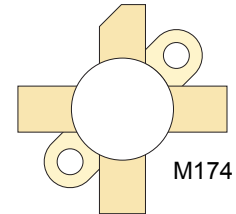



## RF POWER VERTICAL MOSFET

The VRF161 is a gold-metallized silicon n-channel RF power transistor designed for broadband commercial and military applications requiring high power and gain without compromising reliability, ruggedness, or inter-modulation distortion.



### FEATURES

- Improved Ruggedness  $V_{(BR)DSS} = 170V$
- 200W with 24dB Typical Gain @ 30MHz, 50V
- 200W with 14dB Typical Gain @ 150MHz, 50V
- Excellent Stability & Low IMD
- Available in Matched Pairs
- 70:1 Load VSWR Capability at Specified Operating Conditions
- Nitride Passivated
- Refractory Gold Metallization
- High Power Replacement for MRF151
- RoHS Compliant 

### Maximum Ratings

All Ratings:  $T_c = 25^\circ C$  unless otherwise specified


Symbol	Parameter	VRF161(MP)	Unit
$V_{DSS}$	Drain-Source Voltage	170	V
$I_D$	Continuous Drain Current @ $T_c = 25^\circ C$	20	A
$V_{GS}$	Gate-Source Voltage	$\pm 40$	V
$P_D$	Total Device dissipation @ $T_c = 25^\circ C$	350	W
$T_{STG}$	Storage Temperature Range	-65 to 150	$^\circ C$
$T_J$	Operating Junction Temperature	200	

### Static Electrical Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage ( $V_{GS} = 0V, I_D = 100mA$ )	170	180		V
$V_{DS(ON)}$	On State Drain Voltage ( $I_{D(ON)} = 10A, V_{GS} = 10V$ )		2.0	2.3	
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{DS} = 100V, V_{GS} = 0V$ )			1	mA
$I_{GSS}$	Gate-Source Leakage Current ( $V_{DS} = \pm 20V, V_{GS} = 0V$ )			1.0	$\mu A$
$g_{fs}$	Forward Transconductance ( $V_{DS} = 10V, I_D = 5A$ )	6.0	8.1		mhos
$V_{GS(TH)}$	Gate Threshold Voltage ( $V_{DS} = 10V, I_D = 100mA$ )	2.9	3.6	4.4	V

### Thermal Characteristics

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to Case Thermal Resistance			0.50	$^\circ C/W$

 **CAUTION:** These Devices are Sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed.

## Dynamic Characteristics

VRF161(MP)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$C_{iss}$	Input Capacitance	$V_{GS} = 0V$		500		pF
$C_{oss}$	Output Capacitance	$V_{DS} = 150V$		180		
$C_{rss}$	Reverse Transfer Capacitance	$f = 1MHz$		20		

## Functional Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
$G_{PS}$	$f_1 = 30MHz, V_{DD} = 50V, I_{DQ} = 250mA, P_{out} = 200W$	20	24		dB
$G_{PS}$	$f = 150MHz, V_{DD} = 50V, I_{DQ} = 250mA, P_{out} = 200W$		14		
$\eta_D$	$f_1 = 30MHz, V_{DD} = 50V, I_{DQ} = 250mA, P_{out} = 200W$		50		%
IMD <sub>(dB)</sub>	$f_1 = 30MHz, f_2 = 30.001MHz, V_{DD} = 50V, I_{DQ} = 250mA, P_{out} = 200W_{PEP}^1$		-30		dBc
$\psi$	$f = 30MHz, V_{DD} = 50V, I_{DQ} = 250mA, P_{out} = 200W$ CW 70:1 VSWR - All Phase Angles, 0.2mSec X 20% Duty Factor	No Degradation in Output Power			

1. To MIL-STD-1311 Version A, test method 2204B, Two Tone, Reference Each Tone

Microsemi reserves the right to change, without notice, the specifications and information contained herein.

## Typical Performance Curves

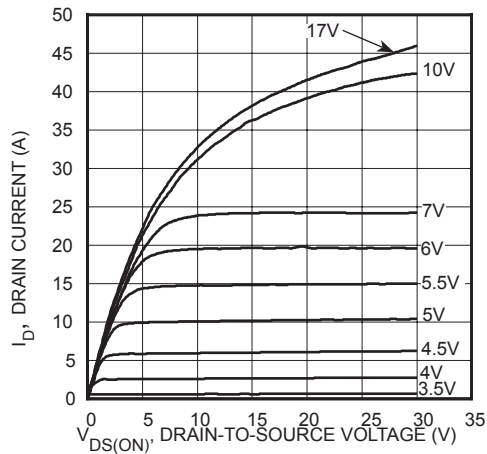


FIGURE 1, Output Characteristics

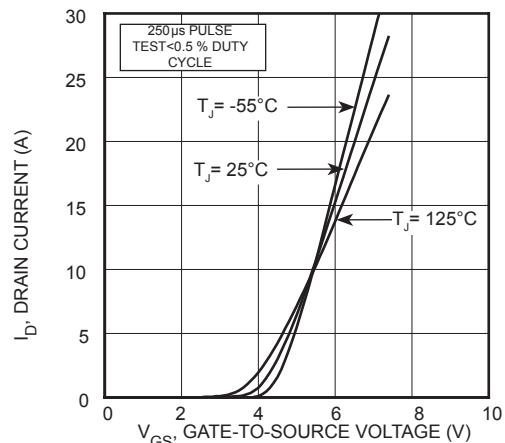


FIGURE 2, Transfer Characteristics

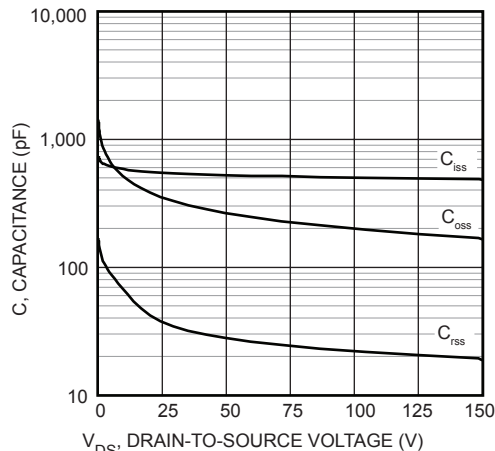


FIGURE 3, Capacitance vs Drain-to-Source Voltage

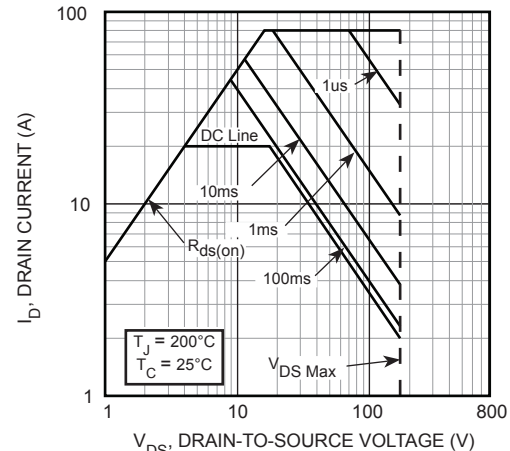


FIGURE 4, Forward Safe Operating Area

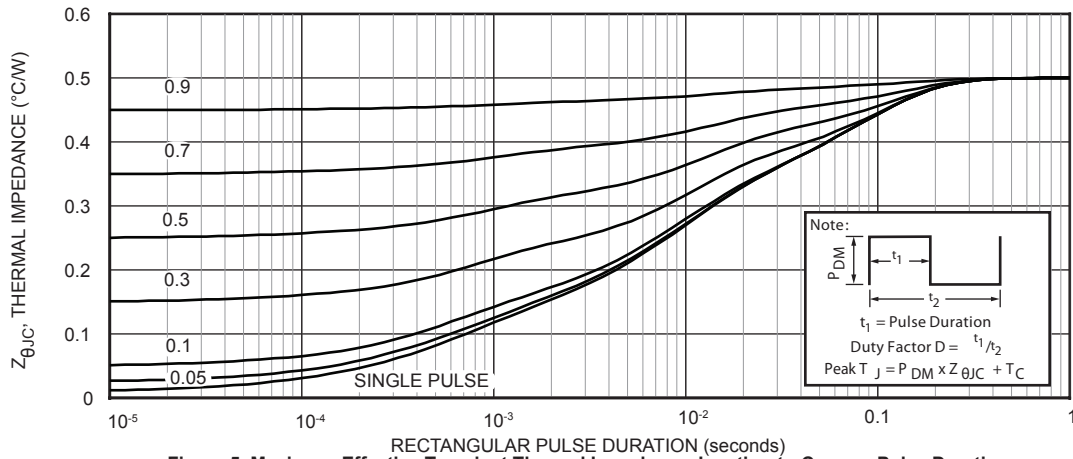


Figure 5. Maximum Effective Transient Thermal Impedance Junction-to-Case vs Pulse Duration

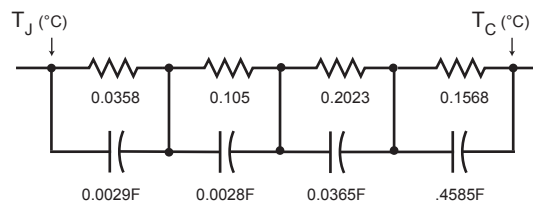


Figure 5a. Maximum Effective Transient Thermal Impedance Junction-to-Case vs Pulse Duration

Table 1. Typical Class AB Large Signal Impedances

freq	Zin*	Zout*
2.00MHz	24- j4.01	6.15-j0.13
13.56MHz	11.3- j10.6	6.11-j0.9
30MHz	5.36- j6.7	5.68-j1.81
100MHz	3.5- j2.91	2.35-j4.12
150MHz	3.45- j1.83	1.81-j2.99

Zin - gate shunted with 25 ohms Idq = .25A Zol = conj of opt load for 200w out at Vdd = 50V

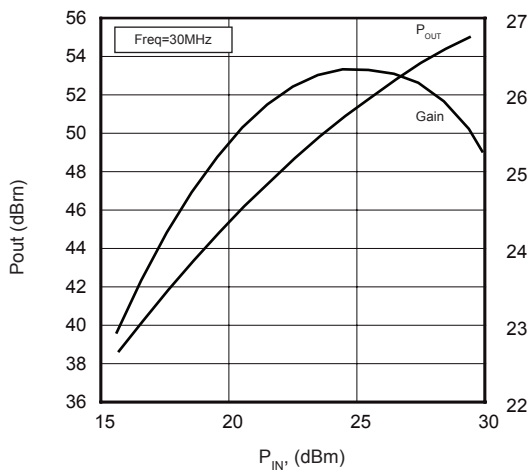


Figure 6. P<sub>OUT</sub> and Gain vs P<sub>IN</sub>

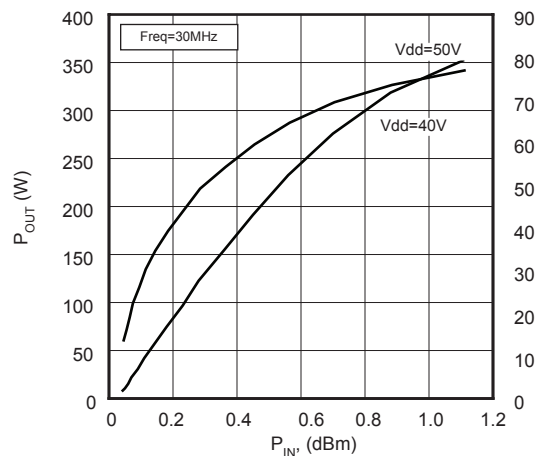
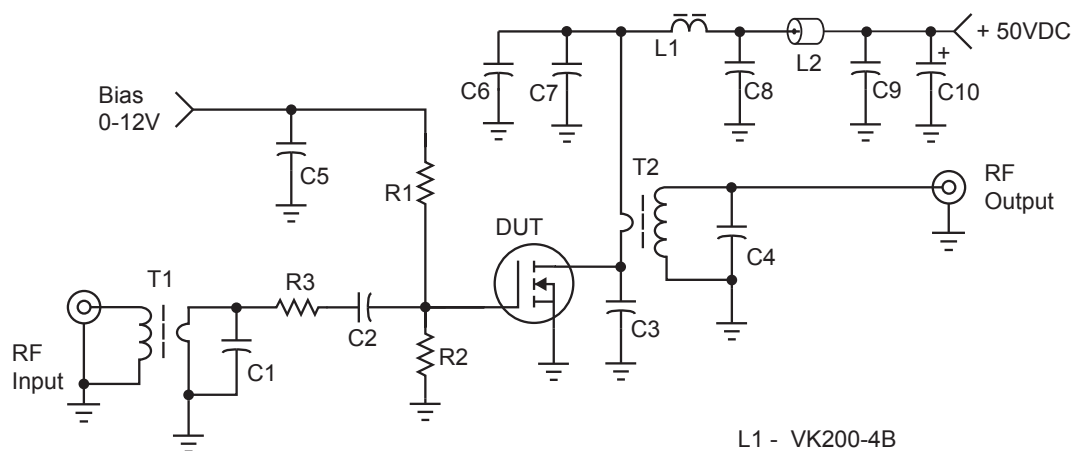


Figure 7. Eff and P<sub>OUT</sub> vs. P<sub>IN</sub>

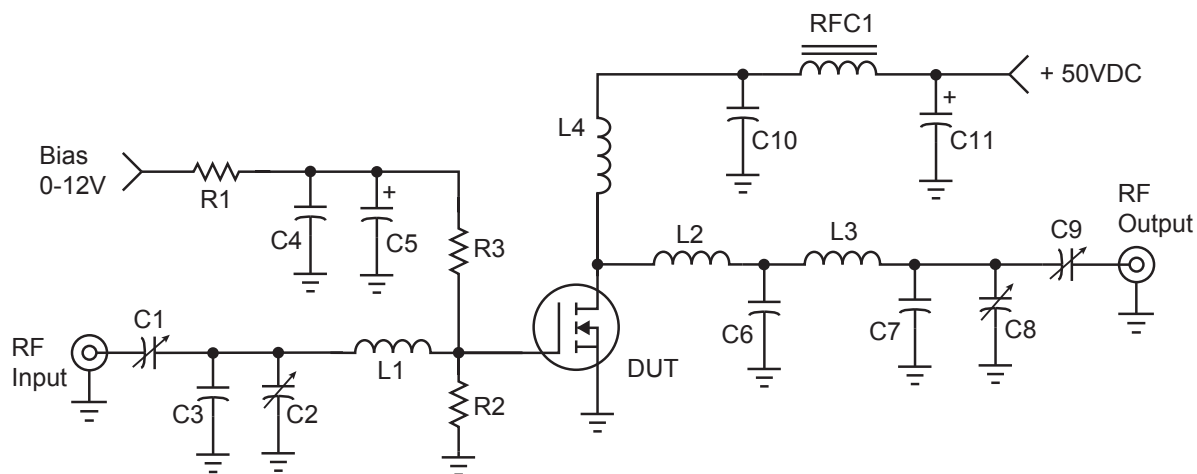
## 30 MHz test Circuit



C1 -- 470 pF ATC 700B  
 C2, C5, C6 - C9 -- 0.1uF 100V  
 C3 -- 220pF clad mica  
 C4 -- 15pF, ATC 700B  
 C10 -- 10uF, 100V Electrolytic

L1 - VK200-4B  
 L2 -- 2 Ferrite beads, 2.0 uH  
 R1, R2 -- 100Ω, 2W SMT  
 R3 -- 1Ω, 2W SMT  
 T1 -- 9:1 Transformer  
 T2 -- 1:9 Transformer

## 150 MHz test Circuit



C1, C2, C8 -- Arco 463 or equivalent  
 C3 -- 25pF, Unelco  
 C4 -- 0.1uF, Ceramic SMT 50V  
 C5 -- 1.0 uF, 15 WV Tantalum  
 C6 -- 250pF, Unelco J101  
 C7 -- 25pF, Unelco J101  
 C9 -- Arco 262 or equivalent

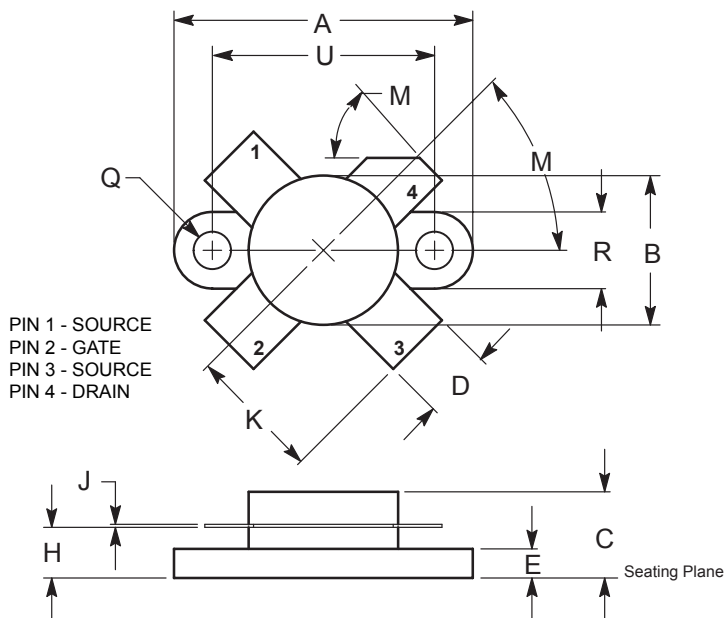
C10 -- 50nF, Ceramic SMT 100V  
 C11 -- 15uF, 63WV Electrolytic  
 L1 -- 3/4", #18 into Hairpin  
 L2 -- Printed Line, 0.200" W x 0.500" L  
 L3 -- 1", #16 into Hairpin approx 16nH  
 L4 -- 2 turns #16, 5/16" ID  
 RFC1 - VK200-4B  
 R1-R3 -- 330 Ω, 1/4W Carbon

Adding MP at the end of P/N specifies a matched pair where  $V_{GS(TH)}$  is matched between the two parts.  $V_{TH}$  values are marked on the devices per the following table.

Code	Vth Range	Code 2	Vth Range
A	2.900 - 2.975	M	3.650 - 3.725
B	2.975 - 3.050	N	3.725 - 3.800
C	3.050 - 3.125	P	3.800 - 3.875
D	3.125 - 3.200	R	3.875 - 3.950
E	3.200 - 3.275	S	3.950 - 4.025
F	3.275 - 3.350	T	4.025 - 4.100
G	3.350 - 3.425	W	4.100 - 4.175
H	3.425 - 3.500	X	4.175 - 4.250
J	3.500 - 3.575	Y	4.250 - 4.325
K	3.575 - 3.650	Z	4.325 - 4.400

$V_{TH}$  values are based on Microsemi measurements at datasheet conditions with an accuracy of 1.0%.

**.5" SOE Package Outline**  
**All Dimensions are  $\pm .005$**



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.960	0.990	24.39	25.14
B	0.465	0.510	11.82	12.95
C	0.229	0.275	5.82	6.98
D	0.216	0.235	5.49	5.96
E	0.084	0.110	2.14	2.79
H	0.144	0.178	3.66	4.52
J	0.003	0.007	0.08	0.17
K	0.435		11.0	
M	45° NOM		45° NOM	
Q	0.115	0.130	2.93	3.30
R	0.246	0.255	6.25	6.47
U	0.720	0.730	18.29	18.54


**Microsemi Headquarters**

One Enterprise, Aliso Viejo,  
CA 92656 USA  
Within the USA: +1 (800) 713-4113  
Outside the USA: +1 (949) 380-6100  
Sales: +1 (949) 380-6136  
Fax: +1 (949) 215-4996  
Email: sales.support@microsemi.com  
www.microsemi.com

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