POWERTIP TECH. CORP.

DISPLAY DEVICES FOR BETTER ELECTRONIC DESIGN

Specification For Approval

Customer : _____

Model Type : LCD MODULE

Sample Code : _____

Mass Production Code : PG320240WRF-DE4-HY4

Revision : 0

Customer Sign	Sales Sign	Checked By (QA)	Approved By	Prepared By

Revision Record

Date(y/m/d)	Rev.	Description	Note	Page
2003/01/28	0			

Contents

1. SPECIFICATIONS

1.1 Features

Item	Standard Value
Display Type	320 * 240 Dots
LCD Type	FSTN, Positive, Transflective, Extended Temp.
Driver Type	LCD Module: 1/240 Duty , 1/15 Bias
Viewing Direction	6 O'clock
Backlight	LED Backlight
Weight	-
Other	—

1.2 Mechanical Specifications

Item	Standard Value	Unit
Outline Dimension	148.02 (L) * 120.24 (w) * 20.3(H)(Max)	mm
Viewing Area	120.14 (L) * 92.14 (w)	mm
Active Area	115.17 (L) * 86.37 (w)	mm
Dot Size	0.33 (L) * 0.33 (w)	mm
Dot Pitch	0.36 (L) * 0.36 (w)	mm

Note：For detailed information please refer to LCM drawing

1.3 Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Max.	Unit
Power Supply Voltage	V_{DD}	—	-0.3	7.0	V
LCD Driver Supply Voltage	V_{DD}-V_{EE}	—	-	30	V
Input Voltage	V_{IN}	—	-0.5	V_{DD}+0.5	V
Operating Temperature	T_{OP}	—	-20	70	°C
Storage Temperature.	T_{ST}	—	-30	80	°C
Storage Humidity	H_D	Ta＜40 ℃	20	60	%RH

1.4 DC Electrical Characteristics

V_{DD} = 5.0 V ± 10%，V_{SS} = 0V，Ta = 25°C

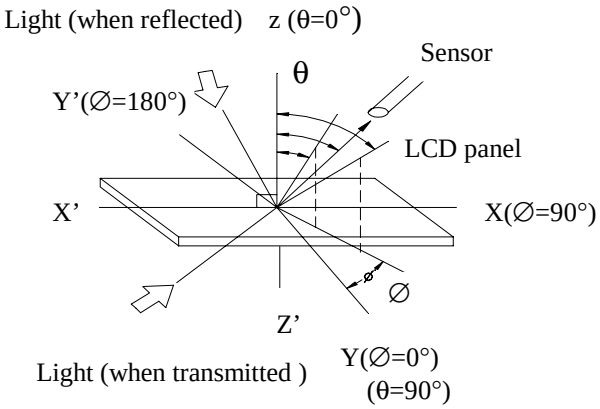
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Supply Voltage	V_{DD}	—	4.5	5	5.5	V
“H” Input Voltage	V_{IH}	—	2.2	-	V_{DD}+0.3	V
“L” Input Voltage	V_{IL}	—	-0.3	-	0.8	V
“H” Output Voltage	V_{OH}	—	2.4	-	-	V
“L” Output Voltage	V_{OL}	—	-	-	0.4	V
Supply current	I_{DD}	V_{DD}=5V	-	60.0	-	mA
LCD driving voltage	V_{OP}(V_{DD}-V_O)	-10℃	-	29.0	-	V
		25℃	-	23.3	-	V
		70℃	-	18.5	-	V

1.5 Optical Characteristics

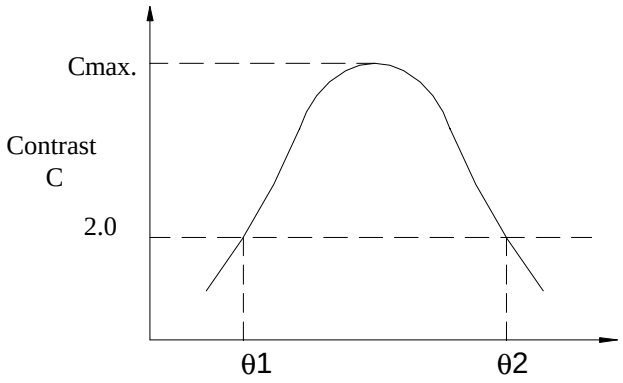
LCD Panel: 1/240 duty, 1/17 bias, V_{LCD} =24.7V, Ta=25°C

Item	Symbol	Conditions	Min.	Typ.	Max.	Reference
View Angle	θ	C≥2.0,∅= 0°	-27	29°	-	Notes 1 & 2
Contrast Ratio	C	θ= 5°, ∅= 0°	4.7	5.5	-	Note 3
Response Time(rise)	tr	θ= 5°, ∅= 0°	275 ms	296 ms	-	Note 4
Response Time(fall)	tf	θ= 5°, ∅= 0°	151 ms	166 ms	-	Note 4

Note 1: Definition of angles θ and ∅



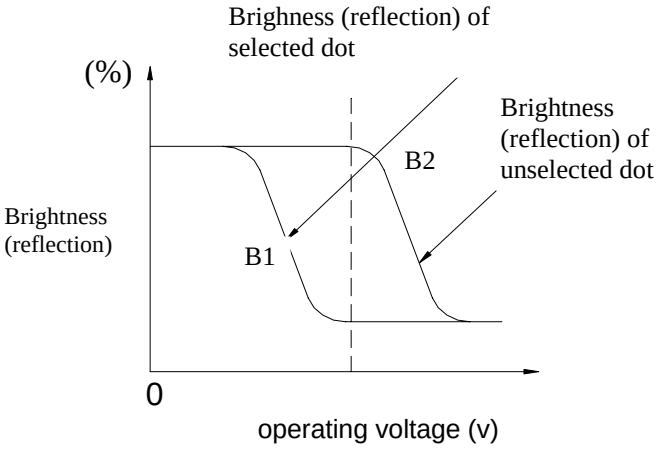
Note 2: Definition of viewing angles θ1 and θ2



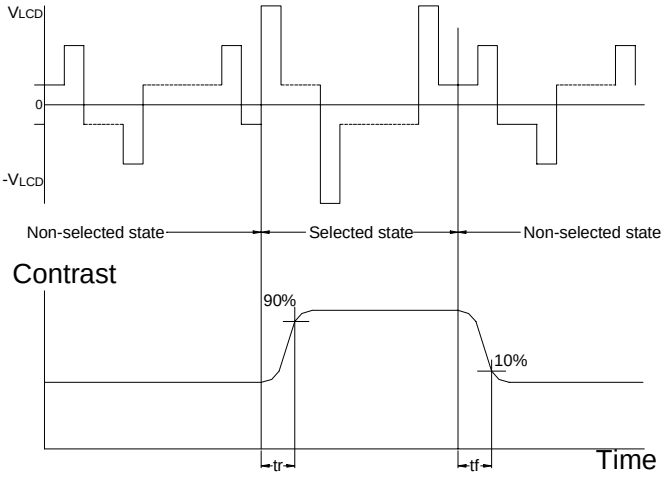
Note : Optimum viewing angle with the naked eye and viewing angle θ at Cmax. Above are not always the same

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

1.6 Backlight Characteristics

LCD Module with LED Backlight

Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Forward current	I_F	T_A=25°C	-	200	mA
Reverse voltage	V_R	T_A=25°C	-	5	V
Power dissipation	P_O	T_A=25°C	-	0.8	W
Operating Temperature	T_{OPR}	-	-20	70	°C
Storage temperature	T_{STG}	-	-40	80	°C

Electrical / Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward voltage	V_F	I_F=160mA	-	3.3	-	V
Reverse current	I_R	V_R=5V	-	-	10	uA
Luminous intensity	I_V	I_F=160mA	-	80	-	cd/m^2
Average Brightness (with LCD)	I_{V1}	V_F=3.3V	5.0	8.5	-	cd/m^2
Color	White					

1.7 Touch Screen Characteristic

1. Input Method and Activation Force
   Stylus < 40grams and Finger < 40grams
2. Typical Optical Characteristics
   Visible Light Transmission : >78%@550nm
   Haze : 5%±2% through hard coated PET only
3. Electrical Specifications
   1. Operating Voltage 5.5V or less
   2. Contact current 20mA(maximum)
   3. Circuit close resistance X : 150~1300Ω Y : 150~1300Ω
   4. Circuit open resistance > 20MΩ at 25V DC
   5. Contact bounce < 15ms
   6. Linear Test Specification : 1.5% (maximum)
4. Linearity Tolerance : 1.5% (maximum)
5. Touch Screen with 3M 7953 Tape
6. Environment Specification
   Operating Temperature 0°C ~ +50°C (Humidity less than 90% RH)
   Storage Temperature -20°C ~ +70°C (at ambient Humidity)

2. MODULE STRUCTURE

2.1 Counter Drawing

* See Appendix

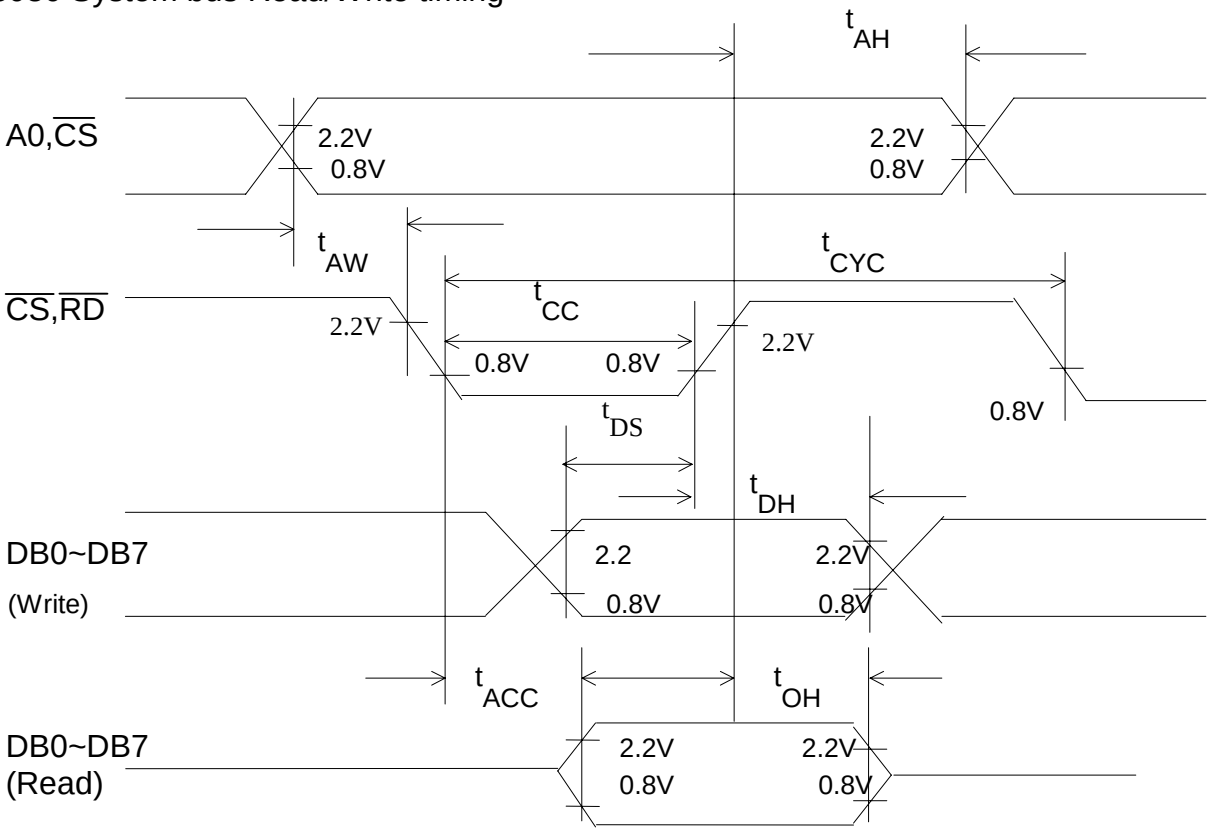
2.2 Interface Pin Description

Pin No.	Symbol	Function
1	V_{SS}	Power Supply (V_{SS}=0)
2	V_{DD}	Power Supply (V_{DD} >V_{SS})
3	V_{LCD}	Operating voltage for LCD; Not connection
4	/RD	Data read (write data to the module at “L)
5	/WR	Data write (read data from the module at “L)
6	A0	MPU address A0
7-14	DB0~DB7	Data bus (DB0=LSB, DB7=MSB)
15	/CS	SED 1335 chip select
16	/RES	SED 1335 rest input
17	VEE	Negative voltage supply; Not connection
18	FG	Frame ground (connected to metal bezel)
19	NC	Not connection
20	NC	Not connection

* Built in negative voltage generator circuit

2.3 Timing Characteristics

8080 System bus Read/Write timing



Item	Symbol	Min.	Typ.	Max.	Unit
System cycle time	T_{CYC}	See note	-	-	ns
Control pulse width	T_{CC}	220	-	-	ns
Address setup time	t_{AW}	30	-	-	ns
Address hold time	t_{AH}	10	-	-	ns
Data setup time	t_{DS}	120	-	-	ns
Data hold time	t_{DH}	10	-	-	ns
RD access time	t_{ACC}	-	-	120	ns
Output disable time	t_{OH}	10	-	50	ns

Note T_{CYC} = 4Tc+Tcc+30

2.4 Instruction Description

The Command Set

Table 1. Command set

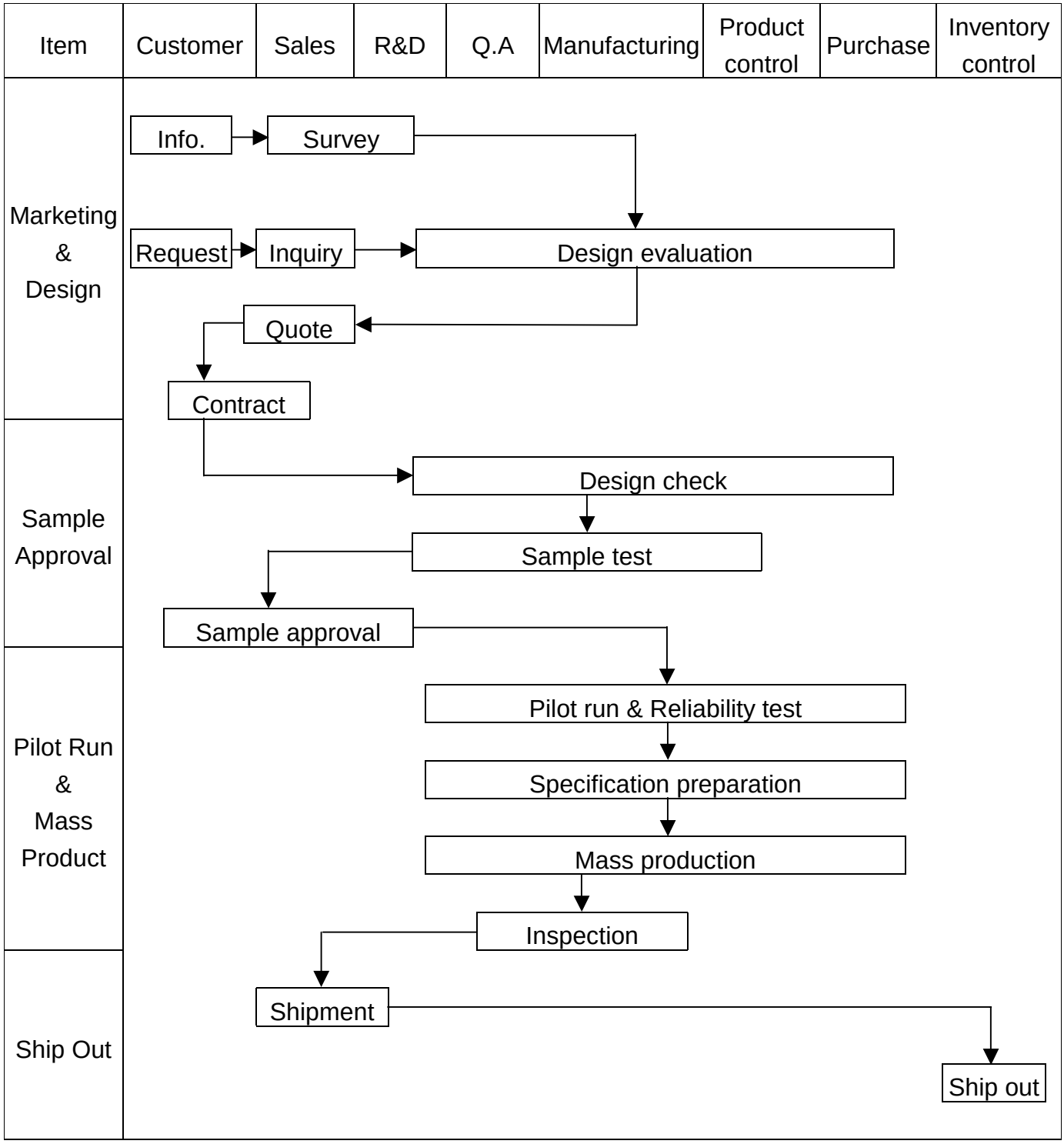
Class	Command	Code											Hex	Command description	Command read Parameters	
		RD	WR	A0	D7	D6	D5	D4	D3	D2	D1	D0			Number of bytes	Section
System control	SYSTEM SET	1	0	1	0	1	0	0	0	0	0	0	40	Initialize device and display	8	8.2.1
	SLEEP IN	1	0	1	0	1	0	1	0	0	1	1	53	Enter standby mode	0	8.2.2
Display control	DISP ON/OFF	1	0	1	0	1	0	1	1	0	0	D	58. 59	Enable and disable display and display flashing	1	8.3.1
	SCROLL	1	0	1	0	1	0	0	0	1	0	0	44	Set display start address and display regions	10	8.3.2
	CSRFORM	1	0	1	0	1	0	1	1	1	0	1	5D	Set cursor type	2	8.3.3
	CGRAM ADR	1	0	1	0	1	0	1	1	1	0	0	5C	Set start address of character generator RAM	2	8.3.6
	CSRDIR	1	0	1	0	1	0	0	1	1	CD 1	CD 0	4C to 4F	Set direction of cursor movement	0	8.3.4
	HDOT SCR	1	0	1	0	1	0	1	1	0	1	0	5A	Set horizontal scroll position	1	8.3.7
	OVLAY	1	0	1	0	1	0	1	1	0	1	1	5B	Set display overlay format	1	8.3.5
Drawing control	CSRW	1	0	1	0	1	0	0	0	1	1	0	46	Set cursor address	2	8.4.1
	CSRR	1	0	1	0	1	0	0	0	1	1	1	47	Read cursor address	2	8.4.2
Memory control	MWRITE	1	0	1	0	1	0	0	0	0	1	0	42	Write to display memory	-	8.5.1
	MRAD	1	0	1	0	1	0	0	0	0	1	1	43	Read from display memory	-	8.5.2

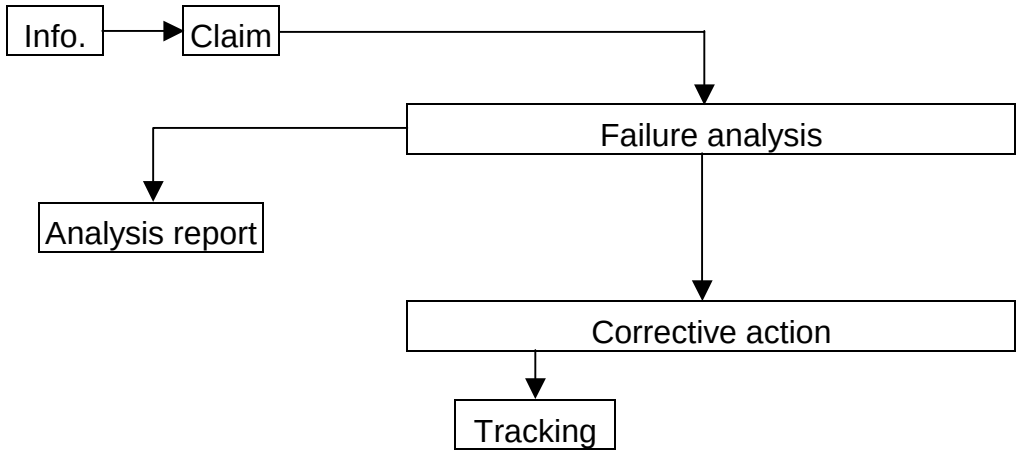
Notes

1. In general, the internal registers of the SED 1335 series are modified as each command parameter is input. However, the microprocessor does not have to set all the parameters of a command and may send a new input will have been changed but the remaining parameter registers are unchanged.
   2-byte parameters (where two bytes are treated as 1 data item) are handled as follows:
   a. CSRW, CSRR: Each byte is processed individually. The microprocessor may read or write just the low byte of the cursor address.
   b. SYSTEM SET, SCROLL, CGRAM ADR: Both parameter bytes are processed together. If the command is changed after half of the parameter has been input, the single byte is ignored.
2. APL and APH are 2-byte parameters, but are treated as two 1-byte parameters.

3. QUALITY ASSURANCE SYSTEM

3.1 Quality Assurance Flow Chart

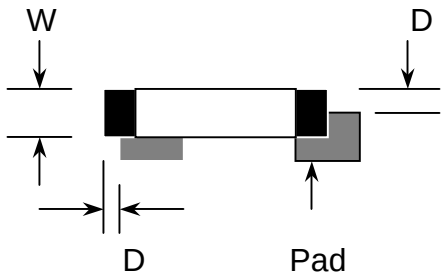


Sales Service	
Q.A Activity	1. ISO 9001 Maintenance Activities 2. Process improvement proposal 3. Equipment calibration 4. Education And Training Activities 5. Standardization Management

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

NO	Item	Test Condition		Applicable Standard
1	High Temperature Storage	Storage At 80 ±2℃ 96~100 hrs Surrounding Temperature，Then Storage At Normal Condition 4hrs.		MIL-202E
2	Low Temperature Storage	Storage At -30 ±2℃ 96~100 hrs Surrounding Temperature, Then Storage At Normal Condition 4hrs.		MIL-202E
3	High Temperature Humidity Storage	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.		MIL-202E
4	Temperature Cycling	-20℃ → 25℃ → 70℃ → 25℃ (30Mins) (5Mins) (30Mins) (5Mins) 10 Cycle		MIL-202E
5	Vibration	10~55Hz (1 Minute) 1.5mm X,Y And Z Direction ＊ (Each 2hrs)		MIL-202E
6	Drop Test	Packing Weight (Kg)	Drop High (Cm)	MIL-810E
		0 ~ 45.4	122	
		45.4 ~ 90.8	76	
		90.8 ~ 454	61	
		Over 454	46	

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.

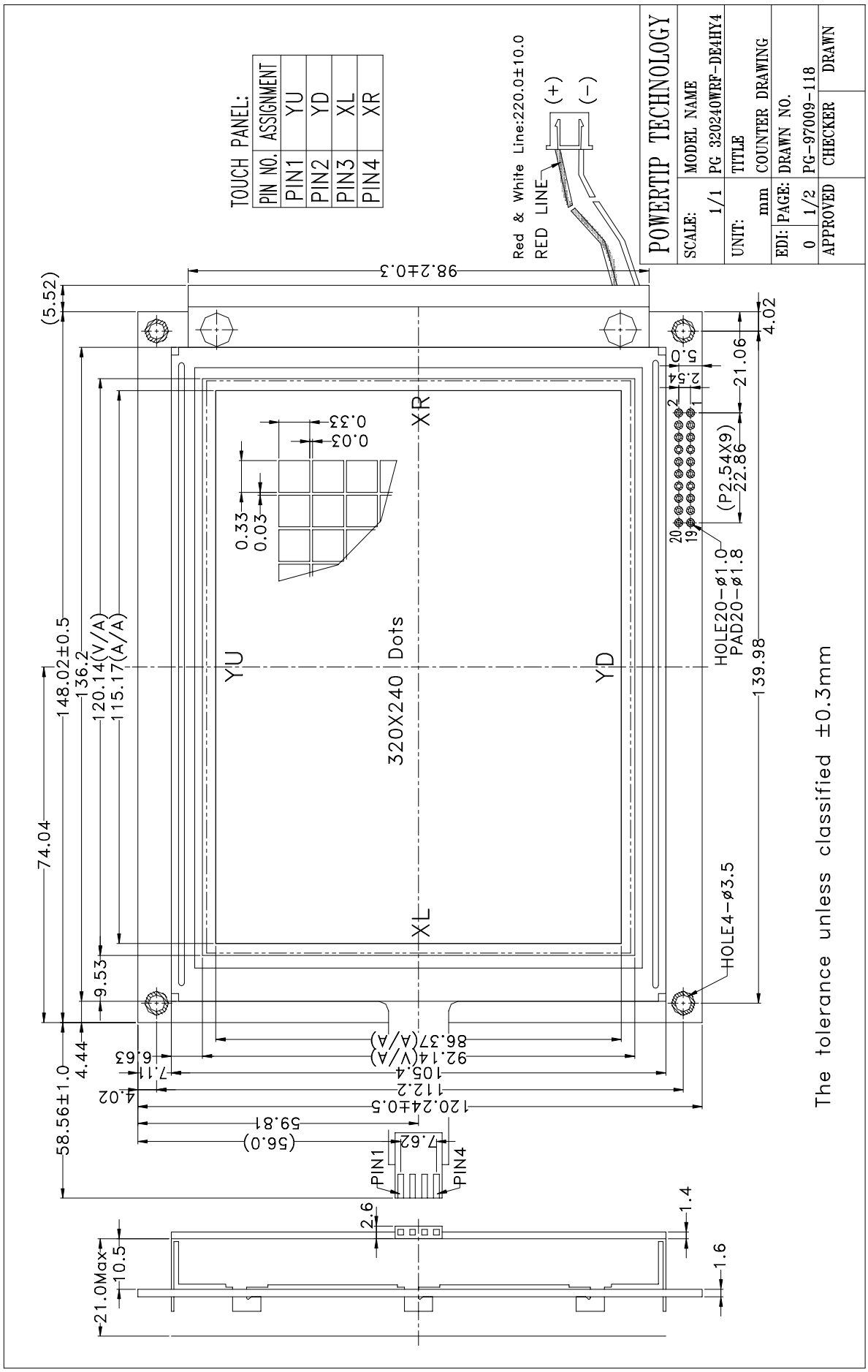
5.4 TERMS OF WARRANTY

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.


TOUCH PANEL:
PIN NO. ASSIGNMENT
PIN1 YU
PIN2 YD
PIN3 XL
PIN4 XR
Red & White Line:220.0±10.0
RED LINE
(+)
(-)
POWERTIP TECHNOLOGY
SCALE: 1/1
MODEL NAME PG 320240WRF-DE4HY4
UNIT: mm
TITLE COUNTER DRAWING
EDI: 0
PAGE: 1/2
DRAWN NO. PG-97009-118
APPROVED
CHECKER
DRAWN
98.2±0.3
(5.52)
4.02
5.0
2.54
21.06
22.86
(P2.54X9)
0.33
0.03
XR
YU
YD
XL
320X240 Dots
HOLE20-ø1.0
PAD20-ø1.8
139.98
148.02±0.5
136.2
120.14(V/A)
115.17(A/A)
74.04
9.53
HOLE4-ø3.5
86.37(A/A)
92.14(V/A)
105.4
112.2
120.24±0.5
4.02
7.11
6.63
4.44
58.56±1.0
59.81
(56.0)
7.62
PIN1
PIN4
2.6
1.4
1.6
10.5
21.0Max
The tolerance unless classified ±0.3mm

PIN NO.	SIGNAL
1	Vss
2	Vdd
3	VLCD
4	/RD
5	/WR
6	Ao
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	/CS
16	/RST
17	Vee
18	FG
19	NC(A)
20	NC(K)

POWERTIP TECHNOLOGY		
SCALE: N/A	MODEL NAME PG 320240WRF-DE4HY4	
UNIT: mm	TITLE COUNTER DRAWING	
EDI: 0	PAGE: 2/2	DRAWN NO. PG-97009-118
APPROVED	CHECKER	DRAWN