

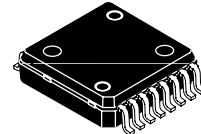
The RF Sub-Micron MOSFET Line
**RF Power Field Effect
 Transistor Array**
N-Channel Enhancement-Mode Lateral MOSFET

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.

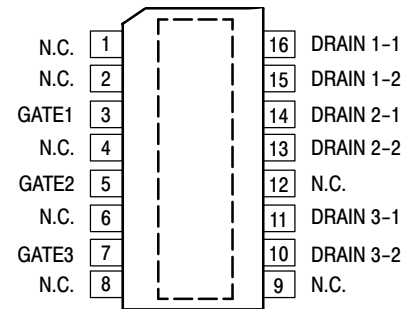
MRF9002R2

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



**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 @ $T_C = 25^\circ\text{C}$ | P_D | 4 | Watts |
| Storage Temperature Range | T_{stg} | - 65 to +150 | $^\circ\text{C}$ |
| Operating Junction Temperature | T_J | 150 | $^\circ\text{C}$ |

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|-----------------|-------|---------------------------|
| Thermal Resistance, Junction to Case, Single Transistor | $R_{\theta JC}$ | 12 | $^\circ\text{C}/\text{W}$ |

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

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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)

| | | | | | |
|--|------------------|--------------------------------|------|-----|-----|
| 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 | | | |

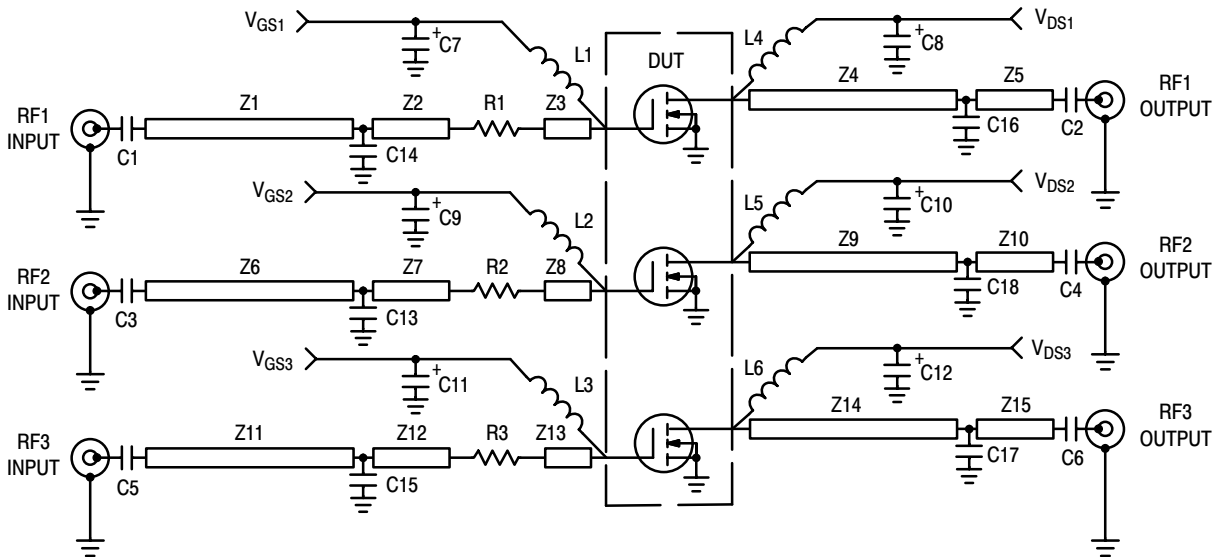


Figure 1. MRF9002R2 Broadband Test Circuit Schematic

Table 1. MRF9002R2 Broadband Test Circuit Component Designations and Values

| Designators | Description |
|------------------|---|
| C1 - C6 | 33 pF Chip Capacitors (0805) |
| C7 - C12 | 1.0 μ F, 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", $\epsilon_r = 3.5$ |
| Bedstead | Copper Heatsink |

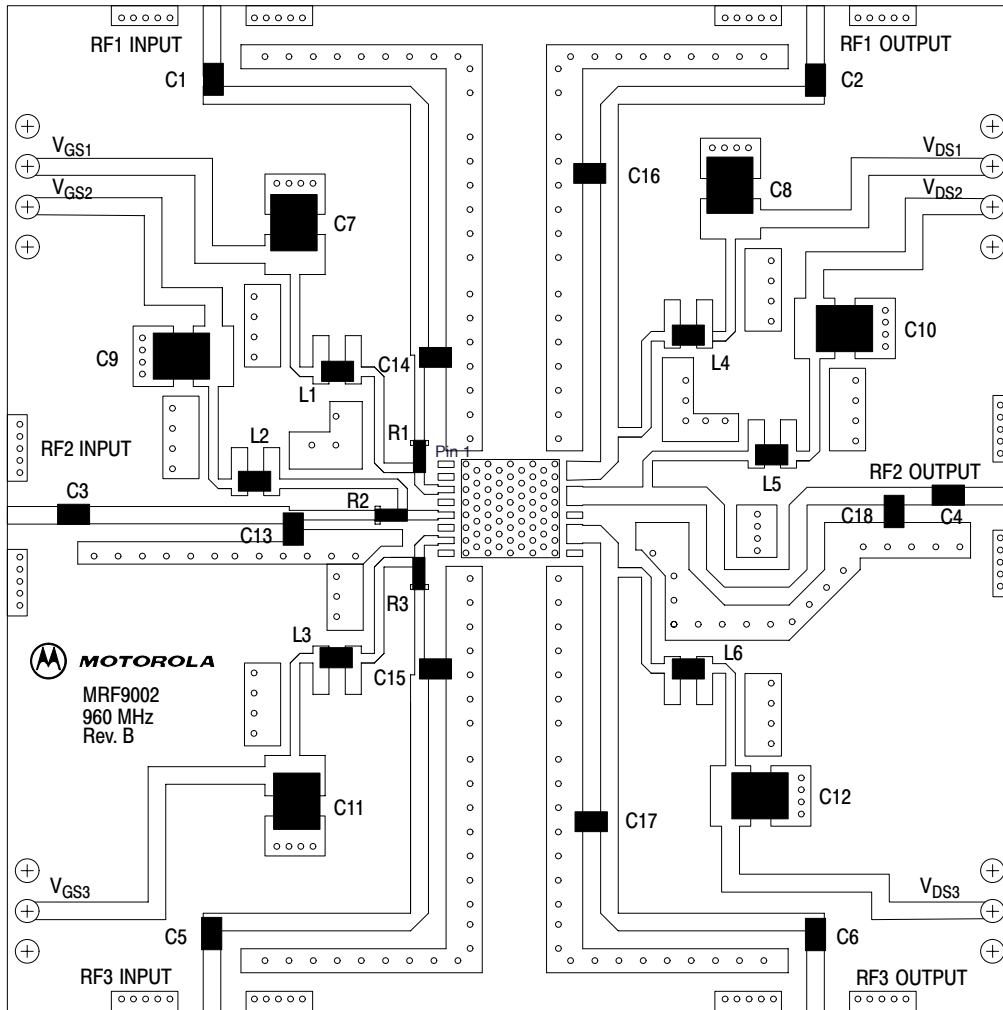


Figure 2. MRF9002R2 Broadband Test Circuit Component Layout

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TYPICAL CHARACTERISTICS

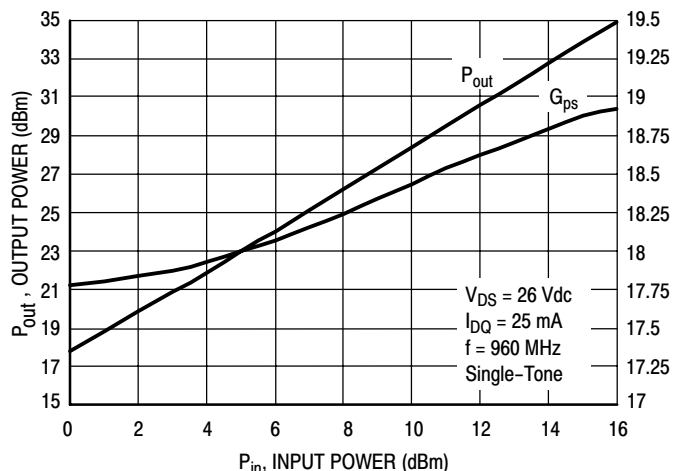


Figure 3. Output Power and Power Gain versus Input Power

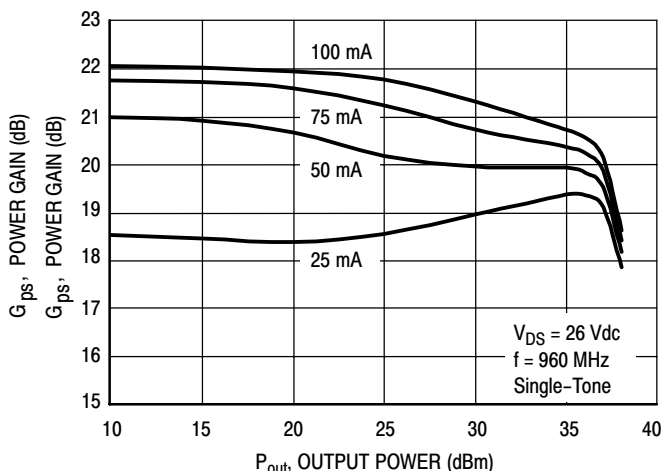


Figure 4. Power Gain versus Output Power

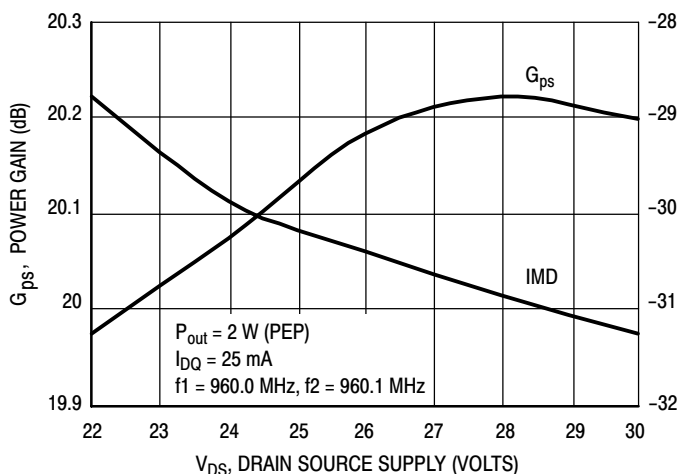


Figure 5. Power Gain and Intermodulation Distortion versus Supply Voltage

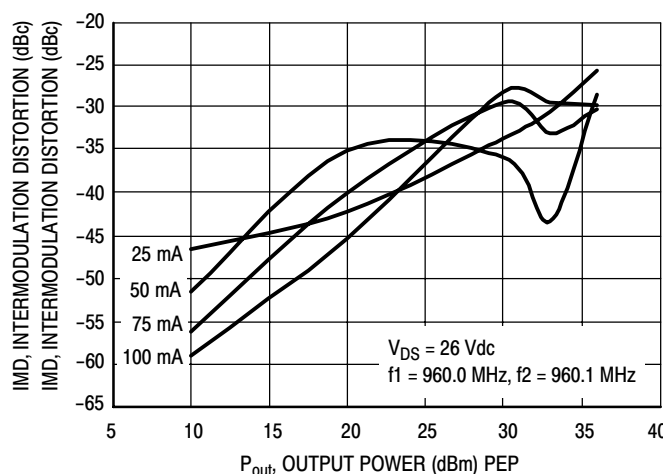


Figure 6. Intermodulation Distortion versus Output Power

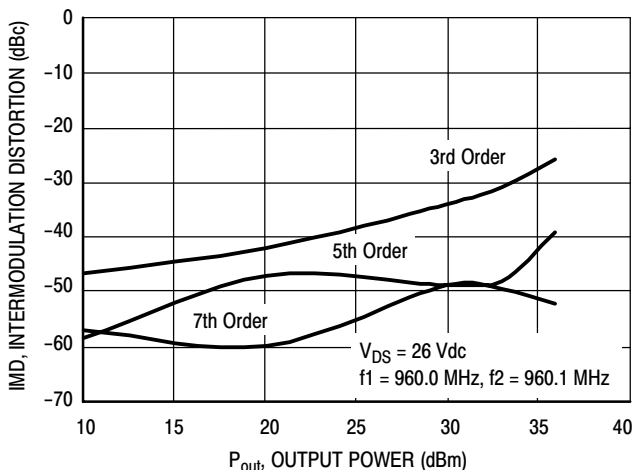


Figure 7. Intermodulation Distortion Products versus Output Power

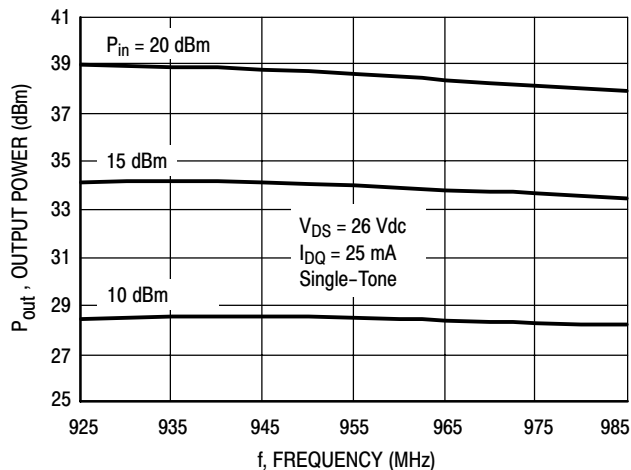


Figure 8. Output Power versus Frequency

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TYPICAL CHARACTERISTICS

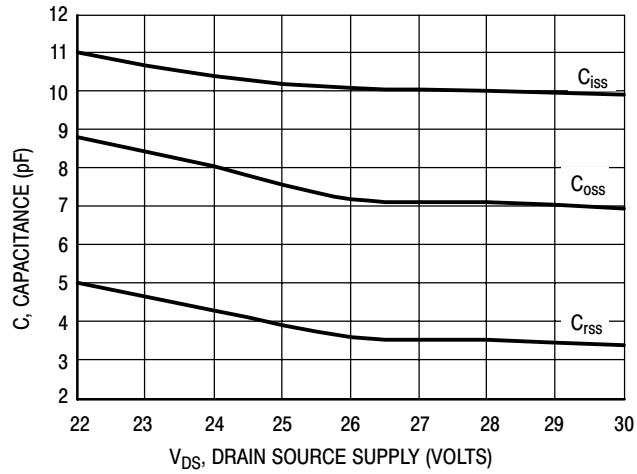
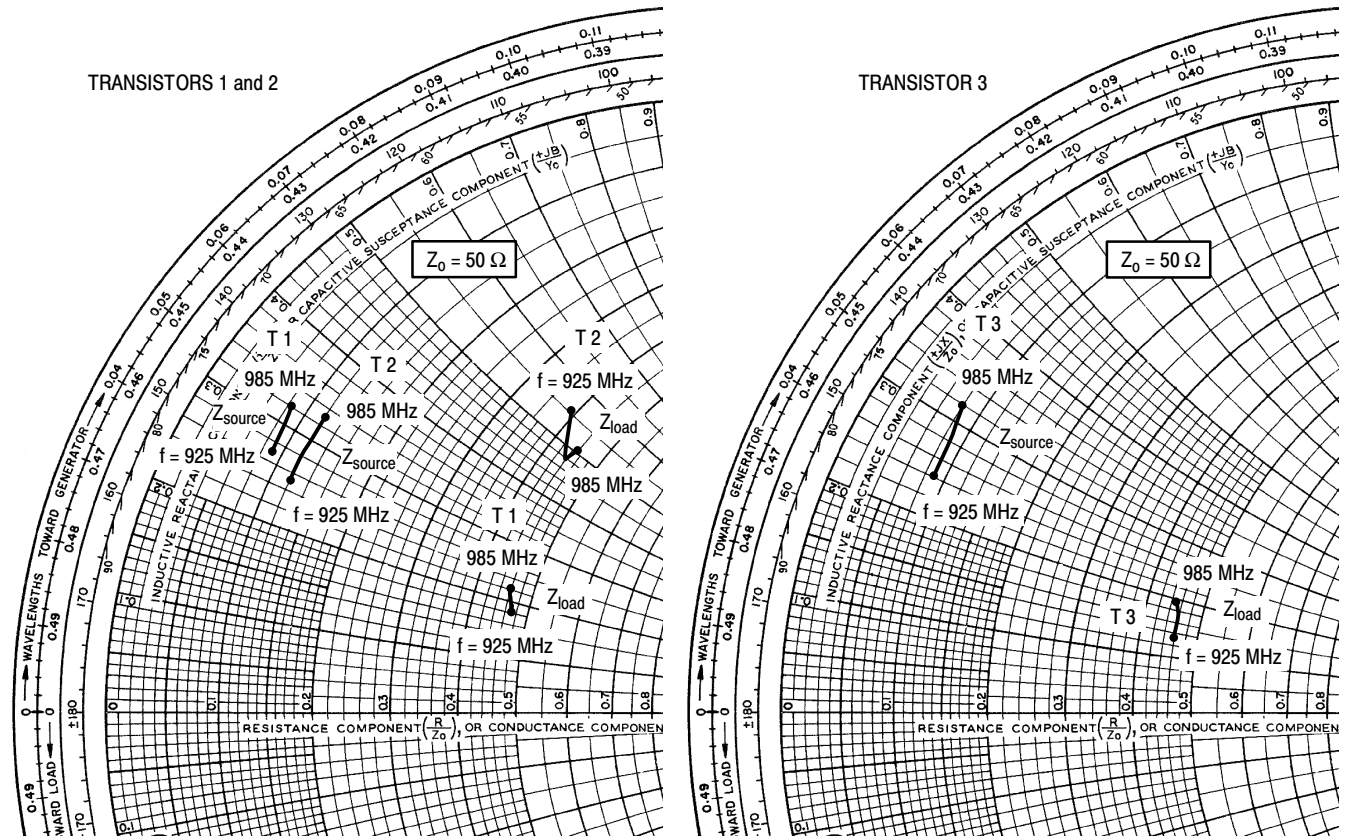


Figure 9. Capacitance versus Drain Source Voltage



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

| 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

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

| 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

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

| 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.

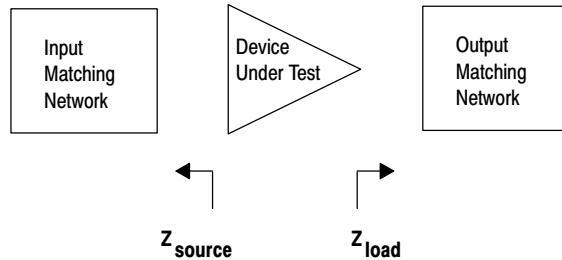


Figure 10. Series Equivalent Source and Load Impedance

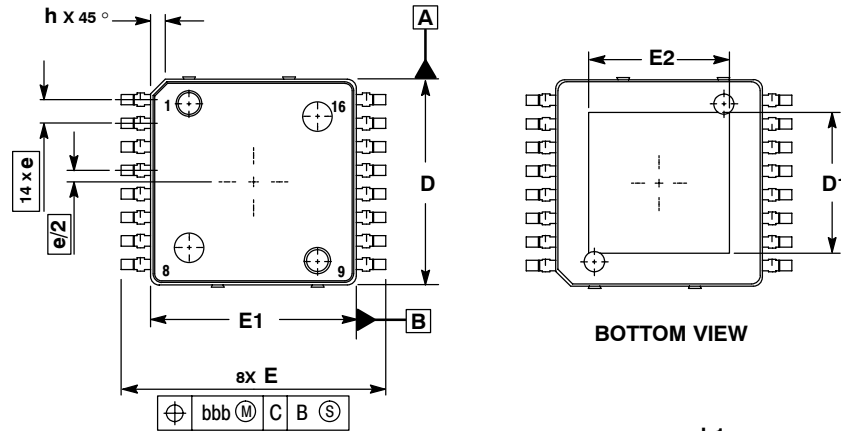
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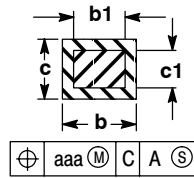
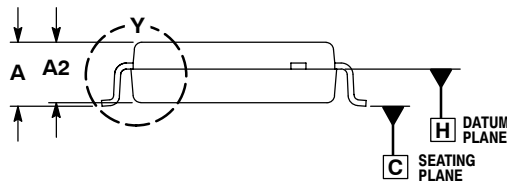
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PACKAGE DIMENSIONS

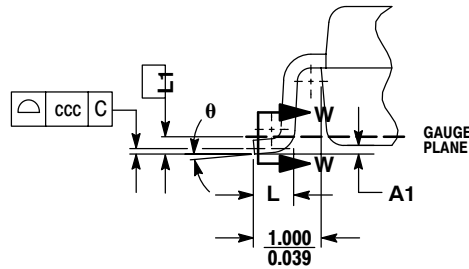


NOTES:

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-.



SECT W-W



DETAIL Y

| DIM | MILLIMETERS | |
|-----|-------------|-------|
| | 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**

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