

**DISPLAY Elektronik GmbH**

# DATA SHEET

**LCD MODULE**

**DEM 16204 SBH-PW-N**

*Product Specification*

*Version: 0*

**05.07.2021**

# GENERAL SPECIFICATION

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## MODULE NO. : DEM 16204 SBH-PW-N

CUSTOMER P/N

VERSION NO.	CHANGE DESCRIPTION	DATE
0	ORIGINAL VERSION	05.07.2021

PREPARED BY: LM

DATE: 05.07.2021

APPROVED BY: WH

DATE: 05.07.2021

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**1. FUNCTIONS & FEATURES**

I DEM 16204 LCD TYPE:

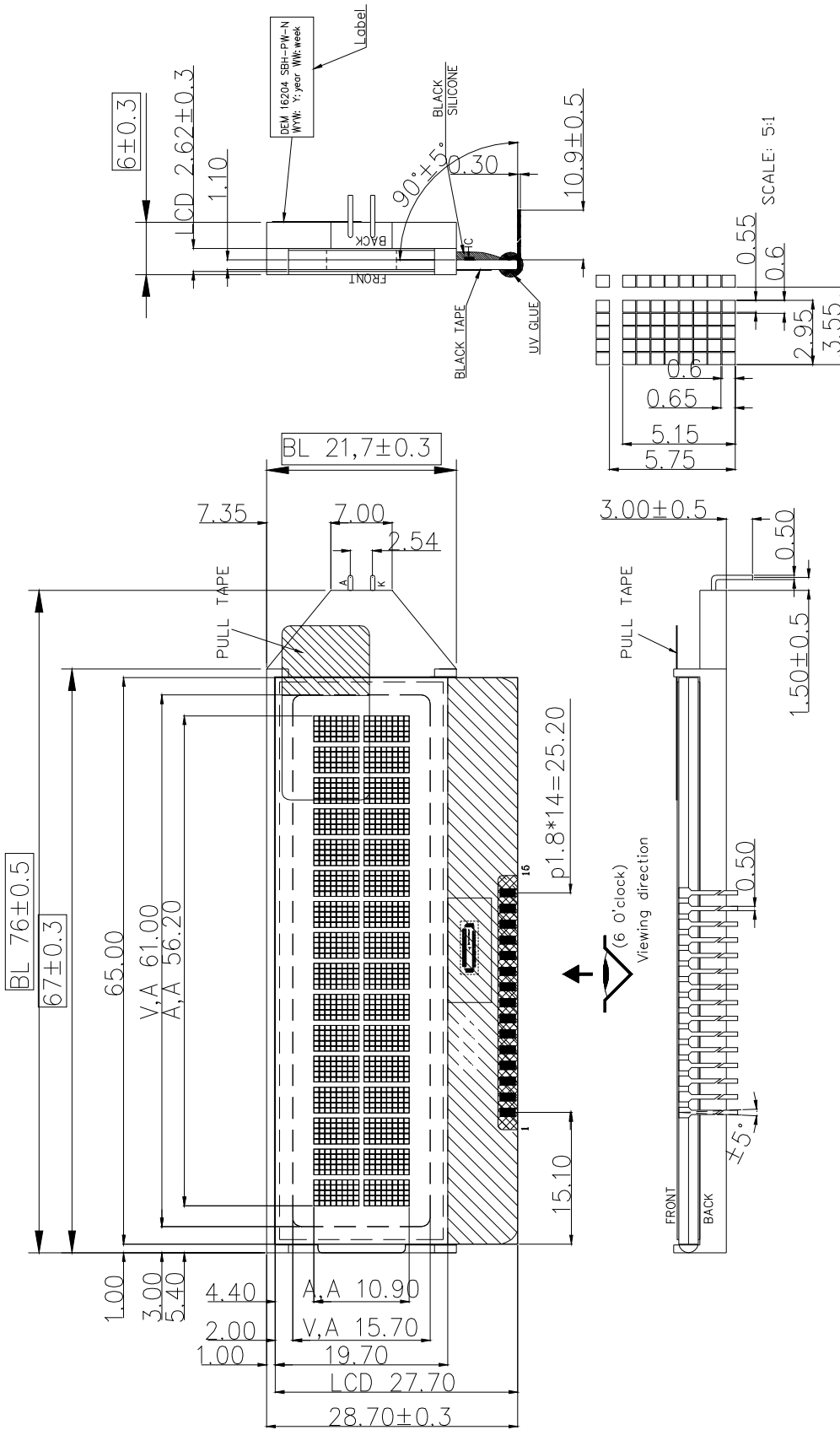
MODULE	LCD TYPE	REMARK
DEM 16204 SBH-PW-N	STN-Blue Transmissive Negative Mode	

I Viewing Direction	: 6 O'clock
I Driving Scheme	: 1/17 Duty Cycle, 1/5Bias
I Power Supply	: 5V
I V <sub>LCD</sub>	: 4.5 V
I Driver IC	: UCi7032c
I Backlight	:LED White Lightguide

**2. MECHANICAL SPECIFICATIONS**

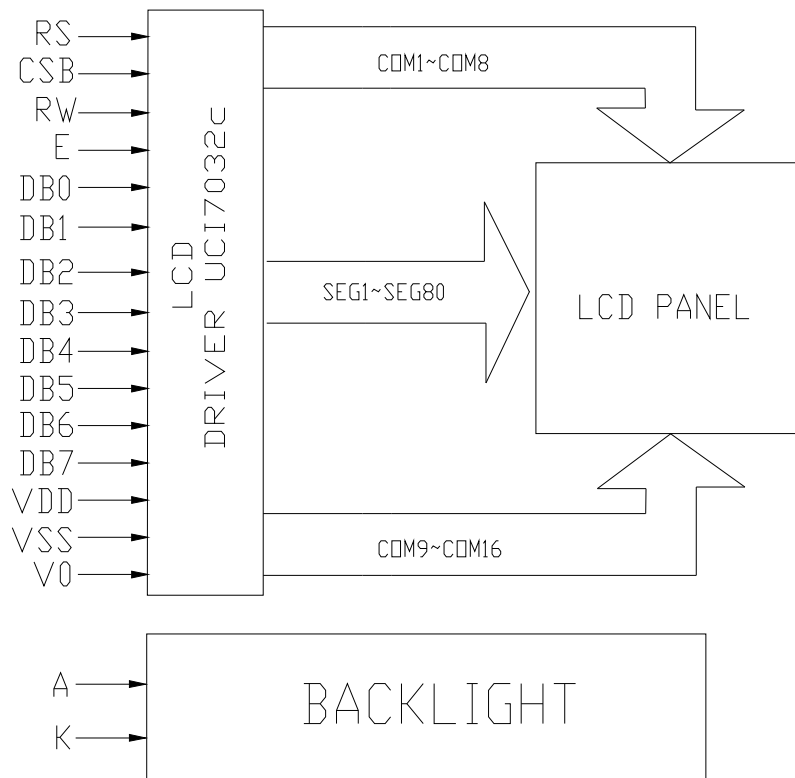
I Module Size	: 76.00 x 28.70 x6.00mm
I Viewing Area	: 61.00 x 15.70 mm
I Active Area	: 56.20 x 10.90 mm
I Character Pitch	: 3.55 x 5.75 (mm)
I Character Size	: 2.95 x 5.15 (mm)
I Dot Pitch	: 0.60 x 0.65 (mm)
I Dot Size	: 0.55 x 0.60 (mm)

3. EXTERNAL DIMENSIONS



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

4. BLOCK DIAGRAM

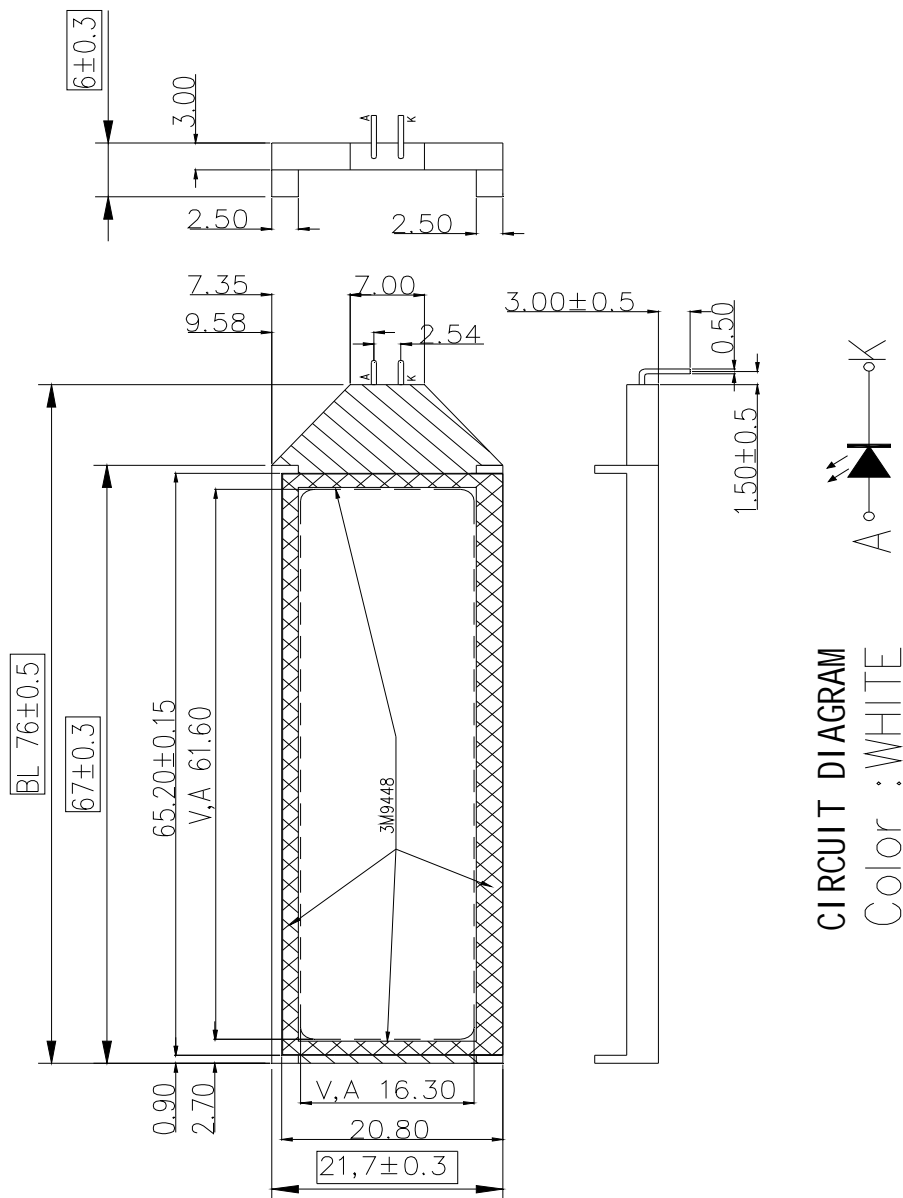


5. PIN ASSIGNMENT

Pin No.	Name	Description
1	RS	Register selection. 0: Instruction register (for write), or Busy flag & address counter (for read) 1: Data register (for read and write)
2	CSB	Chip Select. When the SCB is in falling edge state in serial interface, the shift register and the clock counter are reset. Active Low.
3	RW	Read or Write selection (in parallel mode) 0: Write 1: Read
4	E	Starts Data Read/Write. Must connect to VDD when serial interface is selected.
5~8	DB0~DB3	Low-order bi-directional data bus pins, used for data transfer and receive between the MPU and the UCi7032. These pins are not used during 4-bit operation.
9~12	DB4~DB7	High-order bi-directional data bus pins, used for data transfer and receive between the MPU and the UCi7032.
13	VSS	Ground of chip
14	VDD	Power supply
15	V0	Power supply for LCD drive

**6. BACKLIGHT ELECTRICAL/OPTICAL SPECIFICATIONS**

Item	symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	IF=15mA	2.8	3.1	3.4	V
Reverse Current	Ir	VR=5.0V	---	10	---	uA
Luminous Intensity(Without LCD)	Lv	IF=15mA	140	190	---	cd/m <sup>2</sup>
Wave length	$\lambda p$	IF=15mA	x=0.26 y=0.26	---	x=0.30 y=0.30	
Lifetime	30000 Hour					



**MGCF16273B00/B01**

- Remarks:
- 1.Unmarked tolerance is  $\pm 0.3$
  - 2.All materials comply with RoHs
  3. [ ] :...:critical dimension.

7. MAXIMUM ABSOLUTE LIMIT

Characteristic	Symbol	Value	Unit
Power Supply Voltage	V <sub>DD</sub>	-0.3 to+6.0	V
Power Supply Voltage	V <sub>LCD</sub>	11-VSS to -0.3+VSS	V
Input Voltage	V <sub>IN</sub>	-0.3 to VDD+0.3	V
Operating Temperature Range	TOPR	-20 to +70	°C
Storage Temperature Range	TSTR	-30 to +80	°C

8. ELECTRICAL CHARACTERISTICS

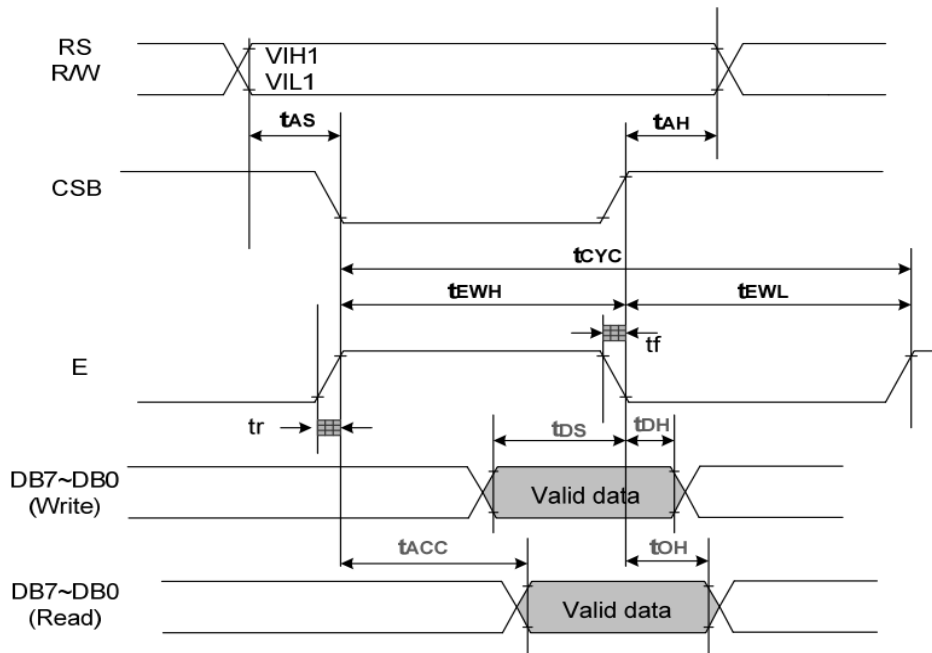
8-1.DC Characteristics

Item	Symbol	Standard Value			Unit
		MIN	TYP	MAX	
Operating Voltage	V <sub>DD</sub>	4.7	5.0	5.3	V
LCD Driving Voltage	V <sub>LCD</sub>	4.2	4.5	4.8	V
Supply Current	I <sub>DD</sub>	----	TBD	----	mA

8-2. AC Characteristics

6800 Interface

Symbol	Signal	Description	Condition	2.7V ≤ V <sub>DD</sub> < 4.5V		4.5V ≤ V <sub>DD</sub> < 5.5V		Unit
				Min.	Max.	Min.	Max.	
t <sub>AH</sub> t <sub>AW</sub> t <sub>CYC</sub>	RS	Address hold time Address setup time System cycle time		20 20 400		20 20 280		nS
t <sub>r</sub> , t <sub>f</sub> t <sub>EWH</sub> t <sub>EWL</sub>	E	Enable rising/falling time Enable high pulse time Enable low pulse time		200 150	20	120 130	20	nS
t <sub>DS</sub> t <sub>DH</sub>	DB7~DB0	Data setup time Data hold time		100 40		80 20		nS
t <sub>ACC</sub> t <sub>OH</sub>	DB7~DB0	Access time Output disable time	CL=100pF	300	500	150	400	nS





## 9. INSTRUCTION DESCRIPTION

Instructions for Extension mode (When "EXT" option pin is connected to Vss)

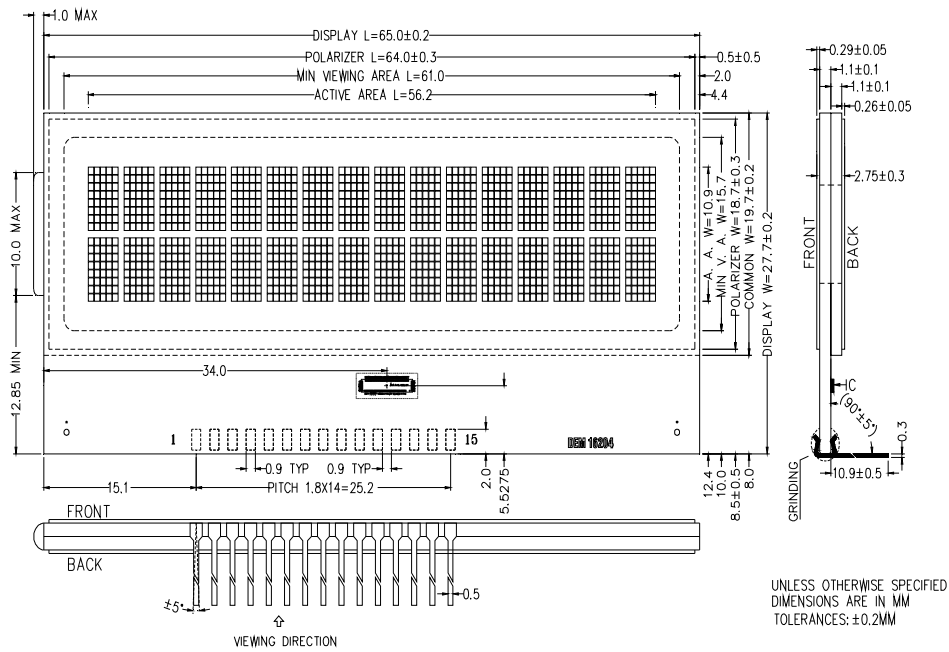
No	Command	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Action
1.	Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM and set DDRAM address to "00H" from AC
2.	Return Home	0	0	0	0	0	0	0	0	1	-	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.
3.	Set Entry Mode	0	0	0	0	0	0	0	1	VD	S	Set cursor move direction and specifies display shift. These operations are performed during data write and read.
4.	Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1: Entire display ON C=1: Cursor ON B=1: Cursor position ON
5.	Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	-	-	Note: when IS=0 only S/C and R/L: Set cursor moving, display shift control and the direction without changing DDRAM data
6.	Set Function	0	0	0	0	1	DL	N	DH	0	IS	DL: 8-bit or 4-bit N: 2 lines or 1 line DH: double height font IS: instruction table select
7.	Set CGRAM	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Note: when IS=0 only Set CGRAM address in address counter
8.	Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter
9.	Read Busy Flag / Address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.
10.	Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM / CGRAM)
11.	Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM / CGRAM)
12.	Internal OSC Frequency	0	0	0	0	0	1	BS	F2	F1	F0	Note: when IS=1 only BS=1: 1/4 bias BS=0: 1/5 bias F2~F0: Adjust internal OSC frequency for frame rate
13.	Set ICON Address	0	0	0	1	0	0	AC3	AC2	AC1	AC0	Note: when IS=1 only Set ICON address in address counter
14.	Power/ICON/Contrast Set	0	0	0	1	0	1	ION	BON	C5	C4	Note: when IS=1 only ION: ICON display on/off BON: Booster circuit on/off C5,C4: Contrast set for internal follower mode
15.	Follower Control	0	0	0	1	1	0	FON	Rab2	Rab1	Rab0	Note: when IS=1 only FON: Follower circuit on/off Rab2~Rab0: Follower amplified rate select
16.	Contrast Set	0	0	0	1	1	1	C3	C2	C1	C0	Note: when IS=1 only C3~C0: Contrast set for internal follower mode

Note: Command (5) and command (7) are available when IS=0 only, while commands (12) ~ (16) are available when IS=1 only.

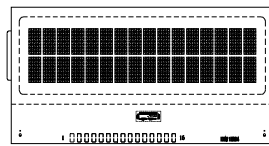
10. STANDARD CHARACTER PATTERN

b7-b4 b0-b0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111	
0000	Replaced By CGRAM Pattern	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
0001		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
0010		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
0011		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
0100		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
0101		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
0110		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
0111		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
1000	Replaced By CGRAM Pattern	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
1001		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
1010		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
1011		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
1100		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
1101		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
1110		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
1111		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

11. LCD ARTWORK



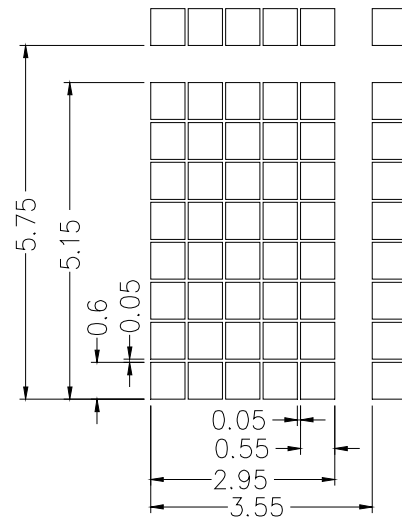
UNLESS OTHERWISE SPECIFIED  
DIMENSIONS ARE IN MM  
TOLERANCES: ±0.2MM



(1 : 1)

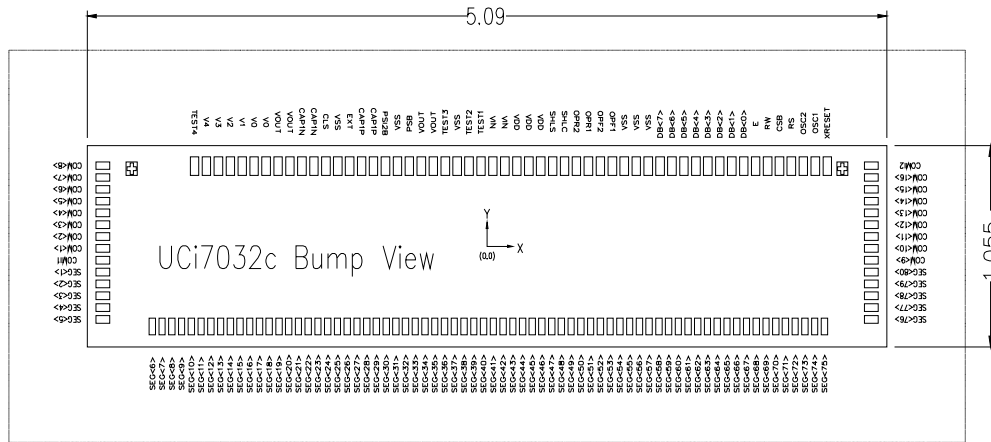
12.PAD CONFIGURATION&GRAPHIC DIMENSION

IC NO.	PAD CONFIGURATION
COM16	COM16[R16(C1-C80)]
COM9	COM9[R9(C1-C80)]
SEG80	SEG80[C80(R1-R16)]
SEG1	SEG1[C1(R1-R16)]
COM1	COM1[R1(C1-C80)]
COM8	COM8[R8(C1-C80)]



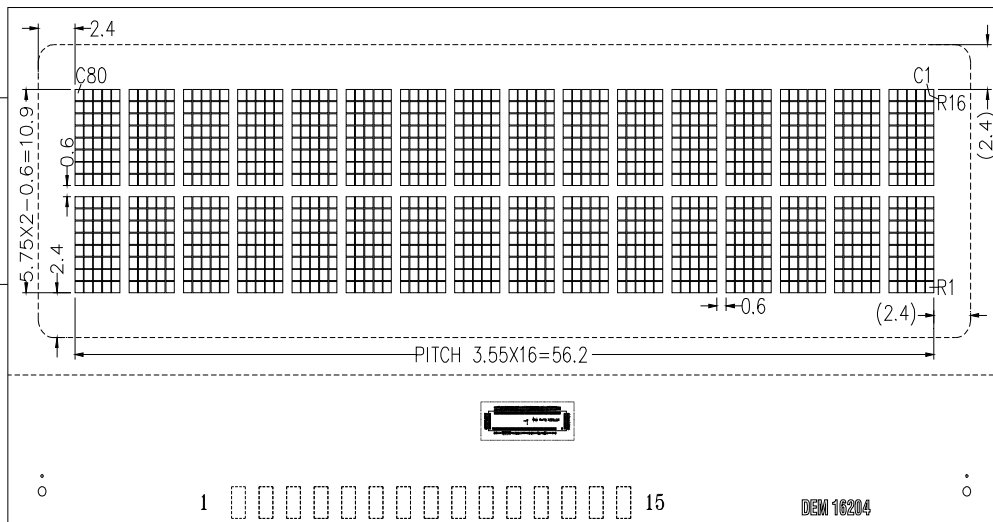
UNLESS OTHERWISE SPECIFIED  
DIMENSIONS ARE IN MM  
TOLERANCES: ±0.1MM

13.PAD CONFIGURATION&IC NO.CONFIGURATION



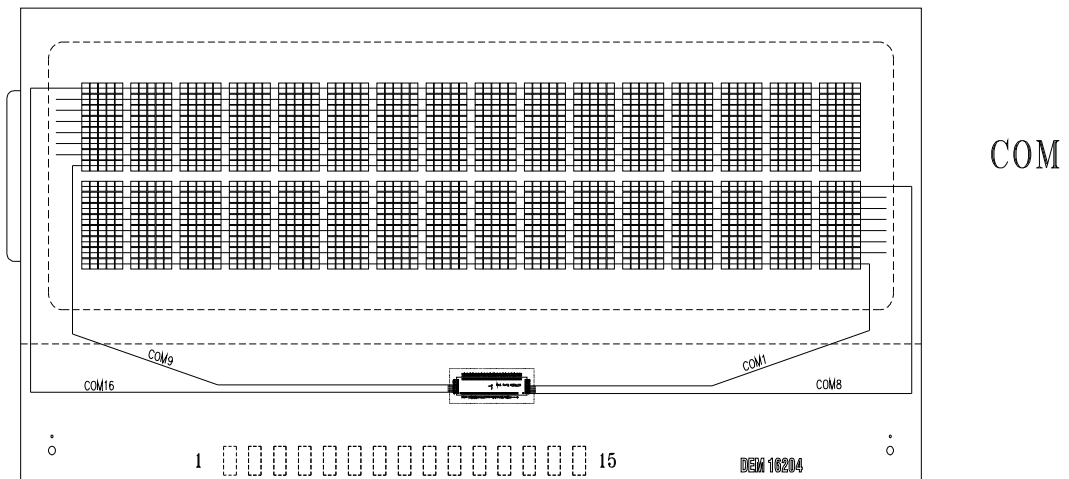
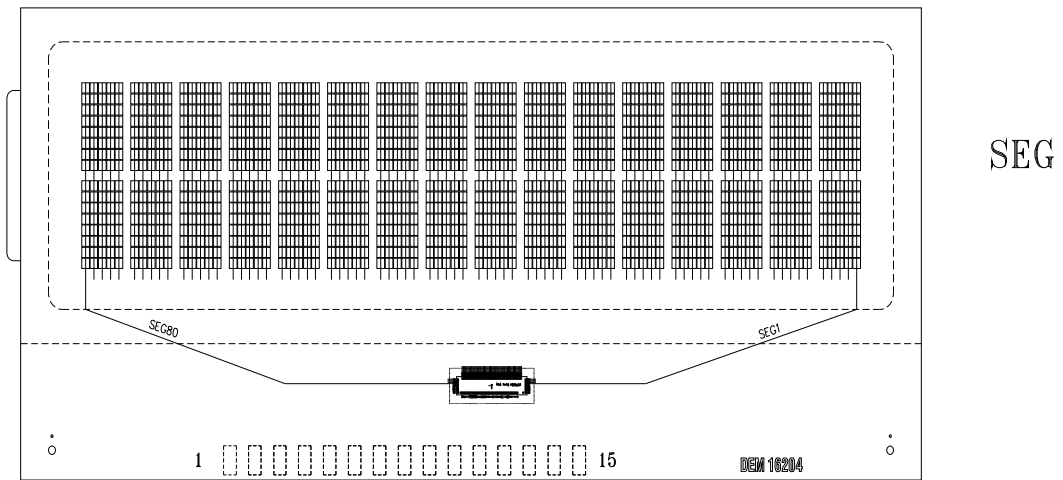
PAD NO.	PAD CONFIGURATION	PAD NO.	PAD CONFIGURATION
1	RS	9	DB4
2	CSB	10	DB5
3	RW	11	DB6
4	E	12	DB7
5	DB0	13	VSS,OPF1,OPR1,OPR2,SHLC,SHLS
6	DB1	14	VDD,XRESET,OPF2,VIN,TEST1,TEST2,PSB,PSI2B,CLS
7	DB2	15	V0
8	DB3		

14. LABELLING

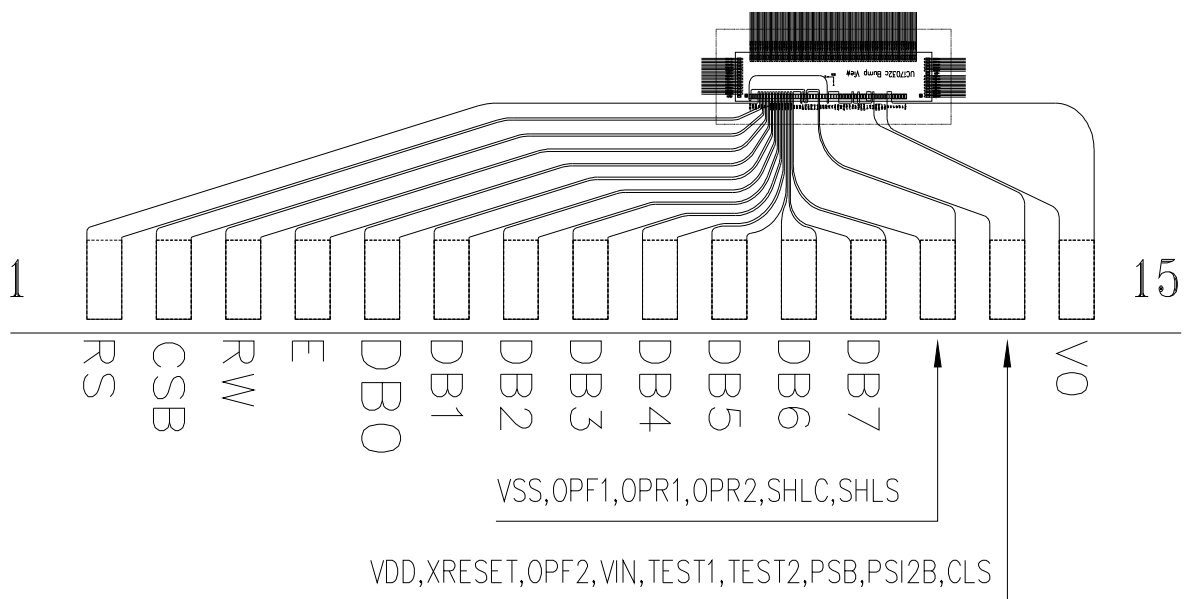


UNLESS OTHERWISE SPECIFIED  
DIMENSIONS ARE IN MM  
TOLERANCES: ±0.2MM

15. SEG LAYOUT & COM LAYOUT



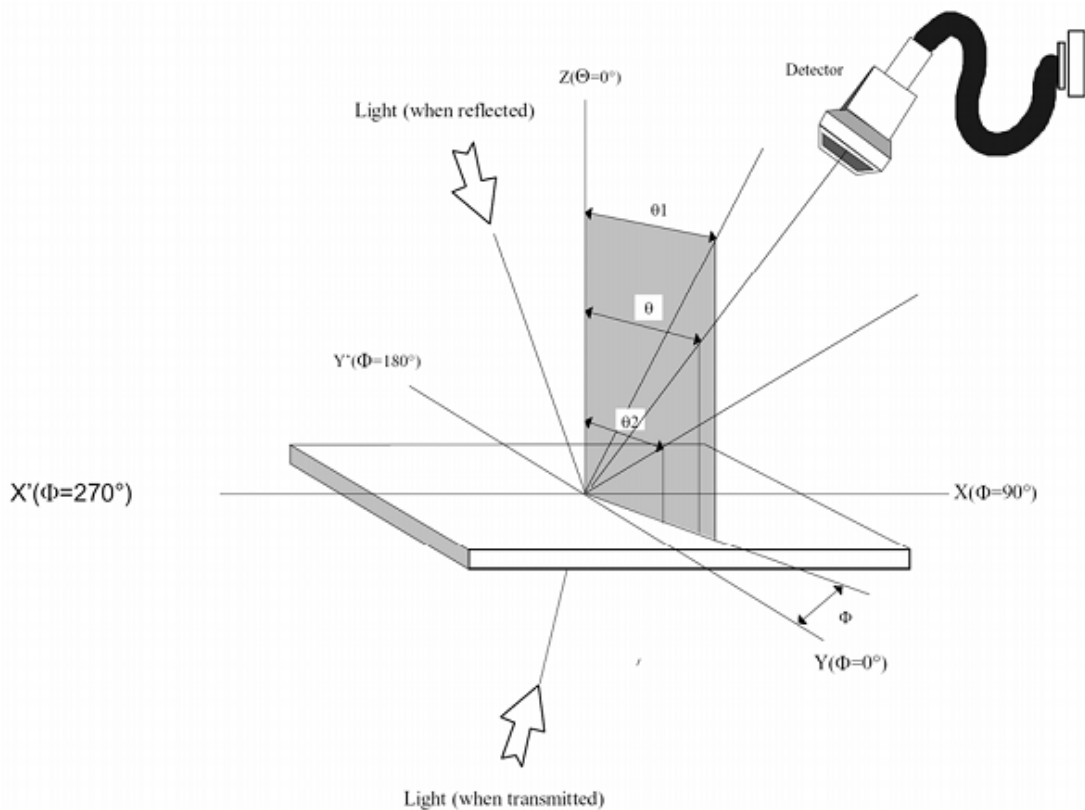
16. IC LAYOUT

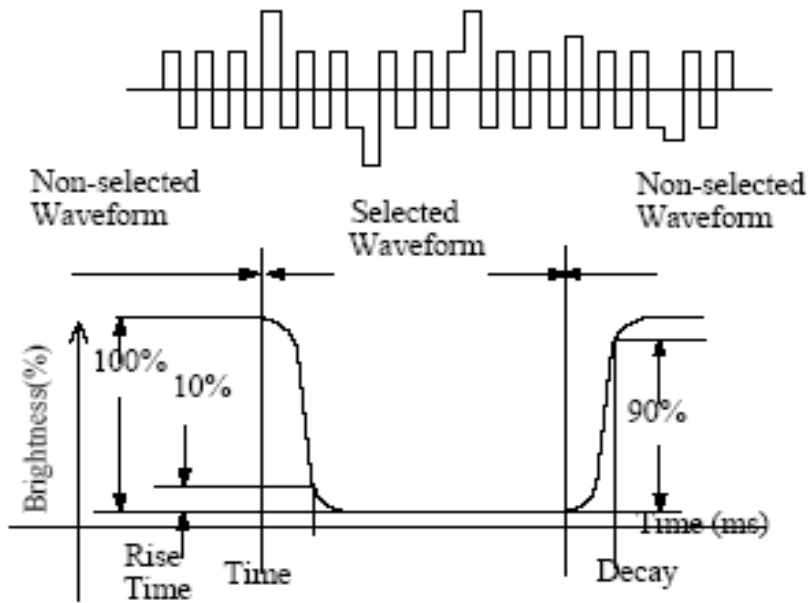


17. ELECTRO-OPTICAL DEFINITION

Optical Characteristics

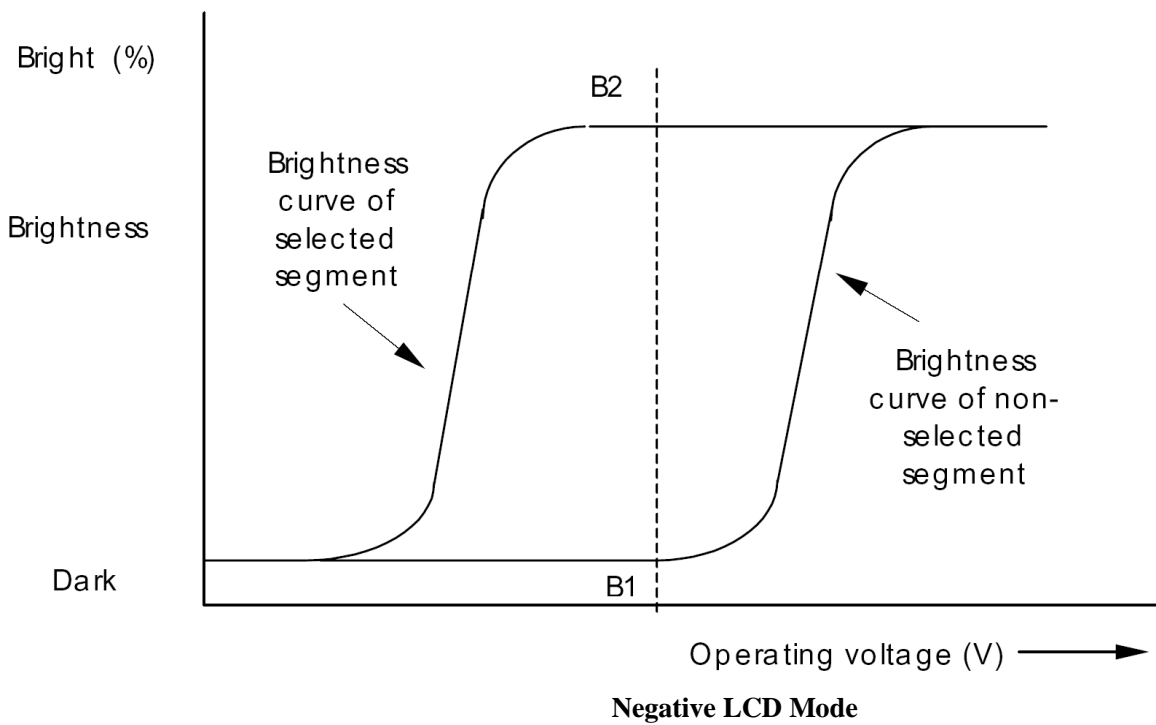
Item	Symbol	Description	Condition	Min	Typ	Max	Unit
Operating Voltage of LCD	$V_{LCD}$	---	$T_a = -20^{\circ}C$	4.7	5.0	5.3	V
		---	$T_a = 25^{\circ}C$	4.2	4.5	4.8	
		---	$T_a = 70^{\circ}C$	3.7	4.0	4.3	
Response time	$T_r$	Rise	$25^{\circ}C$	---	100	160	ms
	$T_f$	Fall	$25^{\circ}C$	---	150	200	ms
Contrast	$Cr$		$VDD = 5.0V \pm 3\%$ , $25^{\circ}C$	---	6	---	
Viewing angle	$\theta$	6 o'clock axis	$Cr \geq 2.0$ $VDD = 5.0V \pm 3\%$ , $25^{\circ}C$	---	50	---	
		12 o'clock axis	$VDD = 5.0V \pm 3\%$ , $25^{\circ}C$	---	40	---	
		3 o'clock axis	$VDD = 5.0V \pm 3\%$ , $25^{\circ}C$	---	40	---	
		9 o'clock axis	$VDD = 5.0V \pm 3\%$ , $25^{\circ}C$	---	40	---	





Definition of contrast

$$Cr. = \frac{B1}{B2} = \frac{\text{Brightness of not selected segment}}{\text{Brightness of selected segment}}$$



**18. 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 x 96hrs
Low temperature Storage	-30°C x 4hrs
High Temperature Operation	+70°C x 96hrs
Low Temperature Operation	-20°C x 4hrs
High Temperature, High Humidity (Storage)	+60°C x 95%RH x 96hrs
Thermal Shock	-20°C x 30min. ← 10s ↓      5Cycles +70°C x 30min. —
Vibration Test	Frequency x Swing x Time 40Hz x 4mm x 4hrs
Drop Test	Drop height x Times 1.0m x 6times

**19. MODULE ACCEPT QUALITY LEVEL (AQL)**

Inspection Standard: ANSI Z-1.4 Table Normal Inspection Single Sampling Level II .

**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 0°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