

## KS0076B 16COM/40SEG DRIVER & CONTROLLER FOR DOT MATRIX LCD

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### INTRODUCTION

The KS0076B is a dot matrix LCD driver & controller LSI which is fabricated by low power CMOS technology.

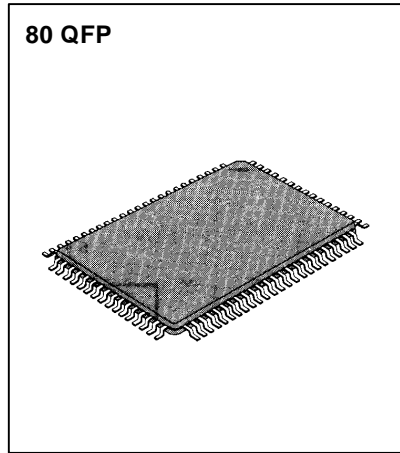
### FUNCTION

- Character type dot matrix LCD driver & controller
- Internal driver: 16 common and 40 segment signal output.
- Display character format; 5 x 7 dot + cursor, 5 x 10 dots + cursor
- Easy Interface with a 4-bit or 8-bit MPU
- Display character pattern:
  - 5 x 7 dots format: 192 kinds, 5 x 10 dots format: 32 kinds
- The special character pattern can be programmable by character generator RAM directly.
- A customer character pattern can be programmable by mask option.(KS0076B-00 : Standard type)
- Automatic power on reset function.
- It can drive a maximum 80 characters by using the KS0065B or KS0063 externally.
- It is possible to read both Character Generator and Display Data RAM from MPU.

### FEATURES

- Wave form: M signal B type
- Internal Memory
  - Character Generator ROM: 8320bits
  - Character Generator RAM: 512 bits
  - Display Data RAM: 80 x 8bits for 80 digits.
- Power supply Voltage; +5V±10%
- Supply voltage for display : 0V(V5)
- CMOS process
- 1/8 duty, 1/11 duty or 1/16 duty: selectable
  - (1/8 duty; 5x7 dots format 1 line, 1/11 duty; 5x10 dots format 1 line, 1/16 duty: 5x7 dots format 2 line)
- 80 QFP or bare chip available .

80 QFP



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## BLOCK DIAGRAM

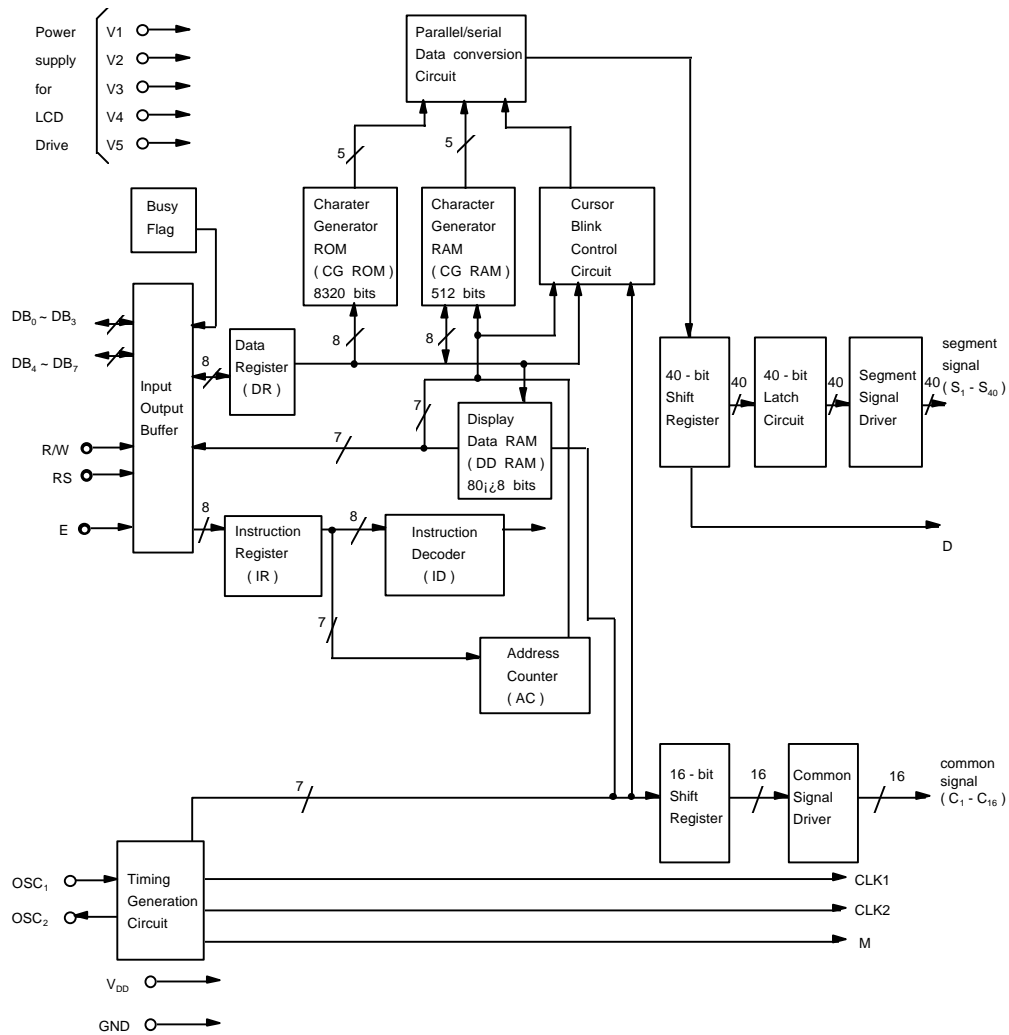


Fig. 1. KS0076B functional block diagram.



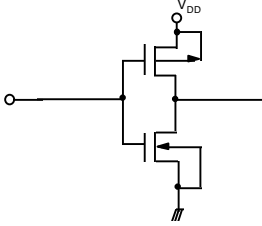
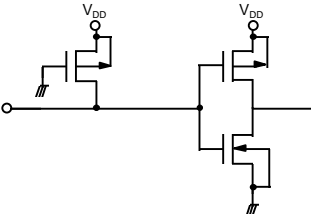
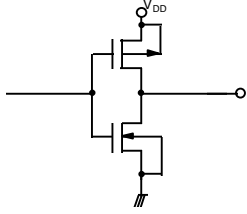
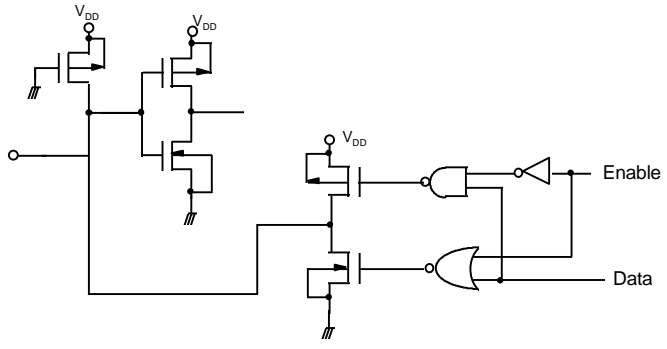
## KS0076B 16COM/40SEG DRIVER & CONTROLLER FOR DOT MATRIX LCD

### PIN DESCRIPTION

| PIN (NO)   | INPUT/OUTPUT  | NAME   | DESCRIPTION  | INTERFACE                          |      |   |     |               |
|--|---|--|--|------------------------------------|------|---|-----|---------------|
| V <sub>DD</sub> (33)                             | Power   | Operating Voltage  | for logical circuit (5V±10%)   | Power supply                       |      |   |     |               |
| V <sub>SS</sub> (GND) (23)                       |   |  | 0V (GND)   |                                    |      |   |     |               |
| V <sub>1</sub> -V <sub>5</sub> (26-30)           |   | Supply Voltage   | Bias voltage level fro LCD driving   |                                    |      |   |     |               |
| S <sub>1</sub> -S <sub>40</sub><br>(22-1, 80-63) | Output  | Segment output   | Segment signal output for LCD driving  | LCD                                |      |   |     |               |
| C <sub>1</sub> -C <sub>16</sub><br>(47-62)       | Output  | Common output  | Common signal output for LCD driving   | LCD                                |      |   |     |               |
| OSC1, OSC2<br>(24, 25)                           | Input (OSC1)<br>Output (OSC2)   | Oscillator   | Both pin connected to Rf resistor or ceramic resonator for internal oscillator circuit. In case of external frequency use only, the frequency is input to OSC1 terminal.   | Resistor or Ceramic Resonator      |      |   |     |               |
| CLK1 (31)  | Output  | Data latch Cock  | Clock output terminal for the serially transfered data to be latched to the driver.  | KS0065B<br>or<br>KS0063            |      |   |     |               |
| CLK2 (32)  |   | Data shift clock   | Clock output terminal used when D terminal data output shifts the inside of the driver.  |                                    |      |   |     |               |
| M (34)   |   | Alternated signal for LCD driver output  | The alternating signal to convert LCD drive waveform to AC   |                                    |      |   |     |               |
| D (35)   |   | Display data interface   | Character pattern data, which is corresponding to each common signal, is supplied to driver serially.<br><table border="1" style="margin-left: 20px;"> <tr> <td>High</td> <td>Selection</td> </tr> <tr> <td>Low</td> <td>Non selection</td> </tr> </table> |                                    | High | Selection   | Low | Non selection |
| High   | Selection   |  |  |                                    |      |   |     |               |
| Low  | Non selection   |  |  |                                    |      |   |     |               |
| E (38)   | Input   | Enable   | Start enable signal to read or write the data  | MPU                                |      |   |     |               |
| R/W (37)   |   | Read/Write   | R/W signal input is used to select the read/write mode<br><table border="1" style="margin-left: 20px;"> <tr> <td>High</td> <td>Read mode</td> </tr> <tr> <td>Low</td> <td>Write Mode</td> </tr> </table>   |                                    | High | Read mode   | Low | Write Mode    |
| High   |   | Read mode  |  |                                    |      |   |     |               |
| Low  | Write Mode  |  |  |                                    |      |   |     |               |
| RS (36)  | Register select   | Register selection input<br><table border="1" style="margin-left: 20px;"> <tr> <td>High</td> <td>Data register (for read and write)</td> </tr> <tr> <td>Low</td> <td>Instruction register (for write), Busy flag, address counter (for read)</td> </tr> </table> | High   | Data register (for read and write) | Low  | Instruction register (for write), Busy flag, address counter (for read) |     |               |
| High   | Data register (for read and write)                                      |  |  |                                    |      |   |     |               |
| Low  | Instruction register (for write), Busy flag, address counter (for read) |  |  |                                    |      |   |     |               |
| DB <sub>0</sub> -DB <sub>7</sub><br>(39-46)      | Input / Output  | Data interface   | Used for data transfer between the MPU and KS0076B. These terminals are for data bus with bidirectional three-state. Initial 4 bit (DB <sub>0</sub> -DB <sub>3</sub> ) are not used during 4-bit operation (DB <sub>7</sub> can be used as a busy flag)    | MPU                                |      |   |     |               |

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**Internal logic of input/output terminal**

| Input/output    | Logic diagram  |   | Applicable pin                    |
|-----------------|--|---|-----------------------------------|
| Input           | No Pull up   |  | E                                 |
|                 | with pull up   |  | RS, R/W                           |
| Output          |    |   | CLK1, CLK2<br>M,D                 |
| Input<br>Output |  |   | DB <sub>0</sub> - DB <sub>7</sub> |

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## MAXIMUM ABSOLUTE LIMIT (Ta=25°C)

| Characteristic        | Symbol           | Value                       | Unit |
|-----------------------|------------------|-----------------------------|------|
| Operating Voltage     | V <sub>DD</sub>  | -0.3~+7.0                   | V    |
| Driver Supply Voltage | V <sub>LCD</sub> | -0.3~V <sub>DD</sub> +0.3   | V    |
| Input Voltage         | V <sub>IN</sub>  | -0.3 ~ V <sub>DD</sub> +0.3 | V    |
| Power Dissipation     | P <sub>D</sub>   | 500                         | mW   |
| Operating Temperature | T <sub>OPR</sub> | -20~+75                     | °C   |
| Storage Temperature   | T <sub>STG</sub> | -55~+125                    | °C   |

\* Voltage greater than above may damage to the circuit (V<sub>DD</sub>≥V<sub>1</sub>≥V<sub>2</sub>≥V<sub>3</sub>≥V<sub>4</sub>≥V<sub>5</sub>)

## ELECTRICAL CHARACTERISTICS

DC Characteristics (V<sub>DD</sub>= +5V±10%, V<sub>SS</sub>=0V, Ta=-20°C ~+75°C)

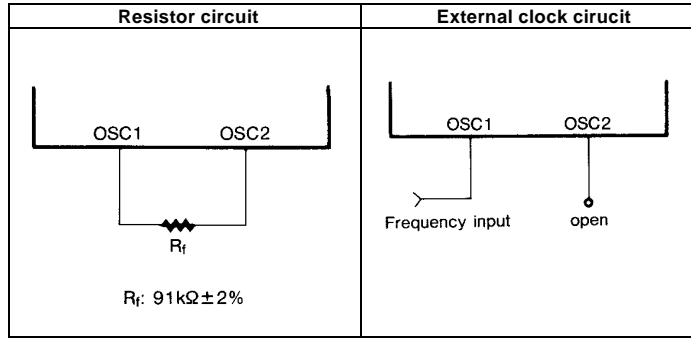
| Characteristic                                | Symbol            | Test condition   | Min                  | Typ  | Max                | Unit            | Applicable Pin                                   |   |
|---|-------------------|--|----------------------|------|--------------------|-----------------|--|---|
| Operating Voltage                             | V <sub>DD</sub>   | -  | 4.5                  | -    | 5.5                | V               |  |   |
| Operating Current(*1)                         | I <sub>DD1</sub>  | Ceramic resonator<br>fosc=250KHz                               | -                    | 0.55 | 0.8                | mA              |  |   |
|   | I <sub>DD2</sub>  | Resistor oscilation<br>external clock operation<br>fosc=270KHz | -                    | 0.35 | 0.6                |                 |  |   |
| Input Voltage 1                               | V <sub>IH1</sub>  | -  | 2.2                  | -    | V <sub>DD</sub>    | V               | E, OB <sub>0</sub> -DB <sub>7</sub> ,<br>R/W, RS |   |
|   | V <sub>IL1</sub>  | -  | -0.3                 | -    | 0.6                |                 |  |   |
| Input Voltage 2                               | V <sub>IH2</sub>  | -  | V <sub>DD</sub> -1.0 | -    | V <sub>DD</sub>    |                 | OSC1   |   |
|   | V <sub>IL2</sub>  | -  | -0.2                 | -    | 1.0                |                 |  |   |
| Output Voltage 1                              | V <sub>OH1</sub>  | I <sub>OH</sub> =-0.205mA                                      | 2.4                  | -    | -                  |                 | DB <sub>0</sub> -DB <sub>7</sub>                 |   |
|   | V <sub>OL1</sub>  | I <sub>OL</sub> =1.2mA   | -                    | -    | 0.4                |                 |  |   |
| Output Voltage 2                              | V <sub>OH2</sub>  | I <sub>O</sub> =-40μA  | 0.9V <sub>DD</sub>   | -    | -                  |                 | CLK1, CLK2, M<br>D                               |   |
|   | V <sub>OL2</sub>  | I <sub>O</sub> =40μA   | -                    | -    | 0.1V <sub>DD</sub> |                 |  |   |
| Voltage Drop (*2)                             | V <sub>dCOM</sub> | I <sub>O</sub> =±0.1mA   | -                    | -    | 1                  |                 | C1-C16<br>S1-S40                                 |   |
|   | V <sub>dSEG</sub> |  | -                    | -    | 1                  |                 |  |   |
| Input Leakage Current                         | I <sub>LKG</sub>  | V <sub>IN</sub> =0 or V <sub>DD</sub>                          | -1                   | -    | 1                  |                 | μA   | E                                       |
| Input Low Current                             | I <sub>IL</sub>   | V <sub>DD</sub> =5V (test pull up R)                           | -50                  | -125 | -250               |                 |  | RS,R/W,DB <sub>0</sub> -DB <sub>7</sub> |
| External Clock                                | Frequency(*3)     | f <sub>EC</sub>  | 125                  | 250  | 350                | KHz             | OSC1   |   |
|   | Duty              | duty   | 45                   | 50   | 55                 |                 |  | %                                       |
|   | Rise Time         | t <sub>R</sub>   | -                    | -    | 0.2                |                 |  | μs                                      |
|   | Fall Time         | t <sub>F</sub>   | -                    | -    | 0.2                |                 |  | μs                                      |
| Internal Clock Frequency(*3)                  | f <sub>OSC1</sub> | Rf=91KΩ±2%   | 190                  | 270  | 350                | KHz             | OSC1, OSC2                                       |   |
| Ceramic Resinator Oscillation<br>Frquency(*3) | f <sub>OSC2</sub> | -  | 245                  | 250  | 255                |                 |  |   |
| LCD Driving Voltage(*4)                       | V <sub>LCD1</sub> | V <sub>DD</sub> -V <sub>5</sub>                                | 1/5 bias             | 4.6  | -                  | V <sub>DD</sub> | V <sub>1</sub> ~ V <sub>5</sub>                  |   |
|   | V <sub>LCD2</sub> |  | 1/4 bias             | 3.0  | -                  | V <sub>DD</sub> |  |   |

Note: \*1) Applies to the current value flown in terminal V<sub>DD</sub> when power is input as follows; V<sub>DD</sub>=5V, GND=0V, V<sub>1</sub> = 3.75V, V<sub>2</sub> = 2.5V, V<sub>3</sub> = 2.5V, V<sub>4</sub> = 1.25V and V<sub>5</sub> = 0V.

\*2) Applied to the voltage drop occurring from terminals V<sub>DD</sub>, V<sub>1</sub>, V<sub>4</sub> and V<sub>5</sub> to each common terminal (C1-C16) when 0.1mA is flown in or out to and from all COM and SEG terminals, and also to voltage drop occurring from terminals V<sub>DD</sub>, V<sub>2</sub>, V<sub>3</sub> and V<sub>5</sub> to each SEG terminal S1-S40. When the output level is at V<sub>DD</sub>, V<sub>1</sub> or V<sub>2</sub> level, 0.1 mA is flown out, while 0.1 mA flow in when the output level is at V<sub>3</sub>, V<sub>4</sub>, or V<sub>5</sub> level. This occurs when 5V is input to V<sub>DD</sub>, V<sub>1</sub> and V<sub>3</sub> or to V<sub>2</sub>, V<sub>4</sub>, and V<sub>5</sub> respectively.

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\*3) Oscillator circuit



\*4) Input the voltage listed in the table below to  $V_1$ - $V_5$

|              | Duty Bias | 1/8, 1/11             | 1/16                  |
|--------------|-----------|-----------------------|-----------------------|
| <b>Power</b> |           | 1/4                   | 1/5                   |
| $V_1$        |           | $V_{DD} - V_{LCD}/4$  | $V_{DD} - V_{LCD}/5$  |
| $V_2$        |           | $V_{DD} - V_{LCD}/2$  | $V_{DD} - 2V_{LCD}/5$ |
| $V_3$        |           | $V_{DD} - V_{LCD}/2$  | $V_{DD} - 3V_{LCD}/5$ |
| $V_4$        |           | $V_{DD} - 3V_{LCD}/4$ | $V_{DD} - 4V_{LCD}/5$ |
| $V_5$        |           | $V_{DD} - V_{LCD}$    | $V_{DD} - V_{LCD}$    |

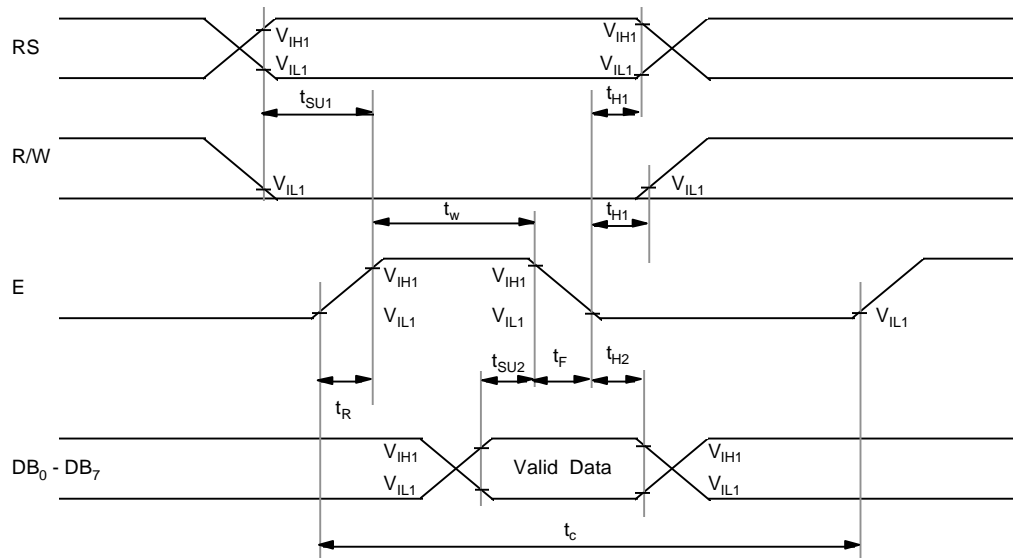
\* $V_{LCD}$  is the LCD driving voltage, refer to the initial set of the instruction code.

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### AC Characteristics ( $V_{DD}=5V \pm 10\%$ , $V_{SS}=0V$ $T_a=-20 \sim +75^\circ C$ )

(1) Write mode (Writing data from Micom to KS0076B)

| Characteristic             | Symbol    | Min | Typ | Max | Unit | Test pin                          |
|----------------------------|-----------|-----|-----|-----|------|-----------------------------------|
| E Cycle Time               | $t_c$     | 500 | -   | -   | ns   | E                                 |
| E Rise Time                | $t_R$     | -   | -   | 25  | ns   | E                                 |
| E Fall Time                | $t_F$     | -   | -   | 25  | ns   | E                                 |
| E Pulse Width ( High, Low) | $t_w$     | 220 | -   | -   | ns   | E                                 |
| R/W And RS Set-Up Time     | $t_{SU1}$ | 40  | -   | -   | ns   | R/W, RS                           |
| R/W And RS Hold Time       | $t_{H1}$  | 10  | -   | -   | ns   | R/W, RS                           |
| Data Set-Up Time           | $t_{SU2}$ | 60  | -   | -   | ns   | DB <sub>0</sub> ~ DB <sub>7</sub> |
| Data Hold Time             | $t_{H2}$  | 10  | -   | -   | ns   | DB <sub>0</sub> ~ DB <sub>7</sub> |

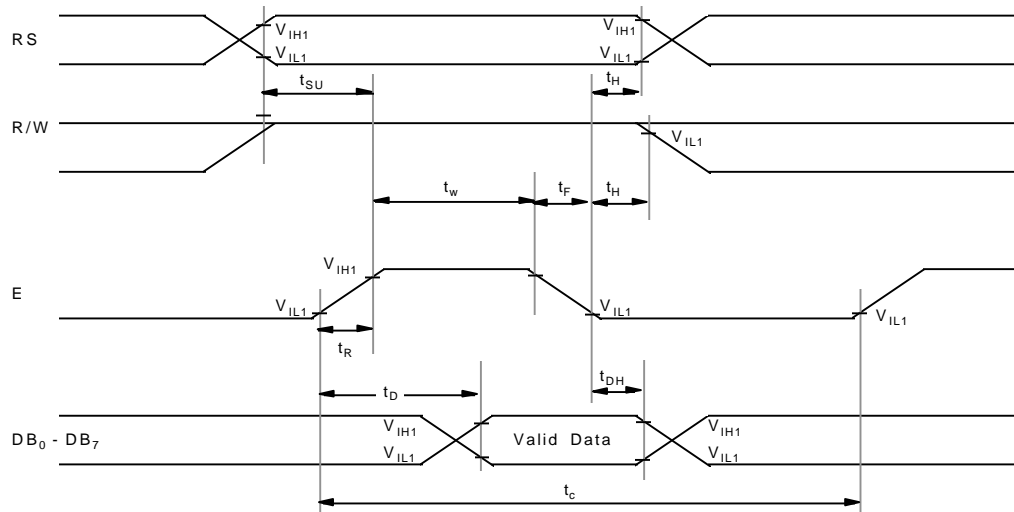


(2) Read mode (Reading data from KS0076B to Micom)

| Characteristic             | Symbol   | Min | Typ | Max | Unit | Test pin                          |
|----------------------------|----------|-----|-----|-----|------|-----------------------------------|
| E Cycle Time               | $t_c$    | 500 | -   | -   | ns   | E                                 |
| E Rise Time                | $t_R$    | -   | -   | 25  | ns   | E                                 |
| E Fall Time                | $t_F$    | -   | -   | 25  | ns   | E                                 |
| E Pulse Width ( High, Low) | $t_w$    | 220 | -   | -   | ns   | E                                 |
| R/W And RS Set-Up Time     | $t_{SU}$ | 40  | -   | -   | ns   | R/W, RS                           |
| R/W And RS Hold Time       | $t_{H1}$ | 10  | -   | -   | ns   | R/W, RS                           |
| Data Output Delay Time     | $t_D$    | -   | -   | 120 | ns   | DB <sub>0</sub> ~ DB <sub>7</sub> |
| Data Hold Time             | $t_{DH}$ | 20  | -   | -   | ns   | DB <sub>0</sub> ~ DB <sub>7</sub> |

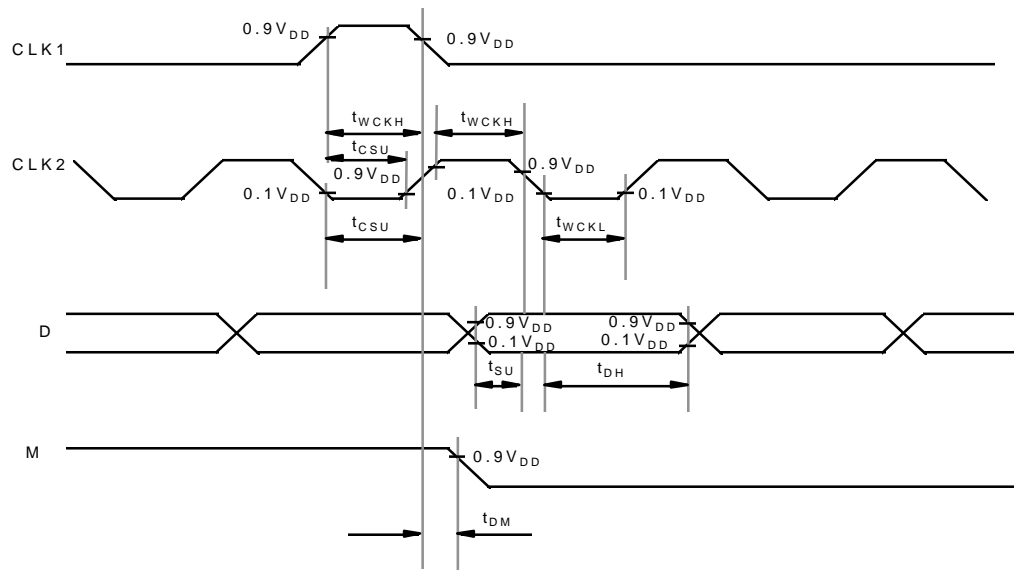


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(3) Interface mode with KS0065B, KS0063

| Characteristic         | Symbol            | Min   | Typ | Max  | Unit | Test pin |
|------------------------|-------------------|-------|-----|------|------|----------|
| Clock Pulse Width High | t <sub>wckH</sub> | 800   | -   | -    | ns   | CLK      |
| Clock Pulse Width Low  | t <sub>wckL</sub> | 800   | -   | -    | ns   | CLK      |
| Data Set-Up Time       | t <sub>su</sub>   | 300   | -   | -    | ns   | D        |
| Data Hold Time         | t <sub>dh</sub>   | 300   | -   | -    | ns   | D        |
| Clock Set-Up Time      | t <sub>csu</sub>  | 500   | -   | -    | ns   | CLK      |
| M Delay Time           | t <sub>dm</sub>   | -1000 | -   | 1000 | ns   | M        |



**KS0076B 16COM/40SEG DRIVER & CONTROLLER FOR DOT MATRIX LCD**

**CONTROL and DISPLAY COMMAND**

| Command        | RS | R/W                    | DB <sub>7</sub> | DB <sub>6</sub> | DB <sub>5</sub> | DB <sub>4</sub> | DB <sub>3</sub> | DB <sub>2</sub> | DB <sub>1</sub> | DB <sub>0</sub> | Excution time<br>(fosc=250KHz) | Remark  |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
|----------------|----|------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|--------------------------------|---|-----|---|------------------|-----|---|------------------|-----|---|--------------------|-----|---|------------------------|---|---|-------------|---|---|--------------|
| DISPLAY CLEAR  | L  | L                      | L               | L               | L               | L               | L               | L               | L               | H               | 1.64ms                         |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| RETURN HOME    | L  | L                      | L               | L               | L               | L               | L               | L               | H               | X               | 1.64ms                         | cursor move to first digit  |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| ENTRY MODE SET | L  | L                      | L               | L               | L               | L               | L               | H               | I/D             | SH              | 40μs                           | <ul style="list-style-type: none"> <li>I/D: set cursor move direction                             <table border="1"> <tr><td>I/D</td><td>H</td><td>Increase</td></tr> <tr><td>I/D</td><td>L</td><td>Decrease</td></tr> </table> </li> <li>SH: Specifies shift of display                             <table border="1"> <tr><td>SH</td><td>H</td><td>display is shifted</td></tr> <tr><td>SH</td><td>L</td><td>display is not shifted</td></tr> </table> </li> </ul>  | I/D | H | Increase         | I/D | L | Decrease         | SH  | H | display is shifted | SH  | L | display is not shifted |   |   |             |   |   |              |
| I/D            | H  | Increase               |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| I/D            | L  | Decrease               |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| SH             | H  | display is shifted     |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| SH             | L  | display is not shifted |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| DISPLAY ON/OFF | L  | L                      | L               | L               | L               | L               | H               | D               | C               | B               | 40μs                           | <ul style="list-style-type: none"> <li>Display                             <table border="1"> <tr><td>D</td><td>H</td><td>Display on</td></tr> <tr><td>D</td><td>L</td><td>Display off</td></tr> </table> </li> <li>Cursor                             <table border="1"> <tr><td>C</td><td>H</td><td>Cursor on</td></tr> <tr><td>C</td><td>L</td><td>Cursor off</td></tr> </table> </li> <li>Blinking                             <table border="1"> <tr><td>B</td><td>H</td><td>Blinking on</td></tr> <tr><td>B</td><td>L</td><td>Blinking off</td></tr> </table> </li> </ul> | D   | H | Display on       | D   | L | Display off      | C   | H | Cursor on          | C   | L | Cursor off             | B | H | Blinking on | B | L | Blinking off |
| D              | H  | Display on             |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| D              | L  | Display off            |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| C              | H  | Cursor on              |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| C              | L  | Cursor off             |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| B              | H  | Blinking on            |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| B              | L  | Blinking off           |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| SHIFT          | L  | L                      | L               | L               | L               | H               | S/C             | R/L             | X               | X               | 40μs                           | <table border="1"> <tr><td>SC</td><td>H</td><td>Display shift</td></tr> <tr><td>SC</td><td>L</td><td>Cursor move</td></tr> </table> <table border="1"> <tr><td>R/L</td><td>H</td><td>Right shift</td></tr> <tr><td>R/L</td><td>L</td><td>Left shift</td></tr> </table>  | SC  | H | Display shift    | SC  | L | Cursor move      | R/L | H | Right shift        | R/L | L | Left shift             |   |   |             |   |   |              |
| SC             | H  | Display shift          |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| SC             | L  | Cursor move            |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| R/L            | H  | Right shift            |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| R/L            | L  | Left shift             |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| SET FUNCTION   | L  | L                      | L               | L               | H               | DL              | N               | F               | X               | X               | 40μs                           | <table border="1"> <tr><td>DL</td><td>H</td><td>8 bits interface</td></tr> <tr><td>DL</td><td>L</td><td>4 bits interface</td></tr> </table> <table border="1"> <tr><td>N</td><td>H</td><td>2 line display</td></tr> <tr><td>N</td><td>L</td><td>1 line display</td></tr> </table> <table border="1"> <tr><td>F</td><td>H</td><td>5x10 dots</td></tr> <tr><td>F</td><td>L</td><td>5x7 dots</td></tr> </table>  | DL  | H | 8 bits interface | DL  | L | 4 bits interface | N   | H | 2 line display     | N   | L | 1 line display         | F | H | 5x10 dots   | F | L | 5x7 dots     |
| DL             | H  | 8 bits interface       |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| DL             | L  | 4 bits interface       |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| N              | H  | 2 line display         |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| N              | L  | 1 line display         |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| F              | H  | 5x10 dots              |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |
| F              | L  | 5x7 dots               |                 |                 |                 |                 |                 |                 |                 |                 |                                |   |     |   |                  |     |   |                  |     |   |                    |     |   |                        |   |   |             |   |   |              |

Table 1.

**KS0076B 16COM/40SEG DRIVER & CONTROLLER FOR DOT MATRIX LCD**

**CONTROL and DISPLAY COMMAND** (continued)

| Command                  | RS | R/W   | DB <sub>7</sub> | DB <sub>6</sub>                                   | DB <sub>5</sub>                                   | DB <sub>4</sub> | DB <sub>3</sub> | DB <sub>2</sub> | DB <sub>1</sub> | DB <sub>0</sub>             | Excution time<br>(fosc=250KHz)   | Remark  |   |      |  |   |       |
|--------------------------|----|-------|-----------------|---|---|-----------------|-----------------|-----------------|-----------------|-----------------------------|--|---|---|------|--|---|-------|
| SET CG RAM ADDRESS       | L  | L     | L               | H   | CG RAM address<br>(corresponds to cursor address) |                 |                 |                 |                 |                             | 40μs   | CG RAM Data is sent and received after this setting |   |      |  |   |       |
| SET DD RAM ADDRESS       | L  | L     | H               | DD RAM address                                    |   |                 |                 |                 |                 | 40μs                        | DD RAM Data is sent and received after this setting  |   |   |      |  |   |       |
| READ BUSY FLAG & ADDRESS | L  | H     | BF              | Address Counter used for Both DD & CG RAM address |   |                 |                 |                 |                 | 0μs                         | <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>BF</td> <td>H</td> <td>Busy</td> </tr> <tr> <td></td> <td>L</td> <td>Ready</td> </tr> </table> <p>- Reads BF indication internal operating is being performed.<br/>- reads address counter contents</p> | BF  | H | Busy |  | L | Ready |
| BF                       | H  | Busy  |                 |   |   |                 |                 |                 |                 |                             |  |   |   |      |  |   |       |
|                          | L  | Ready |                 |   |   |                 |                 |                 |                 |                             |  |   |   |      |  |   |       |
| WRITE DATA               | H  | L     | Read Data       |   |   |                 |                 |                 | 46μs            | Write data into DD or CGRAM |  |   |   |      |  |   |       |
| READ DATA                | H  | H     | Write Data      |   |   |                 |                 |                 | 46μs            | Read data from DD or CGRAM  |  |   |   |      |  |   |       |

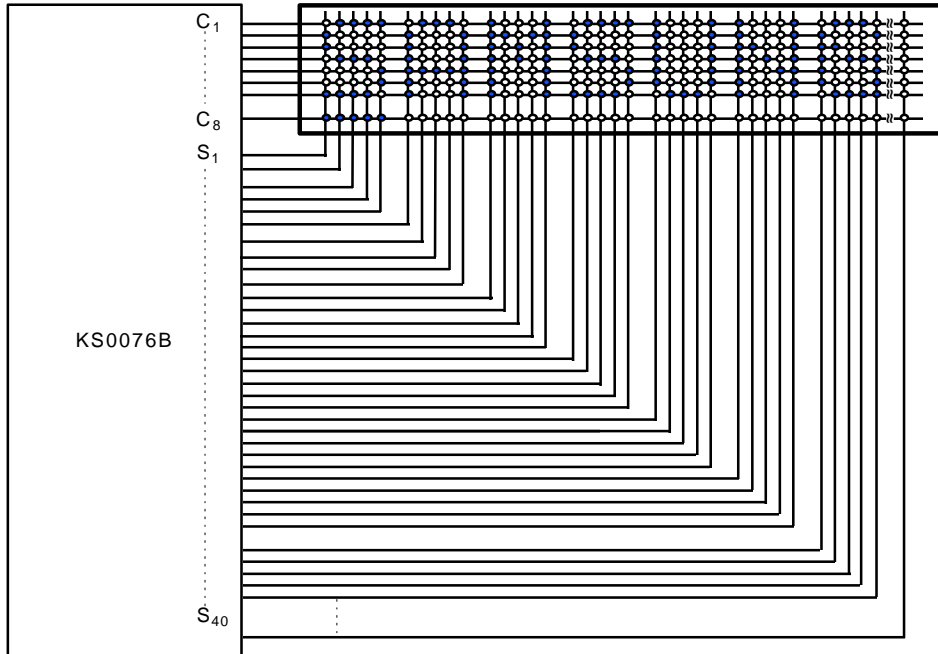
X: don't care

Table 1

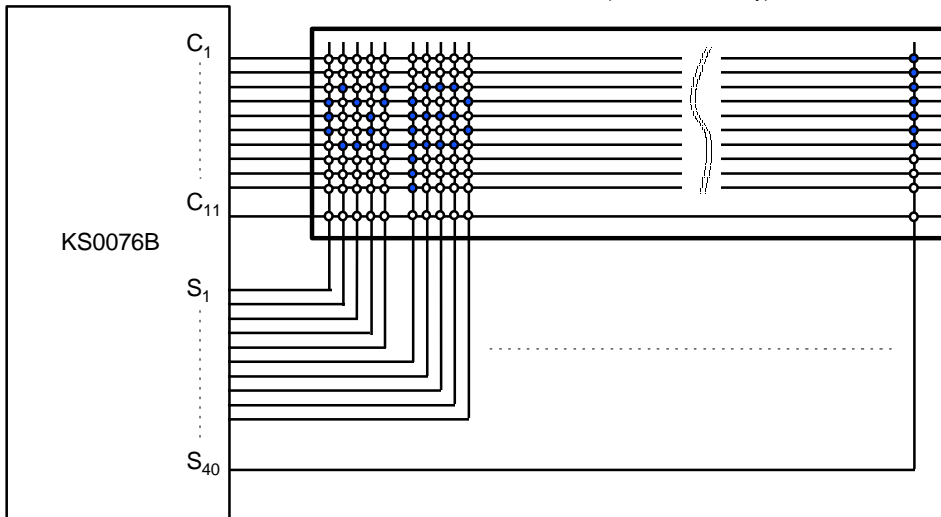
# KS0076B 16COM/40SEG DRIVER & CONTROLLER FOR DOT MATRIX LCD

## APPLICATION INFORMATION ACCORDING TO LCD PANEL

1) LCD Panel: 8 character x 1 line character format; 5x7 dots + 1 cursor line (1/4 bias, 1/8 duty)

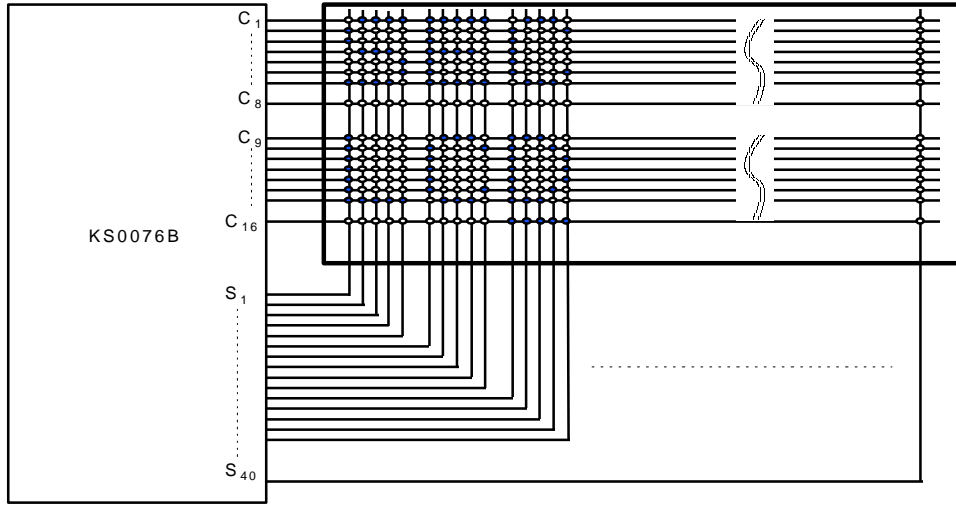


2) LCD Panel: 8 character x 1 line character format; 5x10 dots + 1 cursor line (1/4 bias, 1/11 duty)

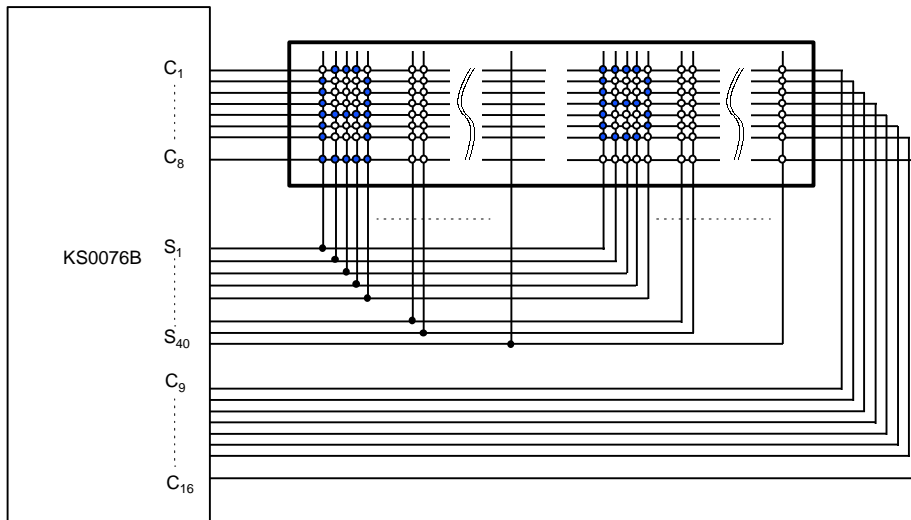


# KS0076B 16COM/40SEG DRIVER & CONTROLLER FOR DOT MATRIX LCD

3) LCD Panel : 8 character x 2 line character format; 5 x 7 dots + 1 cursor line (1/5 bias, 1/16 duty)

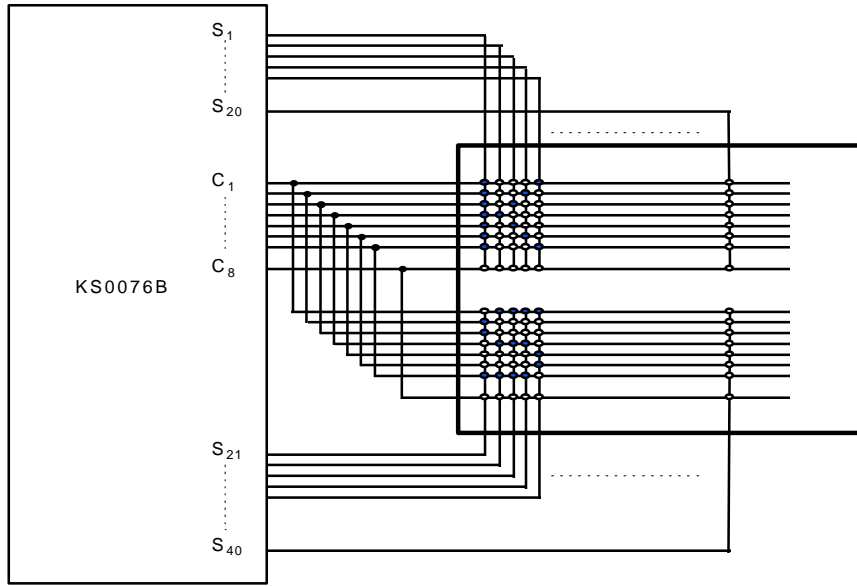


4) LCD Panel : 16 character x 1 line Character format; 5x7 dots + 1 cursor line (1/5 bias, 1/16 duty)



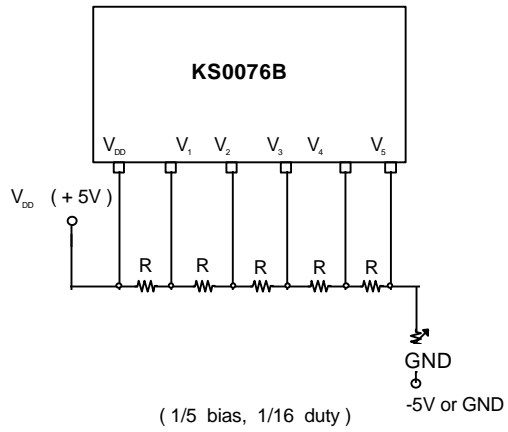
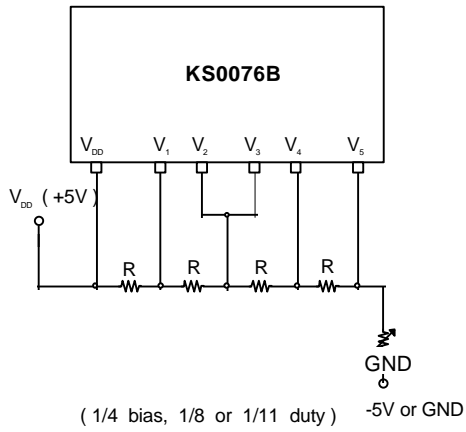
# KS0076B 16COM/40SEG DRIVER & CONTROLLER FOR DOT MATRIX LCD

5) LCD Panel : 4character x 2 line character ; 5x 7 dots + 1 cursor line (1/4 bias, 1/8 duty)



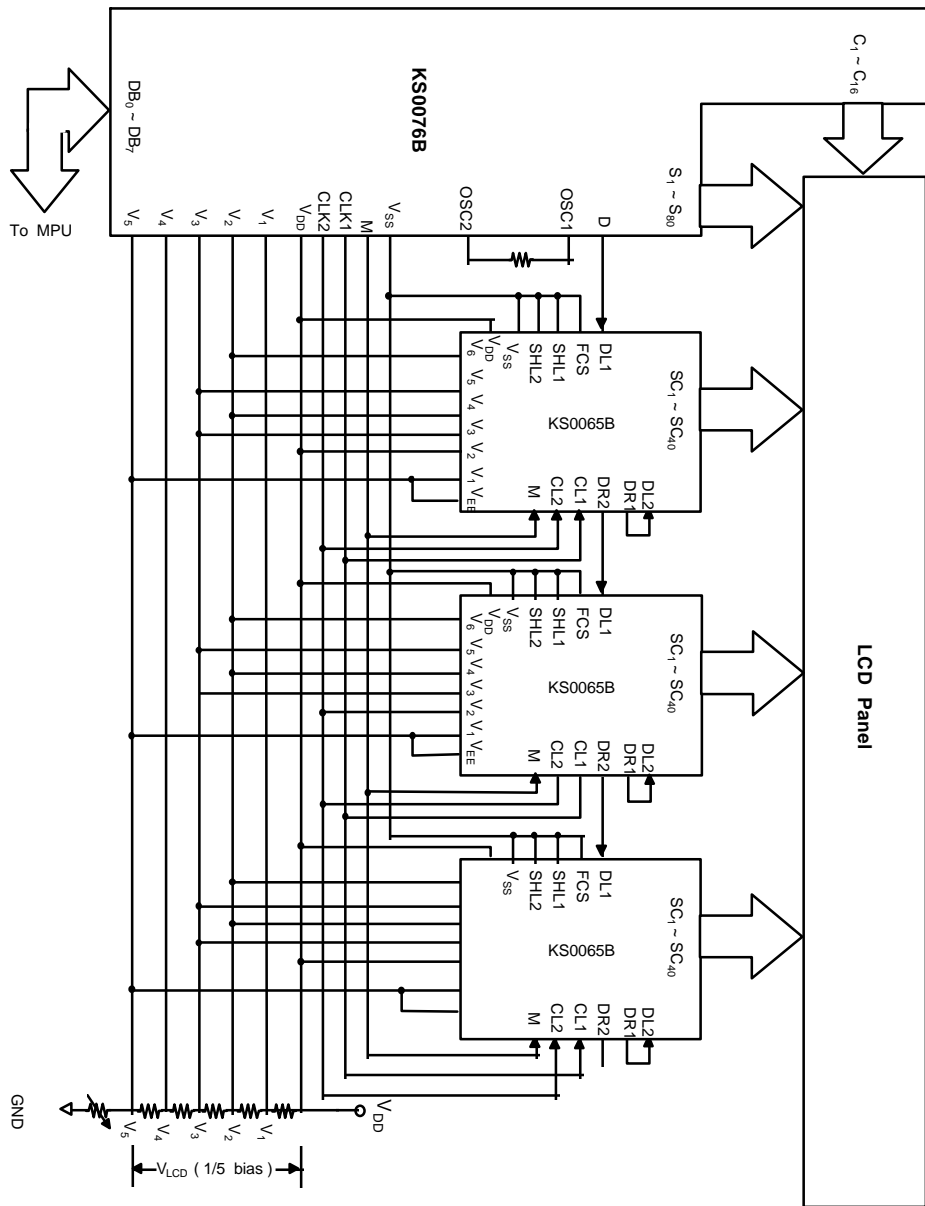
**DIVIDE CIRCUIT**

**BIAS VOLTAGE**



# KS0076B 16COM/40SEG DRIVER & CONTROLLER FOR DOT MATRIX LCD

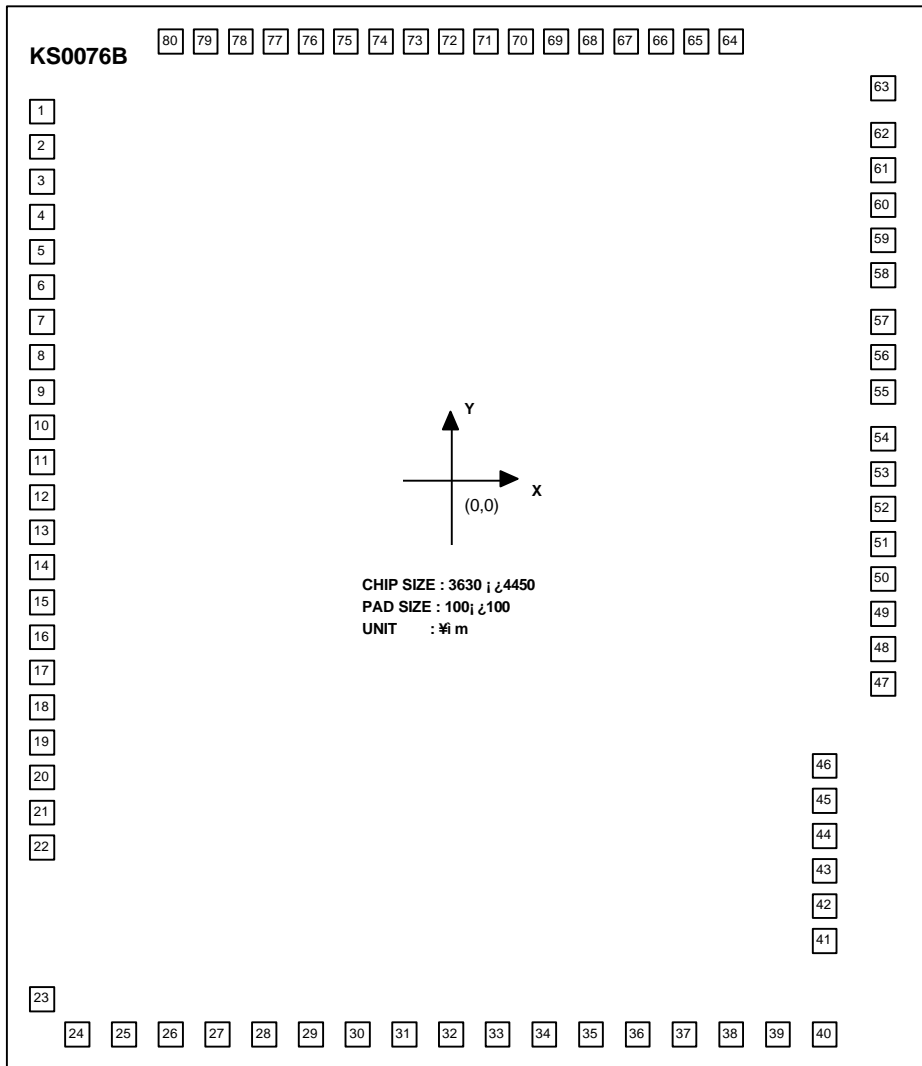
## APPLICATION CIRCUIT



When KS0065B is externally connected to the KS0076B, you can increase the number of display digits up to 80 characters.

# KS0076B 16COM/40SEG DRIVER & CONTROLLER FOR DOT MATRIX LCD

## PAD DIAGRAM



\* "KS0076B" Marking : easy to find the PAD No.1



**KS0076B 16COM/40SEG DRIVER & CONTROLLER FOR DOT MATRIX LCD**

**PAD LOCATION**

UNIT (μm)

| NUMBER | PAD NAME | COORDINATE |         | PAD NUMBER | PAD NAME | COORDINATE |         | PAD NUMBER | PAD NAME | COORDINATE |       |
|--------|----------|------------|---------|------------|----------|------------|---------|------------|----------|------------|-------|
|        |          | X          | Y       |            |          | X          | Y       |            |          | X          | Y     |
| 1      | S22      | -1630      | 1816.5  | 28         | V3       | -673.5     | -1911.5 | 55         | C9       | 1630       | 717.5 |
| 2      | S21      | -1630      | 1676.5  | 29         | V4       | -489.5     | -1911.5 | 56         | C10      | 1630       | 857.5 |
| 3      | S20      | -1630      | 1536.5  | 30         | V5       | -305.5     | -1911.5 | 57         | C11      | 1630       | 997.5 |
| 4      | S19      | -1630      | 1396.5  | 31         | CLK1     | -121.5     | -1911.5 | 58         | C12      | 1630       | 1166  |
| 5      | S18      | -1630      | 1256.5  | 32         | CLK2     | 62.5       | -1911.5 | 59         | C13      | 1630       | 1306  |
| 6      | S17      | -1630      | 1116.5  | 33         | VDD      | 240.5      | -1911.5 | 60         | C14      | 1630       | 1446  |
| 7      | S16      | -1630      | 976.5   | 34         | M        | 409.5      | -1911.5 | 61         | C15      | 1630       | 1586  |
| 8      | S15      | -1630      | 836.5   | 35         | D        | 593.5      | -1911.5 | 62         | C16      | 1630       | 1276  |
| 9      | S14      | -1630      | 696.5   | 36         | RS       | 777.5      | -1911.5 | 63         | S40      | 1630       | 1918  |
| 10     | S13      | -1630      | 556.5   | 37         | R/W      | 961.5      | -1911.5 | 64         | S39      | 1104.5     | 2040  |
| 11     | S12      | -1630      | 416.5   | 38         | E        | 1145.5     | -1911.5 | 65         | S38      | 964.5      | 2040  |
| 12     | S11      | -1630      | 276.5   | 39         | DB0      | 1329.5     | -1911.5 | 66         | S37      | 824.5      | 2040  |
| 13     | S10      | -1630      | 136.5   | 40         | DB1      | 1513.5     | -1911.5 | 67         | S36      | 684.5      | 2040  |
| 14     | S9       | -1630      | -3.5    | 41         | DB2      | 1501.5     | -1573   | 68         | S35      | 544.5      | 2040  |
| 15     | S8       | -1630      | -143.5  | 42         | DB3      | 1501.5     | -1389   | 69         | S34      | 404.5      | 2040  |
| 16     | S7       | -1630      | -283.5  | 43         | DB4      | 1501.5     | -1205   | 70         | S33      | 264.5      | 2040  |
| 17     | S6       | -1630      | -423.5  | 44         | DB5      | 1501.5     | -1021   | 71         | S32      | 124.5      | 2040  |
| 18     | S5       | -1630      | -563.5  | 45         | DB6      | 1501.5     | -837    | 72         | S31      | -15.5      | 2040  |
| 19     | S4       | -1630      | -703.5  | 46         | DB7      | 1501.5     | -653    | 73         | S30      | -155.5     | 2040  |
| 20     | S3       | -1630      | -843.5  | 47         | C1       | 1630       | -452    | 74         | S29      | -295.5     | 2040  |
| 21     | S2       | -1630      | -983.5  | 48         | C2       | 1630       | -312    | 75         | S28      | -435.5     | 2040  |
| 22     | S1       | -1630      | -1123.5 | 49         | C3       | 1630       | -172    | 76         | S27      | -575.5     | 2040  |
| 23     | GND      | -1630      | -1722.5 | 50         | C4       | 1630       | -32     | 77         | S26      | -715.5     | 2040  |
| 24     | OSC1     | -1401.5    | -1911.5 | 51         | C5       | 1630       | 108     | 78         | S25      | -855.5     | 2040  |
| 25     | OSC2     | -1217.5    | -1911.5 | 52         | C6       | 1630       | 248     | 79         | S24      | -995.5     | 2040  |
| 26     | V1       | -1041.5    | -1911.5 | 53         | C7       | 1630       | 388     | 80         | S23      | -1135.5    | 2040  |
| 27     | V2       | -857.5     | -1911.5 | 54         | C8       | 1630       | 528     |            |          |            |       |

**Standard Character Pattern (KS0076B-00)**

