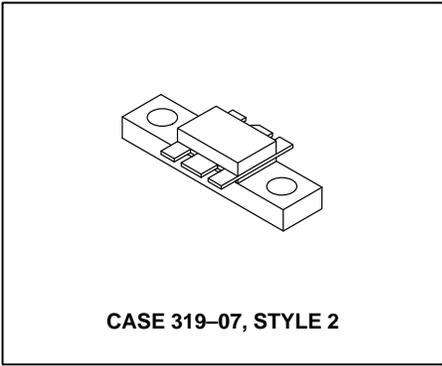


The RF Line
NPN Silicon
RF Power Transistor



The MRF6409 is designed for GSM base stations applications. It incorporates high value emitter ballast resistors, gold metallizations and offers a high degree of reliability and ruggedness.

- To be used in Class AB
- Specified 26 Volts, 960 MHz Characteristics
 - Output Power — 20 Watts CW
 - Gain — 11 dB Typ
 - Efficiency — 60% Typ

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	V_{CEO}	24	Vdc
Collector–Emitter Voltage	V_{CES}	55	Vdc
Emitter–Base Voltage	V_{EBO}	4.0	Vdc
Collector–Current — Continuous	I_C	5.0	Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	45 0.26	Watts W/°C
Storage Temperature Range	T_{stg}	-65 to +150	°C
Operating Junction Temperature	T_J	200	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (1)	$R_{\theta JC}$	3.8	°C/W

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
----------------	--------	-----	-----	-----	------

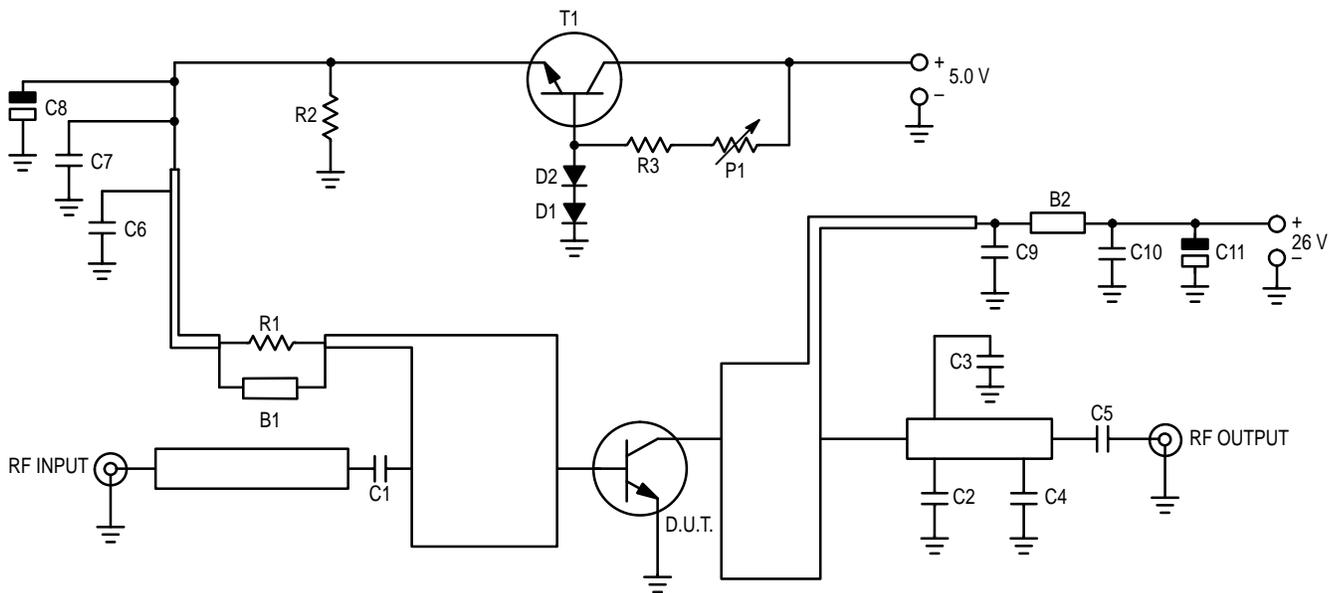
OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage ($I_C = 20\text{ mAdc}$, $I_B = 0$)	$V_{(BR)CEO}$	24	30	—	Vdc
Emitter–Base Breakdown Voltage ($I_B = 5.0\text{ mAdc}$, $I_C = 0$)	$V_{(BR)EBO}$	4.0	5.0	—	Vdc
Collector–Emitter Breakdown Voltage ($I_C = 20\text{ mAdc}$, $V_{BE} = 0$)	$V_{(BR)CES}$	55	60	—	Vdc
Collector–Cutoff Current ($V_{CE} = 30\text{ Vdc}$, $V_{BE} = 0$)	I_{CES}	—	—	6.0	mA

(1) Thermal resistance is determined under specified RF operating condition.

ELECTRICAL CHARACTERISTICS — continued ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS					
DC Current Gain ($I_{CE} = 1.0 \text{ A dc}$, $V_{CE} = 5.0 \text{ V dc}$)	h_{FE}	20	35	80	—
DYNAMIC CHARACTERISTICS					
Output Capacitance ($V_{CB} = 26 \text{ V dc}$, $I_E = 0$, $f = 1.0 \text{ MHz}$)	C_{ob}	—	18	—	pF
FUNCTIONAL TESTS					
Common-Emitter Amplifier Power Gain ($V_{CC} = 26 \text{ V dc}$, $P_{out} = 20 \text{ W (CW)}$, $I_{CQ} = 50 \text{ mA}$, $f = 960 \text{ MHz}$)	G_{pe}	10	11	—	dB
Collector Efficiency ($V_{CC} = 26 \text{ V dc}$, $P_{out} = 20 \text{ W (CW)}$, $I_{CQ} = 50 \text{ mA}$, $f = 960 \text{ MHz}$)	η	50	60	—	%
Load Mismatch ($V_{CC} = 26 \text{ V dc}$, $P_{out} = 15 \text{ W (CW)}$, $I_{CQ} = 50 \text{ mA}$, $f = 960 \text{ MHz}$, Load VSWR = 3:1, All Phase Angles at Frequency of Test)	Ψ	No Degradation in Output Power			



B1, B2	Ferrite Bead	C11	4.7 μF , 50 V, Tantalum Capacitor
C1	3.3 pF, Chip Capacitor, High Q	D1, D2	Diode BAS16 Type or Equivalent
C2, C3	4.7 pF, Chip Capacitor, High Q	P1	1.0 k Ω , Trimmer
C4	2.2 pF, Chip Capacitor, High Q	R1	3.3 Ω , Chip Resistor
C5	82 pF, Chip Capacitor, High Q	R2	68 Ω , Chip Resistor
C6, C9	330 pF, Chip Capacitor, High Q	R3	2.2 k Ω , Resistor
C7, C10	0.1 μF , Chip Capacitor	T1	NPN Transistor
C8	22 μF , 16 V, Tantalum Capacitor	Board	Glass Teflon [®] , $\epsilon_r = 2.55$, H = 1/50 inch

Figure 1. Test Circuit Electrical Schematic

TYPICAL CHARACTERISTICS

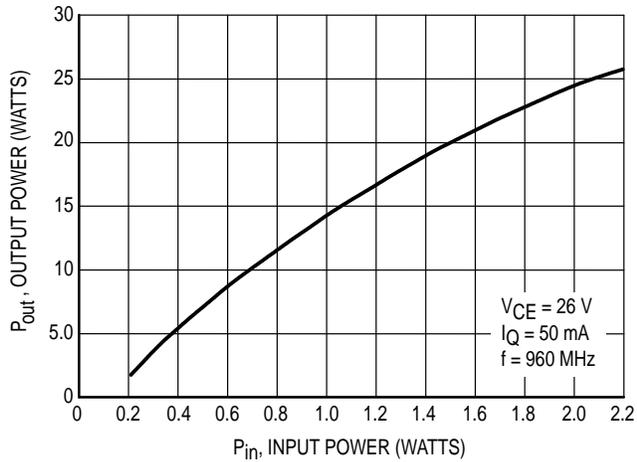


Figure 2. Output Power versus Input Power (CW)

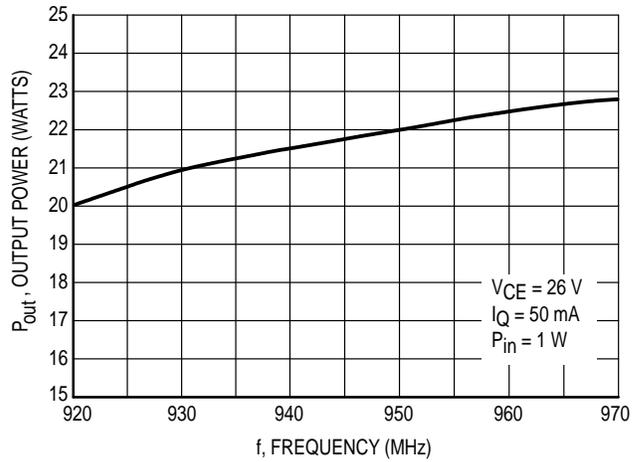


Figure 3. Output Power versus Frequency (CW)

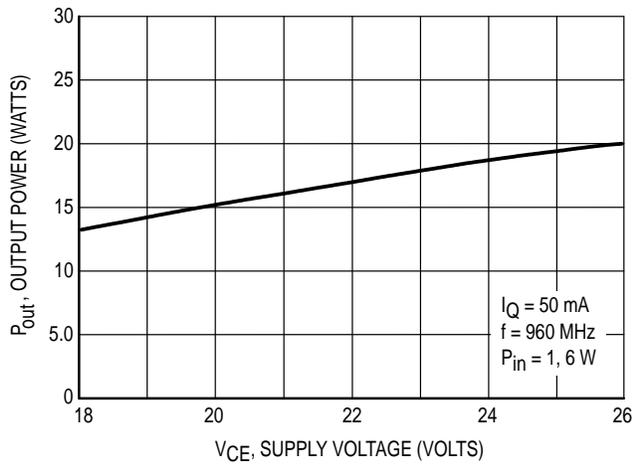


Figure 4. Output Power versus Supply Voltage (CW)

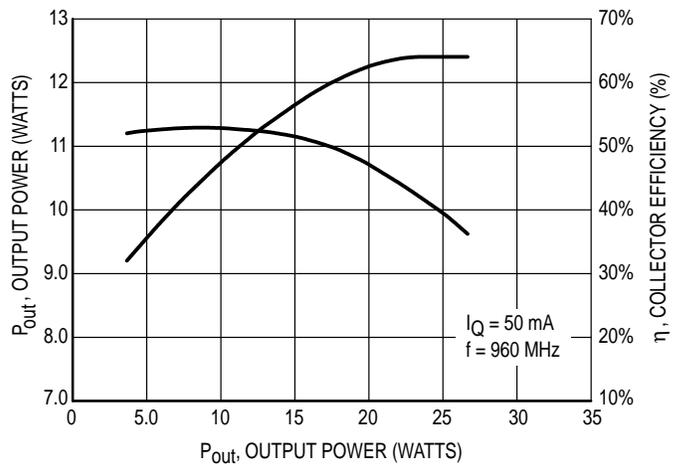


Figure 5. Power Gain and Efficiency versus Output Power

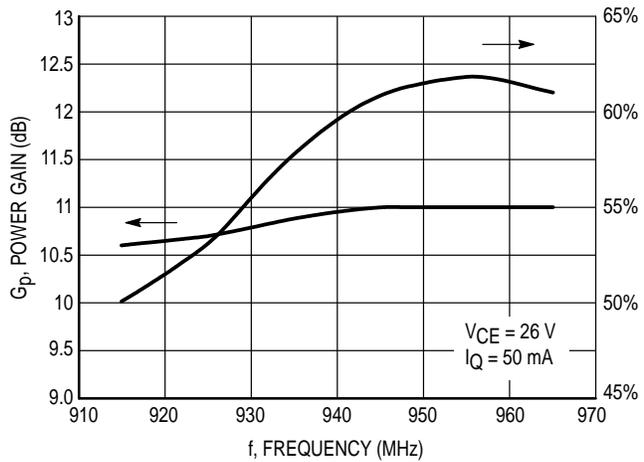


Figure 6. Typical Broadband Performances

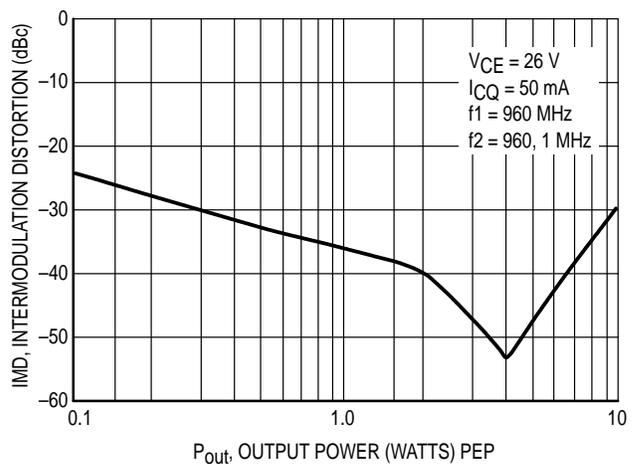
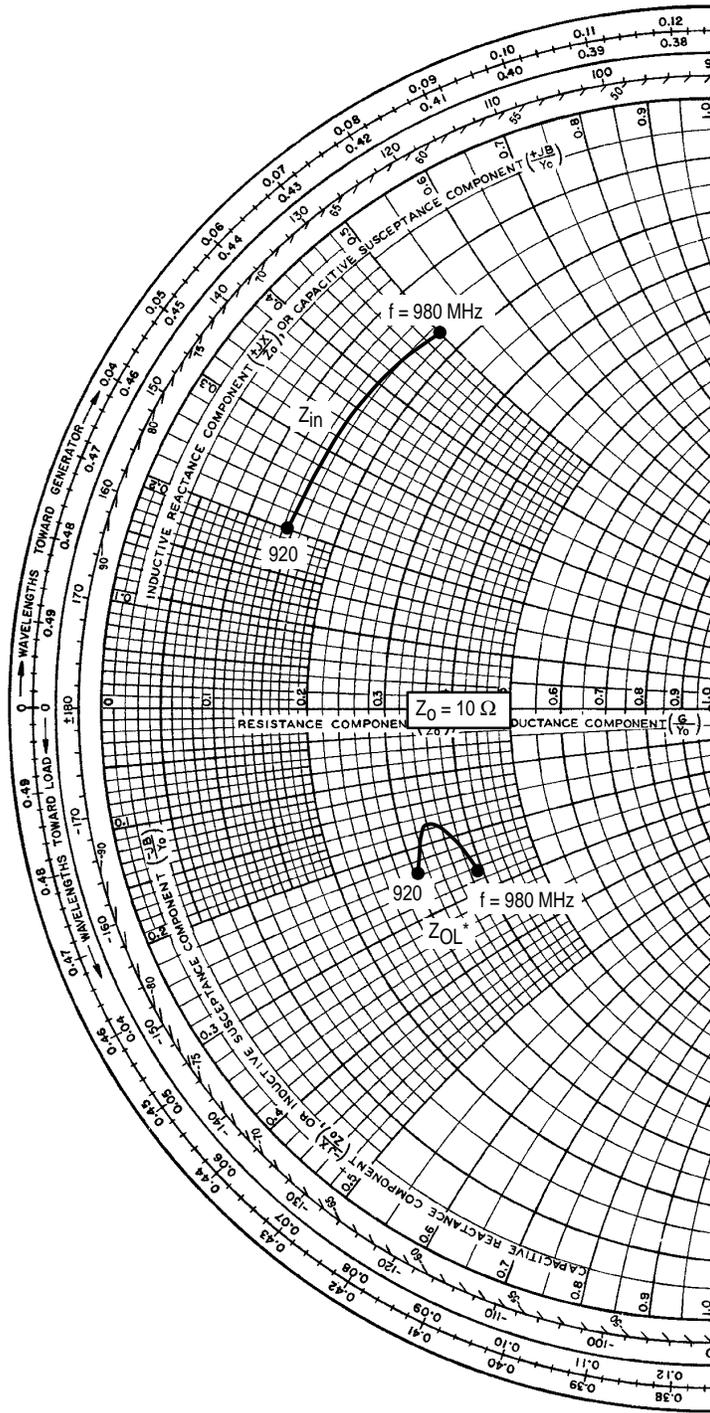


Figure 7. Intermodulation Distortion versus Output Power



f (MHz)	Z _{in} (Ω)	Z _{OL} * (Ω)
920	1.4 + j3.0	3.2 - j2.5
940	1.5 + j3.9	3.5 - j1.88
960	1.5 + j4.2	3.9 - j2.5
980	1.6 + j4.4	4.0 - j2.8

Z_{OL}*: Conjugate of optimum load impedance into which the device operates at a given output power, voltage, current and frequency.

Figure 8. Input and Output Impedances with Circuit Tuned for Maximum Gain @ V_{CC} = 26 V, I_{CQ} = 50 mA, P_{out} = 20 W (CW)

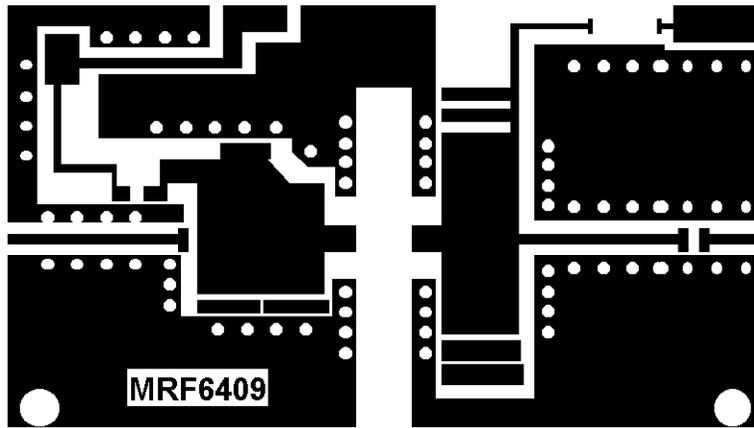


Figure 9. 960 MHz Test Circuit RF, Photomaster Scale 1:1
(Reduced 25% in printed data book, DL110/D)

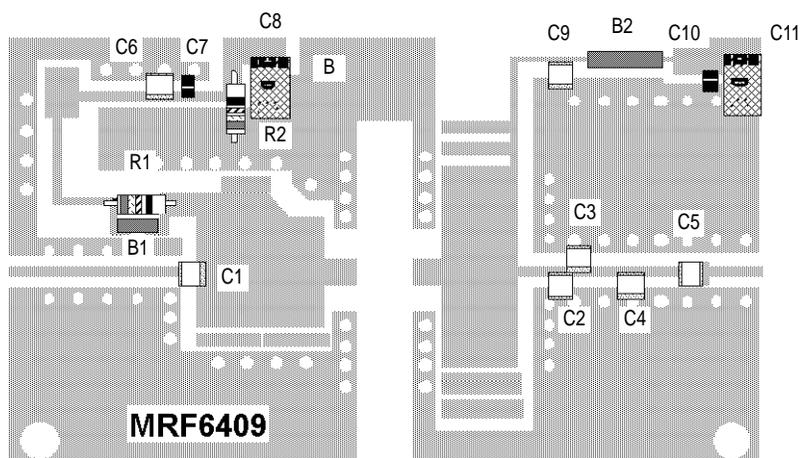
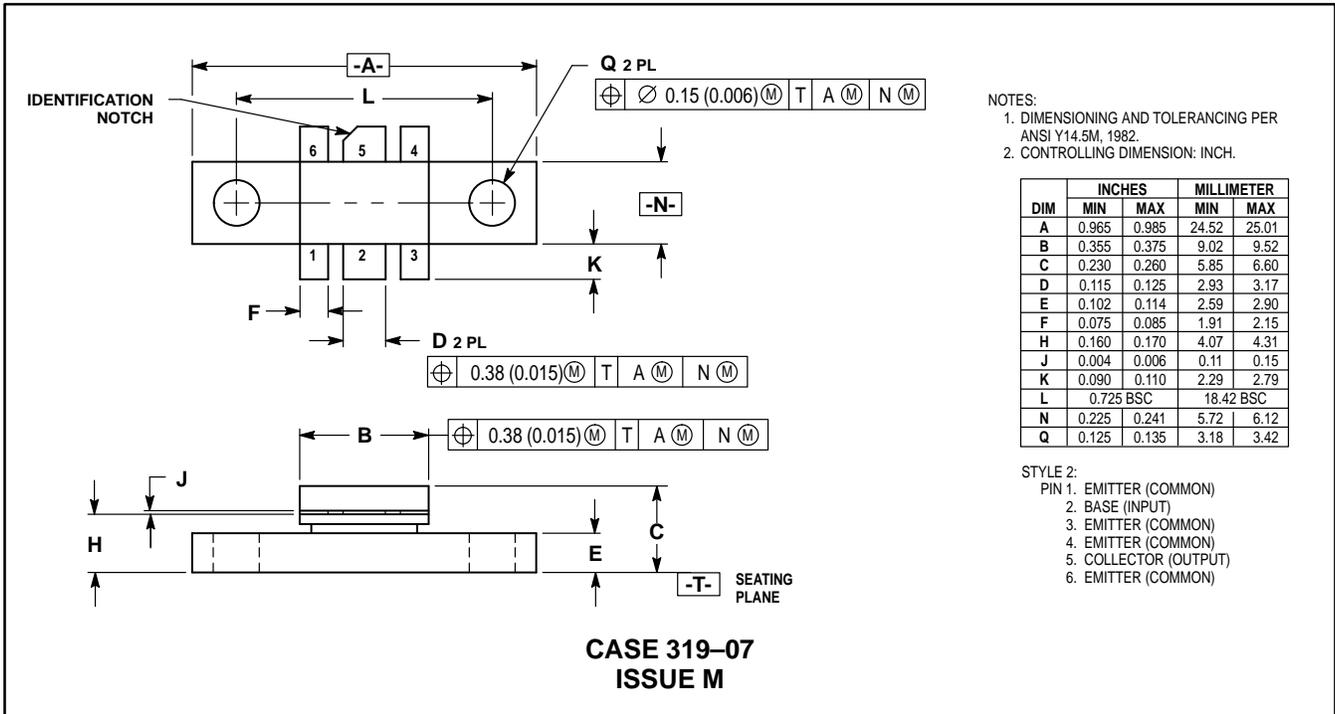


Figure 10. 960 MHz Test Circuit RF, Photomaster Scale 1:1
and Components Location
(Reduced 25% in printed data book, DL110/D)

PACKAGE DIMENSIONS



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

DIM	INCHES		MILLIMETER	
	MIN	MAX	MIN	MAX
A	0.965	0.985	24.52	25.01
B	0.355	0.375	9.02	9.52
C	0.230	0.260	5.85	6.60
D	0.115	0.125	2.93	3.17
E	0.102	0.114	2.59	2.90
F	0.075	0.085	1.91	2.15
H	0.160	0.170	4.07	4.31
J	0.004	0.006	0.11	0.15
K	0.090	0.110	2.29	2.79
L	0.725 BSC		18.42 BSC	
N	0.225	0.241	5.72	6.12
Q	0.125	0.135	3.18	3.42

STYLE 2:
 PIN 1. EMITTER (COMMON)
 2. BASE (INPUT)
 3. EMITTER (COMMON)
 4. EMITTER (COMMON)
 5. COLLECTOR (OUTPUT)
 6. EMITTER (COMMON)

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters which may be provided in Motorola data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

Mfax is a trademark of Motorola, Inc.

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

JAPAN: Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, 6F Seibu-Butsuryu-Center,
 3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 81-3-3521-8315

Mfax™: RMFAX0@email.sps.mot.com – TOUCHTONE 602-244-6609
INTERNET: http://sps.motorola.com

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

