



**上海冠显光电科技有限公司**  
Shanghai Top Display Optoelectronics Co., LTD

**PRODUCTION SPECIFICATION  
OF LCD MODULE  
MODULE NO.: TL013QVC01-H1170B**

<b>Customer Name:</b>			
<b>Customer Part Number:</b>			
<b>Approved By:</b>		<b>Date:</b>	

<b>Prepared By</b>	<b>Checked By</b>	<b>Approved By</b>



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## Revision History

Rev	Issued Date	Description	Page	Editor
1.0	Sep 05,2018	First release	All	



## 1 General Specifications

	Feature	Specifications
<b>Display Spec.</b>	LCD type	1.28 inch
	Resolution (H*V)	240(RGB)×240
	Technology Type	a-Si TFT
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	Transmissive / Normally Black
	Surface Treatment	Anti-Glare
	Viewing Direction	ALL
<b>Mechanical Characteristics</b>	OutlineDimensions (W x H x T) (mm)	35.5*38.23*1.4
	Active Area(mm)	32.4*32.4
	With /Without Touch screen	Without
	Match Connector Type	FH26-31S
	Backlight Type	White LED
	Weight (g)	TBD
<b>Electrical Characteristics</b>	Interface	3SPI, 4SPI, MCU 8/16BIT
	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	I	Ground
2	IOVCC	I	Power Supply 1.8V Voltage
3	VCC2.8V	I	Power Supply 2.8V Voltage
4~7	IM3~IM0	I	The MCU interface mode select.
8	RESET	I	Reset
9	CS	I	Chip select
10	RS	I	Display data/command selection pin in parallel interface. This pin is used to be serial interface clock.
11	WR	I	Write enable in MCU parallel interface. Display data/command selection pin in 4-line serial interface.
12	RD	I	Read enable in 8080 MCU parallel interface.
13~28	DB0~DB15	I/O	DB[0:15] are used as MCU parallel interface data bus.
29	SDA	I	When IM3: Low, SPI interface input/output pin. When IM3: High, SPI interface input pin
30	LED+	I	LED Anode
31	LED-	I	LED Cathode

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

-The MCU interface mode select.

IM3	IM2	IM1	IM0	MPU Interface Mode	Data pin
0	0	0	0	80-8bit parallel I/F	DB[7:0]
0	0	0	1	80-16bit parallel I/F	DB[15:0]
0	0	1	0	80-9bit parallel I/F	DB[8:0]
0	0	1	1	80-18bit parallel I/F	DB[17:0]
0	1	0	1	3-line 9bit serial I/F	SDA: in/out
				2 data lane serial I/F	SDA: in/out WRX: in
0	1	1	0	4-line 8bit serial I/F	SDA: in/out
1	0	0	0	80-16bit parallel I/F II	DB[17:10], DB[8:1]
1	0	0	1	80-8bit parallel I/F II	DB[17:10]
1	0	1	0	80-18bit parallel I/F II	DB[17:0]
1	0	1	1	80-9bit parallel I/F II	DB[17:9]
1	1	0	1	3-line 9bit serial I/F II	SDA: in/ SDO: out
1	1	1	0	4-line 8bit serial I/F II	SDA in/ SDO: out

### 3 Absolute Maximum Ratings

GND=0V, Ta= 25°C

Item	Symbol	Value	Unit
Power supply voltage for logic	$V_{DD}$	0.3~3.6	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 Driving TFT LCD Panel

GND=0V, Ta=25°C

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

Note: Voltage greater than above may damage the module.

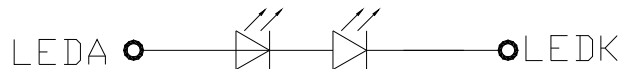
All voltages are specified relative to VSS=0V.

#### 4.2 Driving Backlight

Ta=25°C

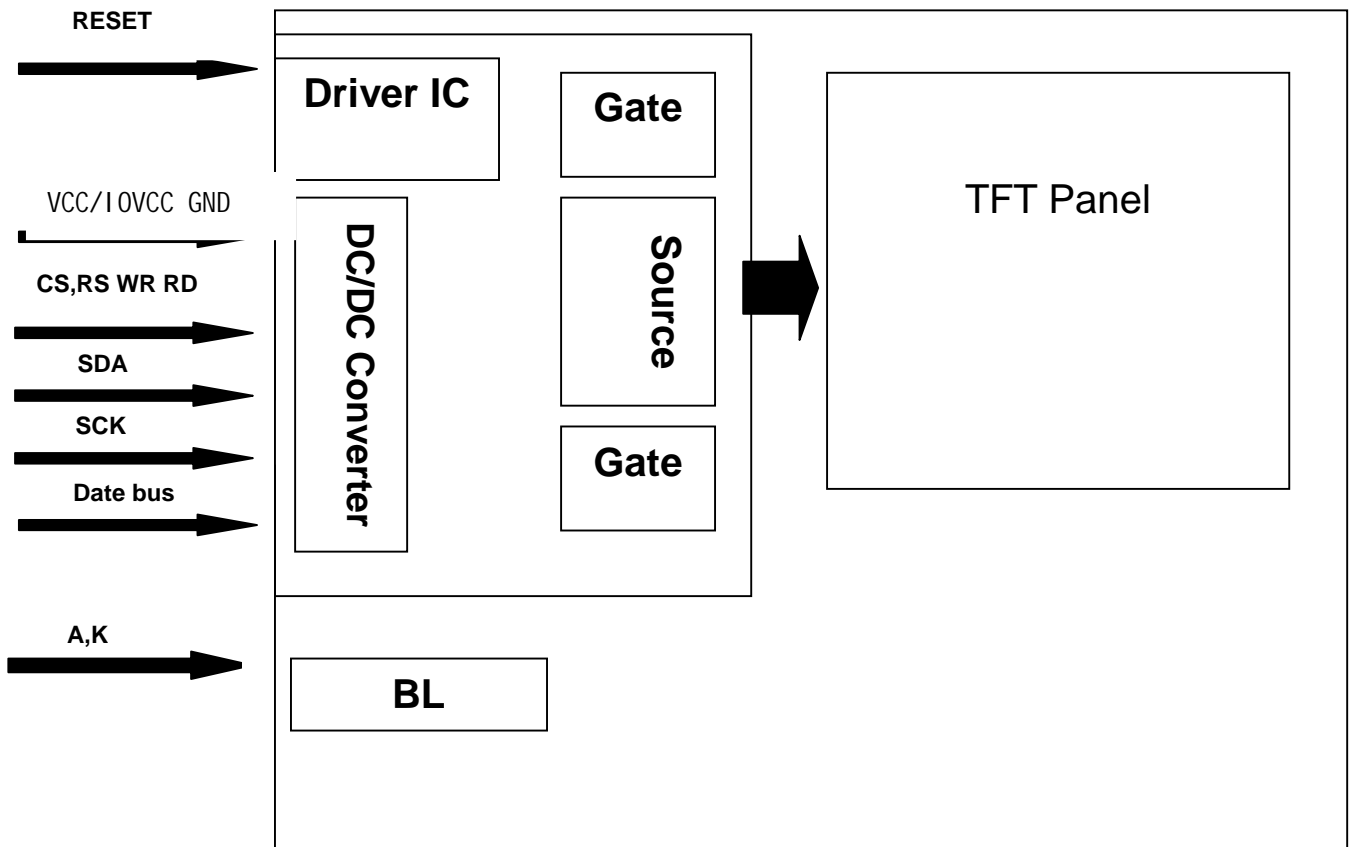
Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	$I_F$	--	20	22	mA	
Forward Voltage	$V_F$	-	6.4	-	V	
Connection mode	P	--	2 Series	--		
LED number	/		2		pcs	

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.



BACKLIGHT LED CIRCUIT  
 $V_F=6.4V$   $I_F=20MA$

### 4.3 Block Diagram



## 5 INTERFACE TIMING

### 5.1 SPI Interface Characteristics.

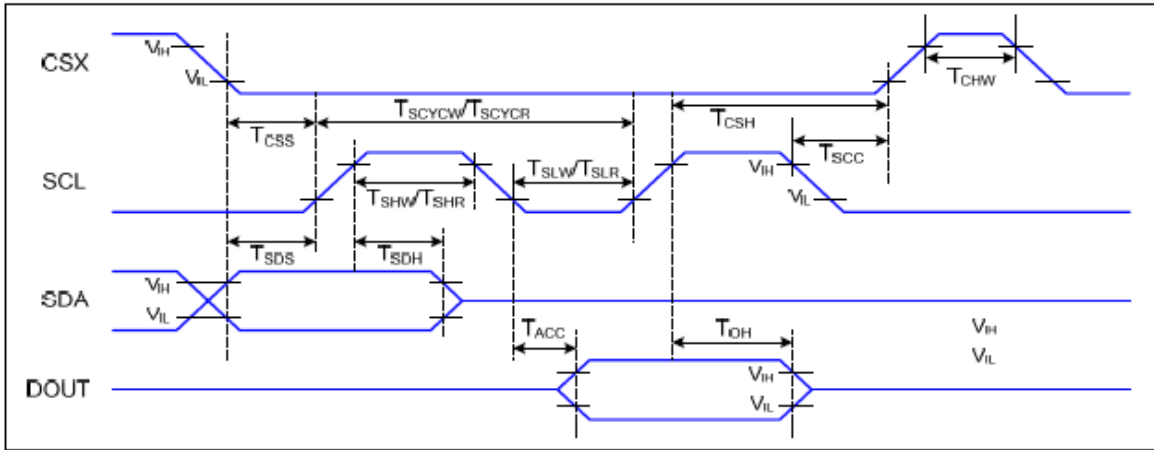


Figure 4 3-line serial Interface Timing Characteristics

V<sub>DDI</sub>=1.65 to 3.3V, V<sub>DD</sub>=2.4 to 3.3V, A<sub>GND</sub>=D<sub>GND</sub>=0V, T<sub>a</sub>=-30 to 70 °C

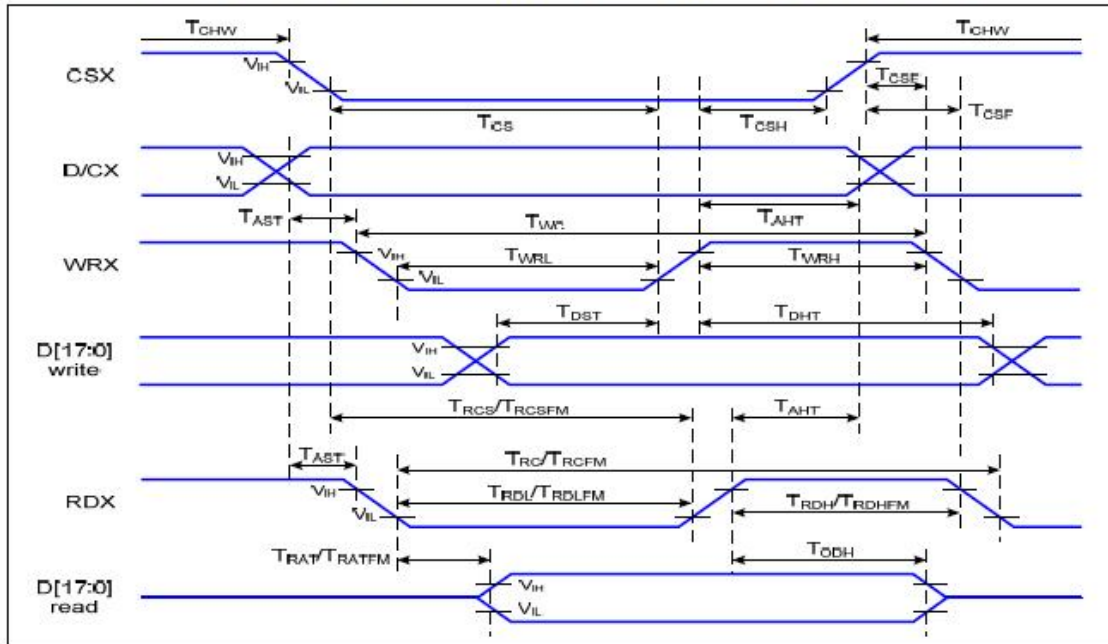
Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T <sub>CSS</sub>	Chip select setup time (write)	15		ns	
	T <sub>CSH</sub>	Chip select hold time (write)	15		ns	
	T <sub>CSS</sub>	Chip select setup time (read)	60		ns	
	T <sub>SCC</sub>	Chip select hold time (read)	65		ns	
	T <sub>CHW</sub>	Chip select "H" pulse width	40		ns	
SCL	T <sub>SCYCW</sub>	Serial clock cycle (Write)	66		ns	
	T <sub>SHW</sub>	SCL "H" pulse width (Write)	15		ns	
	T <sub>SLW</sub>	SCL "L" pulse width (Write)	15		ns	
	T <sub>SCYCR</sub>	Serial clock cycle (Read)	150		ns	
	T <sub>SHR</sub>	SCL "H" pulse width (Read)	60		ns	
	T <sub>SLR</sub>	SCL "L" pulse width (Read)	60		ns	
SDA (DIN)	T <sub>SDS</sub>	Data setup time	10		ns	
	T <sub>SDH</sub>	Data hold time	10		ns	
DOUT	T <sub>ACC</sub>	Access time	10	50	ns	For maximum CL=30pF
	T <sub>OH</sub>	Output disable time	15	50	ns	For minimum CL=8pF

Table 5 3-line serial Interface Characteristics



**5.1.1 MCU Interface Characteristics.**

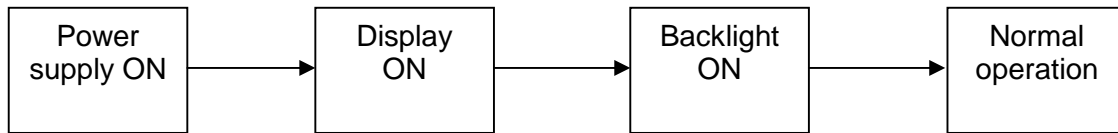
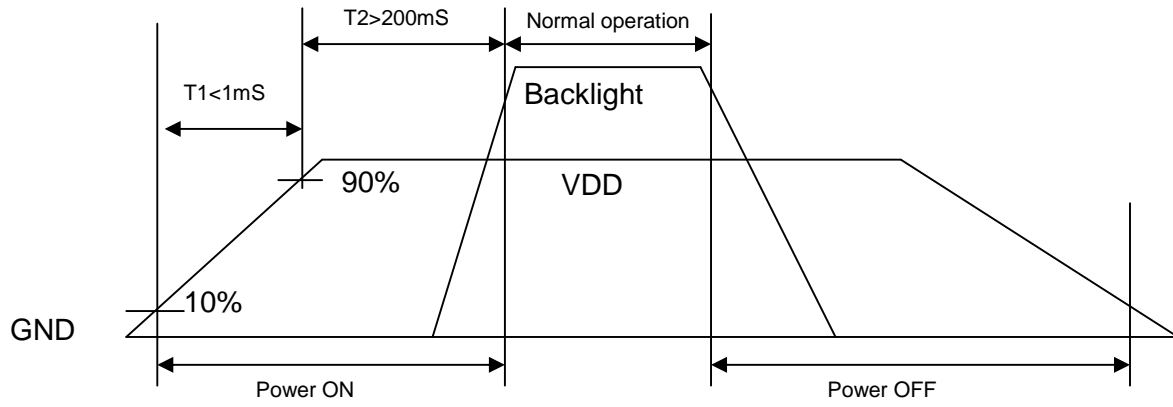
**7.4.1 8080 Series MCU Parallel Interface Characteristics: 18/16/9/8-bit Bus**



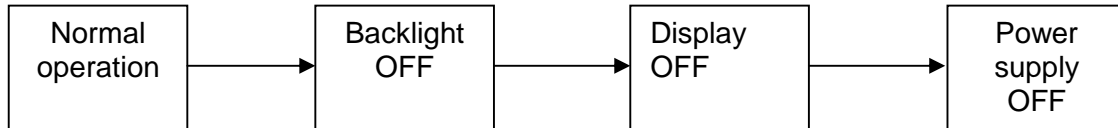
**Figure 1 Parallel Interface Timing Characteristics (8080-Series MCU Interface)**

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°C

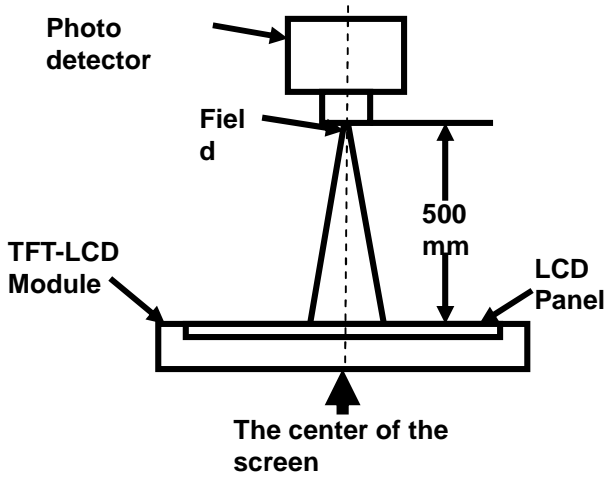
Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	$\theta T$	$CR \geq 10$	-	80	-	Degree	Note 2
	$\theta B$		-	80	-		
	$\theta L$		-	80	-		
	$\theta R$		-	80	-		
Contrast Ratio	CR	$\theta=0^\circ$	600	800	-	-	Note1 Note3
Response Time	$T_{ON}$	25°C	-	30	35	ms	Note1
	$T_{OFF}$						Note4
Uniformity	U	-	70	80	-	%	Note1 Note6
NTSC	-	-	-	50	-	%	Note 5
Luminance	L		250	300	-	cd/m <sup>2</sup>	Note1 Note7

Test Conditions:

1.  $V_F=6.4V$ ,  $I_F=20mA$  (One LED channel), the ambient temperature is 25°C.
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	BM-7A	2°
Response Time		

**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).

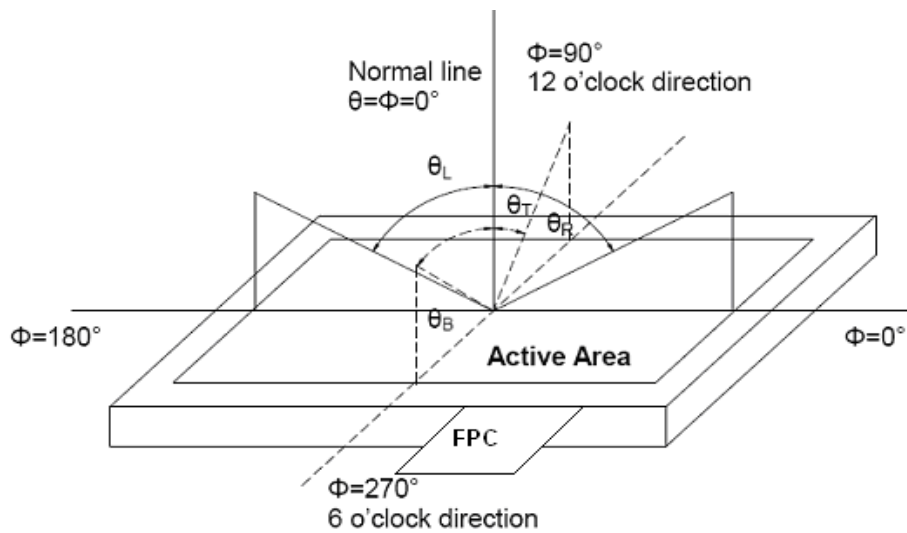


Fig. 1 Definition of viewing angle

**Note 3: Definition of contrast ratio**

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

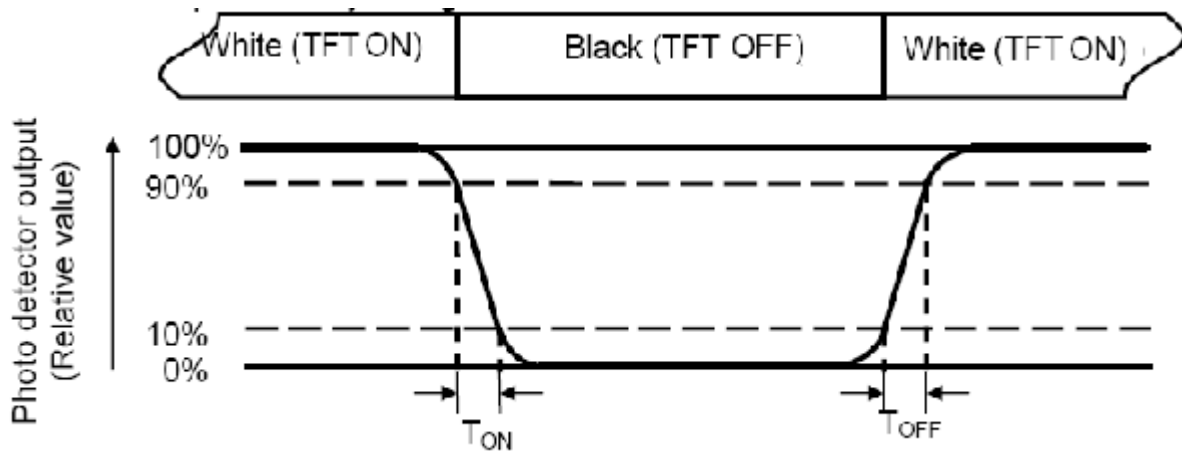
“White state “:The state is that the LCD should be driven by Vwhite.

“Black state”: The state is that the LCD should be driven by Vblack.

Vwhite: To be determined    Vblack: 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 (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) 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

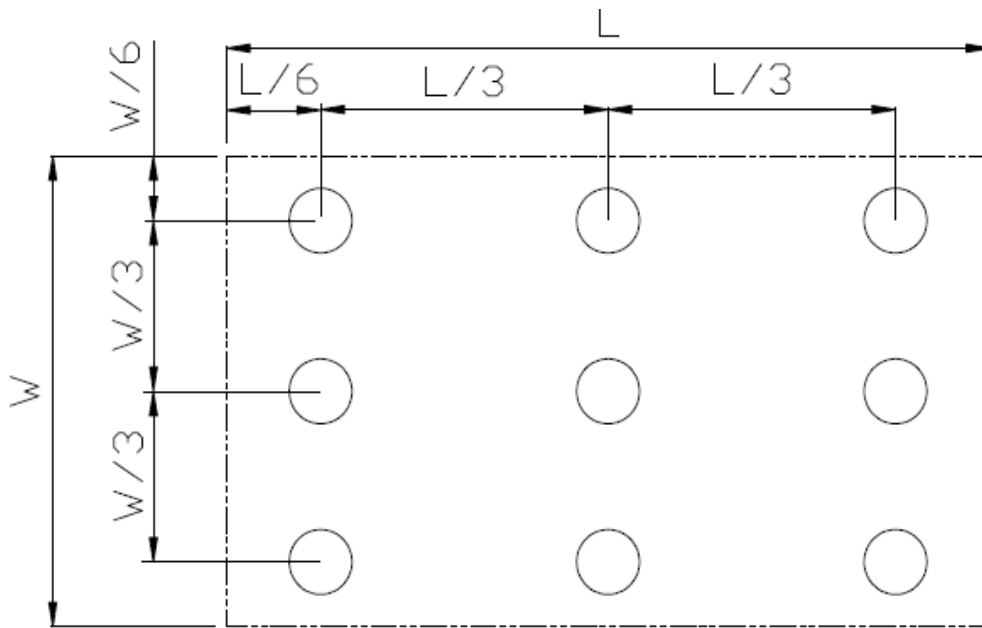


Fig. 2 Definition of uniformity

$L_{max}$ : 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

	上海冠显光电科技有限公司 Shanghai Top Display Optoelectronics Co., Ltd	DESIGN: (设计)	CHECKED: (检查)	APPROVED: (批准)	SPECIFICATION	规格	EDIT ION: (版本号)
		Page: (页数)	1/1	图纸视角: 30°	CUSTOMER'S CODE: (客户型号)		EDIT ION: (版本号)
Date: (日期)	2018.08.27				TDO'S CODE: (冠显料号)	TL013QVC01-H1170B	
						01	

Notes:

- Unit: mm
- Modification rev. number.
- All radii without dimension R0.3mm
- All draft angles to be 1.5°
- Unspecified Tolerances is : ±0.20mm
- Driver IC: ST7789V
- 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

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

标示	日期	更改内容	签署

LED A ○

BACKLIGHT LED CIRCUIT

VF=6.4V IF=20MA

LEDK ○

PIN	SYMBOL
1	GND
2	IDVCC18
3	VCC28
4	IM3
5	IM2
6	IM1
7	IM0
8	RESET
9	CS
10	RS
11	WR
12	RD
13	D0
14	D1
15	D2
16	D3
17	D4
18	D5
19	D6
20	D7
21	D8
22	D9
23	D10
24	D11
25	D12
26	D13
27	D14
28	D15
29	SDA
30	LEDA
31	LEDK





## 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 alcohol

Solvents 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°C ~ 40°C      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.