



深圳市一众显示科技有限公司

SHEN ZHEN TEAM SOURCE DISPLAYTECH. CO, TD.

# TFT-LCD Module Specification

**Module NO.:** TST101T-HBD-50D

**Version:** V2.0

APPROVAL FOR SPECIFICATION

APPROVAL FOR SAMPLE

For Customer' s Acceptance:	
Approved by	Comment

Team Source Display:		
Presented by	Reviewed by	Organized by

Version No.	Date	Content	Remark
V1.0	2017-10-31	Initial Release	
V2.0	2017-11-29	updates	

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## 1 General Characteristics

ITEM	Specification	Unit
LCD Type	a-Si TFT, Transmissive, Normally white, TN	-
LCD Size	10.1	inch
Resolution (W x H)	1024 x (RGB) x 600	pixel
LCM (W x H x D)	235(W) x 143(H) x 6.68(D)	mm
Active Area (H x V)	222.72 (H) x 125.28 (V)	mm
Dot Pitch (H x V)	0.2175(H)x0.2088(V)	mm
Viewing Direction	12 o'clock	-
Gray Scale Inversion Direction	6 o'clock	-
Viewing Angle	Top:70, Bottom:50; Left/ Right:70	deg.
Color Depth	16.7M	-
Pixel Arrangement	RGB-stripe	-
Backlight Type	42 LEDs, 210mA, 17V	-
Surface Luminance	750(TYP.)	cd/m <sup>2</sup>
Surface Treatment	Anti-Glare	-
Driver IC	HX8696+HX8282	-
Interface Type	TTL	-
Input Voltage	3.3	V
With/Without TP	Without	-
Weight	TBD	g

**Note 1: RoHS compliant**

**Note 2: LCM weight tolerance: ± 5%.**



### 3 Interface description

PIN NO.	Symbol	description
1	NC	
2	NC	
3	NC	
4	NC	
5	GND	System Ground. (0V)
6	VCOM	VCOM DC voltage
7	DVDD	Digital power +3.3V
8	MODE	DE/SYNC mode select: Mode=1, DE mode; Mode=0, SYNC mode.
9	DE	Input data enable control.
10	VS	Vertical sync input in digital parallel RGB. Negative polarity.
11	HS	Horizontal sync input in digital parallel RGB. Negative polarity.
12~19	B7~B0	Blue data
20~27	G7~G0	Green data
28~35	R7~R0	Red data
36	GND	System Ground. (0V)
37	DCLK	Clock for input data.
38	GND	System Ground. (0V)
39	L/R	Source shift direction control. (Normally pull high)
40	U/D	Gate scan direction control (Normally pull low)
41	VGH	Voltage gate high
42	VGL	Voltage gate low
43	AVDD	Analog Power
44	RESET	Global reset.
45	NC	No connect
46	VCOM	VCOM DC voltage
47	DITHB	Dithering function
48	GND	System Ground. (0V)
49	NC	No connect
50	NC	No connect

Setting of scan control input		Scanning direction
U/D	L/R	
1	1	Down to up, left to right
0	1	Up to Down , left to right
1	0	Down to up, right to left
0	0	Up to Down, right to left

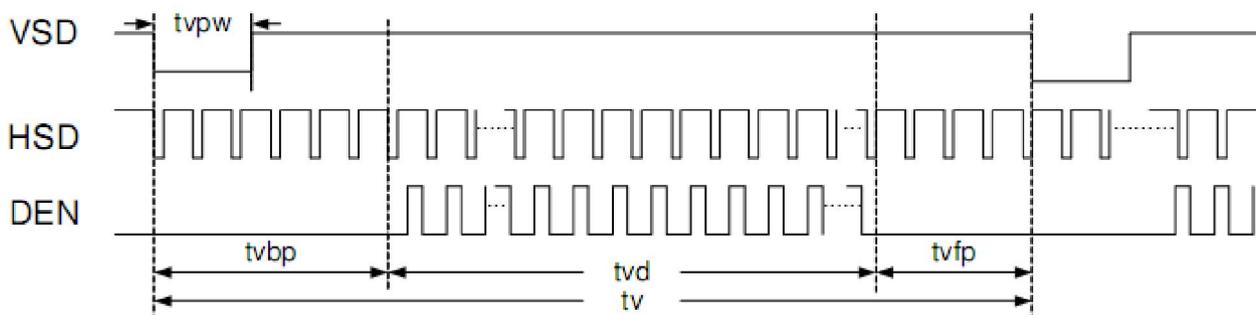
Note: “0”connect to GND; “1”connect to DVDD.

## 4 TTL AC electrical characteristics

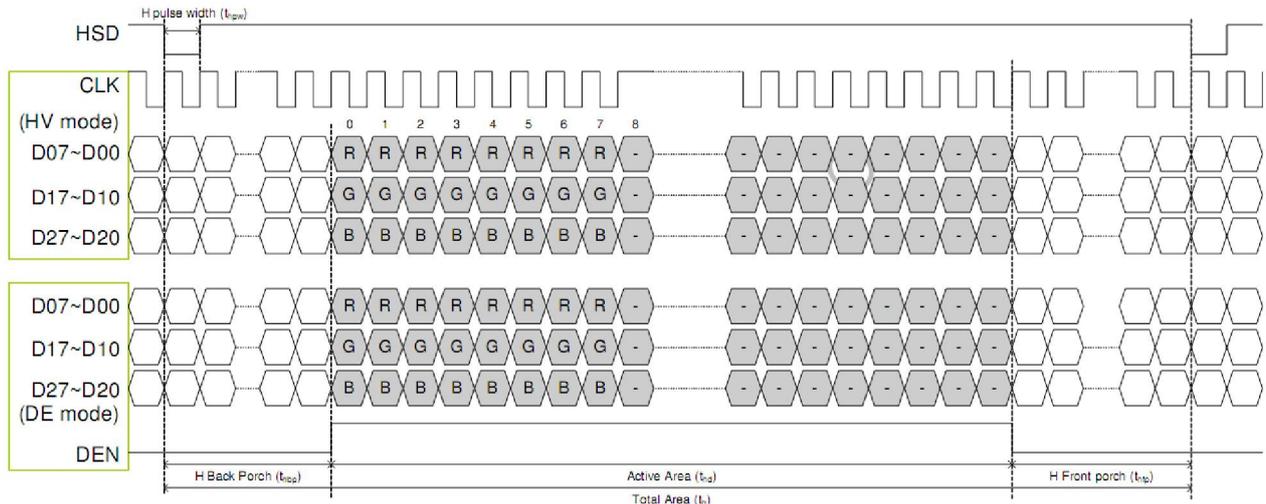
Parameter	Symbol	Spec.			Unit	Condition
		Min.	Typ.	Max.		
VDD Power On Slew rate	TPOR	-	-	20	ms	From 0V to 90% VDD
RSTB pulse width	TRst	50	-	-	us	DCLK=65MHz
DCLK cycle time	Tcph	14	-	-	ns	-
DCLK pulse duty	Tcwh	40	50	60	%	-
VSD setup time	Tvst	5	-	-	ns	-
VSD hold time	Tvhd	5	-	-	ns	-
HSD setup time	Thst	5	-	-	ns	-
HSD hold time	Thhd	5	-	-	ns	-
Data set-up time	Tdsu	5	-	-	ns	D0[7:0], D1[7:0], D2[7:0] to DCLK
Data hold time	Tdhd	5	-	-	ns	D0[7:0], D1[7:0], D2[7:0] to DCLK
DE setup time	Tesu	5	-	-	ns	-
DE hold time	Tehd	5	-	-	ns	-
Output stable time	Tsst	-	-	6	us	10% to 90% target voltage. CL=90pF, R=10K ohm(Cascade)
				3		Dual gate

## 5 TTL mode data input format

Vertical Timing



Horizontal Timing



## 6 Parallel RGB input timing table

### 6.1.1 DE mode

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	40.8	-	-	MHz
Horizontal Display Area	thd	1024			DCLK
HS Period	th	1114	1344	1400	DCLK
HS Blanking	thb+ thfp	90	320	376	DCLK
Vertical Display Area	tvd	600			Th
VS Period	tvbp	610	635	800	Th
VS Blanking	tvbp+ tvfp	10	35	200	Th

### 6.1.2 HV mode

#### Horizontal Timing

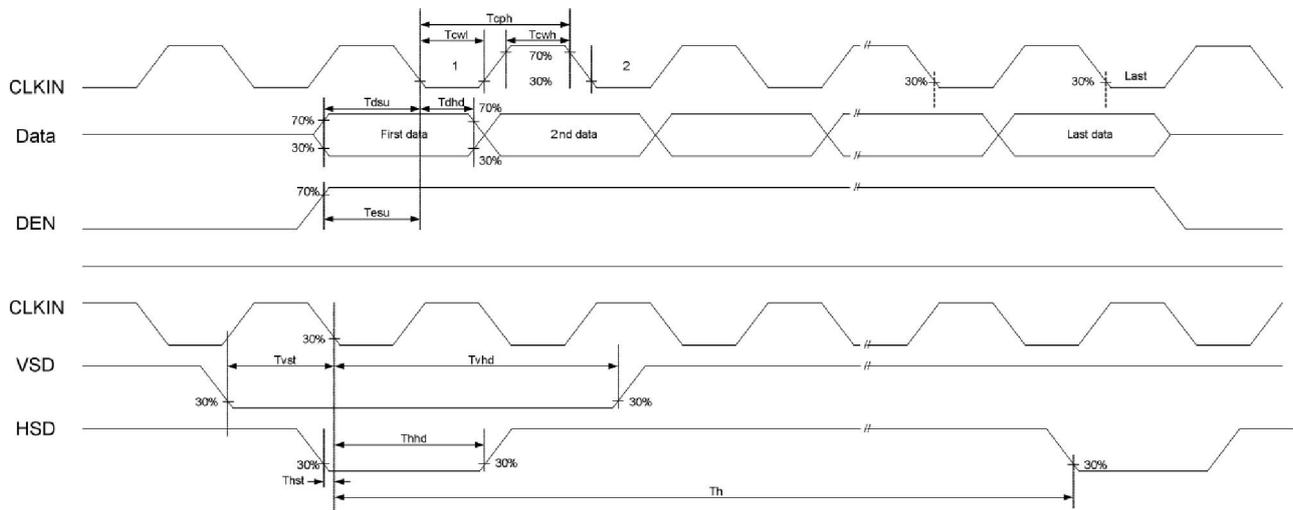
Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	44.9	51.2	63	MHz
Horizontal Display Area	thd	1024			DCLK
HS Period	th	1200	1344	1400	DCLK
HS Pulse Width	thpw	1	-	140	DCLK
HS Back Porch	thbp	160			DCLK
HS Front Porch	thfp	610	635	800	DCLK

#### Vertical Timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Vertical Display Area	thd	600			Th
VS Period	tv	624	635	750	Th
VS Pulse Width	tvpw	1	-	20	Th
VS Back Porch	tvbp	23			Th
VS Front Porch	tvfp	1	12	127	Th

## 7 Timing Diagram

Input Clock and Data Timing Diagram



## 8 Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Digital Voltage	DVDD~GND	-0.5	+5.0	V
Analog voltage	AVDD~GND	-0.5	+15	V
Operating Temperature	TOP	-20	70	° C
Storage Temperature	TST	-30	80	° C
Humidity	RH	-	85%(Max 40° C)	RH

## 9 Electrical Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Digital operating voltage	DVDD	2.5	3.3	3.6	V
Analog operating voltage	AVDD	8.0	10.5	13.5	V
vcom voltage	VCOM	3.0	3.2	3.4	V
vgh voltage	VGH	17	18	19	V
Vgl voltage	VGL	-6.5	-6	-5.5	V
Input Current	IDD	-	196.8	-	mA
Input Voltage ' H ' level	VIH	0.7VDD	-	DVDD	V
Input Voltage ' L ' level	VIL	GND	-	0.3VDD	
Output Voltage ' H ' level	VOH	VDD-0.4	-	--	
Output Voltage ' L ' level	VOL	--	-	GND+0.4	

## 10 Backlight Characteristics

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Voltage for LED backlight	V <sub>f</sub>	-	16.6	17	V
Current for LED backlight	I <sub>f</sub>	-	175	210	mA

Power consumption	Wbl	-	2905	3570	mW
Uniformity	Avg	80	-	-	%
LED Life Time	-	-	30000	-	Hrs

Note:

1. The LED life time is defined as the module brightness decrease to 50% original brightness at Ta=25°C, 60%RH ±5 %.
2. The life time of LED will be reduced if LED is driven by high current, high ambient temperature and humidity conditions.
3. Typical operating life time is an estimated data.
4. Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded .Functional operation should be restricted to the conditions described under normal operating conditions.

## 11 LCD Optical specifications

Item	Symbol	Condition	Specification			Unit	Remark
			Min	Typ	Max		
Response time (By Quick)	Tr+Tf	$\theta = 0^\circ$	-	25	40	ms	Note 5
Contrast ratio	CR	$\theta = 0^\circ$	500	600	-		Note 2,6
Viewing angle	Top	$CR \geq 10$	-	70	-	Deg.	Note 2,6,7
	Bottom	$CR \geq 10$	-	50	-		
	Left	$CR \geq 10$	-	70	-		
	Right	$CR \geq 10$	-	70	-		
Color chromaticity ( CF only with ITO, light source is C light, CIE 1931)	Wx	$\theta = 0^\circ$	-	0.302	-		Note 3
	Wy		-	0.338	-		
	Rx		-	0.606	-		
	Ry		-	0.325	-		
	Gx		-	0.303	-		
	Gy		-	0.567	-		
	Bx		-	0.147	-		
	By		-	0.161	-		
NTSC			45%	50%	-		Note 3

Note 1: Ambient temperature = 25°C.

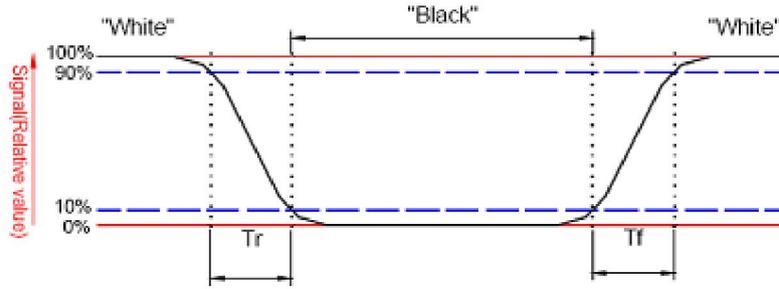
Note 2: To be measured with a viewing cone of 2°by Topcon luminance meter BM-5A.

Note 3: To be measured with Otsuta chromaticity meter LCF-2100M, CF only measure under C light simulation.

Note 4: LCD shipping status is cell without polarizer. Transmittance of Specification is cell with polarizer.  
The tolerance of Transmittance is ±10%.

Note 5: Definition of response time:

The output signals of TRD-100 are measured when the input signals are changed to “White” (falling time) and from “White” to “Black” (rising time), respectively. The interval is between the 10% and 90% of amplitudes. Refer to figure as below.

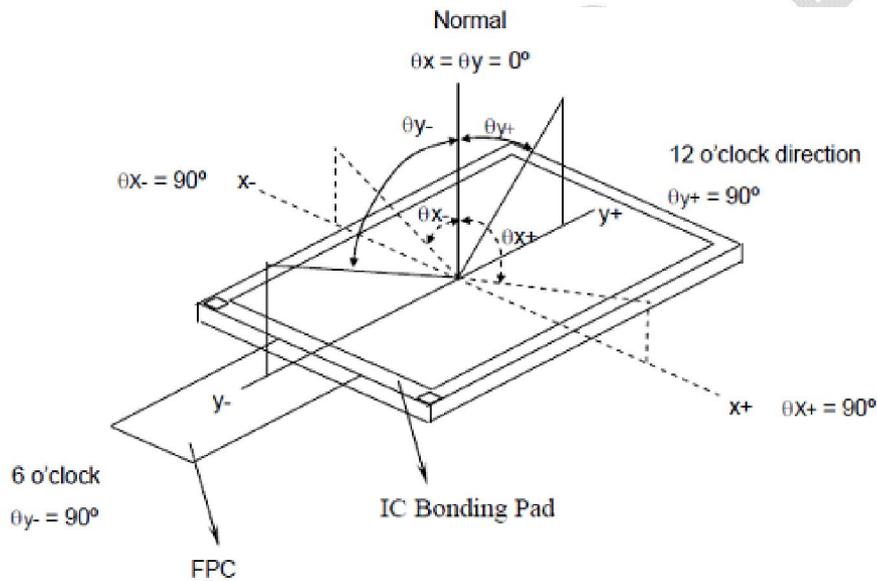


Note 6: Definition of contrast ratio:

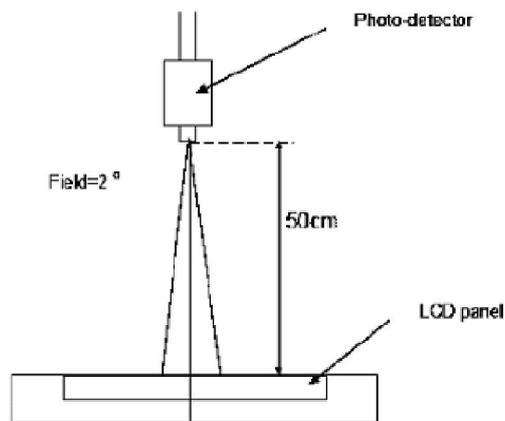
Contrast ratio is calculated by the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

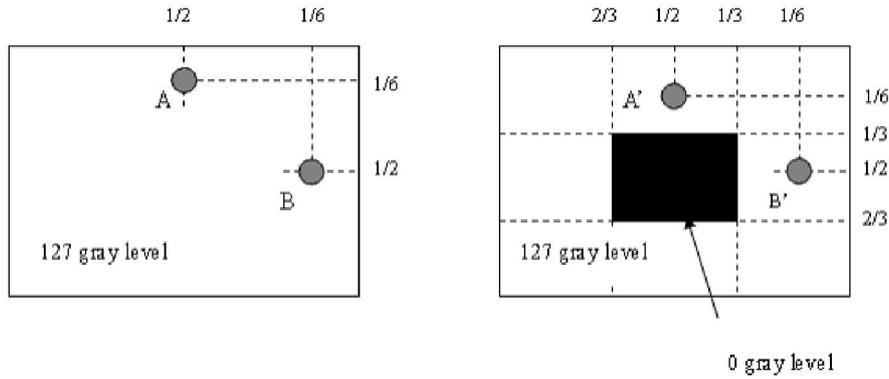
Note 7: Definition of viewing angle



Note 8: Optical characteristic measurement setup.



Note 9:



$1 LA-LA' / LA \times 100\% = 2\% \text{ max.}$ , LA and LA' are brightness at location A and A'.

$1 LB-LB' / LB \times 100\% = 2\% \text{ max.}$ , LB and LB' are brightness at location B and B'.

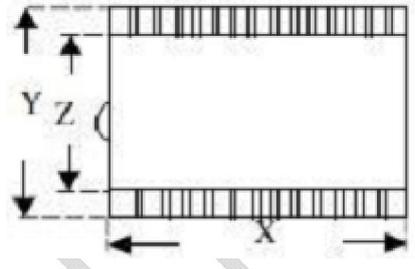
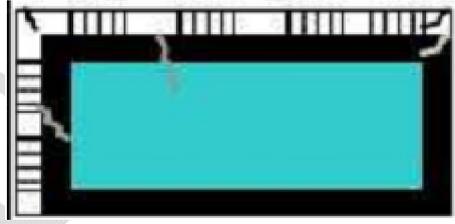
## 12 RELIABILITY TEST

NO.	TEST ITEM	TEST CONDITION	INSPECTION AFTER TEST
1	High Temperature Storage	80±2°C/96 hours	Inspection after 2~4 hours storage at room temperature and humidity. The condensation is not accepted. The sample shall be free from defects:  1. Air bubble in the LCD 2. Seal leak 3. Non-display 4. Missing segments 5. Glass crack
2	Low Temperature Storage	-30±2°C/96 hours	
3	High Temperature Operating	70±2°C/96 hours	
4	Low Temperature Operating	-20±2°C/96 hours	
5	Temperature Cycle	-30±2°C ~ 25~ 80± 2°C × 10 cycles (30 min.) (5min.) (30min.)	
6	Damp Proof Test	60°C ±5°C × 90%RH/96 hours	
7	Vibration Test	Frequency 10Hz~55Hz Stroke: 1.5mm Sweep: 10Hz~150 Hz~10Hz 2 hours For each direction of X, Y, Z	
8	Shock Test	Half-sine, wave, 300m/s	
9	Packing Drop Test	Height: 80 cm 1 corner, concrete floor	
10	Electrostatic Discharge Test	C=150pF, R=330 Ω Air: ±8KV 150pF/330Ω 30 times Contact: ±4KV,20 times	

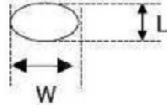
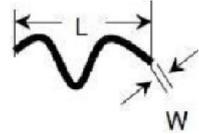
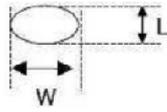
### 13 Inspection standards

#### 13.1 Visual inspection criterion in cosmetic

##### 13.1.1 Glass defect

NO.	Defect	Criteria	Remark
1	Dimension(Minor)	By engineering diagram	
2	Cracks(Major)	Extensive crack [Reject]	

##### 13.1.2 LCM appearance defect

NO.	Defect	Criteria		Remark
		Spec	Permissible Qty	
1	Round type(Minor)	$\phi \leq 0.1\text{mm}$	Disregard	1. $\phi = (W+L)/2$ , L:Length,W=Width 2.Disregard if out of A.A 
		$0.1\text{mm} < \phi \leq 0.2\text{mm}$	1	
		$\phi > 0.2\text{mm}$	0	
2	Line type(Minor)	$W \leq 0.05\text{mm}$	Disregard	1. L:Length,W=Width 2.Disregard if out of A.A 
		$L \leq 2.0\text{mm}$ and $0.1\text{mm} < W \leq 0.3\text{mm}$	2	
		$L > 2.0\text{mm}$ and $0.3\text{mm} < W \leq 0.5\text{mm}$	1	
		$W > 0.5\text{mm}$ or $L > 10\text{mm}$	0	
3	Polarizer dent(Minor)	$\phi \leq 0.3\text{mm}$	Disregard	1. $\phi = (W+L)/2$ , L:Length,W=Width 2.Disregard if out of A.A 
		$0.3\text{mm} < \phi \leq 0.5\text{mm}$	2	
		$\phi > 0.5\text{mm}$	0	

### 13.1.3 FPC

NO.	Defect	Criteria	Remark
1	Copper peeling(Minor)	Copper peeling [Reject]	
2	Damaged	Damaged[Reject]	

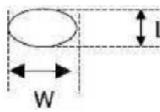
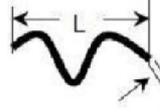
### 13.1.4 Black tape

NO.	Defect	Criteria	Remark
1	Shift(Minor)	IC exposed [Reject]	
2	No black tape(Minor)	No black tape [Reject]	

### 13.1.5 Silicon

NO.	Defect	Criteria	Remark
1	Amount of silicon (Minor)	ITO exposed [Reject]	

## 13.2 Visual inspection criterion in electrical display

NO.	Defect	Criteria		Remark
		Spec.	Permissible Qty	
1	No display (Major)	Not allowed		
2	Missing line (Major)	Not allowed		
3	Darker or lighter Line (Major)	Not allowed		
4	Weak line(Major)	By limited sample		
5	Bright / Dark point (Minor)	Bright point	1	1:1 sub-pixel: 1R or 1G or 1B 2:Point defect area 1/2 sub pixel.
		Dark point	2	
6	Round type (Minor)	$\phi \leq 0.2\text{mm}$	Disregard	1. $\phi = (W+L)/2$ , L:Length,W=Width 2.Disregard if out of A.A 
		$0.2 < \phi \leq 0.4$	2	
		$\phi > 0.4\text{mm}$	0	
	Line type (Minor)	$W \leq 0.05\text{mm}$	Disregard	1. L:Length,W=Width 2.Disregard if out of A.A 
		$L \leq 2.0\text{mm}$ and $0.1\text{mm} < W \leq 0.3\text{mm}$	2	
		$L > 2.0\text{mm}$ and $0.3\text{mm} < W \leq 0.5\text{mm}$	1	
		$W > 0.5\text{mm}$ or $L > 10\text{mm}$	0	
	Mura (Minor)	By 5% ND filter invisible		

## 13.3 Others

1. Issues that are not defined in this document shall be discussed and agreed with both parties. (Customer and supplier)
2. Unless otherwise agreed upon in writing, the criteria shall be applied to both parties. (Customer and supplier)

## 14 Suggestions for using LCD modules

### 14.1 Handling of LCM

1. The LCD screen is made of glass. Don't give excessive external shock, or drop from a high place.
2. If the LCD screen is damaged and the liquid crystal leaks out, do not lick and swallow. When the liquid is attach to your hand, skin, cloth etc, wash it off by using soap and water thoroughly and immediately.
3. Don't apply excessive force on the surface of the LCM.
4. If the surface is contaminated, clean it with soft cloth. If the LCM is severely contaminated, use Isopropyl alcohol/Ethyl alcohol to clean. Other solvents may damage the polarizer. The following solvents is especially prohibited: water , ketone Aromatic solvents etc.
5. Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
6. Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
7. Don't disassemble the LCM.
8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
  - Be sure to ground the body when handling the LCD modules.
  - Tools required for assembling, such as soldering irons, must be properly grounded.
  - To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
  - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
9. Do not alter, modify or change the the shape of the tab on the metal frame.
10. Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
11. Do not damage or modify the pattern writing on the printed circuit board.
12. Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector
13. Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
14. Do not drop, bend or twist LCM.

### 14.2 Storage

1. Store in an ambient temperature of 5 to 45 C, and in a relative humidity of 40% to 60%. Don't expose to sunlight or fluorescent light.
2. Storage in a clean environment, free from dust, active gas, and solvent.
3. Store in antistatic container.

