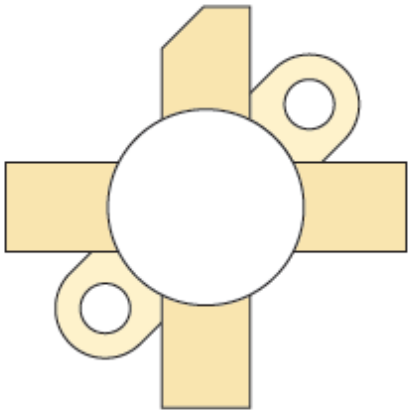
VRF141, VRF141MP

28 V, 150 W, 175 MHz RF Power MOSFET

Product Overview

The VRF141(MP) 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 $V_{(BR)DSS}$ = 80 V
- 150 W with 22 dB typical gain at 30 MHz, 28 V
- 150 W with 13 dB typical gain at 175 MHz, 28 V
- Excellent stability and low IMD
- Common source configuration
- Available in matched pairs (VRF141MP)
- 30:1 load VSWR capability at specified operating conditions
- Nitride passivated
- Refractory gold metallization
- High voltage replacement for MRF141
- RoHS compliant

1. Device Specifications

This section shows the specifications of the VRF141(MP) device.

1.1 Absolute Maximum Ratings

The following table shows the absolute maximum ratings of the VRF141(MP) device. T_C = 25 °C unless otherwise specified.

Table 1-1. Absolute Maximum Ratings

Symbol	Parameter	Ratings	Unit
V_{DSS}	Drain source voltage	80	V
I_D	Continuous drain current at T_C = 25 °C	20	A
V_{GS}	Gate-source voltage	±40	V
P_D	Total power dissipation at T_C = 25 °C	300	W
T_{STG}	Storage temperature range	–65 to 150	°C
T_J	Operating junction temperature	200	

1.2 Electrical Performance

The following table shows the static characteristics of the VRF141(MP) device. T_C = 25 °C unless otherwise specified.

Table 1-2. Static Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0 V, I_D = 100 mA	80			V
$V_{DS(ON)}$	On-state drain voltage	$I_{D(ON)}$ = 10 A, V_{GS} = 10 V		1.0	1.4	
I_{DSS}	Zero gate voltage drain current	V_{DS} = 60 V, V_{GS} = 0 V			1.0	mA
I_{GSS}	Gate-source leakage current	V_{DS} = ±20 V, V_{GS} = 0 V			1.0	µA
g_{fs}	Forward transconductance	V_{DS} = 10 V, I_D = 5 A	5.0			mhos
$V_{GS(th)}$	Gate-source threshold voltage	V_{DS} = 10 V, I_D = 100 mA	2.9	3.6	4.4	V

The following table shows the thermal characteristics of the VRF141(MP) device.

Table 1-3. Thermal Characteristics

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction-to-case thermal resistance			0.60	°C/W

The following table shows the dynamic characteristics of the VRF141(MP) device. T_C = 25 °C unless otherwise specified.

Table 1-4. Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input capacitance	V_{GS} = 0 V, V_{DS} = 28 V, f = 1 MHz		400		pF
C_{oss}	Output capacitance			375		
C_{rss}	Reverse transfer capacitance			50		

The following table shows the functional characteristics of the VRF141(MP) device. T_C = 25 °C unless otherwise specified.

Table 1-5. Functional Characteristics

Parameter	Test Conditions	Min	Typ	Max	Unit
G_{PS}	f_1 = 30 MHz, f_2 = 30.001 MHz, V_{DD} = 28 V, I_{DQ} = 250 mA, P_{out} = 150 W_{PEP}	16	20		dB
G_{PS}	f_1 = 175 MHz, V_{DD} = 28 V, I_{DQ} = 250 mA, P_{out} = 150 W		13		
η	f_1 = 30 MHz, f_2 = 30.001 MHz, V_{DD} = 28 V, I_{DQ} = 250 mA, P_{out} = 150 W_{PEP}	40	45		%
$IMD_{(d3)}$	f_1 = 30 MHz, f_2 = 30.001 MHz, V_{DD} = 28 V, I_{DQ} = 250 mA, P_{out} = 150 W_{PEP}[1]		–30	–28	dB
$IMD_{(d11)}$	f_1 = 30 MHz, f_2 = 30.001 MHz, V_{DD} = 28 V, I_{DQ} = 250 mA, P_{out} = 150 W_{PEP}		–60		
Ψ	f_1 = 30 MHz, f_2 = 30.001 MHz, V_{DD} = 28 V, I_{DQ} = 250 mA, P_{out} = 150 W_{PEP} 30:1 VSWR — all phase angles	No degradation in output power			

Note:

1. To MIL-STD-1311 Version A, test method 2204B, Two Tone, Reference Each Tone

The following table shows the class A characteristics of the VRF141(MP) device. T_C = 25 °C unless otherwise specified.

Table 1-6. Class A Characteristics

Parameter	Test Conditions	Min	Typ	Max	Unit
G_{PS}	f_1 = 30 MHz, f_2 = 30.001 MHz, V_{DD} = 28 V, I_{DQ} = 4.0 A, P_{out} = 50 W_{PEP}		23		dB
$IMD_{(d3)}$			–50		
$IMD_{(d11)}$			–75		

1.3 Typical Performance Curves

This section shows the typical performance curves of the VRF141(MP) device.

Figure 1-1. Output Characteristics

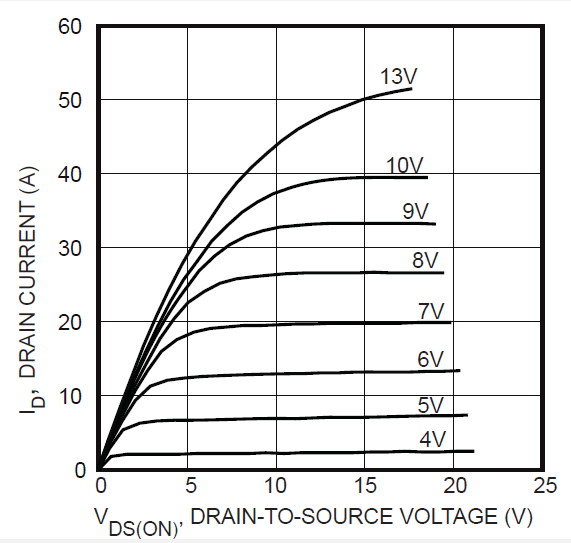


Figure 1-2. Transfer Characteristics

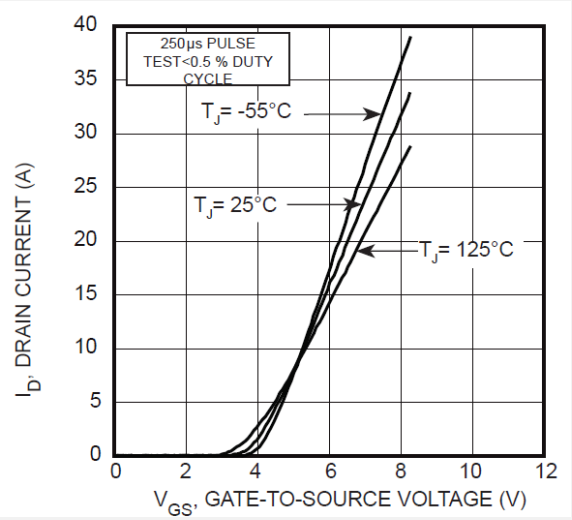


Figure 1-3. Capacitance vs. Drain-to-Source Voltage

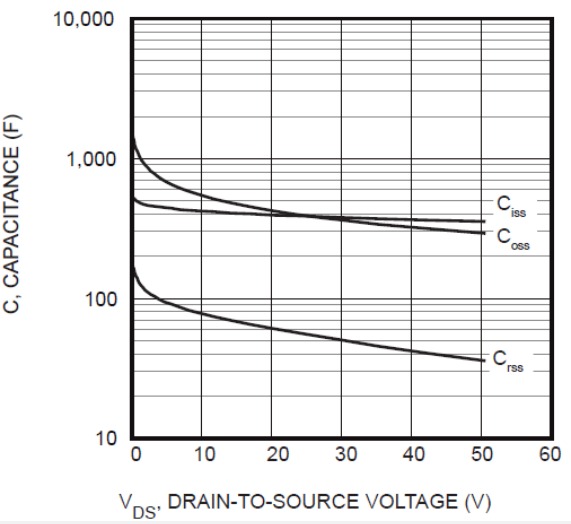


Figure 1-4. Forward Safe Operating Area

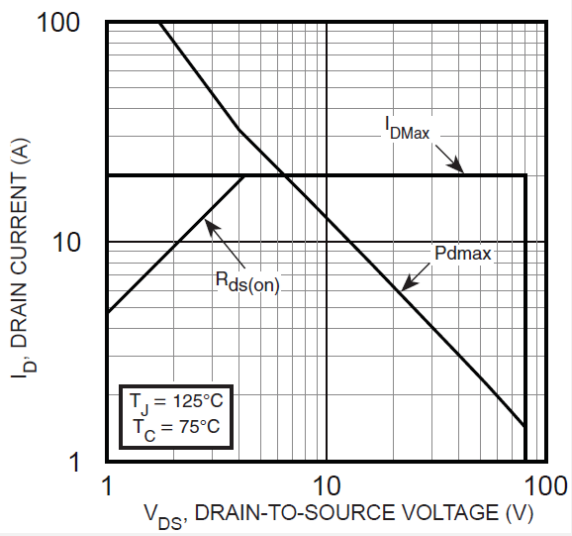


Figure 1-5. Maximum Effective Transient Thermal Impedance Junction-to-Case vs Pulse Duration

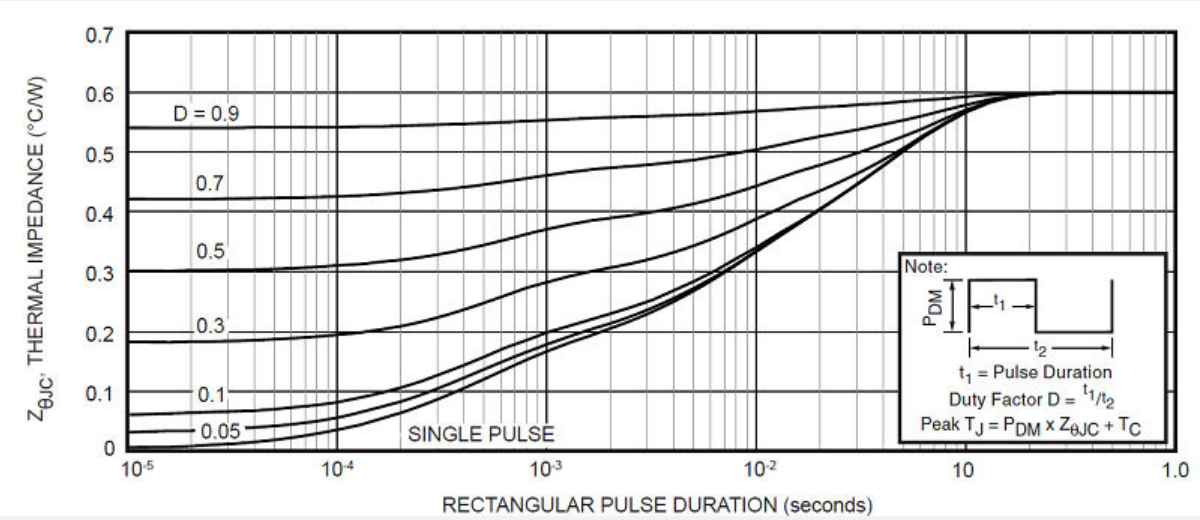


Figure 1-6. IMD vs. P_{OUT}

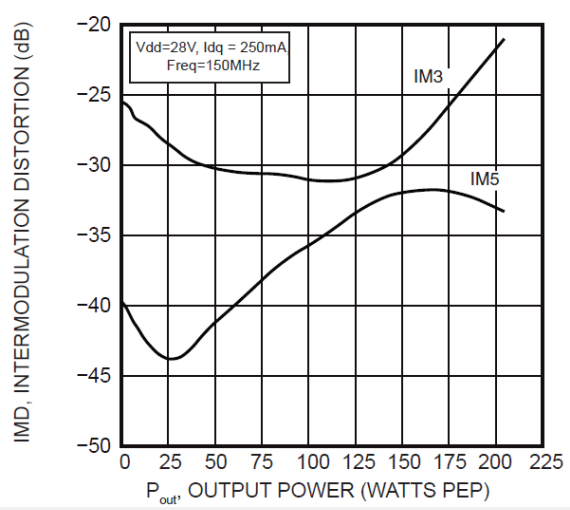


Figure 1-7. P_{IN} vs. P_{OUT}

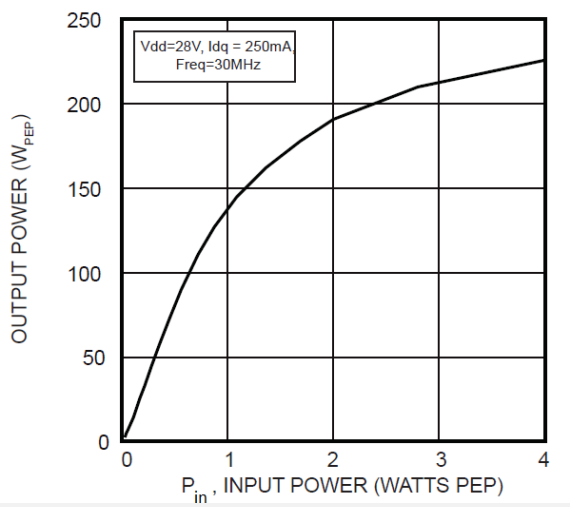
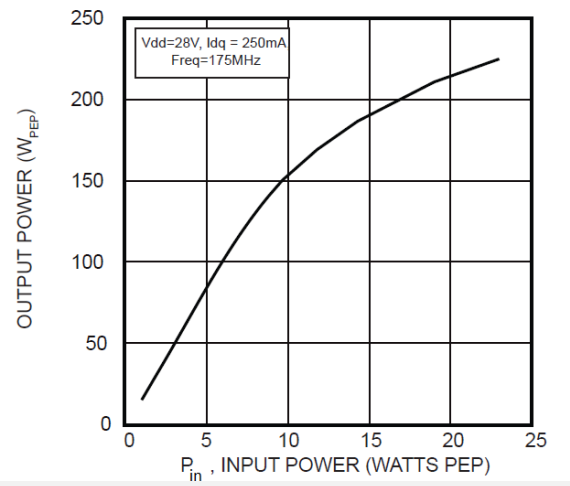


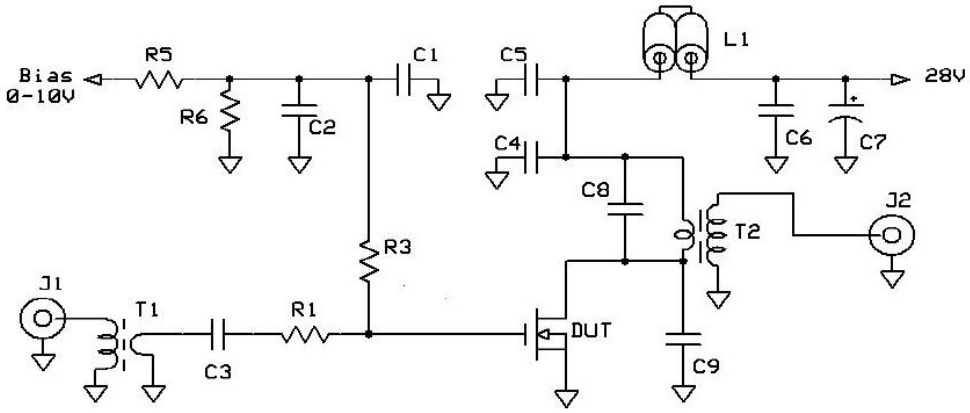
Figure 1-8. P_{IN} vs. P_{OUT}



2. Test Circuits

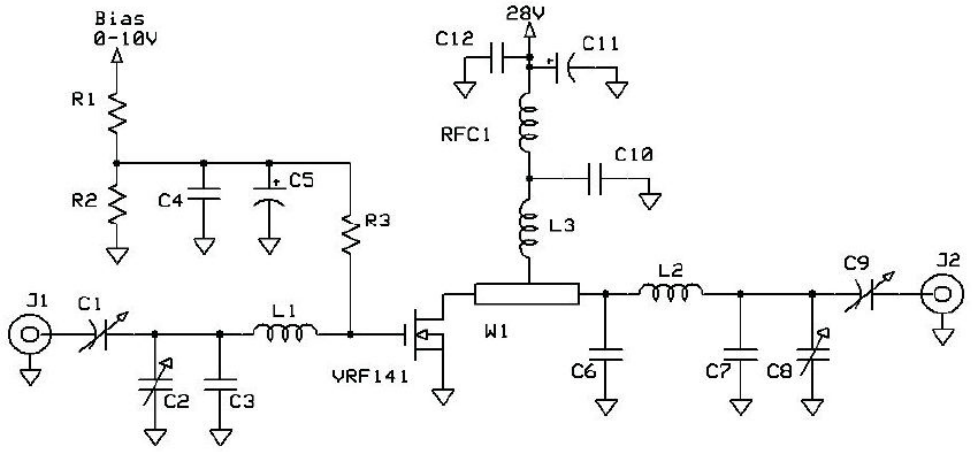
The following figures show the test circuits of the VRF141(MP) device.

Figure 2-1. 30 MHz Test Circuit



C1 - 1uF 50V tantalum
C2-C6 - 0.1uF 100V SMT
C7 - 15uF 100V Elect
C8 - 820 pF ATC 100B
T1 - 16:1 bead/tube transformer
T2 = 1:25 bradband bead/tube transformer u=125
C9 - 100 pF ATC 100B
L1 - two ferrite beads on #18
R1 - 1 ohm 1 W SMT
R3 - 200 ohm 1/2 Carbn
R4 - 470 ohm 1W
R5 R6 - 2200 ohm 1/4W

Figure 2-2. 175 MHz Test Circuit



C1, 2, 8, 9 - ARCO 463
C3 C7 - 25 pF ATC 100B
C4 C10 C12 - 0.1uF 100V SMT
C5 - 1 uF 15WV tant
C6 - 270 pF ATC 100B
C10 - .05 100V 1206 SMT
C11 - 15uF 100V Elect
L1 - 3/4" #18 ga into Hairpin
W1 - printed line 0.23"W x 0.7" L
L2 - 2t #16 ga .25" dia x .25" ~ 35nH
L3 -2 turns #16 ga 5/16" ID tight. ~ 50nH
R1 R2 - 2.2k ohm 1/4W
R3 - 150 ohm 1/4W
RFC1 Fair-Rite 2961666631 (WK200-4B)

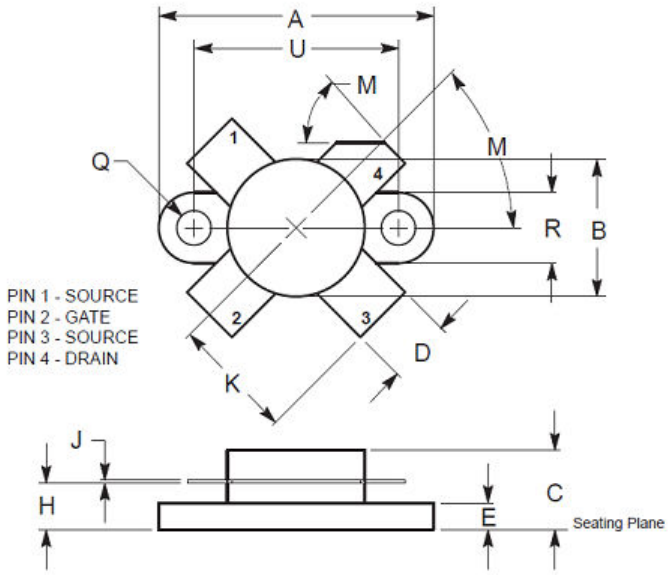
3. Package Specification

This section shows the package specification of the VRF141(MP) device.

3.1 Package Outline Drawing

The following figure illustrates the package outline of the VRF141(MP) device.

Figure 3-1. M174 Package Outline 0.5” SOE



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.096	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

4. Matched Pair Part Marking

Adding MP at the end of part number 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.

Table 4-1. V_{TH} Range Codes

Code	V_{TH} Range	Code	V_{TH} 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

Note: V_{TH} values are based on Microchip measurements at datasheet conditions with an accuracy of 1.0%.

5. Revision History

Table 5-1. Revision History

Revision	Date	Description
A	12/2021	• Document migrated from Microsemi template to Microchip template; Assigned Microchip literature number DS-00004329A,which replaces the previous Microsemi literature number 050-4942. • Increased $V_{DS(on)}$ limit from 1.3V max. to 1.4V max.
Initial releases (Microsemi Revisions A through E)	09/2007 – 12/2020	Previous releases.

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