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PART NO. : MG2406B-SERIES

FOR MESSRS. : \_\_\_\_\_

## CONTENTS

| <i>NO.</i> | <i>ITEM</i>                                   | <i>PAGE</i> |
|------------|---|-------------|
| 1.         | COVER   | 1           |
| 2.         | RECORD OF REVISION                            | 2           |
| 3.         | GENERAL SPECIFICATION                         | 3           |
| 4.         | MECHANICAL DATA                               | 4           |
| 5.         | ABSOLUTE MAXIMUM RATINGS                      | 5           |
| 6.         | ELECTRICAL CHARACTERISTICS                    | 6           |
| 7.         | OPTICAL CHARACTERISTICS                       | 7           |
| 8.         | OUTLINE DIMENSION AND INTERNAL PIN CONNECTION | 8~9         |
| 9.         | BLOCK DIAGRAM                                 | 10          |
| 10.        | POWER SUPPLY                                  | 11          |
|            |   |             |
|            |   |             |



ACCEPTED BY : \_\_\_\_\_

PROPOSED BY : \_\_\_\_\_

## RECORD OF REVISION

| DATE | PAGE | SUMMARY |
|------|------|---------|
|      |      |         |

### 3. General specifications

#### 3.1 General specifications

PLEASE REFER TO:

“CUSTOMER ACCEPTANCE STANDARD SPECIFICATIONS (MS-10-79810)”

#### 3.2 This individual specification is prior to general specifications

#### 3.3 NUMBERING SYSTEM

**MG2406B** - 

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

  
(1) (2) (3) (4) (5) (6)

(1).LCD TYPE :

“S” : STN TYPE

“F” : FSTN TYPE

(2).LCD COLOR :

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

“G” : GRAY      “W” : WHITE(FSTN/POSITIVE)

(3).LCD POLARIZE TYPE

“nil” : TRANSFLECTIVE

“M” : TRANSMISSIVE

(4).BACKLIGHT TYPE :

“E” : EL BACKLIGHT

“L” : LED BACKLIGHT

“R” : REFLECTIVE

(5).BACKLIGHT COLOR :

LED TYPE :

“nil” : YELLOW-GREEN      “A” : AMBER      “B” : BLUE

“G” : PURE-GREEN      “O” : ORANGE      “R” : RED

“W” : WHITE

EL TYPE :

“nil” : WHITE      “B” : BLUE-GREEN

(6).VIEWING DIRECTION :

“nil” : 6 O’CLOCK      “3” : 3 O’CLOCK

“U” : 12 O’CLOCK      “9” : 9 O’CLOCK

#### **4. Mechanical data**

- (1) NUMBER OF DOT----- 240 W\* 64 H DOTS
- (2) MODULE SIZE----- 140.0 W \* 62.0 H \* "C" T (Max) mm
- (3) EFFECTIVE AREA----- 116.0 W \* 37.0 H mm
- (4) ACTIVE AREA----- 105.57 W \* 31.97 H mm
- (5) DOT SIZE ----- 0.41 W \* 0.47 H mm
- (6) DOT PITCH----- 0.44 W \* 0.50 H mm

*NOTE : The dimension of "C" , please refer to Outline dimension on PAGE 8/11*

## 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 <sub>DD</sub> -V <sub>SS</sub> | 0               | 6.0             | V                | -----                                 |
| INPUT VOLTAGE                 | V <sub>I</sub>                   | V <sub>SS</sub> | V <sub>DD</sub> | V                | -----                                 |
| STATIC ELECTRICITY            | -----                            | -----           | 100             | V                | NOTE (1)                              |
| POWER SUPPLY FOR EL BACKLIGHT | V <sub>EL</sub>                  | -----           | AC200           | V <sub>rms</sub> | f <sub>EL</sub> =1.0KHz<br>60 SEC.MAX |
|                               | f <sub>EL</sub>                  | -----           | 2.0             | KHz              | AC115 V <sub>rms</sub><br>60 SEC.MAX  |
| POWER SUPPLY FOR LED          | V <sub>LED</sub>                 | -----           | 5.0             | V                | -----                                 |

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

### 5.2 Environmental absolute maximum ratings

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

NOTE (2): Ta = 50 : 90% RH MAX.

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

NOTE (3): 1G = 9.8 m/s<sup>2</sup>

## 6. Electrical characteristics

$T_a = 25$

$V_{DD} = 5.0 \pm 0.25 \text{ V}$

| ITEM                                     | SYMBOL          | CONDITION  | MIN.                      | TYP.    | MAX.     | UNIT  |   |
|--|-----------------|--|---------------------------|---------|----------|-------|---|
| POWER SUPPLY VOLTAGE FOR CIRCUIT         | $V_{DD}-V_{SS}$ | -----  | 4.75                      | 5.0     | 5.25     | V     |   |
| INPUT VOLTAGE                            | $V_{IH}$        | H LEVEL  | 2.0                       | -----   | $V_{DD}$ | V     |   |
|  | $V_{IL}$        | L LEVEL  | 0                         | -----   | 0.8      | V     |   |
| OUTPUT VOLTAGE                           | $V_{OH}$        | $I_{OH} = -0.3 \text{ mA}$                           | 2.4                       | -----   | $V_{DD}$ | V     |   |
|  | $V_{OL}$        | $I_{OH} = 3.0 \text{ mA}$                            | 0                         | -----   | 0.4      | V     |   |
| POWER SUPPLY CURRENT                     | $I_{DD}$        | $V_{DD}-V_{SS} = 5.0 \text{ V}$                      | -----                     | 10.0    | 20.0     | mA    |   |
| RECOMMENDED LCD DRIVING VOLTAGE, NOTE(1) | $V_{DD}-V_O$    | STN/<br>FSTN<br>DUTY<br>=1/64<br>=10°<br>NOTE(2)     | $T_a = -20^\circ\text{C}$ | -----   | 8.9      | ----- | V |
|  |                 |  | $T_a = 25^\circ\text{C}$  | -----   | 8.5      | ----- | V |
|  |                 |  | $T_a = 70^\circ\text{C}$  | -----   | 8.1      | ----- | V |
| POWER SUPPLY CURRENT FOR EL BACKLIGHT    | $I_{EL}$        | $V_{EL} = 115\text{Vrms}$<br>$f_{EL} = 400\text{Hz}$ | -----                     | 8.0     | -----    | mArms |   |
| POWER SUPPLY CURRENT FOR LED             | $I_{LED}$       | NOTE(3)  | -----                     | NOTE(3) | NOTE(3)  | mA    |   |

NOTE (1): RECOMMENDED LCD DRIVING VOLTAGE MAY FLUCTUATE ABOUT  $\pm 0.5\text{V}$  BY EACH MODULE.

(2):  $= 0^\circ$  : VIEWING DIRECTION AT 6 O'CLOCK

$= 180^\circ$  : VIEWING DIRECTION AT 12 O'CLOCK

(3): LED CURRENT FOR DIFFERENT LED BACKLIGHT TYPE

| LED B.L TYPE    | CONDITION               | $I_{LED}$ |      |      |       | LED COLOR                          |
|-----------------|-------------------------|-----------|------|------|-------|------------------------------------|
|                 |                         | MIN.      | TYP. | MAX. | UNIT. |                                    |
| LED B.L (ARRAY) | $V_{LED} = 5.0\text{V}$ | -----     | 280  | 420  | mA    | YELLOW-GREEN<br>RED, AMBER, ORANGE |
| LED B.L (EDGE)  | $V_{LED} = 4.0\text{V}$ | -----     | 75   | 100  | mA    | BLUE, WHITE<br>PURE-GREEN          |

## 7. Optical characteristics

### STN TYPE LCD

 $T_a = 25$ 
 $V_{DD}-V_O = 8.5V$ 

| <i>I T E M</i> | <i>SYMBOL</i> | <i>CONDITION</i>   | <i>MIN.</i> | <i>TYP.</i> | <i>MAX.</i> | <i>UNIT</i> | <i>NOTE</i> |
|----------------|---------------|--------------------|-------------|-------------|-------------|-------------|-------------|
| VIEWING ANGLE  | 2- 1          | K = 2.0<br>NOTE(1) | 30          | 40          | ----        | deg.        | NOTE(2)     |
| CONTRAST RATIO | K             | = 10°<br>NOTE(1)   | 3.0         | 4.0         | ----        | ----        | NOTE(2)     |
| RESPONSE TIME  | tr (rise)     | = 10°<br>NOTE(1)   | ----        | 200         | 350         | ms          | NOTE(2)     |
|                | tf (fall)     | = 10°<br>NOTE(1)   | ----        | 300         | 400         | ms          | NOTE(2)     |

### FSTN、STN BLUE TYPE LCD

 $T_a = 25$ 
 $V_{DD}-V_O = 8.5V$ 

| <i>I T E M</i> | <i>SYMBOL</i> | <i>CONDITION</i>   | <i>MIN.</i> | <i>TYP.</i> | <i>MAX.</i> | <i>UNIT</i> | <i>NOTE</i> |
|----------------|---------------|--------------------|-------------|-------------|-------------|-------------|-------------|
| VIEWING ANGLE  | 2- 1          | K = 2.0<br>NOTE(1) | 30          | 40          | ----        | deg.        | NOTE(2)     |
| CONTRAST RATIO | K             | = 10°<br>NOTE(1)   | 4.0         | 5.0         | ----        | ----        | NOTE(2)     |
| RESPONSE TIME  | tr (rise)     | = 10°<br>NOTE(1)   | ----        | 200         | 350         | ms          | NOTE(2)     |
|                | tf (fall)     | = 10°<br>NOTE(1)   | ----        | 300         | 400         | ms          | NOTE(2)     |

### Brightness for LCM backlight

| <i>SYMBOL</i> | <i>CONDITION</i> | <i>MIN.</i> | <i>TYP.</i> | <i>MAX.</i> | <i>UNIT</i>       | <i>LED TYPE</i>                    | <i>NOTE</i>        |
|---------------|------------------|-------------|-------------|-------------|-------------------|------------------------------------|--------------------|
| B             | = 0°<br>= 0°     | 4.0         | ----        | ----        | cd/m <sup>2</sup> | EL BACKLIGHT                       | NOTE(2)<br>NOTE(3) |
|               |                  | 5.0         | ----        | ----        |                   | YELLOW-GREEN, RED<br>AMBER, ORANGE |                    |
|               |                  | 6.0         | ----        | ----        |                   | BLUE, WHITE,<br>PURE-GREEN         |                    |

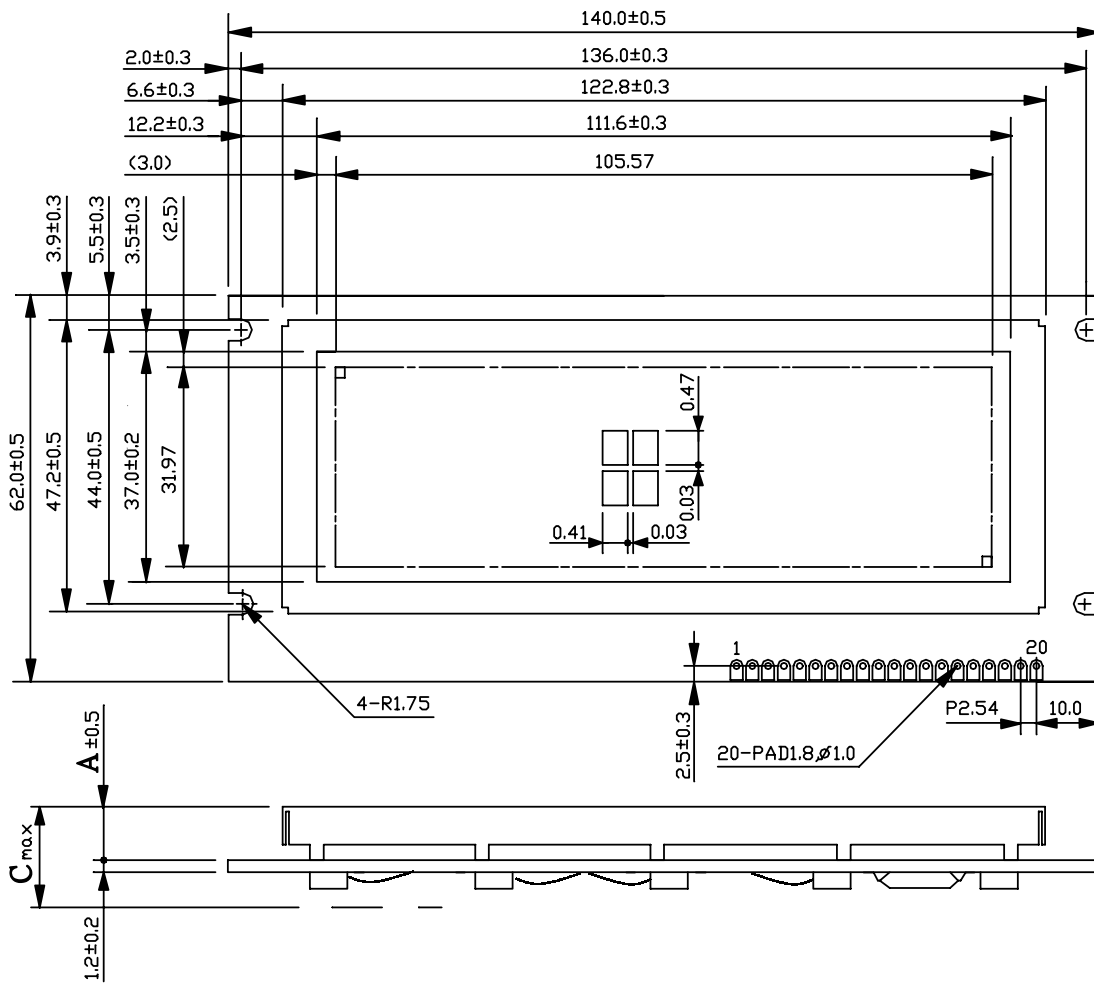
NOTE (1): = 0° : VIEWING DIRECTION AT 6 O'CLOCK

= 180° : VIEWING DIRECTION AT 12 O'CLOCK

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

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

## 8. Outline dimension



| TYPE        | A    | C    |
|-------------|------|------|
| LED B.L     | 10.0 | 15.0 |
| EL & NO B.L | 4.9  | 9.5  |

NOTE :

1.UNIT : mm

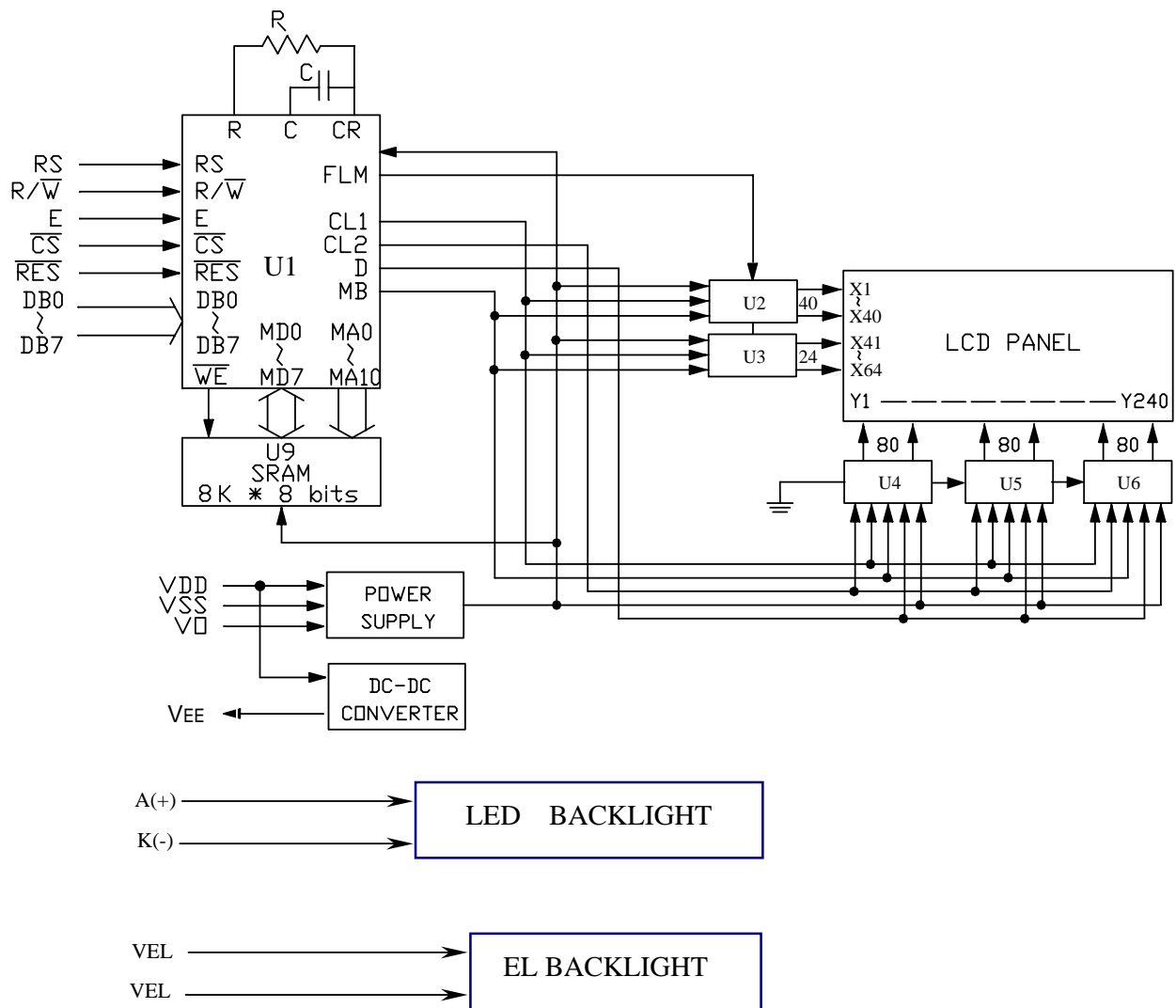
2.SCALE : NTS



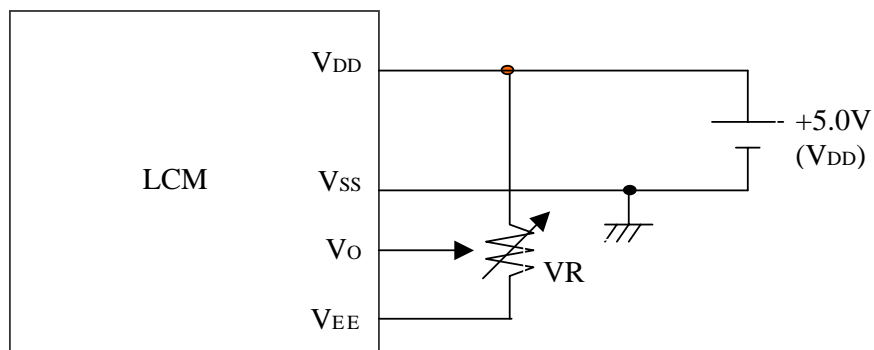
### *Interface pin connection*

| PIN NO. | SYMBOL                     | FUNCTION  |
|---------|----------------------------|---|
| 1       | V <sub>SS</sub>            | POWER SUPPLY ( GND )  |
| 2       | V <sub>DD</sub>            | POWER SUPPLY ( +5.0V )  |
| 3       | V <sub>O</sub>             | OPERATING VOLTAGE FOR LCD DRIVING                               |
| 4       | RS                         | L : DATA INPUT<br>H : INSTRUCTION CODE INPUT                    |
| 5       | R/W                        | H: DATA READ (LCD MODULE MPU)<br>L: DATA WRITE (LCD MODULE MPU) |
| 6       | E                          | ENABLE SINGAL   |
| 7       | DB0                        | DATA INPUT/OUTPUT (LSB)   |
| 8       | DB1                        | DATA INPUT/OUTPUT   |
| 9       | DB2                        | DATA INPUT/OUTPUT   |
| 10      | DB3                        | DATA INPUT/OUTPUT   |
| 11      | DB4                        | DATA INPUT/OUTPUT   |
| 12      | DB5                        | DATA INPUT/OUTPUT   |
| 13      | DB6                        | DATA INPUT/OUTPUT   |
| 14      | DB7                        | DATA INPUT/OUTPUT (MSB)   |
| 15      | $\overline{CS}$            | L: CHIP ENABLE  |
| 16      | $\overline{RES}$           | L: RESET  |
| 17      | V <sub>EE</sub>            | POWER SUPPLY FOR LCD DRIVING OUTPUT                             |
| 18      | N.C                        | NO CONNECTION   |
| 19      | A(+)<br>(V <sub>EL</sub> ) | POWER SUPPLY FOR LED BACKLIGHT (+)<br>(POWER SUPPLY FOR EL)     |
| 20      | K(-)<br>(V <sub>EL</sub> ) | POWER SUPPLY FOR LED BACKLIGHT (-)<br>(POWER SUPPLY FOR EL)     |

## 9. Block diagram



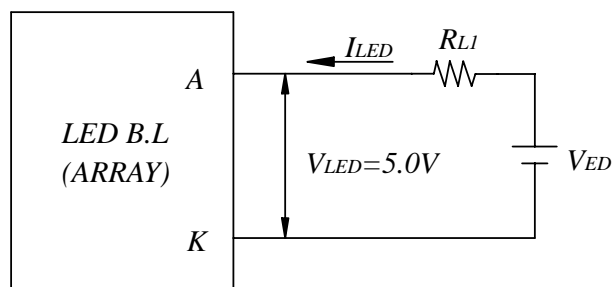
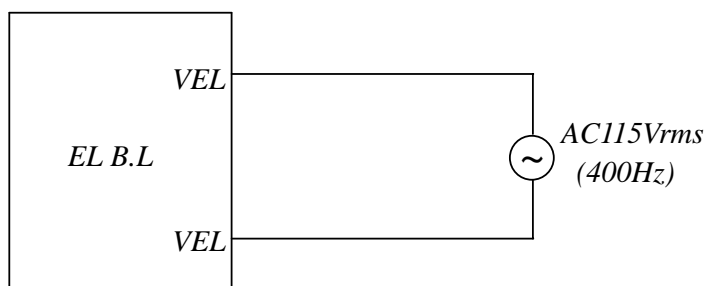
## 10. Power supply for LCM



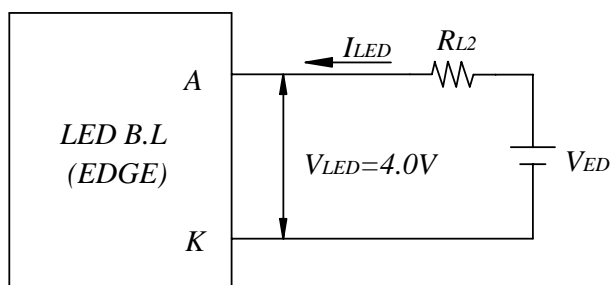
$V_{DD}-V_o$ : LCD DRIVING VOLTAGE

VR: 200K $\Omega$

### 10.1 Power supply for backlight



$$RL1 = (V_{ED}-V_{LED}) / I_{LED}, I_{LED} = 420.0 \text{ mA (max)}$$



$$RL2 = (V_{ED}-V_{LED}) / I_{LED}, I_{LED} = 100.0 \text{ mA (max)}$$