





Messrs.					
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## LCD MODULE SPECIFICATION FOR CUSTOMER'S APPROVAL

**CUSTOMER** : \_\_\_\_\_

**MODULE TYPE** : NMTG-S12864BFYHSGY-C

**APPROVED BY: (FOR CUSTOMER USE ONLY)**

Approved by	Checked by		Made by
			



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#### Revise Records

Rev.	Date	Contents	Written	Approved
A	2011/02/24	Initial Edition	Jill Hsu	Steele Lee

#### Special Notes

Note1.	Avant IC updated edition.
Note2.	
Note3.	
Note4.	
Note5.	



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**SPECIFICATION FOR**  
**LIQUID CRYSTAL DISPLAY MODULE**  
**MODEL NO. : NMTG-S12864BFYHSGY-C**

View Direction	<input checked="" type="checkbox"/> 6 O'clock		<input type="checkbox"/> 12 O'clock		
LCD Type	<input type="checkbox"/> FSTN Positive		<input type="checkbox"/> FSTN Negative		
	<input type="checkbox"/> STN Gray	<input checked="" type="checkbox"/> STN Yellow Green	<input type="checkbox"/> STN Blue		
Rear Polarizer	<input type="checkbox"/> Reflective	<input checked="" type="checkbox"/> Transflective		<input type="checkbox"/> Transmissive	
Backlight Type	<input checked="" type="checkbox"/> LED	<input type="checkbox"/> EL	<input checked="" type="checkbox"/> Internal Power		<input checked="" type="checkbox"/> 5V input
		<input type="checkbox"/> CCFL	<input type="checkbox"/> External Power		<input type="checkbox"/> 24V input
Backlight Color	<input type="checkbox"/> White	<input type="checkbox"/> Amber	<input type="checkbox"/> Blue Green	<input checked="" type="checkbox"/> Yellow Green	<input type="checkbox"/> Other
Temperature Range	<input type="checkbox"/> Normal		<input checked="" type="checkbox"/> Wide		<input type="checkbox"/> Super Wide
EL Driver IC	<input type="checkbox"/> Build-in		<input checked="" type="checkbox"/> Not Build-in		
Touch Screen	<input type="checkbox"/> With		<input checked="" type="checkbox"/> Without		
LCD LSI	SBN640G21 / SBN0064G-D				

**TO BE VERY CAREFUL !**

The LCD driver ICs are made by CMOS process, which are very easy to be damaged by static charge, make sure the user is grounded when handling the LCM.



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## **GENERAL SPECIFICATION**

Item	Content
Display Resolution	128(W)×64(H)
Dimensional Outline(mm)	75.0(W)×52.7(H)×9.0max(D)
Dot Size	0.40(W)mm×0.40(H)mm
Dot Pitch	0.43(W)mm×0.43(H)mm
Display mode	Transflective/ Positive Type
Circuit	Avant IC
Interface	Data (D0~D7), D/I, R/W, E, RST, CS1, CS2, V <sub>EE</sub>

## **ABSOLUTE MAXIMUN RATING**

### (1) Electrical Absolute Ratings

Item	Symbol	Min.	Max.	Unit	Note
Power Supply for Logic	V <sub>DD</sub> - V <sub>SS</sub>	-0.3	7.0	Volt	--
Power Supply for LCD	V <sub>DD</sub> - V <sub>EE</sub>	-0.3	19.0	Volt	--
Input Voltage	V <sub>I</sub>	-0.3	V <sub>DD</sub> +0.3	Volt	--
Current for LED backlight	--	--	200	mA	--
Static Electricity	--	--	--	--	Note 1

Note 1: Operator should be grounded during handling LCM.

### (2) Environmental Absolute Maximum Ratings

Item	Normal Temperature				Wide Temperature			
	Operating		Storage		Operating		Storage	
	Max,	Min.	Max,	Min.	Max,	Min.	Max,	Min.
Ambient Temperature	0℃	+50℃	-20℃	+70℃	-20℃	+70℃	-30℃	+80℃
Humidity(without condensation)	Note 2,4		Note 3,5		Note 4,5		Note 4,6	

Note 2: Ta ≤ 50℃ : 80% RH max

Ta > 50℃ : Absolute humidity must be lower than the humidity of 85%RH at 50℃

Note 3: Ta at -20℃ will be <48hrs at 70℃ will be <120hrs when humidity is higher than 75%.

Note 4: Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note 5: Ta ≤ 70℃ : 75RH max

Ta > 70℃ : absolute humidity must be lower than the humidity of 75%RH at 70℃

Note 6: Ta at -30℃ will be <48hrs, at 80℃ will be <120hrs when humidity is higher than 75%.



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## **ELECTRICAL OPTICAL**

Characteristics

Ta = 25°C

Parameter	Symbol	Rating			Unit	Test Condition
		Min.	Typ	Max.		
Total Forward Voltage	VF	3.8	4.05	4.3	V	--
Average Luminous Intensity	IV	18	25	--	cd/m <sup>2</sup>	--
Luminous Tolerance	IV-m	50	--	--	%	--
Chromaticity Coordinate *	X	0.4000	0.4441	0.4878	--	--
Chromaticity Coordinate *	y	0.5906	0.5547	0.5152	--	--

Note1: This product must be in VF MAX. under the testing.

Note2: The current should be set at 2x50mA when the finished goods is under the testing.

## **BACKLIGHT ABSOLUTE MAXIMUM RATING**

Ta = 25°C

Parameter	Symbol	Rating	Unit
Power Dissipation	Po	860	W
Peak Forward Current	IF	200	mA
Reverse Voltage	VR	8	V
Operating Temperature Range	TOPR	-20°C TO + 70°C	--
Storage Temperature Range	TSTO	-30°C TO + 80°C	--



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## ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ	Max.	Unit
Power Supply for Logic	$V_{DD} - V_{SS}$	--	4.5	5.0	5.5	Volt
Input Voltage	$V_{IL}$	L level	0	--	0.8	Volt
	$V_{IH}$	H level	$V_{DD}-2.2$	--	$V_{DD}$	Volt
Power Supply Current for LCM	$I_{DD}(\text{LED B/L OFF})$	$V_{DD} = 5.0V$ $T_a = 25^\circ C$ $V_{DD} - V_{EE} = 10.3V$ $V_{LED} = 5.0V$	--	1.5	1.8	mA
	$I_{EE}$		--	0.6	1.0	--
	$I_{LED}$		--	100	150	
Power Supply for EL Backlight	$V_{EL}$		--	100V/ 400Hz	--	--

## OPTICAL CHARACTERISTICS

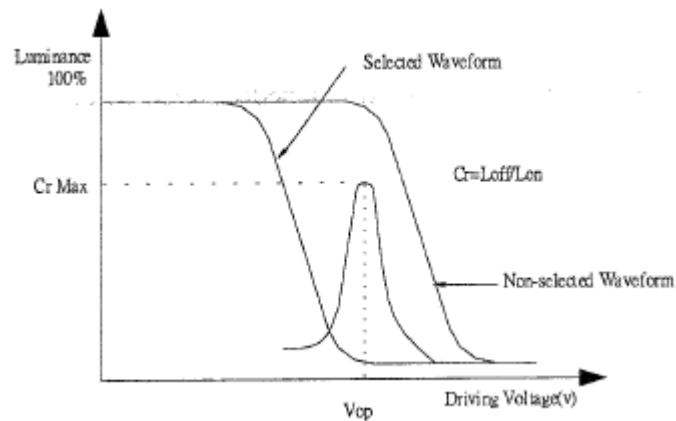
Item	Symbol	Condition	Min.	Typ	Max.	Unit	note
LCM Recommend LCD Module Driving Voltage	Vop	$T_a = -20^\circ C$	9.14	9.64	10.14	Volt	1.
		$T_a = 25^\circ C$	8.60	9.10	9.60		
		$T_a = 70^\circ C$	8.06	8.56	9.06		
Viewing Angle	Front-Back	$\theta = 0^\circ$	30	92	--	deg.	3.
	Left-Right	$\theta = 0^\circ$	60	90	--	deg.	
Rise Time	$T_r$	$V_{DD} - V_{EE} = 10.3V$ $T_a = 25^\circ C$	--	90	220	mS	2.
Fall Time	$T_f$		--	210	200		
Contrast	Cr		2.0	6.0	--	--	4



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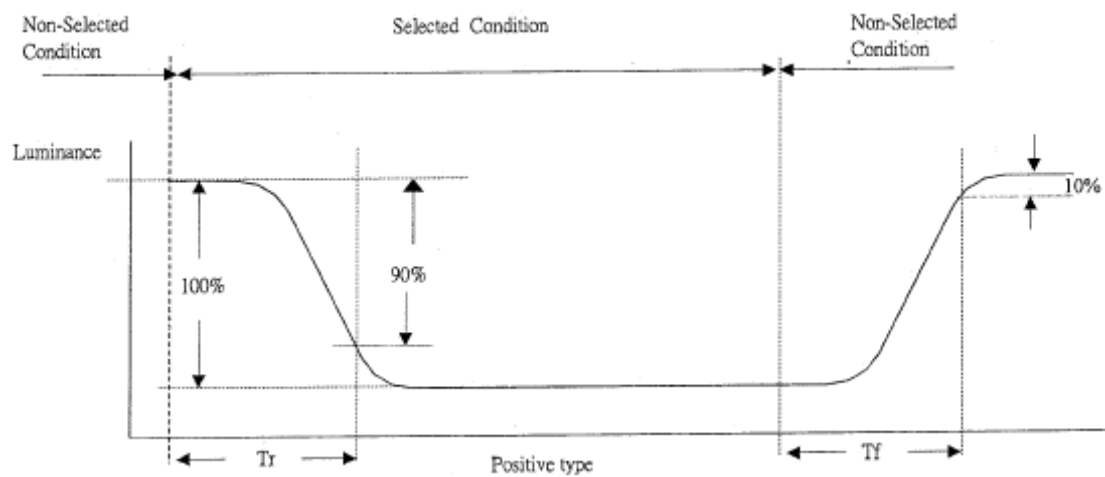
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**[Note 1] Definition of Operation Voltage (Vop)**



$$\theta = 0^\circ \quad \phi = 0^\circ$$

**[Note 2] Definition of Response Time (Tr, Tf)**

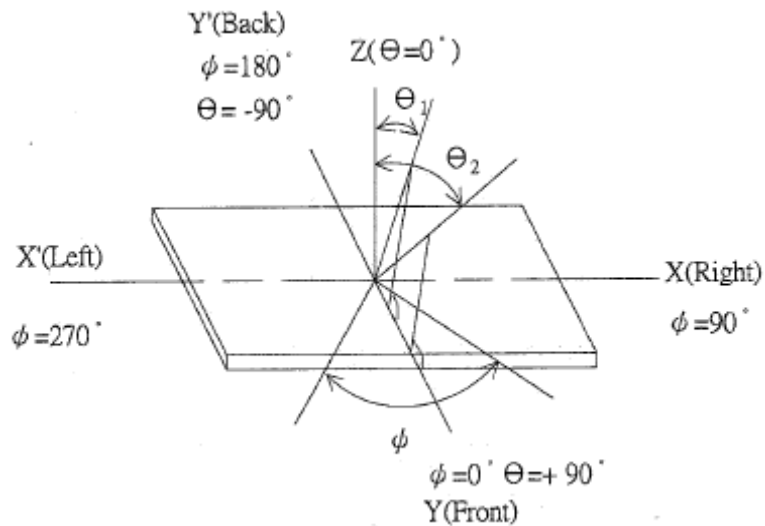


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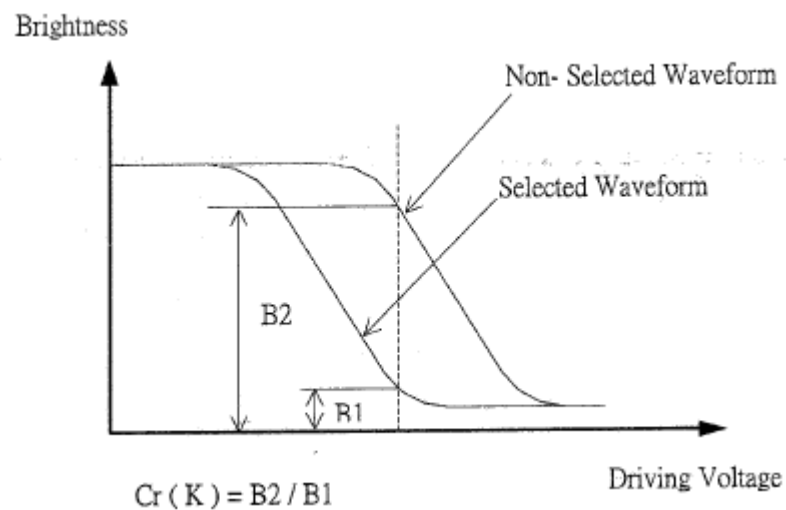


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**[Note 3] Definition of Angle  $\theta$  &  $\phi$**



**[Note 4] Description of Contrast Ratio (K)**



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## **INTERFACE PIN ASSIGNMENT**

Pin No.	Pin Out	I/O	Description
1.	V <sub>DD</sub>	--	Logic supply voltage
2.	V <sub>SS</sub>	--	GND
3.	V <sub>EE</sub>	--	Supply Voltage for LCD panel.
4.   11.	DB0   DB7	I/O	Data bus. 3-state I/O common terminal.
12.	/CS1	I	Chip-select for the left half of the display. Active LOW.
13.	/CS2	I	Chip-select for the right half of the display. Active LOW.
14.	/RST	I	Setting the RES signal to Low level can initialize the following registers. 1. ON/OFF register 0 set(Display off) 2. Display start line register 0 set(display starts from line 0) After releasing reset, this condition can be changed only by software.
15.	R/W	I	Read/Write R/W=high : Data of DB0~DB7 can be read by CPU. R/W=low : Data of DB0~DB7 can be written into LCD driver IC at the falling edge of E when CS1 and CS2 is high.
16.	D/I	I	Data/Instruction D/I=high : Indicates that data of DB0~DB7 is display data. D/I=low : Indicates that data of DB0~DB7 is instruction.
17.	E	I	Enable When write(R/W=low) : Data of DB0~DB7 is latched at the fall of E When read(R/W=high) : Data is read while E is at high level.
18.	FGND	--	Frame Ground
19.	BKL <sub>A</sub>	--	Power supply for backlight. (4.2V/100~150 mA DC for LED backlight, 110V/400Hz AC for EL)
20.	BKL <sub>K</sub>	--	



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## **TIMING CHARACTERISTICS**

MPU interface timing: ( $V_{SS}=0V$ ,  $V_{DD}=4.5V\sim 5.5V$ ,  $T_a=-20$  to  $60^{\circ}C$ )

Item	Symbol	Min.	Typ.	Max.	Unit
E Cycle Time	$t_C$	1000	--	--	ns
E High Level Width	$t_{WH}$	450	--	--	ns
E Low Level Width	$t_{WL}$	450	--	--	ns
E Rise Time	$t_R$	--	--	25	ns
E Fall Time	$t_F$	--	--	25	ns
Address Setup Time	$t_{ASU}$	140	--	--	ns
Address Hold Time	$t_{AH}$	10	--	--	ns
Data Setup Time	$t_{DSU}$	200	--	--	ns
Data Delay Time	$t_D$	--	--	320	ns
Data Hold Time(Write)	$t_{DHW}$	10	--	--	ns
Data Hold Time(Read)	$t_{DHR}$	20	--	--	ns



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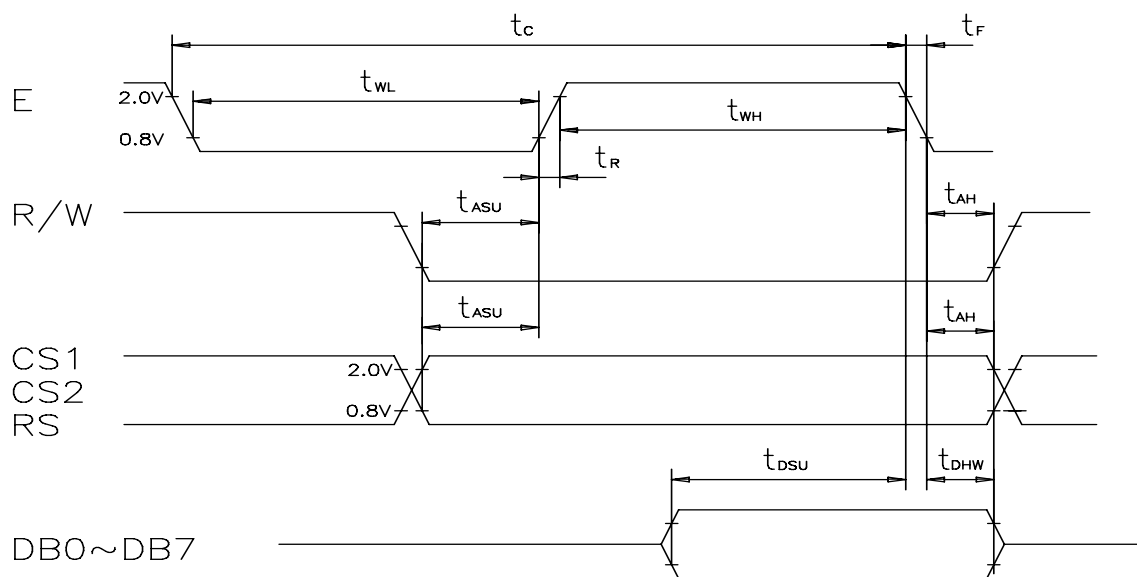
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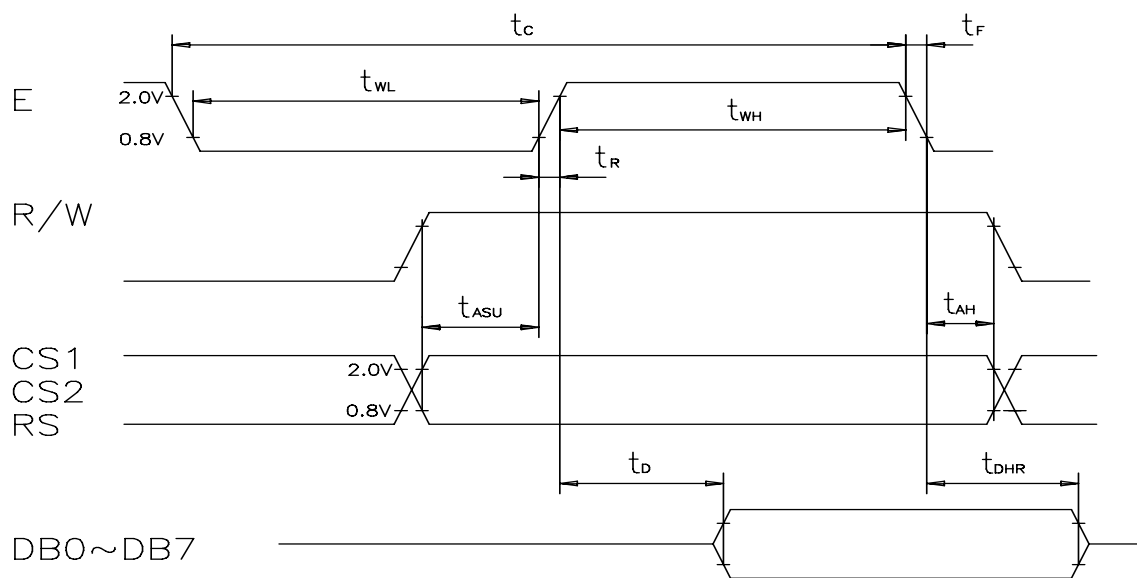
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MPU Write Timing



MPU Read Timing



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## **DISPLAY COMMANDS**

The display commands shown below control the internal state of the LCD driver ICs. Commands are sent from CPU to LCD module for the display control.

Command	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
Display ON/OFF	0	0	0	0	1	1	1	1	1	1/0	To control the display ON or OFF. The internal status and display RAM data are not affected. 0:OFF, 1:ON
Set address (Y address)	0	0	0	1	Y address (0~63)						To set the Y address in the Y address counter.
Set page (X address)	0	0	1	0	1	1	1	Page(0~7)			To set the X address at the X address register.
Display Start Line	0	0	1	1	Display Start Line(0~63)						To indicate the display data RAM displayed at the top of the screen.
Status Read	0	1	Busy	0	ON/OFF	Reset	0	0	0	0	To read status of the LCD controller IC: Busy 0:Ready, 1: In operation ON/OFF: 0:Display ON, 1:Display OFF Reset: 0:Normal, 1:Reset
Write display data	1	0	Write Data								To write data into display data RAM. Y address is increased by 1 after this command.
Read Display data	1	1	Read Data								To read data from display data RAM to the data bus.



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## MEMORY MAPPING

Relationship between RAM data and display

		RAM Y address(Y0 ~Y127)												Data	
1st page(X=0)	Line 0→	0	1	1	1	0	0	.....	0	0	1	0	0	0	←DB0(LSB)
	Line 1→	1	0	0	0	1	0	.....	0	0	1	1	0	0	←DB1
	Line 2→	1	0	0	0	1	0	.....	0	0	1	0	1	0	←DB2
	Line 3→	1	0	0	0	1	0	.....	0	0	1	0	1	0	←DB3
	.....	1	1	1	1	1	0	.....	0	0	1	0	0	0	←DB4
	.....	1	0	0	0	1	0	.....	1	1	1	0	0	0	←DB5
	.....	1	0	0	0	1	0	.....	1	1	1	0	0	0	←DB6
	Line 7→	0	0	0	0	0	0	.....	0	0	0	0	0	0	←DB7(MSB)
2nd page(X=1)	Line 8→	1	1	1	1	0	0	.....	0	1	1	1	0	0	←DB0(LSB)
	Line 9→	1	0	0	0	1	0	.....	0	1	0	0	1	0	←DB1
	Line 10→	1	0	0	0	1	0	.....	0	1	0	0	1	0	←DB2
	.....	1	1	1	1	0	0	.....	1	1	1	0	1	0	←DB3
	.....	1	0	0	0	1	0	.....	0	1	0	0	1	0	←DB4
	.....	1	0	0	0	1	0	.....	0	1	0	0	1	0	←DB5
	.....	1	1	1	1	0	0	.....	0	1	1	1	0	0	←DB6
	Line 15→	0	0	0	0	0	0	.....	0	0	0	0	0	0	←DB7(MSB)
	.....						.....								
8th page(X=7)	Line 56→	1	0	0	0	1	0	.....	0	0	0	0	0	0	←DB0(LSB)
	.....	1	0	0	0	1	0	.....	0	0	0	0	0	0	←DB1
	.....	1	0	0	0	1	0	.....	0	1	0	0	1	0	←DB2
	.....	1	1	1	1	1	0	.....	1	0	1	0	1	0	←DB3
	.....	1	0	0	0	1	0	.....	1	0	0	1	0	0	←DB4
	.....	1	0	0	0	1	0	.....	1	0	0	1	0	0	←DB5
	Line 62→	1	0	0	0	1	0	.....	0	1	1	0	1	0	←DB6
	Line 63→	0	0	0	0	0	0	.....							←DB7(MSB)



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## **ADDRESS CONFIGURATION OF DISPLAY DATA RAM**

		Y address	
		0 1 2 3 .....126 127	
X=0→	DB0	Page0	Line0
	To		To
	DB7		Line7
X=1→	DB0	Page1	Line8
	To		To
	DB7		Line15
X=2→	DB0	Page2	Line16
	To		To
	DB7		Line23
X=3→	DB0	Page3	Line24
	To		To
	DB7		Line31
X=4→	DB0	Page4	Line32
	To		To
	DB7		Line39
X=5→	DB0	Page5	Line40
	To		To
	DB7		Line47
X=6→	DB0	Page6	Line48
	To		To
	DB7		Line55
X=7→	DB0	Page7	Line56
	To		To
	DB7		Line63

Address configuration of Display Data RAM



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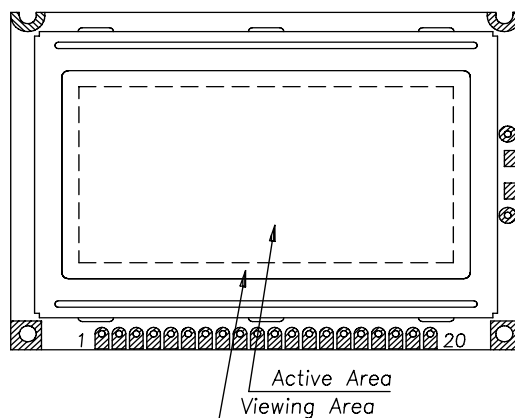
## **RELIABILITY TEST**

No	Item	Conditions		Note
1.	High Temp. Operation	70°C	240 Hr	--
2.	High Temp. Storage	80°C	240 Hr	--
3.	Low Temp. Operation	-20°C	240 Hr	--
4.	Low Temp. Storage	-30°C	240 Hr	--
5.	High Temp./Humid Storage	40°C 90%RH	240 Hr	--
6.	Thermal Shock	-20°C ,30min +40°C ,30min	10 cycles	--
7.	Vibration Test ( IEC-68-2-6 )	Frequency : 10~55 Hz Duration : 20 times, 6 min/time Amplitude : 0.75 mm	--	--
8.	Shock ( IEC 68-2-27)	Duration : 11 mS Acceleration : 100g	--	X, Y, Z direction

## **APPEARANCE CHECK**

CONDIITON OF APPEARANCE CHECK:

(1) Specimen shall be checked by eyes in distance of 30cm under 40w-fluorescence lamp.



(2) Checking direction shall be in 45 degree from perpendicular line op specimen surface.



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## **HANDLING PRECAUTIONS**

- (1) Treat polarizer very carefully since it is easy to be damaged.
- (2) When cleaning the display surface, use soft cloth (e.g. gauss) with a solvent (recommended below) and wipe lightly.
  - ◆ ethyl alcohol
  - ◆ iso-procolol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvents:

- ◆ water
- ◆ ketone
- ◆ aromatics

- (3) Direct current causes electro-chemical reaction with remarkable degradation of the display quality. Give careful consideration to prevent direct current at ON/OFF timing and during operation.
- (4) Avoid strong shock and drop from the height.
- (5) To prevent LCD panels from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.
- (6) Give careful consideration to avoid electrical static discharge with causes uneven contrast.
- (7) Even a small condensation on the contact pads (terminals) causes electro-chemical reaction which makes missing row and column. Give careful attention to avoid condensation. When assembling with zebra connector, clean the surface of the pads with alcohol and keep the air very clean.



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## **LCD PRODUCT QUALITY STANDARD**

### **DISPLAY APPEARANCE**

No	Item	Criteria
1.	inclusions (black spot, white spot, dust)	(1) round type diameter mm(a*)      no of defect* $a \leq 0.20$ neglect $0.20 < a \leq 0.35$ 5max $0.35 < a$ none (2) linear type length mm(l)      width mm(W)      no. of defect na $W \leq 0.03$ neglect $1 \leq 3$ $0.03 < W \leq 0.08$ 6 $3 < l$ $0.08 < W$ none
2.	scratch	1. scratch on protective film is permitted. 2. scratch on polarizer shall be as follow: (1) round type diameter mm(a*)      no of defect $a \leq 0.15$ neglect $0.15 < a \leq 0.20$ 2 max $0.20 < a$ none (2) linear type be judged by 1.-(2) linear type
3.	dent	diameter < 1.5mm
4.	bubble	not exceeding 0.5mm average diameter is acceptable between glass and polarizing film
5.	pin hole	$(a+b)/2 \leq 0.15\text{mm}$ maximum number: ignored $0.15 < (a+b)/2 \leq 0.20\text{mm}$ maximum number: 10
6.	dot defect	$(a+b)/2 \leq 0.20\text{mm}$ maximum number: ignored $0.20 < (a+b)/2 \leq 0.30\text{mm}$ maximum number: 5 x=width
7.	contrast irregularity(spot)	diameter spec      no of defect $a \leq 0.50\text{mm}$ neglect $0.50 < a \leq 0.75$ 5 $0.75 < a \leq 1.00$ 3 $1.00 < a$ none
8.	dot width	design width $\pm 15\%$
9.	color tone and uniformity	obvious uneven color is not permitted



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## **WARRANTY**

This product has been manufactured to your company's specifications 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. If the product is to be used in any of the above applications, we will need to enter into a separate product liability agreement.

- 1 13 months guarantee starts from the date code.
- 2 We cannot accept responsibility for any defect, which may arise from additional manufacturing of the product (including disassembly and reassembly), after product delivery.
- 3 We cannot accept responsibility for any defect, which may arise after the application of strong external force to the product.
- 4 We cannot accept responsibility for any defect, which may arise due to the application of static electricity after the product has passed your company's acceptance inspection procedures.
- 5 We cannot accept responsibility for industrial property, which may arise through the use of your product, with exception to those issues relating directly to the structure or method of manufacturing of our product. Microtips-origin longer than one year from Microtips production.

## **DIMENSIONAL OUTLINES**

- See the next page.....



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# Mouser Electronics

Authorized Distributor

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