GaN on SiC Amplifier, 1200 W, 65 V
1.2 - 1.4 GHz

MACOM PURE CARBIDE

MAPC-A1558-AB
Rev. V3

Features

- Saturated Power: 1200 W
- Drain Efficiency: 68%
- Small Signal Gain: 16 dB
- Lead-Free Air Cavity Ceramic Package
- RoHS* Compliant

AC-780B-2

Applications

- Avionics - TACAN, DME, IFF
- L-band Radar
- General Amplification

Description

The MAPC-A1558-AB is an 1200W packaged, partially-matched amplifier. The MAPC-A1558-AB operates up to 1.4 GHz and supports both defense and commercial-related avionics and radar applications. Under 65 V operation, the MAPC-A1558-AB typically achieves 1200 W of saturated output power with 16 dB of large signal gain and 68% drain efficiency via a 1.2 - 1.4 GHz reference design.

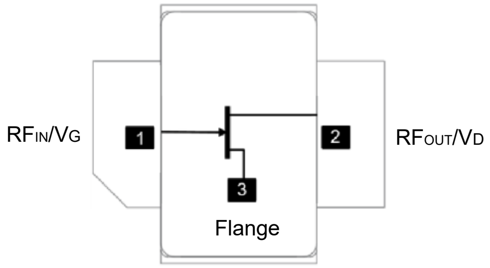
Packaged in a thermally-enhanced, flange package, the MAPC-A1558-AB provides superior performance under long pulse operation allowing customers to improve SWaP-C benchmarks in their next-generation systems.

Typical RF Performance:

- Pulsed measurement, P_{IN} = 45 dBm, V_{DS} = 65 V, I_{DQ} = 800 mA, T_C = 25°C

Frequency (GHz)	Output Power (dBm)	Gain (dB)	η_D (%)
1.2	61.0	16.0	70.7
1.3	60.9	15.9	68.6
1.4	60.6	15.6	67.5

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[1]	Ground / Source

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

Ordering Information

Part Number	MOQ Increment
MAPC-A1558-AB000	Bulk Quantity: Bolt-down
MAPC-A1558-ABSB1	Sample Board: Bolt-down

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

RF Electrical Characteristics: Freq. = 1.2 - 1.4 GHz, T_C = 25°C, V_{DS} = 65 V, I_{DQ} = 800 mA
Note: Performance in MACOM Evaluation Test Fixture, 50 Ω system

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Output Power	Pulsed, P_{IN} = 45 dBm	P_{OUT}	-	60.9	-	dBm
Drain Efficiency	Pulsed, P_{IN} = 45 dBm	DE	-	68.6	-	%
Large Signal Gain	Pulsed, P_{IN} = 45 dBm	G_P	-	15.9	-	dB
Small Signal Gain	CW, P_{IN} = -20 dBm	S21	-	17.8	-	dB
Input Return Loss	CW, P_{IN} = -20 dBm	S11	-	-13	-	dB
Output Return Loss	CW, P_{IN} = -20 dBm	S22	-	-5.8	-	dB
Output Mismatch Stress	V_{DD} = 65 V, I_{DQ} = 800 mA, P_{IN} = 46 dBm	ψ	VSWR =10:1, No Device Damage			

RF Electrical Specifications[1] : Freq. = 1.2 and 1.4 GHz, Pulse Width 100 µs, 10% Duty Cycle, P_{IN} = 45 dBm, T_A = +25°C, V_{DS} = 65 V, I_{DQ} = 800 mA

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Units
Output Power	1.2 GHz 1.4 GHz	P_{OUT}	1170 1080	1280 1240	—	W
Drain Efficiency	1.2 GHz 1.4 GHz	η	71 65	73 70	—	%
Power Gain	1.2 GHz 1.4 GHz	G_P	15.6 15.4	16.0 16.0	—	dB

1. Final testing and screening for all transistor sales is performed using the MAPC-A1558-AB production test fixture at 1.2 GHz and 1.4 GHz.

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_{DLK}	-	-	36.92	mA
Gate-Source Leakage Current	V_{GS} = -8 V, V_{DS} = 10 V	I_{GLK}	-36.92	-	-	mA
Gate Threshold Voltage	V_{DS} = 50 V, I_D = 132.8 mA	V_T	-3.8	-3.1	-2.3	V
Gate Quiescent Voltage	V_{DS} = 50 V, I_D = 800 mA	V_{GSQ}	-	-2.75	-	V

Absolute Maximum Ratings[2,3]

Parameter	Absolute Maximum
Drain-Source Voltage	195 V
Gate Voltage	-10 V, +2 V
Drain Current	24 A
Gate Current	133 mA
Input Power	47 dBm
Junction Temperature[4]	+225°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Mounting Temperature	+260°C

2. Exceeding any one or combination of these limits may cause permanent damage to this device.
3. MACOM does not recommend sustained operation near these survivability limits.
4. Operating at nominal conditions with $T_J \leq +225$ °C will ensure MTTF > 1 x 10^6 hours.

Thermal Characteristics

Parameter	Symbol	Test Conditions	Units	Rating
Operating Junction Temperature	T_J	Pulse Width = 100 µs , Duty Cycle = 10%, P_{DISS} = 650 W, T_C = 85°C	°C	183
Thermal Resistance, Junction to Case	$R_{\theta JC}$		°C/W	0.15

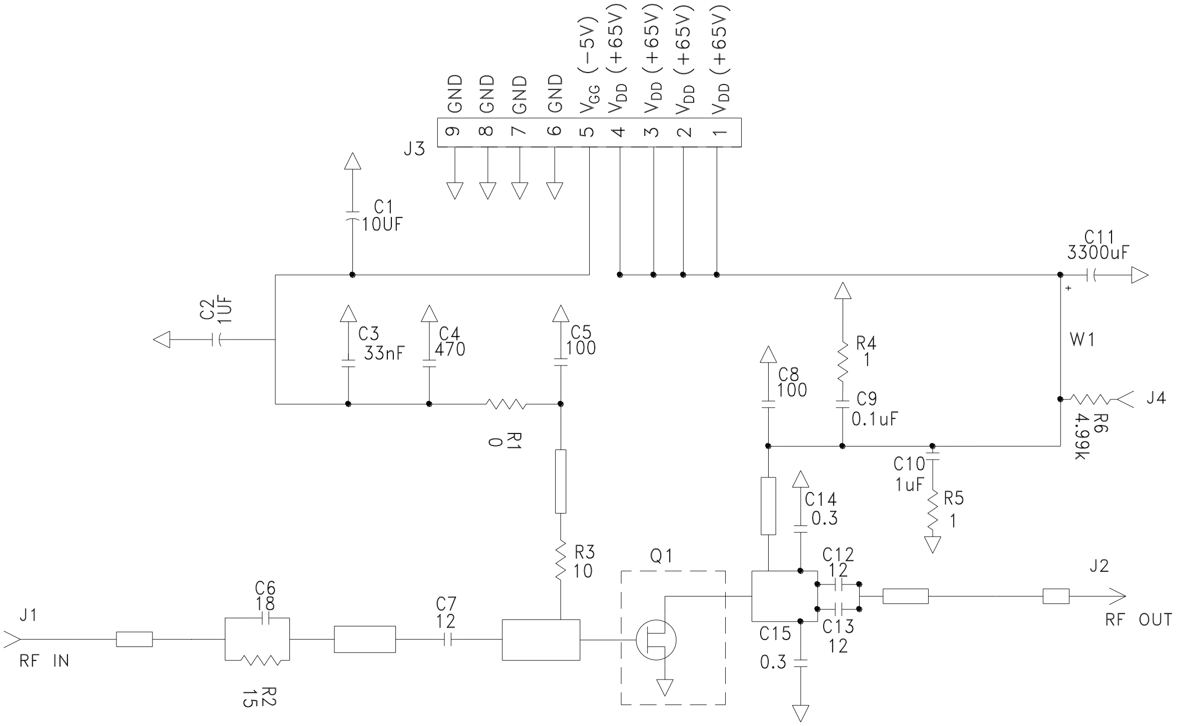
Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

These electronic devices 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 and CDM Class C3 devices.

Evaluation Test Fixture and Recommended Tuning Solution, 1.2 - 1.4 GHz



Description

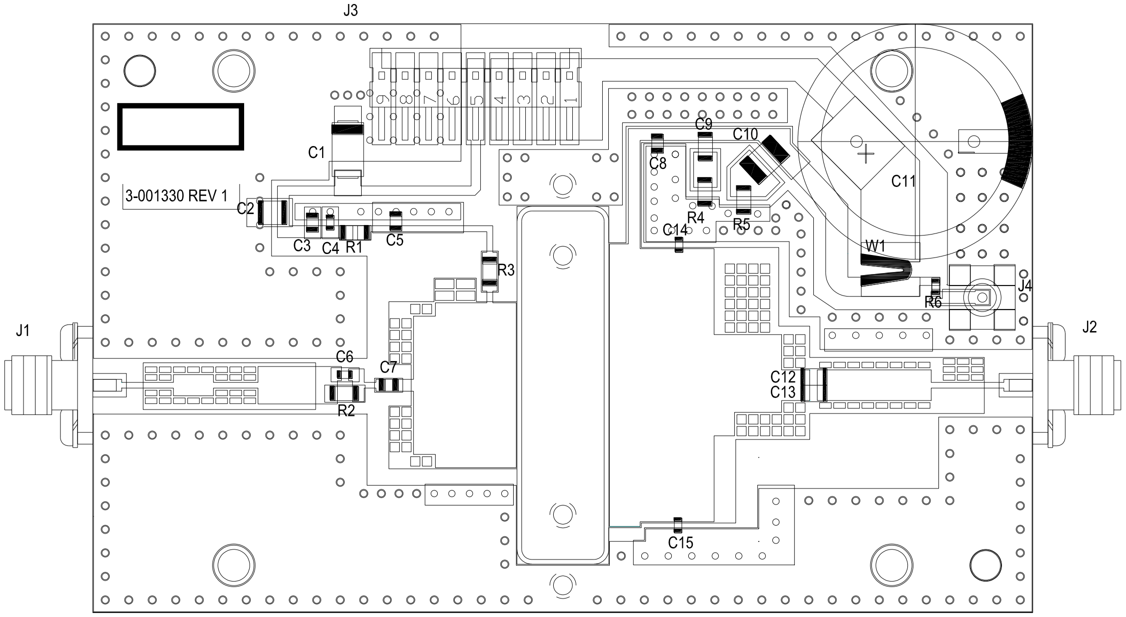
Parts measured on evaluation board (25-mil thick RO3010). Matching is provided using a combination of lumped elements and transmission lines as shown in the simplified schematic above. Recommended tuning solution component placement, transmission lines, and details are shown on the next page.

Biasing Sequence

Bias ON
1. Ensure RF is turned off
2. Apply pinch-off voltage of -5 V to the gate
3. Apply nominal drain voltage
4. Bias gate to desired quiescent drain current
5. Apply RF

Bias OFF
1. Turn RF off
2. Apply pinch-off voltage of -5 V to the gate
3. Turn-off drain voltage
4. Turn-off gate voltage

Evaluation Test Fixture and Recommended Tuning Solution, 1.2 - 1.4 GHz



Assembly Parts List

Reference Designator	Description	Manufacturer	Part Number
R1	RES, 1/4W, 1206, 1%, 0 OHM	KOA	RK73Z2BTTD
R2	RES, 15 Ohm, 5%, 1/4W, 1206	KOA	RK73B2BTTD150J
R3	RES, 10 OHM, 5%, 1/4W 1206	Bourns	CR1206-JX100 E LF
R4, R5	RES, 1 Ohm 5%, 1/4W, 1206	XICON	263-1.0-RC
R6	RES,1/16W,0603,1%,4.99K OHMS	Vishay	CRCW06034K99FKTA
C1	CAP 10UF 16V TANTALUM	Kemet	T496C106K016ATE2K0
C2, C10	CAP, 1.0UF, 100V, 10%, X7R, 1210	Murata	GRM32ER72A105KA01L
C3	CAP, 0.033UF, 100V, X7R, 0805	Murata	GRM21BR72A333KA01L
C4	CAP, 470pF, 0603, 250V, C0G	Murata	GCM1885C1H471JA16J
C5, C8	CAP, 100PF, +/-5%, 250V, 0805, ATC 600F	KAVX	600F101JT250XT
C6	CAP, 18pF, +/-5%, 250V, 0603, ATC 600S	KAVX	600S180JT250XT
C7	CAP, 12 PF, +/- 5%, 250V, 0805, ATC 600F	KAVX	600F120JT250XT
C9	CAP, 0.1UF, 250V, X7R, 1206	KEMET	C1206C104KARAC7800
C11	CAP, 3300 UF, +/-20%, 100V, ELECTROLYTIC	NICHICON	UFW2A332MRD
C12, C13	CAP, 12PF, +/- 2%,500V, ATC800B	KAVX	800B120GT500XT
C14, C15	CAP, 0.3PF, +/- 0.05pF, 0603, ATC 600S	KAVX	600S0R3AT250XT
J1,J2	CONN, SMA, PANEL MOUNT JACK, FLANGE, 4-HOLE, BLUNT POST	Amphenol RF	132150
J3	HEADER RT>PLZ .1CEN LK 9POS	AMP	640457-9
J4	CONNECTOR; SMB, Straight, JACK, SMD	JOHNSON	131-3711-201
Q1	MACOM GaN Power Amplifier		MAPC-A1558-AB
PCB	Rogers 3010, 25mil, 2 oz Cu		

Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture

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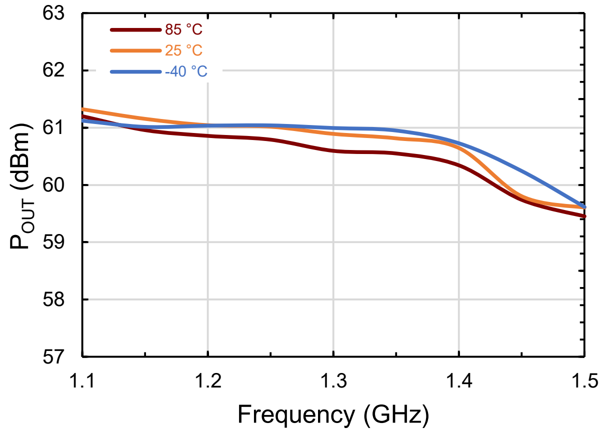
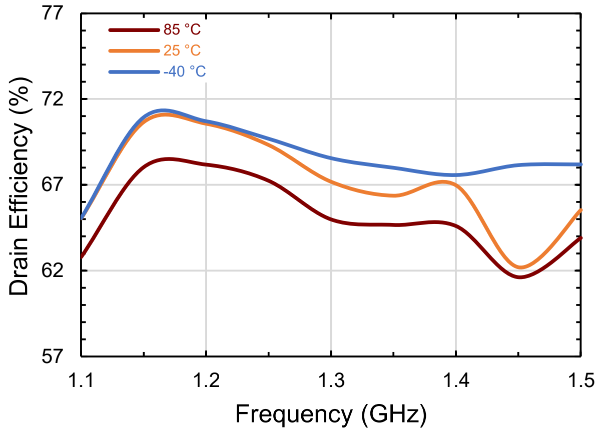
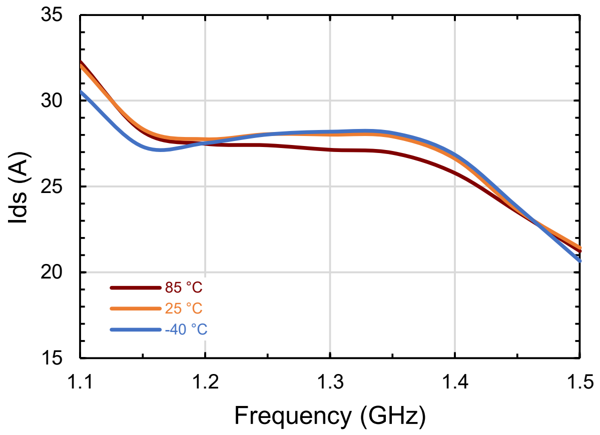
Output Power vs. Temperature and Frequency



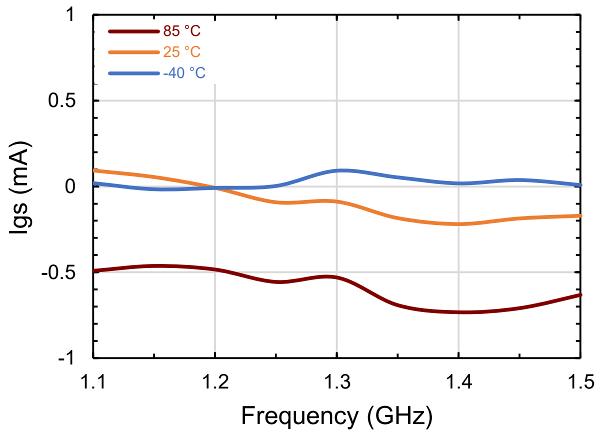
Drain Efficiency vs. Temperature and Frequency



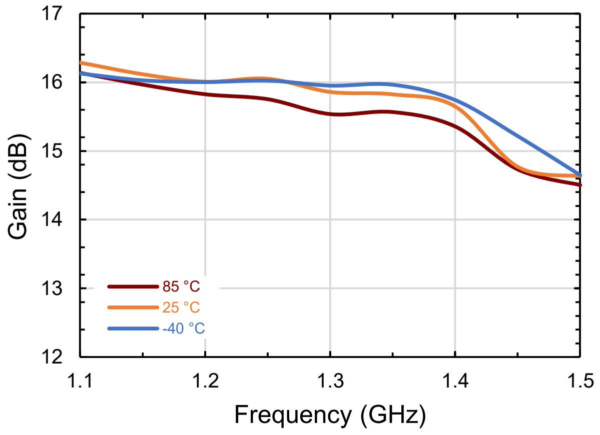
Drain Current vs. Temperature and Frequency



Gate Current vs. Temperature and Frequency



Large Signal Gain vs. Temperature and Frequency



Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture

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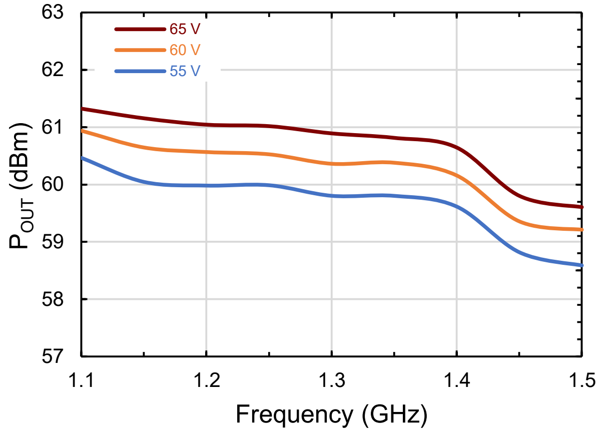
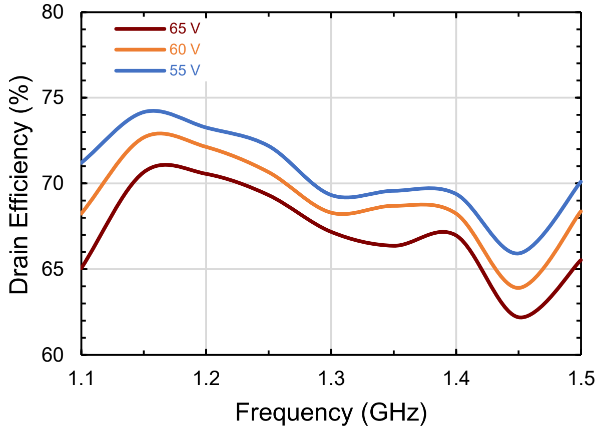
Output Power vs. V_{DS} and Frequency



Drain Efficiency vs. V_{DS} and Frequency



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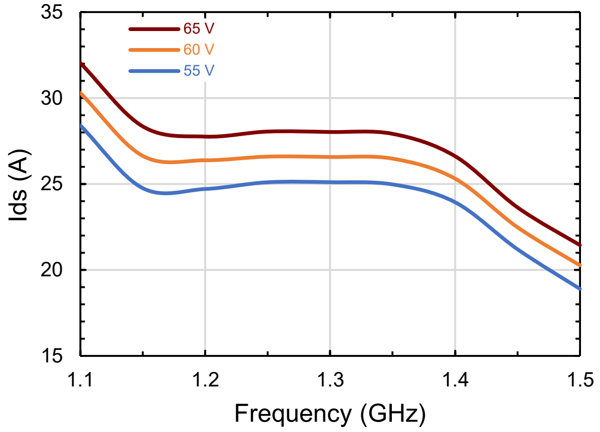
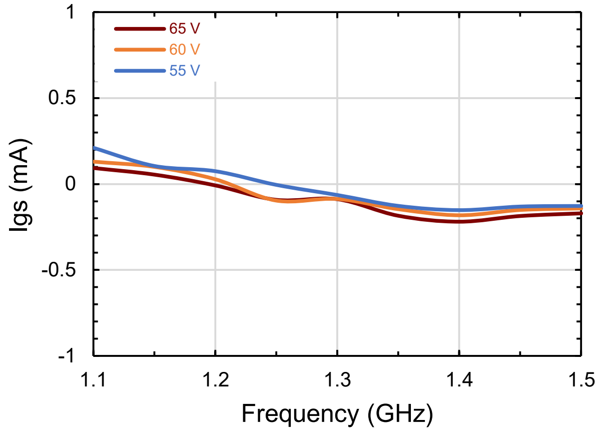


Gate Current vs. V_{DS} and Frequency



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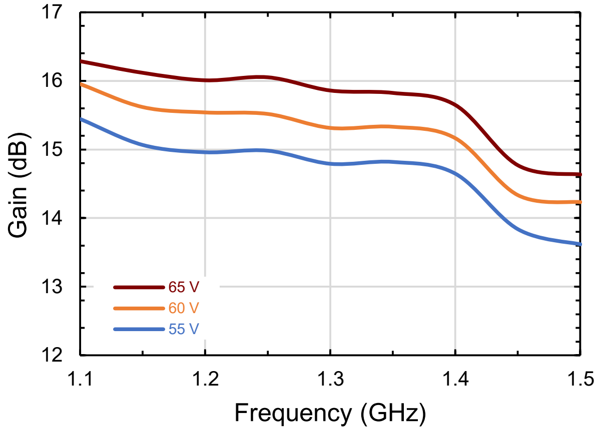

Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture

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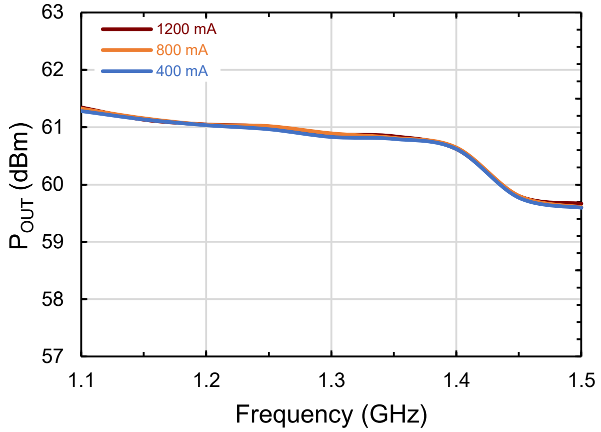
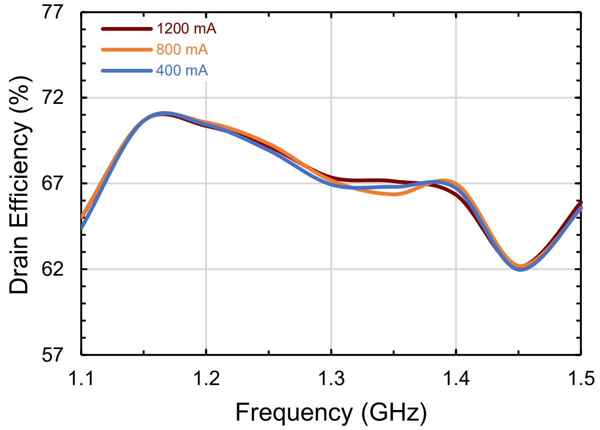
Output Power vs. I_{DQ} and Frequency



Drain Efficiency vs. I_{DQ} and Frequency



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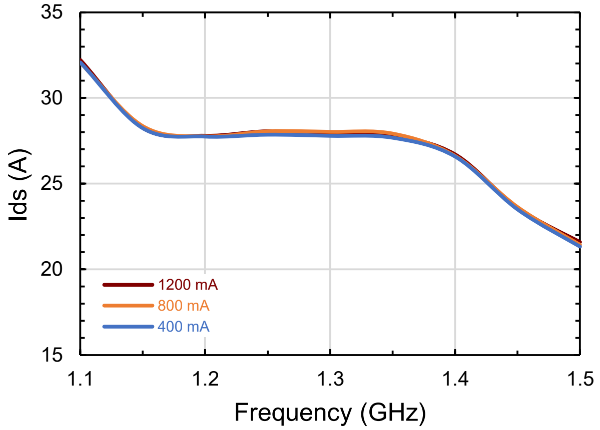
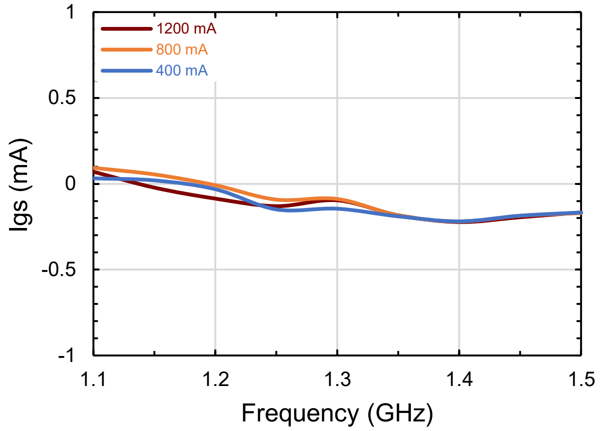


Gate Current vs. I_{DQ} and Frequency



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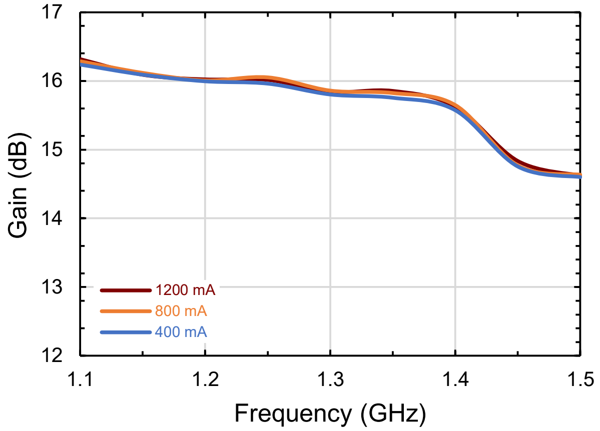

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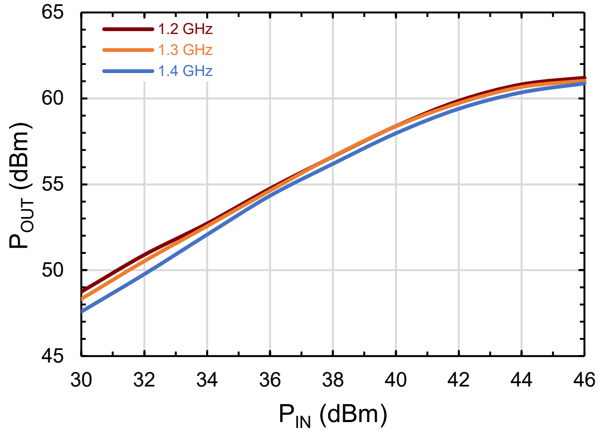
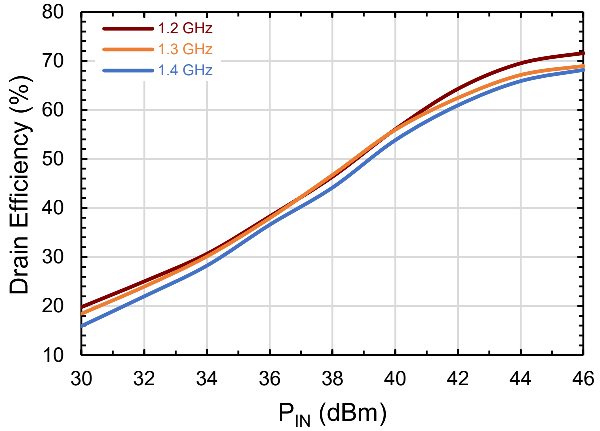
Output Power vs. Frequency and P_{IN}



Drain Efficiency vs. Frequency and P_{IN}



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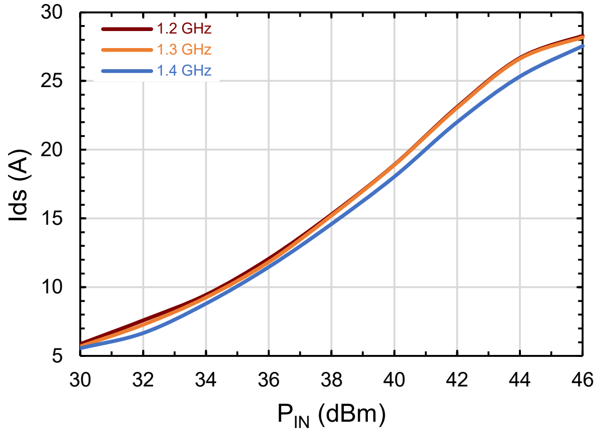

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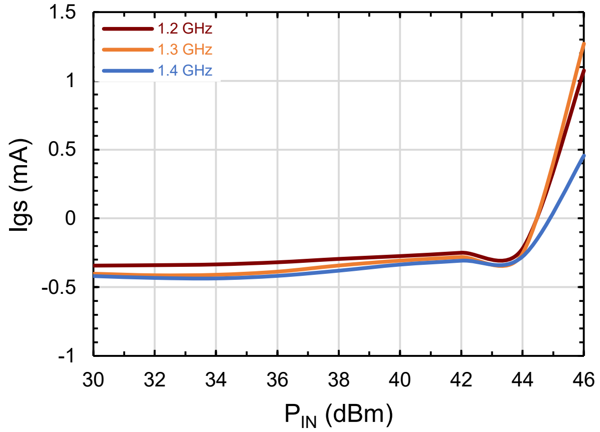

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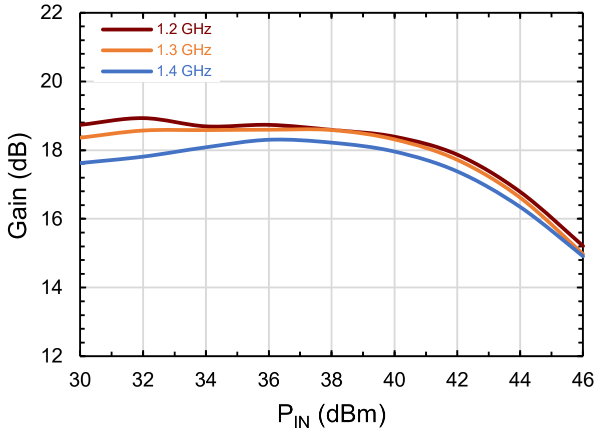

Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture

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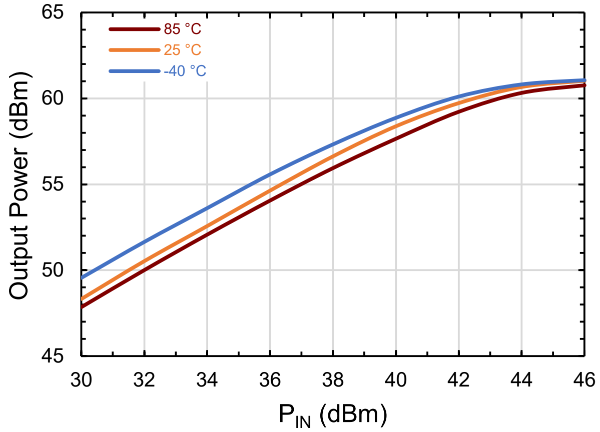
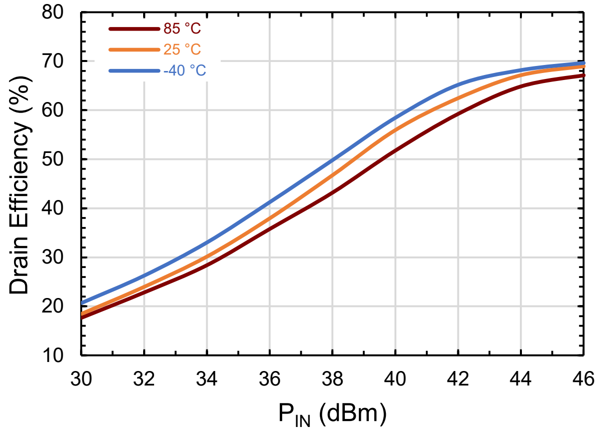
Output Power vs. Temperature and P_{IN}



Drain Efficiency vs. Temperature and P_{IN}



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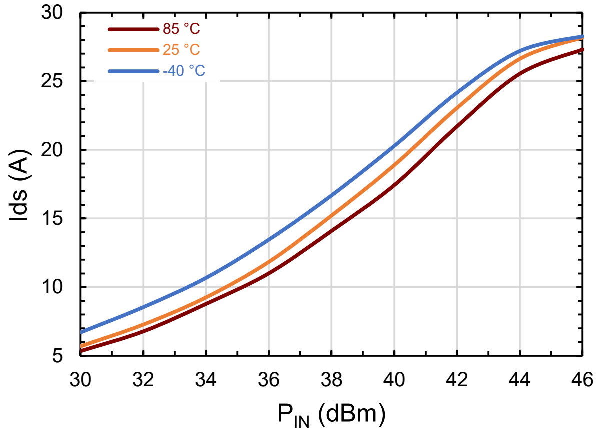
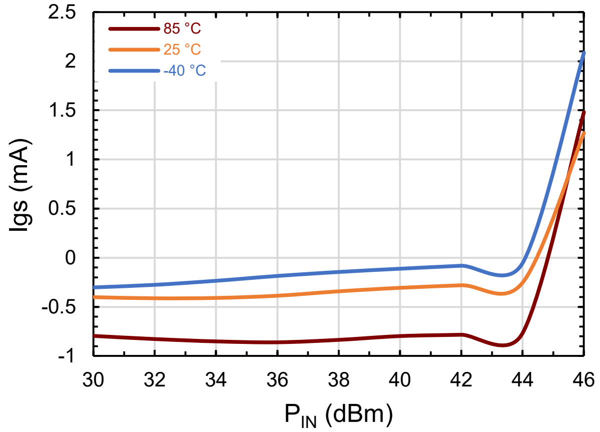
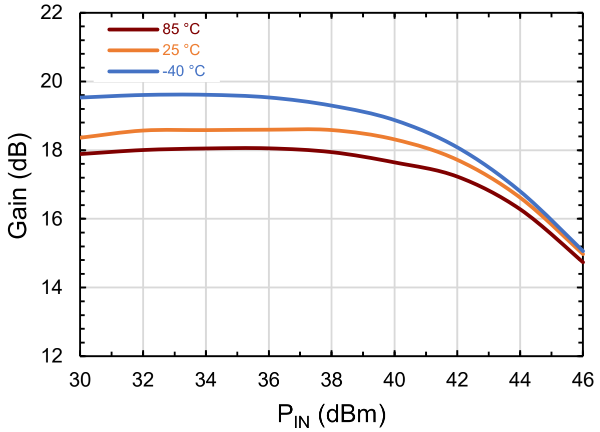


Gate Current vs. Temperature and P_{IN}



Large Signal Gain vs. Temperature and P_{IN}



Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture

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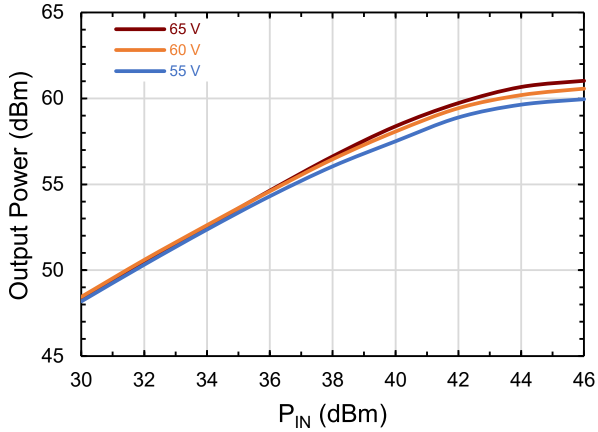
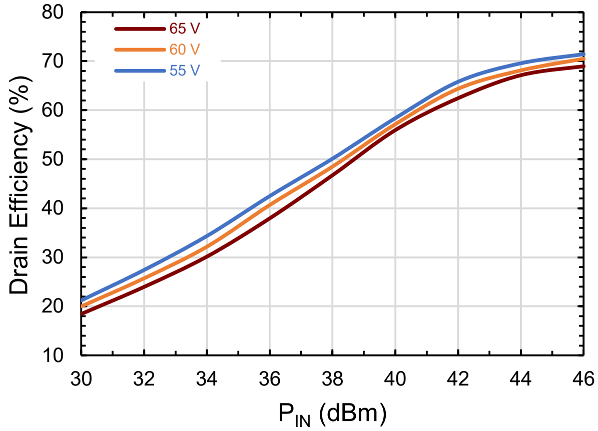
Output Power vs. V_{DS} and P_{IN}



Drain Efficiency vs. V_{DS} and P_{IN}



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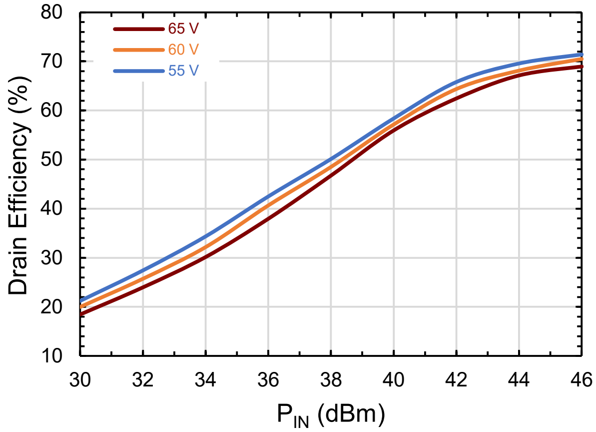

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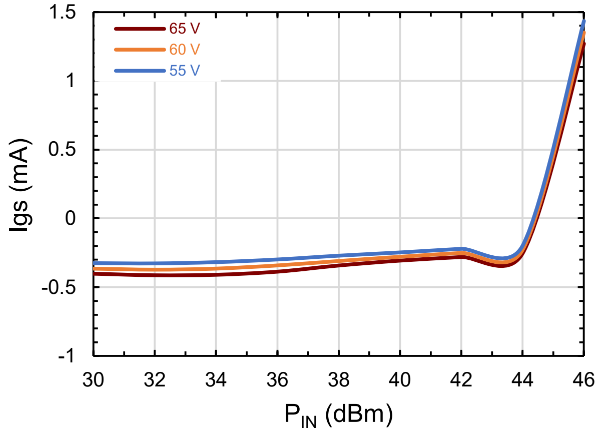

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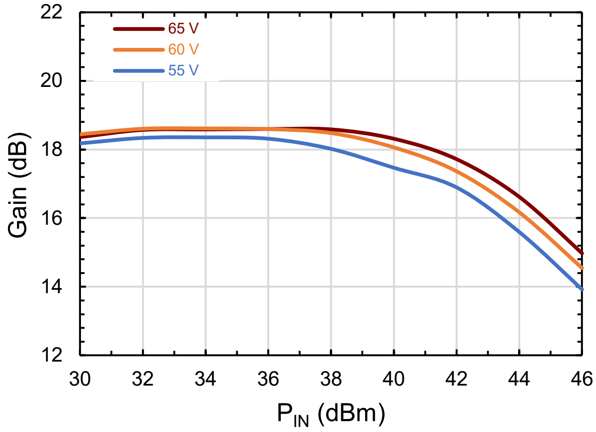

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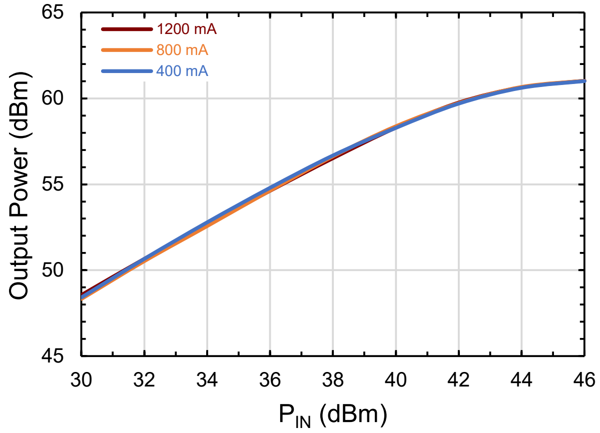
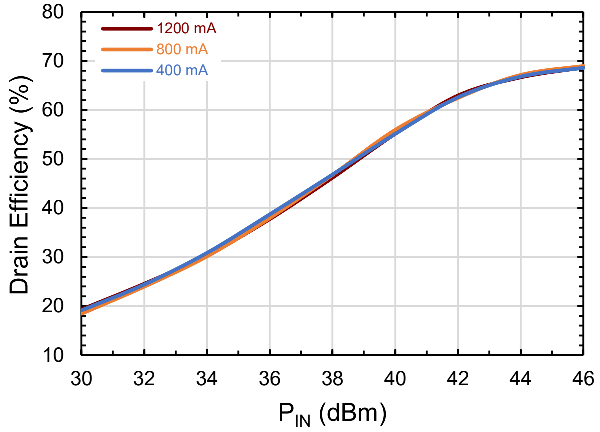


Drain Efficiency vs. I_{DQ} and P_{IN}



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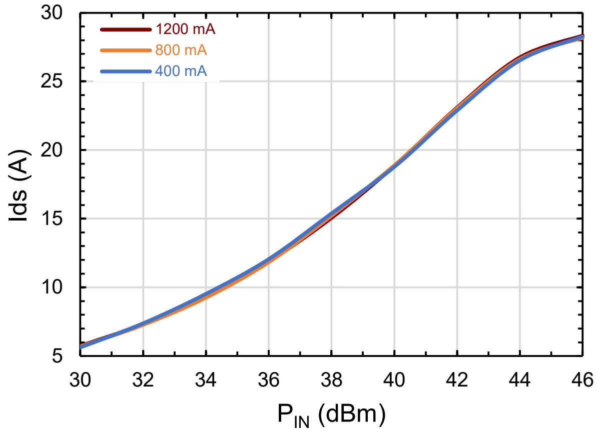

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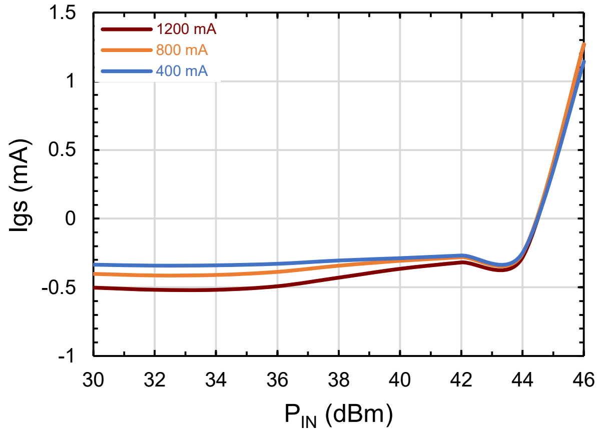
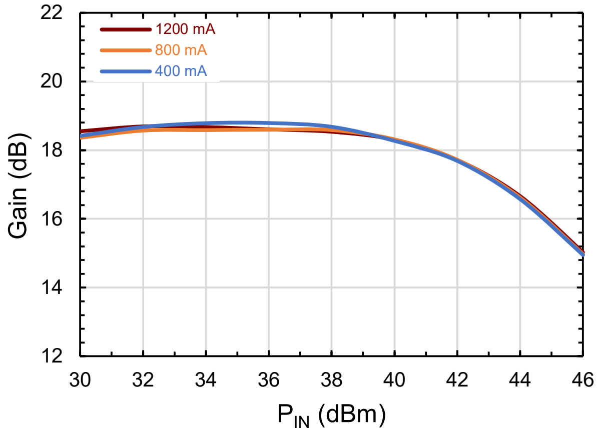


Large Signal Gain vs. I_{DQ} and P_{IN}



Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture

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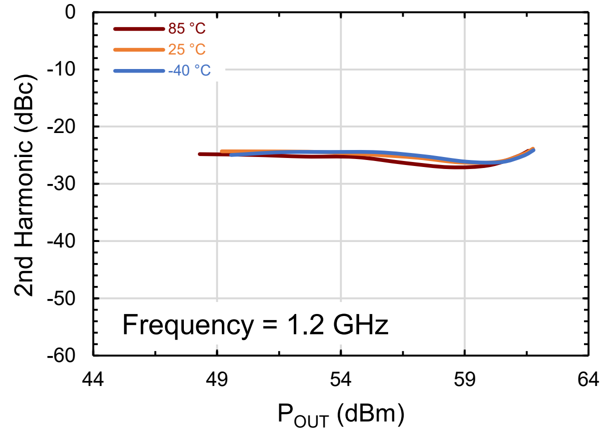
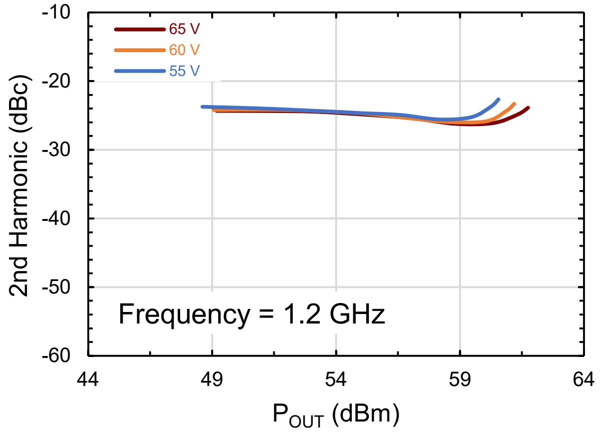
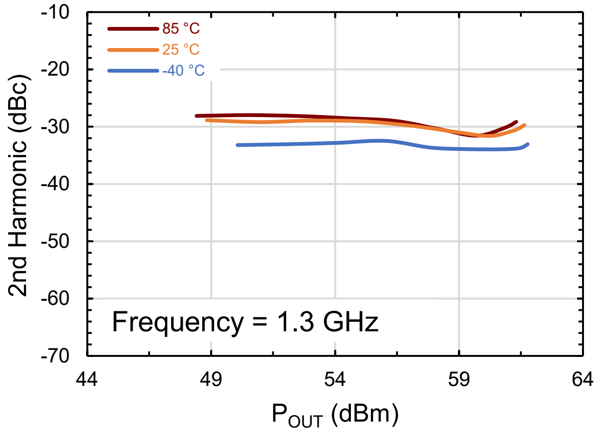
2^{nd} Harmonic vs. Temperature and P_{IN}



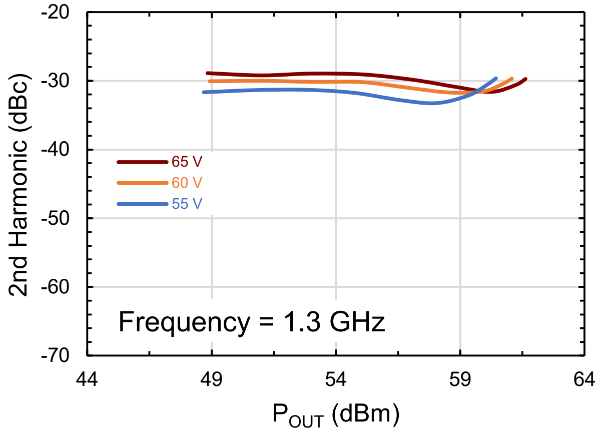
2^{nd} Harmonic vs. V_{DS} and P_{IN}



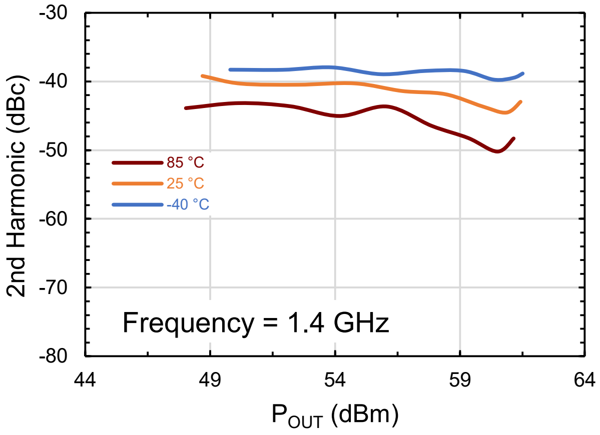
2^{nd} Harmonic vs. Temperature and P_{IN}



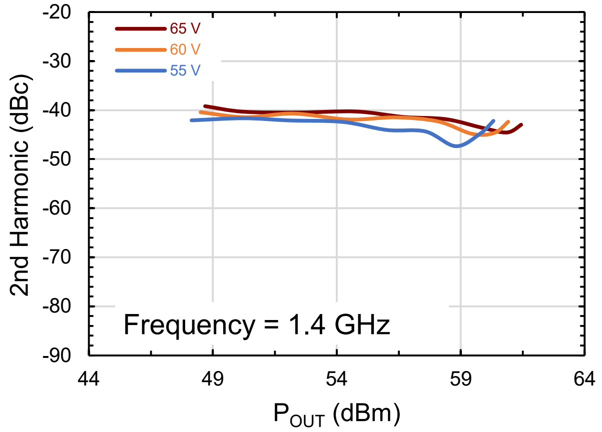
2^{nd} Harmonic vs. V_{DS} and P_{IN}



2^{nd} Harmonic vs. Temperature and P_{IN}



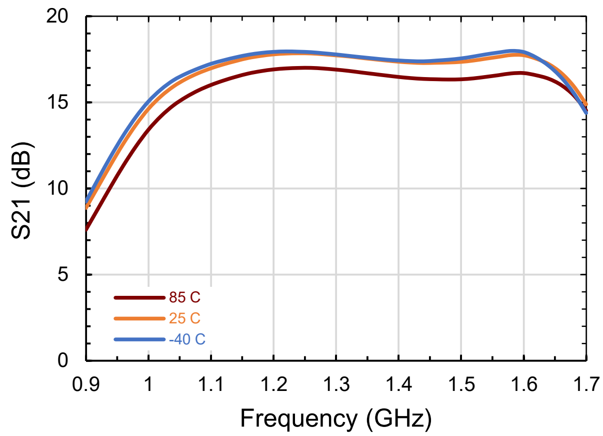
2^{nd} Harmonic vs. V_{DS} and P_{IN}



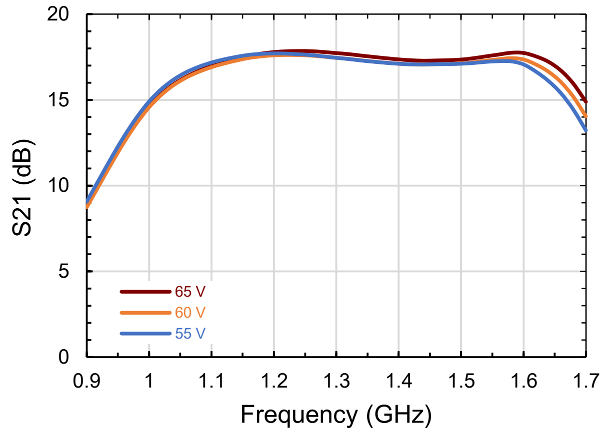
Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture:

CW, V_{DS} = 65 V, I_{DQ} = 800 mA, P_{IN} = -20 dBm (unless Otherwise Noted)
For Engineering Evaluation Only—This data does not Modify MACOM's Datasheet Limits.

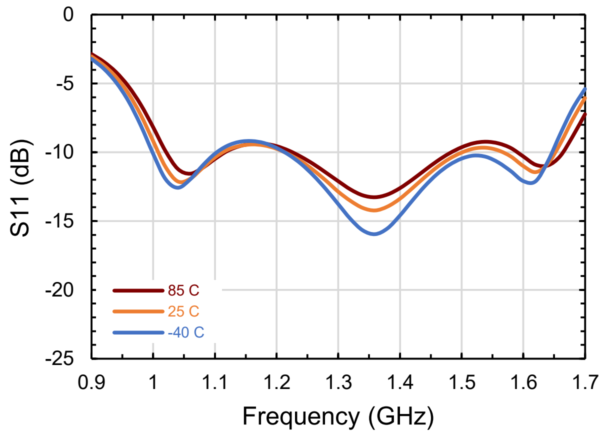
S21 vs Frequency and Temperature



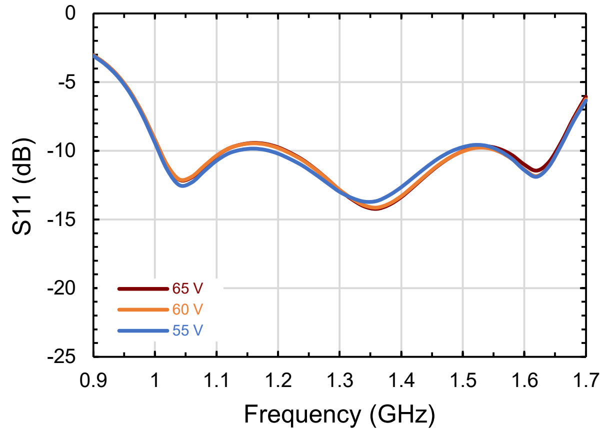
S21 vs Frequency and V_{DS}



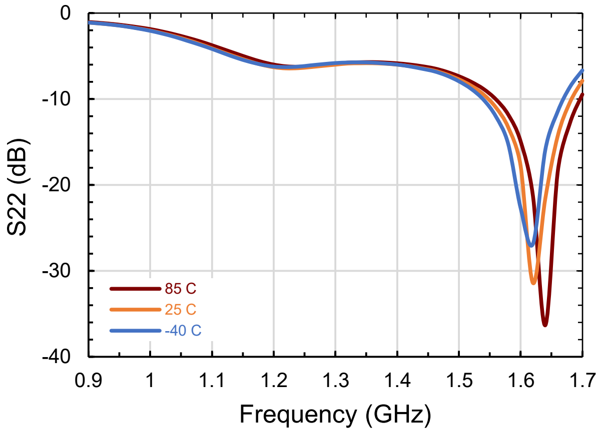
S11 vs Frequency and Temperature



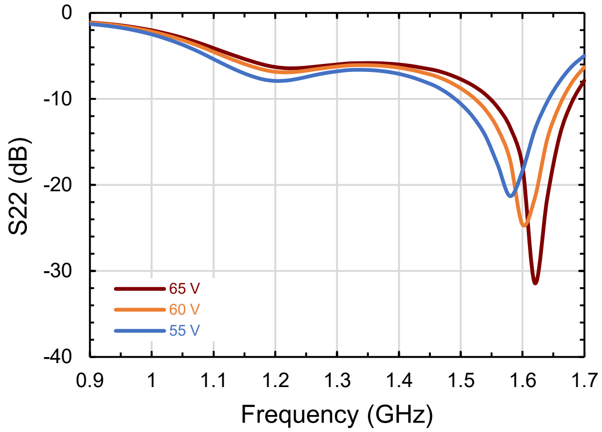
S11 vs Frequency and V_{DS}



S22 vs Frequency and Temperature



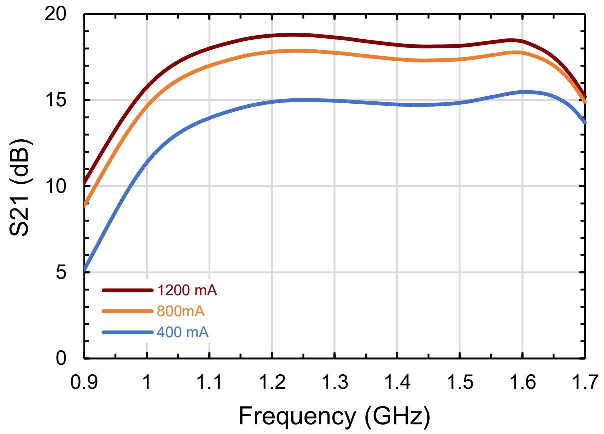
S22 vs Frequency and V_{DS}



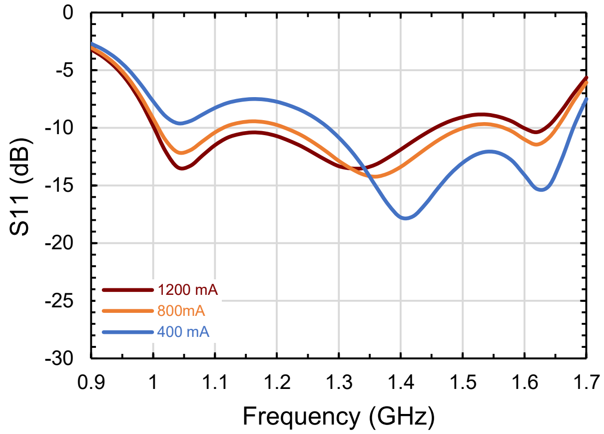
Typical Performance Curves as Measured in the 1.2 - 1.4 GHz Evaluation Test Fixture:

CW, V_{DS} = 65 V, I_{DQ} = 800 mA, P_{IN} = -20 dBm (unless Otherwise Noted)
For Engineering Evaluation Only—This data does not Modify MACOM's Datasheet Limits.

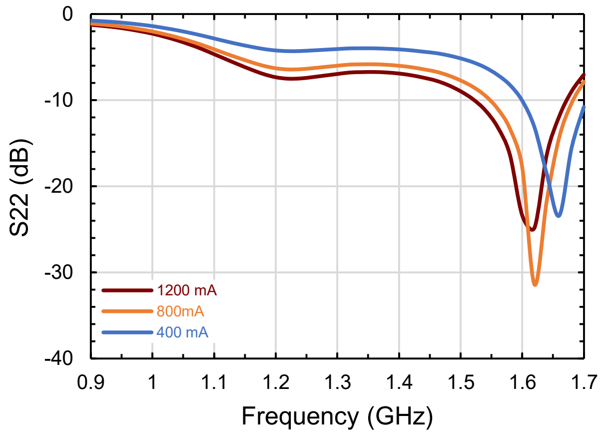
S21 vs Frequency and I_{DQ}



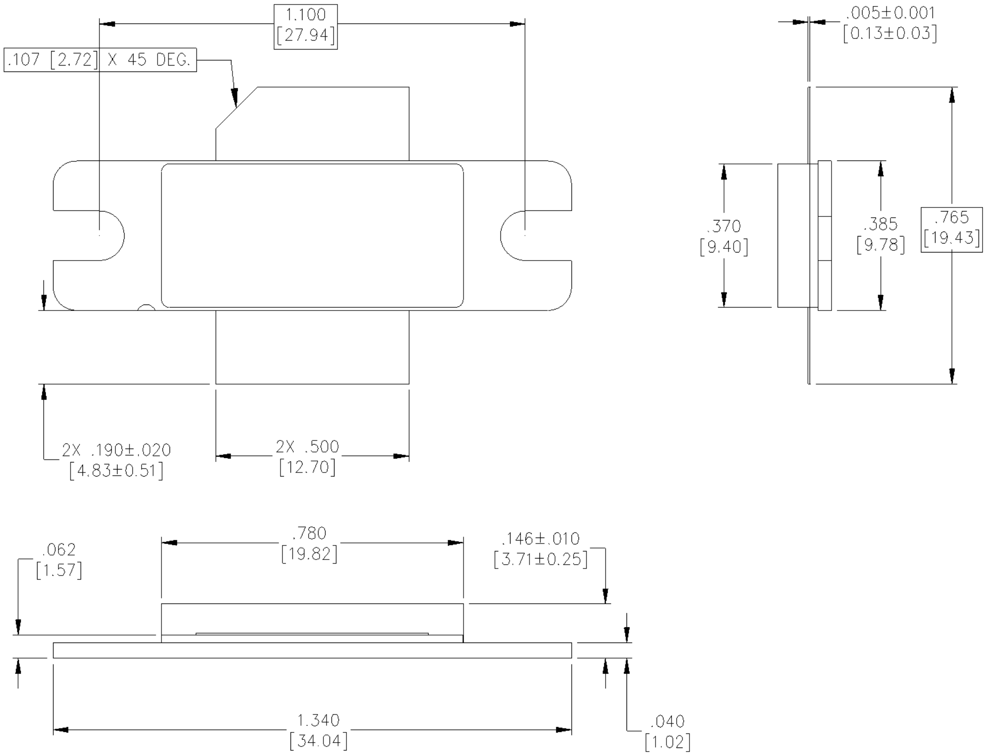
S11 vs Frequency and I_{DQ}



S22 vs Frequency and I_{DQ}



AC-780B-2 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
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

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