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1. Scope

This manual defines general provisions as well as inspection standards for standard LCD module supplied by Dalian Dongfu Color Display Co., Ltd.

If the event of unforeseen problem or unspecified items may occur, please contact the nearest supplier or our company.

2. Warranty

If module is not stored or used as specified in this manual, it will be void the 12- month warranty.

3. Features

3-1. Features

Display mode:	Transmissive and negative type FSTN LCD
Display color:	Display dots: Dark blue Background: White
Display format:	320(w)×240(h) full dots
Input data:	8-bit parallel data interface from controller
Multiplexing ratio:	1/240 Duty
Viewing direction:	6 O'clock
Backlight:	White

3-2. Mechanical features

Item	Specification	Unit
Outline dimensions	103.0(W)×80.8(H) ×14.0 Max.(T)	mm
Number of dots	320(W) ×240(H) Dots	—
Viewing area	81.05(W)×61.6(H)	mm
Image area	76.78(W)×57.58 (H)	mm
Dot pitch	0.24(W)×0.24(H)	mm
Dot size	0.22W)×0.22(H)	mm
Weight	-----	g

3-3. Absolute maximum ratings

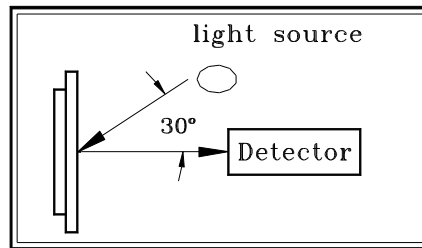
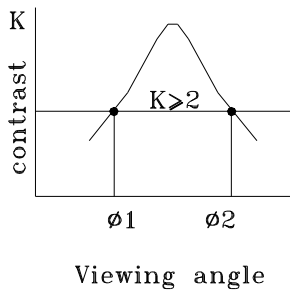
Item		Symbol	Min.	Max.	Unit	Note
Supply Voltage	Logic	Vdd	0	5.5	V	
	LCD drive	Vdd – Vee	0	22	V	
Input Voltage		Vi	-0.3	Vdd+0.3	V	
Operating Temperature		Top	0	60	°C	
Storage Temperature		Tstg	-20	75	°C	
Humidity		—	—	90	%RH	

3-4. Electro-optical Characteristics

Item	Symbol	Temp.	Conditions	Min.	Typ.	Max.	Unit	Note
LCD Driving Voltage (Recommended voltage)	Vop	0°C	$\phi = 0^\circ, \theta = 0^\circ$	—	—	—	V	1,2,5
		25°C		20.0	22.0	—		
		50°C		—	—	—		
Response Time	Rise Time	0°C	$\phi = 0^\circ, \theta = 0^\circ$	—	1500	2000	mS	1,3,5
		25°C		—	150	200		
	Decay Time	0°C		—	3000	3500		
		25°C		—	200	250		
Viewing angle	$\Delta \phi$	25°C	Vertical	-35	—	35	deg.	1,4,5
			Horizontal	-30	—	30		
Contrast Ratio	K	25°C	$\phi = 0^\circ, \theta = 0^\circ$	2.0	5.0	—	—	1,5,6

Note: <1> Definition of ϕ and θ

<2> Contrast ratio higher than 2 ($k \geq 2$) can be obtained in this voltage range.

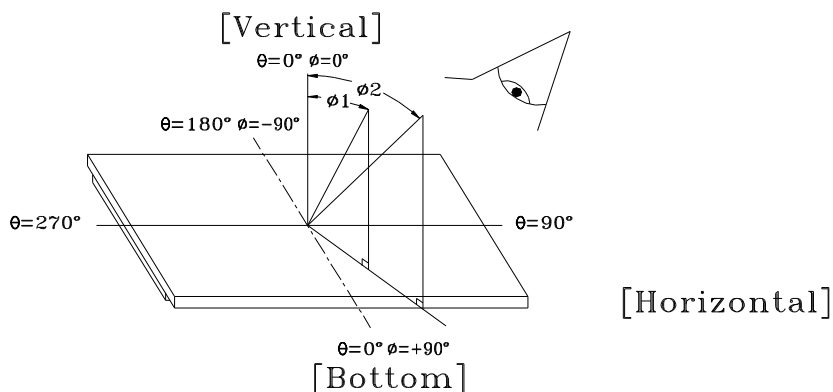


Measuring equipment: DMS
(Made in AUTRONIC)

Note: <3> Definition of response time waveform

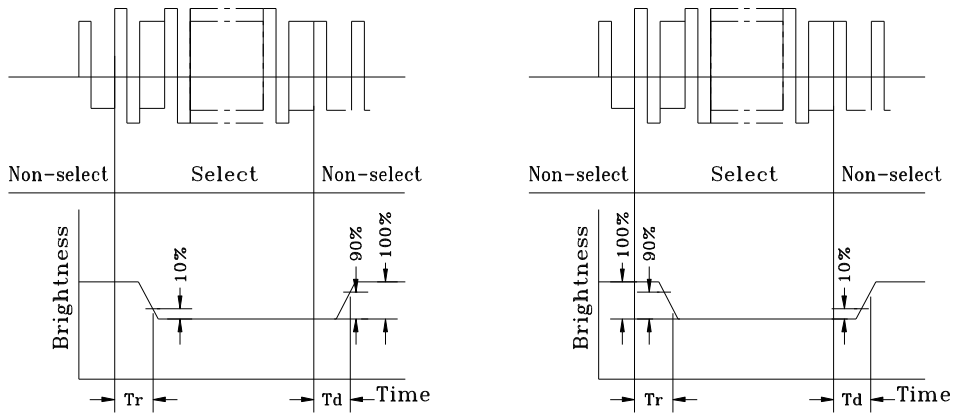
Positive Display

Negative Display



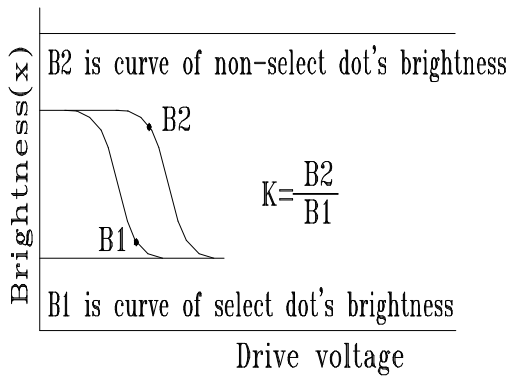
Note: <4> Definition of viewing angle
($\Delta \Phi$) $\Delta \Phi = |\Phi 1 - \Phi 2|$

Note: <5> Optical measuring system
temperature-regulated chamber

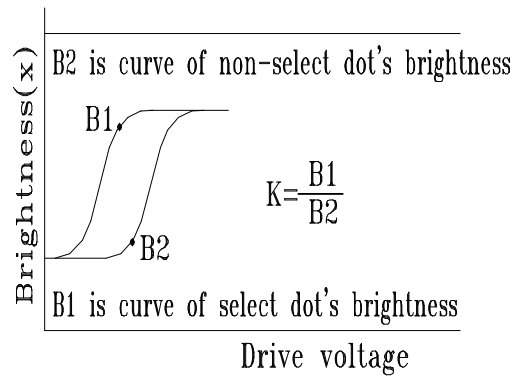


Note: <6> Definition of Contrast Ratio (K)

Positive Display



Negative Display

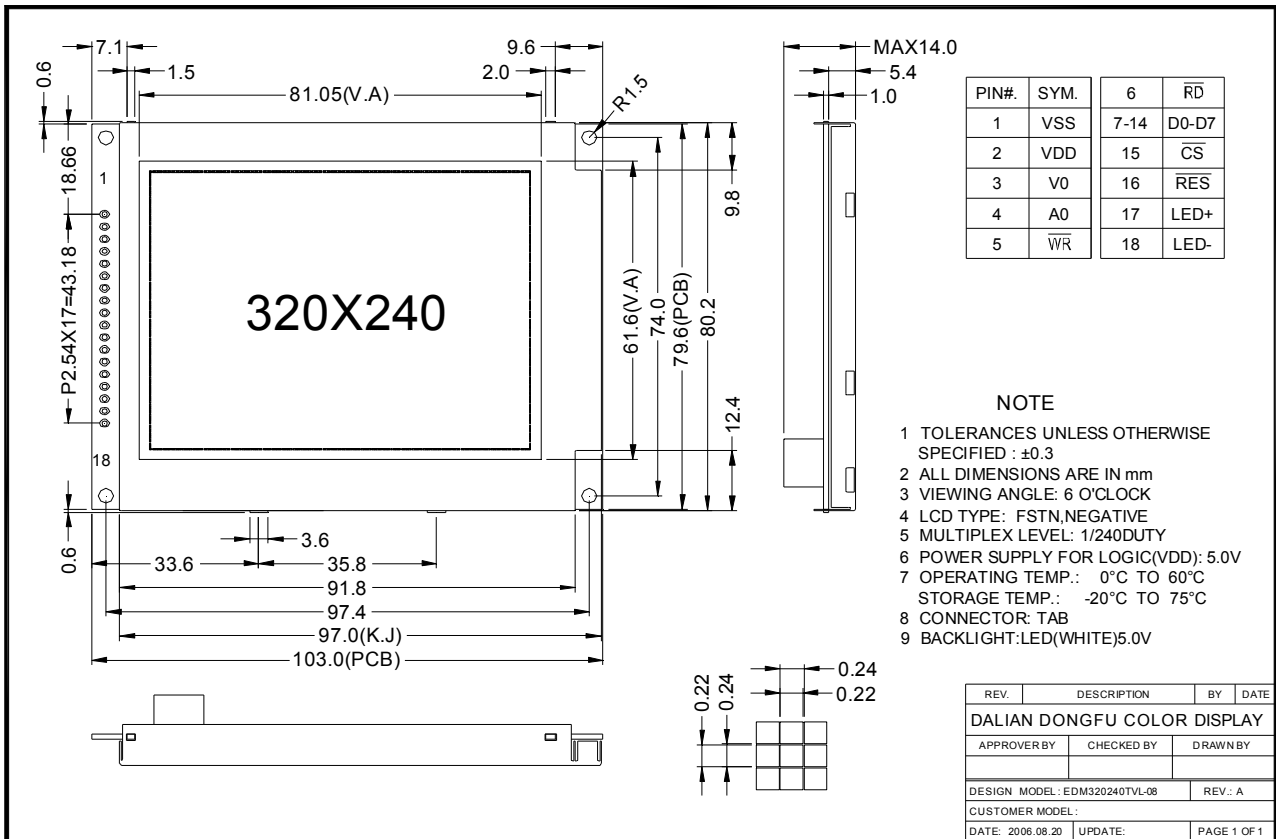


$$\text{Contrast Ratio (K)} = \frac{\text{Brightness of non-selected dot (B2)}}{\text{Brightness of selected dot (B1)}}$$

3-5. LED Backlight

Item	Unit	标准值			条件
		Min	Typ.	Max.	
Voltage	V	—	4.0	—	—
Luminance	cd/m ² (nit)	—	800	—	Vf=4.0V
Current	mA	100	120	140	Vf=4.0V
Color	—	White			—
Operating Temperature	°C	-30~ 70			—
Storage Temperature	°C	-40~ 85			—

4. Dimensional outline



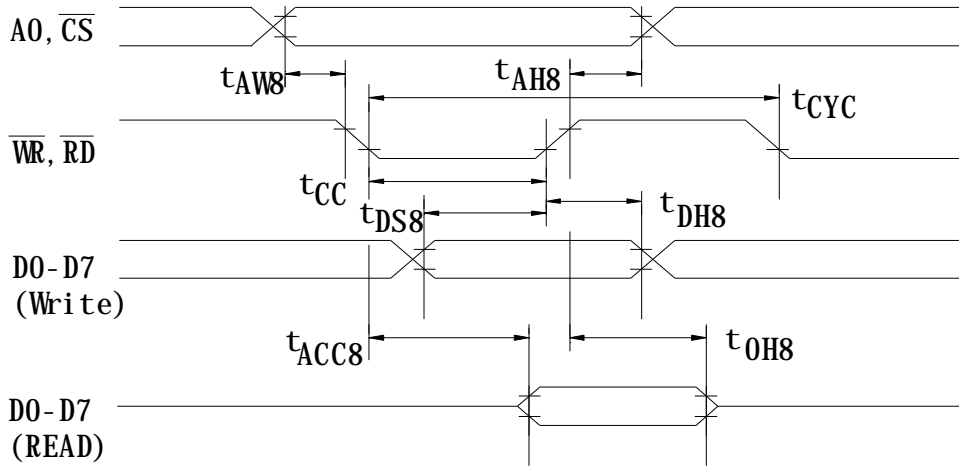
5. I/O Terminal

5-1. I/O interface

Pin No.	Symbol	Function
1	VSS	Ground (GND)
2	VDD	Power supply (+5.0V)
3	V0	Power supply for LCD driving
4	A0	Data type select
5	/WR	8080family:Write singal;6800family:R/Wsingal
6	/RD	8080family:Read singal;6800family:Enable clock(E)
7-14	D0-D7	Data bus
15	/CS	Chip select
16	/RES	Reset
17	LED+	BACKLIGHT
18	LED-	BACKLIGHT

5-2. SED1335 Timing Diagrams

5-5-1. 8080 family interface timing



$V_{DD}=5V \pm 10\%$, $T_a=-20$ to 75 deg.C

Signal	Symbol	Parameter	min	max	Unit	Condition
A0,/CS	t_{AH8}	Address hold time	10	-	ns	CL=100pF
	t_{AW8}	Address setup time	0	-	ns	
/WR,/RD	t_{CYC}	System cycle time	SEE NOTE	-	ns	
	t_{CC}	Strobe pulsewidth	120	-	ns	
D0-D7	t_{DS8}	Data setup time	120	-	ns	
	t_{DH8}	Data hold time	5	-	ns	
	t_{ACC8}	/RD access time	-	50	ns	
	t_{OH8}	Output disable time	10	50	ns	

NOTE:

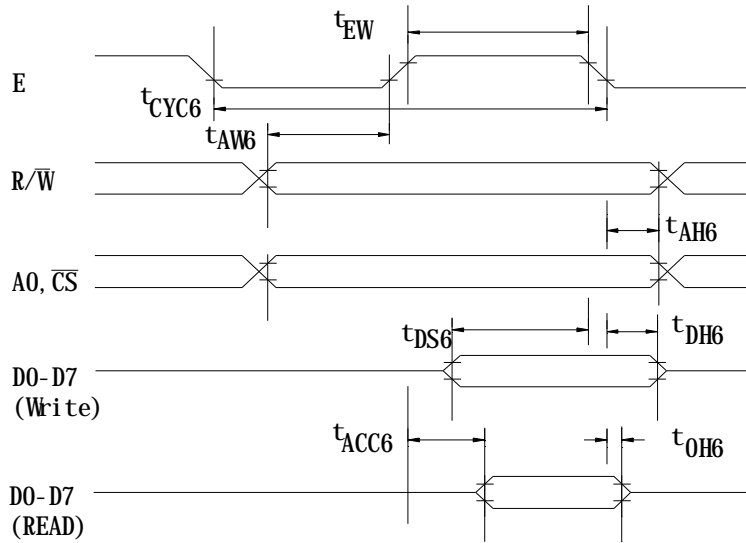
For memory control and system control commands :

$$t_{CYC8}=2t_C+t_{CC}+t_{CEA}+75>t_{ACV}+245$$

For all other commands:

$$t_{CYC8}=4t_C+t_{CC}+30$$

5-2-2. 6800 family interface timing



NOTE:

t_{CYC6} 表示 CS 变低和 E 变高的间隔时间.

$V_{DD}=5V \pm 10\%$, $T_a=-20$ to 75 deg.C

$V_{DD}=5V \pm 10\%$, $T_a=-20$ to 75 deg.C

Signal	Symbol	Parameter	min	max	Unit	Condition
A0/ \bar{CS} , R/ \bar{W}	t_{CYC6}	System cycle time	SEE NOTE	-	ns	CL=100pF
	t_{AW6}	Address setup time	0	10	ns	
	t_{AH6}	Address hold time	0	0		
E	t_{EW}	Enable pulsewidth	120	-	ns	
D0-D7	t_{DS6}	Data setup time	100	-	ns	
	t_{DH6}	Data hold time	0	50	ns	
	t_{ACC6}	/RD access time	10	85	ns	
	t_{OH6}	Output disable time	10	-	ns	

NOTE:

For memory control and system control commands :

$$t_{CYC6}=2t_C+t_{EW}+t_{CEA}+75>t_{ACV}+245$$

For all other commands:

$$t_{CYC6}=4t_C+t_{EW}+30$$

6. Handling precautions

6-1. Mounting method

A panel of LCD module made by Dalian Dongfu Color Display Co., Ltd. consists of two thin glass plates with polarizers that easily get damaged.

And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board (PCB), extreme care should be used when handling the LCD modules.

6-2. Cautions of LCD handling and cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- .. Isopropyl alcohol
- .. Ethyl alcohol
- .. Trichlorotrifluoroethane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- .. Water
- .. Ketene
- .. Aromatics

6-3. Caution against static charge

The LCD module uses C-MOS LSI drivers. So we recommend you:

Connect any unused input terminal to V_{dd} or V_{ss} . Do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

6-4. Packaging

- Module employs LCD elements, and must be treated as such.
Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity.

6-5. Caution for operation

- It is an indispensable condition to drive LCD module within the limits of the specified voltage since the higher voltage over the limits may cause the shorter life of LCD module.
An electrochemical reaction due to DC (direct current) causes LCD undesirable deterioration so that the uses of DC (direct current) drive should be avoided.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD module may show dark color in them. However those phenomena do not mean malfunction or out of order of LCD module, which will come back in the specified operating temperature.

6-6. Storage

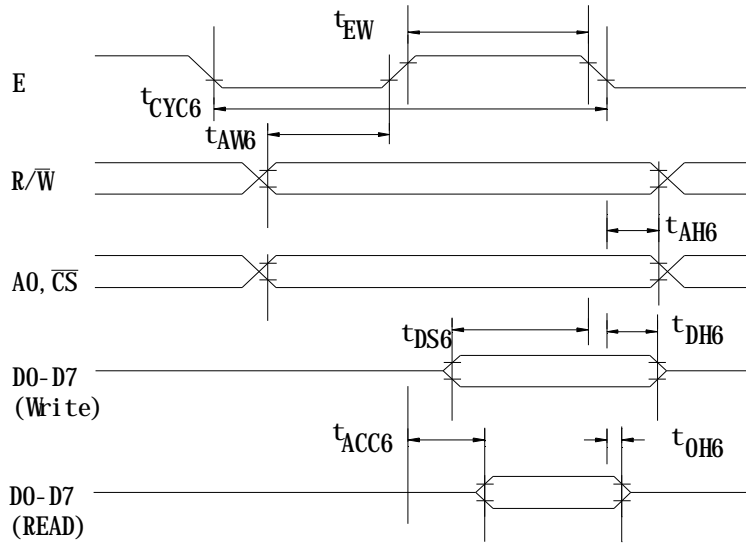
In the case of storing for a long period of time, the following ways are recommended:

- Storage in polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with not desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping the storage temperature range.
- Storing with no touch on polarizer surface by any thing else.

6-7. Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and to wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.

5-2-2. 6800 family interface timing



NOTE:

t_{CYC6} 表示 CS 变低和 E 变高的间隔时间.

$V_{DD}=5V \pm 10\%$, $T_a=-20$ to 75 deg.C

$V_{DD}=5V \pm 10\%$, $T_a=-20$ to 75 deg.C

Signal	Symbol	Parameter	min	max	Unit	Condition
A0/ \bar{CS} , R/ \bar{W}	t_{CYC6}	System cycle time	SEE NOTE	-	ns	CL=100pF
	t_{AW6}	Address setup time	0	10	ns	
	t_{AH6}	Address hold time	0	0		
E	t_{EW}	Enable pulsewidth	120	-	ns	
D0-D7	t_{DS6}	Data setup time	100	-	ns	
	t_{DH6}	Data hold time	0	50	ns	
	t_{ACC6}	/RD access time	10	85	ns	
	t_{OH6}	Output disable time	10	-	ns	

NOTE:

For memory control and system control commands :

$$t_{CYC6}=2t_C+t_{EW}+t_{CEA}+75>t_{ACV}+245$$

For all other commands:

$$t_{CYC6}=4t_C+t_{EW}+30$$

1. APPLICABLE SCOPE

This document defines the performance, quality and reliability standard of a Liquid Crystal Module (LCM).

2. QUALITY ASSURANCE

We can offer the quality assurance for 1 year under the right condition of operating and storage.

3. INSPECTION CONDITION

3.1 outside vision inspection

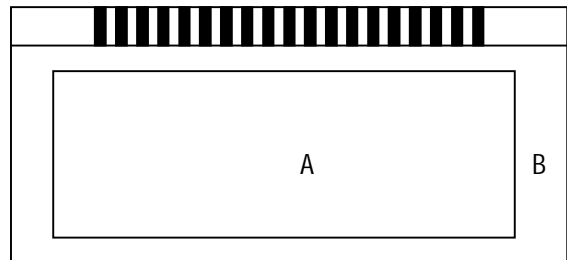
Under two 20W fluorescent lamps or a 40W one, There is a Distance about 30 cm between the eyes and the LCM panel.

3.2 definition of area

A area: visible domain

B area: invisible domain

Basic principle: If the defects in B area and which doesn't influence the assembling are acceptable. When the user doesn't accept the criteria, we can consult then we will reach an acceptable criteria. We must add new items when necessary.



4. QUALITY LEVEL:

It shall be based on MIL-STD-105D, inspections by single sampling.

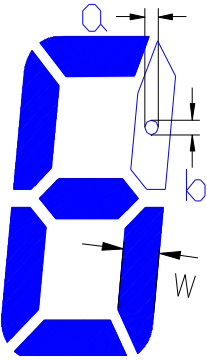
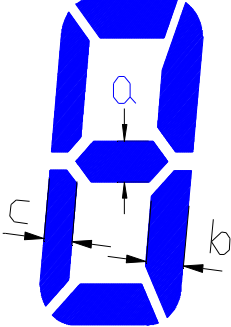
Fatal defect (AQL)	Slight defect (AQL)	Total (AQL)
0.65 %	1.5 %	1.5 %

5. TEST STANDARD

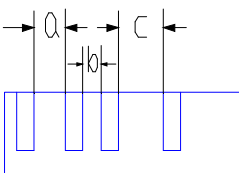
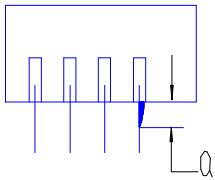
All the data's units below are millimeter(mm).

5.1 LCD(visible domain)

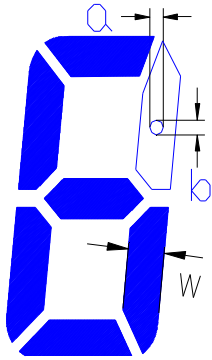
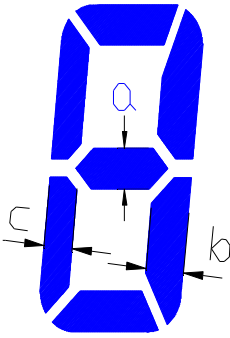
User's Manual

No.	Defect	Classification	Standard/Acceptable quantity	Defect class
1	Electric performance		$\phi = (\text{length} + \text{width}) / 2$	
1.1	None or partial display due to pinholes or short		Not allowable	fatal
1.2	Creepage		Not allowable	fatal
1.3	Partial missing Due to pinholes, disconnected or wrong orientation		$\phi \leq 0.1$ ok. $\phi = \text{MAX } 0.2$ $a \leq w/3$, $b \leq w/3$ acceptable: 2 pcs. /cell	slight
1.4	The lines are not well proportioned		a : standard width $b \leq 4a/3$ $c \geq 2a/3$	slight
2	Internal defect			
2.1	Black or white spots due to air bubbles, foreign objects or wrong orientation in glass or polarizer.	$\phi \leq 0.1$ $0.1 < \phi \leq 0.2$ $0.2 < \phi \leq 0.25$ $0.25 < \phi$ total defects:	Ok. 3 2 0 3	slight
	Density of black or white spots	$\phi \leq 0.1$ $\phi > 0.1$	Ok Far from 1.0	
2.2	Black or white lines due to air bubbles foreign objects or wrong orientation in glass or polarizer.	$w \leq 0.01$ $0.01 < w \leq 0.03$ $0.03 < w \leq 0.05$ $0.05 < w$	Ok. $L \leq 3.0$ (2) $L \leq 2.0$ (2) According to 2.1	slight

User's Manual

No.	Defect	Classification	Standard/Acceptable quantity	Defect class
3	pol arizer			
3.1	defects on the polarizer (protecting film is excluded)	$\phi \leq 0.1$ $0.1 < \phi \leq 0.25$ $0.25 < \phi$	0k 2 0	slight
		$w \leq 0.01$ $0.01 < w \leq 0.03$ $0.03 < w \leq 0.05$ $0.05 < w$	0k. $L \leq 3.0$ (2 place) $L \leq 2.0$ (2 place) According to 4.1	
3.2	Bubble between glass and polarizer	$\phi \leq 0.15$ $0.15 < \phi \leq 0.3$ $0.3 < \phi \leq 0.5$ $0.5 < \phi$	0k 2 1 0	slight
3.3	Polarizer is turned up or desquamate		Not allowable	slight
3.4	Stained polarizer		Not allowable	slight
3.5	Stained protect film		0k	slight
4	Pin and pin glue			
4.1	Pin broken		Not allowable	fatal
4.2	Pin rusted		Not allowable	fatal
4.3	Insert error of pin		a: regular dimension $b \geq a/2$ $c \leq 3a/2$	slight
4.4	Pin glue flow out		$a \leq 1.5$	slight
4.5	Pin glue excessive		Not over the protecting film	slight
4.6	Bubble in pin glue		0k	slight

User's Manual

No.	Defect	Classification	Standard/Acceptable quantity	Defect class
1	Electric performance		$\phi = (\text{length} + \text{width}) / 2$	
1.1	None or partial display due to pinholes or short		Not allowable	fatal
1.2	Creepage		Not allowable	fatal
1.3	Partial missing Due to pinholes, disconnected or wrong orientation		$\phi \leq 0.1$ ok. $\phi = \text{MAX } 0.2$ $a \leq w/3$, $b \leq w/3$ acceptable: 2 pcs. /cell	slight
1.4	The lines are not well proportioned		a : standard width $b \leq 4a/3$ $c \geq 2a/3$	slight
2	Internal defect			
2.1	Black or white spots due to air bubbles, foreign objects or wrong orientation in glass or polarizer.	$\phi \leq 0.1$ $0.1 < \phi \leq 0.2$ $0.2 < \phi \leq 0.25$ $0.25 < \phi$ total defects:	Ok. 3 2 0 3	slight
	Density of black or white spots	$\phi \leq 0.1$ $\phi > 0.1$	Ok Far from 1.0	
2.2	Black or white lines due to air bubbles foreign objects or wrong orientation in glass or polarizer.	$w \leq 0.01$ $0.01 < w \leq 0.03$ $0.03 < w \leq 0.05$ $0.05 < w$	Ok. $L \leq 3.0$ (2) $L \leq 2.0$ (2) According to 2.1	slight

User's Manual

No.	Defect	Standard	Slight defect/Acceptable quantity	Fatal defect
8	Spot	1. $\phi < 0.1$ 2. $1.0 < \phi < 4.0$ 3. $\phi > 5.0$	≤ 6 ≤ 3 ≤ 1 (The space between the two dots is not less than 5)	
9	The feet of the frame distort.	The distorted feet scrape the copper foil >2	≤ 1	

5.4 Zebra

No.	Defect	Standard	Slight defect/Acceptable quantity	Fatal defect
1	The zebra extrudes from the frame.			The zebra extrudes from the frame.
2	The zebra is deflected		The zebra is deflected	

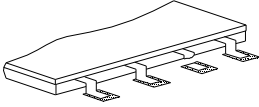
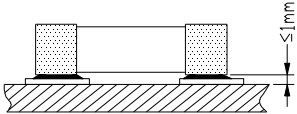
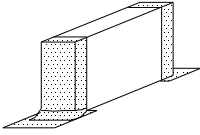
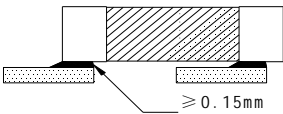
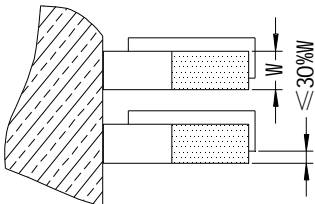
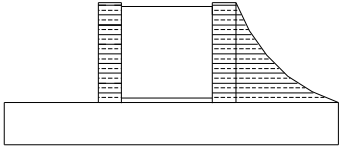
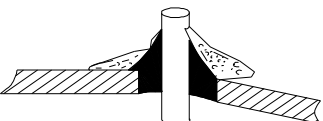
5.5 Heat Seal

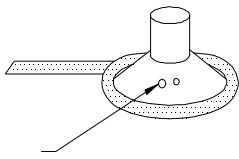
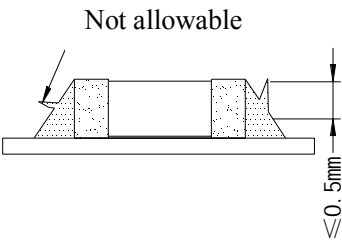
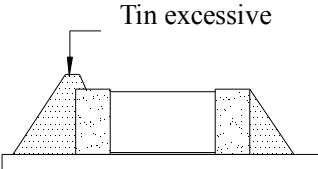
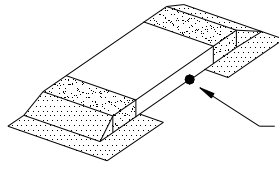
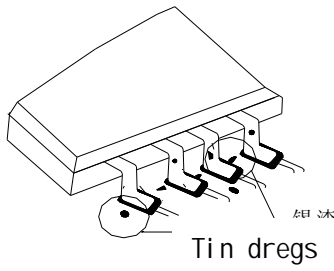
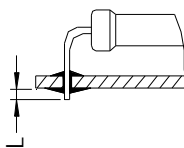
No.	Defect	Standard	Slight defect/Acceptable quantity	Fatal defect
1	Heat Seal extrudes from the frame.		Heat Seal extrudes from the frame	
2	Heat press badly		The interface between the heat seal and PCB's gold finger < 2/3 of gold finger	

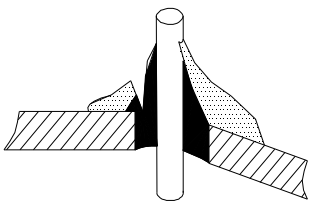
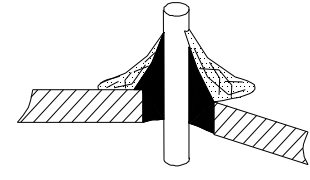
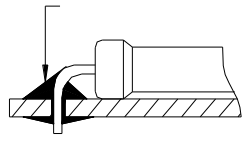
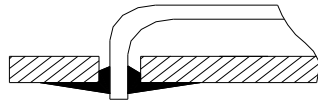
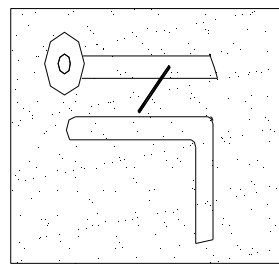
5.6 PCB-COB part

No.	Defect	Standard	Slight defect/Acceptable quantity	Fatal defect
1	IC's mark is wrong		IC's mark is wrong	
2	The height of the COB's glue		The exterior of the IC leaks	
3	COB pinhole			Pinhole
4	COB bares the aluminium line		Baring the aluminium line	
5	Gold feet leak.		Gold feet leak	
6	The appearance of the COB's glue is repaired			The appearance of the COB's glue is repaired

5.7 PCB-SMT part

No.	Defect	Standard	Illustration	Defect class	Inspection method
1	SMT damage	The appearance of IC is damaged slightly, but it's character is good. This is ok. But if the feet of the IC break or fall off, this is not allowable.		fatal	eyeballing
2	SMT turn up	The height between the component and weld ≤ 1		fatal	vernier caliper
3	Arises	The component should be put on face, and can't be put on side		fatal	eyeballing
4	Component's vertical excursion	The surface of the PAD $\geq 75\%$ of the weld's width		fatal	eyeballing
5	Component's horizontal excursion	The part of component's feet overstepping the PAD $\leq 30\%$ of the width of the PAD		fatal	eyeballing
6	SMT not be welded	The soldered should been weld but doesn't been weld. this is not allowable		fatal	eyeballing
7	Not good of soldered	The surface of the soldering tin is rough, and it is not hard if it been peeled lightly. This is not allowable.		fatal	thin needle

No.	Defect	Standard	Illustration	Defect class	Inspection method
8	Tin hole	Tin hole $\leq 1/4$ of tin surface		fatal	eyeballing
9	Tin tine	The tine which is over or under tin surface more than 0.5 level is not allowable.		fatal	eyeballing
10	SMT tin quantity	Soldering tin should not overstep the component's weld so that the contour between the component and the PAD can't be distinguished.		slight	eyeballing
11	Tin bead	The diameter of the tin bead ≤ 0.15 , and one side should not have more than two tin beads.		fatal	eyeballing
12	Tin dregs	Not allowable.		fatal	eyeballing
13	Component's pin	$1 \leq$ the length of the pin which come out the weld ≤ 1.5		slight	ruler

No.	Defect	Standard	Illustration	Defect class	Inspection method
14	Crack tin	The weld of the component's feet cracks.		fatal	eyeballing
15	Crinkle tin	The weld is chapped.		fatal	eyeballing
16	DIP's tin is excessive	The pin of the component absorbs the tin much more so that the tin overstep the bend of the feet.		slight	eyeballing
17	The pad lacks tin	The immersed quantity of the tin should be over 3/4 of the weld hole		slight	eyeballing
18	Scrape	①The scrape which is 10 × 0.3 on the component surface allow 1 pieces, and which is 10×0.3 on the weld surface allow 2 pieces. ②The circuitry should not have any scrapes.		slight	eyeballing
19	Repair line	One PCB allow repairing five lines. And only one area is not been enveloped, it's length must be less than 7 .		fatal	eyeballing、vernier caliper