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**Freescale Semiconductor**

Technical Data

# RF Power Field Effect Transistors

## N-Channel Enhancement-Mode Lateral MOSFETs

Designed for class AB PCN and PCS base station applications with frequencies from 1800 to 2000 MHz. Suitable for FM, TDMA, CDMA and multicarrier amplifier applications.

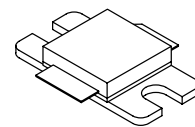
- CDMA Performance @ 1990 MHz, 26 Volts  
IS-95 CDMA Pilot, Sync, Paging, Traffic Codes 8 Thru 13  
885 kHz — -47 dBc in 30 kHz BW  
1.25 MHz — -55 dBc in 12.5 kHz BW  
2.25 MHz — -55 dBc in 1 MHz BW  
Output Power — 4.5 Watts Avg.  
Power Gain — 13.5 dB  
Efficiency — 17%
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 1960 MHz, 30 Watts CW Output Power

**Features**

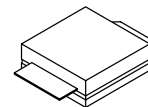
- Internally Matched for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Low Gold Plating Thickness on Leads, 40µ" Nominal.
- RoHS Compliant
- In Tape and Reel. R3 Suffix = 250 Units per 32 mm, 13 Inch Reel.

**MRF19030LR3**  
**MRF19030LSR3**

**1930 - 1990 MHz, 30 W, 26 V**  
**LATERAL N-CHANNEL**  
**RF POWER MOSFETs**



**CASE 465E-04, STYLE 1**  
**NI-400**  
**MRF19030LR3**



**CASE 465F-04, STYLE 1**  
**NI-400S**  
**MRF19030LSR3**

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**Table 1. Maximum Ratings**

Rating	Symbol	Value	Unit
Drain - Source Voltage	V <sub>DSS</sub>	-0.5, +65	Vdc
Gate - Source Voltage	V <sub>GS</sub>	-0.5, +15	Vdc
Total Device Dissipation @ T <sub>C</sub> = 25°C Derate above 25°C	P <sub>D</sub>	83.3 0.48	W W/°C
Storage Temperature Range	T <sub>stg</sub>	- 65 to +150	°C
Case Operating Temperature	T <sub>C</sub>	150	°C
Operating Junction Temperature	T <sub>J</sub>	200	°C

**Table 2. Thermal Characteristics**

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	2.1	°C/W

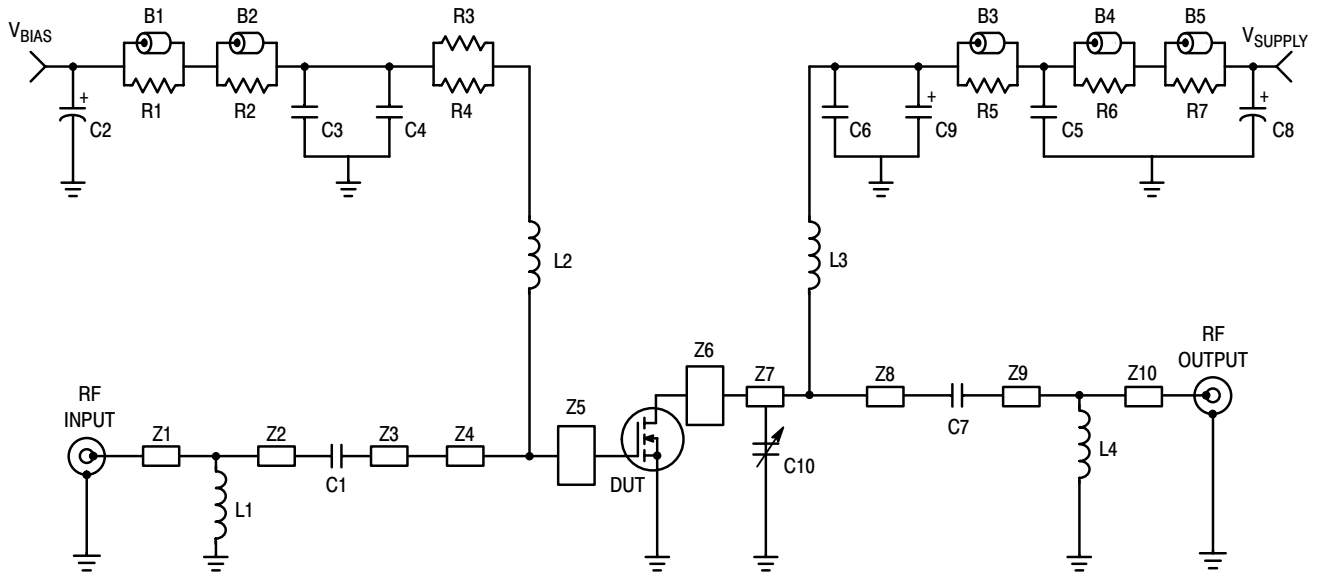
**Table 3. ESD Protection Characteristics**

Test Conditions	Class
Human Body Model	2 (Minimum)
Machine Model	M3 (Minimum)

**Table 4. Electrical Characteristics** ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>Off Characteristics</b>					
Drain-Source Breakdown Voltage ( $V_{GS} = 0\text{ Vdc}$ , $I_D = 20\ \mu\text{A}$ )	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Current ( $V_{DS} = 28\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ )	$I_{DSS}$	—	—	1	$\mu\text{Adc}$
Gate-Source Leakage Current ( $V_{GS} = 5\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )	$I_{GSS}$	—	—	1	$\mu\text{Adc}$
<b>On Characteristics</b>					
Gate Threshold Voltage ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 100\ \mu\text{Adc}$ )	$V_{GS(th)}$	2	3	4	Vdc
Gate Quiescent Voltage ( $V_{DS} = 28\text{ Vdc}$ , $I_D = 300\text{ mA}$ )	$V_{GS(Q)}$	2	3.3	4.5	Vdc
Drain-Source On-Voltage ( $V_{GS} = 10\text{ Vdc}$ , $I_D = 1\text{ Adc}$ )	$V_{DS(on)}$	—	0.29	0.4	Vdc
Forward Transconductance ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 1\text{ Adc}$ )	$g_{fs}$	—	2	—	S
<b>Dynamic Characteristics</b>					
Input Capacitance (Including Input Matching Capacitor in Package) <sup>(1)</sup> ( $V_{DS} = 26\text{ Vdc}$ , $V_{GS} = 0$ , $f = 1\text{ MHz}$ )	$C_{iss}$	—	98.5	—	pF
Output Capacitance <sup>(1)</sup> ( $V_{DS} = 26\text{ Vdc}$ , $V_{GS} = 0$ , $f = 1\text{ MHz}$ )	$C_{oss}$	—	37	—	pF
Reverse Transfer Capacitance ( $V_{DS} = 26\text{ Vdc}$ , $V_{GS} = 0$ , $f = 1\text{ MHz}$ )	$C_{rss}$	—	1.3	—	pF
<b>Functional Tests</b> (In Freescale Test Fixture, 50 ohm system)					
Two-Tone Common-Source Amplifier Power Gain ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 30\text{ W PEP}$ , $I_{DQ} = 300\text{ mA}$ , $f_1 = 1960.0\text{ MHz}$ , $f_2 = 1960.1\text{ MHz}$ )	$G_{ps}$	—	13	—	dB
Two-Tone Drain Efficiency ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 30\text{ W PEP}$ , $I_{DQ} = 300\text{ mA}$ , $f_1 = 1960.0\text{ MHz}$ , $f_2 = 1960.1\text{ MHz}$ )	$\eta$	—	36	—	%
3rd Order Intermodulation Distortion ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 30\text{ W PEP}$ , $I_{DQ} = 300\text{ mA}$ , $f_1 = 1960.0\text{ MHz}$ , $f_2 = 1960.1\text{ MHz}$ )	IMD	—	-31	—	dBc
Input Return Loss ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 30\text{ W PEP}$ , $I_{DQ} = 300\text{ mA}$ , $f_1 = 1960.0\text{ MHz}$ , $f_2 = 1960.1\text{ MHz}$ )	IRL	—	-13	—	dB
Two-Tone Common-Source Amplifier Power Gain ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 30\text{ W PEP}$ , $I_{DQ} = 300\text{ mA}$ , $f_1 = 1930.0\text{ MHz}$ , $f_2 = 1930.1\text{ MHz}$ and $f_1 = 1990.0\text{ MHz}$ , $f_2 = 1990.1\text{ MHz}$ )	$G_{ps}$	12	13	—	dB
Two-Tone Drain Efficiency ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 30\text{ W PEP}$ , $I_{DQ} = 300\text{ mA}$ , $f_1 = 1930.0\text{ MHz}$ , $f_2 = 1930.1\text{ MHz}$ and $f_1 = 1990.0\text{ MHz}$ , $f_2 = 1990.1\text{ MHz}$ )	$\eta$	33	36	—	%
3rd Order Intermodulation Distortion ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 30\text{ W PEP}$ , $I_{DQ} = 300\text{ mA}$ , $f_1 = 1930.0\text{ MHz}$ , $f_2 = 1930.1\text{ MHz}$ and $f_1 = 1990.0\text{ MHz}$ , $f_2 = 1990.1\text{ MHz}$ )	IMD	—	-31	-28	dBc
Input Return Loss ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 30\text{ W PEP}$ , $I_{DQ} = 300\text{ mA}$ , $f_1 = 1930.0\text{ MHz}$ , $f_2 = 1930.1\text{ MHz}$ and $f_1 = 1990.0\text{ MHz}$ , $f_2 = 1990.1\text{ MHz}$ )	IRL	—	-13	-9	dB

1. Part is internally matched both on input and output.

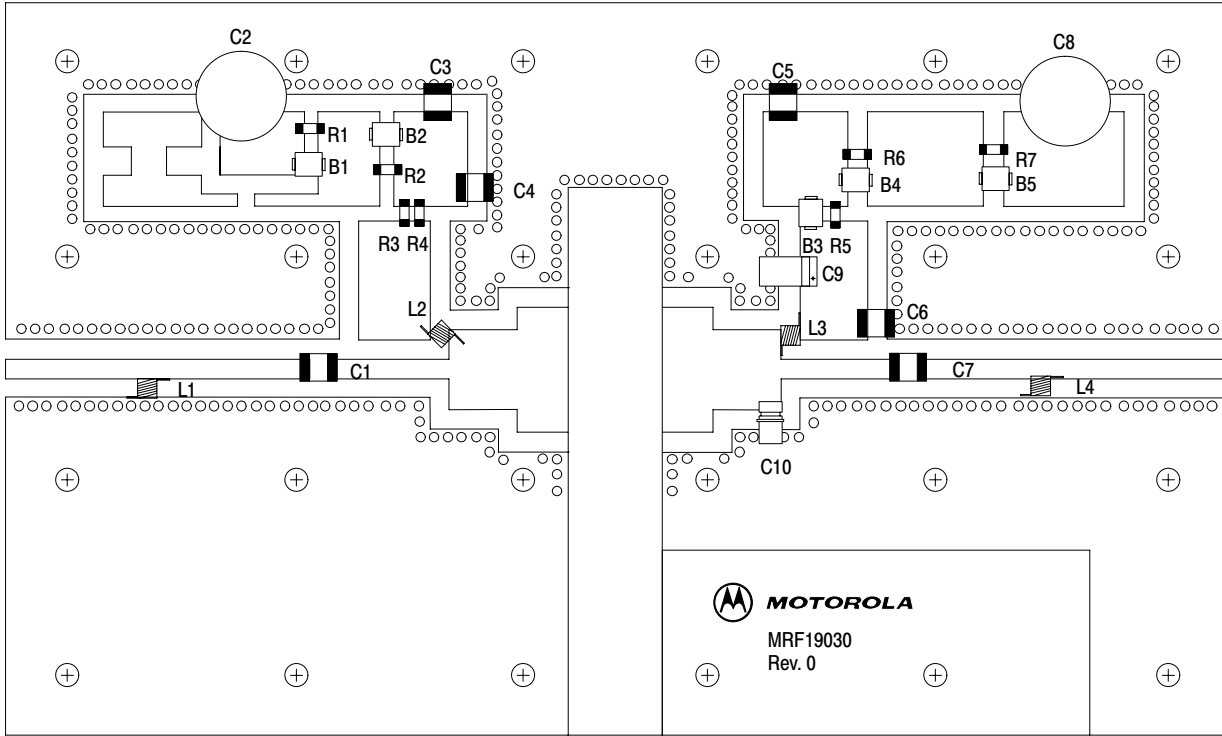


B1 - B5	Short Ferrite Beads	Z3	0.080" x 0.480" Microstrip
C1, C7	10 pF Chip Capacitors	Z4	0.325" x 0.280" Microstrip
C2, C8	470 $\mu$ F, 35 V Electrolytic Capacitors	Z5	0.510" x 0.200" Microstrip
C3, C5	0.1 $\mu$ F Chip Capacitors	Z6	0.510" x 0.200" Microstrip
C4, C6	5.1 pF Chip Capacitors	Z7	0.325" x 0.280" Microstrip
C9	22 $\mu$ F Tantalum Chip Capacitor	Z8	0.080" x 0.480" Microstrip
C10	0.4 - 2.5 pF Variable Capacitor, Johanson Gigatrim	Z9	0.080" x 0.530" Microstrip
L1 - L4	12.5 nH Inductors	Z10	0.080" x 0.671" Microstrip
R1 - R7	12 $\Omega$ Chip Resistors (0805)	Substrate	0.030" x 3.00" x 5.00" Glass Teflon <sup>®</sup> , Arlon
Z1	0.080" x 0.595" Microstrip		
Z2	0.080" x 0.600" Microstrip		

Figure 1. MRF19030LR3(SR3) Test Circuit Schematic

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Figure 2. MRF19030LR3(SR3) Test Circuit Component Layout

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TYPICAL CHARACTERISTICS

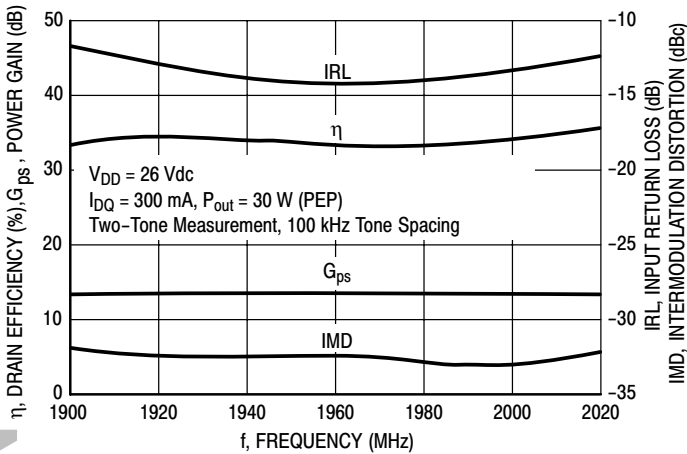


Figure 3. Class AB Broadband Circuit Performance

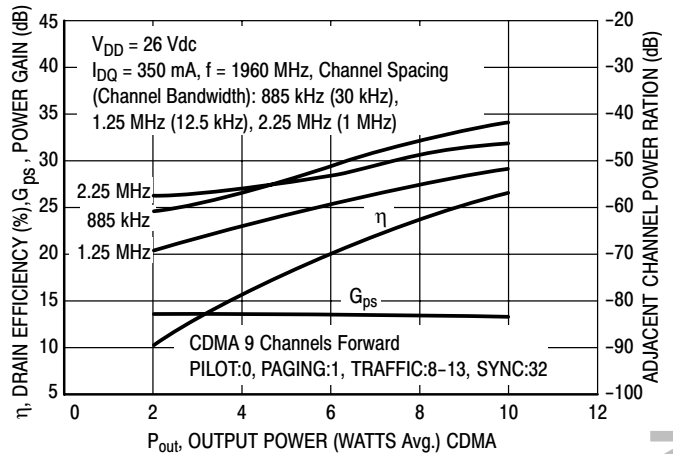


Figure 4. CDMA ACPR, Power Gain and Drain Efficiency versus Output Power

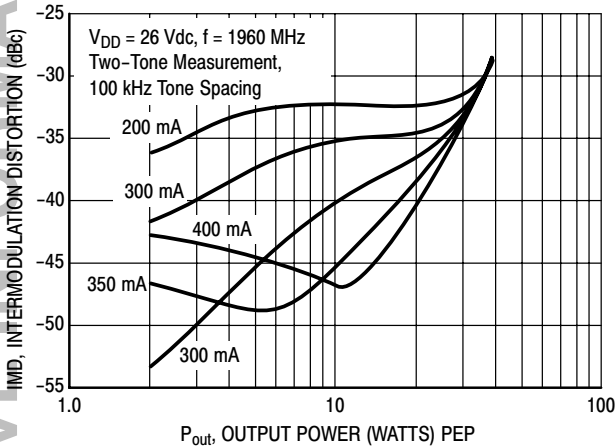


Figure 5. Intermodulation Distortion versus Output Power

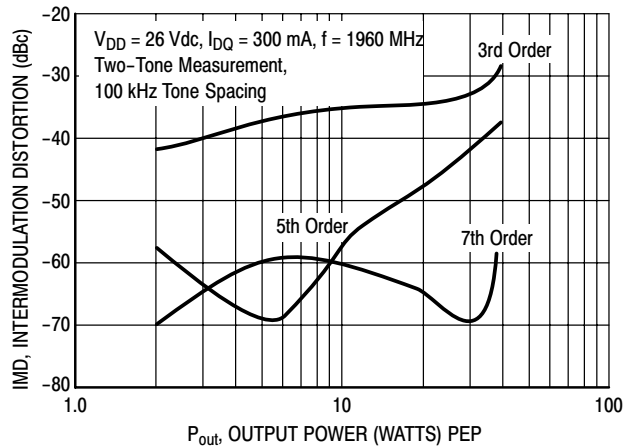


Figure 6. Intermodulation Distortion Products versus Output Power

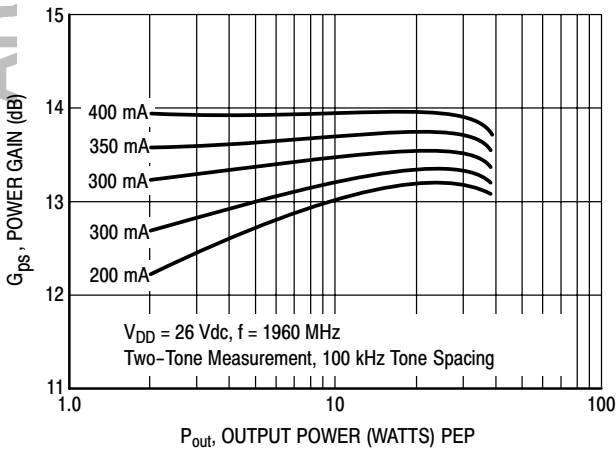


Figure 7. Power Gain versus Output Power

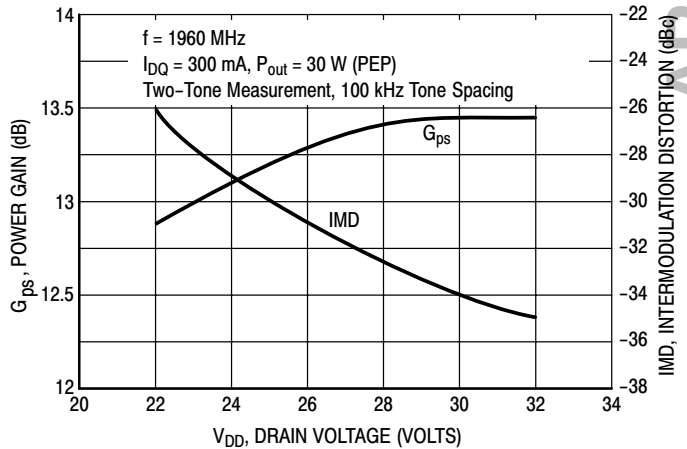
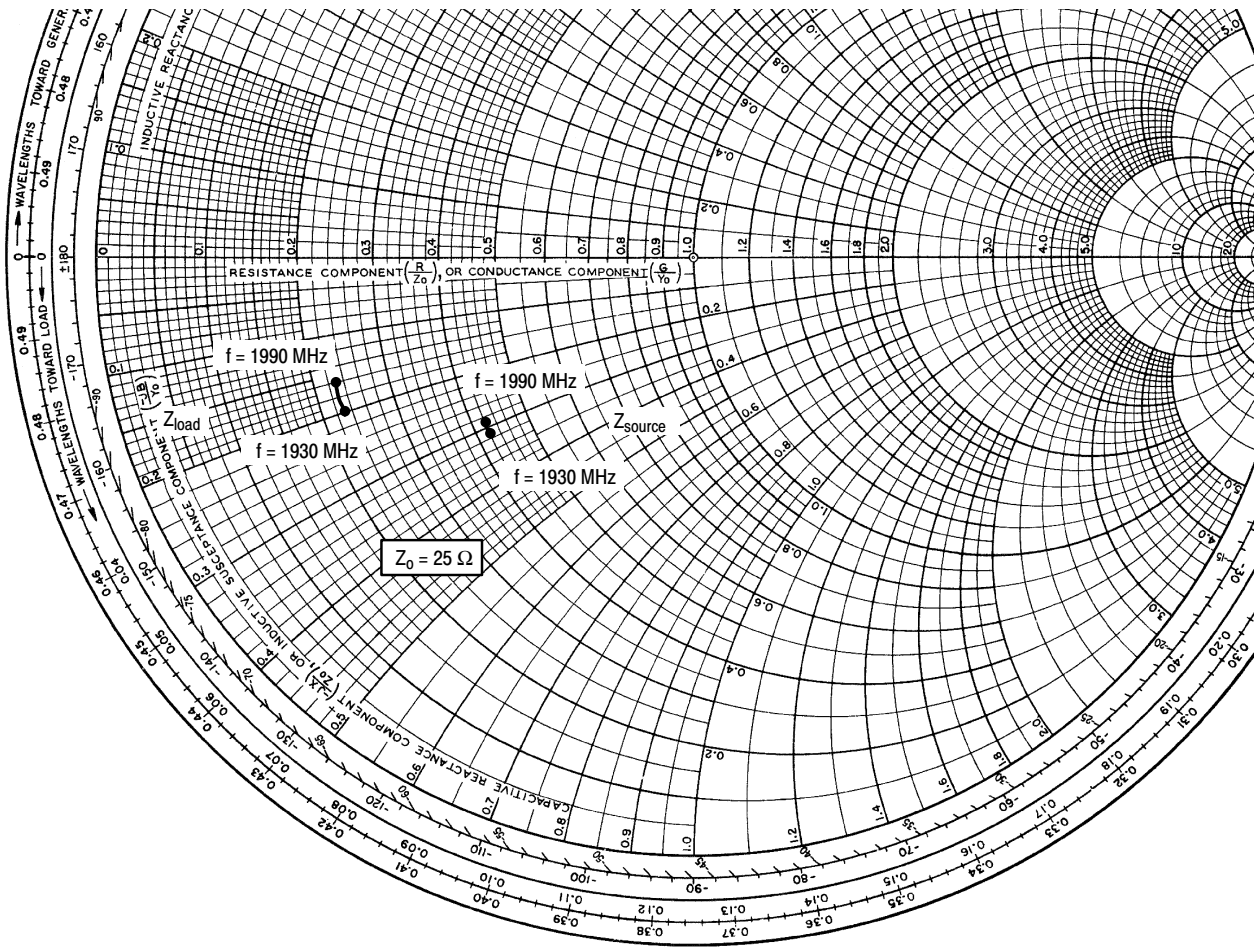


Figure 8. Power Gain and Intermodulation Distortion versus Supply Voltage

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$V_{DD} = 26\text{ V}$ ,  $I_{DQ} = 300\text{ mA}$ ,  $P_{out} = 30\text{ W PEP}$

f MHz	$Z_{source}$ $\Omega$	$Z_{load}$ $\Omega$
1930	10.57 - j7.69	5.81 - j5.01
1960	10.54 - j7.43	5.84 - j4.67
1990	10.47 - j7.21	5.84 - j4.35

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

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

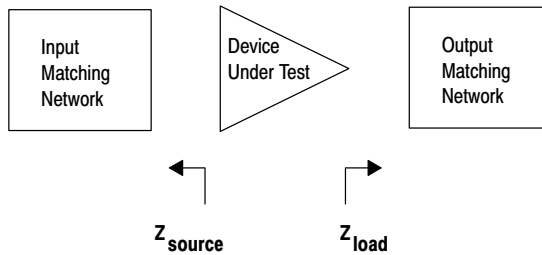
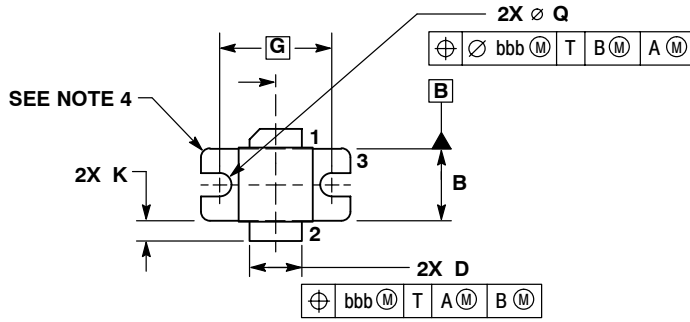


Figure 9. Series Equivalent Source and Load Impedance

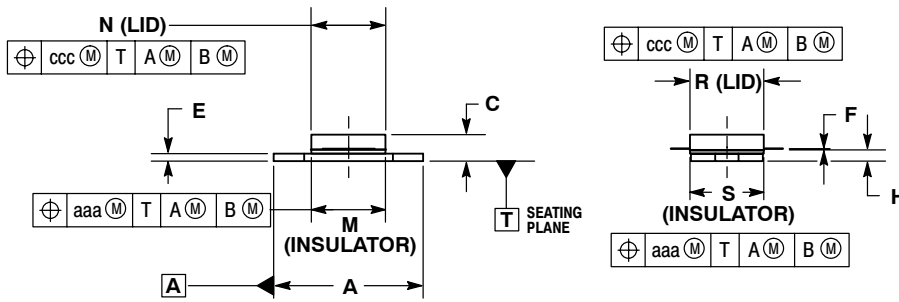
PACKAGE DIMENSIONS



NOTES:

1. CONTROLLING DIMENSION: INCH.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.
4. INFORMATION ONLY: CORNER BREAK (4X) TO BE .060±.005 (1.52±0.13) RADIUS OR .06±.005 (1.52±0.13) x 45° CHAMFER.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.795	.805	20.19	20.44
B	.380	.390	9.65	9.9
C	.125	.163	3.17	4.14
D	.275	.285	6.98	7.24
E	.035	.045	0.89	1.14
F	.004	.006	0.10	0.15
G	.600 BSC		15.24 BSC	
H	.057	.067	1.45	1.7
K	.092	.122	2.33	3.1
M	.395	.405	10	10.3
N	.395	.405	10	10.3
Q	∅ .120	∅ .130	∅ 3.05	∅ 3.3
R	.395	.405	10	10.3
S	.395	.405	10	10.3
aaa	.005 BSC		0.127 BSC	
bbb	.010 BSC		0.254 BSC	
ccc	.015 BSC		0.381 BSC	



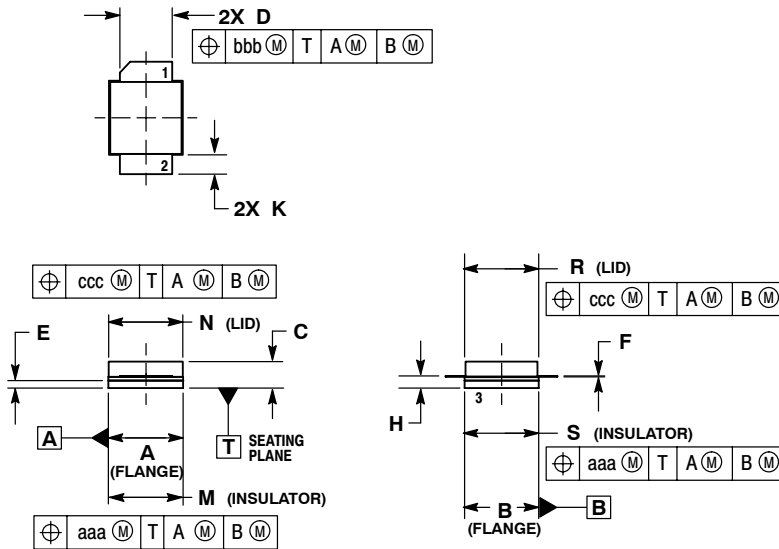
STYLE 1:

1. DRAIN
2. GATE
3. SOURCE

CASE 465E-04  
ISSUE F  
NI-400  
MRF19030LR3

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NOTES:

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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.395	.405	10.03	10.29
B	.395	.405	10.03	10.29
C	.125	.163	3.18	4.14
D	.275	.285	6.98	7.24
E	.035	.045	0.89	1.14
F	.004	.006	0.10	0.15
H	.057	.067	1.45	1.70
K	.092	.122	2.34	3.10
M	.395	.405	10.03	10.29
N	.395	.405	10.03	10.29
R	.395	.405	10.03	10.29
S	.395	.405	10.03	10.29
aaa	.005 REF		0.127 REF	
bbb	.010 REF		0.254 REF	
ccc	.015 REF		0.381 REF	

STYLE 1:

1. DRAIN
2. GATE
3. SOURCE

CASE 465F-04  
ISSUE E  
NI-400S  
MRF19030LSR3

MRF19030LR3 MRF19030LSR3



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