Display Elektronik GmbH

DATA SHEET

OLED MODULE

DEP 450600A-RGB

2,4“ AM-OLED

Product Specification

Version: 1

10.05.2025

Revision History

Date	Rev. No.	Page	Summary
27.04.2025	0	ALL	FIRST ISSUE
10.05.2025	1	6	UPDATE DRAWING

Contents

* Description

This is a color active matrix AMOLED module using Low Temperature Polysilicone Thin Film-Transistors as active switching devices. This module has a 2.4 Inch diagonally measured active area with 450 x 600 Pixel arrays.

Each pixel is divided into RED and GREEN dots, or BLUE and GREEN dots, and two pixels sha re RED or BLUE dots which are arranged in vertical stripe and this module can display colors.

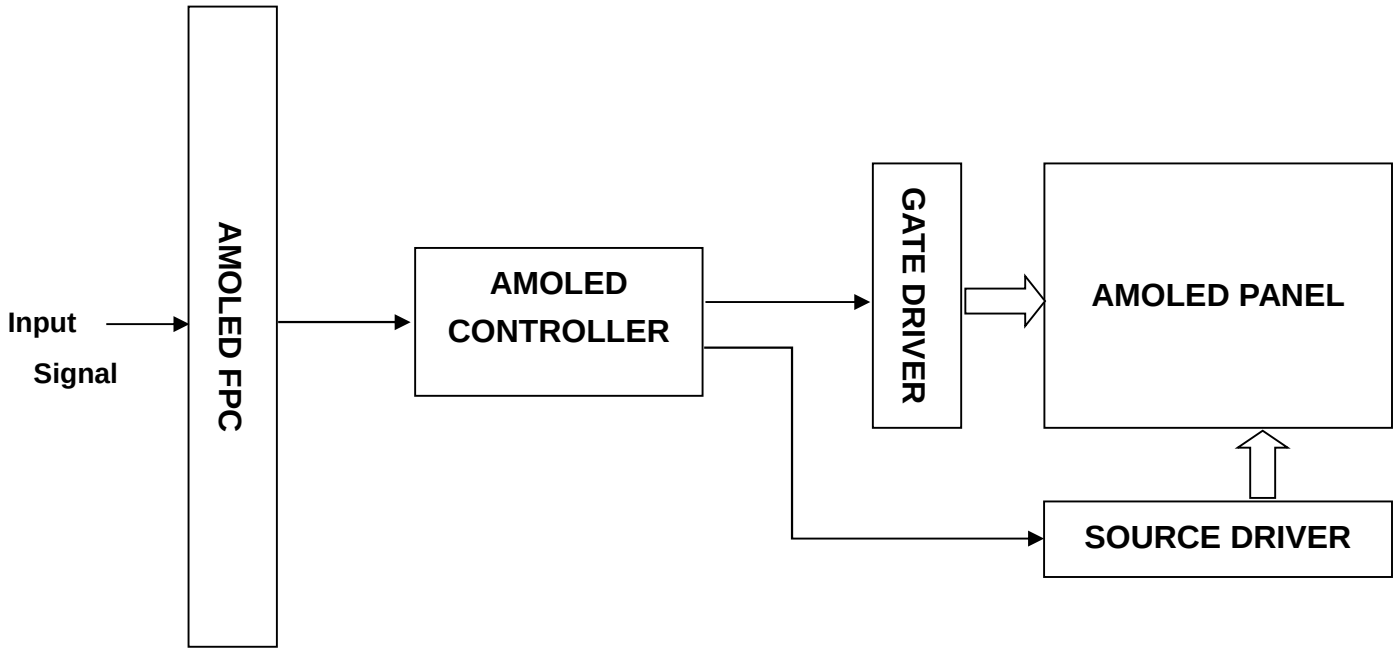
* Features

General Information Items	Specification	Unit	Note
	Main Panel		
Display Area (AA)	36.72 x 48.96 (2.4 Inch)	mm	-
Driver Element	TFT Active Matrix	-	-
PPI	311	-	-
Pixel Configuration	V-Style3	-	-
Number of Pixels	450 x (RGB) x 600	dots	-
Viewing Angle	ALL	o'clock	-
Controller IC	ICNA3312	-	-
Touch Controller IC	GTW623 (On Cell*)	-	-
LCM Interface	MIPI / MCU / SPI	-	-
Display Mode	AMOLED	-	-
Operating Temperature	-20°C ~ +80°C	°C	-
Storage Temperature	-40°C ~ +80°C	°C	-

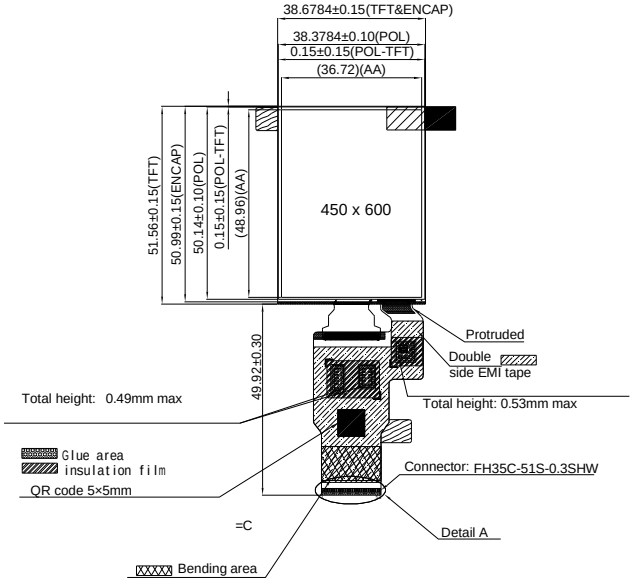
* Mechanical Information

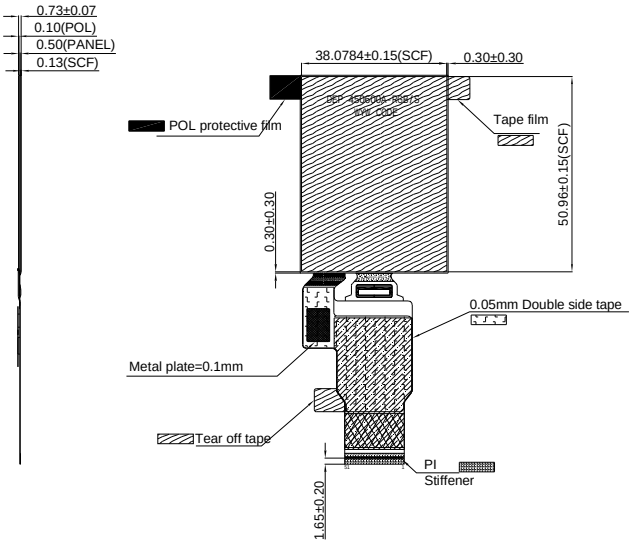
Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	-	38.6784	-	mm	-
	Vertical(V)	-	51.56	-	mm	-
	Depth(D)	-	0.5	-	mm	-
Weight		-	4	-	g	-

1. Block Diagram



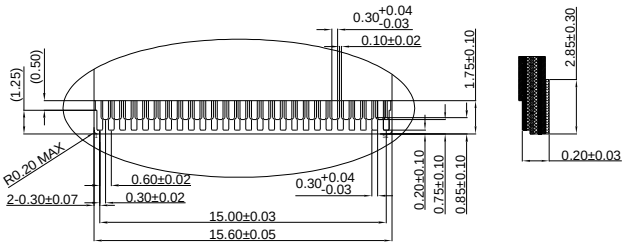
2. Outline Dimension





NOTES:

1. Display mode: AMOLED
2. Resolution: 2.4",450*600
3. Operating Voltage: VCI:2.5~ 3.6V
   IOVCC:1.65~ 3.3V
   ELVDD:3.5V
   ELVSS:-3.5V
4. Operating Temp: -20? ~ 80?
5. Storage Temp: -40? ~ 80?
6. Unspecified tolerance: ±0.2
7. controller/driver IC:ICNA3312
8. Touch driver IC:GTW623
9. Customer No.:
10. RoHS compliant



Detail B
SCALE 5:1

FPC PIN	
? ?	SYMBOL
1	GND
2	ELVSS
3	ELVSS
4	GND
5	ELVDD
6	ELVDD
7	GND
8	VCI
9	VDDIO
10	GND
11	TE1
12	SWIRE
13	TE
14	GND
15	RESX
16	GND
17	SDO
18	SDI_RDX
19	DCX
20	SCL
21	CSX
22	GND
23	D0
24	D1
25	D2
26	D3
27	D4
28	D5
29	D6
30	D7
31	GND
32	IM1
33	IM0
34	GND
35	DSI_CLKP
36	DSI_CLKN
37	GND
38	DSI_D0P
39	DSI_D0N
40	GND
41	MTP_PWR
42	GND
43	GND
44	TSP_SDA
45	TSP_SCL
46	TSP_INT
47	TSP_RESET
48	GND
49	TSP_VDDIO
50	TSP_AVDD
51	GND

3. Input terminal Pin Assignment

NO	SYMBOL	DISCRIPTION	I/O
1	GND	Ground	P
2	ELVSS	Negative Power supply for Panel	O
3	ELVSS	Negative Power supply for Panel	O
4	GND	Ground	P
5	ELVDD	Positive Power supply for Panel	O
6	ELVDD	Positive Power supply for Panel	O
7	GND	Ground	P
8	VCI	Power supply for display driver IC analog system.	O
9	VDDIO	Power supply for display driver IC interface and logic system	O
10	GND	Ground	P
11	TE1	IC Status active reporting pin.	O
12	SWIRE	Swire protocol setting pin of Power IC	O
13	TE	Tearing effect output pin to synchronize MCU to frame writing, activated by S/W command. When this pin is not activated, this pin is output low.	P
14	GND	Ground	O
15	RESX	Display driver reset, must be applied to properly initialize the chip. Signal is active low.	O
16	GND	Ground	P
17	SDO		I
18	SDI_RDX	SDI: Serial input signal in SPI I/F. The data is input on ther ising edge of the SCL signal. RDX: Reads strobe signal to write data when RDX is “Low” in 80-series MPU interface.	I
19	DCX	Display data / command selection in 80-series MPU I/F and 4-wire SPI I/F.	I
20	SCL	WRX : Writes strobe signal to write data when WRX is “Low” in 80-series MPU I/F. SCL: A synchronous clock signal in SPI I/F.	I
21	CSX	Chip select input pin (“Low” enable) in 80-series MPU	P

<table>
<tr><td></td><td></td><td>I/F and SPI I/F.</td><td></td></tr>
<tr><td>22</td><td>GND</td><td>Ground</td><td>P</td></tr>
<tr><td>23</td><td>D0</td><td rowspan="8">8-bit bi-directional data bus for 80-series MPU I/F and 8-bit input data bus for RGB I/F.</td><td>P</td></tr>
<tr><td>24</td><td>D1</td><td>O</td></tr>
<tr><td>25</td><td>D2</td><td>O</td></tr>
<tr><td>26</td><td>D3</td><td>O</td></tr>
<tr><td>27</td><td>D4</td><td>I</td></tr>
<tr><td>28</td><td>D5</td><td>P</td></tr>
<tr><td>29</td><td>D6</td><td>P</td></tr>
<tr><td>30</td><td>D7</td><td rowspan="2">P</td></tr>
<tr><td>31</td><td>GND</td><td>Ground</td></tr>
<tr><td>32</td><td>IM1</td><td rowspan="2"><table><tr><th>IM[1:0]</th><th>Display Data</th><th>Command</th></tr><tr><td>00</td><td>MIPI/3-wire SPI</td><td>MIPI/3-wire SPI</td></tr><tr><td>01</td><td>MIPI/4-wire SPI</td><td>MIPI/4-wire SPI</td></tr><tr><td>10</td><td>MIPI/QUAD SPI</td><td>MIPI/QUAD SPI</td></tr><tr><td>11</td><td>MCU 8-bit</td><td>MCU 8-bit</td></tr></table></td><td>P</td></tr>
<tr><td>33</td><td>IM0</td><td>P</td></tr>
<tr><td>34</td><td>GND</td><td>Ground</td><td rowspan="3">P</td></tr>
<tr><td>35</td><td>DSI_CLKP</td><td>Differential data signals if MIPI interface</td></tr>
<tr><td>36</td><td>DSI_CLKN</td><td>Differential data signals if MIPI interface</td></tr>
<tr><td>37</td><td>GND</td><td>Ground</td><td>I</td></tr>
<tr><td>38</td><td>DSI_D0P</td><td>Differential data signals if MIPI interface</td><td>P</td></tr>
<tr><td>39</td><td>DSI_D0N</td><td>Differential data signals if MIPI interface</td><td>O</td></tr>
<tr><td>40</td><td>GND</td><td>Ground</td><td></td></tr>
<tr><td>41</td><td>MTP_PWR</td><td>MTP programming power supply.
Must be left open or connected to GND in normal condition</td><td></td></tr>
<tr><td>42</td><td>GND</td><td>Ground</td><td></td></tr>
<tr><td>43</td><td>GND</td><td>Ground</td><td></td></tr>
<tr><td>44</td><td>TSP_SDA</td><td>TP I2C Data</td><td></td></tr>
<tr><td>45</td><td>TSP_SCL</td><td>TP I2C CLK</td><td></td></tr>
<tr><td>46</td><td>TSP_INT</td><td>TP INT</td><td></td></tr>
<tr><td>47</td><td>TSP_RESET</td><td>TP RESET</td><td></td></tr>
</table>

48	GND	Ground	
49	TSP_VDDIO	1.8V power for TP	
50	TSP_AVDD	2.8V power for TP	
51	GND	Ground	

4. AMOLED Optical Characteristics

4.1 Optical Specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	Θ=0 Normal Viewing Angle	10000	--	--		(1)(2)
LCM Luminance		LV	White	765	850	935	cd/m2	
Color Gamut		S(%)	vs. NTSC	--	93	--	%	(1)
Color Filter Chromacicity	White	W_X		-0.04	0.304	+0.04		(1)(4)
		W_Y			0.320			
	Red	R_X			0.675			
		R_Y			0.324			
	Green	G_X			0.257			
		G_Y			0.663			
	Blue	B_X			0.139			
		B_Y			0.049			
OLED Lifetime				--	20000	--	Hrs	T95
Option View Direction		ALL						

*The data comes from the LCD specification.

Measuring Condition

Measuring surrounding: dark room

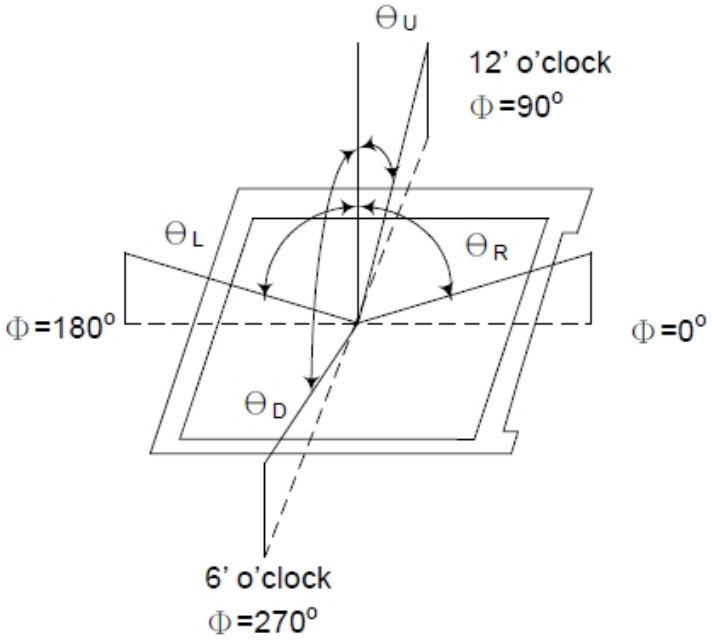
Ambient temperature: 25°C±2°C

15min. warm-up time.

Measuring Equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

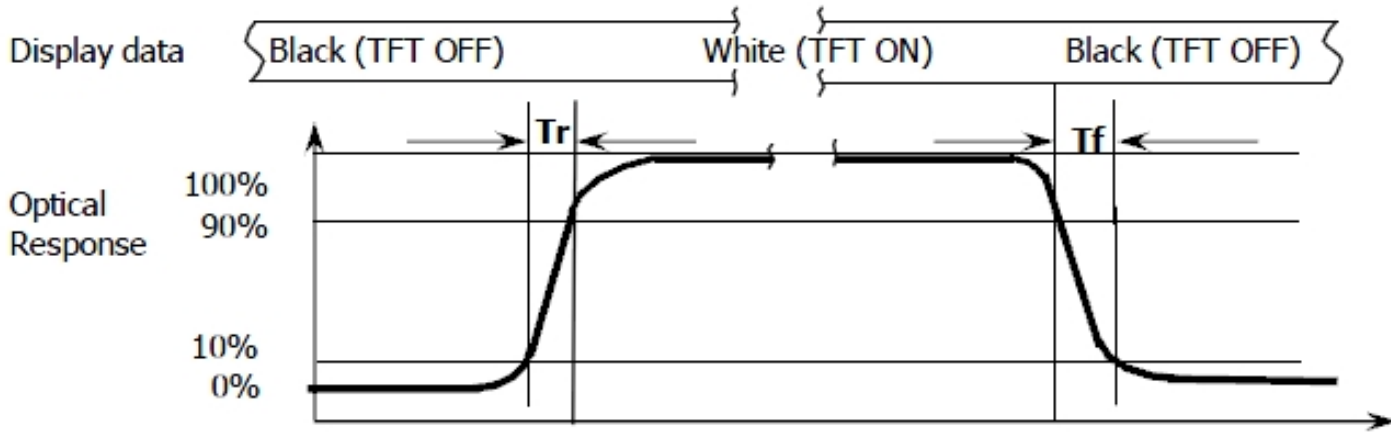
Note (1): Definition of Viewing Angle :



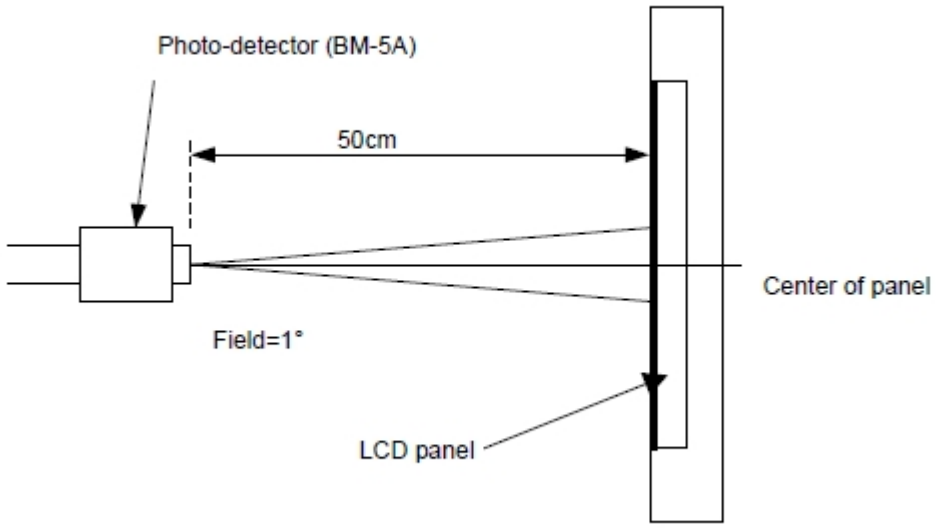
Note (2): Definition of Contrast Ratio(CR) :measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3): Response Time



Note (4): Definition of optical measurement setup



5. AMOLED Electrical Characteristics

5.1 Absolute Maximum Rating (Ta=25 VSS=0V)

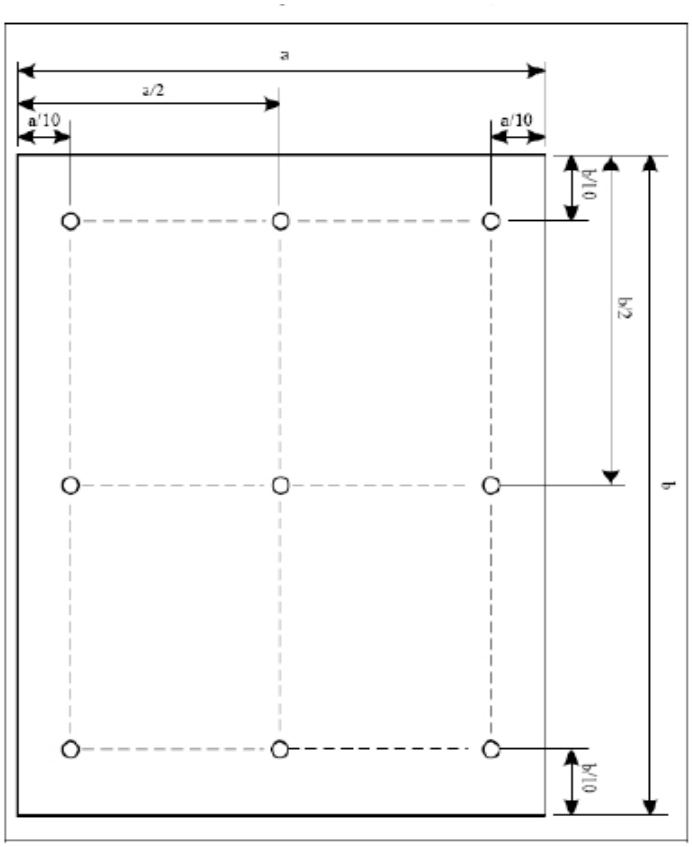
Characteristics	Symbol	Min.	Max.	Unit
Analog Power Supply	VCI	0	5.5	V
Logic Power Supply	VDDIO	0	5.5	V
Positive Power Input	ELVDD	-	5.0	V
Negative Power Input	ELVSS	-5.0	-	V
Operating Temperature	T_{OP}	-20	+80	°C
Storage Temperature	T_{ST}	-40	+80	°C

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.

5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Logic Power Supply	VDDIO	1.65	1.8	3.3	V	--
Analog Power Supply	VCI	2.5	3.0	3.6	V	--
Positive Output Voltage	ELVDD	--	3.5	--	V	--
Negative Output Voltage	ELVSS	--	-3.5	--	V	--
Power consumption	$W_{总}$	370.7	376.5	384.3	mW	--
Level input voltage	V_{IH}	0.7*VDDIO	--	VDDIO	V	--
	V_{IL}	0	--	0.3*VDDIO	V	--
Level output voltage	V_{OH}	0.8*VDDIO	--	VDDIO	V	--
	V_{OL}	0	--	0.2*VDDIO	V	--

NOTE 3: Luminance Uniformity of these 9 points is defined as below:



$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

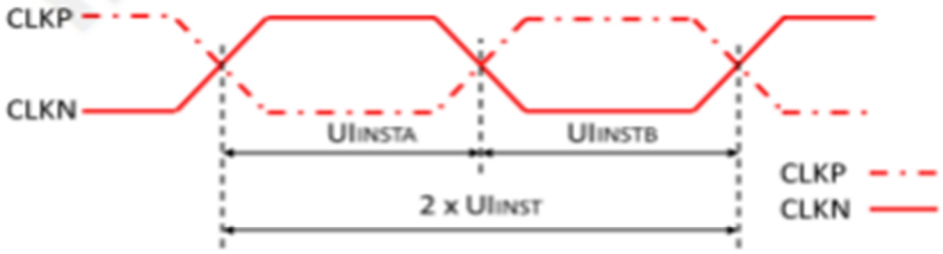
$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$

6. AC Characteristic

6.1 MIPI Interface Characteristics

HS Data Transmission Burst

High Speed Mode - Clock Timings

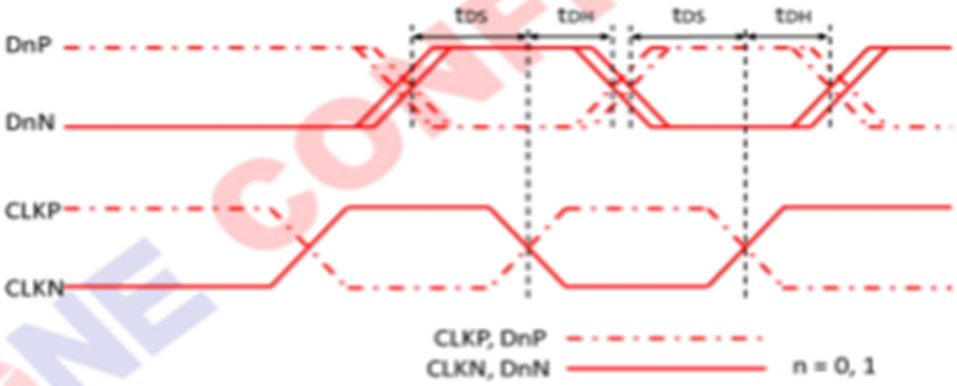


Clock Timing

High Speed Mode - Clock Timing

Signal	Symbol	Parameter	Specification			Unit	Notes
			MIN	TYP	MAX		
CLK P/N	2xUIINST	Double UI instantaneous	4		25	nS	
CLK P/N	UIINSTA, UIINSTB	UI instantaneous Half	2		12.5	nS	1

High Speed Mode - Clock / Data Timings



DSI Clock / Data Timings

High Speed Mode - Clock / Data Timing

Signal	Symbol	Parameter	Specification			Unit	Notes
			MIN	TYP	MAX		
Dn P/N (n=0, and1)	tDS	Data to Clock Setup time	0.15*UI			UI	
	tDH	Clock to Data Hold time	0.15*UI			UI	

High Speed Mode - Rising and Falling Timings

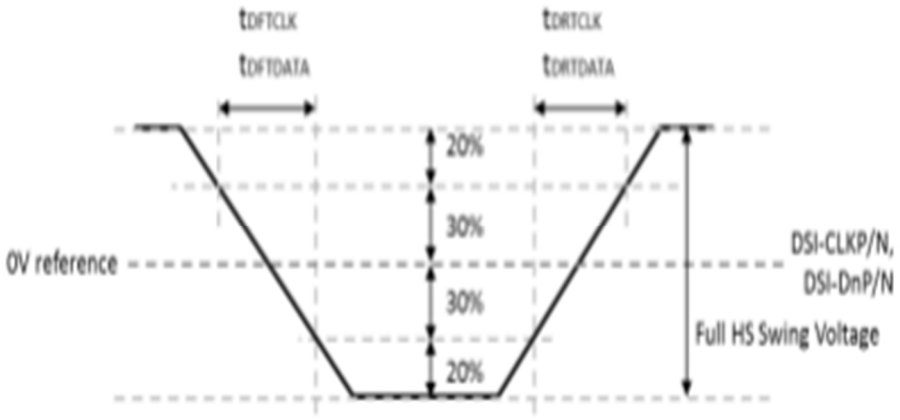


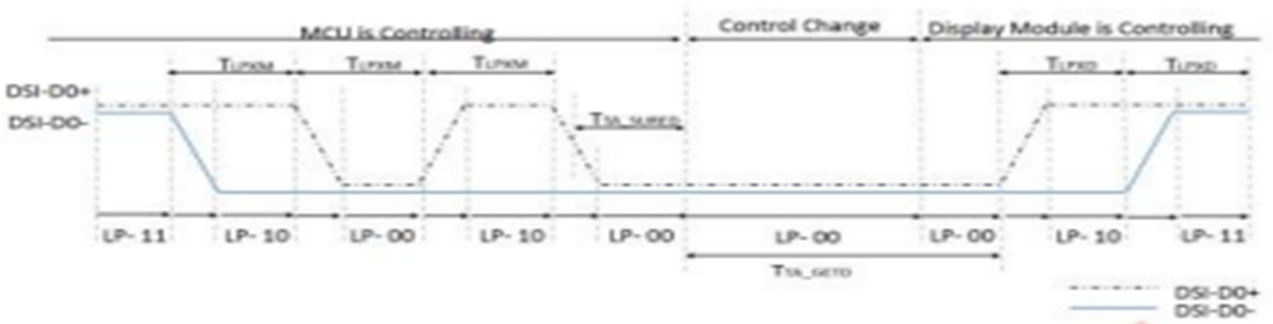
Figure 6-2 Rising and Falling Timings

High Speed Mode - Rising and Falling Timing

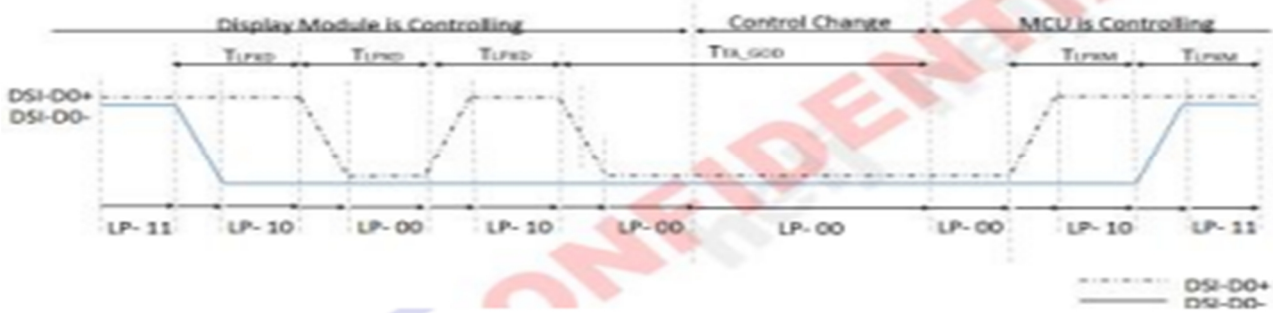
Parameter	Symbol	Conditions	Specification			Unit	Notes
			MIN	TYP	MAX		
Differential Rise Time for Clock	t_{DRTCLK}	CLKP/N	150pS		0.3*UI		2,3
Differential Rise Time for Data	$t_{DRTDATA}$	DnP/N	150pS		0.3*UI		1,2,3
Differential Fall Time for Clock	t_{DFTCLK}	CLKP/N	150pS		0.3*UI		2,3
Differential Fall Time for Data	$t_{DFTDATA}$	DnP/N	150pS		0.3*UI		1,2,3

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

Low Speed Mode - Bus Turn Around



Bus Turnaround (BTA) from MCU to display module Timing

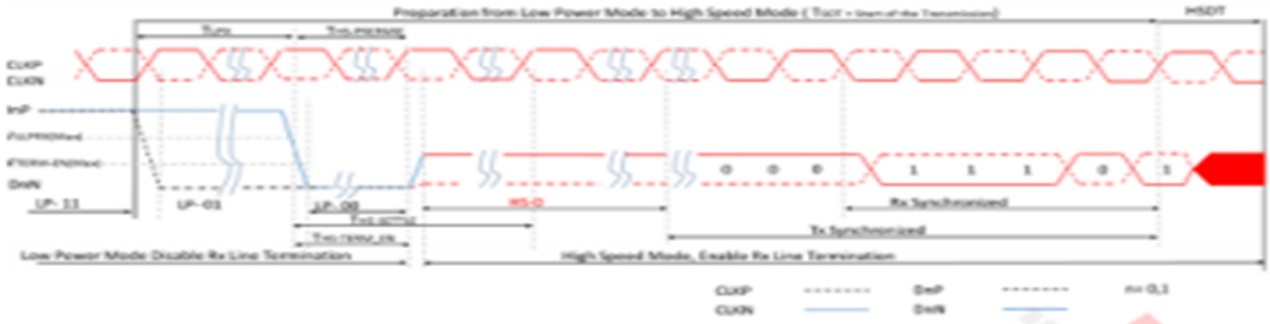


Low Speed Mode - Bus Turn Around Timing

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

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

Data Lanes from Low Power Mode to High Speed Mode



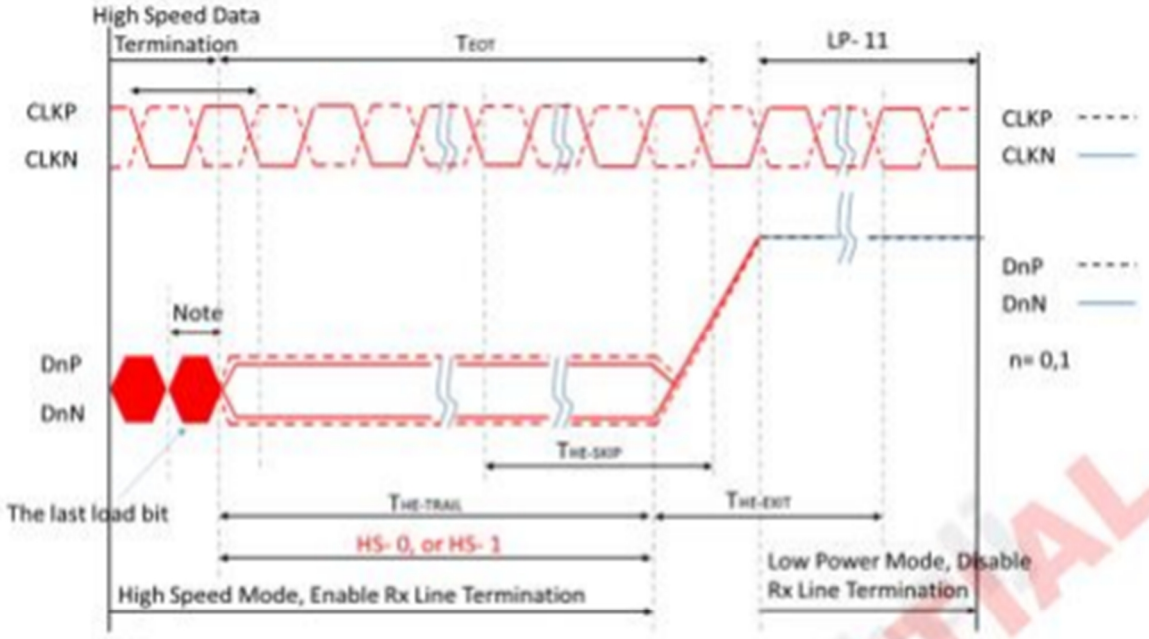
Data Lanes from High Speed Mode to Low Power Mode Timing

Data Lanes from Low Power Mode to High Speed Mode Timing

Signal	Symbol	Parameter	Specification			Unit	Notes
			MIN	TYP	MAX		
DnP/N	T_{LPX}	Length of any Low Power State Period	50			nS	1
DnP/N	$T_{HS-PREPARE}$	Time to drive LP-00 to prepare for HS Transmission	40+4*UI		85+6*UI	nS	1
DnP/N	$T_{HS-TRM-EN}$	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,and 1*

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

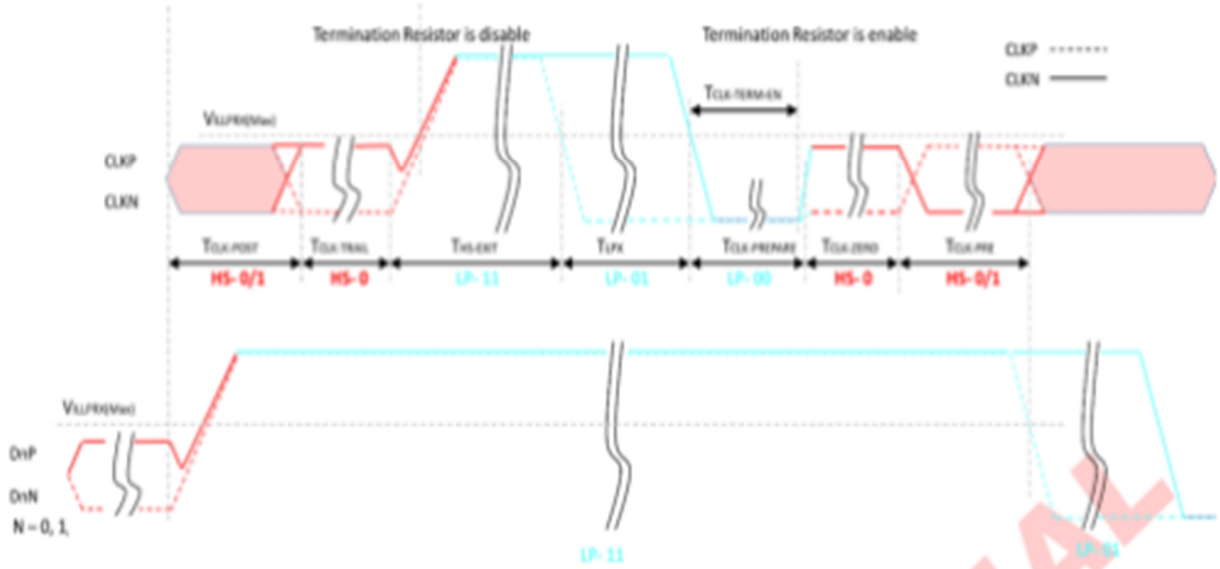
Data Lanes from High Speed Mode to Low Power Mode Timing

Data Lanes from High Speed Mode to Low Power Mode Timing

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

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

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

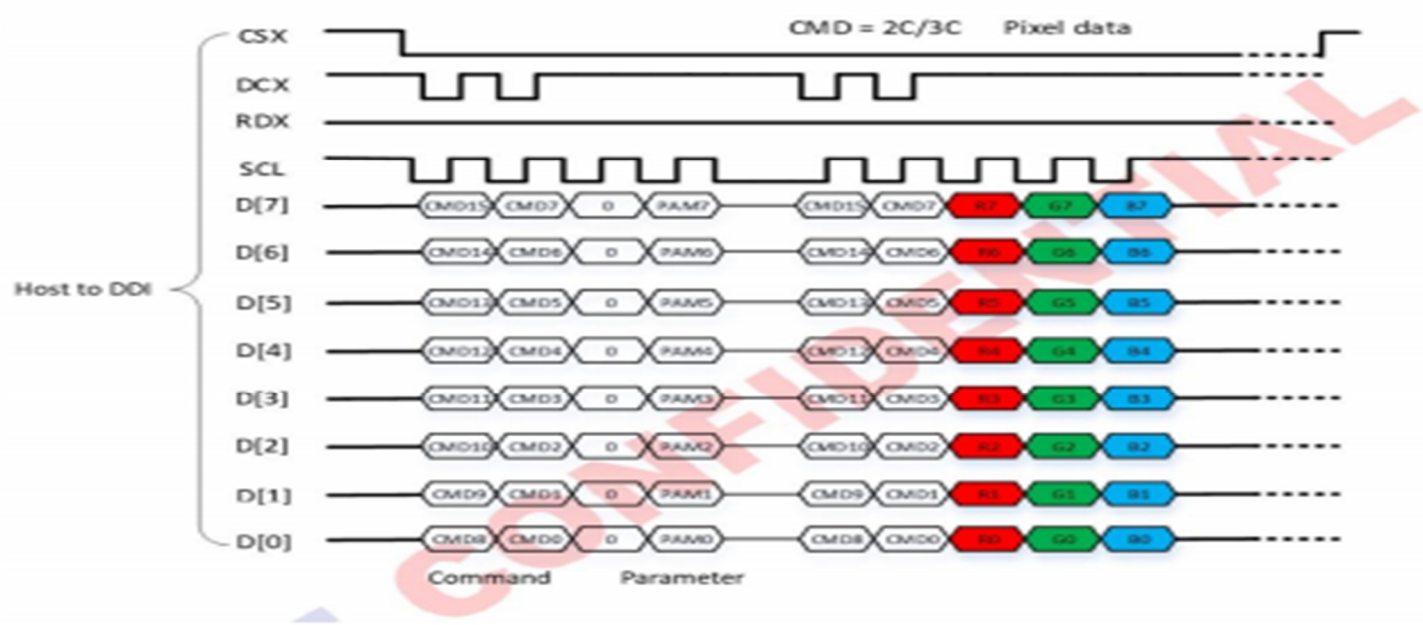


Clock Lane –High speed mode to / from Low Power Mode Timing

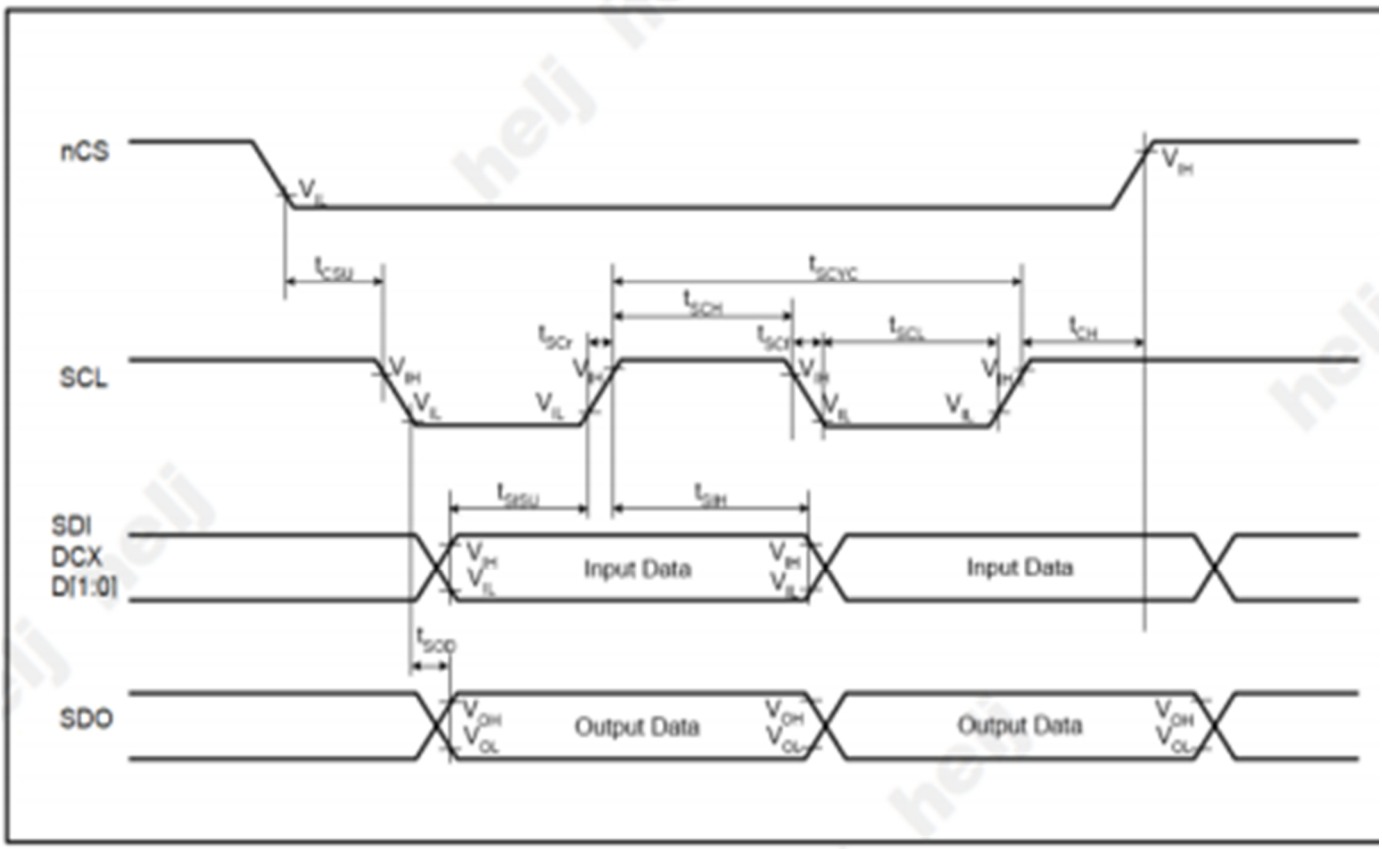
DSI Clock Burst – High speed mode to /from Low Power Mode Timing

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

6.2 MCU Interface Characteristics



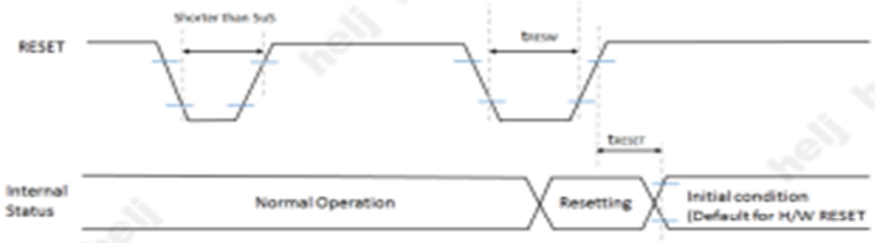
6.3 QSPI Interface Characteristics



Parameter	Symbol	Conditions	Specification			Unit	Notes
			MIN	TYP	MAX		
SCL	T_{SCYC}	Clock cycle (Write)	20	-	-	ns	
	T_{SCYC}	Clock cycle (Read)	100		-	ns	
	T_{SCH}	Clock "H" pulse width (Write)	6.5	-	-	ns	
	T_{SCH}	Clock "H" pulse width (Read)	45	-	-	ns	
	T_{SCL}	Clock "L" pulse width (Write)	6.5	-	-	ns	
	T_{SCL}	Clock "L" pulse width (Read)	45	-	-	ns	
	T_{SCr}	Clock rise time	-	-	3.5	ns	
	T_{SCf}	Clock fall time	-	-	3.5	ns	
CSX	T_{CSU}	Chip select setup time	10	-	-	ns	
	T_{CH}	Chip select hold time	10	-	-	ns	
SDI DCX D[1:0]	T_{SISU}	Data input setup time	4	-	-	ns	
	T_{SIH}	Data input hold time	4	-	-	ns	
SDO	T_{SOD}	Data output setup time	-	-	45	ns	
	T_{SOH}	Data output hold time	5	-	-	ns	

***Note 1**: Logic high and low levels are specified as 20% and 80% of VDDI for Input signals.*
***Note 2**: Ta = -30 to 85 °C, VDDI=1.65V to 3.3V, VCI=2.7V to 3.6V, GND=0V*
***Note 3**: The max SCL sequence of 4-wire QSPI transferring RGB888, RGB666 and RGB555 is 50Mhz.*

6.4 Display RESET Timing Characteristics



Reset Input Timing

Condition : Ta =25°C

Reset Input Timing

Signal	Symbol	Parameter	Description	Specification			Unit	Notes
				MIN	TYP	MAX		
RESET	tRESW	Reset "L" pulse width		10			µS	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**: Spike due to an electrostatic discharge on RESET line does not cause irregular system reset according to the table below.*

Reset Input Actions

RESET Pulse	Action
Short than 5us	Reset Rejected
Long than 10μS	Reset
Between 5us and 10μS	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 HW 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 HW RESET complete time(tRESET) within 5ms after a rising edge of RESET.*

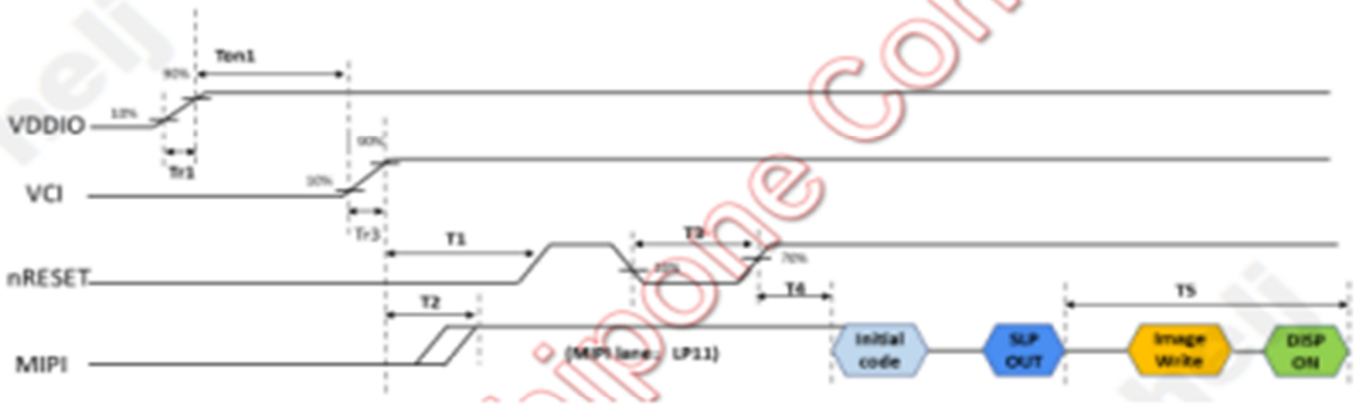
Note4: *Spike Rejection also applies during a valid reset pulse as shown below.*

Note5: *It is necessary to wait 5ms after releasing RESET before sending commands. Also Sleep Out command cannot be sent for 120msec.*

6.5 Display Power On Sequence

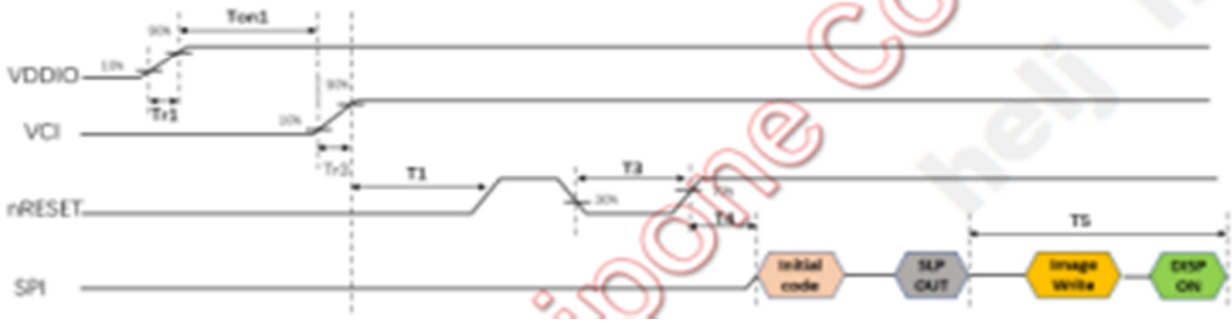
Power on sequence-MIPI

Symbol	Description	Value			Unit	Remark
		Min.	Typ.	Max.		
Ton1	VDDI on to VCI on delay	>0	-	-	us	
T1	VCI on to valid to nRESET high	10	-	-	ms	
T2	VCI to MIPI bus ready delay	0	-	T1	ms	
T3	RESET low period	50	-	-	us	
T4	nRESET high to OTP code reload ready	10	-	-	ms	
T5	Sleep-out command received to display on command received	60	-	-	ms	
Tr1	VDDI power rising time	0.3	-	2	ms	
Tr3	VCI power rising time	0.3	-	2	ms	



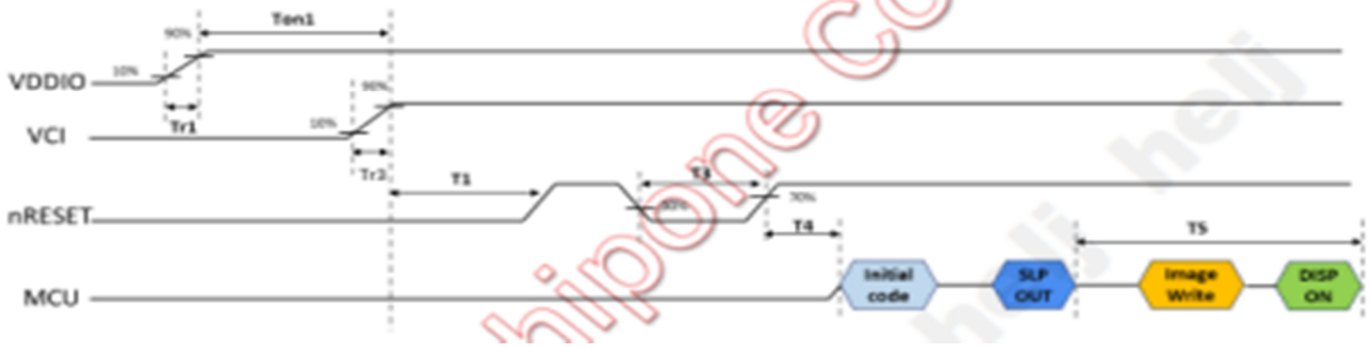
Power on sequence-SPI

Symbol	Description	Value			Unit	Remark
		Min.	Typ.	Max.		
Ton1	VDDI on to VCI on delay	>0	-	-	us	
T1	VCI on to valid to nRESET high	10	-	-	ms	
T3	RESET low period	50	-	-	us	
T4	nRESET high to OTP code reload ready	10	-	-	ms	
T5	Sleep-out command received to display on command received	60	-	-	ms	
Tr1	VDDI power rising time	0.3	-	2	ms	
Tr3	VCI power rising time	0.3	-	2	ms	



Power on sequence-MCU

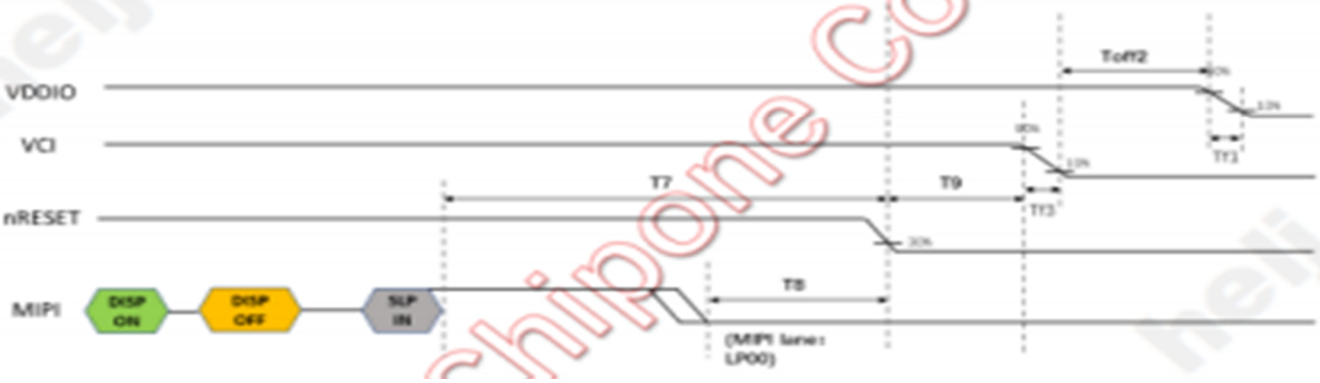
Symbol	Description	Value			Unit	Remark
		Min.	Typ.	Max.		
Ton1	VDDI on to VCI on delay	=0	-	-	us	
T1	VCI on to valid to nRESET high	10	-	-	ms	
T3	RESET low period	50	-	-	us	
T4	nREST high to OTP code reload ready	10	-	-	ms	
T5	Sleep-out command received to display on command received	60	-	-	ms	
Tf1	VDDI power fisling time	0.3	-	2	ms	
Tf3	VCI power fisling time	0.3	-	2	ms	



6.6 Display Power Off Sequence

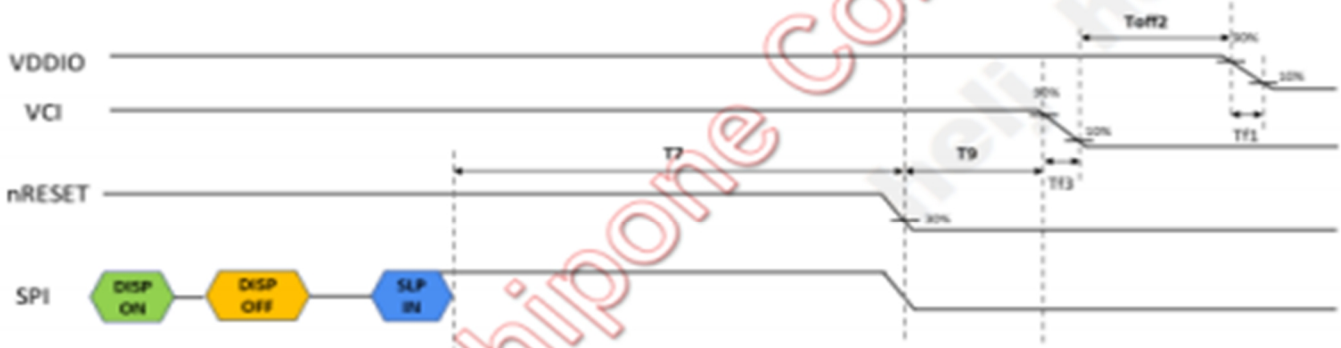
Power off sequence-MIPI

Symbol	Description	Value			Unit	Remark
		Min.	Typ.	Max.		
Toff2	VCI off to VDDI off delay	>0	-	-	us	
T7	Sleep In command received to valid to nREST low	100	-	-	ms	
T8	MIPI ultra low power mode to valid to nREST low	0	-	-	ns	
T9	nREST low to VCI off delay	0	-	-	us	
Tf1	VDDI Power falling time	0.1	-	5	ms	
Tf3	VCI Power falling time	0.1	-	5	ms	



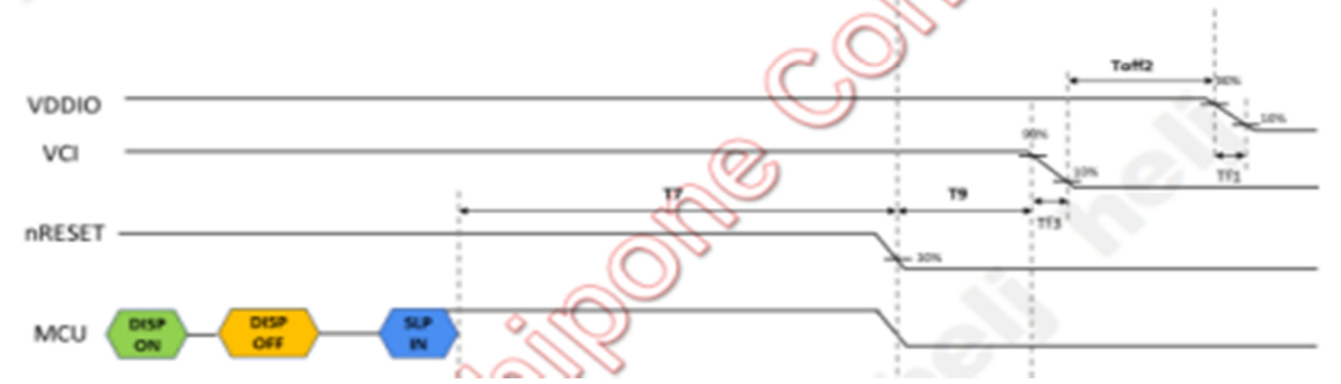
: Power off sequence-SPI

Symbol	Description	Value			Unit	Remark
		Min.	Typ.	Max.		
Toff2	VCI off to VDDI off delay	>0	-	-	us	
T7	Sleep In command received to valid to nREST low	100	-	-	ms	
T9	nREST low to VCI off delay	0	-	-	us	
Tf1	VDDI Power falling time	0.1	-	5	ms	
Tf3	VCI Power falling time	0.1	-	5	ms	



: Power off sequence-MCU

Symbol	Description	Value			Unit	Remark
		Min.	Typ.	Max.		
Toff2	VCI off to VDDI off delay	>0	-	-	us	
T7	Sleep In command received to valid to nREST low	100	-	-	ms	
T9	nREST low to VCI off delay	0	-	-	us	
Tf1	VDDI Power falling time	0.1	-	5	ms	
Tf3	VCI Power falling time	0.1	-	5	ms	



7. Touch Specification

7.1 Electrical Characteristics

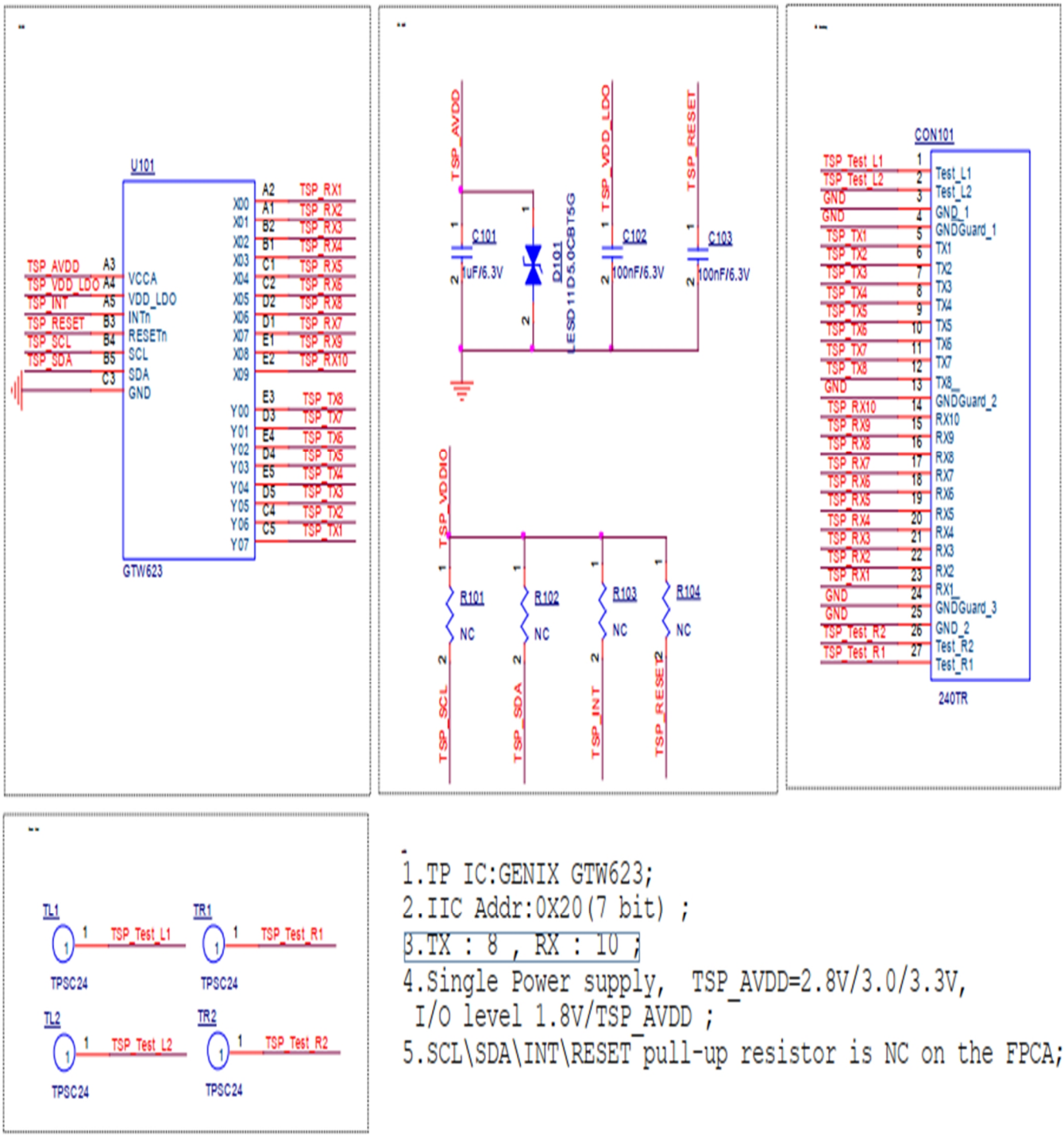
7.1.1 Absolute Maximum Rating

Item	Symbol	Min.	Max.	Unit	Note
TP Power Supply Input	TSP_AVDD	2.7	3.6	V	-
Operating Temperature	T_{OP}	-20	+70	°C	-
Storage Temperature	T_{ST}	-30	+80	°C	-

7.1.2 DC Electrical Characteristics (Ta=25°C)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
TP Power Supply Input	TSP_AVDD	2.8	2.8/3.0/3.3	3.6	V	-

7.2 Touch Part Schematic



1.TP IC:GENIX GTW623;
2.IIC Addr:0X20(7 bit) ;
3.TX : 8 , RX : 10 ;
4.Single Power supply, TSP_AVDD=2.8V/3.0/3.3V,
I/O level 1.8V/TSP_AVDD ;
5.SCL\SDA\INT\RESET pull-up resistor is NC on the FPCA;

8. Quality Level

8.1 AMOLED Module of Characteristic Inspection

The environmental condition and visual inspection shall be conducted as below:

8.1.1 Inspection conditions

Test conditions: OLED is not light, cold white fluorescent lamp, illumination 1000 ± 200lux; OLED lighting source shall not be higher than 200lux, with black background around.

8.1.2 Inspection distance: the standard observation distance of all surfaces of the tested object is 30cm ± 5cm.

8.1.3 Inspection angle: the angle between the product and the horizontal plane is 45°, and the eyes are perpendicular to the inspection plane. During inspection, the product needs to rotate 45 ° up, down, left and right. The observation line of sight needs to be within the half section of the cone. The observation angle is 45 ° with the vertical axis of the product apex. The central axis of the cone must be standard and perpendicular to the product surface and pass through the fluorescent lamp; For non-conventional display defects (including but not limited to local bright lines or local floodlights), the observation angle is 75 degrees from the normal of the product surface; Full visual angle of appearance.

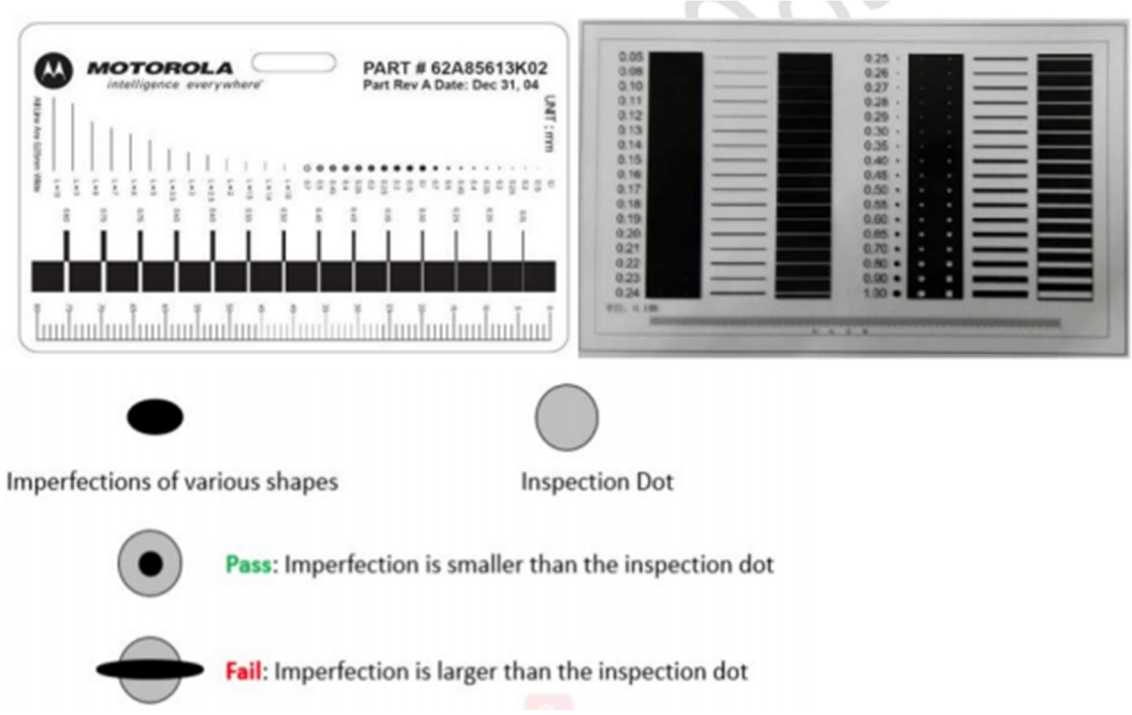
8.1.4 Inspection time: the inspection time without lighting is at least 10-12 seconds; The time of OLED lighting inspection for each picture is 1~3 seconds. If the defect is still not visible within the specified time, the inspection piece is deemed to be qualified.

8.1.5 Test temperature: room temperature 15°C-35°C, ambient humidity: 20%-75% RH.

8.1.6 Inspection tools:

ND Filter: The ND Filter is placed at a distance of 2-3 cm above the defect for 2-3s to judge whether the defect is visible. As Figure below: (ND Filter is used to test mura isochromatic and light unevenness)

Point gauge (point gauge in the figure below is recommended), determination method: as shown in the figure, the point gauge film can cover is pass, and the point gauge film can not cover is Fail。 For example, a maximum of 0.2mm same-color spot defect is allowed on the Class A surface, and the pass that can be covered by 0.2mm on the film，The one that can be covered is Fail.



Digital caliper: resolution 0.01mm.

Projector: anime microscope, 3D projector.

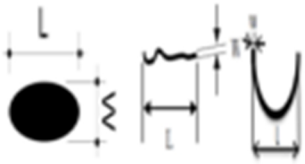
Judgment description

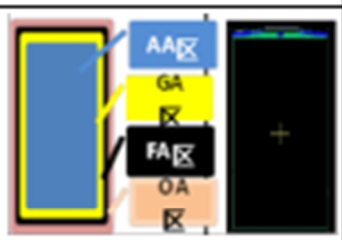
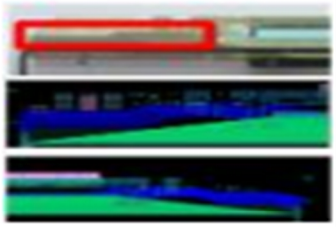
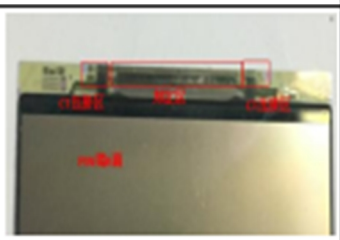
The measurement accuracy shall refer to the specification definition. When the measurement equipment accuracy is higher than the specification definition, the

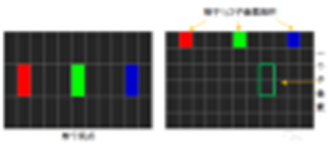
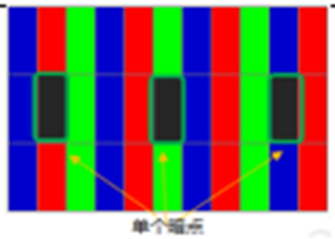
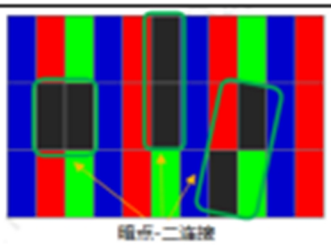
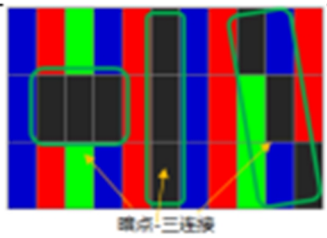
measured value needs to be rounded to the precision defined by the specificationthe. For example, the size of edge collapse is 0.20mm, and the thousandth is the reference position, which is rounded to 0.200mm~0.204mm is OK,>=0.205mm, it is judged as NG.

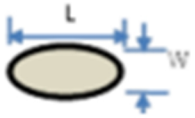
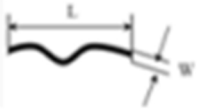
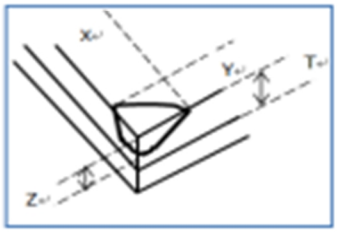
In addition to the tools used above, if additional inspection tools are needed to assist the judgment, they can only be carried out after the coordination of both parties.

Bad code and definition

Code and name		legend	explain
N	Number	-	Visually calculate the number; The statistics of the total number of defects does not include the completely "omitted" part. For the column defined as "omitted" and "omitted", it is not counted as the number of defects if it meets the requirements, otherwise it is calculated as an independent defect.
L	Length (mm)		Dot line distinguishing rule: L is the long side, W is the short side A. When L > 3W, handle as per line, otherwise handle as per point; B. When it is judged as line defect, S-shaped or C-shaped line appears, and the enclosed amount is less than 3/4 circle, it shall be treated as line defect; otherwise, it shall be treated as point defect, and the inner tangent circle shall simulate the size of point.
W	Width (mm)		
S	Area (mm^2)	-	Surface gauge
D	Diameter (mm) D=(L+W)/2	-	Point diameter calculation: calculated by half of the sum of the long side and the short side, that is,

			D=(L+W)/2, where D represents the diameter of the point, L is the long side, and W is the short side;
H	Depth (mm)	-	Digital micrometer
DS	Distance (mm)		Distance between two points or between two lines
Schematic diagram of screen area			AA area: display area; GA area: GIP circuit area; FA area: Frit area; OA area: outside FA area
Leader area			Screen GIP circuit area, screen data circuit area
PAD Bangding District			COG/FOG Bonding alignment mark and Bonding Pad on LTPS substrate
PAD Non-state area			Screen test pad, cutting area and lead-free area on LTPS substrate
CT crimping area			Pin end screen test pad

Highlights		A single sub-pixel (or red, or green, or blue) of one pixel is called a point; The definition of bright spot is that in the environment of 200 ± 50 Lux, the pixels or dots seen by employees with naked eyes are always bright, and the bright spot is checked under the black screen
Scotoma		A single sub-pixel (or red, or green, or blue) of one pixel is called a point; A dark point is defined as a point that is not bright in a single sub-pixel seen with naked eyes in a 100% white picture under the environment of 200 ± 50 Lux.
Dark spot - two connection		Two adjacent sub-pixels under the magnifying glass are not bright at the same time (horizontal, vertical and oblique)
Dark Spot - Three Links		The adjacent R, G and B sub-pixels under the magnifying glass are not bright at the same time (horizontal, vertical and oblique)
CG monomer area division		AA: Front visible area, black ink internal area; A: Black ink area; B: Cover plate edge; The front defect that runs through the AA area and the A area shall be judged according to the specification of the strictest area, and the back defect shall be judged according to whether the AA area is visible.
Foreign matter highlights	-	Due to the foreign matter in the polarizer, the phenomenon that appears as a bright spot is called a foreign matter bright spot

point defect		There are bright spots and black spots in local positions, including but not limited to the internal dirt of the screen itself, pinholes, serrations, concave-convex spots, color spots, tiny bubbles, white spots, stains on the fitting of the polarizer, poor polarizer itself and other spot-like defects. Point defects are judged by diameter.
Linear defect		Linear impurities in the screen, including filaments, fibers, polarizer fitting impurities in the screen, and scratches on the surface of polarizer, etc. Linear defects are judged by length and width. Sensible scratch: also known as hard scratch, is a deep scratch on the surface, which is felt by hand. Senseless scratch: also known as fine scratch, no deep scratch on the surface, no feeling when touching.
Serrated defect		W: Distance from sawtooth crest to trough
Edge collapse/angle collapse		In the process of screen production, especially in the process of molding and cutting, the small glass missing at the glass edge is caused. X direction: parallel to FOG Pad or glass edge; Y direction: perpendicular to FOG Pad or glass edge; Z direction: screen thickness direction; T : The thickness of single-layer glass;
Pitting	-	In the unit area of 10mm * 10mm, the defect point with D ≤ 0.1mm, DS ≥ 2mm, and the number N ≥ 5. If the customer has other requirements, follow the customer's requirements.

Dirty	-	Including handprints, oil stains, fingerprints, stains, white fog and other undesirable phenomena. It is divided into erasable dirt and non-erasable dirt. Use a dust-free cloth dipped in alcohol, which can not be erased as non-erasable dirt. Wipable dirt is determined as follows: A. Dry dust-free cloth can be directly erased; B. Wipe with clean cloth dipped with anhydrous alcohol Press the alcohol-stained dust-free cloth on the dry dust-free cloth twice to absorb excess alcohol; Wipe back and forth with a dust-free cloth twice, and the dirt can be removed.

8.2 Sampling Procedures for Each Item Acceptance Table

Critical Defect (CR): any defect that directly or indirectly affects human health and safety, or the function of the product is lost.

Major Defect (MA): directly or indirectly affect the product function, or make part of the pr oduct function lost, and other customers do not acceptable defects.

Minor Defect (MI): appearance defect that does not affect product function and can be ac cepted by customers.

Defect Type	Sampling Procedures	AQL
Critical Defect (CR)	Take the normal inspection solution of the sampling plan of GB/T2828.1-2012 Inspection level Ⅱ	0.065
Major Defect (MA)	Take the normal inspection solution of the sampling plan of GB/T2828.1-2012 Inspection level Ⅱ	0.65
Minor Defect (MI)	Take the normal inspection solution of the sampling plan of GB/T2828.1-2012 Inspection level Ⅱ	1.0

8.3 Telecommunications Inspection Item

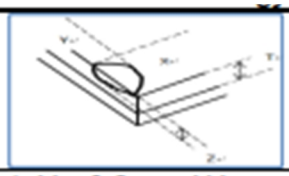
category	NO.	Inspection items	Inspection specification	test mode	defect type
	1	Display exception	not allow	visual	CR

Poor function	2	No display	not allow	visual	CR
	3	The picture flickers	not allow	visual	MA
TP function	4	TP test NG	not allow	visual	MA
Dot	5	Bright dot	not allow	visual	MI
	6	Partial Bright dot	ND6% or reference limit sample	visual	MI
	7	Dark dot	1.D≤0.15mm, ignored; 2.0.15mm < D≤ 0.2mm, DS ≥ 10mm, N ≤ 10; 3.D > 0.2mm,not allowed;	Visual inspection, Flinka	MI
Line	8	Bright line	not allow	visual	MA
	9	Dark line	not allow	visual	MA
	10	Slightly bright line	not allow	visual	MA
Mura	11	horizontal mura	No control under W64/127 screen; The 4%ND Filter on the 255 screen determines that the invisible is OK and the visible is NG.	Visual ND Filter/limit sample	MI
	12	vertical mura	No control under W64/127 screen; The 4% ND Filter on the 255 screen determines that the invisible is OK and the visible is NG.	Visual ND Filter/limit sample	MI
	13	White spot	No control under W64/127 screen; The 4% ND Filter on the 255 screen determines that the invisible is OK and the visible is NG.	Visual ND Filter/limit sample	MI
	14	Black spot	No control under W64/127 screen; The 4% ND Filter on the 255 screen determines that the invisible is OK and the visible is NG.	Visual ND Filter/limit sample	MI
	15	Color mura	4% ND Filter in W64/255 screen determines that the invisible is OK and the visible is NG	Visual ND Filter/limit sample	MI

	16	snowflake	No control under W64/127 screen; The 4% ND Filter on the 255 screen determines that the invisible is OK and the visible is NG.	Visual ND Filter/limit sample	MI
	17	Twill mura	No control under W64/127 screen; The 4% ND Filter on the 255 screen determines that the invisible is OK and the visible is NG.	Visual ND Filter/limit sample	MI
	18	Newtonian ring	No control under W64/127 screen; The 4% ND Filter on the 255 screen determines that the invisible is OK and the visible is NG.	Visual ND Filter/limit sample	MI
	19	Uneven transition	Reference homogeneity standard to assist in judgment; The 4% ND Filter in the W64/255 screen determines that the invisible product is OK and the visible product is NG.	Visual ND Filter/limit sample	MI
	1、 Mura all specify the screen judgment. For example, if the ELA mura judgment standard is 255, the ELA mura will only be judged on the W255 screen. 2、 Other types of mura have a low adverse effect rate and low incidence. According to the 4% ND Filter in the W64/255 screen, the invisible products are OK and the visible ones are NG.				
Dot/line of foreign material	20	Dot/line defects (foreign material, black white dot, scratch, bubble, etc.)	Same point/line specifications	Visual inspection/Flinka	MI

8.4 Appearance Inspection Item

NO.	Inspection items	Surface Area	Inspection specification	test mode	defect type
1	Broken glass	AA/OA	not allow	visual	MA
2	crack	AA/OA	not allow	visual	MA
3	Edge collapse/corner	AA/OA	1. Y ≤ 0.15mm, X and N are ignored; 2. 0.15 < Y ≤ 0.4mm, X ≤ 2mm, N is ignored; 3. Y > 0.4mm, not allowed; 4. Z ≤ t, without damage to Frit body;	Visual inspection, Flinka	MI

					
4	flange	AA/OA	1. Y ≤ 0.2mm, X is uncontrolled; 2. Y > 0.2mm, not allowed; 	Visual inspection, Flinka	MI
5	Glass warp	Whole area	 The product is placed horizontally on the front and back, and the lifting height at one end (plug gauge) ≤ 0.6mm	Visual inspection, Flinka	MI
6	Pin dirty	Bongding area	No control	visual	MI
7	Pin scratch	Bongding area	Scratches and whitening are found by visual inspection, and need to be rechecked with a microscope. The broken lead is not allowed, and the overlap is not allowed Note: CT pad area and pin non-bonding area are not controlled	visual	MI
8	PF film bump	LTPS	Touch is not allowed	visual	MI
9	PF film pinholes/pits	LTPS	No control	visual	MI
10	PF film scratch	LTPS	1. No scratch, no control; Scrape through, L<10mm; 2. The film shall be scraped through the exposed glass surface, referring to the lack of glue of PF film;	Visual inspection, Flinka	MI
11	PF film lacks glue	LTPS	50> 5mm, W>5mm not allowed	Visual inspection, Flinka	MI
12	PF membrane is dirty	LTPS	Wipable dirt needs to be wiped, and non-wipe dirt refers to the color difference of PF film;	visual	MI
13	PF film overflow	LTPS	1. Edge overflow W<0.2mm, acceptable; 2. W>0.2mm, not allowed;	Visual inspection, Flinka	MI

<table>
<tr><td>14</td><td>Color difference/stain (no convex touch)</td><td>LTPS</td><td colspan="4">No control</td><td>visual</td><td>MI</td></tr>
<tr><td>15</td><td>PF film gluing offset</td><td>LTPS</td><td colspan="4">1. Step area is not allowed;
2. Except for the step area, the rest shall be controlled by 0.5 ± 0.2mm;</td><td>Visual inspection, Flinka</td><td>MI</td></tr>
<tr><td>16</td><td>Screen body is dirty</td><td>LTPS</td><td colspan="4">1. The front can be wiped and the dirt can be wiped, and the polarizer of the dirt cover cannot be wiped;
2. The back is not controlled;</td><td>visual</td><td>MI</td></tr>
<tr><td rowspan="3">17</td><td rowspan="3">point defect</td><td rowspan="3">AA</td><td>D (mm)</td><td colspan="2">DS (mm)</td><td>Acceptable number</td><td rowspan="3">Visual inspection, Flinka</td><td rowspan="3">MI</td></tr>
<tr><td>D≤ 0.15mm</td><td colspan="2">/</td><td>Ignore</td></tr>
<tr><td>0.15mm< D≤0.2mm</td><td colspan="2">DS≥10</td><td>N≤10</td></tr>
<tr><td rowspan="6">18</td><td rowspan="6">Linear defect/foreign matter linear/non-inductive scratch</td><td rowspan="6">AA</td><td>W (mm)</td><td>L (mm)</td><td>DS (mm)</td><td>Acceptable number</td><td rowspan="6">Visual inspection, Flinka</td><td rowspan="6">MI</td></tr>
<tr><td>W≤ 0.03</td><td>L≤5</td><td>≥10</td><td>ignore</td></tr>
<tr><td>0.03< W≤ 0.05</td><td>L≤2</td><td>≥10</td><td>ignore</td></tr>
<tr><td>0.03< W≤ 0.05</td><td>2 < L≤5</td><td>≥10</td><td>N≤4</td></tr>
<tr><td>W>0.05</td><td>-</td><td>/</td><td>Not allowed</td></tr>
<tr><td>-</td><td>L>5</td><td>/</td><td>Not allowed</td></tr>
<tr><td rowspan="4">19</td><td rowspan="4">Point/Line defects</td><td rowspan="4">Camera hole area/Blind hole area</td><td colspan="2">D(mm)</td><td colspan="2">Acceptable number</td><td rowspan="4">Visual inspection, Flinka</td><td rowspan="4">MI</td></tr>
<tr><td colspan="2">D≤0.15</td><td colspan="2">ignore</td></tr>
<tr><td colspan="2">0.15 < D≤0.2</td><td colspan="2">ignore</td></tr>
<tr><td colspan="4">D>0.2</td></tr>
<tr><td>20</td><td>Newton rings（Blind hole area）</td><td>Camera hole area/Blind hole area</td><td colspan="4">Not control</td><td>Visual inspection</td><td>MI</td></tr>
<tr><td>21</td><td>offset</td><td>Camera hole</td><td colspan="4">The metal ring extends inward 0.1mm ,ingore</td><td>Visual inspection</td><td>MI</td></tr>
</table>

		area/Blind hole area			
22	Blind hole color bias(same color)	Camera hole area/Blind hole area	Functional requirements such as transmittance and PV value are met,not control appearance	Visual inspection	MI
23	Protective film scratch	Whole area	No control under no hurt boby	Visual inspection	MI
24	Protective film starved/overflow glue/burr	Whole area	No control under no hurt boby	Visual inspection	MI
25	Dirt inside the protective film	Whole area	Not allowed	Visual inspection	MI
26	Easy to tear	Cover front	Function is invalid, damaged, leaked not allowed Wrinkles, bumps, dirt, punching bad, burr, overflow glue is not controlled	Visual inspection	MI
27	Polarizer edge overflow	AA	W≤0.35mm , Not control; W>0.35mm, Not allowed.	Visual inspection, Flinka	MI
28	Polarizer concave convex point	AA	convex point: D≤0.2mm or refer to limit sample concave point: D≤3mm, DS≥10mm, N≤3 or refer to limit sample	Visual inspection, Flinka	MI
29	Polarizer fold / indentation	AA	Does not affect the display as OK or refer to limit sample;	Visual inspection	MI
30	Polarizer chromatism	AA	No control	Visual inspection	MI
31	IC chip	IC	Not allowed	Visual inspection	MI
32	FPC body defect	FPC	1. The parts on the FPC must be consistent with the product BOM table, and there are incorrect, multiple, or missing parts, which are not allowed; Polarities such as capacitors and inductors should not be soldered backwards or crooked; 2. FPC scratches/scratches are based on the absence of exposed copper; 3. Creases/Indentations: Indentations in the circuit area should not cause the back of the	Visual inspection	MI

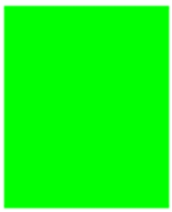
			covering film to turn white; Non line area indentation should not cause FPC damage 4. Except for the golden finger. FPC foreign object: a. Spot shape: D ≤ 0.5mm, N ≤ 3; b. Linear: length and width ≤ 0.3 * 5mm;		
33	FPC gold finger defect	Golden Finger Region	1. Golden finger cracking: The length and width of the crack/damage at the top of the golden finger ≤ the line width; 2. Gold finger copper leakage: W ≤ 1/3 line width, L ≤ line width, unlimited quantity 3. Gold finger gap W1 ≤ 1/3 line width W, length L1 ≤ 1/2 line width W, unlimited quantity, all of the above conditions are met and allowed; 4. Gold finger pressure/scratch should not expose copper, there should be no unevenness, and there should be no depth visible to the naked eye, which does not affect assembly and is acceptable; 5. Gold fingers should not have sharp creases or dead folds; 6. FPC gold fingers should not have oxidation, blackening, burns, or browning;	Visual inspection	MI
34	connector	connect or	There should be no tin or residual solder beads on the connector, and there should be no tin connection on the connector pins; PIN deformation shall be controlled within 0.05mm; Does not affect the lighting function; Visual inspection of pin breakage, pin detachment, and deformation of the outer frame is not allowed;	Visual inspection	MI
35	Insulating tape	Bondin g area	There must be no obvious wrinkles or bubbles	Visual inspection	MI
		Compo nent area	1. Scratches and glue splashes are uncontrollable; 2. Do not wipe dirt or dirt; 3. The offset of the insulation tape should not exceed the edge of the product, and other requirements should be determined based on the drawing; 4. Burr edges, no control over glue overflow;		

			5. Damaged, incomplete, or missing labels are not allowed;		
36	Composite tape	All	1. It is not allowed for the composite tape to leak out of the edge of the screen body; 2. Folding of composite tape, light leakage during assembly, or affecting assembly and thickness are not allowed; 3. Damaged composite tape is not allowed; 4. The size of the composite tape cutting defect does not meet the requirements of the drawing and cannot be controlled; 5. Composite tape should not be wiped with dirt or foreign objects, and foreign objects should follow the dotted line standard; 6. The burrs of the composite tape should not exceed the edge of the screen body, regardless of control; 8. Composite adhesive tape with no control over glue splashes or overflow; 9. Composite tape bubbles: D ≤ 5mm, N not included; 10. Composite tape bumps: acute angle bumps D ≤ 0.3mm, N ≤ 3; Smooth concave convex points D ≤ 0.8mm, N ≤ 3; 11. Composite tape foreign object (foreign object between copper foil and blue film): D ≤ 0.3mm, N ≤ 3; 12. Edge sawtooth of composite tape: 0.5 * 3mm, N ≤ 3; 13. The color difference of the protective film in the composite tape is not controlled; 14. Copper foil indentation and dead bending in composite tape are not allowed, which does not affect assembly and thickness control; Or reference limit sample; 15. No control of foreign objects/dents in copper foil in composite tape;	Visual inspection	MI
37	OCA overflow	All	Not allowed within AA area; Externally visible: Control standard ≤ 0.15mm	Visual inspection	MI

38	Sealing glue	Pin	1. Broken adhesive is not allowed, and the circuit cannot be exposed. 2. The thickness of the colloid shall not be higher than the POL surface. 3. Bubble diameter<1mm. 4. Other: According to the drawings and work instructions.	Visual inspection	MI
39	Conductive cloth	All	1. Conductive cloth dirt: D ⩽ 5mm, N ⩽ 2; 2. Conductive cloth bubbles: D ⩽ 2mm, N ⩽ 2; 3. Conductive cloth foreign object: D ⩽ 1mm, N ⩽ 3; 4. Folding of conductive fabric: N ⩽ 2;	Visual inspection	MI
40	Copper foil	All	Copper foil sticking is not allowed to leak out of the edge of the screen body; Abnormal color of copper foil refers to standard samples/sealed samples, and damage is not allowed. Soft scratches on the surface are not controlled.	Visual inspection	MI
41	QR code	QR code	It is not allowed to be unable to scan or difficult to scan (recognition can only be achieved after three consecutive scans), with a clear appearance, no blurring, missing printing, and other defects	Visual inspection	MI
42	Package	Other	Products should put into the anti-static trays, with non-overlapping, and the trays should be staggered placed. Different products cannot be mixed into the same inner package. The package should not have obvious deformation or breakage .The printing labels type and quantity are correct. The package should have QC signature. ROHS label is needed if the product is under ROHS control.	visual	-
43	Boundary dimension NG	Other	It is not allowed to exceed the dimensional tolerance required by the specifications and drawings	Calipers, measuring instruments	-

8.4 Inspection picture library

Serial number	picture	Picture name	Mainly judged as defective	remarks

1		W_ GRAD(64) 64 gray scale	Point/line type, foreign matter point/line, mura type	/
2		W_ GRAD(128) 128 gray scale	Point/line type, foreign matter point/line, mura type	/
3		WHITE white	Point/line type, foreign matter point/line, mura type	/
4		Black black	Bright spot, bright line, dark mura	/
5		RED red	Point type, line type, foreign matter point/line	/
6		GREEN green	Point type, line type, foreign matter point/line	/
7		BLUE blue	Point type, line type, foreign matter point/line	/

9. Reliability Test Result

Item	Condition	Inspection after test
High Temperature Operating	+70°C,96h	IEC60068-2-
Low Temperature Operating	-20°C, 96h	IEC60068-2-1 GB2423.1
High Temperature Storage	+80°C, 96h	IEC60068-2-2 GB2423.2
Low Temperature Storage	-40°C, 96h	IEC60068-2-1 GB2423.1
High Temperature & High Humidity Storage	+60°C, 90% RH, 96h	IEC60068-2-78 GB/T2423.3
Thermal Shock (Non-operation)	-40°C, 30 min ↔ 80°C, 30 min, Change time: 5min 20CYC.	Start with cold temperature, End with high temperature, IEC60068-2-14,GB2423.22

10. Cautions and Handling Precautions

10.1 Handling Precautions:

(1) The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from height..
(2) Do not press down the screen or the adjoining areas too hard because the color tone may be shifted.
(3) The polarizer covering the display surface of the AMOLED module is soft and easily scratched. Handle this polarizer carefully.
(4) If the display surface is contaminated, blow on the surface and gently wipe it with a soft dry cloth. If it is still not completely clear, moisten the cloth with ethyl alcohol.
(5) Solvents may damage the polarizer. Do not use water, ketone or aromatic solvents except ethyl alcohol. Do not attempt to disassemble the AMOLED Module.
(6) If the logic circuit power is off, do not apply the input signals.
(7) To prevent destruction from static electricity, be careful to maintain an optimum working environment.
(8) Be sure to make yourself in contact with the ground when handling with the AMOLED Modules.
(9) Tools required for assembly, such as soldering irons, must be properly ground.
(10) To reduce the generation of static electricity, do not conduct assembly or other work under dry conditions.
(11) To protect the display surface, the AMOLED Module is coated with a film. Be careful when peeling off this protective film, because static electricity may generate.

10.2 Storage Precautions.

(1) When storing the AMOLED modules, be sure that they are not directly exposed to the sunlight or the light of fluorescent lamps.
(2) The AMOLED modules should be stored under the storage temperature range. If the AMOLED modules will be stored for a long time, the recommended condition is: Temperature: 0°C ~ 40°C. Relatively humidity: ≤80%
(3) The AMOLED modules should be stored in the room without acid, alkali or harmful gas.

10.3 Transportation Precautions:

(1) The AMOLED modules should not be suffered from falling and violent shocking during transportation. Besides, excessive press, water, damp and sunshine, should be avoided.