BITSTRATA SYSTEMS M1000 Intelligent Bluetooth Low-Energy IoT Controller User Manual

Contents

BITSTRATA SYSTEMS M1000 Intelligent Bluetooth Low-Energy IoT Controller

Specifications

- Dimensions (LxWxH): 1.3 x 0.96 x 0.46
- Weight: 10 g
- Connectors:
  - Type: 2 mm pitch through-hole stackable headers/sockets
  - Organization: Two 1×10 connectors for basic operation, One 2×10 connector for expanded functionality (optional)
  - Supply Voltage: 3.3 V
- Digital I/O Voltage Domain: 3.3 V
- Host Microcontroller:
  - Flash: 256 kB
  - RAM: 18 kB
  - Integrated Clock: 32.768 kHz to 20 MHz (dynamically configurable)
- Non-volatile Storage: 128 Mbit
- Integrated Radio:
  - Band: 2.4 GHz ISM
  - Receiver Sensitivity (max): -97 dBm
  - Transmitter Power (max): +5 dBm
  - Protocol: Bluetooth Low-Energy version 4.2
  - Max Range (typical):
    - Connected: 30 m (line-of-sight, 2 m height)
    - Connectionless: 100 m (line-of-sight, 2 m height)
  - Radiation Pattern Gain (typ): Omni-directional 0.5 dBi peak /-0.5 dBi average
  - Electronics Protection: Conformally coated

Product Usage Instructions

Connection Setup

1. Ensure the M1000 device is powered with a stable 3.3V power supply.
2. Connect the necessary headers/sockets to the corresponding pins on your host circuit board.

3. If using the optional expanded functionality connector, securely attach it to the board.

Data Transmission

1. Utilize the GPIO, SPI, UART, or other supported functions based on your application requirements.
2. Follow the protocol guidelines for Bluetooth Low-Energy version 4.2 for efficient data transmission.

FAQ

Q: What is the max range of the M1000 device?
A: The typical max range for connected devices is 30 meters in line-of-sight conditions at a height of 2 meters.

Q: Can I use the M1000 device without connecting the optional expanded functionality connector?
A: Yes, the M1000 device can be used with just the basic operation connectors without the need for the optional expanded functionality connector.

Features

- Integrated Bluetooth Low-Energy Radio with Chip Antenna
- 16-Bit Low-power Host Microcontroller
  - 25 GPIO Shared with Special Functions
  - 20 Interruptible I/O
  - 17 Timer Capture/Compare I/O
  - Two UARTs
  - One High-Speed SPI Interface (10 MHz max)
  - One I2C
  - Five 12-Bit ADC Inputs with Integrated Reference
  - Five Comparator Inputs
  - Six Channel DMA
  - Hardware Multiplier and CRC Generator
- 128-Mbit Non-volatile Flash Storage
- Open-drain Reset Input (optional)
- Operating Voltage: 3.3V @ -40°C to +85°C
- Low Current Operation
- Status LED and Push-button Reset
- Small Stackable Form-factor

Introduction

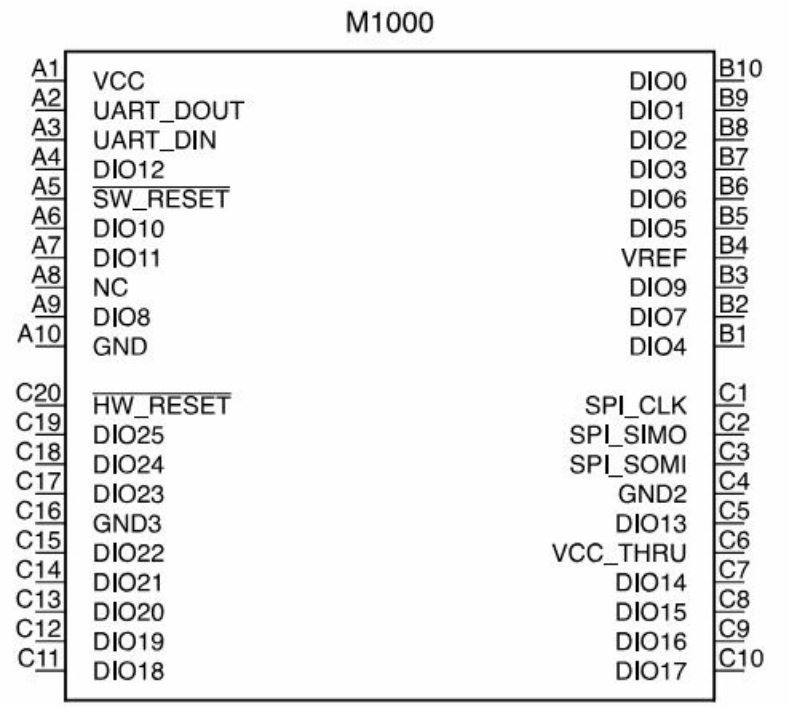
The Bitstrata Systems Inc. model M1000 Intelligent Bluetooth Low-Energy IoT Controller empowers application-specific host circuit boards to connect with Bitstrata’s mobile software and wider cloud ecosystem. It is certified to comply with regulations of various governing agencies.

Identification

- **Model No** M1000
- **FCC ID** 2BAFL-GC848354

- **ISED no** 30137-GC848354
- **PMN** M1000
- **HVIN** 830-00021A
- **FVIN** 2.2.7

Symbol



Specifications

Physical	
Dimensions (LxWxH)	1.3″ x 0.96″ x 0.46″
Weight	10 g
Connectors	
Type	2 mm pitch through-hole stackable headers/sockets
Organization	Two 1×10 connectors for basic operation
	One 2×10 connector for expanded functionality (optional)
Supply Voltage	3.3 V
Digital I/O Voltage Domain	3.3 V
Host Microcontroller	
Flash	256 kB
RAM	18 kB
Integrated Clock	32.768 kHz to 20 MHz (dynamically configurable)
Non-volatile Storage	128 Mbit
Integrated Radio	
Band	2.4 GHz ISM
Receiver Sensitivity (max)	-97 dBm
Transmitter Power (max)	+5 dBm
Protocol	Bluetooth Low-Energy version 4.2
Max Range (typical)	Connected: 30 m (line-of-sight, 2 m height)
	Connectionless: 100 m (line-of-sight, 2 m height)
Integrated Chip-antenna	
Radiation Pattern	Omni-directional
Gain (typ)	0.5 dBi peak / -0.5 dBi average
Electronics Protection	Conformally coated

Pin-out

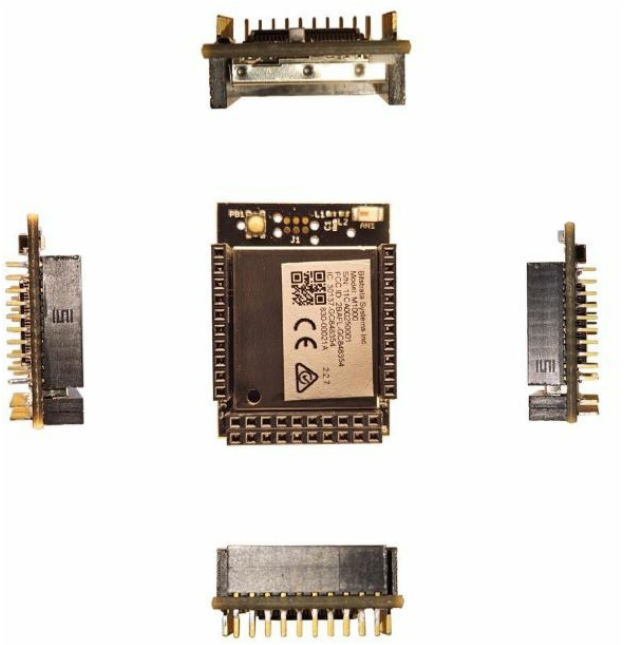
Pin	Name	Description	Available Functions	Type
A1	VCC IN	Voltage supply input	<N/A>	supply
A2	UART_DOUT	UART transmitter data output	GPIO/SPI/UART	I/O
A3	UART_DIN	UART receiver data input	GPIO/SPI/UART	I/O
A4	DIO12	Digital I/O	GPIO	I/O
A5	SW_RESET	Reset request input	GPIO/TMR	I/O

A6	DIO10	Digital I/O	GPIO/TMR	I/O
A7	DIO11	Digital I/O	GPIO/TMR	I/O
A8	<NC>	<DO NOT CONNECT>	<N/A>	N.C.
A9	DIO8	Digital I/O	GPIO/TMR	I/O
A10	GND	Ground connection	<N/A>	supply
B1	DIO4	Digital I/O	GPIO/CMP_OUT/UART/SPI/I2C/TMR	I/O
B2	DIO7	Digital I/O	GPIO/CMP_OUT/UART/SPI/I2C/TMR	I/O
B3	DIO9	Digital I/O	GPIO/CLK_OUT	I/O
B4	VREF	ADC voltage reference I/O	<N/A>	supply
B5	DIO5	Digital I/O	GPIO/CMP/ADC	I/O
B6	DIO6	Digital I/O	GPIO/CMP_OUT/UART/SPI/I2C/TMR	I/O
B7	DIO3	Digital I/O	GPIO/CMP/ADC	I/O
B8	DIO2	Digital I/O	GPIO/CMP/ADC	I/O
B9	DIO1	Digital I/O	GPIO/CMP/ADC	I/O
B10	DIO0	Digital I/O	GPIO/CMP/ADC	I/O
C1	SPI_CLK		SPI	O
C2	SPI_SIMO		SPI	O
C3	SPI_SOMI		SPI	I
C4	GND2	Ground connection	<N/A>	supply
C5	DIO13	Digital I/O	GPIO/CMP_OUT/UART/SPI/I2C/TMR	I/O
C6	VCC_THRU	Filtered supply output	<N/A>	supply
C7	DIO14	Digital I/O	GPIO/CMP_OUT/UART/SPI/I2C/TMR	I/O
C8	DIO15	Digital I/O	GPIO/TMR	I/O
C9	DIO16	Digital I/O	GPIO/TMR	I/O
C10	DIO17	Digital I/O	GPIO/TMR	I/O
C11	DIO18	Digital I/O	GPIO/TMR	I/O
C12	DIO19	Digital I/O	GPIO/TMR	I/O
C13	DIO20	Digital I/O	GPIO/CLK_OUT/CMP_OUT	I/O
C14	DIO21	Digital I/O	GPIO/TMR	I/O
C15	DIO22	Digital I/O	GPIO/TMR	I/O
C16	GND3	Ground connection	<N/A>	supply
C17	DIO23	Digital I/O	GPIO/TMR	I/O
C18	DIO24	Digital I/O	GPIO/CLK_OUT	I/O

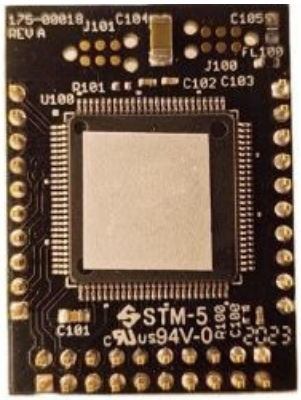
C19	DIO25	Digital I/O	GPIO/TMR	I/O
C20	HW_RESET	H/W reset (47 kOhm pull-up)	<N/A>	O.D.

Module Images

Top and Side Views



Bottom View



Mating Connectors

The M1000 provides headers located on its bottom surface for connection with sockets of a host circuit board designed with the following socket parts (recommended):

- 1×10

  SAMTEC MMS-110-01-<plating options>-SV
- 2×10

  SAMTEC MMS-110-01-<plating options>-DV

See the Footprint section for pin arrangement details. Further, the M1000’s stackable design allows purpose-built

daughter cards to be inserted into sockets located on the module's top side. Compatible header pins must comply with the following specifications:

- Cross-section (XxY)
  0.020″ x 0.020”
- Insertion Depth
  0.145″
- Plating
  gold in contact area (thickness as needed for application)

Label Requirements

Module (M1000)

Due to limited available space and to ensure visibility when attached to a host circuit board, the device's label is located on the RF shield cover. The RF shield frame is permanently affixed to the device (soldered) and the RF shield cover snaps onto the frame with its twelve integrated detents mated to holes in the frame. While this attachment is not permanent, the RF shield is attached in factory, is not intended to be removed by the integrator or end user, and further is very difficult to remove if attempted.

Final End Product
The final end product into which the M1000 device is integrated must be labeled in accordance with instructions in the section of this document named Integrator Responsibilities (OEM/Host Manufacturer). All instructions in that section must be followed to ensure regulatory authorization is considered valid and the FCC and ISED IDs can used on the final product.

Programming Header
The host microcontroller may be programmed by attaching a debugger to the module's J1 connector pads through an adapter board and cable assembly—parts listed below:

Debugger	Texas Instruments	MSP430 Flash Emulation Tool (FET)
Adapter	Tag-Connect	SPY-BI-TAG (TC2030-MCP to SPY-BI-WIRE)
Cable	Tag-Connect	TC2030-MCP-NL (6-pin No-Legs Cable with RJ12 Plug)

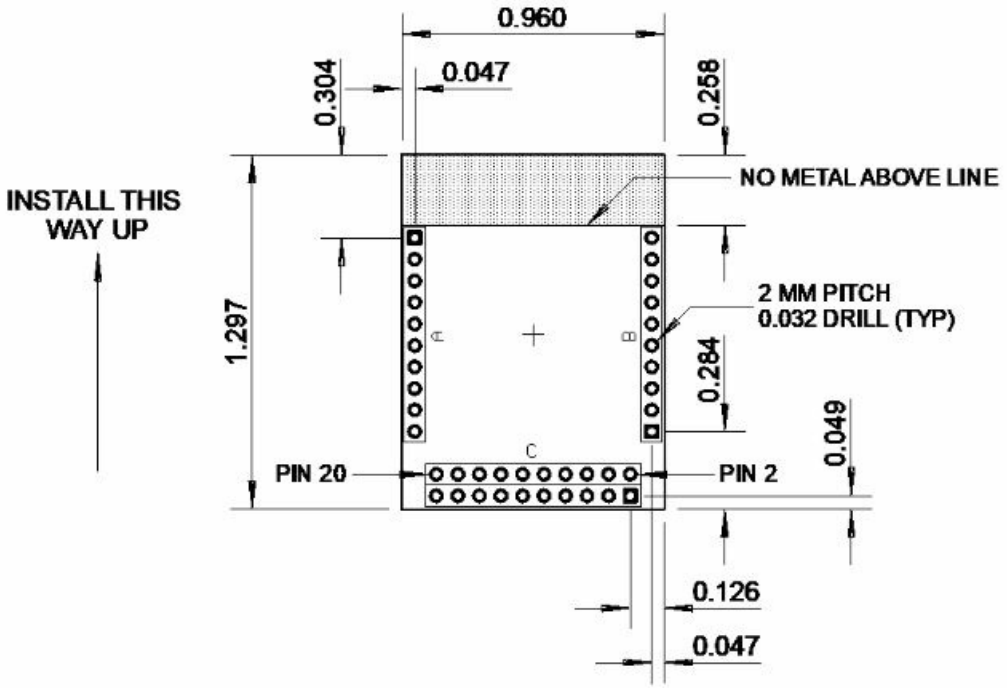
SAR and RF Exposure

The M1000 meets the exemption from the routine Specific Absorbtion Rate (SAR) and Radio Frequency (RF) exposure evaluation limits in Section 2.5 of the RSS-102 standard, and meets the SAR and/or RF field strength limits of RSS-102 so that no minimum distance limit must be set between device and user for safe operation.

Installation Orientation

The integrated chip-antenna of the M1000 radiates omni-directionally in the plane that is perpendicular to the plane of the circuit board and that aligns with the top edge of the circuit board. Best performance is achieved with the module installed in the orientation indicated in the Footprint drawing.

Footprint



Regulatory Statements

Federal Communication Commission (FCC)

Interference Statement
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. this device may not cause harmful interference; and
2. this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CAUTION: Any changes or modifications to this device not explicitly approved by the manufacturer could void your authority to operate this equipment.

Radiation Exposure Statement
The product complies with the FCC portable RF exposure limit set forth for an uncontrolled environment and is safe for intended operation as described in this manual. Further RF exposure reduction can be achieved if the product can be kept as far as possible from the user’s body or set the device to lower output power if such function is available.

Innovation, Science and Economic Development Canada

Interference Statement
This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Radiation Exposure Statement
The product complies with the Canada portable RF exposure limit set forth for an uncontrolled environment and is safe for intended operation as described in this manual. Further RF exposure reduction can be achieved if the product can be kept as far as possible from the user's body or the device's output power is lowered if such function is available.

Integrator Responsibilities (OEM/Host Manufacturer)

The final end product must be labeled in a visible area with the following:

Contains FCC ID: 2BAFL-GC848354
Contains ISED no: 30137-GC848354
Label and text information should be in a size of type large enough to be readily legible, consistent with the dimensions of the equipment and the label. However, the type size for the text is not required to be larger than eight point.

WARNING: This device is intended for integration only under the following two conditions:

1. The transmitter module may not be co-located with any other transmitter or antenna.
2. The module shall not be used with any antenna other than the certified integral on-board chip antenna.

As long as the conditions above are met, further transmitter tests will not be required.

WARNING: The integrator should have their device (final end product) which incorporates the M1000 tested by a qualified test house to verify compliance with regulatory limits for unintentional radiators as well as any additional compliance requirements.

www.bitstrata.com
Toll Free: **888-241-7216**

WARNING: The integrator must be aware not to provide to the end user, by means of the user's manual for the final end product that integrates this module, information on how to install or remove this RF module. The end user manual shall include all required regulatory information/warnings as show in this manual.

IMPORTANT NOTE: If these conditions cannot be met, then the regulatory authorization is no longer considered valid and the FCC and ISED IDs cannot be used on the final end product. In these circumstances, the integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate regulatory authorization.

Documents / Resources

	**BITSTRATA SYSTEMS M1000 Intelligent Bluetooth Low-Energy IoT Controller** [pdf] User Manual M1000 Intelligent Bluetooth Low-Energy IoT Controller, M1000, Intelligent Bluetooth Low-Energy IoT Controller, Bluetooth Low-Energy IoT Controller, Low-Energy IoT Controller, IoT Controller, Controller

References

- **User Manual**