

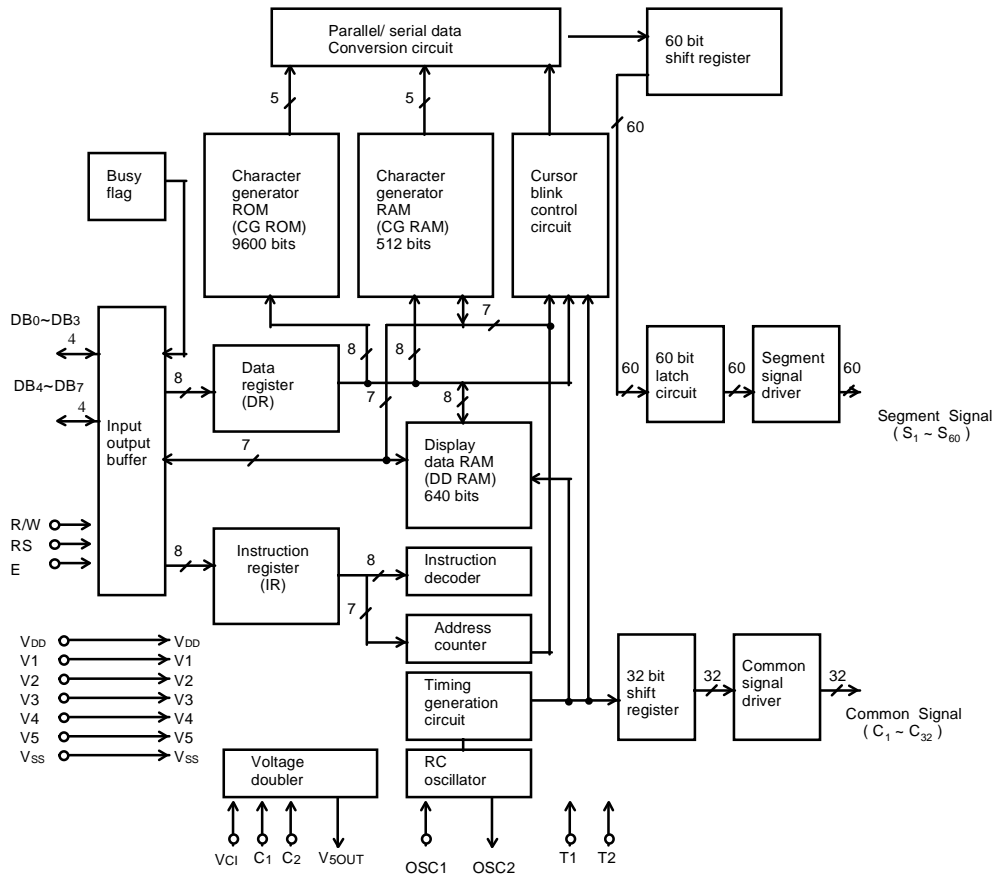
INTRODUCTION

The KS0071B is a dot matrix LCD controller & driver LSI which is fabricated by low power CMOS technology, designed to drive a split screen dot matrix LCD display of 1 line \times 24 characters or 2 line \times 24 characters with 5 \times 7 dots format.

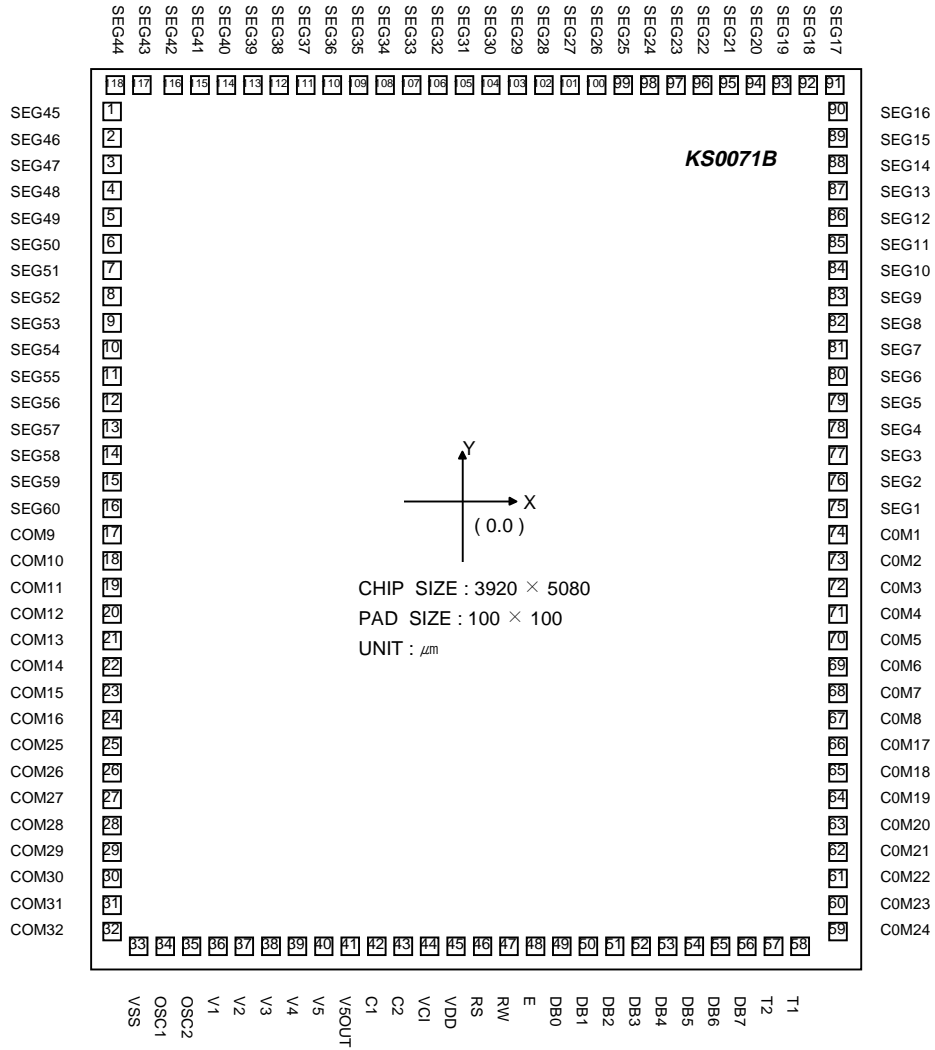
FEATURES

- Character type dot matrix single chip LCD controller & driver
- High voltage LCD driver 32 common and 60 segment signal output.
- Easy interface with a 4 bit or 8 bit MPU.
- Internal memory
 - Character generator ROM : 8400bits (240 characters for 5 \times 7 dots)
 - Character generator RAM : 512 bits (8 patterns for 5 \times 7 dots)
 - Display data RAM : 640 bits (80 \times 8 bits for 80 characters)
- Maximum display characters
 - 1 line, 1/16 duty, 5 \times 7 dots + cursor, 24 characters.
 - 2 line, 1/32 duty, 5 \times 7 dots + cursor, 24 characters .
- A customer character pattern can be programmable by mask option.
- The special character pattern can be programmable by character generator RAM directly.
- It is possible to read both character generator and display data RAM from MPU.
- Useful 11 code instruction set
- Automatic power on reset function
- On chip generation of LCD supply voltage from voltage doubler (external supply also possible)
- Voltage doubler generates about double from single power supply (5V)
- High contrast display can be performed though the simple power supply circuits.
- On chip oscillator requires external resistor (external clock also possible)
- Power supply voltage: +5V \pm 10%, +3V \pm 20%
- Supply voltage for display: -5V
- Package outline: 118 TAB or bare chip available.

BLOCK DIAGRAM



PAD DIAGRAM



*"KS0071B" Marking : easy to find PAD No. 95

PAD LOCATION

UNIT : (μm)

| PAD NO. | PAD Name | Coordinate | | PAD NO. | PAD Name | Coordinate | | PAD NO. | PAD Name | Coordinate | | PAD NO. | PAD Name | Coordinate | |
|---------|----------|------------|-------|---------|----------|------------|-------|---------|----------|------------|-------|---------|----------|------------|------|
| | | X | Y | | | X | Y | | | X | Y | | | X | Y |
| 1 | SEG45 | -1794 | 2170 | 33 | VSS | -1564.5 | -2374 | 65 | COM18 | 1794 | -1330 | 97 | SEG23 | 936 | 2374 |
| 2 | SEG46 | -1794 | 2030 | 34 | OSC1 | -1437.5 | -2374 | 66 | COM17 | 1794 | -1190 | 98 | SEG24 | 811 | 2374 |
| 3 | SEG47 | -1794 | 1890 | 35 | OSC2 | -1312.5 | -2374 | 67 | COM8 | 1794 | -1050 | 99 | SEG25 | 686 | 2374 |
| 4 | SEG48 | -1794 | 1750 | 36 | V1 | -1187.5 | -2374 | 68 | COM7 | 1794 | -910 | 100 | SEG26 | 561 | 2374 |
| 5 | SEG49 | -1794 | 1610 | 37 | V2 | -1062.5 | -2374 | 69 | COM6 | 1794 | -770 | 101 | SEG27 | 436 | 2374 |
| 6 | SEG50 | -1794 | 1470 | 38 | V3 | -937.5 | -2374 | 70 | COM5 | 1794 | -630 | 102 | SEG28 | 311 | 2374 |
| 7 | SEG51 | -1794 | 1330 | 39 | V4 | -812.5 | -2374 | 71 | COM4 | 1794 | -490 | 103 | SEG29 | 186 | 2374 |
| 8 | SEG52 | -1794 | 1190 | 40 | V5 | -687.5 | -2374 | 72 | COM3 | 1794 | -350 | 104 | SEG30 | 61 | 2374 |
| 9 | SEG53 | -1794 | 1050 | 41 | V5OUT | -562.5 | -2374 | 73 | COM2 | 1794 | -210 | 105 | SEG31 | -64 | 2374 |
| 10 | SEG54 | -1794 | 910 | 42 | C1 | -437.5 | -2374 | 74 | COM1 | 1794 | -70 | 106 | SEG32 | -189 | 2374 |
| 11 | SEG55 | -1794 | 770 | 43 | C2 | -312.5 | -2374 | 75 | SEG1 | 1794 | 70 | 107 | SEG33 | -314 | 2374 |
| 12 | SEG56 | -1794 | 630 | 44 | VCI | -187.5 | -2374 | 76 | SEG2 | 1794 | 210 | 108 | SEG34 | -439 | 2374 |
| 13 | SEG57 | -1794 | 490 | 45 | VDD | -62.5 | -2374 | 77 | SEG3 | 1794 | 350 | 109 | SEG35 | -564 | 2374 |
| 14 | SEG58 | -1794 | 350 | 46 | RS | 62.5 | -2374 | 78 | SEG4 | 1794 | 490 | 110 | SEG36 | -689 | 2374 |
| 15 | SEG59 | -1794 | 210 | 47 | RW | 187.5 | -2374 | 79 | SEG5 | 1794 | 630 | 111 | SEG37 | -814 | 2374 |
| 16 | SEG60 | -1794 | 70 | 48 | E | 312.5 | -2374 | 80 | SEG6 | 1794 | 770 | 112 | SEG38 | -939 | 2374 |
| 17 | COM9 | -1794 | -70 | 49 | DB0 | 437.5 | -2374 | 81 | SEG7 | 1794 | 910 | 113 | SEG39 | -1064 | 2374 |
| 18 | COM10 | -1794 | -210 | 50 | DB1 | 562.5 | -2374 | 82 | SEG8 | 1794 | 1050 | 114 | SEG40 | -1189 | 2374 |
| 19 | COM11 | -1794 | -350 | 51 | DB2 | 687.5 | -2374 | 83 | SEG9 | 1794 | 1190 | 115 | SEG41 | -1314 | 2374 |
| 20 | COM12 | -1794 | -490 | 52 | DB3 | 812.5 | -2374 | 84 | SEG10 | 1794 | 1330 | 116 | SEG42 | -1439 | 2374 |
| 21 | COM13 | -1794 | -630 | 53 | DB4 | 937.5 | -2374 | 85 | SEG11 | 1794 | 1470 | 117 | SEG43 | -1564 | 2374 |
| 22 | COM14 | -1794 | -770 | 54 | DB5 | 1062.5 | -2374 | 86 | SEG12 | 1794 | 1610 | 118 | SEG44 | -1689 | 2374 |
| 23 | COM15 | -1794 | -910 | 55 | DB6 | 1187.5 | -2374 | 87 | SEG13 | 1794 | 1750 | | | | |
| 24 | COM16 | -1794 | -1050 | 56 | DB7 | 1312.5 | -2374 | 88 | SEG14 | 1794 | 1890 | | | | |
| 25 | COM25 | -1794 | -1190 | 57 | T2 | 1437.5 | -2374 | 89 | SEG15 | 1794 | 2030 | | | | |
| 26 | COM26 | -1794 | -1330 | 58 | T1 | 1562.5 | -2374 | 90 | SEG16 | 1794 | 2170 | | | | |
| 27 | COM27 | -1794 | -1470 | 59 | COM24 | 1794 | -2170 | 91 | SEG17 | 1686 | 2374 | | | | |
| 28 | COM28 | -1794 | -1610 | 60 | COM23 | 1794 | -2030 | 92 | SEG18 | 1561 | 2374 | | | | |
| 29 | COM29 | -1794 | -1750 | 61 | COM22 | 1794 | -1890 | 93 | SEG19 | 1436 | 2374 | | | | |
| 30 | COM30 | -1794 | -1890 | 62 | COM21 | 1794 | -1750 | 94 | SEG20 | 1311 | 2374 | | | | |
| 31 | COM31 | -1794 | -2030 | 63 | COM20 | 1794 | -1610 | 95 | SEG21 | 1186 | 2374 | | | | |
| 32 | COM32 | -1794 | -2170 | 64 | COM19 | 1794 | -1470 | 96 | SEG22 | 1061 | 2374 | | | | |

PAD DESCRIPTION

| PAD (No.) | NAME | I/O | Description | Interface | | | | |
|---|--|--------------|---|----------------------------|------------------------------------|-----|--|-----|
| V _{DD} (45) | Power Supply | Input | For logical circuit (+5V ± 10%, +3V ± 20%) | Power supply | | | | |
| V _{SS} (33) | | | 0V (GND) | | | | | |
| OSC1 (34) OSC2 (35) | Oscillator | Input output | OSC1 and OSC2 pin should be connected to external Rf resistor for internal oscillator. External clock can be input to OSC1. | Resistor or external clock | | | | |
| E (48) | Enable | Input | Start enable signal to read or write the data | MPU | | | | |
| R/W (47) | Read / write | Input | R/W signal input is used to select the read/write mode <table border="1" style="margin-left: auto; margin-right: auto;"> <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 | MPU |
| High | Read mode | | | | | | | |
| Low | Write mode | | | | | | | |
| RS (46) | Register select | Input | Register select input. <table border="1" style="margin-left: auto; margin-right: auto;"> <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) | MPU |
| High | Data register (for read and write) | | | | | | | |
| Low | Instruction register (for write) busy flag, address counter (for read) | | | | | | | |
| DB ₀ ~ DB ₇ (49 ~ 56) | Data interface | Input/output | Used for data transfer between the MPU and KS0071B. These terminals are for data bus with bidirectional three-state. lower 4 bit (DB ₀ ~ DB ₃) are not used during 4 bit operation (DB ₇ can be used as a busy flag.) | MPU | | | | |
| V _{CI} (44) | Voltage doubler output | Input | Input terminal for voltage doubler. (normally V _{CI} =V _{DD}) | Power supply | | | | |
| C1 (42) C2 (43) | Capacitor | Input | Capacitor for voltage doubler connecting terminal (+). Capacitor for voltage doubler connecting terminal(-). | Capacitor | | | | |
| V _{5OUT} (41) | Voltage doubler output | Output | Voltage doubler output terminal connected to LCD supply voltage | V5 | | | | |
| V1, V2, V3, V4, V5 (36 ~ 40) | LCD supply Voltage | Input | Bias voltage level for LCD driving | Divide resistor | | | | |
| S ₁ ~ S ₄₄ (75~118) S ₄₅ ~ S ₆₀ (1 ~ 16) | Segment output | Output | Segment signal output for LCD driving | LCD | | | | |
| C ₁ ~ C ₈ (74 ~ 67) C ₉ ~ C ₁₆ (17~24) C ₁₇ ~ C ₂₄ (66~59) C ₂₅ ~ C ₃₂ (25~32) | Common output | Output | Common signal output for LCD driving | LCD | | | | |
| T1(58), T2(57) | Test pin | Input | Maker testing terminal (normally open) | | | | | |

MAXIMUM ABSOLUTE LIMIT

| Description | Symbol | Value | Unit |
|-----------------------|----------------|-----------------------------------|------|
| Operating Voltage | V_{DD} | - 0.3 ~ + 7.0 | - |
| Driver Supply Voltage | $V_1 \sim V_5$ | $V_{DD} - 13.5 \sim V_{DD} + 0.3$ | - |
| Input Voltage | V_{IN} | - 0.3 ~ $V_{DD} + 0.3$ | - |
| Power Dissipation | P_D | 500 | mW |
| Operating Temperature | T_{OPR} | - 30 ~ + 85 | °C |
| Storage Temperature | T_{STG} | - 55 ~ + 125 | °C |

. Voltage greater than above may damage the circuit

. The voltage relation : $V_{DD} \geq V_{CI} \geq V_5 \geq V_{SOUT}$, $V_{DD} \geq V_{SS} \geq V_{SOUT}$, $V_{SS} = 0V$

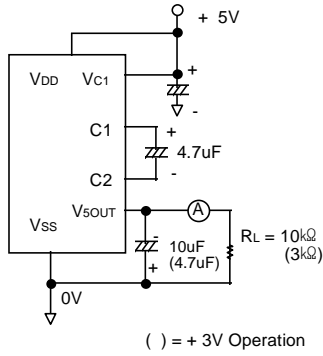
ELECTRICAL CHARACTERISTICS

DC Characteristics

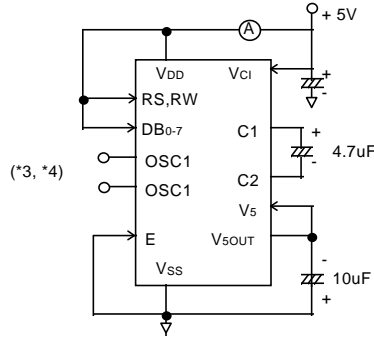
($V_{DD} = +5V \pm 10\%$, $V_{SS} = 0V$, $T_a = -30^\circ C \sim +85^\circ C$)

| Characteristic | Symbol | Condition | Min | Typ | Max | Unit | Applicable pin | |
|-------------------------|----------------|---|---|-------------|------|-------------|----------------|---|
| Operating voltage | V_{DD} | - | 4.5 | 5.0 | 5.5 | V | - | |
| Supply current (*1) | I_{DD} | Internal oscillation or external clock $V_{DD}=5V$ $f_{OSC}=270KHz$ | - | 0.6 | 1.0 | mA | - | |
| Input voltage 1 | High | V_{IH1} | - | 2.3 | - | V_{DD} | V | E, DB ₀ ~ DB ₇ , R/W, RS |
| | Low | V_{IL1} | - | - | - | 0.8 | | |
| Input voltage 2 | High | V_{IH2} | - | $V_{DD}-1$ | - | V_{DD} | V | OSC1 |
| | Low | V_{IL2} | - | - | - | 1.0 | | |
| Output voltage 1 | High | V_{OH1} | $I_{OH}=-0.205mA$ | 2.4 | - | - | V | DB ₀ ~ DB ₇ |
| | Low | V_{OL1} | $I_{OL}=1.6mA$ | - | - | 0.4 | | |
| Output voltage 2 | High | V_{OH2} | $I_O=-40uA$ | $0.9V_{DD}$ | - | - | V | OSC2 |
| | Low | V_{OL2} | $I_O=40uA$ | - | - | $0.1V_{DD}$ | | |
| Voltage drop (*2) | COM | V_{dCOM} | $I_O = \pm 0.1mA$ | - | - | 1 | V | COM1 ~ COM32 |
| | SEG | V_{dSEG} | - | - | - | 1 | | SEG1 ~ SEG60 |
| Input Leakage Current | | I_{IL1} | $V_{IN}=0V$ or V_{DD} | -1 | - | 1 | uA | E |
| | | I_{IL2} | $V_{IN}=V_{DD}$ | -5 | - | 5 | | RS, R/W, DB ₀ -DB ₇ |
| Low Input Current | | I_{IN} | $V_{IN}=0V$, $V_{DD}=5V$ (Test pull up R) | -50 | -125 | -250 | | |
| Internal Frequency (*3) | | f_{ic} | $Rf=91k\Omega \pm 2\%$ | 190 | 270 | 350 | KHz | OSC1, OSC2 |
| External clock (*4) | Frequency | f_{EC} | - | 160 | 250 | 350 | | OSC1 |
| | Duty | duty | - | 45 | 50 | 55 | % | |
| | Rise, Fall | tr, tf | - | - | - | 0.2 | μs | |
| Voltage doubler (*5) | Output Voltage | V_{SOUT} | $I_{OUT}=5mA$, $T_a=25^\circ C$ | -2.8 | -3.9 | - | V | V_{SOUT} |
| | Voltage | | $I_{OUT}=1mA$, $T_a=25^\circ C$ | -4.5 | -4.7 | - | | |
| | conv. rate | V_{EF} | $RL=\infty$ | 95 | 99.9 | - | % | |
| | Input Voltage | V_{CI} | - | 2.5 | - | 5.5 | V | |
| LCD driving voltage(*6) | V_{LCD} | $V_{LCD}-V_5$ | 1/5 bias | 3.0 | - | 13.5 | V | $V_1 \sim V_5$ |
| | | | 1/6.7 bias | 3.0 | - | 13.5 | | |

* 4) Voltage doubler measuring circuit



* 5) Supply current measuring circuit



* 6) LCD driving voltage V_1, V_2, V_3, V_4, V_5 ($V_{LCD} = V_{DD} - V_5$)

| Power | Duty | 1/16 duty | 1/32 duty |
|-------------------------------------|------|--------------------------|------------------------------|
| | Bias | 1/5 bias | 1/6.7 bias |
| V_{DD} (COM / SEG select voltage) | | V_{DD} | V_{DD} |
| V_1 (COM non select voltage) | | $V_{DD} - (1/5) V_{LCD}$ | $V_{DD} - (1/6.7) V_{LCD}$ |
| V_2 (SEG non select voltage) | | $V_{DD} - (2/5) V_{LCD}$ | $V_{DD} - (2/6.7) V_{LCD}$ |
| V_3 (SEG non select voltage) | | $V_{DD} - (3/5) V_{LCD}$ | $V_{DD} - (4.7/6.7) V_{LCD}$ |
| V_4 (COM non select voltage) | | $V_{DD} - (4/5) V_{LCD}$ | $V_{DD} - (5.7/6.7) V_{LCD}$ |
| V_5 (COM / SEG select voltage) | | $V_{DD} - V_{LCD}$ | $V_{DD} - V_{LCD}$ |

AC Characteristics

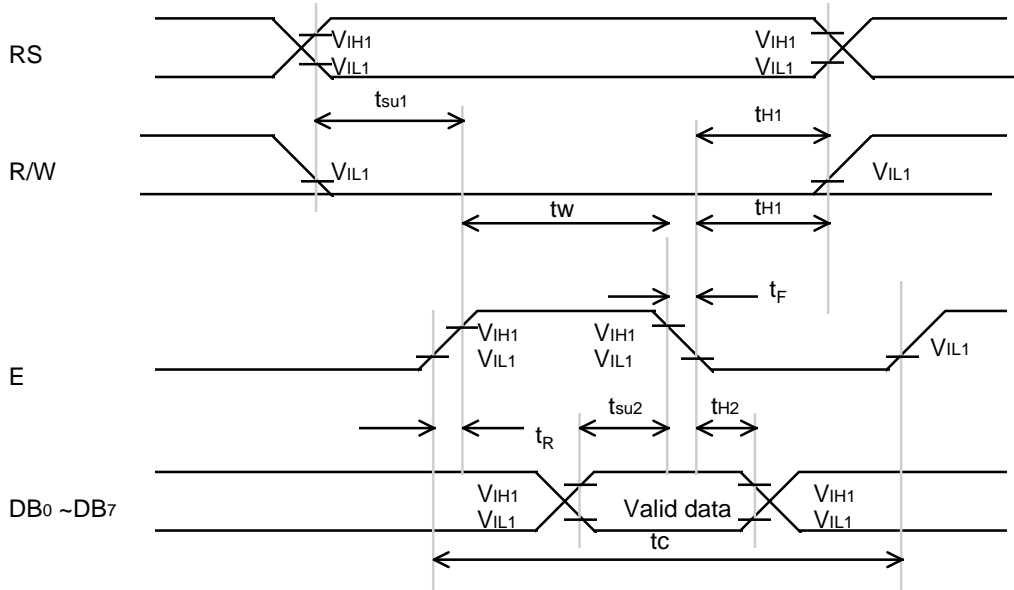
(1) Write mode

($V_{DD} = 5V \pm 10\%$, $V_{SS} = 0V$, $T_a = -30^{\circ}C \sim +85^{\circ}C$)

| Description | Symbol | Min | Typ | Max | Unit | Test Pin |
|---------------------------|------------|-----|-----|-----|------|-----------------------------------|
| Cycle Time | t_c | 500 | - | - | ns | E |
| Rise Time / Fall Time | t_R, t_F | - | - | 20 | ns | 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 ₀ ~ DB ₇ |
| Data Hold Time | t_{H2} | 10 | - | - | ns | DB ₀ ~ DB ₇ |

($V_{DD} = 3V \pm 20\%$, $V_{SS} = 0V$, $T_a = -30^{\circ}C \sim +85^{\circ}C$)

| Description | Symbol | Min | Typ | Max | Unit | Test Pin |
|---------------------------|------------|------|-----|-----|------|-----------------------------------|
| Cycle Time | t_c | 1400 | - | - | ns | E |
| Rise Time / Fall Time | t_R, t_F | - | - | 20 | ns | E |
| Pulse Width (High, Low) | t_W | 500 | - | - | ns | E |
| R/W And RS Set-Up Time | t_{SU1} | 70 | - | - | ns | R/W, RS |
| R/W And RS Hold Time | t_{H1} | 10 | - | - | ns | R/W, RS |
| Data Set-Up Time | t_{SU2} | 195 | - | - | ns | DB ₀ ~ DB ₇ |
| Data Hold Time | t_{H2} | 10 | - | - | ns | DB ₀ ~ DB ₇ |



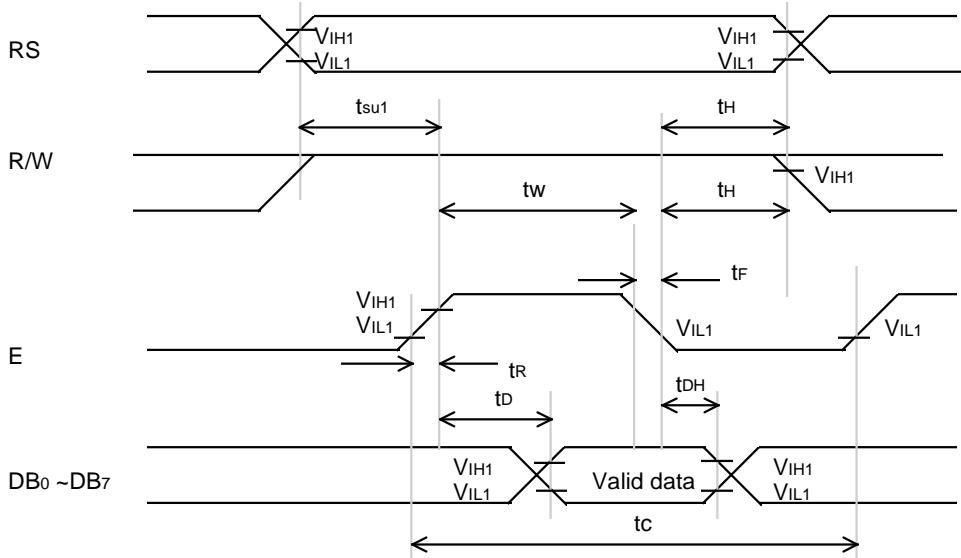
(2) Read mode

($V_{DD} = 5V \pm 10\%$, $V_{SS} = 0V$, $T_a = -30^{\circ}C \sim +85^{\circ}C$)

| Description | Symbol | Min | Typ | Max | Unit | Test Pin |
|------------------------|------------|-----|-----|-----|------|-----------------------------------|
| E Cycle Time | t_c | 500 | - | - | ns | E |
| Rise Time / Fall Time | t_r, t_f | - | - | 20 | ns | E |
| E Pulse Width | 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_h | 10 | - | - | ns | R/W, RS |
| Data Output Delay Time | t_d | - | - | 120 | ns | DB ₀ ~ DB ₇ |
| Data Hold Time | t_{dh} | 10 | - | - | ns | DB ₀ ~ DB ₇ |

($V_{DD} = 3V \pm 20\%$, $V_{SS} = 0V$, $T_a = -30^{\circ}C \sim +85^{\circ}C$)

| Description | Symbol | Min | Typ | Max | Unit | Test Pin |
|------------------------|------------|------|-----|-----|------|-----------------------------------|
| E Cycle Time | t_c | 1400 | - | - | ns | E |
| Rise Time / Fall Time | t_r, t_f | - | - | 20 | ns | E |
| E Pulse Width | t_w | 500 | - | - | ns | E |
| R/W And RS Set-Up Time | t_{su} | 70 | - | - | ns | R/W, RS |
| R/W And RS Hold Time | t_h | 10 | - | - | ns | R/W, RS |
| Data output Delay Time | t_d | - | - | 600 | ns | DB ₀ ~ DB ₇ |
| Data Hold Time | t_{dh} | 20 | - | - | ns | DB ₀ ~ DB ₇ |



CONTROL and DISPLAY COMMAND

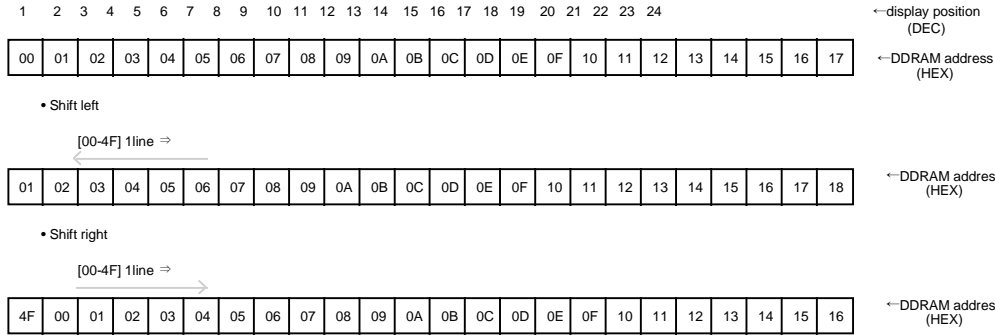
| Command | RS | R/W | DB ₇ | DB ₆ | DB ₅ | DB ₄ | DB ₃ | DB ₂ | DB ₁ | DB ₀ | Execution time f _{osc} =250KHz | Remark | | | | | | | | | | | | | | | | | | |
|--------------------------|----|------------------------|-----------------|---|---|-----------------|-----------------|-----------------|------------------------------|--|---|--|-----|---|------------|--|---|-------------|----|---|--------------------|--|---|------------------------|---|---|-------------|--|---|--------------|
| 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 | 40uS | I/D: Set cursor move direction <table border="1"> <tr> <td>I/D</td> <td>H</td> <td>Increase</td> </tr> <tr> <td></td> <td>L</td> <td>Decrease</td> </tr> </table> SH: Specifies shift of display <table border="1"> <tr> <td>SH</td> <td>H</td> <td>Display is shifted</td> </tr> <tr> <td></td> <td>L</td> <td>Display is not shifted</td> </tr> </table> | I/D | H | Increase | | L | Decrease | SH | H | Display is shifted | | L | Display is not shifted | | | | | | |
| I/D | H | Increase | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | L | Decrease | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SH | H | Display is shifted | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | L | Display is not shifted | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Display on/off | L | L | L | L | L | L | H | D | C | B | 40uS | Display <table border="1"> <tr> <td>D</td> <td>H</td> <td>Display on</td> </tr> <tr> <td></td> <td>L</td> <td>Display off</td> </tr> </table> Cursor <table border="1"> <tr> <td>C</td> <td>H</td> <td>Cursor on</td> </tr> <tr> <td></td> <td>L</td> <td>Cursor off</td> </tr> </table> Blinking <table border="1"> <tr> <td>B</td> <td>H</td> <td>Blinking on</td> </tr> <tr> <td></td> <td>L</td> <td>Blinking off</td> </tr> </table> | D | H | Display on | | L | Display off | C | H | Cursor on | | L | Cursor off | B | H | Blinking on | | L | Blinking off |
| D | H | Display on | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | L | Display off | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C | H | Cursor on | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | L | Cursor off | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| B | H | Blinking on | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | L | Blinking off | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Shift | L | L | L | L | L | H | S/C | R/L | X | X | 40uS | S/C H Display shift L Cursor move R/L H Right shift L Left shift | | | | | | | | | | | | | | | | | | |
| Set function | L | L | L | L | H | DL | N | X | X | X | 40uS | DL H 8 bits interface L 4 bits interface N H 2 line display L 1line display | | | | | | | | | | | | | | | | | | |
| Set CG RAM address | L | L | L | H | CG RAM address (corresponds to cursor address) | | | | | 40uS | CG RAM data is sent and received after this setting | | | | | | | | | | | | | | | | | | | |
| Set DD RAM address | L | L | H | DD RAM address | | | | | 40uS | 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 | | | | | 0uS | BF H Busy L Ready - Reads BF indication internal operating performed - Reads address counter contents | | | | | | | | | | | | | | | | | | | | |
| Write data | H | L | Write data | | | | | 46uS | Write data into DD or CG RAM | | | | | | | | | | | | | | | | | | | | | |
| Read data | H | H | Read data | | | | | 46uS | Read data into DD or CG RAM | | | | | | | | | | | | | | | | | | | | | |

X : don't care

DISPLAY MODE DESCRIPTION

1) 1 Line Max. 24 character display (function set N=L)

• Normal DDRAM(HEX) line



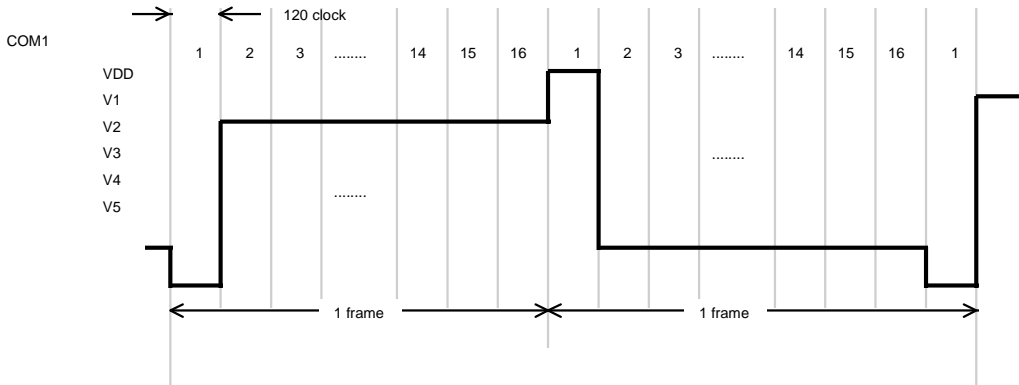
2) 2 Line Max. 24 character display (function set N=H)

• Normal DDRAM(HEX) line



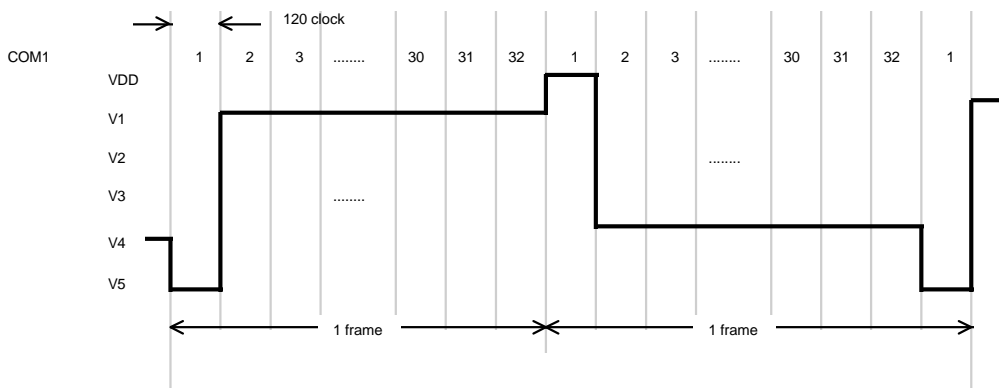
3) RELATION BETWEEN OSCILLATION FREQUENCY and LCD FRAME FREQUENCY

a) 1/16 duty



- * One clock = 4 μ s (Fosc = 250 kHz)
- * Latch clock = 120 clock = 4 μ s \times 120 = 480 μ s , Frequency = 2.08 kHz
- * One frame = 4 μ s \times 120 \times 16 = 7,680 μ s = 7.68 ms
- * Frame frequency = 1/7.68ms = 130.2 Hz

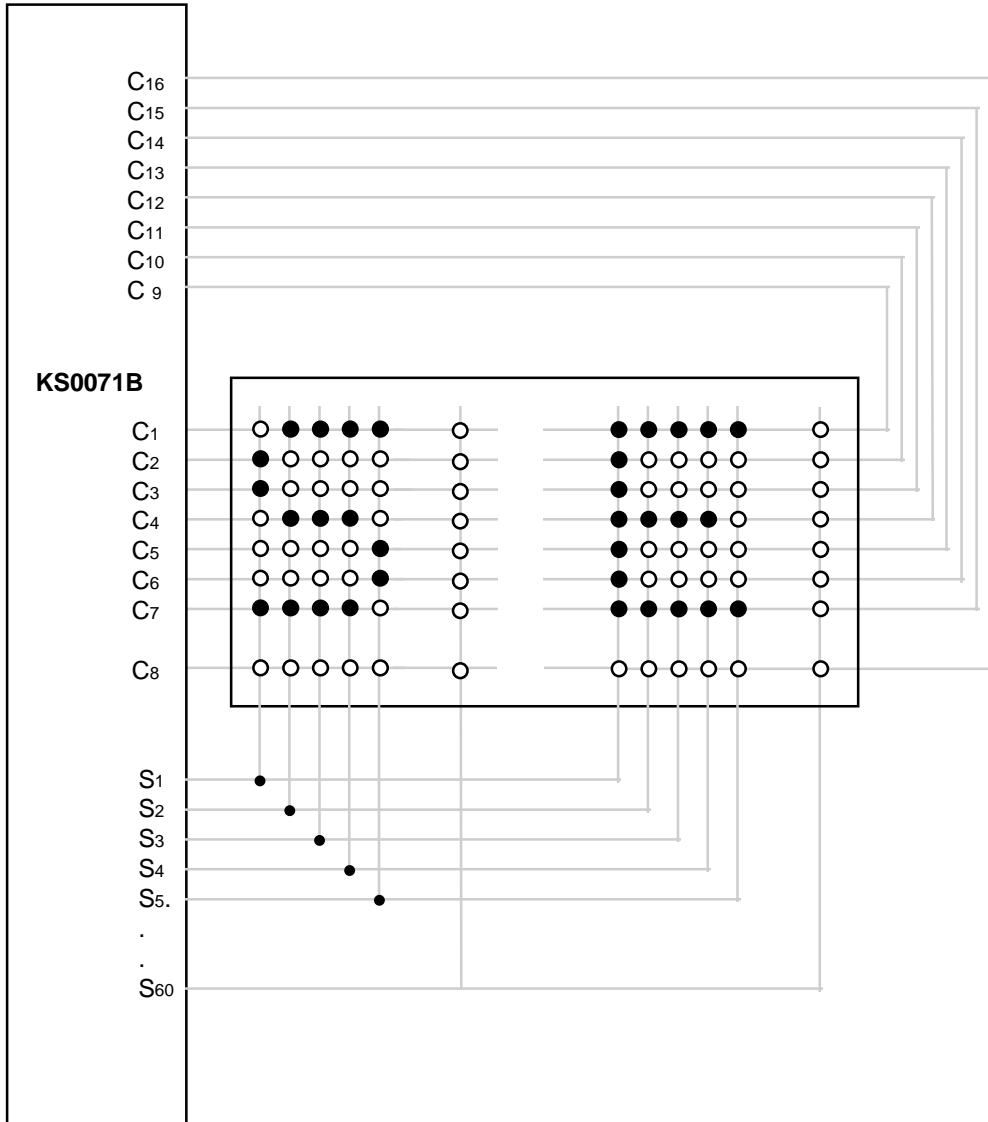
b) 1/32 duty



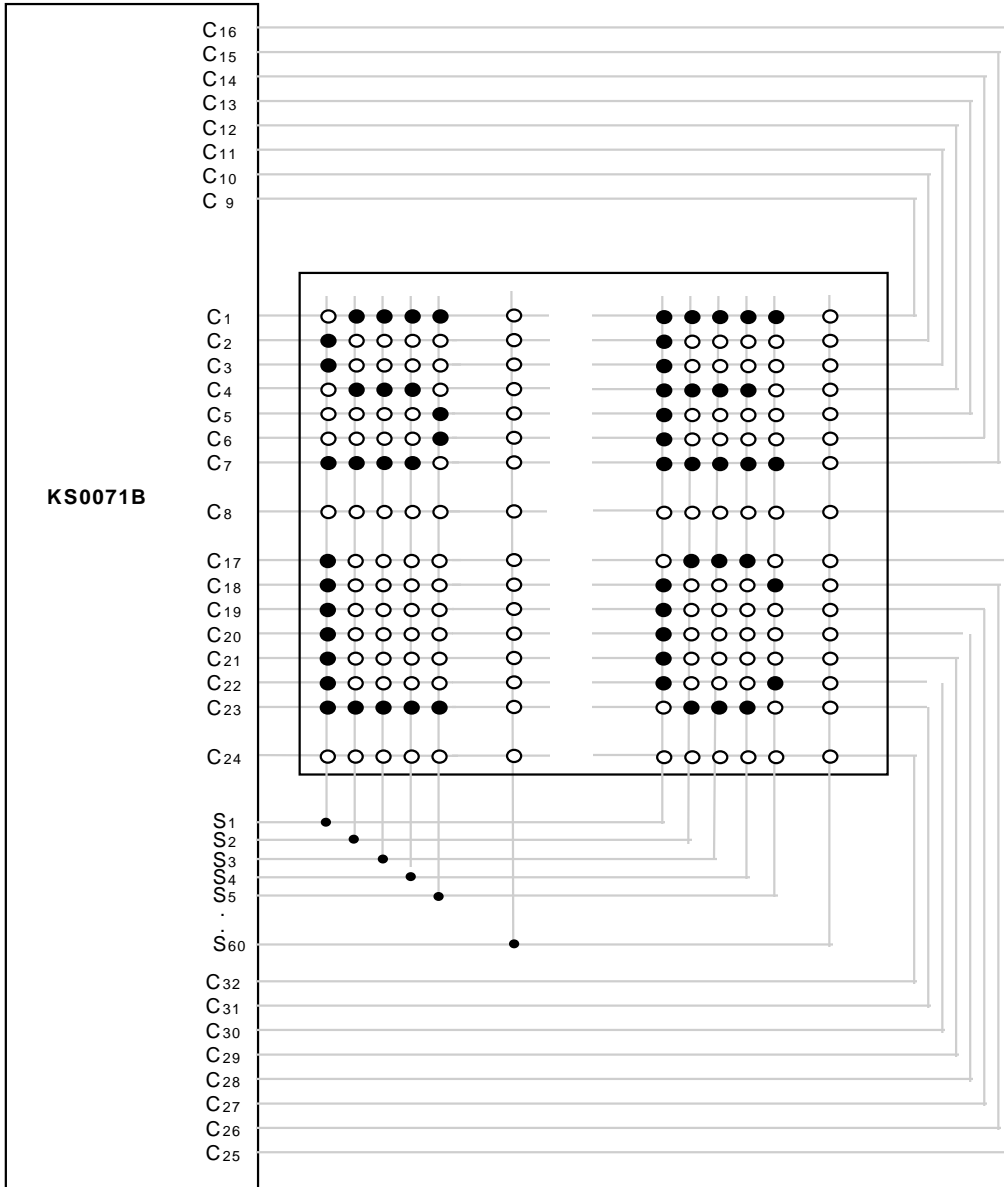
- * One clock = 4 μ s (Fosc = 250 kHz)
- * Latch clock = 120 clock = 4 μ s \times 120 = 480 μ s, Frequency = 2.08 kHz
- * One frame = 4 μ s \times 120 \times 32 = 15,360 μ s = 15.36 ms
- * Frame frequency = 1/15.36 ms = 65.1 Hz

APPLICATION INFORMATION

1) LCD panel: 24 character × 1 line character format: 5 × 7 dots + cursor line (1/5 bias, 1/16 duty)

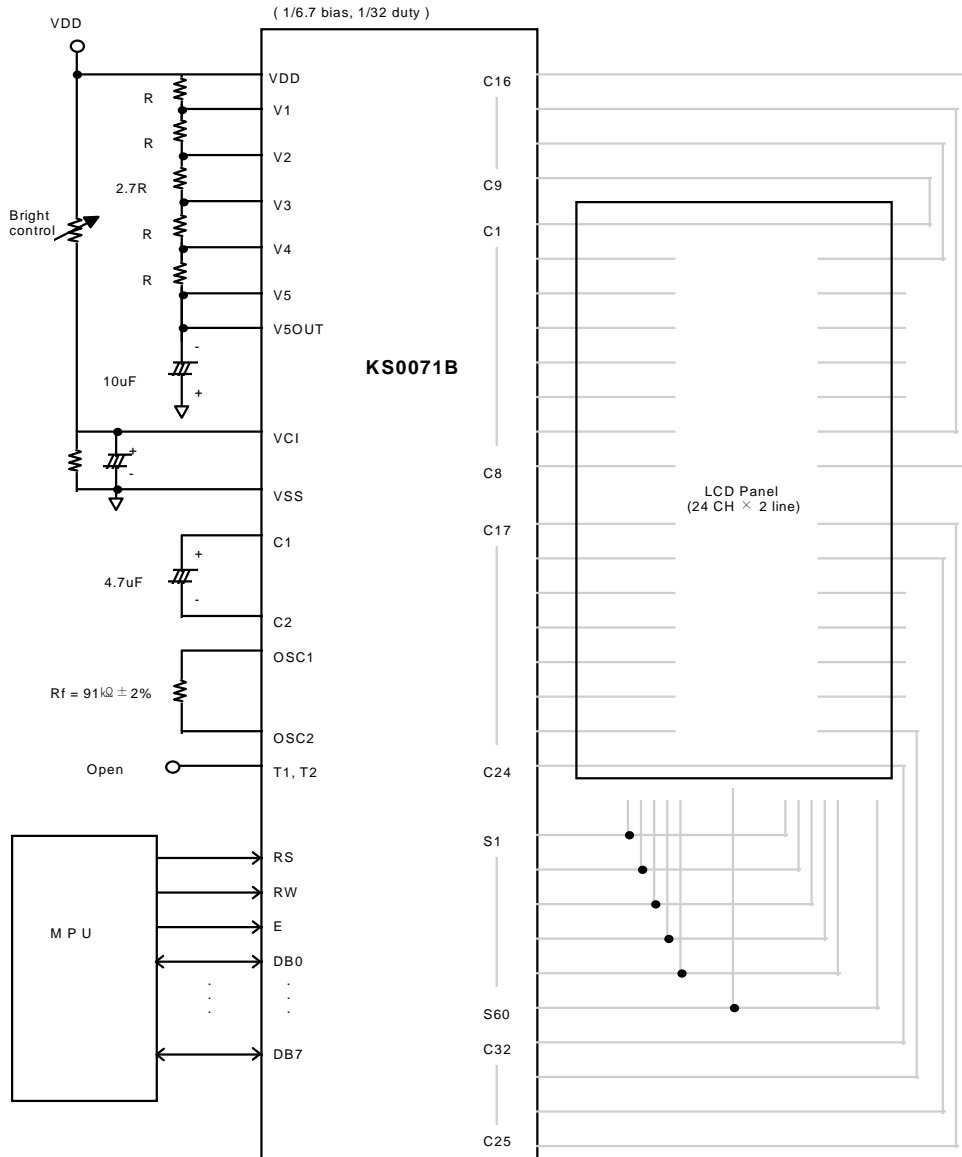


2) LCD panel: 24 character × 2 line character format: 5×7 dots + cursor line (1/6.7 bias, 1/32 duty)

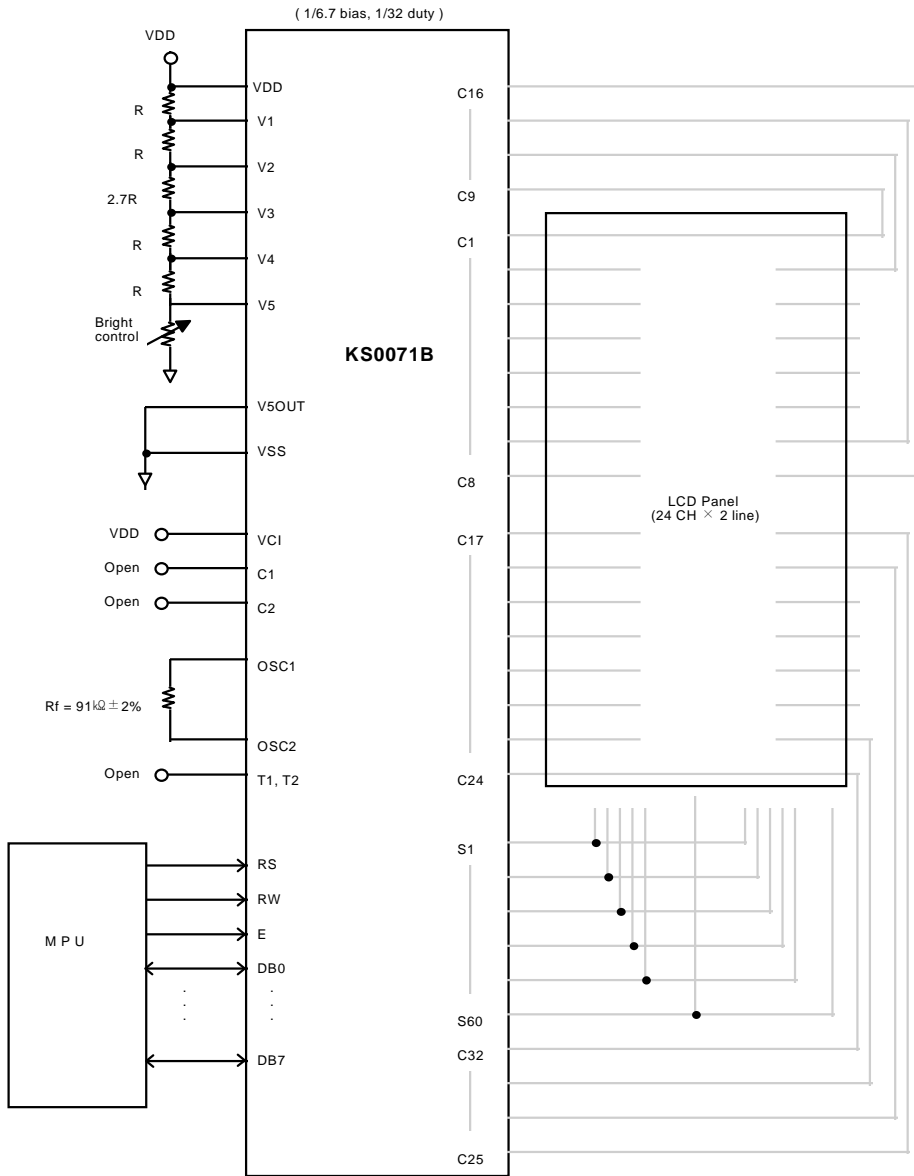


APPLICATION CIRCUIT

1) LCD driving voltage is generated by KS0071B (voltage doubler)



2) LCD driving voltage is supplied from external power supply



Standard Character Pattern (KS0071B-00)