



深圳市華宇彩晶科技有限公司
SHENZHEN UNICO DISPLAY TECHNOLOGY CO., LTD

PRODUCT SPECIFICATION

Rev. A

Customer Name:

Customer No:

Module No: UD0032KQ045

CUSTOMER'S APPROVAL:

A:尺寸 (Structure) ☐OK ☐NG

B:效果 (Effectation) ☐OK ☐NG

C:可靠性 (Reliability) ☐OK ☐NG

D:其他 (Other) _____

客户签字/日期 (Customer's Signature&Date) : _____

Please sign the cover page of the spec for your approval and return it to our local sales within a month after your receipt of the spec from Unico Display. In the case Unico Display does not receive the signed spec even after one month later; in general we will consider that the spec was already accepted by your company.

Prepared	Checked	Approved	Date

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1. GENERAL DESCRIPTION

1.1 Introduction

Shenzhen Unico Display model **UD0032KQ045** is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit and a back-light system. This TFT LCD has a **4.5** inch diagonally measured active display area with **FW (480 horizontal by 854 vertical pixel)** resolution.

1.2 Features

- 4.5 inch configuration
- MIPI interface
- LED Backlight
- RoHS Compliance

1.3 Applications

- Multimedia applications
- Mobile Phone applications

1.4 General information

Size	4.5"
Display Type	16.7M TFT
Display Mode	TN
Viewing Direction	6 o'clock
Connection Type	ZIF
Interface	MIPI
ColorPixel Arrangement	RGB Vertical Stripe
Driving IC	ILI9806C

1.5 Mechanical Description

Item	Standard Value	Unit	Remark
Number of dots	480RGB×854dots	-	
LCM dimension	60.12(W)×109.2(H)×2.0(T)	mm	
Active area	55.44(W)×98.64(H)	mm	
Dot pitch	0.1155(W)×0.1155(H)	mm	
Backlight	10-CHIP-white LEDS Series	/	
The KEY and accessory materials of our product according with ROHS standard			

2. OUTLINE DIMENSION

Pinout Table:

PIN	Symbol
1	GND
2	LED A
3	GND
4	LED K
5	GND
6	VCC(2.8V)
7	GND
8	IOVCC(1.8V)
9	RESET
10	NC
11	NC
12	NC
13	FMARK
14	LCD ID
15	GND
16	DSI_D0N
17	DSI_D0P
18	GND
19	DSI_CN
20	DSI_CP
21	GND
22	DSI_D1N
23	DSI_D1P
24	GND
25	NC

Notes:

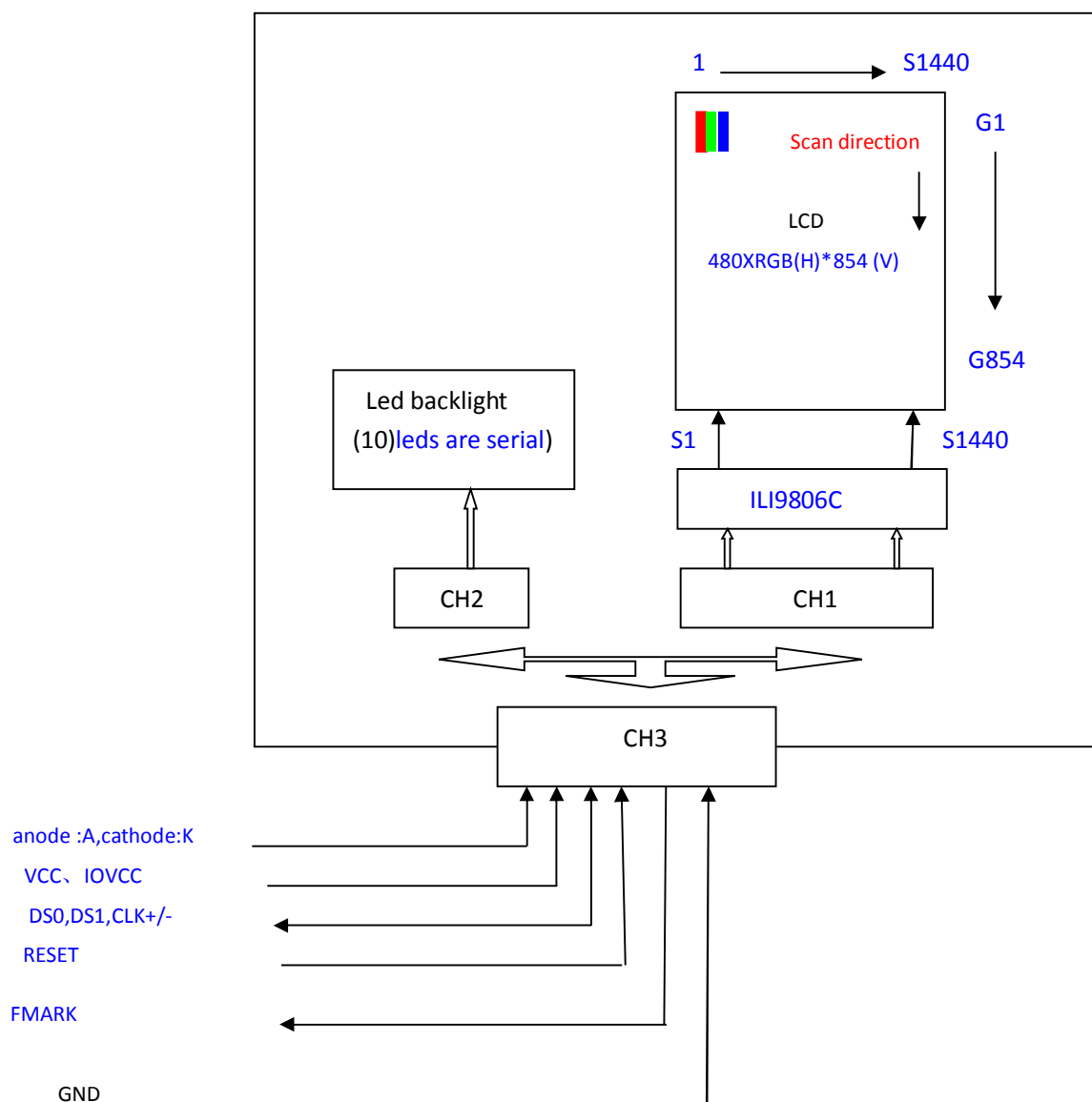
- DISPLAY TYPE: 4.5" TFT
- DRIVER IC: IL19806C
- BACKLIGHT CIRCUIT:
 - 10 CHIP WHITE LED IN SERIES (20 mA/LED)
 - LOM LUMINANCE: 350 cd/m2 TYP
 - OPERATING TEMPERATURE: -20°C~70°C
 - STORAGE TEMPERATURE: -30°C~80°C
- "Q" MEANS KEY DIMENSION
- "△" MEANS REVISION RECORD
8. ROHS REQUIREMENT

CUSTOMER APPROVED: _____

3.PIN ASSIGNMENTS

No.	Signal	I/O	Fuction	
1	GND	I	Ground	
2	LEDA	P	LED1 Anode(+)	
3	GND	P	Ground	
4	LEDK	I	LEDCathode(-)	
5	GND	I	Ground	
6	VCC(2.8V)	P	Power supply(2.8v)	
7	GND	I	Ground	
8	IOVCC	--	Power supply(1.8v)	
9	RESET	P	Reset signal	
10	NC	P	Open	
11	NC	P	Open	
12	NC	P	Open	
13	FMARK	P	Tearing effect output pin	
14	LCD_ID	P	Read ID(connect 100Kohm to Ground)	
15	GND	I/O	Ground	
16	DSI_D0N	I/O	MIPI-DSI data Lane 0 negative -end input/output pin	
17	DSI_D0P	P	MIPI-DSI data Lane 0 positive -end input/output pin	
18	GND	I	Ground	
19	DSI_CLKN	I	MIPI-DSI clock Lane negative-end input pin	
20	DSI_CLKP	P	MIPI-DSI clock Lane positive-end input pin	
21	GND	I	Ground	
22	DSI_D1N	I	MIPI-DSI data Lane 1 negative -end input/output pin	
23	DSI_D1P	P	MIPI-DSI data Lane 1 positive -end input/output pin	
24	GND		Ground	
25	Open		Open	

4.BLOCK DIAGRAM

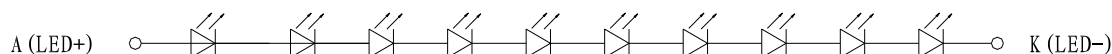


5. BACKLIGHT CHARACTERISTICS

5.1 Backlight specification

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	V _f	T _a =25°C, I _f =20mA	--	30	-	V
Forward Current	I _f	T _a =25°C, V _f =19.2V	--	20	--	mA
Uniformity	Avg		80			%
Reverse Current	I _r				20	uA
Power consumption	P _d			600		mW
Drive method	Constant current 20mA/LED					
LED configuration	10 LEDs in series					

5.2 LED Circuit Diagram



BACKLIGHT CIRCUIT DIAGRAM 20mA/LED

6.ELECTRICAL CHARACTERISTICS

LCD MODULE DC CHARACTERISTICS

VSS=0,Ta=25°C

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Power Supply Voltage for I/O Interface	IOVCC	----	1.65	1.8	3.3	V	
Power Supply Voltage for Analog and MIPI-DSI	VCC	----	2.6	2.8	3.3	V	
Power Supply for Switching Regulator	VCI	-----	2.6	2.8	3.3	V	
Input Voltage for Logic Circuits	Vi	"H" level	0.80×IOVCC	-	IOVCC	V	
		"L" level	0		0.20×IOVCC	V	
Output Voltage for Logic Circuits	Vo	"H" level	0.80×IOVCC	-	IOVCC	V	
		"L" level	0		0.20×IOVCC	V	
Power Supply Current for IOVCC	Iio	Display on	-	-	TBD	mA	
		Sleep IN	-	-	TBD	uA	
Power Supply Current for VCC and VCI	Icc+Ici	Display on	-	-	TBD	mA	
		Sleep IN	-	-	TBD	uA	

7. ABSOLUTE MAXIMUM RATINGS

7.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS OF LCD

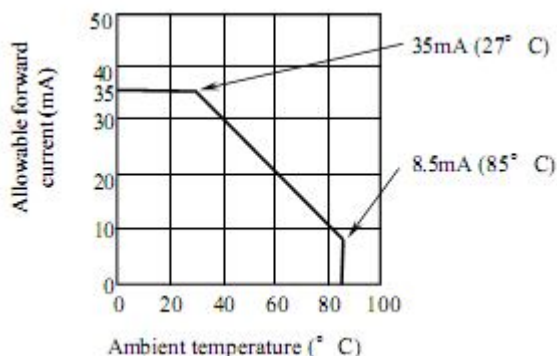
VSS=0,Ta=25°C

Item	Symbol	Min	Max	Unit	Note
Power Supply for Interface	IOVCC	-0.3	6.0	V	(1) (4)
Power Supply for Analog and MIPI-DSI	VCC	-0.3	4.5	V	(1)
Power Supply for Switching Regulator	VCI	-0.3	4.5	V	(1)
Input Voltage	Vi	-0.3	4.5	V	(2)
LED Reverse Voltage	Vr	-	5	V	Per led
LED Forward Current	Iled	-	Note(3)	mA	Per led

Notes (1) Keep all Voltages no lower than GND.

(2) Applies to the RES.

(3) Ambient Temperatures vs. Allow able Forward Current.



(4) IOVCC < VCI

7.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

Item	Operating		Storage		Remark
	Min	Max	Min	Max	
Ambient temperature	-20°C	70°C	-30°C	80°C	Note(2)
Humidity	Note(1)		Note(1)		No condensation

Notes (1) Ta < 40°C 85%RH max.

Ta > 40°C Absolute humidity must be lower than the humidity of 85%RH at 40°C.

(2) Background color slightly changes depending on ambient temperature and viewing angle.

8. OPTICAL CHARACTERISTICS

8.1 Optical specification

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Contrast	CR	$\Theta=0$	-	TBD	-		(1)(2)
Response time	Tr+Tf	Normal viewing angle	-	25	(30)	ms	(1)(3)
White Brightness (Center)	L	viewing angle	-	350	-	cd/m ²	(1)(4)
Viewing angle	Hor	Θ_L	-	TBD	-		
		Θ_R	-	TBD	-		
	Ver	Θ_U	-	TBD	-		
		Θ_D	-	TBD	-		
Brightness uniformity	U	$\Theta=0$	-	80	-		(5)
Color Tone (Primary Color)	red	x	-	TBD	-		CF glass-
		y	-	TBD	-		
	green	x	-	TBD	-		
		y	-	TBD	-		
	blue	x	-	TBD	-		
		y	-	TBD	-		
	white	x	-	TBD	-		
		y	-	TBD	-		
NTSC Ratio	-		-	61	-	%	
Optima View Direction	6 o'clock						(6)

8.2 Measuring Condition

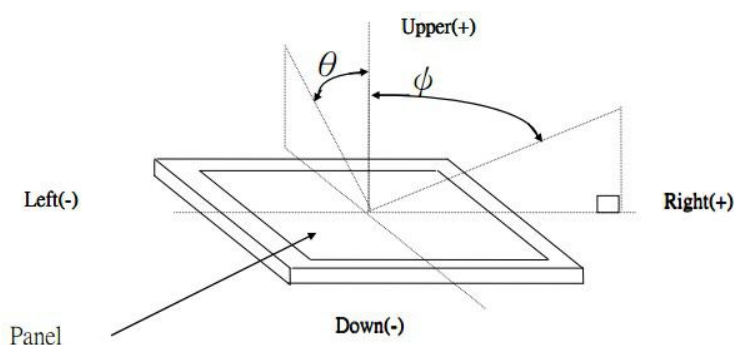
- Measuring surrounding: dark room
- LED current I_L: 20mA
- Ambient temperature: 25±2°C

- Power supply voltage : IOVCC=1.8V, VCC=VCI=2.8V
- Backlight current : ILED=20mA

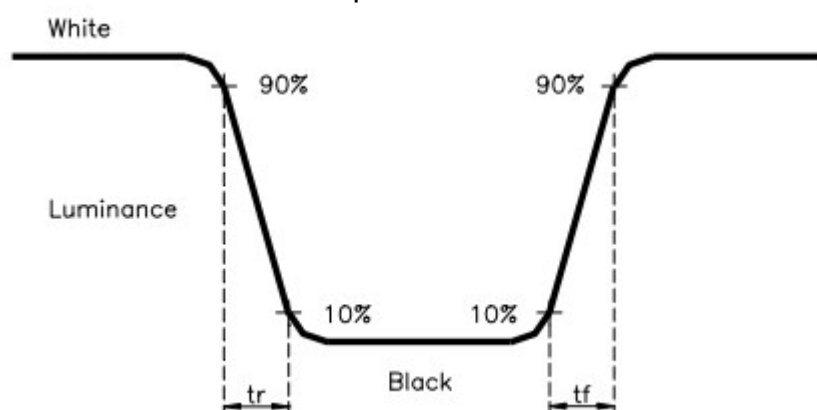
8.3 Measuring Equipment

- BM-7

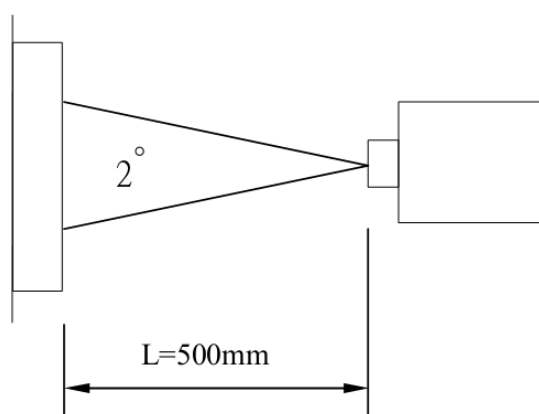
Note (1) Definition of Viewing Angle:



Note (2) Definition of response time: The response time is defined as the time interval between the 10% and 90% amplitudes

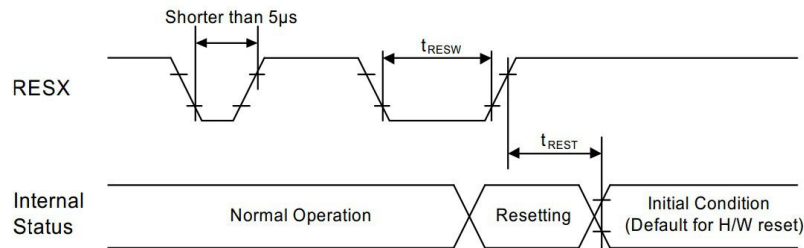


Note (3) Definition of optical measurement setup



9. SEQUENTIAL CHART

9.1 RESET TIMING CHARACTERISTICS



(VSS=VSSI=DVSS=0V, VDDI=1.65V to 3.3V, VDD=2.3V to 4.8V, Ta = -30 to 70°C)

Signal	Symbol	Parameter	MIN	TYP	MAX	Unit	Description
RESX	tRESW	Reset " L " pulse width (Note 1)	10	--	--	US	
	tREST	Reset complete time (Note 2)	--	--	5	MS	When reset applied during Sleep In Mode
			--	--	120	MS	When reset applied during SleepOut Mode

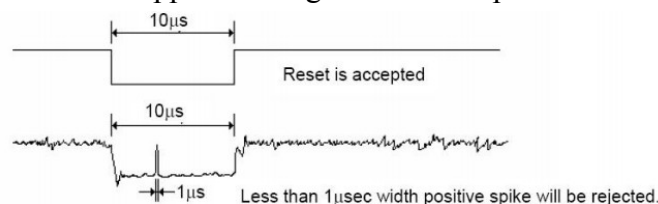
Note 1) Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below.

RESX Pulse	Action
Shorter than 5µs	Reset Rejected
Longer than 10µs	Reset
Between 5µs 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 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In–mode) and then return to Default condition for H/W reset.

Note 3) 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 (tREST) within 5ms after a rising edge of RESX.

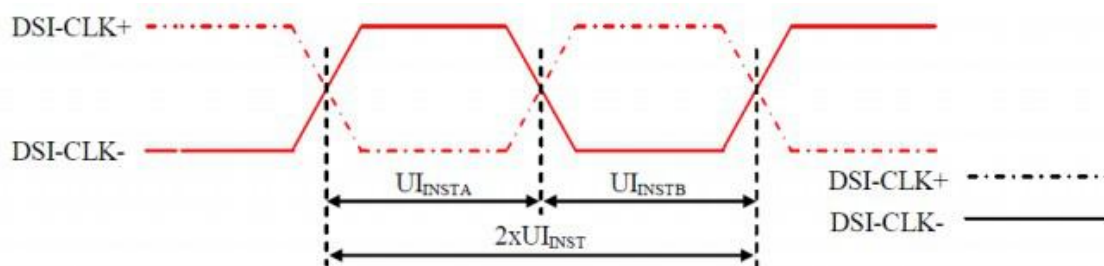
Note 4) Spike Rejection also applies during a valid reset pulse as shown below:



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

9.2 MIPI-DSI characteristics

9.2.1. High speed mode

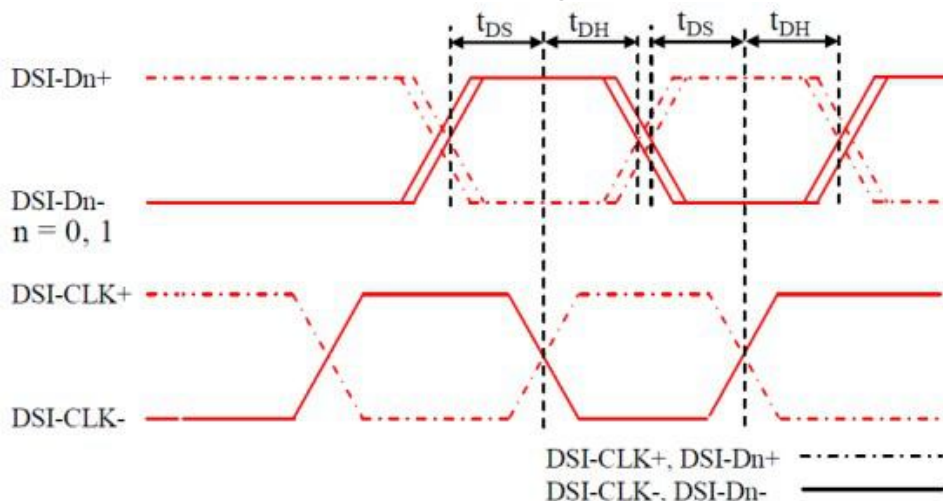


DSI Clock Channel Timing

Signal	Symbol	Parameter	Min	Max	Unit
DSI-CLK+/-	$2xUI_{INST}$	Double UI instantaneous	4	25	ns
DSI-CLK+/-	UI_{INSTA}, UI_{INSTB}	UI instantaneous Half	2	12.5	ns

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

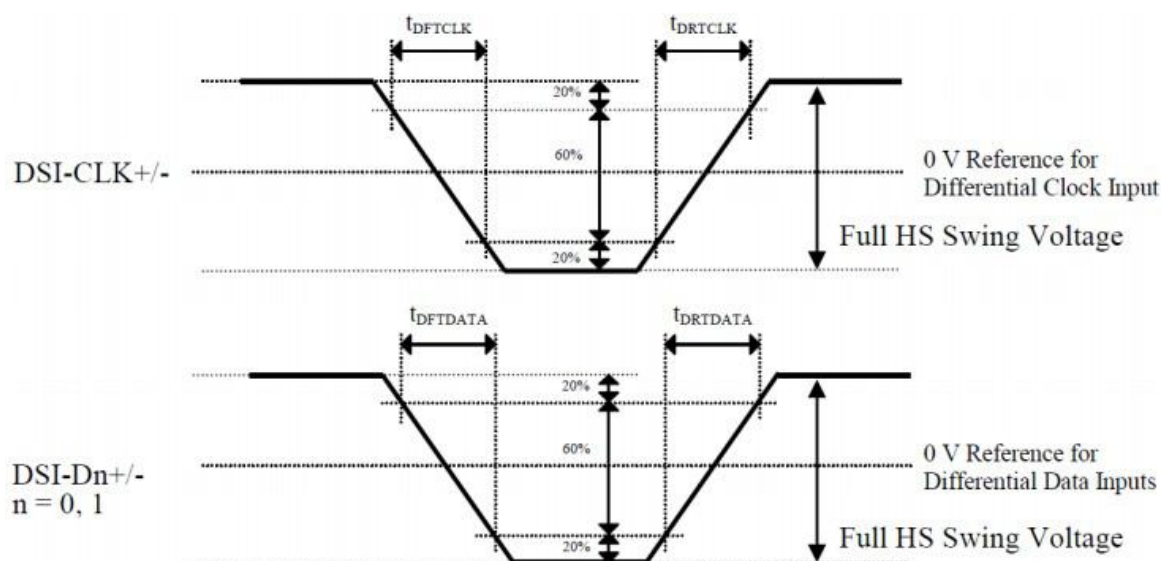
9.2.2.High Speed Mode - Data Clock Channel Timing



DSI Data to Clock Channel Timings

Signal	Symbol	Parameter	Min	Max
DSI-Dn+/- , n=0 or 1	t_{DS}	Data to Clock Setup time	$0.15xUI$	-
	t_{DH}	Clock to Data Hold Time	$0.15xUI$	-

9.2.3.High Speed Mode – Rising and Falling Timings



Rising and Falling Timings on Clock and Data Channels

Parameter	Symbol	Condition	Specification			Unit
			Min	Typ	Max	
Differential Rising Time for Clock	t_{DRTCLK}	DSI-CLK+/-	-	-	150 (Note 1)	ps
Differential Rising Time for Data	$t_{DRTDATA}$	DSI-Dn+/- n=0 and 1	-	-	150 (Note 1)	ps
Differential Falling Time for Clock	t_{DFTCLK}	DSI-CLK+/-	-	-	150 (Note 1)	ps
Differential Falling Time for Data	$t_{DFTDATA}$	DSI-Dn+/- n=0 and 1	-	-	150 (Note 1)	ps

Note: The display module has to meet timing requirements, what are defined for the transmitter (MPU) on MIPI D-Phy standard

10.RELIABILITY TEST ITEMS

NO	ITEM	CONDITION	STANDARD
1	High Temp. Storage	70℃, 12 hours	1. Functional test is OK. Missing Segment, short, unclear segment, non-display, display abnormally and liquid crystal leak are un-allowed. 2. No low temperature bubbles, end seal loose and fall, frame rainbow.
2	Low Temp. Storage	-20℃, 12 hours	
3	High Temp. Operation	60℃, 12 hours	
4	Low Temp. Operation	-20℃, 12 hours	
5	High temperature and high Humidity storage	40℃, 90%RH, 12 hours	
6	Thermal and cold shock	Static state, -20℃ (30 Min) ~ 70℃ (30 Min) ~ -20℃ (30 Min), packaging, 10 cycles	1. Function test is OK. 2. No glass crack, chipped glass, end seal loose and fall, epoxy frame crack and so on. 3. No structure loose and fall.
7	Vibration test	Packaging, Frequency : 10-55Hz Amplitude : 1.0mm, Each direction on X,Y axe 0.5 hours, circle 2 hours	
8	Dropping test	Pack products into the carton box. Drop it from 80cm height to ground. Once for each side of the carton	

NOTE:

- 2.1 The reliability items will be fully performed in new sample qualification,
- 2.2 The reliability status will be tested as monitor during mass production. Individual reliability test shall be performed by lot, Moreover, the individual reliability item shall be decided according to reliability plan.
- 2.3 All samples are inspected after keeping in the room with normal temperature and humidity for 2 hours or above.
- 2.4 Vibration test: It is not necessary to test for those products without assembly frame, back light, PCB and so on.
- 2.5 Dropping test: It is necessary for affirming new package.
- 2.6 For the high temperature and high humidity test, pure water of over 10 MΩ.cm should be used.
- 2.7 Each test item applies for test LCM only once. Then tested LCM cannot be used again in any other test item.
- 2.8 The quantity of LCM examination for each test item is 5pcs to 10pcs.

11. VISUAL & FUNCTION INSPECTION STANDARD

1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

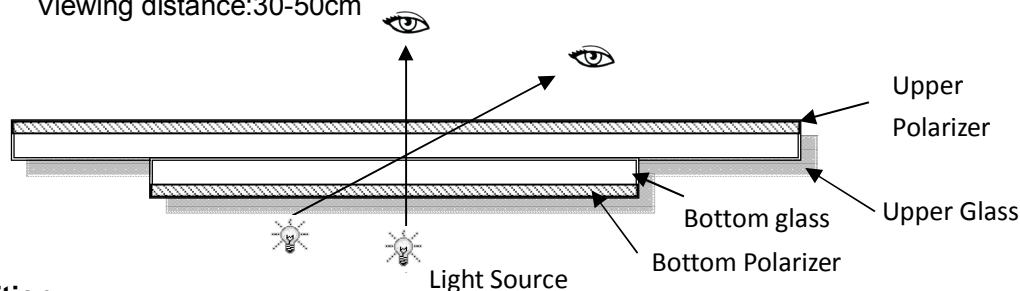
Temperature : 25±5℃

Humidity : 65%±10%RH

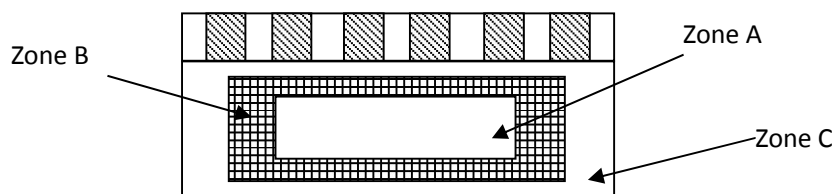
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Note: As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function

or appearance after assembly by customer.

1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class II AQL:

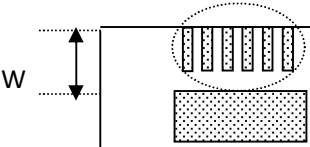
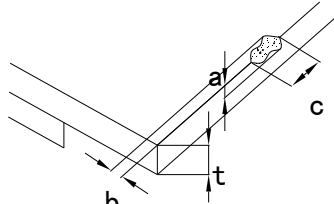
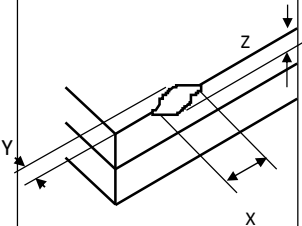
Major defect	Minor defect
0.65	1.5

LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Soldering appearance	Good soldering , Peeling off is not allowed.	
6	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

1.4 Criteria (Visual)

项目	检验项目	检验标准		不良等级
1	电性功能测试	1) 无显示 2) 线缺陷 3) 黑屏 4) 视觉不符		Major 主缺
2	外形尺寸	外形尺寸应在规定的范围内		Major 主缺
3	Spot defect (in LCD or Backlight) 点状不良(黑点,白点,亮点,暗点等)	Φ(mm)	Acceptable 接受	Major 主缺
		Φ≤0.10	Ignore 忽略	
		0.10 < Φ≤0.2	2	
		Φ>0.2	0	
4	Line type defect 线状缺陷(刮伤,毛丝等)	W(mm)	Acceptable 接受	Major 主缺
		W≤0.03	Ignore 忽略	
		0.03<W≤0.05 L≤1.5	1	
		W > 0.05 L>1.5	Judge as spot 按点状不良判定	
5	Dot defect 像素缺陷	Item 项目	Acceptable 接受	Major 主缺
		像素亮点 (Bright Dot)	0	
		像素暗点 (Bright Dot)	0	
6	Dent , Bubble, Dirt , pinhole in POL 偏光片凹凸点, 气泡, 脏污, 针孔等	Φ(mm)	Acceptable 接受	Major 主缺
		Φ≤0.10	Ignore 忽略	
		0.10 < Φ≤0.2	2	
		Φ>0.2	0	
Remark:针对点及线状不良(3,4,5,6),任何两个不良之间距离需大于 20mm,群点和族点不允许				
8	leakage of light 漏光 (不接受漏光, 正面 90 度目视 AA 区, 不可以漏光, 参照限度样品)	Unhallowed 不允许(不接受漏光, 正面 90 度目视 AA 区, 不可以漏光)		Major 主缺

9	LCD defect LCD 破裂	Crack 破裂	Unhallowed 不允许	Major 主缺
		Pad break Pad 面破碎	 $W > 0.5\text{mm}$, unallowed 不允许。	Major 主缺
		Con-Pad break Con-pad 面破碎	When $a < 1/2T$ (T=the thickness of single LCD 一片玻璃的厚度) : $b \geq 1/2 \text{ PAD NG}$ or $c \geq 5\text{mm NG}$ When $a \geq 1/2T$: as same as PAD break 类似 pad 面破碎 	Major 主缺
		Break not in PAD PAD 面没破碎	 $X \leq 1/8A$; Y into the inspect area is unallowed; Y 不能在检验范围内 $X \leq 1/8A$, if Y not into the frame, Z ignore; 如 Y 不在框架内, Z 可忽略 $X \leq 1/8A, Y \leq 1/2 \text{ Seal}, Z \leq 1/2T$ is allowed $X \leq 1/8A, Y > 1/2 \text{ Seal}, Z \leq 1/4T$ is allowed	Major 主缺

12.SUGGESTIONS FOR USING LCD MODULES

● Safety instructions

1. If the LCD panel breaks, be careful not to get any liquid crystal substance in your mouth.
2. If the liquid crystal substance touches your skin or clothes, please wash it off immediately by using soap and water.

● Handling Precautions

1. Avoid static electricity damaging the LSI.
2. Do not remove the panel or frame from the module .
- 3 .The polarizing plate of the display is very fragile . So, please handle it very carefully.
4. Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of the plate.
5. The color tone of display and background of LCM has the possibility to be changed in the storage temperature range.
6. Pay attention to the working environment, as the element may be destroyed by static electricity.
 - Be sure to ground human body and electric appliance during work.
 - Avoid working in a dry environment to minimize the generations of static electricity.
 - Static electricity may be generated when the protective film is fast peeled off.
7. When soldering the terminal of LCM, make certain the AC power source of soldering iron does not leak.
8. If the display surface becomes contaminated ,breathe on the surface and gently wipe it with a soft-dry- clean cloth .If it is heavily contaminated ,moisten cloth with the following solvent(ex:Ethyl alcohol).Solvents other than those above-mentioned may damage the polarizer(Especially ,do not use them .ex: Warter / Ketone)

● Operation instructions

1. It is recommended to drive the LCD within the specified voltage limits, try to adjust the operating voltage for the optimal contrast, the color and contrast of LCD panel will varies at different temperature.
2. Response time is greatly delayed at low operating temperature range. However, this does not mean the LCD will be out of the order, It will recover when it returns to the specified temperature range.
3. If the display area is pushed hard during operation, the display will become abnormal.
4. Do not operate the LCD at the environments over the specified conditions, this may cause damage on the LCD and shorten the lifetime.

● Storage instructions

1. Store LCDs in a sealed polyethylene bag.
- 2 .Store LCDs in a dark place, Do not expose to sunlight or fluorescent light. Keep the temperature between 0℃and 35℃.
3. Avoid the polarizer touch any other object, (It is recommended to store them in the container in which they were shipped.)

● Limited Warranty

1. LEAD will replace or repair any of its LCD modules, which are found to be defective, when inspected in accordance with LEAD LCM acceptance standards (copies available upon request) for a period of 12 months from ink- print date on product
2. Any defects must be returned to LEAD within 60 days since ship-out. Confirmation of such date

- shall be based on freight documents. The warranty liability of LEAD limited to repair and/or replacement on defects above (7.1,7.2)
3. No warranty can be granted if the precautions stated above have been disregarded. The typical samples are as below:
- LCD glass crack/break
 - PCB outlet is damaged or modified.
 - PCB conductors damaged.
 - Circuit modified with by grinding, engraving or painting varnish.
 - FPC crack
4. Modules must be returned with sufficient description of the failures of defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB outlet, conductors and terminals. Modules must be packed with the container in which they were shipped.



13.PACKAGE SPECIFICATION

TBD