

# 10 W SiC RF Power MESFET

# PRELIMINARY

## Features

- 15 dB Small Signal Gain
- 10 W Minimum  $P_{1dB}$
- 48 V Operation
- High Breakdown Voltage
- High Temperature Operation
- Up to 2.7 GHz Operation
- High Efficiency

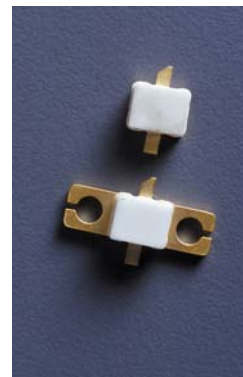
## Applications

- Wideband Military Communications
- Secure Comms for Homeland Defense
- Class A, AB Amplifiers
- TDMA, EDGE, CDMA, and W-CDMA
- Broadband Amplifiers
- CATV Amplifiers
- MMDS

## Description

Cree's CRF-24010 is a silicon carbide (SiC) RF power Metal-Semiconductor Field-Effect Transistor (MESFET). SiC has superior properties compared to silicon or gallium arsenide, including higher breakdown voltage, higher saturated electron drift velocity, and higher thermal conductivity. SiC MESFETs offer greater power density and wider bandwidths compared to Si and GaAs transistors.

CASE STYLE 001  
CRF-24010-001



CASE STYLE 101  
CRF-24010-101

Angled lead = Gate  
Non-angled lead = Drain  
Case/Flange = Source

## Absolute Maximum Ratings (not simultaneous) at 25°C Case Temperature

Parameter	Symbol	Rating	Units
Drain-Source Voltage	$V_{DSS}$	110	VDC
Gate-Source Voltage	$V_{GS}$	-25, +3	VDC
Storage Temperature	$T_{STG}$	-40, 150	°C
Operating Junction Temperature	$T_J$	250	°C
Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.6	°C/W
Soldering Temperature	$T_S$	250	°C

**Electrical Characteristics ( $T_C = 25^\circ\text{C}$ )**

Characteristic	Symbol	Min	Typ	Max	Units	Conditions
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**DC CHARACTERISTICS**

Gate Threshold Voltage	$V_{GS(th)}$	-12	-10	-	VDC	$V_{DS} = 10\text{ V}, I_D = 0.5\text{ mA}$
Gate Quiescent Voltage	$V_{GS(Q)}$	-	-9	-	VDC	$V_{DS} = 48\text{ V}, I_D = 250\text{ mA}$
Zero Gate Voltage Drain Current	$I_{DSS}$	1.2	1.5	1.8	A	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}$
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	100	110	120	VDC	$V_{GS} = -26\text{ V}, I_D = 3\text{ mA}$
Forward Transconductance	$g_m$	140	160	-	mS	$V_{DS} = 48\text{ V}, I_D = 250\text{ mA}$
Case Operating Temperature	$T_C$	-30	-	120	$^\circ\text{C}$	
Screw Torque (101 Style Package)	T	0.33	-	0.37	ft·lb	

**RF CHARACTERISTICS**

Gain	$G_{SS}$	13	15	-	dB	$V_{DD} = 48\text{ V}, I_{DQ} = 250\text{ mA}, f = 2000\text{ MHz}$
Power Output at 1 dB Compression	$P_{1dB}$	10	12	-	W	$V_{DD} = 48\text{ V}, I_{DQ} = 250\text{ mA}, f = 2000\text{ MHz}$
Drain Efficiency <sup>1, 2</sup>	$\eta$	40	45	-	%	$V_{DD} = 48\text{ V}, I_{DQ} = 250\text{ mA}, f = 2000\text{ MHz}, P_{OUT} = P_{1dB}$
Intermodulation Distortion	$IMD_3$	-	-31	-	dBc	$V_{DD} = 48\text{ V}, I_{DQ} = 250\text{ mA}, f_1 = 2000.0\text{ MHz}, f_2 = 2000.1\text{ MHz}, P_{OUT} = 10\text{ W PEP}$

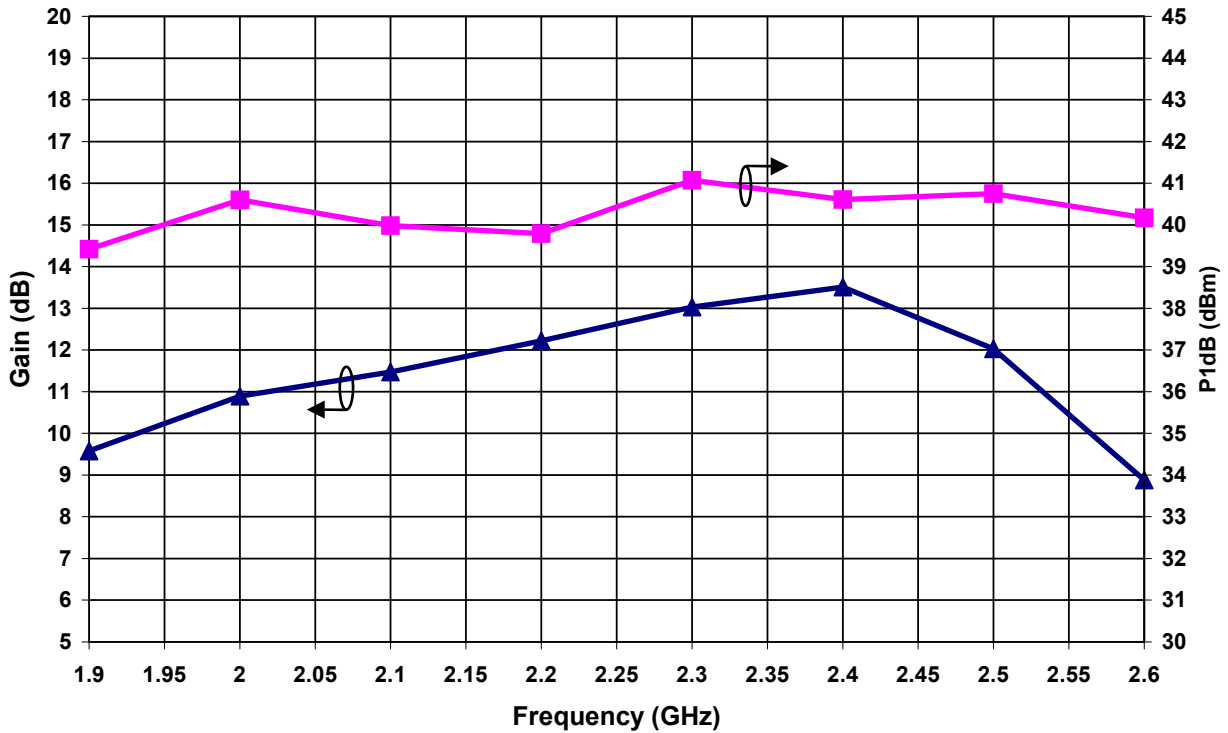
Notes:

<sup>1</sup> Drain Efficiency =  $P_{OUT}/P_{DC}$

<sup>2</sup> Power Added Efficiency (PAE) =  $(P_{OUT} - P_{IN})/P_{DC}$

Typical Wideband Performance ( $T_C = 25^\circ\text{C}$ ,  $V_{DS} = 48\text{ V}$ ,  $I_{DQ} = 500\text{ mA}$ )

Swept P1dB and Gain CRF-24010 Broadband Test Fixture



**Typical Packaged S-Parameters (Small Signal,  $V_{DS} = 48\text{ V}$ ,  $I_{DQ} = 500\text{ mA}$ , ang in deg)**

freq	S(1,1)	S(2,1)	S(1,2)	S(2,2)
100.0MHz	0.933 / -24.697	9.470 / 164.826	0.022 / 72.184	0.281 / -34.171
200.0MHz	0.917 / -47.336	8.814 / 150.896	0.041 / 60.244	0.311 / -62.220
300.0MHz	0.898 / -66.755	7.970 / 138.866	0.055 / 49.176	0.344 / -83.098
400.0MHz	0.881 / -82.780	7.113 / 128.773	0.066 / 39.787	0.372 / -98.337
500.0MHz	0.867 / -95.802	6.332 / 120.339	0.073 / 31.953	0.394 / -109.583
600.0MHz	0.856 / -106.375	5.654 / 113.216	0.078 / 25.378	0.411 / -118.050
700.0MHz	0.847 / -115.027	5.079 / 107.100	0.082 / 19.781	0.425 / -124.563
800.0MHz	0.841 / -122.187	4.592 / 101.752	0.084 / 14.932	0.436 / -129.678
900.0MHz	0.837 / -128.190	4.179 / 96.993	0.086 / 10.659	0.445 / -133.774
1.000GHz	0.834 / -133.288	3.828 / 92.691	0.088 / 6.834	0.454 / -137.115
1.100GHz	0.831 / -137.674	3.526 / 88.750	0.089 / 3.362	0.462 / -139.886
1.200GHz	0.830 / -141.491	3.266 / 85.096	0.090 / 0.172	0.469 / -142.221
1.300GHz	0.829 / -144.852	3.039 / 81.675	0.090 / -2.790	0.475 / -144.221
1.400GHz	0.829 / -147.841	2.840 / 78.445	0.091 / -5.564	0.482 / -145.960
1.500GHz	0.828 / -150.526	2.665 / 75.375	0.091 / -8.183	0.488 / -147.492
1.600GHz	0.829 / -152.959	2.509 / 72.440	0.091 / -10.671	0.495 / -148.863
1.700GHz	0.829 / -155.183	2.370 / 69.618	0.091 / -13.047	0.501 / -150.104
1.800GHz	0.830 / -157.231	2.246 / 66.896	0.091 / -15.328	0.507 / -151.244
1.900GHz	0.830 / -159.132	2.133 / 64.258	0.091 / -17.526	0.513 / -152.301
2.000GHz	0.831 / -160.907	2.032 / 61.696	0.091 / -19.652	0.519 / -153.294
2.100GHz	0.832 / -162.576	1.940 / 59.200	0.091 / -21.714	0.525 / -154.235
2.200GHz	0.833 / -164.155	1.855 / 56.763	0.091 / -23.720	0.530 / -155.136
2.300GHz	0.834 / -165.657	1.778 / 54.379	0.091 / -25.676	0.536 / -156.004
2.400GHz	0.836 / -167.092	1.708 / 52.042	0.091 / -27.587	0.542 / -156.847
2.500GHz	0.837 / -168.471	1.643 / 49.748	0.091 / -29.458	0.547 / -157.670
2.600GHz	0.838 / -169.802	1.583 / 47.492	0.091 / -31.294	0.552 / -158.479
2.700GHz	0.839 / -171.093	1.528 / 45.273	0.091 / -33.096	0.558 / -159.277
2.800GHz	0.840 / -172.348	1.477 / 43.085	0.091 / -34.870	0.563 / -160.067
2.900GHz	0.842 / -173.575	1.430 / 40.926	0.091 / -36.616	0.568 / -160.852
3.000GHz	0.843 / -174.777	1.386 / 38.795	0.091 / -38.340	0.572 / -161.634
3.100GHz	0.844 / -175.960	1.346 / 36.687	0.091 / -40.041	0.577 / -162.415
3.200GHz	0.845 / -177.126	1.308 / 34.602	0.091 / -41.724	0.581 / -163.197
3.300GHz	0.846 / -178.281	1.273 / 32.537	0.091 / -43.390	0.586 / -163.981
3.400GHz	0.848 / -179.426	1.240 / 30.490	0.091 / -45.041	0.590 / -164.768
3.500GHz	0.849 / 179.435	1.210 / 28.459	0.091 / -46.679	0.594 / -165.559
3.600GHz	0.850 / 178.299	1.181 / 26.443	0.091 / -48.306	0.597 / -166.355
3.700GHz	0.851 / 177.164	1.155 / 24.440	0.091 / -49.924	0.601 / -167.157
3.800GHz	0.852 / 176.027	1.130 / 22.447	0.091 / -51.534	0.604 / -167.966
3.900GHz	0.853 / 174.886	1.107 / 20.464	0.091 / -53.138	0.607 / -168.783
4.000GHz	0.853 / 173.738	1.086 / 18.489	0.091 / -54.738	0.610 / -169.607

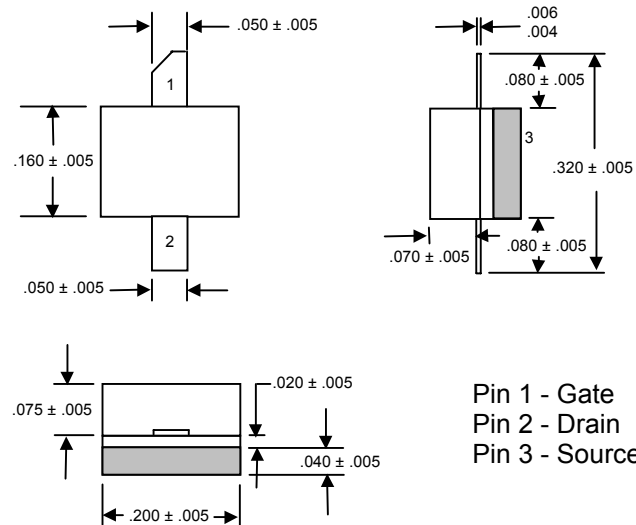
**Typical Packaged S- Parameters (Small Signal,  $V_{DS} = 48\text{ V}$ ,  $I_{DQ} = 250\text{ mA}$ , ang in deg)**

freq	S(1,1)	S(2,1)	S(1,2)	S(2,2)
100.0MHz	0.935 / -22.097	7.829 / 165.893	0.024 / 73.361	0.341 / -26.953
200.0MHz	0.920 / -42.676	7.370 / 152.734	0.045 / 62.187	0.356 / -50.854
300.0MHz	0.900 / -60.781	6.758 / 141.088	0.062 / 51.523	0.374 / -70.354
400.0MHz	0.881 / -76.139	6.110 / 131.067	0.074 / 42.232	0.392 / -85.633
500.0MHz	0.865 / -88.933	5.497 / 122.511	0.083 / 34.306	0.407 / -97.471
600.0MHz	0.852 / -99.537	4.950 / 115.167	0.090 / 27.540	0.420 / -106.682
700.0MHz	0.842 / -108.354	4.474 / 108.786	0.095 / 21.708	0.431 / -113.933
800.0MHz	0.834 / -115.739	4.064 / 103.160	0.098 / 16.614	0.441 / -119.725
900.0MHz	0.828 / -121.985	3.712 / 98.128	0.101 / 12.099	0.450 / -124.423
1.000GHz	0.824 / -127.324	3.408 / 93.564	0.103 / 8.043	0.458 / -128.294
1.100GHz	0.821 / -131.937	3.146 / 89.373	0.104 / 4.354	0.466 / -131.533
1.200GHz	0.819 / -135.963	2.917 / 85.485	0.105 / 0.962	0.473 / -134.284
1.300GHz	0.818 / -139.514	2.717 / 81.845	0.106 / -2.188	0.481 / -136.655
1.400GHz	0.818 / -142.674	2.541 / 78.410	0.107 / -5.136	0.488 / -138.729
1.500GHz	0.818 / -145.513	2.385 / 75.148	0.107 / -7.916	0.495 / -140.568
1.600GHz	0.818 / -148.084	2.246 / 72.032	0.107 / -10.553	0.502 / -142.219
1.700GHz	0.818 / -150.432	2.121 / 69.041	0.107 / -13.067	0.509 / -143.721
1.800GHz	0.819 / -152.591	2.009 / 66.159	0.108 / -15.476	0.516 / -145.104
1.900GHz	0.820 / -154.592	1.908 / 63.373	0.108 / -17.792	0.523 / -146.390
2.000GHz	0.821 / -156.457	1.816 / 60.670	0.108 / -20.028	0.530 / -147.598
2.100GHz	0.823 / -158.208	1.733 / 58.043	0.107 / -22.191	0.537 / -148.744
2.200GHz	0.824 / -159.860	1.657 / 55.482	0.107 / -24.290	0.544 / -149.838
2.300GHz	0.826 / -161.428	1.587 / 52.981	0.107 / -26.332	0.550 / -150.892
2.400GHz	0.827 / -162.924	1.523 / 50.536	0.107 / -28.322	0.557 / -151.911
2.500GHz	0.829 / -164.358	1.464 / 48.139	0.107 / -30.265	0.563 / -152.904
2.600GHz	0.831 / -165.738	1.410 / 45.789	0.107 / -32.166	0.569 / -153.875
2.700GHz	0.832 / -167.073	1.360 / 43.479	0.107 / -34.029	0.575 / -154.829
2.800GHz	0.834 / -168.368	1.314 / 41.208	0.106 / -35.856	0.581 / -155.768
2.900GHz	0.836 / -169.630	1.271 / 38.972	0.106 / -37.652	0.587 / -156.696
3.000GHz	0.837 / -170.865	1.231 / 36.767	0.106 / -39.418	0.592 / -157.616
3.100GHz	0.839 / -172.075	1.194 / 34.593	0.106 / -41.158	0.597 / -158.529
3.200GHz	0.841 / -173.266	1.160 / 32.446	0.106 / -42.874	0.602 / -159.437
3.300GHz	0.842 / -174.441	1.127 / 30.323	0.106 / -44.569	0.607 / -160.342
3.400GHz	0.844 / -175.604	1.098 / 28.223	0.106 / -46.244	0.612 / -161.246
3.500GHz	0.845 / -176.757	1.070 / 26.145	0.106 / -47.902	0.616 / -162.148
3.600GHz	0.846 / -177.904	1.044 / 24.085	0.106 / -49.544	0.621 / -163.051
3.700GHz	0.848 / -179.046	1.020 / 22.042	0.106 / -51.173	0.625 / -163.955
3.800GHz	0.849 / 179.813	0.997 / 20.014	0.106 / -52.790	0.628 / -164.862
3.900GHz	0.850 / 178.671	0.976 / 17.999	0.106 / -54.398	0.632 / -165.772
4.000GHz	0.852 / 177.526	0.957 / 15.996	0.106 / -55.998	0.635 / -166.687

All products conform to the listed mechanical specifications within the tolerances shown.

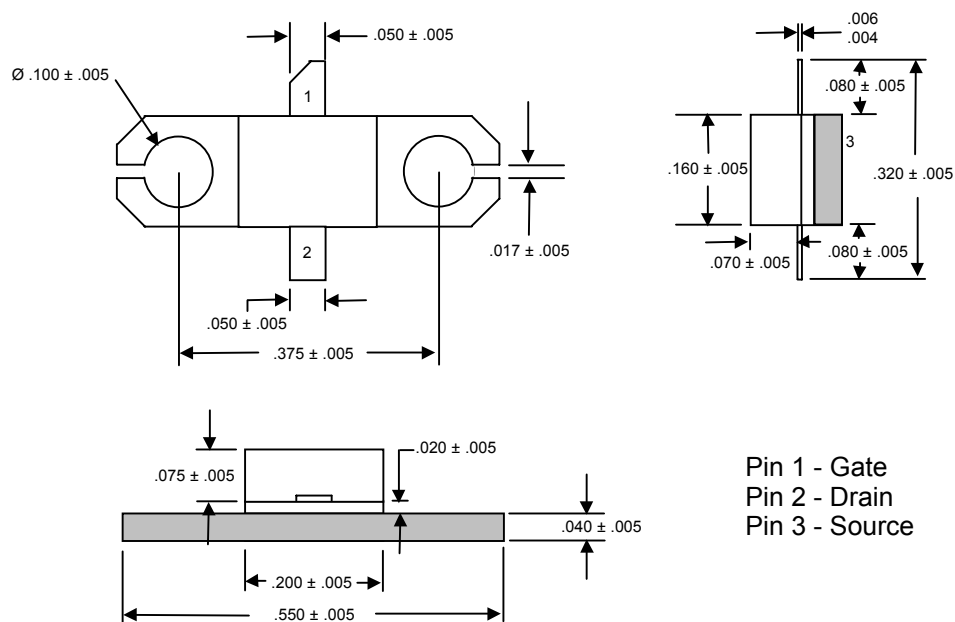
**PACKAGE DIMENSIONS (UNITS IN INCHES)**

**STYLE 001**



Pin 1 - Gate  
Pin 2 - Drain  
Pin 3 - Source

**STYLE 101**



Pin 1 - Gate  
Pin 2 - Drain  
Pin 3 - Source

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**Contact Information:**

Cree Microwave, Inc.  
160 Gibraltar Court  
Sunnyvale, CA 94089-1319

Sheryle Henson (Cree Microwave--Marketing Manager) 408-962-7783  
Tom Dekker (Cree Microwave--Sales Director) 919-313-5639

Web: <http://www.cree.com/>