MMIC, LOW NOISE, SHUTDOWN FEATURE

Monolithic Amplifier TSY-173LN+

50Ω 13.5 to 17 GHz

THE BIG DEAL

- Positive Gain Slope
- Shutdown Feature
- Excellent Noise Figure, 1.2dB Typ.
- Built-In ESD Protection Circuits (Class 1C)
- Low Current Operation, 13.2mA



Generic photo used for illustration purposes only

CASE STYLE: MC1630-1

+RoHS Compliant

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

APPLICATIONS

- Point to Point ODU System
- Fixed Satellite
- Radio Location
- Mobile

PRODUCT OVERVIEW

The TSY-173LN+ is a GaAs E-PHEMT based low noise MMIC Amplifier with shutdown feature with a unique combination of low noise (1.2dB Typ.), and Low Current (13.2mA Typ.) It is suitable for receiver application. This design operates on a single supply of 3V. It is well-matched to 50Ω and comes in a tiny, low profile package (2x2mm 6 Lead), accommodating dense circuit board layouts.

KEY FEATURES

Feature	Advantages
Low noise, 1.2dB Typical from 13.5 – 17GHz	Enables lower system noise figure performance.
Positive Gain Slope vs. Frequency +0.6 dB/GHz from 13.5 GHz to 15 GHz +0.4 dB/GHz from 15 GHz to 17 GHz	Useful for compensating negative gain slope of most wideband microwave components and eliminating the need for equalization.
Shutdown Feature	Allow users to turn on and off the amplifier with pulsed signals while keeping the power supply at constant voltage.
Integrated DC Blocks and Bias-Tee	Saves motherboard space and minimizes overall cost. Very User Friendly.
Small Size (2x2 mm 6L MCLP)	Tiny footprint saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB.

REV. A
ECO-011994
TSY-173LN+
MCL NY
220222

Monolithic Amplifier TSY-173LN+

ELECTRICAL SPECIFICATIONS[1] AT 25°C, 50Ω, UNLESS NOTED

Parameter	Condition (GHz)	Amplifier - ON			Amplifier- OFF	Units
		Min.	Typ.	Max.	Typ.	
Frequency range		13.5		17	13.5-17	GHz
Noise Figure	13.5		1.2		—	dB
	14		1.2		—	
	15		1.1		—	
	16		1.2		—	
	17		1.2		—	
Gain	13.5	14.2	15.6	17	-14.8	dB
	14		16		-14.7	
	15	15.1	16.5	18	-15.1	
	16		16.8		-15.6	
	17	15.2	16.7	18.2	-16.7	
Input Return Loss	13.5		16.4		2.6	dB
	14		18.9		2.7	
	15		18.8		3.1	
	16		15.4		3.3	
	17		16.6		3.2	
Output Return Loss	13.5		11.7		8.8	dB
	14		14.9		8.0	
	15		21.4		6.0	
	16		20.3		5.9	
	17		16		5.2	
Output P1dB (AMP-ON)	13.5		9.3		—	dBm
	14		9.4		—	
	15		8.7		—	
	16		8.4		—	
	17		6.6		—	
Output IP3 (Pout = -10 dBm/Tone)	13.5		22.4		—	dBm
	14		22.9		—	
	15		24.2		—	
	16		21.9		—	
	17		21		—	
Device Operating Voltage(VDD)		2.75	3	3.25	3	V
Device Operating Current (IDD)			13.2	19	0.00012	mA
Control Voltage (VC)		2.25	2.5	2.75	0	V
Control Current (IC)			0.56		0	mA
DC Current (IDD) Variation Vs. Temperature[2]			11.54		—	uA/degC
DC Current (IDD) Variation Vs. Voltage[3]			0.014		—	mA/mV
Thermal Resistance			106.7		—	degC/W

1. Measured on Mini-Circuits Characterization Test Board TB-TSY-173LN+. See Characterization Test & Application Circuit (Fig. 1)
2. Device Current Variation vs. Temperature= (Current in mA at 85°C - Current in mA at -45°C)/130°C
3. Device Current Variation vs. Voltage = (Current in mA at 3.25V – Current in mA at 2.75V) / ((3.25V-2.75V)*1000 mA/mV)

MAXIMUM RATINGS[4]

Parameter	Ratings
Operating temperature (ground lead)	-40°C to 85°C
Storage temperature	-65°C to 150°C
Junction Temperature	130°C
Total power dissipation	0.42W
Input power (CW)	+22 dBm
DC voltage at VC	3V
DC voltage at VDD	8V

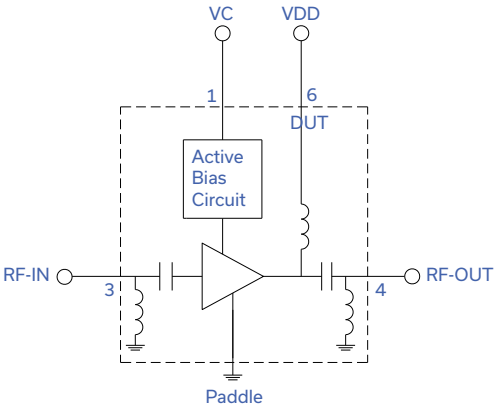
4. Permanent damage may occur if any of those limits are exceeded. Electrical maximum ratings are not intended for continuous normal operation.

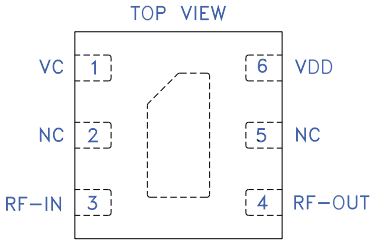
TRUTH TABLE + SWITCHING TIME SPECIFICATION

Truth Table		VC Min.	VC Typ.	VC Max.	Units
Amplifier- ON		2.25	2.5	2.75	V
Amplifier -OFF			0	0.2	V
Switching Time Parameter		**Min.**	**Typ.**	**Max.**	**Units**
Amplifier ON to OFF	OFF Time (50% Control to 10% RF)		13.7		ns
	FALL Time (90% RF to 10% RF)		8.8		ns
Amplifier OFF to ON	ON Time (50% Control to 90% RF)		52.4		ns
	RISE Time (10% RF to 90% RF)		38.8		ns
Control Voltage Leakage (Rising Edge)			0.64		mV
Control Voltage Leakage (Falling Edge)			1.45		mV

Monolithic Amplifier TSY-173LN+

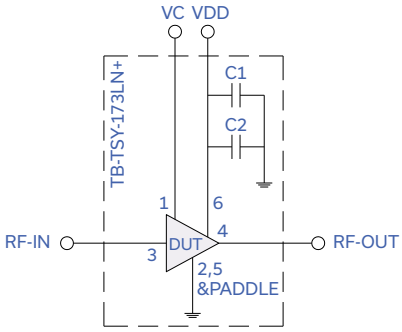
SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION





Function	Pad Number	Description (Fig 1)
VC	1	Control Voltage Pad for Shutdown (VC)
RF - IN	3	RF Input Pad
RF-OUT	4	RF Output Pad
VDD	6	DC Power Supply (VDD)
No Connection	2 & 5	Not used internally. Connected to ground on Test Board
Ground	Paddle	Soldered to Ground

CHARACTERIZATION TEST & APPLICATION CIRCUIT

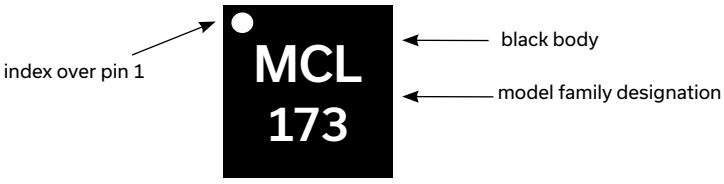


Component	Size	Value	Part Number	Manufacturer
C1	0402	0.1uF	GRM155R71C104KA88D	Murata
C2	0402	100pF	GRM1555C1H101JA01D	Murata

Fig 1. Application and Characterization Circuit
Note: This block diagram is used for characterization. (DUT is soldered on Mini-Circuits Characterization test board TB-TSY-173LN+)
Gain, Return loss, Output power at 1dB compression (P1dB), output IP3 (OIP3) and noise figure measured using Agilent's N5242A PNA-X microwave network analyzer.

Conditions:
1. Gain and Return loss: Pin= -25dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, -10 dBm/tone at output.
3. Switching Time: RF Signal: Pin = -10dBm, fRF =15GHz
VDD = 3V, VC = Pulse Signal at 100Hz with Vhigh =2.5V and Vlow =0V & 50% Duty Cycle.

PRODUCT MARKING



Marking may contain other features or characters for internal lot control

Monolithic Amplifier TSY-173LN+

ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD. TO ACCESS CLICK HERE

Performance Data	Data Table Swept Graphs S-Parameter (S2P Files) Data Set (.zip file)
Case Style	MC1630-1 Plastic package, exposed paddle, lead finish: Matt Tin
Tape & Reel **Standard quantities available on reel**	F66 7" reels with 20, 50, 100, 200, 500 or 2K devices
Suggested Layout for PCB Design	PL-719
Evaluation Board	TB-TSY-173LN+ (Without Connectors) TB-TSY-173LNC+ (With Connectors)
Environmental Ratings	ENV08T1

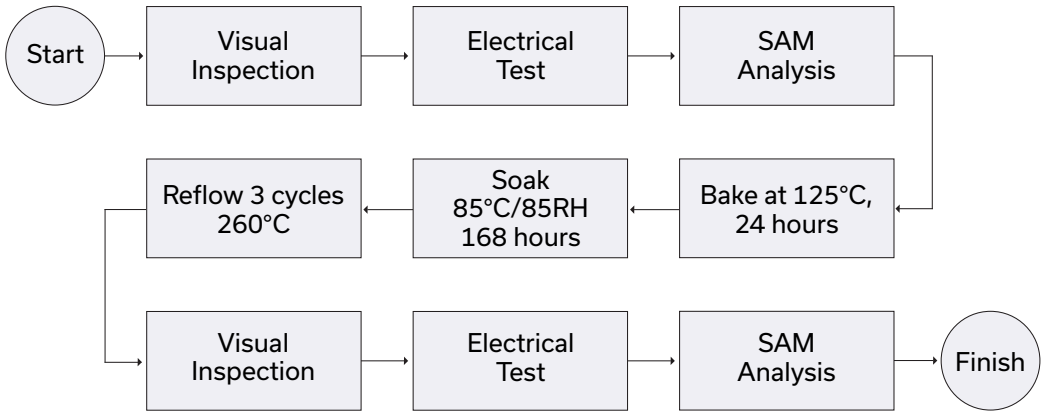
ESD RATING

Human Body Model (HBM): Class 1C (1000V) in accordance with ANSI/ESD STM 5.1 - 2001

MSL RATING

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D

MSL TEST FLOW CHART



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-Circuit's 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/MCLStore/terms.jsp

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: Ven = 2.50V, Vd = 3.00V, Id = 14mA @ Temperature = +25°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
12000	14.32	26.15	11.61	7.32	1.85	0.77	21.96	8.80	1.18
12200	14.50	26.12	12.21	7.74	1.85	0.78	24.16	9.01	1.19
12400	14.67	26.17	12.82	8.20	1.86	0.79	22.19	9.18	1.16
12600	14.83	26.18	13.41	8.69	1.87	0.81	21.93	9.25	1.17
12800	15.00	26.26	14.06	9.28	1.89	0.82	22.95	9.13	1.14
13000	15.17	26.25	14.80	9.94	1.90	0.84	21.62	9.39	1.15
13200	15.33	26.34	15.58	10.72	1.92	0.85	22.31	9.51	1.12
13400	15.50	26.40	16.51	11.68	1.93	0.87	22.51	9.41	1.13
13600	15.66	26.43	17.50	12.84	1.94	0.88	24.10	9.28	1.12
13800	15.82	26.49	18.39	14.15	1.95	0.89	22.39	9.62	1.08
14000	15.97	26.61	19.36	15.84	1.96	0.91	23.32	9.37	1.09
14200	16.11	26.75	19.89	17.79	1.98	0.92	22.27	9.10	1.06
14400	16.23	26.91	20.18	20.05	2.00	0.93	22.34	9.14	1.07
14600	16.34	27.08	20.11	22.04	2.02	0.93	24.02	9.23	1.07
14800	16.43	27.20	19.67	23.02	2.03	0.94	22.29	8.98	1.06
15000	16.51	27.38	19.09	22.29	2.04	0.94	23.38	8.59	1.06
15200	16.57	27.50	18.34	20.92	2.05	0.94	22.71	8.42	1.09
15400	16.63	27.68	17.50	19.59	2.06	0.94	22.88	8.36	1.02
15600	16.67	27.86	16.76	18.61	2.08	0.95	22.62	8.59	1.02
15800	16.71	27.93	16.12	18.15	2.08	0.95	22.41	8.09	1.05
16000	16.74	28.03	15.56	18.06	2.09	0.95	22.14	8.43	1.08
16200	16.77	28.14	15.14	18.18	2.10	0.96	20.83	8.35	1.08
16400	16.77	28.06	15.11	18.58	2.09	0.96	20.72	7.67	1.15
16600	16.76	28.16	15.23	18.97	2.11	0.96	22.70	7.66	1.10
16800	16.73	28.11	15.56	18.59	2.11	0.96	20.48	7.09	1.11
17000	16.61	28.06	16.19	17.08	2.12	0.95	20.47	6.69	1.14
17200	16.43	28.01	16.95	14.99	2.13	0.94	21.60	6.38	1.19
17400	16.19	27.92	17.80	12.91	2.13	0.92	20.73	5.49	1.22
17600	15.90	27.90	18.24	11.09	2.14	0.89	20.91	5.15	1.23
17800	15.58	27.75	17.87	9.62	2.12	0.86	19.68	4.92	1.18
18000	15.18	27.77	17.11	8.41	2.13	0.82	18.91	4.50	1.24

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: Ven = 2.25V, Vd = 2.75V, Id = 10mA @ Temperature = +25°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
12000	13.85	25.67	10.99	7.66	1.86	0.79	20.19	7.32	1.29
12200	14.03	25.64	11.54	8.12	1.86	0.80	21.40	7.43	1.29
12400	14.20	25.65	12.09	8.63	1.87	0.81	20.51	7.59	1.24
12600	14.37	25.70	12.60	9.21	1.89	0.83	20.56	7.80	1.24
12800	14.53	25.73	13.21	9.88	1.90	0.84	21.28	7.74	1.21
13000	14.69	25.74	13.86	10.64	1.91	0.86	20.55	7.99	1.20
13200	14.85	25.83	14.54	11.55	1.93	0.87	21.09	8.08	1.24
13400	15.00	25.88	15.34	12.69	1.94	0.89	20.60	8.03	1.16
13600	15.16	25.92	16.19	14.07	1.95	0.90	22.85	8.03	1.17
13800	15.30	25.99	16.97	15.69	1.96	0.91	20.87	8.18	1.16
14000	15.43	26.12	17.75	17.77	1.98	0.92	22.27	8.20	1.16
14200	15.55	26.25	18.19	20.37	2.00	0.93	20.26	7.95	1.07
14400	15.65	26.37	18.49	23.51	2.01	0.94	20.54	7.96	1.13
14600	15.73	26.57	18.45	25.88	2.04	0.94	20.48	7.88	1.11
14800	15.80	26.76	18.09	25.11	2.06	0.95	19.85	7.75	1.11
15000	15.85	26.84	17.58	22.81	2.05	0.95	20.25	7.22	1.10
15200	15.90	27.04	16.92	20.80	2.08	0.95	19.80	6.79	1.09
15400	15.93	27.20	16.21	19.37	2.09	0.96	18.87	6.35	1.08
15600	15.95	27.36	15.52	18.42	2.11	0.96	18.79	6.88	1.12
15800	15.96	27.49	14.93	17.90	2.12	0.96	18.58	6.45	1.12
16000	15.96	27.65	14.43	17.82	2.15	0.97	18.89	6.41	1.13
16200	15.97	27.70	14.04	17.84	2.15	0.97	18.40	6.42	1.16
16400	15.94	27.72	13.97	17.88	2.16	0.97	18.19	5.86	1.19
16600	15.90	27.70	14.03	17.72	2.17	0.97	18.16	5.84	1.21
16800	15.82	27.69	14.24	16.87	2.17	0.97	16.29	5.23	1.24
17000	15.66	27.71	14.67	15.29	2.20	0.96	16.86	4.80	1.19
17200	15.46	27.71	15.19	13.47	2.22	0.95	16.58	4.49	1.26
17400	15.18	27.79	15.78	11.70	2.26	0.92	15.75	3.72	1.28
17600	14.87	27.73	16.05	10.18	2.27	0.89	15.66	3.34	1.28
17800	14.52	27.75	15.79	8.92	2.29	0.86	14.75	2.90	1.29
18000	14.12	27.66	15.33	7.88	2.28	0.82	13.94	2.32	1.28

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: Ven = 2.75V, Vd = 3.25V, Id = 17mA @ Temperature = +25°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
12000	14.61	26.59	12.10	7.05	1.85	0.75	23.37	9.92	1.20
12200	14.80	26.54	12.73	7.42	1.85	0.76	24.54	10.11	1.17
12400	14.97	26.61	13.39	7.85	1.87	0.78	23.76	10.28	1.13
12600	15.13	26.59	14.04	8.30	1.87	0.79	24.22	10.34	1.13
12800	15.31	26.67	14.79	8.83	1.89	0.81	25.10	10.05	1.10
13000	15.48	26.63	15.62	9.42	1.89	0.82	23.47	10.33	1.08
13200	15.65	26.69	16.50	10.13	1.91	0.84	23.22	10.46	1.10
13400	15.83	26.82	17.60	10.99	1.93	0.85	23.73	10.32	1.08
13600	16.00	26.83	18.74	12.02	1.93	0.87	26.05	10.07	1.10
13800	16.17	26.89	19.90	13.13	1.94	0.88	23.21	10.45	1.08
14000	16.34	26.85	21.09	14.58	1.93	0.89	24.74	10.29	1.06
14200	16.49	27.11	21.75	16.18	1.97	0.91	23.25	9.89	1.08
14400	16.63	27.26	22.04	17.96	1.99	0.92	23.47	9.95	1.04
14600	16.75	27.42	21.92	19.57	2.00	0.92	23.70	10.05	1.02
14800	16.86	27.56	21.37	20.59	2.01	0.93	23.07	9.79	1.03
15000	16.96	27.70	20.65	20.49	2.02	0.93	24.25	9.39	1.04
15200	17.04	27.84	19.78	19.73	2.02	0.93	23.69	9.10	1.03
15400	17.12	28.04	18.83	18.74	2.04	0.93	23.87	9.23	1.00
15600	17.18	28.16	17.98	17.90	2.04	0.94	25.36	9.64	1.03
15800	17.23	28.31	17.31	17.48	2.06	0.94	23.90	8.87	1.02
16000	17.29	28.31	16.72	17.40	2.04	0.94	23.29	9.43	1.05
16200	17.34	28.38	16.25	17.55	2.04	0.94	23.46	9.38	1.06
16400	17.37	28.43	16.24	18.12	2.05	0.94	23.91	8.69	1.07
16600	17.39	28.42	16.44	18.94	2.05	0.95	22.62	8.69	1.11
16800	17.38	28.30	16.85	19.32	2.03	0.95	23.09	8.16	1.12
17000	17.30	28.28	17.71	18.31	2.04	0.94	22.27	7.76	1.13
17200	17.15	28.21	18.80	16.18	2.05	0.93	22.75	7.34	1.16
17400	16.94	28.19	20.04	13.87	2.07	0.91	21.25	6.45	1.19
17600	16.66	27.99	20.63	11.82	2.04	0.89	21.07	6.14	1.19
17800	16.35	28.06	19.95	10.17	2.06	0.86	22.77	6.20	1.21
18000	15.97	27.97	18.71	8.84	2.06	0.82	22.40	5.82	1.20

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: Ven = 2.50V, Vd = 3.00V, Id = 13mA @ Temperature = -45°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
12000	14.71	26.32	11.82	6.70	1.73	0.73	21.26	8.88	0.63
12200	14.90	26.28	12.58	7.11	1.74	0.74	23.29	9.10	0.66
12400	15.07	26.34	13.25	7.55	1.76	0.76	21.26	9.28	0.61
12600	15.24	26.36	13.85	8.01	1.77	0.77	21.30	9.36	0.62
12800	15.41	26.40	14.62	8.51	1.79	0.79	22.40	9.28	0.60
13000	15.58	26.41	15.51	9.06	1.79	0.80	21.30	9.52	0.58
13200	15.76	26.48	16.44	9.69	1.81	0.82	21.94	9.66	0.55
13400	15.94	26.49	17.56	10.46	1.81	0.83	21.73	9.57	0.55
13600	16.12	26.52	18.78	11.43	1.82	0.85	23.99	9.47	0.54
13800	16.29	26.59	19.75	12.49	1.83	0.86	21.51	9.72	0.53
14000	16.47	26.68	20.63	13.75	1.84	0.88	22.93	9.58	0.51
14200	16.62	26.81	20.96	15.06	1.85	0.89	21.45	9.33	0.50
14400	16.75	26.97	21.10	16.36	1.87	0.90	21.99	9.38	0.51
14600	16.88	27.07	21.18	17.49	1.87	0.90	22.48	9.39	0.47
14800	17.00	27.24	20.94	18.02	1.88	0.91	21.55	9.14	0.48
15000	17.11	27.38	20.63	17.97	1.89	0.91	22.96	8.89	0.47
15200	17.20	27.49	20.37	17.73	1.89	0.91	22.37	8.60	0.51
15400	17.30	27.64	20.04	17.46	1.89	0.91	21.60	8.58	0.45
15600	17.39	27.81	19.71	17.14	1.91	0.91	21.92	8.80	0.50
15800	17.48	27.93	19.42	17.03	1.91	0.92	21.94	8.11	0.48
16000	17.55	27.94	19.23	16.92	1.90	0.91	21.25	8.49	0.48
16200	17.62	28.05	18.71	16.62	1.90	0.92	21.13	8.52	0.50
16400	17.67	28.08	18.17	16.65	1.89	0.92	21.51	7.91	0.53
16600	17.71	28.06	17.97	16.96	1.88	0.92	20.88	7.92	0.52
16800	17.73	27.87	17.81	17.50	1.85	0.92	20.53	7.40	0.54
17000	17.70	27.89	18.37	17.39	1.86	0.92	21.13	6.94	0.53
17200	17.60	27.83	19.41	16.01	1.86	0.91	20.45	6.55	0.59
17400	17.44	27.77	20.65	14.05	1.86	0.90	20.48	5.68	0.63
17600	17.19	27.67	22.10	11.70	1.85	0.86	20.16	5.21	0.61
17800	16.90	27.56	21.12	9.75	1.82	0.82	19.85	5.10	0.62
18000	16.53	27.51	19.48	8.23	1.80	0.78	18.92	4.57	0.60

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: Ven = 2.25V, Vd = 2.75V, Id = 9mA @ Temperature = -45°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
12000	14.25	25.79	11.14	7.02	1.74	0.75	18.71	7.18	0.66
12200	14.44	25.79	11.81	7.47	1.76	0.76	20.03	7.29	0.68
12400	14.61	25.81	12.40	7.96	1.77	0.78	19.18	7.46	0.68
12600	14.78	25.86	12.92	8.47	1.79	0.79	18.51	7.56	0.65
12800	14.94	25.86	13.56	9.04	1.79	0.81	19.08	7.63	0.64
13000	15.11	25.90	14.29	9.67	1.80	0.82	18.72	7.89	0.60
13200	15.28	25.97	15.01	10.40	1.82	0.84	19.30	7.86	0.57
13400	15.45	26.02	15.93	11.30	1.83	0.85	18.74	7.92	0.58
13600	15.62	26.02	16.83	12.43	1.83	0.87	20.44	7.98	0.60
13800	15.78	26.12	17.57	13.70	1.85	0.88	18.87	8.01	0.53
14000	15.94	26.24	18.23	15.18	1.86	0.89	19.45	8.03	0.53
14200	16.07	26.35	18.53	16.87	1.88	0.91	18.60	7.95	0.55
14400	16.19	26.52	18.64	18.51	1.90	0.91	18.96	7.83	0.52
14600	16.29	26.66	18.73	19.76	1.91	0.92	19.32	7.76	0.53
14800	16.38	26.76	18.54	20.05	1.91	0.92	18.53	7.64	0.56
15000	16.47	26.96	18.22	19.53	1.92	0.93	18.80	7.11	0.51
15200	16.54	27.06	17.94	18.88	1.92	0.93	18.77	6.80	0.54
15400	16.62	27.22	17.63	18.26	1.93	0.93	17.52	6.53	0.52
15600	16.68	27.37	17.30	17.68	1.94	0.93	17.78	6.55	0.50
15800	16.74	27.49	17.02	17.33	1.95	0.93	17.62	6.14	0.50
16000	16.79	27.55	16.85	17.01	1.95	0.93	17.65	6.27	0.52
16200	16.83	27.59	16.43	16.62	1.94	0.93	17.30	6.14	0.53
16400	16.85	27.64	16.05	16.53	1.94	0.93	17.31	5.65	0.57
16600	16.85	27.72	15.85	16.60	1.96	0.94	17.28	5.65	0.60
16800	16.83	27.62	15.73	16.66	1.94	0.94	15.60	5.09	0.55
17000	16.76	27.66	16.06	15.90	1.95	0.94	16.02	4.74	0.59
17200	16.61	27.57	16.63	14.35	1.95	0.92	15.83	4.35	0.62
17400	16.41	27.58	17.33	12.56	1.96	0.91	15.13	3.48	0.61
17600	16.13	27.48	18.15	10.60	1.95	0.87	15.00	3.08	0.63
17800	15.81	27.42	18.03	8.98	1.93	0.83	14.17	2.65	0.64
18000	15.43	27.44	17.37	7.68	1.93	0.78	13.47	2.06	0.61

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: Ven = 2.75V, Vd = 3.25V, Id = 17mA @ Temperature = -45°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
12000	14.99	26.55	12.24	6.49	1.71	0.71	22.96	10.16	0.67
12200	15.18	26.64	13.08	6.87	1.74	0.73	24.68	10.26	0.62
12400	15.35	26.61	13.81	7.27	1.74	0.74	23.76	10.44	0.62
12600	15.51	26.67	14.49	7.69	1.76	0.76	23.56	10.49	0.58
12800	15.68	26.71	15.34	8.16	1.77	0.77	23.94	10.34	0.60
13000	15.86	26.71	16.33	8.66	1.78	0.79	23.61	10.50	0.53
13200	16.04	26.75	17.42	9.23	1.79	0.80	23.56	10.65	0.55
13400	16.23	26.77	18.81	9.92	1.79	0.82	23.82	10.53	0.58
13600	16.41	26.83	20.31	10.78	1.80	0.83	26.32	10.37	0.55
13800	16.59	26.87	21.56	11.74	1.81	0.85	23.45	10.78	0.52
14000	16.78	26.98	22.77	12.83	1.82	0.86	25.15	10.51	0.51
14200	16.94	27.09	23.16	13.98	1.83	0.88	23.38	10.13	0.51
14400	17.09	27.22	23.21	15.10	1.84	0.89	23.84	10.20	0.50
14600	17.24	27.37	23.39	16.10	1.85	0.89	24.96	10.33	0.51
14800	17.37	27.51	22.98	16.66	1.86	0.90	23.62	10.08	0.51
15000	17.49	27.65	22.64	16.73	1.86	0.90	24.83	9.69	0.48
15200	17.60	27.71	22.40	16.68	1.85	0.90	23.63	9.40	0.49
15400	17.72	27.92	22.01	16.54	1.87	0.90	23.70	9.48	0.49
15600	17.83	28.00	21.66	16.39	1.86	0.90	24.93	10.00	0.47
15800	17.93	28.13	21.32	16.42	1.87	0.90	23.29	9.13	0.50
16000	18.03	28.24	21.15	16.41	1.87	0.90	24.26	9.76	0.53
16200	18.12	28.24	20.43	16.22	1.85	0.90	23.68	9.71	0.50
16400	18.19	28.22	19.76	16.30	1.83	0.90	23.22	9.10	0.55
16600	18.25	28.20	19.64	16.74	1.82	0.91	23.05	9.11	0.54
16800	18.30	28.11	19.48	17.58	1.80	0.91	23.39	8.74	0.55
17000	18.31	27.98	20.36	18.14	1.78	0.91	21.82	8.18	0.57
17200	18.24	27.93	21.88	17.21	1.78	0.90	23.39	7.65	0.57
17400	18.12	27.76	24.22	15.34	1.77	0.89	20.52	6.77	0.65
17600	17.90	27.63	26.64	12.68	1.75	0.86	20.72	6.34	0.61
17800	17.63	27.65	23.51	10.44	1.75	0.82	23.75	6.43	0.63
18000	17.28	27.61	20.34	8.71	1.73	0.78	22.70	6.06	0.59

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: Ven = 2.50V, Vd = 3.00V, Id = 14mA @ Temperature = +85°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
12000	13.97	26.27	11.65	7.72	1.98	0.79	22.46	8.59	1.68
12200	14.16	26.28	12.19	8.12	1.98	0.81	23.40	8.81	1.67
12400	14.33	26.35	12.76	8.59	2.00	0.82	23.37	8.98	1.65
12600	14.49	26.41	13.31	9.12	2.02	0.83	21.81	9.03	1.63
12800	14.66	26.37	13.98	9.75	2.02	0.85	23.05	8.92	1.61
13000	14.83	26.41	14.72	10.48	2.03	0.86	22.12	9.04	1.58
13200	14.99	26.47	15.44	11.32	2.04	0.87	22.92	9.29	1.61
13400	15.15	26.53	16.29	12.38	2.06	0.89	22.87	9.19	1.58
13600	15.31	26.60	17.15	13.71	2.07	0.90	24.86	8.93	1.57
13800	15.46	26.75	17.90	15.18	2.10	0.92	23.04	9.29	1.54
14000	15.60	26.80	18.62	17.13	2.11	0.93	23.09	9.11	1.55
14200	15.73	27.03	19.01	19.43	2.14	0.94	22.44	8.70	1.55
14400	15.84	27.10	19.28	22.11	2.15	0.94	22.75	8.74	1.54
14600	15.94	27.29	19.24	24.19	2.17	0.95	23.64	8.82	1.50
14800	16.02	27.42	18.88	23.90	2.18	0.95	22.02	8.55	1.52
15000	16.08	27.58	18.47	22.16	2.19	0.95	24.04	8.28	1.50
15200	16.13	27.80	17.86	20.44	2.22	0.96	23.56	8.10	1.53
15400	16.17	27.96	17.09	19.05	2.24	0.96	22.69	8.08	1.49
15600	16.19	28.10	16.38	18.04	2.25	0.96	23.02	8.40	1.53
15800	16.21	28.20	15.76	17.50	2.26	0.96	22.69	7.73	1.52
16000	16.21	28.22	15.19	17.44	2.26	0.96	22.29	8.06	1.56
16200	16.20	28.40	14.70	17.50	2.30	0.97	22.18	8.05	1.57
16400	16.17	28.45	14.56	17.78	2.32	0.97	20.96	7.40	1.59
16600	16.11	28.41	14.58	18.09	2.33	0.98	23.00	7.32	1.60
16800	16.02	28.41	14.72	17.76	2.35	0.98	21.01	6.88	1.64
17000	15.86	28.35	15.15	16.28	2.36	0.97	20.40	6.43	1.62
17200	15.63	28.30	15.70	14.23	2.38	0.95	20.81	5.91	1.69
17400	15.35	28.35	16.21	12.25	2.42	0.93	19.74	5.16	1.68
17600	15.02	28.38	16.35	10.53	2.45	0.90	20.50	4.79	1.73
17800	14.64	28.29	15.96	9.16	2.44	0.87	19.98	4.71	1.74
18000	14.22	28.16	15.49	8.07	2.44	0.83	19.10	4.30	1.73

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: Ven = 2.25V, Vd = 2.75V, Id = 10mA @ Temperature = +85°C

FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
12000	13.51	25.75	11.05	8.04	1.98	0.81	20.85	7.16	1.74
12200	13.69	25.74	11.57	8.50	1.98	0.82	21.99	7.39	1.75
12400	13.86	25.81	12.09	9.03	2.00	0.84	21.03	7.55	1.67
12600	14.02	25.84	12.61	9.64	2.01	0.85	20.83	7.63	1.69
12800	14.19	25.82	13.22	10.36	2.02	0.87	21.24	7.69	1.72
13000	14.35	25.90	13.90	11.20	2.04	0.88	20.78	7.80	1.68
13200	14.50	25.97	14.56	12.19	2.06	0.89	21.12	7.91	1.69
13400	14.65	26.06	15.34	13.46	2.08	0.91	20.84	7.96	1.68
13600	14.81	26.07	16.11	15.05	2.08	0.92	23.35	7.80	1.65
13800	14.94	26.20	16.77	16.91	2.10	0.93	20.63	8.09	1.61
14000	15.06	26.34	17.42	19.43	2.13	0.94	23.01	7.95	1.64
14200	15.17	26.44	17.79	22.61	2.14	0.95	20.66	7.67	1.60
14400	15.25	26.67	18.00	26.13	2.18	0.95	21.22	7.68	1.60
14600	15.33	26.82	18.01	26.76	2.19	0.96	21.16	7.61	1.55
14800	15.38	26.97	17.71	23.88	2.21	0.96	20.40	7.45	1.60
15000	15.43	27.18	17.35	21.28	2.24	0.96	20.98	7.04	1.59
15200	15.45	27.39	16.75	19.48	2.27	0.96	20.38	6.84	1.56
15400	15.47	27.45	16.08	18.25	2.26	0.96	19.03	6.60	1.58
15600	15.46	27.65	15.42	17.38	2.30	0.97	19.20	6.72	1.57
15800	15.46	27.74	14.82	16.89	2.31	0.97	19.07	6.23	1.62
16000	15.43	27.85	14.31	16.81	2.33	0.97	19.20	6.44	1.64
16200	15.40	27.97	13.84	16.80	2.36	0.98	18.37	6.29	1.66
16400	15.33	27.99	13.68	16.84	2.38	0.98	18.38	5.74	1.69
16600	15.24	28.02	13.64	16.76	2.41	0.99	18.44	5.66	1.66
16800	15.12	27.97	13.72	16.14	2.42	0.98	16.47	5.17	1.72
17000	14.92	28.02	14.01	14.71	2.46	0.97	16.70	4.70	1.74
17200	14.66	28.06	14.39	12.95	2.51	0.96	16.63	4.31	1.76
17400	14.36	28.05	14.73	11.24	2.54	0.93	15.82	3.55	1.80
17600	14.00	27.94	14.83	9.72	2.53	0.90	15.51	3.14	1.84
17800	13.61	27.90	14.55	8.54	2.54	0.86	14.69	2.73	1.82
18000	13.18	27.89	14.21	7.56	2.56	0.83	13.78	2.28	1.82

Typical Performance Data

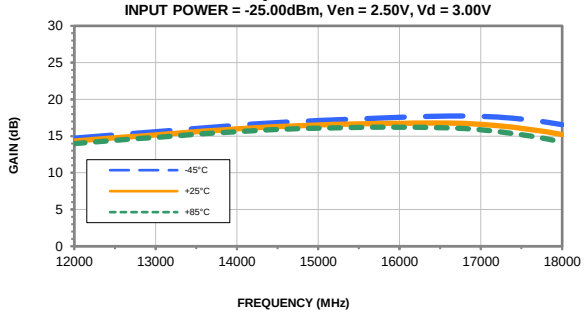
Definitions:
Input Return Loss = -S11 (dB)
Gain(Power Gain) = S21 (dB)
Reverse Isolation = -S12 (dB)
Output Return Loss = -S22 (dB)

TEST CONDITIONS: Ven = 2.75V, Vd = 3.25V, Id = 17mA @ Temperature = +85°C

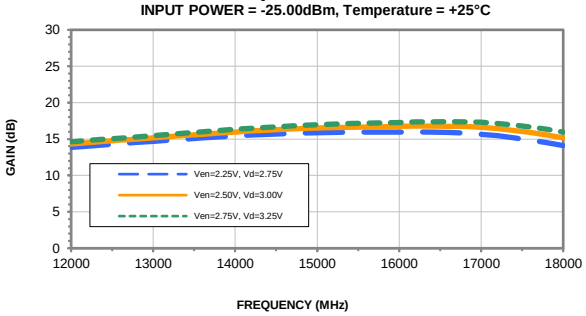
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
12000	14.28	26.66	12.11	7.43	1.97	0.78	24.14	9.70	1.62
12200	14.47	26.64	12.69	7.80	1.97	0.79	23.40	9.78	1.63
12400	14.64	26.69	13.31	8.23	1.99	0.80	23.43	9.94	1.60
12600	14.81	26.74	13.91	8.70	2.00	0.82	23.01	9.98	1.60
12800	14.98	26.79	14.64	9.28	2.02	0.83	23.88	9.70	1.59
13000	15.16	26.85	15.44	9.92	2.03	0.84	23.06	9.94	1.57
13200	15.32	26.92	16.25	10.68	2.05	0.86	24.02	10.09	1.56
13400	15.49	27.00	17.22	11.63	2.07	0.88	24.05	9.96	1.55
13600	15.67	26.96	18.22	12.77	2.06	0.89	24.96	9.67	1.56
13800	15.83	27.13	19.08	14.05	2.09	0.90	23.26	10.06	1.52
14000	15.99	27.20	19.92	15.68	2.10	0.91	24.15	9.74	1.51
14200	16.13	27.39	20.38	17.54	2.13	0.93	23.53	9.42	1.50
14400	16.26	27.52	20.66	19.65	2.14	0.93	23.36	9.36	1.50
14600	16.37	27.64	20.66	21.39	2.15	0.94	24.09	9.46	1.51
14800	16.47	27.82	20.23	21.97	2.17	0.94	22.80	9.18	1.49
15000	16.55	28.02	19.73	21.20	2.19	0.95	24.74	8.90	1.47
15200	16.62	28.12	19.03	19.98	2.19	0.95	23.46	8.61	1.49
15400	16.68	28.37	18.19	18.80	2.23	0.95	23.39	8.76	1.47
15600	16.71	28.43	17.40	17.77	2.22	0.95	24.57	9.25	1.48
15800	16.76	28.60	16.73	17.29	2.24	0.95	22.70	8.32	1.49
16000	16.78	28.68	16.10	17.19	2.25	0.95	23.72	8.85	1.52
16200	16.79	28.75	15.62	17.31	2.26	0.96	22.18	8.87	1.52
16400	16.78	28.79	15.49	17.73	2.27	0.96	22.93	8.20	1.56
16600	16.75	28.67	15.54	18.42	2.26	0.96	23.37	8.13	1.59
16800	16.69	28.58	15.75	18.62	2.25	0.96	22.64	7.72	1.61
17000	16.56	28.53	16.34	17.44	2.27	0.96	21.53	7.19	1.60
17200	16.35	28.52	17.04	15.28	2.30	0.95	21.00	6.65	1.65
17400	16.10	28.54	17.75	13.08	2.33	0.93	21.08	5.90	1.71
17600	15.78	28.50	17.89	11.16	2.34	0.90	21.63	5.55	1.68
17800	15.42	28.32	17.37	9.64	2.31	0.87	24.40	5.65	1.71
18000	15.00	28.16	16.67	8.44	2.30	0.83	23.30	5.38	1.69

Typical Performance Curves

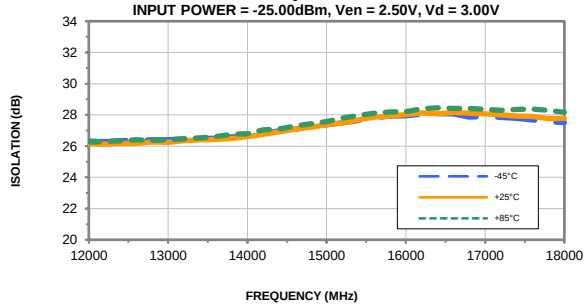
GAIN vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25.00dBm, Ven = 2.50V, Vd = 3.00V



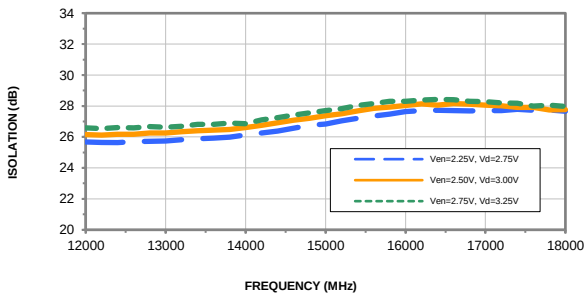
GAIN vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25.00dBm, Temperature = +25°C



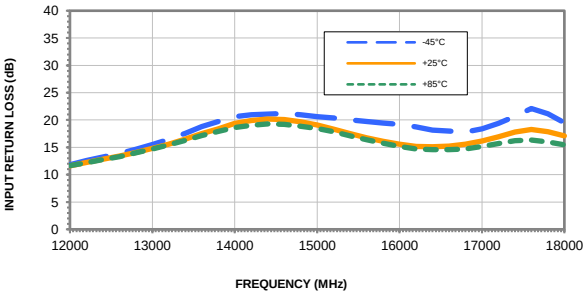
ISOLATION vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25.00dBm, Ven = 2.50V, Vd = 3.00V



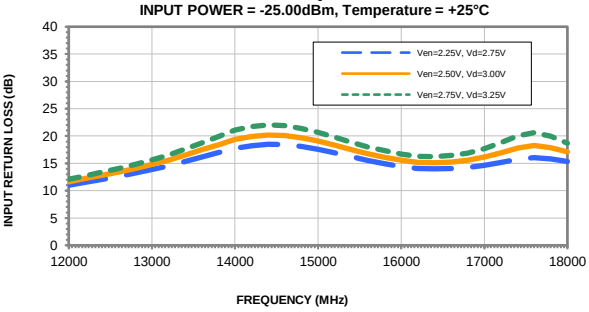
ISOLATION vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25.00dBm, Temperature = +25°C



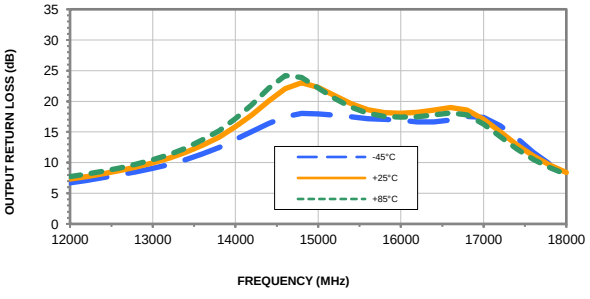
INPUT RETURN LOSS vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25.00dBm, Ven = 2.50V, Vd = 3.00V



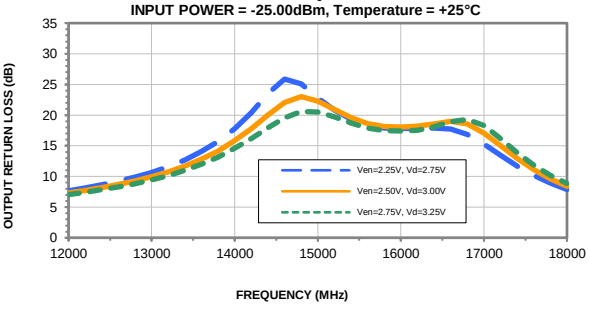
INPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25.00dBm, Temperature = +25°C



OUTPUT RETURN LOSS vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25.00dBm, Ven = 2.50V, Vd = 3.00V

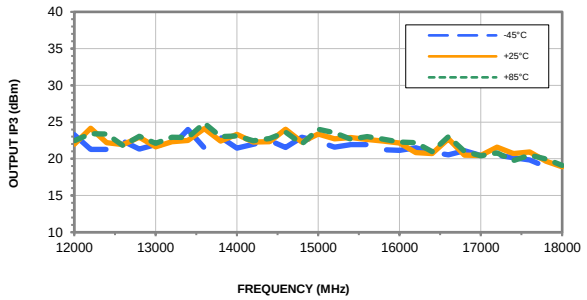


OUTPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25.00dBm, Temperature = +25°C

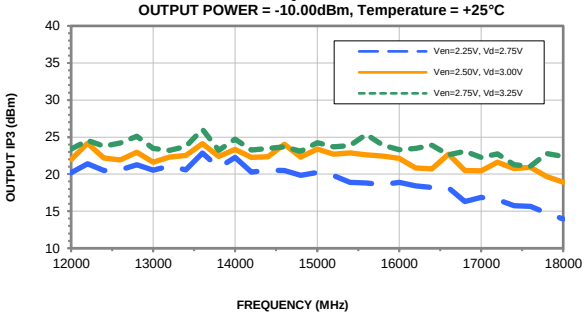


Typical Performance Curves

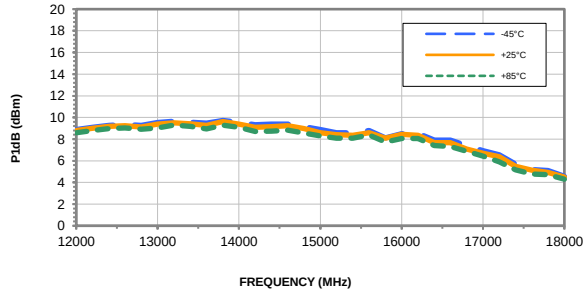
OUTPUT IP3 vs. FREQUENCY & TEMPERATURE
OUTPUT POWER = -10.00dBm, Ven = 2.50V, Vd = 3.00V



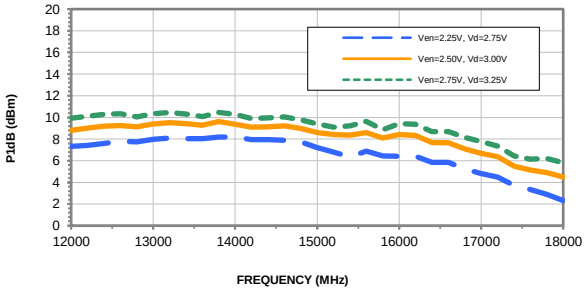
OUTPUT IP3 vs. FREQUENCY & DEVICE VOLTAGE
OUTPUT POWER = -10.00dBm, Temperature = +25°C



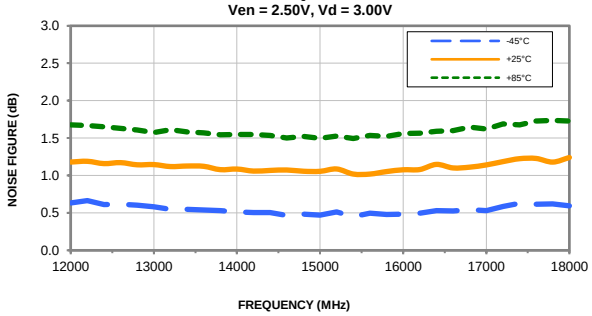
P1dB vs. FREQUENCY & TEMPERATURE
Ven = 2.50V, Vd = 3.00V



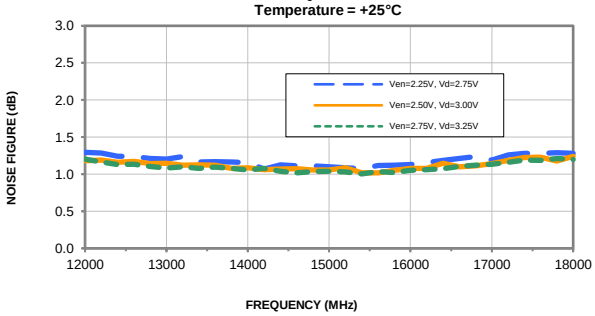
P1dB vs. FREQUENCY & DEVICE VOLTAGE
Temperature = +25°C



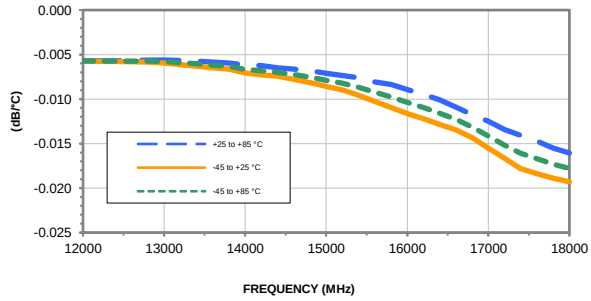
NOISE FIGURE vs. FREQUENCY & TEMPERATURE
Ven = 2.50V, Vd = 3.00V



NOISE FIGURE vs. FREQUENCY & DEVICE VOLTAGE
Temperature = +25°C



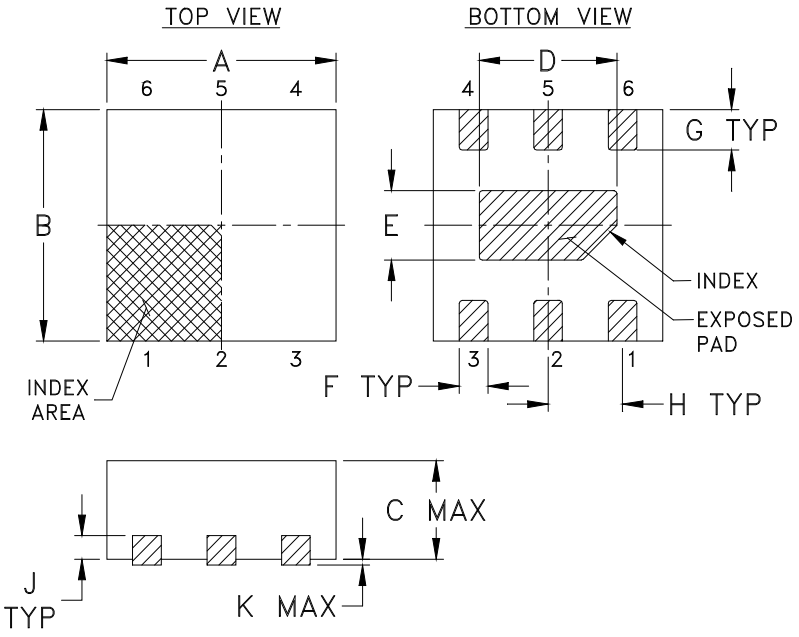
GAIN VARIANTS VS FREQUENCY & TEMPERATURE
INPUT POWER = -25.00dBm, Ven = 2.50V, Vd = 3.00V



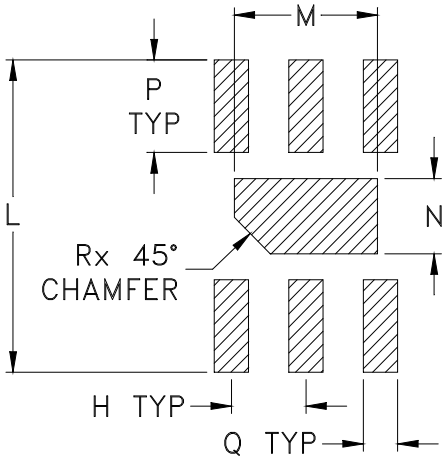
Case Style MC

MC1630-1

Outline Dimensions



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

CASE #.	A	B	C	D	E	F	G	H	J	K	L	M	N	P
MC1630-1	.079 (2.00)	.079 (2.00)	.039 (1.00)	.047 (1.20)	.024 (.60)	.010 (.25)	.014 (.35)	.026 (.65)	.008 (.20)	.002 (.05)	.106 (2.70)	.049 (1.25)	.026 (.65)	.031 (.80)

CASE #.	Q	R	WT, GRAM
MC1630-1	.012 (.30)	.012 (.30)	.010*

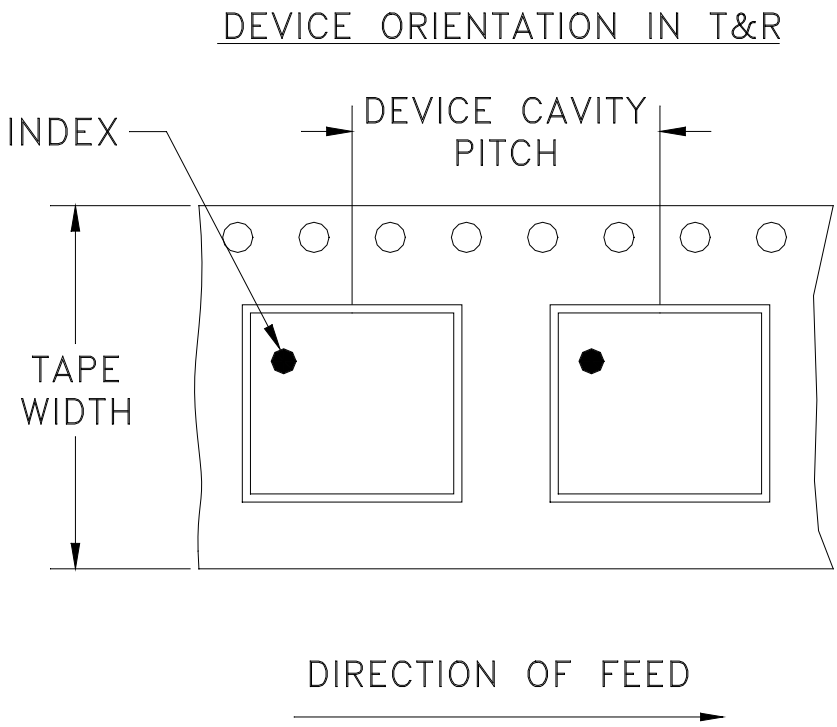
Dimensions are in inches (mm). Tolerances: 2 Pl. ± .01; 3 Pl. ± .005

Notes:

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

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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

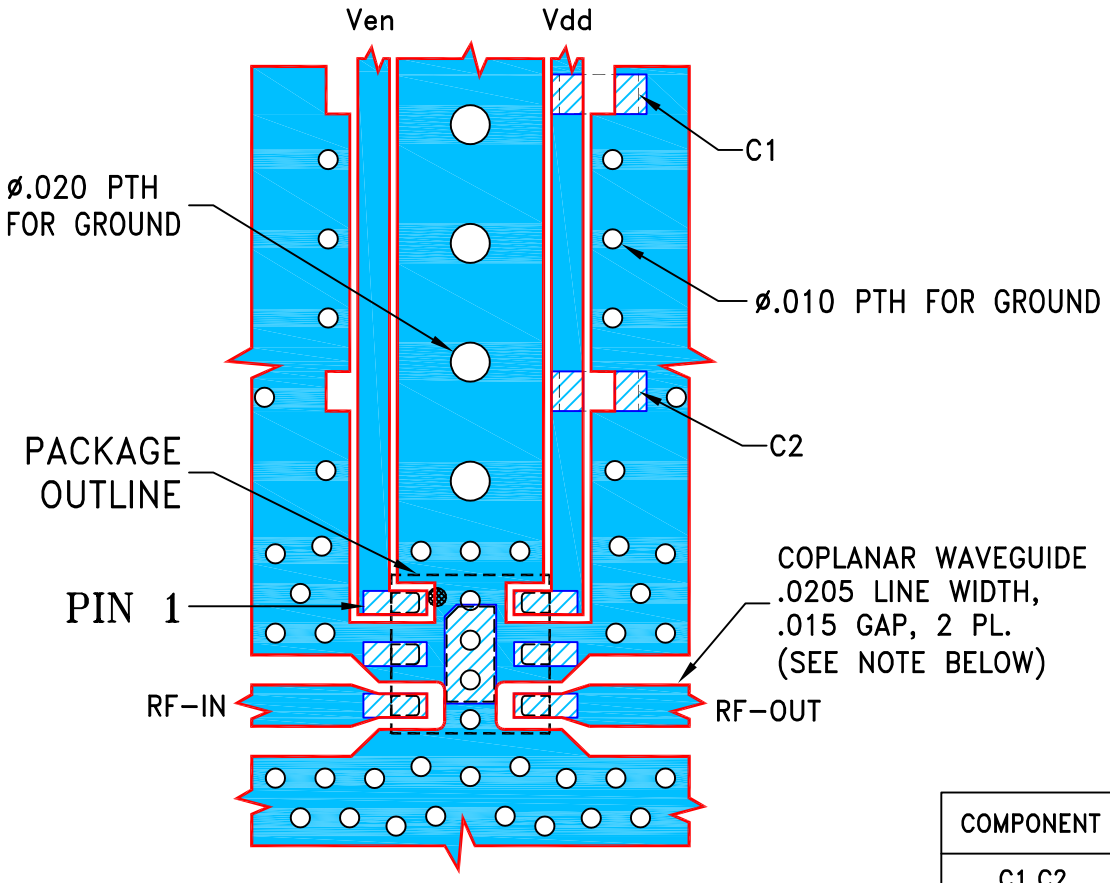
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THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-011113	NEW RELEASE	12/16/21	ITG	IL

SUGGESTED MOUNTING CONFIGURATION FOR MC1630-1 CASE STYLE



COMPONENT	SIZE
C1,C2	0402

NOTES:

1. TRACE WIDTH AND GAP ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010";
   COPPER: 1/2 OZ. EACH SIDE.
   FOR OTHER MATERIALS LINE WIDTH AND GAP MAY NEED TO BE MODIFIED.
2. CHIP COMPONENT FOOT PRINTS SHOWN FOR REFERENCE. FOR COMPONENT VALUES REFER TO TB-TSY-173LN+.
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	12/16/21
TOLERANCES ON:	CHECKED	GF	12/16/21
2 PL DECIMALS ±	APPROVED	IL	12/16/21
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

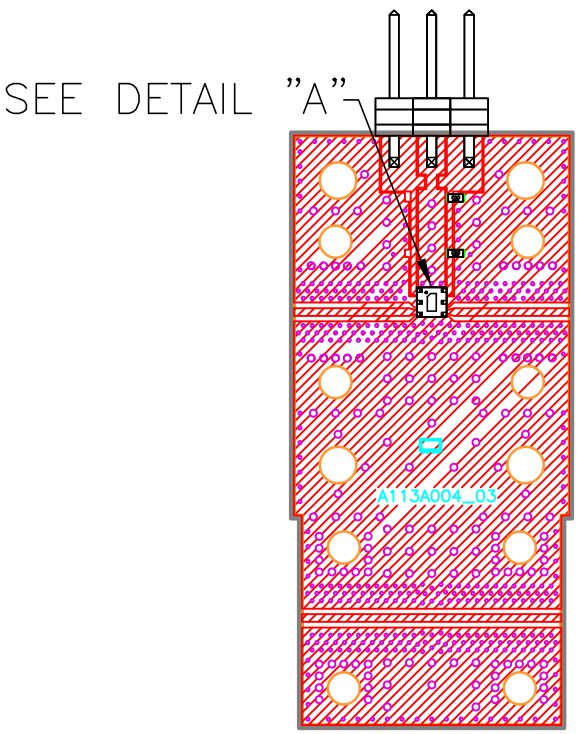
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

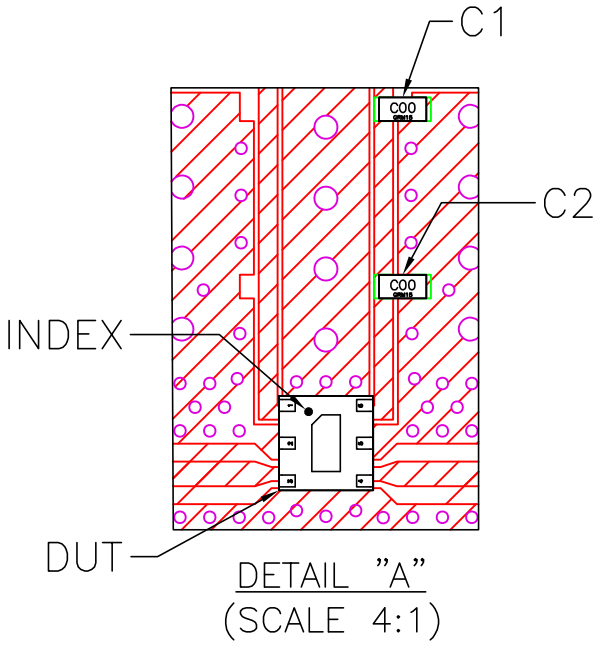
PL, MC1630-1, TB-TSY-173LN+/173LNC+

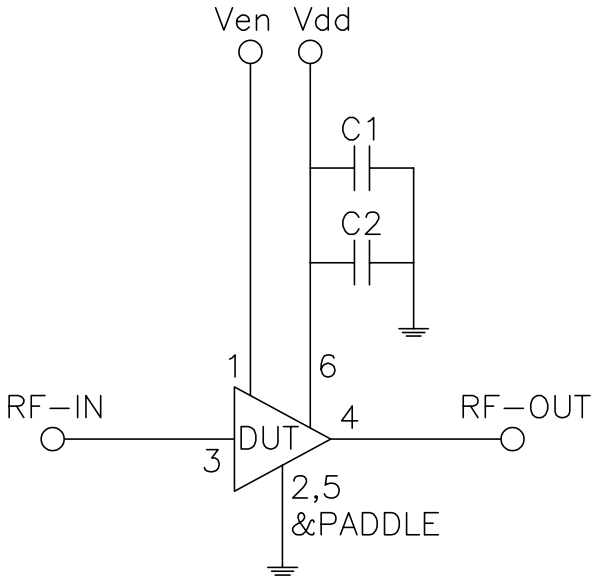
SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-719	OR

FILE:	SCALE:	SHEET:
98PL719	10:1	1 OF 1

Evaluation Board and Circuit







SCHEMATIC DIAGRAM

Component	Size	Value	Part Number	Manufacturer
C1	0402	0.1uF	GRM155R71C104KA88D	Murata
C2	0402	100pF	GRM1555C1H101JA01D	Murata

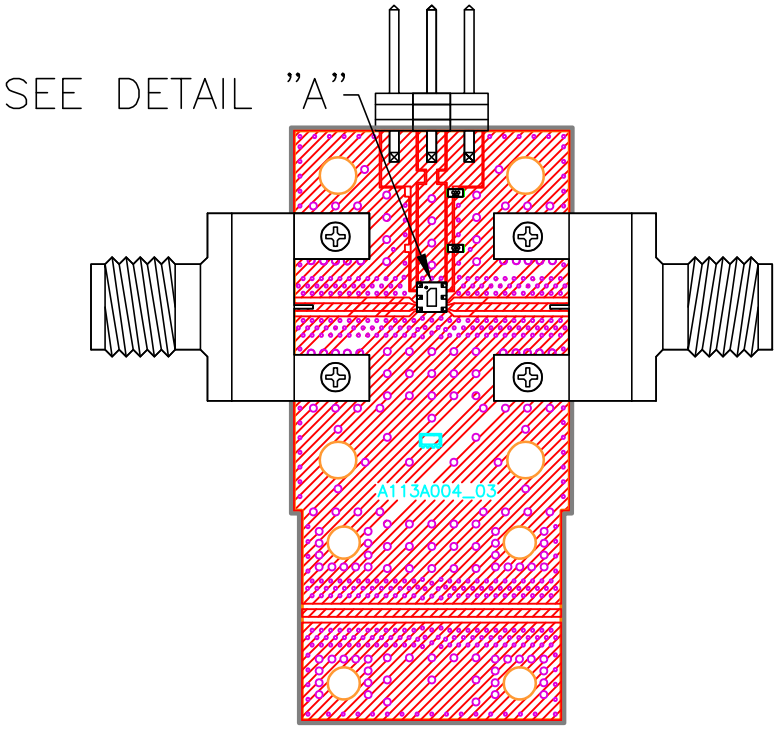
NOTES:

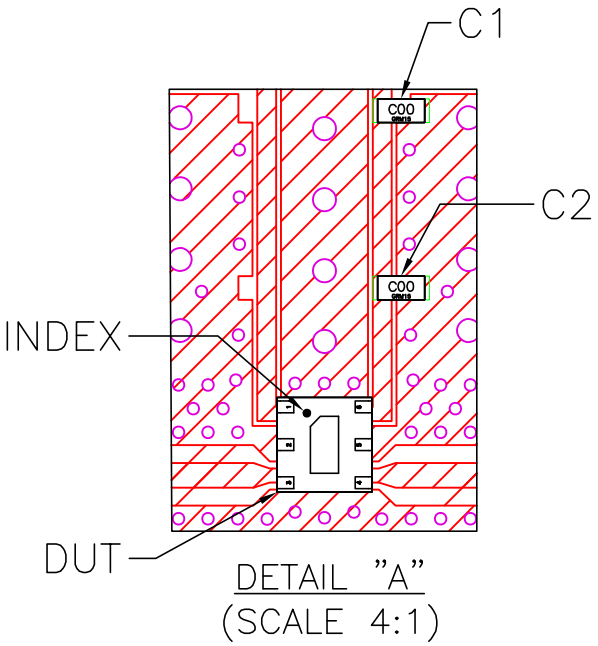
1. PCB Material: Roger RO4350B or equivalent, Dielectric constant=3.5, Thickness=0.010 inch

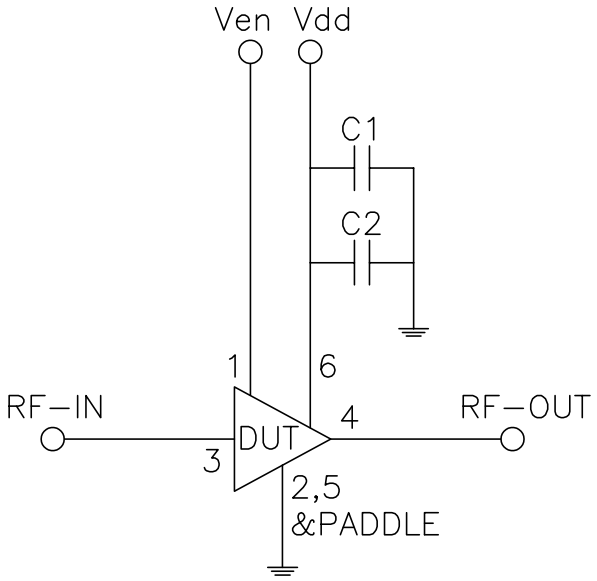
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Evaluation Board and Circuit







SCHEMATIC DIAGRAM

Component	Size	Value	Part Number	Manufacturer
C1	0402	0.1uF	GRM155R71C104KA88D	Murata
C2	0402	100pF	GRM1555C1H101JA01D	Murata

NOTES:

1. 2.92mm Female Connectors.
2. PCB Material: Roger RO4350B or equivalent, Dielectric constant=3.5, Thickness=0.010 inch

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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

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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

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