

Cara-S

BSC8001-05-S-NRY

Datasheet

Elite Semiconductor Memory Technology Inc.

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1 Product Overview

Conventional GPS tracker requires 3G/4G or other internet connectivity to deliver the item's location. The significant portion of the power budget has to be allocated to the mobile technology. Sigfox is a powerful but much lower power consuming alternative to deliver the GPS information to the network. Under the "one global Sigfox network", a true worldwide GPS tracker product is realizable. No extra roaming charge is needed and 24-7 tracker across boarder is realizable at reasonable cost. Unlike Monarch which is the low cost alternative to tracking applications, GPS tracker can provide a much higher locational accuracy and the power consumption is not necessarily any higher.

To speed up product development and enable POC at shortest development time, ESMT makes Cara-S available to the market as an off-the-shelf Worldwide GPS tracker solution with the lowest power consumption and widest locational support around the world. Worldwide Sigfox operation is supported by LiteOn's WSG303M module while the power optimized firmware is developed and ran on ESMT XS8001 32bit MCU core.

Cara-S is a self-contained PCBA with sensors and antennas which also carries a preloaded firmware. This enables immediate POC and it is also a platform which user can develop their own firmware at minimum hardware risk.

2 Product Features

- Sigfox Verified™ RF module (SIGFOX Library Version: V2.3.1)
- Support RCZ1,2,3c,4 and 5 by LiteON's WSG303M module
- Preloaded with Sigfox ID/PAC and WiFi –Sigfox locational firmware
- Sigfox Region support:
 - RCZ1: Europe (868MHz)
 - RCZ2: US (902MHz)
 - RCZ3c: Japan (923MHz)
 - RCZ4: Argentina, Colombia, Australia, New Zealand, Hong-Kong, Singapore, Taiwan (920MHz)
 - RCZ5: Korea (923MHz)
- Operating Voltage: 3.5V to 5.5V
- Operating Temperature: -40°C to 85°C
- RCZ1/3/5 : 1 year battery life¹
- RCZ2/4 : 1.5 year battery life¹
- On board Sigfox antenna and GPS antenna
- Integrated
 - 3-axis G-sensor
 - ±1C° accuracy temperature sensor
 - Battery detection

¹ GPS report every 60 min with battery capacity 1300mAh

3 Functional Block

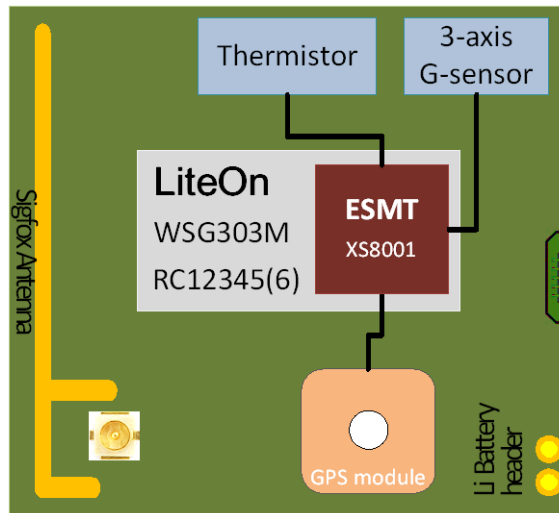


Figure 3-1 Cara-S Block Diagram

The core of Cara-S is LiteOn’s WSG303M module which is Sigfox verified for RC12345(6) operation. The multi-zone support is enabled by ESMT XS8001 wireless MCU onboard. The WiFi-Sigfox locational firmware is running in the embedded 32 bit core. Besides, a micro-B usb connector can be used to power the device or charge a Li-ion battery (connected via a battery header)

A 3-axis g-sensor and a thermistor are integrated on the PCB which acquires ambient temperature and physical states of the platform. To minimize the risk of RF design and manufacturing, Cara-S also embeds all necessary antenna which balance size and performance. IPEX connector is also available for external antenna connection in case extra boost of RF performance is required.

4 *WiFi-Sigfox locational firmware behavior*

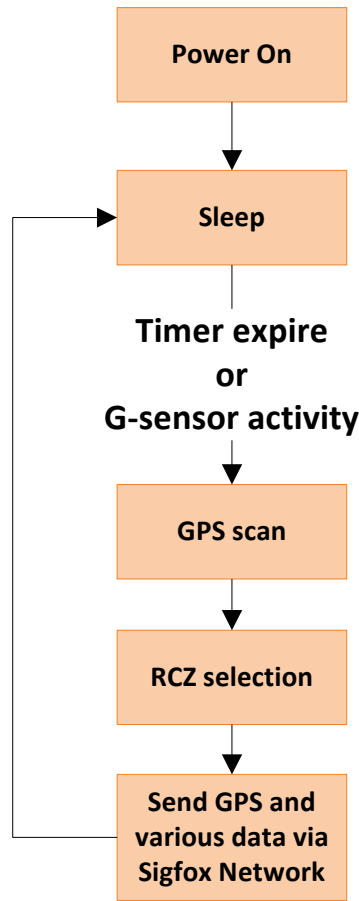


Figure 4-1 Cara-S firmware state machine

The device enters sleep mode after initiation. Cara-S wakes up on regular intervals or detection of acceleration of over 0.5g at any of the axis. The wakeup interval and acceleration threshold are configurable. The unit wakes up and scans for GPS signal. The correct Sigfox RC configuration is selected according to the GPS location.

Byte Index	Item	Name	Description
State Register			
1	-bit[7]	Device exposed to stress	Cautious Flag is raised based on a special criteria
	-bit[6]	OverTemperature event	If 2 consecutive over temperature event is recorded (30 mins in total), a packet is sent with this field set to 1 and the over stressed temperature is carried in byte 2 if the device temperature changes from over temperatuere to normal for 2 consecutive interval, a packet is sent with this filed set to 0. It is a set and reset event logic .
	-bit[5]	Over Stress event	if the G-sensor event is triggered, a packet is sent with this field set to 1. The byte 3 will carry the value of G-force that triggers the event
	-bit[4]	GPS data valid	if a valid GPS data is acquired, a packet is sent with this field set to 1. byte 4 to 11 will carry the valid GPS data . If this field is 0, no GPS data is sent. (to keep the frame shorted to save power)
	-bit[3]	Battery[3]	4 bit battery level (1111 full, 0000 empty)
	-bit[2]	Battery[2]	
	-bit[1]	Battery[1]	
	-bit[0]	Battery[0]	
2	Current Temperature Data		Temperature in byte (UINT8 0x00 = -40C; 0x78 = 80C)
3	reserved		
4	Overstressed G-sensor value		Average G-shock in milli-G.
5	GPS Latitude		
6	GPS Latitude		
7	GPS Latitude		
8	GPS Latitude		When GPS data is acquired successfully, data is carried in this field. If not GPS data is acquired, send 200 200
9	GPS longitutde		
10	GPS longitutde		
11	GPS longitutde		
12	GPS longitutde		

Table 4-1 Cara-S packet format

Category	Item	Description
Regular Monitoring	Sigfox RC support	Auto configurable across RC12345
	Temperature	+ -1C accuracy
	G-shock stress level	0~2G max (absolute value only)
Event trigger (configurable threshold levels)	Battery level	0~100% (16 levels)
	Over Stress	>0.5G (configurable)
Local recording (data is written into local flash memory)	Temperature and G-shock level	
		Every 15 minutes for 3 months

Table 4-2 Figure 4-2 Cara-S Features highlight

5 Physical Dimension

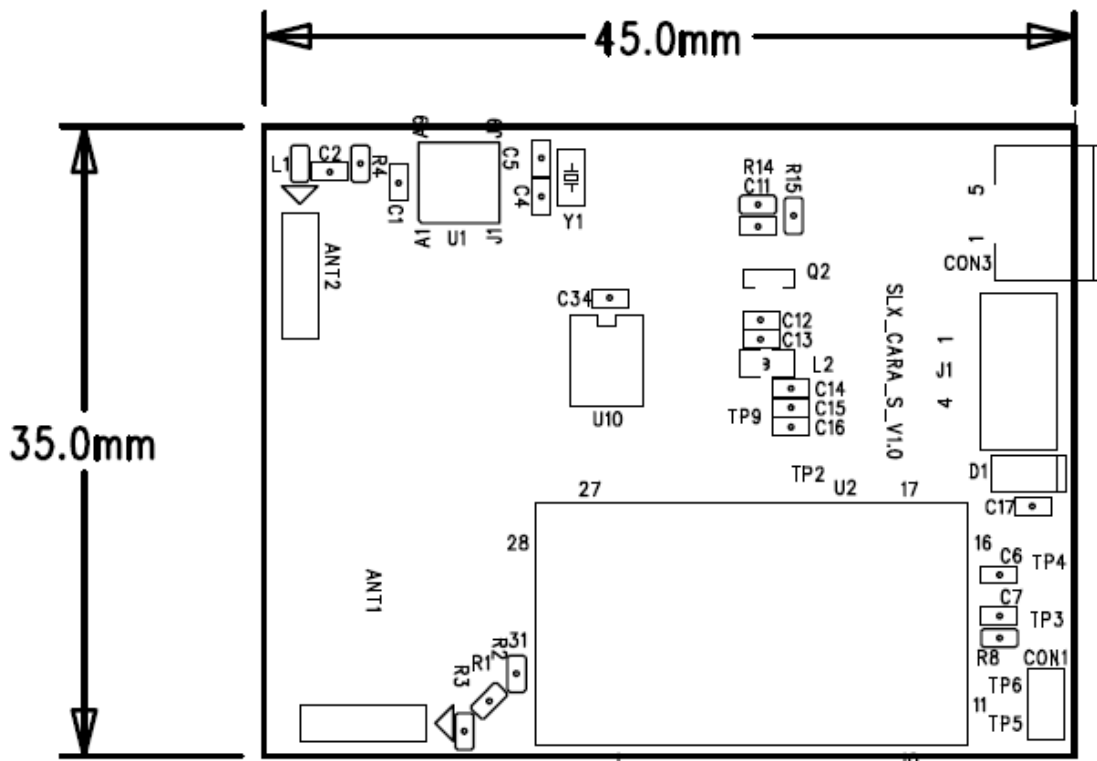


Figure 5-1 Module Dimension and pad location

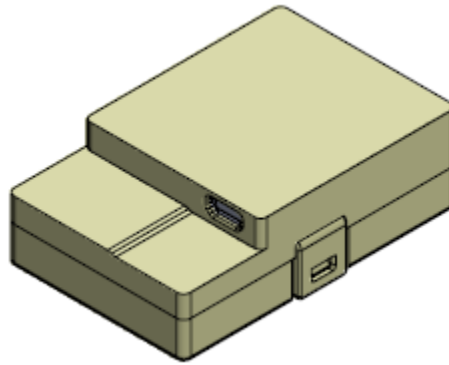


Figure 5-2 Housing 3D²

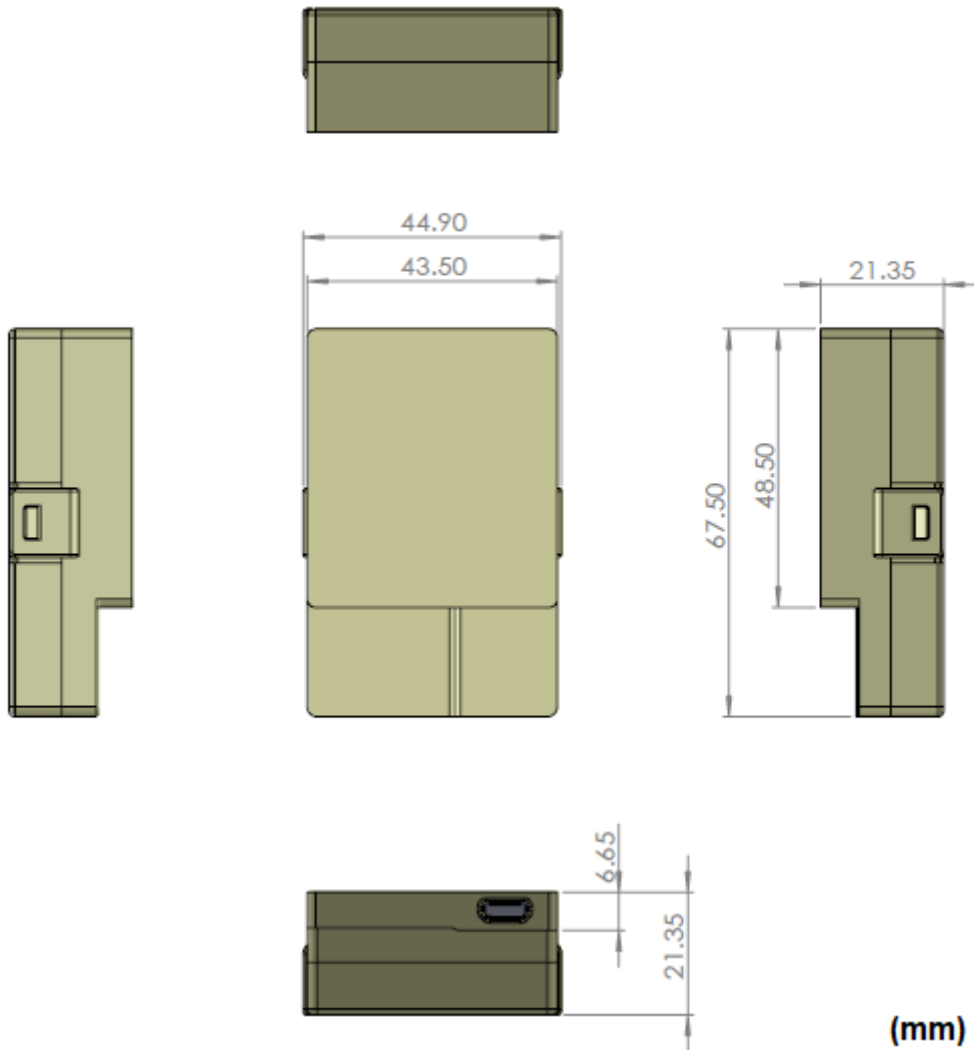


Figure 5-3 Housing mechanical info

² Housing is available upon request

6 Electrical Specifications

Parameter	Min	Max	Unit
Power (VDD)	-0.3	5.5	V
Storage Temperature	-40	140	°C

Table 6-1 Absolute Maximum Ratings

Parameter	Min	Max	Unit
VDD	3.5	5.5	V
Operating Temperature	-40	85	°C

Table 6-2 Recommended Operating Conditions

Parameter	Min	Typ.	Max	Unit
Off mode		0.05	1	µA
Average current RCZ35 send bit at 923MHz (13dBm)		56		mA
Average current RCZ4 send bit at 902/920MHz (20dBm)		130		mA

Table 6-3 DC Current Characteristics

Parameter	Min	Typ.	Max	Unit
Output power	8		20	dBm
Output Power deviation vs Input voltage (3.5V ~5.5V)			1	dB
Listen Before Talk Threshold 923MHz		-80		dBm

Table 6-4 Transmitter RF Performance

Zone of operation	Centre Frequency
RCZ1	868.130
RCZ2	902.2
RCZ3c	923.2
RCZ4	920.8
RCZ5	923.25

Table 6-5 Sigfox Operating Zone support

Parameter	Note	Min	Typ.	Max	Unit
Calibrated frequency	±5% course calibration		32.768		kHz
Frequency accuracy after calibration	With software offset adjustment routine			±1	%
Supply voltage coefficient	Frequency drift when supply voltage changes after calibration		+10		%/V
Initial calibration time			2.5		ms

Table 6-6 32kHz RC Oscillator Specification

Parameter	Condition/Note	Min	Typ.	Max	Unit
TCXO Frequency			24		MHz
Frequency accuracy			±5		ppm

Table 6-7 Oscillator Specification

Parameter	Min	Typ.	Max	Unit
Input Low Voltage	-0.3		0.8	V
Input High Voltage	2		3.6	V
Threshold point	1.36	1.45	1.55	V
Output High Voltage	2.4			V
Output Low Voltage			0.4	V
Schmitt Trigger Low to High Threshold Point	1.56	1.66	1.76	V
Schmitt Trigger High to Low Threshold Point	1.1	1.19	1.27	V
Input Leakage Current			±10	µA
Pull up resistor	42k	59k	88k	Ω
Pull down resistor	34k	54k	92k	Ω
Output current drive			20	mA

Table 6-8 Pin IO Voltage

7 Current Consumption

The current consumption for RCZ1/3/5 and RCZ2/4 are different because the Sigfox packet transmission power and packet length are different.

	RCZ1 14dBm GPS tracker (ESMT)	RCZ35 13dBm GPS tracker (ESMT)	RCZ24 22dbm GPS tracker (ESMT))	
Num of report per day		24		times
Report Period		60		min
Warm Start		6		s
total consumption per day	3.6	4.1	2.5	mAhr
Battery Capacity		1300		mAhr
Battery life (year)	1.0	0.9	1.5	year

Table 7-1 Current consumption and battery life estimation

8 Preloaded Software

The BSC8001-05-S is loaded with the following software prior shipping:

1. Worldwide autozone GPS tracker firmware
2. Bootloader
3. Device ID, KEY and Portable Access Code (PAC)

For Software development on the module, the features of the bootloader can be found in: ESAN-UPLYNX-003 Uplynx Products (Addendum - Boot Procedure)

9 Order Information

Part Number	Description
BSC8001-05-S-NRY	Cara-S WiFi Sigfox locational platform solution