SPECIFICATIONS

CUSTOMER : _____

SAMPLE CODE : GFG128064E-FPBE

DRAWIG NO. : _____

DATE : 2009.04.16

CERTIFICATION : ROHS

Customer Sign	Sales Sign	Approved By	Prepared By

Revision Record

Data(y/m/d)	Ver.	Description	Note	page
2009.04.16	00	New		

CONTENTS

1. SCOPE

This specification covers the engineering requirements for the GFG128064E-FPBE liquid crystal module.

2. PRODUCT SPECIFICATIONS

2.1 General

- 128 ◈64 dot matrix LCD
- FSTN , Positive mode LCD panel
- Transflective , Wide temperature type
- 6 o'clock
- Back light: Edge LED (ORANGE)
- Multiplexing driving : 1/65duty, 1/9bias
- Conteroller IC NT7534H-BDT

2.2 Mechanical Characteristics

Item	Characteristic
Dot configuration	128 ◈64
Dot dimensions(mm)	0.225 ◈0.285
Dot spacing (mm)	0.24 ◈0.3
Module dimensions (Horizontal ◈ Vertical ◈Thickness, mm)	40.5 ◈34.35 ◈4.8 max.
Viewing area (Horizontal ◈ Vertical, mm)	33.8 ◈22.2.
Active area (Horizontal ◈Vertical, mm)	30.705 ◈19.185

2.3 Absolute Maximum Ratings (Without LED back-light)

Characteristic	Symbol	Unit	Value
Operating Voltage (logic)	**V_{DD}**	**V**	**-0.3 to +4.0**
Input Voltage	**V_{IN}**	**V**	**-0.3 to V_{DD}+0.3**

Note 1: Referenced to V_{SS}=0V

2.4 Electrical Characteristics (Without LED back-light)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
VDD VDD3	Operating Voltage	1.8	-	3.6	V	
VDD2	Operating Voltage	1.8	-	3.6	V	2X, 3X boosting
		1.8	-	3.3		4X boosting
		1.8	-	2.8		5X boosting
VOUT	Booster Voltage	6.0	-	14.2	V	
V0	Voltage Regulator Operating Voltage	4.0	-	14.2	V	
VREG	Reference Voltage	2.04	2.10	2.16	V	Ta = 25°C, -0.05%/°C
IDD	Current Consumption	-	20	35	µA	VDD = 3V, V0 = 11V, built-in boosting power supply off, display on, display data = checker and no access, Ta = 25°C
		-	90	160	µA	VDD, VDD2 = 3V, V0 = 11V, 4X built-in boosting power supply, display on, display data = checker and no access, temperature gradient is -0.05%/ °C, Ta = 25°C, V0 voltage internal resistor is used, /HPM = 1 (normal power mode).
		-	150	255	µA	VDD, VDD2 = 3V, V0 = 11V, 4X built-in boosting power supply, display on, display data = checker and no access, temperature gradient is -0.05%/ °C, Ta = 25°C, V0 voltage internal resistor is used, /HPM = 0 (high power mode).

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition	
ISP	Sleep Mode Current Consumption	-	0.01	5	μA	During sleep, Ta = 25°C	
ISB	Standby Mode Current Consumption	-	4	8	μA	During standby, Ta = 25°C	
VIHC	High-Level Input Voltage	0.8 x VDD	-	VDD	V	A0, D0 - D7, /RD (E), /WR (R/W), /CS1, CS2, CLS, CL, FR, M/S, C86, P/S, /DOF, /RES, IRS and /HPM	
VILC	Low-Level Input Voltage	VSS	-	0.2 x VDD	V		
VOHC	High-Level Output Voltage	0.8 x VDD	-	VDD	V	IOH = -0.5mA (D0 - D7, FR, FRS, /DOF, and CL)	
VOLC	Low -Level Output Voltage	VDD	-	0.2 x VDD	V	IOL = 0.5mA (D0 - D7, FR, FRS, /DOF, and CL)	
ILI	Input Leakage Current	-1.0	-	1.0	μA	Vin = VDD or VSS (A0, /RD (E), /WR (R/W), /CS1, CS2, CLS, M/S, C86, P/S, IRS and /RES)	
IHZ	HZ Leakage Current	-3.0	-	3.0	μA	When the D0 - D7, FR, CL, and /DOF are in high impedance	
RON1	LCD Driver ON Resistance	-	2.0	3.5	KΩ	V0 = 11.0V	Ta = 25°C, These are the resistance values for when a 0.1V voltage is applied between the output terminals SEGn or COMn and the various power supply terminal (V0, V1, V2, V3, V4)
RON2	LCD Driver ON Resistance	-	3.2	5.4	KΩ	V0 = 8.0V	
CIN	Input Pad Capacity	-	5.0	8.0	pF	Ta = 25°C, f = 1MHz	
fFRM	Frame Frequency	78.0	80.5	83.0	Hz	fOSC = 31.4 KHz, 1/65duty VDD = 1.8~3.6V	
		65.3	67.4	69.5	Hz	fOSC = 26.3 KHz, 1/65duty VDD = 1.8~3.6V	

Notes: 1. Voltages V0 ≥ V1 ≥ V2 ≥ V3 ≥ V4 ≥ VSS2 must always be satisfied.

2.5 Optical Characteristics Absolute maximum ratings

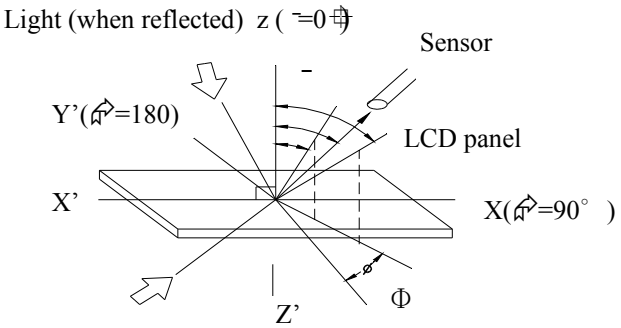
Item	Symbol	Rating	Unit
Operating temperature range	**Top**	**-20~70**	**艹C**
Storage temperature range	**Tst**	**-30~80**	**艹C**

2.6 Optical Characteristics

1/65 duty, 1/9bias, Vop=9.2V, Ta=25℃

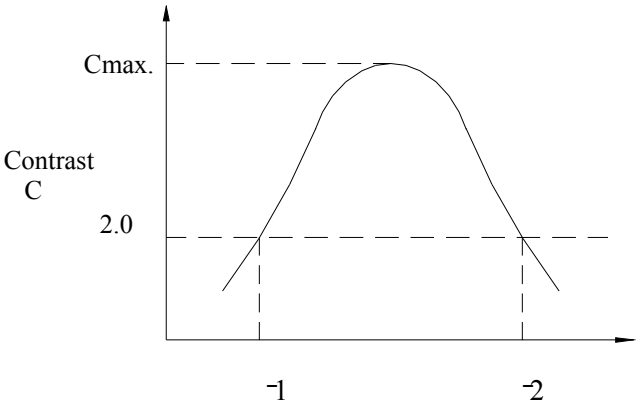
Item	Symbol	Conditions	Min.	Typ.	Max	Reference
Driving voltage	Vop=VDD-VO			9.2		
Viewing angle	-	C≥2.0,=0	30	--	--	Notes 1 & 2
Contrast	C	- =5 =0	3.0	--	--	Note 3
Response time(rise)	ton	- =5 =0	--	--	198ms	Note 4
Response time(fall)	toff	- =5 =0	--	--	176ms	Note 4

Note 1: Definition of angles - and



Light (when transmitted) Y(=0°)
(=90°)

Note 2: Definition of viewing angles -1 and 2

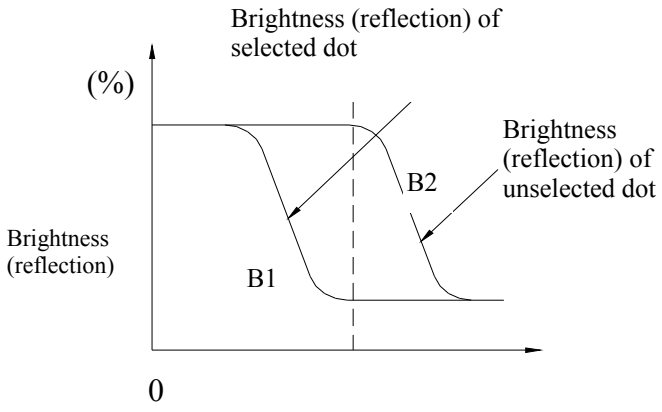


viewing angle -(Φ fixed)

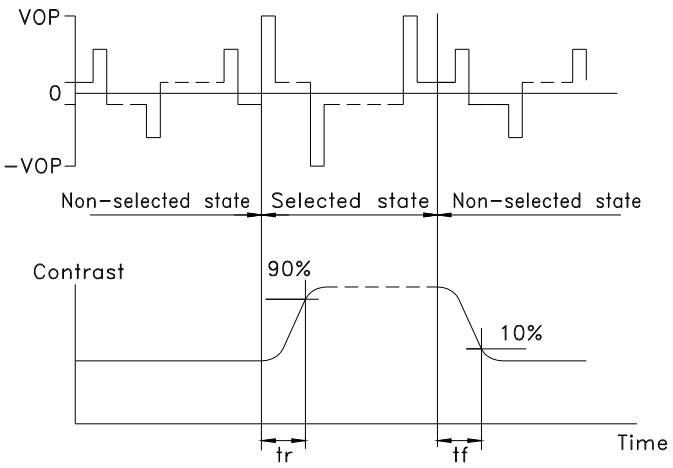
Note : Optimum viewing angle with the naked eye and viewing angle - at Cmax. Above are not always the same

Note 3: Definition of contrast C

$$C = \frac{\text{Brightness (reflection) of unselected dot (B2)}}{\text{Brightness (reflection) of selected dot (B1)}}$$



Note 4: Definition of response time



Note: Measured with a transmissive LCD panel which is displayed 1 cm²

V_{OPR} : Operating voltage f_{FRM} : Frame frequency

t_{ON} : Response time (rise) t_{OFF} : Response time (fall)

2.7 LED Back-light Characteristics

2.7.1 Electrical / optical specifications

Ta = 25℃

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward voltage	V_f	If=10mA, ORANGE	-	10.9	-	V
LED *Luminous Intensity	I_V	If=10mA, ORANGE	--	80	--	Cd/m2
Reverse Current	I_R	VR=5V, ORANGE	--	--	0.1	mA

Note: * Measured at the bare LED back-light unit.

2.7.2 LED Maximum Operating Range

Item	Symbol	ORANGE	Unit
Power Dissipation	P_{AD}	109	mW
Forward Current	I_F	10	mA
Reverse Voltage	V_R	5	V

3. RELIABILITY

3.1 Reliability

Test item	Test condition	Evaluation and assessment

Operation at high temperature and humidity	40 °C ±2 °C 90%RH for 500hours	No abnormalities in functions* and appearance**
Operation at high temperature	60 °C ±2 °C for 500 hours	No abnormalities in functions* and appearance**
Heat shock	-20 ± ~ +60 °C Left for 1 hour at each temperature, transition time 5 min, repeated 10times	No abnormalities in functions* and appearance**
Low temperature	-20 ±2 °C for 500 hours	No abnormalities in functions* and appearance**
Vibration	Sweep for 1 min at 10 Hz, 55Hz, 10Hz, amplitude 1.5mm 2 hrs each in the X,Y and Z directions	No abnormalities in functions* and appearance**
Drop shock	Dropped onto a board from a height of 10cm	No abnormalities in functions* and appearance**

* Dissipation current, contrast and display functions

** Polarizing filter deterioration, other appearance defects

3.2 Liquid crystal panel service life

100,000 hours minimum at 25 °C ±10 °C

3.3 definition of panel service life

- Contrast becomes 30% of initial value
- Current consumption becomes three times higher than initial value
- Remarkable alignment deterioration occurs in LCD cell layer
- Unusual operation occurs in display functions

4. OPERATING INSTRUCTIONS

4.1 Input signal Function

Pin no.	Symbol	Function
1	VDD	Power supply input.

<table>
<tr><td>2</td><td>C86</td><td>This is the MPU interface switch terminal
C86 = “H”: 6800 Series MPU interface
C86 = “L”: 8080 Series MPU interface</td></tr>
<tr><td>3</td><td>VSS</td><td>Ground.</td></tr>
<tr><td>4</td><td>V0</td><td rowspan="5">LCD driver supplies voltages. The voltage determined by the LCD cell is impedance-converted by a resistive driver or an operation amplifier for application. Voltages should be according to the following relationship:
V0≥V1≥V2≥V3≥V4≥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 LCD Bias Set command.

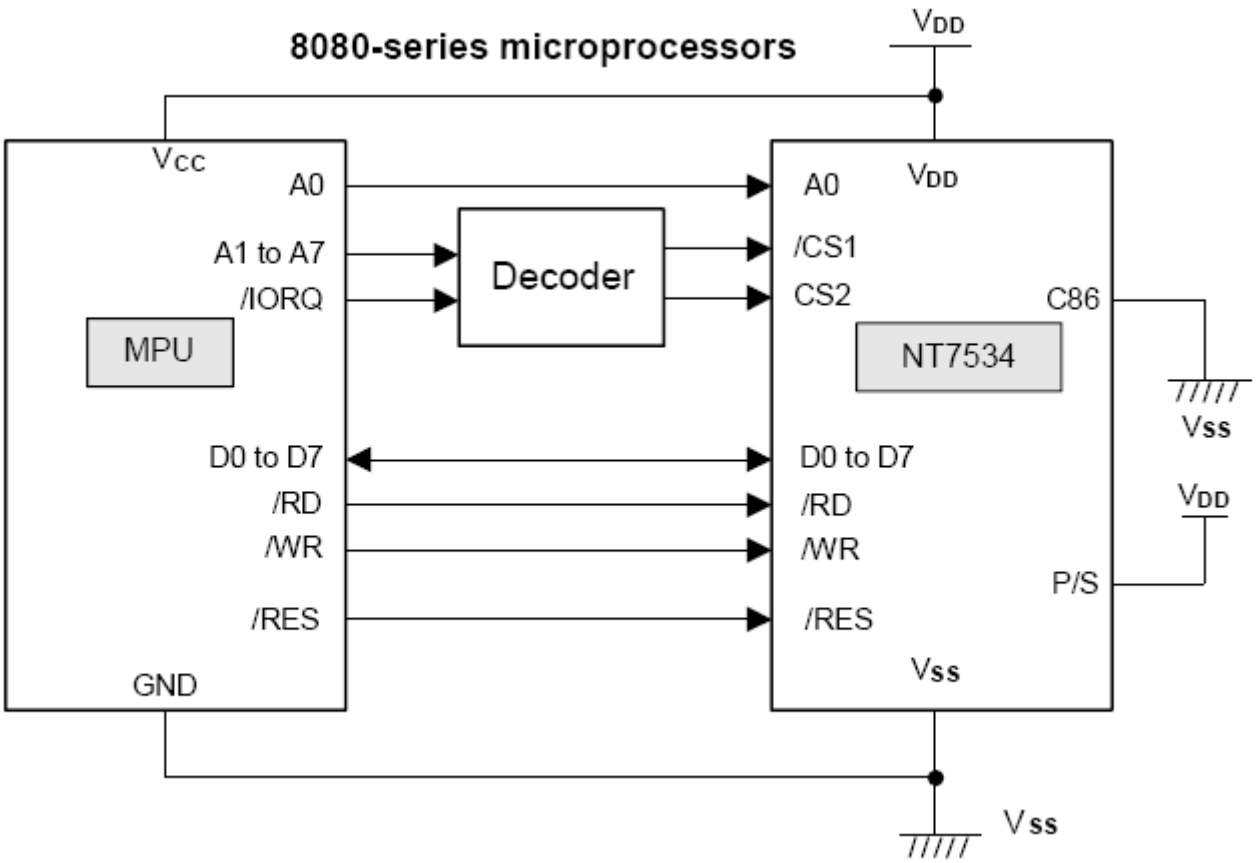
<table><tr><td>LCD bias</td><td>V1</td><td>V2</td><td>V3</td><td>V4</td></tr><tr><td>1/4 bias</td><td>3/4V0</td><td>2/4V0</td><td>2/4V0</td><td>1/4V0</td></tr><tr><td>1/5 bias</td><td>4/5V0</td><td>3/5V0</td><td>2/5V0</td><td>1/5V0</td></tr><tr><td>1/6 bias</td><td>5/6V0</td><td>4/6V0</td><td>2/6V0</td><td>1/6V0</td></tr><tr><td>1/7 bias</td><td>6/7V0</td><td>5/7V0</td><td>2/7V0</td><td>1/7V0</td></tr><tr><td>1/8 bias</td><td>7/8V0</td><td>6/8V0</td><td>2/8V0</td><td>1/8V0</td></tr><tr><td>1/9 bias</td><td>8/9V0</td><td>7/9V0</td><td>2/9V0</td><td>1/9V0</td></tr></table></td></tr>
<tr><td>5</td><td>V4</td></tr>
<tr><td>6</td><td>V3</td></tr>
<tr><td>7</td><td>V2</td></tr>
<tr><td>8</td><td>V1</td></tr>
<tr><td>9</td><td>CAP2-</td><td></td></tr>
<tr><td>10</td><td>CAP2+</td><td>Capacitor 2+ pad for internal DC/DC voltage converter.</td></tr>
<tr><td>11</td><td>CAP1+</td><td>Capacitor 1+ pad for internal DC/DC voltage converter.</td></tr>
<tr><td>12</td><td>CAP1-</td><td>Capacitor 1-pad for internal DC/DC voltage converter.</td></tr>
<tr><td>13</td><td>CAP3+</td><td>Capacitor 3+ pad for internal DC/DC voltage converter.</td></tr>
<tr><td>14</td><td>VOUT</td><td>DC/DC voltage converter output</td></tr>
<tr><td>15</td><td>VSS</td><td>Ground.</td></tr>
<tr><td>16</td><td>D7</td><td rowspan="8">This is an 8-bit bi-directional data bus that connects to an 8-bit or 16-bit standard MPU data bus.</td></tr>
<tr><td>17</td><td>D6</td></tr>
<tr><td>18</td><td>D5</td></tr>
<tr><td>19</td><td>D4</td></tr>
<tr><td>20</td><td>D3</td></tr>
<tr><td>21</td><td>D2</td></tr>
<tr><td>22</td><td>D1</td></tr>
<tr><td>23</td><td>D0</td></tr>
<tr><td>24</td><td>RD(E)</td><td>When connected to an 8080 MPU, it is active LOW. This pad is connected to the /RD signal of the 8080MPU, and the
NT7534 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</td></tr>
</table>

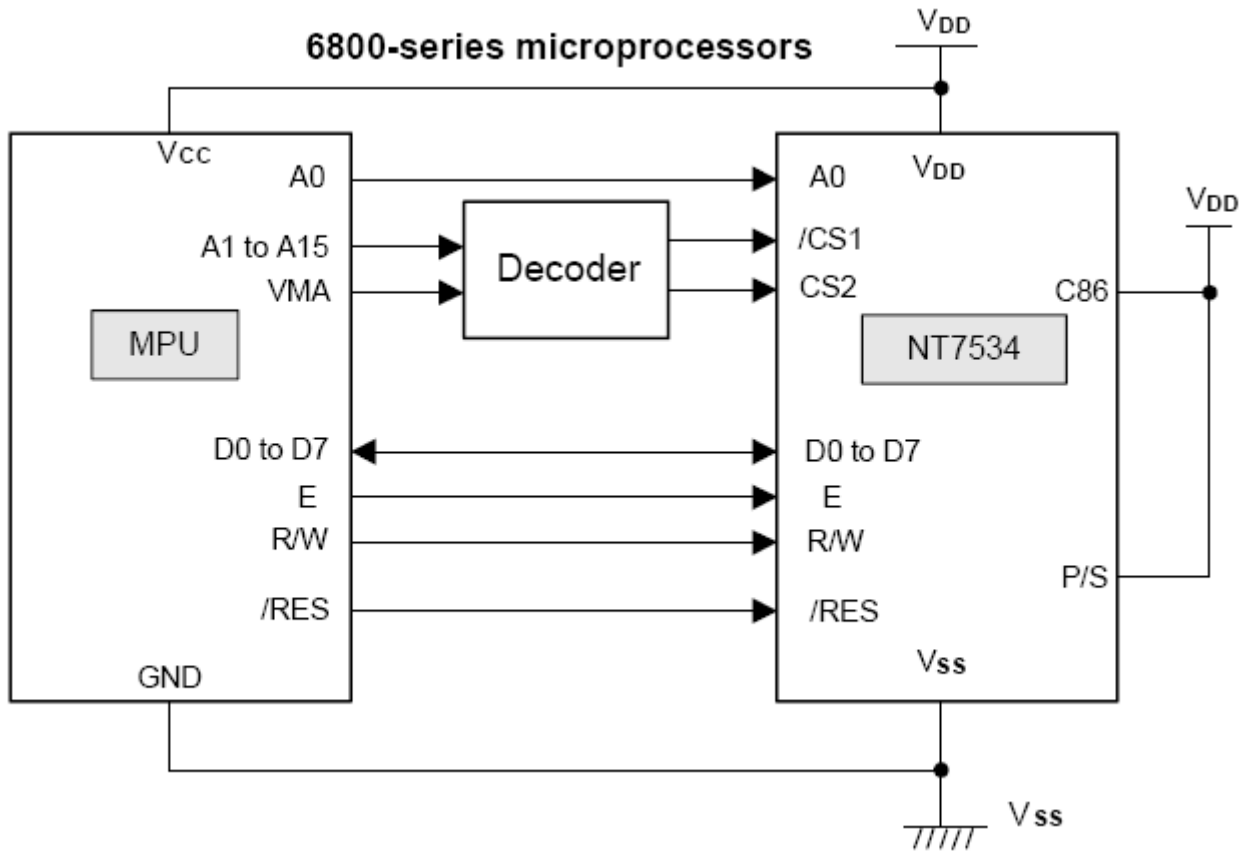
		MPU
25	WR	When connected to an 8080 MPU, this is active LOW. This terminal connects to the 8080 MPU /WR signal. The signals on the data bus are latched at the rising edge of the /WR signal. When connected to a 6800 Series MPU, this is the read/write control signal input terminal. When R/W = “H”: Read When R/W = “L”: Write
26	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
27	RES	When RES is set to “L”, the settings are initialized. The reset operation is performed by the /RES signal level
28	CS	This is the chip select signal. When /CS1=“L” and CS2=“H”, then the chip select becomes active, and data/command I/O is enabled.

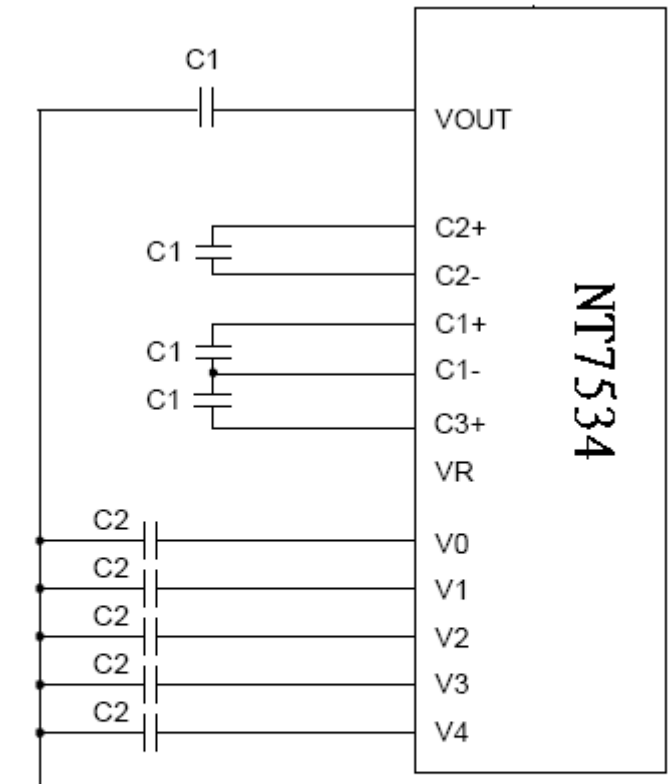
C86	Type	/CS1	CS2	A0	/RD	/WR	D0 to D7
H	6800 microprocessor bus	/CS1	CS2	A0	E	R/W	D0 to D7
L	8080 microprocessor bus	/CS1	CS2	A0	/RD	/WR	D0 to D7

Common	6800 processor	8080 processor		Function
A0	(R/W)	/RD	/WR	
1	1	0	1	Reads display data
1	0	1	0	Writes display data
0	1	0	1	Reads status
0	0	1	0	Writes control data in internal register. (Command)

4.2 Voltage Generator Circuit


8080-series microprocessors
VDD
Vcc
A0
A1 to A7
/IORQ
MPU
Decoder
A0
VDD
/CS1
CS2
C86
NT7534
Vss
D0 to D7
/RD
/WR
/RES
GND
D0 to D7
/RD
/WR
P/S
/RES
Vss
VDD
Vss

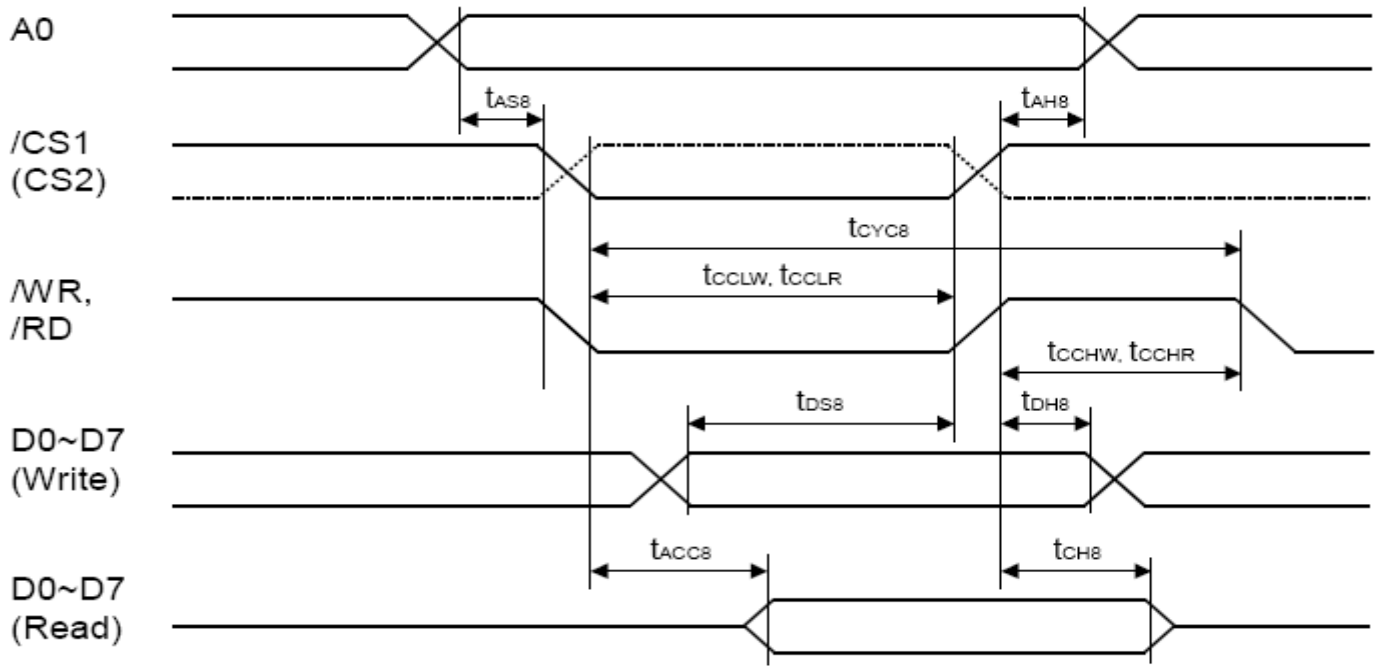

6800-series microprocessors
VDD
Vcc
A0
A1 to A15
VMA
MPU
Decoder
A0
VDD
/CS1
CS2
C86
NT7534
VDD
D0 to D7
E
R/W
/RES
GND
D0 to D7
E
R/W
P/S
/RES
Vss
Vss



*Value of External Capacitance		
Item	Value	
C1	1.0 - 4.7	uF
C2	0.1 - 2.2	

4.3 Timing Diagram

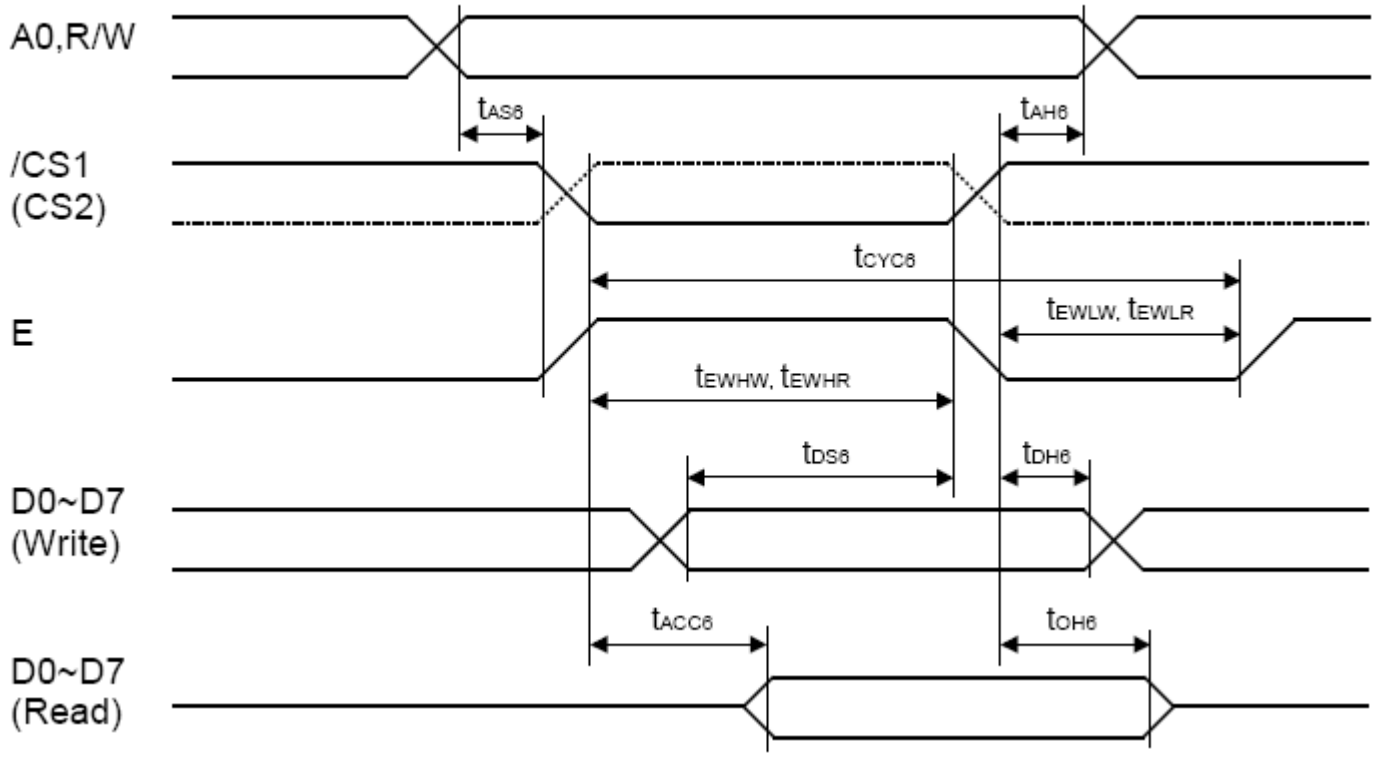
System Buses Read/Write Characteristics (for 8080 Series MPU)



(VDD = 2.7 ~ 3.6V, Ta = -40 ~ +85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
t_{AH8}	Address hold time	0	-	-	ns	A0
t_{AS8}	Address setup time	0	-	-	ns	
t_{CYC8}	System cycle time	240	-	-	ns	
t_{CCLW}	Control low pulse width (write)	120	-	-	ns	/WR
t_{CCLR}	Control low pulse width (read)	120	-	-	ns	/RD
t_{CCHW}	Control high pulse width (write)	100	-	-	ns	/WR
t_{CCHR}	Control high pulse width (read)	100	-	-	ns	/RD
t_{DS8}	Data setup time	40	-	-	ns	D0~D7
t_{DH8}	Data hold time	10	-	-	ns	
t_{ACC8}	/RD access time	-	-	140	ns	D0~D7, CL = 100pF
t_{CH8}	Output disable time	5	-	50	ns	

System Buses Read/Write Characteristics (for 6800 Series MPU)



(VDD = 2.7 ~ 3.6V, Ta = -40 ~ +85°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
t_{AH6}	Address hold time	0	-	-	ns	A0, R/W
t_{AS6}	Address setup time	0	-	-	ns	
t_{CYC6}	System cycle time	240	-	-	ns	
t_{EWHW}	Control low pulse width (write)	120	-	-	ns	E
t_{EWHR}	Control low pulse width (read)	120	-	-	ns	E
t_{EWLW}	Control high pulse width (write)	100	-	-	ns	E
t_{EWLR}	Control high pulse width (read)	100	-	-	ns	E
t_{DS6}	Data setup time	40	-	-	ns	D0~D7
t_{DH6}	Data hold time	10	-	-	ns	
t_{ACC6}	/RD access time	-	-	140	ns	D0~D7 CL = 100pF
t_{OH6}	Output disable time	5	-	50	ns	

5. NOTES

Safety

- If the LCD panel breaks, be careful not to get the liquid crystal in your mouth. If the liquid crystal touches

your skin or clothes, wash it off immediately using soap and plenty of water.

Handling

- Avoid static electricity as this can damage the CMOS LSI.
- The LCD panel is plate glass; do not hit or crush it.
- Do not remove the panel or frame from the module.
- The polarizing plate of the display is very fragile; handle it very carefully

Mounting and Design

- Mount the module by using the specified mounting part and holes.
- To protect the module from external pressure, leave a small gap by placing transparent plates (e.g. acrylic or glass) on the display surface, frame, and polarizing plate
- Design the system so that no input signal is given unless the power-supply voltage is applied.
- Keep the module dry. Avoid condensation, otherwise the transparent electrodes may break.

Storage

- Store the module in a dark place where the temperature is 25 ºC±10 ºC and the humidity below 65% RH.
- Do not store the module near organic solvents or corrosive gases.
- Do not crush, shake, or jolt the module (including accessories).

Cleaning

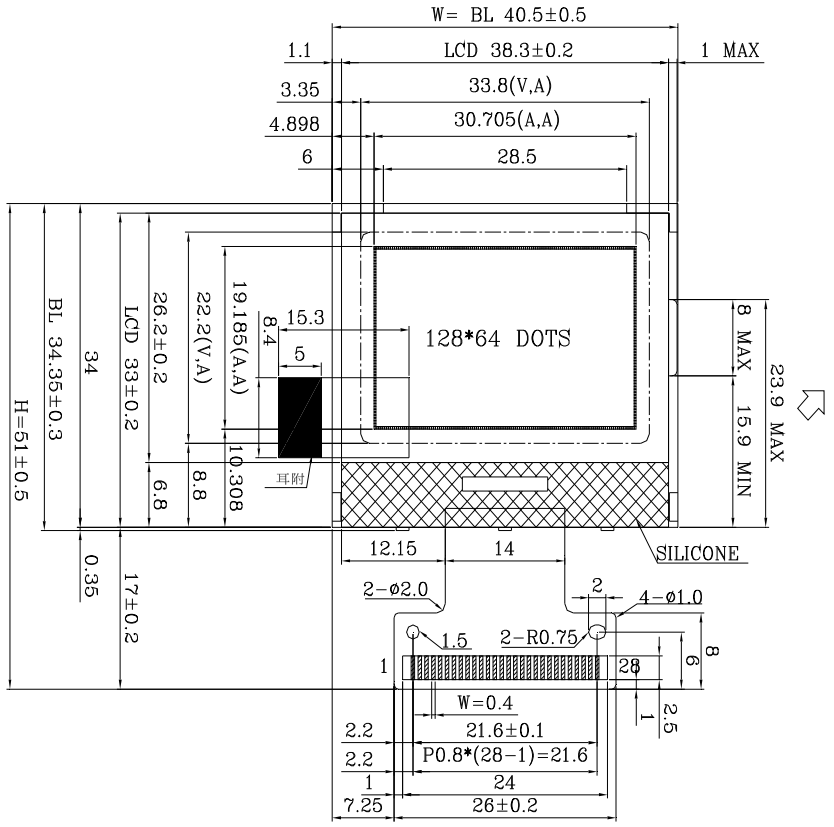
- Do not wipe the polarizing plate with a dry cloth, as it may scratch the surface.
- Wipe the module gently with soft cloth soaked with a petroleum benzine.
- Do not use ketonic solvents (ketone and acetoe) or aromatic solvents (toluene and xylene), as they may damage the polarizing plate.

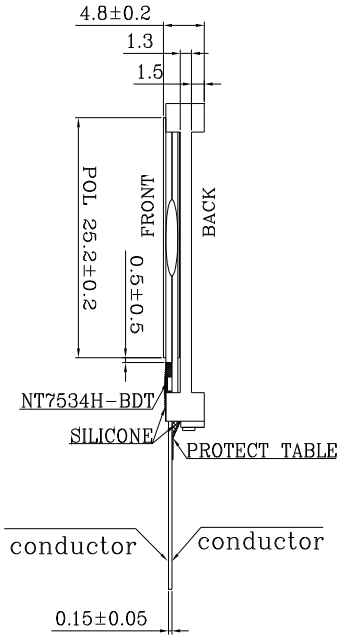
6. OPERATION PRECAUTIONS

Any changes that need to be made in this specification or any problems arising from it will be dealt with quickly by discussion between both companies.

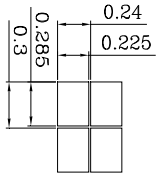
7. LCM Dimension

RoHS

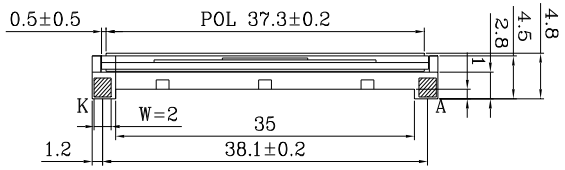




PIN	NAME	PIN	NAME
1	VDD	15	VSS
2	C86	16	D7
3	VSS	17	D6
4	V0	18	D5
5	V4	19	D4
6	V3	20	D3
7	V2	21	D2
8	V1	22	D1
9	CAP2-	23	D0
10	CAP2+	24	RD(E)
11	CAP1+	25	WR(R/W)
12	CAP1-	26	A0
13	CAP3+	27	RES
14	VOUT	28	CS



DOTS SIZE



NOTES:

1. DRIVE METHOD: 1/65DUTY, 1/9BIAS, VOP 9.2±0.2V.
2. VIEWING ANGLE: 6 O'CLOCK.
3. DISPLAY TYPE: FSTN, TRANSFLECTIVE/POSITIVE.
4. OPERATING TEMP: -20 TO 70°C.
5. STORAGE TEMP: -30 TO 80°C.
6. CONNECTION: COG+FPC.(Small panel is on top layer)
7. IC :NT7534H-BDT.
8. 磨邊.
9. B/L:LED(ORANGE).
10. NOT DIMENSION TOLERANCES IS ±0.2.

日期	版本	修改內容