MRF160

The RF MOSFET Line: Broadband Power FET 4W, to 500MHz, 28V

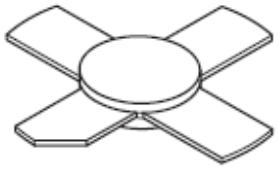
M/A-COM Products
Released - Rev. 07.07

Designed primarily for wideband large–signal output and driver from 30–500 MHz.

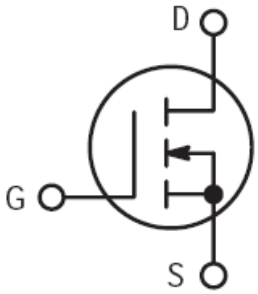
N–Channel enhancement mode MOSFET

- Guaranteed 28 V, 500 MHz performance
  - Output power = 4.0 W
  - Gain = 16 dB (min.)
  - Efficiency = 55% (typ.)
- Excellent thermal stability, ideally suited for Class A operation
- Facilitates manual gain control, ALC and modulation techniques
- 100% Tested for load mismatch at all phase angles with 30:1 VSWR
- Low Crss – 0.8 pF Typical at VDS = 28 V

Product Image



CASE 249–06, STYLE 3



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

Rating	Symbol	Value	Unit
Drain–Gate Voltage	V_{DSS}	65	Vdc
Drain–Gate Voltage (R_{GS} = 1.0 MΩ)	V_{DGR}	65	Vdc
Gate–Source Voltage	V_{GS}	± 20	Vdc
Drain Current–Continuous	I_D	1.0	ADC
Total Device Dissipation @ T_C = 25°C Derate Above 25°C	P_D	24 0.14	Watts W/°C
Storage Temperature Range	T_{stg}	– 65 to +150	°C
Operating Junction Temperature	T_J	200	°C

THERMAL CHARACTERISTICS

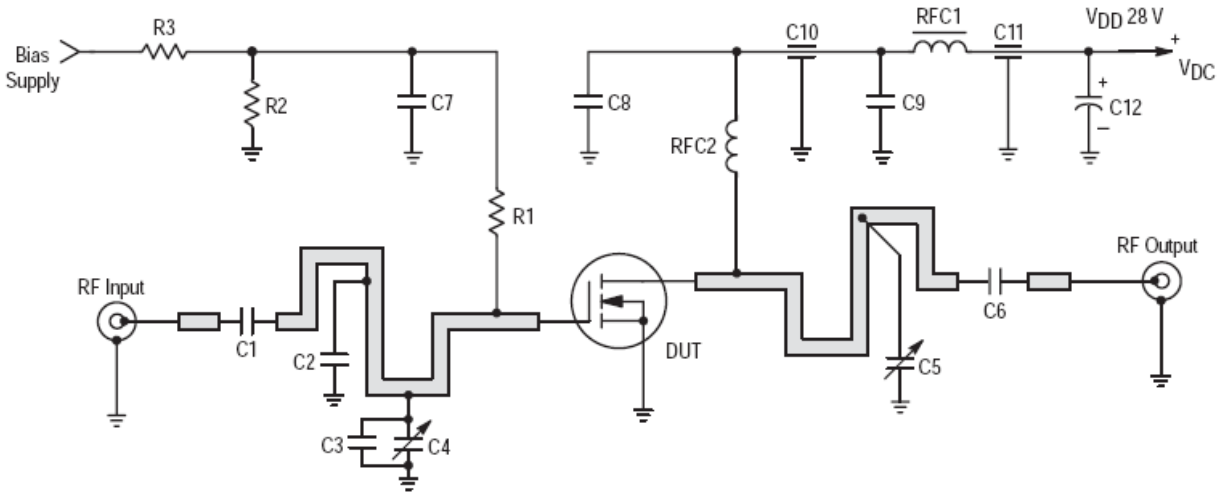
Thermal Resistance — Junction to Case	$R_{\theta JC}$	7.2	°C/W

NOTE — **CAUTION** — MOS devices are susceptible to damage from electrostatic charge. Reasonable precautions in handling and packaging MOS devices should be observed.

• **North America** Tel: 800.366.2266 / Fax: 978.366.2266
• **Europe** Tel: 44.1908.574.200 / Fax: 44.1908.574.300
• **Asia/Pacific** Tel: 81.44.844.8296 / Fax: 81.44.844.8298
Visit www.macomtech.com for additional data sheets and product information.

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

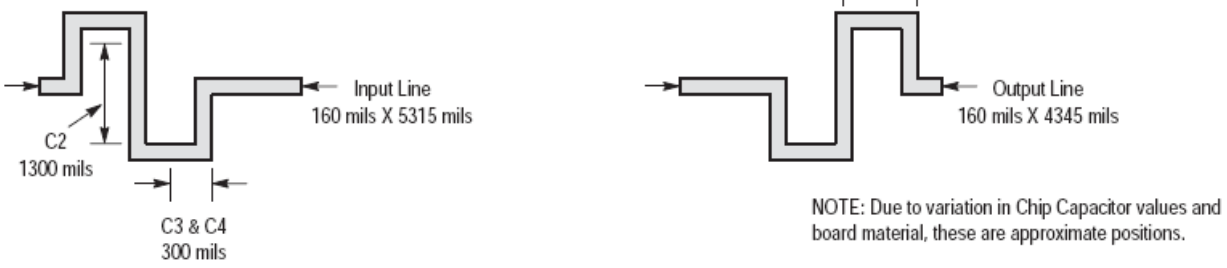
Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain–Source Breakdown Voltage (V_{DS} = 0 Vdc, V_{GS} = 0 Vdc, I_D = 1.0 mA)	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Current (V_{DS} = 28 Vdc, V_{GS} = 0 V)	I_{DSS}	—	—	0.5	mA
Gate–Source Leakage Current (V_{GS} = 20 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1.0	µA
ON CHARACTERISTICS					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 10 mA)	$V_{GS(th)}$	1.5	3.0	4.5	Vdc
Drain Source On–Voltage ($V_{DS\ (on)}$, V_{GS} = 10 Vdc, I_D = 500 mA)	$V_{DS(on)}$	—	3.8	—	Vdc
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 250 mA)	g_{fs}	150	220	—	mS
DYNAMIC CHARACTERISTICS					
Input Capacitance (V_{DS} = 28 Vdc, V_{GS} = 0 V, f = 1.0 MHz)	C_{iss}	—	6.0	—	pF
Output Capacitance (V_{DS} = 28 V, V_{GS} = 0 Vdc, f = 1.0 MHz)	C_{oss}	—	6.5	—	pF
Reverse Transfer Capacitance (V_{DS} = 28 Vdc, V_{GS} = 0 Vdc, f = 1.0 MHz)	C_{rss}	—	0.8	—	pF
FUNCTIONAL CHARACTERISTICS					
Common Source Power Gain (V_{DD} = 28 Vdc, P_{out} = 4.0 W, f = 500 MHz, I_{DQ} = 50 mA)	G_{ps}	16	18	—	dB
Drain Efficiency (V_{DD} = 28 Vdc, P_{out} = 4.0 W, f = 500 MHz, I_{DQ} = 50 mA)	η	50	55	—	%
Electrical Ruggedness (V_{DD} = 28 Vdc, P_{out} = 4.0 W, f = 500 MHz, I_{DQ} = 50 mA) Load VSWR = 30:1 at All Phase Angles at Frequency of Test	ψ	No Degradation in Output Power			
Series Equivalent Input Impedance (V_{DD} = 28 Vdc, P_{out} = 4.0 W, f = 500 MHz, I_{DQ} = 50 mA)	Z_{in}	—	6.8 – j21	—	Ohms
Series Equivalent Output Impedance (V_{DD} = 28 Vdc, P_{out} = 4.0 W, f = 500 MHz, I_{DQ} = 50 mA)	Z_{out}	—	21 – j28	—	Ohms



C1, C6	240 pF, 100 mil Chip Capacitors
C2	15 pF, 100 mil ATC Chip Capacitor
C4, C5	1 – 10 pF, Johanson Trimmer Capacitors
C3	24 pF, 100 mil ATC Chip Capacitor
C7, C9	0.1 μF, 100 mil Chip Capacitors
C8	220 pF, 100 mil ATC Chip Capacitor
C10, C11	680 pF, Feed Through Capacitors
C12	50 μF, 50 V Electrolytic Capacitor

R1	200 Ω, 1/2 Watt
R2	10 kΩ, 1/2 Watt
R3	1 kΩ, 1/2 Watt
RFC1	Ferroxcube VK200–19/4B
RFC2	8 Turns, #20 AWG, Enameled, ID 110 mils

Board Material — 0.062″, Teflon® Fiberglass, 1 oz., Copper clad both sides, $\varepsilon_r = 2.55$



NOTE: Due to variation in Chip Capacitor values and board material, these are approximate positions.

Figure 1. MRF160 500 MHz Test Circuit

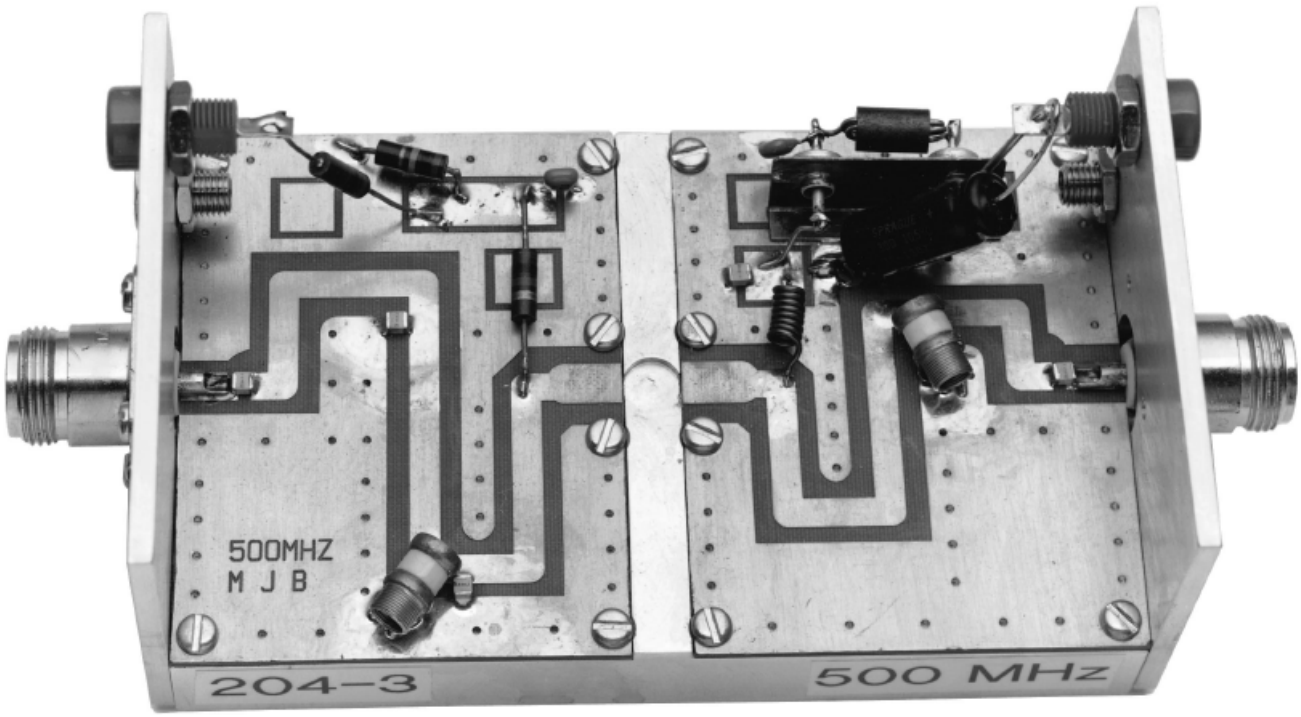


Figure 2. MRF160 Broadband Test Fixture

TYPICAL CHARACTERISTICS

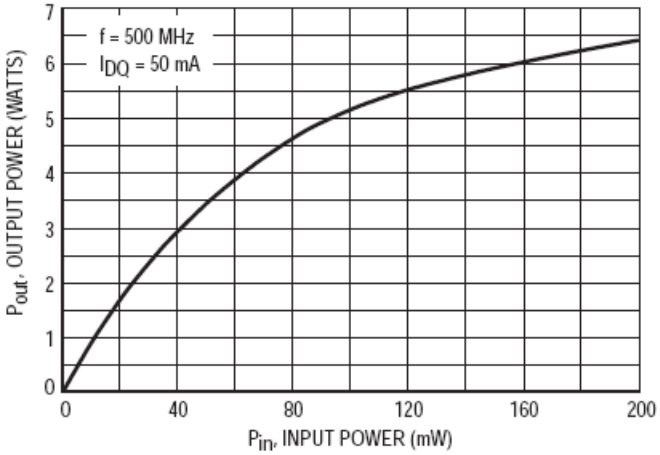


Figure 3. Output Power versus Input Power

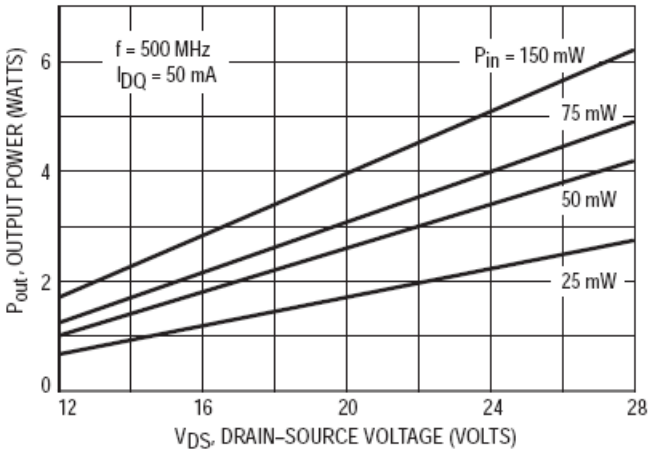


Figure 4. Output Power versus Voltage

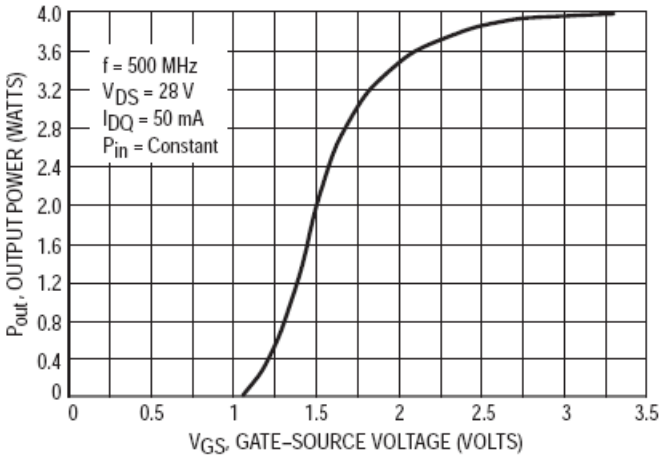


Figure 5. Output Power versus Gate Voltage

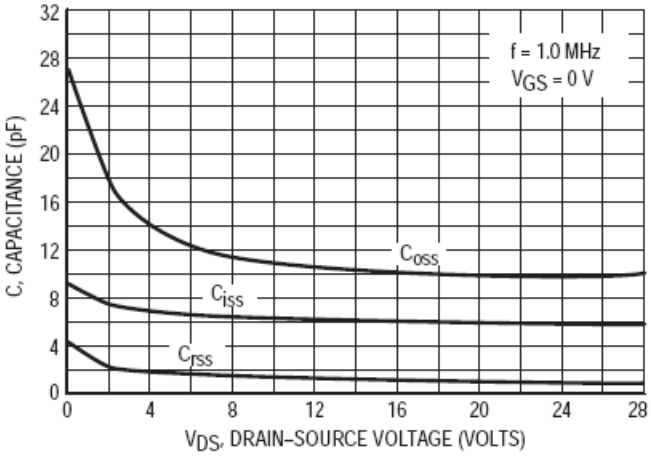


Figure 6. Capacitance versus Drain–Source Voltage

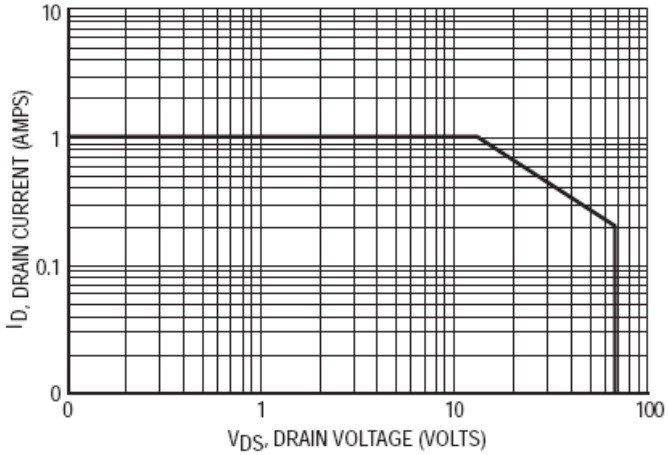


Figure 7. DC Safe Operating Area

Table 1. Common Source S–Parameters (V_{DS} = 12.5 V, I_D = 120 mA)

f	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	$\|S_{11}\|$	ϕ	$\|S_{21}\|$	ϕ	$\|S_{12}\|$	ϕ	$\|S_{22}\|$	ϕ
30	0.991	–19	15.80	166	0.019	77	0.938	–19
40	0.970	–25	15.50	161	0.025	72	0.933	–25
50	0.959	–31	15.20	156	0.030	67	0.918	–31
60	0.943	–37	14.80	151	0.035	63	0.900	–37
70	0.925	–42	14.30	147	0.040	59	0.880	–42
80	0.912	–48	13.90	143	0.044	56	0.863	–47
85	0.903	–51	13.70	141	0.046	54	0.857	–49
90	0.896	–53	13.50	139	0.048	52	0.851	–52
100	0.872	–58	12.90	135	0.051	48	0.830	–57
110	0.853	–63	12.40	131	0.054	46	0.812	–60
120	0.841	–67	11.90	128	0.056	43	0.796	–63
130	0.831	–71	11.50	126	0.059	40	0.788	–67
140	0.814	–75	11.10	122	0.061	37	0.777	–70
150	0.797	–79	10.70	119	0.063	34	0.760	–74
160	0.782	–82	10.20	117	0.064	32	0.739	–78
170	0.776	–85	9.81	115	0.066	32	0.740	–79
180	0.769	–89	9.55	112	0.068	28	0.737	–83
190	0.754	–92	9.24	109	0.069	25	0.725	–87
200	0.737	–94	8.83	107	0.068	23	0.707	–90
210	0.731	–96	8.47	105	0.068	22	0.692	–92
220	0.730	–99	8.20	103	0.069	21	0.692	–94
230	0.724	–101	7.94	101	0.071	20	0.697	–95
240	0.713	–104	7.69	99	0.072	16	0.696	–99
250	0.705	–106	7.44	97	0.070	15	0.676	–100
260	0.699	–108	7.18	96	0.070	15	0.673	–102
270	0.697	–109	6.91	94	0.070	14	0.661	–103
280	0.697	–111	6.70	93	0.071	13	0.654	–104
290	0.693	–113	6.54	92	0.071	11	0.658	–106
300	0.686	–115	6.36	90	0.072	9	0.664	–108
310	0.679	–116	6.12	88	0.069	7	0.639	–111
320	0.679	–117	5.96	87	0.070	9	0.642	–110
330	0.679	–119	5.80	86	0.070	8	0.648	–112
340	0.679	–121	5.63	84	0.071	7	0.648	–114
350	0.674	–122	5.47	83	0.070	5	0.645	–114
360	0.669	–123	5.33	82	0.070	4	0.650	–116
370	0.667	–124	5.18	80	0.068	3	0.644	–118
380	0.672	–125	5.02	80	0.066	3	0.614	–119
390	0.675	–127	4.96	78	0.071	4	0.655	–116
400	0.672	–129	4.83	77	0.070	2	0.655	–119
410	0.668	–130	4.70	75	0.069	0	0.654	–121
420	0.666	–131	4.56	74	0.067	–1	0.644	–122
430	0.667	–131	4.48	74	0.066	–1	0.646	–122

Table 1. Common Source S–Parameters (V_{DS} = 12.5 V, I_D = 120 mA) (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	$\|S_{11}\|$	ϕ	$\|S_{21}\|$	ϕ	$\|S_{12}\|$	ϕ	$\|S_{22}\|$	ϕ
440	0.671	–132	4.39	72	0.066	–1	0.651	–123
450	0.670	–134	4.29	71	0.068	–1	0.663	–123
460	0.662	–135	4.15	70	0.067	–6	0.677	–127
470	0.663	–135	4.05	69	0.065	–5	0.664	–127
480	0.666	–136	3.95	68	0.064	–5	0.663	–128
490	0.670	–137	3.88	67	0.064	–5	0.663	–128
500	0.670	–138	3.81	66	0.063	–6	0.670	–128
600	0.693	–147	3.06	55	0.053	–17	0.689	–136
700	0.708	–152	2.61	46	0.044	–14	0.723	–142
800	0.731	–158	2.22	40	0.037	–15	0.733	–146
900	0.724	–165	1.93	32	0.037	–32	0.760	–151
1000	0.748	–169	1.73	28	0.027	–6	0.778	–153

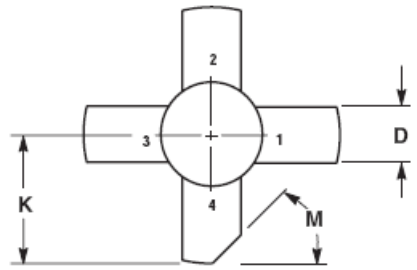
Table 2. Common Source S–Parameters (V_{DS} = 28 V, I_D = 250 mA)

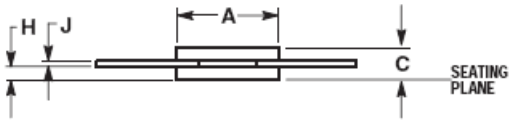
f	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	$\|S_{11}\|$	ϕ	$\|S_{21}\|$	ϕ	$\|S_{12}\|$	ϕ	$\|S_{22}\|$	ϕ
30	0.995	–18	15.00	167	0.014	78	0.919	–15
40	0.978	–24	14.70	162	0.018	73	0.913	–19
50	0.971	–30	14.50	158	0.022	69	0.900	–23
60	0.961	–36	14.20	153	0.026	65	0.885	–28
70	0.947	–41	13.80	149	0.029	62	0.867	–32
80	0.938	–46	13.40	145	0.033	58	0.851	–35
85	0.932	–49	13.30	143	0.034	56	0.845	–37
90	0.927	–51	13.10	141	0.036	55	0.839	–39
100	0.908	–56	12.70	138	0.038	51	0.825	–43
110	0.893	–61	12.20	134	0.040	49	0.802	–46
120	0.884	–65	11.80	131	0.043	46	0.788	–48
130	0.875	–69	11.40	128	0.045	44	0.781	–51
140	0.862	–74	11.10	125	0.047	40	0.772	–54
150	0.848	–78	10.70	122	0.048	37	0.754	–57
160	0.836	–81	10.30	119	0.049	35	0.733	–60
170	0.830	–84	9.86	117	0.050	35	0.718	–60
180	0.824	–88	9.64	115	0.053	31	0.729	–64
190	0.813	–91	9.38	112	0.053	29	0.719	–67
200	0.798	–94	9.00	109	0.053	26	0.701	–70
210	0.792	–96	8.63	107	0.053	25	0.682	–72
220	0.790	–98	8.36	105	0.054	24	0.677	–73
230	0.785	–101	8.10	104	0.055	22	0.677	–75
240	0.777	–104	7.92	101	0.057	19	0.694	–78
250	0.769	–106	7.65	99	0.055	18	0.663	–80
260	0.764	–108	7.40	97	0.055	18	0.662	–81
270	0.761	–109	7.13	96	0.055	17	0.649	–82
280	0.760	–111	6.91	95	0.055	16	0.640	–82

Table 2. Common Source S–Parameters (V_{DS} = 28 V, I_D = 250 mA) (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
MHz	$\|S_{11}\|$	ϕ	$\|S_{21}\|$	ϕ	$\|S_{12}\|$	ϕ	$\|S_{22}\|$	ϕ
290	0.757	–113	6.75	93	0.055	14	0.641	–84
300	0.751	–115	6.59	91	0.056	12	0.645	–86
310	0.743	–117	6.37	89	0.055	9	0.635	–90
320	0.744	–118	6.17	88	0.054	11	0.619	–89
330	0.744	–120	6.01	87	0.055	11	0.628	–90
340	0.743	–121	5.85	85	0.055	10	0.629	–92
350	0.738	–123	5.70	84	0.055	8	0.629	–92
360	0.733	–124	5.55	82	0.054	6	0.631	–94
370	0.730	–126	5.40	81	0.054	4	0.623	–96
380	0.732	–127	5.21	80	0.052	4	0.593	–98
390	0.737	–129	5.17	79	0.055	7	0.627	–93
400	0.734	–130	5.04	77	0.055	4	0.639	–97
410	0.731	–131	4.92	76	0.054	3	0.641	–99
420	0.728	–132	4.78	75	0.052	1	0.630	–100
430	0.729	–133	4.67	74	0.051	0	0.628	–101
440	0.731	–134	4.57	72	0.051	1	0.626	–102
450	0.731	–136	4.47	71	0.053	1	0.630	–102
460	0.723	–137	4.37	69	0.054	–4	0.673	–106
470	0.724	–137	4.24	68	0.050	–3	0.647	–107
480	0.727	–138	4.13	68	0.049	–3	0.642	–108
490	0.730	–139	4.05	67	0.048	–3	0.641	–107
500	0.730	–140	3.99	66	0.048	–4	0.647	–108
600	0.736	–150	3.54	56	0.037	–14	0.657	–118
700	0.745	–156	2.99	46	0.029	–9	0.699	–126
800	0.765	–161	2.54	39	0.025	–5	0.713	–131
900	0.759	–168	2.20	31	0.022	–34	0.742	–136
1000	0.769	–173	1.98	27	0.018	19	0.756	–139

PACKAGE DIMENSIONS





NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. SEATING PLANE = GROUND AND IS CONNECTED TO PIN 1 AND 3.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.271	0.286	6.88	7.26
C	0.112	0.136	2.84	3.45
D	0.215	0.235	5.46	5.97
H	0.055	0.065	1.40	1.65
J	0.003	0.007	0.08	0.18
K	0.435	---	11.05	---
M	45° REF		45° REF	

STYLE 3:
PIN 1. SOURCE
2. GATE
3. SOURCE
4. DRAIN

CASE 249–06
ISSUE H

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