The RF MOSFET Line

RF Power Field Effect Transistors

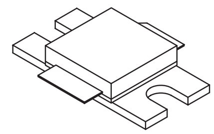
N–Channel Enhancement–Mode Lateral MOSFETs

MRF21030
MRF21030S

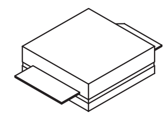
Designed for PCN and PCS base station applications from frequencies up to 2.0 to 2.2 GHz. Suitable for FM, TDMA, CDMA and multicarrier amplifier applications. To be used in class AB for PCN–PCS/cellular radio and WLL applications.

- Wideband CDMA Performance: –45 dB ACPR @ 4.096 MHz, 28 Volts
  Output Power — 3.5 Watts
  Power Gain — 14 dB
  Efficiency — 15%
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Ease of Design for Gain and Insertion Phase Flatness
- Capable of Handling 10:1 VSWR, @ 28 Vdc, 2.11 GHz, 30 Watts CW Output Power
- Excellent Thermal Stability
- Characterized with Series Equivalent Large–Signal Impedance Parameters

2.2 GHz, 30 W, 28 V
LATERAL N–CHANNEL
RF POWER MOSFETs



CASE 465E–02, STYLE 1
(MRF21030)



CASE 465F–02, STYLE 1
(MRF21030S)

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain–Source Voltage	V_{DSS}	65	Vdc
Gate–Source Voltage	V_{GS}	+15, –0.5	Vdc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	83.3 0.48	Watts W/°C
Storage Temperature Range	T_{stg}	–65 to +200	°C
Operating Junction Temperature	T_J	200	°C

ESD PROTECTION CHARACTERISTICS

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

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.1	°C/W

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

© Motorola, Inc. 2001

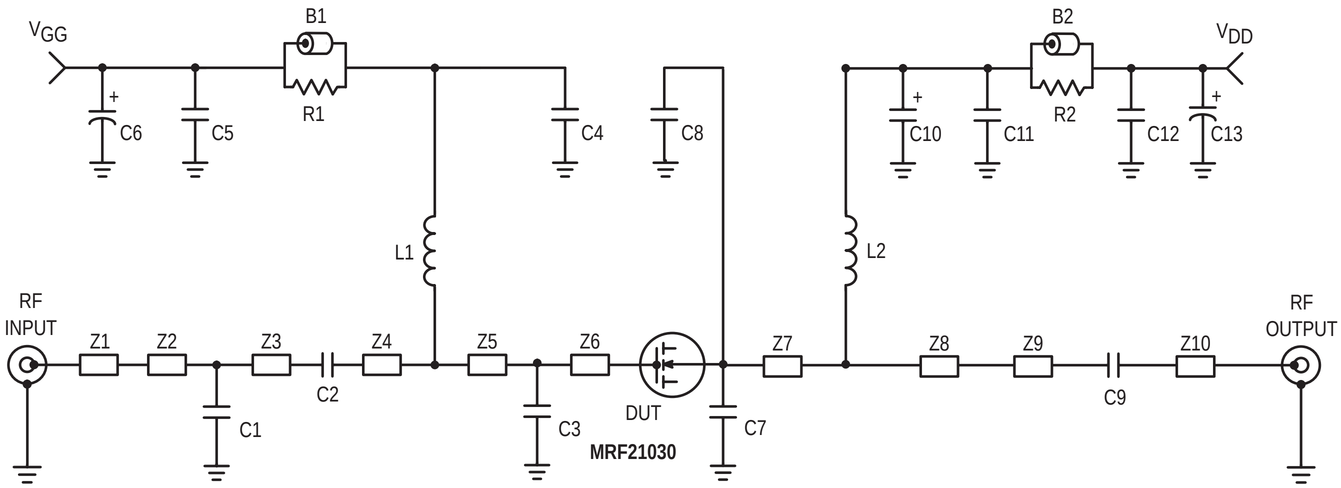
Downloaded from Elcodis.com electronic components distributor

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 = 20 µA)	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Current (V_{DS} = 28 Vdc, V_{GS} = 0)	I_{DSS}	—	—	1	µAdc
Gate–Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0)	I_{GSS}	—	—	1	µAdc
ON CHARACTERISTICS					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 100 µAdc)	$V_{GS(th)}$	2	3	4	Vdc
Gate Quiescent Voltage (V_{DS} = 28 Vdc, I_D = 250 mA)	$V_{GS(Q)}$	2	3.3	4.5	Vdc
Drain–Source On–Voltage (V_{GS} = 10 Vdc, I_D = 1 Adc)	$V_{DS(on)}$	—	0.29	0.4	Vdc
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 1 Adc)	g_{fs}	—	2	—	S
DYNAMIC CHARACTERISTICS					
Input Capacitance (Including Input Matching Capacitor in Package) (1) (V_{DS} = 28 Vdc, V_{GS} = 0, f = 1 MHz)	C_{iss}	—	98.5	—	pF
Output Capacitance (1) (V_{DS} = 28 Vdc, V_{GS} = 0, f = 1 MHz)	C_{oss}	—	37	—	pF
Reverse Transfer Capacitance (V_{DS} = 28 Vdc, V_{GS} = 0, f = 1 MHz)	C_{rss}	—	1.3	—	pF
FUNCTIONAL TESTS (In Motorola Test Fixture)					
Two–Tone Common–Source Amplifier Power Gain (V_{DD} = 28 Vdc, P_{out} = 30 W PEP, I_{DQ} = 250 mA, f1 = 2140.0 MHz, f2 = 2140.1 MHz)	G_{ps}	—	13	—	dB
Two–Tone Drain Efficiency (V_{DD} = 28 Vdc, P_{out} = 30 W PEP, I_{DQ} = 250 mA, f1 = 2140.0 MHz, f2 = 2140.1 MHz)	η	—	33	—	%
3rd Order Intermodulation Distortion (V_{DD} = 28 Vdc, P_{out} = 30 W PEP, I_{DQ} = 250 mA, f1 = 2140.0 MHz, f2 = 2140.1 MHz)	IMD	—	–30	—	dBc
Input Return Loss (V_{DD} = 28 Vdc, P_{out} = 30 W PEP, I_{DQ} = 250 mA, f1 = 2140.0 MHz, f2 = 2140.1 MHz)	IRL	—	–13	—	dB
Two–Tone Common–Source Amplifier Power Gain (V_{DD} = 28 Vdc, P_{out} = 30 W PEP, I_{DQ} = 250 mA, f1 = 2110.0 MHz, f2 = 2110.1 MHz and f1 = 2170.0 MHz, f2 = 2170.1 MHz)	G_{ps}	12	13	—	dB
Two–Tone Drain Efficiency (V_{DD} = 28 Vdc, P_{out} = 30 W PEP, I_{DQ} = 250 mA, f1 = 2110.0 MHz, f2 = 2110.1 MHz and f1 = 2170.0 MHz, f2 = 2170.1 MHz)	η	31	33	—	%
3rd Order Intermodulation Distortion (V_{DD} = 28 Vdc, P_{out} = 30 W PEP, I_{DQ} = 250 mA, f1 = 2110.0 MHz, f2 = 2110.1 MHz and f1 = 2170.0 MHz, f2 = 2170.1 MHz)	IMD	—	–30	–27.5	dBc
Input Return Loss (V_{DD} = 28 Vdc, P_{out} = 30 W PEP, I_{DQ} = 250 mA, f1 = 2110.0 MHz, f2 = 2110.1 MHz and f1 = 2170.0 MHz, f2 = 2170.1 MHz)	IRL	—	–13	–9	dB
Output Mismatch Stress (V_{DD} = 28 Vdc, P_{out} = 30 W CW, I_{DQ} = 250 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.

Downloaded from Elcodis.com electronic components distributor



B1, B2	Short Ferrite Beads	Z1	0.153″ x 0.087″ Microstrip
C1	1 pF, Chip Capacitor	Z2	0.509″ x 0.156″ Microstrip
C2	4.7 pF, Chip Capacitor	Z3	0.572″ x 0.087″ Microstrip
C3	0.5 pF, Chip Capacitor	Z4	0.509″ x 0.232″ Microstrip
C4	3.9 pF, Chip Capacitor	Z5	0.277″ x 0.143″ Microstrip
C5, C12	0.1 μF, Chip Capacitors	Z6	0.200″ x 0.305″ Microstrip
C6, C13	470 μF, 63 V, Electrolytic Chip Capacitors	Z7	0.200″ x 0.511″ Microstrip
C7, C8	0.3 pF, Chip Capacitors	Z8	0.510″ x 0.328″ Microstrip
C9	3.6 pF, Chip Capacitor	Z9	0.608″ x 0.081″ Microstrip
C10	22 μF, Tantalum Chip Capacitor	Board	0.030″ Glass Teflon®, TLX8-0300
C11	5.1 pF, Chip Capacitor		Taconix (ϵ_r = 2.55)
L1, L2	12.5 nH, Inductors		
R1, R2	12 Ω, Chip Resistors, 1206		

Figure 1. MRF21030 Schematic

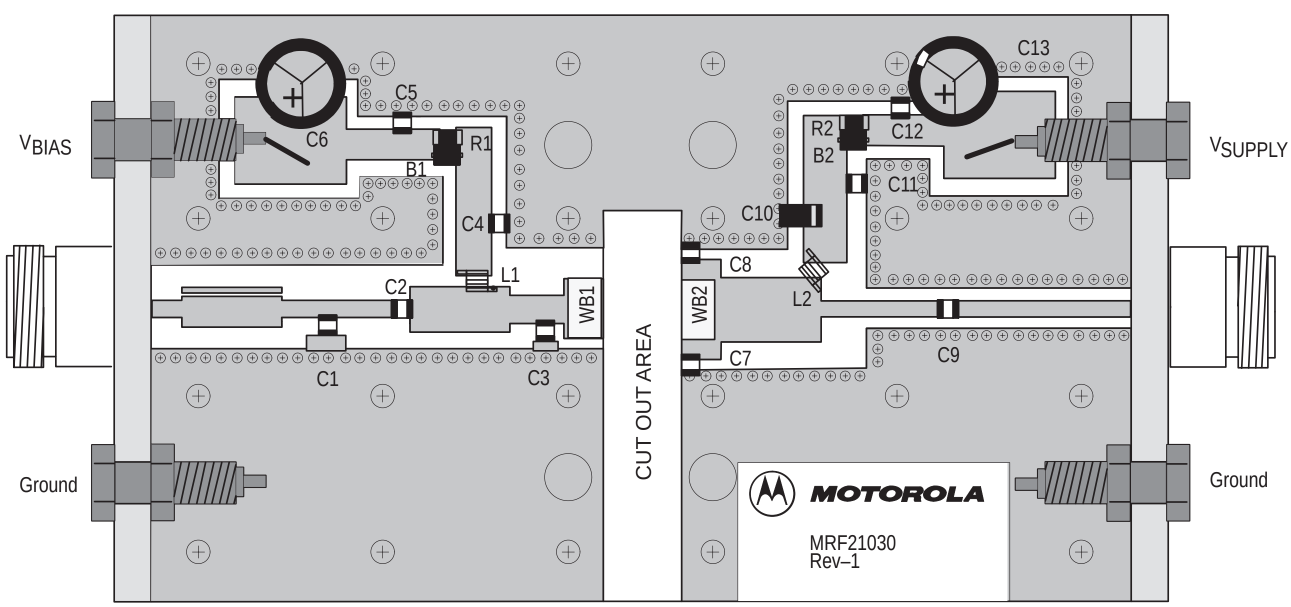


Figure 2. MRF21030 Populated PC Board Layout Diagram

Downloaded from Elcodis.com electronic components distributor

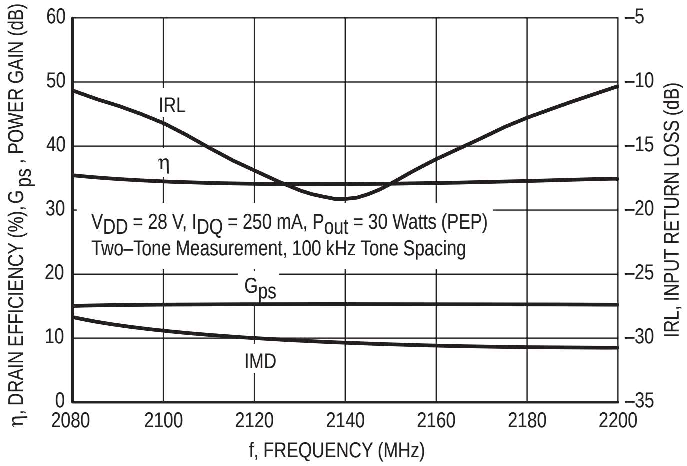


Figure 3. Class AB Broadband Circuit Performance

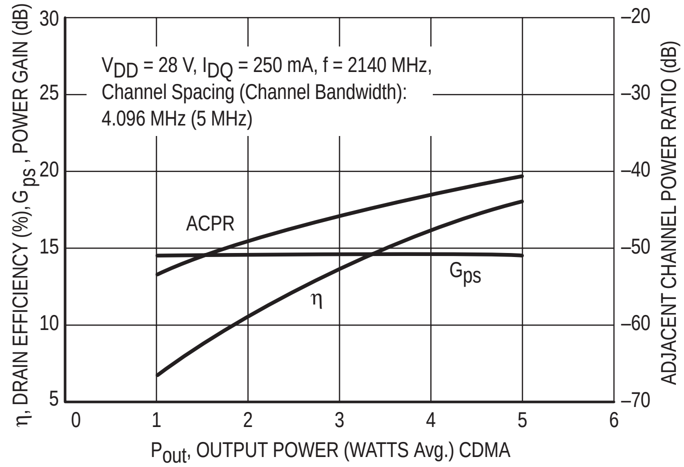


Figure 4. CDMA ACPR, Power Gain and Drain Efficiency versus Output Power

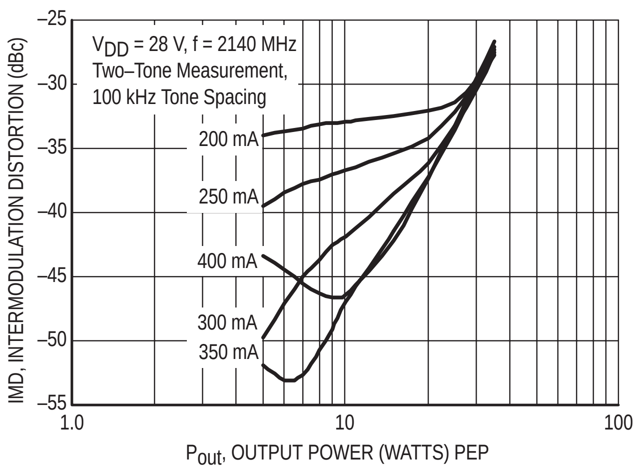


Figure 5. Intermodulation Distortion versus Output Power

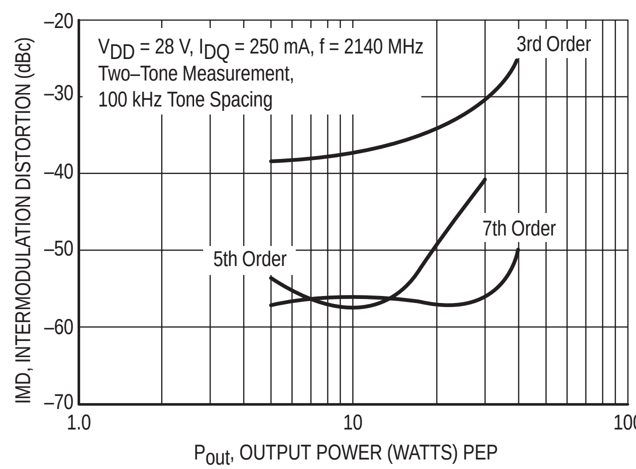


Figure 6. Intermodulation Distortion Products versus Output Power

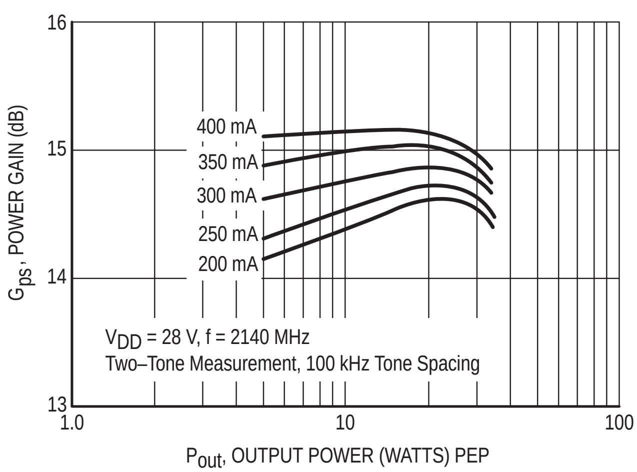


Figure 7. Power Gain versus Output Power

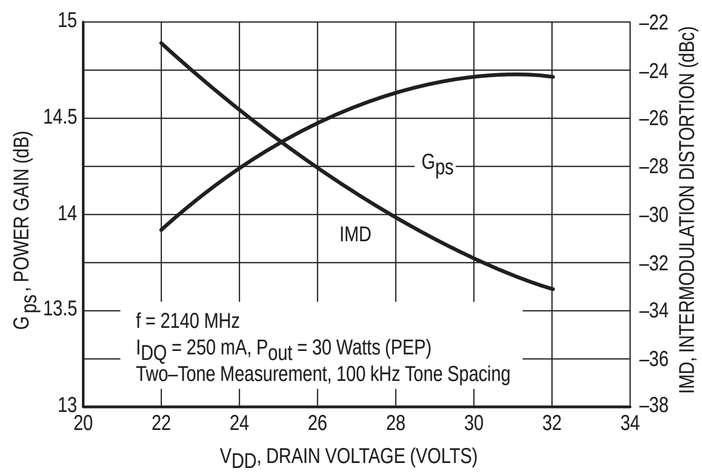
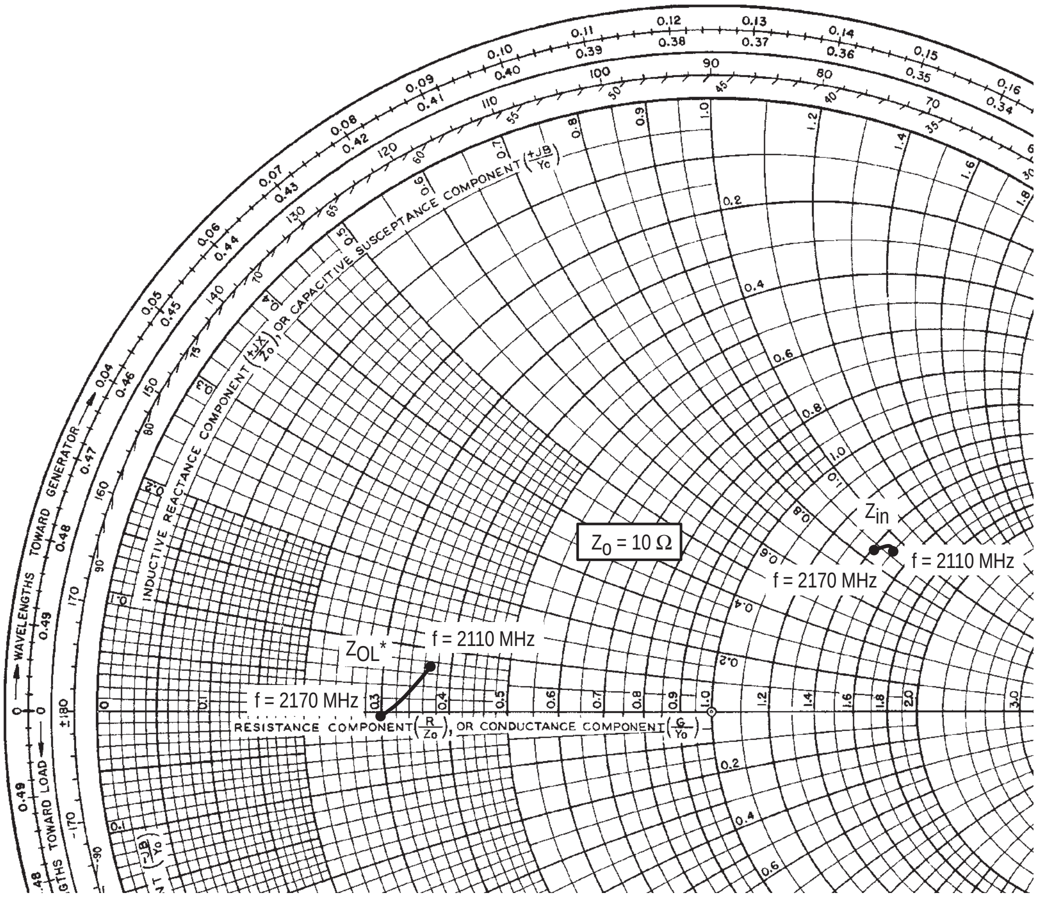


Figure 8. Power Gain and Intermodulation Distortion versus Supply Voltage

Downloaded from Elcodis.com electronic components distributor



V_{DD} = 28 V, I_{DQ} = 250 mA, P_{out} = 30 Watts (PEP)

f MHz	Z_{in} Ω	$Z_{OL}*$ Ω
2110	15.3 + j9.4	3.7 + j0.78
2140	14.6 + j9.4	3.4 + j0.37
2170	14.3 + j8.8	3.0 – j0.13

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.

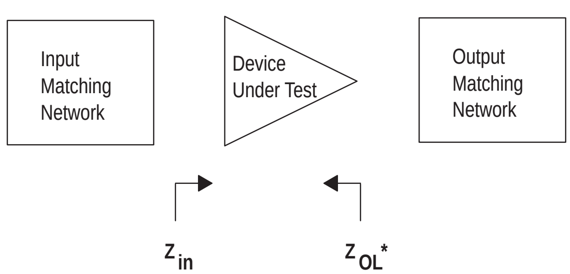


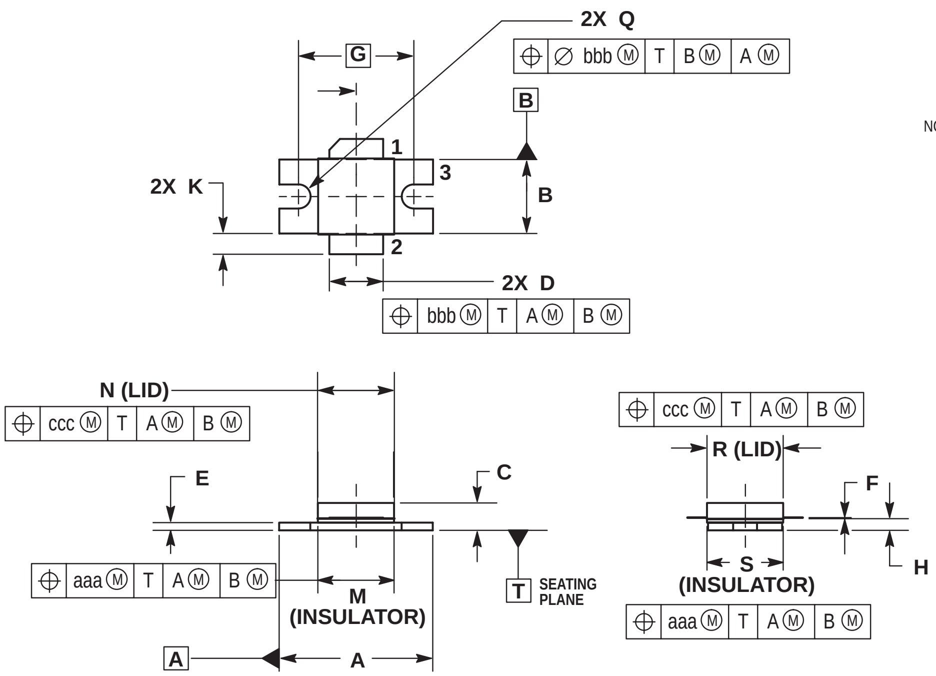
Figure 9. Series Equivalent Input and Output Impedance

Downloaded from Elcodis.com electronic components distributor

NOTES

Downloaded from Elcodis.com electronic components distributor

PACKAGE DIMENSIONS

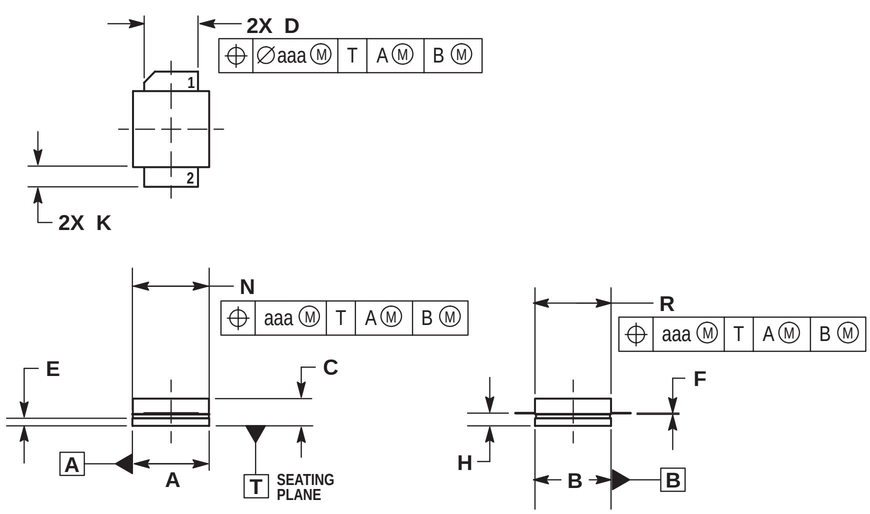


NOTES:
1. CONTROLLING DIMENSION: INCH.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSION H IS MEASURED 0.030 INCH AWAY FROM FLANGE.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	.795	.805	20.19	20.44
B	.380	.390	9.65	9.9
C	.125	.160	3.17	4.06
D	.275	.285	6.98	7.24
E	.035	.045	0.89	1.14
F	.003	.006	0.07	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	.110	.130	2.79	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:
PIN 1. DRAIN
2. GATE
3. SOURCE

CASE 465E–02
ISSUE C
(MRF21030)



NOTES:
1. CONTROLLING DIMENSION: INCH.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994.
3. DIMENSION H IS MEASURED .30 (0.762) AWAY FROM FLANGE.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	.395	.405	10.03	10.29
B	.395	.405	10.03	10.29
C	.125	.16	3.18	4.06
D	.275	.285	6.98	7.24
E	.035	.045	0.89	1.14
F	.003	.006	0.08	0.15
H	.057	.067	1.45	1.70
K	.092	.122	2.34	3.10
N	.392	.4	9.96	10.16
R	.392	.4	9.96	10.16
aaa	.015		0.38	

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

CASE 465F–02
ISSUE A
(MRF21030S)

Downloaded from Elcodis.com electronic components distributor

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. “Typical” parameters which may be provided in Motorola data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including “Typicals” must be validated for each customer application by customer’s technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and Ⓜ are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

How to reach us:
USA / EUROPE / Locations Not Listed: Motorola Literature Distribution; P.O. Box 5405, Denver, Colorado 80217. 1–303–675–2140 or 1–800–441–2447

JAPAN: Motorola Japan Ltd.; SPS, Technical Information Center, 3–20–1, Minami–Azabu. Minato–ku, Tokyo 106–8573 Japan. 81–3–3440–3569

ASIA / PACIFIC: Motorola Semiconductors H.K. Ltd.; Silicon Harbour Centre, 2 Dai King Street, Tai Po Industrial Estate, Tai Po, N.T., Hong Kong. 852–26668334

Technical Information Center: 1–800–521–6274

HOME PAGE: http://www.motorola.com/semiconductors/

Downloaded from Elcodis.com electronic components distributor