



**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.: TL023QVH03**

<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	Aug. 04,2015	First release	All	



## 1 General Specifications

	Feature	Specifications
<b>Display Spec.</b>	LCD type	2.3 inch
	Resolution (H*V)	320(RGB)x 240
	Technology Type	a-Si TFT
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	Transmissive / Normally White
	Surface Treatment	Glare
	Viewing Direction	12 o'clock
	Gray Scale Inversion Direction	6 o'clock
<b>Mechanical Characteristics</b>	OutlineDimensions (W x H x T) (mm)	50.80*45.60*2.3
	Active Area(mm)	46.75*35.06
	With /Without Touch screen	Without
	Match Connector Type	AEFC2-52-36
	Backlight Type	LED
	Weight (g)	TBD
<b>Electrical Characteristics</b>	Interface	RGB 16bit
	Number of color	65K
	Driver IC	ILI9342C

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	GND
2	GND	P	GND
3	Dotclk	I	Pixel clock
4	HSYNC	I	Horizontal sync signal
5	VSYNC	I	Vertical sync signal
6	SCL	I	SPI clock
7	SI(SDA)	I/O	Serial in/out signal
8	DEN	I	Data enable
9	NC	-	Not connect
10	NC	-	Not connect
11	RESET	I	Reset signal, Low active
12	CS		Chip select, low enable
13	DB0	I/O	B0(Blue LSB)
14	DB1	I/O	B1
15	DB2	I/O	B2
16	DB3	I/O	B3
17	DB4	I/O	B4(Blue MSB)
18	DB5	I/O	G0(Green LSB)
19	DB6	I/O	G1
20	DB7	I/O	G2
21	DB8	I/O	G3
22	DB9	I/O	G4
23	DB10	I/O	G5(Green MSB)
24	DB11	I/O	R0(Red LSB)
25	DB12	I/O	R1
26	DB13	I/O	R2
27	DB14	I/O	R3
28	DB15	I/O	R4(Red MSB)
29	VDD	P	power
30	GND	P	power
31	GND	P	power
32	LEDK1	P	Cathode
33	LEDK2	P	Cathode
34	LEDK3	P	Cathode
35	LEDK4	P	Cathode
36	LEDA	P	Anode

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 <sub>DD</sub>	1.6~3.3	V
Input voltage	V <sub>in</sub>	V <sub>DD</sub> +0.3	V
Operating temperature	Topr	-20 to 70	°C
Storage temperature	Tstg	-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	VDD	*	3.2	3.4	V	-
Supply current	IDD	-	-	60	mA	VDD=2.8V, Ta=25°C
Input voltage	VIH	0.8VDD	-	VDD	V	-
	VIL	0	-	0.2VDD	V	
Input leakage current	IIL	-1.0	-	1.0	mA	VIN=VDD or VSS

Note: Voltage greater than above may damage the module.

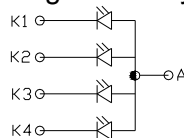
All voltages are specified relative to VSS=0V.

#### 4.2 Driving Backlight

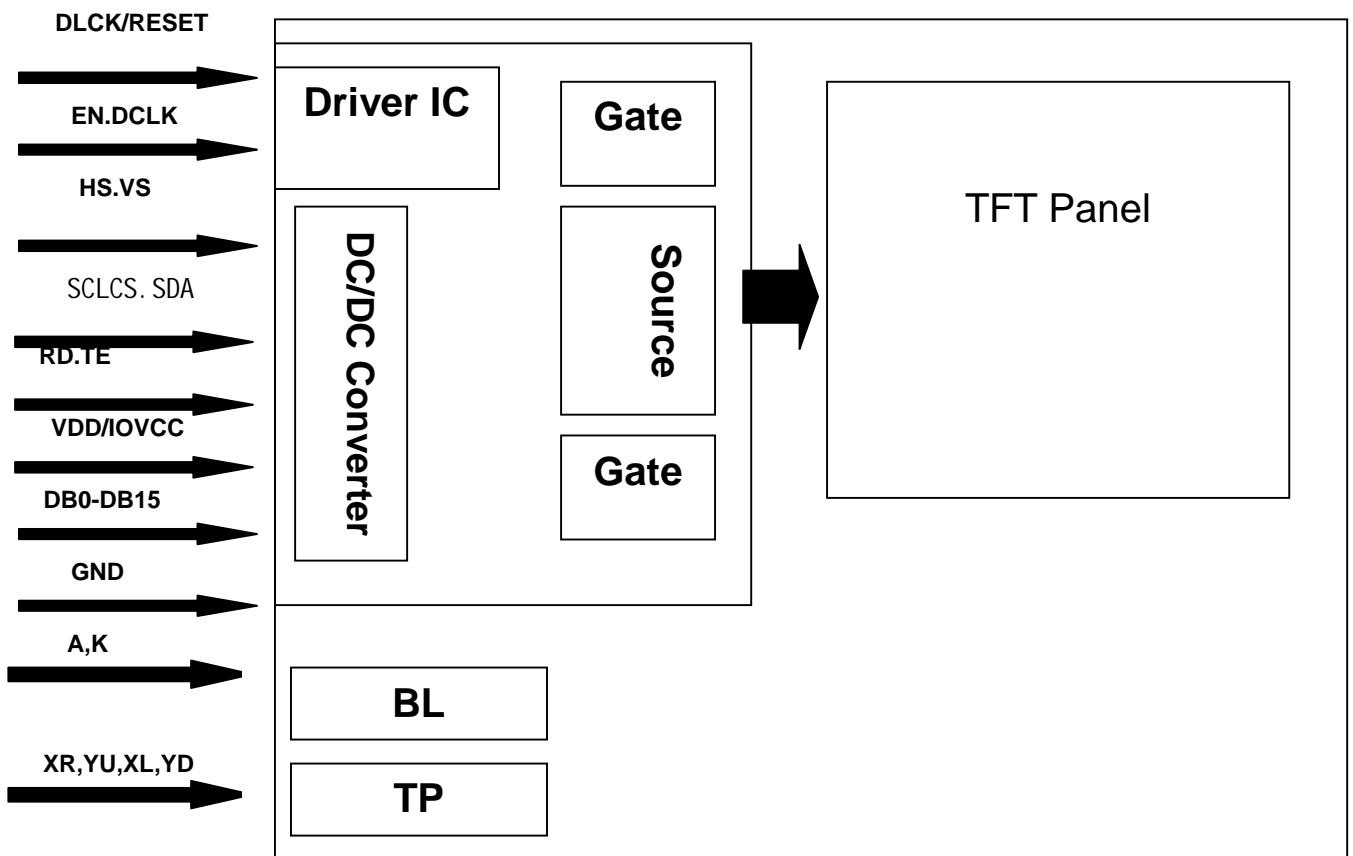
Ta=25°C

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I <sub>F</sub>	--	80	100	mA	
Forward Voltage	V <sub>F</sub>	-	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.

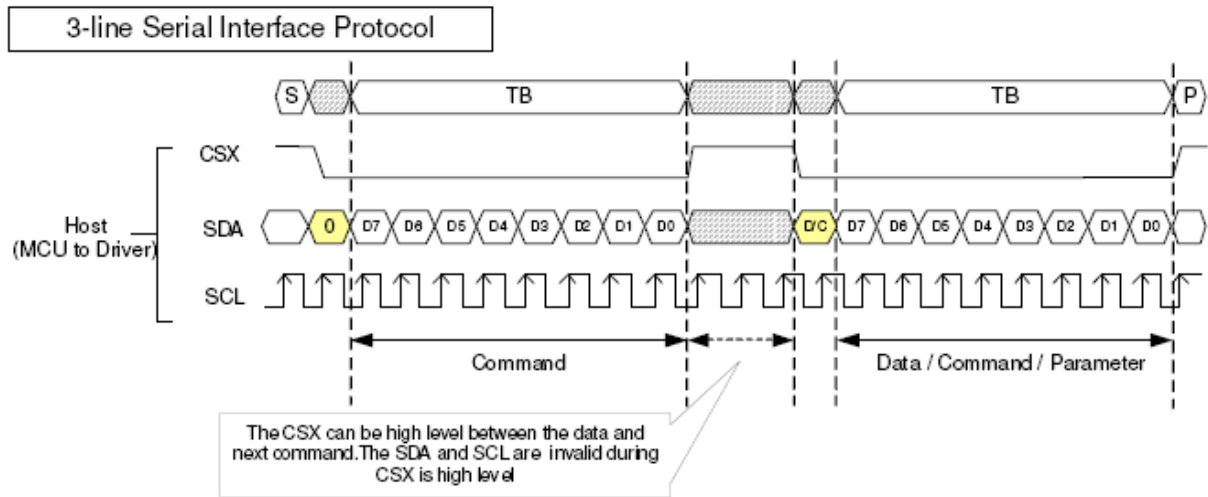


### 4.3 Block Diagram



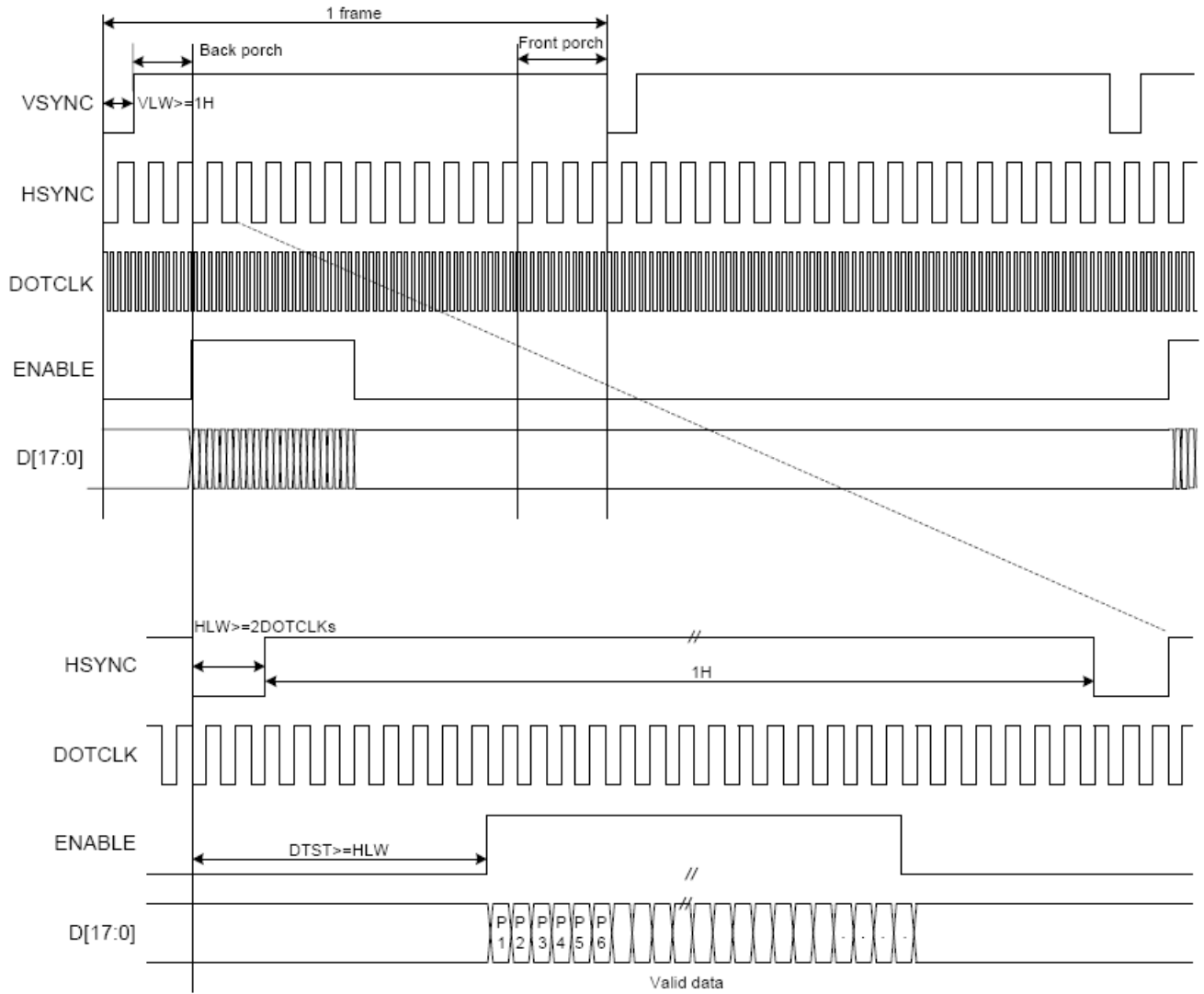
## 5 INTERFACE TIMING

### 5.1 3W SPI+RGB interface

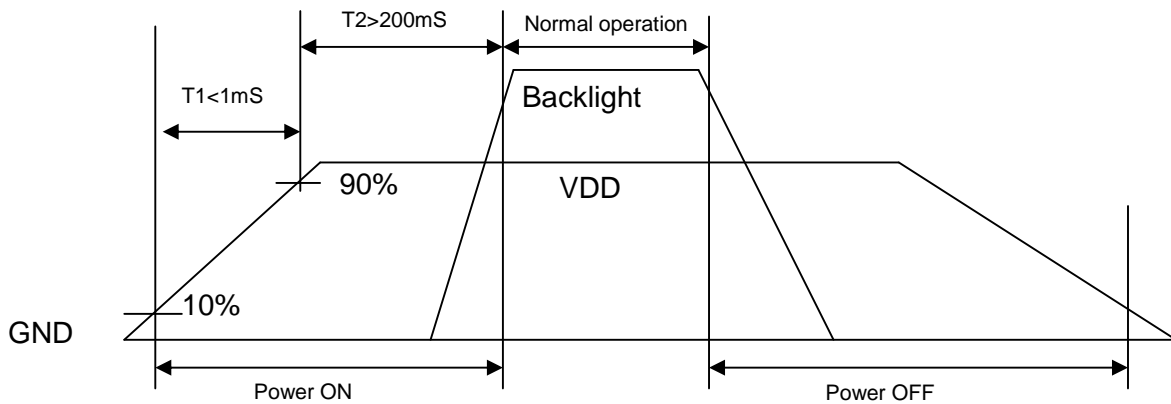


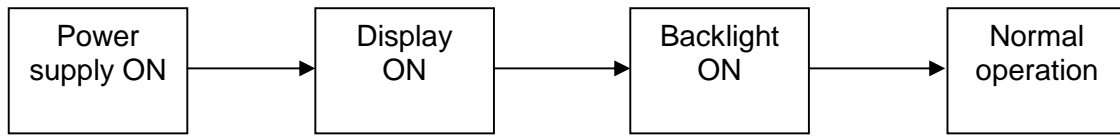
Parameters	Symbols	Condition	Min.	Typ.	Max.	Units
Horizontal Synchronization	Hsync		2	10	16	DOTCLK
Horizontal Back Porch	HBP		2	20	24	DOTCLK
Horizontal Back Porch(By pass mode)*	HBP(BP)		58	68	200	DOTCLK
Horizontal Address	HAdr		-	320	-	DOTCLK
Horizontal Front Porch	HFP		2	10	16	DOTCLK
Vertical Synchronization	Vsync		1	2	4	Line
Vertical Back Porch	VBP		1	2	-	Line
Vertical Address	VAdr		-	240	-	Line
Vertical Front Porch	VFP		3	4	-	Line



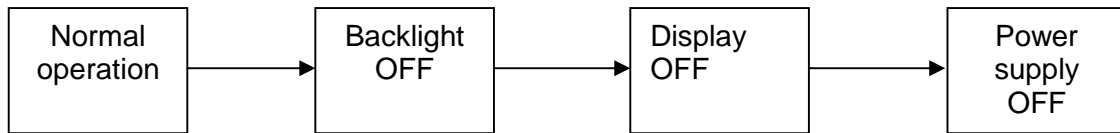


### 5.2 Power ON/OFF Timing





Power ON sequence



Power OFF sequence



## 6 Optical Characteristics

Ta=25°C

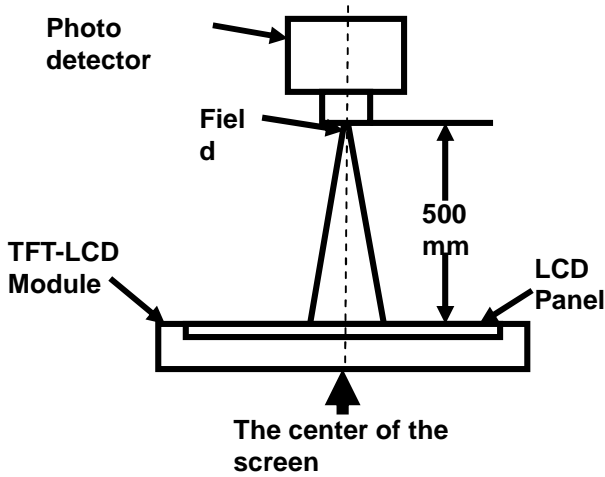
Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	$\theta T$	$CR \geq 10$	50	60	-	Degree	Note 2
	$\theta B$		40	50	-		
	$\theta L$		60	70	-		
	$\theta R$		60	70	-		
Contrast Ratio	CR	$\theta=0^\circ$	200	250	-	-	Note1 Note3
Response Time	$T_{ON}$	25°C	-	25	35	ms	Note1
	$T_{OFF}$						Note4
Uniformity	U	-	70	80	-	%	Note1 Note6
NTSC	-	-	-	50	-	%	Note 5
Luminance	L		280	300	-	cd/m <sup>2</sup>	Note1 Note7

Test Conditions:

1.  $V_F=19.2V$ ,  $I_F=20mA$  (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		
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).

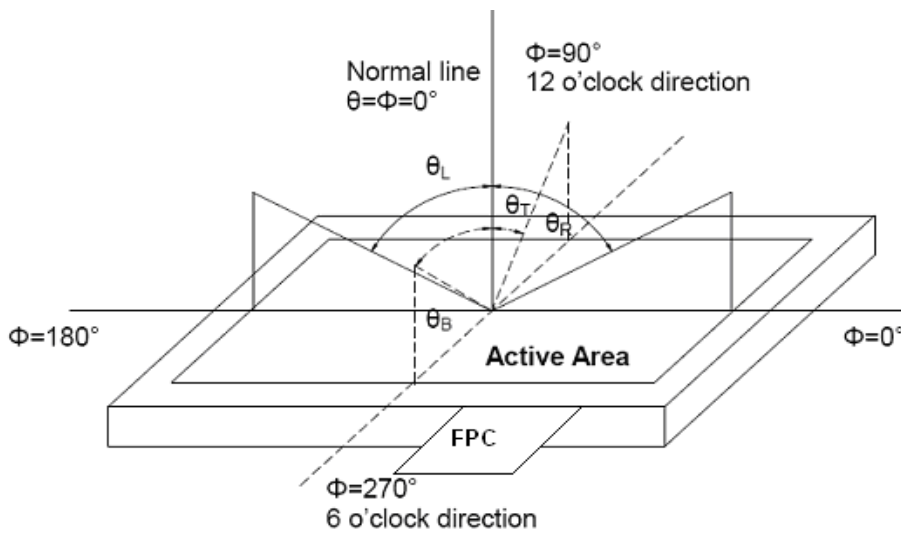


Fig. 1 Definition of viewing angle

**Note 3: Definition of contrast ratio**

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

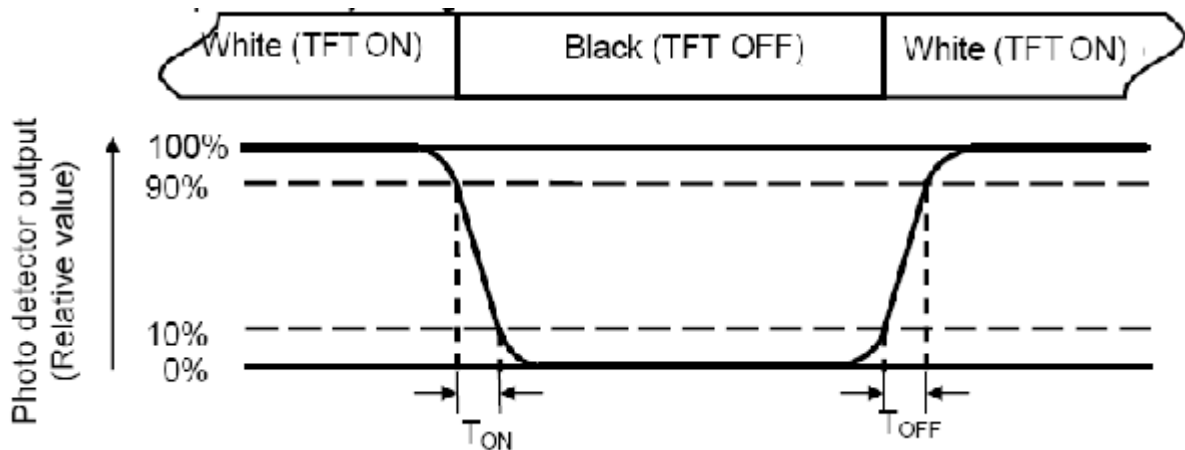
“White state “:The state is that the LCD should be driven by Vwhite.

“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

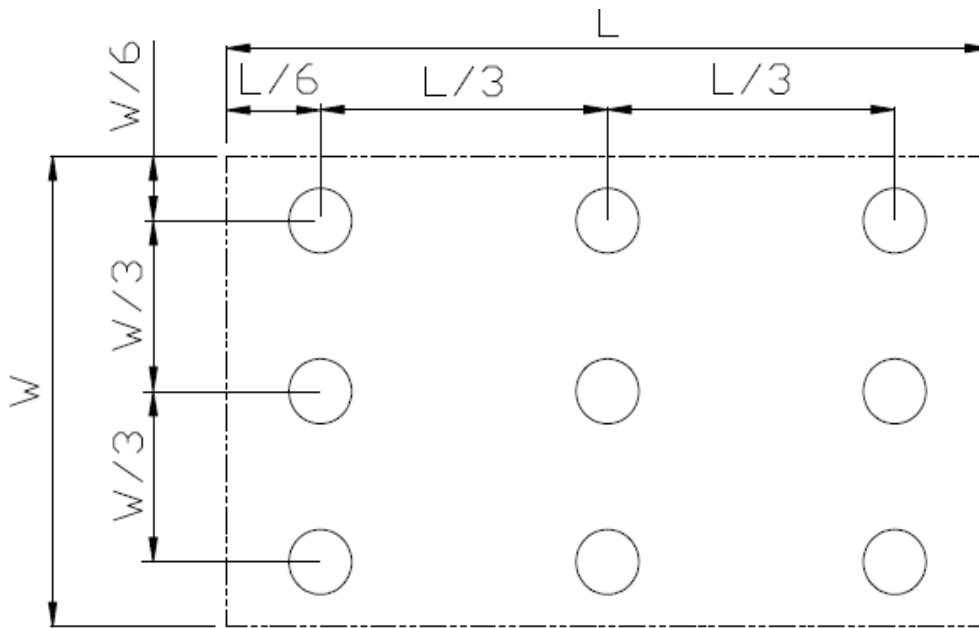


Fig. 2 Definition of uniformity

$L_{max}$ : 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	







## 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.