
Bluetooth® 3.0 Multi-Speaker Stereo Audio Module

Features

System Specification

- Compliant with Bluetooth Specification v.3.0 + EDR in 2.4 GHz ISM band module
- It supports following profiles :
 - Hands Free 1.5
 - Headset 1.0
 - A2DP 1.0
 - AVRCP 1.0

Baseband Hardware

- Built-in 16MHz main clock input.
- Built-in internal ROM for program memory
- Support to connect to two hosts (phones, tablets...) with HFP or A2DP profiles simultaneously
- Adaptive Frequency Hopping (AFH) avoids occupied RF channels
- Fast Connection supported

RF Hardware

- Fully Bluetooth 3.0 + EDR system in 2.4 GHz ISM band.
- Combined TX/RX RF terminal simplifies external matching and reduces external antenna switches.
- Max. +4dBm output power with 20 dB level control from register control.
- Built-in T/R switch for Class 2/3 application
- To avoid temperature variation, temperature sensor with temperature calibration is utilized into bias current and gain control.
- Fully integrated synthesizer has been created. There requires no external VCO, varactor diode, resonator and loop filter.
- Crystal oscillation with built-in digital trimming for temperature/process variations.
- Built-in PCB antenna.

Audio processor

- Support A-Law or μ -Law PCM format, or CVSD (Continuous Variable Slope Delta Modulation) for SCO channel operation.
- Noise suppression
- Echo suppression
- SBC decoding
- Packet loss concealment
- Build-in one languages (English) voice prompts and 20 events for each one
- Support SCMS-T

Audio Codec

- 16 bit DAC and 16 bit ADC codec
- 94dB SNR DAC playback
- 85 dB SNR ADC.

Peripherals

- Built-in Lithium-ion battery charger (up to 350mA)
- Integrate 3V, 1.8V configurable switching regulator and LDO
- Built-in ADC for battery monitor and voltage sense.
- A line-in port for external audio input
- Two LED drivers
- Built-in 32Kb EEPROM

Flexible HCI interface

- High speed HCI-UART (Universal Asynchronous Receiver Transmitter) interface (up to 921600bps)



Package

- 15x29mm² 40 pins package

Description

BM90 multi-speaker stereo audio module is a compact, highly integrated module for Bluetooth v3.0 with Enhanced Data Rate 2.4GHz applications. This module is fully compliant with Bluetooth specification and completely backward-compatible with Bluetooth 2.0 or 1.2 systems.

It incorporates IS1690S multi-speaker stereo audio chip, 32Kb EEPROM, PCB antenna, and ISSC's own Bluetooth software stack to achieve the required BT v3.0 with EDR functions.

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To provide the superior audio and voice quality, it also integrates a DSP co-processor, a PLL, and a CODEC dedicated for voice and audio applications.

For voice, not only basic CVSD encoding and decoding but also enhanced noise reduction and echo cancelation are implemented by the built-in DSP to reach the better quality in the both sending and receiving sides. For enhanced audio applications, SBC decoding functions can be also carried out by DSP to satisfy Bluetooth A2DP requirements.

In addition, to minimize the external components required for portable devices, a battery voltage sensor, battery charger, a switching regulator and LDO are integrated to reduce system BOM cost for various Bluetooth applications.

Applications

- Stereo headsets
- Portable speakerphones
- Multi speaker.

BM90 Module

Table of Contents

| | | |
|-----|---------------------------|----|
| 1.0 | DEVICE OVERVIEW | 4 |
| 2.0 | KEY FEATURES TABLE | 6 |
| 3.0 | PIN DESCRIPTION | 7 |
| 4.0 | SPECIFICATIONS | 9 |
| 5.0 | APPLICATIONS | 17 |
| 6.0 | REFERENCE CIRCUIT | 27 |
| 7.0 | PACKING INFORMATION | 28 |

BM90 Module

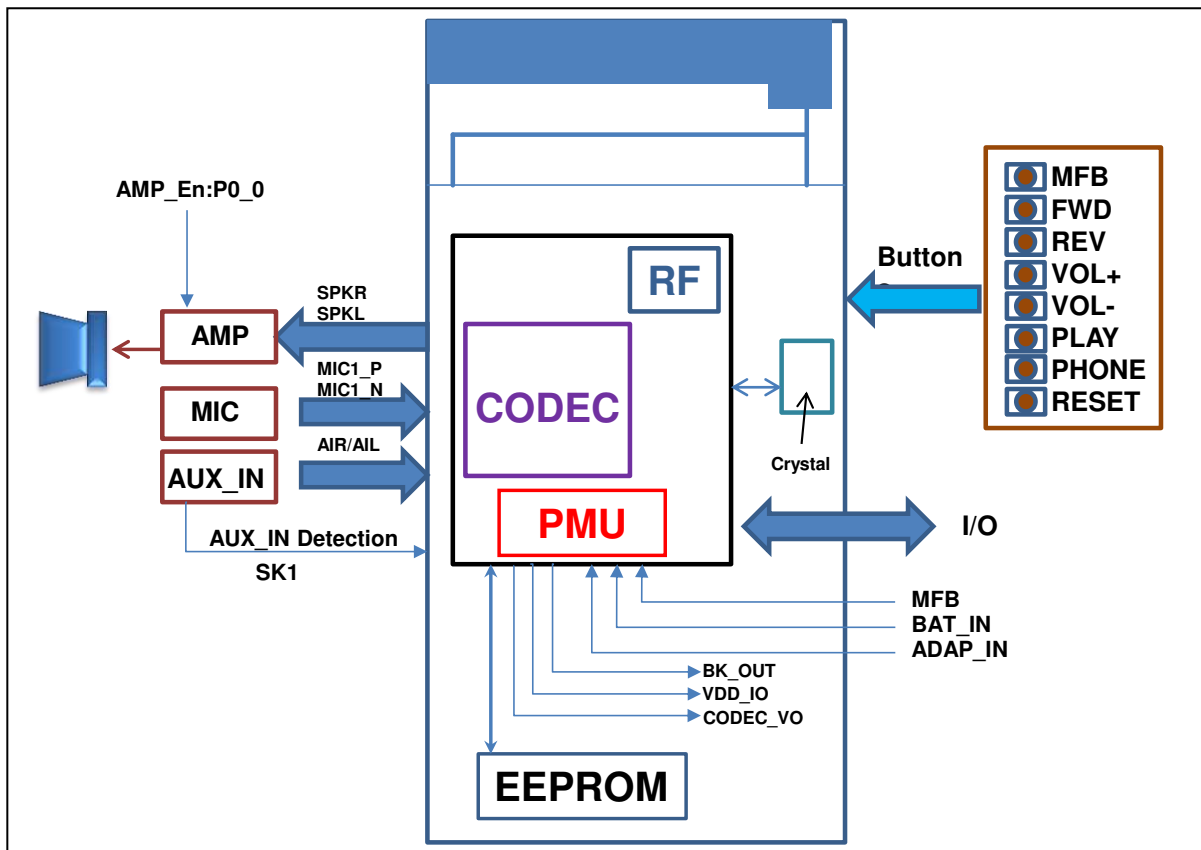
Abbreviations List:

HFP: Hands-free Profile
AVRCP: Audio Video Remote Control Profile
A2DP: Advanced Audio Distribution Profile
PBAP: Phone Book Access Profile
HSP: Headset Profile
SPP: Serial Port Profile
NFC: Near Field Communication
SCMS-T: Serial Copy Management System

1.0 DEVICE OVERVIEW

BM90 multi-speaker stereo audio module integrate IS1690S multi-speaker stereo audio chip . Figure 1-1 shows the application block diagram.

FIGURE 1-1: APPLICATION BLOCK DIAGRAM



* PMU: Power Management Unit and all voltages generated internally.

* Aux in: analog line in signal.

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Audio Interface

The module audio interface circuit consists of

- Stereo audio CODEC.
- One MIC. Input and Aux-in port
- Stereo outputs.

FIGURE 1-2: Analog audio interface block diagram

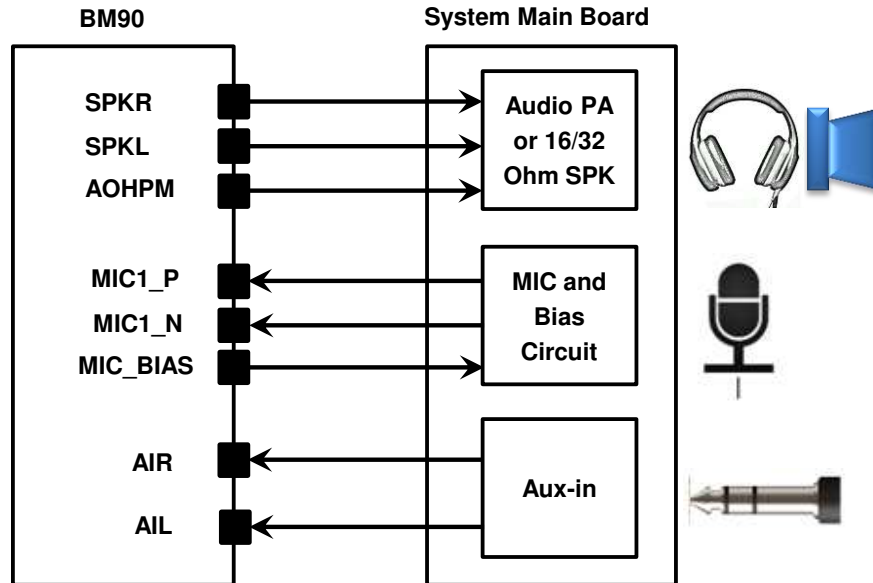
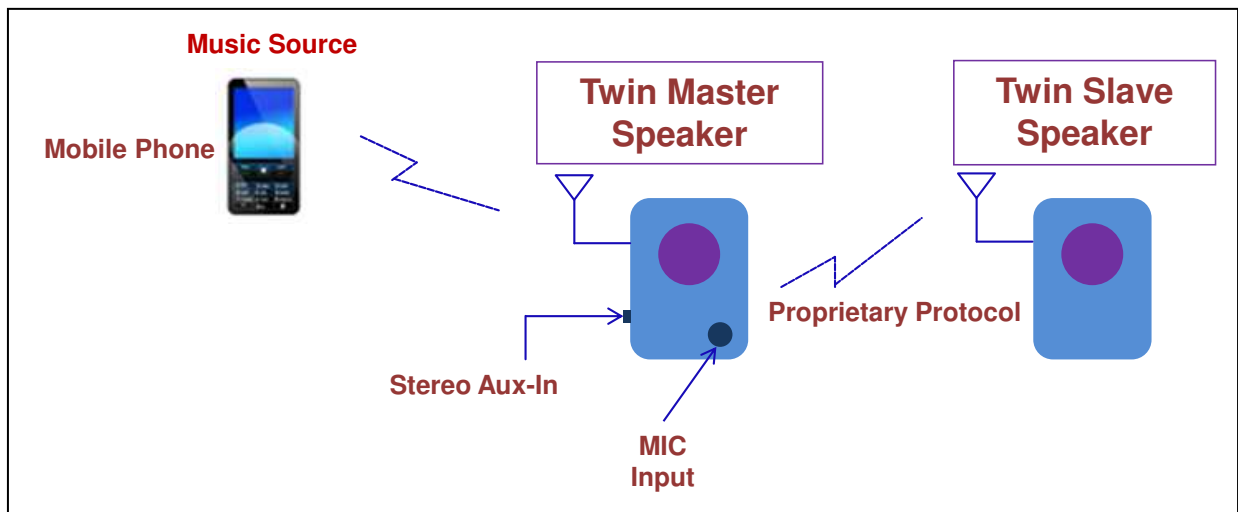


FIGURE 1-3: Twin Speaker Link block diagram



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2.0 Key Features Table

| SPEC | Chip | BM90 |
|------------------------------------|------|-----------|
| Application | | Multi-SPK |
| Stereo/Mono | | Stereo |
| Pin count | | 40 |
| Dimension (mm ²) | | 15X29 |
| Audio DAC output | | 2-ch |
| DAC (cap-less) SNR@2.8V (dB) | | -94 |
| ADC SNR @2.8V (dB) | | -85 |
| I ² S digital interface | | X |
| Analog aux-in | | √ |
| Mono MIC | | 1 |
| Support external audio amplifier | | √ |
| Built-in class-D audio amplifier | | X |
| UART | | X |
| LED Driver | | 2 |
| Internal DC-DC step-down regulator | | √ |
| DC 5V ADAPTER | | √ |
| Battery charger (350mA max) | | √ |
| IO for application | | 10 |
| Switches support | | 6 |
| Support NFC application | | √ |
| Voice prompt | | √ |
| Multi-tone | | √ |
| DSP sound effects | | √ |
| Built-in EEPROM | | √ |
| Profile | | |
| A2DP | | 1.0 |
| AVRCP | | 1.0 |
| HFP | | 1.5 |
| HSP | | 1.0 |
| PBAP | | X |
| SPP | | X |

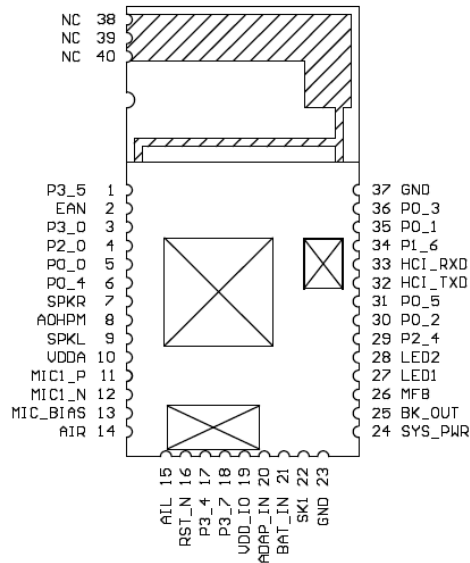
√ :Support the feature

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3.0 PIN DESCRIPTION

TABLE 3-1: BM90 PIN DESCRIPTION

Pin Diagram (Top View)



| Pin No. | Pin Type | Name | Description |
|---------|----------|----------|---|
| 1 | I/O | P3_5 | IO, default pull-high input Phone button |
| 2 | I | EAN | Embedded ROM/External Flash enable H: Embedded; L: External Flash |
| 3 | P | P3_0 | IO, default pull-high input Low: N_SPK Role Master/Slave |
| 4 | I/O | P2_0 | IO, default pull-high input System Configuration, H: Application L: Baseband(IBDK Mode) |
| 5 | I/O | P0_0 | IO, default pull-high input . Audio amplifier enable |
| 6 | I/O | P0_4 | IO, default pull-high input NFC |
| 7 | AO | SPKR | R-channel analog headphone output, for cap-less and single-ended application both |
| 8 | AO | AOHPM | Headphone common mode output/sense input. Cap-less application only. |
| 9 | AO | SPKL | L-channel analog headphone output, for cap-less and single-ended application both |
| 10 | AP | VDDA | Positive power supply/reference voltage for CODEC. Reserve for external cap to fine tune audio frequency response. Do not add external power to this pin. |
| 11 | AI | MIC1_P | Mic 1 mono differential analog positive input |
| 12 | AI | MIC1_N | Mic 1 mono differential analog negative input |
| 13 | AP | MIC_BIAS | Microphone biasing voltage |

BM90 Module

| | | | |
|----|-----|---------|---|
| 14 | AI | AIR | Stereo analog aux in, R-channel |
| 15 | AI | AIL | Stereo analog aux in, L-channel |
| 16 | I/O | RST_N | System Reset Pin |
| 17 | I/O | P3_4 | IO, default pull-high input. SLIDE SWITCH |
| 18 | I/O | P3_7 | IO, default pull-high input. FWD button |
| 19 | P | VDD_IO | VDD_IO pin, for calibration only Do not add external power to this pin |
| 20 | P | ADAP_IN | Power adaptor DC 5V input |
| 21 | P | BAT_IN | Li-Ion Battery input, should be always connected even if the power is given on power Adaptor input. |
| 22 | I/O | SK1 | Line-in detection |
| 23 | P | GND | Ground |
| 24 | P | SYS_PWR | System Power Output |
| 25 | P | BK_OUT | Buck feedback sense pin |
| 26 | P | MFB | Multi-Function Push Button key |
| 27 | P | LED1 | LED Driver 1 |
| 28 | P | LED2 | LED Driver 2 |
| 29 | I/O | P2_4 | IO, default pull-high input. System Configuration, H: Boot Mode Low: N_SPK Role Master/Slave |
| 30 | I/O | P0_2 | IO, default pull-high input. PLAY/PAUSE button |
| 31 | I/O | P0_5 | IO, default pull-high input when system power on. After system power on, the IO function is by FW programming. REV button |
| 32 | O | HCI_TXD | HCI TX data |
| 33 | I | HCI_RXD | HCI RX data |
| 34 | I/O | P1_6 | IO, default pull-high input. Volume down button |
| 35 | I/O | P0_1 | IO, default pull-high input. Volume up button |
| 36 | I/O | P0_3 | IO for 3 rd LED optional. |
| 37 | P | GND | Ground. |
| 38 | | NC | NC . |
| 39 | | NC | NC . |
| 40 | | NC | NC . |
| | | | |

- * I: signal input pin
- * AI: analog signal input pin
- * O: signal output pin
- * AO: analog signal output pin
- * I/O: signal input/output pin
- * P: power pin
- * AP: analog power pin

BM90 Module

4.0 SPECIFICATIONS

4.1 SPECIFICATIONS

Table 4-1: Absolute Maximum Specifications

| Symbol | Parameter | Min | Max | Unit |
|------------------------|-----------------------------|-----|------|------|
| 1V8 | Digital core supply voltage | 0 | 2.1 | V |
| VCC_RF | RF supply voltage | 0 | 2.1 | V |
| SAR_VDD | SAR ADC supply voltage | 0 | 2.1 | V |
| VDDA/VDDAO | CODEC supply voltage | 0 | 3.3 | V |
| VDD_IO | I/O supply voltage | 0 | 3.6 | V |
| BK_VDD | BUCK supply voltage | 0 | 4.3 | V |
| 3V1_IN | LDO Supply voltage | 0 | 4.3 | V |
| BAT_IN | Input voltage for battery | 0 | 4.3 | V |
| ADP_IN | Input voltage for adaptor | 0 | 7.0 | V |
| T _{STORE} | Storage temperature | -65 | +150 | °C |
| T _{OPERATION} | Operation temperature | -20 | +70 | °C |

Table 4-2: Recommended operating condition

| Symbol | Parameter | Min | Typical | Max | Unit |
|--------|-----------------------------|-----|---------|------|------|
| 1V8 | Digital core supply voltage | 1.8 | 1.85 | 1.95 | V |
| VDD_IO | I/O supply voltage | 2.8 | 3.0 | 3.3 | V |
| BAT_IN | Input voltage for battery | 3 | 3.7 | 4.25 | V |
| ADP_IN | Input voltage for adaptor | 4.5 | 5 | 5.5 | V |

*Absolute and Recommended operating condition tables reflect typical usage for device.

*All these supply voltage are programmable by EEPROM parameters.

Table 4-3: Battery Charger

| Parameter | Min | Typical | Max | Unit | |
|---|-----------------------------------|---------|-------|------|----|
| Input Voltage | 4.5 | 5.0 | 5.5 | V | |
| Battery trickle charge current (BAT_IN < trickle charge voltage threshold) | | 0.1C | | mA | |
| Maximum Battery Fast Charge Current Note: ENX2=0 | Headroom > 0.7V (ADAP_IN=5V) | 170 | 200 | 240 | mA |
| | Headroom = 0.3V (ADAP_IN=4.5V) | 160 | 180 | 240 | mA |
| Maximum Battery Fast Charge Current Note: ENX2=1 | Headroom > 0.7V (ADAP_IN=5V) | 330 | 350 | 420 | mA |
| | Headroom = 0.3V (ADAP_IN=4.5V) | 180 | 220 | 270 | mA |
| Trickle Charge Voltage Threshold | | 3 | | V | |
| Float Voltage | 4.158 | 4.2 | 4.242 | V | |
| Battery Charge Termination Current, (% of Fast Charge Current) | | 10 | | % | |

Note:

(1) C is set in EEPROM

(2) Headroom = $V_{ADAP_IN} - V_{BAT}$

(3) ENX2 is not allowed to be enabled when $V_{ADAP_IN} - V_{BAT} > 2V$

(4) The Li-Ion battery has operation temperature limiting condition which is depended on vender..

(5) These parameters are characterized but not tested in manufacturing.

BM90 Module

Table 4-4: LED driver

| Parameter | Min | Typical | Max | Unit |
|-------------------------------|-----|---------|-----|------|
| Open-drain Voltage | | | 5.1 | V |
| Open-drain Current | | | 5.5 | mA |
| Intensity Control | | 16 | | step |
| Current Step | | 0.35 | | mA |
| Power Down Open-drain Current | | | 1 | μA |
| Shutdown Current | | | 1 | μA |

*Test condition: SAR_VDD=1.8V, temperature=25 °C.

*These parameters are characterized but not tested in manufacturing.

Table 4-5: Digital IO

| Parameters | MIN | TYP | MAX | Unit |
|---------------------------------------|-----|-----|-----------------|------|
| Input Voltage | 2.7 | 3 | 3.6 | V |
| V _{IH} (Input High Voltage) | 2.0 | | V _{dd} | V |
| V _{IL} (Input Low Voltage) | 0 | | 0.8 | V |
| Input Reference Resistor | | | | |
| R _{PU} (Pull-Up Resistor) | | 50K | | Ohm |
| R _{PD} (Pull-Down Resistor) | | 50K | | Ohm |
| Output Voltage | | | | |
| V _{OH} (Output High Voltage) | 2.4 | | V _{dd} | V |
| V _{OL} (Output Low Voltage) | 0 | | 0.4 | V |

*These parameters are characterized but not tested in manufacturing.

BM90 Module

Table 4-6: Audio codec Digital to Analogue Converter

T= 25°C, VDDA/VDDAO=2.8V, 1KHz sine wave input, Bandwidth = 20~20KHz

| Parameter (Condition) | Min. | Typ. | Max. | Unit | |
|---|------------|------|------|--------|----|
| Over-sampling rate | | 128 | | f_s | |
| Resolution | | 16 | | Bits | |
| Output Sample Rate | 8 | | 48 | KHz | |
| Signal to Noise Ratio Note: 1 (SNR @line-load) for 48kHz | | 94 | | dB | |
| Signal to Noise Ratio (SNR @earphone load 16Ω load, 0dBFS input relative to digital silence) | | | 94 | dB | |
| Digital Gain | -54 | | 0 | dB | |
| Analog Gain | -28 | | 3 | dB | |
| Analog Gain Resolution | | 1 | | dB | |
| Output Voltage Full-scale Swing (AVDD=2.8V) | | 792 | | mV rms | |
| Maximum Output Power (16Ω load) | | 34 | | mW | |
| Maximum Output Power (32Ω load) | | 17 | | mW | |
| Allowed Load | Resistive | 8 | 16 | O.C. | Ω |
| | Capacitive | | | 500 | pF |
| THD+N (16Ω load) | | | 0.05 | % | |

Note:

(1) f_{in} =1KHz, B/W=20~20KHz, A-weighted, THD+N < 0.01%, 0dBFS signal, Load=100KΩ

(2) These parameters are characterized but not tested in manufacturing.

* O.C. : open circuit.

BM90 Module

Table 4-7: Audio codec Analogue to Digital Converter

T= 25°C, VDDA/VDDAO=2.8V, 1KHz sine wave input, Bandwidth = 20~20KHz

| Parameter (Condition) | Min. | Typ. | Max. | Unit |
|--|---------------|------|------|------------|
| Resolution | | | 16 | Bits |
| Output Sample Rate | 8 | | 48 | KHz |
| Signal to Noise Ratio Note: 1 (SNR @MIC or Line-in mode) | 8KHz | 85 | | dB |
| | 44.1KHz/48KHz | 85 | | |
| Digital Gain | -54 | | 4.85 | dB |
| MIC Boost Gain | | 20 | | |
| Analog Gain | | | 26 | dB |
| Input full-scale at maximum gain (differential) | | 4 | | mV rms |
| Input full-scale at minimum gain (differential) | | 800 | | mV rms |
| 3dB bandwidth | | 20 | | KHz |
| Microphone mode (input impedance) | | 6 | 10 | K Ω |
| THD+N (microphone input) @30mVrms input | | 0.04 | | % |

Note:

(1) f_{in} =1KHz, B/W=20~20KHz, A-weighted, THD+N < 1%, 150mVpp input

(2) These parameters are characterized but not tested in manufacturing.

BM90 Module

Table 4-8: Transmitter section for BDR

| Parameter | Min | Typ | Max | Bluetooth specification | Unit |
|--------------------------------------|-----|-----|-----|-------------------------|------|
| Maximum RF transmit power | | 3 | 4.0 | -6 to 4 | dBm |
| RF power control range | | 20 | | ≥16 | dB |
| 20dB bandwidth for modulated carrier | | 900 | | ≤1000 | KHz |

*Test condition: VCC_RF= 1.8V, temperature=25 °C.

*The RF Transmit power is calibrated during production using MP Tool software and MT8852 Bluetooth Test equipment.

Table 4-9: Transmitter section for EDR

| | Min | Typ | Max | Bluetooth specification | Unit |
|-------------------------|-----|------|-----|-------------------------|------|
| Relative transmit power | | -1.6 | | -4 to 1 | dB |

*Test condition: VCC_RF= 1.8V, temperature=25 °C.

*The RF Transmit power is calibrated during production using MP Tool software and MT8852 Bluetooth Test equipment.

Table 4-10: Receiver section for BDR

| | Min | Typ | Max | Bluetooth specification | Unit |
|-------------------------|-----|-----|-----|-------------------------|------|
| Sensitivity at 0.1% BER | | -90 | | ≤-70 | dBm |

*Test condition: VCC_RF= 1.8V, temperature=25 °C.

Table 4-11: Receiver section for EDR

| | Modulation | Min | Typ | Max | Bluetooth specification | Unit |
|--------------------------|------------|-----|-----|-----|-------------------------|------|
| Sensitivity at 0.01% BER | π/4 DQPSK | | -91 | | ≤-70 | dBm |
| | 8DPSK | | -83 | | ≤-70 | dBm |

*Test condition: VCC_RF= 1.8V, temperature=25 °C.

BM90 Module

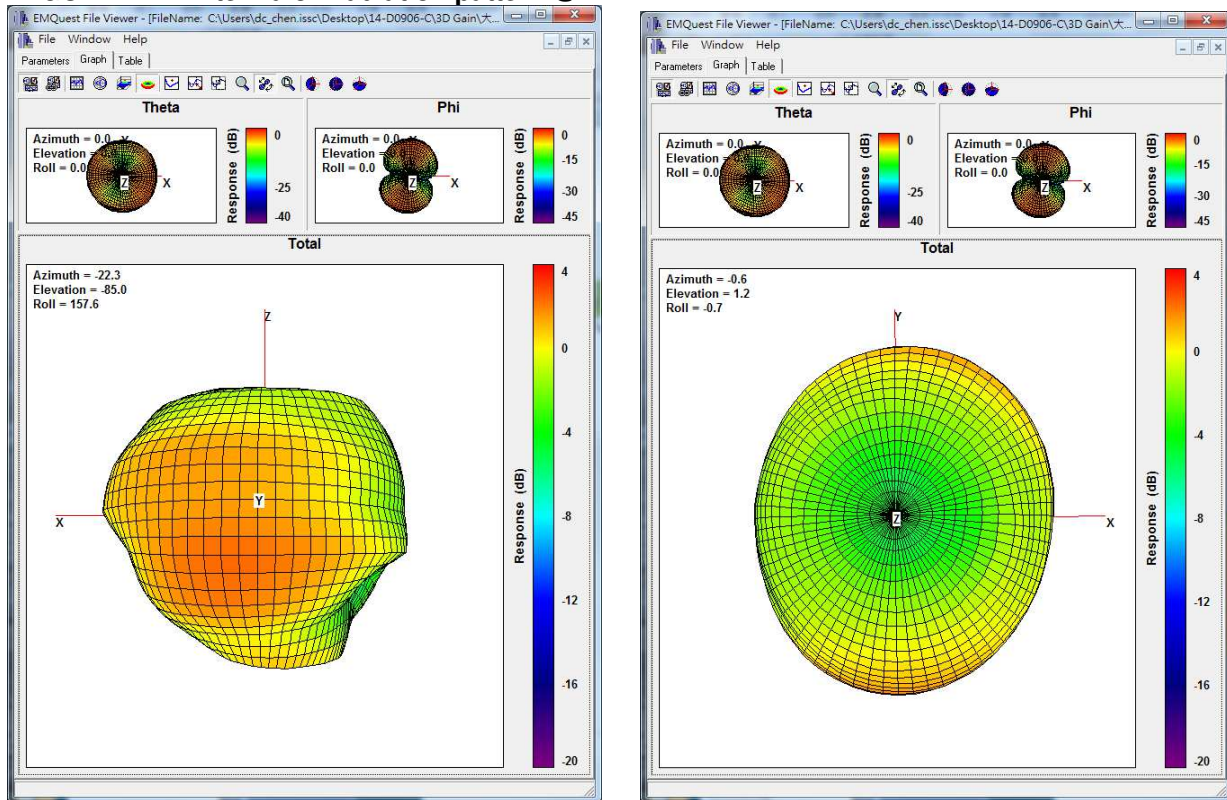
4.2 PRINTED ANTENNA PERFORMANCE

Table 4-12: Antenna Parameters

| Parameters | MIN | TYP | MAX | Unit |
|--------------|-----|-----|-----|------|
| Antenna gain | | 2 | | dBi |
| Efficiency | 70 | | 80 | % |

Note: The antenna gain and efficiency is measured on ISSC evaluation board, and will vary over PCB form factor and host PCB design. Therefore, it is recommended to verify the antenna performance on final host PCB..

FIGURE 4-1: Antenna 3D radiation pattern @2441 MHz



BM90 Module

4.3 BQTF INFORMATION

FIGURE 4-2: BQTF Information

The screenshot displays the Bluetooth.com website interface. On the left is a navigation menu with links for Home, Register, Login, Events, Resources (FAQ, Qualified Listings, List of BQTFs, Member Directory), and Report Issues. The main content area is titled "Listing Details" and contains the following information:

Bluetooth.com

Select Language Search site Enter keywords here Search >

[<< Go Back <<](#) [>> DISPLAY ICS DETAILS >>](#)

Member Company ISSC Technologies Corp.

Declaration ID D022688

QD ID 56495 | [Export ICS](#)

PRD 1.0 ID (QP ID)

Wi-Fi® Certification ID

Subsetted Projects

| Date Created | Type | ICS |
|--------------|--------|---------------------|
| Apr 17, 2014 | Main | ICS |
| Apr 18, 2014 | Subset | ICS |
| Jun 9, 2014 | Subset | ICS |

Design Name BM90SPK

Design Model Number BM90SPK

Hardware Version Number BM90SPK

Software Version Number BM90SPK

Qualification Assessment Date April/18/2014

Listing Date April/18/2014

Design Description Bluetooth Speaker Module with A2DP, AVRCP, HFP, HSP, GAVDP profiles

Product Type End Product

Specification Name 3.0

Product List

| Model | URL | Description | Subset ID | Publish Date |
|---------|-----|---|-----------------------|--------------|
| BM90SPK | | Bluetooth Speaker Module with A2DP, AVRCP, HFP, HSP, GAVDP profiles | | Apr 18, 2014 |
| BM91 | | Bluetooth speaker/headset | 58026 | Jun 9, 2014 |

[Technical Data Sheet \(RIN\)](#) (not available)

Listed By [Paul Wu](#)

BQE [Frankie Lin](#)

Referenced QDID Profile Information

> QDID: 56495

BM90 Module

4.4 CURRENT CONSUMPTION

Table 4-13: Single Mode current consumption

| Test Condition: T= 25°C, BAT_IN=3.8V, codec without loading | | | | |
|---|-----|------|-----|------|
| Normal Operation | Min | Typ | Max | Unit |
| Off mode | | | 10 | uA |
| Standby mode | | 0.83 | | mA |
| Link mode | | 0.49 | | mA |
| SCO link | | 17.4 | | mA |
| A2DP link @ 1KHz Tone | | 23 | | mA |

* For reference.

Table 4-14: Twin Mode: Master current consumption

| Test Condition: T= 25°C, BAT_IN=3.8V, codec without loading | | | | |
|---|-----|-------|-----|------|
| | Min | Typ | Max | Unit |
| Off mode | | | 10 | uA |
| Standby mode | | 2 | | mA |
| Link mode | | 0.63 | | mA |
| SCO link | | 18.06 | | mA |
| A2DP link @ 1KHz Tone | | 27.8 | | mA |

* For reference.

Table 4-15: Twin Mode: Slave current consumption

| Test Condition: T= 25°C, BAT_IN=3.8V, codec without loading | | | | |
|---|-----|------|-----|------|
| | Min | Typ | Max | Unit |
| Off mode | | | 10 | uA |
| Standby mode | | 0.75 | | mA |
| Link mode | | 0.7 | | mA |
| SCO link | | 9.4 | | mA |
| A2DP link @ 1KHz Tone | | 23.2 | | mA |

* For reference.

BM90 Module

5.0 APPLICATIONS

5.1 EXTERNAL CONFIGURATION

Figure 5-1 shows the configuration interface on BM90. It is recommended to include a pin header on the main PCB for development .

Configuration modes are entered accordingly to the system configuration I/O pins as shown in Table5-1
Pin 2_0 , P2_4 and EAN pin have internal pull-up.

FIGURE 5-1: External Configuration Header Connections

(Here is the interface connect example of the BM90)

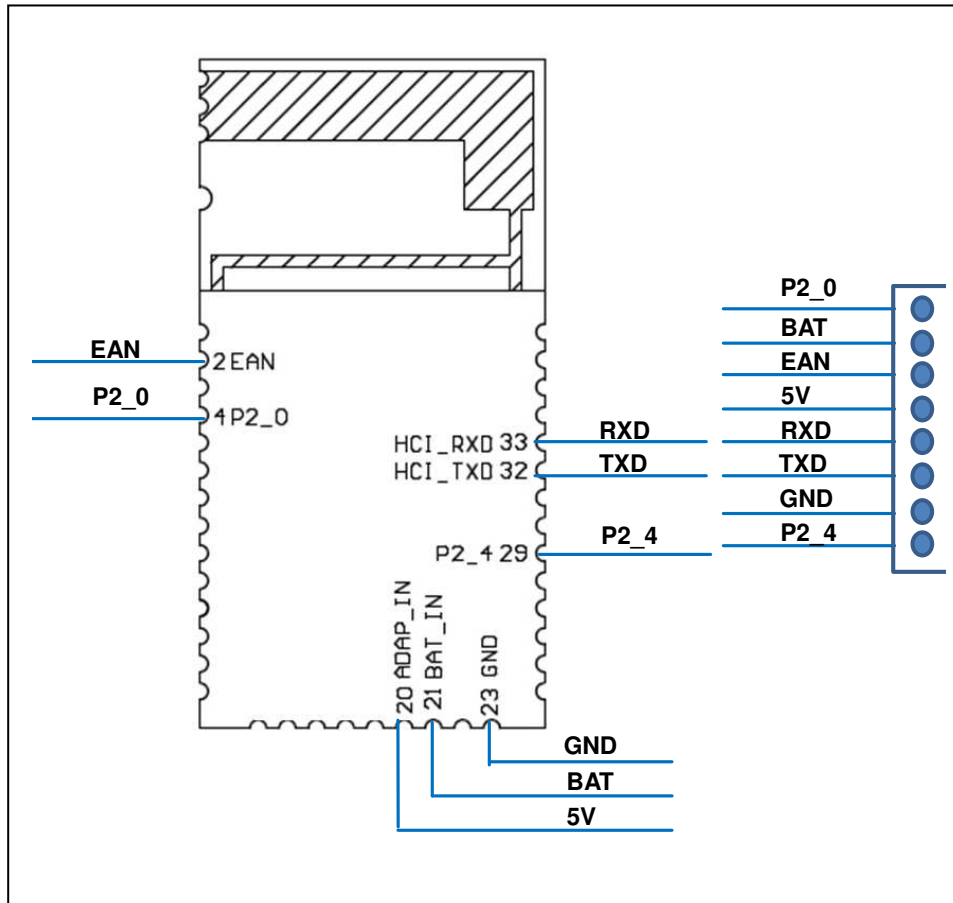


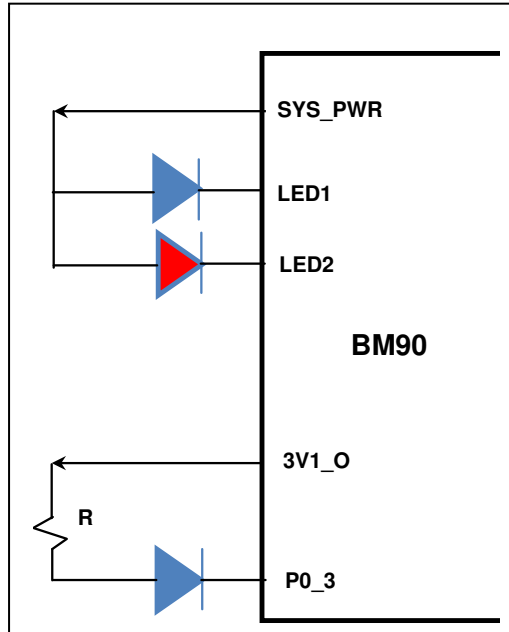
TABLE 5-1: SYSTEM CONFIGURATION SETTINGS

| P2_0 | P2_4 | EAN | Operational Mode |
|------|------|------|------------------------------------|
| High | High | High | Normal operation |
| Low | High | High | Test (Write EEPROM) |
| Low | Low | High | Write Flash (Firmware programming) |

BM90 Module

5.2 LED DRIVER

There are two dedicate LED drivers to control the LEDs. They provide enough sink current (16 step control and 0.35mA for each step) that LED can be connected directly with BM90. If the third LED is necessary, use P0_3 to light up LED, an external resistor to fine tune the driving current is necessary. Under this configuration, the power source must be VDD_IO, and the LED brightness could be adjusted by R(resistor). When use P0_3 to light up LED, UI tool need to be modified, too.



BM90 Module

5.3 FUNCTION OF PIN

BM90 audio chip provides six general purpose IOs for key functions. The corresponding key functions are saved in EEPROM. The first button must be power key. The power on/off functions only can be set on MFB pin. There are four different operations for every button. They are short click, long click, double click and combinations.

TABLE 5-2: IOs for Buttons

| Button Name | Default Functions | IO name |
|-------------|-------------------|---------|
| Button 0 | Power / MFB | PWR |
| Button 1 | Volume UP | P0_1 |
| Button 2 | Volume DN | P1_6 |
| Button 3 | PLAY/PAUSE | P0_2 |
| Button 4 | REV | P0_5 |
| Button 5 | FWD | P3_7 |

Some signals were generated to indicate or control outside devices. The most popular applications are NFC for easy pairing, external audio amplifier for louder speaker.

TABLE 5-3: IOs for added functions

| Functions | IO configurable features |
|---------------------------|--------------------------|
| Slide switch | P3_4 |
| PHONE | P3_5 |
| NFC detect | P0_4 |
| External amplifier enable | P0_0 |
| 3rd LED | P0_3 |

BM90 Module

5.4 Adaptive Frequency Hopping (AFH)

FW will scan and use background noise power to determine 20 channels to stand for good channels. Adaptive Frequency Hopping (AFH) avoids occupied RF channels

5.5 MULTI-SPEAKER

IS1690S is designed for stereo Bluetooth multi speaker & speaker phone application with stereo aux in input function.

5.5.1 TWIN SPEAKER LINK TECHNOLOGY INTRODUCTION

Twin Speaker can be configured as

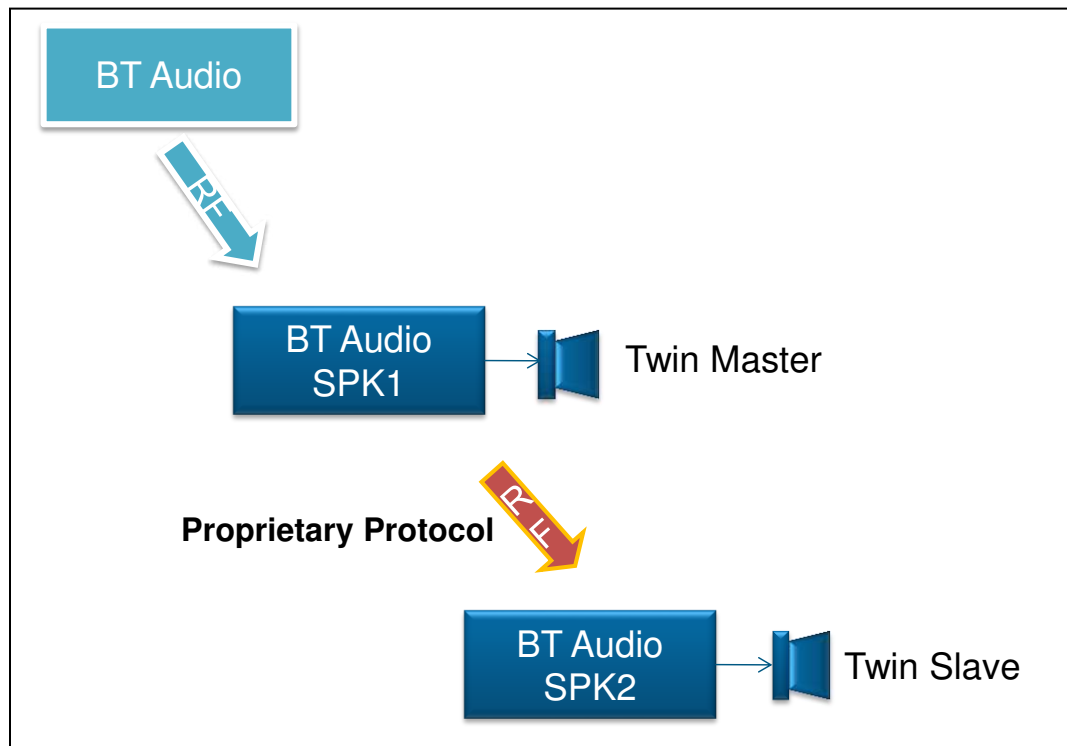
- Double Mode: Both Speakers output the mixed L and R channel.
- Stereo Mode: Both Speakers output the separated L and R channel

5.5.1.1 TWIN SPEAKER LINK

Figure 11-1 illustrates the concept of Twin Speaker link technology. In order to speed up the Twin Speaker link establishment and optimize the audio synchronization, Twin Speaker Link is a Bluetooth proprietary A2DP link between both Twin Master and Twin Slave Speakers.

- Twin_Master:
 - It can be setup the standard HF, A2DP and AVRCP link with host Bluetooth devices like mobile phone and Notebook.
 - It will also take the responsibility to setup proprietary A2DP link with the other Twin_Slave speaker.
 - Once the Twin Speaker Link is established, Twin_Master will redirect the A2DP media packets and control signaling to Twin_Slave Speaker.
 - Notice: The voice channel (SCO link) and HF operation can be executed by Twin_Master operating only.
- Twin_Slave:
 - It can only be operated with Twin_Master by proprietary A2DP protocol. It cannot be connected by standard A2DP protocol.
 - Once the Twin Speaker Link is established, it can feedback the specific status and event to Twin_Master. These status and events include button operation, low battery voltage, power off event etc.

Figure 5-2 A2DP Twin Speaker Link Diagram



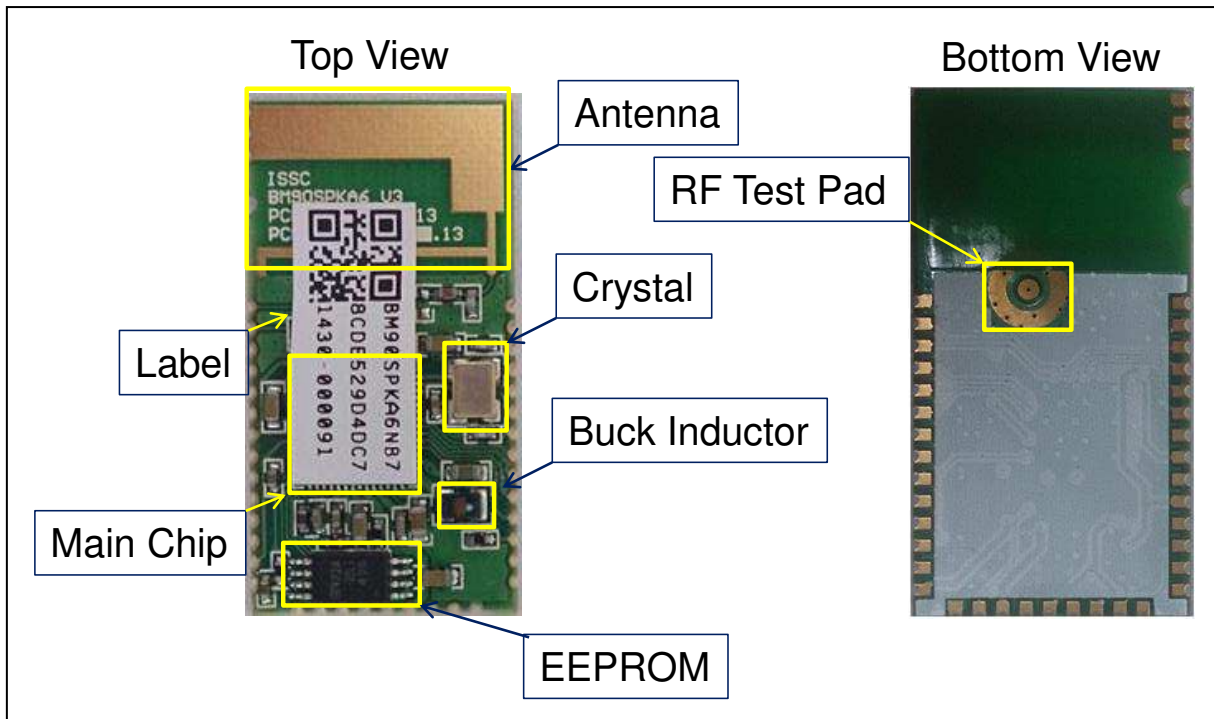
BM90 Module

5.6 Mounting Details

BM90 physical dimensions are shown in Figure 5-4. Figure 5-5 shows the recommended PCB footprint and the recommended module placement is shown in Figure 5-6. There should be no top copper layer near the test pin area shown in Figure 5-6. On the main PCB, the areas under the antenna should not contain any top, inner layer, or bottom copper. A PCB cut-out is recommended as shown in Figure 5-6. A low-impedance ground plane will ensure the best radio performance (best range, lowest noise). Figure 5-6 shows the minimum ground plane area to the left and right of the module for the best antenna performance. The ground plane can be extended beyond the minimum recommended as need for the main PCB EMC noise reduction. For the best range performance, keep all external metal structures away from the antenna by at least 15 mm.

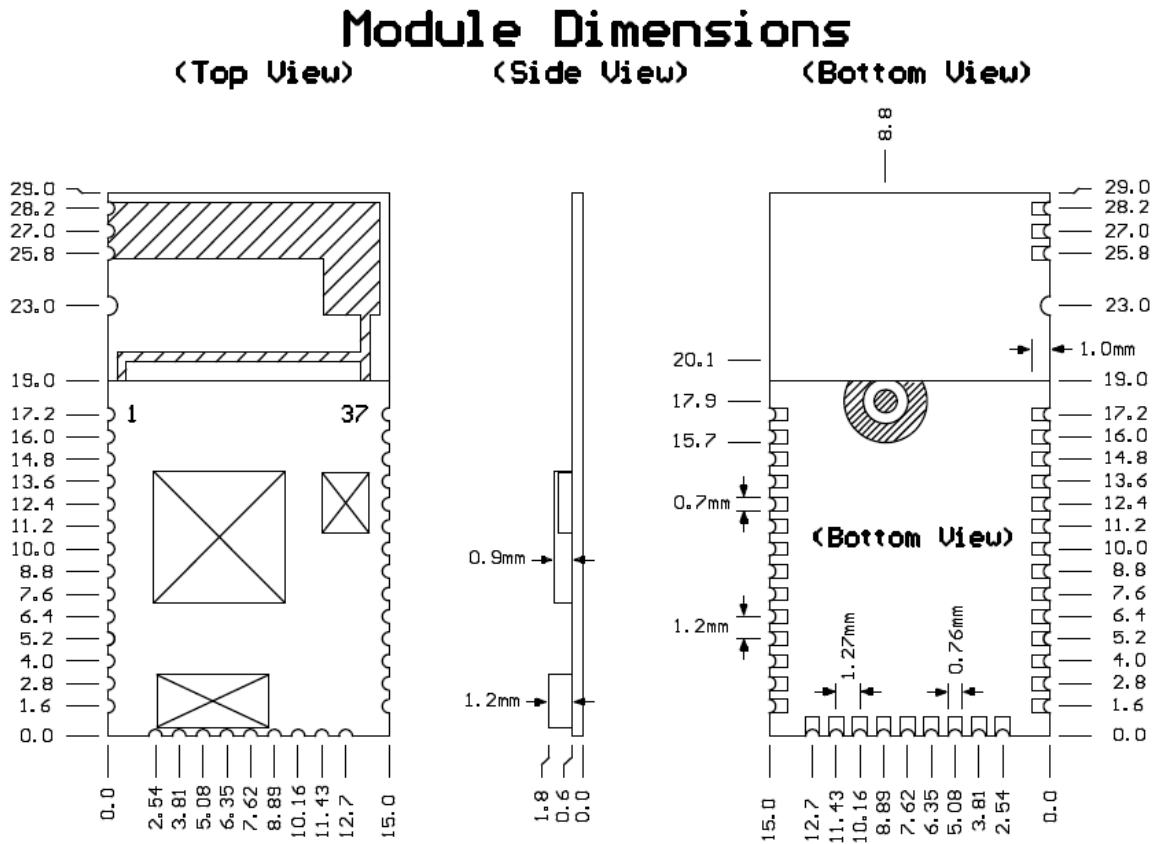
5.7 Module Dimension

FIGURE 5-3: BM90 module

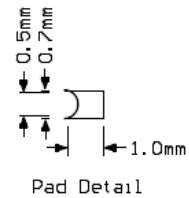


BM90 Module

FIGURE 5-4: Outline Dimension



Dimensions are in millimeters
 Tolerances:
 PCB Thickness: ± 0.06 mm



PCB dimension:

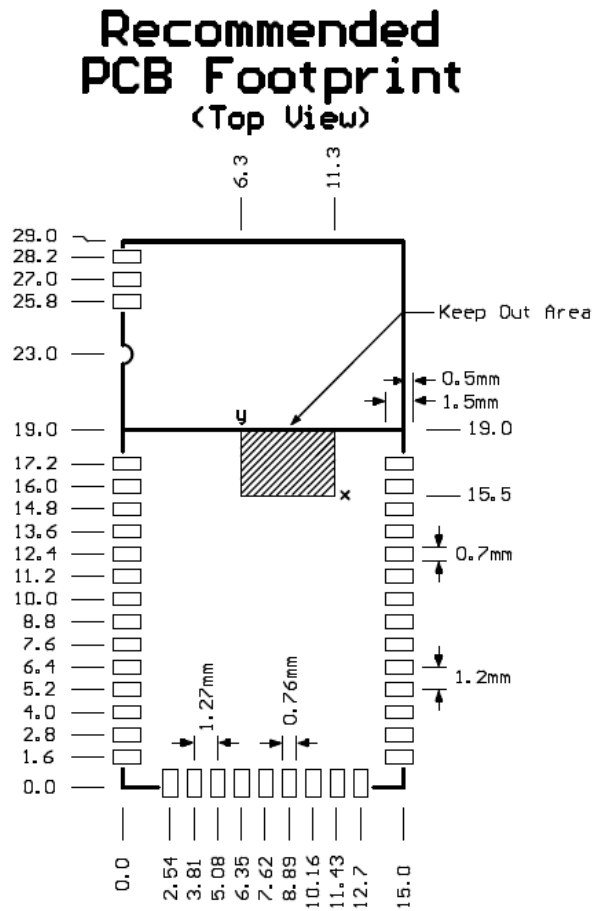
X : 15.1 mm

Y : 29.2 mm

Tolerances: 0.25 mm

BM90 Module

FIGURE 5-5: Module Foot print

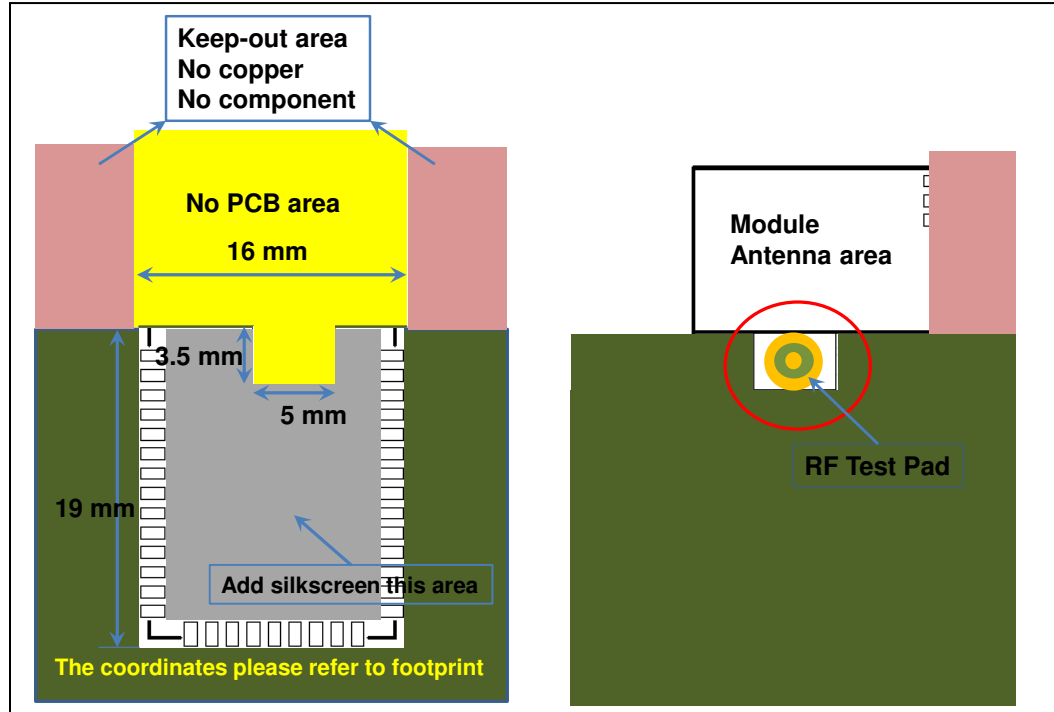
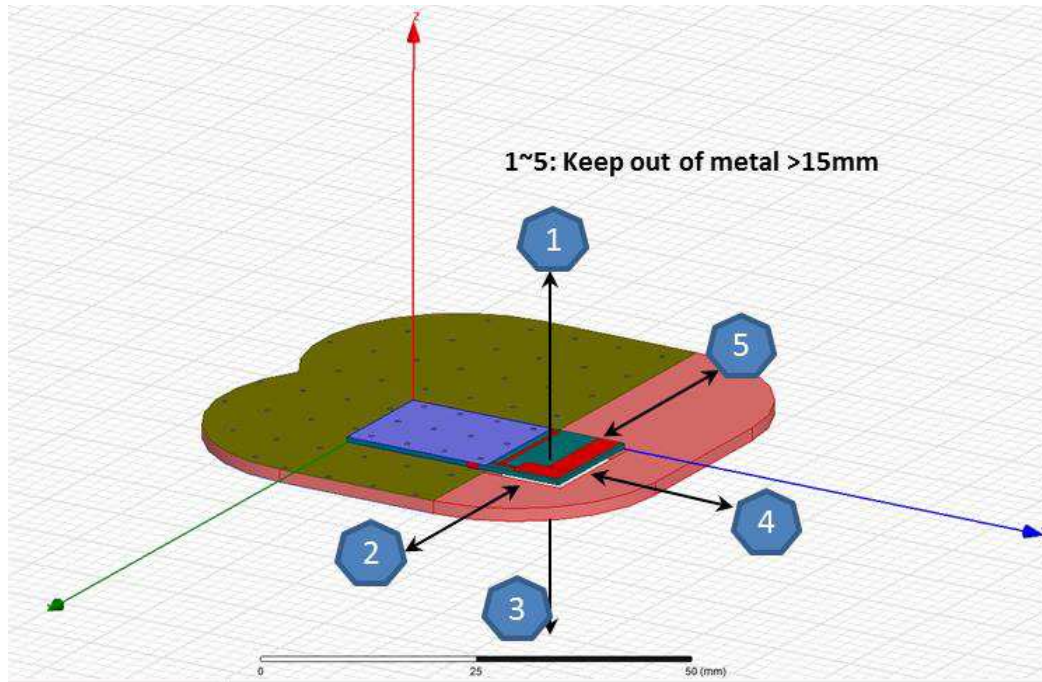


BM90 Module

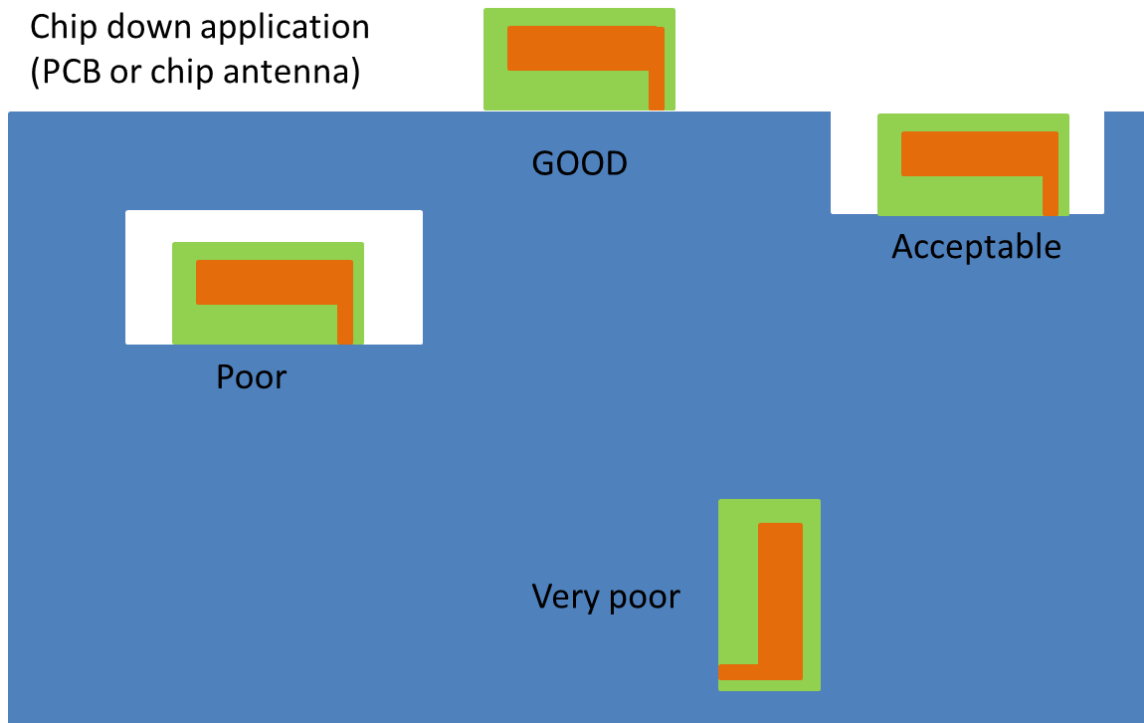
5.8 Main Board Antenna Area Layout Guide

Antenna keep out area is very important.

FIGURE 5-6: Mother Board Antenna Area Layout Guide



BM90 Module



For more detail free space of antenna placement design, you can reference the design rule of antenna produce vendor.

5.9 RFLOW PROFILE

5.9.1 Soldering Recommendations

Standard : IPC/JEDEC J-STD-020

Condition :

Preheat : 150~200°C 、 60~120 seconds

Average ramp-up rate (217°C to peak): 3°C/sec max.

Temperature maintained above 217°C : 60~150 seconds

Time within 5°C of peak temperature: 30 ~ 40 seconds.

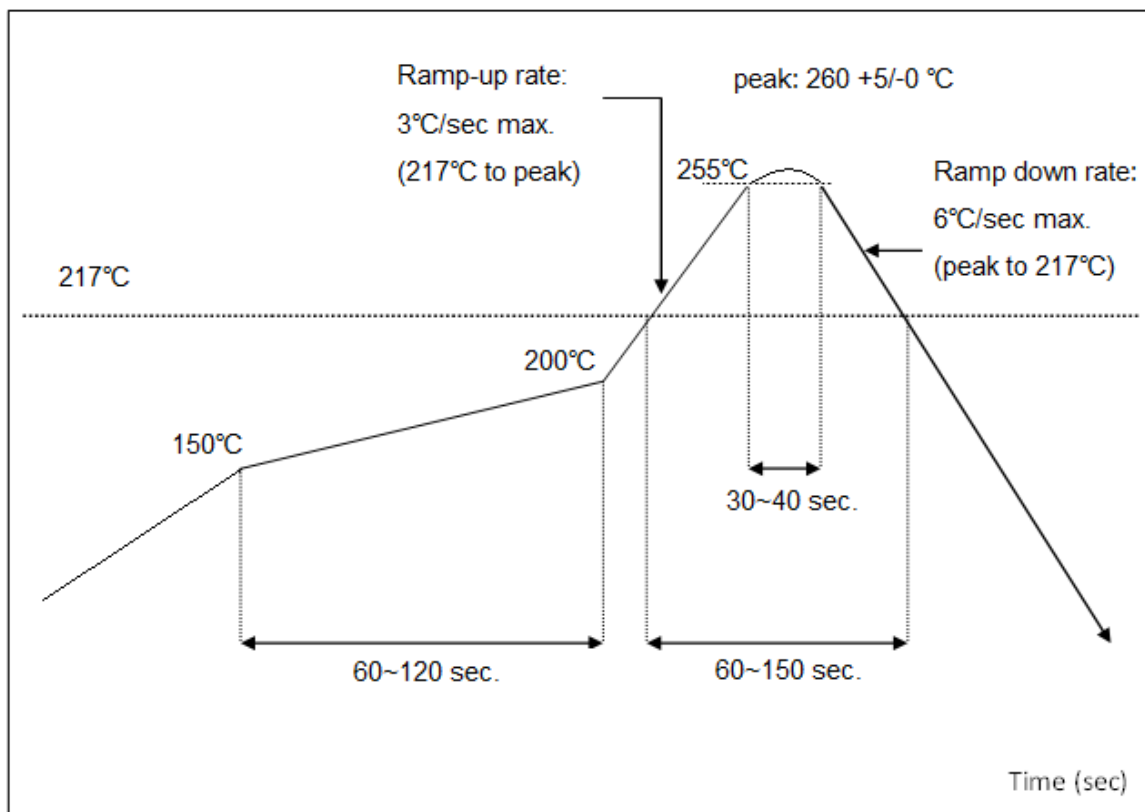
Peak temperature : 260 +5/-0 °C

Ramp-down rate (peak to 217°C) : 6°C/sec. max.

Time 25°C to peak temperature : 8 minutes max.

Cycle interval : 5 minutes

FIGURE 5-7: Reflow profile

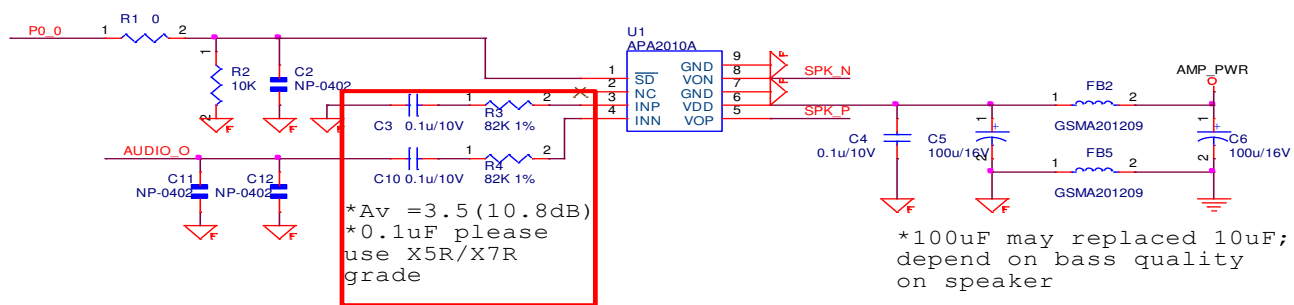
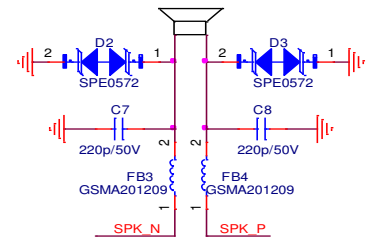


* For reference.

BM90 module was assembled using standard lead-free reflow profile IPC/JEDEC J-STD-020. The module can be soldered to the main PCB using standard leaded and lead-free solder reflow profiles. To avoid damaging of the module, the recommendations are listed as follows:

- Refer to Microchip Technology Application Note AN233 Solder Reflow Recommendation (DS00233) for the soldering reflow recommendations
- Refer to the solder paste data sheet for specific reflow profile recommendations
- Use no-clean flux solder paste
- Do not wash as moisture can be trapped under the shield
- Use only one flow. If the PCB requires multiple flows, apply the module on the final flow

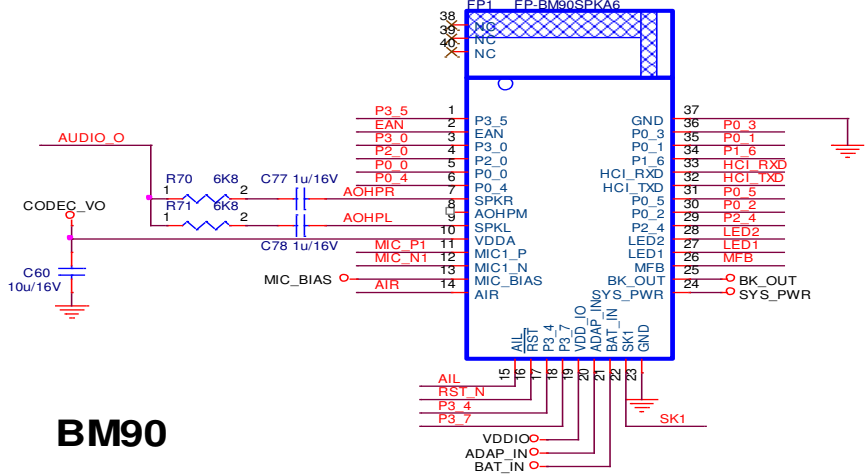
SPEAKER OUTPUT PATH



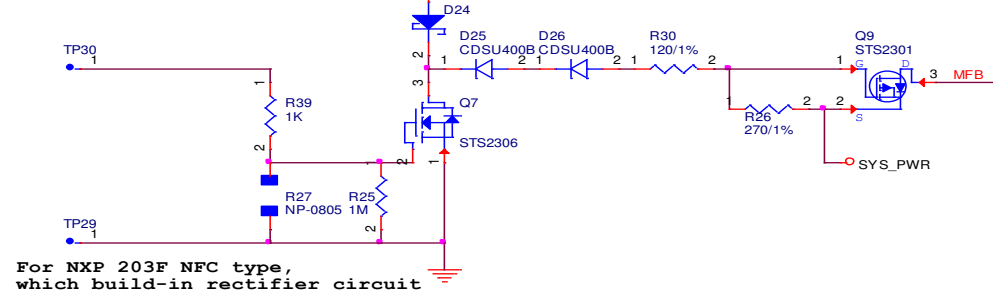
*AMP GND should be layout out independantly

Single-ended input mode AMP

BM90

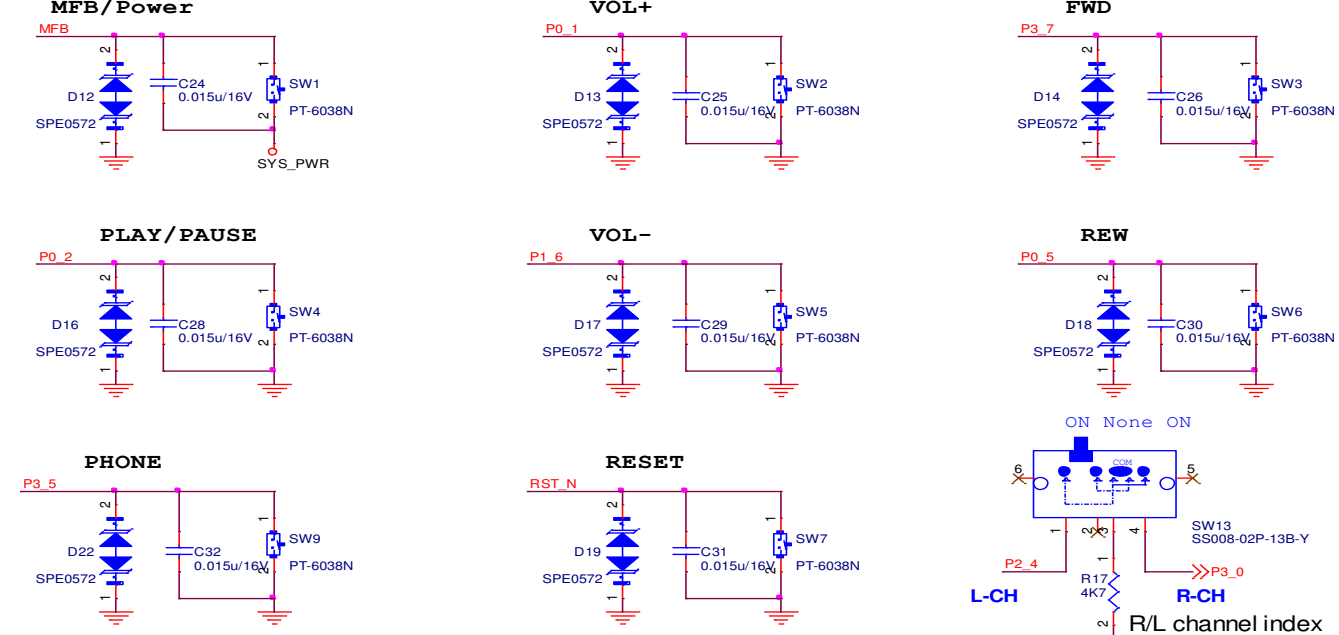


NFC



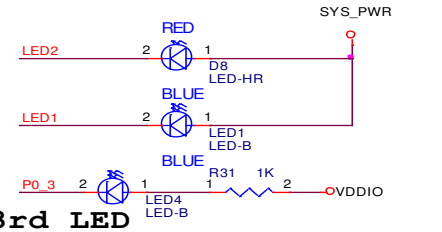
For NXP 203F NFC type, which build-in rectifier circuit

PUSH BUTTON



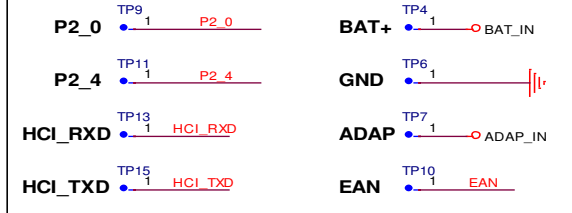
All ESD diodes in this schematics are reserved for testing and can be removed if ESD can be pass without adding it.

LED



3rd LED

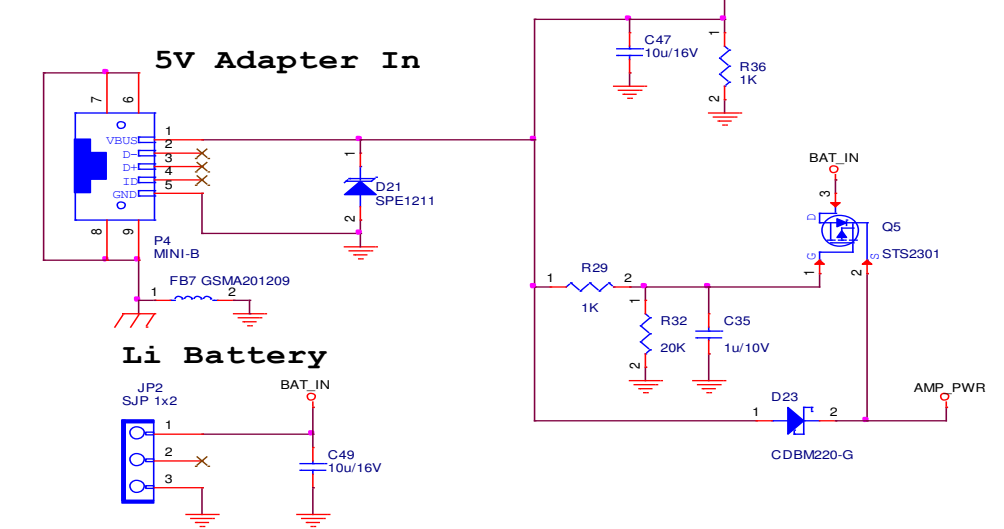
For FW/EEP update



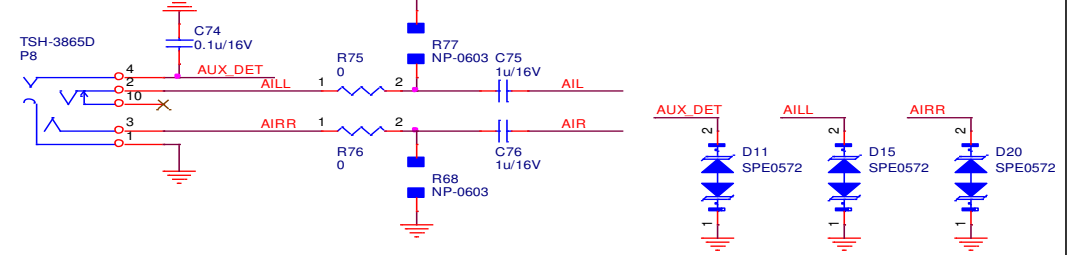
GPIO vs. APPLICATION FUNCTION

| | |
|-----|--|
| P00 | Audio AMP Enable |
| P01 | Volume up |
| P02 | Play/Pause |
| P03 | 3rd LED / DRC INDICATION |
| P04 | NFC |
| P05 | REW |
| P16 | Volume down |
| P20 | System Configuration |
| P24 | System Configuration / N_SPK Role / L-CH |
| P30 | N_SPK Role / R-CH |
| P34 | SLIDE SWITCH |
| P37 | FWD |
| P35 | Phone |
| SK1 | Line-in detection |

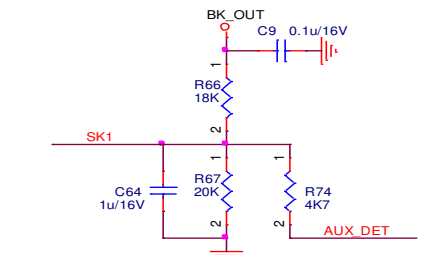
POWER



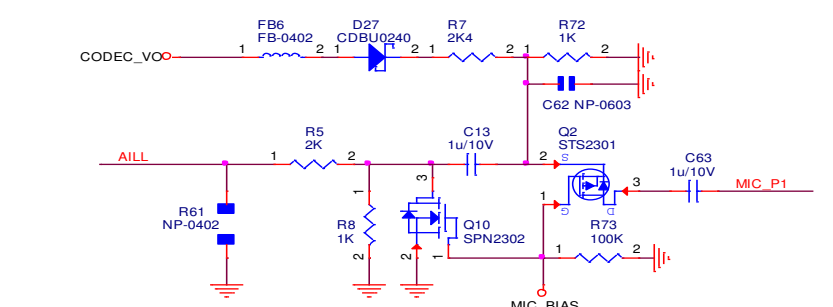
AUX-IN



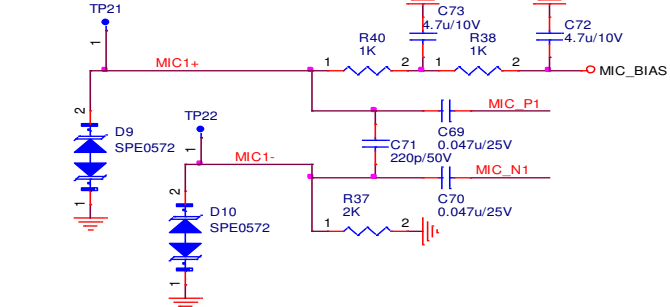
LINE-IN DETECTION



Line In Silence Detect



MIC



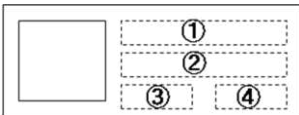
BM90 Module

7.0 PACKING INFORMATION

7.1 QR code label information



Label Size: 15±1.5 mm * 6±1.5 mm



- ① Device Name: BMxxxxxxxx (12 digits)
- ② MAC ID: xxxxxxxxxxx (12 digits)
- ③ Date Code: xxxx (4 digits)
- ④ Customer Code No: xxxxxx (6 digits)

Customer Part No example: BM90SPKA6NBB-C58096

↓ ↓
Device Name Customer code no.

Module Weight

(Test condition: module with QR label)

0.95g ± 10%

7.2 Storage standard

1. Calculated shelf life in sealed bag: 24 months at < 40 °C and <90% relative humidity (RH)
2. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must be Mounted within 168 hours of factory conditions <30°C/60% RH

BM90 Module

7.3 Ordering Information

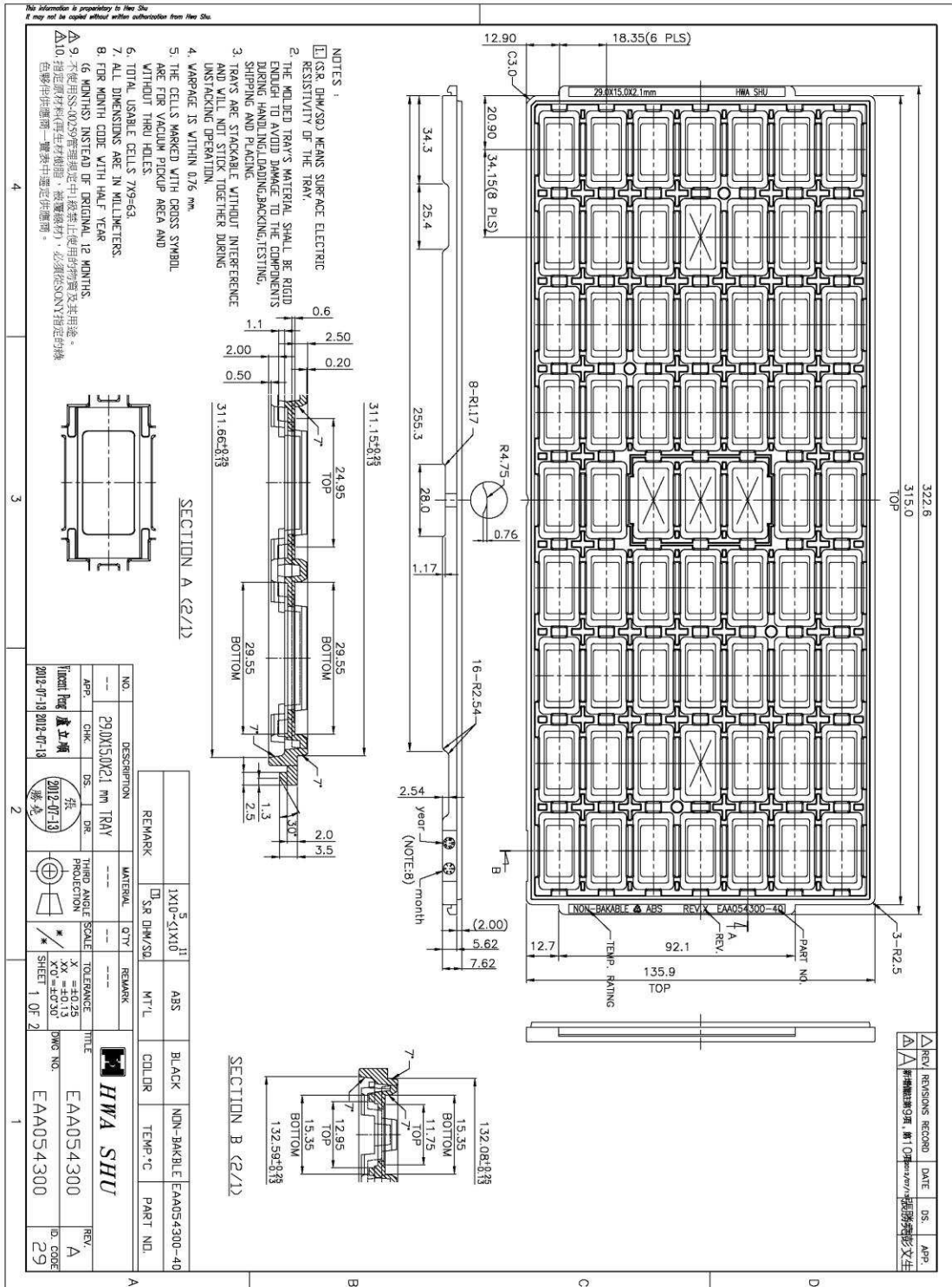
| Device | Module | | Order Number |
|---|----------|-----------------|--------------|
| | Size | Shipment Method | |
| BM90SPKA6NBB Bluetooth 3.0 EDR Wireless Speaker Module | 29*15 mm | Tray | |

Note:

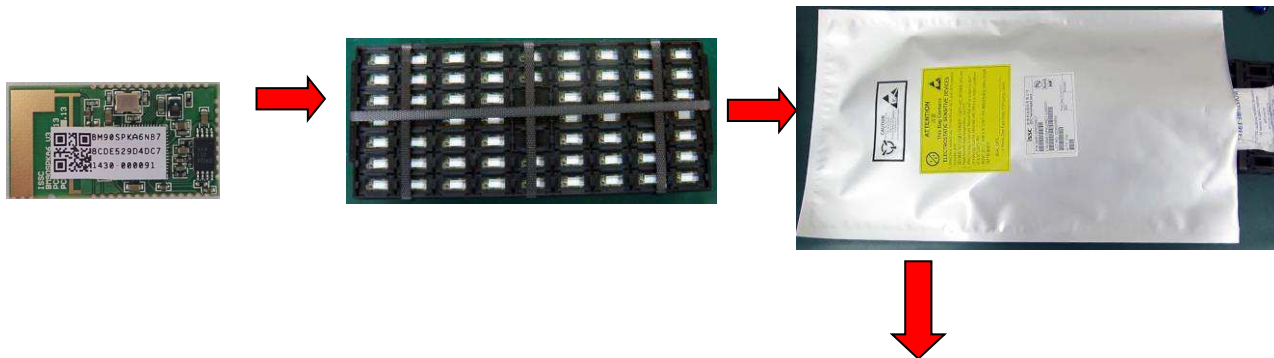
Minimum Order Quantity is 630pcs Tray.

BM90 Module

7.4 Tray Dimensions

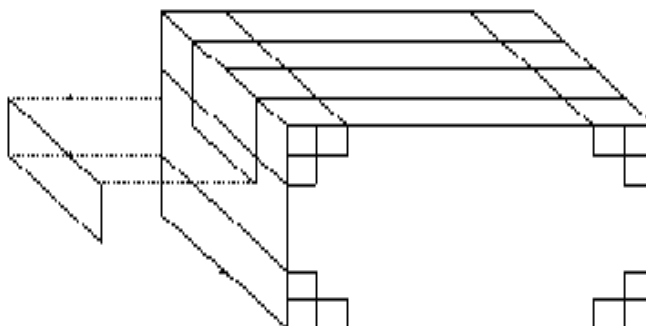


7.5 Packing Method



Inner box: Q'ty (630 Pcs)
Dimensions: 36*16*9.5 cm

Bar Code Label Example
P/N: Part No. (device name)
C/N: Customer Part No. (Part no. - customer code no.)
Lot No: Lot ID
Q'ty: box or Carton Module's Q'ty



Carton: Q'ty (3780 Pcs)
Dimensions: 38*35*30 cm