

FM Low-Noise-Amplifier in Alliance with Internal Antenna

FEATURES

- Without any earphone or telescopic antenna, receive FM-radio signal through re-using GSM antenna
- Ultra-low noise-figure: 1.2dB
- Standard CMOS process technology
- High power gain of 21dB under 2.8V supply
- High linearity
- EN supports 1.8V / 2.8V GPIO
- Supply voltage: 1.5V~3.6V
- Shut-down current: <math><0.1\mu\text{A}</math>
- Slim 2.1x2.3x1 mm³ SOT363-6L package

APPLICATIONS

- Mobile phone
- Mobile audio device

GENERAL DESCRIPTION

AW5007A is a Low-Noise-Amplifier (LNA), without earphone or telescopic antenna, re-using GSM antenna to receive FM-radio signal.

AW5007A is characterized with low noise, high gain and high linearity. Typical noise figure is 1.2dB and power gain is 21dB.

AW5007A is powered by 1.5V~3.6V supply with typical 2.8V. EN supports 2.8V / 1.8V GPIO input.

AW5007A integrates RF radio switch inside, implementing high impedance under shut-down condition. Shut-down current is less than 0.1 μA .

AW5007A is available in slim 2.1mmx2.3mmx1mm SOT363-6L package. The specified operating free-air temperature ranges from -40 $^{\circ}\text{C}$ to 85 $^{\circ}\text{C}$.

TYPICAL APPLICATION CIRCUIT

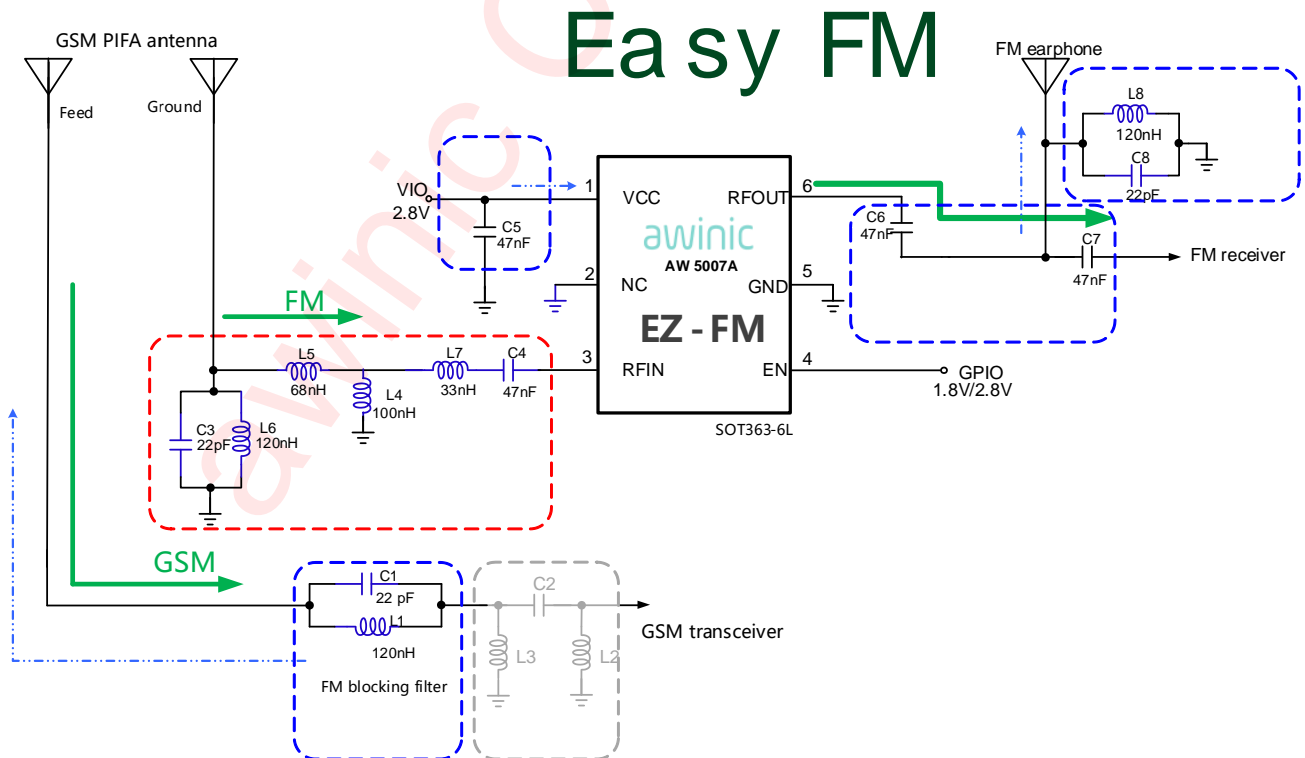


Figure 1 Typical Application Circuit of AW5007A

PIN CONFIGURATION AND TOP MARK

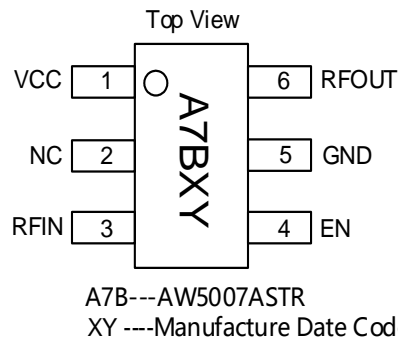


Figure 2 Pin Configuration and Top Mark

PIN DEFINITION

No.	NAME	DESCRIPTION
1	VCC	Supply connection.
2	NC	Not connected. Prefer ground.
3	RFIN	RF input.
4	EN	EN(high) supports 1.8V / 2.8V IO with internal 150Kohm pull-down resistor.
5	GND	Ground.
6	RFOUT	RF output.

FUNCTIONAL BLOCK DIAGRAM

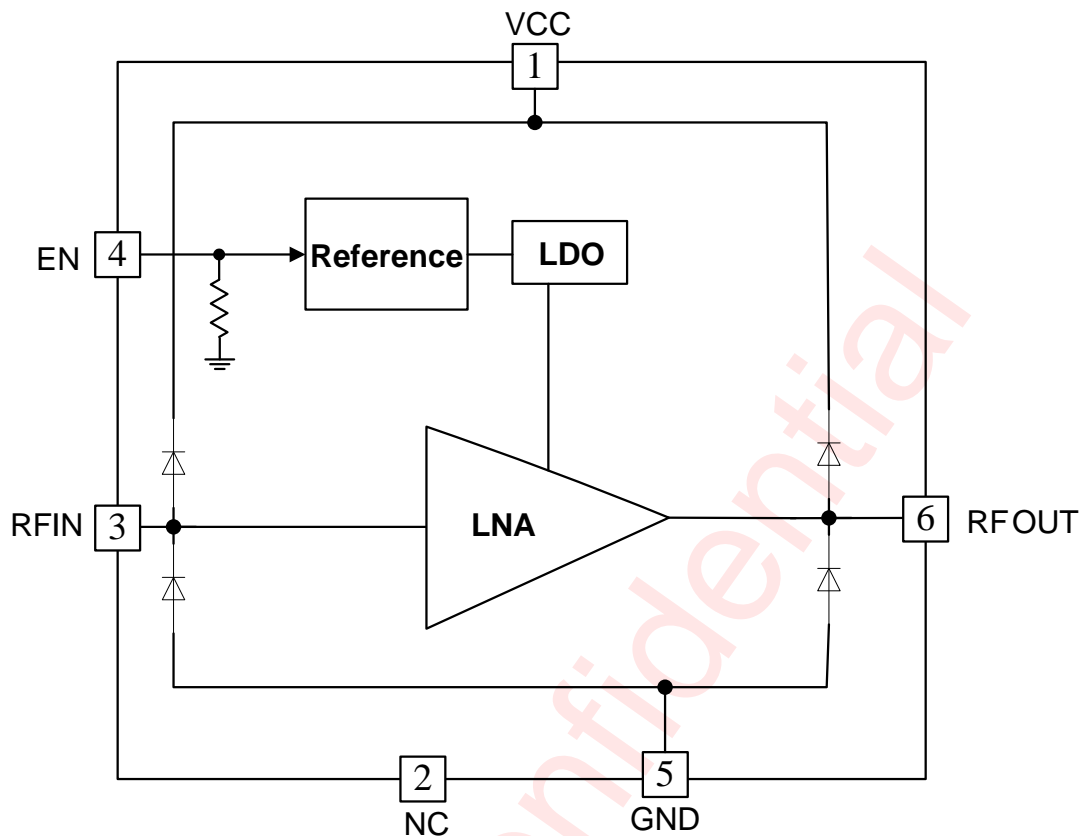


Figure 3 FUNCTION BLOCK DIAGRAM

ORDERING INFORMATION

Part Number	Temperature	Package	Marking	Moisture Sensitivity Level	Environmental Information	Delivery Form
AW5007ASTR	-40°C~85°C	SOT363 2.1mm*2.3mm -6L	A7B	MSL3	ROHS+HF	3000 units/ Tape and Reel

AW5007A □ □ □

Shipping
R: Tape & ReelPackage Type
ST: SOT

ABSOLUTE MAXIMUM RATINGS(NOTE1)

PARAMETERS	RANGE
Supply Voltage VCC	-0.3 V to 4.2 V
EN pin voltage	-0.3 V to 4.2 V
Supply maximum current ICC	30 mA
RFIN input power Pin	20 dBm
Maximum Junction temperature T _{JMAX}	125 °C
Storage temperature T _{STG}	-65 °C to 150 °C
Operating free-air temperature range	-40 °C to 85 °C
Lead Temperature (Soldering 10 Seconds)	260 °C
ESD(NOTE 2)	
HBM	±2kV
CDM	±1kV
Latch-up	
JEDEC STANDARD NO.78E SEPTEMBER 2016	+IT: +200mA -IT: -200mA

ELECTRICAL CHARACTERISTICS

TA=25 °C, VCC=2.8 V, EN=2.8 V, Rs=Ro=50 ohm, frequency=90 MHz for typical values (unless otherwise noted).

	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
ISD	Shut-down Current	EN=0V		0.1	1	μA
IQ	Static Current	EN=2.8V		9.2		mA
NF	Noise Figure	Input / Output 50ohm		1.2		dB
S11	Input Return Loss	Input / Output 50ohm		-3.7		dB
S12	Reverse Isolation	Input / Output 50ohm		-39.8		dB
S21	Power Gain	Input / Output 50ohm		21.0		dB
S22	Output Return Loss	Input / Output 50ohm		-20.5		dB
Kf	Stability Factor	Input / Output 50ohm		>1		
IIP3	Input 3rd-order intercept point	(NOTE 3)		-9		dBm
IB P-1dB	In-Band 1dB-compression point	Input / Output 50ohm		-20		dBm
OOB P-1dB	Output-Of-Band 1dB- compression point	(NOTE 4)		-7		dBm

NOTE1: Conditions out of those ranges listed in "absolute maximum ratings" may cause permanent damages to the device. In spite of the limits above, functional operation conditions of the device should within the ranges listed in "recommended operating conditions". Exposure to absolute-maximum-rated conditions for prolonged periods may affect device reliability.

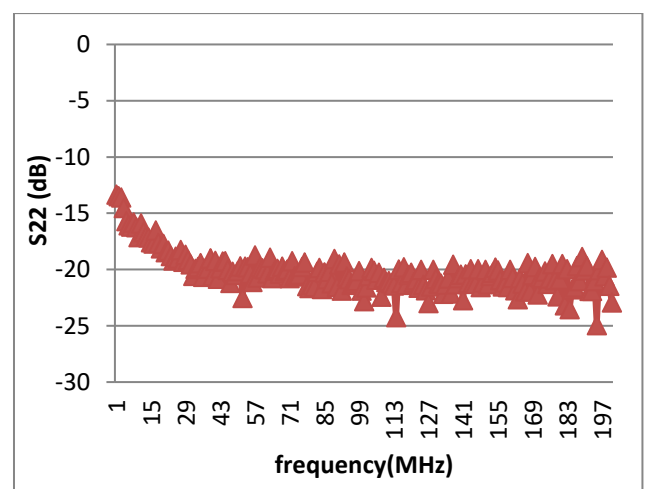
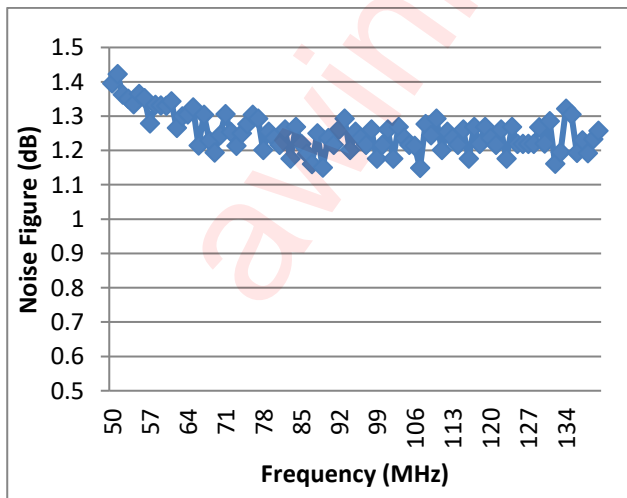
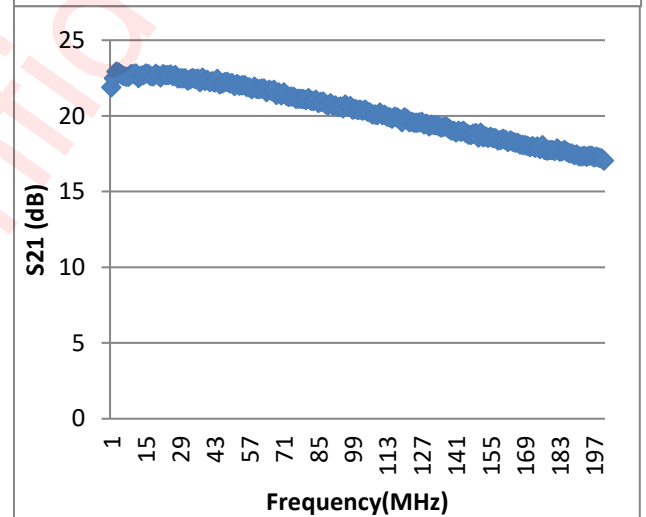
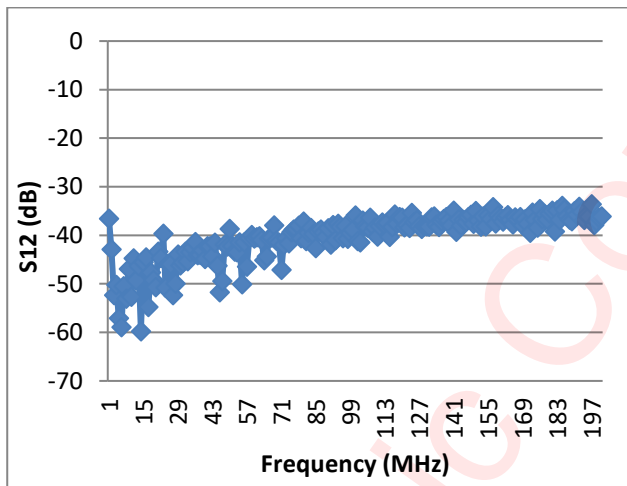
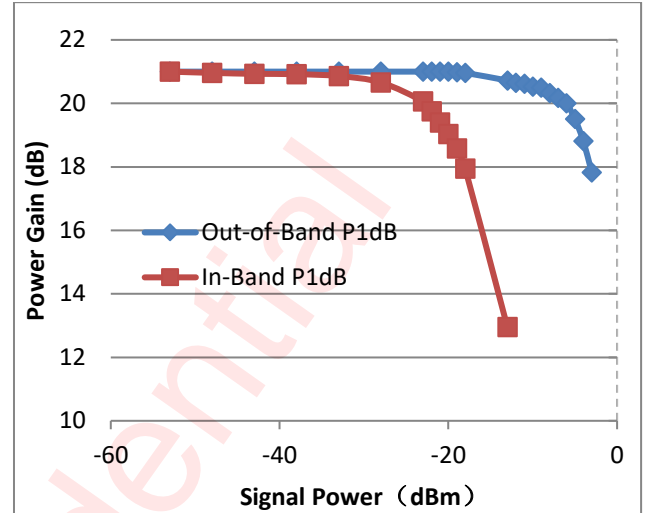
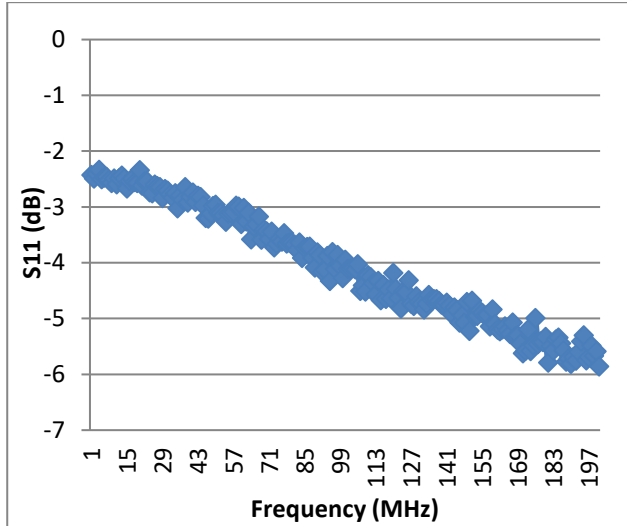
NOTE2: The human body model is a 100pF capacitor discharged through a 1.5kΩ resistor into each pin. Test method: MIL-STD-883G Method 3015.7

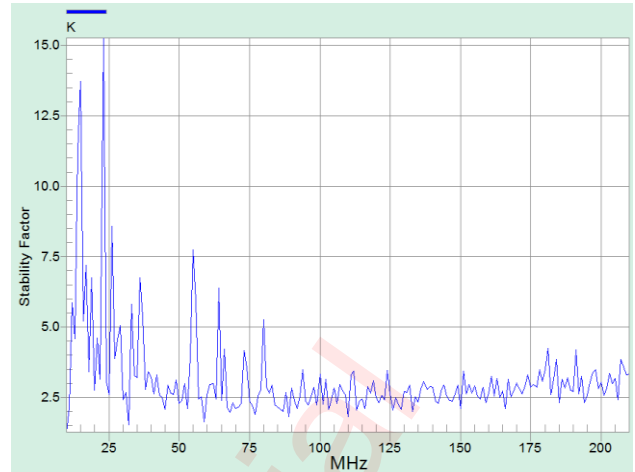
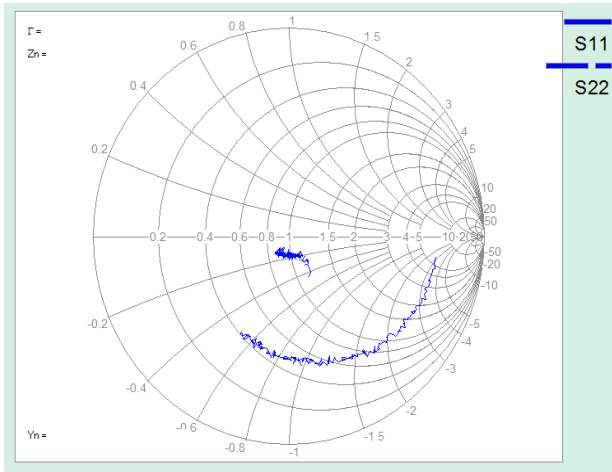
NOTE3: Measure IIP3 parameter through two tones of -40dBm/tone with the frequency of 97M and 98MHz

NOTE4: Input / Output are both 50-ohm; Input signal is composed of in-band 90-MHz signal and out-of-band 900MHz signal. Signal of 90-MHz is fixed to -40-dBm; signal of 900MHz varies and power level is measured when power gain of 90MHz signal drops 1dB.

TYPICAL CHARACTERISTICS

Test condition: TA=25 °C, VCC=2.8 V, EN=2.8 V, Rs=Ro=50 ohm, frequency=90 MHz for typical values (unless otherwise noted)





MEASUREMENT DIAGRAM

Test DC Characteristics (Current & Power)

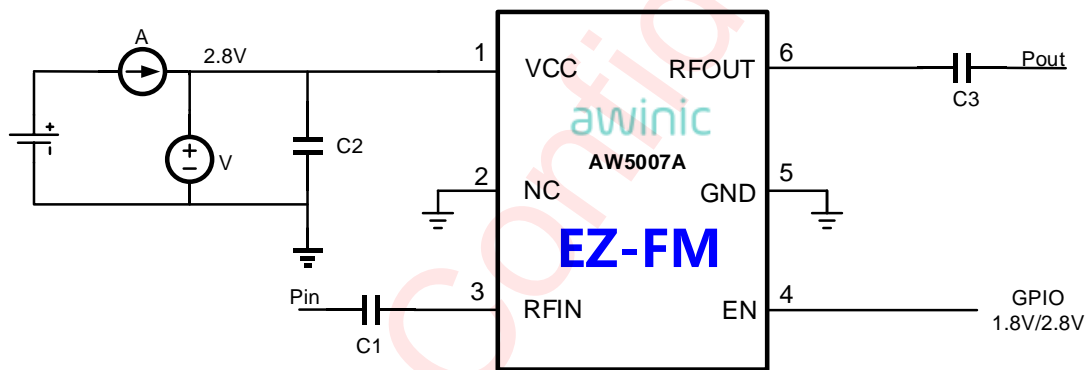


Figure 4 AW5007A DC Test diagram

Test S-parameter

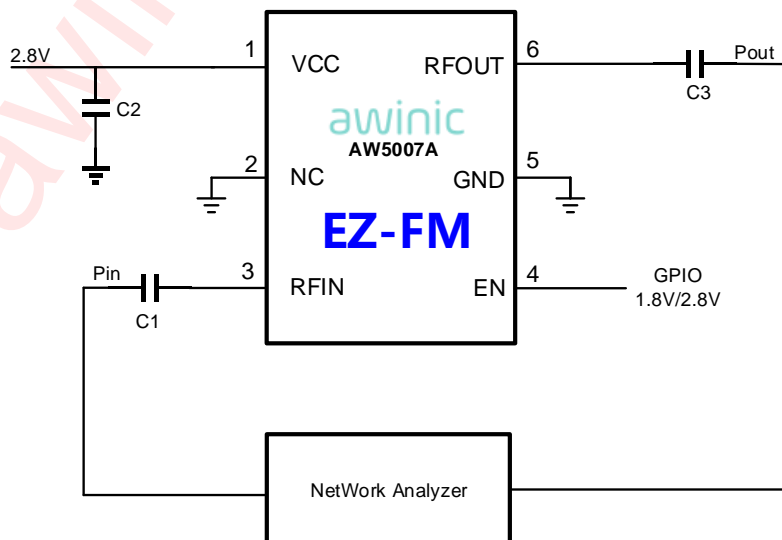
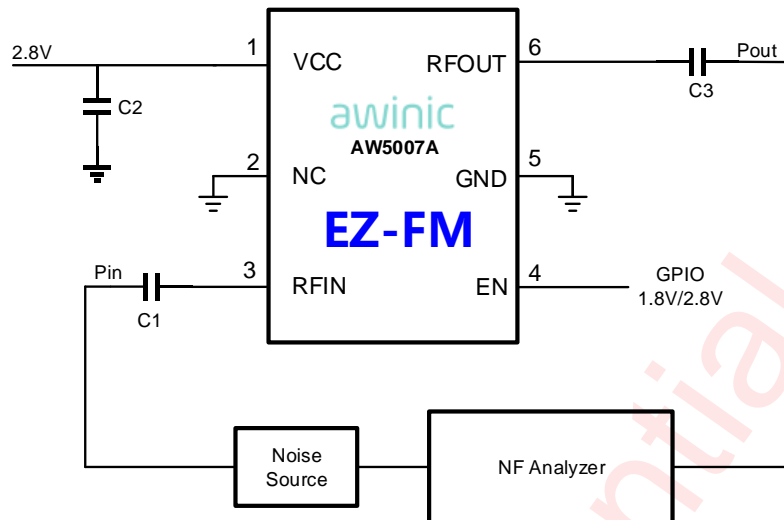
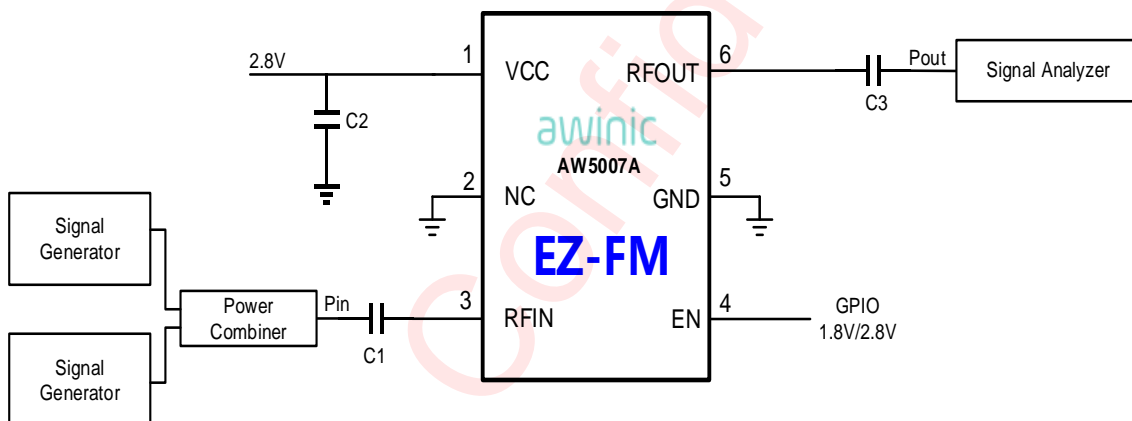


Figure 5 AW5007A S-parameter measurement Diagram

Test Noise-Figure



Test IIP3



APPLICATION INFORMATION

EN Control

AW5007A supports earphone. When baseband detects earphone inserting, GPIO will pull down, cutting off AW5007A to avoid unnecessary power consumption.

Choice of components

Take Figure 1 for example:

Filter block near PIFA antenna is composed of L6 and C3. These two components can be removed for Dipole antenna. Typical value of L6 is 120 nH and of C3 is 22 pF.

Filter block of FM signal is composed of C1 and L1. GSM signal could go through and FM signal will be blocked. GSM antenna π -type matching circuit is composed of C2, L3 and L2, adjustable based on GSM antenna characteristics. Typically C1 is 22 pF and L1 is 120 nH.

Matching circuit of FM signal path is composed of C4, L4, L5 and L7. FM signal could go through and GSM signal will be blocked. Typically L4 is 100 nH, L5 is 68 nH and L7 is 33 nH.

C5 is supply filtering capacitor. C6 is DC-blocking capacitor. Both are 47 nF typically.

Only when supporting earphone antenna application, C7 is added with the value of 47 nF.

Following tables show recommended inductor/capacitor types and values.

CHOICE OF INDUCTOR

PART No.	TYP.	Q(min)	Frequency	MFR	SIZE
LQG15HS33NJ02	33nH	8	100MHz	Murata	0402
LQG15HS68NJ02	68nH	8	100MHz		0402
LQG15HSR12J02	120nH	8	100MHz		0402
LQG15HSR10J02	100nH	8	100MHz		0402
SDCL1005C33NJTDF	33nH	8	100MHz	Sunlord	0402
SDCL1005C68NJTDF	68nH	8	100MHz		0402
SDCL1005CR12JTDF	120nH	8	100MHz		0402
SDCL1005CR10JTDF	100nH	8	100MHz		0402

CHOICE OF CAPACITOR

PART No.	TYP.	Voltage	MFR	SIZE
GRM1555C1H220JA01	22pF	25V	Murata	0402
GRM1555C1H390JA01	39pF	25V		0402
GRM155R71C473KA01	47nF	16V		0402

PACKAGE DESCRIPTION

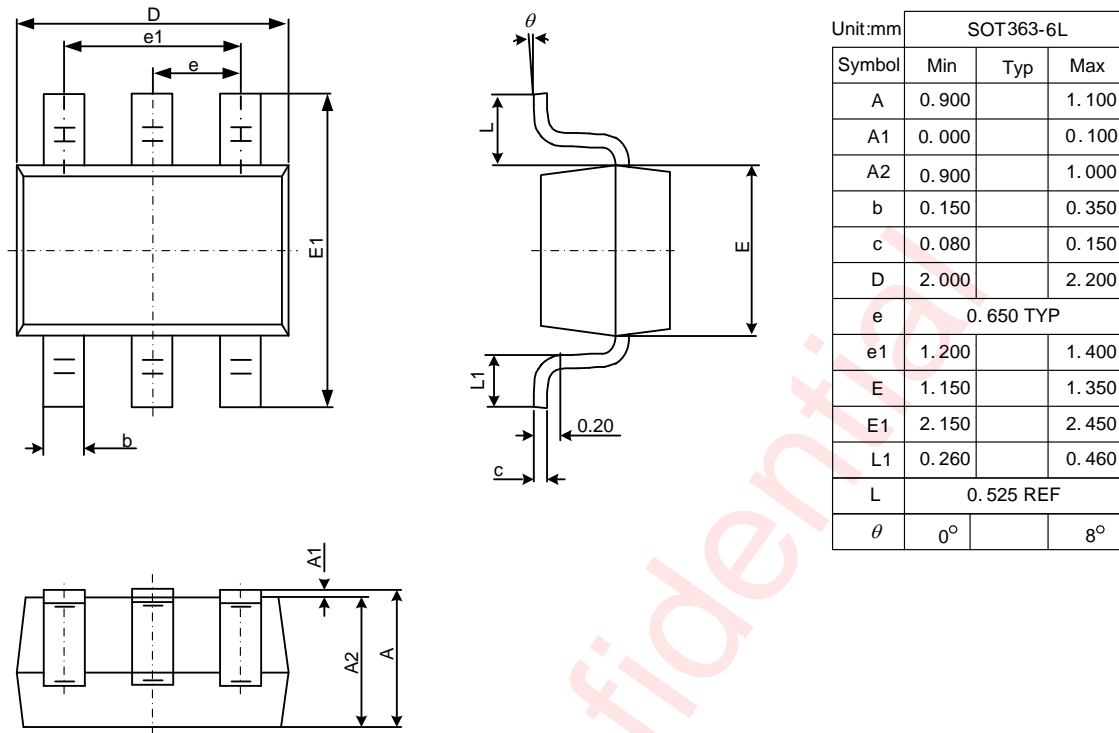


Figure 8 Package outline

LAND PATTERN

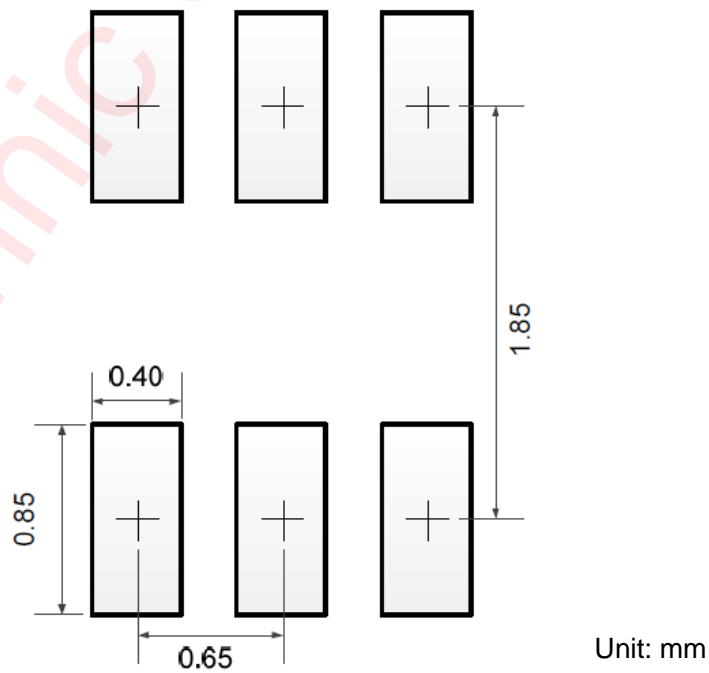
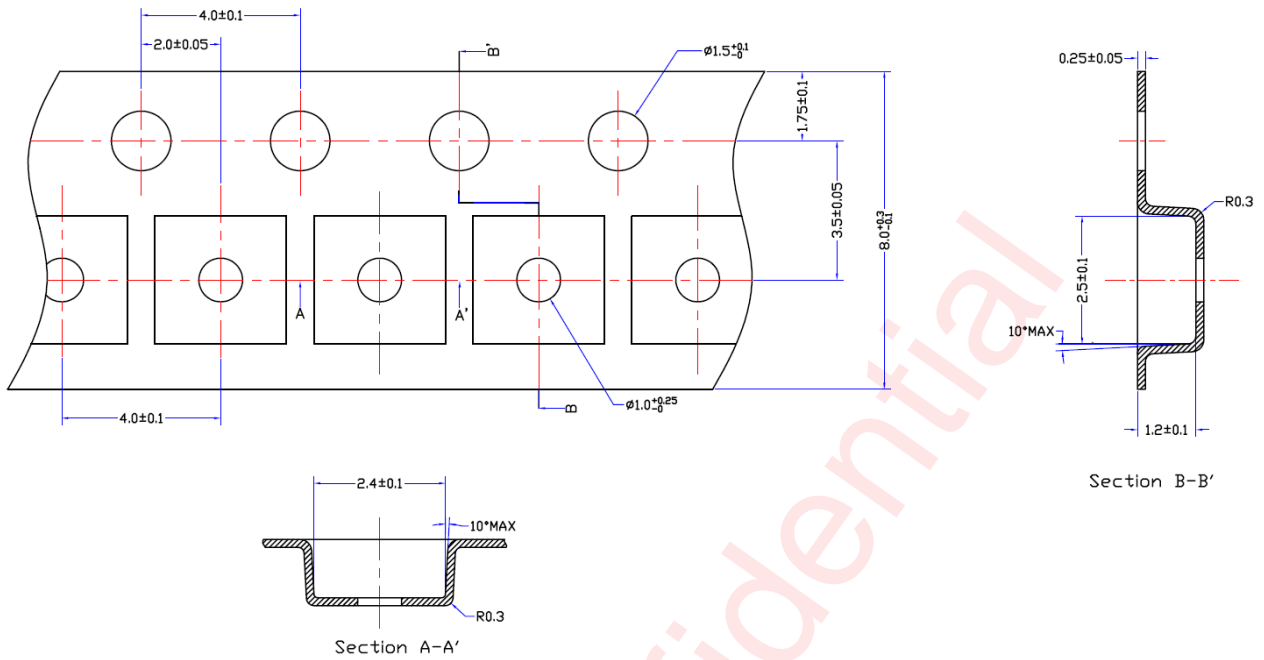


Figure 9 Package outline

TAPE DESCRIPTION



ALL DIMS IN mm

Pin 1 direction

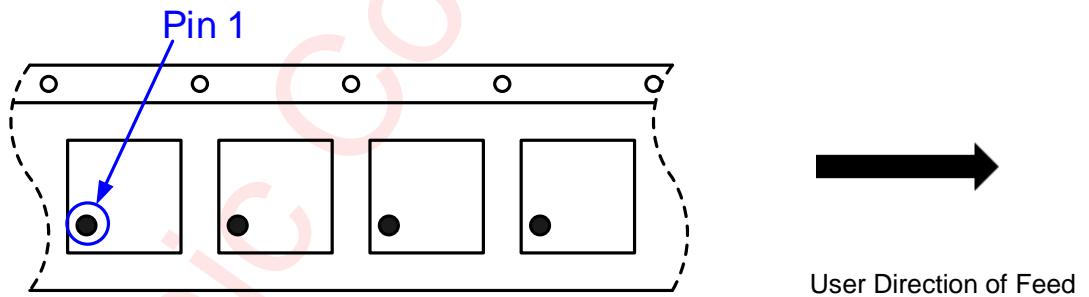
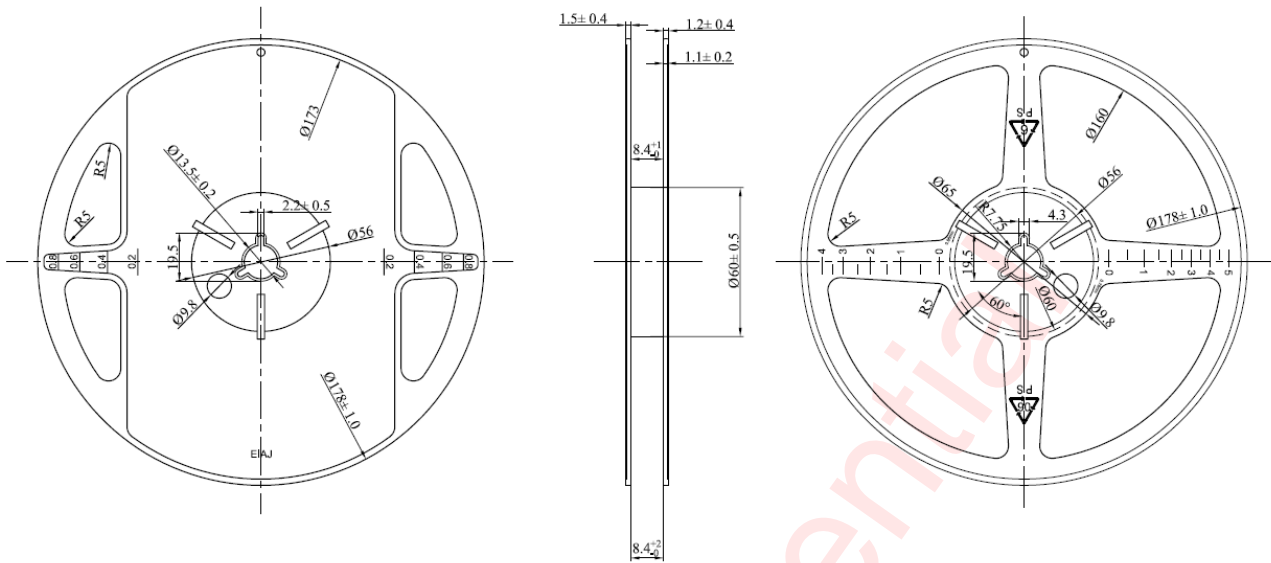


Figure 10 Tape Description

REEL DESCRIPTION



NOTES:

1. ALL DIMS IN mm;
2. General Tolerance ± 0.25 mm.

Figure 11 Reel Description

REFLOW

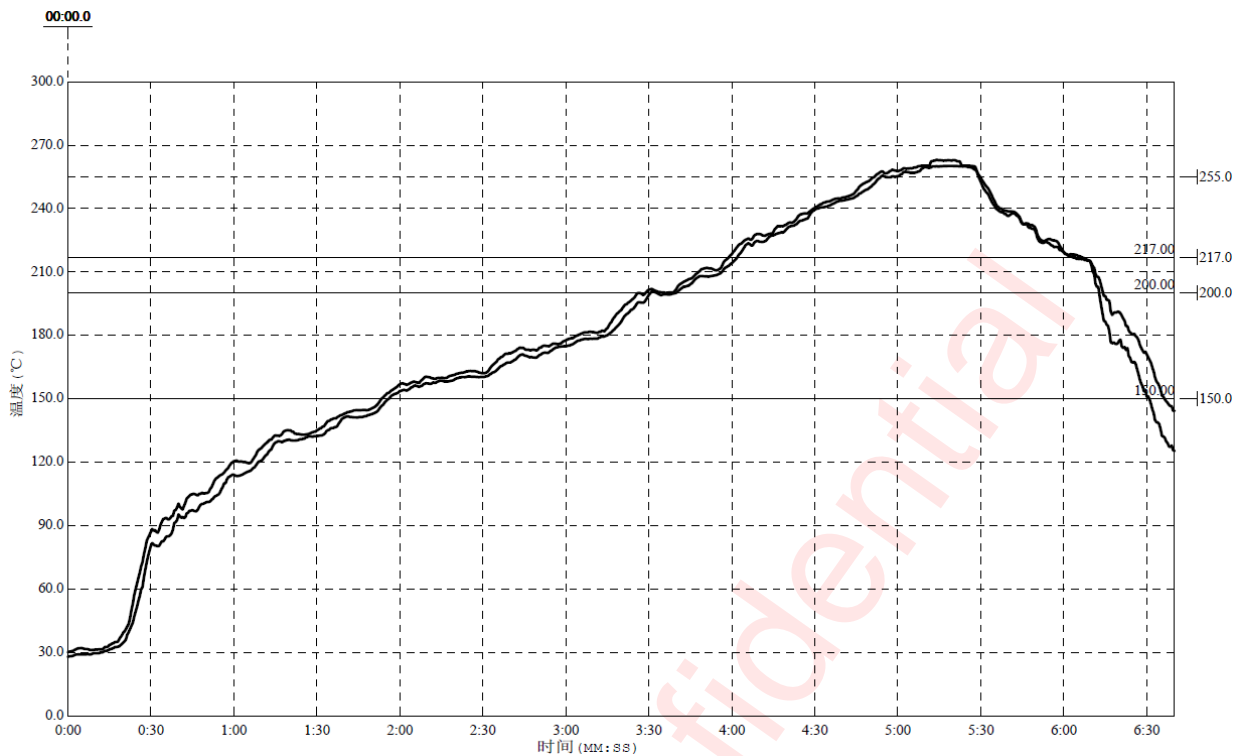


Figure 12 Package Reflow Oven Thermal Profile

Reflow Note	Spec
Average ramp-up rate (217°C to Peak)	Max. 3°C/sec
Time of Preheat temp.(from 150°C to 200°C)	60-120sec
Time to be maintained above 217°C	60-150sec
Peak Temperature	>260°C
Time within 5°C of actual peak temp	20-40sec.
Ramp-down rate	Max. 6°C/sec
Time from 25°C to peak temp	Max. 8min.

NOTES:

- All data are compared with the package-top temperature, measured on the package surface;
- AW5007A adopted the Pb-Free assembly.

REVISION HISTORY

Document ID	Release date	Change notice	Supersedes
AW5007A_V0.9	2015-04	Preliminary Version	-
AW5007A_V1.1	2015-11	Change filter network to 22pF+120nH	AW5007A_V0.9
AW5007A_V1.2	2018-02	Change datasheet format	AW5007A_V1.1
AW5007A_V1.3	2018-10	Add latch up info	AW5007A_V1.2

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