HMC789ST89E

v00.0409

InGaP HBT GAIN BLOCK MMIC AMPLIFIER, 0.7 - 2.8 GHz

Typical Applications

The HMC789ST89E is ideal for:

- Cellular/4G
- Fixed Wireless & WLAN
- CATV, Cable Modem & DBS
- Microwave Radio & Test Equipment
- IF & RF Applications

Features

High Output IP3: +42 dBm

High Output P1dB: +25 dBm

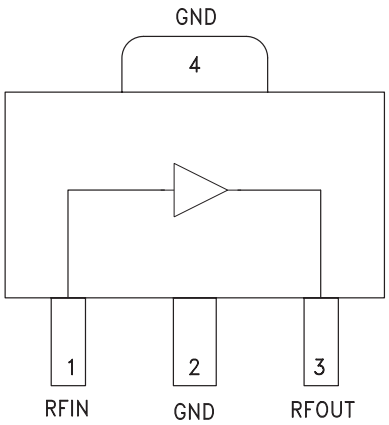
High Gain: 18 dB

Single Supply: +5V

45% PAE @ +25 dBm Pout

Industry Standard SOT89 Package

Functional Diagram



General Description

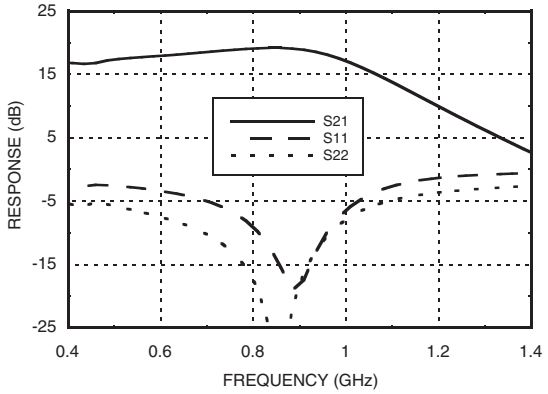
The HMC789ST89E is a high linearity GaAs InGaP HBT gain block MMIC operating from 0.7 to 2.8 GHz and packaged in an industry standard SOT89 package. Utilizing a minimum number of external components and a single +5V supply, the amplifier output IP3 can be optimized to +45 dBm. The high output IP3 and high gain make the HMC789ST89E ideal for use in PA driver & pre-driver applications in Cellular/4G and Fixed Wireless.

Electrical Specifications, T_A = +25°C, Vs= +5V [1]

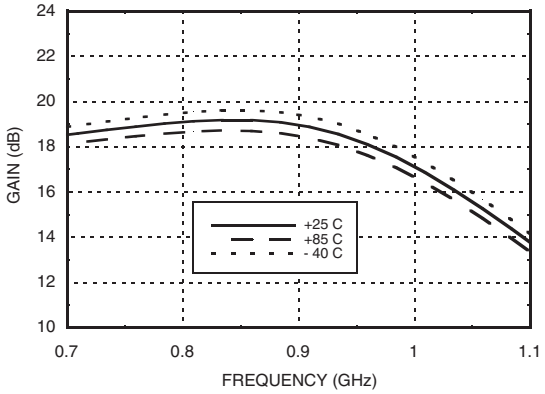
Parameter	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency Range	810 - 960			1710 - 1990			2420 - 2700			MHz
Gain	17	18		12	13.5		10	11		dB
Gain Variation Over Temperature		0.01			0.01			0.01		dB / °C
Input Return Loss		12			12			10		dB
Output Return Loss		20			15			10		dB
Output Power for 1dB Compression (P1dB)	21	23.5		23	25		22	24		dBm
Saturated Output Power (Psat)		25.5			27			26		dBm
Output Third Order Intercept (IP3) [2]		42			42			42		dBm
Noise Figure		3.8			3.8			3.8		dB
Supply Current (Icq)		125	150		125	150		125	150	mA

[1] Specifications and data reflect HMC789ST89E measured using the respective application circuits for each designated frequency band found herein. Contact the HMC Applications Group for assistance in optimizing performance for your application.
[2] Two-tone output power of +10 dBm per tone, 1 MHz spacing.

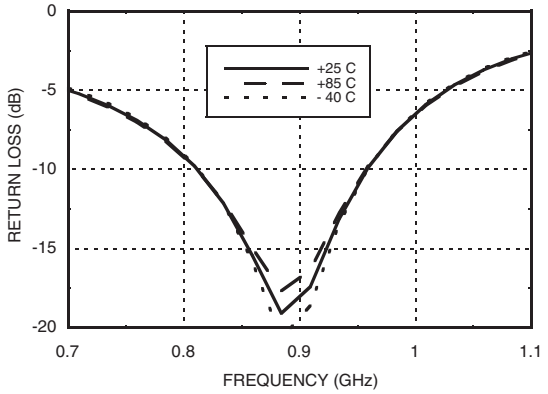
Broadband Gain & Return Loss @ 900 MHz



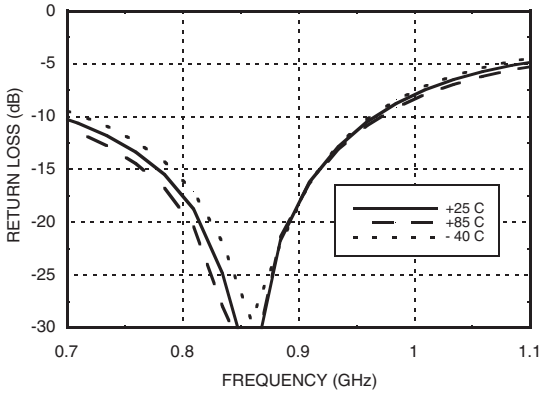
Gain vs. Temperature @ 900 MHz



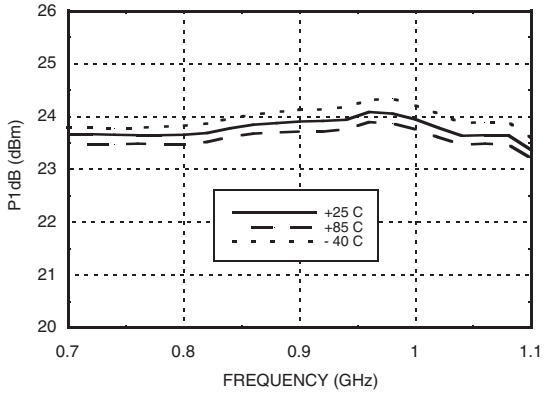
Input Return Loss vs. Temperature @ 900 MHz



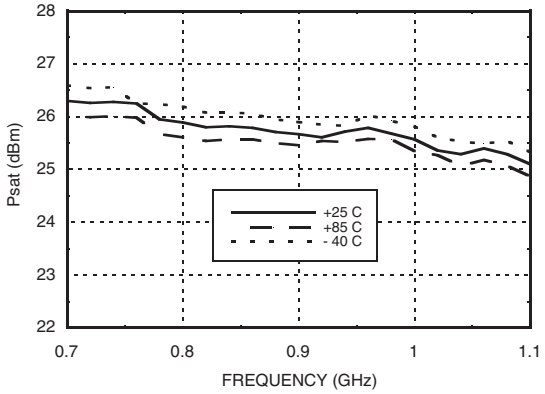
Output Return Loss vs. Temperature @ 900 MHz



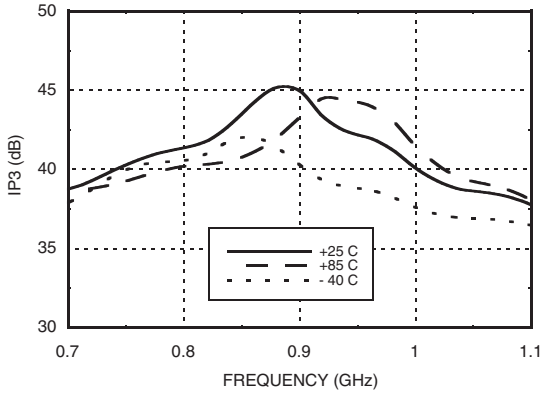
P1dB vs. Temperature @ 900 MHz



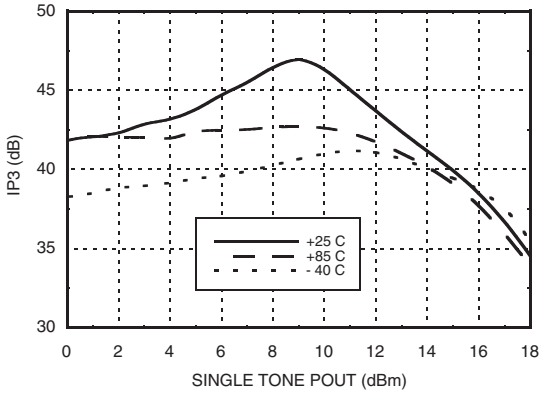
Psat vs. Temperature @ 900 MHz



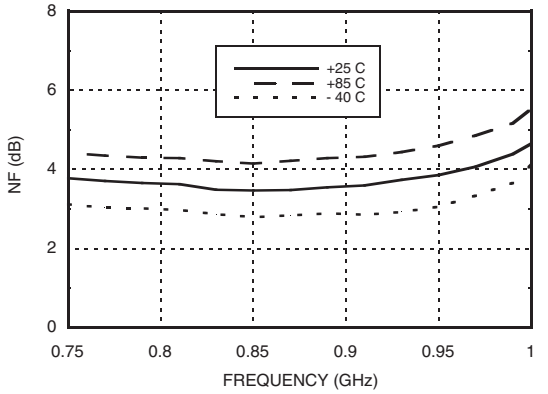
Output IP3 vs. Temperature @ 900 MHz Pout = 10 dBm Each Tone



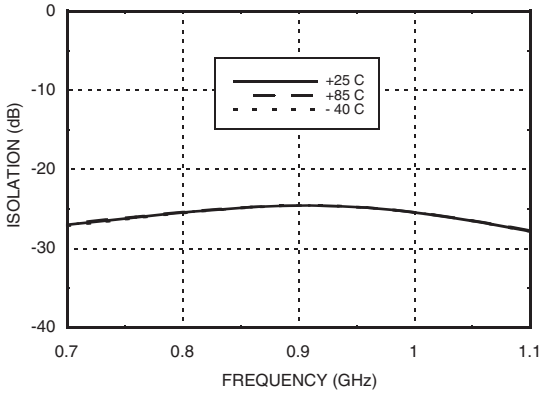
Output IP3 vs. Output Power @ 900 MHz



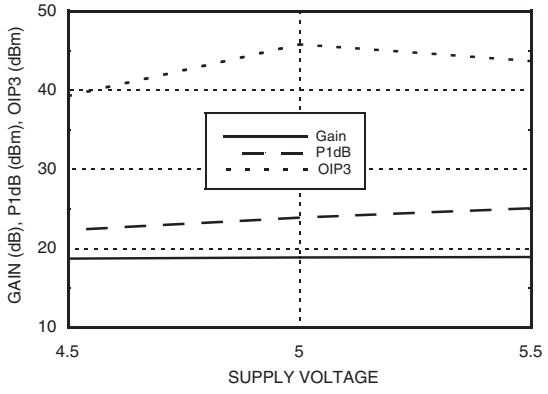
Noise Figure vs. Temperature @ 900 MHz



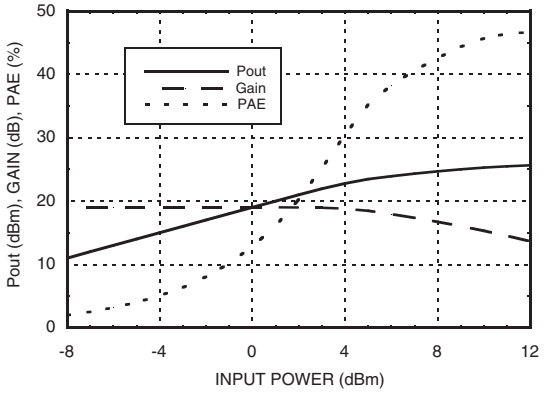
Reverse Isolation vs. Temperature @ 900 MHz



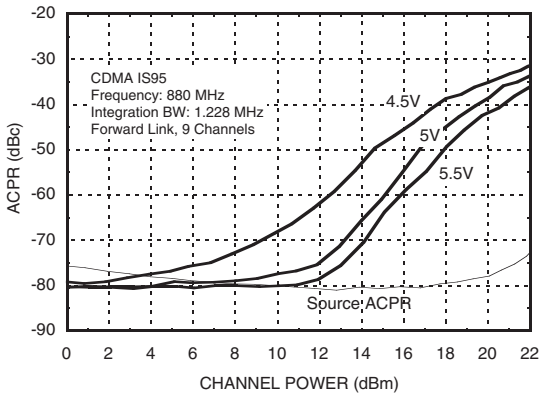
Gain, Power & IP3 vs. Supply Voltage @ 900 MHz



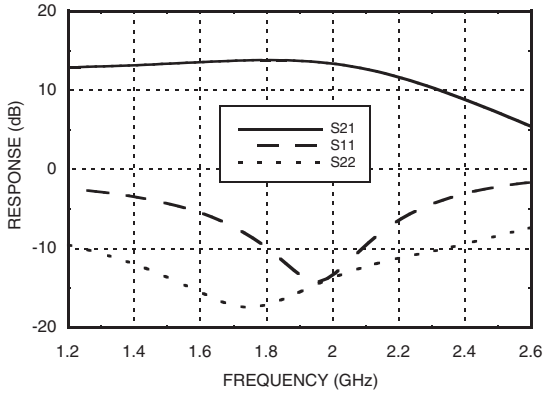
Power Compression @ 900 MHz



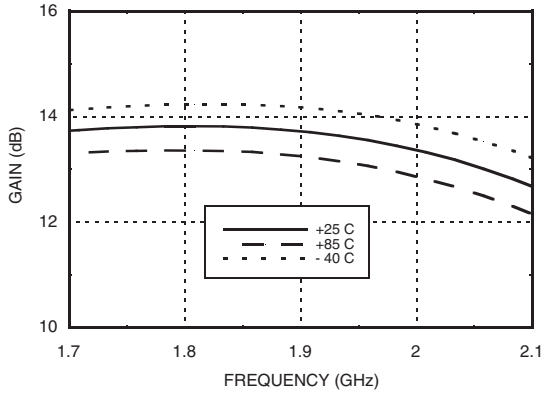
ACPR vs. Supply Voltage @ 880 MHz CDMA IS95, 9 Channels Forward



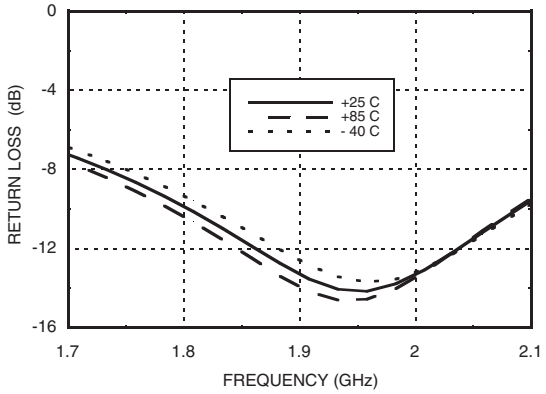
Broadband Gain & Return Loss @ 1900 MHz



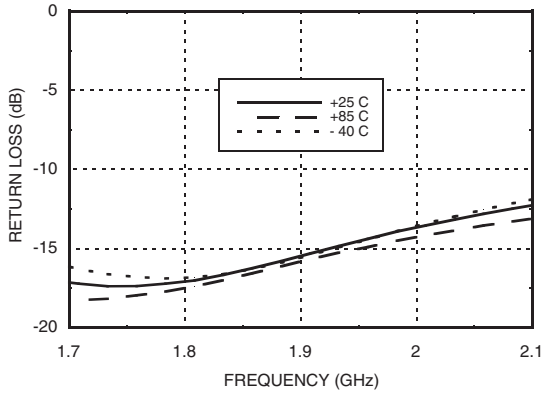
Gain vs. Temperature @ 1900 MHz



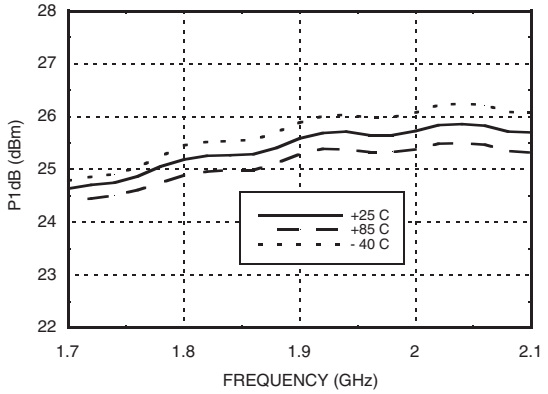
Input Return Loss vs. Temperature @ 1900 MHz



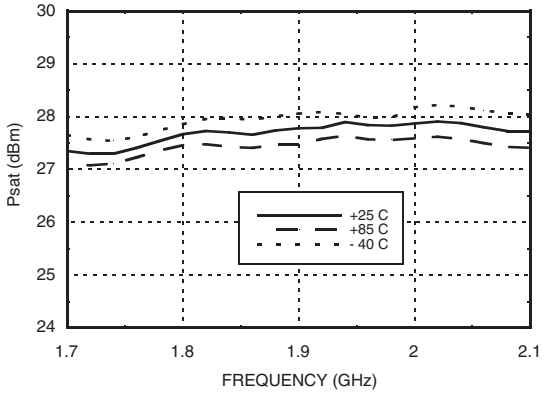
Output Return Loss vs. Temperature @ 1900 MHz



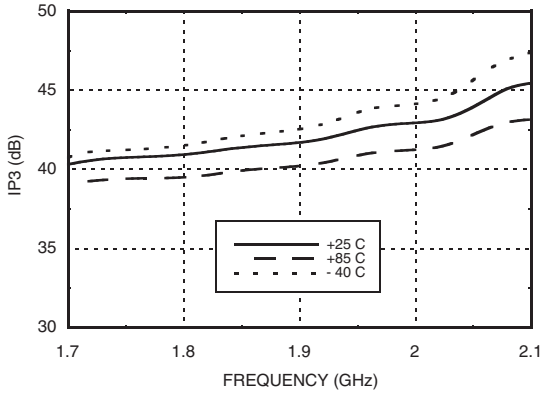
P1dB vs. Temperature @ 1900 MHz



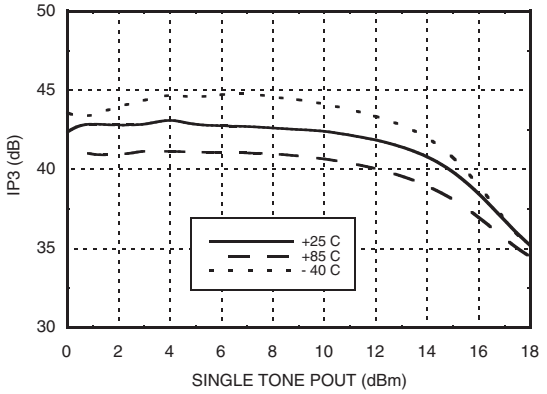
Psat vs. Temperature @ 1900 MHz



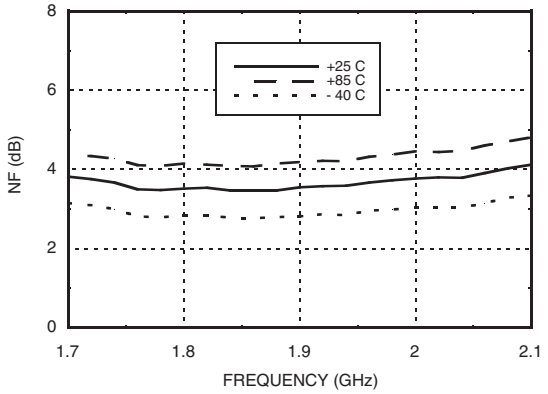
Output IP3 vs. Temperature @ 1900 MHz



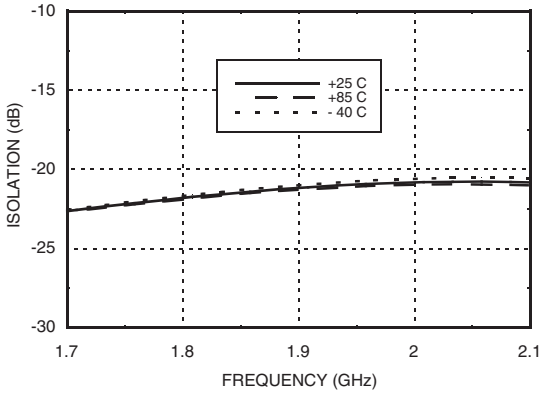
Output IP3 vs. Output Power @ 1900 MHz



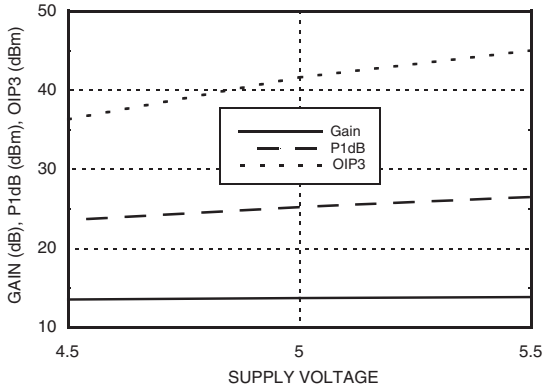
Noise Figure vs. Temperature @ 1900 MHz



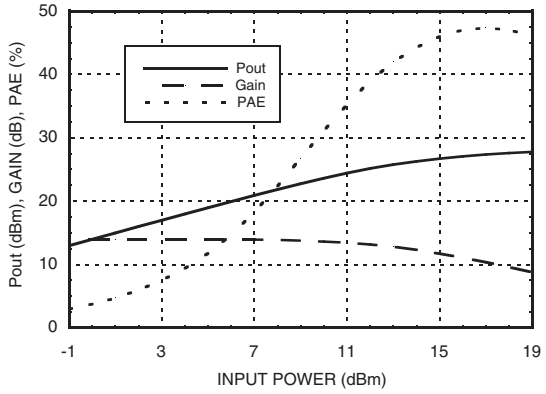
Reverse Isolation vs. Temperature @ 1900 MHz



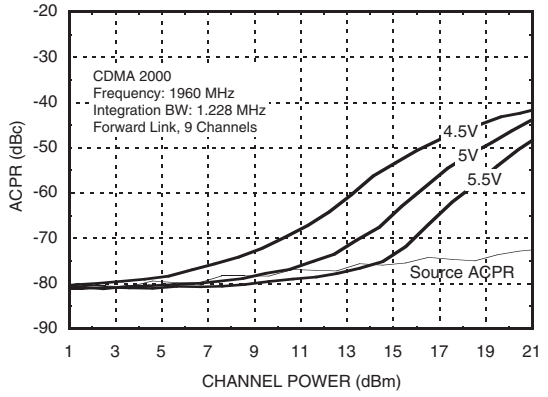
Gain, Power & IP3 vs. Supply Voltage @ 1900 MHz



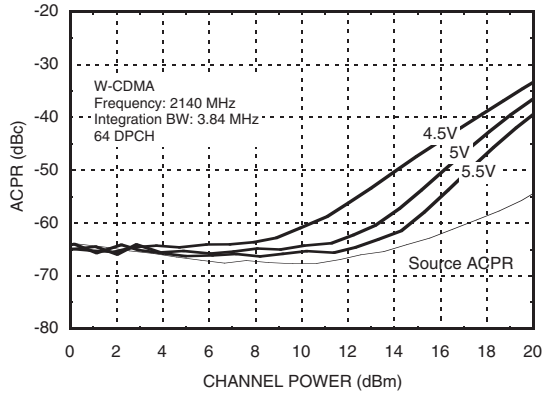
Power Compression @ 1900 MHz



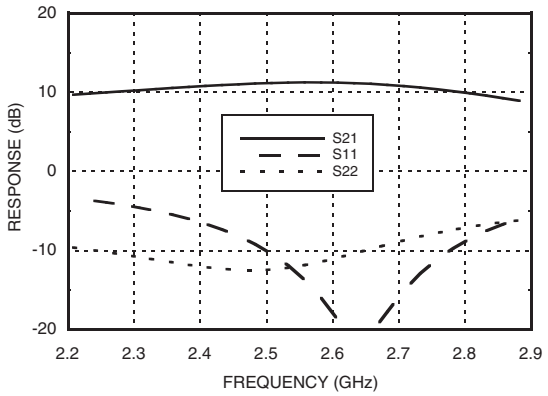
ACPR vs. Supply Voltage @ 1960 MHz CDMA 2000, 9 Channels Forward



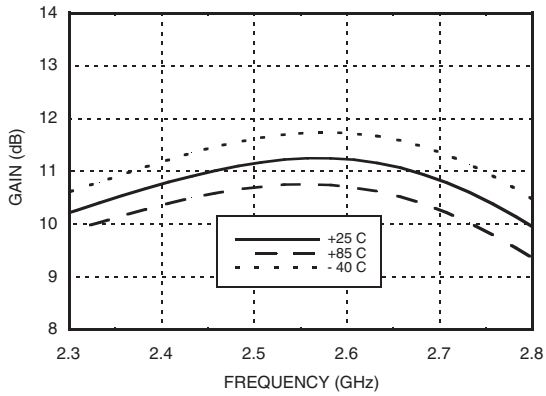
ACPR vs. Supply Voltage @ 2140 MHz W-CDMA, 64 DPCH



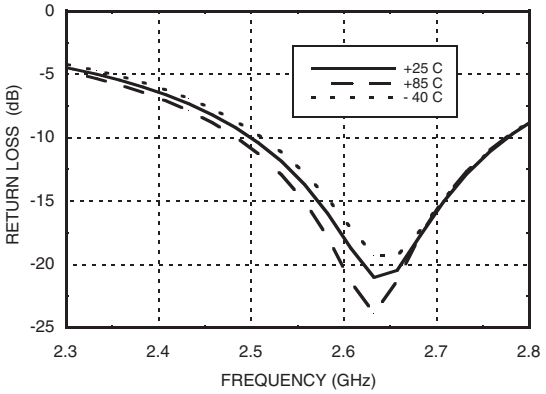
Broadband Gain & Return Loss @ 2600 MHz



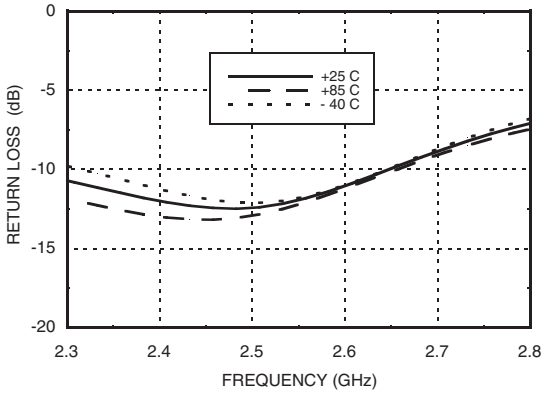
Gain vs. Temperature @ 2600 MHz



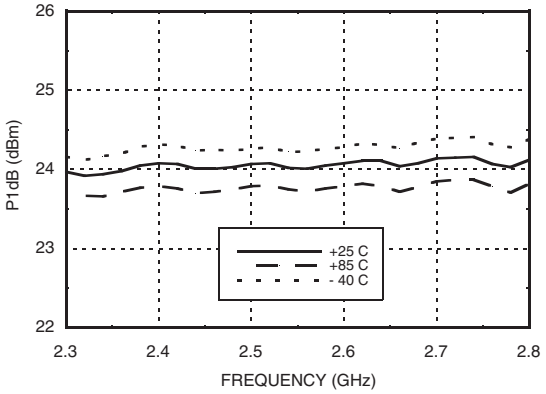
Input Return Loss vs. Temperature @ 2600 MHz



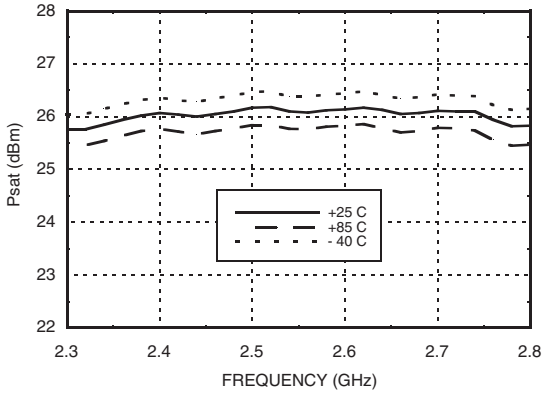
Output Return Loss vs. Temperature @ 2600 MHz



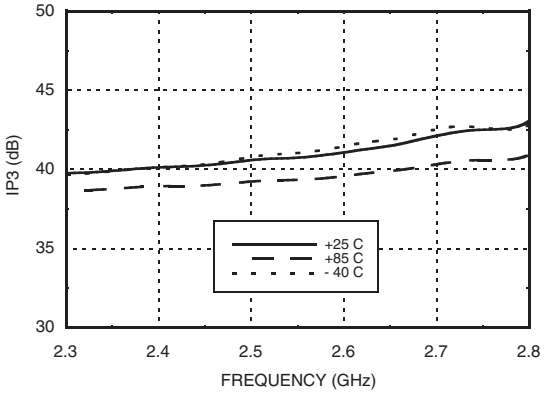
P1dB vs. Temperature @ 2600 MHz



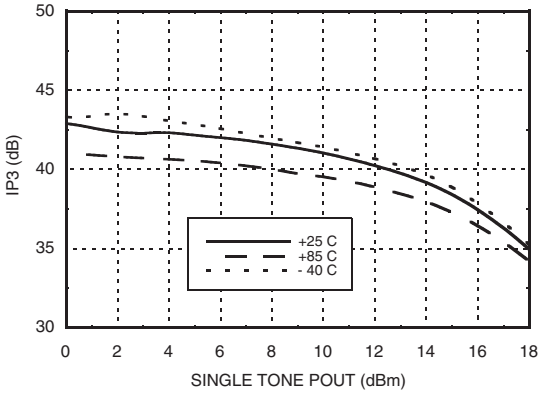
Psat vs. Temperature @ 2600 MHz



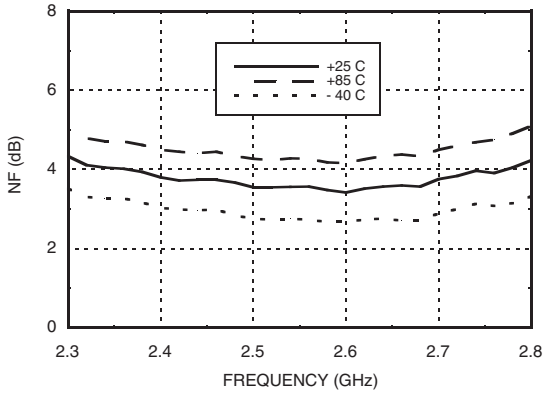
Output IP3 vs. Temperature @ 2600 MHz



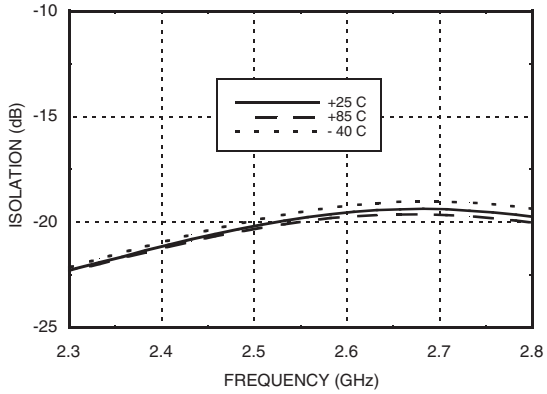
Output IP3 vs. Output Power @ 2600 MHz



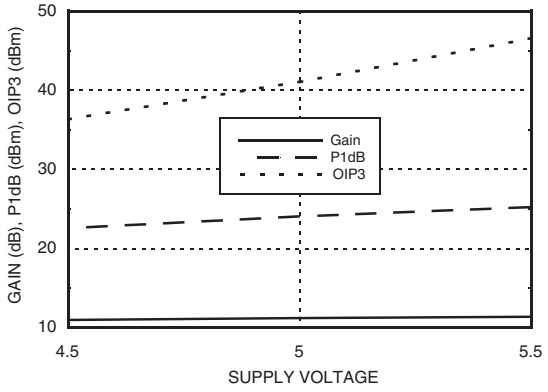
Noise Figure vs. Temperature @ 2600 MHz



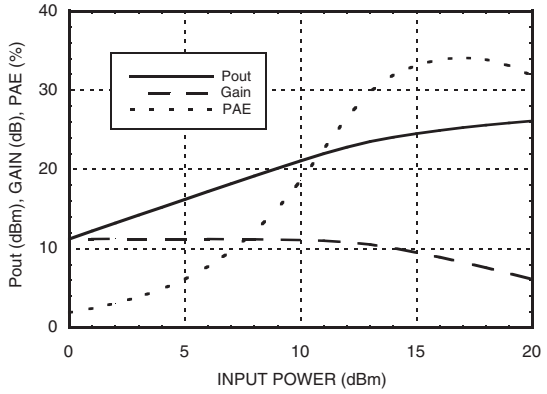
Reverse Isolation vs. Temperature @ 2600 MHz



Gain, Power & IP3 vs. Supply Voltage @ 2600 MHz



Power Compression @ 2600 MHz

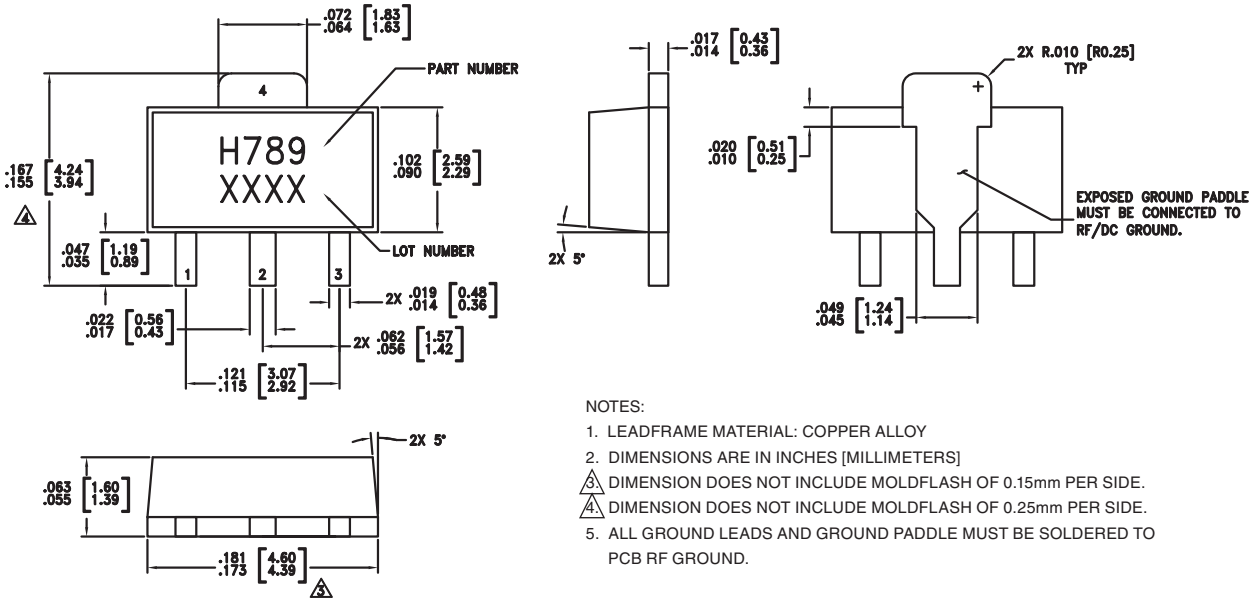


Absolute Maximum Ratings

Collector Bias Voltage (Vcc)	+6.0 V
RF Input Power (RFIN)(Vs +5Vdc)	+18 dBm
Junction Temperature	150 °C
Continuous Pdiss (T = 85 °C) (derate 13.0 mW/°C above 85 °C)	0.85 W
Thermal Resistance (junction to ground paddle)	77 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



NOTES:

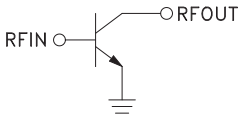
1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
4. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
5. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.

Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [1]
HMC789ST89E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [2]	H789 XXXX

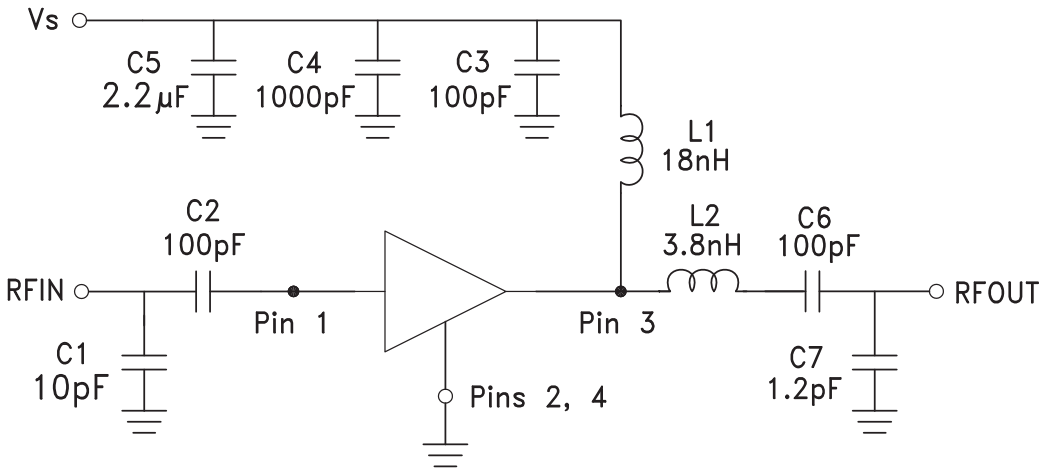
[1] 4-Digit lot number XXXX
[2] Max peak reflow temperature of 260 °C

Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1	RFIN	This pin is DC coupled. Off chip matching components are required. See Application Circuit herein.	
3	RFOUT	RF output and DC Bias input for the amplifier. Off chip matching components are required. See Application Circuit herein.	
2, 4	GND	These pins & package bottom must be connected to RF/DC ground.	

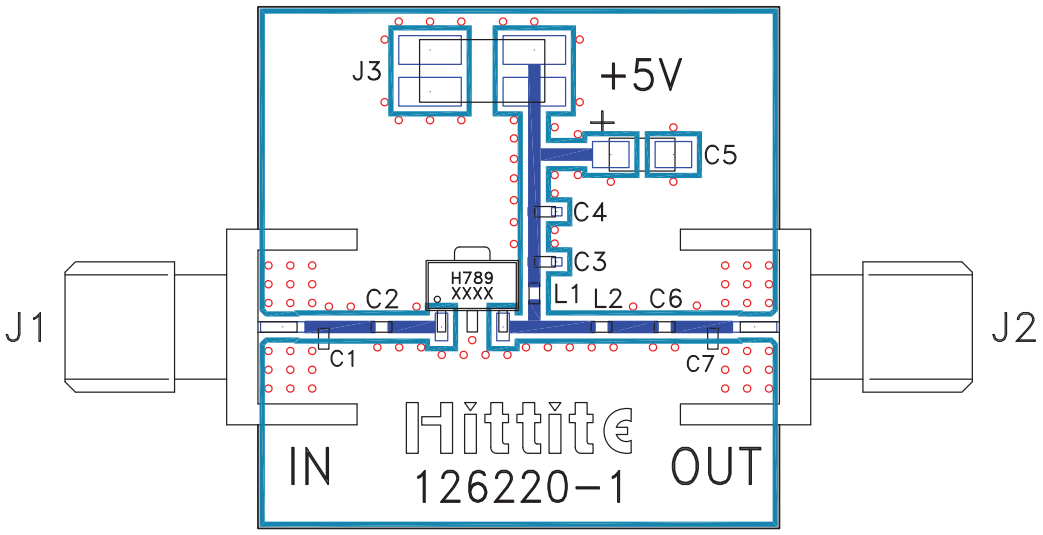
900 MHz Application Circuit

This circuit was used to specify the performance for 810-960 MHz operation. Contact the HMC Applications Group for assistance in optimizing performance for your application.



Recommended Component Values	
C1	10 pF
C2	100 pF
C3	100 pF
C4	1000 pF
C5	2.2 µF
C6	100 pF
C7	1.2 pF
L1	18 nH
L2	3.8 nH

900 MHz Evaluation PCB



List of Materials for 900 MHz Evaluation PCB 126222 [1]

Item	Description
J1 - J2	PCB Mount SMA Connector
J3	2 mm DC Header
C1	10 pF Capacitor, 0402 Pkg.
C2	100 pF Capacitor, 0402 Pkg.
C3	100 pF Capacitor, 0402 Pkg.
C4	1000 pF Capacitor, 0402 Pkg.
C5	2.2 µF Capacitor, Tantalum
C6	100 pF Capacitor, 0402 Pkg.
C7	1.2 pF Capacitor, 0402 Pkg.
L1	18 nH Inductor, 0402 Pkg.
L2	3.8 nH Inductor, 0402 Pkg.
U1	HMC789ST89E Linear Amplifier
PCB [2]	126220 Evaluation PCB

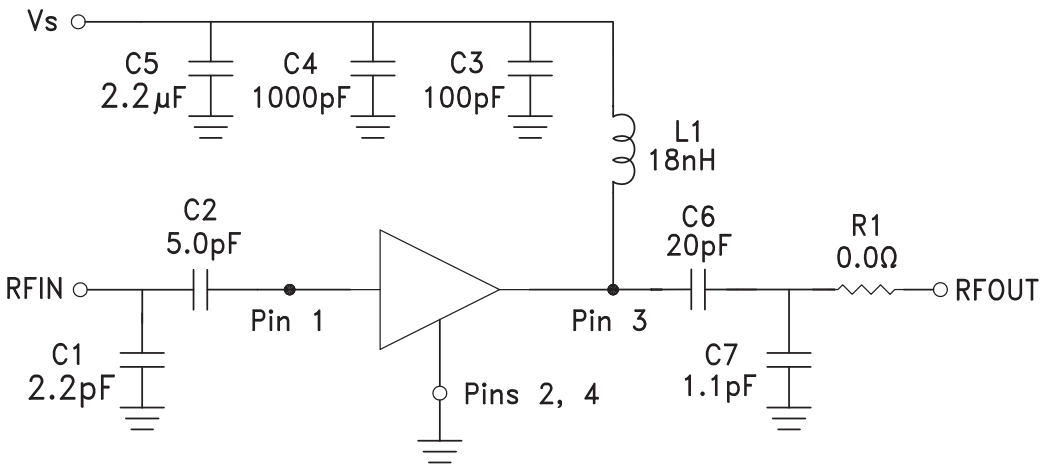
[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350 or Arlon 25 FR

The circuit board used in this application should use RF circuit design techniques. Signal lines should have 50 ohm impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation board should be mounted to an appropriate heat sink. The evaluation circuit board shown is available from Hittite upon request.

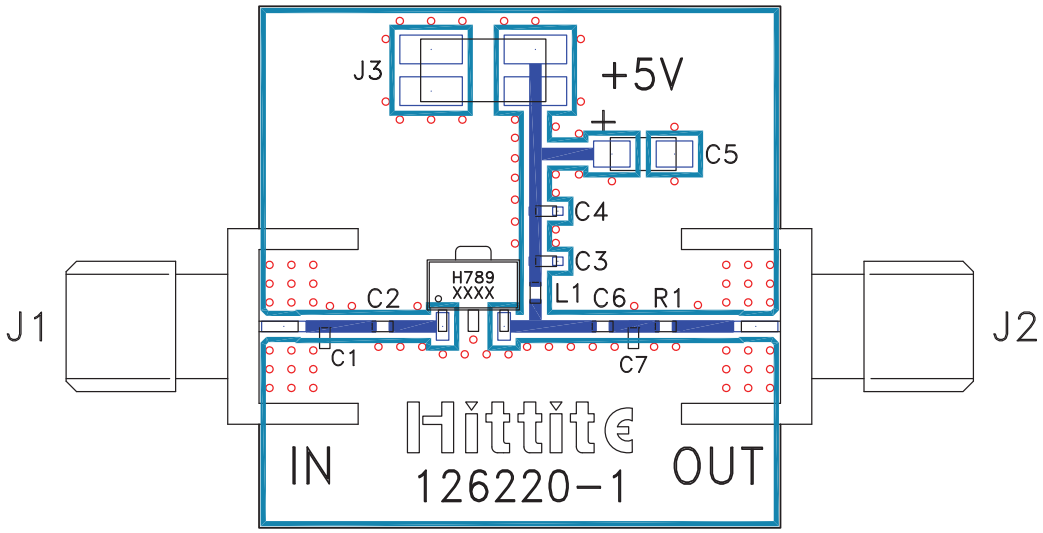
1900 MHz Application Circuit

This circuit was used to specify the performance for 1710-1990 MHz operation. Contact the HMC Applications Group for assistance in optimizing performance for your application.



Recommended Component Values	
C1	2.2 pF
C2	5.0 pF
C3	100 pF
C4	1000 pF
C5	2.2 µF
C6	20 pF
C7	1.1 pF
L1	20 nH
R1	0.0 Ohm

1900 MHz Evaluation PCB



List of Materials for 1900 MHz Evaluation PCB 126223 [1]

Item	Description
J1 - J2	PCB Mount SMA Connector
J3	2 mm DC Header
C1	2.2 pF Capacitor, 0402 Pkg.
C2	5.0 pF Capacitor, 0402 Pkg.
C3	100 pF Capacitor, 0402 Pkg.
C4	1000 pF Capacitor, 0402 Pkg.
C5	2.2 µF Capacitor, Tantalum
C6	20 pF Capacitor, 0402 Pkg.
C7	1.1 pF Capacitor, 0402 Pkg.
L1	18 nH Inductor, 0402 Pkg.
R1	0.0 Ohm Resistor, 0402 Pkg.
U1	HMC789ST89E Linear Amplifier
PCB [2]	126220 Evaluation PCB

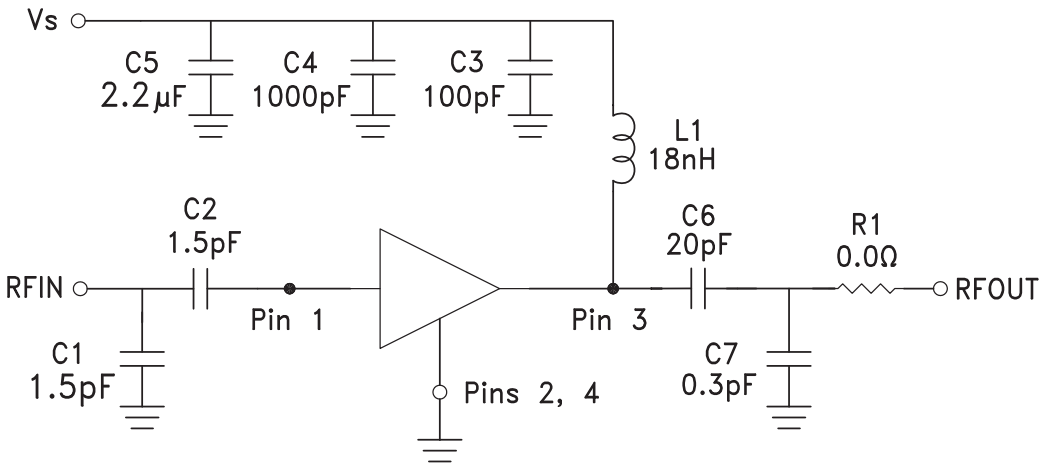
[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350 or Arlon 25FR

The circuit board used in this application should use RF circuit design techniques. Signal lines should have 50 ohm impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation board should be mounted to an appropriate heat sink. The evaluation circuit board shown is available from Hittite upon request.

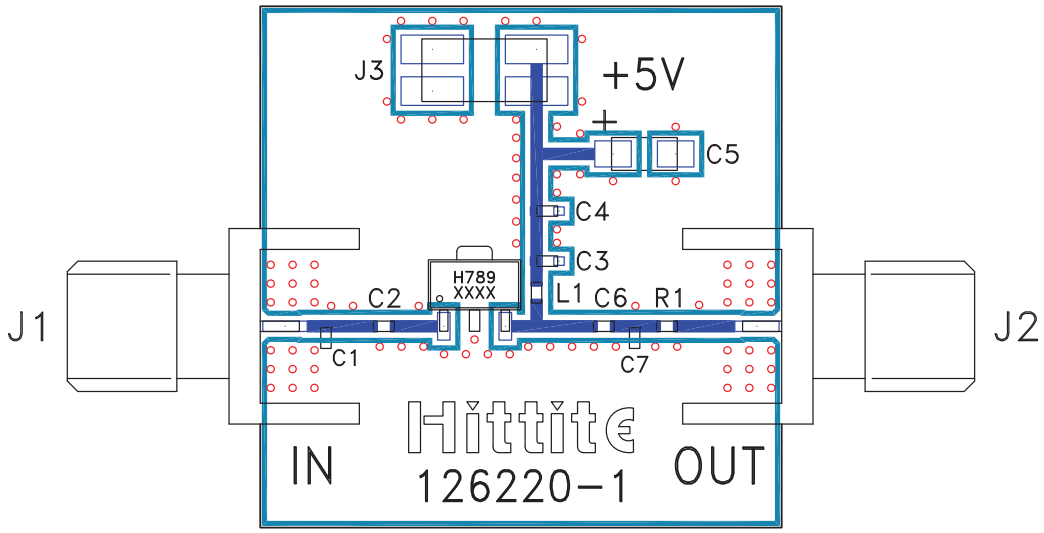
2600 MHz Application Circuit

This circuit was used to specify the performance for 2420-2700 MHz operation. Contact the HMC Applications Group for assistance in optimizing performance for your application.



Recommended Component Values	
C1	1.5 pF
C2	1.5 pF
C3	100 pF
C4	1000 pF
C5	2.2 µF
C6	20 pF
C7	0.3 pF
L1	18 nH
L2	12 nH
R1	0.0 Ohm

2600 MHz Evaluation PCB



List of Materials for 2600 MHz Evaluation PCB 125682 [1]

Item	Description
J1 - J2	PCB Mount SMA Connector
J3	2 mm DC Header
C1	1.5 pF Capacitor, 0402 Pkg.
C2	1.5 pF Capacitor, 0402 Pkg.
C3	100 pF Capacitor, 0402 Pkg.
C4	1000 pF Capacitor, 0402 Pkg.
C5	2.2 µF Capacitor, Tantalum
C6	20 pF Capacitor, 0402 Pkg.
C7	0.3 pF Capacitor, 0402 Pkg.
L1	18 nH Inductor, 0402 Pkg.
R1	0.0 Ohm Resistor, 0402 Pkg.
U1	HMC789ST89E Linear Amplifier
PCB [2]	125220 Evaluation PCB

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350 or Arlon 25FR

The circuit board used in this application should use RF circuit design techniques. Signal lines should have 50 ohm impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation board should be mounted to an appropriate heat sink. The evaluation circuit board shown is available from Hittite upon request.