MMIC SURFACE MOUNT

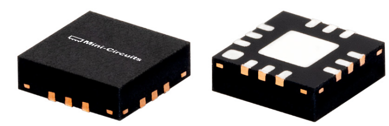
Power Amplifier

PMA3-43-1W+

50Ω 10 to 4000 MHz 1.5 W Output Power

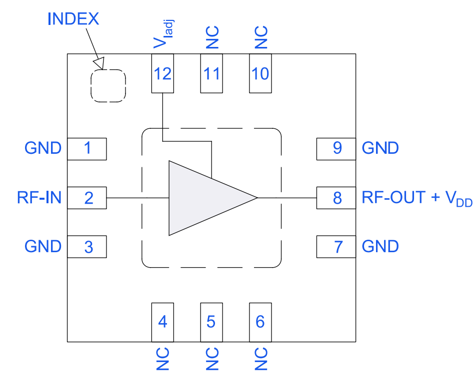
THE BIG DEAL

- High P1dB, Typ. +32.2 dBm
- High P_{SAT}, Typ. +32.6 dBm
- Low Noise Figure, Typ. 3.2 dB
- High OIP3, Typ. +37 dBm
- Single Supply Voltage, +12 V @ 190 mA
- 3x3 mm 12-Lead QFN-Style Package
- Patent Pending



Generic photo used for illustration purposes only

FUNCTIONAL DIAGRAM



APPLICATIONS

- Test and Measurement Equipment
- Radar, EW, and ECM Defense Systems
- 5G Sub6, MIMO Wireless Infrastructure Systems
- Microwave Radio & VSAT

PRODUCT OVERVIEW

The PMA3-43-1W+ is a GaAs MMIC Power Amplifier operating from 10 to 4000 MHz. The amplifier provides 21 dB of gain, +32.6 dBm saturated output power, and achieves +37 dBm output IP3, while operating from a single +12 V power supply. In addition, it is internally matched to 50 Ohms and comes in a 3x3 mm 12-Lead QFN-Style package. These characteristics make it ideally suited for wideband test instrumentation and defense systems that require high operating output power, while maintaining very low distortion characteristics.

KEY FEATURES

Feature	Advantages
High P1dB Typ. +32.2 dBm	Flat gain and output power make this device excellent for wideband systems from 0.01 to 4 GHz that require at least 1 W of operating output power over the full band.
Low Noise Figure Typ. 3.2 dB	High operating output power accompanied by low noise figure enables a significant signal to noise ratio advantage for systems requiring high dynamic range.
High OIP3 Typ. +37 dBm	High operating OIP3, as well as low 2nd and 3rd harmonic responses, provides very low in-band distortion products, which is typically needed for high fidelity measurement systems.
3x3 mm 12-Lead QFN-Style Package	Small footprint saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB. Industry standard packaging allows for ease of assembly in high volume manufacturing processes.

ELECTRICAL SPECIFICATIONS[1] AT +25°C, V_{DD} = +12 V, V_{Iadj} = OPEN, UNLESS NOTED OTHERWISE

Parameter	Condition (MHz)	Min.	Typ.	Max.	Units
Frequency Range		10		4000	MHz
Gain	10		25.9		dB
	1000	19.9	21.7		
	2000	20.0	21.0		
	3000	19.1	20.3		
	4000	18.2	20.2		
Isolation	10 - 4000		29		dB
Input Return Loss	10		13		dB
	1000		14		
	2000		12		
	3000		11		
	4000		16		
Output Return Loss	10		13		dB
	1000		11		
	2000		14		
	3000		11		
	4000		15		
Output Power at 1 dB Compression (P1dB)	10		+29.6		dBm
	1000		+31.8		
	2000		+32.2		
	3000		+32.4		
	4000		+31.9		
Output Power at Saturation (P_{SAT})[2]	10		+31.1		dBm
	1000		+32.0		
	2000		+32.6		
	3000		+32.8		
	4000		+32.7		
Output Third-Order Intercept (P_{OUT} = +18 dBm/Tone)	10		+35		dBm
	1000		+37		
	2000		+37		
	3000		+36		
	4000		+38		
2nd Harmonics P_{OUT}= +18 dBm	10		-30		dBc
	1000		-27		
	2000		-21		
	3000		-21		
	4000		-26		
3rd Harmonics P_{OUT} = +18 dBm	10		-44		dBc
	1000		-45		
	2000		-40		
	3000		-48		
	4000		-53		

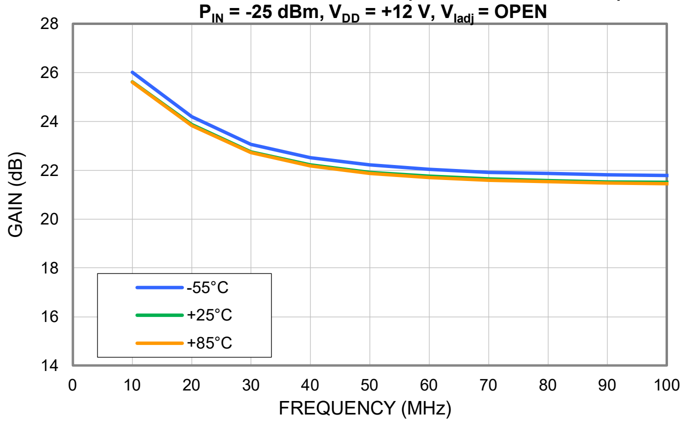
ELECTRICAL SPECIFICATIONS[1] AT +25°C, V_{DD} = +12 V, V_{Iadj} = OPEN, UNLESS NOTED OTHERWISE

Parameter	Condition (MHz)	Min.	Typ.	Max.	Units
Noise Figure	10		7.1		dB
	1000		3.0		
	2000		3.2		
	3000		2.7		
	4000		2.5		
Device Operating Voltage (V_{DD})		+10	+12	+12.5	V
Device Operating Current (I_{DD})[3]			190		mA
DC Current Variation vs. Temperature[4]			67.9		μA/°C
DC Current Variation vs. V_{DD}[5]			0.023		mA/mV
DC Current Variation vs. V_{Iadj}[6]			0.056		mA/mV

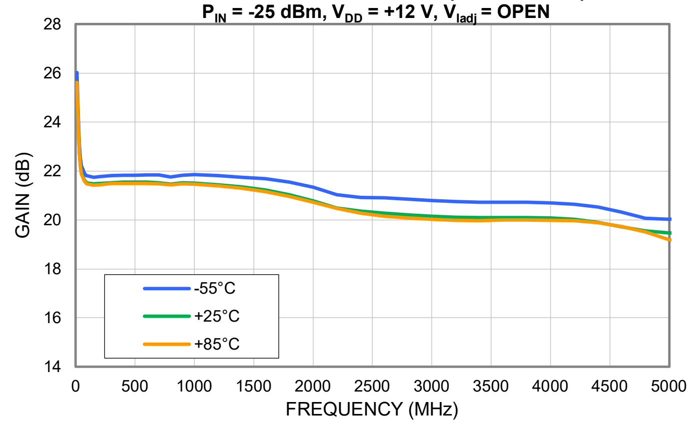
1. Tested on Mini-Circuits Characterization Test Board TB-PMA3-43-1WC+. See Figure 2. Board loss de-embedded.
2. P_{SAT} defined as when the Output Power changes 0.1 dB per 1 dB change in Input Power.
3. Current at P_{IN} = -25 dBm. Increases to ~550 mA at P1dB.
4. (Current at +85°C - Current at -55°C)/(140°C).
5. (Current at V_{DD} = +12.5 V - Current at V_{DD} = +10 V)/(+2.5 V). V_{Iadj} kept open.
6. (Current at V_{Iadj} = +1.8 V - Current at V_{Iadj} = +0.8 V)/(+1.0 V). V_{DD} kept constant.

TYPICAL PERFORMANCE GRAPHS

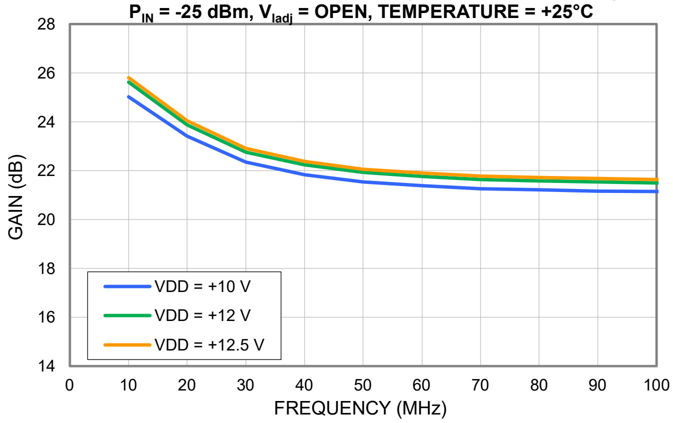
GAIN vs. TEMPERATURE (LOW FREQUENCY)
P_{IN} = -25 dBm, V_{DD} = +12 V, V_{Iadj} = OPEN



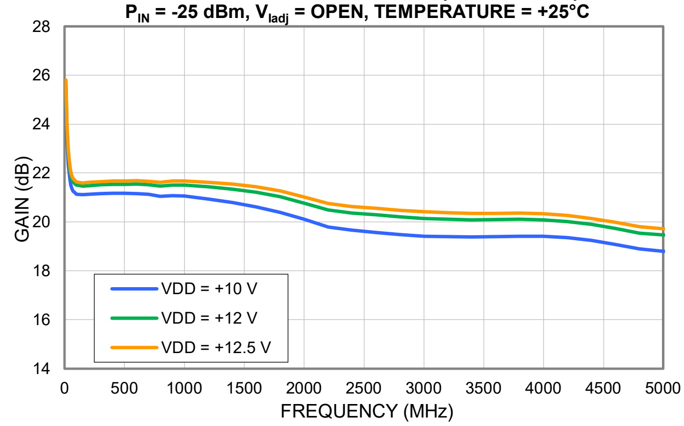
GAIN vs. TEMPERATURE (WIDEBAND)
P_{IN} = -25 dBm, V_{DD} = +12 V, V_{Iadj} = OPEN



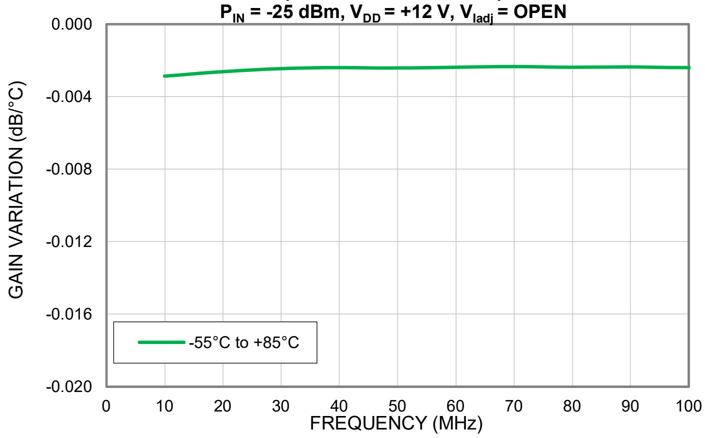
GAIN vs. DEVICE VOLTAGE (LOW FREQUENCY)
P_{IN} = -25 dBm, V_{Iadj} = OPEN, TEMPERATURE = +25°C



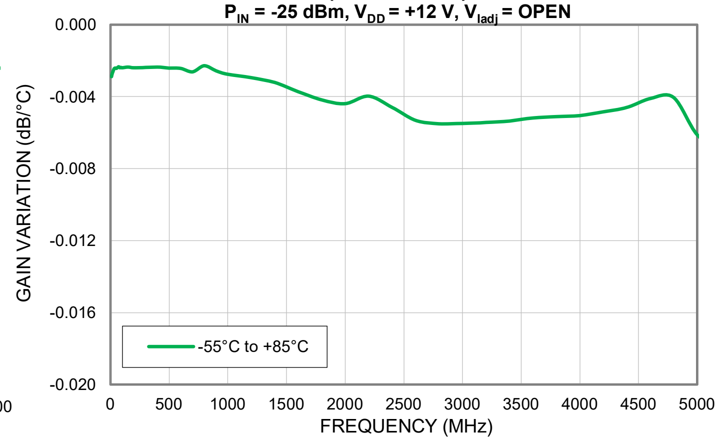
GAIN vs. DEVICE VOLTAGE (WIDEBAND)
P_{IN} = -25 dBm, V_{Iadj} = OPEN, TEMPERATURE = +25°C



GAIN VARIATION vs. TEMPERATURE (LOW FREQUENCY)
P_{IN} = -25 dBm, V_{DD} = +12 V, V_{Iadj} = OPEN



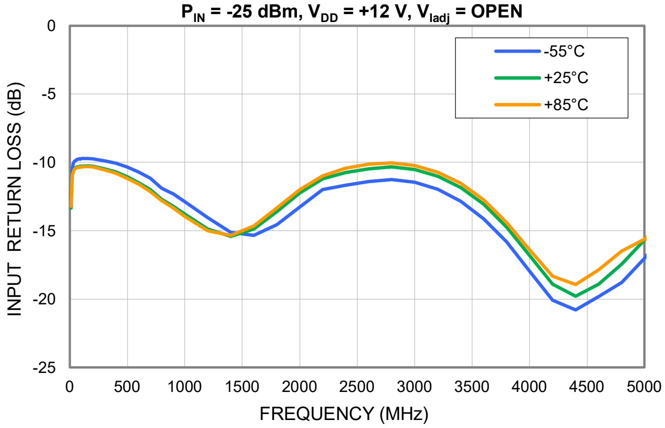
GAIN VARIATION vs. TEMPERATURE (WIDEBAND)
P_{IN} = -25 dBm, V_{DD} = +12 V, V_{Iadj} = OPEN



TYPICAL PERFORMANCE GRAPHS

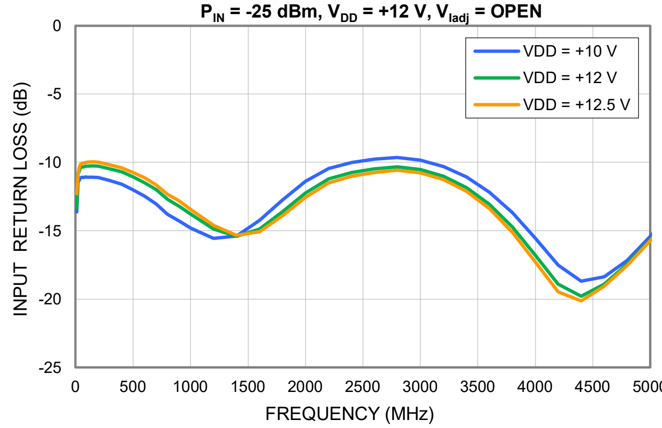
INPUT RETURN LOSS vs. TEMPERATURE

P_{IN} = -25 dBm, V_{DD} = +12 V, V_{Iadj} = OPEN



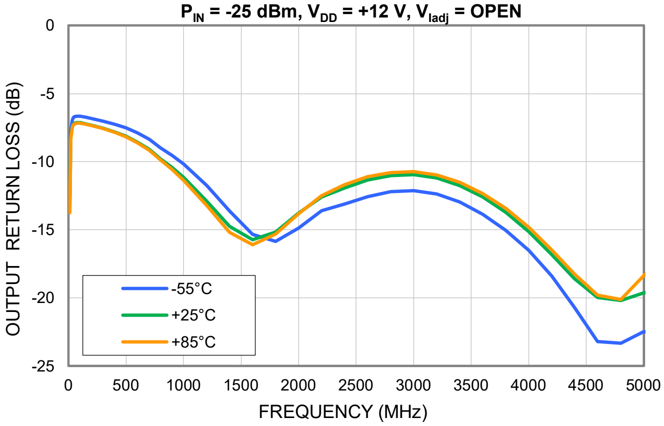
INPUT RETURN LOSS vs. DEVICE VOLTAGE

P_{IN} = -25 dBm, V_{DD} = +12 V, V_{Iadj} = OPEN



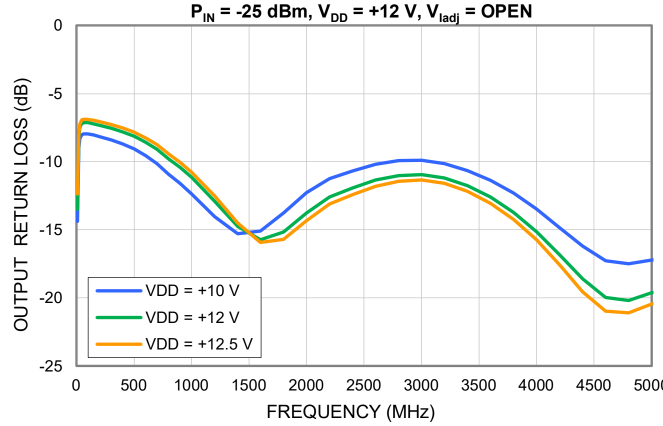
OUTPUT RETURN LOSS vs. TEMPERATURE

P_{IN} = -25 dBm, V_{DD} = +12 V, V_{Iadj} = OPEN



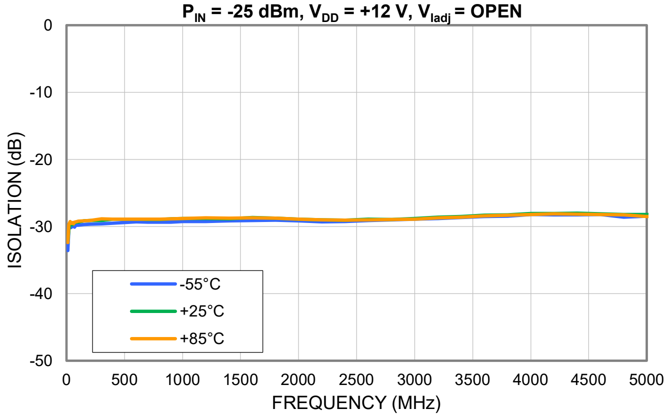
OUTPUT RETURN LOSS vs. DEVICE VOLTAGE

P_{IN} = -25 dBm, V_{DD} = +12 V, V_{Iadj} = OPEN



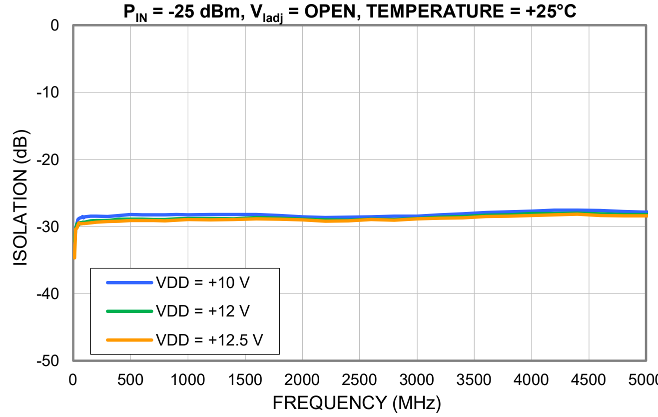
ISOLATION vs. TEMPERATURE

P_{IN} = -25 dBm, V_{DD} = +12 V, V_{Iadj} = OPEN

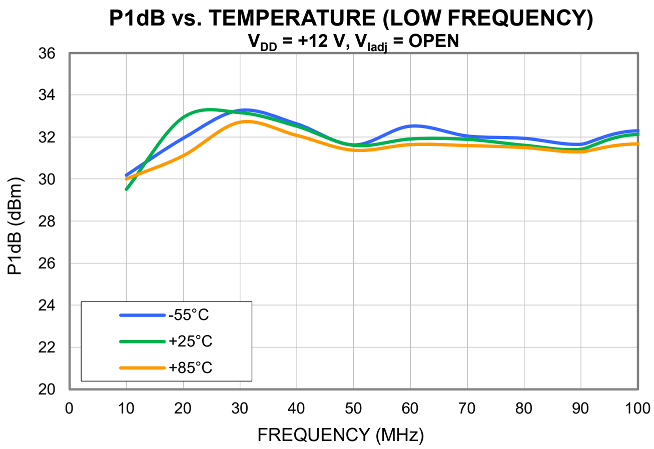


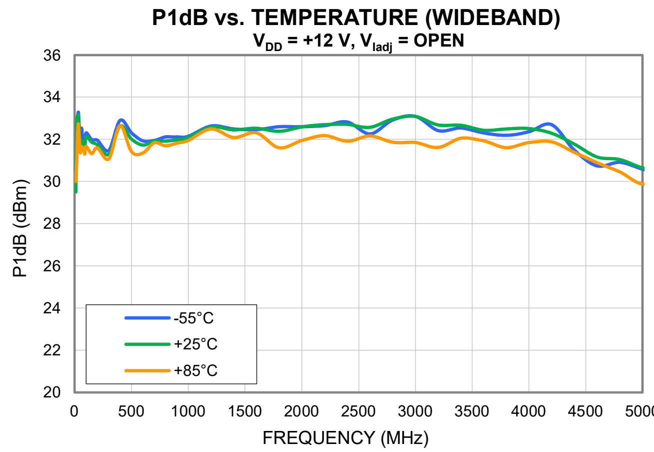
ISOLATION vs. DEVICE VOLTAGE

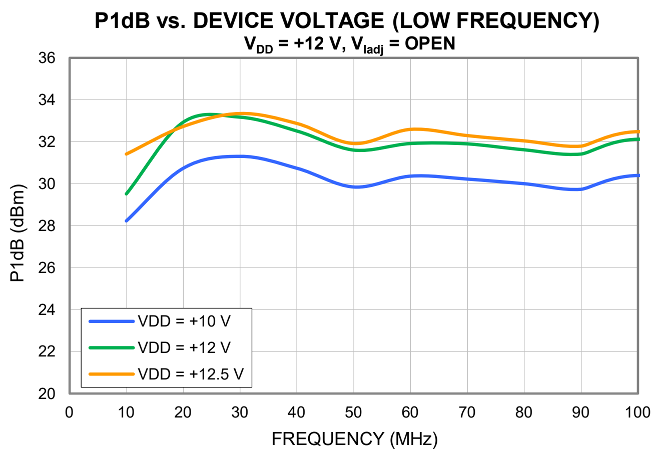
P_{IN} = -25 dBm, V_{Iadj} = OPEN, TEMPERATURE = +25°C

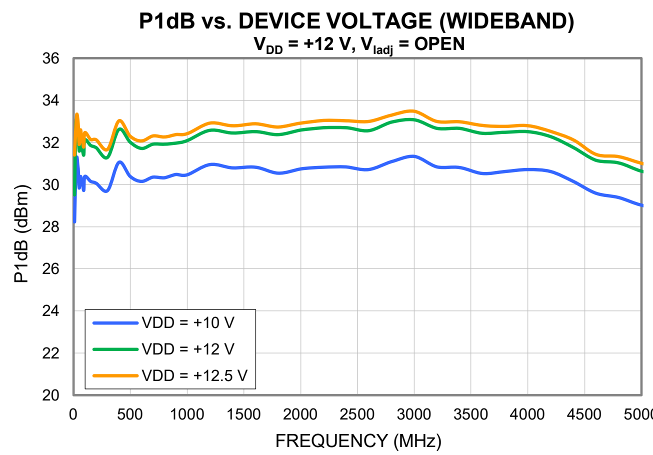


TYPICAL PERFORMANCE GRAPHS









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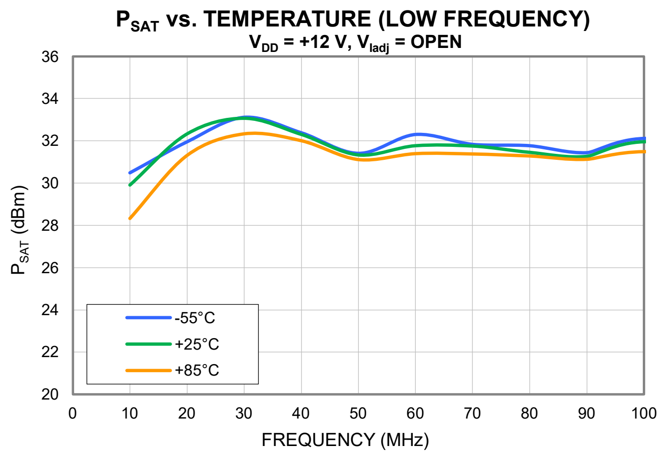

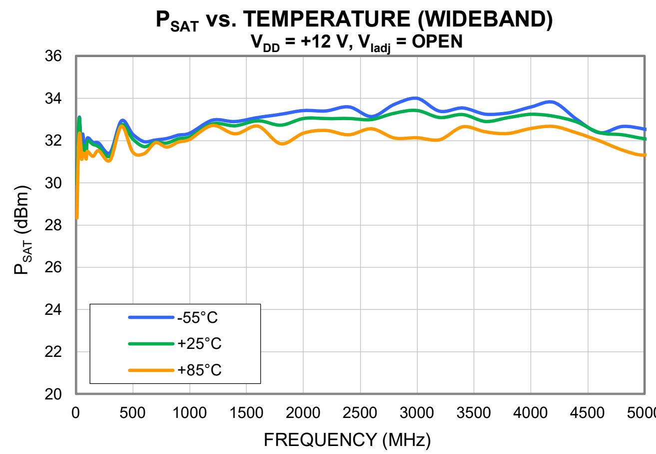

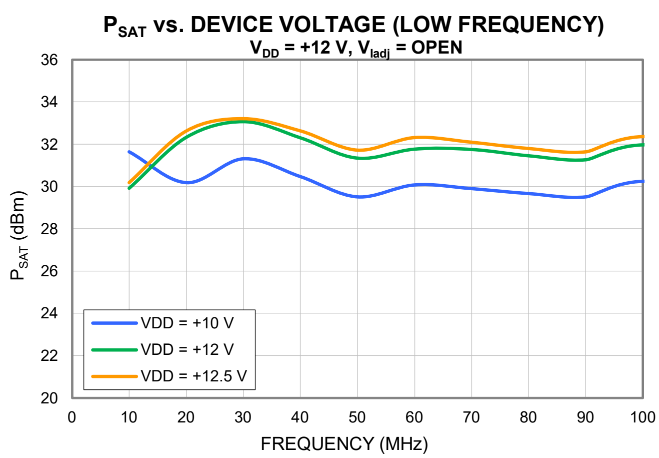

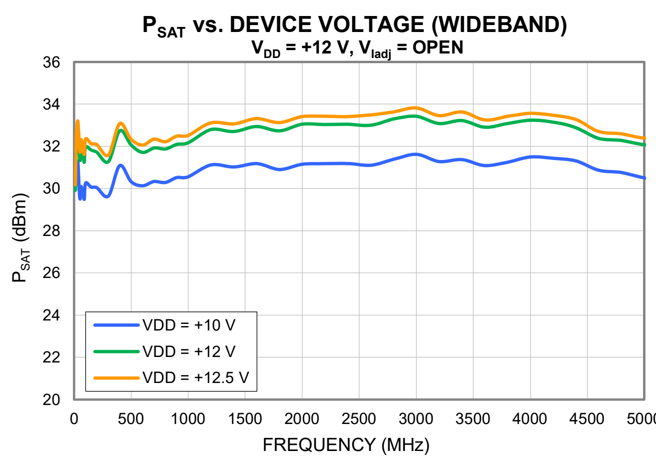

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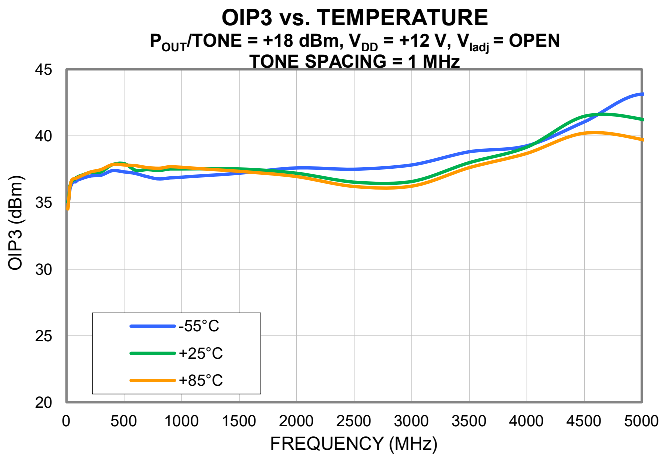
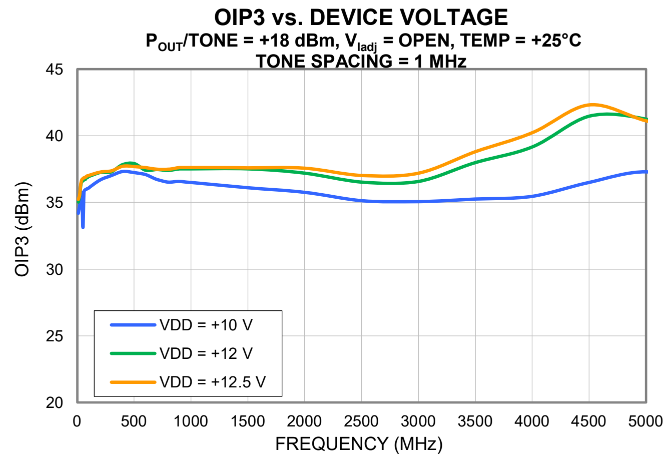
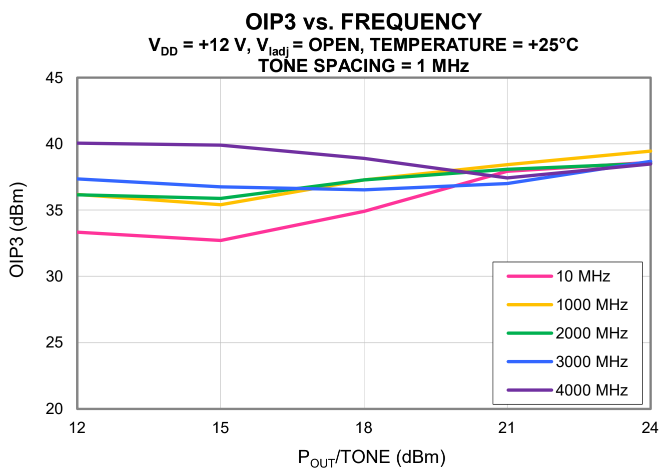
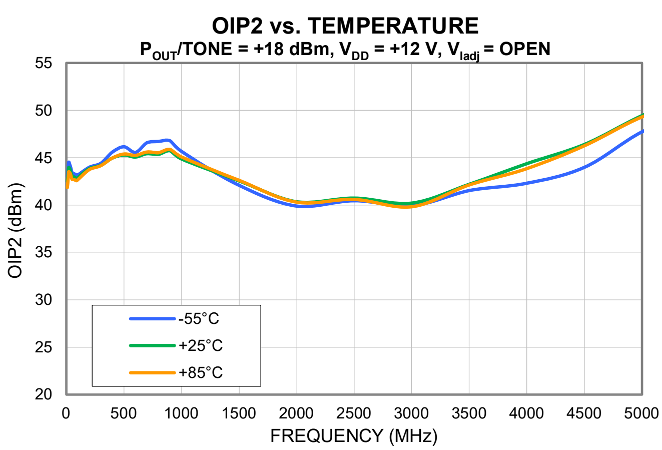
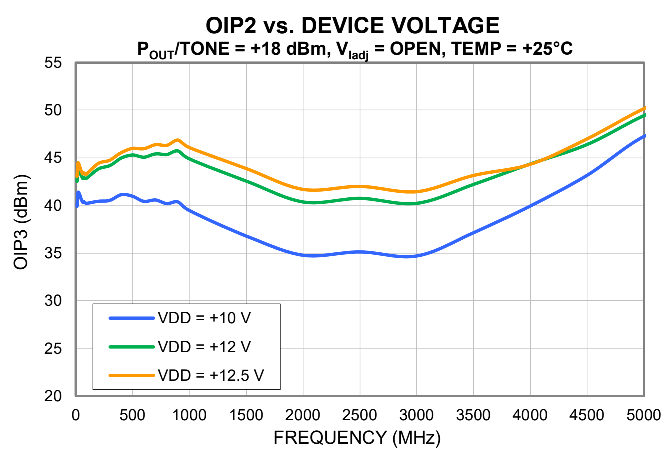




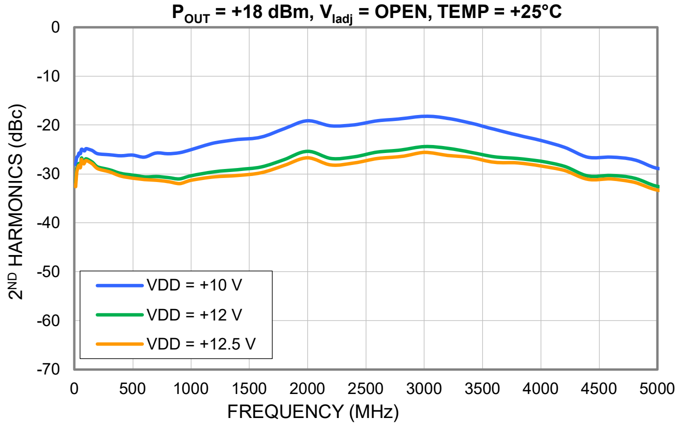




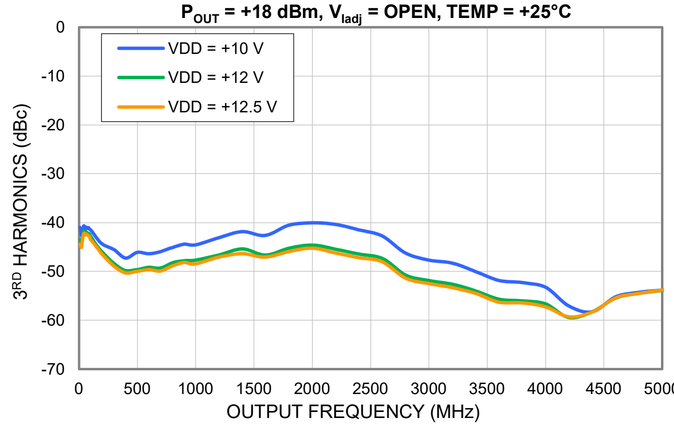


TYPICAL PERFORMANCE GRAPHS

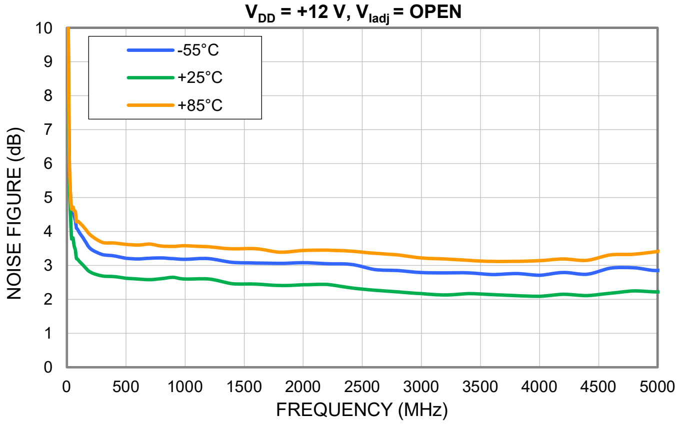
2ND HARMONICS vs. DEVICE VOLTAGE
P_{OUT} = +18 dBm, V_{Iadj} = OPEN, TEMP = +25°C



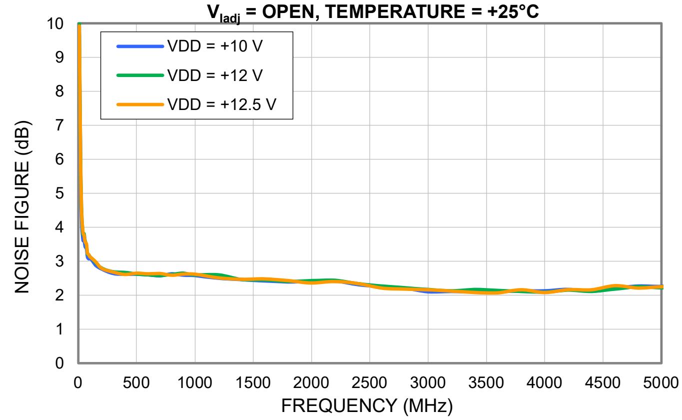
3RD HARMONICS vs. DEVICE VOLTAGE
P_{OUT} = +18 dBm, V_{Iadj} = OPEN, TEMP = +25°C



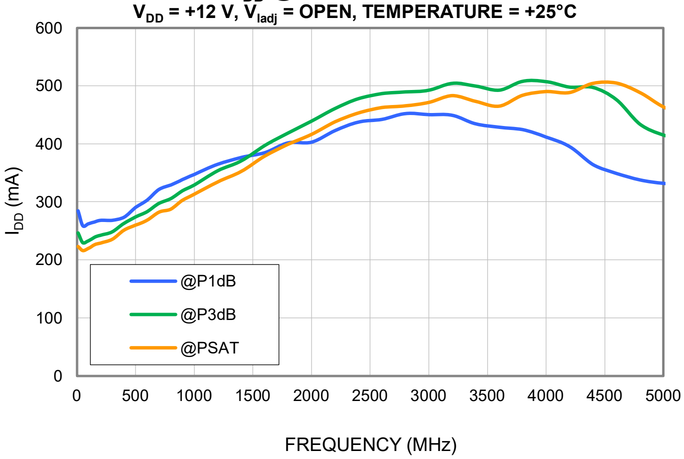
NOISE FIGURE vs. TEMPERATURE
V_{DD} = +12 V, V_{Iadj} = OPEN



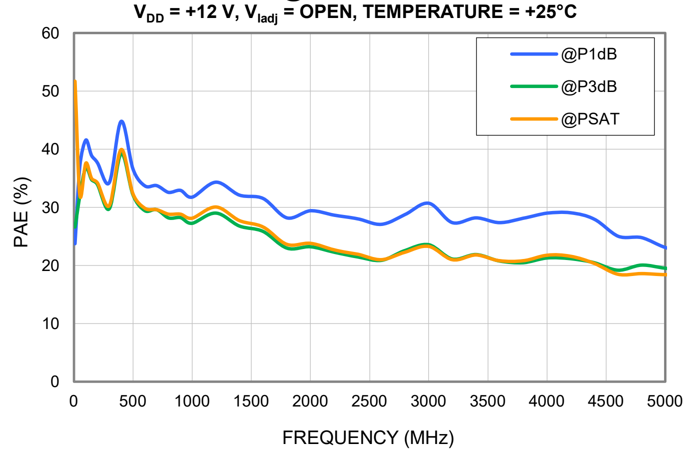
NOISE FIGURE vs. DEVICE VOLTAGE
V_{Iadj} = OPEN, TEMPERATURE = +25°C



I_{DD} @ COMPRESSION
V_{DD} = +12 V, V_{Iadj} = OPEN, TEMPERATURE = +25°C



PAE @ COMPRESSION
V_{DD} = +12 V, V_{Iadj} = OPEN, TEMPERATURE = +25°C



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50Ω 10 to 4000 MHz 1.5 W Output Power

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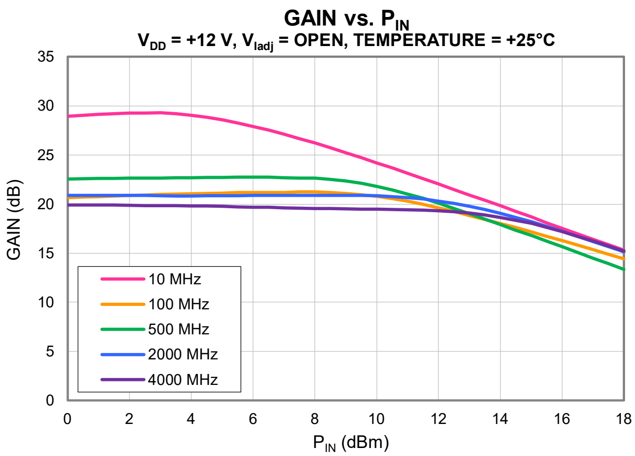

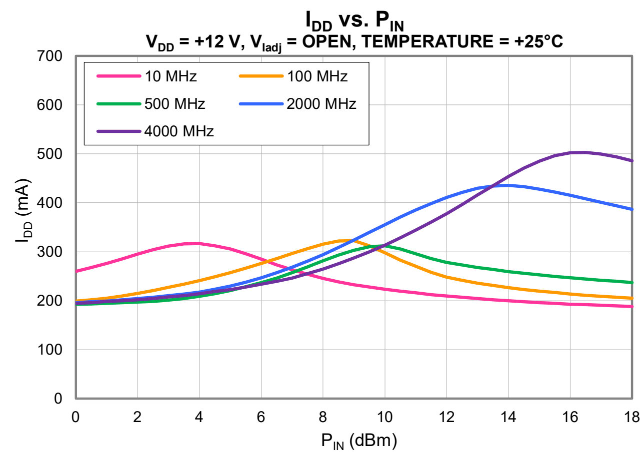

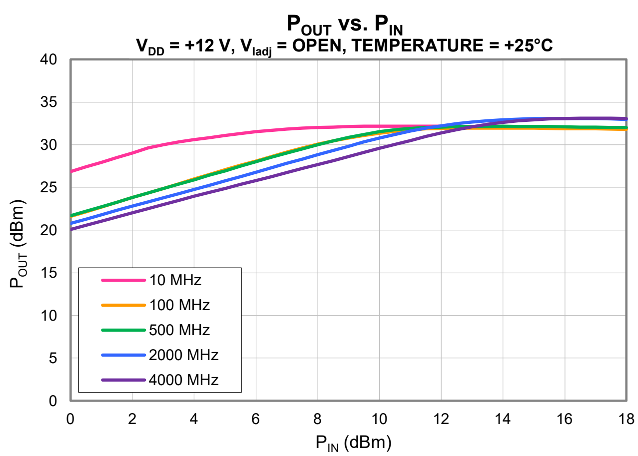

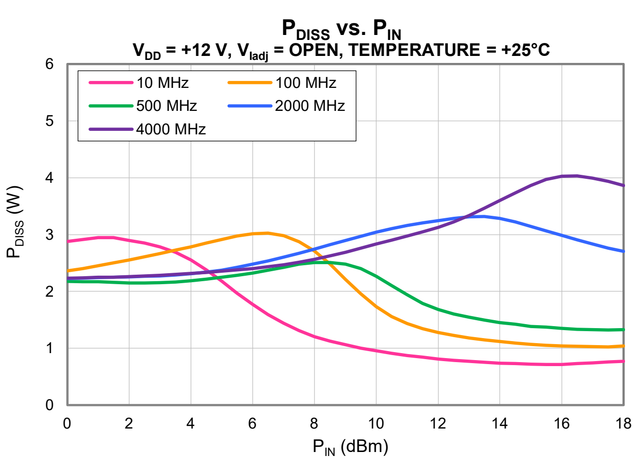

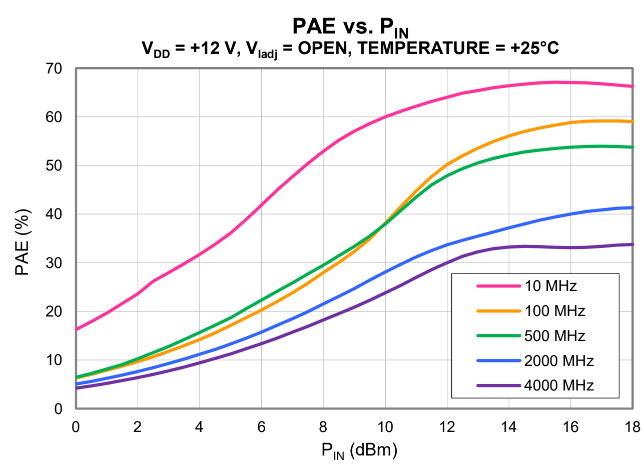

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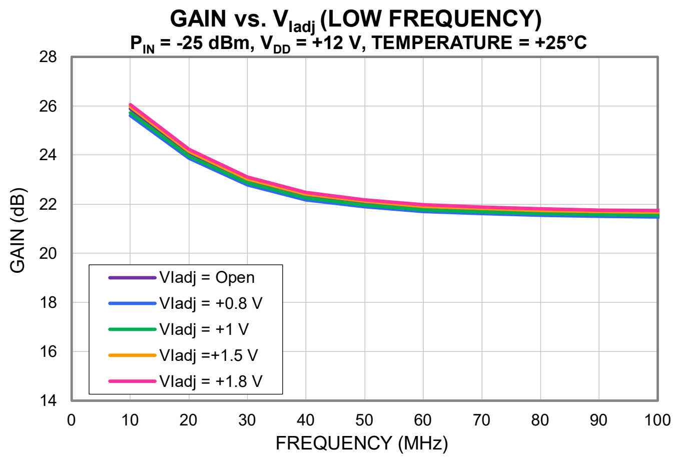
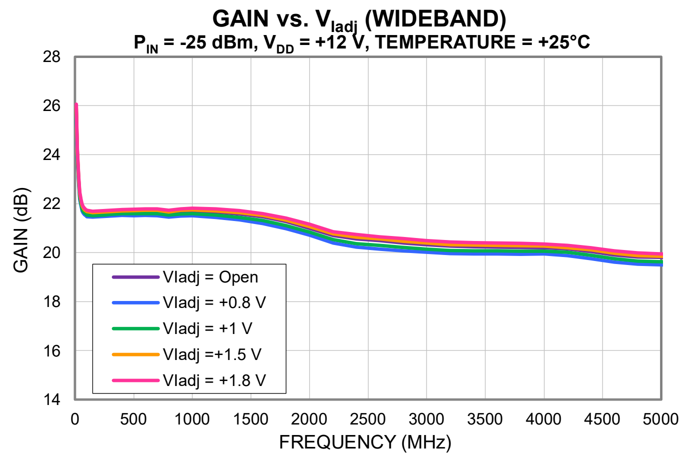
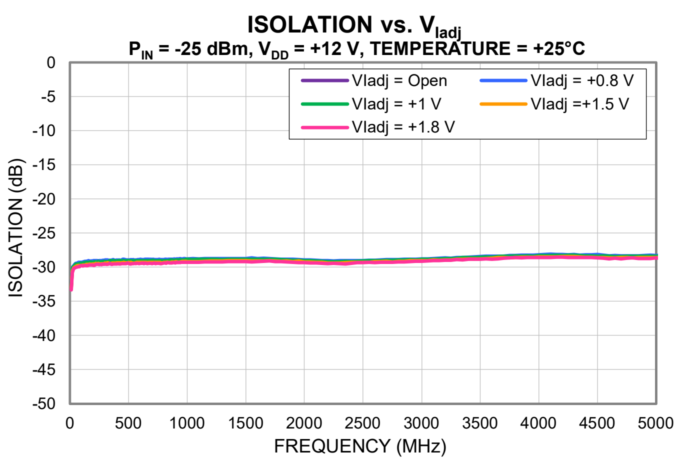
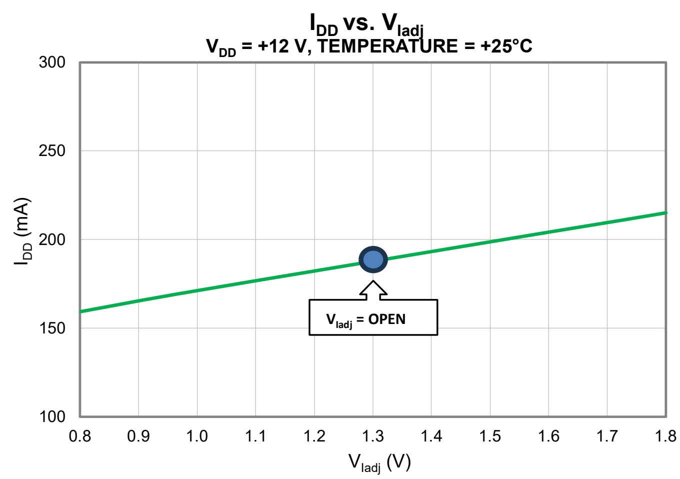
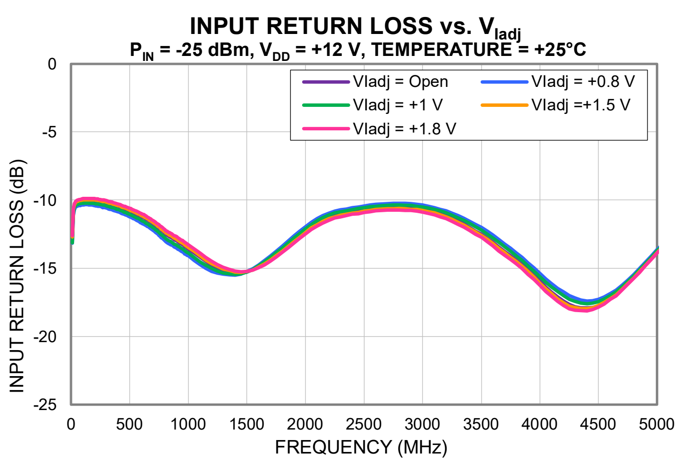
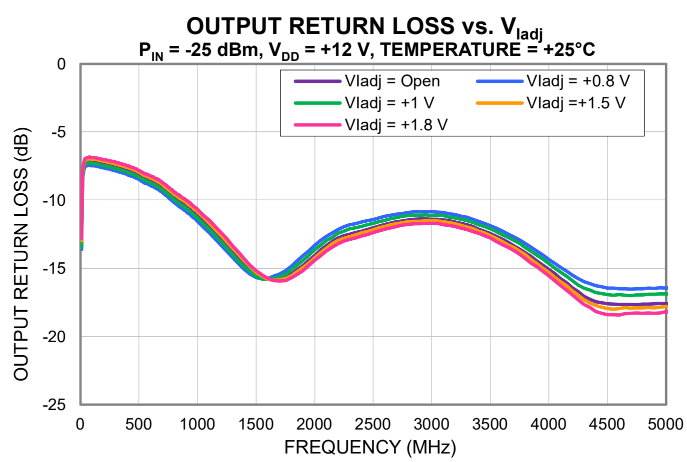






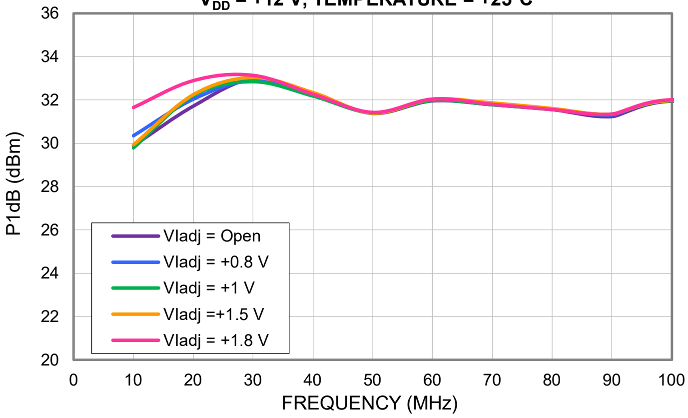




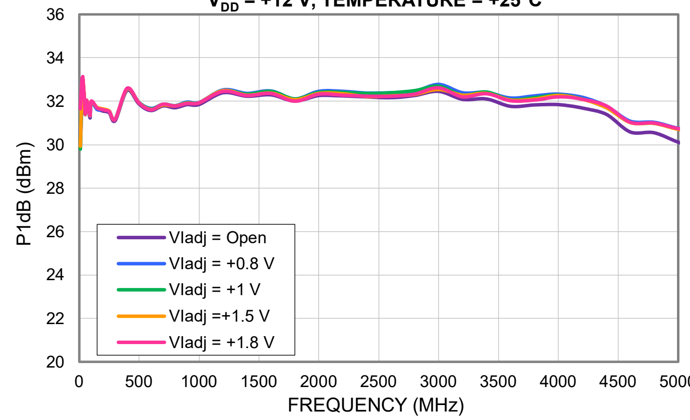


TYPICAL PERFORMANCE GRAPHS

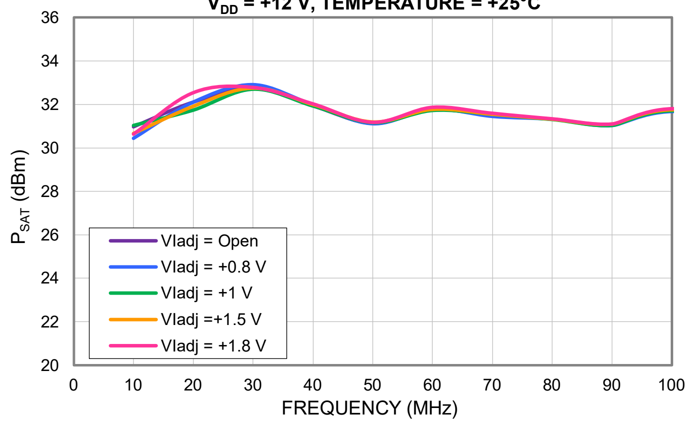
P1dB vs. V_{ladj} (LOW FREQUENCY)
V_{DD} = +12 V, TEMPERATURE = +25°C



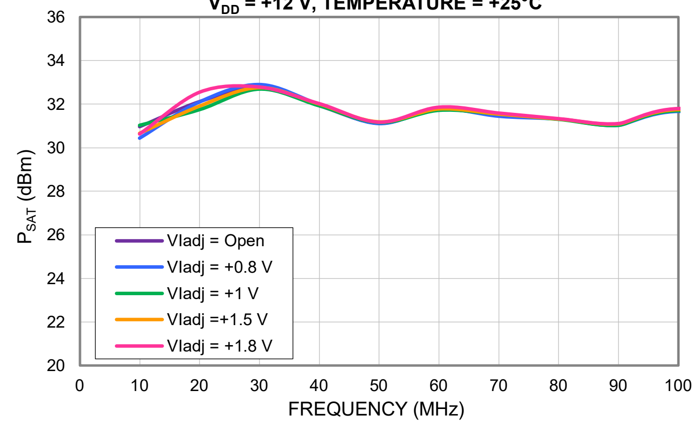
P1dB vs. V_{ladj} (WIDEBAND)
V_{DD} = +12 V, TEMPERATURE = +25°C



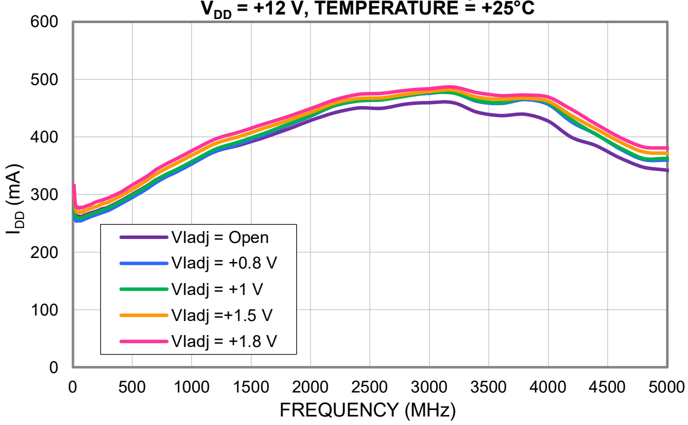
P_{SAT} vs. V_{ladj} (LOW FREQUENCY)
V_{DD} = +12 V, TEMPERATURE = +25°C



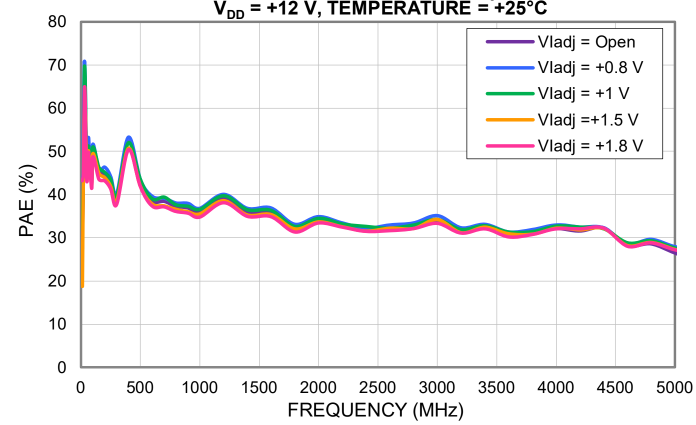
P_{SAT} vs. V_{ladj} (WIDEBAND)
V_{DD} = +12 V, TEMPERATURE = +25°C



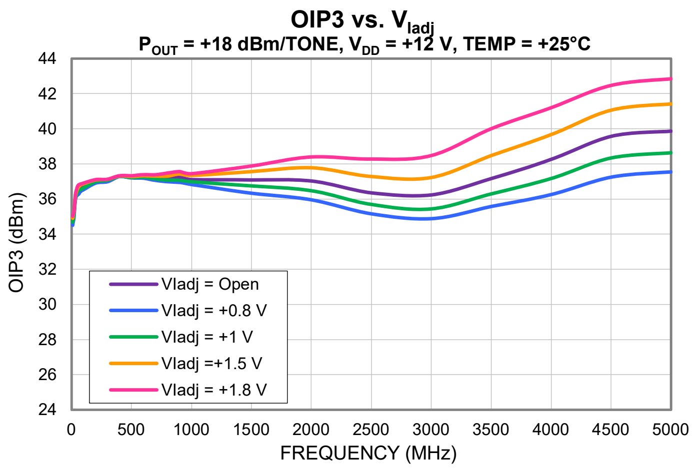
I_{DD} @ P1dB vs. V_{ladj}
V_{DD} = +12 V, TEMPERATURE = +25°C

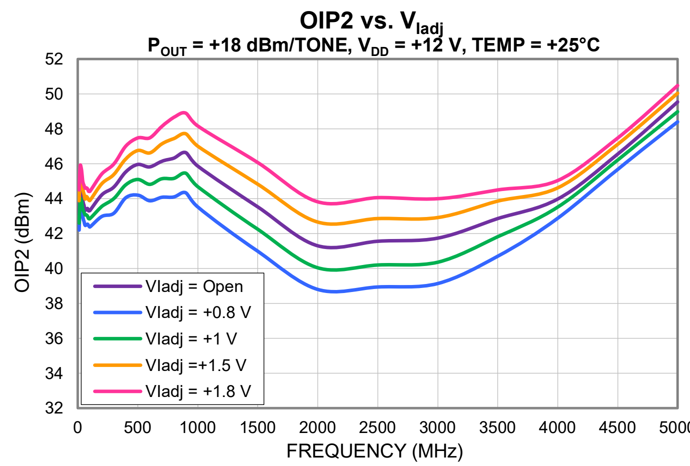


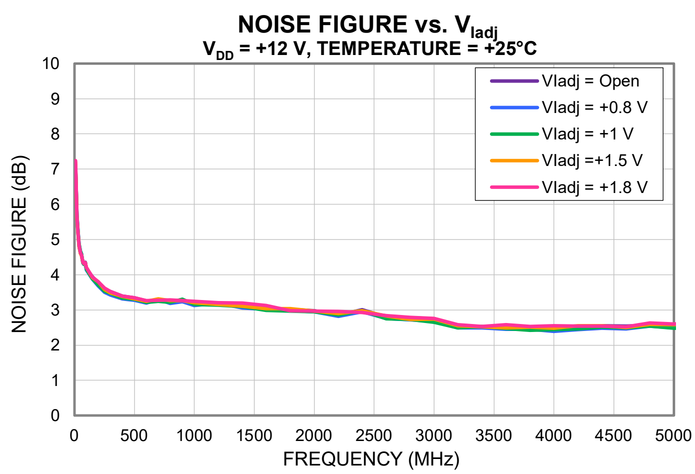
PAE @ P1dB vs. V_{ladj}
V_{DD} = +12 V, TEMPERATURE = +25°C



TYPICAL PERFORMANCE GRAPHS







ABSOLUTE MAXIMUM RATINGS[7]

Parameter	Ratings
Operating Temperature (ground lead)	-55°C to +85°C
Storage Temperature	-65°C to +150°C
Junction Temperature[8]	+175°C
Total Power Dissipation	5.5 W
Input Power (CW), V_{DD} = +12 V	+17 dBm
DC Voltage at RF-OUT + V_{DD}	+18 V
DC Voltage at V_{Iadj}	+6 V

7. Permanent damage may occur if any of these limits are exceeded. Maximum ratings are not intended for continuous normal operation.
8. Peak temperature on top of Die.

THERMAL RESISTANCE

Parameter	Ratings
Thermal Resistance (Θ_{JC})[9]	12.9°C/W

9. Θ_{JC}= (Hot Spot Temperature on Die - Temperature at Ground Lead)/Dissipated Power

ESD RATING

	Class	Voltage Range	Reference Standard
HBM	1A	250 V to <500 V	ANSI/ESDA/JEDEC JS-001-2023
CDM	C3	≥ 1000 V	ANSI/ESDA/JEDEC JS-001-2022

ESD HANDLING PRECAUTION: This device is designed to be Class 1A for HBM. Static charges may easily produce potentials higher than this with improper handling and can discharge into DUT and damage it. As a preventive measure Industry standard ESD handling precautions should be used at all times to protect the device from ESD damage.

MSL RATING

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020E/JEDEC J-STD-033C

FUNCTIONAL DIAGRAM

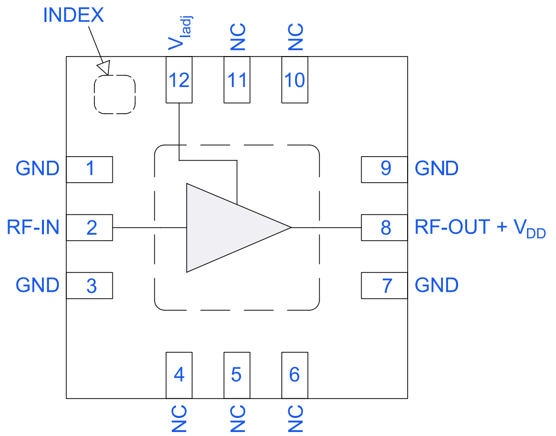


Figure 1. PMA3-43-1W+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description (Refer to Figure 2)
RF-IN	2	RF-IN Pad connects to RF Input port.
RF-OUT + V_{DD}	8	RF-OUT Pad connects to RF Output port. V_{DD} is applied via external bias tee.
V_{Iadj}	12	Voltage Adjust Pad to set I_{DD} current level.
NC	4-6, 10-11	Not used internally. Connected to ground on test board.
GND	1, 3, 7, 9, Index, & Paddle	Connects to ground.

CHARACTERIZATION TEST BOARD

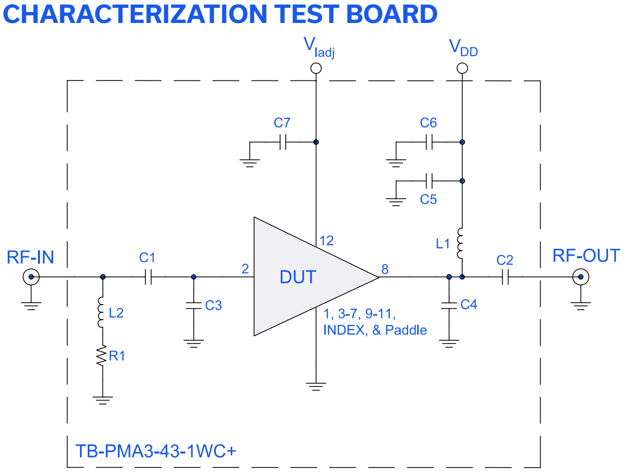


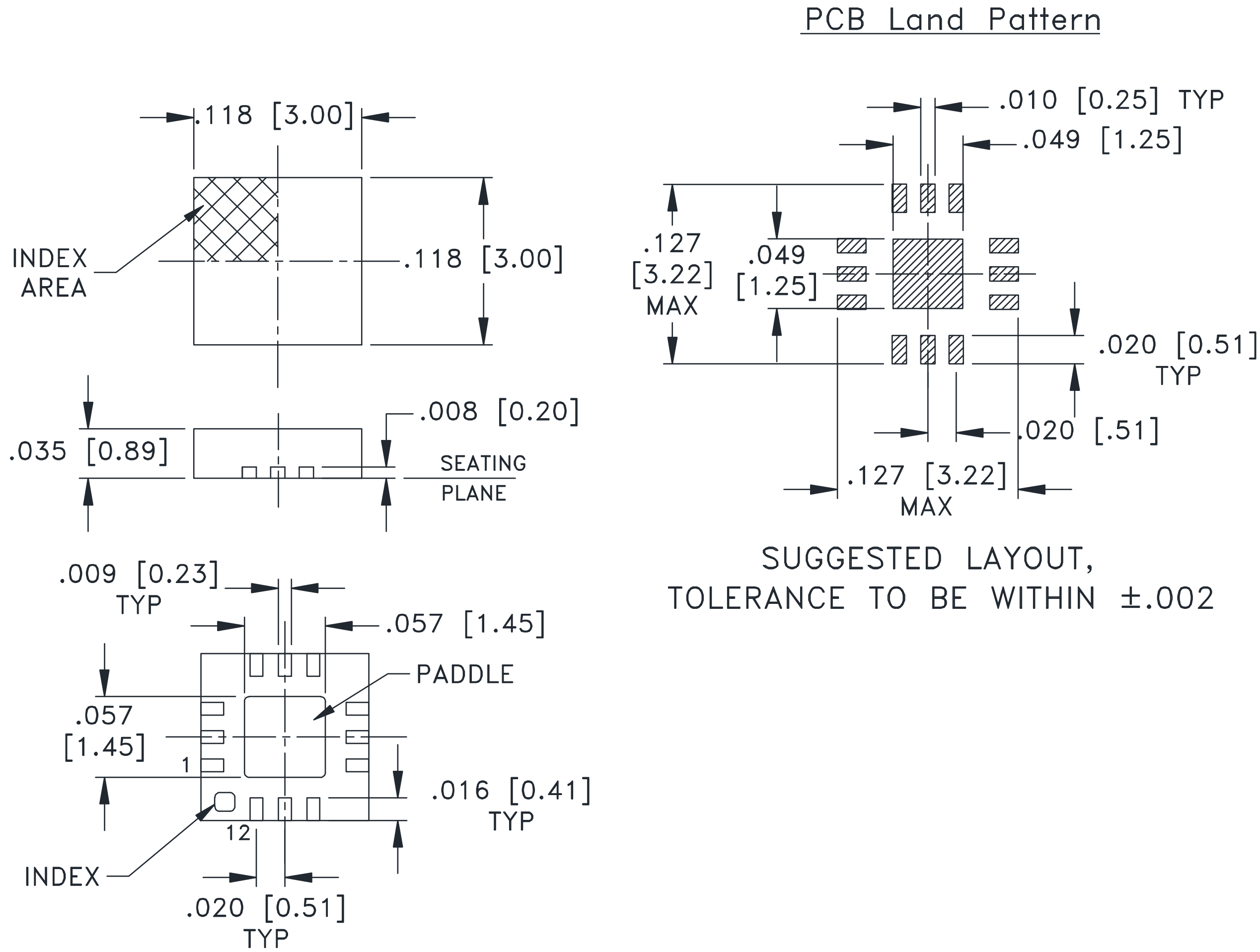
Figure 2. PMA3-43-1W+ Evaluation and Characterization Circuit

Electrical Parameters and Conditions
Gain, Return Loss, Output Power at 1 dB Compression (P1dB), Output IP3 (OIP3), and Noise Figure measured using N5245A PNA-X Microwave Network Analyzer.

Conditions:
1. Gain and Return Loss: P_{IN} = -25 dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, +18 dBm/Tone at output.

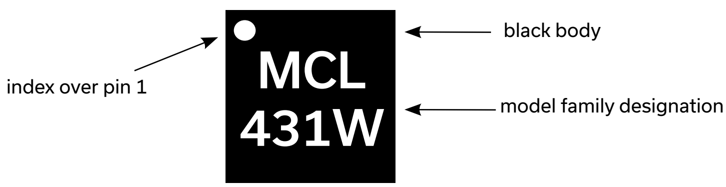
Component	Value	Size	Part Number	Manufacturer
C1, C2, C5	1000 pF	0402	GRM1555CH102JA01D	Murata
C3, C4	0.4 pF	0402	GJM1555C1HR40WB01D	Murata
C6, C7	0.1 µF	0402	GRM155R71H104KE14J	Murata
L1, L2	1.5 µH	0805	0805LS-152XJEC	Coilcraft
R1	50 Ω	0402	RN73R1ETTP50R0F50	KOA Speer

CASE STYLE DRAWING



Weight: .02 Grams
Dimensions are in inches [mm]. Tolerances in inches: 2 Pl. ±.01; 3 Pl.±.004 inches

PRODUCT MARKING



Marking may contain other features or characters for internal lot control

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASHBOARD CLICK HERE

Performance Data	Data Graphs S-Parameter (S2P Files) Data Set (.zip file)
Case Style	DQ1225 Plastic package, exposed paddle, lead finish: Matte-Tin
RoHs Status	Compliant
Tape & Reel **Standard quantities available on reel**	F66 7″ reels with 20, 50, 100, 200, 500, 1K, 2K, or 3K devices
Suggested Layout for PCB Design	PL-812
Evaluation Board	TB-PMA3-43-1WC+ Gerber File
Environmental Ratings	ENV08T1

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