

## **BT50 Datasheet**

Amp'ed RF Technology, Inc.

## BT50 Product Specification



13.5mm x 10.5mm x 2.6mm

### Description

Amp'ed RF Technology presents the BT50 Smart Ready Bluetooth module supporting v4.1 Bluetooth Low Energy and Classic: dual mode. Including an integrated internal or external antenna option, the BT50 provides a complete ready-to-use RF platform.

The BT50 is a surface mount PCB module, with pre-tested RF regulatory certifications improving time to market and reliability.

Fully compatible with our AmpedUP embedded protocol stack, the BT50 may be matched with many Host MCU chipsets. Additionally, Linux and other OS systems can host the BT50.

### BT50 features

#### Bluetooth features

- FCC, IC, CE & Bluetooth certified
- Bluetooth v4.1 Smart Ready
- Class 1 radio
- Range up to 80m LOS
- 1.5Mbps data throughput
- 128-bit encryption security

#### Hardware configuration

- UART H4 HCI interface
- PCM interface
- 1 LPO input

#### Embedded software

- Amp'edUP dual mode Bluetooth stack: BT Classic and BT Low Energy
- abSerial, AT command set
- SDK, Software Development Kit (Optional)

#### Additional documentation

- abSerial User Guide
- abSerial Reference Guide
- abSerial Configuration Guide

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## 1. Hardware Specifications

General Conditions ( $V_{IN}$  = 2.5V and 25°C)

### 1.1. Recommended Operating Conditions

Rating	Min	Typical	Max	Unit
Operating Temperature Range	-40	-	85	°C
Supply Voltage $V_{IN}$	2.2	2.5	4.8	Volts
Signal Pin Voltage	-	1.8	-	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	-	-	-5	dBm

### 1.3. Current Consumption

Modes (Typical Power Consumption)	Avg	Unit
ACL data 115K Baud UART at max throughput (Master)	14	mA
ACL data 115K Baud UART at max throughput (Slave)	16	mA
Connection, no data traffic, master	4.2	mA
Connection, no data traffic, slave	6.4	mA
Connection, 375ms sniff, slave	390	µA
Standby, without deep sleep	3.9	mA
Standby, with deep sleep	90	µA
Page/Inquiry Scan, with deep sleep	600	µA
BLE Advertising, 1.28s, non-connectable	175	µA
BLE Advertising, 1.28s, discoverable	195	µA

### 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	
<b>Radio Transmitter</b>			
Maximum output power	50 $\Omega$ load	+12	dBm
Initial Carrier Frequency Tolerance		0	kHz
20 dB Bandwidth for modulated carrier		935	kHz

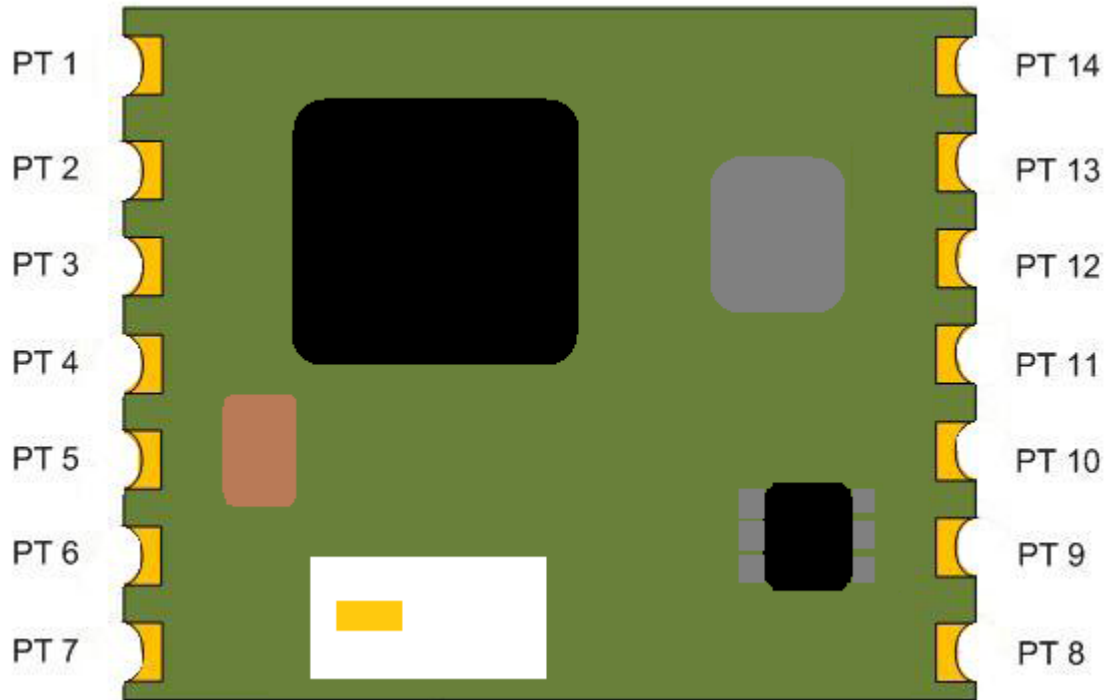
### 1.5. I/O Operating Characteristics

Symbol	Parameter	Min	Max	Unit	Conditions
V <sub>IL</sub>	Low-Level Input Voltage	-	0.6	Volts	2.2V ≤ V <sub>IN</sub> ≤ 4.8V
V <sub>IH</sub>	High-Level Input Voltage	1.4	-	Volts	2.2V ≤ V <sub>IN</sub> ≤ 4.8V
V <sub>OL</sub>	Low-Level Output Voltage	-	0.4	Volts	2.2V ≤ V <sub>IN</sub> ≤ 4.8V
V <sub>OH</sub>	High-Level Output Voltage	1.5	-	Volts	2.2V ≤ V <sub>IN</sub> ≤ 4.8V
I <sub>OL</sub>	Low –Level Output Current	-	4.0	mA	V <sub>OL</sub> = 0.4 V
I <sub>OH</sub>	High-Level Output Current	-	4.0	mA	V <sub>OH</sub> = 1.8V
R <sub>PU</sub>	Pull-up Resistor	80	120	K $\Omega$	Resistor Turned On
R <sub>PD</sub>	Pull-down Resistor	80	120	K $\Omega$	Resistor Turned On

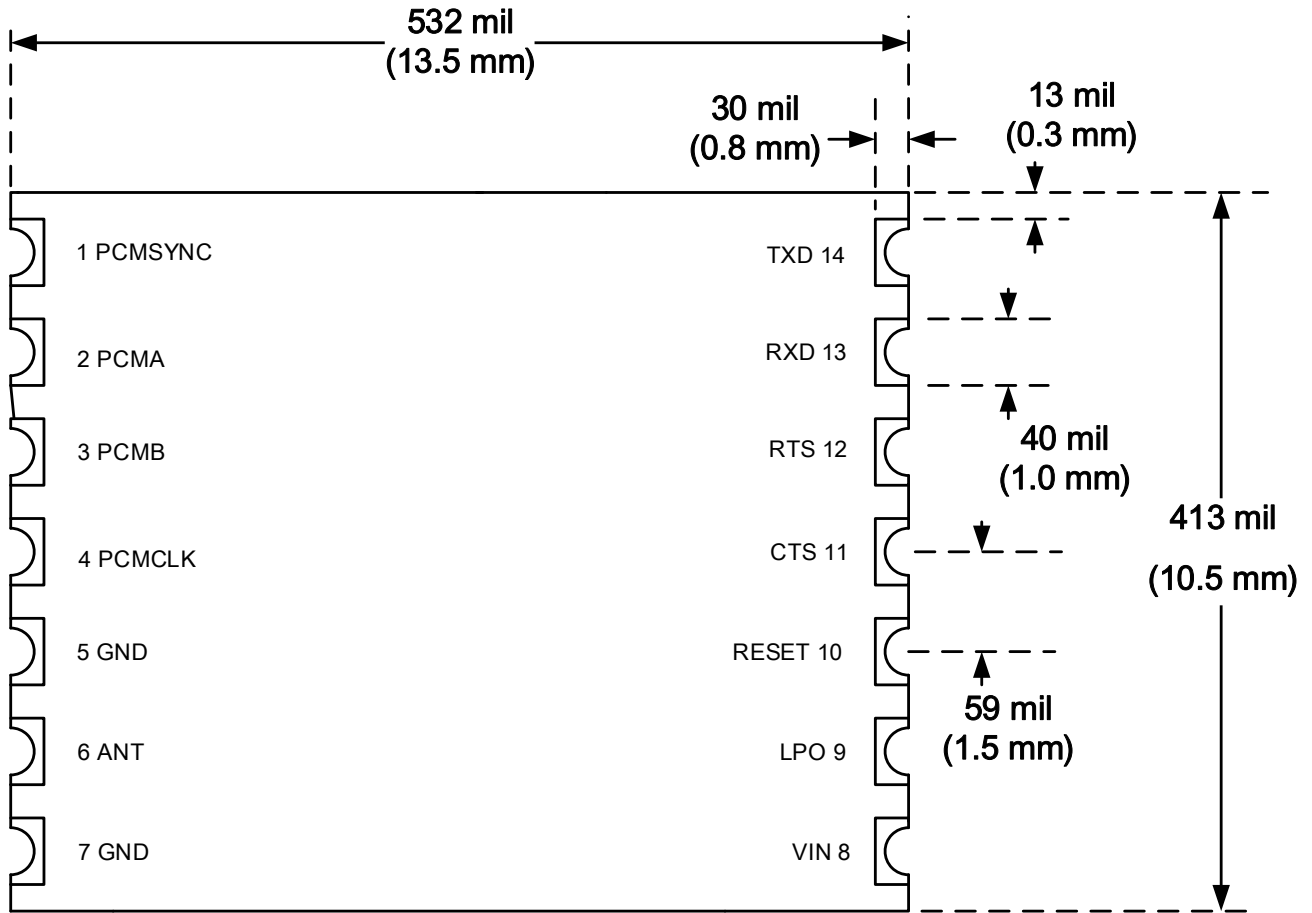
## 1.6. Pin Assignment

Name	Type	Pin #	Description
UART Interface			
RXD	I	13	Receive data
TXD	O	14	Transmit data
RTS	O	12	Request to send (active low)
CTS	I	11	Clear to send (active low)
Antenna Port			
ANT		6	Antenna port for external antenna
GND		9	GND
Power and Ground			
VIN	I/O	8	VIN
GND		7	GND
Reset			
RESETN	I	10	Reset input
LPO			
LPO	I	9	Low power clock input (required)
PCM			
PCM SYNC		1	PCM frame sync
PCM A		2	PCM data input
PCM B		3	PCM data output
PCM CLK		4	PCM clock

1.7. Pin Placement Diagram (Top View)



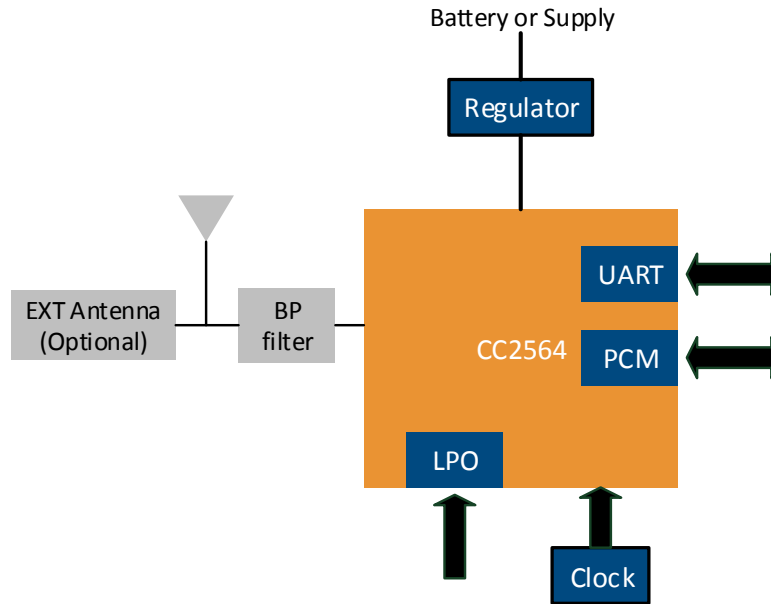
1.8. Layout Drawing



Height: 13.5 mm x 10.5 mm x 2.6 mm (tolerance +/-0.2mm)



## 2. Module Block Diagram



## 3. Layout Design

The BT50 supports UART and PCM interfaces. Please note that the usage of these interfaces is dependent upon the firmware hosting the module, and is beyond the scope of this document. UART H4 is the default HCI command interface.

### Notes

- An external Low Power Oscillator is *required* on pin 9.
- 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 6 mm in all directions.
- Traces should not be routed underneath the module.

### 3.1. Module Reflow Installation

The BT50 is a surface mount Bluetooth module supplied on a 14 pin, 6-layer PCB. The final assembly recommended reflow profiles are:

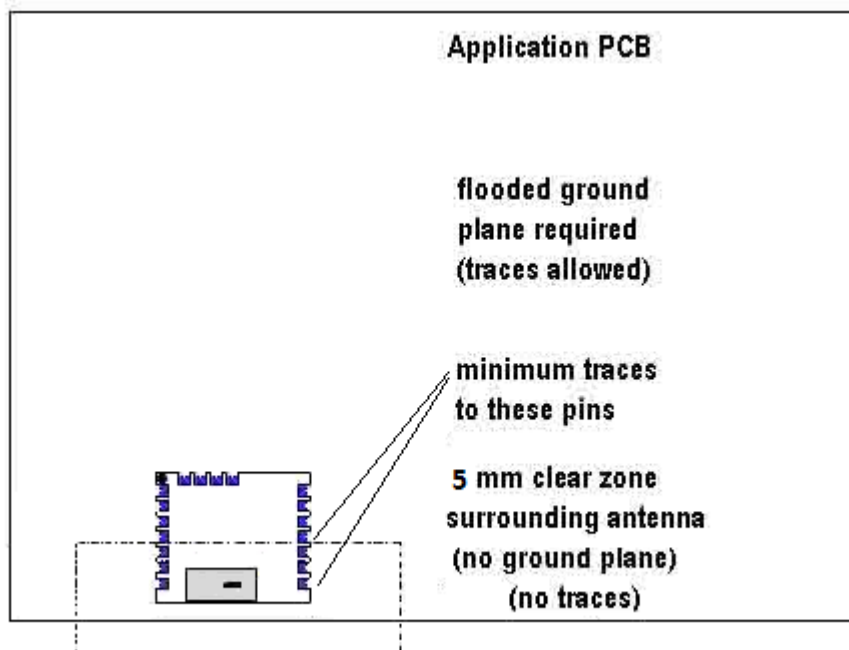
For RoHS/Pb-free applications, Sn96.5/Ag3.0/Cu0.5 solder is recommended.

- 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

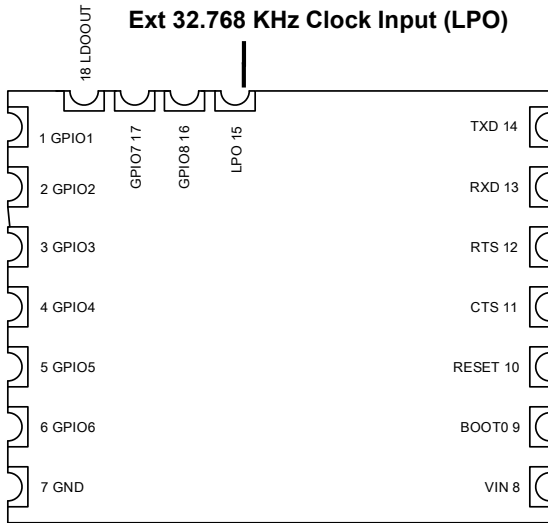
All GPIOs are capable of sinking and sourcing 6mA of I/O current.

### 3.3. PCB Layout Guidelines



### 3.4. External LPO Input Circuit

An external source must supply the slow clock and connect to the LPO pin. The source must be a digital signal in the range of 0 to 1.8 V. The accuracy of the slow clock frequency must be 32.768 KHz  $\pm$ 200 ppm for Bluetooth use.



#### LPO Parameters:

Frequency: 32.768 KHz

Tolerance: 200 ppm

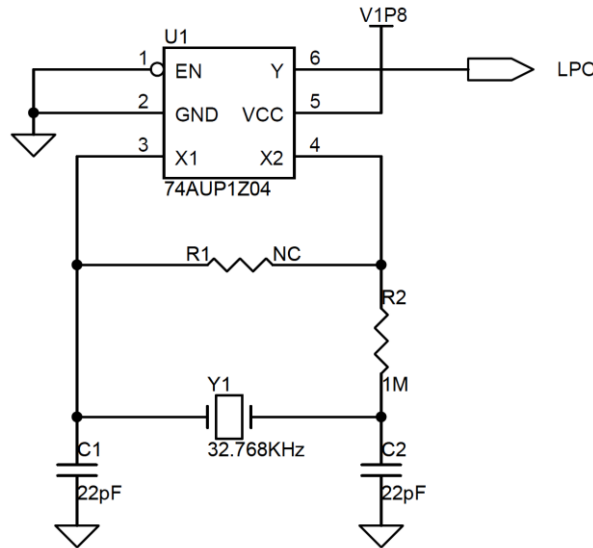
Voltage Levels:

Low: 0.1 V

High: 1.8 V

Input Capacitance: 2.5 pF maximum

#### External LPO Requirements



External LPO Reference Circuit

## 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: TBD" or "Contains FCC ID: TBD."

(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 end 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

TBD

In accordance with FCC Part 15, the BT50 is listed above as a Limited Modular Transmitter device.

#### 4.2. FCC Label Instructions

The outside of final products that contain a BT50 device must display a label referring to the enclosed module.

This exterior label can use wording such as the following:

Contains Transmitter Module

TBD

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

#### 4.3. CE Label Instructions

TBD

### 5. Ordering Information

Part Name	Description
BT50	Internal antenna
BT50-EXT	External antenna

### 6. Revision History

Date	Revision	Description
29, October 2015	1.0	First release
4, December 2015	1.1	Updated picture