

**VRF164FL**  
**Datasheet**  
**RF Power Vertical MOSFET**

Final  
May 2018



## Contents

---

<b>1</b>	<b>Revision History</b>	<b>1</b>
1.1	Revision A	1
<b>2</b>	<b>Product Overview</b>	<b>2</b>
2.1	Features	2
<b>3</b>	<b>Electrical Specifications</b>	<b>3</b>
3.1	Absolute Maximum Ratings	3
3.2	MOSFET Electrical Performance	3
3.3	Functional Performance	4
3.4	Typical Test Circuit	4
<b>4</b>	<b>Package Specifications</b>	<b>6</b>
4.1	Hazardous Material Warning	6

# 1 Revision History

---

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

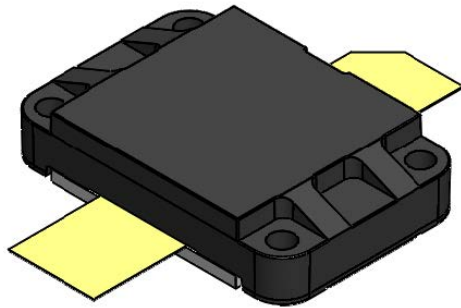
## 1.1 Revision A

Revision A was published in May 2018. It is the first publication of this document.

## 2 Product Overview

---

The VRF164FL 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.



### 2.1 Features

The following are key features of the VRF164FL device:

- Improved ruggedness  $V_{(BR)DSS} = 170\text{ V}$
- Designed for 2 MHz–100 MHz operation
- 800 W with 17 dB minimum gain at 30 MHz, 50 V
- Excellent stability and 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 MRF154
- RoHS compliant

### 3 Electrical Specifications

This section details the electrical specifications for the VRF164FL device.

#### 3.1 Absolute Maximum Ratings

The following table shows the absolute maximum ratings for the VRF164FL device. All ratings are at  $T_c = 25\text{ }^\circ\text{C}$  unless otherwise specified.

**Table 1 • Absolute Maximum Ratings**

Symbol	Parameter	VRF164FL(MP)	Unit
$V_{DS}$	Drain-source voltage	170	V
$I_D$	Continuous drain current	75	A
$V_{GS}$	Gate-source voltage	$\pm 40$	V
$P_D$	Total device dissipation	1750	W
$T_{STG}$	Storage temperature range	-65 to 150	$^\circ\text{C}$
$T_{JMAX}$	Operating junction temperature maximum	200	$^\circ\text{C}$

#### 3.2 MOSFET Electrical Performance

The following table shows the static electrical characteristics of the VRF164FL device. All ratings are at  $T_c = 25\text{ }^\circ\text{C}$  unless otherwise specified.

**Table 2 • Static Electrical Characteristics**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_{(BR)DS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$ , $I_D = 100\text{ mA}$	170	180		V
$V_{DS(ON)}$	On-state drain voltage	$I_{D(ON)} = 40\text{ A}$ , $V_{GS} = 10\text{ V}$		2.1	3.5	V
$I_{DSS}$	Zero gate voltage drain current	$V_{DS} = 100\text{ V}$ , $V_{GS} = 0\text{ V}$			4.0	mA
$I_{GSS}$	Gate-source leakage current	$V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$			4.0	mA
$g_{fs}$	Forward transconductance	$V_{DS} = 10\text{ V}$ , $I_D = 35\text{ A}$	20		41	mhos
$V_{GS(TH)}$	Gate threshold voltage	$V_{DS} = 10\text{ V}$ , $I_D = 100\text{ mA}$	2.9	3.6	4.4	V

The following table shows the thermal characteristics of the VRF164FL device.

**Table 3 • Thermal Characteristics**

Symbol	Parameter	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction to case thermal resistance			0.10	$^\circ\text{C/W}$
$R_{\theta JHS}$	Junction to sink thermal resistance (Use high-efficiency thermal joint compound and planar heat sink surface)		0.22		$\Omega$

The following table shows the dynamic characteristics of the VRF164FL device.

**Table 4 • Dynamic Characteristics**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$C_{iss}$	Input capacitance	$V_{GS} = 0\text{ V}$		2100		pF
$C_{oss}$	Output capacitance	$V_{DS} = 50\text{ V}$		1000		pF
$C_{rss}$	Reverse transfer capacitance	$f = 1\text{ MHz}$		110		pF

### 3.3 Functional Performance

The following table shows the functional characteristics of the VRF164FL device.

**Table 5 • Dynamic Characteristics**

Symbol	Parameter	Min	Typ	Max	Unit
$G_{PS}$	$f = 30\text{ MHz}$ , $V_{DD} = 50\text{ V}$ , $I_{DQ} = 800\text{ mA}$ , $P_{out} = 800\text{ W}$	18	21		dB
$\eta_D$	$f = 30\text{ MHz}$ , $V_{DD} = 50\text{ V}$ , $I_{DQ} = 800\text{ mA}$ , $P_{out} = 800\text{ W}_{PEP}$		45		%
$IMD_{(dB)}$	$f_1 = 30\text{ MHz}$ , $f_2 = 30.001\text{ MHz}$ , $V_{DD} = 50\text{ V}$ , $I_{DQ} = 800\text{ mA}$ , $P_{out} = 600\text{ W}_{PEP}^1$		-25		dBc

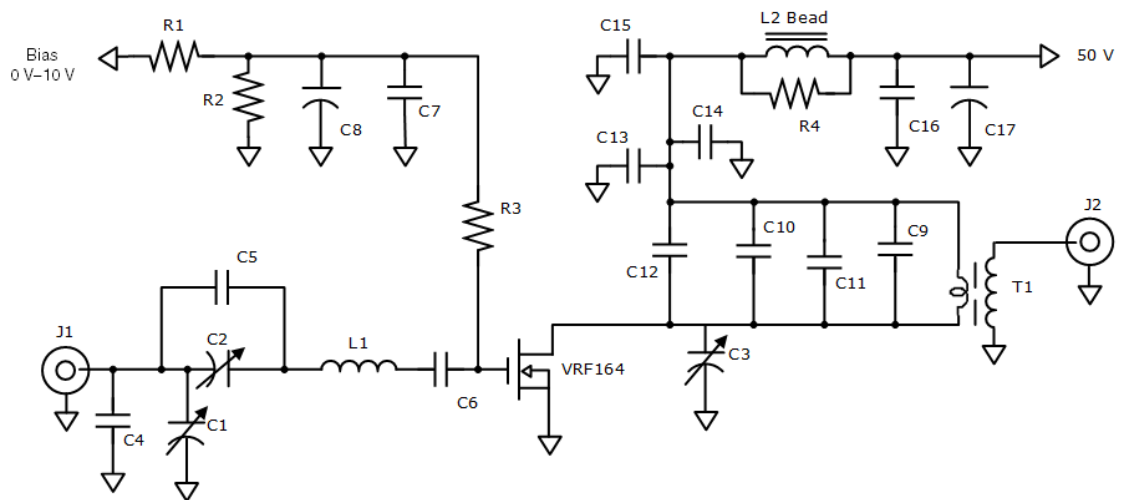
**Note:**

1. To MIL-STD-1311 version A, test method 2204B, two tone, reference each tone. Microsemi reserves the right to change the specifications and information contained herein without notice.

### 3.4 Typical Test Circuit

The following drawing shows the test circuit of the VRF164FL devices.

**Figure 1 • 30 MHz Test Circuit**



The following table shows the test circuit characteristics of the VRF164FL devices.

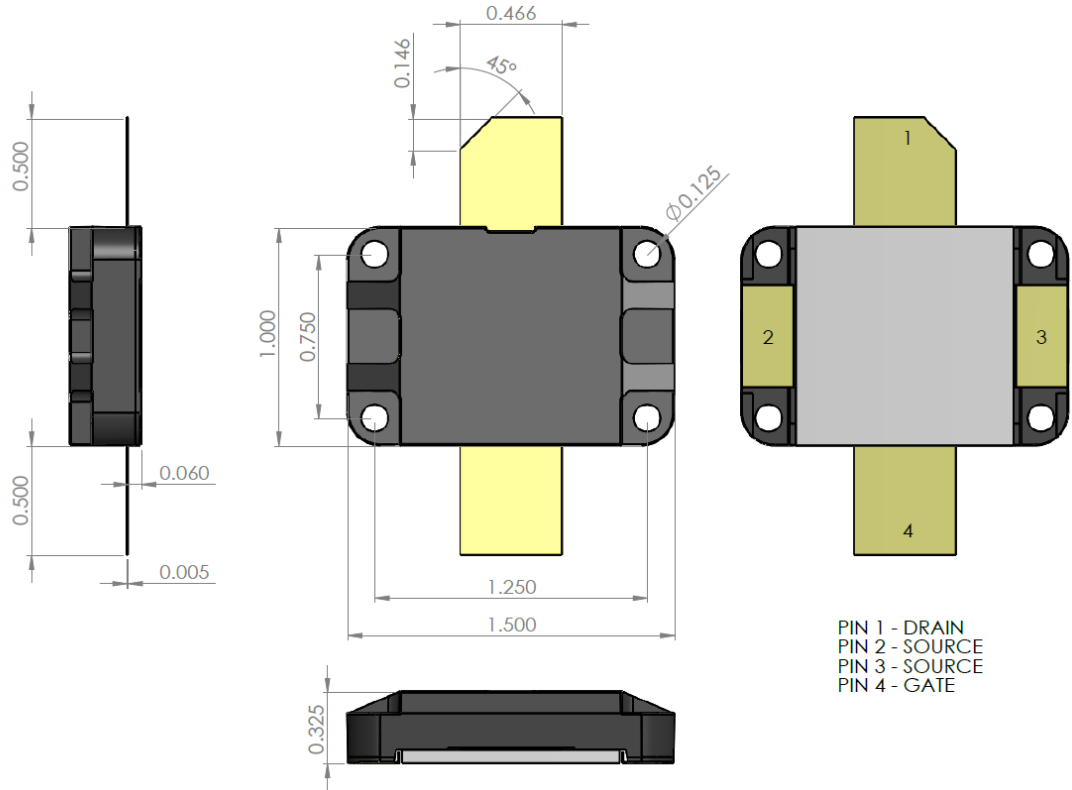
**Table 6 • Test Circuit Characteristics**

Component	Characteristic
C1–C3	Arco 469 mica trimmer
C4	330 pF ceramic ATC 100B
C5	680 pF ceramic ATC 100B
C6–C7	3× 0.1 μF 50 V SMT in parallel
C8	10 μF 35 V electrolytic
C10–C12	470 pF ATC 100B
C9	Two 1000 pF clad mica in series
C13–C16	3× 0.1 μF 100 V SMT in parallel
C17	15 μF 100 V electrolytic
L1	2t #16 0.5" ID, 0.375" long
L2	Two 2673000801 ferrite beads on #14
R1–R3	1 kΩ, ½ W
R4	2.2 Ω, 3 W
T1	1:5 turns ratio on Fair-Rite 286701000 or 2× 2667541602

## 4 Package Specifications

This following image the package specifications of the VRF164FL device.

Figure 2 • Package Outline



### 4.1 Hazardous Material Warning

The ceramic portion of the device between the leads and the 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. The BeO substrate weight is 1.934 g. The percentage of the total module weight that is BeO is 20%.



**Microsemi Corporate Headquarters**

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

© 2018 Microsemi Corporation. All rights reserved. Microsemi and the Microsemi logo are trademarks of Microsemi Corporation. All other trademarks and service marks are the property of their respective owners.

Microsemi makes no warranty, representation, or guarantee regarding the information contained herein or the suitability of its products and services for any particular purpose, nor does Microsemi assume any liability whatsoever arising out of the application or use of any product or circuit. The products sold hereunder and any other products sold by Microsemi have been subject to limited testing and should not be used in conjunction with mission-critical equipment or applications. Any performance specifications are believed to be reliable but are not verified, and Buyer must conduct and complete all performance and other testing of the products, alone and together with, or installed in, any end-products. Buyer shall not rely on any data and performance specifications or parameters provided by Microsemi. It is the Buyer's responsibility to independently determine suitability of any products and to test and verify the same. The information provided by Microsemi hereunder is provided "as is, where is" and with all faults, and the entire risk associated with such information is entirely with the Buyer. Microsemi does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other IP rights, whether with regard to such information itself or anything described by such information. Information provided in this document is proprietary to Microsemi, and Microsemi reserves the right to make any changes to the information in this document or to any products and services at any time without notice.

Microsemi Corporation (Nasdaq: MSCC) offers a comprehensive portfolio of semiconductor and system solutions for aerospace & defense, communications, data center and industrial markets. Products include high-performance and radiation-hardened analog mixed-signal integrated circuits, FPGAs, SoCs and ASICs; power management products; timing and synchronization devices and precise time solutions, setting the world's standard for time; voice processing devices; RF solutions; discrete components; enterprise storage and communication solutions; security technologies and scalable anti-tamper products; Ethernet solutions; Power-over-Ethernet ICs and midspans; as well as custom design capabilities and services. Microsemi is headquartered in Aliso Viejo, California, and has approximately 4,800 employees globally. Learn more at [www.microsemi.com](http://www.microsemi.com).

050-4990