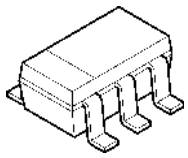
300/400MHz BAND DOWN MIXER WITH AMPLIFIER

■ GENERAL DESCRIPTION

The **NJM2288** is a low-current, low-voltage down mixer, which operates from 2V supply. It is very suitable for situations where small size, low cost, low parts count is important.

■ PACKAGE OUTLINE

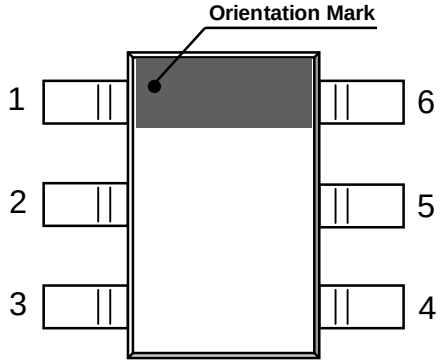


NJM2288F1

■ FEATURES

- Wide Operating Voltage 2V to 5.5V
- Low Operating Current 2.8mA type. @ V+=2.2V, 429MHz input
- Conversion Gain 9dB @V+ =2.2V, 429MHz input
- Input Frequency 300MHz to Up to 500MHz (recommended range)
- Excellent Thermal Stability
  Conversion Gain 2dB @ V+=2.2V, 429MHz input, -- 40 to + 85°C (reference range)
- Third - Order Intercept Point --12dBm @V+ =2.2V, 429MHz input
- Local Input Resistance 9.1kΩ
- Bipolar Technology
- Package Outline SOT-23-6-1

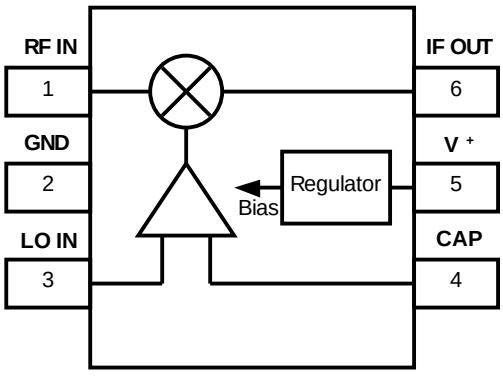
■ PIN CONFIGULATION



Top View

Pin Function
1. RF IN
2. GND
3. LO IN
4. CAP
5. V+
6. IF OUT

■ Simplified Block Diagram



■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V+	7	V
Power Dissipation	P_D	200	mW
RF Input Level	Pr f max	6	dBm
LO Input Level	Pl o max	6	dBm
Operating Temperature	T o p r	- 40 to + 85	°C
Storage Temperature	T s t g	- 40 to +125	°C

■ RECOMMENDED OPERATING CONDITIONS (Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V+		2	2.2	5.5	V

■ ELECTRICAL CHARACTERISTICS

Ta=25°C, V+ =2.2V, frf = 429MHz, Prf = --35dBm, flo = 407.7MHz, Plo = --15dBm, fif = 21.3MHz, unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating Current	I c c q	No signal Test circuit 1	-	2.8	3.5	mA
Conversion Gain	CG	Test circuit 1	-	9	-	dB
Mixer Intercept Point	IIP3	Test circuit 1	-	- 12	-	dBm
Noise Figure	NF	Test Circuit 2	-	9	-	dB
RF Input Return Loss	$\|S11\|^2$	Test Circuit 3	-	- 0.8	-	dB
Impedance between LO IN and CAP Terminal	Zlo	Test Circuit 4 DC value	-	9.1		kΩ
LO Leakage at RF IN (1)	Plo–rf1	Test Circuit 3	-	- 40	-	dB
LO Leakage at RF IN (2)	Plo–rf2	Test Circui3 flo=800MHz, Plo= -15dBm	-	- 25	-	dB
LO Leakage at IF OUT	Plo–if	Test Circuit1	-	- 40	-	dB

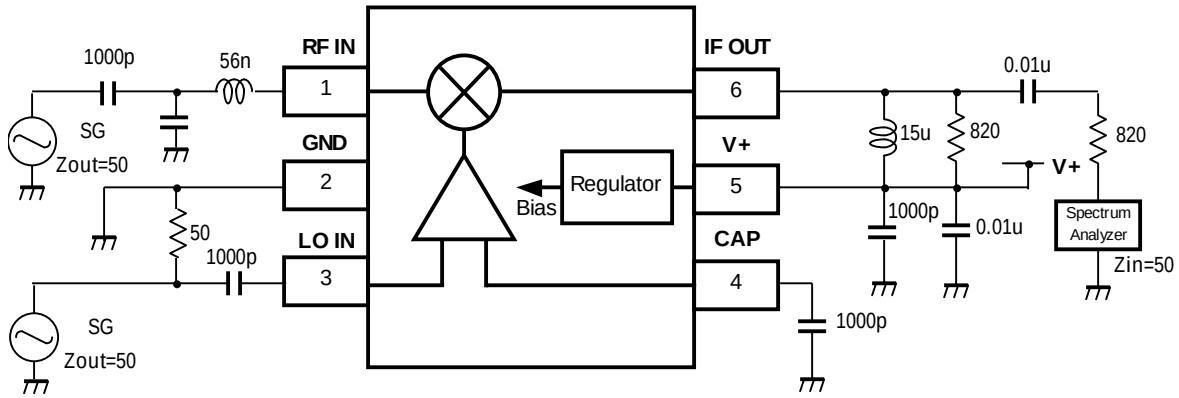
■ TEMPERATURE DRIFT (Reference)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Conversion Gain	--	Ta= -- 40 to + 85°C	- 2	0	2	dB

■ TEST CIRCUIT

These test circuits allow the measurement of all parameters described in “ELECTRICAL CHARACTERISTICS”.

- **Test Circuit 1 for Iccq, CG, IIP3 and Plo-if**



CG is calculated from

CG=Pif – Prf

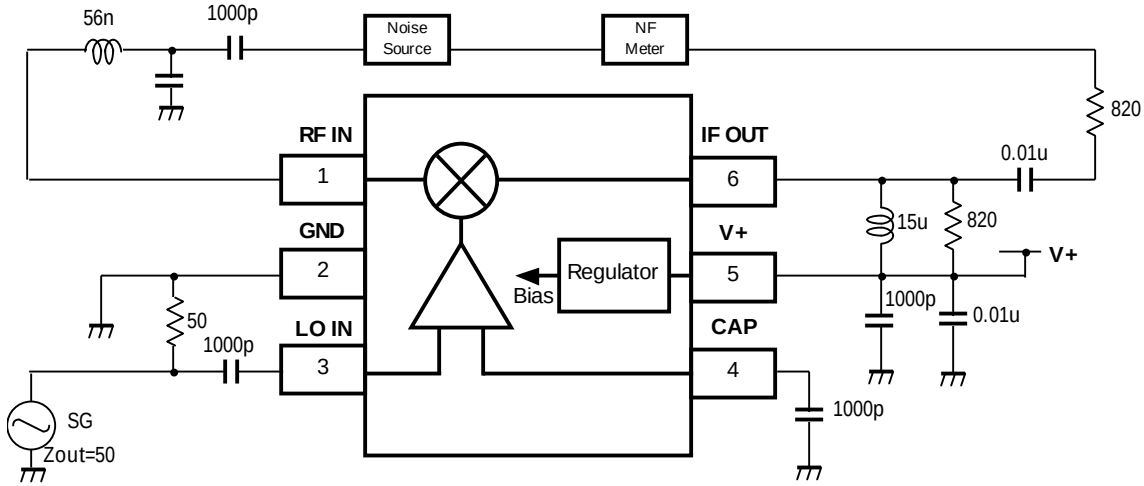
Where

Psa =the value of spectrum analyzer in dBm

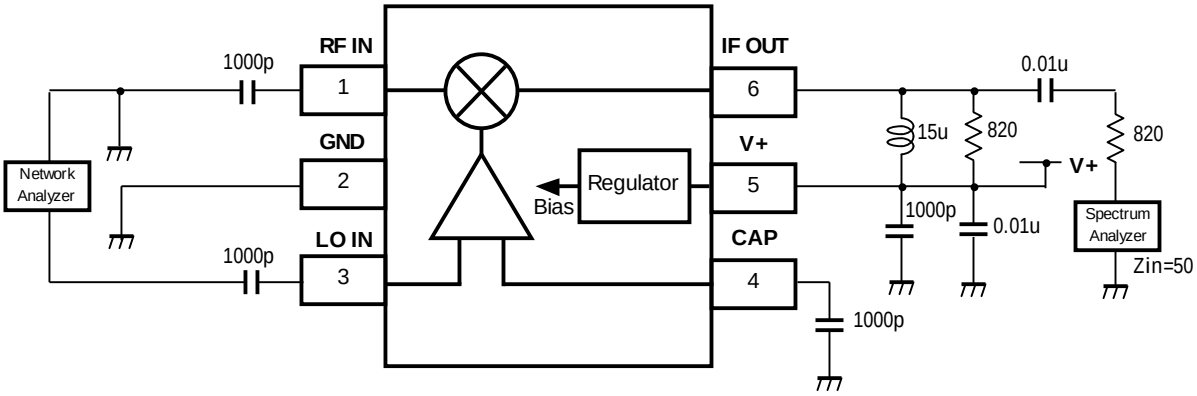
Pif= Psa+10 log 820/50 (dBm)

Prf=input level in dBm

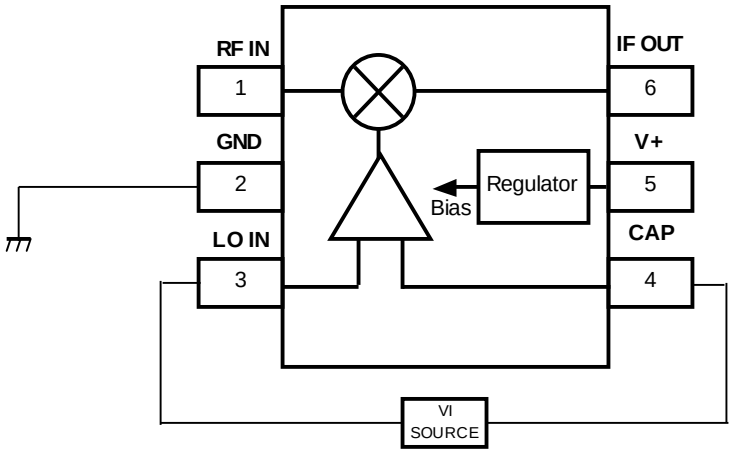
- **Test Circuit 2 for NF**



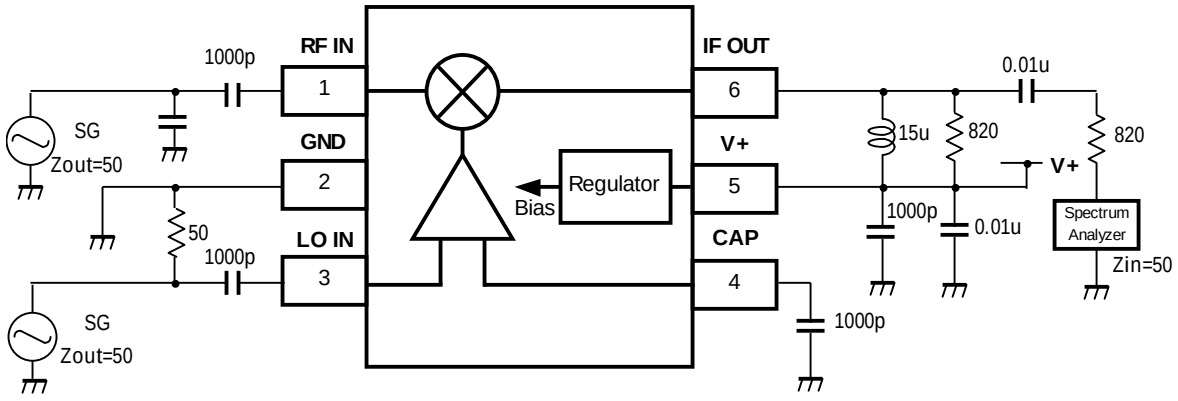
- **Test Circuit 3 for $|S11|^2$, Plo-rf1 and Plo-rf2**



- **Test Circuit 4 for Zlo**



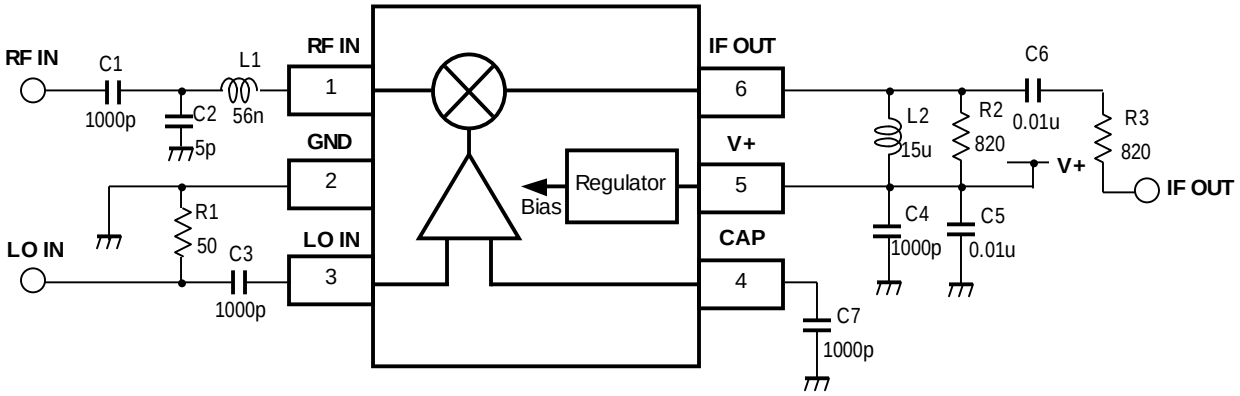
- **Test Circuit 5 for VCG (voltage conversion gain)**



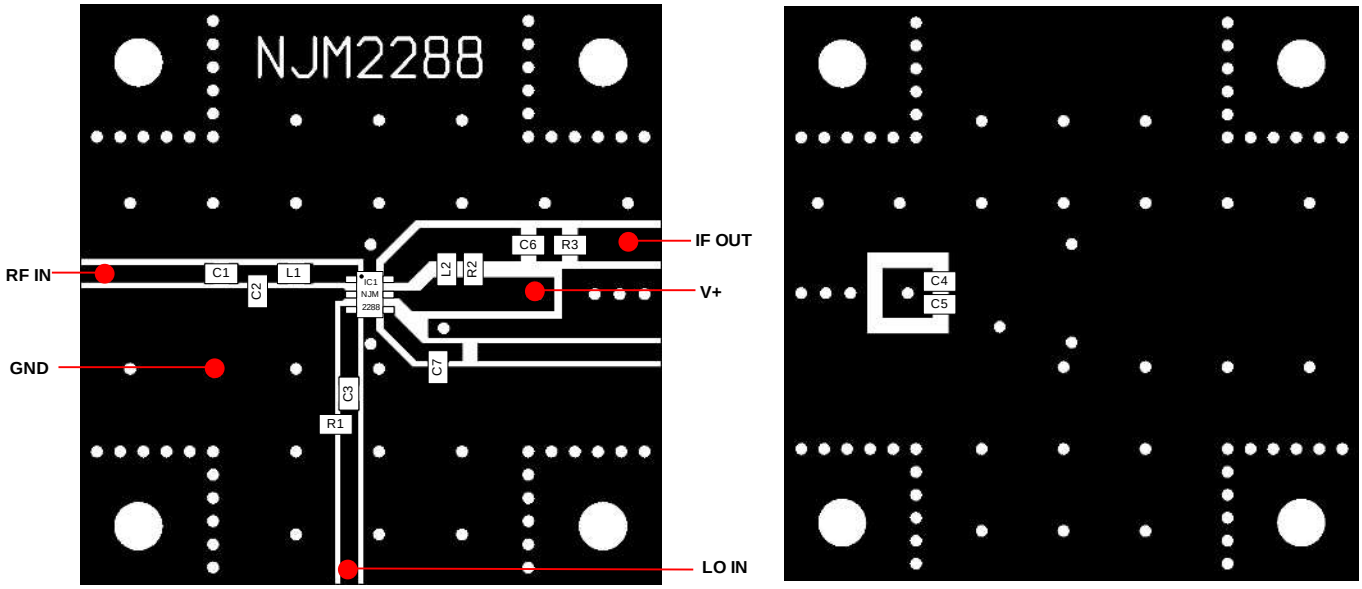
■ EVALUATION PC BOARD

The evaluation board is useful for your design and to have more understanding of the usage and performance of this device. This circuit is the same as TEST CIRCUIT. Note that this board is not prepared to show the recommendation of pattern and parts layout.

● Circuit Diagram



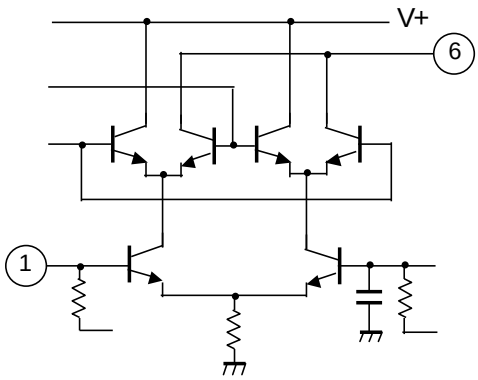
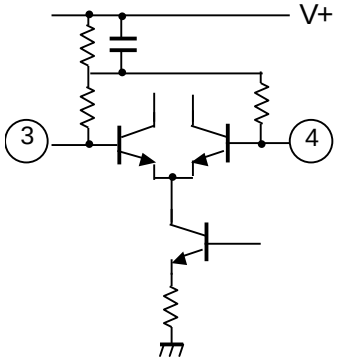
● Evaluation PC Board



● External Components

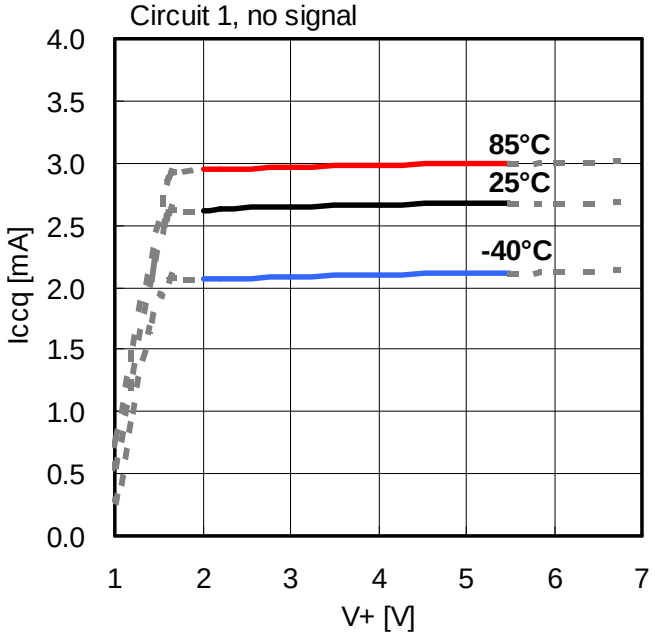
Number	Value	Supplier	Number	Value	Supplier
IC1	NJM2288	New Japan Radio	C1	1000pF	Murata (GRM21 series)
			C2	5pF	Murata (GRM21 series)
R1	50Ω	KOA (RK73B series)	C3	1000pF	Murata (GRM21 series)
R2	820Ω	KOA (RK73B series)	C4	1000pH	Murata (GRM21 series)
R3	820Ω	KOA (RK73B series)	C5	0.01uF	Murata (GRM21 series)
			C6	0.01uF	Murata (GRM21 series)
L1	56nH	Taiyo Yuden (HK1608)	C7	1000pF	Murata (GRM21 series)
L2	15uH	Taiyo Yuden (LAP02)			

■ TERMINAL FUNCTION (Ta=25°C, V^+=2.2 V)

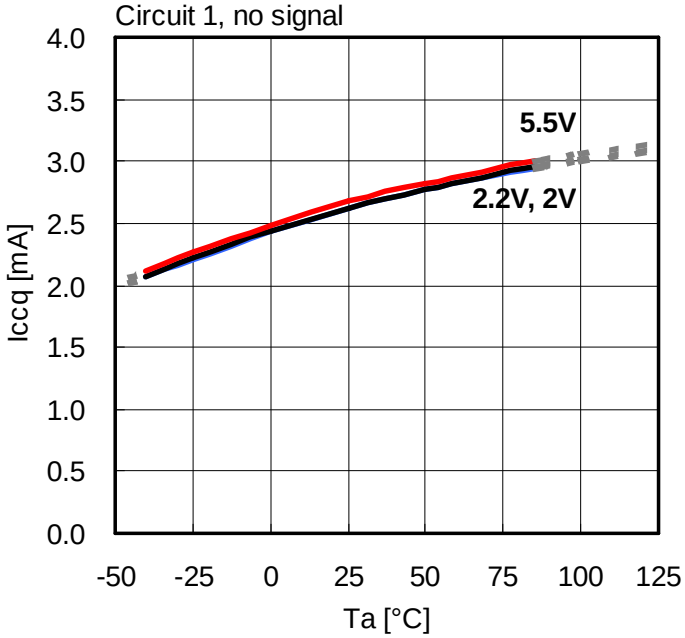
Pin No.	SYMBOL	EQUIVARENT CIRCUIT	VOLTAGE	FUNCTION
1	RF IN		1.18V	**RF Input** Recommended input frequency range is from 300 to 500MHz. For using at another frequency, please refer to the data shown in "TYPICAL CHARACTERISTICS".
6	IF OUT		--	**IF Output** Output frequency fif is calculated from fif = frf- flo. where frf=RF IN input signal frequency flo=LO IN input signal frequency
2	GND	--	--	**Ground**
3	LO IN		2.03V	**Local Input** Input level of over –20dBm is recommended to obtain high IF output level, where IF output is saturated. Note that absolute maximum input level is 6dBm.
4	CAP		2.03V	**Local Signal Reverse Input** An external decoupling capacitor is placed between this pin and ground. The value of capacitance should be selected to be very low impedance at LO IN input signal frequency.
5	V+	--	--	**Supply Voltage** ESD protection transistor exists between V+ and ground.

■ **TYPICAL CHARACTERISTICS (Ta=25°C, V+ =2.2V, frf = 429MHz, Prf = --35dBm, flo = 407.7MHz, Plo = --15dBm, fif = 21.3MHz, unless otherwise noted)**

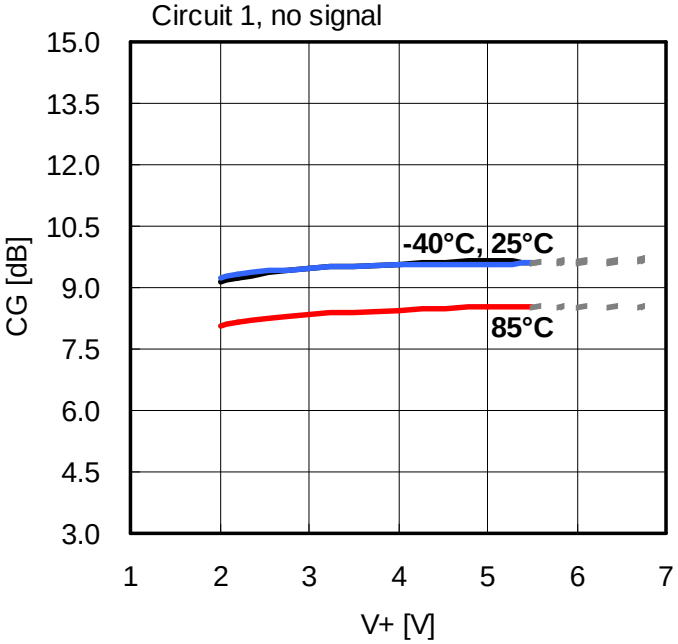
Operating Current Iccq versus Supply Voltage V+



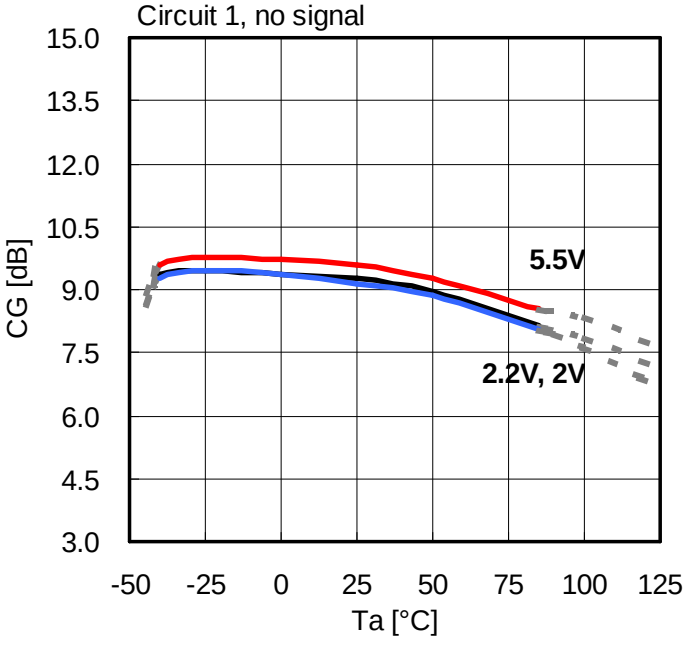
Operating Current Iccq versus Ambient Temperature Ta



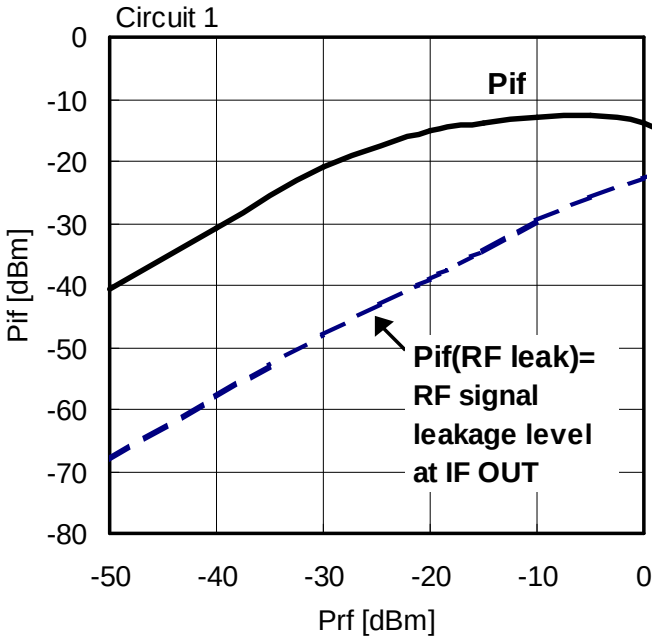
Conversion Gain CG versus Supply Voltage V+



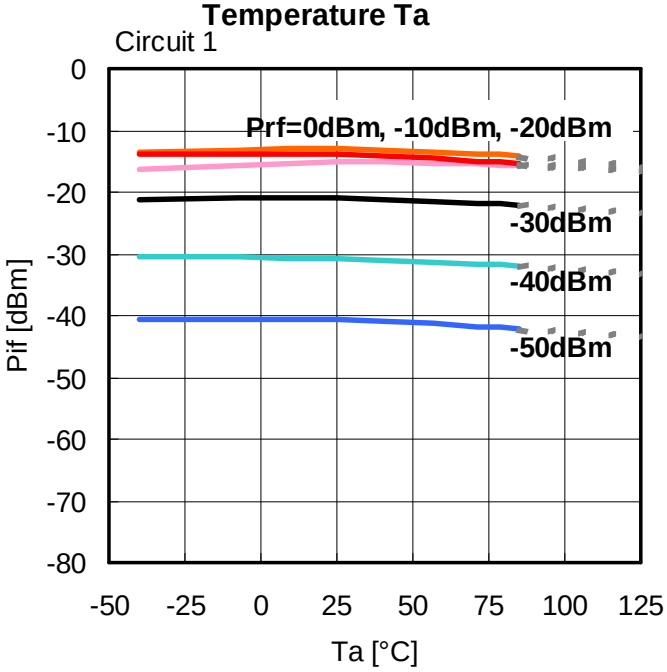
Conversion Gain CG versus Ambient Temperature Ta



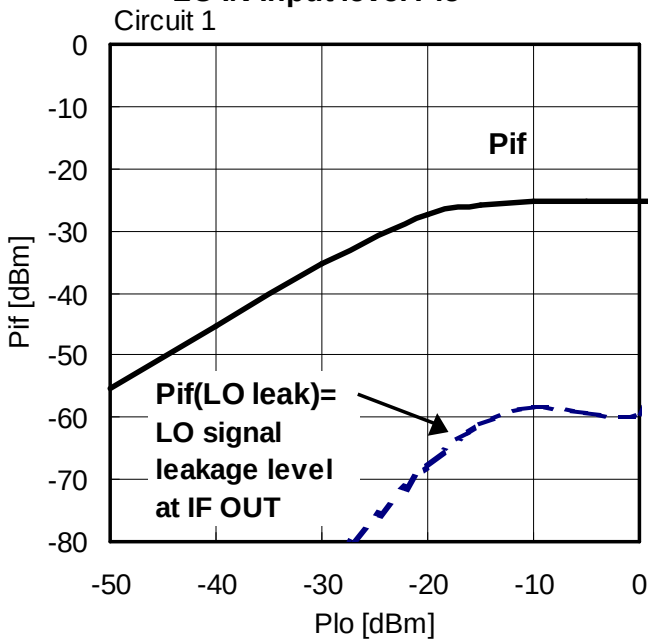
IF Output Level Pif versus RF Input Level Prf



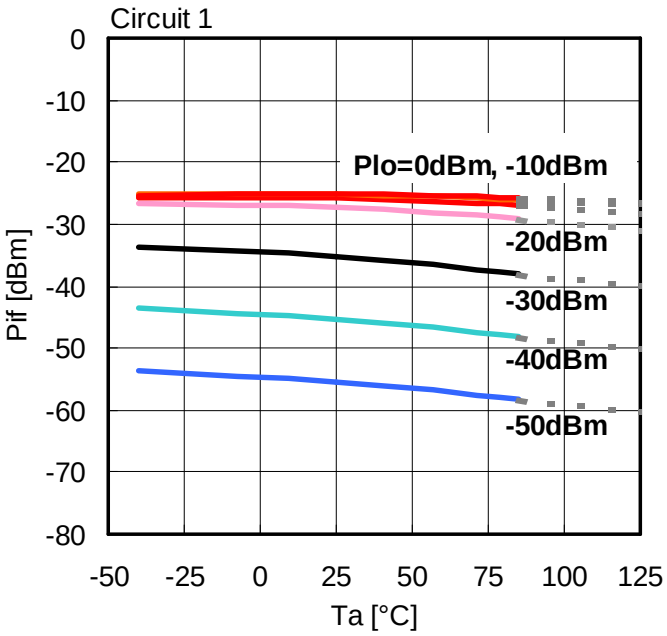
IF Output Level Pif versus Ambient Temperature Ta



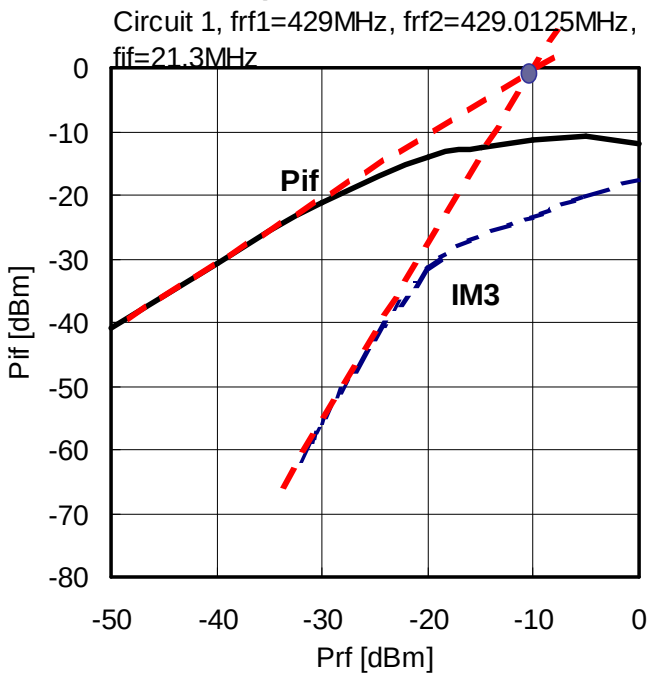
IF Output Level Pif versus LO IN Input level Plo



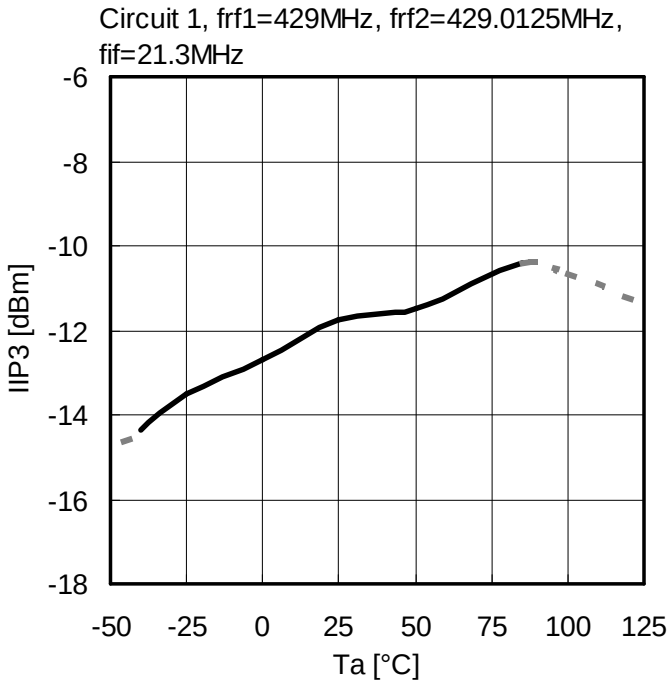
IF Output Level Pif versus Ambient Temperature Ta



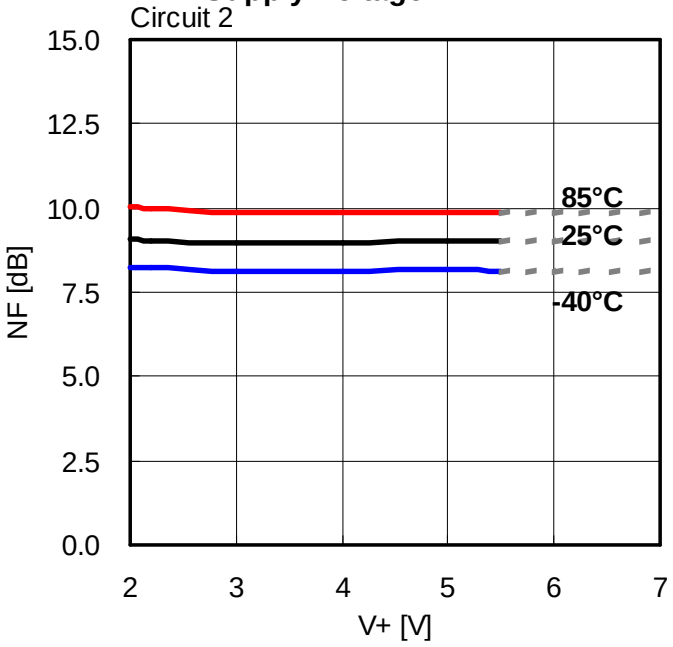
Intermodulation versus RF Input Level Prf



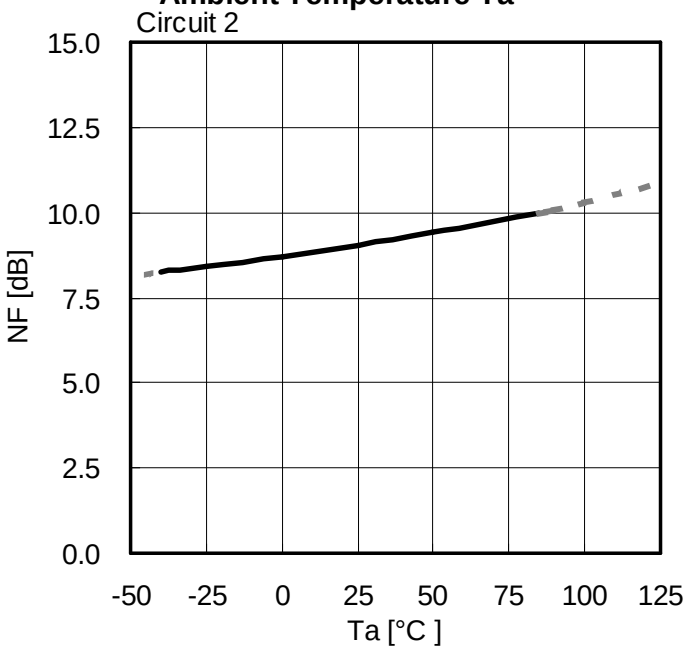
IP3 versus Ambient Temperature Ta



Noise Figure NF versus Supply Voltage V+

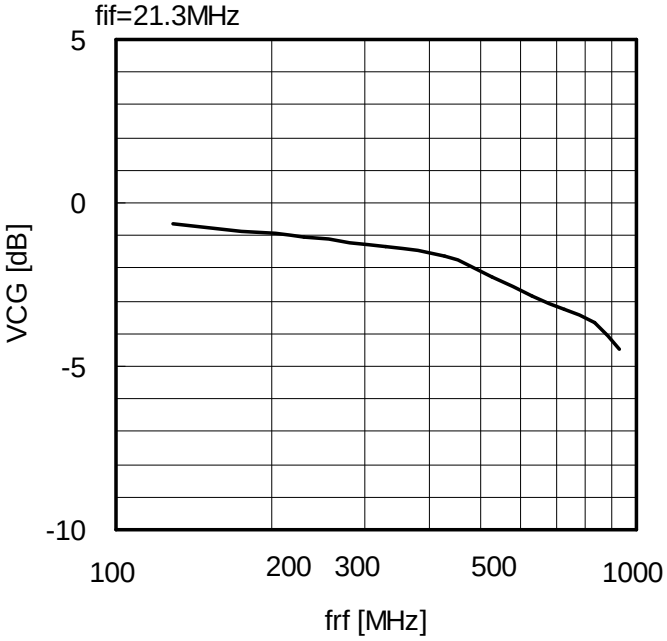


Noise Figure NF versus Ambient Temperature Ta



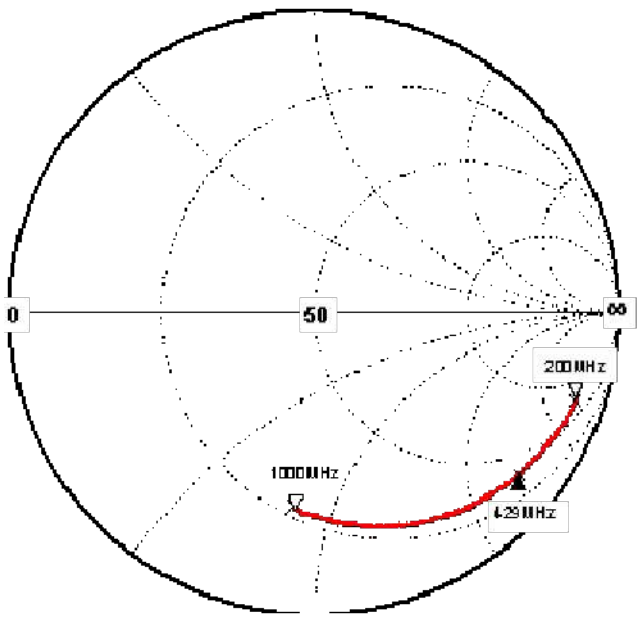
Voltage Conversion Gain VCG versus RF Input Frequency frf

Circuit 5, Prf=-35dBm, Plo=-15dBm, fif=21.3MHz



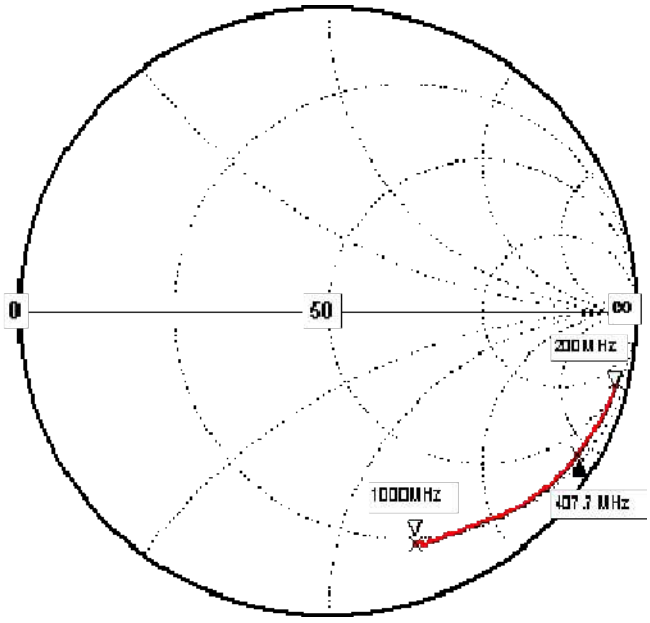
RF IN Characteristics

Circuit 3



LO IN Characteristics

Circuit 3



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