P-TEC

PRODUCT SPECIFICATION

Part Number

PG12864E1-O Series

CUSTOMER	
CUSTOMER PART NUMBER	
DESCRIPTION	
APPROVED BY	
DATE	

Table of Contents

Record of Revisions

Rev.	Comments	Page	Date
1	Preliminary Specification was first issued.	All	7/4'14

1. FUNCTIONS & FEATURES

1.1. Format : 128x64dots
1.2. LCD mode : STN /Positive / Transflective/ Yellow-green Mode
1.3. Viewing direction : 6 o'clock
1.4. Driving scheme : 1/64 Duty , 1/9 Bias
1.5. Power supply voltage (V_{DD}) : 5.0V
1.6. LCD driving voltage(Vop) : 13V
1.7. Operation temp : -20~70℃
1.8. Storage temp : -30~80℃
1.9. Backlight color : Bottom Yellow-green
1.10. RoHS standard

2. MECHANICAL SPECIFICATIONS

2.1. Module size : 78.0mm(L)*70.0mm(W)*13.5max mm(H)
2.2. Viewing area : 62.0mm(L)*44.0mm(W)
2.3. Dot pitch : 0.44mm(L)*0.60mm(W)
2.4. Dot size : 0.40mm(L)*0.56mm(W)
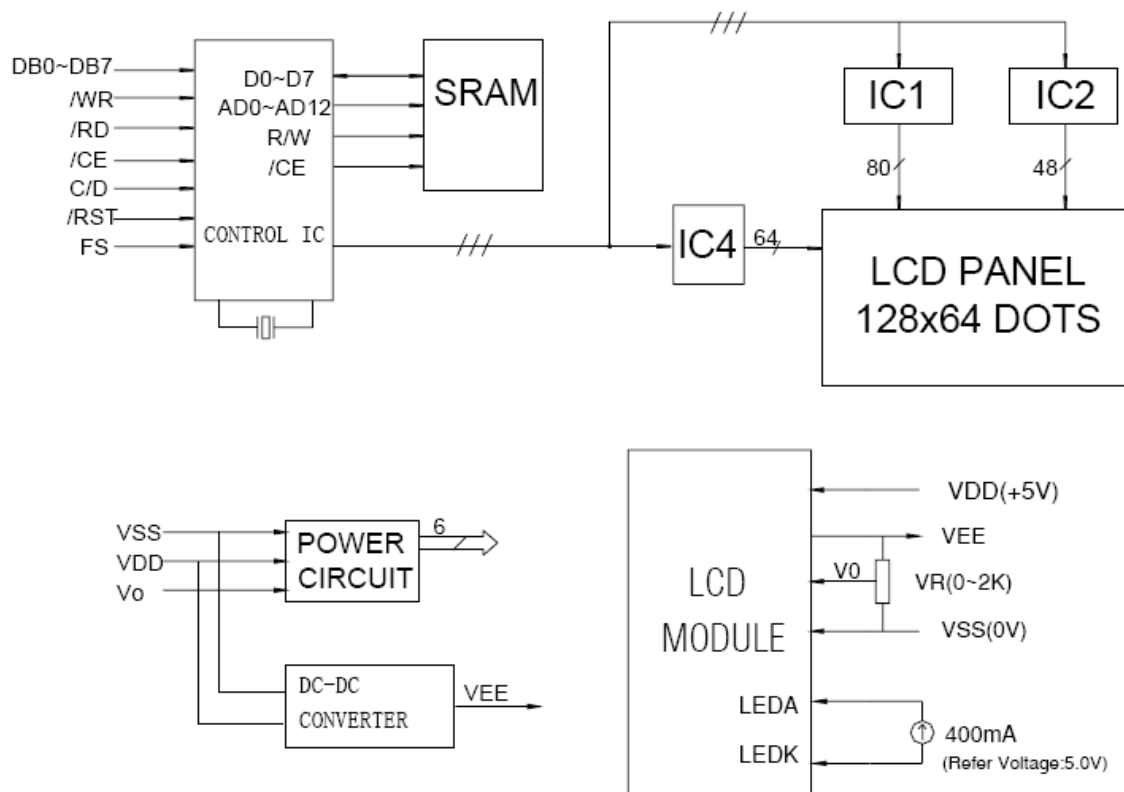2.5. Weight : Approx.

3. BLOCK DIAGRAM

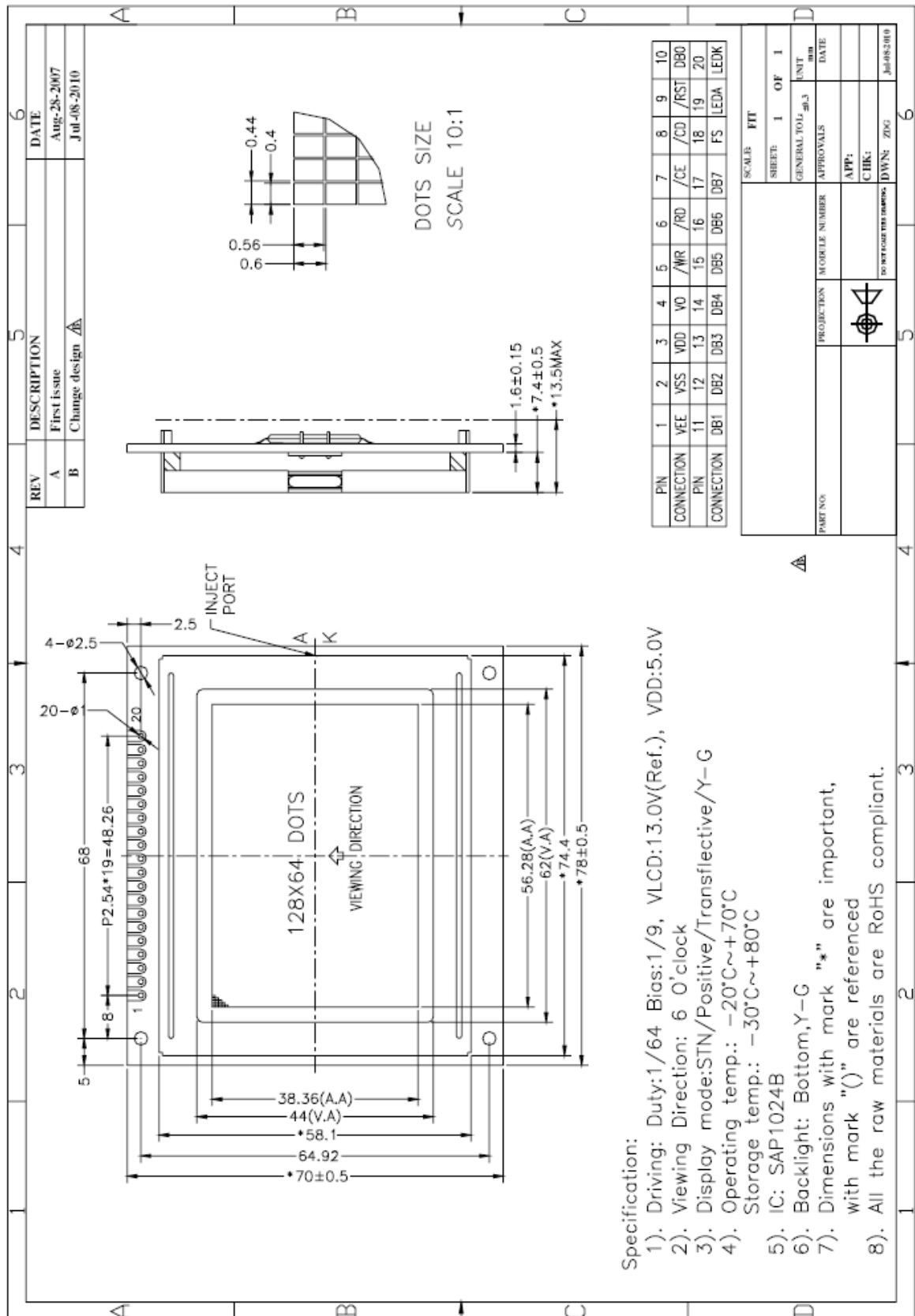Figure1. Block diagram

4. DIMENSIONAL OUTLINE

Figure 2. Dimensional outline

5. PIN DESCRIPTION

No.	Symbol	Function
1	VEE	Negative voltage output;
2	VSS	GND
3	VDD	Power supply for Logic(+5.0V)
4	VO	Supply voltage for LCD drive
5	/WR	Write signal.
6	/RD	Read signal
7	/CE	Chip enable signal
8	C/D	Data or instruction select signal(H: data register; L: instruction register)
9	/RST	Reset signal
10~17	DB0~DB7	Data bus lines
18	FS	Font selection
19	LEDA	Power supply for Backlight (+5.0V)
20	LEDK	Power supply for Backlight (0V)

6. MAXIMUM ABSOLUTE LIMIT

Item	Symbol	MIN	MAX	Unit
Supply Voltage for Logic	V_{DD}	-0.3	7.0	V
Supply Voltage for LCD	V0	V_{DD}-15.0	V_{DD}+0.3	V
Input Voltage	Vin	-0.3	V_{DD}+0.3	V
Supply Current for Backlight	I (Ta = 25°C)	---	400+400*20%	mA
Reverse Voltage for Backlight	V (Ta = 25°C)	---	5.0	V
Operating Temperature	Top	-20	70	℃
Storage Temperature	Tst	-30	80	℃

7. ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage for Logic	V_{DD}-Vss	Ta = 25°C	4.75	5.0	5.25	V
Input High Voltage	V_{IH}	Ta = 25°C	$0.7V_{DD}$	---	V_{DD}	V
Input Low Voltage	V_{IL}	Ta = 25°C	0	---	$0.3V_{DD}$	V
Output High Voltage	V_{OH}	Ta = 25°C	2.4	---	---	V
Output Low Voltage	V_{OL}	Ta = 25°C	---	---	0.4	V
Supply Current	I_{DD}	Ta = 25°C	---	15	20	mA

8.BACKLIGHT CHARACTERISTICS

Ta = 25°C

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	IF=400mA	3.85	4.05	4.25	V
Reverse Current	IR	VR=5.0V	---	---	100	uA
Wave length	$\lambda \rho$	IF=400mA	---	570	---	nm
Luminous Intensity (Without LCD)	IV	IF=400mA	151	216		Cd/m^2
Color	Yellow-green					

Note:

when the temperature exceed 25℃, the approved current decrease rate for Backlight chang
the temperature increase is: -0.36x40mA/℃(below 25℃, the current refer to constant, wh
would not change with temperature).

9. ELECTRO-OPTICAL CHARACTERISTICS

(VDD=5.0V, Ta = 25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit
Operating Voltage Of LCD	Vop	Ta =-20°C	13.7	14.0	14.3	V
		Ta = 25°C	13.3	13.6	13.9	
		Ta = 70°C	12.9	13.2	13.5	
Response time	Tr	Ta = 25°C	---	185	---	ms
	Tf		---	200	---	ms
Contrast	Cr	Ta = 25°C	---	4.0	---	---
Viewing angle range	θ	Cr≥2	-40	---	+40	deg
	Φ		-40	---	+40	deg

$$Cr = \frac{\text{Brightness of non-selected segment(B2)}}{\text{Brightness of selected segment(B1)}}$$
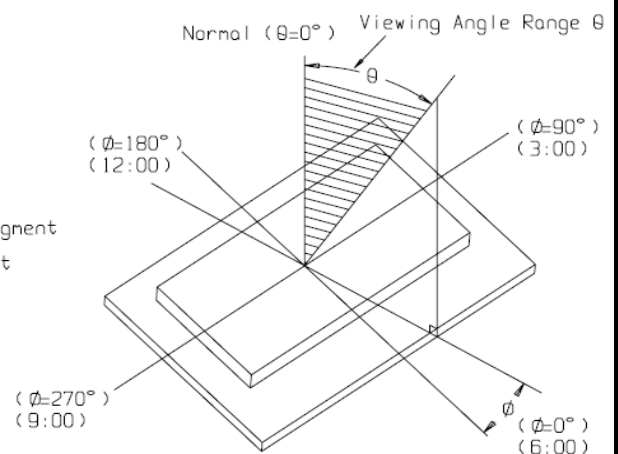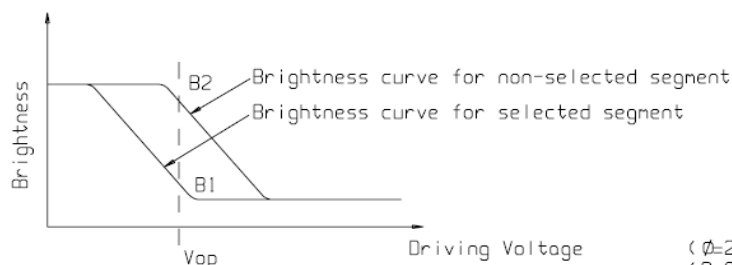
10. TIMING CHARACTERISTICS
Bus Timing
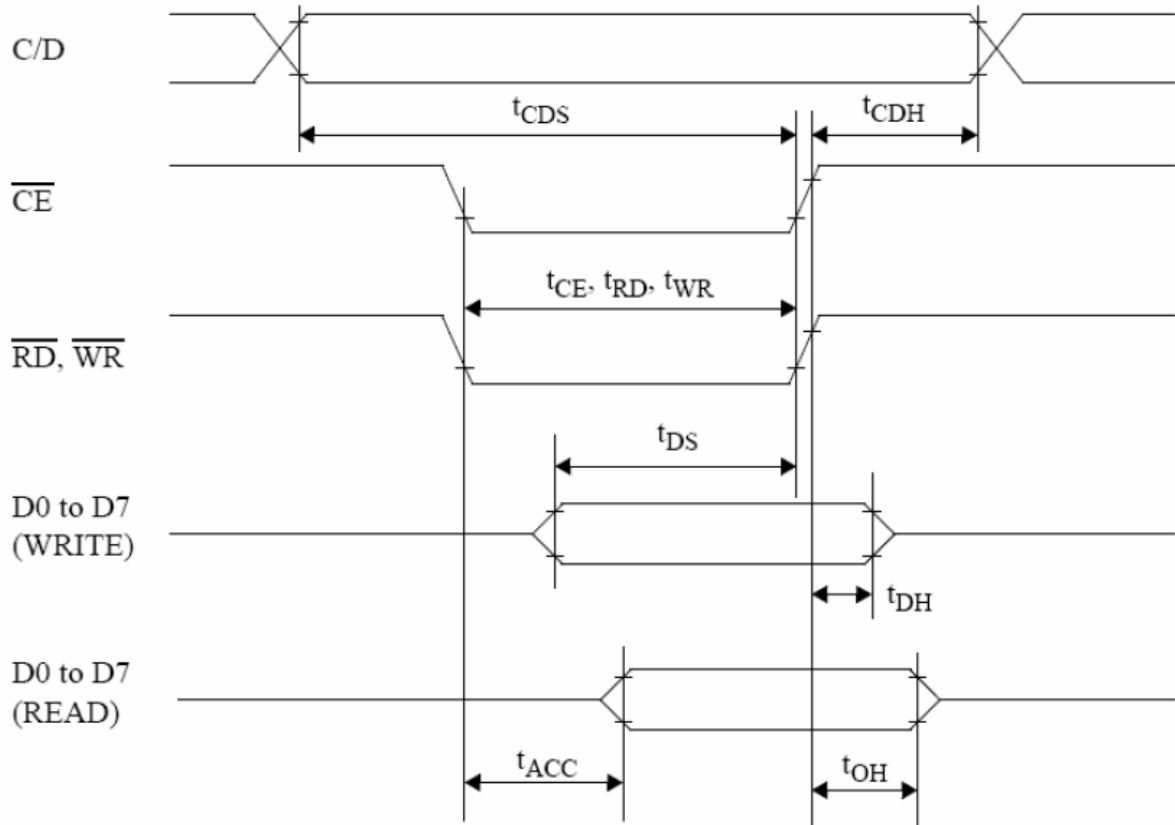
Test Conditions(Unless Otherwise Noted, V_{DD}=5.0± 10%, V_{ss}=0V, Ta=-20 to 75℃)

Item	Symbol	Test Conditions	Min	Max	Unit
C/D Set-up Time	t_{CDS}	–	100	–	ns
C/D Hold Time	t_{CDH}	–	10	–	ns
CE, RD, WR Pulse Width	t_{CE}, t_{RD}, t_{WR}	–	80	–	ns
Data Set-up Time	t_{DS}	–	80	–	ns
Data Hold Time	t_{DH}	–	40	–	ns
Access Time	t_{ACC}	–	–	150	ns
Output Hold Time	t_{OH}	–	10	50	ns

11. CONTROL AND DISPLAY COMMAND

Commands	D7	D6	D5	D4	D3	D2	D1	D0	Description	Execute Time
Pointer Set	0	0	1	0	0	N2	N1	N0		Status check
						0	0	1	Cursor Pointer Set	
						0	1	0	Offset Register Set	
						1	0	0	Address Pointer Set	
Control Word Set Commands	0	1	0	0	0	0	N1	N0		32 x 1/fosc
							0	0	Text Home Address Set	
							0	1	Text Area Set	
							1	0	Graphic Home Address Set	
							1	1	Graphic Area Set	
Mode Set	1	0	0	0	CG	N2	N1	N0		32 x 1/fosc
					0				CG ROM Mode	
					1				CG RAM Mode	
						0	0	0	"OR" Mode	
						0	0	1	"EXOR" Mode	
						0	1	1	"AND" Mode	
						1	0	0	Text only (attribute capability)	
Display Modes	1	0	0	1	N3	N2	N1	N0		32 x 1/fosc
					0				Graphics Off	
					1				Graphics On	
						0			Text Off	
						1			Text On	
							0		Cursor Off	
							1		Cursor On	
								0	Cursor blink Off	
								1	Cursor blink On	
Cursor Pattern Select	1	0	1	0	0	N2	N1	N0	N2~N0: No. of lines for cursor +1	32 x 1/fosc
						0	0	0	Bottom Line cursor	
						0	0	1	2 line cursor	
						|	|	|		
						1	1	1	8 line cursor (block cursor)	
Data Auto Read/Write	1	1	0	0	0	0	N1	N0		32 x 1/fosc
							0	0	Data Auto Write Set	
							0	1	Data Auto Read Set	
							1	0	Auto reset (Address pointer auto-incremented) for continuous rd/wr	
Data Read/Write	1	1	0	0	0	N2	N1	N0		
						0			Address Pointer up/down	
						1			Address Pointer unchanged	
							0		Address Pointer up	
							1		Address Pointer down	
								0	Data Write	
								1	Data Read	
Screen Peeking	1	1	1	0	0	0	0	0	Read Displayed Data	Status
Screen Copy (Note 3)	1	1	1	0	1	0	0	0	Copies 1 line of displayed data whose address is indicated by the Address Pointer to Graphic RAM area	Status check
Bit Set/Reset	1	1	1	1	N3	N2	N1	N0	N2~N0 indicates the bit in the pointed address	Status check
					0				Bit Reset	
					1				Bit Set	
						0	0	0	Bit 0 (LSB)	
						0	0	1	Bit 1	
						|	|	|		
						1	1	1	Bit 7 (MSB)	

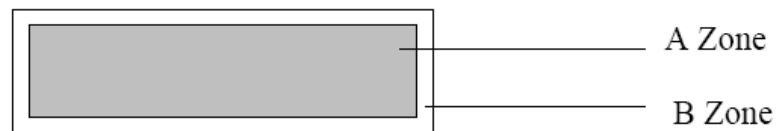# 12.QUALITY SPECIFICATIONS

12.1 Standard of the product appearance test

Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps. Distance between LCM and fluorescent lamps should be 100 cm or more. Distance between LCM and inspector eyes should be 30 cm or more.

Viewing direction for inspection is 45° from vertical against LCM.
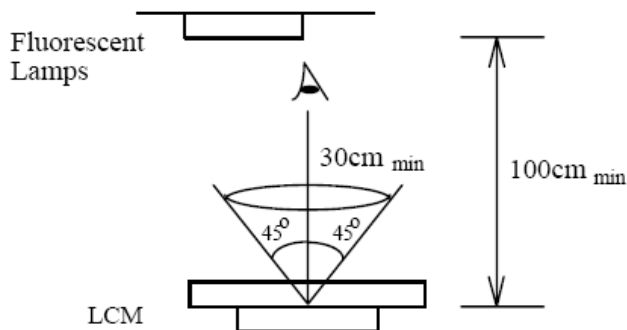
Definition of zone:

A Zone: Active display area (minimum viewing area).
B Zone: Non-active display area (outside viewing area).

12.2 Specification of quality assurance
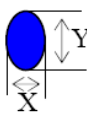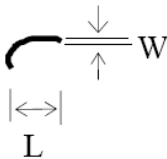
AQL inspection standard
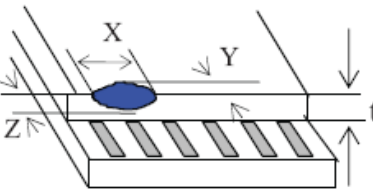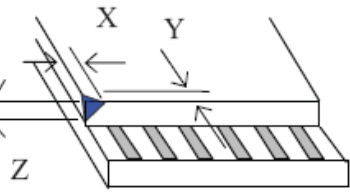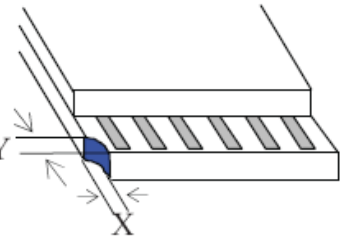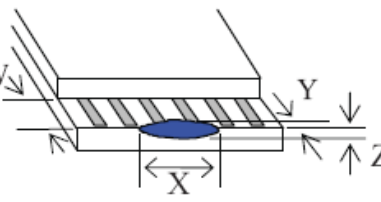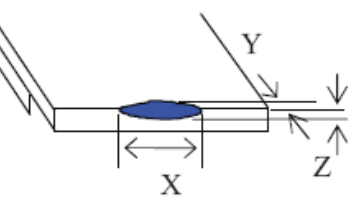
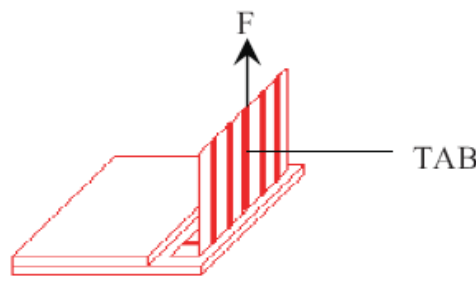Sampling method: MIL-STD-105E, Level II, single sampling
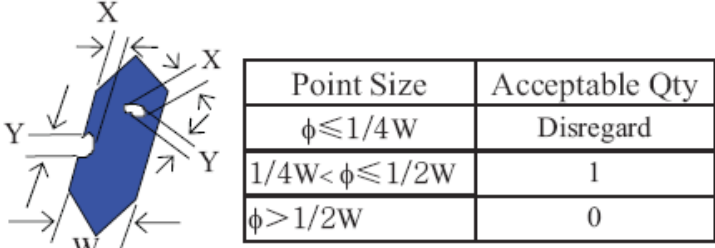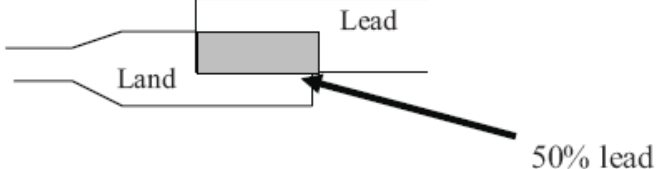
Defect classification **(Note: * is not including)**
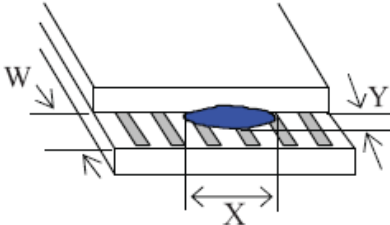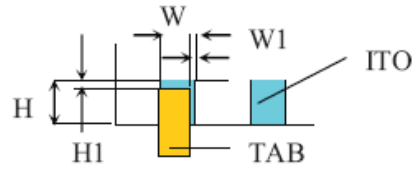
Classify		Item	Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	2	
		Back-light	1,8	
	Non-display	Flat cable or pin reverse	10	
		Wrong or missing component	11	
Minor	Display state	Background color deviation	2	1.0
		Black spot and dust	3	
		Line defect, Scratch	4	
		Rainbow	5	
		Chip	6	
		Pin hole	7	
		Protruded	12	
	Polarizer	Bubble and foreign material	3	
	Soldering	Poor connection	9	
	Wire	Poor connection	10	
	TAB	Position, Bonding strength	13	

Note on defect classification

No.	Item	Criterion
1	Short or open circuit	Not allow
	LC leakage	
	Flickering	
	No display	
	Wrong viewing direction	
	Wrong Back-light	
2	Contrast defect	Refer to approval sample
	Background color deviation	

No.	Item	Criterion
3	Point defect, Black spot, dust (including Polarizer) $\phi = (X+Y)/2$	<table><tr><th colspan="2">Point Size</th><th>Acceptable Qty.</th></tr><tr><td colspan="2">$\phi \leq 0.10$</td><td>Disregard</td></tr><tr><td colspan="2">$0.10 < \phi \leq 0.20$</td><td>3</td></tr><tr><td colspan="2">$0.20 < \phi \leq 0.25$</td><td>2</td></tr><tr><td colspan="2">$0.25 < \phi \leq 0.30$</td><td>1</td></tr><tr><td colspan="2">$\phi > 0.30$</td><td>0</td></tr></table> Unit:mm

No.	Item	Criterion
4	Line defect, Scratch	<table><tr><th colspan="2">Line</th><th>Acceptable Qty.</th></tr><tr><td>L</td><td>W</td><td></td></tr><tr><td>---</td><td>$0.015 \geq W$</td><td>Disregard</td></tr><tr><td>$3.0 \geq L$</td><td>$0.03 \geq W$</td><td rowspan="2">2</td></tr><tr><td>$2.0 \geq L$</td><td>$0.05 \geq W$</td></tr><tr><td>$1.0 \geq L$</td><td>$0.1 > W$</td><td>1</td></tr><tr><td>---</td><td>$0.05 < W$</td><td>Applied as point defect</td></tr></table> Unit: mm
5	Rainbow	Not more than two color changes across the viewing area.

No	Item	Criterion

6	Chip
	
	Remark:
	  X: Length
	    direction
	  Y: Short
	    direction
	  Z: Thickness
	    direction
	  t: Glass
	    thickness
	  W: Terminal
	    Width
		(see diagrams)

Acceptable criterion

X	Y	Z
≦2	0.5mm	≦t/2

Acceptable criterion

X	Y	Z
≦2	0.5mm	≦t

Acceptable criterion

X	Y	Z
≦3	≦2	≦t
shall not reach to ITO		

Acceptable criterion

X	Y	Z
Disregard	≦0.2	≦t

Acceptable criterion

X	Y	Z
≦5	≦2	≦t/3

No.	Item	Criterion
7	Segment pattern W = Segment width $\phi = (X+Y)/2$	(1) Pin hole $\phi < 0.10mm$ is acceptable. Unit: mm
8	Back-light	(1) The color of backlight should correspond its specification. (2) Not allow flickering
9	Soldering	(1) Not allow heavy dirty and solder ball on PCB. (The size of dirty refer to point and dust defect) (2) Over 50% of lead should be soldered on Land.
10	Wire	(1) Copper wire should not be rusted (2) Not allow crack on copper wire connection. (3) Not allow reversing the position of the flat cable. (4) Not allow exposed copper wire inside the flat cable.
11*	PCB	(1) Not allow screw rust or damage. (2) Not allow missing or wrong putting of component.

Table for item 7:

Point Size	Acceptable Qty
$\phi \leqslant 1/4W$	Disregard
$1/4W < \phi \leqslant 1/2W$	1
$\phi > 1/2W$	0

No	Item	Criterion
12	Protruded W: Terminal Width	 Acceptable criteria: $Y \leq 0.4$
13	TAB	1. Position $W1 \leq 1/3W$ $H1 \leq 1/3H$ 2 TAB bonding strength test P (=F/TAB bonding width) ≥ 650gf/cm ,(speed rate: 1mm/min) 5pcs per SOA (shipment)
14	Total no. of acceptable Defect	A. Zone Maximum 2 minor non-conformities per one unit. Defect distance: each point to be separated over 10mm B. Zone It is acceptable when it is no trouble for quality and assembly in customer's end product.

12.3 Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	48	
High temp. Operating	70°C	48	
Low temp. Storage	-30°C	48	No abnormalities
Low temp. Operating	-20°C	48	in functions
Humidity	40°C/ 90%RH	48	and appearance
Temp. Cycle	-20°C ← 25°C →70°C (30 min ← 5 min → 30min)	10cycles	

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance ,etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (20 ± 8°C), normal humidity (below 45 ± 20% RH), and in the area not exposed to direct sun light. The life time is not content the life time of the LED (for the life time of LED which decay only 50%,in the industry the experience value is 50000 hours, but there are not any experimentation data to support this).

12.4 Precaution for using LCD/LCM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isoproply alcohol, ethyl alcohol or trichlorotriflorothane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not make any modification on the PCB without consulting P-tec.
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.

6.   Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.

7.   Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1.   CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2.   Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3.   Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4.   The modules should be kept in anti-static bags or other containers resistant to static for storage.
5.   Only properly grounded soldering irons should be used.
6.   If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7.   The normal static prevention measures should be observed for work clothes and working benches.
8.   Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1.   Soldering should be performed only on the I/O terminals.
2.   Use soldering irons with proper grounding and no leakage.
3.   Soldering temperature: $280°C \pm 10°C$
4.   Soldering time: 3 to 4 second.
5.   Use eutectic solder with resin flux filling.
6.   If flux is used, the LCD surface should be protected to avoid spattering flux.
7.   Flux residue should be removed.

Operation Precautions:

1.   The viewing angle can be adjusted by varying the LCD driving voltage Vo.
2.   Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3.   Driving voltage should be kept within specified range; excess voltage will shorten display life.
4.   Response time increases with decrease in temperature.
5.   Display color may be affected at temperatures above its operational range.
6.   Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7.   For long-term storage over 40°C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

Limited Warranty

P-tec LCDs and modules are not consumer products, but may be incorporated by P-tec's customers into consumer products or components thereof, P-tec does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of P-tec is limited to repair or replacement on the terms set forth below. P-tec will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between P-tec and the customer, P-tec will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with P-tec general LCD inspection standard . (Copies available on request)
2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.
3. In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.