Noritake itron

RoHS 2002/95/EC

Vacuum Fluorescent Display Module
Hardware Specification

Model: GU256X64C-3900B

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This product complies with RoHS Directive 2002/95/EC

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1 General Description

1.1 Scope

This specification covers the hardware aspects of the GU256X64C-3900B vacuum fluorescent graphic display module.

1.2 Construction

The module consists of a 256 × 64 dot graphic BD-VFD, 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

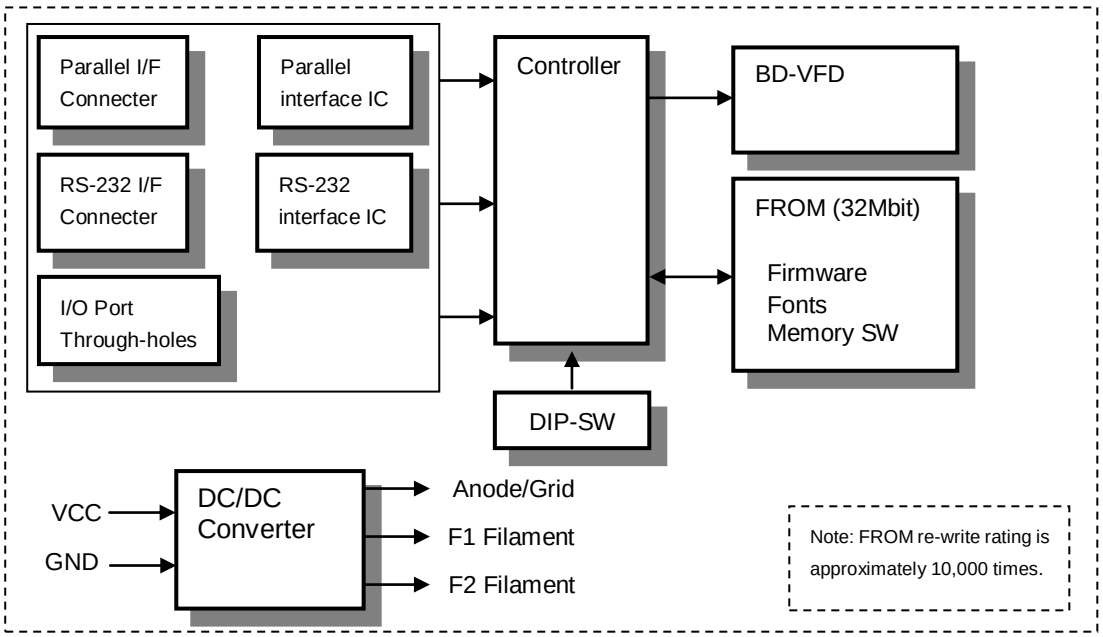
Power supply:	+ 5 V_{DC} only
Interface:	Parallel interface (CMOS)
	Serial interface (Asynchronous, RS-232 -level)
I/O port:	12 bits General-purpose I/O port
Protocol:	Direct mode
	Packet mode
Function:	Character display
	Graphic display
	Control command
	Display action command
	Draw command
	Window function
	General-purpose I/O port control
	Macro, Program Macro function
	Character and Bit Image download function
	Memory SW
	Display power auto-OFF function
	General-purpose data storage

For full details, refer to:

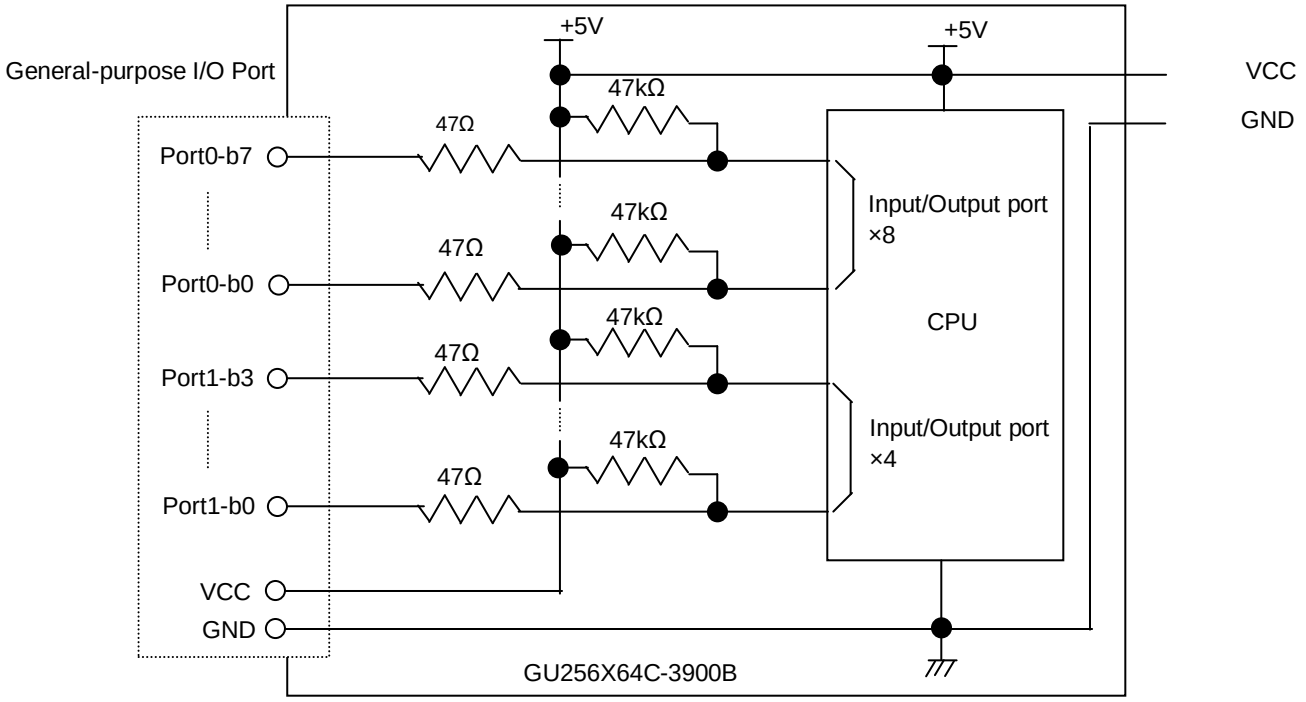
DS-1600-0008-XX: GU-3900B series “General Function” Software Specification.

DS-1600-0006-XX: “Program Macro” software specification.

1.4 Block Diagram



2 General-purpose I/O port



Refer to 3.3 Electrical Characteristics, “General-purpose I/O port supply Voltage”.
For controlling, refer to “General Function” Software Specification, “I/O Port Input / Output setting”, “I/O Port Output”, and “I/O Port Input”.

3 Electrical Specifications

3.1 Absolute Maximum Ratings

Power Supply Voltage

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	VCC	−0.3	-	+6.0	VDC	

Logic Supply Voltage

Parameter		Symbol	Min.	Typ.	Max.	Unit	Note
Parallel I/F	D0 – D7, /WR	VpIN	−0.3	-	Vcc+0.3	VDC	
RS-232 I/F	RXD, DSR	VsIN	−25	-	+25	VDC	

I/O port supply Voltage

Parameter		Symbol	Min.	Typ.	Max.	Unit	Note
I/O port	Port 0, Port 1	ViIN	−0.3	-	Vcc+0.3	VDC	

3.2 Electrical Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	VCC	4.75	5.0	5.25	VDC	

All driving voltage for the VFD is converted from the on-board DC/DC converter.

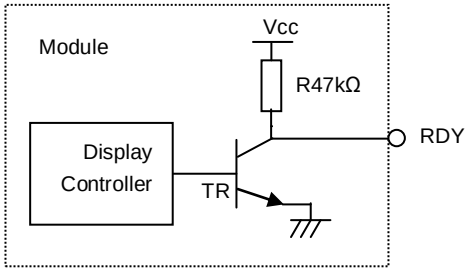
3.3 Electrical Characteristics

Logic input/output condition

Measuring Conditions: Ambient temperature = 25 ºC, VCC=5.0VDC

Parameter		Symbol	Min.	Typ.	Max.	Unit	Condition	Note
Parallel I/F	Logic input current D0 – D7, /WR	IpIH	-	-	1.0	uADC	-	-
		IpIL	-	-	−200	uADC	-	-
	Logic input voltage D0 – D7, /WR	VpIH	0.8VCC		VCC	VDC	-	-
		VpIL	0		0.2VCC	VDC	-	-
	Logic output voltage RDY	VpOH	3.5		VCC	VDC	IOH=−10μA	(1)
		VpOL	0		0.6	VDC	IOL=4mA	
RS-232 I/F	Logic input voltage RXD, DSR	VsIH	3	-	15	VDC	-	-
		VsIL	−15	-	−3	VDC	-	-
	Logic output voltage TXD, DTR	VsOH	5	-	-	VDC	RL=3kΩ	-
		VsOL	-	-	−5	VDC		-
	Logic input Impedance RXD, DSR	RsIN	3	-	7	kΩ		-

(1) “RDY” terminal is open collector (pulled-up by 47kΩ)



General-purpose I/O port supply Voltage

Measuring Conditions: Ambient temperature = 25 ºC, VCC=5.0VDC

Parameter		Symbol	Min.	Typ.	Max.	Unit	Condition	Note
General-purpose I/O port	Logic input current Port 0, 1	IiIH	-	-	1.0	μADC	-	-
		IiIL	-	-	−200	μADC	-	-
	Logic input voltage Port 0, 1	ViIH	4.1	-	VCC	VDC	-	-
		ViIL	0	-	0.8	VDC	-	-
	Logic output voltage Port 0, 1	ViOH	VCC−0.6	-	-	VDC	IOH=−200μA	-
		ViOL	-	-	0.5	VDC	IOL=1.6mA	

General-purpose I/O port output permissible current

Measuring Conditions: Ambient temperature = 25 ºC, VCC=5.0VDC

Parameter		Symbol	Min.	Typ.	Max.	Unit	Condition	Note
General-purpose I/O port	Output permissible current Port 0, 1 (Single port)	IiOH	-	-	1.5	mADC	-	-
		IiOL	-	-	3	mADC	-	-
	Output permissible current Port 0, 1 (Sum of all ports)	IiOH	-	-	8	mADC	-	-
		IiOL	-	-	30	mADC	-	-

Output current should not exceed the values in the above table.
If driving LED or other device directly, insert appropriate current limiter into output line.

Power Supply condition

Measuring Conditions: Ambient temperature = 25 ºC, VCC=5.0VDC

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Power Supply Current 1	ICC1	-	0.43	0.56	ADC	All dots ON
Power Supply Current 2	ICC2	-	0.33	0.43	ADC	All dots OFF
Power Supply Current 3	ICC3	-	80	120	mADC	Display power OFF
Power Consumption		-	2.15	2.80	W	All dots ON

Note:
The rise time of supply voltage should not exceed 100ms.
Inrush current at power-on may exceed twice normal current.
Display power OFF: Refer to “General Function” Software Specification, “Display power ON/OFF/auto-OFF” command.

4 Environmental Specifications

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

5 Optical Specifications

Luminance:	250cd/m^2 Min. (500cd/m^2 Typ.)
Color of illumination:	Green (Blue Green)

6 Physical Specifications

Number of dots:	16,384 (256 × 64)
Display area:	83.08mm × 20.68mm (X × Y)
Dot size:	0.2mm × 0.2mm (X × Y)
Dot pitch:	0.325mm × 0.325mm (X × Y)
Weight:	Approximately 65g

7 Applicable Specifications

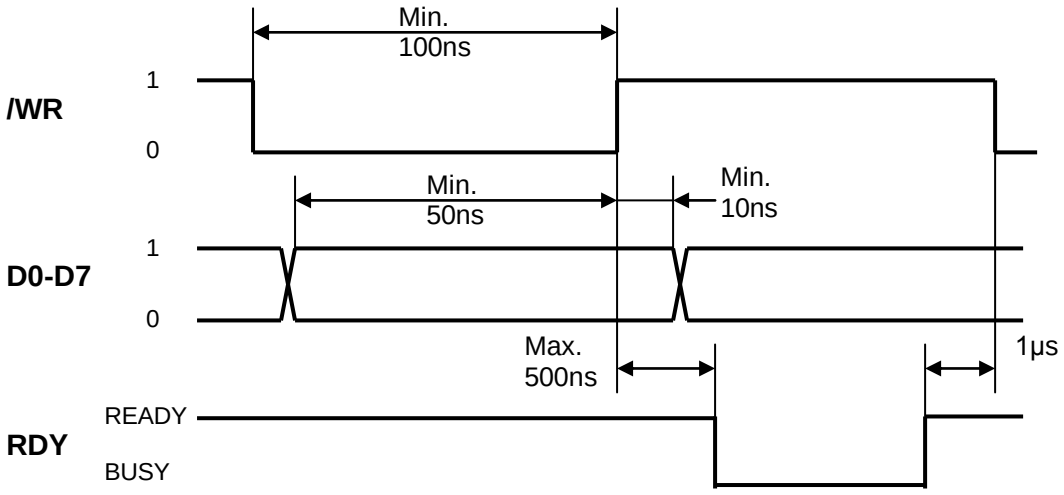
Applicable reliability specification:	TT-99-3102
Applicable production specification:	TT-98-3413

8 Interface

Parallel and RS-232 Serial interfaces are available on this module.

8.1 Interface timing

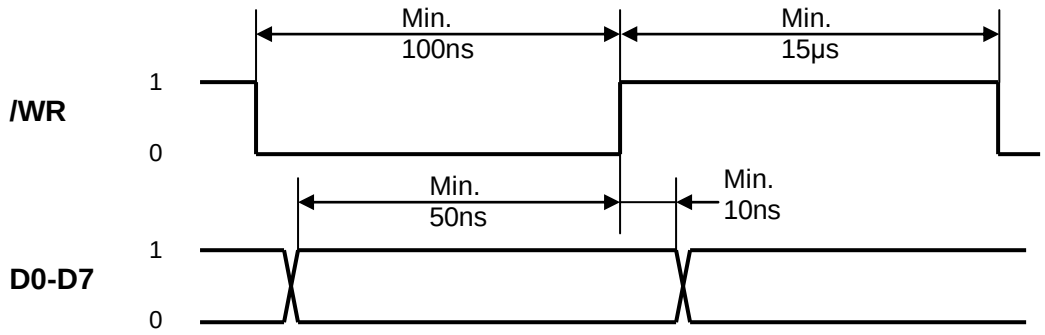
8.1.1 Parallel interface timing 1 (Not applicable for bit image data transfer in DMA mode)



Note: RDY=0 (BUSY) is output after every byte.

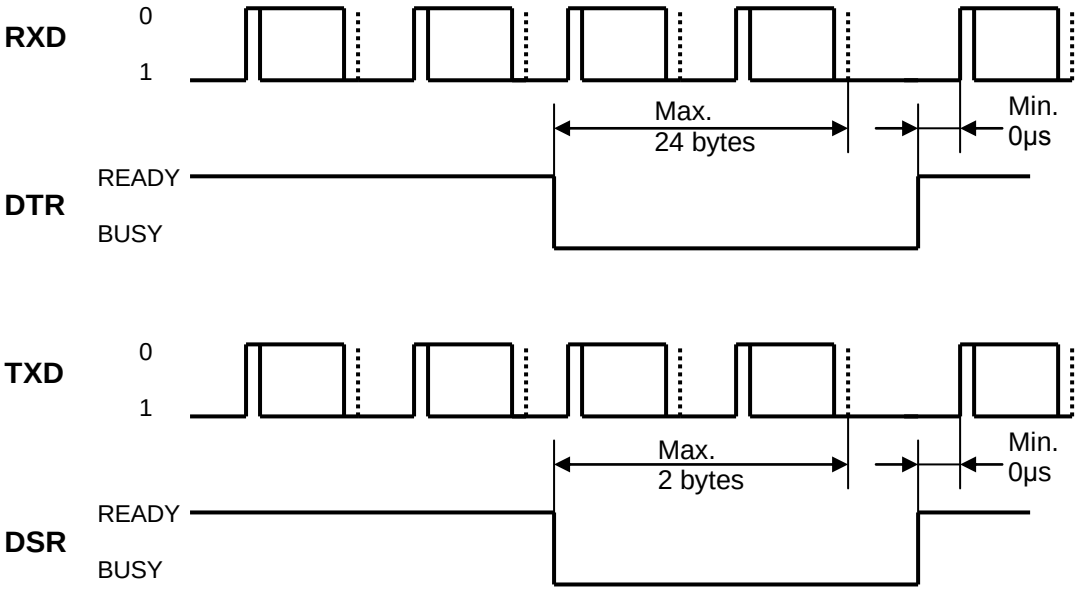
Internal receive buffer capacity is 256 bytes. After data is input, RDY signal is immediately set to RDY=0 (BUSY) until the received byte is stored to the receive buffer. If the internal receive buffer is full, RDY signal will remain BUSY until space for 1 byte becomes available. The required time for this varies, depending on the type of commands and rate at which data is input. The RDY signal should always be checked before writing data.

8.1.2 Parallel interface timing 2 (Applicable for bit image data transfer in DMA mode)



Note: Monitoring RDY signal is not necessary for bit image data transfer in DMA mode.

8.1.3 RS-232 Asynchronous serial interface timing



The above timing is RS-232 level. Logical value is the inverse of the above. (VsIH: 0, VsIL: 1)

Interface:

Baud rate	4800, 9600, 19200, **38400 (default)**, 57600, 115200bps (Selected by DIP SW and Memory-SW)
Parity	**None (default)**, Even, Odd
Format	Start (1 bit) + Data (8 bits) [+ Parity (1 bit)] + Stop (1 bit)
Handshake	DTR, DSR

Buffer Capacity

Receive buffer	256 bytes
Transmit buffer	128 bytes

DTR signal change timing

DTR change	1 (READY) → 0 (BUSY)	0 (BUSY) → 1 (READY)
Receive buffer space	32 bytes or less	64 bytes or more

9 Setup

9.1 DIP-Switch (SW1)

SW No.	Function	Default
1	Display address select (For multi-connection)	Off
2		Off
3		Off
4		Off
5	RS-232 interface setting	Off
6	Command mode select	Off
7	Operating Mode select	Off
8	Protocol select	Off

For DIP-SW setup details, refer to “General Function” Software Specification, “Setup”.

10 Connectors

10.1 Parallel interface & Power connector (CN2)

Pin No.	Signal name	Function	Direction	Pin No.	Signal name	Function	Direction
1	D7	Data input	Input	2	D6	Data input	Input
3	D5	Data input	Input	4	D4	Data input	Input
5	D3	Data input	Input	6	D2	Data input	Input
7	D1	Data input	Input	8	D0	Data input	Input
9	GND	Ground	Input	10	/WR	Data write	Input
11	GND	Ground	Input	12	RDY	Display READY	Output
13	GND	Ground	Input	14	GND	Ground	Input
15	VCC	Power supply (5V)	Input	16	VCC	Power supply (5V)	Input

10.2 RS-232 Interface & Power connector (CN3)

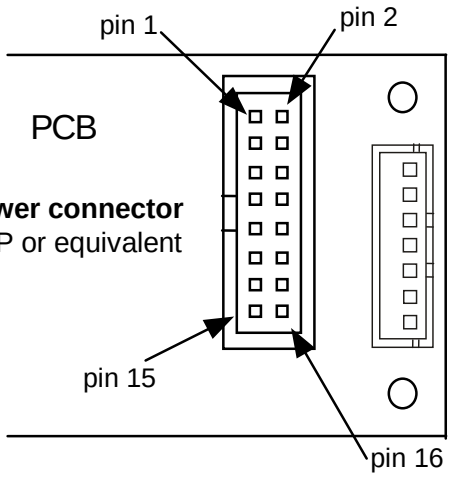
Pin No.	Signal name	Function	Direction
1	RXD	Data receive	Input
2	DTR	Display busy	Output
3	DSR	Host busy	Input
4	TXD	Data send	Output
5	TEST *	TEST (Factory use only)	Input
6	VCC	Power supply (5V)	Input
7	GND	Ground	Input

* Factory use only (leave this pin open)

10.3 General-purpose I/O Port through-holes (CN1)

Pin No.	Signal name	Function	Direction	Pin No.	Signal name	Function	Direction
1	Bit 7	Input/Output Port 0	Input/Output	8	Bit 0	Port 0	Input/Output
2	Bit 6			9	Bit 3	Input/Output Port 1	Input/Output
3	Bit 5			10	Bit 2		
4	Bit 4			11	Bit 1		
5	Bit 3			12	Bit 0		
6	Bit 2			13	VCC	Power supply (5V)	Input
7	Bit 1			14	GND	Ground	Input

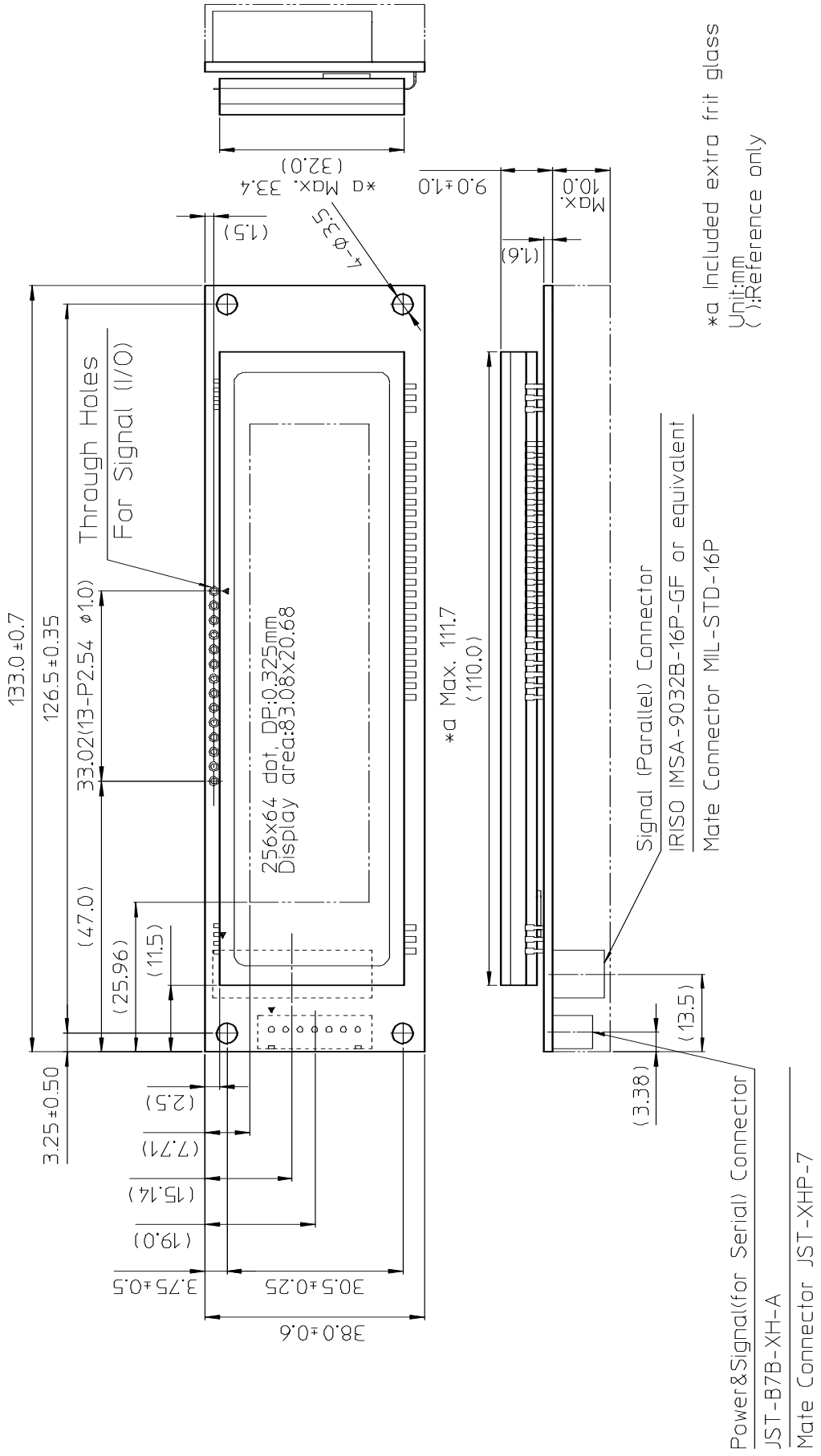
10.4 Connector position



Parallel interface & Power connector
IRISO: IMSA-9032B-16P or equivalent

RS-232 Interface & Power connector
JST: B7B-XH-A or equivalent

11 Physical Dimensions



Notice for the Cautious Handling of VFD Modules

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

[VFD tubes are made of glass]
- The edges of the VFD glass envelope are not smooth, so it is necessary to handle carefully to avoid injuries to hands.
- Use caution to avoid breaking the VFD glass envelope, to prevent injury from sharp glass particles.
- The tip of the exhaust pipe is fragile so avoid shock from impact.
- It is recommended to allow sufficient open space surrounding the exhaust pipe to avoid possible damage.
- Please design the PCB for the VFD module within 0.3 mm warping tolerance to avoid any forces that may damage the display due to PCB distortion causing a breakdown of the electrical circuit leading to VFD failure.

[High voltage]
- Avoid touching conductive electrical parts, because the VFD module uses high voltage exceeding 30 – 100 volts.
- Even when electric power is turned off, it may take more than one minute for the electrical current to discharge.

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

[Electrostatic charge]
- VFD modules need electrostatic-free packaging and protection from electrostatic charges during handling and usage.

[Structure]
- During operation, VFD and VFD modules generate heat. Please consider sufficient heat radiation dissipation using heat sink solutions.
- Preferably, use UL-grade materials or components in conjunction with VFD modules.
- Warp and twist movement causes stress and may break VFDs and VFD modules. Please adhere to allowances within 0.3mm at the point of attachment.

[Power]
- Apply regulated power to the VFD module within specified voltages to protect from failures.
- VFD modules may draw in-rush current exceeding twice the typical current at power-on, so a power supply with sufficient capacity and quick starting of the power regulator is recommended.
- VFD 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.

[Operating consideration]
- Illuminating phosphor will decrease in brightness during extended operation. If a fixed pattern illuminates for an extended period (several hours), the phosphor efficiency will decrease compared to the non-operating phosphor, causing non-uniform brightness. Please consider programming the display patterns to use all phosphor segments evenly. Scrolling may be a consideration for a period of time to refresh the phosphor condition and improve even illumination of the pixels.
- A signal cable 30cm or less is recommended to avoid possible disturbances to the signal.

[Storage and operating environment]
- Please use VFD modules under the recommended specified environmental conditions. Salty, sulfuric and dusty environments may damage the VFD module even during storage.

[Disposal]
- VFD uses lead-containing materials (RoHS directive exempts these lead compounds in the glass for electronic devices). When discarding VFDs or VFD modules, please adhere to applicable laws and regulations.

[Other cautions]
- Although the VFD 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 VFD module without our authorization. We cannot assure the quality or reliability of unauthorized reconstructed VFD modules.

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.

MBBZ-009-S18A

Revision history

Specification number	Date	Revision
DS-1615-0001-00	Oct. 27, 2010	Initial Issue.
DS-1615-0001-01	Mar. 1, 2011	· The complementary information (VsIH: 0, VsIL: 1) has been added to "8.1.3 RS-232 Asynchronous serial interface timing". · “11 Physical Dimensions” has been changed. · "Notice for the Cautious Handling VFD Modules" has been revised. · ”Revision history” has been added.