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## LCD MODULE SPECIFICATION FOR CUSTOMER'S APPROVAL

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

**MODULE TYPE** : NMTG-S12864BFYHSGY-B

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

Approved by	Checked by		Made by
			



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

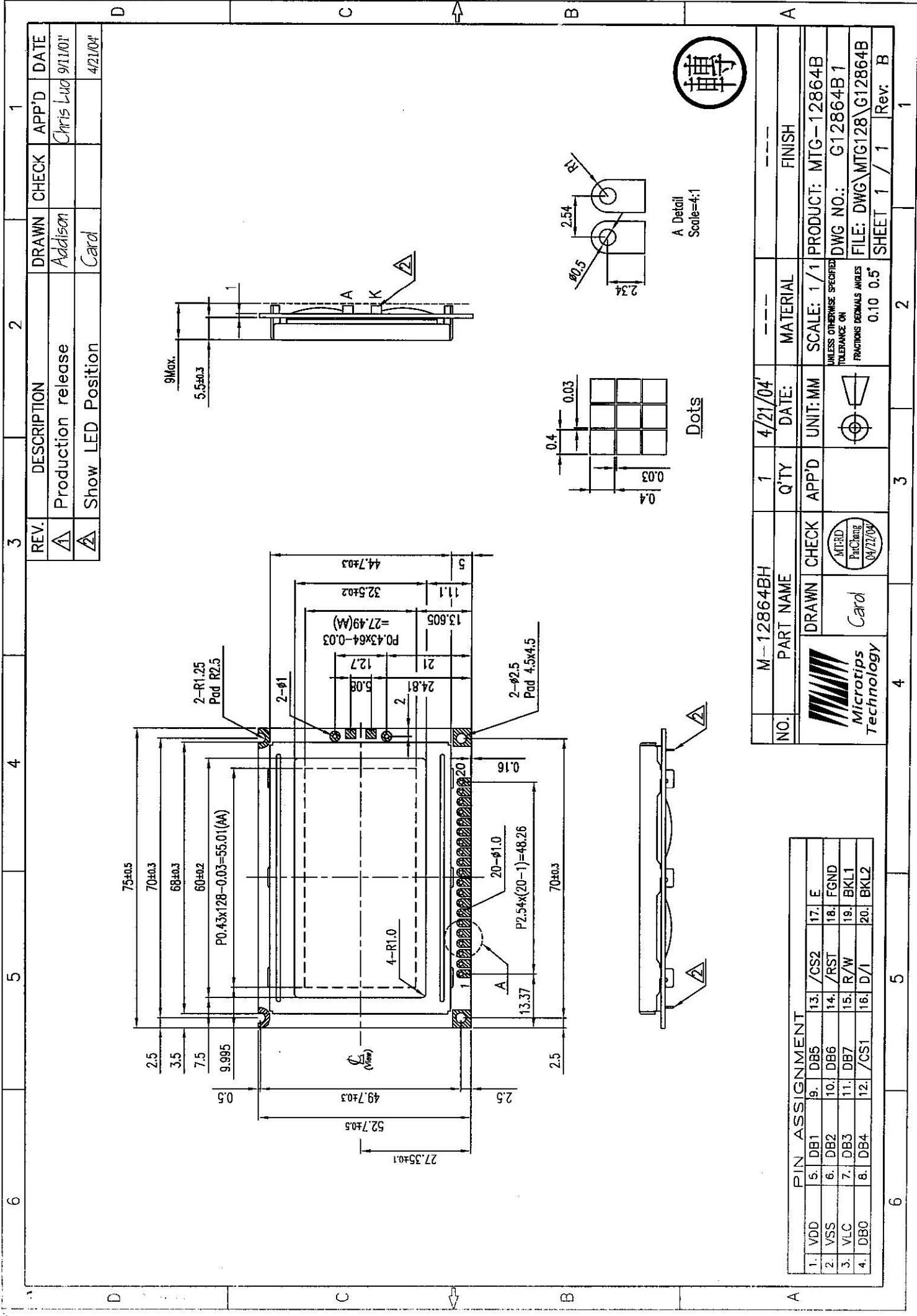
View Direction	<input checked="" type="checkbox"/> 6 O'clock		<input type="checkbox"/> 12 O'clock		
LCD Type	<input type="checkbox"/> FSTN Positive		<input type="checkbox"/> FSTN Negative		
	<input type="checkbox"/> STN Gray	<input checked="" type="checkbox"/> STN Yellow Green	<input type="checkbox"/> 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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REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
1	Production release	Addison		Chris Liu	9/11/01
2	Show LED Position	Card			4/21/04

NO.	PART NAME	QTY	DATE	MATERIAL	FINISH
1	M-12864BH	1	4/21/04		
DRAWN CHECK		APP'D	UNIT:MM	SCALE: 1/1	PRODUCT: MTC-12864B
Card				UNLESS OTHERWISE SPECIFIED TOLERANCE ON FRACTIONS DENOMIAL ANGLES 0.10 0.5°	DWG NO.: G12864B 1
Microtips Technology					FILE: DWG\MTC128\G12864B
					SHEET 1 / 1 Rev: B

PIN ASSIGNMENT					
1. VDD	5. DB1	9. DB5	13. /CS2	17. E	
2. VSS	6. DB2	10. DB6	14. /RST	18. /GND	
3. VLC	7. DB3	11. DB7	15. R/W	19. BKL1	
4. DB0	8. DB4	12. /CS1	16. D/I	20. BKL2	

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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	Common-Driver IC, Segment-driver IC with build-in SRAM
Interface	Data (D0~D7), D/I, R/W, E, RST, CS1, CS2, V <sub>EE</sub>

## ABSOLUTE MAXIMUM 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°C	+50°C	-20°C	+70°C	-20°C	+70°C	-30°C	+80°C
Humidity(without condensation)	Note 2,4		Note 3,5		Note 4,5		Note 4,6	

Note 2 Ta ≤ 50°C : 80% RH max

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

Note 3 Ta at -20°C will be < 48hrs at 70°C 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°C : 75RH max

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

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



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## ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ	Max.	Unit	note
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	--
LCM Recommend LCD Module Driving Voltage	$V_{DD}-V_{EE}$	$T_a=-20^{\circ}C$	9.14	9.64	10.14	Volt	--
		$T_a=25^{\circ}C$	8.60	9.10	9.60		
		$T_a=70^{\circ}C$	8.06	8.56	9.06		
Power Supply Current for LCM	$I_{DD}(LED\ B/L\ OFF)$	$V_{DD}=5.0V$ $T_a=25^{\circ}C$ $V_{DD}-V_{EE}=10.3V$ $V_{LED}=5.0V$	--	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
Viewing Angle	Front-Back	$\theta=0^{\circ}$	30	92	--	deg.	--
	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	--
Fall Time	$T_f$		--	210	200		
Contrast	Cr		2.0	6.0	--		



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## INTERFACE PIN ASSIGNMENT

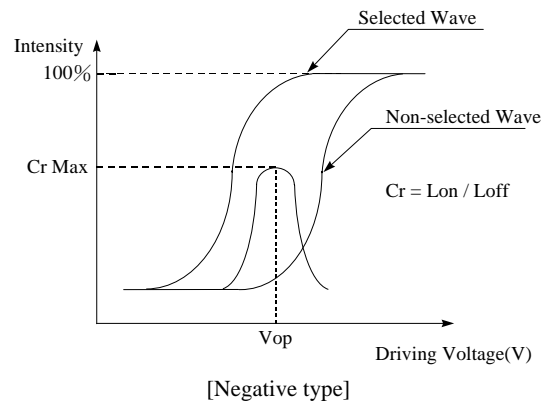
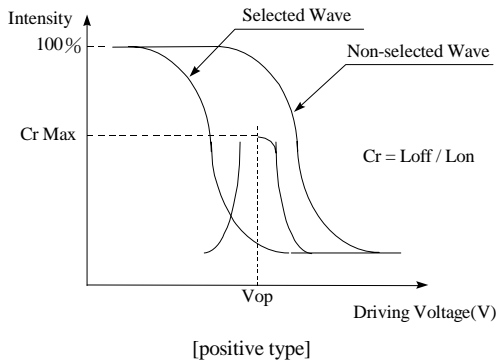
Pin No.	Pin Out	I/O	Description
1	V <sub>DD</sub>	-	Logic supply voltage
2	V <sub>SS</sub>	-	GND
3	V <sub>EE</sub>	-	Supply Voltage for LCD panel.
4   11	DB0   DB7	I/O	Data bus. 3-state I/O common terminal.
12	/CS1	I	Chip-select for the left half of the display. Active LOW.
13	/CS2	I	Chip-select for 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.
117	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>	-	



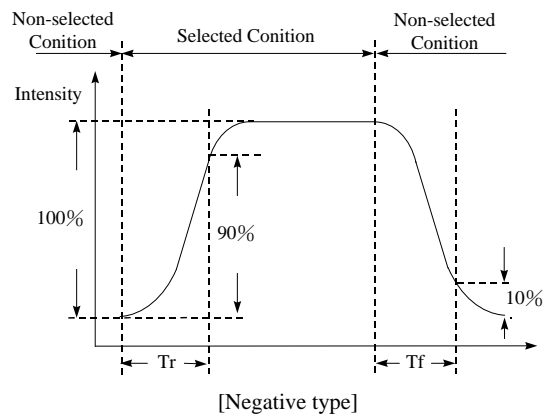
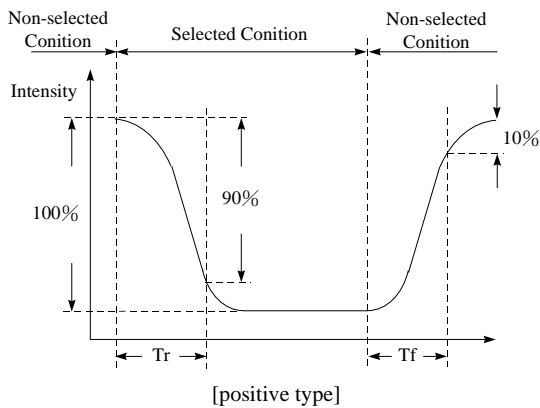
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**[Note 7] Definition of Operation Voltage (Vop)**



**[Note 8] Definition of Response Time (Tr, Tf)**

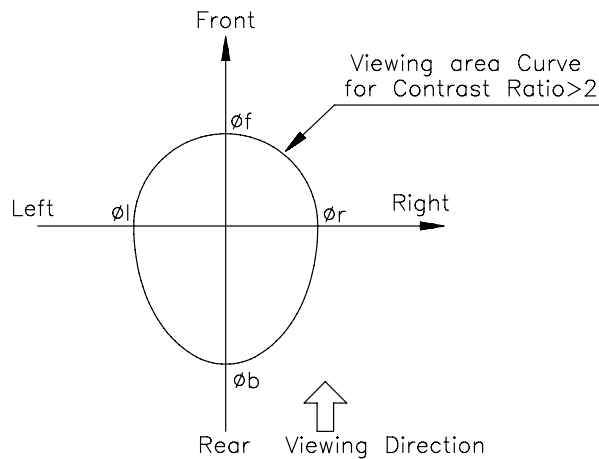


**Conditions:**

**Operating Voltage : Vop**  
**Frame Frequency : 64 Hz**

**Viewing Angle ( $\theta, \varphi$ ): 0°, 0°**  
**Driving Wave form : 1/N duty, 1/a bias**

**[Note 9] Definition of Viewing Direction**

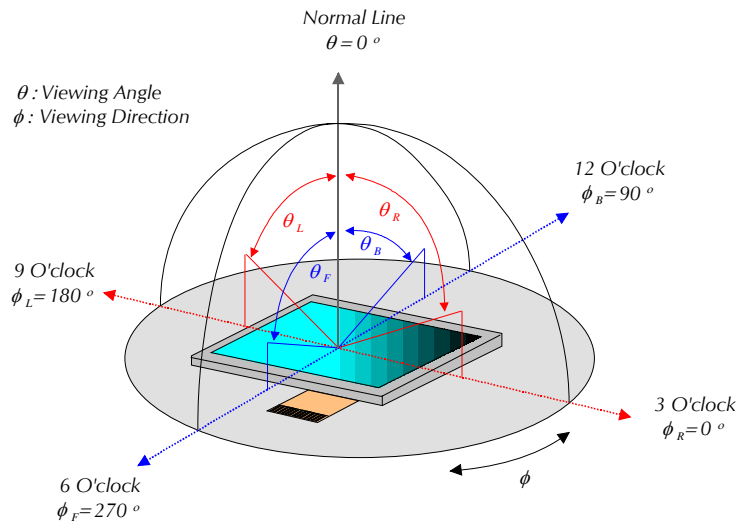


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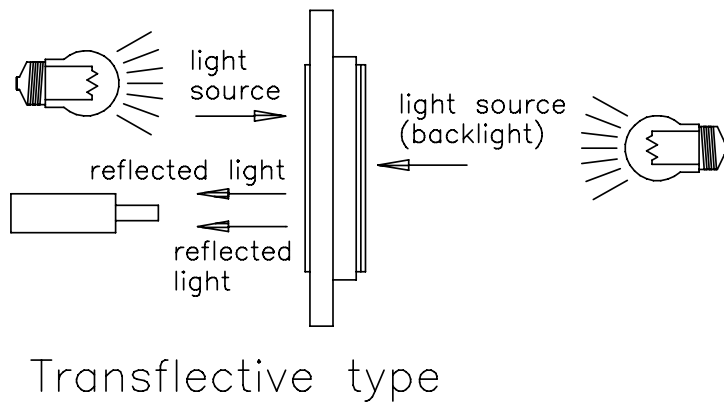
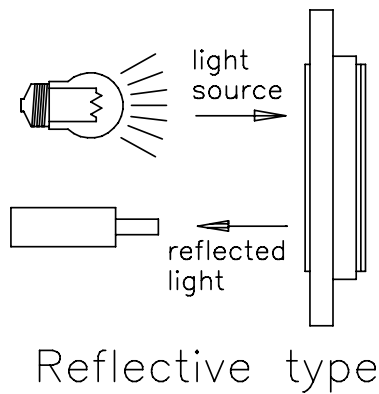


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**[Note 10] Definition of viewing angle**



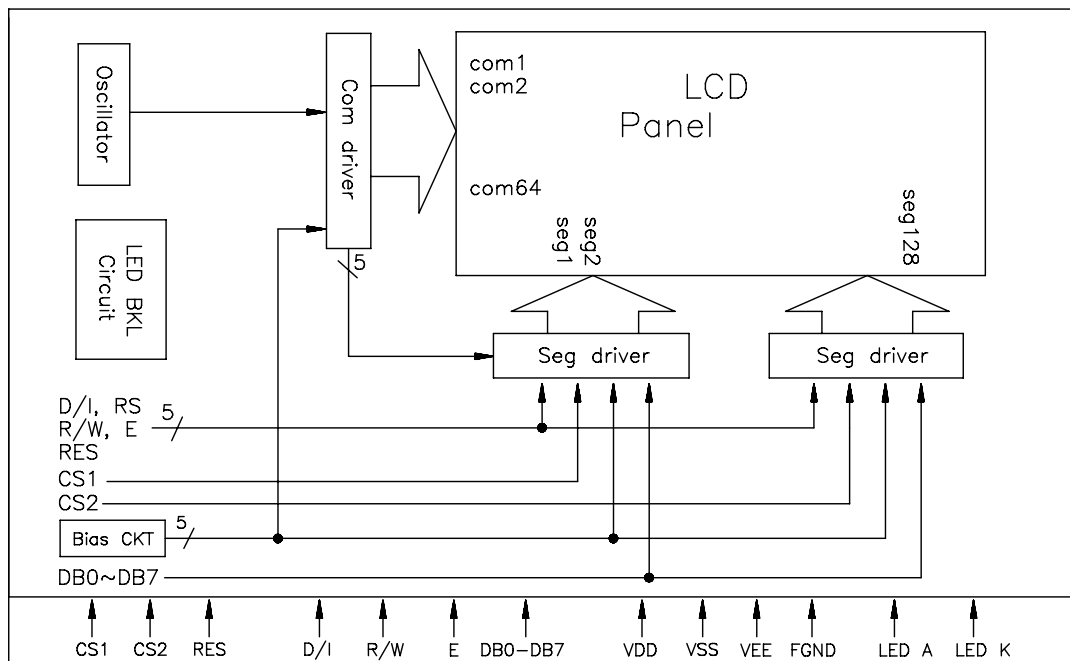
**[Note 11] Description of Measuring Equipment**



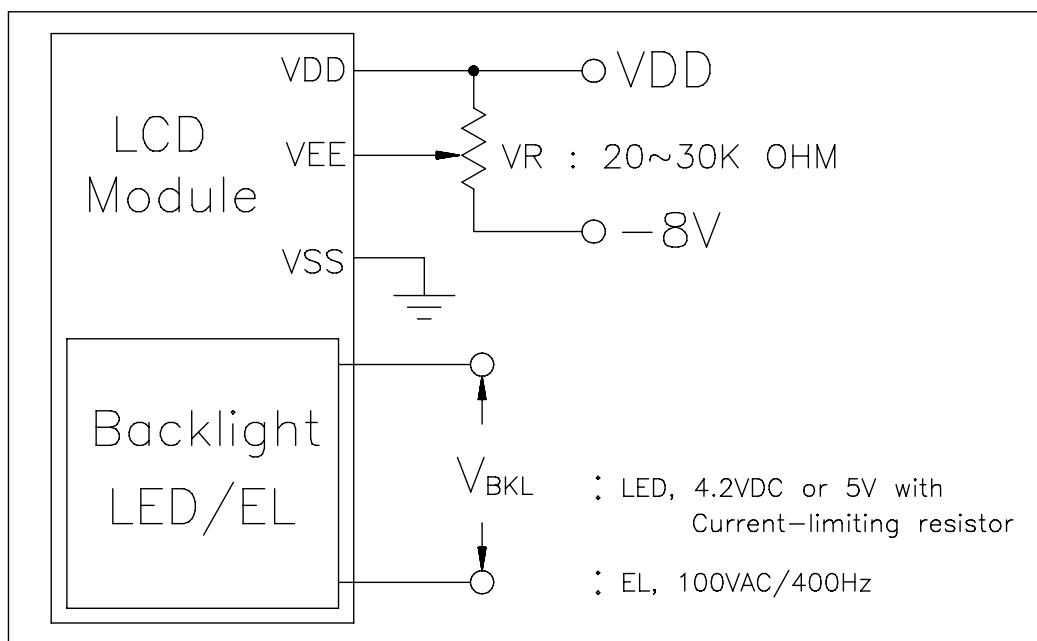
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## BLOCK DIAGRAM



## POWER SUPPLY



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## TIMING CHARACTERISTICS

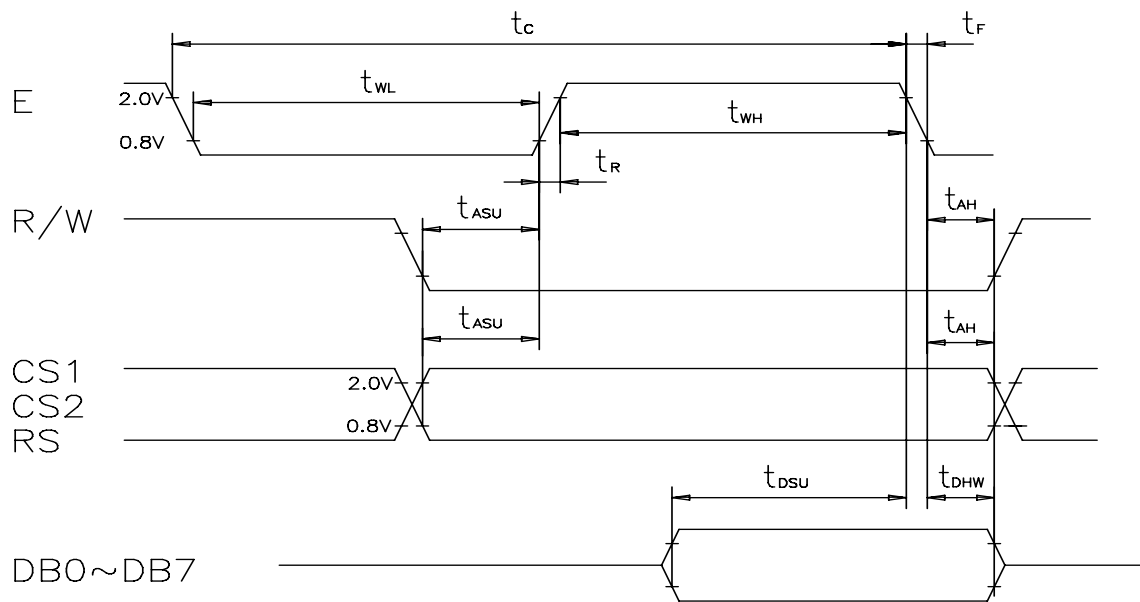
MPU interface timing: ( $V_{SS}=0V$ ,  $V_{DD}=4.5V\sim 5.5V$ ,  $T_a=-20$  to  $60^{\circ}C$ )

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

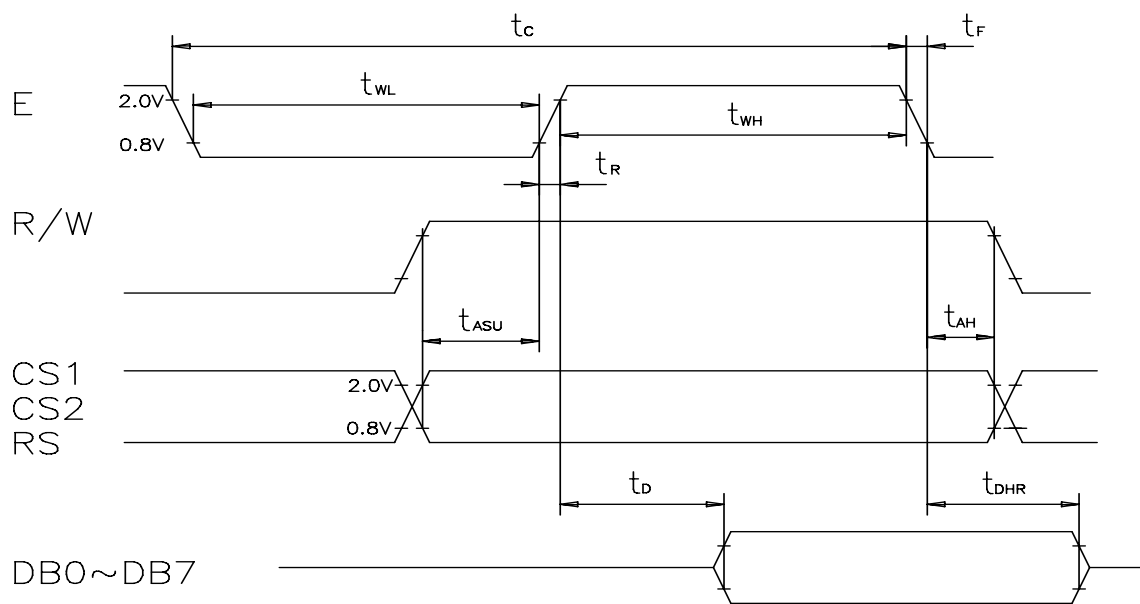


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MPU Write Timing



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

Address configuration of Display Data RAM



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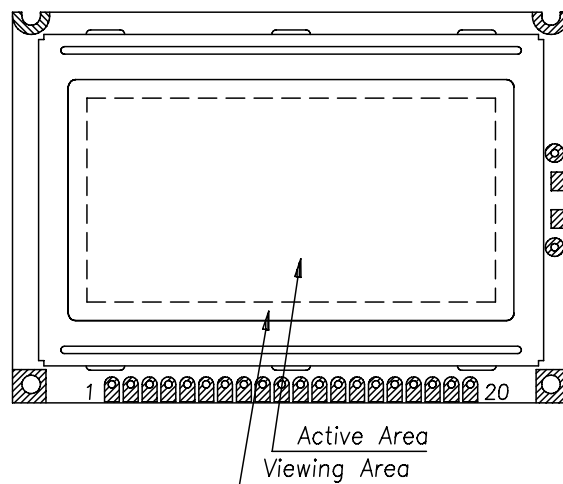
## RELIABILITY TEST

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	60°C 90%RH	240 Hr	--
6	Thermal Shock	-20°C ,30min +60°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-propanol

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 which 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 $l \leq 3$ $0.03 < W \leq 0.08$ 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.



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### REVISION HISTORY

Rev	Revision Content	Page	Date
A	Initial Release	1~20	2000/10/03
B	Change IC and Add Warranty	19	2008/06/18



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