MWA0204
MWA0211L
MWA0270

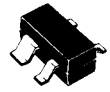
Monolithic Microwave Integrated Circuit

MONOLITHIC MICROWAVE INTEGRATED CIRCUIT

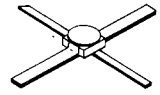
. . . designed for narrow or wideband IF and RF applications in industrial and commercial systems up to 3 GHz.

- 12 dB Gain at 1000 MHz (Typ)
- Fully Cascadable
- 50 Ω Input and Output Impedance
- Choice of Package Types
  - Low Cost
  - Surface Mount
  - Hermetic
- Tape and Reel Package Options
- 4.0 dBm P_O 1 dB, at 500 MHz (Typ)
- Unconditionally stable

CASE 317-01, STYLE 3
MWA0204



CASE 318A-05, STYLE 4
MWA0211L



CASE 303A-01, STYLE 3
MWA0270

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Parameters		Symbol	Ratings	Unit
Circuit Current		I_{CC}	40	mAdc
Input Power, RF		P_{in}	+16	dBm
Bias Voltage		V_{CC}	6	Vdc
Storage Temperature	0204/0211L 0270	T_{stg}	−65 to +150 −65 to +200	°C

RECOMMENDED OPERATING CONDITIONS

Parameters	Symbol	Ratings	Unit
Operating Current	I_{CC}	25	mA
Source Impedance	Z_S	50 to 75	Ω
Load Impedance	Z_L	50 to 75	Ω

THERMAL CHARACTERISTICS

Thermal Resistance, Die to Case	MWA0204 MWA0211L MWA0270	$R_{\theta JC}$	150 200 130	°C/W

DEVICE MARKING

MWA0211,L = 06

ELECTRICAL CHARACTERISTICS (T_A = 25°C, I_{CC} = 25 mA, Z_S = Z_L = 50 Ω, unless specified otherwise)

Characteristic		Symbol	Min	Typ	Max	Unit
Gain (f = 1000 MHz) (f = 100 MHz)	MWA0204/0211L MWA0270	G_T	10 11.5	12 12.5	— 13.5	dB dB
Gain Flatness (f = DC to 800 MHz — MWA0204/0211L) (f = DC to 1500 MHz — MWA0270)			 — —	 1 1	 — —	dB
Noise Figure (f = 100–1600 MHz)		NF	—	5.5	—	dB
Third Order Intercept Output Power (f_1 = 480 MHz) (f_2 = 500 MHz) (f_1 = 980 MHz) (f_2 = 1000 MHz)		ITO_1 ITO_2 ITO_3 ITO_4	— — — —	16 16 16 16	— — — —	dBm
Second Order Intercept Output Power (f_1 = 480 MHz) (f_2 = 500 MHz) (f_1 = 980 MHz) (f_2 = 1000 MHz)		ISO_1 ISO_2 ISO_3 ISO_4	— — — —	20 20 19 19	— — — —	dBm

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TYPICAL CHARACTERISTICS

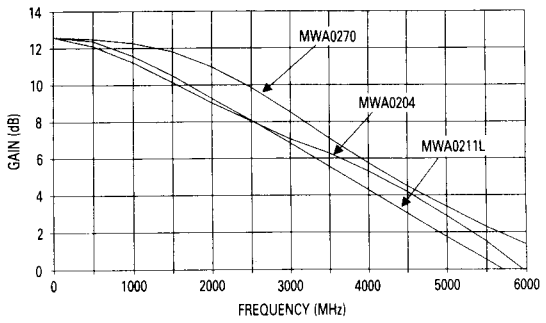

Figure 1. Gain versus Frequency

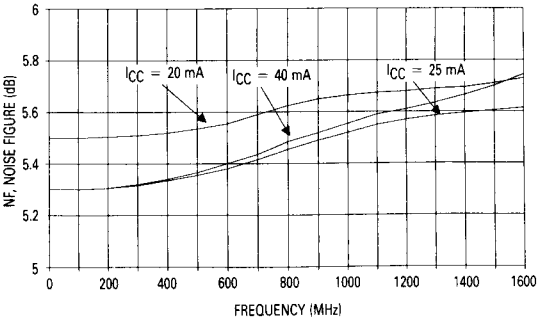

Figure 2. Noise Figure versus Frequency

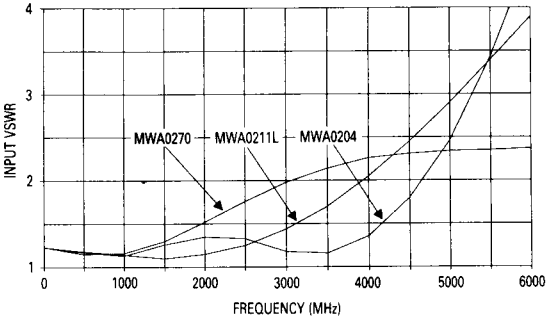

Figure 3. Input VSWR versus Frequency

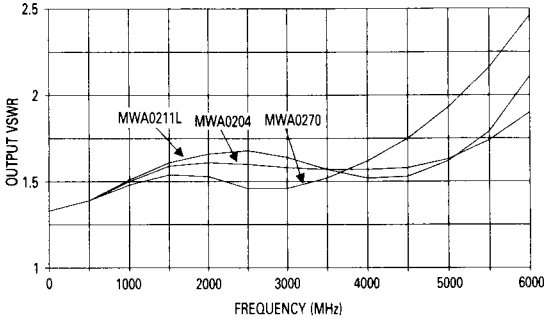

Figure 4. Output VSWR versus Frequency

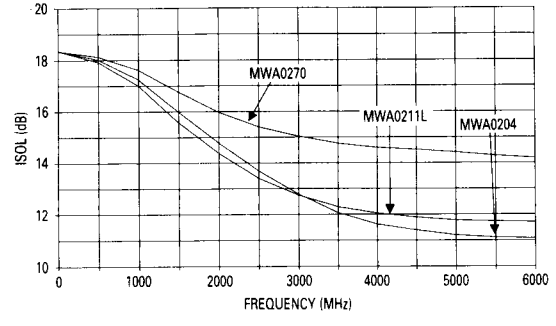

Figure 5. Reverse Isolation versus Frequency

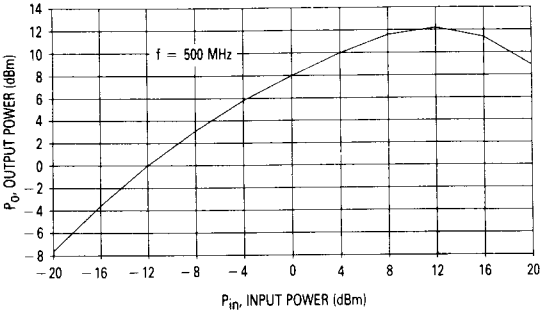

Figure 6. Output Power versus Power

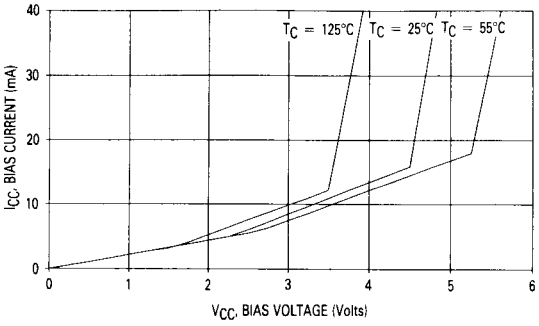

Figure 7. Bias Currrent versus Bias Voltage

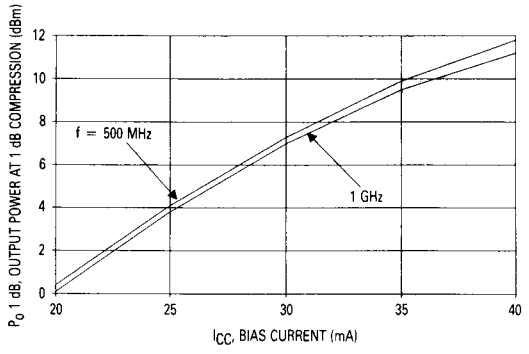

Figure 8. Output power at 1 dB Gain Compression versus Bias Current

Table 1 — Typical S-Parameters and Stability Factor K
MWA0204

I_{CC} (mA)	f (MHz)	S_{11}		S_{21}			S_{12}		S_{22}		K
		$\|S_{11}\|$	$\angle\phi$	S_{21} (dB)	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$	
25	100	0.106	174.2	12.48	4.21	173.1	0.121	2.3	0.132	−13.5	1.195
	200	0.107	164.4	12.46	4.2	166.5	0.121	3.6	0.131	−23.3	1.196
	400	0.093	149.5	12.25	4.1	153.7	0.124	5.8	0.149	−41.1	1.199
	600	0.07	126.3	11.98	3.97	141.2	0.127	9.9	0.168	−56.4	1.208
	800	0.051	88.2	11.63	3.81	129.4	0.134	11.1	0.19	−66.9	1.2
	1000	0.052	41.2	11.23	3.64	118	0.139	13.3	0.201	−74	1.208
	1500	0.116	−20.3	10.15	3.22	92.3	0.16	15.2	0.228	−85.1	1.19
	2000	0.156	−45.7	9.04	2.83	69.3	0.182	14	0.235	−95.8	1.177
	2500	0.145	−64.4	8.05	2.53	48.7	0.207	9.9	0.23	−107.8	1.17
	3000	0.083	−89.6	7.06	2.25	28.8	0.229	5.4	0.225	−123.3	1.179
	3500	0.043	143.7	6.29	2.06	10.3	0.249	−0.9	0.224	−143.5	1.17
	4000	0.153	96.5	5.31	1.84	−8.1	0.262	−7.6	0.221	−160.7	1.181
	5000	0.421	66.5	2.89	1.39	−41.5	0.278	−18.8	0.238	162	1.163
	6000	0.644	49.2	−0.14	0.98	−68.6	0.277	−29.8	0.318	123.8	1.096

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Table 2 — Typical S-Parameters and Stability Factor K
MWA0211L

I_{CC} (mA)	f (MHz)	S_{11}		S_{21}			S_{12}		S_{22}		K
		$\|S_{11}\|$	$\angle\phi$	S_{21} (dB)	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$	
25	100	0.093	172.7	12.7	4.31	173.8	0.121	1.4	0.142	−11.7	1.179
	200	0.093	167.3	12.66	4.3	167	0.122	3.6	0.144	−23.2	1.178
	400	0.083	151.7	12.48	4.21	153.8	0.125	7.2	0.158	−47.7	1.196
	600	0.082	142.5	12.26	4.1	141.4	0.128	10.1	0.171	−69.6	1.178
	800	0.071	137.1	11.97	3.97	129.5	0.136	13	0.186	−86.4	1.161
	1000	0.066	127.2	11.57	3.79	117.4	0.141	12.9	0.206	−103.3	1.163
	1500	0.036	140.1	10.52	3.36	90.7	0.166	16.3	0.233	−127.8	1.126
	2000	0.069	151.9	9.28	2.91	66.6	0.191	14.8	0.248	−153.8	1.116
	2500	0.11	173.4	8.08	2.54	57.3	0.214	20.8	0.265	−156.4	1.105
	3000	0.179	153.5	6.84	2.2	37.9	0.231	15.3	0.228	−167	1.142
	3500	0.289	146	5.56	1.9	20.1	0.237	7.9	0.224	−173.6	1.155
	4000	0.342	132.4	4.37	1.65	4.6	0.252	2.6	0.194	−171.1	1.183
	5000	0.487	107.5	1.86	1.24	−22.8	0.259	−6.2	0.237	177	1.205
	6000	0.573	89.7	−0.74	0.92	−44.5	0.26	−14.8	0.356	159.2	1.222

Table 3 — Typical S-Parameters and Stability Factor K
MWA0270

I_{CC} (mA)	f (MHz)	S_{11}		S_{21}			S_{12}		S_{22}		K
		$\|S_{11}\|$	$\angle\phi$	S_{21} (dB)	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$	
25	100	0.111	179	12.6	4.27	175.2	0.121	1.3	0.146	−10.6	1.178
	200	0.1	177.4	12.56	4.25	170.4	0.122	2	0.147	−19.6	1.18
	400	0.087	176.4	12.49	4.21	161.2	0.122	3.7	0.154	−36.9	1.187
	600	0.072	179.7	12.46	4.2	152	0.125	5.6	0.171	−54.3	1.172
	800	0.065	−171	12.36	4.15	142.7	0.128	7.1	0.183	−66.3	1.161
	1000	0.061	−151.1	12.28	4.11	133.5	0.132	8.2	0.195	−77.6	1.145
	1500	0.116	−119.9	11.82	3.9	109.9	0.145	10	0.211	−99	1.093
	2000	0.205	−126.9	10.99	3.55	86.8	0.159	8.7	0.208	−111	1.057
	2500	0.276	−141.9	9.86	3.11	65.6	0.17	5.7	0.186	−118.7	1.063
	3000	0.33	−157.6	8.53	2.67	47.3	0.177	2.1	0.188	−116.5	1.096
	3500	0.364	−171.1	7.11	2.27	31.1	0.183	−0.4	0.206	−116.1	1.154
	4000	0.382	176.8	5.76	1.94	17.5	0.186	−3.7	0.237	−120.5	1.229
	5000	0.401	156	3.39	1.48	−5	0.19	−8	0.321	−135.4	1.373
	6000	0.407	138.1	1.35	1.17	−23.6	0.196	−11.7	0.422	−149.2	1.456

TYPICAL CHARACTERISTICS (MWA0270 ONLY)

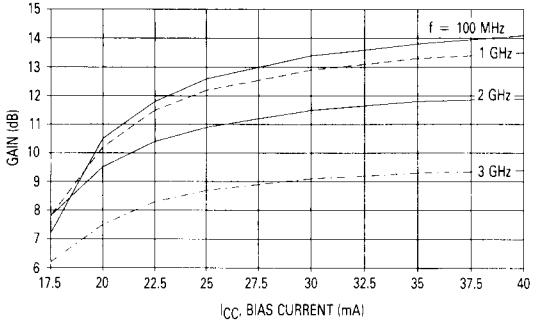

Figure 9. Gain versus Bias Current

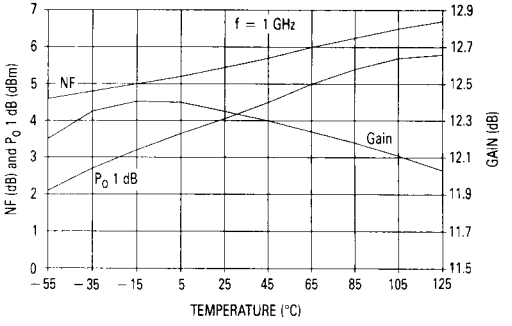

Figure 10. Output Power at 1 dB Gain Compression Noise Figure and Gain versus Temperature

MMIC AMPLIFIER APPLICATIONS INFORMATION

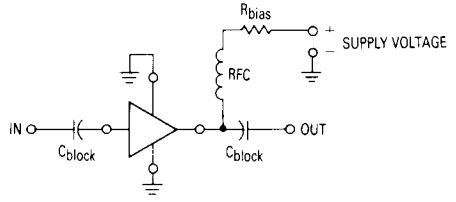

Figure 11. Typical Biasing Configuration

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Operation

Operation of the Monolithic Microwave Integrated Circuit as an amplifier is achieved by simply connecting it to 50 ohm driving source and load impedances with dc blocking capacitors at both input and output.

DC Bias

A positive current must be supplied to the device output terminal. Power supply decoupling elements must include resistive current limiting. Device output voltage at the recommended operating current of 25 mA is typically 5 Vdc, see Fig. 7, R_{bias} (Figure 9) is selected to permit the device to draw 25 mA. For example, when operating with a 12 Vdc supply:

$$R_{bias} = \frac{(12-5)}{0.025} = 280 \text{ ohms}$$

The nearest standard value of 270 ohms would suffice.

External Decoupling Impedance

In all cases the external bias (decoupling elements) must present an impedance which is large compared to the 50 Ω load impedance to minimize RF gain reduction. The loss in gain due to the decoupling impedance is given by the equation:

$$\text{Loss} = -20 \text{ Log } \frac{Z_D}{Z_D + 25} \text{ dB}$$

where Z_D = decoupling impedance in ohms. For example, if Z_D = 1 kΩ, Loss = 0.214 dB.

The RF choke is not mandatory, but including it improves gain by raising the dc supply voltage decoubling impedance. 4 turns of #26 AWG enameled wire wound on a ferrite bead is suggested for the choke.

Low Frequency Response

The value of the blocking capacitors determines the low frequency response of the amplifier. The following expression is used to determine the blocking capacitor value to yield a desired 3 dB low frequency corner (f_{LFC}).

$$C_{Block}(\text{Farads}) = \frac{1}{100\ \pi\ f_{LFC}(\text{Hz})}$$