POWERTIP TECH. CORP.

DISPLAY DEVICES FOR BETTER ELECTRONIC DESIGN

Specification For Approval

Customer	:	
Model Type	:	LCD MODULE
Sample Code	:	
Mass Production Code	:	PE12864LRF-001-H
Revision	:	0

Customer Sign	Sales Sign	Checked By	Prepared By

Revision Record

Date(y/m/d)	Rev.	Description	Note	Page
2002/05/20	0	New sample		

Contents

1. SPECIFICATIONS

1.1 Features

Item	Standard Value
Display Type	128 * 64 Dots
LCD Type	FSTN, Transflective, Positive, Extended Temp.
Driver Type	1/65 Duty , 1/9 Bias
Viewing Direction	6 O'clock
Backlight	Yellow-Green Edge LED B/L
Weight	10 g
Other	3 mode interface: serial/parallel 68000 & 80X86 Low power consumption

1.2 Mechanical Specifications

Item	Standard Value	Unit
Outline Dimension	55.2 (L) * 39.8 (w) * 6.0 (H)(Max)	Mm
Viewing Area	45.2 (L) * 27.0 (w)	Mm
Active Area	40.92 (L) * 24.28 (w)	Mm
Dot Size	0.28 (L) * 0.34 (w)	Mm
Dot Pitch	0.32 (L) * 0.38 (w)	Mm

1.3 Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Max.	Unit
Power Supply Voltage	V_{DD}	—	-0.3	5.0	V
LCD Driver Supply Voltage	V_{DD}-V_5	—	-13.0	-4.0	V
Input Voltage	V_{IN}	—	-0.3	V_{DD}+0.3	V
Operating Temperature	T_{OP}	—	-20	70	°C
Storage Temperature.	T_{ST}	—	-30	80	°C

1.4 DC Electrical Characteristics

V_{DD} = 3.3 V ± 5%，V_{SS} = 0V，Ta = 25°C

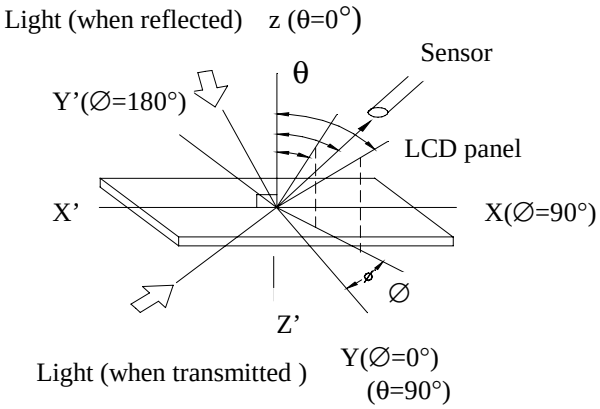
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Supply Voltage	V_{DD}	—	3.2	3.3	3.4	V
“H” Input Voltage	V_{IH}	—	0.8V_{DD}	-	V_{DD}	V
“L” Input Voltage	V_{IL}	—	V_{SS}	-	0.2V_{DD}	V
“H” Output Voltage	V_{OH}	—	0.8V_{DD}	-	V_{DD}	V
“L” Output Voltage	V_{OL}	—	V_{SS}	-	0.2V_{DD}	V
Supply Current	I_{DD}	V_{DD} = 3.3 V	-	0.27	0.55	mA
LCD Driver Voltage	V_{OP}	V_{DD}-V_5 (25°C)	9.4	9.6	9.8	V

1.5 Optical Characteristics

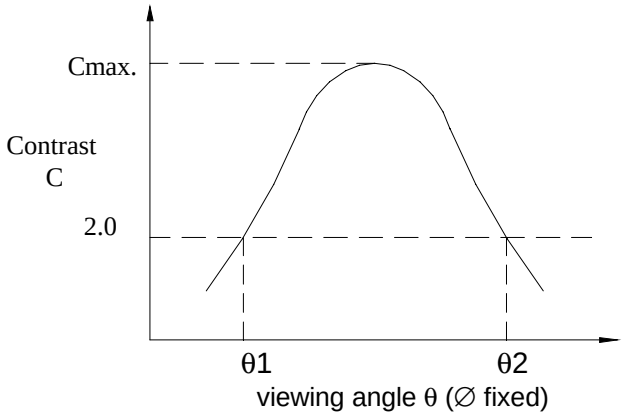
1/64 Duty，1/9 Bias，VOP = 9.6 V，Ta = 25°C

Item	Symbol	Conditions	Min.	Typ.	Max.	Reference
View Angle	θ	C≥2.0,∅=0°	-40°	-	40°	Notes 1 & 2
Contrast Ratio	C	θ=5°, ∅=0°	-	5	-	Note 3
Response Time(rise)	tr	θ=5°, ∅=0°	-	200 ms	400 ms	Note 4
Response Time(fall)	tf	θ=5°, ∅=0°	-	200 ms	400 ms	Note 4

Note 1: Definition of angles θ and ∅



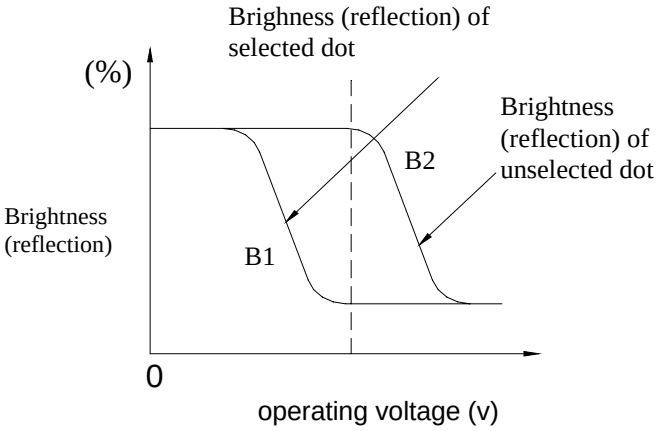
Note 2: Definition of viewing angles θ1 and θ2



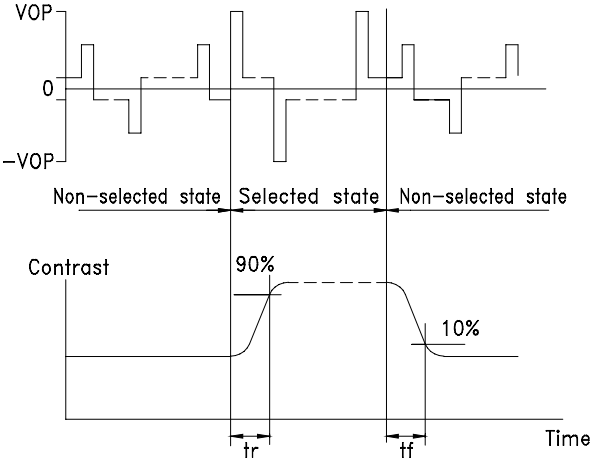
Note : Optimum viewing angle with the naked eye and viewing angle θ at Cmax. Above are not always the same

Note 3: Definition of contrast C

$$C = \frac{\text{Brightness (reflection) of unselected dot (B2)}}{\text{Brightness (reflection) of selected dot (B1)}}$$



Note 4: Definition of response time



Note: Measured with a transmissive LCD panel which is displayed 1 cm^2

V_{OPR} : Operating voltage
t_r : Response time (rise)
f_{FRM} : Frame frequency
t_f : Response time (fall)

1.6 Backlight Characteristics

LCD Module with Edge LED Backlight

Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Forward Current	IF	Ta =25°C	-	100	mA
Reverse Voltage	VR	Ta =25°C	-	4.0	V
Power Dissipation	PO	Ta =25°C	-	0.25	W
Operating Temperature	T_{OP}	-	-20	70	°C
Storage Temperature	T_{ST}	-	-30	80	°C

Electrical Ratings

Ta =25°C

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Forward Voltage	VF	IF=40 mA	-	2.1	2.5	V
Reverse Current	IR	VR=4.0 V	-	-	0.2	mA
Luminous Intensity (with LCD, Dots Off)	IV	IF=40 mA	5	6	-	cd/m^2
Wavelength	λp	IF=40 mA	569	-	576	nm
Color	Yellow-Green					

2. MODULE STRUCTURE

2.1 Counter Drawing

* See Appendix

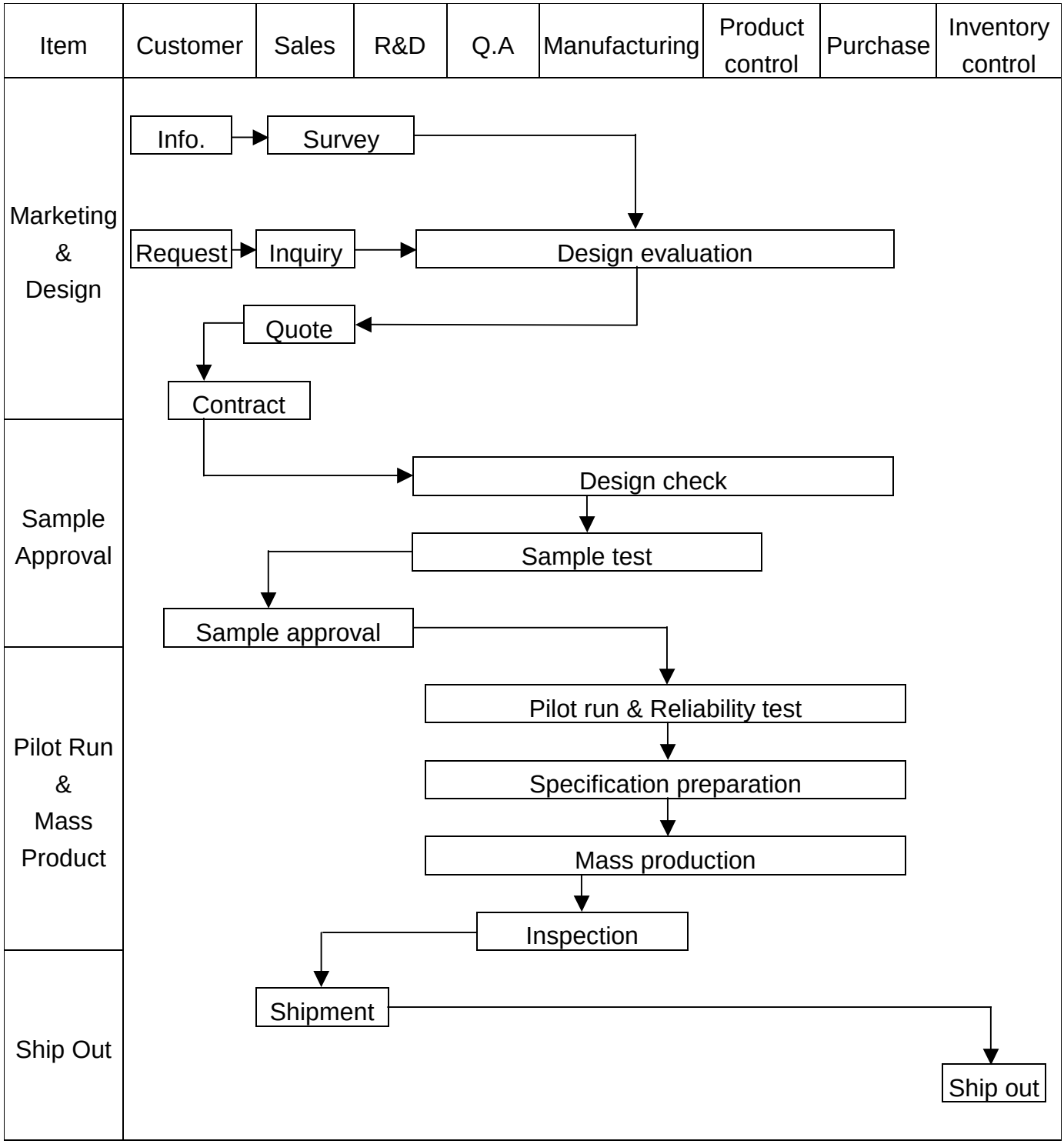
2.2 Interface Pin Description

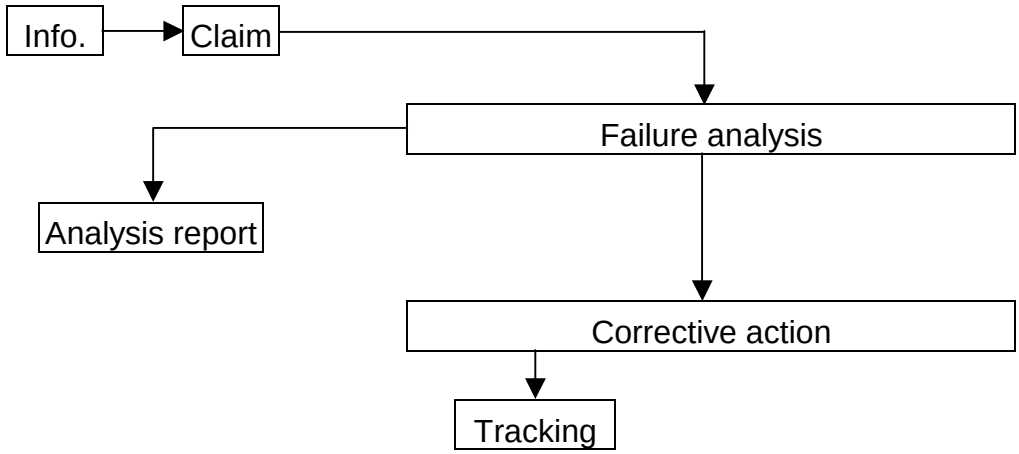
NO	SYMBOL	FUNCTION
1	/CS1	This is the chip select signal. When $\overline{CS1}$ = "L" then the chip select becomes active, and data/command I/O is enabled.
2	/RES	When $\overline{RES}$ is set to "L," the settings are initialized. The reset operation is performed by the $\overline{RES}$ signal level.
3	A0	This is connect to the least significant bit of the normal MPU address bus, and it determines whether the data bits are data or a command. A0 = "H": Indicates that D0 to D7 are display data. A0 = "L": Indicates that D0 to D7 are control data.
4	WR (R/W)	• When connected to an 8080 MPU, this is active LOW. (R/W) This terminal connects to the 8080 MPU WR signal. The signals on the data bus are latched at the rising edge of the WR signal. • When connected to a 6800 Series MPU: This is the read/write control signal input terminal. When R/W = "H": Read. When R/W = "L": Write.
5	RD (E)	• When connected to an 8080 MPU, this is active LOW. (E) This pin is connected to the RD signal of the 8080 MPU, and the ST7565S series data bus is in an output status when this signal is "L". • When connected to a 6800 Series MPU, this is active HIGH. This is the 6800 Series MPU enable clock input terminal.
6	D0	This is an 8-bit bi-directional data bus that connects to an 8-bit or 16-bit standard MPU data bus. When the serial interface is selected (P/S = "L") : D7 : serial data input (SI) ; D6 : the serial clock input (SCL). D0 to D5 are set to high impedance. When the chip select is not active, D0 to D7 are set to high impedance.
7	D1	
8	D2	
9	D3	
10	D4	
11	D5	
12	D6	
13	D7	
14	VDD	Shared with the MPU power supply terminal Vcc.
15	VSS	This is a 0V terminal connected to the system GND.

NO	SYMBOL	FUNCTION
16	VOUT	DC/DC voltage converter. Connect a capacitor between this terminal and VSS.
17	CAP5-	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP1+ terminal.
18	CAP3-	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP1+ terminal.
19	CAP1+	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP1- terminal.
20	CAP1-	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP1+ terminal.
21	CAP2-	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP2+ terminal.
22	CAP2+	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP2- terminal.
23	CAP4-	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP2+ terminal.
24	VRS	This is the internal-output VREG power supply for the LCD power supply voltage regulator.
25	V1	This is a multi-level power supply for the liquid crystal drive. The voltage Supply applied is determined by the liquid crystal cell, and is changed through the use of a resistive voltage divided or through changing the impedance using an op. amp. Voltage levels are determined based on VDD, and must maintain the relative magnitudes shown below.
26	V2	
27	V3	
28	V4	
29	V5	
30	VR	Output voltage regulator terminal. Provides the voltage between VDD and V5 through a resistive voltage divider. IRS = "L" : the V5 voltage regulator internal resistors are not used . IRS = "H" : the V5 voltage regulator internal resistors are used .
31	C86	This is the MPU interface switch terminal. C86 = "H": 6800 Series MPU interface. C86 = "L": 8080 MPU interface.
32	P/S	This is the parallel data input/serial data input switch terminal. P/S = "H": Parallel data input. P/S = "L": Serial data input.
33	HPM	This is the power control terminal for the power supply circuit for liquid crystal drive. $\overline{\text{HPM}}$ = "H": Normal mode $\overline{\text{HPM}}$ = "L": High power mode
34	IRS	This terminal selects the resistors for the V5 voltage level adjustment. IRS = "H": Use the internal resistors IRS = "L": Do not use the internal resistors. The V5 voltage level is regulated by an external resistive voltage divider attached to the VR terminal

3. QUALITY ASSURANCE SYSTEM

3.1 Quality Assurance Flow Chart

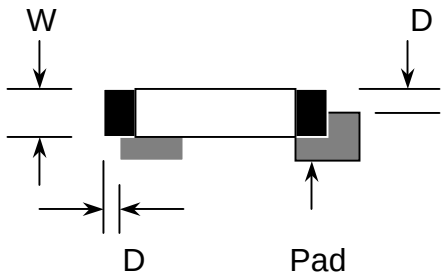


Sales Service	
Q.A Activity	1. ISO 9001 Maintenance Activities 2. Process improvement proposal 3. Equipment calibration 4. Education And Training Activities 5. Standardization Management

3.2 Inspection Specification

Inspection Standard：MIL-STD-105E Table Normal Inspection Single Sampling Level Ⅱ。
Equipment：Gauge、MIL-STD、Powertip Tester、Sample。
IQC Defect Level：Major Defect AQL 0.65; Minor Defect AQL 1.0。
FQC Defect Level：100% Inspection。
OUT Going Defect Level：Sampling。
Specification：

N O	Item	Specification	Judge	Level
1	Part Number	Inconsistent with the P/N on the flow chart of production	N.G.	Major
2	Quantity	Inconsistent Q'TY with the flow chart of production	N.G.	Major
3	Electronic characteristics A=(L + W)÷2	Display short	N.G.	Major
		Missing line	N.G.	Major
		Dot missing A＞1/2 Dot size	N.G.	Major
		No function	N.G.	Major
		Out put data error	N.G.	Major
4	Appearance A=(L + W)÷2 Dirty particle (Include scratch、bubble)	Material difference with flow chart	N.G.	Major
		LCD Assembled in opposite direction	N.G.	Major
		Bezel assembled in opposite direction	N.G.	Major
		Shadow within LCD V./A + 1.0 mm	N.G.	Major
		Dirty particle A＞0.4 mm	N.G.	Minor
		Dirty particle length ＞3.0mm And 0.01mm＜ Width ≦0.05mm (Width＞ 0.05mm Measure by area)	N.G.	Minor
		Without protective film	N.G.	Minor
		Conductive rubber over bezel	N.G.	Minor
5	PCB Appearance A=(L + W)÷2	Burned PCB	N.G.	Major
		Green paint stripped & visible circuit A＞1.0mm (Finish coat not counted in)	N.G.	Minor
		A particle across the circuit	N.G	Minor
		Circuit split ＞1/2 Circuit width	N.G	Minor
		Any circuit risen	N.G	Minor
		0.2mm＜Tin ball area A≦0.4mm And Q'TY＞4 Pieces	N.G	Minor
		Tin ball area A＞0.4mm	N.G	Minor

N O	Item	Specification	Judge	Level
6	Molding appearance A=(L + W)÷2	Too soft：Shape by touch changed	N.G.	Major
		Insufficient epoxy：IC circuit or IC pad visible	N.G.	Minor
		Excessive epoxy：Diameter ＞20mm Or High＞2.5mm	N.G.	Minor
		Pin hole through to IC and A＞0.2mm	N.G.	Minor
7	Bezel appearance A=(L + W)÷2	Angle between frame and TAB＞45° +10°	N.G.	Minor
		Electroplate strip A ＞1.0mm (Top view only)	N.G.	Minor
		Rust (Top view only)	N.G.	Minor
		Crack	N.G.	Minor
8	Backlight electric characteristics A=(L + W)÷2	Error backlight color	N.G.	Major
		No function	N.G.	Major
		Any LED dot no function	N.G.	Major
		PIN soldering without tin A＞1/2 solder pad	N.G.	Minor
		Solder PIN high＞1.5mm	N.G.	Minor
9	LCD Appearance A=(L + W)÷2	Polarize rise over V/A	N.G.	Minor
10	Assembly parts A=(L + W)÷2	Components mark unclearly	N.G.	Minor
		Components' distance more than 0.7mm firm the PCB	N.G.	Minor
		Error position ,not in center D＞1/4W 	N.G.	Minor
		Non- solder area＞Twice solder area	N.G.	Minor
		Flux area A＞1/4 solder area	N.G.	Minor
		Component broken	N.G.	Minor

4. RELIABILITY TEST

4.1 Reliability Test Condition

<table>
<tr><th>NO</th><th>Item</th><th colspan="2">Test Condition</th><th>Applicable Standard</th></tr>
<tr><td>1</td><td>High Temperature Storage</td><td colspan="2">Storage At 80 ±2℃ 96~100 hrs
Surrounding Temperature，Then Storage
At Normal Condition 4hrs.</td><td>MIL-202E</td></tr>
<tr><td>2</td><td>Low Temperature Storage</td><td colspan="2">Storage At -30 ±2℃ 96~100 hrs
Surrounding Temperature, Then Storage
At Normal Condition 4hrs.</td><td>MIL-202E</td></tr>
<tr><td>3</td><td>High Temperature
Humidity Storage</td><td colspan="2">1.Storage 96~100 hrs 60 ±2℃, 90~95%RH
Surrounding Temperature, Then Storage
At Normal Condition 4hrs .(Polarizer may fail in this environment).
or
2.Storage 96~100 hrs 40 ±2℃, 90~95%RH
Surrounding Temperature, Then Storage
At Normal Condition 4 hrs.</td><td>MIL-202E</td></tr>
<tr><td>4</td><td>Temperature Cycling</td><td colspan="2">-20℃ → 25℃ → 70℃ → 25℃
(30Mins) (5Mins) (30Mins) (5Mins)
10 Cycle</td><td>MIL-202E</td></tr>
<tr><td>5</td><td>Vibration</td><td colspan="2">10~55Hz (1 Minute) 1.5mm
X,Y And Z Direction ＊ (Each 2hrs)</td><td>MIL-202E</td></tr>
<tr><td rowspan="5">6</td><td rowspan="5">Drop Test</td><td>Packing Weight (Kg)</td><td>Drop High (Cm)</td><td rowspan="5">MIL-810E</td></tr>
<tr><td>0 ~ 45.4</td><td>122</td></tr>
<tr><td>45.4 ~ 90.8</td><td>76</td></tr>
<tr><td>90.8 ~ 454</td><td>61</td></tr>
<tr><td>Over 454</td><td>46</td></tr>
</table>

5. PRECAUTION RELATING PRODUCT HANDLING

5.1 SAFETY

5.1.1 If the LCD panel breaks , be careful not to get the liquid crystal to touch your skin.

5.1.2 If the liquid crystal touches your skin or clothes , please wash it off immediately by using soap and water.

5.2 HANDLING

5.2.1 Avoid any strong mechanical shock which can break the glass.

5.2.2 Avoid static electricity which can damage the CMOS LSI—When working with the module , be sure to ground your body and any electrical equipment you may be using.

5.2.3 Do not remove the panel or frame from the module.

5.2.4 The polarizing plate of the display is very fragile. So , please handle it very carefully , do not touch , push or rub the exposed polarizing with anything harder than an HB pencil lead (glass , tweezers , etc.)

5.2.5 Do not wipe the polarizing plate with a dry cloth , as it may easily scratch the surface of plate.

5.2.6 Do not touch the display area with bare hands , this will stain the display area.

5.2.7 Do not use ketonics solvent & aromatic solvent. Use with a soft cloth soaked with a cleaning naphtha solvent.

5.3 STORAGE

5.3.1 Store the panel or module in a dark place where the temperature is 25℃ ±5℃ and the humidity is below 65% RH.

5.3.2 Do not place the module near organics solvents or corrosive gases.

5.3.3 Do not crush , shake , or jolt the module.

5.4 TERMS OF WARRANTY

5.4.1 Applicable warrant period

The period is within thirteen months since the date of shipping out under normal using and storage conditions.

5.4.2 Unaccepted responsibility

This product has been manufactured to your company's specification 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.

PIN NO.	SIGNAL	PIN NO.	SIGNAL
1	IRS	21	Vdd
2	/HPM	22	D7
3	P/S	23	D6
4	C86	24	D5
5	VR	25	D4
6	V5	26	D3
7	V4	27	D2
8	V3	28	D1
9	V2	29	D0
10	V1	30	/RD(E)
11	VRS	31	/WR(R/W)
12	C4−	32	A0
13	C2+	33	/RES
14	C2−	34	/CS1
15	C1−		
16	C1+		
17	C3−		
18	C5−		
19	Vout		
20	Vss		

POWERTIP TECHNOLOGY			
SCALE: 1/1	MODEL NAME: PE 12864LRF-001-H		
UNIT: mm	TITLE: COUNTER DRAWING		
EDI: PAGE: 0 1/1	DRAWN NO.: PG-01020-005		
APPROVED: DANIEL	CHECKER: DARKEN	DRAWN: CHING