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SPECIFICATION

DEVICE SPECIFICATION for
TFT LCD Module
(1080× RGB × 1920 dots)

Model No.

LS047T1SC02

□CUSTOMER'S APPROVAL

DATE

BY

PRESENTED BY For
H. Watatani

H.WATATANI
GENERAL MANAGER
DEVELOPMENT DEPT. I DESIGN CENTER I
LCD DESIGN DEVELOPMENT
DISPLAY DEVICE BUSINESS GROUP
SHARP (CHINA) INVESTMENT CO.,LTD.

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[For handling and system design]

(1) Do not scratch the surface of the polarizer film as it is easily damaged.

(2) If the cleaning of the surface of the LCD panel is necessary, wipe it swiftly with cotton or other soft cloth. Do not use organic solvent as it damages polarizer.

(3) Water droplets on polarizer must be wiped off immediately as they may cause color changes, or other defects if remained for a long time.

(4) Since this LCD panel is made of glass, dropping the module or banging it against hard objects may cause cracks or fragmentation.

(5) Epoxy resin (amine series curing agent), silicone adhesive material (dealcoholization series and oxime series), tray forming agent (azo compound) etc, in the cabinet or the packing materials may induce abnormal display with polarizer film deterioration regardless of contact or noncontact to polarizer film.
Check carefully that gas from materials used in system housing or packaging do not hart polarizer. Be sure to confirm the component of them.

(6) Liquid crystal material will freeze below specified storage temperature range and it will not get back to normal quality even after temperature comes back within specified temperature range. Liquid crystal material will become isotropic above specified temperature range and may not get back to normal quality. Keep the LCD module always within specified temperature range.

(7) Do not expose LCD module to the direct sunlight or to strong ultraviolet light for long time.

(8) If the LCD driver IC (COG) is exposed to light, normal operation may be impeded. It is necessary to design so that the light is shut off when the LCD module is mounted.

(9) Do not disassemble the LCD module as it may cause permanent damage.

(10) As this LCD module contains components sensitive to electrostatic discharge, be sure to follow the instructions in below.

① Operators

Operators must wear anti-static wears to prevent electrostatic charge up to and discharge from human body.

② Equipment and containers

Process equipment such as conveyer, soldering iron, working bench and containers may possibly generate electrostatic charge up and discharge. Equipment must be grounded through 100Mohms resistance. Use ion blower.

③ Floor

Floor is an important part to leak static electricity which is generated from human body or equipment.
There is a possibility that the static electricity is charged to them without leakage in case of insulating floor, so the countermeasure (electrostatic earth:$1\times10^{8}\Omega$) should be made.

④Humidity

Proper humidity of working room may reduce the risk of electrostatic charge up and discharge. Humidity should be kept over 50% all the time.

⑤Transportation/storage

Storage materials must be anti-static to prevent causing electrostatic discharge.

⑥Others

Protective film is attached on the surface of LCD panel to prevent scratches or other damages. When removing this protective film, remove it slowly under proper anti-ESD control such as ion blower.

(11) Hold LCD very carefully when placing LCD module into the system housing. Do not apply excessive stress or pressure to LCD module. Do not to use chloroprene rubber as it may affect on the reliability of the electrical interconnection.

(12) Do not hold or touch LCD panel to flex interconnection area as it may be damaged.

(13) As the binding material between LCD panel and flex connector mentioned in 12) contains an organic material, any type of organic solvents are not allowed to be used. Direct contact by fingers is also prohibited.

(14) When carrying the LCD module, place it on the tray to protect from mechanical damage. It is recommended to use the conductive trays to protect the CMOS components from electrostatic discharge. When holding the module, hold the Plastic Frame of LCD module so that the panel, COG and other electric parts are not damaged.

(15) Do not touch the COG‘s patterning area. Otherwise the circuit may be damaged.

(16) Do not touch LSI chips as it may cause a trouble in the inner lead connection.

(17) Place a protective cover on the LCD module to protect the glass panel from mechanical damages.

(18) LCD panel is susceptible to mechanical stress and even the slightest stress will cause a color change in background and pooling. So make sure the LCD panel is placed on flat plane without any continuous twisting, bending or pushing stress.

(19) Protective film is placed onto the surface of LCD panel when it is shipped from factory. Make sure to peel it off before assembling the LCD module into the system. Be very careful not to damage LCD module by electrostatic discharge when peeling off this protective film. Ion blower and ground strap are recommended.

(20) Make sure the mechanical design of the system in which the LCD module will be assembled matches specified viewing angle of this LCD module.

(21) This LCD module does not contain nor use any ODS (1,1,1-Trichloroethane, CCL4), CFCS, Carbon tetrachloride, Halon in all materials used, in all production processes.

(22) Do not bend FPC in PC5500 area. In LCM manufacturing, crack might be caused in PC5500.

(23) SHARP strongly recommend to use OCA as glue between LCD and touch window in case of direct bonding.
If the customer use liquid glue as UV resin by direct bonding, it can easily cause chemical crack on polarizer film layers.

(24) LCD module is structurally very thin, therefore, please sustain the surface of polarizer.
(We recommend touch panel to be directly adhered by OCA tape.)

[For operating LCD module]

(1) Do not operate or store the LCD module under outside of specified environmental conditions.

(2) At the shipment, adjust the contrast of each LCD module with electric volume. LCD contrast may vary from panel to panel depending on variation of LCD power voltage from system.

(3) As opt-electrical characteristics of LCD will be changed, dependent on the temperature, the confirmation of display quality and characteristics has to be done after temperature is set at 25 °C and it becomes stable.

[Precautions for Storage]

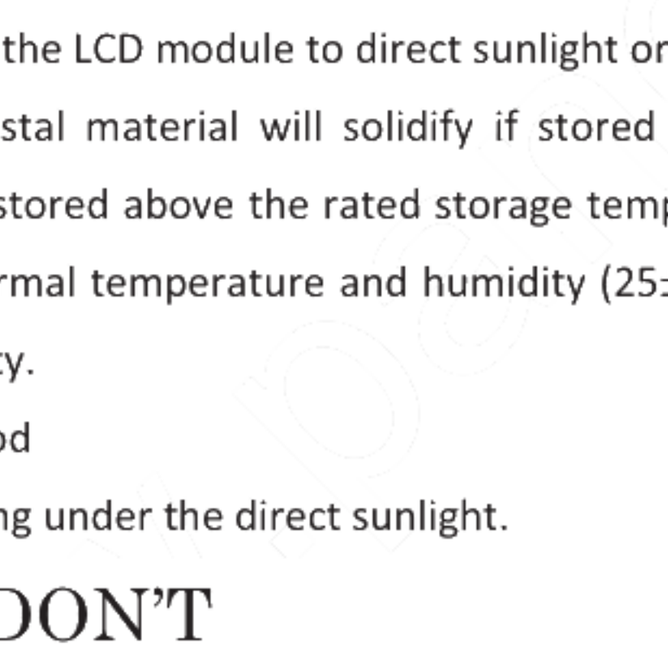
(1) Do not expose the LCD module to direct sunlight or strong ultraviolet light for long periods. Store in a dark place.

(2) The liquid crystal material will solidify if stored below the rated storage temperature and will become an isotropic liquid if stored above the rated storage temperature, and may not retain its original properties. Only store the module at normal temperature and humidity (25±5°C,60±10%RH) in order to avoid exposing the front polarizer to chronic humidity.

(3) Keeping Method

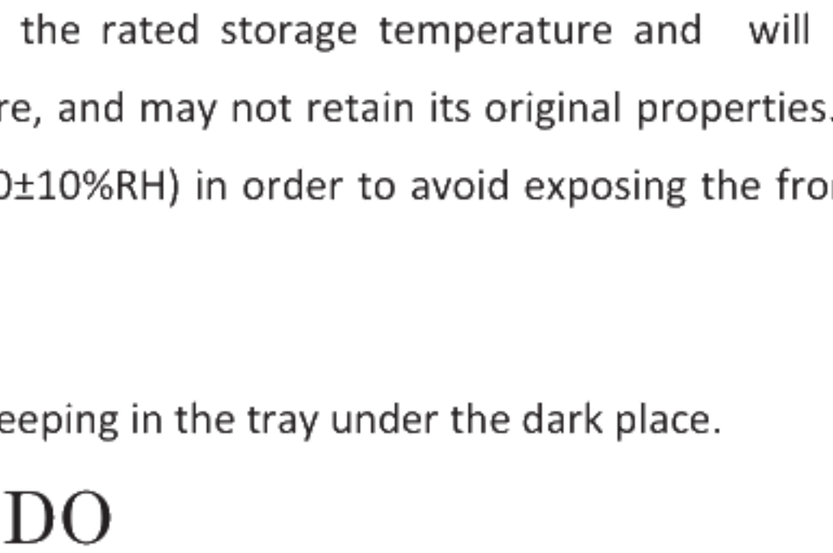
a. Don't keeping under the direct sunlight.

DON'T



b. Keeping in the tray under the dark place.

DO



(4) Do not operate or store the LCD module under outside of specified environmental conditions.

(5) Be sure to prevent light striking the chip surface.

[Other Notice]

(1) Do not operate or store the LCD module under outside of specified environmental conditions.

(2) As electrical impedance of power supply lines (AVDD/IOVCC-GND) are low when LCD module is working, place the de-coupling capacitor nearby LCD module as close as possible.

(3) Reset signal must be sent after power on to initialize LSI. LSI does not function properly until initialize it by reset signal.

(4) Generally, at power on, in order not to apply DC charge directly to LCD panel, supply logic voltage first and initialize LSI logic function including polarity alternation. Then supply voltage for LCD bias. At power off, in order not to apply DC charge directly to LCD panel, execute Power OFF sequence and Discharge command.

(5) Don't touch to FPC surface, exposed IC chip, electric parts and other parts, to any electric, metallic materials.

(6) No bromide specific fire-retardant material is used in this module.

(7) Do not display still picture on the display over 2 hours as this will damage the liquid crystal.

(8) U/V glue (Liquid OCA) should not be attached on upper polarizer edge, when customer laminate cover glass and touch panel on LCD.

[Precautions for Discarding Liquid Crystal Modules]

COG: After removing the LSI from the liquid crystal panel, dispose of it in a similar way to circuit boards from electronic devices.

LCD panel: Dispose of as glass waste. This LCD module contains no harmful substances. The liquid crystal panel contains no dangerous or harmful substances. The liquid crystal panel only contains an extremely small amount of liquid crystal (approx.100mg) and therefore it will not leak even if the panel should break.

-Its median lethal dose (LD50) is greater than 2,000 mg/kg and a mutagenetic (Aims test: negative) material is employed.

FPC: Dispose of as similar way to circuit board from electric device.

1. Application

This data sheet is to introduce the specification of LS047T1SC02 active matrix 16,777,216colors LCD module.

LCD module is controlled by Driver IC RSP R63417 (with RAM).

If any problem occurs concerning the items not stated in this specification, it must be solved sincerely by both parties after deliberation.

As to basic specification of driver IC refer to the IC specification and handbook.

2. Construction and Outline

This module is a color transmissive, high contrast, wide viewing angle and active matrix LCD module incorporating CG-Silicon TFT (Continuous Grain-Silicon Thin Film Transistor).

Construction: LCD panel, Driver (COG), FPC with electric components, 11 white LEDs, prism sheet, diffuser, light guide, reflector, plastic frame and metal frame to fix them mechanically.

Outline: See page 20(Fig.2 Outline Dimensions)

User side connection: Board to Board Connector (Panasonic, AXE540124)

There shall be no scratches, stains, chips, distortions and other external drawbacks that may affect the display function.

Rejection criteria shall be noted in Inspection Standard.

3. Mechanical (Physical) Specifications

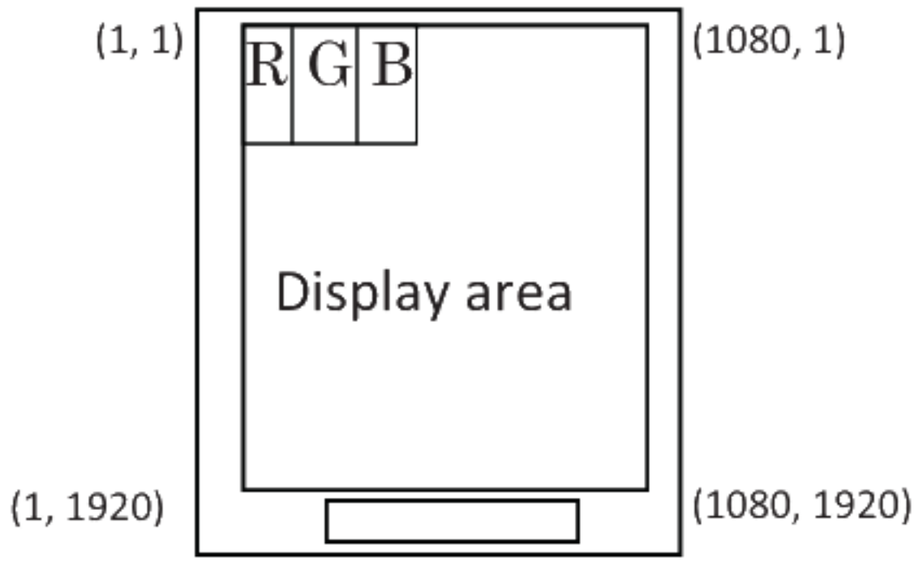
Table1

Item	Specifications	Unit	Remarks
Screen size	11.8296 (4.66” type) Diagonal	cm	
Active area	57.996(H)X103.14(V)	mm	
Pixel format	1080(H)×1920(V)	Pixel	
	1 Pixel =R+G+B dots	-	
Pixel pitch	0.0179(H) x 0.0537(V)	mm	
Pixel configuration	R,G,B vertical stripes	-	
Display mode	Normally Black	-	
LDC Driving method	DC Driving / 3Column Inversion	-	
Liquid Crystal Mode	New Mode2	-	
Number of colors	16,777,216	Colors	24bits
Outline dimensions	60.4(W)×112.2 (H)×1.38(D) TYP	mm	*1
Mass	About 19	g	

*1: The above-mentioned table indicates module sizes without some projections and FPC.

For detailed measurements and tolerances, please refer to Fig.2 Outline Dimensions.

4. Pixel Configuration



5. Input Terminal Names and Functions

Table2

Pin No.	Symbol	I/O	Description	Remarks
1	LED2-	-	LED back light power group2 negative	
2	LED1-	-	LED back light power group1 negative	
3	LED2+	-	LED back light power group2 positive	
4	LED1+	-	LED back light power group1 positive	
5	GND	-	Ground	
6	AVDD	-	Power supply for analog(+5.0V)	
7	GND	-	Ground	
8	AVEE	-	Power supply for analog(-5.0V)	
9	GND	-	Ground	
10	IOVCC	-	Power supply for I/O(1.8V)	
11	ID0（IOVCC）	-	ID code	ID0=”1”
12	ID1（GND）	-	ID code	ID1=”0”
13	RESET	I	Device reset signal	“L” Active
14	GND	-	Ground	
15	TE	O	Tearing signal output from driver IC	
16	GND	-	Ground	
17	LEDPWM	-	Backlight LED driver PWM	
18	GND	-	Ground	
19	CTP_SDA	-	TP pin	
20	CTP_SCL	-	TP pin	
21	CTP_INT	-	TP pin	
22	CTP_REST	-	TP pin	
23	CTP_VDD_1.8V	-	TP pin	
24	CTP_VCC_2.8V	-	TP pin	
25	GND	-	Ground	
26	DSI_D3-	I	MIPI data3 negative signal	
27	DSI_D3+	I	MIPI data3 positive signal	
28	GND	-	Ground	
29	DSI_D0-	I/O	MIPI data0 negative signal	
30	DSI_D0+	I/O	MIPI data0 positive signal	
31	GND	-	Ground	
32	DSI_CLK-	I	MIPI clock negative signal	
33	DSI_CLK+	I	MIPI clock positive signal	
34	GND	-	Ground	
35	DSI_D1-	I	MIPI data1 negative signal	

36	DSI_D1+	I	MIPI data1 positive signal	
37	GND	-	Ground	
38	DSI_D2-	I	MIPI data2 negative signal	
39	DSI_D2+	I	MIPI data2 positive signal	
40	GND	-	Ground	

LCD side connector : AXE640124

6. Absolute Maximum Ratings

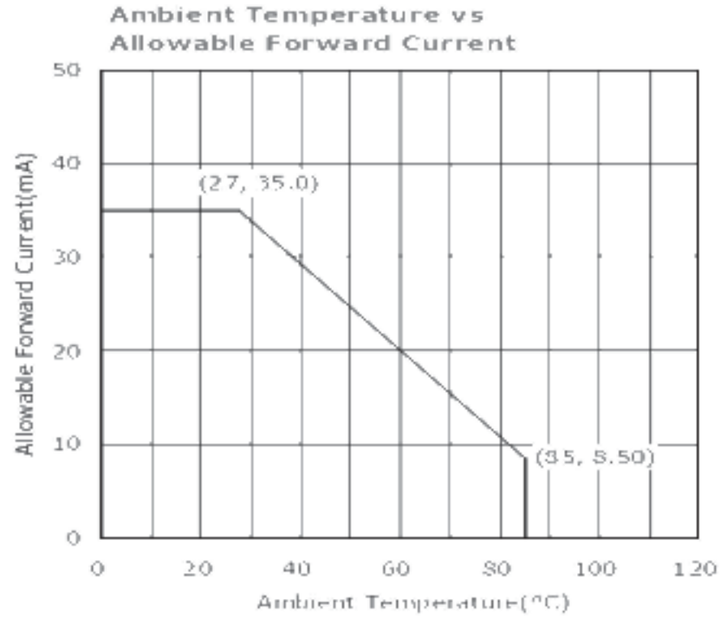
Table 3 GND=0V

Parameter	Symbol	Conditions	Rated value	Unit	Remarks
Driver IC (Positive Analog) Power Supply Voltage	AVDD	Ta=+25℃	-0.3 ~ +6.5	V	【Note6-1】
Driver IC (Negative Analog) Power Supply Voltage	AVEE	Ta=+25℃	+0.3 ~ -6.5	V	【Note6-1】
Driver IC (Digital) Power Supply Voltage	IOVCC	Ta=+25℃	-0.3 ~ +4.6	V	【Note6-1】
Temperature for storage	Tstg	-	-30 ~ +70	℃	【Note6-2】
Temperature for operation	Topr	-	-20 ~ +60	℃	【Note6-2】
LED Input electric current	ILED	Ta=+25°C	25	mA	【Note6-3】

【Note6-1】 Voltage applied to GND pins. GND pin conditions are based on all the same voltage (0V). Always connect all GND externally and use at the same voltage.

【Note6-2】 Humidity : 95%RHMax.(at Ta≤40°C). Maximum wet-bulb temperature is less than 39°C(at Ta>40°C). Condensation of dew must be avoided.

【Note6-3】 Ambient temperature and the maximum input are fulfilling the following operating conditions.



7. Electrical Characteristics

7-1. TFT-LCD Panel Driving Section

Table 4 GND=0V

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Driver IC(Positive Analog) Power Supply Voltage	AVDD	4.75	5.00	5.25	V	【Note7-1】
Driver IC(Negative Analog) Power Supply Voltage	AVEE	-4.75	-5.00	-5.25	V	【Note7-1】
Driver IC(Digital) Power Supply Voltage	IOVCC	1.71	1.80	3.30	V	【Note7-1】
Input voltage (Low)	V_{IL}	0	-	0.3IOVDD	V	【Note7-2】
Analog voltage ripple noise	AVDDn	-	-	100	mV	
Input voltage (High)	V_{IH}	0.7IOVDD	-	IOVDD	V	【Note7-2】
Input current (Low)	I_{IL}	-10	-	-	μA	
Input current (High)	I_{IH}	-	-	10	μA	
Output voltage (Low)	V_{oL}	0	-	0.2IOVDD	V	I_{oL}=+0.1mA
Output voltage (High)	V_{oH}	0.8IOVDD	-	IOVDD	V	I_{oH}=-0.1mA
Current consumption (*1)	$I_{AVDD\ 1}$	-	8.4	12.9	mA	【Note7-3】 White
	$I_{AVEE\ 1}$	-	5.8	8.7	mA	【Note7-3】 White
	$I_{IOVCC\ 1}$	-	10.6	15.9	mA	【Note7-3】 White
	$I_{AVDD\ 2}$	-	8.3	-	mA	【Note7-4】 Black
	$I_{AVEE\ 2}$	-	4.8	-	mA	【Note7-4】 Black
	$I_{IOVCC\ 2}$	-	10.3	-	mA	【Note7-4】 Black

【Note7-1】 Include Ripple Noise

【Note7-2】 Applied overshoot

【Note7-3】 Measurement Conditions: Full screen white pattern, AVDD=5.00V, AVEE=-5.00V,IOVCC=1.80V, Still image (Command mode)

【Note7-4】 Measurement Conditions : Full screen black pattern, AVDD=5.00V, AVEE=-5.00V, IOVCC=1.80V, Still image (Command mode)

7-2. Back Light Driving Section

Table 5 Ta=+25°C, GND=0V

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
LED Voltage	V_{LED}	-	(14.5+17.4)	16.5+19.8	V	【Note7-6】
LED Current	I_{LED}	-	20	-	mA	
Power Consumption	W_{LED}	-	(638)	-	mW	【Note7-7】
LED Quantity		11			pcs	
LED Rank		Brightness: (NW800~)			-	NSSW206C
		Chromaticity: (Sa621/Sa622)			-	

【Note7-6】 at I_{LED}=20mA , 5serial/6serial 2Parallel

*Please consider Allowable Forward Current on used temperature

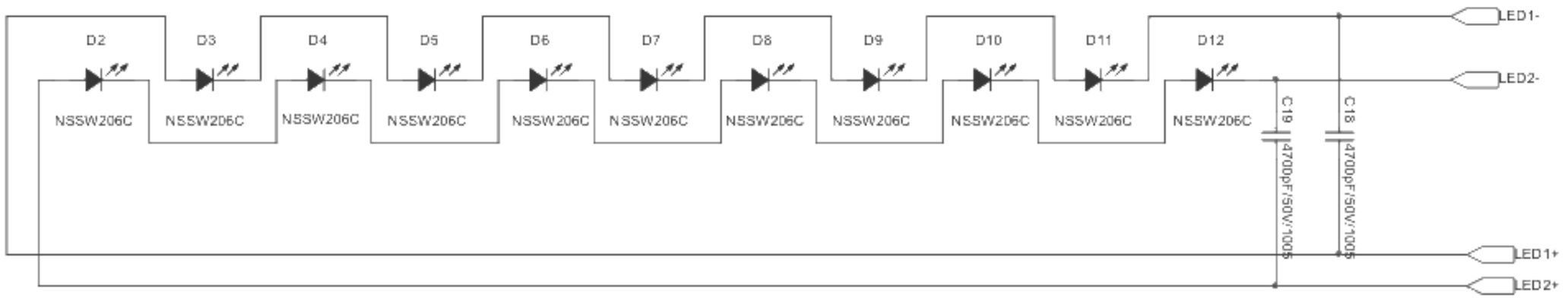


Fig.1 Schematics drawing of lighting

【Note7-7】 $W_{LED}=V_L \times I_L$

7-3.Timing characteristics of LEDPWM signal

Table 6 Ta=+25°C, GND=0V

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
LEDPWM Frequency	fLEDPWM	0.2	-	109.8	kHz	【Note7-8】
LEDPWM Frequency Tolerance	ftLEDPWM	-5	-	5	%	

【Note7-8】 Base clock (FSOC) = 28MHz

8. Timing characteristics of input signals

8-1.MIPI DC/AC Characteristics

<DC characteristics>

Table 7 Ta=+25°C, GND=0V

Item		Symbol	Unit	Test condition	Min.	Typ.	Max.	Note
HS-RX	Differential input high threshold	VIDTH	mV	IOVDD= 1.65V~3.30V	-	-	70	2
	Differential input low threshold	VIDTL	mV	IOVDD= 1.65V~3.30V	-70	-	-	2
	Single-ended input low voltage	VILHS	mV	IOVDD= 1.65V~3.30V	-40	-	-	
	Single-ended input high voltage	VIHHS	mV	IOVDD= 1.65V~3.30V	-	-	460	
	Common-mode voltage HS receive mode	VCMRX(DC)	mV	IOVDD= 1.65V~3.30V	70	-	330	1
	Differential input impedance	ZID	Ω	IOVDD= 1.65V~3.30V	-	100	-	
LP-RX	Logic 0 input voltage not in ULP State	VIL	mV	IOVDD= 1.65V~3.30V	-50	-	550	
	Logic 1 input voltage	VIH	mV	IOVDD= 1.65V~3.30V	880	-	1350	
	I/O leakage current	ILEAK	μA	Vin = -50mV - 1350mV	-10	-	10	
LP-TX	Thevenin output low level	VOL	mV	IOVDD= 1.65V~3.30V	-50	-	50	
	Thevenin output high level	VOH	V	IOVDD= 1.65V~3.30V	1.1	1.2	1.3	
	Output impedance of LP transmitter	ZOLP	Ω	IOVDD=1.80V	110	-	-	
CD-RX	Logic 0 contention threshold	VILCD	mV	IOVDD= 1.65V~3.30V	-	-	200	
	Logic 1 contention threshold	VIHCD	mV	IOVDD= 1.65V~3.30V	450	-	-	

Notes: 1. VCMRX (DC) = (VP+VDN)/2

2. Minimum 110mV/-110mV HS differential swing is required for display data transfer.

<AC Characteristics>

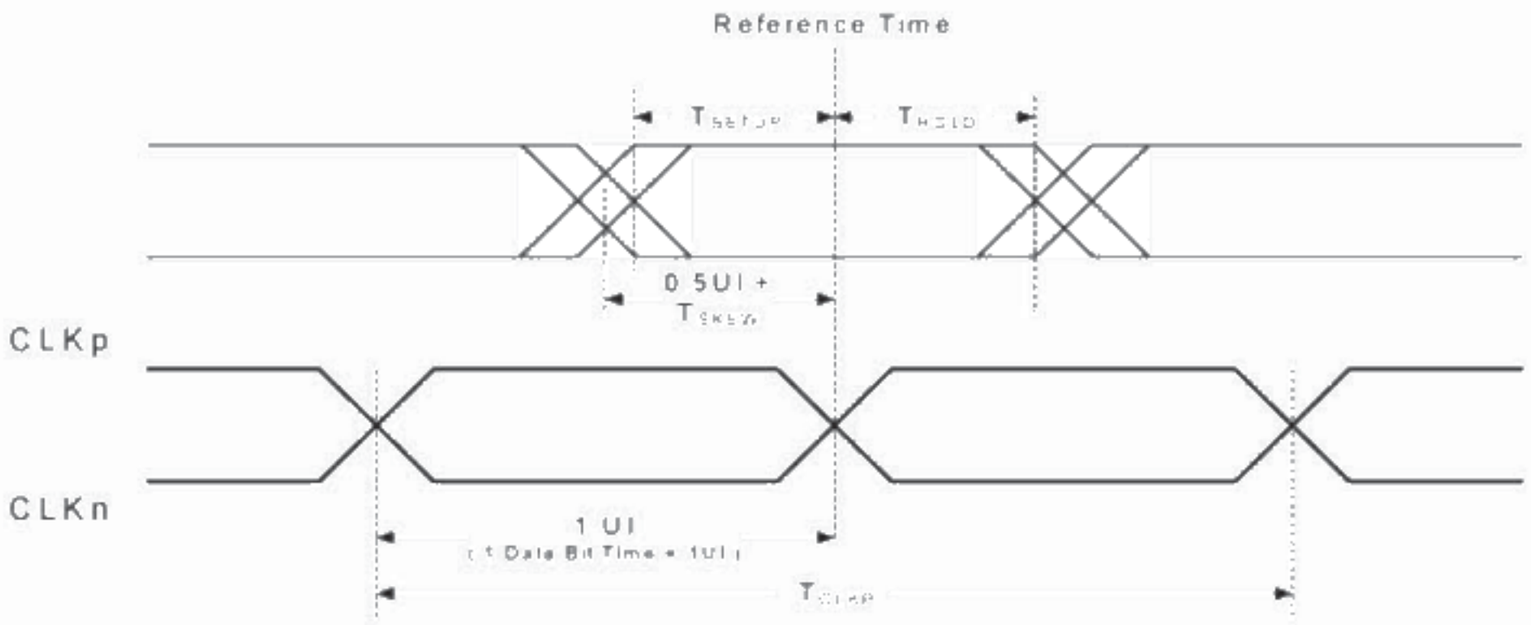
Table 8 Ta=+25°C, GND=0V

Item	Symbol	Unit	Test condition	Min.	Typ.	Max.	Note
DSICLK Frequency	fDSICLK	MHz	IOVCC=1.65V~ 3.30V DPHYVCC=1.65V~ 3.30V	100	-	500	1
DSICLK Cycle time	tCLKP	ns	IOVCC=1.65V~ 3.30V DPHYVCC=1.65V~ 3.30V	1	-	10	
DSI Data Transfer Rate	tDSIR	Mbps	IOVCC=1.65V~ 3.30V DPHYVCC=1.65V~ 3 30V DSI 2 lanes, 3 lanes,4lane	200	-	1000	1
Data to Clock Setup Time	tSETUP	UI	IOVCC=1.65V~ 3.30V DPHYVCC=1.65V~ 3 30V	0.15	-	-	3
		ns	IOVCC=1.65V~ 3.30V DPHYVCC=1.65V~ 3 30V	0.15	-	-	2 ,3
Clock to Data Hold Time	tHOLD	UI	IOVCC=1.65V~ 3.30V DPHYVCC=1.65V~ 3.30V	0.15	-	-	3
		ns	IOVCC=1.65V~ 3.30V DPHYVCC=1.65V~ 3 30V	0.15	-	-	2,3

Notes: 1. When fDSICLK<125MHz, change auto load NV setting so that it is compliant with THS-PREPARE+THS-ZERO spec.

2. Minimum tSETUP/tHOLD Time is 0.15UI. This value may change according to DSI transfer rate.

3. tSETUP/tHOLD Time are measured without HS-TX Jitter.

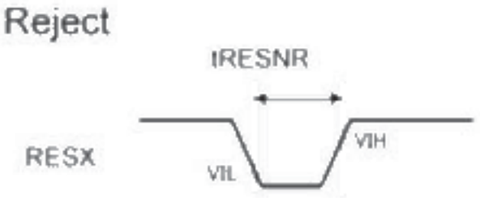


8-2.Reset Timing Characteristics

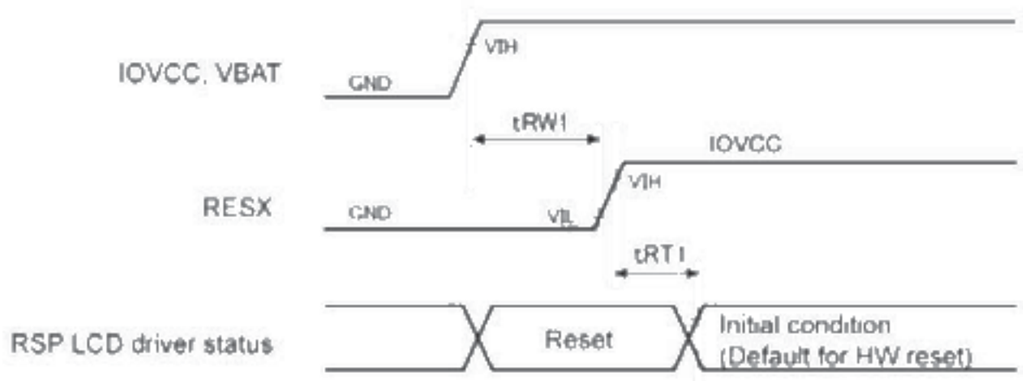
Table 9 Ta=+25°C, GND=0V

Item	Symbol	Unit	Test condition	Min.	Max.
Reset low-level width1	tRW1	us	Power supply on	1000	—
Reset low-level width2	tRW2	us	Operation	1000	—
Reset time (Sleep IN)	tRT1	ms	—	—	3
Reset time (Sleep OUT)	tRT2	ms	—	—	3
Noise reject width	tRESNR	us	—	—	1

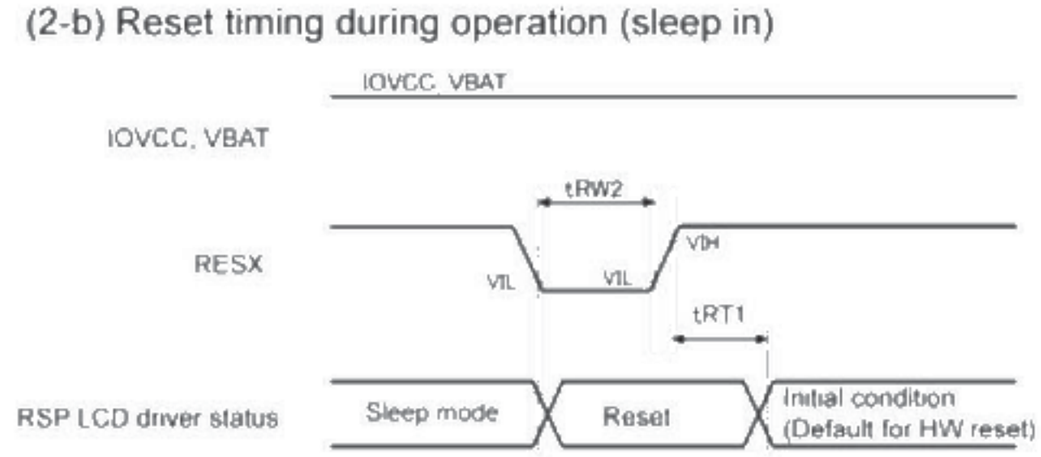
(1)Reset Reject



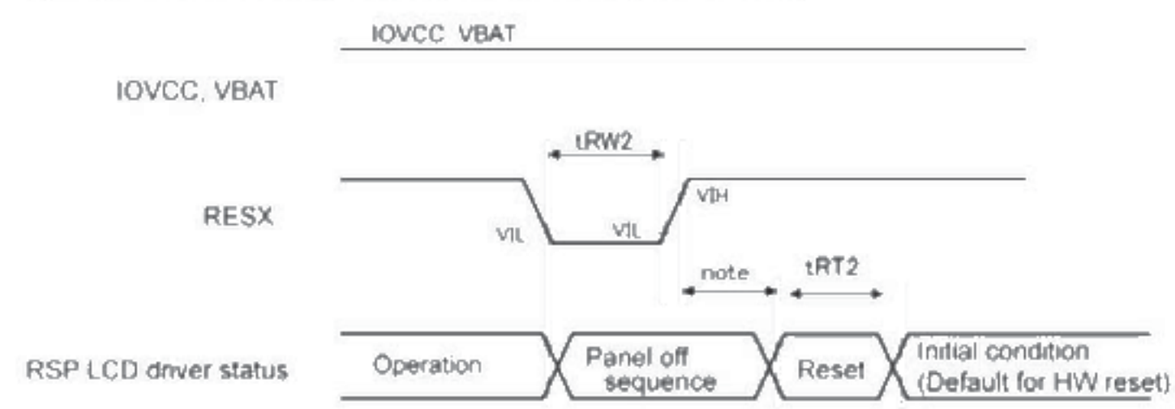
(2-a) Reset timing at power supply on



(2-b) Reset timing during operation (sleep in)



(2-c) Reset timing during operation (sleep out)



8-3. Vertical Timing Characteristics

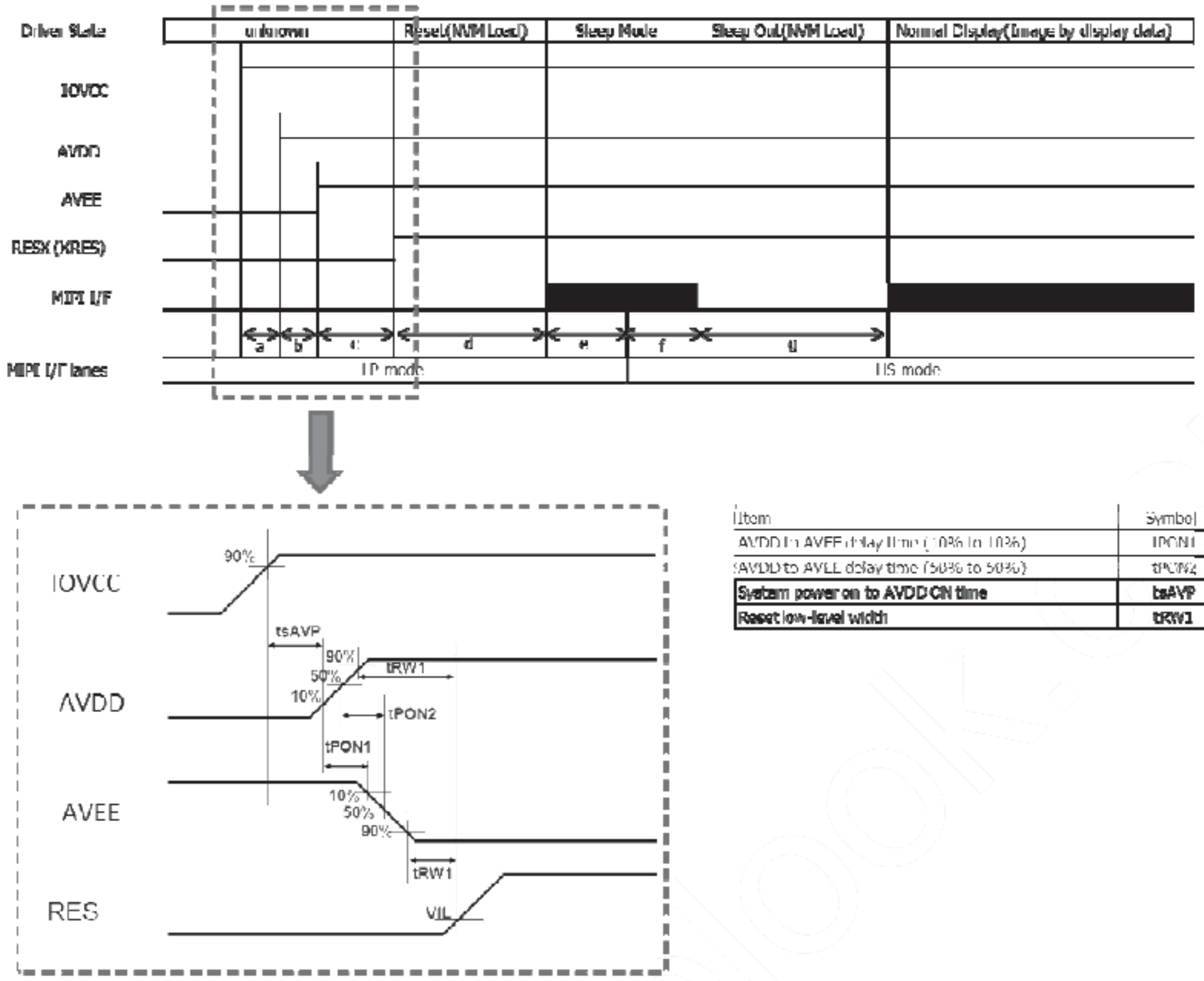
Table 10 Ta=+25°C

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Remarks
Refresh frame rate operation range	Rfror	57	60	63	Hz	
Refresh frame rate tolerance	Rfrt	-5	-	-	%	

*Command mode in still image 60Hz self-refresh

9. Power Sequence

9-1 Power On Sequence for Command mode

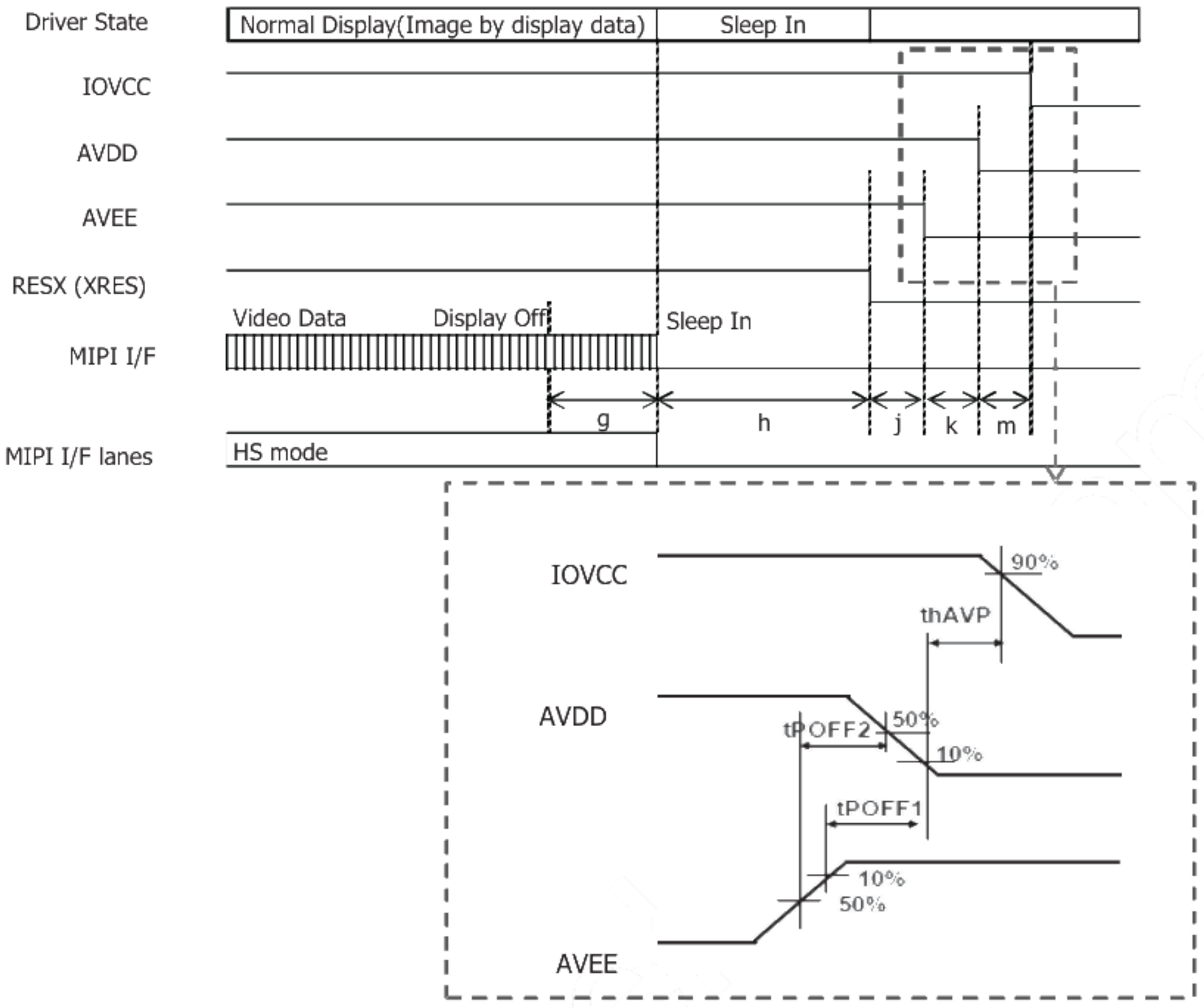


Item	Symbol	min
AVDD to AVEE delay time (10% to 10%)	tPON1	0ms
AVDD to AVEE delay time (50% to 50%)	tPON2	0ms
System power on to AVDD ON time	**tsAVP**	**1ms**
Reset low-level width	**tRW1**	**1ms**

Table 11

Recommended Power On Sequence								term
Step	Address	Parameter	Data	DSI data type		Delay	Command	
1	Initial condition						XRES = L	
2	Power Supply IOVDD (Typ1.8V)						IOVDD ON	
3	Wait					tsAVP	Wait until power stable	a.
4	Power Supply AVDD+ (Typ5.0V)						AVDD+ ON	
5	Wait					tPON1/tPON2		b.
6	Power Supply AVDD- (Typ-5.0V)						AVDD- ON	
7	Wait					tRW1		c.
8	RESX High						XRES = H	
9	Wait					Min.10 ms	[Automatic] NVM Auto load	d.
10							[Automatic] Sleep Mode On	e.
11	0xB0	P1	00h	Generic	29h		The command to unlock manufacturing command write (CABC, CE etc.)	
	0xD6	P1	01h	Generic	29h		The command to remove NVM reload after sleep out.	
	0x51	P1	FFh	DCS	39h		Display Brightness = 100%	
	0x53	P1	0Ch	DCS	39h		LED PWM output enable / Dimming function ON	
	If customer need, please add initial command in here.							
12	Display data transfer						Image Write	f.
13	0x29	-	-	DCS	39h		Display On	
14	0x11	-	-	DCS	39h		Sleep Out	
15	Wait					Min.6 frame		g.
16							[Automatic] Sleep Mode Off/Display On	

9-2 Power Off Sequence for Command mode



Item	Symbol	Min
AVEE to AVDD delay time (10% to 10%)	tPOFF1	0ms
AVEE to AVDD delay time (50% to 50%)	tPOFF2	0ms
AVDD off to system power off time	thAVP	100ms

Table 12

Recommended Power Off Sequence								
Step	Address	Parameter	Data	DSI data type		**Delay**	**Command**	**term**
1	28h	-	-	DCS	39h		Display Off	g
2	Wait					Min.1 frame		
3	10h	-	-	DCS	39h		Sleep In	h
4	Wait					Min. 4frame		
5	RESX Low						XRES = L	j
6	Wait					Min.0ms		
7	AVEE (Typ-5.0V) OFF							k
8						tPOFF1/tPOFF2	Wait	
9	AVDD (Typ+5.0V) OFF							m
10						thAVP	Wait	
11	IOVCC OFF(Typ1.8V) OFF							

10. Input Signals, Basic Display Colors and Gray Scale of Each Color

Table 13

	Colors & Gray Scale	Gray Scale	Data signals																							
			R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7
			LSB							MSB	LSB							MSB	LSB							MSB
Basic Color	Black	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	-	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	-	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	-	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	-	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale of Red	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓				↓								↓								↓				
	⇩	↓				↓								↓								↓				
	Brighter	GS253	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇩	GS254	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS255	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	↓				↓								↓								↓				
	⇩	↓				↓								↓								↓				
	Brighter	GS253	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	⇩	GS254	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Green	GS255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale of Blue	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	⇧	GS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	⇧	↓				↓								↓								↓				
	⇩	↓				↓								↓								↓				
	Brighter	GS253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
	⇩	GS254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Blue	GS255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Low level voltage, 1: High level voltage

Each basic color can be displayed in 256 gray scales from 8 bit data signals. According to the combination of total 24 bit data signals, the 16,777,216-color display can be achieved on the screen.

11. Optical Characteristics

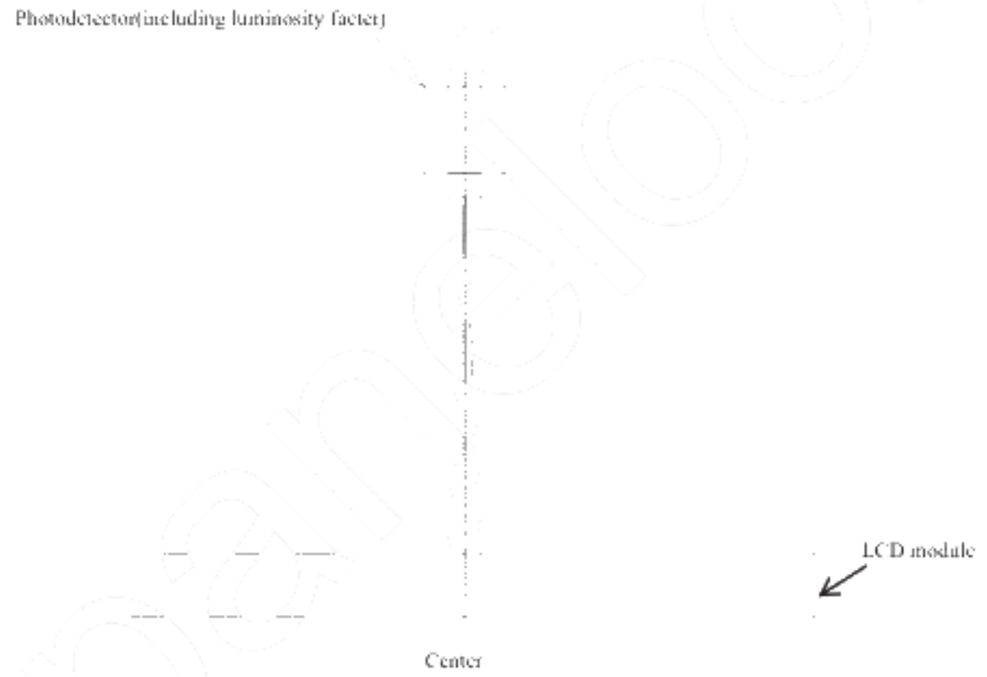
11-1 Driving the Back Light Condition

Table 14 Ta=+25°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Contrast Ratio	CR	θ=0°	700	1,000			【Note11-1,2】
Response Time	τr +τd	θ=0°			35	ms	【Note11-3】
White Chromaticity	x	θ=0°	0.270	0.300	0.330		
	y		0.290	0.320	0.350		
Red Chromaticity	x		0.610	0.640	0.670		
	y		0.300	0.330	0.360		
Green Chromaticity	x		0.270	0.300	0.330		
	y		0.570	0.600	0.630		
Blue Chromaticity	x		0.120	0.150	0.180		
	y		0.030	0.060	0.090		
Brightness	L	θ=0°	330	470		cd/m^2	I_{LED}=20mA
Uniformity	U	θ=0°	75	-		%	【Note11-4】
NTSC Ratio	S		-	70.8		%	

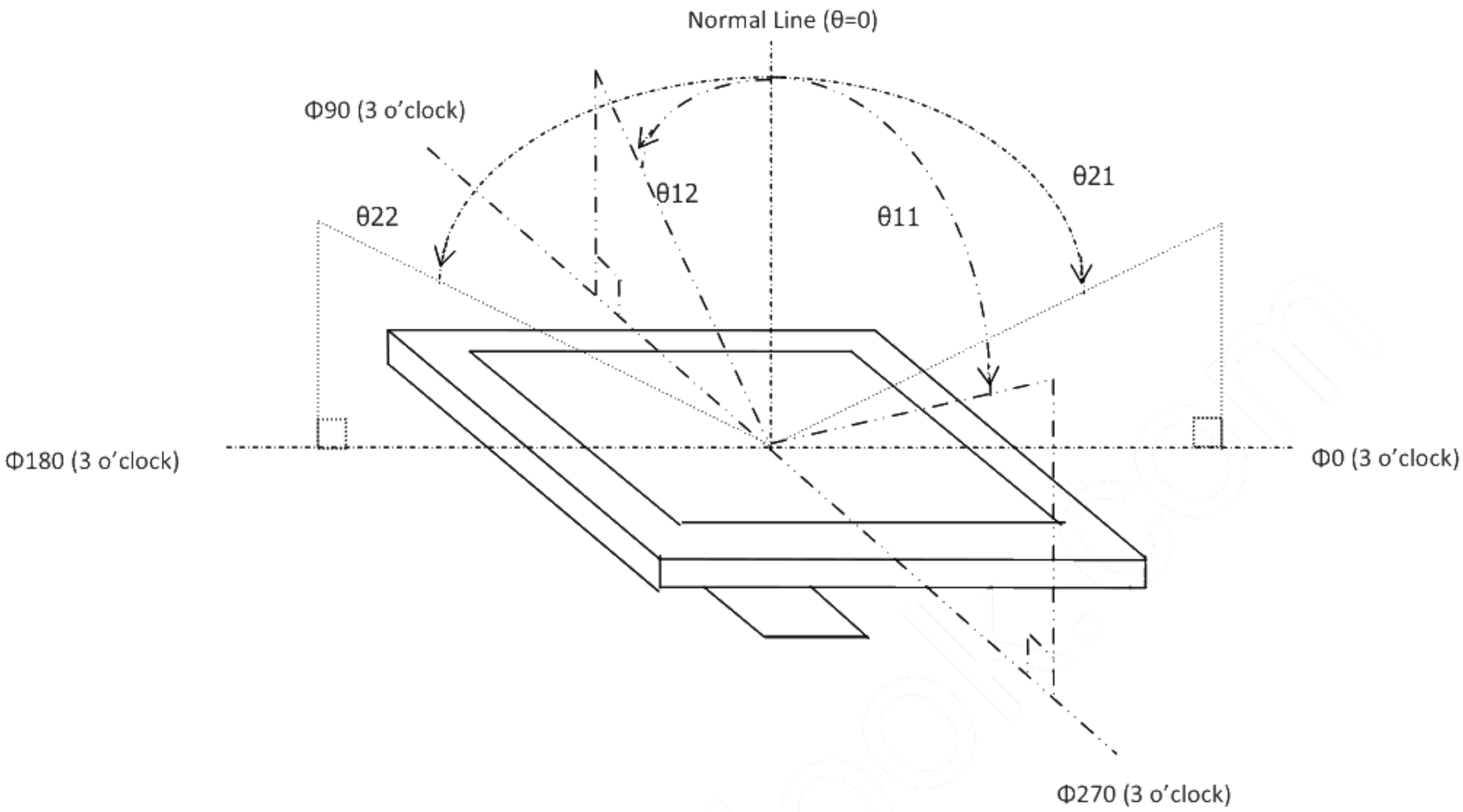
*The measuring method of the optical characteristics is shown by the following figure.

*A measurement device is TOPCON luminance meter SR-3. (Viewing cone1.)



Measuring method for optical characteristics

【Note 11-1】Contrast / NTSC / GAMMA Viewing angle is defined as follows.



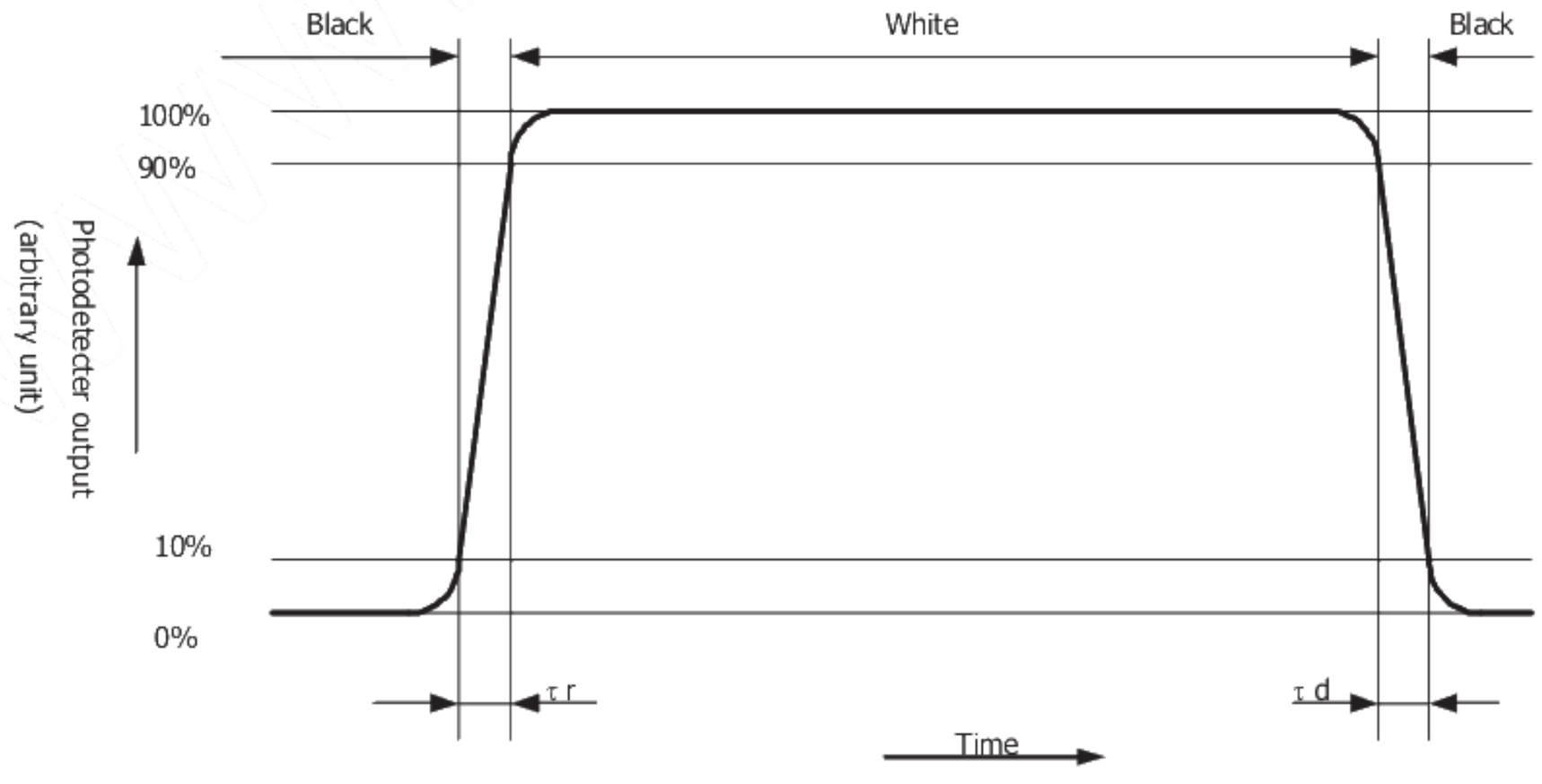
【Note 11-2】Definition of contrast ratio:

The contrast ratio is defined as the follows:

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

【Note 11-3】Definition of response time:

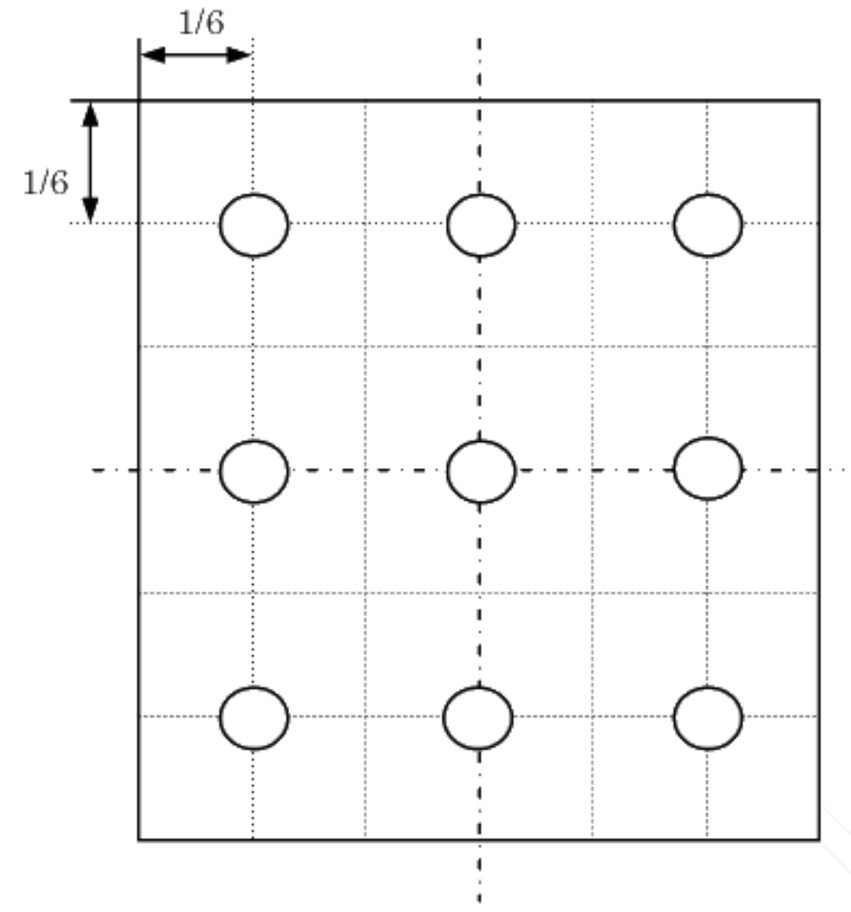
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white"



【Note 11-4】 Definition of Uniformity.

$$\text{Uniformity} = \frac{\text{Minimum Brightness}}{\text{Maximum Brightness}} \times 100\,(\%)$$

The brightness should be measured on the 9-points as shown in the following figure.



12. Reliability Test Items

Table 15

No.	Test item	Conditions
1	High temperature storage test	Ta = +70°C, 240h
2	Low temperature storage test	Ta = -30°C, 240h
3	High temperature operation test	Ta = +60°C, 240h
4	Low temperature operation test	Ta = -20°C, 240h
5	High temperature and high humidity operation test	Ta = +40°C95%RH, 240h (No condensation)
6	Heat shock test	Ta = -30°C(30min) ~ 70°C(30min), 5cycle
7	Electro static discharge test	±200V, 200pF(0Ω) to Terminals(Contact) (1 time for each terminals)

*Ta = Ambient temperature

* Check items for other Test

In the standard condition, there shall be no practical problems that may affect the display function.

13. Indication of lot number

Numbering is specified as follows.

LS047T1SC02 3 X 000001 A Q

① ②③④ ⑤⑥

① LCM's name

② product year (lower 1 digits)

3: 2013

4: 2014

③ product month

1: January
2: February
3: March
:
9: September
X: October
Y: November
Z: December

④ serial number

01 ~ 999999

⑤ Version number

⑥ factory code

14. Forwarding form

(a) Piling number of cartons: 10 deep

(b) Package quality in one cartons: 160pcs

(c) Carton size: 580mm ×365mm ×187mm

(d) Total mass of 1 carton filled with full modules: Approx 7.5kg

Condition for storage

Environment

(1) Temperature : 0 ~ 40°C

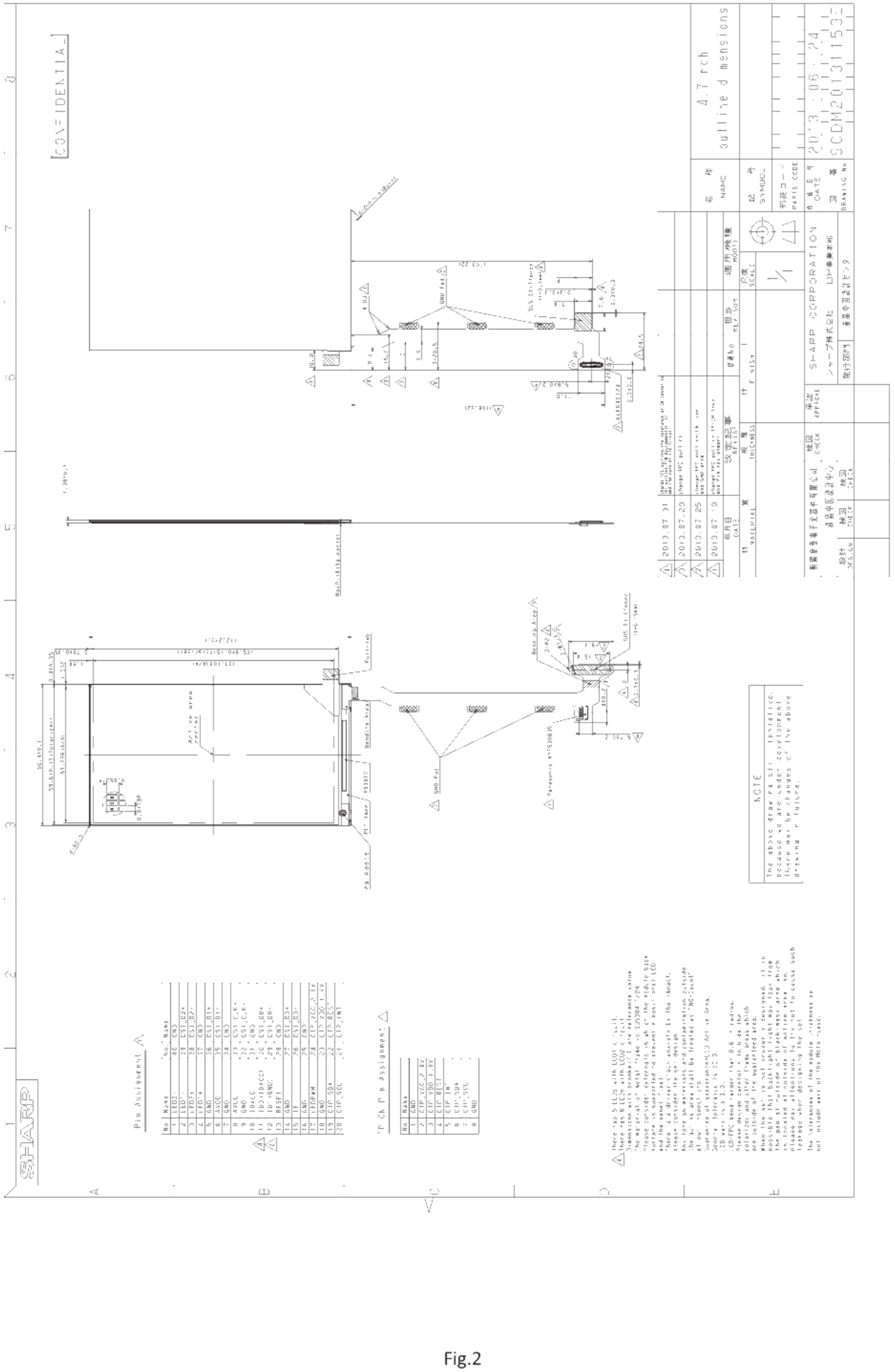
(2) Humidity: 60%RH or less(at 40°C)

(3) Atmosphere: Harmful gas, such as acid or alkali which erodes electronic components and/or wires, must not be detected.

(4) Period: about 3 months

(5) Opening of the package: In order to prevent the LCD module from breakdown by electrostatic charges, please control the room humidity over 50%RH and open the package taking sufficient countermeasures against electrostatic charges, such as earth, etc.

15. Outline dimension



16. FPC Schematic

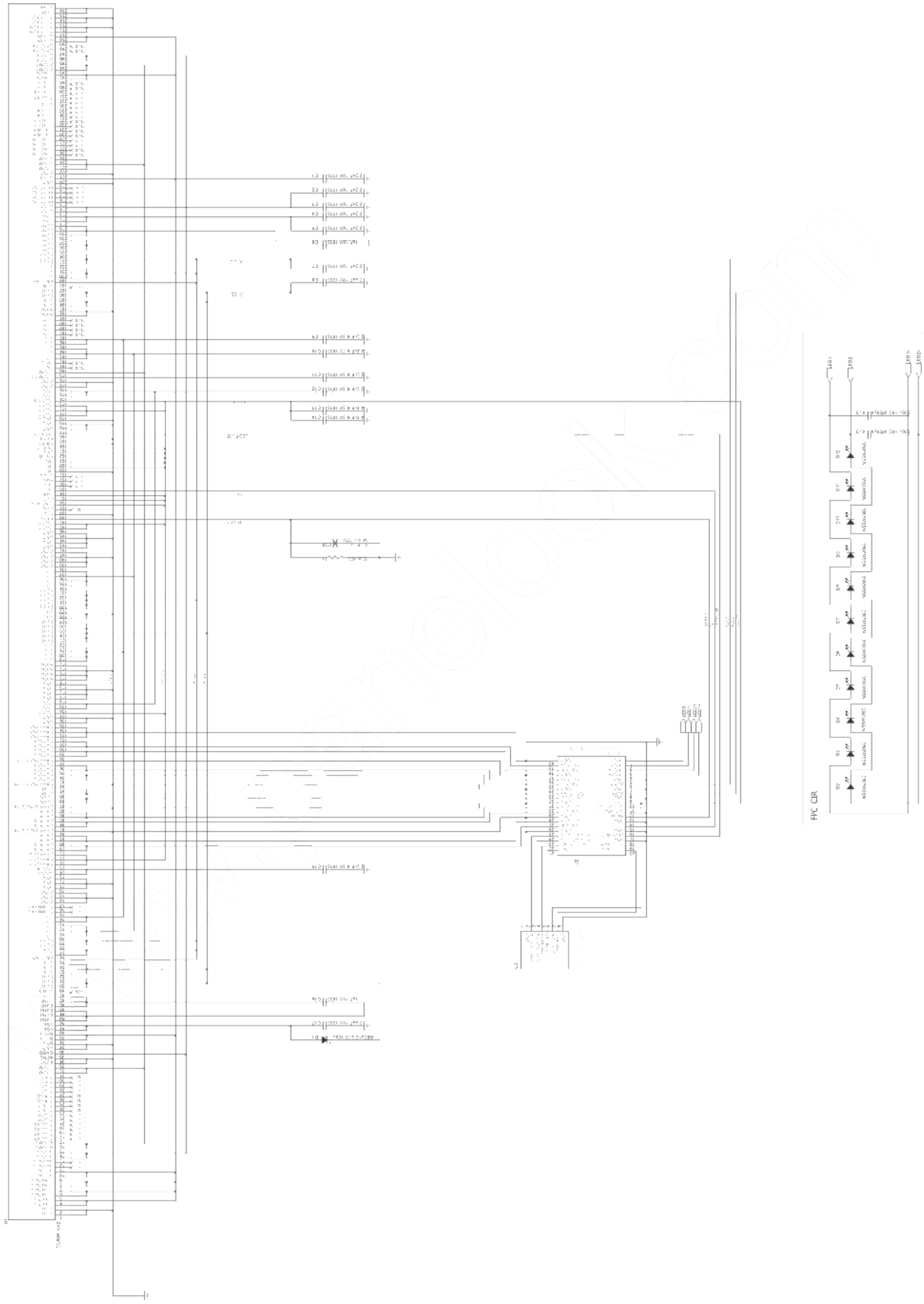


Fig.3