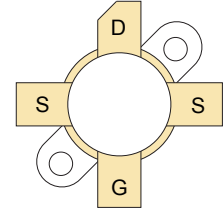



## RF POWER VERTICAL MOSFET

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

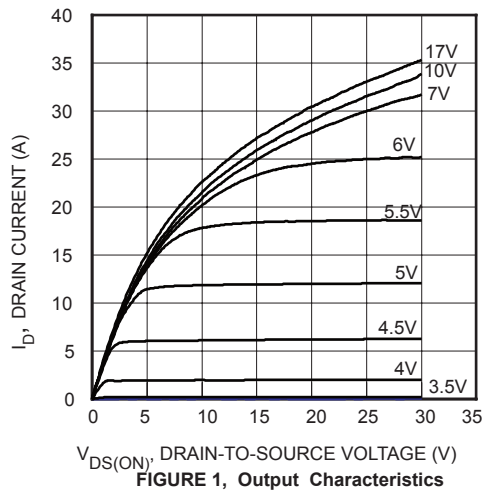


FIGURE 1, Output Characteristics

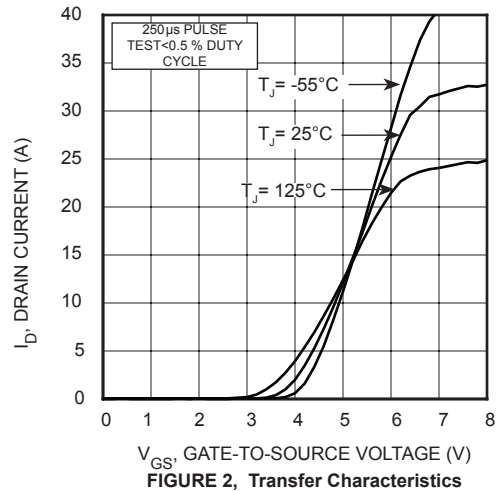


FIGURE 2, Transfer Characteristics

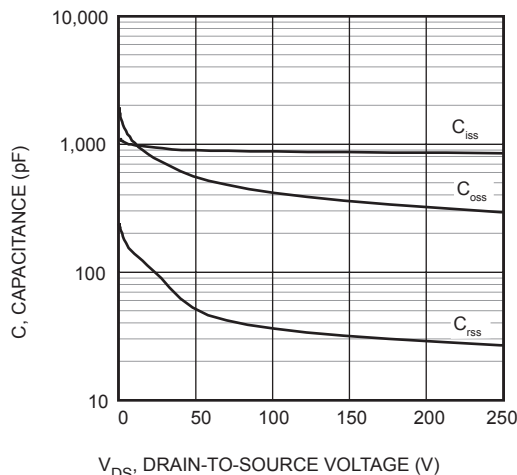


FIGURE 3, Capacitance vs Drain-to-Source Voltage

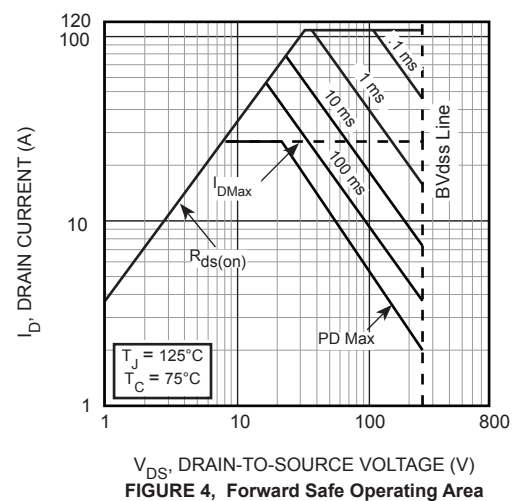


FIGURE 4, Forward Safe Operating Area

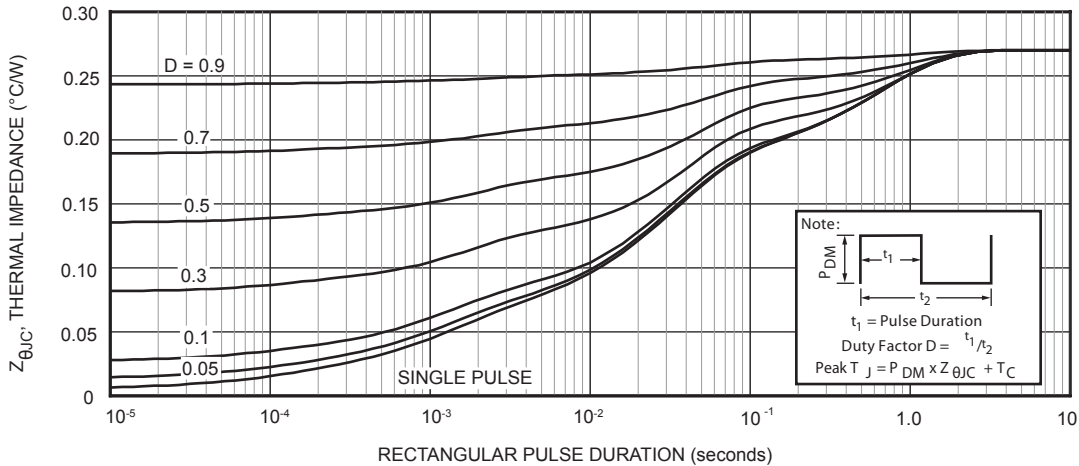


Figure 5. Maximum Effective Transient Thermal Impedance Junction-to-Case vs Pulse Duration

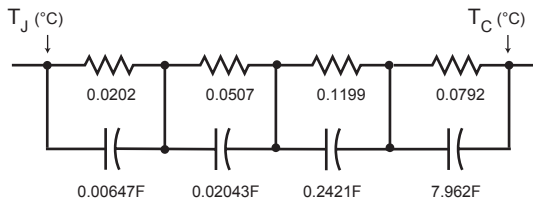


FIGURE 5b, TRANSIENT THERMAL IMPEDANCE MODEL

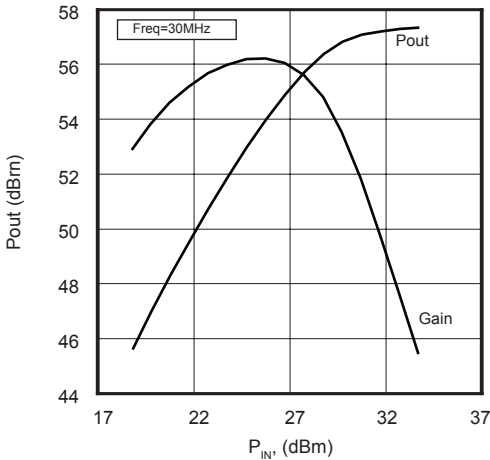


Figure 6. P<sub>OUT</sub> and Gain vs P<sub>IN</sub>

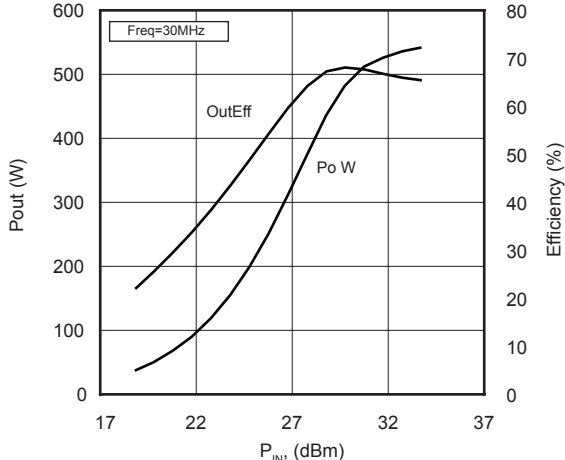


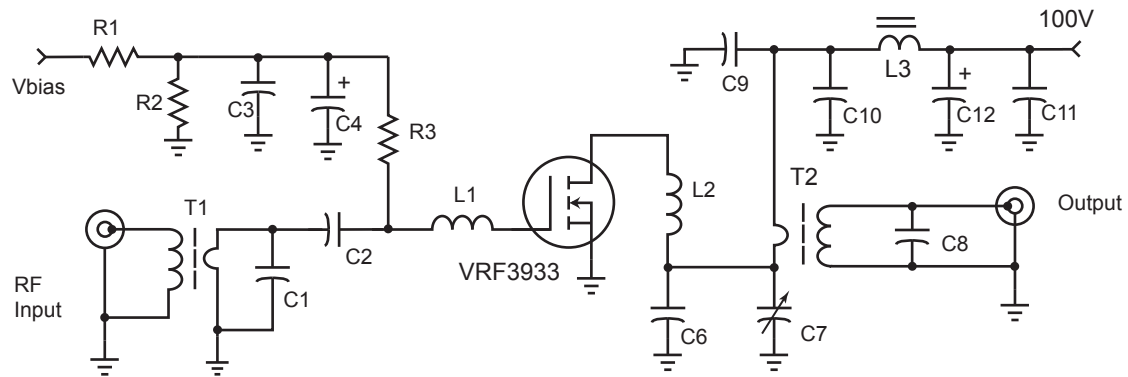
Figure 7. Eff and P<sub>OUT</sub> vs. P<sub>IN</sub>

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

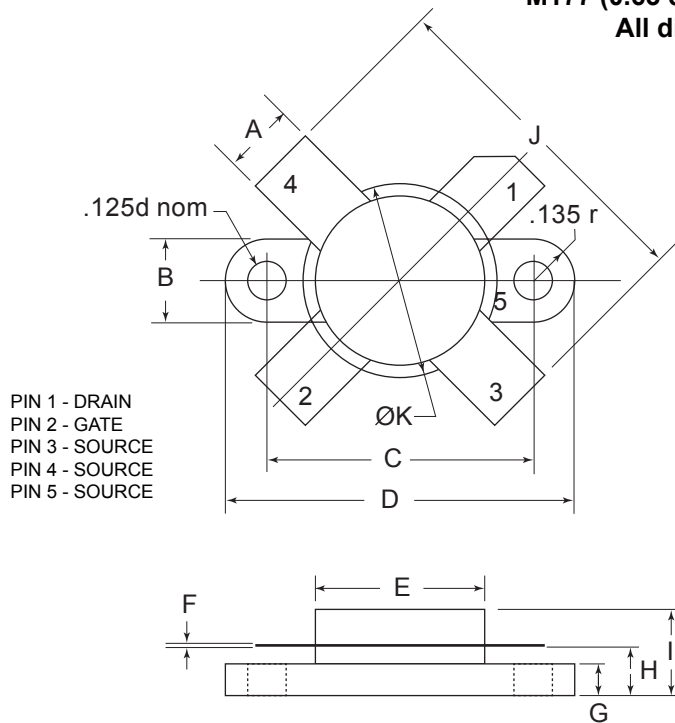
L2 62 nH - 3t #12 0.31"dia  
 L3 2t #16 on 2x 267300081 .5" bead  
 R1-R2 1k  $\Omega$  1/4W  
 R3 100  $\Omega$  1W  
 T1 9:1 transformer 3t #24 teflon on  
 RF Parts Co. T1/2 transformer core  
 T2 4:1 transformer 2t 3-ply #16 teflon on  
 RF Parts Co. T1 transformer core

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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