

搭配内置天线的 FM 低噪声放大器

特性

- 无需耳机及拉杆天线,通过复用 GSM 天线实现 FM 信号接收
- 极低的噪声系数:1.2dB
- 高性能,低噪声的标准 CMOS 工艺
- 21dB 的高增益
- 高线性度
- EN 支持 1.8V/2.8V 的 GPIO
- 工作电压: 2.6V~3.6V
- 关机电流<0.1 μ A
- 纤小的 2.2 $\times$ 2.2 $\times$ 1 mm³ SOT363-6L 封装

描述

AW5007A 是一款低噪声放大器,无需耳机和拉杆天线,通过复用 GSM 天线实现 FM 信号接收。

AW5007A 具有低噪声,高增益,高线性度的特性,典型值噪声系数 1.2dB,增益 21dB。

AW5007A 的电源电压范围在 2.6V~3.6V 典型值 2.8V,EN 支持 2.8V/1.8V 的 GPIO 口输入。

AW5007A 将 RF 射频开关集成在内部芯片,在关断的条件下可以实现高阻抗,关机电流小于 0.1 μ A。

AW5007A 采用纤小的 2.2mm $\times$ 2.2mm $\times$ 1mm SOT363-6L 封装,额定的工作温度范围为-40 $^{\circ}$ C 至 85 $^{\circ}$ C。

应用

- 手机
- 便携式音频设备

引脚分布及标记图

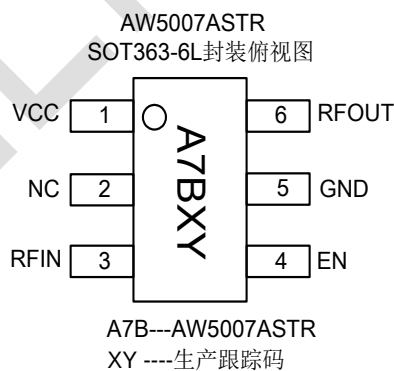


图1. AW5007A 引脚分布图

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
- High linearity
- EN supports 1.8V / 2.8V GPIO
- Supply voltage: 2.6V~3.6V
- Shut-down current: <0.1μA
- Slim 2.2×2.2×1 mm³ SOT363-6L package

APPLICATIONS

- Mobile phone
- Mobile audio device

PIN CONFIGURATION AND TOP MARK

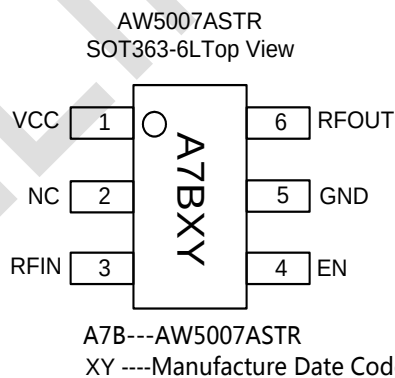


Figure 1 AW5007A pin configuration and top mark

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 2.6V~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 0.1μA.

AW5007A is available in slim 2.2mm×2.2mm×1mm SOT363-6L package. The specified operating free-air temperature ranges from -40°C to 85°C.

TYPICAL APPLICATION CIRCUIT

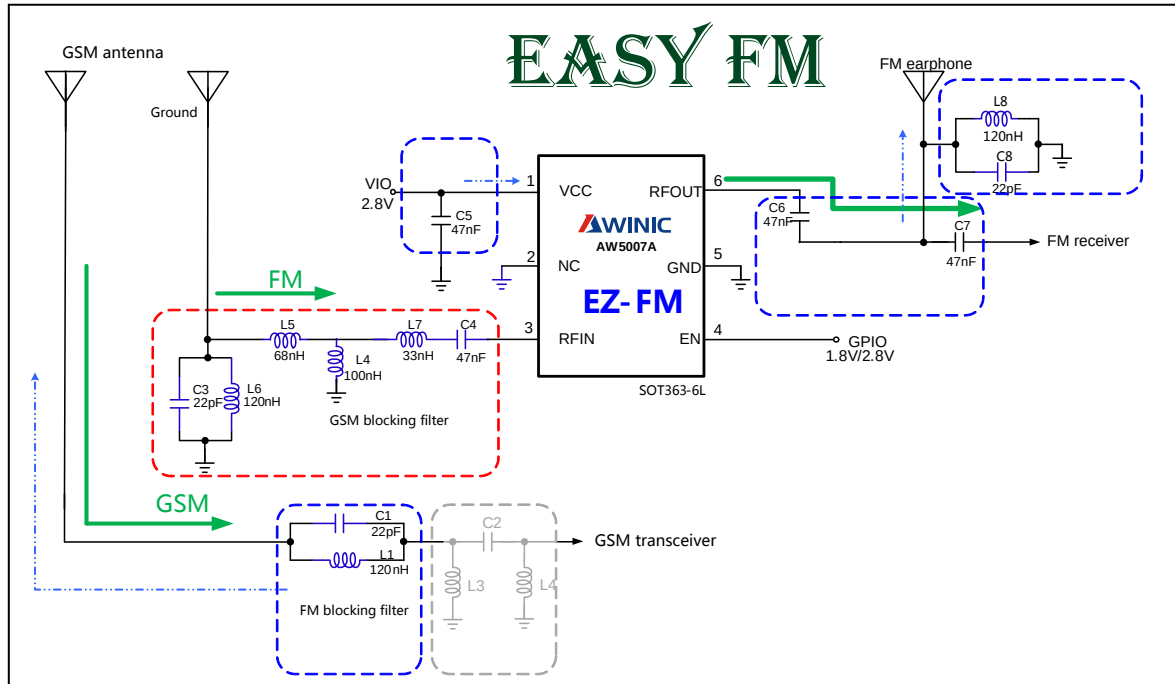


Figure 2 AW5007A typical application circuit

ORDERING INFORMATION

Table 1 ORDERING INFORMATION

Part Number	Temperature	Package	RoHS	Marking	Delivery Form
AW5007ASTR	-40℃~85℃	2.2mm×2.2mm×1mm SOT363-6L	Yes	A7B	3000 units/ Tape and Reel

AW5007A ☐ ☐ ☐

Shipping
R: Tape & Reel

Package Type
ST: SOT

PIN DEFINITION

Table 2 PIN DEFINITION AND THEIR FUNCTION DESCRIPTION

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.

ABSOLUTE MAXIMUM RATINGS^(NOTE1)

Table 3 ABSOLUTE MAXIMUM RATINGS

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
Junction-to-ambient thermal resistance θ_{JA}	625 °C/W
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)	
PINs HBM (human body model)	RFIN/RFOUT PINs: ± 3500 V Other PINs: ± 5000 V
Latch-up	
Test Condition: JEDEC STANDARD NO.78B DECEMBER 2008	+IT: +300 mA -IT: -300 mA

ELECTRICAL CHARACTERISTICS

Table 4 INFORMATION OF ELECTRICAL 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).

	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
VCC	Supply Voltage		2.6	2.8	3.6	V
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).

Table 5 TABLE OF FIGURES

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Power Gain	S21	FIGURE 4
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Input / Output Impedance	Zin / Zout	FIGURE 7
Stability Factor	Kf	FIGURE 8
P1dB Compression Point	P1dB(In-band / Out-of-Band)	FIGURE 9
Noise Figure	NF	FIGURE 10

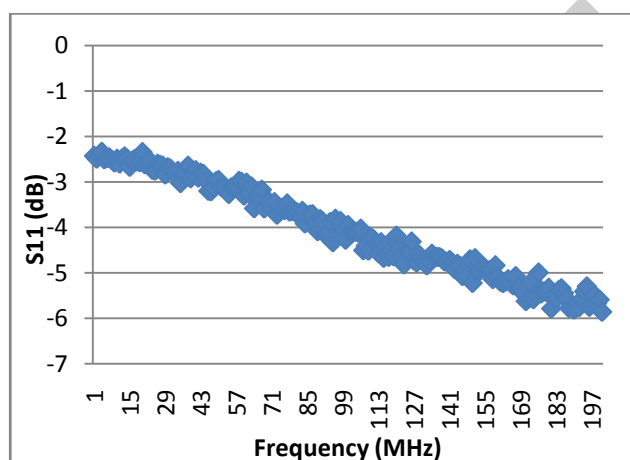


Figure 3 Input Return Loss(S11)

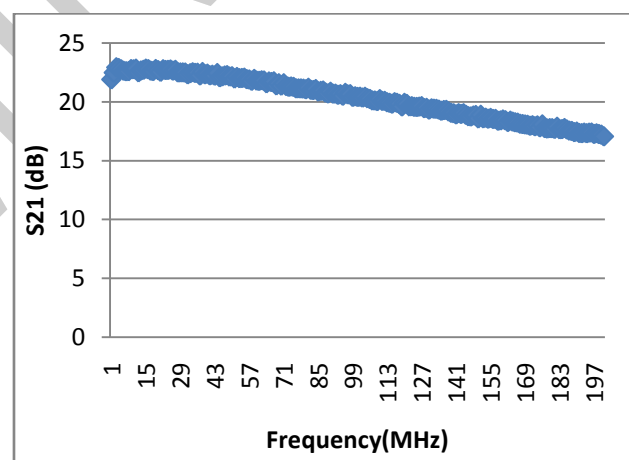


Figure 4 Power Gain(S21)

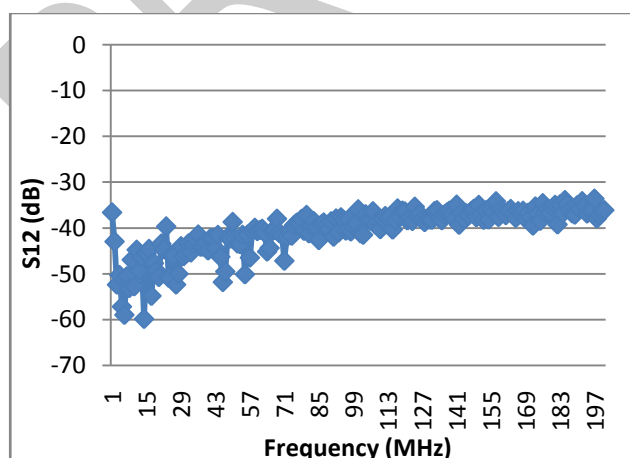


Figure 5 Reverse Isolation(S12)

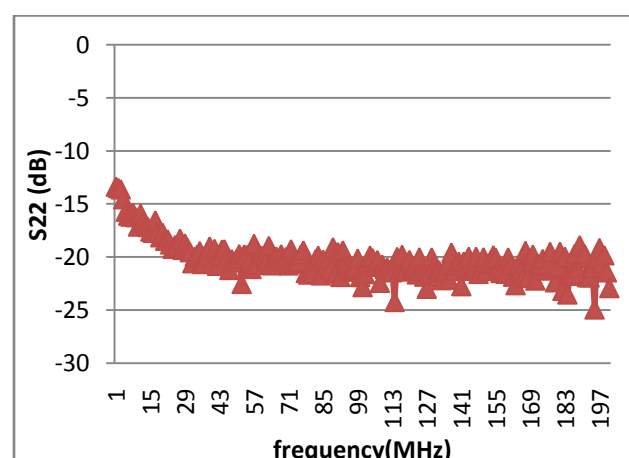


Figure 6 Output Return Loss(S22)

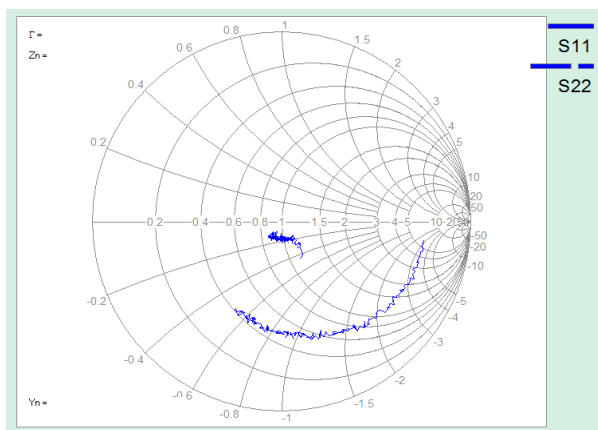


Figure 7 Input / Output Impedance

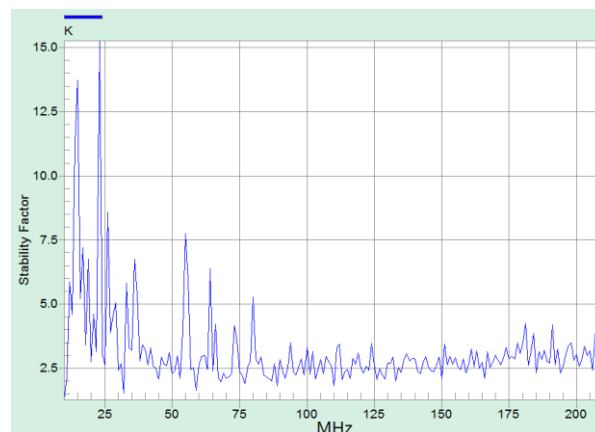


Figure 8 Stability Factor Kf

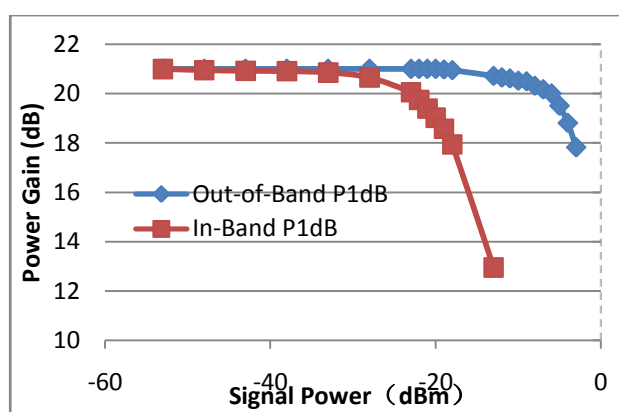


Figure 9 Input P1dB Compression Point(P1dB)

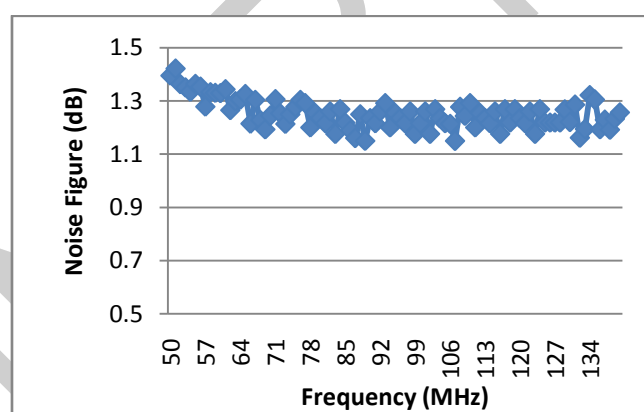


Figure 10 Noise Figure(NF)

FUNCTIONAL BLOCK DIAGRAM

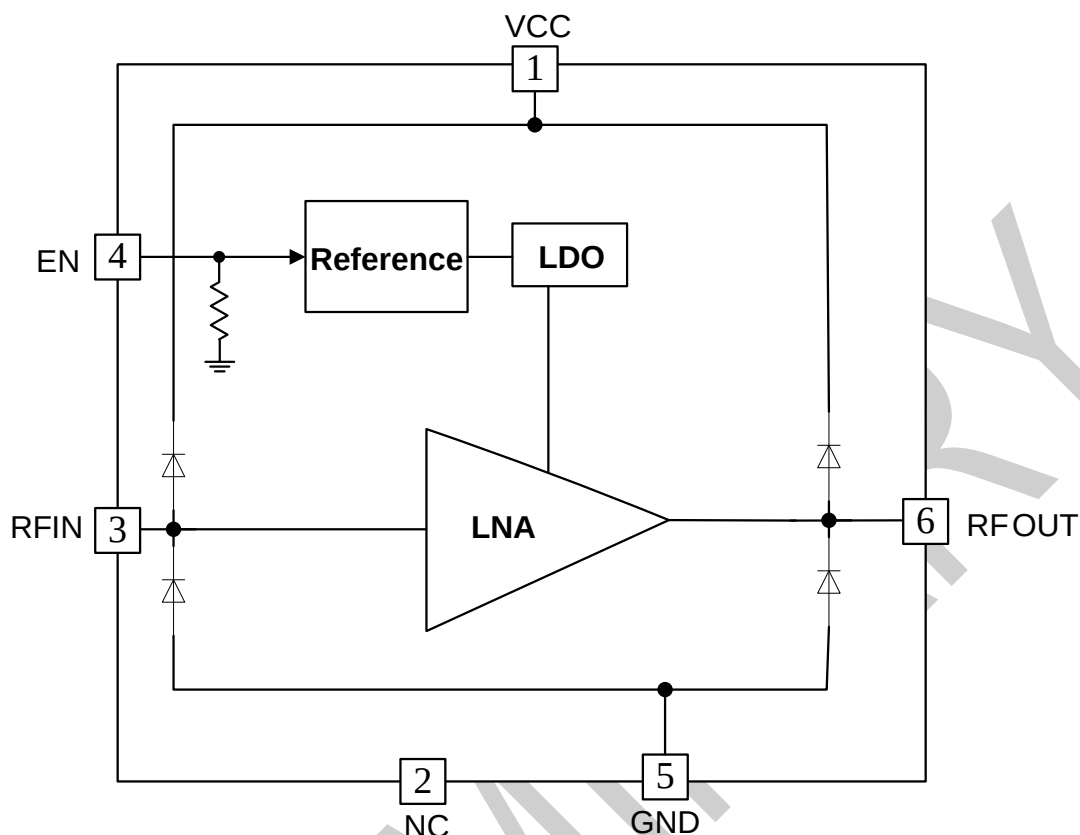


Figure 11 AW5007A FUNCTION BLOCK DIAGRAM

MEASUREMENT DIAGRAM

Test DC Characteristics (Current & Power)

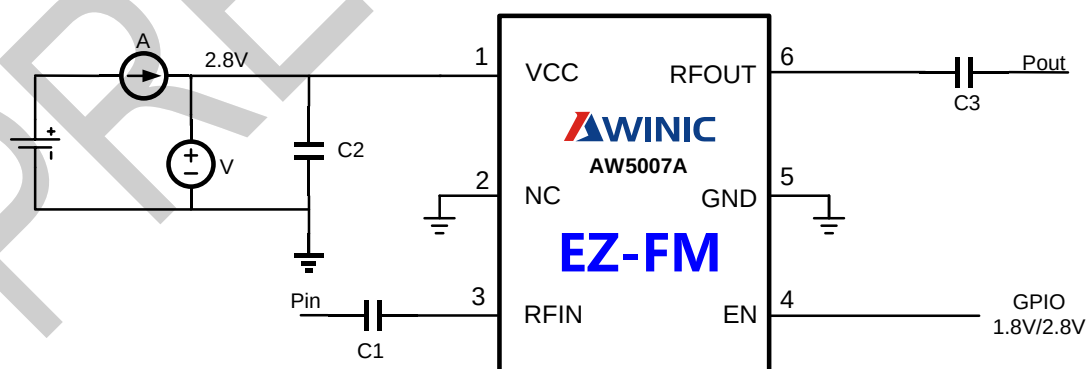


Figure 12 AW5007A DC Test diagram

Test S-parameter

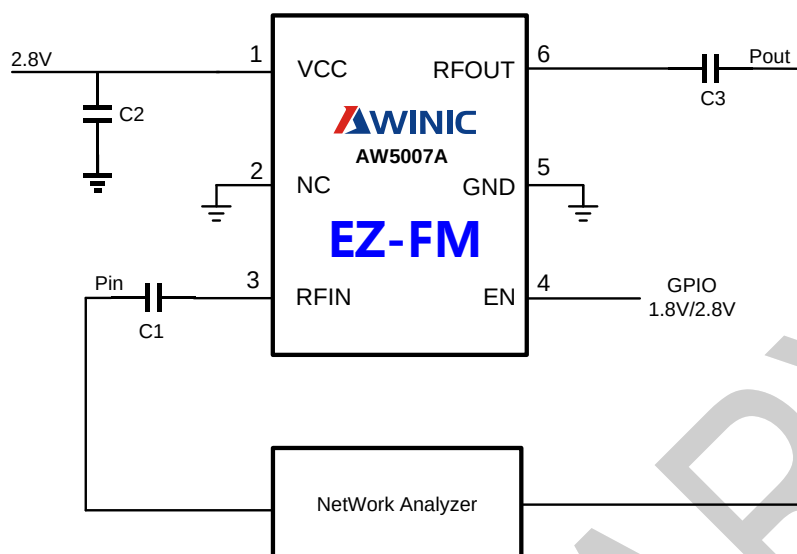


Figure 13 AW5007A S-parameter measurement Diagram

Test Noise-Figure

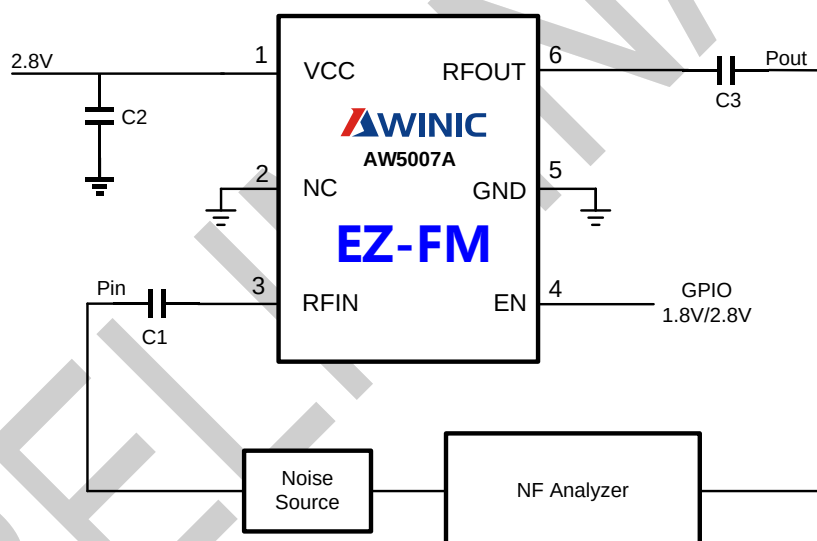


Figure 14 AW5007A Noise Figure Measurement Diagram

Test IIP3

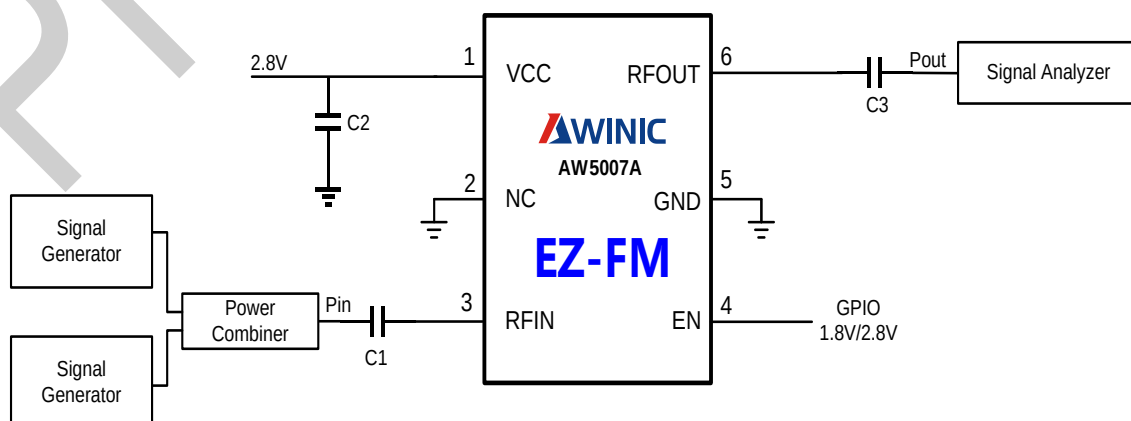


Figure 15 AW5007A IIP3 Measurement Diagram

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 2 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 L4, 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.

Table 6 shows recommended inductor type and values. Table 7 shows recommended capacitor type and values.

Table 6 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

Table 7 CHOICE OF CAPACITOR

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

PACKAGE DESCRIPTION

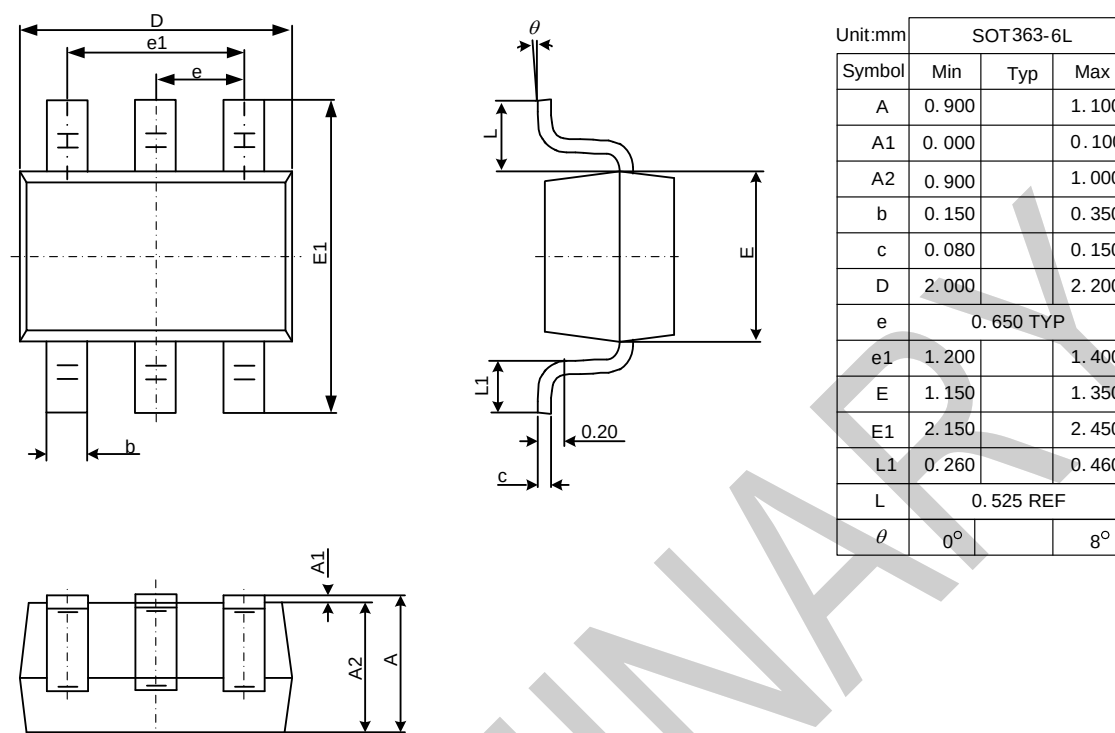


Figure 16 Package outline

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