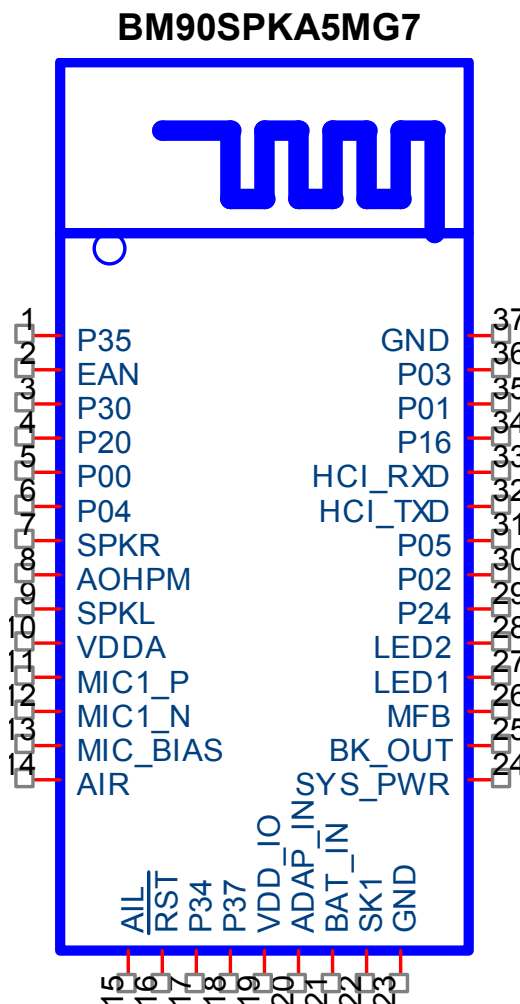# BM90SPKA5MG7

Bluetooth 3.0 EDR Audio Module

Product Description

The ISSC BM90SPKA5MG7 is a highly integrated Bluetooth 3.0 EDR stereo module, designed for high data rate, short-range wireless communication in the 2.4 GHz ISM band. With the build-in ISSC Bluetooth stack and profile, the ISSC BM90SPKA5MG7 provides a low power and ultra-low cost Bluetooth 3.0+EDR solution for multi-speaker applications.

Features

- Main Chip: ISSC IS1690SM
- Bluetooth 3.0 EDR compliant
- Max. +4dBm Class 2 output power
- Receiver Sensitivity: GFSK typical -90dBm, π/4 PSK typical -91dBm, 8DPSK typical -83dBm
- Piconet and Scatter net support
- CVSD, A-law, μ-law CODEC algorithms for voice applications
- SBC decode for Bluetooth audio streaming
- Build-in High performance stereo audio codec
- Microphone input and audio line-in support
- Build-in audio mux/gain control for line-in audio signal
- Cap-less/single end headphone driver
- Audio DAC: 94dB SNR
- Build in 350mAH Li-ion battery charger
- HSP, HFP, A2DP, AVRCP 1.5 profiles supported
- 3.3V operating voltage
- 4Mb Embedded flash program memory and 32Kb EEPROM
- 37pins for SMT module Size: 15mm x29mm
- Build-in PCB Antenna
- RoHS compliant

Module Pin out Diagram

BM90SPKA5MG7

Pin	Name
1	P35
2	EAN
3	P30
4	P20
5	P00
6	P04
7	SPKR
8	AOHPM
9	SPKL
10	VDDA
11	MIC1_P
12	MIC1_N
13	MIC_BIAS
14	AIR
15	AIL
16	RST
17	P34
18	P37
19	VDD_IO
20	ADAP_IN
21	BAT_IN
22	SK1
23	GND
24	SYS_PWR
25	BK_OUT
26	MFB
27	LED1
28	LED2
29	P24
30	P02
31	P05
32	HCI_TXD
33	HCI_RXD
34	P16
35	P01
36	P03
37	GND

Pin Definition

Pin No.	I/O	Name	Description
1	I/O	P35	GPIO, default pull-high input REW button
2	I	EAN	Embedded ROM/External Flash enable H: Embedded; L: External Flash
3	P	P30	GPIO, default pull-high input Line-in detection, 1: no line-in detected; 0: line-in detected
4	I/O	P20	GPIO, default pull-high input System Configuration, H: Application L: Baseband(IBDK Mode)
5	I/O	P00	GPIO, default pull-low input. Audio AMP Enable
6	I/O	P04	GPIO, default pull-high input NFC
7	AO	SPKR	R-channel analog headphone output, for cap-less and single-ended application both
8	AP	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	Reserve for external cap to fine tune audio frequency response
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
14	AI	AIR	Stereo analog line in, R-channel
15	AI	AIL	Stereo analog line in, L-channel
16	I/O	RST_N	System Reset Pin
17	I/O	P34	GPIO, default pull-high input NFC_SW
18	I/O	P37	GPIO, default pull-high input FWD button
19	P	VDDIO	VDDIO pin, for calibration only Do not add external power to this pin

20	P	ADAP_IN	Power adaptor input
21	P	BAT_IN	Battery input
22	I/O	SK1	Default SAR input for battery 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	P24	GPIO, default pull-high input System Configuration, H: Boot Mode
30	I/O	P02	GPIO, default pull-high input PLAY/PAUSE button
31	I/O	P05	GPIO, default pull-high input Phone button
32	O	HCI_TXD	HCI TX data
33	I	HXI_RXD	HCI RX data
34	I/O	P16	GPIO, default pull-high input Volume down button
35	I/O	P01	GPIO, default pull-high input Volume up button
36	I/O	P03	3rd LED
37	P	GND	Ground.

Electrical Characteristics

Absolute Maximum Ratings

Rating		Min	Max	Max
Operation Temperature		-40ºC	+85ºC	ºC
Core supply voltage	VDD_CORE, VCC_RF, AVDD_SAR, AVDD_PLL	1.7V	1.98V	V
Codec supply voltage	VDD_AUDIO		3	V
I/O voltage	VDD_IO		3.3	V
Supply voltage	BK_VDD		4.3	V
	3V1_VIN		5	V
	BAT_IN		4.3	V
	ADAP_IN		7.7	V
	LED[1:0]		5	V
	Power switch		5	V

Recommended Operate Condition

Symbol	Parameter	Min	Typical	Max	Unit
V_{DD18}	Digital core supply voltage SAR ADC supply voltage CODEC supply voltage	1.8	1.85	1.95	V
V_{DDIO}	I/O supply voltage	2.8	3	3.3	V
$T_{OPERATION}$	Operating temperature range	-20	+25	+70	ºC
T_{stg}	Storage temperature	-40		+125	ºC
V_{LDO}	LDO supply voltage	1.8		3.3	V
V_{BAT_IN}	Supply voltage for Battery_in	3.0		4.2	V

Radio Characteristics:

Transmitter section for BDR

VCC_RF = 1.85V Temperature = 25°C		Min	Typ	Max	Bluetooth specification	Unit
Maximum RF transmit power			3	4.0	-6 to 4	dBm
RF power variation over temperature range with compensation enabled			±2			dB
RF power control range			20		≥16	dB
RF power range control resolution			0.5			dB
20dB bandwidth for modulated carrier			900		≤1000	KHz
ACP	$F = F_0 \pm 2MHz$		-28		≤-20	dBm
	$F = F_0 \pm 3MHz$		-46		≤-40	dBm
Note: $F_0 = 2441MHz$	$F = F_0 \pm > 3MHz$		-54		≤-40	dBm
Δf_{1avg} maximum modulation		150		165	$140 < \Delta f_{1avg} < 175$	KHz
Δf_{2max} maximum modulation		140		150	≥115	KHz
$\Delta f_{2avg} / \Delta f_{1avg}$		0.95	1		≥0.80	
ICFT (abs)		0	5	10	75	KHz
Drift rate (abs)		2		7	≤20	KHz/50us
Drift (single slot packet, abs)			12		≤25	KHz
2nd harmonic content @ Tx= 4dBm			-53		≤-47	dBm
3rd harmonic content @ Tx= 4dBm			-55		≤-47	dBm

Receiver section for BDR

Temperature = 25ºC	Frequency (GHz)	Min	Typ	Max	Bluetooth specification	Unit
Sensitivity at 0.1% BER for all basic rate packet types	2.402		-90		≤-70	dBm
	2.441		-90			
	2.480		-90			
Maximum received signal at 0.1% BER			-10		≥-20	dBm
C/I co-channel			5		≤11	dB
Adjacent channel selectivity C/I Note: F_0=2441MHz	F = F_0+1MHz		-7		≤0	dB
	F = F_0-1MHz		-7		≤0	dB
	F = F_0+2MHz		-36		≤-30	dB
	F = F_0-2MHz		-22		≤-9	dB
	F = F_0-3MHz		-24		≤-20	dB
	F = F_0+5MHz		-50		≤-40	dB
	F = F_{image}		-22		≤-9	dB
Maximum level of intermodulation interferers			-38		≥-39	dB

Transmitter Section for EDR

Temperature = 25ºC		Min	Typ	Max	Bluetooth specification	Unit
Relative transmit power			-1.6		-4 to 1	dB
π/4 DQPSK max carrier frequency stability	$|\omega_o|$ freq. error		5		≤10 for all blocks	KHz
	$|\omega_i|$ initial freq. error		10		≤75 for all blocks	KHz
	$|\omega_o+\omega_i|$ block freq. error		10		≤75 for all blocks	KHz
8DPSK max carrier frequency stability	$|\omega_o|$ freq. error		5		≤10 for all blocks	KHz
	$|\omega_i|$ initial freq. error		10		≤75 for all blocks	KHz
	$|\omega_o+\omega_i|$ block freq. error		10		≤75 for all blocks	KHz
π/4 DQPSK modulation accuracy @ Tx= 2dBm	RMS DEVM		7		≤20	%
	99% DEVM		Pass		≤30	%
	Peak DEVM			25	≤35	%
8DQPSK modulation accuracy @ Tx= 2dBm	RMS DEVM		7		≤13	%
	99% DEVM		Pass		≤20	%
	Peak DEVM			20	≤25	%

In-band spurious emissions Note: F_0=2441MHz	F > F_0+3MHz		<-54		≤-40	dBm
	F = F_0-3MHz		-46		≤-40	dBm
	F = F_0-2MHz		-28		≤-20	dBm
	F = F_0-1MHz		-30		≤-26	dBm
	F = F_0+1MHz		-30		≤-26	dBm
	F = F_0+2MHz		-28		≤-20	dBm
	F = F_0+3MHz		-46		≤-40	dBm
EDR differential phase encoding			100		≥99	%

Receiver Section for EDR

Temperature = 25ºC	Frequency (GHz)	Modulation	Min	Typ	Max	Bluetooth specification	Unit
Sensitivity at 0.01% BER	2.402	$\pi/4$ DQPSK		-91		≤-70	dBm
	2.441	$\pi/4$ DQPSK		-91			
	2.480	$\pi/4$ DQPSK		-91			
	2.402	8DPSK		-83		≤-70	dBm
	2.441	8DPSK		-83			
	2.480	8DPSK		-83			
Maximum received signal at 0.1% BER		$\pi/4$ DQPSK		-10		≥-20	dBm
		8DPSK		-10		≥-20	
C/I co-channel at 0.1% BER		$\pi/4$ DQPSK		4		≤13	dB
		8DPSK		5		≤21	dB
Adjacent channel selectivity C/I Note: F_0=2441MHz	F = F_0+1MHz	$\pi/4$ DQPSK		-14		≤0	dB
		8DPSK		-8		≤5	dB
	F = F_0-1MHz	$\pi/4$ DQPSK		-13		≤0	dB
		8DPSK		-8		≤5	dB
	F = F_0+2MHz	$\pi/4$ DQPSK		-38		≤-30	dB
		8DPSK		-34		≤-25	dB
	F = F_0-2MHz	$\pi/4$ DQPSK		-21		≤-7	dB
		8DPSK		-21		≤0	dB

	F = F$_0$-3MHz	π/4 DQPSK		-27		≤-20	dB
		8DPSK		-20		≤-13	dB
	F = F$_0$+5MHz	π/4 DQPSK		-52		≤-40	dB
		8DPSK		-45		≤-33	dB
	F = F$_{image}$	π/4 DQPSK		-21		≤-7	dB
		8DPSK		-21		≤0	dB

Audio Codec: ADC (MIC PATH/Line-in path)

Test Condition:

T= 25°C, V_{DD}=2.8V, 1KHz sine wave input, Bandwidth = 20~20KHz

Parameter	Condition		Min.	Typ.	Max.	Unit
Input full-scale	Full scale (line-in)				2.2	Vpp
Resolution				16		bits
Input Sampling Rate			8		48	kHz
SNR	f_{in}=1KHz B/W=20~20KHz A-weighted THD+N < 1% 150mVpp input	8KHz		85		dB
		16KHz		85		
		32KHz		85		
		44.1KHz		85		
		48KHz		85		
SNR	A-weighted 1KHz@full scale, Microphone boost enable			75		dB
THD+N (Mic input) @30mVrms input				0.04		%
THD+N (line input)				0.01		%
Mic Boost Gain				20		dB
Digital Gain			-54		4.85	dB
Analog Gain					26	dB
Digital Gain Step				6		dB
Analog Gain Step				1.7		dB
Input impedance (microphone mode)	Input impedance			6	10	KΩ
	Input capacitance				20	pF
Analog supply voltage (AVDD)			1.8	2.8	3.0	V

Audio Codec: DAC (SPEAKER path)

Parameter	Condition		Min.	Typ.	Max.	Unit
Test Condition: T= 25°C, V_{DD}=2.8V, 1KHz sine wave input, Bandwidth= 20~20KHz						
Output Level	Full scale			2.1		Vpp
Resolution			16			bits
Output Sampling Rate			8		48	KHz
SNR	f_{in}=1KHz B/W=20~20KHz A-weighted THD+N < 0.01% 0dBFS signal Load=100KΩ	8KHz		94		dB
		16KHz		94		dB
		32KHz		94		dB
		44.1KHz		94		dB
		48KHz		94		dB
Max Output Power	R_L=16Ohm			35		mW
	R_L=32Ohm			17		mW
THD+N	16Ohm load				0.05	%
	100KΩ load				0.01	%
Digital Gain			-54		4.85	dB
Digital Gain Resolution				6		dB
Analog Gain			-28		3	dB
Analog Gain step				1		dB
Output resistance	R_L		8	16		Ohm
Output capacitance	Cp				500	pF
Crosstalk between channels	L vs. R, measured at -10dBFS@1KHz input			-90	-80	dB
Analog supply voltage (AVDD)			1.8	2.8	3.0	V

Battery Charger

Charging Mode (BAT_IN rising to 4.2V)		Min	Typ	Max	Unit
Operation Temperature		-10		55	℃
Input Voltage (Vin) Note: It needs more time to get battery fully charged when Vin=4.5V		4.5		7	V
Battery trickle charge current (BAT_IN < trickle charge voltage threshold)			0.1C		mA
Trickle charge voltage threshold			3		V
Maximum battery charge current	Headroom > 0.7V		350		mA
	Headroom = 0.3V		150		mA
Minimum battery charge current	Headroom > 0.7V		1		mA
	Headroom = 0.3V		1		mA
Battery charge termination current, % of fast charge current			10		%
Battery recharge hysteresis (Note1)			100		mV
Battery recharge current (Note2) Note: C → Battery capacity			0.25C		mA

Note1：When charging complete and the adapter is still in, the battery voltage will slowly drop down. When the voltage drop is larger than 100mV from the full voltage, the re-charging cycle will start.

Note2：If the battery voltage during plug in is larger than 4V, the charging current will be limited to 0.25C to avoid the battery voltage overshoot.

Clock

Parameters	MIN	TYP	MAX	Unit
Crystal Frequency		16		MHz
Frequency Tolerance		±20		ppm
Operating Temperature	-20		70	^{O}C
Trimming Capacitance		6.4		pF
Trimming Step Size		0.2		pF

Digital GPIO

Parameters	MIN	TYP	MAX	Unit
Input Voltage	2.7	3	3.6	V
V_{IH} (Input High Voltage)	2.0		Vdd	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		Vdd	V
V_{OL} (Output Low Voltage)	0		0.4	V

Current Consumption Flash version

Single Mode

Test Condition: T= 25°C, BAT_IN=4.0V, with flash code, codec without loading				
Normal Operation	**Min**	**Typ**	**Max**	**Unit**
Off mode		5.6		uA
Standby mode		1		mA
Link mode		0.9		mA
SCO link		23.5		mA
A2DP link		26.9		mA

Twin Mode

Test Condition: T= 25°C, BAT_IN=4.0V, with flash code, codec without loading				
Normal Operation	**Min**	**Typ**	**Max**	**Unit**
Off mode		5.6		uA
Standby mode		1.3		mA
Link mode		1.1		mA
SCO link		25.8		mA
A2DP link		34		mA

Antenna performance

Parameters	MIN	TYP	MAX	Unit
Antenna gain		1.76		dBi
Efficiency	70		80	%

Outline Dimension (Module Foot print)

Dimension(TOP)

ANT AREA

Dimension(BOT)

ANT AREA

ISSC BM90SPK05

0.6mm+/-0.06mm
PCB Thickness

Side view

2.2mm+/- 0.1mm
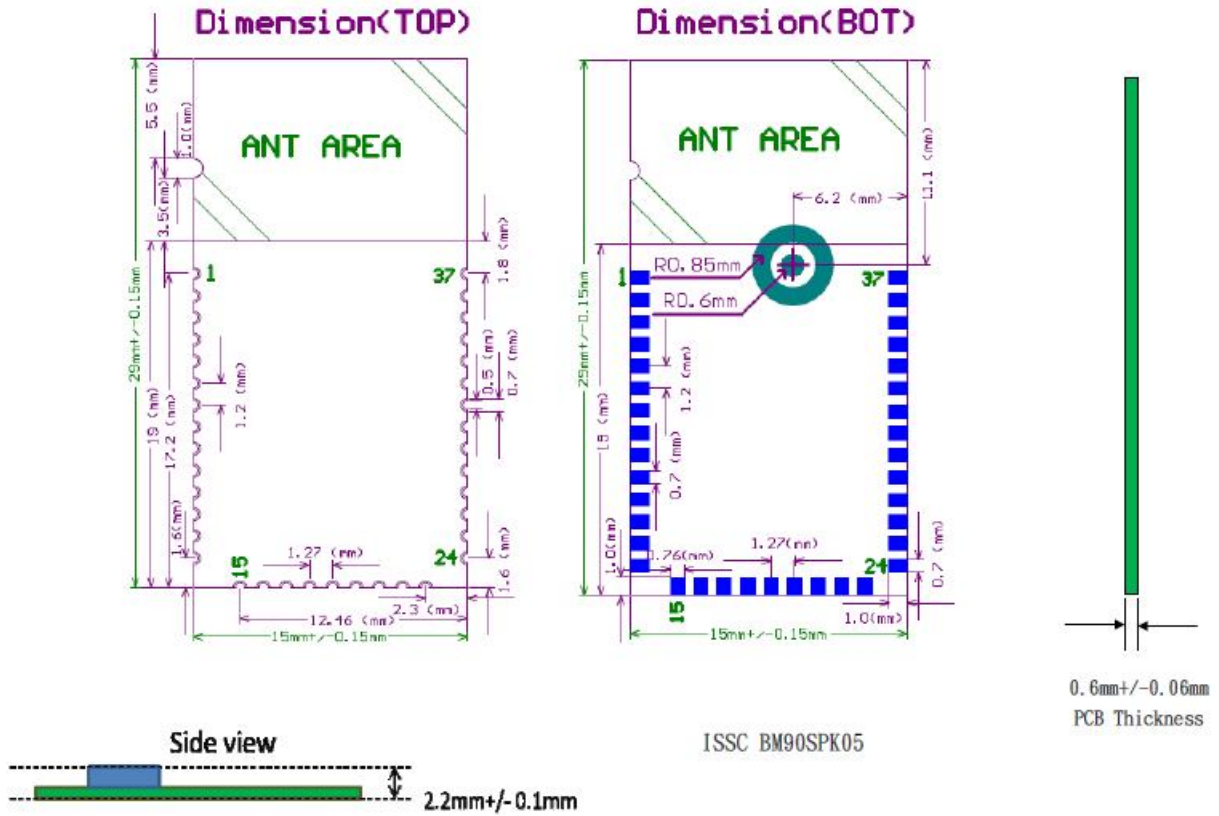
Reflow profile
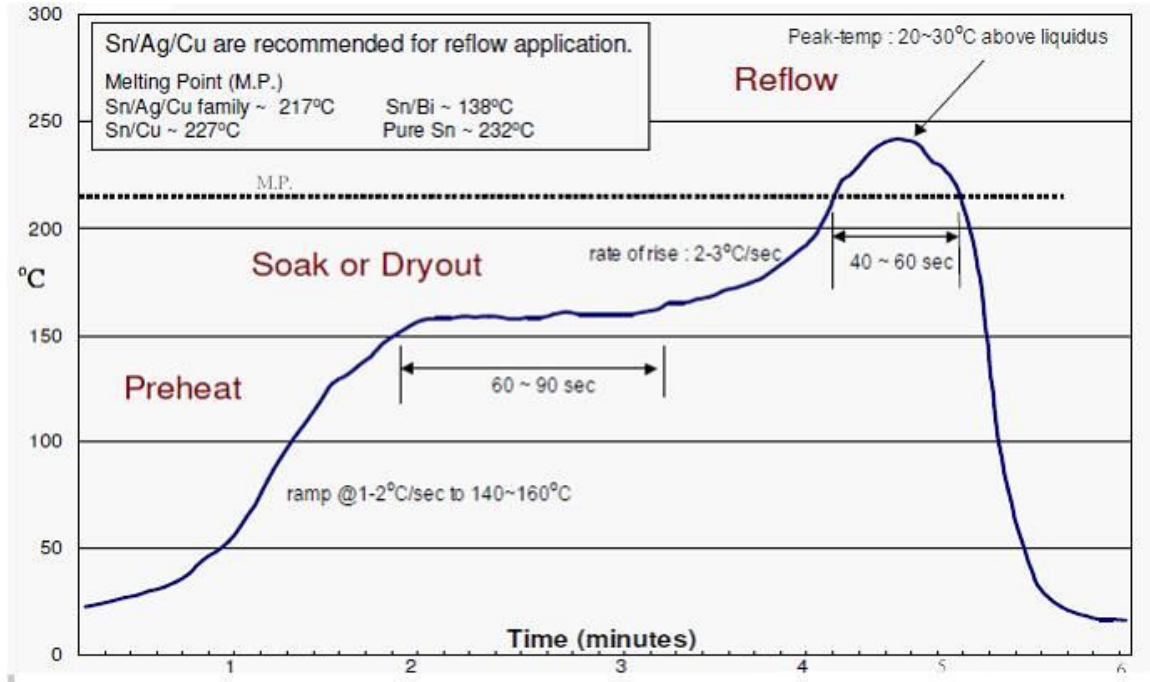
QR code label information

Label Size:15±1.5 mm *6±1.5 mm
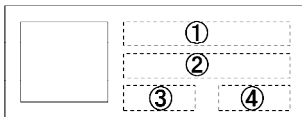
①Device Name: BMxxxxxxxxxx (12digits)

②MAC ID: xxxxxxxxxxxx (12 digits)

③Date Code: xxxx (4 digits)

④Customer Code No: xxxxxx (6 digits)

Customer Part No example: <u>BM90SPKA5MG7</u>-<u>C58096</u>

          ↓   ↓

Device Name   Customer code no.

Module Weight

(Test condition: module with QR label)

0.95g ± 10%

Storage standard

1. Calculated shelf life in sealed bag: 12 months at < 40 ℃ 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℃/60% RH

Ordering Information

Device	Module		Order Number
	Size	**Shipment Method**	
BM90SPKA5MG7 Bluetooth 3.0 EDR Wireless Speaker Module	29*15 mm	Tray	

Note:

Minimum Order Quantity is 630pcs Tray.

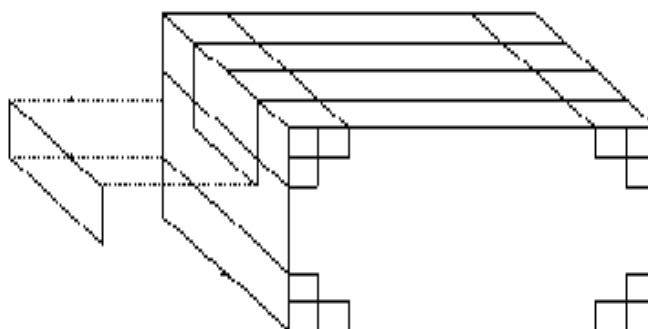## Packing Information

Tray Dimensions

Packing Method

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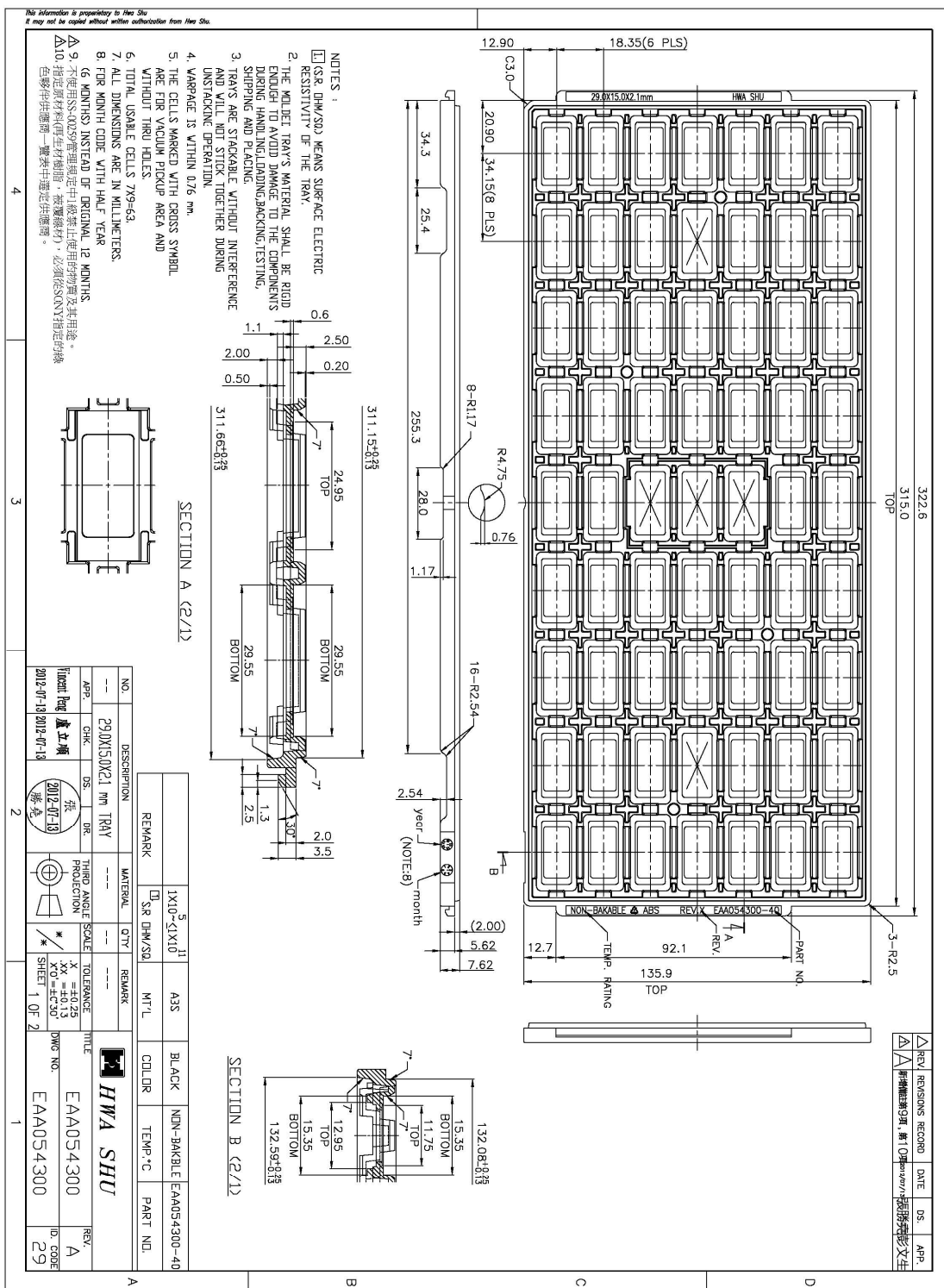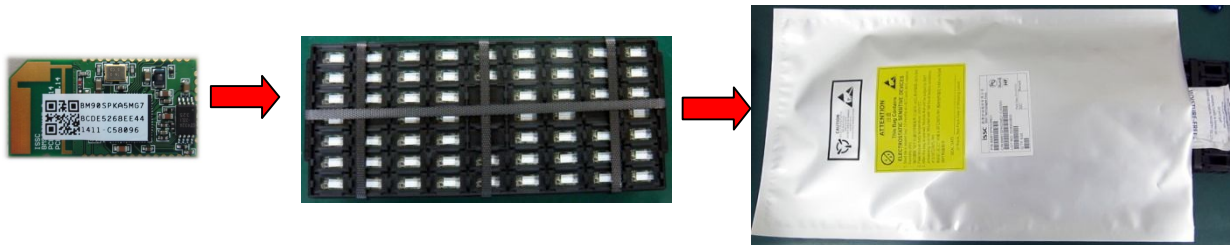
Bar Code Label Example

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

How to fix the BT model BM90SPK to SRS-X11

1、 BM90SPK BT Model contains PCB Antenna；

2、 The gain of PCB Antenna is about 1.76dBi；

1、 Every model has 37 pin；

2、 Fix the BT model to SRS-X11 main board by its 37 pin；

3、 Every pin is fixed on the main board by tin.

1、 Main board is fixed to SRS-X11 by the Screw

SRS-X11

FCC Statement

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment

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.

IC Statement

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the

device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement. The end host device should bear the label which indicate "Contains FCC ID:ZVA07" or "Contains IC: 9976A-07".