



MMIC SURFACE MOUNT

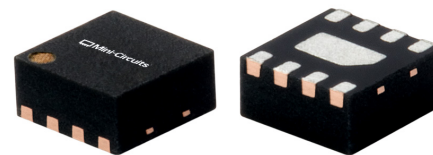
Low Noise Amplifier

TSS-63ULN+

50Ω 1000 to 6000 MHz Shutdown Feature

THE BIG DEAL

- Low Noise Figure, Typ. 0.5 dB
- High Gain, Typ. 18.7 dB
- High OIP3, Typ. +33.9 dBm
- Fast Shutdown Feature, 7.7 ns
- Single Supply Voltage, 56 mA at +5 V
- 2x2 mm 8-Lead QFN Style Package

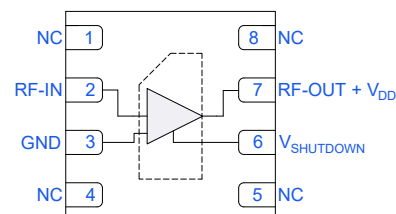


Generic photo used for illustration purposes only

APPLICATIONS

- Cellular Infrastructure
- Satellite Communications
- Radar, EW, and ECM Defense Systems

FUNCTIONAL DIAGRAM (TOP VIEW)



PRODUCT OVERVIEW

The TSS-63ULN+ is a pHEMT-based wideband, ultra-low noise MMIC amplifier with high P1dB, high IP3, and voltage-controlled shutdown capability. Operating from 1000 to 6000 MHz, this amplifier features typical 0.5 dB noise figure, 18.7 dB gain, +21.6 dBm P1dB, and +33.9 dBm OIP3. This combination of characteristics makes it ideal for sensitive receiver applications. The TSS-63ULN+ operates on a single +5 V supply and comes in a small, low profile, 2x2 mm QFN-style package for ease of integration into dense circuit board layouts.

KEY FEATURES

Features	Advantages
Ultra-Low Noise Figure, Typ. 0.5 dB	Operating from a single supply, this ultra-low noise MMIC enables low system noise figure performance, without the need for complicated discrete-based solutions.
High Gain, Typ. 18.7 dB	The MMIC amplifier's high gain enables fewer system components in receiver signal chains.
Shutdown Feature	A voltage-controlled shutdown feature allows the part to be quickly disabled to conserve power when not in use.
High Dynamic Range • Gain, Typ. 18.7 dB • OIP3, Typ. +33.9 dBm • P1dB, Typ. +21.6 dBm	The MMIC amplifier's unique combination of low noise figure, high gain, high P1dB, and high OIP3 enables optimum performance in sensitive high dynamic range receivers.
2x2 mm 8-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.





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50Ω 1000 to 6000 MHz Shutdown Feature

ELECTRICAL SPECIFICATIONS¹ AT +25°C AND Z₀ = 50Ω UNLESS NOTED OTHERWISE

Parameter	Condition (MHz)	Amplifier - ON V _{DD} = +5 V (V _{SHUTDOWN} = 0 V)			Amplifier - ON V _{DD} = +3 V (V _{SHUTDOWN} = 0 V)	Amplifier - OFF ² V _{DD} = +5 V (V _{SHUTDOWN} = +5 V)	Units
		Min.	Typ.	Max.	Typ.	Typ.	
Frequency Range		1000		6000		1000–6000	MHz
Gain	1000	24.2	25.8		24.5	-39.8	dB
	2000	19.9	21.4		20.5	-37.4	
	3000	17.2	18.7		18.0	-28.5	
	4000	15.4	17.1		16.4	-22.2	
	6000	11.6	13.5		12.6	-17.6	
Input Return Loss	1000		5		4		dB
	2000		8		6		
	3000		9		7		
	4000		8		6		
	6000		6		5		
Output Return Loss	1000		4		5		dB
	2000		5		6		
	3000		6		8		
	4000		10		13		
	6000		9		12		
Isolation	1000–6000		28.5		26.6	29.4	dB
Output Power at 1 dB Compression (P _{1dB})	1000		+21.7		+16.2		dBm
	2000		+21.8		+16.2		
	3000		+21.6		+16.1		
	4000		+20.9		+15.6		
	6000		+21.2		+15.7		
Output Third-Order Intercept Point (P _{OUT} = +4 dBm/Tone)	1000		+33.3		+25.6		dBm
	2000		+34.5		+27.2		
	3000		+33.9		+28.5		
	4000		+34.5		+27.5		
	6000		+35.8		+27.6		
Noise Figure ³	1000		0.4		0.4		dB
	2000		0.4		0.4		
	3000		0.5		0.6		
	4000		0.6		0.7		
	6000		1.3		1.5		
ON Time (50% V _{CTRL} to 90% RF)			17.8				ns
RISE Time (10% RF to 90% RF)			4.0				ns
FALL Time (90% RF to 10% RF)			5.6				ns
OFF Time (50% V _{CTRL} to 90% RF)			7.7				ns
Device Operating Voltage (V _{DD})		+4.75	+5	+5.25	+3	+5	V
Device Operating Current (I _{DD}) ⁴			56		29	4	mA
Device Shutdown Voltage (V _{SHUTDOWN})			0		0	+5	V
Device Shutdown Current (I _{SHUTDOWN})			0.01		0.01	152	μA
Device Current Variation vs. Temperature ⁵			-0.027		-0.027		mA/°C
Device Current Variation vs. Voltage ⁶			0.014		0.014		mA/mV

1. Tested in Mini-Circuits Characterization Test/Evaluation Board TB-TSS-63ULNC+. See Figure 2. Board loss de-embedded to the device.

2. Performance is comparable when V_{SHUTDOWN} = +5 V or +3 V when amplifier is OFF.

3. Typical value verified and set by averaging performance across three setups.

4. Current at P_{IN} = -25 dBm. Increases to 77 mA at P_{1dB}.

5. (Current at +105°C - Current at -45°C) / (+150°C)

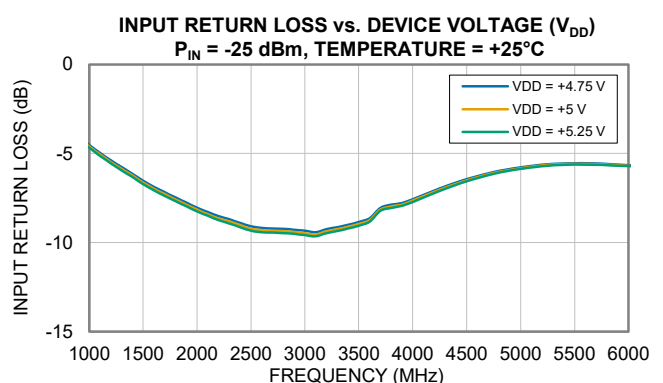
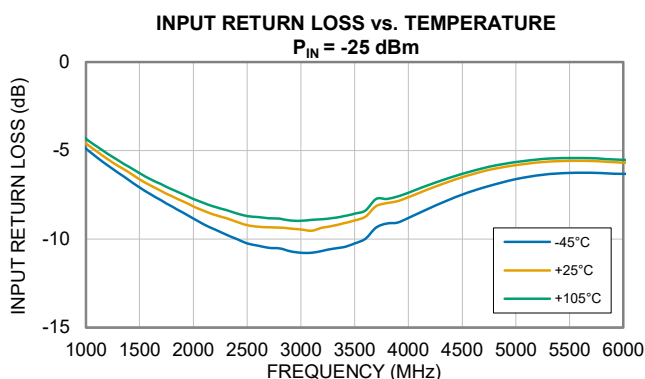
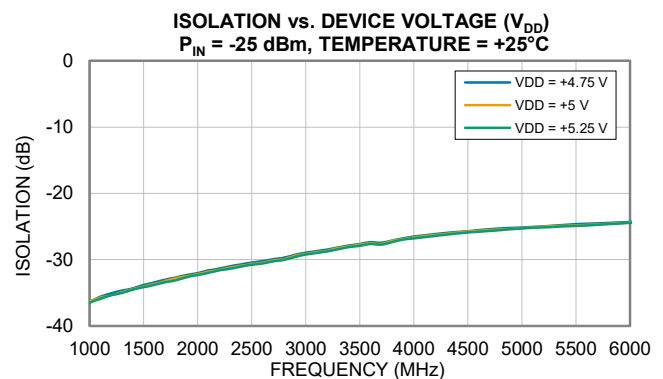
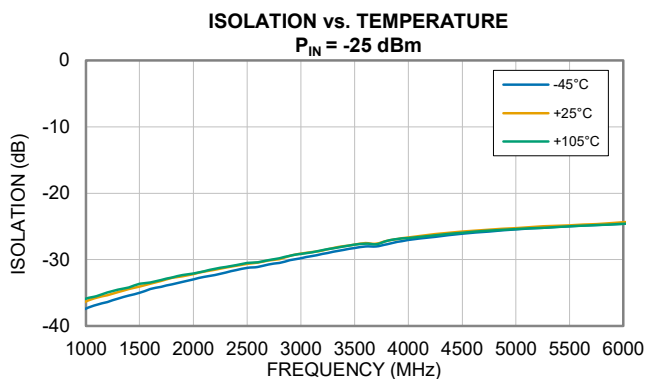
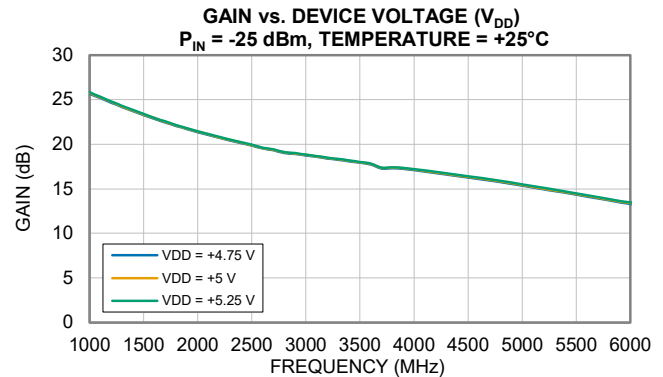
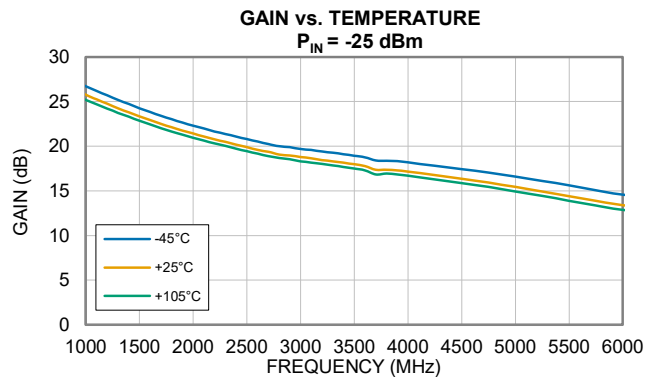
6. (Current at +5.25 V - Current at +4.75 V) / (+0.5 V)





TYPICAL PERFORMANCE GRAPHS

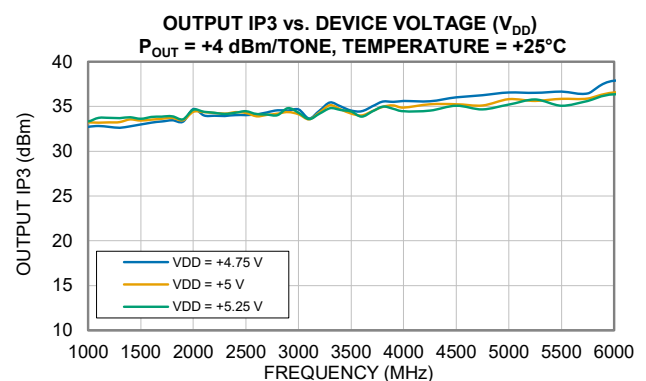
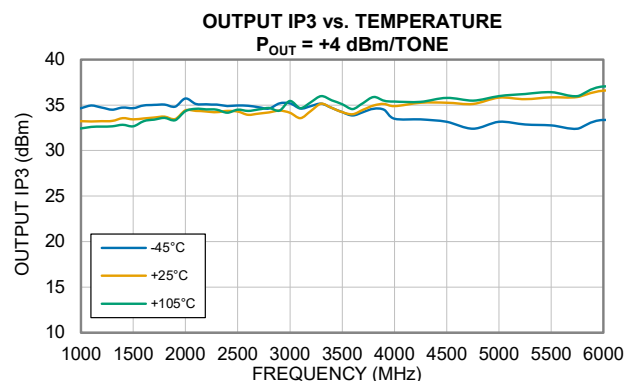
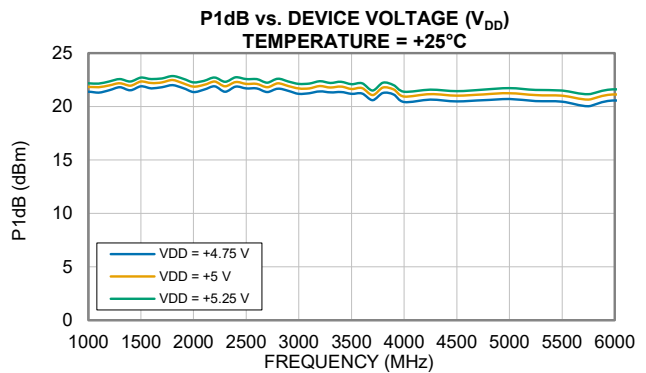
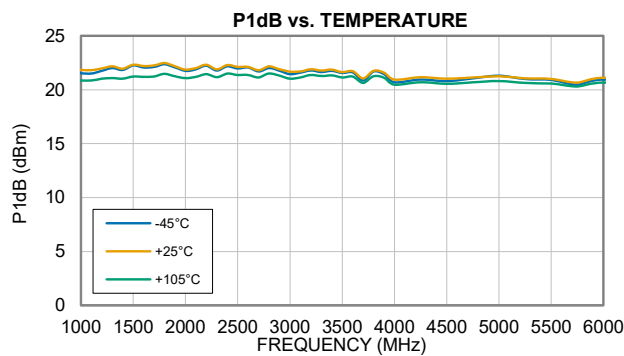
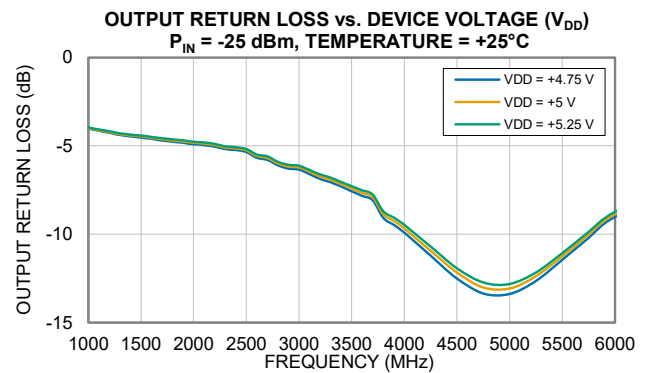
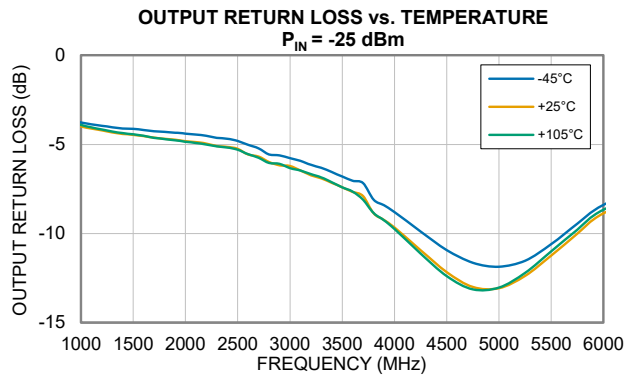
Note: The following data was taken on the Mini-Circuits Characterization Test Board TB-TSS-63ULNC+ (Figure 2). All data taken at nominal condition of $V_{DD} = +5$ V and at $V_{SHUTDOWN} = 0$ V unless noted otherwise.





TYPICAL PERFORMANCE GRAPHS

Note: The following data was taken on the Mini-Circuits Characterization Test Board TB-TSS-63ULNC+ (Figure 2). All data taken at nominal condition of $V_{DD} = +5\text{ V}$ and at $V_{SHUTDOWN} = 0\text{ V}$ unless noted otherwise.





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Low Noise Amplifier

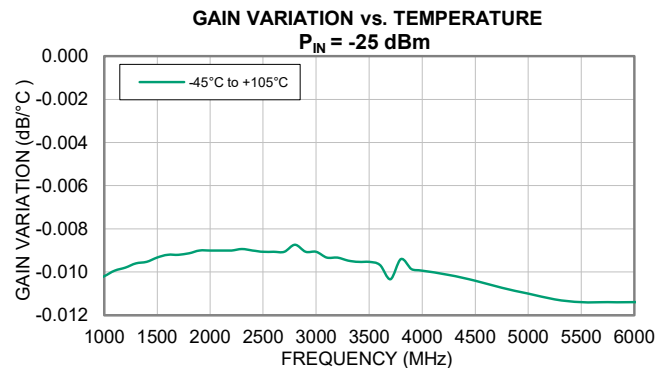
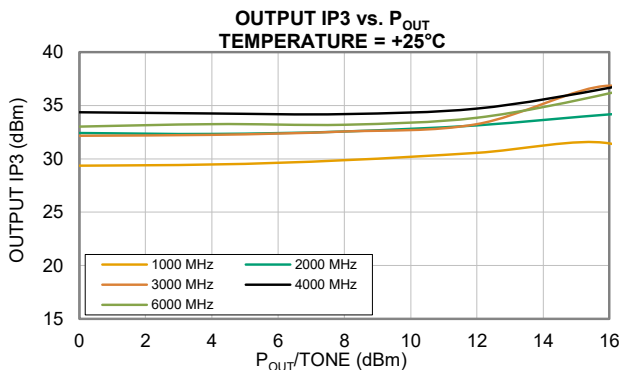
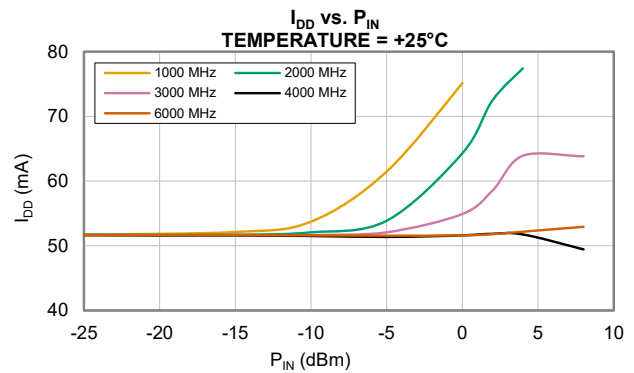
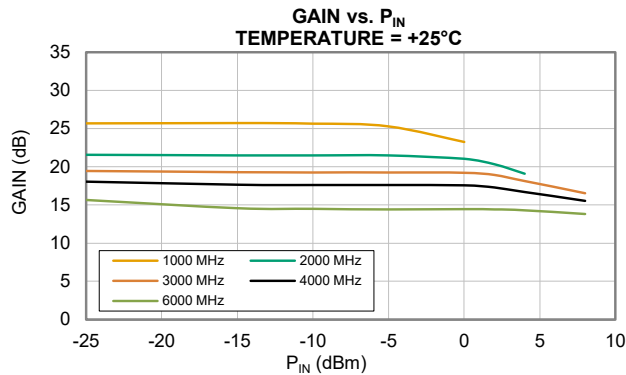
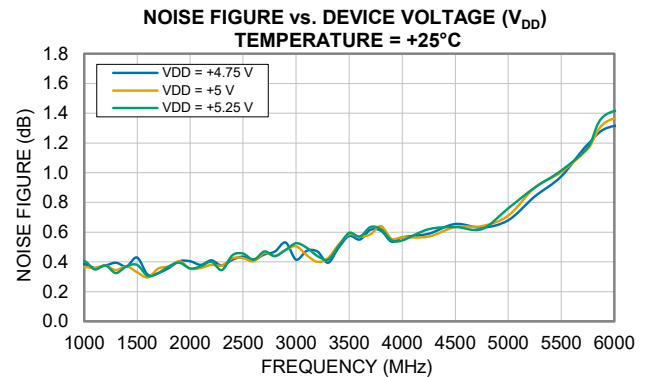
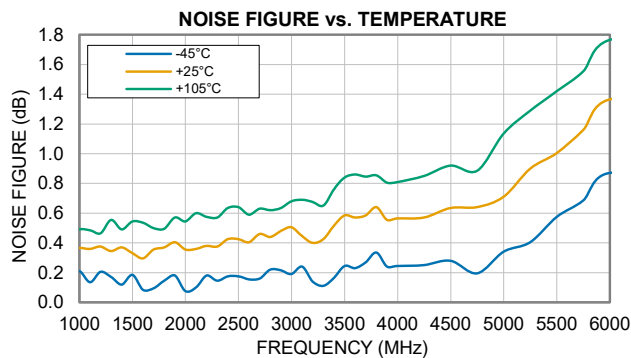
TSS-63ULN+

Mini-Circuits

50Ω 1000 to 6000 MHz Shutdown Feature

TYPICAL PERFORMANCE GRAPHS

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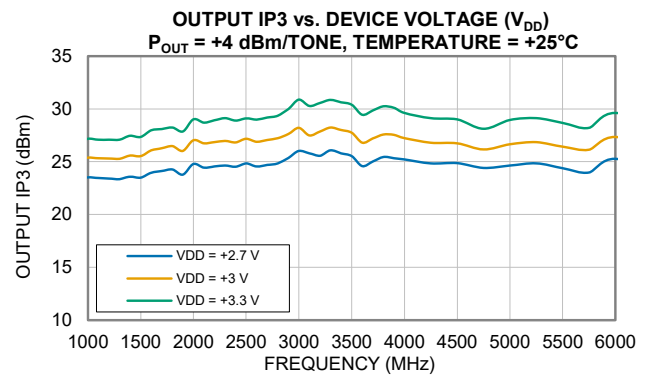
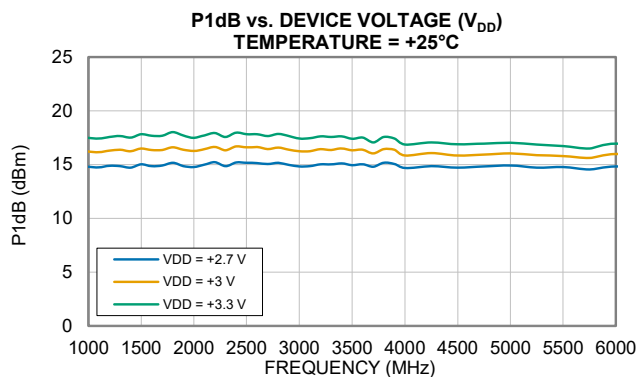
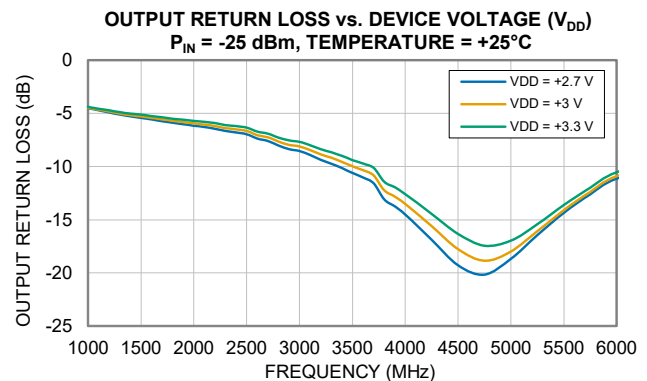
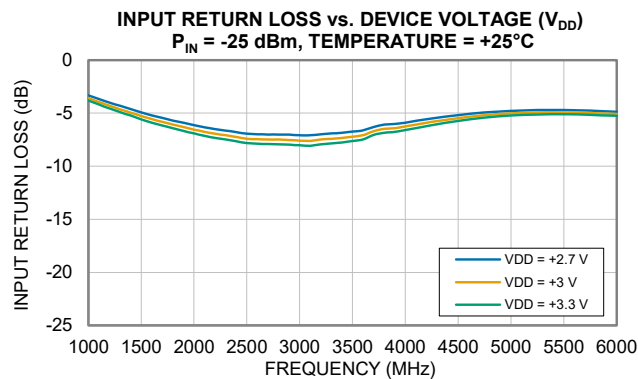
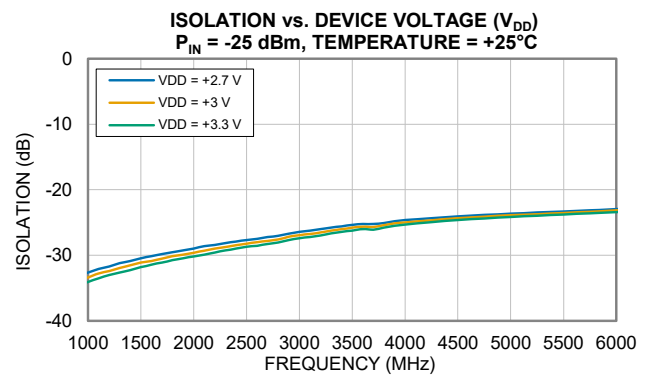
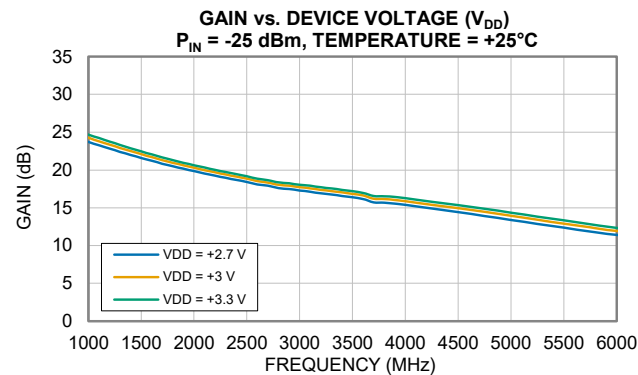


Mini-Circuits



TYPICAL LOW VOLTAGE PERFORMANCE GRAPHS

Note: The following data was taken on the Mini-Circuits Characterization Test Board TB-TSS-63ULNC+ (Figure 2). All data taken at $V_{\text{SHUTDOWN}} = 0$ V unless noted otherwise.





MMIC SURFACE MOUNT

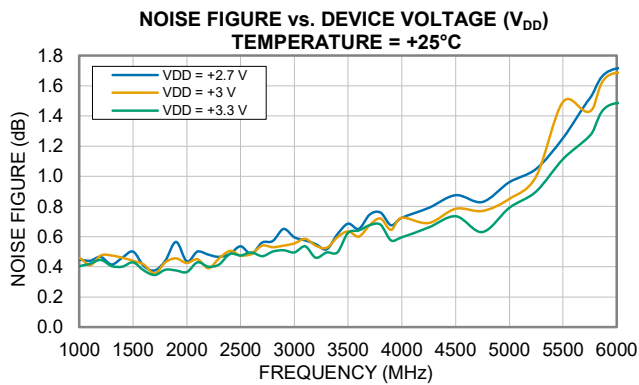
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TYPICAL LOW VOLTAGE PERFORMANCE GRAPHS

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ABSOLUTE MAXIMUM RATINGS⁷

Parameter	Ratings
Operating Temperature	-45°C to +105°C
Storage Temperature	-65°C to +150°C
Total Power Dissipation	0.8 W
Junction Temperature ⁸	+150°C
Input Power (CW) $V_{DD} = +5\text{ V}$ & $V_{SHUTDOWN} = 0\text{ V}$ $V_{DD} = +3\text{ V}$ & $V_{SHUTDOWN} = 0\text{ V}$	+19 dBm +19 dBm
DC Voltage on RF-OUT & V_{DD} $V_{SHUTDOWN} = 0\text{ V}$ $V_{SHUTDOWN} = +5\text{ V}$	+10 V +10 V
DC Voltage on RF-IN $V_{SHUTDOWN} = 0\text{ V}$ $V_{SHUTDOWN} = +5\text{ V}$	+1 V +1 V
DC Voltage on $V_{SHUTDOWN}$ $V_{DD} = 0\text{ V}$ $V_{DD} = +5\text{ V}$	+8 V +8 V
DC Current on RF-OUT & V_{DD} $V_{SHUTDOWN} = 0\text{ V}$ $V_{SHUTDOWN} = +5\text{ V}$	130 mA 10 mA
DC Current $V_{SHUTDOWN}$ $V_{SHUTDOWN} = 0\text{ V}$ $V_{SHUTDOWN} = +5\text{ V}$	0.5 mA 0.5 mA

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.

POWER ON / POWER OFF LOGIC

Amplifier State	V_{DD}			$V_{SHUTDOWN}$		
	Min	Typ.	Max	Min	Typ.	Max
Amplifier - ON ($V_{DD} = +5\text{ V}$)	+2.7 V	+5 V	+5.25 V	0 V	0 V	+0.9 V
Amplifier - OFF ($V_{DD} = +5\text{ V}$)				+1 V	+5 V	+5.25 V
Amplifier - ON ($V_{DD} = +3\text{ V}$)	+2.7 V	+3 V	+5.25 V	0 V	0 V	+0.9 V
Amplifier - OFF ($V_{DD} = +3\text{ V}$)				+1 V	+3 V	+5.25 V

THERMAL RESISTANCE

Parameter	Ratings
Thermal Resistance (Θ_{JC}) ⁹	58.2°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-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: MSL1 in accordance with IPC/JEDEC J-STD-020E/JEDEC J-STD-033C

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FUNCTIONAL DIAGRAM (TOP VIEW)

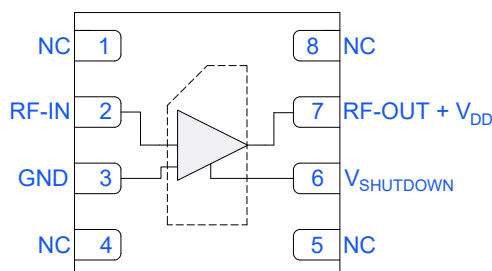


Figure 1. TSS-63ULN+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description (Refer to Figure 2)
RF-OUT + V_{DD}	7	RF-OUT + V_{DD} Pad connects to RF-Output port and voltage input port, V_{DD} .
$V_{SHUTDOWN}$	6	DC Input Pad connects to voltage input port, $V_{SHUTDOWN}$.
RF-IN	2	RF-IN Pad connects to RF-Input port.
NC	1, 4, 5, and 8	Not used internally. May be connected to ground or left floating. All pins but pin 1 are grounded on evaluation board.
GND	3 & Paddle	Connects to ground.

EVALUATION BOARD

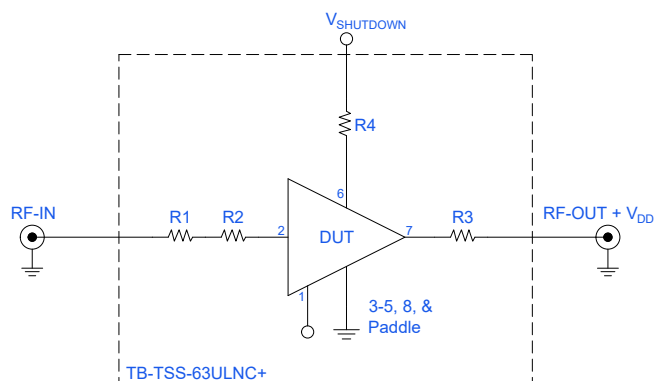


Figure 2. TSS-63ULN+ Evaluation and Application Circuit

Electrical Parameters and Conditions

Gain, Return Loss, Output Power at 1 dB Compression (P1dB), Output IP3 (OIP3), and Noise Figure measured using N5242A 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, +4 dBm/tone at output.

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 $V_{DD} = +5$ V.
2. Set $V_{SHUTDOWN} = 0$ V for ON mode or $V_{SHUTDOWN} = +5$ V for OFF mode.
3. Turn on V_{DD} .
4. Turn on $V_{SHUTDOWN}$.
5. Apply RF signal.

POWER OFF:

1. Turn off RF signal.
2. Turn off $V_{SHUTDOWN}$.
3. Turn off V_{DD} .

Component	Size	Value	Part Number	Manufacturer
R1-R4	0402	0Ω	RK73Z1ETTP	KOA Speer



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APPLICATION CIRCUIT

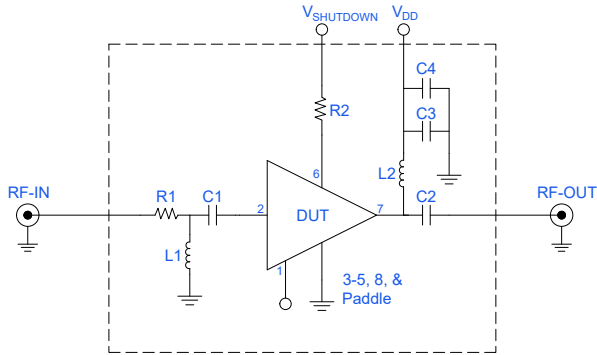


Figure 3. TSS-63ULN+ 3400-3800 MHz Application Circuit

Electrical Parameters and Conditions

Gain, Return Loss, Output Power at 1 dB Compression (P1dB), Output IP3 (OIP3), and Noise Figure measured using N5242A PNA-X microwave network analyzer.

Conditions:

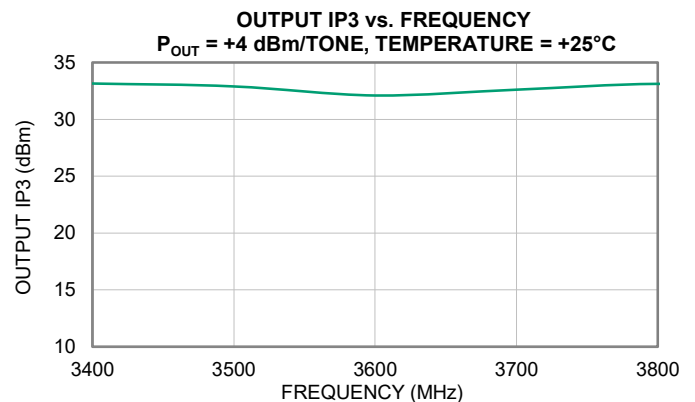
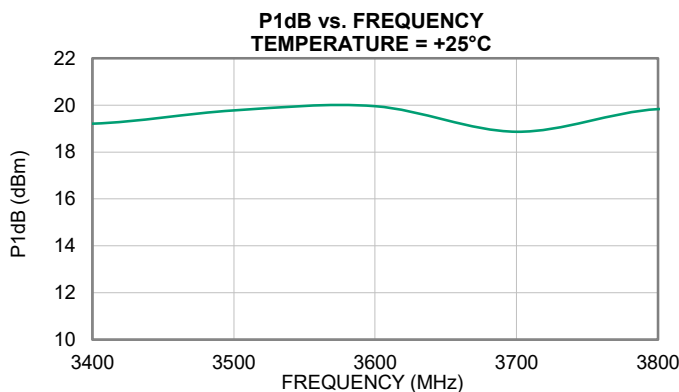
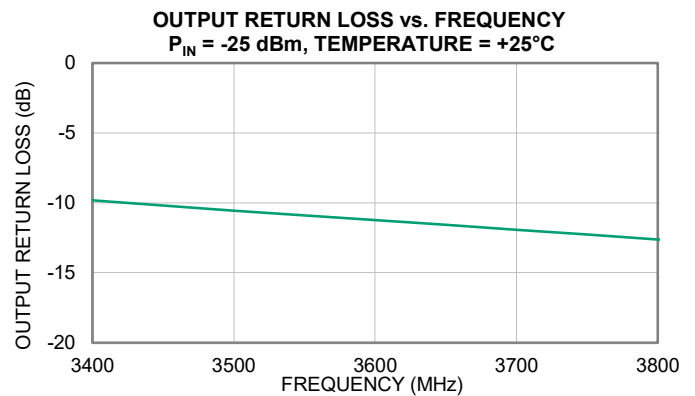
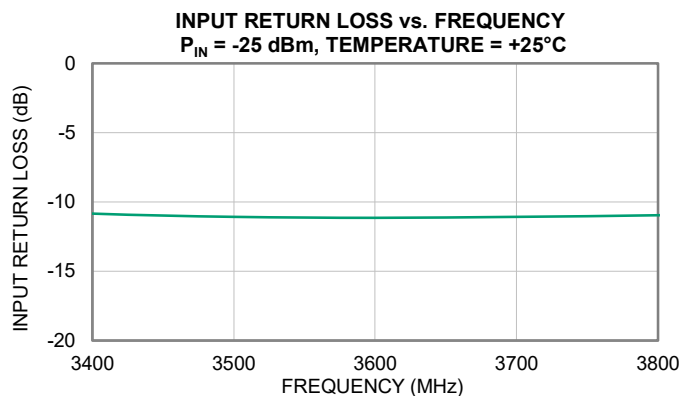
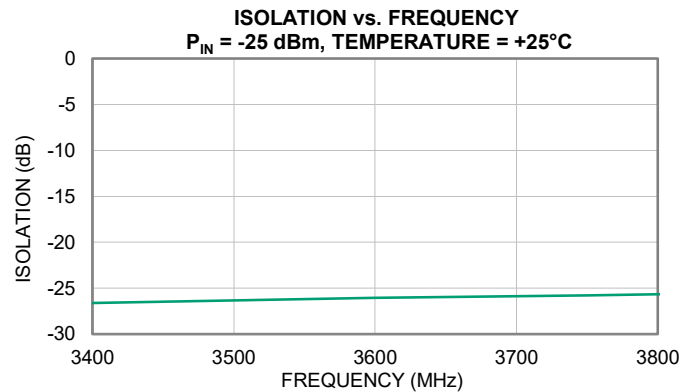
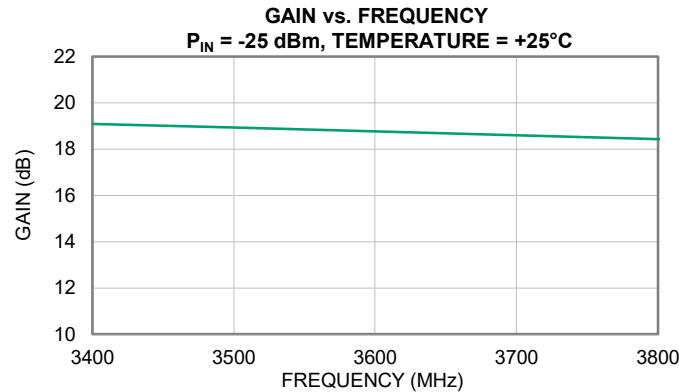
3. Gain and Return Loss: $P_{IN} = -25$ dBm
4. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, +4 dBm/tone at output.

Component	Size	Value	Part Number	Manufacturer
R1-R2	0402	0Ω	RK73Z1ETTP	KOA Speer
C1	0402	1.2 pF	GJM1555C1H1R2CB01J	Murata
C2	0402	100 pF	GRM1555C1H101JA01J	Murata
C3	0402	1 nF	GRM1555C1H102JA01J	Murata
C4	0402	0.1 μF	GRM155R71H104KE14D	Murata
L1-L2	0402	1.8 nH	LQG15HS1N8B02	Murata



TYPICAL MATCHING TEST BOARD PERFORMANCE GRAPHS

Note: The following data was taken on the Mini-Circuits 3400-3800 MHz Matched Characterization Test Board (Figure 3). All data taken at nominal condition of $V_{DD} = +5$ V and at $V_{SHUTDOWN} = 0$ V.





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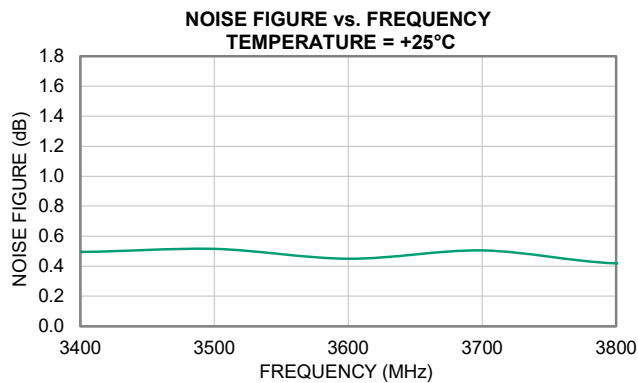
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TYPICAL MATCHING TEST BOARD PERFORMANCE GRAPHS

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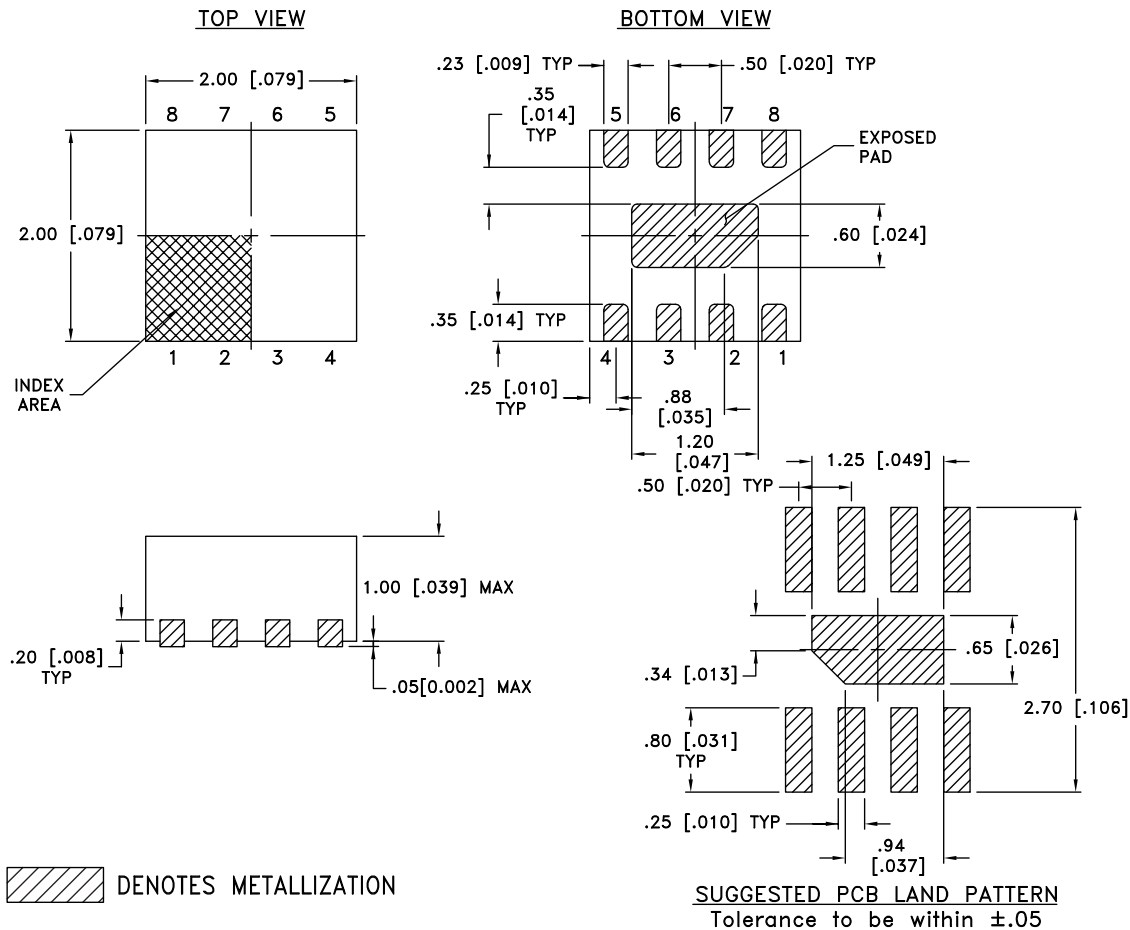
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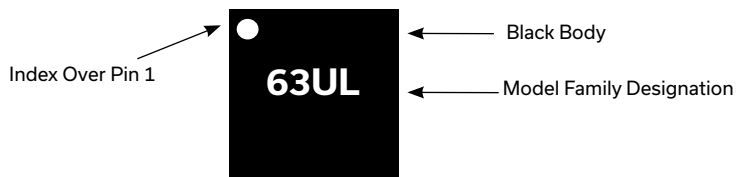
CASE STYLE DRAWING



Weight: 0.006 grams

Dimensions are in mm [Inches]. Tolerances: 2 Pl. ± 0.13 mm

PRODUCT MARKING



Marking may contain other features or characters for internal lot control.

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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	MC1631-1. 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, 1000, 2000, or 3000 devices
Suggested Layout for PCB Design	PL-849
Evaluation Board	TB-TSS-63ULNC+ Gerber File
Environmental Ratings	ENV08T1

NOTES

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



Typical Performance Data

NOTE: Use PDF Bookmarks to view DATA at required conditions**Definitions:**

Input Return Loss = S11 (dB)

Gain = S21 (dB)

Isolation = S12 (dB)

Output Return Loss = S22 (dB)

TEST CONDITIONS: $V_{DD} = +2.7\text{ V}$, $V_{SHUTDOWN} = 0\text{ V}$, $I_{DD} = 24\text{ mA}$, $I_{SHUTDOWN} = 0.007\text{ }\mu\text{A}$ @ Temperature = $+25^{\circ}\text{C}$

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		1dB Comp. Output	Noise Figure	IP-3 Output $P_{OUT} = +4$
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dB)	(dBm)
800	24.6	-33.8	-2.6	-4.0	0.7	0.8	14.3	0.5	23.5
900	24.2	-33.2	-2.9	-4.3	0.7	0.8	14.9	0.4	23.2
1000	23.7	-32.6	-3.3	-4.5	0.7	0.8	14.8	0.4	23.5
1100	23.3	-32.1	-3.7	-4.7	0.8	0.8	14.7	0.4	23.5
1200	22.8	-31.7	-4.0	-4.9	0.8	0.8	14.9	0.5	23.4
1300	22.4	-31.2	-4.3	-5.1	0.8	0.8	14.9	0.4	23.4
1400	22.0	-30.9	-4.6	-5.3	0.8	0.8	14.7	0.5	23.6
1500	21.6	-30.5	-4.9	-5.4	0.9	0.8	15.0	0.5	23.5
1600	21.2	-30.1	-5.2	-5.6	0.9	0.8	14.8	0.4	24.0
1700	20.8	-29.8	-5.4	-5.7	0.9	0.8	14.9	0.4	24.1
1800	20.5	-29.5	-5.7	-5.9	1.0	0.8	15.2	0.4	24.3
1900	20.2	-29.3	-5.9	-6.0	1.0	0.8	14.9	0.6	23.8
2000	19.8	-29.0	-6.1	-6.2	1.0	0.8	14.8	0.4	24.8
2100	19.5	-28.6	-6.3	-6.3	1.0	0.8	15.0	0.5	24.4
2200	19.2	-28.4	-6.5	-6.4	1.0	0.8	15.2	0.5	24.5
2300	19.0	-28.2	-6.6	-6.7	1.1	0.9	14.8	0.5	24.6
2400	18.7	-27.9	-6.8	-6.8	1.1	0.9	15.2	0.5	24.5
2500	18.4	-27.7	-6.9	-7.0	1.1	0.9	15.2	0.5	24.8
2600	18.1	-27.5	-7.0	-7.4	1.1	0.9	15.1	0.5	24.5
2700	17.9	-27.2	-7.0	-7.6	1.1	0.9	15.1	0.6	24.7
2800	17.6	-27.0	-7.0	-8.0	1.2	0.9	15.2	0.6	24.8
2900	17.5	-26.7	-7.0	-8.4	1.2	0.9	15.0	0.7	25.4
3000	17.3	-26.5	-7.1	-8.5	1.2	0.9	14.8	0.6	26.0
3100	17.1	-26.2	-7.1	-8.9	1.2	1.0	14.9	0.6	25.8
3200	16.9	-26.0	-7.0	-9.4	1.2	1.0	15.0	0.6	25.6
3300	16.8	-25.8	-6.9	-9.7	1.2	1.0	15.0	0.5	26.1
3400	16.6	-25.6	-6.8	-10.2	1.2	1.0	15.1	0.6	25.8
3500	16.4	-25.4	-6.7	-10.6	1.2	1.0	15.0	0.7	25.5
3600	16.2	-25.2	-6.6	-11.0	1.2	1.0	15.0	0.7	24.6
3700	15.7	-25.2	-6.3	-11.6	1.2	1.1	14.8	0.7	25.0
3800	15.7	-25.1	-6.1	-13.1	1.2	1.1	15.2	0.8	25.5
3900	15.6	-24.8	-6.0	-13.7	1.2	1.1	15.1	0.7	25.3
4000	15.4	-24.6	-5.9	-14.5	1.2	1.1	14.7	0.7	25.2
4250	14.9	-24.3	-5.5	-16.9	1.2	1.2	14.9	0.8	24.8
4500	14.4	-24.1	-5.2	-19.3	1.2	1.2	14.7	0.9	24.9
4750	13.9	-23.8	-4.9	-20.2	1.2	1.3	14.8	0.8	24.4
5000	13.4	-23.7	-4.8	-18.7	1.2	1.3	14.9	1.0	24.6
5250	12.9	-23.5	-4.7	-16.5	1.2	1.3	14.7	1.1	24.9
5500	12.4	-23.3	-4.7	-14.4	1.2	1.3	14.8	1.3	24.4
5750	11.9	-23.1	-4.8	-12.6	1.2	1.3	14.6	1.5	24.0
6000	11.4	-23.0	-4.9	-11.2	1.2	1.2	14.8	1.7	25.3
7000	10.2	-22.0	-5.2	-8.2	1.3	1.1	14.7	1.7	23.4
7500	10.4	-21.1	-6.4	-8.1	1.3	1.0	14.1	1.7	23.4
8000	10.9	-20.0	-6.7	-9.9	1.3	1.0	13.5	1.4	22.4

Typical Performance Data

NOTE: Use PDF Bookmarks to view DATA at required conditions**Definitions:**

Input Return Loss = S11 (dB)

Gain = S21 (dB)

Isolation = S12 (dB)

Output Return Loss = S22 (dB)

TEST CONDITIONS: $V_{DD} = +3\text{ V}$, $V_{SHUTDOWN} = 0\text{ V}$, $I_{DD} = 28\text{ mA}$, $I_{SHUTDOWN} = 0.0062\text{ }\mu\text{A}$ @ Temperature = +25°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		1dB Comp. Output	Noise Figure	IP-3 Output $P_{OUT} = +4$
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dB)	(dBm)
800	25.2	-34.6	-2.8	-4.0	0.7	0.8	15.7	0.5	25.2
900	24.8	-33.9	-3.2	-4.3	0.7	0.8	16.2	0.4	25.1
1000	24.3	-33.4	-3.6	-4.5	0.8	0.8	16.2	0.5	25.4
1100	23.8	-32.8	-3.9	-4.7	0.8	0.8	16.2	0.4	25.3
1200	23.4	-32.4	-4.3	-4.8	0.8	0.8	16.3	0.5	25.3
1300	22.9	-31.9	-4.6	-5.0	0.9	0.8	16.4	0.5	25.3
1400	22.5	-31.5	-4.9	-5.2	0.9	0.8	16.2	0.5	25.6
1500	22.1	-31.1	-5.3	-5.3	0.9	0.8	16.5	0.4	25.5
1600	21.7	-30.9	-5.6	-5.4	0.9	0.8	16.4	0.4	26.1
1700	21.3	-30.5	-5.8	-5.6	1.0	0.8	16.4	0.4	26.3
1800	21.0	-30.2	-6.1	-5.7	1.0	0.8	16.6	0.4	26.5
1900	20.6	-29.9	-6.3	-5.8	1.0	0.8	16.4	0.5	26.0
2000	20.3	-29.6	-6.5	-6.0	1.0	0.8	16.3	0.4	27.0
2100	20.0	-29.3	-6.7	-6.1	1.0	0.8	16.4	0.5	26.7
2200	19.7	-29.0	-6.9	-6.2	1.1	0.8	16.7	0.4	26.9
2300	19.4	-28.7	-7.1	-6.4	1.1	0.8	16.3	0.5	27.0
2400	19.1	-28.5	-7.2	-6.5	1.1	0.8	16.7	0.5	26.8
2500	18.9	-28.2	-7.4	-6.7	1.1	0.8	16.6	0.5	27.2
2600	18.5	-28.0	-7.5	-7.1	1.1	0.9	16.6	0.5	26.9
2700	18.3	-27.8	-7.5	-7.3	1.2	0.9	16.5	0.5	27.1
2800	18.0	-27.6	-7.5	-7.6	1.2	0.9	16.6	0.5	27.2
2900	17.9	-27.2	-7.5	-8.0	1.2	0.9	16.4	0.5	27.6
3000	17.7	-26.9	-7.6	-8.1	1.2	0.9	16.2	0.6	28.2
3100	17.6	-26.8	-7.6	-8.5	1.2	0.9	16.3	0.6	27.5
3200	17.4	-26.5	-7.5	-8.9	1.2	0.9	16.4	0.5	27.9
3300	17.2	-26.2	-7.4	-9.2	1.2	1.0	16.4	0.5	28.2
3400	17.0	-26.0	-7.3	-9.6	1.2	1.0	16.5	0.6	28.0
3500	16.9	-25.8	-7.2	-10.0	1.2	1.0	16.3	0.6	27.7
3600	16.6	-25.6	-7.1	-10.4	1.2	1.0	16.4	0.6	26.8
3700	16.2	-25.7	-6.7	-10.8	1.2	1.0	16.0	0.7	27.2
3800	16.2	-25.4	-6.5	-12.2	1.2	1.1	16.4	0.7	27.6
3900	16.1	-25.2	-6.4	-12.8	1.2	1.1	16.4	0.6	27.5
4000	15.9	-25.0	-6.3	-13.5	1.2	1.1	15.8	0.7	27.2
4250	15.4	-24.7	-5.8	-15.6	1.2	1.2	16.1	0.7	26.8
4500	14.9	-24.3	-5.5	-17.8	1.2	1.2	15.8	0.8	26.8
4750	14.5	-24.1	-5.2	-18.9	1.2	1.2	15.9	0.8	26.2
5000	13.9	-23.9	-5.0	-18.0	1.2	1.3	16.0	0.9	26.7
5250	13.4	-23.7	-4.9	-16.1	1.2	1.3	15.9	1.0	26.8
5500	12.9	-23.5	-4.9	-14.1	1.2	1.3	15.8	1.5	26.4
5750	12.4	-23.4	-5.0	-12.4	1.2	1.2	15.6	1.4	26.1
6000	11.9	-23.1	-5.1	-10.9	1.2	1.2	16.0	1.7	27.3
7000	10.7	-22.2	-5.4	-7.9	1.2	1.1	15.7	1.5	25.7
7500	10.8	-21.3	-6.5	-7.7	1.3	1.0	15.2	1.6	25.5
8000	11.4	-20.2	-6.8	-9.3	1.3	1.0	14.5	1.3	24.2

Typical Performance Data

NOTE: Use PDF Bookmarks to view DATA at required conditions**Definitions:**

Input Return Loss = S11 (dB)

Gain = S21 (dB)

Isolation = S12 (dB)

Output Return Loss = S22 (dB)

TEST CONDITIONS: $V_{DD} = +3.3\text{ V}$, $V_{SHUTDOWN} = 0\text{ V}$, $I_{DD} = 32\text{ mA}$, $I_{SHUTDOWN} = 0.0062\text{ }\mu\text{A}$ @ Temperature = $+25^{\circ}\text{C}$

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		1dB Comp. Output	Noise Figure	IP-3 Output $P_{OUT} = +4$
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dB)	(dBm)
800	25.7	-35.2	-3.0	-4.0	0.7	0.7	16.9	0.4	26.8
900	25.2	-34.7	-3.4	-4.2	0.8	0.7	17.5	0.4	26.7
1000	24.7	-34.1	-3.8	-4.4	0.8	0.8	17.5	0.4	27.2
1100	24.2	-33.5	-4.2	-4.6	0.8	0.8	17.4	0.4	27.1
1200	23.8	-33.0	-4.6	-4.7	0.9	0.8	17.6	0.4	27.1
1300	23.3	-32.7	-4.9	-4.9	0.9	0.8	17.7	0.4	27.1
1400	22.9	-32.3	-5.2	-5.0	0.9	0.8	17.5	0.4	27.5
1500	22.5	-31.8	-5.6	-5.1	0.9	0.8	17.8	0.4	27.3
1600	22.1	-31.4	-5.9	-5.3	1.0	0.8	17.7	0.4	28.0
1700	21.7	-31.1	-6.1	-5.4	1.0	0.8	17.7	0.3	28.1
1800	21.3	-30.8	-6.4	-5.5	1.0	0.8	18.0	0.4	28.2
1900	21.0	-30.4	-6.7	-5.6	1.0	0.8	17.7	0.4	27.9
2000	20.6	-30.2	-6.9	-5.7	1.1	0.8	17.5	0.4	29.0
2100	20.3	-29.9	-7.1	-5.8	1.1	0.8	17.7	0.4	28.7
2200	20.0	-29.6	-7.3	-5.9	1.1	0.8	17.9	0.4	28.9
2300	19.7	-29.3	-7.5	-6.1	1.1	0.8	17.6	0.4	29.1
2400	19.5	-29.0	-7.7	-6.2	1.1	0.8	18.0	0.5	28.9
2500	19.2	-28.7	-7.8	-6.3	1.1	0.8	17.8	0.5	29.1
2600	18.9	-28.5	-7.9	-6.7	1.2	0.8	17.8	0.5	29.0
2700	18.7	-28.3	-7.9	-6.9	1.2	0.8	17.7	0.5	29.2
2800	18.4	-28.1	-7.9	-7.3	1.2	0.9	17.9	0.5	29.4
2900	18.2	-27.7	-8.0	-7.6	1.2	0.9	17.7	0.5	30.0
3000	18.1	-27.4	-8.0	-7.7	1.2	0.9	17.4	0.5	30.9
3100	17.9	-27.2	-8.1	-8.0	1.2	0.9	17.5	0.5	30.3
3200	17.7	-27.0	-7.9	-8.4	1.2	0.9	17.6	0.5	30.6
3300	17.6	-26.7	-7.9	-8.7	1.2	0.9	17.6	0.5	30.9
3400	17.4	-26.4	-7.8	-9.0	1.2	0.9	17.6	0.5	30.6
3500	17.2	-26.2	-7.6	-9.4	1.2	1.0	17.4	0.6	30.4
3600	17.0	-26.0	-7.5	-9.7	1.2	1.0	17.5	0.6	29.4
3700	16.6	-26.1	-7.0	-10.1	1.2	1.0	17.1	0.7	29.8
3800	16.5	-25.8	-6.8	-11.4	1.2	1.1	17.6	0.7	30.2
3900	16.4	-25.5	-6.8	-12.0	1.2	1.1	17.4	0.6	30.1
4000	16.3	-25.3	-6.6	-12.6	1.2	1.1	16.9	0.6	29.6
4250	15.8	-24.9	-6.1	-14.5	1.2	1.1	17.1	0.7	29.1
4500	15.3	-24.6	-5.7	-16.3	1.2	1.2	16.9	0.7	29.0
4750	14.9	-24.4	-5.4	-17.4	1.2	1.2	17.0	0.6	28.1
5000	14.4	-24.2	-5.2	-17.0	1.2	1.2	17.0	0.8	29.0
5250	13.8	-24.0	-5.1	-15.4	1.2	1.2	16.9	0.9	29.1
5500	13.3	-23.8	-5.1	-13.6	1.2	1.2	16.7	1.1	28.7
5750	12.8	-23.6	-5.2	-12.0	1.2	1.2	16.5	1.3	28.2
6000	12.4	-23.4	-5.2	-10.6	1.2	1.2	16.9	1.5	29.6
7000	11.1	-22.5	-5.5	-7.5	1.2	1.0	16.6	1.4	27.9
7500	11.2	-21.6	-6.6	-7.3	1.3	0.9	16.1	1.4	27.7
8000	11.7	-20.5	-6.9	-8.7	1.2	0.9	15.3	1.2	26.1

Typical Performance Data

NOTE: Use PDF Bookmarks to view DATA at required conditions

Definitions:

Input Return Loss = S11 (dB)

Gain = S21 (dB)

Isolation = S12 (dB)

Output Return Loss = S22 (dB)

TEST CONDITIONS: $V_{DD} = +4.75$ V, $V_{SHUTDOWN} = 0$ V, $I_{DD} = 50$ mA, $I_{SHUTDOWN} = 0.006$ μ A @ Temperature = +25°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		1dB Comp. Output	Noise Figure	IP-3 Output P _{OUT} = +4
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dB)	(dBm)
800	26.8	-37.4	-3.6	-3.7	0.8	0.7	20.9	0.4	32.5
900	26.3	-36.8	-4.0	-3.9	0.9	0.7	21.4	0.4	32.5
1000	25.7	-36.3	-4.5	-4.0	0.9	0.7	21.4	0.4	32.7
1100	25.2	-35.6	-5.0	-4.1	0.9	0.7	21.3	0.4	32.8
1200	24.7	-35.1	-5.4	-4.3	1.0	0.7	21.5	0.4	32.7
1300	24.2	-34.7	-5.8	-4.4	1.0	0.7	21.8	0.4	32.6
1400	23.7	-34.3	-6.1	-4.5	1.0	0.7	21.5	0.4	32.8
1500	23.3	-33.8	-6.5	-4.5	1.0	0.7	21.9	0.4	33.0
1600	22.9	-33.5	-6.9	-4.6	1.1	0.7	21.7	0.3	33.2
1700	22.4	-33.0	-7.2	-4.7	1.1	0.7	21.8	0.3	33.3
1800	22.1	-32.7	-7.5	-4.8	1.1	0.7	22.0	0.4	33.5
1900	21.7	-32.3	-7.8	-4.8	1.1	0.7	21.7	0.4	33.3
2000	21.4	-32.0	-8.0	-4.9	1.1	0.7	21.4	0.4	34.7
2100	21.0	-31.6	-8.3	-5.0	1.1	0.7	21.6	0.4	34.0
2200	20.7	-31.4	-8.5	-5.0	1.2	0.7	21.9	0.4	34.0
2300	20.4	-31.0	-8.7	-5.2	1.2	0.7	21.4	0.4	34.0
2400	20.1	-30.7	-8.9	-5.2	1.2	0.7	21.8	0.4	34.0
2500	19.9	-30.4	-9.1	-5.3	1.2	0.7	21.7	0.4	34.1
2600	19.5	-30.2	-9.2	-5.7	1.2	0.8	21.7	0.4	34.1
2700	19.3	-29.9	-9.2	-5.8	1.2	0.8	21.4	0.5	34.4
2800	19.0	-29.7	-9.2	-6.1	1.3	0.8	21.7	0.5	34.6
2900	18.9	-29.3	-9.3	-6.3	1.3	0.8	21.5	0.5	34.6
3000	18.7	-28.9	-9.3	-6.3	1.2	0.8	21.2	0.4	34.7
3100	18.6	-28.7	-9.4	-6.6	1.3	0.8	21.2	0.5	33.7
3200	18.4	-28.5	-9.2	-6.9	1.3	0.8	21.4	0.5	34.6
3300	18.3	-28.2	-9.1	-7.1	1.2	0.8	21.3	0.4	35.5
3400	18.1	-27.9	-9.0	-7.3	1.2	0.9	21.4	0.5	35.0
3500	17.9	-27.6	-8.8	-7.6	1.2	0.9	21.2	0.6	34.6
3600	17.7	-27.4	-8.6	-7.8	1.2	0.9	21.2	0.6	34.5
3700	17.3	-27.5	-8.1	-8.1	1.3	0.9	20.6	0.6	35.0
3800	17.3	-27.1	-7.9	-9.1	1.3	1.0	21.3	0.6	35.6
3900	17.2	-26.8	-7.8	-9.5	1.3	1.0	21.1	0.5	35.5
4000	17.1	-26.5	-7.6	-9.9	1.2	1.0	20.4	0.6	35.6
4250	16.7	-26.1	-7.0	-11.2	1.2	1.1	20.6	0.6	35.6
4500	16.3	-25.7	-6.4	-12.5	1.2	1.1	20.5	0.7	36.0
4750	15.8	-25.4	-6.0	-13.4	1.2	1.2	20.6	0.6	36.3
5000	15.4	-25.1	-5.8	-13.4	1.2	1.2	20.7	0.7	36.6
5250	14.9	-24.9	-5.6	-12.6	1.2	1.2	20.5	0.8	36.5
5500	14.3	-24.7	-5.5	-11.5	1.2	1.2	20.4	1.0	36.7
5750	13.8	-24.5	-5.6	-10.2	1.2	1.2	20.0	1.2	36.5
6000	13.3	-24.3	-5.7	-9.0	1.2	1.1	20.6	1.3	37.9
7000	11.9	-23.4	-5.9	-6.4	1.2	1.0	20.1	1.3	38.1
7500	12.0	-22.6	-6.8	-6.1	1.2	0.8	19.6	1.4	37.2
8000	12.6	-21.4	-7.0	-7.1	1.2	0.9	18.6	1.0	37.0

Typical Performance Data

NOTE: Use PDF Bookmarks to view DATA at required conditions**Definitions:**

Input Return Loss = S11 (dB)

Gain = S21 (dB)

Isolation = S12 (dB)

Output Return Loss = S22 (dB)

TEST CONDITIONS: $V_{DD} = +5\text{ V}$, $V_{SHUTDOWN} = 0\text{ V}$, $I_{DD} = 55\text{ mA}$, $I_{SHUTDOWN} = 0.0067\text{ }\mu\text{A}$ @ Temperature = $+25^{\circ}\text{C}$

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		1dB Comp. Output	Noise Figure	IP-3 Output $P_{OUT} = +4$
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dB)	(dBm)
800	26.9	-37.7	-3.6	-3.7	0.8	0.7	21.5	0.4	32.7
900	26.4	-37.1	-4.1	-3.8	0.9	0.7	21.8	0.4	33.2
1000	25.8	-36.3	-4.6	-4.0	0.9	0.7	21.8	0.4	33.2
1100	25.2	-35.7	-5.0	-4.1	0.9	0.7	21.8	0.4	33.2
1200	24.8	-35.4	-5.5	-4.2	1.0	0.7	22.0	0.4	33.2
1300	24.2	-34.9	-5.9	-4.3	1.0	0.7	22.2	0.3	33.3
1400	23.8	-34.4	-6.2	-4.4	1.0	0.7	22.0	0.4	33.6
1500	23.3	-34.1	-6.6	-4.5	1.1	0.7	22.3	0.3	33.4
1600	22.9	-33.7	-7.0	-4.5	1.1	0.7	22.2	0.3	33.5
1700	22.5	-33.2	-7.3	-4.6	1.1	0.7	22.2	0.4	33.6
1800	22.1	-32.8	-7.6	-4.7	1.1	0.7	22.5	0.4	33.7
1900	21.8	-32.5	-7.9	-4.7	1.1	0.7	22.2	0.4	33.5
2000	21.4	-32.2	-8.2	-4.8	1.2	0.7	21.9	0.4	34.4
2100	21.1	-31.8	-8.4	-4.9	1.2	0.7	22.0	0.4	34.4
2200	20.8	-31.5	-8.6	-5.0	1.2	0.7	22.3	0.4	34.3
2300	20.5	-31.2	-8.8	-5.1	1.2	0.7	21.9	0.4	34.2
2400	20.2	-30.9	-9.0	-5.1	1.2	0.7	22.3	0.4	34.4
2500	19.9	-30.7	-9.2	-5.3	1.2	0.7	22.1	0.4	34.3
2600	19.6	-30.5	-9.3	-5.6	1.3	0.8	22.1	0.4	33.9
2700	19.4	-30.1	-9.3	-5.7	1.3	0.8	21.8	0.5	34.1
2800	19.1	-29.9	-9.4	-6.0	1.3	0.8	22.2	0.4	34.2
2900	19.0	-29.4	-9.4	-6.2	1.3	0.8	21.9	0.5	34.4
3000	18.8	-29.1	-9.5	-6.2	1.2	0.8	21.7	0.5	34.2
3100	18.6	-28.9	-9.5	-6.5	1.3	0.8	21.7	0.4	33.6
3200	18.5	-28.7	-9.4	-6.7	1.3	0.8	21.9	0.4	34.4
3300	18.3	-28.3	-9.3	-6.9	1.2	0.8	21.8	0.4	35.1
3400	18.1	-28.0	-9.1	-7.2	1.2	0.9	21.9	0.5	34.7
3500	18.0	-27.8	-9.0	-7.4	1.2	0.9	21.6	0.6	34.2
3600	17.8	-27.5	-8.7	-7.7	1.2	0.9	21.7	0.6	34.0
3700	17.3	-27.6	-8.1	-7.9	1.3	0.9	21.1	0.6	34.5
3800	17.4	-27.2	-8.0	-8.9	1.3	1.0	21.8	0.6	35.0
3900	17.3	-26.9	-7.9	-9.2	1.3	1.0	21.6	0.6	35.1
4000	17.2	-26.7	-7.6	-9.7	1.2	1.0	20.9	0.6	34.9
4250	16.8	-26.2	-7.0	-10.9	1.2	1.1	21.2	0.6	35.3
4500	16.3	-25.8	-6.5	-12.2	1.2	1.1	21.0	0.6	35.3
4750	15.9	-25.5	-6.1	-13.0	1.2	1.2	21.1	0.6	35.1
5000	15.4	-25.3	-5.8	-13.1	1.2	1.2	21.2	0.7	35.8
5250	14.9	-25.0	-5.6	-12.4	1.2	1.2	21.1	0.9	35.6
5500	14.4	-24.8	-5.6	-11.2	1.2	1.2	21.0	1.0	35.9
5750	13.9	-24.6	-5.6	-10.0	1.2	1.2	20.7	1.2	35.9
6000	13.4	-24.4	-5.7	-8.9	1.2	1.1	21.1	1.4	36.6
7000	12.0	-23.5	-5.9	-6.2	1.2	1.0	20.7	1.4	37.3
7500	12.1	-22.7	-6.8	-5.9	1.2	0.8	20.1	1.4	36.5
8000	12.7	-21.5	-7.1	-6.9	1.2	0.9	19.2	1.1	35.7

Typical Performance Data

NOTE: Use PDF Bookmarks to view DATA at required conditions**Definitions:**

Input Return Loss = S11 (dB)

Gain = S21 (dB)

Isolation = S12 (dB)

Output Return Loss = S22 (dB)

TEST CONDITIONS: $V_{DD} = +5.25\text{ V}$, $V_{SHUTDOWN} = 0\text{ V}$, $I_{DD} = 58\text{ mA}$, $I_{SHUTDOWN} = 0.0077\text{ }\mu\text{A}$ @ Temperature = +25°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		1dB Comp. Output	Noise Figure	IP-3 Output $P_{OUT} = +4$
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dB)	(dBm)
800	27.0	-37.7	-3.7	-3.7	0.9	0.7	21.9	0.4	33.4
900	26.4	-37.2	-4.2	-3.8	0.9	0.7	22.2	0.4	33.4
1000	25.8	-36.5	-4.7	-4.0	0.9	0.7	22.2	0.4	33.3
1100	25.3	-35.9	-5.1	-4.1	0.9	0.7	22.1	0.4	33.7
1200	24.8	-35.4	-5.6	-4.2	1.0	0.7	22.3	0.4	33.7
1300	24.3	-35.1	-5.9	-4.3	1.0	0.7	22.5	0.3	33.7
1400	23.9	-34.5	-6.3	-4.4	1.0	0.7	22.3	0.4	33.8
1500	23.4	-34.2	-6.7	-4.4	1.1	0.7	22.7	0.4	33.6
1600	23.0	-33.8	-7.1	-4.5	1.1	0.7	22.6	0.3	33.8
1700	22.6	-33.4	-7.4	-4.6	1.1	0.7	22.6	0.3	33.9
1800	22.2	-33.1	-7.7	-4.6	1.1	0.7	22.8	0.4	33.9
1900	21.8	-32.7	-8.0	-4.7	1.1	0.7	22.6	0.4	33.6
2000	21.5	-32.3	-8.3	-4.8	1.2	0.7	22.2	0.4	34.7
2100	21.1	-32.0	-8.5	-4.8	1.2	0.7	22.4	0.4	34.4
2200	20.8	-31.6	-8.7	-4.9	1.2	0.7	22.7	0.4	34.3
2300	20.5	-31.4	-8.9	-5.0	1.2	0.7	22.3	0.3	34.2
2400	20.2	-31.1	-9.1	-5.1	1.2	0.7	22.7	0.4	34.3
2500	19.9	-30.8	-9.3	-5.2	1.2	0.7	22.5	0.5	34.5
2600	19.6	-30.6	-9.4	-5.5	1.3	0.7	22.5	0.4	34.2
2700	19.4	-30.3	-9.4	-5.6	1.3	0.8	22.2	0.5	34.1
2800	19.1	-30.1	-9.5	-5.9	1.3	0.8	22.6	0.4	34.0
2900	19.0	-29.6	-9.5	-6.1	1.3	0.8	22.3	0.5	34.8
3000	18.8	-29.2	-9.6	-6.1	1.3	0.8	22.1	0.5	34.3
3100	18.7	-29.0	-9.6	-6.4	1.3	0.8	22.1	0.5	33.6
3200	18.5	-28.8	-9.5	-6.6	1.3	0.8	22.4	0.4	34.2
3300	18.4	-28.4	-9.4	-6.8	1.3	0.8	22.2	0.4	34.8
3400	18.2	-28.1	-9.2	-7.0	1.2	0.8	22.3	0.5	34.6
3500	18.0	-27.9	-9.1	-7.3	1.3	0.9	22.1	0.6	34.4
3600	17.8	-27.7	-8.8	-7.5	1.2	0.9	22.2	0.6	33.9
3700	17.4	-27.7	-8.2	-7.8	1.3	0.9	21.5	0.6	34.4
3800	17.4	-27.4	-8.1	-8.7	1.3	1.0	22.2	0.6	35.0
3900	17.3	-27.0	-7.9	-9.1	1.2	1.0	22.0	0.5	34.8
4000	17.2	-26.8	-7.7	-9.5	1.3	1.0	21.4	0.5	34.5
4250	16.8	-26.3	-7.1	-10.7	1.2	1.1	21.6	0.6	34.6
4500	16.4	-25.9	-6.6	-11.9	1.2	1.1	21.4	0.6	35.1
4750	16.0	-25.6	-6.1	-12.7	1.2	1.1	21.6	0.6	34.7
5000	15.5	-25.3	-5.9	-12.8	1.2	1.2	21.7	0.8	35.2
5250	15.0	-25.1	-5.7	-12.2	1.2	1.2	21.5	0.9	35.8
5500	14.5	-24.9	-5.6	-11.1	1.2	1.2	21.5	1.0	35.1
5750	14.0	-24.7	-5.6	-9.9	1.2	1.2	21.1	1.2	35.6
6000	13.5	-24.5	-5.7	-8.7	1.2	1.1	21.6	1.4	36.4
7000	12.1	-23.6	-5.9	-6.2	1.1	0.9	21.1	1.4	36.4
7500	12.2	-22.8	-6.8	-5.8	1.2	0.8	20.6	1.4	35.8
8000	12.8	-21.6	-7.1	-6.8	1.2	0.9	19.7	1.0	35.1

Typical Performance Data

NOTE: Use PDF Bookmarks to view DATA at required conditions**Definitions:**

Input Return Loss = S11 (dB)

Gain = S21 (dB)

Isolation = S12 (dB)

Output Return Loss = S22 (dB)

TEST CONDITIONS: $V_{DD} = +5\text{ V}$, $V_{SHUTDOWN} = 0\text{ V}$, $I_{DD} = 59\text{ mA}$, $I_{SHUTDOWN} = 0.006\text{ }\mu\text{A}$ @ Temperature = -45°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		1dB Comp. Output	Noise Figure	IP-3 Output $P_{OUT} = +4$
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dB)	(dBm)
800	27.9	-38.8	-3.9	-3.5	0.8	0.6	21.4	0.2	34.2
900	27.3	-38.1	-4.4	-3.7	0.8	0.6	21.7	0.2	34.5
1000	26.7	-37.4	-4.9	-3.8	0.8	0.6	21.5	0.2	34.7
1100	26.2	-36.8	-5.4	-3.9	0.9	0.6	21.5	0.1	34.9
1200	25.7	-36.4	-5.8	-4.0	0.9	0.6	21.7	0.2	34.7
1300	25.2	-35.9	-6.2	-4.0	0.9	0.6	22.0	0.2	34.5
1400	24.7	-35.4	-6.7	-4.1	0.9	0.6	21.8	0.1	34.7
1500	24.3	-35.0	-7.1	-4.1	1.0	0.6	22.2	0.2	34.7
1600	23.8	-34.5	-7.5	-4.2	1.0	0.6	22.1	0.1	35.0
1700	23.4	-34.1	-7.8	-4.3	1.0	0.6	22.1	0.1	35.0
1800	23.0	-33.7	-8.2	-4.3	1.0	0.6	22.4	0.1	35.1
1900	22.6	-33.4	-8.5	-4.3	1.1	0.6	22.1	0.2	34.8
2000	22.3	-33.0	-8.8	-4.4	1.1	0.6	21.7	0.1	35.7
2100	22.0	-32.6	-9.2	-4.5	1.1	0.6	21.9	0.1	35.1
2200	21.7	-32.3	-9.5	-4.5	1.1	0.6	22.2	0.2	35.1
2300	21.4	-32.0	-9.7	-4.6	1.1	0.6	21.8	0.1	35.0
2400	21.1	-31.6	-10.0	-4.7	1.1	0.6	22.2	0.2	34.9
2500	20.8	-31.3	-10.2	-4.8	1.1	0.7	22.0	0.2	35.0
2600	20.5	-31.1	-10.4	-5.0	1.2	0.7	22.1	0.2	34.9
2700	20.2	-30.7	-10.5	-5.2	1.2	0.7	21.7	0.2	34.8
2800	20.0	-30.5	-10.5	-5.6	1.2	0.7	22.0	0.2	34.6
2900	19.9	-30.1	-10.7	-5.6	1.2	0.7	21.8	0.2	35.2
3000	19.7	-29.8	-10.8	-5.8	1.2	0.7	21.4	0.2	35.2
3100	19.6	-29.5	-10.8	-5.9	1.2	0.7	21.6	0.2	34.6
3200	19.4	-29.2	-10.7	-6.2	1.2	0.8	21.8	0.1	34.9
3300	19.3	-28.8	-10.6	-6.3	1.2	0.8	21.6	0.1	35.2
3400	19.1	-28.5	-10.5	-6.6	1.2	0.8	21.7	0.2	34.7
3500	18.9	-28.3	-10.3	-6.8	1.2	0.8	21.5	0.2	34.2
3600	18.8	-28.0	-10.0	-7.0	1.2	0.8	21.6	0.2	33.9
3700	18.4	-28.0	-9.4	-7.2	1.2	0.8	20.8	0.3	34.2
3800	18.4	-27.7	-9.1	-8.1	1.2	0.9	21.7	0.3	34.6
3900	18.3	-27.4	-9.1	-8.4	1.2	0.9	21.5	0.2	34.5
4000	18.2	-27.1	-8.8	-8.8	1.2	0.9	20.7	0.2	33.5
4250	17.8	-26.6	-8.1	-9.9	1.2	1.0	20.9	0.3	33.4
4500	17.4	-26.1	-7.5	-10.9	1.2	1.0	20.8	0.3	33.2
4750	17.1	-25.8	-7.0	-11.6	1.2	1.1	21.0	0.2	32.4
5000	16.6	-25.5	-6.6	-11.9	1.2	1.1	21.3	0.3	33.2
5250	16.1	-25.2	-6.4	-11.5	1.2	1.1	21.0	0.4	32.9
5500	15.6	-25.0	-6.3	-10.6	1.2	1.1	20.9	0.6	32.8
5750	15.1	-24.8	-6.3	-9.5	1.1	1.1	20.5	0.7	32.4
6000	14.6	-24.6	-6.3	-8.4	1.1	1.1	21.0	0.9	33.4
7000	13.2	-23.7	-6.4	-5.8	1.1	0.9	20.5	0.8	32.7
7500	13.2	-22.9	-7.1	-5.3	1.1	0.8	19.9	0.8	31.5
8000	13.6	-21.8	-7.2	-6.0	1.1	0.8	18.9	0.6	30.0

Typical Performance Data

NOTE: Use PDF Bookmarks to view DATA at required conditions**Definitions:**

Input Return Loss = S11 (dB)

Gain = S21 (dB)

Isolation = S12 (dB)

Output Return Loss = S22 (dB)

TEST CONDITIONS: $V_{DD} = +5\text{ V}$, $V_{SHUTDOWN} = 0\text{ V}$, $I_{DD} = 55\text{ mA}$, $I_{SHUTDOWN} = 0.004\text{ }\mu\text{A}$ @ Temperature = +105°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		1dB Comp. Output	Noise Figure	IP-3 Output $P_{OUT} = +4$
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dB)	(dBm)
800	26.3	-37.2	-3.4	-3.6	0.8	0.7	20.7	0.4	32.1
900	25.8	-36.5	-3.9	-3.8	0.9	0.7	20.8	0.4	32.3
1000	25.2	-35.9	-4.3	-3.9	0.9	0.7	20.9	0.5	32.4
1100	24.7	-35.5	-4.8	-4.1	0.9	0.7	20.8	0.5	32.6
1200	24.2	-35.0	-5.2	-4.2	1.0	0.7	21.0	0.5	32.6
1300	23.7	-34.5	-5.6	-4.3	1.0	0.7	21.1	0.6	32.7
1400	23.3	-34.2	-5.9	-4.4	1.0	0.7	21.0	0.5	32.8
1500	22.9	-33.7	-6.3	-4.4	1.0	0.7	21.2	0.5	32.7
1600	22.4	-33.5	-6.6	-4.5	1.1	0.7	21.2	0.5	33.2
1700	22.0	-33.1	-6.9	-4.6	1.1	0.7	21.2	0.5	33.4
1800	21.6	-32.7	-7.2	-4.7	1.1	0.7	21.5	0.5	33.6
1900	21.3	-32.3	-7.5	-4.8	1.1	0.7	21.2	0.6	33.3
2000	20.9	-32.1	-7.7	-4.9	1.2	0.7	21.1	0.5	34.3
2100	20.6	-31.8	-8.0	-4.9	1.2	0.7	21.2	0.6	34.6
2200	20.3	-31.4	-8.2	-5.0	1.2	0.7	21.4	0.6	34.5
2300	20.0	-31.1	-8.4	-5.1	1.2	0.7	21.2	0.6	34.5
2400	19.7	-30.8	-8.5	-5.2	1.2	0.7	21.5	0.6	34.2
2500	19.4	-30.5	-8.7	-5.3	1.2	0.7	21.4	0.6	34.5
2600	19.2	-30.4	-8.8	-5.6	1.3	0.8	21.4	0.6	34.4
2700	18.9	-30.1	-8.8	-5.8	1.3	0.8	21.1	0.6	34.5
2800	18.7	-29.8	-8.9	-6.0	1.3	0.8	21.5	0.6	34.7
2900	18.5	-29.4	-9.0	-6.1	1.3	0.8	21.3	0.6	34.4
3000	18.3	-29.1	-9.0	-6.3	1.3	0.8	21.0	0.7	35.4
3100	18.2	-28.9	-8.9	-6.5	1.3	0.8	21.1	0.7	34.7
3200	18.0	-28.6	-8.9	-6.7	1.3	0.8	21.4	0.7	35.3
3300	17.9	-28.3	-8.8	-6.9	1.3	0.9	21.3	0.7	36.0
3400	17.7	-28.0	-8.7	-7.1	1.3	0.9	21.3	0.8	35.5
3500	17.5	-27.8	-8.6	-7.4	1.3	0.9	21.1	0.8	35.1
3600	17.3	-27.6	-8.4	-7.7	1.3	0.9	21.2	0.9	34.6
3700	16.8	-27.7	-7.7	-8.1	1.3	1.0	20.6	0.8	35.2
3800	16.9	-27.2	-7.7	-8.9	1.3	1.0	21.3	0.9	35.9
3900	16.8	-26.9	-7.6	-9.3	1.3	1.0	21.1	0.8	35.5
4000	16.7	-26.8	-7.4	-9.8	1.3	1.0	20.5	0.8	35.4
4250	16.3	-26.3	-6.8	-11.1	1.3	1.1	20.7	0.9	35.4
4500	15.9	-26.0	-6.3	-12.4	1.3	1.1	20.5	0.9	35.8
4750	15.4	-25.7	-5.9	-13.1	1.3	1.2	20.7	0.9	35.5
5000	14.9	-25.4	-5.7	-13.0	1.3	1.2	20.8	1.1	36.0
5250	14.4	-25.2	-5.5	-12.2	1.3	1.2	20.6	1.3	36.2
5500	13.9	-25.0	-5.4	-11.0	1.3	1.2	20.6	1.4	36.4
5750	13.4	-24.8	-5.4	-9.8	1.3	1.2	20.3	1.6	36.0
6000	12.9	-24.6	-5.5	-8.7	1.2	1.1	20.7	1.8	37.0
7000	11.5	-23.7	-5.7	-6.2	1.2	1.0	20.4	1.8	36.8
7500	11.5	-23.0	-6.7	-6.0	1.3	0.9	19.9	2.1	36.1
8000	12.3	-21.6	-7.0	-7.1	1.2	0.9	19.0	1.6	35.0

Typical Performance Data on 3400-3800 MHz Matching Test Board

NOTE: Use PDF Bookmarks to view DATA at required conditions

Definitions:

Input Return Loss = S11 (dB)

Gain = S21 (dB)

Isolation = S12 (dB)

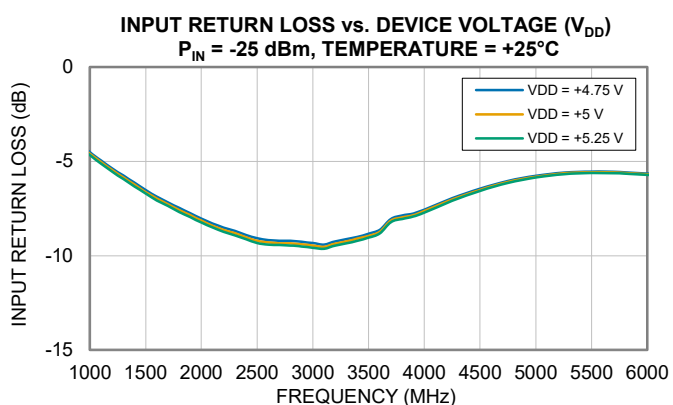
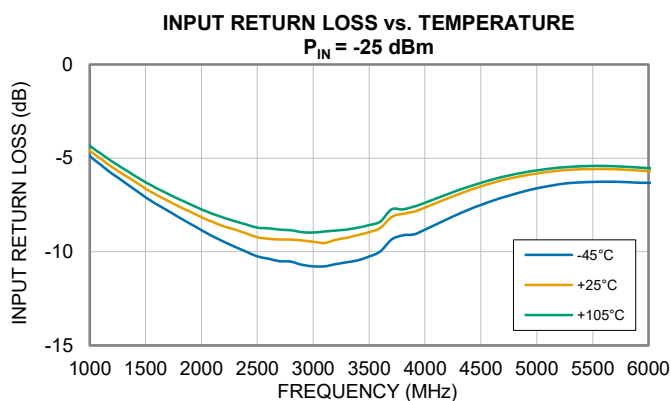
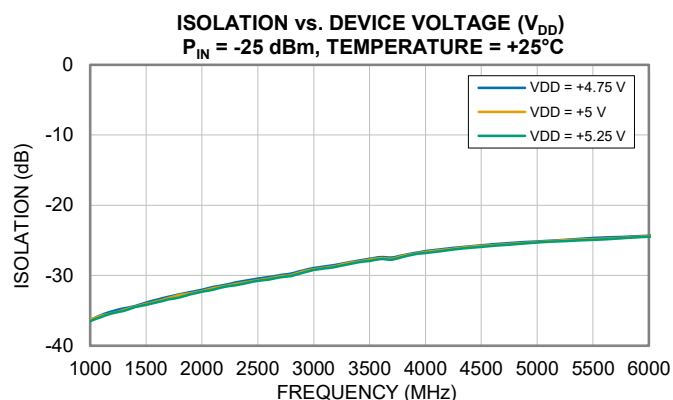
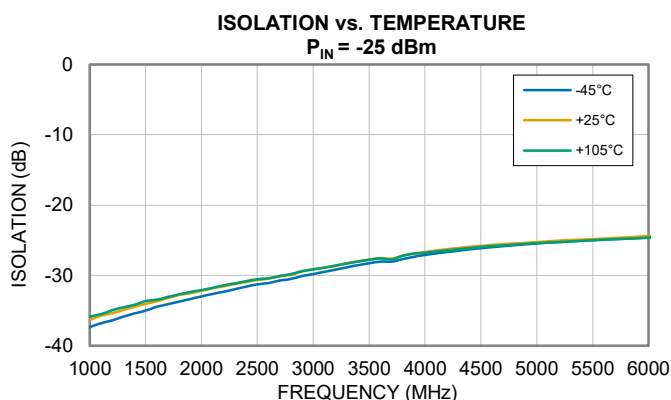
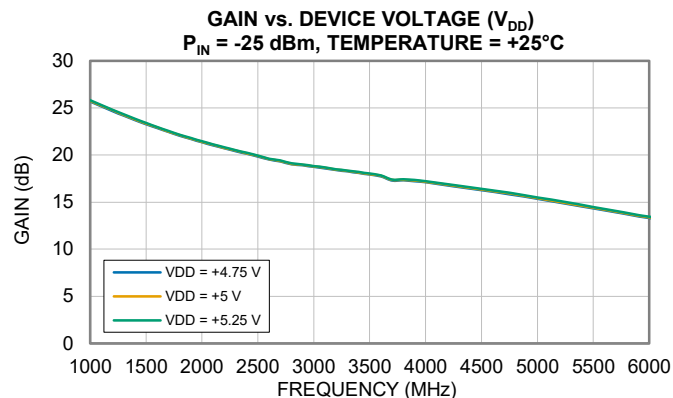
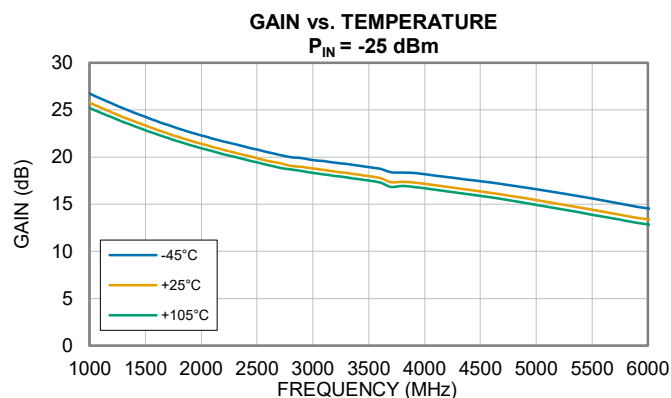
Output Return Loss = S22 (dB)

TEST CONDITIONS: $V_{DD} = +5\text{ V}$, $V_{SHUTDOWN} = 0\text{ V}$, $I_{DD} = 55\text{ mA}$, $I_{SHUTDOWN} = 0.0067\text{ }\mu\text{A}$ @ Temperature = +25°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		1dB Comp. Output	Noise Figure	IP-3 Output $P_{OUT} = +4$
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dB)	(dBm)
800	-4.2	-65.6	-0.3	-0.6	13.3	0.3	8.8	9.1	22.2
900	-2.0	-62.7	-0.3	-0.7	7.8	0.3	10.9	7.9	21.1
1000	-0.1	-60.4	-0.3	-0.8	6.4	0.3	10.3	6.9	23.8
1100	1.7	-57.4	-0.3	-0.9	4.6	0.4	13.4	6.2	25.1
1200	3.4	-56.9	-0.4	-1.0	4.6	0.4	14.1	5.5	26.9
1300	5.0	-53.8	-0.4	-1.2	3.4	0.4	14.8	4.3	28.7
1400	6.4	-51.0	-0.4	-1.3	2.6	0.5	15.4	3.7	28.6
1500	7.8	-49.1	-0.5	-1.4	2.3	0.5	16.0	3.1	31.1
1600	9.1	-46.7	-0.6	-1.5	2.1	0.5	16.5	2.8	31.4
1700	10.4	-44.7	-0.7	-1.7	1.8	0.6	17.1	2.4	32.3
1800	11.7	-42.7	-0.8	-1.8	1.6	0.6	17.4	2.0	33.3
1900	12.8	-40.8	-1.0	-2.0	1.5	0.6	17.7	1.8	32.8
2000	13.9	-39.0	-1.2	-2.2	1.4	0.6	17.8	1.5	33.4
2100	15.0	-37.4	-1.4	-2.4	1.4	0.7	18.0	1.4	33.8
2200	16.0	-35.8	-1.8	-2.7	1.3	0.7	18.3	1.3	33.7
2300	16.8	-34.3	-2.2	-3.1	1.3	0.7	18.7	1.1	33.7
2400	17.5	-33.0	-2.8	-3.5	1.3	0.7	18.8	1.0	33.8
2500	18.1	-31.9	-3.4	-4.0	1.3	0.7	19.1	0.9	33.7
2600	18.5	-31.1	-4.2	-4.8	1.3	0.7	18.9	0.8	33.0
2700	18.9	-30.1	-5.1	-5.3	1.3	0.7	18.7	0.8	33.3
2800	19.0	-29.5	-6.1	-6.1	1.3	0.7	19.1	0.7	33.6
2900	19.2	-28.8	-7.0	-6.8	1.3	0.7	19.2	0.7	33.2
3000	19.3	-28.2	-8.0	-7.3	1.3	0.7	19.6	0.6	33.4
3100	19.3	-27.7	-9.0	-7.9	1.3	0.7	19.6	0.6	32.6
3200	19.3	-27.3	-9.8	-8.6	1.3	0.8	19.6	0.5	33.0
3300	19.2	-26.9	-10.5	-9.2	1.3	0.8	19.4	0.5	33.4
3400	19.1	-26.6	-10.9	-9.8	1.2	0.8	19.2	0.5	33.1
3500	18.9	-26.3	-11.1	-10.6	1.2	0.8	19.8	0.5	32.9
3600	18.8	-26.0	-11.1	-11.2	1.2	0.8	20.0	0.5	32.1
3700	18.6	-25.9	-11.1	-11.9	1.2	0.9	18.9	0.5	32.6
3800	18.4	-25.7	-11.0	-12.6	1.2	0.9	19.8	0.4	33.1
3900	18.3	-25.5	-10.8	-13.4	1.2	0.9	19.5	0.5	32.7
4000	18.1	-25.3	-10.5	-14.1	1.2	0.9	19.4	0.5	32.7
4250	17.6	-24.9	-9.9	-16.1	1.2	0.9	19.4	0.5	32.5
4500	17.2	-24.5	-9.3	-17.6	1.2	1.0	19.8	0.5	32.7
4750	16.7	-24.3	-8.8	-17.5	1.2	1.0	19.8	0.4	32.4
5000	16.2	-24.0	-8.4	-16.0	1.2	1.0	19.7	0.5	32.6
5250	15.7	-23.8	-8.1	-14.1	1.2	1.0	19.8	0.6	32.8
5500	15.2	-23.7	-8.0	-12.4	1.2	1.0	19.6	0.8	32.5
5750	14.6	-23.5	-8.1	-10.9	1.2	1.0	19.4	0.8	32.5
6000	14.1	-23.3	-8.3	-9.6	1.2	1.0	20.1	1.0	33.6
7000	12.5	-22.5	-11.3	-6.4	1.3	0.8	19.5	1.3	33.1
7500	12.5	-21.9	-9.6	-6.7	1.2	0.8	19.4	1.1	33.1
8000	13.1	-20.7	-13.1	-7.6	1.2	0.8	18.5	0.7	32.3

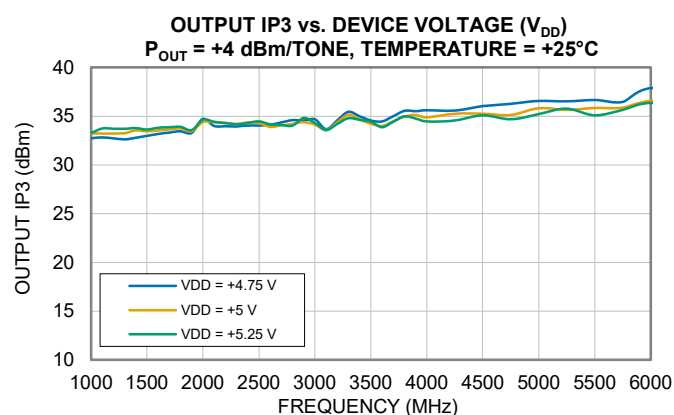
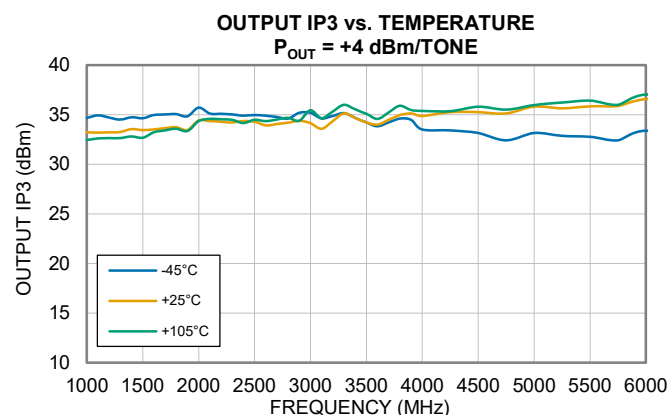
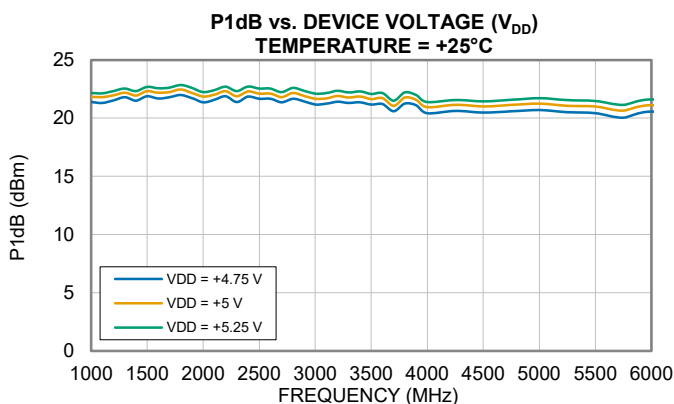
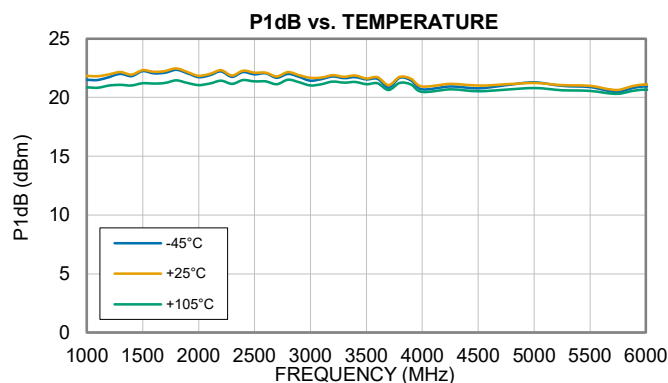
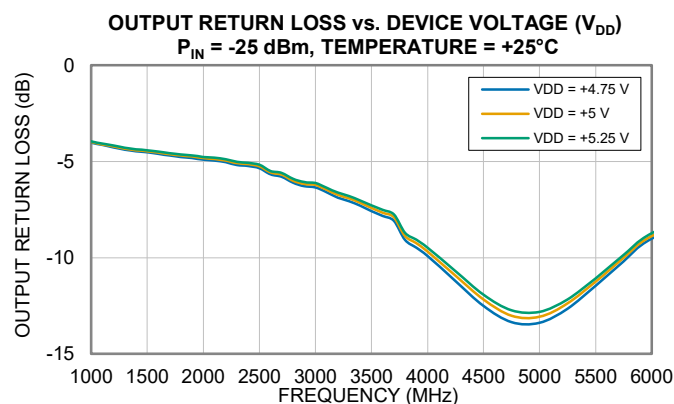
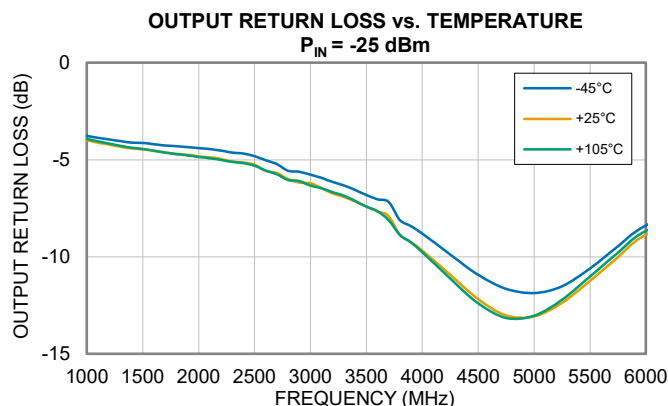
Typical Performance Curves

Note: The following data was taken on the Mini-Circuits Characterization Test Board TB-TSS-63ULNC+ (Figure 2). All data taken at nominal condition of $V_{DD} = +5$ V and at $V_{SHUTDOWN} = 0$ V unless noted otherwise.



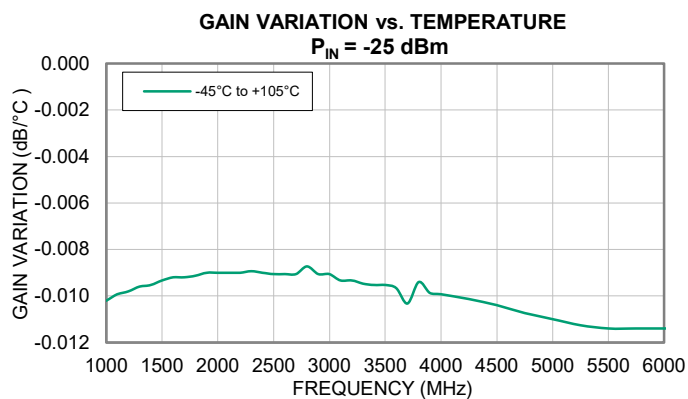
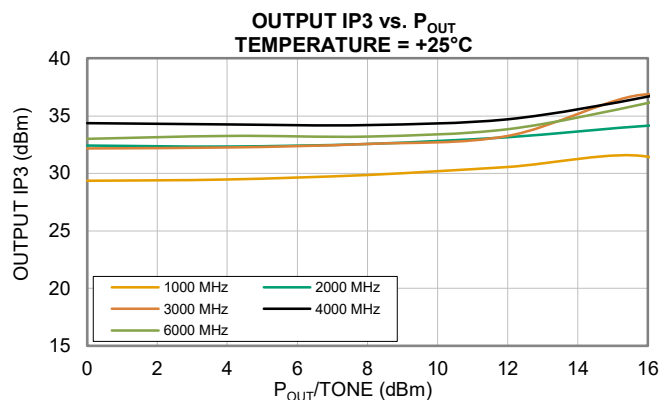
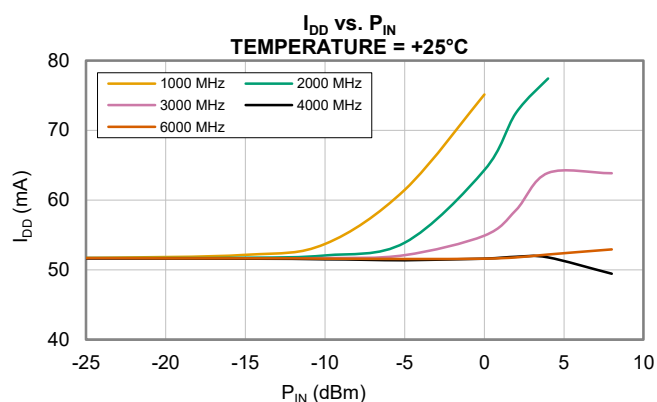
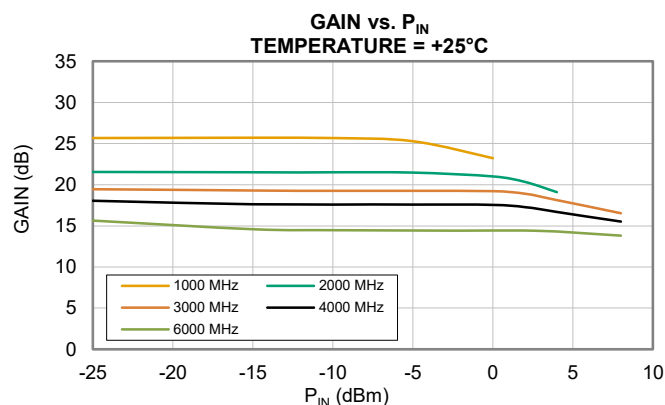
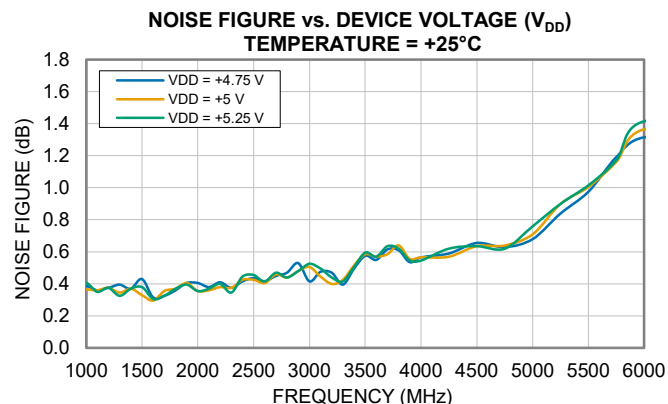
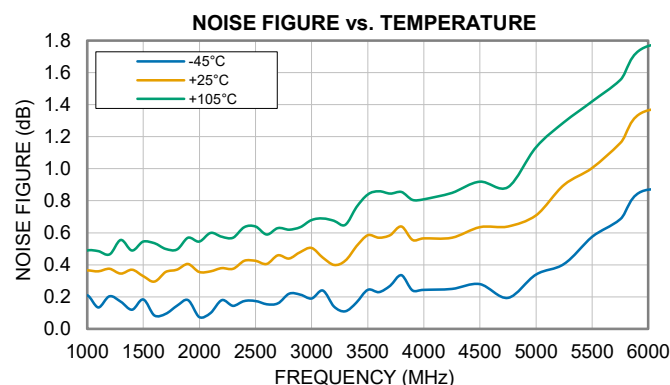
Typical Performance Curves

Note: The following data was taken on the Mini-Circuits Characterization Test Board TB-TSS-63ULNC+ (Figure 2). All data taken at nominal condition of $V_{DD} = +5$ V and at $V_{SHUTDOWN} = 0$ V unless noted otherwise.



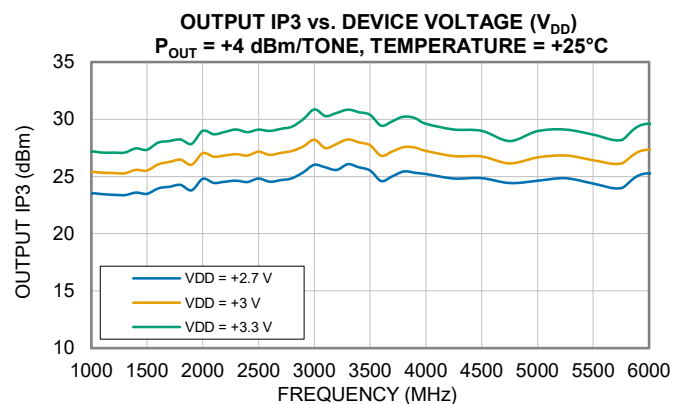
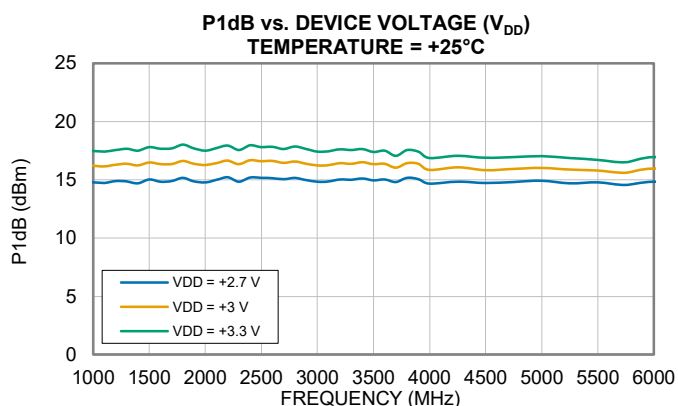
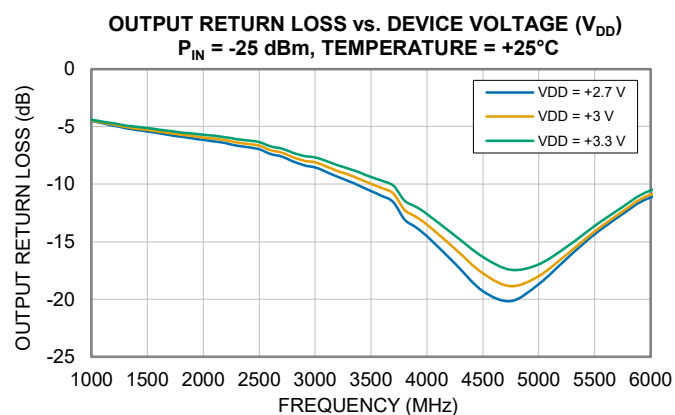
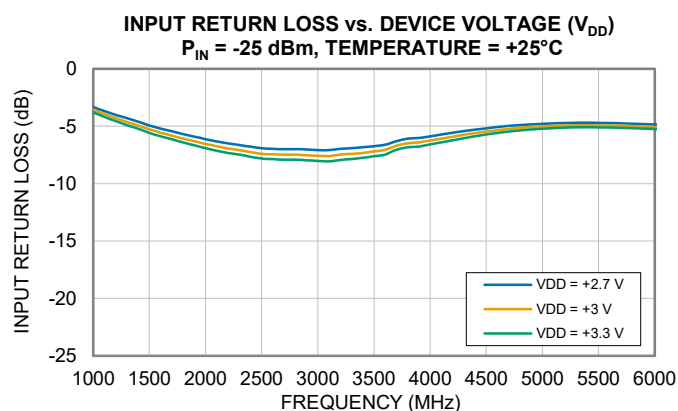
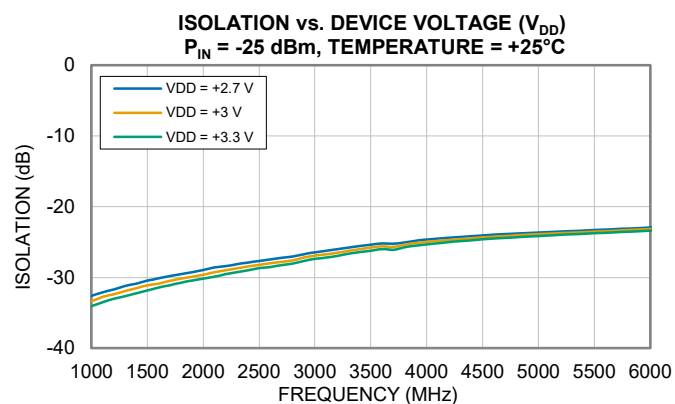
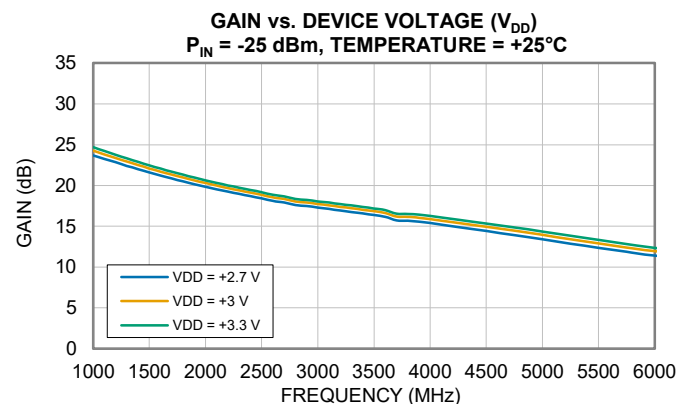
Typical Performance Curves

Note: The following data was taken on the Mini-Circuits Characterization Test Board TB-TSS-63ULNC+ (Figure 2). All data taken at nominal condition of $V_{DD} = +5$ V and at $V_{SHUTDOWN} = 0$ V unless noted otherwise.



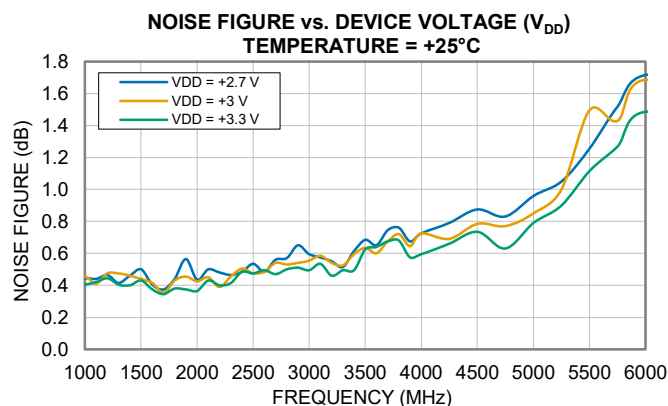
Typical Performance Curves

Note: The following data was taken on the Mini-Circuits Characterization Test Board TB-TSS-63ULNC+ (Figure 2). All data taken at $V_{SHUTDOWN} = 0$ V unless noted otherwise.



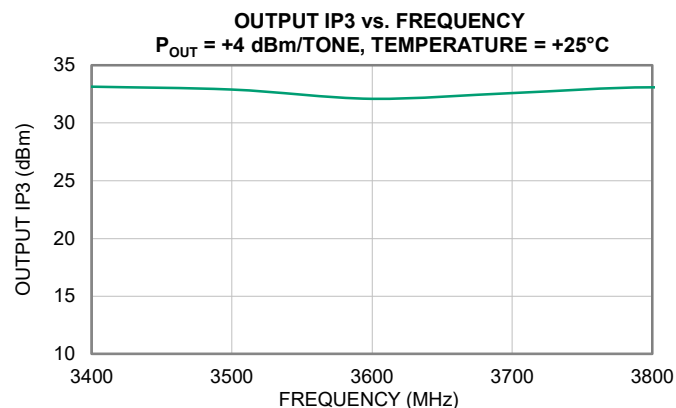
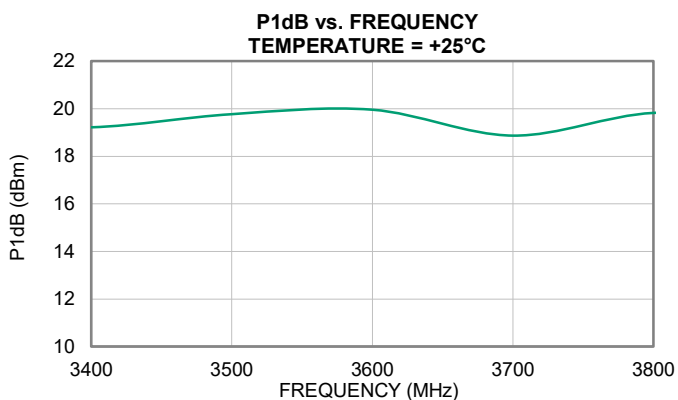
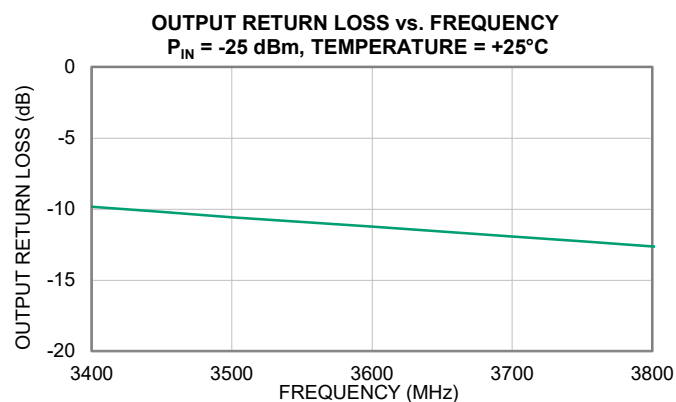
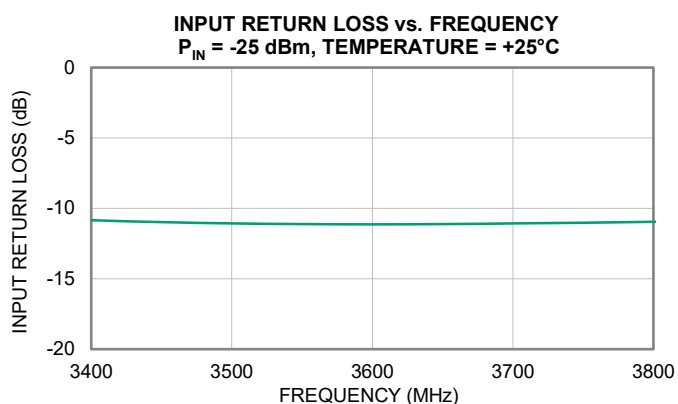
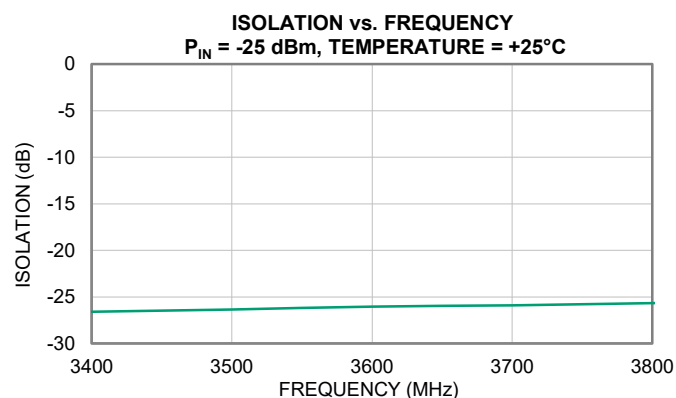
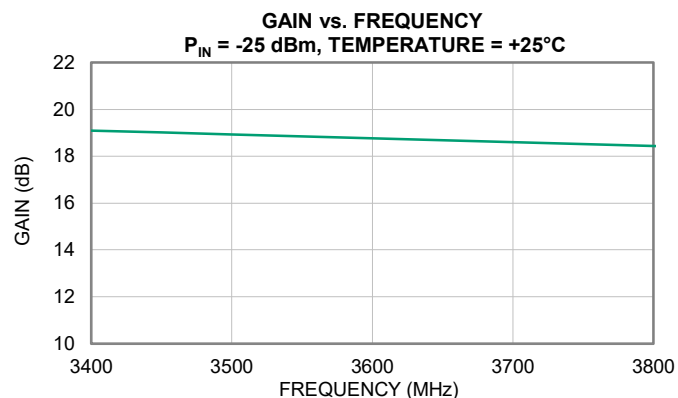
Typical Performance Curves

Note: The following data was taken on the Mini-Circuits Characterization Test Board TB-TSS-63ULNC+ (Figure 2). All data taken at $V_{SHUTDOWN} = 0\text{ V}$ unless noted otherwise.



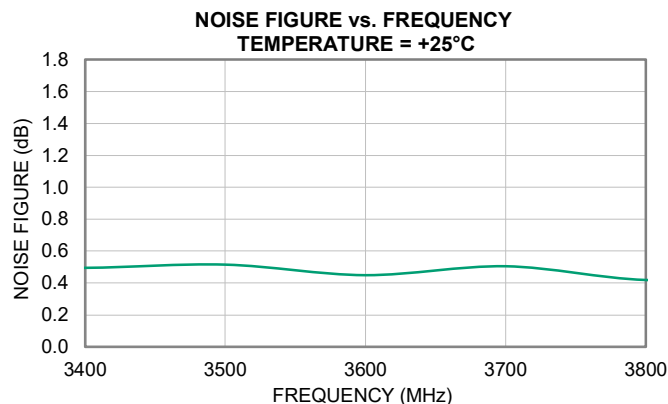
Typical Performance Curves

Note: The following data was taken on the Mini-Circuits 3400-3800 MHz Matched Characterization Test Board (Figure 3). All data taken at nominal condition of $V_{DD} = +5\text{ V}$ and at $V_{SHUTDOWN} = 0\text{ V}$.

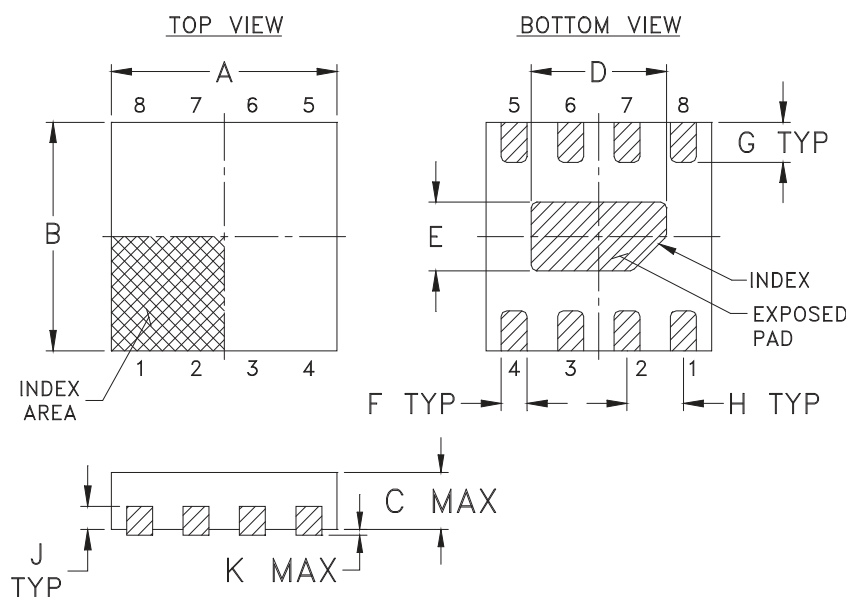


Typical Performance Curves

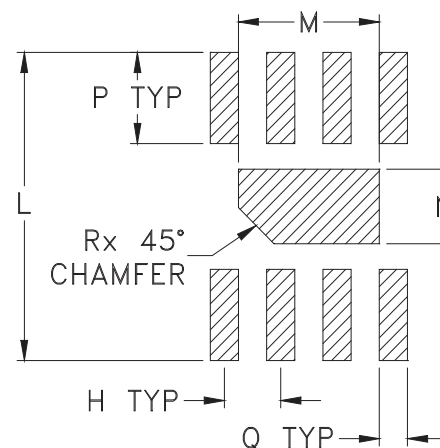
Note: The following data was taken on the Mini-Circuits 3400-3800 MHz Matched Characterization Test Board (Figure 3). All data taken at nominal condition of $V_{DD} = +5$ V and at $V_{SHUTDOWN} = 0$ V.



Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within $\pm.002$

SE #.	A	B	C	D	E	F	G	H	J	K	L	M	N	P
MC1631-1	.079 (2.00)	.079 (2.00)	.039 (1.00)	.047 (1.20)	.024 (.60)	.009 (.23)	.014 (.35)	.020 (.50)	.008 (.20)	.002 (.05)	.106 (2.70)	.049 (1.25)	.026 (.65)	.031 (.80)

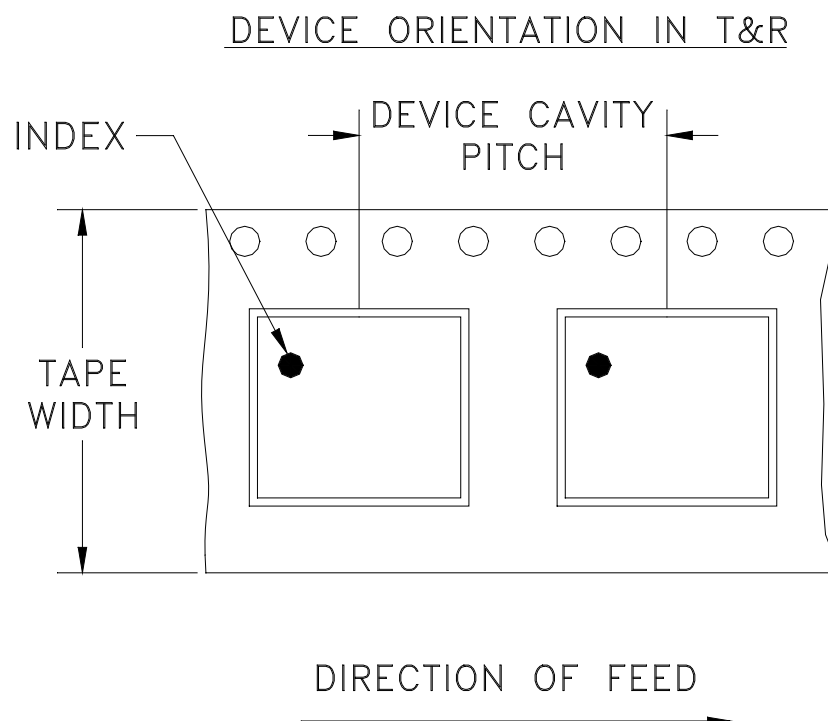
CASE #.	Q	R	WT, GRAM
MC1631-1	.010 (.25)	.012 (.30)	.006

Dimensions are in inches (mm). Tolerances: 2 Pl. $\pm .01$; 3 Pl. $\pm .005$

Notes:

- Case material: Plastic.
- Termination finish:
For RoHS Case Styles: Tin-Silver over Nickel plated or Matte-Tin Plated (See Data sheet).
All models, (+) suffix.
- Lead #1 identifier shall be located in the cross-hatched area shown.
Identifier may be either a molded or marked feature.

Tape & Reel Packaging TR-F66



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note	
8	4	7	Small quantity standard	20
				50
				100
				200
				500
		7	Standard	1000, 2000, 3000

Note: Please consult individual model data sheet to determine device per reel availability.

Mini-Circuits carrier tape materials provide protection from ESD (Electro-Static Discharge) during handling and transportation. Tapes are static dissipative and comply with industry standards EIA-481/EIA-541.

Go to: www.minicircuits.com/pages/pdfs/tape.pdf



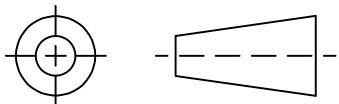
INTERNET <http://www.minicircuits.com>

P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

Distribution Centers NORTH AMERICA 800-654-7949 • 417-335-5935 • Fax 417-335-5945 • EUROPE 44-1252-832600 • Fax 44-1252-837010

Mini-Circuits ISO 9001 & ISO 14001 Certified

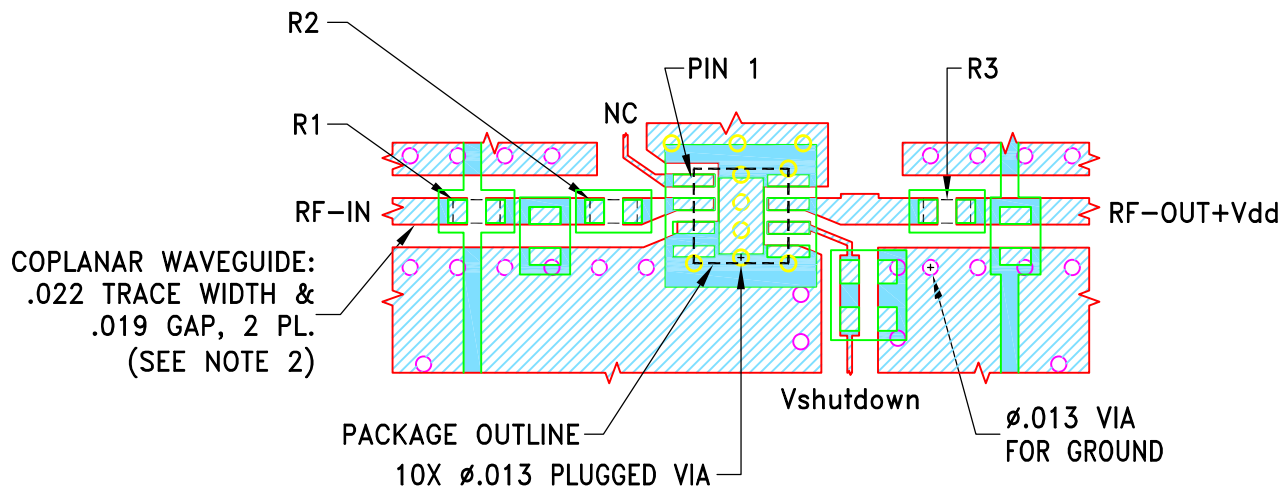
THIRD ANGLE PROJECTION



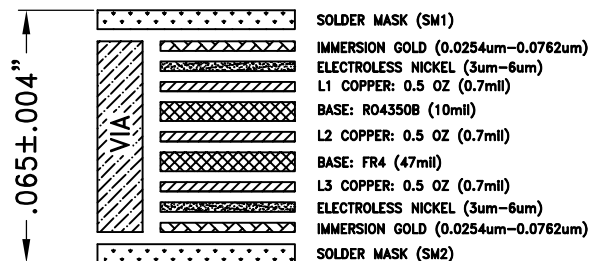
REVISIONS

REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-027827	NEW RELEASE	12/03/25	ITG	IL

SUGGESTED MOUNTING CONFIGURATION FOR MC1631-1 CASE STYLE



3 LAYER STACK-UP DETAIL



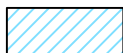
COMPONENT	SIZE
R1-R3	0402

NOTES:

1. PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
2. TRACE WIDTH & GAP ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010".
COPPER: 1/2 OZ. EACH LAYER. FOR OTHER MATERIALS TRACE WIDTH & GAP MAY NEED TO BE MODIFIED.
3. CHIP COMPONENT FOOT PRINTS SHOWN FOR REFERENCE, FOR COMPONENT VALUES REFER TO TB-TSS-63ULNC+.
4. LAYERS 2 & 3 OF PCB ARE CONTINUOUS GROUND PLANE.
5. UNIT LAND PATTERN WAS OPTIMIZED FOR BETTER PERFORMANCE.



DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER).



DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK.

UNLESS OTHERWISE SPECIFIED	INITIALS	DATE
DIMENSIONS ARE IN INCHES	DRAWN	ITG
TOLERANCES ON:	CHECKED	GF
2 PL DECIMALS ±	APPROVED	IL
3 PL DECIMALS ± .005		
ANGLES ±		
FRACTIONS ±		

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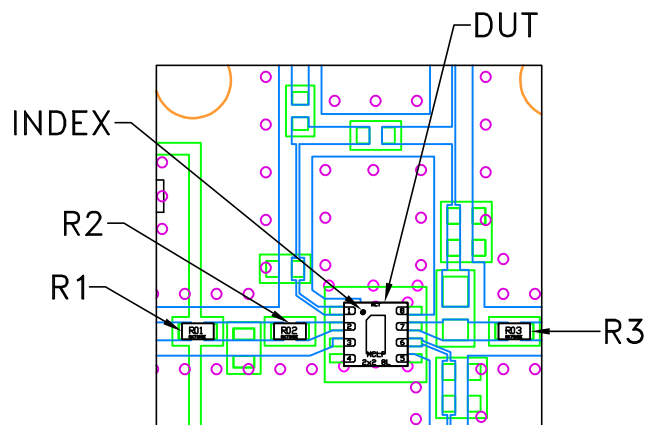
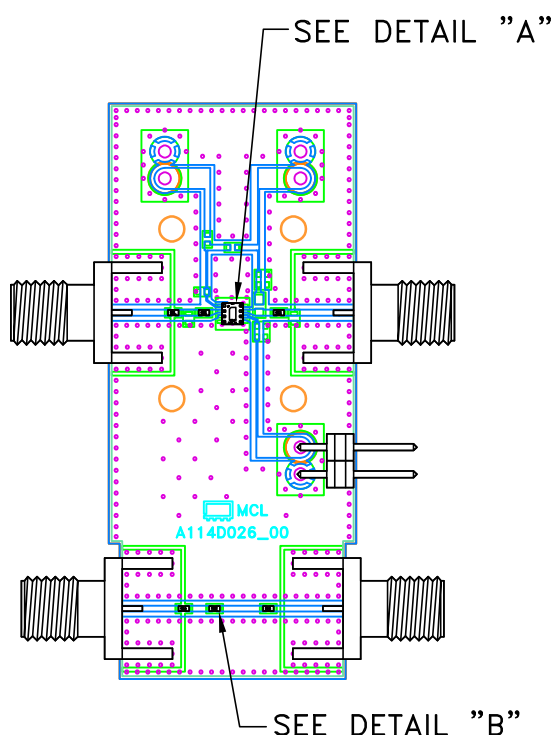
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Brooklyn NY 11235

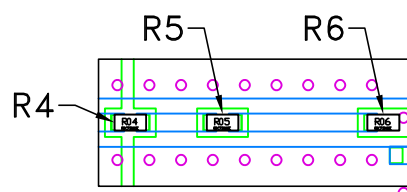
PL, MC1631-1, TB-TSS-63ULNC+

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-849	OR
FILE:	98PL849	SCALE:	6:1
		SHEET:	1 OF 1

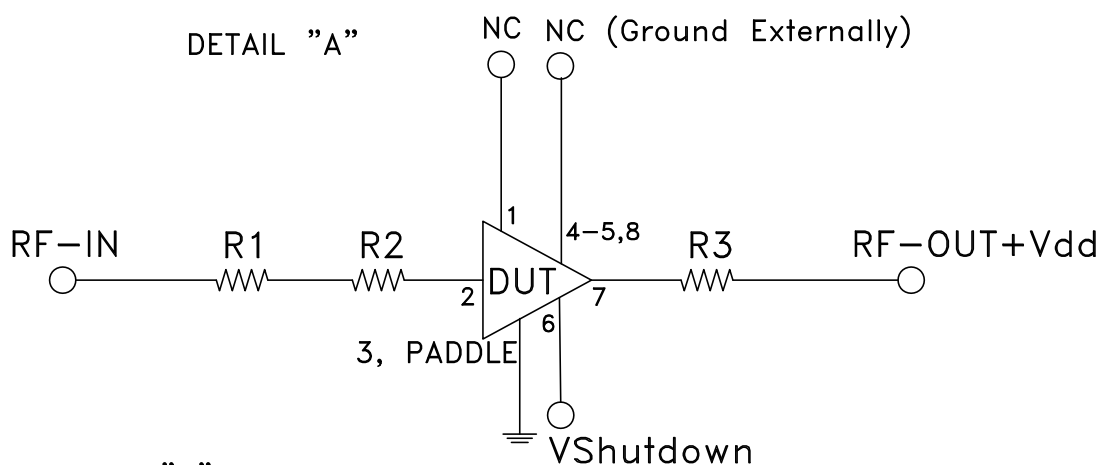
Evaluation Board and Circuit



DETAIL "A"
LOCATION OF COMPONENTS ON THE PCB
(SCALE 3:1)



DETAIL "B"
LOCATION OF COMPONENTS ON THE PCB
(SCALE 3:1)



DETAIL "B"



THRU LINE
SCHEMATIC DIAGRAM

Component	Size	Value	Part Number	Manufacturer
R1,R2,R3,R4,R5,R6	0402	00hm	RK73Z1ETTP	KOA Speer

NOTES:

1. 50 Ohm SMA Female Connectors.
2. PCB Material: Roger RO4350B or equivalent,
Dielectric constant=3.5, Thickness=0.010 inch



Mini-Circuits®



All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

Specification	Test/Inspection Condition	Reference/Spec
Operating Temperature	-40° to 85° C or -45° to 85° C or -55° to 105° C or -40° to 105° C or -40° to 95° C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° C or -65° to 150° Ambient Environment	Individual Model Data Sheet
HTOL	1000 hours at 125°C	MIL-STD-883, Method 1005, Condition B
Thermal Shock	-55° to 100°C, 100 cycles	MIL-STD-202, Method 107, Condition A-3, except +100°C
Mechanical Shock	1.5Kg, 0.5 ms, 5 shock pulses, Y1 direction only	MIL-STD-883, Method 2002, Condition B, except Y1 direction only
Vibration (Variable Frequency)	50g peak	MIL-STD-883, Method 2007, Condition B
Autoclave	15 psig, 100% RH, 121°C, 96 hours	JESD22-A102, Condition C
HAST	130°C, 85% RH, 96 hours	JESD22-A110
Solderability	10X Magnification	J-STD-002, Para 4.2.5, Test S, 95% Coverage
Solder Reflow Heat	Sn-Pb Eutetic Process: 240°C peak Pb-Free Process: 260°C peak	J-STD-020, Table 4-1, 4-2 and 5-2; Figure 5-1
Moisture Sensitivity: Level 1	Bake at 125°C for 24 hours Soak at 85°C/85% RH for 168 hours, Reflow 3 cycles at 260°C peak	J-STD-020



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Specification	Test/Inspection Condition	Reference/Spec
Marking Resistance to Solvents	Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C; distilled water + proylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C	MIL-STD-202, Method 215