Dual Matched High Dynamic Range

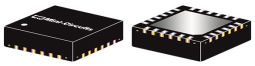
Monolithic Amplifier

MPGA-152+

50Ω 30 to 1500 MHz

The Big Deal

- High IP3
- High IP2
- 1.3W Output Power



4x4mm 24-lead, MCLP package

Product Overview

MPGA-152+ (RoHS compliant) is an advanced wideband dual amplifier fabricated using E-PHEMT* technology and offers extremely high dynamic range over a broad frequency range and with low noise figure and flat gain. In addition, the MPGA-152+ has excellent input and output return loss when used per suggested application circuit over a broad frequency range. It is enclosed in a 4x4mm, 24 lead MCLP package for very good thermal performance.

Key Features

Feature	Advantages
Broad Band: 0.03 to 1.5 GHz	Covers VHF, UHF bands
High IP3 Versus DC power Consumption: 48 dBm typical at 0.5 GHz	The MPGA-152+ matches industry leading IP3 performance relative to device size and power consumption. The combination of the design and E-PHEMPT structure provides enhanced linearity over a broad frequency range as evidence in the IP3 being typically 14-19 dB above the P 1dB point. This feature makes this amplifier ideal for use in CATV applications.
High IP2, 67 dBm at 0.5 GHz	Suppresses second order product on wideband applications such as CATV
Low Noise Figure, 2.7 dB at 0.5 GHz	Low noise figure performance in combination with the high output IP3 results in high dynamic range.

Dual Matched High Dynamic Range

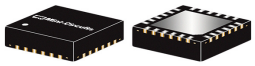
Monolithic Amplifier

MPGA-152+

50Ω 30 to 1500 MHz

Product Features

- High IP3, 48 dBm typ. at 0.5 GHz
- Gain, 14.9 dB typ. at 0.5 GHz
- High Pout, P1dB 31 dBm typ. at 0.5 GHz
- Low Noise Figure, 2.7 dB at 0.5 GHz
- Usable over 30-1800 MHz



Generic photo used for illustration purposes only

CASE STYLE: DG1847

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

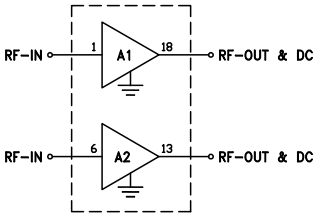
Typical Applications

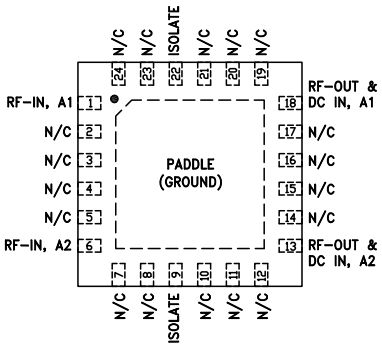
- CATV
- Instrumentation
- Cellular infrastruture
- Military mobile
- VHF/UHF

General Description

MPGA-152+ (RoHS compliant) is an advanced wideband dual amplifier fabricated using E-PHEMT* technology and offers extremely high dynamic range over a broad frequency range and with low noise figure and flat gain. In addition, the MPGA-152+ has excellent input and output return loss when used per suggested application circuit over a broad frequency range. It is enclosed in a 4x4mm, 24 lead MCLP package for very good thermal performance.

simplified schematic and pad description





Function	Pad Number	Description
RF IN, A1	1	RF input pad. This pad requires the use of an external DC blocking capacitor
RF IN, A2	6	RF input pad. This pad requires the use of an external DC blocking capacitor
RF-OUT and DC-IN, A1	18	RF output and bias pad. DC voltage is present on this pad; 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. 1
RF-OUT and DC-IN, A2	13	RF output and bias pad. DC voltage is present on this pad; 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. 1
GND	Paddle	Connections to ground. Use via holes as shown in "Suggested Layout for PCB Design" to reduce ground path inductance for best performance.
N/C	2-5, 7,8 10-12,14-17, 19-21 23-24	No connection. Ground externally
Do not use	9,22	Isolate on PCB trace

*Enhanced mode pseudomorhic High Electron Mobility Transistor.

Electrical Specifications[1] at 25°C, 50Ω unless noted

Parameter	Condition (GHz)	V_{DD}=9V (Note 1)			V_{DD}=8V (Note 1)			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Frequency range		0.03		1.5	0.03		1.5	GHz
Gain	0.03		14.3			14.3		dB
	0.5		14.9			14.9		
	0.86	13.2	14.6	16.1	13.1	14.6	16.0	
	1.25	12.2	13.5	14.9	12.1	13.4	14.8	
	1.5		13.2			13.1		
Input return loss	0.03		11.7			11.7		dB
	0.5		26.5			26.4		
	0.86		20.5			20.5		
	1.25		10.7			10.5		
	1.5		9.9			9.8		
Output return loss	0.03		16.4			16.4		dB
	0.5		25.1			24.5		
	0.86		19.8			19.2		
	1.25		9.0			8.9		
	1.5		8.3			8.2		
Reverse isolation	1.0		22.4			22.4		dB
Output power @1dB compression	0.05		30.3			29.3		dBm
	0.5		30.9			29.9		
	0.85		29.6			28.4		
	1.25		28.3			27.1		
	1.5		28.5			27.3		
Output IP3[2]	0.05		47.3			48.5		dBm
	0.5		47.6			46.1		
	0.85		43.6			42.3		
	1.25		49.1			46.5		
	1.5		49.8			48.5		
Output IP2[3]	0.05		77.1			75.4		dBm
	0.5		66.8			67.5		
	0.85		71.0			65.3		
	1.25		71.6			67.6		
	1.5		59.5			57.5		
Noise figure	0.05		2.7			2.6		dB
	0.5		2.7			2.7		
	0.85		3.2			3.1		
	1.25		3.7			3.6		
	1.5		4.1			4.1		
Device operating voltage			9.0[Note 5]			8.0 [Note 5A]		V
Supply operating current (Total)		-	407	450		358		mA
Device current variation vs temperature[4]			56.7			64.9		µA/°C
Device current variation vs voltage			0.04892			0.04896		mA/mV
Thermal resistance, junction-to-ground lead			8.6			8.6		°C/W

1. Measured on Mini-Circuits Characterization Test board TB-MPGA-152+. PCB material Rogers 4350B. See Characterization Test Circuit (Fig. 1).
2. Measurements performed with Pout=5 dBm/tone, tones spaced 1 MHz apart.
3. Output IP2 measured at sum frequency of the two tones (f means= f1+f2).
4. (Current at 85°C - Current at -45°C)/130
5. Supply Voltage [V+]=12V

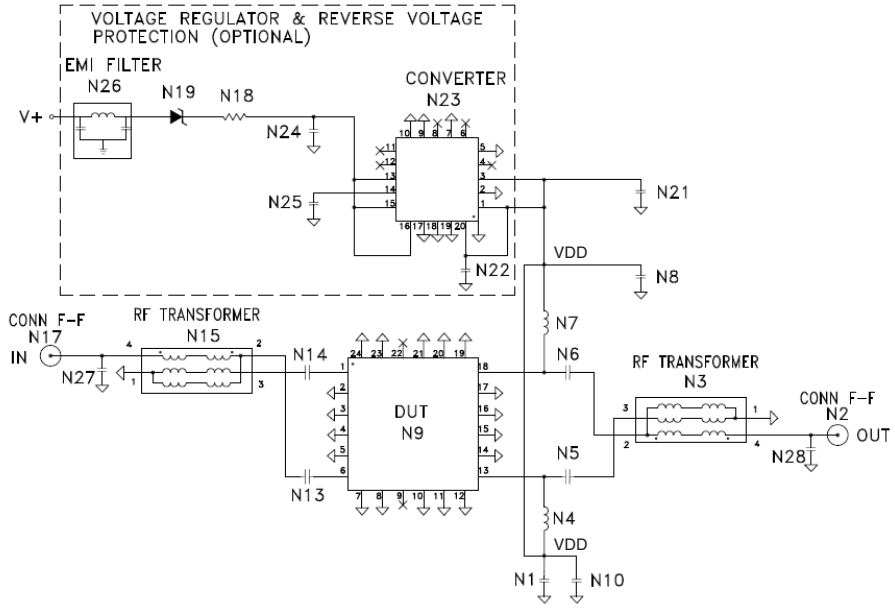
5A. V_{DD} applied at location indicated in Figure 1, bypassing rest of the circuit.

Absolute Maximum Ratings[6]

Parameter	Ratings
Operating Temperature (ground lead)[7]	-40°C to 85°C
Storage Temperature	-65°C to 150°C
Operating Current at 9.0V[7]	464 mA
Power Dissipation[8]	8.5 W
Input Power (CW) at 9V[8]	+28 dBm (5 minutes) +25 dBm (continuous)
DC Voltage on Pad 13 & 18[8]	12V

6. Permanent damage may occur if any of these limits are exceeded. Electrical maximum ratings are not intended for continuous normal operation.
7. Max ratings measured on Mini-Circuits characterization test board MB012.
8. Max rating measured on Mini-Circuits characterization test fixture MF012.

Application Circuit



Component	Value	Size	Manufacturer's P/N(s)
N9 (DUT)	Mini-Circuits MPGA-152+	4x4 mm	Mini-Circuits MPGA-152+
N1,N21,N24	Capacitor 10 µF	1206	MURATA P/N GRM31CR71E106KA12L
N3,N15	Mini-Circuits TRS1.5-182+	7.11x6.35 mm	Mini-Circuits TRS1.5-182+
N4,N7	Inductor 390 nH	0805	COILCRAFT P/N 0805CS-391XGLC
N5,N6,N13,N14	Capacitor 220 pF	0402	MURATA P/N GRM1555C1H221JA01D OR AVX 04025A221JAT2A
N8,N10	Capacitor .01 µF		MURATA P/N GRM155R71E103KA01D
N18	Resistor 4.32 Ohms, 1W	2512	KOA SPEER P/N RK73H3ATTE4R32F
N19	Diod Schottky SMA 40V MSL1	5.21x2.60 mm	ON SEMI P/N MBRA340T3G
N22	Capacitor 10 µF	1210	MURATA P/N GRM32ER7YA106KA12L
N23	Voltage Regulator QFN20 ADJ MSL2	5x5 mm	TEXAS INSTRUMENT P/N TPS7A4700RG-WT
N25	Capacitor 1 µF	0603	AVX P/N 0603YC105KAT2A
N26	EMI Filter	-	TUSONIX P/N 4201-601LF
N27,N28	Capacitor .50 pF	0402	MURATA P/N GJM1555C1HR50WB01D

Fig 1. Block Diagram of Application Circuit (DUT soldered on TB-MPGA-152+) due to 3V drop at the voltage regulator and reversed voltage protection circuit, V+=12V is needed to get 9V at DUT.

Product Marking

Marking may contain other features or characters for internal lot control

Additional Detailed Technical Information *additional information is available on our dash board. To access this information click here*	
Performance Data	Data Table
	Swept Graphs
	S-Parameter (S2P Files) Data Set (.zip file)
Case Style	DG1847 *Plastic package, exposed paddle* *lead finish: matt-tin*
Tape & Reel **Standard quantities available on reel**	F68 *7" reels with 20, 50, 100, 200, 500 or 1K devices*
Suggested Layout for PCB Design	PL-671
Evaluation Board	TB-MPGA-152+
Environmental Ratings	ENV08T1

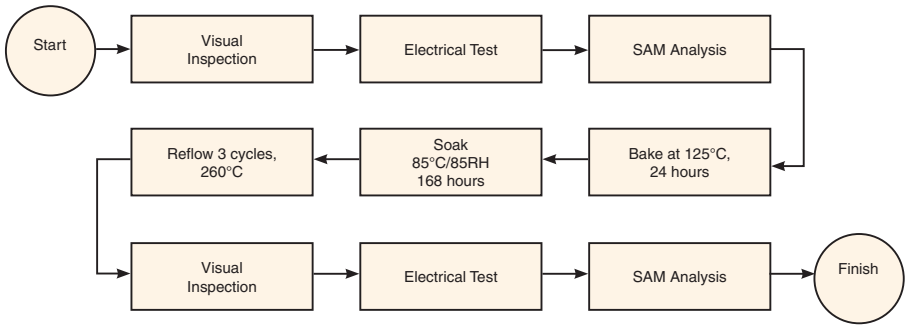
ESD Rating

Human Body Model (HBM): Class 1A (Pass 250V) 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



Additional 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

Dual Matched MMIC Amplifier MPGA-152+

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: Vd = 8.00V, Id = 357.81mA @ 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)
20	12.86	23.17	6.70	9.20	1.45	0.88	37.55	28.12	3.65
30	14.03	21.83	10.75	15.13	1.34	0.85	41.77	28.93	3.18
40	14.25	21.54	12.46	15.04	1.31	0.81	47.64	29.07	2.91
50	14.35	21.43	13.10	14.22	1.29	0.78	43.65	29.30	2.71
60	14.39	21.37	13.33	13.71	1.28	0.77	47.13	29.39	2.63
70	14.42	21.33	13.48	13.40	1.28	0.76	46.35	29.46	2.61
80	14.45	21.30	13.59	13.19	1.27	0.75	46.76	29.47	2.61
90	14.47	21.28	13.67	13.05	1.27	0.74	47.46	29.49	2.58
100	14.49	21.26	13.78	12.99	1.26	0.74	46.29	29.48	2.61
150	14.56	21.18	14.37	13.19	1.25	0.73	45.18	29.60	2.57
200	14.65	21.11	15.22	13.79	1.25	0.73	50.06	29.68	2.55
250	14.71	21.06	16.45	14.70	1.25	0.73	44.84	29.79	2.57
300	14.77	21.02	18.06	15.93	1.25	0.74	47.80	30.04	2.58
350	14.82	21.00	20.24	17.64	1.25	0.74	46.13	30.13	2.62
400	14.86	20.99	22.90	19.84	1.25	0.75	46.02	30.03	2.72
450	14.88	21.01	25.72	22.60	1.25	0.75	45.31	29.88	2.76
500	14.87	21.05	26.39	25.90	1.26	0.76	45.38	29.81	2.76
550	14.84	21.12	24.65	29.13	1.27	0.77	45.63	29.56	2.86
600	14.80	21.21	22.55	28.07	1.28	0.78	45.24	29.37	2.92
650	14.75	21.31	21.09	25.27	1.29	0.79	43.52	29.14	2.97
700	14.71	21.41	20.14	23.34	1.30	0.79	43.42	29.14	3.01
750	14.66	21.52	19.71	22.07	1.31	0.80	43.51	29.03	3.10
800	14.61	21.64	19.63	20.88	1.32	0.81	42.16	28.63	3.18
850	14.54	21.79	19.81	19.39	1.33	0.82	42.25	28.24	3.18
900	14.47	21.96	19.65	17.80	1.35	0.83	42.39	27.77	3.19
950	14.36	22.16	18.72	16.03	1.37	0.83	42.56	27.40	3.27
1000	14.22	22.39	17.05	14.26	1.39	0.84	42.96	26.99	3.39
1100	13.87	22.94	13.30	11.19	1.44	0.83	45.51	26.68	3.50
1200	13.42	23.59	10.54	8.95	1.50	0.81	49.07	26.59	3.42
1300	13.03	24.20	8.88	7.62	1.56	0.79	46.21	26.85	3.77
1400	12.77	24.69	8.19	7.11	1.63	0.79	45.53	27.06	3.87
1500	12.82	24.90	8.43	7.40	1.69	0.80	47.43	27.06	4.09
1600	13.02	24.94	9.96	8.83	1.78	0.83	43.20	27.19	4.31
1700	13.26	25.00	13.82	12.53	1.92	0.89	40.99	26.97	4.56
1800	13.17	25.39	21.31	22.95	2.14	0.94	38.95	25.93	4.99
1900	12.54	26.35	16.73	20.99	2.49	0.97	37.66	24.20	5.45
2000	11.34	27.90	12.26	13.05	3.09	0.98	36.36	22.40	6.07
2100	9.41	30.20	9.12	8.84	4.11	0.99	35.26	20.85	6.80
2200	6.61	33.38	6.36	5.67	5.89	0.92	33.11	19.21	7.69
2300	3.48	36.89	4.50	3.85	8.62	0.81	30.54	17.98	8.66

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: Vd = 9.00V, Id = 406.32mA @ 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)
20	12.87	23.17	6.71	9.16	1.45	0.87	39.93	29.18	3.69
30	14.04	21.86	10.76	15.12	1.34	0.85	43.37	29.92	3.31
40	14.27	21.55	12.52	15.07	1.31	0.80	42.09	30.05	2.98
50	14.37	21.43	13.16	14.28	1.29	0.78	43.38	30.28	2.78
60	14.41	21.38	13.41	13.79	1.28	0.77	45.32	30.36	2.69
70	14.44	21.34	13.56	13.48	1.28	0.76	45.81	30.43	2.68
80	14.47	21.31	13.68	13.26	1.27	0.75	44.90	30.43	2.63
90	14.48	21.29	13.78	13.10	1.27	0.74	46.76	30.45	2.66
100	14.50	21.27	13.87	13.03	1.26	0.74	47.77	30.43	2.65
150	14.58	21.19	14.46	13.24	1.26	0.73	46.52	30.53	2.61
200	14.66	21.13	15.33	13.90	1.25	0.73	49.96	30.60	2.60
250	14.72	21.07	16.58	14.81	1.25	0.73	48.89	30.67	2.65
300	14.78	21.04	18.22	15.99	1.25	0.74	45.24	30.89	2.62
350	14.83	21.02	20.44	17.78	1.25	0.74	47.80	31.02	2.64
400	14.86	21.01	23.13	20.09	1.25	0.75	45.40	30.94	2.78
450	14.88	21.03	25.93	23.06	1.25	0.75	45.58	30.81	2.83
500	14.87	21.07	26.40	26.36	1.26	0.76	47.66	30.76	2.85
550	14.85	21.14	24.51	30.49	1.27	0.77	44.59	30.53	2.90
600	14.80	21.23	22.39	29.16	1.28	0.78	45.29	30.37	2.99
650	14.76	21.33	20.95	25.86	1.29	0.79	45.75	30.18	3.01
700	14.72	21.42	19.99	23.76	1.30	0.79	43.49	30.18	3.09
750	14.67	21.53	19.60	22.72	1.31	0.80	44.13	30.11	3.13
800	14.62	21.65	19.53	21.59	1.32	0.81	43.43	29.77	3.24
850	14.57	21.78	19.75	20.04	1.33	0.82	43.25	29.41	3.25
900	14.49	21.95	19.70	18.33	1.35	0.83	43.41	29.01	3.25
950	14.39	22.14	18.90	16.44	1.37	0.83	43.52	28.74	3.38
1000	14.26	22.37	17.28	14.64	1.39	0.84	43.76	28.26	3.44
1100	13.92	22.90	13.49	11.42	1.44	0.83	47.21	27.89	3.52
1200	13.48	23.55	10.68	9.07	1.50	0.81	46.79	27.79	3.65
1300	13.10	24.14	8.97	7.71	1.55	0.79	46.99	28.06	3.83
1400	12.83	24.65	8.27	7.15	1.62	0.78	48.92	28.03	3.98
1500	12.88	24.85	8.50	7.44	1.68	0.79	46.39	28.18	4.16
1600	13.08	24.92	10.03	8.82	1.77	0.83	43.64	28.36	4.36
1700	13.33	24.95	13.89	12.50	1.90	0.89	41.40	28.17	4.68
1800	13.25	25.35	21.06	22.38	2.11	0.94	39.82	27.19	5.09
1900	12.65	26.27	16.45	21.44	2.44	0.97	37.82	25.51	5.62
2000	11.51	27.77	12.21	13.45	3.00	0.99	36.95	23.73	6.16
2100	9.64	30.02	9.20	9.16	3.98	0.99	35.71	22.19	6.94
2200	6.88	33.16	6.44	5.83	5.67	0.93	34.04	20.55	7.79
2300	3.75	36.68	4.54	3.92	8.28	0.81	32.07	19.28	8.78

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: Vd = 8.00V, Id = 353.95mA @ 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)
20	13.76	22.37	7.07	10.62	1.31	0.86	37.74	28.42	2.88
30	14.44	21.52	11.01	15.37	1.28	0.81	41.81	29.25	2.53
40	14.54	21.35	12.40	14.65	1.26	0.78	44.76	29.34	2.25
50	14.61	21.27	12.92	13.77	1.25	0.75	46.19	29.55	2.11
60	14.65	21.22	13.09	13.18	1.24	0.74	44.33	29.62	2.02
70	14.67	21.19	13.17	12.76	1.24	0.73	46.95	29.69	2.01
80	14.70	21.16	13.24	12.48	1.23	0.72	47.27	29.70	2.02
90	14.72	21.13	13.28	12.28	1.23	0.71	46.83	29.73	1.99
100	14.74	21.12	13.33	12.13	1.22	0.70	47.50	29.72	1.99
150	14.84	21.01	13.80	12.02	1.21	0.69	48.17	29.85	1.93
200	14.95	20.92	14.81	13.19	1.21	0.69	46.77	29.92	1.90
250	15.04	20.84	16.36	15.28	1.21	0.70	50.38	30.05	1.93
300	15.12	20.79	18.51	17.54	1.21	0.71	47.02	30.32	1.92
350	15.18	20.76	21.27	18.58	1.20	0.71	46.08	30.41	1.90
400	15.22	20.75	24.46	19.11	1.20	0.71	48.04	30.30	2.08
450	15.24	20.77	27.13	20.44	1.20	0.71	45.00	30.08	2.07
500	15.24	20.80	27.12	23.35	1.20	0.72	46.49	30.07	2.10
550	15.23	20.86	25.13	29.03	1.21	0.73	45.78	29.85	2.18
600	15.20	20.94	22.88	35.46	1.22	0.74	45.32	29.61	2.21
650	15.16	21.03	21.24	26.95	1.23	0.75	46.07	29.39	2.26
700	15.11	21.13	20.04	22.31	1.24	0.75	43.25	29.34	2.33
750	15.06	21.23	19.50	19.84	1.24	0.76	43.77	29.33	2.45
800	15.02	21.34	19.36	18.24	1.24	0.77	43.07	29.00	2.42
850	14.97	21.46	19.62	17.20	1.25	0.78	42.47	28.63	2.46
900	14.91	21.61	19.61	16.16	1.26	0.79	42.20	28.22	2.53
950	14.83	21.78	18.79	15.21	1.27	0.80	42.96	27.88	2.54
1000	14.72	21.98	17.12	13.93	1.29	0.80	42.44	27.56	2.58
1100	14.41	22.47	13.28	11.30	1.33	0.80	44.77	27.09	2.62
1200	14.04	23.05	10.46	8.96	1.36	0.78	47.37	26.87	2.75
1300	13.68	23.61	8.81	7.60	1.40	0.76	47.82	27.08	2.89
1400	13.46	24.06	8.05	6.85	1.44	0.74	49.54	27.12	2.96
1500	13.49	24.27	8.23	7.02	1.49	0.74	44.67	27.30	3.14
1600	13.71	24.30	9.68	8.79	1.58	0.80	42.27	27.46	3.37
1700	13.94	24.34	13.47	12.89	1.69	0.87	39.94	27.35	3.54
1800	13.87	24.70	19.94	24.76	1.86	0.92	38.28	26.44	3.94
1900	13.27	25.62	15.67	18.66	2.13	0.95	36.75	24.81	4.38
2000	12.13	27.10	11.76	12.12	2.56	0.96	36.03	23.04	4.93
2100	10.36	29.26	9.00	8.57	3.27	0.98	35.76	21.50	5.59
2200	7.61	32.45	6.15	5.55	4.54	0.92	34.75	20.11	6.42
2300	4.55	35.94	4.28	3.50	6.14	0.78	31.76	18.46	7.34

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: Vd = 9.00V, Id = 403.31mA @ 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)
20	13.81	22.41	7.02	10.60	1.30	0.86	38.92	29.31	2.95
30	14.51	21.54	10.99	15.45	1.27	0.81	42.12	30.23	2.59
40	14.61	21.36	12.45	14.77	1.26	0.78	45.60	30.35	2.38
50	14.68	21.28	12.95	13.88	1.25	0.75	44.83	30.57	2.17
60	14.71	21.23	13.12	13.26	1.24	0.74	44.44	30.63	2.11
70	14.74	21.20	13.22	12.84	1.23	0.72	45.80	30.70	2.07
80	14.77	21.17	13.28	12.57	1.23	0.72	49.94	30.71	2.08
90	14.79	21.14	13.34	12.37	1.22	0.71	48.21	30.73	2.06
100	14.81	21.12	13.40	12.23	1.22	0.70	46.21	30.71	2.07
150	14.91	21.03	13.86	12.10	1.21	0.68	45.46	30.84	2.03
200	15.01	20.94	14.90	13.26	1.20	0.69	50.20	30.90	1.98
250	15.11	20.86	16.48	15.39	1.20	0.70	55.06	31.00	1.97
300	15.18	20.81	18.68	17.76	1.20	0.71	43.94	31.25	2.00
350	15.24	20.78	21.50	18.82	1.20	0.71	47.52	31.37	2.03
400	15.28	20.77	24.72	19.33	1.20	0.71	45.27	31.28	2.14
450	15.30	20.79	27.29	20.68	1.20	0.71	48.69	31.07	2.16
500	15.30	20.83	26.97	23.78	1.20	0.72	46.38	31.07	2.16
550	15.28	20.89	24.84	30.03	1.21	0.73	46.53	30.86	2.26
600	15.25	20.96	22.59	36.86	1.22	0.74	45.88	30.64	2.29
650	15.21	21.05	20.96	26.99	1.23	0.74	48.09	30.45	2.34
700	15.17	21.15	19.80	22.38	1.23	0.75	44.61	30.43	2.40
750	15.12	21.25	19.27	19.97	1.24	0.76	43.84	30.41	2.49
800	15.08	21.35	19.16	18.48	1.24	0.77	43.10	30.12	2.53
850	15.04	21.47	19.46	17.54	1.25	0.78	43.76	29.79	2.50
900	14.98	21.61	19.55	16.56	1.26	0.79	43.45	29.41	2.66
950	14.90	21.78	18.86	15.59	1.27	0.79	43.64	29.12	2.63
1000	14.80	21.97	17.27	14.24	1.29	0.80	44.10	28.77	2.66
1100	14.50	22.45	13.41	11.50	1.32	0.80	45.12	28.28	2.78
1200	14.13	23.02	10.55	9.09	1.36	0.78	50.67	28.08	2.85
1300	13.78	23.58	8.87	7.68	1.40	0.76	51.81	28.30	2.94
1400	13.56	24.02	8.09	6.92	1.43	0.73	54.60	28.30	3.07
1500	13.58	24.24	8.27	7.06	1.48	0.74	46.17	28.49	3.20
1600	13.80	24.27	9.73	8.82	1.56	0.80	43.44	28.67	3.41
1700	14.03	24.31	13.53	12.90	1.68	0.87	40.45	28.57	3.67
1800	13.96	24.68	19.76	24.57	1.84	0.92	38.77	27.66	4.10
1900	13.38	25.57	15.41	18.82	2.09	0.95	37.04	26.01	4.58
2000	12.28	27.02	11.65	12.36	2.51	0.96	35.73	24.28	5.09
2100	10.55	29.13	9.04	8.80	3.19	0.99	35.33	22.78	5.73
2200	7.84	32.29	6.21	5.68	4.41	0.93	34.05	21.40	6.53
2300	4.80	35.76	4.30	3.57	5.93	0.78	31.89	19.72	7.47

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: Vd = 8.00V, Id = 361.61mA @ 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)
20	12.56	23.44	7.18	9.41	1.54	0.89	40.42	27.92	4.41
30	13.81	22.05	11.36	15.95	1.40	0.86	42.59	28.67	3.88
40	14.04	21.74	13.14	15.44	1.36	0.82	41.84	28.76	3.53
50	14.14	21.62	13.74	14.38	1.34	0.80	44.60	28.98	3.35
60	14.18	21.58	13.98	13.81	1.33	0.78	44.98	29.05	3.25
70	14.20	21.55	14.11	13.56	1.32	0.78	45.44	29.12	3.22
80	14.23	21.52	14.24	13.51	1.32	0.77	46.54	29.12	3.19
90	14.25	21.50	14.33	13.54	1.32	0.77	54.07	29.13	3.20
100	14.26	21.48	14.44	13.66	1.31	0.77	47.19	29.11	3.23
150	14.33	21.41	15.02	14.42	1.31	0.77	48.68	29.22	3.21
200	14.41	21.35	15.84	14.87	1.30	0.77	46.54	29.32	3.12
250	14.48	21.30	16.77	15.07	1.29	0.76	47.36	29.41	3.19
300	14.54	21.26	17.95	15.55	1.28	0.76	47.50	29.64	3.20
350	14.60	21.23	19.50	16.63	1.28	0.76	44.63	29.78	3.25
400	14.64	21.23	21.49	18.81	1.29	0.77	43.40	29.72	3.33
450	14.66	21.25	23.66	22.27	1.29	0.78	46.61	29.57	3.36
500	14.65	21.29	24.82	28.53	1.30	0.79	45.02	29.52	3.41
550	14.63	21.37	23.84	33.27	1.31	0.79	45.44	29.31	3.54
600	14.58	21.46	22.11	28.76	1.32	0.80	43.32	29.08	3.55
650	14.53	21.56	20.62	24.59	1.33	0.81	42.59	28.84	3.60
700	14.48	21.67	19.65	22.84	1.34	0.82	43.05	28.77	3.70
750	14.43	21.80	19.19	21.37	1.36	0.82	41.97	28.64	3.78
800	14.37	21.93	19.20	20.58	1.37	0.83	41.61	28.25	3.85
850	14.30	22.10	19.50	19.11	1.39	0.84	41.86	27.84	3.87
900	14.20	22.29	19.51	17.75	1.42	0.85	41.86	27.34	3.91
950	14.08	22.51	18.61	15.78	1.44	0.85	42.76	26.87	4.03
1000	13.91	22.77	16.85	13.93	1.47	0.86	42.41	26.49	4.10
1100	13.49	23.40	12.94	10.85	1.54	0.85	45.23	26.20	4.26
1200	12.98	24.12	10.17	8.87	1.63	0.84	48.18	26.15	4.34
1300	12.53	24.80	8.58	7.82	1.72	0.83	45.42	26.50	4.57
1400	12.28	25.30	7.93	7.39	1.80	0.83	45.94	27.04	4.74
1500	12.32	25.52	8.17	7.58	1.86	0.84	44.94	26.75	4.91
1600	12.57	25.54	9.62	8.66	1.95	0.85	45.84	26.82	5.09
1700	12.85	25.55	13.27	11.27	2.08	0.89	41.40	26.64	5.36
1800	12.83	25.89	21.75	17.56	2.31	0.94	38.85	25.69	5.74
1900	12.26	26.79	18.70	31.87	2.72	0.98	37.78	23.95	6.31
2000	11.10	28.32	13.06	15.65	3.43	1.00	36.36	22.10	6.85
2100	9.17	30.65	9.48	9.72	4.65	1.00	34.90	20.54	7.62
2200	6.50	33.77	6.66	6.06	6.61	0.93	32.95	18.90	8.54
2300	3.35	37.34	4.69	3.98	9.68	0.81	30.91	17.69	9.53

Typical Performance Data

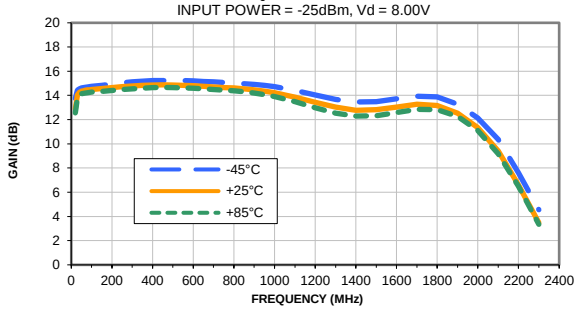
Definitions:
Input Return Loss = -S11 (dB)
Gain(Power Gain) = S21 (dB)
Reverse Isolation = -S12 (dB)
Output Return Loss = -S22 (dB)

TEST CONDITIONS: Vd = 9.00V, Id = 409.92mA @ Temperature = +85°C

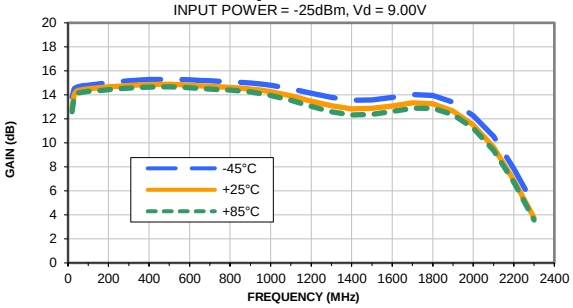
FREQ	Gain	Isolation	Input Return Loss	Output Return Loss	Stability		IP-3 Output	1dB Comp. Output	Noise Figure
(MHz)	(dB)	(dB)	(dB)	(dB)	K	Measure	(dBm)	(dBm)	(dB)
20	12.60	23.45	7.23	9.42	1.54	0.89	38.21	28.97	4.46
30	13.83	22.07	11.45	16.03	1.40	0.86	43.69	29.64	3.96
40	14.06	21.76	13.21	15.54	1.36	0.82	42.75	29.71	3.63
50	14.15	21.65	13.85	14.46	1.34	0.80	42.11	29.92	3.46
60	14.19	21.61	14.08	13.89	1.33	0.79	44.73	29.98	3.34
70	14.22	21.57	14.20	13.64	1.32	0.78	46.81	30.04	3.31
80	14.25	21.54	14.33	13.58	1.32	0.77	48.04	30.04	3.29
90	14.26	21.52	14.42	13.62	1.32	0.77	47.95	30.04	3.29
100	14.28	21.50	14.53	13.74	1.31	0.77	46.76	30.01	3.26
150	14.35	21.43	15.14	14.50	1.31	0.77	46.77	30.10	3.25
200	14.43	21.37	15.96	14.96	1.30	0.77	49.27	30.19	3.22
250	14.50	21.32	16.90	15.16	1.29	0.76	45.88	30.24	3.23
300	14.56	21.28	18.10	15.66	1.28	0.76	48.03	30.43	3.26
350	14.61	21.26	19.67	16.76	1.28	0.76	45.49	30.60	3.30
400	14.65	21.25	21.69	18.97	1.29	0.77	44.59	30.58	3.41
450	14.67	21.27	23.83	22.51	1.29	0.78	47.92	30.46	3.44
500	14.66	21.32	24.83	29.16	1.30	0.79	47.14	30.43	3.52
550	14.64	21.39	23.73	35.36	1.31	0.79	47.14	30.24	3.58
600	14.59	21.48	21.96	29.38	1.32	0.80	45.96	30.06	3.62
650	14.54	21.58	20.48	25.03	1.33	0.81	44.71	29.87	3.68
700	14.49	21.69	19.52	23.28	1.35	0.82	42.75	29.80	3.77
750	14.44	21.81	19.06	21.85	1.36	0.82	43.08	29.71	3.89
800	14.39	21.94	19.09	21.14	1.37	0.83	43.43	29.38	3.89
850	14.32	22.10	19.43	19.69	1.39	0.84	42.94	29.02	3.96
900	14.23	22.28	19.55	18.29	1.42	0.85	43.67	28.62	4.02
950	14.12	22.50	18.77	16.22	1.44	0.85	44.17	28.24	4.15
1000	13.96	22.75	17.06	14.25	1.47	0.86	44.22	27.77	4.18
1100	13.55	23.37	13.11	11.02	1.54	0.85	46.17	27.41	4.31
1200	13.04	24.08	10.28	8.96	1.62	0.84	52.19	27.33	4.57
1300	12.59	24.76	8.66	7.88	1.71	0.83	49.47	27.64	4.71
1400	12.34	25.26	8.00	7.43	1.79	0.83	47.34	27.86	4.83
1500	12.37	25.48	8.24	7.61	1.86	0.83	47.18	27.77	4.99
1600	12.62	25.51	9.70	8.67	1.94	0.85	45.09	27.90	5.23
1700	12.89	25.53	13.37	11.24	2.06	0.89	41.70	27.77	5.48
1800	12.87	25.86	21.64	17.28	2.29	0.94	39.57	26.91	5.88
1900	12.34	26.73	18.40	31.06	2.68	0.98	37.68	25.27	6.43
2000	11.23	28.21	13.04	16.25	3.35	1.00	36.53	23.47	7.01
2100	9.35	30.49	9.57	10.07	4.52	1.01	35.47	21.90	7.62
2200	6.73	33.57	6.75	6.23	6.41	0.94	33.98	20.29	8.70
2300	3.57	37.14	4.74	4.05	9.37	0.82	32.41	19.01	9.74

Typical Performance Curves

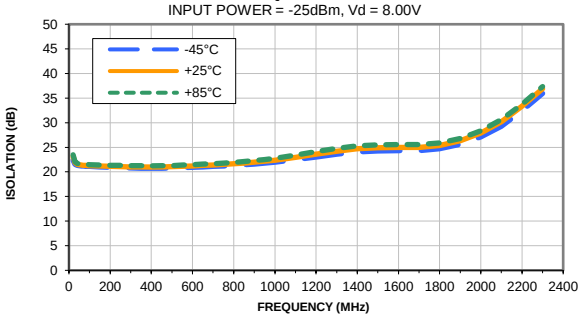
GAIN vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25dBm, Vd = 8.00V



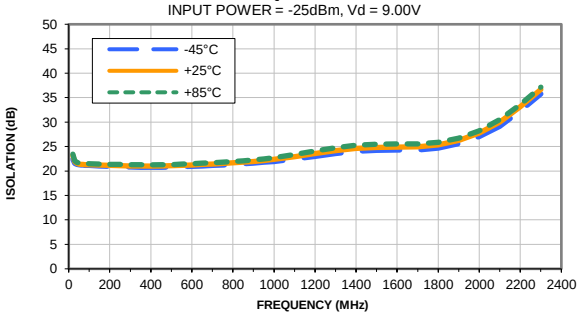
GAIN vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25dBm, Vd = 9.00V



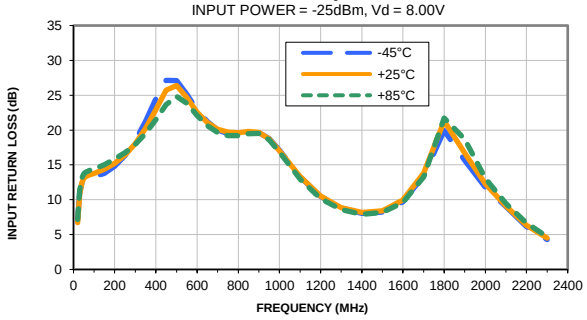
ISOLATION vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25dBm, Vd = 8.00V



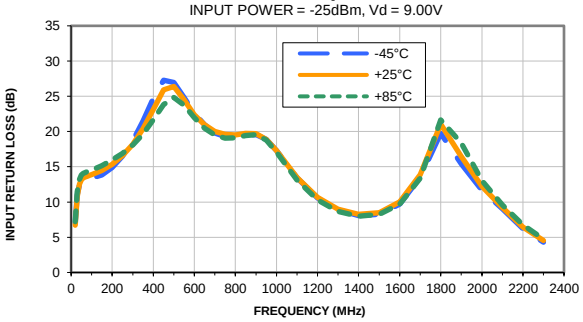
ISOLATION vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25dBm, Vd = 9.00V



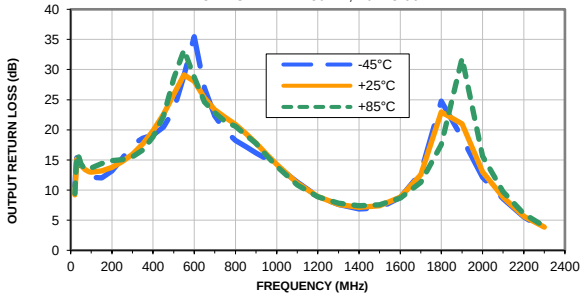
INPUT RETURN LOSS vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25dBm, Vd = 8.00V



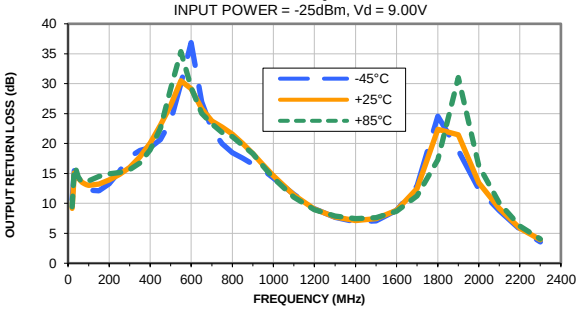
INPUT RETURN LOSS vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25dBm, Vd = 9.00V



OUTPUT RETURN LOSS vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25dBm, Vd = 8.00V

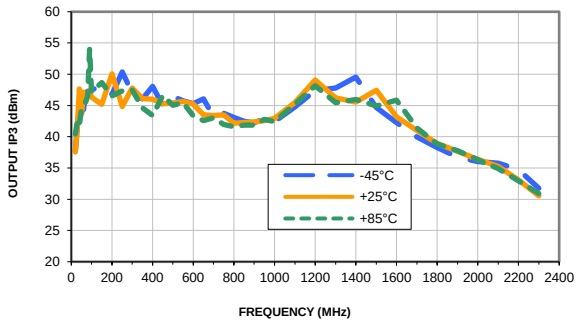


OUTPUT RETURN LOSS vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25dBm, Vd = 9.00V

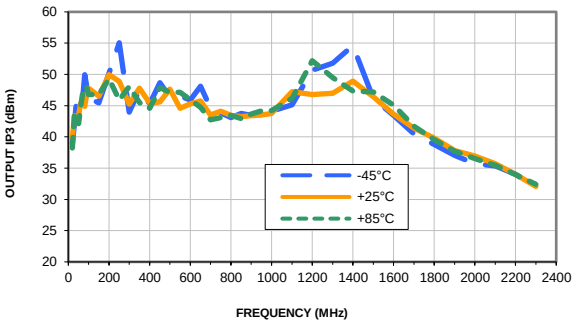


Typical Performance Curves

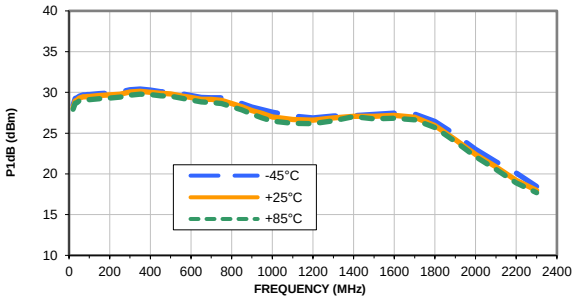
OUTPUT IP3 vs. FREQUENCY & TEMPERATURE
Vd = 8.00V



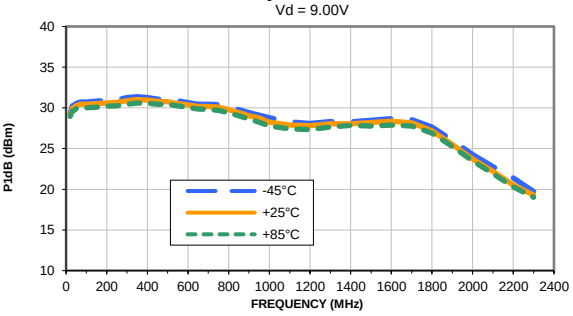
OUTPUT IP3 vs. FREQUENCY & TEMPERATURE
Vd = 9.00V



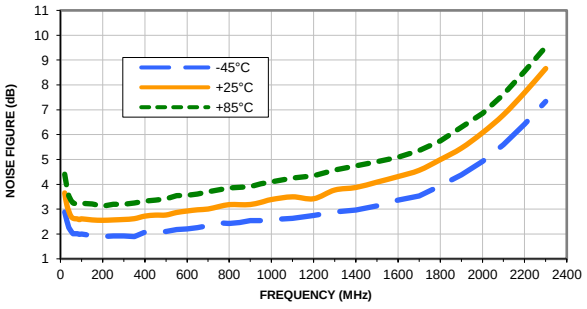
P1dB vs. FREQUENCY & TEMPERATURE
Vd = 8.00V



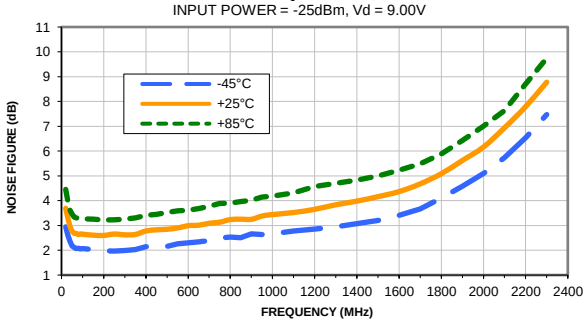
P1dB vs. FREQUENCY & TEMPERATURE
Vd = 9.00V



NOISE FIGURE vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25dBm, Vd = 8.00V

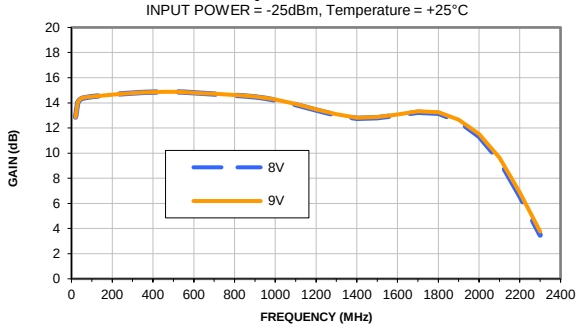


NOISE FIGURE vs. FREQUENCY & TEMPERATURE
INPUT POWER = -25dBm, Vd = 9.00V

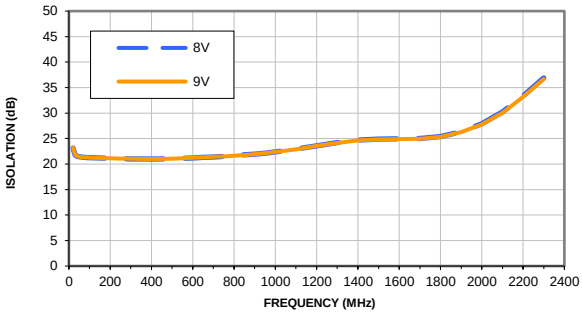


Typical Performance Curves

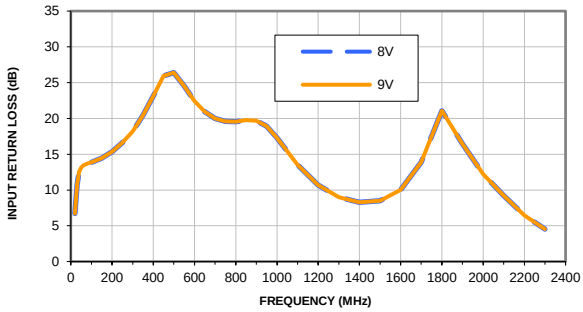
GAIN vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25dBm, Temperature = +25°C



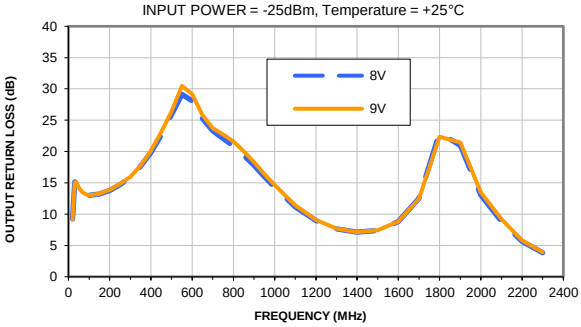
ISOLATION vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25dBm, Temperature = +25°C



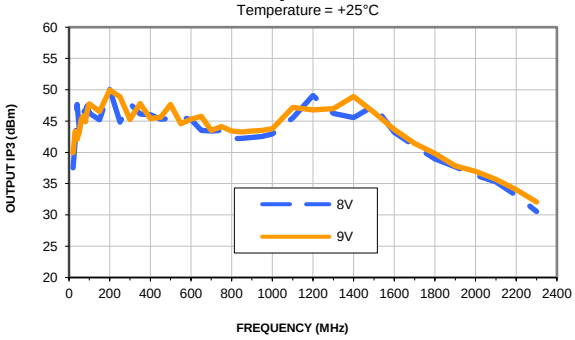
INPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25dBm, Temperature = +25°C



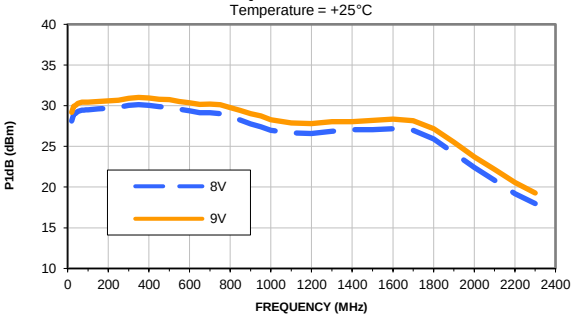
OUTPUT RETURN LOSS vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25dBm, Temperature = +25°C



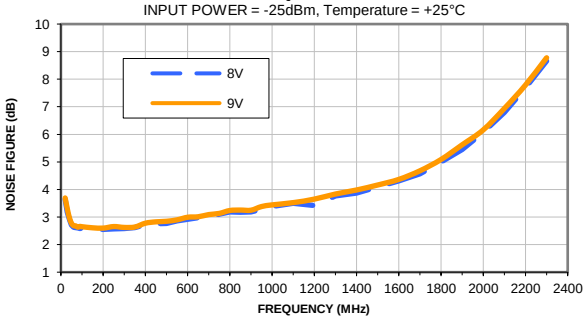
OUTPUT IP3 vs. FREQUENCY & DEVICE VOLTAGE
Temperature = +25°C



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



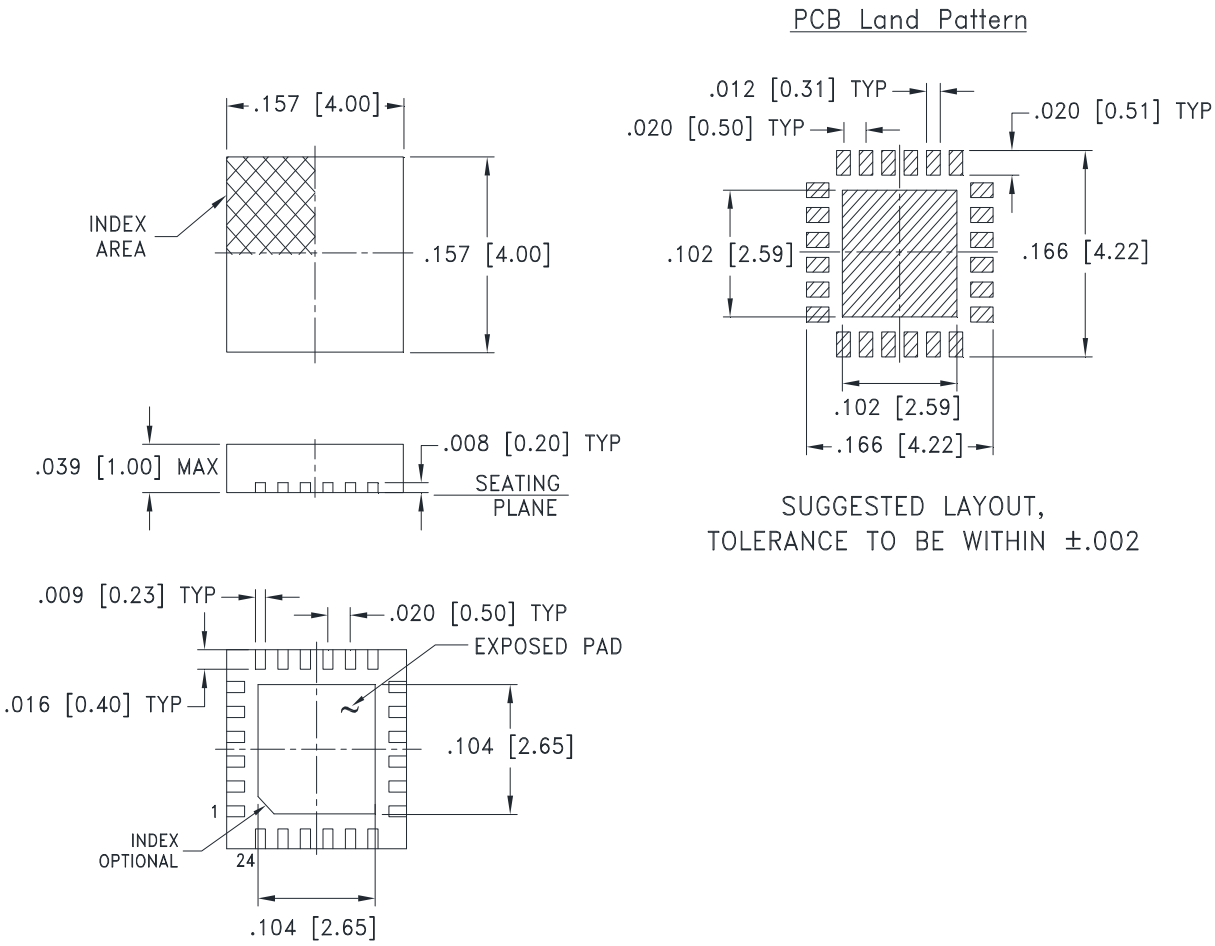
NOISE FIGURE vs. FREQUENCY & DEVICE VOLTAGE
INPUT POWER = -25dBm, Temperature = +25°C



Case Style DG

DG1847

Outline Dimensions



Weight: .04 Grams

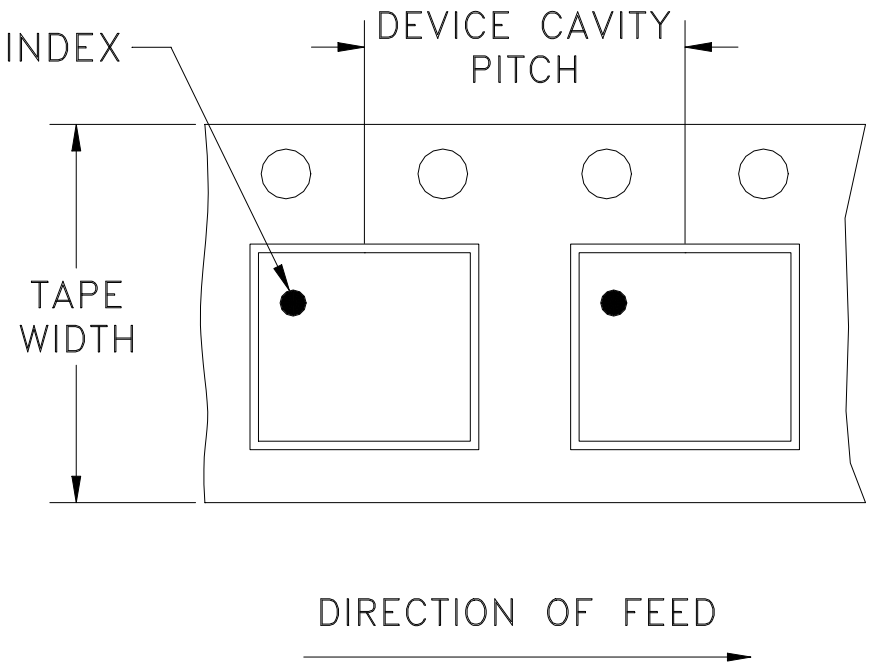
Dimensions are in inches (mm). Tolerances: 2 Pl. ± .01; 3 Pl. ± .005

Notes:

1. Case material: Plastic.
2. Termination finish:
   For RoHS Case Styles: Tin-Silver 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.

Tape & Reel Packaging TR-F68

DEVICE ORIENTATION IN T&R



Tape Width, mm	Device Cavity Pitch, mm	Reel Size, inches	Devices per Reel see note	
12	8	7	Small quantity standard	20
				50
				100
				200
				500
		7	Standard	1000
		13	Standard	2000
				3000
				4000

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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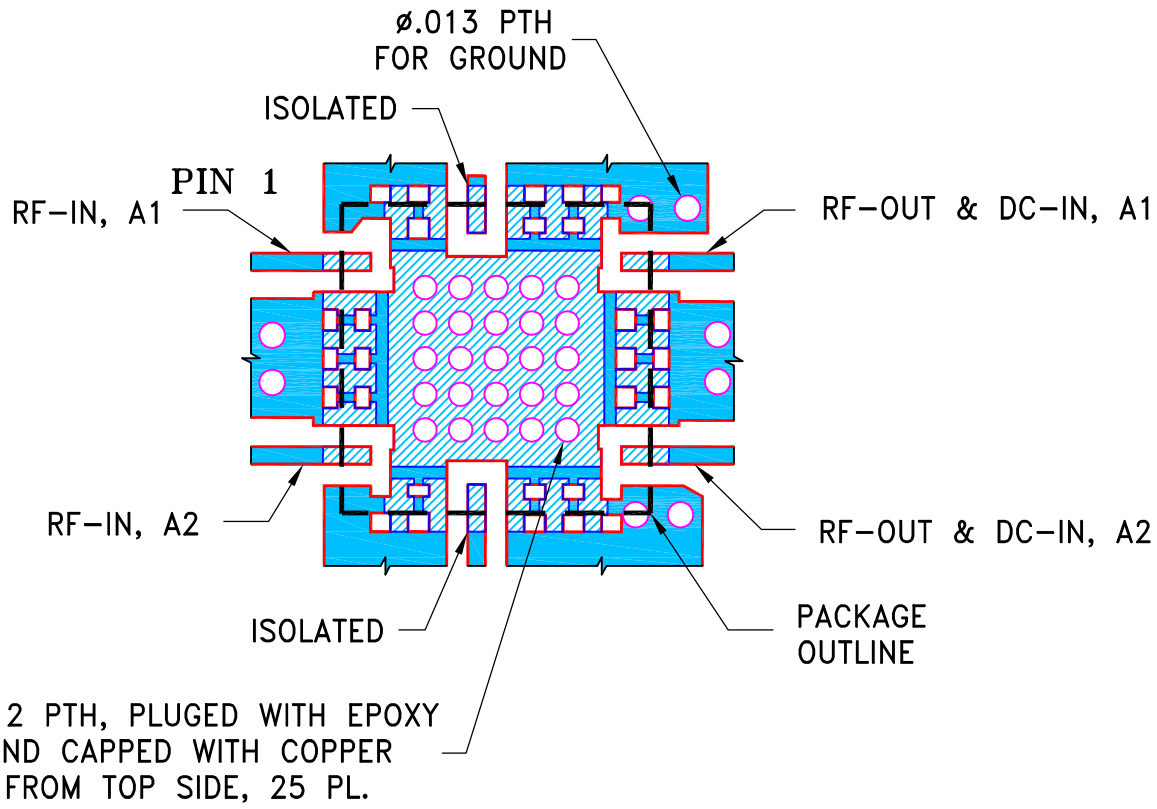
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-002406	NEW RELEASE	04/14/20	ITG	CM

SUGGESTED MOUNTING CONFIGURATION FOR DG1847 CASE STYLE, "24AM02" PIN CONNECTION



NOTES:

1. MATERIAL: FR4 WITH DIELECTRIC THICKNESS 0.024 ± 0.002";
   COPPER: 1/2 OZ. EACH SIDE.
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	DRAWN	ITG	04/14/20
TOLERANCES ON:	CHECKED	GF	04/14/20
2 PL DECIMALS ±	APPROVED	CM	04/14/20
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

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

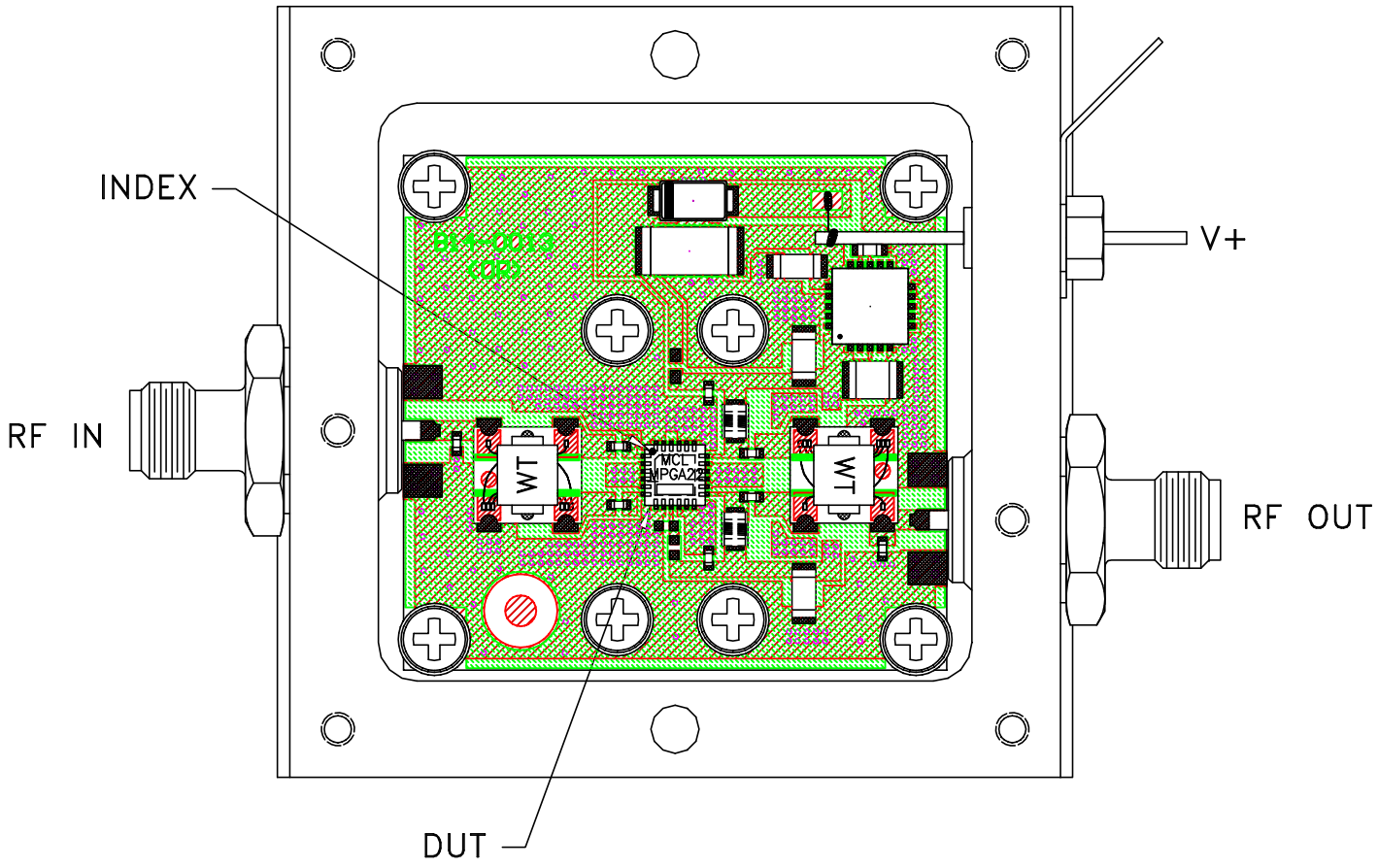
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

PL, 24AM02, DG1847, TB-MPGA-152+

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-671	OR

FILE:	SCALE:	SHEET:
98PL671	10:1	1 OF 1

Evaluation Board and Circuit



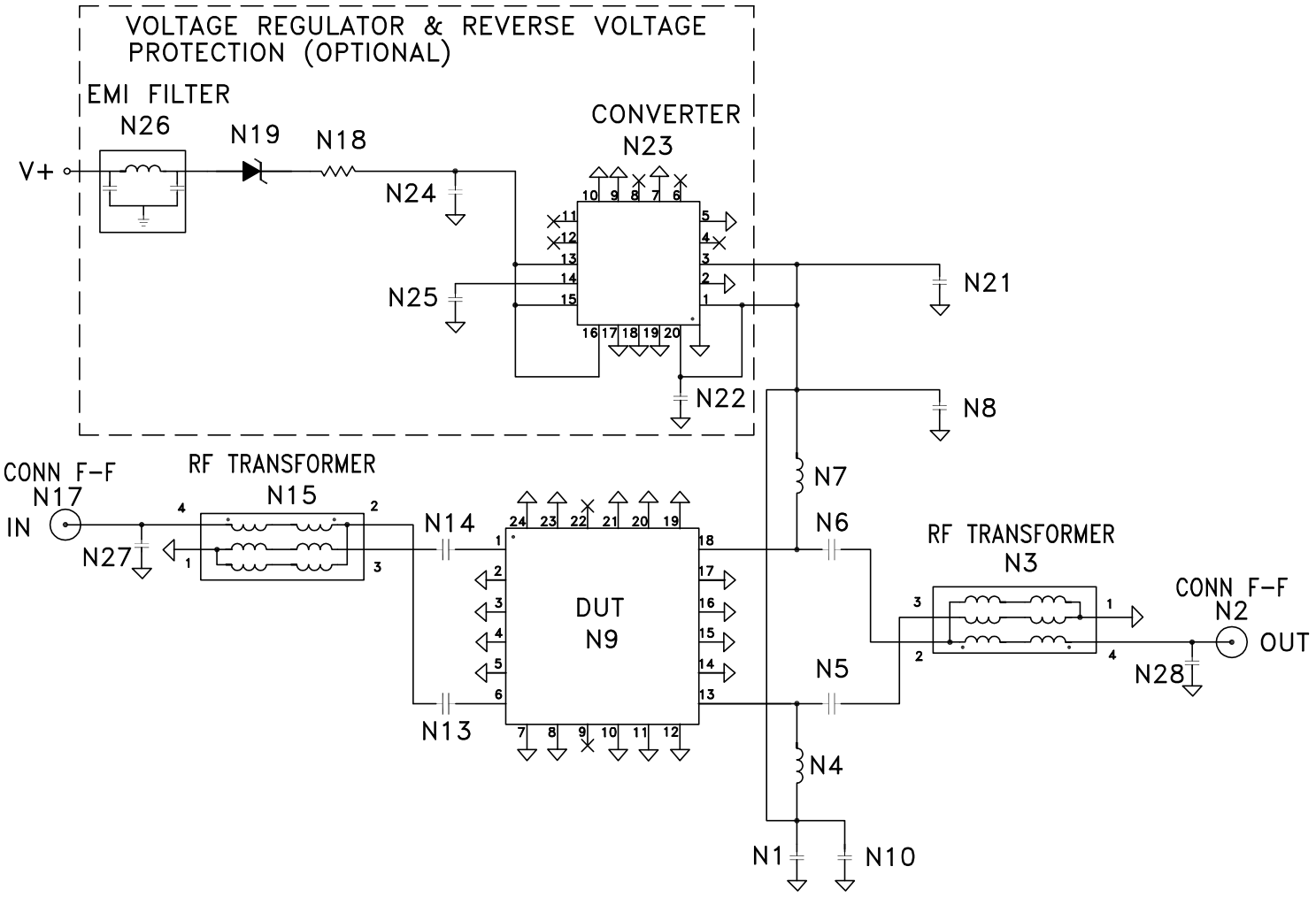
TB-MPGA-152+

Notes:

1. 50 Ohm SMA Female connectors.
2. PCB Material: FR4 or equivalent, Dielectric Constant=4.5.
   Total Finished Thickness – .024".

Mini-Circuits®

Evaluation Board and Circuit



COMPONENT	VALUE	SIZE
N9 (DUT)	Mini-Circuits MPGA-152+	4X4 mm
N1,N21,N24	Capacitor 10 uF	1206
N3,N15	Mini-Circuits TRS1.5-182+	7.11X6.35 mm
N4,N7	Inductor 390 nH	0805
N5,N6,N13,N14	Capacitor 220 pF	0402
N8,N10	Capacitor .01 uF	
N18	Resistor 4.32 Ohms,1W	2512
N19	Diod Schottky SMA 40V MSL1	5.21X2.60 mm
N22	Capacitor 10 uF	1210
N23	Voltage Regulator QFN20 ADJ MSL2	5X5 mm
N25	Capacitor 1 uF	0603
N26	EMI Filter	-
N27, N28	Capacitor .50 pF	0402

Schematic Diagram

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 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.

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