

LIQUID CRYSTAL DISPLAY MODULE

Product Specification

PRODUCT NUMBER	84-0079-000
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INTERNAL APPROVALS		
Product Manager	Engineering	Document Control

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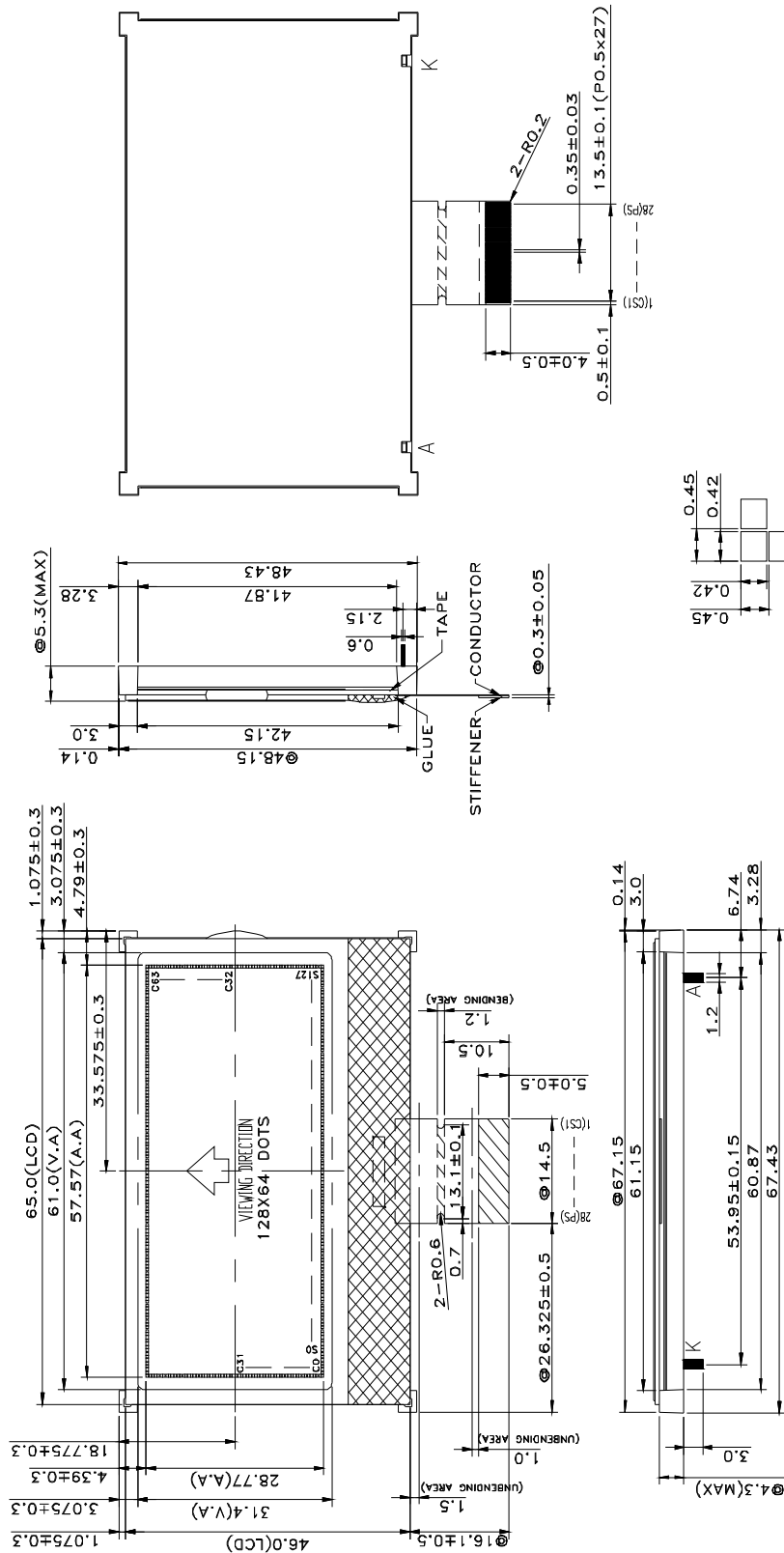
REVISION RECORD

Rev.	Date	Page	Par.	Comment	ECN no.
A	07/07/08	--	--	New DCA Specification	E3773

1 MAIN FEATURES

ITEM	CONTENTS	UNIT
Outline Dimension	67.15 (W) x 48.15 (H) x 5.3 (D)	mm
Display Format	128 x 64	Dots
Active Area	57.57 (W) x 28.77 (H)	mm
Viewing Area	61.0 (W) x 31.4 (H)	mm
Dot Size	0.42 x 0.42	mm
Dot Pitch	0.45 x 0.45	mm
Viewing Angle	6:00	O'clock
LCD Type	FSTN / Positive	--
LCD Mode	Transflective	--
Backlight Color	White (3 pcs. LED)	--
Duty Ratio	1/65	Duty
IC Controller / Driver	ST7565R	--
DC /DC Converter	Built-In	--
Operating Temperature	-20 ~ 70	°C
Storage Temperature	-30 ~ 80	°C
RoHS Compliant	Yes	-

2 MECHANICAL DRAWING



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3 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min	Max	Unit	Note
Supply Voltage for Logics	V _{DD}	-0.3	3.6	V	--
Power Supply for LCD	V ₀	-0.3	13.5	V	--
Operating Temperature	T _{op}	-20	70	°C	Note 1
Storage Temperature	T _{st}	-30	80	°C	Note 2
Static Electricity	Be Sure that you are grounded when handling displays				

Note 1: Background color changes slightly depending on ambient temperature.

This phenomenon is reversible. Ta ≤ 70°C: 75% RH max.

Note 2: Ta ≤ 70°C: 75% RH max.

4 ELECTRICAL CHARACTERISTICS

4.1 DC CHARACTERISTIC

Items	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage (Logic)	V _{DD}	*NOTE1	-	3.3	-	V
Supply Voltage (LCD)	VLCD	-20°C	-	10.26	-	V
		*NOTE2	-	9.06	-	V
		70°C	-	8.24	-	V
Power Supply Current	I _{DD}	*NOTE3	-	-	1.26	mA
Input High level Voltage	V _{IH}	--	0.8VDD	-	VDD	V
Input low level Voltage	V _{IL}	--	VSS	-	0.2VCC	V
Output high level voltage	V _{OH}	--	0.8VDD	-	VDD	V
Output low level voltage	V _{OL}	--	VSS	-	0.2VDD	V
Oscillator frequency	f _{OSC}	--	17	20	24	kHz

*NOTE1: If the VLCD is changed, the voltage boost and contrast needs to be set again.

*NOTE2: Min. and Max. Voltage means within the range will have optimum contrast at Ta: 25°C.

Typ. Voltage is specified as module driving condition Ta: 25°C, V_{op} at optimum contrast, the measuring condition as below, this value is Densitron recommended when customer change the set condition, VLCD will change.

*NOTE3:

Measuring Condition: Standard Value MAX.

Ta = 25°C

VDD-VSS = 3.3V

V_{op} = V_{op} at optimum contrast

Fosc = 20 kHz

Duty = 1/65 Duty

Bias = 1/9 Bias

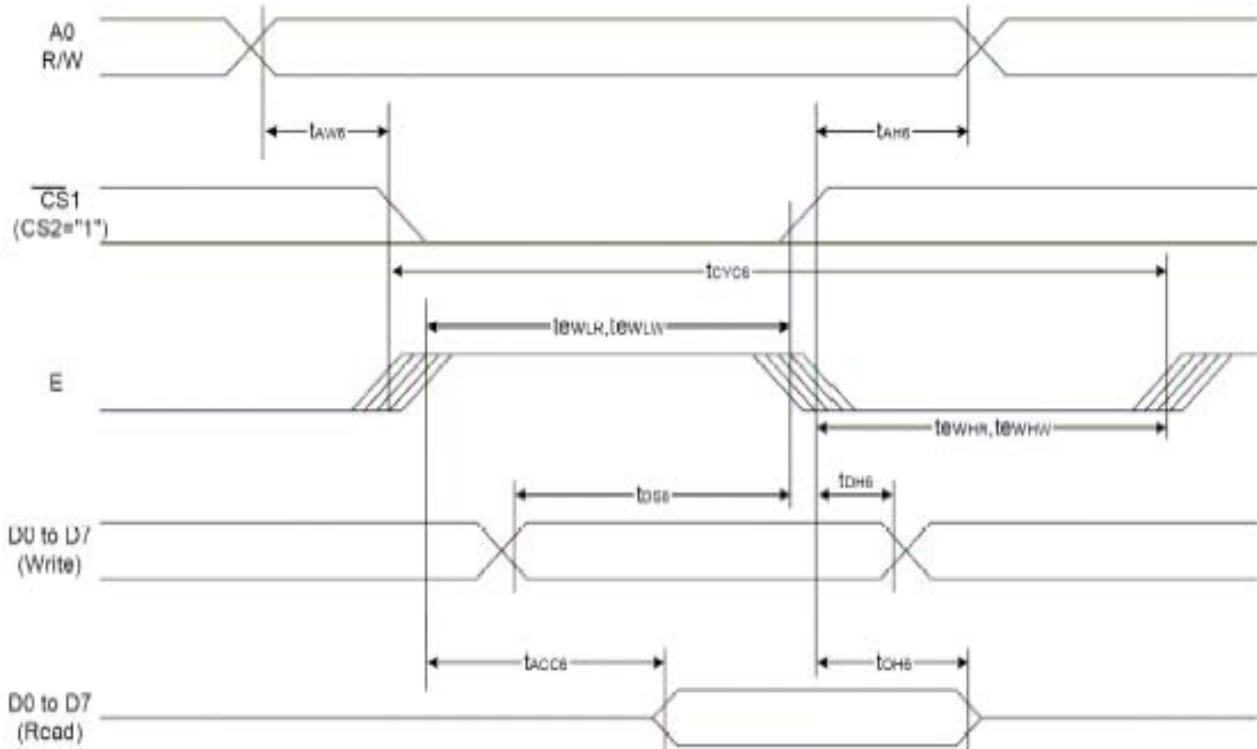
Display pattern = Checkered pattern

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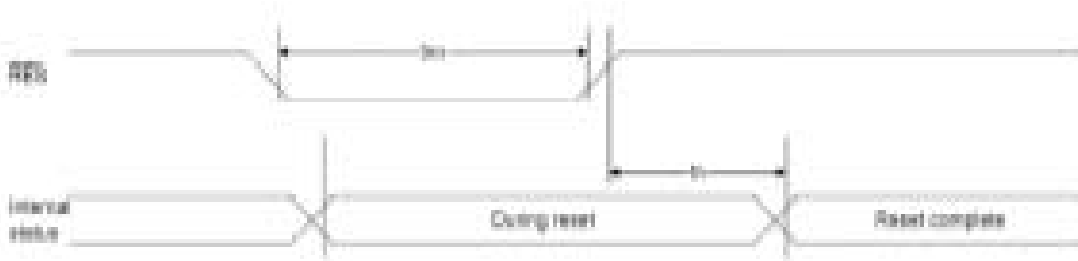
4.2 AC CHARACTERISTICS

System Bus Read/Write Characteristics(For the 6800 Series MPU)



Item	Signal	Symbol	Condition	Min.	Max.	Units
Address hold time	A0	t_{AH6}		0	-	ns
Address Setup time		t_{AW6}		0	-	
System cycle time		t_{CYC6}		240	-	
Enable L pulse width (WRITE)	WR	t_{EWLW}		80	-	
Enable H pulse width (WRITE)		t_{EWHW}		80	-	
Enable L Pulse width (READ)	RD	t_{EWLR}		80	-	
Enable H Pulse width (READ)		t_{EWHR}		140	-	
WRITE Data Setup time	D0 to D7	t_{DS6}		40	-	
WRITE Address hold time		t_{DH6}		0	-	
READ access time		t_{ACC6}	$C_L = 100 \text{ pF}$	-	70	
READ Output disable time		t_{OH6}	$C_L = 100 \text{ pF}$	5	50	

4.3 RESET TIMING



Item	Signal	Symbol	Min.	Typ.	Max.	Units
Reset Time	--	t_R	--	--	1.0	us
Reset "L" Pulse Width	/RES	t_{RW}	1.0	--	--	us

4.4 BACK-LIGHT SPECIFICATION

Item	Condition	Min	Typ.	Max.	Unit
Input Current	--	--	60	--	mA
Input Voltage	--	--	3.5	--	V
Brightness	--	300	--	--	cd/m ²
Half Life	--	--	10,000	--	Hr

Note: The "Half-Life Time" is defined as the module brightness decrease to 50% original Brightness.

5 INTERFACE PIN ASSIGNMENT

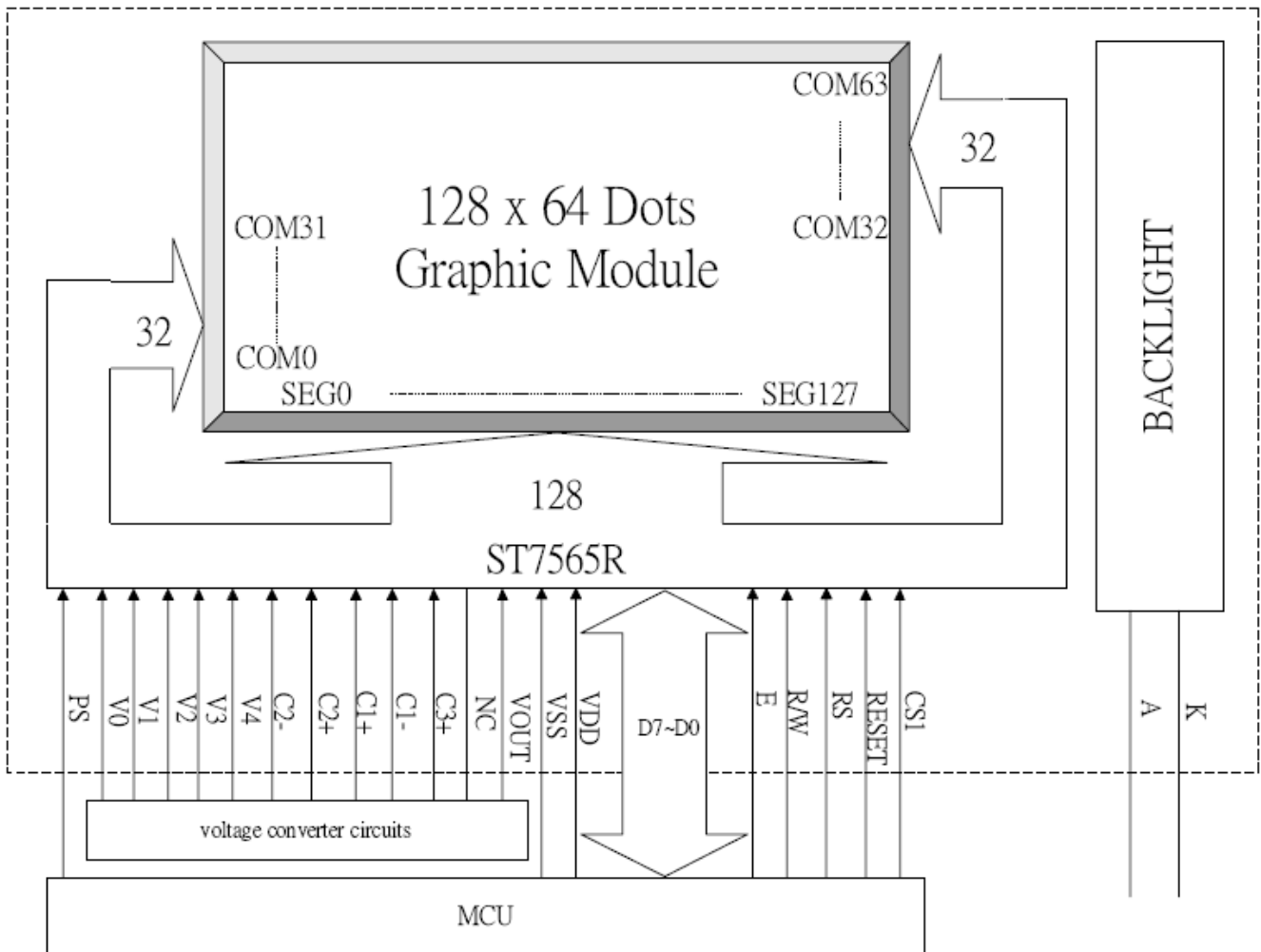
No.	Symbol	I/O	Function
1	CS1	I	This is the chip select pin.
2	RESET	I	Reset input pin. When RESET is "L", initialization is executed.
3	RS	I	Register select input pin. - RS = "H": D0 to D7 are display data. - RS = "L": D0 to D7 are control data.
4	R/W	I	Read/Write control pin. - RW = "H" : Read - RW = "L" : Write
5	E	I	Read/Write control input pin. - RW="H": When E is "H", D0 to D7 are in an output states. - RW="L": The data on D0 to D7 are latched at the falling edge of the E signal.
6	D0	I/O	8-bit bi-directional data bus that is connected to the standard 8-bit microprocessor data bus. When the serial interface selected (PS="L"); -D0 to D5: high impedance. -D6: serial input clock (SCLK) -D7: serial input data (SID) When chip select is not active, D0 to D7 may be high impedance.
7	D1		
8	D2		
9	D3		
10	D4		
11	D5		
12	D6-SCLK		
13	D7-SID		
14	VDD	Supply	Power Supply.
15	VSS	Supply	Ground.
16	VOUT	I/O	Voltage converter input/output. Connect this pin to VSS through capacitor.
17	NC	--	No connection
18	C3+	O	Capacitor 3 positive connection pin for voltage converter.
19	C1-	O	Capacitor 1 negative connection pin for voltage converter.
20	C1+	O	Capacitor 1 positive connection pin for voltage converter.

21	C2+	O	Capacitor 2 positive connection pin for voltage converter.
22	C2-	O	Capacitor 2 negative connection pin for voltage converter.
23	V4	I/O	LCD driver supply voltages. The voltage determined by LCD pixel is impedance-converted by an operational amplifier for application. Voltages should have the following relationship: $V0 \geq V1 \geq V2 \geq V3 \geq V4 \geq VSS$ When the internal power circuit is active, these voltage are generated as following table according to the state of LCD bias.
24	V3	I/O	
25	V2	I/O	
26	V1	I/O	
27	V0	I/O	
28	PS	I	In serial mode, it's impossible to read data from the on-chip RAM. And D0 to D5 are high impedance and E and RW must be fixed to either "H" or "L".

How to Select Serial or Parallel Interface:

PS	Mode	D/ Instruction	Data	R/W	Serial Clock
High	Parallel 6800	RS	D0-D7	E, RW	--
Low	Serial	RS	D7-SID	WR, only	D6-SCLK

6 BLOCK DIAGRAM



7 OPTICAL CHARACTERISTICS

7.1 DRIVING CONDITION

Item	Duty	Bias	Note
Value	1/65	1/9	1

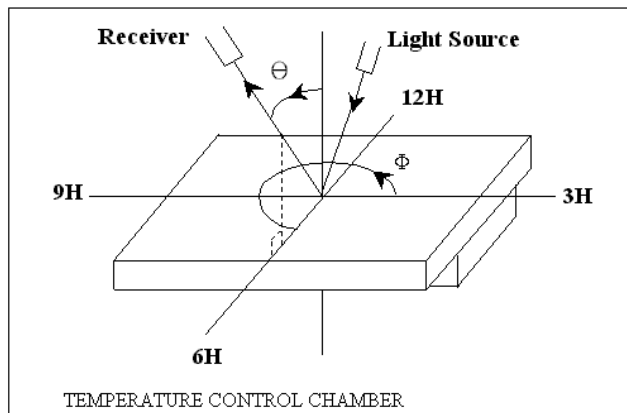
7.2 ELECTRICAL AND OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Mn.	Typ.	Max.	Unit	Note	
Response Time	Tr	Ta=25°C	--	185	370	ms	2	
	Tf	Ta=25°C	--	300	600			
Viewing Angle	Front-Rear	$\Theta 1$	$\Phi=270^\circ$	-10	--	30	Degree	3
	Left-Right	$\Theta 2$	$\Phi=270^\circ$	-30	--	30	Degree	
Contrast Ratio	CR	Ta=25°C	--	4	--	--	4	

Definition of Optical Characteristics:

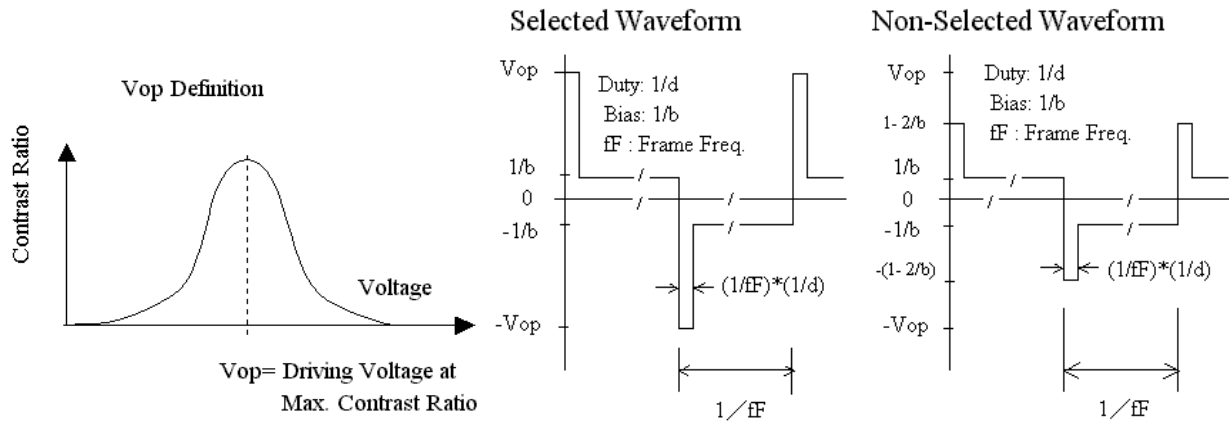
Measurement Condition:

Reflective type



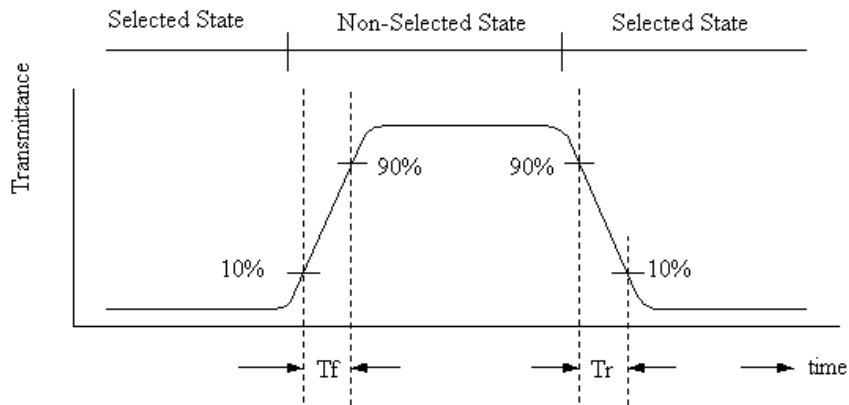
PHOTAL LCD-5000

Note 1: Definition of LCD Driving Vop and Waveform:

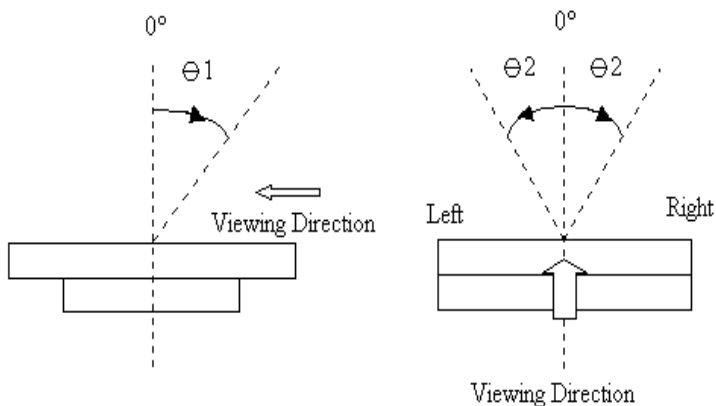


Note 2: Definition of Response Time:

for Positive type :

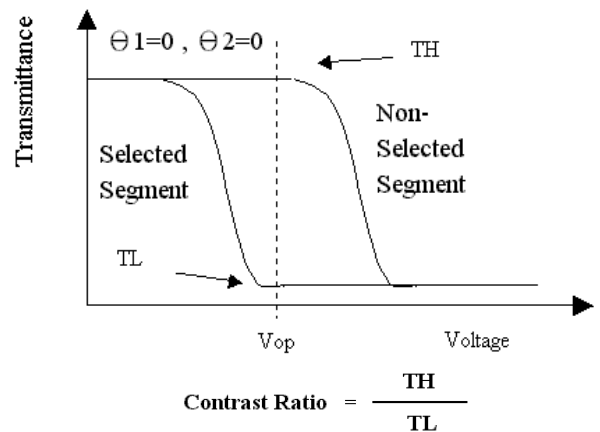


Note 3: Definition of Viewing Angle:



Note 4: Definition of Contrast Ratio:

for Positive type



8 RELIABILITY TEST

8.1 RELIABILITY TESTS

Test Item	Test Condition	Note
High Temperature Operation	70°C ± 2, 240 hours	No abnormalities in function* and appearance**
Low Temperature Operation	-20°C ± 2, 240 hours	No abnormalities in function* and appearance**
High Temperature Storage	80°C ± 2, 240 hours	No abnormalities in function* and appearance**
Low Temperature Storage	-30°C ± 2, 240 hours	No abnormalities in function* and appearance**
High Temperature & High Humidity Storage	40°C ± 2, 90% RH, 240 hours	No abnormalities in function* and appearance**
Thermal Shock Storage	1 cycle of -20°C 30 min, R.T. 5 min, 70°C 30 min	No abnormalities in function* and appearance**
Vibration	Frequency: 10 to 55 Hz Acceleration: 5g 1 cycle time: 1 min Time: 15 min (each direction)	No abnormalities in function* and appearance**
Drop Shock	Height: 60 cm 1 corner , 3 Edges 6 Surfaces Each one: Test once.	No abnormalities in function* and appearance**

8.2 LIFE TIME

Item	Description
1	Function, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions of room temperature (25±10°C), normal humidity (45±20% RH), and in area not exposed to direct sunlight.
2	Function, performance, appearance, etc. shall be free from remarkable deterioration within 5,000 hours under ordinary operating and storage conditions of 70°C temperature, normal humidity (45±20% RH), and in area not exposed to direct sunlight.

9 QUALITY ASSURANCE SPECIFICATION

9.1 CONFORMITY

The performance, function and reliability of the shipped products conform to the Product Specification.

9.2 DELIVERY ASSURANCE

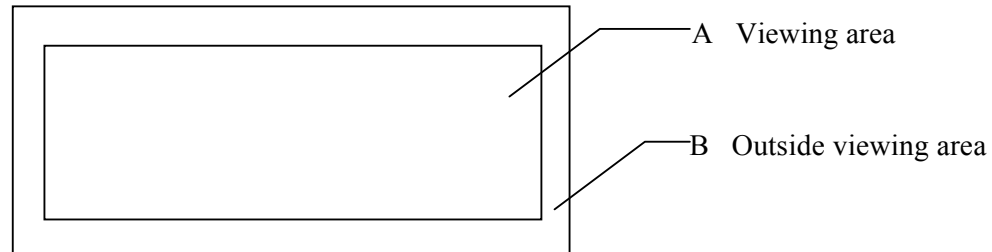
9.2.1 Delivery inspection standards

- IPC-AA610, class 2 electronic assemblies standard

The quality assurance levels are shown below:

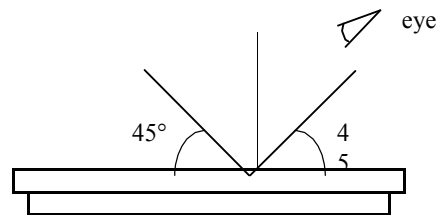
Rank	Item Inspected	Defect type	AQL	Remark
Major defect	Display	Non display	0.25%	Fit/Function defect
		Over current		
		Missing segment		
		Wrong viewing direction		
		Incorrect operating		
		Backlight OFF		
	Backlight flashing			
Dimension	PCB and bezel out of specification			
Minor defect	LCD	Black and white spot	1.0%	Appearance defect
		Black and white lines		
		Polariser scratch		
		Bubbles in polariser		
		Segment deformation, pin hole		
		Colour uniformity		
		Glass chip		
	COB	Wire bond pad exposed		
		Insufficient covering with resin (wire bond line exposed)		
		Bubble, dust on COB		
	PCB	Dust, solder ball on PCB		
Pad scratch				
Tray	Particles	Every tray		
Total			1.0%	

9.2.2 Zone definition



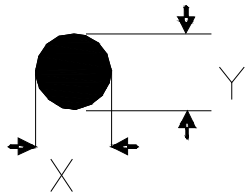
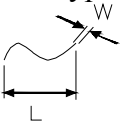
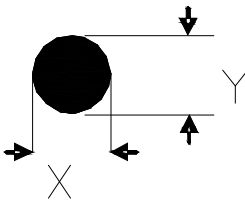
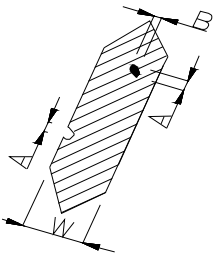
9.2.3 Visual inspection

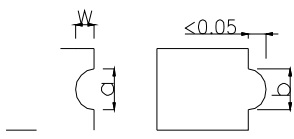
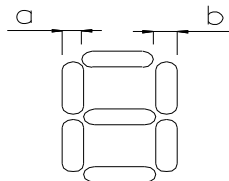
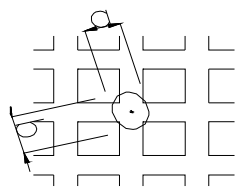
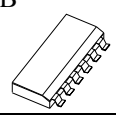
- Inspect under 2x20W or 40W fluorescent lamp (approximately 3000 lux) leaving 25 to 30 cm between the module and the lamp and 30 cm between the module and the eye (measuring position).
- Appearance is inspected at the best contrast voltage (best contrast is adjusted considering clearness and crosstalk on screen).
- Inspect the module at 45° right and left, top and bottom.
- Use the optimum viewing angle during the contrast inspection.



9.2.3.1 Standard of appearance inspection

units: mm

No.	Item	Criteria																																				
1	Black spot, White spot, dust	<p>Round type: as per following drawing $\Phi = (X+Y)/2$</p>  <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="3">Acceptable quantity</th> </tr> <tr> <th>size</th> <th>Zone A</th> <th>Zone B</th> </tr> </thead> <tbody> <tr> <td>$\Phi < 0.1$</td> <td>Any number</td> <td rowspan="4" style="text-align: center;">Any number</td> </tr> <tr> <td>$0.1 < \Phi < 0.2$</td> <td>2</td> </tr> <tr> <td>$0.2 < \Phi < 0.25$</td> <td>1</td> </tr> <tr> <td>$0.25 < \Phi$</td> <td>0</td> </tr> </tbody> </table> <p>Line type: as per following drawing</p>  <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="4">Acceptable quantity</th> </tr> <tr> <th>Length</th> <th>Width</th> <th>Zone A</th> <th>Zone B</th> </tr> </thead> <tbody> <tr> <td>-</td> <td>$W \leq 0.02$</td> <td rowspan="2" style="text-align: center;">Any number</td> <td rowspan="2" style="text-align: center;">Any number</td> </tr> <tr> <td>$L \leq 3.0$</td> <td>$0.02 < W \leq 0.03$</td> </tr> <tr> <td>$L \leq 2.5$</td> <td>$0.03 < W \leq 0.05$</td> <td style="text-align: center;">2</td> <td rowspan="2" style="text-align: center;">r</td> </tr> <tr> <td>-</td> <td>$0.05 < W$</td> <td style="text-align: center;">as round type</td> </tr> </tbody> </table> <p style="text-align: center;">Total acceptable quantity: 3</p>	Acceptable quantity			size	Zone A	Zone B	$\Phi < 0.1$	Any number	Any number	$0.1 < \Phi < 0.2$	2	$0.2 < \Phi < 0.25$	1	$0.25 < \Phi$	0	Acceptable quantity				Length	Width	Zone A	Zone B	-	$W \leq 0.02$	Any number	Any number	$L \leq 3.0$	$0.02 < W \leq 0.03$	$L \leq 2.5$	$0.03 < W \leq 0.05$	2	r	-	$0.05 < W$	as round type
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-	$W \leq 0.02$	Any number	Any number																																			
$L \leq 3.0$	$0.02 < W \leq 0.03$																																					
$L \leq 2.5$	$0.03 < W \leq 0.05$	2	r																																			
-	$0.05 < W$	as round type																																				
2	Polariser scratch	Scratch on protective film is permitted Scratch on polariser: same as No. 1																																				
3	Polariser bubble	<p>$\Phi = (X+Y)/2$</p>  <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="3">Acceptable quantity</th> </tr> <tr> <th>Size</th> <th>Zone A</th> <th>Zone B</th> </tr> </thead> <tbody> <tr> <td>$\Phi < 0.2$</td> <td>Any number</td> <td rowspan="4" style="text-align: center;">Any number</td> </tr> <tr> <td>$0.2 < \Phi < 0.5$</td> <td>2</td> </tr> <tr> <td>$0.5 < \Phi < 1.0$</td> <td>1</td> </tr> <tr> <td>$1.0 < \Phi$</td> <td>0</td> </tr> </tbody> </table> <p>Total acceptable quantity: 3</p>	Acceptable quantity			Size	Zone A	Zone B	$\Phi < 0.2$	Any number	Any number	$0.2 < \Phi < 0.5$	2	$0.5 < \Phi < 1.0$	1	$1.0 < \Phi$	0																					
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$1.0 < \Phi$	0																																					
4	Segment deformation	<p>1.a. Pin hole on segmented display</p> <p>W: segment width $\Phi = (A+B)/2$</p>  <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2">Acceptable quantity</th> </tr> <tr> <th>Width</th> <th>Φ</th> </tr> </thead> <tbody> <tr> <td>$W \leq 0.4$</td> <td>$\Phi \leq 0.2$ and $\Phi \leq 1/2W$</td> </tr> <tr> <td>$W > 0.4$</td> <td>$\Phi \leq 0.25$ and $\Phi \leq 1/3W$</td> </tr> </tbody> </table> <p>Total acceptable quantity: 1 defect per segment Pin holes with Φ under 0.10 mm are acceptable.</p>	Acceptable quantity		Width	Φ	$W \leq 0.4$	$\Phi \leq 0.2$ and $\Phi \leq 1/2W$	$W > 0.4$	$\Phi \leq 0.25$ and $\Phi \leq 1/3W$																												
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$W > 0.4$	$\Phi \leq 0.25$ and $\Phi \leq 1/3W$																																					

No.	Item	Criteria																												
5	Black spot, White spot, dust	<p>1b. Pin hole on dot matrix display</p>  <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2">Acceptable quantity</th> </tr> <tr> <th>Size</th> <th></th> </tr> </thead> <tbody> <tr> <td>$a, b < 0.1$</td> <td>Any number</td> </tr> <tr> <td>$(a+b)/2 \le 0.1$</td> <td>Any number</td> </tr> <tr> <td>$0.5 < \Phi < 1.0$</td> <td style="text-align: center;">3</td> </tr> </tbody> </table> <p>2. Segments / dots with different width</p>  <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2">Acceptable</th> </tr> </thead> <tbody> <tr> <td>$a \geq b$</td> <td>$a/b \leq 4/3$</td> </tr> <tr> <td>$a < b$</td> <td>$a/b > 4/3$</td> </tr> </tbody> </table> <p>3. Alignment layer defect</p> <p>$\Phi = (a+b)/2$</p>  <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2">Acceptable quantity</th> </tr> <tr> <th>Size</th> <th></th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.4$</td> <td>Any number</td> </tr> <tr> <td>$0.4 < \Phi \leq 1.0$</td> <td style="text-align: center;">5</td> </tr> <tr> <td>$1.0 < \Phi \leq 1.5$</td> <td style="text-align: center;">3</td> </tr> <tr> <td>$1.5 < \Phi \leq 2.0$</td> <td style="text-align: center;">2</td> </tr> </tbody> </table>	Acceptable quantity		Size		$a, b < 0.1$	Any number	$(a+b)/2 \le 0.1$	Any number	$0.5 < \Phi < 1.0$	3	Acceptable		$a \geq b$	$a/b \leq 4/3$	$a < b$	$a/b > 4/3$	Acceptable quantity		Size		$\Phi \leq 0.4$	Any number	$0.4 < \Phi \leq 1.0$	5	$1.0 < \Phi \leq 1.5$	3	$1.5 < \Phi \leq 2.0$	2
Acceptable quantity																														
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Acceptable quantity																														
Size																														
$\Phi \leq 0.4$	Any number																													
$0.4 < \Phi \leq 1.0$	5																													
$1.0 < \Phi \leq 1.5$	3																													
$1.5 < \Phi \leq 2.0$	2																													
6	Colour uniformity	Level of sample for approval set as limit sample																												
7	Backlight	The backlight colour should correspond to the product specification Flashing and or unlit backlight is not allowed Dust larger than 0.25 mm is not allowed																												
8	COB	Exposed wire bond pad is not allowed Insufficient covering with resin is not allowed (wire bond line exposed) Dust or bubble on the resin are not allowed																												
9	PCB 	No unmelted solder paste should be present on PCB Cold solder joints, missing solder connections, or oxidation are not allowed No residue or solder balls on PCB are allowed Short circuits on components are not allowed																												
10	Tray particles	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>Size</th> <th>Quantity</th> </tr> </thead> <tbody> <tr> <td rowspan="2">On tray</td> <td>$\Phi < 0.2$</td> <td>Any number</td> </tr> <tr> <td>$\Phi > 0.25$</td> <td style="text-align: center;">4</td> </tr> <tr> <td rowspan="2">On display</td> <td>$\Phi \geq 0.25$</td> <td style="text-align: center;">2</td> </tr> <tr> <td>$L = 3$</td> <td style="text-align: center;">1</td> </tr> </tbody> </table>		Size	Quantity	On tray	$\Phi < 0.2$	Any number	$\Phi > 0.25$	4	On display	$\Phi \geq 0.25$	2	$L = 3$	1															
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10 HANDLING PRECAUTIONS

Safety

If the LCD panel breaks, be careful not to get the liquid crystal fluid in your mouth or in your eyes.
If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

Mounting and Design

Place a transparent plate (e.g. acrylic, polycarbonate or glass) on the display surface to protect the display from external pressure. Leave a small gap between the transparent plate and the display surface.
When assembling with a zebra connector, clean the surface of the pads with alcohol and keep the surrounding air very clean. Design the system so that no input signal is given unless the power supply voltage is applied.

Caution during LCD cleaning

Lightly wipe the display surface with a soft cloth soaked with Isopropyl alcohol, Ethyl alcohol or Trichlorotrifluoroethane. Do not wipe the display surface with dry or hard materials that will damage the polariser surface. Do not use aromatic solvents (toluene and xylene), or ketonic solvents (ketone and acetone).

Caution against static charge

As the display uses C-MOS LSI drivers, connect any unused input terminal to VDD or VSS. Do not input any signals before power is turned on. Also, ground your body, work/assembly table and assembly equipment to protect against static electricity.

Packaging

Displays use LCD elements, and must be treated as such. Avoid strong shock and drop from a height. To prevent displays from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.

Caution during operation

It is indispensable to drive the display within the specified voltage limit since excessive voltage shortens its life. Direct current causes an electrochemical reaction with remarkable deterioration of the display quality. Give careful consideration to prevent direct current during ON/OFF timing and during operation.
Response time is extremely delayed at temperatures lower than the operating temperature range while, at high temperatures, displays become dark. However, this phenomenon is reversible and does not mean a malfunction or a display that has been permanently damaged. If the display area is pushed on hard during operation, some graphics will be abnormally displayed but returns to a normal condition after turning off the display once. Even a small amount of condensation on the contact pads (terminals) can cause an electrochemical reaction which causes missing rows and columns. Give careful attention to avoid condensation.

Storage

Store the display in a dark place where the temperature is $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ and the humidity below 50%RH.
Store the display in a clean environment, free from dust, organic solvents and corrosive gases.
Do not crash, shake or jolt the display (including accessories).

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