DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 097032B1 SGH-PY

Product specification ***Version: 1***

25.08.2021

GENERAL SPECIFICATION

MODULE NO. :

DEM 097032B SERIES

CUSTOMER P/N

VERSION NO.	CHANGE DESCRIPTION	DATE
0	Orginal Version	24.08.2021
1	Add the information of "1kOhm resistor at PIN2" in remark for B01 on page 2	25.08.2021

PREPARED BY: CC DATE: 25.08.2021/

APPROVED BY: WH DATE: 25.08.2021

CONTENTS

1. FUNCTIONS &FEATURES

- LCD TYPE:

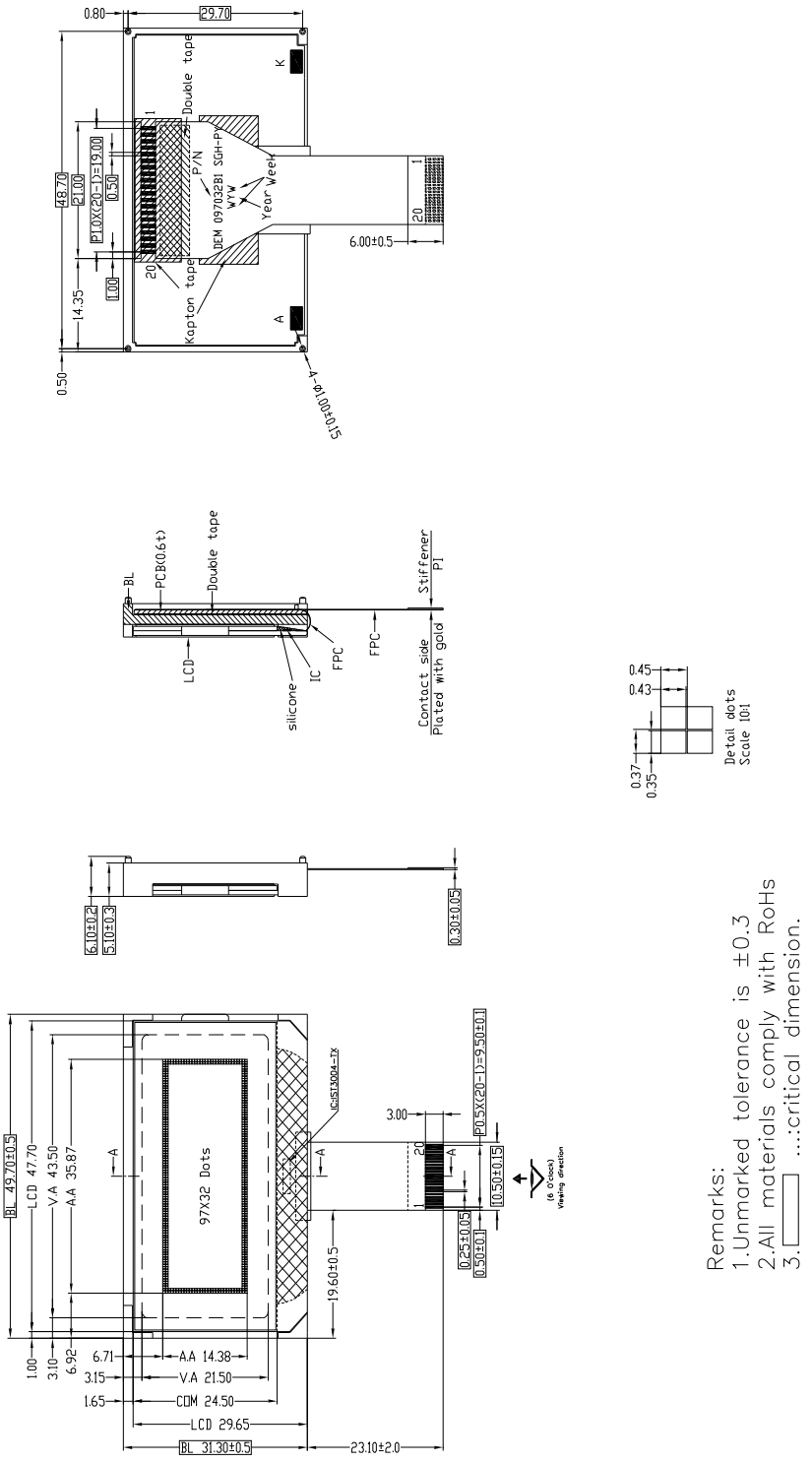
MODULE MODEL	LCD TYPE	REMARK
DEM 097032B1 SGH-PY	STN-GRAY TRANSFLECTIVE POSITIVE	

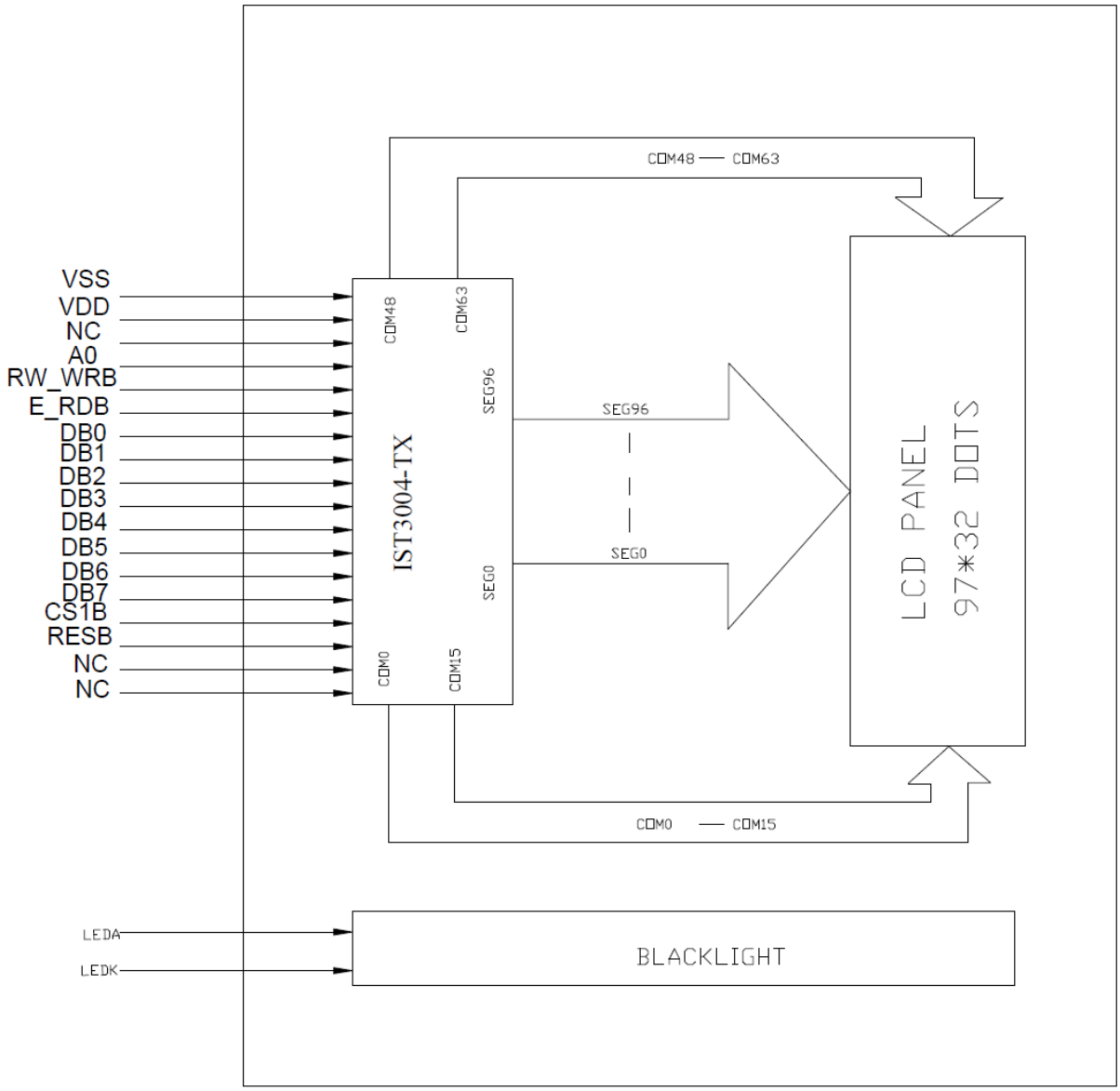
- Viewing Direction : 6 O'clock
- Driving Scheme : 1/33Duty, 1/6Bias
- Power Supply For Logic : 3.0V
- LCD Voltage : 6.2V
- Interface : 8-Bit-Parallel-MCU Interface (8080)
- Driver IC : IST3004-TX
- RoHS in accordance

2. MODULE ARTWORK

- Module Size : 49.70 mm x 31.30 x 6.10mm(max)
- Viewing Area : 43.50mm x 21.50 mm
- Active Area : 35.87mm x 14.38 mm
- Dot Size : 0.35mm x 0.43 mm
- Dot Gap : 0.02mm

3. EXTERNAL DIMENSIONS




COM48 — COM63
VSS
VDD
NC
A0
RW_WRB
E_RDB
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
CS1B
RESB
NC
NC
COM48
COM63
SEG96
IST3004-TX
SEG96
SEG0
SEG0
COM0
COM15
LCD PANEL
97*32 DOTS
COM0 — COM15
LEDA
LEDK
BLACKLIGHT

5. PIN ASSIGNMENT

<table>
<tr><th>N0.</th><th>SYMBOL</th><th>FUCTION</th></tr>
<tr><td>1</td><td>VSS</td><td>Ground</td></tr>
<tr><td>2</td><td>VDD</td><td>power supply</td></tr>
<tr><td>3</td><td>NC</td><td>No connection</td></tr>
<tr><td>4</td><td>A0</td><td>Register select input pin
- A0 = “H” : DB0 to DB7 are display data
- A0 = “L” : DB0 to DB7 are control data</td></tr>
<tr><td>5</td><td>RW_WRB</td><td>Read / Write execution control pin
<table>
<tr><td>C68</td><td>MPU Type</td><td>RW_WRB</td><td>Description</td></tr>
<tr><td>H</td><td>6800-series</td><td>RW</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>
</table></td></tr>
<tr><td>6</td><td>E_RDB</td><td>Read / Write execution control pin
<table>
<tr><th>C68</th><th>MPU Type</th><th>E_RDB</th><th>Description</th></tr>
<tr><td>H</td><td>6800-series</td><td>E</td><td>Read / Write control input pin
- RW = “H” : When E is “H”, DB0 to DB7 are in an output status.
- RW = “L” : The data on DB0 to DB7 are latched at the falling edge the E signal.</td></tr>
<tr><td>L</td><td>8080-series</td><td>/RDB</td><td>Read enable clock input pin
When / RDB is “L”, DB0 to DB7 are in an output status.</td></tr>
</table></td></tr>
<tr><td>7</td><td rowspan="8">DB0~DB7</td><td rowspan="8">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.</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td><td>CS1B</td><td>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.</td></tr>
<tr><td>16</td><td>RESB</td><td>Hardware Reset input pin
When RESB is “L”, initialization is executed.</td></tr>
<tr><td>17</td><td>NC</td><td>No connection</td></tr>
<tr><td>18</td><td>NC</td><td>No connection</td></tr>
<tr><td>19</td><td>A</td><td>LED A(+)</td></tr>
<tr><td>20</td><td>K</td><td>LED K(-)</td></tr>
</table>

6. PCB DRAWING

6.1 PCB DRAWING

TBD

Note: The PCB drawing is just for reference!!

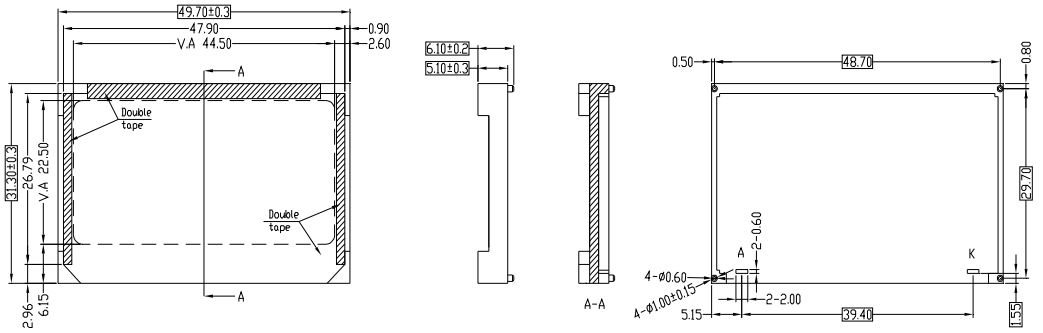
6.2 THE DESCRIPTION OF THE JUMPER

TBD

7. BACKLIGHT CHARACTERISTICS

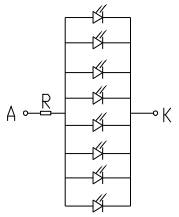
ELECTRICAL-OPTICAL CHARACTERISTICS:

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Forward Voltage	Vf	1.9	2.1	2.3	V	If= 80 mA
Luminance	Lv	32	44	--	cd/m^2	
Uniformity	Avg	70			%	
Dominant Wave Length	λD	565	570	575	nm	



REMARKS:
1.Unmarked tolerance is ±0.3,
2.All materials comply with RoHs.
3.[ ]...:critical dimension.

Electrical Circuit:



8PCS Yellow-Green LED

8. MAXIMUM ABSOLUTE POWER RATINGS.

Item	Symbol	Standard value	Unit
Power Supply Voltage(1)	V_{DD}	-0.3 ~ 7.0	**V**
Power Supply Voltage(2)	V_{LCD}	-0.3 ~ 15.0	**V**
Input Voltage	V_I	-0.3V~VDD+0.3	**V**
Operating Temperature	Topr	-20~+70	**°C**
Storage Temperature	Tstg	-30~+80	**°C**

9. ELECTRICAL CHARACTERISTICS

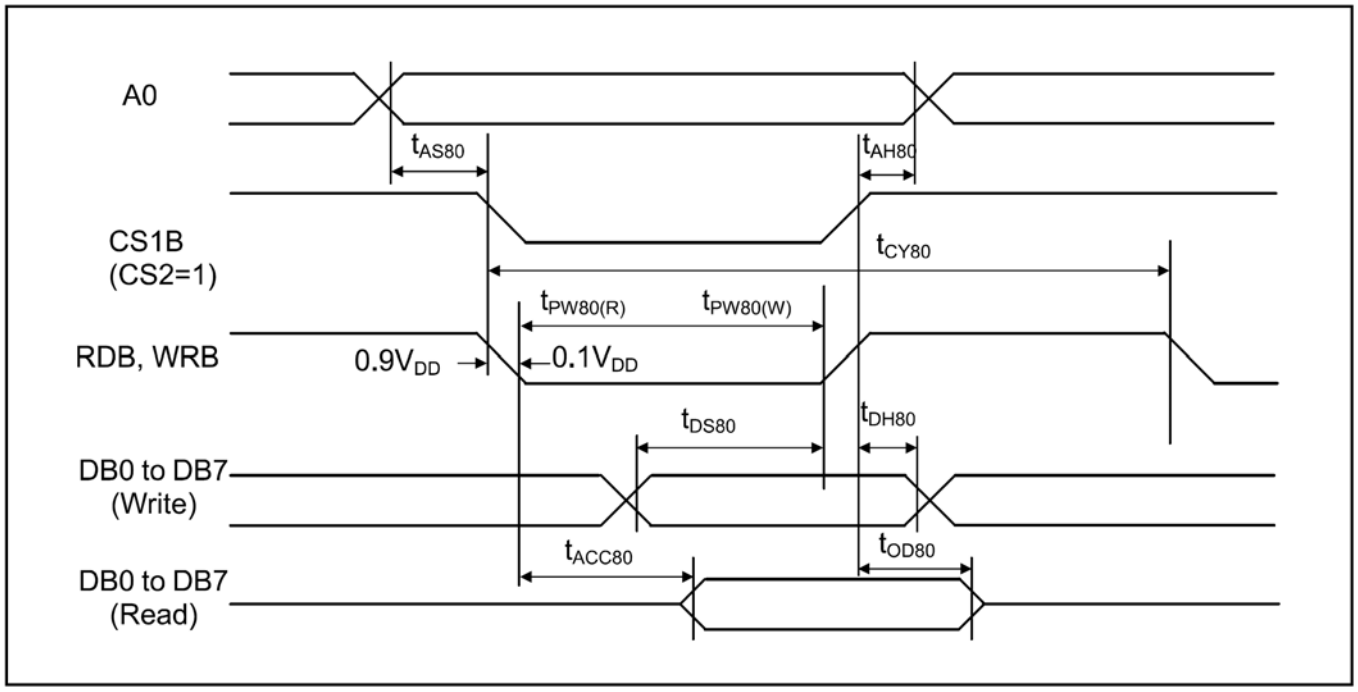
9.1 DC Characteristics

ITEM		symbol	Condition	STANDARD VALUE			TEST CONDITION	UNIT
				MIN	TYP	MAX		
Supply Voltage For Logic		V_{DD}		2.4	3.0	3.6		V
Supply Voltage For LCD		V_{LCD}		5.9	6.2	6.5		
Current Consumption		I_{DD}			TBD			mA
Input Voltage	High	VIH		0.8xVDD	-	VDD		V
	Low	VIL		VSS	-	0.2xVDD		
Output Voltage	High	VOH	IOH= -0.5mA	0.8xVDD	-	VDD		
	Low	VOL	IOL = 0.5mA	VSS	-	0.2xVSS		

9.2 AC Characteristics

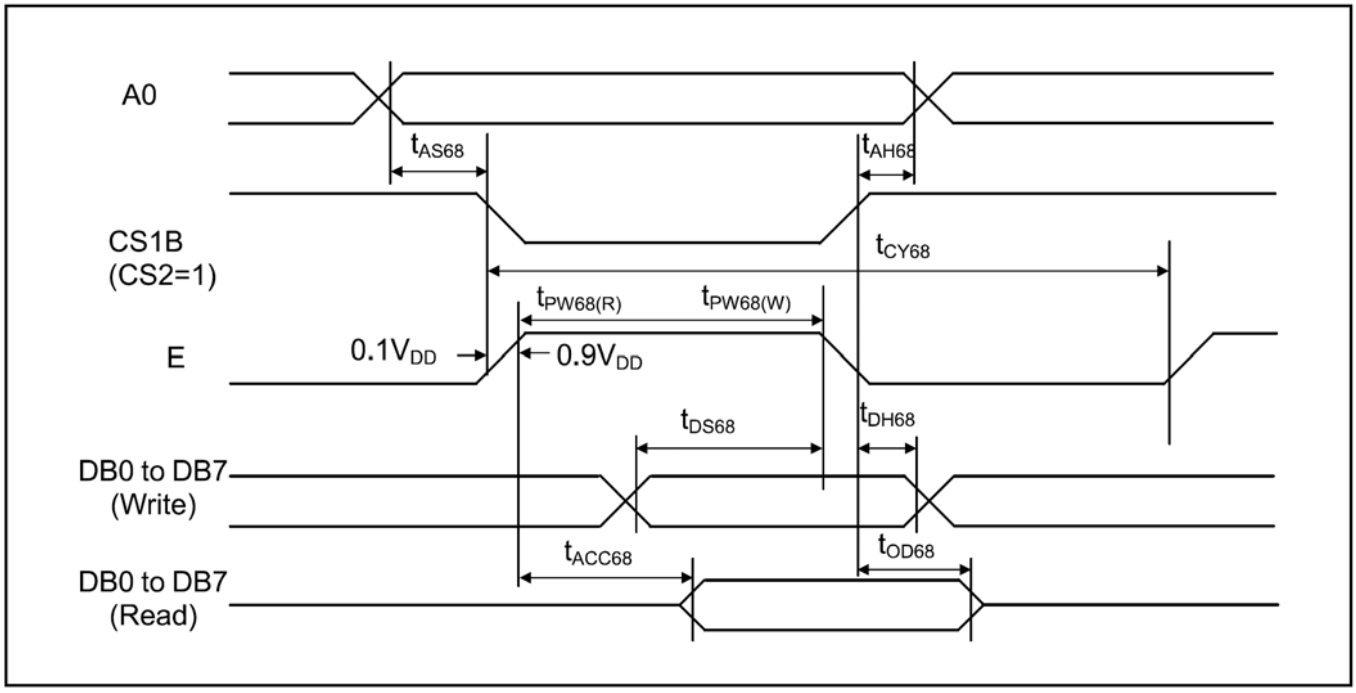
9.2.1 System Buses Read/Write Characteristics (for 8080 Series MPU)

Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Address setup time Address hold time	A0	t_{AS80} t_{AH80}	0 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 Data hold time	DB7 to DB0	t_{DS80} t_{DH80}	60 0	-	-	ns	
Read access time Output disable time		t_{ACC80} t_{OD80}	140 -	-	- 10	ns	(No load)



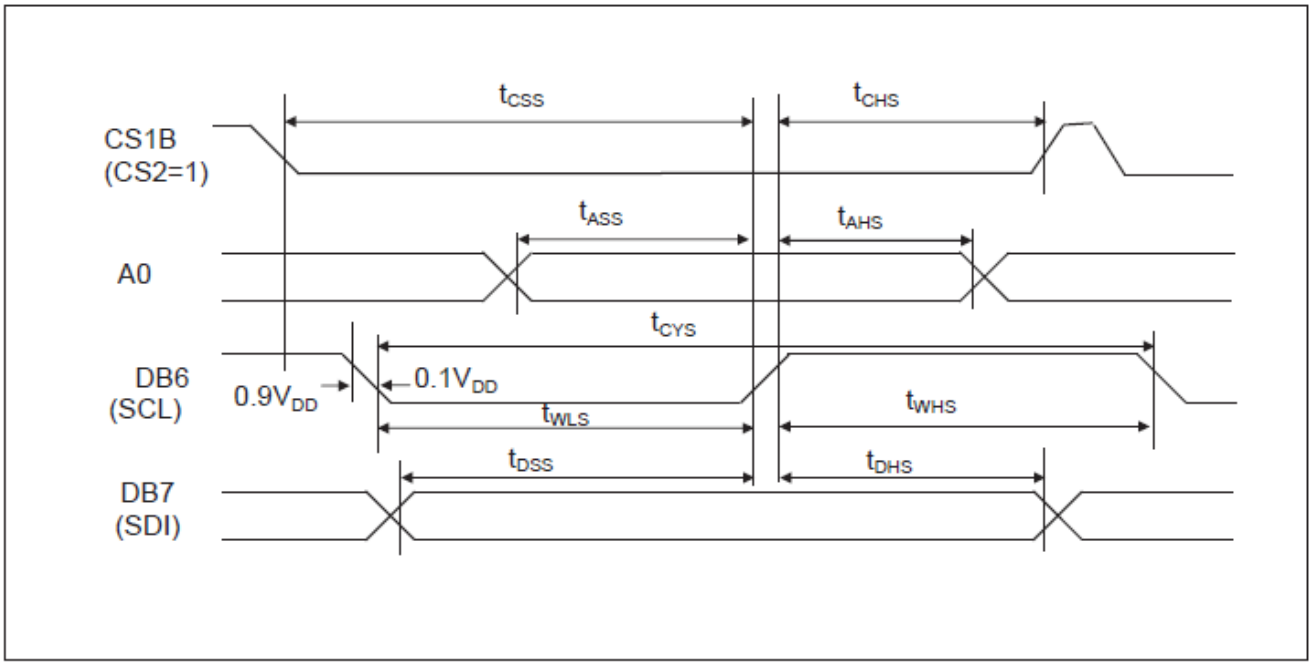
9. 2.2 System Buses Read/Write Characteristics (for 6800 Series MPU)

Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Address setup time Address hold time	A0	t_{AS68} t_{AH68}	0 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		t_{ACC68} t_{OD68}	140 -	-	- 10	ns	(No load)



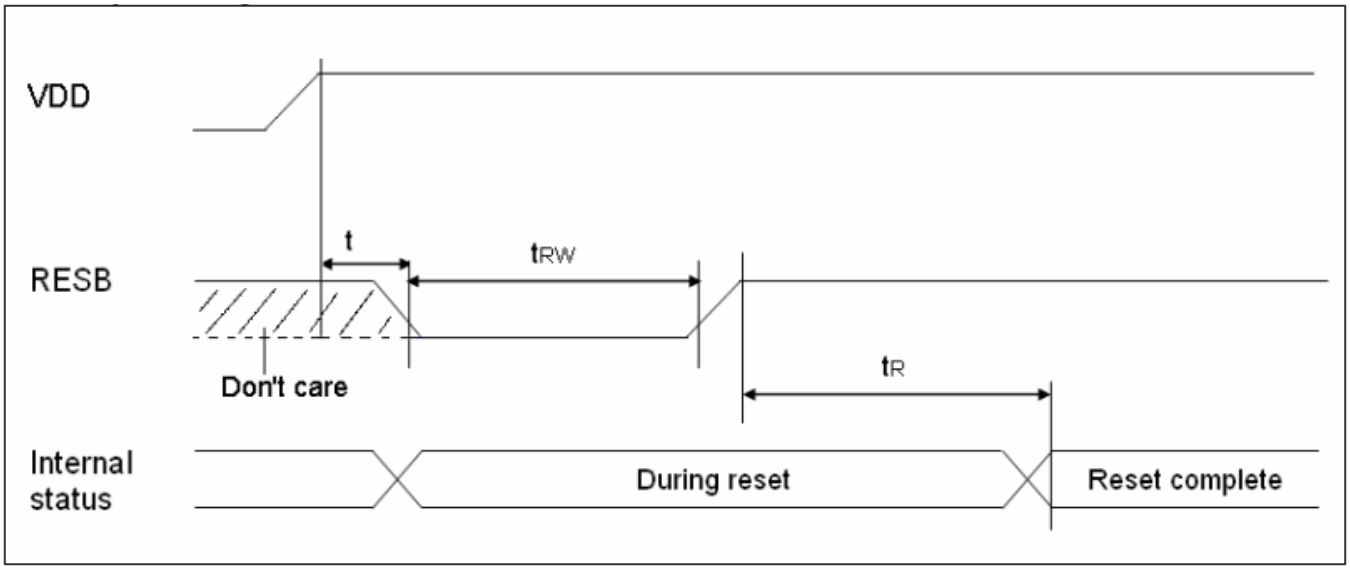
9.2.3 Serial Interface Timing

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



9.2.4 Reset Timing

Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Reset low pulse width	RESB	t_{RW}	2	-	-	us	
Reset time	-	t_R	-	-	2	us	
Reset time	RESB	t	0	-	-	us	



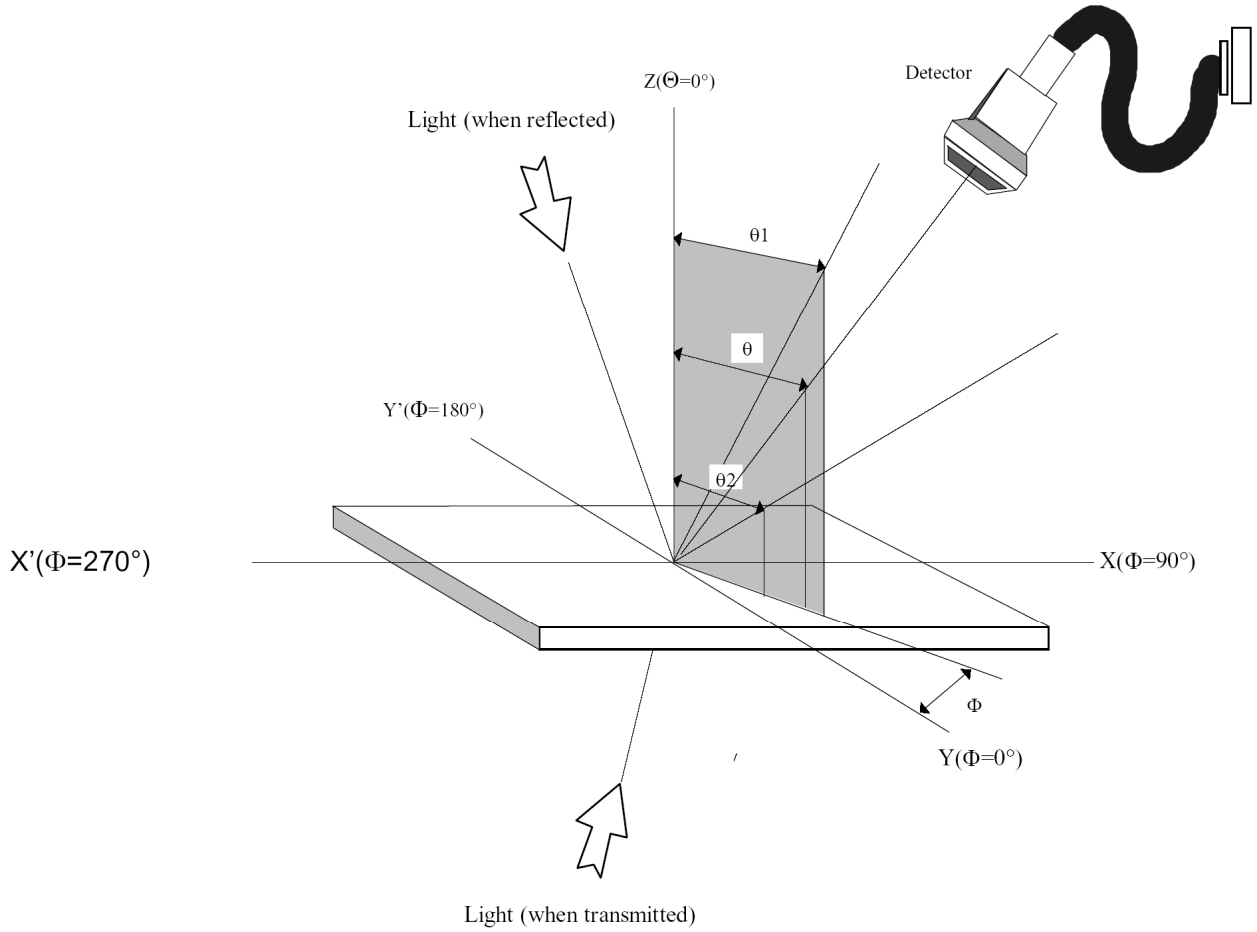
10. INSTRUCTION TABLE

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	ON/OFF	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	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)

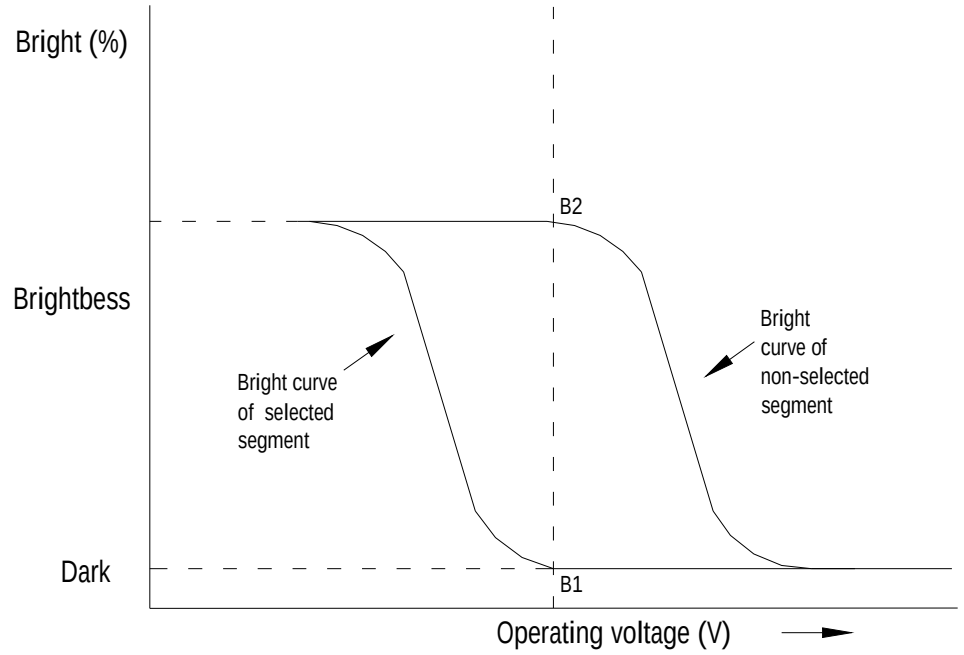
11. LCD ELECTRICAL& OPTICAL CHARACTERISTICS

Item	Symbol	Description	Condition	Temp.	Min.	Typ.	Max.	Unit
Contrast	Cr		θ=10°, Φ=0° V_{CC}=3.0V±3%	25℃	-	4	-	-
Viewing Angle	θ	6 o'clock axis	Cr≥2.0 V_{CC}=3.0V±3%	25℃	35	40	-	°
		12 o'clock axis			30	35	-	
		3 o'clock axis			30	35	-	
		9 o'clock axis			30	35	-	
Response Time	T_r	Rise	V_{CC}=3.0V±3%	25℃	-	200	300	ms
	T_f	Fall	V_{CC}=3.0V±3%	25℃	-	200	300	

11.1 Definition of characteristics.

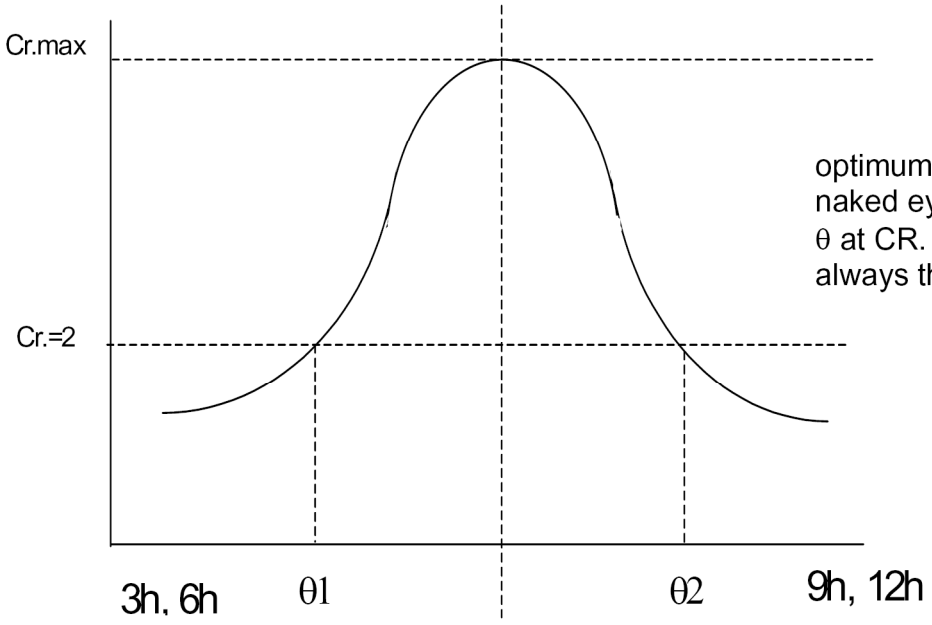


Definition of contrast $Cr. = \frac{B2}{B1} = \frac{\text{Bright curve of not selected segment}}{\text{Bright curve of selected segment}}$



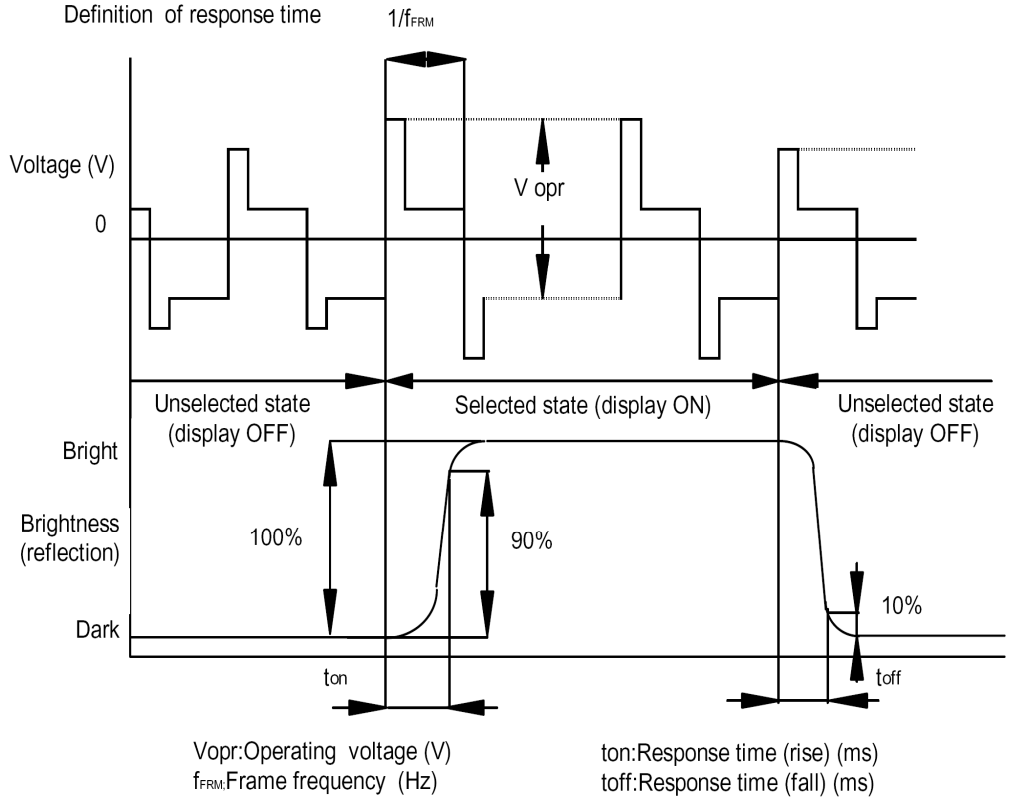
11.2. Definition of viewing angle

Definition of viewing angle θ1 and θ2

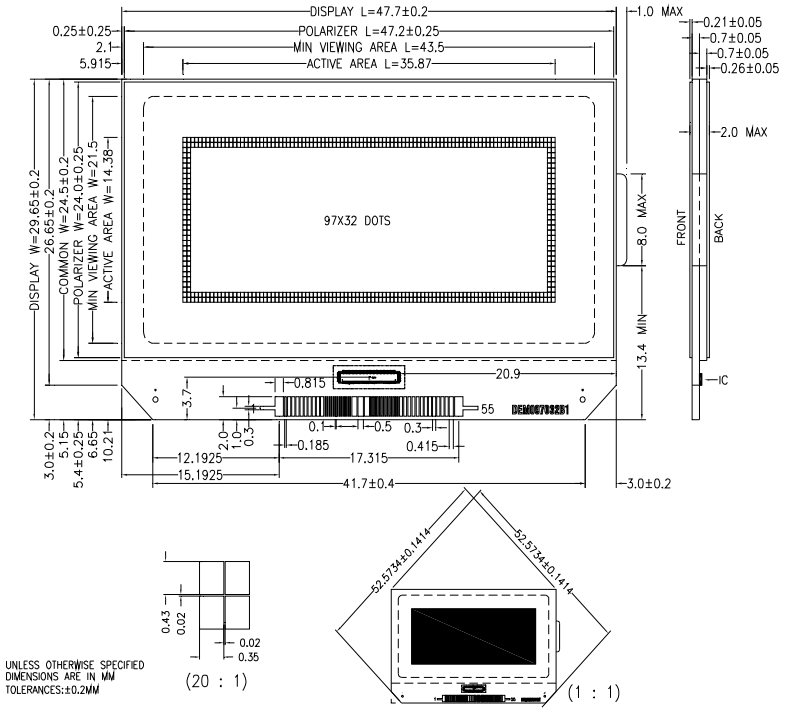


optimum vision with the naked eye and viewing angle θ at CR. max above are not always the same

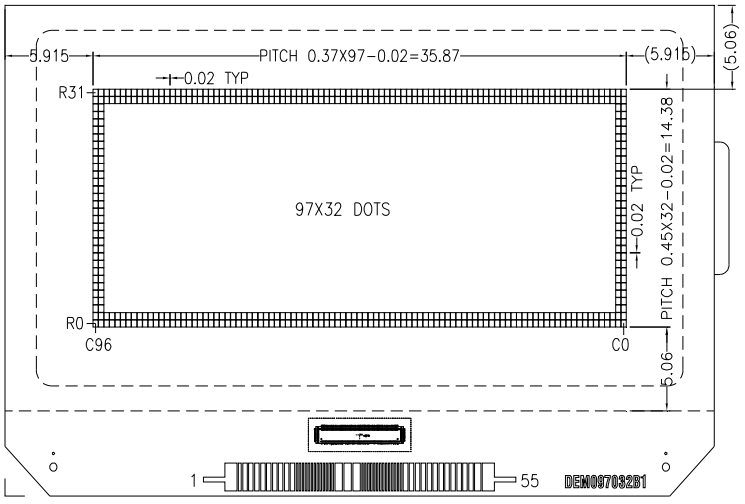
11.3 Definition of response time



12. LCD ARTWORK

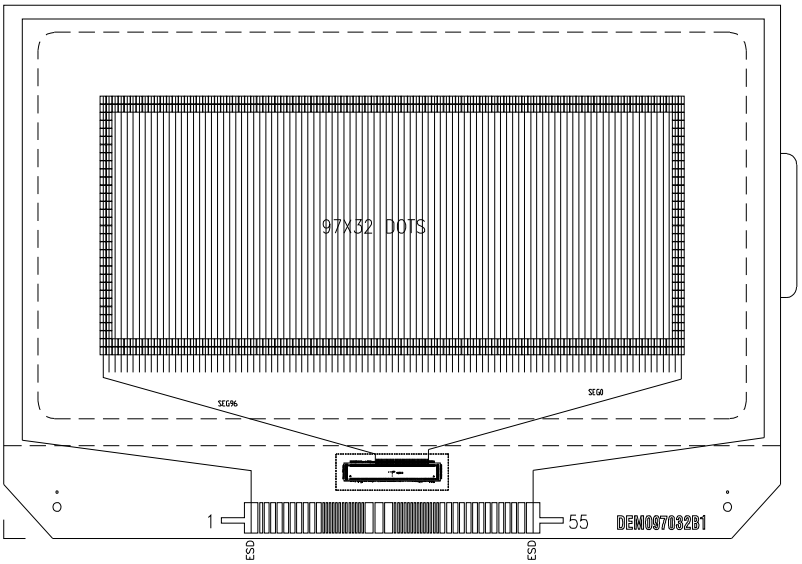


13. LABELLING&PAD CONFIGURATION



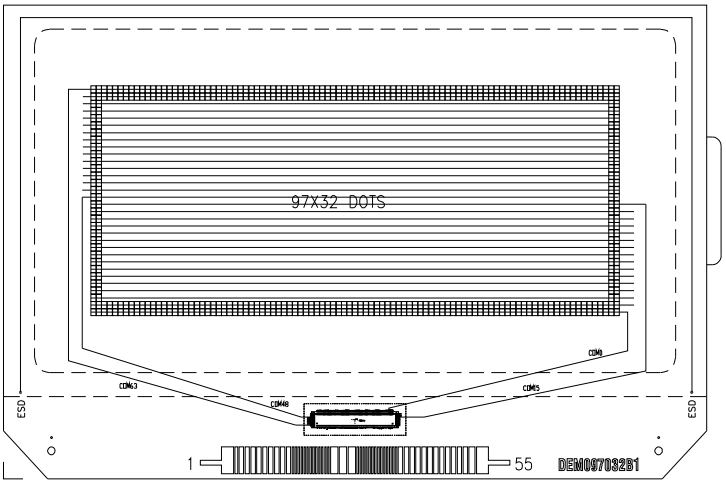
IC NO.	CONFIGURATION
COM63	COM63[R31(C0-C96)]
COM62	COM62[R30(C0-C96)]
COM49	COM49[R17(C0-C96)]
COM48	COM48[R16(C0-C96)]
SEG96	SEG96[C96(R0-R31)]
SEG95	SEG95[C95(R0-R31)]
SEG1	SEG1[C1(R0-R31)]
SEG0	SEG0[C0(R0-R31)]
COM0	COM0[R0(C0-C96)]
COM1	COM1[R1(C0-C96)]
COM14	COM14[R14(C0-C96)]
COM15	COM15[R15(C0-C96)]

14. SEG LAYOUT



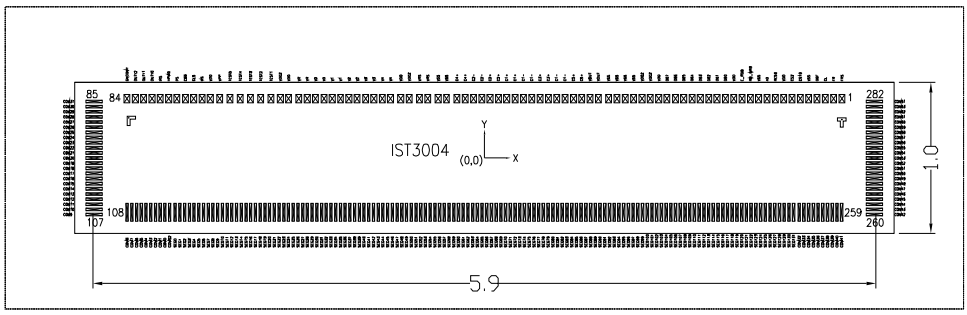
SEG

15. COM LAYOUT



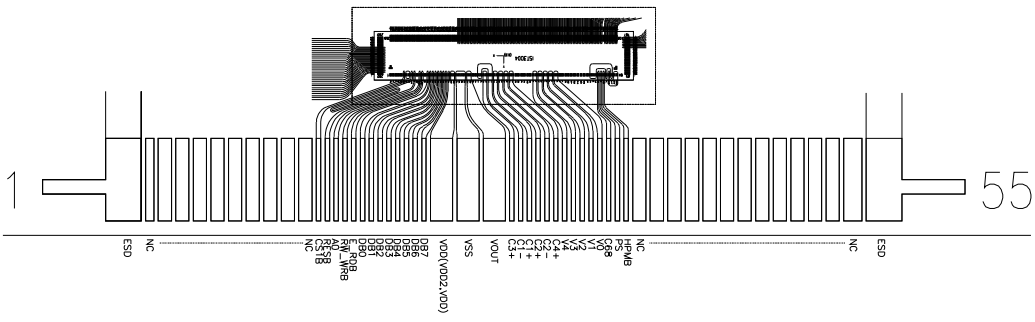
COM

16 . GRAPHIC DIMENSION & PAD CONFIGURATION



PAD NO.	PAD CONFIGURATION	PAD NO.	PAD CONFIGURATION
1	ESD	27	VOUT
2−10	NC	28	C3+
12	CS1B	29	C1−
13	RESB	30	C1+
14	A0	31	C2+
15	RW_WRB	32	C2−
16	E_RDB	33	C4+
17	DB0	34	V4
18	DB1	35	V3
19	DB2	36	V2
20	DB3	37	V1
21	DB4	38	V0
22	DB5	39	C68
23	DB6	40	PS
24	DB7	41	HPMB
25	VDD,VDD2	42−54	NC
26	VSS	55	ESD

17. IC LAYOUT

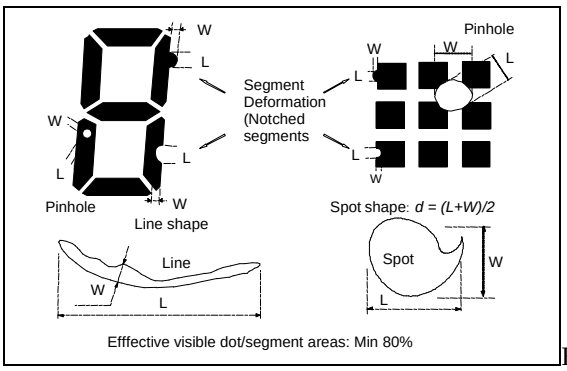


18. QUALITY DESCRIPTION

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)



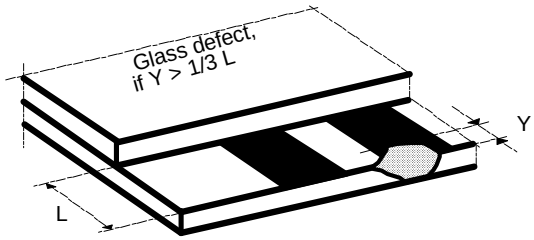
Examples/ Shapes

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

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.



19. RELIABILITY TEST

Operating life time: 50000 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 96hrs
Low Temperature Storage	-30°C x 96hrs
High Temperature Operation	+70°C x 96hrs
Low Temperature Operation	-20°C x 96hrs
High Temperature, High Humidity (Storage)	+75°C x 90%RH x 96hrs
Thermal Shock	-30°C x 30min →+25°C x 10s →+75°C x 30min 5Cycles
Vibration Test	Frequency x Swing x Time 40Hz x 4mm x 4hrs
Drop Test	Drop Height x No. of drops 1.0m x 6 drops

20. LCD MODULES HANDLING PRECATIONS

- Please remove the protection foil of polarizer before using.

- 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℃).Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

21. 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.