Order this document
by MRFIC0915/D

The MRFIC Line

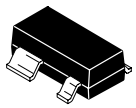
General Purpose RF Cascode Amplifier

MRFIC0915

100 to 2500 MHz
SILICON GENERAL PURPOSE
RF CASCODE AMPLIFIER

The MRFIC0915 is a cost–effective, high isolation cascode silicon monolithic amplifier in the industry standard SOT–143 surface mount package designed for general purpose RF applications. The device is a lower current version of the MRFIC0916 and is appropriate for VCOs, VCO buffers and amplifiers. On–chip bias circuitry sets the bias point while matching is accomplished off chip affording the maximum in application flexibility.

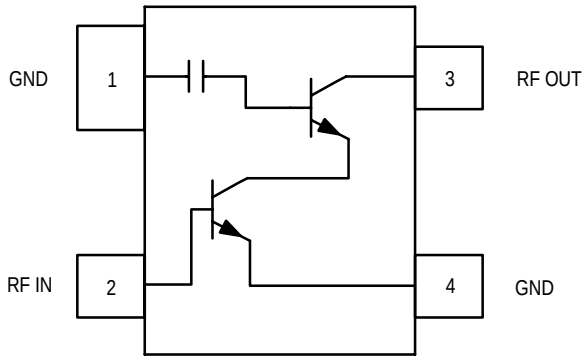
- Usable Frequency Range = 100 to 2500 MHz
- Good Small Signal Gain at V_{CC} = 2.7 Volts
  16.2 dB Typ at 850 MHz
  9.6 dB Typ at 1800 MHz
  5.8 dB Typ at 2400 MHz
- –4.6 dBm typical Output Power at 1 dB Gain Compression at 850 MHz, V_{CC} = 2.7 Volts
- 38 dB Typical Reverse Isolation at 850 MHz
- 2.5 mA Max Bias Current at V_{CC} = 2.7 Volts
- 2.7 to 5 Volt Supply
- Order MRFIC0915T1 for Tape and Reel.
  T1 Suffix = 3.000 Units per 8 mm, 7 inch Reel.
- Device Marking = 22



CASE 318A–05
(SOT–143)

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

Rating	Symbol	Limit	Unit
Supply Voltage	V_{CC}	6	Vdc
RF Input Power	P_{RF}	10	dBm
Power Dissipation	P_{DIS}	100	mW
Supply Current	I_{CC}	10	mA
Thermal Resistance, Junction to Case	$R_{\theta JC}$	250	°C/W
Storage Temperature Range	T_{stg}	– 65 to +150	°C
Operating Case Temperature	T_C	– 40 to +100	°C



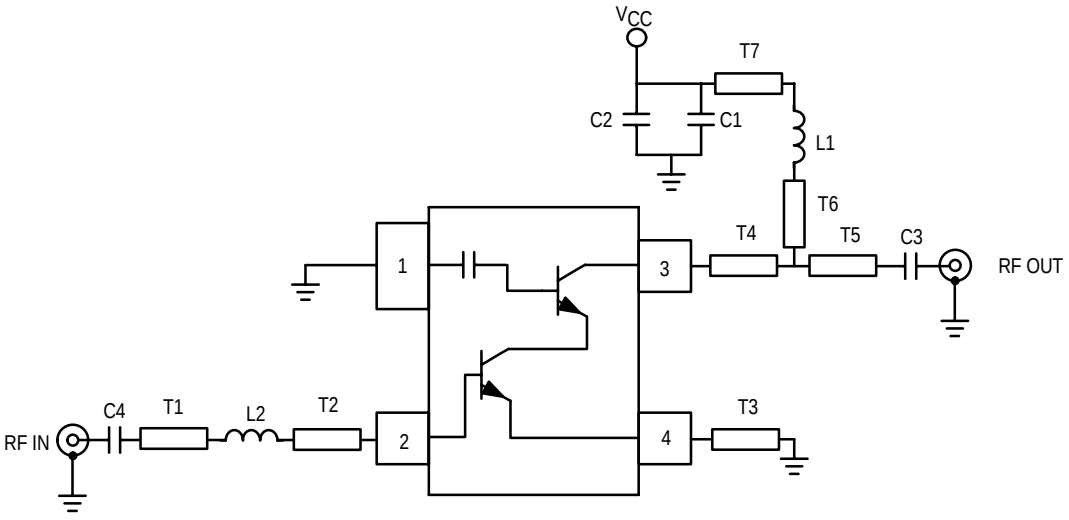
Pin Connections and Functional Block Diagram

RECOMMENDED OPERATING RANGES

Parameter	Symbol	Value	Unit
RF Frequency	f_{RF}	100 to 2500	MHz
Supply Voltage	V_{CC}	2.7 to 5	Vdc

ELECTRICAL CHARACTERISTICS (V_{CC} = 2.7 V, T_A = 25°C)

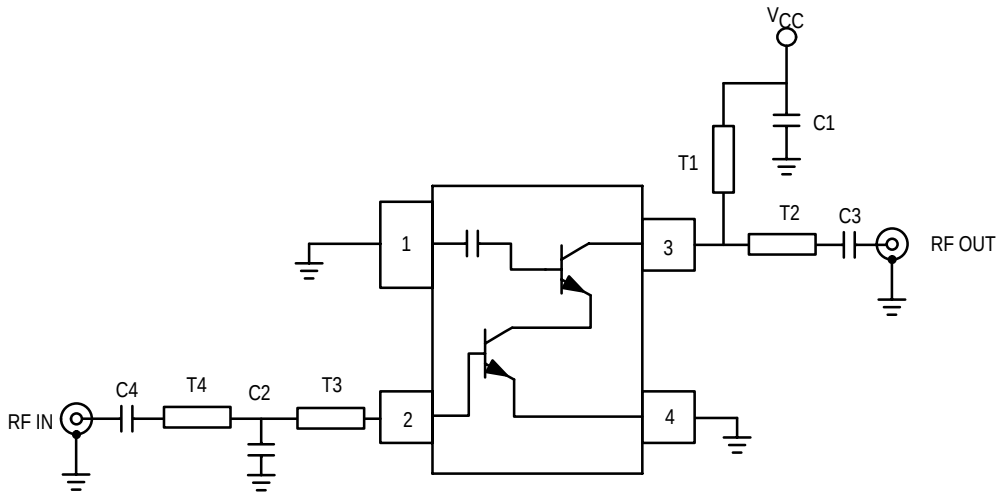
Characteristic	Min	Typ	Max	Unit
Small Signal Gain				
850 MHz	14.2	16.2	—	dB
1800 MHz	7.4	9.6	—	dB
2400 MHz	5	5.8	—	dB
Noise Figure				
850	—	1.9	—	dB
1800 MHz	—	3.6	—	dB
2400 MHz	—	5.5	—	dB
Power Output at 1dB Gain Compression				
850 MHz	—	–4.6	—	dBm
1800 MHz	—	–7.8	—	dBm
2400 MHz	—	–9.8	—	dBm
Output 3rd Order Intercept Point				
850 MHz	—	4	—	dBm
1800 MHz	—	1	—	dBm
2400 MHz	—	–1	—	dBm
Reverse Isolation				
850 MHz	—	38	—	dB
1800 MHz	—	33	—	dB
2400 MHz	—	29	—	dB
Supply Current	1.5	2.0	2.5	mA



C1	10 pF, NPO/COG	T1	50 Ω MICROSTRIP, 0.13”
C2	0.01 µF	T2	76 Ω MICROSTRIP, 0.072”
C3	1.4 pF, NPO/COG	T3	100 Ω MICROSTRIP, 0.035”
C4	12 pF, NPO/COG	T4	50 Ω MICROSTRIP, 0.048”
L1	8.2 nH	T5	50 Ω MICROSTRIP, 0.08”
L2	10 nH	T6	76 Ω MICROSTRIP, 0.062”
		T7	76 Ω MICROSTRIP, 0.07”

BOARD MATERIAL: FR4, ε_r = 4.45, THICKNESS = 0.014”

Figure 1. 850 MHz Applications Circuit Configuration



1.8 GHz DESCRIPTION		2.4 GHz DESCRIPTION	
C1	18 pF, NPO/COG	C1	12 pF, NPO/COG
C2	1.0 pF, NPO/COG	C2	1.2 pF, NPO/COG
C3	0.9 pF, NPO/COG	C3	0.7 pF, NPO/COG
C4	10 pF, NPO/COG	C4	10 pF, NPO/COG
T1	50 Ω MICROSTRIP, 0.41”	T1	50 Ω MICROSTRIP, 0.228”
T2	50 Ω MICROSTRIP, 0.076”	T2	50 Ω MICROSTRIP, 0.076”
T3	50 Ω MICROSTRIP, 0.528”	T3	50 Ω MICROSTRIP, 0.229”
T7	N/A	T4	50 Ω MICROSTRIP, 0.345

BOARD MATERIAL: FR4, ε_r = 4.45, THICKNESS = 0.014”

Figure 2. 1800 and 2400 MHz Applications Circuit Configuration

TYPICAL CHARACTERISTICS

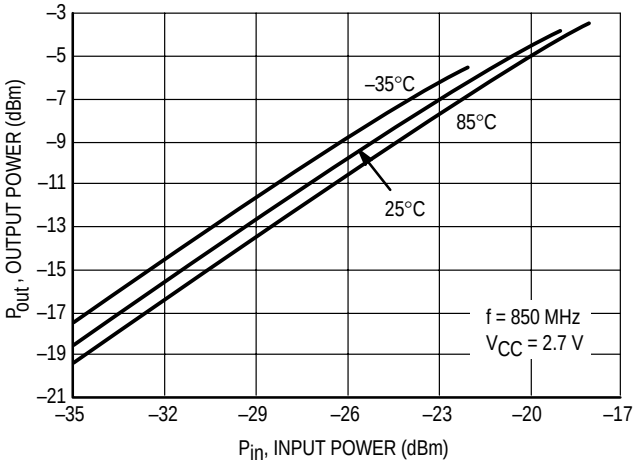


Figure 3. Output Power versus Input Power

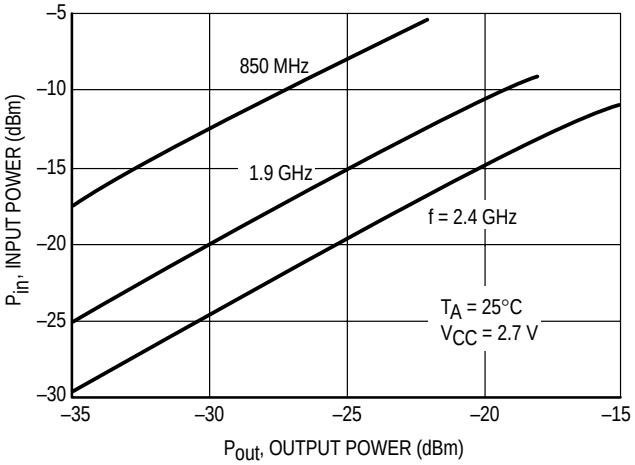


Figure 4. Output Power versus Input Power

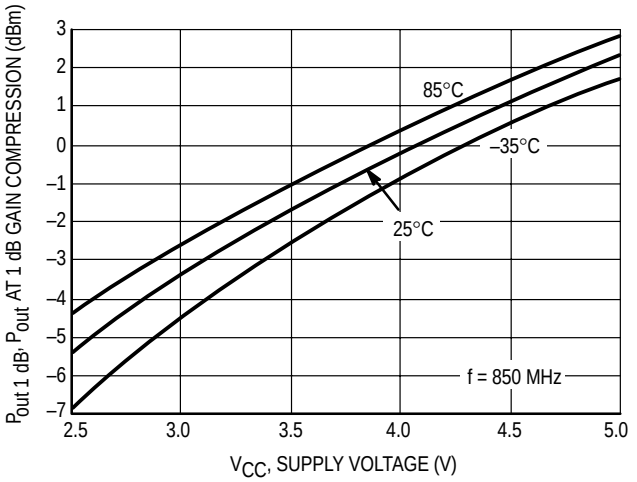


Figure 5. Output Power at 1 dB Gain Compression versus Supply Voltage

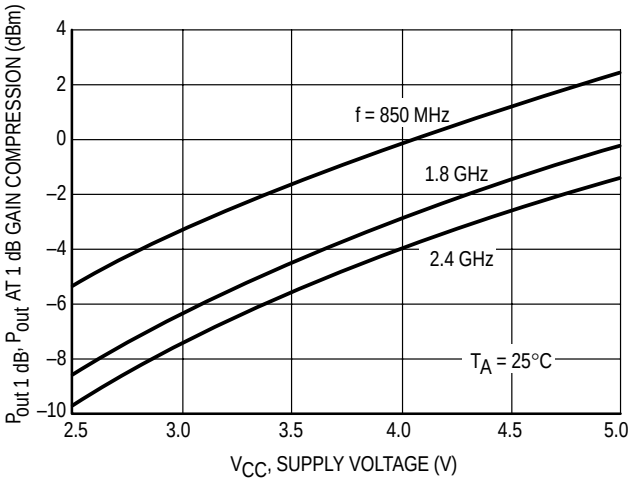


Figure 6. Output Power at 1 dB Gain Compression versus Supply Voltage

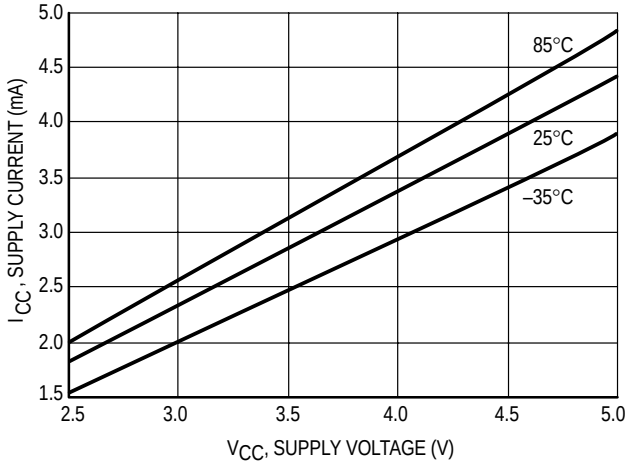


Figure 7. Supply Current versus Supply Voltage

f MHz	S_{11}		S_{21}		S_{12}		S_{22}	
	$\|S_{11}\|$	$\angle\phi$	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$
100	0.91	–11	5.72	168	0.000	53	0.97	–3
200	0.90	–22	5.50	156	0.001	85	0.97	–7
300	0.86	–32	5.32	145	0.002	80	0.96	–10
400	0.82	–42	5.00	134	0.002	74	0.95	–13
500	0.75	–52	4.72	122	0.002	69	0.94	–16
600	0.70	–60	4.35	113	0.002	67	0.92	–18
700	0.66	–68	4.05	105	0.003	66	0.91	–21
800	0.63	–75	3.65	97	0.003	67	0.90	–24
900	0.57	–83	3.52	89	0.002	69	0.89	–26
1000	0.54	–90	3.28	82	0.002	73	0.87	–29
1100	0.50	–96	3.05	75	0.002	78	0.86	–32
1200	0.48	–103	2.81	69	0.002	92	0.85	–34
1300	0.45	–109	2.71	62	0.002	108	0.84	–37
1400	0.43	–114	2.53	56	0.002	129	0.83	–40
1500	0.41	–120	2.37	51	0.002	147	0.81	–42
1600	0.39	–125	2.28	45	0.003	160	0.80	–45
1700	0.38	–132	2.12	39	0.004	167	0.79	–48
1800	0.37	–137	2.00	34	0.005	113	0.78	–51
1900	0.36	–141	1.88	28	0.006	116	0.77	–53
2000	0.35	–146	1.78	23	0.008	–2	0.76	–56
2100	0.34	–150	1.71	18	0.010	–61	0.75	–59
2200	0.33	–155	1.65	12	0.012	–120	0.74	–62
2300	0.34	–159	1.51	7	0.013	–120	0.73	–65
2400	0.33	–161	1.51	2	0.016	–61	0.72	–69
2500	0.34	–167	1.39	–5	0.019	58	0.71	–73
2600	0.34	–171	1.32	–10	0.022	176	0.70	–77
2700	0.34	–173	1.26	–15	0.025	175	0.69	–80
2800	0.34	–176	1.20	–20	0.028	174	0.68	–83
2900	0.34	–119	1.14	–25	0.032	172	0.67	–86
3000	0.34	118	1.09	–30	0.036	170	0.66	–90

Table 1. S–Parameters (V_{CC} = 2.7 V, 50 Ω System)

f MHz	S_{11}		S_{21}		S_{12}		S_{22}	
	$\|S_{11}\|$	$\angle\phi$	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$
100	0.88	–12	8.65	167	0.001	48	0.97	–3
200	0.85	–23	8.23	154	0.001	93	0.97	–6
300	0.80	–34	7.73	142	0.002	82	0.96	–10
400	0.75	–44	7.15	131	0.002	73	0.95	–12
500	0.67	–53	6.56	119	0.002	68	0.93	–15
600	0.62	–60	5.99	111	0.002	66	0.92	–18
700	0.57	–67	5.47	102	0.002	63	0.91	–21
800	0.53	–74	5.02	95	0.002	65	0.90	–23
900	0.48	–80	4.67	88	0.002	66	0.88	–26
1000	0.44	–86	4.31	81	0.002	69	0.87	–29
1100	0.41	–92	3.98	75	0.001	79	0.86	–31
1200	0.38	–97	3.71	69	0.001	101	0.85	–34
1300	0.36	–102	3.49	63	0.001	139	0.84	–36
1400	0.34	–107	3.26	58	0.002	102	0.82	–39
1500	0.32	–111	3.07	53	0.003	–4	0.81	–42
1600	0.30	–116	2.89	49	0.004	–119	0.80	–44
1700	0.29	–122	2.72	43	0.005	–115	0.79	–47
1800	0.28	–126	2.56	38	0.007	–113	0.78	–50
1900	0.28	–130	2.42	33	0.008	–113	0.77	–53
2000	0.27	–134	2.30	29	0.010	–112	0.76	–55
2100	0.26	–137	2.20	24	0.012	–113	0.75	–58
2200	0.25	–141	2.08	19	0.014	–114	0.74	–61
2300	0.26	–146	1.98	14	0.017	–115	0.73	–64
2400	0.25	–147	1.90	10	0.019	–117	0.72	–68
2500	0.26	–153	1.79	5	0.022	–119	0.71	–72
2600	0.26	–157	1.71	0	0.025	59	0.70	–75
2700	0.27	–159	1.63	–5	0.028	177	0.69	–78
2800	0.27	–162	1.55	–9	0.032	175	0.68	–81
2900	0.27	–164	1.48	–14	0.036	173	0.67	–85
3000	0.27	–167	1.41	–18	0.040	171	0.66	–88

Table 2. S–Parameters (V_{CC} = 4.0 V, 50 Ω System)

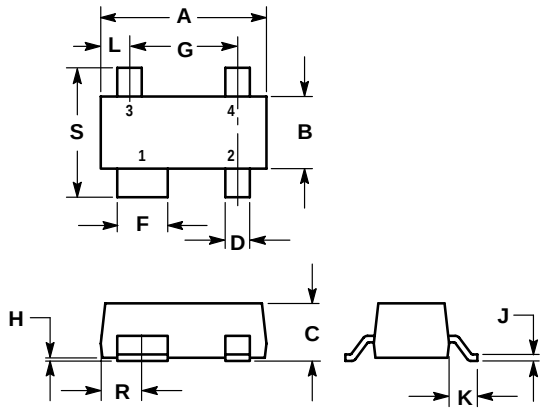
f MHz	S_{11}		S_{21}		S_{12}		S_{22}	
	$\|S_{11}\|$	$\angle\phi$	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$
100	0.85	–12	11.04	166	0.00	39	0.97	–3
200	0.82	–24	10.44	152	0.00	94	0.97	–6
300	0.77	–35	9.79	140	0.00	82	0.96	–9
400	0.70	–44	8.95	128	0.00	74	0.96	–12
500	0.62	–53	8.16	117	0.00	69	0.94	–15
600	0.57	–59	7.34	109	0.00	64	0.93	–18
700	0.52	–66	6.70	100	0.00	63	0.92	–20
800	0.48	–72	6.02	93	0.00	65	0.90	–23
900	0.43	–77	5.58	86	0.00	68	0.89	–26
1000	0.39	–82	5.11	80	0.00	71	0.88	–28
1100	0.36	–87	4.71	75	0.00	81	0.87	–31
1200	0.34	–92	4.33	69	0.00	114	0.86	–33
1300	0.32	–95	4.08	63	0.00	152	0.84	–36
1400	0.30	–99	3.80	59	0.00	114	0.83	–38
1500	0.28	–104	3.54	54	0.00	–118	0.82	–41
1600	0.26	–108	3.35	49	0.00	–114	0.81	–44
1700	0.25	–113	3.13	44	0.01	–111	0.80	–47
1800	0.25	–117	2.96	40	0.01	–110	0.79	–49
1900	0.24	–120	2.79	35	0.01	–111	0.78	–52
2000	0.23	–123	2.64	31	0.01	–111	0.77	–55
2100	0.22	–126	2.52	26	0.01	–112	0.76	–58
2200	0.22	–130	2.40	22	0.01	–114	0.75	–61
2300	0.23	–135	2.25	18	0.02	–115	0.74	–64
2400	0.23	–136	2.19	13	0.02	–117	0.73	–67
2500	0.23	–142	2.05	8	0.02	–119	0.72	–71
2600	0.23	–146	1.96	4	0.02	–1	0.71	–74
2700	0.24	–149	1.87	0	0.03	177	0.70	–77
2800	0.24	–151	1.78	–4	0.03	175	0.69	–80
2900	0.25	–153	1.70	–9	0.03	173	0.68	–84
3000	0.25	–156	1.62	–13	0.04	171	0.68	–87

Table 3. S–Parameters (V_{CC} = 5.0 V, 50 Ω System)

V_{CC} (Volts)	f (GHz)	NF_{min} (dB)	Γ_0		R_N (Ω)
			MAG	∠ ϕ	
2.7	0.30	1.26	0.47	18	0.47
	0.50	1.48	0.42	29	0.44
	0.70	1.71	0.38	41	0.42
	0.90	1.96	0.34	53	0.41
	1.00	2.09	0.33	60	0.40
	1.50	2.82	0.27	94	0.38
	2.00	3.67	0.25	132	0.36
	2.40	4.43	0.25	165	0.36
4.0	0.30	1.27	0.37	18	0.37
	0.50	1.41	0.33	29	0.35
	0.70	1.56	0.30	40	0.33
	0.90	1.73	0.27	52	0.32
	1.00	1.82	0.25	59	0.31
	1.50	2.32	0.21	93	0.30
	2.00	2.91	0.20	133	0.29
	2.40	3.44	0.21	168	0.29
4.5	0.30	1.41	0.38	18	0.40
	0.50	1.53	0.34	26	0.38
	0.70	1.67	0.31	36	0.37
	0.90	1.83	0.27	46	0.36
	1.00	1.92	0.26	52	0.35
	1.50	2.42	0.20	85	0.33
	2.00	3.03	0.17	126	0.32
	2.40	3.61	0.16	165	0.34
5.0	0.30	1.36	0.33	18	0.35
	0.50	1.47	0.29	28	0.33
	0.70	1.60	0.26	40	0.32
	0.90	1.74	0.24	52	0.31
	1.00	1.82	0.22	58	0.30
	1.50	2.25	0.18	93	0.29
	2.00	2.78	0.17	133	0.28
	2.40	3.27	0.18	170	0.29

Table 4. Typical Noise Parameters (50 Ω System)

PACKAGE DIMENSIONS



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	2.80	3.04	0.110	0.120
B	1.20	1.39	0.047	0.055
C	0.84	1.14	0.033	0.045
D	0.39	0.50	0.015	0.020
F	0.79	0.93	0.031	0.037
G	1.78	2.03	0.070	0.080
H	0.013	0.10	0.0005	0.004
J	0.08	0.15	0.003	0.006
K	0.46	0.60	0.018	0.024
L	0.445	0.60	0.0175	0.024
R	0.72	0.83	0.028	0.033
S	2.11	2.48	0.083	0.098

CASE 318A–05
ISSUE R

How to reach us:

USA / EUROPE / Locations Not Listed: Motorola Literature Distribution;
P.O. Box 5405, Denver, Colorado 80217. 1–303–675–2140 or 1–800–441–2447

JAPAN: Motorola Japan Ltd.; SPD, Strategic Planning Office, 141,
4–32–1 Nishi–Gotanda, Shinagawa–ku, Tokyo, Japan. 81–3–5487–8488

Customer Focus Center: 1–800–521–6274

Mfax™: RMFAX0@email.sps.mot.com – TOUCHTONE 1–602–244–6609
Motorola Fax Back System – US & Canada ONLY 1–800–774–1848
– http://sps.motorola.com/mfax/

ASIA / PACIFIC: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852–26629298

HOME PAGE: http://motorola.com/sps/