

The RF MOSFET Line

RF Power Field Effect Transistors

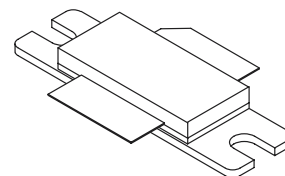
N-Channel Enhancement-Mode Lateral MOSFETs

Designed for PCN and PCS base station applications with frequencies from 1.9 to 2.0 GHz. Suitable for CDMA, TDMA, GSM and multicarrier amplifier applications.

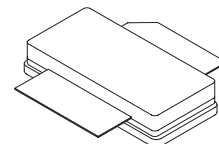
- Typical CDMA Performance: 1960 MHz, 26 Volts
IS-97 CDMA Pilot, Sync, Paging, Traffic Codes 8 Through 13
Output Power — 7.5 Watts
Power Gain — 12.5 dB
Adjacent Channel Power —
885 kHz: -47 dBc @ 30 kHz BW
1.25 MHz: -55 dBc @ 12.5 kHz BW
2.25 MHz: -55 dBc @ 1 MHz BW
- Internally Matched, Controlled Q, for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 1.93 GHz, 60 Watts CW Output Power
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Available in Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 Inch Reel.

MRF19060
MRF19060R3
MRF19060SR3

1990 MHz, 60 W, 26 V
LATERAL N-CHANNEL
RF POWER MOSFETs



CASE 465-06, STYLE 1
NI-780
MRF19060R3



CASE 465A-06, STYLE 1
NI-780S
MRF19060SR3

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	65	Vdc
Gate-Source Voltage	V_{GS}	-0.5, +15	Vdc
Total Device Dissipation @ $T_C \geq 25^\circ\text{C}$ Derate above 25°C	P_D	180 1.03	Watts $\text{W}/^\circ\text{C}$
Storage Temperature Range	T_{stg}	-65 to +150	$^\circ\text{C}$
Operating Junction Temperature	T_J	200	$^\circ\text{C}$

ESD PROTECTION CHARACTERISTICS

Test Conditions	Class
Human Body Model	1 (Minimum)
Machine Model	M3 (Minimum)

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.97	$^\circ\text{C}/\text{W}$

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

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain–Source Breakdown Voltage ($V_{GS} = 0\text{ Vdc}$, $I_D = 10\text{ }\mu\text{Adc}$)	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Current ($V_{DS} = 26\text{ Vdc}$, $V_{GS} = 0\text{ Vdc}$)	I_{DSS}	—	—	6	μAdc
Gate–Source Leakage Current ($V_{GS} = 5\text{ Vdc}$, $V_{DS} = 0\text{ Vdc}$)	I_{GSS}	—	—	1	μAdc

ON CHARACTERISTICS

Forward Transconductance ($V_{DS} = 10\text{ Vdc}$, $I_D = 2\text{ Adc}$)	g_{fs}	—	4.7	—	S
Gate Threshold Voltage ($V_{DS} = 10\text{ Vdc}$, $I_D = 300\text{ }\mu\text{Adc}$)	$V_{GS(th)}$	2	—	4	V
Gate Quiescent Voltage ($V_{DS} = 26\text{ Vdc}$, $I_D = 500\text{ mAdc}$)	$V_{GS(Q)}$	2.5	3.9	4.5	V
Drain–Source On–Voltage ($V_{GS} = 10\text{ Vdc}$, $I_D = 2\text{ Adc}$)	$V_{DS(on)}$	—	0.27	—	V

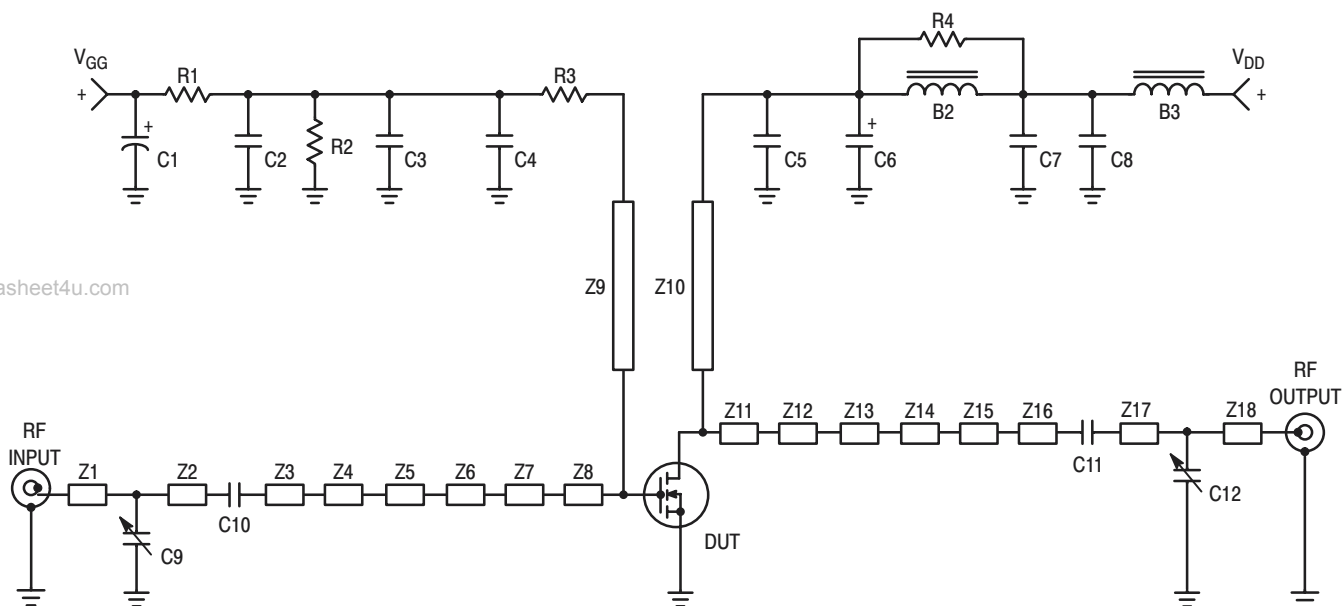
DYNAMIC CHARACTERISTICS

Reverse Transfer Capacitance (1) ($V_{DS} = 26\text{ Vdc}$, $V_{GS} = 0$, $f = 1\text{ MHz}$)	C_{rss}	—	2.7	—	pF
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FUNCTIONAL TESTS (In Motorola Test Fixture, 50 ohm system)

Two–Tone Common–Source Amplifier Power Gain ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 60\text{ W PEP}$, $I_{DQ} = 500\text{ mA}$, $f = 1930\text{ MHz}$ and 1990 MHz , Tone Spacing = 100 kHz)	G_{ps}	11	12.5	—	dB
Two–Tone Drain Efficiency ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 60\text{ W PEP}$, $I_{DQ} = 500\text{ mA}$, $f = 1930\text{ MHz}$ and 1990 MHz , Tone Spacing = 100 kHz)	η	33	36	—	%
3rd Order Intermodulation Distortion ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 60\text{ W PEP}$, $I_{DQ} = 500\text{ mA}$, $f = 1930\text{ MHz}$ and 1990 MHz , Tone Spacing = 100 kHz)	IMD	—	–31	–28	dBc
Input Return Loss ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 60\text{ W PEP}$, $I_{DQ} = 500\text{ mA}$, $f = 1930\text{ MHz}$ and 1990 MHz , Tone Spacing = 100 kHz)	IRL	—	–12	—	dB
P_{out} , 1 dB Compression Point ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 60\text{ W CW}$, $f = 1990\text{ MHz}$)	P1dB	—	60	—	W
Output Mismatch Stress ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 60\text{ W CW}$, $I_{DQ} = 500\text{ mA}$, $f = 1930\text{ MHz}$, VSWR = 10:1, All Phase Angles at Frequency of Tests)	Ψ	No Degradation In Output Power Before and After Test			

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



B2 – B3	Ferrite Beads, Fair Rite, 2743019447	Z4	0.152" x 0.140" Microstrip
C1	10 μ F, 50 V Electrolytic Capacitor, Panasonic #ECEV1HV100R	Z5	0.090" x 0.102" Microstrip
C2, C7	1000 pF Chip Capacitors, B Case, ATC #100B102JCA500X	Z6	0.245" x 0.217" Microstrip
C3, C8	0.10 μ F Chip Capacitors, B Case, Kemet #CDR33BX104AKWS	Z7	0.090" x 0.737" Microstrip
C4	5.1 pF Chip Capacitor, B Case, ATC #100B5R1JCA500X	Z8	0.530" x 0.941" Microstrip
C5	6.2 pF Chip Capacitor, B Case, ATC #100B6R2JCA500X	Z9	1.010" x 0.050" Microstrip
C6	22 μ F, 35 V Tantalum Capacitor, SMT, Sprague	Z10	1.060" x 0.050" Microstrip
C9	0.8 pF – 8.0 pF Variable Capacitor, Johanson Gigatrim	Z11	0.446" x 1.137" Microstrip
C10, C11	10 pF Chip Capacitors, B Case, ATC #100B100JCA500X	Z12	0.152" x 0.567" Microstrip
C12	0.4 pF – 2.5 pF Variable Capacitor, Johanson Gigatrim	Z13	0.183" x 0.220" Microstrip
R1	1 k Ω , 1/4 W Fixed Film Chip Resistor, 0.08" x 0.13"	Z14	0.100" x 0.338" Microstrip
R2	560 k Ω , 1/4 W Fixed Film Chip Resistor, 0.08" x 0.13"	Z15	0.480" x 0.142" Microstrip
R3	15 Ω , 1/4 W Fixed Film Chip Resistor, 0.08" x 0.13"	Z16	0.140" x 0.080" Microstrip
R4	10 Ω , 1/4 W Fixed Film Chip Resistor, 0.08" x 0.13"	Z17	0.173" x 0.080" Microstrip
Z1	0.580" x 0.074" Microstrip	Z18	0.420" x 0.080" Microstrip
Z2	0.100" x 0.074" Microstrip	Board	0.030" Glass Teflon [®] Arlon
Z3	0.384" x 0.074" Microstrip		GX-0300-55-22, 2 oz Cu

Figure 1. MRF19060 Test Circuit Schematic

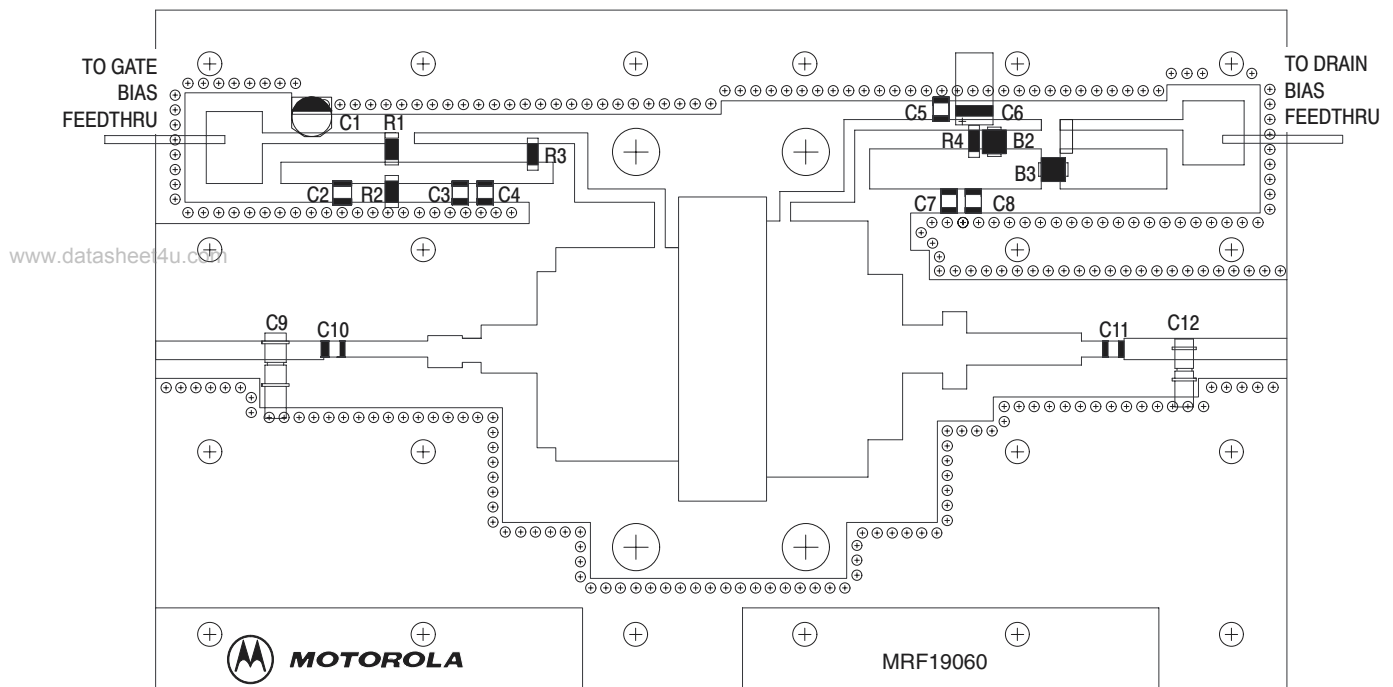


Figure 2. MRF19060 Test Circuit Component Layout

TYPICAL CHARACTERISTICS

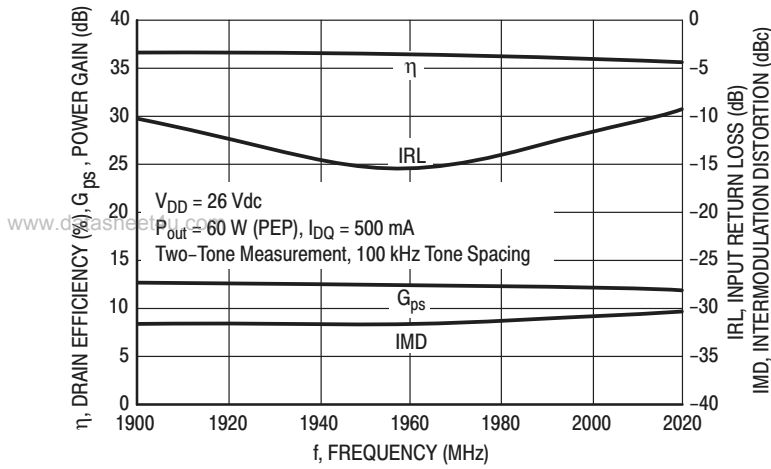


Figure 3. Class AB Broadband Circuit Performance

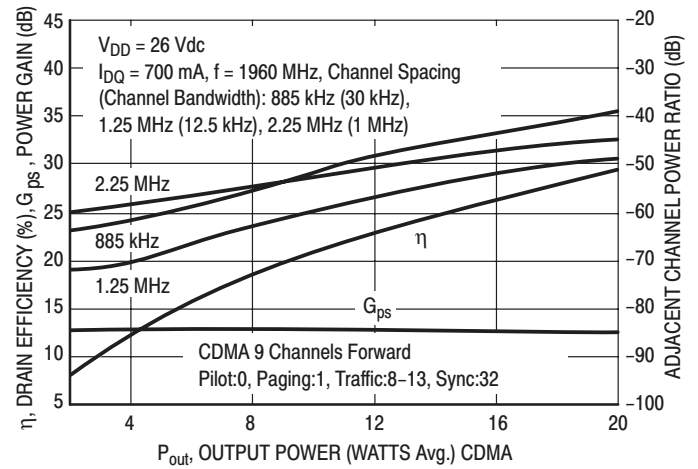


Figure 4. CDMA ACPR, Power Gain and Drain Efficiency versus Output Power

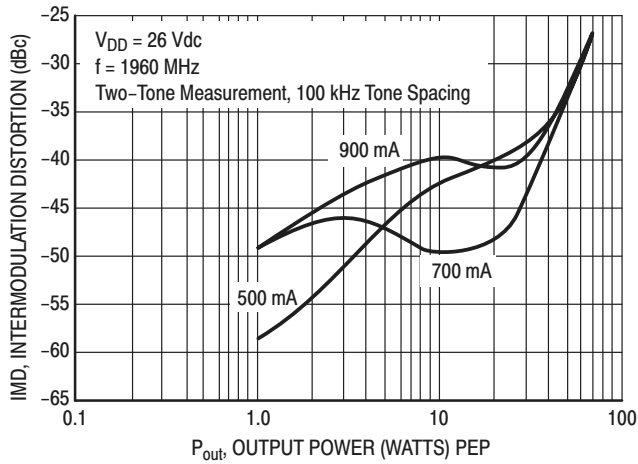


Figure 5. Intermodulation Distortion versus Output Power

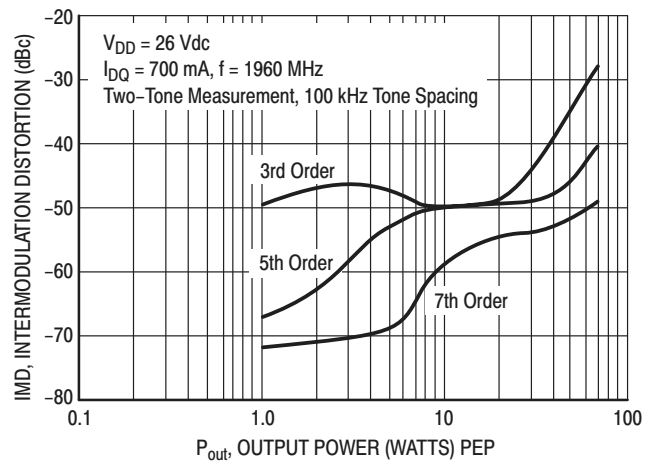


Figure 6. Intermodulation Products versus Output Power

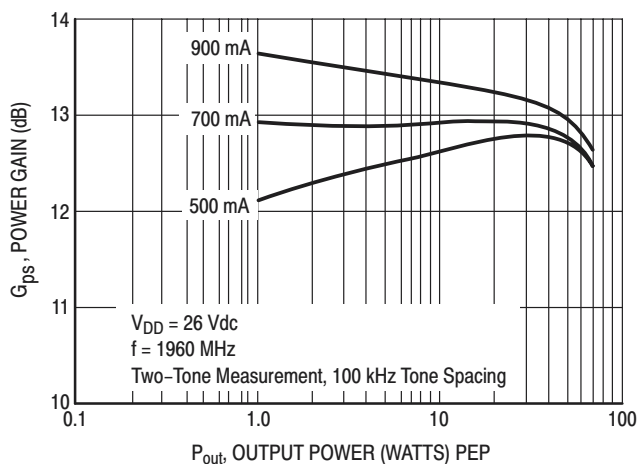


Figure 7. Power Gain versus Output Power

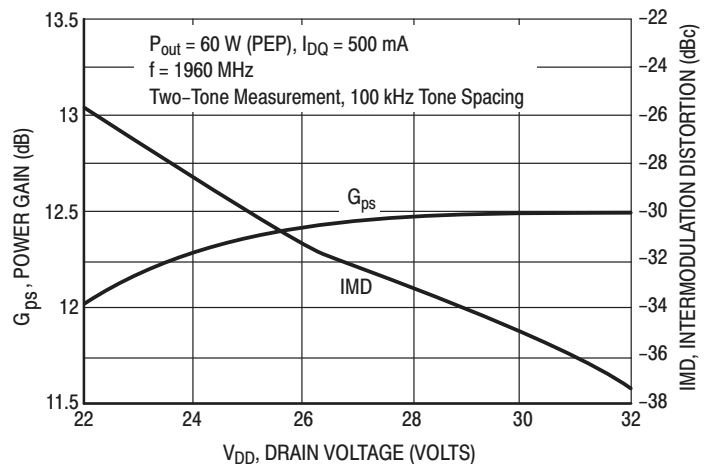
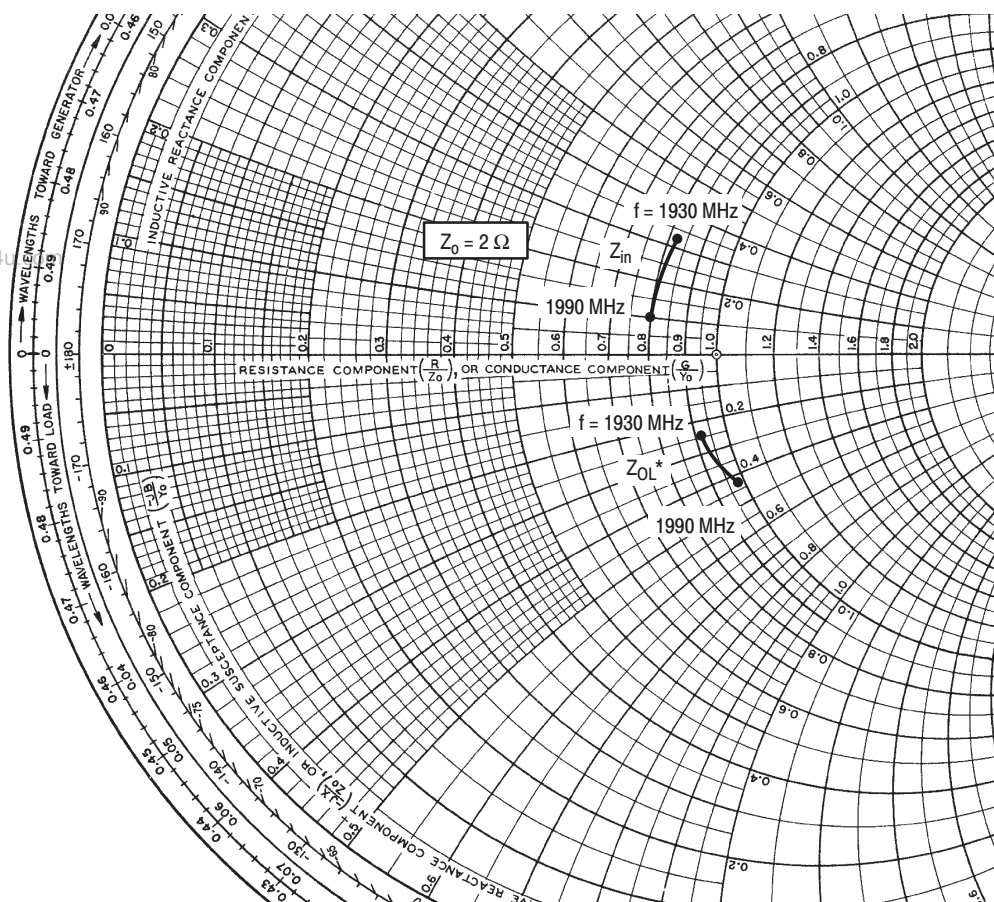


Figure 8. Power Gain and Intermodulation Distortion versus Supply Voltage



$V_{DD} = 26 \text{ V}$, $I_{DQ} = 500 \text{ mA}$, $P_{out} = 60 \text{ W PEP}$

f MHz	Z_{in} Ω	Z_{OL}^* Ω
1930	$1.65 + j0.67$	$1.85 - j0.50$
1960	$1.64 + j0.45$	$1.89 - j0.74$
1990	$1.60 + j0.20$	$1.96 - j0.94$

Z_{in} = Complex conjugate of source impedance.

Z_{OL}^* = Complex conjugate of the optimum load impedance at a given output power, voltage, IMD, bias current and frequency.

Note: Z_{OL}^* was chosen based on tradeoffs between gain, output power, drain efficiency and intermodulation distortion.

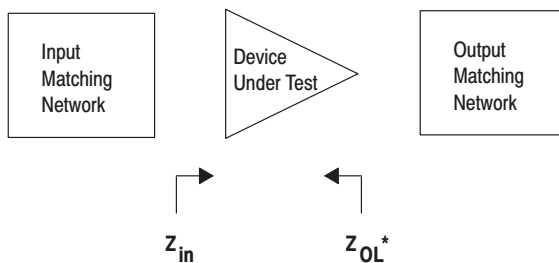
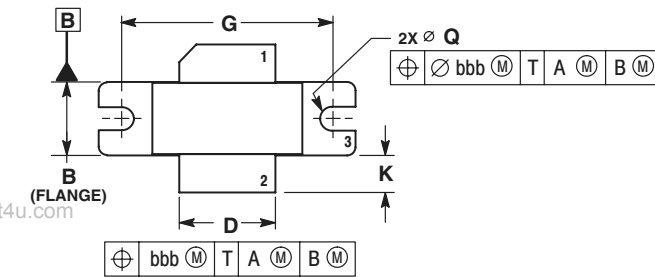


Figure 9. Series Equivalent Input and Output Impedance

PACKAGE DIMENSIONS



NOTES:

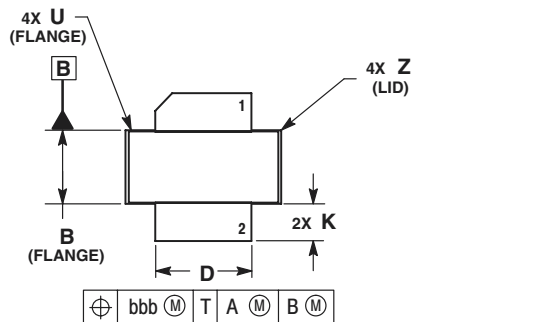
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
2. CONTROLLING DIMENSION: INCH.
3. DELETED
4. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.335	1.345	33.91	34.16
B	0.380	0.390	9.65	9.91
C	0.125	0.170	3.18	4.32
D	0.495	0.505	12.57	12.83
E	0.035	0.045	0.89	1.14
F	0.003	0.006	0.08	0.15
G	1.100	BSC	27.94	BSC
H	0.057	0.067	1.45	1.70
K	0.170	0.210	4.32	5.33
M	0.774	0.786	19.66	19.96
N	0.772	0.788	19.60	20.00
Q	Ø 0.118	Ø 0.138	Ø 3.00	Ø 3.51
R	0.365	0.375	9.27	9.53
S	0.365	0.375	9.27	9.52
aaa	0.005	REF	0.127	REF
bbb	0.010	REF	0.254	REF
ccc	0.015	REF	0.381	REF

STYLE 1:

- PIN 1. DRAIN
- GATE
- SOURCE

CASE 465-06
ISSUE F
NI-780
MRF19060



NOTES:

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2. CONTROLLING DIMENSION: INCH.
3. DELETED
4. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.805	0.815	20.45	20.70
B	0.380	0.390	9.65	9.91
C	0.125	0.170	3.18	4.32
D	0.495	0.505	12.57	12.83
E	0.035	0.045	0.89	1.14
F	0.003	0.006	0.08	0.15
H	0.057	0.067	1.45	1.70
K	0.170	0.210	4.32	5.33
M	0.774	0.786	19.61	20.02
N	0.772	0.788	19.61	20.02
R	0.365	0.375	9.27	9.53
S	0.365	0.375	9.27	9.52
U	---	0.040	---	1.02
Z	---	0.030	---	0.76
aaa	0.005	REF	0.127	REF
bbb	0.010	REF	0.254	REF
ccc	0.015	REF	0.381	REF

STYLE 1:

- PIN 1. DRAIN
- GATE
- SOURCE

CASE 465A-06
ISSUE F
NI-780S
MRF19060SR3

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