

The RF GaAs Line

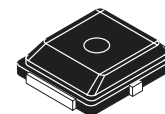
Gallium Arsenide PHEMT

RF Power Field Effect Transistor

MRFG35003MT1
3.5 GHz, 3 W, 12 V
POWER FET
GaAs PHEMT

Designed for WLL/MMDS/BWA or UMTS driver applications with frequencies from 1.8 to 3.6 GHz. Device is unmatched and is suitable for use in Class AB linear base station applications.

- Typical W-CDMA Performance: -42 dBc ACPR, 3.55 GHz, 12 Volts, $I_{DQ} = 55$ mA, 5 MHz Offset/3.84 MHz BW, 64 DPCH (8.5 dB P/A @ 0.01% Probability)
 Output Power — 300 mWatt
 Power Gain — 11.5 dB
 Efficiency — 25%
- 3 Watts P1dB @ 3.55 GHz
- Excellent Phase Linearity and Group Delay Characteristics
- High Gain, High Efficiency and High Linearity
- In Tape and Reel. T1 Suffix = 1000 Units per 12 mm, 7 inch Reel.


CASE 466-02, STYLE 1
PLD-1.5
PLASTIC

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	15	Vdc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	8.1 ⁽²⁾ 0.05 ⁽²⁾	Watts W/ $^\circ\text{C}$
Gate-Source Voltage	V_{GS}	- 5	Vdc
RF Input Power	P_{in}	29	dBm
Storage Temperature Range	T_{stg}	- 65 to +150	$^\circ\text{C}$
Channel Temperature ⁽¹⁾	T_{ch}	175	$^\circ\text{C}$
Operating Case Temperature Range	T_C	- 20 to +85	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case Class AB	$R_{\theta JC}$	18.5 ⁽²⁾	$^\circ\text{C/W}$

MOISTURE SENSITIVITY LEVEL

Test Methodology	Rating
Per JESD 22-A113	1

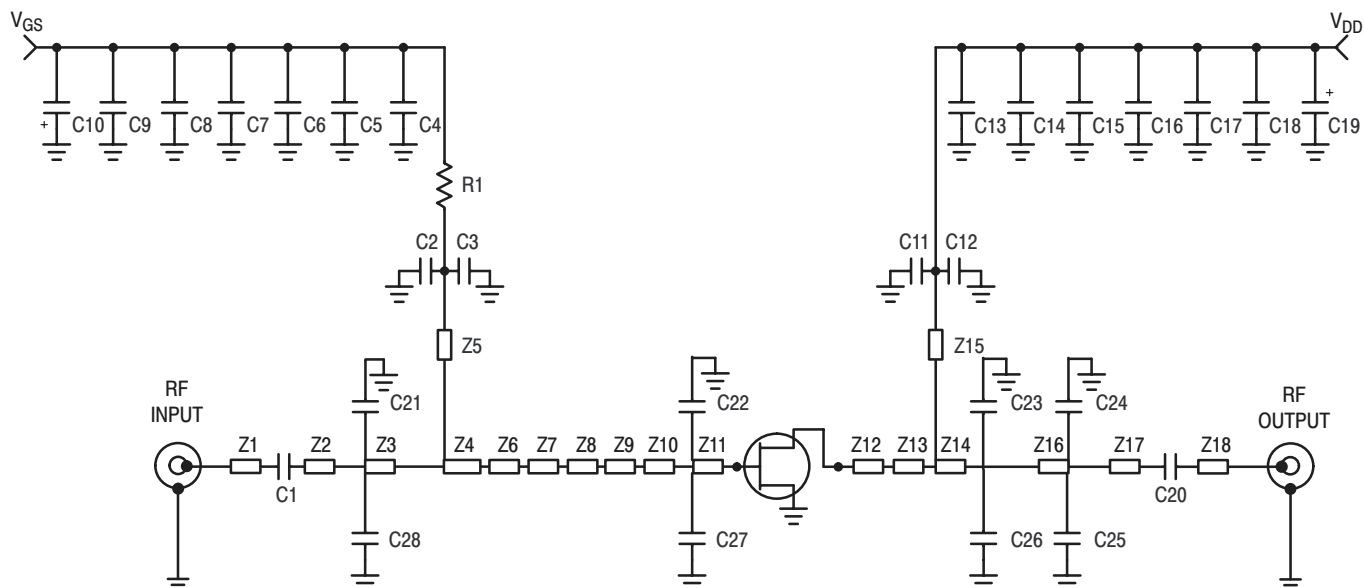
- (1) For reliable operation, the operating channel temperature should not exceed 150°C .
 (2) Simulated.

Freescale Semiconductor, Inc.

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Saturated Drain Current (V _{DS} = 3.5 Vdc, V _{GS} = 0 Vdc)	I _{DSS}	—	1.3	—	Adc
Off State Leakage Current (V _{GS} = -0.4 Vdc, V _{DS} = 0 Vdc)	I _{GSS}	—	< 1.0	100	μAdc
Off State Drain Current (V _{DS} = 12 Vdc, V _{GS} = -2.5 Vdc)	I _{DSO}	—	—	450	μAdc
Off State Current (V _{DS} = 28.5 Vdc, V _{GS} = -2.5 Vdc)	I _{DSX}	—	< 1.0	7	mAdc
Gate–Source Cut–off Voltage (V _{DS} = 3.5 Vdc, I _{DS} = 6.5 mA)	V _{GS(th)}	-1.2	-0.9	-0.7	Vdc
Quiescent Gate Voltage (V _{DS} = 12 Vdc, I _D = 80 mA)	V _{GS(Q)}	-1.2	-0.9	-0.7	Vdc
Power Gain (V _{DD} = 12 Vdc, I _{DQ} = 55 mA, f = 3.55 GHz)	G _{ps}	10	11.5	—	dB
Output Power, 1 dB Compression Point (V _{DD} = 12 Vdc, I _{DQ} = 55 mA, f = 3.55 GHz)	P _{1dB}	—	3	—	W
Drain Efficiency (V _{DD} = 12 Vdc, I _{DQ} = 55 mA, P _{out} = 0.30 W Avg., f = 3.55 GHz)	η _D	23	25	—	%
Adjacent Channel Power Ratio (V _{DD} = 12 Vdc, P _{out} = 0.30 W Avg., I _{DQ} = 55 mA, f = 3.55 GHz, W–CDMA, 8.5 P/A @ 0.01% Probability, 64 CH, 3.84 MCPS)	ACPR	—	-42	-40	dBc

Freescale Semiconductor, Inc.



Z1, Z18	0.125" x 0.044" Microstrip	Z11	0.082" x 0.372" Microstrip
Z2	0.409" x 0.044" Microstrip	Z12	0.169" x 0.471" Microstrip
Z3	0.326" x 0.288" Microstrip	Z13	0.196" x 0.093" Microstrip
Z4	0.333" x 0.572" Microstrip	Z14	0.313" x 0.338" Microstrip
Z5, Z15	0.527" x 0.015" Microstrip	Z16	0.200" x 0.065" Microstrip
Z6, Z8, Z10	0.050" x 0.025" Microstrip	Z17	0.472" x 0.044" Microstrip
Z7, Z9	0.097" x 0.025" Microstrip	PCB	Rogers 4350, 20 mil, $\epsilon_r = 3.5$

Figure 1. 3.5 GHz Test Circuit Schematic

Table 1. 3.5 GHz Test Circuit Component Designations and Values

Part	Description	Value, P/N or DWG	Manufacturer
C1, C20	7.5 pF Chip Capacitors, B Case	100A7R5JP150X	ATC
C2, C3, C11, C12	3.9 pF Chip Capacitors (0805)	08051J3R9BBT	AVX
C4, C13	10 pF Chip Capacitors, A Case	100A100JP500X	ATC
C5, C14	100 pF Chip Capacitors, A Case	100A101JP500X	ATC
C6, C15	100 pF Chip Capacitors, B Case	100B101JP500X	ATC
C7, C16	1000 pF Chip Capacitors, B Case	100B102JP500X	ATC
C8, C17	3.9 μ F Chip Capacitors, B Case		ATC
C9, C18	0.1 μ F Chip Capacitors, B Case		ATC
C10, C19	22 μ F, 35 V Tantalum Surface Mount Capacitors		ATC
C21	0.7 pF Chip Capacitor (0805)	08051J0R7BBT	AVX
C22, C27	0.2 pF Chip Capacitors (0805)	08051J0R2BBT	AVX
C23, C28	0.8 pF Chip Capacitors (0805)	08051J0R8BBT	AVX
C24	1.0 pF Chip Capacitor, B Case	08051J1R0BBT	AVX
C25	1.2 pF Chip Capacitor, B Case	08051J1R2BBT	AVX
C26	0.5 pF Chip Capacitor, B Case	08051J0R5BBT	AVX
R1	100 Ω Chip Resistor		Newark

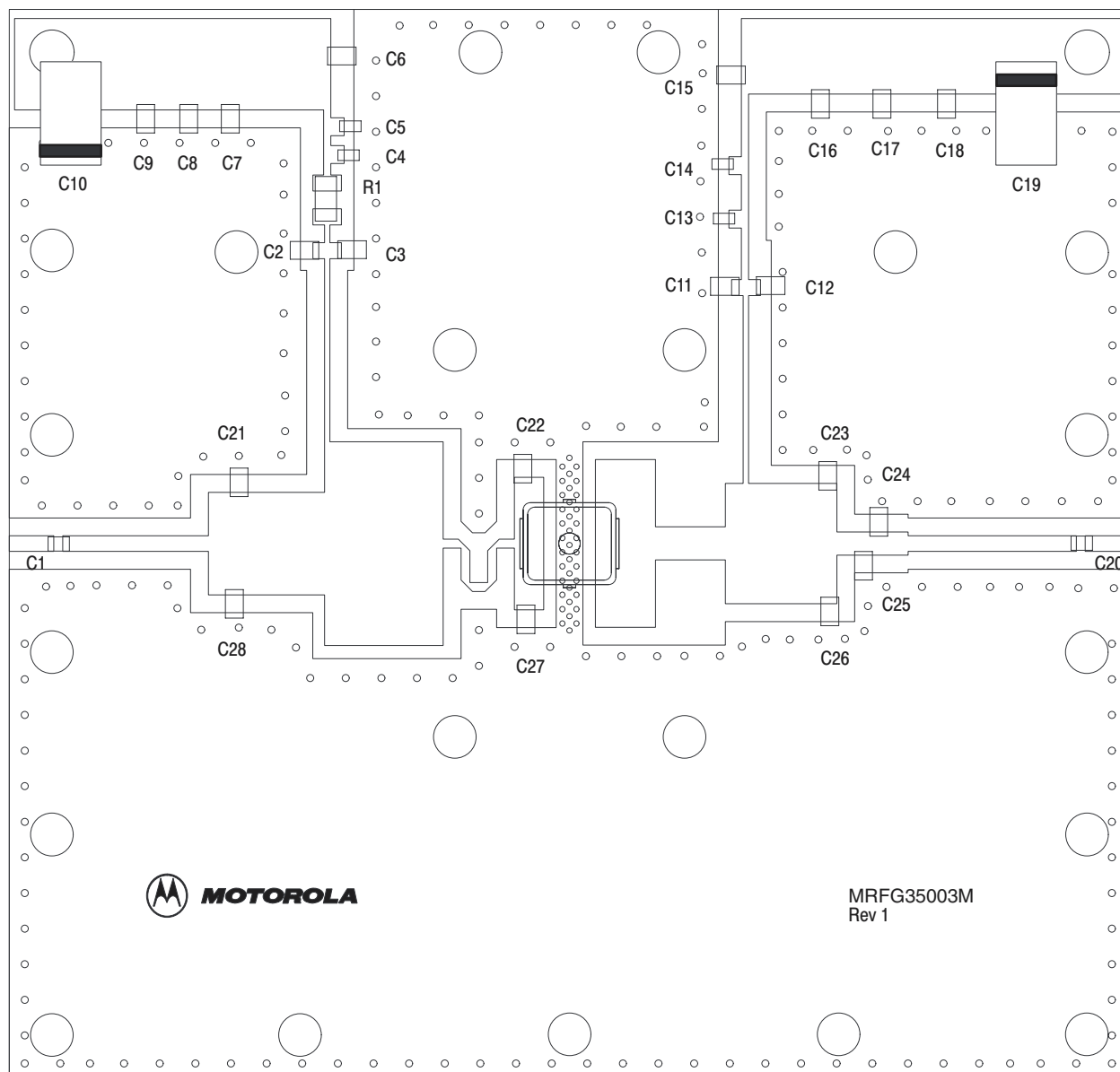


Figure 2. 3.5 GHz Test Circuit Component Layout

Freescale Semiconductor, Inc.

TYPICAL CHARACTERISTICS

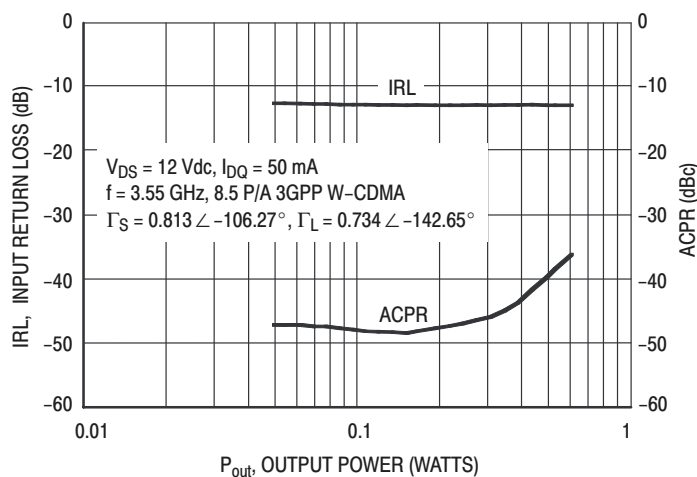


Figure 3. W-CDMA ACPR and Input Return Loss versus Output Power

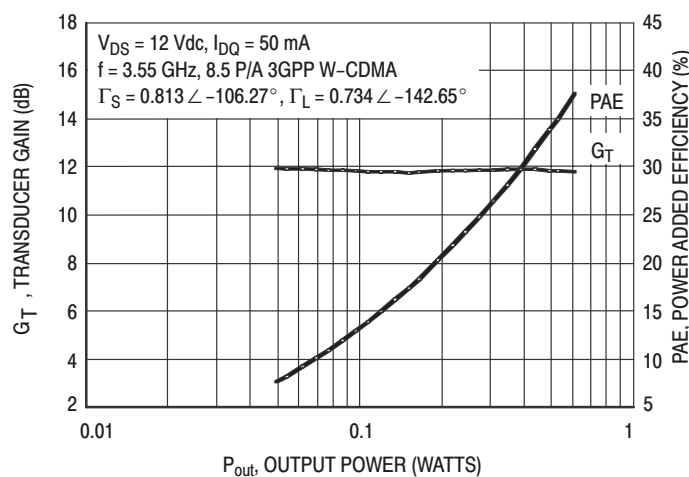


Figure 4. Transducer Gain and Power Added Efficiency versus Output Power

NOTE: All data is referenced to package lead interface. Γ_S and Γ_L are the impedances presented to the DUT. All data is generated from load pull, not from the test circuit shown.

Freescale Semiconductor, Inc.

Table 2. Class AB Common Source S-Parameters at $V_{DS} = 12 \text{ Vdc}$, $I_{DQ} = 50 \text{ mA}$

f GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	S ₁₁	∠ φ	S ₂₁	∠ φ	S ₁₂	∠ φ	S ₂₂	∠ φ
0.50	0.879	-160.58	8.644	88.22	0.038	6.94	0.520	-161.47
0.55	0.879	-163.33	7.924	85.88	0.039	5.42	0.520	-163.29
0.60	0.877	-166.03	7.317	83.57	0.039	3.80	0.520	-165.21
0.65	0.876	-168.54	6.811	81.29	0.039	2.37	0.520	-167.01
0.70	0.877	-170.64	6.380	79.13	0.039	0.94	0.521	-168.58
0.75	0.875	-172.68	5.988	77.06	0.039	-0.41	0.520	-170.13
0.80	0.877	-174.56	5.653	75.00	0.040	-1.67	0.520	-171.60
0.85	0.876	-176.25	5.310	72.83	0.040	-2.81	0.520	-172.89
0.90	0.874	-177.90	5.058	71.00	0.040	-4.01	0.519	-174.37
0.95	0.875	-179.54	4.825	69.08	0.040	-5.15	0.520	-175.84
1.00	0.876	179.00	4.608	67.27	0.040	-6.31	0.520	-177.05
1.05	0.875	177.53	4.411	65.38	0.040	-7.28	0.519	-178.37
1.10	0.874	176.04	4.224	63.51	0.040	-8.43	0.520	-179.67
1.15	0.875	174.55	4.056	61.69	0.040	-9.47	0.521	179.15
1.20	0.874	173.13	3.894	59.88	0.040	-10.47	0.520	177.91
1.25	0.873	171.63	3.743	58.01	0.040	-11.78	0.521	176.52
1.30	0.876	170.20	3.609	56.26	0.040	-12.79	0.522	175.56
1.35	0.871	168.97	3.479	54.57	0.040	-13.72	0.520	174.80
1.40	0.878	167.17	3.355	52.76	0.040	-14.65	0.526	173.34
1.45	0.876	165.98	3.237	51.14	0.040	-15.48	0.526	172.88
1.50	0.874	162.45	3.118	49.25	0.040	-16.80	0.528	174.64
1.55	0.874	161.17	3.024	47.67	0.040	-17.76	0.529	173.65
1.60	0.874	160.09	2.929	46.14	0.040	-18.51	0.530	172.88
1.65	0.876	159.00	2.848	44.54	0.040	-19.27	0.530	172.31
1.70	0.878	157.85	2.767	42.99	0.039	-20.03	0.531	171.29
1.75	0.878	156.84	2.690	41.32	0.039	-20.89	0.533	170.58
1.80	0.878	155.94	2.625	39.82	0.039	-21.53	0.533	170.03
1.85	0.880	154.93	2.557	38.21	0.039	-22.22	0.533	168.95
1.90	0.879	154.05	2.492	36.74	0.039	-23.01	0.536	168.19
1.95	0.879	153.24	2.434	35.28	0.039	-23.74	0.535	167.63
2.00	0.881	152.32	2.379	33.68	0.039	-24.55	0.535	166.68
2.05	0.881	151.56	2.325	32.27	0.040	-25.32	0.538	165.91
2.10	0.880	150.85	2.279	30.90	0.040	-25.97	0.539	165.46
2.15	0.881	149.96	2.236	29.41	0.040	-26.76	0.537	164.56
2.20	0.881	149.27	2.191	27.93	0.040	-27.75	0.539	163.66
2.25	0.880	148.61	2.151	26.53	0.040	-28.56	0.541	163.24
2.30	0.880	147.74	2.121	24.99	0.040	-29.32	0.539	162.46
2.35	0.881	146.91	2.084	23.54	0.040	-29.95	0.539	161.41
2.40	0.879	146.12	2.051	22.12	0.040	-30.72	0.540	160.97
2.45	0.877	145.07	2.023	20.46	0.040	-31.44	0.539	160.26
2.50	0.876	144.07	1.992	18.93	0.040	-32.36	0.539	159.16
2.55	0.876	143.15	1.971	17.38	0.040	-32.95	0.541	158.56
2.60	0.873	142.10	1.948	15.95	0.041	-33.58	0.538	157.90
2.65	0.872	140.88	1.924	14.31	0.041	-34.41	0.538	156.83
2.70	0.872	139.83	1.901	12.69	0.041	-35.22	0.538	156.16
2.75	0.867	138.60	1.882	11.19	0.042	-36.04	0.537	155.70
2.80	0.868	137.26	1.864	9.40	0.042	-37.16	0.535	154.59

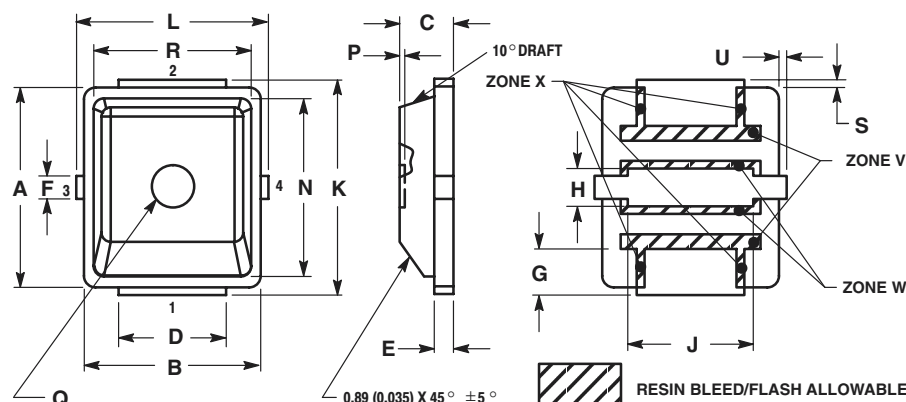
Freescale Semiconductor, Inc.

Table 2. Class AB Common Source S-Parameters at $V_{DS} = 12$ Vdc, $I_{DQ} = 50$ mA (continued)

f GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	S ₁₁	∠ φ	S ₂₁	∠ φ	S ₁₂	∠ φ	S ₂₂	∠ φ
2.85	0.868	136.03	1.845	7.80	0.043	-38.56	0.537	153.86
2.90	0.866	134.67	1.828	6.20	0.043	-39.94	0.536	153.32
2.95	0.866	133.02	1.812	4.39	0.043	-41.41	0.534	152.08
3.00	0.868	131.47	1.795	2.53	0.043	-42.49	0.536	151.08
3.05	0.865	129.99	1.780	0.80	0.043	-43.57	0.535	150.49
3.10	0.864	128.11	1.766	-1.00	0.043	-44.68	0.532	149.20
3.15	0.865	126.39	1.745	-2.87	0.043	-45.67	0.533	148.09
3.20	0.864	124.86	1.728	-4.58	0.043	-46.62	0.533	147.42
3.25	0.861	122.97	1.714	-6.48	0.043	-47.78	0.531	146.29
3.30	0.863	121.30	1.697	-8.33	0.043	-49.02	0.532	145.13
3.35	0.862	119.77	1.681	-9.97	0.043	-49.91	0.532	144.52
3.40	0.860	117.84	1.665	-11.83	0.043	-50.93	0.529	143.46
3.45	0.862	116.26	1.648	-13.70	0.043	-51.73	0.529	142.35
3.50	0.861	114.65	1.630	-15.43	0.043	-52.55	0.530	141.50
3.55	0.860	112.77	1.620	-17.24	0.044	-53.64	0.527	140.51
3.60	0.862	111.19	1.602	-18.99	0.044	-54.74	0.525	139.19
3.65	0.861	109.76	1.584	-20.65	0.044	-55.56	0.525	138.23
3.70	0.860	108.08	1.572	-22.49	0.044	-56.84	0.524	137.30
3.75	0.861	106.70	1.557	-24.18	0.044	-58.11	0.523	136.00
3.80	0.862	105.31	1.544	-25.86	0.044	-59.31	0.524	134.95
3.85	0.862	103.85	1.533	-27.47	0.044	-60.49	0.523	134.13
3.90	0.861	102.50	1.519	-29.14	0.044	-61.50	0.521	132.71
3.95	0.862	101.16	1.508	-30.97	0.044	-62.41	0.522	131.61
4.00	0.861	99.84	1.499	-32.49	0.044	-63.14	0.520	130.97
4.05	0.861	98.44	1.494	-34.26	0.044	-64.07	0.518	129.57
4.10	0.861	97.12	1.482	-35.96	0.044	-64.91	0.518	128.23
4.15	0.859	96.07	1.474	-37.51	0.045	-65.77	0.515	127.49
4.20	0.858	94.61	1.471	-39.42	0.045	-67.06	0.512	125.93
4.25	0.859	93.26	1.463	-41.19	0.045	-68.21	0.512	124.32
4.30	0.859	92.06	1.458	-42.86	0.045	-69.40	0.511	123.47
4.35	0.857	90.72	1.457	-44.58	0.046	-70.54	0.507	122.03
4.40	0.857	89.22	1.450	-46.51	0.046	-71.95	0.508	120.25
4.45	0.855	87.99	1.446	-48.27	0.046	-73.34	0.508	119.27
4.50	0.855	86.49	1.453	-50.09	0.047	-74.58	0.504	117.72
4.55	0.855	84.61	1.448	-52.14	0.046	-75.92	0.503	115.65
4.60	0.854	83.10	1.449	-53.98	0.047	-76.82	0.501	114.46
4.65	0.853	81.10	1.454	-56.16	0.047	-78.14	0.495	112.83
4.70	0.851	78.94	1.450	-58.44	0.048	-79.84	0.492	110.59
4.75	0.851	77.09	1.450	-60.56	0.048	-81.55	0.491	109.01
4.80	0.848	74.85	1.450	-62.75	0.048	-83.28	0.486	107.24
4.85	0.849	72.60	1.448	-65.03	0.048	-84.88	0.483	105.01
4.90	0.845	70.48	1.443	-67.33	0.048	-86.30	0.482	103.27
4.95	0.841	68.09	1.443	-69.60	0.048	-87.72	0.477	101.51
5.00	0.841	65.50	1.442	-72.12	0.048	-89.22	0.474	99.28

Freescal Semiconductor, Inc.

PACKAGE DIMENSIONS



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH
3. RESIN BLEED/FLASH ALLOWABLE IN ZONE V, W, AND X.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.255	0.265	6.48	6.73
B	0.225	0.235	5.72	5.97
C	0.065	0.072	1.65	1.83
D	0.130	0.150	3.30	3.81
E	0.021	0.026	0.53	0.66
F	0.026	0.044	0.66	1.12
G	0.050	0.070	1.27	1.78
H	0.045	0.063	1.14	1.60
J	0.160	0.180	4.06	4.57
K	0.273	0.285	6.93	7.24
L	0.245	0.255	6.22	6.48
N	0.230	0.240	5.84	6.10
P	0.000	0.008	0.00	0.20
Q	0.055	0.063	1.40	1.60
R	0.200	0.210	5.08	5.33
S	0.006	0.012	0.15	0.31
U	0.006	0.012	0.15	0.31
ZONE V	0.000	0.021	0.00	0.53
ZONE W	0.000	0.010	0.00	0.25
ZONE X	0.000	0.010	0.00	0.25

STYLE 1:

1. DRAIN
2. GATE
3. SOURCE
4. SOURCE

**CASE 466-02
ISSUE B
PLD-1.5
PLASTIC**

Information in this document is provided solely to enable system and software implementers to use Motorola products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits or integrated circuits based on the information in this document.

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 that 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 the Stylized M Logo are registered in the US Patent and Trademark Office. All other product or service names are the property of their respective owners. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

© Motorola Inc. 2003

HOW TO REACH US:

USA/EUROPE/LOCATIONS NOT LISTED:

Motorola Literature Distribution
P.O. Box 5405, Denver, Colorado 80217
1-800-521-6274 or 480-768-2130

JAPAN: Motorola Japan Ltd.; SPS, Technical Information Center,
3-20-1, Minami-Azabu, Minato-ku, Tokyo 106-8573, Japan
81-3-3440-3569

ASIA/PACIFIC: Motorola Semiconductors H.K. Ltd.; Silicon Harbour Centre,
2 Dai King Street, Tai Po Industrial Estate, Tai Po, N.T., Hong Kong
852-2668334

HOME PAGE: <http://motorola.com/semiconductors>



MOTOROLA

**For More Information On This Product,
Go to: www.freescale.com**

MRFG35003MT1/D