Noritake itron

RoHS 2011/65/EU

OLED Display Module

Specification

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1 General Description

1.1 Scope

This specification covers the operation and operating requirements of the OLED graphic display module GE256X64B-7032B

1.2 Construction

The module consists of a 256 × 64 dot graphic OLED-panel, refresh RAM, character generator, DC/DC converter, display controller, and all necessary control logic.
The module can simultaneously display graphic patterns and characters on the screen.

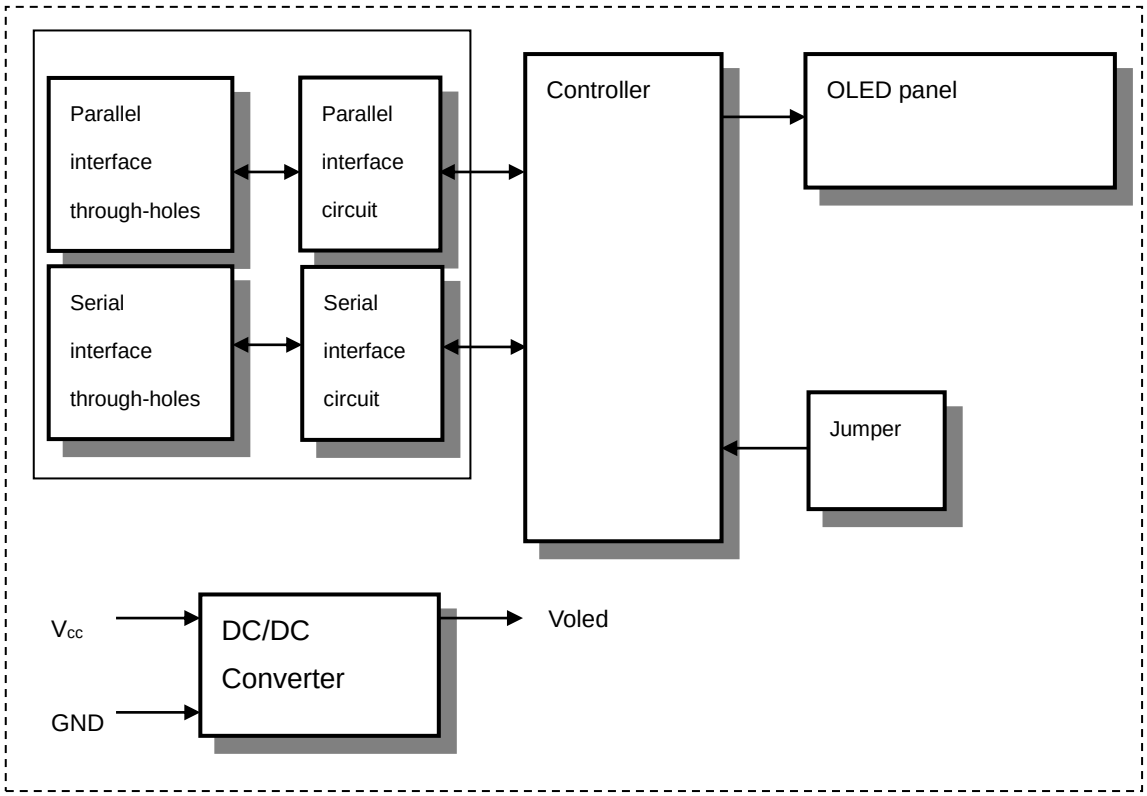
1.3 Outline

Power supply: Single 3.3 V_{DC} power supply
Interface: Parallel interface (CMOS-level)
Serial interface (Asynchronous, CMOS-level input)
Function: Character display – 5×7 dot, with display attributes
5×7 Character font (specification DS-898-0002-xx)
Graphic display
Control command
Character download function
Screen saver function
Applicable Display Module reliability specification : TT-99-3102
Applicable Display Module quality specification : TT-93-3404D

1.4 Weight

Approximately 20g

1.5 Block Diagram



2 Electrical specifications

2.1 Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power Supply Voltage	V_{cc}	−0.3	-	3.6	V_{DC}
Logic Input Voltage D0-D7, /WR, /RD, /RESET,SIN,CLK,/CS	V_{IN}	−0.3	-	V_{cc}+0.3	V_{DC}

2.2 Electrical ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power Supply Voltage	V_{cc}	3.14	3.30	3.47	V_{DC}

Driving voltage for the OLED is obtained from the on-board DC/DC converter.

2.3 Electrical Characteristics

Measuring Conditions: Ambient temperature = 25 ºC, V_{CC} = 3.3 V_{DC}

Parameter		Symbol	Min.	Typ.	Max.	Unit	Condition
'L' Level Logic Input Current D0-D7, /WR, /RD		I_{IL1}	-	-	−0.15	mA	V_{IN}=0V
'L' Level Logic Input Current SIN,SCK,/RESET,/CS		I_{IL2}	-	-	−0.6	mA	V_{IN}=0V
'H' Level Logic Input Current D0-D7, /WR, /RD,SIN,SCK, /RESET,/CS		I_{IH}	-	-	3.0	μA_{DC}	V_{IN}=3.3V
Logic Input Voltage D0-D7, /WR, /RD, /RESET SIN, CLK,/CS	'H'	V_{IH1}	0.8V_{CC}	-	V_{CC}	-	-
	'L'	V_{IL1}	0	-	0.2V_{CC}	V_{DC}	-
Logic Output Voltage D7(Busy flag), SBUSY,PBUSY	'H'	V_{OH1}	2.4	-	V_{CC}	V_{DC}	I_{OH1}=−1.5mA
	'L'	V_{OL1}	0	-	0.6	V_{DC}	I_{OL1}=1.6mA
Power Supply Current 1		I_{CC1}	-	220	280	mA	All dots ON
Power Supply Current 2		I_{CC2}		90	110	mA	50% Display Area Turn on
Power Supply Current 3		I_{CC3}	-	40	60	mA	All dots OFF
Power Supply Current 4		I_{CC4}	-	15	-	mA	Power Save Mode
Power Consumption			-	0.73	0.92	W	All dots ON

Note:

Inrush current at power-on may exceed twice normal current.
Peak current may exceed twice normal current.
Peak current is changed by the lighting pattern.
The rise time of supply voltage should not exceed 100ms.

3 Optical Specifications

Number of dots:	16384（256 x 64）
Display area:	71.394mm × 19.042mm (X × Y)　(2.91inch)
Dot size:	0.249mm × 0.268mm (X × Y)
Dot pitch:	0.279mm × 0.298mm (X × Y)
Luminance:	68cd/m^2 Min. (85cd/m^2 Typ.)
Color of illumination:	White

4 Environmental Specifications

Operating temperature:	−30 to +75 ºC
Storage temperature:	−40 to +85 ºC
Operating humidity:	20 to 80 % RH (non-condensing)
Storage humidity:	20 to 80 % RH (non-condensing)
Vibration:	10-55-10Hz, all amplitude 1mm, X-Y-Z, 30 minutes (non-operating)
Shock:	392m/s^2 (40G), 9ms, X-Y-Z, 3 times each direction (non-operating)

5 Interface

5.1 Type of interface

The following interfaces are available on this module:

Parallel interface (CMOS-level)

Serial interface (C-MOS Synchronous, Asynchronous or SPI, Selectable)

5.2 Parallel interface

5.2.1 Basic function

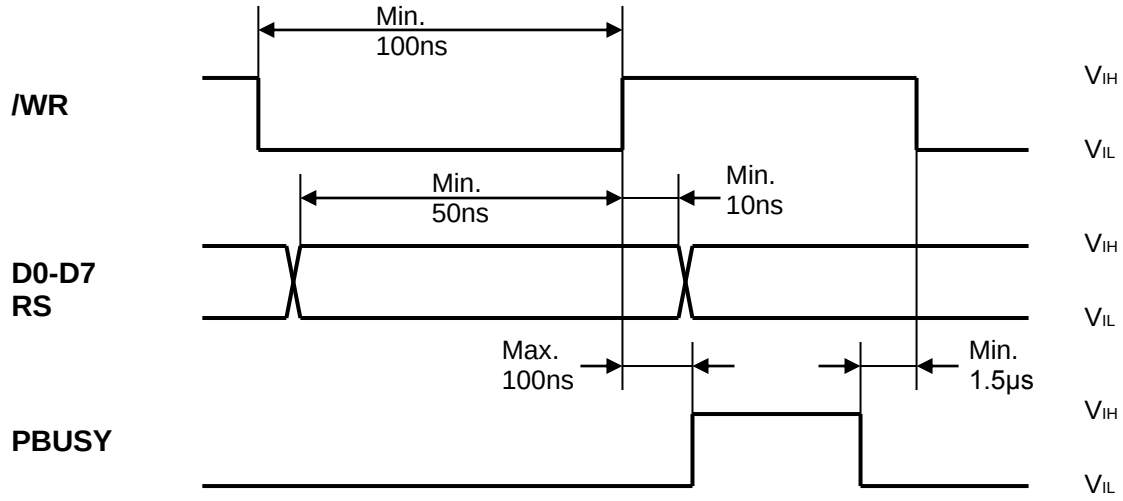
The module sets the PBUSY line upon receipt of data, and clears the line when ready to receive more data. PBUSY signal can be read directly, or by bit D7 Status read.

RS terminal is not used in this module.

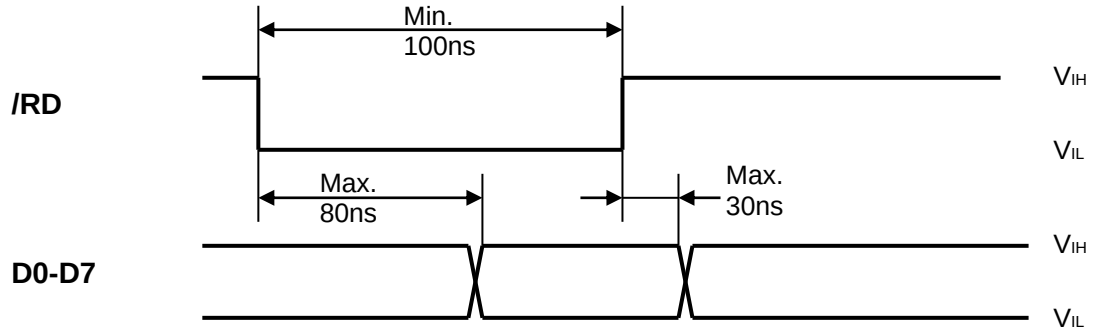
Operation	/WR	/RD	/RS	D0-D7
Data write	0 → 1	1	X	D0-D7: Data write
Status read	1	0	X	D0-D6: Undefined D7: PBUSY Flag 1:BUSY, 0:READY

5.2.2 Parallel Interface timing

Write timing



Read timing

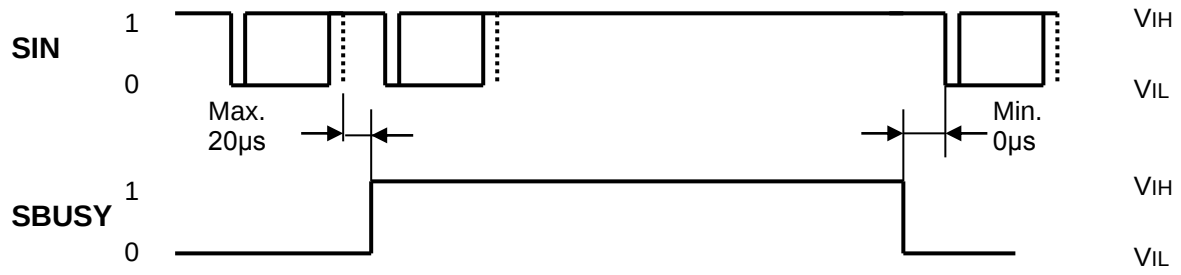


5.3 Serial interface

5.3.1 Basic function

There are three Serial interfaces: C-MOS Synchronous, Asynchronous or SPI and they are Selectable by jumper. The module sets the SBUSY line upon receipt of data, and clears the line when ready to receive more data.

5.3.2 Asynchronous serial interface timing



Interface:

Baud rate	9,600 / 19,200 / 38,400 / 115,200bps (set by Jumper)
Parity	None
Format	Start (1 bit) + Data (8 bit) + Stop (1 bit)
Handshake	SBUSY

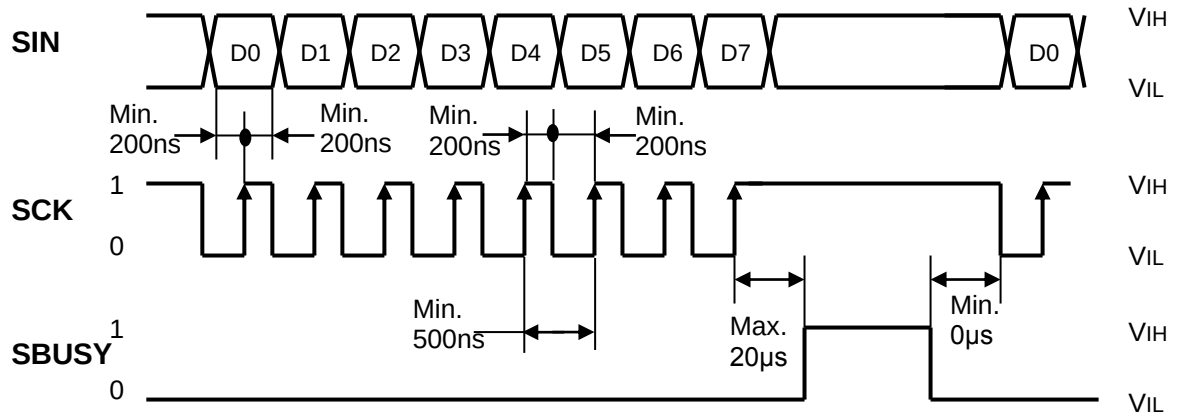
Receive buffer capacity: 60 bytes

SBUSY change timing:

SBUSY	1(BUSY)	0(READY)
Condition	When there is data in buffer	When there is no data in buffer

Data can be stored into receiving buffer. However, it recommends not sending the data when SBUSY=1.

5.3.3 Synchronous serial interface timing



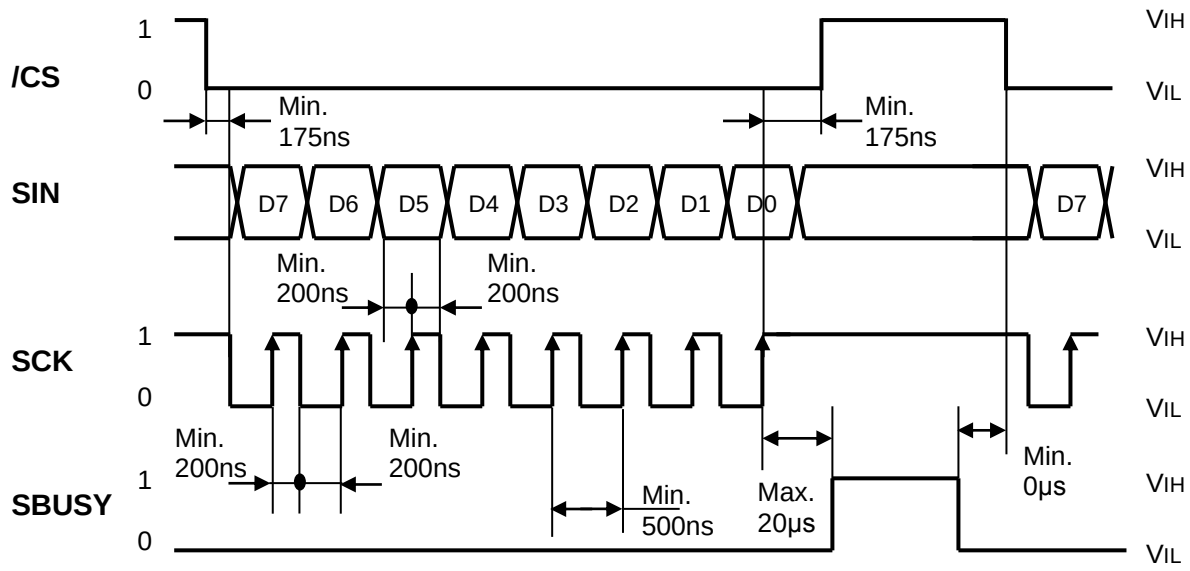
Receiving Buffer Capacity: 60 bytes

SBUSY change timing:

SBUSY	1(BUSY)	0(READY)
Condition	When there is data in buffer	When there is no data in buffer

Data can be stored into receiving buffer. However, it recommends not sending the data when SBUSY=1.

5.3.4 SPI interface timing



Receiving Buffer Capacity: 60 bytes

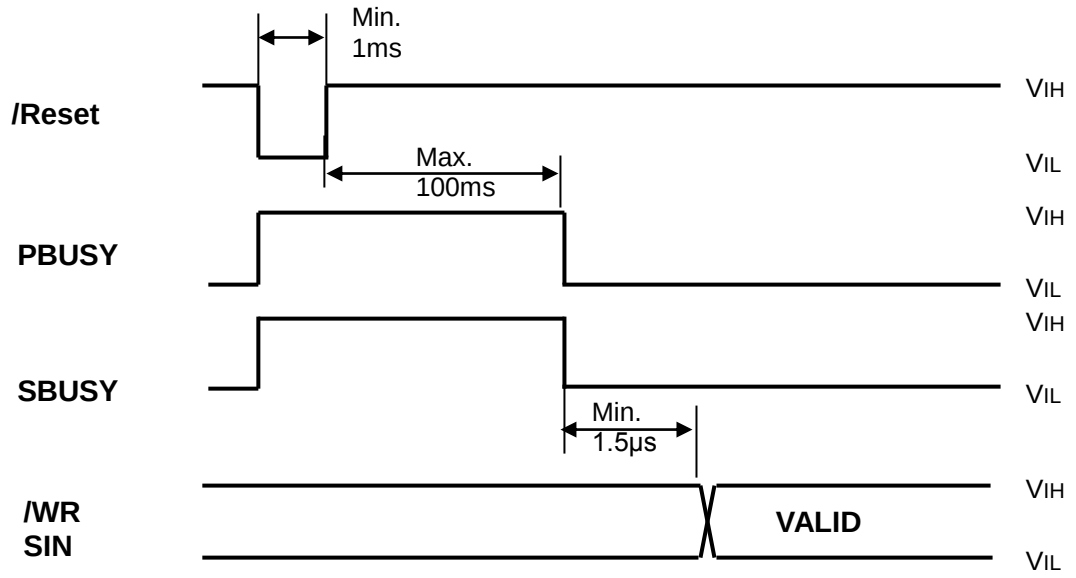
SBUSY change timing:

SBUSY	1(BUSY)	0(READY)
Condition	When there is data in buffer	When there is no data in buffer

Data can be stored into receiving buffer. However, it recommends not sending the data when SBUSY=1.

5.4 Reset timing

Reset pulse (active low) should be longer than 1ms.
The module sets the SBUSY/PBUSY line upon receipt of Reset signal and clears the line when ready to receive data.



6 Display specification

6.1 Displayable image types

6.1.1 Graphic display

Number of dots: 256×64 dots

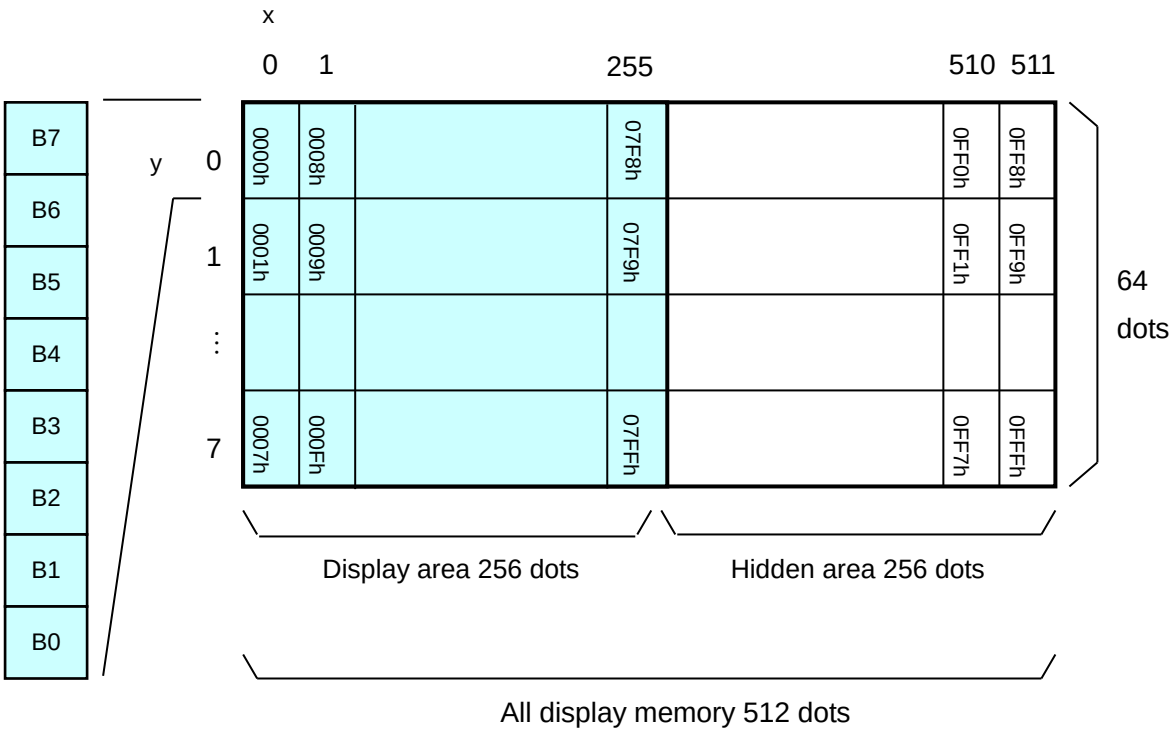
6.1.2 Character display

Character mode: 5×7 dot
Character font type: 5×7 dot characters: ANK, international font
Character display width: Fixed character format 1 & 2, Proportional character format 1 & 2
Attribution: Font Magnification, Reverse

6.2 Display memory

Size: 512 × 64 dots - separated as: Display area (256 × 64dots)
Hidden area (256 × 64dots)

Display Memory is comprised of Display area and Hidden area, as shown below.
By using “User Window” function, the memory area can be separated, and each separate window can be controlled independently (refer to 7.1.37 Window command group, page 30).
Hidden area can be displayed by using scroll or other action commands (refer to 7.1.23 Display action command group, page 21).

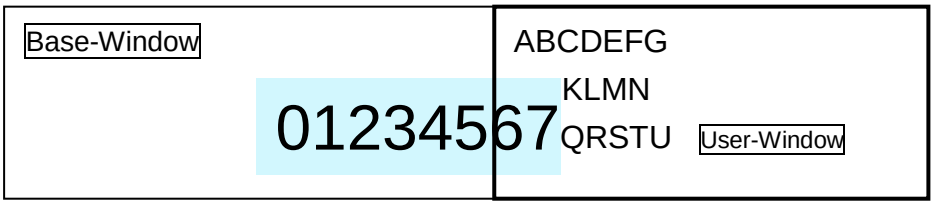


6.3 Window

Window function enables the display screen to be divided into “windows” each of which can be controlled and displayed independently.
Display Memory is shared by all windows; individual windows do not have their own display memory.
There are 2 types of “window”: Base-Window and User-Window. Refer to “Window command group”, page 30.

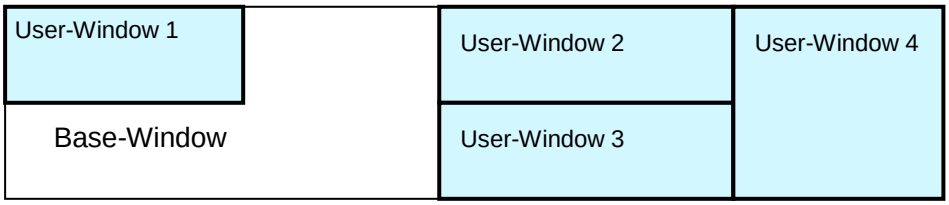
6.3.1 Base-Window

Base-Window covers the entire display screen. If no User-Windows are defined, all display operation is processed on this window. If one or more User-Windows are defined, display operation on any area not covered by a User-Window is done by selecting Base-Window.
When Base-Window is selected, even if User-Window(s) are defined, all display operation is processed under Base-Window. Therefore the current display contents of User-Window(s) is overwritten.



6.3.2 User-Window

User-Window is defined by User-Window definition command.
Display operation is processed on the window selected by Current Window select command.
A maximum of 4 User-Windows can be defined.



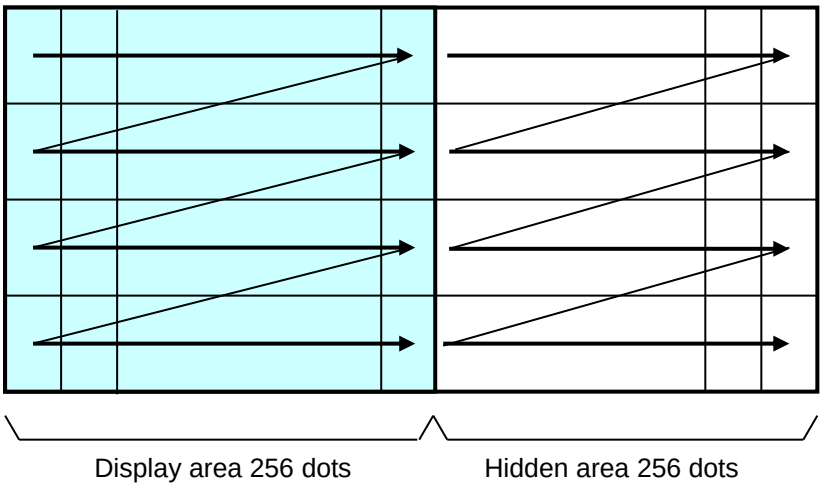
6.4 Write screen mode

This setting is only applicable for Base-Window.

There are two Write screen modes, Display screen mode and All screen mode. The mode is set by command (refer to Window command group, “Write screen mode select”, page 32).

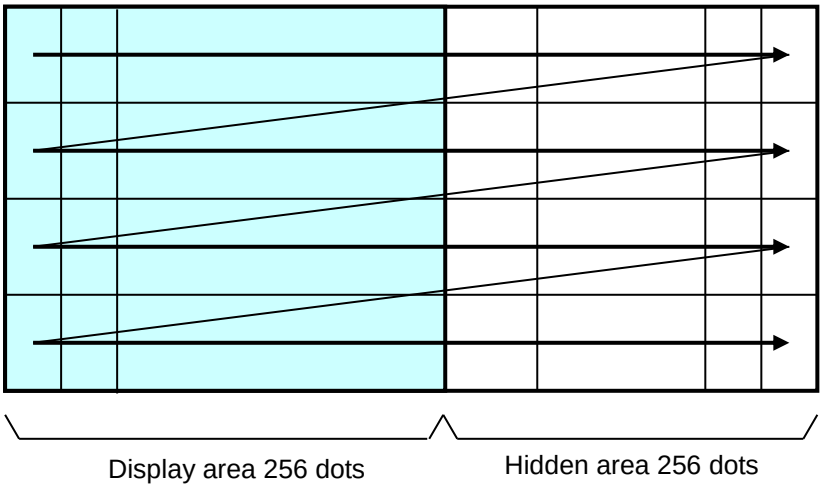
6.4.1 Display screen mode

When the cursor is located in the Display area, all operation will be done within Display area, and when cursor is located in the Hidden area, it will be done within Hidden area.



6.4.2 All screen mode

Regardless of the cursor position, operation will be done over the entire area.



6.5 Character display format

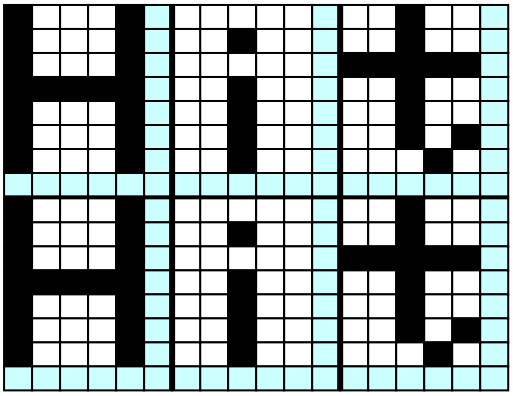
Character display format is following selectable by “Character display width” command.

Type of character	Display position	Format	Fixed character width 1	Fixed character width 2	Proportional character width 1	Proportional character width 2
Standard character and Download character 5x7dot	Y=0～7	Character format	5 x 7	5 x 7	n x 7	n x 7
		Upper space	0	0	0	0
		Lower space	1	1	1	1
		Left space	0	1	0	1
		Right space	1	1	1	1
Download character 7x8	Y=0～7	Character format	6 x 8 *	7 x 8	6 x 8 *	7 x 8
		Upper space	0	0	0	0
		Lower space	0	0	0	0
		Left space	0	0	0	0
		Right space	0	0	0	0

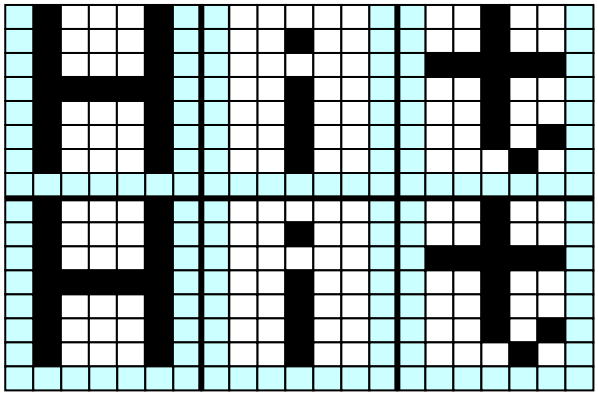
* The most left part of 6x8 dot within 7x8 dot is displayed.

Note: In case of proportional character width is specified, the blank character (20H) will be operated as same as 2 dot width character.

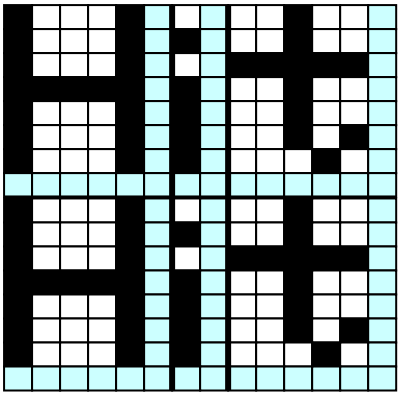
Fixed character width 1



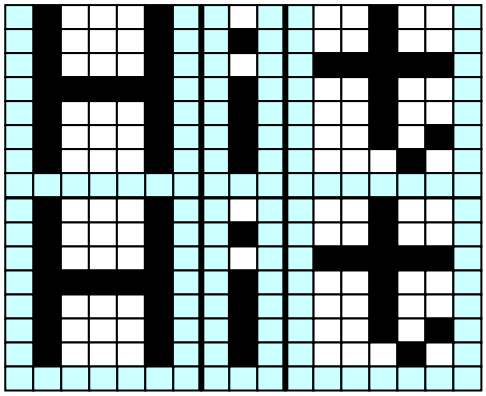
Fixed character width 2



Proportional character width 1



Proportional character width 2



7 Function

7.1 Commands

This section describes the operation of each command.

Note: The character size (X × Y dot) referred to in this section, depends on the “Character display width” and “Font magnified display” settings.
The number of X dots and Y dots for 1 character for each character display width are as follows:

Character type	Fixed character width 1	Fixed character width 2	Proportional character width 1	Proportional character width 2
Number of X dots	5 + 1	5 + 2	5 + 1	5 + 2
Number of Y dots	7 + 1	7 + 1	7 + 1	7 + 1

MD1 mode, MD2 mode, and MD3 mode, described below, refer to Over-write mode, Vertical scroll mode, and Horizontal scroll mode respectively. (To select the mode, refer to the commands “US MD1”, “US MD2”, and “US MD3”.)

7.1.1 Character display

Code: 20h – FFh

Name: Character display
Function: Display character at cursor position.
This command operates on the currently-selected window (refer to Window select).

MD1 (Over-write mode)

Cursor position		**Display Operation**
X direction	**Y direction**	
Space for character on right side.	-	Display >> HT
Right end	Space for character in next lower line.	HT >> Display >> HT
	No space for character in next lower line.	HT >> Display >> HT

MD2 (Vertical scroll mode)

Cursor position		**Display Operation**
X direction	**Y direction**	
Space for character on right side.	-	Display >> HT
Right end	Space for character in next lower line.	HT >> Display >> HT
	No space for character in next lower line.	HT >> Display >> HT

MD3 (Horizontal scroll mode)

Cursor position		**Display Operation**
X direction	**Y direction**	
The space for 1 character size is in right side.	-	Display >> HT
Right end	-	HT >> Display >> HT

7.1.2 BS *(Back Space)*

Code: 08h

Function: Cursor moves to the left by one character.
This command has effect for the currently-selected window.

MD1 (Over-write mode) and MD2 (Vertical scroll mode)

Cursor position		Display Operation
X direction	Y direction	
Space for character on left side.	-	Cursor moves left by one character.
Left end	Space for one line above.	Cursor moves to right end of next upper line.
	No space for one line above.	Cursor does not move.

MD3 (Horizontal scroll mode)

Cursor position		Display Operation
X direction	Y direction	
Space for character on left side.	-	Cursor moves left by one character.
Left end	-	Cursor does not move.

7.1.3 HT *(Horizontal Tab)* – 1 character to right

Code: 09h

Function: Cursor moves to the right by one character.
This command has effect for the currently-selected window.

MD1 (Over-write mode)

Cursor position		Display Operation
X direction	Y direction	
Space for character on right side.	-	Cursor moves right by one character.
Right end	Space for character in next lower line.	Cursor moves to left end of next lower line.
	No space for character in next lower line.	Cursor moves to left end of top line.

MD2 (Vertical scroll mode)

Cursor position		Display Operation
X direction	Y direction	
Space for character on right side.	-	Cursor moves right by one character.
Right end	Space for character in next lower line.	Cursor moves to left end of next lower line.
	No space for character in next lower line.	Display contents are scrolled up the required number of dots, and the bottom line is cleared. Cursor moves to left end of bottom line.

MD3 (Horizontal scroll mode)

Cursor position		Display Operation
X direction	Y direction	
Space for character on right side.	-	Cursor moves right by one character.
Right end	-	Contents of current line scroll left until sufficient space for character is available at the right end. Cursor moves to the left edge of newly-created space.

7.1.4 LF *(Line Feed)*

Code: 0Ah

Function: Cursor moves to next lower line.
This command has effect for the currently-selected window.

MD1 (Over-write mode)

Cursor position		Display Operation
X direction	Y direction	
-	Space for character in next lower line.	Cursor moves to the same position on next lower line.
	No space for character in next lower line.	Cursor moves to the same position on top line.

MD2 (Vertical scroll mode)

Cursor position		Display Operation
X direction	Y direction	
-	Space for character in next lower line.	Cursor moves to the same position on next lower line.
	No space for character in next lower line.	Display contents are scrolled up the required number of dots, and the bottom line is cleared. Cursor does not move.

MD3 (Horizontal scroll mode)

Cursor position		Display Operation
X direction	Y direction	
-	-	Cursor does not move.

7.1.5 HOM *(Home Position)*

Code: 0Bh

Function: Cursor moves to home position (top left).
This command has effect for the currently-selected window.

7.1.6 CR *(Carriage Return)*

Code: 0Dh

Function: Cursor moves to left end of current line.
This command has effect for the currently-selected window.

7.1.7 US $ xL xH yL yH *(Cursor Set)*

Code: 1Fh 24h xL xH yL yH

xL: Cursor position x, lower byte (1 dot / unit)
xH: Cursor position x, upper byte (1 dot / unit)
yL: Cursor position y, lower byte (8 dots / unit)
yH: Cursor position y, upper byte (8 dots / unit)
Definable area: 0000h ≤ (xL + xH×100h) ≤ 01FFh
0000h ≤ (yL + yH×100h) ≤ 0007h
Function: Cursor moves to the specified (X, Y) position on Display Memory.
If the specified X, Y position (X and/or Y) is outside the definable area, or outside the currently-selected window, the command is ignored and the cursor remains in the same position.
This command has effect for the currently-selected window.

7.1.8 CLR *(Display Clear)*

Code: 0Ch

Function: Display screen is cleared and cursor moves to home position.
This command has effect for the currently-selected window.

7.1.9 US C n *(Cursor display)*

Code: 1Fh 43h n

n: Cursor display setting
Definable area: 00h ≤ n ≤ 01h
n = 00h: Cursor display OFF
n = 01h: Cursor display ON
Default: n = 00h (Cursor OFF)
Function: Cursor display setting.
When cursor display is ON, cursor position appears as reverse blinking, 1×8 dots.
When cursor is in hidden area, it does not appear, even when cursor display is set ON.
This command has effect for the currently-selected window.

7.1.10 ESC @ *(Initialize Display)*

Code: 1Bh 40h

Settings return to default values.

Jumper settings are not re-loaded.

Contents of receive buffer remain in memory.

7.1.11 ESC % n *(Download character ON/OFF)*

Code: **1Bh 25h n**

Function: Enable or disable display of download characters.

n = 01h: Enable (If download character is not defined, built-in character is displayed)

n = 00h: Disable

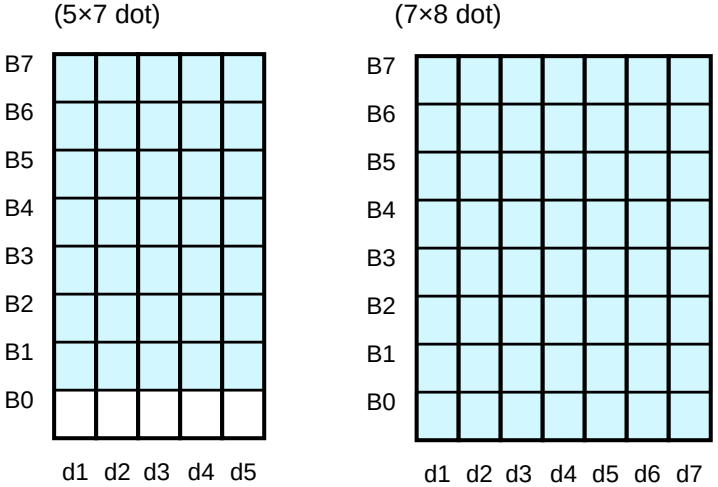
Characters already displayed are not affected.

7.1.12 ESC & a c1 c2 [x1 d1...d(a×x1)]...[xk d1...d(a×xk)] *(Download character definition)*

Code: **1Bh 26h a c1 c2 [x1 d1...d(a×x1)]...[xk d1...d(a×xk)]**

a: Select character type
c1: Start character code
c2: End character code
x: Number of dots for X-direction
d: Definition data
Definable area: a = 01h
x = 05h: 5×7 dot
x = 07h: 7×8 dot
20h ≤ c1 ≤ c2 ≤ FFh
00h ≤ d ≤ FFh
x = 05h: Upper 7 bits are valid.
x = 07h: All 8 bits are valid.
k = c2 − c1 + 1

Function: Define download characters into RAM.
A maximum of 16 download characters can be defined.
x = 05h: Defined as 5×7 dot. Surrounding space is same as standard character display.
x = 07h: Defined as 7×8 dot. Displayed as 6×8 or 7×8 dot character (refer to 6.5 “Character display format”).
After the maximum number of download characters are defined, in order to define other character codes, space must first be obtained using the Download character delete command.
Downloaded characters are valid until redefined, an initialize (ESC @) sequence is executed, or the power is turned off.
To display download characters the commands Download character definition and Download character ON/OFF (set to ON) are required.
If a currently-displayed download character is re-defined, there is no affect on the currently-displayed character. It is effective only for newly input characters.



7.1.13 ESC ? a c *(Download character delete)*

Code: **1Bh 3Fh a c**

a: Select character type

c: Delete Character code

Definable area: a = 01h

20h ≤ c ≤ FFh

Function: Delete defined download character.

Built-in character is displayed after download character is deleted.

Characters already displayed are not affected.

Command is ignored if download character is not defined for the given character code.

7.1.14 ESC R n *(International font set)*

Code: **1Bh 52h n**

Definable area: 00h ≤ n ≤ 0Dh

Default: n = 00h

Function: Select international font set.

Characters already displayed are not affected.

n	Font set
00h	America
01h	France
02h	Germany
03h	England
04h	Denmark 1
05h	Sweden
06h	Italy
07h	Spain1
08h	Japan
09h	Norway
0Ah	Denmark2
0Bh	Spain2
0Ch	Latin America
0Dh	Korea

7.1.15 ESC t n *(Character table type)*

Code: **1Bh 74h n**

Definable area: n = 00h, 01h, 02h, 03h, 04h, 05h, 10h, 11h, 12h, 13h

Default: n = 00h

Function: Select Character table type.

Characters already displayed are not affected.

n	Font code type
00h	PC437(USA – Euro std)
01h	Katakana – Japanese
02h	PC850 (Multilingual)
03h	PC860 (Portuguese)
04h	PC863 (Canadian-French)
05h	PC865 (Nordic)
10h	WPC1252
11h	PC866 (Cyrillic #2)
12h	PC852 (Latin 2)
13h	PC858

7.1.16 US MD1 *(Over-write mode)*

Code: **1Fh 01h**

Function: Display mode set to Over-write mode.

This command has effect for the currently-selected window.

7.1.17 US MD2 *(Vertical scroll mode)*

Code: 1Fh 02h

Function: Display mode set to Vertical scroll mode.

This command has effect for the currently-selected window.

7.1.18 US MD3 *(Horizontal scroll mode)*

Code: 1Fh 03h

Function: Display mode set to Horizontal scroll mode.

This command has effect for the currently-selected window.

7.1.19 US s n *(Horizontal scroll speed)*

Code: 1Fh 73h n

Definable area: 00 ≤ n ≤ 1Fh

Default: n = 00h

Function: Set speed for Horizontal scroll mode.

Scroll speed is set by 'n'.

Subsequent commands are not processed until scroll is completed.

Scroll base time period 'T' depends on screen mode and character size, etc.

n	Speed
00h	Instantaneous
01h	T ms / 2 dots
02h – 1Fh	(n−1)×T ms / dot

7.1.20 US r n *(Reverse display)*

Code: 1Fh 72h n

n: Reverse display ON/OFF

Definable area: 00h ≤ n ≤ 01h

n = 00h: Reverse OFF

n = 01h: Reverse ON

Default: n = 00h

Function: Reverse display ON/OFF for character and image display.

Changing this setting only affects subsequent data. Content already displayed is not affected.

7.1.21 US w n *(Write mixture display mode)*

Code: **1Fh 77h n**

n: Display write mode

Definable area: 00h ≤ n ≤ 03h

n = 00h: Normal display write (not mixture display)

n = 01h: OR display write

n = 02h: AND display write

n = 03h: EX-OR display write

Default: n = 00h

Function: Specifies write mixture mode.

Newly-written characters and images are combined with current display contents in Display Memory.

7.1.22 US X n *(Brightness level setting)*

Code: **1Fh 58h n**

n: Brightness level setting

Definable area: 01h ≤ n ≤ 08h

Default: n = 08h

Function: Set display brightness level.

n: Level

n	Level	*Rate
n=01H	1	20.0%
n=02H	2	26.0%
n=03H	3	40.0%
n=04H	4	53.3%
n=05H	5	66.7%
n=06H	6	73.3%
n=07H	7	86.7%
n=08H	8	100%

* The rate of brightness is reference only.

7.1.23 US (a n [parameter] *(Display action command group)*

Function: Execute processing of display action command.

n	Function No.	Function
01h	Function 01h	Wait
10h	Function 10h	Scroll display action
11h	Function 11h	Blink display action
40h	Function 40h	Screen saver

n: Function code.

Subsequent commands are not processed until display action processing is completed.

7.1.24 <Function 01h> US (a 01h t *(Wait)*

Code: 1Fh 28h 61h 01h t

t: Wait time

Definable area: 00h ≤ t ≤ FFh

Function: Waits for the specified time (command and data processing is stopped).

Wait time = t × approximately 0.5s

7.1.25 <Function 10h> US (a 10h wL wH cL cH s *(Scroll display action)*

Code: 1Fh 28h 61h 10h wL wH cL cH s

wL: Display screen shift byte count, lower byte

wH: Display screen shift byte count, upper byte

cL: Number of cycles, lower byte

cH: Number of cycles, upper byte

s: Scroll speed

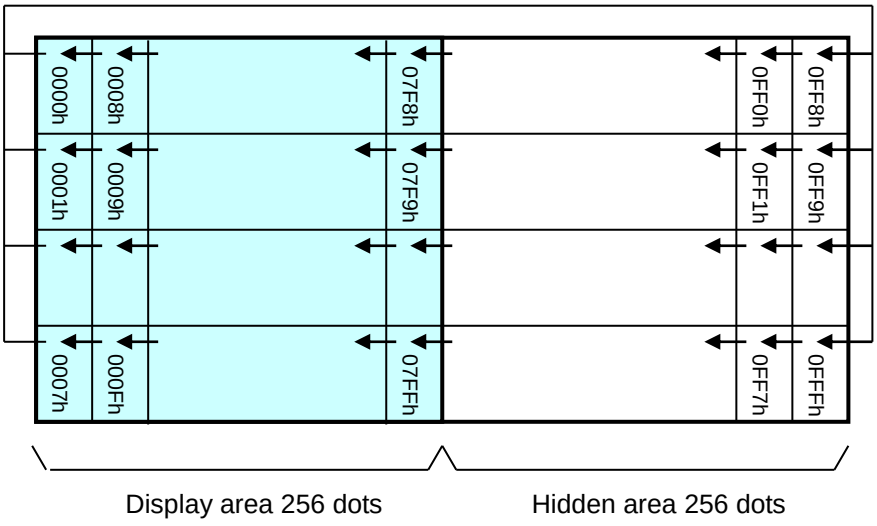
Definable area: 0000h ≤ (wL + wH×100h) ≤ 0FFFh
0001h ≤ (cL + cH×100h) ≤ FFFFh
00h ≤ s ≤ FFh

Function: Shift the display screen.

Horizontal scrolling is possible by specifying as the shift byte count a multiple of (Display screen 'y' dot /8). Display switching is possible by specifying shift byte count as (Display screen 'x' dot × Display screen 'y' dot /8). Scroll speed is specified by 's'.

Scroll speed: s × 14ms (approximately) / shift

For example: 1 dot scroll to the left: wL=08h, wH=00h



7.1.26 <Function 11h> US (a 11h p t1 t2 c *(Blink)*

Code: 1Fh 28h 61h 11h p t1 t2 c

p: Blink pattern
t1: Normal display time
t2: Blank or reverse display time
c: Number of cycles
Definable area: 00h ≤ p ≤ 02h
p = 00h: Normal display.
p = 01h: Blink display (alternately Normal and Blank display).
p = 02h: Blink display (alternately Normal and Reverse display).
01h ≤ t1 ≤ FFh
01h ≤ t2 ≤ FFh
00h ≤ c ≤ FFh
Function: Blink display action Blink pattern specified by 'p'.
Time is specified by 't1' and 't2'
A: t1 × 14ms (approximately) Normal display
B: t2 × 14ms (approximately) Blank or Reverse display
Repeated 'c' times.

This command does not affect Display Memory.
c=00h: Blink continues during subsequent command and data processing, until c=01h–FFh is set, or Initialize command.
c=01h – FFh: Blink display is repeated 1–255 times while command and data processing is stopped. After display blinking is completed, Normal display returns and command and data processing resumes. Command / data processing does not resume until operation is completed.

7.1.27 <Function 40h> US (a 40h p *(Screen saver)*

Code: 1Fh 28h 61h 40h p

p: Screen saver mode
Definable area: 00h ≤ p ≤ 04h
p = 00h: Display power OFF (Power save mode)
p = 01h: Display power ON
p = 02h: All dot OFF
p = 03h: All dot ON
p = 04h: Repeat blink display with normal and Reverse display
(Normal: 2s, Reverse: 2s)

Function: Control Power ON or OFF, and Start Screen saver mode.
p = 00h – 01h: Control Power ON or OFF. This setting is applied until this command is re-specified.
p = 02h – 04h: Start Screen saver mode. This setting is cancelled when next data is input.

7.1.28 US (f n [parameter] *(Bit image display group)*

Function: Display bit image data.

n	Function No.	Function
11h	Function 11h	Real-time bit image display

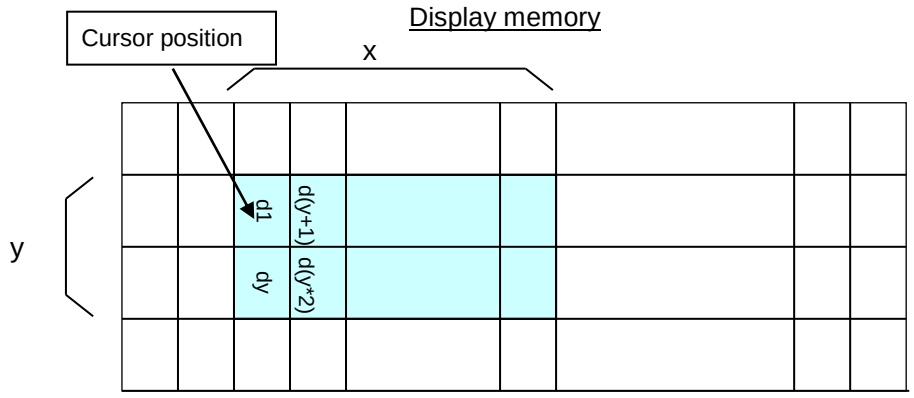
n: Function code.

7.1.29 <Function 11h> US (f 11n xL xH yL yH g d(1)...d(k) *(Real-time bit image display)*

Code: 1Fh 28h 66h 11h xL xH yL yH g d(1)...d(k)

xL: Bit image X size, lower byte (by 1 dot)
xH: Bit image X size, upper byte (by 1 dot)
yL: Bit image Y size, lower byte (by 8 dots)
yH: Bit image Y size, upper byte (by 8 dots)
g: Image information = 1 (fixed)
d(1)–d(k): Bit Image data (see below)
Definable area: 0001h ≤ (xL + xH×100h) ≤ 0200h
0001h ≤ (yL + yH×100h) ≤ 0008h
g = 01h
k = x × y × g
00h ≤ d ≤ FFh

Function: Display the bit image data at the cursor position in real-time.
Cursor position does not change.
If bit image exceeds the bounds of the current window, only the portion within the currently-selected window is displayed.
If Display position or display size etc, are outside the definable area, the command is cancelled at the point where the error is detected, and the remaining data is treated as standard data.



7.1.30 US (d n [parameter] *(Dot unit command group)*

Function: Dot unit display bit image data or character.

n	Function No.	Function
20h	Function 20h	Dot unit downloaded bit image display
21h	Function 21h	Dot unit real-time bit image display
30h	Function 30h	Dot unit character display

n: Function code.

7.1.31 <Function 20h> US (d 20h xPL xPH yPL yPH m aL aH aE ySL ySH xOL xOH yOL yOH xL xH yL yH g *(Dot unit downloaded bit image display)*

Code: 1Fh 28h 64h 20h xPL xPH yPL yPH m aL aH aE ySL ySH xOL xOH yOL yOH xL xH yL yH g

xPL: Display position x, lower byte (by 1 dot)
xPH: Display position x, upper byte (by 1 dot)
yPL: Display position y, lower byte (by 1 dot)
yPH: Display position y, upper byte (by 1 dot)
m: Image data display memory select
aL: Bit image data definition address, lower byte
aH: Bit image data definition address, upper byte
aE: Bit image data definition address, extension byte
ySL: Bit image defined, Y size, lower byte (by 8 dots)
ySH: Bit image defined, Y size, upper byte (by 8 dots)
xOL: Image data offset x, lower byte (by 1 dot)
xOH: Image data offset x, upper byte (by 1 dot)
yOL: Image data offset y, lower byte (by 1 dot)
yOH: Image data offset y, upper byte (by 1 dot)
xL: Bit image display X size, lower byte (by 1 dot)
xH: Bit image display X size, upper byte (by 1 dot)
yL: Bit image display Y size, lower byte (by 1 dot)
yH: Bit image display Y size, upper byte (by 1 dot)
g: Image information = 1 (fixed)

Definable area: 0000h ≤ (xPL + xPH×100h) ≤ 01FFh
0000h ≤ (yPL + yPH×100h) ≤ 003Fh
m = 02h: Display Memory bit image
Display Memory bit image:
(aL + aH×100h + aE×10000 h) = 000000h
(ySL + ySH×100h) = 0000h
0000h ≤ (xOL + xOH×100h) ≤ 01FFh
0000h ≤ (yOL + yOH×100h) ≤ 003Fh
0001h ≤ (xL + xH×100h) ≤ 0200h
0001h ≤ (yL + yH×100h) ≤ 0040h
g = 01h

Function: Display the bit image defined in Display Memory at the specified (x,y) position.
Display position, display size, and image data offset are specified in unit of 1 dot.
If bit image exceeds the bounds of the current window, only the portion within the curre ntly-selected window is displayed.
If Display position or image size, etc are outside the definable area, the command is cancelled at the point where the error is detected, and the remaining data is teated as standard data.

7.1.32 <Function 21h> US (d 21h xPL xPH yPL yPH xL xH yL yH g d(1)...d(k) *(Dot unit real-time bit image display)*

Code: 1Fh 28h 64h 21h xPL xPH yPL yPH xL xH yL yH g d(1)...d(k)

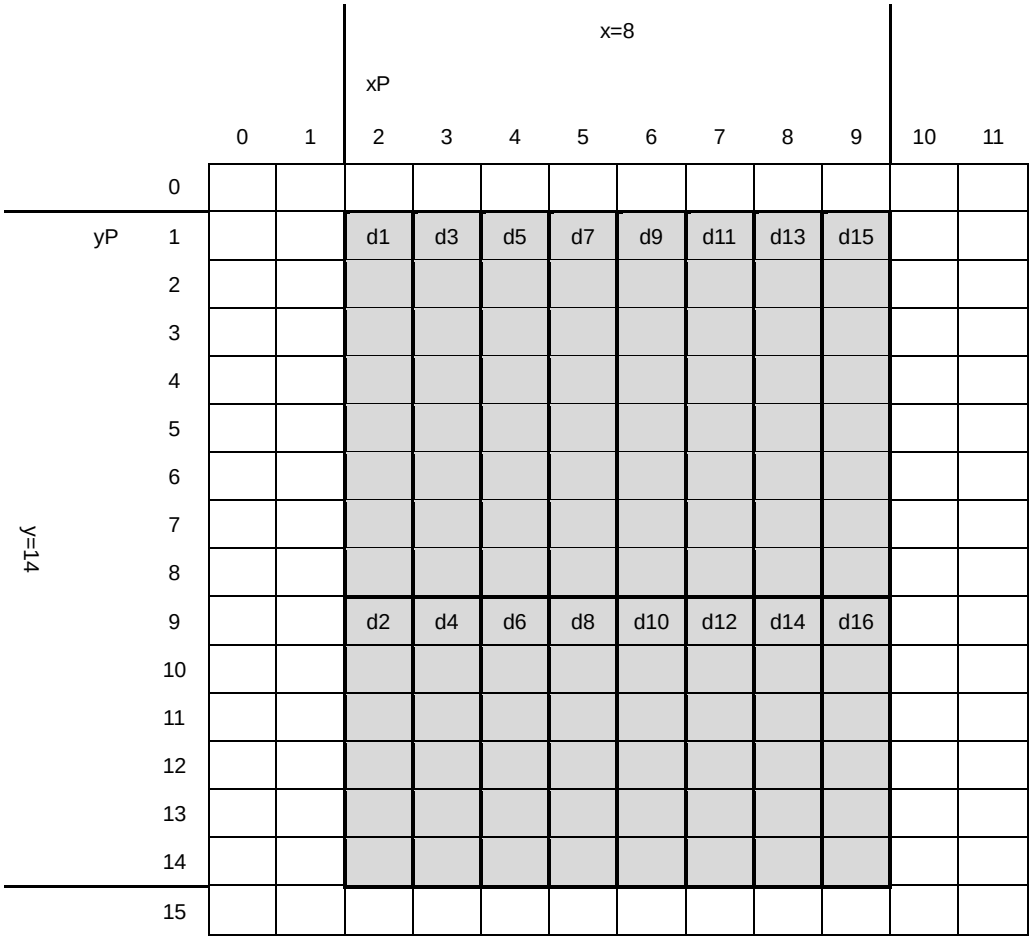
xPL: Display position x, lower byte (by 1 dot)
xPH: Display position x, upper byte (by 1 dot)
yPL: Display position y, lower byte (by 1 dot)
yPH: Display position y, upper byte (by 1 dot)
xL: Bit image display X size, lower byte (by 1 dot)
xH: Bit image display X size, upper byte (by 1 dot)
yL: Bit image display Y size, lower byte (by 1 dot)
yH: Bit image display Y size, upper byte (by 1 dot)
g: Display information = 1 (fixed)
d(1)–d(k): Bit image data (see below)
Definable area: 0000h ≤ (xPL + xPH×100h) ≤ 01FFh
0000h ≤ (yPL + yPH×100h) ≤ 003Fh
0001h ≤ (xL + xH×100h) ≤ 0200h
0001h ≤ (yL + yH×100h) ≤ 0040h
g = 01h
00h ≤ d ≤ FFh
Function: Display the bit image data at the specified (x,y) position in real-time.
Display position and display size are specified in units of 1 dot.
If bit image exceeds the bounds of the current window, only the portion within the currently-selected window is displayed.
If Display position or display size are outside the definable area, the command is cancelled at the point where the error is detected, and the remaining data is treated as standard data.

Example: xP=2, yP=1, Display size x=8, y=14

Image data

b7	d1	d3	d5	d7	d9	d11	d13	d15
b6								
b5								
b4								
b3								
b2								
b1								
b0								
b7	d2	d4	d6	d8	d10	d12	d14	d16
b6								
b5								
b4								
b3								
b2								
b1								
b0								

Display Memory



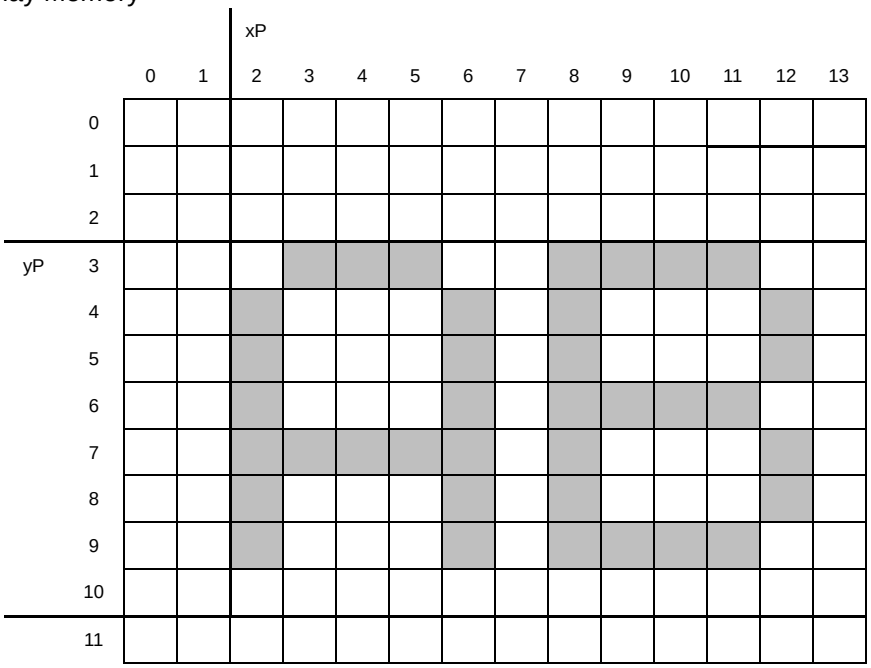
7.1.33 <Function 30h> US (d 30h xPL xPH yPL yPH m bLen d(1)...d(bLen) *(Dot unit character display)*

Code: 1Fh 28h 64h 30h xPL xPH yPL yPH m bLen d(1)...d(bLen)

xPL: Display position x, lower byte (by 1 dot)
xPH: Display position x, upper byte (by 1 dot)
yPL: Display position y, lower byte (by 1 dot)
yPH: Display position y, upper byte (by 1 dot)
m: -
bLen: Character data length
d(1)–d(bLen): Character data / reverse select
Definable area: 0000h ≤ (xPL + xPH×100h) ≤ 01FFh, FFFFh
0000h ≤ (yPL + yPH×100h) ≤ 003Fh
m = 00h
00h ≤ bLen ≤ FFh
00h ≤ d ≤ FFh
d=10h: Reverse OFF
d=11h: Reverse ON

Function: Display the specified text characters at the specified (x,y) position.
Display position is specified in units of 1 dot.
For display position xP=FFFFh, write position continues from previous writes done using this command.
The current settings for character size and table type, etc are used.
Character magnification and bold settings are not used.
If character display exceeds the bounds of the current window, only the portion within the currently-selected window is displayed.
If Display position is outside the definable area, the command is cancelled at the point where the error is detected, and the remaining data is treated as standard data.
Example: Display position xP=2, yP=3, 6×8 dot character “AB”

Display Memory



7.1.34 US (g n [parameter] *(Font command group)*

Function: Font Width and Font Magnification settings.

n	Function No.	Function
03h	Function 03h	Font Width
40h	Function 40h	Font Magnification

n: Function code.

7.1.35 <Function 03h> US (g 03h w *(Font Width)*

Code: 1Fh 28h 67h 03h w

w: Font width setting

Definable area: 00h ≤ w ≤ 03h
w = 00h: Fixed character width 1 (1 dot space on right side)
w = 01h: Fixed character width 2 (1 dot space on right side and left side)
w = 02h: Proportional character width 1 (1 dot space on right side)
w = 03h: Proportional character width 2 (1 dot space on right side and left side)

Default: w = 01h

Function: Sets the character width.

Fixed character width 1 & 2: Character is written with fixed character width (6 or 7 dot).

Proportional character width: Character is written with proportioned character width.

7.1.36 <Function 40h> US (g 40h x y *(Font Magnification)*

Code: 1Fh 28h 67h 40h x y

x: X magnification factor

y: Y magnification factor

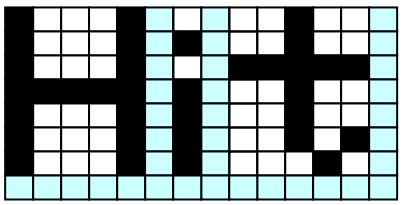
Definable area: 01h ≤ x ≤ 04h
01h ≤ y ≤ 02h

Default: x = 01h
y = 01h

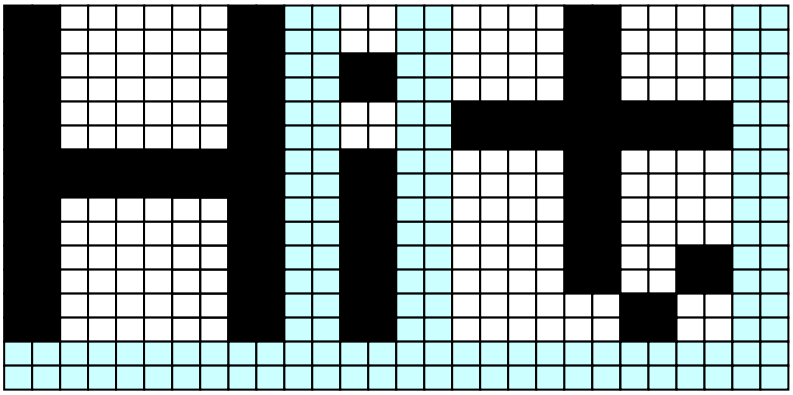
Function: Set character magnification ‘x’ times to the right and ‘y’ times downward.

Character magnification includes the space specified by Font Width command.

(x=1, y=1)



(x=2, y=2)



7.1.37 US (w n [parameter] *(Window command group)*

Function: Window / screen commands

n	Function No.	Function
01h	Function 01h	Current window select
02h	Function 02h	User-Window definition and cancel
10h	Function 10h	Write screen mode select

n: Function code.

7.1.38 <Function 01h> US (w 01h a *(Window select)*

Code: 1Fh 28h 77h 01h a

a: Window number
a = 00h: Base-Window
a = 01h – 04h: User-Window

Definable area: 00h ≤ a ≤ 04h

Function: Select current window.

Command is ignored if Window number is for a User-Window that is not defined.

7.1.39 <Function 02h> US (w 02h a b[xPL xPH yPL yPH xSL xSH ySL ySH]

(User Window define / cancel)

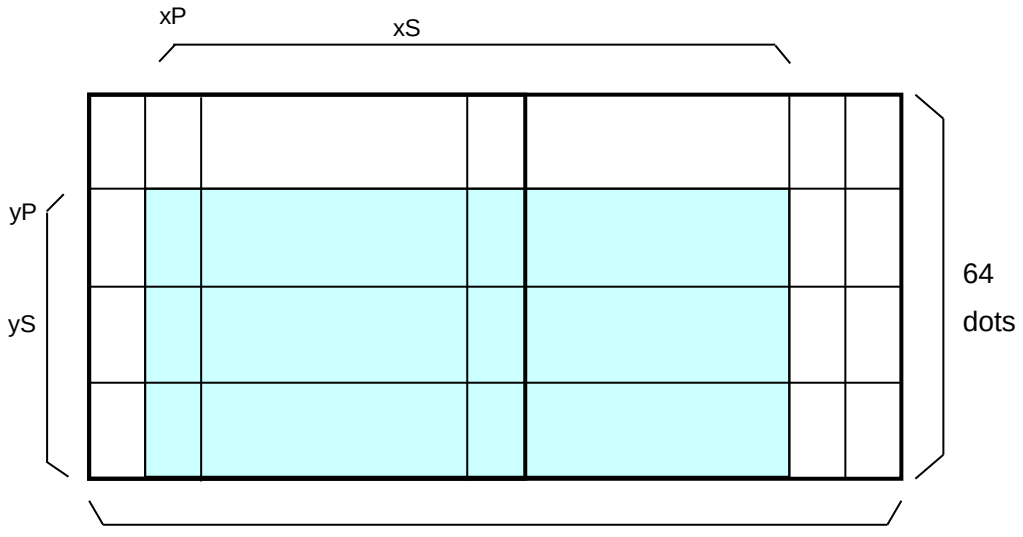
Code: 1Fh 28h 77h 02h a b [xPL xPH yPL yPH xSL xSH ySL ySH]

a: Definable window No. No. 1 – 4
b: Define or Cancel b = 00h: Cancel, b = 01h: Define
xPL: Left position of window x, lower byte (by 1 dot)
xPH: Left position of window x, upper byte (by 1 dot)
yPL: Top position of window y, lower byte (by 8 dot)
yPH: Top position of window y, upper byte (by 8 dot)
xSL: X size of window, lower byte (by 1 dot)
xSH: X size of window, upper byte (by 1 dot)
ySL: Y size of window, lower byte (by 8 dot)
ySH: Y size of window, upper byte (by 8 dot)
Definable area: 01h ≤ a ≤ 04h
00h ≤ b ≤ 01h
0000h ≤ (xPL + xPH×100h) ≤ 01FFh
0000h ≤ (yPL + yPH×100h) ≤ 0007h
0001h ≤ (xSL + xSH×100h) ≤ (0200h − (xPL + xPH×100h))
0001h ≤ (ySL + ySH×100h) ≤ (0008h − (yPL + yPH×100h))
Function: Define or cancel User-Window
Display contents are not changed by this command.
User-Window define (b = 01h):
Specify User-Window number, window position, and window size. Window position and Window size are specified in units of one block (1×8 dot).

Up to 4 User-Windows can be defined.
The cursor position for the window is initialized to top left (X=0, Y=0).

User-Window cancel (b = 00h):
For User-Window cancel, window range parameters [xPL – ySH] are not used.
If the currently-selected window is cancelled, the Base-Window becomes the currently-selected window.

If any of ‘a’, ‘b’, ‘xP’, ‘yP’, ‘xS’, or ‘yS’ are outside the definable area, the command is cancelled at that point and the following data is treated as standard data.



7.1.40 <Function 10h> US (w 10h a *(Write screen mode select)*

Code: 1Fh 28h 77h 10h a

a: Write screen mode
a = 00h: Display screen mode
a = 01h: All screen mode

Definable area: 00h ≤ a ≤ 01h
Default: a = 00h
Function: Select the write screen mode. **This setting is only applicable for Base-Window.**
Display screen mode: Display action is valid within area of either Display area or Hidden area, depending on cursor position.
All screen mode: Display action is valid over the entire display memory.
For details, refer to 6.4 Write screen mode.

7.1.41 WINx *(Window select shortcut)*

Function: Select current window (1-byte command).

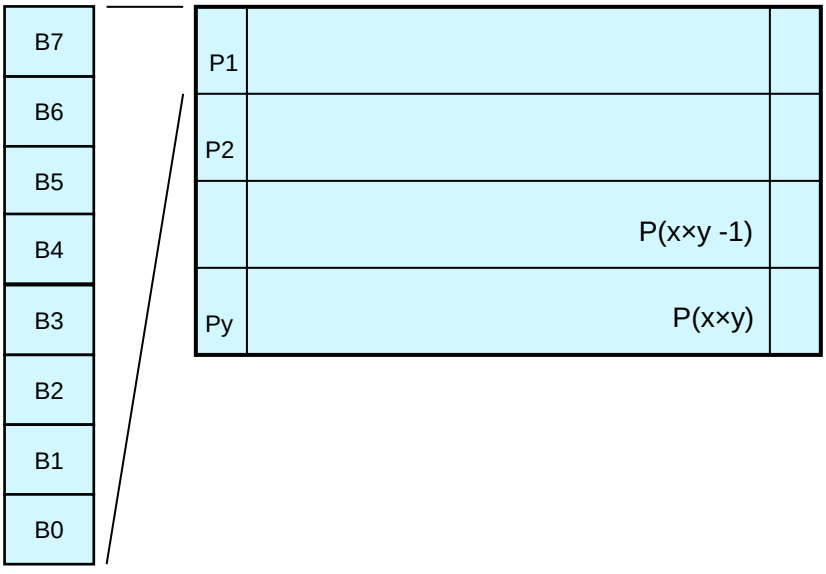
Refer to 7.1.38 for more detail.

WINx	Function
WIN0 (10h)	Select Base-Window
WIN1 (11h)	Select User-Window 1
WIN2 (12h)	Select User-Window 2
WIN3 (13h)	Select User-Window 3
WIN4 (14h)	Select User-Window 4

7.2 Bit image data format

The Bit image consists of the data for image size (x × y) as follows;

Data	Pattern position
d (1)	P1
d (2)	P2
d (x × y)	P(x × y)



8 Setup

8.1 Jumper

No.	Function	Default
J0	Baud Rate select	OPEN
J1		OPEN
J2	Select serial I/F	OPEN
J3		OPEN
JRB	Parallel interface through-holes Pin #3 signal setting	OPEN

Note: “JT” and “BT” are for factory use only.

8.1.1 Baud rate setting (for serial interface)

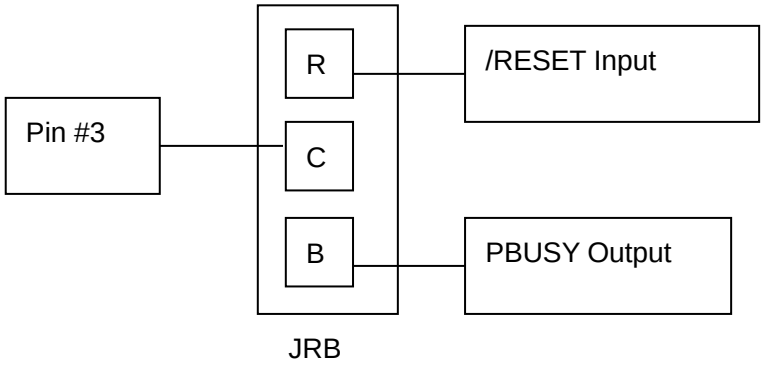
J0	J1	Baud rate
OPEN	OPEN	38,400bps
SHORT	OPEN	19,200bps
OPEN	SHORT	9,600bps
SHORT	SHORT	115,200bps

8.1.2 Serial interface select

J2	J3	Interface type
OPEN	-	Asynchronous serial I/F
SHORT	OPEN	Synchronous serial I/F
SHORT	SHORT	SPI

8.1.3 Parallel interface through-holes Pin #3 signal setting

JRB	Signal of Pin#3
OPEN	NC
C-R SHORT	/RESET (Input)
C-B SHORT	PBUSY (Output)
R-C-B SHORT	Do not use.



9 Connector

9.1 Parallel interface 14 through-holes (CN1)

Pin No.	Signal name	Function	Direction	Pin No.	Signal name	Function	Direction
1	GND	Ground	Input	8	D1	Data input	Input/output
2	V_{CC}	Power supply	Input	9	D2	Data input	Input/output
3	NC *1	No connection	-	10	D3	Data input	Input/output
4	RS *2	Switch signal	Input	11	D4	Data input	Input/output
5	/WR	Data write	Input	12	D5	Data input	Input/output
6	/RD	Data read	Input	13	D6	Data input	Input/output
7	D0	Data input	Input/output	14	D7(PBUSY)	Data input	Input/output

* 1: Pin #3 can be changed to /RESET or PBUSY terminal, selected by jumper.

* 2: Factory use only.

9.2 Serial interface 7 through-holes (CN2)

9.2.1 Case of Asynchronous serial interface is selected.

Pin No.	Signal name	Function	Direction
1	V_{CC}	Power supply	Input
2	SIN	Data receive	Input
3	GND	Ground	Input
4	SBUSY	Display busy	Output
5	NC	No connection	-
6	/RESET	Reset	Input
7	IC*	No connection	-

* leave this pin open

9.2.2 Case of Synchronous serial interface is selected.

Pin No.	Signal name	Function	Direction
1	V_{CC}	Power supply	Input
2	SIN	Data receive	Input
3	GND	Ground	Input
4	SBUSY	Display busy	Output
5	SCK	Display clock	Input
6	/RESET	Reset	Input
7	IC*	No connection	-

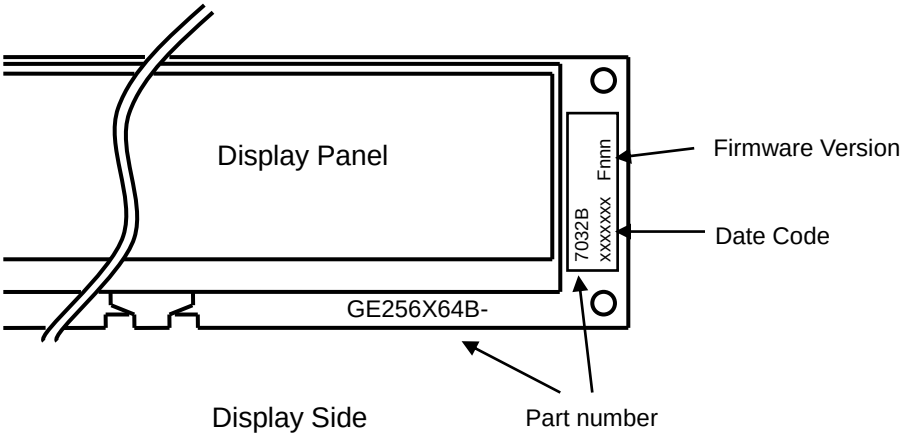
* leave this pin open

9.2.3 Case of SPI interface is selected.

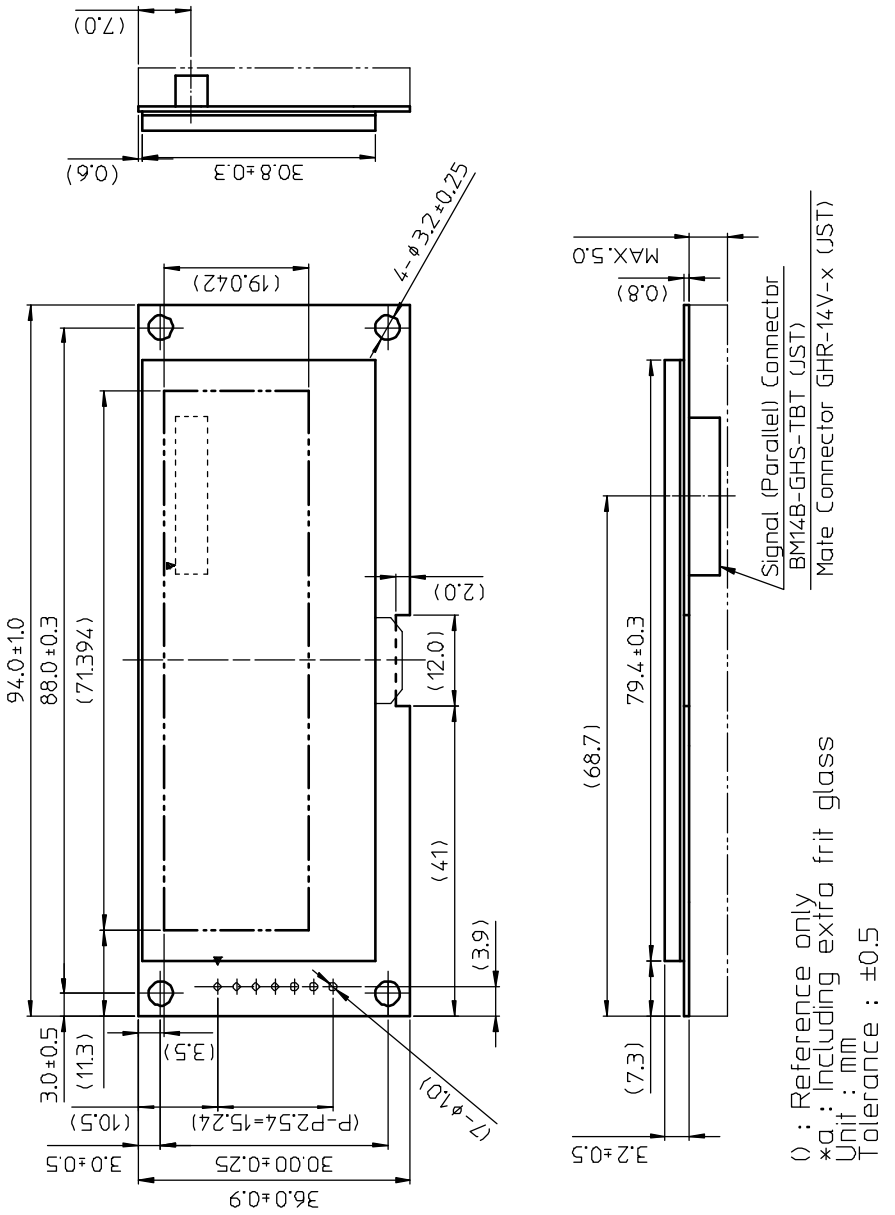
Pin No.	Signal name	Function	Direction
1	V_{CC}	Power supply	Input
2	SIN	Data receive	Input
3	GND	Ground	Input
4	SBUSY	Display busy	Output
5	SCK	Display clock	Input
6	/RESET	Reset	Input
7	/CS	Chip select	Input

10 Firmware Version Notation

The firmware version is written in the following position.



11 Outline Drawing



DS-1859-0100-01

Notice for the Cautious Handling of OLED Modules

Handling and Usage Precautions:
Please carefully follow the appropriate product application notes and operation standards for proper usage, safe handling, and maximum performance.

[OLED Panel are made of glass]

- The edges of the OLED glass envelope are not smooth, so it is necessary to handle carefully to avoid injuries to hands.
- Use caution to avoid breaking the OLED glass envelope, to prevent injury from sharp glass particles.
- Be careful of the glass chips that may cause injury to fingers or skin, when the display part is broken. Though the unit's surface has the structure which avoids dispersal of glass with plastic films (i.e. polarizer or UV protective film) attached onto the glass plate, a touch to the edges or chips may cause injury.
- Since the OLED panel contains hazardous and noxious substances, do not break the seal of the OLED panel. If the OLED panel is broken and its ingredients get out of the panel, DO NOT touch, suck or inhale them. If ingredients get in your eyes or mouth, immediately rinse them off with water and receive medical treatment. If such ingredients touch your skin, wipe them off with a disposable paper towel or a clean piece of gauze, and rinse them off with water. If necessary, receive medical treatment.

[Cable connection]

- Do not unplug the power and/or data cables of OLED modules during operation, because unrecoverable damage may result.
- Sending input signals to the OLED module when not powered can cause I/O port damage.
- It is recommended to use a 30cm or shorter signal and power cable to prevent functional failures.

[Electrostatic charge]

- OLED modules need electrostatic-free packaging and protection from electrostatic charges during handling and usage.

[Structure]

- Preferably, use UL-grade materials or components in conjunction with OLED modules.
- Warp and twist movement causes stress and may break OLED s and OLED modules. Please adhere to allowances within 0.3mm at the point of attachment.

[Power]

- Apply regulated power to the OLED module within specified voltages to protect from failures.
- OLED modules may draw in-rush current exceeding twice the Maximum current at power-on, so a power supply with sufficient capacity and quick starting of the power regulator is recommended.
- OLED module needs a specified voltage at the point of connection. Please use an adequate power cable to avoid a decrease in voltage. As a safety measure, a fuse or other over-current protection is recommended.
- Adhere to the absolute maximum rating values which are defined in this specification, otherwise burnout of or damage to the unit may be caused or performance of the OLED unit may not be recovered. Use the OLED unit not exceeding the absolute maximum rating values with due consideration to ambient temperature, input signal variations and variation in electrical parts constants.

[Operating consideration]

- If the OLED unit is operated with the same display pattern, the difference between the operation durations of adjacent dots may be perceived as the difference between the luminances of such dots. In order to minimize such difference, operate the OLED unit so that each dot can be turned on at a frequency as equal as possible.
- A signal cable 30cm or less is recommended to avoid possible disturbances to the signal.

[Storage and operating environment]

- Please use OLED modules under the recommended specified environmental conditions. Salty, sulfuric and dusty environments may damage the OLED module even during storage.
- Do not leave the OLED unit in high temperature environments not less than 30°C or high humidity environments not less than 70% RH) for a long time (approx. one month or more). Do not store the OLED unit in acid or alkaline atmosphere, or where organic solvent may be evaporated since storage conditions may deteriorate the picture quality of the OLED unit. If long-term storage is necessitated, the unit shall be stored at temperatures between 0°C and 30°C.
- Do not store the OLED unit under conditions where condensation is easily caused. Do not operate the OLED unit while the condensation is caused on such unit. Condensation may cause malfunction or failure of the OLED unit.
- In the case of severe environmental condition such as outdoor usage, it is recommended that the display part be covered with a proper transparent protective covering to prevent scratches or invasion of dust and/or water. It is also recommended that the ultraviolet ray cutoff filter (which cuts off ultravioletray below 410nm) be applied on the OLED unit in case the unit is exposed to direct sunlight for a long time.

[Disposal]

- OLED uses lead-containing materials (RoHS directive exempts these lead compounds in the glass for electronic devices). When discarding OLEDs or OLED modules, please adhere to applicable laws and regulations.
- Law on Waste Disposal and Cleaning is applicable to organic compounds contained in the OLED unit. Accordingly, the OLED unit (including its panel) shall be disposed of by industrial wastes disposal facilities.

[Other cautions]

- Although the OLED module is designed to be protected from electrical noise, please plan your circuitry to exclude as much noise as possible.
- Do not reconstruct or repair the OLED module without our authorization. We cannot assure the quality or reliability of unauthorized reconstructed OLED modules.
- It is recommended that the OLED unit be handled in the environment with as little dust as possible. Do not handle the OLED unit in acidic or alkaline atmosphere, or where organic solvent may be evaporated or other abnormal atmosphere. Handling in such environment may cause deterioration of the display surface or failure of the OLED unit.
- Disassembly or modification may cause electric shock, damages to sensitive parts inside of the OLED unit, dust invasion, or scratches on the display part. Dust invasion or damages to certain circuit parts may cause burnout or fatal damage to

circuit(s) or other circuit parts. Noritake Itron Corporation does not extend its product warranty program to any OLED unit disassembled or modified by a customer.

Notice:

- We do not authorize the use of any patents that may be inherent in these specifications.
- Neither whole nor partial copying of these specifications is permitted without our approval. If necessary, please ask for assistance from our sales consultant.
- This product is not designed for military, aerospace, medical or other life-critical applications. If you choose to use this product for these applications, please ask us for prior consultation or we cannot accept responsibility for problems that may occur.
- The OLED modules described in this specification is not intended or designed for the use in applications where performance failures could be life threatening or result in personal injury. These applications include, but not limited to, nuclear energy control devices, aerospace equipments, combustion control systems, or any applications for safety. If the customer intends to use the OLED modules for such unintended or unauthorized applications, the customer must obtain Notitake Itron Corporation prior written consent to such use. Noritake Itron Corporation is not liable to customers for any claims, costs, damages or expenses arising out of such unintended or unauthorized use without Noritake itron corporation prior consent.

MBBZ-009-S20A

Revision Note

Specification No.	Date	Revision
DS-****-0000-00R	June. 18, 2013	Initial issue
DS-****-0000-01R (S-27571)	July. 23, 2013	OUTLINE Drawing has been revised. (Added the Parallel Connector.) The I/F has been revised. (RS232 to Parallel and CMOS Serial) The Electrical specifications has been revised.
DS-1859-0000-00R	Aug. 22, 2013	Tentative Initial issue as production model
DS-1859-0000-01R	Dec. 17, 2013	The unit has been changed the Power Supply Current 1 and 2. mA_{DC} → mA Added the current value. Added the explanation of peak current values.
DS-1859-0000-02R	Jan. 06, 2014	2.3 Electrical Characteristics (Page. 4) Power Supply Current 2 The explanation of condition has been changed. Lighting Ratio 50% → 50% Display Area Turn on 6.2 Display memory (Page. 10) The error has been corrected. B → B 0～7 (Bit # added.)
DS-1859-0000-00	Feb. 07, 2014	Initial Issue 2.3 Electrical Characteristics Added the current value of power save mode. 7.1.22 US X n (Brightness level setting) Added the value of brightness level. And added the reference brightness rate. 11. Outline Drawing The error of display area position has been corrected. Firmware Revision No. F093