AC02 BLE Sugar Specification

1 Description

The leaf which is equipped with the technical certification satisfied BLE module BGM11S22F256GA-V of Silicon Labs can connect with MCU leaf by UART.

2 Leaf specification

2.1 Block diagram

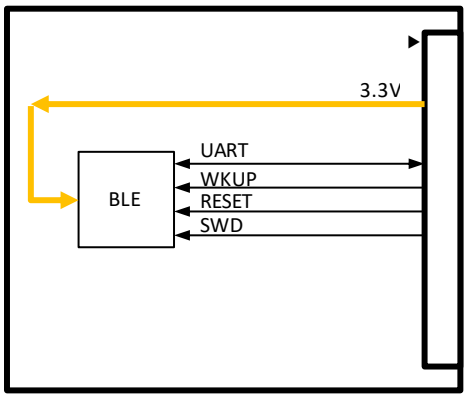


Figure 2.1 Block diagram

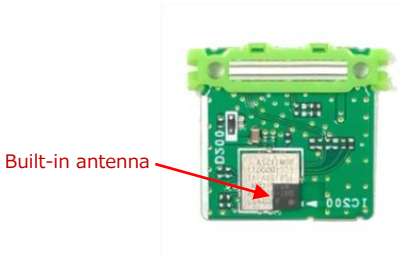
2.2 Power supply specification

Symbol	Parameter	Condition	Min.	Typ.	Max.
Vdd	Power Supply Voltage	—	2.4V	3.3V	3.8V
Idd	Operating current	Active	-	3.8mA	-
		Sleep	-	2.8uA	-

2.3 Main parts

Reference No.	Part name	Part number	Vendor name	note
IC200	BLE module	BGM11S22F256GA-V2	Silicon Labs	—

2.4 Appearance

Top Side	Back Side
	

2.5 Pin assignment

Name	Function
A2	TXD：UART send D9 can also be the alternative due to the replacement of chip's resistor
A1	RXD：UART receive D8 can also be the alternative due to the replacement of chip's resistor
D7	WAKEUP：wakeup H：wakeup

RESET	RST：reset
SWCLK	Debug I/F clock
SWDIO	Debug I/F data input/output
3V3	3.3V power input
GND	GND

3 BLEModule(BGM11S22F256GA-V2) Specifications

3.1 Description

Item	Description
SoC	EFR32BG1 (ARM Cortex-M4)
Bluetooth version	4.2
Frequency range	2400M ~ 2483.5MHz
Internet Security	• General Purpose CRC • Random Number Generator • Hardware Cryptographic Acceleration for AES 128/256,SHA-1, SHA-2 (SHA-224 and SHA-256) and ECC
RX sensitivity	-90 dBm @ 1 Mbit/s GFSK
TX power	+8dBm
RF certification	CE, full FCC, ISED Canada, Japan and South-Korea
Flash	256KB
RAM	32KB
Interfaces	UART

3.2 Electrical characteristics

3.2.1 Absolute Maximum Ratings

Parameter	Value
Operating Temperature	-40℃ to +85℃
Maximum Operation Voltage	3.8V

3.2.2 Rating

Symbol	Parameter	Condition	Min.	Typ.	Max.
Vdd	Power Supply Voltage	_	2.4V	3.3V	3.8V
Idd	EM0 Active mode	38 MHz HFRCO all peripherals disabled	-	3.8mA	3.99mA
	EM1 Sleep mode	38 MHz HFRCO all peripherals disabled	-	1.33mA	1.44mA
	EM2 Deep Sleep mode	Full RAM retention and RTCC running from LFXO	-	33uA	-
	EM3 Stop mode	Full RAM retention and CRYOTIMER running from ULFRCO	-	2.8uA	6uA
	EM4H Hibernate mode	128 byte RAM retention, RTCC running from LFXO	-	1.1uA	-
	EM4S Shutoff mode	no RAM retention, no RTCC	-	0.04uA	0.20uA
	Receive mode, active packet reception (MCU in EM1 @38.4 MHz, peripheral clocks disabled)	1 Mbit/s, 2GFSK, F = 2.4 GHz,Radio clock prescaled by 4	-	9.0mA	-
	Transmit mode (MCU in EM1@ 38.4 MHz, peripheral clocks disabled)	0 dBm output power, Radio clock prescaled by 3	-	8.2mA	-
		2 dBm output power	-	16.5mA	-
		8 dBm output power	-	24.6mA	-

3.3 Link destination of data sheet

https://jp.silabs.com/products/wireless/bluetooth/bluetooth-low-energy-modules/bgm11s-bluetooth-sip-module

3.4 Main functions and libraries

3.4.1 The control of BLE

include file：BGLib.h(Leaf Libraies)

Definition	Description
BGLib ble112(HardwareSerial *module, HardwareSerial *output, uint8_t pMode)	Creating an instance of BGLib. 【statement】 BGLib ble112(HardwareSerial *module, HardwareSerial *output, pMode) 【parameter】 ble112: the name of instance module: The instance of serial board communicating with BLE leaf output: The instance of serial board to which BLE leaf output Null fixed pMode: packet mode 0 fixed 【return value】 null
ble112.ble_cmd_le_gap_set_adv_parameters(interval_min, interval_max, channnel_map)	Set advertisement parameters. 【statement】 ble_cmd_le_gap_set_adv_parameters(uint16 interval_min, uint16 interval_max, uint8 channnel_map) 【parameter】 ble112: the name of instance interval_min: Minimum advertising interval. Value in units of 0.625 ms • Range: 0x20 to 0xFFFF • Time range: 20 ms to 40.96 s Default value: 100 ms interval_max:Maxmum advertising interval. Value in units of 0.625 ms • Range: 0x20 to 0xFFFF • Time range: 20 ms to 40.96 s Default value: 200 ms channel_map: Advertising channel map which determines which of the three channels will be used for advertising. This value is given as a bitmask. • 1: Advertise on CH37 • 2: Advertise on CH38 • 3: Advertise on CH37 and CH38 • 4: Advertise on CH39 • 5: Advertise on CH37 and CH39 • 6: Advertise on CH38 and CH39 • 7: Advertise on all channels Default value: 7 【return value】 0
ble112.ble_cmd_le_gap_discover(mode)	Bluetooth discovery mode setting. 【statement】 ble_cmd_le_gap_discover(uint8 mode) 【parameter】 ble112: the name of instance mode: discovery mode refer to ‘enum_le_gap_discover_mode’ 【return value】 0

ble112.ble_cmd_le_gap_set_adv_data (scan_rsp, adv_data_len, adv_data);	Set advertisement data. 【statement】 ble_cmd_le_gap_set_adv_data(uint8 scan_rsp, uint8 adv_data_len, const uint8 *adv_data_data) 【parameter】 ble112: the name of instance scan_rsp: This value selects if the data is intended for advertising packets,scan response packets or advertising packet in OTA. Values: • 0: Advertising packets • 1: Scan response packets • 2: OTA advertising packets • 4: OTA scan response packets adv_data_len: advertise data length, maximum: 31 byte adv_data_data: advertise data 【return value】 0
ble112.ble_cmd_le_gap_start_advertising(handle, discover, connect)	Start advertising. 【statement】 ble_cmd_le_gap_start_advertising(uint8 handle, uint8 discover, uint8 connect) 【parameter】 ble112: the name of instance handle: BLE leaf handle discover:Discoverable mode refer to 'enum_le_gap_discoverable_mode' connect: Connectable mode refer to 'enum_le_gap_connectable_mode' 【return value】 0
ble112.ble_cmd_le_gap_stop_advertising(handle)	Stop advertising. 【statement】 ble_cmd_le_gap_stop_advertising(uint8 handle) 【parameter】 ble112: the name of instance 【return value】 0
ble112.checkActivity(timeout)	Wait for response. 【statement】 checkActivity(uint16_t timeout) 【parameter】 ble112: the name of instance timeout: value of timeout (ms) 【return value】 0 :nobusy 1 :busy

ble112.ble_cmd_gatt_set_characteristic_notification(connection, characteristic, flags)	Set notification to GATT Server. 【statement】 ble_cmd_gatt_set_characteristic_notification(uint8 connection, uint16 characteristic, uint8 flags) 【parameter】 ble112: the name of instance connection: Connection handle characteristic:GATT characteristic handle flags: Characteristic client configuration flags • 0: Disable notifications and indications • 1: Notification • 2: Indication 【return value】 0
ble112.ble_cmd_gatt_server_send_characteristic_notification(connection, characteristic, value_len, (const uint8 *)value_data)	Send notification to GATT clients. 【statement】 ble_cmd_gatt_server_send_characteristic_notification(uint8 connection, uint16 characteristic, uint8 value_len, const uint8 *value_data) 【parameter】 ble112: the name of instance connection: Connection handle • 0xff: Sends notification or indication to all connected devices. • Other: Connection handle characteristic:Characteristic handle refer to 'enum_le_gap_discoverable_mode' value_len: value length value: Value to be notified or indicated 【return value】 0
ble112.ble_cmd_gatt_write_characteristic_value(connection, characteristic, value_len, *value_data);	Set notification to GATT Server. 【statement】 ble_cmd_gatt_write_characteristic_value(uint8 connection, uint16 characteristic, uint8 value_len, const uint8 *value_data) 【parameter】 ble112: the name of instance connection: Connection handle characteristic:GATT characteristic handle value_len:Characteristic value length value_data:Characteristic value 【return value】 0

ble112.ble_cmd_le_gap_set_scan_parameters(scan_interval, scan_window, active)	Set scan parameters. 【statement】 ble_cmd_le_gap_set_scan_parameters(uint16 scan_interval, uint16 scan_window, uint8 active) 【parameter】 ble112: the name of instance scan_interval: Scanner interval • Time = Value x 0.625 ms • Range: 0x0004 to 0x4000 • Time Range: 2.5 ms to 10.24 s Default value: 10 ms scan_window: Scan window. The duration of the scan. • Time = Value x 0.625 ms • Range: 0x0004 to 0x4000 • Time Range: 2.5 ms to 10.24 s Default value: 10 ms Note that packet reception is aborted if it has been started before scan window ends. active : Scan type indicated by a flag • 0: Passive scanning • 1: Active scanning Default value: 0 【return value】 0
ble112.ble_cmd_le_gap_end_procedure()	Stop using current GAP procedure. 【statement】 ble_cmd_le_gap_end_procedure(void) 【parameter】 ble112: the name of instance 【return value】 0
ble112.ble_cmd_le_gap_connect(address, address_type, initiating_phy)	Connect with devices. 【statement】 ble_cmd_le_gap_connect(bd_addr address, uint8 address_type, uint8 initiating_phy) 【parameter】 ble112: the name of instance address: Address of the device to connect to address_type: Address type of the device to connect to refer to 'enum_le_gap_address_types' initiating_phy:The initiating PHY. • 1: LE 1M PHY • 4: LE Coded PHY 【return value】 0
ble112.ble_cmd_le_connection_close(connection)	Disconnect from devices. 【statement】 ble_cmd_le_connection_close(uint8 connection) 【parameter】 ble112: the name of instance connection: Handle of the connection 【return value】 0

ble112.ble_cmd_system_reset(boot_in_dfu)	Run system reset. 【statement】 ble_cmd_system_reset(uint8 boot_in_dfu) 【parameter】 ble112: the name of instance boot_in_dfu: Boot mode • 0: Normal reset • 1: Boot to UART DFU mode • 2: Boot to OTA DFU mode 【return value】 0
ble112.ble_cmd_system_halt(halt)	Shift into SLEEP mode. 【statement】 ble_cmd_system_halt(uint8 halt) 【parameter】 ble112: the name of instance halt: halt mode • 1: halt • 0: resume 【return value】 0
ble112.getLastEvent()	Get last event. 【statement】 getLastEvent() 【parameter】 ble112: the name of instance 【return value】 lastEvent[0] : Message class: System lastEvent[1] :Message ID

enum_le_gap_connectable_mode

Value	Name	Description
0	le_gap_non_connectable	Non-connectable non-scannable.
1	le_gap_directed_connectable	Directed connectable (RESERVED, DO NOT USE)
2	le_gap_undirected_connectable	Undirected connectable scannable. Deprecated, replaced by enum le_gap_connectable_ scannable. This mode can only be used in legacy advertising PDUs.
2	le_gap_connectable_scannable	Undirected connectable scannable. This mode can only be used in legacy advertising PDUs.
3	le_gap_scannable_non_connectable	Undirected scannable (Non-connectable but responds to scan requests)
4	le_gap_connectable_non_scannable	Undirected connectable non-scannable. This mode can only be used in extended advertising PDUs.

enum_le_gap_discoverable_mode

Value	Name	Description
0	le_gap_non_discoverable	Not discoverable
1	le_gap_limited_discoverable	Discoverable using both limited and general discovery procedures
2	le_gap_general_discoverable	Discoverable using general discovery procedure

3	le_gap_broadcast	Device is not discoverable in either limited or generic discovery procedure, but may be discovered by using the Observation procedure
4	le_gap_user_data	Send advertising and/or scan response data defined by the user using le_gap_bt5_set_adv_data. The limited/general discoverable flags are defined by the user.

enum_le_gap_discover_mode

Value	Name	Description
0	le_gap_discover_limited	Discover only limited discoverable devices
1	le_gap_discover_generic	Discover limited and generic discoverable devices
2	le_gap_discover_observation	Discover all devices

enum_le_gap_address_type

Value	Name	Description
0	le_gap_address_type_public	Public address
1	le_gap_address_type_random	Random address
2	le_gap_address_type_public_identity	Public identity address resolved by stack
3	le_gap_address_type_random_identity	Random identity address resolved by stack

3.5 Event callback function

Event callback function	Description
ble_evt_gatt_server_attribute_value	The callback function pointer is being called when the attribute value in local GATT database is changed by remoted GATT client 【statement】 name.ble_evt_gatt_server_attribute_value = my_evt_gatt_server_attribute_value;
ble_evt_le_connection_opend	The callback function pointer is being called when center is connected 【statement】 name..ble_evt_le_connection_opend = my_evt_le_connection_opend;
ble_evt_le_connection_closed	The callback function pointer is being called when center is disconnected 【statement】 name.ble_evt_le_connection_closed = my_evt_le_connection_closed;
ble_evt_system_boot	The callback function pointer is being called when system is launched 【statement】 name.ble_evt_system_boot = my_evt_system_boot;
ble_evt_system_awake	The callback function pointer is being called when system has returned from sleep mode 【statement】 name.ble_evt_system_awake = my_evt_system_awake;
ble_evt_le_gap_scan_response	The callback function pointer is being called when receiving scan responce 【statement】 name.ble_evt_le_gap_scan_response = my_evt_le_gap_scan_response;

3.6 Power saving

Sleep mode saves power and can be done by the function below.

function：ble112.ble_cmd_system_halt(1)

Wakeup if the WAKEUP signal of D7 is high.

4 Revision history

Rev A1.0: First edition, August 2019