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SPEC. NUMBER
AM-0686004B

PRODUCT GROUP
TFT- LCM

REV.
V1

ISSUE DATE
2023-04-12

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FN0686D004B

Product Specification Rev.V1


BUYER	
SUPPLIER	FANNAL Electronics CO., LTD
FG-Code	FN0686D004B

Preliminary Specification

Approval Specification

ITEM	BUYER SIGNATURE	DATE
Quality	_____	_____
R&D	_____	_____
Approved	_____	_____

ITEM	SUPPLIER SIGNATURE	DATE
Prepared	<u>DONG</u>	<u>2023-06-07</u>
Reviewed	<u>XIONG</u>	<u>2023-06-07</u>
Approved	<u>JACK</u>	<u>2023-06-07</u>

PRODUCT GROUP	REV	ISSUE DATE	
TFT- LCM PRODUCT	V1	2023-04-12	

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REVISION HISTORY

REV.	Page.	DESCRIPTION OF CHANGES	DATE	PREPARED
V0		Change driver IC ICNL9707AC-02 to ST 7703I based on FN0686D004A	2023-04-12	JACK
V1		Changing the brightness Change from 800Min 1000Typ to 950Min 1100Typ	2023-06-07	JACK

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1.0 General Description

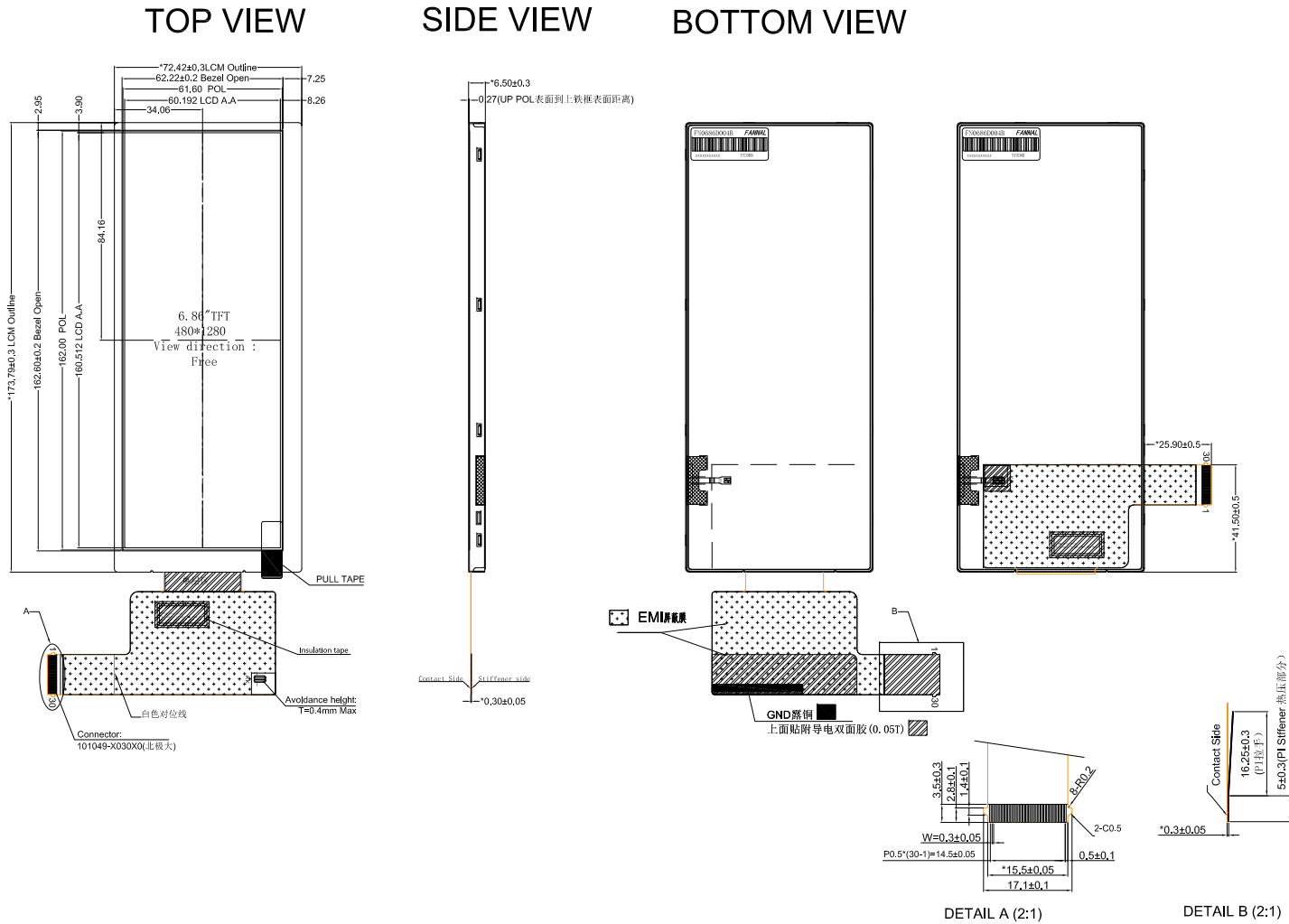
1.1 Application

- Industrial Medical Outdoor highlight
- Automotive Smart Home Digital & Consumer

1.2 General Specification

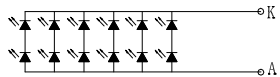
Parameter	Specification	Unit
LCD size	6.86 (Diagonal)	inch
Resolution Ratio	480(H)×1280(V)	pixels
Pixel Pitch	0.1254x0.1254(V)	mm
Active Area	60.192(H)×160.512(V)	mm
Module Size	72.42(W)×173.79(H)×6.5(D)	mm
Display Mode	Normally Black	
Interface	MIPI	
Pixel arrangement	RGB Stripe	
View Direction	ALL	
Power Supply	3.3	V
Power Consumption	3.5	W
Weight	105	g
Luminance	1100 (TYP.)	cd/m ²
Driver IC	ST7703I	

TECHNOLOGY CHARACTERISTICS LCM	
尺寸 SIZE	6.86 inch
Resolution ratio	480x1280
Display mode	Transmissive Normally Black
Display direction	<input type="checkbox"/> 6 <input type="checkbox"/> 12 <input type="checkbox"/> 3 <input type="checkbox"/> 9 <input checked="" type="checkbox"/> Free
Contrast ratio	1500:1
Luminance	1100Typ 950Min
Uniformity	80% MIN
Interface	MIPI
Power supply	<input checked="" type="checkbox"/> 3.3 <input type="checkbox"/> 5.0
Operation temperature	-20~70°C
Storage temperature	-30~80°C
Driver IC	ST7703I
Connection mode	<input checked="" type="checkbox"/> FPC Plug-in <input type="checkbox"/> FPC Welded <input type="checkbox"/> Connector
Environmental requirements	<input checked="" type="checkbox"/> RoHS-2.0 <input type="checkbox"/> REACH
Unmarked tolerance	±0.2mm



PIN	FUNCTION
1	GND
2	VCI
3	VCI
4	VCI
5	GND
6	RESET
7	TE
8	GND
9	GND
10	D3N
11	D3P
12	GND
13	D2N
14	D2P
15	GND
16	CLKN
17	CLKP
18	GND
19	D1N
20	D1P
21	GND
22	D0N
23	D0P
24	GND
25	NC
26	NC
27	LEDK
28	LEDK
29	LEDA
30	LEDA

LED CIRCUIT DIAGRAM:



2*6=12EA

VF=5.6~6.8V(TYP=6.2V);If=480mA

						DRAWN	LCF	TITLE MODULE SPEC.	Drawing NO: FN0686D004B
						CHECKED	Dong		Project No: LCM70093
						APPROVED	JACK		
BQ01		Changing the brightness Change from 800Min 1000Typ to 950Min 1100Typ	JACK	2023 0607		CSR APPROVED			
B		换IC, 由ICNL9707AC-02换成ST7703I	LCF	2023 0321		Customer No:			
A		First issue	LCF	2023 0220					
VER.	SYMBOL	AMENDMENT	SIGN	DATE	SHEET 1 OF 1				FANNAL ELECTRONICS CO., LTD

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3.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit.

Parameter	Symbol	Min.	Max.	Unit
Digital Supply Voltage	VCI/VDD	-0.3	6.6	V
Digital interface supple Voltage	IOVCC	-0.3	5.5	V
Operating Temperature	T _{OP}	-20	70	°C
Storage Temperature	T _{ST}	-30	80	°C
Operating Ambient Humidity	H _{OP}	10	60°C 90%RH	RH
Storage Humidity	H _{ST}	10	60°C 90%RH	RH

NOTE: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

4.0 ELECTRICAL SPECIFICATIONS

4.1 TFT LCM Module

[Ta =25 ± 2 °C]

Parameter	Symbol	Min.	Typ.	Max.	Unit
Digital supply voltage	VDD	2.5	-	6.2	V
Digital interface supply Voltage	IOVCC	1.6	1.8	3.6	V
Normal mode Current consumption	IDD	-	8	16	mA
Level input voltage	V _{IH}	0.7IOVCC		IOVCC	V
	V _{IL}	GND		0.3IOVCC	V
Level output voltage	V _{OH}	0.8IOVCC		IOVCC	V
	V _{OL}	GND		0.2IOVCC	V

4.2 Backlight Driving Conditions

[Ta =25 ± 2 °C]

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Forward Current Voltage	V _F	5.6	6.2	6.8	V	Note 1
Forward Current	I _f		480		mA	
Backlight Power Consumption	W _{bl}	-	3.0	-	W	
LED Life Time	-	30000	-	-	Hrs	Note 2

Note1: Under LCM operating, the stable forward current should be inputted. And forward voltage is for reference only.

Note2: Optical performance should be evaluated at Ta=25°C. if LED is driven by high current, high ambient temperature & Humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

5.0 Interface Description

Connector Name/Designation	Interface Connector/Interface Card
Type Part Number	FPC 0.5Pitch 30P
Mating Housing Part Number	101049-X030X0(BJD)

5.1 Pin assignment for LCM module

Pin No.	Symbol	Description
1	GND	Ground
2	VCI	Power supply
3	VCI	Power supply
4	VCI	Power supply
5	GND	Ground
6	RESET	Reset pin
7	TE	Tearing effect output signal
8	GND	Ground
9	GND	Ground
10	MIPI_DATA3_N	MIPI data input
11	MIPI_DATA3_P	MIPI data input
12	GND	Ground
13	MIPI_DATA2_N	MIPI data input
14	MIPI_DATA2_P	MIPI data input
15	GND	Ground
16	MIPI_CLK_N	MIPI clock input
17	MIPI_CLK_P	MIPI clock input
18	GND	Ground
19	MIPI_DATA1_N	MIPI data input
20	MIPI_DATA1_P	MIPI data input
21	GND	Ground
22	MIPI_DATA0_N	MIPI data input
23	MIPI_DATA0_P	MIPI data input
24	GND	Ground

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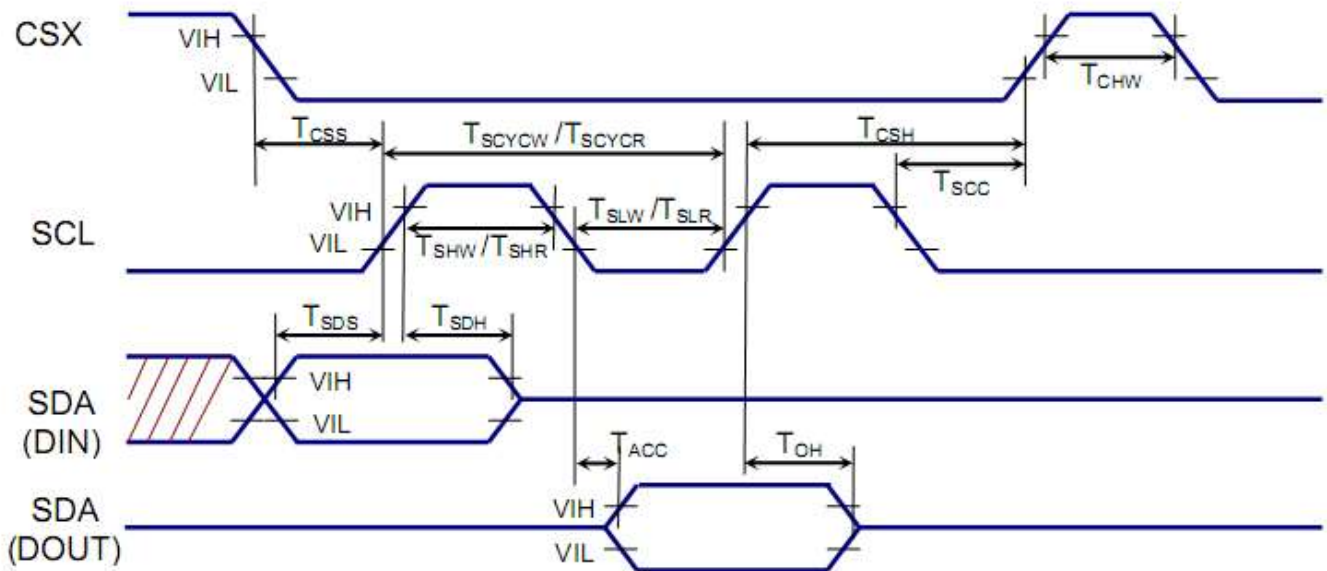
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Pin No.	Symbol	Description
25	NC	No connection
26	NC	No connection
27	LEDK	LED power cathode
28	LEDK	LED power cathode
29	LEDA	LED power anode
30	LEDA	LED power anode

5.2 AC Characteristic

5.2.1 Serial Interface Characteristics



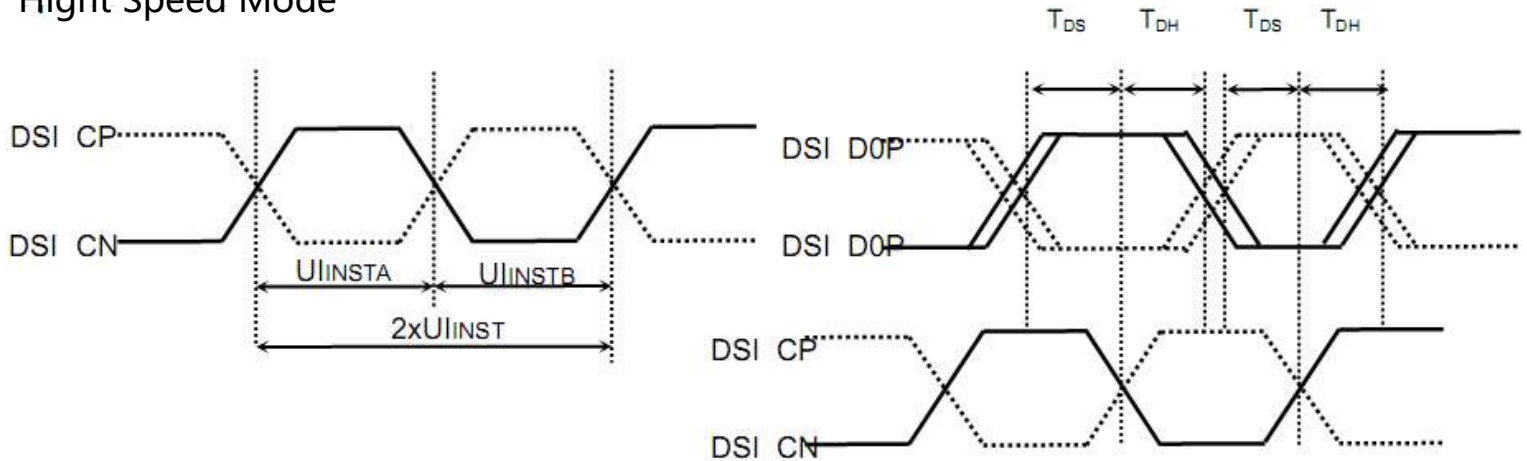
(VSSA=0V, IOVCC=1.8V, VCI=2.8V, T_A = 25°C)

Signal	Symbol	Parameter	Min.	Max.	Unit	Description
CSX	t _{css}	Chip select setup time (Write)	15	-	ns	-
	t _{css}	Chip select setup time (Read)	60	-		
	t _{csh}	Chip select hold time (Write)	15	-		
	t _{csh}	Chip select hold time (Read)	65	-		
DCX	t _{ast}	Address setup time	0	-	ns	-
	t _{aht}	Address hold time (Write/Read)	10	-		
SCL (Write)	t _{wc}	Write cycle	66	-	ns	-
	t _{wrh}	Control pulse "H" duration	15	-		
	t _{wrl}	Control pulse "L" duration	15	-		
SCL (Read)	t _{rc}	Read cycle	150	-	ns	-
	t _{rdh}	Control pulse "H" duration	60	-		
	t _{rdl}	Control pulse "L" duration	60	-		
SDA (Input)	t _{ds}	Data setup time	10	-	ns	For maximum C _L =30pF
	t _{dh}	Data hold time	10	-		
SDA (Output)	t _{acc}	Read access time	-	100	ns	For minimum C _L =8pF
	t _{oh}	Output disable time	10	-		

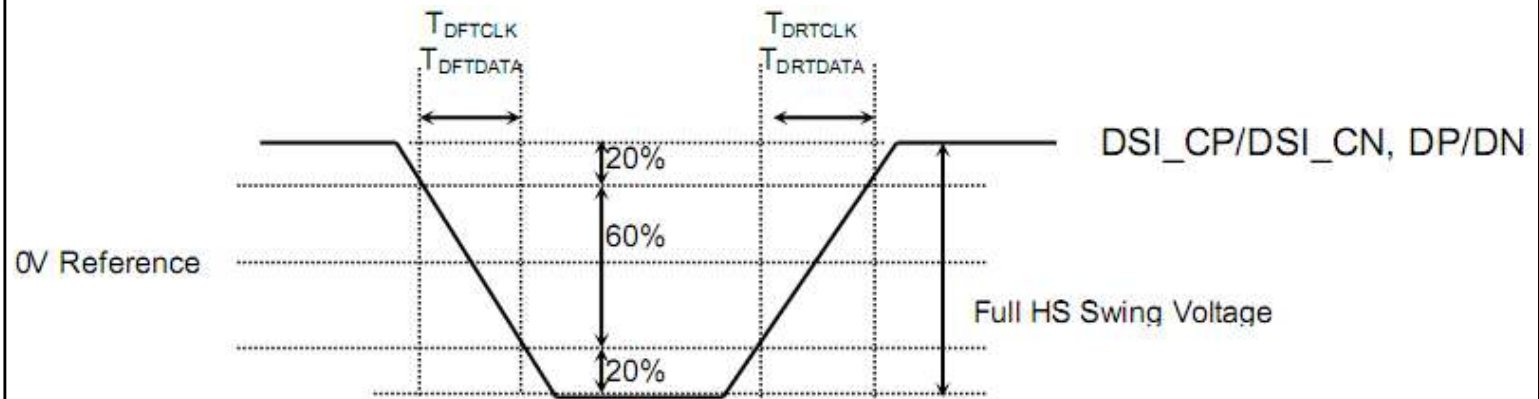
Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

5.2.2 DSI Interface Timing Characteristics

High Speed Mode



DSI clock timing Characteristics



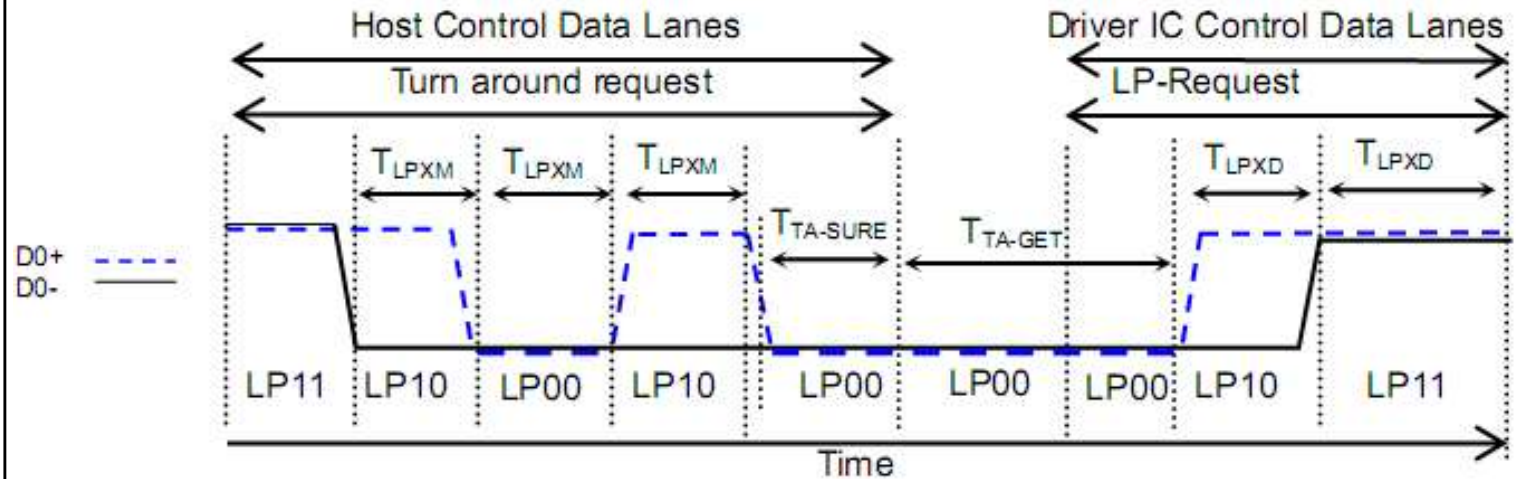
Rising and falling time on clock and data channel

(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V, T_A = -30 to 70°C)

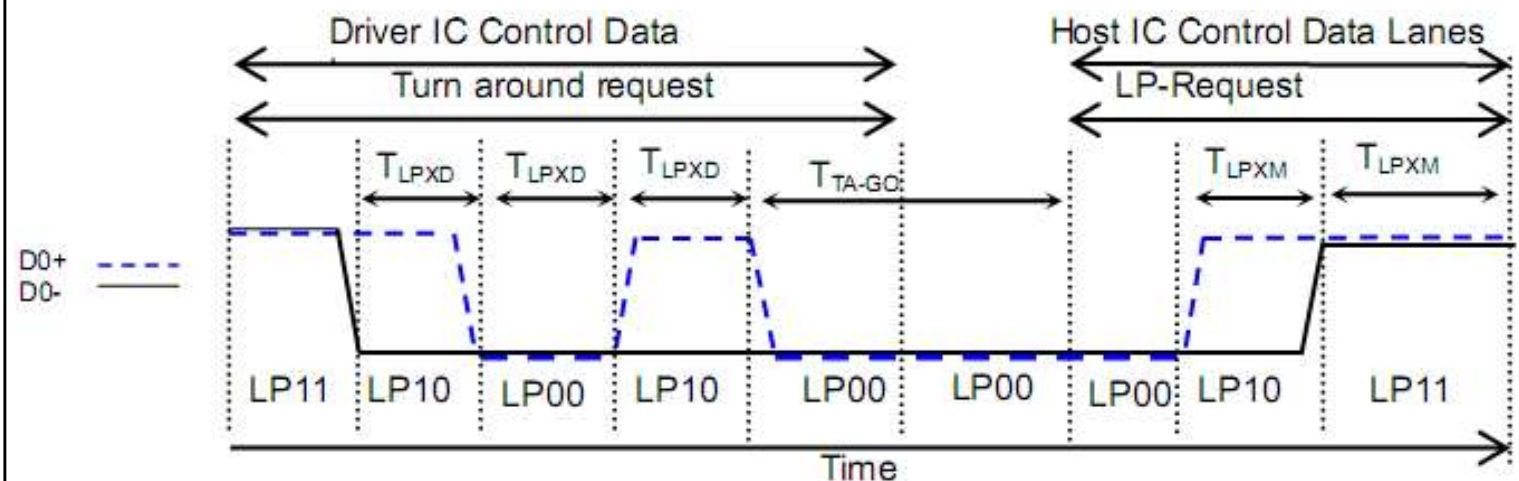
Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_CP/ DSI_CN	Double UI instantaneous	2xUIINST	TBD	-	25	ns
	UI instantaneous	UIINSTA UIINSTB	TBD	-	12.5	ns
DP/DN	Data to clock setup time	T _{DS}	0.15xUI	-	-	ps
	Data to clock hold time	T _{DH}	0.15xUI	-	-	ps
DSI_CP/ DSI_CN	Differential rise time for clock	T _{DRTCLK}	150	-	0.3UI	ps
	Differential fall time for clock	T _{DFTCLK}	150	-	0.3UI	ps
DP/DN	Differential rise time for data	T _{DRTDATA}	150	-	0.3UI	ps
	Differential fall time for data	T _{DFTDATA}	150	-	0.3UI	ps

DSI High Speed Mode Characteristics

Low Power Mode



BTA from HOST to Display Module Timing



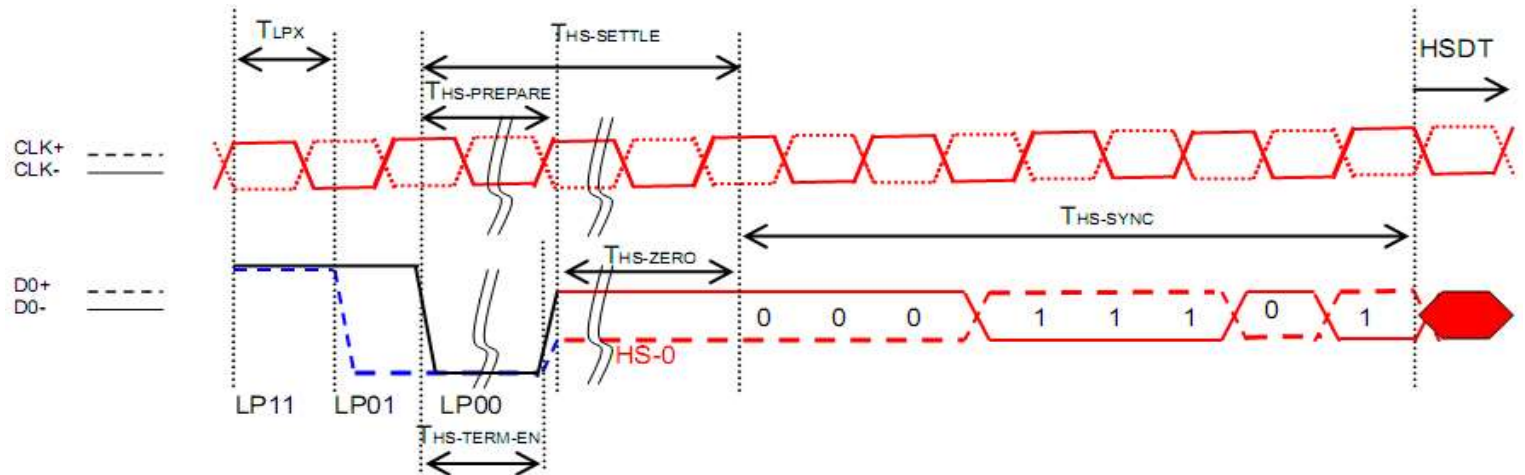
BTA from Display Module Timing to HOST

(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.3V to 3.3V, T_A = -30 to 70°C)

Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Length of LP-00/LP01/LP10/LP11 Host → Display module	T _{LPXM}	50	-	-	ns
	Length of LP-00/LP01/LP10/LP11 Display module → Host	T _{LPXD}	50	-	-	ns
	Time-out before the MPU start driver	T _{TA-SURE}	T _{LPXD}	-	2xT _{LPXD}	ns
	Time to drive LP-00 by display module	T _{TA-GET}	5xT _{LPXD}	-	-	ns
	Time to drive LP-00 after turnaround request Host	T _{TAGO}	4xT _{LPXD}	-	-	ns

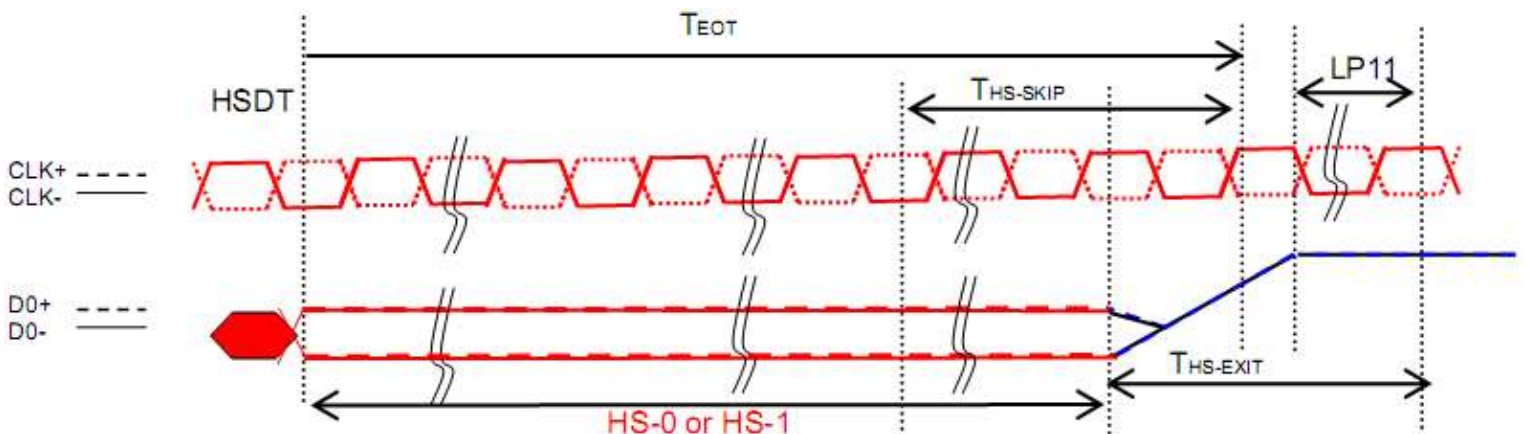
DSI Low Power Mode Characteristics

DSI Bursts



Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Length of LP-00/LP01/LP10/LP11	T_{LPX}	50	-	-	ns
	Time to Driver LP-00 to prepare for HS transmission	$T_{HS-prepare}$	$40+4UI$	-	$85+6UI$	ns
	Time to enable data receiver line termination	$T_{HS-term-en}$	-	-	$35+4xUI$	ns
	Time to drive LP-00 by display module	T_{TA-GET}	$5xT_{LPXD}$	-	-	ns
	Time to drive LP-00 after turnaround request Host	T_{TAGO}	$4xT_{LPXD}$	-	-	ns

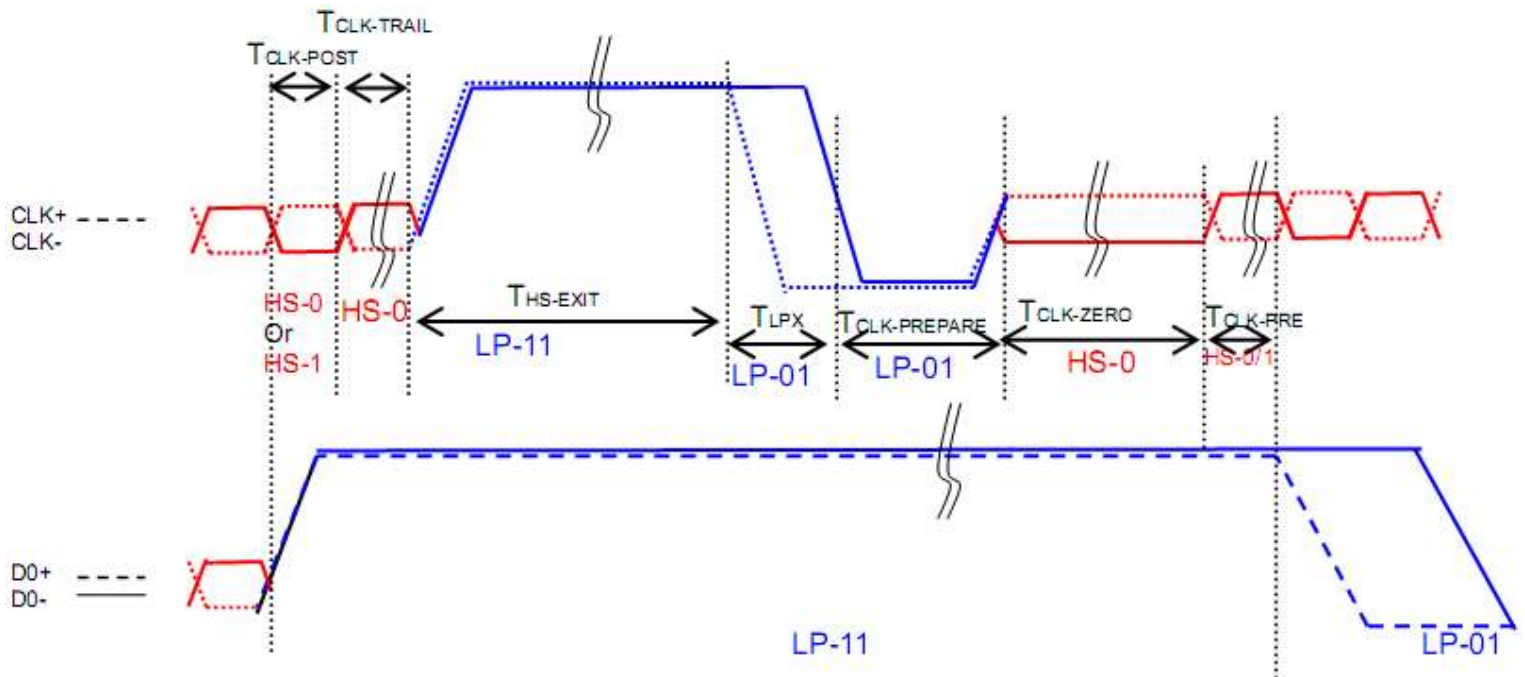
DSI Low Power Mode to High Speed Mode Timing



NOTE:
 If the last bit is HS-0, the transmitter changes from HS-0 to HS-1
 If the last bit is HS-0, the transmitter changes from HS-1 to HS-0

Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Time-Out at Display Module to Ignore Transition Period of EoT	$T_{HS-skip}$	40	-	$55+4xUI$	ns
	Time to Driver LP-11 after HS Burst	$T_{HS-exit}$	100	-	-	ns

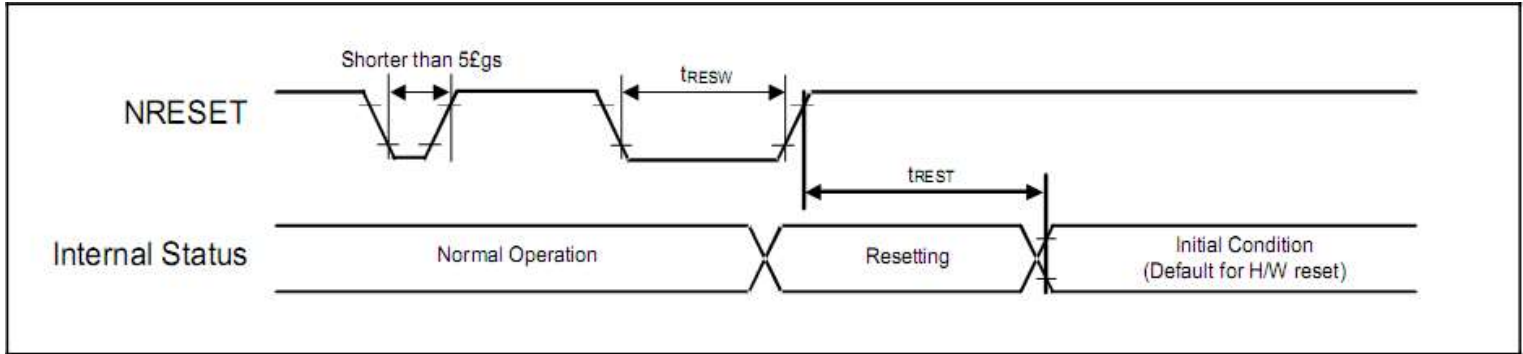
DSI Low Power Mode to High Speed Mode Timing



Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_CP/ DSI_CN	Time that the MCU shall continue sending HS clock after the last associated Data Lane has transitioned to LP mode	$T_{CLK-POST}$	$60+52xUI$	-	-	ns
	Time to drive HS differential state after last payload clock bit of a HS transmission burst	$T_{CLK-TRAIL}$	60	-	-	ns
	Time to drive LP-11 after HS burst	$T_{HS-EXIT}$	100	-	-	ns
	Time to drive LP-00 to prepare for HS transmission	$T_{CLK-PREPARE}$	38	-	95	ns
	Time-out at Clock Lane Display Module to enable HS Termination	$T_{CLK-TERM-EN}$	-	-	38	ns
	Minimum lead HS-0 drive period before starting Clock	$T_{CLK-PREPARE} + T_{CLK-ZERO}$	300	-	-	ns
	Time that the HS clock shall be driven prior to any associated data Lane beginning the transition from LP to HS mode	$T_{CLK-PRE}$	$8xUI$			

Clock Lanes High Speed Mode to/from Low Power Mode Timing

5.3 Reset input timing



Symbol	Parameter	Related Pins	Spec.			Note	Unit
			Min.	Typ.	Max.		
tRESW	Reset low pulse width ⁽¹⁾	NRESET	10	-	-	-	μs
tREST	Reset complete time ⁽²⁾	-	15	-	-	When reset applied during SLPIN mode	ms
		-	120	-	-	When reset applied during SLPOUT mode	ms

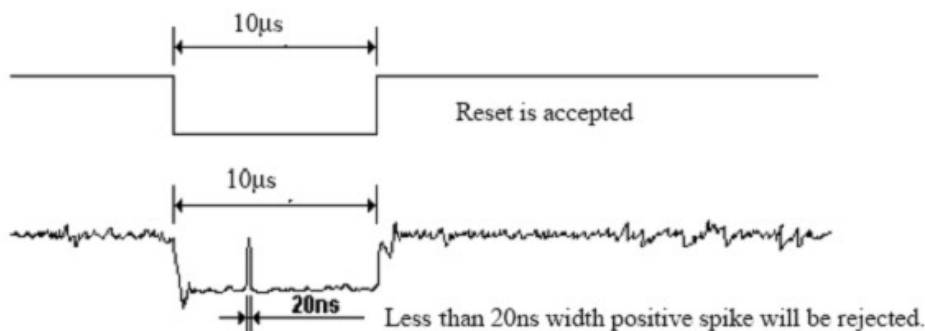
Note: (1) Spike due to an electrostatic discharge on NRESET line does not cause irregular system reset according to the following table.

NRESET Pulse	Action
Shorter than 5 μs	Reset Rejected
Longer than 10 μs	Reset
Between 5 μs and 10 μs	Reset Start

(2) During the resetting period, the display will be blanked (The display is entering blanking sequence, which Maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode) and then return to Default condition for H/W reset.

(3) During Reset Complete Time, ID and VCOM value in OTP will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time (tREST) within 15ms after a rising edge of NRESET.

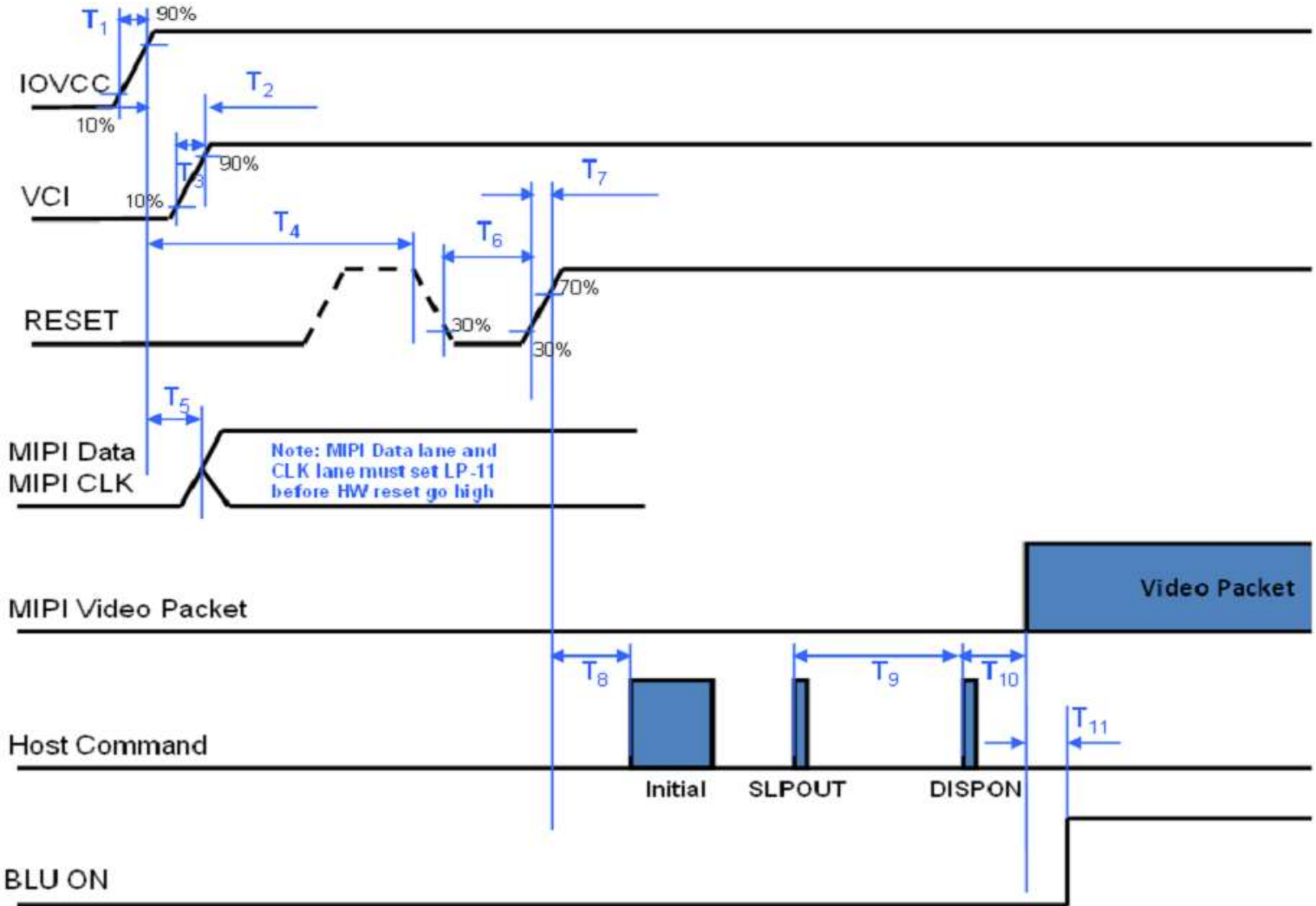
(4) Spike Rejection also applies during a valid reset pulse as shown as below:



(5) It is necessary to wait 15msec after releasing NRESET before sending commands. Also Sleep Out command cannot be sent for 120msec.

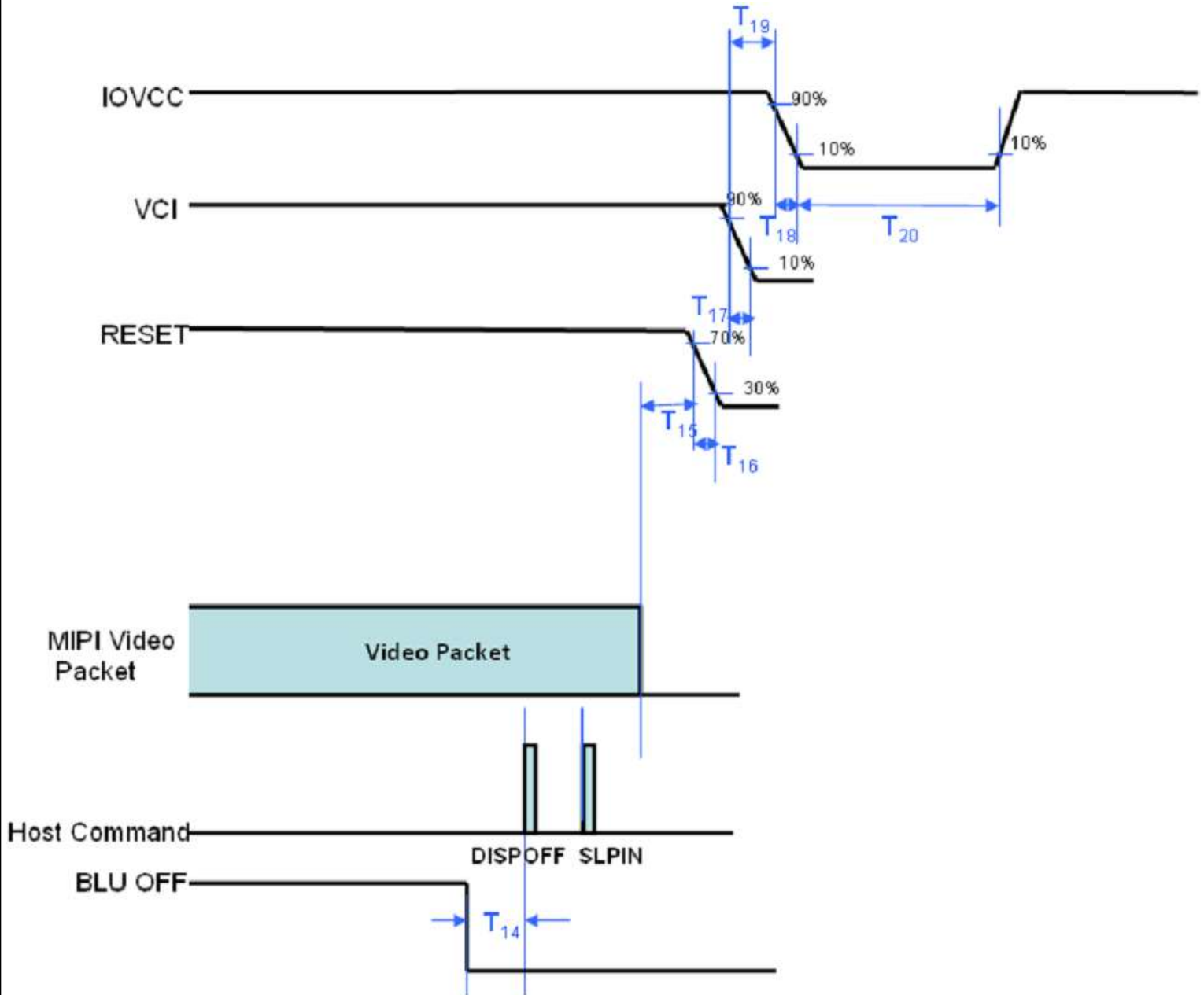
5.4 DSI Power On/Off Timing

5.4.1 Power On Timing of External Power IC



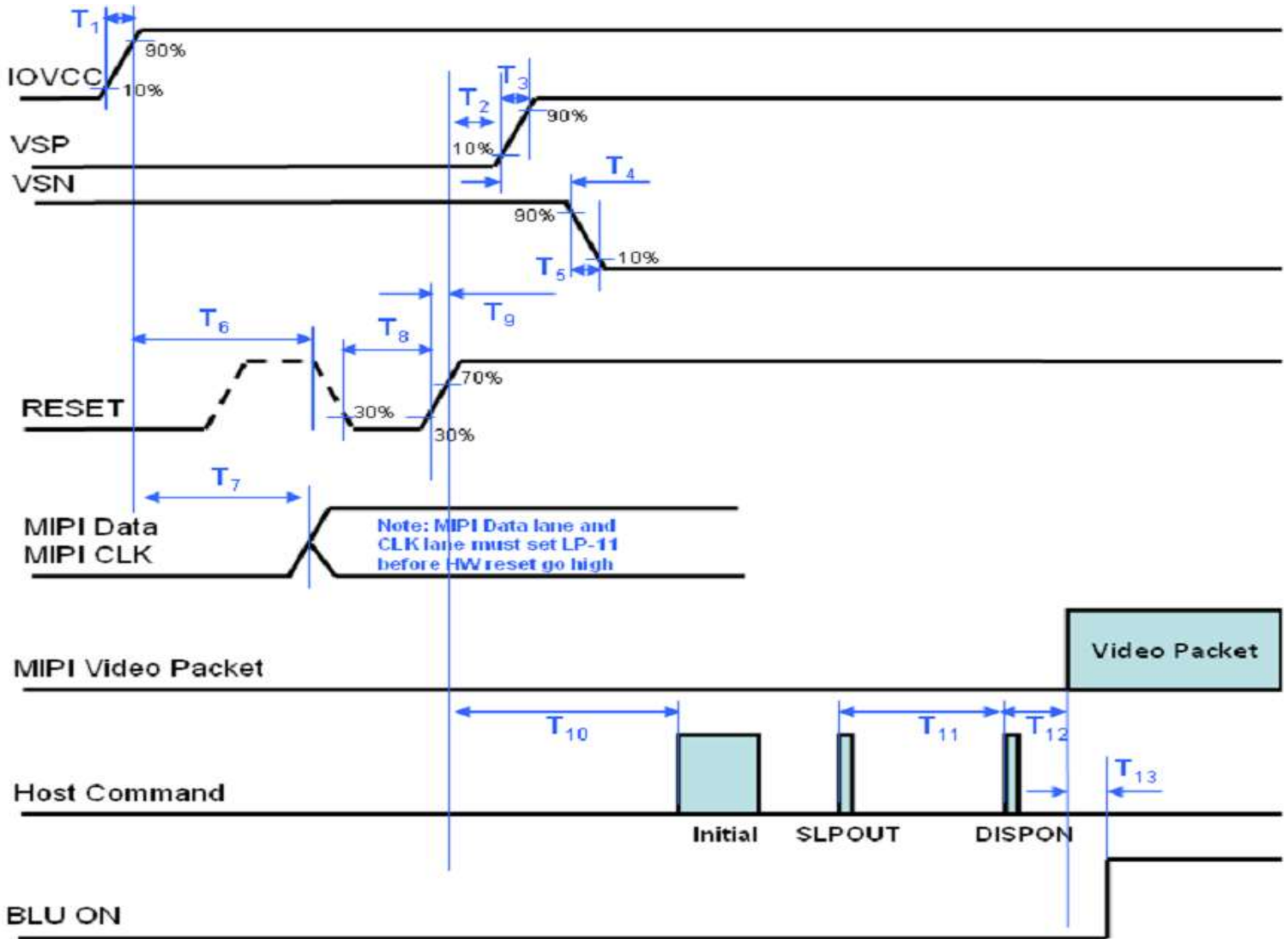
	Min.	Typ.	Max.	Unit
T1	0.01	-	10	ms
T2	No Limit			ms
T3	0.01	-	10	ms
T4	1	-	-	ms
T5	1	-	-	ms
T6	10	-	-	us
T7	No Limit			ns
T8	15	-	-	ms
T9	120	-	-	ms
T10	No Limit			ms
T11	100	150	-	ms

5.4.2 Power Off Timing of External Power IC



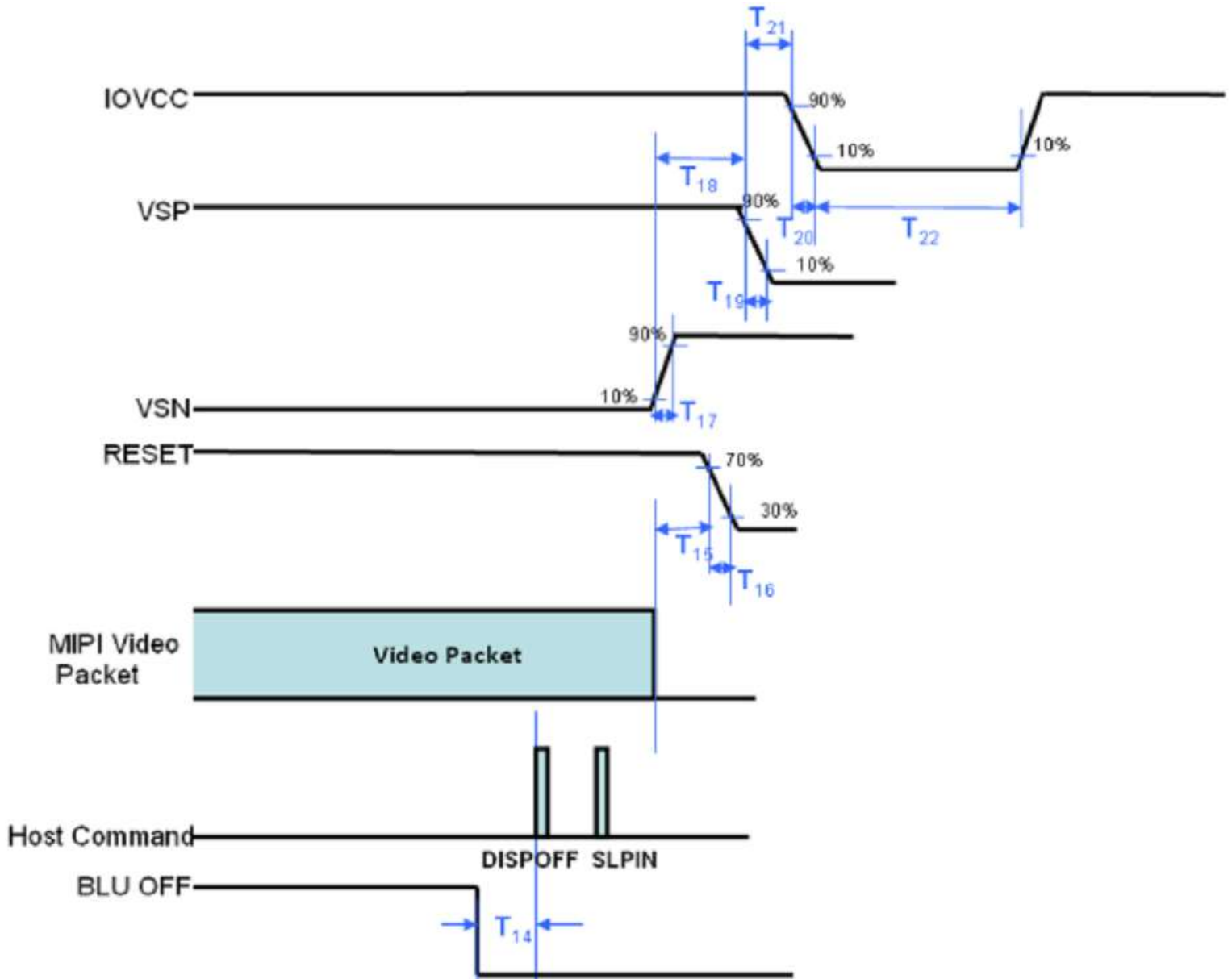
	Min.	Typ.	Max.	Unit
T14	40	100	-	ms
T15	10	-	-	ms
T16		No Limit		ms
T17		No Limit		ms
T18		No Limit		ms
T19		No Limit		ms
T20	100			ms

5.4.3 Power On Timing of 3-Power Mode



	Min.	Typ.	Max.	Unit
T1	0.01	-	10	ms
T2	10	-	-	ms
T3	0.01	-	10	ms
T4	No Limit			ms
T5	0.01	-	10	ms
T6	1	-	-	ms
T7	1	-	-	ms
T8	10	-	-	us
T9	No Limit			ns
T10	15	-	-	ms
T11	120	-	-	ms
T12	No Limit			ms
T13	100	150	-	ms

5.4.4 Power Off Timing of 3-Power Mode



	Min.	Typ.	Max.	Unit
T14	40	100	-	ms
T15	10	-	-	ms
T16		No Limit		ms
T17		No Limit		ms
T18		No Limit		ms
T19		No Limit		ms
T20		No Limit		ms
T21		No Limit		ms
T22	500	-	-	ms

6.0 OPTICAL SPECIFICATIONS

6.1 Overview

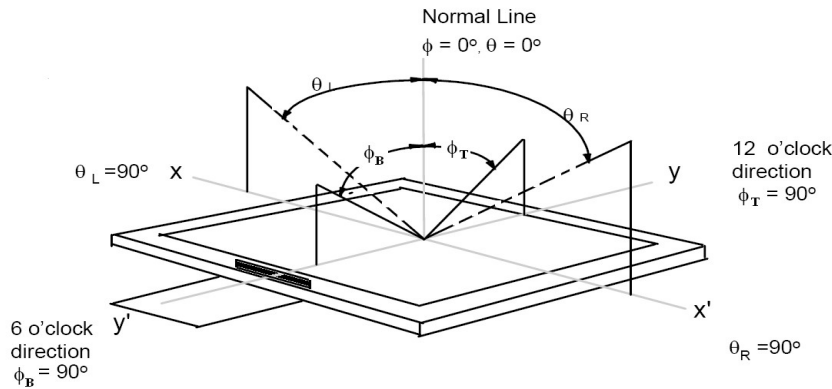
The test of optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = $25 \pm 2^\circ\text{C}$) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and ϕ equal to 0° . We refer to $\theta\phi=0$ ($=\theta 3$) as the 3 o'clock direction (the "right"), $\theta\phi=90$ ($=\theta 12$) as the 12 o'clock direction ("upward"), $\theta\phi=180$ ($=\theta 9$) as the 9 o'clock direction ("left") and $\theta\phi=270$ ($=\theta 6$) as the 6 o'clock direction ("bottom"). While scanning θ and/or ϕ , the center of the measuring spot on the display surface shall stay fixed.

6.2 Optical Specifications

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Viewing Angle	θ_L	$Cr \geq 10$	-	85	-	deg	<u>Note 1</u>
	θ_R		-	85	-		
	ψ_T		-	85	-		
	ψ_B		-	85	-		
Contrast Ratio	Cr	$\theta=0^\circ$	1000	1500	-	-	<u>Note 2</u>
Response Time	Tr+Tf	FF=0°	--	-	40	ms	<u>Note 3</u>
Color Coordinate of CIE1931	Wx	$\theta=0^\circ$	0.274	0.304	0.334	-	<u>Note 4</u>
	Wy		0.291	0.321	0.351		
	Rx		0.605	0.635	0.665		
	Ry		0.312	0.342	0.372		
	Gx		0.300	0.330	0.360		
	Gy		0.590	0.620	0.650		
	Bx		0.116	0.146	0.176		
	By		0.035	0.065	0.095		
Uniformity	U		80	--	--	%	<u>Note 5</u>
Color Gamut			--	65	--	%	
Luminance	L		950	1100	--	cd/m ²	<u>Note 6</u>

Note 1: The definition of Viewing Angle

Refer to the graph below marked by θ and ϕ .



Note 2: The definition of Contrast Ratio

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance When LCD is at "White" state}}{\text{Luminance When LCD is at "Black" state}}$$

(Contrast Ratio is measured in optimum common electrode voltage)

Note 3: Definition of Response time. (Test LCD using RD80S or similar equipments):

The output sign also photo detector are measured when the input sign also are changed from "black" to "white" (Voltage falling time) and from "white" to "black" (Voltage rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figures below.

Note 4: Color Coordinates of CIE 1931

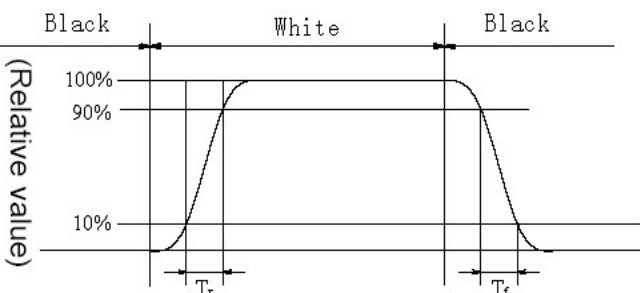
The test condition is at ILED=20mA and measured on the surface of LCD module at 25°C.

Measurement equipment: CS2000 or similar equipments

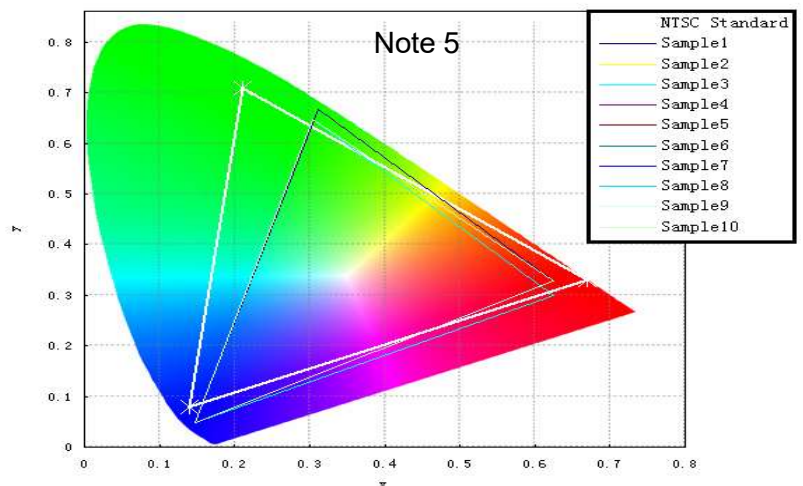
The Color Coordinate (CIE 1931) is the measurement of the center of the display shown in below figure.

Note 5: Definition of Color of CIE Coordinate and NTSC Ratio.

$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$



Note 3




7.0 RELIABILITY TEST

The Reliability test items and its conditions are shown in below.

No	Test Items	Conditions	Testing standard
1	High temperature storage Test	Ta=+80°C, 240 hours	IEC60068-2-1:2007 GB2423.2-2008
2	Low temperature storage Test	Ta=-30°C, 240 hours	IEC60068-2-1:2007 GB2423.1-2008
3	High temperature operation Test	Ta=+70°C, 240 hours	IEC60068-2-1:2007 GB2423.2-2008
4	Low temperature operation Test	Ta=-20°C, 240 hours	IEC60068-2-1:2007 GB2423.1-2008
5	High temperature & humidity (storage Test)	Ta=+60°C, 90%RH max, 240 hours	IEC60068-2-78:2001 GB/T2423.3-2006
6	Thermal shock Test	-30°C 30min~80°C 30min, Change time:5min 20cycle	Start with cold temperature End with high temperature IEC60068-2-14:1984,GB2423.22-2002
7	Vibration Test	Frequency range:10Hz-55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z (6 hours for total)	IEC60068-2-6 GB/T17626.2
8	Mechanical shock	Half Sine Wave 100G 6ms,+X,+Y,+Z 3times for each direction	IEC60068-2-27 GB/T2423.5
9	Dropping Test	Height: 60 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32:1990 GB/T2423.8-1995
10	ESD Test	C=150pF, R=330 Ω, 5 points/panel Air:±8KV, 5 times; Contact: ±4KV, 5times; (Environment:15°C~35°C, 30%~60%RH,86Kpa a~106Kpa)	IEC61000-4-2:2001 GB/T17626.2-2006 Class C

Notes:

- 1、 Maximum acceleration 20g, 1g=9.8m/s²
- 2、 Maximum amplitude 5mm
- 3、 Maximum acceleration =0.002 x F² (frequency Hz) x D (amplitude p-pmm)


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- **8.0 Precautions**

- Please pay attention to the followings when you use this TFT LCD Panel.

- **8.1 Mounting Precautions**

- (1) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (2) You must mount a module using specified mounting holes (Details refer to the drawings).
- (3) Please make sure to avoid external forces applied to the Source PCB or FPC and D-IC during the process of handling or assembling. If not, It causes panel damage or malfunction.
- (4) Note that polarizers are very fragile and could be easily damaged. Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
- (5) Do not pull or fold the source D-IC which connect the source PCB or FPC and the panel.
- Do not pull or fold the LED wire.
- (6) After removing the protective film, when the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with alcohol or purified water.
- Do not strong polar solvent because they cause chemical damage to the polarizer.
- (7) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (8) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (9) Since the LCD is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass may be broken.
- (10) Do not disassemble the module.
- (11) To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- (12) If the customer's set presses the main parts of the LCD, the LCD may show the abnormal display. But this phenomenon does not mean the malfunction of the LCD and should be pressed by the way of mutual agreement.
- (13) Do not drop water or any chemicals onto the LCD's surface.

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8.2 Operating Precautions

- (1) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (2) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
- (3) The electrochemical reaction caused by DC voltage will lead to LCD degradation, so DC drive should be avoided.
- (4) The LCD modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.
- (5) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- (6) Design the length of cable to connect between the connector for back-light and the converter as short as possible and the shorter cable shall be connected directly.
The longer cable between that of back-light and that of converter may cause the luminance of LED to lower and need a higher startup voltage(Vs).
- (7) Connectors are precise devices for connecting PCB and transmitting electrical signals. Operators should insert and unplug MDL in parallel when assembling MDL.
- (8) Do not connect or disconnect the cable to/ from the module at the "Power On" condition.
- (9) When the module is operating, do not lose CLK, ENAB signals. If any one these signals is lost, the LCD panel would be damaged.
- (10) Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- (11) Do not re-adjust variable resistor or switch etc.
- (12) For the Q/Single/OC Product, If the LED designed side view, LED bar should be putted in the Long/short side ; Otherwise, its reliability and function may not be guaranteed.

注：
 ①(1)涉及到Pol相关条目适用于OC/MDL出货产品，
 ②(6)(7)涉及到connector相关适用于OC/MDL出货产品
 ③ (12) 涉及到客户进行BLU设计， LED Bar位置需要避开GOA位置；

8.3 Electrostatic Discharge Control

- (1) Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly. Keep products as far away from static electricity as possible.
- (2) Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.

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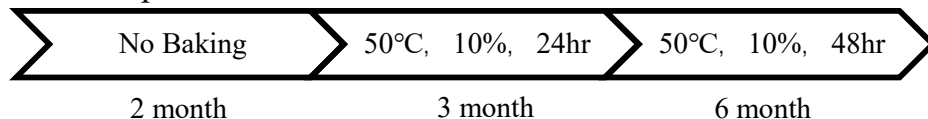
8.4 Precautions for Strong Light Exposure

It is not allowed to store or run directly in strong light or in high temperature and humidity for a long time; Strong light exposure causes degradation of polarizer and color filter.

8.5 Storage Precautions

When storing modules as spares for a long time, the following precautions are necessary.

- (1) The polarizer surface should not come in contact with any other object.
It is recommended that they be stored in the container in which they were shipped.
Temperature : 5 ~ 40 °C
- (2) Humidity : 35 ~ 75 %RH
- (3) Period : 6 months
- (4) Control of ventilation and temperature is necessary.
- (5) Please make sure to protect the product from strong light exposure, water or moisture.
Be careful for condensation.
- (6) Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.
- (7) Do not store the LCD near organic solvents or corrosive gasses.
- (8) Please keep the Modules/OC/FOG at a circumstance shown below Fig.




8.6 Precautions for Protection Film

- (1) Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, If possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.
- (2) In handling the LCD, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

8.7 Appropriate Condition for Display

- (1) Normal operating condition
 - Temperature: 0 ~ 40°C
 - Operating Ambient Humidity : 10 ~ 90 %
 - Display pattern: dynamic pattern (Real display)
 - Suitable operating time: under 12 hours a day.
- (2) Special operating condition
If the product will be used in extreme conditions such as high temperature, humidity, display patterns or 7*24hrs operation time etc., It is strongly recommended to contact us for Application engineering advice. Otherwise, its reliability and function may not be guaranteed.
- (3) Black image or moving image is strongly recommended as a screen save.

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- (4) Lifetime in this spec. is guaranteed only when commercial display is used according to operating usages.
- (5) Please contact us in advance when you display the same pattern for a long time.
- (6) If the Module keeps displaying the same pattern for a long period of time, the image may be “sticked“ or “turn off” to the screen. To avoid image sticking, it is recommended to use a screen saver.
- (7) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- (8) Dew drop atmosphere should be avoided.
- (9) The storage room should be equipped with a good ventilation facility and avoid to expose to corrosive gas , which has a temperature controlling system.
- (10) The LCD should be avoided to expose to corrosive gas for long time, ,the LCD may be affected by the gas as SO₂ ,H₂S etc.
- (11) When expose to drastic fluctuation of temperature (hot to cold or cold to hot) ,the LCD may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD's surface which may affect the operation of the polarizer and the LCD.
- (12) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD may turn black at temperature above its operational range. However those phenomena do not mean malfunction or out of order with the LCD. The LCD will revert to normal operation once the temperature returns to the recommended temperature range for normal operation

8.8 Others

A. LC Leak

- If the liquid crystal material leaks from the panel, it is recommended to wash the LC with acetone or ethanol and then burn it.
- In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- If LC in mouth, mouth need to be washed, drink plenty of water to induce vomiting and follow medical advice.
- If LC touch eyes, eyes need to be washed with running water at least 15 minutes.

B. Rework

- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

- C. In order to prevent potential problems, flicker should be adjusted by optimizing the Vcom value in customer LCM Line (适用于Q/Single/OC出货产品)

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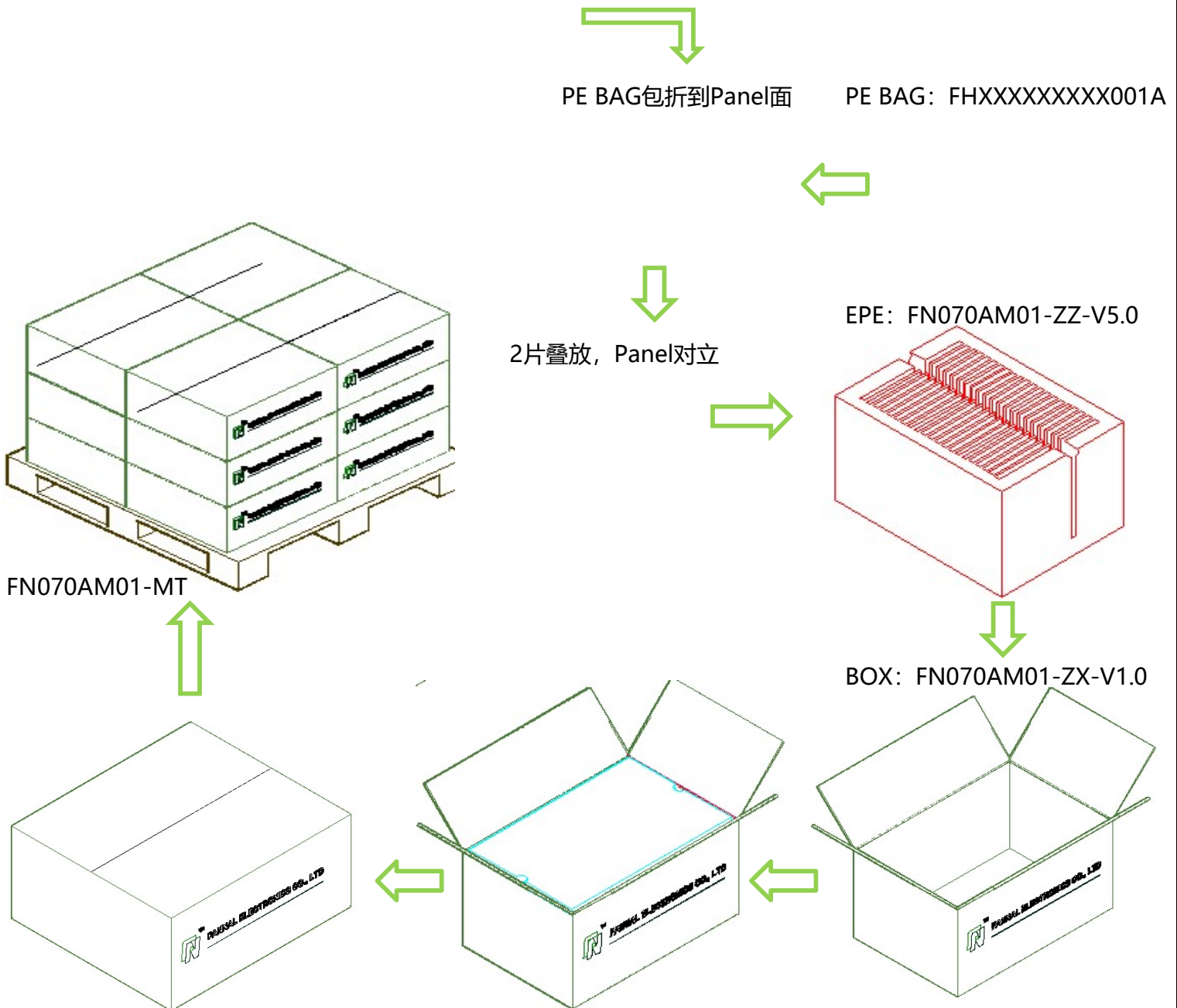
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9.0 PACKING INFORMATION

LCM MODEL	LCM Qty. in the Box	Carton Size(mm)	LCM Qty. in the Pallet
TBD			



10.0 VISUAL INSPECTION CRITERIA FOR ALL CUSTOMERS

10.1 Sampling Method

Unless otherwise agreed upon in writing, the sampling inspection shall be applied to the Customers incoming inspection.

10.1.1 Lot size : 1 pallet per same model

10.1.2 Sampling type : Random sampling

10.1.3 Inspection level : II

10.1.4 Sampling table : MIL-STD-105E

10.2 Inspection Environment

10.2.1 Ambient conditions

a. Ambient Temperature: $25 \pm 3^{\circ}\text{C}$

b. Relative Humidity: $65 \pm 20\% \text{RH}$

c. Ambient Illumination: 300-700LUX (Normal: 500LUX)

10.2.2 Viewing Distance

The distance between the LCM and the inspector's eyes shall be at least 30cm-50cm

10.2.3 Viewing Angle

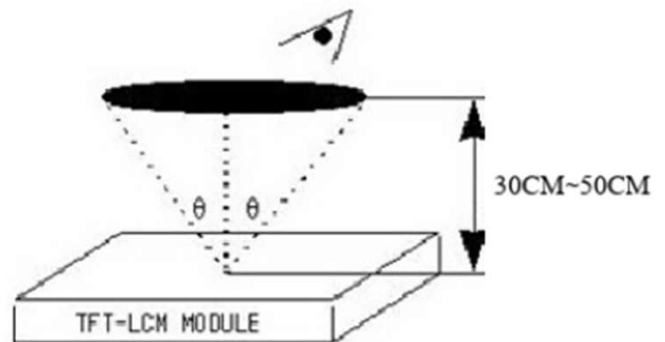
performing in front of the panel

[Vertical] : $\pm 25^{\circ}$

[Horizontal] : $\pm 40^{\circ}$

10.2.4 Inspection Area:

Display Area (Active Area)



10.3 Definitions

10.3.1 Dark / Bright Spots

Points on display which appear dark/bright and usually result from the contamination.

These defects do not vary in size or intensity (contrast) when contrast is varied.

10.3.2 Dark / Bright Lines

Lines on display which appear dark/bright and usually result from the contamination.

10.3.3 Polarizer Scratch


Lines on display which are seen across a darker background and do not vary in size.

10.3.4 Polarizer Dent

White spots on display which appear against a darker background and do not vary in size.

10.3.5 Bright Dot Defects

Dots (sub-pixels) on display which appear bright in the display area and visible through the 5%ND filter at Black Pattern.

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10.3.6 Dark Dot Defects

Dots(sub-pixels)on display which appear dark in the display area at R.G.B Color Pattern.

10.3.7 Line Defects

All line defects on display which appear bright/dark such as vertical, horizontal, or cross lines.

10.3.8 Mura

Mura on display which appears darker/brighter against background brightness on parts of display area.

10.3.9 BM Defects

Bright(white)Points on display which are off BM(Black Matrix).

10.3.10 Visual Inspection

Inspection for LCM when the unit turns on.

10.3.11 Appearance Inspection

External inspection for LCM when the unit turns off.

10.3.12 Other

Defects which cannot be classified into the above defect definitions.

Note 1: Bright& Dark dots are not smaller than a sub-pixel(Dots smaller than a sub-pixel are not counted as defect dots)

10.4 Inspection Criteria

Refer to 《TFT LCM general inspection standard》

10.5 Verification

The supplier can verify the defective LCMs to segregate the responsibilities at customer's facility or can request the Customer to ship the defective LCMs to assigned place for verification


This verification result shall be agreed mutually by the Customer and Supplier. This result can be corrected/changed after detail failure analysis at Supplier's facilities.

10.6 Supplier Induced Defects

All of the Supplier induced defective LCMs shall be returned to the Supplier for repair or replacement.

Before return the defective LCMs, the Customer needs Supplier's confirmation with RMA Number.

All of the returned LCMs shall be returned to the Customer within agreed time period.

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10.7 Customer Induced Defects

The Customer can return the customer induced defective LCMs to the Supplier for repair. The repair cost for Customer induced defective LCMs shall be agreed with both parties, Customer and Supplier.

10.8 Warranty Period

In-warranty period is Eighteen(18)Months from manufacturing month of LCM

Note :

- a. Eighteen months are composed of twelfth months in-warranty period and sixth months distribution period
- b. The manufacturing Month is on the LCMs as Supplier's serial No.

10.9 Repair Warranty

Repair warranty is Twelve(12)Months from repaired month for repaired LCMs

Note : a. The Label for repair will be added after repairing.

10.10 Warranty avoidance

The warranty will be avoided in cases of below:

- a. When the warranty period is expired.
- b. The Customer induced defective LCMs.
- c. When the LCMs were repaired by 3rd party without Supplier's approval.
- d. When the LCMs were treated like Disassemble and Rework by the Customer and/or Customer's representatives without Supplier's approval.

10.11 Others

If any problems arise with the LCMs supplied by supplier, the customer and supplier will cooperate and make efforts to solve it with mutual confidence and respect