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PART NO. : MC16021E8-SERIES

FOR MESSRS. : _____

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| | | |
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ACCEPTED BY: _____

PROPOSED BY : _____

RECORD OF REVISION

| DATE | PAGE | SUMMARY |
|----------|------|--|
| 92/04/10 | 6 | NOTE(3): I _{LED} B:60mA/80mA→30mA/40mA |
| 92/04/10 | 10 | Power supply for LCM : CONDITION B: I _{LED} 80mA → I _{LED} 40mA |
| 92/04/21 | 8 | Outline dimension of LCD dot:LC→0.04 |
| 92/04/21 | 8 | Outline dimension of LCM:Add size (2.9) and size(3.0) |
| | | |

3. General specifications

3.1 General specifications

PLEASE REFER TO:

“CUSTOMER ACCEPTANCE STANDARD SPECIFICATIONS (MS-10-0069)”.

3.2 This individual specification is prior to general specifications

3.3 NUMBERING SYSTEM

MC16021E

| | |
|---|---|
| B | W |
|---|---|

 8-

| | | | | | | |
|---|---|---|---|---|---|---|
| S | Y | M | L | W | U | N |
|---|---|---|---|---|---|---|

(1) (2) (3) (4) (5) (6) (7) (8) (9)

(1).CHARACTER FONTS :

PLEASE REFER TO

“CUSTOMER ACCEPTANCE STANDARD SPECIFICATIONS (MS-10-0069)”

(2).LCM TEMPERATURE :

“nil” : NORMAL TEMP

“W” : WIDE TEMP

(3).LCD TYPE :

“T” : TN TYPE

“S” : STN TYPE

“H” : HTN TYPE

“F” : FSTN TYPE

(4).LCD COLOR :

“Y” : YELLOW-GREEN “B” : BLUE(STN/NEGATIVE)/BLACK(FSTN/NEGATIVE)

“G” : GRAY “W” : WHITE(FSTN/POSITIVE)

(5)LCD POLARIZE TYPE

“nil” : TRANSFLECTIVE

“M” : TRANSMISSIVE

(6).BACKLIGHT TYPE :

“L” : LED BACKLIGHT

(7).BACKLIGHT COLOR :

LED TYPE :

“nil” : YELLOW-GREEN

“A” : AMBER

“B” : BLUE

“G” : GREEN

“O” : ORANGE

“R” : RED

“W” : WHITE

(8).VIEWING ANGLE :

“nil” : 6 O’CLOCK

“3” : 3 O’CLOCK

“U” : 12 O’CLOCK

“9” : 9 O’CLOCK

(9).BACKLIGHT TYPE :

“nil” : LED(+),LED(---)NORMAL

“N” : LED(+),LED(---)CHANGE

4. Mechanical data

- (1) NUMBER OF DOT-----16 CH * 2 LINE
- (2) MODULE SIZE -----84.0 W * 44.0 H * 10.0T(max) mm
- (3) EFFECTIVE AREA -----64.5 W * 16.0 H mm
- (4) CHARACTER PATTERN -----5 * 7 DOTS + CURSOR
- (5) CHARACTER SIZE-----2.96W * 4.86 H mm
- (6) CHARACTER PITCH -----3.55 mm
- (7) DOT SIZE-----0.56 W * 0.66 H mm
- (8) DOT PITCH -----0.60 W * 0.70H mm

5. Absolute maximum ratings

5.1 Electrical absolute maximum ratings

| <i>I T E M</i> | <i>SYMBOL</i> | <i>MIN.</i> | <i>MAX.</i> | <i>UNIT</i> | <i>COMMENT</i> |
|------------------------|----------------------------------|-----------------|-----------------|-------------|----------------|
| POWER SUPPLY FOR LOGIC | V _{DD} -V _{SS} | 0 | 6.0 | V | ----- |
| INPUT VOLTAGE | V _I | V _{SS} | V _{DD} | V | ----- |
| STATIC ELECTRICITY | ----- | ----- | 100 | V | NOTE (1) |
| POWER SUPPLY FOR LED | V _{LED} | ----- | NOTE(2) | V | ----- |

NOTE (1): ELECTRO-STATIC DISCHARGE RESISTANCE IS TESTED BY CHARGING A 200PF CAPACITOR AND DISCHARGING IT BY CONTACT WITH A INTERFACE CONNECTOR PIN.

NOTE (2):

| <i>SYMBOL</i> | <i>V_{LED} MAX.</i> | <i>LED TYPE</i> |
|------------------|-----------------------------|-------------------------------|
| V _{LED} | 6.0V | YELLOW-GREEN,AMBER,ORANGE,RED |
| | 5.0V | BLUE,GREEN,WHITE |

5.2 Environmental absolute maximum ratings

| <i>I T E M</i> | <i>OPERATING</i> | | | <i>STORAGE</i> | | <i>COMMENT</i> |
|-----------------------|------------------|-------------|----------------|----------------|-----------------|---|
| | <i>CONDITION</i> | <i>MIN.</i> | <i>MAX.</i> | <i>MIN.</i> | <i>MAX.</i> | |
| AMBIENT TEMPERATURE | NORMAL | 0 | 50 | -20 | 70 | ----- |
| | WIDE | -20 | 70 | | | |
| HUMIDITY | NOTE (3) | | NOTE (3) | | NO CONDENSATION | |
| VIBRATION NOTE (4) | ----- | 0.5G | ----- | 2G | | 10~300Hz XYZ DIRECTIONS 1 Hr EACH |
| SHOCK NOTE (4) | ----- | 3G | ----- | 50G | | 10 msec XYZ DIRECTIONS 1 TIME EACH |
| CORROSIVE GAS | NOT ACCEPTABLE | | NOT ACCEPTABLE | | ----- | |

NOTE (3): T_a 50 : 90% RH MAX.

T_a > 50 : ABSOLUTE HUMIDITY MUST BE LOWER THAN THE HUMIDITY OF 90% RH AT 50 . (80%RH AT 60)

NOTE (4): 1G = 9.8 m/s²

6. Electrical characteristics

Ta = 25

VDD = 5.0 ± 0.25 V

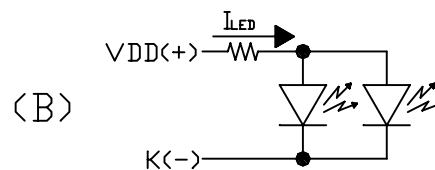
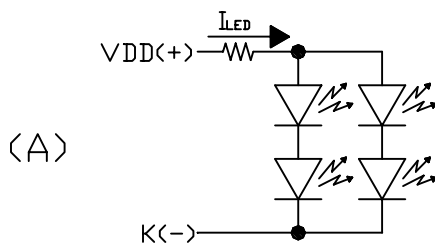
| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | |
|--|---------------------------------|--|----------|---------|---------|-------|---|
| INPUT VOLTAGE | V _{IH} | ----- | 2.2 | ----- | ----- | V | |
| | V _{IL} | ----- | ----- | ----- | 0.6 | V | |
| OUTPUT VOLTAGE | V _{OH} | -I _{OH} = 0.205 mA | 2.4 | ----- | ----- | V | |
| | V _{OL} | I _{OL} = 1.2 mA | ----- | ----- | 0.4 | V | |
| POWER SUPPLY CURRENT | I _{DD} | V _{DD} = 5.0V | ----- | 1.0 | 1.5 | mA | |
| RECOMMENDED LCD DRIVING VOLTAGE, NOTE(1) | V _{DD} -V _O | STN/ FSTN DUTY =1/16 =10° NOTE(2) | Ta=-20°C | ----- | 4.8 | ----- | V |
| | | | Ta= 0°C | ----- | 4.7 | ----- | V |
| | | | Ta= 25°C | ----- | 4.5 | ----- | V |
| | | | Ta= 50°C | ----- | 4.3 | ----- | V |
| | | | Ta= 70°C | ----- | 4.2 | ----- | V |
| | | TN DUTY =1/16 =25° NOTE(2) | Ta=-20°C | ----- | 4.5 | ----- | V |
| | | | Ta= 0°C | ----- | 4.4 | ----- | V |
| | | | Ta= 25°C | ----- | 4.2 | ----- | V |
| | | | Ta= 50°C | ----- | 4.0 | ----- | V |
| | | | Ta= 70°C | ----- | 3.9 | ----- | V |
| POWER SUPPLY CURRENT FOR LED | I _{LED} | V _{LED} | ----- | NOTE(3) | NOTE(3) | mA | |

NOTE (1): RECOMMENDED LCD DRIVING VOLTAGE MAY FLUCTUATE ABOUT ±0.5V BY EACH MODULE.

- (2): = 0° : VIEWING ANGLE AT 6 O’CLOCK
 = 180° : VIEWING ANGLE AT 12 O’CLOCK

⚠ (3): LED CURRENT OF DEFFERENT LED TYPE

| TYPE | I _{LED} TYP. / MAX. | LED TYPE |
|------|------------------------------|----------------------------------|
| A | 30mA / 40mA | YELLOW-GREEN, AMBER, ORANGE, RED |
| B | 30mA / 40mA | BLUE, GREEN, WHITE |



7. Optical characteristics

TN TYPE LCD

 $T_a = 25$
 $V_{DD}-V_O = 4.2V$

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE |
|----------------|-----------|--------------------|------|------|------|------|---------|
| VIEWING ANGLE | 2- 1 | K = 1.4 NOTE(1) | 20 | 30 | ---- | deg. | NOTE(2) |
| CONTRAST RATIO | K | = 25° NOTE(1) | 2.0 | 3.0 | ---- | ---- | NOTE(2) |
| RESPONSE TIME | tr (rise) | = 25° NOTE(1) | ---- | 150 | 250 | ms | NOTE(2) |
| | tf (fall) | = 25° NOTE(1) | ---- | 150 | 250 | ms | NOTE(2) |

STN TYPE LCD

 $T_a = 25$
 $V_{DD}-V_O = 4.5V$

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE |
|----------------|-----------|--------------------|------|------|------|------|---------|
| VIEWING ANGLE | 2- 1 | K = 2.0 NOTE(1) | 30 | 40 | ---- | deg. | NOTE(2) |
| CONTRAST RATIO | K | = 10° NOTE(1) | 3.0 | 4.0 | ---- | ---- | NOTE(2) |
| RESPONSE TIME | tr (rise) | = 10° NOTE(1) | ---- | 200 | 350 | ms | NOTE(2) |
| | tf (fall) | = 10° NOTE(1) | ---- | 300 | 400 | ms | NOTE(2) |

FSTN TYPE LCD

 $T_a = 25$
 $V_{DD}-V_O = 4.5V$

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE |
|----------------|-----------|--------------------|------|------|------|------|---------|
| VIEWING ANGLE | 2- 1 | K = 2.0 NOTE(1) | 30 | 40 | ---- | deg. | NOTE(2) |
| CONTRAST RATIO | K | = 10° NOTE(1) | 4.0 | 5.0 | ---- | ---- | NOTE(2) |
| RESPONSE TIME | tr (rise) | = 10° NOTE(1) | ---- | 200 | 350 | ms | NOTE(2) |
| | tf (fall) | = 10° NOTE(1) | ---- | 300 | 400 | ms | NOTE(2) |

Brightness for LED backlight

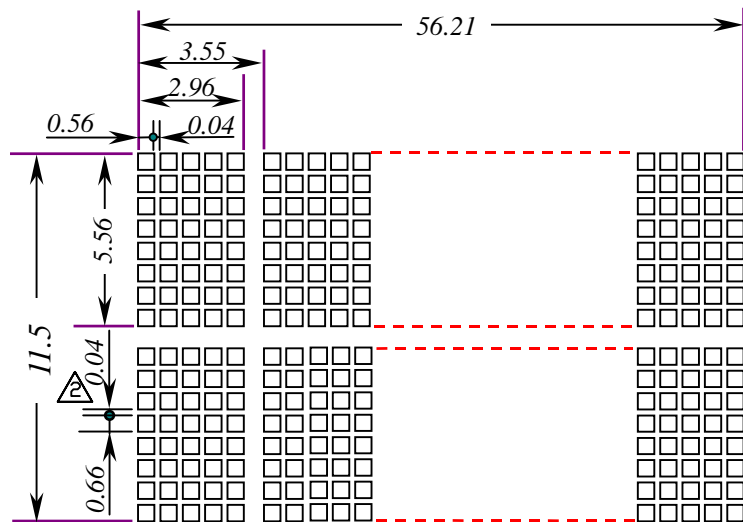
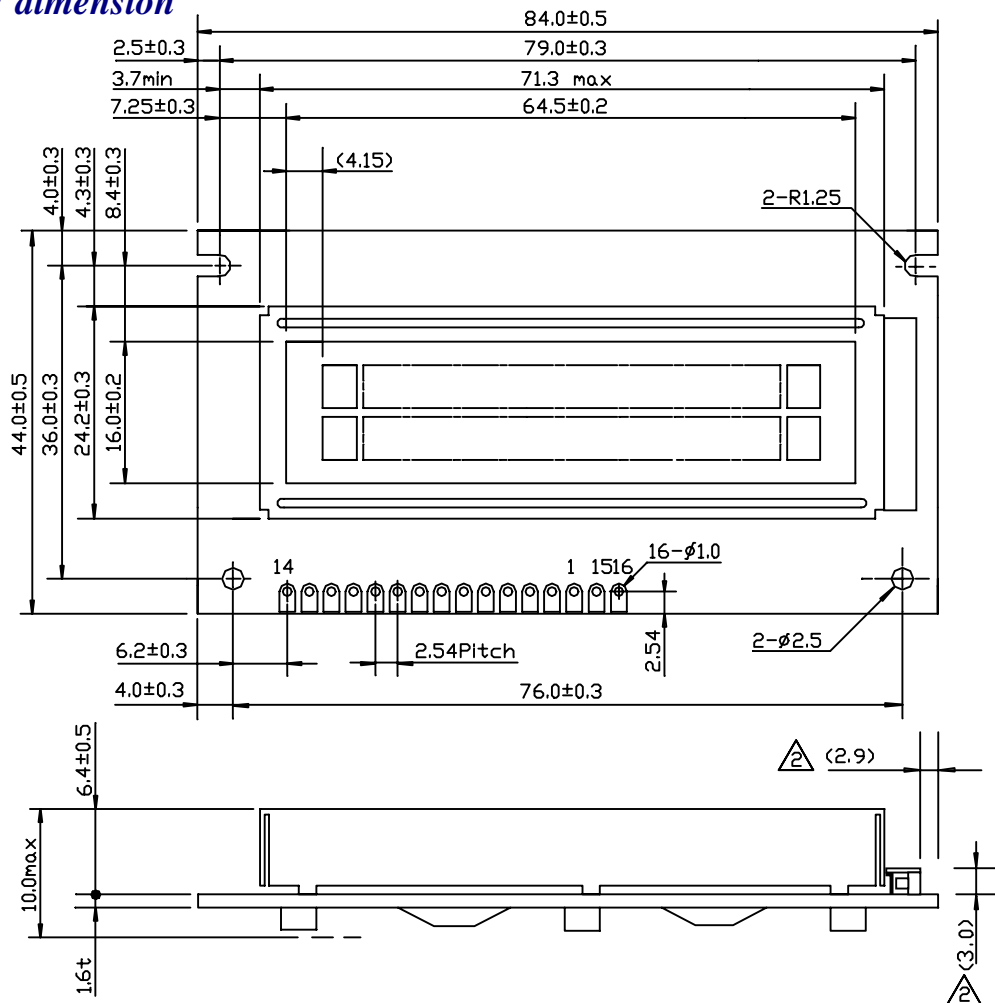
| SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | LED TYPE | NOTE |
|--------|-----------|------|------|------|-------------------|-------------------------------------|---------|
| B | = 0° | 4.0 | ---- | ---- | cd/m ² | YELLOW-GREEN, RED, AMBER, ORANGE | NOTE(2) |
| | = 0° | 6.0 | ---- | ---- | | BLUE, GREEN, WHITE | NOTE(3) |

NOTE (1): = 0° WHEN VIEWING ANGLE AT 6 O'CLOCK
= 180° WHEN VIEWING ANGLE AT 12 O'CLOCK

(2): SEE CUSTOMER ACCEPTANCE STANDARD SPECIFICATION FOR DEFINITION OF OPTICAL CHARACTERISTICS.

(3): UNDER NORMAL TEMPERATURE AND HUMIDITY IN A DARK ROOM.

8. Outline dimension

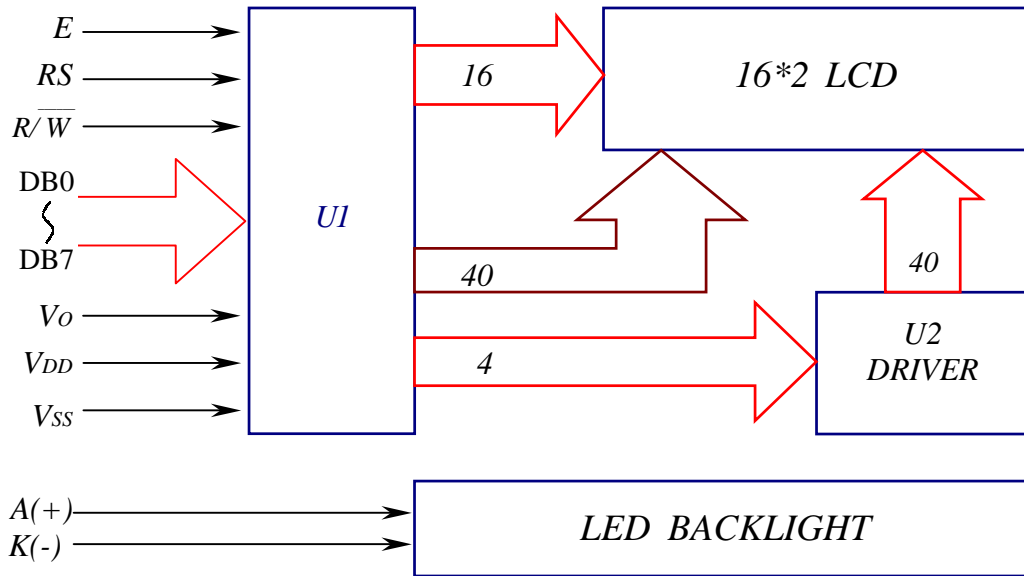


NOTE :
 1.UNIT : mm
 2.SCALE : NTS

Interface pin connection

| | | | | | | | | |
|----------------|-----------------|-----------------|----------------|-----------|-----------|-----------|-----------|-----------|
| PIN NO. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| SYMBOL | V _{SS} | V _{DD} | V _O | RS | R/W | E | DB0 | DB1 |
| PIN NO. | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| SYMBOL | DB2 | DB3 | DB4 | DB5 | DB6 | DB7 | A(+) | K(-) |

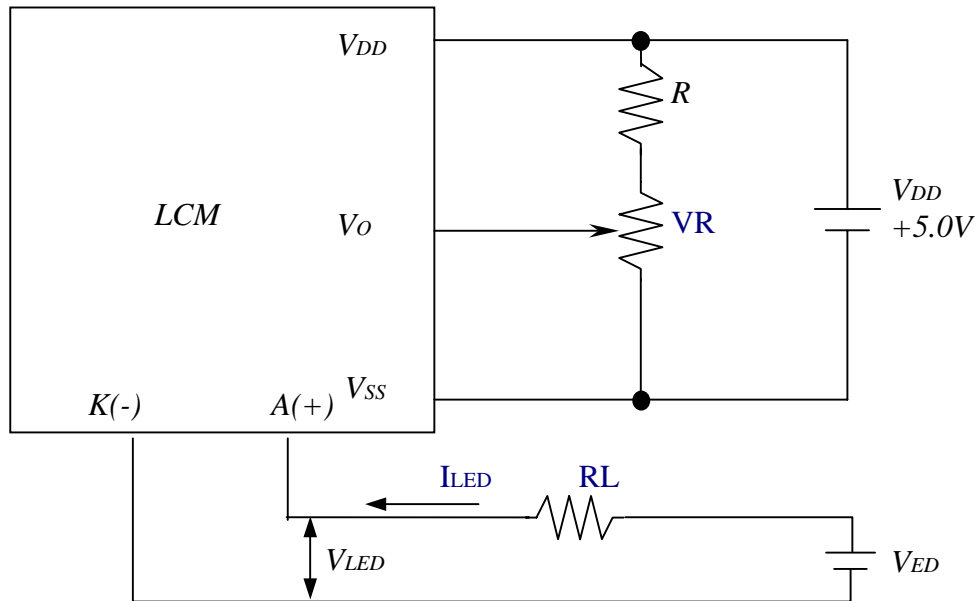
9. Block diagram



Display data address charts

| Character | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|-----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| LINE 1 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F |
| LINE 2 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4B | 4C | 4D | 4E | 4F |

10. Power supply for LCM



RECOMMENDED RESISTOR R : $V_{DD}-V_o$ 1.5V

$V_{DD}-V_o$: LCD DRIVING VOLTAGE

VR: 10K ~20K

| ITEM | LED TYPE | CONDITION |
|----------------------------|---------------|---|
| Limit resister of LED (RL) | A | $RL = ((V_{ED}-5.0V) / I_{LED})$, $I_{LED} = 40mA$ |
| | \triangle B | $RL = ((V_{ED}-4.0V) / I_{LED})$, $I_{LED} = 40mA$ |