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CASIL OPTOELECTRONIC PRODUCT DEVELOPMENT LTD.



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RECORDS OF REVISION

Date	Rev.	Description	Note	Page
2009.12.30	1.0	New Sample		
2010.4.22	2.0	Change LCD from transmissive to transfective		
2010.5.3	3.0	Add lcd color		1

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OPTO0747GF LCD MODULE

1、Features

- Display Type: FSTN
- Display Mode: Positive, Transflective
- Display Format: 128X 64 Dots
- Driving Mode : 1/65Duty,1/9Bias
- Operating Voltage: 3.0V
- Viewing Direction: 12 O'clock
- NOTE: Gray background with black text

2、Absolute Maximum Rating

Item	Symbol	Condition	Min.	Max.	Unit
Digital Power Supply Voltage	V _{DD1}	Ta=25℃	-0.3	+3.6	V
Analog Power Supply Voltage	V _{DD2} , V _{DD3}	Ta=25℃	-0.3	0.6	
LCD Power Supply Voltage	V ₀ —XV ₀	Ta=25℃	-0.3	16	V
LCD Power Supply Voltage	VG	Ta=25℃	-0.3	3.6	
LCD Power Supply Voltage	VM	Ta=25℃	-0.3	V _{DD2}	
Input Voltage	V _I	Ta=25℃	-0.3	V _{DD1} +0.3	V
Operating Temperature	T _A	-	0	50	℃
Storage Temperature	T _{STO}	-	-10	60	℃

3. MECHANICAL PARAMETERS

Item	Description	Unit
LCM Outline Dimension	49.0X 44.0 X2.9	mm
Viewing Area	46.0X34	mm
Weight	---	g



4、Electrical Characteristics

4.1 Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power Supply Voltage	V_{DD}	$T_a=25^{\circ}\text{C}$		3		V
Power Supply current	I_{DD}	$V_{DD}=3\text{V}$	-			mA
Input voltage	V_{IH}	$T_a=25^{\circ}\text{C}$	$0.7V_{DD}$	-	V_{DD}	V
	V_{IL}	$T_a=25^{\circ}\text{C}$	VSS	-	$0.3V_{DD}$	
Output voltage	V_{OH}	$I_{Out} = 1\text{ mA}, V_{DD}=1.8\text{V}$	$0.8V_{DD}$	-	V_{DD}	V
	V_{OL}	$I_{Out} = 1\text{ mA}, V_{DD}=1.8\text{V}$	-VSS	-	$0.2V_{DD}$	
Power supply for LCD= V_{LCD}	$V_{DD}-V_L$	$T_a=-20^{\circ}\text{C}$	-	-	-	V
		$T_a=25^{\circ}\text{C}$	-	4.5	-	
		$T_a=70^{\circ}\text{C}$	-	-	-	

4.2. AC Characteristics ($V_{DD}=5\text{V}$, $T_a=25^{\circ}\text{C}$)

($V_{DD1} = 3.3\text{V}$, $T_a = 25^{\circ}\text{C}$)

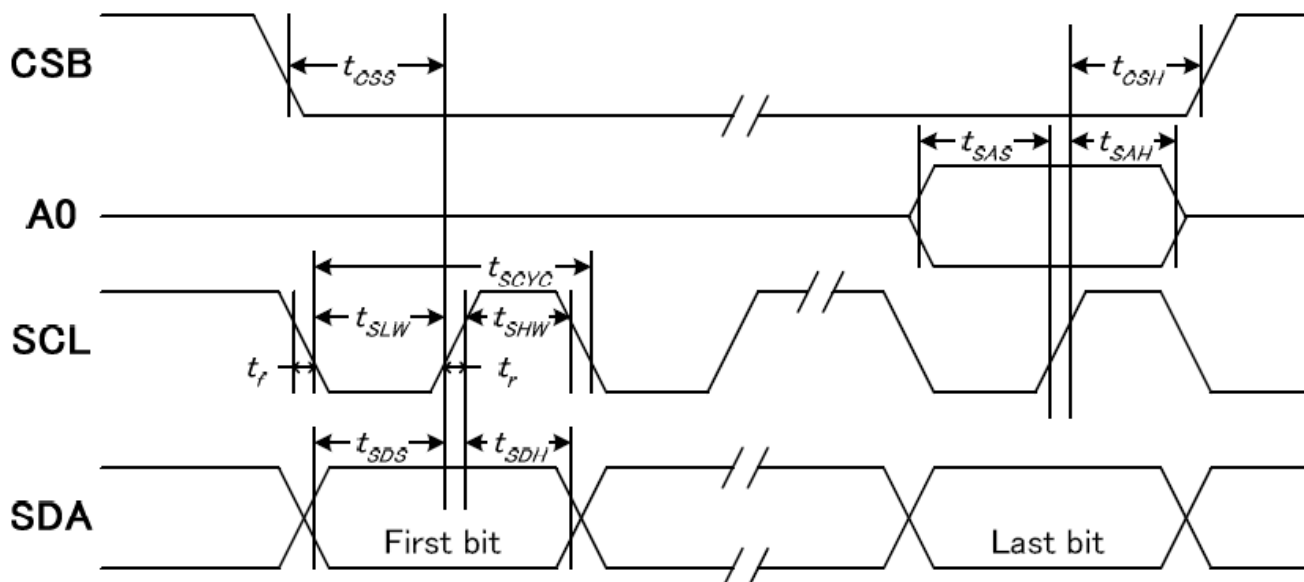
Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period	SCLK	tSCYC		50	—	ns
SCLK "H" pulse width		tSHW		25	—	
SCLK "L" pulse width		tSLW		25	—	
Address setup time	A0	tSAS		20	—	
Address hold time		tSAH		10	—	
Data setup time	SDA	tSDS		20	—	
Data hold time		tSDH		10	—	
CSB-SCLK time	CSB	tCSS		20	—	
CSB-SCLK time		tCSH		40	—	

($V_{DD1} = 2.8\text{V}$, $T_a = 25^{\circ}\text{C}$)

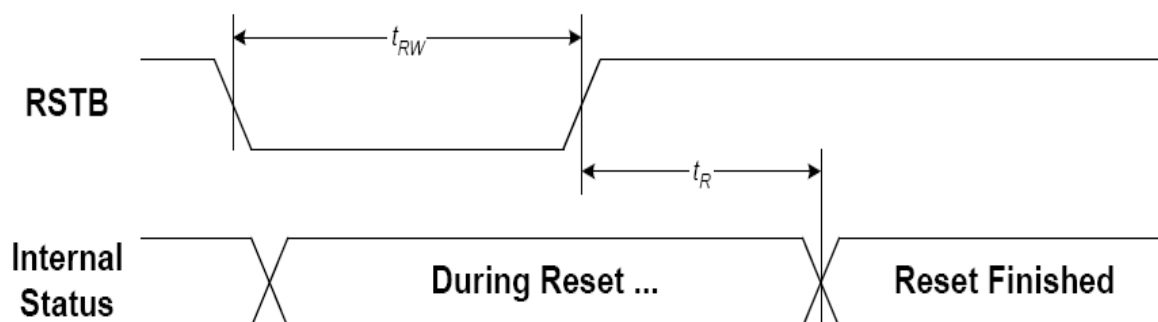
Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period	SCLK	tSCYC		100	—	ns
SCLK "H" pulse width		tSHW		50	—	
SCLK "L" pulse width		tSLW		50	—	
Address setup time	A0	tSAS		30	—	
Address hold time		tSAH		20	—	
Data setup time	SDA	tSDS		30	—	
Data hold time		tSDH		20	—	
CSB-SCLK time	CSB	tCSS		30	—	
CSB-SCLK time		tCSH		60	—	



4.3. Writing Data From MPU To ST7567



4.4. Hardware Reset Timing



(VDD1 = 3.3V, Ta = 25°C)

Item	Symbol	Condition	Min.	Max.	Unit
Reset time	tR		—	1.0	us
Reset "L" pulse width	tRW		1.0	—	

(VDD1 = 2.8V, Ta = 25°C)

Item	Symbol	Condition	Min.	Max.	Unit
Reset time	tR		—	2.0	us
Reset "L" pulse width	tRW		2.0	—	



6、Instruction Set

INSTRUCTION	A0	R/W (RWR)	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
(1) Display ON/OFF	0	0	1	0	1	0	1	1	1	D	D=1, display ON D=0, display OFF
(2) Set Start Line	0	0	0	1	S5	S4	S3	S2	S1	S0	Set display start line
(3) Set Page Address	0	0	1	0	1	1	Y3	Y2	Y1	Y0	Set page address
(4) Set Column Address	0	0	0	0	0	1	X7	X6	X5	X4	Set column address (MSB)
	0	0	0	0	0	0	X3	X2	X1	X0	Set column address (LSB)
(5) Read Status	0	1	0	MX	D	RST	0	0	0	0	Read IC Status
(6) Write Data	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write display data to RAM
(7) Read Data	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read display data from RAM
(8) SEG Direction	0	0	1	0	1	0	0	0	0	MX	Set scan direction of SEG MX=1, reverse direction MX=0, normal direction
(9) Inverse Display	0	0	1	0	1	0	0	1	1	INV	INV =1, inverse display INV =0, normal display
(10) All Pixel ON	0	0	1	0	1	0	0	1	0	AP	AP=1, set all pixel ON AP=0, normal display
(11) Bias Select	0	0	1	0	1	0	0	0	1	BS	Select bias setting 0=1/9; 1=1/7 (at 1/65 duty)
(12) Read-modify-Write	0	0	1	1	1	0	0	0	0	0	Column address increment: Read:+0 , Write:+1
(13) END	0	0	1	1	1	0	1	1	1	0	Exit Read-modify-Write mode
(14) RESET	0	0	1	1	1	0	0	0	1	0	Software reset
(15) COM Direction	0	0	1	1	0	0	MY	-	-	-	Set output direction of COM MY=1, reverse direction MY=0, normal direction
(16) Power Control	0	0	0	0	1	0	1	VB	VR	VF	Control built-in power circuit ON/OFF
(17) Regulation Ratio	0	0	0	0	1	0	0	RR2	RR1	RR0	Select regulation resistor ratio
(18) Set EV	0	0	1	0	0	0	0	0	0	1	Double command!! Set electronic volume (EV) level
	0	0	0	0	EV5	EV4	EV3	EV2	EV1	EV0	
(19) Set Booster	0	0	1	1	1	1	1	0	0	0	Double command!! Set booster level: 00=4X, 01=5X, 10=6X
	0	0	0	0	0	0	0	0	BL1	BL0	
(20) Power Save	0	0	Compound Command								Display OFF + All Pixel ON
(21) NOP	0	0	1	1	1	0	0	0	1	1	No operation
(22) Test	0	0	1	1	1	1	1	1	1	-	Do NOT use. Reserved for testing.

Note: Symbol "-" means this bit can be "H" or "L".



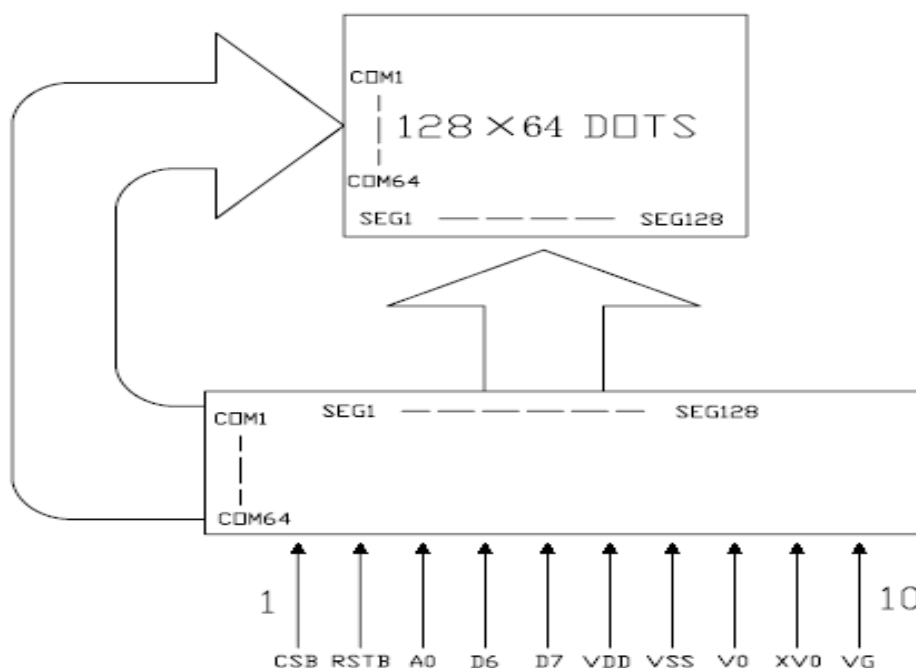
7、Pin Descriptions

Pin No.	Symbol	Level	Description
1	CSB	H/L	Chip select input, L: chip selected
2	RSTB	H/L	Hardware reset input pin.,L; internal initialization is executed
3	A0	H/L	It determines whether the access is related to data or command.; L: command; H: display data
4	D6	H/L	Serial clock input.
5	D7	H/L	Serial data input.
6	VDD	H/L	Power supply
7	VSS	H/L	ground
8	V0	H/L	LCD driving voltage for common circuits at negative frame
9	XV0	H/L	XV0 is the LCD driving voltage for common circuits at positive frame
10	VG	H/L	LCD driving voltage for segment circuits.

8、Parts List

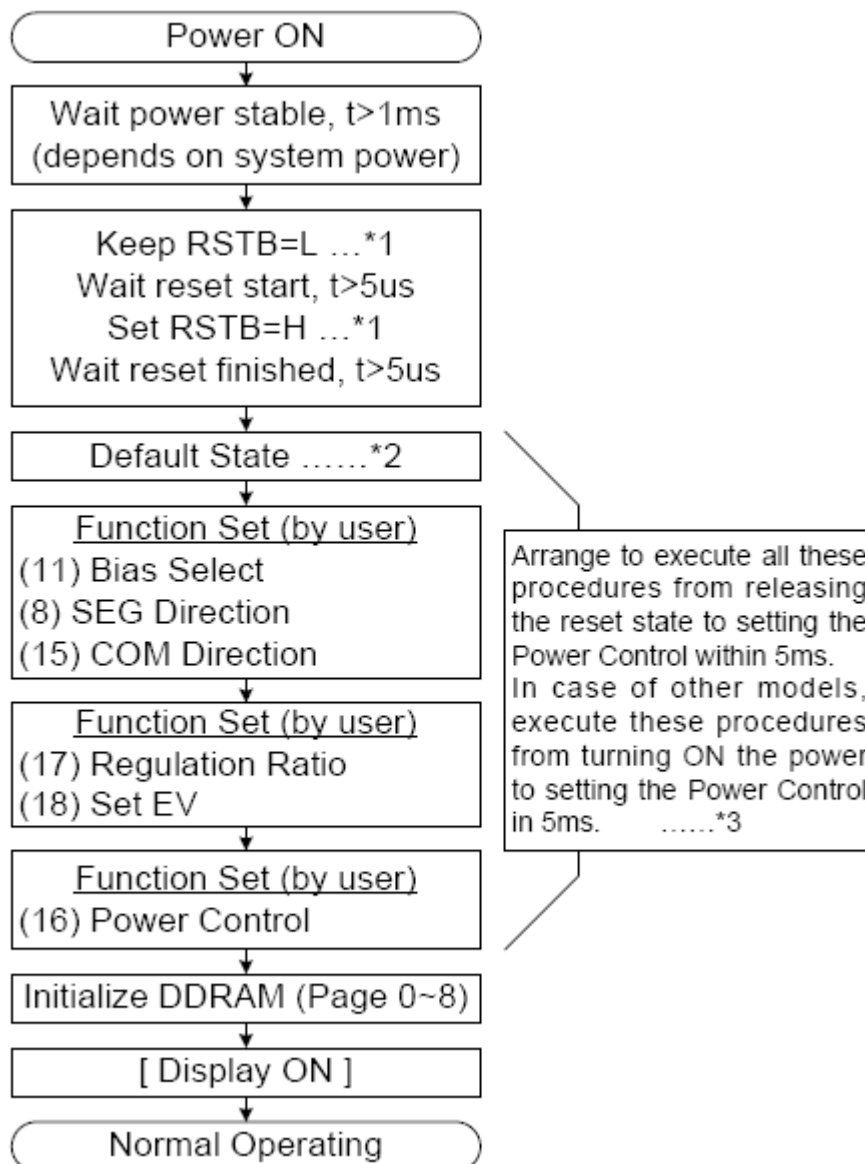
Part	Spec	Number	Description
LCD	CSL-20908	1	
FPC	OPT00747GF	1	
IC	ST7567	1	

9. SYSTEM BLOCK DIAGRAM





10、Initializing By Instruction



Note: The detailed description can be found in the respective sections listed below.

1. Please refer to the timing specification of t_{RW} and t_R .
2. Refer to Section 7. RESET CIRCUIT.
3. The 5ms requirement depends on the characteristics of LCD panel and the external component of the power circuit. It is recommended to check with the real products with external component.
4. The detailed instruction functionality is described in Section 9. INSTRUCTION DESCRIPTION;
5. Power stable is defined as the time that the later power (VDDI or VDDA) reaches 90% of its rated voltage.



11、Specification of Quality Assurance

1.Acceptable Quality Level

Each lot should be satisfied the quality level defined as follows.

-Inspection method;MIL-STD-105E level II Normal One Time sampling.

-AQL

Partition	AQL	Definition
Major	0.65%	Functional defective as Product
Minor	1.5%	Satisfy all functions as product but not satisfy cosmetic standard

2.Definition of “LOT”

One lot means the delivery quantity for customer at one time.

3.Conditions of Cosmetic & Functional Inspection

3.1 Environmental Condition

The inspection should be performed at the 1m of height from the LCD module under 2 PCS of 40W white fluorescent lamps (Normal temperature 20~25°C and normal humidity 85±15%RH).

3.2 Inspection Method

The visual check should be performed vertically at more 30cm's distance from the LCD panel.

3.3 Driving Voltage

Operating voltage according to specification.

3.4 Test pattern

Pattern will automatically displayed according to the software.



12、Inspection Criteria

12.1. Electrical Inspection Failure


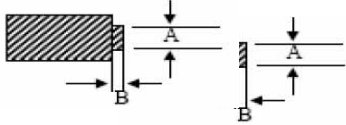
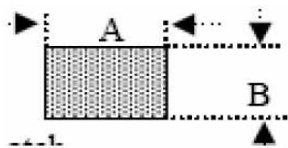
Defect	Define/description	Criteria
1. open circuit/no displaying (maj)	missing or no displaying due to Circuit open	reject
2. short circuit (maj)	Circuit short	reject
3. Dim (maj)	part of figures display dim than normal obviously	reject
4. all display dim (maj)	all the figure display dimmer than sample	If required strictly, refer to the signed sample limit. Normally, $ V_{th, product} - V_{th, sample} \leq 0.05V$.
5. ghost (maj)	the figures in Voff state display	if required strictly, refer to the signed sample limit. Normally, $ V_{th, product} - V_{th, sample} \leq 0.05V$.
6. Large current (maj)	the current larger than the engineer SPEC.	Reject
7. Response slow (maj)	The response time is longer than the Spec.	Reject
8. Wrong viewing angle (maj)	Viewing angle different from pec. (Or sample)	Reject
9. Twist segment (maj)	Some segments displaying with the wrong viewing angle.	Reject
10. Segment pervasion (maj)	The displaying segment pervasion	Reject
11. Extra lines (maj)	Displaying the extra lines than the Spec	Reject

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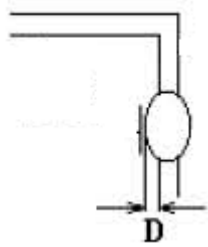


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15. Dot Matrix Pin Hole Lack (min)	<p>Dot Matrix: Pin Hole Lack</p> 	Specification	Acceptable number
		$\phi \leq 0.1\text{mm}$	Disregard
		$0.1\text{mm} < \phi \leq 0.2\text{mm}$ (Distance between two points $\geq 10\text{mm}$)	3
		$0.2\text{mm} < \phi \leq 0.25\text{mm}$	1
		$\phi > 0.25\text{mm}$	0
		$\phi > 1/3$ width of the character	0
16. Convex (min)		1. $A > 0.25\text{mm}$ 2. $B > 0.05\text{mm}$	Reject
17. assembly not match (min)	<p>assembly not match(dot-matrix)</p> 	1. Distortion of A: $ A - \text{define} / \text{define} \leq 15\%$ 2. Distortion of B: $ B - \text{define} / \text{define} \leq 15\%$	Accept
18 . Black spot (min)	Black spots in displaying	if not clear in normal state of working, regardless. If defect clear, according to item of black/white spot.	



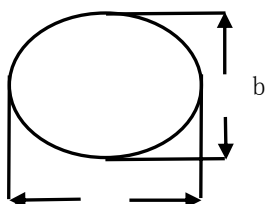
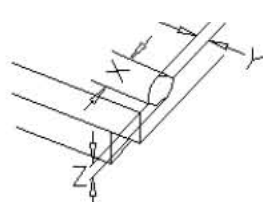
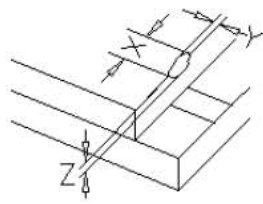
12.2. Appearance Inspection

ITEM	conation	Criteria
1. Leakage (maj)	LC in the cell leaks out.	Reject
2. Cracks (maj)	ITO glass crack	Reject
3. Malalignment	Different color from normal due to misalignment	Refer to the standard of spots and lines.
4. End sealant over height, over width (min)		According to engineering spec.
5. Permeating resin (min)		Baffle: not overstep baffle No baffle: The resin exceed the C zone, reject.
6. seal line larger/smaller (min)	The width of the seal larger or smaller than the define.	1. Refer to the Spec. 2. A: the measurement value B: Spec. (or Value of sample) $ A-B /B \leq 1/3$
7. Rainbow (min)	Different color in one panel	In the viewing angle, if the rainbow is obvious, reject. If required strictly, sign and refer to the limited samples.
8. ITO lines appear	Design shows without voltage input	Reject (if required strictly, sign and refer to the limited samples.)
9. Dirty spot of ITO glass		A: outside seal expose, disregard B: inside seal epoxy, according to black spot



10. Polarizer attaching	Uncorrect Polarzerl (maj) Wrong polarizer type (maj)	Reject
	Attaching on the wrong face (maj)	Reject
	polarizer damage (min)	Not allow perforation of polarizer. Refer to the standard of spots and lines
	Polarizer slanting (min)	Polarizer should touch all the inner sealing side and not exceeding outside of the glass.

12.3. Standard For Spot、Line、Cutting Breaking Defect

ITEM	CONATION	Criteria				
1. Black/white spots(min)	 $\Phi=(a+b)/2$ Not allow 2 defects within 10 mm	Φ (mm)	$S \geq 50\text{cm}$		normal	
			A	B	A	B
		$\Phi \leq 0.10$	disregard	disregard	disregard	disregard
		$0.10 < \Phi \leq 0.15$	3	disregard	2	2
		$0.15 < \Phi \leq 0.20$	1	2	1	1
		$0.20 < \Phi \leq 0.25$	1	1	0	
$\Phi > 0.3$	0	0	0	0		
2. LCD side damage (min) X: Length Y: Width Z: Depth K: length of ITO pin T: Thickness of glass		$X \leq 2.0\text{mm}$ $Y \leq K1/3$ $Z \leq T$ ACC NO. ≤ 2 Products with pins disregard				
		$X \leq 2.0\text{mm}$ Y: not reach the seal line $Z \leq T$ ACC NO. ≤ 2				

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		$X \leq 2.0\text{mm}$ Y: not reach the seal line $Z \leq T$			
3. Corner damage(min)		X	Y	Z	
		3cm	$\leq K1/3$	$\leq T$	
		X: $\leq 2.0\text{mm}$ and not reach the common point Y: not allow common point appear outside. Z: $\leq T$			
4. Poor cutting		1. $D \leq 0.2\text{mm}$ and $D \leq K1/4$ 2. according to engineering diagram			
		According to engineering diagram			
		1. $D \leq 0.25$ and $D \leq K1/4$ 2. according to engineering diagram			
5. Linear defect		L (mm)	W (mm)	A	B
			$W \leq 0.02$	不计	不计
		$L \leq 3.0$	$W \leq 0.03$	1	2
		$L \leq 2.0$	$0.03 < W \leq 0.05$	1	2
		$L > 3.0$	$W \leq 0.03$	0	1
		$L > 2.0$	$0.03 < W \leq 0.05$	0	1



13.RELIABILITY

NO	Test Item		Description	Test Condition	Remark
1	Environmental Test	High Temperature Storage	Applying the high storage temperature Under normal humidity for a long time Check normal performance.	<30% RH 60°C 100H	
2		Low Temperature Storage	Applying the low storage temperature Under normal humidity for a long time Check normal performance.	-10°C 100H	
3		High Temperature Operation	Apply the electric stress (Voltage & current) under high temperature for a Long time.	<30% RH 50°C 100H	
4		Low Temperature Operation	Apply the electric stress under low Temperature for a long time	0°C 100H	
5		High Temperature/High Humidity storage	Apply high temperature and high Humidity storage for a long time	93%RH 40°C 100H	
6		Temperature Cycle	Apply the low and high temperature cycle -20°C<->25°C<->70°C<->25°C 30 mines 10 mines 30 mines 10mins ←-----→ 1 cycle Check normal performance	-10°C/60°C 10 cycle	
7	Mechanical Test	Vibration test (Package state)	Applying vibration to the product Check normal performance	Freq.: 10-55Hz Max. Acceleration: 5G 1Cycle time: 1 min Time X.Y.X. each direction For 15 mines.	
8		Shock Test (Package State)	Applying shock to the product Check normal performance	Drop them through 70cm height to strike horizontal plane	

Remark:

#1: Normal operations condition

- a. Power supply for LCD driver: 9.0V
- b. Power supply voltage for LCD system: Getting optimum contrast at 25°C

#2: Pay attention to keep dewdrops from the module during this test.



14、Precaution In Use Of LCD Panels & LCM

1. Storage

When long term storage is required, the following precautions are necessary.

- (1) Store them in a sealed polyethylene bag (Antistatic type), seal the opening, and store it where it is not subjected to direct sunshine, or to the light of a fluorescent lamp. If properly sealed, there is no need for desiccant.
- (2) Store them in the temperature range of 0°C-35°C and low humidity is recommended.

2. Precaution for handing LCD modules

LCD modules are assembled and adjusted with a high degree of precision, do not applying excessive shocks to it or making any alterations or modifications to it. The following precautions should be taken when handing.

- (1) Do not drop, bend or twist the module.
- (2) Do not alter or making any modification on the shape of the metal frame.
- (3) Do not change the shape, the pattern wiring or add any extra hole on the printed circuit board.
- (4) Do not modify or touch the zebra rubber strip (conductive rubber) with another object.
- (5) Do not change the positions of components on the PCB.

3. Precaution for soldering to LCD module

- (1) Soldering should apply to I/O terminals only.
- (2) Soldering temperature is $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$
- (3) Soldering time 3 to 4 seconds
- (4) Eutectic solder (rosin flux filled) should used.
- (5) If soldering flux is used, be sure to remove any remaining flux after finishing the soldering operation and LCD surface should be covered during soldering to prevent any damage due to flux spatters.
- (6) When removing the lead wires from the I/O terminals, use proper de-soldering methods e.g. suction type-disordering irons. Do not repeat wiring by soldering more than three times as the pads and plated through holes may be damaged.

4. Electro-static discharge control

Careful attention should be paid to control the electrostatic discharge of the modules, since LCD modules contain no. of COMS LSI.

- (1) Make sure you are grounded properly when removing LCD module from its antistatic bag. Be sure that the module and your body have the same electric potential.
- (2) Only properly grounded soldering iron should be used.
- (3) Modules should store in antistatic bag or other containers resistant to static after remove from its original package.
- (4) When using the electric screwdriver is used, make sure the screwdriver had been ground potentiality to minimize the transmission of EM waves produced by commutator sparks.

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(5) In order to reduce the generation of static electricity, a relative humidity of 50-60% is recommended.

5. Precaution for operation

- (1) Adjust liquid crystal driving voltage (V_o) to varies viewing angle and obtain the best contrast.
- (2) V_o should be kept in proper range stated in the specification. Excess voltage will shorten the LCD life.
- (3) Response time is greatly delayed at temperatures below the operating temperature range. It will recover when it returns to the specified temperature range.
- (4) If the display area is pushed hard during operation, the display will become abnormal. However, it will return off and then back on.
- (5) Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. Therefore it must be used under the relative condition of 50% RH.



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15、Assembly Diagram

