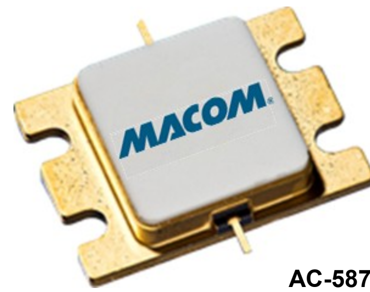
GaN Amplifier 40 V, 60 W
5.85 - 6.75 GHz

MACOM PURE CARBIDE

Features
- *MACOM PURE CARBIDE*® Amplifier Series
- Broad Band Internally Matched Amplifier
- High Output Power of 48 dBm
- High Linear Gain of 13.5 dB
- Low Intermodulation Distortion with Wide Spacing Tone
- 100% RF Tested
- RoHS* Compliant



AC-587BH-2

Applications
- Civil Communications
- Military Communications
- Satellite Communications

Description
The MAPC-A4019 is a 60 W package amplifier fully matched to 50 Ω at both input and output ports. This amplifier is optimized for 5.85 - 6.75 GHz Satcom applications.

Typical Performance:
Measured in Evaluation Test Fixture[1]
@ P_{IN} = 38 dBm, CW
- V_{DS} = 40 V, I_{DQ} = 400 mA, T_C = 25°C

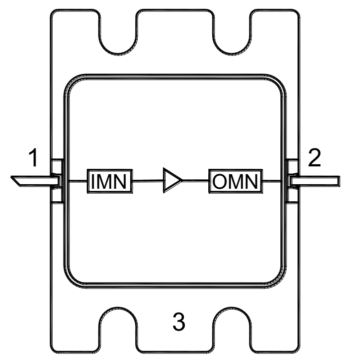
Frequency (GHz)	G_P (dB)	η (%)
5.85	10.3	41
6.3	10.6	39
6.75	9.9	34

Two-Tone Test
@ P_{OUT} = 41 dBm (Single Carrier Level), CW
- V_{DS} = 40 V, I_{DQ} = 400 mA, T_C = 25°C

Frequency (GHz)	IM3 (dBc) ∆f = 5 MHz	IM3-2 (dBc) ∆f = 150 MHz
5.85	-28	-29
6.3	-32	-34
6.75	-28	-29

1. Performance values and curves in this data sheet were measured in this fixture, de-embedded to the package lead reference planes.

Functional Schematic



Pin Configuration

Pin #	Pin Name	Function
1	RF_{IN} / V_G	RF Input / Gate
2	RF_{OUT} / V_D	RF Output / Drain
3	Flange[2]	Ground / Source

2. The flange on the package bottom must be connected to RF, DC and thermal ground.

Ordering Information

Part Number	Package
MAPC-A4019-AB000	Bulk Quantity
MAPC-A4019-ABSB1	Sample Board

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

RF Electrical Characteristics: Measured in 50 Ω Evaluation Test Fixture[3]
Freq. = 5.85 - 6.75 GHz, T_C = 25°C, V_{DS} = 40 V, I_{DQ} = 400 mA, CW

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Output Power	P_{IN} = 38 dBm	P_{OUT}	—	48	—	dBm
Drain Current	P_{IN} = 38 dBm	IDS1	—	4.1	—	A
Power Added Efficiency	P_{IN} = 38 dBm	η	—	38	—	%
Large Signal Gain	P_{IN} = 38 dBm	G_P	—	10	—	dB
Intermodulation Distortion	P_{OUT} = 41 dBm SCL, Δf = 5 MHz Δf = 150 MHz	IM3 IM3-2	—	-28 -28	—	dBc
Drain Current	P_{OUT} = 41 dBm SCL, Δf = 5 MHz, Δf = 150 MHz	IDS2	—	2.0	—	A
Small Signal Gain	P_{IN} = 20 dBm	SSG	—	13.5	—	dB
SSG Gain Flatness	P_{IN} = 20 dBm	ΔG	—	1.0	—	dB

RF Electrical Specifications: Measured in 50 Ω Production Test Fixture[3]
T_C = 25°C, V_{DS} = 40 V, I_{DQ} = 400 mA, CW

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Output Power	5.85, 6.3 & 6.75 GHz, P_{IN} = 38 dBm	P_{OUT}	47	47.7	—	dBm
Drain Current	5.85, 6.3 & 6.75 GHz, P_{IN} = 38 dBm	IDS1	—	4.1	4.5	A
Intermodulation Distortion	5.85 & 6.75 GHz, P_{OUT} = 41 dBm SCL, Δf = 5 MHz Δf = 150 MHz	IM3 IM3-2	—	-28 -29	-25 -25	dBc
Drain Current	5.85 & 6.75 GHz, P_{OUT} = 41 dBm SCL, Δf = 5 MHz, Δf = 150 MHz	IDS2	—	2.1	2.5	A
Small Signal Gain	5.85, 6.05, 6.55 & 6.75 GHz, P_{IN} = 20 dBm	SSG	—	13.5	—	dB
SSG Gain Flatness	5.85, 6.05, 6.55 & 6.75 GHz, P_{IN} = 20 dBm	ΔG	0	1.2	1.6	dB

3. Final testing and screening for all amplifier sales is performed using the MAPC-A4019-ABSB1.

DC Electrical Characteristics T_A = 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Drain-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{DS}	—	—	2.0	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{GS}	-2.0	—	—	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 14.4 mA	V_T	-3.8	-3.0	-2.3	V
Gate Quiescent Voltage	V_{DS} = 40 V, I_D = 140 mA	V_{GSQ}	—	-3.0	—	V

Absolute Maximum Ratings[4,5,6,7,8]

Parameter	Absolute Maximum
Drain Source Voltage, V_{DS}	120 V
Gate Source Voltage, V_{GS}	-10 to 2 V
Forward Gate Current, I_{GMAX}	14.4 mA
Drain Current, I_D	6 A
Storage Temperature Range, T_S	-65°C to +150°C
Case Operating Temperature Range, T_C	-40°C to +85°C
Channel Operating Temperature Range, T_{CH}	-40°C to +225°C
Absolute Maximum Channel Temperature	+225°C

4. Exceeding any one or combination of these limits may cause permanent damage to this device.
5. MACOM does not recommend sustained operation above maximum operating conditions.
6. Operating at drain source voltage V_{DS} <45 V will ensure MTTF > 1 x 10^7 hours.
7. Operating at nominal conditions with $T_{CH} \leq 225°C$ will ensure MTTF > 1 x 10^7 hours.
8. MTTF may be estimated by the expression MTTF (hours) = A $e^{[B + C/(T+273)]}$ where *T* is the channel temperature in degrees Celsius, *A* = 1, *B* = -38.215, and *C* = 26,343.

Thermal Characteristics[9]

Parameter	Test Conditions	Symbol	Typical	Units
Thermal Resistance using Finite Element Analysis	CW, V_{DS} = 40 V T_C = 85°C, T_{CH} = 225 °C	R_θ(FEA)	2.0	°C/W

9. Case temperature measured using thermocouple embedded in heat-sink. Contact local applications support team for more details on this measurement.

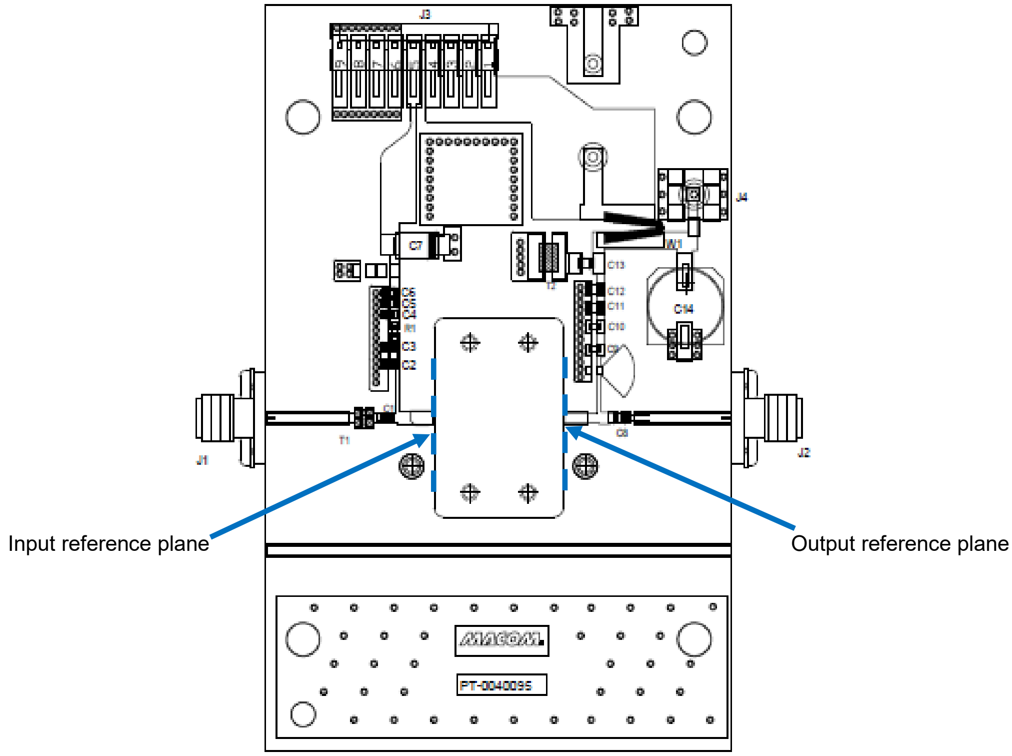
Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

Gallium Nitride 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 2, CDM Class C2B devices.

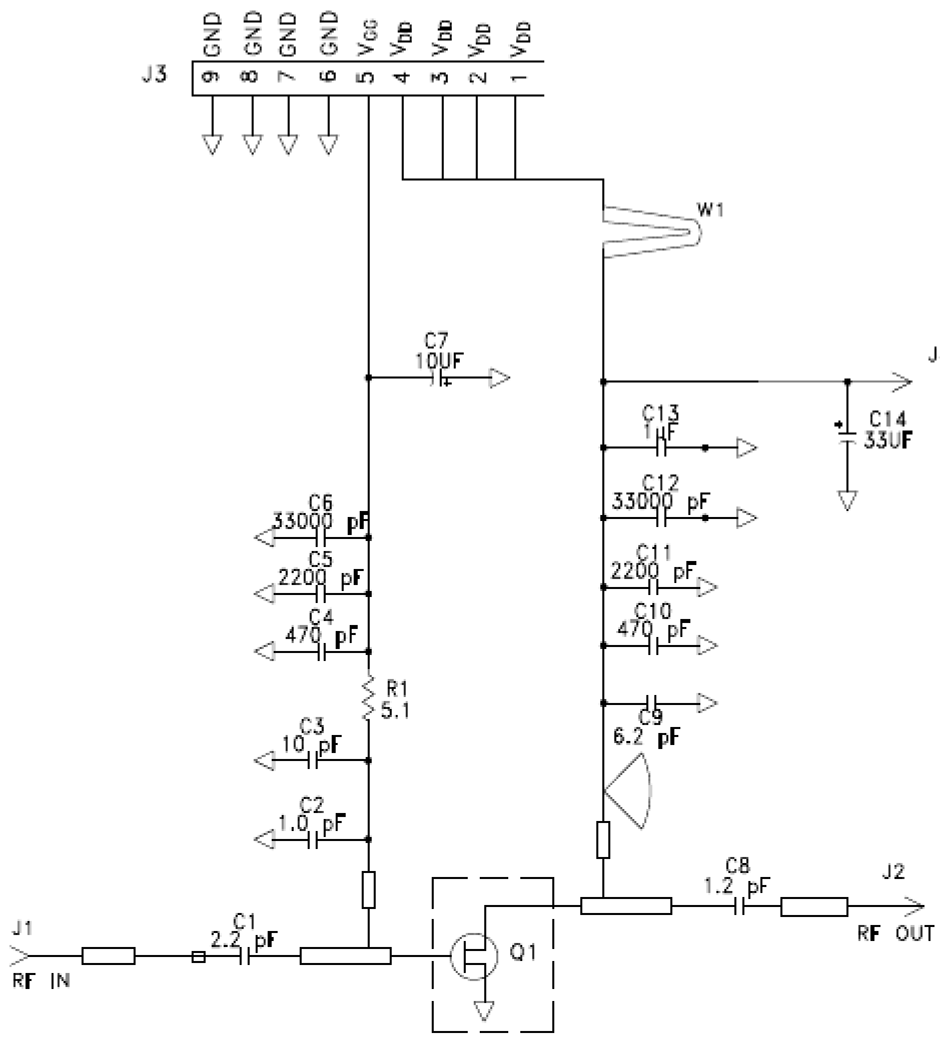
Applications Board Layout



Applications Board Parts List

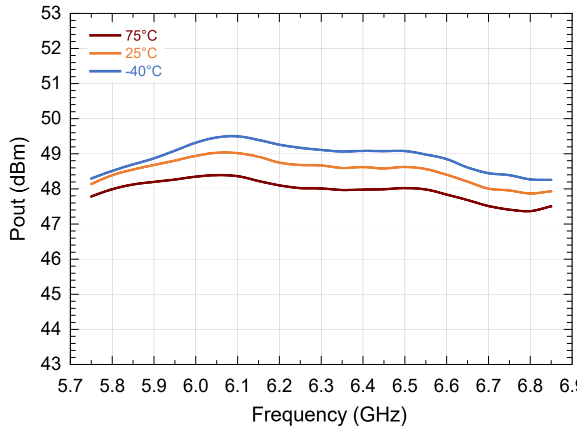
Reference Designator	Value	Tolerance	Manufacturer	Manufacture Part #
C1	2.2 pF	0.1 pF	Kyocera/AVX	ATC600S2R2BT250XT
C2	1 pF	0.1 pF	Kyocera/AVX	ATC600S1R0BT250XT
C3	10 pF	0.1 pF	Kyocera/AVX	ATC600S100BT250XT
C4, C10	470 pF	5%	Murata	GRM39X7R471J100AD
C5, C11	2200 pF	10%	Murata	GRM188R72A222K01D
C6, C12	33000 pF	10%	Murata	GRM21BR72A333KA01
C7	10 µF	10%	Kemet	T496C106K016ATE2K0
C8	1.2 pF	0.1 pF	Kyocera/AVX	ACT600F1R2BW500XT
C9	6.2 pF	0.1 pF	Kyocera/AVX	ATC600S6R2BT250XT
C13	1 µF	10%	Murata	GCJ21BC72A105KE02L
C14	33 µF	20%	Panasonic	EEE-2AA330P
R1	5.1 Ω	1%	Vishay/Dale	CRCW06035R10FKEAC
J1, J2	-		Amphenol	901-2GB100000AE
J3	-		TE Connectivity	640457-9
J4	-		Cinch	131-3711-201
T1, T2	-		-	Tined Copper Tab
W1	CABLE,18AWG,4.2”		-	18 AWG Black

Applications Board Schematic

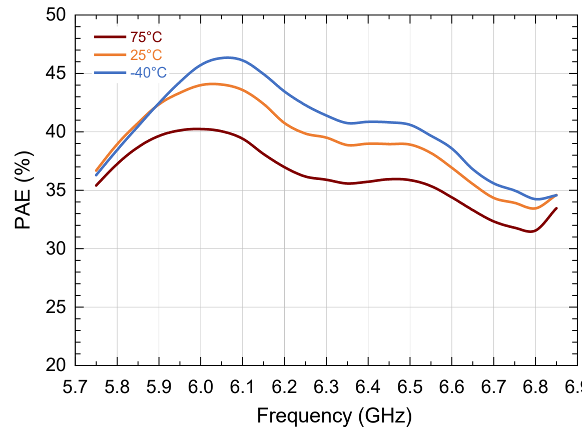


Typical Performance Curves as Measured in the Evaluation Test Fixture:
CW, V_{DS} = 40 V, I_{DQ} = 400 mA, P_{IN} = 38 dBm, T_C = 25°C (Unless Otherwise Noted)
For Engineering Evaluation Only - This data does not Modify MACOM's Datasheet Limits.

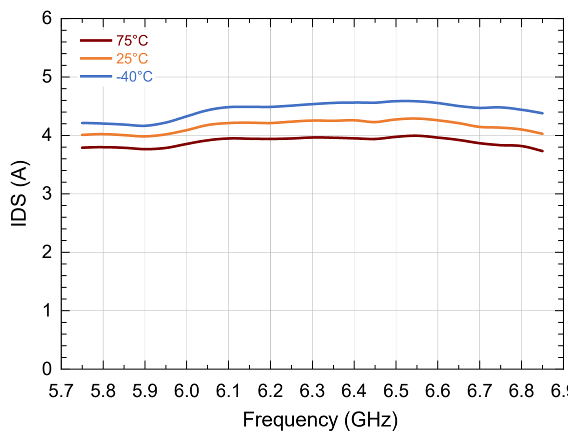
Output Power vs. Frequency and Temperature



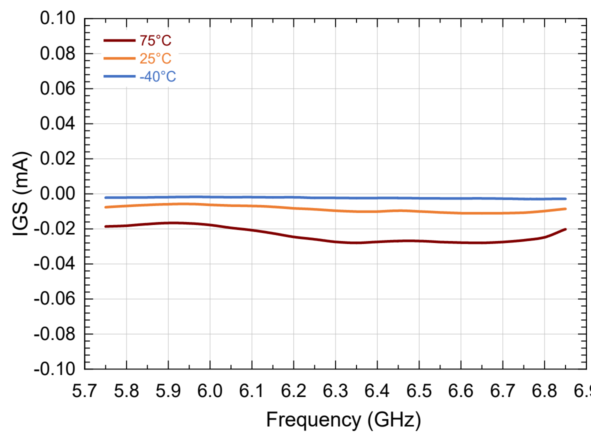
PAE vs. Frequency and Temperature



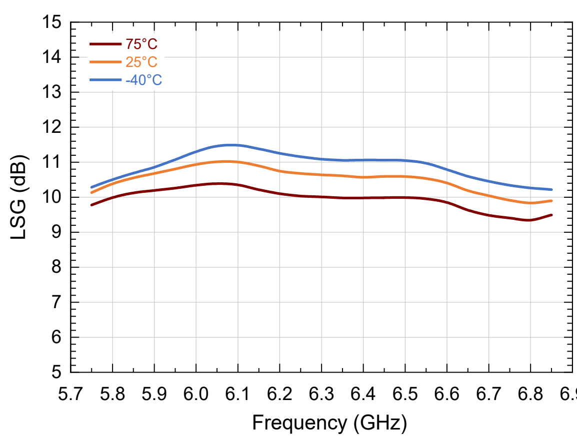
Drain Current vs. Frequency and Temperature



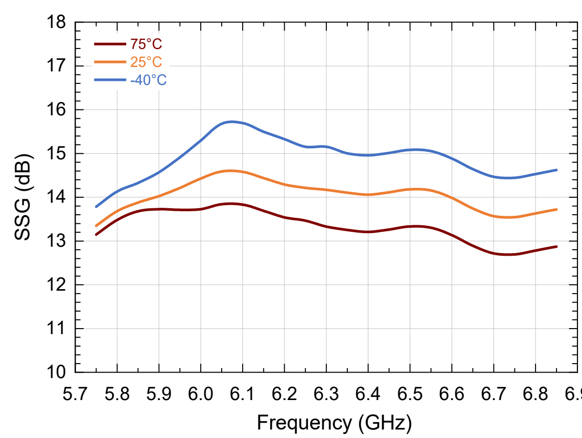
Gate Current vs. Frequency and Temperature



Large Signal Gain vs. Frequency and Temperature



SSG (Pin = 20 dBm) vs. Frequency and Temperature



Typical Performance Curves as Measured in the Evaluation Test Fixture:
CW, V_{DS} = 40 V, I_{DQ} = 400 mA, P_{IN} = 38 dBm, T_C = 25°C (Unless Otherwise Noted)
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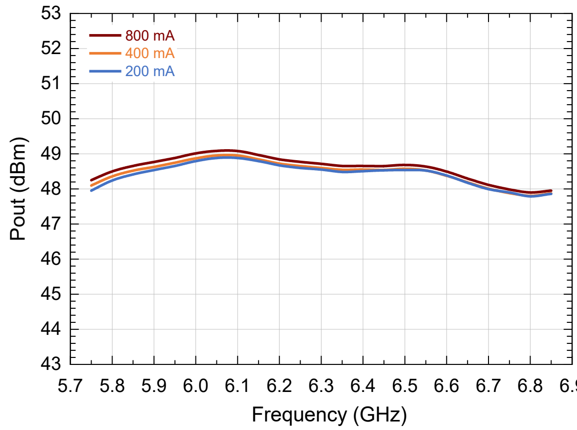
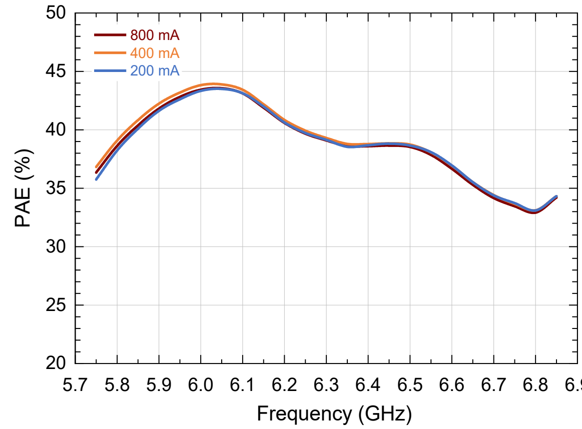
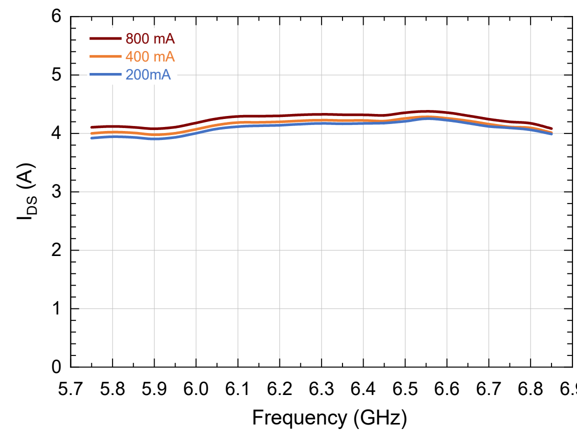
Output Power vs. Frequency and I_{DQ}



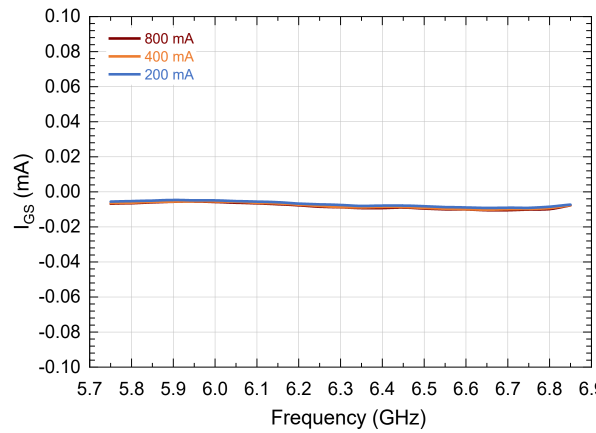
PAE vs. Frequency and I_{DQ}



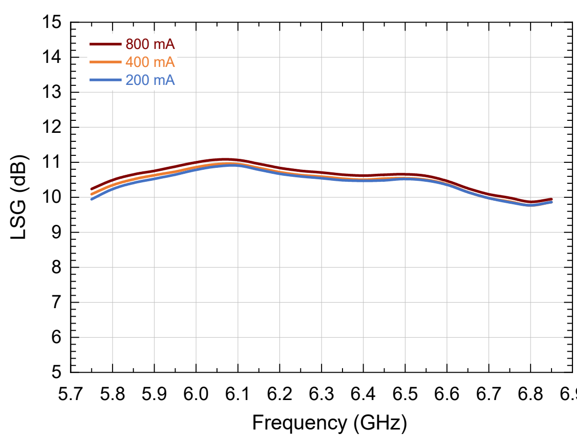
Drain Current vs. Frequency and I_{DQ}



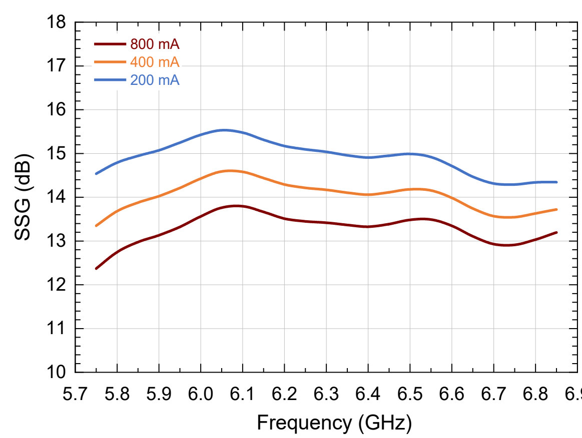
Gate Current vs. Frequency and I_{DQ}



Large Signal Gain vs. Frequency and I_{DQ}



SSG (Pin = 20 dBm) vs. Frequency and I_{DQ}



Typical Performance Curves as Measured in the Evaluation Test Fixture:
CW, V_{DS} = 40 V, I_{DQ} = 400 mA, T_C = 25°C (Unless Otherwise Noted)
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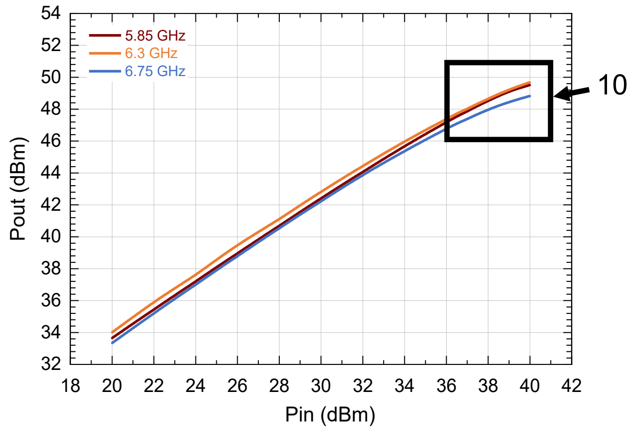
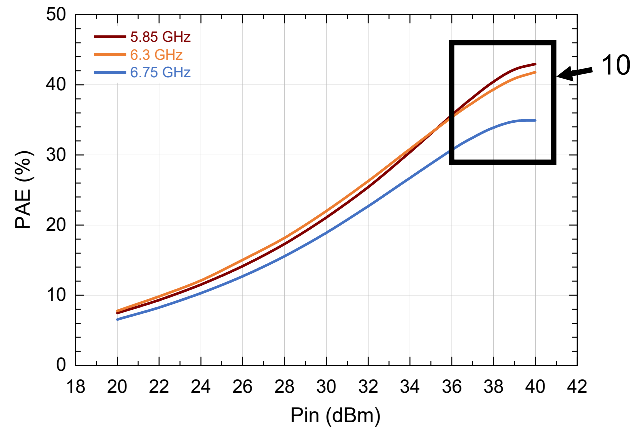
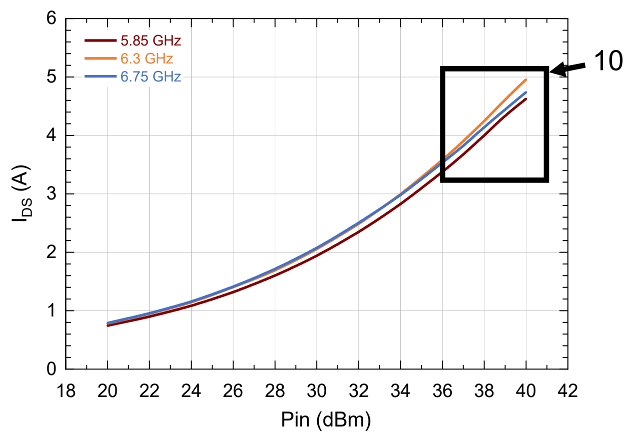
Output Power vs. Input Power and Frequency



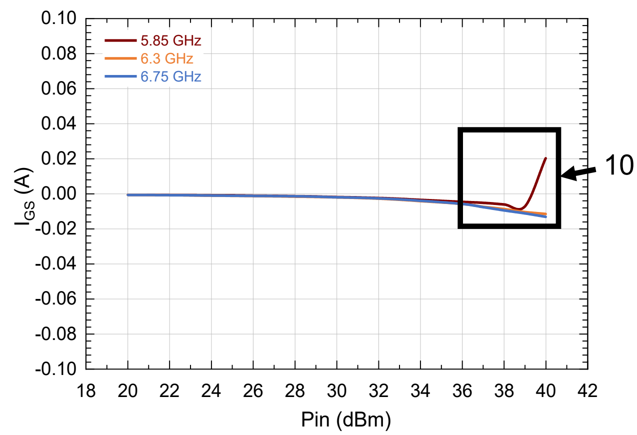
PAE vs. Input Power and Frequency



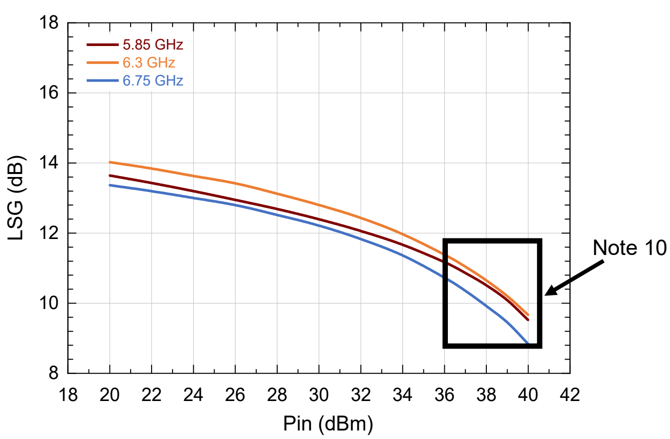
Drain Current vs. Input Power and Frequency



Gate Current vs. Input Power and Frequency



Large Signal Gain vs. Input Power and Frequency



10. Part would exceed recommended maximum channel temperature at 75°C case temperature, if operated in this region.

Typical Performance Curves as Measured in the Evaluation Test Fixture:

CW, Two Tone, Po = 41 dBm S.C.L, V_{DS} = 40 V, I_{DQ} = 400 mA, T_C = 25°C (Unless Otherwise Noted)
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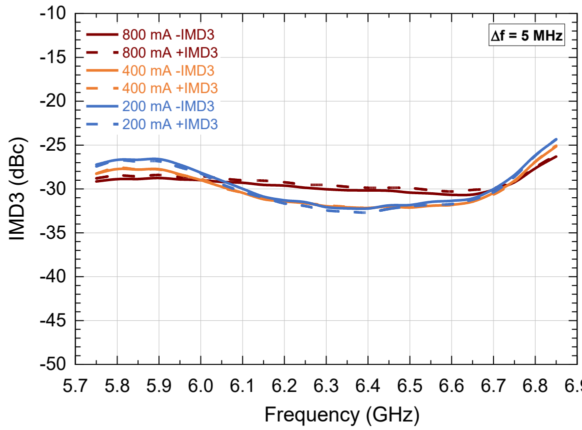
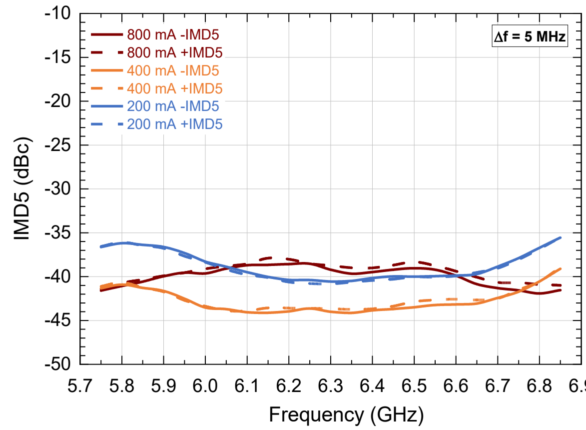
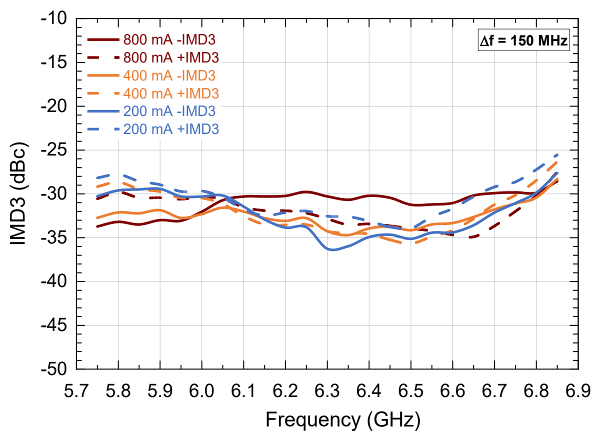
IMD3 vs. Frequency and I_{DQ}



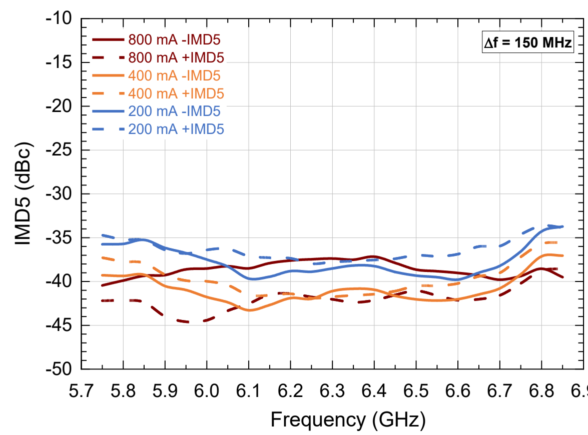
IMD5 vs. Frequency and I_{DQ}



IMD3 vs. Frequency and I_{DQ}

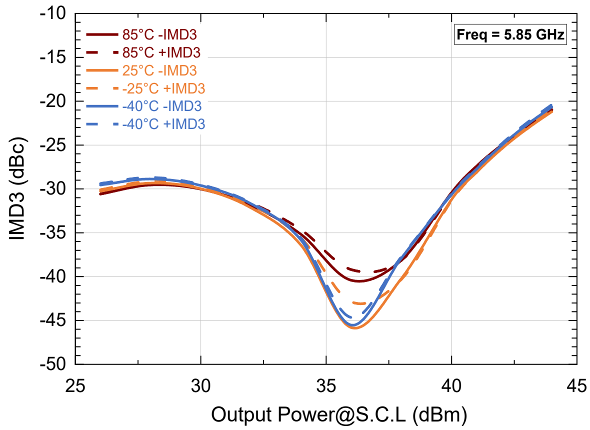


IMD5 vs. Frequency and I_{DQ}

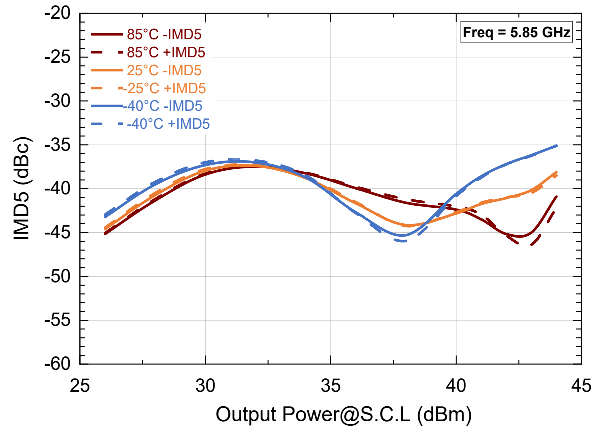


Typical Performance Curves as Measured in the Evaluation Test Fixture:
CW, Two Tone, ΔF = 5 MHz, V_{DS} = 40 V, I_{DQ} = 400 mA, T_C = 25°C (Unless Otherwise Noted)
For Engineering Evaluation Only - This data does not Modify MACOM's Datasheet Limits.

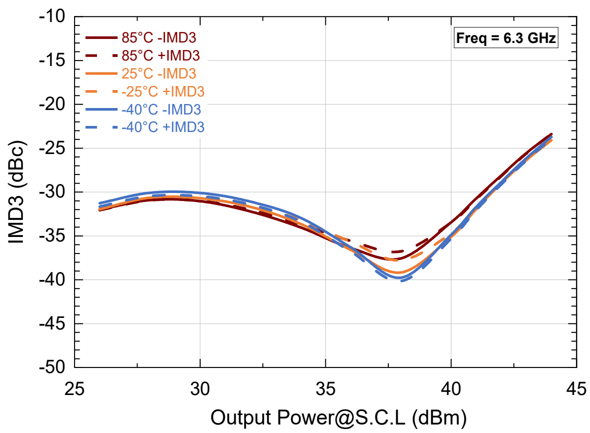
IMD3 vs. Output Power @ S.C.L and Temperature



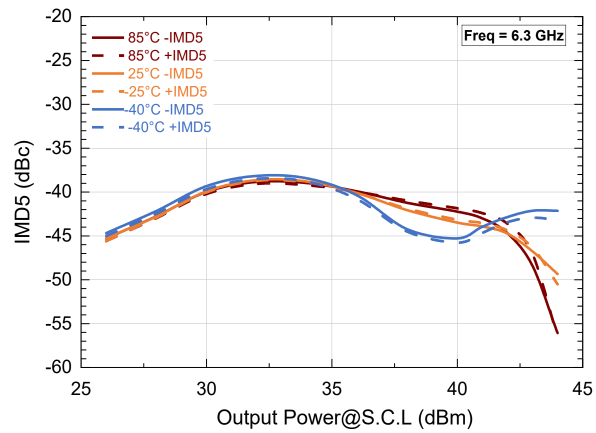
IMD5 vs. Output Power @ S.C.L and Temperature



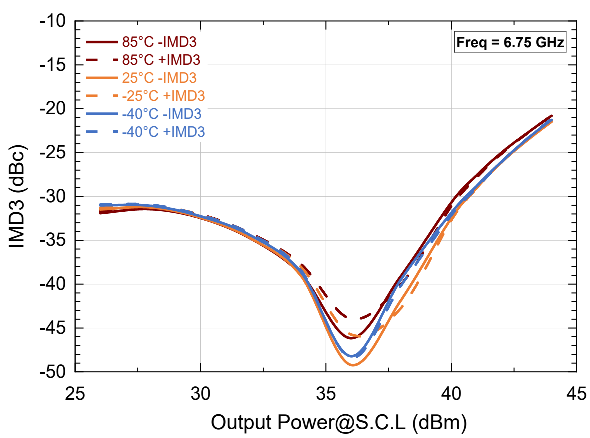
IMD3 vs. Output Power @ S.C.L and Temperature



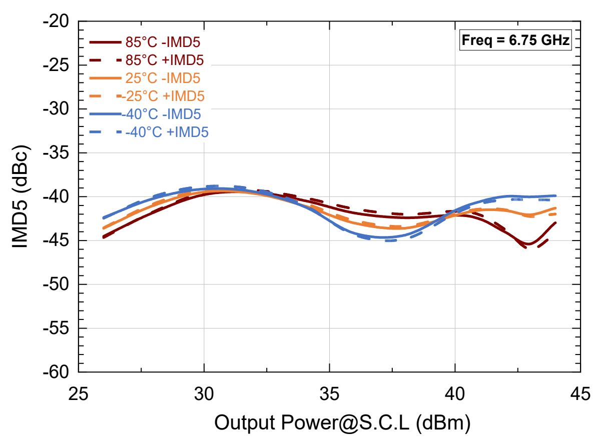
IMD5 vs. Output Power @ S.C.L and Temperature



IMD3 vs. Output Power @ S.C.L and Temperature

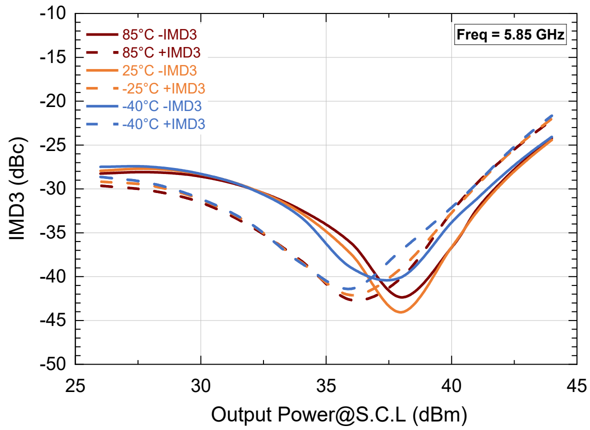


IMD5 vs. Output Power @ S.C.L and Temperature

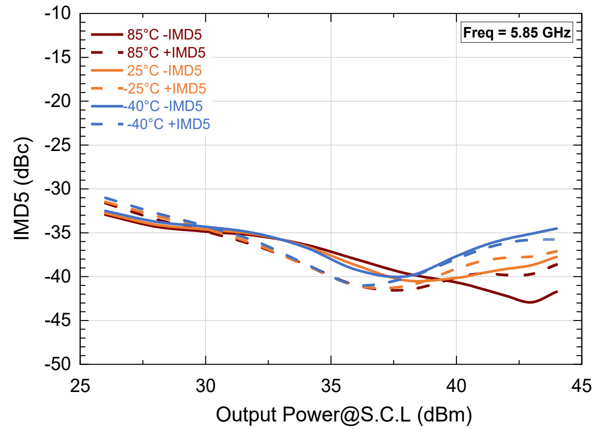


Typical Performance Curves as Measured in the Evaluation Test Fixture:
CW, Two Tone, ΔF = 150 MHz, V_{DS} = 40 V, I_{DQ} = 400 mA, T_C = 25°C (Unless Otherwise Noted)
For Engineering Evaluation Only - This data does not Modify MACOM's Datasheet Limits.

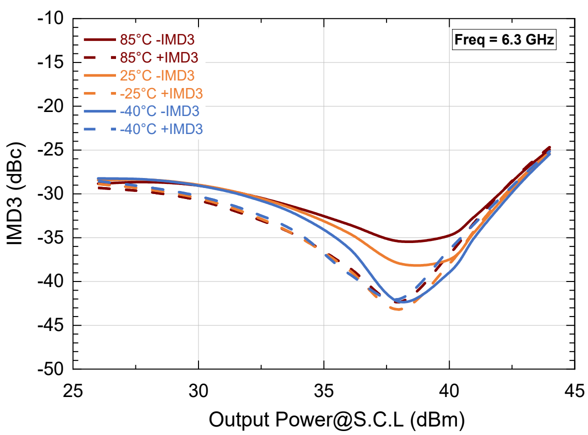
IMD3-2 vs. Output Power @ S.C.L and Temperature



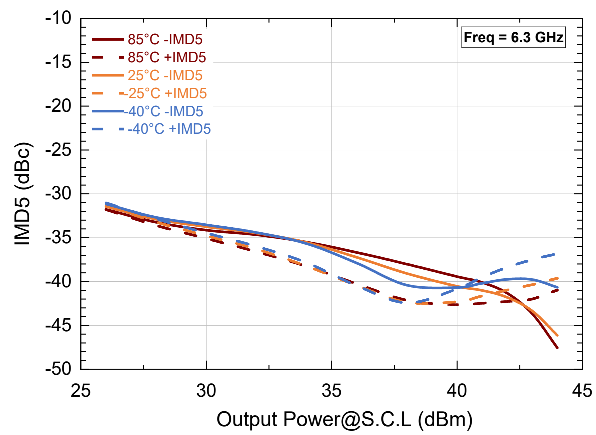
IMD5-2 vs. Output Power @ S.C.L and Temperature



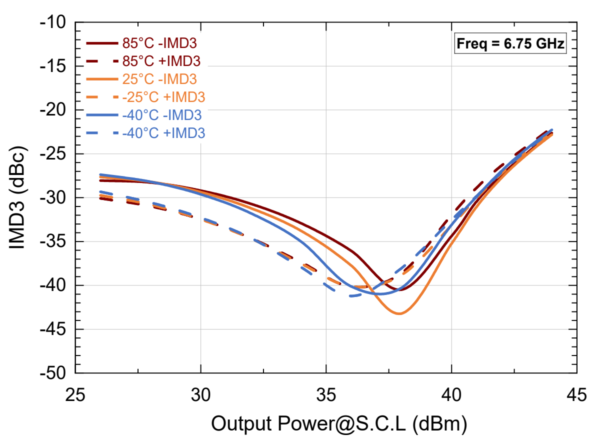
IMD3-2 vs. Output Power @ S.C.L and Temperature



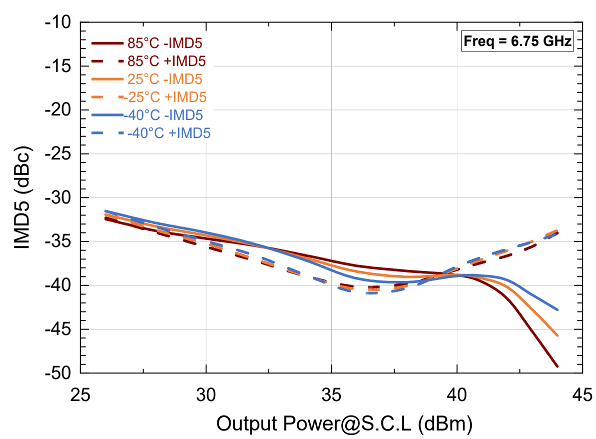
IMD5-2 vs. Output Power @ S.C.L and Temperature



IMD3-2 vs. Output Power @ S.C.L and Temperature



IMD5-2 vs. Output Power @ S.C.L and Temperature



Typical Performance Curves as Measured in the Evaluation Test Fixture:
CW, Two Tone, Po = 41 dBm S.C.L, V_{DS} = 40 V, I_{DQ} = 400 mA (Unless Otherwise Noted)
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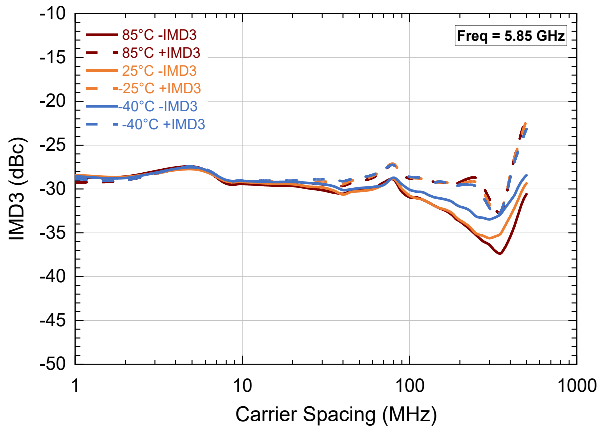
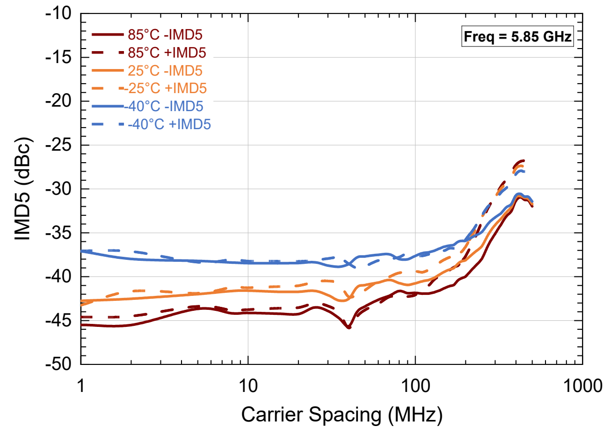
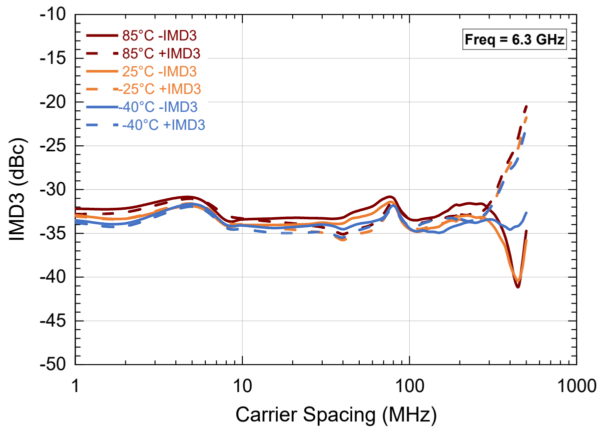
IMD3 vs. Two-Tone Spacing and Temperature



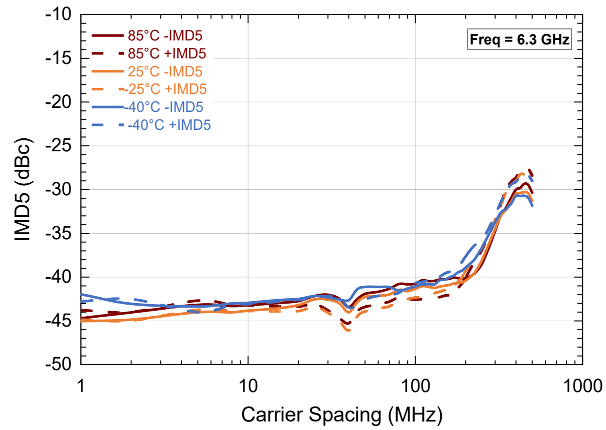
IMD5 vs. Two-Tone Spacing and Temperature



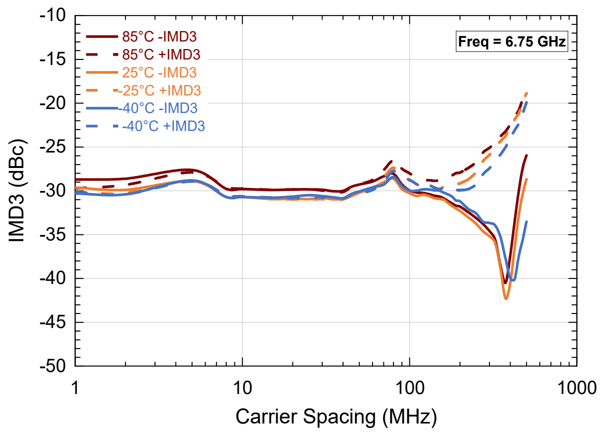
IMD3 vs. Two-Tone Spacing and Temperature



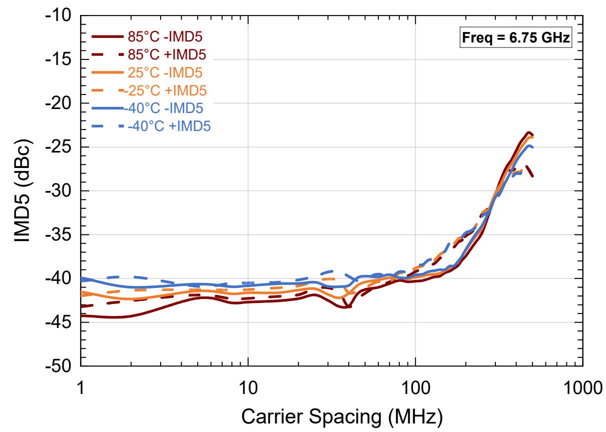
IMD5 vs. Two-Tone Spacing and Temperature



IMD3 vs. Two-Tone Spacing and Temperature



IMD5 vs. Two-Tone Spacing and Temperature

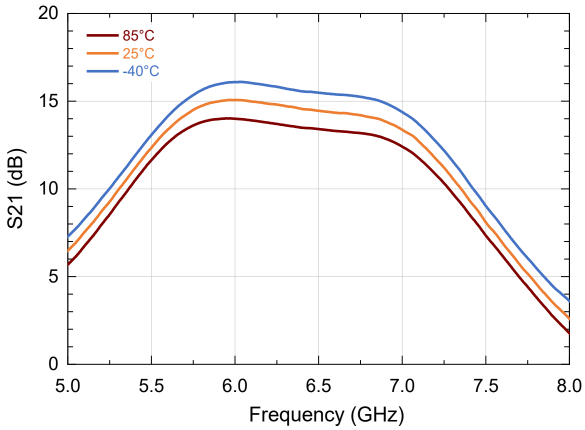


Typical Performance Curves as Measured in the Evaluation Test Fixture:

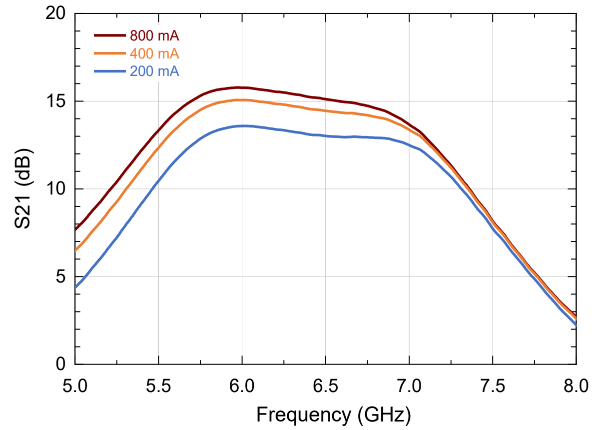
V_{DS} = 40 V, I_{DQ} = 400 mA, T_C = 25°C (Unless Otherwise Noted)

For Engineering Evaluation Only—This data does not Modify MACOM's Datasheet Limits.

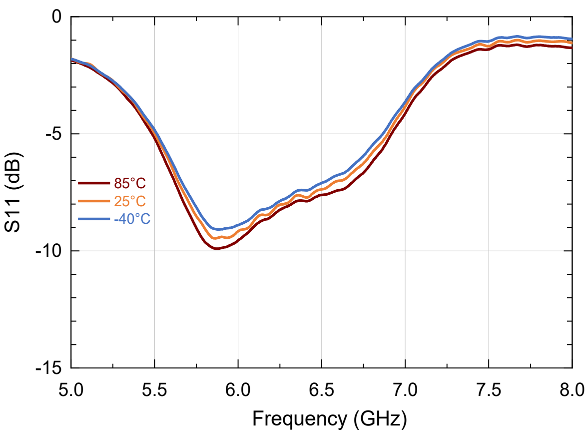
S21 vs Frequency and Temperature



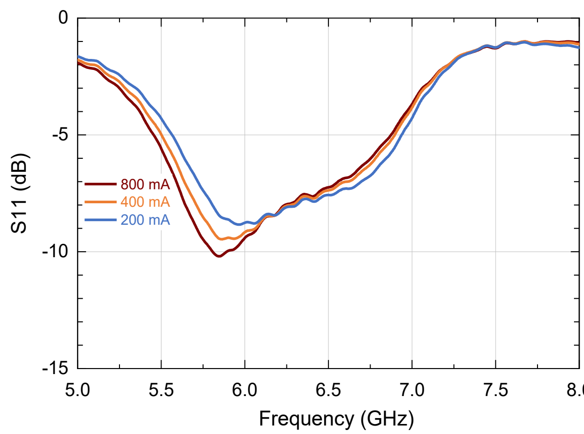
S21 vs Frequency and I_{DQ}



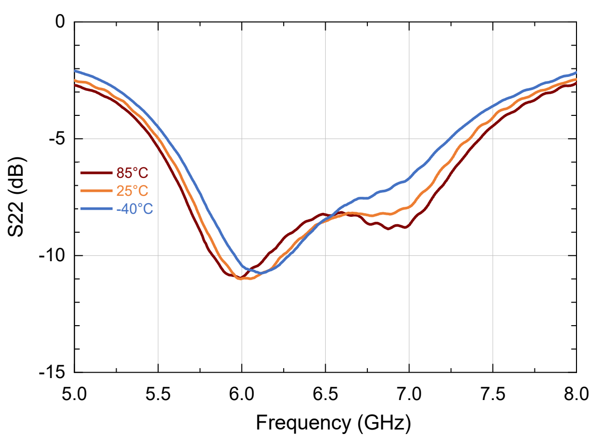
S11 vs Frequency and Temperature



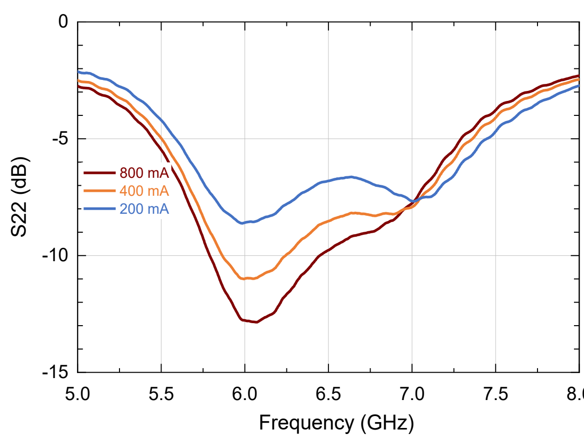
S11 vs Frequency and I_{DQ}



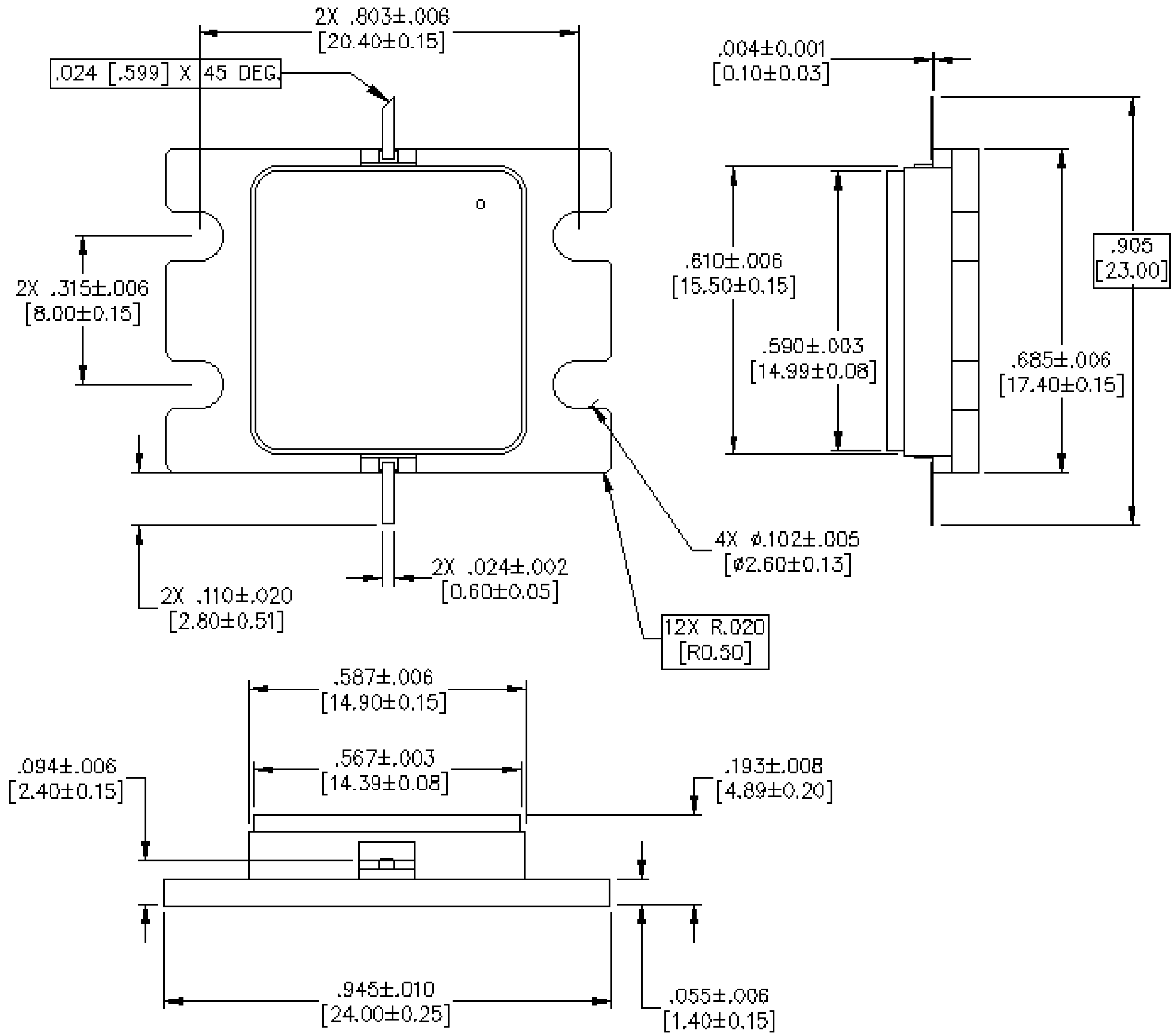
S22 vs Frequency and Temperature



S22 vs Frequency and I_{DQ}



Lead-Free Package Dimensions†



NOTES:

1. ALL DIMENSIONS SHOWN AS in[mm]. CONTROLLING DIMENSIONS ARE IN in AND CONVERTED mm DIMENSIONS ARE NOT NECESSARILY EXACT.
2. ALL TOLERANCES ARE ±.005 [0.13] UNLESS OTHERWISE NOTED
3. LEAD FINISH: AU
   FLANGE FINISH: AU
   LID MATERIAL: LCP
4. LID SEAL EPOXY MAY FLOW OUT A MAXIMUM OF .020 [0.51] FROM EDGE OF LID
5. LID MAY BE MIS-ALIGNED UP TO .010 [0.25] FROM PACKAGE IN ANY DIRECTION