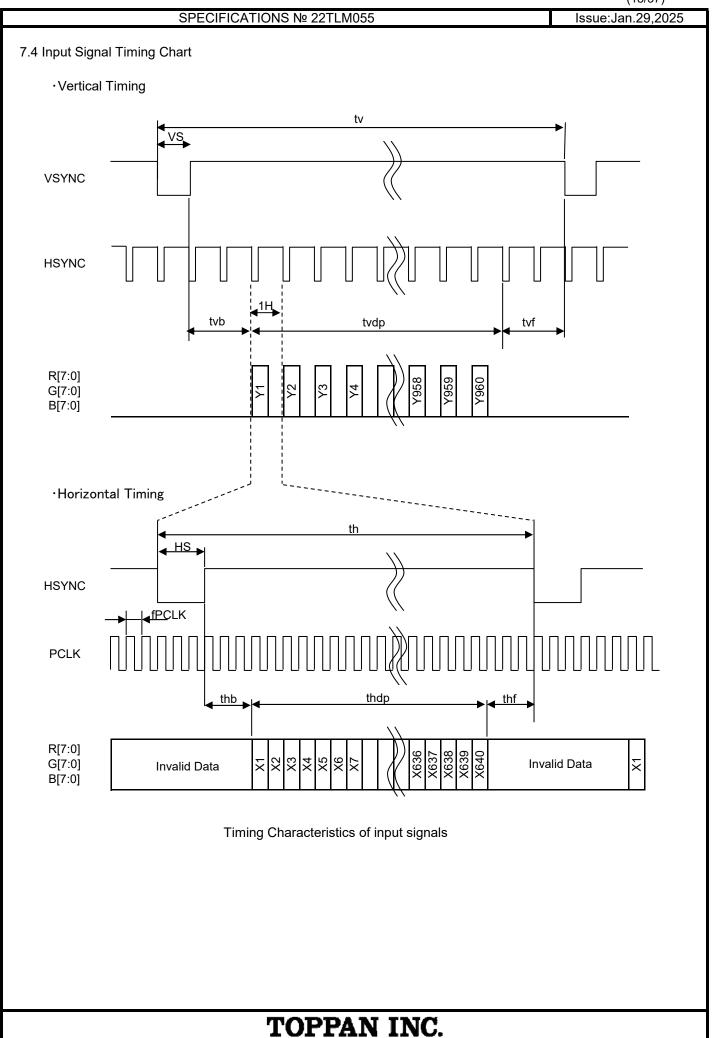
Item	Symbol	Condition		Rating	Unit	Remark	
			MIN	TYP	MAX]	
Reset Low Pulse width	tRESW		10	-	-	us	RESX



7.3 Input Timing Characteristics

Item	Symbol	Condition		Rating		Unit	Remark
			MIN	TYP	MAX		
CLK Frequency	fPCLK		42.86	43.45	-	MHz	PCLK
VSYNC Frequency Note	fVSYNC			60		Hz	VSYNC
VSYNC Cycle	tv		-	984	-	Н	
VSYNC Pulse Width	VS		-	2	-	Н	
Vertical Back Porch	tvb		-	14	-	Н]
Vertical Front Porch	tvf		-	8	-	Н	
Vertical data start Point	VS+tvb		-	16	-	Н	
Vertical Display Period	tvdp			960		Н	
HSYNC frequency	fHSYNC			59.04		kHz	HSYNC
HSYNC Cycle	th		726	736	-	CLK	
HSYNC Pulse Width	HS		30	36	-	CLK	
Horizontal Back Porch	thb		35	32	-	CLK	
Horizontal Front Porch	thf		21	28	-	CLK	
Horizontal data start Point	HS+thb		65	68	-	CLK	
Horizontal Blanking Period	HS+thb+thf		121	128	-	CLK]
Horizontal Display Period	thdp			640		CLK	

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



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8. About MIPI Interface

8.1 Version

The DSI incorporated in the LCD-Driver complies with the following standards.

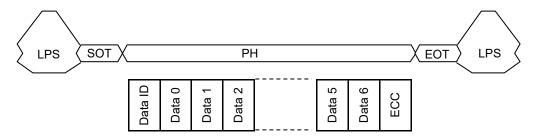
MIPI DSI : Version 1.1 MIPI D-PHY : Version 1.1

Data transfer mode: Video mode only. Virtual Channel: Set to VC[1:0]=00.

It is recommended to turn DSI_CLK off (LP mode) during the blanking period.

8.2 DSI protocol

- Short packets specify the payload length using the Data Type field and are from 2 to 9 bytes in length. Short packets is used for most Command Mode commands and associated parameters.

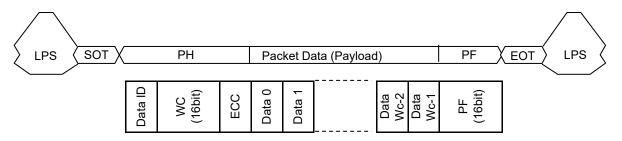


LPS : Low power state SOT : Start of Transmission PH : Packet Header

DI(Data ID): Contain Virtual Channel Identifier and Data Type

ECC: Error Correction Code

- Long packets specify the payload length using a two-byte Word Count field and then the payload maybe 0 to 65,541 bytes in length. Long packets permit transmission of large blocks of pixel or other data.



LPS : Low power state SOT : Start of Transmission PH : Packet Header

DI(Data ID): Contain Virtual Channel Identifier and Data Type WC(Word Count): The receiver use WC to define packet end.

ECC: Error Correction Code

PF(Packet Footer): Mean 16-bit Checksum.

8.3 Packet data types

LCD-Driver has the following restriction.

Generic short / Long Write Cmd is not supported.

It is only DCS Short / Long Write Cmd.

Processor to peripheral direction

Data Type Hex	Description	Size					
01 h	Sync Event , V Sync Start (01,00,00,07)	Short					
11 h	Sync Event , V Sync End (11,00,00,14)	Short					
21 h	Sync Event , H Sync Start (21,00,00,12)	Short					
31 h	Sync Event , H Sync End (31,00,00,01)	Short					
22 h	Shut Down Peripheral Command (22,00,00,1E)	Short					
32 h	Turn On Peripheral Command (32,00,00,0D)	Short					
05 h	DCS WRITE , no parameters	Short					
15 h	DCS WRITE , one parameters	Short					
06 h	DCS READ , no parameters	Short					
37 h	Set Maximum Return Packet Size	Short					
08 h	End of Transmission Packet (08,0F,0F,01)	Short					
09 h	Null Packet , no data	Long					
19 h	Blanking Packet , no data	Long					
39 h	DCS Long Write Command Packet	Long					
0E h	0E h Packed Pixel Stream , 16-bit RGB , 5-6-5 Format						
1E h	E h Packed Pixel Stream , 18-bit RGB , 6-6-6 Format						
2E h	Packed Pixel Stream , 18-bit RGB , 6-6-6 Format Loosely Packed Pixel Stream , 18-bit RGB ,6-6-6 Format Lo						
3E h							

Peripheral to processor direction

Data Type	Description	Size
Hex		
02 h	Acknowledge with Error Report	Short
1C h	DCS Long READ Response	Long

8.4 Packet Footer on the long packet

After Packet Data, Packet Footer is added in Long packet. Packet Footer adds CRC calculated from Packet Data as Checksum.

Checksum(2byte) = CRC(Packet Data) CRC = X^16 + X^12 + X^5 + X^0

9.Sequence

9.1 Power-ON Sequence

PH :Packet Header

9.1	ower-ON Seque	ence	Ph.Packet header				
No.		Function	DNC	Command /Parameter	Туре	Command/Parameter	
	Power on	VCC, IOVCC On					
	MIPI signal state	Keep CN/P, D0N/P, D1N/P D2N/P,D3N/P in STOP state LP-11 al state (Must be set to LP-11 is all lanes of MIPI before rising edge of RESX.)					
	Wait	wait 1 msec or more					
	H/W RESET	RESX=1					
	Wait	wait 10 msec or more					
1	SLEEP OUT	Sleep out	0	11h	PH	[05 11 00 36]	
	Wait	wait 200 msec or more					
2	DISPON	Display on	0	29h	PH	[05 29 00 1C]	
	Wait	wait 50 msec or more					
3	Video stream						

9.2 Power-OFF Sequence

No.		Function	DNC	Command /Parameter	Туре	Command/Parameter
1	DISPOFF	Display off	0	28h	PH	[05 28 00 06]
2	SLPIN	Sleep in	0	10h	PH	[05 10 00 2C]
	Wait	wait 120 msec or more				
3	Video signals	Video signals stop				
4	RESET	RESX off (low)				

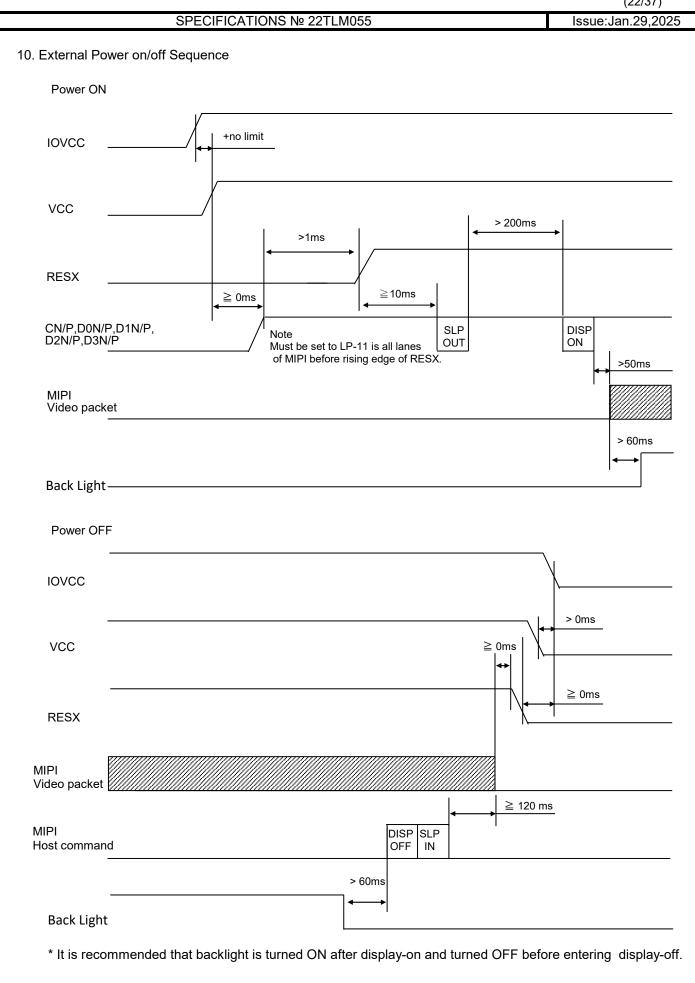
▼ Power off

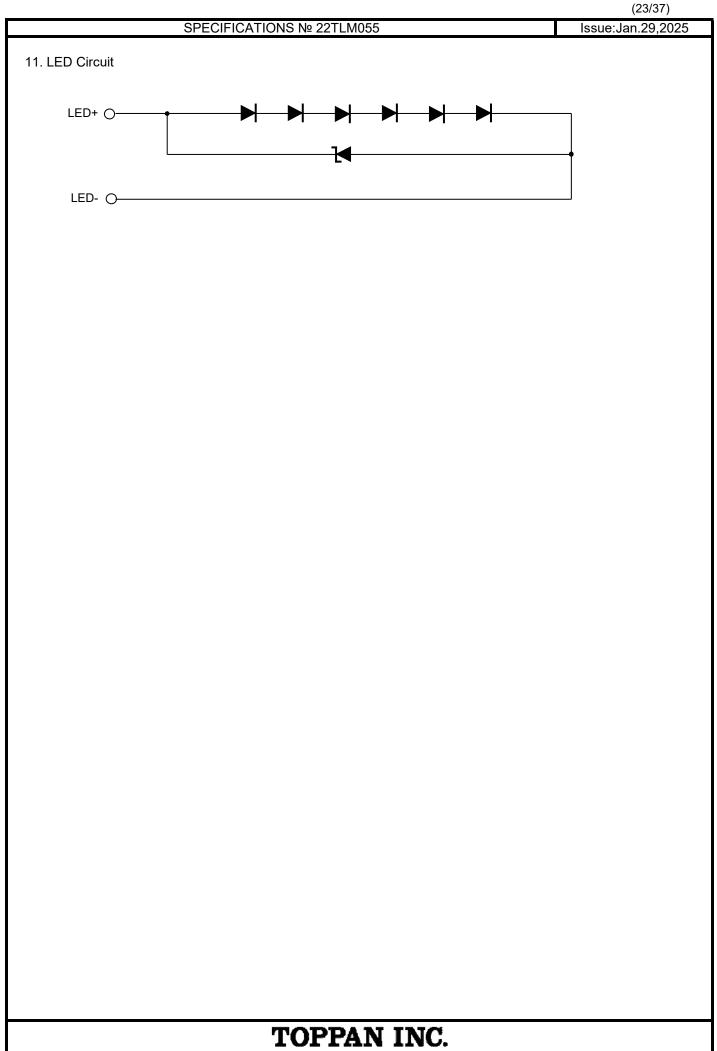
9.3 Sleep Sequence

No.	·	Function	DNC	Command /Parameter	Туре	Command/Parameter
1	SLPIN	Sleep in	0	10h	PH	[05 10 00 2C]
	Wait	wait 120 msec or more				
2	Video signals	Video signals stop			1	

9.4 Sleep Release Sequence

No.	·	Function	DNC	Command /Parameter	Туре	Command/Parameter
1	Video signals	Video signals start				
	Wait	wait 120 msec or more				
2	SLPOUT	Sleep out	0	11h	PH	[05 11 00 36]





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12. Characteristics

12.1 Optical Characteristics

(Measurement Condition)

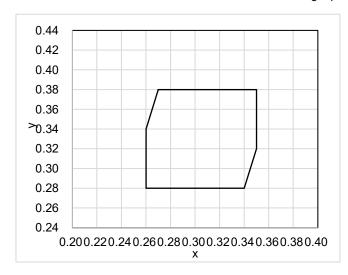
Measuring instruments: CS2000 (KONICA MINOLTA), LCD7200 (OTSUKA ELECTRONICS), EZcontrastXL88 (ELDIM)

Driving condition: VCC=2.9V,IOVCC=1.8V,VSS=0V, Optimized VCOMDC

Backlight: IL= 10.0 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← → FFh	-	1	100	ms	1	
Contrast ratio	Backlight ON	CR	[Data]= FFh / 00h	350	700	-		2	
So.	Backlight OFF			-	3.0	-			
D	Left	θL	[Data]=	80	-	-	deg	3	
Viewing angle	Right	θR	FFh / 00h	80	ı	ı	deg		
/je/	Up	φU	CR ≧ 10	80	ı	ı	deg		
	Down	φD		80	-	-	deg		
White	e Chromaticity	Х	[Data]= FFh	White chromaticity range			4		
		у							
Cente	er Brightness		[Data]= FFh	220	400	-	cd/m²	5	
Brightness distribution			[Data]= FFh	70	-	-	%	6	
Burn-in					eable burved afterpattern d	r 2 hours	-	7	

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



(White Chromaticity Range)

Х	у
0.27	0.38
0.26	0.34
0.26	0.28
0.34	0.28
0.35	0.32
0.35	0.38

White Chromaticity Range

12.2 About Sunlight readable

Item	Illuminance	Display visibility	Remarks
Sunlight readable	100,000 lx	Possible	Refer to <features blanview="" of=""></features>

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12.3 Temperature Characteristics

(Measurement Condition)

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

Driving condition: VCC=2.9V,IOVCC=1.8V,VSS=0V, Optimized VCOMDC

Backlight: IL= 10.0 mA

Item		Symbol	Specif	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 of should be observed.		

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13. Criteria of Judgment

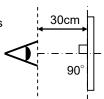
13.1 Defective Display and Screen Quality

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, A1h, FFh (3steps)

Observation distance: 30 cm

Illuminance: 200 to 350 lx Backlight: IL=10.0mA



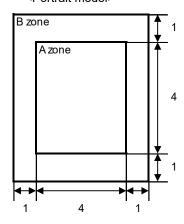
De	efect item	Defect content		Criteria
	Line defect	Black, white or color lin	ne, 3 or more neighboring defective dots	Not exists
Display Quality	Dot defect	TFT or CF, or dust is of (brighter dot, darker dot). High bright dot: Visible Low bright dot: Visible		Refer to table 1
		Invisible through 5% N	D filter at [Data]=00h	Acceptable
	Stain	Uneven brightness (wl	nite stain, black stain etc)	Invisible through 5% ND filter at Black screen. Invisible through 1% ND filter at other screen.
ΞĘ	Foreign	eign Point-like	0.25mm< φ	N=0
na	Foreign particle		0.20mm< φ ≦0.25mm	N≦2
S L			φ ≦0.20mm	Acceptable
Screen		Liner	3.0mm < length and 0.08mm < width	N=0
Sc			length \leq 3.0mm or width \leq 0.08mm	Acceptable
	Others			Use boundary sample for judgment when necessary

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

Table1

	High	Low	Dark		
Area	bright	bright	dot	Total	Criteria
	dot	dot			
Α	0	2	2	3	Permissible distance between same color bright dots
					(includes neighboring dots): 3 mm or more
В	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)

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13.2 Screen and Other Appearance

Testing conditions

Observation distance: 30 cm

Illuminance: 1200 \sim 2000 lx

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

Item	Appearance	Criteria	
Glass chipping	Corner area	$\begin{array}{l} a \leqq 3 \\ b \leqq 3 \\ c \leqq t \qquad (\text{ t: glass thickness}) \\ a,b \leqq 0.5 \text{ is acceptable} \\ n \leqq 2 \end{array}$	Unit : mm
	Others Progressive crack	$\begin{array}{l} a \leqq 5 \\ b \leqq 1 \\ c \leqq t \qquad (\text{ t: glass thickness}) \\ a,b \leqq 0.5 \text{ is acceptable} \\ \text{Maximum permissible number} \\ \text{of chipping off on a side is 5.} \\ \text{None} \end{array}$	Unit : mm

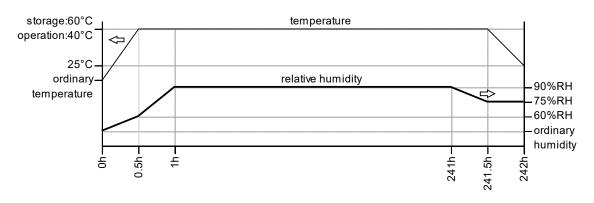
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14. Reliability Test

	Test item	Test condition	number of failures / number of examinations
	High temperature storage	Ta = 80°C 240hrs	0/3
	Low temperature storage	Ta = -40°C 240hrs	0/3
, t	High temperature &	Ta = 60°C, RH = 90%, 240hrs	0/3
Ě	high humidity storage	non condensing **	
Durability test	High temperature operation	Tp = 70°C 240hrs	0/3
Irab	Low temperature operation	Tp = -20°C 240hrs	0/3
≧	High temperature &	Tp = 40°C, RH = 90%, 240hrs	0/3
	high humidity operation	non condensing **	
	Thermal shock storage	-30°C ↔ 80°C (30min / 30min) 100cycles	0/3
	Electrostatic discharge test	Confirms to EIAJ ED-4701/300, C=200pF,R=0Ω,V=±200V	0/3
	(Non operation)	Each 3 times of discharge on and power supply	
	•	and other terminals.	
٠.	Surface discharge test	0/3	
tes	(Non operation)	Each 5 times of discharge in both polarities	
Mechanical environmental test			
ner	FPC tension test	Pull the FPC with the force of 3N for 10 sec.	0/3
onr		in the direction - 90-degree to its original direction.	
١٧i	FPC bend test	Pull the FPC with the force of 3N for 10 sec.	0/3
e e		in the direction -180-degree to its original direction.	
ica		Reciprocate it 3 times.	
har	Vibration test	Total amplitude 1.5mm, f=10∼55Hz,	0/3
Jec		X,Y,Z directions for each 2 hours	
=	Impact test	Use TOPPAN original jig (see next page) and	0/3
		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	
ס	Packing vibration-proof test Acceleration of 19.6m/s ² with frequency of 10→55→10Hz,		0 / 1 packing
cking est		X,Y, Zdirection for each 30 minutes.	
Packing test	Packing drop test	Drop from 75cm high.	0 / 1 packing
Ľ.		1 time to each 6 surfaces, 3 edges, 1 corner	

Note:Ta=ambient temperature

Tp=Panel temperature



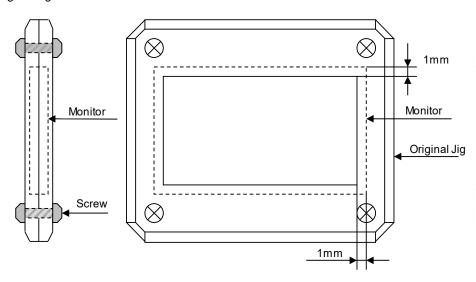
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Table2. Reliability Criteria

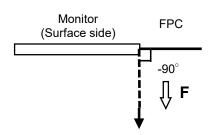
The parameters should be measured after leaving the monitor at the ordinary temperature for 24 hours or more after the test completion.

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

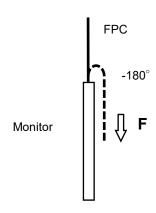
TOPPAN Original Jig



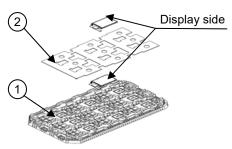
FPC tension test

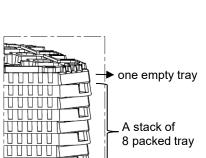


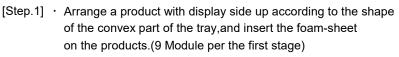
FPC bend test



15. Packing Specifications

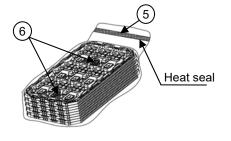


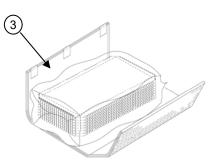


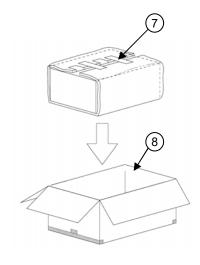


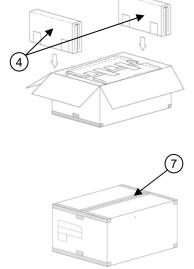
Arrange a product with display side up. (9 Module per the second stage)

- [Step.2] Each tray needs to be stacked with 180 degrees alternate to the tray under or over it and the trays be in a stack of 8.
 - One empty tray is to be put on the top of stack of 8 packed trays. when overlaying the tray, change the direction of 180.
- [Step.3] Moisture absorbers are to be placed at the Panel pocket on the top tray.
 - · Place the entire stacked tray in a sealing bag.
 - Vacuum and seal the sealing bag with the vacuum sealing machine.
- [Step.4] The stack of trays in the sealing bag is to be wrapped with B SHEET A.
- [Step.5] The wrapped trays are placed in the outer carton.
- [Step.6] · B SHEET B are to be inserted into the outer carton
- [Step.7] The outer carton is to be sealed in H-shape with packing tape
- [Step.8] The model number, quantity of products, and shipping date are to be printed on the carton.
 - If necessary, shipping labels or impression markings are to be put on the carton.









Remark: The return of packing materials is not required.

remark. The retain of packing materials is not required			
Packing item name		Specs., Materials	
1	Tray	A-PET (Antistatic material)	
2	Foam sheet	Antistatic Polyethylene	
3	B SHEET A	Antistatic air bubble sheet	
4	B SHEET B	Antistatic air bubble sheet	
(5)	Sealing bag		
6	Drier	Moisture absorber	
7	Packing tape		
8	Outer carton	Corrugated cardboard	

Dimension of extra outer carton		
D : Approx.	(356 mm)	
W : Approx.	(664 mm)	
H : Approx.	(182 mm)	
Quantity of products packe	d in one carton:	144
Gross weight : Approx.	6.4 kg	

16. Handling Instruction

16.1 Cautions for Handling LCD panels

Ŵ

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.

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16.2 Precautions for Handling

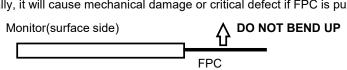
 Wear finger tips at incoming inspection and for handling the TFT monitors to keep display quality and keep the working area clean.

Do not touch the surface of the monitor as it is easily scratched.

- 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.
- Do not stain or damage the contacts of the FPC cable .
 FPC cable needs to be inserted until it can reach to the end of connector slot.
 During insertion, make sure to keep the cable in a horizontal position to avoid an oblique insertion.
 Otherwise, it may cause poor contact or deteriorate reliability of the FPC cable.
- 7) Do not bend or pull the FPC cable or carry the TFT monitor by holding the FPC cable.

 Especially, it will cause mechanical damage or critical defect if FPC is pull up or bent up to short of display.



- 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

- 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.

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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° CHumidity 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.

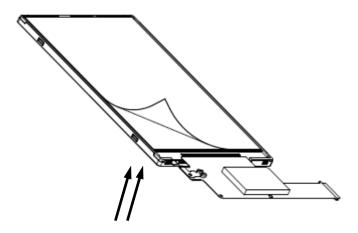
A) Work Environment

- 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 left when FPC 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)

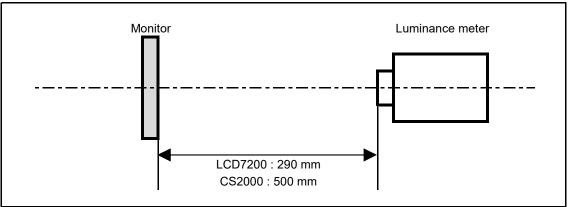
Driving condition: Refer to the section "Optical Characteristics"

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

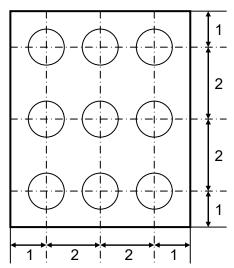


^{*}Measurement is made after 30 minutes of lighting of the backlight.

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=10.0mA

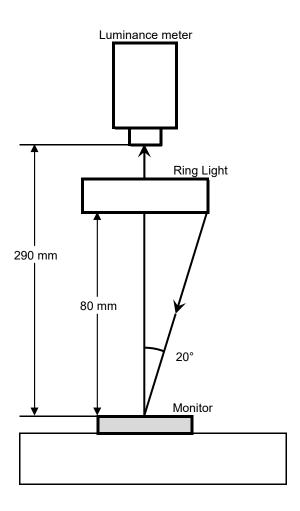
Measurement Condition (Contrast ratio Backlight OFF only)

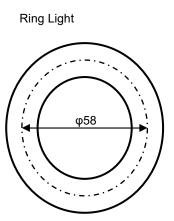
Measuring instruments: LCD7200(OTSUKA ELECTRONICS), Ring Light (40,000 lx, ϕ 58)

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





	SPECIFICATIONS № 22TLM055			
2. Test		l e		- - 1
Notice	Item	Test method	Measuring	Remark
1	Response	Measure output signal waveform by the luminance	instrument LCD7200	Black display
'	time	meter when raster of window pattern is changed from	LOD7200	[Data]=00h
	unic	white to black and from black to white.		White display
		Black White Black		[Data]=FFh
				TON
		100%		Rise time
		90%		TOFF
				Fall time
		10%		
		0%		
		TON		
2	2 Contrast ratio	Measure maximum luminance Y1([Data]=FFh) and	CS2000	Backlight ON
		minimum luminance Y2([Data]=00h) at the center of	LCD7200	Backlight OFF
		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: 7.5mmq(C32000)		
3	Viewing angle Move the luminance meter from right to left and up		EZcontrastXL88	
	l	and down and determine the angles where		
	Horizontalθ	contrast ratio is 10.		
	Verticalφ			
4	White	Measure chromaticity coordinates x and y of CIE1931	CS2000	
	chromaticity	colorimetric system at [Data] = FFh		
		Color matching function: 2°view		
		measurement angle: 1°		
5	g and a second s		CS2000	
3			032000	
6		(Brightness distribution) = 100 x B/A %	CS2000	
	_	, -	002000	
		B : min. brightness of the 9 points		
7	Burn-in	Visually check burn-in image on the screen		At optimized
		after 2 hours of "window display" ([Data]=00h/FFh).		VCOMDC
6	brightness Brightness distribution	(Brightness distribution) = 100 x B/A % A: max. brightness of the 9 points B: min. brightness of the 9 points Visually check burn-in image on the screen	CS2000	

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