



MEDIUM POWER, 0.3W

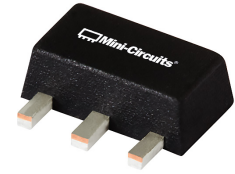
# Monolithic Amplifier

## GVA-92+

50Ω 869 to 2170 MHz

### THE BIG DEAL

- Medium power, +24.1 dBm typ. at 920 MHz at P3dB
- High gain, 21.2 dB typ.
- High power added efficiency, up to 50%
- Usable over 10 to 3600 MHz in balanced amplifiers



Generic photo used for illustration purposes only

CASE STYLE: DF782

### APPLICATIONS

- Base station infrastructure
- LTE
- WCDMA

#### +RoHS Compliant

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

### PRODUCT OVERVIEW

Mini-Circuits' GVA-92+ is an advanced wideband amplifier fabricated using GaAs HBT technology. It offers high gain and excellent output power with high Power Added Efficiency (PAE) in application bands. Application circuits may also be developed to achieve outstanding performance significantly beyond the specified operating frequency range (see application note AN-60-066). Housed in an SOT-89 package, it has repeatable performance from lot to lot and very good thermal performance.

### KEY FEATURES

Feature	Advantages
Optimized over 869 – 960 MHz and 2110 – 2170 MHz	Matched for best Power Added Efficiency in primary wireless communication bands: cellular and LTE. Application circuit with component values provided to minimize design effort on customer end.
Medium power output at P1dB: <ul style="list-style-type: none"> <li>• +23.3 dBm over 869 – 960 MHz</li> <li>• +23.8 dBm over 2110 - 2170</li> </ul>	With a power added efficiency of 45 – 54%, GVA-92+ delivers high power with low DC power consumption.
High gain: <ul style="list-style-type: none"> <li>• 21.2 dB typ. at 920 MHz</li> <li>• 15.5 dB typ. at 2140 MHz</li> </ul>	High gain results in fewer amplifier stages and lower system design cost.
Excellent ESD: <ul style="list-style-type: none"> <li>• HBM: class 1C (1000 to &lt;2000V)</li> <li>• MM: class M1 (50 to &lt;100V)</li> </ul>	Built-in ESD protection makes this amplifier a robust product.
Usable gain unmatched 10 – 29 dB over 10 to 3600 MHz	Usable over octave bandwidths in balanced amplifiers. Refer to application note AN-60-066.





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50Ω 869 to 2170 MHz

## ELECTRICAL SPECIFICATIONS<sup>1</sup> AT +25°C AND VCC=+5 V, UNLESS NOTED

Parameter	Condition (MHz)	900 MHz Match			Condition (MHz)	2100 MHz Match			Units
		Min.	Typ.	Max.		Min.	Typ.	Max.	
Frequency Range		869		960		2110		2170	MHz
Gain	869		21.6		2110		15.4		dB
	920	19.1	21.2	23.3	2140	14.0	15.5	17.1	
	960		20.7		2170		15.5		
Input Return Loss	869		10.8		2110		12.6		dB
	920		10.6		2140		14.6		
	960		9.9		2170		16.8		
Output Return Loss	869		10.7		2110		10.8		dB
	920		9.7		2140		10.6		
	960		9.2		2170		10.4		
Reverse Isolation	869 - 920		33.6		2110 - 2170		29.8		dB
Output Power at 1dB Compression <sup>2</sup>	869		+23.2		2110		+23.7		dBm
	920		+23.3		2140		+23.8		
	960		+23.3		2170		+23.8		
Output Power at 3dB Compression	869		+24.1		2110		+24.8		dBm
	920		+24.1		2140		+24.9		
	960		+24.1		2170		+24.9		
Output IP3	869		+40.9		2110		+41.3		dBm
	920		+42.0		2140		+41.1		
	960		+43.6		2170		+41.6		
Efficiency Power Added at P1dB (PAE)	869 - 920		45.4		2110 - 2170		50		%
Noise Figure	869		6.0		2110		5.5		dB
	920		6.0		2140		5.6		
	960		6.0		2170		5.3		
Device Operating Voltage (Vcc)		+4.8	+5.0	+5.2		+4.8	+5.0	+5.2	V
Device Operating Current <sup>2</sup>			99.1	119			99.1	119	mA
Device Current Variation vs. Temperature <sup>3</sup>			41				66		μA/°C
Device Current Variation vs. Voltage			0.040				0.043		mA/mW
Thermal Resistance, junction-to-ground lead			94.8				94.8		°C/W

1. Measured on Mini-Circuits Characterization test board TB-820+ (900 MHz match) and TB-821+ (2100 MHz match). See Characterization Test Circuit (Fig. 1).

2. Current with no RF or small signal, decreases by 10% typ with 900 MHz and increases by 10% typ with 2100 MHz match.

3. Current at 85°C — Current at -45°C/130



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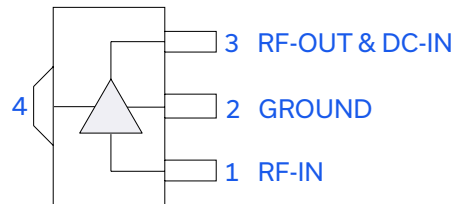
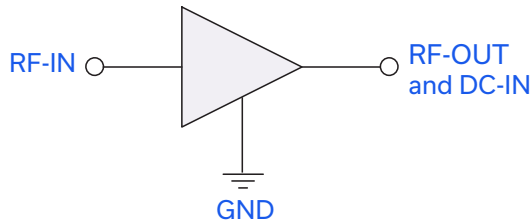
50Ω 869 to 2170 MHz

## MAXIMUM RATINGS<sup>4</sup>

Parameter	Ratings		
Operating Temperature (ground lead)	-40°C to 85°C		
Storage Temperature	-65°C to 150°C		
Power Dissipation	0.68 W		
Input Power (CW) <sup>(1)</sup>	900 MHz	Continuous	5 Minutes Max.
	2100 MHz	+14 dBm	+30 dBm
DC Voltage on Pin 3	+21 dBm	+30 dBm	
DC Voltage on Pin 3	+6 V		

(4) Permanent damage may occur if any of these limits are exceeded. Electrical maximum ratings are not intended for continuous normal operation unless specified.

## SIMPLIFIED SCHEMATIC AND PIN DESCRIPTION



Function	Pin Number	Description
RF-IN	1	RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation.
RF-OUT and DC-IN	3	RF output and bias pin. DC voltage is present on this pin; therefore a DC blocking capacitor is necessary for proper operation. An RF choke is needed to feed DC bias without loss of RF signal due to the bias connection, as shown in "Recommended Application Circuit", Fig. 2
GND	2,4	Connections to ground. Use via holes as shown in "Suggested Layout for PCB Design" to reduce ground path inductance for best performance.



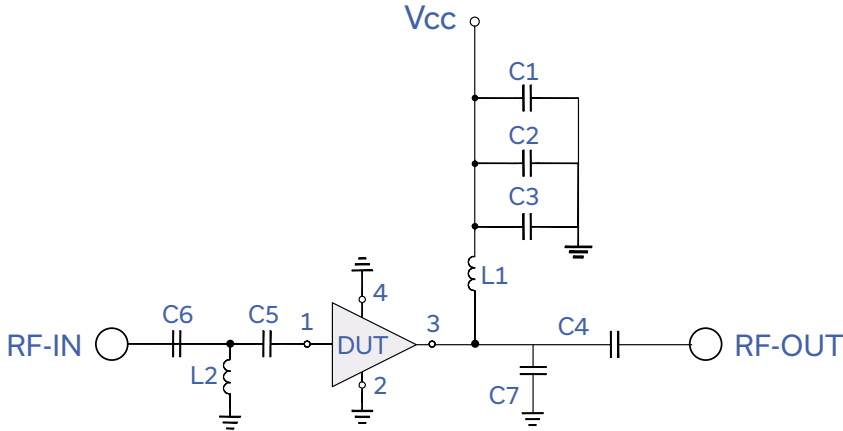
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# Monolithic Amplifier

## GVA-92+

50Ω 869 to 2170 MHz

### CHARACTERIZATION TEST AND APPLICATION CIRCUIT



Component	TB-820+ 896-920 MHz		TB-821+ 2110-2170 MHz	
	Value	Size	Value	Size
C1	10.0μF	1206	10.0μF	1206
C2	0.1 μF	0603	0.1 μF	0603
C3	10 pF	0402	8.2 pF	0402
C4	100 pF	0402	47 pF	0402
C5	5.6 pF	0402	1.3 pF	0402
C6	100 pF	0402	47 pF	0402
C7	Not Used		0.5 pF	0402
L1	18 nH	0603	9.5 nH	0603
L2	7.5 nH	0402	2.2 nH	0402

Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization test board TB-820+(869-960 MHz) and TB-821+(2110-2170 MHz)

Gain, Return loss, Output power at 1dB compression (P1 dB) , output IP3 (OIP3) and noise figure measured using Agilent's N5242A PNA-X microwave network analyzer.

Conditions:

1. Gain and Return loss:  $P_{IN} = -25\text{dBm}$
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 8 dBm/tone at output.

### PRODUCT MARKING



Marking may contain other features or characters for internal lot control



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50Ω 869 to 2170 MHz

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	DF782 (SOT 89) Plastic package, exposed paddle lead finish: Matte-tin
Tape & Reel Standard quantities available on reel	F55 7" reels with 20, 50, 100, 200, 500 or 1K devices
Suggested Layout for PCB Design	PL-370
Evaluation Board	TB-820+ (869-960 MHz) TB-821+ (2110-2140 MHz)
Environmental Ratings	ENV08T1

### ESD RATING

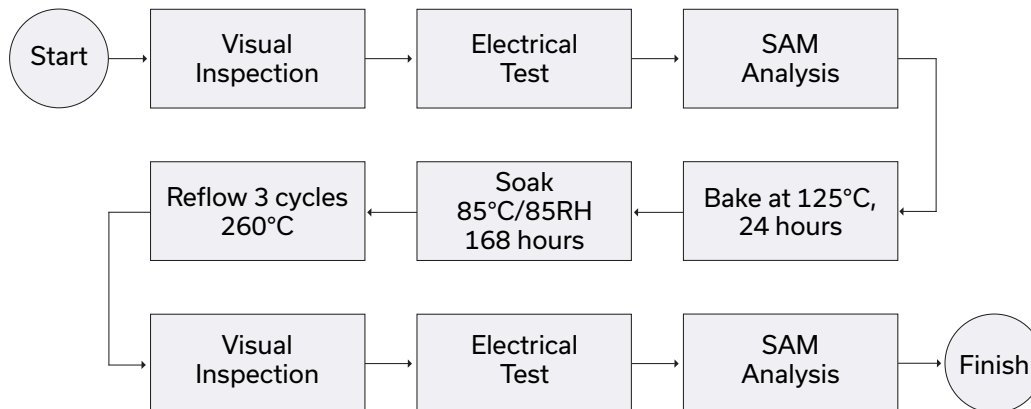
Human Body Model (HBM): Class 1C (1000 to <2000V) in accordance with ANSI/ESD STM 5.1 - 2001

Machine Model (MM): Class M1 (Pass 75V) in accordance with ANSI/ESD STM5.2-2009

### 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](http://www.minicircuits.com/MCLStore/terms.jsp)



## Typical Performance Data

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

**Definitions:**

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

900 MHz Match										
TEST CONDITIONS: Vd = 5V, Id = 108.61 mA @ Temperature = +25degC										
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	3dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dBm)	(dB)
800	22.05	34.30	9.81	13.15	1.82	1.01	38.86	23.20	23.81	6.45
820	21.94	34.11	10.52	12.43	1.83	0.98	39.40	23.30	23.87	6.45
840	21.82	34.08	11.01	11.81	1.86	0.96	39.64	23.33	23.88	6.37
860	21.67	33.85	11.32	11.26	1.84	0.95	40.30	23.38	23.93	6.36
869	21.59	33.83	11.36	11.04	1.85	0.94	40.24	23.44	24.13	6.35
880	21.50	33.80	11.39	10.78	1.85	0.93	40.44	23.53	24.29	6.33
900	21.31	33.73	11.30	10.39	1.86	0.92	40.69	23.54	24.13	6.30
910	21.22	33.72	11.17	10.21	1.87	0.92	41.00	23.43	24.30	6.30
920	21.13	33.57	11.04	10.03	1.85	0.92	40.97	23.38	24.24	6.27
930	21.03	33.72	10.87	9.89	1.89	0.92	41.14	23.57	24.36	6.27
950	20.83	33.67	10.50	9.60	1.90	0.91	41.27	23.69	24.44	6.33
960	20.72	33.65	10.30	9.47	1.90	0.91	42.08	23.59	24.29	6.30
970	20.62	33.66	10.10	9.35	1.91	0.91	41.30	23.69	24.23	6.30
980	20.52	33.69	9.89	9.23	1.93	0.92	41.15	23.59	24.40	6.29
990	20.41	33.64	9.68	9.13	1.92	0.92	41.24	23.71	24.44	6.26
1000	20.31	33.75	9.47	9.04	1.95	0.92	40.74	23.76	24.19	6.28

2100 MHz Match										
TEST CONDITIONS: Vd = 5V, Id = 106.16 mA @ Temperature = +25degC										
2000	15.16	31.22	8.28	11.79	2.51	1.08	41.60	23.86	24.85	6.11
2020	15.28	30.88	9.06	11.75	2.45	1.05	39.17	23.97	25.23	5.97
2040	15.36	30.53	9.94	11.63	2.40	1.02	41.26	24.02	24.99	5.87
2060	15.46	30.39	10.82	11.63	2.39	1.00	41.11	23.72	25.03	5.78
2080	15.52	30.26	11.71	11.52	2.39	0.98	41.73	23.87	25.07	5.72
2100	15.57	30.04	12.76	11.45	2.36	0.97	42.19	23.86	25.07	5.67
2110	15.58	29.99	13.25	11.37	2.36	0.96	43.21	24.20	25.09	5.57
2140	15.58	29.79	14.82	11.17	2.34	0.94	40.81	24.08	25.21	5.55
2170	15.58	29.77	16.21	11.11	2.36	0.92	40.18	24.15	25.26	5.55
2180	15.57	29.60	16.60	11.08	2.33	0.92	40.40	24.15	25.13	5.44
2200	15.55	29.58	17.12	11.03	2.34	0.91	42.31	24.13	25.53	5.39

## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

900 MHz Match										
TEST CONDITIONS: Vd = 4.75V, Id =98.15 mA @ Temperature = +25degC										
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	3dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dBm)	(dB)
800	21.99	33.98	9.66	12.69	1.76	1.01	38.35	22.51	23.20	6.18
820	21.89	33.84	10.35	12.01	1.77	0.98	39.14	22.64	23.26	6.17
840	21.76	33.69	10.86	11.41	1.77	0.96	39.32	22.68	23.28	6.08
860	21.61	33.67	11.18	10.88	1.80	0.94	40.12	22.77	23.34	6.08
869	21.53	33.59	11.23	10.67	1.79	0.93	40.34	22.85	23.54	6.05
880	21.44	33.54	11.29	10.43	1.80	0.93	40.38	22.91	23.69	6.02
900	21.25	33.49	11.22	10.04	1.81	0.92	40.67	22.93	23.54	5.99
910	21.16	33.52	11.10	9.87	1.83	0.91	41.19	22.84	23.71	6.00
920	21.07	33.45	10.97	9.69	1.82	0.91	41.19	22.80	23.66	5.96
930	20.97	33.44	10.81	9.56	1.83	0.91	41.36	22.99	23.77	5.98
950	20.77	33.43	10.46	9.29	1.85	0.91	41.71	23.12	23.86	6.05
960	20.66	33.38	10.26	9.15	1.84	0.90	42.50	23.01	23.71	5.98
970	20.56	33.45	10.06	9.04	1.87	0.90	42.08	23.14	23.64	5.99
980	20.46	33.44	9.86	8.93	1.87	0.90	41.82	23.02	23.82	5.99
990	20.35	33.45	9.67	8.83	1.88	0.91	41.71	23.14	23.85	5.99
1000	20.24	33.50	9.47	8.74	1.90	0.91	41.47	23.19	23.61	5.99

2100 MHz Match										
TEST CONDITIONS: Vd = 4.75V, Id =94.64 mA @ Temperature = +25degC										
2000	14.97	31.05	8.20	11.57	2.49	1.08	40.28	23.08	23.72	5.83
2020	15.09	30.75	8.98	11.51	2.45	1.05	39.96	23.26	24.09	5.72
2040	15.19	30.46	9.83	11.47	2.41	1.03	40.21	23.27	23.84	5.62
2060	15.30	30.22	10.71	11.45	2.38	1.00	39.45	22.92	23.77	5.53
2080	15.38	30.01	11.64	11.39	2.35	0.98	39.80	23.10	23.73	5.46
2100	15.42	29.91	12.61	11.30	2.35	0.97	40.40	23.10	23.73	5.42
2110	15.43	29.81	13.12	11.27	2.34	0.96	41.83	23.46	23.78	5.30
2140	15.42	29.65	14.58	11.04	2.33	0.94	41.25	23.34	23.83	5.29
2170	15.43	29.52	15.97	10.97	2.33	0.92	40.77	23.37	23.81	5.26
2180	15.43	29.52	16.32	10.97	2.34	0.92	41.81	23.42	23.70	5.17
2200	15.41	29.37	16.88	10.92	2.31	0.91	41.29	23.39	24.07	5.10

## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

900 MHz Match										
TEST CONDITIONS: Vd = 5.25V, Id = 117.83 mA @ Temperature = +25degC										
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	3dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dBm)	(dB)
800	22.07	34.57	9.94	13.71	1.89	1.02	37.86	23.80	24.40	6.74
820	21.96	34.39	10.65	12.96	1.90	0.99	38.09	23.91	24.47	6.73
840	21.84	34.20	11.13	12.30	1.89	0.97	38.34	23.94	24.46	6.64
860	21.69	34.20	11.44	11.73	1.92	0.96	38.74	23.94	24.51	6.65
869	21.61	34.01	11.48	11.49	1.90	0.95	38.71	24.02	24.70	6.62
880	21.52	34.01	11.49	11.23	1.91	0.94	38.73	24.09	24.86	6.60
900	21.34	34.01	11.38	10.81	1.94	0.93	38.88	24.14	24.71	6.59
910	21.24	33.97	11.26	10.62	1.94	0.93	38.99	24.02	24.87	6.59
920	21.15	34.09	11.11	10.43	1.97	0.93	38.90	23.97	24.80	6.56
930	21.05	34.01	10.94	10.28	1.97	0.93	38.97	24.14	24.93	6.58
950	20.85	33.84	10.55	9.99	1.95	0.93	39.10	24.25	25.01	6.64
960	20.75	33.92	10.34	9.85	1.97	0.93	39.52	24.18	24.86	6.60
970	20.65	33.84	10.13	9.71	1.97	0.93	39.10	24.25	24.79	6.59
980	20.54	33.86	9.92	9.60	1.98	0.93	39.04	24.16	24.97	6.61
990	20.44	33.91	9.70	9.48	2.00	0.93	39.14	24.28	25.01	6.57
1000	20.33	33.92	9.50	9.38	2.01	0.93	38.72	24.32	24.76	6.63

2100 MHz Match										
TEST CONDITIONS: Vd = 5.25V, Id = 115.77 mA @ Temperature = +25degC										
2000	15.19	31.19	8.35	12.00	2.51	1.08	37.12	24.51	25.47	6.31
2020	15.32	31.08	9.14	11.94	2.52	1.05	37.68	24.66	25.86	6.19
2040	15.40	30.74	10.04	11.81	2.47	1.03	37.79	24.65	25.58	6.09
2060	15.51	30.51	10.94	11.77	2.43	1.00	37.92	24.37	25.65	6.00
2080	15.56	30.38	11.84	11.67	2.42	0.98	38.38	24.60	25.66	5.96
2100	15.61	30.34	12.88	11.59	2.44	0.97	38.43	24.58	25.70	5.90
2110	15.61	30.15	13.39	11.51	2.40	0.96	38.38	24.85	25.69	5.79
2140	15.61	29.98	14.98	11.34	2.39	0.94	38.65	24.77	25.82	5.78
2170	15.62	29.98	16.38	11.27	2.42	0.92	39.41	24.82	25.87	5.77
2180	15.60	29.85	16.79	11.24	2.40	0.92	39.45	24.81	25.72	5.67
2200	15.58	29.68	17.29	11.17	2.36	0.91	39.71	24.78	26.11	5.63



## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

900 MHz Match										
TEST CONDITIONS: Vd = 5V, Id =96.69 mA @ Temperature = -45degC										
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	3dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dBm)	(dB)
800	22.55	34.30	9.56	11.55	1.69	0.99	42.24	23.40	24.06	5.51
820	22.44	34.13	10.23	10.99	1.69	0.96	44.44	23.53	24.13	5.51
840	22.30	33.97	10.67	10.46	1.70	0.94	43.33	23.58	24.15	5.42
860	22.14	33.90	10.94	10.01	1.71	0.92	43.04	23.67	24.20	5.45
869	22.06	33.96	10.97	9.82	1.73	0.91	43.72	23.75	24.40	5.40
880	21.96	33.99	11.00	9.60	1.75	0.91	44.08	23.81	24.57	5.38
900	21.77	33.84	10.88	9.28	1.75	0.89	42.30	23.84	24.41	5.40
910	21.67	33.75	10.76	9.11	1.74	0.89	42.04	23.75	24.58	5.39
920	21.58	33.79	10.61	8.97	1.75	0.89	42.98	23.70	24.51	5.35
930	21.47	33.80	10.45	8.84	1.77	0.88	42.94	23.89	24.64	5.37
950	21.27	33.63	10.09	8.59	1.75	0.88	41.79	24.01	24.73	5.48
960	21.16	33.75	9.90	8.47	1.78	0.88	41.18	23.94	24.58	5.44
970	21.05	33.79	9.70	8.36	1.79	0.88	41.84	24.05	24.50	5.41
980	20.95	33.73	9.51	8.26	1.79	0.88	42.10	23.93	24.69	5.42
990	20.84	33.78	9.31	8.16	1.81	0.88	42.10	24.05	24.71	5.41
1000	20.73	33.72	9.12	8.07	1.80	0.88	42.07	24.09	24.46	5.39

2100 MHz Match										
TEST CONDITIONS: Vd = 5V, Id =96.77 mA @ Temperature = -45degC										
2000	15.61	31.08	8.11	11.56	2.31	1.08	39.86	23.53	23.82	5.18
2020	15.69	30.89	8.84	11.35	2.31	1.05	41.15	23.70	24.18	5.05
2040	15.78	30.46	9.73	11.22	2.25	1.02	39.15	23.67	23.95	4.98
2060	15.90	30.25	10.64	11.20	2.22	1.00	41.30	23.37	23.87	4.88
2080	15.99	30.15	11.61	11.19	2.22	0.98	39.66	23.50	23.83	4.82
2100	16.04	29.88	12.62	11.10	2.18	0.96	39.76	23.49	23.84	4.78
2110	16.05	29.73	13.17	11.06	2.16	0.95	39.30	23.73	23.89	4.70
2140	16.03	29.75	14.64	10.79	2.20	0.93	38.32	23.65	23.92	4.68
2170	16.05	29.59	16.04	10.70	2.19	0.91	38.35	23.64	23.94	4.68
2180	16.04	29.54	16.39	10.67	2.18	0.91	38.10	23.67	23.83	4.56
2200	16.02	29.35	16.83	10.59	2.15	0.90	39.32	23.62	24.19	4.53

## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

900 MHz Match										
TEST CONDITIONS: Vd = 4.75V, Id =87.05 mA @ Temperature = -45degC										
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	3dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dBm)	(dB)
800	22.46	34.04	9.43	11.30	1.64	0.99	40.18	22.66	23.39	5.25
820	22.34	33.83	10.09	10.74	1.64	0.96	42.02	22.81	23.47	5.26
840	22.20	33.75	10.55	10.23	1.66	0.93	42.22	22.89	23.50	5.16
860	22.05	33.59	10.84	9.79	1.66	0.91	43.16	23.01	23.57	5.17
869	21.97	33.69	10.88	9.60	1.68	0.91	45.47	23.10	23.78	5.14
880	21.87	33.56	10.92	9.39	1.68	0.90	46.13	23.16	23.94	5.14
900	21.68	33.53	10.82	9.06	1.69	0.89	43.61	23.16	23.78	5.11
910	21.58	33.48	10.70	8.90	1.69	0.88	43.99	23.12	23.96	5.12
920	21.49	33.42	10.57	8.76	1.69	0.88	46.04	23.08	23.89	5.08
930	21.38	33.48	10.42	8.64	1.71	0.88	48.39	23.29	24.03	5.11
950	21.17	33.45	10.06	8.40	1.72	0.87	44.04	23.39	24.12	5.21
960	21.07	33.54	9.88	8.27	1.74	0.87	43.39	23.33	23.97	5.12
970	20.96	33.42	9.69	8.17	1.73	0.87	45.02	23.44	23.89	5.12
980	20.85	33.44	9.51	8.07	1.74	0.87	45.74	23.33	24.08	5.12
990	20.75	33.48	9.30	7.98	1.75	0.87	45.23	23.45	24.10	5.13
1000	20.64	33.38	9.11	7.89	1.74	0.87	44.94	23.49	23.85	5.12

2100 MHz Match										
TEST CONDITIONS: Vd = 4.75V, Id =87.11 mA @ Temperature = -45degC										
2000	15.51	30.97	8.02	11.37	2.29	1.08	44.91	23.54	23.80	5.00
2020	15.58	30.65	8.75	11.14	2.25	1.05	43.69	23.72	24.19	4.87
2040	15.67	30.38	9.63	11.03	2.23	1.02	44.16	23.71	23.96	4.78
2060	15.80	30.12	10.53	11.01	2.20	1.00	42.36	23.40	23.87	4.71
2080	15.89	29.97	11.49	11.01	2.19	0.98	41.51	23.55	23.84	4.63
2100	15.94	29.78	12.48	10.91	2.17	0.96	41.15	23.52	23.85	4.61
2110	15.96	29.71	13.01	10.88	2.17	0.95	40.08	23.79	23.89	4.52
2140	15.94	29.60	14.47	10.61	2.17	0.92	39.33	23.68	23.93	4.49
2170	15.95	29.44	15.86	10.51	2.16	0.91	40.07	23.68	23.95	4.52
2180	15.95	29.40	16.21	10.50	2.16	0.90	39.92	23.69	23.83	4.36
2200	15.92	29.25	16.67	10.40	2.14	0.89	39.94	23.65	24.19	4.34

## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

900 MHz Match										
TEST CONDITIONS: Vd = 5.25V, Id = 108.86 mA @ Temperature = -45degC										
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	3dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dBm)	(dB)
800	22.68	34.54	9.69	11.82	1.72	0.99	43.79	24.00	24.66	5.80
820	22.56	34.35	10.34	11.24	1.73	0.96	44.93	24.13	24.71	5.83
840	22.42	34.27	10.79	10.70	1.74	0.94	43.48	24.19	24.72	5.74
860	22.26	34.09	11.04	10.24	1.74	0.92	42.71	24.21	24.76	5.75
869	22.18	34.13	11.06	10.06	1.76	0.92	43.53	24.30	24.96	5.74
880	22.08	34.06	11.07	9.85	1.76	0.91	43.44	24.38	25.13	5.71
900	21.89	33.99	10.92	9.51	1.77	0.90	42.35	24.38	24.98	5.70
910	21.79	33.87	10.79	9.35	1.75	0.89	42.18	24.29	25.14	5.70
920	21.70	33.95	10.64	9.20	1.78	0.89	42.83	24.25	25.07	5.68
930	21.59	34.02	10.47	9.07	1.80	0.89	42.72	24.47	25.20	5.69
950	21.39	33.98	10.09	8.81	1.81	0.89	41.67	24.54	25.28	5.78
960	21.28	34.00	9.90	8.69	1.82	0.89	41.37	24.47	25.14	5.72
970	21.17	34.03	9.70	8.58	1.83	0.89	41.68	24.57	25.06	5.73
980	21.07	33.94	9.50	8.47	1.82	0.89	42.10	24.48	25.24	5.74
990	20.96	34.00	9.30	8.38	1.84	0.89	42.19	24.60	25.27	5.74
1000	20.85	34.10	9.11	8.29	1.87	0.89	42.32	24.64	25.02	5.74

2100 MHz Match										
TEST CONDITIONS: Vd = 5.25V, Id = 109.39 mA @ Temperature = -45degC										
2000	15.73	31.18	8.19	11.77	2.33	1.08	40.09	25.05	25.88	5.41
2020	15.81	30.95	8.92	11.55	2.31	1.05	40.99	25.24	26.41	5.28
2040	15.90	30.62	9.84	11.43	2.27	1.02	40.56	25.23	26.04	5.21
2060	16.02	30.35	10.75	11.42	2.23	1.00	39.31	24.99	26.32	5.13
2080	16.11	30.29	11.76	11.42	2.24	0.98	40.25	25.16	26.15	5.08
2100	16.16	30.05	12.78	11.31	2.21	0.96	40.42	25.18	26.33	5.01
2110	16.17	29.90	13.32	11.27	2.19	0.95	39.61	25.39	26.30	4.97
2140	16.15	29.86	14.82	11.00	2.21	0.93	38.73	25.36	26.47	4.94
2170	16.16	29.75	16.23	10.90	2.21	0.91	38.69	25.39	26.45	4.96
2180	16.16	29.71	16.57	10.88	2.21	0.91	38.06	25.40	26.38	4.82
2200	16.13	29.52	16.99	10.79	2.18	0.90	39.18	25.35	26.68	4.79

## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

900 MHz Match										
TEST CONDITIONS: Vd = 5V, Id = 103.87 mA @ Temperature = +85degC										
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	3dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dBm)	(dB)
800	21.44	34.15	10.02	14.41	1.95	1.03	37.31	23.14	23.68	6.89
820	21.34	33.86	10.73	13.64	1.93	1.00	37.76	23.24	23.74	6.89
840	21.22	33.83	11.20	12.95	1.96	0.98	37.92	23.27	23.75	6.79
860	21.08	33.77	11.51	12.36	1.98	0.97	38.38	23.29	23.80	6.78
869	21.01	33.63	11.55	12.13	1.96	0.96	38.61	23.39	24.00	6.76
880	20.92	33.67	11.58	11.85	1.98	0.96	38.67	23.47	24.15	6.74
900	20.74	33.55	11.48	11.42	1.98	0.95	38.65	23.50	24.00	6.72
910	20.65	33.63	11.35	11.22	2.01	0.95	38.73	23.38	24.16	6.72
920	20.56	33.42	11.21	11.03	1.97	0.94	38.82	23.34	24.10	6.69
930	20.46	33.45	11.05	10.88	1.99	0.94	39.09	23.50	24.22	6.68
950	20.27	33.65	10.67	10.58	2.05	0.95	39.06	23.62	24.31	6.77
960	20.17	33.48	10.46	10.43	2.02	0.94	39.52	23.58	24.16	6.71
970	20.07	33.44	10.27	10.29	2.02	0.94	39.12	23.63	24.09	6.68
980	19.97	33.51	10.06	10.17	2.05	0.95	39.26	23.52	24.26	6.69
990	19.86	33.42	9.85	10.05	2.04	0.95	39.28	23.65	24.30	6.69
1000	19.76	33.56	9.65	9.95	2.07	0.95	38.90	23.68	24.07	6.71

2100 MHz Match										
TEST CONDITIONS: Vd = 5V, Id = 105.45 mA @ Temperature = +85degC										
2000	14.57	31.23	8.36	11.98	2.70	1.08	36.53	23.28	23.74	6.66
2020	14.70	30.91	9.11	11.97	2.65	1.05	36.88	23.48	24.07	6.50
2040	14.79	30.60	9.95	11.86	2.60	1.03	36.72	23.43	23.82	6.43
2060	14.87	30.47	10.81	11.77	2.59	1.01	37.14	23.09	23.72	6.32
2080	14.92	30.23	11.70	11.67	2.55	0.99	37.14	23.22	23.70	6.25
2100	14.97	30.14	12.71	11.58	2.55	0.97	36.52	23.23	23.73	6.21
2110	14.98	30.09	13.21	11.51	2.55	0.96	37.64	23.54	23.79	6.10
2140	14.98	29.96	14.79	11.37	2.55	0.94	38.04	23.45	23.82	6.07
2170	14.99	29.75	16.27	11.29	2.52	0.93	37.91	23.37	23.80	5.99
2180	14.98	29.63	16.66	11.28	2.50	0.93	37.03	23.40	23.67	5.96
2200	14.95	29.60	17.21	11.22	2.51	0.92	39.15	23.34	24.06	5.89

## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

Output Return Loss = -S22 (dB)

900 MHz Match										
TEST CONDITIONS: Vd = 4.75V, Id = 94.45 mA @ Temperature = +85degC										
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	3dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dBm)	(dB)
800	21.44	33.77	9.82	13.68	1.85	1.02	36.36	22.45	23.06	6.57
820	21.34	33.77	10.52	12.95	1.88	1.00	36.90	22.58	23.12	6.55
840	21.22	33.46	11.01	12.31	1.86	0.98	36.98	22.62	23.14	6.49
860	21.08	33.45	11.34	11.74	1.88	0.96	37.52	22.67	23.19	6.45
869	21.01	33.37	11.38	11.53	1.88	0.95	37.72	22.74	23.40	6.44
880	20.92	33.44	11.44	11.27	1.91	0.95	37.79	22.80	23.55	6.42
900	20.74	33.33	11.36	10.87	1.91	0.94	37.84	22.83	23.40	6.37
910	20.65	33.23	11.24	10.68	1.90	0.94	38.00	22.73	23.56	6.38
920	20.56	33.23	11.13	10.50	1.91	0.93	38.07	22.68	23.51	6.34
930	20.46	33.19	10.96	10.35	1.91	0.93	38.27	22.87	23.62	6.36
950	20.27	33.26	10.61	10.07	1.94	0.93	38.23	22.99	23.70	6.44
960	20.16	33.18	10.42	9.93	1.93	0.93	38.73	22.92	23.56	6.39
970	20.07	33.21	10.22	9.81	1.95	0.93	38.45	23.01	23.49	6.35
980	19.97	33.17	10.02	9.69	1.95	0.93	38.59	22.90	23.66	6.36
990	19.86	33.13	9.82	9.58	1.95	0.93	38.53	23.01	23.70	6.32
1000	19.76	33.15	9.62	9.48	1.96	0.93	38.18	23.05	23.46	6.34

2100 MHz Match										
TEST CONDITIONS: Vd = 4.75V, Id = 94.49 mA @ Temperature = +85degC										
2000	14.52	30.95	8.24	11.79	2.61	1.08	36.40	22.66	23.71	6.42
2020	14.66	30.61	9.00	11.78	2.55	1.05	36.53	22.80	24.07	6.27
2040	14.74	30.34	9.83	11.68	2.52	1.03	36.96	22.88	23.83	6.17
2060	14.82	30.22	10.67	11.58	2.51	1.01	37.38	22.53	23.72	6.07
2080	14.88	30.01	11.54	11.48	2.49	0.99	36.71	22.70	23.71	5.99
2100	14.93	29.86	12.54	11.40	2.47	0.97	37.11	22.68	23.72	5.94
2110	14.93	29.84	13.02	11.33	2.48	0.96	37.46	23.01	23.78	5.85
2140	14.95	29.69	14.59	11.19	2.48	0.94	37.26	22.91	23.81	5.81
2170	14.95	29.54	16.03	11.11	2.46	0.93	37.56	22.95	23.79	5.76
2180	14.94	29.47	16.43	11.09	2.45	0.92	37.75	22.96	23.67	5.69
2200	14.92	29.37	17.02	11.04	2.44	0.92	37.66	22.93	24.06	5.63

## Typical Performance Data

### Definitions:

Input Return Loss = -S11 (dB)

Gain(Power Gain) = S21 (dB)

Reverse Isolation = -S12 (dB)

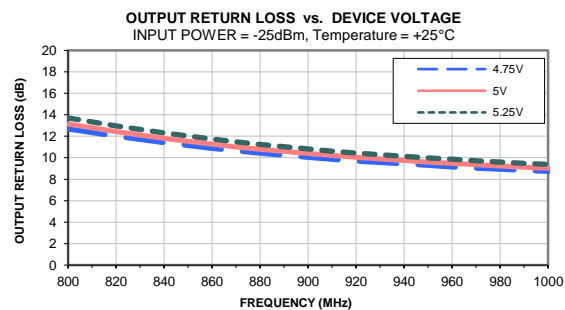
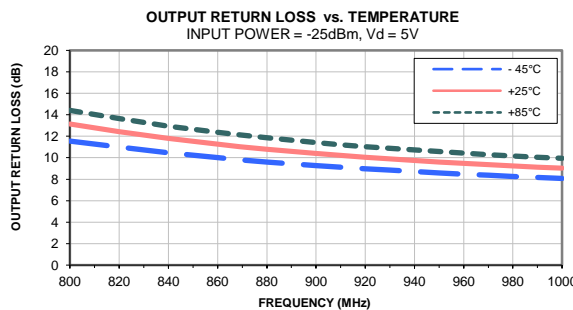
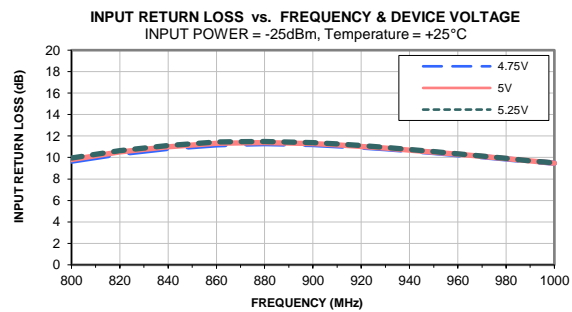
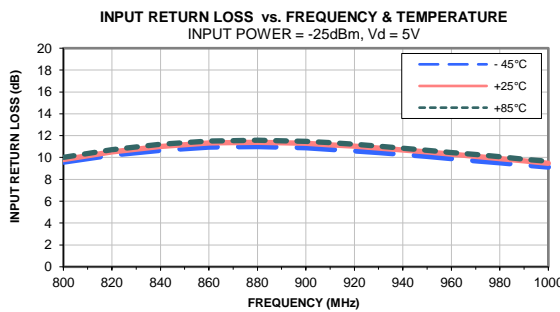
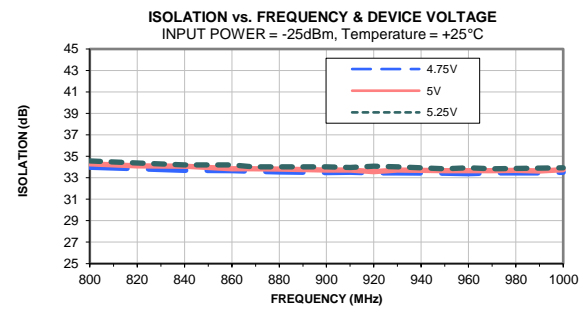
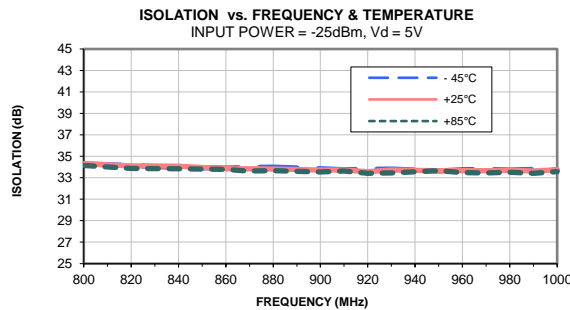
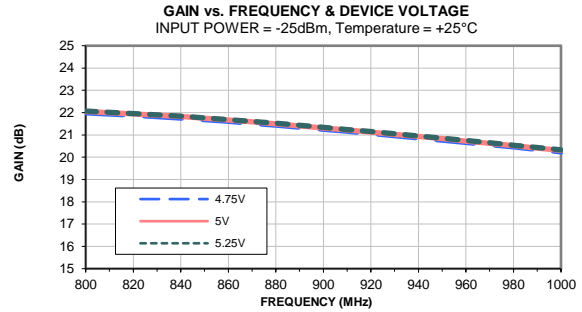
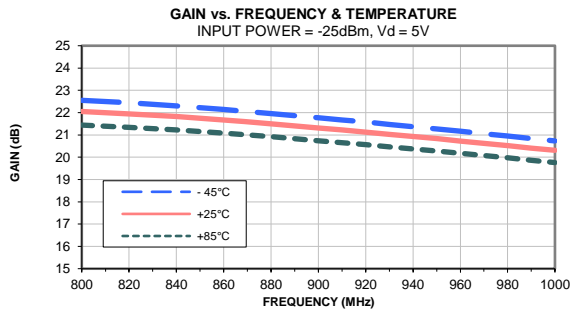
Output Return Loss = -S22 (dB)

900 MHz Match										
TEST CONDITIONS: Vd = 5.25V, Id = 111.49 mA @ Temperature = +85degC										
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	3dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dBm)	(dB)
800	21.40	34.44	10.18	15.16	2.04	1.03	37.57	23.78	24.25	7.12
820	21.30	34.24	10.88	14.34	2.04	1.01	37.93	23.89	24.32	7.15
840	21.17	33.97	11.36	13.60	2.02	0.99	38.06	23.89	24.31	7.06
860	21.03	33.94	11.65	12.96	2.04	0.98	38.54	23.93	24.36	7.04
869	20.96	33.92	11.68	12.71	2.05	0.97	38.68	23.99	24.56	7.02
880	20.87	33.80	11.71	12.42	2.04	0.96	38.76	24.05	24.71	6.99
900	20.69	33.78	11.57	11.97	2.06	0.96	38.74	24.10	24.57	6.99
910	20.60	33.74	11.44	11.76	2.06	0.96	38.97	23.99	24.73	6.99
920	20.52	33.74	11.28	11.56	2.07	0.96	38.86	23.94	24.66	6.95
930	20.42	33.81	11.11	11.40	2.10	0.96	39.07	24.10	24.78	6.96
950	20.22	33.67	10.72	11.07	2.09	0.96	39.02	24.22	24.86	7.03
960	20.12	33.65	10.51	10.91	2.09	0.96	39.31	24.14	24.71	6.97
970	20.02	33.63	10.31	10.77	2.10	0.96	39.14	24.19	24.64	6.98
980	19.92	33.72	10.09	10.65	2.13	0.96	39.28	24.13	24.81	6.99
990	19.82	33.67	9.88	10.52	2.12	0.96	39.26	24.23	24.86	6.96
1000	19.72	33.71	9.66	10.41	2.14	0.96	38.88	24.29	24.62	6.99

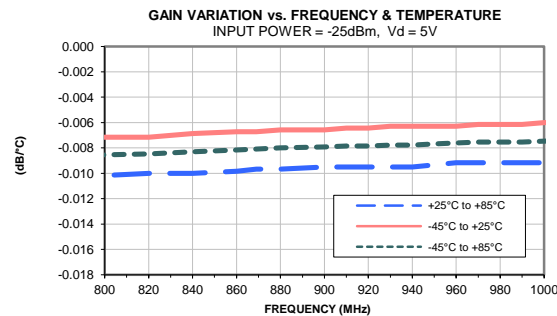
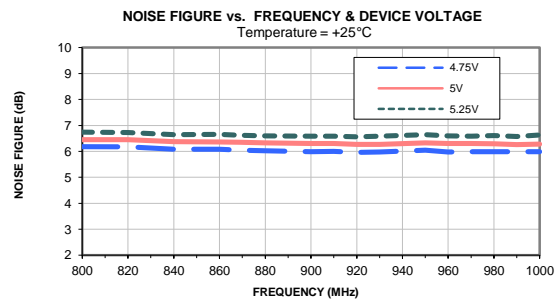
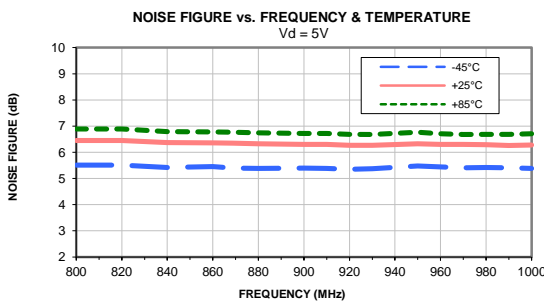
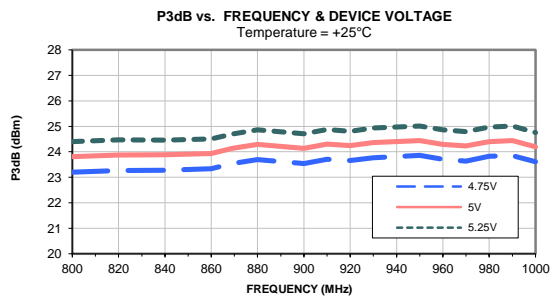
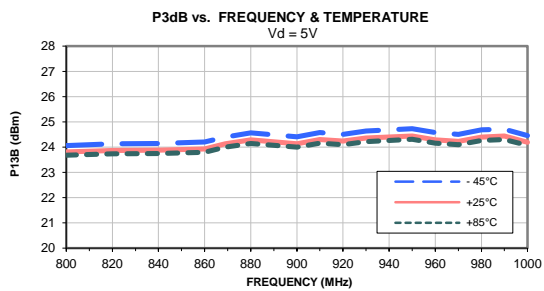
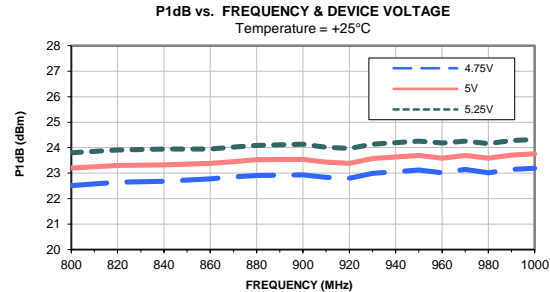
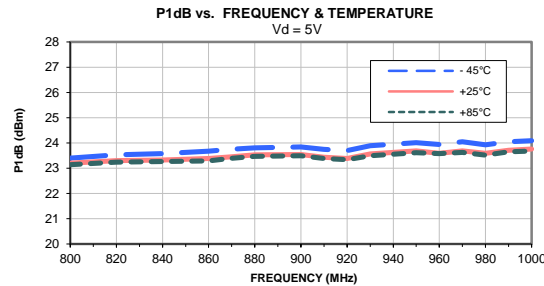
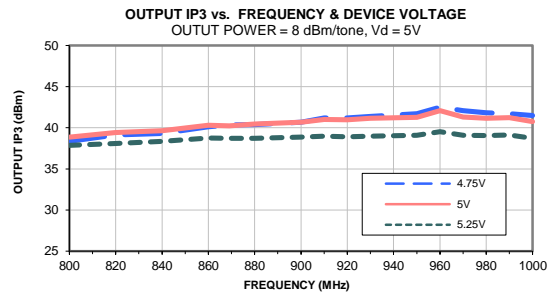
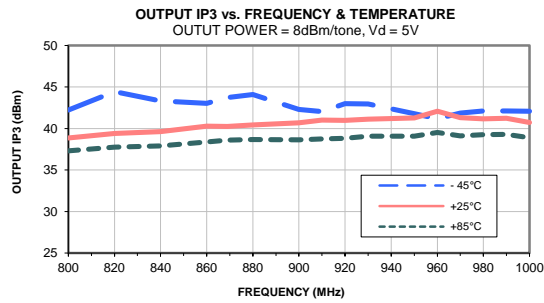
2100 MHz Match										
TEST CONDITIONS: Vd = 5.25V, Id = 113.22 mA @ Temperature = +85degC										
2000	14.57	31.32	8.42	12.10	2.75	1.08	36.25	24.14	25.14	6.87
2020	14.70	30.98	9.20	12.11	2.68	1.05	35.56	24.32	25.53	6.71
2040	14.78	30.71	10.05	12.00	2.64	1.03	36.23	24.30	25.29	6.63
2060	14.87	30.60	10.92	11.90	2.64	1.01	36.79	23.99	25.29	6.54
2080	14.91	30.53	11.81	11.80	2.65	0.99	36.47	24.20	25.37	6.47
2100	14.96	30.22	12.85	11.72	2.59	0.97	35.92	24.20	25.37	6.43
2110	14.97	30.19	13.35	11.63	2.59	0.96	36.25	24.47	25.37	6.31
2140	14.98	30.02	14.94	11.48	2.58	0.94	36.68	24.40	25.49	6.28
2170	14.98	29.86	16.40	11.42	2.57	0.93	36.80	24.36	25.56	6.23
2180	14.96	29.88	16.80	11.40	2.58	0.93	36.78	24.41	25.41	6.16
2200	14.94	29.73	17.33	11.34	2.55	0.92	37.27	24.41	25.79	6.13



## Typical Performance Curves (900 MHz Match)

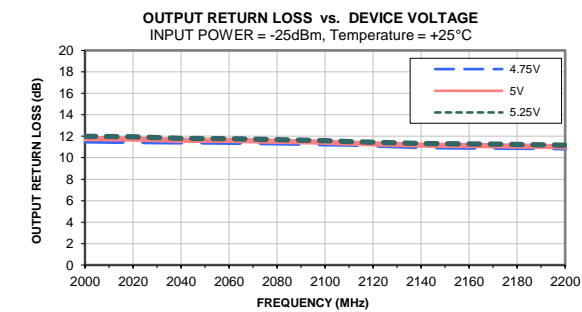
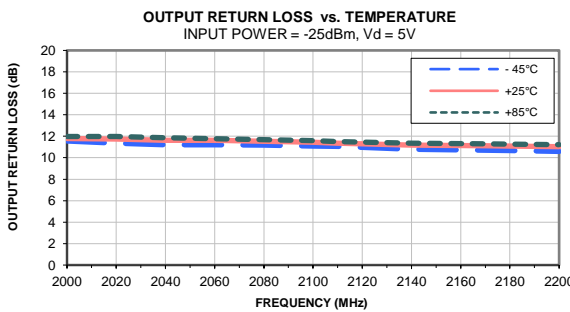
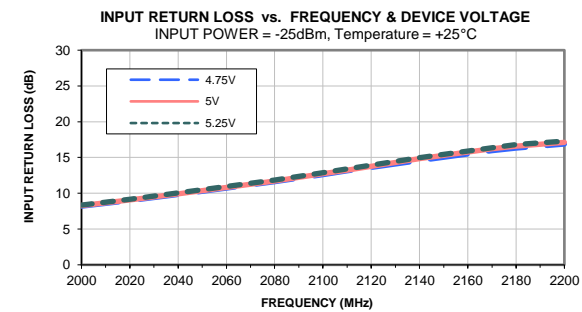
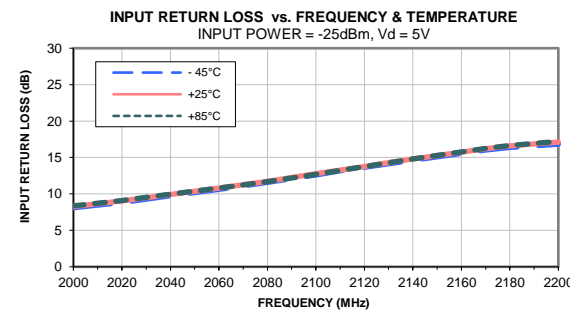
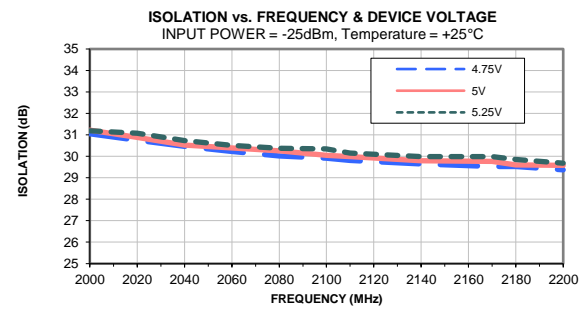
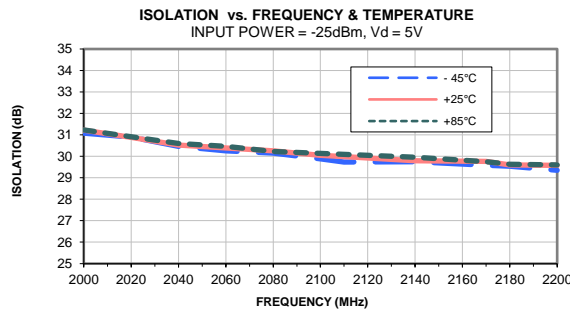
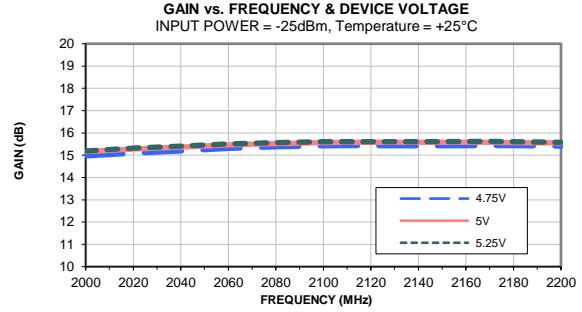
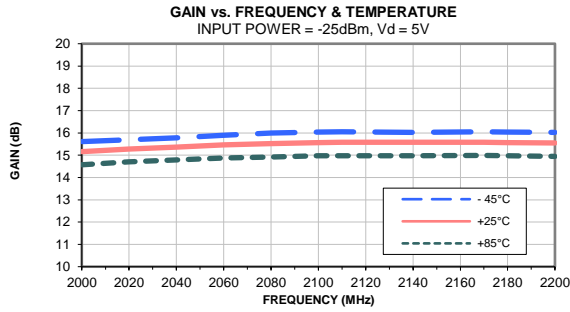


## Typical Performance Curves (900 MHz Match)

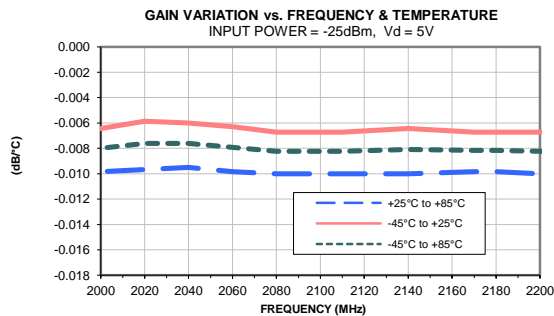
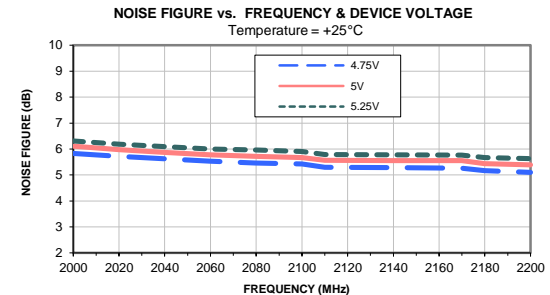
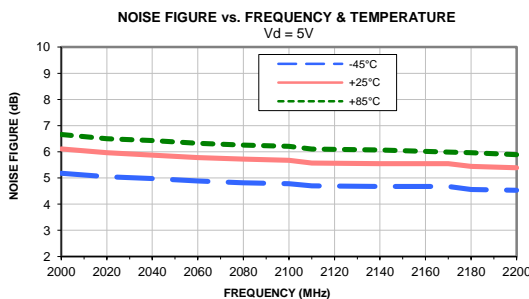
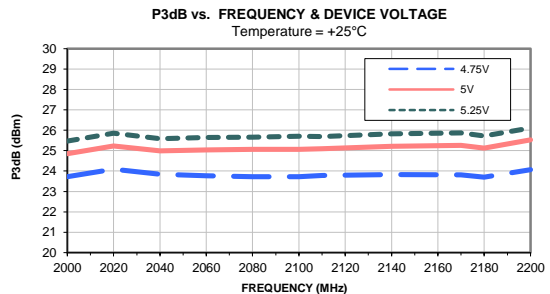
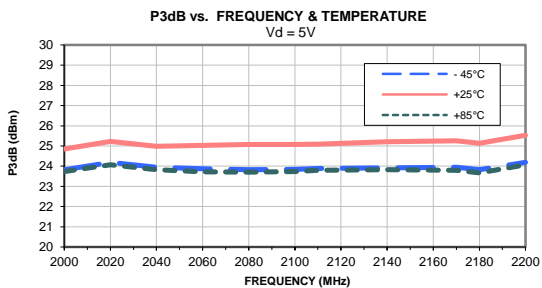
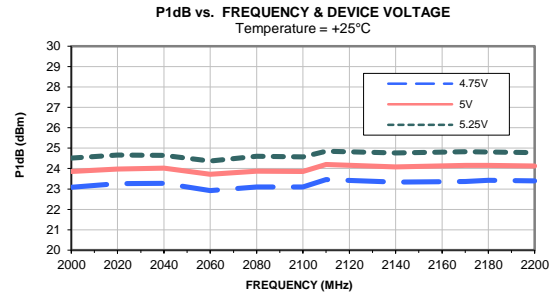
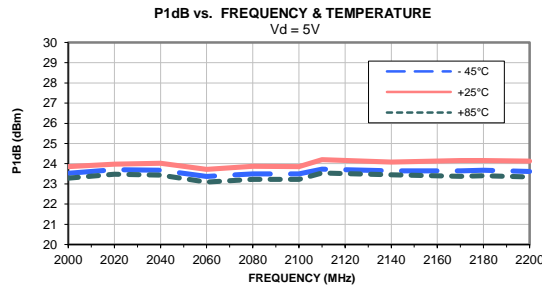
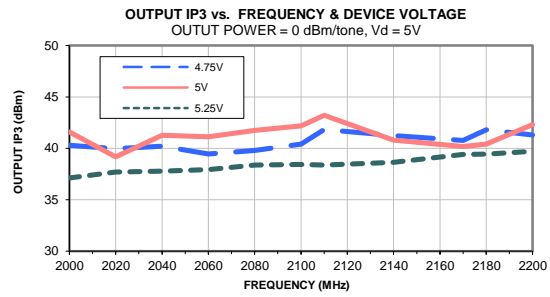
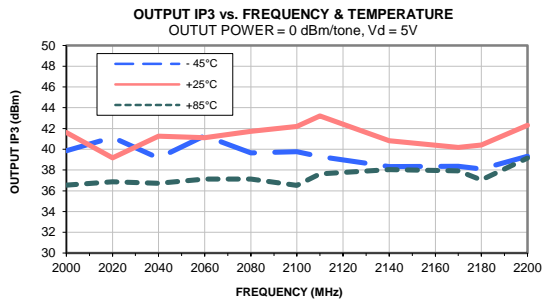




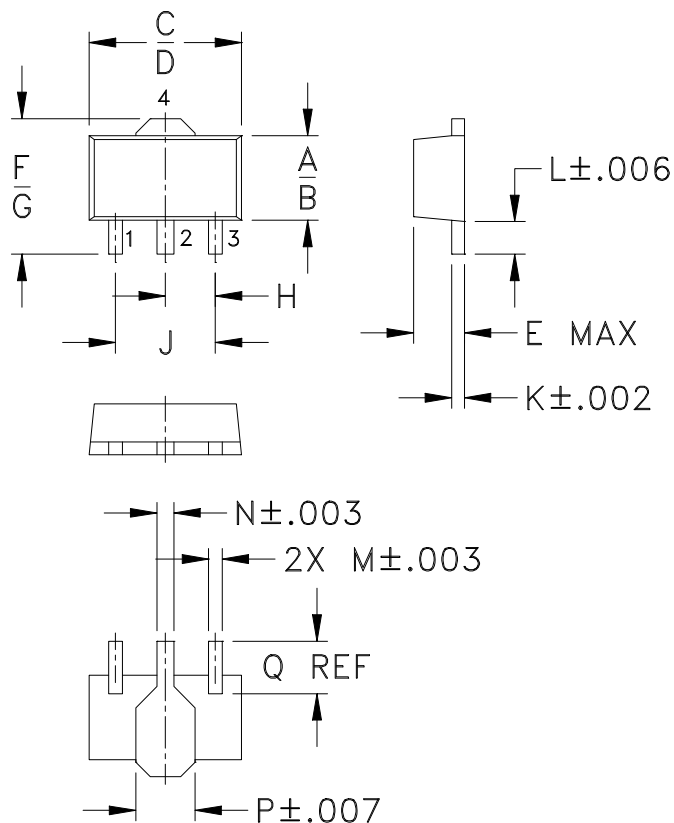
## Typical Performance Curves (2100 MHz Match)



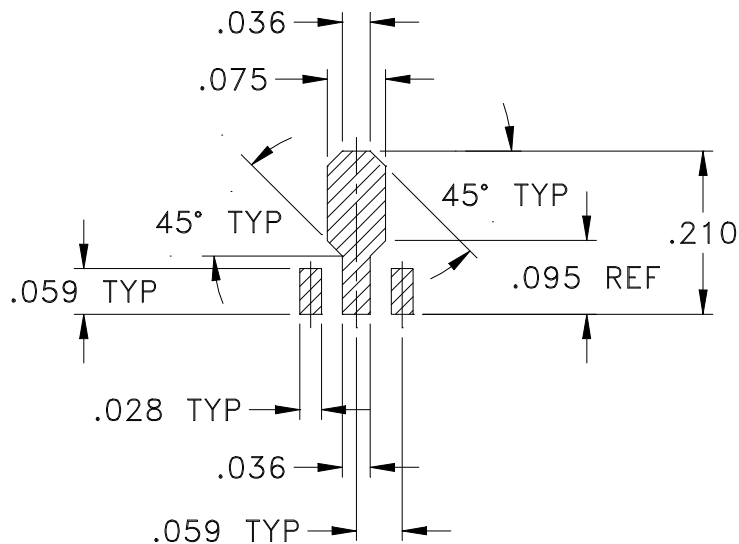
## Typical Performance Curves (2100 MHz Match)



### Outline Dimensions



### PCB Land Pattern



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

CASE #	A	B	C	D	E	F	G	H	J	K	L	M
DF782	.102 (2.59)	.090 (2.29)	.181 (4.60)	.173 (4.39)	.063 (1.60)	.167 (4.24)	.155 (3.94)	.059 (1.50)	.118 (3.00)	.015 (0.38)	.041 (1.04)	.016 (0.41)

CASE #	N	P	Q	WT. GRAM
DF782	.019 (0.48)	.065 (1.65)	.062 (1.57)	.2

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

#### Notes:

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



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

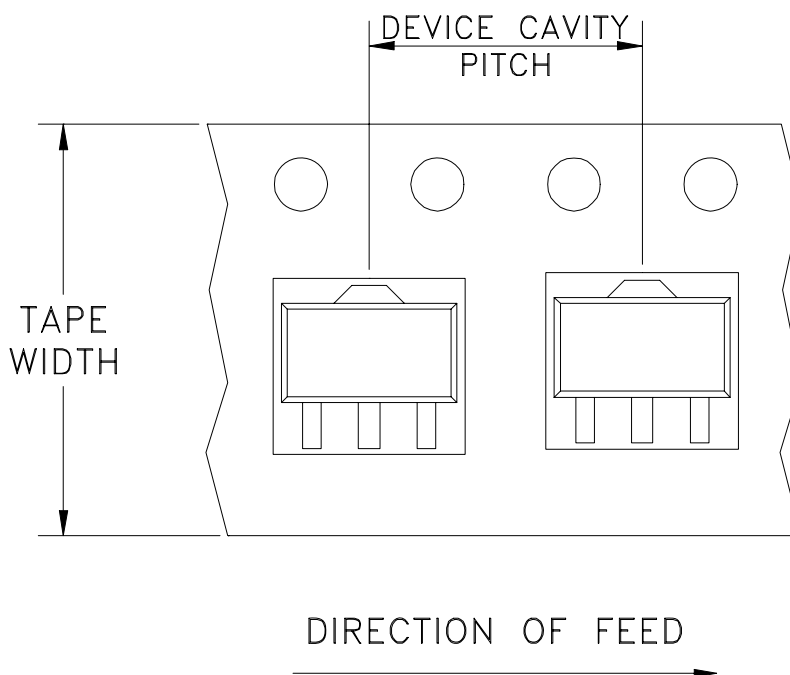
P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661

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Mini-Circuits ISO 9001 & ISO 14001 Certified

# Tape & Reel Packaging TR-F55

## DEVICE ORIENTATION IN T&R



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel	
12	8	7	Small quantity standard (see note)	20
				50
				100
				200
				500
			Standard	1000

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](http://www.minicircuits.com/pages/pdfs/tape.pdf)



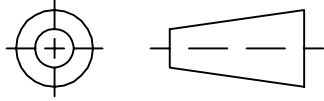
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THIRD ANGLE PROJECTION

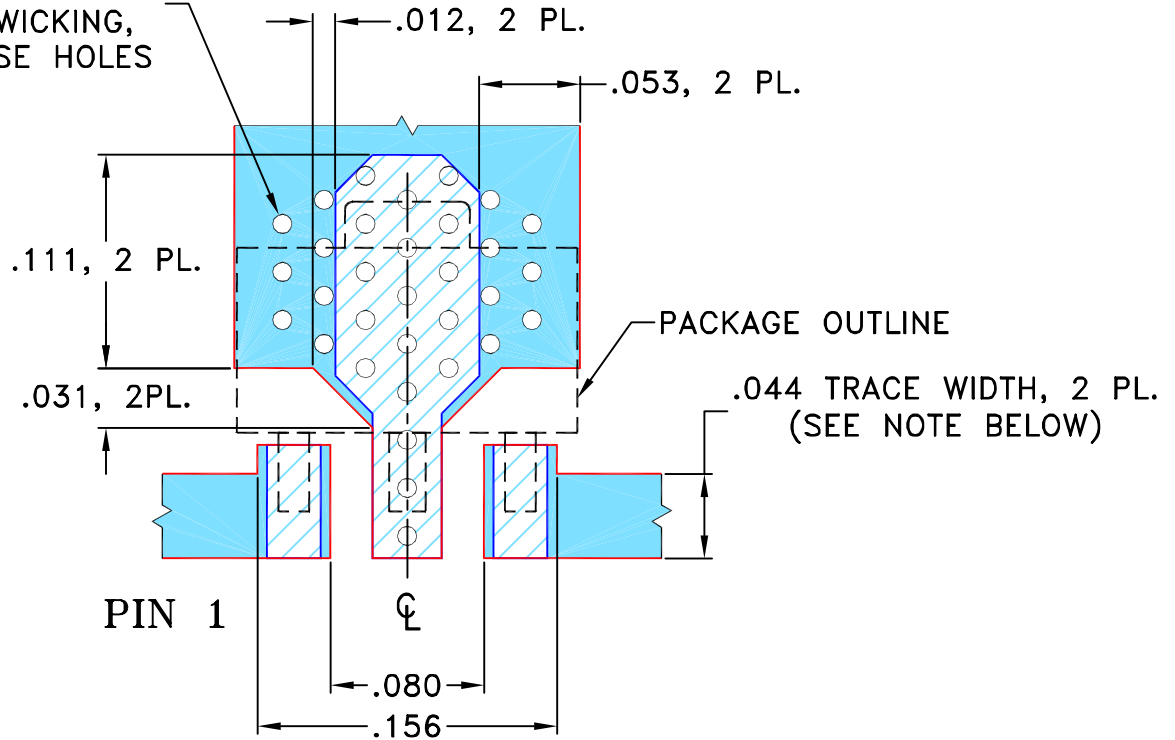


REVISIONS



REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	M137326	NEW RELEASE	07/10/12	PW	DJ

SUGGESTED MOUNTING CONFIGURATION  
FOR DF782 CASE STYLE, "04AM03" PIN CODE

32X  $\phi$ .010 PTH FOR GROUND. TO AVOID SOLDER WICKING, PLUG THESE HOLES



- NOTES: 1. TRACE WIDTH IS SHOWN FOR ROGERS R04350B WITH DIELECTRIC THICKNESS .020"  $\pm$  .0015"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.  
2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.

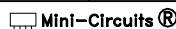
-  DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)  
 DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

UNLESS OTHERWISE SPECIFIED	INITIALS	DATE
DIMENSIONS ARE IN INCHES TOLERANCES ON: 2 PL DECIMALS $\pm$ 3 PL DECIMALS $\pm$ .005 ANGLES $\pm$ FRACTIONS $\pm$	DRAWN	PW 06/01/12
	CHECKED	IL 07/10/12
	APPROVED	DJ 07/10/12

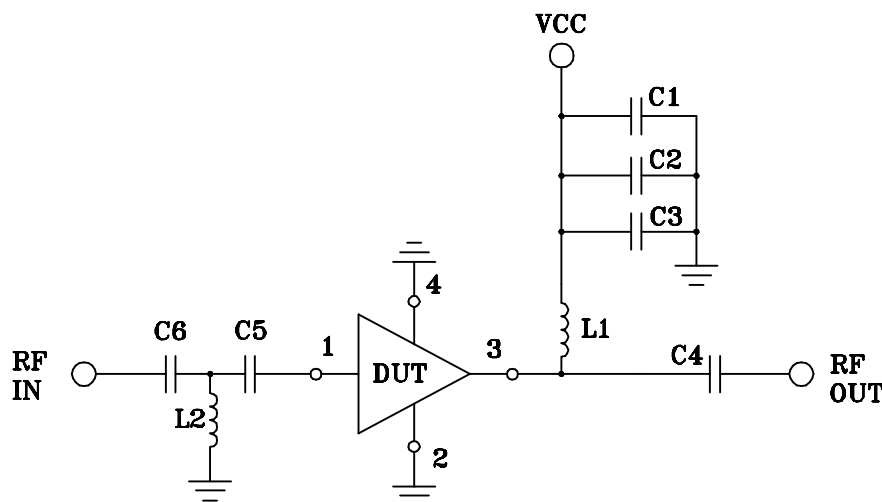
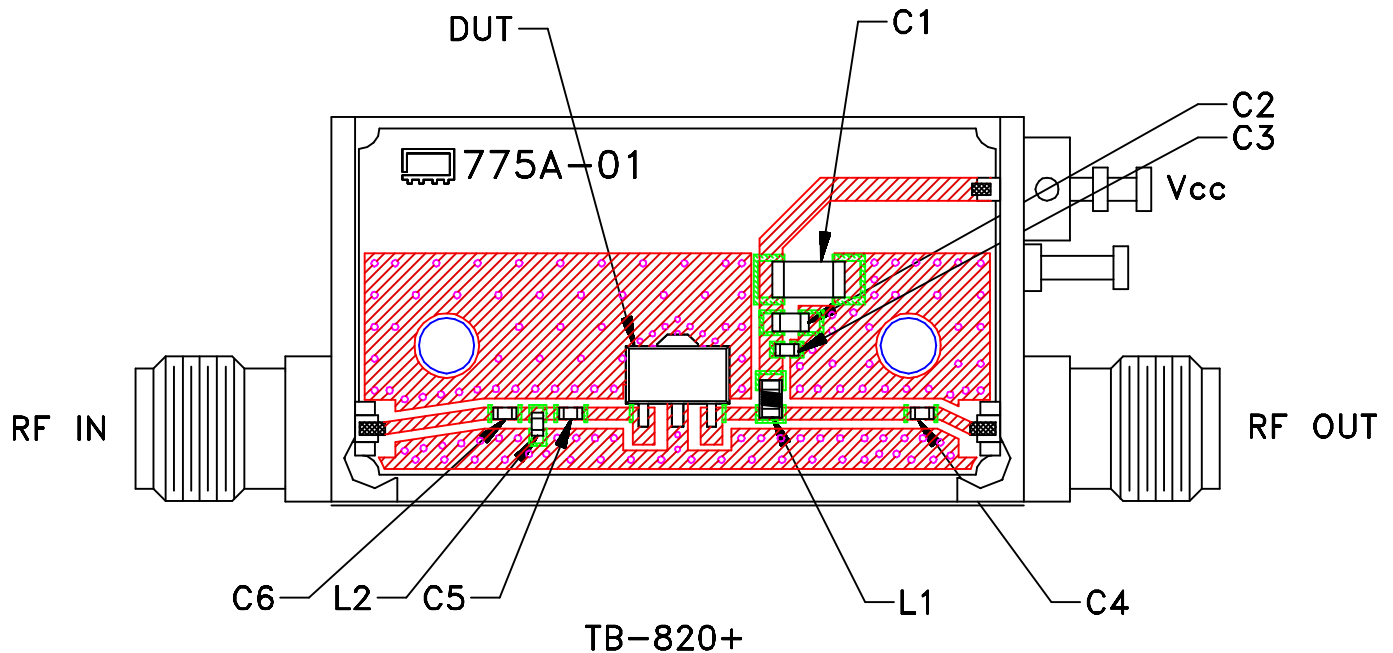
 **Mini-Circuits<sup>®</sup>** 13 Neptune Avenue  
Brooklyn NY 11235

PL, 04AM03, DF782, TB-678-105+

SIZE A	CODE IDENT 15542	DRAWING NO: 98-PL-370	REV: OR
FILE: 98PL370	SCALE: 10:1	SHEET: 1 OF 1	

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# Evaluation Board and Circuit




COMPONENT	SIZE	VALUE	UNITS
C1	1206	10.0	uF
C2	0603	0.1	uF
C3	0402	10.0	pF
C4,C6	0402	100.0	pF
C5	0402	5.6	pF
L1	0603	18.0	nH
L2	0402	7.5	nH

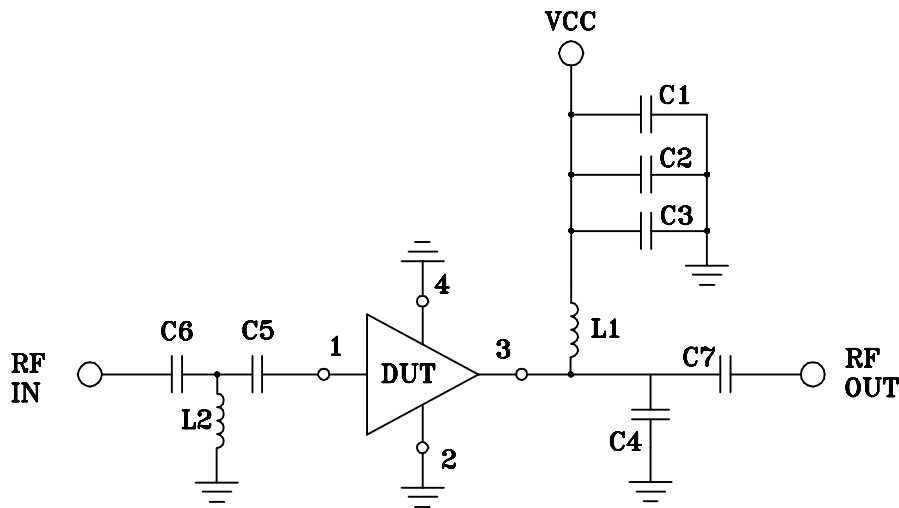
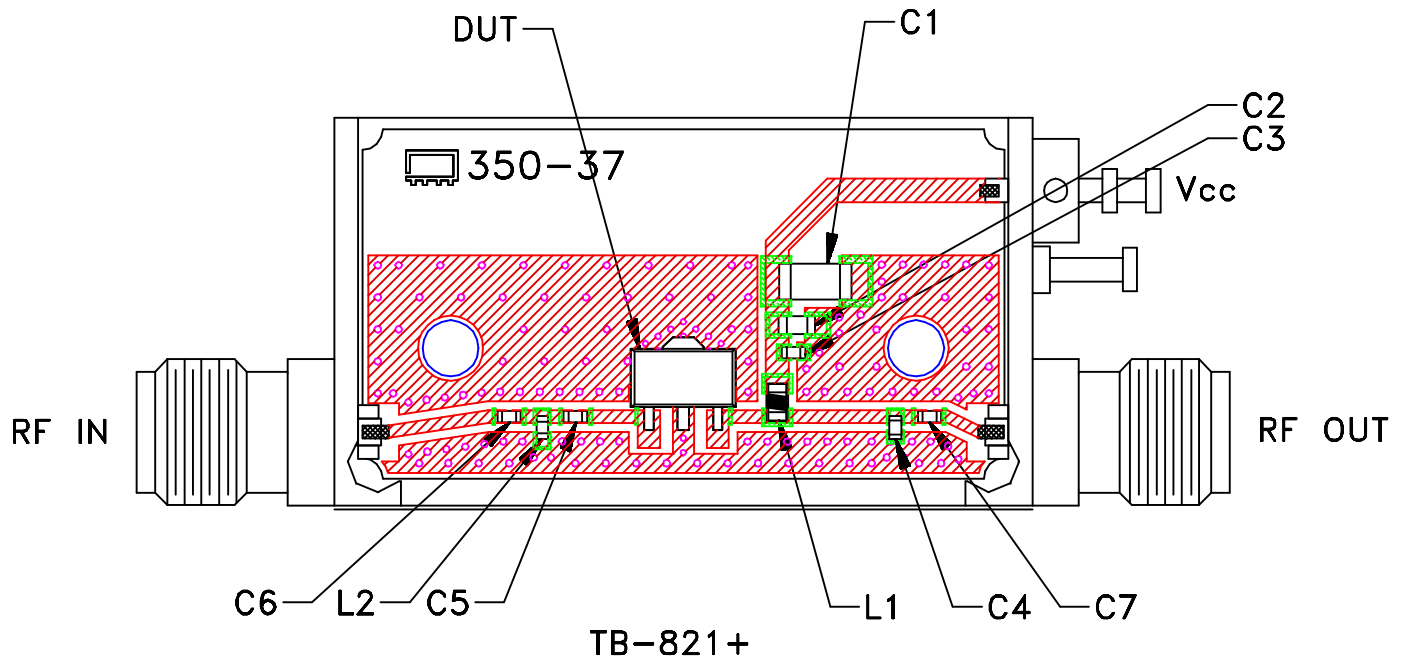
Schematic Diagram

## Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: R04350 or equivalent,  
Dielectric Constant=3.5, Thickness=.010 inch.

 **Mini-Circuits®**

# Evaluation Board and Circuit




COMPONENT	SIZE	VALUE	UNITS
C1	1206	10.0	uF
C2	0603	0.1	uF
C3	0402	8.2	pF
C4	0402	0.5	pF
C5	0402	1.3	pF
C6,C7	0402	47.0	pF
L1	0603	9.5	nH
L2	0402	2.2	nH

Schematic Diagram

## Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: R04350 or equivalent,  
Dielectric Constant=3.5, Thickness=.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 Ambient Environment	Individual Model Data Sheet
Storage Temperature	-55° to 100° C or -65° to 150° Ambient Environment	Individual Model Data Sheet
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
Marking Resistance to Solvents	Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C; distilled water + proylene glycol monomethyl ether +	MIL-STD-202, Method 215





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.

<b>Specification</b>	<b>Test/Inspection Condition</b>	<b>Reference/Spec</b>
	monoethanolamine at 63°C to 70°C	