

DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 120064B FGH (SERIES)

Product specification

Version: 2

15/Oct/2013

GENERAL SPECIFICATION

MODULE NO. :

DEM 120064B FGH (SERIES)

CUSTOMER P/N

VERSION NO.	CHANGE DESCRIPTION	DATE
0	Original Version	09.07.2013
1	Add UL & Date code	12.09.2013
2	Change Bias and Vop	15.10.2013

PREPARED BY: LX

DATE: 15.10.2013

APPROVED BY: MHO

DATE: 15.10.2013

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1. FUNCTIONS & FEATURES

MODULE MODEL	LCD TYPE
DEM 120064B FGH (FPCR, refl.)	FSTN Grey Reflective Positive Mode
DEM 120064B FGH (FPCR, transfl.)	FSTN Grey Transflective Positive Mode

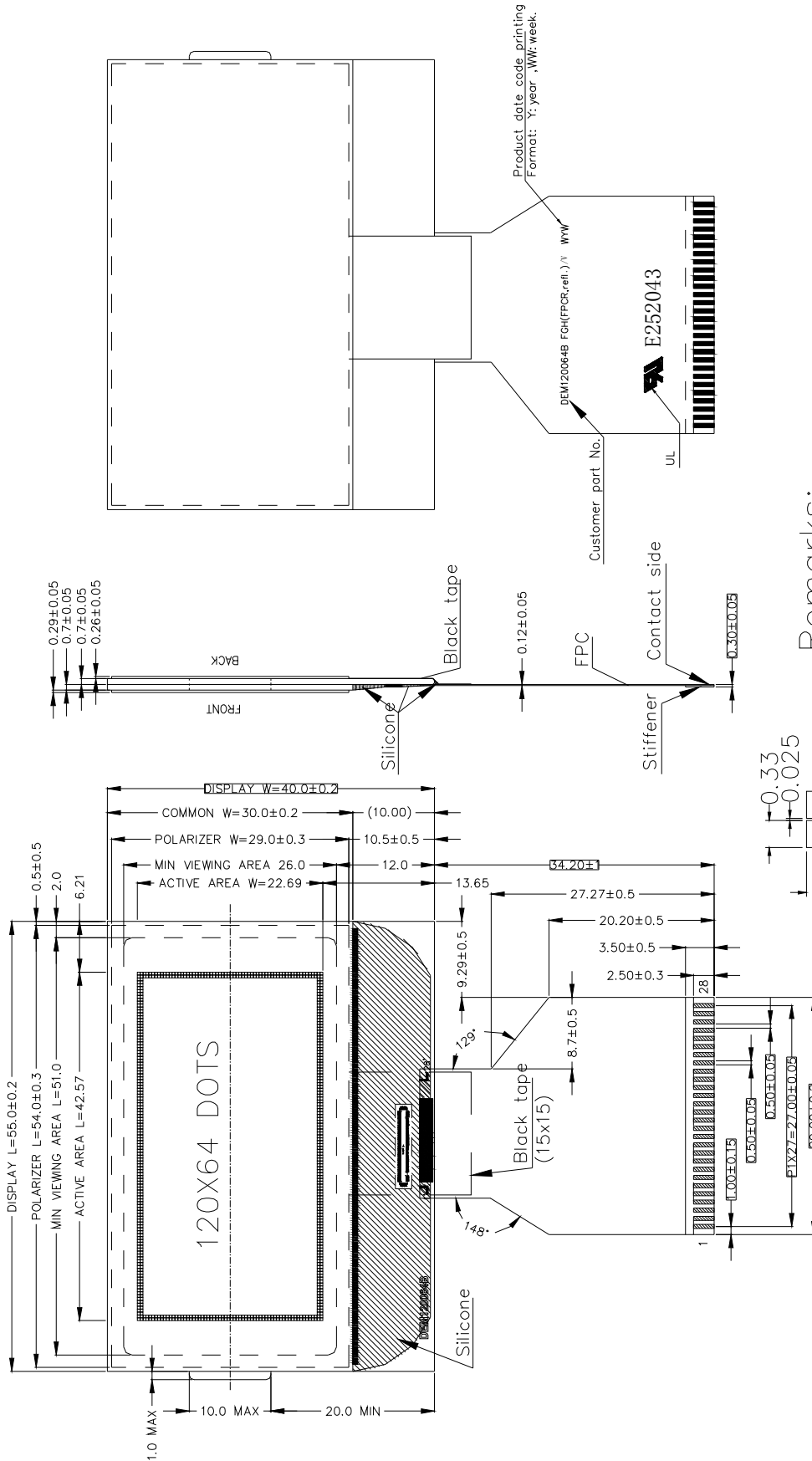
- Viewing Direction : 6 O'clock
- Driving Scheme : 1/64 Duty, 1/7 Bias,
- Display content : 120 x 64Dots
- Power Logic Supply : 3.0 Volt (typ.)
- V_{LCD} : 9.6 Volt (typ.)
- Interface : Parallel /Serial interface
- Driver IC : ST7565V
- RoHS : Compliant

2. MODULE ARTWORK

- Module size(without FPC) : 55.00 x 40.00 x 1.95 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

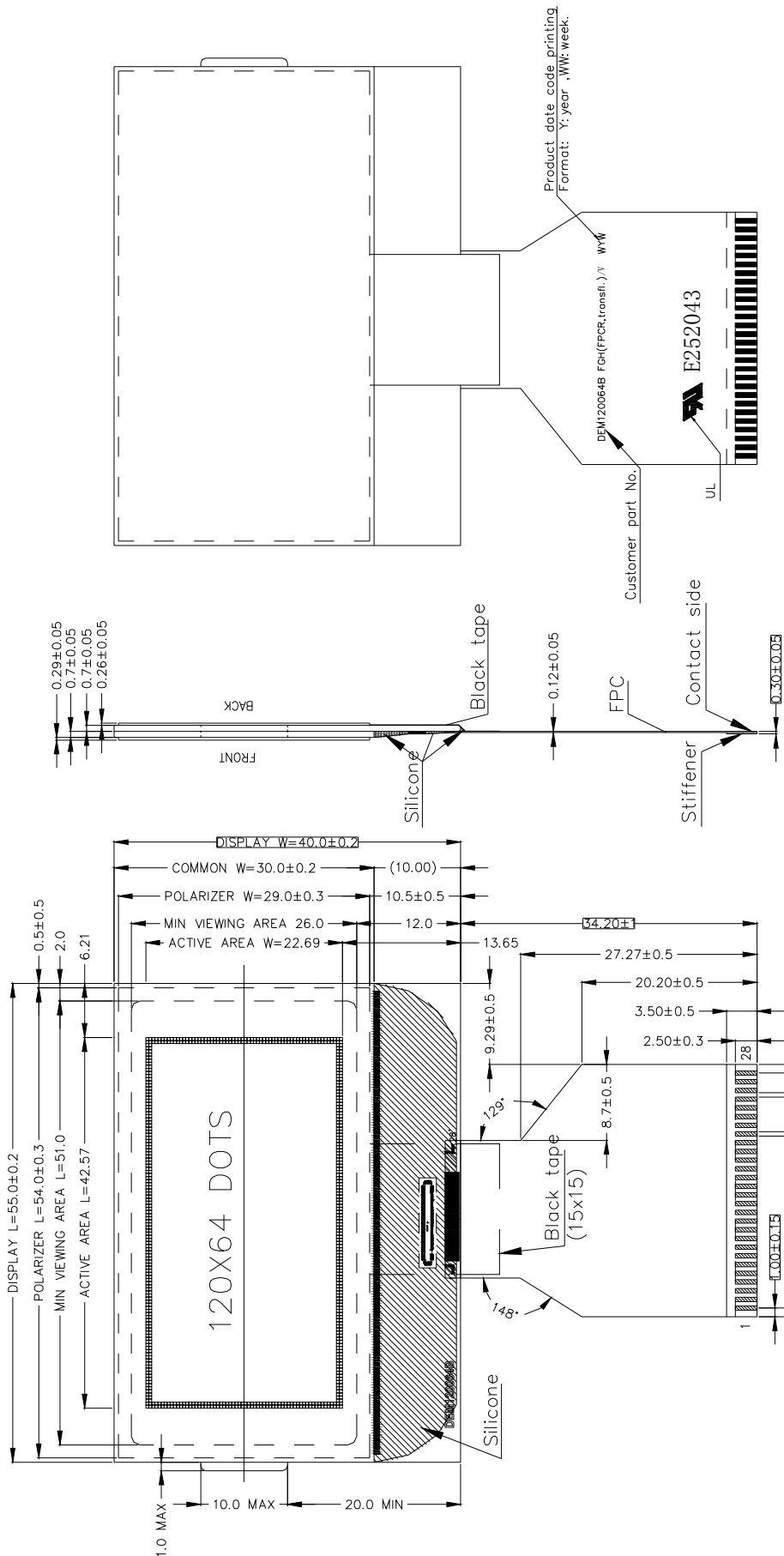
3.1 Relective Version



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

Detail SC 10:1

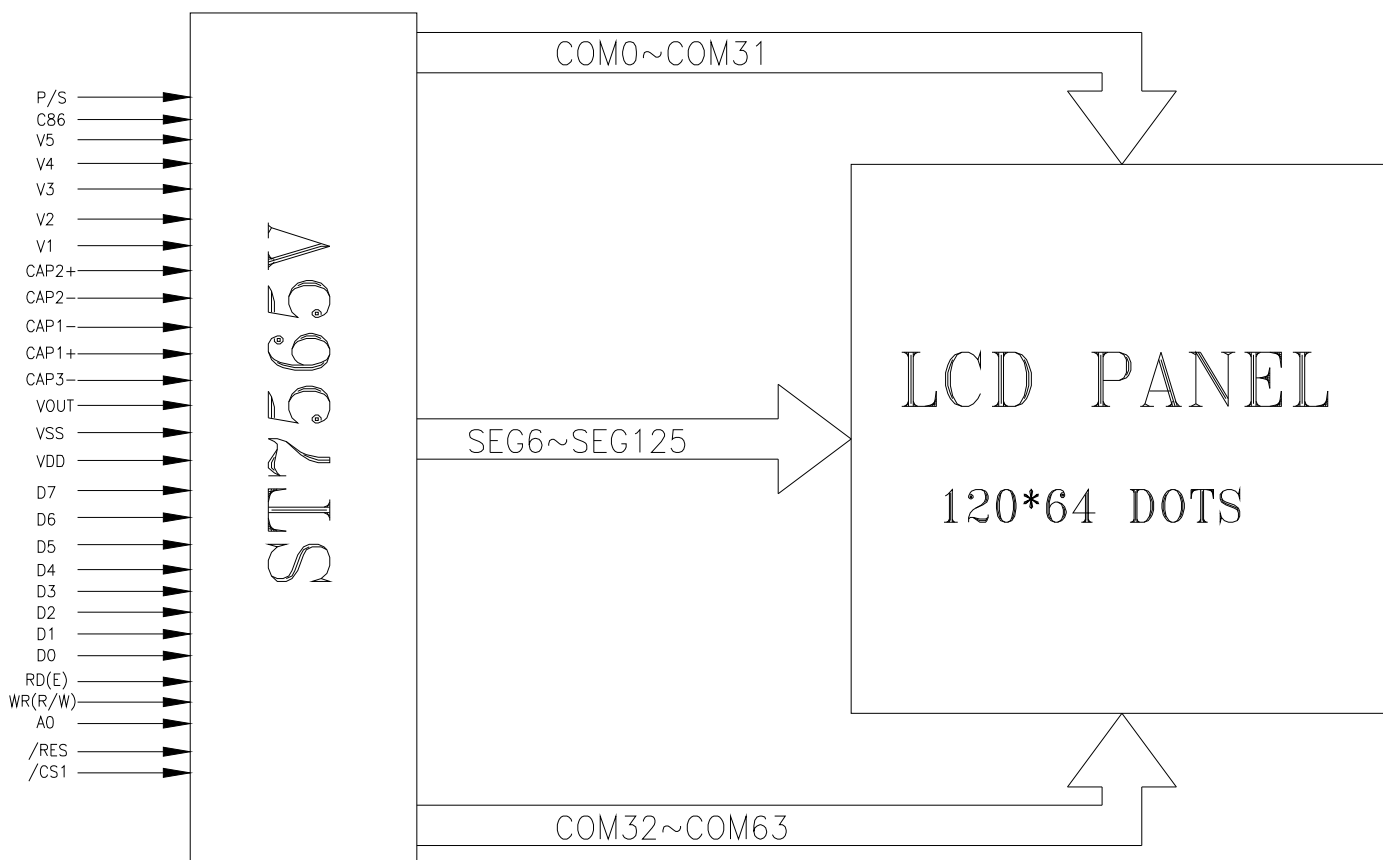
3.1 Transflective Version



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

Detail SC 10:1

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 applied is determined by the liquid crystal cell, and is changed through the use of a resistive voltage divider or through changing the impedance using an op. amp. Voltage levels are determined based on VDD, and must maintain the relative magnitudes shown below.
5	V4	
6	V3	
7	V2	
8	V1	
		$VDD (= V0) \geq V1 \geq V2 \geq V3 \geq V4 \geq V5$
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. When the serial interface is selected (P/S = "L") : D7: serial data input (SI); D6: the serial clock input (SCL). D0 to D5 are set to high impedance. When the chip select is not active, D0 to D7 are set to high impedance.
17	D6	
18	D5	
19	D4	
20	D3	
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.

6. 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

7. ELECTRICAL CHARACTERISTICS

7.1. DC CHARACTERISTICS

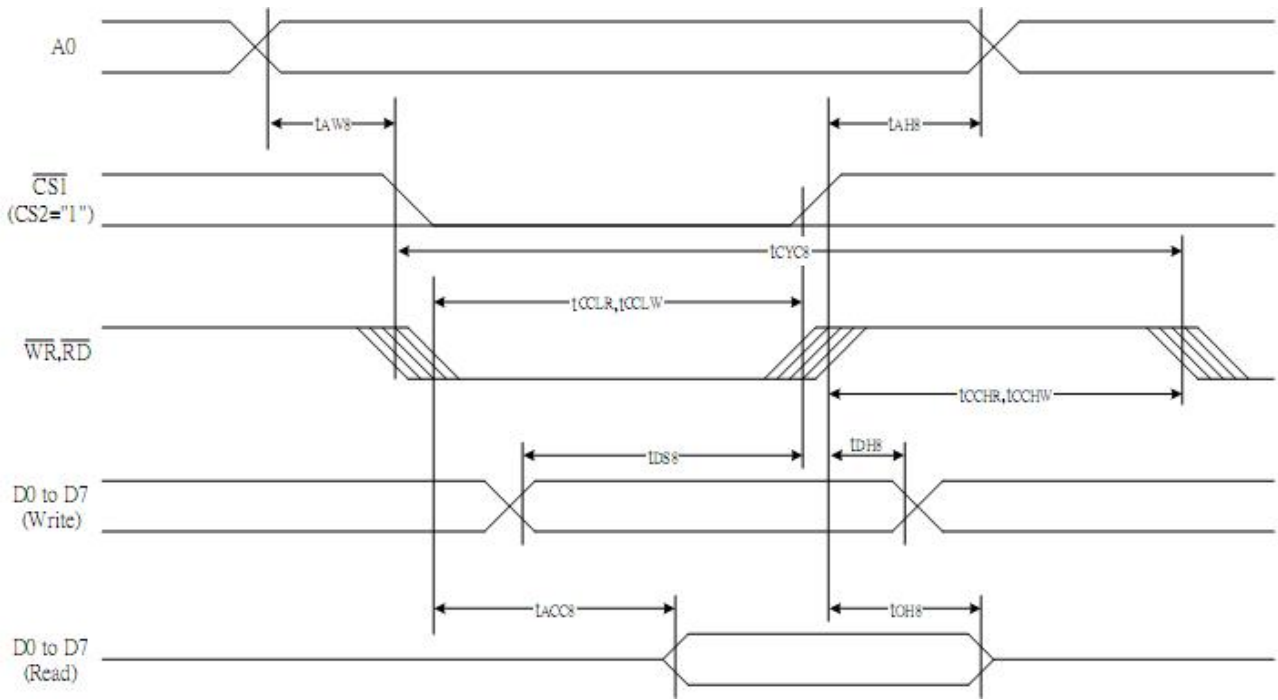
Item	Symbol	Standard Value			Condition	Unit
		Min	Typ	Max		
Supply Voltage	V _{DD}	2.7	3.0	3.3	-	V
LCD Supply Voltage	V _{OP}	9.3	9.6	9.9	-	V
Supply Current	I _{DD}	-	TBD	-	-	uA

7.2. AC CHARACTERISTICS

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

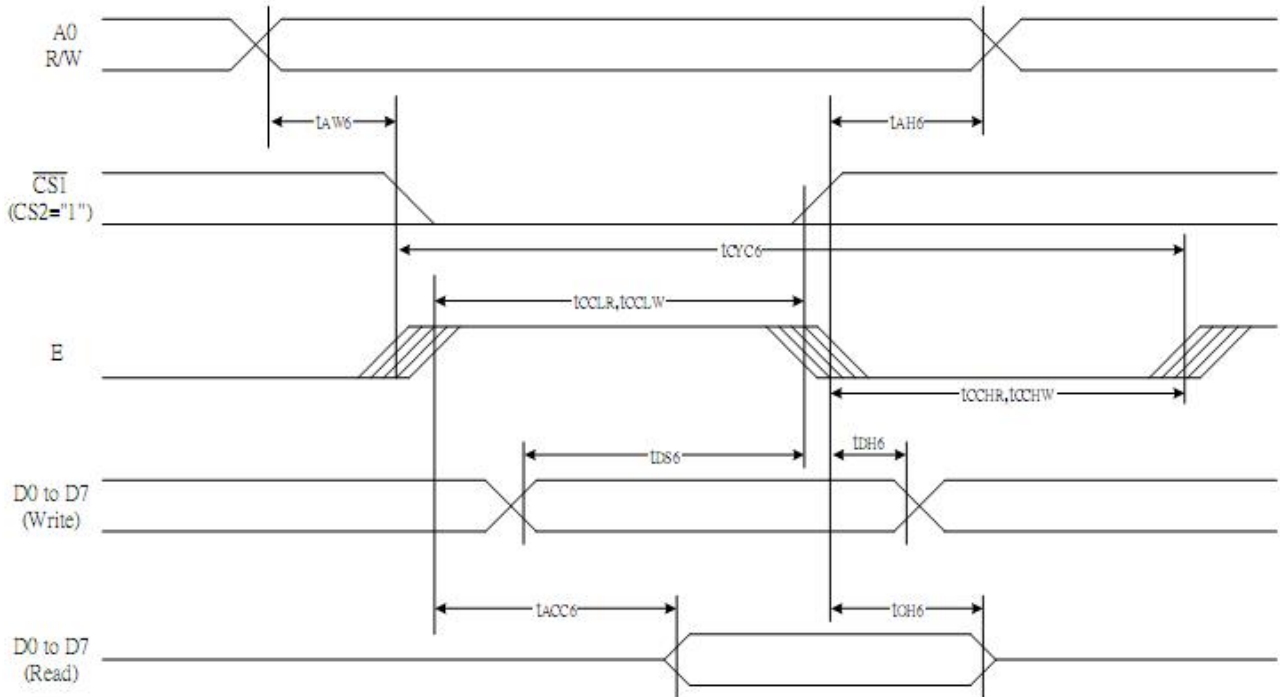
(VDD=3.0V, TA=25°C)

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}	CL = 100 pF	—	70	
READ Output disable time		t _{OH8}	CL = 100 pF	5	50	



7.2.2. System Bus Read/Write Characteristics ST7565V (For the 6800 Series MPU)

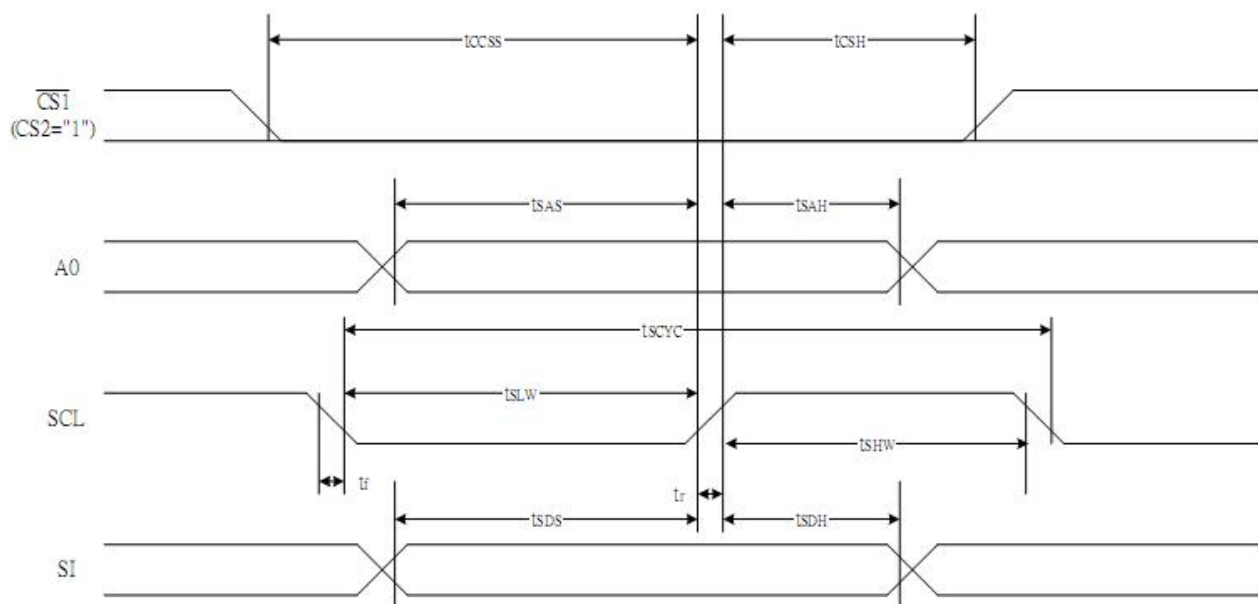
Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	tAH6		0	—	ns
Address setup time		tAW6		0	—	
System cycle time		tCYC6		240	—	
Enable L pulse width (WRITE)	WR	tEWLW		100	—	
Enable H pulse width (WRITE)		tEWHW		100	—	
Enable L pulse width (READ)	RD	tEWLR		100	—	
Enable H pulse width (READ)		tEWHR		140	—	
WRITE Data setup time	D0 to D7	tDS6		40	—	
WRITE Address hold time		tDH6		10	—	
READ access time		tACC6	CL = 100 pF	—	70	
READ Output disable time		tOH6	CL = 100 pF	5	50	



7.2.3 The Serial Interface

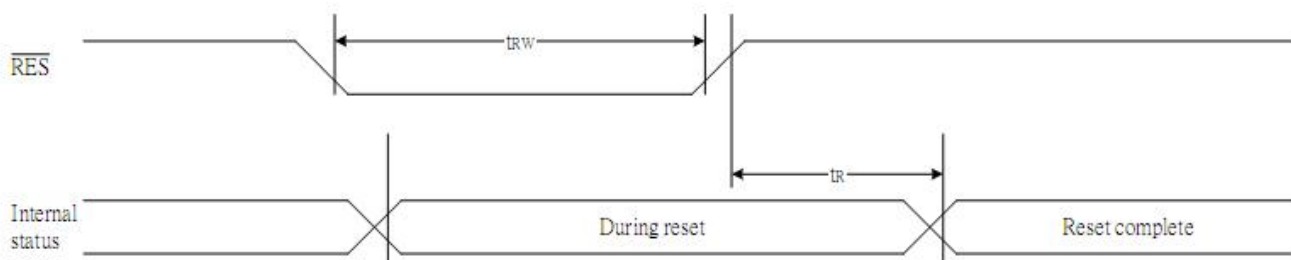
(VDD = 3.3V, Ta = 25°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial Clock Period	SCL	T_{scyc}		100	—	ns
SCL "H" pulse width		T_{shw}		50	—	
SCL "L" pulse width		T_{slw}		50	—	
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	—	



7.3 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

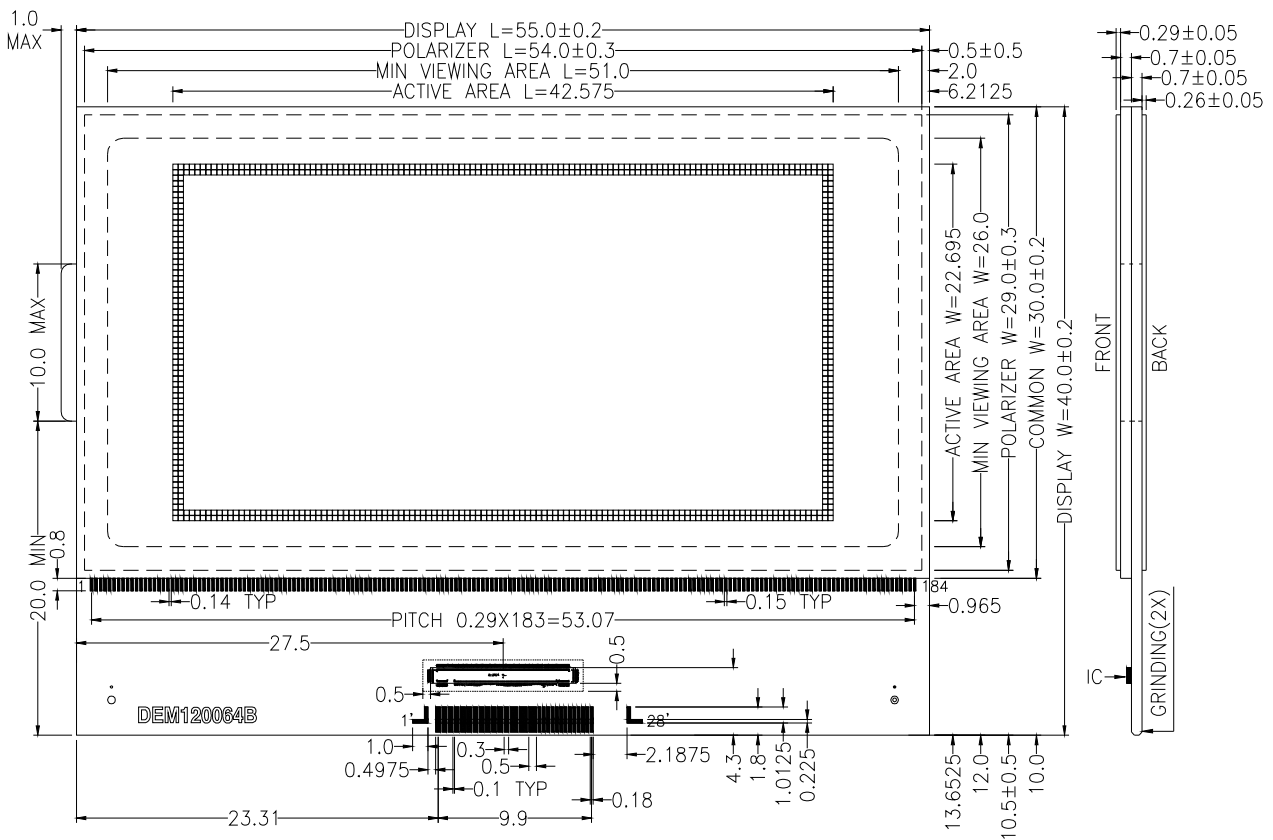


8. COMMANDS DESCRIPTION

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	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	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	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	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	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	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	*	*	*	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	0: OFF, 1: ON
Static indicator register set				0	0	0	0	0	0	0	1	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
(21) Power saver				0	0	0	0	0	0	0	1	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

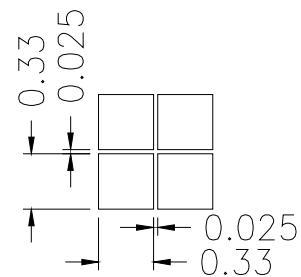
9. LCD LAYOUT

9.1 LCD Artwork



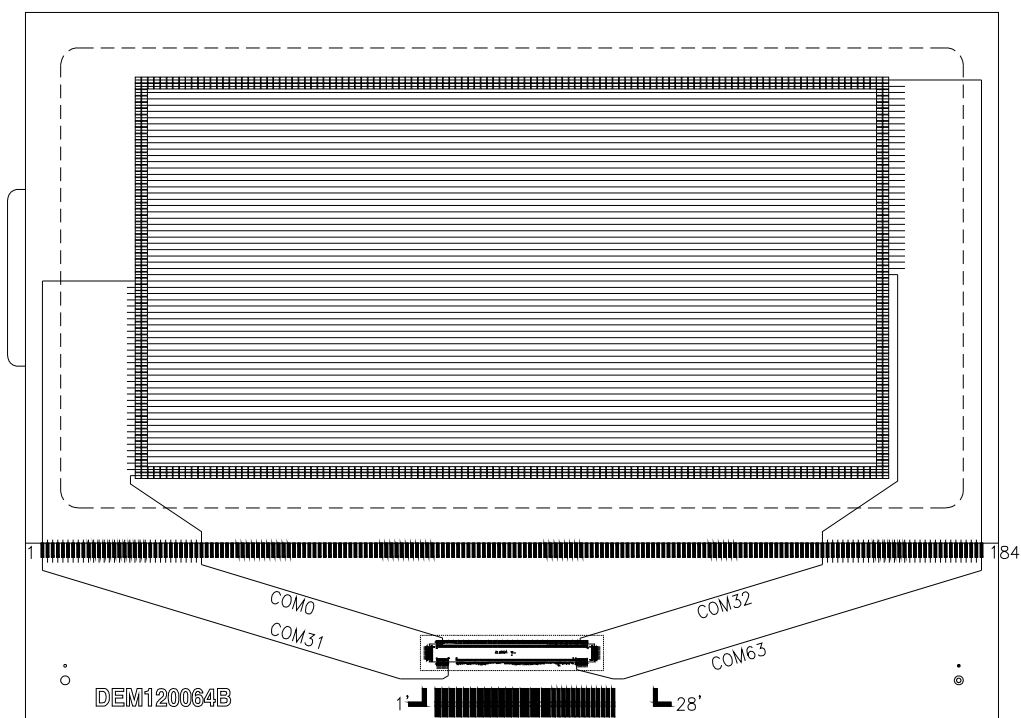
9.2 Pad Configuration Graphic Dimension

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)]

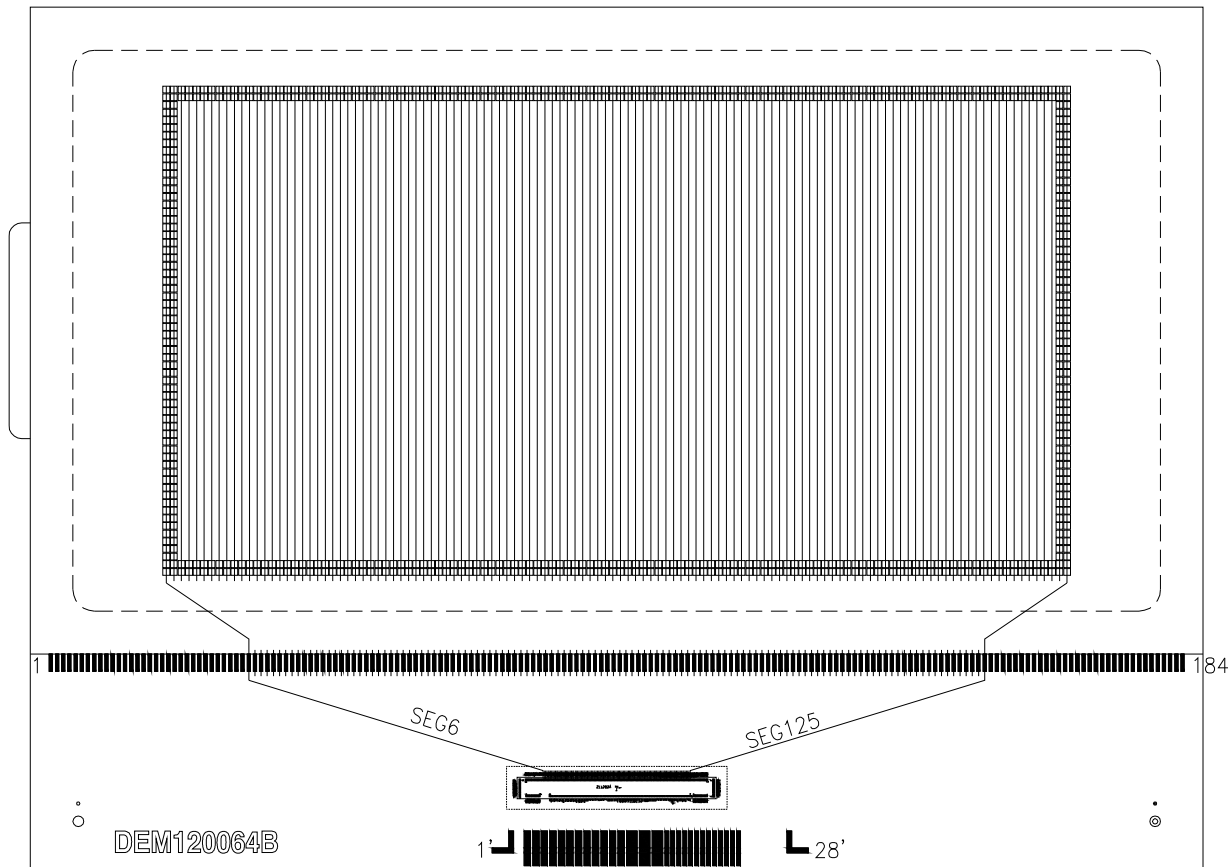


UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN MM
TOLERANCES: ±0.1MM

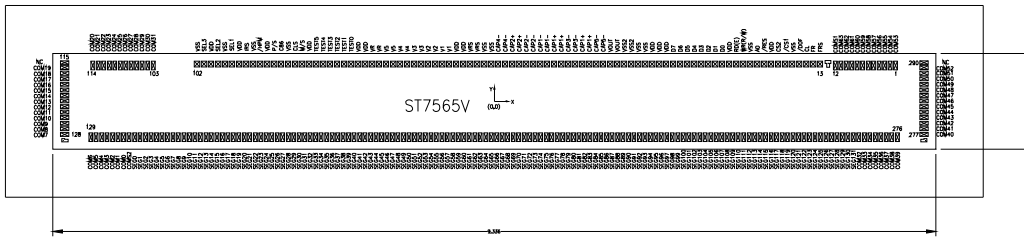
9.3 Common Layout



9.4 Segment Layout

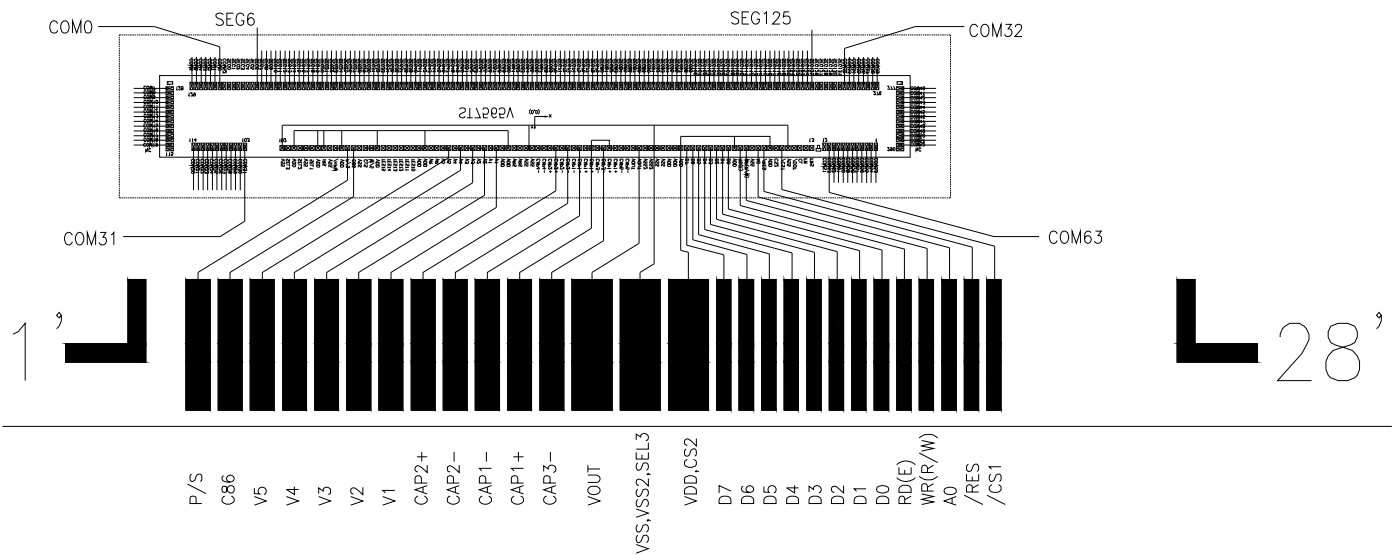


9.5 IC NO. Configuration & Pad Configuration



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		

9.6 IC Layout



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 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.

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