



Product Description

RF2389 is a high performance InGaP HBT MMIC amplifier utilizing a Darlington configuration. The part is designed to run from a 5V supply, does not require a dropping resistor, and is stable over a wide temperature range. RF2389 is designed for high linearity and low noise CATV applications. It is internally matched to 75Ω but can also be used in 50Ω systems. It is offered in a small SOT-89 package and is RoHS compliant.

Features

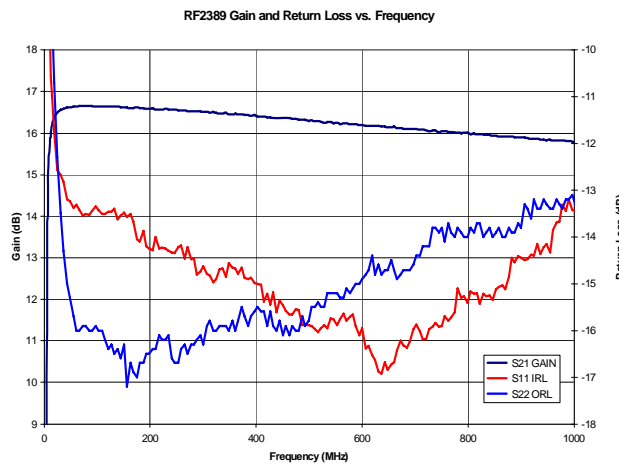
- Flat Gain Response: 16dB ±0.4dB
- Noise Figure: 3.0dB
- Very Low Distortion: -79/-88/-94dBc: CSO/CTB/XMOD
- Single Fixed 5V Supply
- Robust 1000V ESD, Class 1C

Applications

- Broadband CATV Gain Block
- CATV Distribution Amplifiers
- Pre-Amplifier for CATV Multi-Dwelling Units
- General Purpose 50Ω Applications

Optimum Technology Matching® Applied

- GaAs HBT
- GaAs MESFET
- InGaP HBT
- SiGe BiCMOS
- Si BiCMOS
- SiGe HBT
- GaAs pHEMT
- Si CMOS
- Si BJT
- GaN HEMT
- InP HBT
- RF MEMS
- LDMOS



| Parameter | Specification | | | Unit | Condition |
|---|---------------|------|------|------|------------------------------|
| | Min. | Typ. | Max. | | |
| Electrical Characteristics (75Ω) | | | | | |
| Small Signal Gain | | 16.3 | | dB | 500MHz |
| Gain Flatness | | ±0.4 | | dB | 50MHz to 500MHz |
| Output Power at 1dB Compression | | 18.5 | | dBm | 500MHz |
| Third Order Intercept Point | | 36 | | dBm | 500MHz |
| Second Order Intercept Point | | 53 | | dBm | 500MHz |
| CSO | | -65 | | dBc | 77Ch., Flat Tilt, 25dBmV Out |
| CTB | | -88 | | dBc | 77Ch., Flat Tilt, 25dBmV Out |
| XMOD | | -94 | | dBc | 77Ch., Flat Tilt, 25dBmV Out |
| Input Return Loss | | 14 | | dB | 50MHz to 1000MHz |
| Output Return Loss | | 15 | | dB | 50MHz to 1000MHz |
| Reverse Isolation | | 20 | | dB | 50MHz to 1000MHz |
| Noise Figure | | 3.0 | | dB | 500MHz |
| Device Operating Voltage | | 5 | | V | |
| Device Operating Current | | 110 | | mA | |
| Thermal Resistance | | 48.8 | | °C/W | junction - lead |

Test Conditions: V_P=5V, I_P=110mA Typ., T_L=25°C. OIP₃, OIP₂ Tone Spacing=6MHz, P_{OUT} per tone=0dBm. Tested with App Circuit.

Absolute Maximum Ratings

| Parameter | Rating | Unit |
|--------------------------------------|-------------|------|
| Supply Voltage (V_{CC}) | -0 to +6 | VDC |
| RF Input Power | +10 | dBm |
| Operating Lead Temperature (T_L) | -40 to +85 | °C |
| Storage Temperature Range | -40 to +150 | °C |



Caution! ESD sensitive device.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

RoHS status based on EU Directive 2002/95/EC (at time of this document revision).

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Operation of this device beyond any one of these limits may cause permanent damage. For reliable continuous operation, the device voltage and current must not exceed the maximum operating values specified in the table on page one.

Bias Conditions should also satisfy the following expression:

$$I_D V_D < (T_J - T_L) / R_{TH, J-L}$$

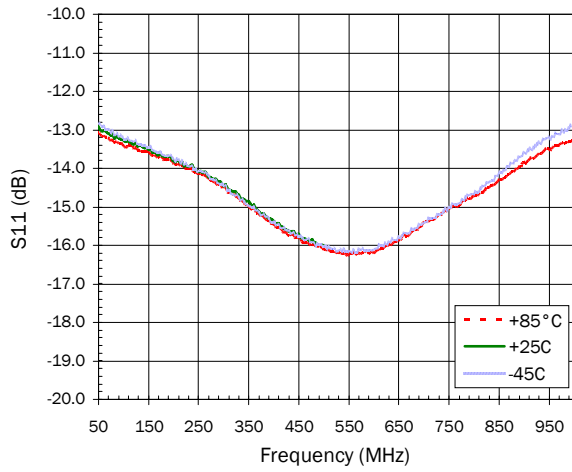
If $V_{CC} > 5V$ is used, a derated dropping resistor should be used to supply V_{CC} of 5V to pin 3.

| Parameter | Specification | | | Unit | Condition |
|---|---------------|------|------|------|------------------|
| | Min. | Typ. | Max. | | |
| Electrical Characteristics (50Ω) | | | | | |
| Small Signal Gain | | 16.5 | | dB | 500MHz |
| Gain Flatness | | ±0.4 | | dB | 50MHz to 1000MHz |
| Output Power at 1dB Compression | | 19.5 | | dBm | 500MHz |
| Third Order Intercept Point | | 38.5 | | dBm | 500MHz |
| Second Order Intercept Point | | 57.5 | | dBm | 500MHz |
| Input Return Loss | | 16 | | dB | 50MHz to 1000MHz |
| Output Return Loss | | 14 | | dB | 50MHz to 1000MHz |
| Reverse Isolation | | 19 | | dB | 50MHz to 1000MHz |
| Noise Figure | | 2.7 | | dB | 500MHz |
| Device Operating Voltage | | 5 | | V | |
| Device Operating Current | | 110 | | mA | |
| Thermal Resistance | | 48.8 | | °C/W | junction - lead |

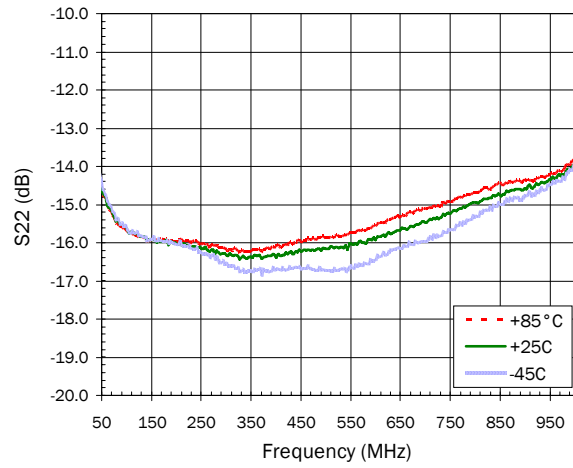
Test Conditions: $V_P = 5V$, $I_P = 110mA$ Typ., $T_L = 25^\circ C$. OIP_3 , OIP_2 Tone Spacing=6MHz, P_{OUT} per tone=0dBm. Tested with App Circuit.

Typical Performance Curves (75Ω)

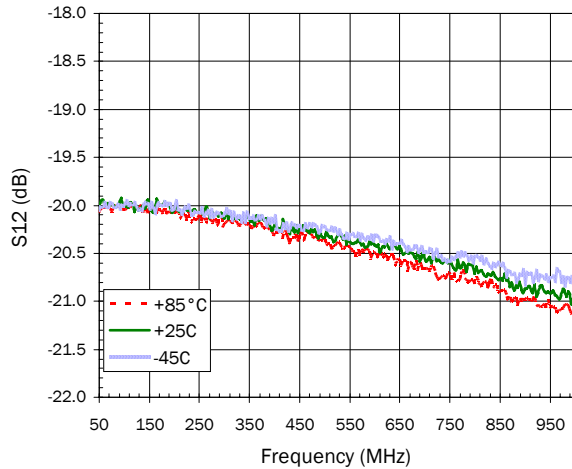
Input Return Loss



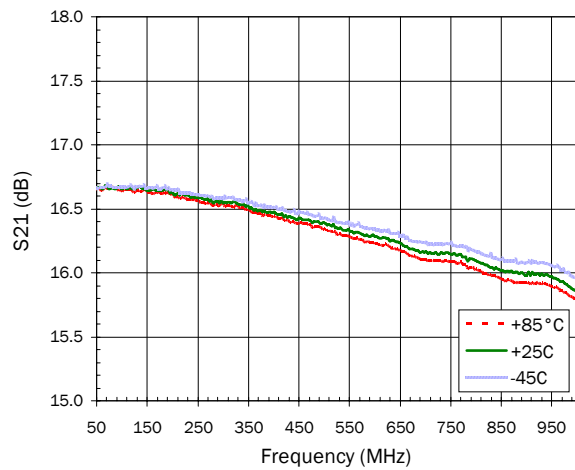
Output Return Loss



Reverse Isolation

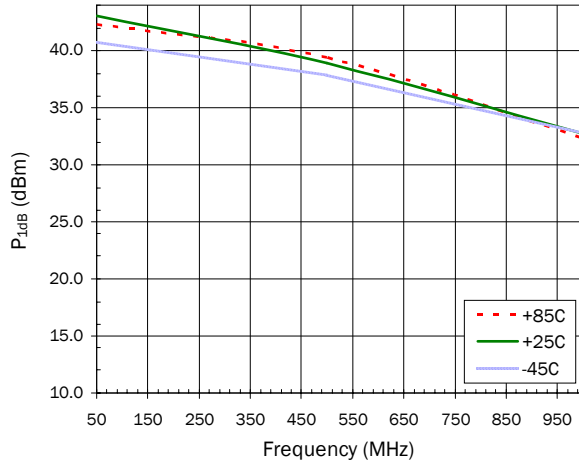


Gain

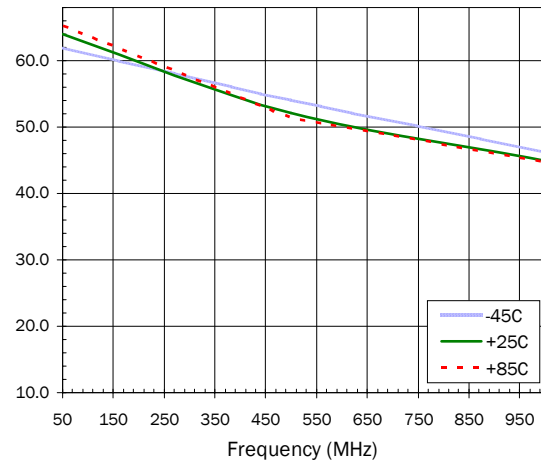


Typical Performance Curves (75Ω)

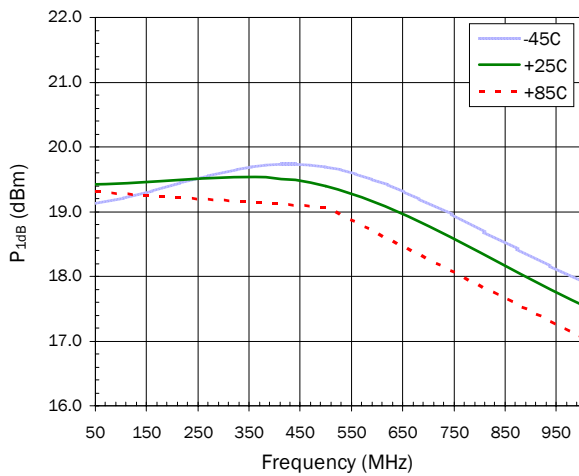
OIP₃ dBm



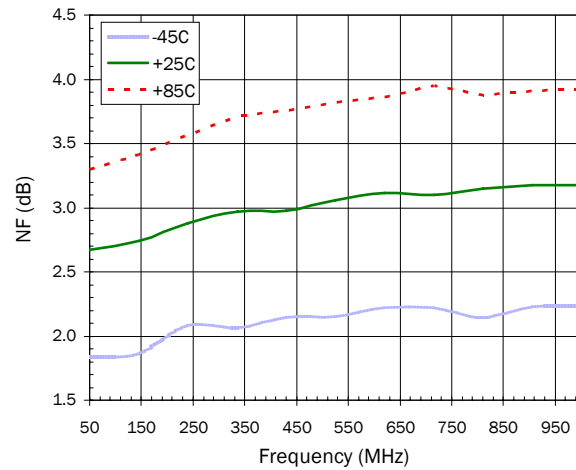
OIP₂ dBm



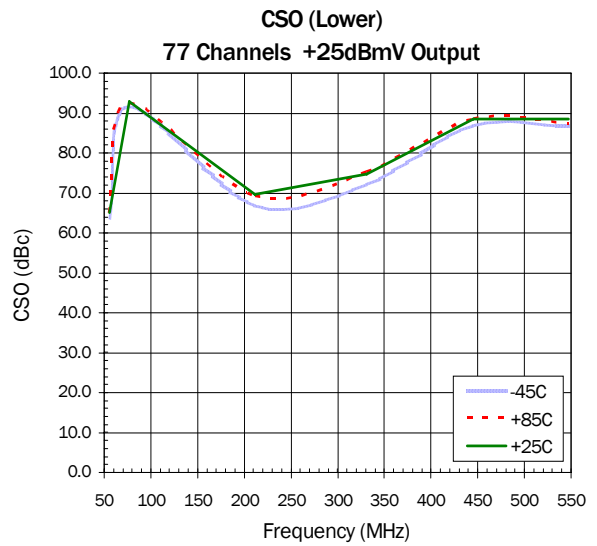
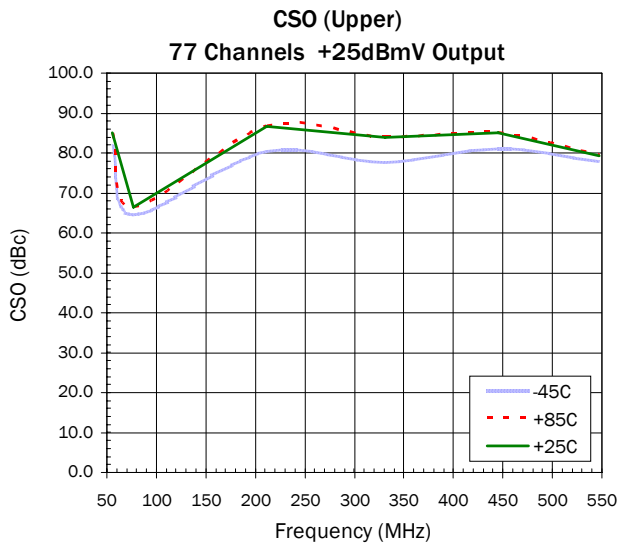
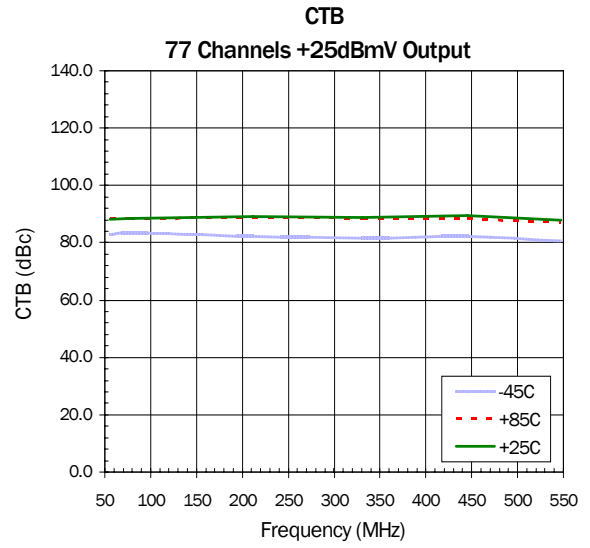
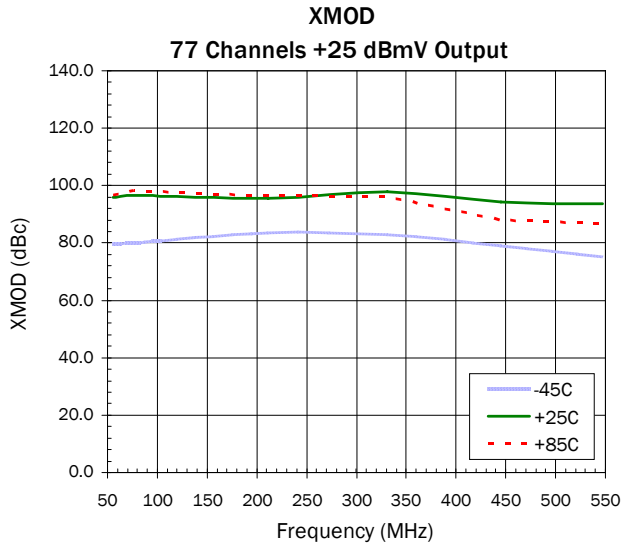
P_{1dB}



Noise Figure

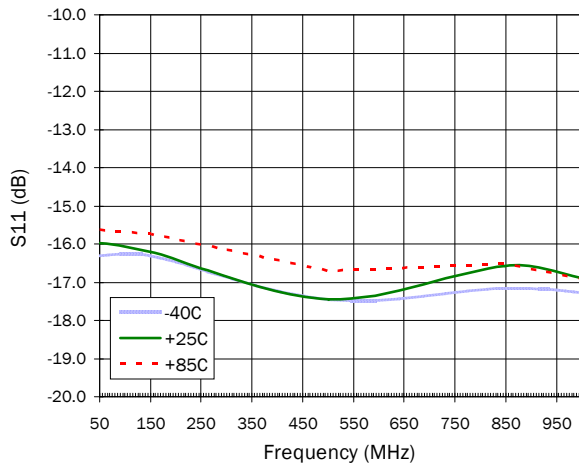


Typical Performance Curves (75Ω)

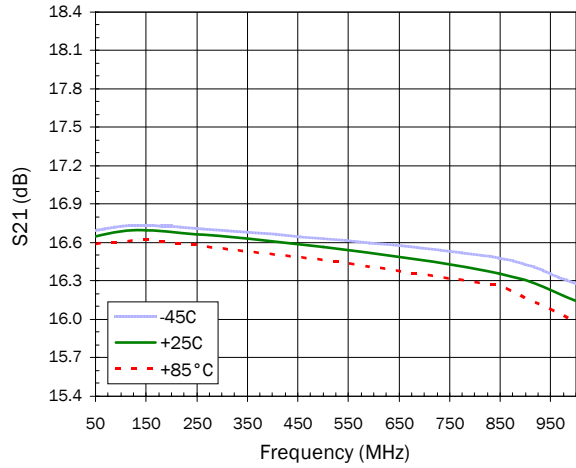


Typical Performance Curves (50Ω)

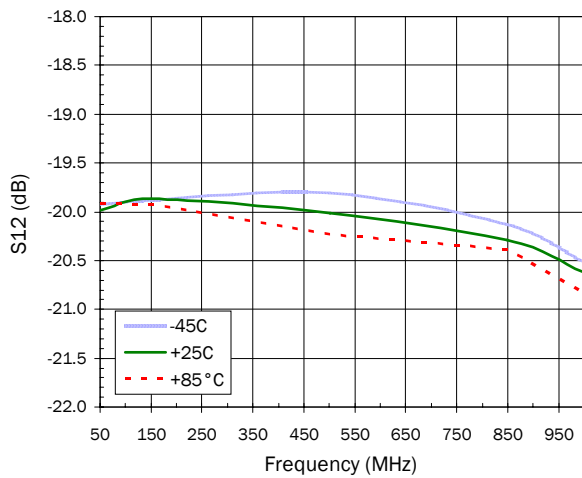
Input Return Loss



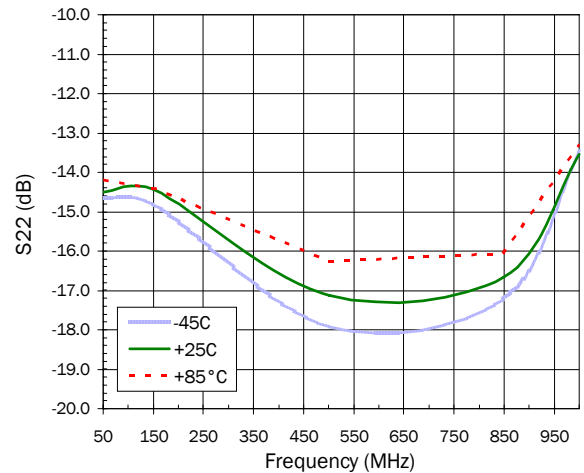
Gain



Reverse Isolation

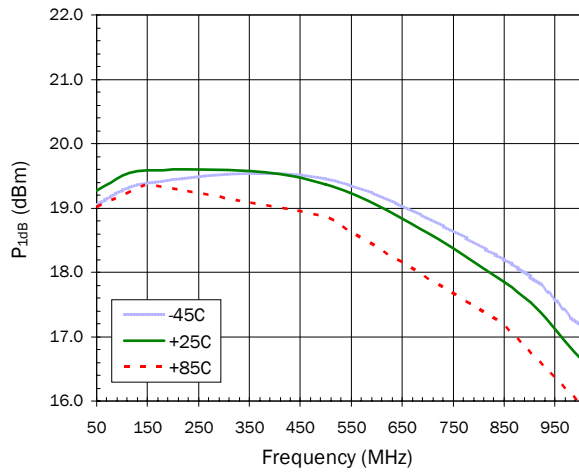


Output Return Loss

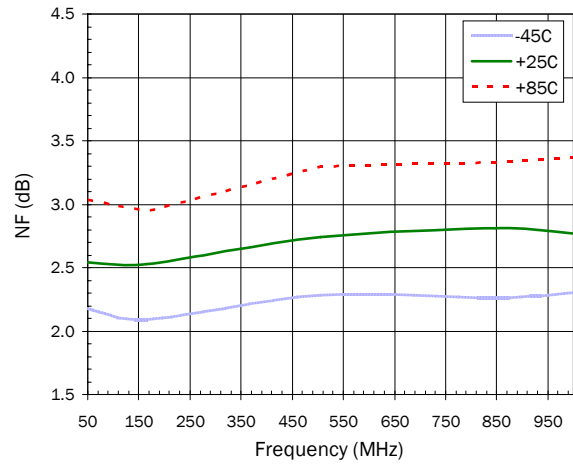


Typical Performance Curves (50Ω)

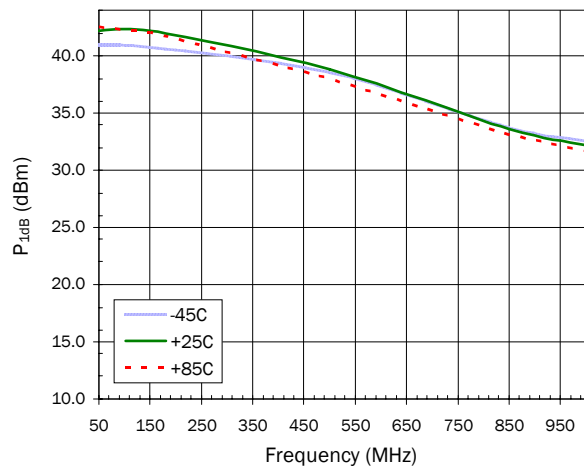
P_{1dB}



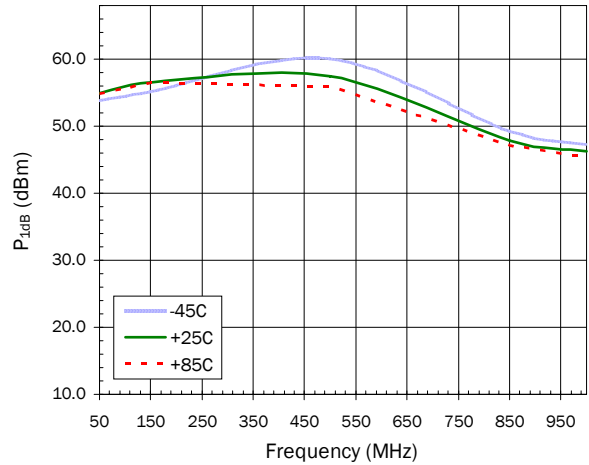
Noise Figure



OIP₃ dBm

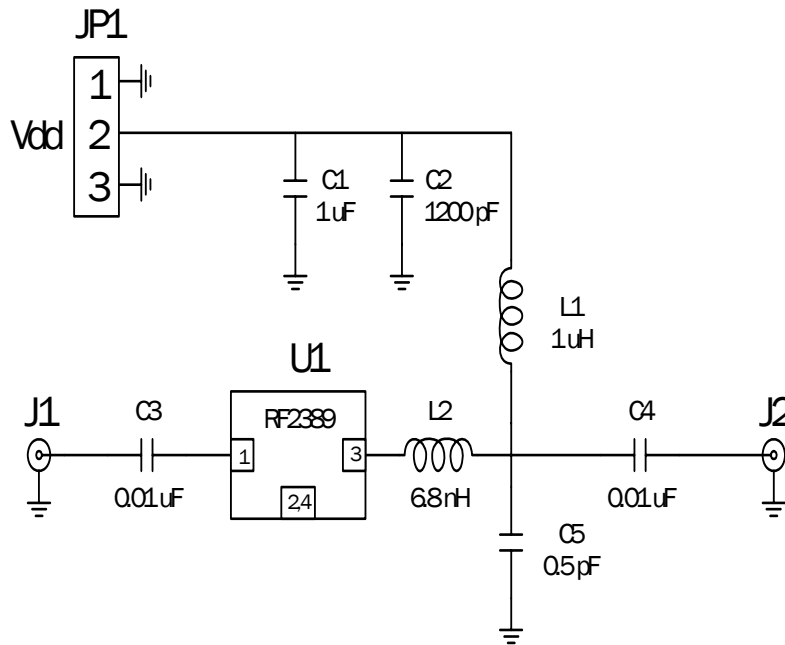


OIP₂ dBm



Application Schematic (50Ω and 75Ω)

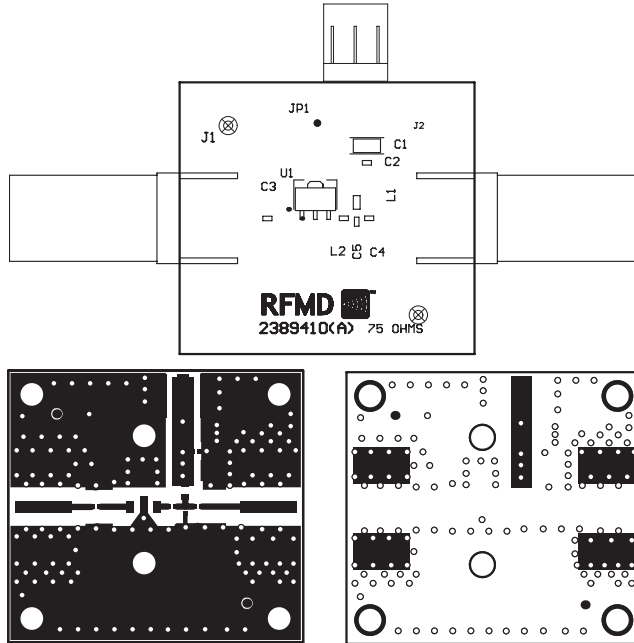
Frequency 50MHz to 1000MHz



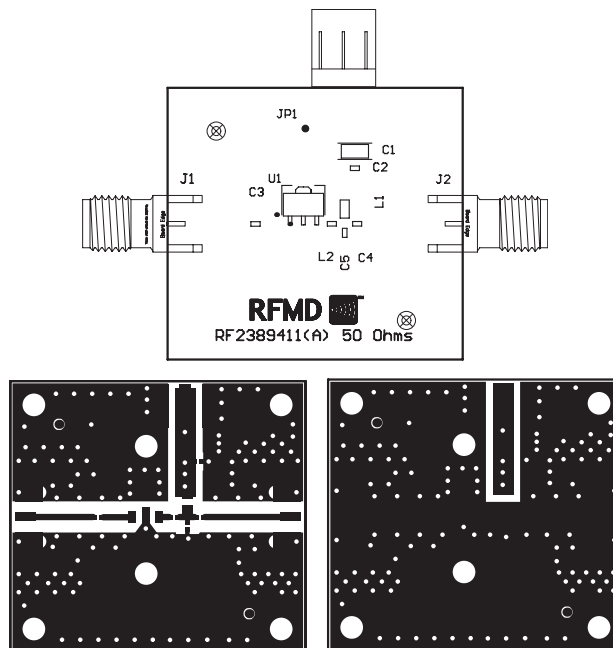
Application Circuit Element Values

| Reference Designator | Description |
|----------------------|--|
| J1, J2 | Trompeter Electronics (COAX-F)/Hielind Electronics (SMA) |
| C1 | 1 uF Panasonic |
| C3, C4 | 10000 pF Panasonic |
| C2 | 1200 pF Panasonic |
| C5 | 0.5 pF Panasonic |
| L1 | 1.0 uH LS Coilcraft |
| L2 | 6.8 nH Toko |

Evaluation Board Layout (75Ω)

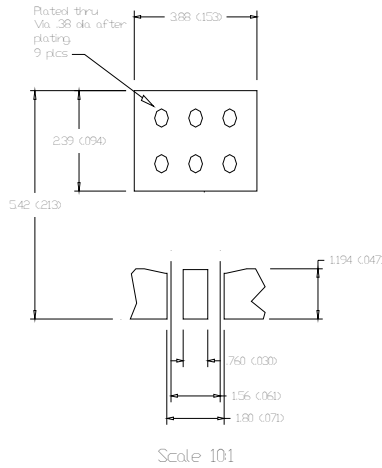


Evaluation Board Layout (50Ω)



| Pin | Function | Description |
|------|------------|---|
| 1 | RFIN | RF input pin. This pin requires the use of an external DC-blocking capacitor chosen for the frequency of operation. |
| 2, 4 | GND | Connection to ground. Use via holes for best performance to reduce lead inductance as close to ground leads as possible. |
| 3 | RFOUT/BIAS | RF output and bias pin. DC-voltage is present on this pin, therefore a DC-blocking capacitor is necessary for proper operation. |

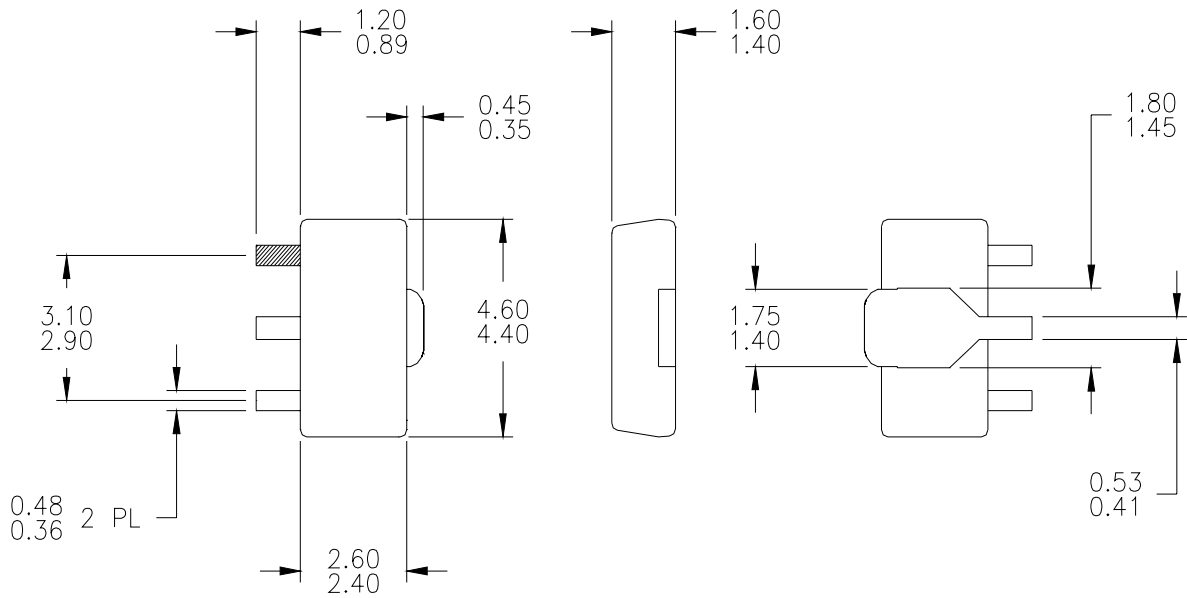
Suggested PCB Pad Layout
Dimensions in inches (millimeters)



Generic Land Pattern. This land pattern is applicable to both backside patterns shown.

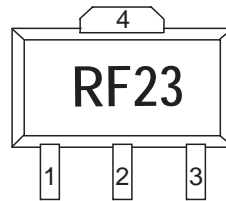
Package Drawing

Dimensions in inches (millimeters)
Refer to drawing posted at www.rfmd.com for tolerances.



NOTE: SHADED LEAD IS PIN 1

Package Marking



Ordering Information

| Part Number | Description |
|---------------|--|
| RF2389 | 25pc Sample Bag |
| RF2389SB | 5pc Sample Bag |
| RF2389TR7 | 750pc Tape and Reel |
| RF2389TR13 | 2500pc Tape and Reel |
| RF2389PCK-410 | RF2389 75Ω Evaluation Board and 5pc Sample Bag |
| RF2389PCK-411 | RF2389 50Ω Evaluation Board and 5pc Sample Bag |