MMIC SURFACE MOUNT

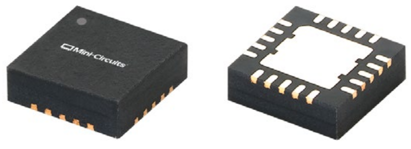
Power Amplifier

GNA-252-5W+

50Ω 10 to 2500 MHz 8 W Output Power

THE BIG DEAL

- P_{SAT}, Typ. +40 dBm
- Output Power, > 8 W @ P_{IN} = +26 dBm
- PAE, Typ. 47%
- Large Signal Gain, Typ. 13.5 dB
- Gain Flatness < ± 0.5 dB
- IM3, Typ. -30 dBc at P_{OUT} = +26 dBm/tone
- IM5, Typ. -57 dBc at P_{OUT} = +26 dBm/tone
- Supply Voltage, +28 V at 400 mA
- 4×4 mm 20-Lead QFN-Style Package

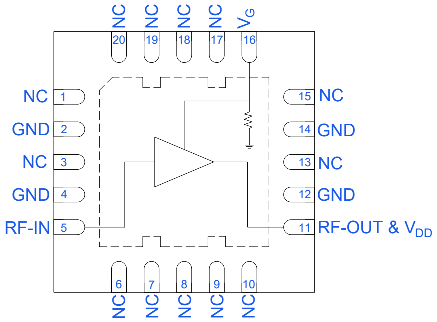


Generic photo used for illustration purposes only

APPLICATIONS

- Land Mobile and Military Radio Systems
- Radar, EW, and ECM Defense Systems
- Satellite Communication

FUNCTIONAL DIAGRAM (TOP VIEW)



PRODUCT OVERVIEW

The GNA-252-5W+ is a GaN-on-SiC HEMT MMIC high power amplifier operating from 10 MHz to 2.5 GHz. Offering flat gain and high efficiency, this power amplifier is designed for demanding RF applications requiring high output power, excellent linearity, and a compact footprint. When driven with an input power level of +26 dBm, the amplifier provides over 13 dB of flat power gain across a broad frequency range, delivers more than 8 W of output power and achieves 47% power-added efficiency. At 1 GHz, IM3 is -30 dBc and IM5 is -57 dBc with a P_{OUT} of +26 dBm/tone. This excellent linearity preserves signal integrity, making the amplifier ideal for high-fidelity communication systems. The device operates from a +28 V supply and consumes 400 mA of quiescent current. Potential applications include radar, electronic warfare, and cellular infrastructure. The GNA-252-5W+ is matched to 50Ω at the input and output, making it easy to implement. It comes in a 4×4 mm, 20-lead QFN-Style surface-mount package, ensuring excellent thermal performance and compatibility with high-volume manufacturing.

KEY FEATURES

Feature	Advantages
• Output Power, > 8 W @ P_{IN} = +26 dBm • Power Gain, Typ. > 13.5 dB • PAE, Typ. 47%	High efficiency, flat gain, and high output power over the full band enables long signal coverage, higher link margin, and improved signal detection capability.
At P_{OUT} = +26 dBm/tone: • IM3: -30 dBc • IM5: -57 dBc	Excellent IM3 and IM5 provide low in-band IM distortion products, enabling clean multi-carrier operation and minimizing signal-to-noise degradation in high fidelity communication systems.
• 50Ω matched • Operating Temperature -55 °C to +95 °C • Single Supply, +28 V	Fully self-contained RF interface with no external matching network required. This reduces component count, board area, and design iteration cycles. Wide temperature operation and standard supply voltage ensure drop-in compatibility across defense, satellite, and communications platforms from prototype to production.
4×4 mm 20-Lead QFN-Style Package	Small footprint saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB. Allows for ease of assembly in high volume manufacturing processes.

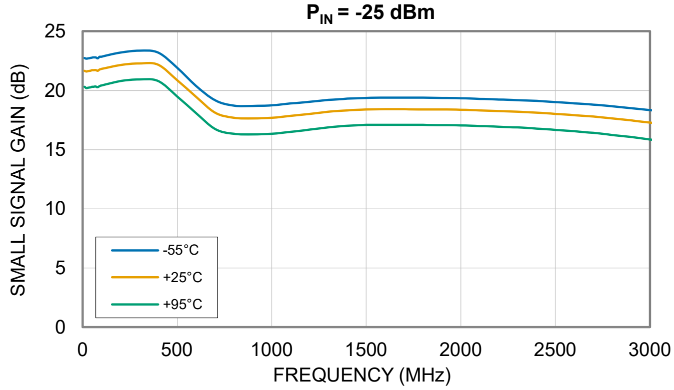
ELECTRICAL SPECIFICATIONS[1] AT +25 °C, AND Z_O = 50Ω UNLESS NOTED OTHERWISE

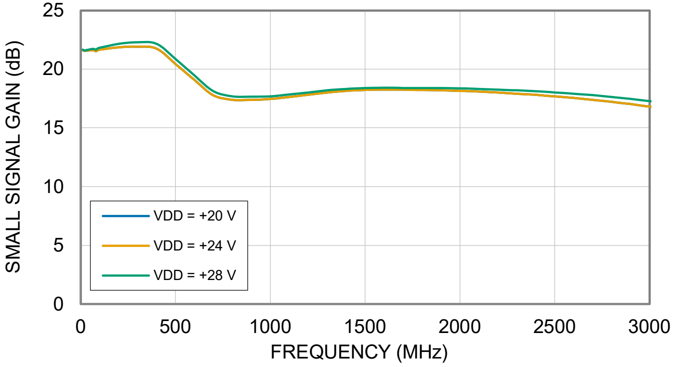
Parameter	Condition (MHz)	Min.	Typ.	Max.	Units
Frequency Range		10		2500	MHz
Small Signal Gain	10	20.7	21.7		dB
	100	20.5	21.5		
	500	19.7	20.6		
	1000	16.9	17.6		
	2000	17.5	18.3		
	2500	17.2	18.1		
Input Return Loss	10		12		dB
	100		12		
	500		7		
	1000		11		
	2000		12		
	2500		12		
Output Return Loss	10		11		dB
	100		12		
	500		13		
	1000		12		
	2000		16		
	2500		20		
Isolation	10–2500		38.7		dB
Output Power at Saturation (P_{SAT})[2]	10		+39.0		dBm
	100		+39.6		
	500		+39.6		
	1000		+40.0		
	2000		+40.3		
	2500		+40.4		
Output Power (P_{IN} = +26 dBm)	10		+39.0		dBm
	100		+39.6		
	500		+39.5		
	1000		+39.5		
	2000		+39.8		
	2500		+39.6		
Power Added Efficiency (P_{IN} = +26 dBm)	10		70		%
	100		68		
	500		62		
	1000		47		
	2000		45		
	2500		48		
Large Signal Gain (P_{IN} = +26 dBm)	10		13.0		dB
	100		13.6		
	500		13.5		
	1000		13.5		
	2000		13.8		
	2500		13.6		
Device Operating Voltage (V_{DD})		+20	+28	+28	V
Device Operating Current (I_{DD})[3]			400		mA
Device Gate Voltage (V_G)			-1.7		V
Device Gate Current (I_G)			30		µA
Device Current Variation Vs. Temperature[4]			-0.3		µA/°C
Device Current Variation Vs. Voltage[5]			3		µA/mV

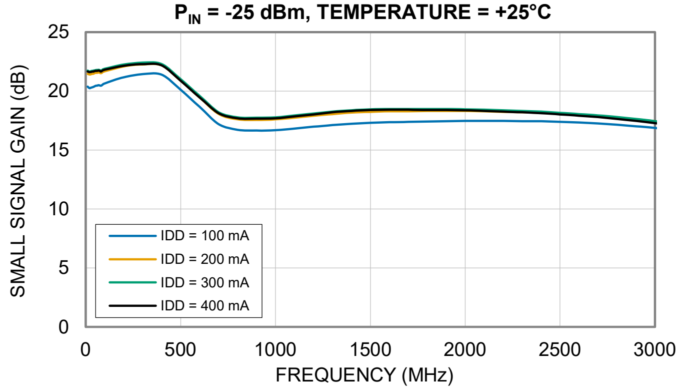
1. Tested on Mini-Circuits Characterization Test Board TB-GNA252-5WCX+ with an external bias-T. See Figure 2. Board loss de-embedded to the device. Data measured in CW operation.
2. P_{SAT} is defined as when the output power changes 0.1 dB per 1 dB change in input power.
3. Current at P_{IN} = -25 dBm. Increases to 800 mA when P_{IN} = +26 dBm.
4. (Current at +95 °C - Current at -55 °C) / (+150 °C)
5. (Current at +28 V - Current at +20 V) / (+8 V)

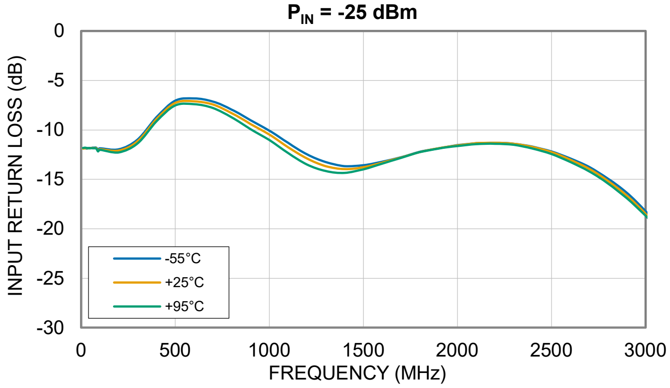
TYPICAL PERFORMANCE GRAPHS

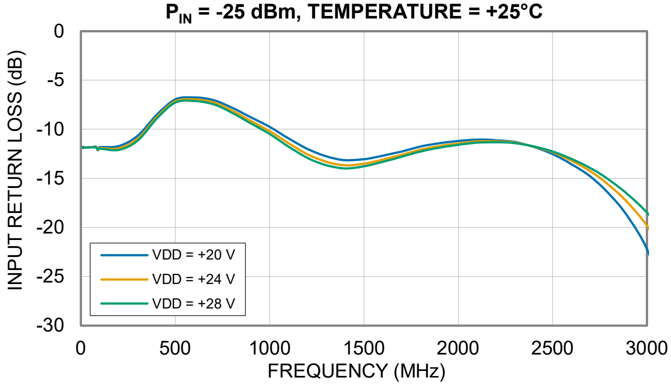
Note: The following data was taken on Mini-Circuits Characterization Test Board TB-GNA252-5WCX+ with external bias-T (Figure 2). All data taken at nominal condition of V_{DD} = +28 V and I_{DD} = 400 mA unless noted otherwise. V_G was adjusted at each voltage and temperature level to achieve I_{DD} = 400 mA.

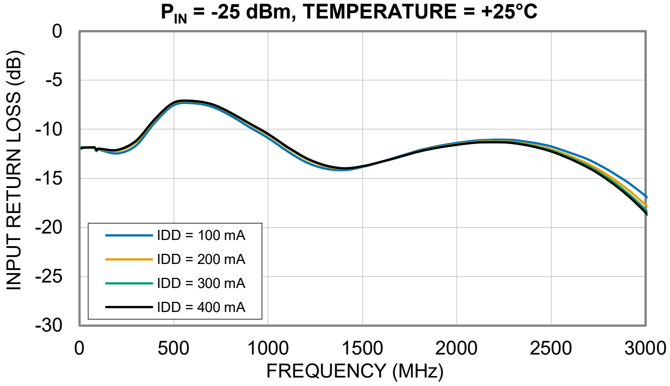

SMALL SIGNAL GAIN vs. TEMPERATURE
P_{IN} = -25 dBm


SMALL SIGNAL GAIN vs. DEVICE VOLTAGE (V_{DD})
P_{IN} = -25 dBm, TEMPERATURE = +25°C


SMALL SIGNAL GAIN vs. DEVICE CURRENT (I_{DD})
P_{IN} = -25 dBm, TEMPERATURE = +25°C


INPUT RETURN LOSS vs. TEMPERATURE
P_{IN} = -25 dBm


INPUT RETURN LOSS vs. DEVICE VOLTAGE (V_{DD})
P_{IN} = -25 dBm, TEMPERATURE = +25°C


INPUT RETURN LOSS vs. DEVICE CURRENT (I_{DD})
P_{IN} = -25 dBm, TEMPERATURE = +25°C

TYPICAL PERFORMANCE GRAPHS

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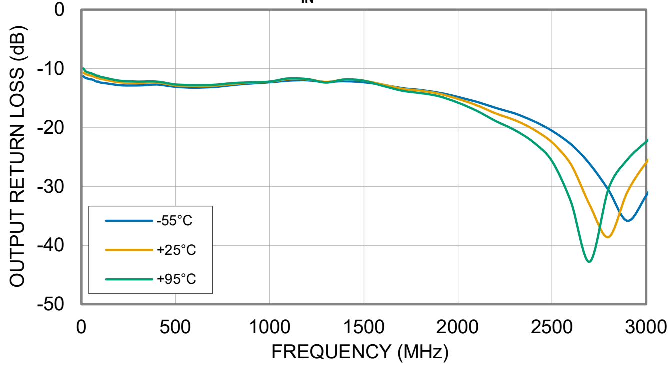
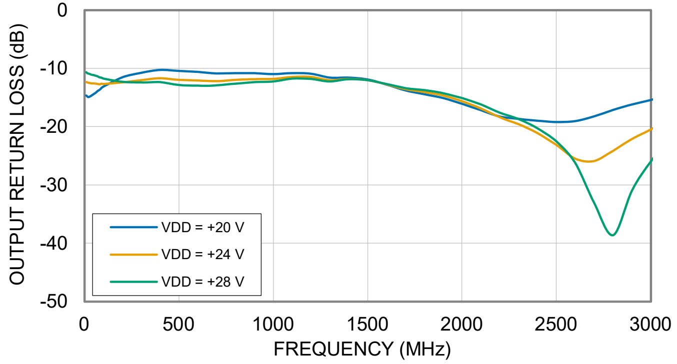
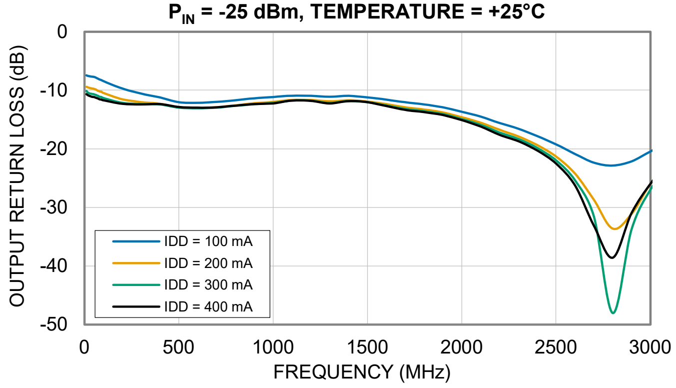
OUTPUT RETURN LOSS vs. TEMPERATURE
P_{IN} = -25 dBm



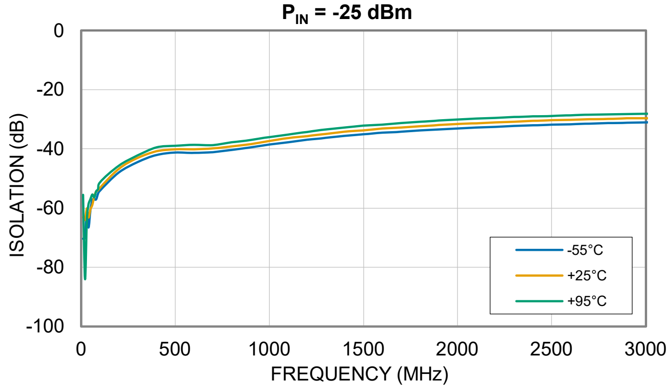
OUTPUT RETURN LOSS vs. DEVICE VOLTAGE (V_{DD})
P_{IN} = -25 dBm, TEMPERATURE = +25°C



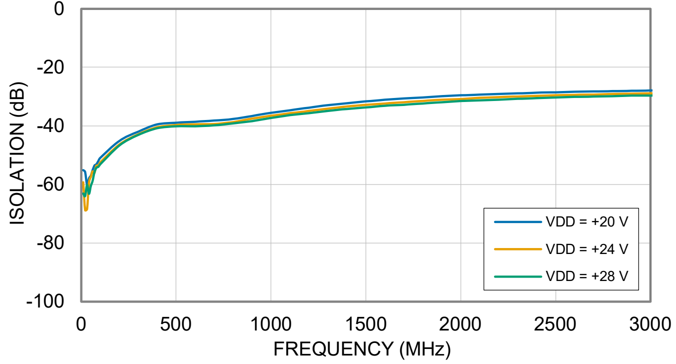
OUTPUT RETURN LOSS vs. DEVICE CURRENT (I_{DD})
P_{IN} = -25 dBm, TEMPERATURE = +25°C



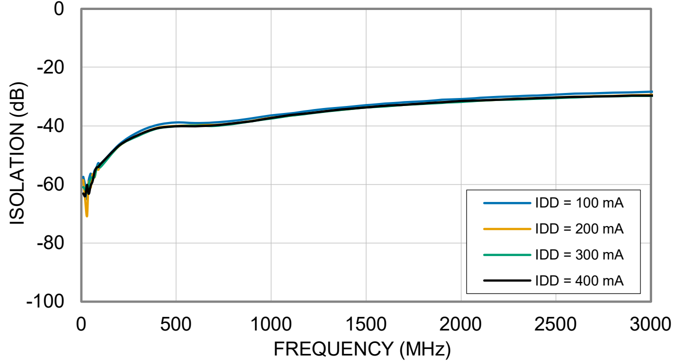
ISOLATION vs. TEMPERATURE
P_{IN} = -25 dBm



ISOLATION vs. DEVICE VOLTAGE (V_{DD})
P_{IN} = -25 dBm, TEMPERATURE = +25°C



ISOLATION vs. DEVICE CURRENT (I_{DD})
P_{IN} = -25 dBm, TEMPERATURE = +25°C



TYPICAL PERFORMANCE GRAPHS

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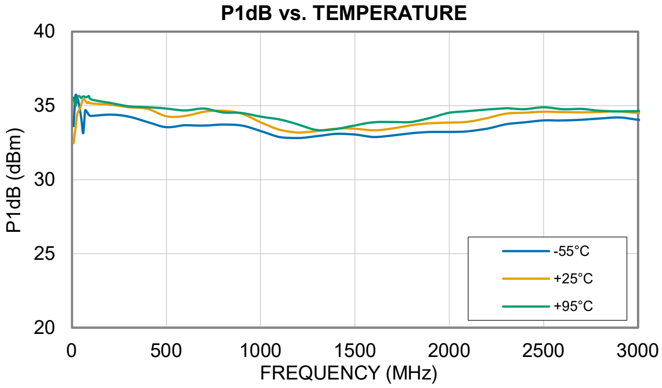

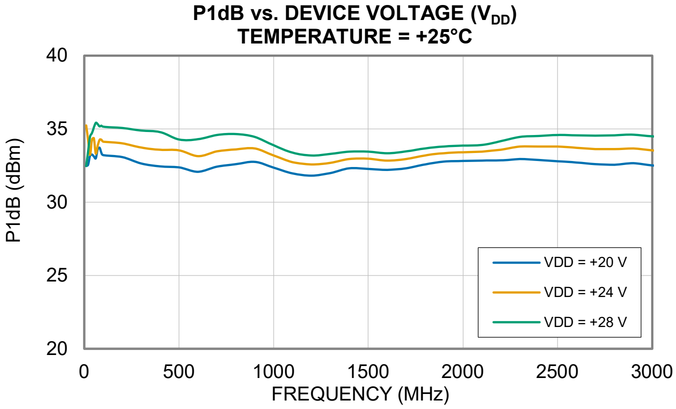

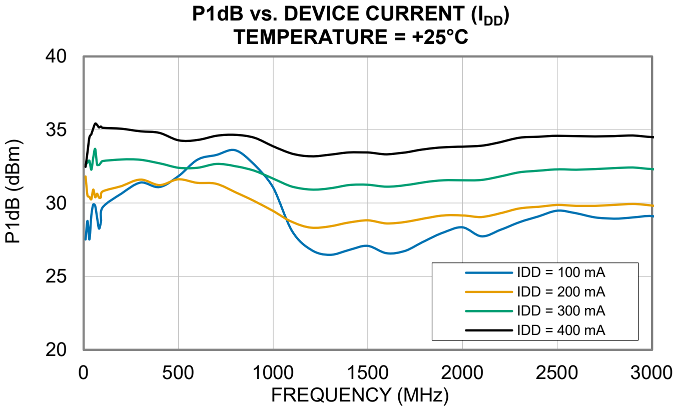

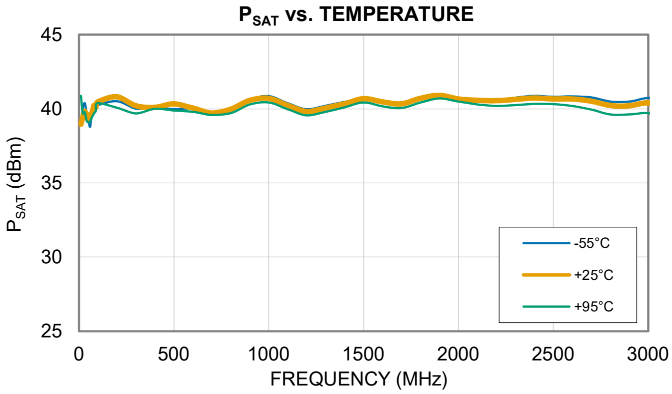

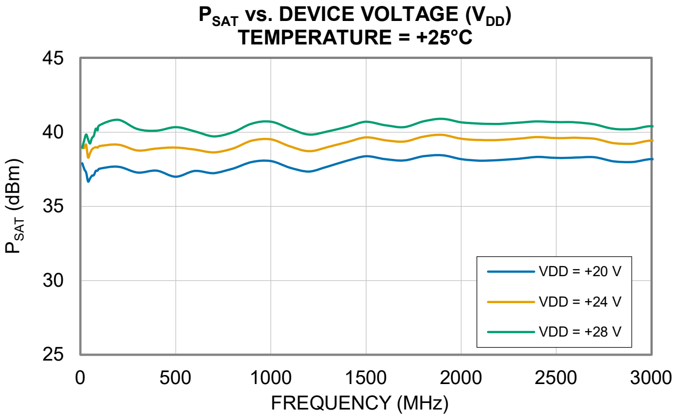

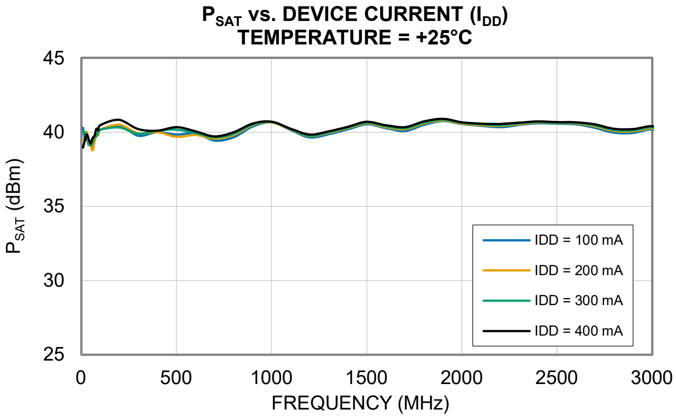

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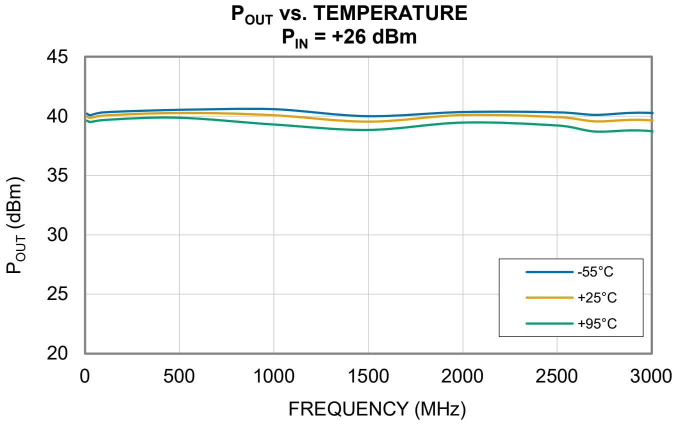
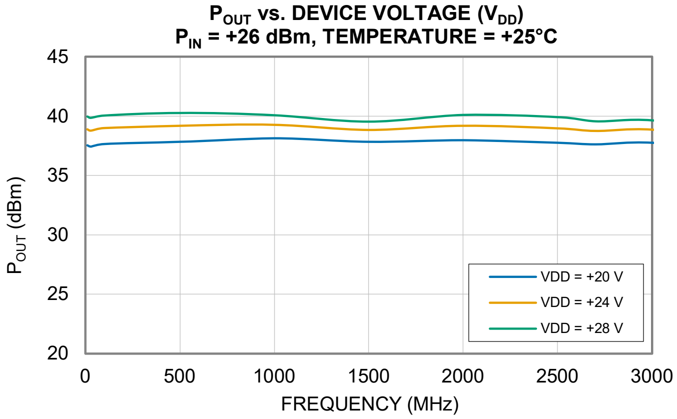
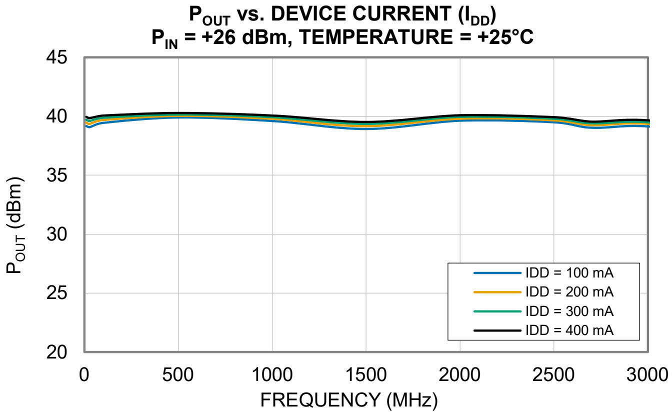


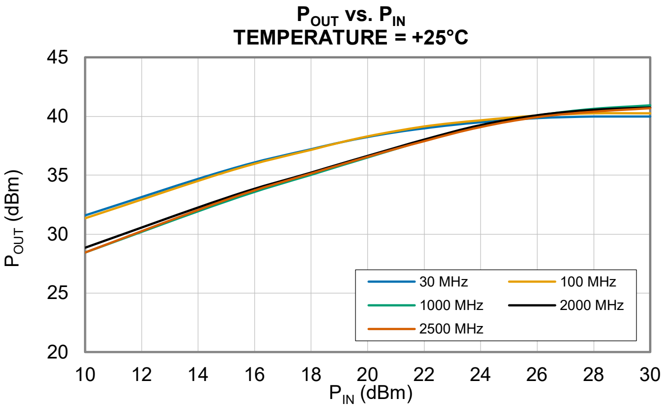
P_{OUT} vs. TEMPERATURE
P_{IN} = +26 dBm



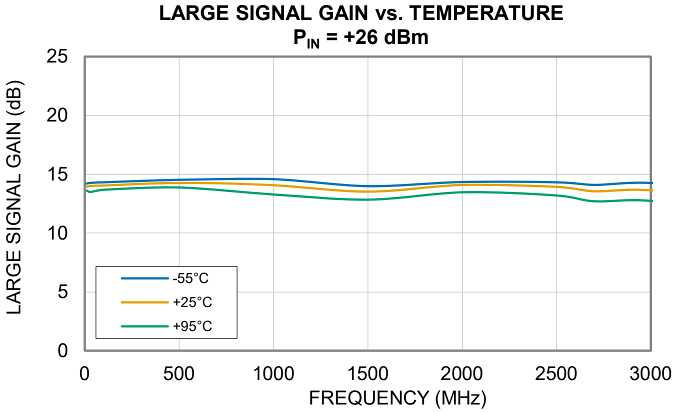
P_{OUT} vs. DEVICE VOLTAGE (V_{DD})
P_{IN} = +26 dBm, TEMPERATURE = +25°C



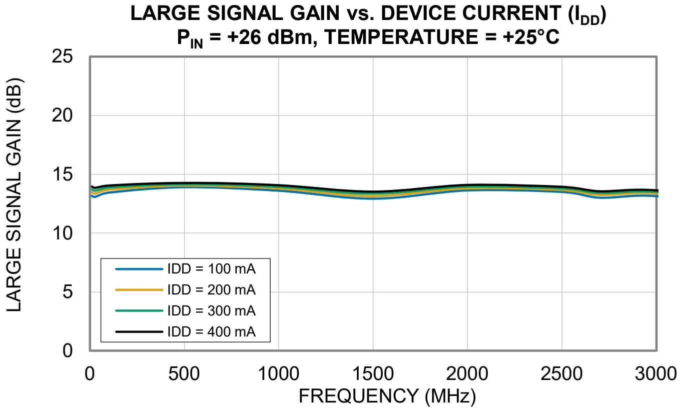
P_{OUT} vs. DEVICE CURRENT (I_{DD})
P_{IN} = +26 dBm, TEMPERATURE = +25°C



P_{OUT} vs. P_{IN}
TEMPERATURE = +25°C



LARGE SIGNAL GAIN vs. TEMPERATURE
P_{IN} = +26 dBm



LARGE SIGNAL GAIN vs. DEVICE CURRENT (I_{DD})
P_{IN} = +26 dBm, TEMPERATURE = +25°C

TYPICAL PERFORMANCE GRAPHS

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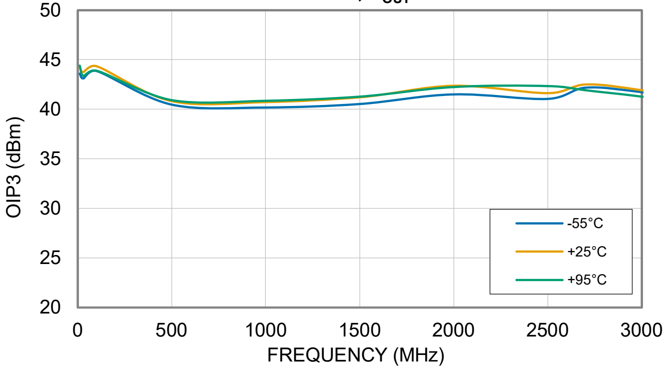
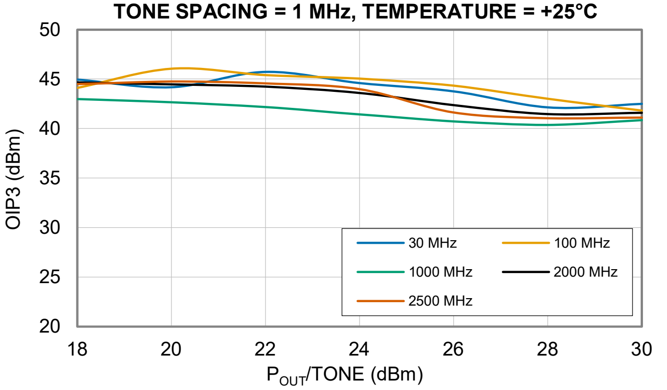
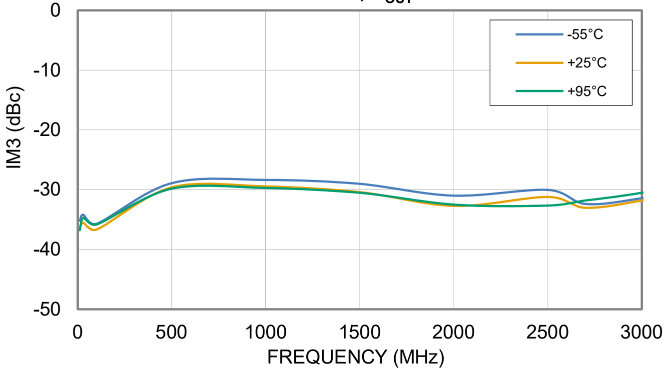
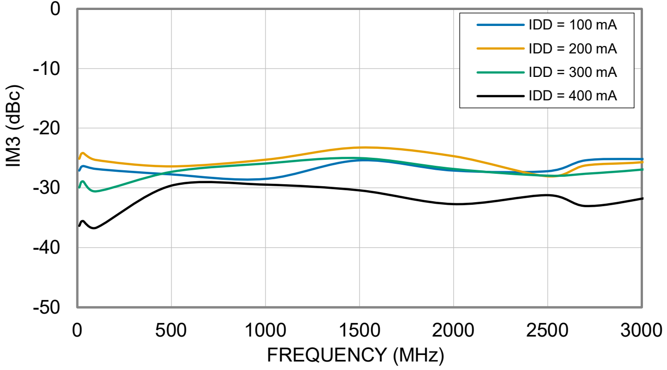
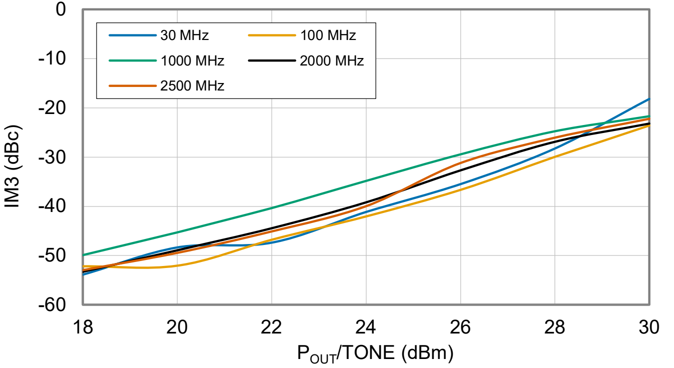
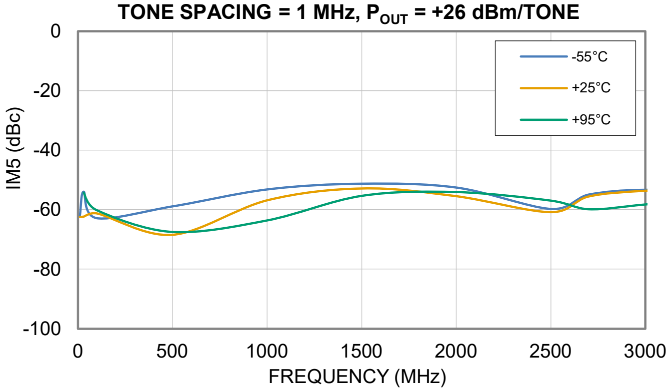

OIP3 vs. TEMPERATURE
TONE SPACING = 1 MHz, P_{OUT} = +26 dBm/TONE


OIP3 vs. P_{OUT}
TONE SPACING = 1 MHz, TEMPERATURE = +25°C


IM3 vs. TEMPERATURE
TONE SPACING = 1 MHz, P_{OUT} = +26 dBm/TONE


IM3 vs. DEVICE CURRENT (I_{DD})
TONE SPACING = 1 MHz, TEMPERATURE = +25°C,
P_{OUT} = +26 dBm/TONE


IM3 vs. P_{OUT}
TONE SPACING = 1 MHz, TEMPERATURE = +25°C


IM5 vs. TEMPERATURE
TONE SPACING = 1 MHz, P_{OUT} = +26 dBm/TONE

TYPICAL PERFORMANCE GRAPHS

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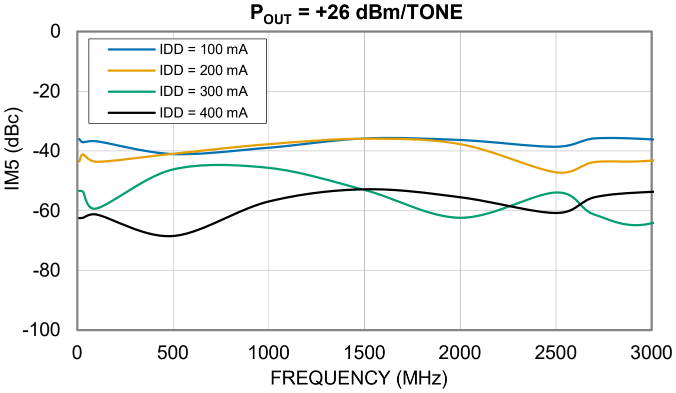
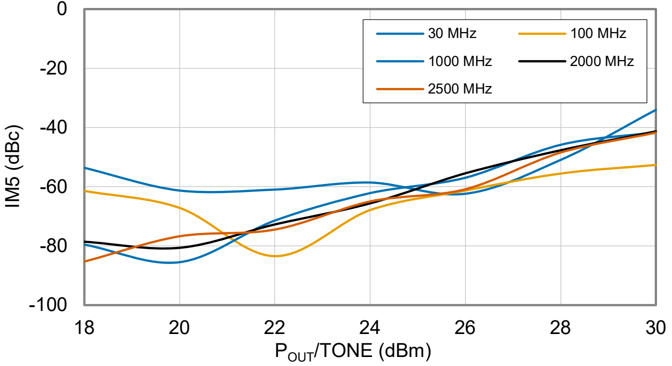
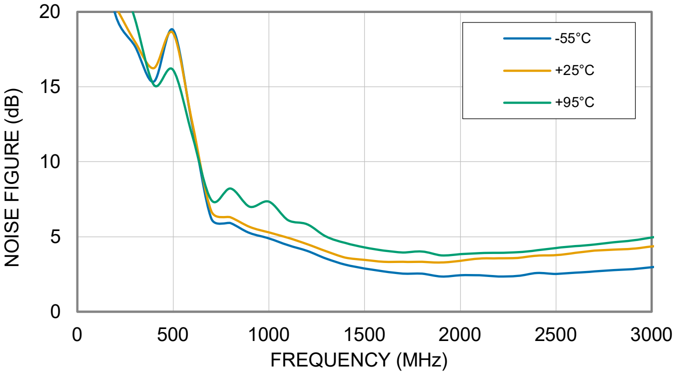


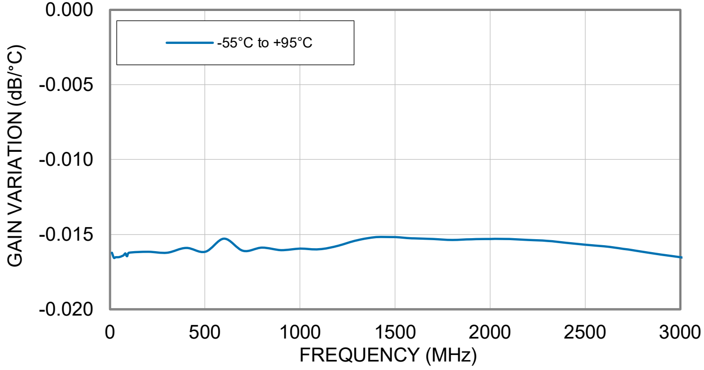
IM5 vs. DEVICE CURRENT (I_{DD})
TONE SPACING = 1 MHz, TEMPERATURE = +25°C,
P_{OUT} = +26 dBm/TONE



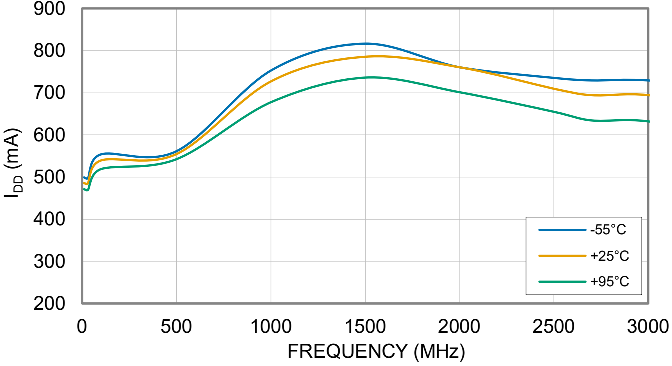
IM5 vs. P_{OUT}
TONE SPACING = 1 MHz, TEMPERATURE = +25°C



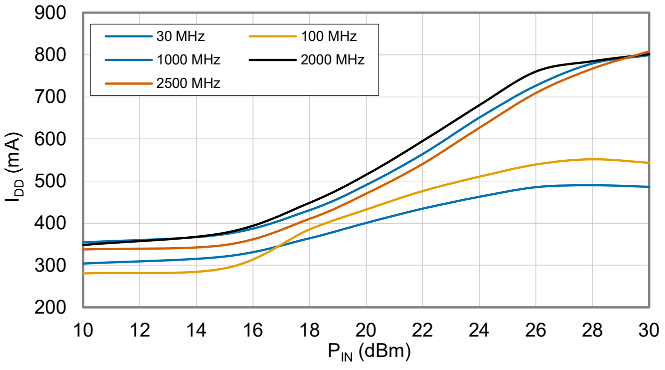
NOISE FIGURE vs. TEMPERATURE



GAIN VARIATION vs. TEMPERATURE
P_{IN} = -25 dBm



I_{DD} vs. TEMPERATURE
P_{IN} = +26 dBm



I_{DD} vs. P_{IN}
TEMPERATURE = +25°C

TYPICAL PERFORMANCE GRAPHS

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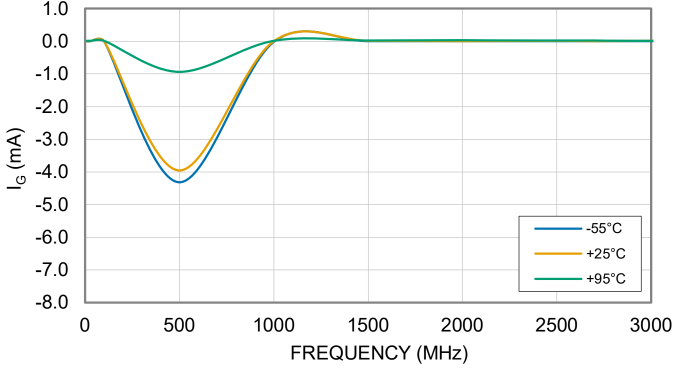
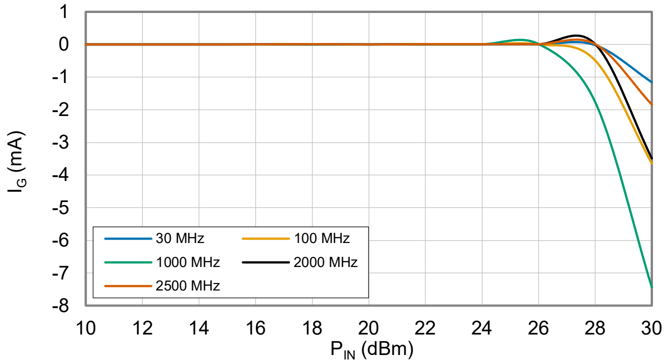
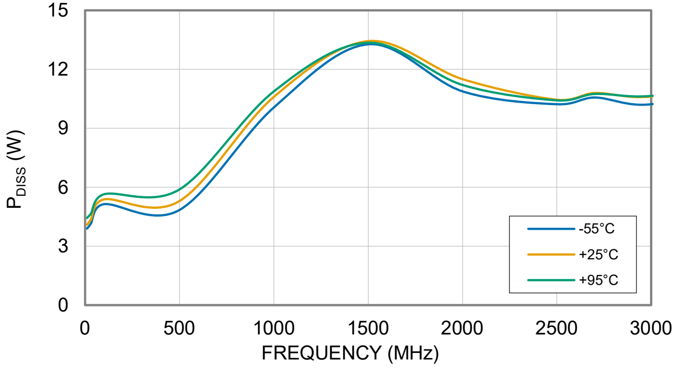
I_G vs. TEMPERATURE
P_{IN} = +26 dBm



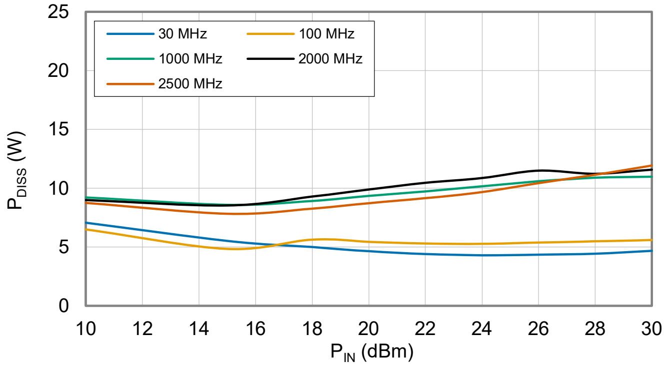
I_G vs. P_{IN}
TEMPERATURE = +25°C



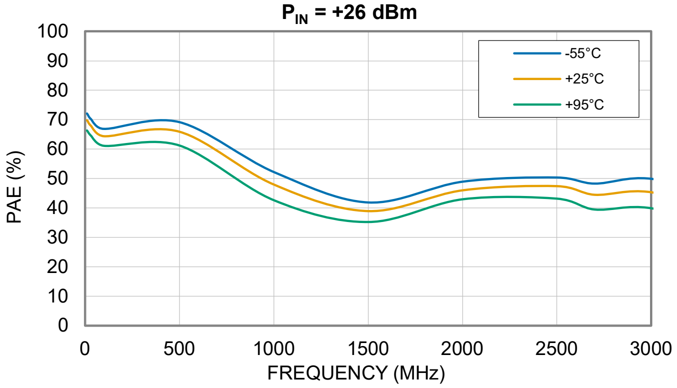
P_{DISS} vs. TEMPERATURE
P_{IN} = +26 dBm, TEMPERATURE = +25°C



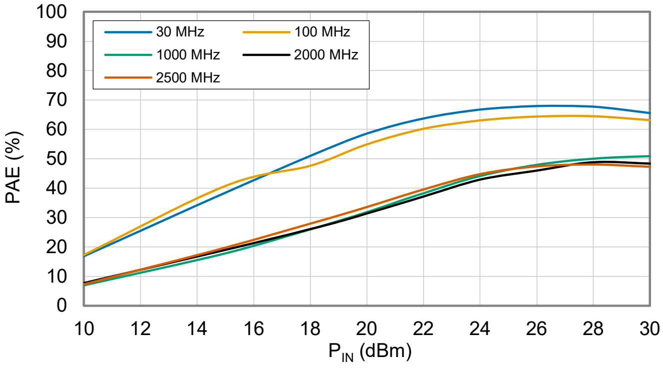
P_{DISS} vs. P_{IN}
TEMPERATURE = +25°C



PAE vs. TEMPERATURE
P_{IN} = +26 dBm

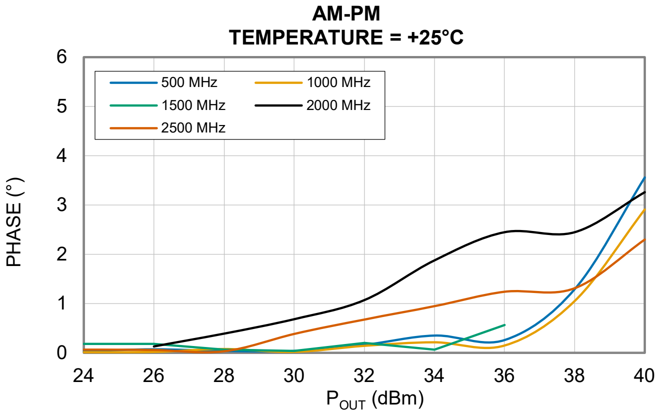


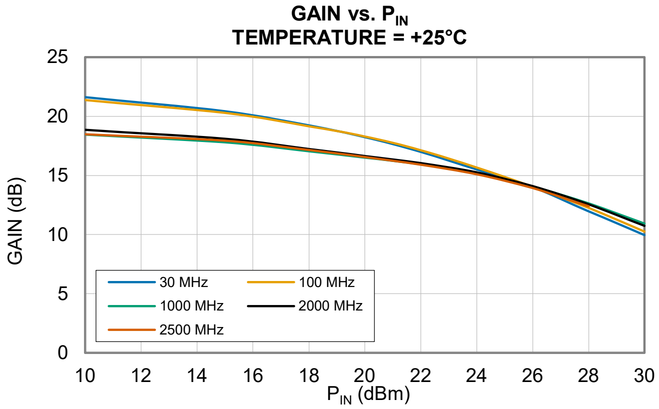
PAE vs. P_{IN}
TEMPERATURE = +25°C

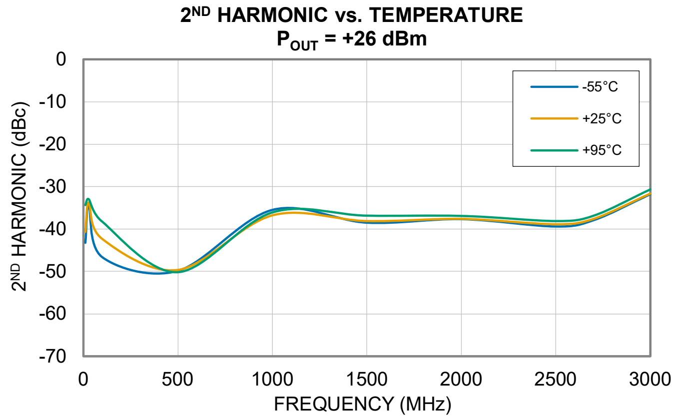


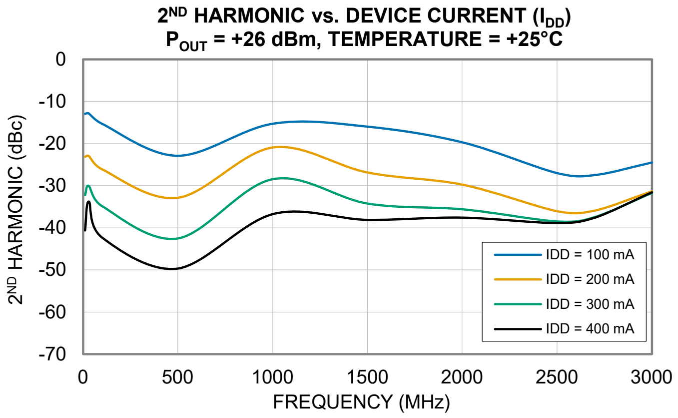
TYPICAL PERFORMANCE GRAPHS

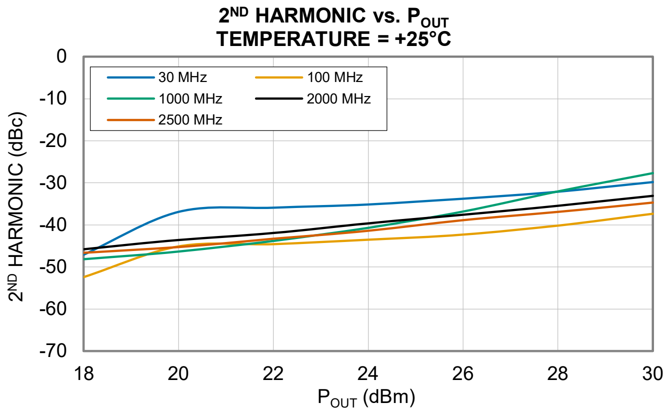
Note: The following data was taken on Mini-Circuits Characterization Test Board TB-GNA252-5WCX+ with external bias-T (Figure 2). All data taken at nominal condition of V_{DD} = +28 V and I_{DD} = 400 mA unless noted otherwise. V_G was adjusted at each voltage and temperature level to achieve I_{DD} = 400 mA.

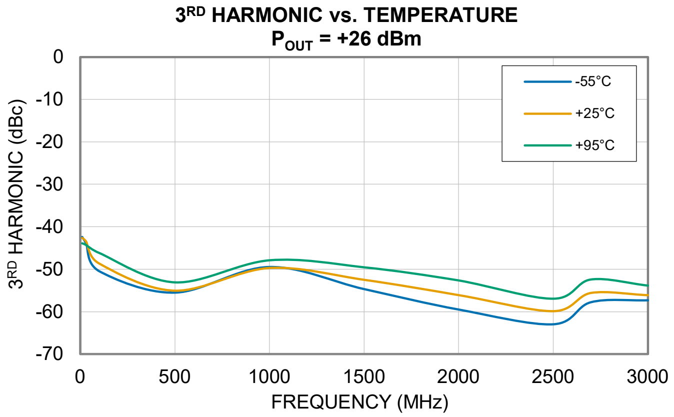

AM-PM
TEMPERATURE = +25°C


GAIN vs. P_{IN}
TEMPERATURE = +25°C


2^{ND} HARMONIC vs. TEMPERATURE
P_{OUT} = +26 dBm


2^{ND} HARMONIC vs. DEVICE CURRENT (I_{DD})
P_{OUT} = +26 dBm, TEMPERATURE = +25°C

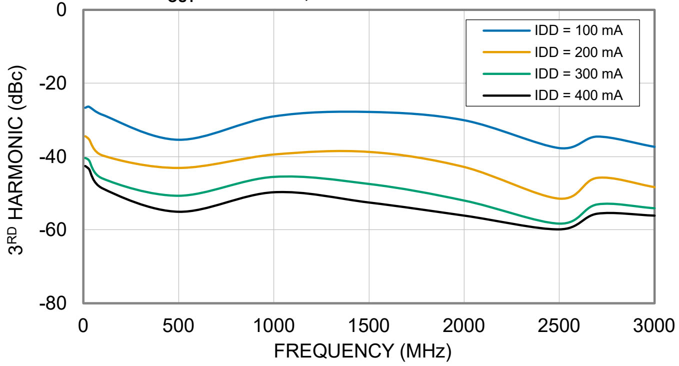

2^{ND} HARMONIC vs. P_{OUT}
TEMPERATURE = +25°C


3^{RD} HARMONIC vs. TEMPERATURE
P_{OUT} = +26 dBm

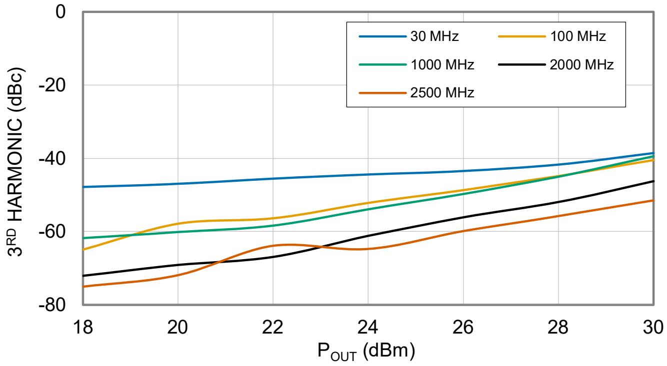
TYPICAL PERFORMANCE GRAPHS

Note: The following data was taken on Mini-Circuits Characterization Test Board TB-GNA252-5WCX+ with external bias-T (Figure 2). All data taken at nominal condition of V_{DD} = +28 V and I_{DD} = 400 mA unless noted otherwise. V_G was adjusted at each voltage and temperature level to achieve I_{DD} = 400 mA.

3RD HARMONIC vs. DEVICE CURRENT (I_{DD})
P_{OUT} = +26 dBm, TEMPERATURE = +25°C



3RD HARMONIC vs. P_{OUT}
TEMPERATURE = +25°C



ABSOLUTE MAXIMUM RATINGS[6]

Parameter	Ratings
Operating Temperature	-55 °C to +95 °C
Storage Temperature	-65 °C to +150 °C
Junction Temperature[7]	+215 °C
Total Power Dissipation	13.5 W
Input Power (CW)	+36 dBm
DC Voltage on RF-OUT & V_{DD}	+45 V
DC Voltage on RF-IN	+15 V
DC Voltage on V_G	$-5\text{ V} < V_G < 0\text{ V}$
DC Current on RF-OUT & V_{DD}	1.2 A
DC Current V_G	-25 mA

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

THERMAL RESISTANCE

Parameter	Ratings
Thermal Resistance (Θ_{JC})[8]	9.6 °C/W

8. 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-002-2022

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: MSL3 in accordance with IPC/JEDEC J-STD-020E /JEDEC J-STD-033C

FUNCTIONAL DIAGRAM

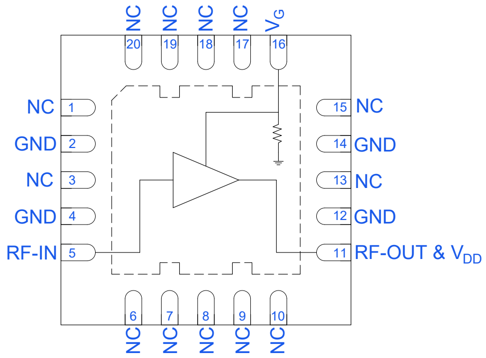


Figure 1. GNA-252-5W+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description (Refer to Figure 2)
RF-OUT & V_{DD}	11	RF-OUT & V_{DD} Pad connects to RF-Output port and voltage input port, V_{DD}.
RF-IN	5	RF-IN Pad connects to RF-Input port.
V_G	16	DC Input Pad connects to voltage input port, V_G.
NC	1, 3, 6-10, 13, 15, & 17-20	Not used internally. Connected to ground on test board.
GND	2, 4, 12, 14, & Paddle	Connects to ground.

CHARACTERIZATION TEST BOARD

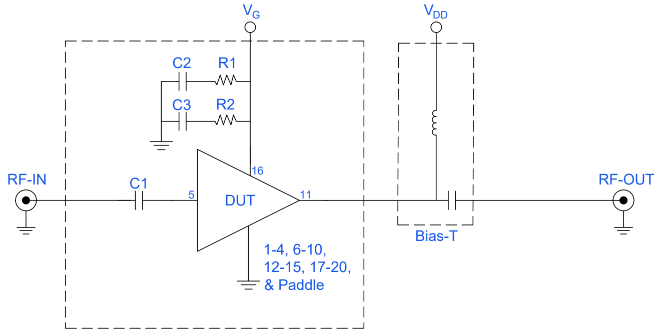


Figure 2. GNA-252-5W+ Characterization Circuit

Electrical Parameters and Conditions
Gain, Return Loss, Output Power at 1 dB Compression (P1dB), Output IP3 (OIP3), Power measurements, and Noise Figure measured using N5242A PNA-X microwave network analyzer. All data taken with test board assembly mounted on heatsink.

Conditions:
1. Gain and Return Loss: P_{IN} = -25 dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, +26 dBm/tone at output.
3. Power taken at P_{IN} = +26 dBm

Power ON/Power OFF Sequence:
Caution: Permanent damage to the device will occur if the Power ON and Power OFF sequences are not followed.

POWER ON:
1. Set V_G = -3 V and turn on.
2. Set V_{DD} = +28 V and turn on.
3. Increase V_G until I_{DD} = 400 mA.
4. Apply RF Signal.

POWER OFF:
1. Turn off RF signal.
2. Set V_G = -3 V and turn off V_{DD}.
3. Turn off V_G.

Component	Size	Value	Part Number	Manufacturer
R1-R2	0201	10Ω	RK73HW2H/2H	KOA Speer
C1, C3	0603	0.1 µF	0603BB104KW101	PPI
C2	1206	1 µF	C3216X7R2A105K160AA	TDK

EVALUATION BOARD

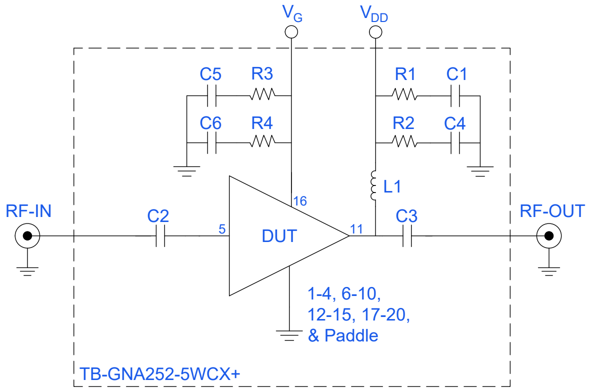


Figure 3. GNA-252-5W+ 100 MHz - 2500 MHz Evaluation and Application Circuit

Electrical Parameters and Conditions
Gain, Return Loss, Output Power at 1 dB Compression (P1dB), Output IP3 (OIP3), Power measurements, and Noise Figure measured using N5242A PNA-X microwave network analyzer. All data taken with test board assembly mounted on heatsink.

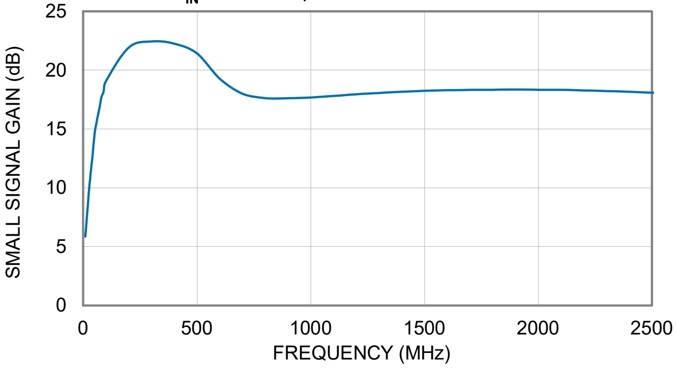
Conditions:
1. Gain and Return Loss: P_{IN} = -25 dBm
2. Power taken at P_{IN} = +26 dBm

Component	Size	Value	Part Number	Manufacturer
R1-R4	0201	10Ω	RK73HW2H/2H	KOA Speer
C1, C5	1206	1 μF	C3216X7R2A105K160AA	TDK
C2, C3, C4, C6	0603	0.1 μF	0603BB104KW101	PPI
L1	0603	47 nH	0603HC-47NXJRW	Coilcraft

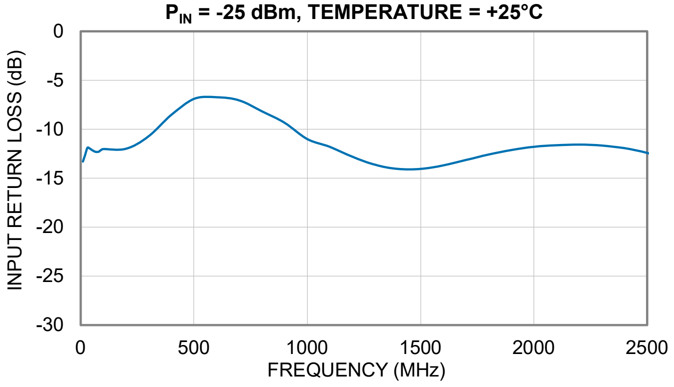
TYPICAL EVALUATION BOARD PERFORMANCE GRAPHS

Note: The following data was taken on Mini-Circuits Characterization Test Board TB-GNA252-5WCX+ (Figure 3). All data taken at nominal condition of V_{DD} = +28 V, I_{DD} = 400 mA, and Temperature = +25°C unless noted otherwise. V_G was adjusted to achieve I_{DD} = 400 mA.

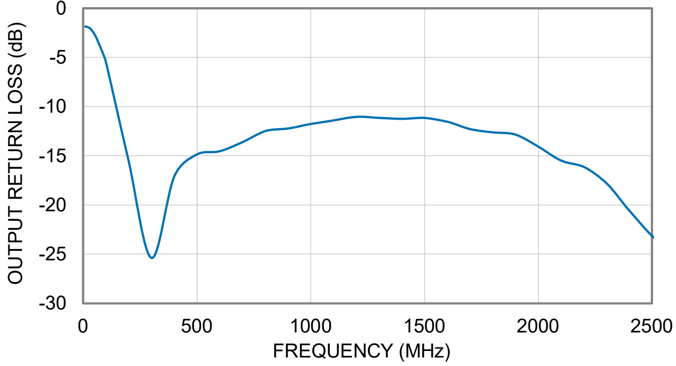
SMALL SIGNAL GAIN vs. FREQUENCY
P_{IN} = -25 dBm, TEMPERATURE = +25°C



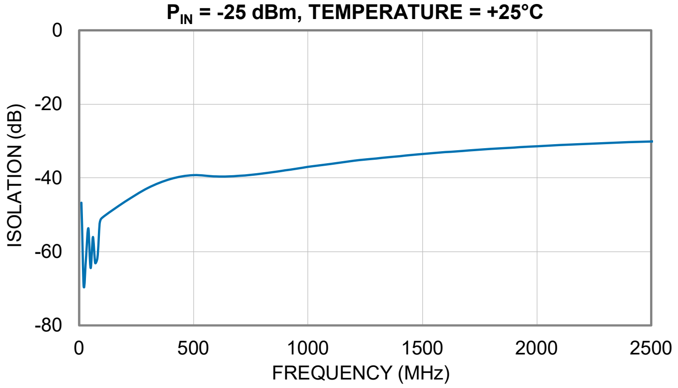
INPUT RETURN LOSS vs. FREQUENCY
P_{IN} = -25 dBm, TEMPERATURE = +25°C



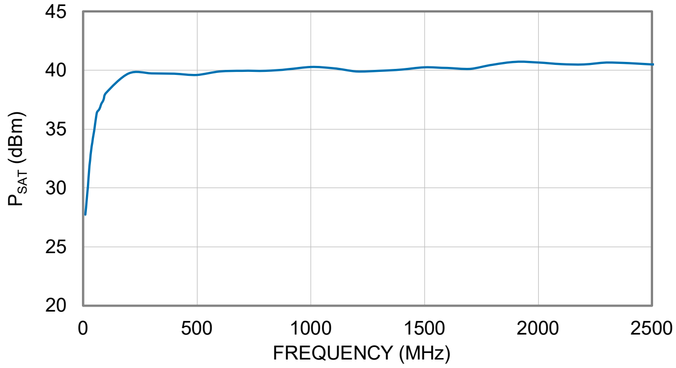
OUTPUT RETURN LOSS vs. FREQUENCY
P_{IN} = -25 dBm, TEMPERATURE = +25°C



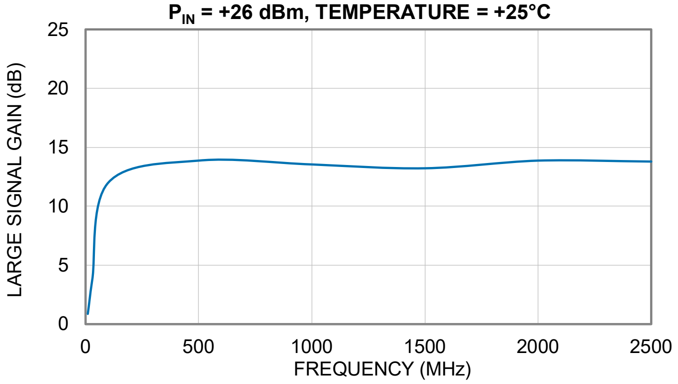
ISOLATION vs. FREQUENCY
P_{IN} = -25 dBm, TEMPERATURE = +25°C



P_{SAT} vs. FREQUENCY
TEMPERATURE = +25°C

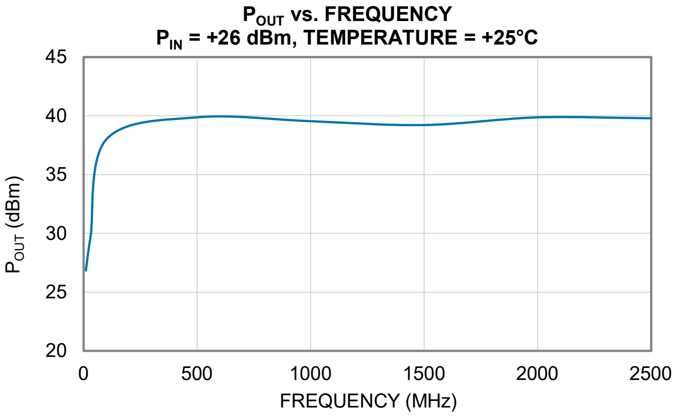


LARGE SIGNAL GAIN vs FREQUENCY
P_{IN} = +26 dBm, TEMPERATURE = +25°C

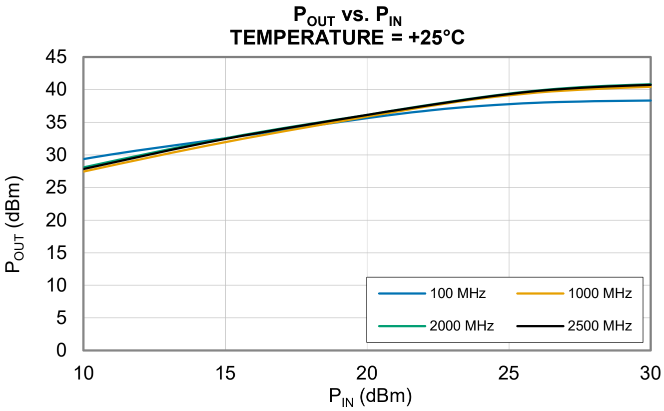


TYPICAL EVALUATION BOARD PERFORMANCE GRAPHS

Note: The following data was taken on Mini-Circuits Characterization Test Board TB-GNA252-5WCX+ (Figure 3). All data taken at nominal condition of V_{DD} = +28 V, I_{DD} = 400 mA, and Temperature = +25°C unless noted otherwise. V_G was adjusted to achieve I_{DD} = 400 mA.

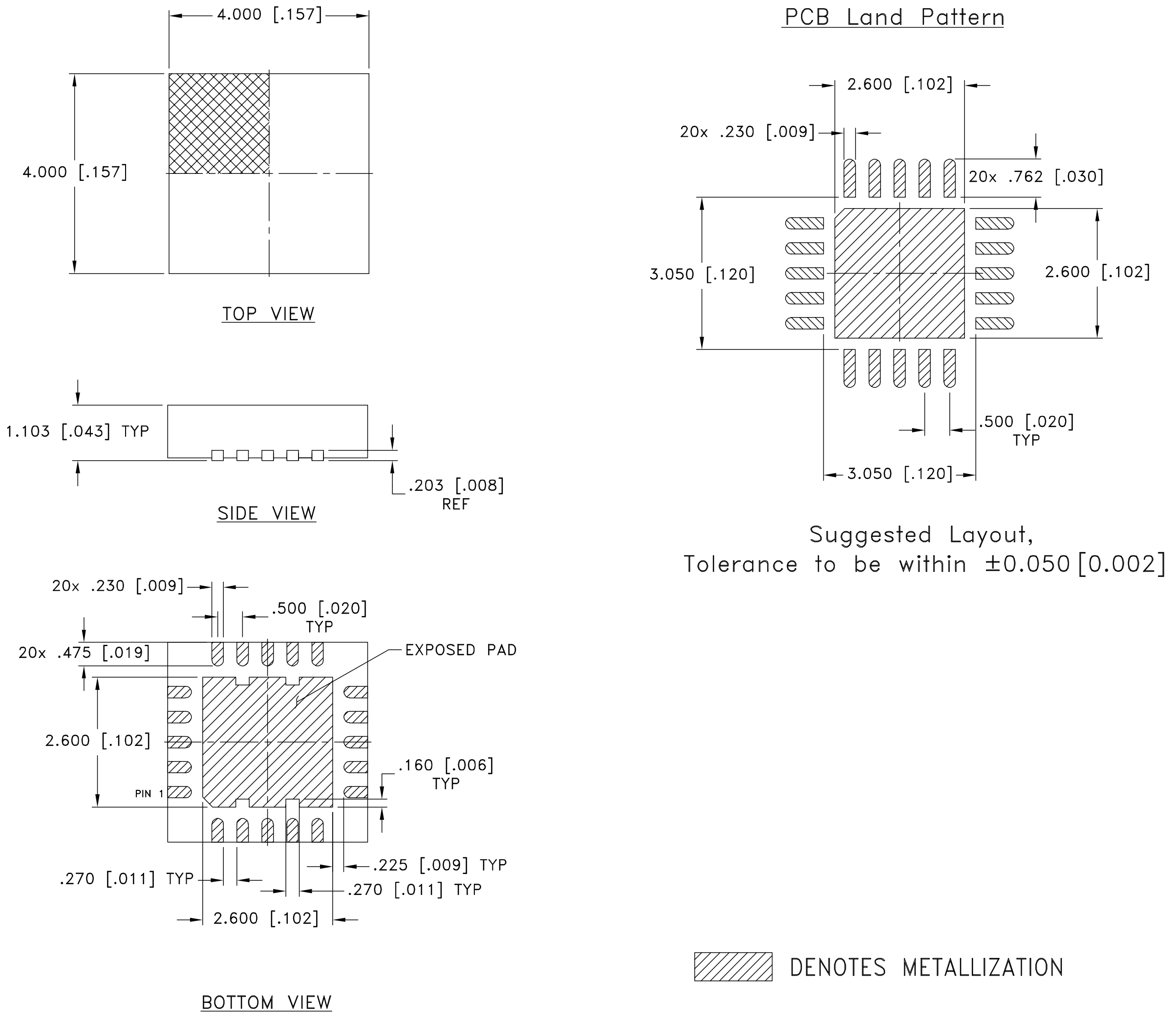


P_{OUT} vs. FREQUENCY
P_{IN} = +26 dBm, TEMPERATURE = +25°C



P_{OUT} vs. P_{IN}
TEMPERATURE = +25°C

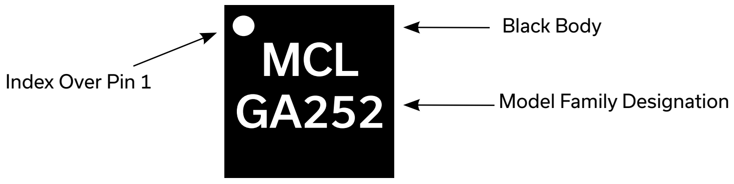
CASE STYLE DRAWING



Weight: .042 Grams

Dimensions are in mm [Inches]. Tolerances: 2 Pl. ± 0.254 [0.01]; 3 Pl. ± 0.127 [0.005] mm [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 & Graphs	Data Graphs S-Parameter (S2P Files) Data Set (.zip file)
Case Style	DG983-4 Plastic package, exposed paddle, Lead Finish: Nickel Palladium Gold
RoHS Status	Compliant
Tape & Reel **Standard Quantities Available on Reel**	F68 7″ Reels with 20, 50, 100, 200, 500, or 1000 devices 13″ Reels with 2000, 3000, or 4000 devices
Suggested Layout for PCB Design	PL-858
Evaluation Board	TB-GNA252-5WCX+ Gerber File
Environmental Ratings	ENV08T10
Product Handling	The use of no-clean solder is recommended. This package cannot be subjected to aqueous wash.