

DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 128064G1 FGH-PW

Product Specification

Version: 2

23.08.2021

GENERAL SPECIFICATION

MODULE NO. :

DEM 128064G1 FGH-PW

CUSTOMER P/N:

Version No.	Change Description	Date
0	Original Version	06.08.2021
1	Change the LCD driver to IST3004-TX from ST7565R.	13.08.2021
2	Update the pin assignment on page 6; Update the LCD drawing on page 12 - page 15.	23.08.2021

PREPARED BY: LM

DATE: 23.08.2021

APPROVED BY: WH

DATE: 23.08.2021

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1. FUNCTIONS &FEATURES**I DEM 128064G1 Series LCD Type**

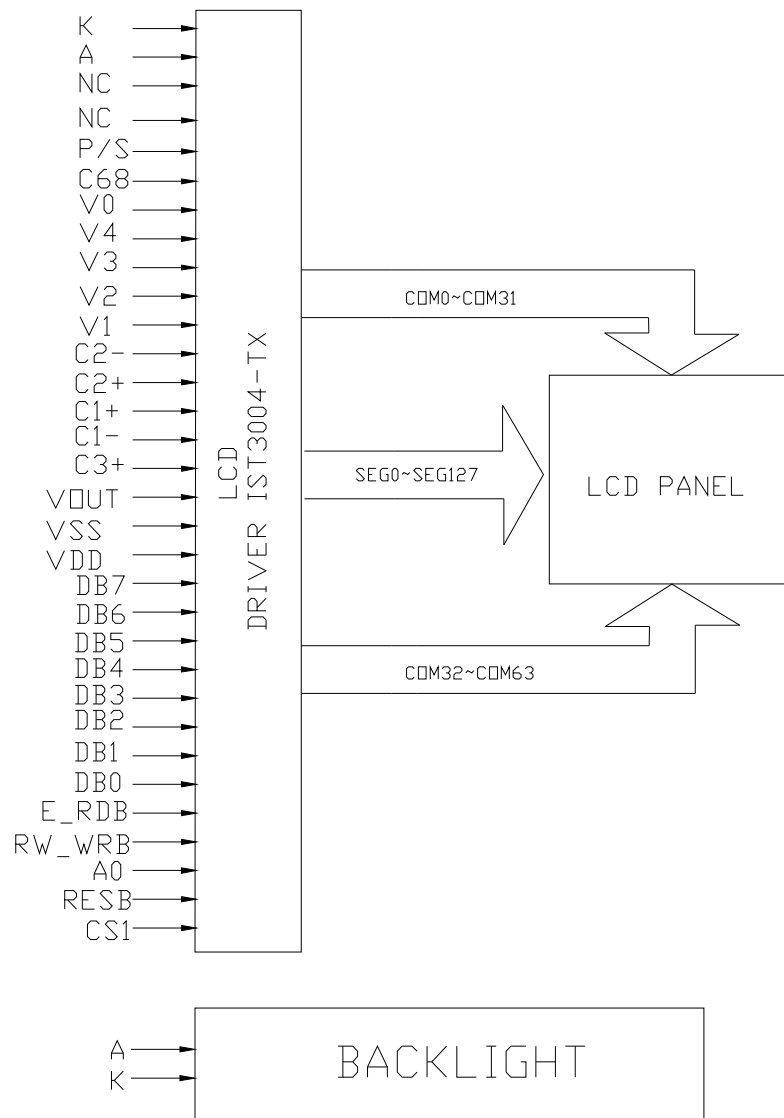
Module	LCD Type	Remark
DEM 128064G1 FGH-PW	FSTN Transflective Positive Mode	

- I Viewing Direction** : 6 O'clock
- I Driving Scheme** : 1/ 65 Duty, 1/ 9 Bias
- I Power supply** : 3.3 V
- I V_{LCD}(V₀-V_{SS})** : 10.7 V
- I Display Contents** : 128 x 64 Dots
- I Interface** : Parallel & Serial
- I LCD Driver** : IST3004-TX
- I RoHS Compliant**

2. MODULE ARTWORK

- I Module Size** : 45.24mm x 29.14mm x 6.00mm(Without FPC)
- I Viewing Area** : 37.04mm x 20.24mm
- I Active Area** : 34.545mm x 17.265mm
- I Dot Size** : 0.255mm x 0.255mm
- I Dot Pitch** : 0.270mm x 0.270mm
- I Dot Gap** : 0.015mm

4. BLOCK DIAGRAM



5. PIN ASSIGNMENT

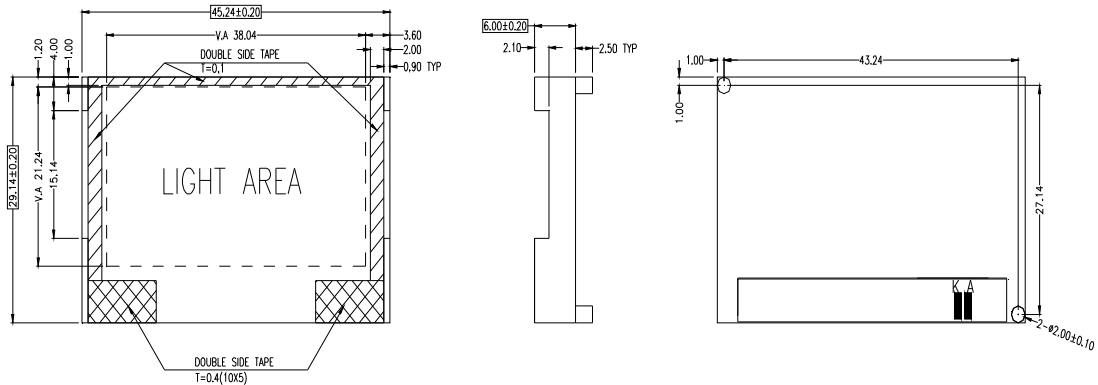
PinNo	Name	Description																					
1	K	Supply voltage for backlight LED-																					
2	A	Supply voltage for backlight LED+																					
3	NC	No connect																					
4	NC	No connect																					
5	P/S	Parallel / serial data input select input																					
		<table border="1"> <thead> <tr> <th>P/S</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>	P/S	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)
		P/S	Interface Mode	Chip Select	Data / instruction	Data	Read / Write	Serial clock															
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"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".																							
6	C68	Microprocessor Interface Select input pin in parallel mode - C68 = "H" : 6800-series MPU interface - C68 = "L" : 8080-series MPU interface																					
7	V0	LCD driver supply voltages The voltage determined by LCD pixel is impedance-converted by an operational amplifier for application.																					
8	V4	Voltages should have the following relationship; $V0 \geq V1 \geq V2 \geq V3 \geq V4 \geq VSS$																					
9	V3	When the internal power circuit is active, these voltages are generated as following as following table according to the state of LCD bias.																					
10	V2	<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) xV0</td> <td>(7/9) xV0</td> <td>(2/9) xV0</td> <td>(1/9) xV0</td> </tr> </tbody> </table>	LCD bias	V1	V2	V3	V4	1/9bias	(8/9) xV0	(7/9) xV0	(2/9) xV0	(1/9) xV0											
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11	V1																						
12	C2-	DC/DC voltage converter																					
13	C2+																						
14	C1+																						
15	C1-																						
16	C3+																						
17	VOUT																						
18	VSS	Ground																					
19	VDD	Voltage supply																					
20	DB7	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.																					
21	DB6																						
22	DB5																						
23	DB4																						
24	DB3																						
25	DB2																						
26	DB1																						
27	DB0																						
28	E_RDB	Read / Write execution control pin																					
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29	RW_WRB	Read / Write execution control pin																					
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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.																				
30	A0	Register select input pin - A0 = "H" : DB0 to DB7 are display data - A0 = "L" : DB0 to DB7 are control data																					

31	RESB	Hardware Reset input pin When RESB is “L”, initialization is executed.
32	CS1B	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

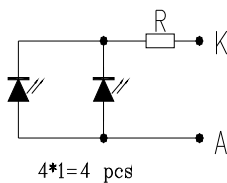
6. BACKLIGHT ELECTRICAL /OPTICAL CHARACTERISTICS

Electronics/Optical Specifications: (Color: White)

	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Forward Voltage	V _f	2.9	3.1	3.3	V	
Forward Current	I _f	--	30	40	mA	V _f =3.1V
Power Dissipation	P _d	--	--	0.14	W	V _f =3.1V
Reverse Voltage	V _R	--	--	5	V	--
Reverse Current	I _R	--	--	0.1	mA	V _R =5V
Luminous Intensity	I _v	400	600	--	cd/m ²	V _f =3.1V
Luminous Uniformity	ΔI _v	70	--	--	%	V _f =3.1V
Color Chromaticity	X	0.26	--	0.33	--	I _f =20mA Ta=25° C Each chip
	Y	0.26	--	0.33	--	



Electrical Circuit



Remarks:

- 1.Unmarked tolerance is ±0.3
- 2.All materials comply with RoHS
3. critical dimension.
- 4.COLOR:WHITE
- 5: LED lifetime 50,000 hours

7. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Condition	Unit
Power Supply Voltage	V _{DD}	-0.3 ~ 7.0	V
	V ₀ , V _{OUT}	-0.3~15.0	V
Power Supply Voltage (VDD Standard)	V1,V2,V3,V4	-0.3 to V ₀	V
Input Voltage Range	V _{IN}	-0.3 to V _{DD} + 0.3	V
Operating Temperature	TOPR	-20~+70	°C
Storage Temperature	TSTR	-30~+80	°C

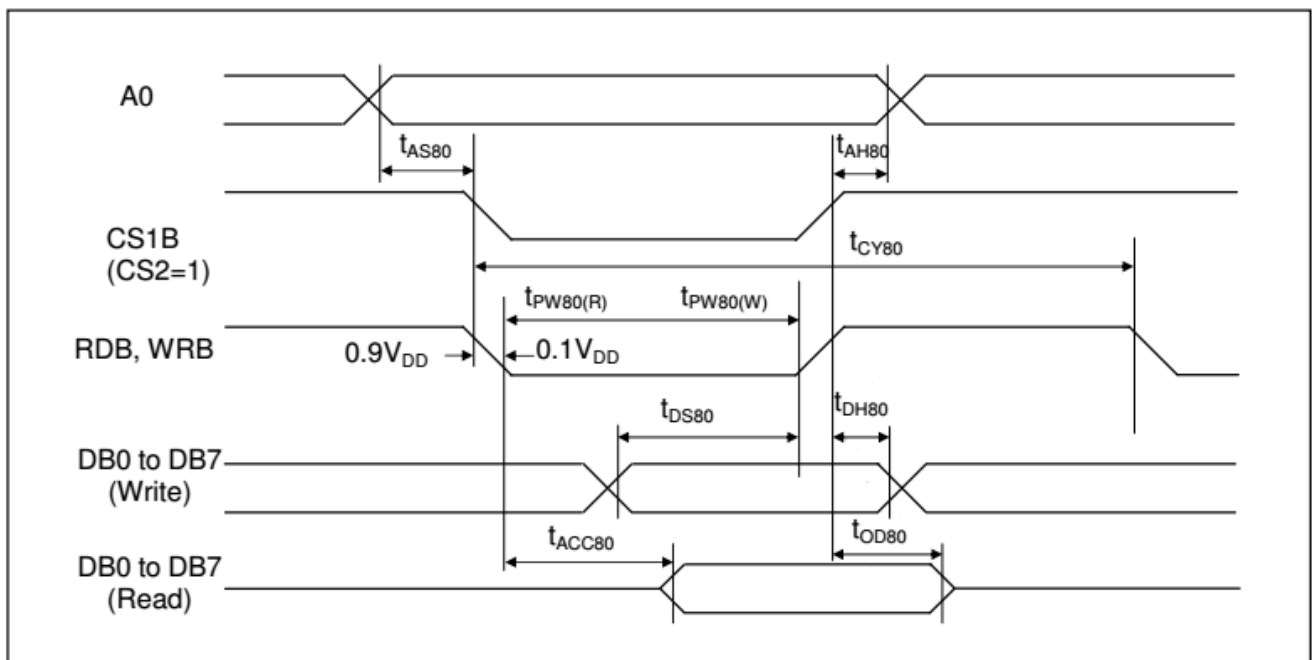
8. ELECTRICAL CHARACTERISTICS

8-1. DC Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Operating Voltage	V_{DD}	3.0	3.3	3.6	V	
LCD Voltage	V_{LCD}	10.4	10.7	11.0	V	V_0-V_{SS}
Current Consumption	I_{DD}	TBD	TBD	TBD	μA	

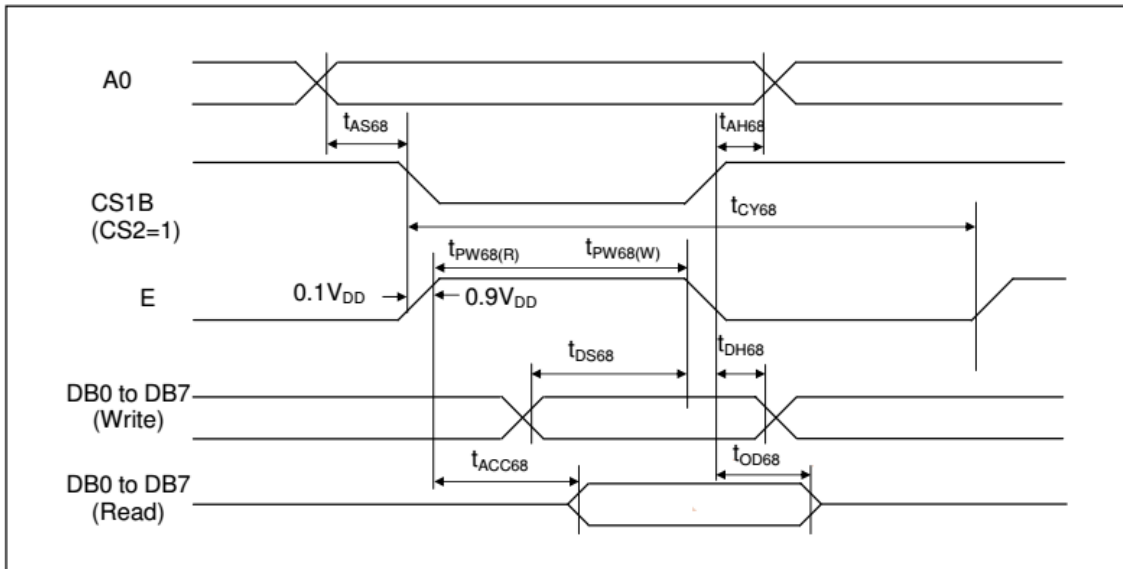
8-2. AC Characteristics

Read / Write Characteristics (8080-series MPU)



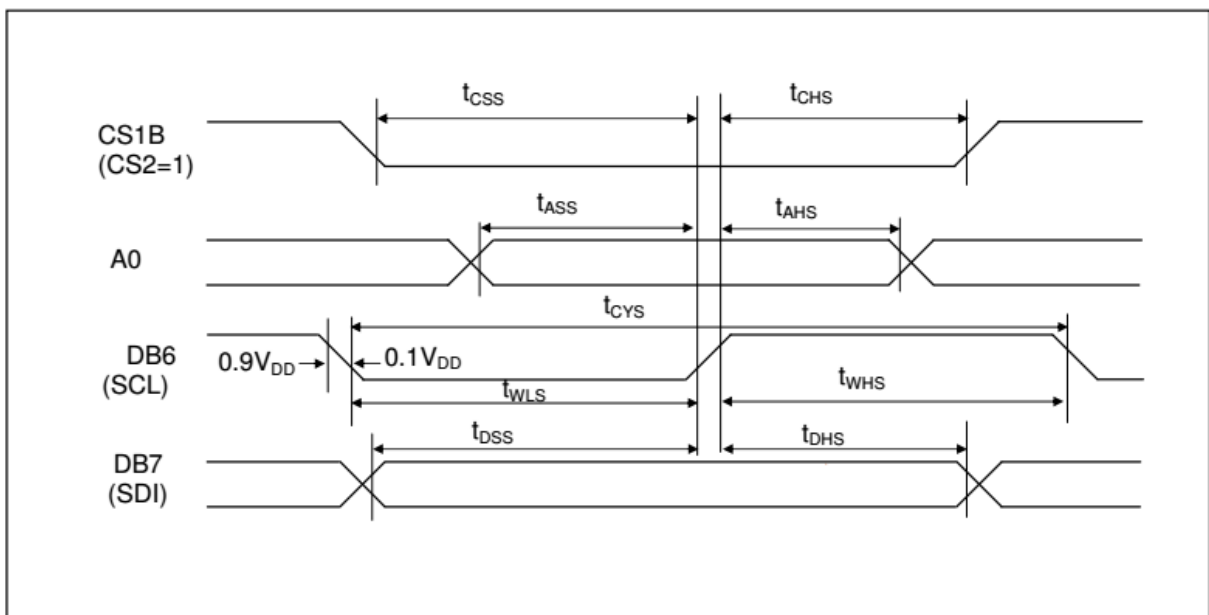
Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Address setup time	A0	t_{AS80}	0	-	-	ns	
Address hold time	A0	t_{AH80}	0	-	-	ns	
System cycle time		t_{CY80}	300	-	-	ns	
Pulse width (WRB)	RW_WRB	$t_{PW80(W)}$	150	-	-	ns	
Pulse width (RDB)	E_RDB	$t_{PW80(R)}$	150	-	-	ns	
Data setup time	DB7 to DB0	t_{DS80}	60	-	-	ns	
Data hold time		t_{DH80}	0	-	-	ns	
Read access time	DB0	t_{ACC80}	140	-	-	ns	(No load)
Output disable time		t_{OD80}	-	-	10	ns	

Read / Write Characteristics (6800-series Microprocessor)



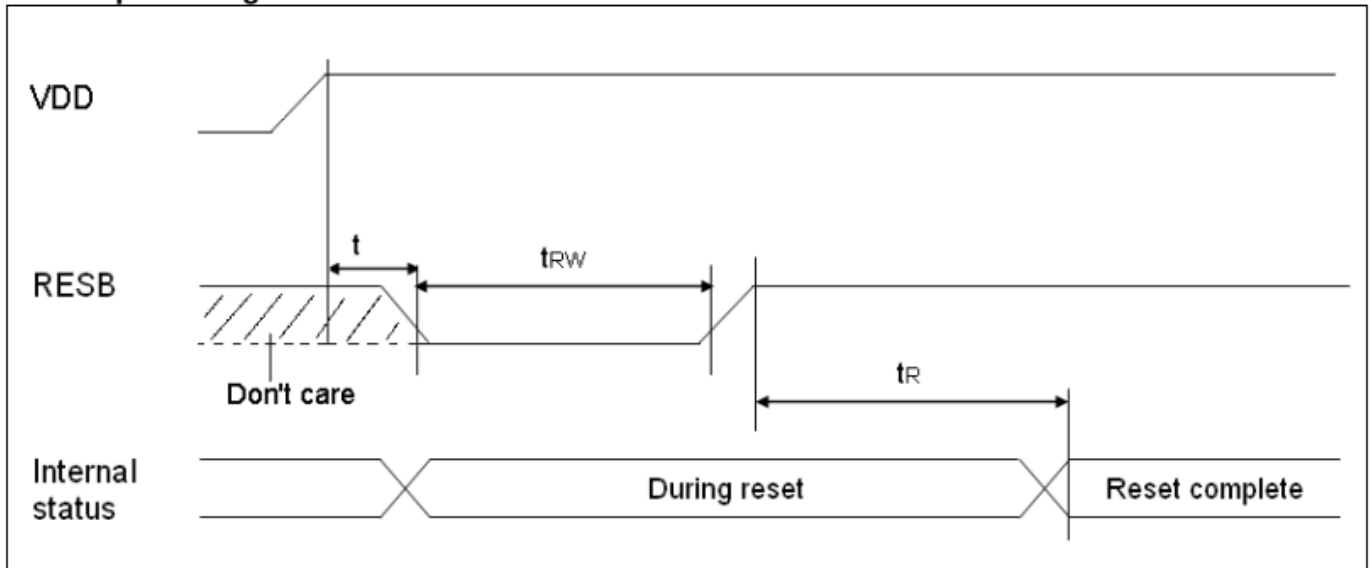
Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Address setup time	A0	t_{AS68}	0	-	-	ns	
Address hold time	A0	t_{AH68}	0	-	-	ns	
System cycle time		t_{CY68}	300	-	-	ns	
Pulse width (E)	RW_WRB	$t_{PW68(W)}$	150	-	-	ns	
Pulse width (E)	E_RDB	$t_{PW68(R)}$	150	-	-	ns	
Data setup time	DB7 to DB0	t_{DS68}	60	-	-	ns	
Data hold time	DB7 to DB0	t_{DH68}	0	-	-	ns	
Read access time	DB0 to DB7	t_{ACC68}	140	-	-	ns	(No load)
Output disable time	DB0 to DB7	t_{OD68}	-	-	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		tWHS	90	-	-		
SCL low pulse width		tWLS	90	-	-		
Address setup time	A0	tASS	45	-	-	ns	
Address hold time		tAHS	45	-	-		
Data setup time	DB7 (SDI)	tDSS	45	-	-	ns	
Data hold time		tDHS	45	-	-		
CS1B setup time	CS1B	tCSS	90	-	-	ns	
CS1B hold time		tCHS	90	-	-		

Reset Input Timing

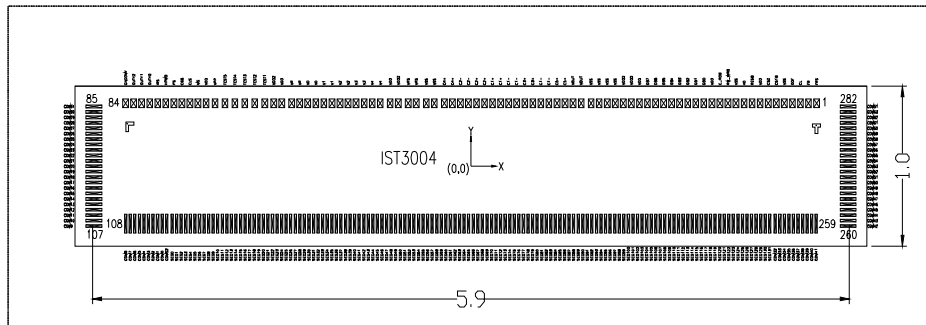


Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Reset low pulse width	RESB	tRW	2	-	-	us	
Reset time	-	tR	-	-	2	us	
Reset time	RESB	t	0	-	-	us	

9. INSTRUCTION DESCRIPTION

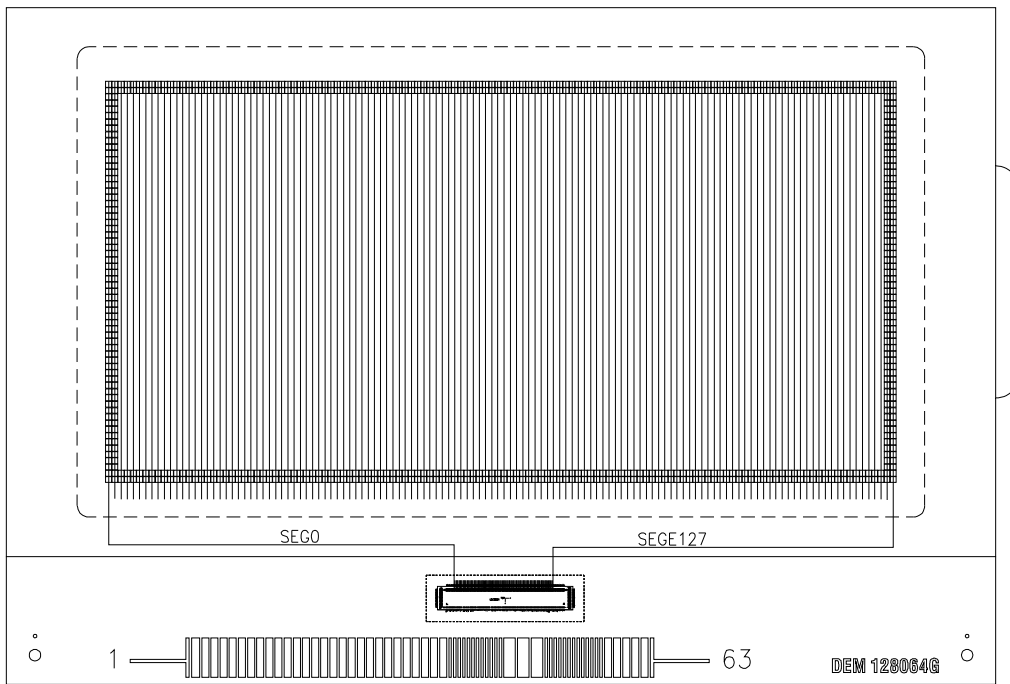
INSTRUCTION	A0	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
Display ON / OFF	0	0	1	0	1	0	1	1	1	DON	LCD display On/Off control DON = 0 : display OFF DON = 1 : display On
Display starting line	0	0	0	1	ST5	ST4	ST3	ST2	ST1	ST0	Specify the line address for the first COM output
page address	0	0	1	0	1	1	P3	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	x	x	x	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	x	x	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	x	x	x	x	x	x	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	x	x	x	x	x	x	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)

12.PAD CONFIGURATION



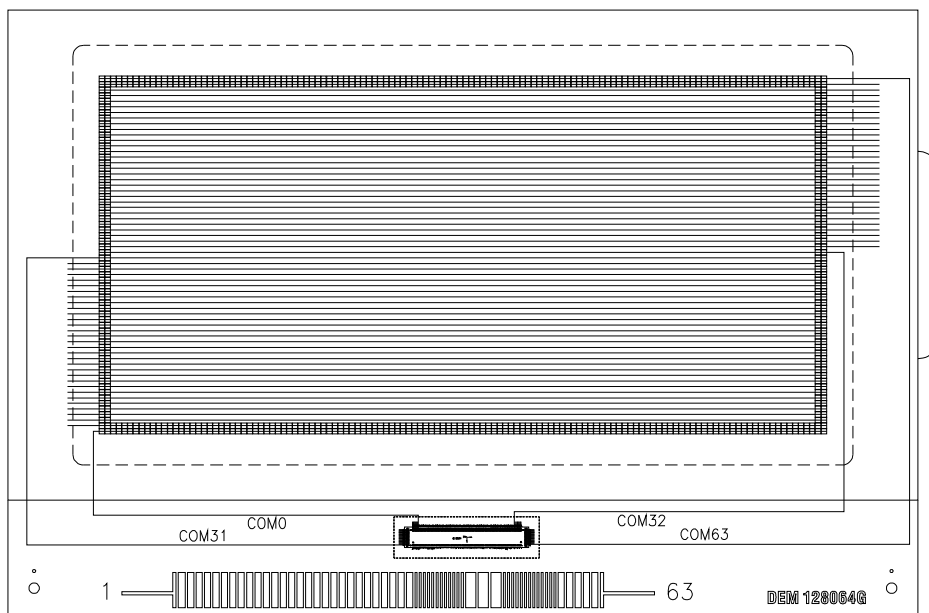
<u>PAD NO.</u>	<u>PAD CONFIGURATION</u>	<u>PAD NO.</u>	<u>PAD CONFIGURATION</u>
1-29	NC	46	DB6
30	PS	47	DB5
31	C68	48	DB4
32	V0	49	DB3
33	V1	50	DB2
34	V2	51	DB1
35	V3	52	DB0
36	V4	53	E_RDB
37	C2-	54	RW_WRB
38	C2+	55	A0
39	C1+	56	RESB
40	C1-	57	CS1B
41	C3+	58-63	NC
42	VOUT		
43	VSS		
44	VDD2,VDD		
45	DB7		

13. SEG LAYOUT



SEG

14. COM LAYOUT

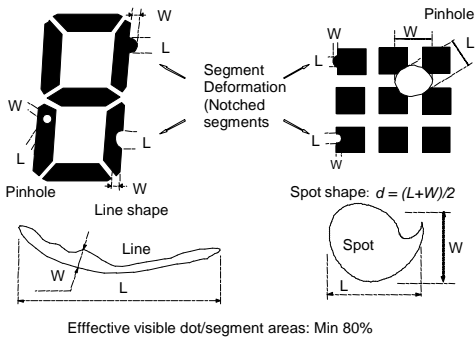


COM

16. QUALITY DESCRIPTION

DEFECT SPECIFICATION:

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

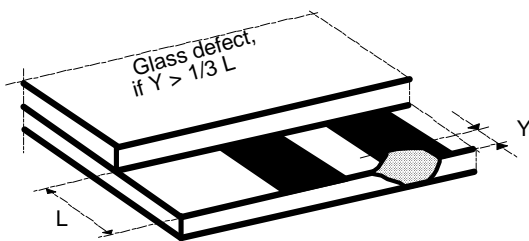


Examples/Shapes

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.

Defect Type	Max. defect size [mm]d or L W	Max. Quantity.
Black or White Spots	$d \leq 100$	nc
	$100 < d \leq 200$	5
Black or White Lines	--	nc
	$L \leq 5000$ $W \leq 30$	3
	$L \leq 2000$ $W \leq 50$	2
Pinhole	$d \leq 100$ $100 < d \leq 200$	nc1/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

17. ACCEPT QUALITY LEVEL (AQL).

17.1. AQL standard value: Critical defect =0.1; Major defect=0.65; Minor defect =2.5.

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

18. RELIABILITY TEST CONDITION

Operating life time: 50,000 hours (at room temperature without direct irradiation of sunlight)

Reliability characteristics shall meet following requirements.

Test Item	Test Condition
High Temperature Storage	+80°C x 96HR
Low Temperature Storage	-30°C x 96HR
High Temperature Operation	+70°C x 96HR
Low Temperature Operation	-20°C x 96HR
High Temperature, High humidity	+60°C x 90%RH x 96HR
Thermal Shock	-30°C x 30min → 25°C x 10s → +80°C x 30min x 5 Cycles
Vibration Test	Frequency x Swing x Time 40Hz x 4mm x 4hrs
Drop Test	Height x no. of drop 1.0m x 6 drops

19. 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.

20. 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.