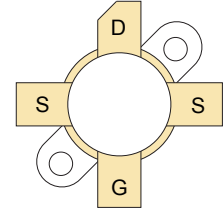



## RF POWER VERTICAL MOSFET

The VRF3933 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  $V_{(BR)DSS} = 250V$
- 300W with 22dB Typ. Gain @ 30MHz, 100V
- Excellent Stability & Low IMD
- Common Source Configuration
- Available in Matched Pairs
- 3:1 Load VSWR Capability at Specified Operating Conditions
- Nitride Passivated
- Refractory Gold Metallization
- Improved Replacement for SD3933
- Thermally Enhanced Package
- RoHS Compliant 

### Maximum Ratings

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


Symbol	Parameter	VRF3933	Unit
$V_{DSS}$	Drain-Source Voltage	250	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 @ $T_c = 25^\circ C$	648	W
$T_{STG}$	Storage Temperature Range	-65 to 150	$^\circ C$
$T_J$	Operating Junction Temperature Max	200	

### Static Electrical Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage ( $V_{GS} = 0V, I_D = 100mA$ )	250	260		V
$V_{DS(ON)}$	On State Drain Voltage ( $I_{D(ON)} = 10A, V_{GS} = 10V$ )		2.7	4.0	
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{DS} = 100V, V_{GS} = 0V$ )			2.0	mA
$I_{GSS}$	Gate-Source Leakage Current ( $V_{DS} = \pm 20V, V_{GS} = 0V$ )			2.0	$\mu A$
$g_{fs}$	Forward Transconductance ( $V_{DS} = 10V, I_D = 10A$ )	8	12		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			0.27	$^\circ C/W$

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

## Dynamic Characteristics

VRF3933(MP)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$C_{ISS}$	Input Capacitance	$V_{GS} = 0V$		850		pF
$C_{OSS}$	Output Capacitance	$V_{DS} = 50V$		300		
$C_{RSS}$	Reverse Transfer Capacitance	$f = 1MHz$		30		

## Functional Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
$G_{PS}$	$f_1 = 30MHz, V_{DD} = 100V, I_{DQ} = 250mA, P_{out} = 300W$	23	26		dB
$\eta_D$	$f_1 = 30MHz, V_{DD} = 100V, I_{DQ} = 250mA, P_{out} = 300W$		50		%
$\Psi$	$f_1 = 30MHz, V_{DD} = 100V, I_{DQ} = 250mA, P_{out} = 300W$ 3:1 VSWR - All Phase Angles	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

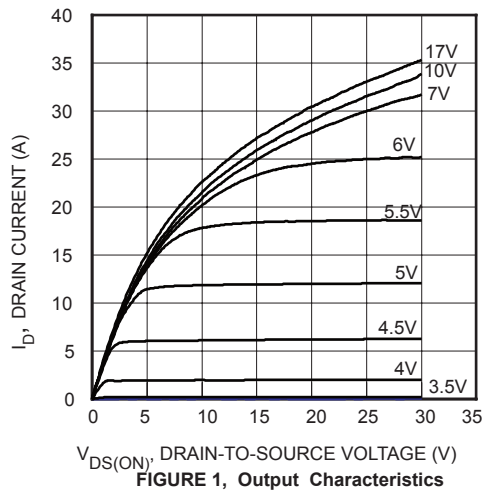


FIGURE 1, Output Characteristics

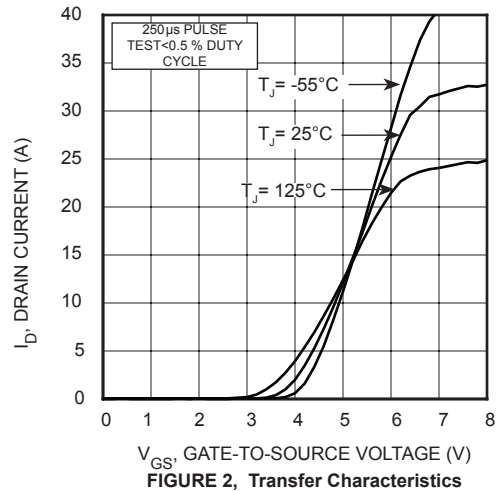


FIGURE 2, Transfer Characteristics

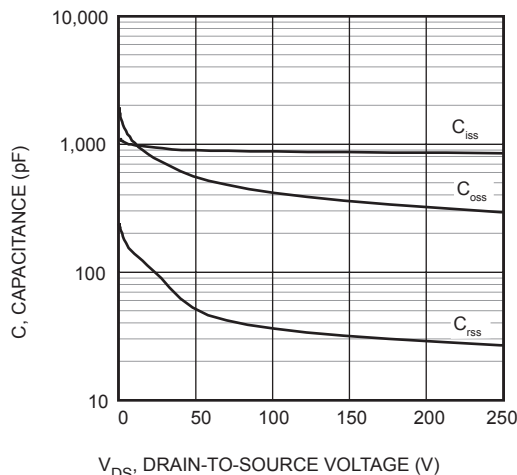


FIGURE 3, Capacitance vs Drain-to-Source Voltage

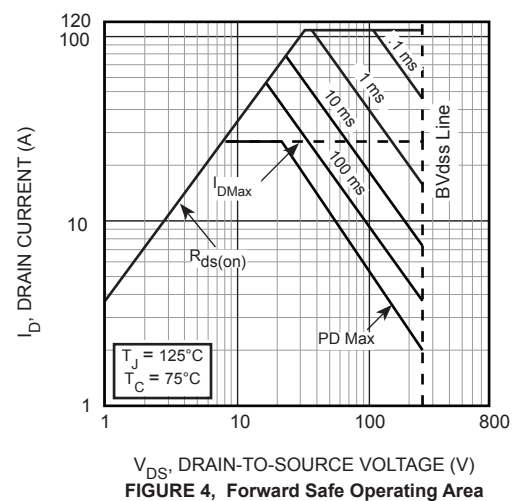


FIGURE 4, Forward Safe Operating Area

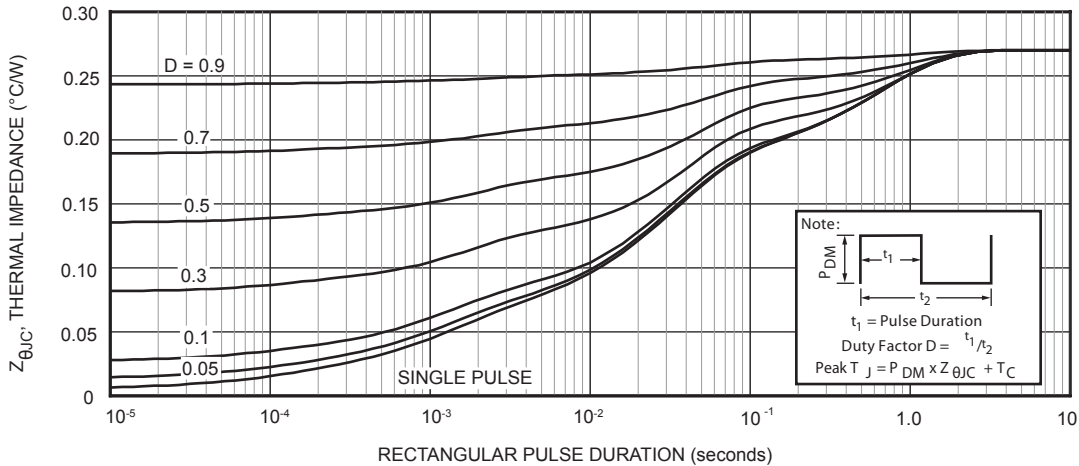


Figure 5. Maximum Effective Transient Thermal Impedance Junction-to-Case vs Pulse Duration

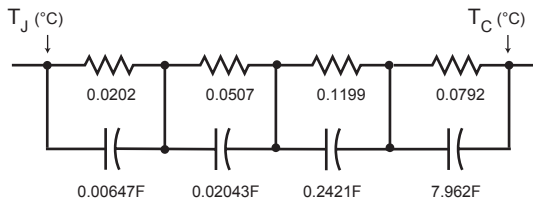


FIGURE 5b, TRANSIENT THERMAL IMPEDANCE MODEL

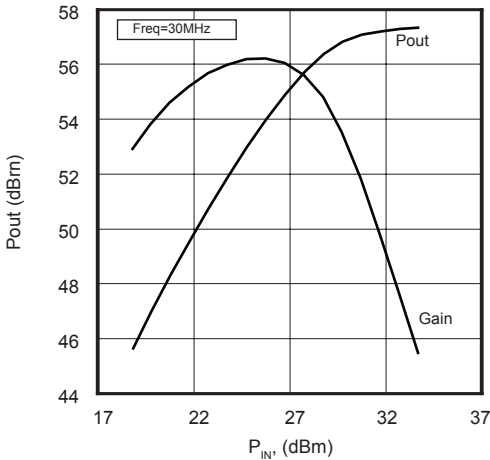


Figure 6. P<sub>OUT</sub> and Gain vs P<sub>IN</sub>

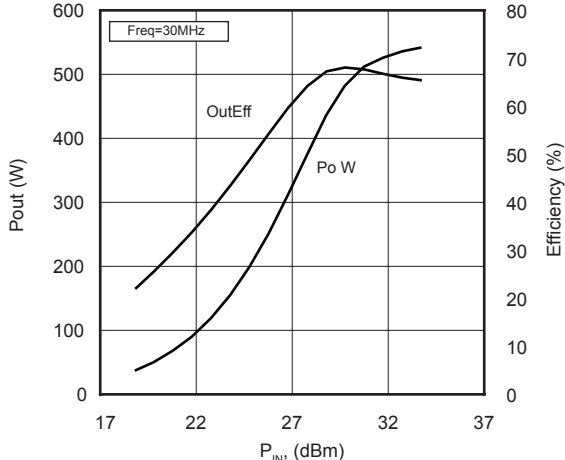


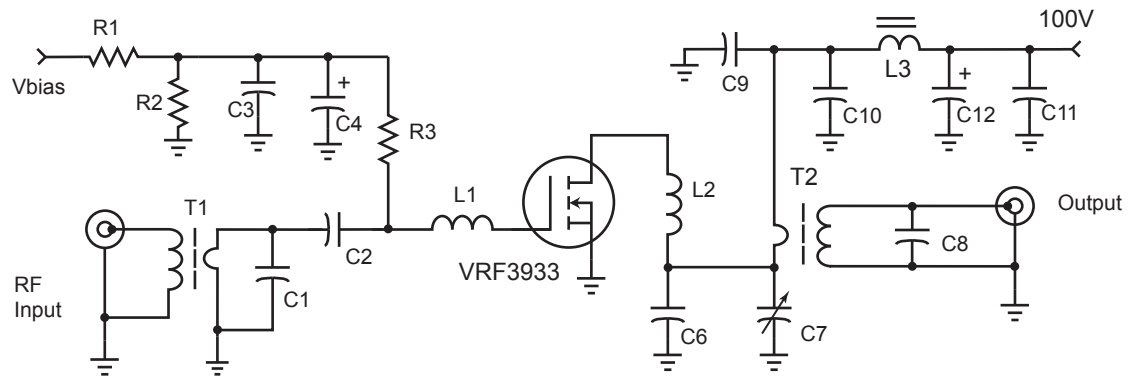
Figure 7. Eff and P<sub>OUT</sub> vs. P<sub>IN</sub>

Table 1 - Typical Class AB Large Signal Input - Output Impedance

Freq. (MHz)	Z <sub>in</sub>	Z <sub>out</sub>
2	21 - j 8.5	14.1 - j 0.6
13.5	4.5 - j 6.5	12.9 - j 4
27.1	2.9 - j 3.1	9.7 - j 6.6
40.7	2.5 - j 2	7.6 - j 7
65	2.4 - j 2.07	4.5 - j 6.6

Z<sub>IN</sub> - Gate shunted with 25Ω I<sub>dq</sub> = 250mA  
 Z<sub>OL</sub> - Conjugate of optimum load for 300 Watts output at V<sub>dd</sub>=50V

30 MHz Test Circuit



- C1 1200pF ATC100B ceramic
- C2, C3 0.1uF 50V 1206 SMT
- C9-C11 .047uF NPO 150V 1218 SMT
- C6 100 pF metal clad mica
- C7 ARCO 462 mica trimmer
- C8 15 pF ATC 100E ceramic
- C4, C12 10uF 100V Electrolytic
- L1 23 nH - 2t #18 0.2"d .2"l

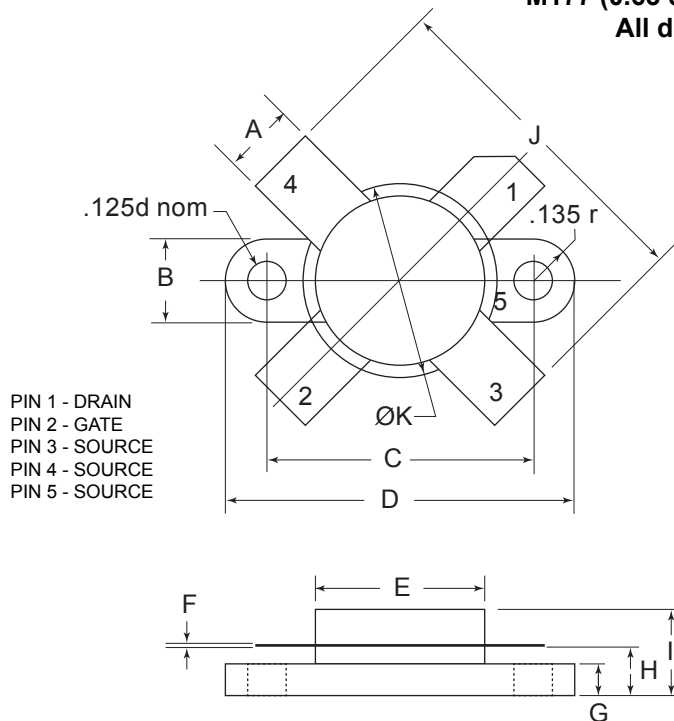
- L2 62 nH - 3t #12 0.31"dia
- L3 2t #16 on 2x 267300081 .5" bead
- R1-R2 1k  $\Omega$  1/4W
- R3 100  $\Omega$  1W
- T1 9:1 transformer 3t #24 teflon on RF Parts Co. T1/2 transformer core
- T2 4:1 transformer 2t 3-ply #16 teflon on RF Parts Co. T1 transformer core

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%.

**M177 (0.63 dia. SOE) Mechanical Data**  
**All dimensions are  $\pm 0.005$**



DIM	MIN	TYP	MAX
A	0.225	0.230	0.235
B	0.265	0.270	0.275
C	0.860	0.865	0.870
D	1.130	1.135	1.140
E	0.545	0.550	0.555
F	0.003	0.005	0.007
G	0.098	0.103	0.108
H	0.150	0.160	0.170
I			0.280
J	1.080	1.100	1.120
K	0.625	0.630	0.635

**HAZARDOUS MATERIAL WARNING:** The ceramic portion of the device below the lead plane is beryllium oxide. Beryllium oxide dust is highly toxic when inhaled. Care must be taken during handling and mounting to avoid damage to this area. These devices must never be thrown away with general industrial or domestic waste. BeO substrate weight: 0.703g. Percentage of total module weight which is BeO: 9%.

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