Display Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 128064K FGH-PW

Product Specification   *Version: 1.1.1*

14.01.2019

GENERAL SPECIFICATION

MODULE NO. :

DEM 128064K FGH-PW

VERSION NO.	CHANGE DESCRIPTION	DATE
0	First Issue	13.11.2009
1.1.0	Change Production Line	13.12.2018
1.1.1	Update the IC layout drawing on page 16	14.01.2019

PREPARED BY: PS   DATE:14.01.2019

APPROVED BY: MHI   DATE:14.01.2019

<div style="border:1px solid black; padding:10px;">

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1. FUNCTIONS & FEATURES

- DEM 128064K FGH-PW LCD Type :

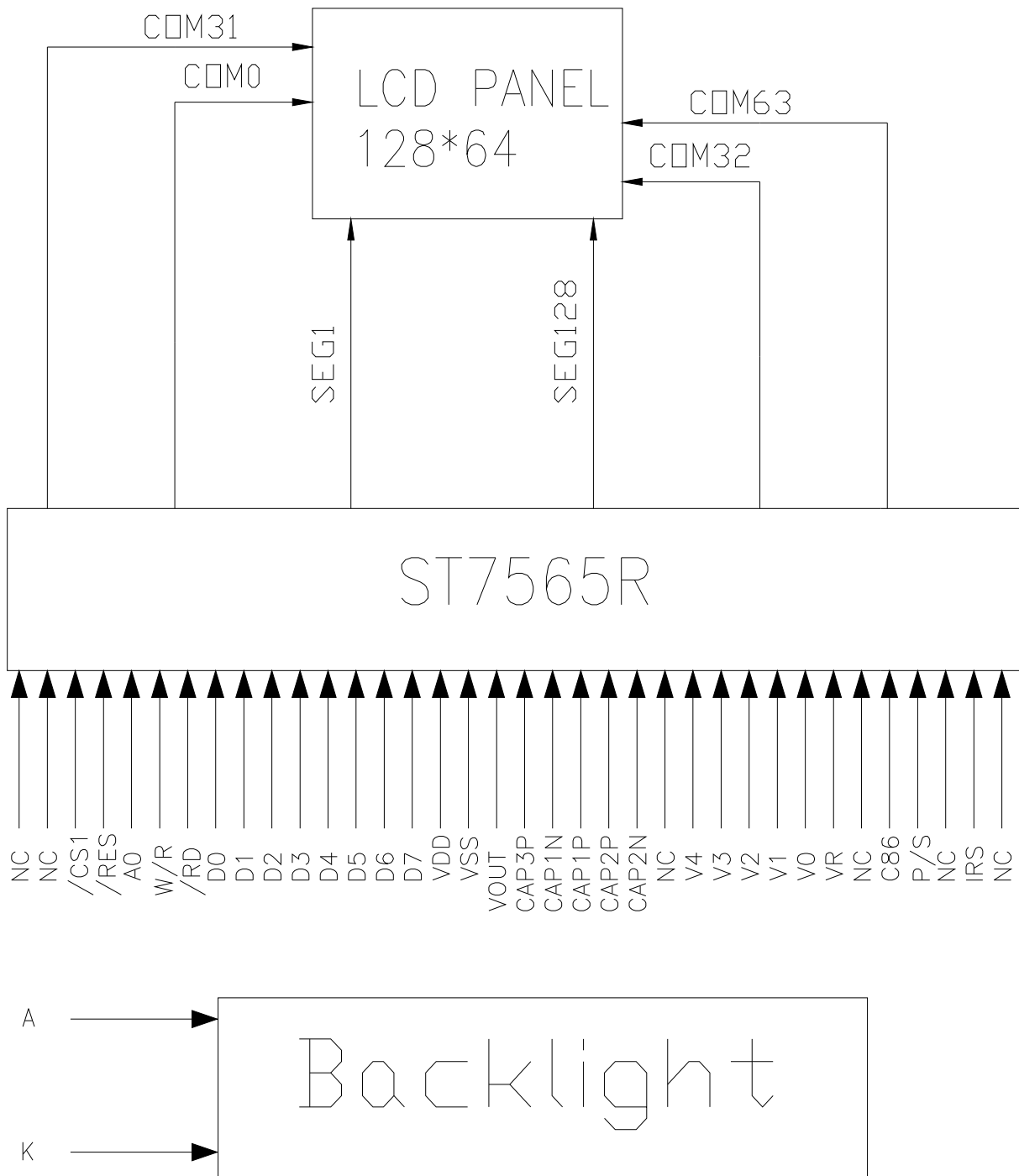| MODULE	LCD TYPE	REMARKS
DEM 128064K FGH-PW	FSTN Transflective Positive Mode	

- Viewing Direction   : 6 O'clock

- Driving Scheme   : 1/65 Duty Cycle, 1/9 Bias

- Power Supply Voltage(Typ.)   : 3.3 Volt (typ.)

- LCD Operation Voltage   : 9.0 Volt (typ.)

- Display Contents   : 128 x 64 Dots

- Backlight   : LED, White, Lightguide

- Driver IC   : ST7565R (Sitronix)

- Operating Temperature   : -20°C ～ **+70**°C

- Storage Temperature   : -30°C ～ **+80**°C

- RoHS Compliant

2. MECHANICAL SPECIFICATIONS

- Module Size: : 77.30 x 51.70 x 5.30 mm (without FPC)

- Viewing Area Size: : 65.50 x 38.00 mm

- Active Area Size   : 60.78 x 32.94 mm

- Dot pitch: : 0.475 x 0.515 mm

- Dot Size: : 0.455 x 0.495 mm

3. EXTERNAL DIMENSIONS

Label Printed Sample:
DEM 128064K FGH-PW/V
WYW

Format:w=week
y=year

DEM 128064K FGH-PW/V
WYW

Label @Bottom side

BACK

FRONT

Black Tape

STIFFENER CONTACT SIDE

5.30±0.3
3.0MAX(LCD)
1.10±0.1

3.70

0.3±0.05

0.475
0.455
0.495
0.515

10:1

51.7(BL)
50.0(LCD)
38.0(V.A)
32.94(A.A)
0.85
2.85
5.38

1.05
2.65
5.01

INJECT PORT

77.3±0.5(BL)
70.8±0.3
68.7(LCD)
65.5(V.A)
60.78(A.A)

128X64 DOTS
⇕
VIEWING DIRECTION

Silk Screen

XXXXXXX UL:xxxxxx
DEM 128064K
UL:XXXXXX

50.0±1.0

W=0.3±0.05
P0.5*35=17.5±0.1
(26.15)
18.5±0.2
0.5±0.1
3.0±0.5
6.0±0.5

1
36

(6.5)

Printed A/K
on the back

20.83
17.1
10.0
(43.5)

2.54

3.0±0.5

0.5
1.5±0.5

Remarks:
1.Unmarked tolerance is ±0.3
2.All materials comply with RoHS
3.▭ ....critical dimension.

4. BLOCK DIAGRAM

5. PIN DESCRIPTION

Pin No.	Name	Description
1~2	NC	Non-Contact Terminal
3	/CS1	This is the Chip Select Signal.
4	/RES	The RESET Signal
5	A0	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.
6	W/R	• When connected to 8080 series MPU, this pin is treated as the "/WR" signal of the 8080 MPU and is LOW-active. The signals on the data bus are latched at the rising edge of the /WR signal. • 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.
7	/RD	• When connected to 8080 series MPU, this pin is treated as the "/RD" signal of the 8080 MPU and is LOW-active. The data bus is in an output status when this signal is "L". • When connected to 6800 series MPU, this pin is treated as the "E" signal of the 6800 MPU and is HIGH-active. This is the enable clock input terminal of the 6800 Series MPU.
8	D0	This is an 8-bit bi-directional data bus that connects to an 8-bit or 16-bit standard MPU data bus. When the serial interface (SPI-4) is selected (P/S = "L") : D7 : serial data input (SI) ; D6 : the serial clock input (SCL). D0 to D5 should be connected to VDD or floating. When the chip select is not active, D0 to D7 are set to high impedance.
9	D1	
10	D2	
11	D3	
12	D4	
13	D5	
14	D6	
15	D7	
16	VDD	Voltage Supply
17	VSS	Ground
18	VOUT	DC/DC Voltage Converter.
19	CAP3P	
20	CAP1N	
21	CAP1P	
22	CAP2P	
23	CAP2N	
24	NC	Non-Contact Terminal
25	V4	LCD Driver Supplies Voltages
26	V3	
27	V2	
28	V1	
29	V0	
30	VR	This is the internal-output VREG power supply for the LCD power supply voltage regulator.
31	NC	Non-contact terminal
32	C86	This is the MPU interface selection pin. C86 = "H": 6800 Series MPU interface. C86 = "L": 8080 Series MPU interface.

| 33 | P/S | 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. |
34	NC	Non-Contact Terminal
35	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
36	NC	Non-Contact Terminal

| A | Supply Voltage for Backlight LED+ |
| K | Supply Voltage for Backlight LED- |

6. BACKLIGHT CHARACTERISTICS

ELECTRICAL—OPTICAL CHARACTERISTICS
Ta=25℃. Unless specified, The Ambient temperature Ta=25℃

Item	Symbol	min.	typ.	max.	Unit	Condition
Forward Voltage	Vf	2.9	3.1	3.3	V	If= 15 mA
Power Dissipation	Pd	43.5	46.5	49.5	mW	If= 15 mA
Luminous Uniformity	D Lv	70			%	MIN/MAX*100%
Luminance	Lv	80	110		cd/m^2	If= 15 mA
Color Coordinate	X	0.250		0.290		T=25℃
	Y	0.250		0.290		
Lifetime			30000Hr			HOURS
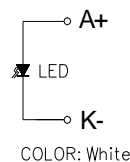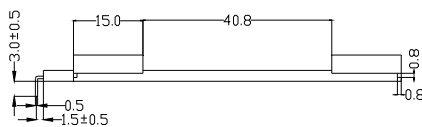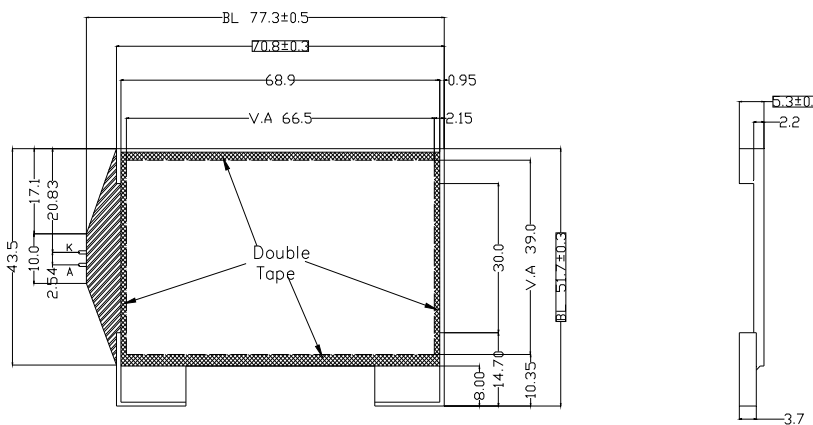
Remarks:
1.Unmarked tolerance is ±0.3;
2.All material comply with ROHS;
3. ☐...:critical dimension;
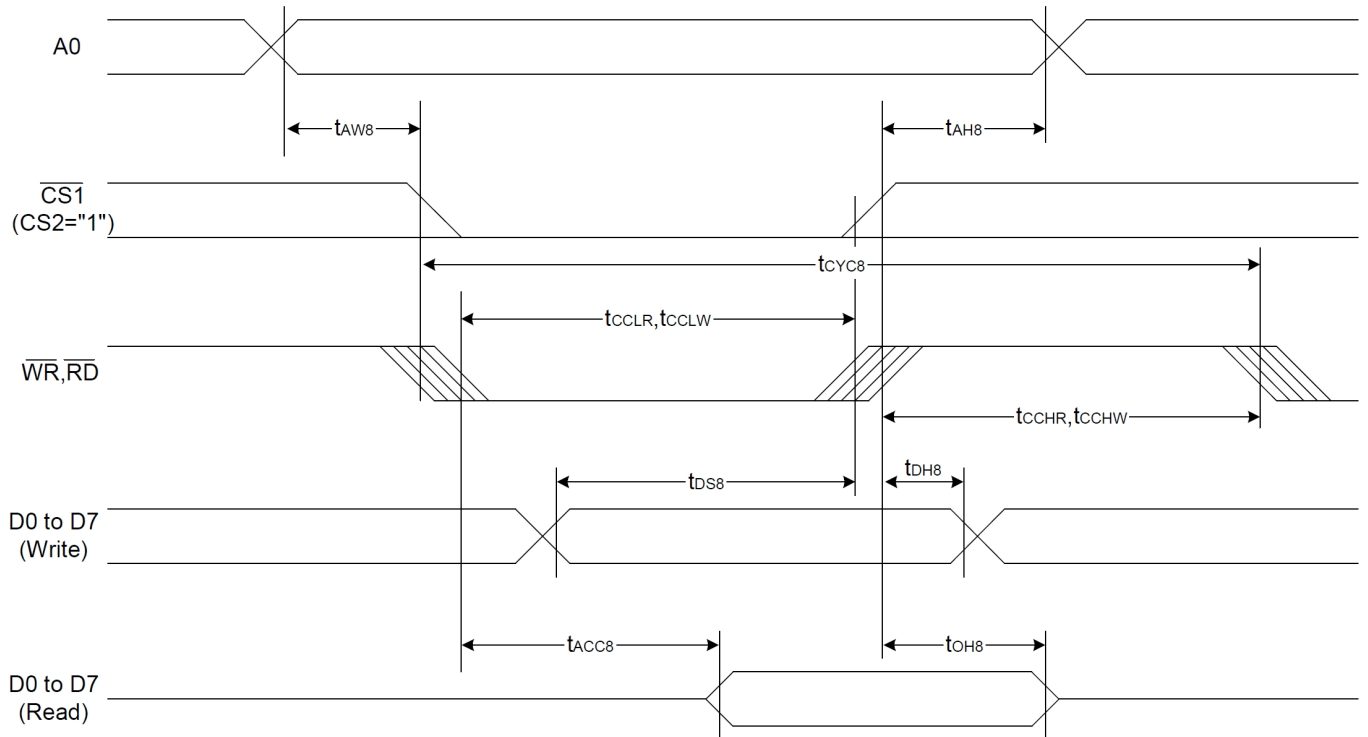4.Color:White

COLOR: White

7. 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	TOPR	–20 to +70	°C
Storage Temperature	TSTR	–30 to +80	°C

8. ELECTRICAL CHARACTERISTICS

8.1. DC CHARACTERISTICS

| Item	Symbol	Condition	STANDARD VALUE			units
			Min.	Typ.	Max.	
Operating Voltage	V_{DD}	Relative to VSS	3.0	3.3	3.3	V
LCD Driving voltage	V_{LCD}	Relative to VSS	8.7	9.0	9.3	
High-Level Input Voltage	V_{IHC}	---	0.8 x VDD	---	VDD	
Low-Level Input Voltage	V_{ILC}	---	VSS	---	0.2 x VDD	
High-Level Output Voltage	V_{OHC}	IOH = –0.5 mA	0.8 x VDD	---	VDD	
Low-Level Output Voltage	V_{OLC}	IOH = –0.5 mA	VSS	---	0.2 x VDD	
Consumption Current	I_{DD}	---	---	TBD	---	mA

8.2. AC CHARACTERISTICS

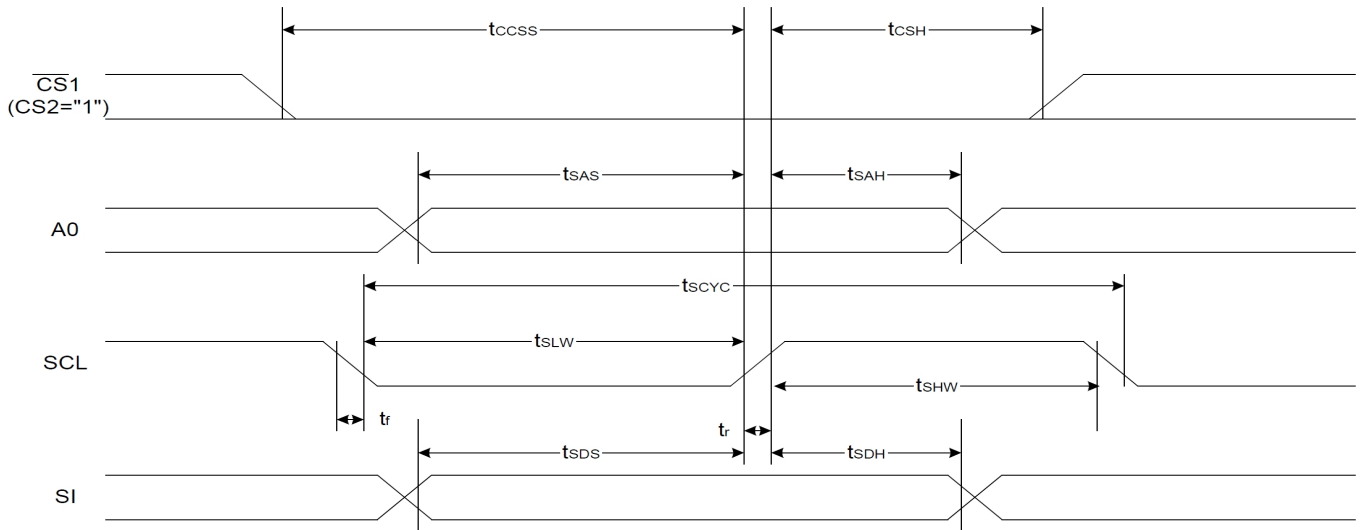**System Bus Read/Write Characteristics 1 (For the 8080 Series MPU)**

Item	Signal	Symbol	Condition	Rating Min.	Rating Max.	Units
Address hold time	A0	t_{AH8}		0	—	
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	—	Ns
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)
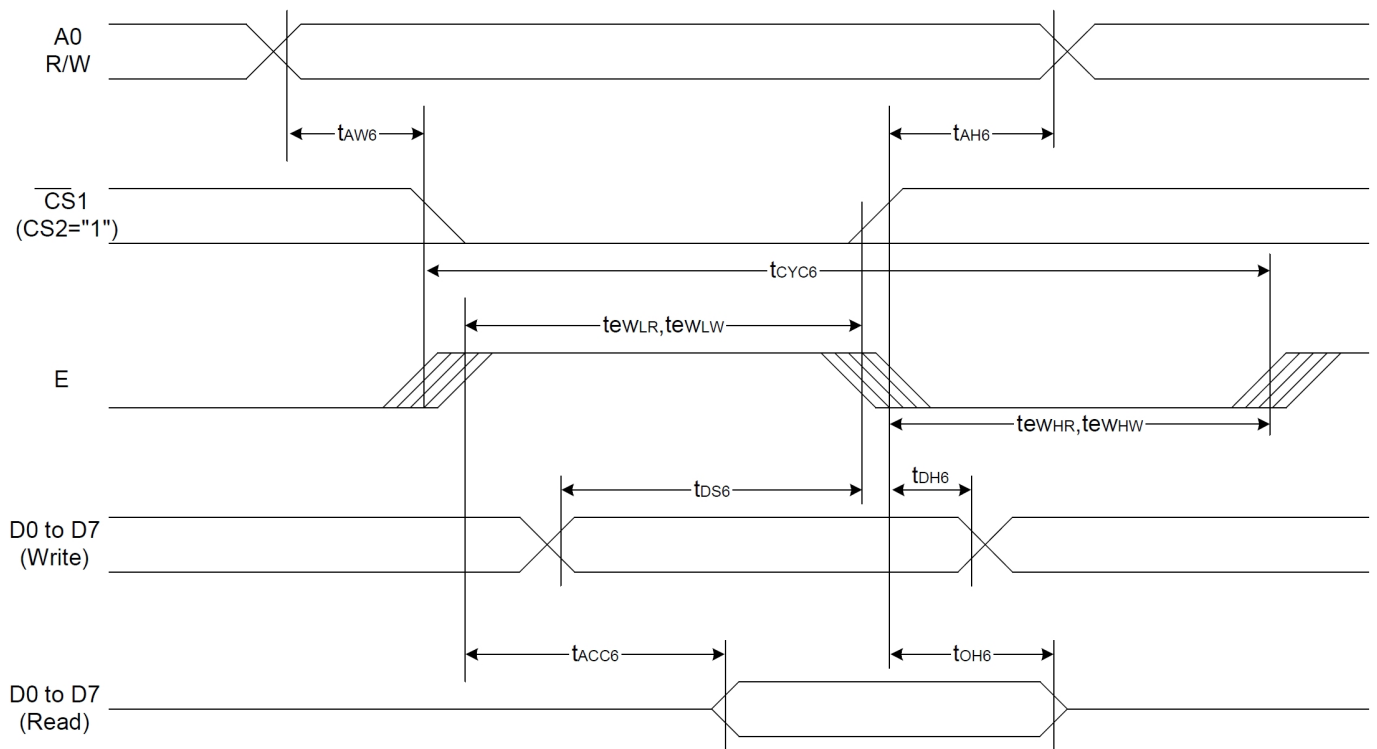
Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH6}		0	—	ns
Address setup time		t_{AW6}		0	—	
System cycle time		t_{CYC6}		240	—	
Enable L pulse width (WRITE)	WR	t_{EWLW}		80	—	
Enable H pulse width (WRITE)		t_{EWHW}		80	—	
Enable L pulse width (READ)	RD	t_{EWLR}		80	—	
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 Min.	Rating Max.	Units
4-line SPI Clock Period	SCL	T_{scyc}		50	—	ns
SCL "H" pulse width	SCL	T_{shw}		25	—	ns
SCL "L" pulse width	SCL	T_{SLW}		25	—	ns
Address setup time	A0	T_{SAS}		20	—	ns
Address hold time	A0	T_{sah}		10	—	ns
Data setup time	SI	T_{sds}		20	—	ns
Data hold time	SI	T_{SDH}		10	—	ns
CS-SCL time	CS	T_{css}		20	—	ns
CS-SCL time	CS	T_{csh}		40	—	ns

Reset Timing

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

9. COMMAND TABLE

Command	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
				Command Code								
(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	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address.
Column address set lower bit				0	0	0	0	Least significant 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	0	1	0	1	0	0	0	0	0	0	1	Set the V_0 output voltage electronic volume register
Electronic volume register set				0	0	Electronic volume value						
(19) Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0 / 1	0: OFF, 1: ON
Static indicator register set				0	0	0	0	0	0	0	Mode	Set the flashing mode
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
				0	0	0	0	0	0	step-up value		
(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. ELECTRO-OPTICAL DEFINITION

Optical Characteristics

Item	Symbol	Description	Condition	Min	Typ	Max	Unt
Operating Voltage of LCD	**V$_{LCD}$**	---	**Ta= -20°C**	**9.2**	**9.5**	**9.8**	**V**
		---	**Ta= 25°C**	**8.7**	**9.0**	**9.3**	
		---	**Ta= 70°C**	**8.2**	**8.5**	**8.8**	
Response Time	**Tr**	**Rise**	**25°C**	---	**200**	**400**	**ms**
	Tf	**Fall**	**25°C**	---	**250**	**500**	**ms**
Contrast	**Cr**		**VDD= 3.3V,25°C**	---	**4**	---	
Viewing Angle	**θ**	**6 o'clock axis**	**Cr≥2.0 VDD= 3.3V,25°C**	---	**40**	---	**deg**
		12 o'clock axis	**VDD= 3.3V,25°C**	---	**40**	---	**deg**
		3 o'clock axis	**VDD= 3.3V,25°C**	---	**40**	---	**deg**
		9 o'clock axis	**VDD= 3.3V,25°C**	---	**40**	---	**deg**
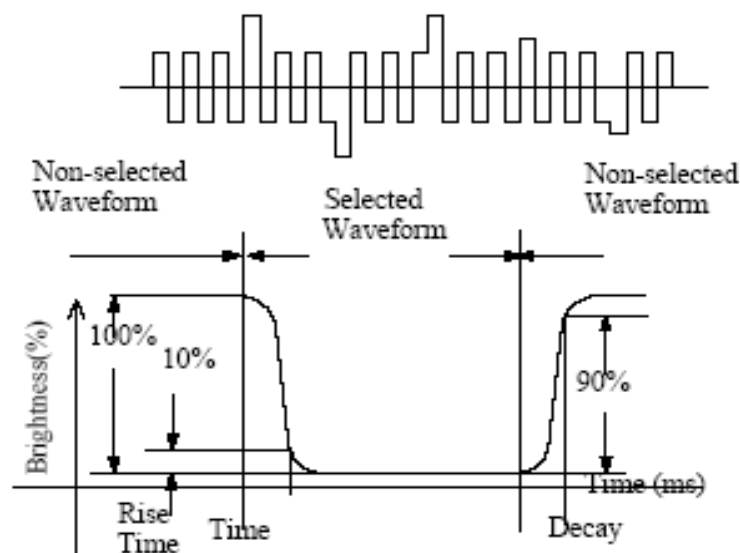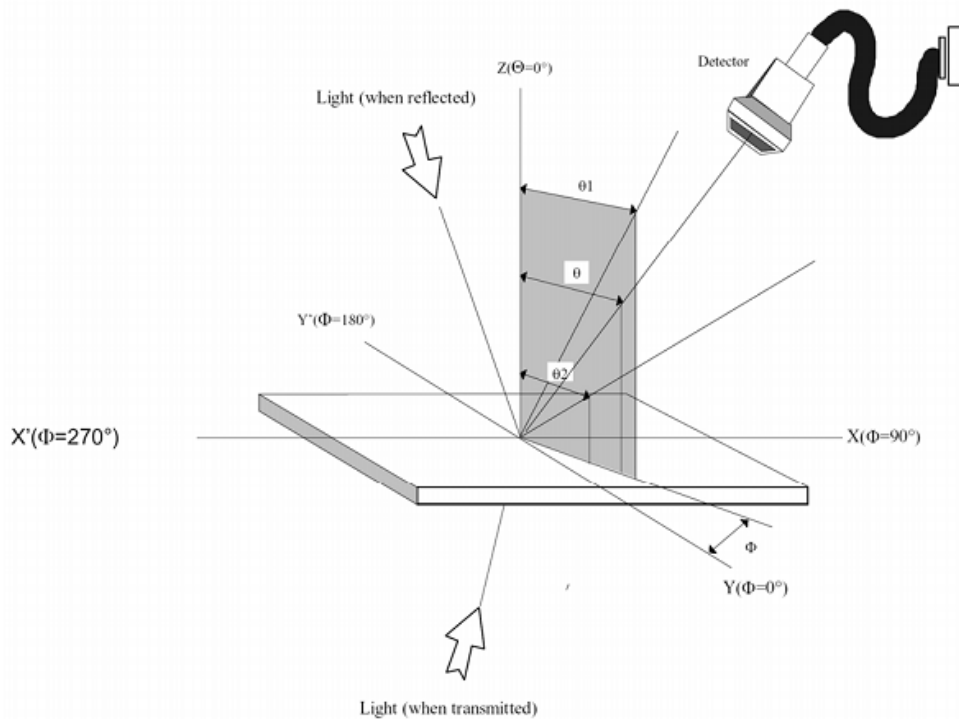
Definition of contrast $Cr. = \dfrac{B2}{B1} = \dfrac{\textbf{Bright curve of not selected segment}}{\textbf{Bright curve of selected segment}}$
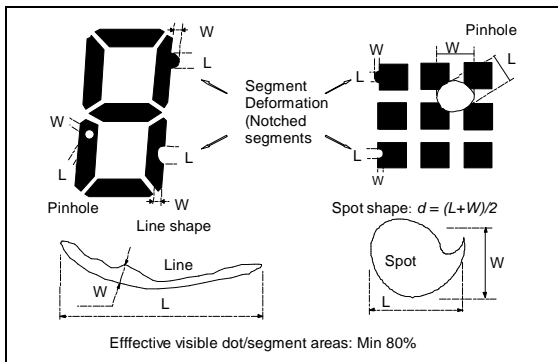
Bright (%)

Brightbess

Bright curve
of selected
segment

Bright
curve of
non-selected
segment

B2

Dark

B1

Operating voltage (V)   →

11. LCD ARTWORK

(1:1)

12. SEG LAYOUT

13. COM LAYOUT

14. IC LAYOUT
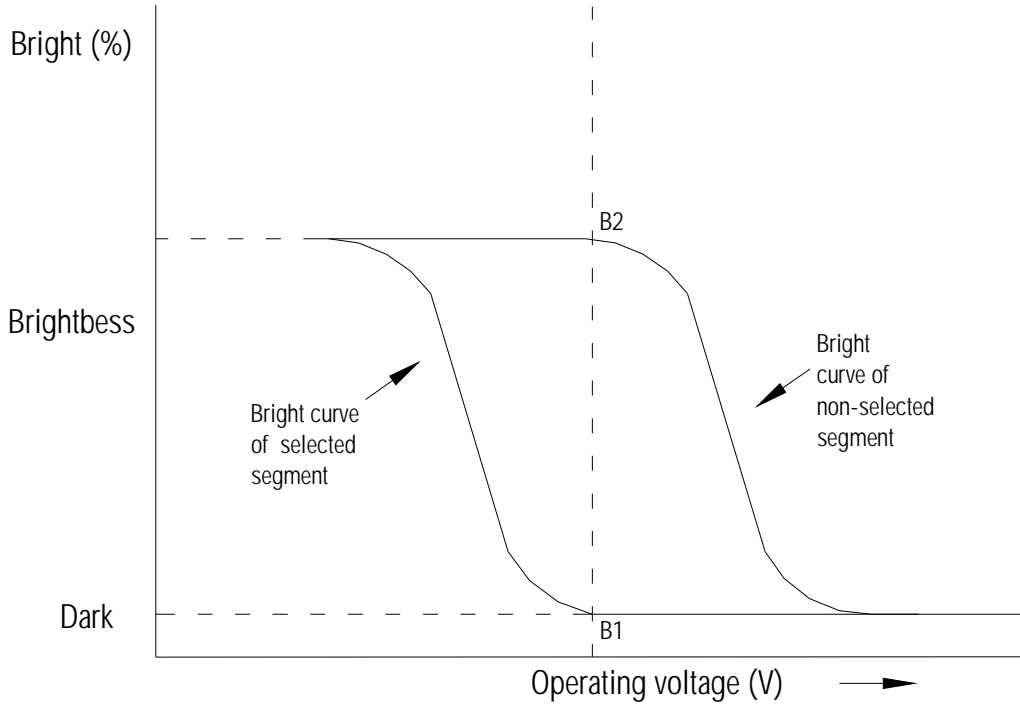
15. QUALITY DESCRIPTION

<u>DEFECT SPECIFICATION:</u>
Specific type-related items are covered in this sheet.

a: Table for Cosmetic defects
       (Note: nc = not counted).
       Sizes and number of defects
       (Max. Qty)

Defect Type	Max. Defect Size [µm] d or L W	Max. Quantity.
Black or White Spots	$d \leq 150$	nc
	$150 < d \leq 300$	5
Black or White Lines	-- $W \leq 10$	nc
	$L \leq 5000$ $W \leq 30$	3
	$L \leq 2000$ $W \leq 50$	2
Pinhole	$d \leq 150$ $150 < d \leq 300$	nc 1/segment
(Total defects)		(5)
Segment Deformation	$W \leq 100$	nc
Bubble (e.g. under pola)	$d \leq 150$	nc
	$200 < d \leq 400$	3
	$400 < d \leq 600$	1

Effective visible dot/segment areas: Min 80%

Examples/ Shapes

b: Glass defects
b1:Glass defects at contact ledge
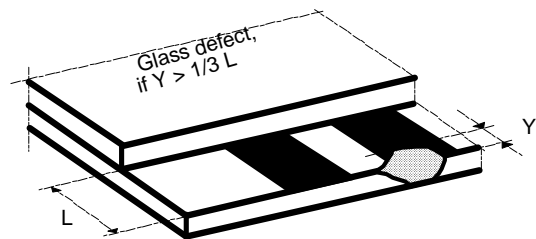
b2:Glass chipping in other areas shall not be in conflict with the product's function.

16. RELIABILITY TEST

Operating life time: Longer than 50000 Hours (at room temperature without direct irradiation of sunlight)

Reliability characteristics shall meet following requirements.

TEMPERATURE TESTS	NORMAL GRADE
High Temperature Storage	+80°C * 96HR
Low Temperature Storage	-30°C * 96HR
High Temperature Operation	+70°C * 96HR
Low Temperature Operation	-20°C * 96HR
High Temperature, High Humidity	+60°C 90%RH 96HR
Thermal Shock	-20°C * 30 min 10s ↓ 5Cycles 70°C * 30 min
Vibration Test	Frequency * Swing * Time 40Hz * 4mm * 4hrs
Drop Test	Drop height * Times 1.0m * 6 times

17. MODULE ACCEPT QUALITY LEVEL (AQL)

Inspection Standard: MIL-STD-105E Table Normal Inspection Single Sampling Level Ⅱ.

18. LCD MODULES HANDLING PRECAUTIONS

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

n   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.

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

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

n   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.

n   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 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.

19. OTHERS

n   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.

n   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.

n   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