

BLE54LXX-XX -C Module Datasheet V1.0

Beijing Jia An Electronics Technology Co., Ltd.

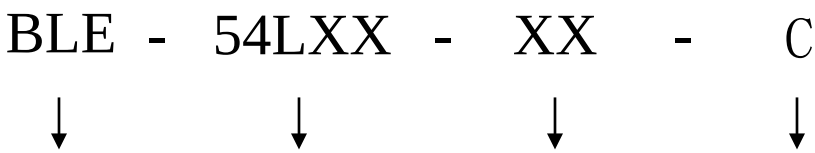
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History

Date	Version	Description	Draft	Approval
2025-8-28	V1.0	Release	Keytone	Jessy

Module Name Information



Module Type: Bluetooth

Chip Type : nRF54Lxx

Antenna Type:
HA: Helical wire antenna
UA: UFL Connector
NA: No Antenna

PCB Version

Module Type Ordering information:

Module Type	Chip Type	NVM	RAM
BLE54L05	nRF54L05	0.5MB	96 KB
BLE54L10	nRF54L10	1.0MB	192 KB
BLE54L15	nRF54L15	1.5MB	256KB

Features

Multiprotocol radio

• Bluetooth®6.0, IEEE 802.15.4-2020, and 2.4 GHz enabled transceiver
  •-96 dBm sensitivity in 1 Mbps Bluetooth Low Energy mode, 0.1% bit error rate
  • -104 dBm sensitivity in 125 kbps Bluetooth Low Energy mode (long range) with a 0.1% bit error rate
  • -102 dBm typical sensitivity in IEEE 802.15.4
  • Up to +8 dBm configurable output power; 1 dB step size from -8 dBm to +8 dBm
  • Supported data rates:
    • Bluetooth 6.0 – 2 Mbps, 1 Mbps, 500 kbps, and 125 kbps
    • IEEE 802.15.4-2020 – 250 kbps
    • Proprietary 2.4 GHz – 4 Mbps, 2 Mbps, and 1 Mbps
  • Single-ended antenna output (on-chip balun)
  • 128-bit AES/ECB/CCM/AAR coprocessor (on-the-fly operation)
  • RSSI (1 dB resolution)

Platform security

• Secure/non-secure memory protection
• Symmetric and asymmetric key crypto accelerator
• Secure key management
• Tamper detection
• Immutable boot partition
• Debug access port protection
• Two watchdog timers for secure and non-secure access

Operating values

• 1.8V to 3.6V supply and I/O voltage
• Single 32 MHz crystal operation
• Optional 32.768 kHz clock
• Operating temperature from -20°C to 70°C

ArmCortex-M33 with TrustZone technology, 128 MHz

- 500 EEMBC CoreMark score running from non-volatile memory,3.90 CoreMark per MHz
- Single-precision floating-point unit (FPU)
- Memory protection unit (MPU)
- Digital signal processing (DSP) instructions
  - Data watchpoint and trace (DWT), embedded trace macrocell (ETM), instrumentation trace macrocell (ITM), and cross trigger interface (CTI)
  - Serial wire debug (SWD)
  - Trace port interface unit (TPIU)
  - 4-bit parallel trace of ITM and ETM trace data
  - Serial wire output (SWO) trace of ITM data

Peripherals

- RISC-V Coprocessor
- Global RTC (GRTC) that can run in System OFF mode and implement a shared system timer
- Seven 32-bit timers with counter mode
- Up to five fully featured serial interfaces with EasyDMA, supporting I2C, SPI controller/peripheral, and UART
  - One high-speed SPIM up to 32 MHz, four up to 8 MHz
  - One high-speed UARTE up to 4 Mbps, four up to 1 Mbps
  - I2C up to 400 kHz
- Three pulse width modulator (PWM) units with EasyDMA
- I2S two channel Inter-IC sound interface
- ADC with up to eight programmable gain channels. 14-bit at 31.25 ksps, 12-bit at 250 ksps, and up to 10-bit at 2 Msps.
- Pulse density modulation (PDM) interface
- Near field communication (NFC)
- Up to two quadrature decoders (QDEC)
- Comparator and low-power comparator with wake-up from System OFF mode
- Temperature sensor

Application

- Advanced computer peripherals and I/O devices
- Safety and security
- Lighting control
- Internet of things (IoT)
- Wearable health and fitness monitorin

Description

The BLE54LXX is designed based on nRF54LXX.

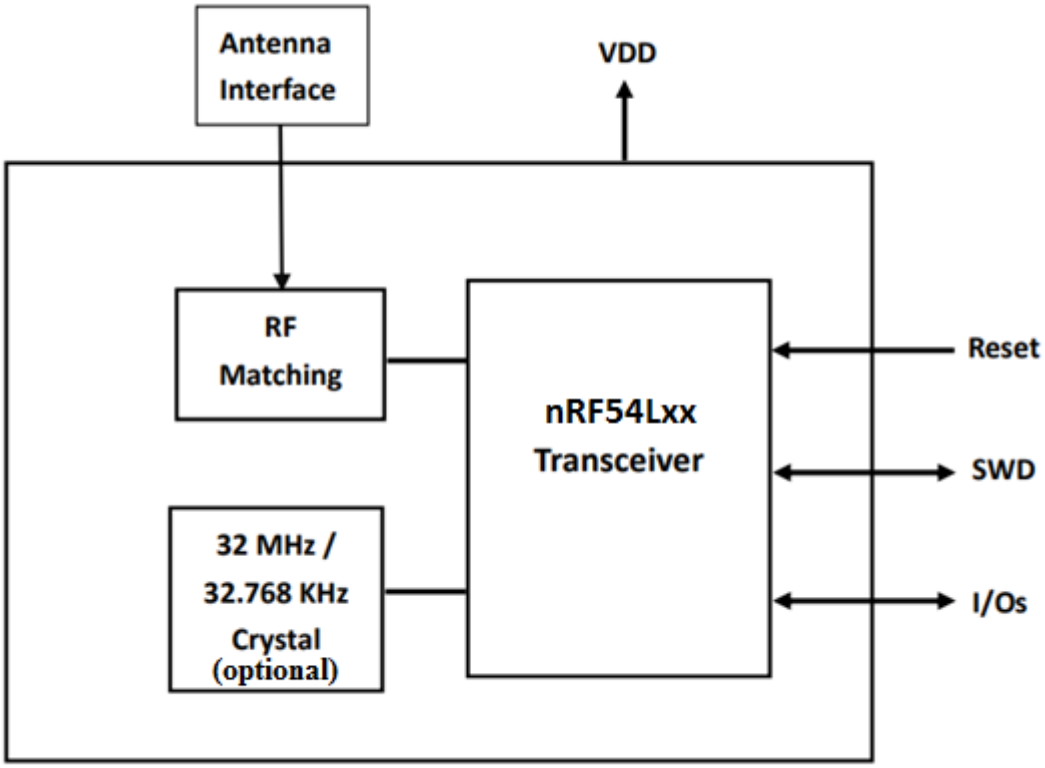
The device is an ultra-low power System on Chip (SoC) with advanced security features, a range of peripherals, and a multiprotocol 2.4 GHz transceiver. It supports Bluetooth Low Energy, IEEE 802.15.4 for Thread and Zigbee protocols, and allows for the implementation of proprietary 2.4 GHz protocols.

The main processing unit is an Arm Cortex-M33 processor running at up to 128 MHz, supported by non-volatile RRAM and RAM memory.

The Arm Cortex-M33 has a full set of digital signal processing (DSP) instructions and a memory protection unit (MPU) for application security. The full-featured single-precision floating-point unit (FPU) supports all single-precision instructions.

The peripheral set offers a variety of analog and digital functionality enabling single-chip implementation of a wide range of applications.

Block Diagram



Specifications

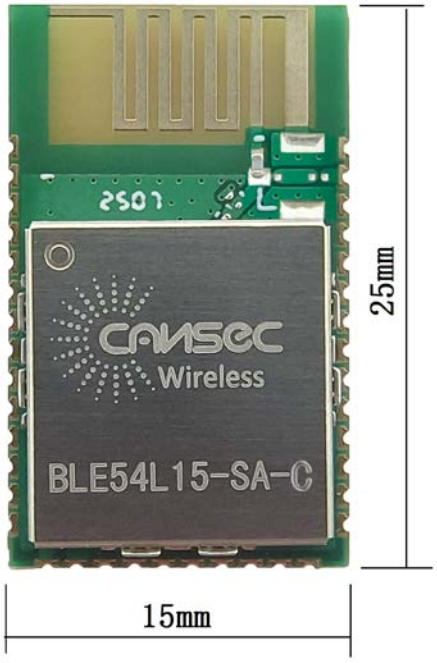
Vcc=3.3V

Parameter		Min	Typ	Max	Unit
Operating Voltage		1.8	-	3.6	V
Operating Temperature		-20	-	+70	℃
Current Consumption	Sleep Mode	-	-	0.9	uA
	Receive mode	-		3.5	mA
	Transmit Mode	-		10.5	mA
TX Power		-		7	dBm
RX Sensitivity（Sensitivity, 125 kbps Bluetooth LE mode）		-	-	-104	dBm

Mechanical Drawing

BLE54L15-SA-C

Unit： mm
H： 3.2mm



Terminal Description



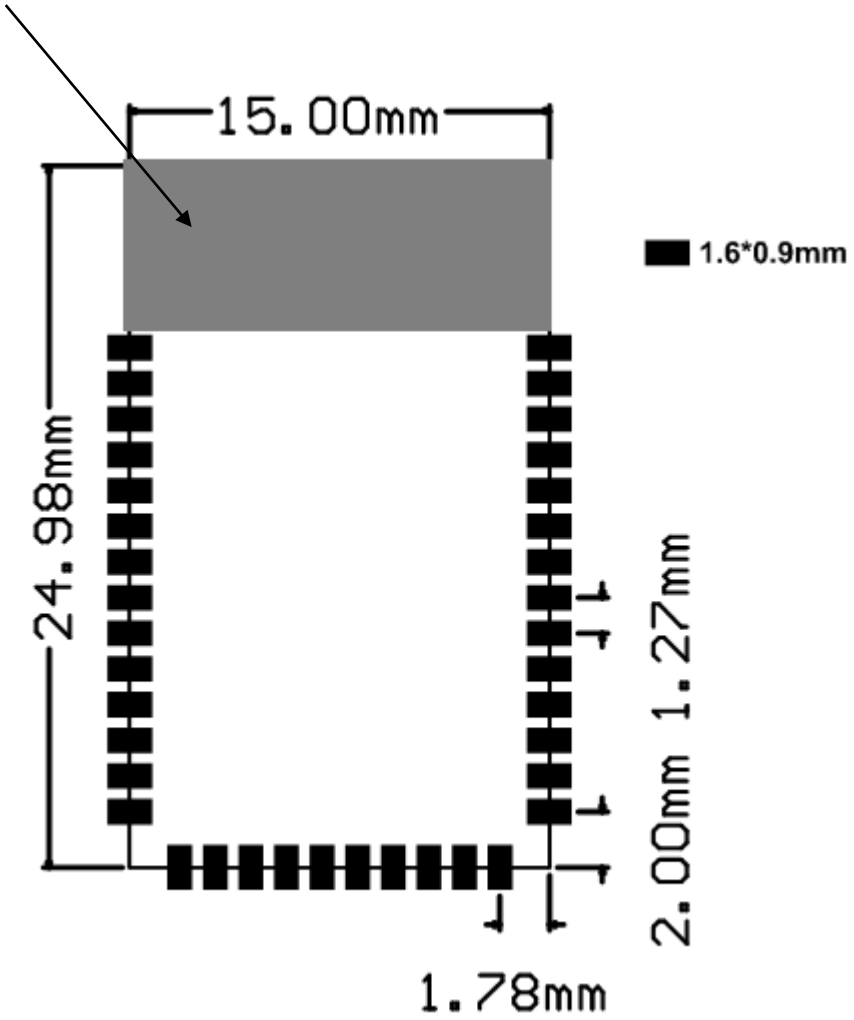
Pad Number	Name	Pin Type	Description
1	P0.02	Digital I/O	General purpose I/O
2	P0.03 GRTCPWM	Digital I/O Digital I/O	General purpose I/O GRTC PWM output
3	P0.04 GRTCLFCLKOUT	Digital I/O Digital I/O	General purpose I/O GRTC LF clock output
4	P1.09 ASI[2] RADIO[0]	Digital I/O Digital I/O Digital I/O	General purpose I/O TAMPC active shield output RADIO DFEGPIO
5	P1.10 ASI[2] RADIO[1]	Digital I/O Digital I/O Digital I/O	General purpose I/O TAMPC active shield input RADIO DFEGPIO
6	P1.11 ASO[3] RADIO[2] AIN4	Digital I/O Digital I/O Digital I/O Analog input	General purpose I/O TAMPC active shield output RADIO DFEGPIO Analog input
7	P1.12 ASI[3] RADIO[3] AIN5	Digital I/O Digital I/O Digital I/O Analog input	General purpose I/O TAMPC active shield input RADIO DFEGPIO Analog input
8	P1.13 RADIO[4] AIN6	Digital I/O Digital I/O Analog input	General purpose I/O RADIO DFEGPIO Analog input
9	P1.14 RADIO[5] AIN7	Digital I/O Digital I/O Analog input	General purpose I/O RADIO DFEGPIO Analog input
10	P1.00 XL1	Digital I/O Analog input	General purpose I/O Connection for 32.768 kHz crystal **※Inside place crystal 32.768KHz.**
11	P1.01 XL2	Digital I/O Analog input	General purpose I/O Connection for 32.768 kHz crystal **※Inside place crystal 32.768KHz.**
12	P1.02 NFC1	Digital I/O NFC input	General purpose I/O NFC antenna connection
13	P1.03 NFC2	Digital I/O NFC input	General purpose I/O NFC antenna connection
14	P1.04 ASO[0] AIN0	Digital I/O Digital I/O Analog input	General purpose I/O TAMPC active shield output Analog input
15	+VCC	+VCC	+1.8V---+3.6V
16	GND	GND	GND

Pad Number	Name	Pin Type	Description
17	P1.05 ASI[0] RADIO[6] AIN1	Digital I/O Digital I/O Digital I/O Analog input	General purpose I/O TAMPC active shield output RADIO DFEGPIO Analog input
18	P1.06 ASO[1] AIN2	Digital I/O Digital I/O Analog input	General purpose I/O TAMPC active shield 1 output Analog input
19	P1.07 ASI[1] AIN3	Digital I/O Digital I/O Analog input	General purpose I/O TAMPC active shield 1 output Analog input
20	P1.08 GRTCHFOUT EXTREF	Digital I/O Digital I/O Analog input	General purpose I/O GRTC HF clock output External reference for SAADC
21	P2.00	Digital I/O Digital I/O Digital I/O Digital I/O	General purpose I/O SPIM DCX UARTE RXD QSPI D3
22	P2.01	Digital I/O Digital I/O Digital I/O Digital I/O	General purpose I/O SPIM SCK SPIS SCK QSPI SCK
23	P2.02	Digital I/O Digital I/O Digital I/O Digital I/O Digital I/O Digital I/O	General purpose I/O SPIM MOSI SPIS MISO UARTE TXD QSPI D0 Serial wire output (SWO)
24	P2.03	Digital I/O Digital I/O	General purpose I/O QSPI D2
25	P2.04	Digital I/O Digital I/O Digital I/O Digital I/O Digital I/O	General purpose I/O SPIM MISO SPIS MOSI UARTE CTS QSPI D1
26	P2.05	Digital I/O Digital I/O Digital I/O Digital I/O	General purpose I/O SPIM CS UARTE RTS QSPI CS
27	P2.06 TRACECLK	Digital I/O Digital I/O Digital I/O Digital I/O	General purpose I/O SPIM SCK SPIS SCK Trace clock
28	P2.07 TRACEDATA[0] SWO	Digital I/O Digital I/O Digital I/O Digital I/O	General purpose I/O Trace data Serial wire output (SWO) SPIM DCX UARTE RXD

Pad Number	Name	Pin Type	Description
29	P2.08 TRACEDATA[1]	Digital I/O Digital I/O Digital I/O Digital I/O Digital I/O	General purpose I/O Trace data SPIM MOSI SPIS MISO UARTE TXD
30	P2.09 TRACEDATA[2]	Digital I/O Digital I/O Digital I/O Digital I/O Digital I/O	General purpose I/O Trace data SPIM MISO SPIS MOSI UARTE CTS
31	P2.10 TRACEDATA[3]	Digital I/O Digital I/O Digital I/O Digital I/O	General purpose I/O Trace data SPIM CS UARTE RTC
32	P0.00	Digital I/O	General purpose I/O
33	P0.01	Digital I/O	General purpose I/O
34	SWDIO	Debug	Serial wire data. Bidirectional with standard-drive and on-chip pull-down.
35	SWDCLK	Debug	Serial wire clock. Input with onchip pull-up.
36	nRT	Reset	Pin reset with on-chip pull-up
37	ANT	RF OUT	Single ended radio antenna Connection **※This pin only has a signal in the NA version.** **If it is UA/SA, this pin is in an OPEN state.**
38	GND	GND	GND

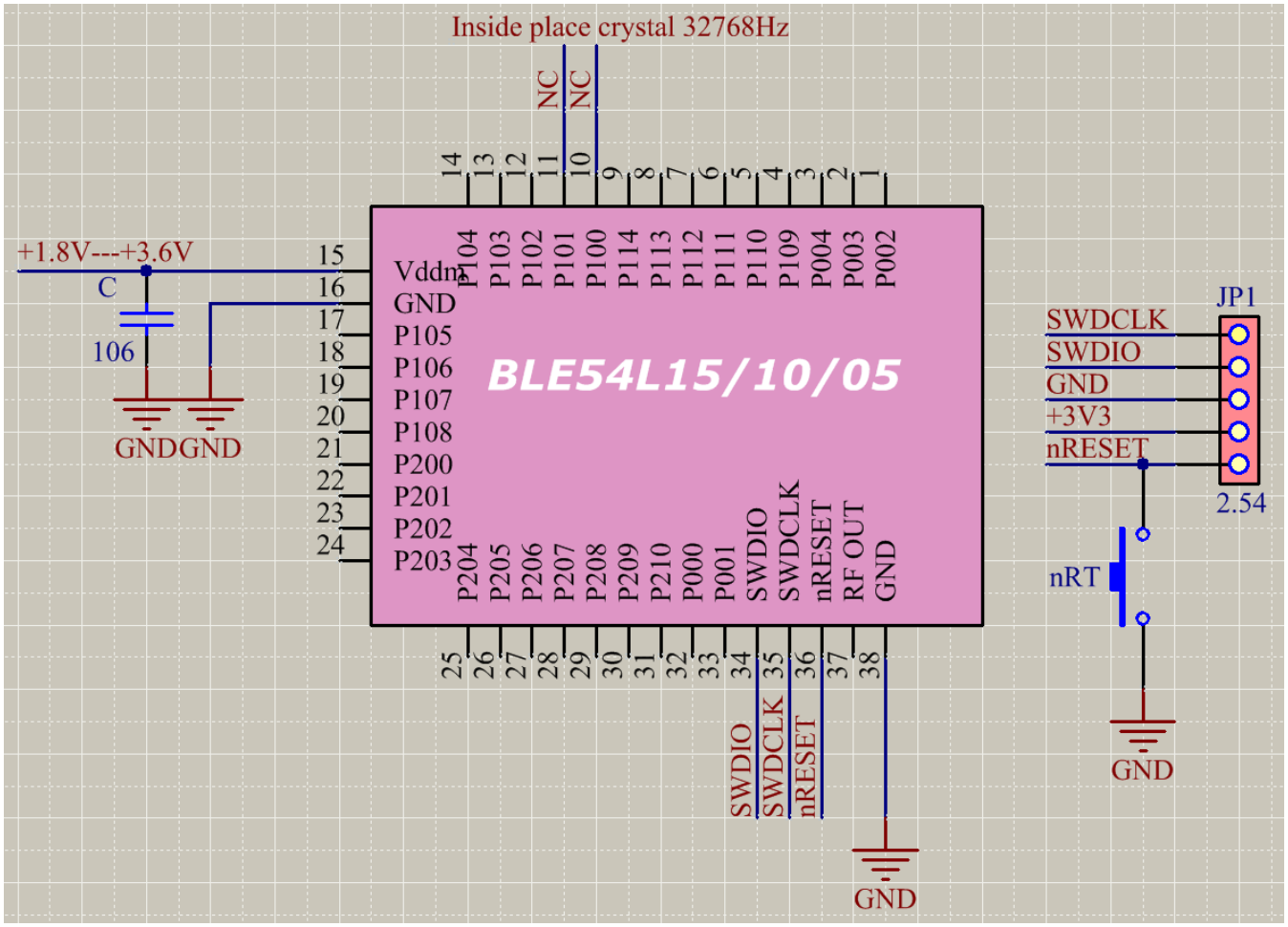
Recommended PCB Layout for Package

NOTE:
Make sure in the shadow area shall without any wiring or ground.
Proposed Module Layout on the edge of the Board, away from other devices.

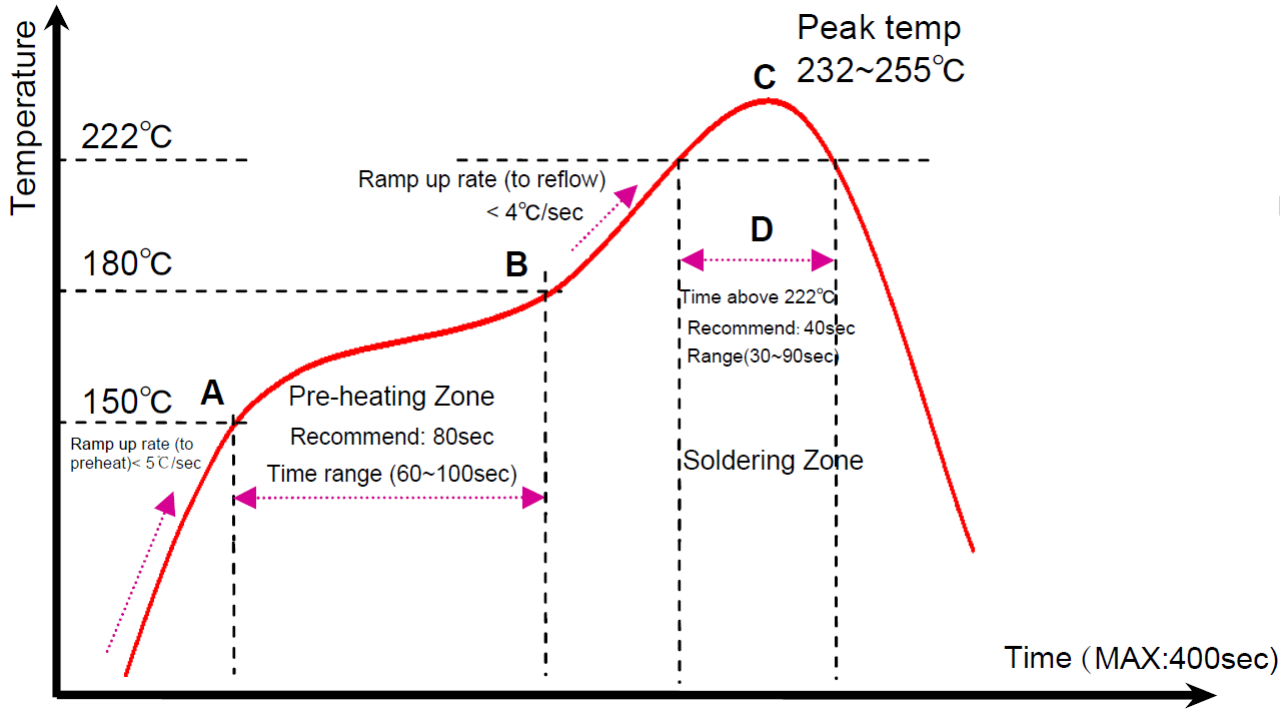


Reference Schematics

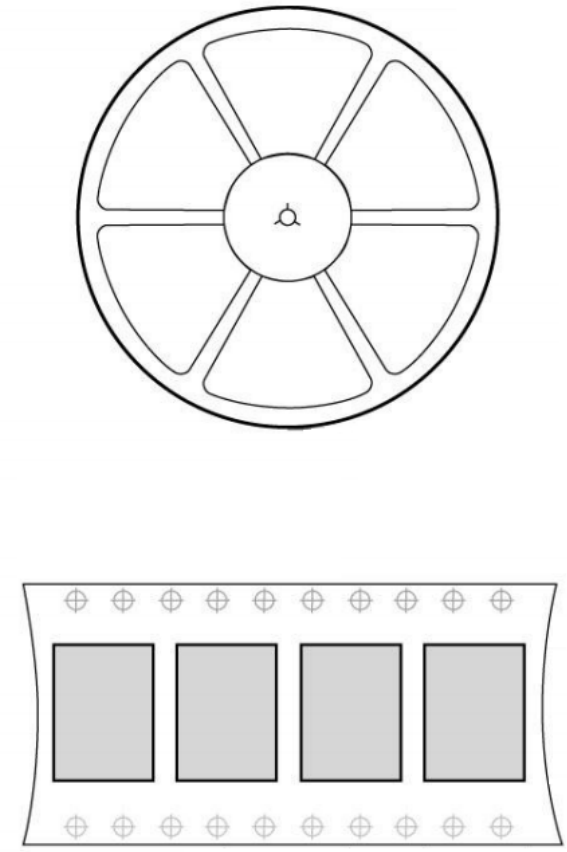
VCC Wide Supply Voltage Range: 1.8 to 3.6V



Recommended Reflow Profile for Lead Free Solder



Package



- Tape and Reel
- Helical antenna version Module exception
- Note：For package, we have three package types: Reel, Tray, Simple way for choosing, depend on customer's request or quantity request

Contact Details

Tel: +86-10-6888 9971
Email: sarolyn@rf-products.com
grace@rf-products.com
norman@rf-products.com
Technical Support: tech@rf-products.com
Addr: Rm.1002, Block B China Railway Venture building, No.28 Pingguoyuan Rd., Shijingshan District, Beijing, 100041,China.
Website: www.rf-products.com