

SaBLE-x™ *Bluetooth*® Smart (BLE) Module

FEATURES

- Built in CC2640F128 Bluetooth Smart (BLE 4.1) System-On-Chip (SOC)
- 128 kB Flash / 20 kB SRAM
- RF Output Power: +5 dBm
- RF Receive Sensitivity: -96 dBm
- Size: 11.6mm x 17.9mm x 2.4mm
- Operating Voltage: 1.8V to 3.8V
- Operating Temperature: -40 to +85C
- 9.1mA Transmit Mode (+5 dBm)
- 6.1mA Receive Mode
- 1µA Standby (SRAM/CPU retention and RTC running) with quick 100 µs start up
- 200nA Shutdown
- 61µA/MHz Active CPU Current
- Drivers, Bluetooth Low Energy Controller, and bootloader in ROM
- Flexible peripheral set
- On board 32 kHz and 24 MHz Crystals.
- Worldwide Acceptance: FCC (USA), IC (Canada), ETSI (Europe), Giteki (Japan), C-Tick (AU/NZ)
- REACH and RoHS compliant

APPLICATIONS

- Consumer electronics
- Mobile phone accessories
- Sports & Fitness equipment
- HID applications
- Home and Building Automation, Lighting Control, Alarm and Security
- Electronic Shelf Labeling, Proximity Tags

DESCRIPTION

LSR would like to announce a low-cost and low-power consumption module which has all of the *Bluetooth Smart* 4.1 functionalities.



The SaBLE-x module fully supports the single mode *Bluetooth* Low Energy operation, and the output power can support class 2. The module provides the ability to either put your entire application into the integrated ARM Cortex M3 microcontroller, or use the module in Network Processor mode in conjunction with the microcontroller of your choice. RF Core's dedicated ARM Cortex M0 improves system performance and frees up FLASH memory for custom applications.

Need to get to market quickly? Not an expert in *Bluetooth* Low Energy? Need a custom antenna? Do you need help with your host board? LSR Design Services will be happy to develop custom hardware or software, or help integrate the design. Contact us at sales@lsr.com or call us at 262-375-4400.

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FOOTPRINT AND PIN DEFINITIONS

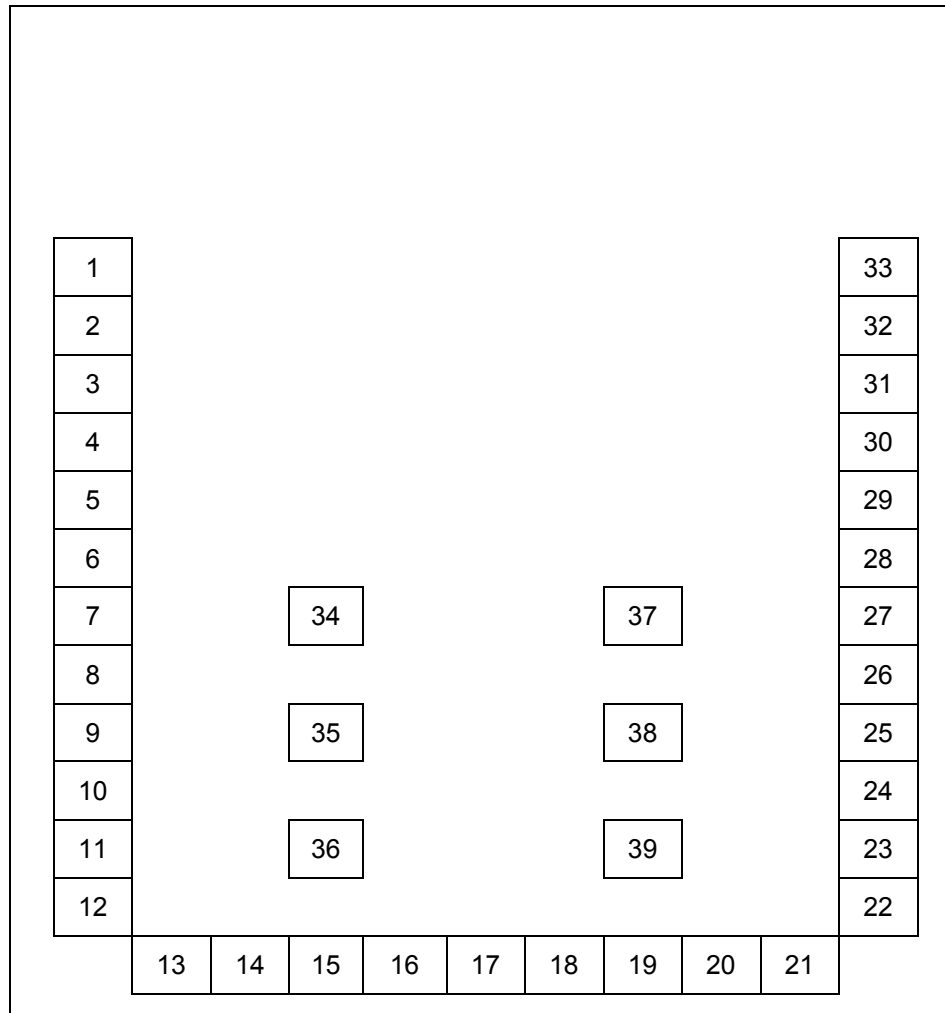


Figure 1 SaBLE-x Module Footprint (Viewed From Top)

PIN DESCRIPTIONS

Module Pin	Name	I/O Type	Description
1	RF OUT	RF	ANTENNA, 50 OHMS
2	GND	GND	GROUND
3	GND	GND	GROUND
4	NC	-	NO CONNECT (DO NOT CONNECT)
5	NC	-	NO CONNECT (DO NOT CONNECT)
6	/RESET	DI	ACTIVE LOW RESET. 100kΩ PULL-UP
7	JTAG TCKC	DI/DIO	JTAG TCKC
8	JTAG TMS	DIO	JTAG TMS
9	NC	-	NO CONNECT (DO NOT CONNECT)
10	NC	-	NO CONNECT (DO NOT CONNECT)
11	VCC	PI	POWER SUPPLY TO MODULE
12	VCC	PI	POWER SUPPLY TO MODULE
13	DIO 5/JTAG TDO	DIO	GPIO, JTAG TDO, ULP SENSOR INTERFACE, LED DRIVING CAPABILITY
14	DIO 6/JTAG TDI	DIO	GPIO, JTAG TDI, ULP SENSOR INTERFACE, LED DRIVING CAPABILITY
15	DIO 4	DIO	GPIO, LED DRIVING CAPABILITY
16	DIO 3	DIO	GPIO, LED DRIVING CAPABILITY
17	DIO 2	DIO	GPIO, ULP SENSOR INTERFACE, LED DRIVING CAPABILITY
18	DIO 1/BOOT RX	DIO	GPIO, ULP SENSOR INTERFACE, BOOTLOADER RX (UART0)
19	DIO 0/BOOT TX	DIO	GPIO, ULP SENSOR INTERFACE, BOOTLOADER TX (UART0)
20	DIO 7	DIO	GPIO, ANALOG INPUT, ULP SENSOR INTERFACE
21	DIO 8	DIO	GPIO, ANALOG INPUT, ULP SENSOR INTERFACE
22	GND	GND	GROUND
23	DIO 10	DIO	GPIO, ANALOG INPUT, ULP SENSOR INTERFACE
24	DIO 9	DIO	GPIO, ANALOG INPUT, ULP SENSOR INTERFACE
25	NC	-	NO CONNECT (DO NOT CONNECT)
26	NC	-	NO CONNECT (DO NOT CONNECT)
27	NC	-	NO CONNECT (DO NOT CONNECT)
28	NC	-	NO CONNECT (DO NOT CONNECT)
29	DIO 11	DIO	GPIO, ANALOG INPUT, ULP SENSOR INTERFACE
30	DIO 12	DIO	GPIO, ANALOG INPUT, ULP SENSOR INTERFACE
31	DIO 13	DIO	GPIO, ANALOG INPUT, ULP SENSOR INTERFACE
32	DIO 14	DIO	GPIO, ANALOG INPUT, ULP SENSOR INTERFACE
33	GND	GND	GROUND
34-39	GND	GND	GROUND AND THERMAL RELIEF PADS

PI = Power Input GND = Ground DI = Digital Input DO = Digital Output DIO = Digital Input/Output AI = Analog Input
RF = Bi-directional RF Port Note: See the Texas Instruments CC2640 datasheet and user guide for further details on the I/O.

Table 1 SaBLE-x Pin Descriptions

The information in this document is subject to change without notice.

ELECTRICAL SPECIFICATIONS

Absolute Maximum Ratings

Symbol	Description	Min	Max	Unit
VCC	Digital Input Supply Voltage	-0.3	4.1	V
Voltage on any digital pin		-0.3	VCC+0.3, max 4.1	V
Input RF level			+5	dBm

Table 2 Absolute Maximum Ratings¹

Recommended Operating Conditions

Test conditions: Ambient Temp = 25°C

Symbol	Min	Typ	Max	Unit
VCC	1.8	3.3	3.8	V

Table 3 Recommended Operating Conditions

General Characteristics

Characteristic	Description
Model Name	SaBLE-x
Product Description	Bluetooth Low Energy Wireless Module
Dimension	11.63 mm x 17.86 mm x 2.4 mm (W*L*T)
Operating temperature	-40°C to 85°C
Storage temperature	-40°C to 85°C
Humidity	Operating Humidity 10% to 95% Non-Condensing Storage Humidity 5% to 95% Non-Condensing
Weight	0.75g +/- 0.05g

Table 4 General Characteristics

¹ Under no circumstances should exceeding the ratings specified in the Absolute Maximum Ratings section be allowed. Stressing the module beyond these limits may result permanent damage to the module that is not covered by the warranty.

DC Characteristics

Parameter	Test Conditions	Min	Typ	Max	Unit
Input low-to-high transition with hysteresis	Transition from 0→1, T _A = 25C, VCC=1.8V		1.07		V
Input high-to-low transition with hysteresis	Transition from 1→0, T _A = 25C, VCC=1.8V		.74		V
Input hysteresis	Difference between 0→1 and 1→0.		.33		V
Input low-to-high transition with hysteresis	Transition from 0→1, T _A = 25C, VCC=3.8V		1.94		V
Input high-to-low transition with hysteresis	Transition from 1→0, T _A = 25C, VCC=3.8V		1.54		V
Input hysteresis	Difference between 0→1 and 1→0.		.4		V
Logic-0 output voltage, 4 mA pins	Output load 4 mA, T _A = 25C, VCC=1.8V		.26		V
Logic-1 output voltage, 4 mA pins	Output load 4 mA, T _A = 25C, VCC=1.8V		1.54		V
Logic-0 output voltage, 8 mA pins	Output load 8 mA, T _A = 25C, VCC=1.8V		.21		V
Logic-1 output voltage, 8 mA pins	Output load 8 mA, T _A = 25C, VCC=1.8V		1.58		V
Logic-0 output voltage, 4 mA pins	Output load 4 mA, T _A = 25C, VCC=3.0V		.33		V
Logic-1 output voltage, 4 mA pins	Output load 4 mA, T _A = 25C, VCC=3.0V		2.72		V
Logic-0 output voltage, 8 mA pins	Output load 8 mA, T _A = 25C, VCC=3.0V		.28		V
Logic-1 output voltage, 8 mA pins	Output load 8 mA, T _A = 25C, VCC=3.0V		2.68		V
Input pullup current	Vpad=0V, T _A = 25C, VCC=1.8V		72		uA
Input pulldown current	Vpad=1.8V, T _A = 25C, VCC=1.8V		22		uA
Input pullup current	Vpad=0V, T _A = 25C, VCC=3.8V		277		uA
Input pulldown current	Vpad=3.8V, T _A = 25C, VCC=3.8V		113		uA

Table 5 SaBLE-x Module Bluetooth General DC Characteristics

General Power Consumption

T_A = 25°C and VCC = 3 V

Parameter	Test Conditions	Min	Typ	Max	Unit
Shutdown	No clocks running, no data retention		200		nA
Standby 1	With RTC, CPU, RAM and partial register retention. XOSC_LF		1.2		uA
Standby 2	With Cache, RTC, CPU, RAM and partial register retention. XOSC_LF		2.7		uA
Idle	Supply Systems and RAM powered.		550		uA
Active	Core running CoreMark		1.45mA + 31uA/MHz		
Radio Receive			6.1		mA
Radio Transmit	+5 dBm output power		9.1		mA

Table 6 SaBLE-x Module Bluetooth Power Consumption Specifications

AGENCY CERTIFICATIONS

FCC ID: TFB-1002, 15.247

IC ID: 5969A-1002, RSS 210

CE: Compliant to standards EN 60950-1, EN 300 328, and EN 301 489

AGENCY STATEMENTS

Federal Communication Commission Interference Statement

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 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.

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 portable transmitter with its antenna complies with FCC/IC RF exposure limits for general population / uncontrolled exposure.

FCC CAUTION: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Industry Canada Statements

This device complies with Industry Canada License-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

This device has been designed to operate with the antenna(s) listed below, and having a maximum gain of 0 dBi (PCB Trace), 2.0 dBi (LSR 2.4 GHz Dipole), 2.0 dBi (LSR 2.4 GHz FlexPIFA), and 2.0 (LSR 2.4 GHz FlexNotch). Antennas not included in this list or having a gain greater than 0 dB, 2.0 dBi, 2.0 dBi, and 2.0 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

List of all Antennas Acceptable for use with the Transmitter

- 1) On module PCB trace antenna.
- 2) LSR 001-0001 center-fed 2.4 GHz dipole antenna and LSR 080-0001 U.FL to Reverse Polarity SMA connector cable.
- 3) LSR 001-0014 2.4 GHz FlexPIFA antenna.
- 4) LSR 001-0015 2.4 GHz FlexNotch antenna.

Cet appareil est conforme aux normes d'Industrie Canada exempts de licence RSS (s). L'opération est soumise aux deux conditions suivantes: (1) cet appareil ne peut pas provoquer d'interférences et (2) cet appareil doit accepter toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.

Pour réduire le risque d'interférence aux autres utilisateurs, le type d'antenne et son gain doivent être choisis de manière que la puissance isotrope rayonnée équivalente (PIRE) ne dépasse pas celle permise pour une communication réussie.

Cet appareil a été conçu pour fonctionner avec l'antenne (s) ci-dessous, et ayant un gain maximum de 0 dBi (PCB Trace), 2,0 dBi (LSR 2.4 GHz Dipole), 2,0 dBi (LSR 2.4 GHz FlexPIFA), et 2,0 dBi (LSR 2.4 GHz FlexNotch). Antennes pas inclus dans cette liste ou présentant un gain supérieur à 0 dB, 2,0 dBi, 2,0 dBi, et 2,0 dBi sont strictement interdites pour une utilisation avec cet appareil. L'impédance d'antenne requise est de 50 ohms.

Liste de toutes les antennes acceptables pour une utilisation avec l'émetteur

- 1) Le module d'antenne PCB trace.
- 2) LSR 001-0001 centre-fed 2,4 GHz antenne dipôle et LSR 080-0001 U.FL pour inverser câble connecteur SMA à polarité.
- 3) LSR 001-0014 antenne FlexPIFA 2,4 GHz.
- 4) LSR 001-0015 antenne FlexNotch 2,4 GHz.

OEM RESPONSIBILITIES TO COMPLY WITH FCC AND INDUSTRY CANADA REGULATIONS

The SaBLE-xModule has been certified for integration into products only by OEM integrators under the following conditions:

The antennas for this transmitter must not be co-located with any other transmitters except in accordance with FCC and Industry Canada multi-transmitter procedures. Co-location means having a separation distance of less than 20 cm between transmitting antennas.

As long as the two conditions above are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

IMPORTANT NOTE: In the event that these conditions cannot be met (for certain configurations or co-location with another transmitter), then the FCC and Industry Canada authorizations are no longer considered valid and the FCC ID and IC Certification Number cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC and Industry Canada authorization.

Le module de SaBLE-xa été certifié pour l'intégration dans des produits uniquement par des intégrateurs OEM dans les conditions suivantes:

Les antennes pour ce transmetteur ne doit pas être co-localisés avec les autres émetteurs sauf en conformité avec la FCC et Industrie Canada multi-émetteur procédures. Co-localisation des moyens ayant une distance de séparation inférieure à 20 cm entre les antennes d'émission.

Tant que les deux conditions précitées sont réunies, les tests de transmetteurs supplémentaires ne seront pas tenus. Toutefois, l'intégrateur OEM est toujours responsable de tester leur produit final pour toutes les exigences de conformité supplémentaires requis avec ce module installé (par exemple, les émissions appareil numérique, les exigences de périphériques PC, etc.)

NOTE IMPORTANTE: Dans le cas où ces conditions ne peuvent être satisfaites (pour certaines configurations ou de co-implantation avec un autre émetteur), puis la FCC et Industrie autorisations Canada ne sont plus considérés comme valides et l'ID de la FCC et IC numéro de certification ne peut pas être utilisé sur la produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'un distincte de la FCC et Industrie Canada l'autorisation.

OEM LABELING REQUIREMENTS FOR END-PRODUCT

The SaBLE-x module is labeled with its own FCC ID and IC Certification Number. The FCC ID and IC certification numbers are not visible when the module is installed inside another device, as such the end device into which the module is installed must display a label referring to the enclosed module. The final end product must be labeled in a visible area with the following:

“Contains Transmitter Module FCC ID: TFB-1002”

“Contains Transmitter Module IC: 5969A-1002”

or

“Contains FCC ID: TFB-1002”

“Contains IC: 5969A-1002”

The OEM of the SaBLE-x module must only use the approved antenna(s) listed above, which have been certified with this module.

Le module de SaBLE-x est étiqueté avec son propre ID de la FCC et IC numéro de certification. L'ID de la FCC et IC numéros de certification ne sont pas visibles lorsque le module est installé à l'intérieur d'un autre appareil, comme par exemple le terminal dans lequel le module est installé doit afficher une étiquette faisant référence au module ci-joint. Le produit final doit être étiqueté dans un endroit visible par le suivant:

“Contient Module émetteur FCC ID: TFB-1002”

“Contient Module émetteur IC: 5969A-1002”

ou

“Contient FCC ID: TFB-1002”

“Contient IC: 5969A-1002”

Les OEM du module SaBLE-x ne doit utiliser l'antenne approuvée (s) ci-dessus, qui ont été certifiés avec ce module.

OEM END PRODUCT USER MANUAL STATEMENTS

The OEM integrator should not provide information to the end user regarding how to install or remove this RF module or change RF related parameters in the user manual of the end product.

Other user manual statements may apply.

L'intégrateur OEM ne devraient pas fournir des informations à l'utilisateur final sur la façon d'installer ou de supprimer ce module RF ou modifier les paramètres liés RF dans le manuel utilisateur du produit final.

Autres déclarations manuel de l'utilisateur peuvent s'appliquer.

EUROPE

CE Notice

This device has been tested and certified for use in the European Union. See the Declaration of Conformity (DOC) for specifics.

If this device is used in a product, the OEM has responsibility to verify compliance of the final product to the EU standards. A Declaration of Conformity must be issued and kept on file as described in the Radio and Telecommunications Terminal Equipment (R&TTE) Directive.

The 'CE' mark must be placed on the OEM product per the labeling requirements of the Directive.

Declaration of Conformity (DOC)

The DOC can be downloaded from the LSR Wiki.

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