Rayson *Bluetooth® Module*

Low Energy Smart Module BTM-800

Features

- Bluetooth standard V4.1 conformity.
- CSR1010 chip
- Programmable general purpose PIO controller :
- Wide supply voltage range 1.8 to 3.6V.
- I2C for EEPROM and ICs peripherals.
- -87dBm Bluetooth low energy RX sensitivity.
- 12 digital PIOs
- 3 analogue AIOs
- 4 PWM modules
- Option for built-in G-sensor
- Wake-up interrupt and Watchdog time
- RoHS Compliant
- Dimension: 20 x 12 x2.0mm

Outline

Applications

- Sports and fitness
- Health care
- Automotive
- Home appliance
- Office and mobile accessories
- Low rate data communications

Electrical Characteristics

Absolute Maximum Ratings		
Ratings	Min.	Max.
Storage Temperature	-30 ℃	+85℃
Supply Voltage(VDD_PADS,VDD_BAT)	1.8V	3.6 V
Recommended Operating Condition		
Operating Condition	Min.	Max.
Operating Temperature range	-20 ℃	+75℃
Supply voltage(VDD_PADS,VDD_BAT)	1.8V	3.6V

Current Consumption（CSR1010 QFN total typical current consumption measured from the battery supply）

Mode	**Descrisption**	**Typical Current at 3V**
Dormant	functions are shutdown. To wake up toggle the WAKE pin	<900nA
Deep sleep	VDD_PADS = ON, REFCLK = OFF, SLEEPCLK = ON, VDD_BAT = ON, RAM = ON, digital circuits = ON, SMPS = ON (low-power mode), 1ms wake-up time	<5μA

Idle	VDD_PADS = ON, REFCLK = ON, SLEEPCLK = ON, VDD_BAT = ON, RAM = ON, digital circuits = ON, MCU = IDLE, <1μs wake-up time	~1mA
RX / TX active	-	peak current 16mA @ 3V

RF Specification:

Battery Supply=3V, Temperature=+20℃

Transmitter

	Min	Typ	Max	Bluetooth Specification	Unit
Maximum RF transmit power（conductive）	-4	0	+2	-6 to +4	dBm
Initial carrier frequency tolerance	-40	-	+40	±75	kHz
Δf1avg maximum modulation	225	258	275	225 < f1avg < 275	
Δf2max minimum modulation	185	197		≥185	
Δf2avg/Δf1avg		0.8	0.86	≥0.8	
Carrier drift rate	-	8	-	≤20	kHz/50μ
Carrier drift	-	7	-	≤50	kHz
2nd Harmonic Content	-	-46	-	≤-30	dBm
3rd Harmonic Content	-	-45	-	≤-30	dBm

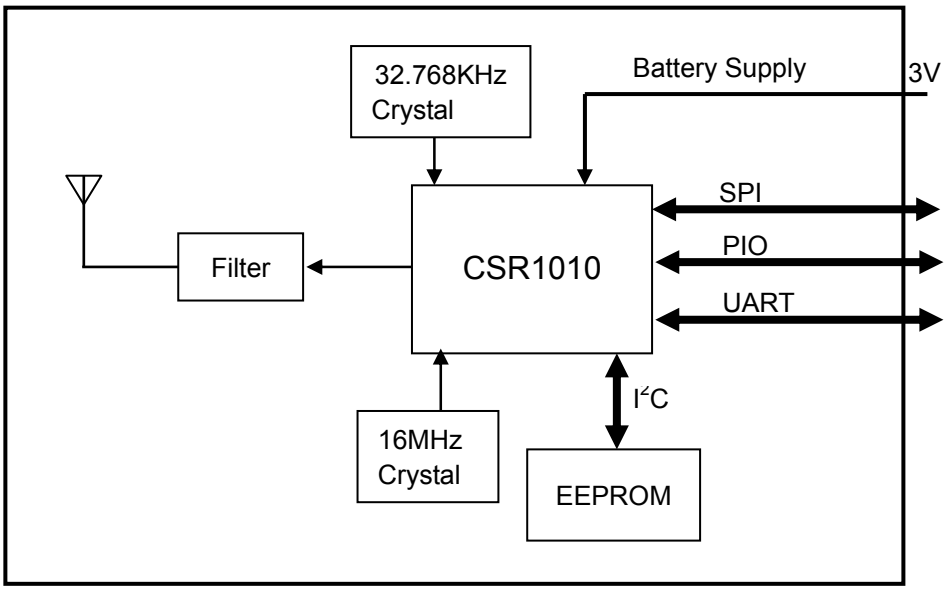
Receiver

Battery Supply=3V, Temperature=+20℃

	Frequency (GHz)	Min	Typ	Max	Bluetooth Specification	Unit
Sensitivity at 30.8% PER for all basic rate packet types（conductive）	2.402	-	-87	-84	≤-70	dBm
	2.440	-	-87	-84		
	2.480	-	-87	-84		
Maximum received signal at 30.8% PER		-10	>-10		≥-10	dBm
C/I co-channel		-	6	21	≤21	dB
Adjacent channel selectivity C/I F = F0 + 1MHz		-	2	15	≤15	dB
Adjacent channel selectivity C/I F = F0 - 1MHz		-	1	15	≤15	dB
Adjacent channel selectivity C/I F = F0 + 2MHz		-	-28	-17	≤-17	dB
Adjacent channel selectivity C/I F = F0 - 2MHz		-	-21	-15	≤-15	dB

Adjacent channel selectivity C/I F = F0 + 3MHz	-	-31	-27	≤-27	dB
Adjacent channel selectivity C/I F = F0 - 5MHz	-	-30	-27	≤-27	dB
Adjacent channel selectivity C/I F = FImage	-	-24	-9	≤-9	dB
Maximum level of intermodulation interferers	-	-50	-33	≥-50	dBm
Spurious output level	-	-154	-		dBm/Hz

Block Diagram



UART Interface

The BTM800 UART interface provides a simple mechanism for communicating with other serial devices using the RS232 protocol.

2 signals implement the UART function, UART_TX and UART_RX. When BTM800 is connected to another digital device via UART interface, the data is exchanged by UART_RX and UART_TX and, the hardware flow control is not available. UART configuration parameters such as baud rate, stop bits and parity bit are set by BTM800's firmware.

As set for UART communications, the general PIO ports PIO[0] and PIO[1] are assigned as UART_TX (output) and UART_RX (input).

Note: To communicate with the UART at its maximum data rate using a standard PC, the PC requires an accelerated serial port adapter card.

The following table shows the possible UART settings for the BTM800:

Parameter		**Possible Values**
Baud rate	Minimum	1200 baud (≤2%Error)
		9600 baud (≤1%Error)
	Maximum	2M baud (≤1%Error)

Parity	None, Odd or Even
Number of stop bits	1 or 2
Bits per byte	8

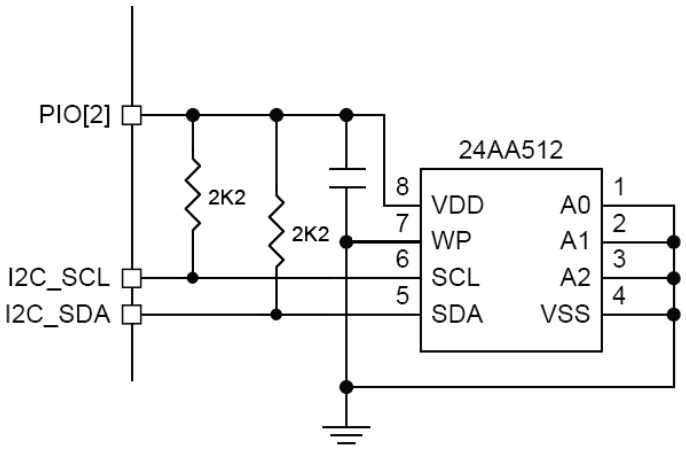
The maximum baud rate is 2400 baud during deep sleep.

As the actual throughput of BLE air traffic is around 2400 baud, higher baud rate setting at UART interface can cause data congestion. Software flow control may required to avoid data loss.

I²C Interface

There is I²C interface of CSR1010 is dedicated for EEPROM connections. The EEPROM usually hold the program code that will be load to CSR1010 during boot up. The BTM800 has the 128K EEPROM built in for the program code.

If extra I²C interface is required for applications, the software emulated I²C interface can be implemented on general PIO ports.



Example of an I²C Interface EEPROM Connection

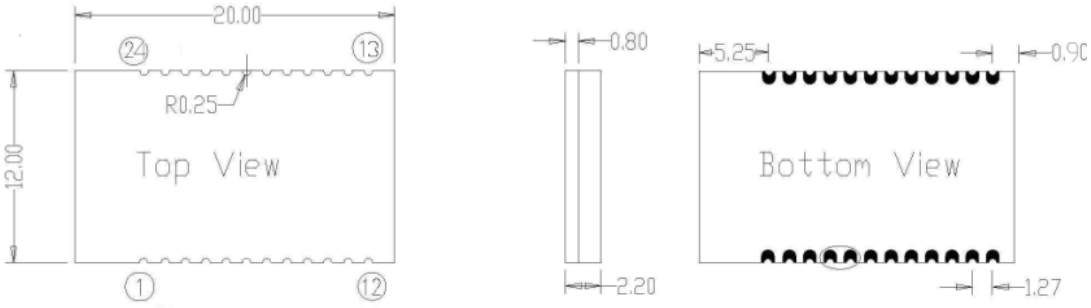
BTM-800 Pins Function

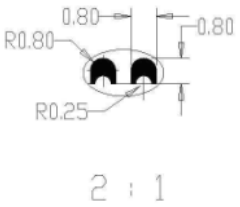
No.	Pin Name	Pin Type	Supply Domain	Pin description
1	PIO[3]	Bi-directional	VDD_PADS	Programmable input/output line or PWN signal output
2	PIO[4]	Bi-directional	VDD_PADS	Programmable input/output
3	SPI_CLK(PIO5)	Bi-directional	VDD_PADS	Programmable input/output or debug SPI_CLK selected
4	SPI_CSB(PIO6)	Bi-directional	VDD_PADS	Programmable input/output or debug SPI chip selected
5	SPI_MOSI(PIO7)	Bi-directional	VDD_PADS	Programmable input/output or debug SPI_MOSI selected
6	SPI_MISO(PIO8)	Bi-directional	VDD_PADS	Programmable input/output or debug SPI_MISO selected
7	PIO[9]	Bi-directional	VDD_PADS	Programmable input/output line
8	PIO[10]	Bi-directional	VDD_PADS	Programmable input/output line
9	PIO[11]	Bi-directional	VDD_PADS	Programmable input/output line or button input

10	3V	Power input		Connect to external 3V（battery）,we advise to connect a decoupling capacitor to this pin and it should be more than 47uF.
11	GND	GND		Common ground
12	PIO2	Bi-directional	VDD_PADS	Provide I2C or SPI Power , pls leave it NC if don't use it.
13	WAKE	Bi-directional	VDD_BAT	Input to wake module from domand/hibernate mode. if no use, pls pull down.
14	I2C-SCL	Bi-directional	VDD_PADS	I2C clock or SPI serial flash clock output(SF_CLK)
15	I2C-SDA	Bi-directional	VDD_PADS	I2C data input/output or SPI serial flash data
16	AIO(2)	Bi- Analogue	VDD_AUX（1.35V）	Analogue Programmable input/output line
17	AIO(1)	Bi- Analogue	VDD_AUX（1.35V）	Analogue Programmable input/output line
18	AIO(0)	Bi- Analogue	VDD_AUX（1.35V）	Analogue Programmable input/output line
19	UART TX	Bi-directional	VDD_PADS	Programmable input/output or UART TX
20	UART RX	Bi-directional	VDD_PADS	Programmable input/output or UART RX
21	SPI_PIO#_SEL	Bi-directional	VDD_PADS	Programmable input/output or SPI/PIO selected，set HI for SPI
22	GND	GND		Common ground
23	RF_IN	Analogue	VDD_BT_RADIO	Antenna interface Request
24	GND	GND		Common ground

Dimension:

Unit: mm





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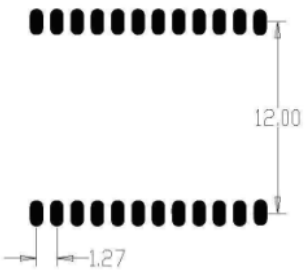
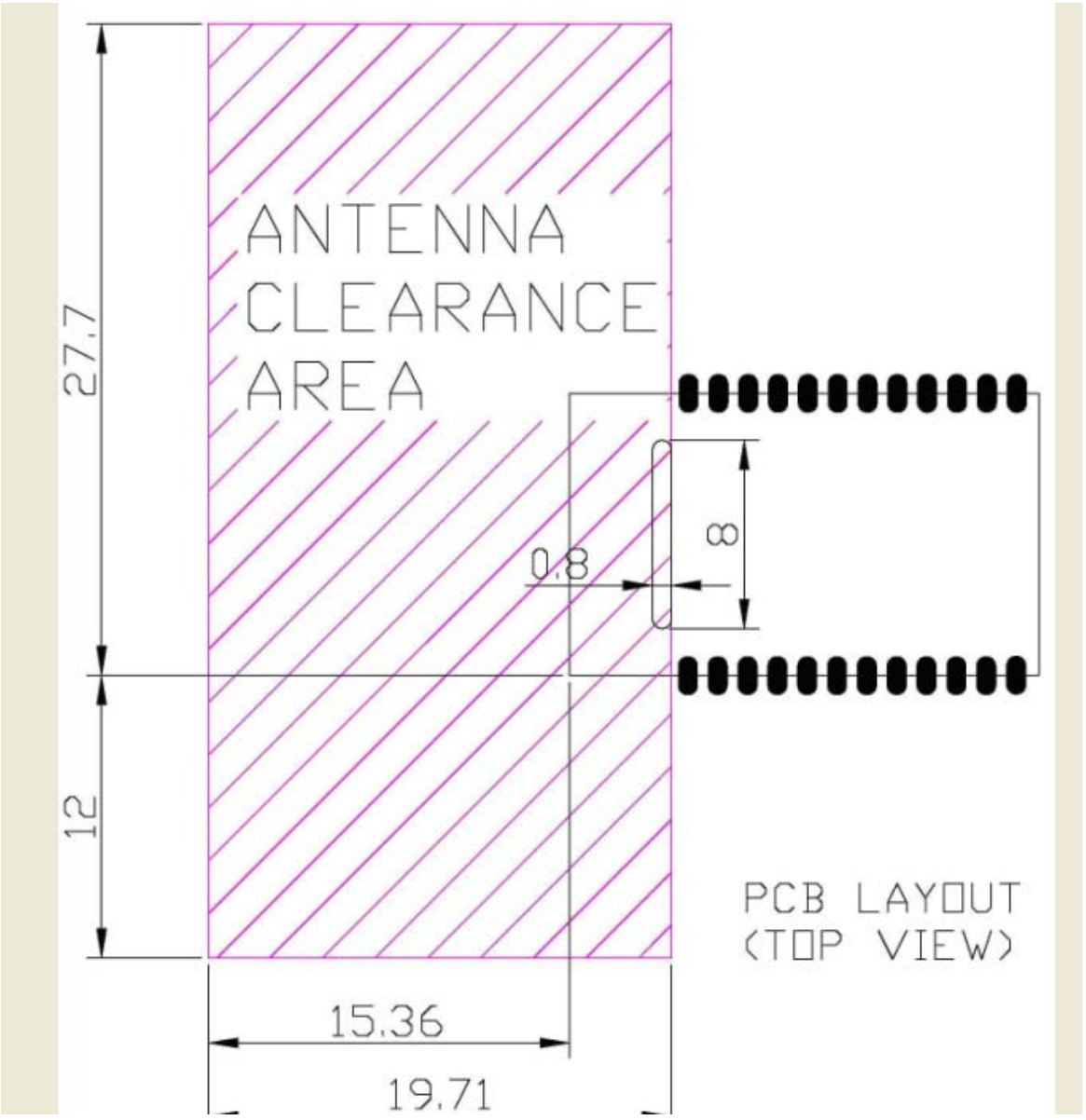


PCB Layout(Top View)


ANTENNA
CLEARANCE
AREA
27.7
12
0.8
8
15.36
19.71
PCB LAYOUT
(TOP VIEW)

Reflow Profile

Reflow profile requirements		
Parameter Specification	**Referenc**	**Specification**
Average temperature gradient in preheating		1~2.5°C/s to 175°C equilibrium.
Soak time	T_{soak}	120~180 seconds
Time above 217°C (T_1)	t_1	45~90 seconds
Peak temperature in reflow	T_2	250°C (–0/+5°C)
Time at peak temperature	t_2	6 seconds
Temperature gradient in cooling		6°C/second max.