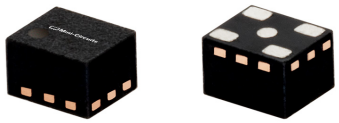
MMIC SURFACE MOUNT

E-PHEMT Transistor TAV1-541NM+

50Ω 45 to 6000 MHz Non-Magnetic Leadframe

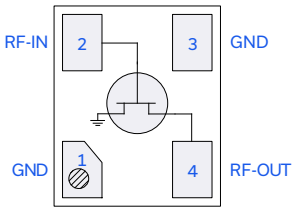
THE BIG DEAL

- Non-Ferrous Package Leadframe
- Low Noise Figure, Typ. 0.4dB
- High Gain, Typ. 24dB
- High Output IP3, Typ. +32dBm
- Output Power at 1dB Compression, Typ. +18dBm
- Single Supply Voltage, 60mA, +3V
- Wide Bandwidth



Generic photo used for illustration purposes only

FUNCTIONAL DIAGRAM



APPLICATIONS

- MRI
- ISM
- 5G MIMO Radio Systems
- Wi-Fi 6
- Tactical Radio

PRODUCT OVERVIEW

Mini-Circuits' TAV1-541NM+ is a MMIC E-pHEMT* transistor with an operating frequency range from 45 to 6000MHz. This model combines high gain with extremely low noise figure, resulting in lower overall system noise. Low noise figure and high IP3 performance make it an ideal choice for sensitive receivers in communications systems. Manufactured using highly repeatable E-pHEMT* technology, the unit comes housed in a tiny 1.4x1.2mm Non-Magnetic package. This model requires external biasing and matching for user-specific applications.

KEY FEATURES

Features	Advantages
Non-Magnetic Package	Ideal for use in MRI and other magnetic sensitive applications.
Wideband, 45 to 6000MHz	Use in multiple applications:UHF, VHF, and Communication Infrastructure. One single high-performance component is effective for use in multiple applications including MRI, Wi-Fi 6, and other communications infrastructure.
High IP3 vs. DC power consumption • +31.4dBm at 2000MHz, 60mA, +3V • +33.9dBm at 2000MHz, 60mA, +4V	Enhanced linearity over a broad frequency range makes the device ideal for use in: • Driver amplifiers for complex waveform up converter paths • Drivers in linearized transmit systems
Combines high Gain (18.6dB) with very low Noise Figure (0.6dB) at 2000MHz, 60mA, +3V	The unique combination of high gain and low noise figure results in lower overall system noise.

* Enhancement mode Pseudomorphic High Electron Mobility Transistor.

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ELECTRICAL SPECIFICATIONS[1] AT 25°C, V_{DS} = +3V/+4V, I_{DS}=60mA, UNLESS NOTED OTHERWISE

Parameter	Condition (MHz)	V_{DS} = +3V; I_{DS} = 60mA			V_{DS} = +4V; I_{DS} = 60mA			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Frequency Range		45		6000	45		6000	MHz
Noise Figure	900		0.4			0.5		dB
	2000		0.6			0.7		
	4000		1			1		
	6000		1.6			1.7		
Gain	900		24.1			24.1		dB
	2000		18.6			18.6		
	4000		13.1			13.1		
	6000		8.9			8.9		
Output Power at 1dB Compression (P1dB)[2]	900		+18.2			+20.4		dBm
	2000		+18.4			+20.7		
	4000		+18.3			+20.8		
	6000		+18.3			+20.3		
Output Third-Order Intercept P_{OUT} = 0dBm/Tone	900		+32			+32.8		dBm
	2000		+31.4			+33.9		
	4000		+31.9			+34.1		
	6000		31.8			+34.9		
Isolation	900		27.7			27.8		dB
	2000		25.5			25.6		
	4000		22.9			23.1		
	6000		21.6			21.8		
Output Return Loss	900		9.8			9.8		dB
	2000		13.1			13.5		
	4000		14.4			15.3		
	6000		11.2			12		

DC SPECIFICATIONS[1] AT 25°C, V_{DS} = +3V, I_{DS} = 60mA, UNLESS NOTED OTHERWISE

Parameter	Condition (MHz)	Min.	Typ.	Max.	Units
Device Operating Gate Voltage (V_{GS})	V_{DS} = +3V, I_{DS} = 60mA	+0.37	+0.48	+0.69	V
Threshold Voltage (V_{TH})	V_{DS} = +3V, I_{DS} = 4mA	+0.18	+0.26	+0.38	V
Saturated Drain Current (I_{DSS})	V_{DS} = +3V, V_{GS} = 0V		1	5	µA
Transconductance (G_M)	V_{DS} = +3V, $G_M = \Delta I_{DS}/\Delta V_{GS}$ $\Delta V_{GS} = V_{GS2} - V_{GS1}$ $V_{GS1} = V_{GS}$ at I_{DS} = 60mA $V_{GS2} = V_{GS1}$ + 50mV	230	392	560	mS
Gate Leakage Current (I_{GSS})	$V_{GD} = V_{GS}$ = -3V			200	µA

1. Tested on Mini-Circuits Characterization Test/Evaluation Board TB-TAV1-541NMC+. See Figure 2. No matching components have been used on RF input and RF output.
2. Drain current bias is allowed to increase during compression measurement.

E-PHEMT Transistor TAV1-541NM+

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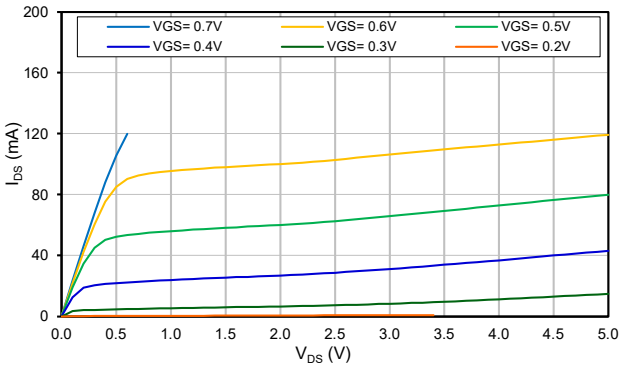
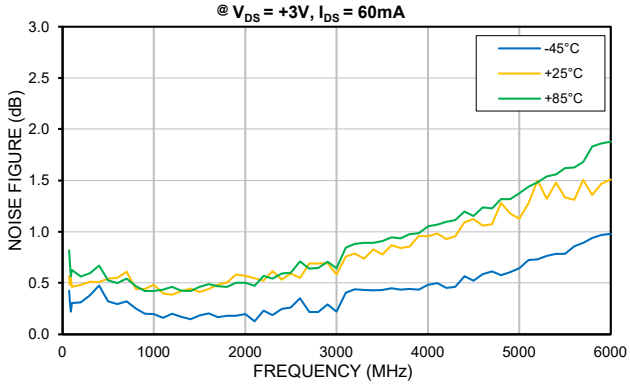
TYPICAL PERFORMANCE GRAPHS

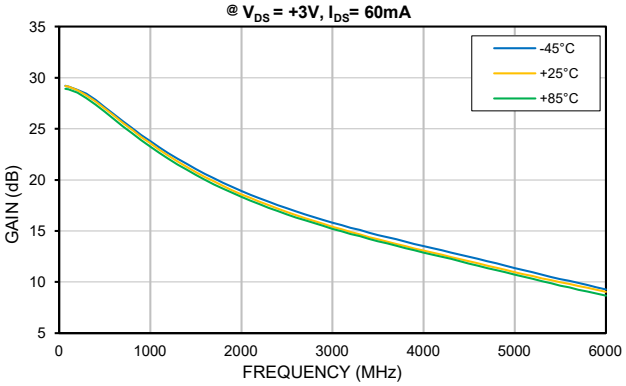
DRAIN CURRENT vs. GATE-SOURCE Voltage[4]



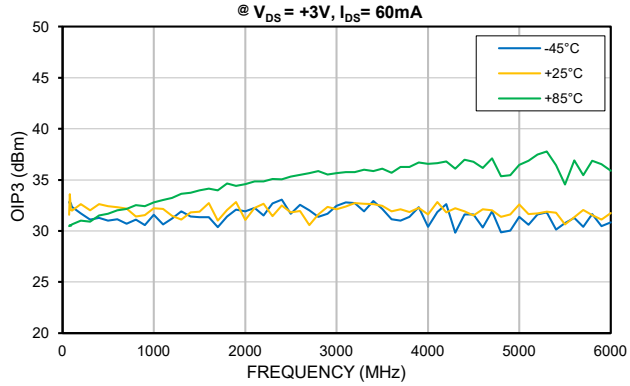
NOISE FIGURE vs. TEMPERATURE[3]
@ V_{DS} = +3V, I_{DS} = 60mA



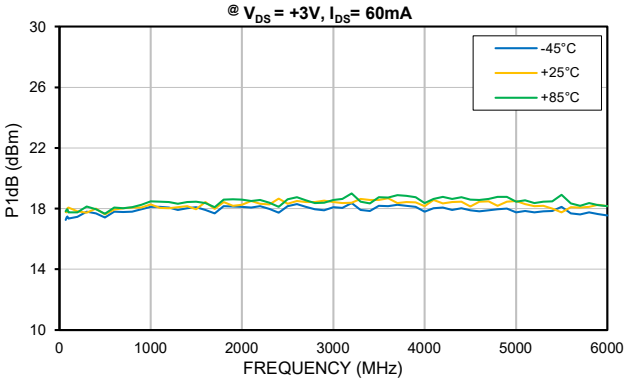
GAIN vs. TEMPERATURE[3]
@ V_{DS} = +3V, I_{DS}= 60mA



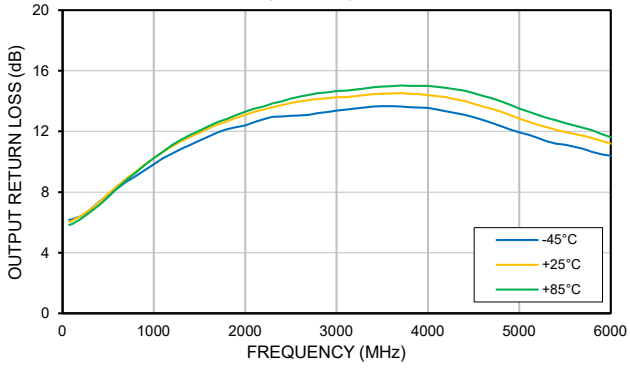
OUTPUT IP3 vs. TEMPERATURE[3]
@ V_{DS} = +3V, I_{DS}= 60mA



P1dB vs. TEMPERATURE[3]
@ V_{DS} = +3V, I_{DS}= 60mA



OUTPUT RETURN LOSS vs. TEMPERATURE[3]
@ V_{DS} = +3V, I_{DS}= 60mA



3. Includes test board loss
4. Drain current was allowed to increase during compression measurement

E-PHEMT Transistor TAV1-541NM+

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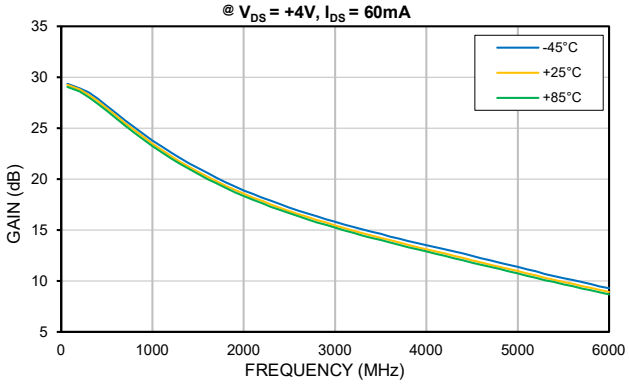
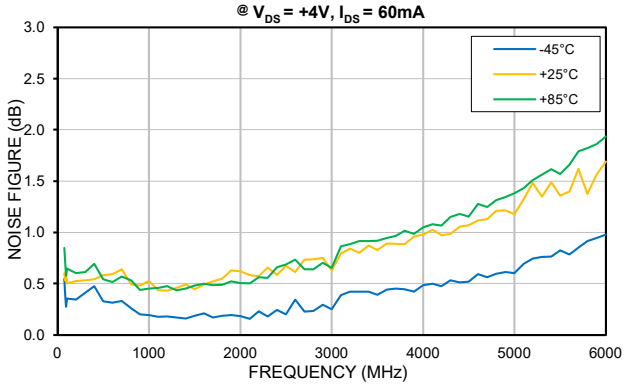
TYPICAL PERFORMANCE GRAPHS

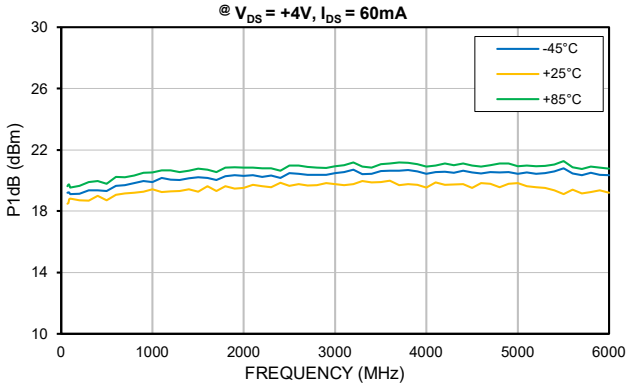
GAIN vs. TEMPERATURE[3]
@ V_{DS} = +4V, I_{DS} = 60mA



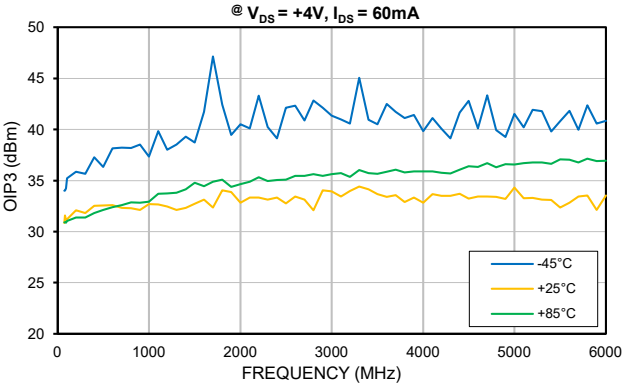
NOISE FIGURE vs. TEMPERATURE[3]
@ V_{DS} = +4V, I_{DS} = 60mA



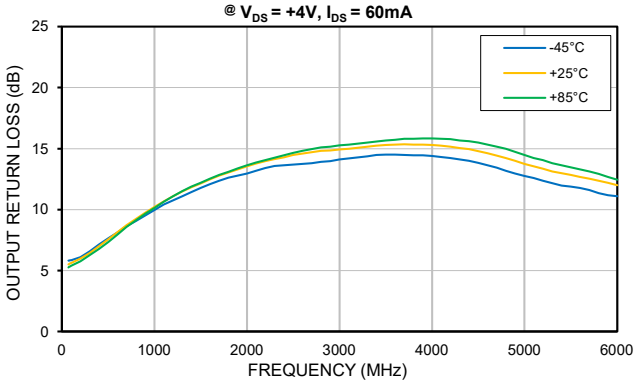
P1dB vs. TEMPERATURE[3]
@ V_{DS} = +4V, I_{DS} = 60mA



OUTPUT IP3 vs. TEMPERATURE[3]
@ V_{DS} = +4V, I_{DS} = 60mA



OUTPUT RETURN LOSS vs. TEMPERATURE[3]
@ V_{DS} = +4V, I_{DS} = 60mA



3. Includes test board loss
4. Drain current was allowed to increase during compression measurement

ABSOLUTE MAXIMUM RATINGS[5]

Parameter	Ratings
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Junction Temperature[6]	+150°C
Total Power Dissipation (P_{DISS})	360mW
Input Power (P_{IN})[7]	+17dBm
Drain-Source Voltage (V_{DS})[8]	+5V
Gate-Source Voltage (V_{GS})[8]	-5V to +0.7V
Gate-Drain Voltage (V_{GD})[8]	-5V to +0.7 V
Drain Current (I_{DS})[8]	120mA
Gate Current (I_{GS})	2mA

5. Permanent damage may occur if any of these limits are exceeded. Maximum ratings are not intended for continuous normal operation.
6. Peak temperature on top of Die.
7. I_{GS} is limited to 2mA during test.
8. Assumes DC quiescent condition.

THERMAL RESISTANCE

Parameter	Ratings
Thermal Resistance (Θ_{jc})[9]	160°C/W

9. Θ_{jc}= (Hot Spot Temperature on Die - Temperature at Ground Lead)/Dissipated Power

ESD RATING

	Class	Voltage Range	Reference Standard
HBM	1A	250 V to <500 V	ANSI/ESDA/JEDEC JS-001-2017

ESD HANDLING PRECAUTION: This device is designed to be Class 1A for HBM. Static charges may easily produce potentials higher than this with improper handling and can discharge into DUT and damage it. As a preventive measure Industry standard ESD handling precautions should be used at all times to protect the device from ESD damage.

MSL RATING

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020E /JEDEC J-STD-033C

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FUNCTIONAL DIAGRAM

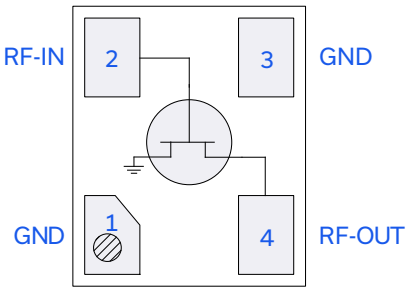

Figure 1. TAV1-541NM+ Functional Diagram

PAD DESCRIPTION

Function	Pad Number	Description (Refer to Figure 2)
RF-IN	2	RF-IN Pad connects to Gate
RF-OUT	4	RF-OUT Pad connects to Drain
GND	1, 3, and Paddle	Connects to ground

CHARACTERIZATION TEST BOARD

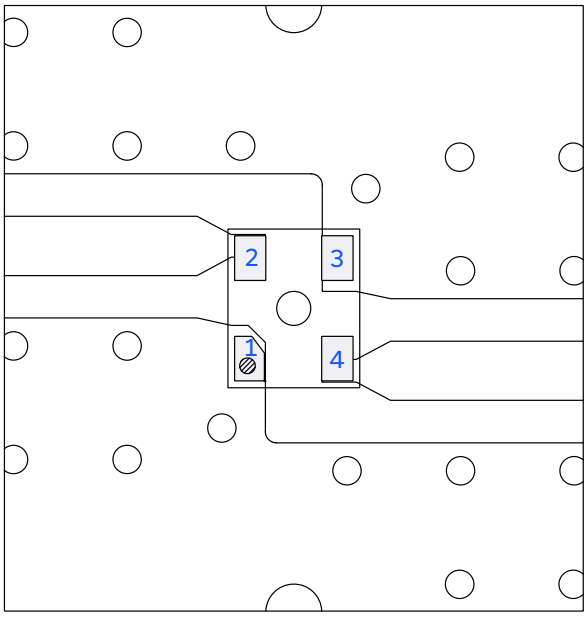

Figure 2. DUT soldered on Mini-Circuits Characterization Test Board: TB-TAV1-541NMC+

Electrical Parameters and Conditions
Gain, Output Power at 1dB Compression (P1dB), Output IP3 (OIP3), and Noise Figure measured using N5247B PNA-X microwave network analyzer.

Conditions:
1. Drain Voltage (with reference to source, V_{DS}) = +3V or +4V as shown
2. Gate Voltage (with reference to source, V_{GS}) is set to obtain desired Drain-Source current (I_{DS}) as shown in Specification Table
3. Gain: P_{IN} = -25dBm
4. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 0dBm/tone at output.
5. No external matching components used on test board; internal PNA-X bias tees used to provide bias voltages.

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

Power ON Sequence:
1) Set V_{GS} = 0V. Apply V_{GS}.
2) Set V_{DS} = +3V or +4V. Apply V_{DS}.
3) Increase V_{GS} to obtain desired I_{DS} as shown in specification table.
4) Apply RF Signal.

Power OFF Sequence:
1) Turn off RF Signal.
2) Adjust V_{GS} down to 0V.
3) Turn off V_{DS}.
4) Turn off V_{GS}.

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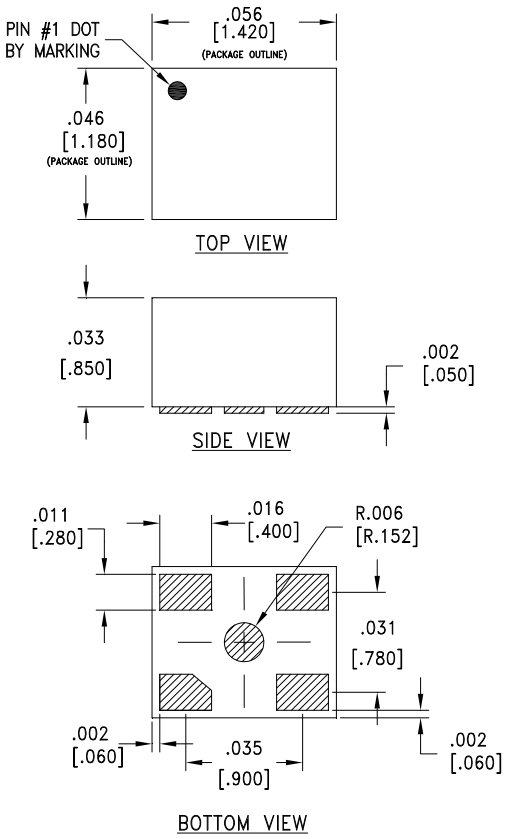
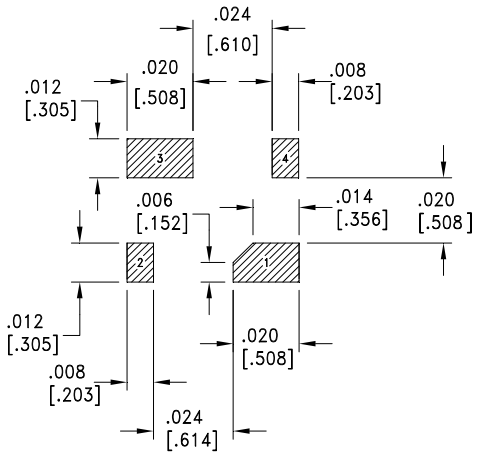
CASE STYLE DRAWING



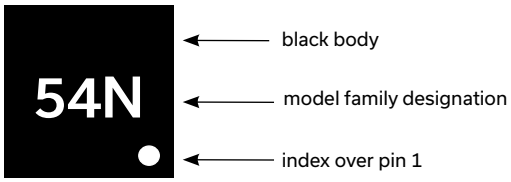
PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

Weight: .0047 grams
Dimensions are in inches [mm]. Tolerances: 2 Pl. + .01; 3 Pl. + .005

PRODUCT MARKING



Marking may contain other features or characters for internal lot control

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ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASH BOARD CLICK HERE

Performance Data & Graphs	Data Graphs S-Parameter (S2P Files) Data Set (.zip file)
Case Style	TE2769 Plastic package, exposed paddle, Lead Finish: Matte-Tin
RoHS Status	Compliant
Tape & Reel **Standard quantities available on reel**	F90 7" reels with 20, 50, 100, 200, 500,1K, 2K or 3K devices
Suggested Layout for PCB Design	PL-758
Evaluation Board	TB-TAV1-541NMC+ Gerber File
Environmental Ratings	ENV08T2

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/terms/viewterm.html

Typical Performance Data

V_{DS} (V)	I_{DS} (mA)					
	V_{GS}= 0.7V	V_{GS}= 0.6V	V_{GS}= 0.5V	V_{GS}= 0.4V	V_{GS}= 0.3V	V_{GS}= 0.2V
0.0	0.09	0.10	0.08	0.08	0.04	0.01
0.1	23.61	21.95	18.97	12.61	3.65	0.27
0.2	46.35	42.39	34.57	18.82	4.15	0.29
0.3	68.02	60.56	45.11	20.58	4.34	0.30
0.4	88.05	75.24	50.24	21.37	4.50	0.33
0.5	105.70	85.18	52.30	21.90	4.65	0.34
0.6	120.00	90.38	53.38	22.33	4.85	0.34
0.7		92.66	54.18	22.76	4.99	0.36
0.8		93.88	54.89	23.24	5.13	0.38
0.9		94.80	55.49	23.62	5.25	0.40
1.0		95.53	56.03	23.97	5.38	0.42
1.1		96.14	56.51	24.29	5.51	0.43
1.2		96.68	56.97	24.61	5.63	0.45
1.3		97.18	57.39	24.91	5.75	0.45
1.4		97.65	57.82	25.22	5.86	0.47
1.5		98.08	58.21	25.50	5.98	0.48
1.6		98.49	58.60	25.77	6.10	0.52
1.7		98.89	58.97	26.04	6.21	0.53
1.8		99.30	59.33	26.32	6.32	0.55
1.9		99.68	59.70	26.58	6.45	0.57
2.0		100.07	60.08	26.87	6.55	0.55
2.1		100.48	60.50	27.17	6.69	0.58
2.2		100.97	60.97	27.51	6.82	0.60
2.3		101.50	61.47	27.89	6.99	0.63
2.4		102.12	62.05	28.29	7.17	0.64
2.5		102.78	62.68	28.74	7.34	0.67
2.6		103.50	63.32	29.19	7.52	0.70
2.7		104.22	63.99	29.65	7.69	0.71
2.8		104.94	64.64	30.15	7.90	0.73
2.9		105.64	65.31	30.62	8.10	0.76
3.0		106.33	65.99	31.13	8.34	0.82
3.1		107.02	66.65	31.63	8.56	0.84
3.2		107.70	67.32	32.17	8.79	0.87
3.3		108.37	68.02	32.72	9.03	0.90
3.4		109.02	68.69	33.28	9.30	0.92
3.5		109.67	69.41	33.87	9.58	0.95
3.6		110.34	70.12	34.46	9.89	1.01
3.7		111.00	70.81	35.06	10.20	1.06
3.8		111.64	71.53	35.67	10.53	1.10
3.9		112.30	72.24	36.29	10.86	1.14
4.0		112.96	72.93	36.89	11.21	1.14
4.1		113.60	73.65	37.51	11.55	1.30
4.2		114.25	74.35	38.13	11.90	1.37
4.3		114.88	75.03	38.74	12.26	1.45
4.4		115.53	75.76	39.36	12.63	1.54
4.5		116.18	76.47	39.99	13.00	1.62
4.6		116.80	77.15	40.62	13.38	1.69
4.7		117.44	77.86	41.23	13.76	1.78
4.8		118.06	78.56	41.86	14.14	1.90
4.9		118.67	79.26	42.50	14.53	1.98
5.0		119.30	79.96	43.13	14.94	2.07

Typical Performance Data

FREQ (MHz)	GAIN vs. FREQ & TEMPERATURE[1] @ V_{DS}=+3V, I_{DS}=60mA			NOISE FIGURE vs. FREQ & TEMPERATURE [1] @ V_{DS}=+3V, I_{DS}=60mA			OUTPUT RETURN LOSS vs. FREQ & TEMPERATURE [1] @ V_{DS}=+3V, I_{DS}=60mA		
	dB			dB			dB		
	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
70	29.2	29.2	28.9	0.4	0.6	0.8	6.2	6.0	5.8
80	29.2	29.2	28.9	0.3	0.5	0.7	6.2	6.0	5.8
90	29.2	29.2	28.9	0.2	0.5	0.6	6.2	6.1	5.9
100	29.1	29.1	28.9	0.3	0.5	0.6	6.2	6.1	5.9
200	28.8	28.8	28.5	0.3	0.5	0.6	6.4	6.4	6.2
300	28.4	28.3	28.0	0.4	0.5	0.6	6.8	6.8	6.7
400	27.8	27.7	27.4	0.5	0.5	0.7	7.3	7.3	7.1
500	27.1	27.0	26.7	0.3	0.5	0.5	7.8	7.9	7.7
600	26.5	26.3	26.0	0.3	0.5	0.5	8.2	8.4	8.2
700	25.7	25.6	25.2	0.3	0.6	0.5	8.7	8.9	8.8
800	25.1	24.9	24.6	0.2	0.4	0.5	9.1	9.3	9.3
900	24.4	24.2	23.9	0.2	0.4	0.4	9.4	9.8	9.8
1000	23.8	23.6	23.2	0.2	0.5	0.4	9.8	10.2	10.2
1100	23.2	23.0	22.6	0.2	0.4	0.4	10.2	10.6	10.7
1200	22.6	22.4	22.1	0.2	0.4	0.5	10.5	11.0	11.1
1300	22.1	21.8	21.5	0.2	0.4	0.4	10.8	11.3	11.5
1400	21.6	21.3	21.0	0.1	0.4	0.4	11.1	11.6	11.8
1500	21.1	20.8	20.5	0.2	0.4	0.5	11.4	11.9	12.1
1600	20.6	20.3	20.0	0.2	0.4	0.5	11.7	12.2	12.3
1700	20.1	19.8	19.6	0.2	0.5	0.5	11.9	12.5	12.6
1800	19.7	19.4	19.1	0.2	0.5	0.5	12.1	12.7	12.8
1900	19.3	19.0	18.7	0.2	0.6	0.5	12.3	12.9	13.1
2000	18.9	18.6	18.3	0.2	0.6	0.5	12.4	13.1	13.3
2100	18.5	18.2	18.0	0.1	0.5	0.5	12.6	13.3	13.5
2200	18.2	17.9	17.6	0.2	0.5	0.6	12.8	13.4	13.7
2300	17.9	17.5	17.3	0.2	0.6	0.5	13.0	13.6	13.8
2400	17.5	17.2	17.0	0.2	0.5	0.6	13.0	13.7	14.0
2500	17.2	16.9	16.6	0.3	0.6	0.6	13.0	13.9	14.2
2600	16.9	16.6	16.3	0.4	0.5	0.7	13.1	14.0	14.3
2700	16.6	16.3	16.0	0.2	0.7	0.6	13.1	14.1	14.4
2800	16.3	16.0	15.8	0.2	0.7	0.6	13.2	14.2	14.5
2900	16.1	15.7	15.5	0.3	0.7	0.7	13.3	14.2	14.6
3000	15.8	15.4	15.2	0.2	0.6	0.6	13.4	14.2	14.7
3100	15.6	15.2	15.0	0.4	0.8	0.8	13.4	14.3	14.7
3200	15.3	14.9	14.7	0.4	0.8	0.9	13.5	14.3	14.8
3300	15.1	14.7	14.5	0.4	0.7	0.9	13.6	14.4	14.8
3400	14.8	14.4	14.2	0.4	0.8	0.9	13.6	14.5	14.9
3500	14.6	14.2	14.0	0.4	0.8	0.9	13.7	14.5	15.0
3600	14.4	14.0	13.8	0.4	0.9	0.9	13.7	14.5	15.0
3700	14.2	13.7	13.6	0.4	0.8	0.9	13.7	14.5	15.0
3800	13.9	13.5	13.3	0.4	0.9	1.0	13.6	14.5	15.0
3900	13.7	13.3	13.1	0.4	1.0	1.0	13.6	14.5	15.0
4000	13.5	13.1	12.9	0.5	1.0	1.1	13.5	14.4	15.0
4100	13.3	12.9	12.7	0.5	1.0	1.1	13.4	14.3	14.9
4200	13.1	12.7	12.5	0.5	0.9	1.1	13.3	14.2	14.9
4300	12.9	12.4	12.2	0.5	1.0	1.1	13.2	14.1	14.8
4400	12.7	12.2	12.0	0.6	1.1	1.2	13.1	14.0	14.7
4500	12.5	12.0	11.8	0.5	1.1	1.2	12.9	13.8	14.5
4600	12.3	11.8	11.6	0.6	1.1	1.2	12.8	13.7	14.4
4700	12.0	11.6	11.4	0.6	1.1	1.2	12.6	13.5	14.2
4800	11.8	11.4	11.2	0.6	1.3	1.3	12.3	13.3	14.0
4900	11.6	11.2	11.0	0.6	1.2	1.3	12.1	13.1	13.8
5000	11.4	11.0	10.7	0.6	1.1	1.4	11.9	12.9	13.5
5100	11.2	10.8	10.5	0.7	1.3	1.4	11.8	12.6	13.3
5200	10.9	10.6	10.3	0.7	1.5	1.5	11.6	12.4	13.1
5300	10.7	10.4	10.1	0.8	1.3	1.5	11.4	12.3	12.9
5400	10.5	10.2	9.9	0.8	1.5	1.6	11.2	12.1	12.7
5500	10.3	10.0	9.7	0.8	1.3	1.6	11.1	12.0	12.6
5600	10.1	9.8	9.5	0.9	1.3	1.6	11.0	11.8	12.4
5700	9.9	9.6	9.3	0.9	1.5	1.7	10.9	11.7	12.2
5800	9.7	9.4	9.1	0.9	1.4	1.8	10.6	11.6	12.1
5900	9.5	9.2	8.9	1.0	1.5	1.9	10.5	11.4	11.8
6000	9.3	9.0	8.7	1.0	1.5	1.9	10.4	11.2	11.6

(1) Includes test board loss

Typical Performance Data

FREQ (MHz)	OIP3 vs FREQ & TEMPERATURE (1) @ V_{DS}=+3V, I_{DS}=60mA			P1dB vs FREQ & TEMPERATURE(1,2) @ V_{DS}=+3V, I_{DS}=60mA		
	dBm			dBm		
	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
70	32.8	31.6	30.5	17.2	17.8	17.8
80	32.7	33.6	30.6	17.4	17.7	17.9
90	32.7	32.1	30.5	17.5	18.0	18.0
100	32.4	32.0	30.6	17.3	18.1	17.8
200	31.7	32.6	31.0	17.4	17.8	17.8
300	31.1	32.0	30.9	17.8	17.7	18.1
400	31.3	32.6	31.5	17.7	18.0	18.0
500	31.0	32.4	31.7	17.4	17.6	17.7
600	31.2	32.3	32.0	17.8	17.9	18.1
700	30.7	32.2	32.2	17.8	18.0	18.0
800	31.1	31.4	32.5	17.8	18.1	18.1
900	30.6	31.6	32.4	18.0	18.1	18.3
1000	31.6	32.2	32.8	18.1	18.3	18.5
1100	30.6	32.2	33.0	18.1	18.1	18.5
1200	31.2	31.5	33.2	18.1	18.0	18.4
1300	31.9	31.1	33.6	17.9	18.1	18.3
1400	31.4	31.8	33.7	18.0	18.2	18.4
1500	31.4	31.9	34.0	18.1	18.0	18.5
1600	31.3	32.7	34.2	17.9	18.4	18.4
1700	30.4	31.0	34.0	17.7	18.0	18.1
1800	31.4	32.1	34.7	18.2	18.4	18.6
1900	32.1	32.8	34.4	18.1	18.2	18.6
2000	31.9	31.1	34.6	18.1	18.3	18.6
2100	32.3	32.3	34.9	18.1	18.5	18.5
2200	31.5	32.7	34.9	18.1	18.3	18.6
2300	32.7	31.4	35.1	18.0	18.3	18.4
2400	33.1	32.5	35.0	17.7	18.7	18.1
2500	31.7	31.8	35.3	18.2	18.3	18.6
2600	32.6	32.0	35.5	18.3	18.5	18.8
2700	32.0	30.6	35.7	18.1	18.4	18.5
2800	31.4	31.6	35.9	18.0	18.4	18.4
2900	31.7	32.4	35.5	17.9	18.5	18.4
3000	32.5	32.1	35.7	18.1	18.4	18.6
3100	32.8	32.4	35.8	18.0	18.4	18.6
3200	32.7	32.7	35.8	18.4	18.4	19.0
3300	31.9	32.7	36.0	17.9	18.6	18.5
3400	32.9	32.6	35.9	17.9	18.6	18.3
3500	32.2	32.5	36.1	18.2	18.6	18.7
3600	31.2	31.9	35.7	18.2	18.7	18.7
3700	31.0	32.1	36.3	18.3	18.4	18.9
3800	31.4	31.9	36.3	18.2	18.4	18.8
3900	32.3	32.3	36.7	18.1	18.4	18.7
4000	30.4	31.6	36.6	17.8	18.1	18.4
4100	31.9	32.8	36.6	18.0	18.6	18.6
4200	32.6	31.8	36.8	18.1	18.3	18.8
4300	29.9	32.2	36.1	17.9	18.4	18.6
4400	31.6	31.9	37.0	18.0	18.5	18.8
4500	31.6	31.5	36.8	17.9	18.1	18.6
4600	30.3	32.1	36.2	17.8	18.5	18.6
4700	31.9	32.0	37.1	17.9	18.5	18.6
4800	29.9	31.4	35.4	18.0	18.2	18.8
4900	30.0	31.6	35.5	18.0	18.5	18.8
5000	31.4	32.6	36.5	17.8	18.5	18.5
5100	30.6	31.7	36.9	17.9	18.3	18.5
5200	31.6	31.7	37.5	17.7	18.2	18.4
5300	31.8	31.9	37.8	17.8	18.2	18.5
5400	30.1	31.8	36.4	17.8	18.0	18.5
5500	30.8	30.7	34.6	18.1	17.8	18.9
5600	31.3	31.3	36.9	17.7	18.1	18.3
5700	30.4	32.1	35.5	17.6	18.1	18.2
5800	31.7	31.6	36.9	17.7	18.1	18.4
5900	30.5	31.1	36.5	17.6	18.3	18.2
6000	30.8	31.8	35.9	17.6	18.2	18.2

(1) Includes test board loss
(2) Drain current was allowed to increase during compression measurement

Typical Performance Data

FREQ (MHz)	GAIN vs. FREQ & TEMPERATURE[1] @ V_{DS}=+4V, I_{DS}=60mA			NOISE FIGURE vs. FREQ & TEMPERATURE [1] @ V_{DS}=+4V, I_{DS}=60mA			OUTPUT RETURN LOSS vs. FREQ & TEMPERATURE [1] @ V_{DS}=+4V, I_{DS}=60mA		
	dB			dB			dB		
	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
70	29.3	29.2	29.0	0.5	0.6	0.8	5.8	5.5	5.3
80	29.3	29.2	29.0	0.4	0.5	0.7	5.8	5.5	5.3
90	29.3	29.2	29.0	0.3	0.6	0.6	5.8	5.6	5.3
100	29.3	29.2	29.0	0.4	0.5	0.6	5.9	5.6	5.4
200	28.9	28.8	28.6	0.3	0.5	0.6	6.1	6.0	5.8
300	28.5	28.3	28.0	0.4	0.5	0.6	6.6	6.5	6.3
400	27.9	27.6	27.4	0.5	0.5	0.7	7.1	7.0	6.8
500	27.2	26.9	26.7	0.3	0.6	0.5	7.7	7.6	7.3
600	26.5	26.2	26.0	0.3	0.6	0.5	8.2	8.2	8.0
700	25.8	25.5	25.3	0.3	0.6	0.6	8.7	8.7	8.6
800	25.1	24.8	24.6	0.3	0.5	0.5	9.1	9.2	9.1
900	24.4	24.1	23.9	0.2	0.5	0.4	9.5	9.7	9.7
1000	23.8	23.5	23.3	0.2	0.5	0.5	10.0	10.2	10.1
1100	23.2	22.9	22.6	0.2	0.4	0.5	10.4	10.7	10.6
1200	22.6	22.3	22.1	0.2	0.4	0.5	10.8	11.1	11.1
1300	22.1	21.7	21.5	0.2	0.5	0.4	11.1	11.5	11.5
1400	21.6	21.2	21.0	0.2	0.5	0.5	11.4	11.8	11.9
1500	21.1	20.7	20.5	0.2	0.4	0.5	11.8	12.1	12.2
1600	20.6	20.2	20.0	0.2	0.5	0.5	12.1	12.5	12.5
1700	20.1	19.8	19.6	0.2	0.5	0.5	12.4	12.8	12.8
1800	19.7	19.4	19.1	0.2	0.5	0.5	12.6	13.0	13.1
1900	19.3	18.9	18.7	0.2	0.6	0.5	12.8	13.3	13.4
2000	18.9	18.6	18.3	0.2	0.6	0.5	12.9	13.5	13.6
2100	18.5	18.2	18.0	0.2	0.6	0.5	13.2	13.8	13.9
2200	18.2	17.8	17.6	0.2	0.6	0.6	13.4	13.9	14.1
2300	17.8	17.5	17.3	0.2	0.7	0.6	13.6	14.1	14.3
2400	17.5	17.2	16.9	0.2	0.6	0.7	13.7	14.3	14.4
2500	17.2	16.9	16.6	0.2	0.7	0.7	13.7	14.5	14.7
2600	16.9	16.6	16.3	0.3	0.6	0.7	13.7	14.6	14.8
2700	16.6	16.3	16.0	0.2	0.7	0.6	13.8	14.7	15.0
2800	16.3	16.0	15.8	0.2	0.7	0.6	13.9	14.8	15.1
2900	16.1	15.7	15.5	0.3	0.7	0.7	14.0	14.8	15.2
3000	15.8	15.4	15.2	0.2	0.6	0.7	14.1	14.9	15.3
3100	15.6	15.2	15.0	0.4	0.8	0.9	14.2	15.0	15.3
3200	15.3	14.9	14.7	0.4	0.8	0.9	14.3	15.1	15.4
3300	15.1	14.7	14.5	0.4	0.8	0.9	14.4	15.1	15.5
3400	14.8	14.5	14.2	0.4	0.9	0.9	14.5	15.2	15.6
3500	14.6	14.2	14.0	0.4	0.8	0.9	14.5	15.3	15.7
3600	14.4	14.0	13.8	0.4	0.9	0.9	14.5	15.3	15.7
3700	14.1	13.8	13.5	0.4	0.9	1.0	14.5	15.4	15.8
3800	13.9	13.5	13.3	0.4	0.9	1.0	14.5	15.3	15.8
3900	13.7	13.3	13.1	0.4	1.0	1.0	14.4	15.3	15.8
4000	13.5	13.1	12.9	0.5	1.0	1.1	14.4	15.3	15.8
4100	13.3	12.9	12.7	0.5	1.0	1.1	14.3	15.2	15.8
4200	13.1	12.7	12.5	0.5	1.0	1.1	14.2	15.2	15.8
4300	12.9	12.5	12.2	0.5	1.0	1.1	14.1	15.0	15.7
4400	12.7	12.3	12.0	0.5	1.1	1.2	14.0	14.9	15.6
4500	12.4	12.0	11.8	0.5	1.1	1.2	13.8	14.8	15.5
4600	12.2	11.8	11.6	0.6	1.1	1.3	13.6	14.6	15.3
4700	12.0	11.6	11.4	0.6	1.1	1.2	13.4	14.4	15.2
4800	11.8	11.4	11.2	0.6	1.2	1.3	13.2	14.2	15.0
4900	11.6	11.2	10.9	0.6	1.2	1.3	12.9	14.0	14.7
5000	11.4	10.9	10.7	0.6	1.2	1.4	12.7	13.8	14.5
5100	11.1	10.7	10.5	0.7	1.3	1.4	12.6	13.5	14.2
5200	10.9	10.5	10.3	0.7	1.5	1.5	12.4	13.3	14.0
5300	10.7	10.3	10.1	0.8	1.3	1.6	12.1	13.1	13.8
5400	10.5	10.1	9.9	0.8	1.5	1.6	12.0	13.0	13.6
5500	10.3	9.9	9.7	0.8	1.4	1.6	11.9	12.8	13.5
5600	10.1	9.7	9.5	0.8	1.4	1.7	11.7	12.7	13.3
5700	9.9	9.5	9.3	0.9	1.6	1.8	11.6	12.5	13.1
5800	9.7	9.3	9.1	0.9	1.4	1.8	11.4	12.4	12.9
5900	9.5	9.1	8.9	0.9	1.6	1.9	11.2	12.2	12.7
6000	9.3	8.9	8.7	1.0	1.7	1.9	11.1	12.0	12.4

(1) Includes test board loss

Typical Performance Data

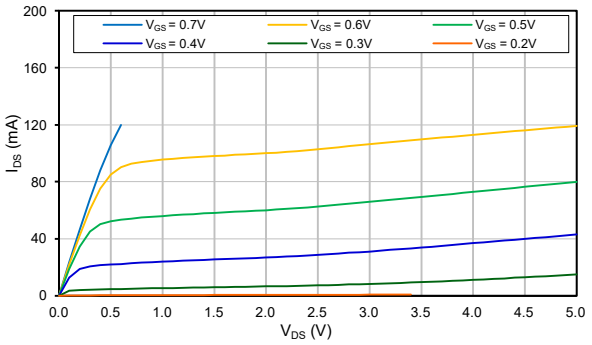
FREQ (MHz)	OIP3 vs FREQ & TEMPERATURE (1) @ V_{DS}=+4V, I_{DS}=60mA			P1dB vs FREQ & TEMPERATURE(1,2) @ V_{DS}=+4V, I_{DS}=60mA		
	dBm			dBm		
	-45°C	+25°C	+85°C	-45°C	+25°C	+85°C
70	34.0	30.9	30.9	19.2	18.5	19.6
80	34.0	31.6	30.9	19.2	18.5	19.7
90	34.3	31.2	30.9	19.2	18.8	19.7
100	35.2	31.2	31.0	19.1	18.8	19.5
200	35.9	32.1	31.4	19.1	18.7	19.7
300	35.7	31.8	31.4	19.4	18.7	19.9
400	37.3	32.5	31.8	19.4	19.0	20.0
500	36.3	32.6	32.1	19.3	18.7	19.8
600	38.1	32.6	32.4	19.7	19.1	20.2
700	38.2	32.3	32.6	19.7	19.2	20.2
800	38.2	32.3	32.9	19.8	19.2	20.3
900	38.5	32.1	32.8	20.0	19.3	20.5
1000	37.3	32.7	32.9	19.9	19.4	20.5
1100	39.8	32.7	33.7	20.2	19.3	20.7
1200	38.0	32.5	33.7	20.1	19.3	20.7
1300	38.5	32.1	33.8	20.0	19.3	20.5
1400	39.3	32.3	34.1	20.1	19.4	20.6
1500	38.7	32.7	34.8	20.2	19.3	20.8
1600	41.7	33.1	34.4	20.2	19.6	20.7
1700	47.2	32.4	34.9	20.1	19.3	20.5
1800	42.4	34.0	35.1	20.3	19.6	20.8
1900	39.5	33.9	34.4	20.3	19.5	20.9
2000	40.5	32.8	34.7	20.3	19.5	20.8
2100	40.1	33.4	34.9	20.3	19.7	20.8
2200	43.3	33.3	35.3	20.2	19.6	20.8
2300	40.2	33.1	34.9	20.3	19.6	20.8
2400	39.1	33.3	35.1	20.2	19.9	20.6
2500	42.1	32.8	35.1	20.5	19.7	21.0
2600	42.3	33.4	35.5	20.5	19.8	21.0
2700	40.9	33.1	35.5	20.4	19.7	20.9
2800	42.8	32.1	35.6	20.4	19.7	20.9
2900	42.1	34.0	35.4	20.4	19.8	20.8
3000	41.4	34.0	35.6	20.5	19.8	20.9
3100	41.0	33.4	35.7	20.6	19.7	21.0
3200	40.6	34.0	35.4	20.7	19.8	21.2
3300	45.1	34.4	36.0	20.4	20.0	20.9
3400	41.0	34.2	35.7	20.5	19.9	20.8
3500	40.5	33.7	35.6	20.6	19.9	21.1
3600	42.5	33.4	35.8	20.6	20.0	21.1
3700	41.7	33.6	36.0	20.6	19.7	21.2
3800	41.1	32.9	35.8	20.7	19.8	21.2
3900	41.4	33.4	35.9	20.6	19.7	21.1
4000	39.8	32.8	35.9	20.4	19.5	20.9
4100	41.1	33.7	35.9	20.6	19.9	21.0
4200	40.1	33.5	35.8	20.6	19.7	21.1
4300	39.1	33.5	35.7	20.5	19.7	21.0
4400	41.7	33.7	36.1	20.7	19.8	21.1
4500	42.8	33.2	36.4	20.5	19.5	21.0
4600	40.1	33.4	36.3	20.5	19.8	20.9
4700	43.4	33.4	36.7	20.5	19.8	21.0
4800	39.9	33.4	36.3	20.5	19.6	21.1
4900	39.2	33.2	36.6	20.5	19.8	21.1
5000	41.5	34.3	36.6	20.4	19.8	20.9
5100	40.2	33.3	36.7	20.5	19.6	21.0
5200	41.9	33.3	36.8	20.5	19.6	20.9
5300	41.8	33.1	36.8	20.5	19.5	21.0
5400	39.8	33.1	36.6	20.6	19.4	21.0
5500	40.8	32.4	37.1	20.8	19.1	21.3
5600	41.8	32.8	37.0	20.5	19.4	20.9
5700	40.0	33.4	36.8	20.3	19.2	20.7
5800	42.4	33.5	37.1	20.5	19.2	20.9
5900	40.6	32.1	36.9	20.4	19.4	20.8
6000	40.9	33.5	36.9	20.4	19.2	20.8

(1) Includes test board loss

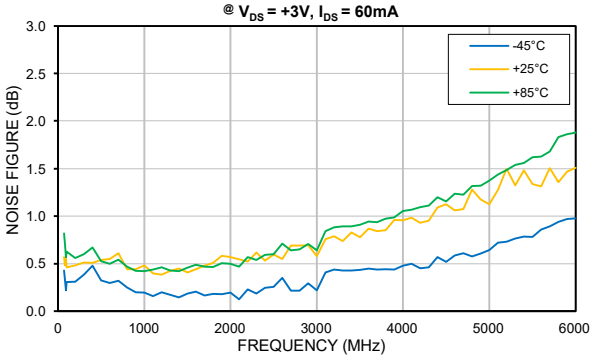
(2) Drain current was allowed to increase during compression measurement

Typical Performance Curves

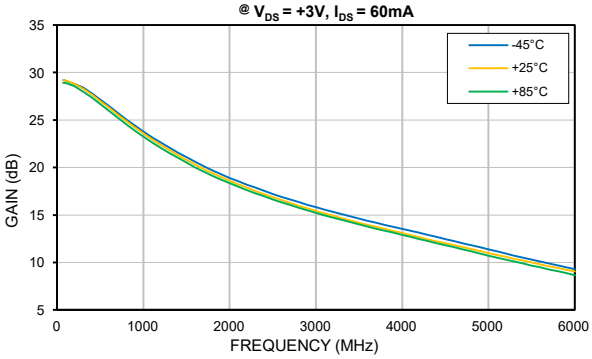
DRAIN CURRENT vs. GATE-SOURCE VOLTAGE(2)



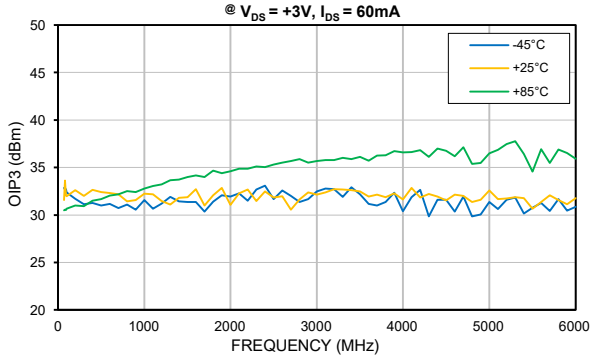
NOISE FIGURE vs. TEMPERATURE(1)
@ V_{DS} = +3V, I_{DS} = 60mA



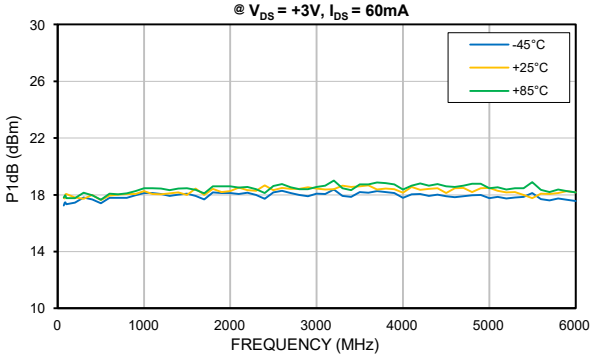
GAIN vs. TEMPERATURE(1)
@ V_{DS} = +3V, I_{DS} = 60mA



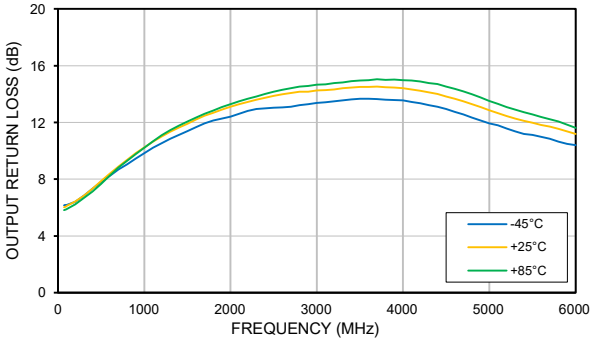
OUTPUT IP3 vs. TEMPERATURE(1)
@ V_{DS} = +3V, I_{DS} = 60mA



P1dB vs. TEMPERATURE(1)
@ V_{DS} = +3V, I_{DS} = 60mA



OUTPUT RETURN LOSS vs. TEMPERATURE(1)
@ V_{DS} = +3V, I_{DS} = 60mA

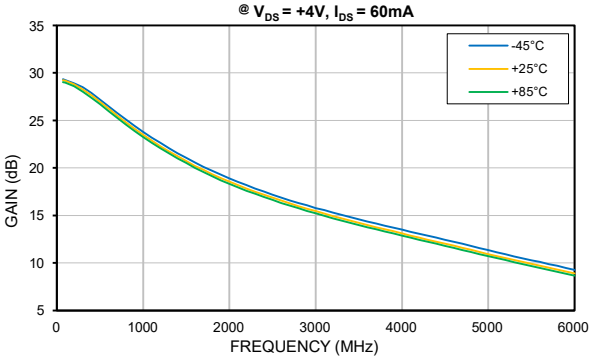


(1). Includes test board loss

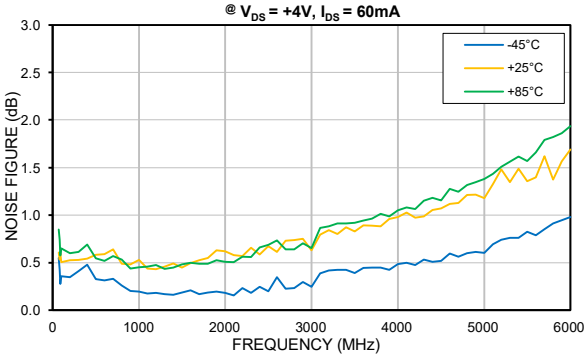
(2). Drain current was allowed to increase during compression measurement

Typical Performance Curves

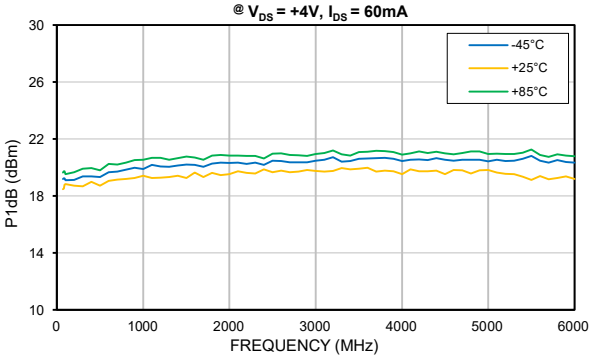
GAIN vs. TEMPERATURE[1]
@ V_{DS} = +4V, I_{DS} = 60mA



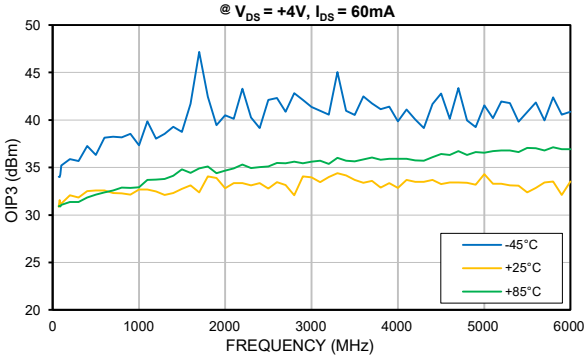
NF vs. TEMPERATURE[1]
@ V_{DS} = +4V, I_{DS} = 60mA



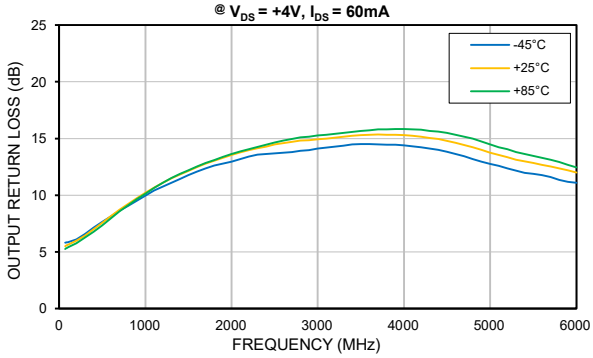
P1dB vs. TEMPERATURE[1]
@ V_{DS} = +4V, I_{DS} = 60mA



OUTPUT IP3 vs. TEMPERATURE[1]
@ V_{DS} = +4V, I_{DS} = 60mA



OUTPUT RETURN LOSS vs. TEMPERATURE[1]
@ V_{DS} = +4V, I_{DS} = 60mA

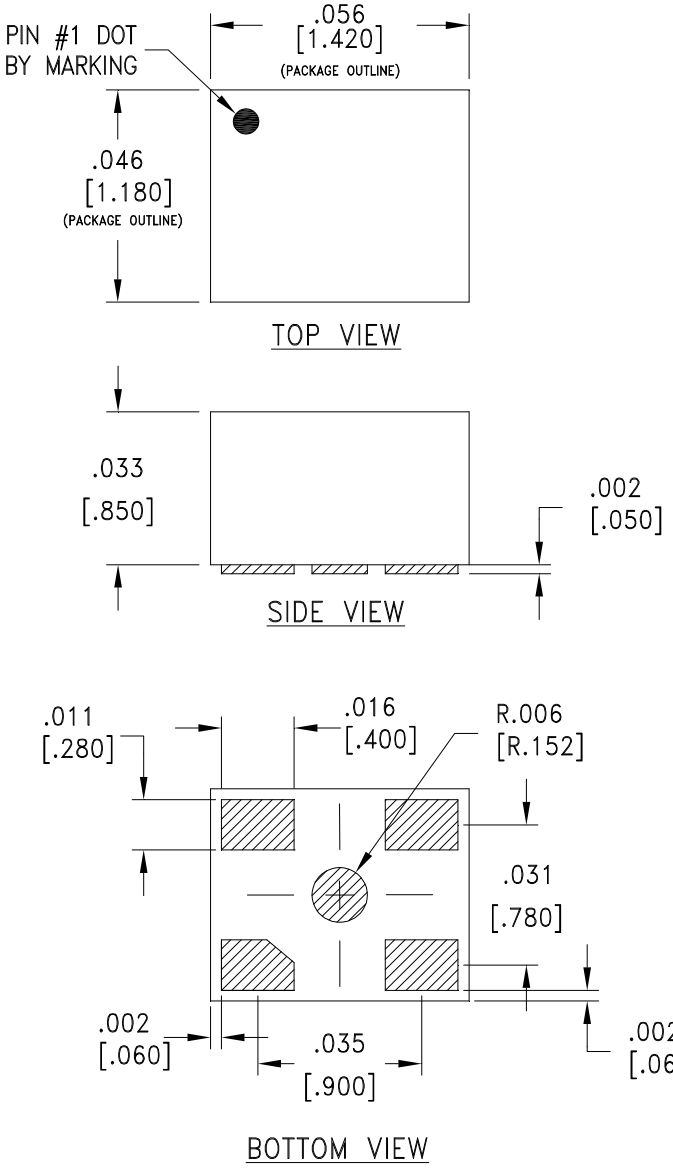


(1). Includes test board loss
(2). Drain current was allowed to increase during compression measurement

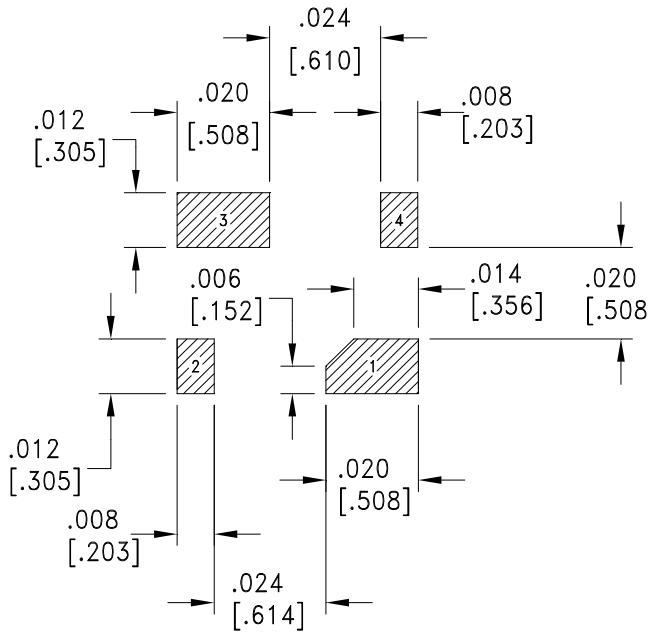
Case Style TE

Outline Dimensions

TE2769



PCB Land Pattern



Suggested Layout,
Tolerance to be within ±.002

Weight: .0047 grams

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

Notes:

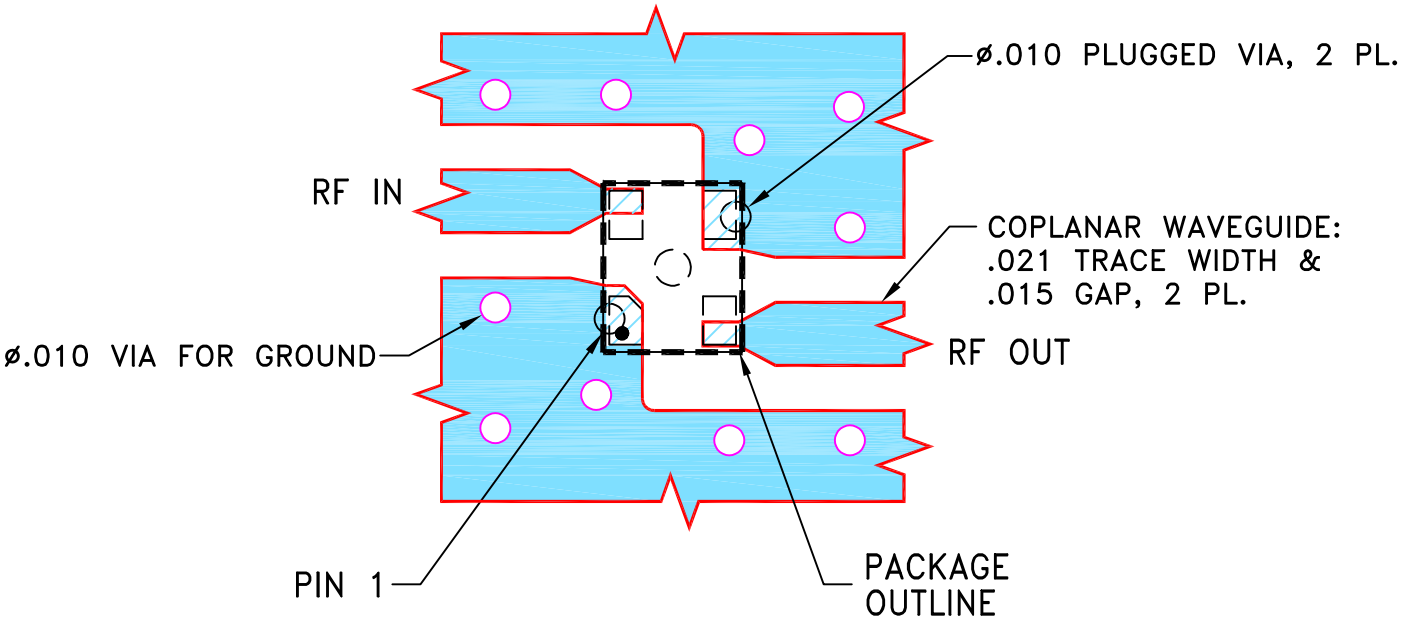
1. Case material: Plastic.
2. Termination finish:

   For RoHS Case Styles: Matte-Tin plate.

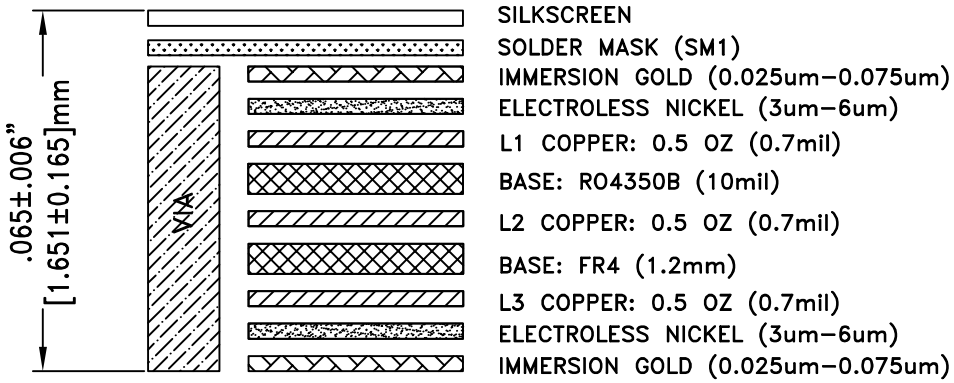
THIRD ANGLE PROJECTION

REVISIONS					
REV	ECN No.	DESCRIPTION	DATE	DR	AUTH
OR	ECO-018788	NEW RELEASE	08/07/23	ITG	IL

SUGGESTED MOUNTING CONFIGURATION FOR TE2769 CASE STYLE



3 LAYER STACK-UP DIAGRAM



NOTES:

1. PCB IS MULTILAYER PCB, SEE STACK-UP DIAGRAM.
2. TRACE WIDTH & GAP PARAMETERS ARE SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .010"; COPPER: 1/2 OZ EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH AND GAP MAY NEED TO BE MODIFIED.
3. COPPER LAYERS L2 & L3 OF THE PCB ARE CONTINUOUS GROUND PLANES.

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	08/07/23
TOLERANCES ON:	CHECKED	GF	08/07/23
2 PL DECIMALS ±	APPROVED	IL	08/07/23
3 PL DECIMALS ± .005			
ANGLES ±			
FRACTIONS ±			

Mini-Circuits®

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

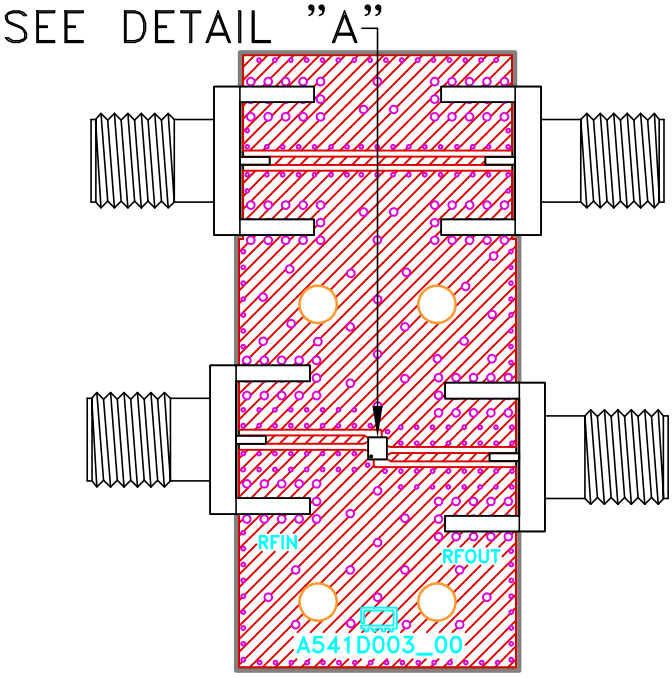
Mini-Circuits® 13 Neptune Avenue Brooklyn NY 11235

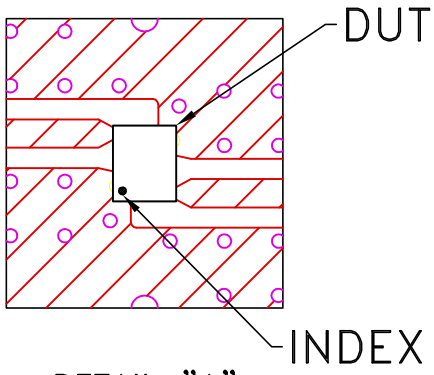
PL,TE2769,TB-TAV1-331NM+/541NM+

SIZE	CODE IDENT	DRAWING NO:	REV:
A	15542	98-PL-758	OR

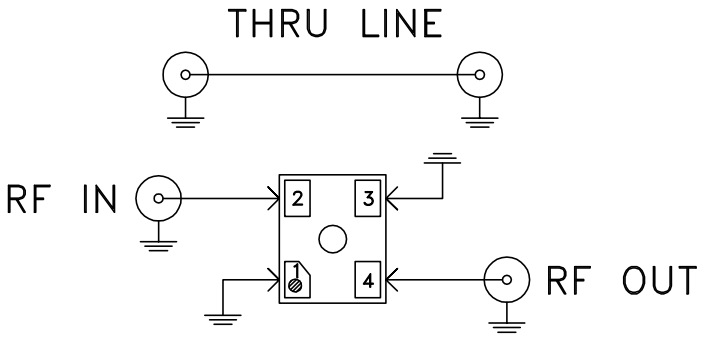
FILE:	SCALE:	SHEET:
98PL758	15:1	1 OF 1

Evaluation Board and Circuit





DETAIL "A"
(SCALE 5:1)



SCHEMATIC DIAGRAM

Function	Pad
RF IN	2
RF OUT	4
GND	1,3

Notes:

1. 50 Ohm SMA Female Connectors.
2. PCB Material: Roger RO4350B or equivalent, Dielectric constant=3.5, Thickness=0.01 inch

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Environmental Specifications **ENV08T2**

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	-45° to 85°C or -40° to 85°C Ambient Environment	Individual Model Data Sheet
Storage Temperature	-65° to 150° C 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	