

## **BLE60 Datasheet**

Amp'ed RF Technology, Inc.

## BLE60 Product Specification



13.5mm x 10.5mm x 2.6mm

### Description

Amp'ed RF Technology presents the BLE60 Smart Ready Bluetooth module supporting v5.2 Bluetooth Low Energy. Including an integrated internal antenna, the BLE60 provides a complete ready-to-use RF platform. The BLE60 is a surface mount PCB module, with pre-tested RF regulatory certifications improving time to market and reliability. A ready to use AT command set enables instant BLE connectivity usage cases.

### BLE60 features

#### Bluetooth features

- Bluetooth v5.2 Smart Ready
- 1Mbps data throughput
- 128-bit encryption security

#### Hardware configuration

- Cortex-M0 microprocessor
- 128K bytes Flash memory
- 64K bytes RAM memory
- 96K bytes ROM memory
- Two UARTs
- Up to 8 general purpose I/Os
- 1 SPI

#### Embedded software

- BLE protocol stack
- AT command set

#### Additional documentation

- BLE Application Note

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## 1. Hardware Specifications

General Conditions ( $V_{IN}$ = 3.0V and 25°C)

### 1.1. Recommended Operating Conditions

Rating	Min	Typical	Max	Unit
Operating Temperature Range	-40	-	85	°C
Supply Voltage $V_{IN}$	2.4	3.0	3.6	Volts
Signal Pin Voltage	-	$0.7V_{DDIO} \sim V_{DDIO}$	-	Volts
RF Frequency	2400	-	2483.5	MHz

### 1.2. Absolute Maximum Ratings

Rating	Min	Typical	Max	Unit
Storage temperature range	-55	-	+150	°C
Supply voltage $V_{IN}$	-0.3	-	+5.0	Volts
I/O pin voltage $V_{IO}$	-0.3	-	+5.5	Volts
RF input power	-	-	0	dBm

### 1.3. Current Consumption

Modes (Typical Power Consumption)	Avg	Unit
Deep sleep mode	6	uA
Sleep mode	8	uA
Idle mode	0.9	mA
Rx mode	13.6	mA
Tx mode	13.3	mA

#### 1.4. Selected RF Characteristics

Parameters	Conditions	Typical	Unit
Antenna load		50	ohm
Radio Receiver			
Sensitivity level	BER < .001 with DH5	-92	dBm
Maximum usable level	BER < .001 with DH1	0	dBm
Input VSWR		2.5:1	
Radio Transmitter			
Maximum output power	50 Ω load	+4	dBm
Initial Carrier Frequency Tolerance		0	kHz
20 dB Bandwidth for modulated carrier		935	kHz

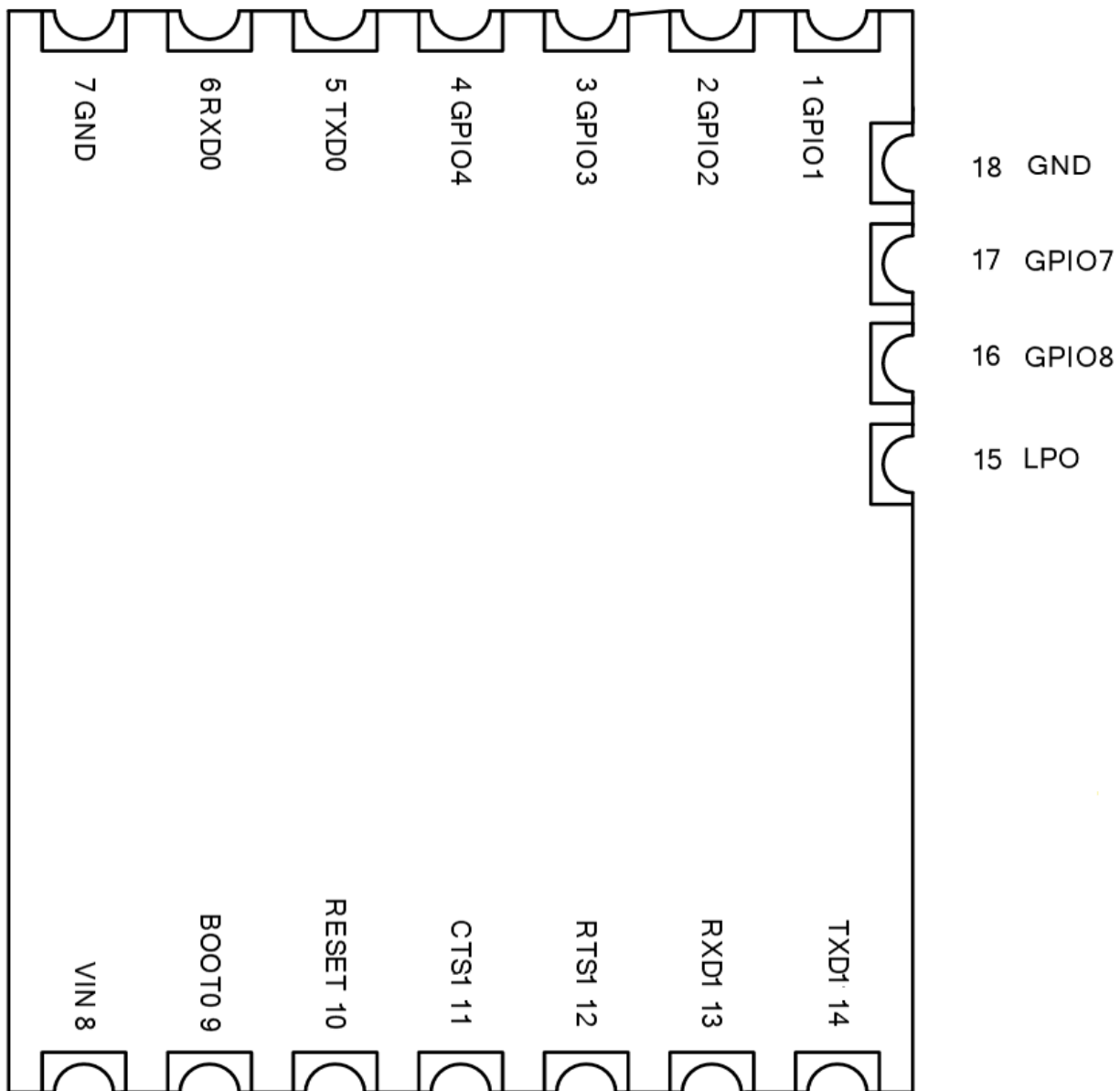
#### 1.5. I/O Operating Characteristics

Symbol	Parameter	Min	Max	Unit	Conditions
V <sub>IL</sub>	Low-Level Input Voltage	-	0.3 × VCC	Volts	V <sub>IN</sub> , 3.0V
V <sub>IH</sub>	High-Level Input Voltage	0.7 × VCC	-	Volts	V <sub>IN</sub> , 3.0V
V <sub>OL</sub>	Low-Level Output Voltage	-	0.1 × VCC	Volts	V <sub>IN</sub> , 3.0V
V <sub>OH</sub>	High-Level Output Voltage	0.9 × VCC	-	Volts	V <sub>IN</sub> , 3.0V

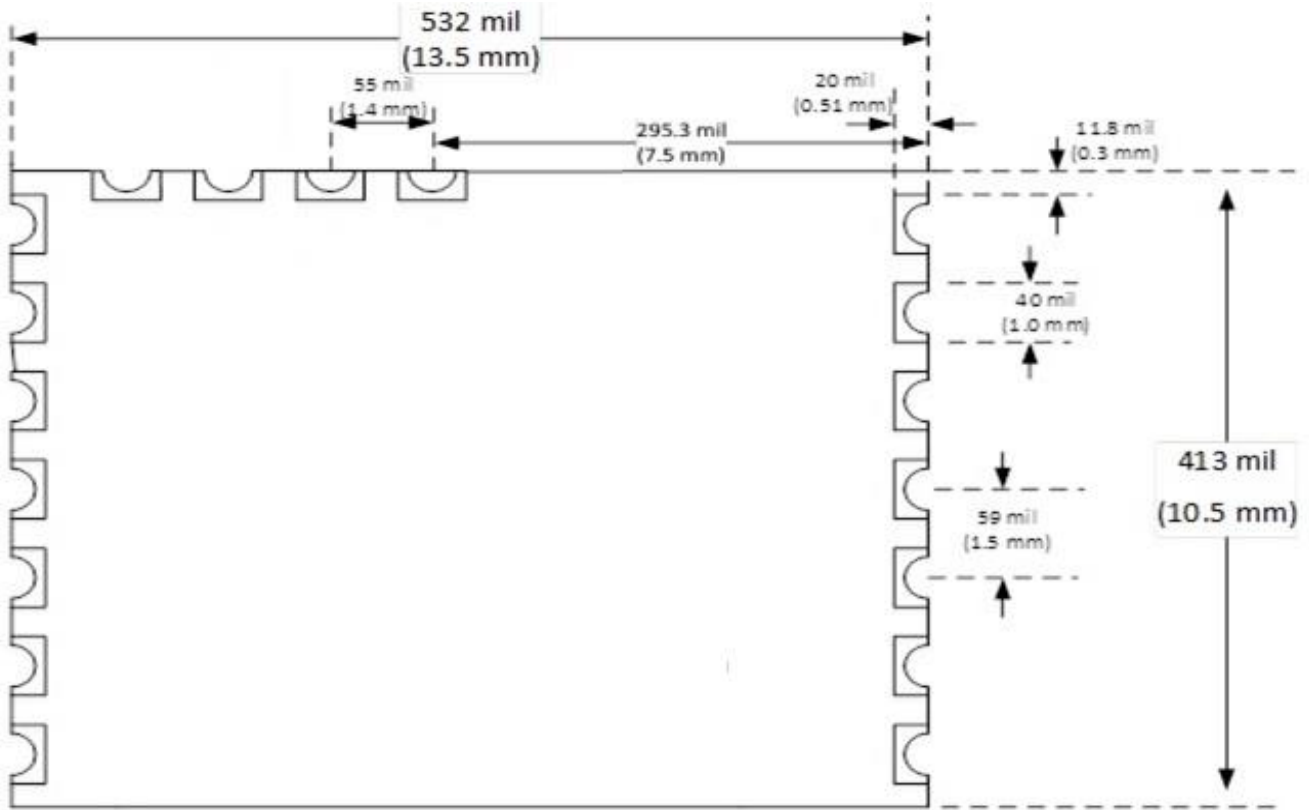
## 1.6. Pin Assignment

Name	Type	Pin #	Description
UART Interface			
RXD1	I	13	Receive data/ SPI_MISO
TXD1	O	14	Transmit data/SPI_MOSI
RTS1	O	12	Request to send (active low)/ SPI_CLK
CTS1	I	11	Clear to send (active low) /SPI_CS
Power and Ground			
VIN		8	VIN
GND		7	GND
GND		18	GND
Reset			
RESETN	I	10	Reset input
LPO			
LPO	I	15	Low power clock input Connect an external source when using PN: BLE60. Be left floating with PN: BLE60_LP
Fast boot			
Fast boot	I	9	Fast boot enable
GPIO			
GPIO1		1	GPIO1/SWCLK/ADC_IN3
GPIO2		2	GPIO2/SWDIO/ADC_IN2
GPIO3		3	GPIO3/PWM output 0
GPIO4		4	GPIO4/CLK output 0
TXD0		5	TXD0/GPIO5
RXD0		6	RXD0/GPIO6
GPIO7		16	GPIO7/SDA
GPIO8		17	GPIO8/SCL/ PWM output 1

1.7. Pin Placement Diagram (Top View)



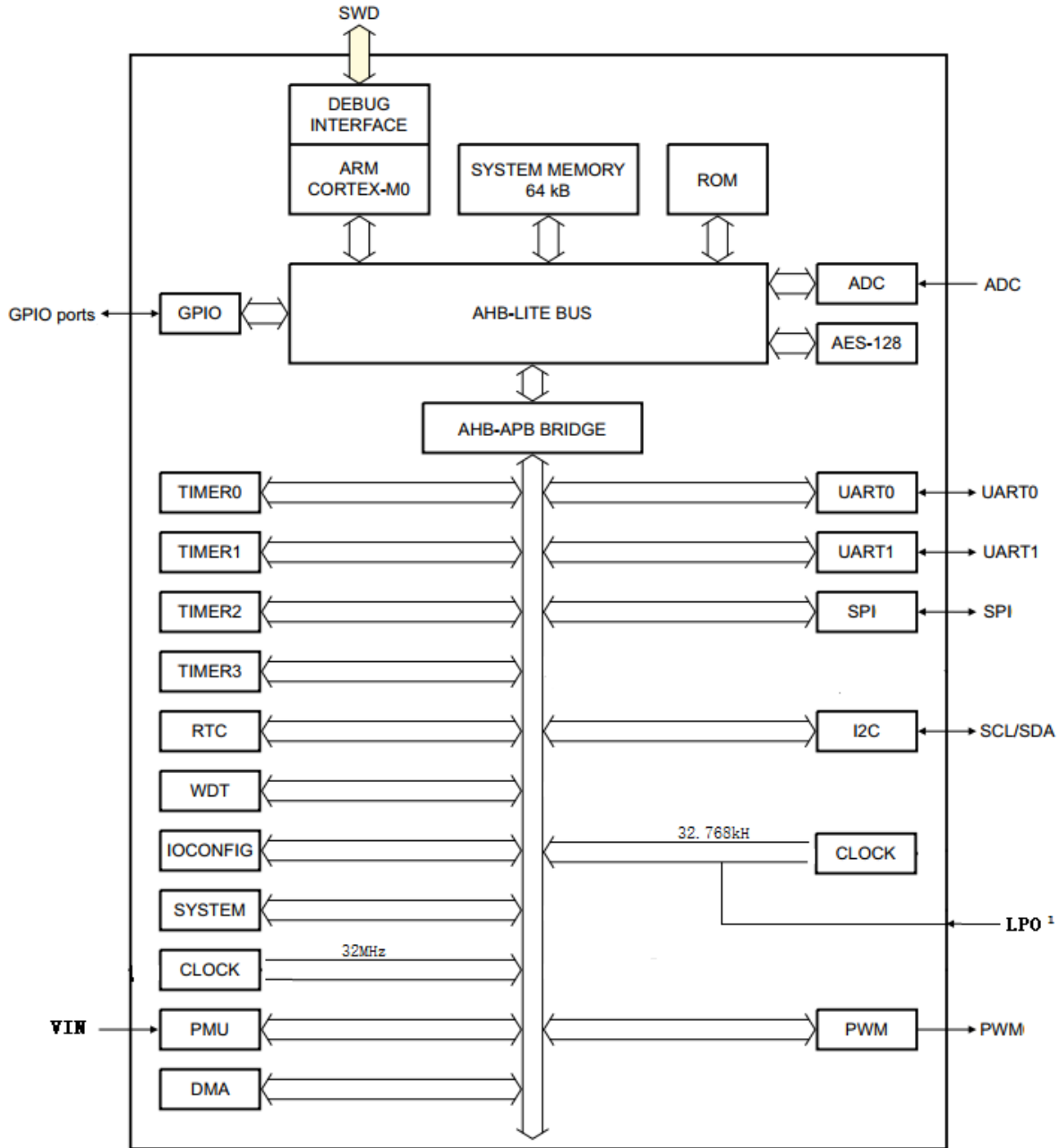
1.8. Layout Drawing



13.5 mm x 10.5 mm x 2.6 mm (+/- 0.2mm, height tolerance)



## 2. Module Block Diagram



An external source may optionally supply the slow clock to the LPO pin when using PN: BLE60. This clock is already supplied on the module with PN: BLE60\_LP, and no additional circuitry is needed.

### 3. Hardware Design

#### Notes

- All unused pins should be left floating; do not ground.
- All GND pins must be well grounded.
- The area around the antenna should be free of any ground planes, power planes, trace routings, or metal for at least 5 mm in all directions.
- Traces should not be routed underneath the module.
- The BLE60s must be reprogrammed via UART0.

#### 3.1. Module Reflow Installation

The BLE60 is a surface mount Bluetooth module supplied on an 18 pin, 6-layer PCB. The final assembly recommended reflow profiles are:

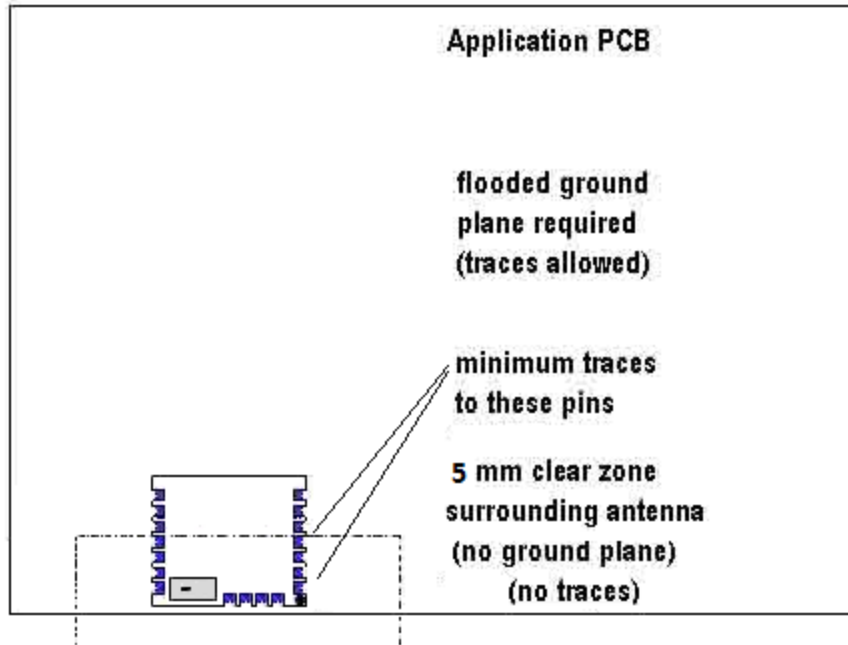
For RoHS/Pb-free applications, Sn96.5/Ag3.0/Cu0.5 solder is recommended.

- Maximum peak temperature of 230° - 240°C (below 250°C).
- Maximum rise and fall slope after liquidous of < 2°C/second.
- Maximum rise and fall slope after liquidous of < 3°C/second.
- Maximum time at liquidous of 40 – 80 seconds.

#### 3.2. GPIO Interface

All GPIOs are capable of sinking and sourcing 6mA of I/O current.

### 3.3. PCB Layout Guidelines



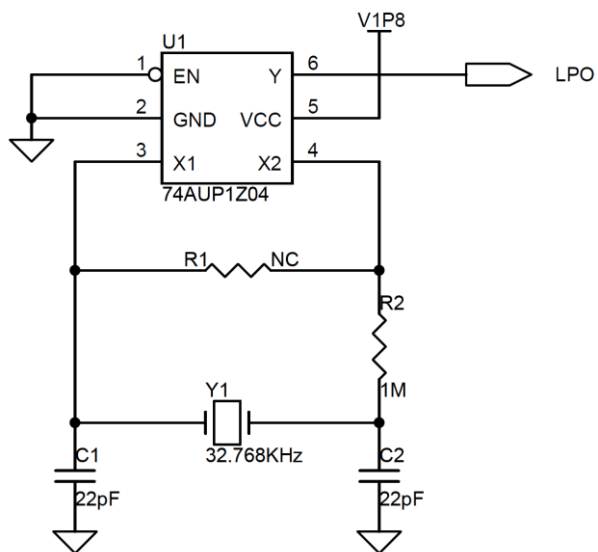
### 3.4. External LPO Input Circuit

An external source may optionally supply the slow clock to the LPO pin when using PN: BLE60. This clock is already supplied on the module with PN: BLE60\_LP, and no additional circuitry is needed. The source must be a digital signal in the range of 0.1V to Vcc. The accuracy of the slow clock frequency must be 32.768 KHz  $\pm$ 100 ppm.

#### 3.4.1. Low power circuit requirements

Module part number	Low power usage	External LPO circuit required
BLE60	No	Not required
BLE60	Yes	Required
BLE60_LP	Yes or no	Not required

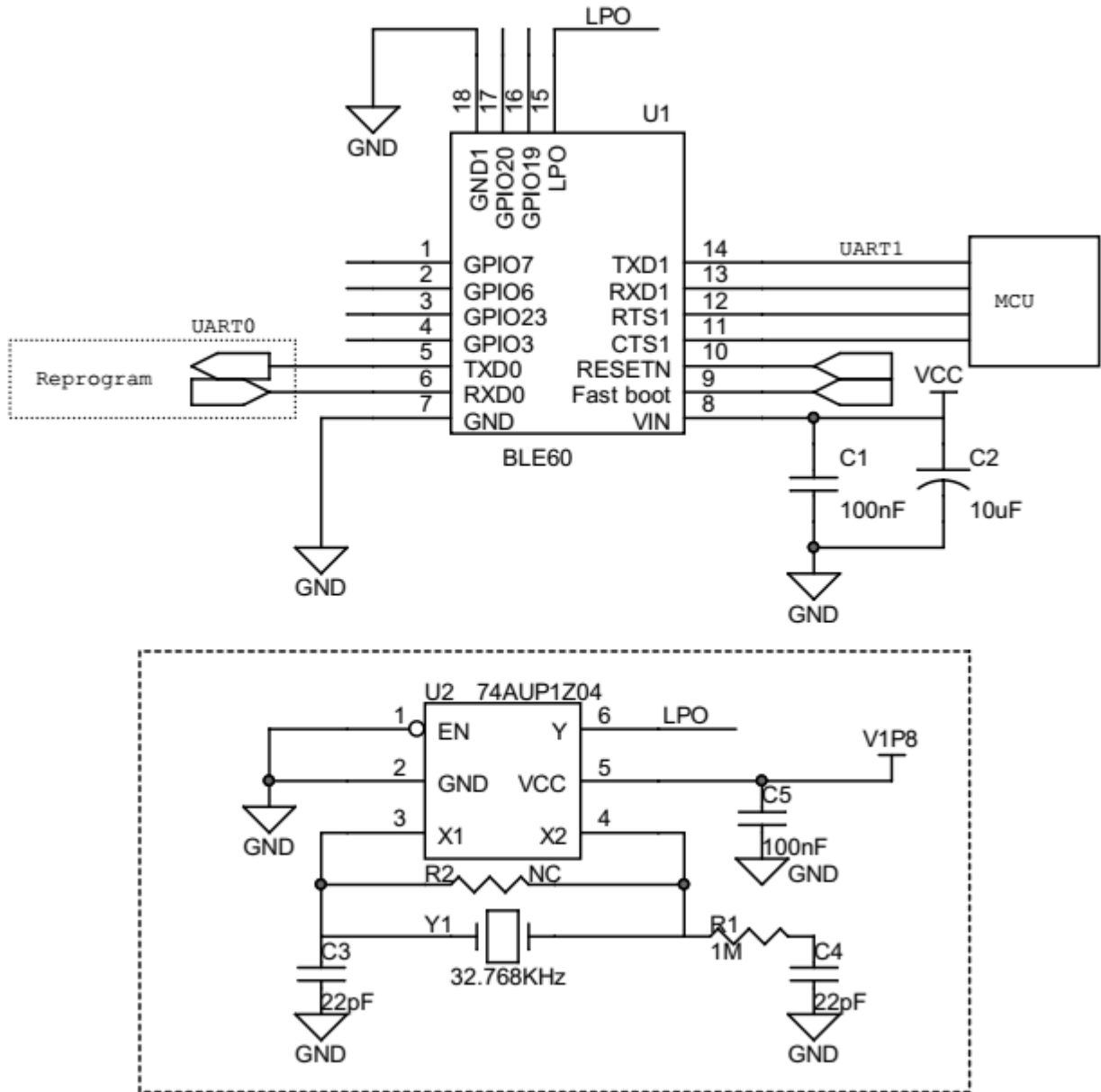
### 3.4.2. External LPO circuit example



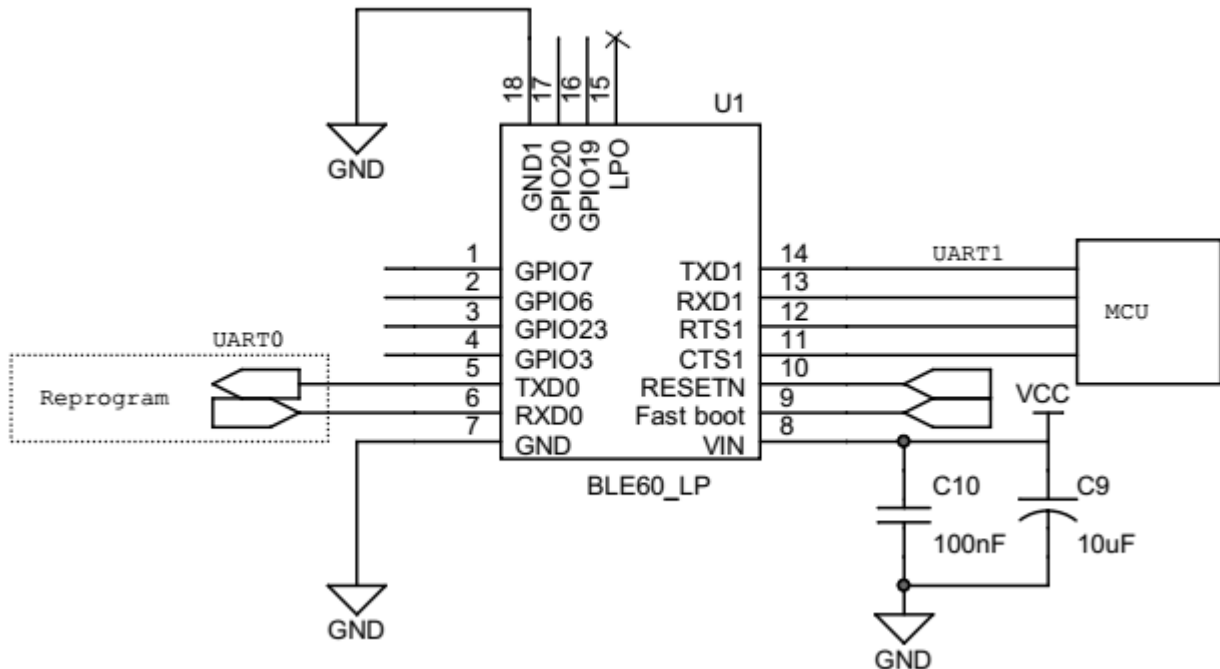
External LPO Reference Circuit

### 3.5. Application Reference Design

#### 3.5.1. Reference Design with EXT LPO



### 3.5.2. Reference Design with INT LPO



Notes: The LPO pin should be left floating; do not ground.

## 4. Regulatory Compliance

### Federal Communications Commission statement:

This module has been tested and found to comply with the FCC Part15.

These limits are designed to provide reasonable protection against harmful interference in approved installations. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

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.

Modifications or changes to this equipment not expressly approved by Amp'ed RF Technology may void the user's authority to operate this equipment.

The modular transmitter must be equipped with either a permanently affixed label or must be capable of electronically displaying its FCC identification number

(A) If using a permanently affixed label, the modular transmitter must be labeled with its own FCC identification number, and, if the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: X3ZBLEMOD1" or "Contains FCC ID: X3ZBLEMOD1."

(B) If the modular transmitter uses an electronic display of the FCC identification number, the information must be readily accessible and visible on the modular transmitter or on the device in which it is installed. If the module is installed inside another device, then the outside of the device into which the module is installed must display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains FCC certified transmitter module(s)."

To satisfy FCC RF Exposure requirements for mobile and base station transmission devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

#### **Industry Canada statement:**

Label of the end product:

The final product must be labeled in a visible area with the following "Contains transmitter module IC: TBD"  
This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

This device complies with RSS-210 of the Industry Canada 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.

Ce dispositif est conforme à la norme CNR-210 d'Industrie Canada applicable aux appareils radio exempts de licence. Son fonctionnement est sujet aux deux conditions suivantes: (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

#### **4.1. Modular Approval, FCC and IC**

FCC ID: X3ZBLEMOD1

IC: 8828A-BLE1

In accordance with FCC Part 15, the BLE60 is listed above as a Modular Transmitter device.

#### **4.2. FCC Label Instructions**

The outside of final products that contain a BLE60 device must display a label referring to the enclosed module. This exterior label can use wording such as the following:

Contains Transmitter Module

FCC ID: X3ZBLEMOD1

IC: 8828A-BLE1

Any similar wording that expresses the same meaning may be used.

#### 4.3. CE Label Instructions

TBD

#### 4.4. Bluetooth Certification

Bluetooth QDID:

### 5. Ordering Information

Part Name	Description
BLE60	BLE module, no LPO
BLE60_LP	BLE module, with LPO

### 6. Revision History

Date	Revision	Description
28, Dec 2018	1.0	Initial version
10, Jan, 2019	1.1	Added application reference design
27, Mar, 2019	1.2	Updated pinout chart
30, Apr, 2019	1.3	FCC and IC certifications