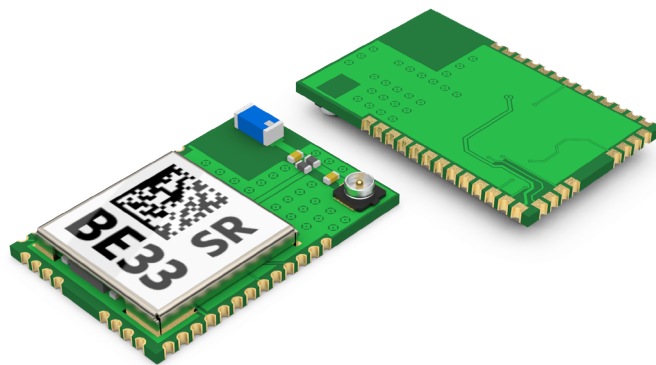


CELIUM DEVICES

Short range radio modules



BE33

Standalone, High performance BLE 5
Engines

DATASHEET

REV02

Document information

Product family	BE
Product name	BE33
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Product Name	Ext. Number	Firmware Version	Status
BE33	Nil	v1.0	Initial production

Document history

Document Name	Revision	Date
BE33 Datasheet	REV01	30-06-2020
BE33 Datasheet	REV02	14-09-2020

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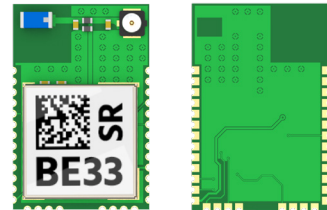
BE33

High performance, Ultra low power, Long range BLE 5.2 modules

1. Overview

BE33 is a high performance, super efficient BLE 5.2 module, targeted for applications where highly reliable wireless connection, ultra low power consumption and ease of integration are the key requirements.

BE33 modules are ideal for battery operated applications that require medium to long range connectivity. BE33 modules features a high performance integrated chip antenna with native USB 2.0 support.



2. Key features

Protocols	v5.2 BLE, BLE Mesh, ANT+, Proprietary 2.4 GHz RF, Zigbee, Thread	Role	Broadcaster, Observer, Central and Peripheral
Processor	ARM Cortex-M4 @ 64 MHz with FPU	Form factor	21 mm x 14 mm x 2.2 mm
RAM	128 kB	Footprint	Castellations 34
ROM	512 kB	Firmware	Celium Connectivity / Open core
Crystals	32 MHz	Max. Range	80 to 400 meters (Line of sight)
Antenna	Ceramic chip, u.FL Connector		Basis PHY mode

3. Applications

Lighting	Climate Monitoring Systems
Low Power Sensor Networks	Agriculture
Asset Tracking	Gaming Control
Access Control	Smart Toys
Beacons	Sports & Fitness
Personal Medical Devices	Industrial IoT

4. Block diagram

4.1 BE33

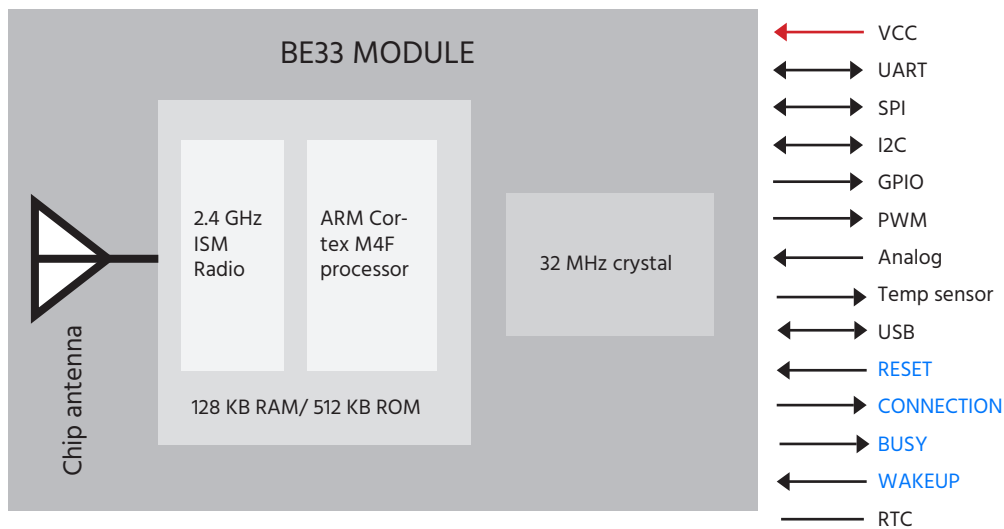


Figure 4.1: Block diagram

5. Specifications

5.1 Specification table

		BE33 - X	BE33 - X/AT
INTERFACES	UART (With Easy DMA)	2	•
	PWM (Channels)	4	-
	ADC (Channels)	4	-
	GPIO	18	-
	SPI (Master and Slave with Easy DMA)	3/3	-
	I2C (Master and slave)	2/2	-
	I2S	1	-
	PDM (Pulse Density Modulation)	1	-
PERIPHERALS	Temperature sensor	1	-
	RTC	2	-
	32 Bit timer with counter	3	-
RADIO	Bluetooth qualification	v5.2	v5.2
	Max transmission current @ 0 dBm (mA)	6	6
	Max receiver current @ 0 dBm (mA)	6	6
	Receiver sensitivity (dBm)	-103	-103
DATARATES (OTA)	125 Kbps, 250 Kbps	•	•
	1 Mbps, 2 Mbps	•	•
MISC	NFC A-Tag	-	-
	Max simultaneous connections	20	12
	Max range (meters)	80-400	80-400

Table 5.1: Specifications table

5.2 Radio specifications

- 125 kbps, 250 kbps, 1 Mbps, 2 Mbps supported data rates
- -103 dBm at 125 kbps
- -95 dBm at 1 Mbps
- -99 dBm at 250 kbps
- -93 dBm at 1 Mbps
- -89 dBm at 2 Mbps
- Tx power -20 to +8 dBm in 4 dB steps
- RSSI (1 dB resolution)

6. Pin assignment

6.1 Pin diagram

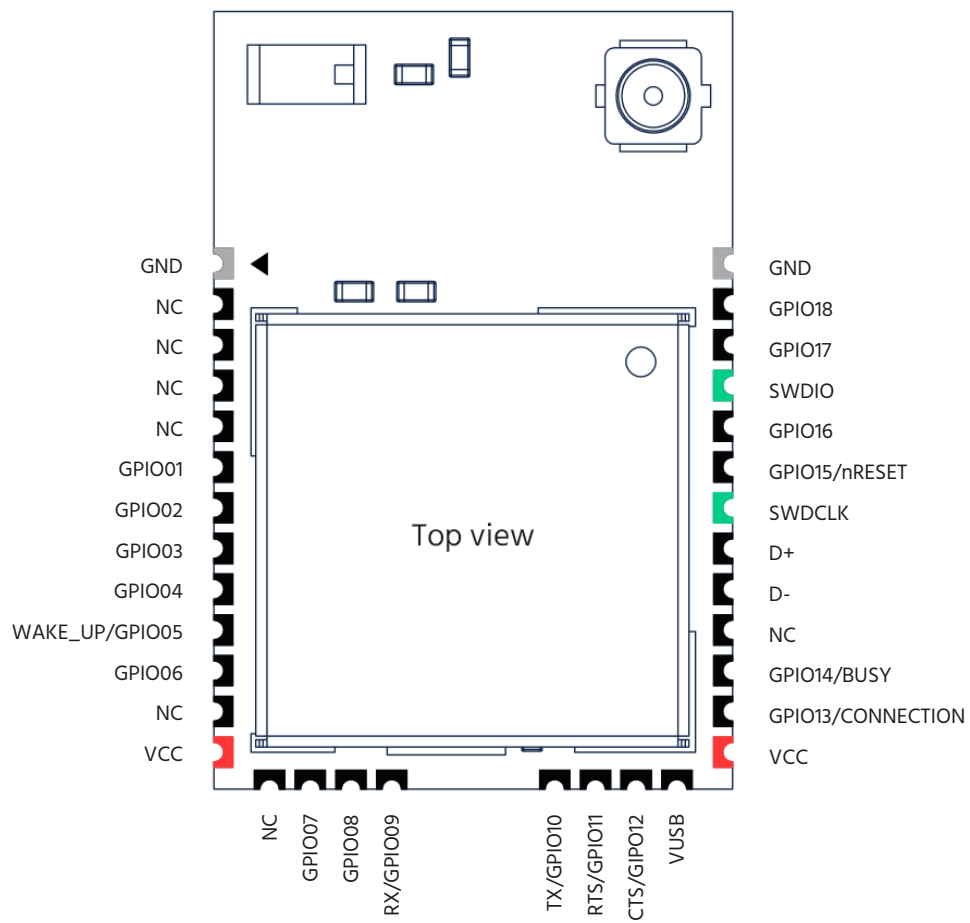


Figure 6.1: BE33 Pin diagram

6.2 Pin description

Pin No.	Pin name	Pin designation	Description
1	GND	GND	Ground
2	NC	NC	Not Connected
3	NC	NC	Not Connected
4	NC	NC	Not Connected
5	NC	NC	Not Connected
6	GPIO01	P0.03/AIN1	General Purpose I/O, Analog In 1
7	GPIO02	P0.02/AIN0	General Purpose I/O, Analog In 0
8	GPIO03	P0.28/AIN4	General Purpose I/O, Analog In 4
9	GPIO04	P0.29/AIN5	General Purpose I/O, Analog In 5
10	WAKE_UP/GPIO05	P0.30/AIN6	General Purpose I/O, Analog In 6
11	GPIO06	P0.31/AIN7	General Purpose I/O, Analog In 7
12	NC	NC	Not Connected
13	VCC	VCC	Power Supply, 3.3V
14	NC	NC	Not Connected
15	GPIO07	P0.00/XL1	General Purpose I/O, LF crystal 1
16	GPIO08	P0.01/XL2	General Purpose I/O, LF crystal 2
17	RX/GPIO09	P0.04/AIN2	General Purpose I/O, Analog In 2
18	TX/GPIO10	P0.05/AIN3	General Purpose I/O, Analog In 3
19	RTS/GPIO11	P1.09	General Purpose I/O
20	CTS/GIPIO12	P0.11	General Purpose I/O
21	VUSB	VUSB	USB power, 5V
22	VCC	VCC	Power Supply, 3.3V
23	CONNECTION/GPIO13	P0.15	General Purpose I/O
24	BUSY/GPIO14	P0.17	General Purpose I/O
25	NC	NC	Not Connected
26	D-	D-	USB D-
27	D+	D+	USB D+
28	SWDCLK	SWDCLK	Serial Wire Debug Clock
29	nRESET/GPIO15	P0.18/nRESET	General Purpose I/O, nRESET
30	GPIO16	P0.20	General Purpose I/O
31	SWDIO	SWDIO	Serial Wire Debug Data
32	GPIO17	P0.09/NFC1	General Purpose I/O, NFC1
33	GPIO18	P0.10/NFC2	General Purpose I/O, NFC2
34	GND	GND	Ground

Table 6.2: BE33 Pin description

7. Reference design

Figure 7.0 illustrates the reference schematic of the power supply design implemented for BE33 module.

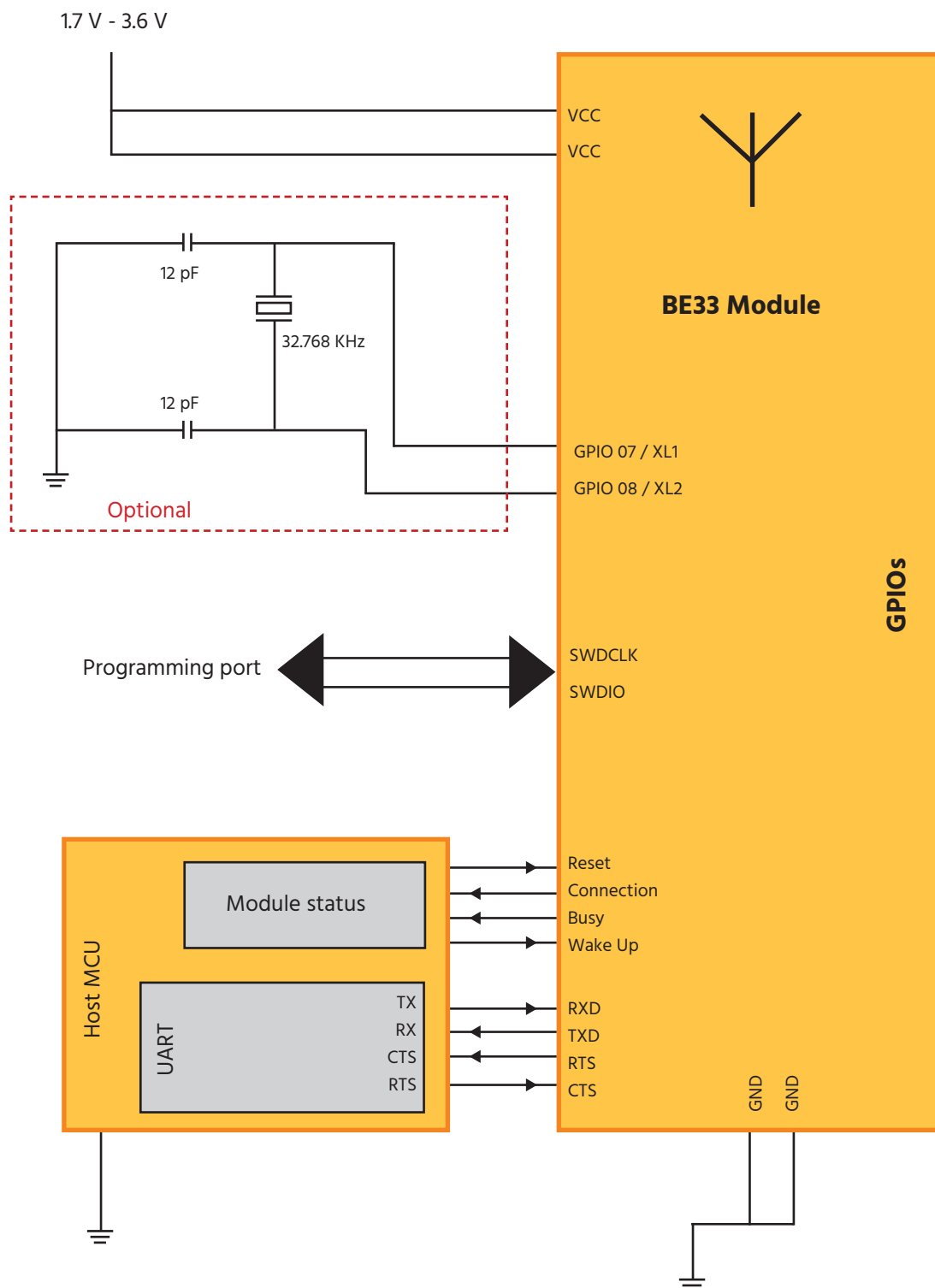


Figure 7.0: BE33 Reference design

8. Operating conditions

This section provides an overview of the operating and storage conditions of BE33 module.

Operating temperature	-40 C to 105 C
Storage temperature	-40 C to 125 C
Operating supply voltage	1.7 V to 3.6 V

Table 8.0: Operating conditions

9. Physical dimensions

9.1 Module dimensions

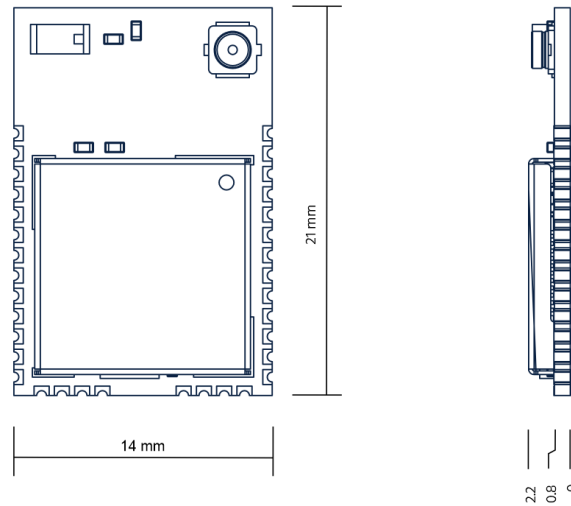


Figure 9.1: BE33 dimensions

9.2 PCB Footprint

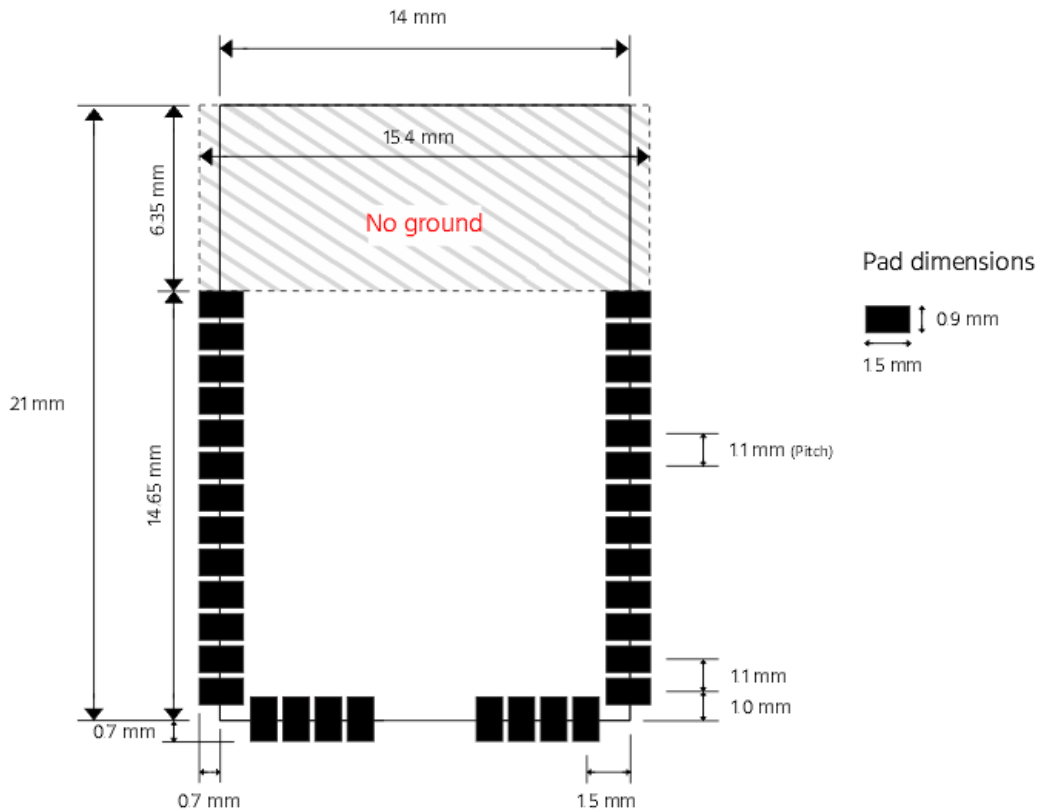


Figure 9.2: BE33 PCB Footprint

10. Module placement

Any wireless systems require proper placement on host PCBs for optimum RF performance. For BE33 module, we recommend that the area underneath the antenna on host PCB should not contain any copper on the top, inner and bottom layers. The module should be placed in such way that it should be away for at least 3 mm from any metals, electrolytic capacitors, inductors and other RF systems.

Recommended placements for optimum placements are shown below.

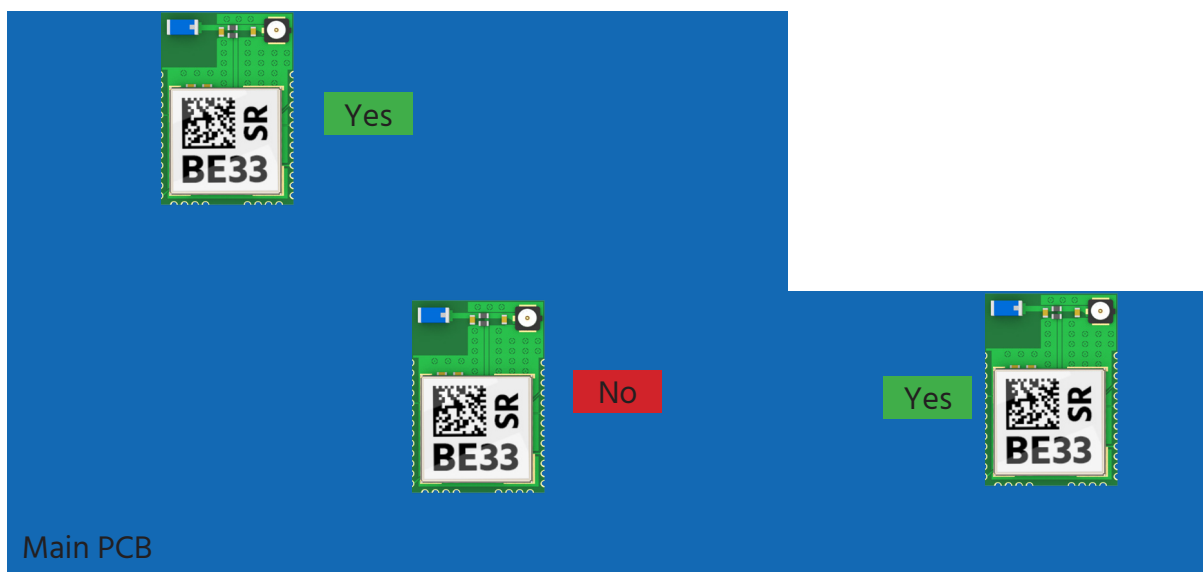


Figure 10.0: Recommended module placement

11. Reflow profile

BE33 is highly recommended to be assembled using a standard lead-free reflow profile, IPC/JEDEC J-STD-020. It can be soldered to host PCB by using the standard leaded and lead-free solder reflow profile as per below details.

Profile feature	Pb-Free assembly
Avg ramp up rate ($T_{s_{max}}$ to T_p)	3°C/second max
Preheat:	
- Temperature Min ($T_{s_{min}}$)	150°C
- Temperature Max ($T_{s_{max}}$)	200°C
- Time ($T_{s_{min}}$ to $T_{s_{max}}$) (ts)	60 - 180 sec
Time maintained above:	
- Temperature (T)	217 °C
- Time (t)	60 - 150 sec
Peak temperature (T_p)	260 +5 °C
Time within 5°C of actual peak temperature (t_p) ²	20 - 40 seconds
Ramp-down rate	6°C/second max
Time - 25°C to peak temperature	8 minutes max

Table 11.0: Pb-free reflow profile

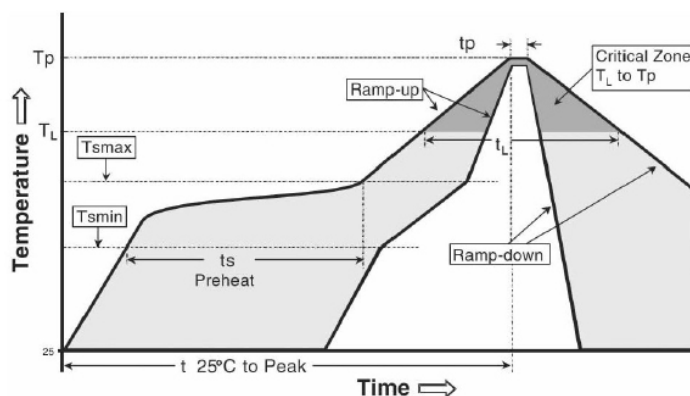


Figure 11.0: Pb-free reflow profile

Note 1: All temperatures refer to topside of the package, measured on the package body surface.
 Note 2: Time within 5 °C of actual peak temperature (t_p) specified for the reflow profiles is a “supplier” minimum and “user” maximum.

12. Ordering information

Table below provides the ordering information for the BE33 module.

Sl. No	Device	Description	Version	Shield	Antenna	Ordering Number
1	BE33	Ultra-low power, standalone , Long range Bluetooth 5 engine without firmware	Open core	Yes	Integrated chip	BE33-C
2	BE33	Ultra-low power, standalone, Long range Bluetooth 5 engine with firmware	Celium connectivity firmware	Yes	Integrated chip	BE33-C/AT
3	BE33	Ultra-low power, standalone, Long range Bluetooth 5 engine without firmware	Open core	Yes	U.FL Connector	BE33-U
4	BE33	Ultra-low power, standalone, Long range Bluetooth 5 engine with firmware	Celium connectivity firmware	Yes	U.FL Connector	BE33-U/AT

Mail us at sales@celium.world for the latest pricing and distributor information.

Table 12.0 : Ordering information

13. Additional resources

1. BE33 product brief : Product brief for the BE33 module for getting started.
2. BE33 Serial command : Firmware release document for Serial-Command.

14. Contact information

Worldwide Sales and Support

For general support	support@celium.world
For technical support	technical@celium.world
For sales	sales@celium.world

15. Appendix

15.1 Document history

REV01

Initial release of datasheet - Date 30-06-2020

REV02

Error correction in Specification table wrt to No of GPIOs - 14-09-2020