

The MRFIC Line

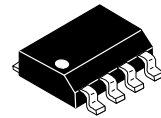
2.4 GHz GaAs Exciter Amplifier

The MRFIC2404 is a single-stage class A GaAs amplifier in a low-cost 8 lead plastic package designed to drive the MRFIC2403 power amplifier for use in the 2.4 to 2.5 GHz Industrial-Scientific-Medical (ISM) band. The design is optimized for 5.0 Volt operation at 2.45 GHz but is usable from 2.0 to 3.0 GHz in applications such as telemetry and Multichannel Multipoint Distribution System (MMDS) wireless cable TV systems. Performance is suitable for frequency hopping or direct sequence spread spectrum as well as single-frequency applications.

- High Output Capability = +5.0 dBm Typical
- High Gain = 17 dB Typical
- Low Current Drain = 9.0 mA Typical
- Single Supply Voltage = 5.0 Volts
- Good Noise Figure = 4.3 dB Typical
- Low-Cost, Low Profile Plastic SOIC Package
- Order MRFIC2404R2 for Tape and Reel.
R2 Suffix = 2,500 Units per 12 mm, 13 inch Reel.
- Device Marking = M2404

MRFIC2404

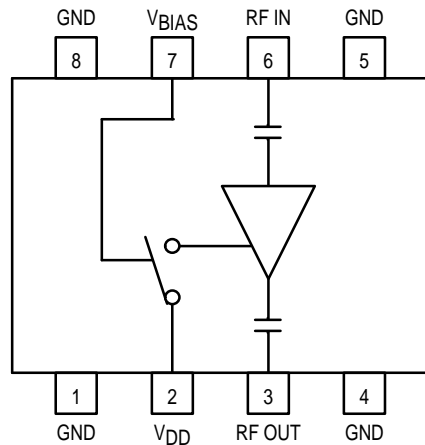
**2.4 GHz
EXCITER AMPLIFIER
GaAs MONOLITHIC
INTEGRATED CIRCUIT**



**CASE 751-05
(SO-8)**

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
Supply Voltage	V _{DD}	12	Vdc
RF Input Power	RF IN	+10	dBm
Bias Enable Voltage	V _{bias}	6.0	Vdc
Ambient Operating Temperature	T _A	-30 to +85	°C
Storage Temperature	T _{stg}	-65 to +125	°C



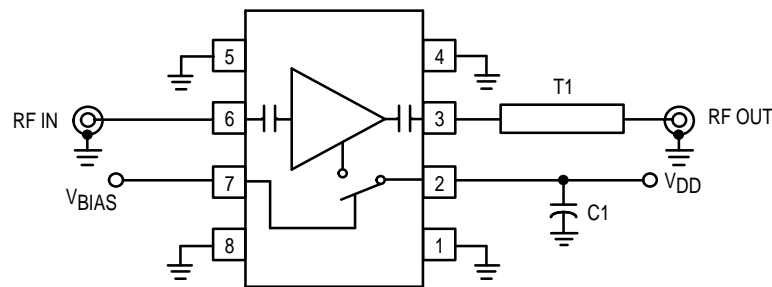
Pin Connections and Functional Block Diagram

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value	Unit
Supply Voltage	V_{DD}	4.75 to 5.25	Vdc
Bias Enable Voltage – ON	V_{bias}	0	Vdc
Bias Enable Voltage – OFF	V_{bias}	5.0	Vdc
Operating Frequency Range	f_{OP}	2000 to 3000	MHz

ELECTRICAL CHARACTERISTICS ($V_{DD} = 5.0$ Vdc, $T_A = 25^\circ\text{C}$, $R_F = 2.45$ GHz, $V_{bias} = 0$ Vdc)

Characteristic	Min	Typ	Max	Unit
Small Signal Gain	16	17	–	dB
Power Output, 1.0 dB Compression	–	+5.0	–	dBm
Power Output ($P_{in} = -11$ dBm)	4.0	5.0	–	dBm
Third Order Intercept Point	–	+15	–	dBm
Noise Figure	–	4.3	–	dB
Reverse Isolation	–	25	–	dB
Turn On Time	–	1.0	–	μs
Supply Current	–	9.0	12	mA
SLEEP Mode Supply Current ($V_{bias} = 5.0$ Vdc)	–	800	–	μA



C1 – 15 pF
T1 – 100 Ω Line, 185 MILs (3.3 nH)
Board Material – 30 MIL FR4
Connectors – SMA Type

Figure 1. Applications Circuit Configuration

Table 1. Scattering Parameters
(VDD = 5 V, T_A = 25°C, 50 Ω System)

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	S ₁₁	∠ φ	S ₂₁	∠ φ	S ₁₂	∠ φ	S ₂₂	∠ φ
2000	0.232	-92.34	6.290	165.97	0.024	-51.08	0.483	-123.13
2050	0.174	-90.78	7.049	147.75	0.029	-66.26	0.383	-125.77
2100	0.122	-76.88	7.563	127.95	0.032	-78.38	0.281	-124.34
2150	0.102	-48.38	7.803	109.02	0.035	-97.84	0.191	-109.23
2200	0.128	-19.45	8.046	91.04	0.037	-105.62	0.159	-80.33
2250	0.185	-6.60	8.144	72.36	0.039	-123.88	0.196	-53.35
2300	0.244	-5.52	7.977	55.31	0.038	-135.36	0.273	-42.38
2350	0.300	-8.04	7.979	39.91	0.043	-144.83	0.350	-41.15
2400	0.343	-12.42	8.147	23.40	0.044	-160.94	0.423	-43.39
2450	0.379	-17.11	8.020	5.27	0.045	-173.09	0.477	-47.05
2500	0.403	-21.90	7.550	-10.93	0.041	173.83	0.522	-50.67
2550	0.424	-26.32	7.245	-25.36	0.043	165.85	0.556	-54.67
2600	0.436	-30.95	6.911	-39.88	0.042	154.14	0.582	-58.35
2650	0.443	-34.94	6.631	-52.32	0.041	145.35	0.600	-62.23
2700	0.447	-39.48	6.566	-65.57	0.044	135.12	0.610	-65.41
2750	0.445	-43.12	6.338	-79.97	0.043	123.72	0.622	-68.57
2800	0.446	-46.68	6.009	-93.15	0.042	114.52	0.624	-72.06
2850	0.441	-50.42	5.733	-105.10	0.043	107.18	0.620	-74.86
2900	0.439	-53.14	5.565	-116.69	0.041	98.95	0.617	-77.74
2950	0.437	-57.27	5.393	-129.54	0.042	90.72	0.608	-80.01
3000	0.409	-61.28	4.938	-142.70	0.043	81.68	0.611	-81.12

Typical Characteristics

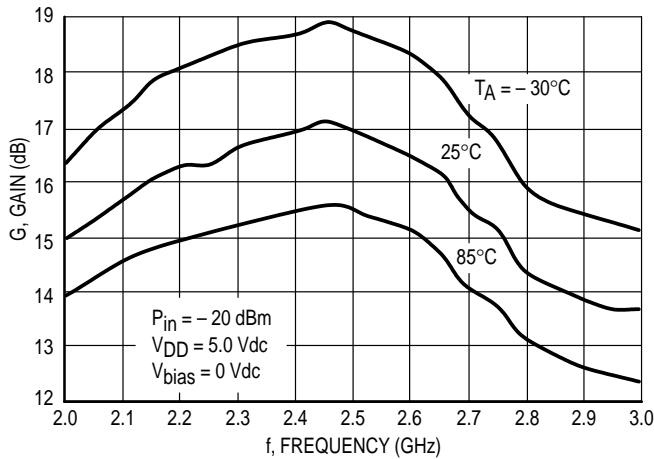


Figure 2. Gain versus Frequency

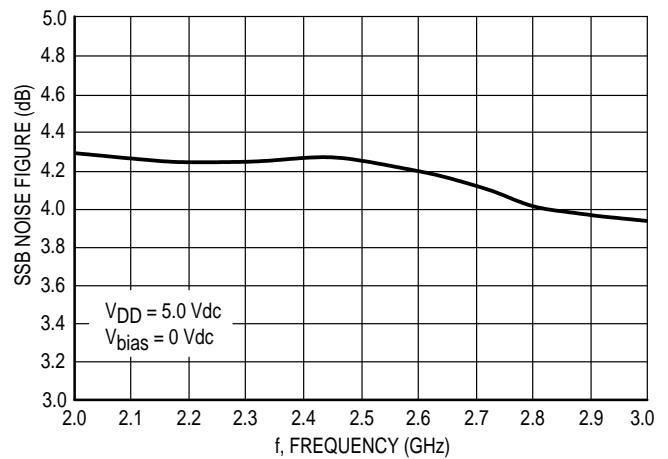


Figure 3. Noise Figure versus Frequency

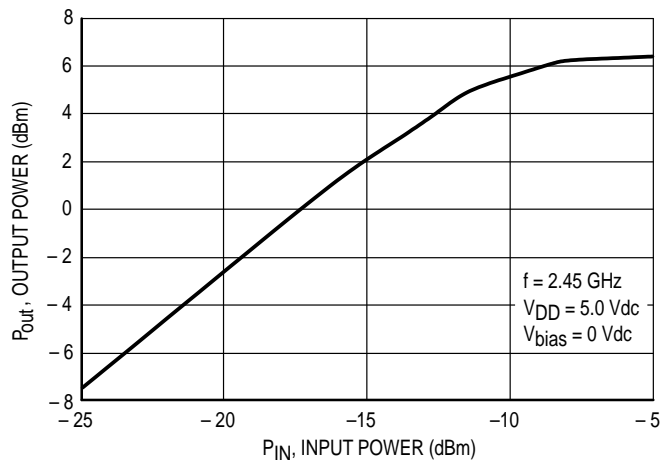


Figure 4. Output Power versus Input Power

DESIGN AND APPLICATIONS INFORMATION

The MRFIC2404 is a single-stage GaAs amplifier designed for exciter applications such as driving the MRFIC2403 power amplifier. The 4.3 dB noise figure, 17 dB gain and +5.0 dBm power output at 1.0 dB gain compression make the MRFIC2404 suitable for high-performance receiver IF application, Multichannel Multipoint Distribution System (MMDS) applications, telemetry and other applications in the 2.0 to 3.0 GHz range.

The characterization curves show typical performance in the 2.0 to 3.0 GHz range in the circuit shown in Figure 1. This circuit was also used to derive the device impedance shown in Table 1. The amplifier input is matched to 50 Ω while the output requires about 3.3 nH series inductance for best

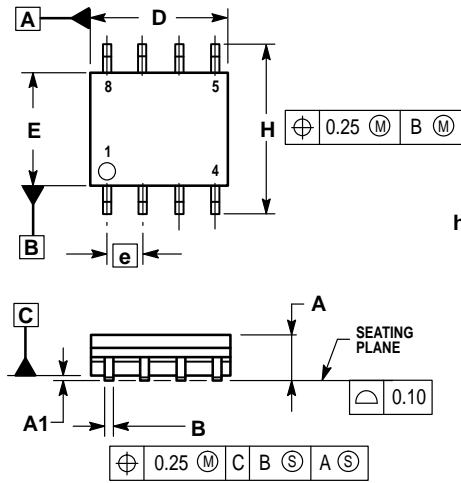
match at 2.45 GHz. The V_{DD} supply line should be bypassed as close to the chip as possible to avoid low frequency oscillations. Power supply "stiffening" and digital transient bypassing in the form of electrolytic or tantalum capacitors should be added.

The device can be put into a reduced current "sleep" mode by 5.0 Vdc to the V_{bias} pin.

EVALUATION BOARDS

Evaluation boards are available for RF Monolithic Integrated Circuits by adding a "TF" suffix to the device type. For a complete list of currently available boards and ones in development for newly introduced product, please contact your local Motorola Distributor or Sales Office.

PACKAGE DIMENSIONS




NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE MOLD PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS	
	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
B	0.35	0.49
C	0.18	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27 BSC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.25
θ	0°	7°

**CASE 751-05
ISSUE S**

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MRFIC2404/D

