MMIC SURFACE MOUNT

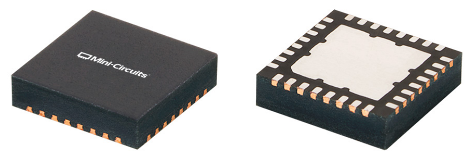
Power Amplifier

GNA-63-5W+

50Ω 10 to 6000 MHz 6 W Output Power

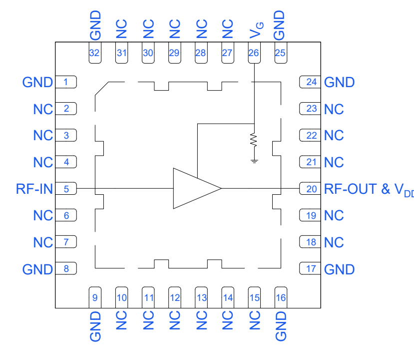
THE BIG DEAL

- P_{SAT}, Typ. +38.5 dBm
- Output Power, > 6 W @ P_{IN} = +26 dBm
- PAE, Typ. 35%
- Large Signal Gain, Typ. 12 dB
- Gain Flatness < ± 1 dB
- IM3, Typ. -32 dBc @ P_{OUT} = +26 dBm/tone
- IM5, Typ. -56 dBc @ P_{OUT} = +26 dBm/tone
- Supply Voltage, +28 V at 400 mA
- 5×5 mm 32-Lead QFN-Style Package



Generic photo used for illustration purposes only

FUNCTIONAL DIAGRAM (TOP VIEW)



APPLICATIONS

- Land Mobile and Military Radio Systems
- Radar, EW, and ECM Defense Systems
- Satellite Communications
- Test & Measurement Systems

PRODUCT OVERVIEW

The GNA-63-5W+ is a GaN-on-SiC HEMT MMIC high power amplifier operating from 10 MHz to 6 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 a typical 12 dB of flat power gain across a broad frequency range, delivers more than 6 W of output power and achieves 35% power-added efficiency. At 3 GHz, IM3 is -32 dBc and IM5 is -56 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 satellite communication systems. The GNA-63-5W+ is matched to 50Ω at the input and output, making it easy to implement. It comes in a 5×5 mm, 32-lead QFN-Style surface-mount package, ensuring excellent thermal performance and compatibility with high-volume manufacturing.

KEY FEATURES

Feature	Advantages
• Output Power, > 6 W @ P_{IN} = +26 dBm • Power Gain, Typ. 12 dB • PAE, Typ. 35%	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 • IM3: -32 dBc • IM5: -56 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	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.
5×5 mm 32-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.

REV. OR
ECO-030116
GNA-63-5W+
MCL NY
260618

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

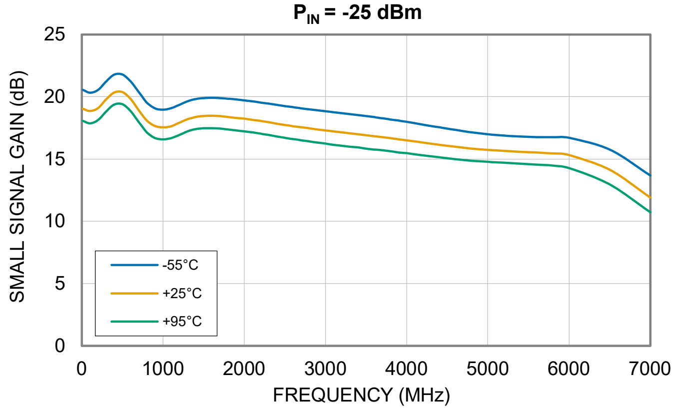
Parameter	Condition (MHz)	Min.	Typ.	Max.	Units
Frequency Range		10		6000	MHz
Small Signal Gain	10	19.4	20.4		dB
	1000	16.0	17.8		
	2000	16.7	18.6		
	3000	15.9	17.7		
	4000	14.9	17.0		
	6000	12.9	15.7		
Input Return Loss	10		11		dB
	1000		10		
	2000		14		
	3000		13		
	4000		20		
	6000		15		
Output Return Loss	10		7		dB
	1000		9		
	2000		8		
	3000		12		
	4000		10		
	6000		14		
Isolation	10–6000		31.7		dB
Output Power at Saturation (P_{SAT})[2]	10		+39.5		dBm
	1000		+39.4		
	2000		+39.0		
	3000		+38.5		
	4000		+38.4		
	6000		+38.8		
Output Power (P_{IN} = +26 dBm)	10		+39.4		dBm
	1000		+39.2		
	2000		+38.9		
	3000		+38.2		
	4000		+37.5		
	6000		+37.5		
Power Added Efficiency (P_{IN} = +26 dBm)	10		66		%
	1000		51		
	2000		42		
	3000		36		
	4000		28		
	6000		33		
Large Signal Gain (P_{IN} = +26 dBm)	10		13.5		dB
	1000		13.3		
	2000		13.0		
	3000		12.3		
	4000		11.7		
	6000		11.7		
Device Operating Voltage (V_{DD})		+20	+28	+28	V
Device Operating Current (I_{DD})[3]		100	400	400	mA
Device Gate Voltage (V_G)			-1.7		V
Device Gate Current (I_G)			20		µA
Device Current Variation Vs. Temperature[4]			-0.146		mA/°C
Device Current Variation Vs. Voltage[5]			-3		µA/mV

1. Tested on Mini-Circuits Characterization Test Board TB-GNA-63-5WCX+ 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 750 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)

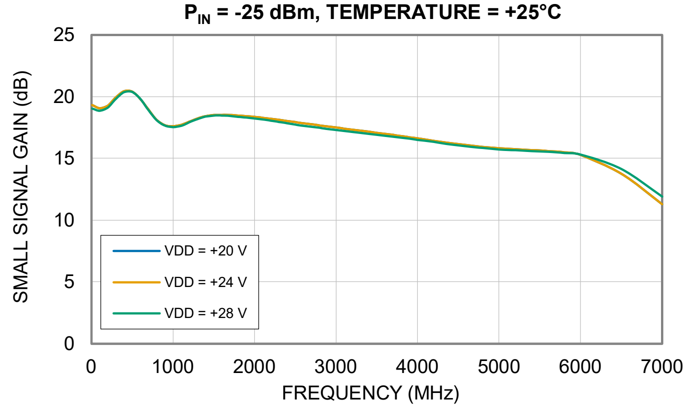
TYPICAL PERFORMANCE GRAPHS

Note: The following data was taken on Mini-Circuits Characterization Test Board TB-GNA-63-5WCX+ 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.

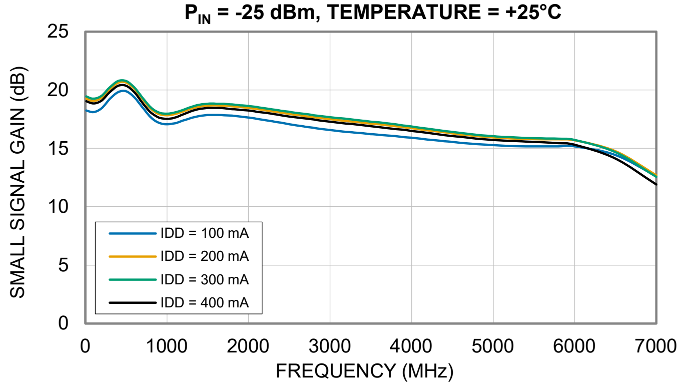
SMALL SIGNAL GAIN vs. TEMPERATURE
P_{IN} = -25 dBm



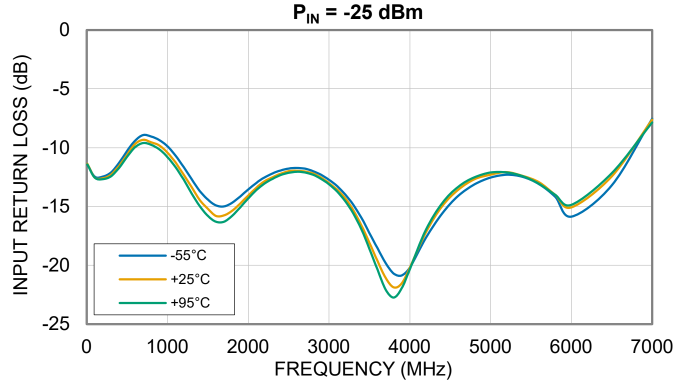
SMALL SIGNAL GAIN vs. DEVICE VOLTAGE (V_{DD})
P_{IN} = -25 dBm, TEMPERATURE = +25°C



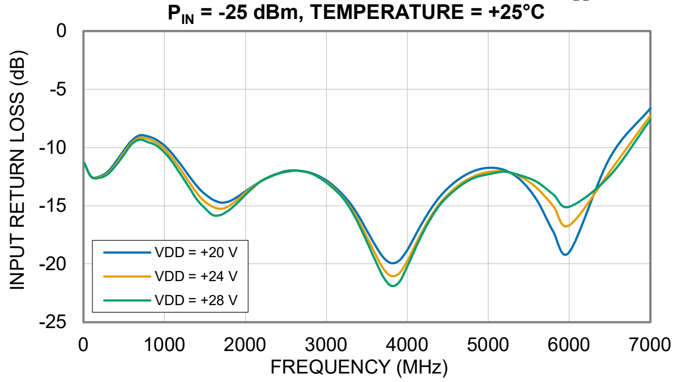
SMALL SIGNAL GAIN vs. DEVICE CURRENT (I_{DD})
P_{IN} = -25 dBm, TEMPERATURE = +25°C



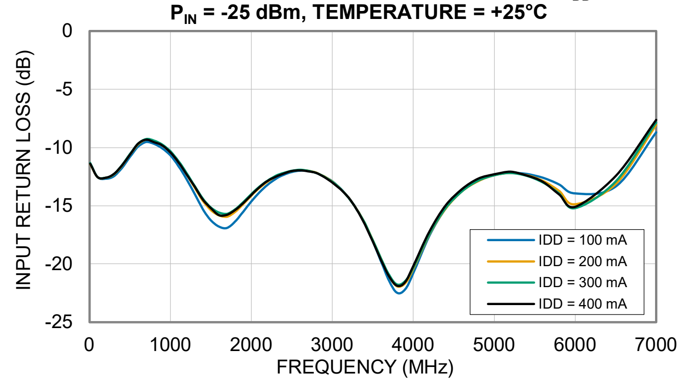
INPUT RETURN LOSS vs. TEMPERATURE
P_{IN} = -25 dBm



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



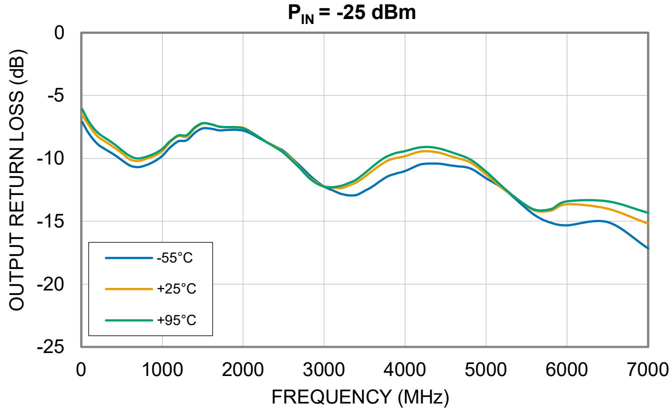
INPUT RETURN LOSS vs. DEVICE CURRENT (I_{DD})
P_{IN} = -25 dBm, TEMPERATURE = +25°C



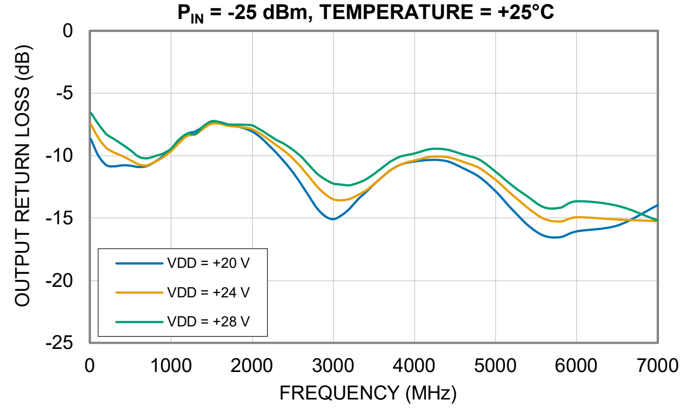
TYPICAL PERFORMANCE GRAPHS

Note: The following data was taken on Mini-Circuits Characterization Test Board TB-GNA-63-5WCX+ 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.

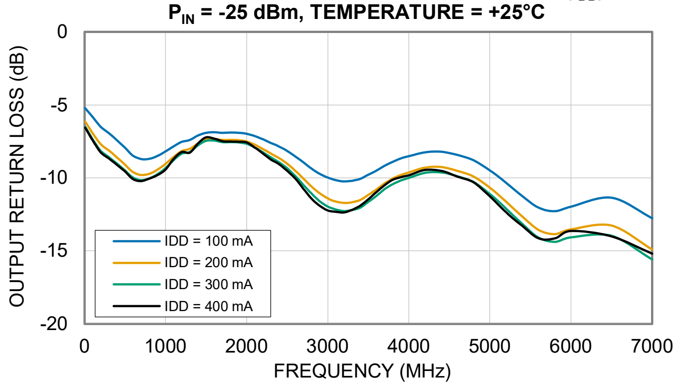
OUTPUT RETURN LOSS vs. TEMPERATURE
P_{IN} = -25 dBm



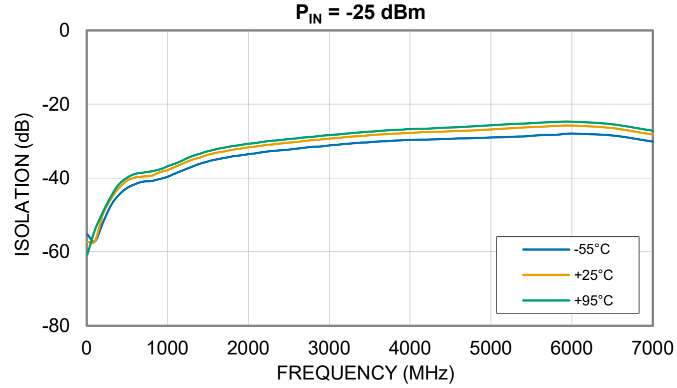
OUTPUT RETURN LOSS vs. DEVICE VOLTAGE (V_{DD})
P_{IN} = -25 dBm, TEMPERATURE = +25°C



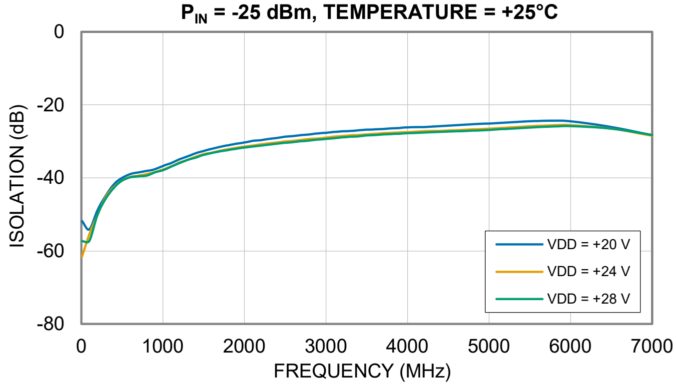
OUTPUT RETURN LOSS vs. DEVICE CURRENT (I_{DD})
P_{IN} = -25 dBm, TEMPERATURE = +25°C



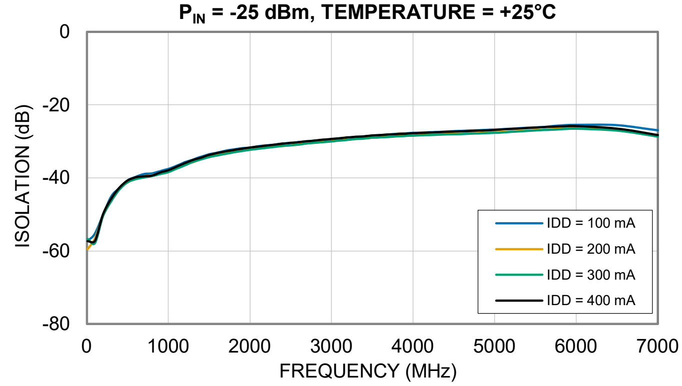
ISOLATION vs. TEMPERATURE
P_{IN} = -25 dBm



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



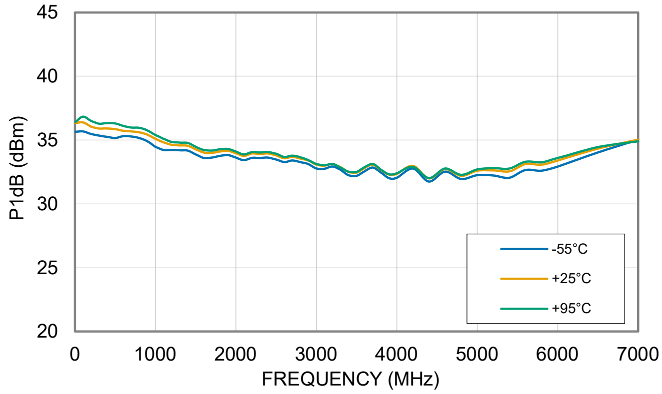
ISOLATION vs. DEVICE CURRENT (I_{DD})
P_{IN} = -25 dBm, TEMPERATURE = +25°C



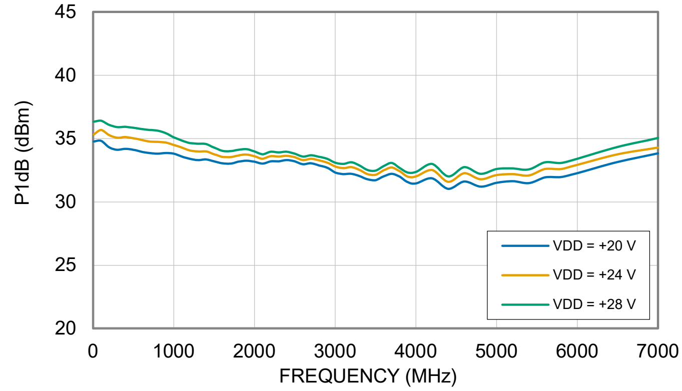
TYPICAL PERFORMANCE GRAPHS

Note: The following data was taken on Mini-Circuits Characterization Test Board TB-GNA-63-5WCX+ 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.

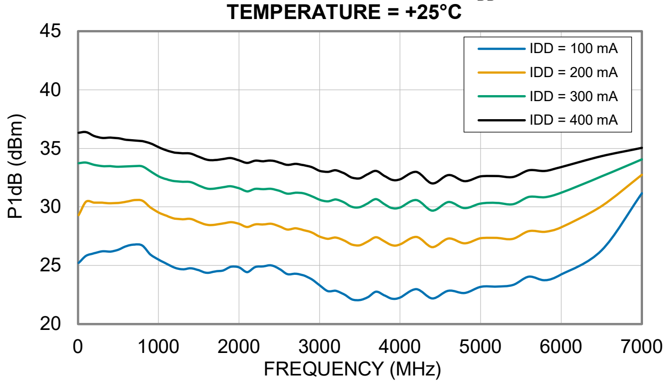
P1dB vs. TEMPERATURE



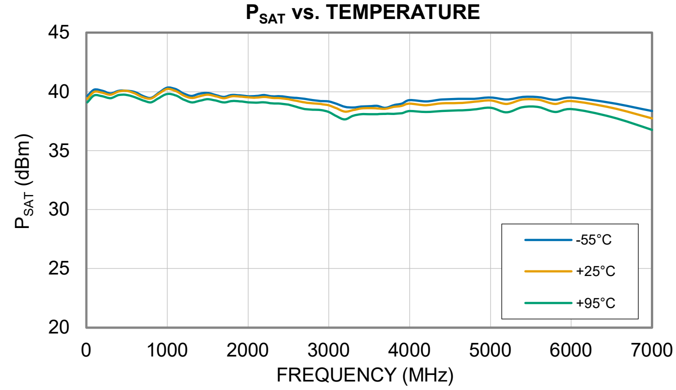
P1dB vs. DEVICE VOLTAGE (V_{DD})
TEMPERATURE = +25°C



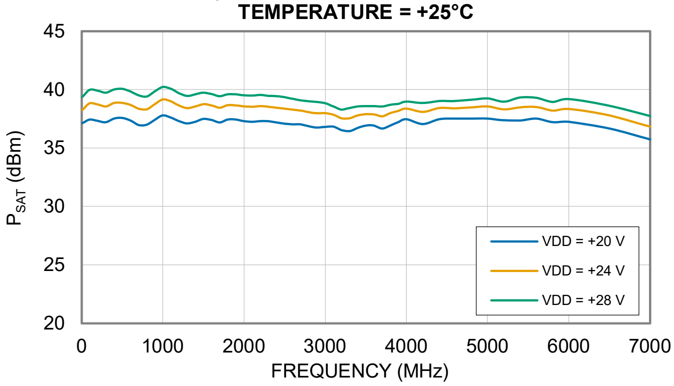
P1dB vs. DEVICE CURRENT (I_{DD})
TEMPERATURE = +25°C



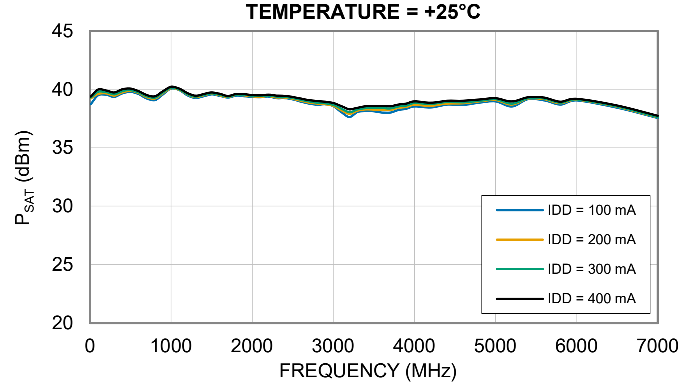
P_{SAT} vs. TEMPERATURE



P_{SAT} vs. DEVICE VOLTAGE (V_{DD})
TEMPERATURE = +25°C



P_{SAT} vs. DEVICE CURRENT (I_{DD})
TEMPERATURE = +25°C



TYPICAL PERFORMANCE GRAPHS

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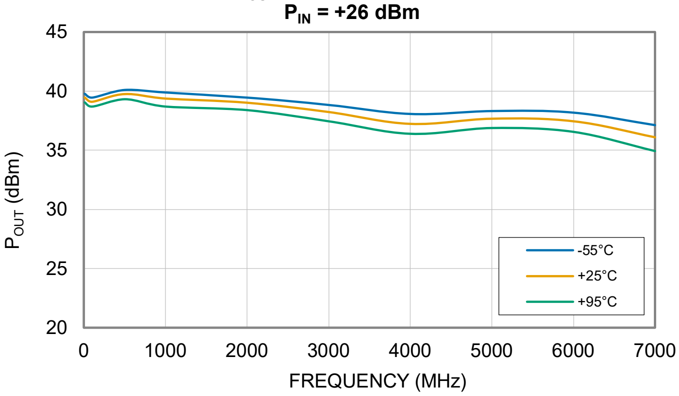
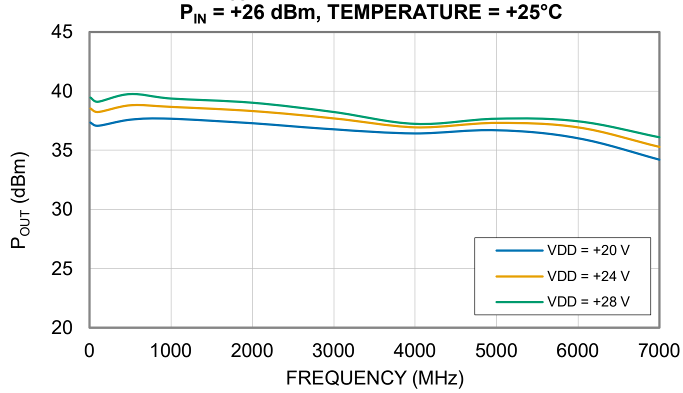
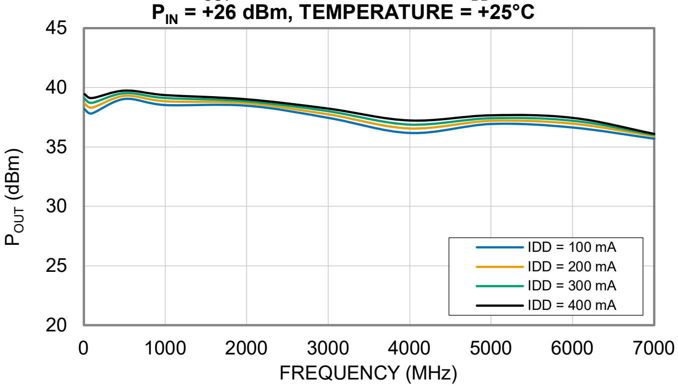
P_{OUT} vs. TEMPERATURE
P_{IN} = +26 dBm



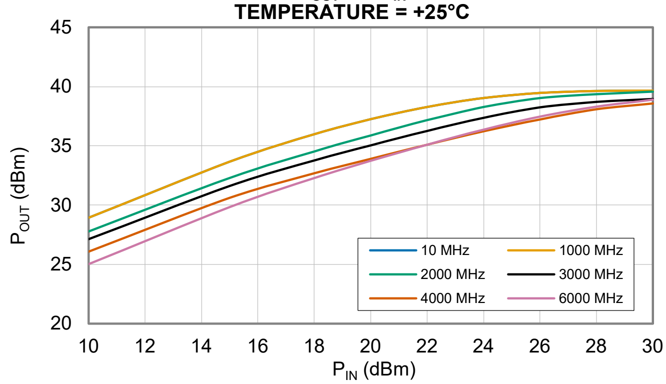
P_{OUT} vs. DEVICE VOLTAGE (V_{DD})
P_{IN} = +26 dBm, TEMPERATURE = +25°C



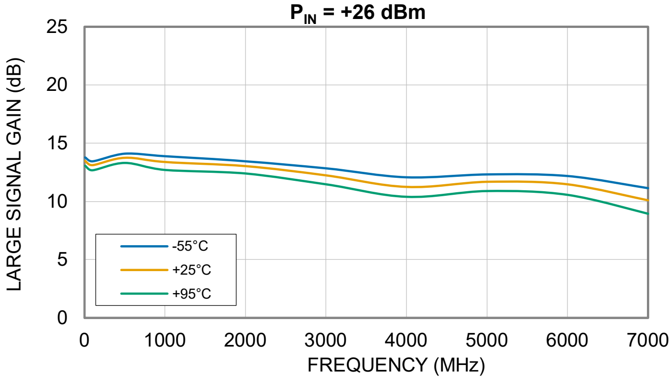
P_{OUT} vs. DEVICE CURRENT (I_{DD})
P_{IN} = +26 dBm, TEMPERATURE = +25°C



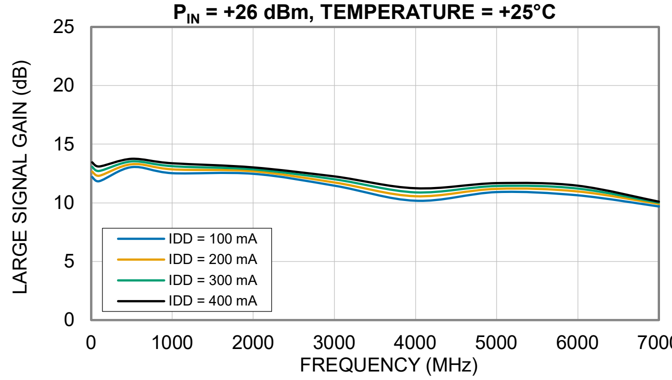
P_{OUT} vs. P_{IN}
TEMPERATURE = +25°C



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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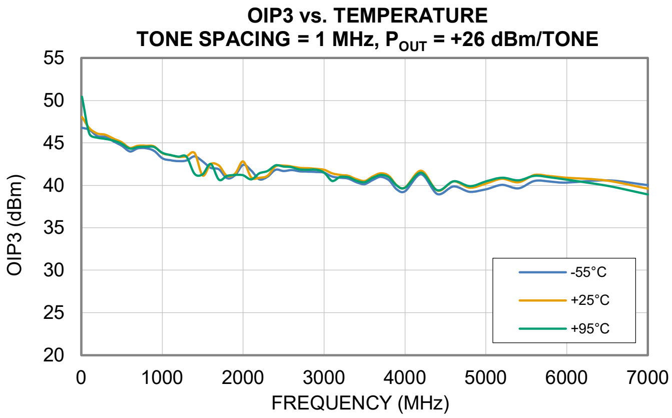
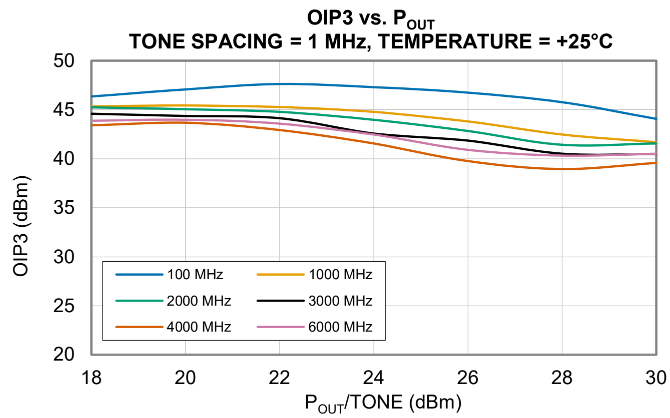
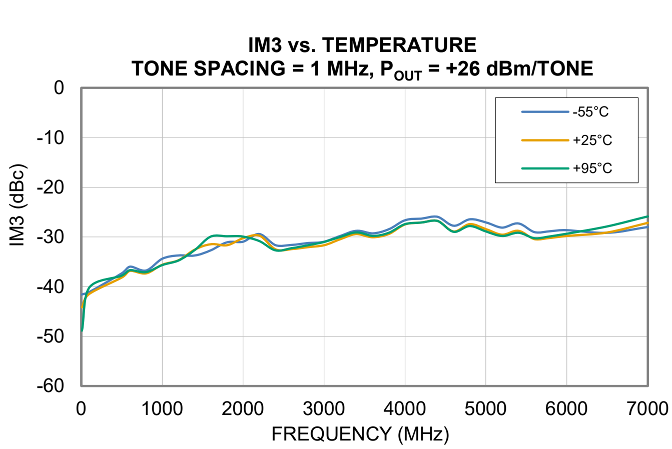
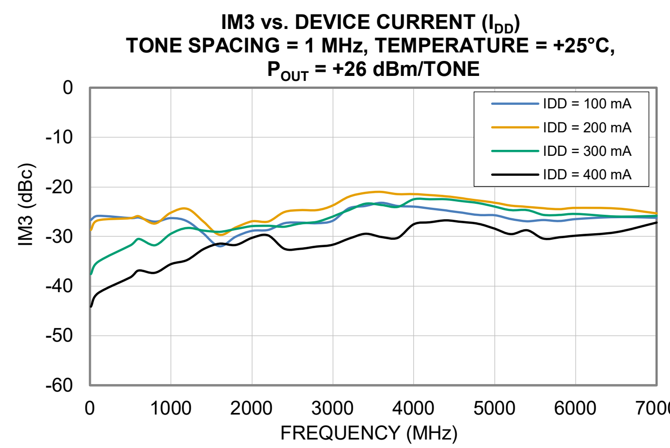
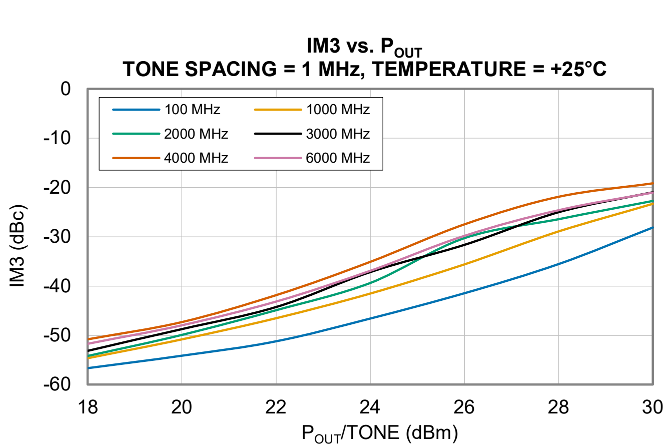
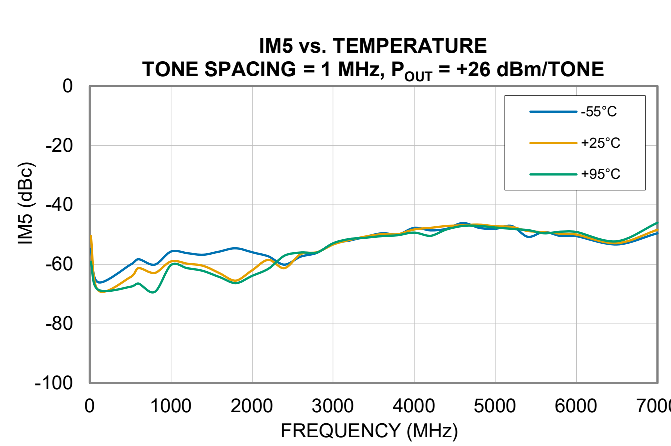








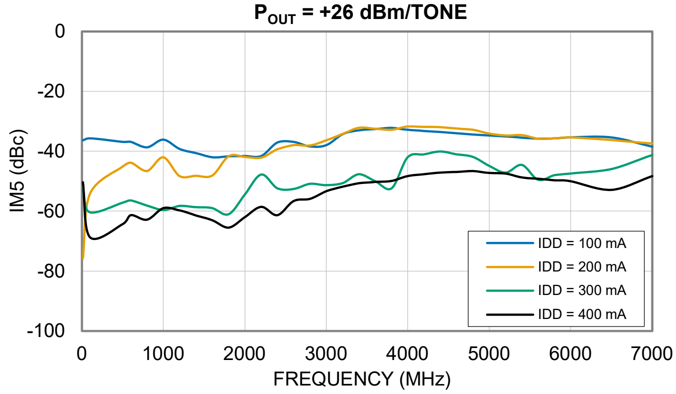




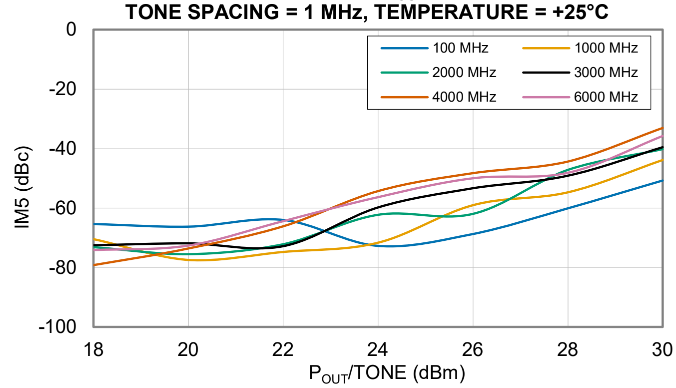
TYPICAL PERFORMANCE GRAPHS

Note: The following data was taken on Mini-Circuits Characterization Test Board TB-GNA-63-5WCX+ 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.

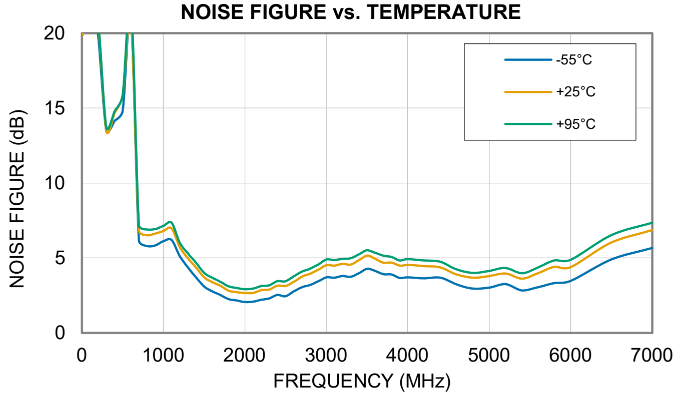
IM5 vs. DEVICE CURRENT (I_{DD})
TONE SPACING = 1 MHz, TEMPERATURE = +25°C, P_{OUT} = +26 dBm/TONE



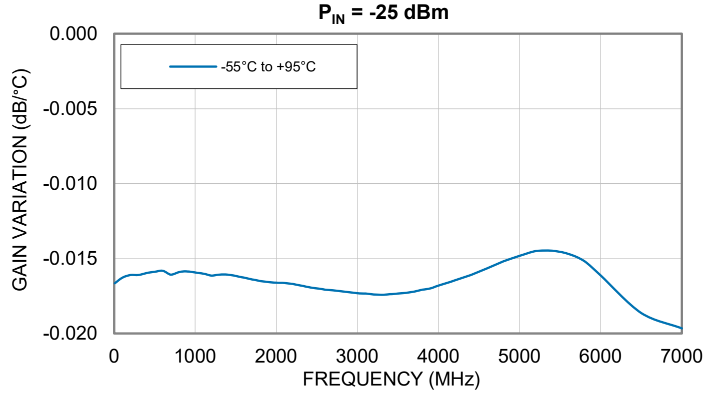
IM5 vs. P_{OUT}
TONE SPACING = 1 MHz, TEMPERATURE = +25°C



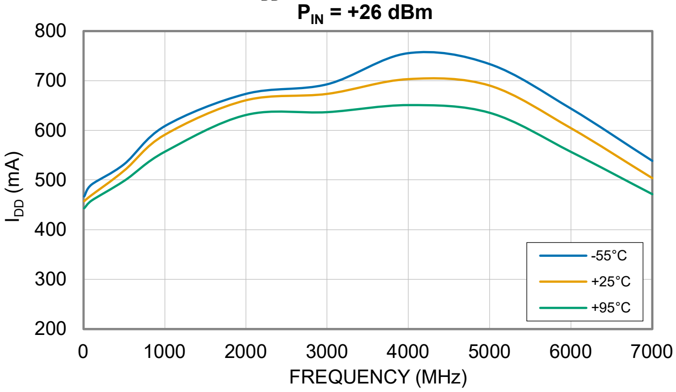
NOISE FIGURE vs. TEMPERATURE



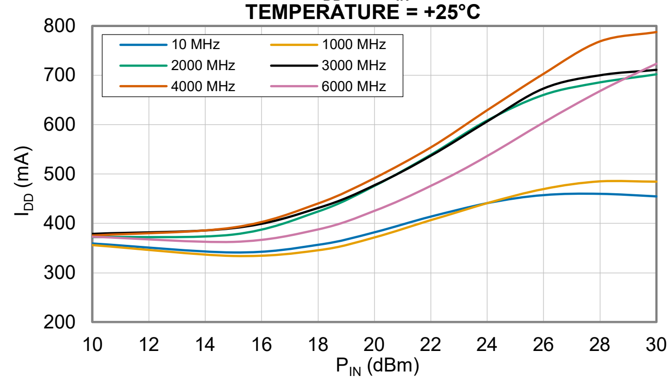
GAIN VARIATION vs. TEMPERATURE
P_{IN} = -25 dBm



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

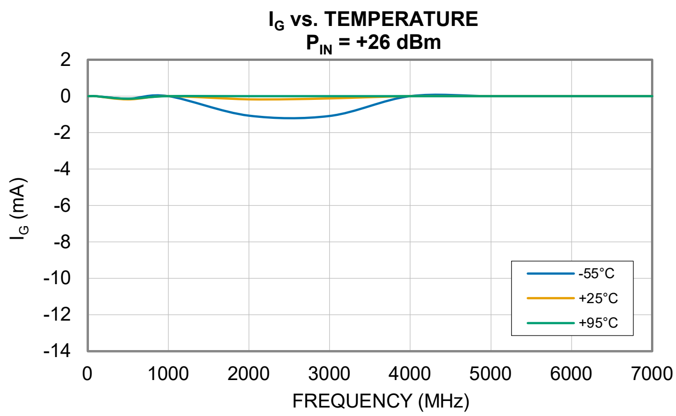


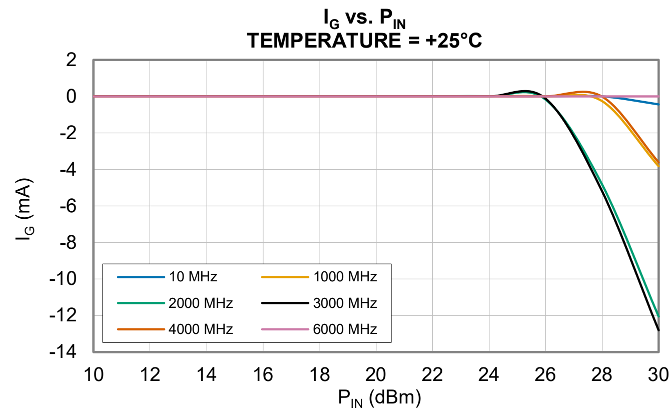
I_{DD} vs. P_{IN}
TEMPERATURE = +25°C

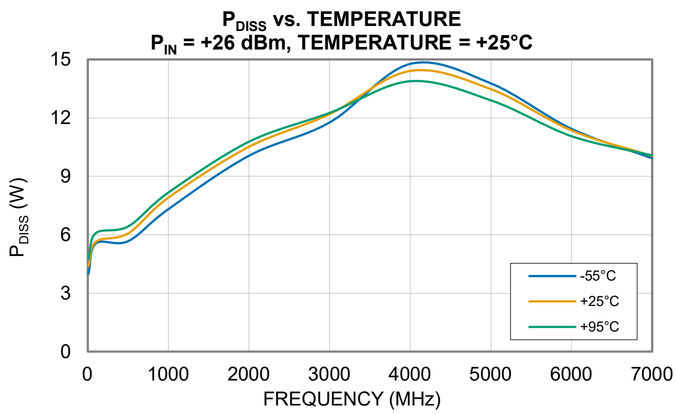


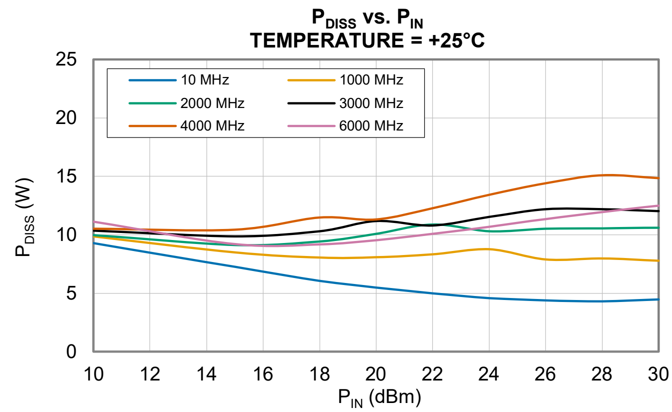
TYPICAL PERFORMANCE GRAPHS

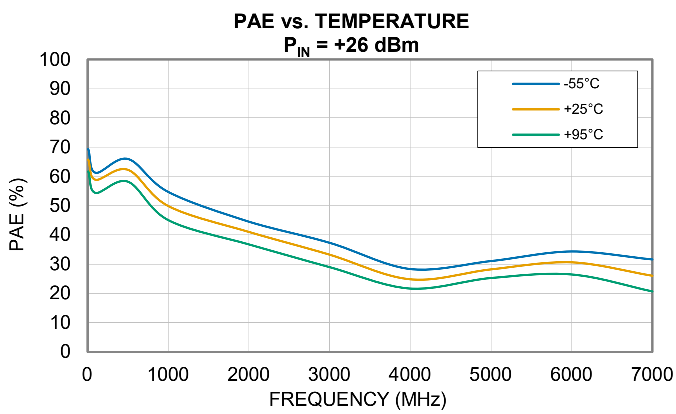
Note: The following data was taken on Mini-Circuits Characterization Test Board TB-GNA-63-5WCX+ with external bias-T (Figure 2). All data taken at nominal condition of V_{DD} = +28 V and I_{DD} = 400 mA unless noted otherwise. V_G was adjusted at each voltage and temperature level to achieve I_{DD} = 400 mA.

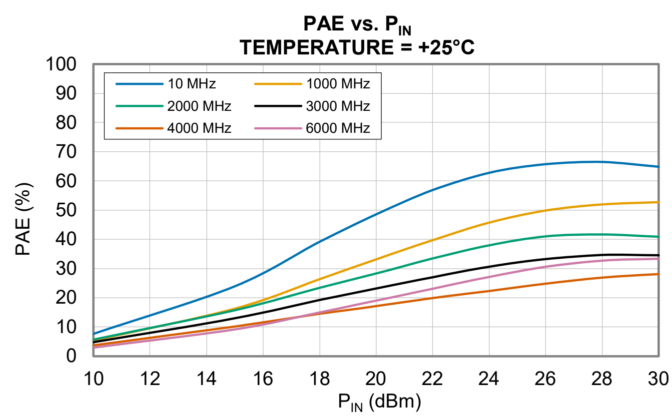








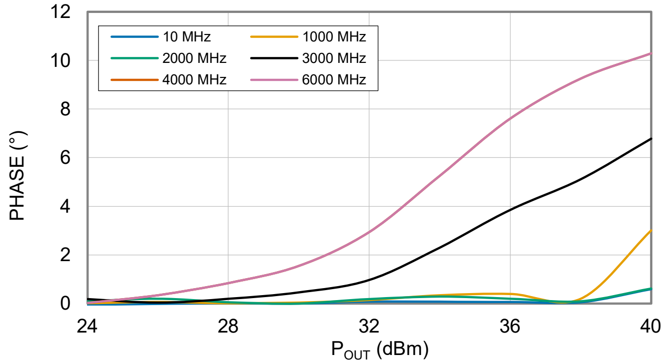




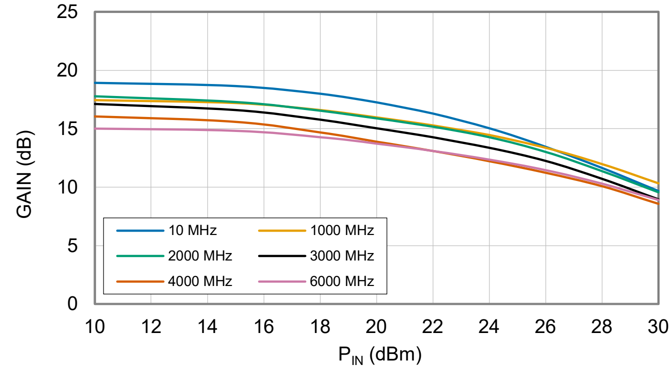
TYPICAL PERFORMANCE GRAPHS

Note: The following data was taken on Mini-Circuits Characterization Test Board TB-GNA-63-5WCX+ 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.

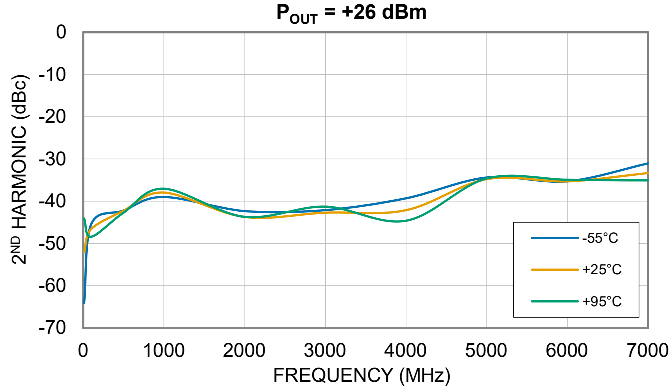
AM-PM
TEMPERATURE = +25°C



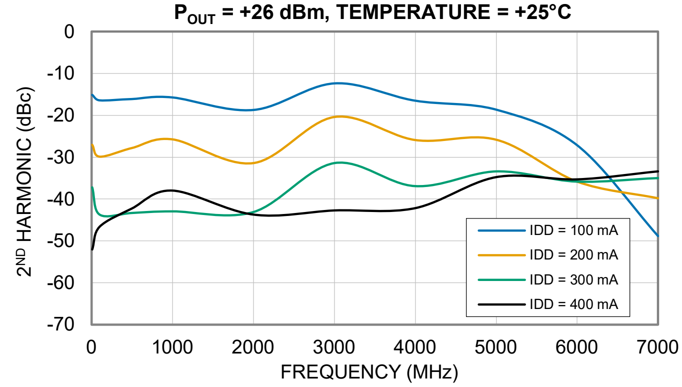
GAIN vs. P_{IN}
TEMPERATURE = +25°C



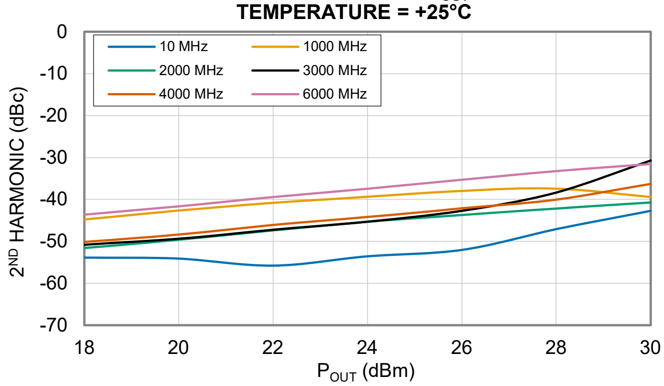
2ND HARMONIC vs. TEMPERATURE
P_{OUT} = +26 dBm



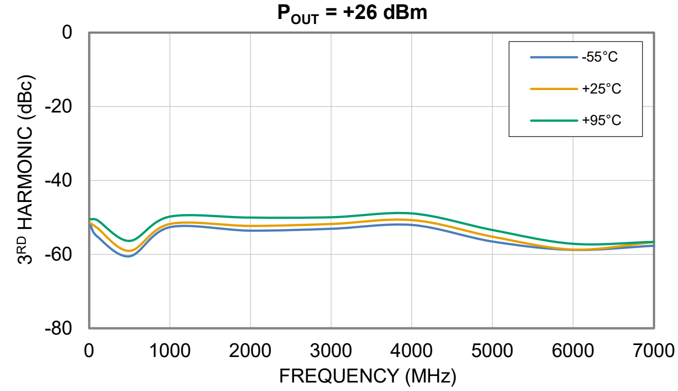
2ND HARMONIC vs. DEVICE CURRENT (I_{DD})
P_{OUT} = +26 dBm, TEMPERATURE = +25°C



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

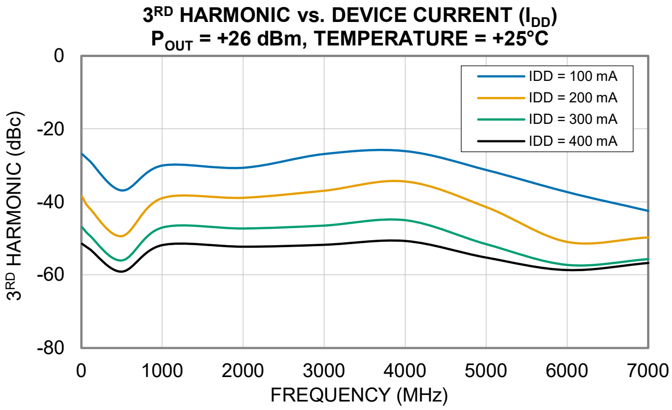


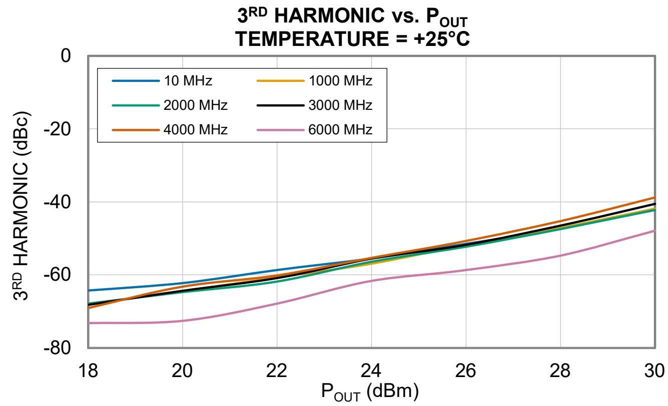
3RD HARMONIC vs. TEMPERATURE
P_{OUT} = +26 dBm



TYPICAL PERFORMANCE GRAPHS

Note: The following data was taken on Mini-Circuits Characterization Test Board TB-GNA-63-5WCX+ 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.





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	16.9 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 V < V_G < 0 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]	7.1 °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	C1	250 V to < 500 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

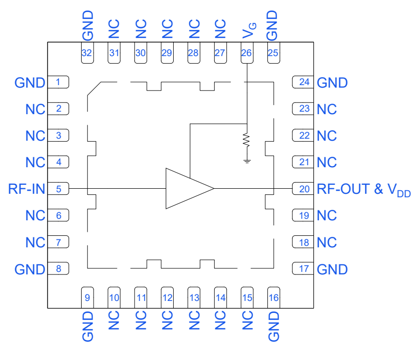


Figure 1. GNA-63-5W+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description (Refer to Figure 2)
RF-OUT & V_{DD}	20	RF-OUT & V_{DD} Pad connects to RF-Output port and voltage input port, VD_D.
RF-IN	5	RF-IN Pad connects to RF-Input port.
V_G	26	DC Input Pad connects to voltage input port, V_G.
NC	2-4, 6-7, 10-15, 18-19, 21-23, & 27-31	Not used internally. Connected to ground on test board.
GND	1, 8-9, 16-17, 24-25, 32, & Paddle	Connects to ground.

CHARACTERIZATION TEST BOARD

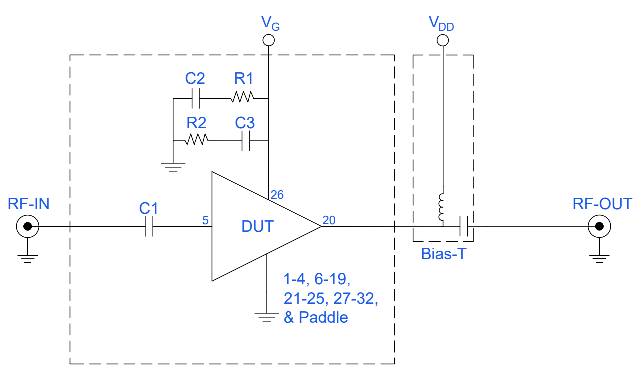


Figure 2. GNA-63-5W+ Characterization Circuit

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	0402	0Ω	RK73Z1ETTP	KOA Speer
C1	0402	1 nF	GRM1555C1H102GA01D	Murata
C2	1206	1 µF	12061C105KAT2A	AVX
C3	0402	100 pF	GRM1555C2A101JA01D	Murata

APPLICATION CIRCUIT

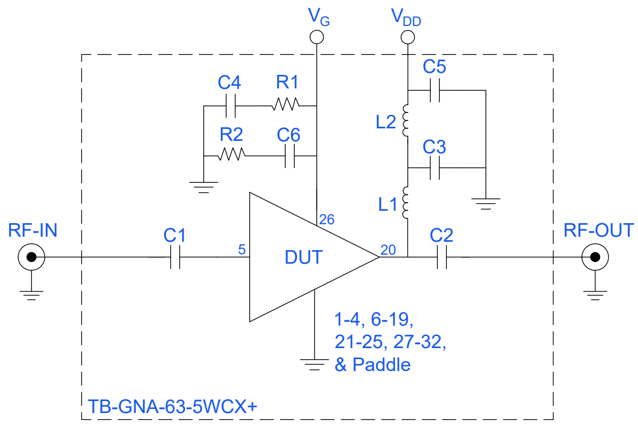


Figure 3. GNA-63-5W+ 500 MHz - 6000 MHz Evaluation and Application Circuit

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.

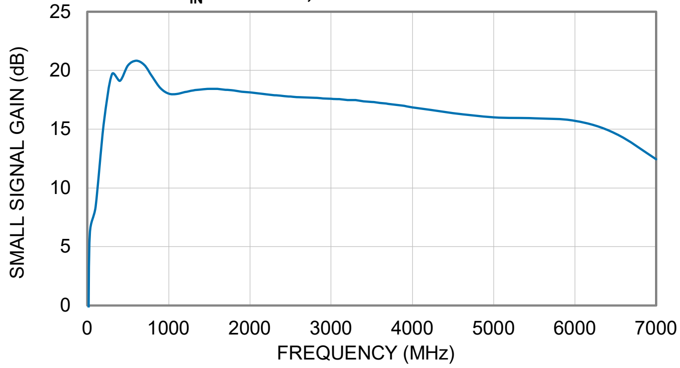
Conditions:
1. Gain and Return Loss: P_{IN} = -25 dBm
2. Power taken at P_{IN} = +26 dBm

Component	Size	Value	Part Number	Manufacturer
R1-R2	0402	0Ω	RK73Z1ETTP	KOA Speer
C1-C3	0402	1 nF	GRM1555C1H102GA01D	Murata
C4	1206	1 µF	12061C105KAT2A	AVX
C5	0402	0.1 µF	04025C104JAT2A	AVX
C6	0402	100 pF	GRM1555C2A101JA01D	Murata
L1	0402	18 nH	0402HP-18NXGRW	Coilcraft
L2	0402	47 nH	0603HC-47NXJRW	Coilcraft

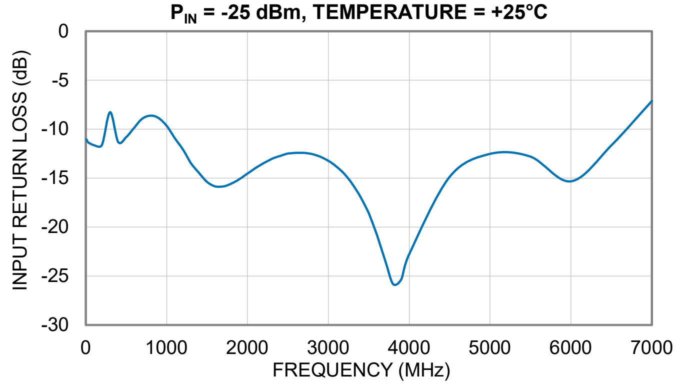
TYPICAL PERFORMANCE GRAPHS

Note: The following data was taken on Mini-Circuits Characterization Test Board TB-GNA-63-5WCX+ (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.

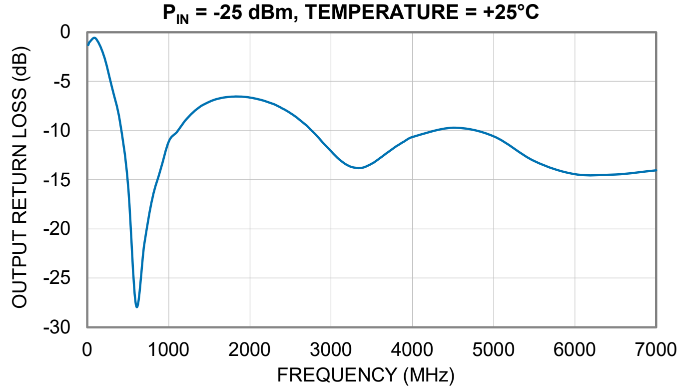
SMALL SIGNAL GAIN vs. FREQUENCY
P_{IN} = -25 dBm, TEMPERATURE = +25°C



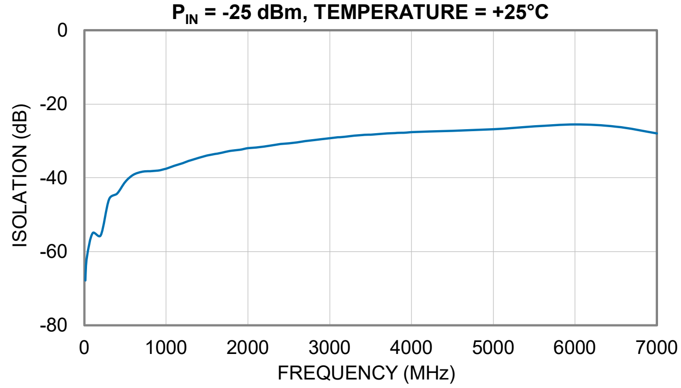
INPUT RETURN LOSS vs. FREQUENCY
P_{IN} = -25 dBm, TEMPERATURE = +25°C



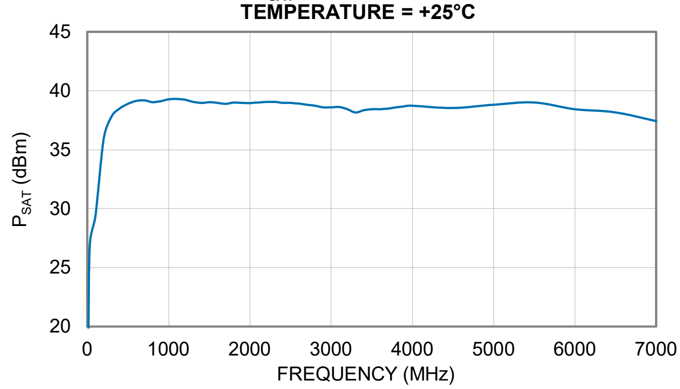
OUTPUT RETURN LOSS vs. FREQUENCY
P_{IN} = -25 dBm, TEMPERATURE = +25°C



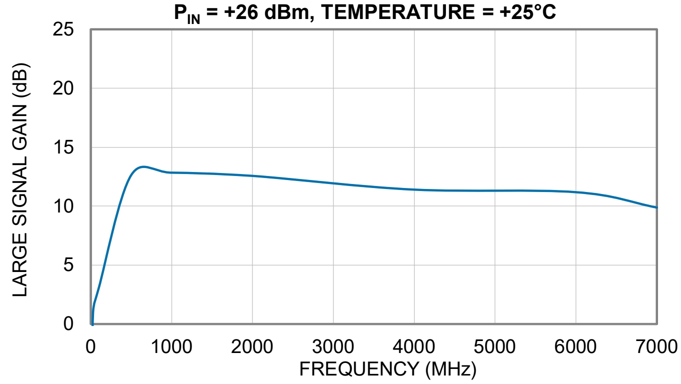
ISOLATION vs. FREQUENCY
P_{IN} = -25 dBm, TEMPERATURE = +25°C



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

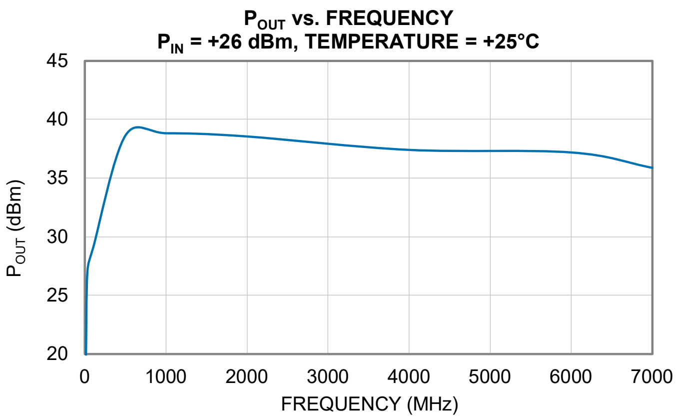


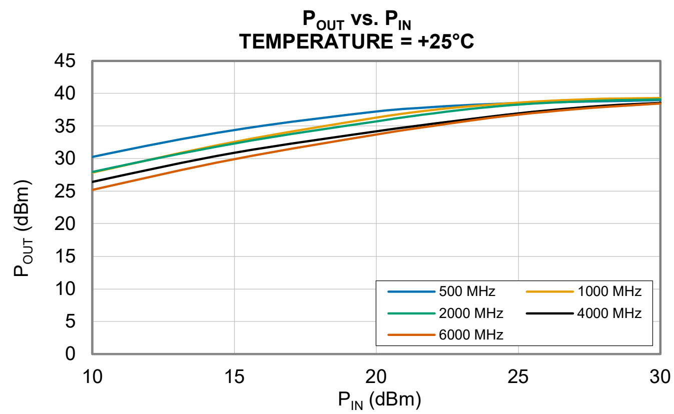
LARGE SIGNAL GAIN vs FREQUENCY
P_{IN} = +26 dBm, TEMPERATURE = +25°C



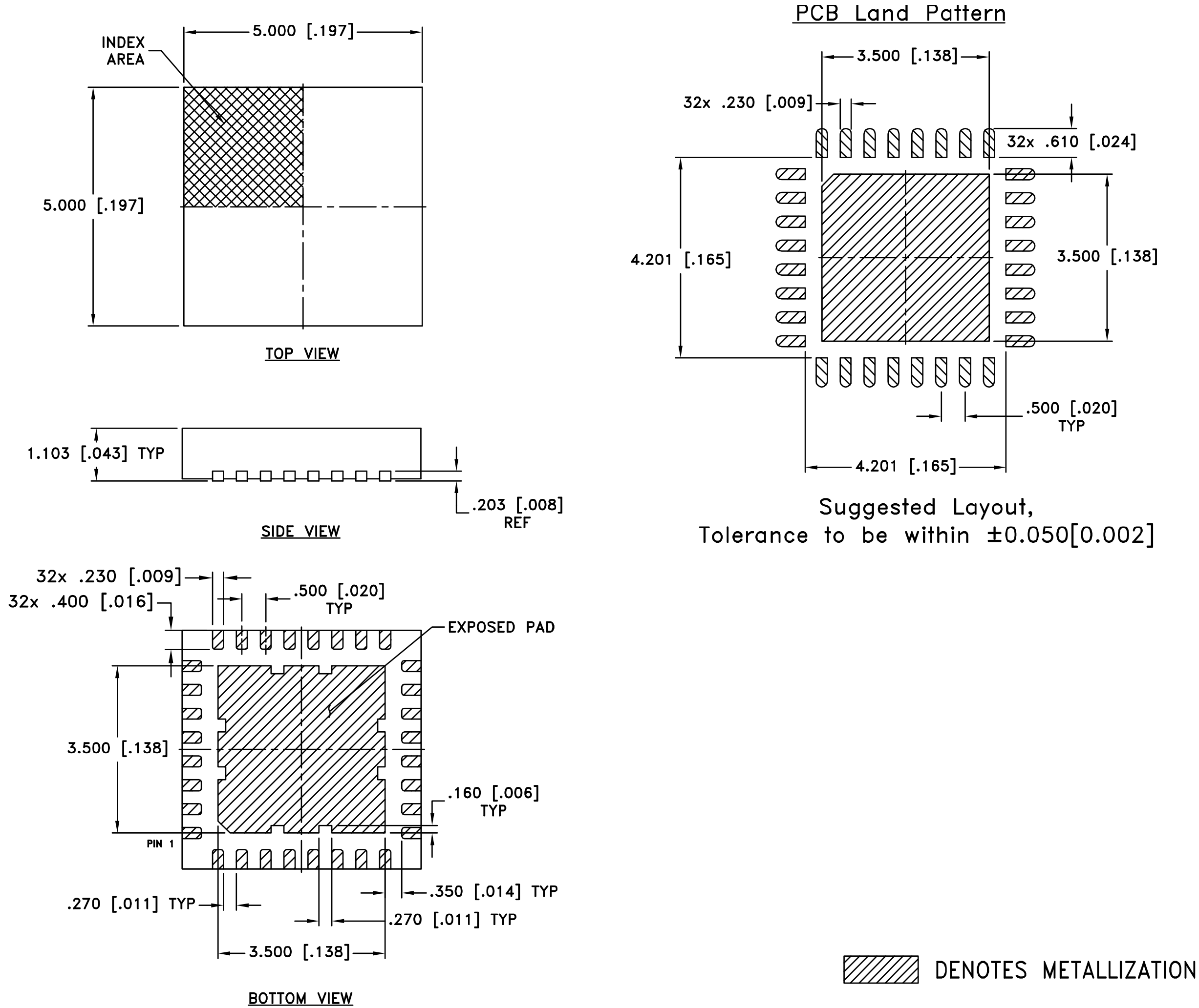
TYPICAL PERFORMANCE GRAPHS

Note: The following data was taken on Mini-Circuits Characterization Test Board TB-GNA-63-5WCX+ (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.



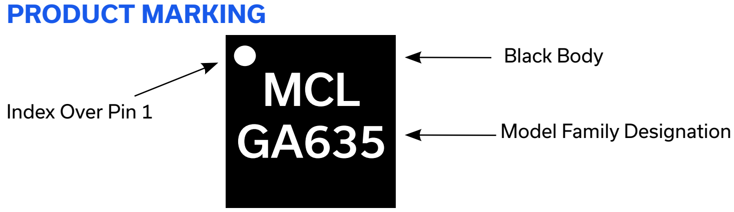


CASE STYLE DRAWING



Weight: .056 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	DG1677-8 Plastic package, exposed paddle, Lead Finish: Nickel Palladium Gold
RoHS Status	Compliant
Tape & Reel **Standard Quantities Available on Reel**	F102 7″ Reels with 20, 50, 100, 200, 500 devices 13″ Reels with 1000 devices
Suggested Layout for PCB Design	PL-859
Evaluation Board	TB-GNA-63-5WCX+ Gerber File
Environmental Ratings	ENV08T10
Product Handling	The use of no-clean solder is recommended. This package cannot be subjected to aqueous wash.

NOTES

A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.

B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuits' applicable established test performance criteria and measurement instructions.

C. The parts covered by this specification document are subject to Mini-Circuits' standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the standard terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/terms/viewterm.html