DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 128064F FGH-P(RGB)

Product Specification ***Version: 1***

07/Apr/2009

GENERAL SPECIFICATION

MODULE NO. :

DEM 128064F FGH-P(RGB)

CUSTOMER P/N:

Version No.	Change Description	Date
0	Original Version	30.12.2008
1	Update Module Drawing	07.04.2009

PREPARED BY: XYP **DATE:** 07.04.2009

APPROVED BY: MH **DATE:** 07.04.2009

CONTENTS

1. FUNCTIONS & FEATURES 2

2. MECHANICAL SPECIFICATIONS 2

3. EXTERNAL DIMENSIONS (unit: mm) 3

4. BLOCK DIAGRAM 4

5. PIN DESCRIPTION 5

6. ABSOLUTE MAXIMUM RATINGS 6

7. BACKLIGHT CHARACTERISTICS 6

8. ELECTRICAL CHARACTERISTICS 7

9. COMMAND TABLE 10

10. LCD MODULES HANDLING PRECAUTIONS 11

11. OTHERS 11

1. FUNCTIONS & FEATURES

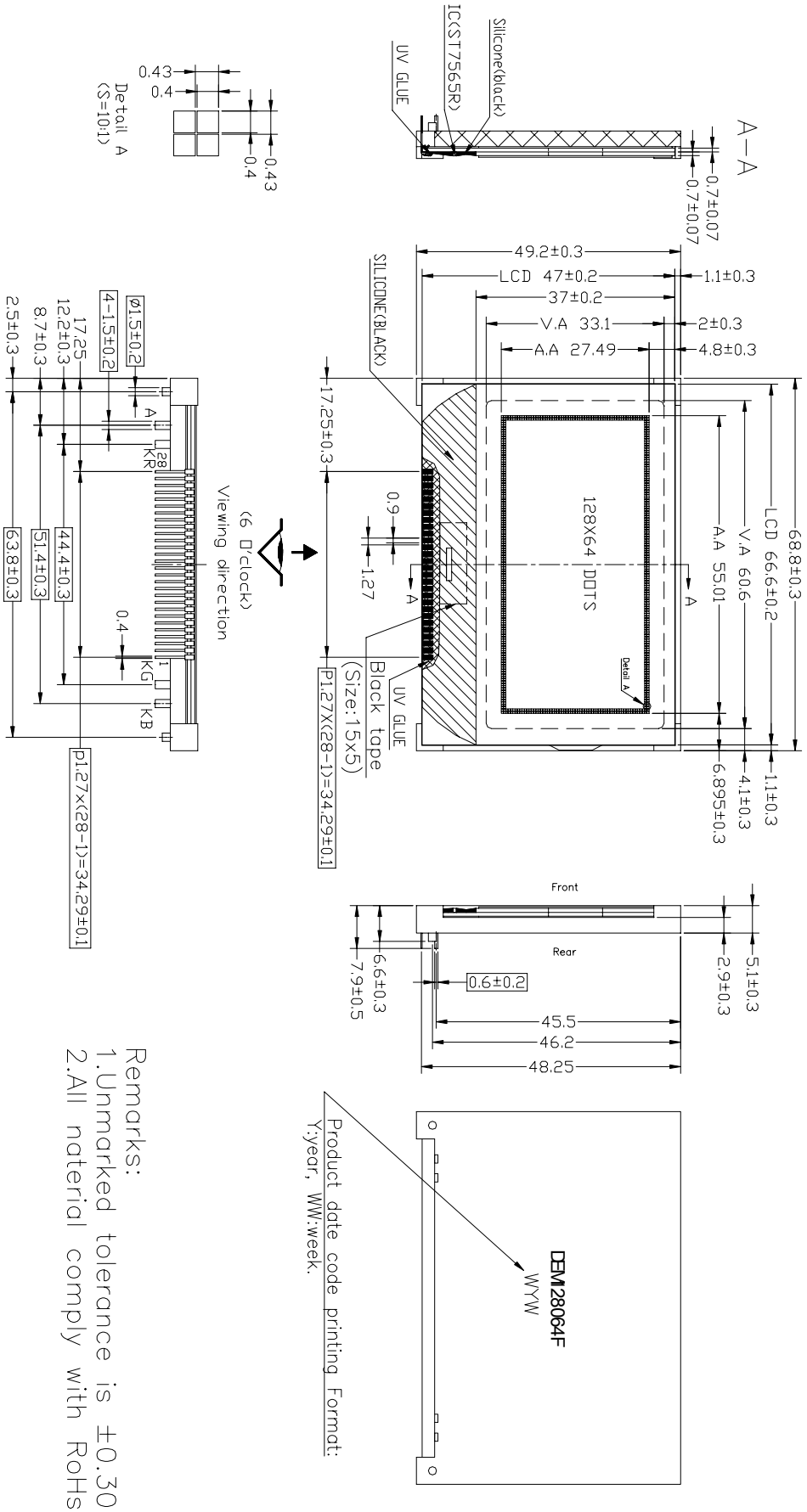
MODULE NAME	LCD Type
DEM 128064F FGH-P(RGB)	FSTN Transflective Positive Mode

- Viewing Direction : 6 o'clock
- Driving Scheme : 1/65 Duty Cycle, 1/9 Bias
- Power Supply Voltage(Typ.) : 3.0 Volt (typ.)
- V_{LCD} : 9.8 Volt (typ.)
- Display Contents :128 x 64 Dots, COG
- Interface : Parallel & Serial
- Driver IC : ST7565R-G (Sitronix)
- Backlight : LED, RGB, Lightguide
- Operating Temperature : -20°C to +70°C
- Storage Temperature : -30°C to +80°C

2. MECHANICAL SPECIFICATIONS

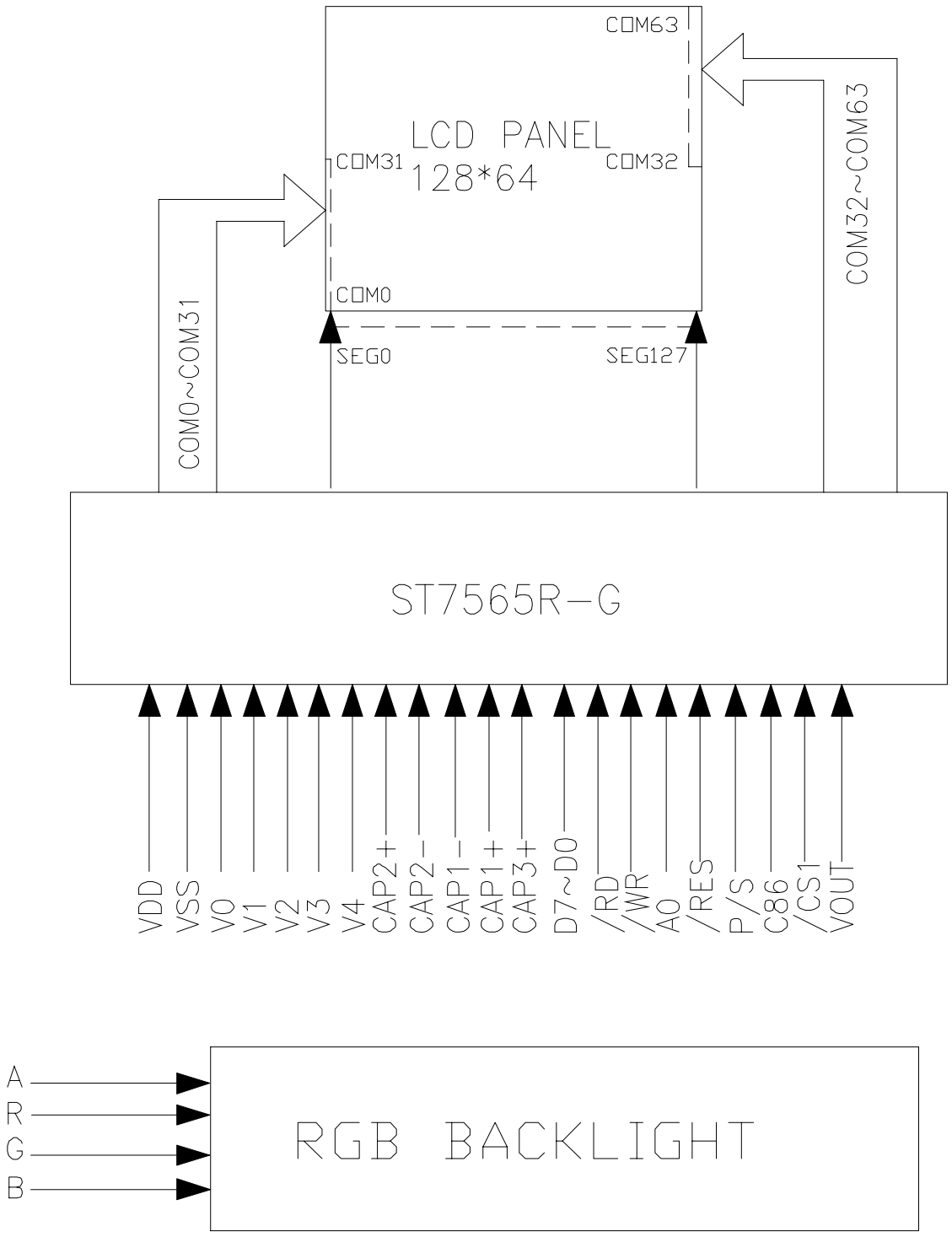
- Module Size : 68.80 x 49.20 x 7.90 mm
- Viewing Area : 60.60 x 33.10 mm
- Active Area : 55.01 x 27.49 mm
- Dot pitch : 0.43 x 0.43 mm
- Dot Size : 0.40 x 0.40 mm

3. EXTERNAL DIMENSIONS (unit: mm)



Remarks:
1.Unmarked tolerance is ±0.30;
2.All material comply with RoHs.

4. BLOCK DIAGRAM



5. PIN DESCRIPTION

<table>
<tr><th>Pin No.</th><th>Name</th><th>I/O</th><th>Description</th></tr>
<tr><td>1</td><td>/CS1</td><td>I</td><td>Chip enable terminal. It is active when /CS=”L”.</td></tr>
<tr><td>2</td><td>/RES</td><td>I</td><td>When /RES is set to “L”, the register settings are initialized (cleared).
The reset operation is performed by the /RES signal level.</td></tr>
<tr><td>3</td><td>A0</td><td>I</td><td>This is connect to the least significant bit of the normal MPU address bus, and it determines whether the data bits are data or command.
A0 = “H”: Indicates that D0 to D7 are display data.
A0 = “L”: Indicates that D0 to D7 are control data.</td></tr>
<tr><td>4</td><td>/WR
(R/W)</td><td>I</td><td>When connected to 8080 series MPU, this pin is treated as the “/WR” signal of the 8080 MPU and is LOW-active.
When connected to 6800 series MPU, this pin is treated as the “R/W” signal of the 6800 MPU and decides the access type: When R/W = “H”: Read. When R/W = “L”: Write</td></tr>
<tr><td>5</td><td>/RD(E)</td><td>I</td><td>This is the enable clock input terminal of the 6800 Series MPU and is HIGH-active.</td></tr>
<tr><td>6~13</td><td>D0~D7</td><td>I/O</td><td>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>14</td><td>VDD</td><td>Supply</td><td>Power supply for logic.</td></tr>
<tr><td>15</td><td>VSS</td><td>Supply</td><td>Ground.</td></tr>
<tr><td>16</td><td>Vout</td><td>Supply</td><td>DC/DC voltage converter. Connect a capacitor between this terminal and VSS or VDD terminal.</td></tr>
<tr><td>17</td><td>C3+</td><td>O</td><td>DC/DC voltage converter. Connect a capacitor between this terminal and the C1- terminal.</td></tr>
<tr><td>18</td><td>C1-</td><td>O</td><td>DC/DC voltage converter. Connect a capacitor between this terminal and the C1+ terminal.</td></tr>
<tr><td>19</td><td>C1+</td><td>O</td><td>DC/DC voltage converter. Connect a capacitor between this terminal and the C1- terminal.</td></tr>
<tr><td>20</td><td>C2+</td><td>O</td><td>DC/DC voltage converter. Connect a capacitor between this terminal and the C2- terminal.</td></tr>
<tr><td>21</td><td>C2-</td><td>O</td><td>DC/DC voltage converter. Connect a capacitor between this terminal and the C2+ terminal.</td></tr>
<tr><td>22</td><td>V4</td><td rowspan="5">Supply</td><td rowspan="5">This is a multi-level power supply for the liquid crystal drive. The voltage Supply applied is determined by the liquid crystal cell, and is changed through the use of a resistive voltage divided or through changing the impedance using an op.amp. Voltage levels are determined based on Vss, and must maintain the relative magnitudes shown below. V0≥V1≥V2≥V3≥V4≥VSS</td></tr>
<tr><td>23</td><td>V3</td></tr>
<tr><td>24</td><td>V2</td></tr>
<tr><td>25</td><td>V1</td></tr>
<tr><td>26</td><td>V0</td></tr>
<tr><td>27</td><td>C86</td><td>I</td><td>This is the MPU interface switch terminal
C86=“H” : 6800 series MPU interface C86=“L” : 8080 MPU interface</td></tr>
<tr><td>28</td><td>P/S</td><td>I</td><td>This pin configures the interface to be parallel mode or serial mode.
P/S = “H”: Parallel data input/output.
P/S = “L”: Serial data input.
The following applies depending on the P/S status:
<table>
<tr><th>P/S</th><th>Data/Command</th><th>Data</th><th>Read/Write</th><th>4-lineSPI Clock</th></tr>
<tr><td>“H”</td><td>A0</td><td>D0 to D7</td><td>/RD, /WR</td><td>x</td></tr>
<tr><td>“L”</td><td>A0</td><td>SI (D7)</td><td>Write only</td><td>SCL (D6)</td></tr>
</table>
When P/S = “L”, D0 to D5 must be fixed to “H”.
/RD (E) and /WR (R/W) are fixed to either “H” or “L”.
The serial access mode does NOT support read operation.</td></tr>
</table>

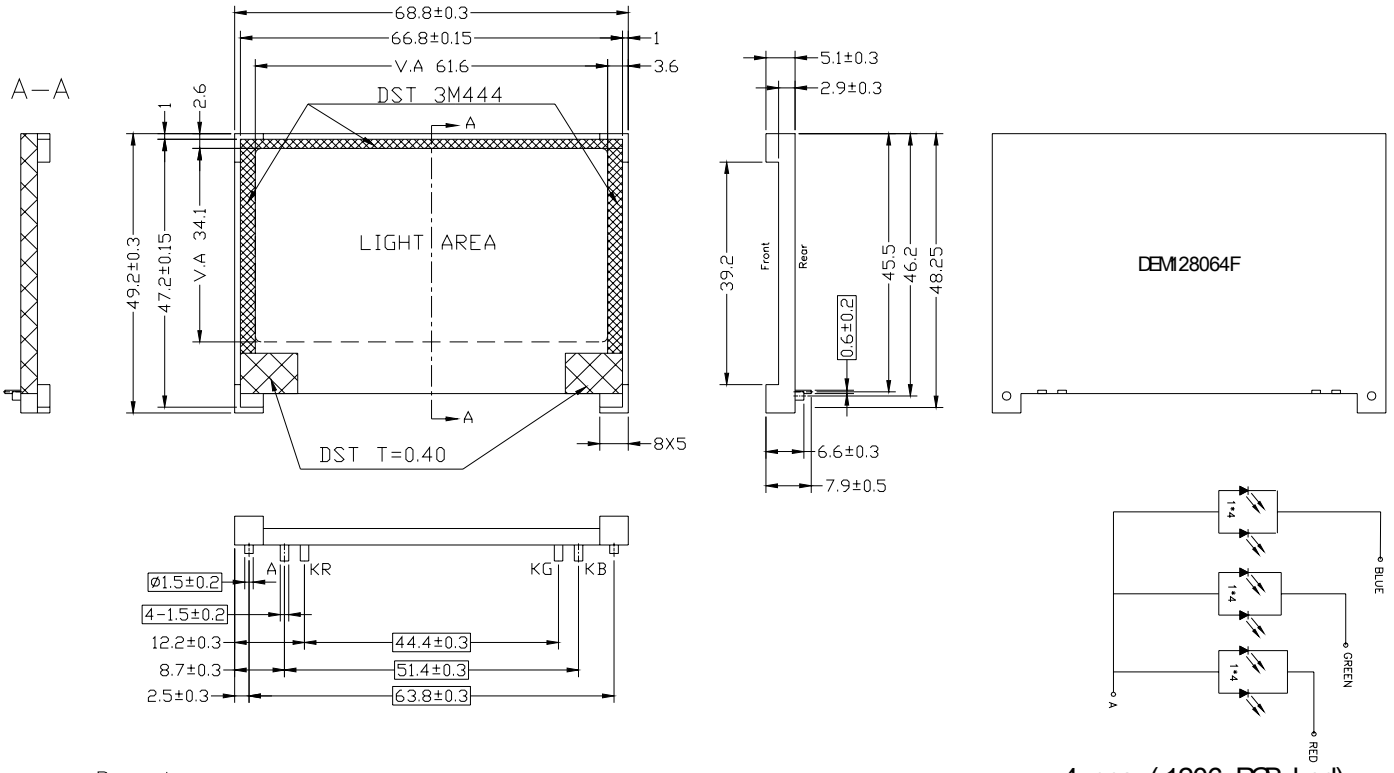
A	Anode of LED backlight
R	Cathode of RED LED backlight.
G	Cathode of GREEN LED backlight.
B	Cathode of BLUE LED backlight.

6. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Unit
Power Supply Voltage	VDD	-0.3 ~ 3.6	V
Power supply voltage (VDD standard)	V0, VOUT	-0.3 ~ 13.5	V
Power supply voltage (VDD standard)	V1, V2, V3, V4	-0.3 to V0	V
Operating temperature range	Topr	–20 to +70	°C
Storage temperature range	Tstr	–30 to +80	°C

7. BACKLIGHT CHARACTERISTICS

Item	Symbol	Min.			Typ.			Max.			Unit	Condition
		R	G	B	R	G	B	R	G	B		
Forward Voltage	Vf	1.7	2.8	2.8	2.0	3.2	3.2	2.4	3.4	3.4	V	If=80mA
Current	If				80						mA	
Luminance	Lv				35	85	45				cd/m^2	
Luminous tolerance	Avg	70									%	
Wavelength	λP	620	515	460	625	518	467	630	525	470	nm	If=80mA



4 pcs (1206 RGB led)

Remarks:
1.Unmarked tolerance is ±0.20;
2.All naterial comply with RoHs.
3.Color:RGB

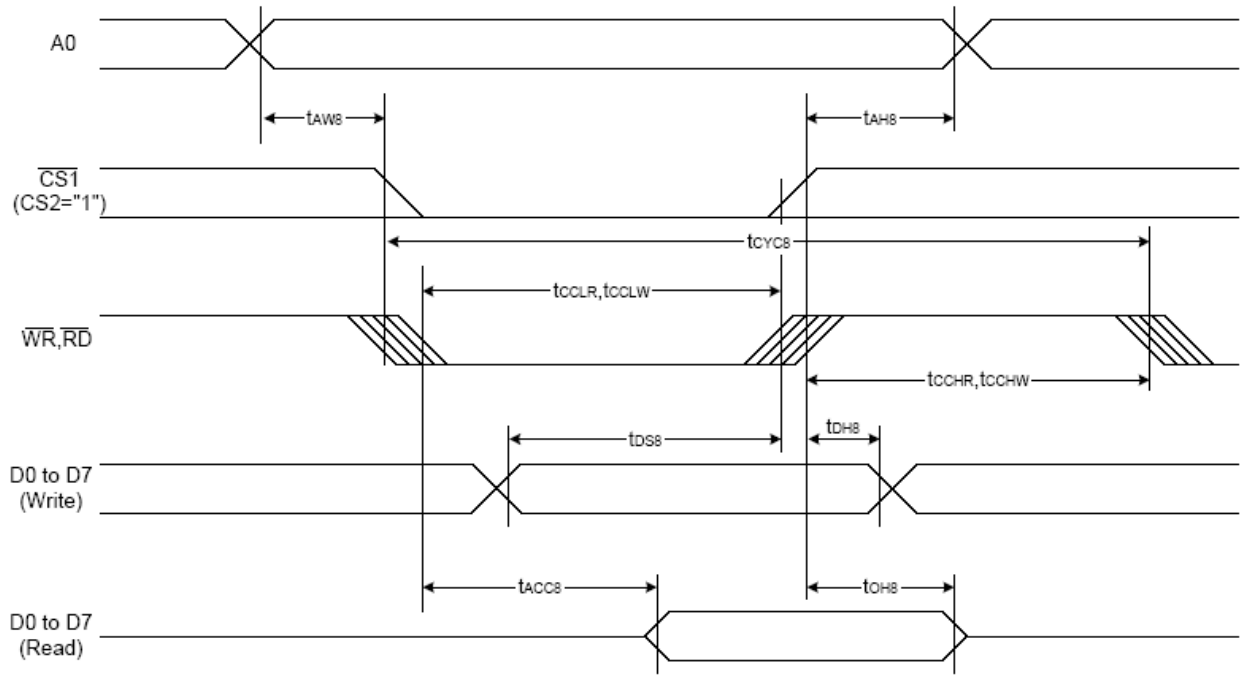
8. ELECTRICAL CHARACTERISTICS

8.1. DC CHARACTERISTICS

Item	Symbol	Condition	Standard Value			Unit
			Min.	Typ.	Max.	
Operating Voltage	V_{DD}	Relative to VSS	2.7	3.0	3.3	V
LCD driving voltage	V_{LCD}	Relative to VSS	9.6	9.8	10.0	
Consumption current	I_{DD}	-	-	TBD	-	mA

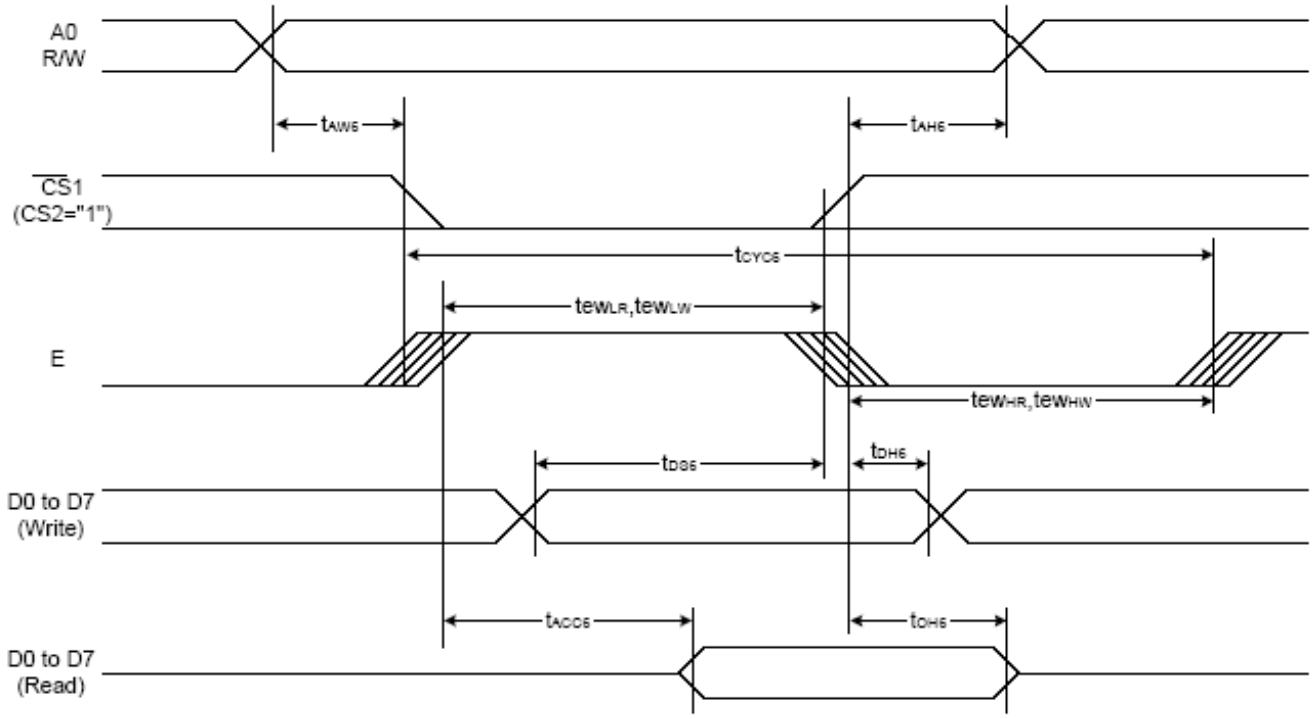
8.2. AC CHARACTERISTICS

System Bus Read/Write Characteristics 1 (For the 8080 Series MPU)



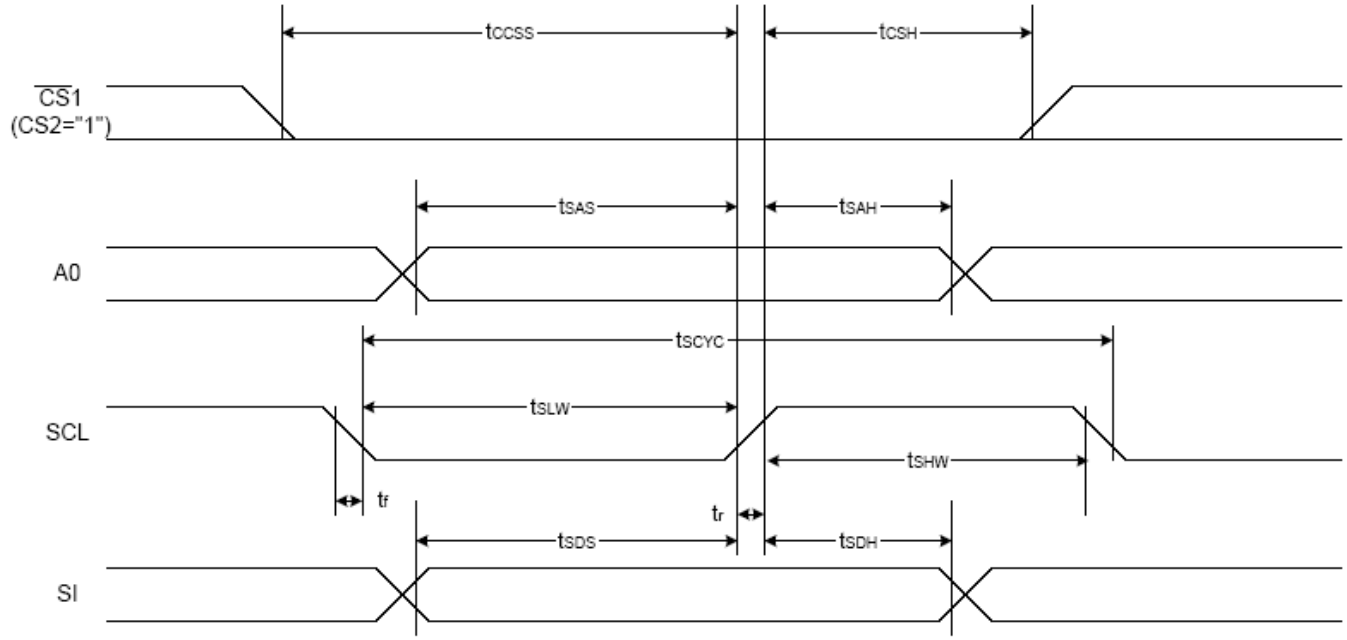
Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH8}		0	—	Ns
Address setup time		t_{AW8}		0	—	
System cycle time		t_{CYC8}		240	—	
Enable L pulse width (WRITE)	WR	t_{CCLW}		80	—	
Enable H pulse width (WRITE)		t_{CCHW}		80	—	
Enable L pulse width (READ)	RD	t_{CCLR}		140	—	
Enable H pulse width (READ)		t_{CCHR}		80		
WRITE Data setup time	D0 to D7	t_{DS8}		40	—	
WRITE Address hold time		t_{DH8}		0	—	
READ access time		t_{ACC8}	C_L = 100 pF	—	70	
READ Output disable time		t_{OH8}	C_L = 100 pF	5	50	

System Bus Read/Write Characteristics 2 (For the 6800 Series MPU)



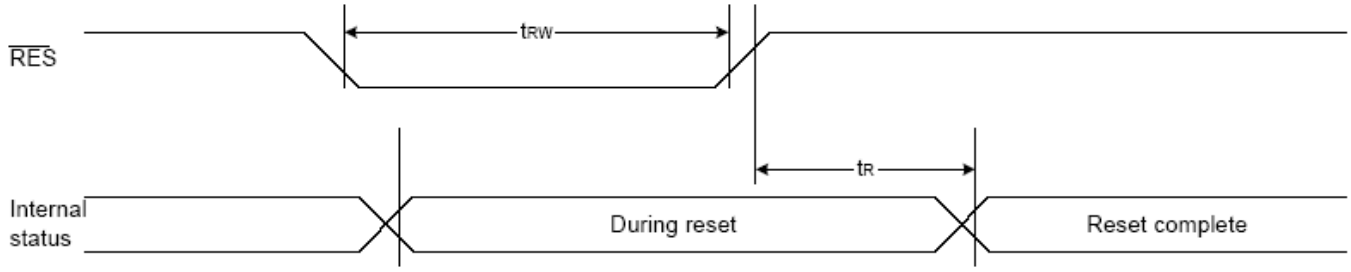
Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH6}		0	—	ns
Address setup time		t_{AW6}		0	—	
System cycle time		t_{CYC6}		240	—	
Enable L pulse width (WRITE)	WR	t_{EWLW}		80	—	
Enable H pulse width (WRITE)		t_{EWHW}		80	—	
Enable L pulse width (READ)	RD	t_{EWLR}		80	—	
Enable H pulse width (READ)		t_{EWHR}		140		
WRITE Data setup time	D0 to D7	t_{DS6}		40	—	
WRITE Address hold time		t_{DH6}		0	—	
READ access time		t_{ACC6}	C_L = 100 pF	—	70	
READ Output disable time		t_{OH6}	C_L = 100 pF	5	50	

The 4-line SPI Interface



Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
4-line SPI Clock Period	SCL	T_{scyc}		50	—	ns
SCL "H" pulse width		T_{shw}		25	—	
SCL "L" pulse width		T_{SLW}		25	—	
Address setup time	A0	T_{SAS}		20	—	
Address hold time		T_{sah}		10	—	
Data setup time	SI	T_{sds}		20	—	
Data hold time		T_{SDH}		10	—	
CS-SCL time	CS	T_{css}		20	—	
CS-SCL time		T_{csh}		40	—	

Reset Timing



Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		t_R		—	—	1.0	us
Reset "L" pulse width	/RES	t_{RW}		1.0	—	—	us

9. COMMAND TABLE

Command	Command Code											Function
	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0 1	LCD display ON/OFF 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address						Sets the display RAM display start line address
(3) Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address
(4) Column address set upper bit Column address set lower bit	0	1	0	0 0	0 0	0 0	1 0	Most significant column address Least significant column address				Sets the most significant 4 bits of the display RAM column address. Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1	Status				0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data								Writes to the display RAM
(7) Display data read	1	0	1	Read data								Reads from the display RAM
(8) ADC select	0	1	0	1	0	1	0	0	0	0	0 1	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9) Display normal/ reverse	0	1	0	1	0	1	0	0	1	1	0 1	Sets the LCD display normal/ reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0 1	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0 1	Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565R)
(12) Read-modify-write	0	1	0	1	1	1	0	0	0	0	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	1	1	1	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	Internal reset
(15) Common output mode select	0	1	0	1	1	0	0	0 1	*	*	*	Select COM output scan direction 0: normal direction 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode			Select internal power supply operating mode
(17) V_0 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set Electronic volume register set	0	1	0	1 0	0 0	0	0	0 Electronic volume value	0	0	1	Set the V_0 output voltage electronic volume register
(19) Static indicator ON/OFF Static indicator register set	0	1	0	1 0	0 0	1 0	0 0	1 0	1 0	0 0	0 1 Mode	0: OFF, 1: ON Set the flashing mode
(20) Booster ratio set	0	1	0	1 0	1 0	1 0	1 0	1 0	0 0	0 step-up value	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
(21) Power save	0	1	0									Display OFF and display all points ON compound command
(22) NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
(23) Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command

10. LCD MODULES HANDLING PRECAUTIONS

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

- If the display panel is damaged and the liquid crystal substance inside it leaks out, do not get any in your mouth. If the substance come into contact with your skin or clothes promptly wash it off using soap and water.

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

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

- 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.

- Storage precautions
  When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags designed to prevent static electricity charging (or in bags designed to prevent static electricity charging) under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperatures below 20°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

11. OTHERS

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

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

- To minimize the performance degradation of the LCD modules resulting from caused by static electricity, etc. exercise care to avoid holding the following sections when handling the modules:
  - Exposed area of the printed circuit board
  - Terminal electrode sections