Freescale Semiconductor
Technical Data

Document Number: MRF9030
Rev. 7, 9/2008

RoHS

RF Power Field Effect Transistor

N-Channel Enhancement-Mode Lateral MOSFET

Designed for broadband commercial and industrial applications with frequencies up to 1000 MHz. 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.

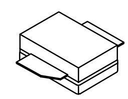
- Typical Two-Tone Performance at 945 MHz, 26 Volts
  Output Power — 30 Watts PEP
  Power Gain — 19 dB
  Efficiency — 41.5%
  IMD — -32.5 dBc
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 945 MHz, 30 Watts CW Output Power

Features

- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Low Gold Plating Thickness on Leads. L Suffix Indicates 40μ″ Nominal.
- RoHS Compliant
- In Tape and Reel. R1 Suffix = 500 Units per 32 mm, 13 inch Reel.

MRF9030LSR1

945 MHz, 30 W, 26 V
LATERAL N-CHANNEL
BROADBAND
RF POWER MOSFET



CASE 360C-05, STYLE 1
NI-360S

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	-0.5, +68	Vdc
Gate-Source Voltage	V_{GS}	-0.5, +15	Vdc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	117 0.67	W W/°C
Storage Temperature Range	T_{stg}	-65 to +150	°C
Case Operating Temperature	T_C	150	°C
Operating Junction Temperature	T_J	200	°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.5	°C/W

Table 3. ESD Protection Characteristics

Test Conditions	Class
Human Body Model	1 (Minimum)
Machine Model	M1 (Minimum)

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Table 4. Electrical Characteristics (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics					
Zero Gate Voltage Drain Leakage Current (V_{DS} = 68 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	μAdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 26 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	1	μAdc
Gate-Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	μAdc
On Characteristics					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 100 μAdc)	$V_{GS(th)}$	2	2.9	4	Vdc
Gate Quiescent Voltage (V_{DS} = 26 Vdc, I_D = 250 mAdc)	$V_{GS(Q)}$	—	3.8	—	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 0.7 Adc)	$V_{DS(on)}$	—	0.19	0.4	Vdc
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 2 Adc)	g_{fs}	—	3	—	S
Dynamic Characteristics					
Input Capacitance (V_{DS} = 26 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{iss}	—	49.5	—	pF
Output Capacitance (V_{DS} = 26 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{oss}	—	26.5	—	pF
Reverse Transfer Capacitance (V_{DS} = 26 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{rss}	—	1	—	pF

(continued)

Table 4. Electrical Characteristics (T_C = 25°C unless otherwise noted) **(continued)**

Characteristic	Symbol	Min	Typ	Max	Unit
Functional Tests (In Freescale Test Fixture, 50 ohm system)					
Two-Tone Common-Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 30 W PEP, I_{DQ} = 250 mA, f1 = 945.0 MHz, f2 = 945.1 MHz)	G_{ps}	18	19	—	dB
Two-Tone Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 30 W PEP, I_{DQ} = 250 mA, f1 = 945.0 MHz, f2 = 945.1 MHz)	η	37	41.5	—	%
3rd Order Intermodulation Distortion (V_{DD} = 26 Vdc, P_{out} = 30 W PEP, I_{DQ} = 250 mA, f1 = 945.0 MHz, f2 = 945.1 MHz)	IMD	—	-32.5	-28	dBc
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 30 W PEP, I_{DQ} = 250 mA, f1 = 945.0 MHz, f2 = 945.1 MHz)	IRL	—	-15.5	-9	dB
Two-Tone Common-Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 30 W PEP, I_{DQ} = 250 mA, f1 = 930.0 MHz, f2 = 930.1 MHz and f1 = 960.0 MHz, f2 = 960.1 MHz)	G_{ps}	—	19	—	dB
Two-Tone Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 30 W PEP, I_{DQ} = 250 mA, f1 = 930.0 MHz, f2 = 930.1 MHz and f1 = 960.0 MHz, f2 = 960.1 MHz)	η	—	41.5	—	%
3rd Order Intermodulation Distortion (V_{DD} = 26 Vdc, P_{out} = 30 W PEP, I_{DQ} = 250 mA, f1 = 930.0 MHz, f2 = 930.1 MHz and f1 = 960.0 MHz, f2 = 960.1 MHz)	IMD	—	-33	—	dBc
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 30 W PEP, I_{DQ} = 250 mA, f1 = 930.0 MHz, f2 = 930.1 MHz and f1 = 960.0 MHz, f2 = 960.1 MHz)	IRL	—	-14	—	dB
Power Output, 1 dB Compression Point (V_{DD} = 26 Vdc, P_{out} = 30 W CW, I_{DQ} = 250 mA, f1 = 945.0 MHz)	P_{1dB}	—	30	—	W
Common-Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 30 W CW, I_{DQ} = 250 mA, f1 = 945.0 MHz)	G_{ps}	—	19	—	dB
Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 30 W CW, I_{DQ} = 250 mA, f1 = 945.0 MHz)	η	—	60	—	%

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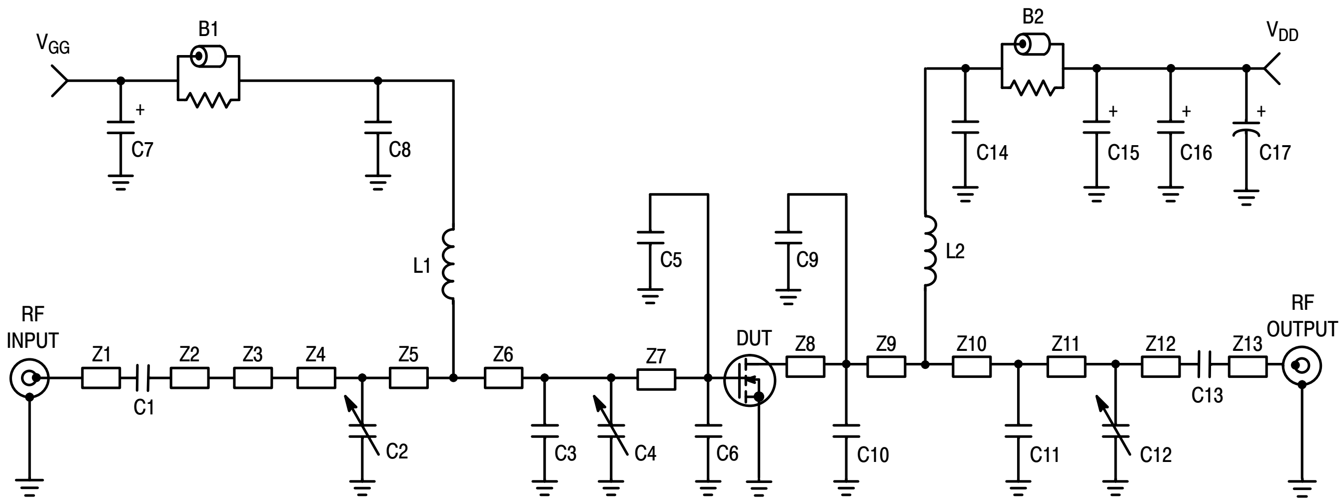
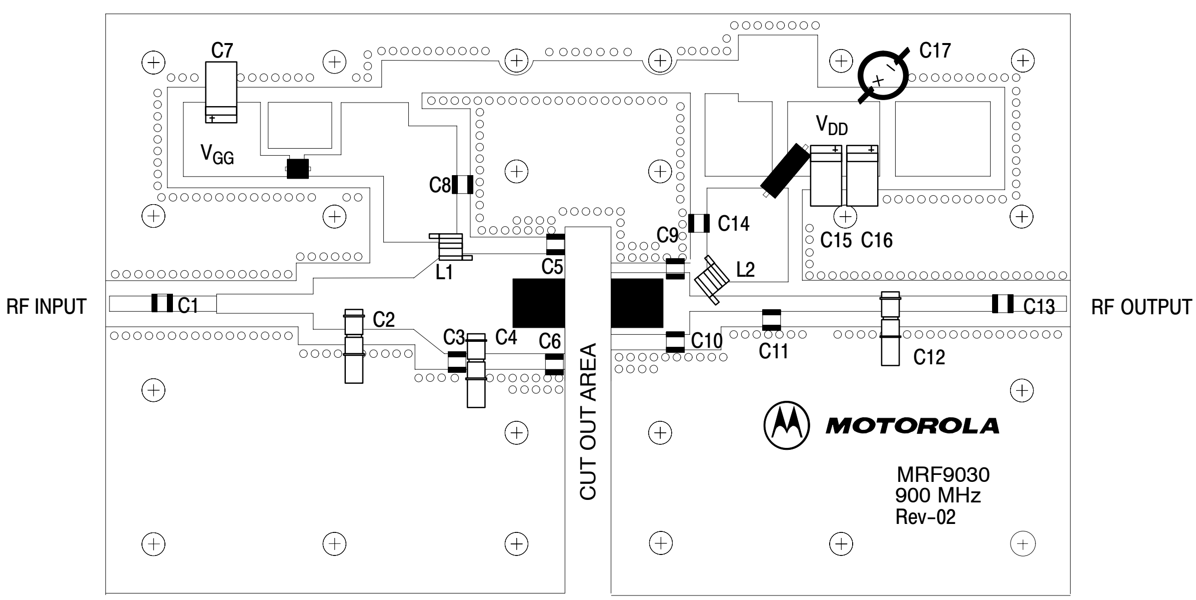


B1	Short Ferrite Bead	Z3	0.500″ x 0.100″ Microstrip
B2	Long Ferrite Bead	Z4	0.215″ x 0.270″ Microstrip
C1, C8, C13, C14	47 pF Chip Capacitors	Z5	0.315″ x 0.270″ Microstrip
C2, C4	0.8 pF to 8.0 pF Trim Capacitors	Z6	0.160″ x 0.270″ x 0.520″, Taper
C3	3.9 pF Chip Capacitor	Z7	0.285″ x 0.520″ Microstrip
C5, C6	7.5 pF Chip Capacitors	Z8	0.450″ x 0.270″ Microstrip
C7, C15, C16	10 μF, 35 V Tantalum Capacitors	Z9	0.140″ x 0.270″ Microstrip
C9, C10	10 pF Chip Capacitors	Z10	0.250″ x 0.060″ Microstrip
C11	9.1 pF Chip Capacitor	Z11	0.720″ x 0.060″ Microstrip
C12	0.6 pF to 4.5 pF Trim Capacitor	Z12	0.490″ x 0.060″ Microstrip
C17	220 μF, 50 V Electrolytic Capacitor	Z13	0.290″ x 0.060″ Microstrip
L1, L2	12.5 nH Surface Mount Inductors	PCB	Taconic RF-35-0300, 30 mil, ε_r = 3.55
Z1	0.260″ x 0.060″ Microstrip		
Z2	0.240″ x 0.060″ Microstrip		

Figure 1. 945 MHz Broadband Test Circuit Schematic



Freescale has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescale Semiconductor signature/logo. PCBs may have either Motorola or Freescale markings during the transition period. These changes will have no impact on form, fit or function of the current product.

Figure 2. 945 MHz Broadband Test Circuit Component Layout

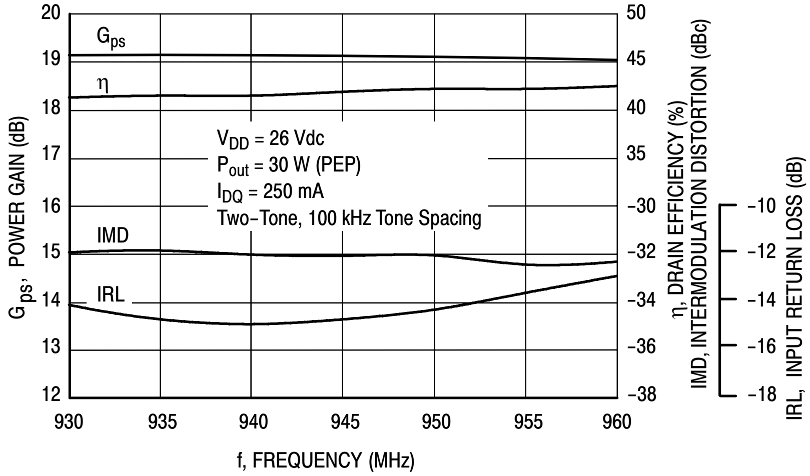


Figure 3. Class AB Broadband Circuit Performance

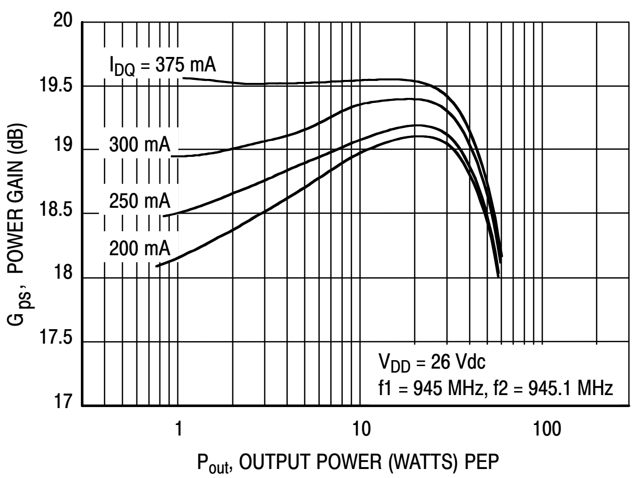


Figure 4. Power Gain versus Output Power

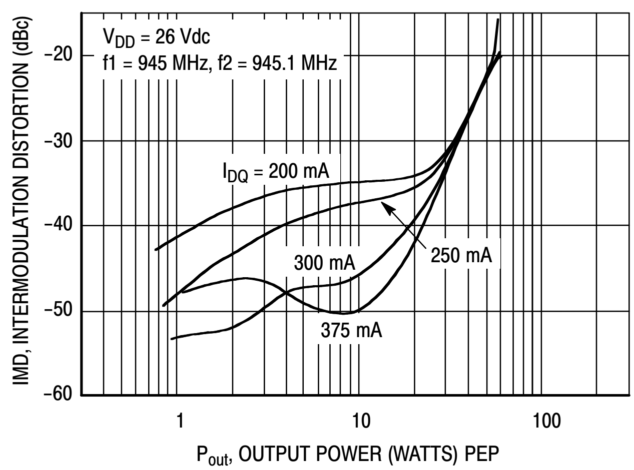


Figure 5. Intermodulation Distortion versus Output Power

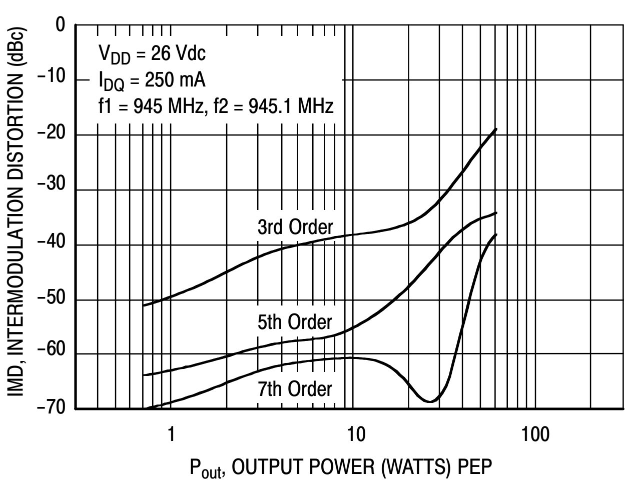


Figure 6. Intermodulation Distortion Products versus Output Power

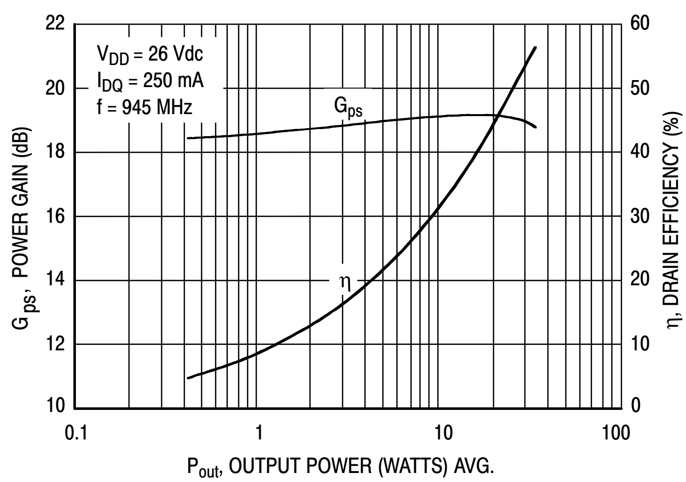


Figure 7. Power Gain and Efficiency versus Output Power

TYPICAL CHARACTERISTICS

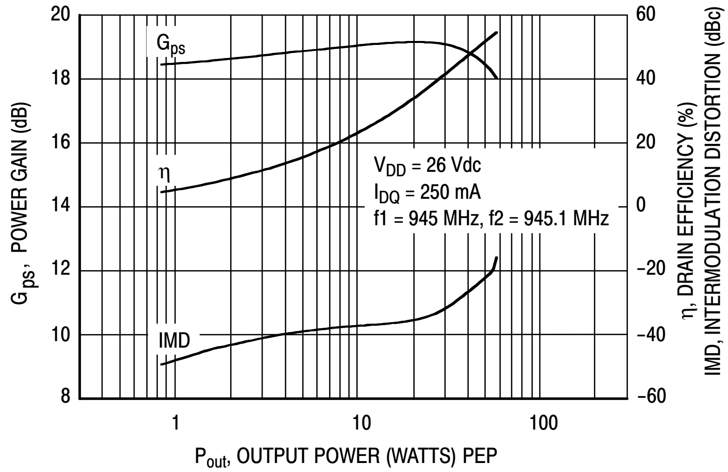
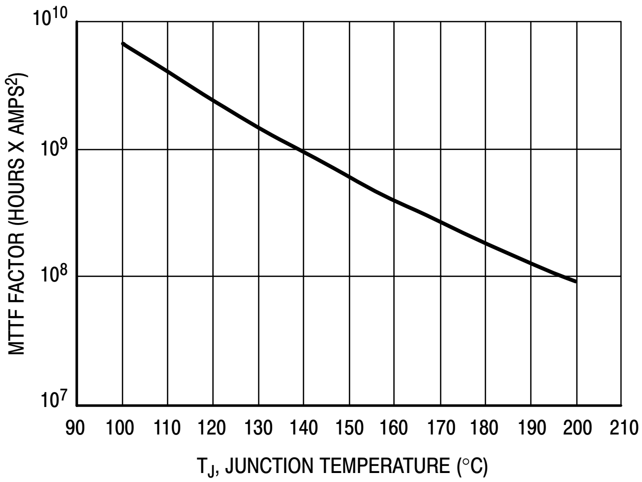


Figure 8. Power Gain, Efficiency and IMD versus Output Power



This above graph displays calculated MTTF in hours x ampere^2 drain current. Life tests at elevated temperatures have correlated to better than ±10% of the theoretical prediction for metal failure. Divide MTTF factor by I_D^2 for MTTF in a particular application.

Figure 9. MTTF Factor versus Junction Temperature

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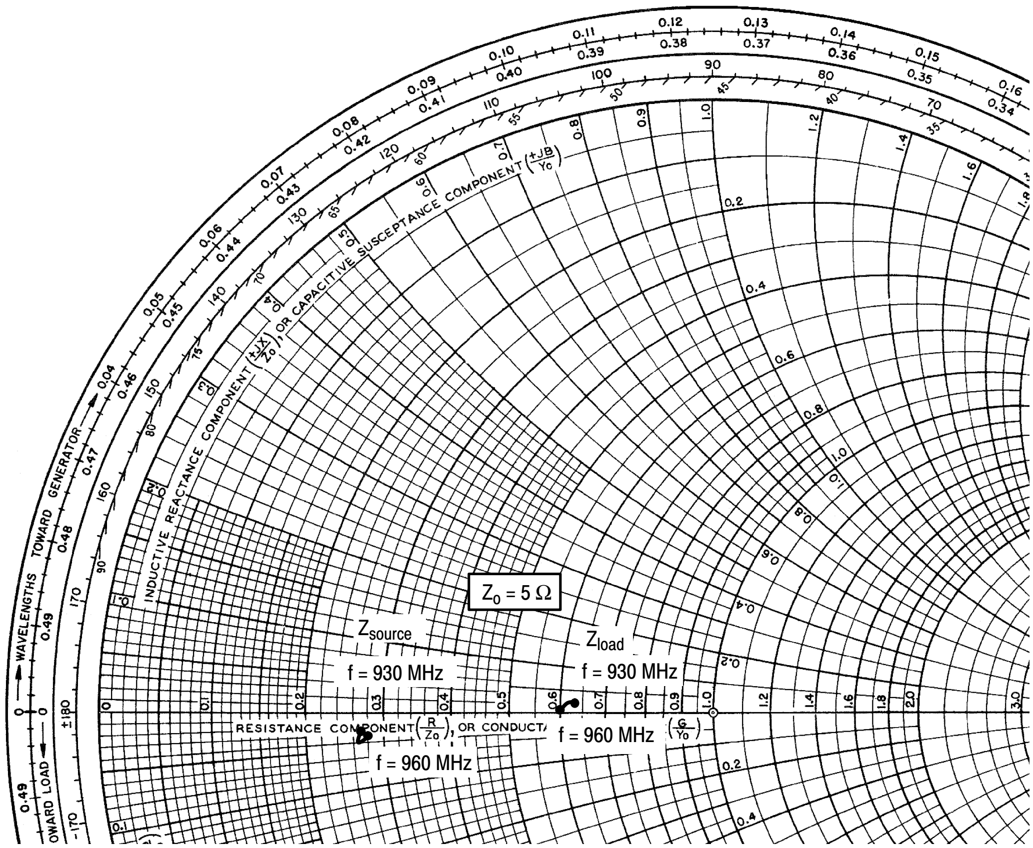

V_{DD} = 26 V, I_{DQ} = 250 mA, P_{out} = 30 W PEP

f MHz	Z_{source} Ω	Z_{load} Ω
930	1.34 - j0.1	3.175 + j0.09
945	1.36 - j0.2	3.1 + j0.08
960	1.4 - j0.14	3.0 + j0.05

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

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

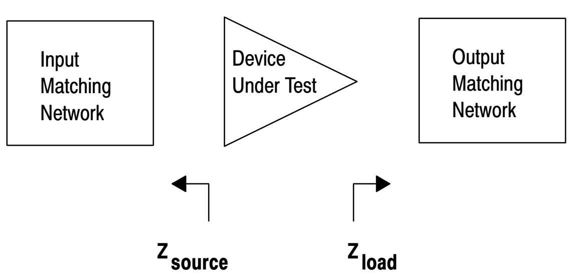

Figure 10. Series Equivalent Source and Load Impedance

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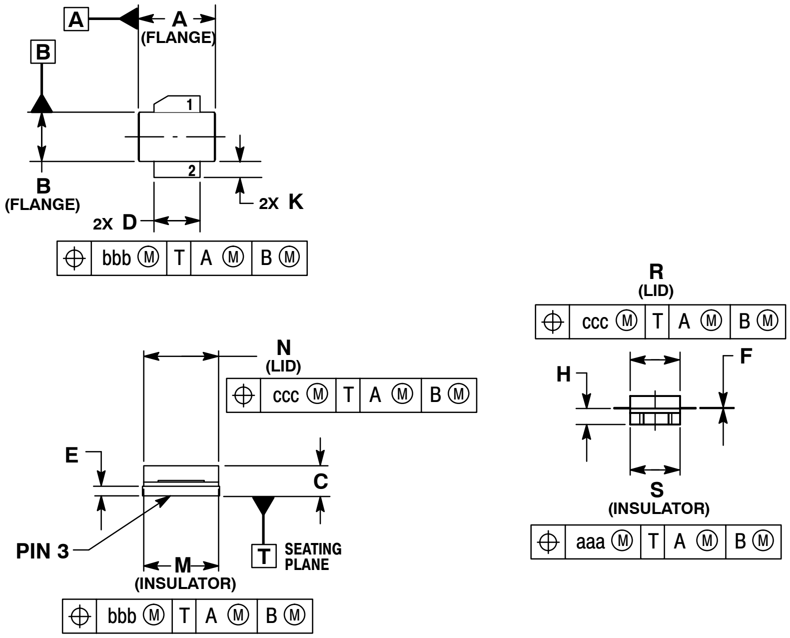
PACKAGE DIMENSIONS



NOTES:
1. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M−1994.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.375	0.385	9.53	9.78
B	0.225	0.235	5.72	5.97
C	0.105	0.155	2.67	3.94
D	0.210	0.220	5.33	5.59
E	0.035	0.045	0.89	1.14
F	0.004	0.006	0.10	0.15
H	0.057	0.067	1.45	1.70
K	0.085	0.115	2.16	2.92
M	0.355	0.365	9.02	9.27
N	0.357	0.363	9.07	9.22
R	0.227	0.23	5.77	5.92
S	0.225	0.235	5.72	5.97
aaa	0.005 REF		0.13 REF	
bbb	0.010 REF		0.25 REF	
ccc	0.015 REF		0.38 REF	

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

CASE 360C-05
ISSUE E
NI-360S
MRF9030LSR1

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
7	Sept. 2008	• Data sheet revised to reflect part status change, p. 1, including use of applicable overlay. • Data sheet archived. Parts no longer manufactured. • Added Revision History, p. 9

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