

SPECIFICATIONS

CUSTOMER : _____

SAMPLE CODE (Ver.) : _____

MASS PRODUCTION CODE (Ver.) : **PE12864WRF-004HL4Q (Ver.A)**

DRAWING NO. (Ver.) : **PE-03007-035 (Ver.0)**

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	Page	Design By
2006/2/13	0	PE12864WRF-004HL4Q is the ROHS compliant part number based on Powertip's standard PE12864WRF-004-HL4	-	-
2007/05/09	A	Updata the function of Pin NO.DB0~DB7	10	

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6. THIS PRODUCT CONFORMS THE ROHS OF PTC .

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 : 1/65 Duty, 1/9 Bias
Viewing Direction	6 O'clock
Backlight	LED White B/L
Weight	46 g
Interface	Use 8080MPU interface, Parallel data input
Other (controller/driver IC)	Driver IC :ST7565S

1.2 Mechanical Specifications

Item	Standard Value	Unit
Outline Dimension	80.0 (L) * 54.0 (w) * 10.2 (H)(Max)	mm
Viewing Area	70.7 (L) * 38.8 (w)	mm
Active Area	66.52 (L) * 33.24 (w)	mm
Dot Size	0.48 (L) * 0.48 (w)	mm
Dot Pitch	0.52 (L) * 0.52 (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 _{LCD}	-	-18.0	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

$V_{DD} = 3.0 \text{ V} \pm 0.3 \text{ V}$, $V_{SS} = 0 \text{ V}$, $T_a = 25^\circ \text{C}$

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}	$V_{DD} = 3.0 \text{ V}$	-	0.3	0.8	mA
LCM Driver Voltage	V_{OP}	$V_{C5}(-20^\circ \text{C})$	-	-	-	V
		$V_{C5}(0^\circ \text{C})$	9.7	10.0	10.3	
		$V_{C5}(70^\circ \text{C})$	-	-	-	

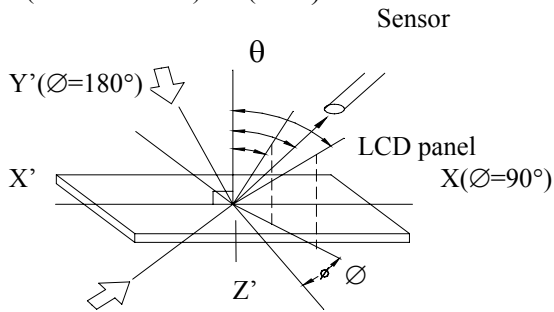
1.5 Optical Characteristics

LCD Panel: 1/65 Duty, 1/9 Bias, $V_{LCD} = 10.0 \text{ V}$, $T_a = 25^\circ \text{C}$

Item	Symbol	Conditions	Min.	Typ.	Max.	Reference
View Angle	θ	$C \geq 2.0, \varnothing = 0^\circ$	0°	-	40°	Notes 1 & 2
Contrast Ratio	C	$\theta = 25^\circ, \varnothing = 0^\circ$	7	9	-	Note 3
Response Time(rise)	t_r	$\theta = 25^\circ, \varnothing = 0^\circ$	-	100ms	150 ms	Note 4
Response Time(fall)	t_f	$\theta = 25^\circ, \varnothing = 0^\circ$	-	230 ms	345 ms	Note 4

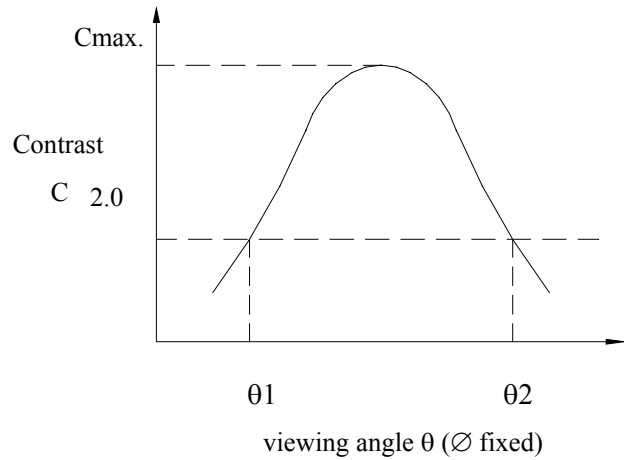
Note 1: Definition of angles θ and \varnothing

Light (when reflected) $z (\theta=0^\circ)$



Light (when transmitted) $Y (\varnothing=0^\circ)$
($\theta=90^\circ$)

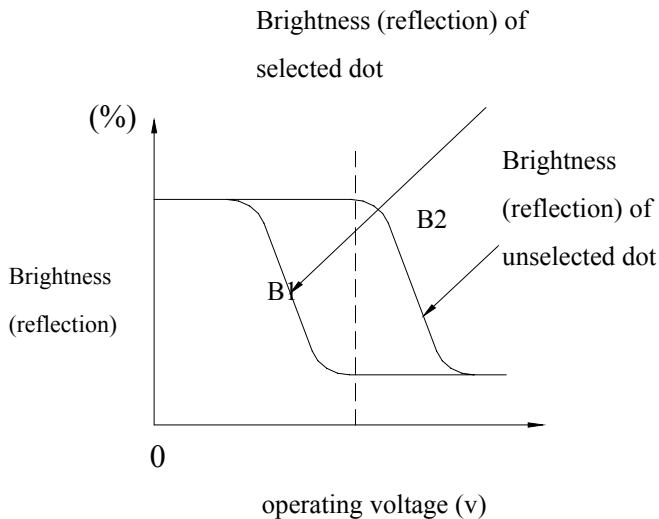
Note 2: Definition of viewing angles θ_1 and θ_2



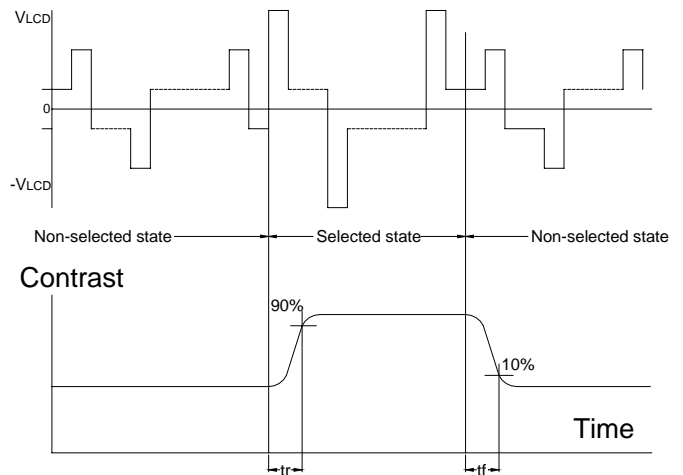
Note : Optimum viewing angle with the naked eye and viewing angle θ at C_{max} . Above are not always the same

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	-	240	mA
Reverse Voltage	VR	Ta =25°C	-	5	V
Power Dissipation	PO	Ta =25°C	-	1.25	W

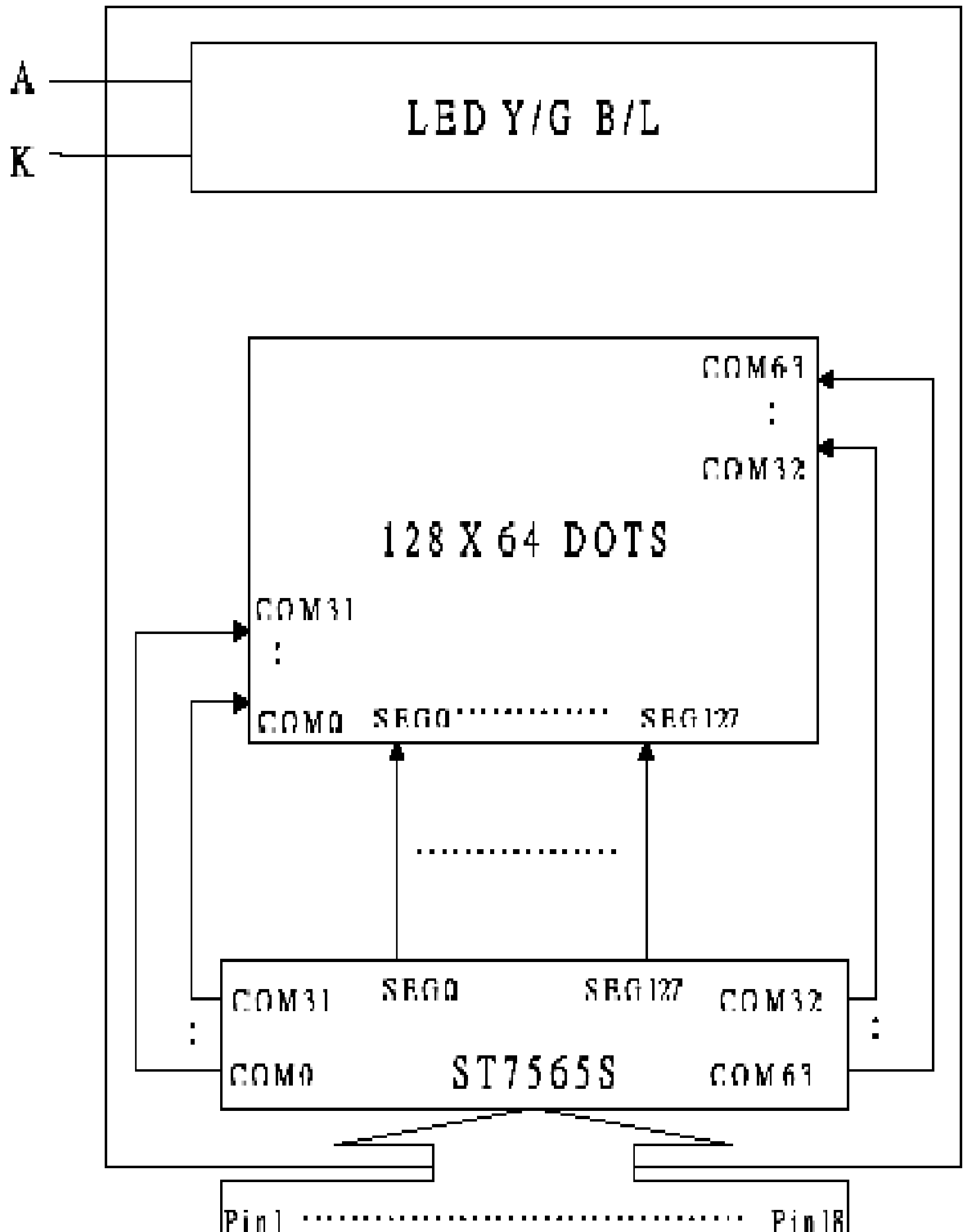
Electrical / Optical Characteristics

Ta =25°C

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Forward Voltage	VF	IF=160 mA	-	5.0	5.2	V
Reverse Current	IR	VR=5V	-	-	0.016	mA
Average Brightness (Without LCD)	IV	IF=160 mA	300	370	-	cd/m ²
Uniformity	△EH	IF= 160 mA	70	-	-	%
CIE Color Coordinate (Without LCD)	X	IF= 160 mA	0.255	-	0.340	-
	Y		0.265	-	0.350	
Color	White					

Note: $\triangle EH\% = B(\text{MIN}) \div B(\text{MAX}) \times 100\%$

2.1.2 Block Diagram



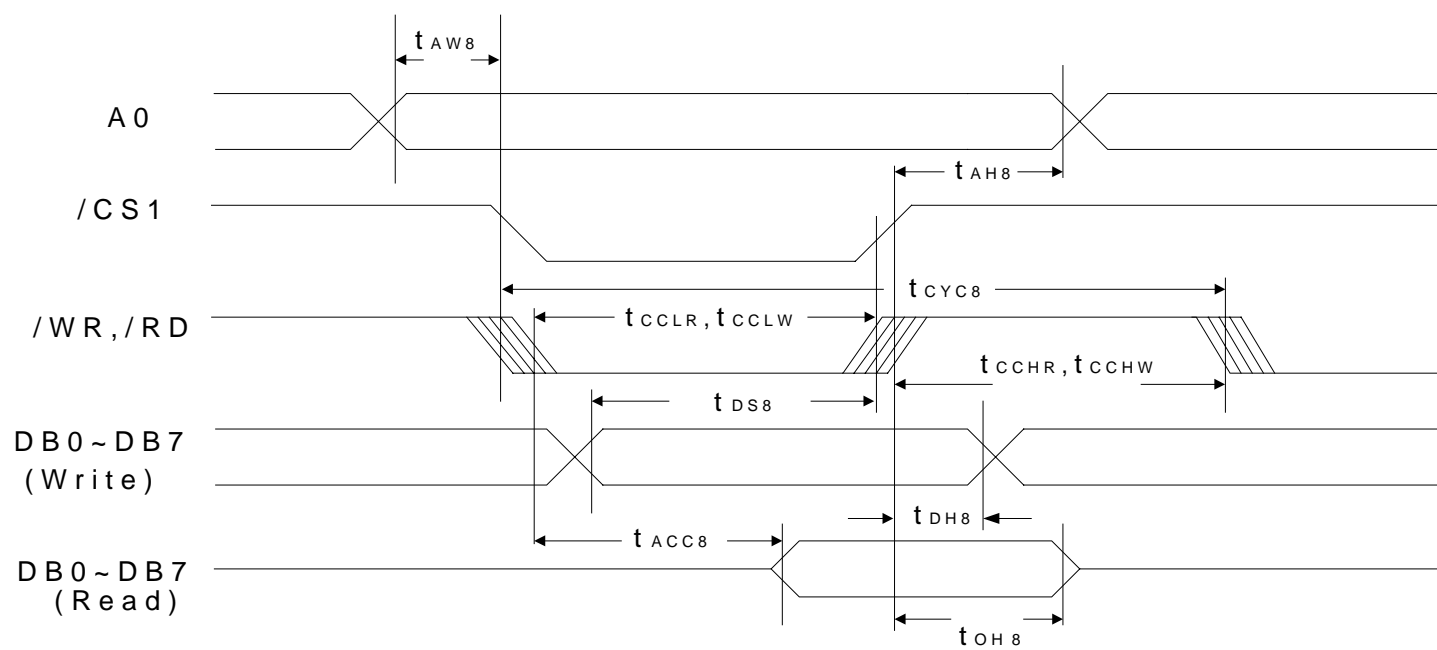
Please refer interface pin description for detail

2.2 Interface Pin Description

Pin No.	Symbol	Function
1	V _{SS}	Power Supply (V _{SS} =0)
2	V _{DD}	Power Supply (V _{DD} =3.0)
3	V _O	NO Connection
4	/RES	/Reset input, active “L”
5	/CS	Used to enter chip select signal, active “L”
6	RS	Select control data or display data for read / write operation “L”=control data “H”=display data
7	/WR	Write signal input pin, active “L”
8	/RD	Read signal input pin, active “L”
9	DB0	Data bus bit 0
10	DB1	Data bus bit 1
11	DB2	Data bus bit 2
12	DB3	Data bus bit 3
13	DB4	Data bus bit 4
14	DB5	Data bus bit 5
15	DB6	Data bus bit 6
16	DB7	Data bus bit 7
17	A	Power supply for LED Backlight Anode input (+5.0)
18	K	Power supply for LED Backlight Cathode input (0)

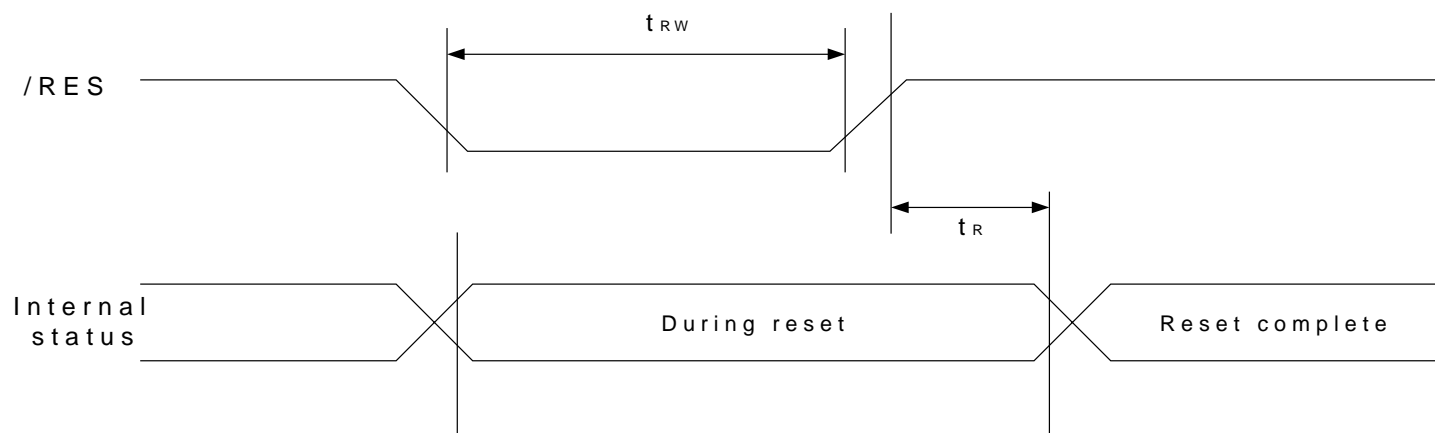
2.3 Timing Characteristics

FOR 8080 Series MPU



Item	Signal	Symbol	Condition	Rating		Units
				Min	Max	
Address hold time	A0	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}	-	140	-	
Control H pulse width (/RD)		t_{CCHR}	-	220	-	
WRITE Data setup time	DB0 to DB7	t_{DS8}	-	180	-	
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	

Reset Timing



Item	Signal	Symbol	Condition	Rating			Units
				Min	Typ	Max	
Reset time	-	t_R	-	-	-	0.5	μs
Reset "L" pulse width	RES	t_{RW}		0.5	-	-	μs

2.4 Display Command

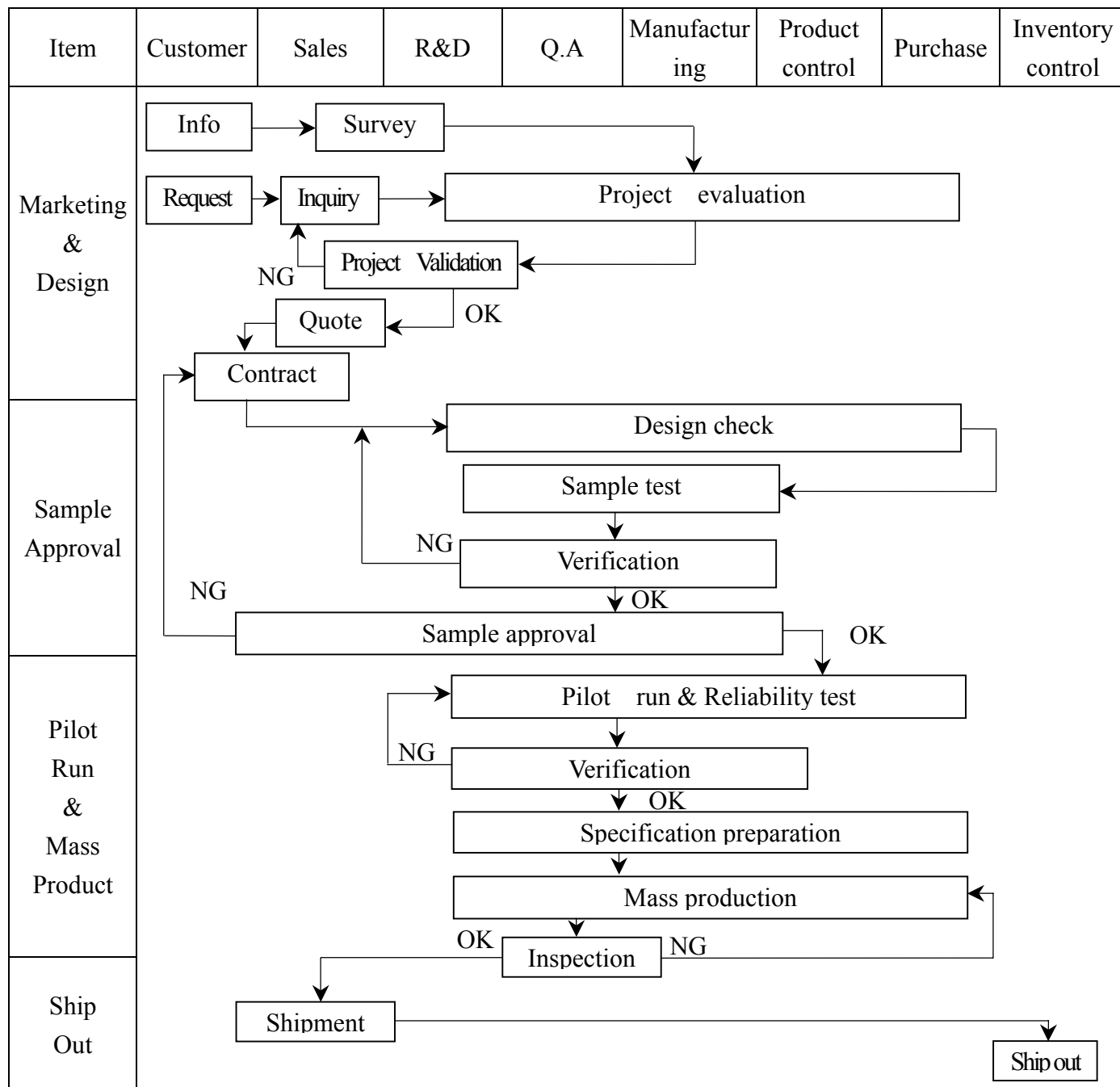
Command	Command Code											Function
	A0	\overline{RD}	\overline{WR}	D7	D6	D5	D4	D3	D2	D2	D0	
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0 1	LCD display ON/OFF 0:OFF, 1:ON
(2) Display start line set	0	1	0	0	1	Display start address						Sets the display RAM display start line address
(3) Page address set	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	0	1	0	1	1	0	0	0	*	*	*	Select COM output scan direction

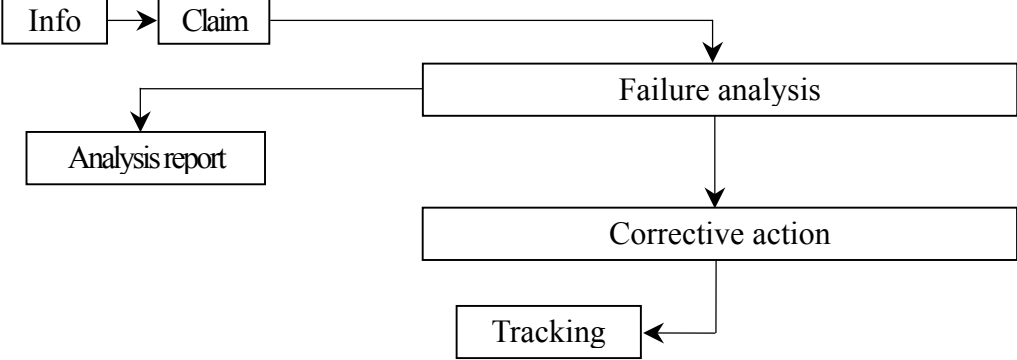
mode select								1				direction 0: normal direction, 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode			Select internal power supply operating mode
(17) V5 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio (Rb/Ra) mode
(18) Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1	Set the V5 output voltage electronic volume register.
Electronic volume register set	0	1	0	*	*	Electronic volume value						
(19) Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0	0: OFF 1: ON Set the flashing mode
Static indicator register set	1	0	1	*	*	*	*	*	*	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	Manufacturing	Product control	Purchase	Inventory control
Sales Service	 <pre> graph TD Info[Info] --> Claim[Claim] Claim --> Failure[Failure analysis] Failure --> Analysis[Analysis report] Failure --> Corrective[Corrective action] Corrective --> Tracking[Tracking] </pre>							
Q.A Activity	1. ISO 9001 Maintenance Activities 3. Equipment calibration 5. Standardization Management				2. Process improvement proposal 4. Education And Training Activities			

3.2 Inspection Specification

Inspection Standard : MIL-STD-105E Table Normal Inspection Single Sampling Level II

Equipment : Gauge , MIL-STD , Powertip Tester , Sample

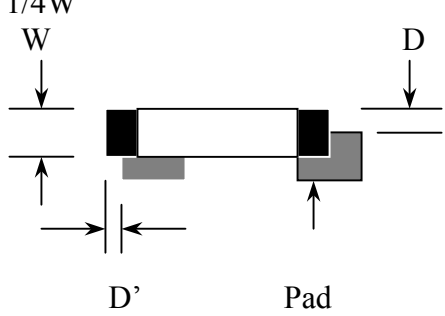
IQC Defect Level : Major Defect AQL 0.4; Minor Defect AQL 1.5

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 > 3.0 mm, and 0.01 mm $<$ width ≤ 0.05 mm	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 > 1.0 mm, the number of bubble is > 1 piece.	N.G.	Minor
		0.4 mm $<$ Area of bubble in polarizer, A < 1.0 mm, 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 > 1.0 mm	N.G.	Minor
		0.3 mm $<$ stripped solder mask or visible circuit, A < 1.0 mm, 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
		0.2 mm $<$ Area of solder ball, A is ≤ 0.4 mm	N.G.	Minor
		The number of solder ball is ≥ 3 pieces	N.G.	Minor
		The magnitude of solder ball, A is > 0.4 mm.	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 $> 20\text{mm}$ or height is $> 2.5\text{mm}$	N.G.	Minor
		The diameter of pinhole in modeling, A is $> 0.2\text{mm}$.	N.G.	Minor
7	Appearance of frame $A=(L+W)/2$	The folding angle of frame must be $> 45^\circ + 10^\circ$	N.G.	Minor
		The area of stripped electroplate in top-view of frame, A is $> 1.0\text{mm}$.	N.G.	Minor
		Rust or crack is (Top view only)	N.G.	Minor
		The scratched width of frame is $> 0.06\text{mm}$. (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 $> 2.0\text{mm}$	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 $> 0.7\text{mm}$	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 $< 0.5\text{mm}$.	N.G.	Minor

4. RELIABILITY TEST

4.1 Reliability Test Condition

NO	Item	Test Condition	
1	High Temperature Storage	Storage at $80 \pm 2^{\circ}\text{C}$ 96~100 hrs Surrounding temperature, then storage at normal condition 4hrs	
2	Low Temperature Storage	Storage at $-30 \pm 2^{\circ}\text{C}$ 96~100 hrs Surrounding temperature, then storage at normal condition 4hrs	
3	High Temperature /Humidity Storage	1.Storage 96~100 hrs $60 \pm 2^{\circ}\text{C}$, 90~95%RH surrounding temperature, then storage at normal condition 4hrs. (Excluding the polarizer).or 2.Storage 96~100 hrs $40 \pm 2^{\circ}\text{C}$, 90~95%RH surrounding temperature, then storage at normal condition 4 hrs.	
4	Temperature Cycling	$ \begin{array}{c} -20^{\circ}\text{C} \rightarrow 25^{\circ}\text{C} \rightarrow 70^{\circ}\text{C} \rightarrow 25^{\circ}\text{C} \\ \text{(30mins) (5mins) (30mins) (5mins)} \\ \longleftrightarrow 10 \text{ Cycle} \end{array} $	
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 $320\pm 10^{\circ}\text{C}$ 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 $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ 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.