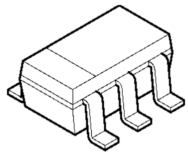
VHF/UHF BAND RF AMPLIFIER

■ GENERAL DESCRIPTION

The **NJM2275** is a low current, low voltage RF amplifier, especially designed for VHF/UHF band.
The center frequency of this narrow band amplifier is changed by external components.

■ PACKAGE OUTLINE

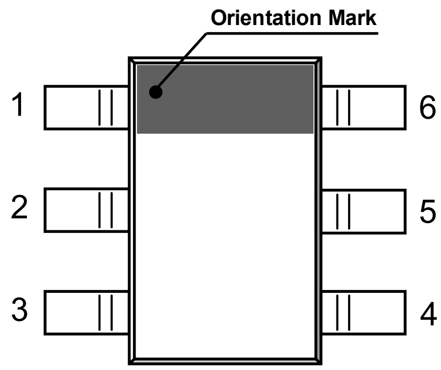


NJM2275F1

■ FEATURES

- Wide Operating Voltage 1.8V to 6V
- Low Operating Current 0.8mA type. @ V^+ =1.9V, no signal input
- High Gain
  - Power Gain 15dB @1.9V, 400MHz input
  - Voltage Gain 30dB @1.9V, 400MHz input, 1kΩ load
- Operating Frequency band Up to 800MHz
- High Isolation (OUT to IN) 45dB @1.9V, 400MHz
- Bipolar Technology
- Package Outline SOT23-6 (MTP6)

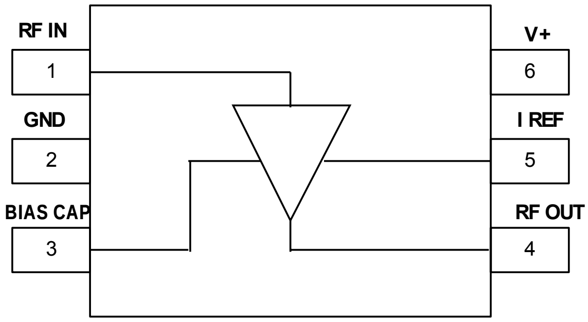
■ PIN CONFIGULATION

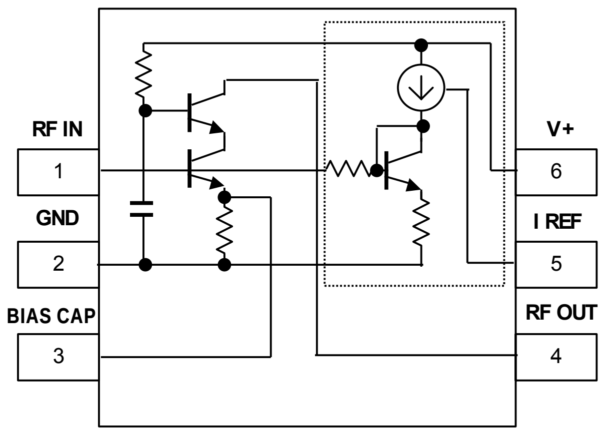


Top View

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

■ Simplified Block Diagram





■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V^+	10.0	V
Power Dissipation	P_D	200	mW
RF Input Level	Pinmax	6	dBm
Operating Temperature	Topr	- 40 to + 85	°C
Storage Temperature	Tstg	- 40 to +125	°C

■ RECOMMENDED OPERATING CONDITIONS (Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V^+		1.8	1.9	6.0	V

■ ELECTRICAL CHARACTERISTICS

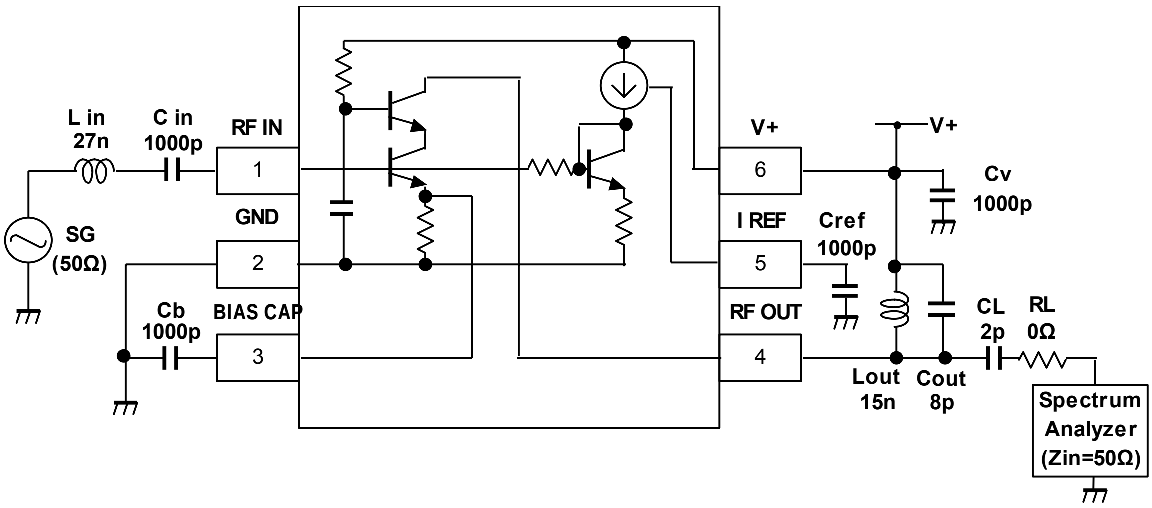
(Ta=25°C, V^+=1.9V, fin=400MHz, unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating Current	Icc	No signal	-	0.8	1.0	mA
Power Gain	PG	Pin= - 40dBm Test circuit 1	-	15	-	dB
Voltage Gain	VG	Pin= - 40dBm Test circuit 2	-	30	-	dB
Noise Figure	NF	Test Circuit 3	-	2.2	-	dB
Input Return Loss	IS11I	Pin= - 40dBm Test Circuit 4	-	- 8	-	dB
Output Return Loss	IS22I	Pin= - 40dBm Test Circuit 4	-	- 20	-	dB
RF OUT - RF IN Isolation	ISL	Pin= - 40dBm Test Circuit1	-	45	-	dB
Power Input at 1dB compression Point	P_{-1dB}	Test Circuit1	-	- 28	-	dBm

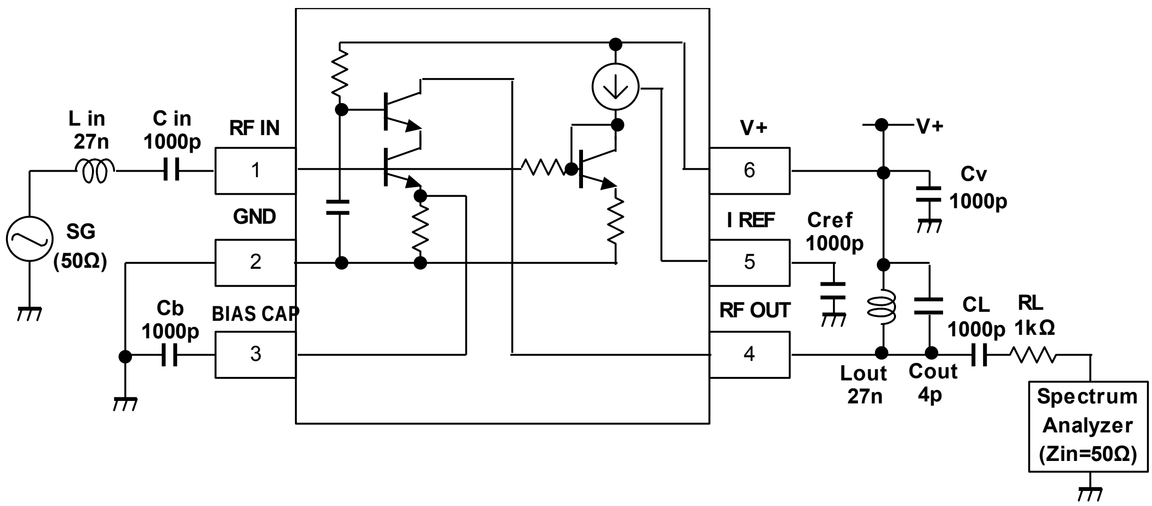
■ TEST CIRCUIT

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

- **Test Circuit 1 for Icc, PG , P_{-1dB} and Pin vs. Pout**



- **Test Circuit 2 for VG**



PG and VG has the following relation.

PG = Pout – Pin

VG = (Pout + Prl) – Pin

where

Pin = input level in dBm

Pout = output level in dBm

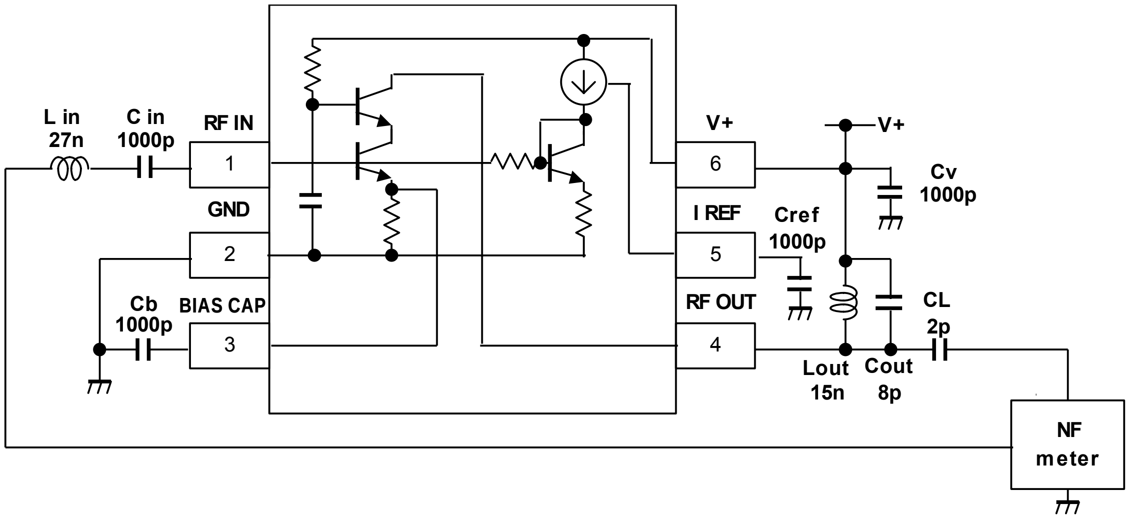
Prl = the loss caused by the voltage drop of RL.

RL is 1000 Ω. The input impedance of spectrum analyzer Zin is 50Ω. Prl is calculated from

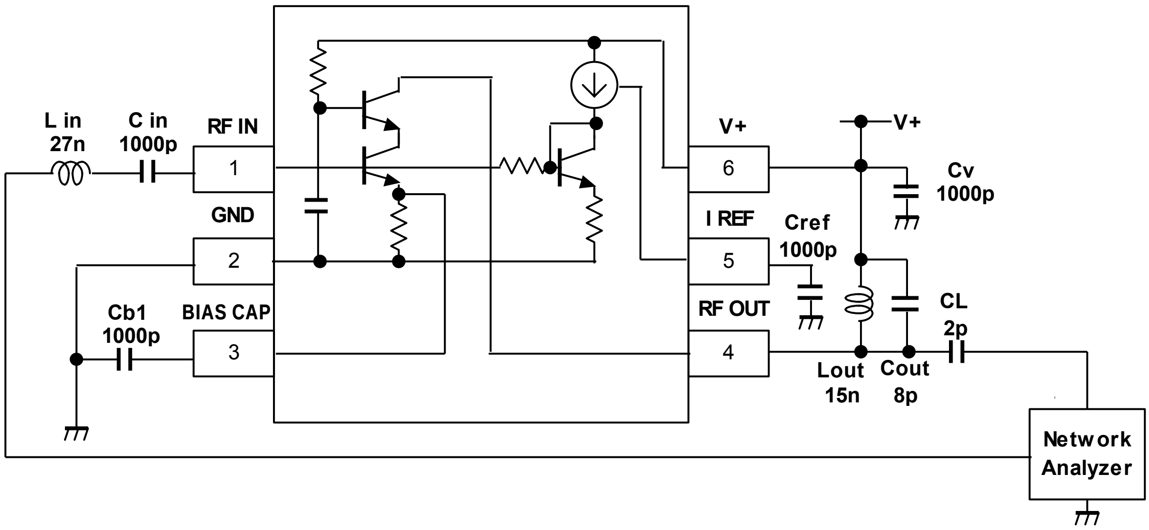
Prl = 20log ((RL + Zin) / RL)

Prl = 20 log (1050 / 50)

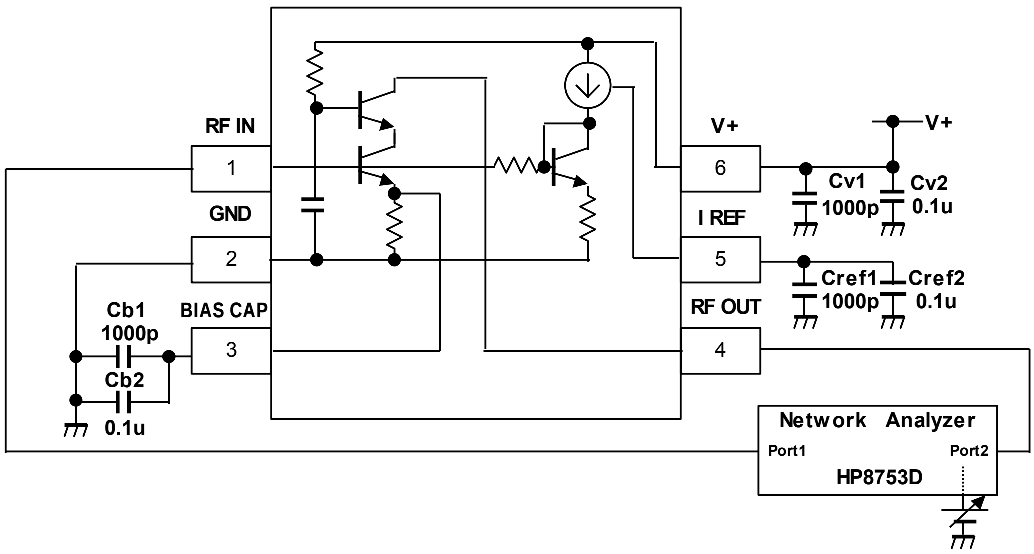
- **Test Circuit 3 for NF**



- **Test Circuit 4 for IS11I and IS22I**



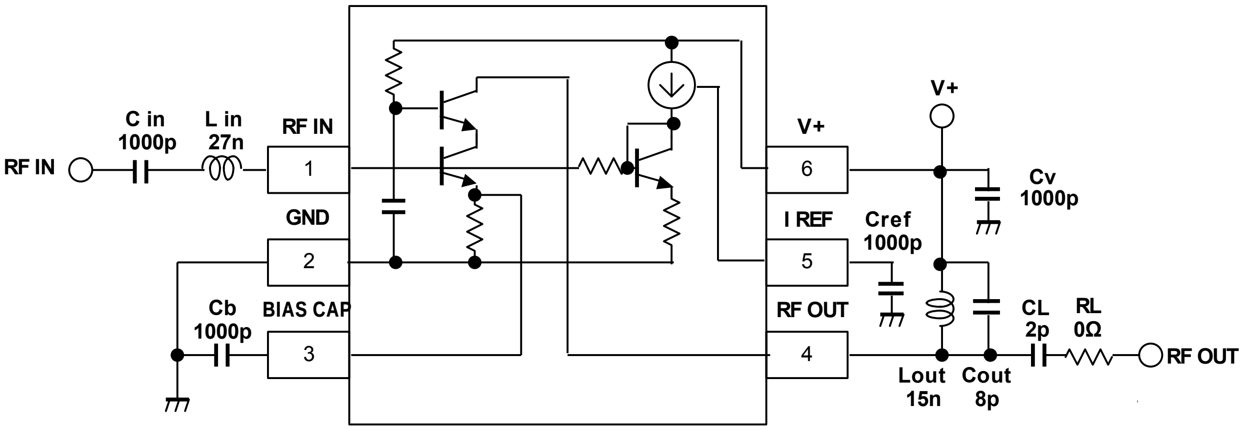
- **Test Circuit 5 for S-Parameters** (this item is not specified in "ELECTRICAL CHARACTERISTICS")



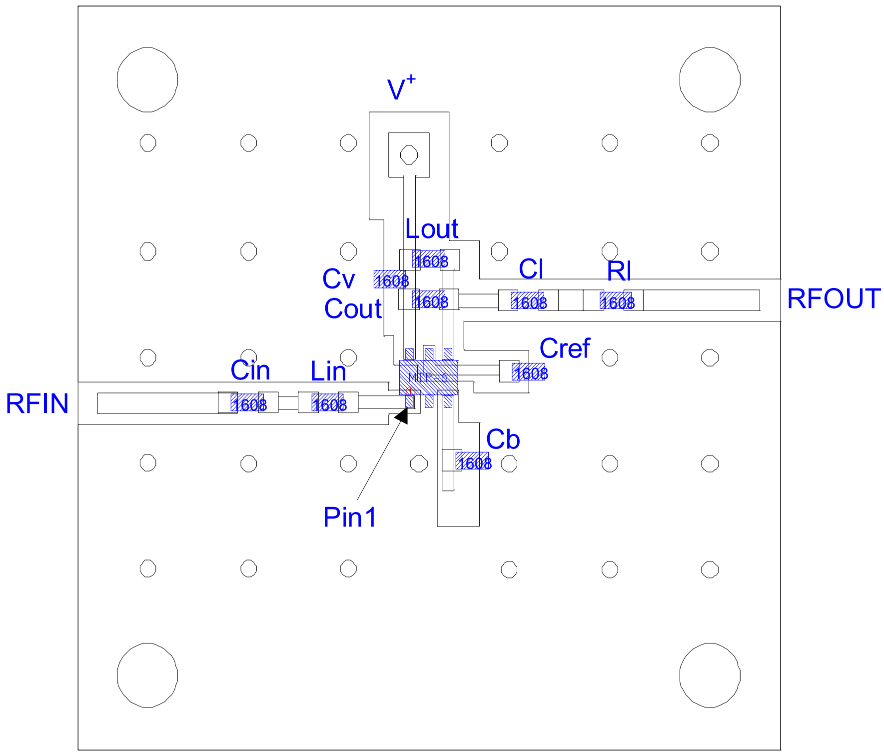
■ EVALUATION PC BOARD

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

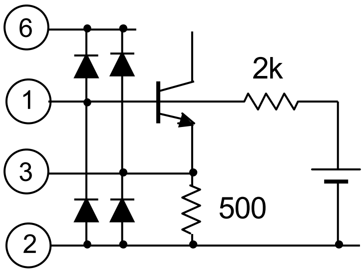
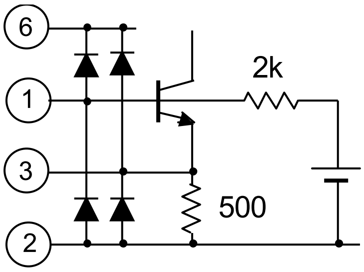
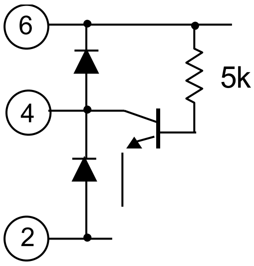
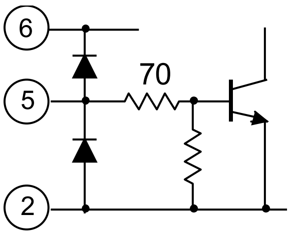
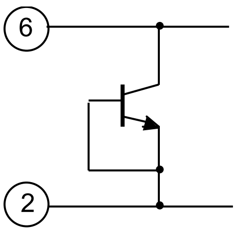


● Evaluation PC Board



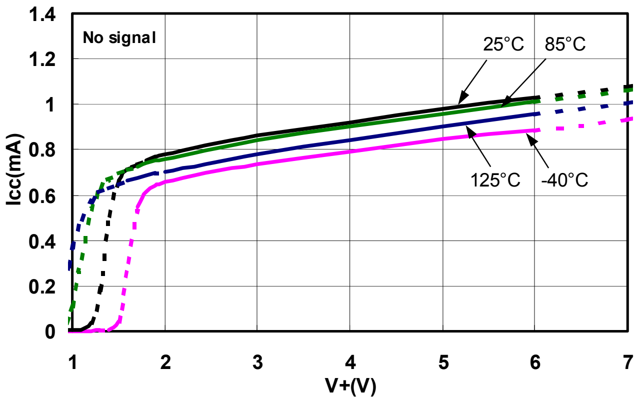
This evaluation board is designed to have the maximum value of PG at 400MHz.
By using the value of Test Circuit2, this board can have the maximum value of VG at 400MHz.
Cref is effective to obtain good NF. However, if the ground has a large noisy signal, NF may become worse.

■ TERMINAL FUNCTION (Ta=25°C, V+=1.9 V)

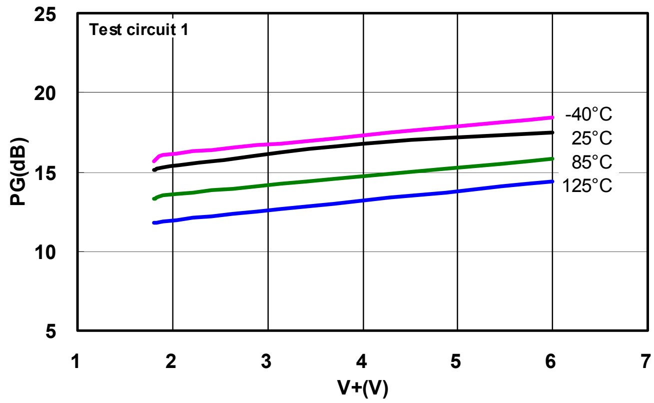
Pin No.	SYMBOL	EQUIVARENT CIRCUIT	VOLTAGE	FUNCTION
1	RF IN		1.09V	**RF Input**
2	GND	--	--	**Ground**
3	BIAS CAP		0.33V	**Bias Capacitance** An external decoupling capacitor is placed between this pin and ground.
4	RF OUT		V+	**RF Output**
5	IREF		0.75V	**Reference of Current Source** An external decoupling capacitor is placed between this pin and ground. An external resistor from this pin to ground can controls the reference current of current source and the related performances, such as NF and gain.
6	V+		--	**Supply Voltage** ESD protection transistor exists between V+ and ground.

■ TYPICAL CHARACTERISTICS (Ta=25°C, V+=1.9V, unless otherwise noted)

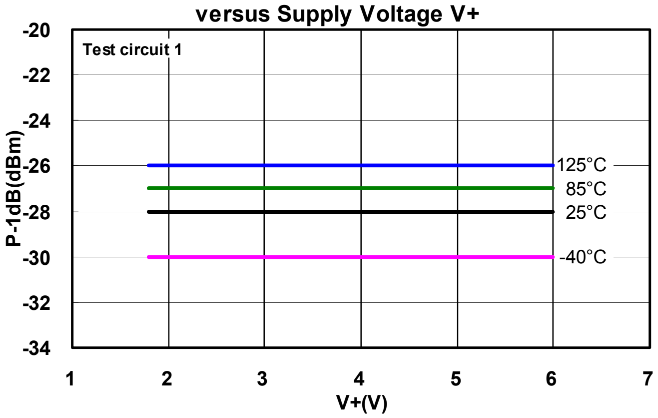
Operating Current Icc versus Supply Voltage V+



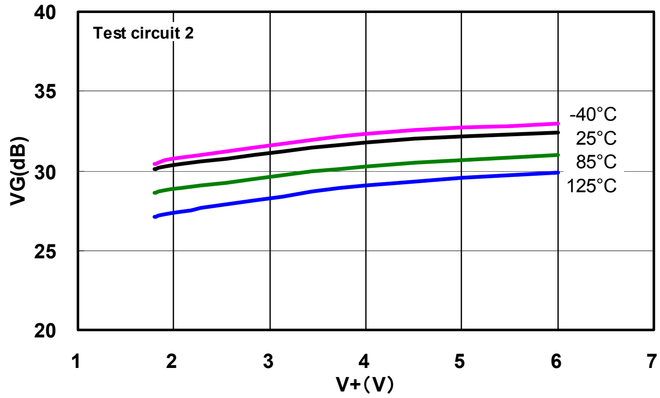
Power Gain PG versus Supply Voltage V+



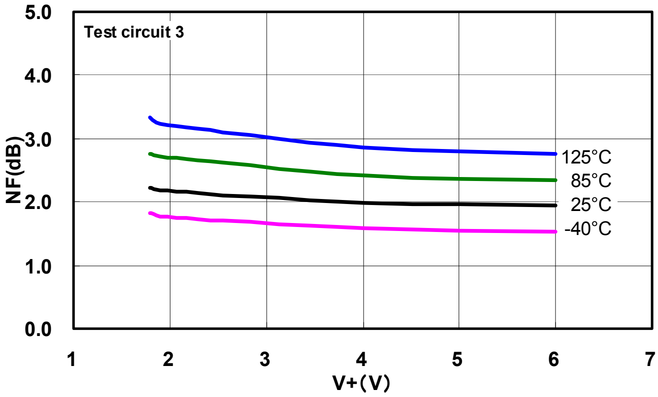
Pin at 1dB Compression Point P-1dB versus Supply Voltage V+



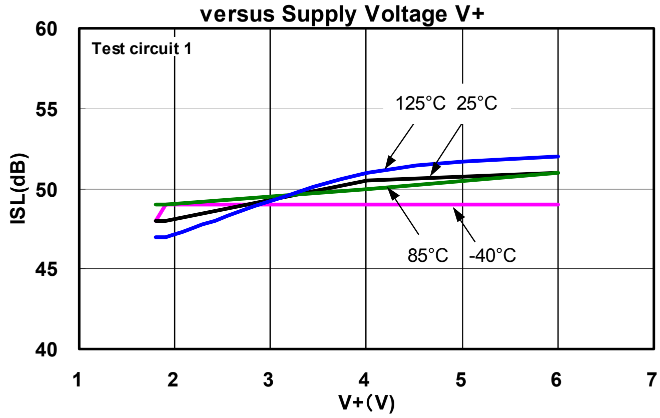
Voltage Gain VG versus Supply Voltage V+



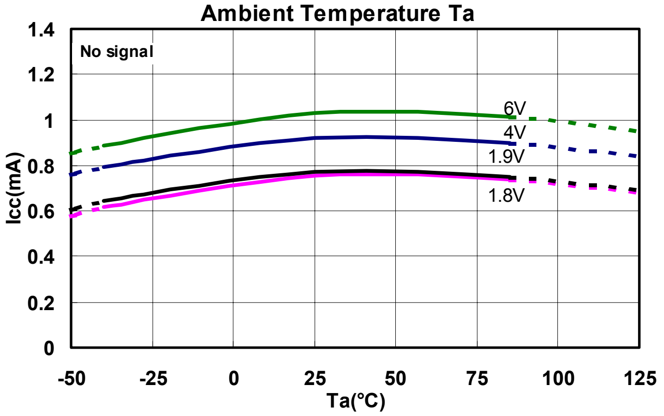
Noise Figure NF versus Supply Voltage V+



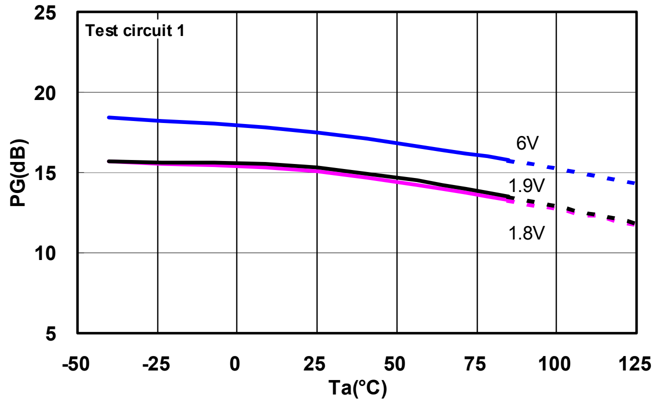
RF OUT-RF IN Isolation ISL versus Supply Voltage V+



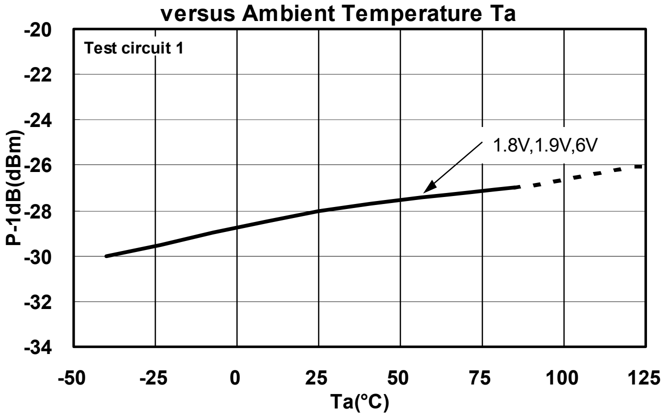
Operating Current Icc versus Ambient Temperature Ta



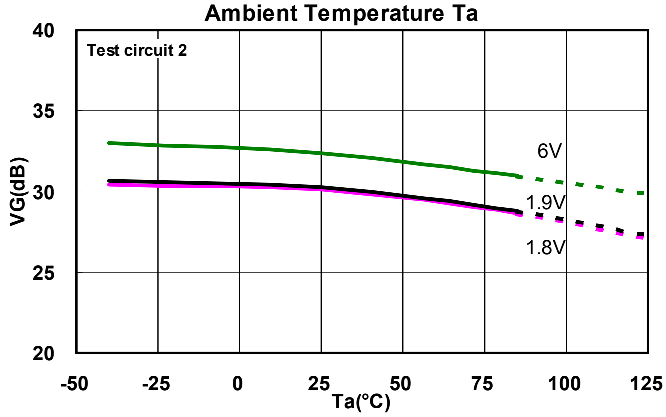
Power Gain PG versus Ambient Temperature Ta



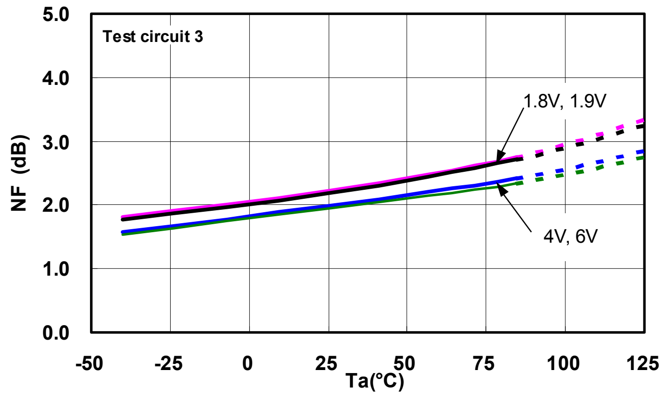
Pin at 1dB Compression Point P-1dB versus Ambient Temperature Ta



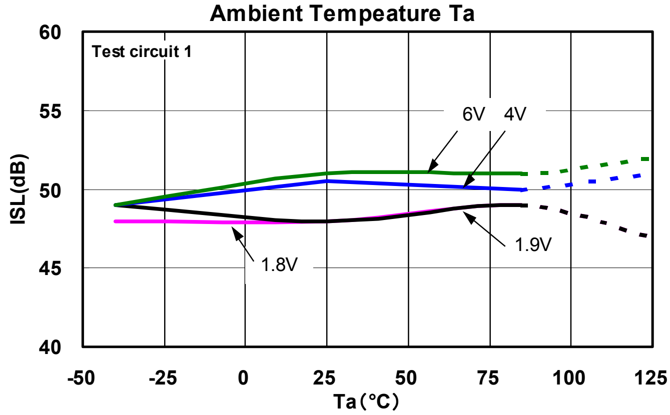
Voltage Gain VG versus Ambient Temperature Ta

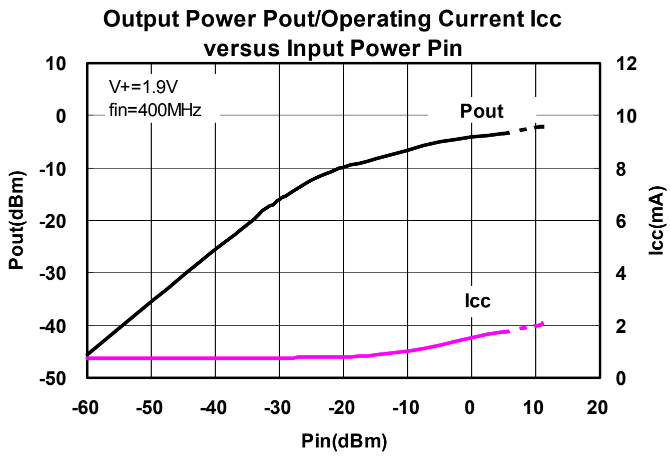


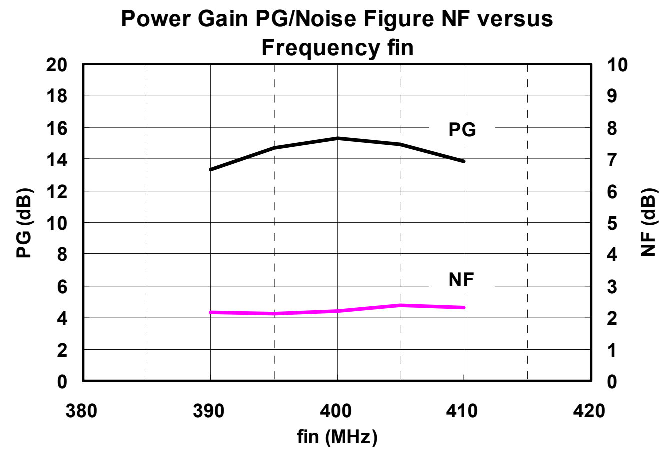
Noise Figure NF versus Ambient Temperature Ta

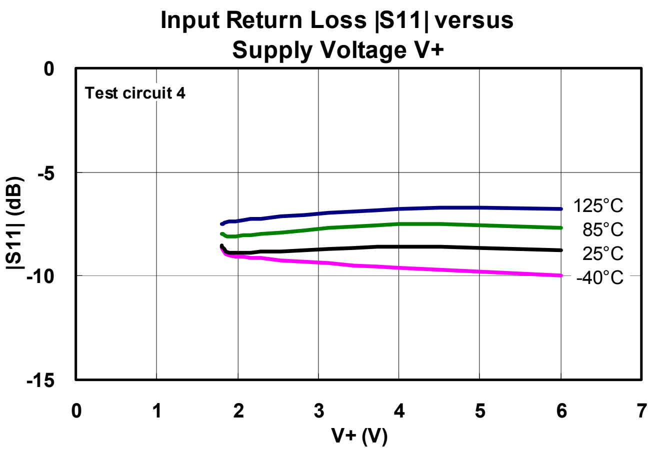


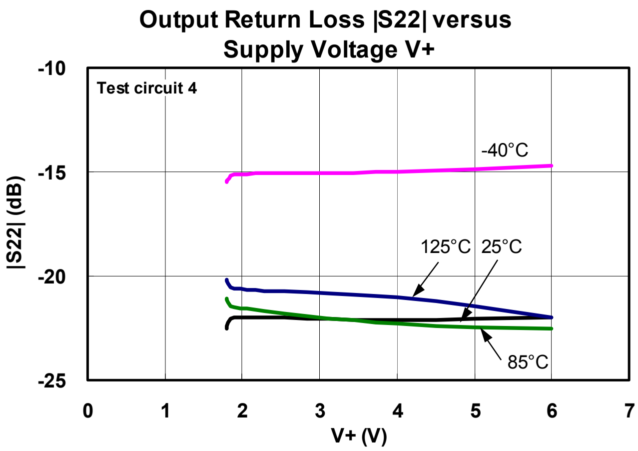
RF OUT-RF IN Isolation ISL versus Ambient Tempeature Ta

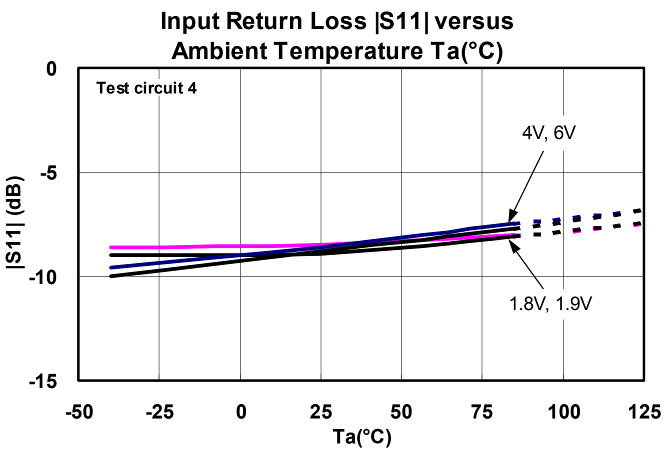


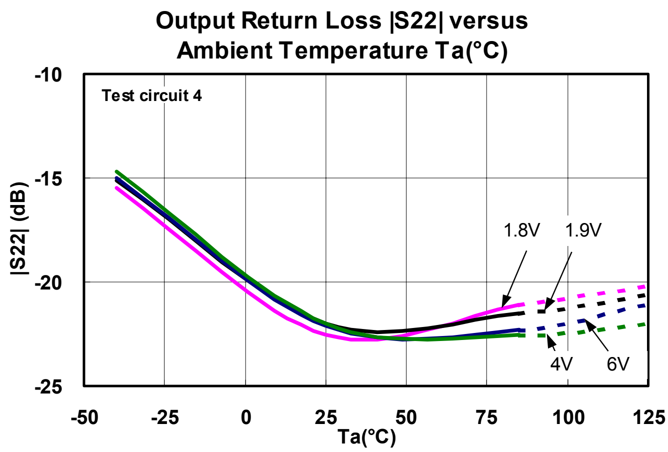

Output Power Pout/Operating Current Icc
versus Input Power Pin
V+=1.9V
fin=400MHz
Pout
Icc
Pout(dBm)
Icc(mA)
Pin(dBm)
10
0
-10
-20
-30
-40
-50
12
10
8
6
4
2
0
-60
-50
-40
-30
-20
-10
0
10
20


Power Gain PG/Noise Figure NF versus
Frequency fin
PG
NF
PG (dB)
NF (dB)
fin (MHz)
380
390
400
410
420

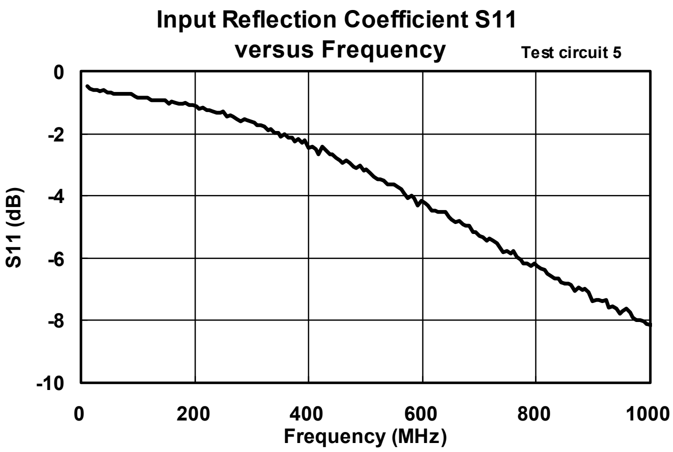

Input Return Loss |S11| versus
Supply Voltage V+
Test circuit 4
125°C
85°C
25°C
-40°C
|S11| (dB)
V+ (V)

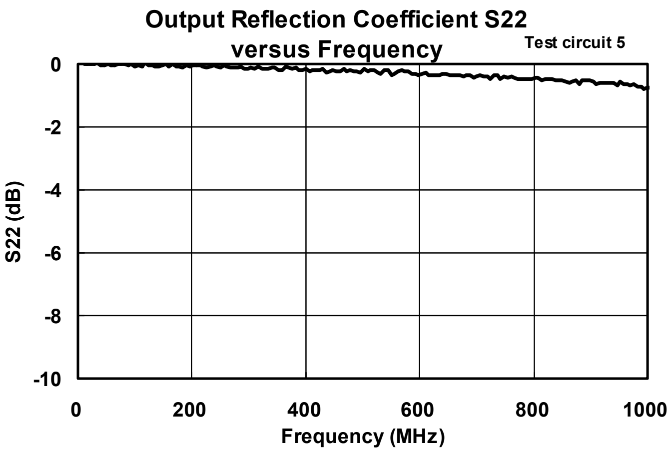

Output Return Loss |S22| versus
Supply Voltage V+
Test circuit 4
-40°C
125°C
25°C
85°C
|S22| (dB)
V+ (V)

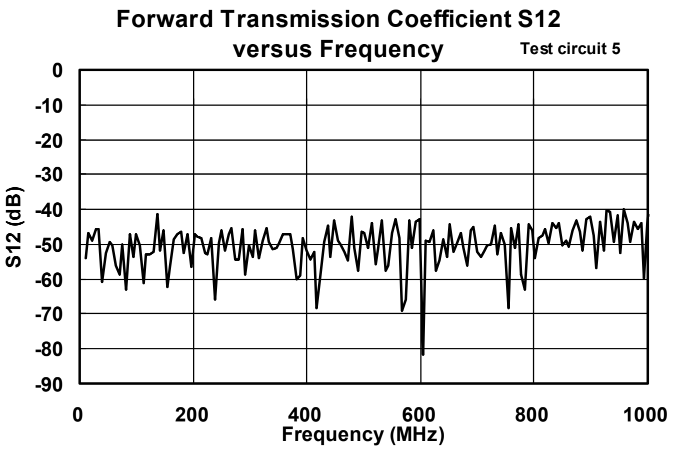

Input Return Loss |S11| versus
Ambient Temperature Ta(°C)
Test circuit 4
4V, 6V
1.8V, 1.9V
|S11| (dB)
Ta(°C)

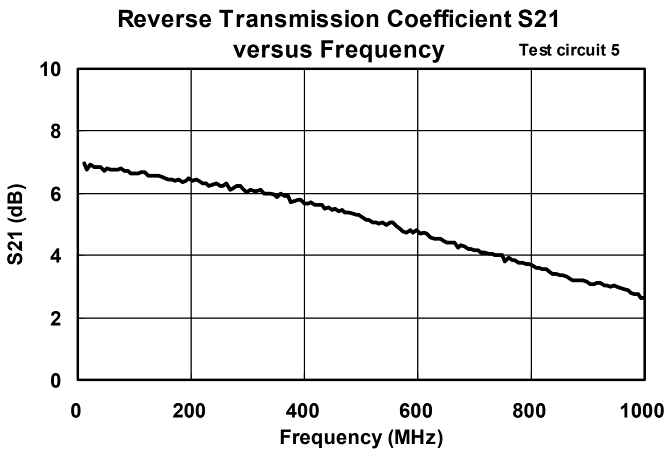

Output Return Loss |S22| versus
Ambient Temperature Ta(°C)
Test circuit 4
1.8V
1.9V
4V
6V
|S22| (dB)
Ta(°C)

S Paramater (reference)

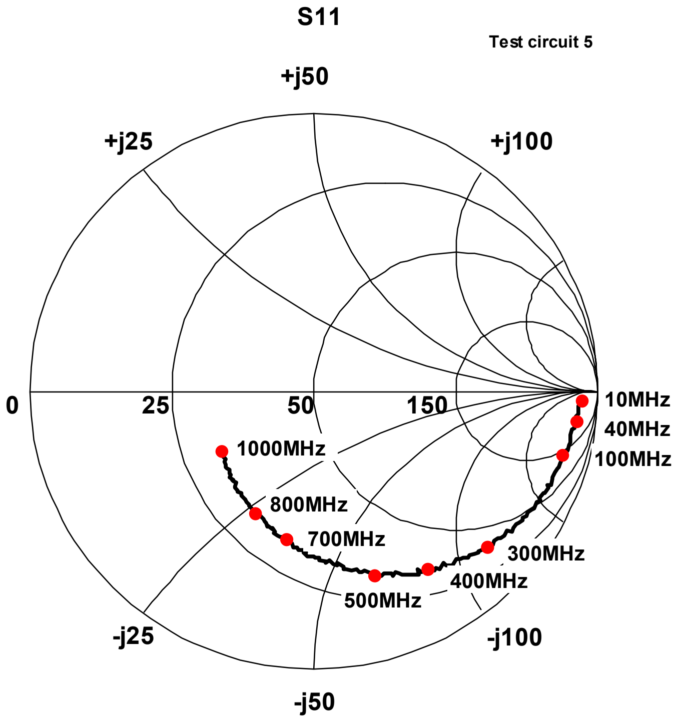


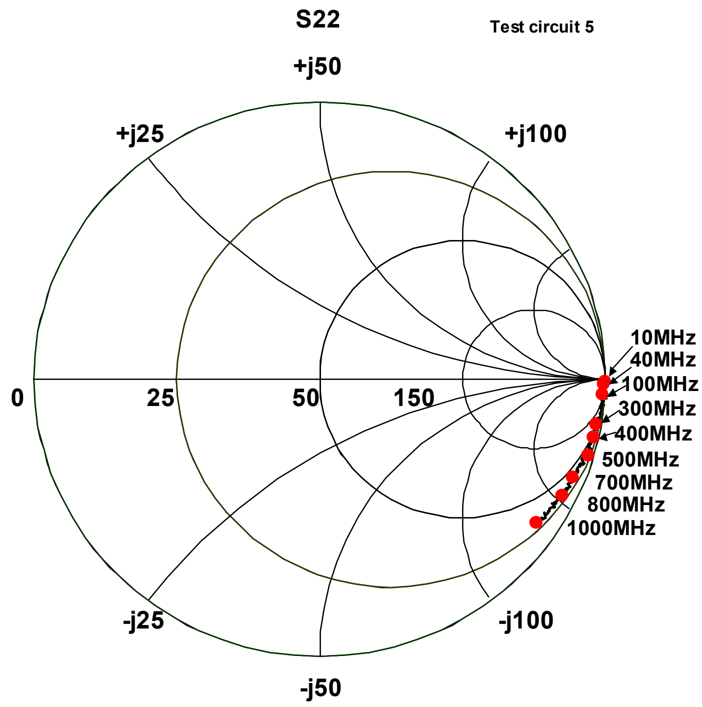






MHz	S11		S21		S12		S22	
	mag(units)	ang(deg)	mag(units)	ang(deg)	mag(units)	ang(deg)	mag(units)	ang(deg)
50	0.95	-2.16	2.23	178.17	0.002	81.16	1.00	-0.42
100	0.91	-14.64	2.14	161.70	0.004	-162.40	0.99	-3.27
300	0.84	-45.83	1.99	130.37	0.003	1.93	0.99	-10.85
322	0.82	-46.06	2.02	125.33	0.004	109.90	0.98	-9.94
400	0.75	-57.89	1.92	112.13	0.003	115.87	0.98	-12.42
430	0.75	-61.93	1.91	107.89	0.003	143.47	0.98	-13.94
500	0.70	-71.95	1.82	96.80	0.005	62.77	0.98	-16.36
700	0.54	-100.22	1.61	67.85	0.002	160.15	0.96	-21.84
1000	0.39	-146.15	1.35	26.94	0.008	60.40	0.92	-34.32





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