DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 120064B FGH-PW

Product Specification   *Version: 2*

15/Oct/2013

GENERAL SPECIFICATION

MODULE NO. :

DEM 120064B FGH-PW

CUSTOMER P/N

VERSION NO.	CHANGE DESCRIPTION	DATE
0	Original Version	09.07.2013
1	Add UL	31.07.2013
2	Change Bias and Vop	15.10.2013

PREPARED BY: LX 　　　　　　　DATE: 15.10.2013

APPROVED BY: MHO 　　　　　　DATE: 15.10.2013

CONTENTS

1. FUNCTIONS & FEATURES

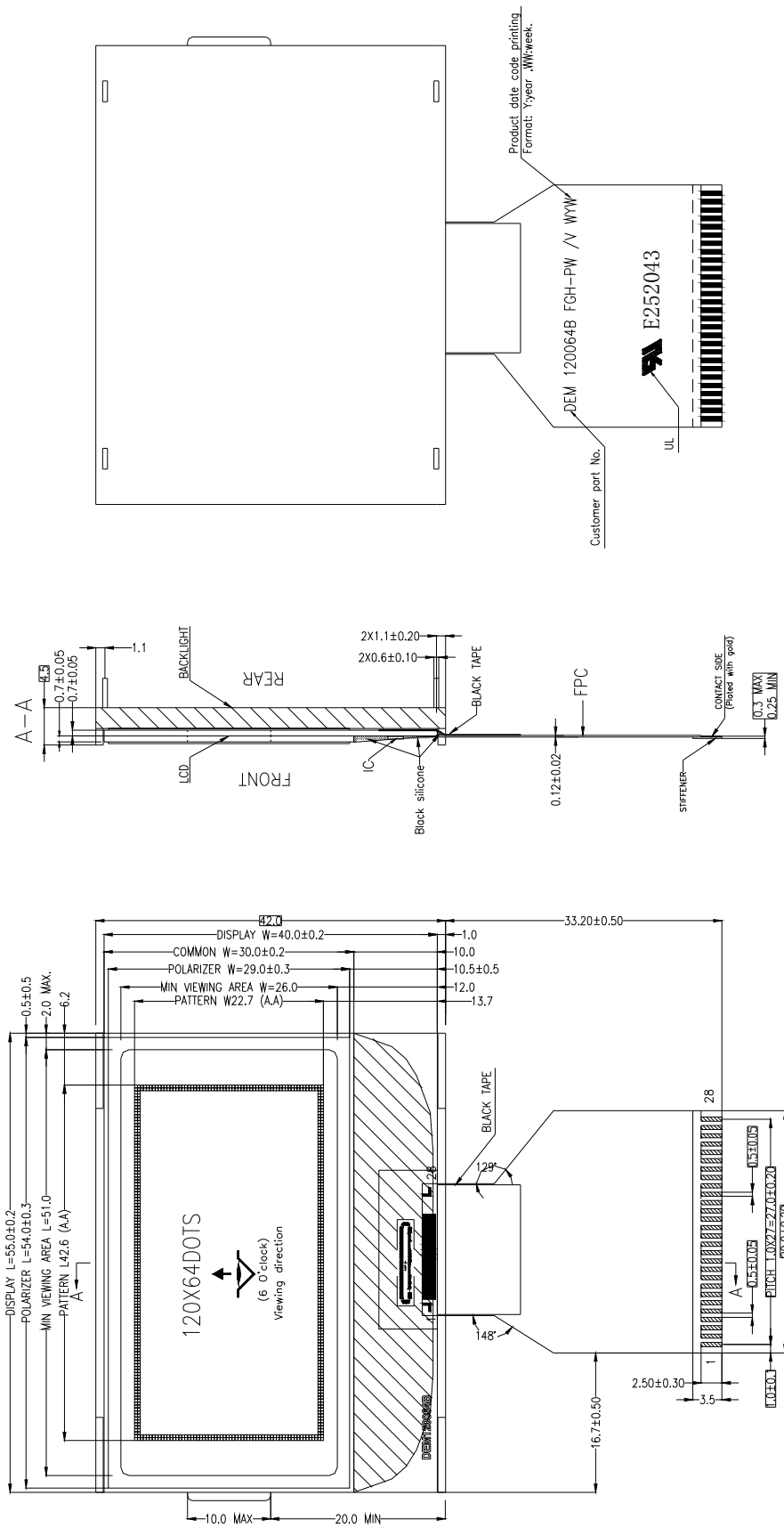| MODULE MODEL	LCD TYPE	REMARK
DEM 120064B FGH-PW	FSTN Grey Transflective Positive Mode	--

- Viewing Direction : 6 O'clock
- Driving Scheme : 1/64 Duty, 1/7 Bias,
- Display content : 120 x 64Dots
- Power Logic Supply : 3.0 Volt (typ.)
- V_{LCD} : 9.6 Volt (typ.)
- Interface : Parallel / Serial
- Driver IC : ST7565V (Sitronix)
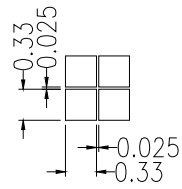- Backlight : LED, Lightguide, White, Long-Lifetime
- RoHS : Compliant

2. MODULE ARTWORK

- Module Size(without FPC) : 55.00 x 42.00 x 4.50 mm
- Viewing Area(Frame) : 51.00 x 26.00 mm
- Active Area(LCD) : 42.575 x 22.695 mm
- Dot Size : 0.33 x 0.33 mm
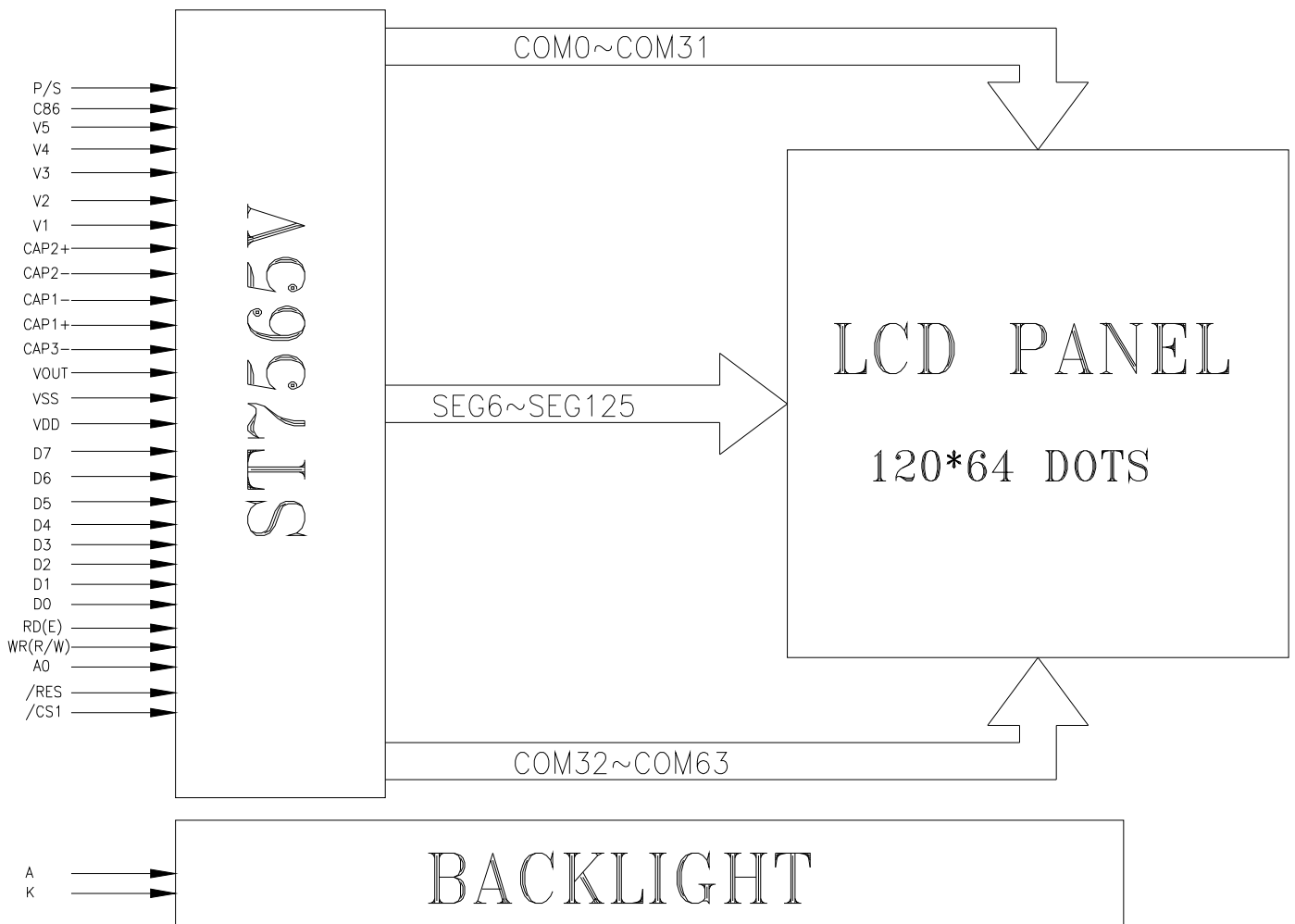- Dot Gap : 0.025 mm

3. EXTERNAL DIMENSIONS

4. BLOCK DIAGRAM

5. PIN ASSIGNMENT

Pin No.	Name	Description
1	VDD	Shared with the MPU power supply terminal Vcc.
2	P/S	This is the parallel data input/serial data input switch terminal. P/S = "H": Parallel data input. P/S = "L": Serial data input.
3	C86	This is the MPU interface switch terminal. C86 = "H": 6800 Series MPU interface. C86 = "L": 8080 MPU interface.
4	V5	This is a multi-level power supply for the liquid crystal drive. The voltage Supply
5	V4	applied is determined by the liquid crystal cell, and is changed through the use of
6	V3	a resistive voltage divided or through changing the impedance using an op. amp.
7	V2	Voltage levels are determined based on VDD, and must maintain the relative magnitudes shown
8	V1	below. VDD (= V0) $\geqq$ V1 $\geqq$ V2 $\geqq$ V3 $\geqq$ V4 $\geqq$ V5
9	CAP2+	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP2- terminal.
10	CAP2-	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP2+ terminal.
11	CAP1-	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP1+ terminal.
12	CAP1+	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP1- terminal.
13	CAP3+	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP1+ terminal.
14	VOUT	DC/DC voltage converter. Connect a capacitor between this terminal and VSS.
15	VSS	This is a 0V terminal connected to the system GND.
16	D7	This is an 8-bit bi-directional data bus that connects to an 8-bit or 16-bit standard MPU data bus.
17	D6	When the serial interface is selected (P/S = "L") :
18	D5	D7: serial data input (SI); D6: the serial clock input (SCL).
19	D4	D0 to D5 are set to high impedance.
20	D3	When the chip select is not active, D0 to D7 are set to high impedance.
21	D2	
22	D1	
23	D0	
24	E	When connected to an 8080 MPU, this is active LOW. (E) This pin is connected to the /RD signal of the 8080 MPU, and the ST7565V series 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 the 6800 Series MPU enable clock input terminal.
25	R/W	When connected to an 8080 MPU, this is active LOW. (R/W) 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 connect 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": Indicates 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.
29	CS1	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.

1	A	Backlight Anode Terminal
2	K	Backlight Cathode Terminal

6. BACKLIGHT CHARATERISTICS

Electrical—Optical Characteristics

Item	Symbol	min.	typ.	max.	Unit	Condition
Current	If		45mA	60mA	mA	Vf= 3.2 V
Power Dissipation	Pd			192	mW	
Luminous Uniformity	DLv	70			%	MIN/MAX*100%
Luminance	Lv	315	450		cd/m^2	
Color Coordinate	X	0.260		0.330		Vf= 3.2 V
	Y	0.260		0.330		T=25°C
Peak wave length	IP	_		_	nm	

The LCD Surface Luminance

Item	Symbol	Min.	TYP	Max.	Unit	Remark
Luminance	Lv	65	95		cd /m^2	---

*Note: This is only for the reference.The exact value of the luminance please refer to the approval sample.

A—A

DST (3M444)

Light area

DST (3M4920)

FRONT　REAR

Circuit Diagram

A

K

(LED 3x1=3)　Color: WHITE
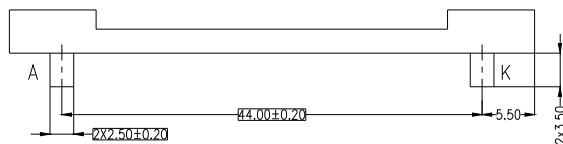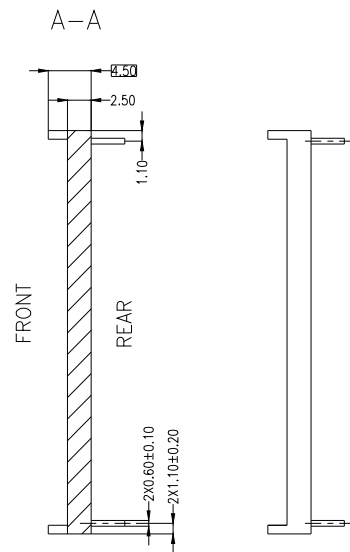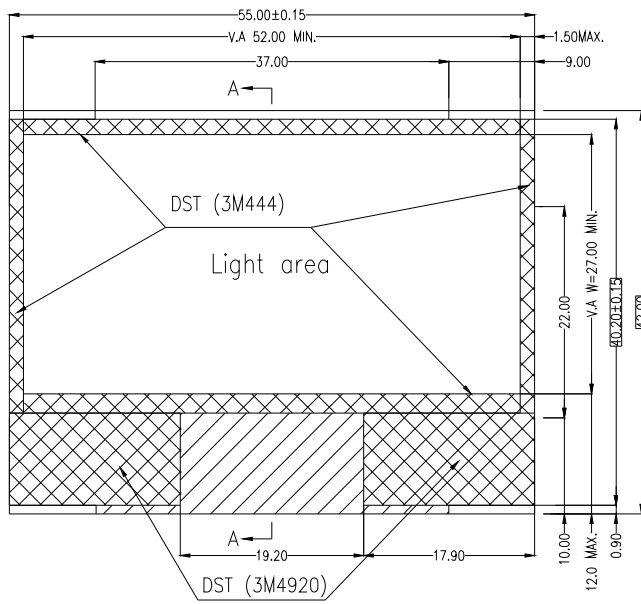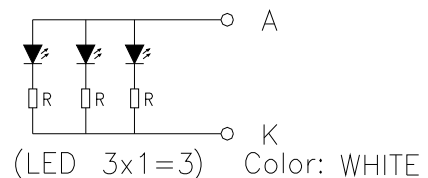
Remarks:
1.Unmarked tolerance is ±0.3
2.All materials comply with RoHs
3.□□□...:critical dimension.
4.LED life time is 50000hours

7. MAXIMUM RATINGS

Parameter	Symbol	Conditions	Unit
Power Supply Voltage	VDD	−0.3 ~ +5.0	V
Power Supply Voltage (VDD standard)	VSS2	−4.0 ~ -1.8	V
Power Supply Voltage (VDD standard)	V5, VOUT	−18.0 ~ +0.3	V
Power Supply Voltage (VDD standard)	V1, V2, V3, V4	V5 to +0.3	V
Input Voltage	VIN	−0.3 to VDD + 0.3	V
Output Voltage	VO	−0.3 to VDD + 0.3	V
Operating Temperature	TOPR	−20 to +70	°C
Storage Temperature	TSTR	−30 to +80	°C

8. ELECTRICAL CHARACTERISTICS

8.1. DC CHARACTERISTICS

Item	symbol	Standard Value			Condition	Unit
		Min	Typ	Max		
Supply Voltage	V_{DD}	2.7	3.0	3.3	-	V
LCD Supply Voltage	V_{OP}	9.3	9.6	9.9	-	V
Supply Current	I_{DD}	-	TBD	-	-	uA

8.2. AC CHARACTERISTICS

8.2.1. System Bus Read/Write Characteristics ST7565V (For the 8080 Series MPU)

(VDD=3.0V, TA=25°C)

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}		100	—	
Enable H pulse width (WRITE)		t_{CCHW}		100	—	
Enable L pulse width (READ)	RD	t_{CCLR}		140	—	
Enable H pulse width (READ)		t_{CCHR}		100		
WRITE Data setup time	D0 to D7	t_{DS8}		40	—	
WRITE Address hold time		t_{DH8}		10	—	
READ access time		t_{ACC8}	$C_L = 100$ pF	—	70	
READ Output disable time		t_{OH8}	$C_L = 100$ pF	5	50	
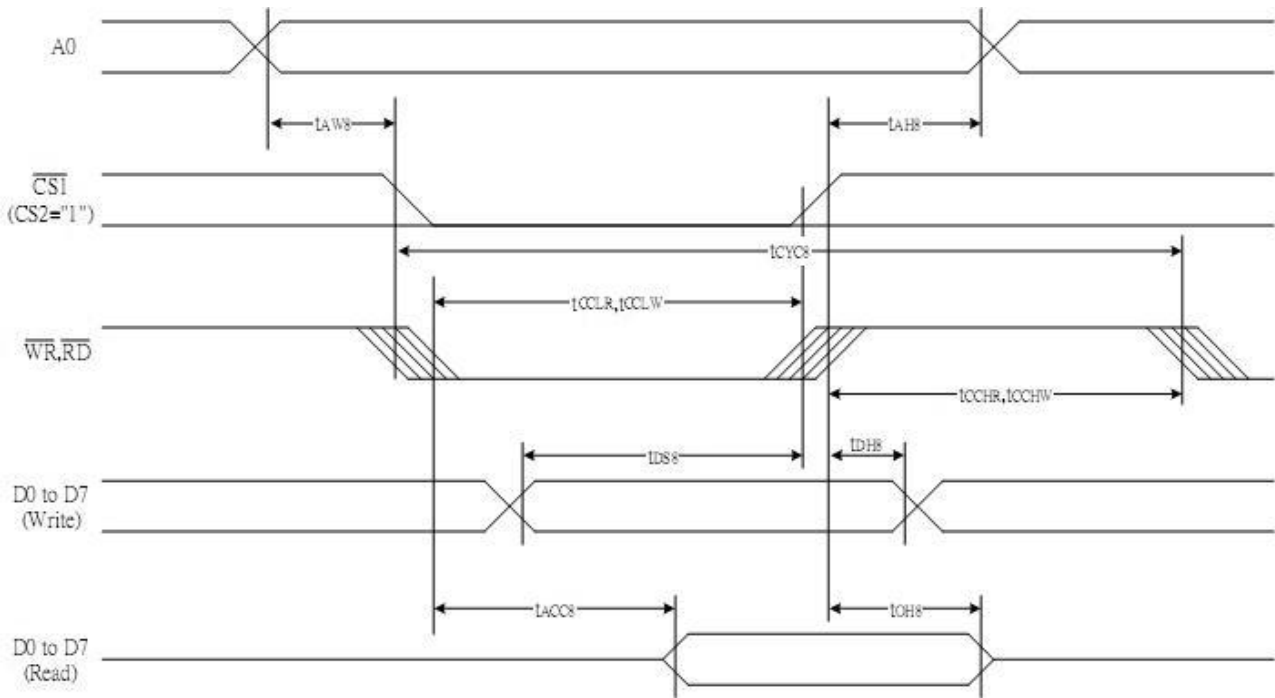
**8.2.2. System Bus Read/Write Characteristics ST7565V (For the 6800 Series MPU)**

Item	Signal	Symbol	Condition	Rating Min.	Rating Max.	Units
Address hold time	A0	t_{AH6}		0	—	ns
Address setup time	A0	t_{AW6}		0	—	ns
System cycle time	A0	t_{CYC6}		240	—	ns
Enable L pulse width (WRITE)	WR	t_{EWLW}		100	—	ns
Enable H pulse width (WRITE)	WR	t_{EWHW}		100	—	ns
Enable L pulse width (READ)	RD	t_{EWLR}		100	—	ns
Enable H pulse width (READ)	RD	t_{EWHR}		140	—	ns
WRITE Data setup time	D0 to D7	t_{DS6}		40	—	ns
WRITE Address hold time	D0 to D7	t_{DH6}		10	—	ns
READ access time	D0 to D7	t_{ACC6}	$C_L = 100$ pF	—	70	ns
READ Output disable time	D0 to D7	t_{OH6}	$C_L = 100$ pF	5	50	ns

8.2.3 The Serial Interface

(VDD = 3.3V, Ta =25°C)

Item	Signal	Symbol	Condition	Rating Min.	Rating Max.	Units
Serial Clock Period	SCL	T scyc		100	—	
SCL "H" pulse width	SCL	T shw		50	—	
SCL "L" pulse width	SCL	T SLW		50	—	
Address setup time	A0	T SAS		20	—	
Address hold time	A0	T sah		10	—	ns
Data setup time	SI	T sds		20	—	
Data hold time	SI	T SDH		10	—	
CS-SCL time	CS	T css		20	—	
CS-SCL time	CS	T csh		40	—	
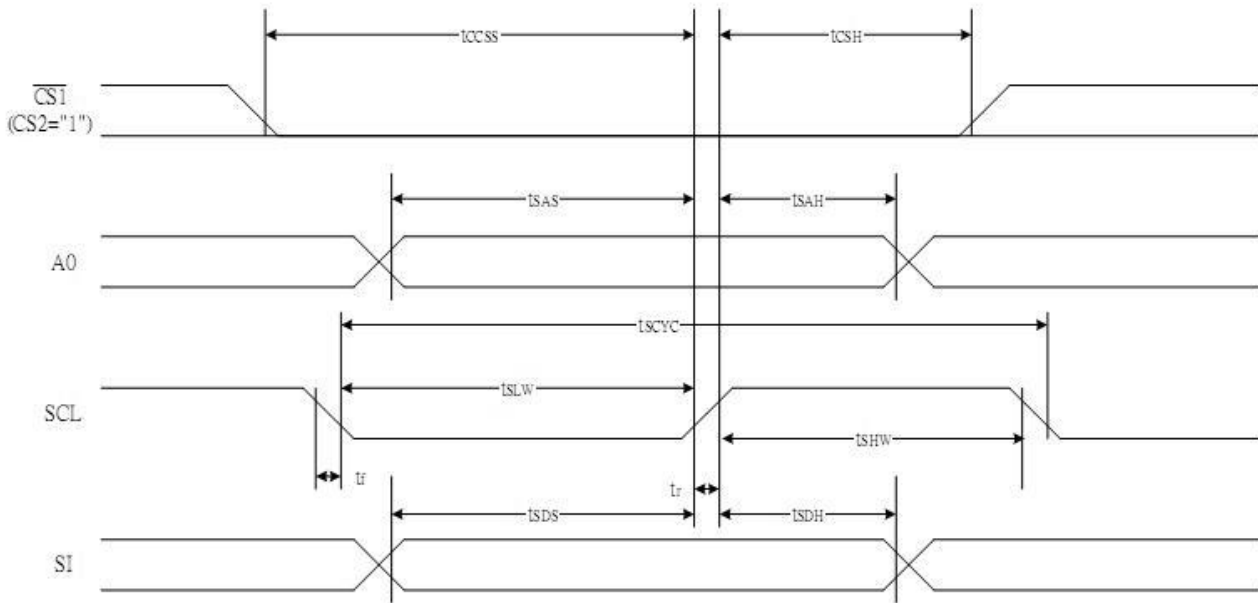
8.3 Reset Timing

Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		tR		—	—	1.0	us
Reset "L" pulse width	/RES	tRW		1.0	—	—	us
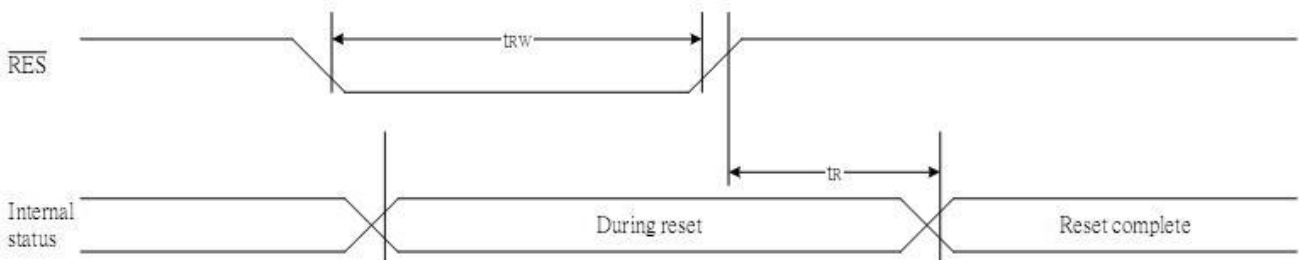
9. COMMANDS DESCRIPTION

Command	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
(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	1	0	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 (ST7565V)
(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) Vs 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 Vs 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 / 0	1 / 0	1 / 0	1 / 0	1 / 0	0	0 / step-up	0 / value	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
(21) Power saver												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 LAYOUT

10.1 LCD Artwork
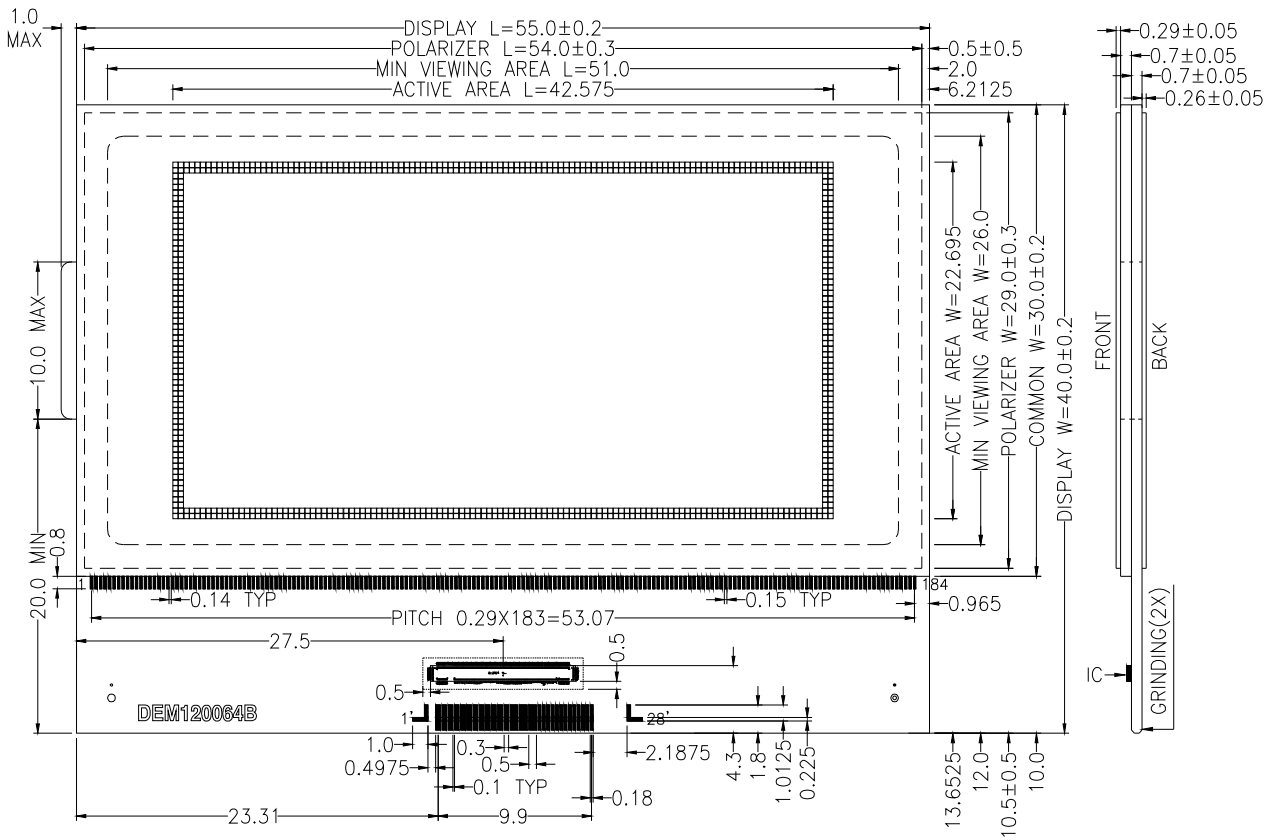
10.2 Pad Configuration Graphic Dimension

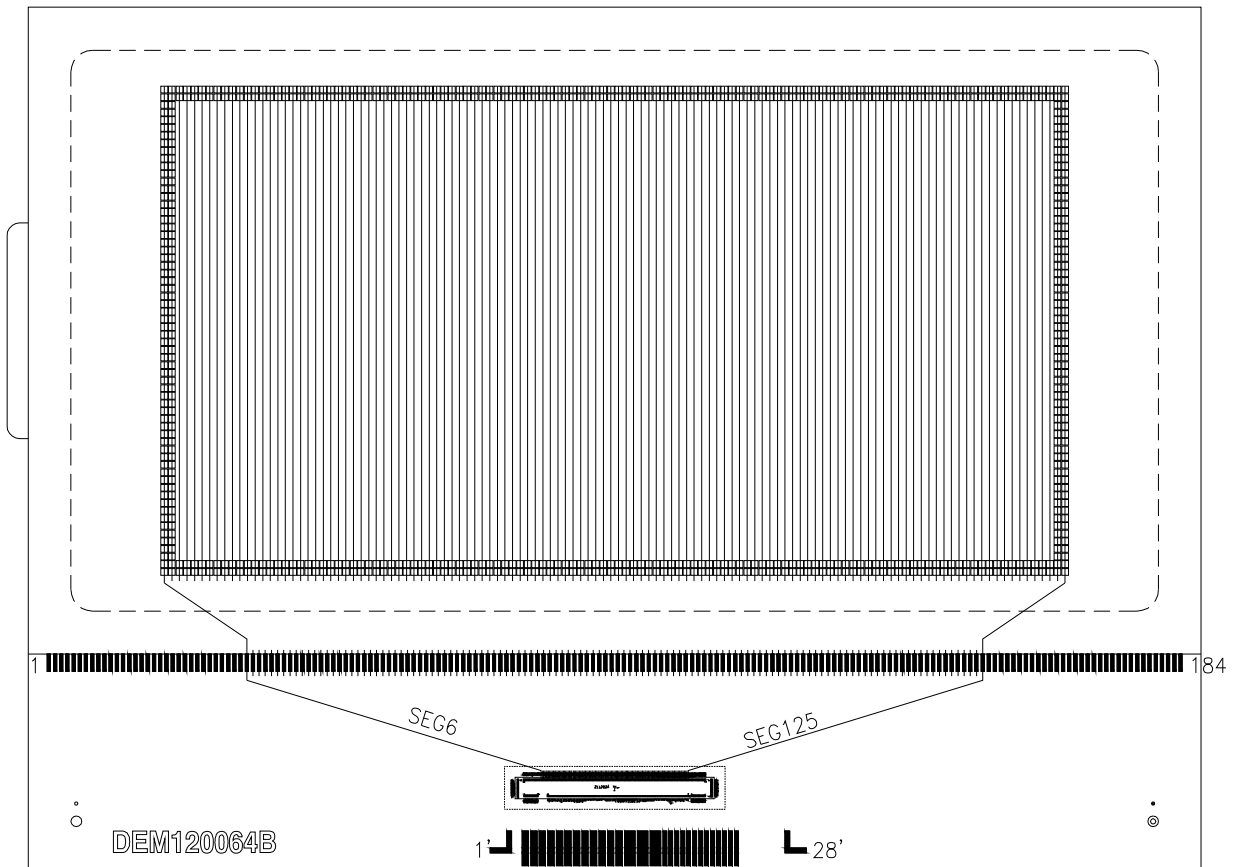| PAD NO.	CONFIGURATION
1	COM31[R33(C1−C120)]
32	COM0[R64(C1−C120)]
33	SEG6[C1(R1−R64)]
152	SEG125[C120(R1−R64)]
153	COM32[R32(C1−C120)]
184	COM63[R1(C1−C120)]
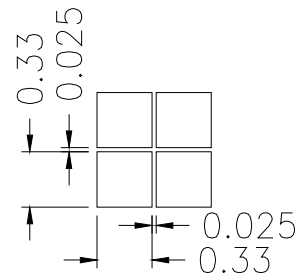
UNLESS OTHERWISE SPECIFIED
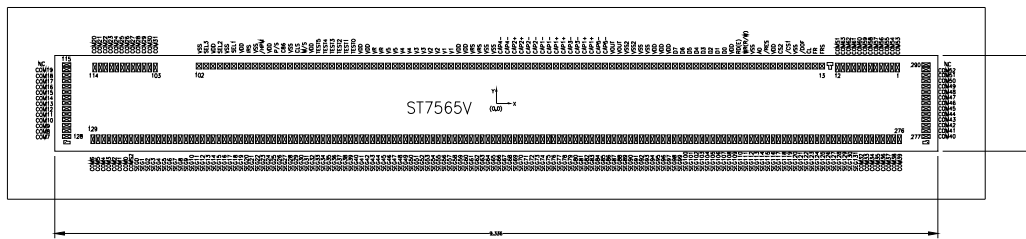DIMENSIONS ARE IN MM
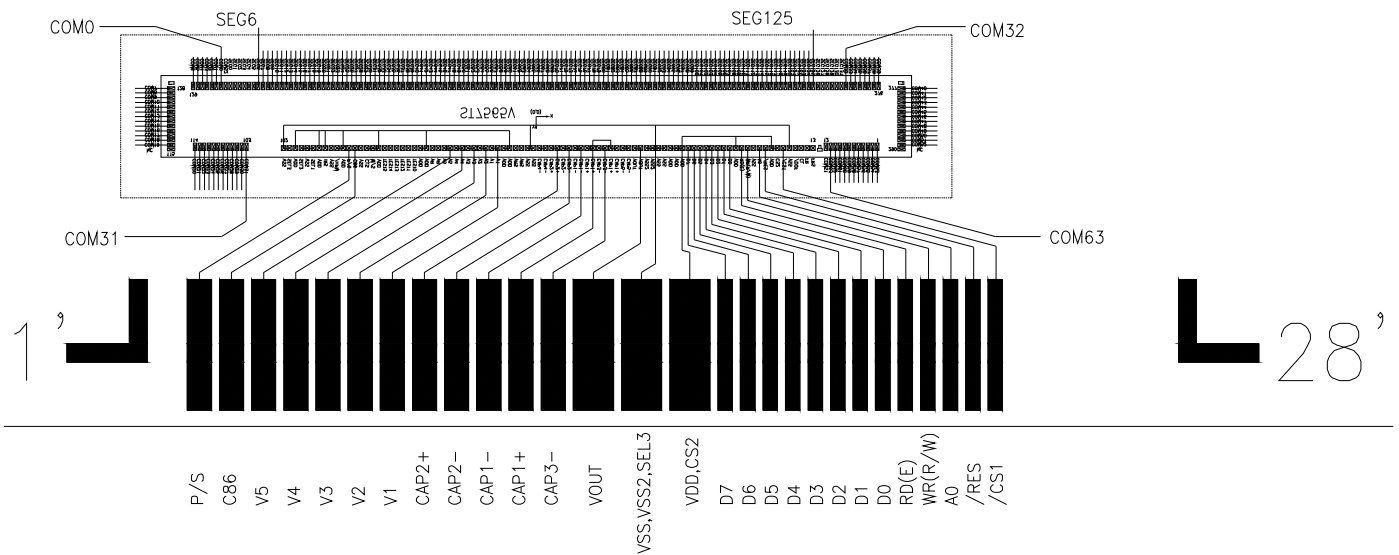TOLERANCES:±0.1MM

10.3 Common Layout
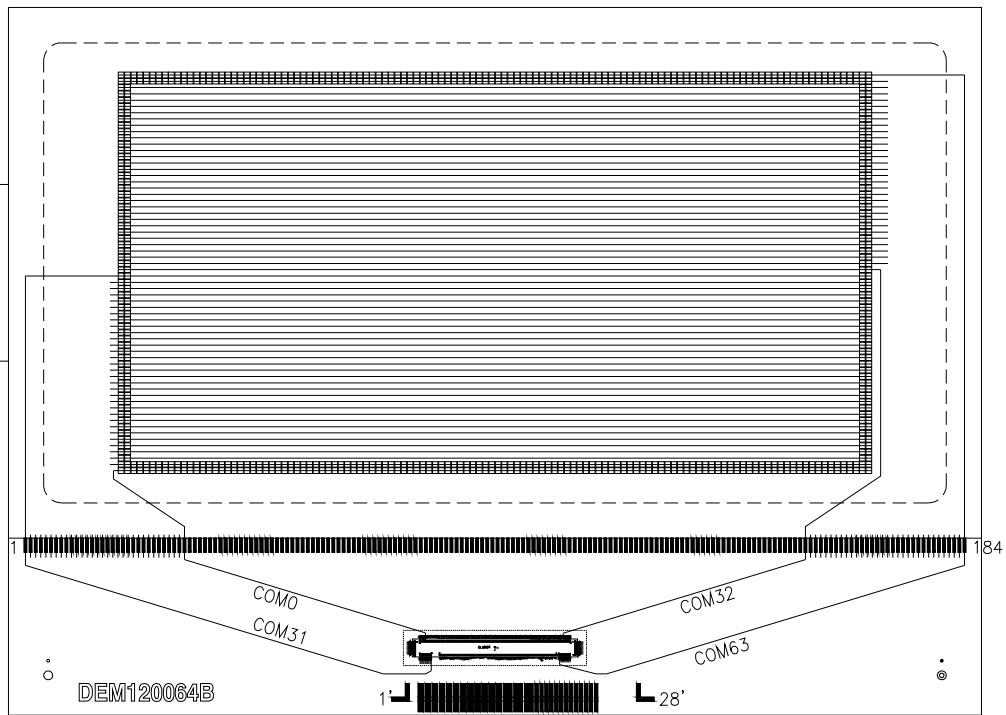
10.4 Segment Layout

10.5 IC NO. Configuration &Pad Configuration

PAD NO.	CONFIGURATION	PAD NO.	CONFIGURATION
1'	P/S	16'	D7
2'	C86	17'	D6
3'	V5	18'	D5
4'	V4	19'	D4
5'	V3	20'	D3
6'	V2	21'	D2
7'	V1	22'	D1
8'	CAP2+	23'	D0
9'	CAP2−	24'	RD(E)
10'	CAP1−	25'	WR(R/W)
11'	CAP1+	26'	A0
12'	CAP3−	27'	/RES
13'	VOUT	28'	/CS1
14'	VSS,VSS2,SEL3		
15'	VDD,CS2		

10.6 IC Layout

11. 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 under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperatures below 0°C).Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

12. 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