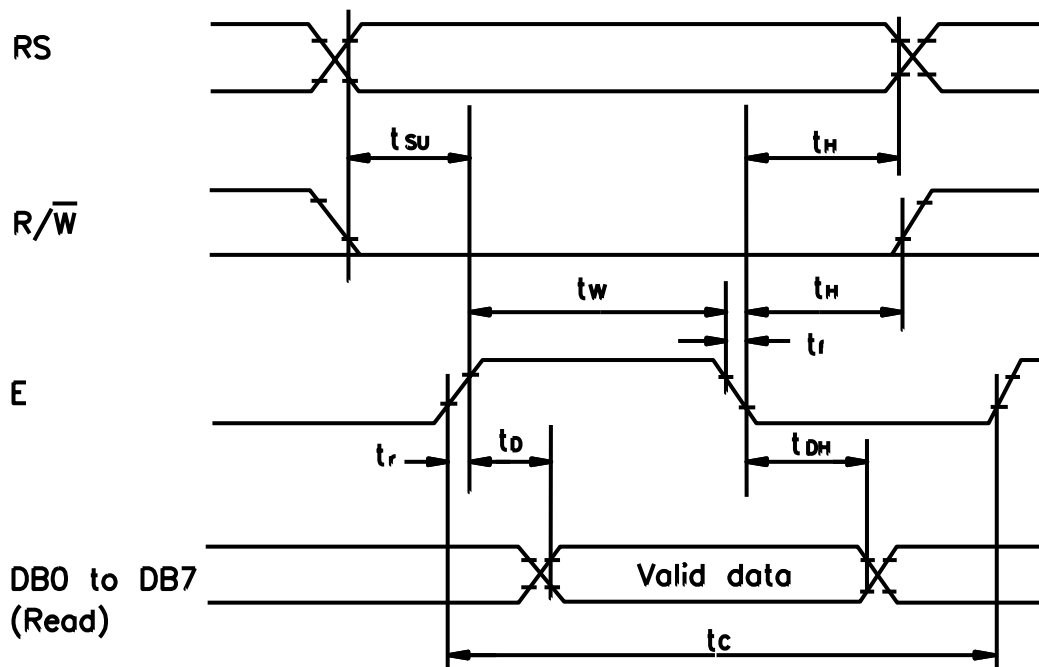
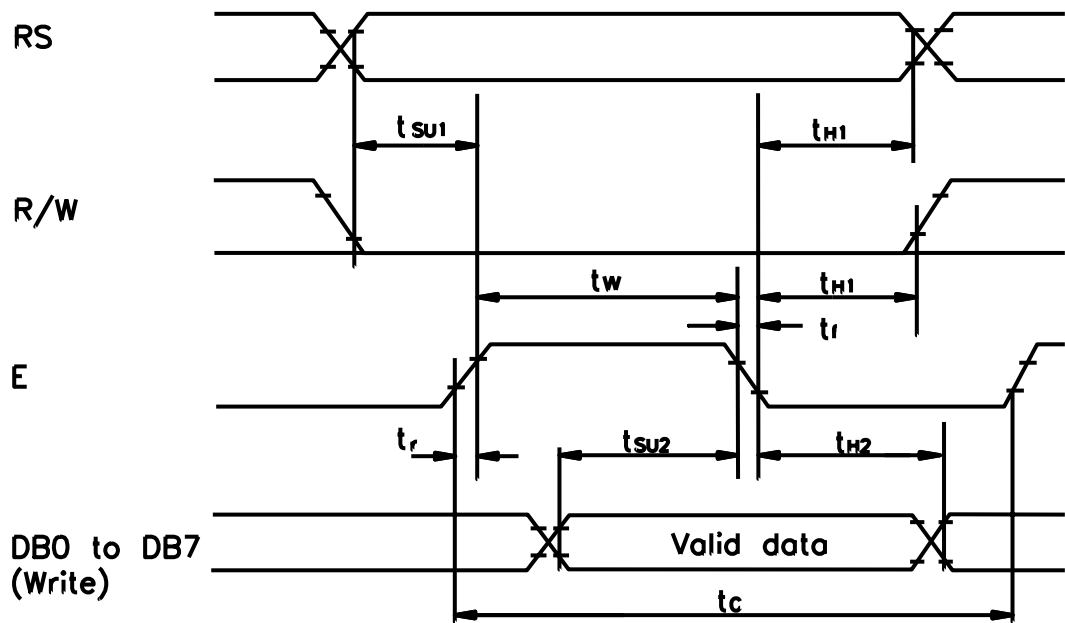


TIMING CHARACTERISTICS

AC Characteristics (VSS=0V , VDD=4.5V to 5.0V , Ta=0 to 50)

| Mode | Characteristics | Symbol | Min. | Typ. | Max. | Unit |
|-------------------|---------------------------|--------------------------------|------|------|------|------|
| Write Mode | E Cycle Time | t _c | 1200 | - | - | ns |
| | E Rise/Fall Time | t _r ,t _f | - | - | 25 | ns |
| | E Pulse Width (High,Low) | t _w | 140 | - | - | ns |
| | R/W And RS Setup Time | t _{SU1} | 0 | - | - | ns |
| | R/W And RS Hold Time | t _{H1} | 10 | - | - | ns |
| | Data Setup Time | t _{SU2} | 40 | - | - | ns |
| | Data Hold Time | t _{H2} | 10 | - | - | ns |
| Read Mode | E Cycle Time | t _c | 1200 | - | - | ns |
| | E Rise /Fall Time | t _r ,t _f | - | - | 25 | ns |
| | E Pulse Width(High , Low) | t _w | 140 | - | - | ns |
| | R/W And RS Setup Time | t _{SU} | 0 | - | - | ns |
| | R/W And RS Hold Time | t _H | 10 | - | - | ns |
| | Data Setup Time | t _D | - | - | 100 | ns |
| | Data Hold Time | t _{DH} | 10 | - | - | ns |

Read/Write Timing Chart



Commands

| Instruction | Instruction code | | | | | | | | | | Description | Execution Time(f_{osc} is 270 kHz) |
|---|------------------|-----|-----|-----|-----|-----|-----|-----|-----|--|--|---|
| | RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | | |
| Clear Display | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Write "20H" to DDRAM and set DDRAM address to "00H" from AC | 1.53mS |
| Return Home | 0 | 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. | 1.53mS |
| Entry Mode | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | I/D | S | Assign cursor moving direction and make shift of entire display enable. | 39 μ S |
| Display ON/OFF | 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C | B | Set display(D), cursor(C), and blinking of cursor(B) on/off Control bit. | 39 μ S |
| Cursor or Display Shift | 0 | 0 | 0 | 0 | 0 | 1 | S/C | R/L | * | * | Set cursor moving and display Shift control bit, and the Direction, without changing DDRAM data. | 39 μ S |
| Function Set | 0 | 0 | 0 | 0 | 1 | DL | N | F | * | * | Set interface data length (DL:4-bit/8-bit), numbers of display line(N:1-line/2-line), display type(F:5*8 dots/5*11 dots) font | 39 μ S |
| Set CG RAM Address | 0 | 0 | 0 | 1 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set CGRAM address in address counter. | 39 μ S |
| Set DD RAM Address | 0 | 0 | 1 | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | Set CGRAM address in address Counter. | 39 μ S |
| Read Busy Flag and 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. | 0 μ S |
| Write Data to ram | 1 | 0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Write data into internal RAM (DDRAM/CGRAM). | 43 μ S |
| Read Data From RAM | 1 | 1 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Read data from internal RAM (DDRAM/CGRAM). | 43 μ S |
| Code | | | | | | | | | | Description | Executed Time (max) | |
| I/D=1 : Increment I/D=0 : Decrement S=1 : With display shift S/C=1 : Display shift S/C=0 : Cursor movement R/L=1 : Shift to the right R/L=0 : Shift to the left DL=1 : 8-bit | | | | | | | | | | DL=0:4-bit N=1 : 2 lines N=0 : 1 lines F=1 : 5 \times 11 dots F=0 : 5 \times 8 dots BF=1:Internal operation is being performed BF=0 : Instruction acceptable | DDRAM: Display Data RAM CGRAM: Character Generator RAM ACG:CGRAM Address ADD:DDRAM Address Corresponds to cursor address. AC: Address Counter, used for both DDRAM and CGRAM * : Invalid. | f_{cp} or f_{osc} =250kHz However, when Frequency changes, execution time also changes EX if f_{cp} or f_{osc} is 270kHz 40 μ s \times 250/270=37 μ s |

COMMANDS DESCRIPTION

Clear Display

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

Clear all the display data by writing "20H" (space code) to all DDRAM address , and set DDRAM Address to "00H" into AC (address counter) .Return cursor to the original status .namely , bring the Cursor to the left edge on first line of the display . Make entry mode increment (I/D="1") .

Return Home

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | * |

Return Home is cursor return home instruction . Set DDRAM address to "00H" into the address Counter . Return cursor to its original site and return display to its original status, if shifted . Content of DDRAM is not changed .

Entry Mode Set

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | I/D | S |

Set the moving direction of cursor and display .

I/D : Increment/ decrement of DDRAM address (cursor or blink)

When I/D= "High" , cursor/blink moves to right and DDRAM address is increased by 1 .

When I/D= "Low" , cursor/blink moves to left and DDRAM address is increased by 1 .

*CGRAM operates the same as DDRAM , when read from or write to CGRAM .

S : Shift of entire display

When DDRAM read (CGRAM read/write) operation or **S** = "Low" , shift of entire display is not performed . If **S** = "High" and DDRAM write operation , shift of entire display is performed according to I/D value (I/D = "1" , shift left , I/D = "0" : shift right) .

Display ON/OFF Control

| | | | | | | | | | |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | D | C | B |

Control display/cursor/blink ON/OFF 1 bit register .

D : Display ON/OFF control bit

When D = "High" , entire display is turned on .

When D = "Low" , display is turned off , but Display data is remained in DDRAM .

C : Cursor ON/OFF control bit

When C = "High" , cursor is turned on .

When C = "Low" , cursor is disappeared in current display , but I/D register remains its data .

B : Cursor Blink ON/OFF control bit

When B = "High" , cursor blink is on , that performs alternate between all the high data and

When B = "Low" , blink is off .

Cursor or Display Shift

| | | | | | | | | | |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
| 0 | 0 | 0 | 0 | 0 | 1 | S/C | R/L | * | * |

Without writing or reading of display data , shift right /left cursor position or display .

This instruction is used to correct or search display data . (Refer to Table 4)

During 2-line mode display , cursor moves to the 2nd line after 40th digit of 1st line .

Note that display shift is performed simultaneously in all the line .

When displayed data is shifted repeatedly , each line shifted individually .

When display shift is performed , the contents of address counter are not changed .

| S/C | R/L | Operation |
|-----|-----|---|
| 0 | 0 | Shift cursor to the left, AC is decreased by 1. |
| 0 | 1 | Shift cursor to the right , AC is increased by 1. |
| 1 | 0 | Shift all of the display to the left, cursor moves according to the display. |
| 1 | 1 | Shift all of the display to the right, cursor moves according to the display. |

Function Set

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0 | 0 | 0 | 0 | 0 | DL | N | F | * | * |

DL : Interface data length control bit

When DL = "High" , it means 8-bit bus mode with MPU .

When DL = " Low" , it means 4-bit mode with MPU . So to speak , DL is a signal to select 8-bit Or 4-bit bus mode . When 4-bit bus mode , it needs to transfer 4-bit data by two times .

N : Display line number control bit

When N = "Low" , it means 1-line display mode .

When N = "High" , 2-line display mode is set .

F : Display font type control bit

When F ="Low" , it means 5*8 dots format display mode

When F ="High" , 5*11 dots format display mode .

Set CG RAM Address

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0 | 0 | 0 | 1 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 |

Set CGRAM address to AC .

This instruction makes CGRAM data available from MPU .

Set DD RAM Address

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0 | 0 | 1 | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 |

Set DDRAM address to AC .

This instruction makes DDRAM data available from MPU .

When 1-line display mode (N=0) , DDRAM address is from "00H" to "4FH" .

In 2-line display mode (N = 1) , DDRAM address in the 1st line is from "00H" to "27H" , and DDRAM address in the 2nd line is from "40H" to "67H" .

Read Busy Flag and Address

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB4 | DB3 | DB2 | DB1 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0 | 1 | BF | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 |

This instruction shows whether KS0066U is in internal operation or not . If the resultant BF is High , It means the internal operation is in progress and you have to wait until BF to be Low , and then the Next instruction can be performed . In this instruction you can read also can read also the value of address counter .

Write Data RAM

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1 | 0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |

Write binary 8-bit data to DDRAM/CGRAM .

The selection of RAM form DDRAM , CGRAM , is set by the previous address set instruction : DDRAM address set , CGRAM address set . RAM set instruction can also determine the AC direction to RAM . After write operation , the address is automatically increased/decreased by 1 , according to the entry mode .

Read Data to RAM

| RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1 | 0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |

Read binary 8-bit data from DDRAM/CGRAM .

The selection of RAM is set by the previous address set instruction . If address set instruction of RAM is not performed before this instruction , the data that read first is invalid , because the Direction of AC is not determined . If you read RAM data several times without RAM address set instruction before read operation , you can get correct RAM data from the second , but the first data would be incorrect , because there is no time margin to transfer RAM data .

In case of DDRAM read operation , cursor shift instruction plays the same role as DDRAM address Counter is automatically increased/decreased by 1 according to the entry mode .After CGRAM read Operation , display shift may not be executed correctly .

NOTE : In case of RAM write operation , after this AC is increased/decreased by 1 like read Operation . In this time , AC indicates the next address position , but you can read only the previous Data by read instruction .

DD RAM ADDRESSING

For 10*4 Display

| | | | | | | | | | | |
|-----------|----|----|----|----|----|----|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Character | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 |
| DD RAM | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 |
| Address | 0A | 0B | 0C | 0D | 0E | 0F | 10 | 11 | 12 | 13 |
| | 5A | 5B | 5C | 5D | 5E | 5F | 50 | 51 | 52 | 53 |

For 16*1 Display

| | | | | | | | | | | | | | | | | |
|-----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Character | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| DD RAM | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 |
| Address | | | | | | | | | | | | | | | | |

For 16*2 or 8*2 Display

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

For 16*4 Display

| | | | | | | | | | | | | | | | | |
|-----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Character | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F |
| DD RAM | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4B | 4C | 4D | 4E | 4F |
| Address | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 1A | 1B | 1C | 1D | 1E | 1F |
| | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 5A | 5B | 5C | 5D | 5E | 5F |

For 20*2 Display

| | | | | | | | | | | | | | | | | |
|-----------|----|----|----|----|----|----|----|----|----|----|-----|-----|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | --- | --- | 17 | 18 | 19 | 20 |
| Character | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | --- | --- | 10 | 11 | 12 | 13 |
| DD RAM | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | --- | --- | 50 | 51 | 52 | 53 |
| Address | | | | | | | | | | | | | | | | |

For 20*4 Display

| | | | | | | | | | | | | | | | | |
|--------------------------------|----|----|----|----|----|----|----|----|----|----|-----|-----|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | --- | --- | 17 | 18 | 19 | 20 |
| Character DD RAM Address | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | --- | --- | 10 | 11 | 12 | 13 |
| | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | --- | --- | 50 | 51 | 52 | 53 |
| | 14 | 15 | 16 | 17 | 18 | 19 | 1A | 1B | 1C | 1D | --- | --- | 24 | 25 | 26 | 27 |
| | 54 | 55 | 56 | 57 | 58 | 59 | 5A | 5B | 5C | 5D | --- | --- | 64 | 65 | 66 | 67 |

For 40*2 Display

| | | | | | | | | | | | | | | | | |
|--------------------------------|----|----|----|----|----|----|----|----|----|----|-----|-----|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | --- | --- | 37 | 38 | 39 | 40 |
| Character DD RAM Address | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | --- | --- | 24 | 25 | 26 | 27 |
| | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | --- | --- | 64 | 65 | 66 | 67 |

For 40*4 Display

| | | | | | | | | | | | | | | | | | |
|--------------------------------|----|----|----|----|----|----|----|----|----|----|----|-----|-----|----|----|----|----|
| | E | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | --- | --- | 37 | 38 | 39 | 40 |
| Character DD RAM Address | E1 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | --- | --- | 24 | 25 | 26 | 27 |
| | | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | --- | --- | 64 | 65 | 66 | 67 |
| | E2 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | --- | --- | 24 | 25 | 26 | 27 |
| | | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | --- | --- | 64 | 65 | 66 | 67 |

SUNLIKE DISPLAY

Model No: Controller-XH

CG RAM MAPPING

| Character Code (DD RAM data) | | | | | | | | CG RAM Address | | | | | | | | Character Patterns (CG RAM data) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------|---|---|---|-----|---|---|---|-----------------|---|---|---|-----|---|---|---|---|---|---|---|-----|---|--|--|-------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--------|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 5 | 4 | 3 | 2 | 1 | 0 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| High | | | | Low | | | | High | | | | Low | | | | High | | | | Low | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 0 0 0 * 0 0 0 | | | | | | | | 0 0 0 | | | | | | | | * * * | | | | | | | | Character Pattern | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | <table border="1"> <tr><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> </table> | | | | | | | | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Cursor |
| 0 | 1 | 1 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 0 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 1 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 1 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | 1 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 0 0 0 * 0 0 1 | | | | | | | | 0 0 1 | | | | | | | | * * * | | | | | | | | Character Pattern | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | <table border="1"> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> </table> | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Cursor |
| 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 0 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 1 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 1 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 0 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ⋮ ⋮ ⋮ ⋮ ⋮ ⋮ ⋮ ⋮ | | | | | | | | ⋮ ⋮ ⋮ ⋮ ⋮ ⋮ ⋮ ⋮ | | | | | | | | ⋮ ⋮ ⋮ ⋮ ⋮ ⋮ ⋮ ⋮ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 0 0 0 * 1 1 1 | | | | | | | | 1 1 1 | | | | | | | | * * * | | | | | | | | Character Pattern | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | <table border="1"> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> </table> | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | Cursor |
| 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 0 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | 1 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 0 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 0 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

CHARACTER FONT TABLE

| Upper 4 bit Lower 4 bit | LLLL | LLLF | LLHL | LLFH | LHLL | LHLF | LHHL | LHFH | HLLL | HLLF | HLHL | HLFH | HHLL | HHLF | HHHL | HHFH |
|----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| LLLL | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| LLLF | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| LLHL | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| LLFH | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| LHLL | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| LHLF | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| LHHL | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| LHFH | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| HLLL | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| HLLF | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| HLHL | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| HLFH | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| HHLL | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| HHLF | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| HHHL | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| HHFH | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |