ZX12864P-5

(SPECIFICATION FOR LCD MODULE)

Design :

Check :

Approval :

Customer :

Customer Approval:

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● <u>REVISION RECORD</u>

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CONTENTS

1　Scope

This specification defines general provision as well as inspection standards for LCD module supplied by HUARI Corporation.

If the event of unforeseen problem or unspecified items may occur, naturally shall negotiate and agree to solution.

2　Warranty

Module products manufactured to this specification will be capable of meeting all the characteristics for a minimum period of 12 months, which calculates from the date of shipping from HUARI Corporation. And all the products should be stored or used as specified conditions described in these sheets.

If module products are not stored or used as specified conditions, herein, it will be void the 12 months warranty.

3　Features

1) Display Type: FSTN

2) Polarizer Mode: Transflective and Positive Type

3) Viewing Angle: 6:00

4) Viewing Area:41.8mm×26.1mm

5) Driving Method:9.0V, 1/65Duty, 1/9 Bias

6) Controller/Driver:NT7532H-BDT

7) Dot Matrix: 128*64DOTS

8) Outline Dimensions: Refer to outline drawing

9)Dot Size:0.29mm×0.34mm

10)Dot Pitch:0.307mm×0.357mm

4 Maximum ratings

Item	Symbol	Standard Value		Unit	Remark
		Min.	Max.		
Supply Voltage Range	V_{DD}	-0.3	+3.6	V	Power Supply Voltage For Logic
	V0	-0.3	13.5	V	Power Supply Voltage For LCD
Input Voltage	V_{IN}	- 0.3	V_{DD}+0.3	V	Input Voltage
Operating Temperature	T_{op}	-20	+60		Operating Temperature
Storage Temperature	T_{st}	-30	+70		Storage Temperature

5 Electrical characteristics

For detail, refer to the specification of IC: NT7532H-BDT   NOVATEK

Electrical Characteristics
DC Characteristics   (Vss = 0V, V$_{DD}$ = 2.7 - 3.3V   T$_A$ = -40 to 85°C unless otherwise specified)

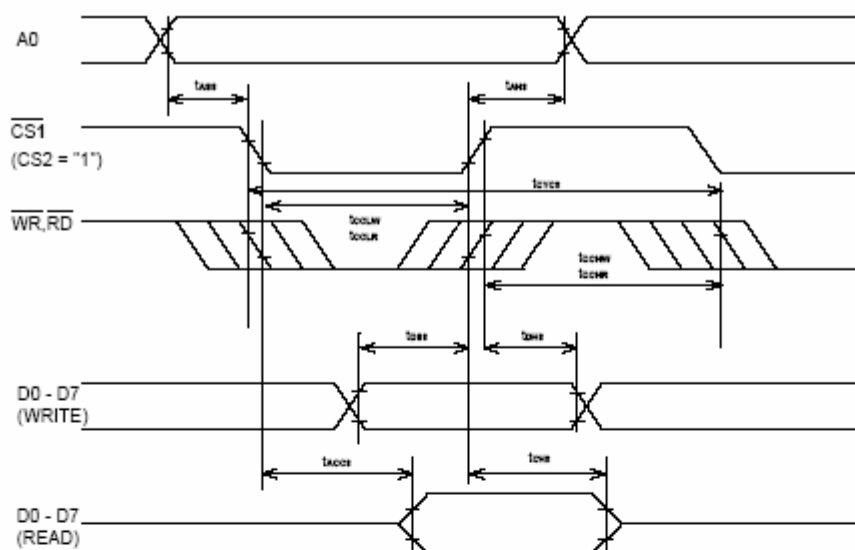| Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
V$_{DD}$	Operating Voltage	2.4		3.5	V	
V$_{DD2}$	Operating Voltage	2.4		3.5	V	
V$_{OUT}$	Booster output voltage	6.0		12.0	V	
V0	Voltage regulator operation voltage	4.5		11.5	V	
V$_{REG1}$	Reference voltage	2.04	2.10	2.16	V	T$_A$ = 25°C, -0.05%/ °C
V$_{REG2}$	Reference voltage	2.00	2.10	2.20	V	T$_A$ = 25°C, -0.2%/ °C
I$_{DD1}$	Dynamic current consumption 1	-	21	35	μA	V$_{DD}$ = 3V, V0 = 11V, built-in power supply off, display on, display data = checker and no access, T$_A$ = 25°C
I$_{DD2}$	Dynamic current consumption 2	-	96	160	μA	4X boosting, V$_{DD}$, V$_{DD2}$ = 3V, V0 = 11V, built-in power supply on, display on, display data = checker and no access, T$_A$ = 25°C, temperature gradient is -0.05%/ °C, when V0 voltage internal resistor is used. Normal mode
I$_{DD3}$	Dynamic current consumption 3	-	153	255	μA	4X boosting, V$_{DD}$, V$_{DD2}$ = 3V, V0 = 11V, built-in power supply on, display on, display data = checker and no access, T$_A$ = 25°C, temperature gradient is -0.05%/ °C, when V0 voltage internal resistor is used. High power mode
I$_{SP}$	Sleep mode current consumption		0.01	5	μA	During sleep, T$_A$ = 25°C
I$_{SB}$	Standby mode current consumption		4	8	μA	During standby, T$_A$ = 25°C
V$_{IHC}$	High-level input voltage	0.8 X V$_{DD}$		V$_{DD}$	V	A0, D0 - D7, $\overline{RD}$(E), $\overline{WR}$ (R/$\overline{W}$), $\overline{CS1}$, CS2, CLS, CL, FR, M/S, C86, P/S, $\overline{DOF}$, $\overline{RES}$, TMPS, VRS, IRS, and $\overline{HPM}$
V$_{ILC}$	Low-level input voltage	Vss		0.2 X V$_{DD}$	V	
V$_{OHC}$	High-level output voltage	0.8 X V$_{DD}$		V$_{DD}$	V	I$_{OH}$ = -0.5mA (D0 - D7, FR, FRS, $\overline{DOF}$, and CL)
V$_{OLC}$	Low -level output voltage	Vss		0.2 X V$_{DD}$	V	I$_{OL}$ = 0.5mA (D0 - D7, FR, FRS, $\overline{DOF}$, and CL)
I$_{LI}$	Input leakage current	-1.0		1.0	μA	V$_{IN}$ = V$_{DD}$ or Vss (A0, $\overline{RD}$(E), $\overline{WR}$ (R/$\overline{W}$), $\overline{CS1}$, CS2, CLS, M/S, C86, P/S, IRS, TMPS, VRS and $\overline{RES}$)

DC Characteristics (continued)

I$_{HZ}$	HZ leakage current	-3.0		3.0	µA	When the D0 - D7, FR, CL, and $\overline{DOF}$ are in high impedance
R$_{ON1}$	LCD driver ON resistance		2.0	3.5	KΩ	V0 = 11.0V	T$_A$ = 25°C, These are the resistance
R$_{ON2}$	LCD driver ON resistance		3.2	5.4	KΩ	V0 = 8.0V	values for when a 0.1V voltage is applied between the output terminal SEGn or COMn and the various power supply terminals (V1, V2, V3, V4).
C$_{IN}$	Input pad capacity		5.0	8.0	pF	T$_A$ = 25°C, f = 1MHz
f$_{osc}$	Oscillation frequency	27	33	39	kHZ	T$_A$ = 25°C

Notes: 1. Voltages V0 ≧ V1 ≧ V2 ≧ V3 ≧ V4 ≧ Vss must always be satisfied.

TIMING CHARACTERISTICS

## System buses Read / Write characteristics 1 (For the 8080 Series MPU)

(V$_{DD}$ = 2.7 - 3.3V, T$_A$ = -40 - 85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
T$_{AH8}$	Address hold time	0			ns	
T$_{AS8}$	Address setup time	0			ns	
T$_{CYC8}$	System cycle time	300			ns	
T$_{CCLW}$	Control L pulse width (WR)	90			ns	
T$_{CCLR}$	Control L pulse width (RD)	120			ns	
T$_{CCHW}$	Control H pulse width (WR)	120			ns	
T$_{CCHR}$	Control H pulse width (RD)	60			ns	
T$_{DS8}$	Data setup time	40			ns	
T$_{DH8}$	Data hold time	15			ns	
T$_{ACC8}$	$\overline{RD}$ access time			140	ns	C$_L$ = 100pF
T$_{CH8}$	Output disable time	10		100	ns	C$_L$ = 100pF

*1. The input signal rise time and fall time (t$_r$, t$_f$) is specified at 15ns or less. When the system cycle time is extremely fast, (t$_r$+t$_f$) ≤ (t$_{CYC8}$-t$_{CCLW}$-t$_{CCHW}$) for (t$_r$+t$_f$) ≤ (t$_{CYC8}$-t$_{CCLR}$-t$_{CCHR}$) are specified.

*2. All timing is specified using 20% and 80% of V$_{DD}$ as the reference.

*3. t$_{CCLW}$ and t$_{CCLR}$ are specified as the overlap between $\overline{CS1}$ being "L" (CS2 = "H") and $\overline{WR}$ and $\overline{RD}$ being at the "L" level.

System buses Read/Write Characteristics 2 (6800 Series MPU)
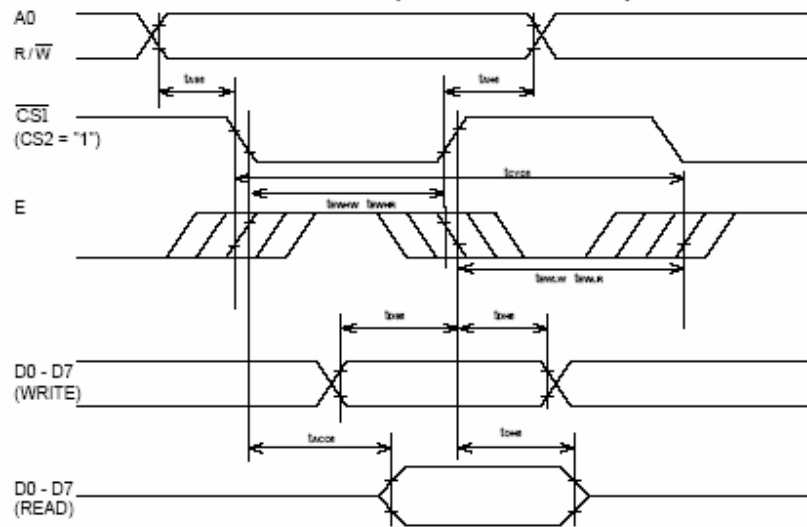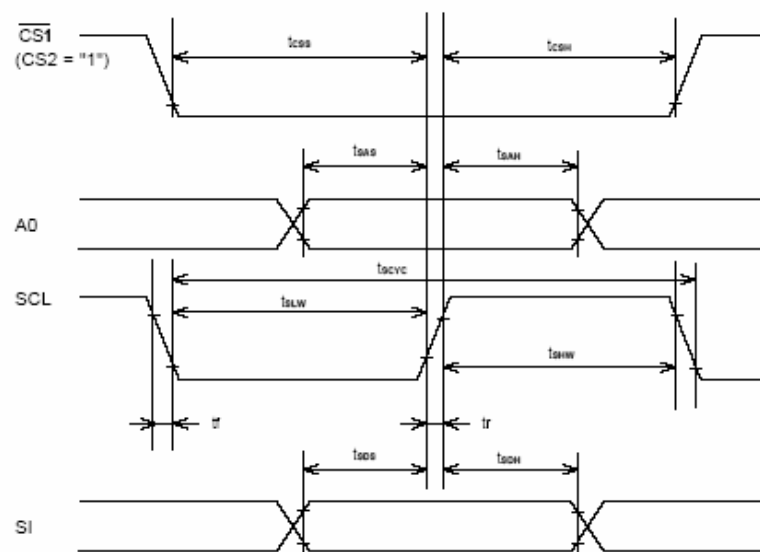

(VDD = 2.7 - 3.3V, TA = -40 - 85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
T_{CYC6}	System cycle time	300			nS	
T_{AS6}	Address setup time	0			nS	
T_{AH6}	Address hold time	0			nS	
T_{DS6}	Data setup time	40			nS	
T_{DH6}	Data hold time	15			nS	
T_{OH6}	Output disable time	10		100	nS	$C_L = 100pF$
T_{ACC6}	Access time			140	nS	$C_L = 100pF$
T_{EWHR}	Enable H pulse width (Read)	120			nS	
T_{EWHW}	Enable H pulse width (Write)	90			nS	
T_{EWLR}	Enable L pulse width (Read)	60			nS	
T_{EWLW}	Enable L pulse width (Write)	120			nS	

*1. The input signal rise time and fall time (t_r, t_f) is specified at 15ns or less. When the system cycle time is extremely fast, (t_r+t_f) ≤ ($t_{CYC6}-t_{EWLW}-t_{EWHW}$) for ($t_r+t_f$) ≤ ($t_{CYC6}-t_{EWLR}-t_{EWHR}$) are specified.

*2. All timing is specified using 20% and 80% of V_{DD} as the reference.

*3. t_{EWLW} and t_{EWLR} are specified as the overlap between $\overline{CS1}$ being "L" (CS2 = "H") and E.

(1)Serial Interface

(V$_{DD}$ = 2.7 - 3.3V, T$_A$ = -40 - 85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
T$_{SCYC}$	Serial clock cycle	250			nS	
T$_{SHW}$	Serial clock H pulse width	100			nS	
T$_{SLW}$	Serial clock L pulse width	100			nS	
T$_{SAS}$	Address setup time	150			nS	
T$_{SAH}$	Address hold time	150			nS	
T$_{SDS}$	Data setup time	100			nS	
T$_{SDH}$	Data hold time	100			nS	
T$_{CSS}$	$\overline{cs}$ serial clock time	150			nS	
T$_{CSH}$	$\overline{cs}$ serial clock time	150			nS	

*1. The input signal rise time and fall time (t$_r$, t$_f$) are specified at 15ns or less

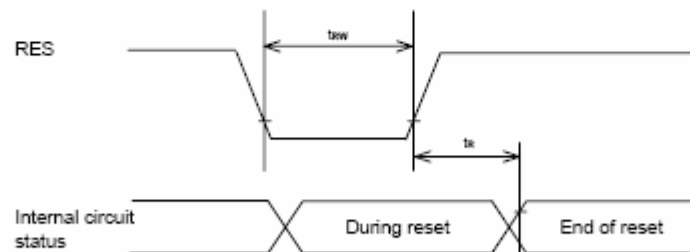*2. All timing is specified using 20% and 80% of V$_{DD}$ as the standard.

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(2)Display Control Timing
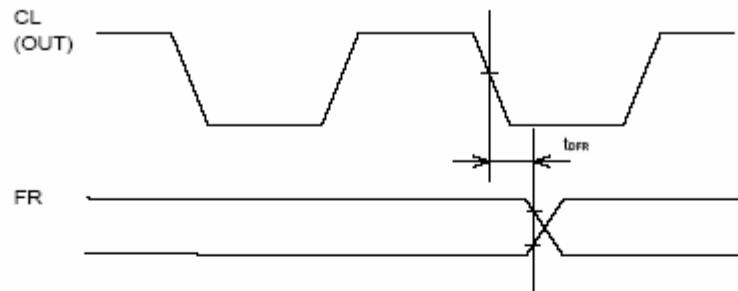
(V_DD = 2.7 - 3.3V, TA = -40 - 85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
T_DFR	FR delay time		20	80	nS	C_L = 50pF

(3)Reset Timing

(V_DD = 2.7 - 3.3V, TA = -40 - 85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
T_R	Reset time			1.0	µS	
T_RW	Reset low pulse width	1.0			µS	

6 Electro –optical   Characteristics

6.1   Electro-optical Characteristics

| Item		Symbol	Condition		Standard Value			Unit
					Min.	Typ.	Max.	
Viewing Angle		θx	Cr 2	θy =0°	-30	-	30	Deg
		θy		θx =0°	-30	-	30	
Contrast Ratio		Cr	θx =0° θy =0°		-	4	-	
Response Time	Turn on	Ton	θx =0°		-	160	250	ms
	Turn off	Toff	θy =0°		-	220	280	

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6.2 Definition of Electro-optical Characteristics
6.2.1 Definition of Viewing Angle
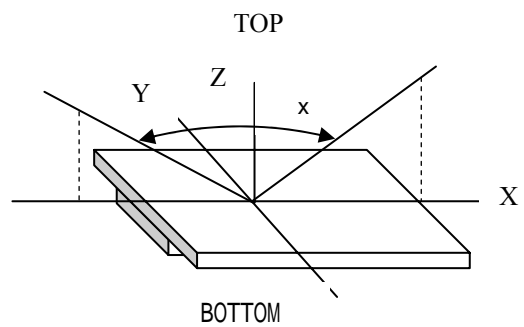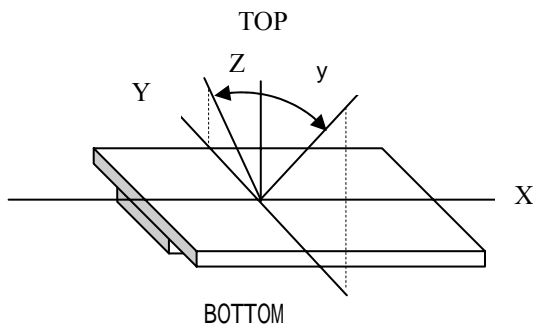
6.2.2 Definition of Contrast Ratio

$$\text{Contrast Ratio} = B2/B1 = \frac{\text{Unselected state brightness}}{\text{Selected state brightness}}$$

Brightness

Curve of selected

Curve of unselected
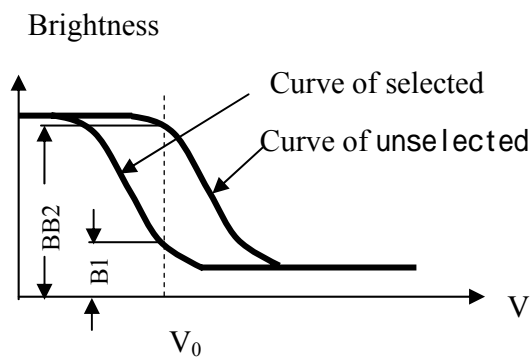
Measuring Conditions
1) Ambient Temperature: 25
2) Frame frequency : 60Hz
3) $\theta x = \theta y = 0°$

7 I/O terminal

NO.	Symbol	Description
1	IRS	This terminal selects the resistors for the V0 voltage level adjustment IRS = "H", Use the internal resistors IRS = "L", Do not use the internal resistors The V0 voltage level is regulated by an external resistive voltage divider attached to the VR terminal This pad is enabled only when the master operation mode is selected It is fixed to either "H" or "L" when the slave operation mode is selected

2	PS	This is the parallel data input/serial data input switch terminal P/S = "H": Parallel data input P/S = "L": Serial data input The following applies depending on the P/S status: | P/S	Data/Command	Data	Read/Write	Serial Clock
"H"	A0	D0 to D7	RD WR	
"L"	A0	SI (D7)	Write only	SCL (D6) | When P/S = "L", D0 to D5 are HZ. D0 to D5 may be "H", "L" or Open. $\overline{RD}$ (E) and $\overline{WR}$ (R/$\overline{W}$) are fixed to either "H" or "L". With serial data input, RAM display data reading is not supported.
3	C86	This is the MPU interface switch terminal C86 = "H": 6800 Series MPU interface C86 = "L": 8080 MPU interface
4	VR	Voltage adjustment pad. Applies voltage between V0 and Vss using a resistive divider
5	V0	LCD driver supplies voltages. The voltage determined by LCD cell is impedance-converted by a resistive driver or an operation amplifier for application. Voltages should be according to the following relationship: $V0 \geq V1 \geq V2 \geq V3 \geq V4 \geq Vss$ When the on-chip operating power circuit is on, the following voltages are supplied to V1 to V4 by the on-chip power circuit. Voltage selection is performed by the Set LCD Bias command. | LCD bias	V1	V2	V3	V4
----------	------	------	------	------
1/5 bias	4/5V0	3/5V0	2/5V0	1/5V0
1/6 bias	5/6V0	4/6V0	2/6V0	1/6V0
1/7 bias	6/7V0	5/7V0	2/7V0	1/7V0
1/8 bias	7/8V0	6/8V0	2/8V0	1/8V0
1/9 bias	8/9V0	7/9V0	2/9V0	1/9V0	
6	V4	
7	V3	
8	V2	
9	V1	
10	CAP2-	Capacitor 2- pad for internal DC/DC voltage converter
11	CAP2+	Capacitor 2+ pad for internal DC/DC voltage converter
12	CAP1+	Capacitor 1+ pad for internal DC/DC voltage converter
13	CAP1-	Capacitor 1- pad for internal DC/DC voltage converter
14	CAP3+	Capacitor 3+ pad for internal DC/DC voltage converter
15	VOUT	DC/DC voltage converter output
16	VSS	Ground
17	VDD	Power Supply

18	D7	This is an 8-bit bi-directional data bus that connects to an 8-bit or 16-bit standard MPU data bus
19	D6	
20	D5	When the serial interface is selected (P/S = "L"), then D7 serves as the serial data input terminal (SI) and D6 serves as the serial clock input terminal (SCL)
21	D4	
22	D3	
23	D2	At this time, D0 to D5 are set to high impedance
24	D1	When the chip select is inactive, D0 to D7 are set to high impedance
25	D0	
26	/RD E	When connected to an 8080 MPU, it is active LOW This pad is connected to the $\overline{RD}$ signal of the 8080MPU, and the NT7532 data bus is in an output status when this signal is "L" When connected to a 6800 Series MPU, this is active HIGH This is used as an enable clock input of the 6800 series MPU
27	/WR R/W	When connected to an 8080 MPU, this is active LOW. This terminal connects to the 8080 MPU $\overline{WR}$ signal. The signals on the data bus are latched at the rising edge of the $\overline{WR}$ signal. When connected to a 6800 Series MPU: This is the read/write control signal input terminal. When R/$\overline{W}$ = "H": Read When R/$\overline{W}$ = "L": Write
28	A0	This is connected to the least significant bit of the normal MPU address bus, and it determines whether the data bits are data or a command A0 = "H": Indicate that D0 to D7 are display data A0 = "L": Indicates that D0 to D7 are control data
29	/RES	When $\overline{RES}$ is set to "L", the settings are initialized The reset operation is performed by the $\overline{RES}$ signal level
30	/CS1	This is the chip select signal. When /CS1 = L, then the chip select becomes active, and data/command I/O is enabled

8. INSPECTION CRITERIA

Refer to the appendix: LCM/LCD   INSPECTION CRITERIA

10. Handling of Defective Products

Party "A" indicates the purchaser, and party "B" indicates HUARI .

If a product which has major or minor trouble (hereafter it is referred to as "defective product")is found at A's incoming inspection or manufacturing process or marketplace, it should be proceeded as follows.

10.1 Defective Product Found During Incoming Inspection

Within three months after receiving a product lot, A must conduct an incoming inspection and determine whether to accept or reject the product. Each lot must be inspected and judged.

With respect to defective products found in the inspection referred to in the above subparagraph, A may take the following steps.

a) Return the particular defective product found in the inspection to B,

b) Return the lot found unacceptable in the inspection to B.

If B is found responsible for the defective products returned under the preceding subparagraph, B will replace the appropriate quantity of products free of charge, and do its best regarding the time of delivery of the replacements, so that A's operations will not be delayed.

When A returned a defective product under subparagraph   , A will attach to the product a document describing the nature of the defect and any other necessary details (Defect Itemization statement of B's form). B will promptly analyze the defective product on the basis of the document, and communicate its findings to A.

10.2 Treatment of Defective Products Found During the Manufacturing Process.

If a defective products for which B is clearly responsible is found in A's manufacturing process within six month s, in principle, after the product was delivered, B will replace the appropriate quantity of the product free of charge, and will do its best not to cause a delay in A's operations.

When A returns a defective product under the preceding subparagraph, A will attach to the product a document describing the particular process where the defective product was found and the nature of the defect (defect itemization statement). B shall promptly analyze product on the basis of the defect itemization statement, and communicate its findings to A.

10.3 Treatment of Defective Products Found in the Marketplace.

The guaranty period will be for one year after the delivery of the product.

For any delivery product found during the period of guaranty for which B is clearly responsible, B will deliver a replacement free of charge, provided that A and B discuss and mutually agree on the cost generated by replacing process for defective products.

For defective products found after the elapse of the period of guaranty, B will replace them at charge upon A's request.

11 Reliability

11.1 Content of Reliability Test

	No	Test Item	Content of Test	Test Condition
Environment Test	1	High Temperature Storage	Endurance test of high temperature for a long time.	70± 2 96H
	2	Low Temperature Storage	Endurance test of low temperature for a long time.	-30± 2 96H
	3	High Temperature Operation	Endurance test of electrical stress (Voltage & Current) and the thermal stress to the element.	60± 2 48H
	4	High Temperature /Humidity Storage	Endurance Test of high temperature and high humidity for a long time.	40± 2 90± 2%RH 96H
	5	Thermal shock	Endurance test of low and high temperature cycles.(air to air) -20± 2 ←——————→ 60± 2 (60min)　　　　　　　(60min) 1 cycle	-20± 2 /60± 2 10 cycle

Note: 1) When making the low temperature test, not to dewy.

2) Driving condition for operation test.

Power Supply Voltage for Logic System (VDD) =3.0V

11.2 Failure Judgment Criterion

After the above mentioned test.

(For Environmental Test, after 2 hours in room temperature.)

1) There should not be conspicuous failure of display quality and appearance.

2) Contrast ratio should be 50% of the initial contrast ratio.

3) There should not have any abnormality of functions.

12 Precaution for use of LCD module

12.1 Handling Precautions

1) The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

2) If the display panel is damaged and the liquid crystal substance inside it leaks out ,be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

5) If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

--Isopropyl alcohol

--Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer.

Especially, do not use the following:

--Water

--Ketone

--Aromatic solvents

6) Do not attempt to disassemble or process the LCD module.

12.2 Assembling Precautions

1) When mounting the LCD module make sure that it is free of twisting, warping, and distortion. Distortion has great influence upon display quality. Also keep the stiffness enough regarding the outer case.

2) Please handle the LCD module by its side.

3) NC terminal should be open. Do not connect anything.

4) If the logic circuit power is OFF, do not apply the input signals.

5) To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

·Be sure to ground the body when handling the LCD module.

·Tools required for assembly, such as soldering irons, must be properly grounded.

·To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

·The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

6) Be careful when treating the glass panel because it has very sharpened edge.

12.3 Storage Precautions

1) When storing the LCD module, avoid exposure to direct sunlight of to the light of fluorescent lamps and high temperature/high humidity. Whenever possible, the LCD module should be stored in the same conditions in which they were shipped from our company.

2) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets or a current flow in a high-humidity environment.

12.4 Design Precautions

1) The absolute maximum ratings represent the rated value beyond which LCD module can not exceed. When the LCD modules are used in excess of this rated value, their operation characteristics may be adversely affected.

2) To prevent the occurrence of erroneous operation caused by noise, attention must be paid to satisfy V_{IL}, V_{IH} specification values including taking the precaution of using signal cables that are short.

3) The LCD exhibits temperature dependency characteristics. Since recognition of the display becomes difficult when the LCD is used outside its designated operating temperature range, be
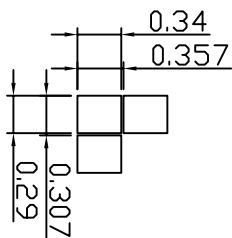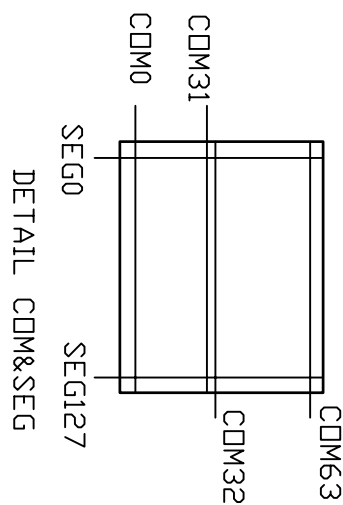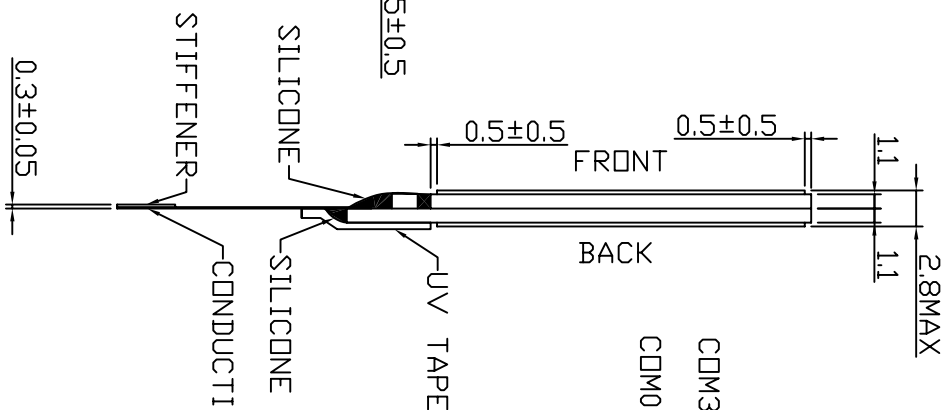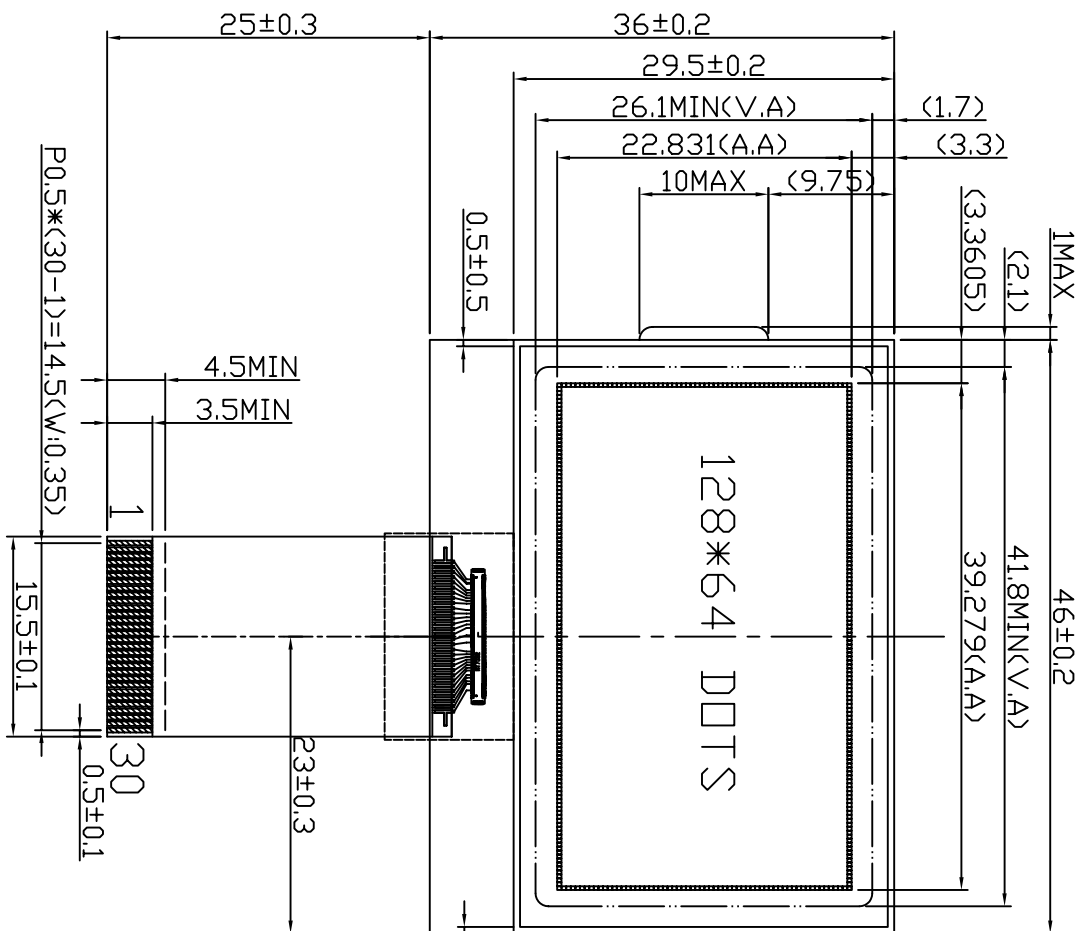
sure to use the LCD within this range. Also keep in mind that the LCD driving voltage levels necessary for clear displays will vary according to temperature.

4) We recommended that power supply lines (VDD) have over-current protection line. (Fuse etc. Recommend Value:0.5A)

5) Sufficiently notice the mutual noise interference occurred by peripheral devices.

6) To cope with EMI, take measures basically on outputting side.

7) When installing an LCD module, fasten it at the LCD panel.

8) The display panel is made of general float glass which is not guaranteed for strength. So please consider about following.
   ·Do not subject panel to a mechanical shock by dropping directly.
   ·Do not let case to touch to panel directly.

12.5 Others

1) Liquid crystal solidifies under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the LCD module is subjected to a strong shock at a low temperature.

2) If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

3) To minimize the performance degradation of the LCD module's resulting from destruction caused by static electricity, etc., exercise care to avoid touching the following section when handling this module: LCD's Terminal electrode sections.

4) Optimum voltage to obtain best contrast value depending on products. Therefore voltage adjustment with electric volume is required in each display.

5) Precaution for disposal of LCD module. When disposal of LCD module, ask specialization company of industrial waste which is permitted by the government. When burn up LCD module, obey the law of environmental hygienics.

13 Outline dimensions

128*64 DOTS

NOTE:
1 DISPLAY TYPE: FSTN
2 VIEWING DIRECTION: 6:00
3 POLARIZER MODE: TRANSFLECTIVE/POSITIVE
4 DRIVE METHOD: 1/65 DUTY 1/9BIAS
5 VOP: 9.0V
6 VDD: 3.3V
7 OPERATING TEMP: -20°C--+60°C
8 STORAGE TEMP: -30°C--+70°C
9 CONTROLLER: NT7532H-BDT
10 CONNECTOR: FPC
12 ALL UNMARKED TOLERANCES: ±0.2mm

1/1

mm
MSB068DFWGW
(040468)
B068DMLA

DETAIL COM&SEG

COM0 / COM31 / SEG0 / SEG127 / COM32 / COM63

DETAIL DOTS
S: 10:1
0.34 / 0.357 / 0.307 / 0.29

NO.	PIN
1	IRS
2	PS
3	C86
4	VR
5	V0
6	V4
7	V3
8	V2
9	V1
10	CAP2-
11	CAP2+
12	CAP1+
13	CAP1-
14	CAP3+
15	VOUT
16	VSS
17	VDD
18	D7
19	D6
20	D5
21	D4
22	D3
23	D2
24	D1
25	D0
26	/RD (E)
27	/WR(R/W)
28	A0
29	/RES
30	/CS1

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