

Crystalfontz America, Inc.

LCD MODULE SPECIFICATIONS

Crystalfontz Model Number	CFAG12864E-WGH-TN
Hardware Version	
Data Sheet Version:	<i>Preliminary Draft</i> November 2006
Product Pages	
Customer Name	

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1. Module Classification Information

□□ **CFA G 1 2 8 6 4 E** □ **W G H** □ **T***

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①	Brand: CRYSTALFONTZ AMERICA, INCORPORATED		
②	Display Type: H→Character Type, G→Graphic Type , X→TAB		
③	Display's Logical Dimensions: 128 pixels by 64 pixels		
④	Model Serial No. E		
⑤	Backlight Type:	N→Without backlight B→EL, Blue green D→EL, Green W→EL, White F→CCFL, White Y→LED, Yellow Green	A→LED, Amber R→LED, Red O→LED, Orange G→LED, Green
⑥	LCD Mode:	B→TN Positive, Gray N→TN Negative, G→STN Positive, Gray Y→STN Positive, Yellow Green M→STN Negative, Blue F→FSTN Positive	T→FSTN Negative
⑦	LCD Polarizer Type/ Temperature range/ View direction	A→Reflective, N.T, 6:00 D→Reflective, N.T, 12:00 G→Reflective, W. T, 6:00 J→Reflective, W. T, 12:00 B→Transflective, N.T,6:00 E→Transflective, N.T.12:00	H→Transflective, W.T,6:00 K→Transflective, W.T,12:00 C→Transmissive, N.T,6:00 F→Transmissive, N.T,12:00 I→Transmissive, W. T, 6:00 L→Transmissive, W.T,12:00
⑧	Special Code:	T→Temperature compensation on board *→ May have additional manufacturer's codes at this location	

2. Precautions

1. Avoid applying excessive shocks to the module or making any alterations or modifications to it.
2. Don't make extra holes on the printed circuit board, modify its shape or change the components of LCD Module.
3. Don't disassemble the LCM.
4. Don't operate it above the absolute maximum rating.
5. Don't drop, bend or twist LCM.
6. Solder only to the I/O terminals.
7. Please store in anti-static electricity container and clean environment.

3. General Specifications

ITEM	SPECIFICATION	UNIT
Number of dots	128 ×64 + 4 Icon	dots
Module dimension	54.0(W) ×50.0(H) ×7.5 max(T)	mm
View area	43.5(W) ×29.0(H)	mm
Active area	40.92(W) ×26.92(H)	mm
Dot size	0.28(W) ×0.35(H)	mm
Dot pitch	0.32(W) ×0.39(H)	mm
LCD type	STN Positive, Gray Transflective	
View direction	6 o'clock	
Backlight	EL (white)	

4. Absolute Maximum Ratings

ITEM	SYMBOL	MINIMUM	TYP.	MAXIMUM	UNIT
Operating Temperature	TOP	-20°C		+70°C	°C
Storage Temperature	TST	-30°C		+80°C	°C
Input Voltage	VI	0		VDD	V
Supply Voltage For Logic	VDD	0		6.7	V
Supply Voltage For LCD	VDD-VLCD	0		17	V

5. Electrical Characteristics

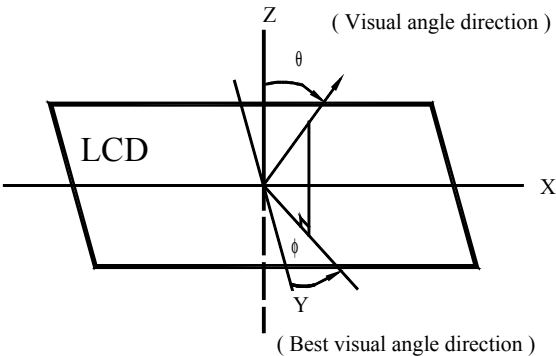
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage For Logic	VDD-VSS	□	4.5	5.0	5.5	V
Supply Voltage For LCD	VDD-V0	Ta=-20°C			9.9	V
		Ta=25°C		8.4		V
		Ta=+70°C	6.8			V
Input High Vol	VIH		2.0		VDD	V
Input Low Vol	VIL		0		0.8	V
Output High Vol	VOH		2.4		VDD	V
Output Low Vol.	VOL		0		0.4	V
Power Supply Current	IDD (EL OFF)			10.0		mA
Power Supply Current	IDD (EL ON)			40.0		mA

6. Optical Characteristics

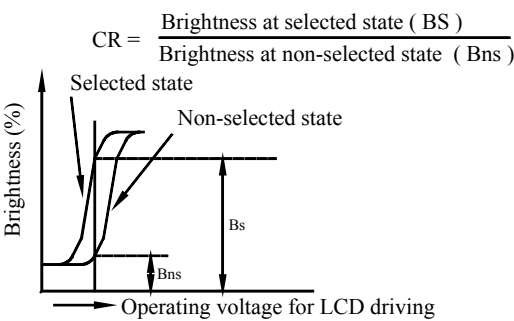
ITEM	SYMBOL	CONDITION	MININUM	TYP	MAXIMUM	UNIT
View Angle						
	(H)φ	CR≥2	-30		30	deg.
Contrast Ratio	CR	□		3		□
Response Time						
	T fall	□		265	400	ms

Optical Definitions

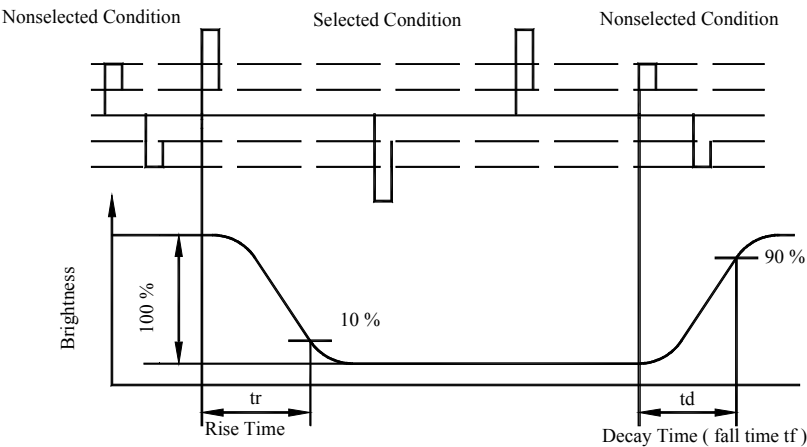
View Angles



Contrast Ratio



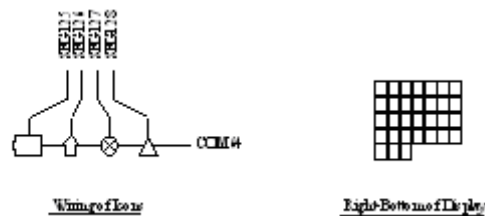
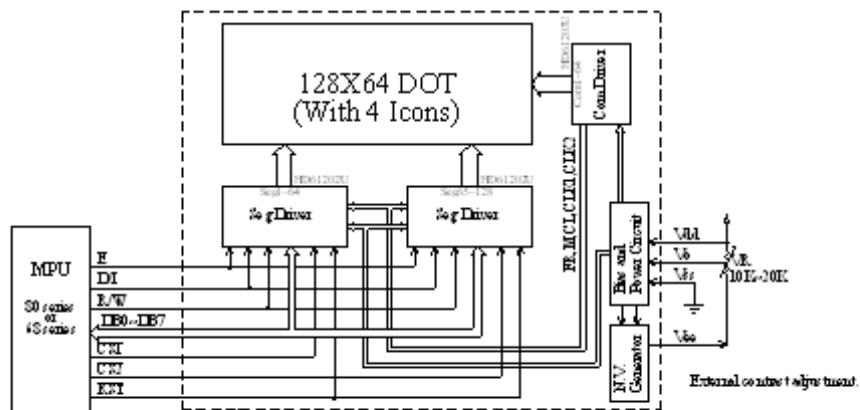
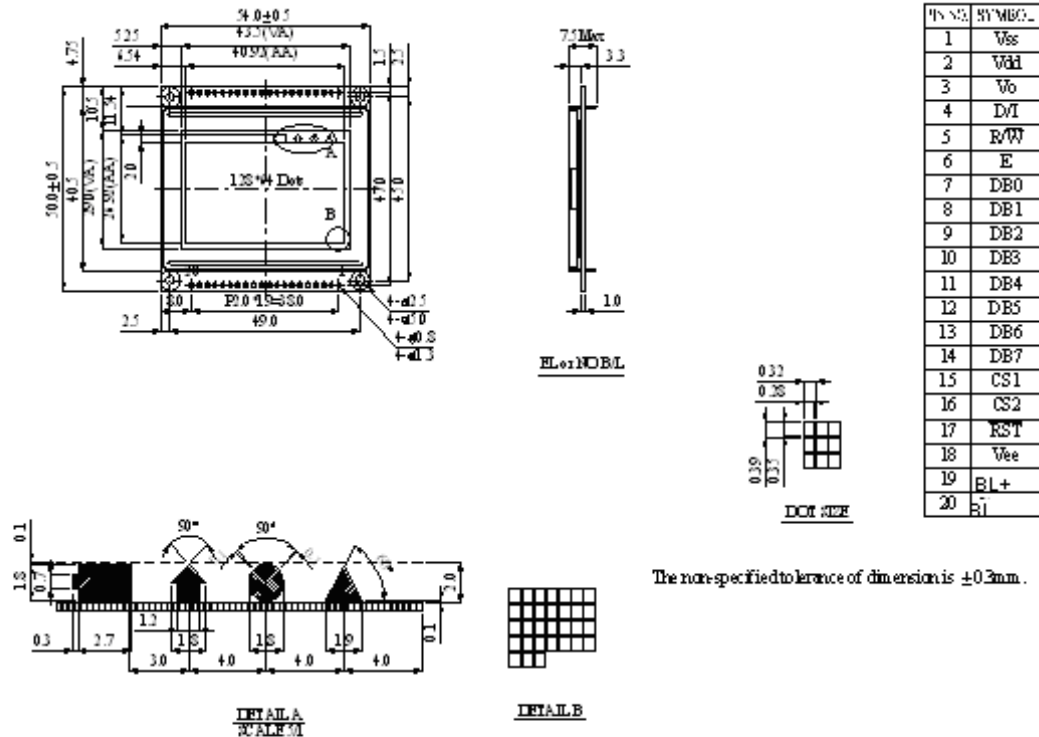
Response Time



7. Interface Pin Function

Pin	Symbol	Level	Description
1	GND	0V	Ground
2	VDD	2.8~5.5V	Supply voltage for logic
3	VO	(Variable)	Operating voltage for LCD
4	D/I	H/L	H: Data , L: Instruction
5	R/W	H/L	H: Read(MPU←Module) , L :Write(MPU→Module)
6	E	H	Enable signal
7	DB0	H/L	Data bus line
8	DB1	H/L	Data bus line
9	DB2	H/L	Data bus line
10	DB3	H/L	Data bus line
11	DB4	H/L	Data bus line
12	DB5	H/L	Data bus line
13	DB6	H/L	Data bus line
14	DB7	H/L	Data bus line
15	CS1	H	Chip Enable (Select Column 1 ~ Column 64)
16	CS2	H	Chip Enable (Select Column 65 ~ Column 128)
17	RST	L	Reset signal
18	VEE		Negative Voltage
19	BL+	□	Enable (on/off) for EL B/L
20	BL-	□	No connection

8. Contour Drawing & Block Diagram



9. Function Description

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	1	1	1	D

The display data appears when D is 1 and disappears when D is 0. Though the data is not on the screen with D=0, it remains in the display data RAM. Therefore, you can make it appear by changing D=0 into D=1.

SET ADDRESS (Y ADDRESS)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0

Y address (AC0-AC5) of the display data RAM is set in the Y address counter. An address is set by instruction and increased by 1 automatically by read or write operations of display data.

SET PAGE (X ADDRESS)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	0	1	1	1	AC2	AC1	AC0

X address (AC0-AC2) of the display data RAM is set in the X address register. Writing or reading to or from MPU is executed in this specified page until the next page is set.

DISPLAY START LINE (Z ADDRESS)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	1	AC5	AC4	AC3	AC2	AC1	AC0

Z address (AC0-AC5) of the display data RAM is set in the display start line register and displayed at the top of the screen. When the display duty cycle is 1/64 or others (1/32-1/64), the data of total line number of LCD screen, from the line specified by display start line instruction, is displayed.

STATUS READ

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	1	BUSY	0	ON/OFF	RESET	0	0	0	0

BUSY

When BUSY is 1, the Chip is executing internal operation and no instructions are accepted.

When BUSY is 0, the Chip is ready to accept any instructions.

ON/OFF

When ON/OFF is 1, the display is OFF.

When ON/OFF is 0, the display is ON.

RESET

When RESET is 1, the system is being initialized.

In this condition, no instructions except status read can be accepted.

When RESET is 0, initializing has finished and the system is in usual operation condition.

WRITE DISPLAY DATA

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	0	D7	D6	D5	D4	D3	D2	D1	D0

Writes data (D0-D7) into the display data RAM. After writing instruction, Y address is increased by

1 automatically.

READ DISPLAY DATA

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	1	D7	D6	D5	D4	D3	D2	D1	D0

Reads data (D0-D7) from the display data RAM. After reading instruction, Y address is increased by 1 automatically.

10. Display Control Instruction

The display control instructions control the internal state of the NT7108. Instruction is received from MPU to NT7108 for the display control. The following table shows various instructions.

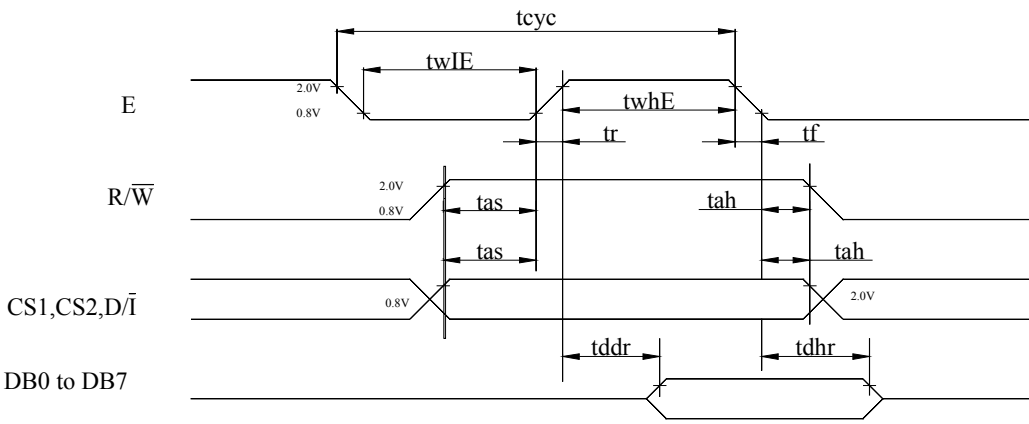
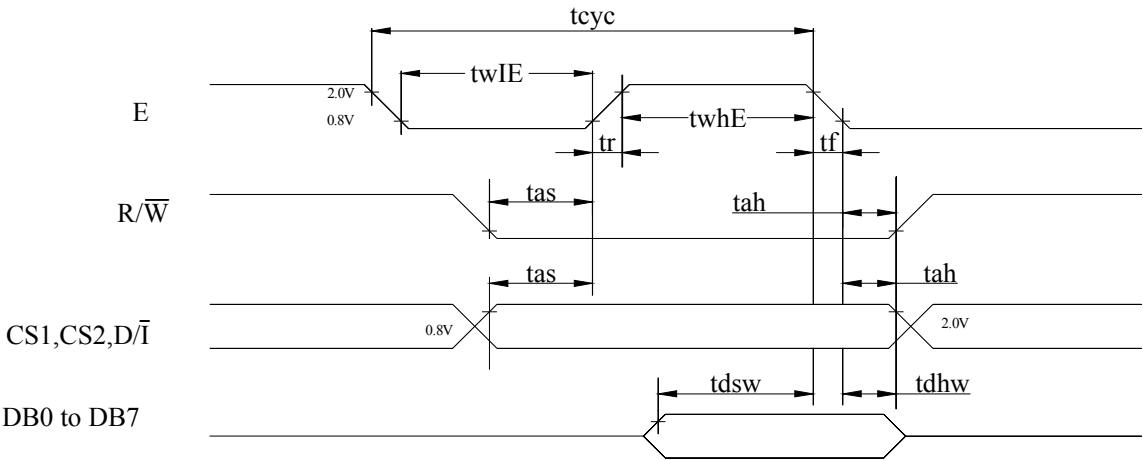
Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
Display on/off	L	L	L	L	H	H	H	H	H	L/H	Controls the display on or off. Internal status and display RAM data is not affected. L:OFF, H:ON
Set address (Y address)	L	L	L	H	Y address (0-63)						Sets the Y address in the Y address counter.
Set page (X address)	L	L	H	L	H	H	H	Page (0-7)			Sets the X address at the X address register.
Display Start line (Z address)	L	L	H	H	Display start line (0-63)						Indicates the display data RAM displayed at the top of the screen.
Status read	L	H	Busy	L	On/Off	Reset	L	L	L	L	Read status. BUSY L: Ready H: In operation ON/OFF L: Display ON H: Display OFF RESET L: Normal H: Reset
Write display data	H	L	Write data								Writes data (DB0: 7) into display data RAM. After writing instruction, Y address is increased by 1 automatically.
Read display data	H	H	Read data								Reads data (DB0: 7) from display data RAM to the data bus.

11. Timing Characteristics

MPU Interface

Characteristic	Symbol	Min	Typ	Max	Unit
E cycle	tcyc	1000			ns
E high level width	twhE	450			ns
E low level width	twlE	450			ns
E rise time	tr			25	ns
E fall time	tf			25	ns
Address set-up time	tas	140			ns
Address hold time	tah	10			ns
Data set-up time	tdsw	200			ns
Data delay time	tddr			320	ns
Data hold time (write)	tdhw	10			ns
Data hold time (read)	tdhr	20			ns

MPU Write Timing



MPU Read Timing

12. RELIABILITY

Content of Reliability Test (wide temperature, -20~70℃)

Environmental Test			
Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80°C 200hrs	2
Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-30°C 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70°C 200hrs	—
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20°C 200hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60℃,90%RH max For 96hrs under no-load condition excluding the polarizer, Then taking it out and drying it at normal temperature.	60°C,90%RH 96hrs	1,2
Thermal shock resistance	The sample should be allowed stand the following 10 cycles of operation -20℃ 25℃ 70℃ 30min 5min 30min 1 cycle	-20°C/70°C 10 cycles	—
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	3
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=800V,RS=1.5kΩ CS=100pF 1 time	—

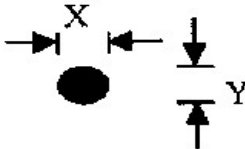
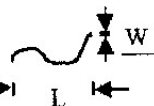
Reliability Test Notes

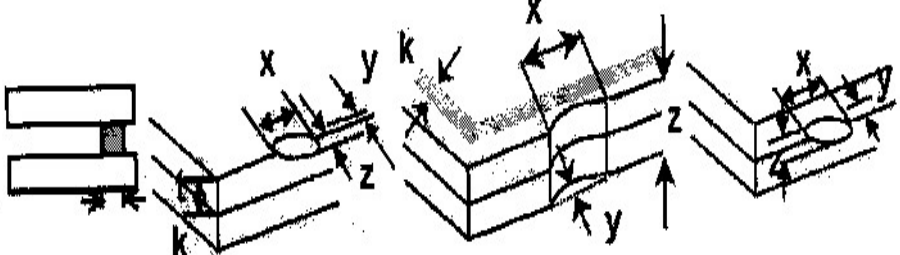
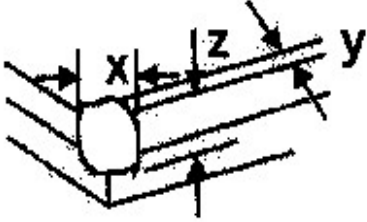
1. No dew condensation to be observed.
2. The function test shall be conducted after 4 hours storage at the normal
3. Temperature and humidity after remove from the test chamber.
4. Vibration test will be conducted to the product itself without putting it in a container.

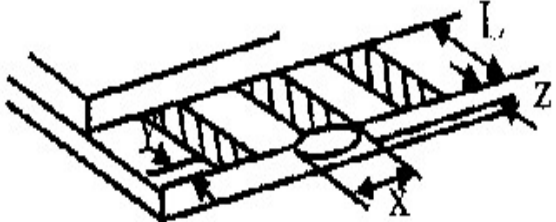
13. Backlight Information

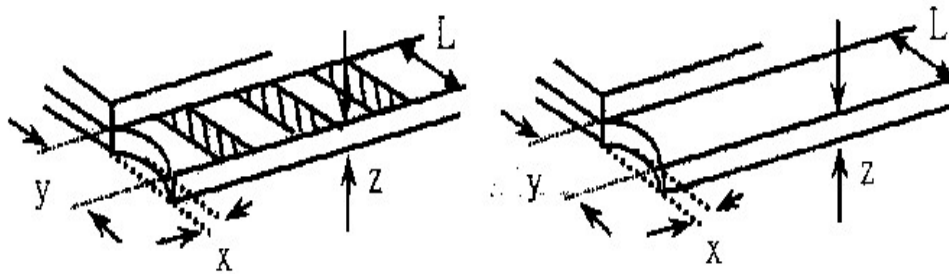
PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	TEST CONDITION
Drive Voltage	Vmax	75	—	85	Vrms	25°C
Drive Wave	Fmax	300	—	1000	Hz	25°C
Brightness		25	□	□	cd/m2	75~85Vrms/300~400Hz
Power Consumption		□	31.5	□	mW	75~85Vrms/300~400Hz
Chromatism	X	□	0.330	□	□	75~85Vrms/300~400Hz
	Y	□	0.365	□	□	75~85Vrms/300~400Hz
Life time		5000			hour	75~85Vrms/300~400Hz
Color		White			□	□

14. Inspection Specifications

NO	Item	Criterion	AQL												
01	Electrical Testing	Missing vertical, horizontal segment, segment contrast defect. Missing character , dot or icon. Display malfunction. No function or no display. Current consumption exceeds product specifications. LCD viewing angle defect. Mixed product types. Contrast defect.	0.65												
02	Black or white spots on LCD (display only)	2.1 White and black spots on display $\square 0.25\text{mm}$, no more than three white or black spots present. 2.2 Densely spaced: No more than two spots or lines within 3mm	2.5												
03	LCD black spots, white spots, contamination (non-display)	<table><thead><tr><th>SIZE</th><th>Acceptable Q TY</th></tr></thead><tbody><tr><td>$\Phi \square 0.10$</td><td>Accept no dense</td></tr><tr><td>$0.10 \square \Phi \square 0.20$</td><td>2</td></tr><tr><td>$0.20 \square \Phi \square 0.25$</td><td>1</td></tr><tr><td>$0.25 \square \Phi$</td><td>0</td></tr></tbody></table> 3.1 Round type : As following drawing $\Phi = (x + y) / 2$ 	SIZE	Acceptable Q TY	$\Phi \square 0.10$	Accept no dense	$0.10 \square \Phi \square 0.20$	2	$0.20 \square \Phi \square 0.25$	1	$0.25 \square \Phi$	0	2.5		
		SIZE	Acceptable Q TY												
$\Phi \square 0.10$	Accept no dense														
$0.10 \square \Phi \square 0.20$	2														
$0.20 \square \Phi \square 0.25$	1														
$0.25 \square \Phi$	0														
3.2 Line type : (As following drawing) <table><thead><tr><th>Length</th><th>Width</th><th>Acceptable Q TY</th></tr></thead><tbody><tr><td>---</td><td>$W \square 0.02$</td><td>Accept no dense</td></tr><tr><td>$L \square 3.0$</td><td>$0.02 \square W \square 0.03$</td><td rowspan="2">2</td></tr><tr><td>$L \square 2.5$</td><td>$0.03 \square W \square 0.05$</td></tr><tr><td>---</td><td>$0.05 \square W$</td><td>As round type</td></tr></tbody></table> 	Length	Width	Acceptable Q TY	---	$W \square 0.02$	Accept no dense	$L \square 3.0$	$0.02 \square W \square 0.03$	2	$L \square 2.5$	$0.03 \square W \square 0.05$	---	$0.05 \square W$	As round type	2.5
Length	Width	Acceptable Q TY													
---	$W \square 0.02$	Accept no dense													
$L \square 3.0$	$0.02 \square W \square 0.03$	2													
$L \square 2.5$	$0.03 \square W \square 0.05$														
---	$0.05 \square W$	As round type													
04	Polarizer bubbles	<table><thead><tr><th>Size Φ</th><th>Acceptable Q TY</th></tr></thead><tbody><tr><td>$\Phi \square 0.20$</td><td>Accept no dense</td></tr><tr><td>$0.20 \square \Phi \square 0.50$</td><td>3</td></tr><tr><td>$0.50 \square \Phi \square 1.00$</td><td>2</td></tr><tr><td>$1.00 \square \Phi$</td><td>0</td></tr><tr><td>Total Q TY</td><td>3</td></tr></tbody></table> If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction.	Size Φ	Acceptable Q TY	$\Phi \square 0.20$	Accept no dense	$0.20 \square \Phi \square 0.50$	3	$0.50 \square \Phi \square 1.00$	2	$1.00 \square \Phi$	0	Total Q TY	3	2.5
Size Φ	Acceptable Q TY														
$\Phi \square 0.20$	Accept no dense														
$0.20 \square \Phi \square 0.50$	3														
$0.50 \square \Phi \square 1.00$	2														
$1.00 \square \Phi$	0														
Total Q TY	3														

NO	Item	Criterion	AQL
05	Scratches	Follow NO.3 LCD black spots, white spots, contamination	
06	Chipped glass	Symbols Define: x: Chip length y: Chip width z: Chip thickness k: Seal width t: Glass thickness a: LCD side length L: Electrode pad length: 6.1 General glass chip : 6.1.1 Chip on panel surface and crack between panels:  □ If there are 2 or more chips, x is total length of each chip. 6.1.2 Corner crack:  □ If there are 2 or more chips, x is the total length of each chip.	2.5

NO	Item	Criterion	AQL
06	Glass crack	Symbols : x: Chip length y: Chip width z: Chip thickness k: Seal width t: Glass thickness a: LCD side length L: Electrode pad length 6.2 Protrusion over terminal : 6.2.1 Chip on electrode pad :  6.2.2 Non-conductive portion:	2.5

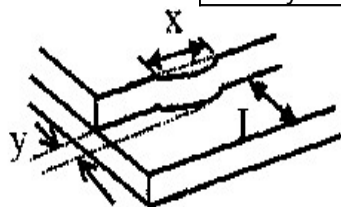


If the chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications.

If the product will be heat sealed by the customer, the alignment mark not be damaged.

6.2.3 Substrate protuberance and internal crack.

y: width	x: length
$y \leq 1/3L$	$x \leq a$



NO	Item	Criterion	AQL
07	Cracked glass	The LCD with extensive crack is not acceptable.	2.5
08	Backlight elements	8.1 Illumination source flickers when lit.	0.65
		8.2 Spots or scratched that appear when lit must be judged. Using LCD spot, lines and contamination standards.	2.5
		8.3 Backlight doesn't light or color wrong.	0.65
09	Bezel	9.1 Bezel may not have rust, be deformed or have fingerprints, stains or other contamination.	2.5
		9.2 Bezel must comply with job specifications.	0.65
10	PCB COB	10.1 COB seal may not have pinholes larger than 0.2mm or contamination.	2.5
		10.2 COB seal surface may not have pinholes through to the IC.	2.5
		10.3 The height of the COB should not exceed the height indicated in the assembly diagram.	0.65
		10.4 There may not be more than 2mm of sealant outside the seal area on the PCB. And there should be no more than three places.	2.5
		10.5 No oxidation or contamination PCB terminals.	2.5
		10.6 Parts on PCB must be the same as on the production characteristic chart. There should be no wrong parts, missing parts or excess parts.	0.65

		10.7 The jumper on the PCB should conform to the product characteristic chart. 10.8 If solder gets on bezel tab pads, LED pad, zebra pad or screw hold pad, make sure it is smoothed down. 10.9 The Scraping testing standard for Copper Coating of PCB $X * Y \leq 2\text{mm}^2$	0.65 2.5 2.5
11	Soldering	11.1 No un-melted solder paste may be present on the PCB. 11.2 No cold solder joints, missing solder connections, oxidation or icicle. 11.3 No residue or solder balls on PCB. 11.4 No short circuits in components on PCB.	2.5 2.5 2.5 0.65

NO	Item	Criterion	AQL
12	General appearance	12.1 No oxidation, contamination, curves or, bends on interface Pin (OLB) of TCP.	2.5
		12.2 No cracks on interface pin (OLB) of TCP.	0.65
		12.3 No contamination, solder residue or solder balls on product.	2.5
		12.4 The IC on the TCP may not be damaged, circuits.	2.5
		12.5 The uppermost edge of the protective strip on the interface pin must be present or look as if it cause the interface pin to sever.	2.5
		12.6 The residual rosin or tin oil of soldering (component or chip component) is not burned into brown or black color.	2.5
		12.7 Sealant on top of the ITO circuit has not hardened.	2.5
		12.8 Pin type must match type in specification sheet.	0.65
		12.9 LCD pin loose or missing pins.	0.65
		12.10 Product packaging must the same as specified on packaging specification sheet.	0.65
		12.11 Product dimension and structure must conform to product specification sheet.	0.65