Microsemi
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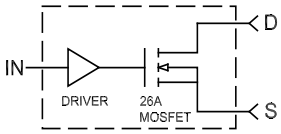
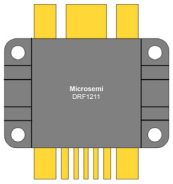
DRF1211

1000V, 26A, 30MHz

MOSFET Driver Hybrid

The DRF1211 hybrid includes a high power gate driver and the power MOSFET. It was designed to provide the system designer increased flexibility and lowered cost over a non-integrated solution.





FEATURES

- **Switching Frequency: DC TO 30MHz**
- **Low Pulse Width Distortion**
- **Single Power Supply**
- **1V CMOS Schmitt Trigger Input 1V Hysteresis**
- **Inverting Non-Inverting Select**
- **RoHS Compliant**
- **Switching Speed 3-4ns**
- **B_{Vds} = 1Kv**
- **I_{ds} = 26A avg.**
- **$R_{DS(on)}$≤ .55 Ohm**
- **P_D = 1000W**

TYPICAL APPLICATIONS

- **Class C, D and E RF Generators**
- **Switch Mode Power Amplifiers**
- **Pulse Generators**
- **Ultrasound Transducer Drivers**
- **Acoustic Optical Modulators**

Driver Absolute Maximum Ratings

Symbol	Parameter	Min	Typ	Max	Unit
V_{dd}	Supply Voltage			15	V
IN	Input Single Voltages			-5.0 to 15.3	
$I_{O\ PK}$	Output Current Peak			15	A
T_{JMAX}	Operating Temperature			150	°C

Driver Specifications

Symbol	Parameter	Min	Typ	Max	Unit
V_{dd}	Supply Voltage	8		15	V
IN	Input Voltage	-5.0		V_{dd} +0.3	
$IN_{(R)}$	Input Voltage Rising Edge		2.5		ns
$IN_{(F)}$	Input Voltage Falling Edge		2.5		
I_{DDQ}	Quiescent Current		15	25	mA
I_O	Output Current		15		A
C_{oss}	Output Capacitance		2500		pF
C_{iss}	Input Capacitance		35		
R_{IN}	Input Parallel Resistance		1		MΩ
$V_{T(ON)}$	V threshhold On, V_{dd} = 12V, Vin = 0 to 5V Ramp	2.2		3.2	V
$V_{T(OFF)}$	V threshhold On, V_{dd} = 12V, Vin = 0 to 5V Ramp	1.0		1.9	
t_r	Rise Time 10% to 90%, V_{dd} = 12V, Vin = 0 to 5V, R_L = 1.0Ω, C_L = 2nF	1.5	2.5	3.0	ns
t_f	Fall Time 90% to 10%, V_{dd} = 12V, Vin = 0 to 5V, R_L = 1.0Ω, C_L = 2nF	1.5	2.5	3.0	
$T_{D(ON)}$	On Delay Time, 50% to 50%, V_{dd} = 12V, Vin = 0 to 5V, R_L = 1.0Ω, C_L = 2nF		18		
$T_{D(OFF)}$	Off Delay Time, 50% to 50%, V_{dd} = 12V, Vin = 0 to 5V, R_L = 1.0Ω, C_L = 2nF		18		

050-4986 Rev A 09-2020

Driver Output Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
C_{out}	Output Capacitance		2500		pF
R_{out}	Output Resistance		0.5		Ω
L_{out}	Output Inductance	2	3	4	nH
F_{MAX}	Operating Frequency CL = 3nF + 50Ω			60	MHz

Driver Thermal Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
$R_{\theta JC}$	Thermal Resistance Junction to Case		1.5		°C/W
T_j, T_{STG}	Operating and Storage Temperature		-55 to 150		°C
P_{DC}	Maximum Power Dissipation @ T_C = 25°C		80		W

MOSFET Absolute Maximum Ratings

Symbol	Parameter	Min	Typ	Max	Unit
BV_{DSS}	Drain Source Voltage	1000			V
I_D	Continuous Drain Current T_C = 25°C @ I_D = 13A			26	A
$R_{DS(on)}$	Drain-Source On State Resistance			0.7	Ω
T_{jmax}	Operating Temperature			175	°C

MOSFET Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	V_{gs} = 0		4000		pF
C_{oss}	Output Capacitance	V_{DS} = 50V		460		
C_{rss}	Reverse Transfer Capacitance	f = 1 MHz		90		

MOSFET Thermal Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
$R_{\theta JC}$	Thermal Resistance Junction to Case (per MOSFET)		0.16	0.17	°C/W
$R_{\theta JHS}$	Thermal Resistance Junction to Heat Sink			0.22	
T_{JSTG}	Storage Temperature			-55 to 150	°C
P_{DHS}	Maximum Power Dissipation @ T_{SINK} = 25°C			680	W
P_{DC}	Total Power Dissipation @ T_C = 25°C		1000		

Microsemi reserves the right to change, without notice, the specifications and information contained herein.

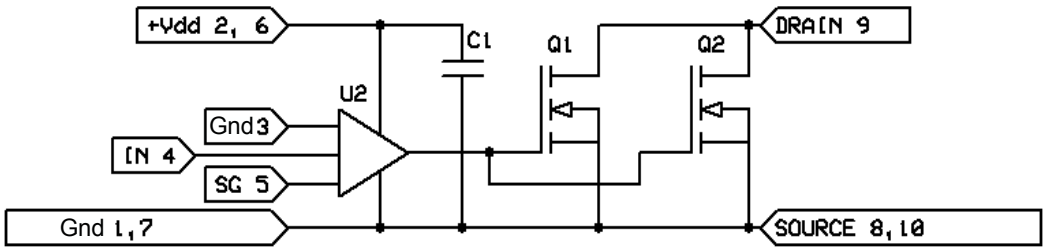


Figure 1, DRF1211 Simplified Circuit Diagram

The Simplified DRF1211 Circuit Diagram is illustrated above. By including the driver high speed by-pass capacitor (C1), the contribution to the internal parasitic loop inductance of the driver output is greatly reduced. This, coupled with the tight geometry of the hybrid, allows optimal gate drive to the MOSFET. This low parasitic approach, coupled with the Schmitt trigger input (IN), Kelvin signal ground (SG) and the Anti-Ring Function, provide improved stability and control in Kilowatt to Multi-Kilowatt, high Frequency applications. IN pin is referenced to the Kelvin ground (SG.) The signal is then applied to the intermediate drivers and level shifters; this section contains proprietary circuitry designed specifically for the ring abatement. The power drivers provide high current to the gate of the MOSFETS.

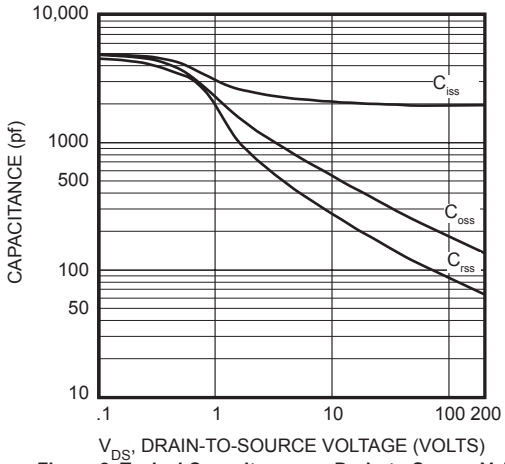


Figure 2, Typical Capacitance vs. Drain-to-Source Voltage

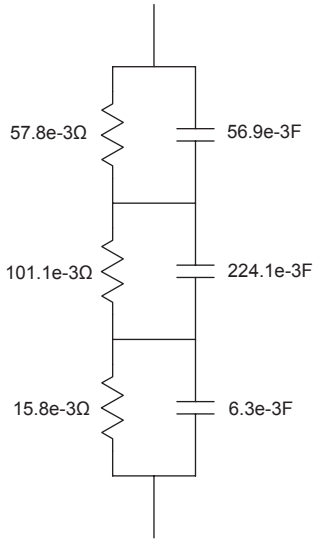


Figure 3a, Transient Thermal Impedance Model

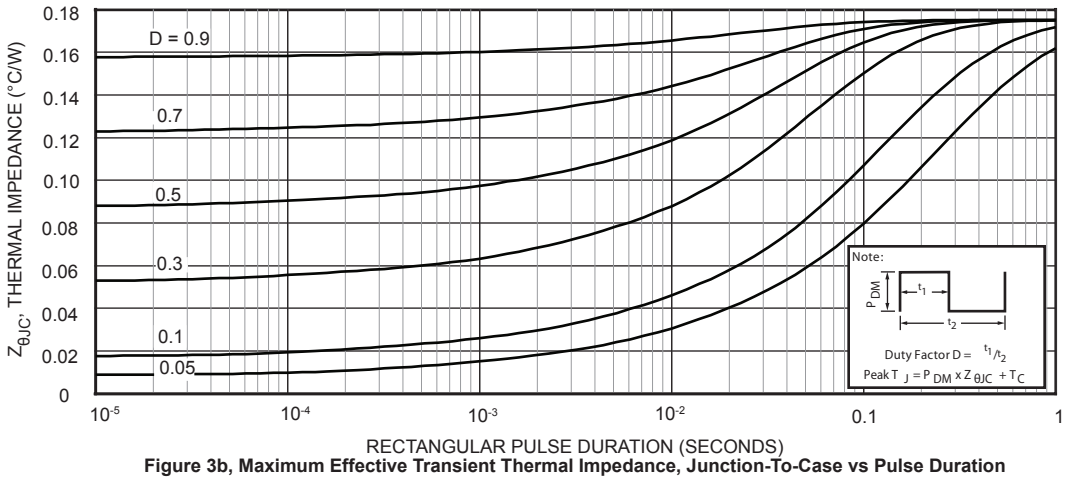


Figure 3b, Maximum Effective Transient Thermal Impedance, Junction-To-Case vs Pulse Duration

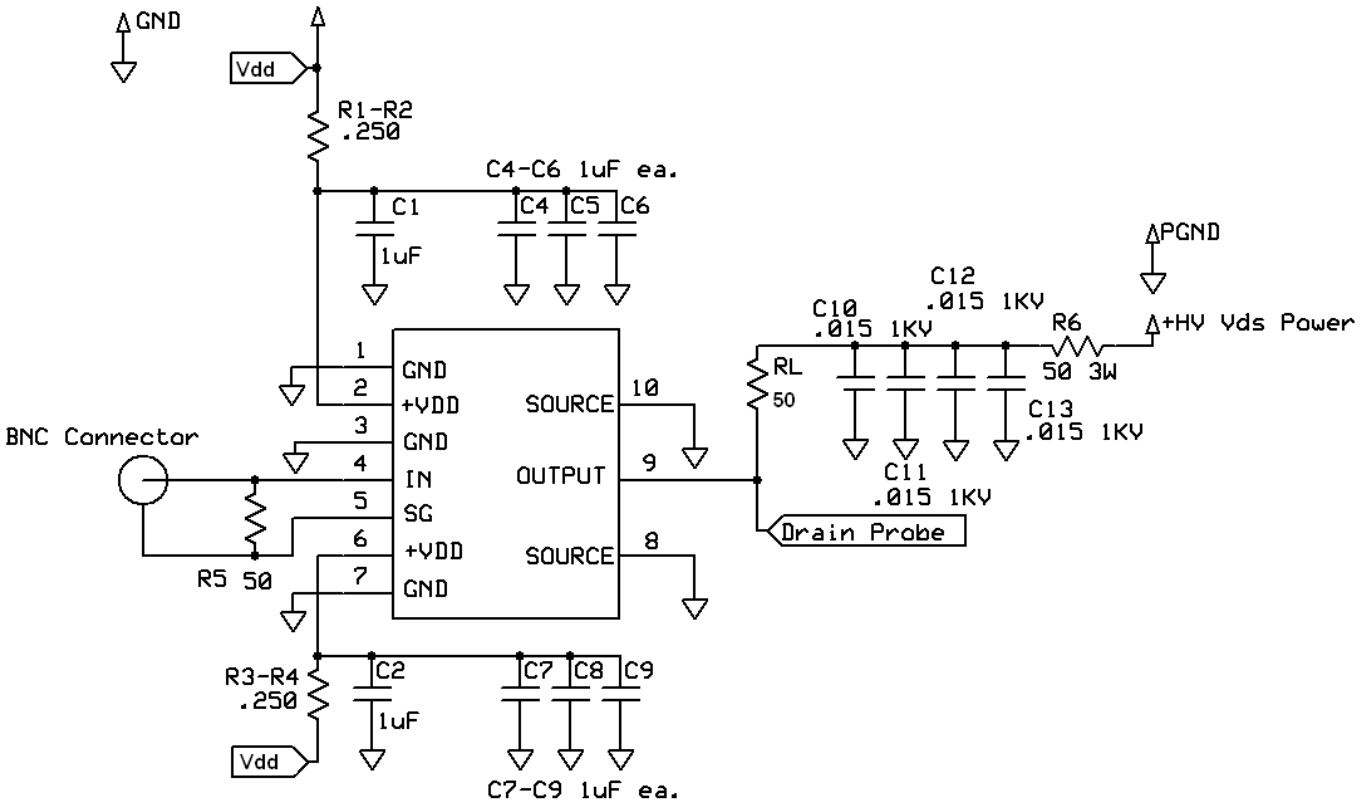
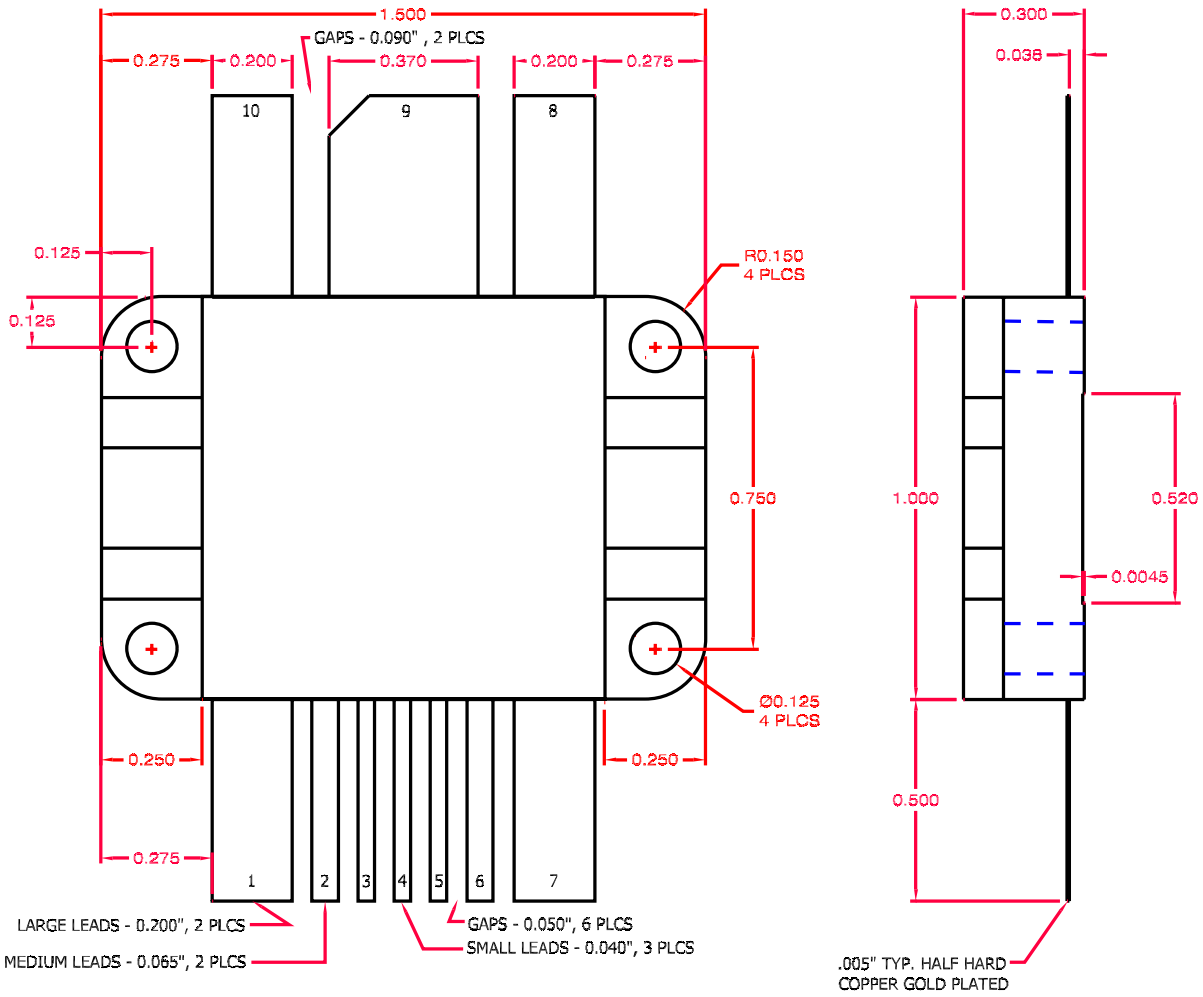


Figure 4, DRF1211 Test Circuit

The Test Circuit illustrated above was used to evaluate the DRF1211 (available as an evaluation Board DRF12XX / EVALSW.) The input control signal is applied to the DRF1211 via IN(4) and SG(5) pins using RG188. This provides excellent noise immunity and control of the signal ground currents.

The $+V_{DD}$ inputs (2,6) are by-passed (C1, C2, C4-C9), this is in addition to the internal by-passing mentioned previously. The capacitors used for this function must be capable of supporting the RMS currents and frequency of the gate load. R_L set for I_{DM} at V_{DS} max this load is used to evaluate the output performance of the DRF1211.

Pin Assignments	
Pin 1	GND
Pin 2	+Vdd
Pin 3	GND
Pin 4	IN
Pin 5	SG
Pin 6	+Vdd
Pin 7	GND
Pin 8	Source
Pin 9	Drain
Pin 10	Source



All dimensions are ± .005

Figure 5, DRF1211 Mechanical Outline

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: 1.973g. Percentage of total module weight which is BeO: 31%.

050-4986 Rev A 09-2020

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050-4986 Rev A 09-2020