The RF Sub-Micron MOSFET Line

RF Power Field Effect Transistor Array

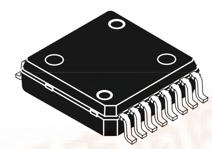
N-Channel Enhancement-Mode Lateral MOSFET

MRF9002R2

1.0 GHz, 2 W, 26 V
LATERAL N-CHANNEL
BROADBAND
RF POWER MOSFET

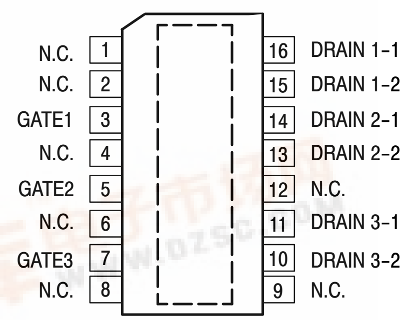
Designed for broadband commercial and industrial applications with frequencies to 1.0 GHz. The high gain and broadband performance of this device make it ideal for large-signal, common-source amplifier applications in 26 volt base station equipment. The device is in a PFP-16 Power Flat Pack package which gives excellent thermal performances through a solderable backside contact.

- Typical Performance at 960 MHz, 26 Volts
  Output Power — 2 Watts Per Transistor
  Power Gain — 18 dB
  Efficiency — 50%
- Designed for Maximum Gain and Insertion Phase Flatness
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 960 MHz, 2 Watts CW Output Power
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- In Tape and Reel. R2 Suffix = 1,500 Units per 16 mm, 13 inch Reel.



CASE 978-03
PLASTIC
PFP-16

PIN CONNECTIONS



(Top View)

NOTE: Exposed backside flag is source terminal for transistors.

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	-0.5, +15	Vdc
Total Dissipation Per Transistor @ T_C = 25°C	P_D	4	Watts
Storage Temperature Range	T_{stg}	-65 to +150	°C
Operating Junction Temperature	T_J	150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case, Single Transistor	$R_{\theta JC}$	12	°C/W

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

MOISTURE SENSITIVITY LEVEL

Test Methodology	Rating
Per JESD 22-A113	3

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

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 20 μAdc)	$V_{GS(th)}$	2.4	—	4	Vdc
Gate Quiescent Voltage (V_{DS} = 26 Vdc, I_D = 25 mAdc)	$V_{GS(Q)}$	3	—	5	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 0.1 Adc)	$V_{DS(on)}$	—	0.3	—	Vdc

FUNCTIONAL TESTS (Per Transistor in Motorola Test Fixture, 50 ohm system)

Characteristic	Symbol	Min	Typ	Max	Unit
Common-Source Amplifier Power Gain @ P1dB (V_{DD} = 26 Vdc, I_{DQ} = 25 mA, f = 960.0 MHz)	G_{ps}	15	18	—	dB
Drain Efficiency @ P1dB (V_{DD} = 26 Vdc, I_{DQ} = 25 mA, f = 960.0 MHz)	η	35	50	—	%
Input Return Loss @ P1dB (V_{DD} = 26 Vdc, I_{DQ} = 25 mA, f = 960.0 MHz)	IRL	—	-15	-9	dB
Power Output, 1 dB Compression Point (V_{DD} = 26 Vdc, I_{DQ} = 25 mA, f = 960.0 MHz)	P_{1dB}	34	37	—	dBm
Output Mismatch Stress (V_{DD} = 26 Vdc, P_{out} = 2 W CW, I_{DQ} = 25 mA, f = 960.0 MHz, VSWR = 10:1, All Phase Angles at Frequency of Tests)	Ψ	No Degradation In Output Power			

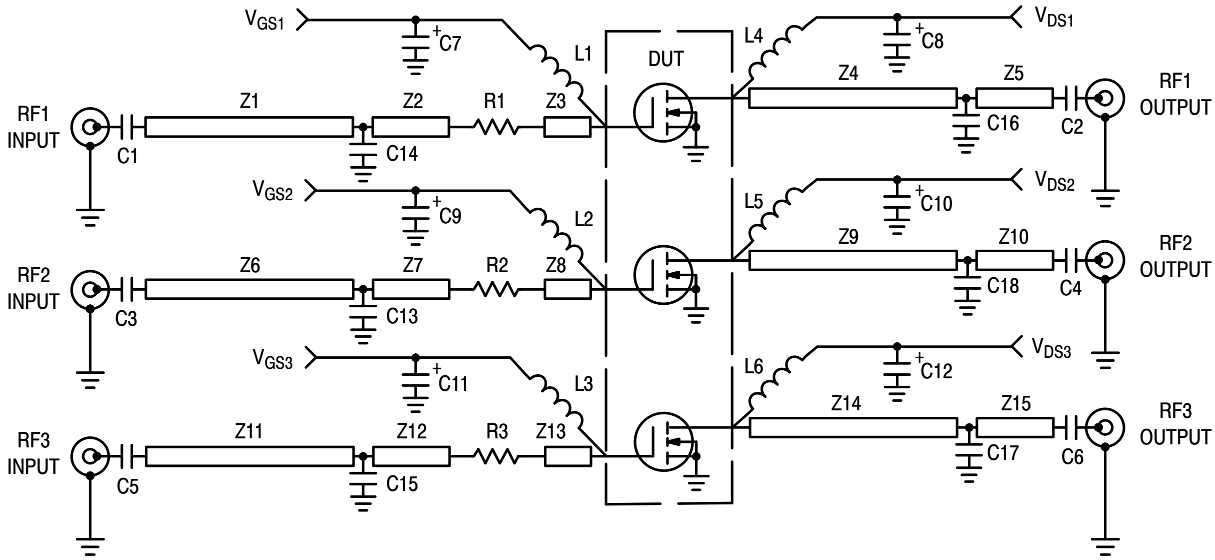


Figure 1. MRF9002R2 Broadband Test Circuit Schematic

Table 1. MRF9002R2 Broadband Test Circuit Component Designations and Values

Designators	Description
C1 - C6	33 pF Chip Capacitors (0805)
C7 - C12	1.0 μF, 35 V Tantalum Capacitors, B Case, Kemet
C13	8.2 pF Chip Capacitor (0805)
C14, C15	10 pF Chip Capacitors (0805)
C16, C17	2.7 pF Chip Capacitors (0805)
C18	3.3 pF Chip Capacitor (0805)
L1 - L6	12 nH Chip Inductors (0805)
R1 - R3	0 Ω Chip Resistors (0805)
Z1, Z11	1.16 x 28.5 mm Microstrip
Z2, Z7, Z12	0.65 x 5.6 mm Microstrip
Z3, Z8, Z13	0.65 x 2.6 mm Microstrip
Z4, Z14	1.16 x 19.5 mm Microstrip
Z5, Z15	1.16 x 17.5 mm Microstrip
Z6	1.16 x 12.9 mm Microstrip
Z9	1.16 x 27.2 mm Microstrip
Z10	1.16 x 4.3 mm Microstrip
PCB	Etched Circuit Board
Raw PCB Material	Rogers RO4350, 0.020″, 2.5″, x 2.5″, ε_r = 3.5
Bedstead	Copper Heatsink

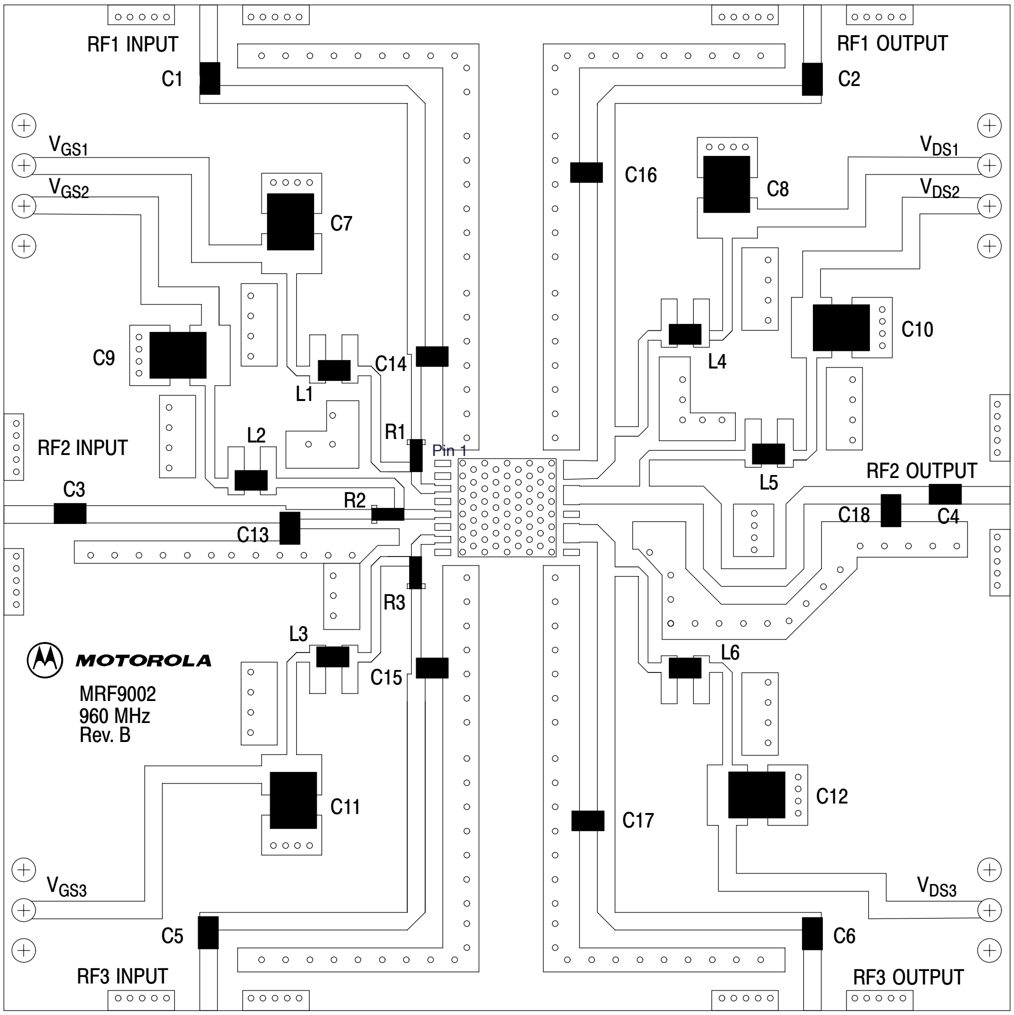


Figure 2. MRF9002R2 Broadband Test Circuit Component Layout

TYPICAL CHARACTERISTICS

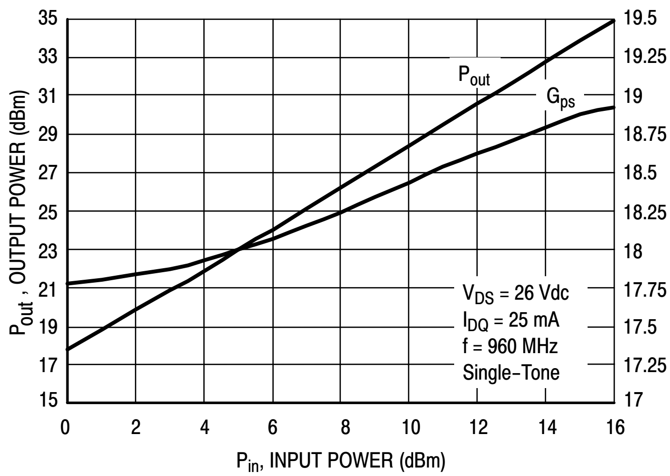


Figure 3. Output Power and Power Gain versus Input Power

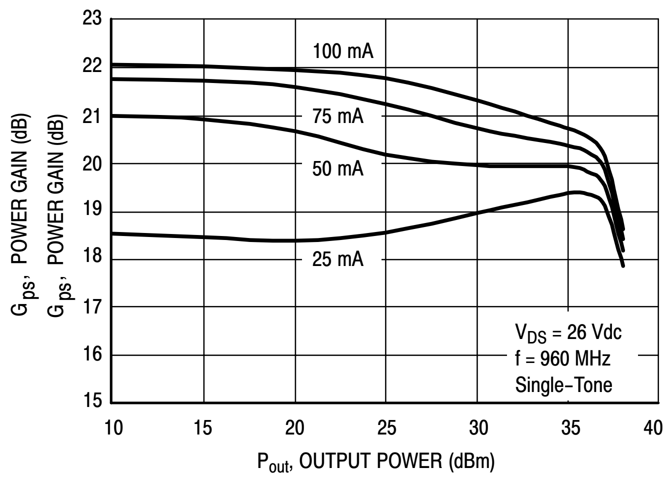


Figure 4. Power Gain versus Output Power

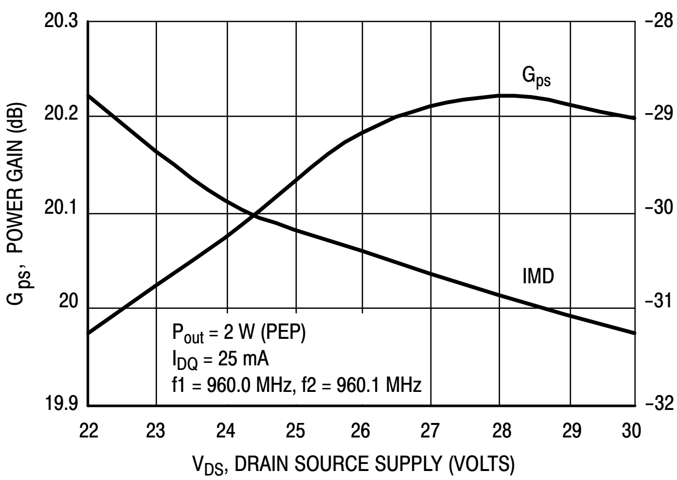


Figure 5. Power Gain and Intermodulation Distortion versus Supply Voltage

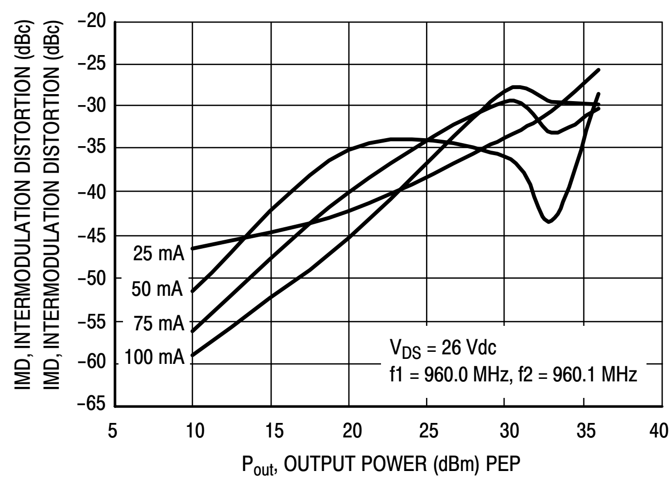


Figure 6. Intermodulation Distortion versus Output Power

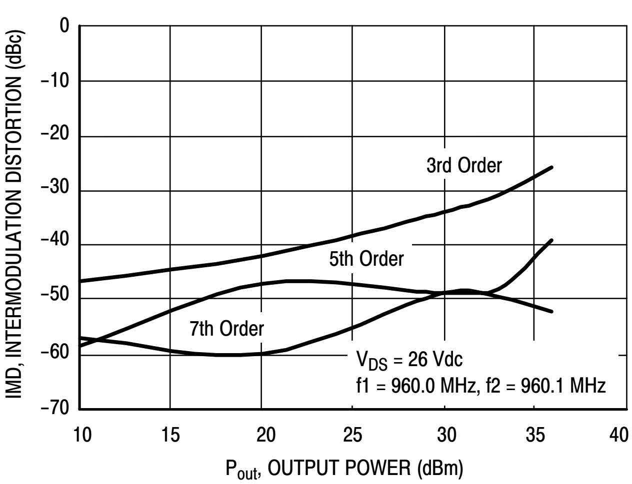


Figure 7. Intermodulation Distortion Products versus Output Power

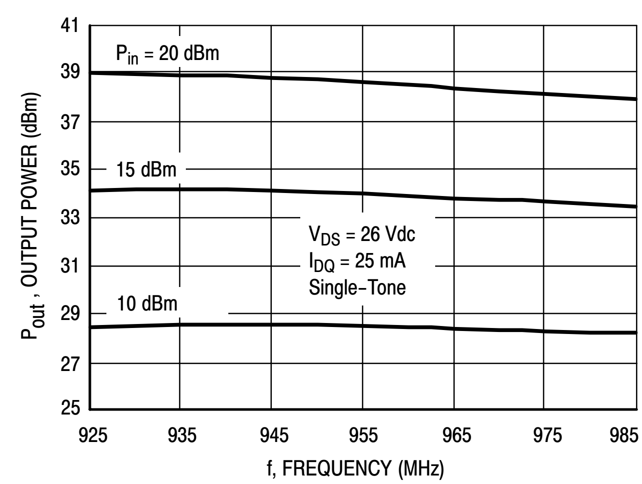


Figure 8. Output Power versus Frequency

TYPICAL CHARACTERISTICS

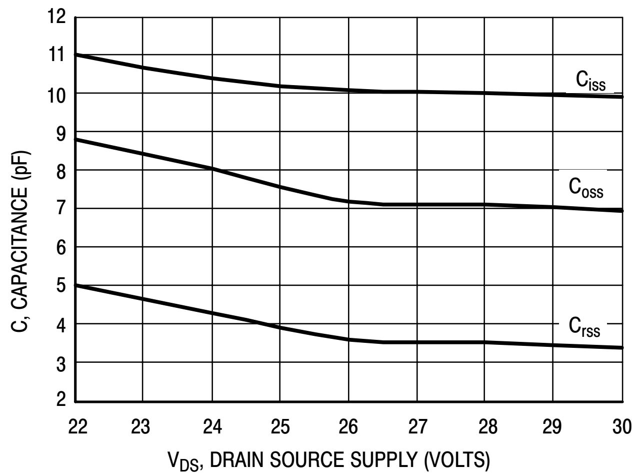
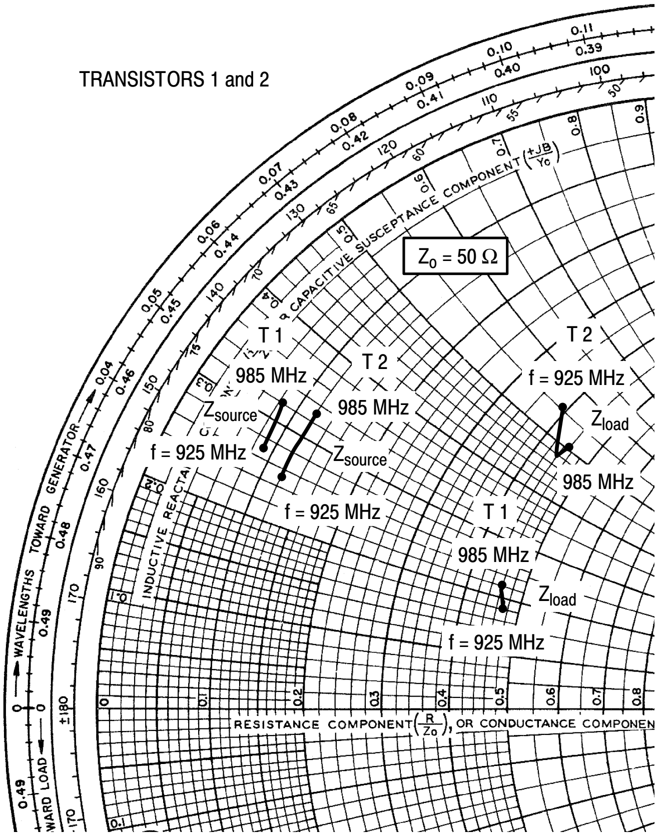
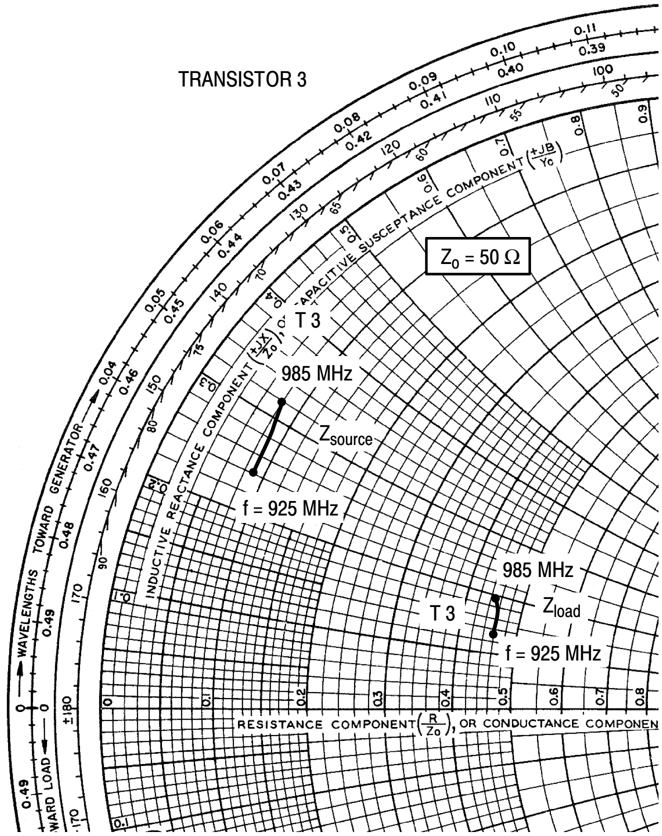


Figure 9. Capacitance versus Drain Source Voltage





V_{DD} = 26 V, I_{DQ} = 25 mA, P_{out} = 2 W PEP

f MHz	Z_{source} Ω	Z_{load} Ω
925	4.5 + j13.3	23.4 + j9.2
960	4.3 + j15.3	23.2 + j10.4
985	4.1 + j15.8	23.0 + j11.1

Transistor 1

V_{DD} = 26 V, I_{DQ} = 25 mA, P_{out} = 2 W PEP

f MHz	Z_{source} Ω	Z_{load} Ω
925	6.0 + j12.3	19.7 + j27.8
960	5.9 + j14.3	22.0 + j23.9
985	5.8 + j16.5	22.5 + j25.4

Transistor 2

V_{DD} = 26 V, I_{DQ} = 25 mA, P_{out} = 2 W PEP

f MHz	Z_{source} Ω	Z_{load} Ω
925	4.3 + j12.2	23.1 + j6.5
960	4.3 + j14.0	22.8 + j8.4
985	3.9 + j15.9	22.6 + j9.3

Transistor 3

Z_{source} = Test circuit impedance as measured from gate to ground.

Z_{load} = Test circuit impedance as measured from drain to ground.

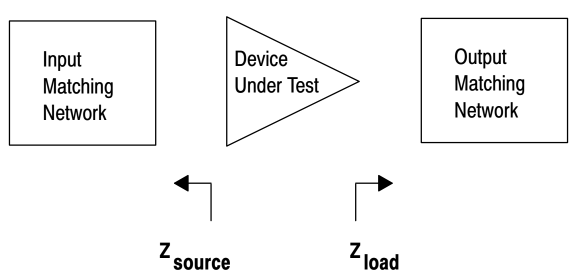


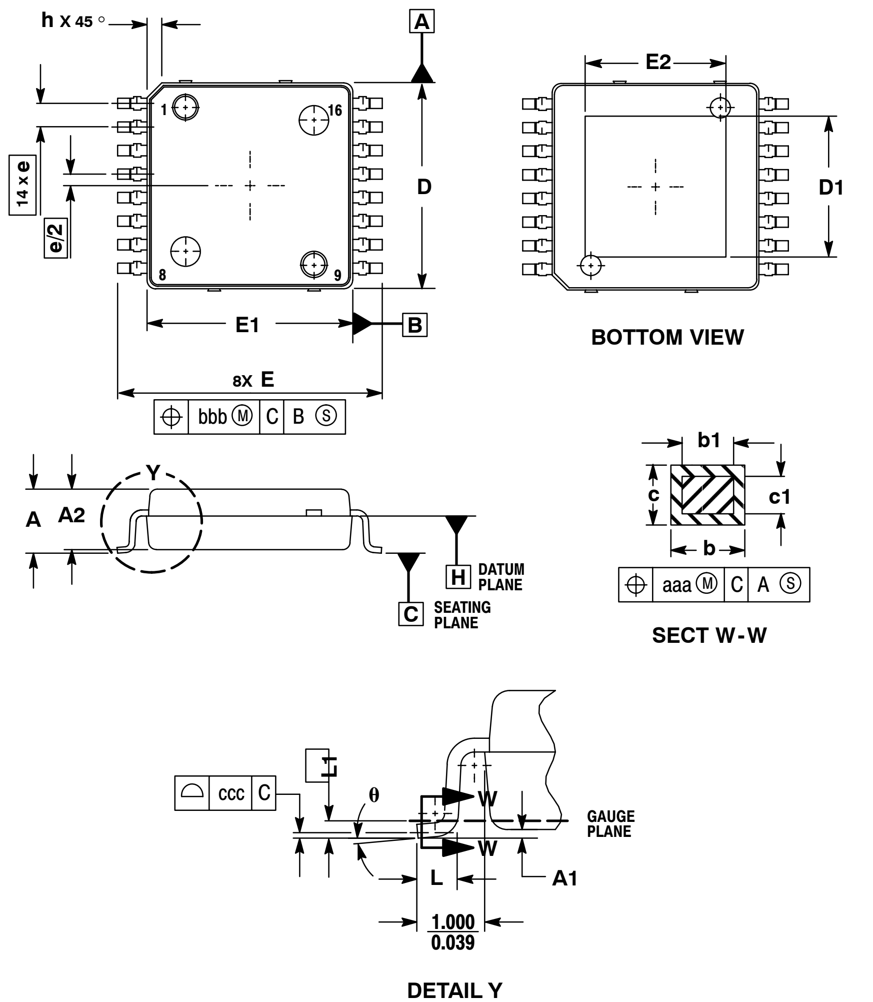
Figure 10. Series Equivalent Source and Load Impedance

NOTES

NOTES

NOTES

PACKAGE DIMENSIONS



NOTES:

1. CONTROLLING DIMENSION: MILLIMETER.
2. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DATUM PLANE -H- IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE BOTTOM OF THE PARTING LINE.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.250 PER SIDE. DIMENSIONS D AND E1 DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -H-.
5. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION IS 0.127 TOTAL IN EXCESS OF THE b DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. DATUMS -A- AND -B- TO BE DETERMINED AT DATUM PLANE -H-.

	MILLIMETERS	
DIM	MIN	MAX
A	2.000	2.300
A1	0.025	0.100
A2	1.950	2.100
D	6.950	7.100
D1	4.372	5.180
E	8.850	9.150
E1	6.950	7.100
E2	4.372	5.180
L	0.466	0.720
L1	0.250 BSC	
b	0.300	0.432
b1	0.300	0.375
c	0.180	0.279
c1	0.180	0.230
e	0.800 BSC	
h	---	0.600
θ	0°	7°
aaa	0.200	
bbb	0.200	
ccc	0.100	

CASE 978-03
ISSUE B
PLASTIC
PFP-16

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
852-26668334

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

MOTOROLA