MMIC SURFACE MOUNT

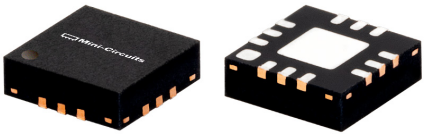
Low Noise Amplifier

TSS-66921LN+

50Ω 660 to 920 MHz Shutdown Feature

THE BIG DEAL

- Ultra-Low Noise Figure, Typ. 1.0 dB
- High P1dB, Typ. +16.3 dBm
- High OIP3, Typ. +25.4 dBm
- High Input Power Handling, Max +24 dBm
- Shutdown Feature
- Single Supply Voltage, +3.3 V
- 3x3 mm, 12-Lead QFN-Style Package

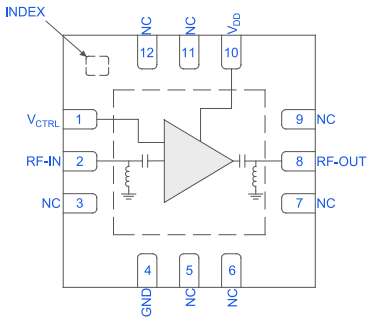


Generic photo used for illustration purposes only

APPLICATIONS

- 5G MIMO Radio Systems
- Radar, EW, and ECM Defense Systems
- ISM

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

The TSS-66921LN+ is a pHEMT-based wideband, ultra-low noise MMIC amplifier with high IP3, flat gain, and voltage-controlled shutdown capability. Operating from 660 to 920 MHz, this amplifier features typical 1.1 dB noise figure, 35.0 dB gain, +16.3 dBm P1dB, and +25.4 dBm OIP3. This combination of characteristics makes it ideal for sensitive receiver applications. The device is internally DC blocked, and a DC path to ground is present at the RF input and output ports for ESD protection. TSS-66921LN+ operates on a single +3.3 V supply and comes in a small, low profile, 3x3 mm QFN-style package for ease of integration into dense circuit board layouts.

KEY FEATURES

Features	Advantages
Ultra-Low Noise Figure, Typ. 1.1 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. 35.0 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.
3x3 mm 12-Lead QFN-Style Package	Small footprint saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB. Industry standard packaging allows for ease of assembly in high volume manufacturing processes.

Low Noise Amplifier TSS-66921LN+

50Ω 660 to 920 MHz Shutdown Feature

ELECTRICAL SPECIFICATIONS[1] AT 25°C, V_{DD} = +3.3 V

Parameter	Condition (MHz)	Amplifier – ON (V_{CTRL} = 0 V) Min.	Typ.	Max.	Amplifier – OFF (V_{CTRL} = +1.5 V) Typ.	Units
Frequency Range		660		920	660 - 920	MHz
Gain	660	33.3	34.9		-45.4	dB
	780	33.4	35.0		-46.4	
	920	33.0	34.6		-40.8	
Input Return Loss	660		15			dB
	780		20			
	920		20			
Output Return Loss	660		18			dB
	780		20			
	920		16			
Isolation	660-920		62		44	dB
Output Power at 1dB Compression (P1dB)	660		+16.0			dBm
	780		+16.3			
	920		+16.0			
Output Third-Order Intercept Point (P_{OUT} = 0 dBm/Tone)	660		+26.1			dBm
	780		+25.4			
	920		+25.2			
Noise Figure	660		1.0			dB
	780		1.1			
	920		1.0			
ON Time (50% V_{CTRL} to 90% RF)			140.0			ns
RISE Time (10% RF to 90% RF)			87.6			ns
FALL Time (90% RF to 10% RF)			17.0			ns
OFF Time (50% V_{CTRL} to 10% RF)			31.6			ns
Device Operating Voltage (V_{DD})		+3	+3.3	+3.5	+3.3	V
Device Operating Current (I_{DD})[2]			58.4	68	0	mA
Device Control Voltage (V_{CTRL})			0		+1.5	V
Device Control Current (I_{CTRL})			3		4	mA
DC Current Variation vs. Temperature[3]			-26.67			µA/°C
DC Current Variation vs. Voltage[4]			12.4			µA/mV

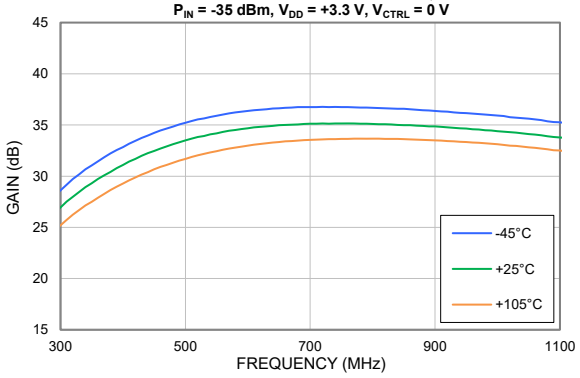
1. Tested on Mini-Circuits Characterization Test Board TB-TSS66921LNC+. See Figure 2. Board loss de-embedded to the device.
2. Current at P_{IN} = -35 dBm.
3. (Current at +105°C - Current at -45°C) / (+150°C)
4. (Current at +3.5 V - Current at +3.0 V) / (+0.5 V)

Low Noise Amplifier TSS-66921LN+

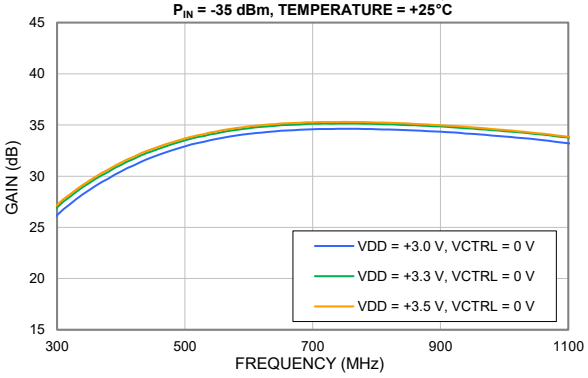
50Ω 660 to 920 MHz Shutdown Feature

TYPICAL PERFORMANCE GRAPHS

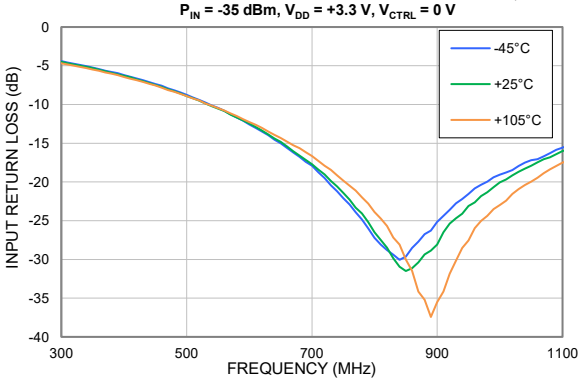
GAIN vs. TEMPERATURE,
P_{IN} = -35 dBm, V_{DD} = +3.3 V, V_{CTRL} = 0 V



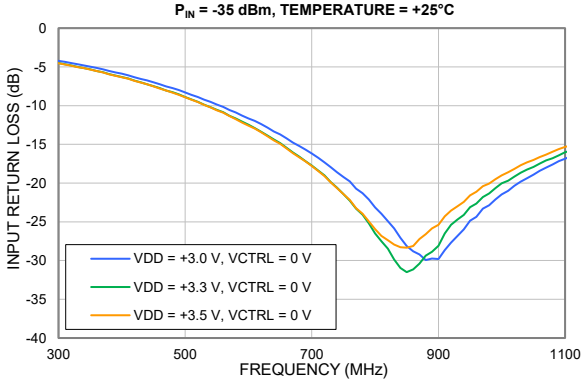
GAIN vs. DEVICE VOLTAGE,
P_{IN} = -35 dBm, TEMPERATURE = +25°C



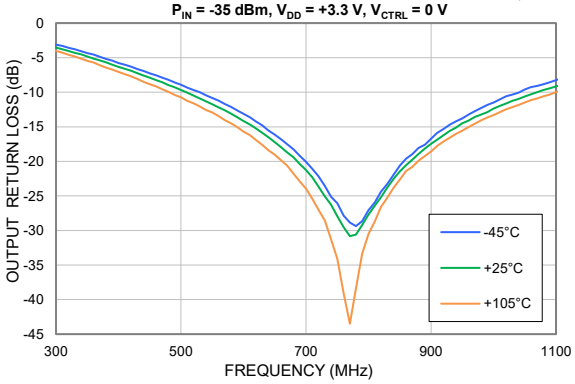
INPUT RETURN LOSS vs.TEMPERATURE,
P_{IN} = -35 dBm, V_{DD} = +3.3 V, V_{CTRL} = 0 V



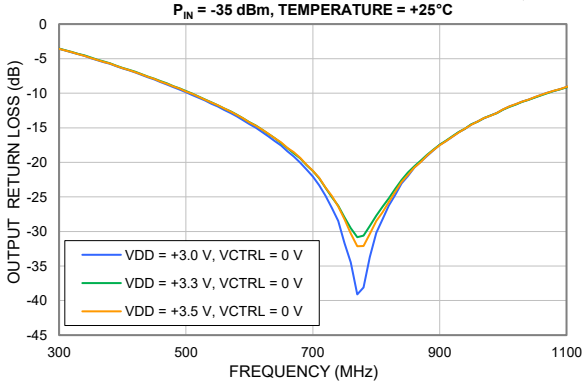
INPUT RETURN LOSS vs. DEVICE VOLTAGE,
P_{IN} = -35 dBm, TEMPERATURE = +25°C



OUTPUT RETURN LOSS vs. TEMPERATURE,
P_{IN} = -35 dBm, V_{DD} = +3.3 V, V_{CTRL} = 0 V

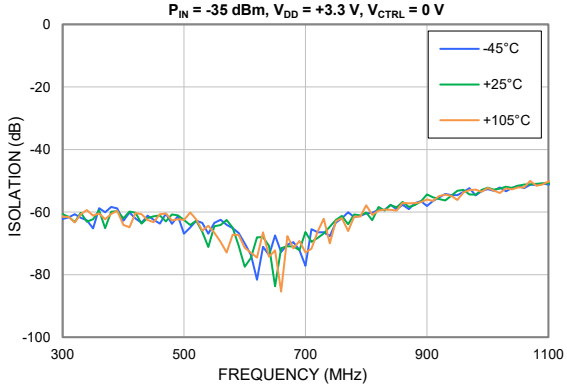


OUTPUT RETURN LOSS vs. DEVICE VOLTAGE,
P_{IN} = -35 dBm, TEMPERATURE = +25°C

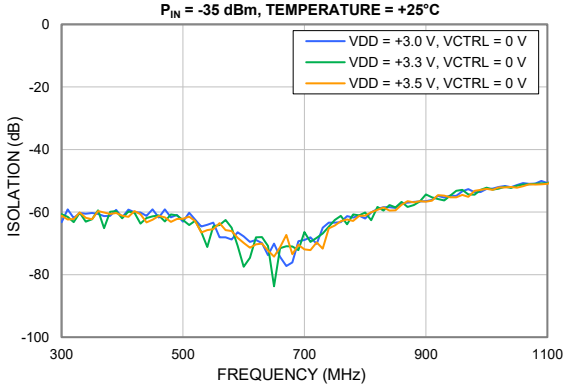


TYPICAL PERFORMANCE GRAPHS

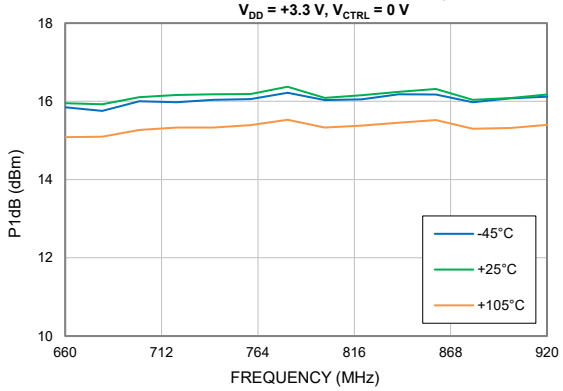
ISOLATION vs.TEMPERATURE,
P_{IN} = -35 dBm, V_{DD} = +3.3 V, V_{CTRL} = 0 V



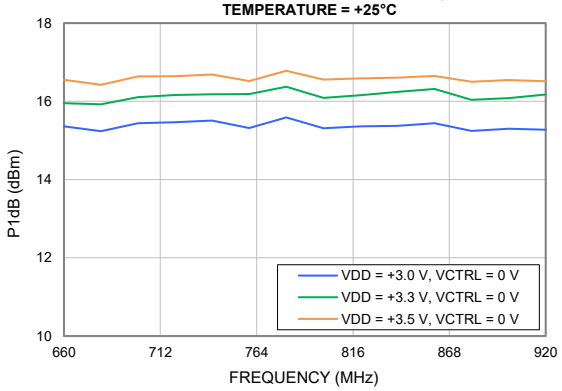
ISOLATION vs. DEVICE VOLTAGE,
P_{IN} = -35 dBm, TEMPERATURE = +25°C



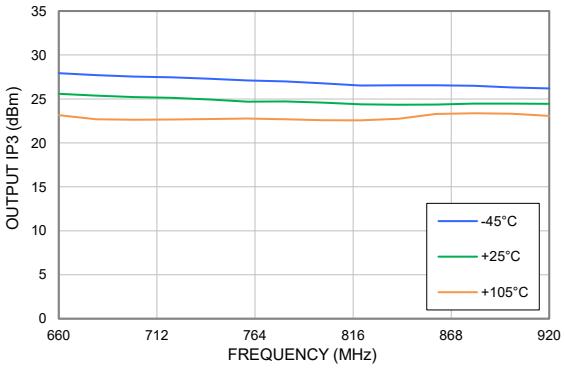
P1dB vs. TEMPERATURE,
V_{DD} = +3.3 V, V_{CTRL} = 0 V



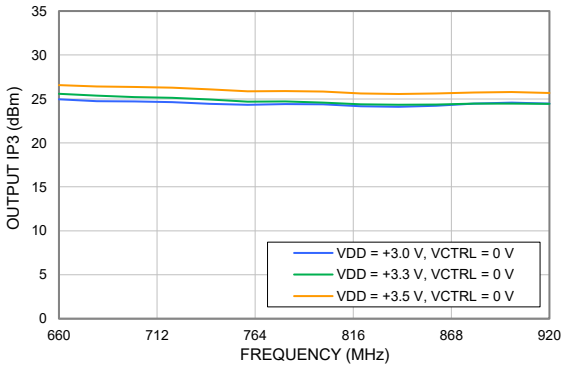
P1dB vs. DEVICE VOLTAGE,
TEMPERATURE = +25°C



OUTPUT IP3 vs. TEMPERATURE,
P_{OUT} = 0 dBm/TONE, V_{DD} = +3.3 V, V_{CTRL} = 0 V



OUTPUT IP3 vs. DEVICE VOLTAGE,
P_{OUT} = 0 dBm/TONE, TEMPERATURE = +25°C

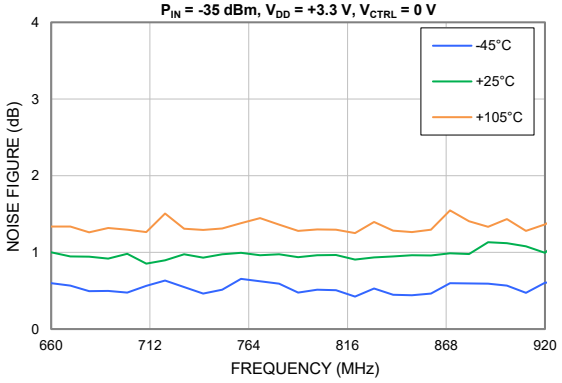


Low Noise Amplifier TSS-66921LN+

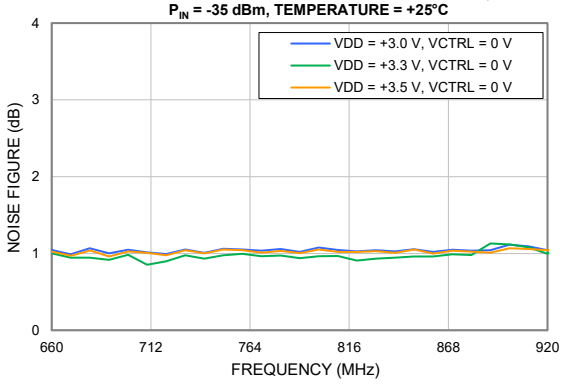
50Ω 660 to 920 MHz Shutdown Feature

TYPICAL PERFORMANCE GRAPHS

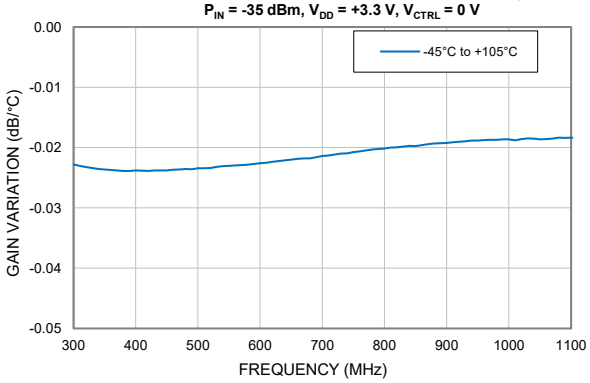
NOISE FIGURE vs. TEMPERATURE,
P_{IN} = -35 dBm, V_{DD} = +3.3 V, V_{CTRL} = 0 V



NOISE FIGURE vs. DEVICE VOLTAGE,
P_{IN} = -35 dBm, TEMPERATURE = +25°C



GAIN VARIATION vs. TEMPERATURE,
P_{IN} = -35 dBm, V_{DD} = +3.3 V, V_{CTRL} = 0 V



ABSOLUTE MAXIMUM RATINGS[5]

Parameter	Ratings
Operating Temperature	-45°C to +105°C
Storage Temperature	-65°C to +150°C
Junction Temperature[6]	+150°C
Total Power Dissipation	0.67 W
Input Power (CW), V_{DD} = +3.3 V V_{CTRL} = 0 V:	 +24 dBm
DC Voltage at V_{DD} V_{CTRL} = 0 V: V_{CTRL} = +1.5 V:	 +5 V +5 V
DC Current I_{DD} V_{CTRL} = 0 V: V_{CTRL} = +1.5 V:	 150 mA 20 mA
DC Voltage at V_{CTRL} V_{DD} = +3.3 V:	 +5 V
DC Current I_{CTRL} V_{DD} = +3.3 V:	 10 mA

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

CONTROL VOLTAGE (V_{CTRL})

Amplifier State	Min.	Typ.	Max.	Units
Amplifier – ON	0	0	+0.2	V
Amplifier – OFF	+1	+1.5	+5	V

THERMAL RESISTANCE

Parameter	Ratings
Thermal Resistance (Θ_{JC})[7]	67.4°C/W

7. 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

Low Noise Amplifier TSS-66921LN+

50Ω 660 to 920 MHz Shutdown Feature

FUNCTIONAL DIAGRAM

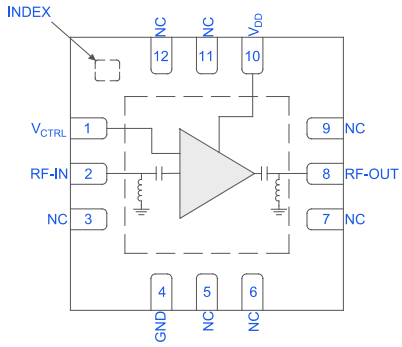


Figure 1. TSS-66921LN+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Application Description (Refer to Figure 2)
V_{CTRL}	1	DC Input Pad connects to control voltage port V_{CTRL}.
RF-IN	2	RF-IN Pad connects to RF Input port.
RF-OUT	8	RF-OUT Pad connects to RF Output port.
V_{DD}	10	DC Input Pad connects to voltage input port V_{DD}.
NC	3,5-7,9,11	Not used internally. Connected to ground on test board.
NC[8]	12	Do not connect to ground on PCB. Pad is used internally.
GND	4, Paddle, Index	Connects to ground.

8. Pin 12 is used internally to the DUT. Connecting Pin 12 externally can cause permanent damage to the DUT.

CHARACTERIZATION TEST BOARD

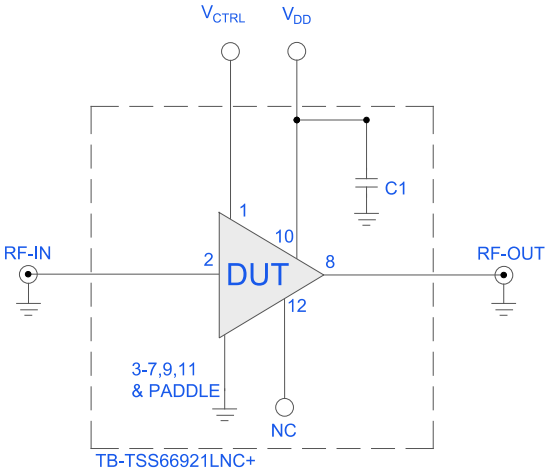


Figure 2. TSS-66921LN+ Characterization and Application Circuit.

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

Conditions:
1) Gain and Return Loss: P_{IN} = -35 dBm
2) Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 0 dBm/Tone at output.
3) V_{DD} = +3.3 V

Component	Value	Size	Part Number	Manufacturer
C1	1 µF	0402	GRM155C81E105KE11D	Murata

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

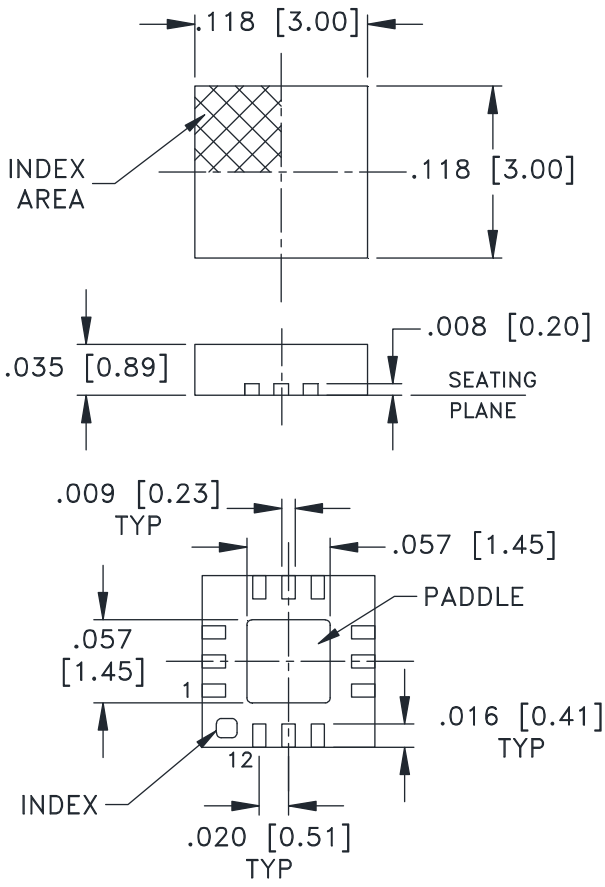
POWER ON:
1) Set V_{DD} to +3.3 V
2) Turn on V_{DD}
3) Set V_{CTRL} to 0 V
4) Turn on V_{CTRL}
5) Apply RF Signal.

POWER OFF:
1) Turn off RF Signal.
2) Turn off V_{CTRL}
3) Turn off V_{DD}

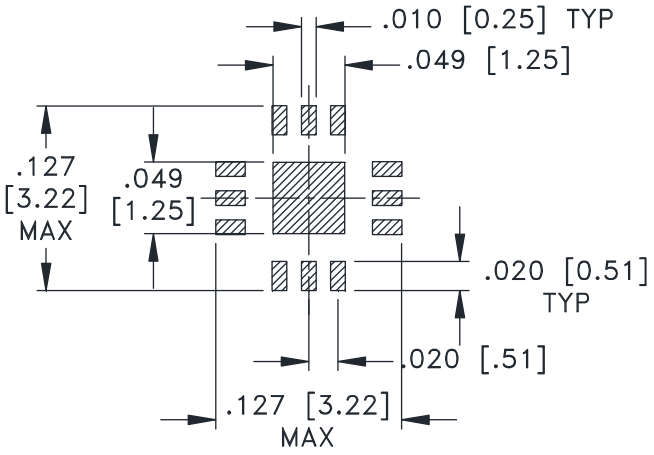
Low Noise Amplifier TSS-66921LN+

50Ω 660 to 920 MHz Shutdown Feature

CASE STYLE DRAWING



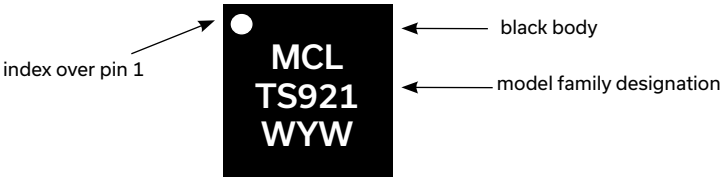
PCB Land Pattern



SUGGESTED LAYOUT,
TOLERANCE TO BE WITHIN ±.002

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

PRODUCT MARKING



Marking may contain other features or characters for internal lot control

Low Noise Amplifier TSS-66921LN+

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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	DQ1225 Plastic package, exposed paddle, Lead Finish: Matte-Tin
RoHS Status	Compliant
Tape & Reel **Standard quantities available on reel**	F66 7" reels with 20, 50, 100, 200, 500, 1K, 2K, or 3K devices
Suggested Layout for PCB Design	PL-807
Evaluation Board	TB-TSS66921LNC+ Gerber File
Environmental Ratings	ENV08T1

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

Typical Performance Data

Definitions:
Input Return Loss = -S11 (dB)
Gain(Power Gain) = S21 (dB)
Reverse Isolation = -S12 (dB)
Output Return Loss = -S22 (dB)

TEST CONDITIONS: V_{DD} = +3.3 V, I_{DD} = 65 mA, V_{CTRL} = +0 V @ Temperature = -45°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Noise Figure	Stability		FREQ	IP-3 Output			1dB Comp. Output
									P_{OUT} = 0 dBm/Tone	P_{OUT} = +3 dBm/Tone	P_{OUT} = +6 dBm/Tone	
(MHz)	(dB)	(dB)	(dB)	(dB)	(dB)	K	Measure	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)
400	32.84	62.73	6.21	5.77	0.73	8.69	0.92	660	27.93	24.29	22.41	15.85
410	33.17	60.17	6.42	6.02	0.52	6.44	0.93	680	27.70	23.89	22.01	15.76
420	33.46	62.09	6.63	6.29	0.61	8.02	0.94	700	27.54	23.58	21.66	16.00
430	33.72	63.47	6.87	6.63	0.69	9.54	0.95	720	27.47	23.43	21.45	15.98
440	33.97	61.13	7.10	6.94	0.65	7.31	0.96	740	27.31	23.41	21.25	16.04
450	34.23	62.42	7.36	7.27	0.63	8.54	0.97	760	27.11	23.34	21.10	16.06
460	34.45	63.66	7.57	7.54	0.61	9.77	0.97	780	26.98	23.23	21.06	16.22
470	34.64	60.52	7.91	7.91	0.60	6.89	0.98	800	26.79	22.95	20.89	16.03
480	34.84	63.78	8.17	8.22	0.63	10.08	0.98	820	26.54	22.66	20.60	16.05
490	35.05	61.31	8.43	8.59	0.71	7.55	0.99	840	26.55	22.79	20.60	16.18
500	35.20	66.92	8.77	8.90	0.60	15.06	0.99	860	26.56	23.14	20.72	16.17
510	35.39	64.95	9.10	9.34	0.57	11.70	0.99	880	26.50	23.34	20.84	15.98
520	35.55	62.78	9.40	9.67	0.71	9.15	0.99	900	26.30	23.32	21.04	16.08
530	35.65	63.43	9.76	10.01	0.58	9.91	1.00	920	26.20	23.17	21.03	16.12
540	35.79	66.89	10.13	10.45	0.64	16.37	1.00					
550	35.90	63.45	10.45	10.84	0.55	10.50	1.00					
560	36.02	62.44	10.81	11.23	0.55	8.87	1.01					
570	36.14	64.09	11.28	11.69	0.54	11.67	1.00					
580	36.23	65.17	11.67	12.13	0.57	12.38	1.00					
590	36.30	66.71	12.09	12.64	0.48	15.27	1.01					
600	36.38	69.97	12.59	13.14	0.57	32.73	1.01					
610	36.44	73.66	13.03	13.61	0.59	33.42	1.00					
620	36.49	81.61	13.48	14.26	0.51	83.55	1.01					
630	36.54	71.08	13.97	14.82	0.54	28.77	1.00					
640	36.60	73.81	14.53	15.55	0.55	34.65	1.01					
650	36.64	67.47	15.02	16.13	0.52	16.81	1.01					
660	36.67	72.79	15.60	16.81	0.60	35.64	1.01					
670	36.70	70.40	16.19	17.54	0.57	32.56	1.01					
680	36.74	69.63	16.75	18.27	0.49	25.97	1.00					
690	36.75	72.18	17.39	19.19	0.50	31.69	1.01					
700	36.75	77.16	17.91	20.09	0.48	56.33	1.01					
710	36.76	65.47	18.74	21.08	0.56	14.24	1.00					
720	36.76	66.43	19.50	22.16	0.63	15.23	1.00					
730	36.76	66.47	20.42	23.56	0.55	17.19	1.00					
740	36.76	67.66	21.21	25.13	0.46	18.41	1.00					
750	36.75	63.35	22.09	26.09	0.51	10.95	1.00					
760	36.74	62.00	22.92	27.85	0.65	9.21	1.00					
770	36.72	60.05	23.90	28.86	0.62	7.37	1.00					
780	36.70	61.62	24.84	29.37	0.59	8.85	1.00					
790	36.69	61.20	26.00	28.66	0.48	8.47	1.00					
800	36.67	60.44	27.22	27.08	0.51	7.77	1.00					
810	36.65	60.21	28.07	25.95	0.51	7.58	0.99					
820	36.64	59.25	28.79	24.38	0.42	6.82	0.99					
830	36.61	59.32	29.39	23.28	0.53	6.88	0.99					
840	36.59	57.69	30.06	21.96	0.45	5.76	0.99					
850	36.57	59.10	29.64	20.63	0.44	6.74	0.99					
860	36.53	57.70	28.53	19.63	0.46	5.76	0.98					
870	36.48	59.02	27.70	18.95	0.60	6.78	0.98					
880	36.45	57.14	26.75	18.04	0.59	5.41	0.98					
890	36.42	56.53	26.29	17.59	0.59	5.04	0.98					
900	36.38	58.05	25.15	16.73	0.57	6.03	0.97					
910	36.33	56.46	24.39	15.87	0.47	5.01	0.97					
920	36.29	55.39	23.59	15.33	0.61	4.46	0.96					
930	36.24	54.23	22.76	14.70	0.62	3.90	0.96					
940	36.19	54.58	22.19	14.23	0.71	4.07	0.95					
950	36.15	54.57	21.53	13.79	0.67	4.08	0.95					
960	36.11	53.59	20.84	13.25	0.62	3.65	0.94					
970	36.06	52.39	20.37	12.76	0.48	3.17	0.93					
980	36.02	54.65	19.96	12.30	0.52	4.06	0.94					
990	35.96	53.25	19.39	11.86	0.51	3.47	0.93					
1000	35.92	52.65	19.05	11.48	0.50	3.24	0.92					

Typical Performance Data

Definitions:
Input Return Loss = -S11 (dB)
Gain(Power Gain) = S21 (dB)
Reverse Isolation = -S12 (dB)
Output Return Loss = -S22 (dB)

TEST CONDITIONS: V_{DD} = +3.3 V, I_{DD} = 62 mA, V_{CTRL} = +0 V @ Temperature = +25°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Noise Figure	Stability		FREQ	IP-3 Output			1dB Comp. Output
									P_{OUT} = 0 dBm/Tone	P_{OUT} = +3 dBm/Tone	P_{OUT} = +6 dBm/Tone	
(MHz)	(dB)	(dB)	(dB)	(dB)	(dB)	K	Measure	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)
400	31.10	61.99	6.30	6.32	1.08	10.70	0.96	660	25.59	20.48	20.10	15.95
410	31.42	59.84	6.49	6.60	1.08	7.87	0.97	680	25.37	20.30	19.75	15.93
420	31.69	60.22	6.77	6.89	1.04	8.39	0.97	700	25.21	20.16	19.57	16.11
430	31.99	63.68	6.98	7.23	1.08	14.59	0.98	720	25.13	20.10	19.44	16.16
440	32.24	61.94	7.23	7.58	1.04	10.27	0.99	740	24.94	19.93	19.21	16.18
450	32.47	61.35	7.48	7.91	1.00	9.75	1.00	760	24.70	19.74	19.08	16.19
460	32.70	61.06	7.73	8.26	1.07	9.42	1.00	780	24.72	19.79	19.09	16.37
470	32.92	63.03	8.03	8.57	1.00	12.10	1.00	800	24.58	19.82	18.99	16.09
480	33.11	60.73	8.28	8.97	1.01	8.98	1.00	820	24.39	19.61	18.87	16.16
490	33.31	61.09	8.55	9.31	1.08	9.28	1.01	840	24.34	19.57	18.80	16.25
500	33.49	62.56	8.90	9.68	1.01	11.15	1.01	860	24.35	19.67	18.81	16.32
510	33.66	64.13	9.19	10.08	1.02	13.33	1.01	880	24.46	19.82	18.84	16.04
520	33.82	62.74	9.51	10.48	1.00	11.31	1.02	900	24.48	19.89	18.92	16.08
530	33.92	66.29	9.87	10.91	1.01	17.21	1.02	920	24.44	19.87	18.98	16.18
540	34.09	71.17	10.20	11.31	0.99	32.98	1.01					
550	34.19	64.55	10.53	11.73	0.99	15.27	1.01					
560	34.33	64.13	10.85	12.18	0.96	13.50	1.02					
570	34.43	62.50	11.31	12.60	0.96	11.28	1.01					
580	34.52	64.96	11.67	13.11	1.00	14.95	1.02					
590	34.60	70.77	12.05	13.63	0.93	29.00	1.02					
600	34.68	77.46	12.47	14.19	0.97	89.84	1.02					
610	34.76	74.59	12.89	14.68	0.98	49.17	1.02					
620	34.80	68.11	13.36	15.27	0.94	21.75	1.02					
630	34.87	67.98	13.86	15.87	0.99	21.27	1.01					
640	34.91	70.82	14.38	16.51	0.93	29.71	1.01					
650	34.97	83.75	14.83	17.21	0.98	150.87	1.01					
660	35.00	71.52	15.42	17.95	1.00	38.40	1.01					
670	35.03	70.93	16.04	18.72	0.95	38.73	1.01					
680	35.06	71.00	16.59	19.41	0.94	46.46	1.01					
690	35.10	72.18	17.15	20.37	0.92	41.78	1.01					
700	35.12	66.36	17.73	21.27	0.98	18.53	1.01					
710	35.13	69.50	18.39	22.31	0.85	28.75	1.01					
720	35.14	68.21	19.01	23.67	0.90	22.33	1.01					
730	35.13	66.82	19.87	25.06	0.98	21.43	1.01					
740	35.14	64.69	20.59	26.27	0.93	15.73	1.00					
750	35.15	62.53	21.42	27.94	0.98	11.81	1.00					
760	35.15	61.19	22.28	29.52	0.99	10.05	1.00					
770	35.14	63.88	23.31	30.83	0.96	13.77	1.00					
780	35.13	60.76	24.07	30.60	0.97	9.62	1.00					
790	35.11	61.10	25.20	29.22	0.94	10.13	1.00					
800	35.09	60.14	26.50	27.71	0.96	9.15	1.00					
810	35.08	62.63	27.50	26.42	0.97	11.99	1.00					
820	35.07	58.40	28.47	25.20	0.91	7.46	0.99					
830	35.04	59.56	29.86	23.82	0.93	8.47	0.99					
840	35.01	57.77	30.94	22.56	0.95	6.94	0.99					
850	34.99	58.55	31.50	21.48	0.96	7.57	0.99					
860	34.97	56.73	31.14	20.55	0.96	6.16	0.99					
870	34.94	58.33	30.38	19.75	0.99	7.43	0.99					
880	34.91	57.76	29.36	18.91	0.98	6.94	0.98					
890	34.87	56.57	28.86	18.16	1.13	6.17	0.98					
900	34.86	54.39	28.08	17.45	1.12	4.75	0.97					
910	34.81	55.28	26.50	16.87	1.08	5.24	0.97					
920	34.77	55.83	25.38	16.25	1.00	5.60	0.97					
930	34.73	56.27	24.69	15.63	1.22	5.88	0.97					
940	34.68	54.76	24.10	15.14	1.47	4.96	0.96					
950	34.65	53.24	23.11	14.51	1.36	4.18	0.96					
960	34.59	52.93	22.64	14.13	1.08	4.06	0.95					
970	34.55	54.37	21.81	13.59	0.99	4.78	0.95					
980	34.49	54.40	21.33	13.24	1.01	4.81	0.95					
990	34.45	52.93	20.66	12.89	1.00	4.04	0.94					
1000	34.39	52.20	20.04	12.36	0.99	3.72	0.94					

Typical Performance Data

Definitions:
Input Return Loss = -S11 (dB)
Gain(Power Gain) = S21 (dB)
Reverse Isolation = -S12 (dB)
Output Return Loss = -S22 (dB)

TEST CONDITIONS: V_{DD} = +3.3 V, I_{DD} = 61 mA, V_{CTRL} = +0 V @ Temperature = +105°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Noise Figure	Stability		FREQ	IP-3 Output			1dB Comp. Output
									P_{OUT} = 0 dBm/Tone	P_{OUT} = +3 dBm/Tone	P_{OUT} = +6 dBm/Tone	
(MHz)	(dB)	(dB)	(dB)	(dB)	(dB)	K	Measure	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)
400	29.28	64.13	6.44	7.07	1.56	20.98	0.99	660	23.15	19.22	20.52	15.09
410	29.59	64.84	6.67	7.38	1.39	19.54	1.00	680	22.68	18.92	20.12	15.09
420	29.88	60.32	6.87	7.68	1.41	10.90	1.01	700	22.63	18.78	19.88	15.27
430	30.15	60.70	7.08	8.09	1.49	11.43	1.02	720	22.66	18.78	19.70	15.33
440	30.40	62.49	7.34	8.49	1.44	14.21	1.02	740	22.72	18.79	19.56	15.33
450	30.66	63.26	7.56	8.84	1.38	18.58	1.02	760	22.78	18.73	19.38	15.39
460	30.90	60.69	7.81	9.15	1.42	11.31	1.03	780	22.70	18.65	19.41	15.53
470	31.10	60.45	8.13	9.56	1.37	11.09	1.03	800	22.58	18.72	19.26	15.33
480	31.31	62.69	8.36	9.97	1.40	14.53	1.03	820	22.57	18.54	19.07	15.38
490	31.51	62.30	8.62	10.40	1.48	13.95	1.04	840	22.74	18.67	19.02	15.46
500	31.69	62.49	8.91	10.74	1.35	13.97	1.04	860	23.28	18.96	19.00	15.52
510	31.88	60.15	9.21	11.26	1.34	10.62	1.04	880	23.37	19.01	18.97	15.30
520	32.04	62.34	9.48	11.59	1.45	13.70	1.04	900	23.33	19.05	19.16	15.32
530	32.17	65.91	9.89	12.04	1.37	21.34	1.03	920	23.07	18.83	19.23	15.40
540	32.32	64.34	10.15	12.56	1.34	17.25	1.04					
550	32.45	66.62	10.47	12.94	1.38	22.18	1.04					
560	32.58	69.57	10.77	13.46	1.30	36.29	1.04					
570	32.70	72.90	11.15	14.04	1.34	51.49	1.03					
580	32.80	67.20	11.49	14.48	1.35	23.74	1.03					
590	32.89	67.27	11.90	15.05	1.27	23.86	1.03					
600	32.99	71.35	12.26	15.70	1.32	50.07	1.03					
610	33.06	73.04	12.62	16.21	1.34	46.32	1.03					
620	33.14	74.57	13.03	16.93	1.26	57.25	1.03					
630	33.21	66.44	13.48	17.64	1.31	21.68	1.03					
640	33.28	74.21	13.91	18.39	1.32	58.17	1.03					
650	33.34	72.25	14.34	19.02	1.29	43.20	1.02					
660	33.39	85.40	14.80	19.82	1.34	214.26	1.02					
670	33.43	67.73	15.25	20.62	1.34	27.59	1.02					
680	33.47	71.63	15.65	21.80	1.26	40.81	1.02					
690	33.51	69.20	16.17	22.88	1.32	29.93	1.02					
700	33.54	72.94	16.67	23.95	1.29	51.33	1.02					
710	33.56	71.68	17.30	25.40	1.27	44.10	1.02					
720	33.59	66.12	17.89	27.00	1.51	21.01	1.01					
730	33.61	62.15	18.44	28.53	1.31	13.28	1.01					
740	33.62	69.98	19.14	31.29	1.29	32.72	1.01					
750	33.64	62.92	19.84	34.13	1.31	15.39	1.01					
760	33.65	61.91	20.48	39.07	1.38	13.00	1.01					
770	33.65	66.05	21.10	43.50	1.45	21.84	1.01					
780	33.65	61.44	22.00	38.43	1.36	12.32	1.00					
790	33.66	61.43	22.78	33.37	1.28	12.67	1.00					
800	33.65	57.84	23.87	30.53	1.30	8.20	1.00					
810	33.65	60.91	24.72	28.74	1.30	11.59	1.00					
820	33.64	59.53	25.69	26.59	1.25	10.17	1.00					
830	33.64	59.20	27.17	25.25	1.40	9.85	1.00					
840	33.63	59.32	28.09	23.84	1.28	9.69	0.99					
850	33.61	59.52	30.00	22.64	1.27	10.50	0.99					
860	33.59	57.09	31.47	21.41	1.30	7.63	0.99					
870	33.57	57.23	34.16	20.79	1.55	7.67	0.99					
880	33.55	57.14	35.21	19.91	1.41	7.64	0.99					
890	33.52	56.84	37.43	19.25	1.33	7.33	0.98					
900	33.50	56.00	35.52	18.58	1.44	6.72	0.98					
910	33.47	56.47	34.14	17.76	1.28	7.05	0.98					
920	33.43	54.90	31.86	17.14	1.36	5.90	0.97					
930	33.40	54.43	30.15	16.58	1.49	5.61	0.97					
940	33.37	54.78	28.50	16.04	1.64	5.83	0.97					
950	33.32	56.16	27.56	15.57	1.55	6.81	0.97					
960	33.30	53.73	25.96	15.05	1.43	5.18	0.96					
970	33.26	52.98	25.05	14.55	1.32	4.76	0.96					
980	33.21	52.82	24.38	14.09	1.34	4.68	0.95					
990	33.17	53.50	23.51	13.64	1.34	5.08	0.95					
1000	33.13	52.30	22.98	13.32	1.34	4.41	0.95					

Typical Performance Data

Definitions:
Input Return Loss = -S11 (dB)
Gain(Power Gain) = S21 (dB)
Reverse Isolation = -S12 (dB)
Output Return Loss = -S22 (dB)

TEST CONDITIONS: V_{DD} = +3.3 V, I_{DD} = 50 mA, V_{CTRL} = +0 V @ Temperature = +25°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Noise Figure	Stability		FREQ	IP-3 Output			1dB Comp. Output
									P_{OUT} = 0 dBm/Tone	P_{OUT} = +3 dBm/Tone	P_{OUT} = +6 dBm/Tone	
(MHz)	(dB)	(dB)	(dB)	(dB)	(dB)	K	Measure	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)
400	30.46	61.67	5.88	6.40	1.01	10.96	0.98	660	24.96	19.58	20.33	15.36
410	30.78	59.21	6.08	6.68	1.19	8.27	0.99	680	24.73	19.38	19.93	15.24
420	31.05	60.06	6.33	7.00	1.10	8.66	0.99	700	24.72	19.30	19.60	15.44
430	31.36	60.13	6.55	7.34	1.10	8.77	1.00	720	24.63	19.26	19.43	15.47
440	31.63	61.24	6.74	7.70	1.05	10.76	1.01	740	24.44	19.08	19.22	15.51
450	31.87	59.13	7.00	8.02	1.03	7.83	1.02	760	24.34	18.97	19.10	15.32
460	32.10	61.79	7.23	8.39	1.14	10.66	1.02	780	24.42	19.08	19.11	15.59
470	32.32	59.11	7.51	8.72	1.03	7.99	1.02	800	24.40	19.07	19.05	15.31
480	32.53	61.65	7.75	9.11	1.02	11.03	1.03	820	24.16	18.90	18.96	15.36
490	32.72	60.92	7.98	9.45	1.09	9.69	1.03	840	24.10	18.90	18.88	15.38
500	32.90	63.10	8.29	9.84	1.07	13.32	1.03	860	24.23	19.01	18.89	15.44
510	33.09	60.25	8.60	10.26	1.10	8.98	1.03	880	24.46	19.17	18.89	15.25
520	33.25	62.43	8.89	10.65	0.96	12.25	1.03	900	24.58	19.30	18.99	15.30
530	33.36	64.60	9.23	11.05	1.08	17.20	1.03	920	24.48	19.29	19.13	15.27
540	33.52	64.07	9.53	11.53	1.02	14.56	1.03					
550	33.63	63.38	9.84	11.91	1.01	13.16	1.03					
560	33.76	68.11	10.15	12.40	1.04	25.00	1.03					
570	33.87	68.04	10.56	12.85	0.98	27.18	1.03					
580	33.96	68.77	10.89	13.35	1.06	26.84	1.03					
590	34.05	66.45	11.27	13.91	0.98	19.53	1.03					
600	34.14	67.80	11.64	14.45	1.02	25.66	1.03					
610	34.21	69.52	11.96	14.99	1.05	31.57	1.03					
620	34.26	68.90	12.36	15.61	1.02	30.74	1.03					
630	34.32	69.91	12.84	16.22	1.07	30.19	1.03					
640	34.36	73.80	13.33	16.92	0.97	53.57	1.03					
650	34.43	70.07	13.70	17.57	1.06	30.74	1.02					
660	34.46	74.31	14.22	18.39	1.05	53.12	1.02					
670	34.50	77.23	14.77	19.17	0.99	102.51	1.02					
680	34.53	76.09	15.22	20.02	1.07	234.25	1.02					
690	34.56	69.32	15.67	21.02	1.00	32.11	1.02					
700	34.58	68.92	16.18	22.05	1.05	29.17	1.02					
710	34.60	68.10	16.73	23.33	1.01	25.44	1.02					
720	34.61	70.16	17.31	24.81	0.99	33.54	1.01					
730	34.61	65.00	17.95	26.63	1.05	16.69	1.01					
740	34.62	63.39	18.60	28.47	1.01	13.94	1.01					
750	34.62	63.36	19.23	31.68	1.06	13.67	1.01					
760	34.62	63.22	19.80	34.48	1.05	15.12	1.01					
770	34.62	61.26	20.71	39.10	1.04	11.05	1.01					
780	34.62	61.75	21.31	38.11	1.06	11.83	1.01					
790	34.60	61.15	22.10	33.70	1.02	10.90	1.00					
800	34.58	62.08	23.16	30.18	1.08	12.34	1.00					
810	34.56	60.11	23.95	28.23	1.05	9.56	1.00					
820	34.55	59.02	24.91	26.24	1.03	8.52	1.00					
830	34.53	58.42	25.84	24.68	1.04	8.04	1.00					
840	34.51	58.41	27.07	23.04	1.03	7.90	0.99					
850	34.48	58.68	28.13	21.99	1.06	8.31	0.99					
860	34.45	57.18	28.79	20.75	1.02	6.98	0.99					
870	34.43	57.02	29.20	19.92	1.05	7.00	0.99					
880	34.40	56.74	29.94	19.09	1.04	6.56	0.98					
890	34.36	56.61	29.72	18.25	1.04	6.46	0.98					
900	34.34	56.51	29.80	17.47	1.12	6.62	0.98					
910	34.30	56.13	28.66	16.94	1.09	6.14	0.98					
920	34.26	54.85	27.69	16.30	1.04	5.41	0.97					
930	34.22	55.36	26.82	15.64	1.09	5.68	0.97					
940	34.17	54.78	25.96	15.17	1.12	5.30	0.96					
950	34.13	54.79	24.85	14.55	1.16	5.35	0.96					
960	34.08	53.33	24.35	14.07	1.07	4.49	0.95					
970	34.04	52.66	23.28	13.62	1.08	4.17	0.95					
980	33.98	53.70	22.88	13.23	1.07	4.67	0.95					
990	33.93	53.62	22.13	12.84	1.07	4.67	0.94					
1000	33.87	52.61	21.47	12.37	1.07	4.16	0.94					

Typical Performance Data

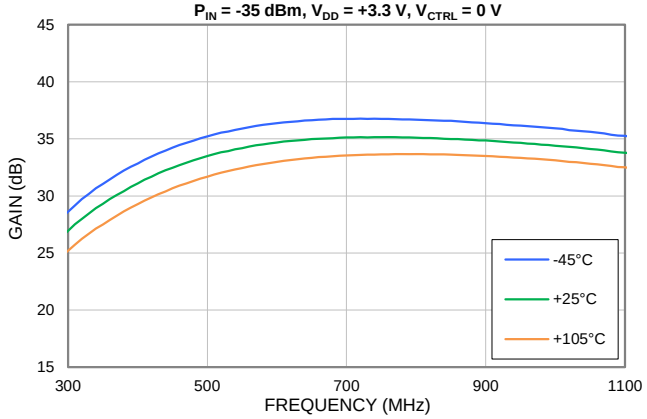
Definitions:
Input Return Loss = -S11 (dB)
Gain(Power Gain) = S21 (dB)
Reverse Isolation = -S12 (dB)
Output Return Loss = -S22 (dB)

TEST CONDITIONS: V_{DD} = +3.3 V, I_{DD} = 65 mA, V_{CTRL} = +0 V @ Temperature = +25°C

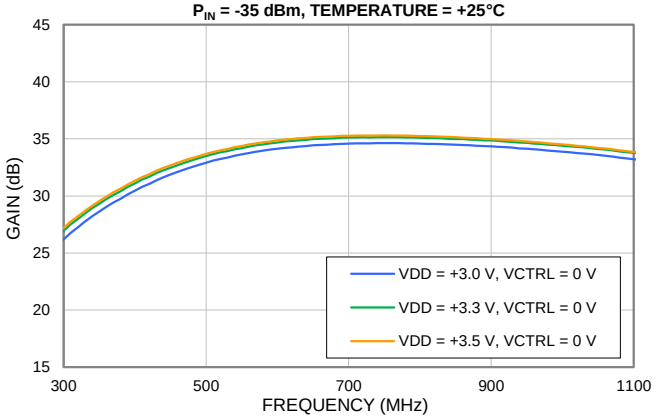
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Noise Figure	Stability		FREQ	IP-3 Output			1dB Comp. Output
									P_{OUT} = 0 dBm/Tone	P_{OUT} = +3 dBm/Tone	P_{OUT} = +6 dBm/Tone	
(MHz)	(dB)	(dB)	(dB)	(dB)	(dB)	K	Measure	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)
400	31.32	61.16	6.33	6.36	0.98	9.86	0.96	660	26.57	21.22	20.08	16.55
410	31.64	61.52	6.54	6.65	1.16	10.23	0.97	680	26.43	21.05	19.82	16.42
420	31.91	59.68	6.81	6.96	1.07	7.93	0.98	700	26.36	20.92	19.66	16.63
430	32.20	60.65	7.02	7.27	1.07	8.78	0.98	720	26.28	20.86	19.57	16.64
440	32.46	63.28	7.24	7.63	1.02	11.95	0.99	740	26.09	20.70	19.38	16.69
450	32.68	62.48	7.51	7.94	1.00	11.04	0.99	760	25.86	20.58	19.23	16.52
460	32.91	61.25	7.79	8.31	1.13	9.53	1.00	780	25.90	20.66	19.26	16.78
470	33.12	61.65	8.05	8.62	1.03	10.16	1.00	800	25.84	20.64	19.16	16.56
480	33.32	63.13	8.33	9.01	1.01	12.24	1.01	820	25.63	20.44	19.00	16.59
490	33.51	62.22	8.60	9.34	1.08	10.61	1.01	840	25.56	20.43	18.99	16.61
500	33.67	62.16	8.93	9.74	1.04	11.03	1.01	860	25.63	20.53	19.02	16.65
510	33.85	61.47	9.23	10.11	1.09	9.99	1.01	880	25.74	20.72	19.09	16.50
520	34.00	62.88	9.53	10.51	0.95	11.52	1.02	900	25.79	20.89	19.20	16.54
530	34.11	66.52	9.92	10.92	1.06	18.31	1.01	920	25.69	20.82	19.21	16.51
540	34.27	65.75	10.24	11.36	1.01	16.52	1.02					
550	34.37	65.45	10.59	11.75	0.99	15.68	1.02					
560	34.51	63.52	10.92	12.20	1.01	12.43	1.02					
570	34.61	65.74	11.36	12.65	0.96	17.26	1.02					
580	34.69	66.10	11.76	13.13	1.02	18.06	1.02					
590	34.78	68.27	12.17	13.63	0.96	27.96	1.01					
600	34.86	69.86	12.58	14.20	1.00	29.11	1.02					
610	34.93	71.39	12.95	14.68	1.03	36.92	1.02					
620	34.98	70.30	13.42	15.26	0.99	28.97	1.02					
630	35.04	70.08	13.96	15.87	1.04	27.48	1.01					
640	35.08	72.35	14.49	16.51	0.96	45.19	1.01					
650	35.14	74.22	14.94	17.12	1.04	60.98	1.01					
660	35.17	71.24	15.51	17.90	1.03	33.70	1.01					
670	35.20	67.34	16.13	18.55	0.97	21.00	1.01					
680	35.23	73.43	16.68	19.34	1.04	42.55	1.01					
690	35.26	70.45	17.20	20.32	0.96	38.50	1.01					
700	35.27	71.94	17.79	21.23	1.03	46.36	1.01					
710	35.28	72.16	18.44	22.23	1.01	57.58	1.01					
720	35.29	69.70	19.08	23.65	0.98	36.40	1.01					
730	35.29	71.66	19.91	24.90	1.04	38.60	1.01					
740	35.30	65.26	20.66	26.38	1.00	16.91	1.01					
750	35.30	64.26	21.44	28.24	1.05	14.38	1.00					
760	35.30	62.94	22.17	30.28	1.04	12.26	1.00					
770	35.29	62.37	23.23	32.14	1.01	12.30	1.00					
780	35.28	62.80	23.94	32.09	1.03	12.47	1.00					
790	35.27	61.21	24.96	30.35	1.01	10.03	1.00					
800	35.25	61.13	25.95	28.48	1.05	10.53	1.00					
810	35.23	60.09	26.81	27.22	1.02	8.86	1.00					
820	35.22	59.33	27.37	25.73	1.02	8.12	1.00					
830	35.19	58.53	27.94	24.21	1.03	7.49	0.99					
840	35.16	59.52	28.26	22.82	1.01	8.42	0.99					
850	35.14	59.42	28.34	21.83	1.05	8.62	0.99					
860	35.10	57.64	28.11	20.73	1.00	6.79	0.99					
870	35.08	56.50	27.22	19.98	1.04	5.93	0.99					
880	35.05	56.86	26.58	19.04	1.03	6.27	0.98					
890	35.01	56.54	25.86	18.23	1.01	5.98	0.98					
900	34.98	56.64	25.37	17.53	1.07	6.02	0.98					
910	34.94	56.40	24.29	16.93	1.06	5.94	0.98					
920	34.90	54.56	23.54	16.30	1.04	4.80	0.97					
930	34.86	54.76	22.98	15.67	1.07	4.89	0.97					
940	34.80	55.25	22.42	15.13	1.11	5.22	0.97					
950	34.76	55.26	21.59	14.55	1.13	5.30	0.96					
960	34.72	54.51	21.11	14.08	1.05	4.76	0.96					
970	34.67	55.17	20.42	13.58	1.06	5.12	0.96					
980	34.61	53.20	20.06	13.27	1.05	4.11	0.95					
990	34.56	52.93	19.51	12.85	1.05	3.98	0.95					
1000	34.51	52.58	19.00	12.34	1.05	3.83	0.94					

Typical Performance Curves

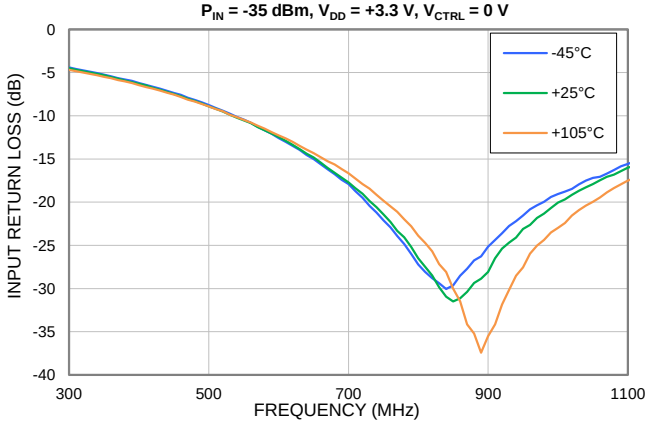
GAIN vs. TEMPERATURE,
P_{IN} = -35 dBm, V_{DD} = +3.3 V, V_{CTRL} = 0 V



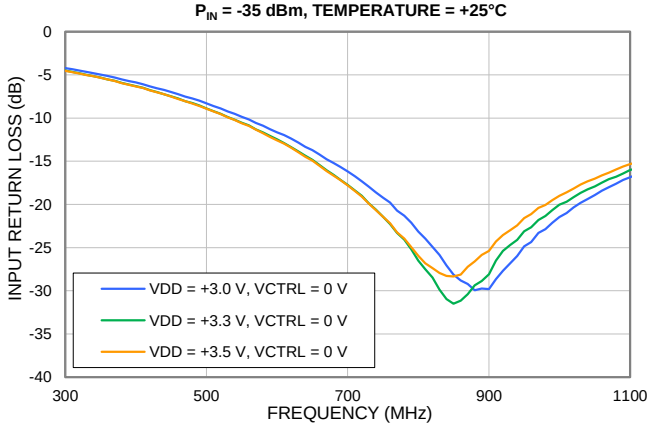
GAIN vs. DEVICE VOLTAGE,
P_{IN} = -35 dBm, TEMPERATURE = +25°C



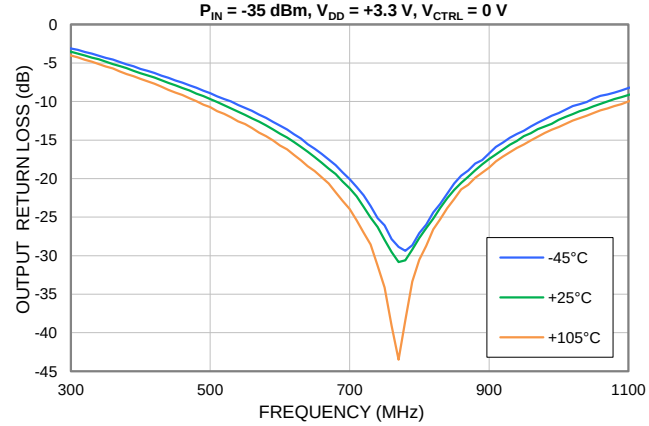
INPUT RETURN LOSS vs.TEMPERATURE,
P_{IN} = -35 dBm, V_{DD} = +3.3 V, V_{CTRL} = 0 V



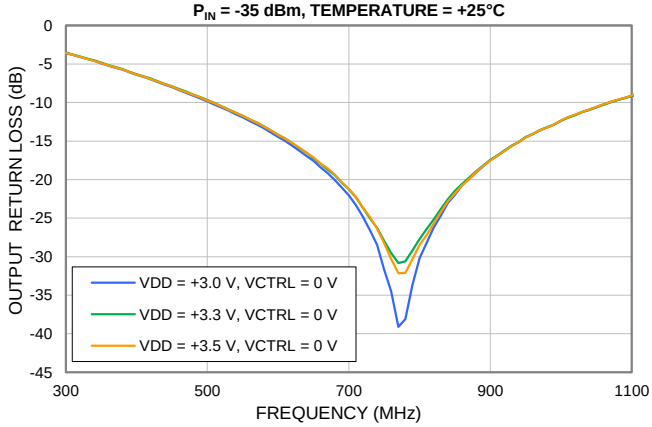
INPUT RETURN LOSS vs. DEVICE VOLTAGE,
P_{IN} = -35 dBm, TEMPERATURE = +25°C



OUTPUT RETURN LOSS vs. TEMPERATURE,
P_{IN} = -35 dBm, V_{DD} = +3.3 V, V_{CTRL} = 0 V

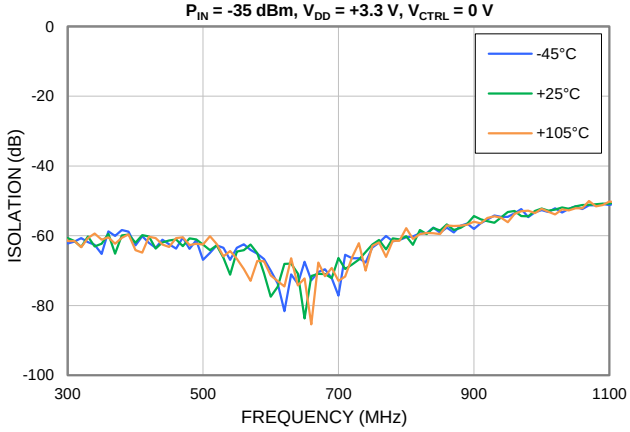


OUTPUT RETURN LOSS vs. DEVICE VOLTAGE,
P_{IN} = -35 dBm, TEMPERATURE = +25°C

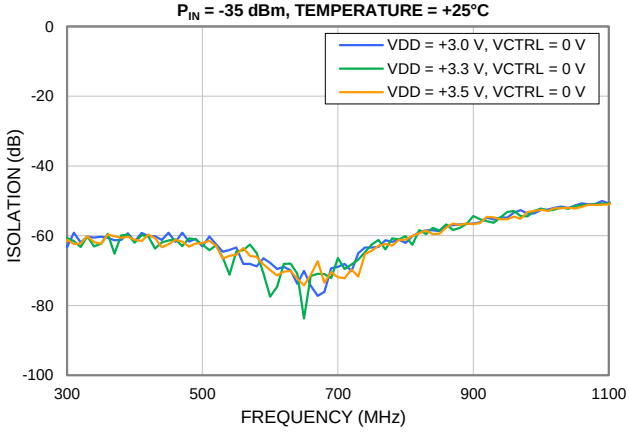


Typical Performance Curves

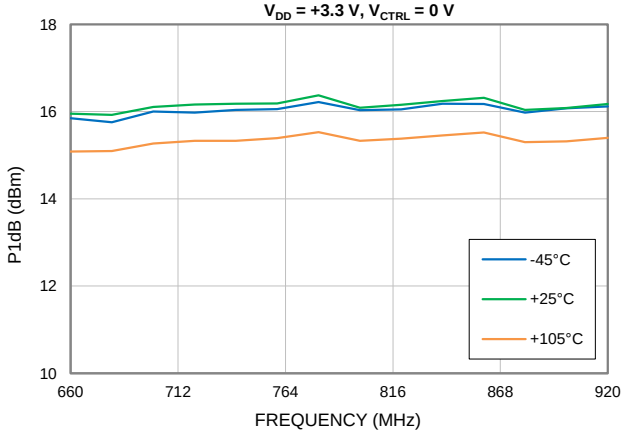
ISOLATION vs.TEMPERATURE,
P_{IN} = -35 dBm, V_{DD} = +3.3 V, V_{CTRL} = 0 V



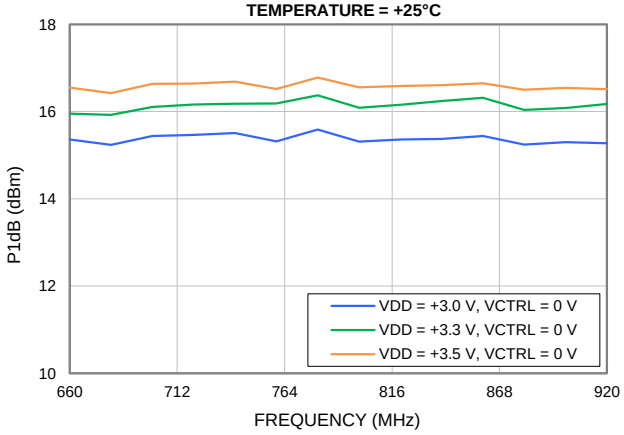
ISOLATION vs. DEVICE VOLTAGE,
P_{IN} = -35 dBm, TEMPERATURE = +25°C



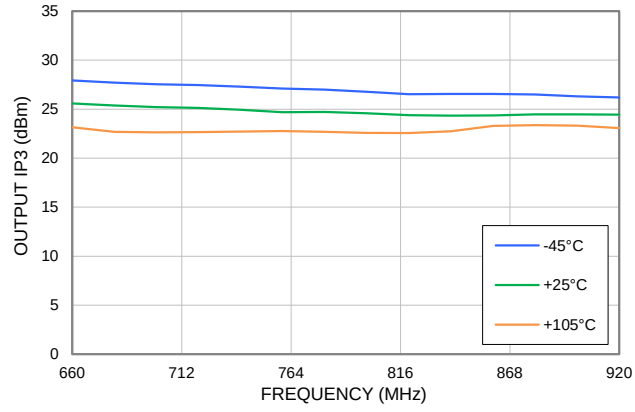
P1dB vs. TEMPERATURE,
V_{DD} = +3.3 V, V_{CTRL} = 0 V



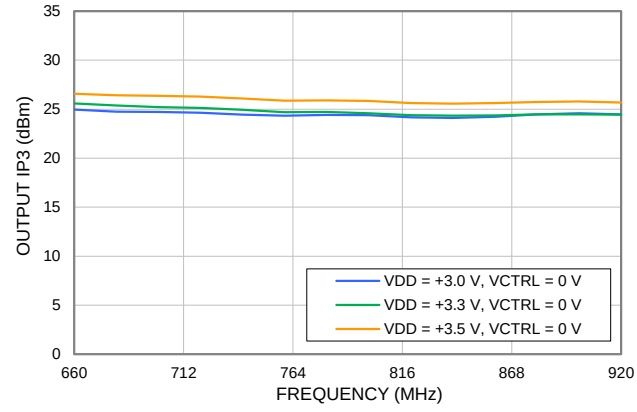
P1dB vs. DEVICE VOLTAGE,
TEMPERATURE = +25°C



OUTPUT IP3 vs. TEMPERATURE,
P_{OUT} = 0 dBm/TONE, V_{DD} = +3.3 V, V_{CTRL} = 0 V

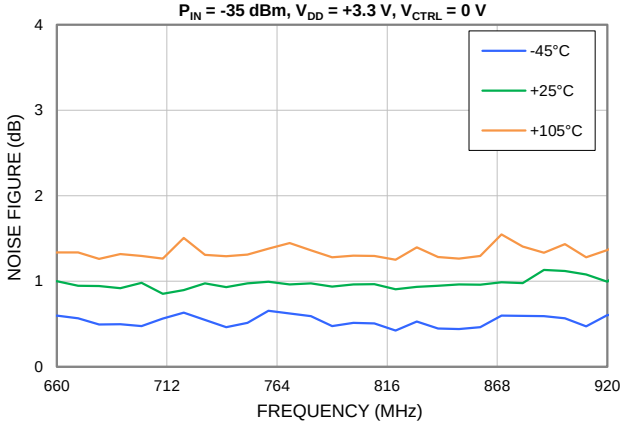


OUTPUT IP3 vs. DEVICE VOLTAGE,
P_{OUT} = 0 dBm/TONE, TEMPERATURE = +25°C

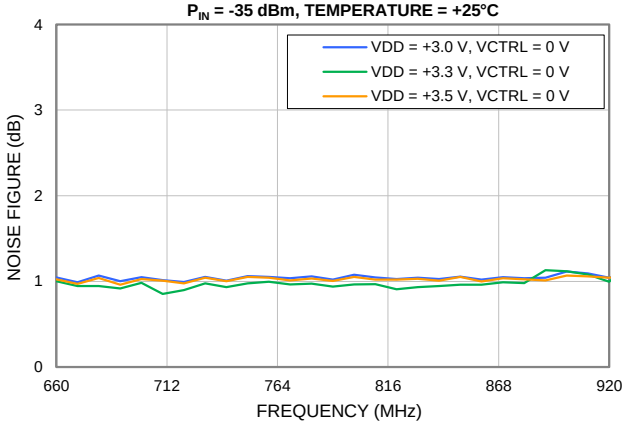


Typical Performance Curves

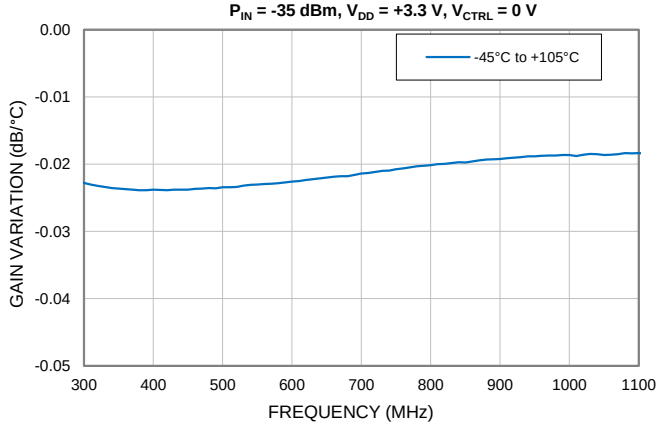
NOISE FIGURE vs. TEMPERATURE,
P_{IN} = -35 dBm, V_{DD} = +3.3 V, V_{CTRL} = 0 V



NOISE FIGURE vs. DEVICE VOLTAGE,
P_{IN} = -35 dBm, TEMPERATURE = +25°C



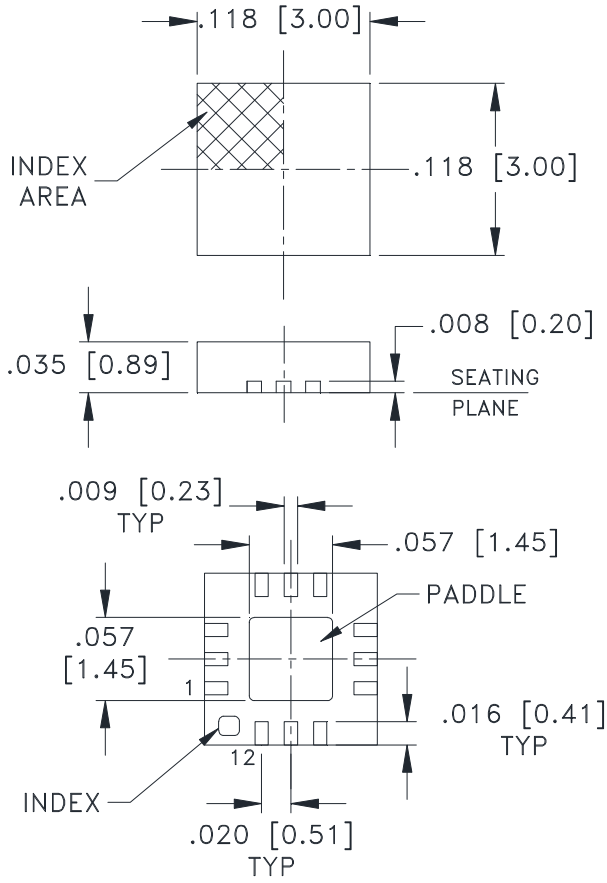
GAIN VARIATION vs. TEMPERATURE,
P_{IN} = -35 dBm, V_{DD} = +3.3 V, V_{CTRL} = 0 V

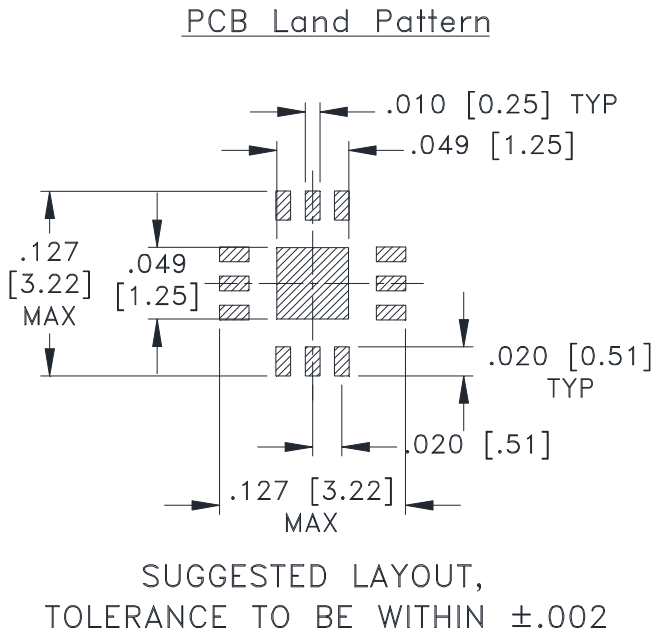


Case Style DQ

DQ1225

Outline Dimensions





Weight: .02 Grams

Dimensions are in inches (mm). Tolerances: 2Pl. ± .01; 3 Pl. ± .004

Notes:

1. Case material: Plastic.
2. Termination finish:
   - For RoHS Case Styles: Tin-Silver alloy plate over Nickel barrier or Matte-Tin. All models, (+) suffix. See Data sheet.
   - For RoHS-5 Case Styles: Tin-Lead plate. All models, no (+) suffix.

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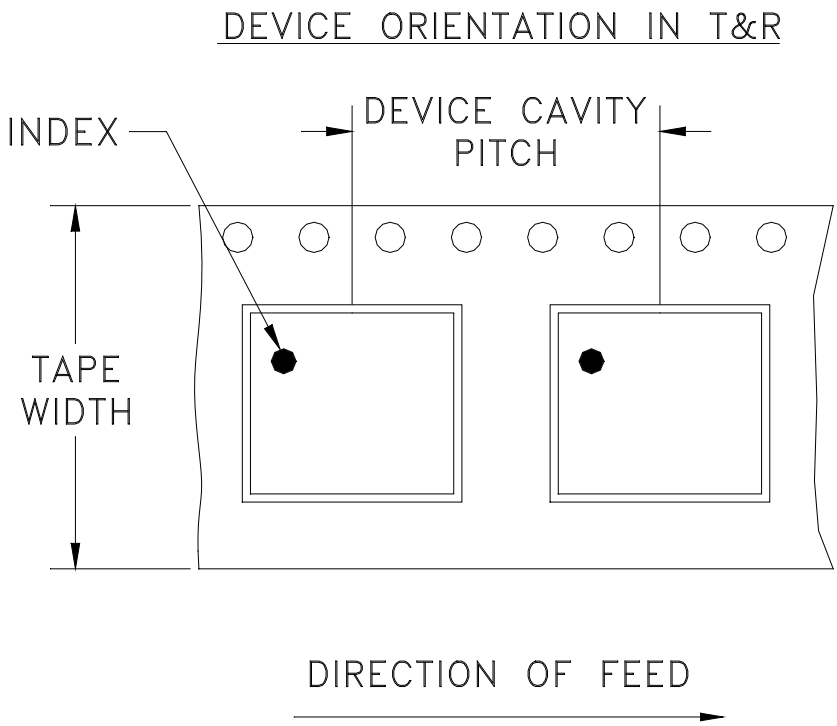
Tape & Reel Packaging TR-F66



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

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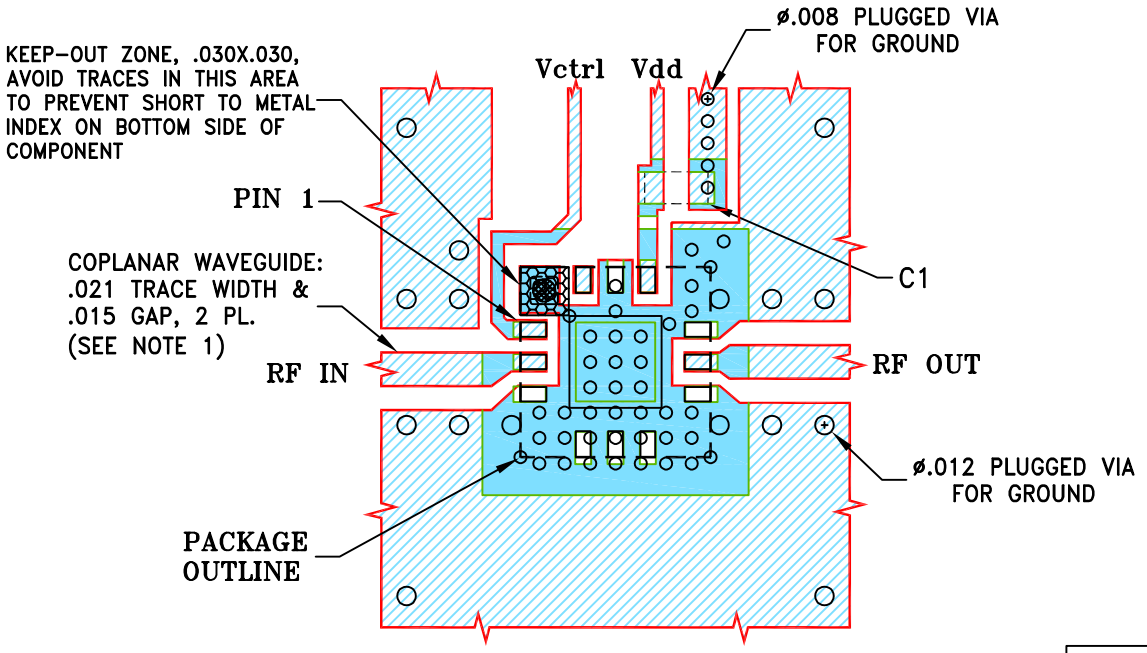
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-023733	NEW RELEASE	11/25/24	ITG	IL

SUGGESTED MOUNTING CONFIGURATION FOR DQ1225 CASE STYLE



COMPONENT	SIZE
C1	0402

NOTES:

1. TRACE WIDTH AND GAP ARE SHOWN FOR ROGERS RO4350B, DIELECTRIC THICKNESS: .010"; COPPER: 1 Oz EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. CHIP COMPONENT FOOT PRINTS SHOWN FOR REFERENCE. FOR COMPONENT VALUES REFER TO TB-TSS66921LNC+.
3. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

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	11/25/24
TOLERANCES ON:	CHECKED	GF	11/25/24
2 PL DECIMALS ±	APPROVED	IL	11/25/24
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

ASHEETA1.DWG REV:A DATE:01/12/95

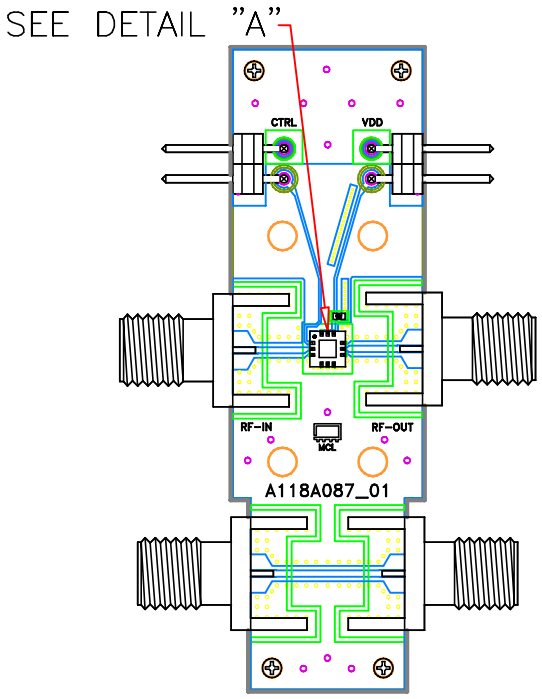
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

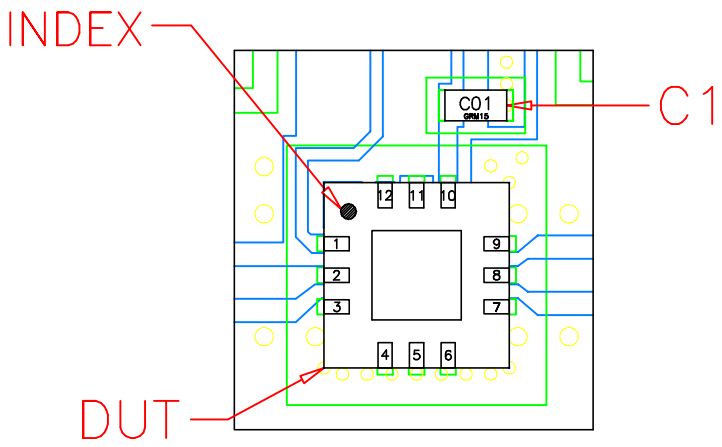
PL, DQ1225, TB-TSS66921LNC+

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-807	OR

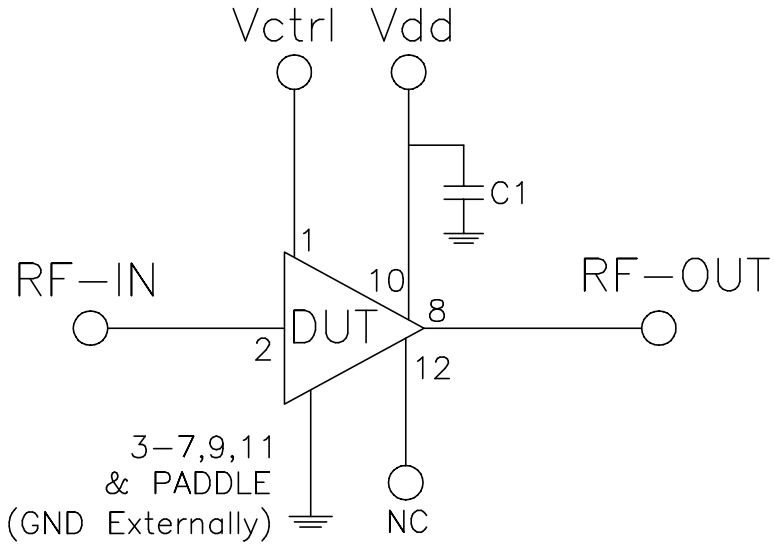
FILE:	SCALE:	SHEET:
98PL807	8:1	1 OF 1

Evaluation Board and Circuit





DETAIL "A"
LOCATION OF
UNITS COMPONENTS
(SCALE 5:1)



SCHEMATIC DIAGRAM

Component	Size	Value	Part Number	Manufacturer
C1	0402	1uF	GRM155C81E105KE11D	Murata

Notes:

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

Mini-Circuits®

Mini-Circuits

Environmental Specifications ENV08T1

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

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
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