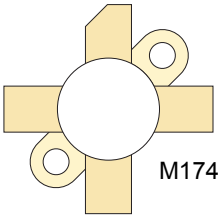
Microsemi
a Microchip company

VRF161(MP)

50V, 200W, 150MHz

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°C unless otherwise specified

Symbol	Parameter	VRF161(MP)	Unit
V_{DSS}	Drain-Source Voltage	170	V
I_D	Continuous Drain Current @ T_C = 25°C	20	A
V_{GS}	Gate-Source Voltage	±40	V
P_D	Total Device dissipation @ T_C = 25°C	350	W
T_{STG}	Storage Temperature Range	-65 to 150	°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} = ±20V, V_{DS} = 0V)			1.0	µA
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	°C/W

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

Dynamic Characteristics

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		
η_D	f_1 = 30MHz, V_{DD} = 50V, I_{DQ} = 250mA, P_{out} = 200W		50		%
$IMD_{(d3)}$	f_1 = 30MHz, f_2 = 30.001MHz, V_{DD} = 50V, I_{DQ} = 250mA, P_{out} = 200W_{PEP} [1]		-30		dBc
ψ	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

Typical Performance Curves

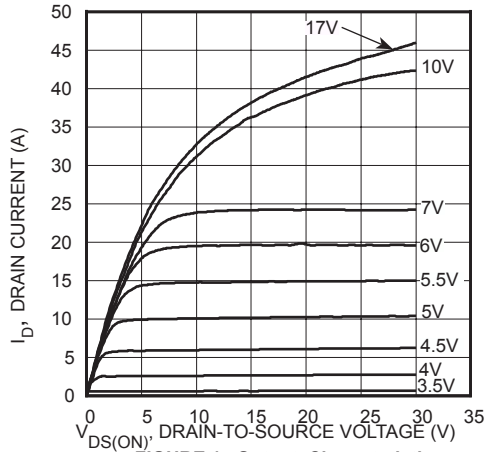


FIGURE 1, Output Characteristics

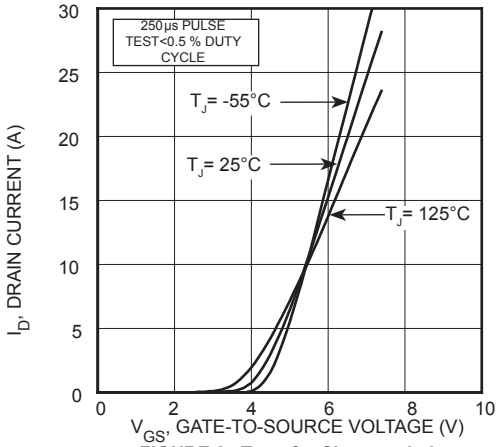


FIGURE 2, Transfer Characteristics

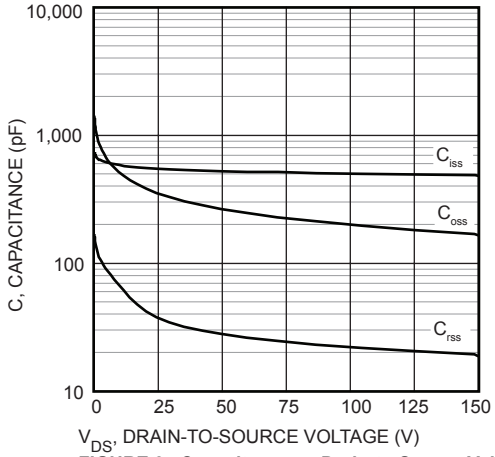


FIGURE 3, Capacitance vs Drain-to-Source Voltage

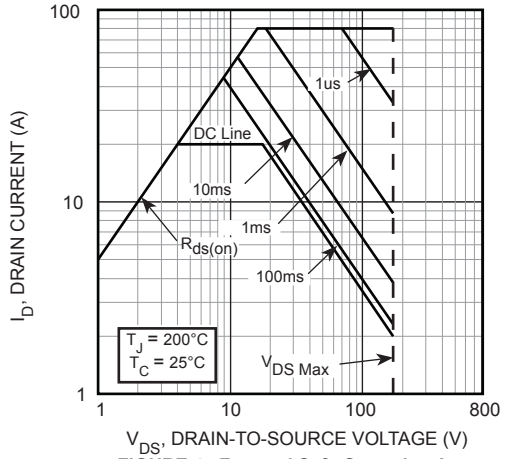


FIGURE 4, Forward Safe Operating Area

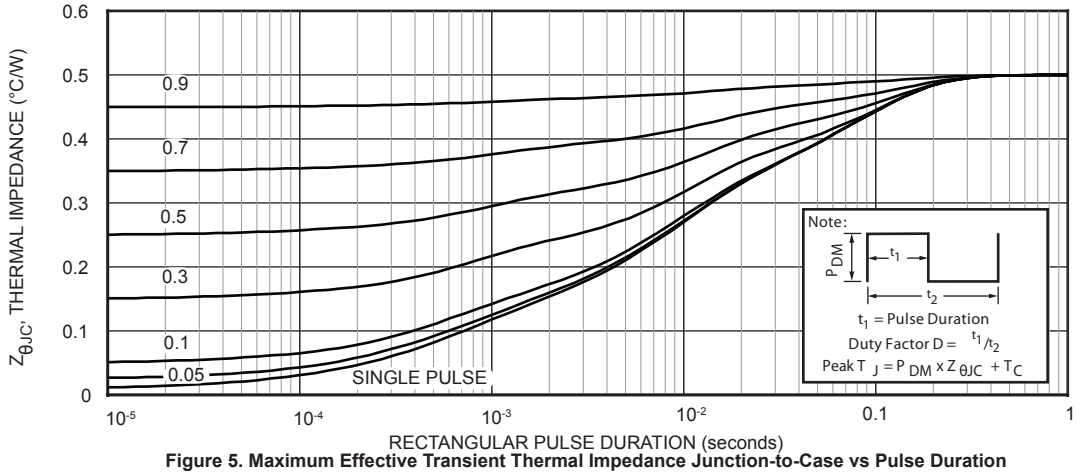
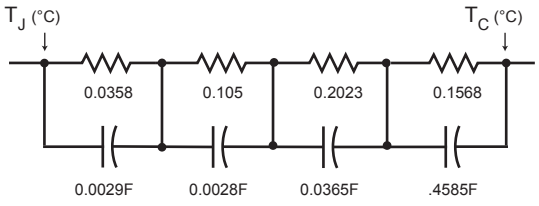


Figure 5. Maximum Effective Transient Thermal Impedance Junction-to-Case vs Pulse Duration



RECTANGULAR PULSE DURATION (seconds)

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

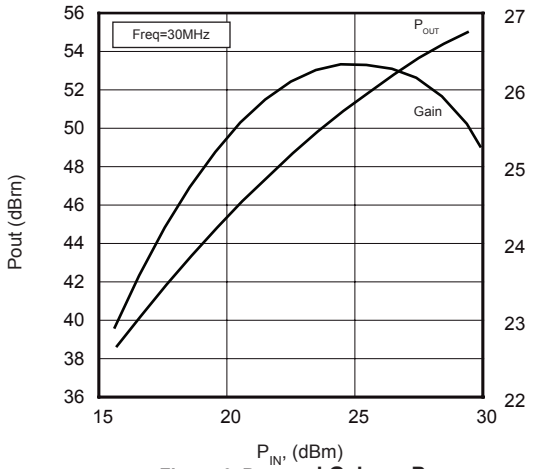


Figure 6. P_{OUT} and Gain vs P_{IN}

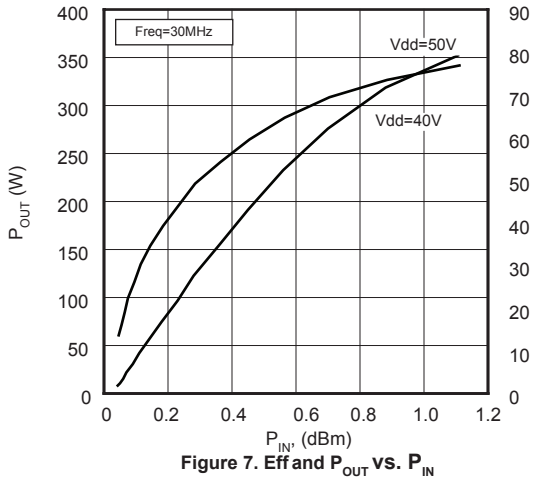
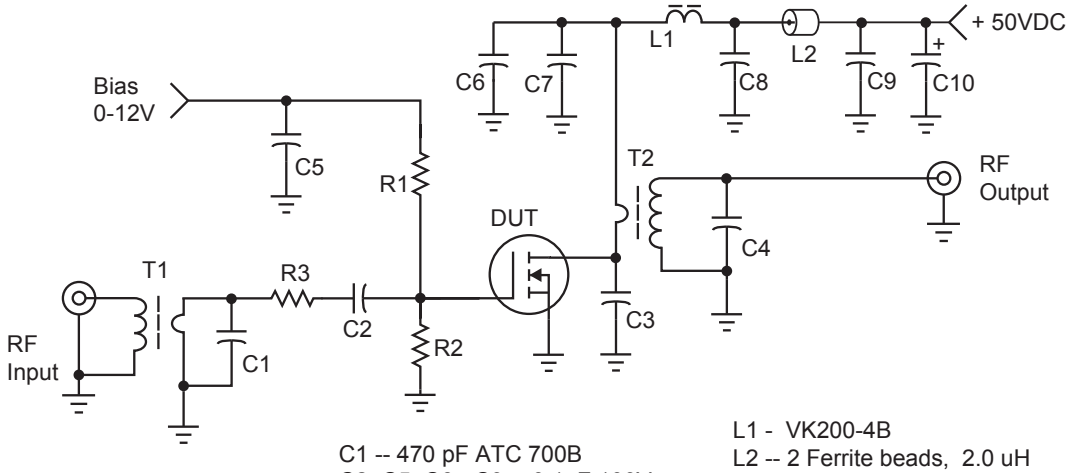


Figure 7. Eff and P_{OUT} vs. P_{IN}

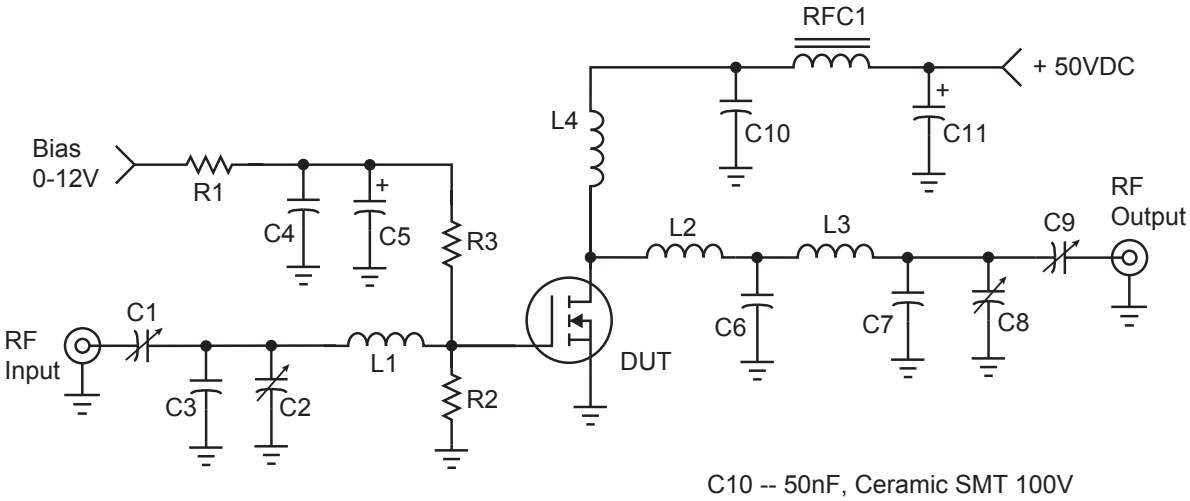
30 MHz test Circuit



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

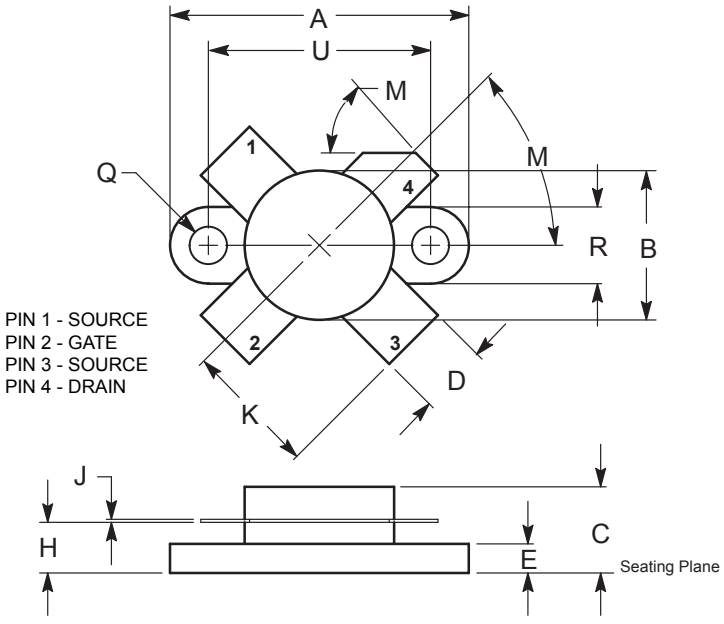
C10 -- 50nF, Ceramic SMT 100V
C11 -- 15uF, 63WV Electrolytic
L1 -- 3/4", #18 into Hairpin
L2 -- Printed Line, 0.200" W x 0.500" L
L3 -- 1", #16 into Hairpin approx 16nH
L4 -- 2 turns #16, 5/16" ID
RFC1 - VK200-4B
R1-R3 -- 330 Ω, 1/4W Carbon

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 ± .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