

**DISPLAY Elektronik GmbH**

**DATA SHEET**

**LCD MODULE**

**DEM 128064F1 FGH-PW**

*Product Specification*

*Version: 0*

**16.08.2021**

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# GENERAL SPECIFICATION

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MODULE NO. :

# DEM 128064F1 FGH-PW

VERSION NO.	CHANGE DESCRIPTION	DATE
0	Original Version	16.08.2021

PREPARED BY: LM

DATE: 16.08.2021

APPROVED BY: WH

DATE: 16.08.2021

**CONTENTS**

**1. FUNCTIONS & FEATURES.....2**

**2. MECHANICAL SPECIFICATIONS ..... 3**

**3. EXTERNAL DIMENSIONS ..... 4**

**4. BLOCK DIAGRAM..... 5**

**5. PIN DESCRIPTION..... 6**

**6. ABSOLUTE MAXIMUM RATINGS ..... 7**

**7. BACKLIGHT CHARACTERISTICS..... 7**

**8. ELECTRICAL CHARACTERISTICS ..... 8**

**9. INSTRUCTION DESCRIPTION ..... 12**

**10. LCD ARTWORK..... 13**

**11.PAD CONFIGURATION ..... 14**

**12. LCD LABELING ..... 15**

**13. SEG LAYOUT ..... 16**

**14 COM LAYOUT ..... 16**

**15. PAD CONFIGURATION GRAPHIC DIMENSION ..... 17**

**16. IC LAYOUT ..... 17**

**17. QUALITY DESCRIPTION ..... 18**

**18. MODULE ACCEPTS QUALITY LEVEL (AQL). ..... 19**

**19. RELIABILITY TEST..... 19**

**20. LCD MODULES HANDLING PRECAUTIONS ..... 20**

**21. OTHERS..... 20**

**1. FUNCTIONS & FEATURES**

I DEM128064F1 Series LCD Type :

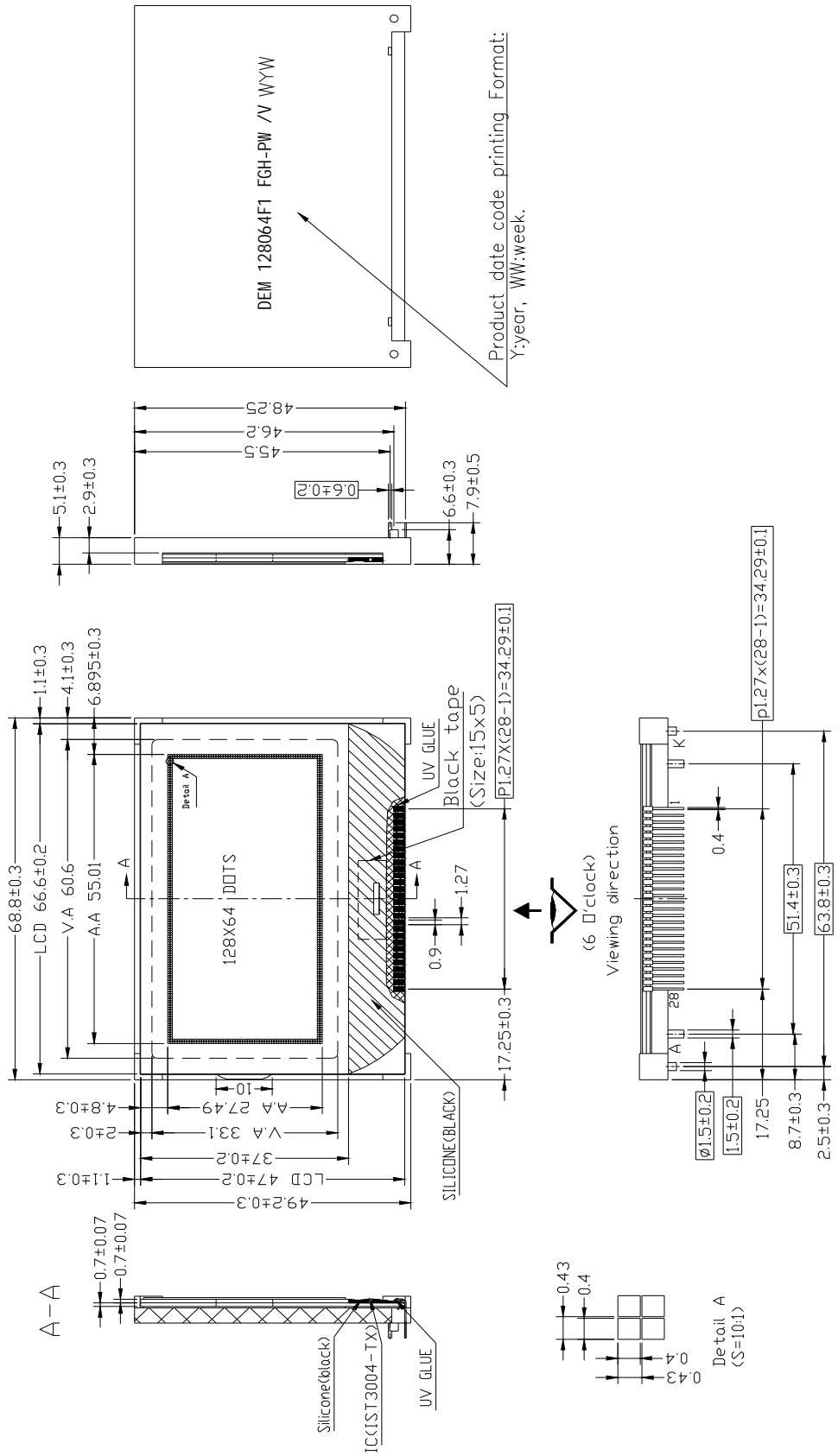
MODULE	LCD TYPE	REMARKS
DEM 128064F1 FGH-PW	FSTN Transflective positive Mode	

- I Viewing Direction : 6 O'clock
- I Driving Scheme : 1/65 Duty Cycle, 1/9 Bias
- I Power Supply Voltage(Typ.) : 3.0 V
- I LCD Operation Voltage : 9.8 V
- I Display Contents :128x64 Dots
- I Backlight Color : White
- I Driver IC : IST3004-TX
- I Operating Temperature : -20°C ~ +70°C
- I Storage Temperature : -30°C ~ +80°C
- I RoHS Compliant

**2. MECHANICAL SPECIFICATIONS**

- I Module Size: : 68.80 x 49.20 x 8.50mm
- I Viewing Area Size: : 60.60 x 33.10 mm
- I Active Area Size : 55.01 x 27.49mm
- I Dot Pitch: : 0.43 x 0.43mm
- I Dot Size: : 0.40 x 0.40mm

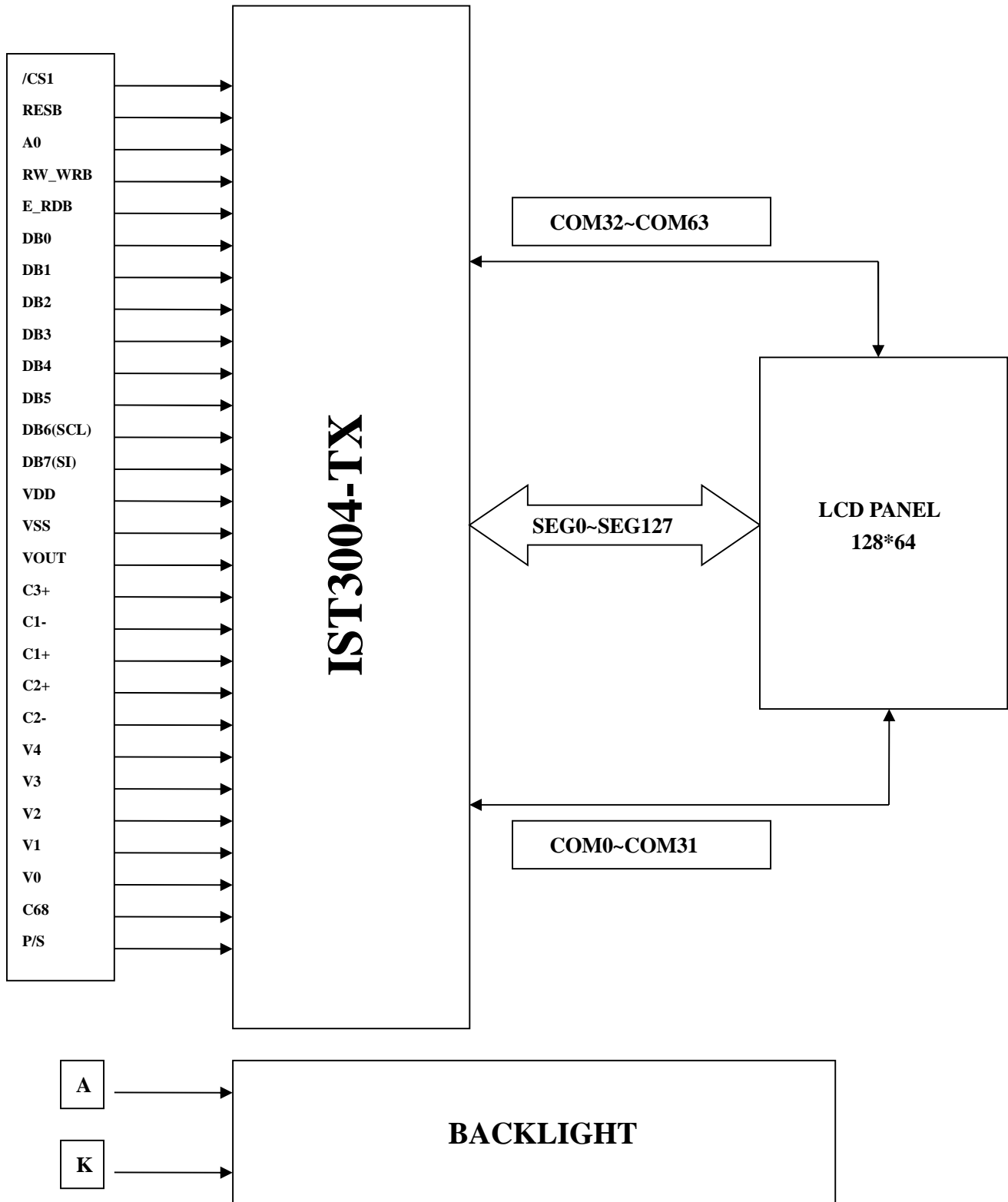
3. EXTERNAL DIMENSIONS



Product date code printing Format:  
Y:year, WW:week.

Remarks:  
1.Unmarked tolerance is  $\pm 0.30$ ;  
2.All material comply with RoHs.

4. BLOCK DIAGRAM



5. PIN DESCRIPTION

Pin No.	Name	I/O	Description																					
1	CS1B	I	Chip select input pins Data / instruction I/O is enabled only when CS1B is "L" and CS2 is "H". when chip select is non-active, DB0 to DB7 may be high impedance																					
2	RESB	I	Hardware Reset input pin When RESB is "L", initialization is executed.																					
3	A0	I	Register select input pin - A0 = "H" : DB0 to DB7 are display data - A0 = "L" : DB0 to DB7 are control data																					
4	RW_WRB	I	Read / Write execution control pin																					
			<table border="1"> <thead> <tr> <th>C86</th> <th>MPU Type</th> <th>RW_WRB</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>H</td> <td>6800-series</td> <td>WR</td> <td>Read / Write control input pin - RW = "H" : read - RW = "L" : write</td> </tr> <tr> <td>L</td> <td>8080-series</td> <td>/WRB</td> <td>Write enable clock input pin The data on DB0 to DB7 are latched at the rising edge of the /WRB signal.</td> </tr> </tbody> </table>	C86	MPU Type	RW_WRB	Description	H	6800-series	WR	Read / Write control input pin - RW = "H" : read - RW = "L" : write	L	8080-series	/WRB	Write enable clock input pin The data on DB0 to DB7 are latched at the rising edge of the /WRB signal.									
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5	E_RDB	I	Read / Write execution control pin																					
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L	8080-series	/RDB	Read enable clock input pin When / RDB is "L", DB0 to DB7 are in an output status.																					
6~13	DB0~DB7	I/O	8-bit bi-directional data bus that is connected to the standard 8-bit microprocessor data bus. When the serial interface selected (PS = "L"); - DB0 to DB5 : high impedance - DB6 : serial input clock (SCL) - DB7 : serial input data (SDI) When chip select is not active, DB0 to DB7 may be high impedance.																					
14	VDD	Supply	Power supply for logic.																					
15	VSS	Supply	Ground.																					
16	Vout	Supply	DC/DC voltage converter																					
17	C3+	O																						
18	C1-	O																						
19	C1+	O																						
20	C2+	O																						
21	C2-	O																						
22	V4	Supply	LCD driver supply voltages The voltage determined by LCD pixel is impedance-converted by an operational amplifier for application. Voltages should have the following relationship; $V0 \geq V1 \geq V2 \geq V3 \geq V4 \geq VSS$ When the internal power circuit is active, these voltages are generated as following as following table according to the state of LCD bias.																					
23	V3																							
24	V2																							
25	V1																							
26	V0																							
			<table border="1"> <thead> <tr> <th>LCD bias</th> <th>V1</th> <th>V2</th> <th>V3</th> <th>V4</th> </tr> </thead> <tbody> <tr> <td>1/9bias</td> <td>(8/9) x V0</td> <td>(7/9) x V0</td> <td>(2/9) x V0</td> <td>(1/9) x V0</td> </tr> </tbody> </table>	LCD bias	V1	V2	V3	V4	1/9bias	(8/9) x V0	(7/9) x V0	(2/9) x V0	(1/9) x V0											
LCD bias	V1	V2	V3	V4																				
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27	C68	I	Microprocessor Interface Select input pin in parallel mode - C68 = "H" : 6800-series MPU interface - C68 = "L" : 8080-series MPU interface																					
28	P/S	I	Parallel / serial data input select input																					
			<table border="1"> <thead> <tr> <th>PS</th> <th>Interface Mode</th> <th>Chip Select</th> <th>Data / instruction</th> <th>Data</th> <th>Read / Write</th> <th>Serial clock</th> </tr> </thead> <tbody> <tr> <td>"H"</td> <td>Parallel</td> <td>CS1B</td> <td>A0</td> <td>DB0 to DB7</td> <td>E_RDB RW_WRB</td> <td>--</td> </tr> <tr> <td>"L"</td> <td>Serial</td> <td>CS1B</td> <td>A0</td> <td>SDI (DB7)</td> <td>Write only</td> <td>SCL (DB6)</td> </tr> </tbody> </table>	PS	Interface Mode	Chip Select	Data / instruction	Data	Read / Write	Serial clock	"H"	Parallel	CS1B	A0	DB0 to DB7	E_RDB RW_WRB	--	"L"	Serial	CS1B	A0	SDI (DB7)	Write only	SCL (DB6)
			PS	Interface Mode	Chip Select	Data / instruction	Data	Read / Write	Serial clock															
"H"	Parallel	CS1B	A0	DB0 to DB7	E_RDB RW_WRB	--																		
"L"	Serial	CS1B	A0	SDI (DB7)	Write only	SCL (DB6)																		
			<NOTE> In serial mode, it is impossible to read data from the on-chip RAM. And DB0 to DB5 and E_RDB and RW_WRB must be fixed to either "H" or "L".																					

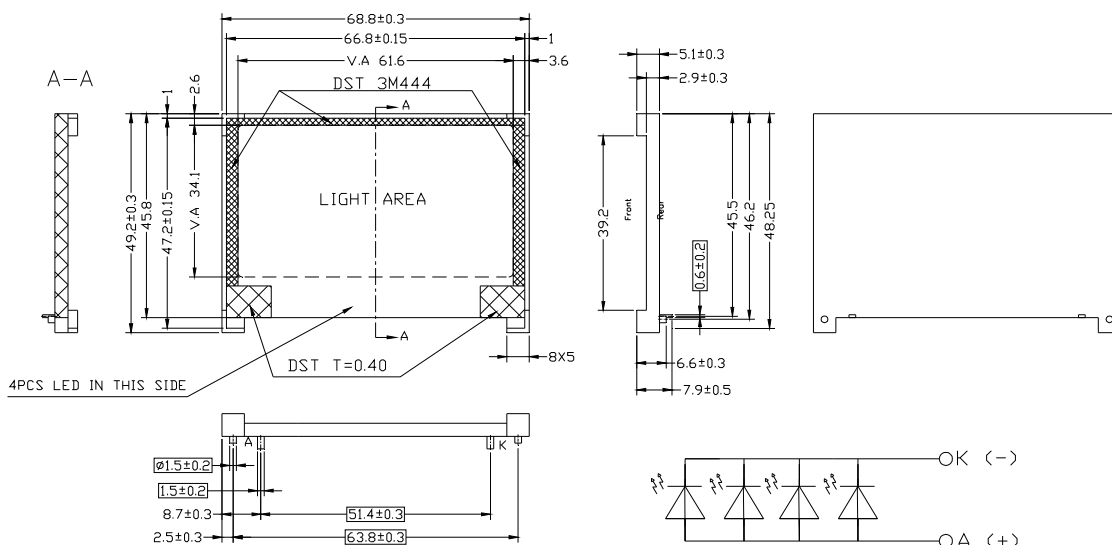
A	Supply voltage for backlight LED+
K	Supply voltage for backlight LED-

6. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Unit
Power Supply Voltage	VDD	-0.3 ~ 7.0	V
Power supply voltage (VDD standard)	V0, VOUT	-0.3 ~ 15.0	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

7. BACKLIGHT CHARACTERISTICS

项目 Item	符号 Symbol	最小值 min.	典型值 typ.	最大值 max.	单位 Unit	测定条件 Condition
正向电压 Forward Voltage	Vf	2.6	3.0	3.3	V	If= 60 mA
消耗功率 Power Dissipation	Pd	156	180	204	mW	If= 60 mA
* 均匀度 Luminous Uniformity	ΔLv	70			%	MIN/MAX*100%
* 亮度 Luminance	Lv		250		cd/m <sup>2</sup>	If= 60 mA T=25°C
* 色度坐标 Color Coordinate	X	0.240		0.330		
	Y	0.240		0.330		
峰值波长 Peak wave length	λP	-	-	-	nm	



Remarks:  
 1.Unmarked tolerance is ±0.20;  
 2.All material comply with RoHs.



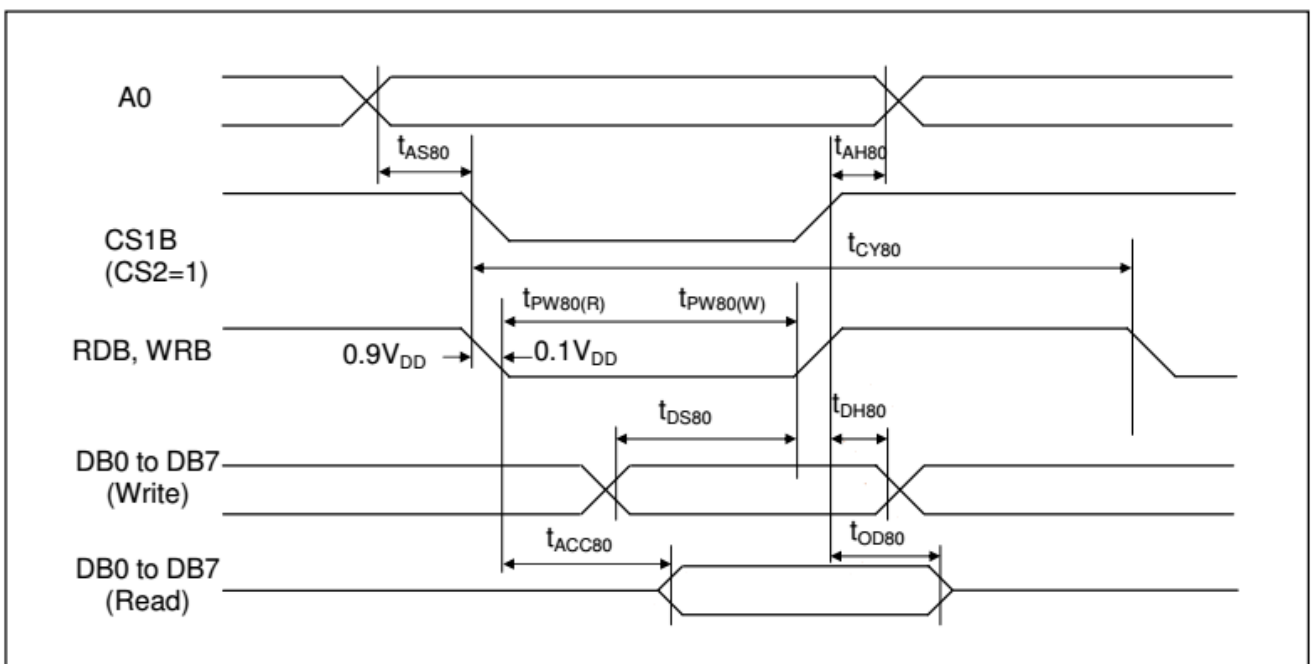
8. ELECTRICAL CHARACTERISTICS

8.1. DC CHARACTERISTICS

Item	Symbol	Condition	STANDARD VALUE			units
			Min.	Typ.	Max.	
Operating Voltage	VDD	Relative to VSS	2.7	3.0	3.3	V
LCD Driving Voltage	VLCD	Relative to VSS	9.6	9.8	10	
Consumption Current	IDD	-	-	TBD	-	mA

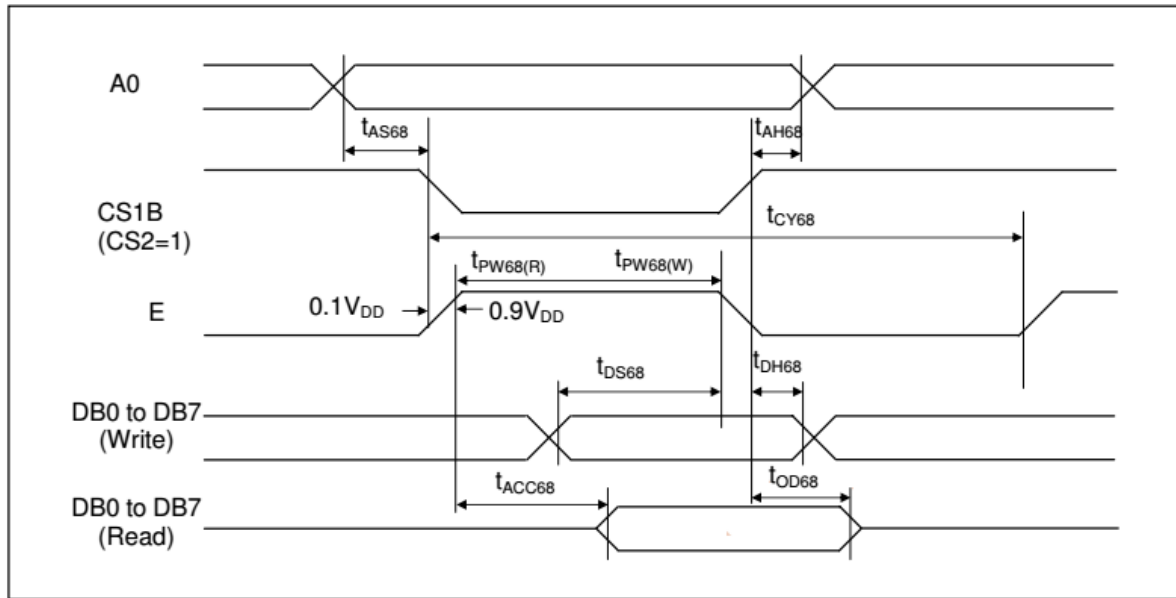
8.2. AC CHARACTERISTICS

Read / Write Characteristics (8080-series MPU)



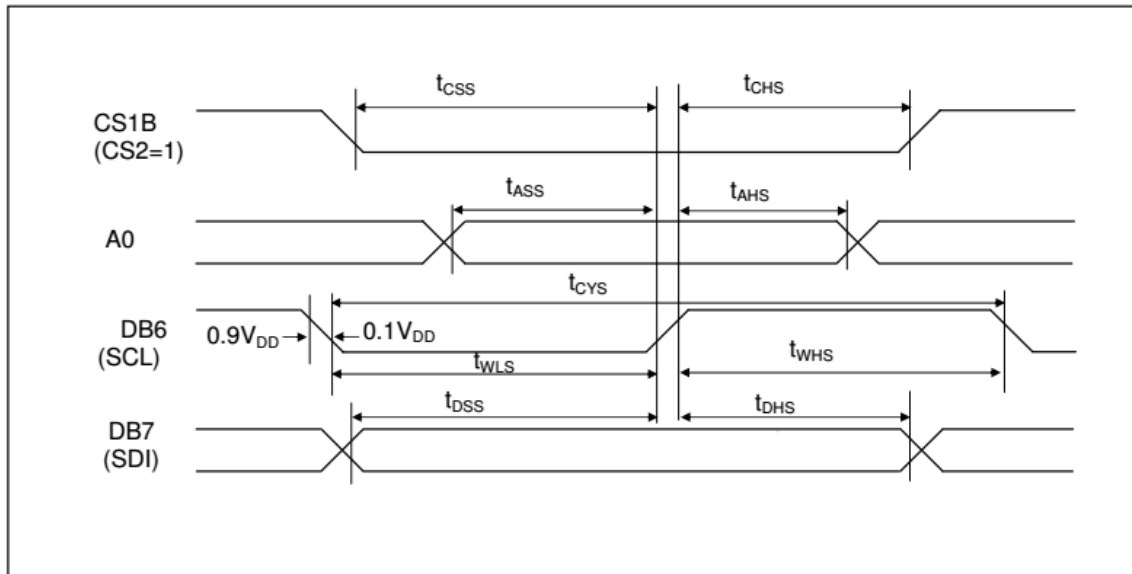
Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Address setup time	A0	tAS80	0	-	-	ns	
Address hold time		tAH80	0	-	-	ns	
System cycle time		tCY80	300	-	-	ns	
Pulse width (WRB)	RW_WRB	tPW80(W)	150	-	-	ns	
Pulse width (RDB)	E_RDB	tPW80(R)	150	-	-	ns	
Data setup time	DB7 to DB0	tDS80	60	-	-	ns	
Data hold time		tDH80	0	-	-	ns	
Read access time	DB0 to DB0	tACC80	140	-	-	ns	(No load)
Output disable time		tOD80	-	-	10	ns	

**Read / Write Characteristics (6800-series Microprocessor)**



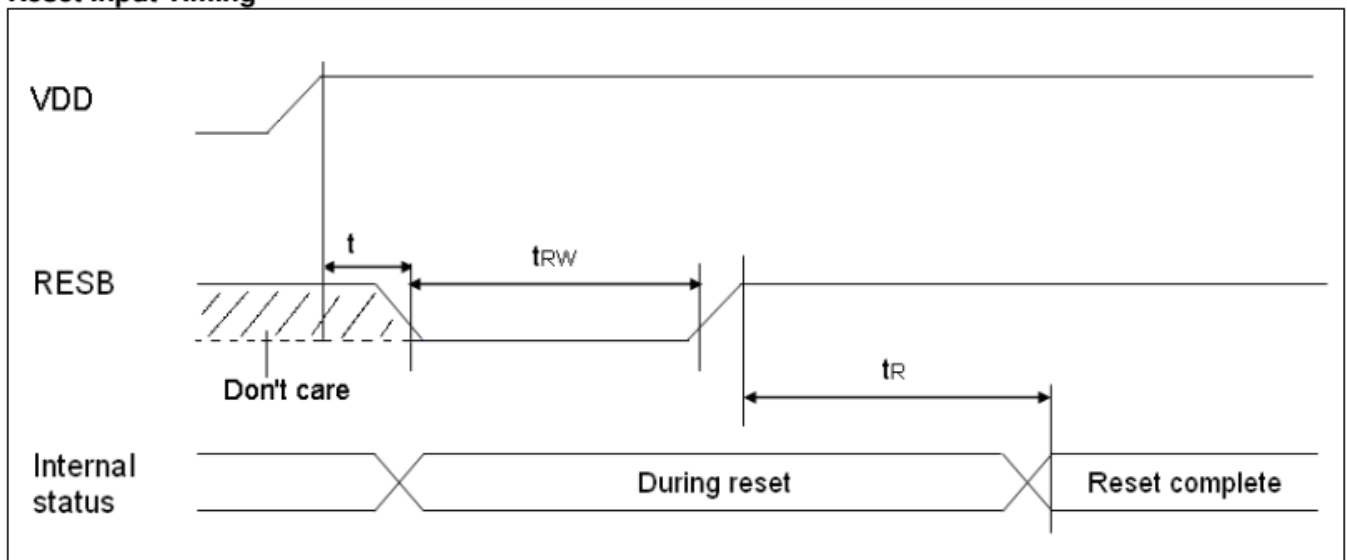
Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Address setup time Address hold time	A0	$t_{AH68}$	0	-	-	ns	
System cycle time		$t_{CY68}$	300	-	-	ns	
Pulse width (E)	RW_WRB	$t_{PW68(W)}$	150	-	-	ns	
Pulse width (E)	E_RDB	$t_{PW68(R)}$	150	-	-	ns	
Data setup time Data hold time	DB7 to DB0	$t_{DS68}$ $t_{DH68}$	60 0	-	-	ns	
Read access time Output disable time	DB0 to DB0	$t_{ACC68}$ $t_{OD68}$	140 -	-	- 10	ns	(No load)

Serial Interface Characteristics



Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Serial clock cycle	DB6 (SCL)	tCYS	200	-	-	ns	
SCL high pulse width	DB6 (SCL)	tWHS	90	-	-	ns	
SCL low pulse width	DB6 (SCL)	tWLS	90	-	-	ns	
Address setup time	A0	tASS	45	-	-	ns	
Address hold time	A0	tAHS	45	-	-	ns	
Data setup time	DB7 (SDI)	tDSS	45	-	-	ns	
Data hold time	DB7 (SDI)	tDHS	45	-	-	ns	
CS1B setup time	CS1B	tCSS	90	-	-	ns	
CS1B hold time	CS1B	tCHS	90	-	-	ns	

Reset Input Timing

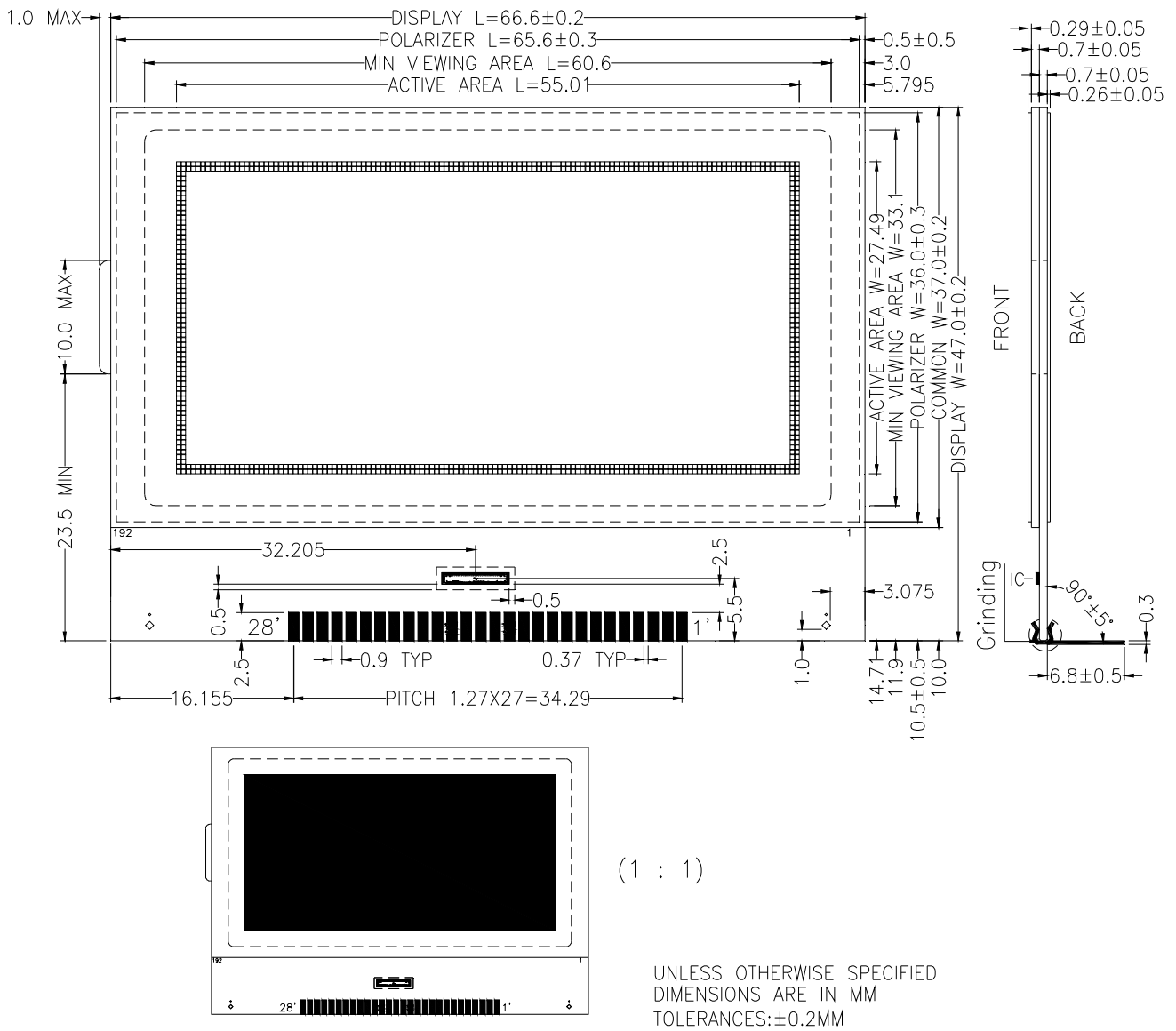


<b>Item</b>	<b>Signal</b>	<b>Symbol</b>	<b>Min.</b>	<b>Typ.</b>	<b>Max.</b>	<b>Unit</b>	<b>Remark</b>
Reset low pulse width	RESB	tRW	2	-	-	us	
Reset time	-	tR	-	-	2	us	
Reset time	RESB	t	0	-	-	us	

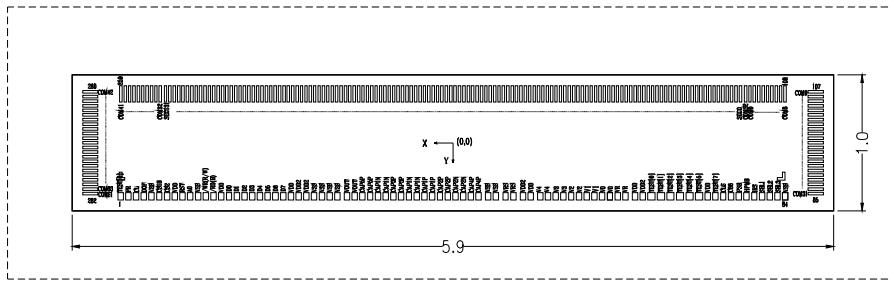
## 9. INSTRUCTION DESCRIPTION

INSTRUCTION	A0	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
Display ON / OFF	0	0	1	0	1	0	1	1	1	DON	LCD display On/Off control DON = 0 : display OFF DON = 1 : display On
Display starting line	0	0	0	1	ST5	ST4	ST3	ST2	ST1	ST0	Specify the line address for the first COM output
page address	0	0	1	0	1	1	P3	P2	P1	P0	Set page address
Set column address MSB	0	0	0	0	0	1	Y7	Y6	Y5	Y4	Set column address MSB
Set column address LSB	0	0	0	0	0	0	Y3	Y2	Y1	Y0	Set column address LSB
Read status	0	1	BUSY	ADC	ONOFF	RESB	0	0	0	0	Read the internal status
Write display data	1	0	Write data								Write data into Display RAM
Read display data	1	1	Read data								Read data from Display RAM
ADC select	0	0	1	0	1	0	0	0	0	ADC	SEG output direction select ADC = 0 : SEG0 → SEG131 ADC = 1 : SEG131 → SEG0
Reverse display ON / OFF	0	0	1	0	1	0	0	1	1	REV	Normal / Reverse display select REV = 0 : Reverse display off REV = 1 : Reverse display on
Entire display ON / OFF	0	0	1	0	1	0	0	1	0	EON	Entire display On/Off control EON = 0 : Entire display off EON = 1 : Entire display on
LCD bias select	0	0	1	0	1	0	0	0	1	BS	Select LCD bias
Set Read-modify-write (RMW)	0	0	1	1	1	0	0	0	0	0	Set Read-modify-write mode
Clear RMW	0	0	1	1	1	0	1	1	1	0	Clear Read-modify-write mode
S/W Reset	0	0	1	1	1	0	0	0	1	0	S/W Reset
SHL select	0	0	1	1	0	0	SHL	×	×	×	COM output direction select SHL = 0 : COM0 → COM63 SHL = 1 : COM63 → COM0
Power control	0	0	0	0	1	0	1	VC	VR	VF	Control power circuit operation
Regulator resistor select	0	0	0	0	1	0	0	R2	R1	R0	Select internal resistance ratio of the regulator resistor
Set reference voltage mode	0	0	1	0	0	0	0	0	0	1	Set reference voltage mode (double byte command)
Set reference voltage register	0	0	×	×	SV5	SV4	SV3	SV2	SV1	SV0	Set reference voltage register
Set static indicator mode	0	0	1	0	1	0	1	1	0	SM	Set static indicator mode (double byte command)
Set static indicator register	0	0	×	×	×	×	×	×	S1	S0	Set static indicator register
Power save	-	-	-	-	-	-	-	-	-	-	Compound Instruction of display OFF and entire display ON
NOP	0	0	1	1	1	0	0	0	1	1	No operation (dummy command)
Set Booster Ratio select mode	0	0	1	1	1	1	1	0	0	0	Set Booster ration select mode (double byte command)
Set Booster Ratio register	0	0	×	×	×	×	×	×	BT1	BT0	Set Booster ration BT[1:0] = 00 : x2, x3, x4 BT[1:0] = 01 : x5 BT[1:0] = 11 : x6 BT[1:0] = 10 : (don't use)
Test Instruction	0	0	1	0	0	0	1	0	0	0	Test command (don't use)

**10. LCD ARTWORK**

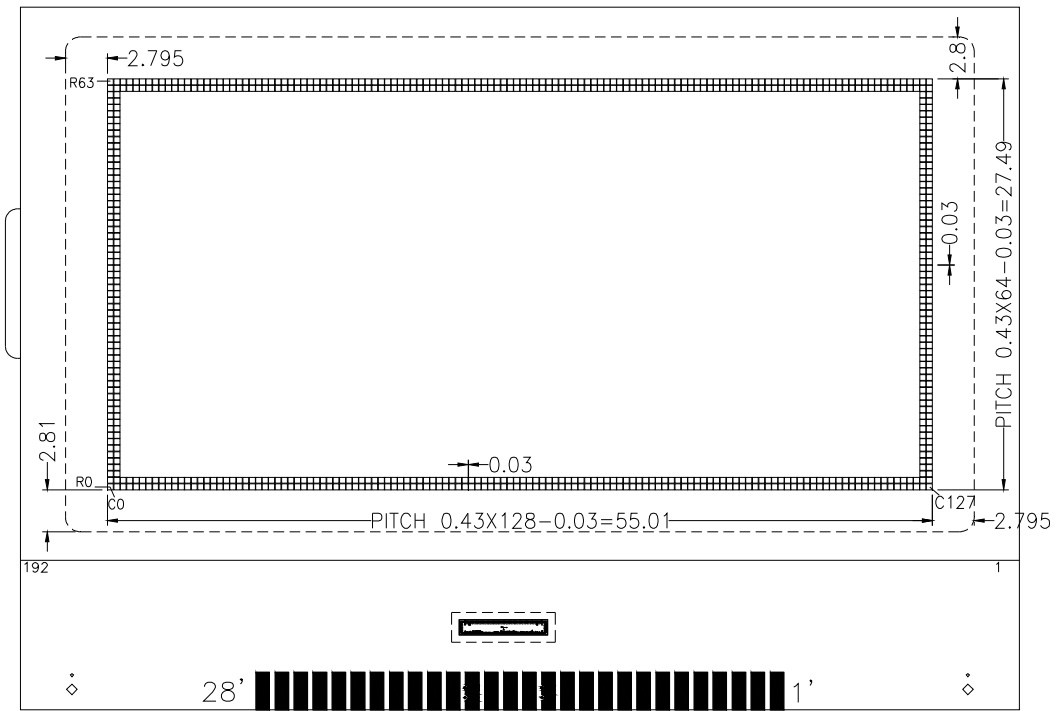


**11.PAD CONFIGURATION**



PAD_NO.	PAD_CONFIGURATION	PAD_NO.	PAD_CONFIGURATION
1'	CS1B	15'	VSS,SEL3,SEL2,SEL1,HPMB
2'	RST	16'	VOUT
3'	A0	17'	CAP3P
4'	/WR(R/W)	18'	CAP1N
5'	/RD(E)	19'	CAL1P
6'	D0	20'	CAP2P
7'	D1	21'	CAP2N
8'	D2	22'	V4
9'	D3	23'	V3
10'	D4	24'	V2
11'	D5	25'	V1
12'	D6	26'	V0
13'	D7	27'	C86
14'	VDD,VDD2	28'	PSB

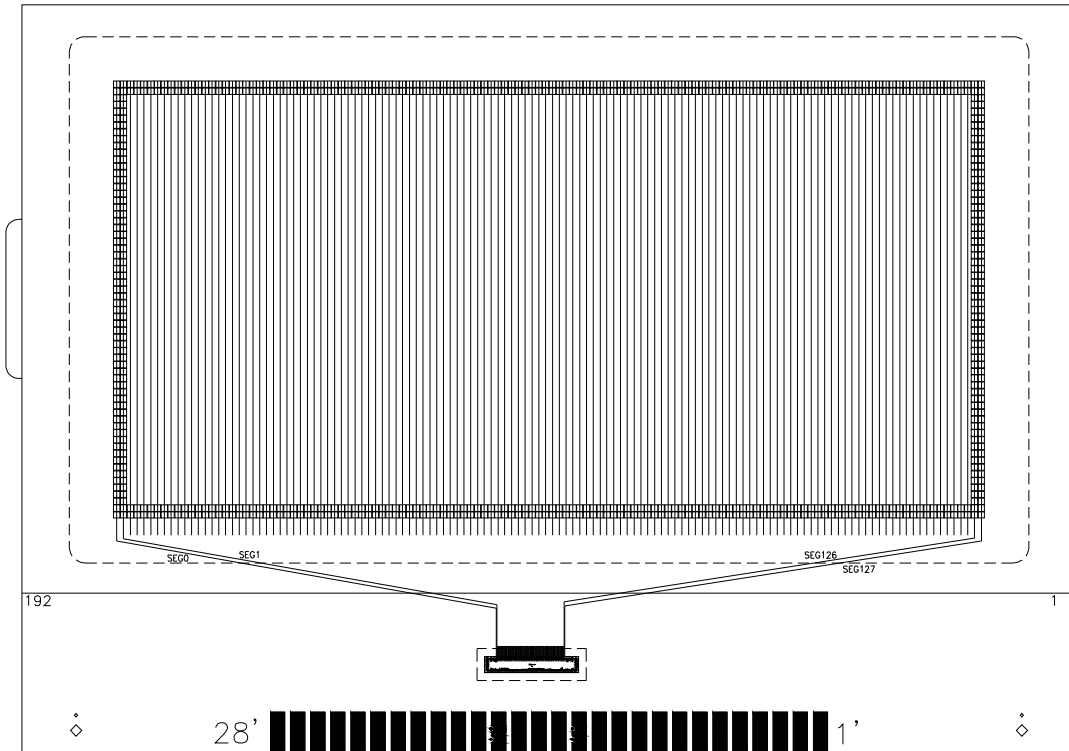
12. LCD LABELING



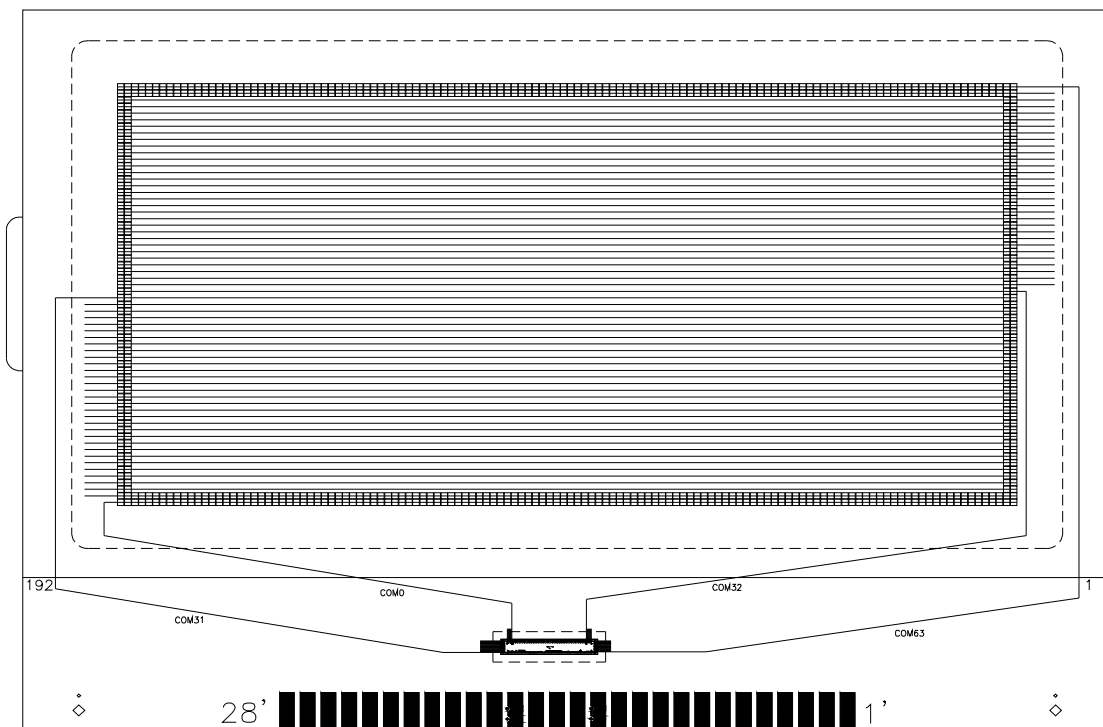
UNLESS OTHERWISE SPECIFIED  
DIMENSIONS ARE IN MM  
TOLERANCES: ±0.2MM



13. SEG LAYOUT

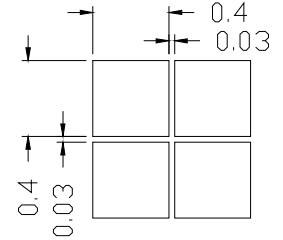


14 COM LAYOUT

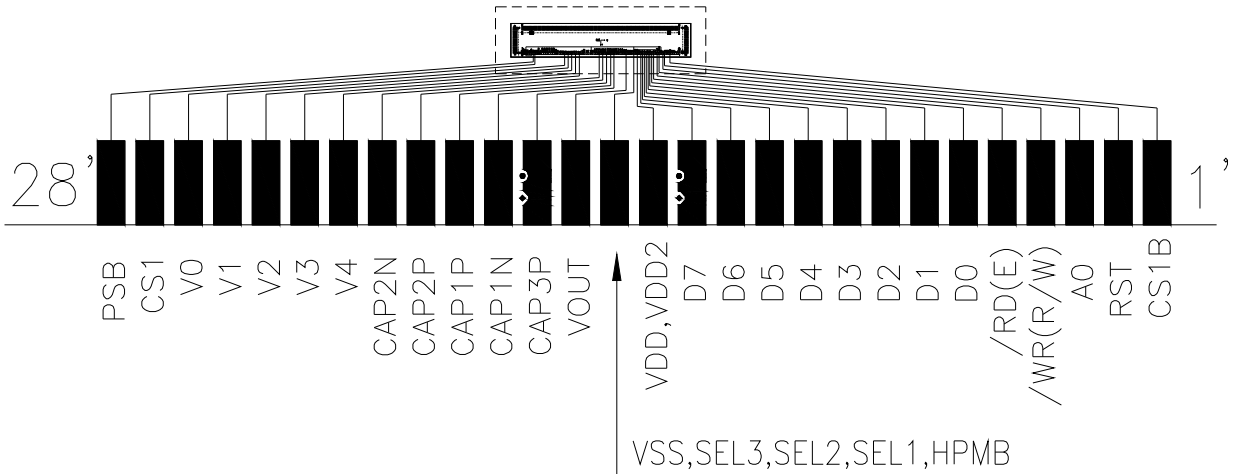


**15. PAD CONFIGURATION GRAPHIC DIMENSION**

PAD NO.	IC NO.	PAD CONFIGURATION
1	COM63	COM63[R63<C0-C127>]
2	COM62	COM62[R62<C0-C127>]
31	COM33	COM33[R33<C0-C127>]
32	COM32	COM32[R32<C0-C127>]
33	SEG127	SEG127[C127<R0-R63>]
34	SEG126	SEG126[C126<R0-R63>]
159	SEG1	SEG1[C1<R0-R63>]
160	SEG0	SEG0[C0<R0-R63>]
161	COM0	COM0[R0<C0-C127>]
162	COM1	COM1[R1<C0-C127>]
191	COM30	COM30[R30<C0-C127>]
192	COM31	COM31[R31<C0-C127>]



**16. IC LAYOUT**

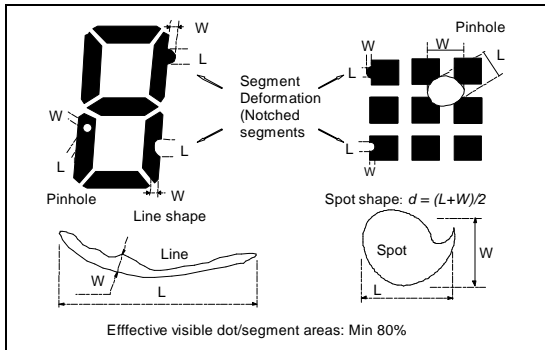


17. QUALITY DESCRIPTION

DEFECT SPECIFICATION:

Specific type-related items are covered in this sheet.

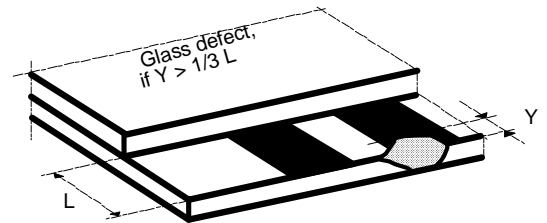
- a: Table for Cosmetic defects  
(Note: nc = not counted).  
Sizes and number of defects  
(Max. Qty)



Defect Type	Max. defect size [ $\mu\text{m}$ ] d or L W	Max. Quantity
Black or White Spots	$d \leq 150$	nc
	$150 < d \leq 300$	5
Black or White Lines	--	$W \leq 10$
	$L \leq 5000$	$W \leq 30$
	$L \leq 2000$	$W \leq 50$
Pinhole	$d \leq 150$	nc
	$150 < d \leq 300$	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

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.



**18. MODULE ACCEPTS QUALITY LEVEL (AQL).**

**18.1. AQL standard value: Fatal defect =0.1, Major defect=0.65; Minor defect =2.5.**

**18.2. Curtailed inspection scheme**

Type	Batch Qty	inspection Qty	AQL value	pass	Reject
module product	350PCS < 1000PCS	125pcs	0.1	0	1
			0.65	2	3
			2.5	7	8
	200PCS < 350PCS	80pcs	0.1	0	1
			0.65	1	2
			2.5	5	6
	<200PCS	32pcs	0.1	0	1
			0.65	0	1
			2.5	4	5
Module sample	<200PCS	All inspected	/	/	The sample will be reject when the fatal defect > 2pcs or main defect > 5pcs.
	>200PCS	125pcs			

- Notes:**
- 1). Batch QTY is the production amount that production department ship to QA department.
  - 2). All of productions will be inspected if the batch QTY less than inspected QTY.
  - 3). Each batch fixed to be 500pcs.

**19. 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

**20. 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.

**21. 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