√RoHS

RF Power Field Effect Transistors

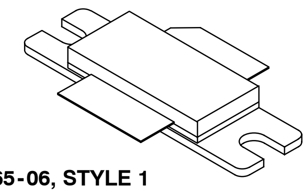
N-Channel Enhancement-Mode Lateral MOSFETs

MRF21060R3
MRF21060SR3

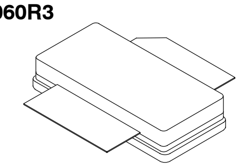
Designed for PCN and PCS base station applications with frequencies from 2100 to 2200 MHz. Suitable for W-CDMA, CDMA, TDMA, GSM and multicarrier amplifier applications.

- Typical W-CDMA Performance: 2140 MHz, 28 Volts
  5 MHz Offset @ 4.096 MHz BW, 15 DTCH
  - Output Power — 6.0 Watts
  - Power Gain — 12.5 dB
  - Drain Efficiency — 15%
- 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, @ 28 Vdc, 2110 MHz, 60 Watts CW Output Power
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 Inch Reel.

2170 MHz, 60 W, 28 V
LATERAL N-CHANNEL
RF POWER MOSFETs



CASE 465-06, STYLE 1
NI-780
MRF21060R3



CASE 465A-06, STYLE 1
NI-780S
MRF21060SR3

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	-0.5, +65	Vdc
Gate-Source Voltage	V_{GS}	-0.5, +15	Vdc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	180 0.98	W W/°C
Storage Temperature Range	T_{stg}	- 65 to +150	°C
Operating Junction Temperature	T_J	200	°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.02	°C/W

Table 3. ESD Protection Characteristics

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

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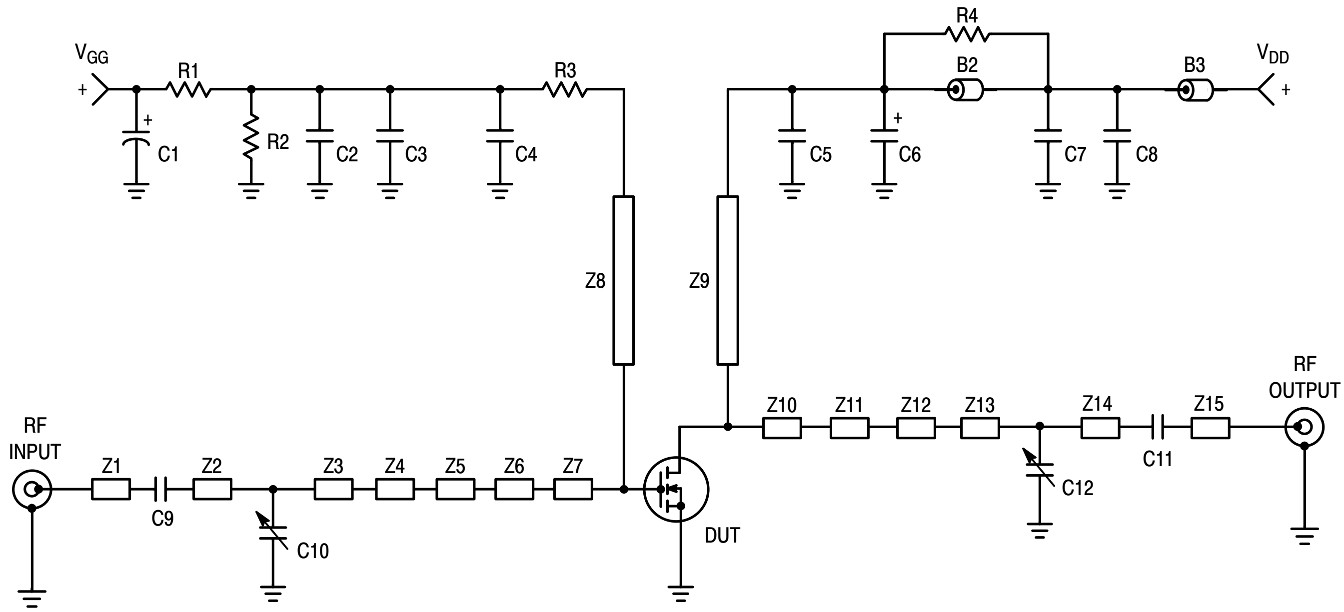
Table 4. Electrical Characteristics (T_C = 25°C unless otherwise noted)

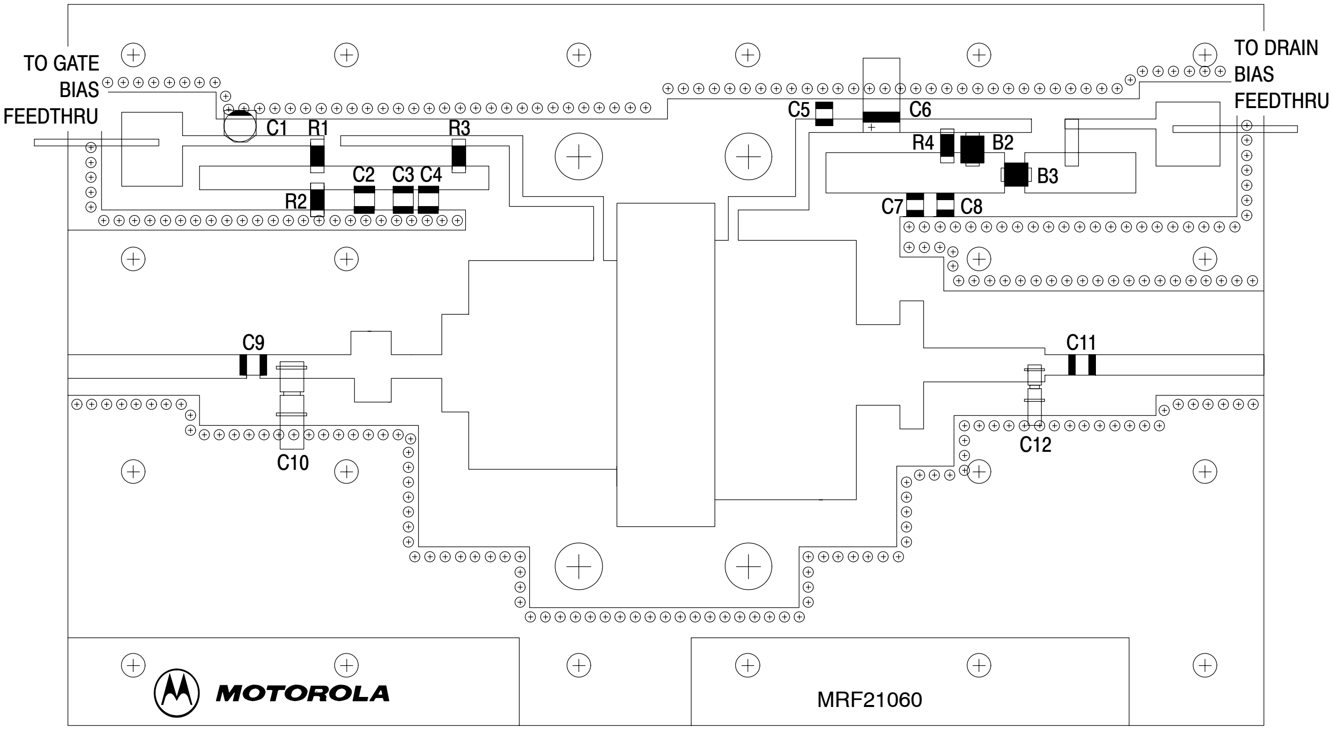
Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics					
Drain-Source Breakdown Voltage (V_{GS} = 0 Vdc, I_D = 10 μAdc)	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Current (V_{DS} = 28 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	6	μAdc
Gate-Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	μAdc
On Characteristics					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 300 μAdc)	$V_{GS(th)}$	2	—	4	Vdc
Gate Quiescent Voltage (V_{DS} = 28 Vdc, I_D = 500 mAdc)	$V_{GS(Q)}$	2.5	3.9	4.5	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 2 Adc)	$V_{DS(on)}$	—	0.27	—	Vdc
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 2 Adc)	g_{fs}	—	4.7	—	S
Dynamic Characteristics					
Reverse Transfer Capacitance (1) (V_{DS} = 28 Vdc, V_{GS} = 0, f = 1 MHz)	C_{rss}	—	2.7	—	pF
Functional Tests (In Freescale Test Fixture, 50 ohm system)					
Two-Tone Common-Source Amplifier Power Gain (V_{DD} = 28 Vdc, P_{out} = 60 W PEP, I_{DQ} = 500 mA, f = 2110 MHz and 2170 MHz, Tone Spacing = 100 kHz)	G_{ps}	11	12.5	—	dB
Two-Tone Drain Efficiency (V_{DD} = 28 Vdc, P_{out} = 60 W PEP, I_{DQ} = 500 mA, f = 2110 MHz and 2170 MHz, Tone Spacing = 100 kHz)	η	31	34	—	%
3rd Order Intermodulation Distortion (V_{DD} = 28 Vdc, P_{out} = 60 W PEP, I_{DQ} = 500 mA, f = 2110 MHz and 2170 MHz, Tone Spacing = 100 kHz)	IMD	—	-30	-28	dBc
Input Return Loss (V_{DD} = 28 Vdc, P_{out} = 60 W PEP, I_{DQ} = 500 mA, f = 2110 MHz and 2170 MHz, Tone Spacing = 100 kHz)	IRL	—	-12	—	dB
P_{out}, 1 dB Compression Point (V_{DD} = 28 Vdc, P_{out} = 60 W CW, f = 2170 MHz)	P1dB	—	60	—	W
Output Mismatch Stress (V_{DD} = 28 Vdc, P_{out} = 60 W CW, I_{DQ} = 500 mA, f = 2110 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
C1	10 μF, 50 V Electrolytic Chip Capacitor, Panasonic #ECEV1HV100R
C2, C7	1000 pF Chip Capacitors, ATC #100B102JCA500X
C3, C8	0.10 μF Chip Capacitors, Kemet #CDR33BX104AKWS
C4, C5	4.7 pF Chip Capacitors, ATC #100B4R7JCA500X
C6	22 μF, 35 V Tantalum Surface Mount Chip Capacitor, Sprague
C9, C11	9.1 pF Chip Capacitors, ATC #100B9R1JCA500X
C10	0.8 pF - 8.0 pF Variable Capacitor, Johanson Gigatrim
C12	0.4 pF - 4.5 pF Variable Capacitor, Johanson Gigatrim
R1	1 kΩ, 1/4 W Fixed Film Chip Resistor, 0.08″ x 0.13″
R2	560 kΩ, 1/4 W Fixed Film Chip Resistor, 0.08″ x 0.13″
R3	10 Ω, 1/4 W Fixed Film Chip Resistor, 0.08″ x 0.13″
R4	10 Ω, 1/4 W Fixed Film Chip Resistor, 0.08″ x 0.13″
Z1	0.743″ x 0.080″ Microstrip
Z2	0.070″ x 0.100″ Microstrip
Z3	0.180″ x 0.100″ Microstrip
Z4	0.152″ x 0.293″ Microstrip
Z5	0.216″ x 0.100″ Microstrip
Z6	0.114″ x 0.410″ Microstrip
Z7	0.626″ x 0.872″ Microstrip
Z8	1.050″ x 0.050″ Microstrip
Z9	0.830″ x 0.050″ Microstrip
Z10	0.596″ x 1.040″ Microstrip
Z11	0.186″ x 0.315″ Microstrip
Z12	0.097″ x 0.525″ Microstrip
Z13	0.353″ x 0.138″ Microstrip
Z14	0.112″ x 0.080″ Microstrip
Z15	0.722″ x 0.080″ Microstrip
Board	0.030″ Glass Teflon®, Arlon GX-0300-55-22, 2 oz Cu

Figure 1. MRF21060 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. MRF21060 Test Circuit Component Layout

TYPICAL CHARACTERISTICS

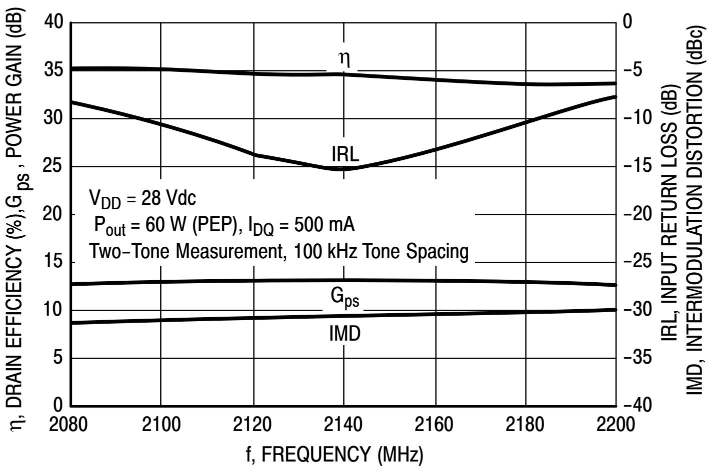


Figure 3. Class AB Broadband Circuit Performance

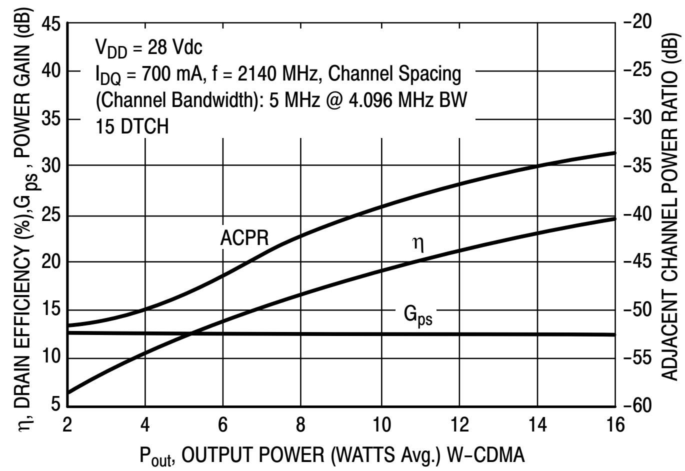


Figure 4. W-CDMA ACPR, Power Gain and Drain Efficiency versus Output Power

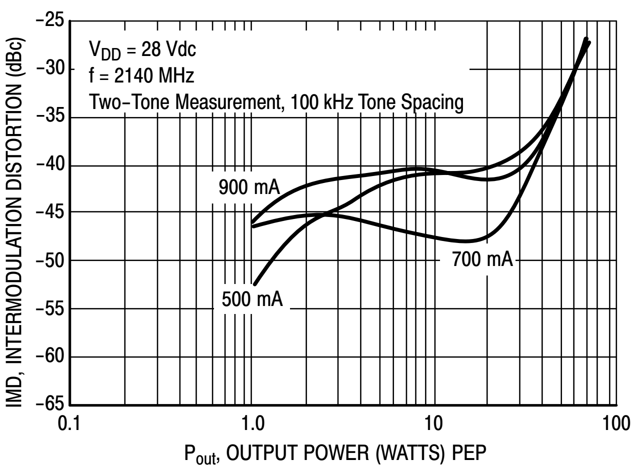


Figure 5. Intermodulation Distortion versus Output Power

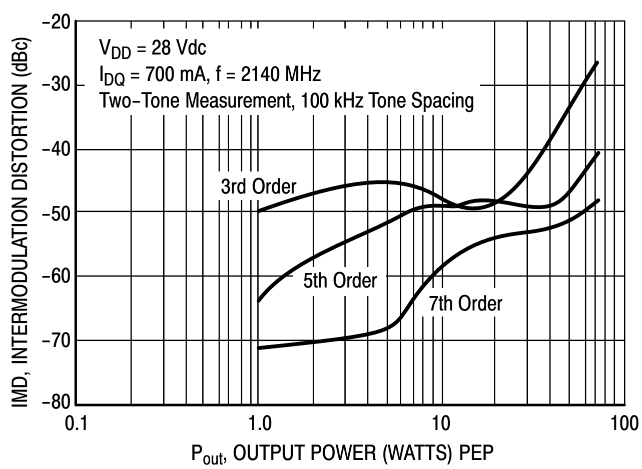


Figure 6. Intermodulation Distortion Products versus Output Power

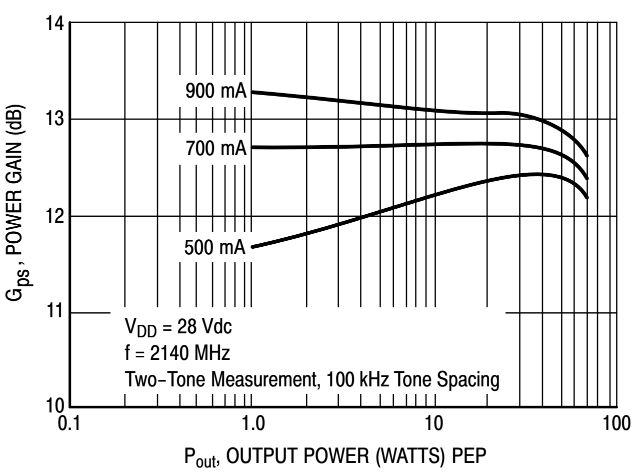


Figure 7. Power Gain versus Output Power

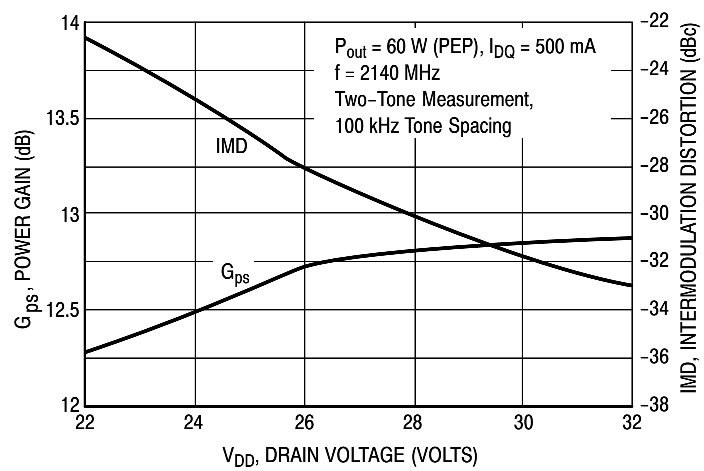
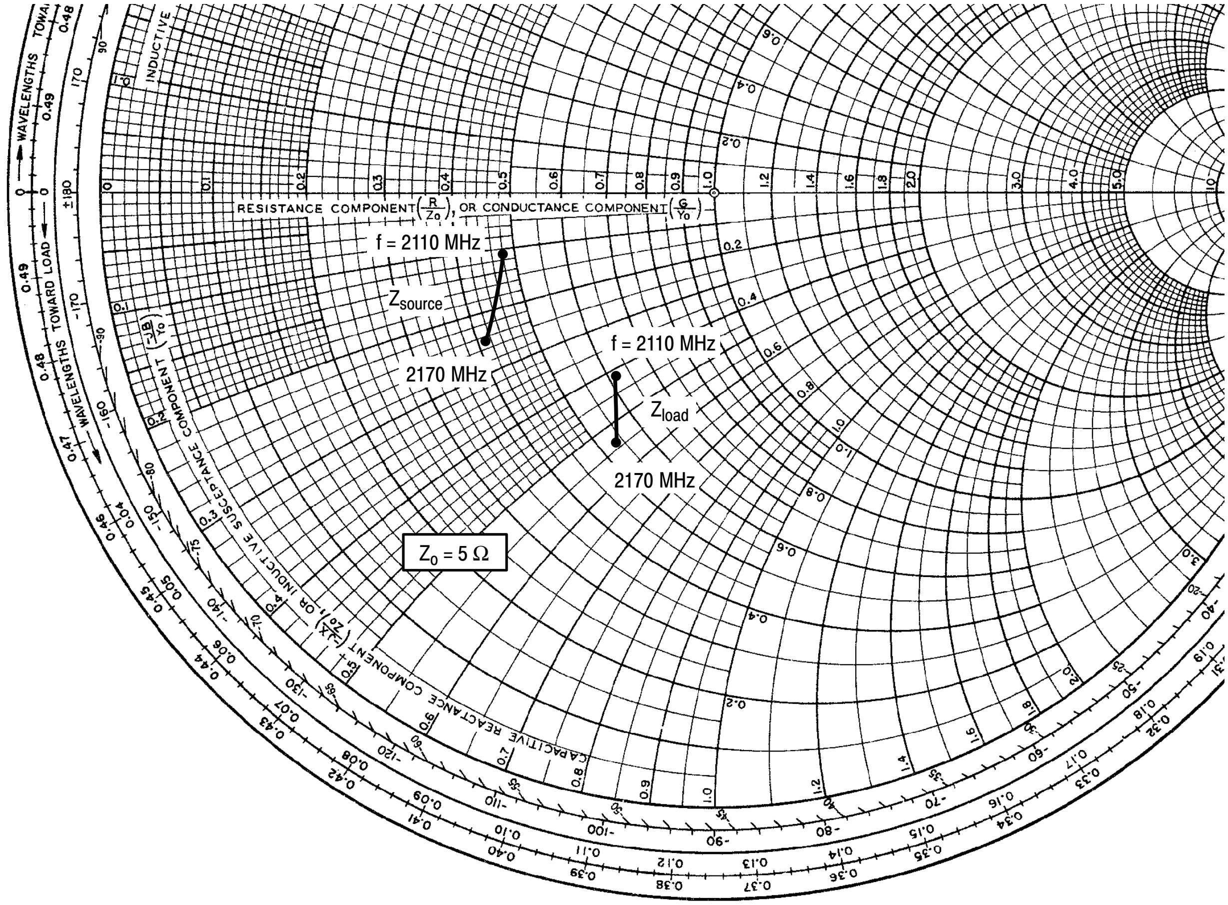


Figure 8. Power Gain and Intermodulation Distortion versus Supply Voltage



V_{DD} = 28 V, I_{DQ} = 500 mA, P_{out} = 60 W PEP

f MHz	Z_{source} Ω	Z_{load} Ω
2110	2.40 - j0.55	3.07 - j2.05
2140	2.26 - j0.87	2.89 - j2.38
2170	2.08 - j1.23	2.66 - j2.71

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

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

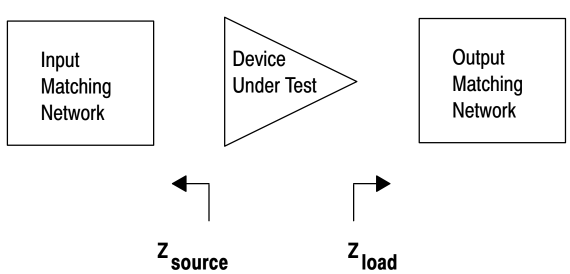
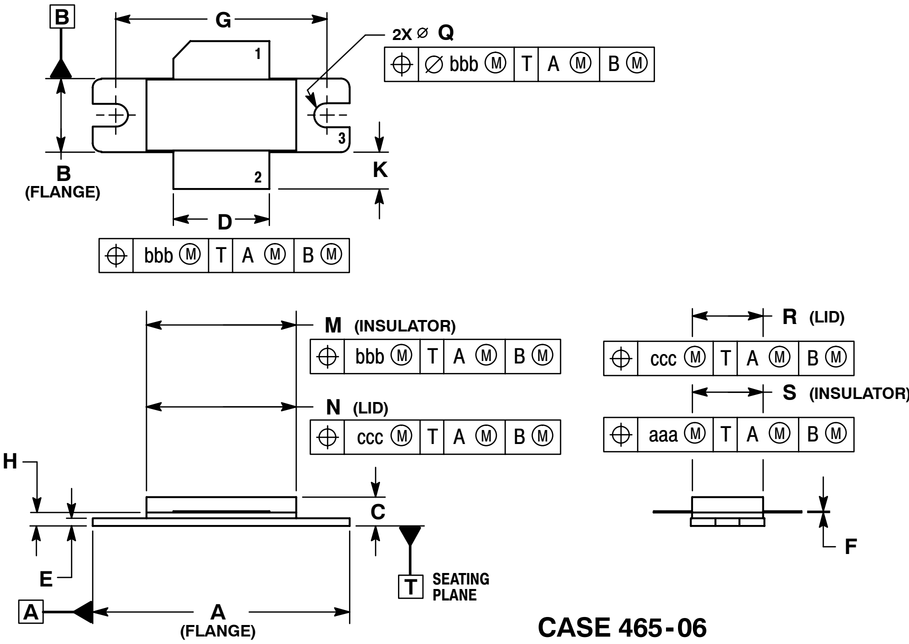


Figure 9. Series Equivalent Source and Load Impedance

PACKAGE DIMENSIONS

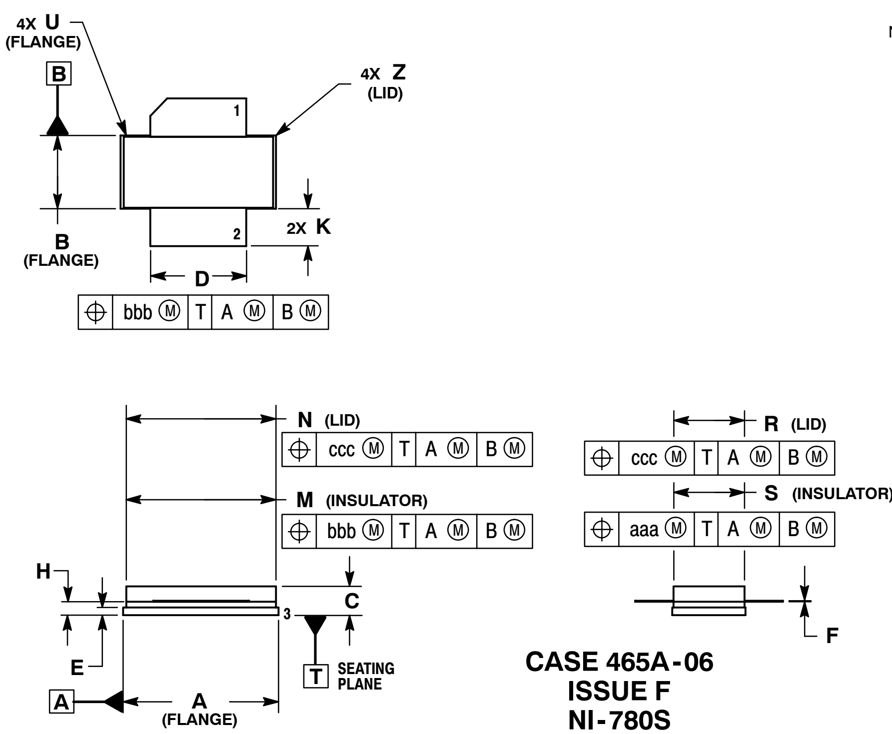


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M−1994.
2. CONTROLLING DIMENSION: INCH.
3. DELETED
4. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

	INCHES		MILLIMETERS	
DIM	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.118	Ø.138	Ø3.00	Ø3.51
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
2. GATE
3. SOURCE

CASE 465-06
ISSUE F
NI-780
MRF21060R3



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	INCHES		MILLIMETERS	
DIM	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
2. GATE
5. SOURCE

CASE 465A-06
ISSUE F
NI-780S
MRF21060SR3

How to Reach Us:

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USA/Europe or Locations Not Listed:
Freescale Semiconductor
Technical Information Center, CH370
1300 N. Alma School Road
Chandler, Arizona 85224
+1-800-521-6274 or +1-480-768-2130
support@freescale.com

Europe, Middle East, and Africa:
Freescale Halbleiter Deutschland GmbH
Technical Information Center
Schatzbogen 7
81829 Muenchen, Germany
+44 1296 380 456 (English)
+46 8 52200080 (English)
+49 89 92103 559 (German)
+33 1 69 35 48 48 (French)
support@freescale.com

Japan:
Freescale Semiconductor Japan Ltd.
Headquarters
ARCO Tower 15F
1-8-1, Shimo-Meguro, Meguro-ku,
Tokyo 153-0064
Japan
0120 191014 or +81 3 5437 9125
support.japan@freescale.com

Asia/Pacific:
Freescale Semiconductor Hong Kong Ltd.
Technical Information Center
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Document Number: MRF21060
Rev. 7, 12/2004