POWERTIP TECH. CORP.

SPECIFICATIONS

CUSTOMER	:	
SAMPLE CODE (Ver.)	:	
MASS PRODUCTION CODE (Ver.)	:	**PE12864WRF-001HL6Q (Ver.0)**
DRAWING NO. (Ver.)		**PE-03004-26**

Customer Approved

Date:

Approved	QC Confirmed	Designer

■ Approval For Specifications Only.

* This specification is subject to change without notice.

Please contact Powertip or it's representative before designing your product based on this specification.

□ Approval For Specifications and Sample.

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RECORDS OF REVISION

Date	Rev.	Description	Note	Page
2005/12/01	0	PE12864WRF-001HL6Qis the ROHS compliant part number based on Powertip's standard PE12864WRF-001-HL6		

Total：22 Page

Contents

Note：For detailed information please refer to IC data sheet：SITRONIX---ST7565S

1. SPECIFICATIONS

1.1 Features

Item	Standard Value
Display Type	128 * 64 Dots
LCD Type	FSTN, White Positive, Transflective Extended Temp
Driver Condition	LCD Module: 1/64 Duty, 1/9 Bias
Viewing Direction	6 O'clock
Backlight	LED White B/L
Weight	12g
Interface	8 bits parallel data input
Other(controller/driver IC)	Driver IC: ST7565S-G

1.2 Mechanical Specifications

Item	Standard Value	Unit
Outline Dimension	55.2 (L) * 39.8(w) * 6.5 (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

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	5.0	V
LCD Driver Supply Voltage	V_{OUT}	-	-16.0	-0.3	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
Storage Humidity	H_D	Ta < 40 °C	-	90	%RH

1.4 DC Electrical Characteristics

V_{DD} = 3.0 V ± 0.3V, V_{SS} = 0V, Ta = 25°C

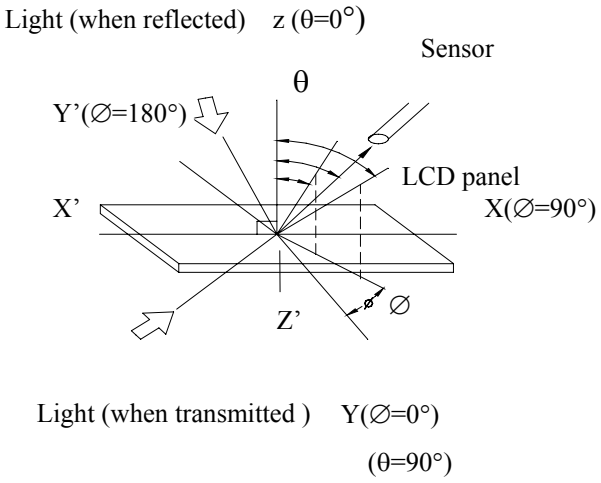
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Supply Voltage	V_{DD}	-	2.7	3.0	3.3	V
"H" Input Voltage	V_{IH}	-	0.8 V_{DD}	-	V_{DD}	V
"L" Input Voltage	V_{IL}	-	V_{SS}	-	0.2 V_{DD}	V
"H" Output Voltage	V_{OH}	-	0.8 V_{DD}	-	V_{DD}	V
"L" Output Voltage	V_{OL}	-	V_{SS}	-	0.2 V_{DD}	V
Supply Current	I_{DD}	V_{DD} = 3.0 V	-	0.2	1.0	mA
LCM Driver Voltage	V_{OP}	V_{C5} (-20°C)	-	-	-	V
		V_{C5} (25°C)	8.3	8.5	8.7	
		V_{C5} (70°C)	-	-	-	

1.5 Optical Characteristics

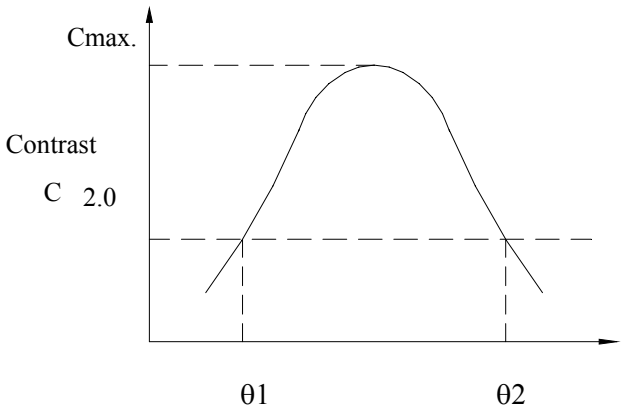
LCD Panel: 1/65 Duty, 1/9 Bias, V_{LCD} = 9.0 V, Ta = 25°C

Item	Symbol	Conditions	Min.	Typ.	Max.	Reference
View Angle	θ	C≥2.0,∅=0°	0°	-	40°	Notes 1 & 2
Contrast Ratio	C	θ=5°, ∅=0°	2	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 ∅



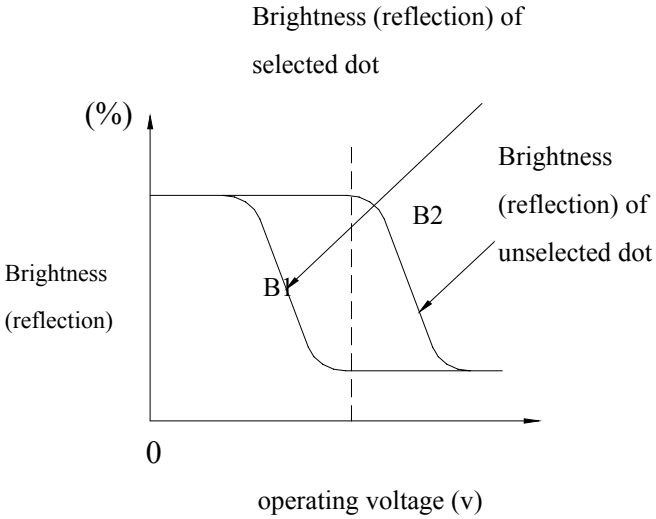
Note 2: Definition of viewing angles θ1 and θ2



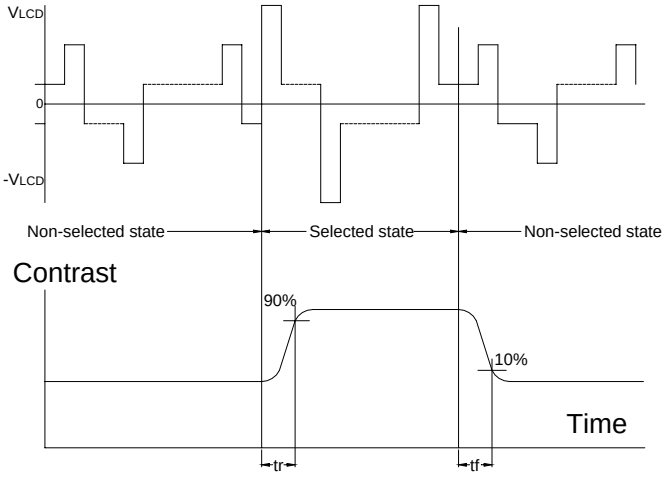
Note : Optimum viewing angle with the naked eye and viewing angle θ at Cmax. Above are not always the same

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_{LCD} : Operating voltage f_{FRM} : Frame frequency

t_r : Response time (rise) t_f : Response time (fall)

1.6 Backlight Characteristics

LCD Module with LED Backlight

Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Forward Current	IF	Ta =25°C	-	120	mA
Reverse Voltage	VR	Ta =25°C	-	10	V
Power Dissipation	PO	Ta =25°C	-	0.6	W

Electrical / Optical Characteristics

Ta =25°C

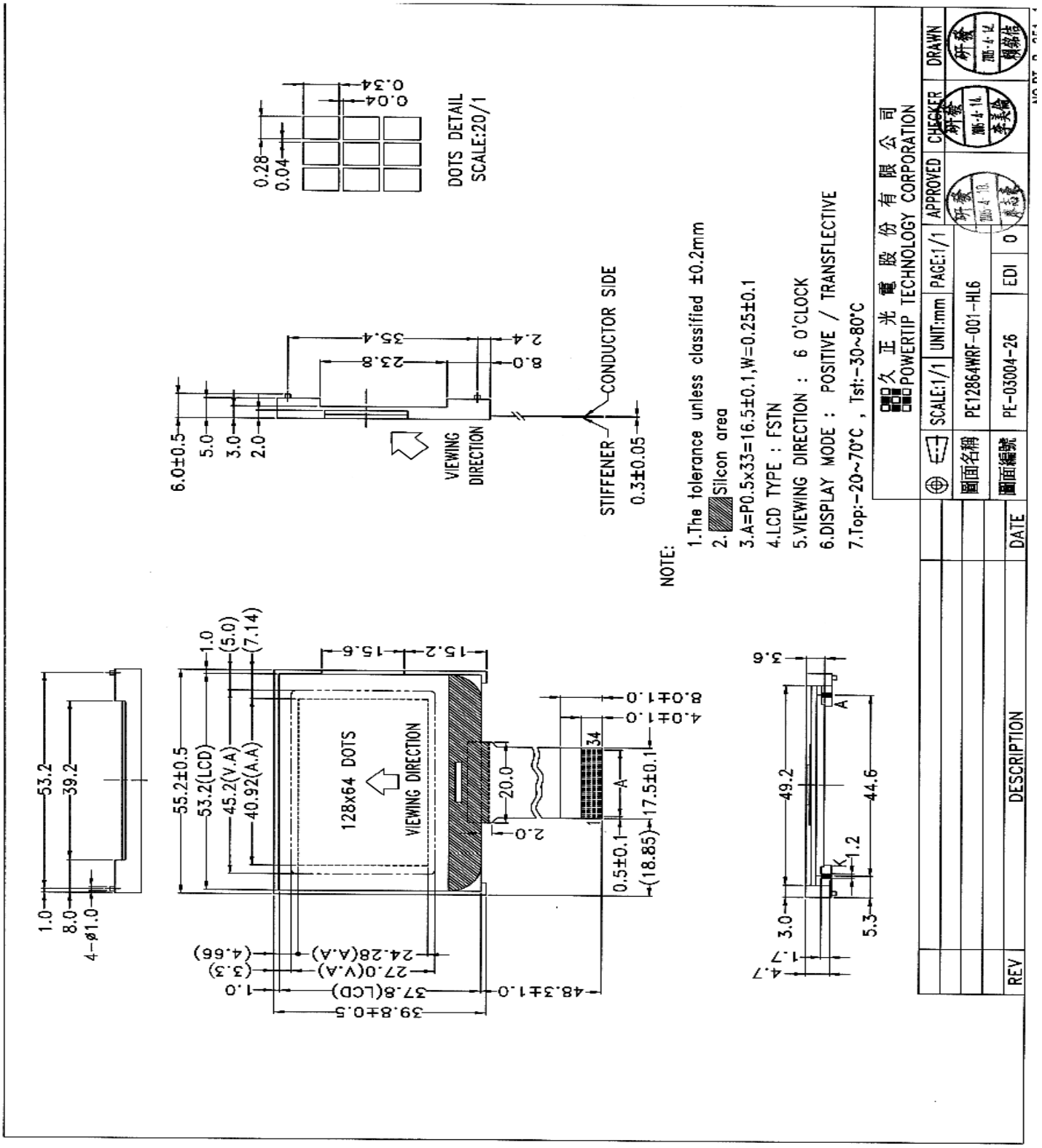
Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Forward Voltage	VF	IF=80 mA	-	4.2	5	V
Reverse Current	IR	VR=10V	-	-	0.2	mA
Average Brightness (Without LCD)	IV	IF=80 mA	200	300	-	cd/m^2
Uniformity	△EH	IF= 80 mA	-	-	-	%
CIE Color Coordinate (Without LCD)	X	IF= 80 mA	0.255	0.297	0.34	-
	Y		0.265	0.307	0.35	
Color	White					

Note:△EH%＝B（MIN）÷ B（MAX）×100%

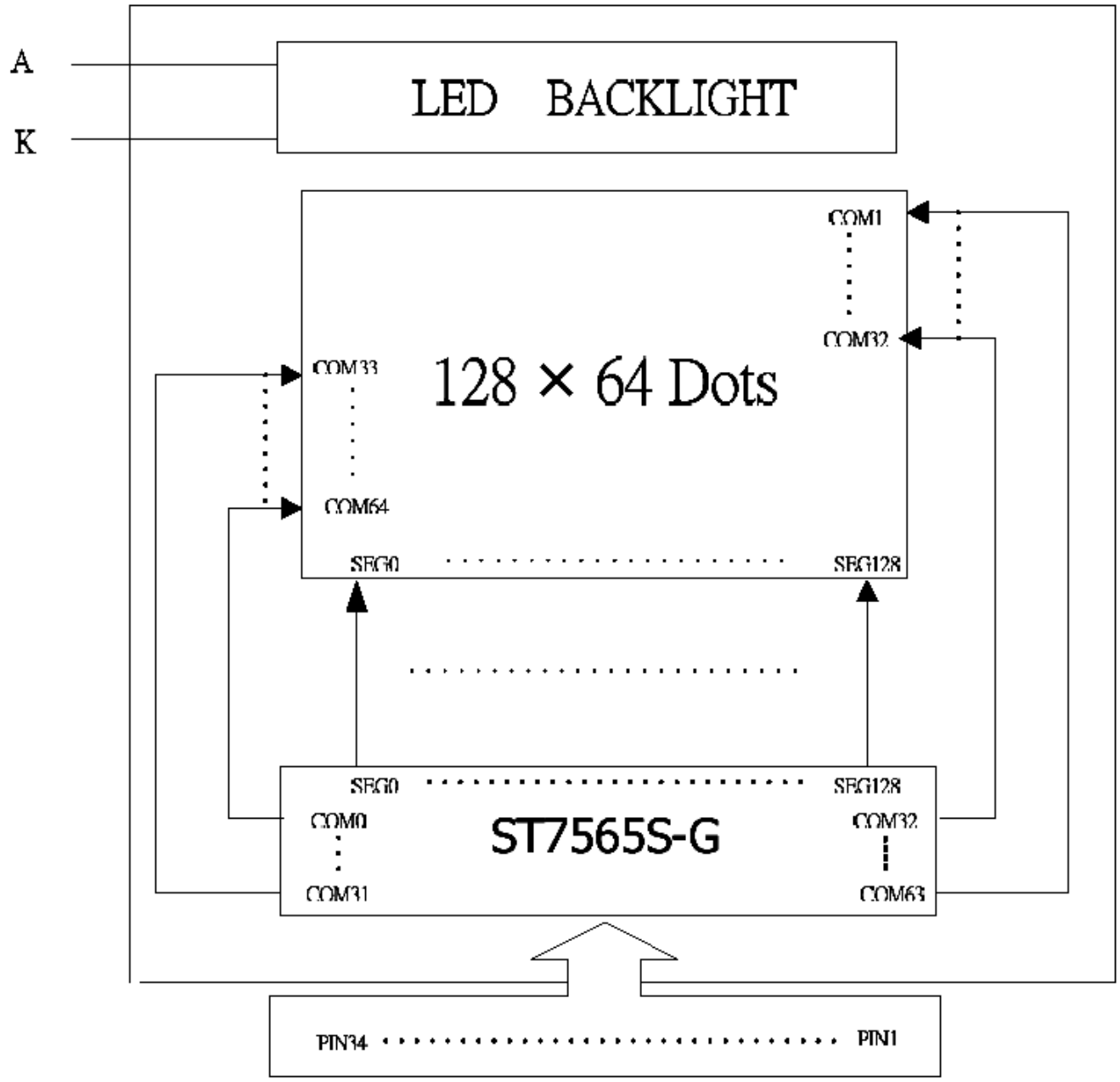
2. MODULE STRUCTURE

2.1 Counter Drawing

2.1.1 Mechanical Diagram



2.1.2 Block Diagram



Prese refer interface pin description for detail

2.2 Interface Pin Description

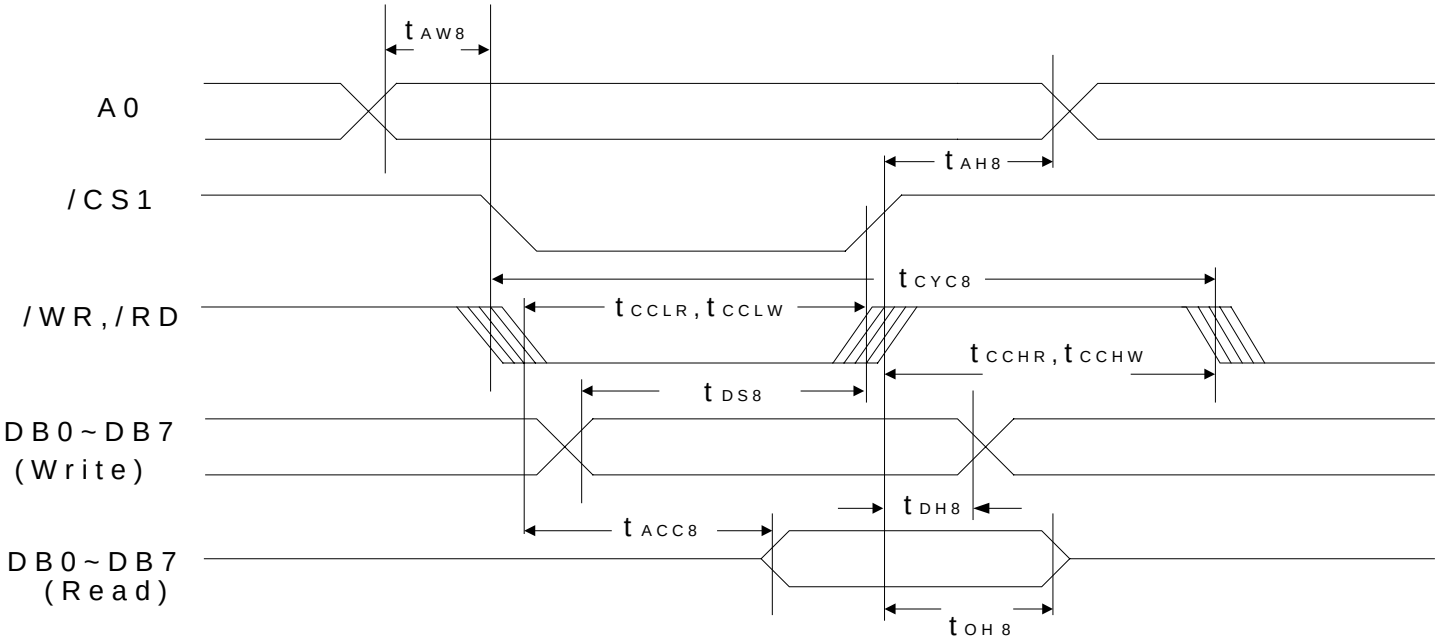
<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Function</th></tr>
<tr><td>1</td><td>IRS</td><td>This terminal selects the resistors for the V5 voltage level adjustment.
IRS = “H”: Use the internal resistors.
IRS = “L”: Do not use the internal resistors.
The V5 voltage level is regulated by an external resistive voltage divider attached to the VR terminal. This pin is enabled only when the master operation mode is selected. It is fixed to either “H”or “L” when the slave operation mode is selected.</td></tr>
<tr><td>2</td><td>HPM</td><td>This is the power cpntrol terminal for the power supply circuit for liquid crystal drive.
HPM=”H”:Normal made
HPM=”L”:High power mode</td></tr>
<tr><td>3</td><td>P/S</td><td>This is the parallel data input/serial data input switch terminal.
P/S = “H”: Parallel data input.
P/S = “L”: Serial data input.
The following applies depending on the PS status:
<table>
<tr><th>P/S</th><th>Data/Command</th><th>Data</th><th>Read/Write</th><th>Serial Clock</th></tr>
<tr><td>“H”</td><td>A0</td><td>DB0 ~ DB7</td><td>/RD, /WR</td><td>X</td></tr>
<tr><td>“L”</td><td>A0</td><td>SI (DB7)</td><td>Write only</td><td>SCL (DB6)</td></tr>
</table>
When P/S = “L”, DB0 to DB5 fixed “H”.
/RD (EP) and /WR (RWP) are fixed to either “H” or “L”.
With serial data input, It is impossible read data from RAM .</td></tr>
<tr><td>4</td><td>C86</td><td>This is the MPU interface switch terminal.
C86 = “H”: 6800 Series MPU interface.
C86 = “L”: 8080 MPU interface.</td></tr>
<tr><td>5</td><td>VR</td><td>Output voltage regulator terminal. Provides the voltage between VDD and V5 through a resistive voltage divider.
These are only enabled when the V5 voltage regulator internal resistors are not used (IRS = “L”). These cannot be used when the V5 voltage regulator internal resistors are used (IRS = “H”).</td></tr>
</table>

6	V5	A multi-level power supply for the liquid crystal drive. The voltage 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. VDD (= V0) ≥V1≥V2≥V3≥V4≥V5
7	V4	
8	V3	
9	V2	
10	V1	
11	VRS	This is the internal-input VREG power supply for the lcd power supply
12	C4-	DC/DC voltage converter. Connect a capacitor between this terminal and C2+
13	C2+	DC/DC voltage converter. Connect a capacitor between this terminal and C2-
14	C2-	DC/DC voltage converter. Connect a capacitor between this terminal and C2+
15	C1-	DC/DC voltage converter. Connect a capacitor between this terminal and C1+
16	C1+	DC/DC voltage converter. Connect a capacitor between this terminal and C1-
17	C3-	DC/DC voltage converter. Connect a capacitor between this terminal and C1+
18	C5-	DC/DC voltage converter. Connect a capacitor between this terminal and C1+
19	VOUT	DC/DC voltage converter. Connect a capacitor between this terminal and V_{SS}
20	V_{SS}	Power Supply (V_{SS}=0)
21	V_{DD}	Power Supply (V_{DD}=3.0)

22	DB7	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 (PS = "L"), DB7 serves as the serial data input terminal (SI) and DB6 serves as the serial clock input terminal (SCL). At the same time, DB5 - 0 are set to high impedance. When the chip select is inactive, DB0 to DB7 are set to high impedance.
23	DB6	
24	DB5	
25	DB4	
26	DB3	
27	DB2	
28	DB1	
29	DB0	
30	/RD(E)	When connected to an 8080 MPU, this is LOW active. 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 Serier MPU enable clock input terminal.
31	/WR(RW)	When connected to an 8080 MPU, this is LOW active. 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.
32	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 DB0 to DB7 are display data. A0 = "L": Indicates that DB0 to DB7 are control data.
33	/RES	/RES is set to "L", the settings are initialized. The /RES signal level performs the reset operation.
34	/CS1	This is the chip select signal. When /CS1 = "L", then the chip select becomes active, and data/command I/O is enabled.

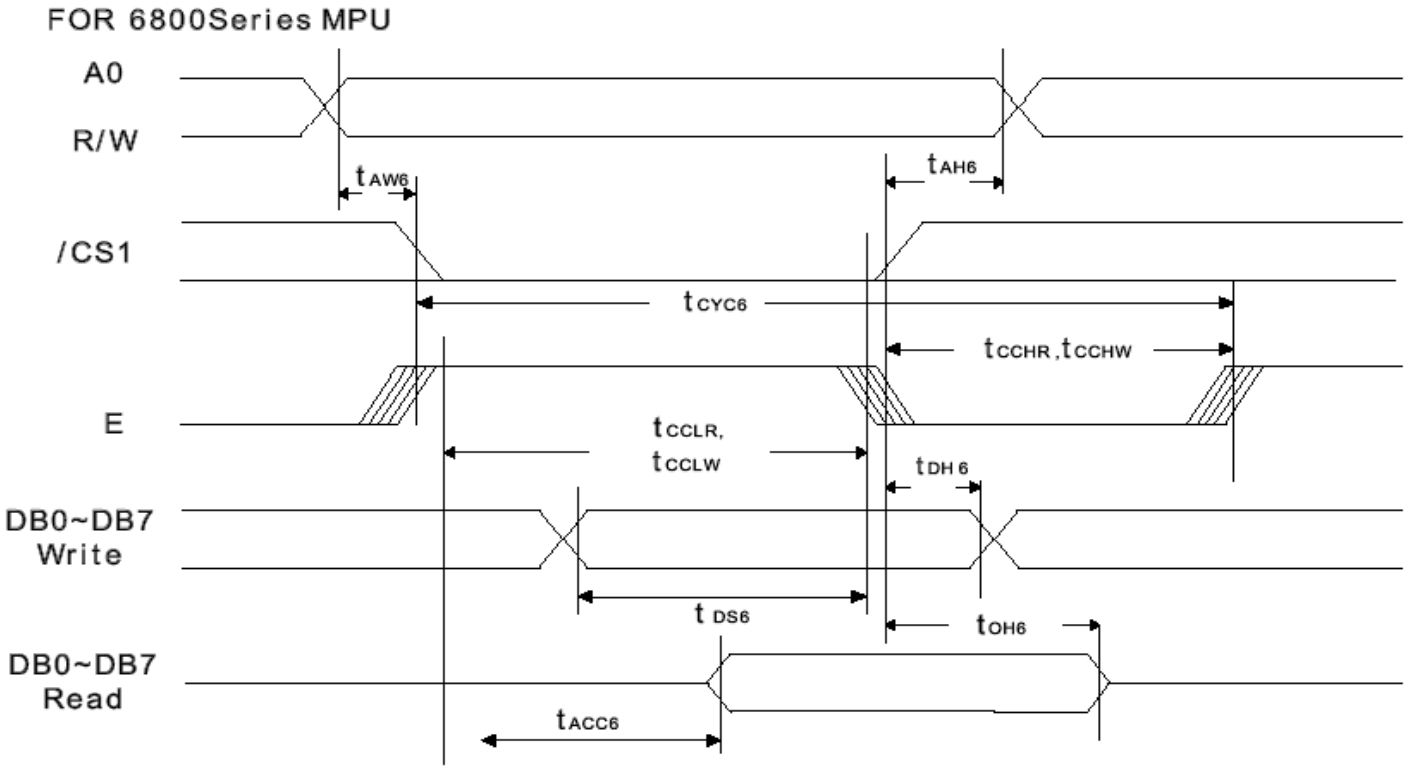
2.3 Timing Characteristics

FOR 8080 Series MPU



VDD=2.7V,Ta=25°C

Item	Signal	Symbol	Condition	Rating		Units
				Min	Max	
Address hold time	A0P	t_{AH8}	-	0	-	ns
Address setup time		t_{AW8}	-	0	-	
System cycle time		t_{CYC8}	-	400	-	
Control L pulse width (/WR)	/WR	t_{CCLW}	-	220	-	
Control H pulse width (/WR)		t_{CCHW}	-	180	-	
Control L pulse width (/RD)	/RD	t_{CCLR}	-	220	-	
Control H pulse width (/RD)		t_{CCHR}	-	180	-	
WRITE Data setup time	DB0 to DB7	t_{DS8}	-	40	-	
WRITE Address hold time		t_{DH8}	-	0	-	
READ access time		t_{ACC8}	C_L=100pF	-	140	
READ Output disable time		t_{OH8}	C_L=100pF	10	100	



VDD=2.7V,Ta=25°C

Item	Signal	Symbol	Condition	Rating		Units
				Min	Max	
Address hold time	A0P	t_{AH6}	-	0	-	ns
Address setup time		t_{AW6}	-	0	-	
System cycle time		t_{CYC6}	-	400	-	
Control L pulse width (/WR)	/WR	t_{EWLW}	-	220	-	
Control H pulse width (/WR)		t_{EWHW}	-	180	-	
Control L pulse width (/RD)	/RD	t_{EWLR}	-	220	-	
Control H pulse width (/RD)		t_{EWHR}	-	180	-	
WRITE Data setup time	DB0 to DB7	t_{DS6}	-	40	-	
WRITE Address hold time		t_{DH6}	-	0	-	
READ access time		t_{ACC6}	C_L=100pF	-	140	
READ Output disable time		t_{OH6}	C_L=100pF	10	100	

2.4 Display Command

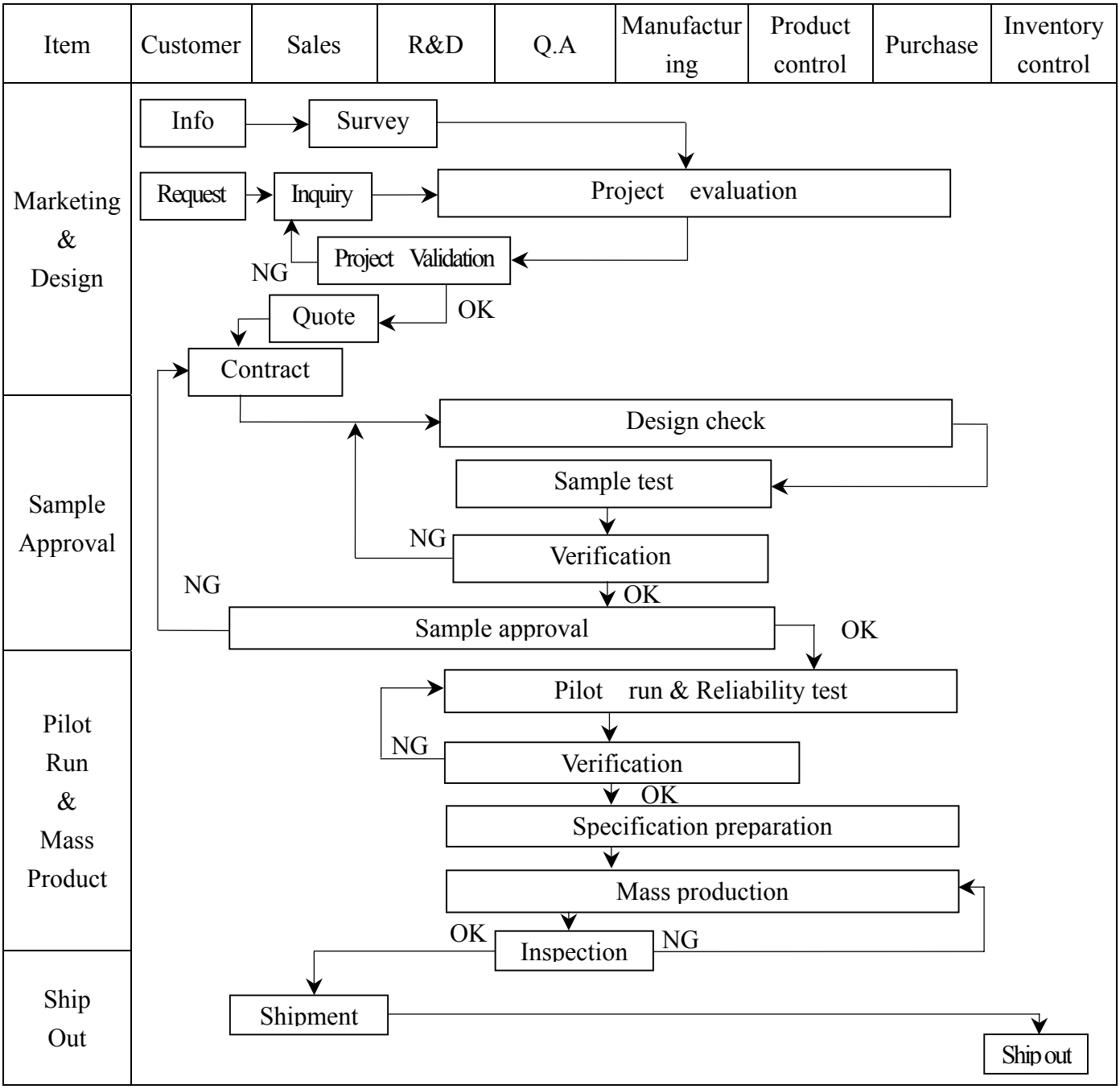
Command	Command Code											Function
	A0	$\overline{RD}$	$\overline{WR}$	D7	D6	D5	D4	D3	D2	D2	D0	
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0 1	LCD display ON/OFF 0:OFF, 1:ON
(2) Display start line set	0	1	0	0	1	Display start address						Sets the display RAM display start line address
(3) Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address.
Column address set lower bit	0	1	0	0	0	0	0	Least significant column address				Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1	Status				0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data								Writes to the display RAM
(7) Display data read	1	0	1	Read data								Reads from the display RAM
(8) ADC select	0	1	0	1	0	1	0	0	0	0	0 1	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9)Display normal/ reverse	0	1	0	1	0	1	0	0	1	1	0 1	Sets the LCD display RAM normal/reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0 1	Display all points 0: normal display, 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0 1	Sets the LCD drive voltage bias ratio 0: 1/9, 1:1/7
(12) Read/modify/write	0	1	0	1	1	1	0	0	0	0	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	1	1	1	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	Internal reset

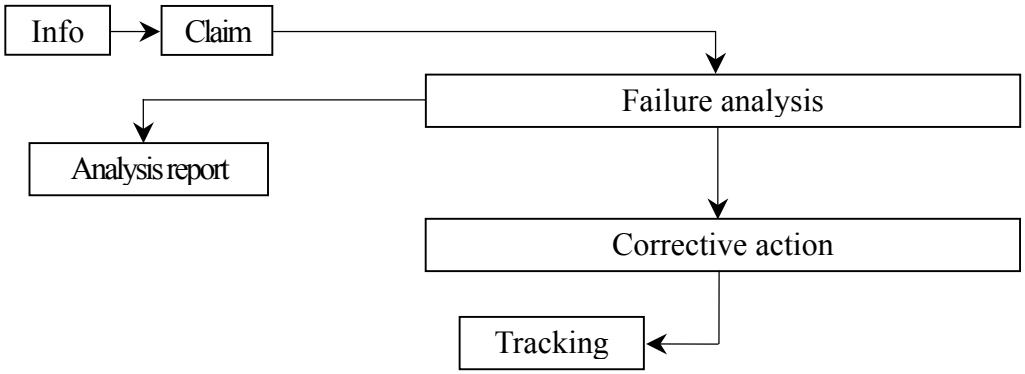
(15) Common output mode select	0	1	0	1	1	0	0	0 1	*	*	*	Select COM output scan direction 0: normal direction, 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode			Select internal power supply operating mode
(17) V5 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio (Rb/Ra) mode
(18) Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1	
Electronic volume register set	0	1	0	*	*	Electronic volume value						Set the V5 output voltage electronic volume register.
(19) Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0 1	0: OFF 1: ON
Static indicator register set	1	0	1	*	*	*	*	*	*	Mode		Set the flashing mode
(20) Power saver												Display OFF and display all points ON compound command
(21) NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
(22) Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command

(Note) *: disabled data

3. QUALITY ASSURANCE SYSTEM

3.1 Quality Assurance Flow Chart

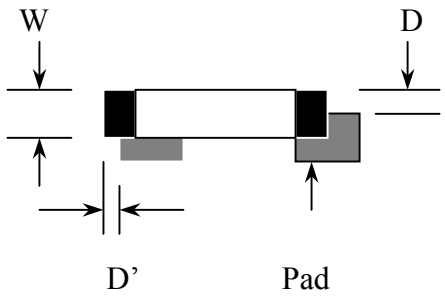


Item	Customer	Sales	R&D	Q.A	Manufactu ring	Product control	Purchase	Inventory control
Sales Service								
Q.A Activity	1. ISO 9001 Maintenance Activities 2. Process improvement proposal 3. Equipment calibration 4. Education And Training Activities 5. Standardization Management							

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 0.4; Minor Defect AQL 1.5
FQC Defect Level : 100% Inspection
OUT Going Defect Level : Sampling
Specification :

NO	Item	Specification	Judge	Level
1	Part Number	The part number is inconsistent with work order of production	N.G.	Major
2	Quantity	The quantity is inconsistent with work order of production	N.G.	Major
3	Electronic characteristics of LCM A=(L + W)/2	The display lacks of some patterns.	N.G.	Major
		Missing line.	N.G.	Major
		The size of missing dot, A is > 1/2 Dot size	N.G.	Major
		There is no function.	N.G.	Major
		Output data is error	N.G.	Major
4	Appearance of LCD A=(L + W)/2 Dirty particle (Including scratch、bubble)	Material is different with work order of production	N.G.	Major
		LCD is assembled in inverse direction	N.G.	Major
		Bezel is assembled in inverse direction	N.G.	Major
		Shadow is within LCD viewing area + 0.5 mm	N.G.	Major
		The diameter of dirty particle, A is > 0.4 mm	N.G.	Minor
		Dirty particle length is > 3.0mm, and 0.01mm < width ≤ 0.05mm	N.G.	Minor
		Display is without protective film	N.G.	Minor
		Conductive rubber is over bezel 1mm	N.G.	Minor
		Polarizer exceeds over viewing area of LCD	N.G.	Minor
		Area of bubble in polarizer, A > 1.0mm, the number of bubble is > 1 piece.	N.G.	Minor
		0.4mm < Area of bubble in polarizer, A < 1.0mm, the number of bubble is > 4 pieces.	N.G.	Minor
5	Appearance of PCB A=(L + W)/2	Burned area or wrong part number is on PCB	N.G.	Major
		The symbol, character, and mark of PCB are unidentifiable.	N.G	Minor
		The stripped solder mask , A is > 1.0mm	N.G.	Minor
		0.3mm < stripped solder mask or visible circuit, A < 1.0mm, and the number is ≥ 4 pieces	N.G.	Minor
		There is particle between the circuits in solder mask	N.G	Minor
		The circuit is peeled off or cracked	N.G	Minor
		There is any circuits risen or exposed.	N.G	Minor
		0.2mm < Area of solder ball, A is ≤ 0.4mm The number of solder ball is ≥ 3 pieces	N.G	Minor
		The magnitude of solder ball, A is > 0.4mm.	N.G	Minor

NO	Item	Specification	Judge	Level
6	Appearance of molding A=(L + W)/2	The shape of modeling is deformed by touching.	N.G.	Major
		Insufficient epoxy: Circuit or pad of IC is visible	N.G.	Minor
		Excessive epoxy: Diameter of modeling is > 20mm or height is > 2.5mm	N.G.	Minor
		The diameter of pinhole in modeling, A is > 0.2mm.	N.G.	Minor
7	Appearance of frame A=(L + W)/2	The folding angle of frame must be > 45°+ 10°	N.G.	Minor
		The area of stripped electroplate in top-view of frame, A is > 1.0mm.	N.G.	Minor
		Rust or crack is (Top view only)	N.G.	Minor
		The scratched width of frame is > 0.06mm. (Top view only)	N.G.	Minor
8	Electrical characteristic of backlight A=(L + W)/2	The color of backlight is nonconforming	N.G.	Major
		Backlight can't work normally.	N.G.	Major
		The LED lamp can't work normally	N.G.	Major
		The unsoldering area of pin for backlight, A is > 1/2 solder joint area.	N.G.	Minor
		The height of solder pin for backlight is > 2.0mm	N.G.	Minor
10	Assembly parts A=(L + W)/2	The mark or polarity of component is unidentifiable.	N.G.	Minor
		The height between bottom of component and surface of the PCB is floating > 0.7mm	N.G.	Minor
		D > 1/4W  	N.G.	Minor
		End solder joint width, D' is > 50% width of component termination or width of pad	N.G.	Minor
		Side overhang, D is > 25% width of component termination.	N.G.	Minor
		Component is cracked, deformed, and burned, etc.	N.G.	Minor
		The polarity of component is placed in inverse direction.	N.G.	Minor
		Maximum fillet height of solder extends onto the component body or minimum fillet height is < 0.5mm.	N.G.	Minor

4. RELIABILITY TEST

4.1 Reliability Test Condition

NO	Item	Test Condition	
1	High Temperature Storage	Storage at 80 ± 2°C 96~100 hrs Surrounding temperature, then storage at normal condition 4hrs	
2	Low Temperature Storage	Storage at -30 ± 2°C 96~100 hrs Surrounding temperature, then storage at normal condition 4hrs	
3	High Temperature /Humidity Storage	1.Storage 96~100 hrs 60 ± 2°C, 90~95%RH surrounding temperature, then storage at normal condition 4hrs. (Excluding the polarizer). or 2.Storage 96~100 hrs 40 ± 2°C, 90~95%RH surrounding temperature, then storage at normal condition 4 hrs.	
4	Temperature Cycling	-20°C → 25°C → 70°C → 25°C (30mins) (5mins) (30mins) (5mins) 10 Cycle	
5	Vibration	10~55Hz (1 minute) 1.5mm X,Y and Z direction * (each 2hrs)	
6	ESD Test	Air Discharge: Apply 6 KV with 5 times discharge for each polarity +/-	Contact Discharge: Apply 250V with 5 times discharge for each polarity +/-
		Testing location: Around the face of LCD	Testing location: 1.Apply to bezel. 2.Apply to Vdd, Vss.
7	Drop Test	Packing Weight (Kg)	Drop Height (cm)
		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.

5.2.8 To control temperature and time of soldering is 320 ± 10°C and 3-5 sec.

5.2.9 To avoid liquid (include organic solvent) stained on LCM.

5.3 STORAGE

5.3.1 Store the panel or module in a dark place where the temperature is 25°C ± 5°C 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 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.