Messrs.					
Product Specification	Model	MTF-TQ28NP911-LB	Rev. No.	Issued Date.	Page.
Product Specification	Model.	MIT-IQZ6NF9II-LB	A	Feb.27,09	1/26

# LIQUID CRYSTAL DISPLAY MODULE MODEL: MTF-TQ28NP911-LB Customer's No.:

Acceptance			

Microtips Technology Inc. 12F. No.31 Lane 169, Kang Ning St., His-Chih, Taipei Hsien, Taiwan FAX: 886-2-26958625

Approved and Checked by				

Approved by	Check	Made by	
微端	微端	微端	微端
2009/02/27	2009/02/27	2009/02/27	2009/02/27
李剛	蔡宜夢	陳世文	許瓊窈



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# Revise Records

Rev.	Date	Contents	Written	Approved
A	2009/02/27	Specification released	Jill Hsu	Steele Lee

# Special Notes

Note1.	
Note2.	
Note3.	
Note4.	
Note5.	



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#### 1. GENERAL DESCRIPTION

The MTF-TQ28NP911-LB model is a Color TFT LCD supplied by Microtips. This main Module has a 2.8 inch Diagonally measured active display area with 240 x RGB x 320 Resolution. Each pixel is divided into Red, Green and Blue sub-pixels and dots which are arranged in vertical stripes. LCD color is determined with Dithering 65K/262K Color signal for each pixel. The MTF-TQ28NP911-LB has been designed to apply the interface method that enables low power, high speed, and high contrast. The MTF-TQ28NP911-LB is intended to support Applications where thin thickness, wide viewing angle, low power are critical factors and graphic displays are important.

### 2. FEATURES

Display Mode TFT module, Transmissive Type, Positive mode			
Display Format	RGB vertical stripe		
Color	56K/262K color		
Input Data	MCU Mode: 8080 system; 8/9/16/18 bits interface		
Viewing Direction	12 O'clock		
Backlight	White LED		

### 3. MECHANICAL SPECIFICATION

Item	Specifications	Unit
Dimensional outline	$50 \text{ (W)} \times 69.2 \text{ (H)} \times 3.8 \text{ (D)}$ without fix posts & FPC tails.	mm
Resolution	240 x RGB x 320	Pixel
Active area	43.2 (W) × 57.6 (H)	mm
Pixel pitch	$0.18 \text{ (W)} \times 0.18 \text{ (H)}$	mm
Dots pitch	0.06 (W) × 0.18 (H)	mm

\* Not: Include FPC

\* 1 Pixel = 3 dots = Red dot + Green dot + Blue dot



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### **ELECTRICAL CHARACTERISTICS**

Typical operating conditions (GND=AV ss=0V)

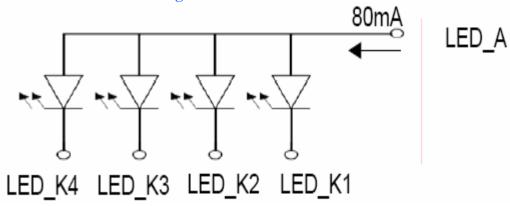
Item	Symbol	Min	Тур	Max	Units
Dower Supply	VDD		2.8		V
Power Supply	IDD		10	12	mA
Consumption current of	VLED		-	3.5	V
VLED	ILED		80		mA
Operating Temperature	Тор	-20		70	$^{\circ}\!\mathbb{C}$
Storage Temperature	Tstg	-30		80	$^{\circ}\!\mathbb{C}$
Humidity			90	%RH	Note1

Note1: Ta≤40°C Without dewing

#### 4.1 Backlight Characteristic

Item	Symbol	Condition	Min	Тур	Max	Units
LED module voltage	VLED	ILED=20mA			3.5	V
LED module current	ILED	VLED=3.5V		80	-	mA
Surface brightness	I n	ILED=80mA	75	80		0/
uniform ( without LCD )	Ld	VLED=3.5V	/3	80		%

### \* 1 Backlight LED Circuit:



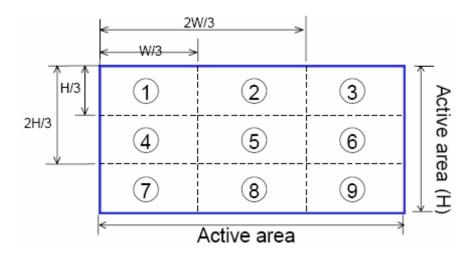


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#### \* 2 Uniform measure condition:

- (a) Measure 9 point. Measure location is show below:
- (b) Uniform = (Min. brightness / Max. brightness) \* 100%
- (c) Best Contrast, Main and sub panel All dots tum ON (White screen)



### 4.2 Touch Panel Pin Assignment

Pin No.	Designation
1	YU
2	XL
3	YD
4	XR



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### 4.3 Pin Description

No	Pin Name			Functions				
1	VDD	Power inp	Power input ( +2.8V )					
2	VDD	Power inp	out ( +2.8V	· )				
3	GND	Power Gr	ound					
4	GND	Power Gr	ound					
5	CS	Chip Sele	ct Input Pl	N				
6	RS	Register S	Select Inpu	t PIN				
7	WR	Chip Sele	ct Input Pl	N				
8	RD	Read Data	a Select In	put PIN				
9~26	DB0~DB17	Data Bus	Pin					
27	RESET	Reset Sele	ect Input P	IN				
28	GND	Power Gro	ound					
		Mode Sele	Mode Select					
		IM0	IM3	Interface				
29~30	IM0~IM3	0	1	8-bits				
29~30	11010~11015	1	1	9-bits				
		0	0	16-bits				
		1	0	18-bits				
31	K4	B/L Powe	r input PII	N negative				
32	К3	B/L Powe	r input PII	N negative				
33	K2	B/L Powe	r input PII	N negative				
34	K1	B/L Powe	r input PII	N negative				
35	AN	B/L Pow	er input PI	N anode				
36	NC/ YU	Not Con	nect					
37	NC/ XL	Not Conn	Not Connect					
38	NC/ YD	Not Conn	ect					
39	NC/ XR	Not Conn	ect					
	I	T.						

#### Note:

80-system 8-bits used DB17 : DB10 80-system 9-bits used DB17 : DB9

 $80\mbox{-system}$   $16\mbox{-bits}$  used DB17 : DB10 and DB7 : DB0

80-system 18-bits used DB17 : DB0



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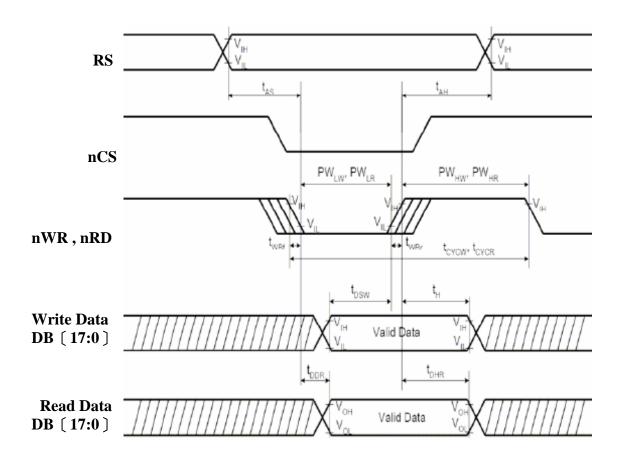
# 4.4 System Interface

# 8080-System Interface Timing

	Item		Symbol	Unit	Min	Тур	Max	Test Condition
Duc	cycle time	Write	tcycw	ns	100			
Dus	cycle time	Read	<b>t</b> cycr	ns	300			
Write lo	w-level pulse widtl	1	PWLW	ns	50		500	
Write hi	gh-level pulse widt	·h	РWнw	ns	50			
Read lov	w-level pulse width	l	PWLR	ns	150			
Read hig	gh-level pulse widt	h	PW <sub>HR</sub>	ns	150			
Write / I	Write / Read rise / fall time		$tw_{Rr}/tw_{Rf}$	ns			25	
Catum	Write ( RS to NCS ,E/NWR )				10			
Setup time	Read ( RS to NCS	,RW/NRD )	tas	ns	5	1		
Address	hold time		<b>t</b> ah	ns	5			
Write d	ata set up time		tdsw	ns	10			
Write data hold time		tн	ns	15				
Read da	nta delay time		t <sub>ddr</sub>	ns			100	
Read da	nta hold time		t <sub>dhr</sub>	ns	5			



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### 4.4.2 Reset Timing

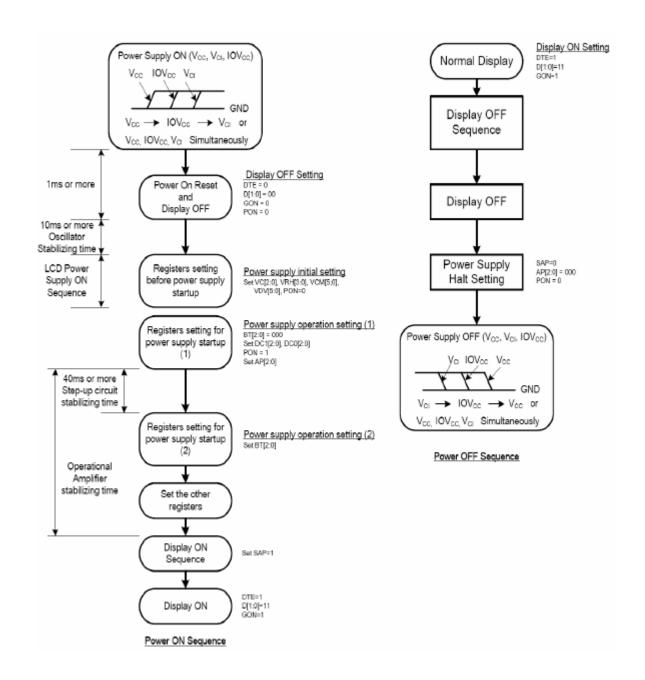
Item	Symbol	Units	Min	Тур	Max
Reset Low-Level Width	tres	ms	1		
Reset Rise Time	tres	us			10





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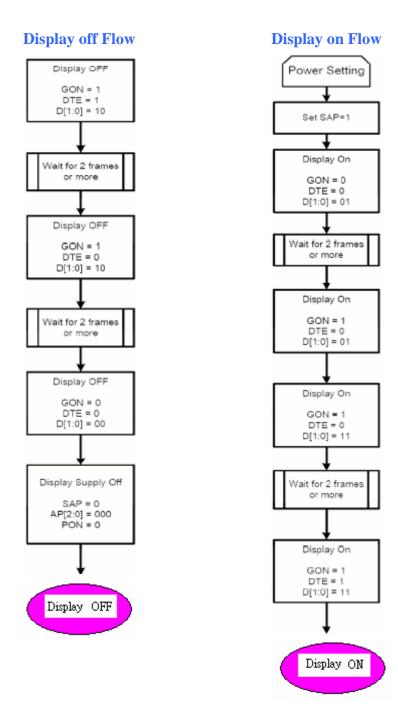
#### 4.4.3 Power ON/OFF





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#### 4.4.4 Display ON/OFF



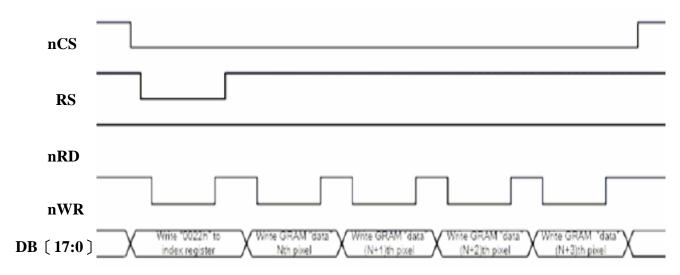


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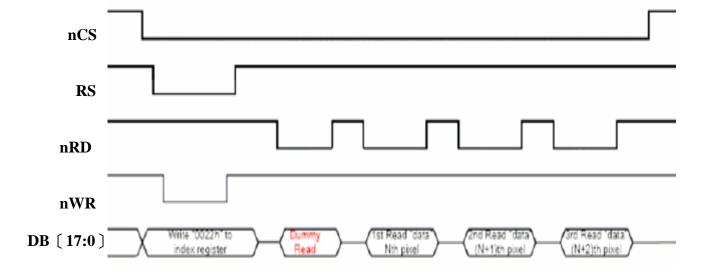
### 4.5 GRAM Address Map & Read / Write

### ! 80 18-/16-bit System Bus Interface Timing

### (a) Write to GRAM



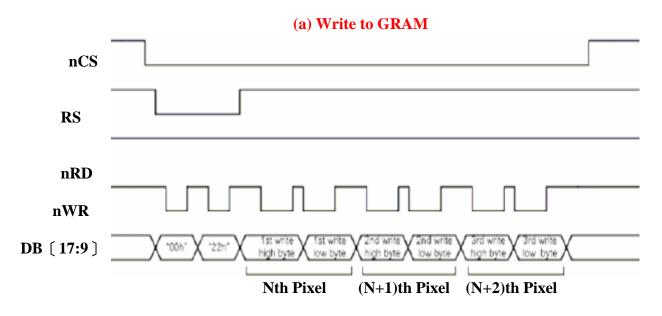
### (b) Read form GRA



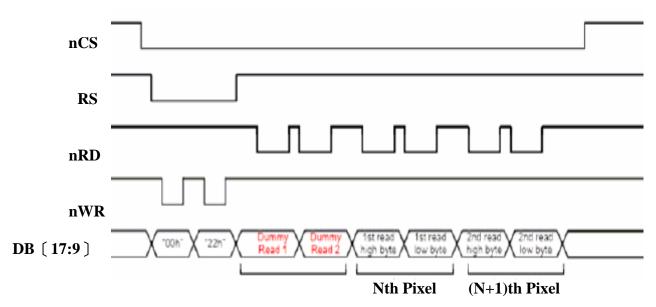


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! 80 9-/ 8-bit System Bus Interface Timing



# (b) Read form GRA





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### **ELECTRO-OPTICAL CHARACTERISTICS**

Para	ameter	Symbol.	Min.	Тур.	Max.	Units.	Note.
Luminance of	white	Lwh	170			cd/m²	
Contrast Ratio		CR		300			* 5
Response Time	e(Tr + Tf)			30		ms	* 4
	X axis right $(\phi = 0^{\circ})$	θх		60			
Viewing Angle	X axis left $(\phi = 180^{\circ})$	θх		60			* 6
Angie (CR≥10)	Y axis up $(\phi = 90^{\circ})$	$\theta$ y		60		Degree	* 0
	Y axis down ( $\phi = 270^{\circ}$ )	$\theta$ y		50			
	White	Wx	0.290	0.310	0.330		
	Winte	Wy	0.323	0.343	0.363		
	Red	Rx	0.584	0.604	0.624		
CIE color	Red	Ry	0.305	0.325	0.345		BM7;
Coordinates	Green	Gx	0.279	0.299	0.319		2° angle
	Green	Gy	0.547	0.567	0.587		
	Blue	Bx	0.115	0.135	0.155		
	Diuc	Ву	0.127	0.147	0.167		

### For LCM

Note1: Ambient temperature= $25^{\circ}$ C  $\pm 2^{\circ}$ C. Note2: To be measured in the dark room.

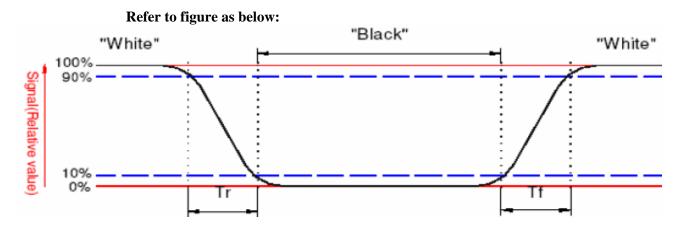
Note3: To be measured at the center area of panel with a viewing cone of 2° by Topcon luminance meter BM-7, after 10 minutes operation (module).



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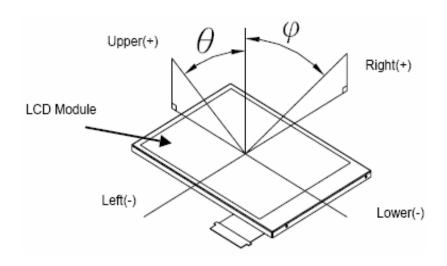
Note4: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from "black" to "white" (falling time) and from "white" to "black" (rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes.



Note5: Definition of contrast ratio: Contrast ratio is calculated with the following formula.

Note6: Definition of viewing angle (LCD-5200): Refer to the figure as below



#### 5.1 Reliability of Touch Panel



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No	Items	Min.	Тур.	Max.	Unit	Remark
1	Activation Force	130			O)	<ol> <li>within active area.</li> <li>R0.8mm polyacetal pen or finger.</li> </ol>
2	Surface Hardness	3			Н	Judgment ref. JIS-K5600
3	Durability (Writing Life)	100,000			characters	<ol> <li>within active area.</li> <li>R0.8mm polyacetal pen.</li> <li>Load: 150g</li> <li>Speed: 60mm/sec</li> </ol>
4	Durability (Pitting Life)	1,000,000			touches	<ol> <li>within active area.</li> <li>R0.8mm polyacetal pen.</li> <li>Load: 250g</li> <li>Frequency: 260 times/min</li> </ol>

### 6. RELIABILITY

#### 6.1 MTTF

The LCD module shall be designed to meet a minimum MTTF value of  $50,\!000$  hours with normal condition.

(25°C in the room without sunlight; not include life time of backlight)

#### 6.2 Tests

NO	Item	Condition	Criterion
1	High Temperature Operating	70°C 240hrs	* No defect of
2	Low Temperature Operating	-20°C 240hrs	Operational function in
3	High Temperature  Non-Operating	80°C 240hrs	Room temperature are Allowable.
4	Low Temperature Non-Operating	-30°C 240hrs	
5	High Temperature / Humidity Non-Operating	50°C , 90%HR 240hrs	* Leakage current should  Be below double of initial
6	Temperature Shock Non-Operating	-30°C ←→ 80°C (30min) (5min) (30min) 10 CYCLES	value.
	Electro-static Discharge	<b>HBM</b> : ±2Kv	

Note1: Test after 24 hours in room temperature.

Note2: The sampling above is Individually for each reliability testing condition.

Note3: The color fading of polarizing filter should not care.

Note4: All of the reliability testing chamber above, is using D.I. water. (Min value:  $1.0\,\mathrm{M}\Omega$ -cm)

Note5: In case of malfunction defect caused by ESD damage, if it would be recovered to Normal state after resetting, it would be judged as a good part.



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#### 7. **INSPECTION CRITERIA**

#### 7.1 Inspection Conditions

#### **Environmental conditions**

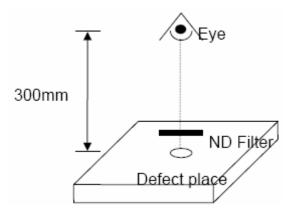
The environmental conditions for inspection shall be as follows

Room temperature: 23±5°C Humidity: 50±20%RH The external visual inspection

> With a single 1000±200lux fluorescent lamp as the light source, the inspection was in the distance of 30cm or more from the LCD to the inspector's eyes.

#### 7.2 Light Method

Environment lamp under 1000±200 lux, Viewing direction for inspection over 30cmThe distance from eye to defect around 300mm, the distance from ND Filter to defect around 25~30mm



#### 7.3 Classification of Defects

#### Minor defect

A major defect refers to a defect that may substantially degrade usability for product applications.

#### Minor defect

A minor defect refers to a defect which is not considered to be able substantially degrade the Product application or a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation.

Notes: If the LCD/LCM 's cosmetic and display performance do not specify in "inspection criterion", it should be based on these delivered samples.



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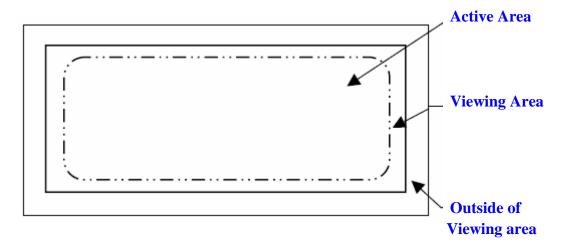
#### 7.4 Sampling & Acceptable Quality Level

Level II, MIL-STD-105E

	Major	Minor
Cosmetic	1.0 %	1.5 %
Electrical-display	0.4%	0.65 %

#### 7.5 Definition Of Inspection Area

V.A: Viewing Area A.A: Active Area





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#### 7.6 Items and Criteria Visual inspection criterion in cosmetic

Glass defect					
No	Defect	Criteria	Remark		
1	Dimension (Minor)	By engineering diagram	↑ ↑		
2	Cracks (Major)	Extensive crack [Reject]			

	LCD appearance defect with in V.A					
No	Defect	Criteria	ı	Remark		
	E'l	Spec.	Permissible Qty	1. L: Length, W: Width		
	Fiber, scratches	W≦0.03mm	Disregard	2. Disregard if out off A.A.		
1	(Major)	$0.03$ mm $<$ W $\leq$ 0.05mm , L $\leq$ 3.0mm	2			
		$\begin{array}{c} 0.05 m_{\text{m}} \!<\! \mathbb{W} \! \leq \! 0.10 m_{\text{m}} \\ \text{, L} \! \leq \! 3.0 m_{\text{m}} \end{array}$	1			
		W>0.10mm or L>3.0mm	0	W		
	Dirty Spots,	Spec.	Permissible Qty	1. $\phi$ = (L+W)/ 2, L: Length, W: Width		
	Round type	$\phi \leq 0.10$ mm	Disregard	2. Disregard if out of A.A.		
2	(Major)	$0.10\text{mm} < \psi \leq 0.20\text{mm}$	3	( ) Įw		
		0.20mm $< arphi$	0	<b>←</b>		
	Polarizer dent	Spec.	Permissible Qty	1. $\phi = (L+W)/2$ , L: Length,		
	rolarizer dent	$\varphi \leq 0.20$ mm	Disregard	W: Width 2. Disregard if out of A.A.		
	(Major)	$0.20 \text{mm} < \varphi \le 0.30 \text{mm}$	2	1		
3	(1/14/01)	$0.30$ mm $< \varphi \le 0.50$ mm	1	↓ VV		
		$0.50$ mm $< \varphi$	0	L		



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		FPC	
No	Item	Criteria	Remark
1	Copper Peeling (Minor)	Copper Peeling  [ Reject ]	

	Silicon			
No	Item	Criteria	Remark	
1	Amount of silicon (Minor)	ITO exposed	ITO silicon	

	LCD appearance defect					
No	Defect	Cr	iteria	Remark		
1	No display (Major)	Not allowable		Not allowable		
2	Missing line (Major)	Not allowable				
3	Darker or lighter line (Major)	By limited sample				
4	Dot defect (Major)	Spec. Bright dot Dark dot	Permissible Qty  1 2	1. dot =1R or 1G or 1B 2. Dot defect area ≥ 1/2 dot 3. Disregard if out of AA area		
5	Mura (Minor)	By limi	ted sample			



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	LCD appearance defect					
No	Defect	Criteria	ı	Remark		
	Fiber, scratches	Spec.	Permissible Qty	1. L: Length, W: Width 2. Disregard if out off A.A.		
	(Major)	W≦0.03mm	Disregard			
6	, ,	$0.03\text{mm}\!<\!\text{W}\!\leq\!0.05\text{mm}$ , L\(\leq\) 3.0mm	2			
		$\begin{array}{c} 0.05m_{\text{m}}\!<\!\text{W}\!\leq\!0.10mm\\ \text{, L}\!\leq\!3.0mm \end{array}$	1			
		W>0.10mm or L>3.0mm	0	W		
	Dirty spots	Spec.	Permissible Qty	1. $\phi$ = (L+W)/ 2, L: Length, W: Width 2. Disregard if out of A.A.		
_	(Major)	$\phi$ $\leq$ 0.10mm	Disregard	2. Disregulari dat di A.A.		
7		$0.10 \text{mm} < \phi \le 0.20 \text{mm}$	3	↓ w		
		$0.20$ mm $< \varphi$	0			

#### 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)



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#### 8. **PRECAUTIONS**

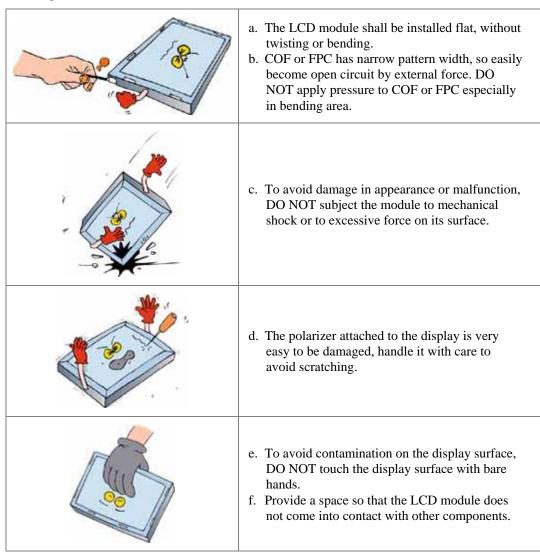
#### 8.1 Operation

Burn-in sometimes happens when the same character was displayed at along time. Therefore, to prevent Burn-in, it is recommended to set up a Screen-saver function.

#### 8.2 Safety

The liquid crystal in the LCD is poisonous, DO NOT put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

#### 8.3 Handling





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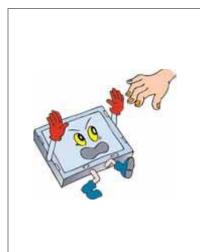
	g. To protect the LCD panel from external pressure, put covering glass (acrylic board or similar board) to keep appropriate space between them.
	h. Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
	Property of semiconductor devices may be affected when they are exposed to light possibly resulting in malfunctioning of the ICs. To prevent such malfunctioning of the ICs, your design and mounting layout done are so that the IC is not exposed to light in actual use.
St. St.	j. Strong light exposure causes degradation of color filter. It may not recover
222	k. DO NOT contact with water to avoid Metal corrosion.
2	1. When it is not in use, the screen must be turned off or the pattern must be frequently changed by a screen saver. If it displays the same pattern for a long period of time, brightness down/image sticking may develop due to the LCD structure.
6 60	m. Never disassemble LCD product under any circumstances. If unqualified operators or users assemble the product after disassembling it, it may not function or its operation may be seriously affected.



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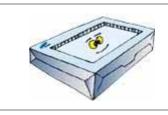
#### 8.4 Static electricity

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge.



- a. The LCD module shall be installed flat, without twisting or bending. Ground soldering iron tips, tools and testers when they operate.
- b. Ground your body when handling the products.
- c. DO NOT apply voltage to the input terminal without applying power supply.
- d. DO NOT apply voltage that exceeds the absolute maximum rating.
- e. Store the products in an anti-electrostatic container.
- f. Peel off protect tape, attached to polarizer, slowly to minimize ESD damage.

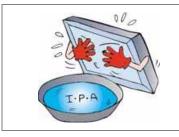
#### 8.5 Storage



Store the products in a dark place at  $+5 \sim +25$  degree C, low humidity (50%RH or less).

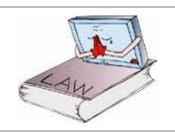
DO NOT store the products in an atmosphere containing organic solvents or corrosive gases.

#### 8.6 Cleaning



- a. DO NOT wipe the polarizer with dry cloth, as it might cause scratch.
- b. Wipe the polarizer with a soft cloth soaked with petroleum IPA, other chemical might damage.

#### 8.7 Waste



When dispose of LCD module, manage it at the production waste according to the relevant laws and regulations.



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#### 9. WARRANTY

This product has been manufactured to your company's specifications as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we cannot take responsibility if the product is used in medical devices, nuclear power control equipment, aerospace equipment, fire and security systems, or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required. If the product is to be used in any of the above applications, we will need to enter into a separate product liability agreement.

- 1 13 months guarantee starts from the date code.
- We cannot accept responsibility for any defect, which may arise from additional manufacturing of the product (including disassembly and reassembly), after product delivery.
- 3 We cannot accept responsibility for any defect, which may arise after the application of strong external force to the product.
- We cannot accept responsibility for any defect, which may arise due to the application of static electricity after the product has passed your company's acceptance inspection procedures.
- We cannot accept responsibility for industrial property, which may arise through the use of your product, with exception to those issues relating directly to the structure or method of manufacturing of our product. Microtips-origin longer than one year from Microtips production.

#### 10. <u>DIMENSIONAL OUTLINES</u>

See next page......



