

Features

- Single Stage, Single Ended
- 3 to 5 V Operation
- Low Current, 50 mA
- 20 dB Flat Gain
- 1.2 dB NF Noise
- Low Distortion Performance
- Lead-Free SOT-89 Plastic Package
- Halogen-Free “Green” Mold Compound
- RoHS* Compliant

Description

The MAAL-011136 is an RF amplifier assembled in a SOT-89 plastic package. This amplifier provides 20 dB of flat gain while biased from 3 to 5 volts. The amplifier provides excellent noise figure.

The MAAL-011136 provides high gain, low noise and low distortion making it ideally suited as input stage for fiber-to-the-home (FTTH) applications and other 75 Ω infrastructure applications.

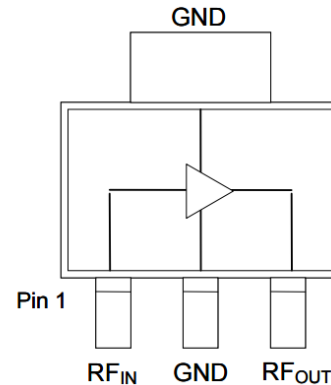
The MAAL-011136 is fabricated using GaAs pHEMT technology.

Ordering Information^{1,2}

| Part Number | Package |
|--------------------|----------------|
| MAAL-011136-TR1000 | 1000 Part Reel |
| MAAL-011136-TR3000 | 3000 Part Reel |
| MAAL-011136-001SMB | Sample Board |

1. Reference Application Note M513 for reel size information.
2. All sample boards include 5 loose parts.

Functional Schematic



Pin Configuration

| Pin No. | Pin Name | Function |
|---------|-------------------|-------------------------|
| 1 | RF _{IN} | RF Input |
| 2 | GND | Ground |
| 3 | RF _{OUT} | RF Output /Drain Supply |

* Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

75 Ω CATV, FTTx Low Noise Amplifier 45 - 1218 MHz

Rev. V1

Electrical Specifications: $T_A = 25^\circ\text{C}$, $V_{DD} = 5\text{ V}$, $Z_0 = 75\ \Omega$

| Parameter | Test Conditions | Units | Min. | Typ. | Max. |
|-----------------------------|--|-------|--------|------------|----------|
| Gain | 45 - 1218 MHz | dB | 19 | 20.5 | 22 |
| Gain Flatness | 45 - 1218 MHz | dB | — | +/- 0.2 | — |
| Reverse Isolation | 45 - 1218 MHz | dB | — | 25 | — |
| Input Return Loss | 45 - 1218 MHz | dB | — | 10 | — |
| Output Return Loss | 45 - 1218 MHz | dB | — | 16 | — |
| Noise Figure | 45 - 1218 MHz 1218 MHz | dB | — — | 1.2 1.2 | — 1.6 |
| Output IP2 | 45 - 1200 MHz, tone spacing 6 MHz, P_{OUT} per tone = 4 dBm | dBm | — | 43 | — |
| Output IP3 | 45 - 1200 MHz, tone spacing 6 MHz, P_{OUT} per tone = 4 dBm | dBm | — | 32 | — |
| P1dB | 45 - 1218 MHz | dBm | — | 17.5 | — |
| Composite Triple Beat, CTB | 79 channels, 0 dB Tilt, 18 dBmV per channel output, QAM to 1000 MHz | dBc | — | -79 | — |
| Composite Second Order, CSO | 79 channels, 0 dB Tilt, 18 dBmV per channel output, QAM to 1000 MHz | dBc | — | -62 | — |
| I_{DD} | $V_{DD} = 5\text{ V}$ | mA | — | 53 | 62 |

Absolute Maximum Ratings^{3,4,5,6}

| Parameter | Absolute Maximum |
|-----------------------|------------------|
| Input Power | 10 dBm |
| Operating Voltage | 6 volts |
| Operating Temperature | -40°C to +85°C |
| Storage Temperature | -65°C to +150°C |

- Exceeding any one or combination of these limits may cause permanent damage to this device.
- MACOM does not recommend sustained operation near these survivability limits.
- These operating conditions will ensure MTTF > 1 x 10⁶ hours.
- Junction Temperature (T_J) = Case Temperature (T_C) + $\Theta_{jc} \cdot (V \cdot I)$
Typical thermal resistance (Θ_{jc}) = 67°C/W.
 - For $T_C = 25^\circ\text{C}$,
 $T_J = 42^\circ\text{C} @ 5\text{ V}, 53\text{ mA}$
 - For $T_C = 85^\circ\text{C}$,
 $T_J = 103^\circ\text{C} @ 5\text{ V}, 53\text{ mA}$

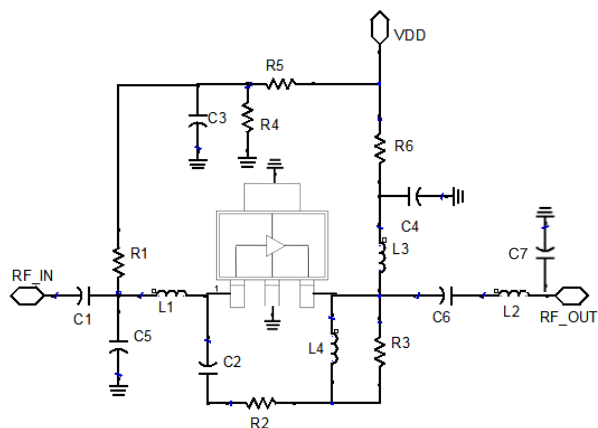
Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM Class 1A.

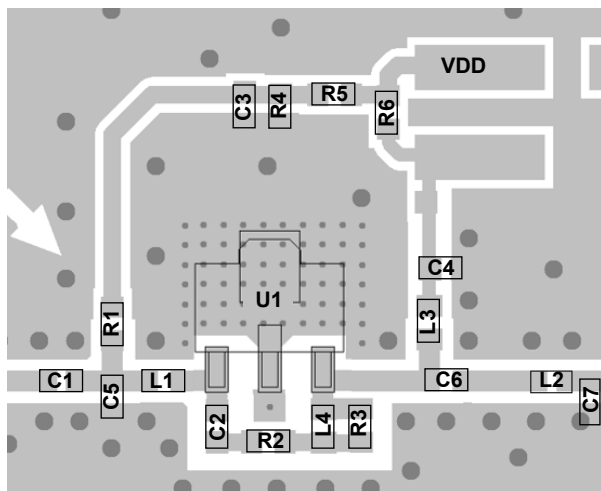
Schematic Including Off-Chip Components



Parts List, $V_{DD} = 5\text{ V}$

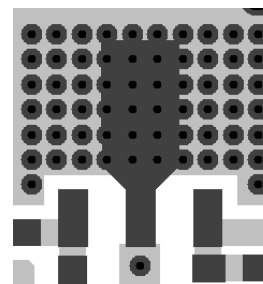
| Component | Value | Package |
|-----------|---------------------------|---------|
| C1-C4 | 10 nF | 0402 |
| C5 | 1.5 pF | 0402 |
| C6 | 1000 pF | 0402 |
| C7 | 1.0 pF | 0402 |
| L1 | 6.2 nH | 0402 |
| L2 | 6.8 nH | 0402 |
| L3 | Ferrite Bead ⁷ | 0402 |
| L4 | 68 nH ⁸ | 0402 |
| R1 | 8.06 kΩ | 0402 |
| R2 | 931 Ω | 0402 |
| R3 | 464 Ω | 0402 |
| R4 | 1.54 kΩ | 0402 |
| R5 | 8.06 kΩ | 0402 |
| R6 | 19.1 Ω | 0402 |

Recommended PCB Layout



- 7. Murata, part number BLM15HD182SN.
- 8. Coilcraft, part number 0402CS-68NXJLW

Recommended PCB Land Pattern

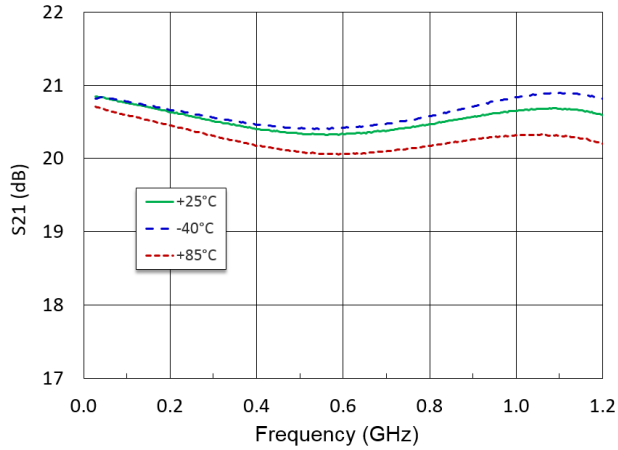


60 vias beneath package

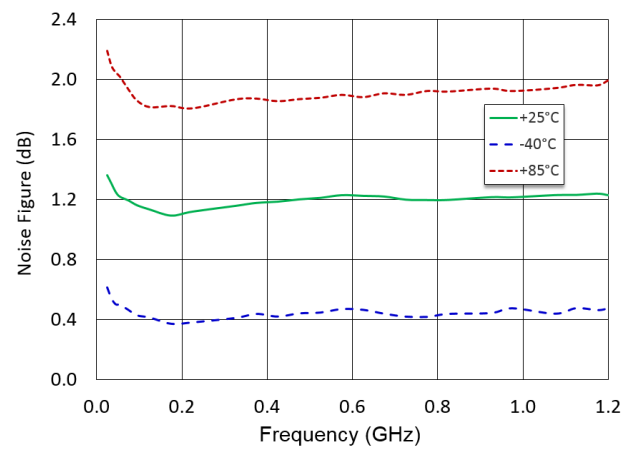
0.012 in. via diameter

Typical Performance Curves: $V_{DD} = 5\text{ V}$

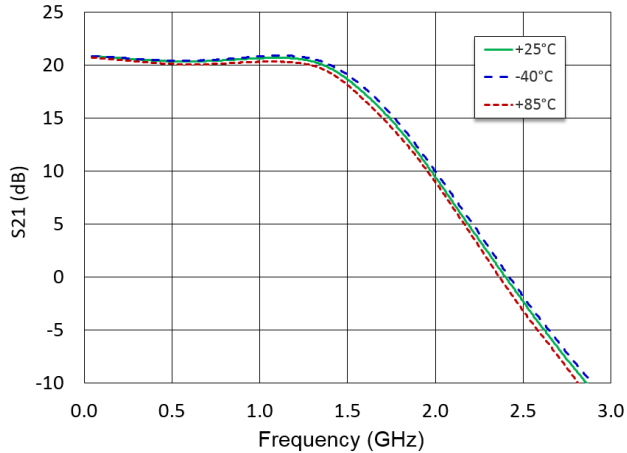
Gain to 1.218 GHz



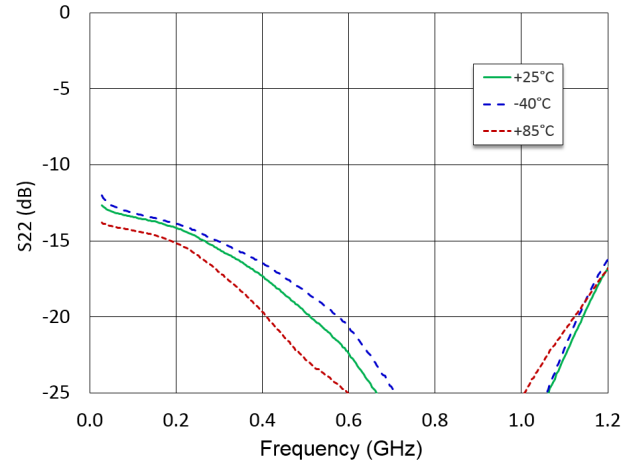
Noise Figure to 1.218 GHz



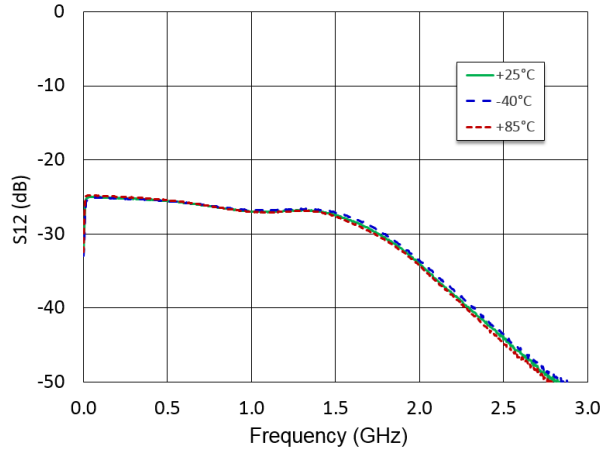
Gain to 3 GHz



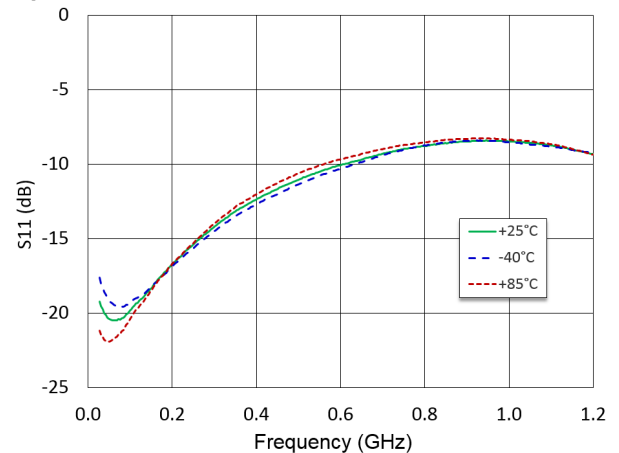
Output Return Loss to 1.218 GHz



Reverse Isolation to 3 GHz



Input Return Loss to 1.218 GHz



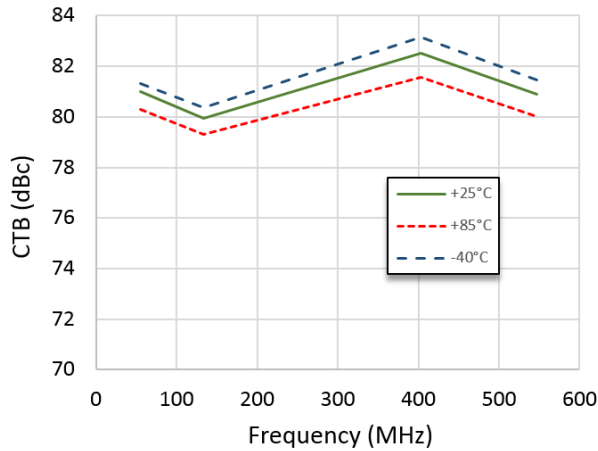
75 Ω CATV, FTTx Low Noise Amplifier 45 - 1218 MHz

Rev. V1

Typical Performance Curves: $V_{DD} = 5\text{ V}$

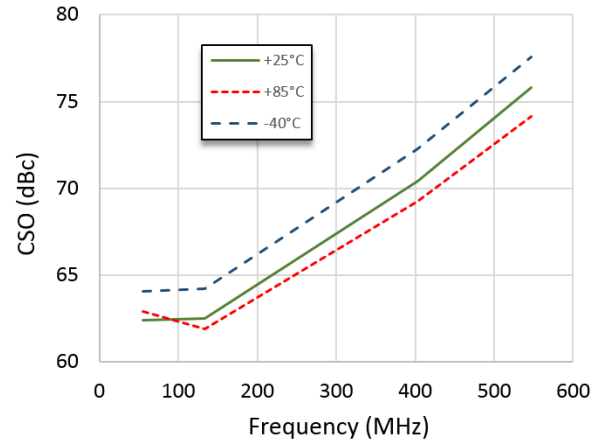
CTB

79 analog channels + QAM, 0 dB tilt,
 $P_{OUT} = 18\text{ dBmV}$ per channel



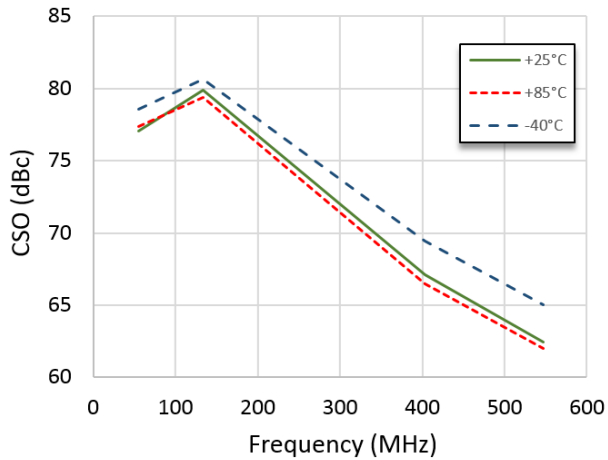
CSO Lower

79 analog channels + QAM, 0 dB tilt,
 $P_{OUT} = 18\text{ dBmV}$ per channel

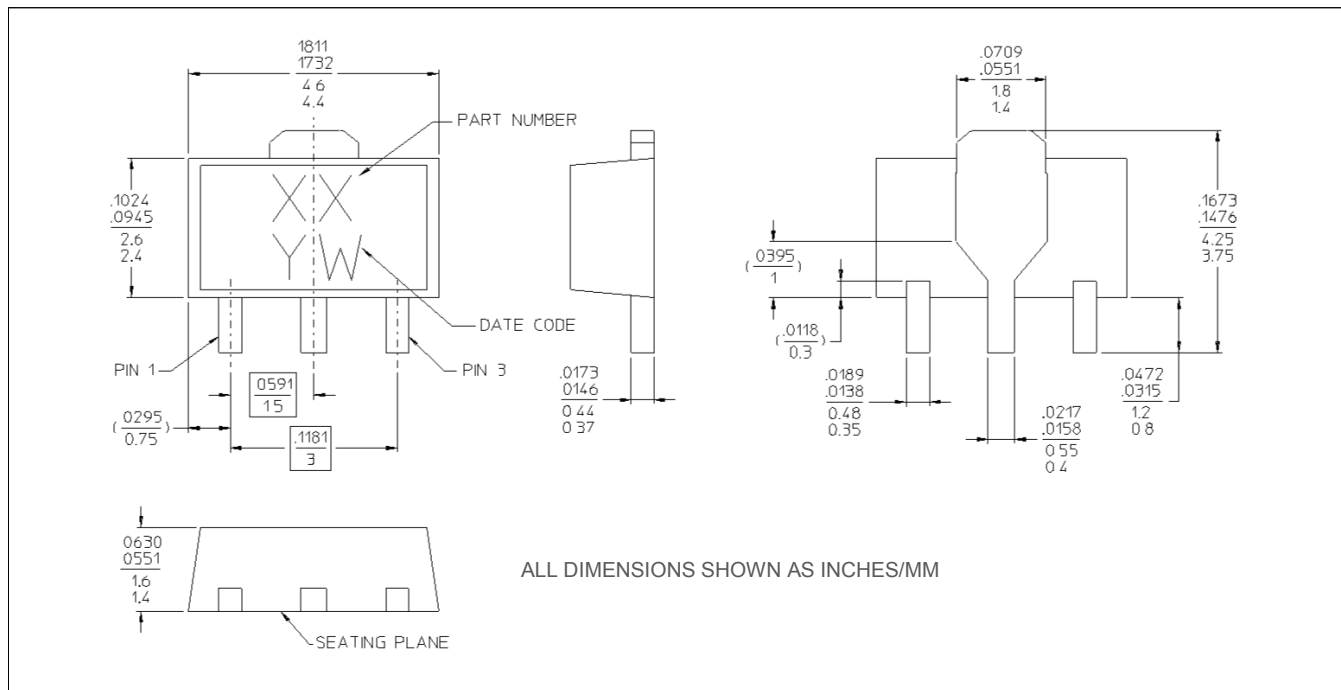


CSO Upper

79 analog channels + QAM, 0 dB tilt,
 $P_{OUT} = 18\text{ dBmV}$ per channel



Lead Free SOT-89[†]



[†] Reference Application Note S2083 for lead-free solder reflow recommendations.
 Meets JEDEC moisture sensitivity level 1 requirements.
 Plating is 100% matte tin over copper.

Applications Section

3 V Application

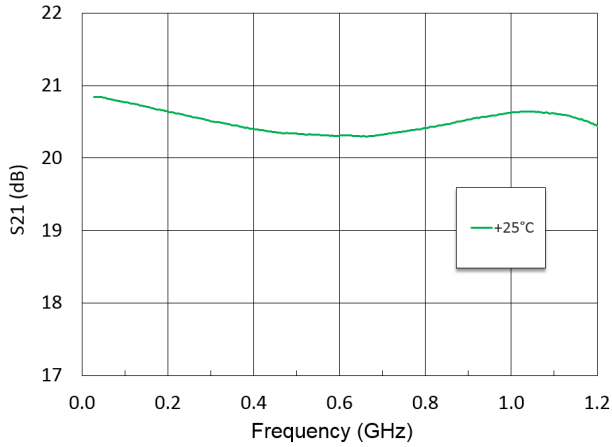
The MAAL-011136 may also be operated from 3 V V_{DD} supply with adjustment of two bias resistors: $R4 = 4.64 \text{ k}\Omega$ to set current at nominal 53 mA; and $R6 = 0 \text{ }\Omega$.

Typical Performance: $T_A = 25^\circ\text{C}$, $V_{DD} = 3 \text{ V}$, $Z_0 = 75 \text{ }\Omega$

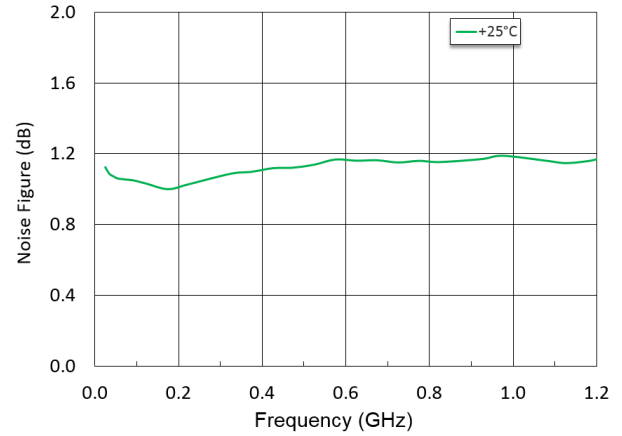
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| Input Return Loss | 45 - 1218 MHz | dB | — | 10 | — |
| Output Return Loss | 45 - 1218 MHz | dB | — | 16 | — |
| Noise Figure | 45 - 100 MHz 100 - 1218 MHz | dB | — | 1.2 1.2 | — |
| Output IP2 | 45 - 1200 MHz, tone spacing 6 MHz, P_{OUT} per tone = 4 dBm | dBm | — | 42 | — |
| Output IP3 | 45 - 1200 MHz, tone spacing 6 MHz, P_{OUT} per tone = 4 dBm | dBm | — | 32 | — |
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| I_{DD} | $V_{DD} = 3 \text{ V}$ | mA | — | 53 | — |

Typical Performance Curves: $V_{DD} = 3\text{ V}$

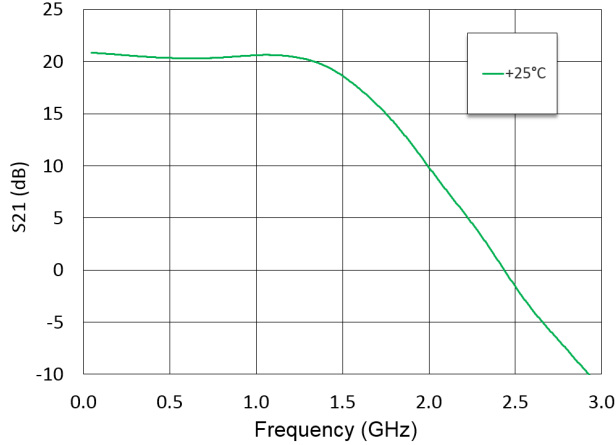
Gain to 1.218 GHz



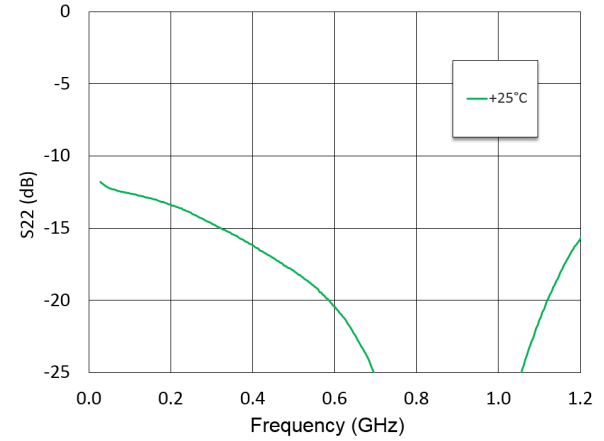
Noise Figure to 1.218 GHz



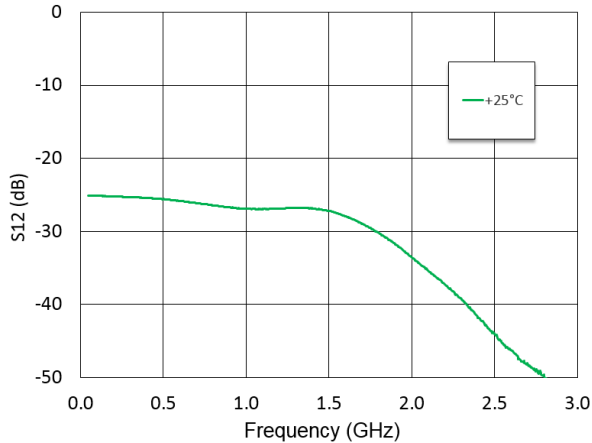
Gain to 3 GHz



Output Return Loss to 1.218 GHz



Reverse Isolation to 3 GHz



Input Return Loss to 1.218 GHz

