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SPEC. NUMBER AM-1025003A	PRODUCT GROUP TFT- LCM	REV. V0	ISSUE DATE 2022-12-27	PAGE 1 OF 35
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**FN1025D003A**

**Product Specification Rev.V0**

BUYER	
SUPPLIER	FANNAL Electronics CO., LTD
FG-Code	FN1025D003A

Preliminary Specification

Approval Specification

ITEM	BUYER SIGNATURE	DATE
_____	_____	_____
_____	_____	_____
_____	_____	_____

ITEM	SUPPLIER SIGNATURE	DATE
Prepared	<u>DONG</u>	<u>2022-12-27</u>
Reviewed	<u>XIONG</u>	<u>2022-12-27</u>
Approved	<u>JACK</u>	<u>2022-12-27</u>

**PRODUCT GROUP**

**REV**

**ISSUE DATE**



TFT- LCM PRODUCT

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## REVISION HISTORY

REV.	Page.	DESCRIPTION OF CHANGES	DATE	PREPARED
V0		Initial Release	2022-12-27	JACK

**PRODUCT GROUP**

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## 1.0 General Description /一般说明

### 1.1 Application /应用

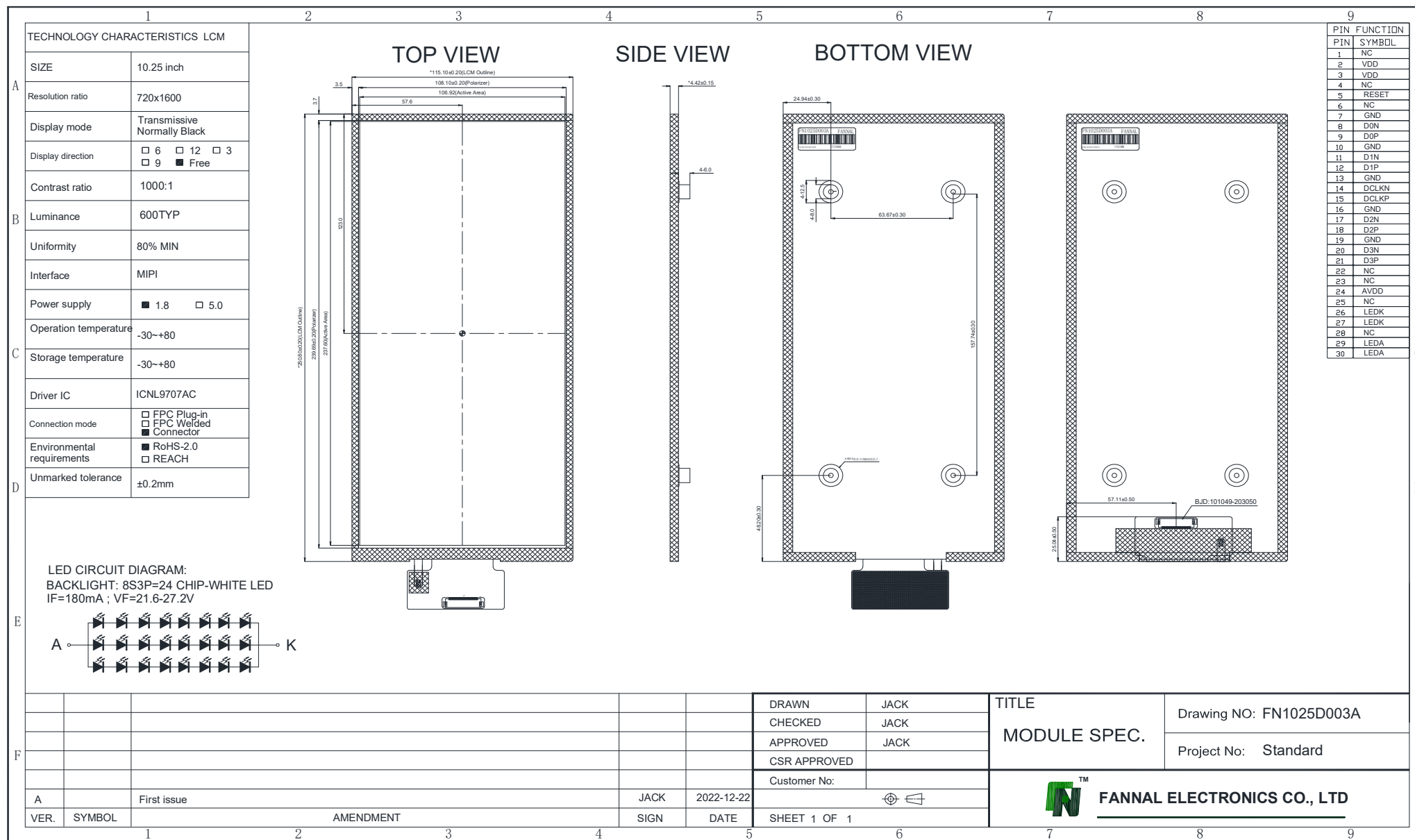
- Industrial
- Automotive
- Medical
- Outdoor highlight

### 1.2 General Specification /通用技术条件

The followings are general specifications at the FN1025D003A.

Parameter	Specification	Unit
LCD size	10.25 (Diagonal)	inch
Number Of Pixels	720(H)×1600(V)	pixels
Pixel Pitch	0.1485x0.1485(V)	mm
Active Area	106.92(H)×237.6(V)	mm
Module Size	115.1(W)×250.8(H)×10.4(D)	mm
Display Mode	Normally Black	
Interface	MIPI-4lane	
Pixel arrangement	RGB-Vertical Stripe	
View Direction	ALL	
Power Consumption	TBD	W
Weight	TBD	g
Luminance	600 (TYP.)	cd/m <sup>2</sup>
Driver IC	ICNL9707AC	

# 2.0 Mechanical Drawing /机械制图



### 3.0 ABSOLUTE MAXIMUM RATINGS /绝对最大额定值

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

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	IOVCC~VSSD	-0.3	3.3	V
	VCI~VSSA	-0.3	6.6	V
	HS_VCC~HS_VSS	-0.3	3.3	V
	VSP~VSSA	-0.3	6.6	V
	VSSA~VSN	-6.6	0	V
	VGH~VGL	VGH-VGL ≤30		V
Input Voltage	V <sub>in</sub>	-0.3	IOVCC+0.3	V
HS Input Voltage	V <sub>hsin</sub>	-0.3	+2.0	V
Operating Temperature	T <sub>OP</sub>	-30	80	°C
Storage Temperature	T <sub>ST</sub>	-30	80	°C
Operating Ambient Humidity	H <sub>OP</sub>	10	60°C 90%RH	RH
Storage Humidity	H <sub>ST</sub>	10	60°C 90%RH	RH

## 4.0 ELECTRICAL SPECIFICATIONS/电气规范

### 4.1 TFT LCM Module

[Ta=25±2 °C]

Parameter	Symbol	Min.	Typ.	Max.	Unit
Analog Operating voltage	VCI	2.6	3.0	3.6	V
	VSP	4.5	5.5	6.5	V
	VSN	-6.5	-5.5	-4.5	V
	VCOM	-0.3	-	-4.0	V
	VGMP	-.0	4.5	6.0	V
	VGMIN	-6.0	-4.5	-3.0	V
I/O Operating voltage	IOVCC	16.5	1.8	1.95	V
MIPI Operating voltage	HS_VCC	1.1	1.2	1.3	V
Power Supply voltage	AVDD	9.0	10.0	11.0	V
	IVADD	--	25	--	mA

### 4.2 Backlight Driving Conditions /背光驱动条件

[Ta=25±2 °C]

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Forward Current Voltage	V <sub>F</sub>	21.6	24.4	27.2	V	Note 1
Forward Current	I <sub>f</sub>	-	180	-	mA	
Backlight Power Consumption	W <sub>bl</sub>	-	4.5		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/接口说明

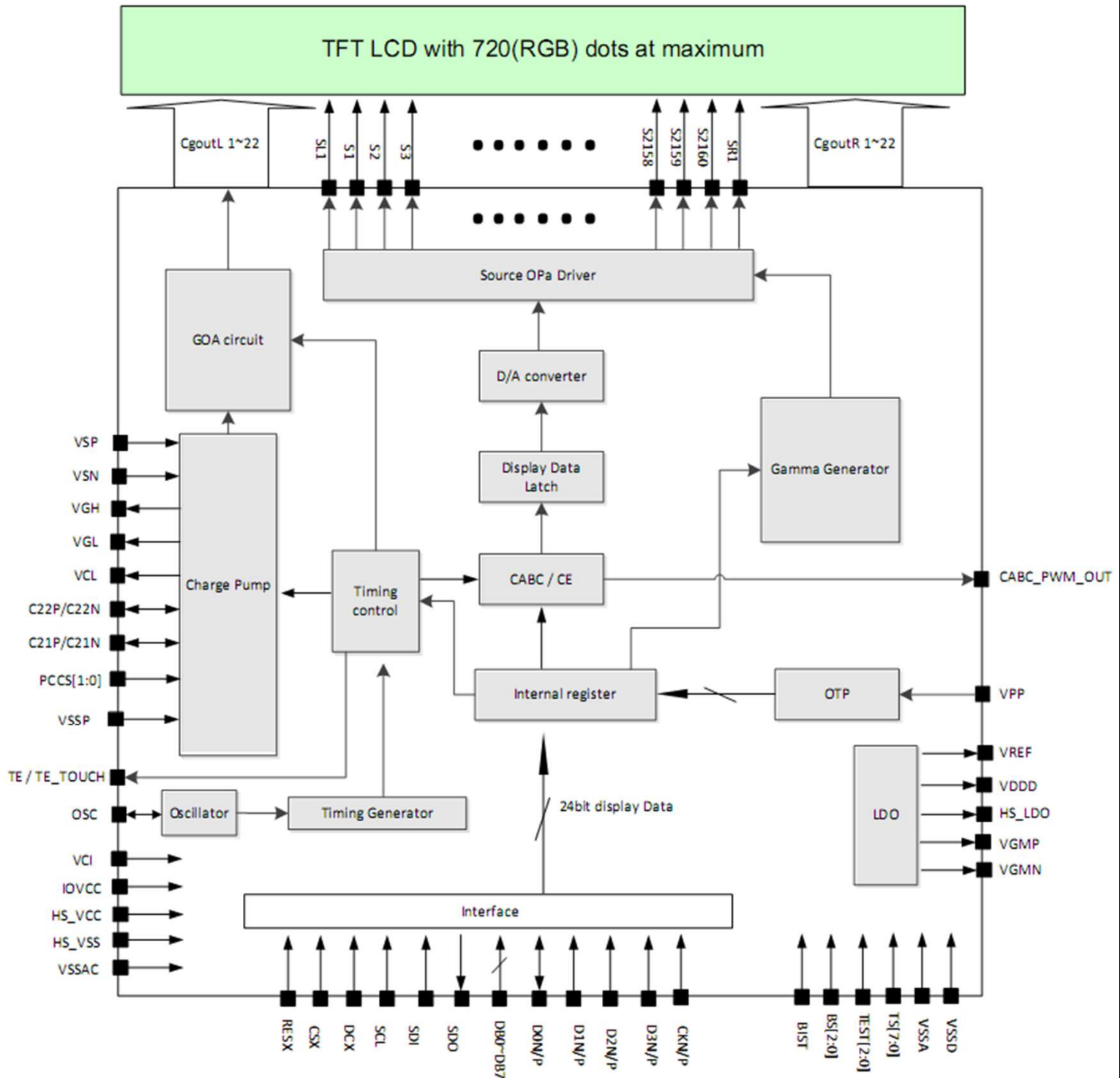
Connector Name/Designation	Interface Connector/Interface Card
Type Part Number	BJD:101049-203050
Mating Housing Part Number	FFC

### 5.1 Pin assignment for LCM module /模组引脚分配

Pin No.	Symbol	Description	Note.
1	NC	No Connect	
2-3	VDD	Power for Digital Circuit(1.8V)	
4	NC	No Connect	
5	RESET	Global reset pin. Active Low to enter Reset State. Normally pull high. Connecting with an RC reset circuit for stability(1.8V) ,RESET:High=IOVCC,Low=0V	
6	NC	No Connect	
7	GND	Power Ground	
8	D0N	Negative MIPI differential Data inputs	
9	D0P	Positive MIPI differential Data inputs	
10	GND	Power Ground	
11	D1N	Negative MIPI differential Data inputs	
12	D1P	Positive MIPI differential Data inputs	
13	GND	Power Ground	
14	DCLKN	Negative MIPI differential clock inputs	
15	DCLKP	Positive MIPI differential clock inputs	
16	GND	Power Ground	
17	D2N	Negative MIPI differential Data inputs	
18	D2P	Positive MIPI differential Data inputs	
19	GND	Power Ground	
20	D3N	Negative MIPI differential Data inputs	
21	D3P	Positive MIPI differential Data inputs	
22-23	NC	No Connect	
24	AVDD	Input + 10V	
25	NC	No Connect	
26-27	LEDK	Power for LED Backlight(Cathode)	
28	NC	No Connect	
29-30	LEDA	Power for LED Backlight(Anode)	



### 4.3 Block Diagram:



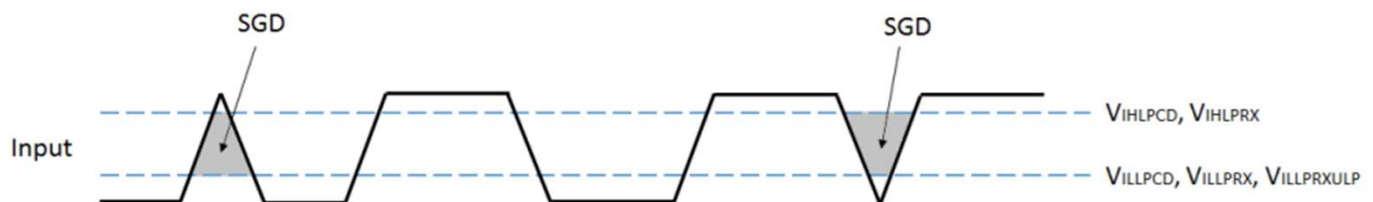
## 5.2 MIPI Characteristics

### 5.2.1 DC Characteristics for DSI LP Mode

Condition : Ta =25°C ,IOVCC =1.6V~3.6V, VCI =2.6V~3.6V.

Parameter	Symbol	Conditions	Specification			Unit	Notes
			MIN	TYP	MAX		
Logic high level input voltage	V <sub>IHLPCD</sub>	LP-CD	450		1350	mV	
Logic Low level input voltage	V <sub>ILLPCD</sub>	LP-CD	0		200	mV	
Logic high level input voltage	V <sub>IHLPRX</sub>	LP-RX (CLK,D0)	880		1350	mV	
Logic Low level input voltage	V <sub>ILLPRX</sub>	LP-RX (CLK,D0)	0		550	mV	
Logic Low level input voltage	V <sub>ILLPRXULP</sub>	LP-RX(CLK ULP mode)	0		300	mV	
Logic high level input voltage	V <sub>OHLPTX</sub>	LP-TX(D0)	1.1		1.3	V	
Logic Low level input voltage	V <sub>OLLPTX</sub>	LP-TX(D0)	-50		50	mV	
Logic high level input voltage	I <sub>IH</sub>	LP-RX,V <sub>in</sub> =0~1.3V			10	uA	
Logic Low level input voltage	I <sub>IL</sub>	LP-RX,V <sub>in</sub> =0~1.3V	-10			uA	
Input pulse rejection	SGD	DSI-CLK+/-,DSI Dn+/-			300	Vps	1

**Note 1:** Peak interference amplitude max. 200mV and interference frequency min. 450MHz.



### 5.2.2 DC Characteristics for DSI HS Mode

Condition : Ta =25°C ,IOVCC =1.6V~3.6V, VCI =2.6V~3.6V.

Parameter	Symbol	Conditions	Specification			Unit	Notes
			MIN	TYP	MAX		
Input voltage common mode range	V <sub>CMCLK</sub> V <sub>CMDATA</sub>	CLK+/-, Dn+/-	70		330	mV	1,2
Input voltage common mode variation (≤450MHz)	V <sub>CMRCLKL</sub> V <sub>CMRDATAL</sub>	CLK+/-, Dn+/-	-50		50	mV	3
Input voltage common mode variation (≥450MHz)	V <sub>CMRCLKM</sub> V <sub>CMRDATAM</sub>	CLK+/-, Dn+/-			100	mV	
Low-level differential input voltage threshold	V <sub>THLCLK</sub> V <sub>THLDATA</sub>	CLK+/-, Dn+/-	-70			mV	
High-level differential input voltage threshold	V <sub>THHCLK</sub> V <sub>THHDATA</sub>	CLK+/-, Dn+/-			70	mV	
Single-ended input low voltage	V <sub>ILHS</sub>	CLK+/-, Dn+/-	-40			mV	2
Single-ended input high voltage	V <sub>IHHS</sub>	CLK+/-, Dn+/-			460	mV	2
Differential input termination resistor	R <sub>TERM</sub>	CLK+/-, Dn+/-	80	100	125	Ω	
Single-ended threshold voltage for termination enable	V <sub>TERM_EN</sub>	CLK+/-, Dn+/-			450	mV	
Termination capacitor	C <sub>TERM</sub>	CLK+/-, Dn+/-	14		60	pF	

**Note 1:** Includes 50mV (-50mV to 50mV) ground difference.

**Note 2:** Without V<sub>CMRCLKM</sub> / V<sub>CMRDATAM</sub>.

**Note3:** Without 50mV (-50mV to 50mV) ground difference.

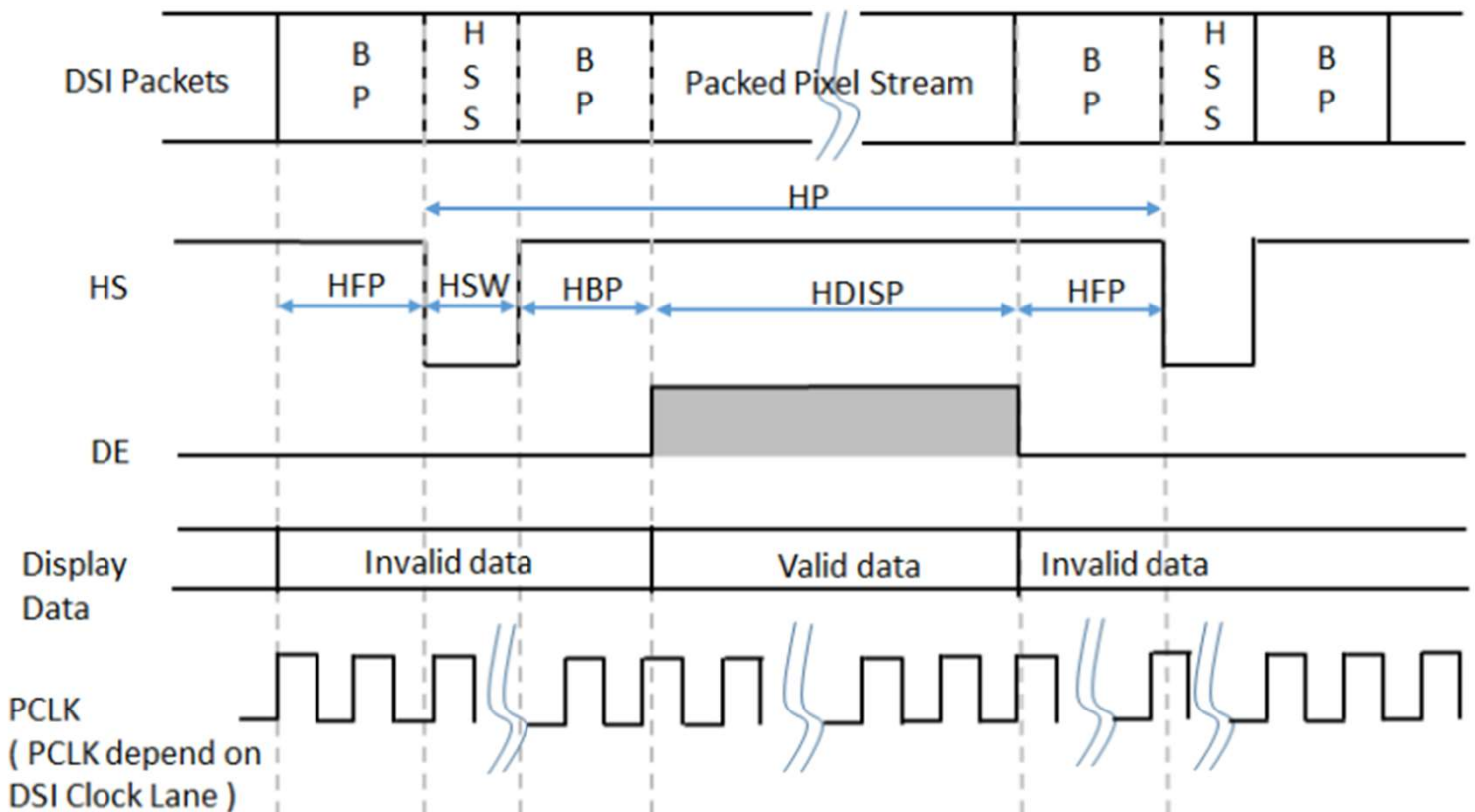
**Note4:** Dn =D0,D1,D2 and D3.



Parameter	Symbol	Conditions	Specification			Unit	Notes
			MIN	TYP	MAX		
Vertical Total	$V_{TOTAL}$		1286			Line	
Vertical low pulse width	$V_{SW}$		2			Line	1
Vertical front porch	$V_{FP}$		2			Line	
Vertical back porch	$V_{BP}$		2			Line	1
Vertical data start point		$V_{SW}+V_{BP}$	4			Line	1
Vertical blanking period	$V_{PT}$	$V_{SW}+V_{BP}+V_{FP}$	6			Line	
Vertical active area		$V_{DISP}$	-	1280	1760	Line	
Vertical Frame rate	$V_{FR}$			60		Hz	

**Note 1:** The  $V_{SW}$  and  $V_{BP}$  pulse width are related to panel GOA timing. The GOA timing must be set at corresponding position for LCM normal display.

### 5.3.2 Horizontal Timings for DSI Video Mode





Parameter	Symbol	Conditions	Specification			Unit	Notes
			MIN	TYP	MAX		
HS low pulse width	HSW		0.2			uS	
Horizontal back porch	HBP		1.0			uS	
Horizontal front porch	HFP		1.0			uS	
Horizontal data start point		HSW+HBP	1.2			uS	
Horizontal blanking period	HBLK	HSW+HBP+HFP	2.2			uS	
Horizontal active area	HDISP			-	720	DCLK	

### 5.4 MIPI AC Characteristics

#### 5.4.1 High Speed Mode-Clock Timings

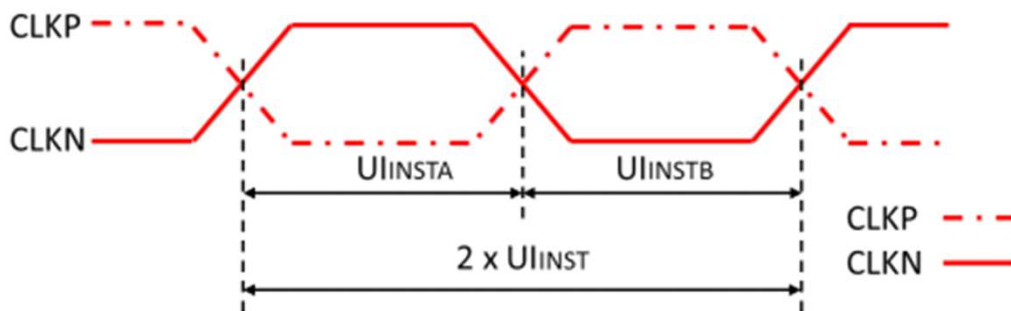


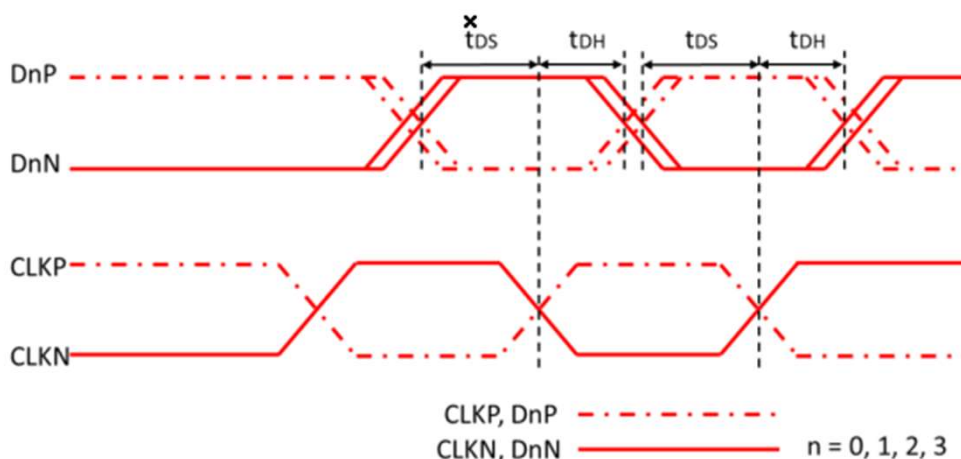
Figure 4-5 Clock Timing

Signal	Symbol	Parameter	Specification			Unit	Notes
			MIN	TYP	MAX		
CLK P/N	$2 \times UI_{INST}$	Double UI instantaneous	2.5		12.5	ns	
CLK P/N	$UI_{INSTA}, UI_{INSTB}$	UI instantaneous Half	1.25		6.25	ns	1,2

Note 1:  $UI = UI_{INSTA} = UI_{INSTB}$ .

Note 2: ICNL9707 can support max 600Mbps/lane at 4 lane and max 800Mbps/lane at 3 lane application.

#### 5.4.2 High Speed Mode-Clock / Data Timings



Signal	Symbol	Parameter	Specification			Unit	Notes
			MIN	TYP	MAX		
Dn P/N (n=0,1,2 and 3)	tDS	Data to Clock Setup time	0.15*UI			UI	
	tDH	Clock to Data Hold time	0.15*UI			UI	

### 5.4.3 High Speed Mode – Rising and Falling Timings

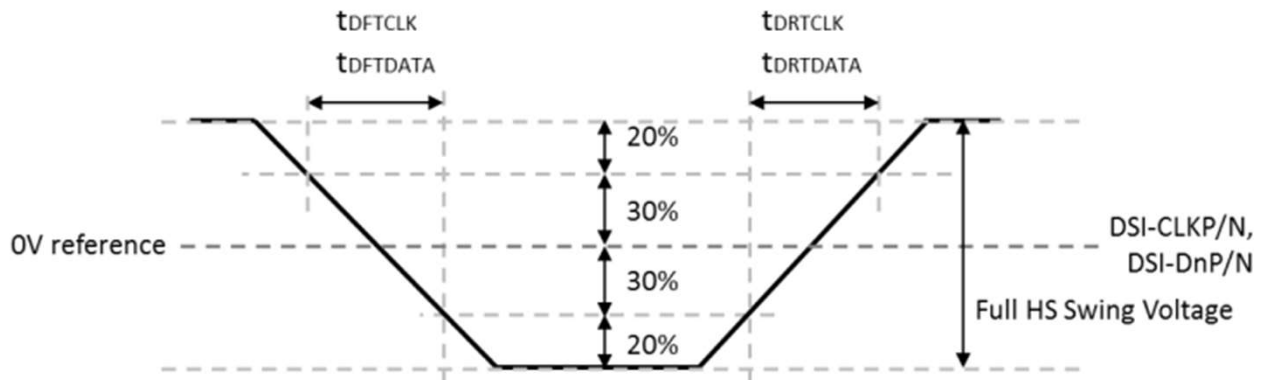


Figure 4-7 R<sub>ring</sub> and F<sub>alling</sub> Timings

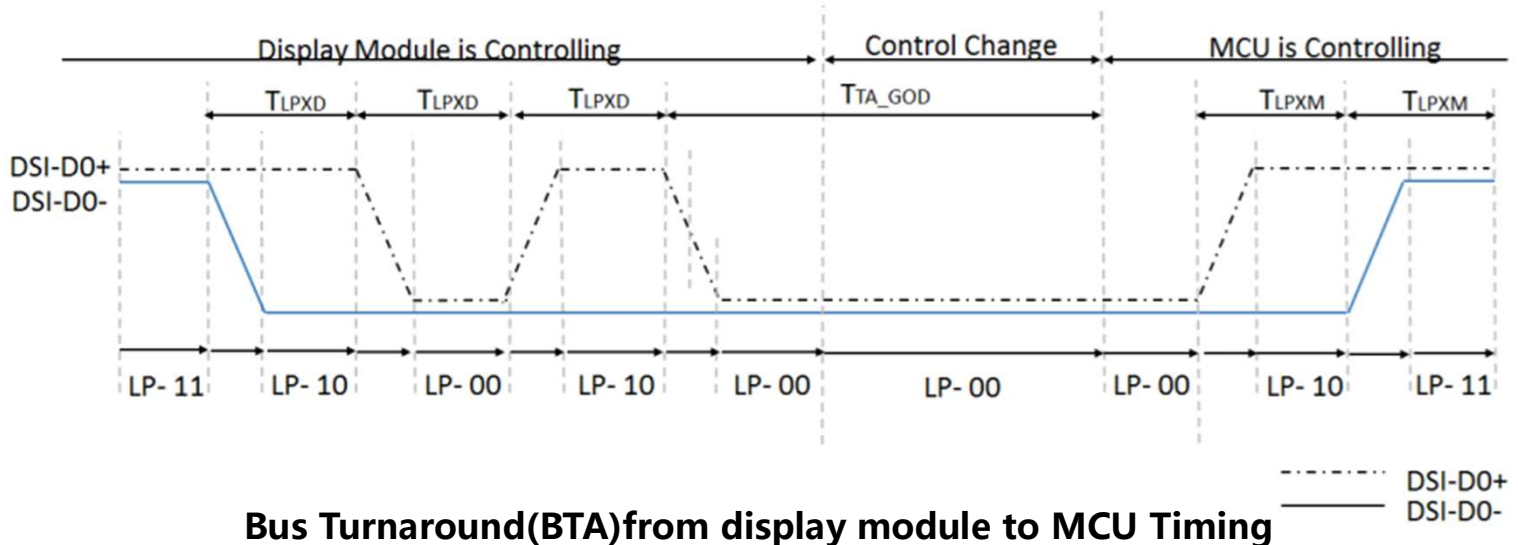
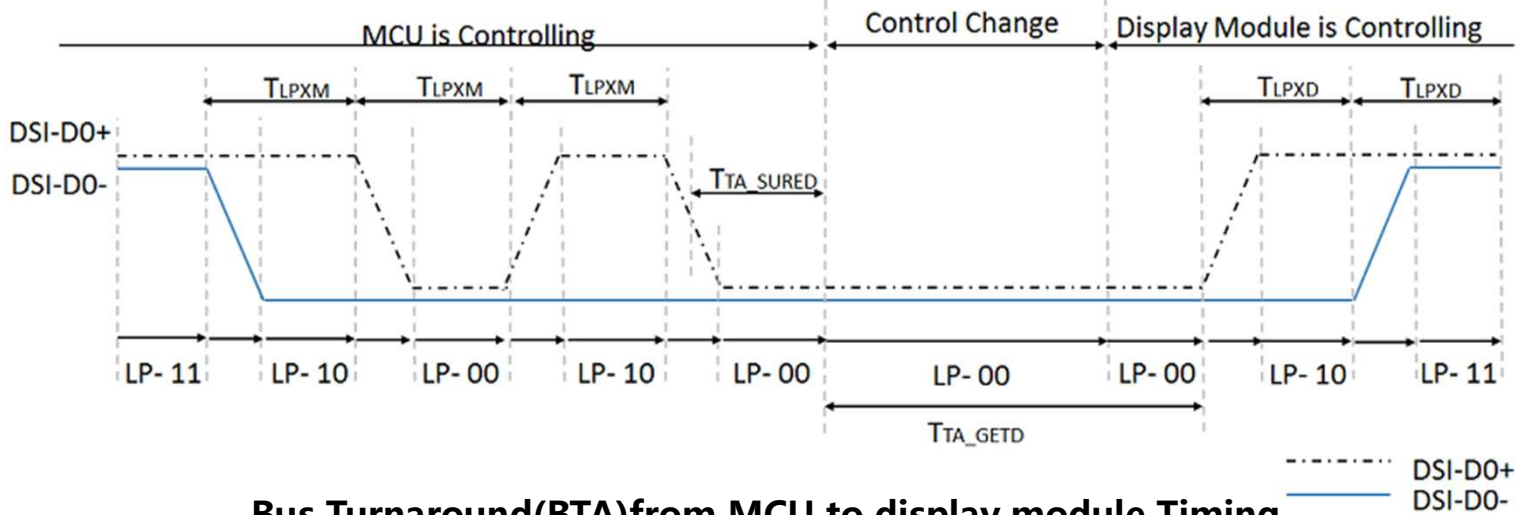
Parameter	Symbol	Conditions	Specification			Unit	Notes
			MIN	TYP	MAX		
Differential Rise Time for Clock	tDRTCLK	CLKP/N	150pS		0.3*UI		2,3
Differential Rise Time for Data	tDRTDATA	DnP/N	150pS		0.3*UI		1,2,3
Differential Fall Time for Clock	tDFTCLK	CLKP/N	150pS		0.3*UI		2,3
Differential Fall Time for Data	tDFTDATA	DnP/N	150pS		0.3*UI		1,2,3

**Note 1:** DnP/N, n =0,1,2 and 3.

**Note 2:** The display module has to meet timing requirements, which are defined for the transmitter (MCU) on MIPI D-PHY standard.

**Note 3:** DSI-CLK+ = CLKP, DSI-CLK- = CLKN, DSI-D0+ = D0P, DSI-D0- = D0N.

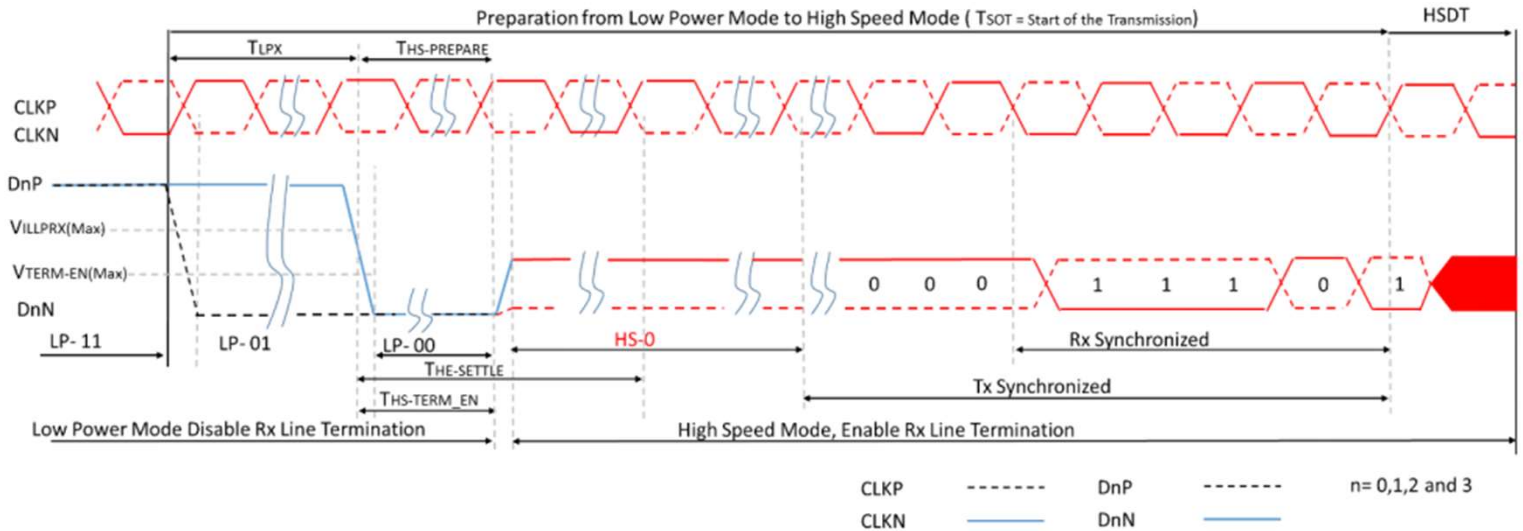
### 5.4.4 Low Speed Mode – Bus Turn Around



Signal	Symbol	Parameter	Specification			Unit	Notes
			MIN	TYP	MAX		
D0P/N	T <sub>LPXM</sub>	Length of LP-00,LP-01,LP-10 or LP11 periods MCU to Display Module	50		75	nS	1
D0P/N	T <sub>LPXD</sub>	Length of LP-00,LP-01,LP-10 or LP11 periods Display Module to MCU	50		75	nS	1
D0P/N	T <sub>TA_SURED</sub>	Time-out before the Display Module starts driving	T <sub>LPXD</sub>		2* T <sub>LPXD</sub>	nS	1
D0P/N	T <sub>TA_GETD</sub>	Time to drive LP-00 by Display Module	5* T <sub>LPXD</sub>			nS	1
D0P/N	T <sub>TA_GOD</sub>	Time to drive LP-00 after turnaround request -MCU	4 * T <sub>LPXD</sub>			nS	1

**Note 1:** D0P = DSI-D0+, D0N = DSI-D0-.

### 5.4.5 Data Lanes from Low Power Mode to High Speed Mode

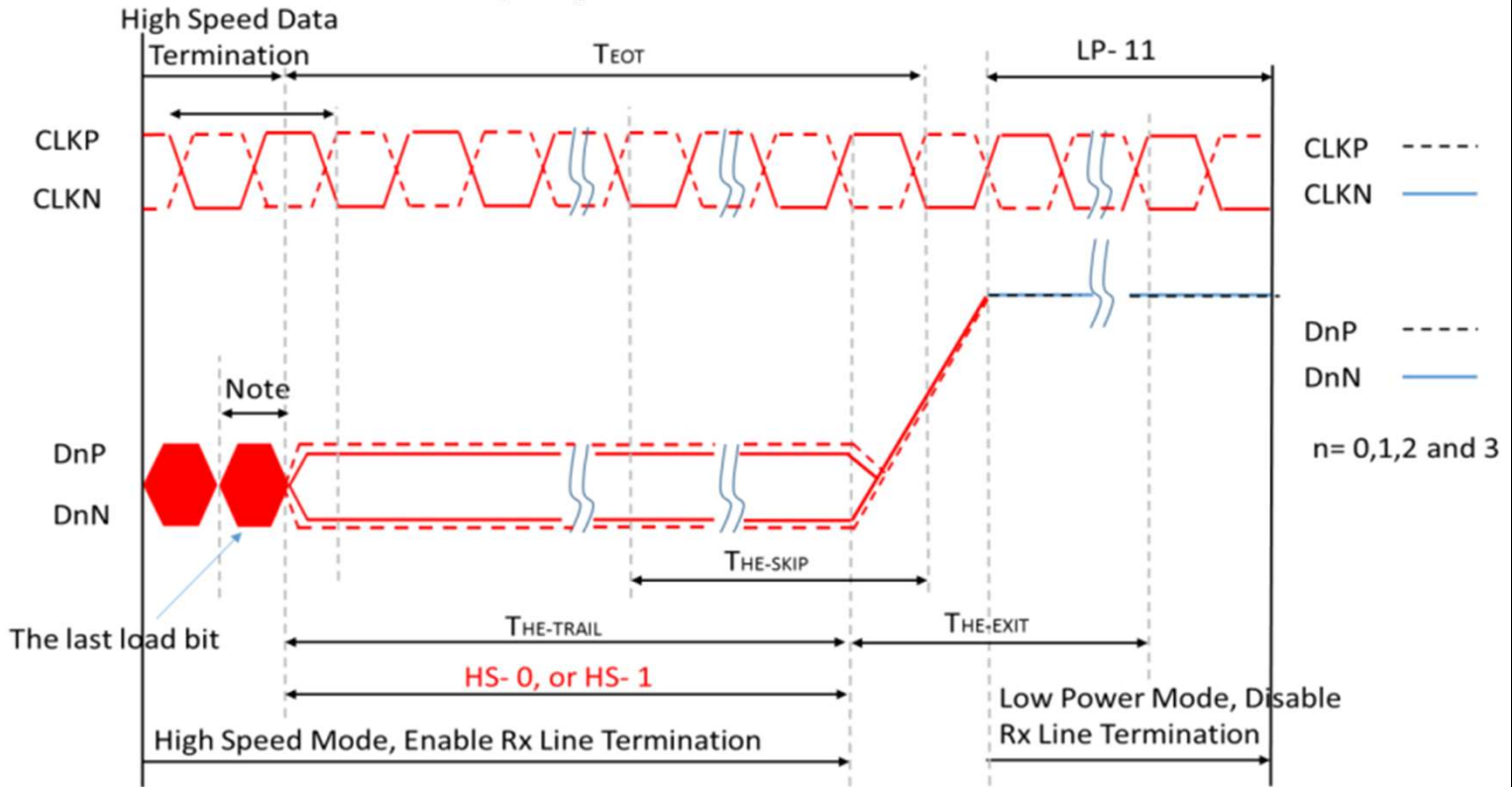


Signal	Symbol	Parameter	Specification			Unit	Notes
			MIN	TYP	MAX		
DnP/N	T <sub>LPX</sub>	Length of any Low Power State Period	50			nS	1
DnP/N	T <sub>HS-PREPARE</sub>	Time to drive LP-00 to prepare for HS Transmission	40+4*UI		85+6*UI	nS	1
DnP/N	T <sub>HS-TREM-EN</sub>	Time to enable Data lane Receiver line termination measured from when Dn crosses VILMAX			35+4*UI	nS	1

Note 1: DnP/N, n=0,1,2 and 3.



### 5.4.6 Data Lanes from High Speed Mode to Low Power Mode



Note:

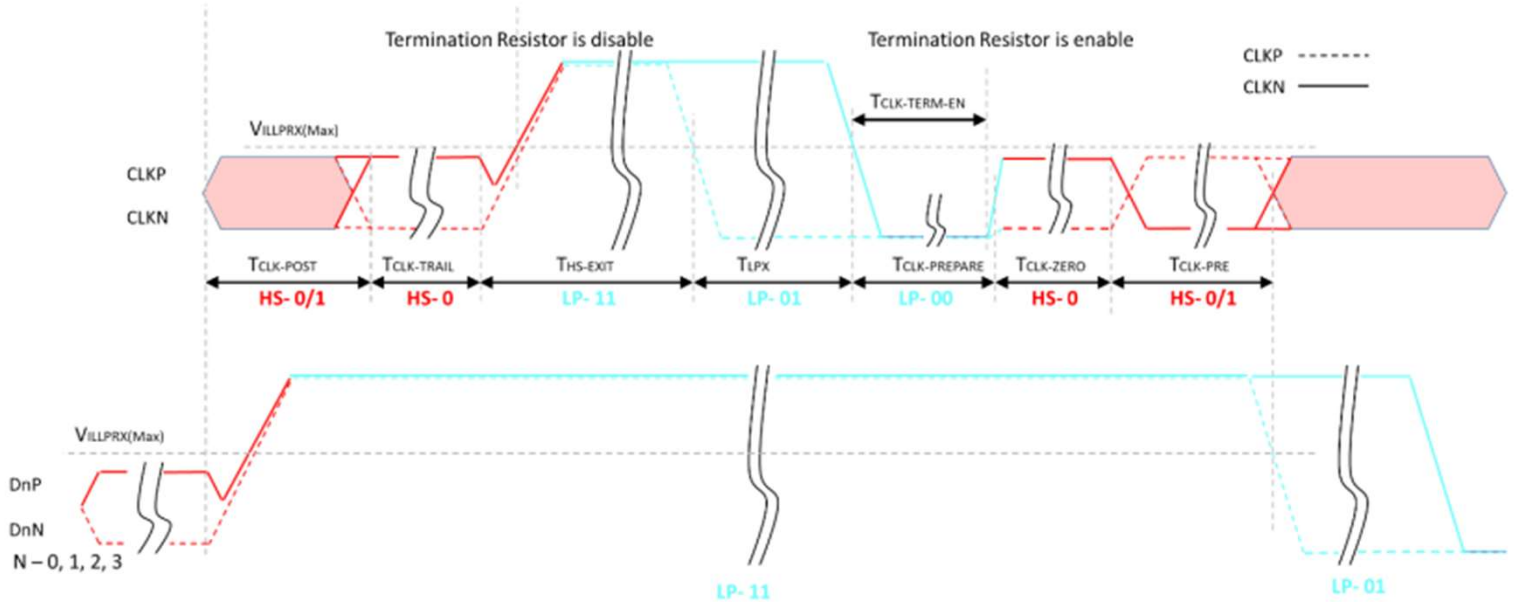
If the last load bit is HS- 0, the transmitter changes from HS- 0 to HS- 1.

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

Signal	Symbol	Parameter *	Specification			Unit	Notes
			MIN	TYP	MAX		
DnP/N	T <sub>HS-SKIP</sub>	Time-Out at Display Module to ignore transition period of EoT	40		55+4*UI	nS	1
DnP/N	T <sub>HS-EXIT</sub>	Time to drive LP-11 after HS burst	100			nS	1

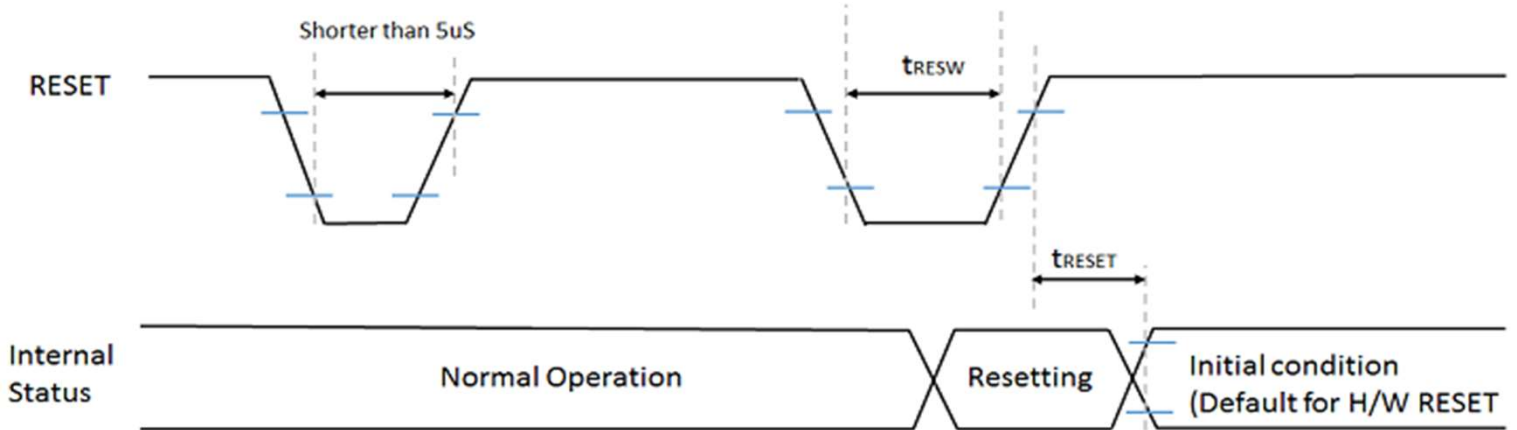
Note 1: DnP/N, n=0,1,2 and 3.

### 5.4.7 DSI Clock Burst – High speed mode to /from Low Power Mode



Signal	Symbol	Parameter	Specification			Unit	Notes
			MIN	TYP	MAX		
CKP/N	T <sub>CK-POST</sub>	Time that the MCU shall continue sending HS clock after the last associated Data Lanes has transitioned to LP mode	60+52*UI			nS	
CKP/N	T <sub>CLK-TRAIL</sub>	Time to drive HS differential state after last payload clock bit of a HS transmission burst	60			nS	
CKP/N	T <sub>HS-EXIT</sub>	Time to drive LP-11 after HS burst	100			nS	
CKP/N	T <sub>CLK-PREPARE</sub>	Time to drive LP-00 to prepare for HS transmission	38		95	nS	
CKP/N	T <sub>CLK-TERM-EN</sub>	Time-out at Clock Lane to enable HS termination			38	nS	
CKP/N	T <sub>CLK-PREPARE+CLK-ZERO</sub>	Minimum lead HS-0 drive period before starting Clock	300			nS	
CKP/N	T <sub>CLK-PRE</sub>	Time that the HS clock shall be driven prior to any associated Data Lane beginning the transition from LP to HS mode	8*UI			nS	

### 5.5 Reset Input Timing



Signal	Symbol	Parameter	Description	Specification			Unit	Notes
				MIN	TYP	MAX		
RESET	tRESW	Reset "L" pulse width		10			uS	1
	tRESET	Reset complete time	When reset applied during Sleep in mode			5	mS	2
When reset applied during Sleep Out mode					120	mS	5	

**Note 1:** Condition : Ta =25°C.

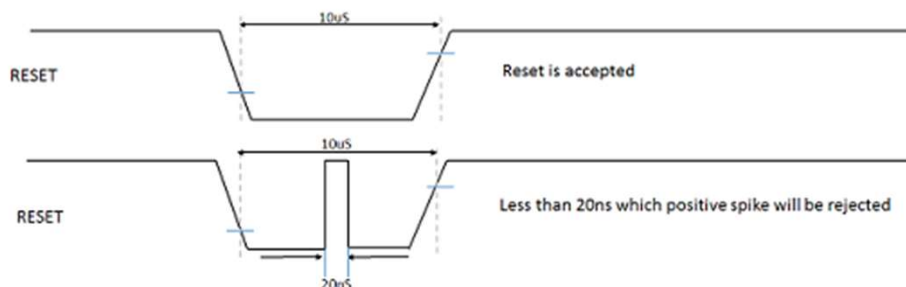
**Note 2:** Spike due to an electrostatic discharge on RESET line does not cause irregular system reset according to the table below.

RESET Pulse	Action
Less than 5us	Reset Rejected
More than 10uS	Reset
Between 5us and 10uS	Reset Start

**Note 2:** During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120ms, 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.

**Note3:** During Reset Complete Time, values in OTP memory will be latched to internal register during this period. This loading is done every time when there is H/W RESET complete time (tRESET) within 5ms after a rising edge of RESET.

**Note 4:** Spike Rejection also applies during a valid reset pulse as shown below:



**Note 5:** It is necessary to wait 5ms after releasing RESET when sending commands, and Sleep Out command can not be sent within 120ms.



### 5.6 Power ON / OFF Sequence

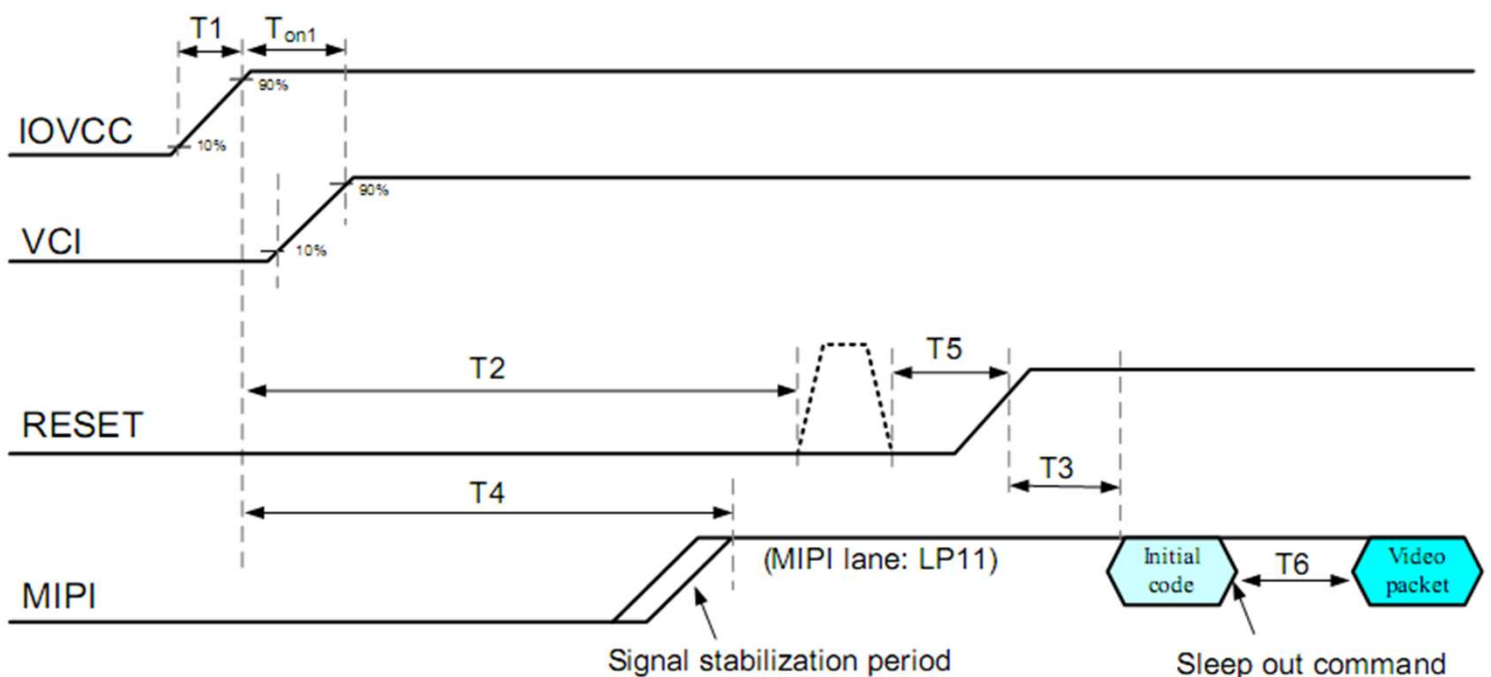
#### 5.6.1 Power ON Sequence

Hardware Reset would be applied when power on. The RESX is held at "H" by the host after both VCI and IOVCC have been applied. Otherwise, correct functionality will not be guaranteed. If RESX is held to "L" by the host during Power On, it must keep "L" at least 10µsec after both VCI and IOVCC applied. The power on sequence for different power input modes are shown below.

Symbol	Description	Value			Unit	Remark
		Min.	Typ.	Max.		
T <sub>on1</sub>	Delay time of IOVCC to VCI	0			ms	
T <sub>on2</sub>	Delay time of IOVCC to VSP	0			ms	
T1	IOVCC rising time	-		2	ms	
T2	Delay time of IOVCC to valid RESX to "H"	10			ms	
T3	Delay time of RESX "H" to initial code ready	20			ms	
T4	Delay time of IOVCC (HS_VCC) to MIPI bus ready	0		T2	ms	
T5	RESX "L" period	10			us	
T6	Delay time of initial code reloaded to video packet transmit	120			ms	

#### 5.6.2 Power on sequence: PCCS [1: 0] = [1, 0]

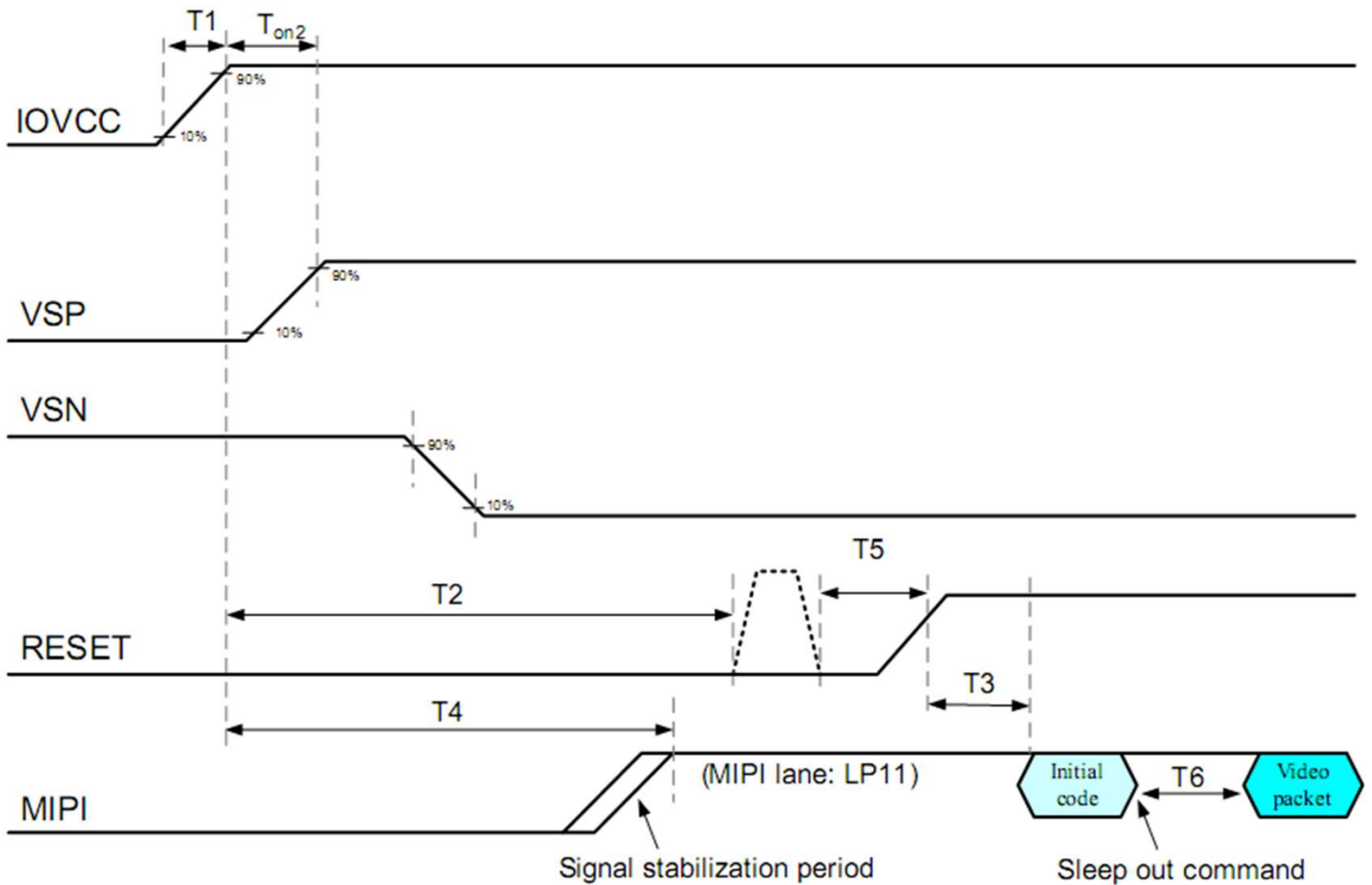
Applied Power: IOVCC, VCI



**Note1:** Unless otherwise specified, timings herein show cross point at 50% of signal/power level.

**5.6.3 Power on sequence: PCCS [1: 0] = [1, 1]**

Applied Power: IOVCC, VSP, VSN



**Note1:** Unless otherwise specified, timings herein show cross point at 50% of signal/power level.

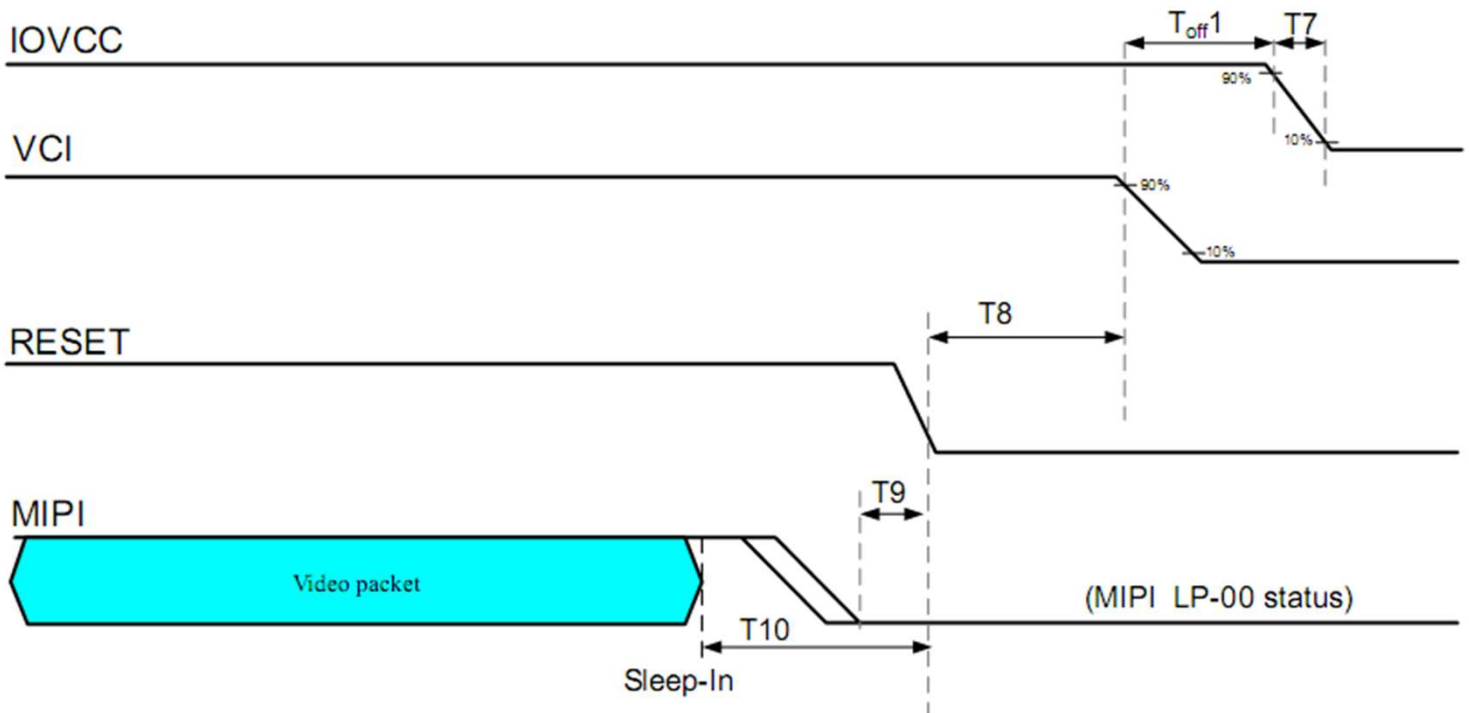
### 5.6.4 Power ON / OFF Sequence

Power off sequence for different PCCS-mode applications are shown below:

Symbol	Description	Value			Unit	Remark
		Min.	Typ.	Max.		
T <sub>off1</sub>	Delay time of VCI to IOVCC	0	-	-	ms	
T <sub>off2</sub>	Delay time of VSP to IOVCC	0	-	-	ms	
T <sub>off3</sub>	Delay time of VSN to VSP	0	-	-	ms	
T7	IOVCC falling time	-	-	-	ms	
T8	Delay time of RESX "L" to VCI	0	-	-	us	
T9	Delay time of MIPI LP-00 to valid RESX "L"	0	-	-	us	
T10	Delay time of Sleep-in received to valid RESX "L"	100	-	-	ms	
T11	Delay time of RESX "L" to VSN	0	-	-	ms	

### 5.6.5 Power off sequence: PCCS[1:0]=[1,0]

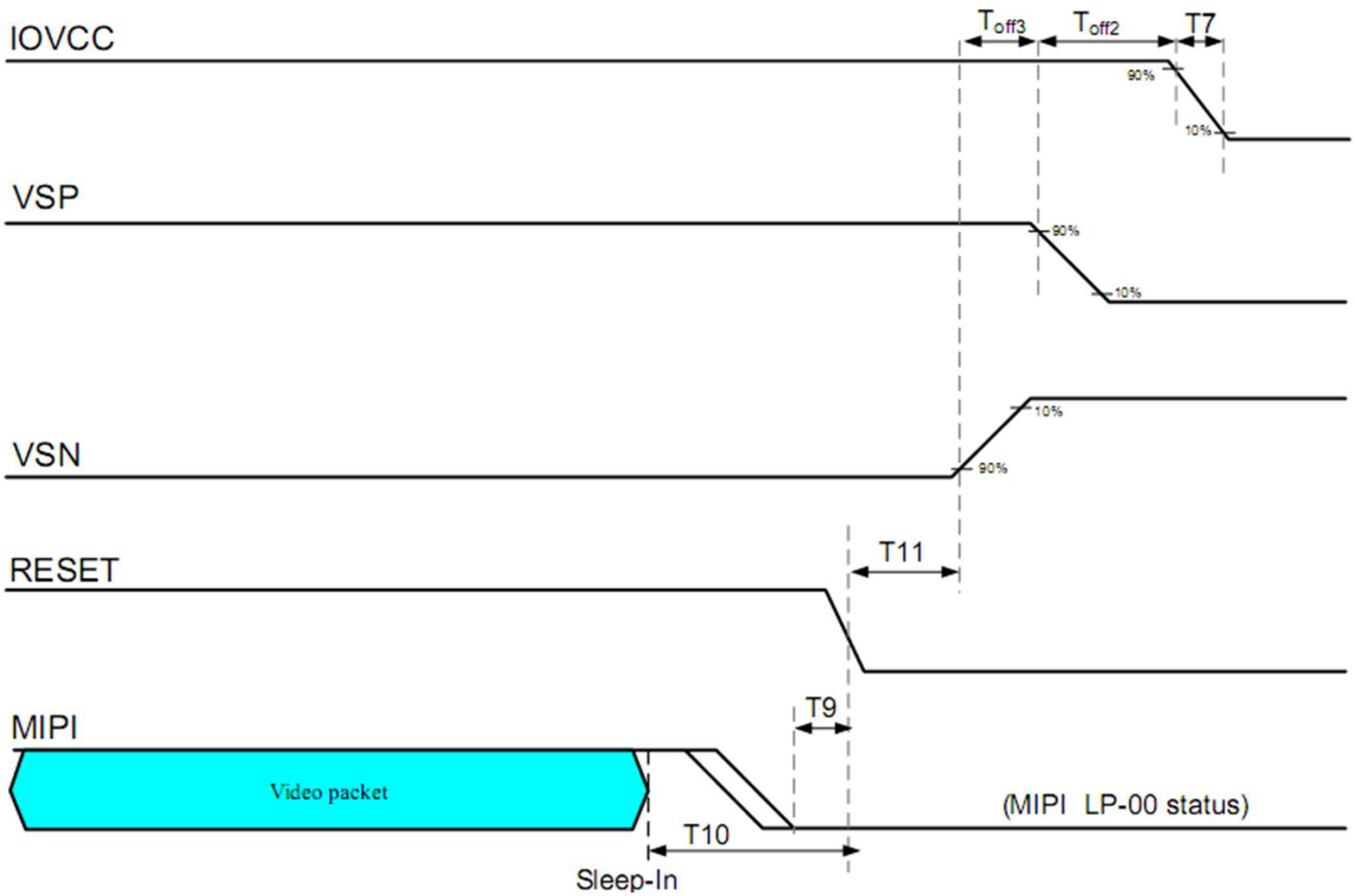
Application Power: IOVCC, VCI,



**Note1:** Unless otherwise specified, timings herein show cross point at 50% of signal/power level.

**5.6.6 Power off sequence: PCCS[1:0]=[1,0]**

Application Power: IOVCC, VSP, VSN



**Note1:** Unless otherwise specified, timings herein show cross point at 50% of signal/power level.

## 5.7 Interface Timing

Item	Symbol	Min	Typ	Max	Unit
MIPI Video data rate(4 lane)	-	-	485	-	Mbps
PCLK Frequency	FPCLK	-	80	-	MHz
Horizontal synchronization	Hsync	-	4	-	PCLK
Horizontal Back porch	HBP	-	50	-	PCLK
Horizontal Front porch	HFP	-	50	-	PCLK
Hsync+HBP+HFP	-	-	104	-	PCLK
Horizontal Address(Display Area)	Hadr	-	720	-	PCLK
Horizontal cycle	-	-	824	-	PCLK
Vertical Synchronization	Vsync	-	4	-	Line
Vertical Back Porch	VBP	-	16	-	Line
Vertical Front Porch	VFP	-	16	-	Line
Vsync+VBP+VFP	-	-	36	-	Line
Vertical Address(Display Area)	Vadr	-	1600	-	Line
Vertical cycle	-	-	1636	-	Line
Frame Rate	-	-	30	-	Hz



## 6.0 OPTICAL SPECIFICATIONS /光学规格

### 6.1 Overview /概述

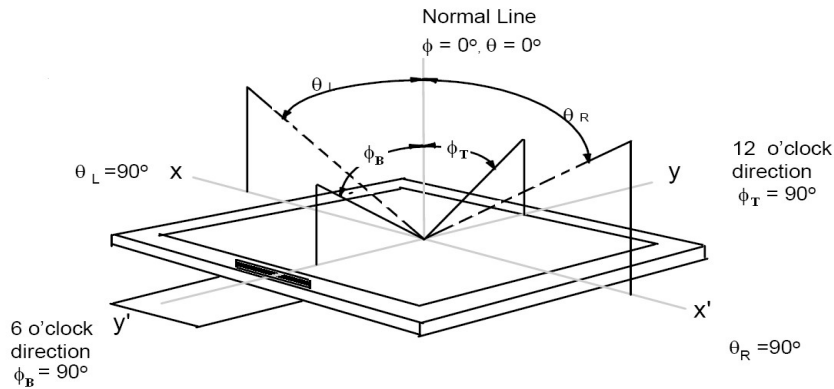
The test of optical specifications shall be measured in a dark room (ambient luminance  $\leq 1$ lux and temperature =  $25 \pm 2^\circ\text{C}$ ) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of  $\theta$  and  $\phi$  equal to  $0^\circ$ . 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  $\theta$  and/or  $\phi$ , the center of the measuring spot on the display surface shall stay fixed.

### 6.2 Optical Specifications /光学规格

Item	Symbol	Condition	Min	Typ.	Max	Unit	Note
Viewing Angle	$\theta_L$	$Cr \geq 10$	-	85	-	deg	Note 1
	$\theta_R$		-	85	-		
	$\psi_T$		-	85	-		
	$\psi_B$		-	85	-		
Contrast Ratio	Cr	$\theta=0^\circ$	800	1000	-	-	Note 2
Response Time	$Tr+Tf$	$FF=0^\circ$	--	30	35	ms	Note 3
Color Coordinate of CIE1931	$W_x$	$\theta=0^\circ$		TBD		-	Note 4
	$W_y$			TBD			
	$R_x$			TBD			
	$R_y$			TBD			
	$G_x$			TBD			
	$G_y$			TBD			
	$B_x$			TBD			
	$B_y$			TBD			
Uniformity	U		80	--	--	%	Note 5
Color Gamut			-	65	--	%	
Luminance	L		500	600	--	$\text{cd}/\text{m}^2$	Note 6

**Note 1: The definition of Viewing Angle**

Refer to the graph below marked by  $\theta$  and  $\phi$ .



**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**

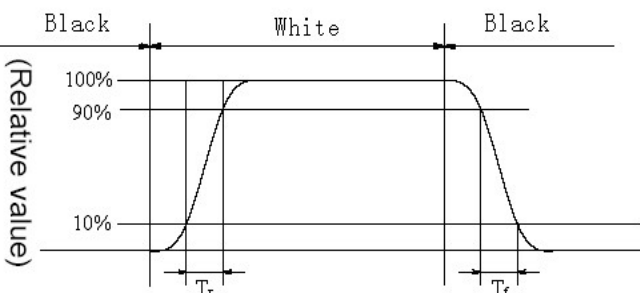
The test condition is at ILED=20mA and measured on the surface of LCD module at 25°C.

Measurement equipment: CS2000 or similar equipments

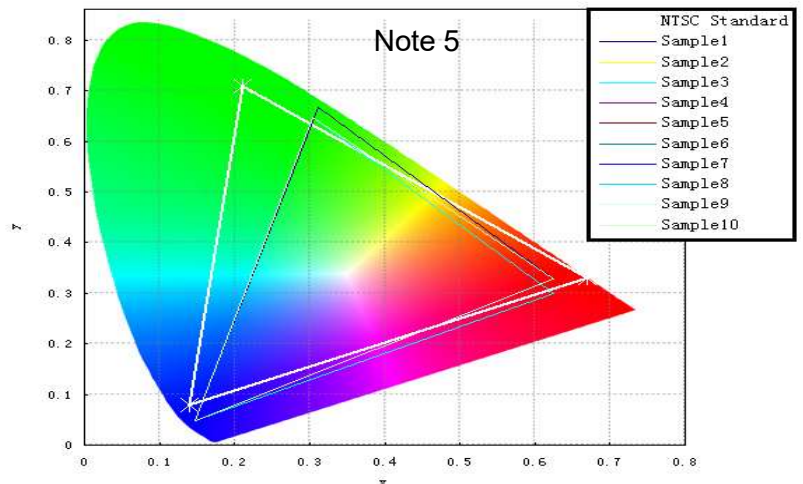
The Color Coordinate (CIE 1931) is the measurement of the center of the display shown in below figure.

**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 /可靠性测试

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

No	Test Items	Conditions	Testing standard
1	High temperature storage test	80°C 240hrs	IEC60068-2-1:2007 GB2423.2-2008
2	Low temperature storage test	-30°C 240hrs	
3	Low temperature operation test	-30°C 240hrs	
4	High temperature operation test	80°C 240hrs	
5	High temperature & humidity (storage test)	60°C 90%RH 240hrs	IEC60068-2-78:2001 GB/T2423.3-2006
6	Thermal Shock Test	-30°C~80°C 1hr/cycle 10cycle	Start with cold temperature End with high temperature IEC60068-2-14:1984, GB2423.22-2002
7	Vibration Test	10Hz-55Hz 100m/s <sup>2</sup> 120min	IEC60068-2-32:1990 GB/T2423.8-1995
8	Mechanical shock	100G ±X, ±Y, ±Z, 3times for each direction	
9	Dropping test	Height: 60 cm, 1 corner, 3 edges, 6 surfaces	
10	ESD test	C=150pF, R=330 Ω, 5 points/panel Air:±8KV, 5 times; Contact: ±4KV, 5 times;	IEC61000-4-2:2001 GB/T17626.2-2006 Class C


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- **8.0 Precautions /注意事项**

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

- **8.1 Mounting Precautions /安装注意事项**

- (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 /操作注意事项

- (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 /静电放电控制

- (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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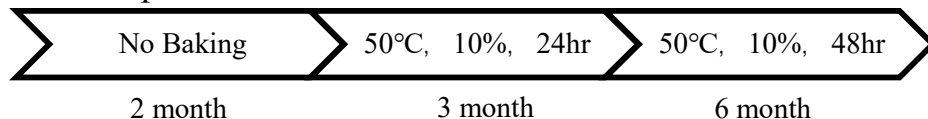
#### 8.4 Precautions for Strong Light Exposure / 强光照射注意事项

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 / 存储注意事项

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 / 保护膜注意事项

- (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 / 适当的显示条件

- (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 SO<sub>2</sub> ,H<sub>2</sub>S 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 /其他

### A. LC Leak /液晶泄露

- 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 /返工

- 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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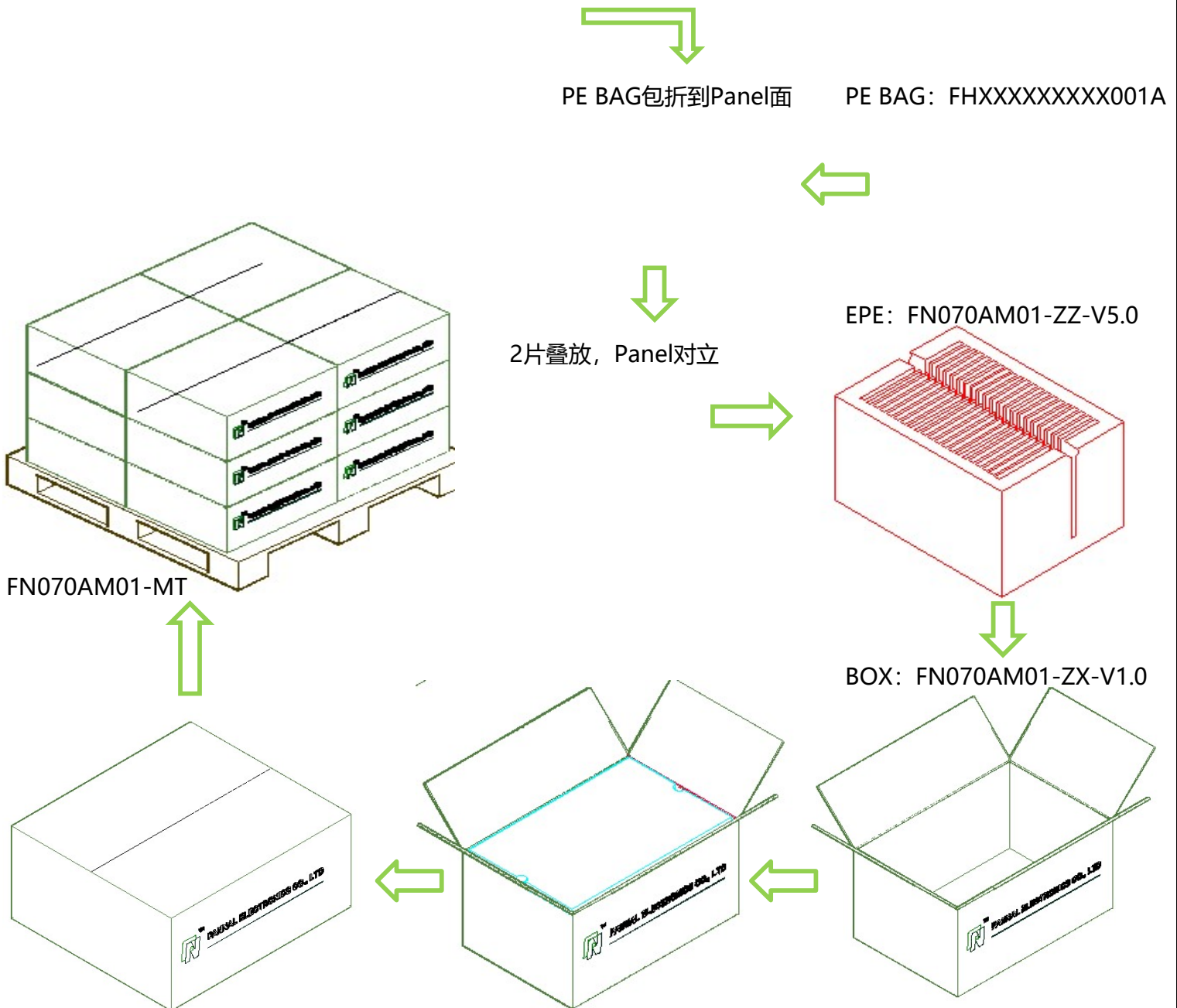
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**9.0 PACKING INFORMATION(产品形态: LCM )**

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





## 10.0 VISUAL INSPECTION CRITERIA FOR ALL CUSTOMERS /所有客户的目视检查标准

### 10.1 Sampling Method /抽样方法

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 /检验环境

#### 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

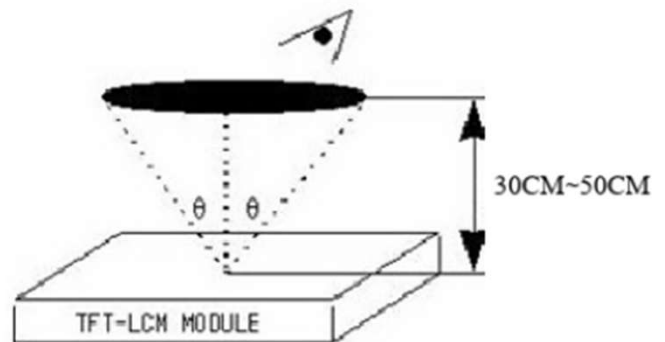
performing in front of the panel

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

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

#### 10.2.4 Inspection Area:

Display Area (Active Area)



### 10.3 Definitions /定义

#### 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 /检验标准

Refer to 《TFT LCM general inspection standard》

### 10.5 Verification /验证

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 /供应商引起的缺陷

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 /顾客引起的缺陷

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 /质量保证期

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 /维修保证书

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 /避免担保

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 /其他

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