LCD MODULE SPECIFICATION
FOR CUSTOMER'S APPROVAL

CUSTOMER : _____

MODULE TYPE: __NMTG-S12864BFYHSGY-D__

APPROVED BY: (FOR CUSTOMER USE ONLY)

Approved by	Checked by		Made by
微 端 2014/06/06 連俊傑	微 端 2014/06/06 韋有乾	微 端 2014/06/06 李照川	微 端 2014/06/06 許瓊窈

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Revise Records

Rev.	Date	Contents	Written	Approved
A.	2014/06/06	Initial Edition	Jill Hsu	Danny Lien

Special Notes

Note 1.	1. Change PCB supplier, Change backlight supplier. 2. Change Model name to NMTG-S12864BFYHSGY-D.
Note 2.	
Note 3.	
Note 4.	
Note 5.	

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

View Direction	☑ 6 O'clock			□12 O'clock	
LCD Type	□ FSTN Positive			□ FSTN Negative	
	□ STN Gray	☑ STN Yellow Green		□ STN Blue	
Rear Polarizer	□ Reflective	☑ Transflective		□ Transmissive	
Backlight Type	☑ LED	□ EL	☑ Internal Power	☑ 5V input	
		□ CCFL	□ External Power	□ 24V input	
Backlight Color	□ White	□ Amber	□ Blue Green	☑ Yellow Green	□ Other
Temperature Range	□ Normal	☑ Wide		□ Super Wide	
EL Driver IC	□ Build-in	☑ Not Build-in			
Touch Screen	□ With	☑ 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_{EE}

ABSOLUTE MAXIMUN RATING

(1) Electrical Absolute Ratings

Item	Symbol	Min.	Max.	Unit	Note
Power Supply for Logic	$V_{DD} - V_{SS}$	-0.3	7.0	Volt	--
Power Supply for LCD	$V_{DD} - V_{EE}$	-0.3	19.0	Volt	--
Input Voltage	V_I	-0.3	V_{DD}+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℃

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/㎡	--
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℃

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℃ TO + 70℃	--
Storage Temperature Range	TSTO	-30℃ TO + 80℃	--

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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}(LED B/L OFF)	V_{DD} = 5.0V T_a = 25℃ $V_{DD} - V_{EE}$ = 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℃	9.14	9.64	10.14	Volt	1.
		T_a = 25℃	8.60	9.10	9.60		
		T_a = 70℃	8.06	8.56	9.06		
Viewing Angle	Front-Back	θ =0°	30	92	--	deg.	3.
	Left-Right	θ =0°	60	90	--	deg.	
Rise Time	T_r	V_{DD} - V_{EE} =10.3V T_a = 25℃	--	90	220	mS	2.
Fall Time	T_f		--	210	200		
Contrast	Cr		2.0	6.0	--	--	4

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[Note 1] Definition of Operation Voltage (Vop)
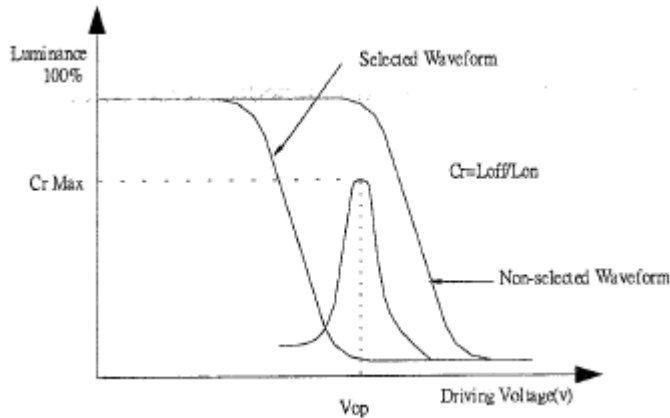
$\theta = 0°$ $\phi = 0°$

[Note 2] Definition of Response Time (Tr, Tf)
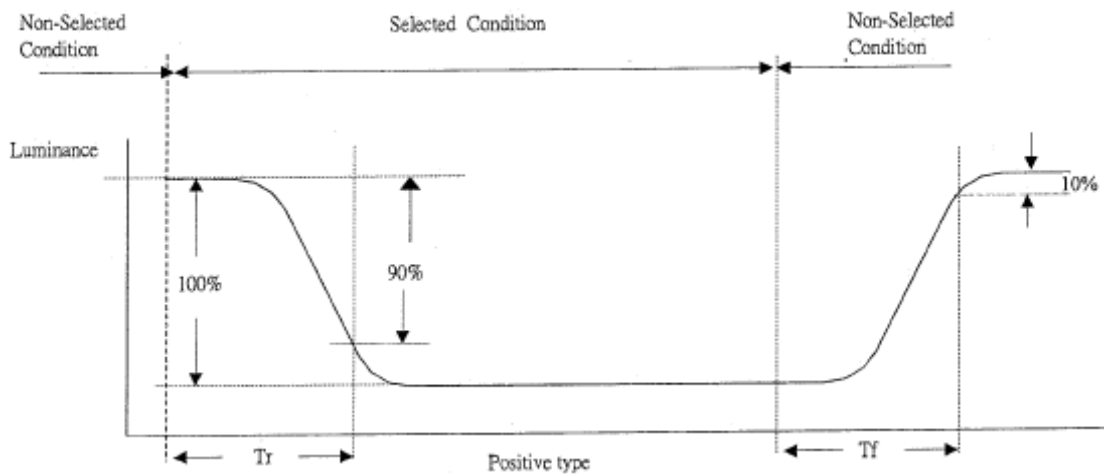
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[Note 3] Definition of Angle θ & ϕ
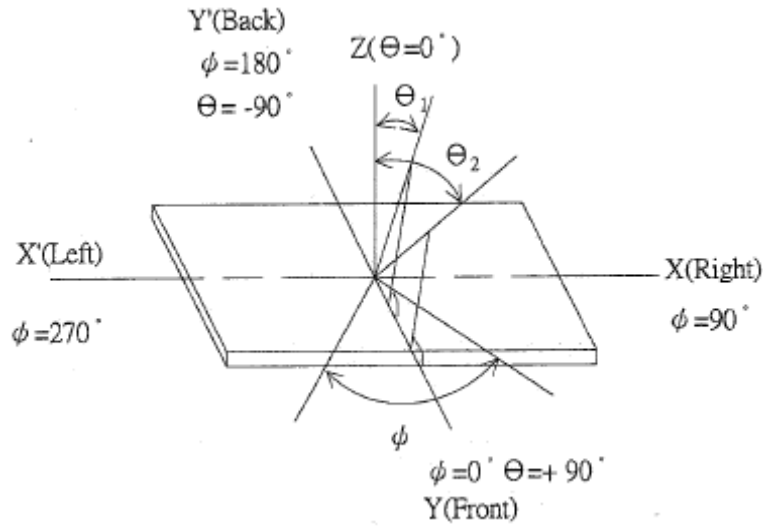
[Note 4] Description of Contrast Ratio (K)
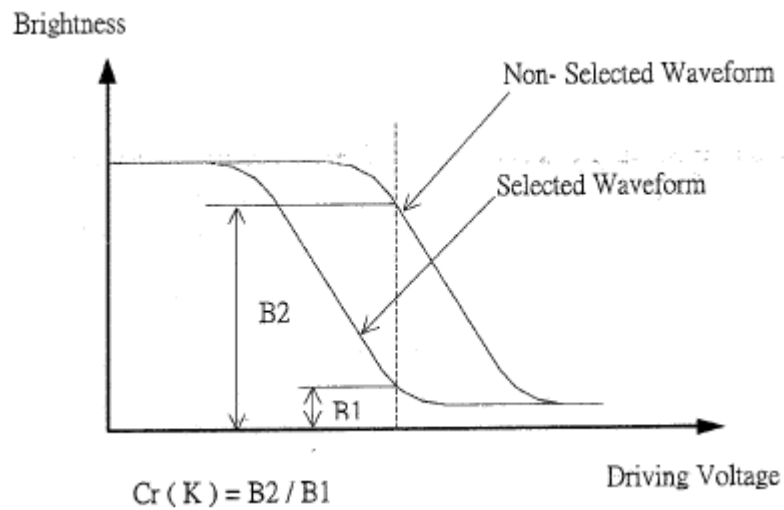
$$Cr(K) = B2 / B1$$

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INTERFACE PIN ASSIGNMENT

Pin No.	Pin Out	I/O	Description
1.	V_{DD}	--	Logic supply voltage
2.	V_{SS}	--	GND
3.	V_{EE}	--	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_A	--	Power supply for backlight. (4.2V/100~150 mA DC for LED backlight, 110V/400Hz AC for EL)
20.	BKL_K	--	

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BLOCK DIAGRAM
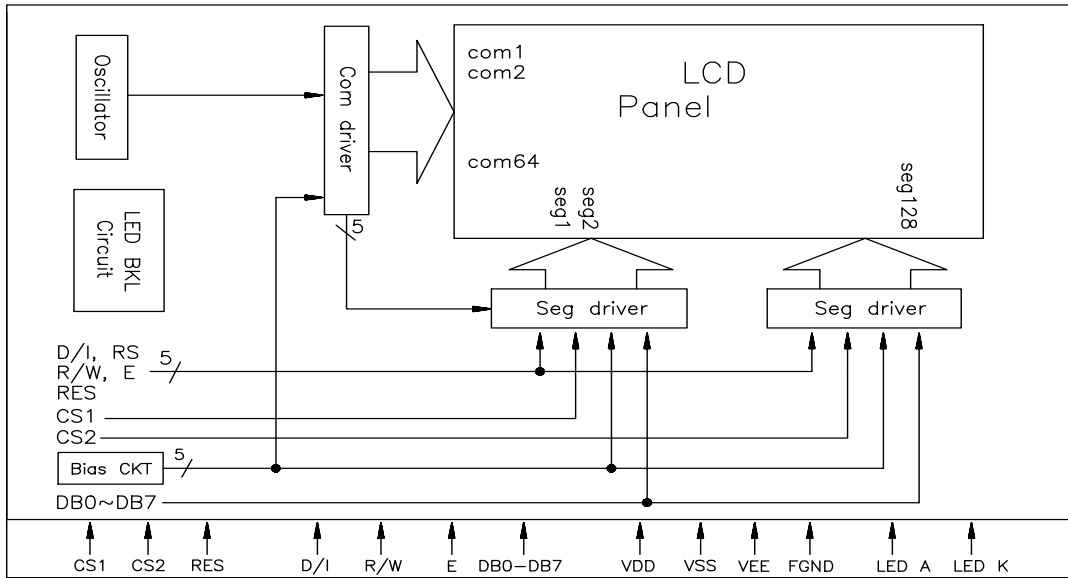
POWER SUPPLY
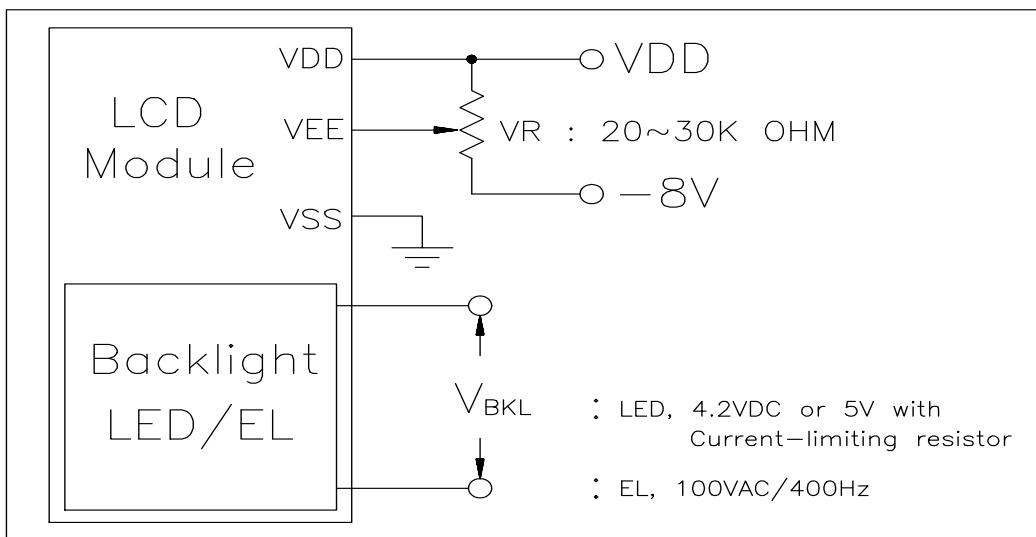
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TIMING CHARACTERISTICS

MPU interface timing: (V_{SS} =0V, V_{DD}=4.5V~5.5V, T_a=-20 to 60℃)

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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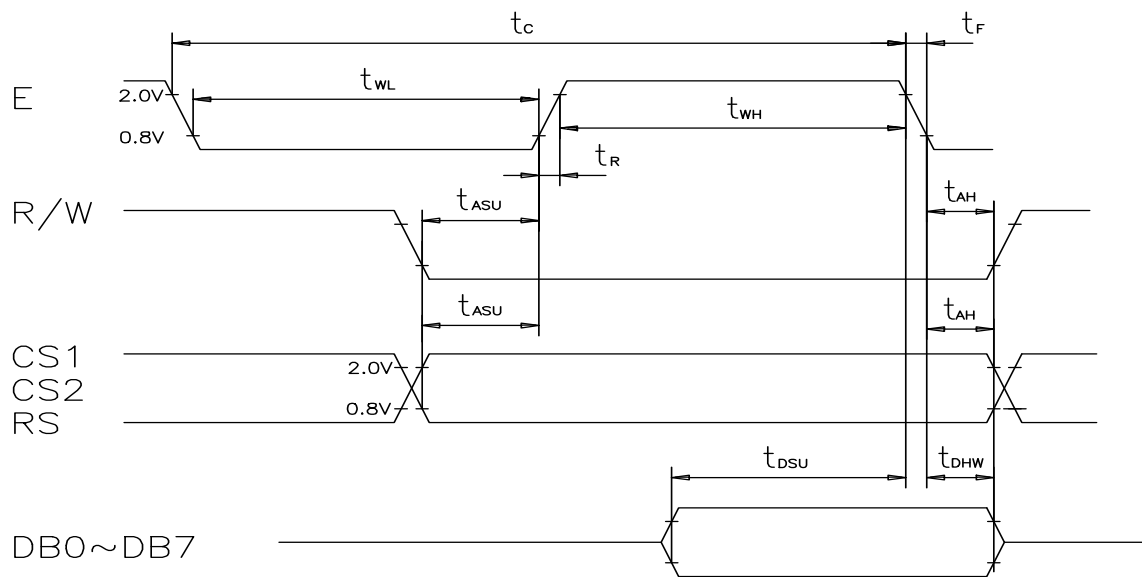
MPU Write Timing
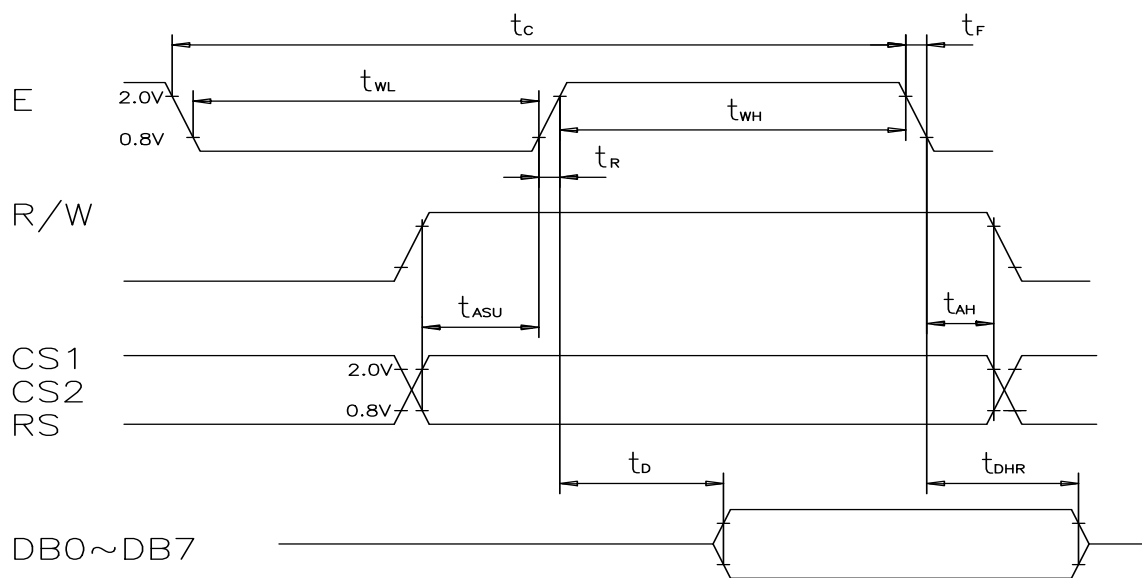
MPU Read Timing

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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 To DB7	Page0	Line0 To Line7
X=1→	DB0 To DB7	Page1	Line8 To Line15
X=2→	DB0 To DB7	Page2	Line16 To Line23
X=3→	DB0 To DB7	Page3	Lint24 To Line31
X=4→	DB0 To DB7	Page4	Line32 To Line39
X=5→	DB0 To DB7	Page5	Line40 To Line47
X=6→	DB0 To DB7	Page6	Line48 To Line55
X=7→	DB0 To DB7	Page7	Line56 To Line63

Address configuration of Display Data RAM

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RELIABILITY TEST

No	Item	Conditions		Note
1.	High Temp. Operation	70℃	240 Hr	--
2.	High Temp. Storage	80℃	240 Hr	--
3.	Low Temp. Operation	-20℃	240 Hr	--
4.	Low Temp. Storage	-30℃	240 Hr	--
5.	High Temp./Humid Storage	40℃ 90%RH	240 Hr	--
6.	Thermal Shock	-20℃ ,30min +40℃ ,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.

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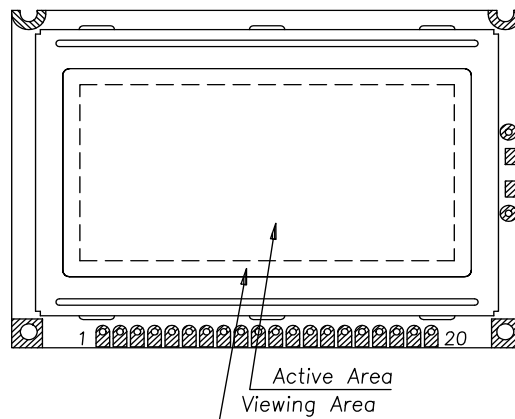
(2) Checking direction shall be in 45 degree from perpendicular line op specimen surface.

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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-prcolol

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$0.03　　neglect 　　l$\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 bye 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 $\leq$ 0.15mm maximum number: ignored 0.15$<$(a+b)/2$\leq$0.20mm maximum number:10
6.	dot defect	(a+b)/2$\leq$0.20mm maximum number: ignored 0.20$<$(a+b)/2$\leq$0.30mm maximum number:5 x=width
7.	contrast irregularity(spot)	diameter spec　　　no of defect a$\leq$0.50mm　　　　neglect 0.50$<$a$\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.
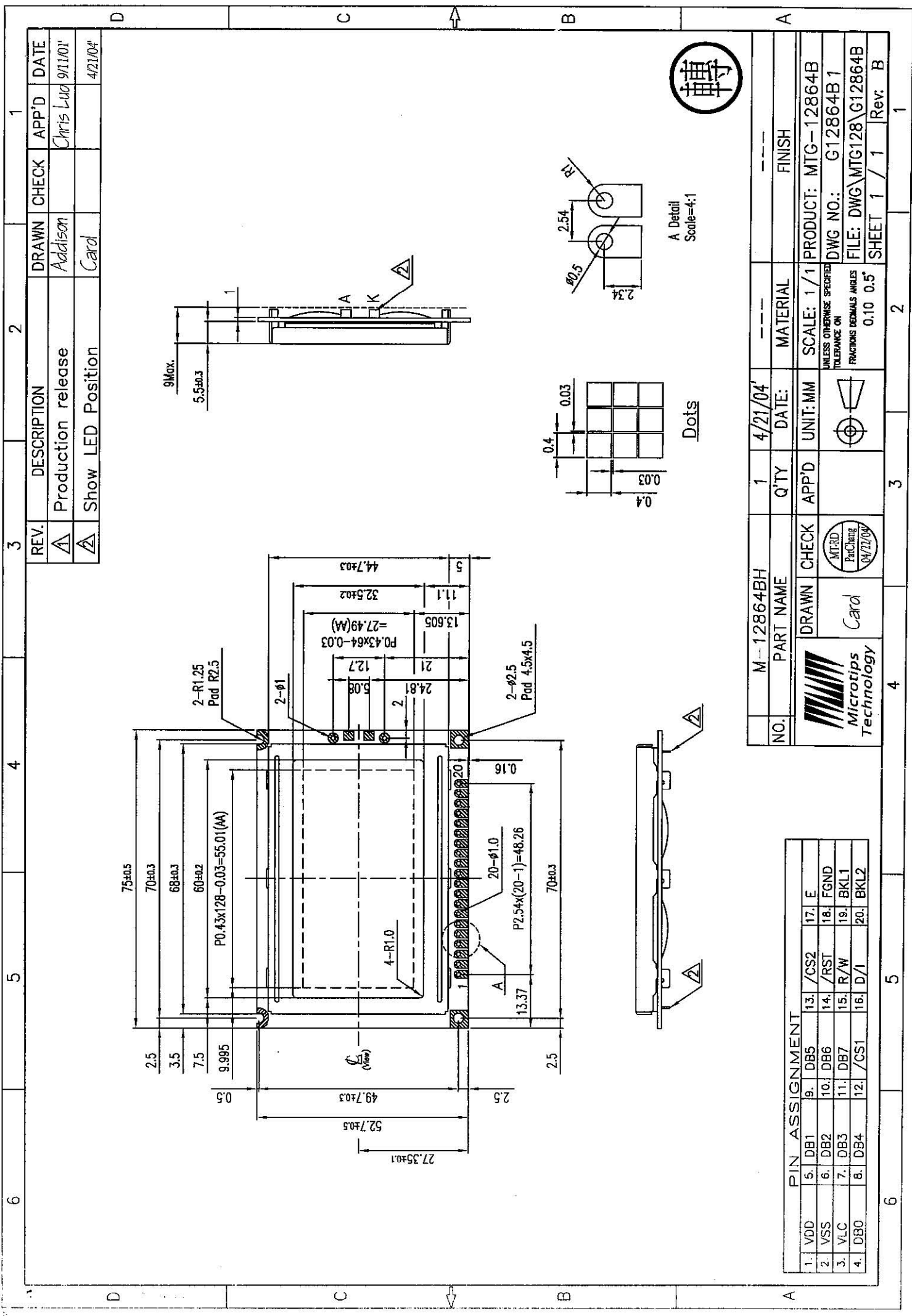
1   13 months guarantee starts from the date code.

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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A Detail
Scale=4:1

2.54
φ0.5
2.34
R1

Dots

0.03
0.4
0.03
0.4

9Max.
5.5±0.3

1

A K △2

Display / panel dimensions

44.7±0.3
32.5±0.2
P0.43x64−0.03=27.49(AA)
12.7
2−φ1
5.08
24.81
2
11.1
13.605
21
2−R1.25 Pad R2.5
2−φ2.5 Pad 4.5x4.5
5

75±0.5
70±0.3
68±0.3
60±0.2
P0.43x128−0.03=55.01(AA)
4−R1.0
70±0.3
2.5
3.5
7.5
9.995
0.5
2.5
0.16
20
20−φ1.0
P2.54x(20−1)=48.26
13.37
A
₵(View)
49.7±0.3
52.7±0.5
27.35±0.1

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