瑞維電子有限公司
S-Power Electronics Ltd

BG312L
(BLE Module)

Specification
Ver:1.2

瑞維電子有限公司

S-Power Electronics Ltd

HK OFFICE

Unit513, Lakeside 1, Bldg.15, No.8 Science Park West Avenue,
Hong Kong Science Park, New Territories., Hong Kong
TEL: +852 2661 1489 | Fax: +852 2661 9845
Email: sam@s-power.com.hk | Website: www.s-power.com.hk

DESCRIPTION

The BG312L is a cost-effective, low-power, true system-on-chip (SoC) for *Bluetooth* low energy applications. It enables robust BLE master or slave nodes to be built with very low total bill-of-material costs. The BG312L combines an excellent RF transceiver with an industry-standard enhanced 8051 MCU, in-system programmable flash memory, 8-KB RAM, and many other powerful supporting features and peripherals. The BG312L is suitable for systems where very low power consumption is required. Very low-power sleep modes are available. Short transition times between operating modes further enable low power consumption.

Combined with the *Bluetooth* low energy protocol stack from Texas Instruments, the BG312LF128/F256 forms the markets most flexible and cost-effective single-mode *Bluetooth* low energy solution.

FEATURES

RF	– *Bluetooth low energy technology* Compatible – Excellent Link Budget (up to 97 dB), Enabling Long-Range Applications Without External Front End – Accurate Digital Received Signal-Strength Indicator (RSSI) – Suitable for Systems Targeting Compliance With Worldwide Radio Frequency Regulations: ETSI EN 300 328 and EN 300 440 Class 2 (Europe), FCC CFR47 Part 15 (US), and ARIB STD-T66 (Japan)
Low Power	– Active Mode RX Down to 20 mA – Active Mode TX (0 dBm): 21 mA – Power Mode 1 (3-µs Wake-Up): 270 µA – Power Mode 2 (Sleep Timer On): 1 µA – Power Mode 3 (External Interrupts): 0.6 µA – Wide Supply Voltage Range (2 V–3.6 V) – Full RAM and Register Retention in All Power Modes
Microcontroller	– High-Performance and Low-Power 8051 Microcontroller Core – In-System-Programmable Flash, 128 KB – 8-KB SRAM
Peripherals	– 12-Bit ADC with Eight Channels and Configurable Resolution – Integrated High-Performance Op-Amp and Ultralow-Power Comparator – General-Purpose Timers (One 16-Bit, Two 8-Bit) – 32-kHz Sleep Timer With Capture – Two Powerful USARTs With Support for Several Serial Protocols – Powerful Five-Channel DMA – AES Security Coprocessor – Each BG312L Contains a Unique 48-bit IEEE Address

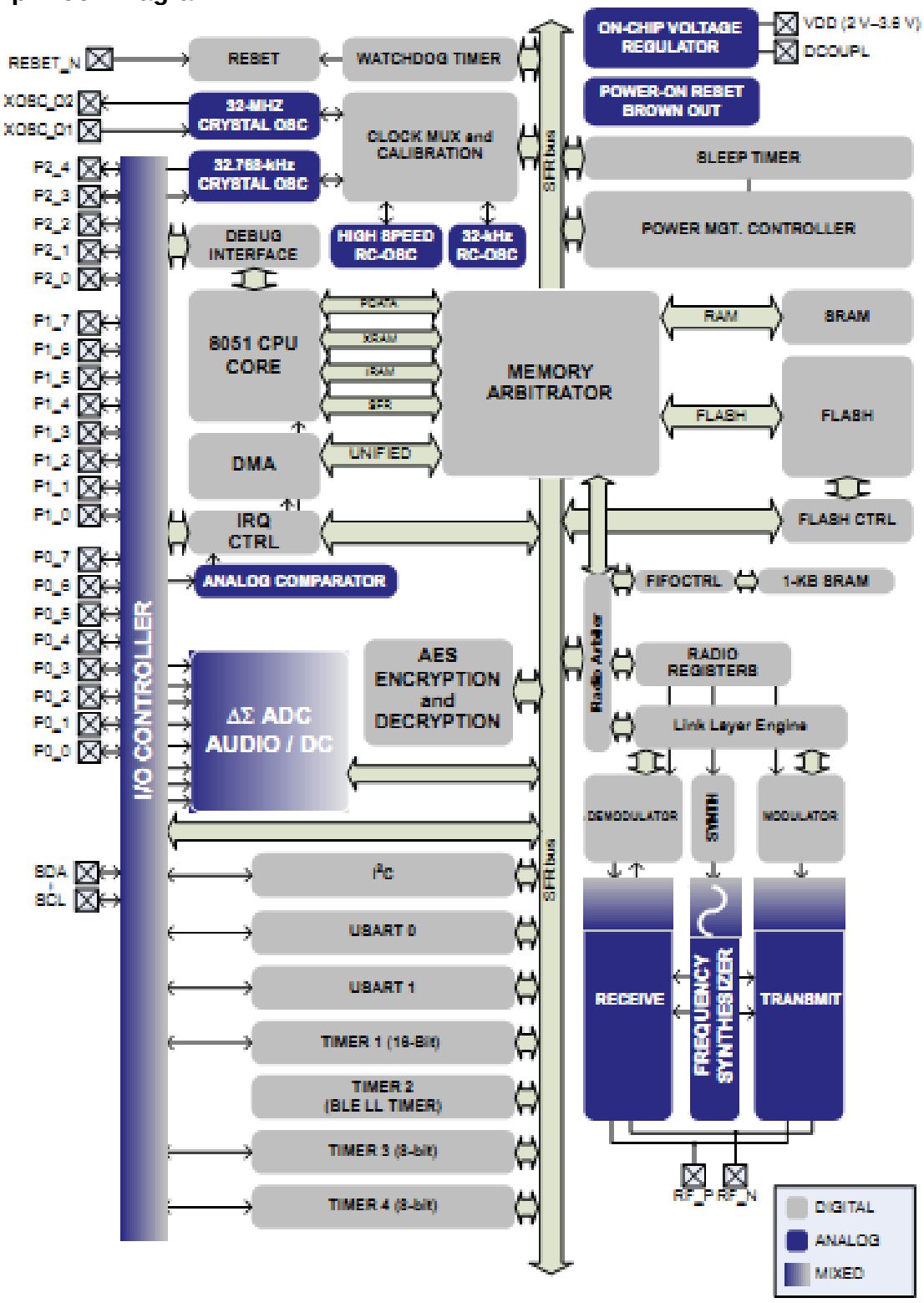
SOFTWARE FEATURES

- ***Bluetooth v4.0 Compliant Protocol Stack for* Single-Mode BLE Solution**
  - **Complete Power-Optimized Stack, Including Controller and Host**
    - **GAP** – Central, Peripheral, Observer, or Broadcaster (Including Combination Roles)
    - **ATT / GATT** – Client and Server
    - **SMP** – AES-128 Encryption and Decryption
    - **L2CAP**
  - **Sample Applications and Profiles**
    - Generic Applications for GAP Central and Peripheral Roles
    - Proximity, Accelerometer, Simple Keys, and Battery GATT Services
  - **Multiple Configuration options**
    - Single-Chip Configuration, Allowing Application to Run on BG312L
    - Network Processor Interface for Applications Running on an External Microcontroller
  - **BTool** – Windows PC Application for Evaluation, Development, and Test

APPLICATIONS

- 2.4-GHz Bluetooth low energy Systems
- Mobile Phone Accessories
- Sports and Leisure Equipment
- Consumer Electronics
- Human Interface Devices (Keyboard, Mouse, Remote Control)
- Health Care and Medical

Chip Block Diagram



ELECTRICAL CHARACTERISTICS

TA = 25°C and VDD = 3 V unless otherwise noted

	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Icore	Core current consumption	Power mode 1. Digital regulator on; 16-MHz RCOSC and 32-MHz crystal oscillator off; 32.768-kHz XOSC, POR, BOD and sleep timer active; RAM and register retention		270		µA
		Power mode 2. Digital regulator off; 16-MHz RCOSC and 32-MHz crystal oscillator off; 32.768-kHz XOSC, POR, and sleep timer active; RAM and register retention		1		µA
		Power mode 3. Digital regulator off; no clocks; POR active; RAM and register retention		0.6		µA
		Low MCU activity: 32-MHz XOSC running. No radio or peripherals. No flash access, no RAM access.		7		mA
Iperi	Peripheral current consumption (Adds to core current Icore for each peripheral unit activated)	Timer 1. Timer running, 32-MHz XOSC used Timer 2. Timer running, 32-MHz XOSC used Timer 3. Timer running, 32-MHz XOSC used Timer 4. Timer running, 32-MHz XOSC used Sleep timer, including 32.753-kHz RCOSC ADC, when converting		90 90 60 70 0.6 1.2		µA µA µA µA µA mA

DC CHARACTERISTICS

TA = 25°C, VDD = 3 V

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Logic-0 input voltage				0.5	V
Logic-1 input voltage		2.5			V
Logic-0 input current	Input equals 0 V	–50		50	nA
Logic-1 input current	Input equals VDD	–50		50	nA
I/O-pin pullup and pulldown resistors			20		kΩ
Logic-0 output voltage, 4-mA pins	Output load 4 mA			0.5	V
Logic-1 output voltage, 4-mA pins	Output load 4 mA	2.4			V

32.768-kHz CRYSTAL OSCILLATOR

TA = 25°C, VDD = 3 V

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Crystal frequency				32.768		kHz
Crystal frequency accuracy requirement(1)			–30		30	ppm
ESR	Equivalent series resistance			40	130	kΩ
C0	Crystal shunt capacitance			0.9	2	pF
CL	Crystal load capacitance			12	16	pF
	Start-up time			0.4		s

(1) Including aging and temperature dependency, as specified by [1]

RF RECEIVE SECTION

T_A = 25° C, VDD = 3 V, f_c = 2440 MHz
1 Mbps, GFSK, 250-kHz deviation, *Bluetooth* low energy mode, and 0.1% BER(1)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Receiver sensitivity(2)	High-gain mode		–92		dBm
Receiver sensitivity(2)	Standard mode		–86		dBm
Saturation(3)			6		dBm
Co-channel rejection(3)			–5		dB
Adjacent-channel rejection(3)	±1 MHz		–5		dB
Alternate-channel rejection(3)	±2 MHz		30		dB
Blocking(3)			–30		dBm
Frequency error tolerance(4)	Including both initial tolerance and drift	–250		250	kHz
Symbol rate error tolerance(5)		–80		80	ppm
Spurious emission. Only largest spurious emission stated within each band.	Conducted measurement with a 50-Ω single-ended load. Complies with EN 300 328, EN 300 440 class 2, FCC CFR47, Part 15 and ARIB STD-T-66		–75		dBm
Current consumption	RX mode, standard mode, no peripherals active, low MCU activity, MCU at 250 kHz		18		mA
Current consumption	RX mode, high-gain mode, no peripherals active, low MCU activity, MCU at 250 kHz		21		mA

(1) 0.1% BER maps to 30.8% PER
(2) The receiver sensitivity setting is programmable using a TI BLE stack vendor-specific API command. The default value is standard mode.
(3) Results based on standard gain mode
(4) Difference between center frequency of the received RF signal and local oscillator frequency
(5) Difference between incoming symbol rate and the internally generated symbol rate

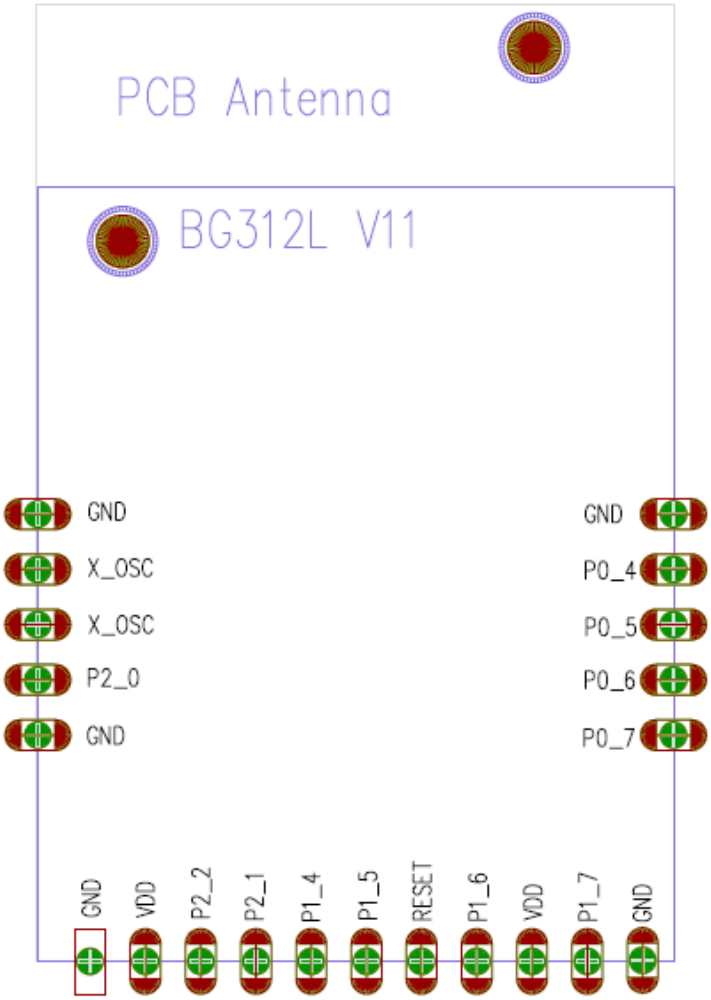
RF TRANSMIT SECTION

TA = 25°C, VDD = 3 V and fc = 2440 MHz

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output power	Delivered to a single-ended 50-Ω load through a balun using maximum recommended output power setting		0		dBm
Output power	Delivered to a single-ended 50-Ω load through a balun using minimum recommended output power setting		–20		dBm
Programmable output power range	Delivered to a single-ended 50 Ω load through a balun		20		dB
Spurious emissions	Conducted measurement with a 50-Ω single-ended load. Complies with EN 300 328, EN 300 440 class 2, FCC CFR47, Part 15 and ARIB STD-T-66(1)		–41		dBm
Current consumption	TX mode, –20 -dBm output power, no peripherals active, low MCU activity, MCU at 250 kHz		17		mA
Current consumption	TX mode, 0 -dBm output power, no peripherals active, low MCU activity, MCU at 250 kHz		20		mA
Optimum load impedance	Differential impedance as seen from the RF port (RF_P and RF_N) toward the antenna		70 + j30		Ω

(1) Designs with antenna connectors that require conducted ETSI compliance at 64 MHz should insert an LC resonator in front of the antenna connector. Use a 1.6-nH inductor in parallel with a 1.8-pF capacitor. Connect both from the signal trace to a good RF ground.

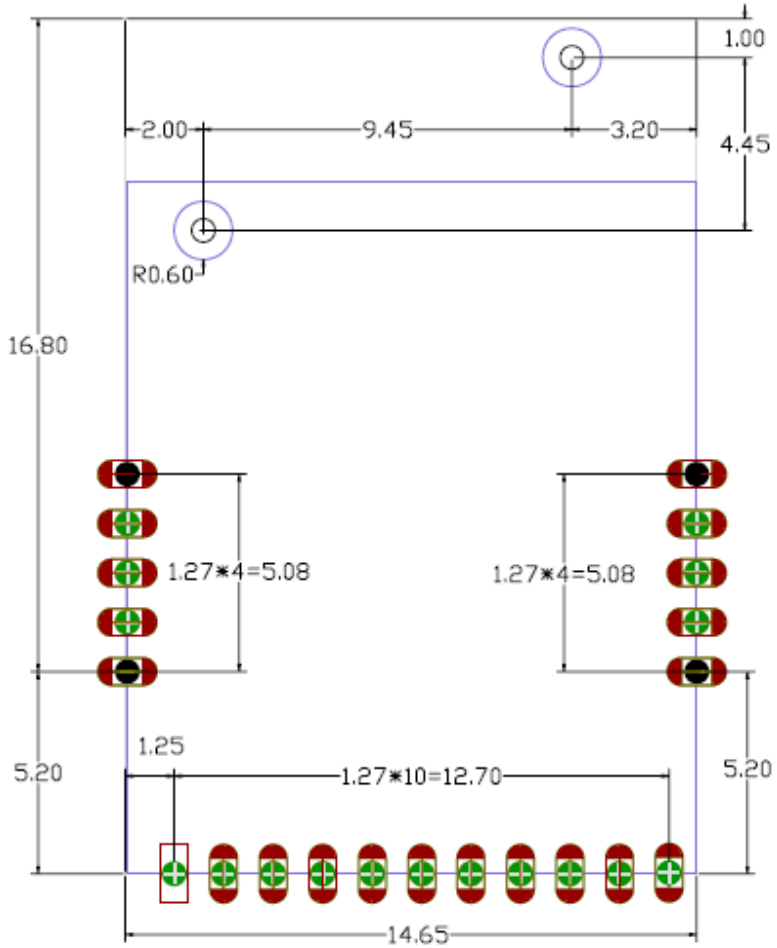
PIN Define



PIN Name	PIN Type	Description	PIN Name	PIN Type	Description
VDD	Power (digital)	2-V–3.6-V digital power-supply connection	X_OSC	Crystal	Connected to 32768Hz Crystal
GND	Ground	The ground pad must be connected to a solid ground plane.	X_OSC	Crystal	Connected to 32768Hz Crystal
P0_4	Digital I/O	Port 0.4	RESET	Digital input	Reset, active-low
P0_5	Digital I/O	Port 0.5	P1_4	**CT**	**BLE module notify Output**
P0_6	Digital I/O	Port 0.6	P1_5	**RT**	**MCU/Host notify Input**
P0_7	Digital I/O	Port 0.7	P1_6	**UART_TX**	**UART Transmit Output**
P2_0	Digital I/O	Port 2.0	P1_7	**UART_RX**	**UART Receive Input**
P2_1	Digital I/O	Port 2.1			
P2_2	Digital I/O	Port 2.2			

Remark:Ver1.2:June27,2012 change VDD or P1_7 for module PIN define

Module Size


1.00
2.00
9.45
3.20
4.45
R0.60
16.80
1.27*4=5.08
1.27*4=5.08
1.25
5.20
1.27*10=12.70
5.20
14.65