
# HY-42Q101CC Bluetooth Low Energy Module Specification

(Qualified for automotive applications )

13.Aug. 2020

Version：V1.1

## Version History

| Version | Revision Date | Reviser | Reviewer | Revised Contents |
|---|---|---|---|---|
| V1.0 | 23/10/2019 | Mark | LYC | 1st issue |
| V1.1 | 13/8/2020 | Joe | GWB | 1. Corrected temperature range<br>2. Changed business address |
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# 1. Description

HY-42Q101CC is a Bluetooth low energy single-mode module that meets the AEC-Q100 automotive specification level 2 temperature range (-40℃~+105℃).
HY-40Q101 Bluetooth low energy single-mode module for car specification is a Bluetooth device for low-power sensors and message transmission.
HY-42Q101CC provides Bluetooth low energy features: radio, Bluetooth protocol stack, configuration files and required space for customer applications. The module also provides a flexible hardware interface for connecting sensors.
HY-42Q101CC can be directly powered by a standard 3V button battery or a pair of AAA batteries. In the lowest power shutdown mode, it only consumes 0.15uA and wakes up within a few microseconds.
Use Simple Link Bluetooth® 5.1 Low Energy Wireless MCU :TI CC2642R-Q1 7*7*0.9mm 48pin IC , Frequency Synthesizer Cryster : 48MHz

1-1.APPLICATIONS:

**Automotive**

- Car access and security systems
- Passive entry passive start (PEPS)
- Phone as a key (PaaK)
- Remote keyless entry (RKE)
- Battery management system (BMS)
- Advanced driver assistance systems (ADAS)
- Telematics control unit (TCU
- Head unit

**Industrial**

- Industrial transport - asset tracking
- Factory automation and control

1-2.KEY FEATURES:

- Bluetooth BLE single mode compliant
- Supports master,slave and master/slave modes
- Integrated Bluetooth low energy stack

- GAP, GATT, L2CAP, SMP Bluetooth low energy profiles
- Suitable for systems targeting compliance: BQB BLE5.0,FCC,IC(Canada),CE ETSI RED,etc.worldwide RF Regulations.
- Ultra low current consumption :Shutdown. No clocks running, no retention: 150 nA(Typical)
- Programmable ARM Cortex-M4F processor for embedding full applications
- 352KB of in-system Programmable Flash
- 256KB of ROM for protocols and library functions
- 8KB of Cache SRAM (Alternatively available as general-purpose RAM)
- 80KB of ultra-low leakage SRAM. The SRAM is protected by parity to ensure high reliability of operation.

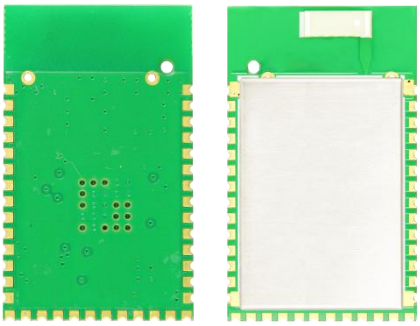
## 2. Hardware Model Description

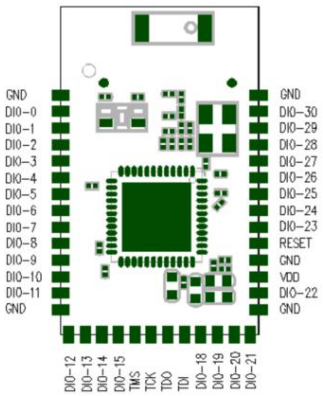
Use TI CC2642R2 integrated chip,Optional with shield case or no shield case)

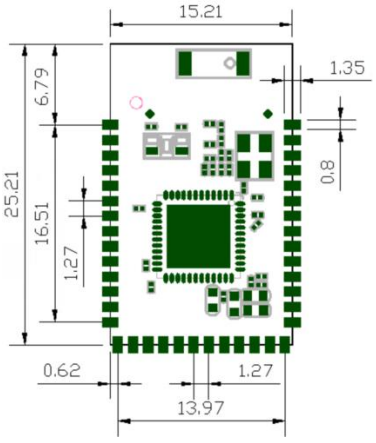
| No. | PCBAModel. | Description |
|---|---|---|
| 1 | HY-42Q101CC | Ceramic Antenna with shield case |
| | | |
| | | |
| | | |

## 3. Dimension & PIN Function

(PCBA dimension size : 25.21 * 15.21 * 2.0/2.7 mm ).






## 4.Application Note

4-1.Attention to the electrostatic protection, prevent the soldering iron and the equipment grounding bad; And the workbench, working environment,packaging materials and from the human body Touch with static electricity,etc., destroy IC and software to be flied; Manual welding module solder iron temperature, should pay attention to avoid the PCB copper Stripping off;Soldering iron strictly Grounding requirements, eliminating solder iron leak Voltage and avoid supply power VCC switch instant turn on/ turn off state ,generate high voltage, Maybe let the module to damaged;

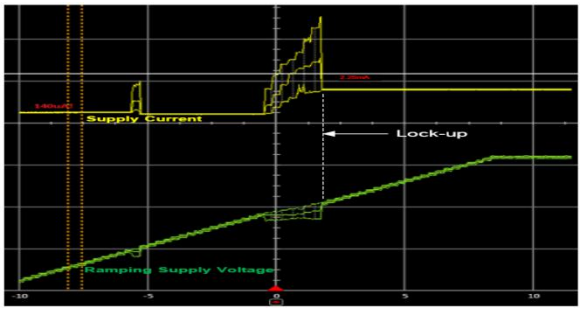
4-1a.Soldering iron front end to ground resistance under the 10 Ω,, and leakage voltage < 0.1 V; The environment and Personnel static voltage shall be within 0±100V. Anti-static labeling shall be show in the operation area. And use high efficiency ionizing blower go to eliminate static voltage of the product during operation.

4-2.Attention to avoid the overall motherboard power supply circuit of bad welding connected to short circuit or open circuit, causing the Bluetooth chip, abnormal voltage,The software will fly and problems of IC was damaged.

4-3.When programming firm ware , the VDDS supply voltage must in DC 2.4~3.3V, To avoid programming has not completely, and abnormal status occur.

4-4.Avoid supply voltage in (BOD Brown - Out Detect) fall within the scope of electrical detection threshold(1.76 V ~ 1.78 V) occurred many times, (diagram below off electric Lock - up area) firmware may be locked.

Cause the Boot Code start up Code suspended, unable to connect to the JTAG protocol,;In case of this state is available use Reset pin action under 1.0 V, to remove this phenomenon; The rechargeable batteries at charge-discharge status;In the application at the same time, to ensure the voltage setting of the protection system;And pay attention to the supply of power caused by the internal resistance and line impedance voltage drop;And make sure that The equipment operating voltage from 2.0 V to 3.6 V, and ensure that the voltage slope faster than 0.5 V/ms (through BOD threshold).

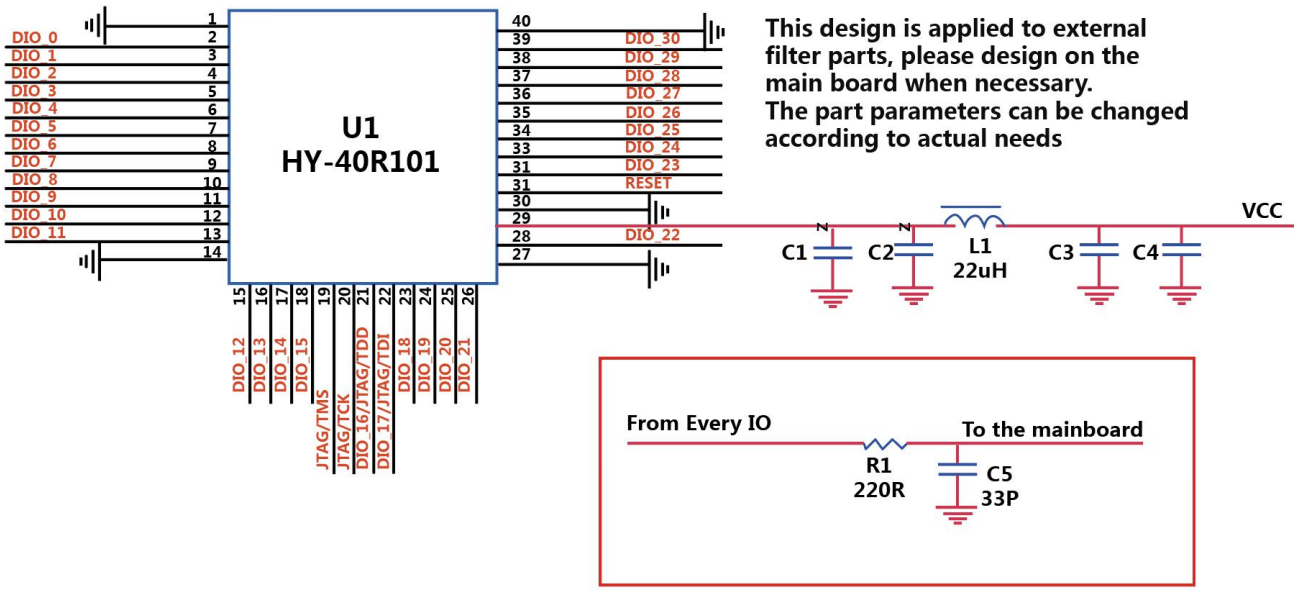



4-5. Use the module in the production and the transport process, please insure module's component protection, prevent the precision parts on the module Damaged (welding furnace exit and assembly, testing, delivery process,suggest using collision buffer material, not collide with each other)

4-6. The module for the humidity sensitive components, if used in SMT reflow soldering operations,

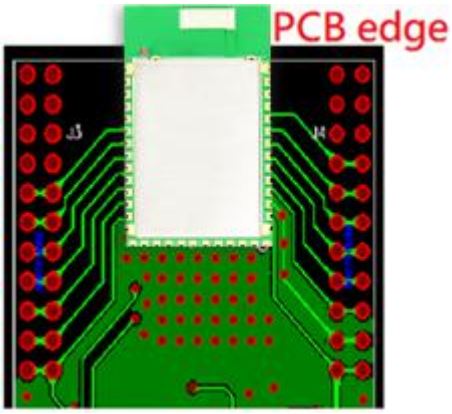
please strictly follow the IPC/JEDECJ - STD – 020regulation, completes the drying dehumidifying , and for this module has second processing work after placed in the functional test environment,the humidity of the chip is no guarantee that in a certain ratio, the honored guest please understand;(The attention note show in below Fig.)

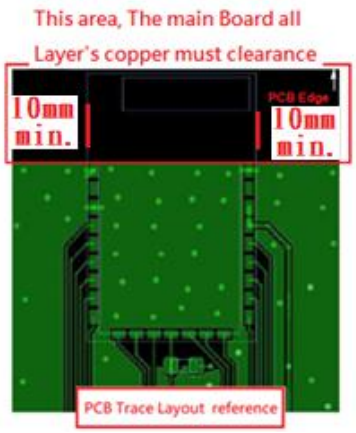
4-7. The diagram (show in below Fig.) of the module application on external filter parts, when need, please design in the main board, the parts parameter can depend on the actual need to changes.
And pay attention to the increase and decrease ramping of supply voltage fast than 0.5v/ms;




4-8.Assembly recommendation 1:Underneath the module antenna and RF circuit on the main board PCB copper need to clearance, and place close to the main board edge, as show in below Fig. The antenna can't be near around metal parts and prevent material existence of electromagnetic radiation , Can affect the manipulation of the distance.

4-9. Assembly recommendation 2:Signal trace and power supply trace, don't cross layout, as show in below Fig.To avoid cross talk, affect the receiving sensitivity.




If the PCB not ground isolation signals between different layers, Trace do not intersect between different layers layout, prevent crosstalk
若 PCB不同層間沒有接地面隔離信號, 不同層間的線路不要交叉布局,防止串擾.

The module assemble in the motherboard, must pay attention to: Around the antenna and all layer's copper must be clear,Module antenna should be on the edge,And there are no metal or obstruct electromagnetic radiation material tosurround antenna area.

## 5. Pin out and GPIO function Description

| Pin | Name | Type | Function Description |
|---|---|---|---|
| 1 | GND | Power GND | Ground |
| 2 | DIO_0 | Digital I/O | GPIO, Sensor Controller (I:4mA max) |
| 3 | DIO_1 | Digital I/O | GPIO, Sensor Controller (I:4mA max) |
| 4 | DIO_2 | Digital I/O | UART RX;<br>GPIO, Sensor Controller (I:4mA max) |
| 5 | DIO_3 | Digital I/O | UART TX;<br>GPIO, Sensor Controller (I:4mA max) |
| 6 | DIO_4 | Digital I/O | WAKE UP; Don't floating<br>GPIO, Sensor Controller (I:4mA max) |
| 7 | DIO_5 | Digital I/O | GPIO, Sensor Controller, high-drive capability (8mA max). |
| 8 | DIO_6 | Digital I/O | GPIO, Sensor Controller, high-drive capability (8mA max). |
| 9 | DIO_7 | Digital I/O | GPIO, Sensor Controller, high-drive capability (8mA max). |
| 10 | DIO_8 | Digital I/O | GPIO (I: 4mA max) |
| 11 | DIO_9 | Digital I/O | GPIO (I: 4mA max) |
| 12 | DIO_10 | Digital I/O | GPIO (I: 4mA max) |
| 13 | DIO_11 | Digital I/O | GPIO (I: 4mA max) |
| 14 | GND | Power GND | Ground |
| 15 | DIO_12 | Digital I/O | GPIO (I: 4mA max) |
| 16 | DIO_13 | Digital I/O | GPIO (I: 4mA max) |
| 17 | DIO_14 | Digital I/O | GPIO (I: 4mA max) |
| 18 | DIO_15 | Digital I/O | GPIO (I: 4mA max) |
| 19 | JTAG TMSC | Digital I/O | JTAG TMSC;<br>high-drive capability |
| 20 | JTAG TCKC | Digital I/O | JTAG TCKC |
| 21 | DIO_16 TDO | Digital I/O | GPIO,JTAG_TDO;<br>high-drive capability(8mA max). |
| 22 | DIO_17 TDI | Digital I/O | GPIO,JTAG_TDI;<br>high-drive capability(8mA max). |
| 23 | DIO_18 | Digital I/O | GPIO (I: 4mA max) |
| 24 | DIO_19 | Digital I/O | GPIO (I: 4mA max) |
| 25 | DIO_20 | Digital I/O | GPIO (I: 4mA max) |

| | | | |
|---|---|---|---|
| 26 | DIO_21 | Digital I/O | GPIO (I: 4mA max) |
| 27 | GND | Power GND | Ground |
| 28 | DIO_22 | Digital I/O | GPIO (I: 4mA max) |
| 29 | VDD | Power Supply | +1.8V to +3.8V (Recommended 2.7~3.3V) |
| 30 | GND | Power GND | Ground |
| 31 | RESET | Digital input | Reset, active-low. Module have pull up. |
| 32 | DIO_23 | Digital I/O | GPIO, Sensor Controller, Analog(I: 4mA max) |
| 33 | DIO_24 | Digital I/O | GPIO, Sensor Controller, Analog(I: 4mA max) |
| 34 | DIO_25 | Digital I/O | GPIO, Sensor Controller, Analog(I: 4mA max) |
| 35 | DIO_26 | Digital I/O | GPIO, Sensor Controller, Analog(I: 4mA max) |
| 36 | DIO_27 | Digital I/O | GPIO, Sensor Controller, Analog(I: 4mA max) |
| 37 | DIO_28 | Digital I/O | GPIO, Sensor Controller, Analog(I: 4mA max) |
| 38 | DIO_29 | Digital I/O | GPIO, Sensor Controller, Analog(I: 4mA max) |
| 39 | DIO_30 | Digital I/O | GPIO, Sensor Controller, Analog(I: 4mA max) |
| 40 | GND | Power GND | Ground |

## 6. Electrical Characteristics

(Test condition: With Ta = 25 ℃, VDD =3.0V with internal DC-DC converter, standard measure:1Mbps 250KHz deviation GFSK modulation ,FRF = 2440MHz Bluetooth Low energy mode.)

6-1.Radio performance&current consumption

(Test condition:With Ta = 25 ℃, VDD =3.0V, with internal DC-DC converter, standard measure:1MbpsGFSKmodulation ,FRF = 2440MHz Bluetooth Low energy mode.)

- Modulation Mode: GFSK
- Frequency range: 2402~2480MHZ (2.4GHz ISM band)
- Transmit power setting Range: -21 ~ +5 dBm typical ( programmable by software) .
- The antenna feed point transmit power: +2 dBm typ. (TX set Max.output)
- The antenna feed point receiver sensitivity : -93 dBm typical. ( PER <30.8%)
- Frequency drift specification:RF ± 60ppm , MCU clock 32.768KHz± 350ppm.( Use X-Tal)
- Suitable for systems targeting compliance:FCC,IC(Canada),CE ETSI RED,BQB,… etc. worldwide RF Regulations.

- Ultra low current consumption
  - Transmit：7.3mA(typical) ( O/P Power setting :0dBm )
  - Transmit：9.6mA(typical) ( O/P Power setting :5dBm )
  - Receive(high gain setting): 6.9 mA(typical)
  - Active-Mode MCU 48 MHz (Core Mark):3.4 mA (71 μA/MHz)
  - Standby: RTC on, 80KB RAM and CPU retention: 0.94 uA(Typical)

- Shutdown. No clocks running, no retention: 150 nA(Typical)

6-2. Absolute Maximum Ratings

Note: These are absolute maximum ratings beyond which the module can be permanently damaged, these are not Maximum operating conditions, the maximum recommended operating conditions are in the table 6.

| Rating | Min | Max | Unit |
|---|---|---|---|
| VDDS | -0.3 | 3.8 | V |
| Other Terminal Voltages | VSS-0.3 | VDDS+0.3 | V |
| Storage Temperature | -40 | +85 | ℃ |

6-3. ESD Ratings

| | | | Value | Unit |
|---|---|---|---|---|
| $V_{ESD}$ Electrostatic discharge | Human body model (HBM), per ANSI / ESDA / JEDEC JS-001 | All pins | ±2000 | V |
| | Charged device model (CDM), per ANSI / ESDA / JEDEC JS-002 | All pins | ±500 | |

6-4. Recommended Operating Conditions

*Supply voltage noise should be less than 10mVpp. Excessive noise at the supply* voltage will reduce the RF performance.

| Rating | Min | Max | Unit |
|---|---|---|---|
| VDD (when BlueTooth Active) | 2.0 | 3.8 | V |
| VDD(when flash programming) | 2.4 | 3.6 | V |
| Operating Temperature Range | -40 | +105 | ℃ |

Note: (1).VDD power supply recommended voltage : 2.7~3.3V

(2).When programming firm ware , the VDD supply voltage must in DC 2.4~3.6V,

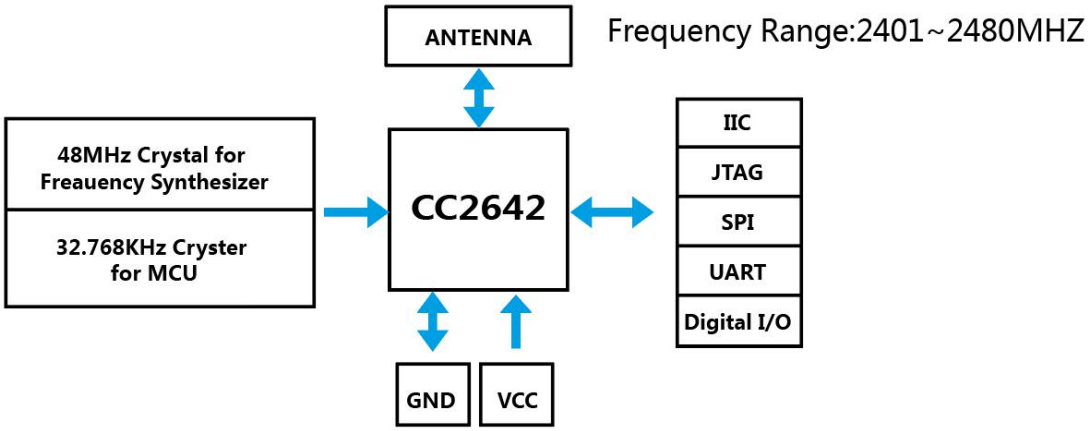
To avoid programming has not completely, or abnormal status occur..

(3).For smaller coin cell batteries, with high worst-case end-of-life equivalent source resistance, a 22-µF VDDS input capacitor must be used to ensure compliance with this slew rate(6-6 timing req.).

6-5.GPIODC Characteristics

| Parameter | Test Condition | Typical | Unit |
|---|---|---|---|
| GPIO VOH at 8-mA load | IOCURR = 2, high-drive GPIOs only | 2.68 | V |
| GPIO VOL at 8-mA load | IOCURR = 2, high-drive GPIOs only | 0.33 | V |
| GPIO VOH at 4-mA load | IOCURR = 1 | 2.72 | V |
| GPIO VOL at 4-mA load | IOCURR = 1 | 0.28 | V |

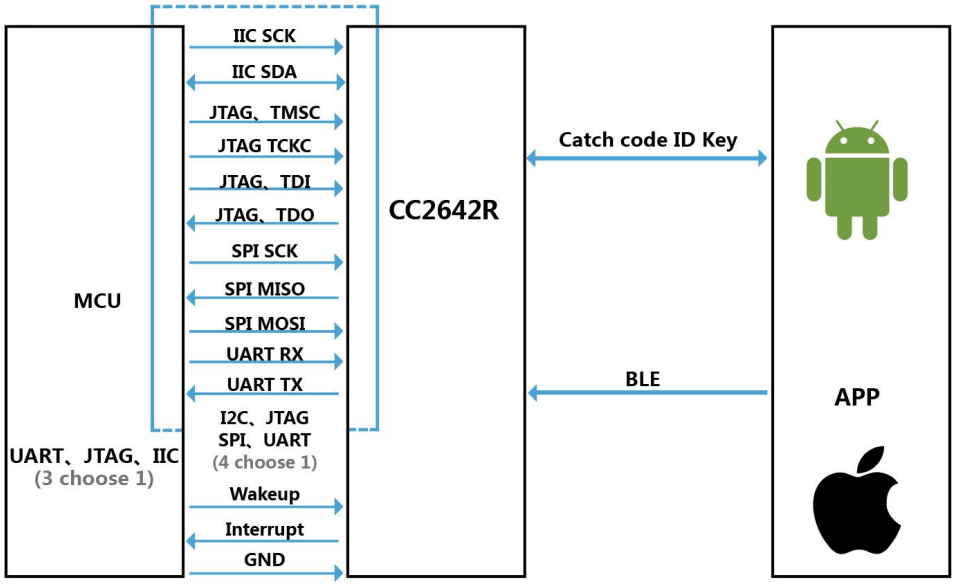
## 7. Block Diagram




## 8. Functional Block Diagram


Figure 1-1. CC2642R Block Diagram

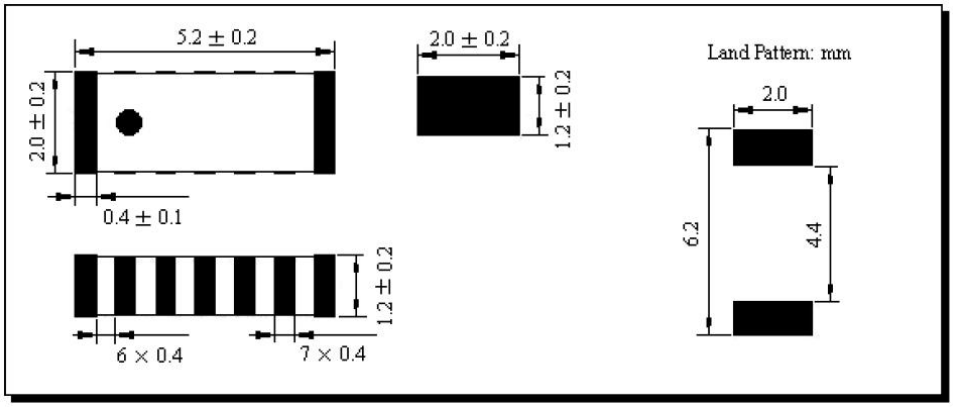
## 9. Working Mode Schematic




## 10. Ceramic Antenna Specification

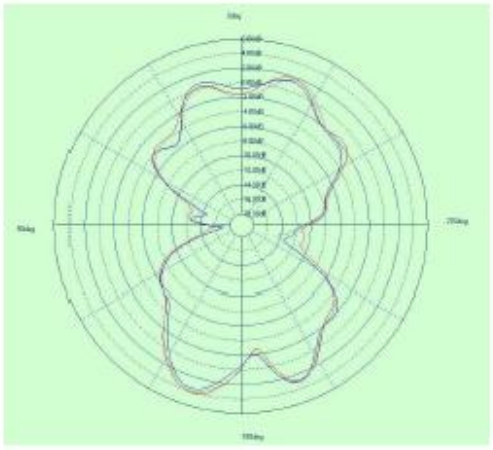
10-1: Antenna peak gain :2.0dBi at 2450MHz

10-2: Antenna Dimensions ( unit: mm)

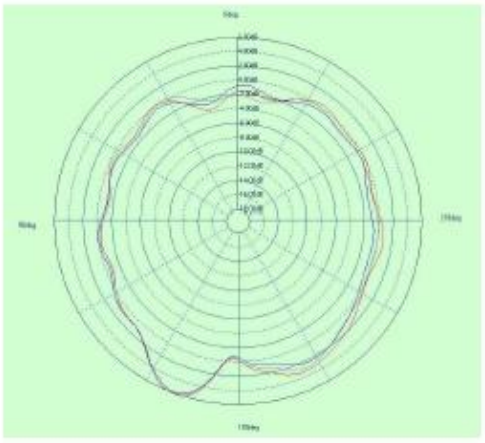


10-3: Radiation Pattern and efficiency

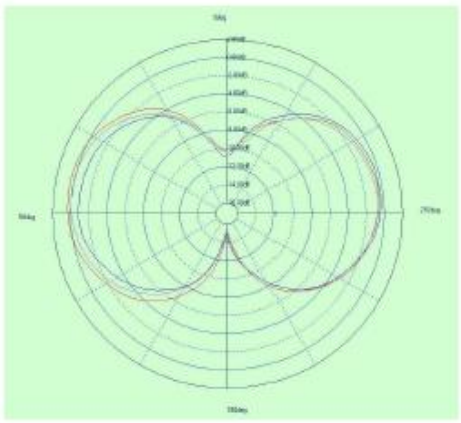
X-Z Plane

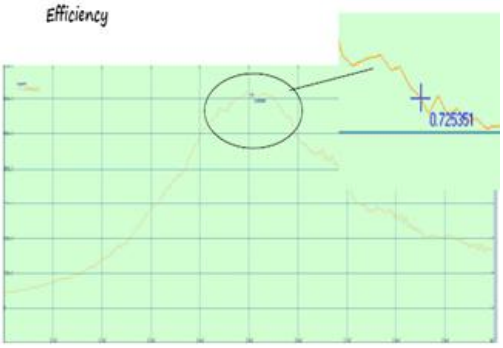


Y-Z Plane



X-Y Plane



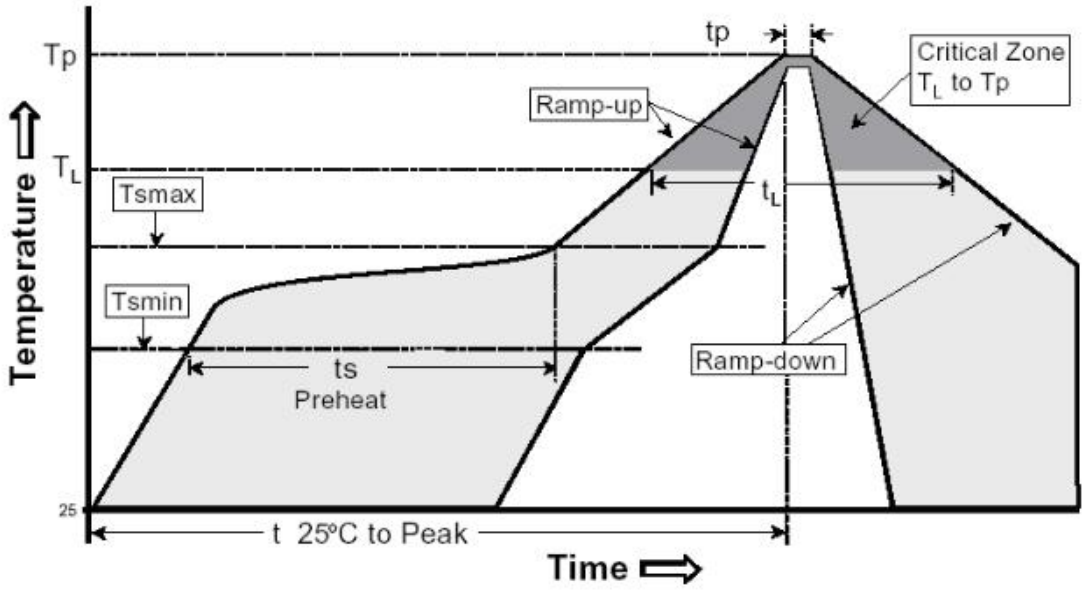


## 11. Recommend Reflow Profile

( Leadless solder cream: Sn 96.5%, Ag 3%, Cu 0.5%)

| Profile Feature | Pb-Free Assembly | |
|---|---|---|
| | Large Body | Small Body |
| Average ramp-up rate($T_L$ to $T_P$) | 3°C/second max | |
| Preheat-Temperature Min ($Ts_{min}$)<br>-Temperature Max ($Ts_{max}$)<br>-Time (min to max)(ts) | 150°C<br>200°C<br>60-180 seconds | |
| $Ts_{max}$ to $T_L$-Ramp-up Rate | 3°C/second max | |
| Time maintained above-Temperature ($T_L$)<br>-Time ($t_L$) | 217°C<br>60-150 seconds | |
| Peak Temperature ($T_P$) | 245 +0/-5°C | 250 +0/-5°C |
| Time within 5°C of actual Peak Temperature ($t_p$) | 10-30 seconds | 20-40 seconds |
| Ramp-down Rate | 6°C/second max | |
| Time 25°C to Peak Temperature | 8 minutes max | |

Reflow Curve Classification



## 12. Contact Us

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