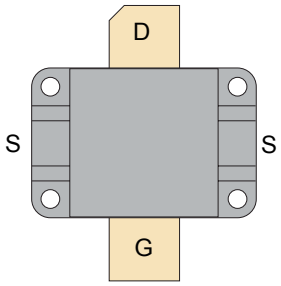
Microsemi
a Microchip company

VRF157FL
VRF157FLMP

50V, 600W, 80MHz

RF POWER VERTICAL MOSFET

The VRF157FL 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 intermodulation distortion.



FEATURES

- **Improved Ruggedness $V_{(BR)DSS}$ = 170V**
- **Designed for 2-100mHz Operation**
- **600W with 21dB Typical Gain @ 30MHz, 50V**
- **Excellent Stability & Low IMD**
- **Common Source Configuration**
- **Available in Matched Pairs**
- **70:1 Load VSWR Capability at Specified Operating Conditions**
- **Nitride Passivated**
- **Economical Flangeless Package**
- **Refractory Gold Metallization**
- **High Voltage Replacement for MRF157**
- **RoHS Compliant**

Maximum Ratings

All Ratings: T_C =25°C unless otherwise specified

Symbol	Parameter	VRF157FL(MP)	Unit
V_{DSS}	Drain-Source Voltage	170	V
I_D	Continuous Drain Current @ T_C = 25°C	60	A
V_{GS}	Gate-Source Voltage	±40	V
P_D	Total Device dissipation @ T_C = 25°C	1350	W
T_{STG}	Storage Temperature Range	-65 to 150	°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)	170	180		V
$V_{DS(ON)}$	On State Drain Voltage ($I_{D(ON)}$ = 40A, V_{GS} = 10V)		3.7	5.7	
I_{DSS}	Zero Gate Voltage Drain Current (V_{DS} = 100V, V_{GS} = 0V)			4.0	mA
I_{GSS}	Gate-Source Leakage Current (V_{DS} = ±20V, V_{DS} = 0V)			4.0	µA
g_{fs}	Forward Transconductance (V_{DS} = 10V, I_D = 20A)	16			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			0.13	°C/W
$R_{\theta JHS}$	Junction to Sink Thermal Resistance (Use High Efficiency Thermal Joint Compound and Planar Heat Sink Surface.)		0.22		

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

Dynamic Characteristics

VRF157FL(MP)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	V_{GS} = 0V		1580		pF
C_{oss}	Output Capacitance	V_{DS} = 50V		810		
C_{rss}	Reverse Transfer Capacitance	f = 1MHz		65		

Functional Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
G_{PS}	f = 30MHz, V_{DD} = 50V, I_{DQ} = 800mA, P_{out} = 600W	17	21		dB
η_D	f = 30MHz, V_{DD} = 50V, I_{DQ} = 800mA, P_{out} = 600W_{PEP}		45		%
$IMD_{(d3)}$	f1 = 30MHz, f2 = 30.001MHz, V_{DD} = 50V, I_{DQ} = 800mA, P_{out} = 600W_{PEP} [1]		-25		dBc
ψ	f = 30MHz, V_{DD} = 50V, I_{DQ} = 800mA, P_{out} = 600W 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

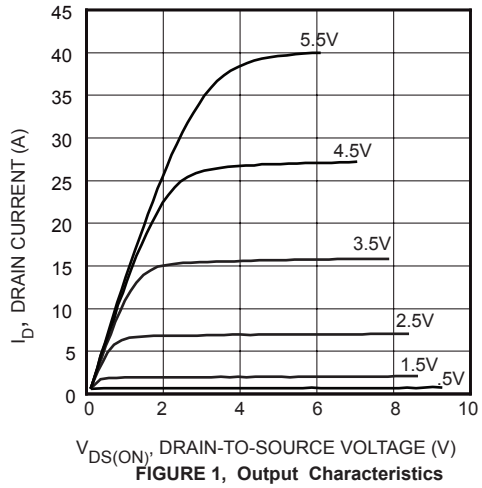


FIGURE 1, Output Characteristics

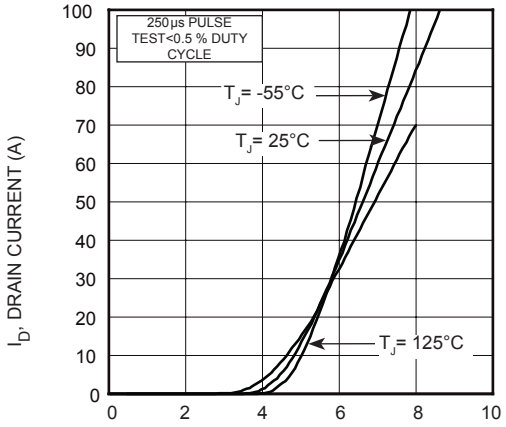


FIGURE 2, Transfer Characteristics

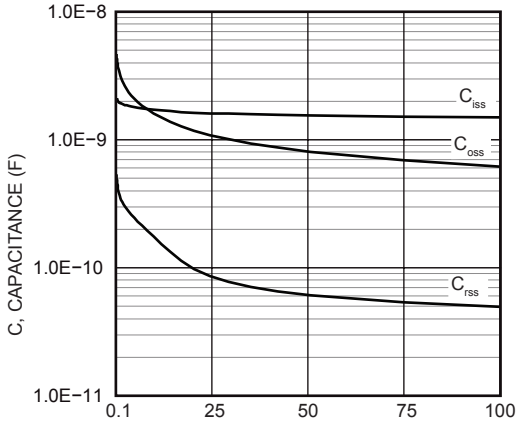


FIGURE 3, Capacitance vs Drain-to-Source Voltage

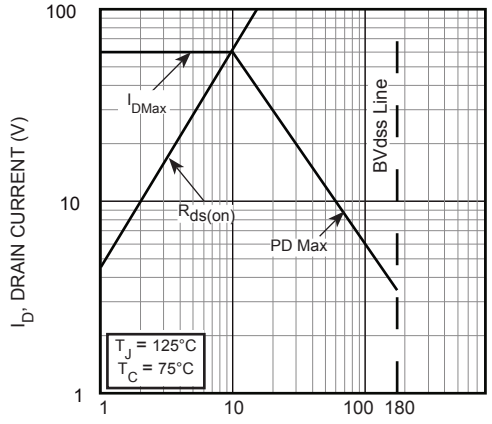


FIGURE 4, Forward Safe Operating Area

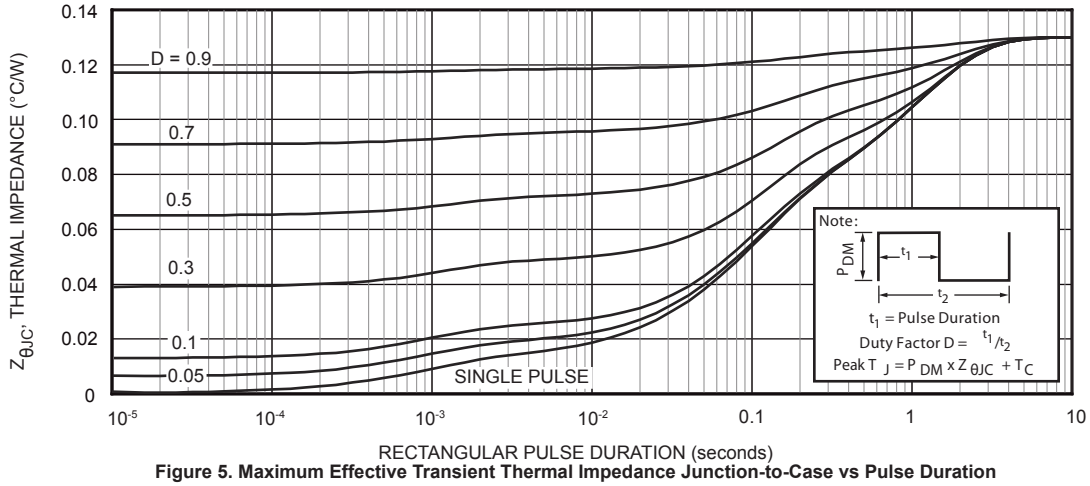


Figure 5. Maximum Effective Transient Thermal Impedance Junction-to-Case vs Pulse Duration

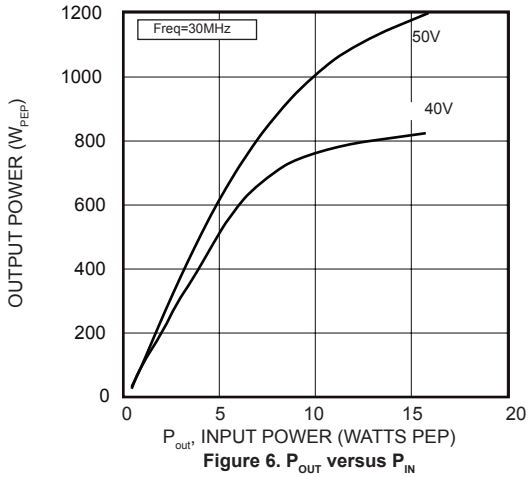


Figure 6. P_{OUT} versus P_{IN}

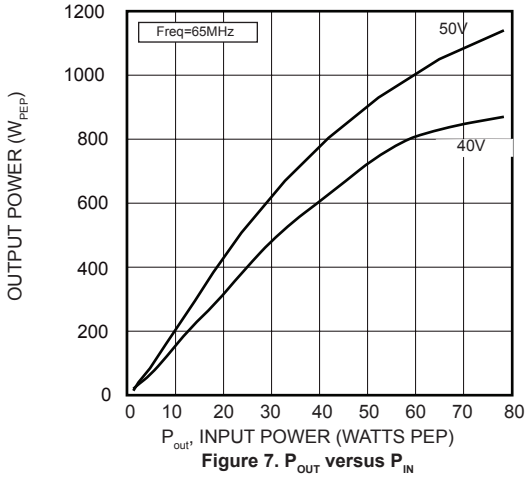
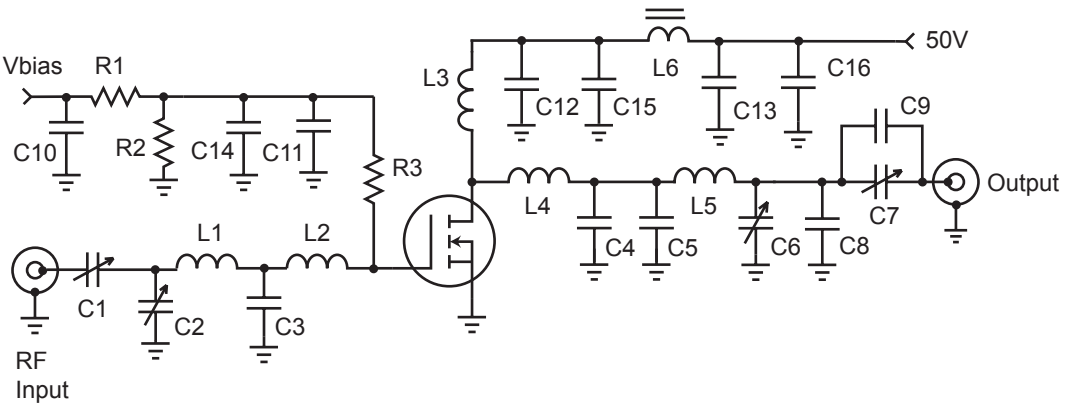


Figure 7. P_{OUT} versus P_{IN}

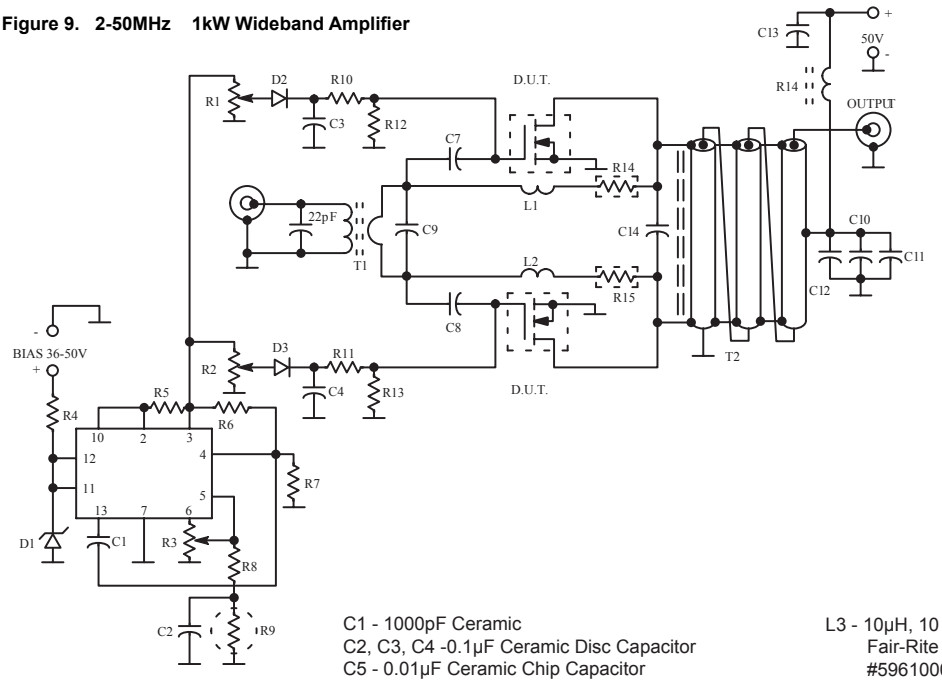
Figure 8. 30MHz Test Circuit



C1, C2, C6, C7 ARCO 465 mica trimmer
C3 1800pF ATC700B ceramic
C4 680pF metal clad 500V mica
C5 390pF metal clad 500V mica
C8 100pF ATC 700E ceramic
C9 120pF ATC 700E ceramic
C10 - C13 .01uF 100V ceramic SMT
C14 - C16 .1uF 100V ceramic SMT

L1 110nH 4t #22 0.312"d .30"l
L2 29nH 2t #22 .188" dia .10" l
L3 0.3uH - 6t #16 enam. .5" dia.
L4 22nH - 1t #16 enam. .375" dia.
L5 117nH - 3t #16 enam. .5" dia. .3"l
L6 1t #16 on 2x 267300081 .5" bead
R1-R2 1kΩ 1/4W
R3 10Ω 1/4W

Figure 9. 2-50MHz 1kW Wideband Amplifier



C1 - 1000pF Ceramic
C2, C3, C4 -0.1µF Ceramic Disc Capacitor
C5 - 0.01µF Ceramic Chip Capacitor
C6, C12 - 0.1µF Ceramic Chip Capacitor
C7, C8 - Two 2200 pF Ceramic Chip Capacitors in Parallel
C9 - 820pF Ceramic Chip Capacitor
C10, C1 1 - 1000pF Ceramic Chip Capacitor
C13 - 0.47µF Ceramic Chip Capacitor or Two Smaller Values in Parallel
C14 - Unencapsulated Mica, 500V Two 1000pF Units in Series, Mounted Under T2
D1 - IN5357A or Equivalent
D2, D3 - IN4148 or Equivalent
C1 - MC1723 (723) Voltage Regulator
L1, L2 - 15 ηH Connecting Wires to R14 and R15, 2.5cm Each #20 AWG
L3 - 10µH, 10 Turns #12 AWG Enameled Wire on Fair-Rite Products Corp. Ferrite Toroid #5961000401 or Equivalent
R1, R2 - 1.0K Single Turn Trimpots
R3 - 10K Single Turn Trimpot
R4 - 470 Ohms, 2.0 Watts
R5 - 10 Ohms
R6, R12, R13 - 2.0K Ohms
R7 - 10K Ohms
R8 - Exact Value Depends on Thermistor R9 used (Typically 5.0 - 10K)
R9 - Thermistor, Keystone RL1009-5820-97-D1 or Equivalent
R10, R11 - 100 Ohms, 1.0W Carbon
R14, R15 - EMC Technology Model 5308 or KDI Pyrofilm PPR 970-150-3 Power Resistors, 25 Ohms
T1, T2 - 9:1 and 1:9 Impedance Ratio RF Transformers

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%.

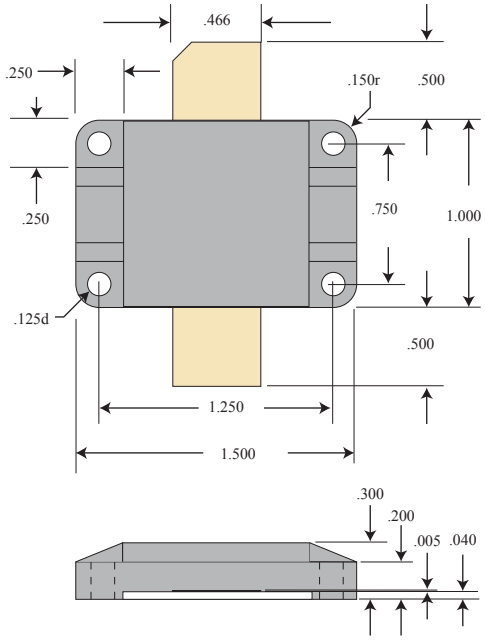
Thermal Considerations and Package Mounting:

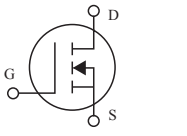
The rated 1350W power dissipation is only available when the package mounting surface is at 25°C and the junction temperature is 200°C. The thermal resistance between junctions and case mounting surface is 0.13°C/W. When installed, an additional thermal impedance of 0.09°C/W between the package base and the mounting surface is smooth and flat. Thermal joint compound must be used to reduce the effects of small surface irregularities. The heatsink should incorporate a copper heat spreader to obtain best results.

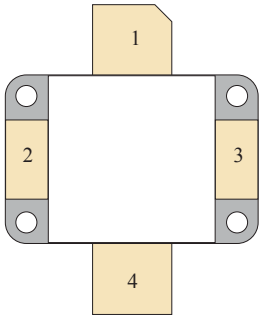
The lid maintains the required mounting pressure while allowing for thermal expansion of both the device and the heat sink. Four 4-40 (M3) screws provide the minimum 125 lb. required mounting force. T=4-6 in-lb. Please refer to App Note 1810 "Mounting Instructions for Flangeless Packages."

HAZARDOUS MATERIAL WARNING

The ceramic portion of the device between leads and mounting flange 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: 1.934g. Percentage of total module weight which is BeO: 20%.







PIN 1 - DRAIN
PIN 2 - SOURCE
PIN 3 - SOURCE
PIN 4 - GATE

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