

75 Ω , High Linearity, Low Noise, CATV Amplifier 45 - 1218 MHz

Rev. V1

Features

- Single Stage, Single Ended
- 8 V, 130 mA or 5 V, 110 mA Operation
- 18 dB Flat Gain
- Low Noise
- Low Distortion Performance
- Lead-Free SOT-89 Plastic Package
- Halogen-Free “Green” Mold Compound
- RoHS* Compliant

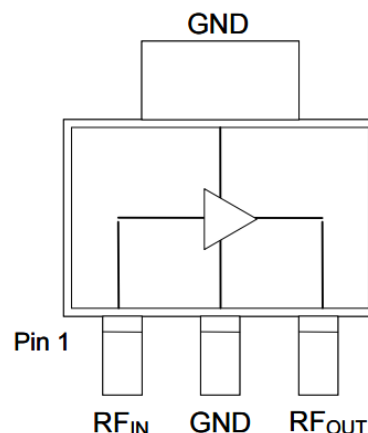
Description

The MAAM-011220 is an RF amplifier assembled in a SOT-89 plastic package. This amplifier provides 18 dB of ultra flat gain while biased at either 8 or 5 volts. The amplifier provides excellent linearity.

The MAAM-011220 provides high gain, low noise and low distortion making it ideally suited for 75 Ω infrastructure applications.

The MAAM-011220 is fabricated using GaAs pHEMT technology.

Functional Schematic



Pin Configuration

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

Ordering Information^{1,2}

Part Number	Package
MAAM-011220-TR1000	1000 piece reel
MAAM-011220-TR3000	3000 piece reel
MAAM-011220-001SMB	Sample Board

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

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

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Electrical Specifications: Freq. = 45 - 1218 MHz, $T_A = 25^\circ\text{C}$, $V_{DD} = 8\text{ V}$, $Z_0 = 75\ \Omega$

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	1218 MHz	dB	18	18.5	20
Tilt	45 - 1218 MHz	dB	—	0.5	—
Reverse Isolation	—	dB	—	21.5	—
Input Return Loss	—	dB	—	20	—
Output Return Loss	—	dB	—	24	—
Noise Figure	50 - 100 MHz 100 - 1218 MHz	dB	—	2.6 2.4	4 3.1
Output IP2	45 - 1218 MHz, tone spacing 6 MHz, P_{OUT} per tone = -10 dBm	dBm	—	66	—
Output IP3	45 - 1218 MHz, tone spacing 6 MHz, P_{OUT} per tone = -10 dBm	dBm	—	38	—
P1dB	—	dBm	—	24	—
Composite Triple Beat, CTB	79 channels, 0 dB Tilt, 34 dBmV per channel output, QAM to 1000 MHz	dBc	—	-73	—
	132 channels, 15 dBmV per channel input			-71	
Composite Second Order, CSO	79 channels, 0 dB Tilt, 34 dBmV per channel output, QAM to 1000 MHz	dBc	—	-69	—
	132 channels, 15 dBmV per channel input			-65	
I_{DD}	$V_{DD} = 8\text{ V}$	mA	110	130	145

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

Parameter	Absolute Maximum
Max Input Power	12 dBm
Operating Voltage	10 volts
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

3. Exceeding any one or combination of these limits may cause permanent damage to this device.
4. MACOM does not recommend sustained operation near these survivability limits.
5. These operating conditions will ensure MTTF > 1×10^6 hours.
6. Junction Temperature (T_J) = Case Temperature (T_C) + $\Theta_{JC} \cdot (V \cdot I)$
 Typical thermal resistance (Θ_{JC}) = 50.4°C/W.
 a) For $T_C = 25^\circ\text{C}$,
 $T_J = 67.5^\circ\text{C} @ 8\text{ V}, 130\text{ mA}$
 b) For $T_C = 85^\circ\text{C}$,
 $T_J = 137.5^\circ\text{C} @ 8\text{ V}, 130\text{ mA}$

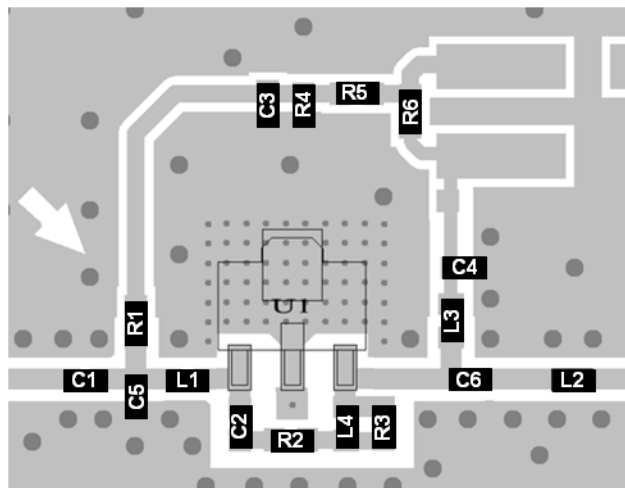
Handling Procedures

Please observe the following precautions to avoid damage:

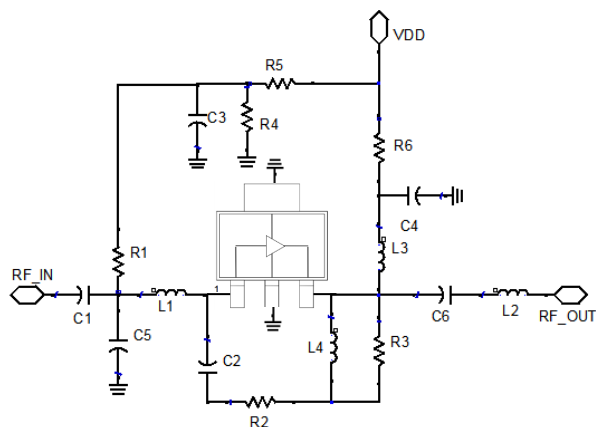
Static Sensitivity

Gallium Arsenide 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 Class1A devices.

Recommended PCB Layout



Schematic Including Off-Chip Components

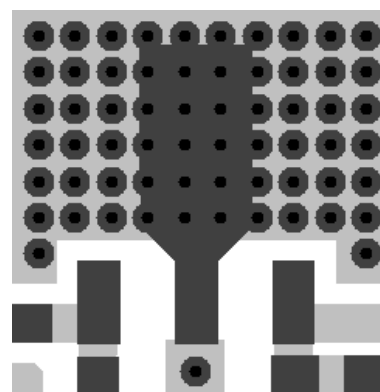


Parts List⁷

Component	Value	Package
C1-C4	10 nF	0402
C5	0.9 pF	0402
C6	150 pF	0402
L1	10 nH	0402
L2	4.3 nH	0402
L3	Ferrite Bead	0402
L4	18 nH	0402
R1	8 k Ω	0402
R2	750 Ω	0402
R3	165 Ω	0402
R4	549 Ω	0402
R5	5 k Ω	0402
R6	0 Ω	0402

7. Ferrite Bead from Murata, part number BLM15HD182SN.

PCB Land Pattern



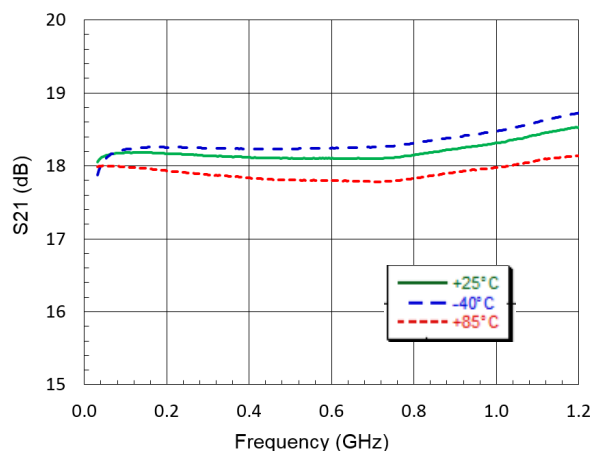
60 vias beneath package
0.012 in. via diameter

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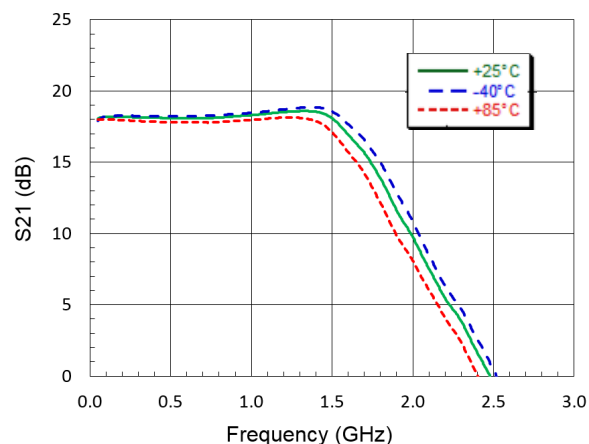
Rev. V1

Typical Performance Curves: $V_{DD} = 8\text{ V}$

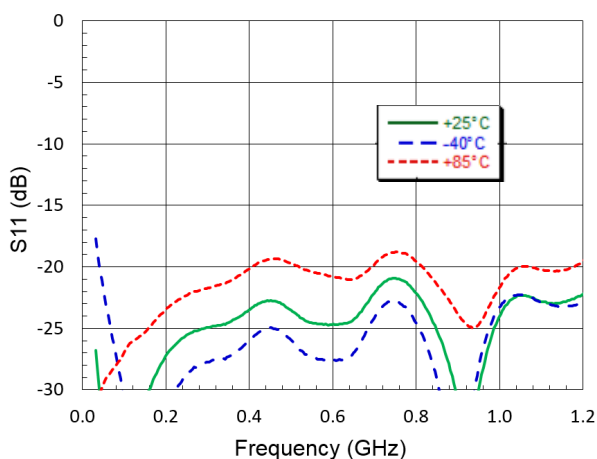
Gain to 1.218 GHz



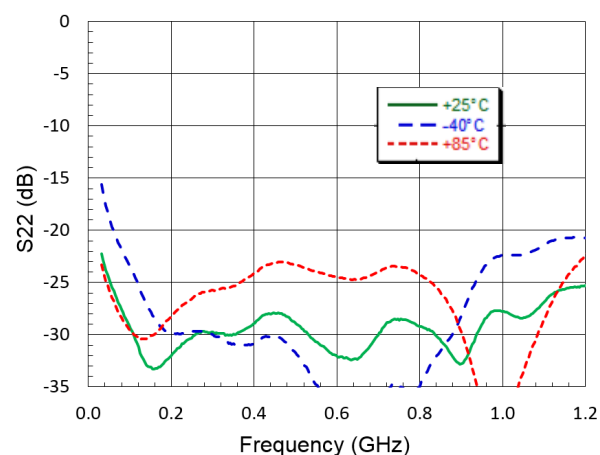
Gain to 3 GHz



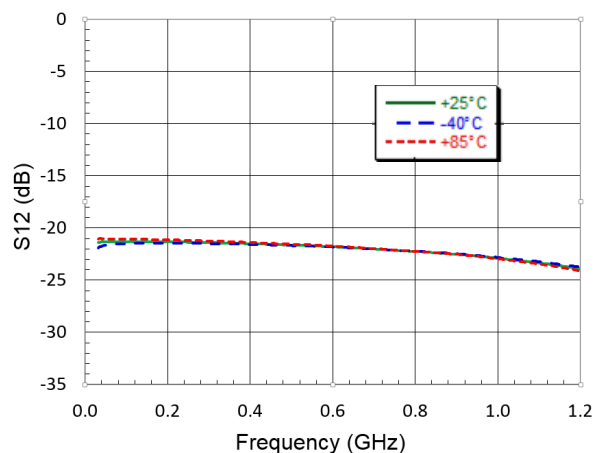
Input Return Loss



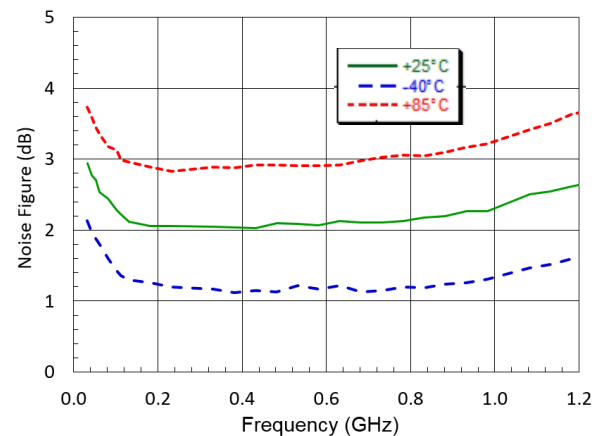
Output Return Loss



Reverse Isolation



Noise Figure



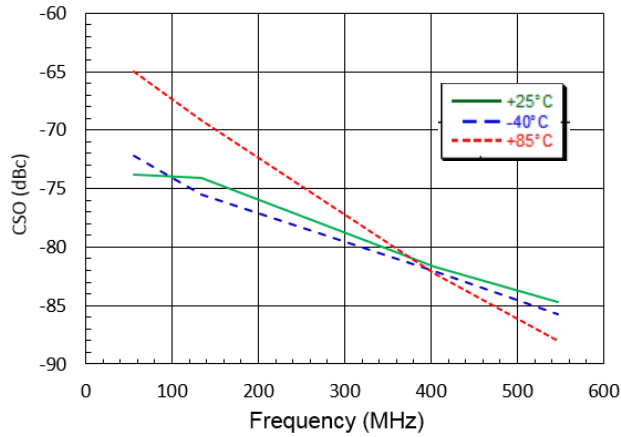
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Typical Performance Curves: $V_{DD} = 8\text{ V}$

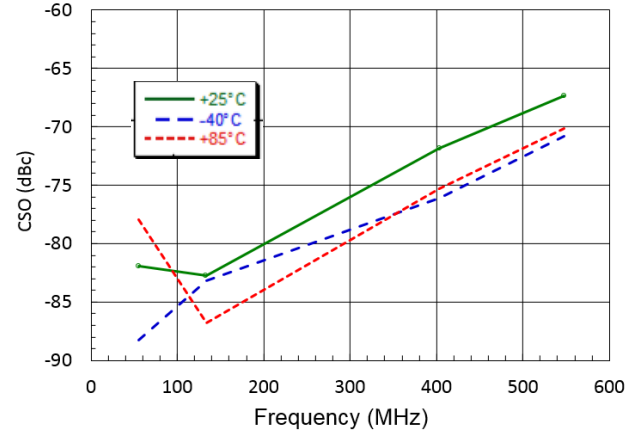
CSO Lower

79 analog ch + QAM, 0 dB tilt, $P_{OUT} = 34\text{ dBmV per ch}$



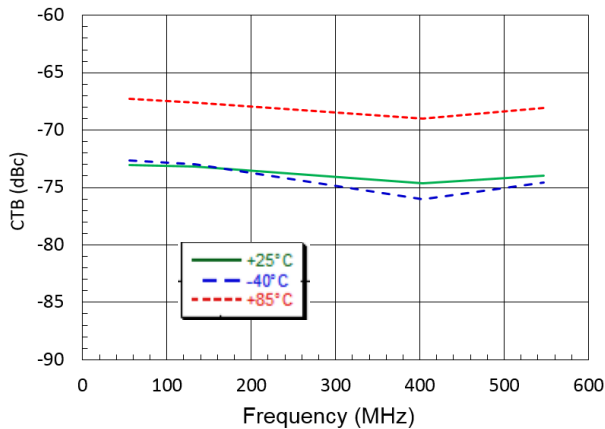
CSO Upper

79 analog ch + QAM, 0 dB tilt, $P_{OUT} = 34\text{ dBmV per ch}$



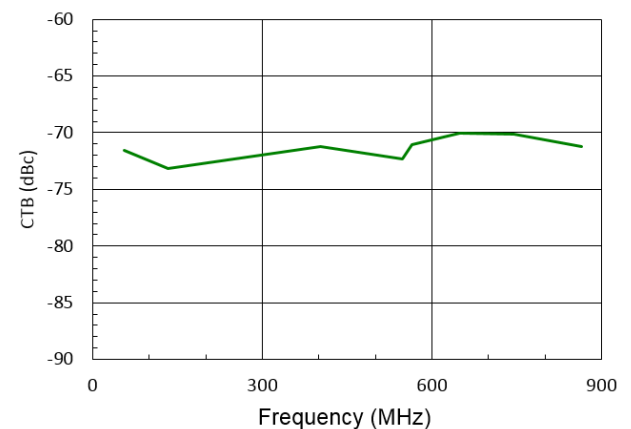
CTB

79 analog ch + QAM, 0 dB tilt, $P_{OUT} = 34\text{ dBmV per ch}$



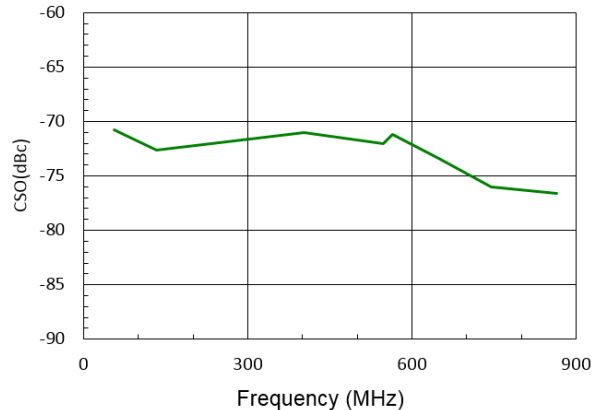
CTB

132 analog ch, $P_{IN} = 15\text{ dBmV per ch, } +25^\circ\text{C}$



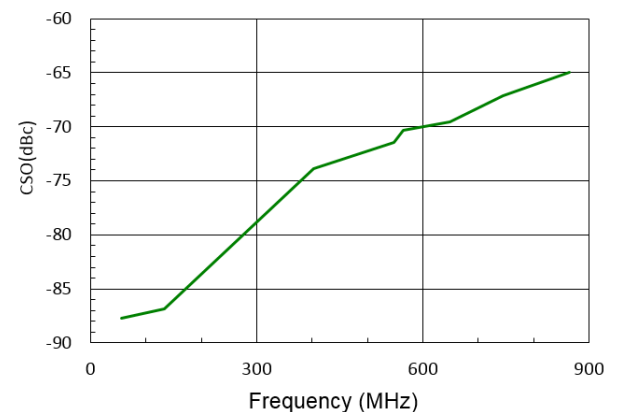
CSO Lower

132 analog ch, $P_{IN} = 15\text{ dBmV per ch, } +25^\circ\text{C}$



CSO Upper

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Electrical Specifications⁸: Freq. = 45 - 1218 MHz, $T_A = 25^\circ\text{C}$, $V_{DD} = 5\text{ V}$, $Z_0 = 75\ \Omega$

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	1218 MHz	dB	—	18.5	—
Tilt	45 - 1218 MHz	dB	—	0.5	—
Reverse Isolation	—	dB	—	21.5	—
Input Return Loss	—	dB	—	20	—
Output Return Loss	—	dB	—	24	—
Noise Figure	50 - 100 MHz 100 - 1218 MHz	dB	—	2.6 2.4	—
Output IP2	45 - 1218 MHz, tone spacing 6 MHz, P_{OUT} per tone = -10 dBm	dBm	—	64	—
Output IP3	45 - 1218 MHz, tone spacing 6 MHz, P_{OUT} per tone = -10 dBm	dBm	—	37	—
P1dB	—	dBm	—	20	—
Composite Triple Beat, CTB	79 channels, 0 dB Tilt, 34 dBmV per channel output, QAM to 1000 MHz 132 channels, 15 dBmV per channel input	dBc	—	-73 -70	—
Composite Second Order, CSO	79 channels, 0 dB Tilt, 34 dBmV per channel output, QAM to 1000 MHz 132 channels, 15 dBmV per channel input	dBc	—	-67 -65	—
I_{DD}	$V_{DD} = 5\text{ V}$	mA	—	110	—

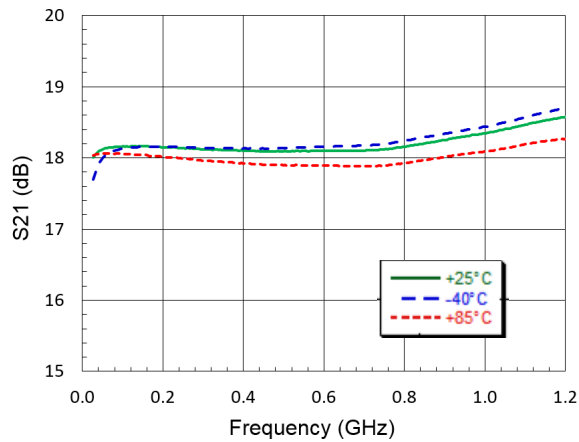
8. The same application circuit and component values are used for $V_{DD}=5\text{V}$ and $V_{DD}=8\text{V}$ operation.

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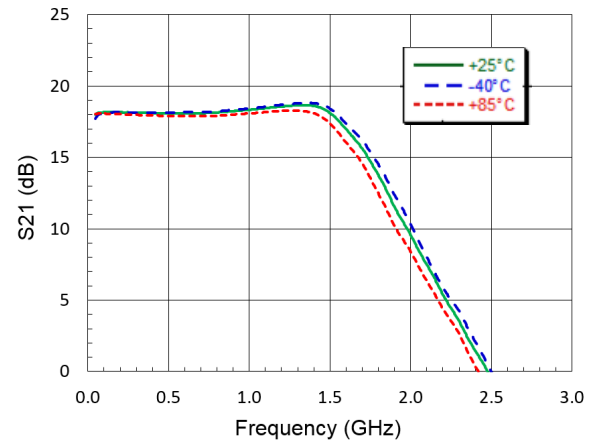
Rev. V1

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

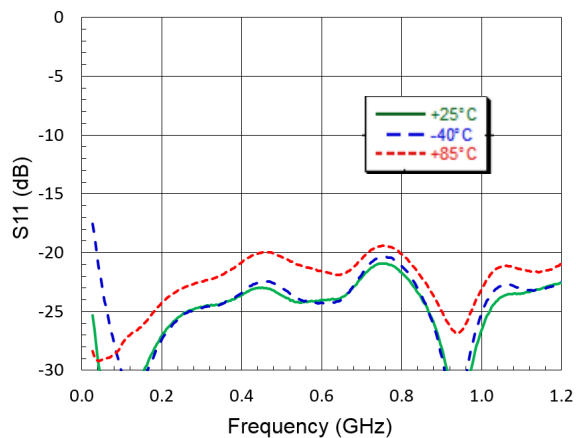
Gain to 1.218 GHz



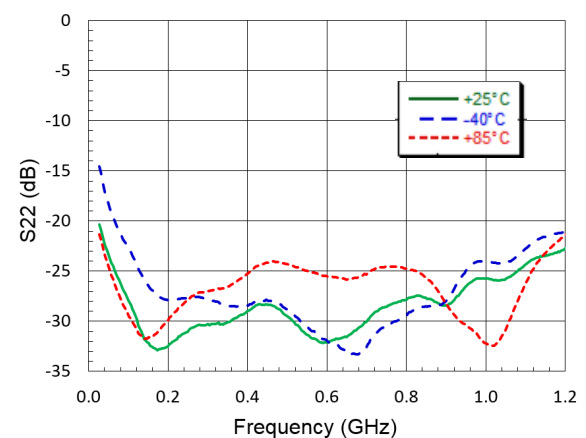
Gain to 3 GHz



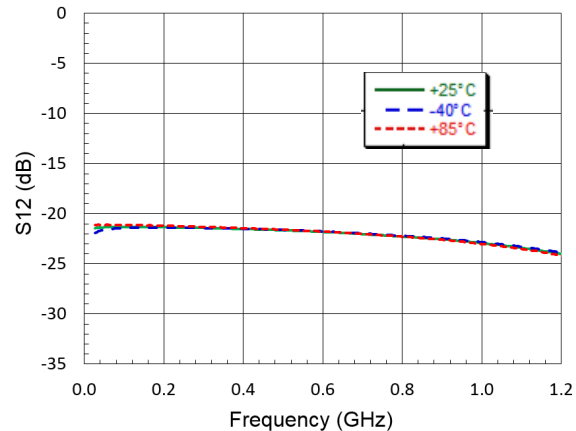
Input Return Loss



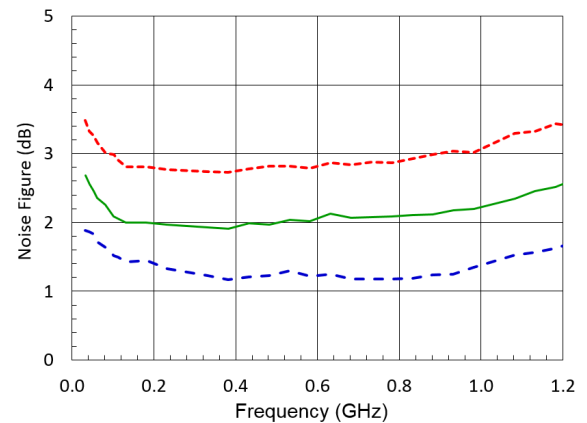
Output Return Loss



Reverse Isolation



Noise Figure



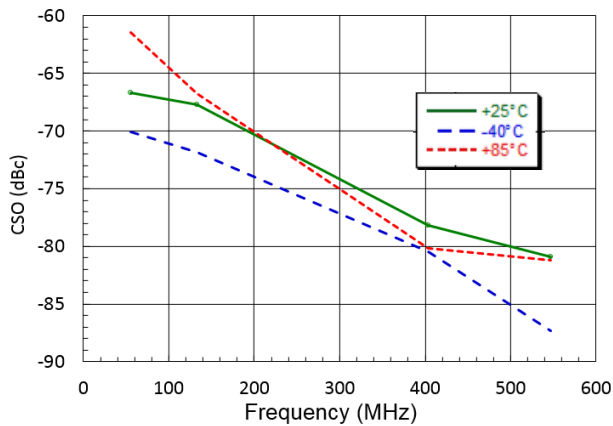
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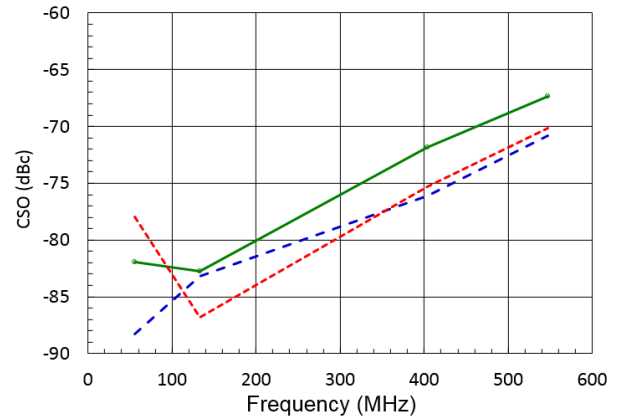
CSO Lower

79 analog ch + QAM, 0 dB tilt, $P_{OUT} = 34\text{ dBmV per ch}$



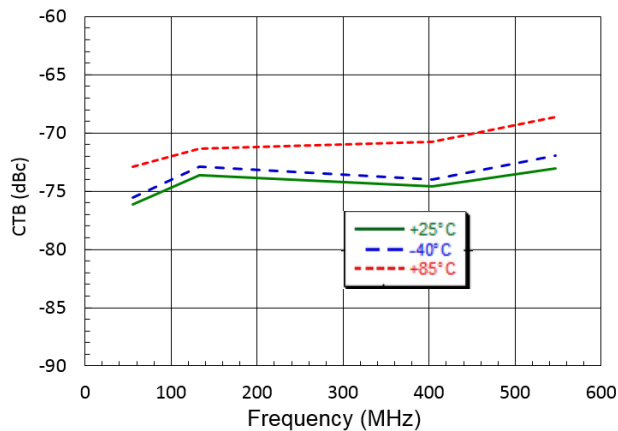
CSO Upper

79 analog ch + QAM, 0 dB tilt, $P_{OUT} = 34\text{ dBmV per ch}$



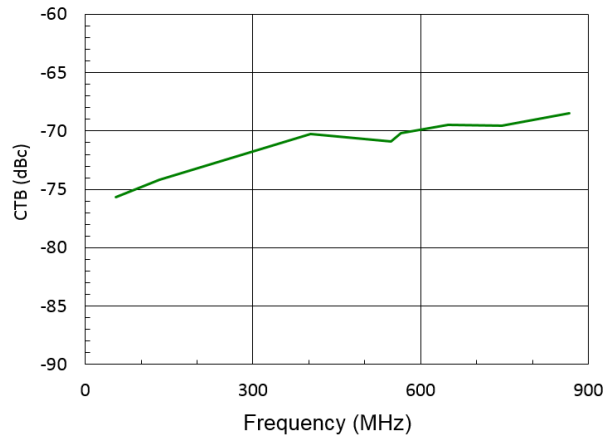
CTB

79 analog ch + QAM, 0 dB tilt, $P_{OUT} = 34\text{ dBmV per ch}$



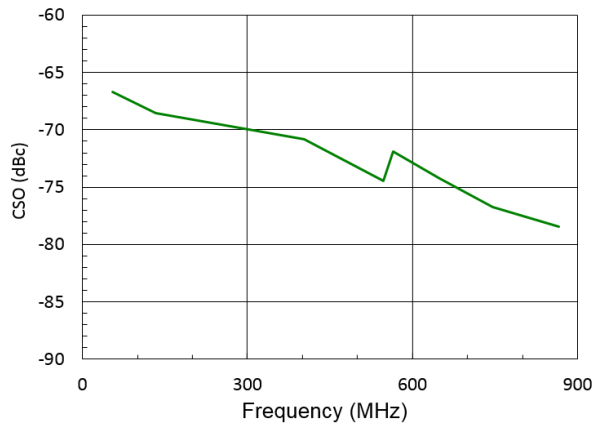
CTB

132 analog ch, $P_{IN} = 15\text{ dBmV per ch, } +25^\circ\text{C}$



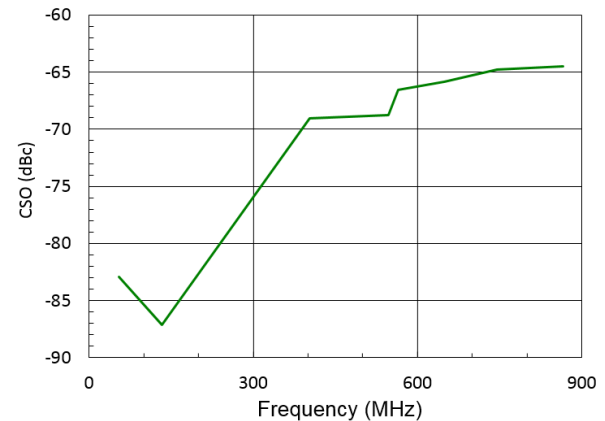
CSO Lower

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CSO Upper

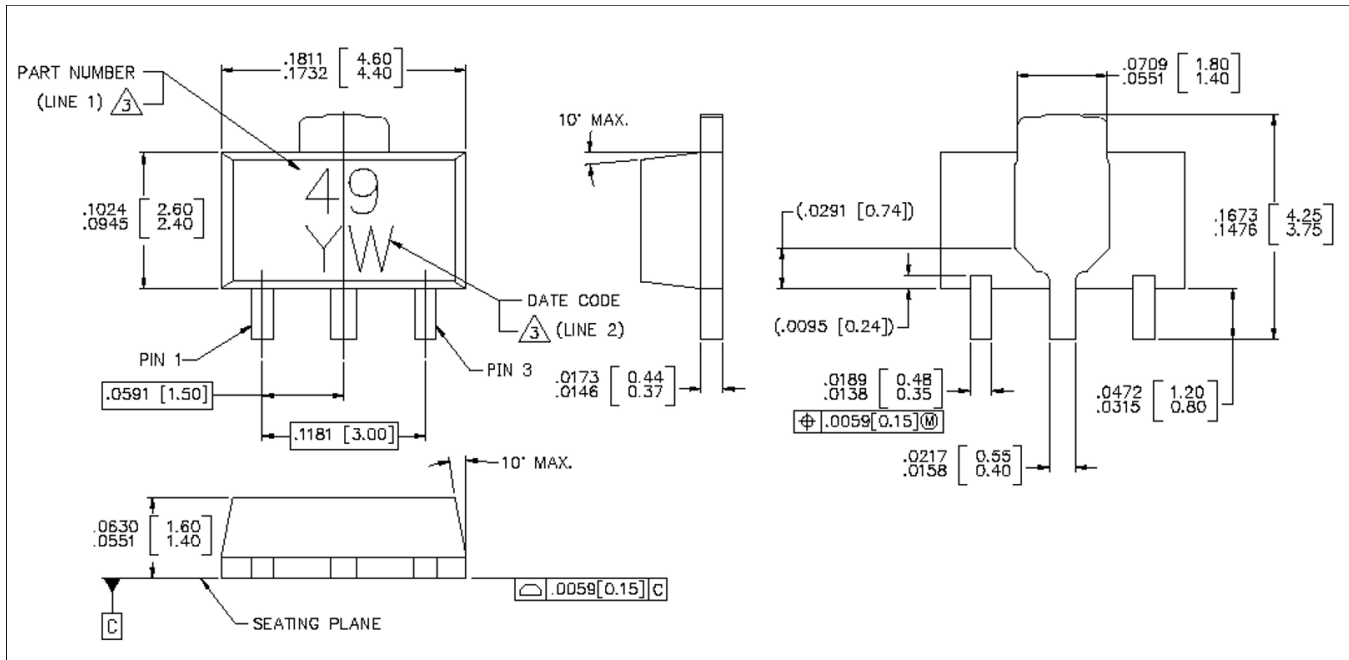
132 analog ch, $P_{IN} = 15\text{ dBmV per ch, } +25^\circ\text{C}$



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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.

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