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PRODUCTION SPECIFICATION OF LCD MODULE MODULE NO.: ET019FQV05-G

Customer Name:			
Customer Part Number:			
Approved By:		Date:	

Prepared By	Checked By	Approved By

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Revision History

Rev	Issued Date	Description	Page	Editor
1.0	NOV 24, 2018	First release	All	

1 General Specifications

Feature		Specifications
Display Spec.	LCD type	1.9 inch
	Resolution (H*V)	170(RGB) × 320
	Technology Type	a-Si TFT /IPS
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	Transmissive / Normally Black
	Viewing Direction	ALL
Mechanical Characteristics	OutlineDimensions (H xV x T) (mm)	25.8*49.72*1.36
	Active Area(mm)	22.7*42.72
	With /Without Touch screen	Without
	Backlight Type	White LED
	Weight (g)	TBD
Electrical Characteristics	Interface	4L-SPI/8Bit-8080 MCU
	Number of color	262K
	Driver IC	ST7789V

Note 1: Viewing direction for best image quality is different from TFT definition. There is a 180 degree shift.

2 Pin Assignment

NO.	PIN NAME	I/O	Description
1	GND	P	Ground
2	VCI	P	Power Supply 2.8V Voltage
3	IM2	I/O	when IM1=0, IM2=0 , 8080-8bit;
4	IM1	I/O	when IM1=1, IM2=1 , 4-line SPI serial
5	RESET	I/O	LCM Reset input signal
6	CSX	I/O	Input pin for chip selection signal
7	DC(SPI-SCL)	I/O	When connecting to an 8080-series microprocessor, this pin receives the data/command selection pin .This pin is used to be serial interface clock in 4-line serial interface
8	WR (SPI-RS)	I/O	When connecting to an 8080-series microprocessor, this pin receives the write signal.Display data/command selection pin in 4-line serial interface.
9	RD	I/O	When connecting to an 8080-series microprocessor, this pin receives the Read signal. Read operation is initiated when this pin is pulled LOW and the chip is selected.When serial interface is selected, this pin must be connected to Ground.
10	SDA	I/O	SPI interface input/output pin. The data is latched on the rising edge of the SCL signal.
11-18	D0-D7	I/O	MCU parallel interface data bus.
19	SDO	I/O	SPI interface output pin.
20	LEDA	P	LED Anode
21	LEDK1	P	LED Cathode
22	LEDK2	P	LED Cathode
23	LEDK3	P	LED Cathode
24	LEDK4	P	LED Cathode
25-29	NC		No Connect
30	GND	P	Ground

Note1: I/O definition: I-----Input O---Output P----Power/Ground

3 Absolute Maximum Ratings

GND=0V, Ta= 25°C

Item	Symbol	Value	Unit
Power supply voltage for logic	V_{DD}	1.6~3.3	V
Input voltage	V_{in}	$V_{DD}+0.3$	V
Operating temperature	T_{opr}	-20 to 70	°C
Storage temperature	T_{stg}	-30 to 80	°C

4 Electrical Characteristics

4.1 DC Characteristics (VDD=2.8V,Ta=25°C)

Item	Symbol	Min	Type	Max	Unit	Test condition
Operating voltage	V_{DD}	2.6	2.8	3.3	V	-
Supply current	I_{DD}	-	-	25	mA	$V_{DD}=2.8V, T_a=25^\circ C$
Input voltage	V_{IH}	0.8VDD	-	VDD	V	-
	V_{IL}	0	-	0.2VDD	V	
Input leakage current	I_{IL}	-1.0	-	1.0	μA	$V_{IN}=V_{DD}$ or V_{SS}

Note: Voltage greater than above may damage the module.

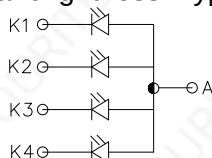
All voltages are specified relative to VSS=0V.

4.2 Driving Backlight

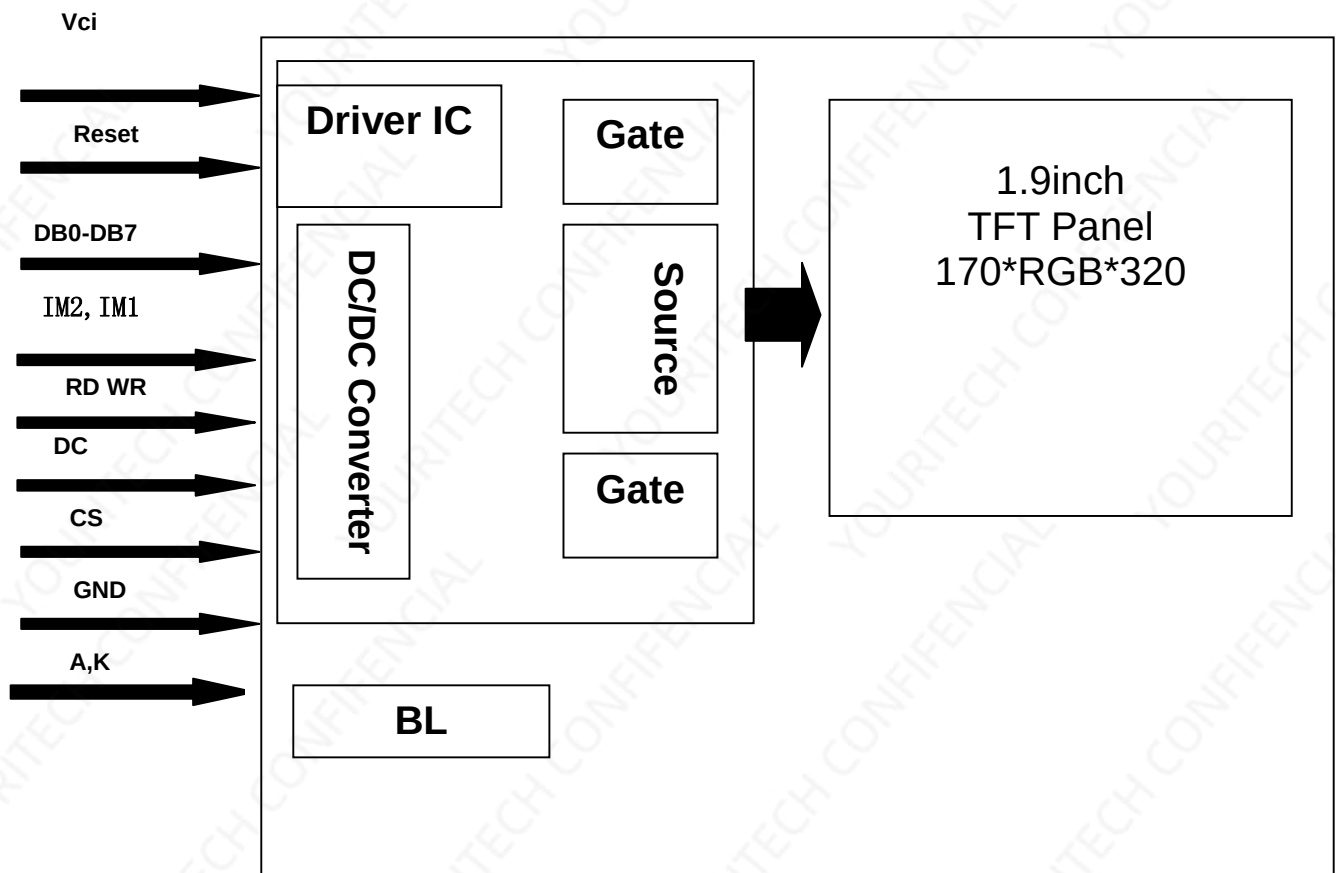
Ta=25°C

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I_F	--	80	100	mA	
Forward Voltage	V_F	-	3.2	-	V	
Connection mode	P	--	4 Parallel	--		
LED number	/		4		pcs	

Note1: Optical performance should be evaluated at Ta=25°C only .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.

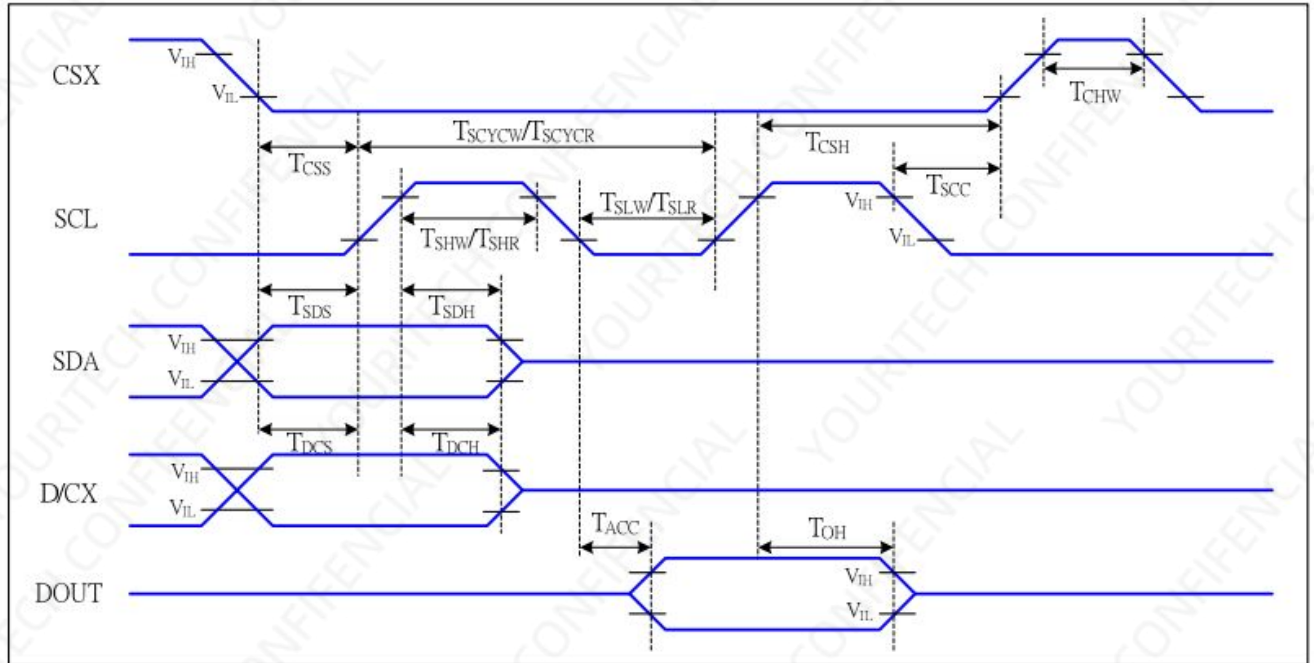


4.3 Block Diagram



5 INTERFACE TIMING

5.1 SPI interface



Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	-write command & data ram
	T_{SHW}	SCL "H" pulse width (Write)	15		ns	
	T_{SLW}	SCL "L" pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	-read command & data ram
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
D/CX	T_{DCS}	D/CX setup time	10		ns	
	T_{DCH}	D/CX hold time	10		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

MCU interface:

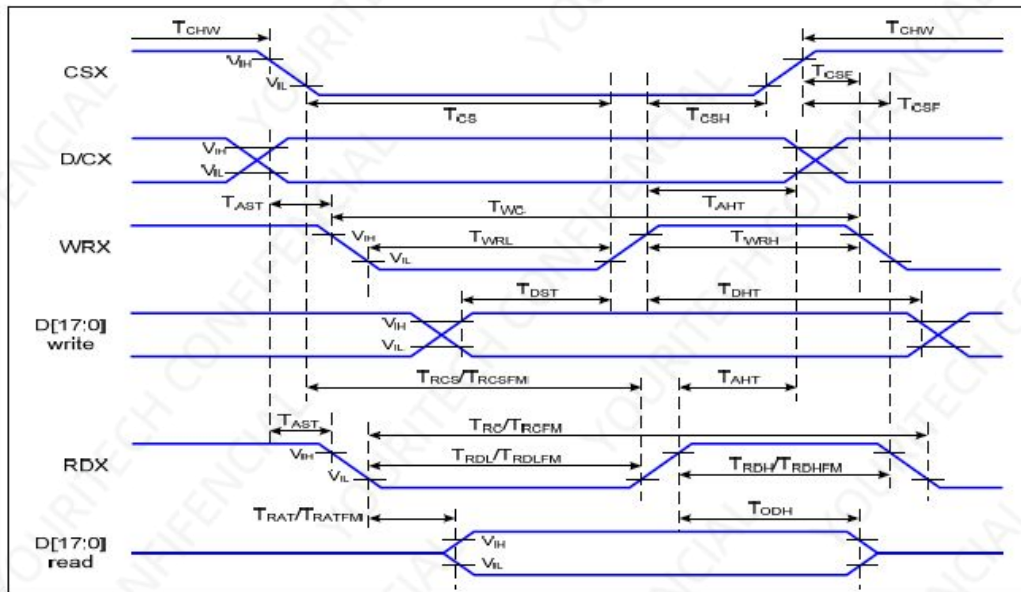
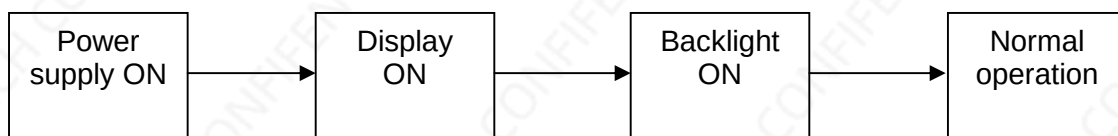
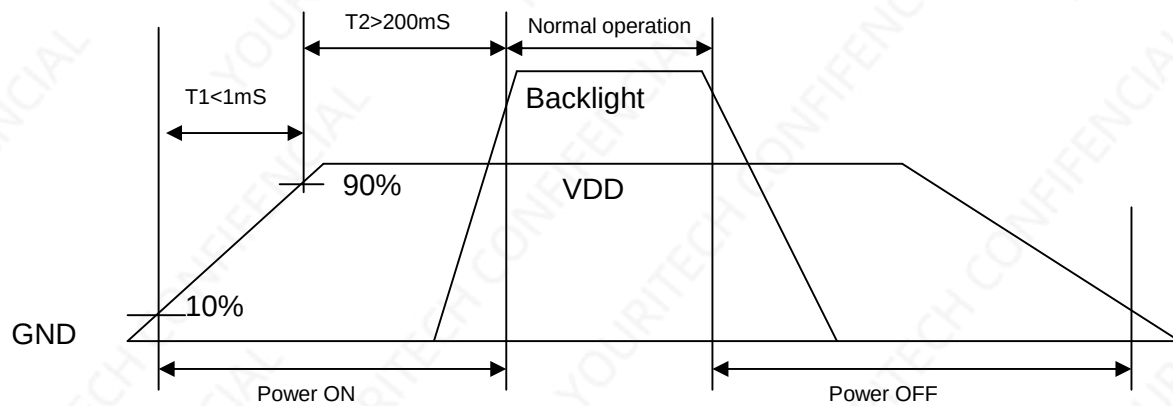


Figure 1 Parallel Interface Timing Characteristics (8080-Series MCU Interface)

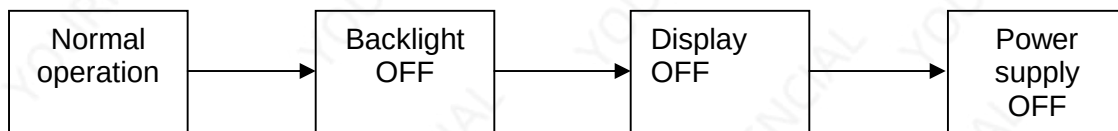
VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta= -30 to 70 °C

Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	T _{AST}	Address setup time	0		ns	
	T _{AHT}	Address hold time (Write/Read)	10		ns	
CSX	T _{CHW}	Chip select "H" pulse width	0		ns	
	T _{CS}	Chip select setup time (Write)	15		ns	
	T _{RCS}	Chip select setup time (Read ID)	45		ns	
	T _{RCSFM}	Chip select setup time (Read FM)	355		ns	
	T _{CSF}	Chip select wait time (Write/Read)	10		ns	
	T _{CSH}	Chip select hold time	10		ns	
WRX	T _{WC}	Write cycle	66		ns	
	T _{WRH}	Control pulse "H" duration	15		ns	
	T _{WRL}	Control pulse "L" duration	15		ns	
RDX (ID)	T _{RC}	Read cycle (ID)	160		ns	When read ID data
	T _{RDH}	Control pulse "H" duration (ID)	90		ns	
	T _{RDL}	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	T _{RCFM}	Read cycle (FM)	450		ns	When read from frame memory
	T _{RDHFM}	Control pulse "H" duration (FM)	90		ns	
	T _{RDLFM}	Control pulse "L" duration (FM)	355		ns	
D[17:0]	T _{DST}	Data setup time	10		ns	For CL=30pF

5.2 Power ON/OFF Timing



Power ON sequence



Power OFF sequence

6 Optical Characteristics

Ta=25℃

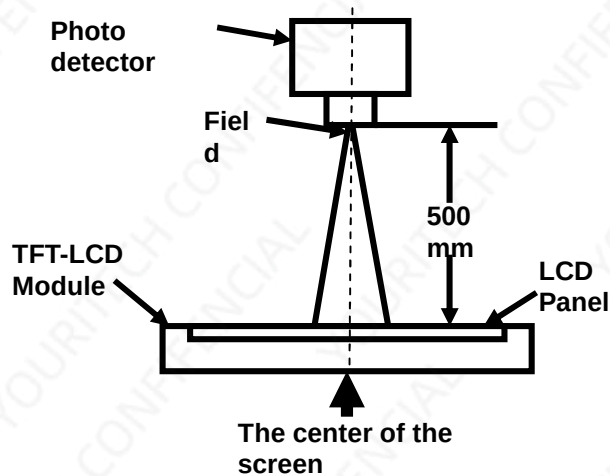
Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	θT	$CR \geq 10$	80		-	Degree	Note 2
	θB		80		-		
	θL		80		-		
	θR		80		-		
Contrast Ratio	CR	$\theta=0^\circ$	700	900	-	-	Note1 Note3
Response Time	T_{ON}	25℃		30	35	ms	Note1 Note4
	T_{OFF}						
Uniformity	U	-	70	80	-	%	Note1 Note6
NTSC	-	-	60	65	-	%	Note 5
Luminance	L		300	350	-	cd/m ²	Note1 Note7

Test Conditions:

1. $V_F=3.2V$, $I_F=80mA$, the ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).

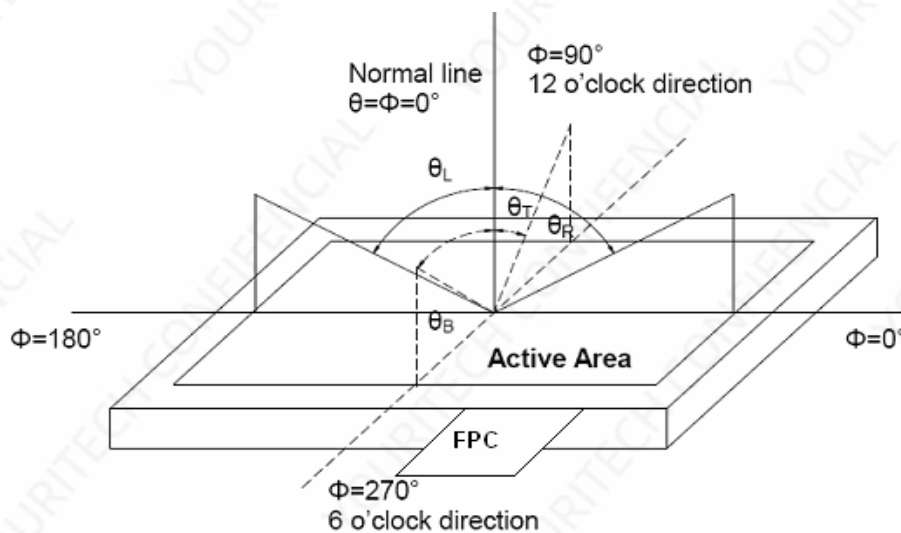


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

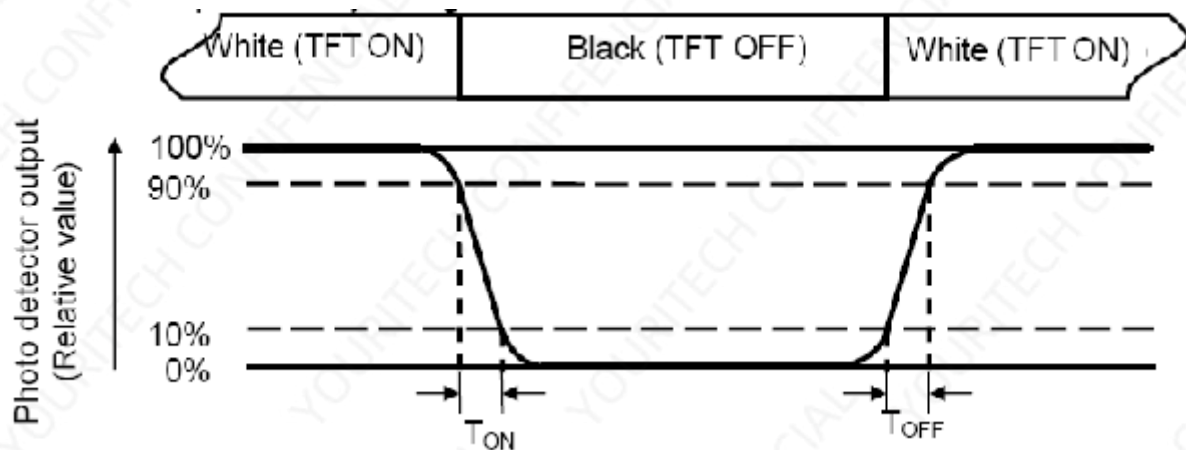
"White state ":The state is that the LCD should be driven by V_{white}.

"Black state": The state is that the LCD should be driven by V_{black}.

V_{white}: To be determined V_{black}: To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = L_{min} / L_{max}

L-----Active area length W----- Active area width

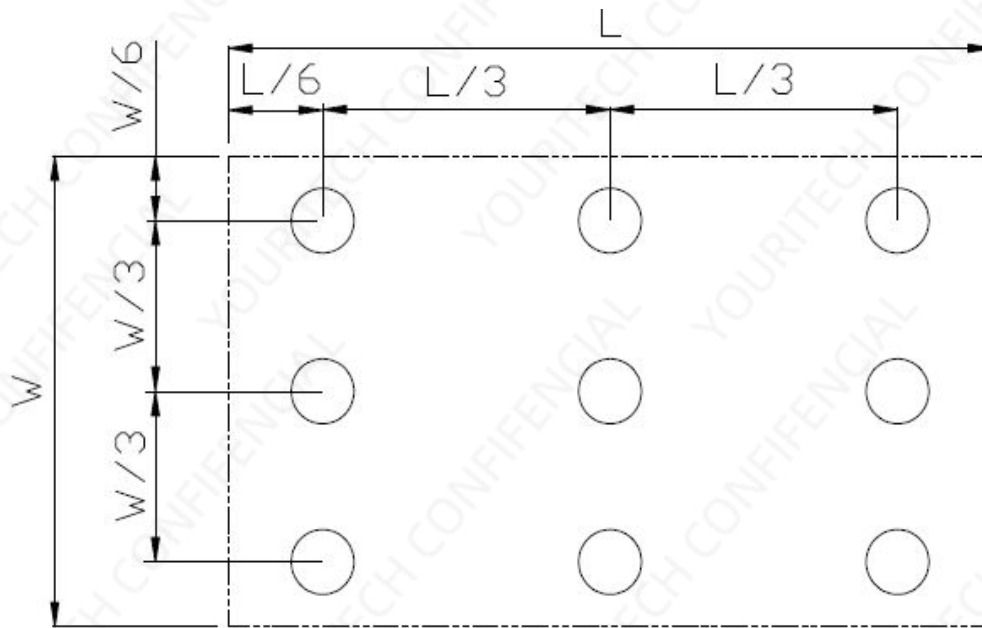


Fig. 2 Definition of uniformity

L_{max} : The measured maximum luminance of all measurement position.

L_{min} : The measured minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

7 Environmental / Reliability Test

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	120	No abnormalities in functions and appearance
High temp. Operating	70°C	120	
Low temp. Storage	-30°C	120	
Low temp. Operating	-20°C	120	
Humidity	40°C/ 90%RH	120	
Thermal Shock(Non-operation)	-20°C ← 25°C → 70°C (0.5 hour ← 5 min → 0.5 hour)	10cycles	

8 Mechanical Drawing

1	2	3	4	5	6	7	8
深圳市优瑞泰克科技有限公司 DESIGN: (设计)		CHECKED: (检查) APPROVED: (批准)		SPECIFICATION CUSTOMER'S CODE: (客户型号)		EDITION: (版本号)	
Date: (日期) 2018.11.24		Page: (页数) 1/1		图纸视角: 0°		CODE: (型号) 01	

Top View Dimensions: 49.72 LCM OD, 12.72 LCD AA, 1.91inch, 170R6BX320, ALL, 1.55, 25.80 LCM OD, 22.70 LCD AA, 1.19±0.05, 0.49MIN.

Side View Dimensions: 36.60, 0.5, 30, 1, 0.3, 15.50, 4.50.

Notes:

- Unit: mm.
- Modification rev.number.
- All radii without dimension R0.3mm.
- All draft angles to be 1.5°.
- Unspecified Tolerances is :±0.30mm.
- Driver IC: ST1789V
- LCD Driver Voltage : 2.8±0.3V
- Color : White
- Operating Temperature : -20°-- +70°C
- Storage Temperature : -30°-- +80°C
- Requirements on Environmental Protection: ROHS HSF

PIN	DESCRIPTION
1	GND
2	VCI
3	IM2
4	IM1
5	RESET
6	CS
7	DC(SPI-SCL)
8	WR(SPI-RS)
9	RD
10	SDA
11	D0
12	D1
13	D2
14	D3
15	D4
16	D5
17	D6
18	D7
19	SDO
20	LEDA
21	LEDK1
22	LEDK2
23	LEDK3
24	LEDK4
25	NC
26	NC
27	NC
28	NC
29	NC
30	GND

B/L CIRCUIT DIAGRAM

4 PCS WHITE LED; IF = 80mA; VF = 3.2V

A (+) K(-)

标示	日期	更改内容	签署

Customer Name: 客户名称	Approval Date: 承认日期	Approved By: 承认	Please Confirm This Drawing On/Before 请 签回 此 图
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9 Precautions For Use of LCD Modules

9.1 Handling Precautions

- 9.1.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 9.1.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
- 9.1.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 9.1.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 9.1.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:
 - Isopropyl alcohol
 - Ethyl alcoholSolvents other than those mentioned above may damage the polarizer. Especially, do not use the following:
 - Water
 - Ketone
 - Aromatic solvents
- 9.1.1.6 Do not attempt to disassemble the LCD Module.
- 9.1.1.7 If the logic circuit power is off, do not apply the input signals.
- 9.1.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
- 9.1.1.9 Be sure to ground the body when handling the LCD Modules.
- 9.1.1.10 Tools required for assembly, such as soldering irons, must be properly ground.
- 9.1.1.11 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
- 9.1.1.12 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.
- 9.1.1.13 Storage precautions
- 9.1.1.14 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.
- 9.1.1.15 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:
- 9.1.1.16 Temperature : 0℃ ~ 40℃ Relatively humidity: ≤80%
- 9.1.1.17 The LCD modules should be stored in the room without acid, alkali and harmful gas.

9.2 Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.