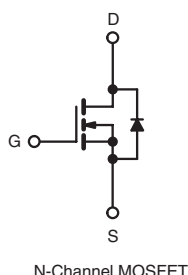
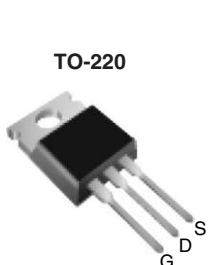


**Power MOSFET****PRODUCT SUMMARY**

V_{DS} (V)	500	
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$	0.450
Q_g (Max.) (nC)	81	
Q_{gs} (nC)	20	
Q_{gd} (nC)	36	
Configuration	Single	



N-Channel MOSFET

FEATURES

- Lower Gate Charge Q_g Results in Simpler Drive Requirements
- Improved Gate, Avalanche and Dynamic dV/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage
- Lead (Pb)-free Available

**RoHS***
COMPLIANT**APPLICATIONS**

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supplies
- High Speed Power Switching

ORDERING INFORMATION

Package	TO-220
Lead (Pb)-free	IRFB13N50APbF
	SiHFB13N50A-E3
SnPb	IRFB13N50A
	SiHFB13N50A

ABSOLUTE MAXIMUM RATINGS $T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V _{DS}	500	V
Gate-Source Voltage			V _{GS}	± 30	
Continuous Drain Current	V _{GS} at 10 V	T _C = 25 °C	I _D	14	A
		T _C = 100 °C		9.1	
Pulsed Drain Current ^a			I _{DM}	56	
Linear Derating Factor				2.0	W/°C
Single Pulse Avalanche Energy ^b			E _{AS}	560	mJ
Avalanche Current ^a			I _{AR}	14	A
Repetitive Avalanche Energy ^a			E _{AR}	25	mJ
Maximum Power Dissipation	T _C = 25 °C		P _D	250	W
Peak Diode Recovery dV/dt ^c			dV/dt	9.2	V/ns
Operating Junction and Storage Temperature Range			T _J , T _{stg}	- 55 to + 150	°C
Soldering Recommendations (Peak Temperature)	for 10 s			300 ^d	
Mounting Torque	6-32 or M3 screw			10	
				1.1	N · m

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Starting $T_J = 25\text{ }^\circ\text{C}$, $L = 5.7\text{ mH}$, $R_G = 25\text{ }\Omega$, $I_{AS} = 14\text{ A}$, $dV/dt = 7.6\text{ V/ns}$ (see fig. 12a).
- $I_{SD} \leq 14\text{ A}$, $dI/dt \leq 250\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^\circ\text{C}$.
- 1.6 mm from case.

* Pb containing terminations are not RoHS compliant, exemptions may apply

THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	62	°C/W
Case-to-Sink, Flat, Greased Surface	R_{thCS}	0.50	-	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.50	

SPECIFICATIONS $T_J = 25\text{ °C}$, unless otherwise noted

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA		500	-	-	V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA		-	0.55	-	V/°C
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		2.0	-	4.0	V
Gate-Source Leakage	I _{GSS}	V _{GS} = ± 30 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 500 V, V _{GS} = 0 V		-	-	25	μA
		V _{DS} = 400 V, V _{GS} = 0 V, T _J = 125 °C		-	-	250	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 8.4 A ^b	-	-	0.450	Ω
Forward Transconductance	g _{fs}	V _{DS} = 50 V, I _D = 8.4 A		8.1	-	-	S
Dynamic							
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 25 V, f = 1.0 MHz, see fig. 5		-	1910	-	pF
Output Capacitance	C _{oss}			-	290	-	
Reverse Transfer Capacitance	C _{rss}			-	11	-	
Output Capacitance	C _{oss}	V _{GS} = 0 V	V _{DS} = 1.0 V, f = 1.0 MHz	-	2730	-	pF
			V _{DS} = 400 V, f = 1.0 MHz	-	82	-	
Effective Output Capacitance	C _{oss eff.}		V _{DS} = 0 V to 400 V ^c	-	160	-	
Total Gate Charge	Q _g		I _D = 14 A, V _{DS} = 400 V, see fig. 6 and 13 ^b	-	-	81	nC
Gate-Source Charge	Q _{gs}			-	-	20	
Gate-Drain Charge	Q _{gd}			-	-	36	
Turn-On Delay Time	t _{d(on)}	V _{GS} = 10 V	V _{DD} = 250 V, I _D = 14 A, R _G = 7.5 Ω, see fig. 10 ^b	-	15	-	ns
Rise Time	t _r			-	39	-	
Turn-Off Delay Time	t _{d(off)}			-	39	-	
Fall Time	t _f			-	31	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I _S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	14	A
Pulsed Diode Forward Current ^a	I _{SM}			-	-	56	
Body Diode Voltage	V _{SD}	T _J = 25 °C, I _S = 14 A, V _{GS} = 0 V ^b		-	-	1.5	V
Body Diode Reverse Recovery Time	t _{rr}	T _J = 25 °C, I _F = 14 A, T _J = 125 °C, di/dt = 100 A/μs ^b		-	370	550	ns
Body Diode Reverse Recovery Charge	Q _{rr}			-	4.4	6.5	μC
Body Diode Reverse Recovery Current	I _{RRM}			-	21	31	A
Forward Turn-On Time	t _{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L _S and L _D)					

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
b. Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.
c. $C_{oss\text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80 % V_{DS} .

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

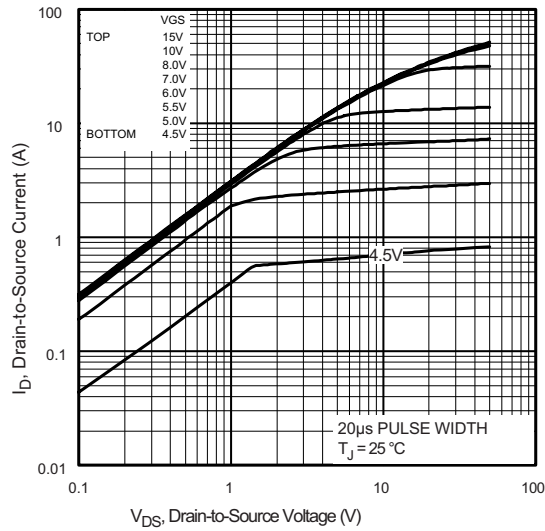


Fig. 1 - Typical Output Characteristics

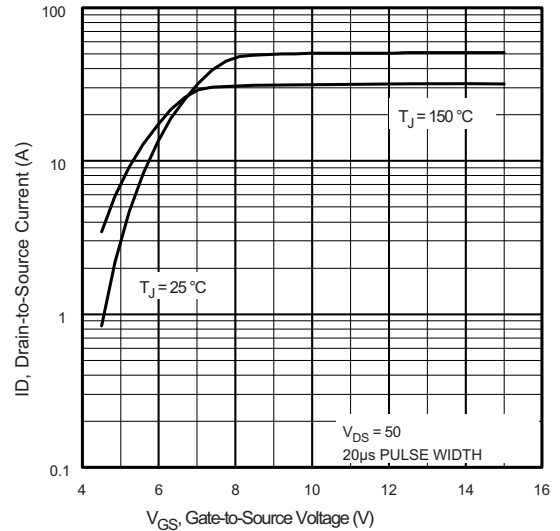


Fig. 3 - Typical Transfer Characteristics

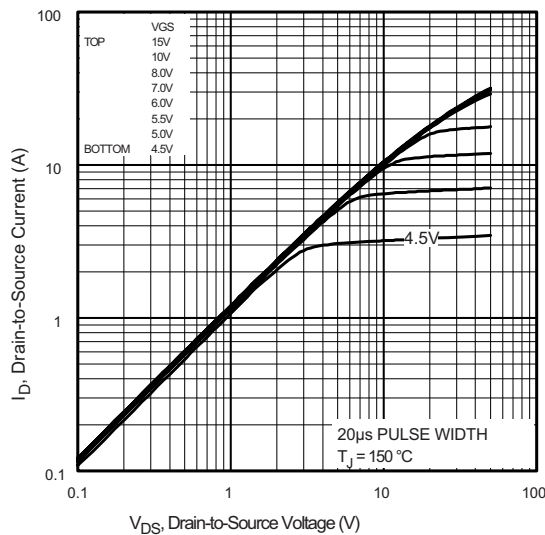


Fig. 2 - Typical Output Characteristics

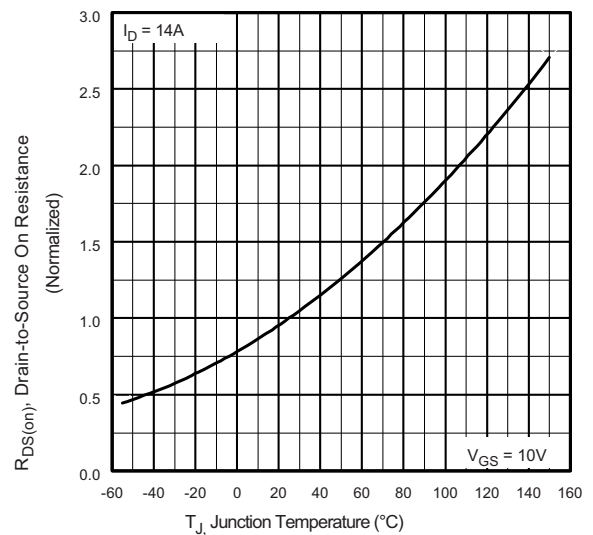


Fig. 4 - Normalized On-Resistance vs. Temperature

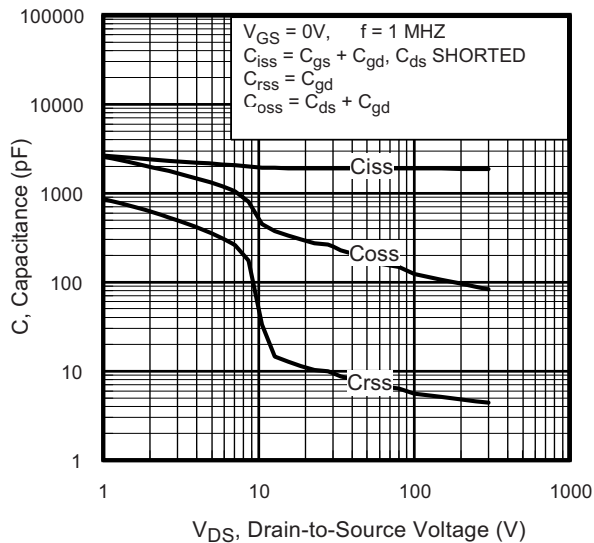


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

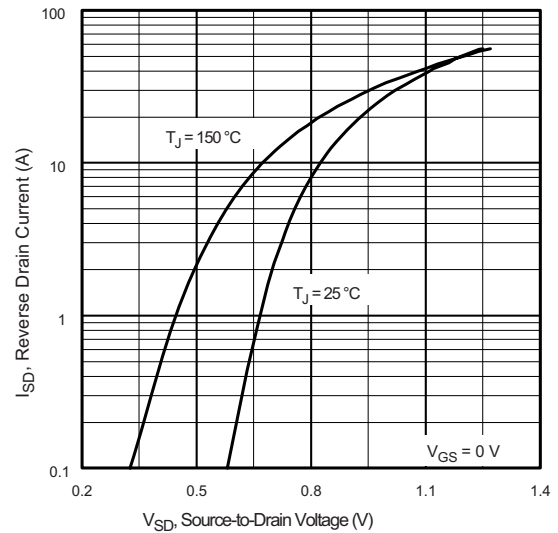


Fig. 7 - Typical Source-Drain Diode Forward Voltage

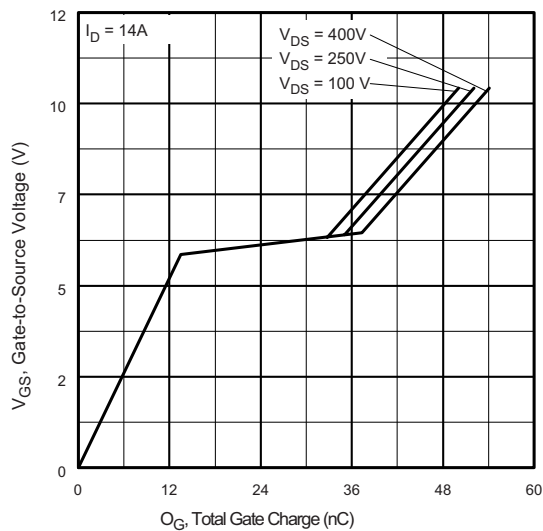


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

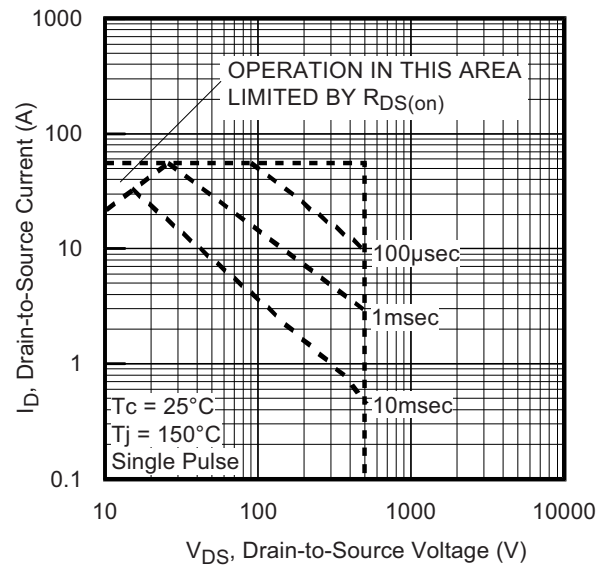


Fig. 8 - Maximum Safe Operating Area

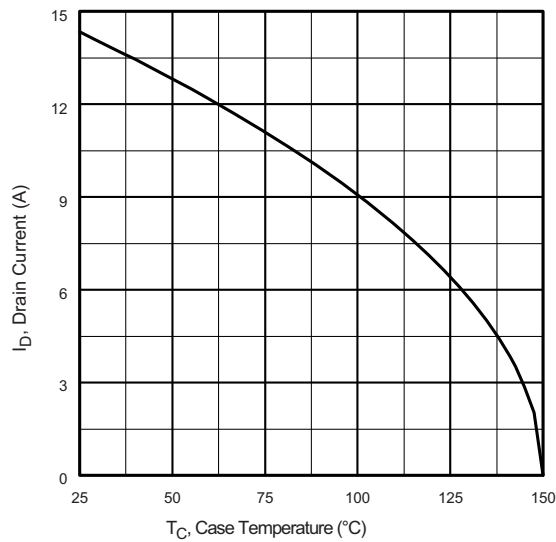


Fig. 9 - Maximum Drain Current vs. Case Temperature

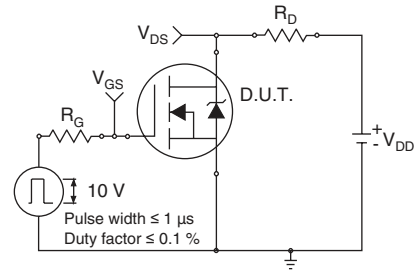


Fig. 10a - Switching Time Test Circuit

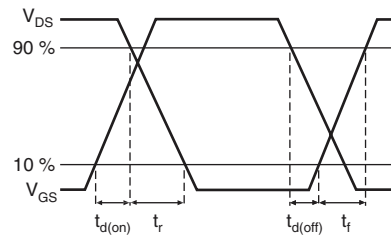


Fig. 10b - Switching Time Waveforms

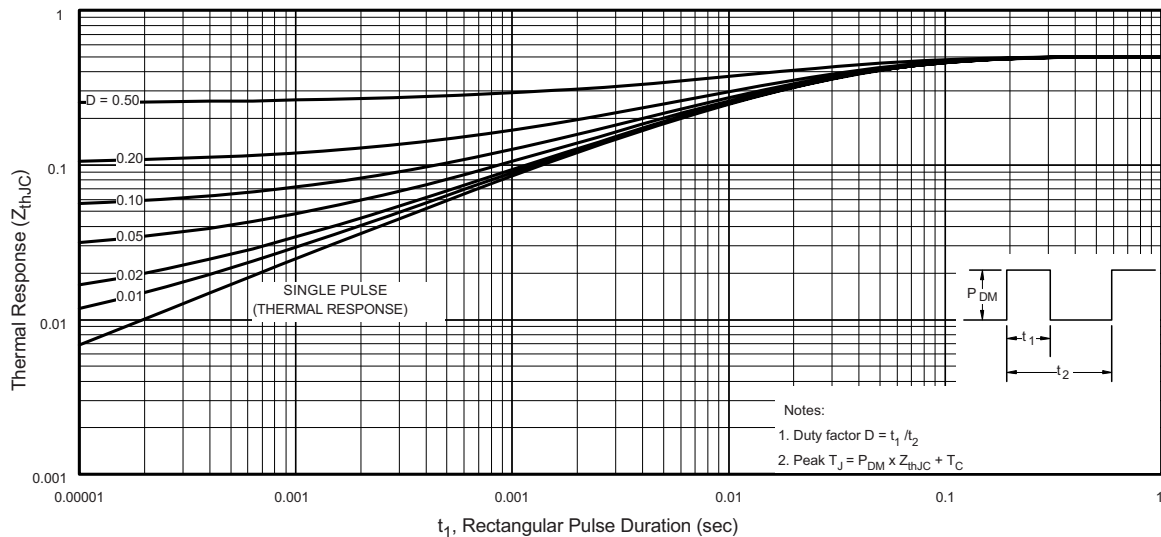


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

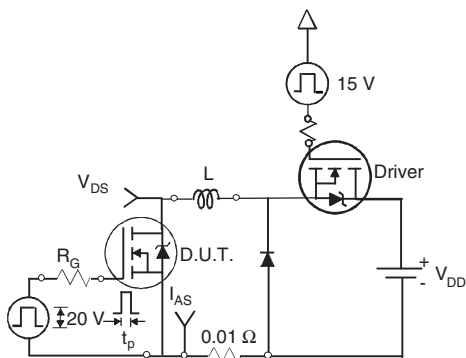


Fig. 12a - Unclamped Inductive Test Circuit

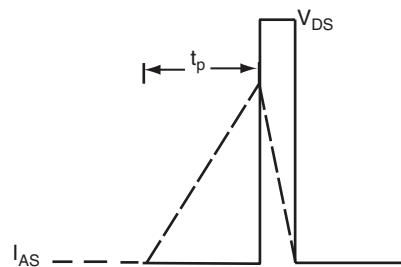


Fig. 12b - Unclamped Inductive Waveforms

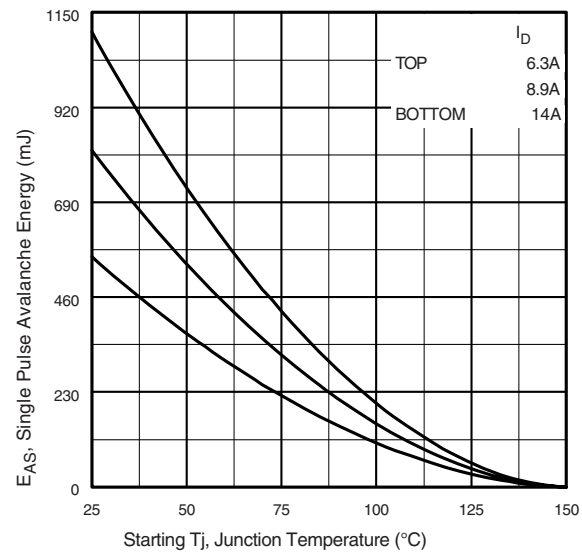


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

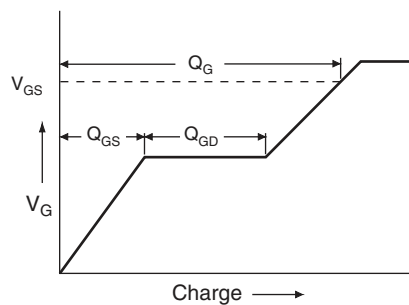


Fig. 13a - Basic Gate Charge Waveform

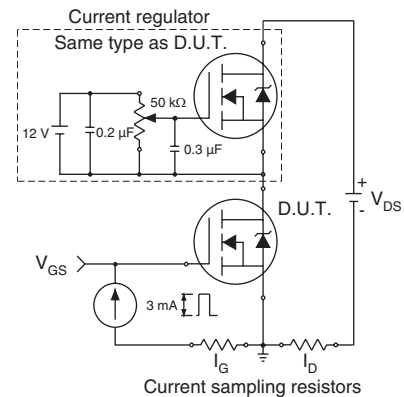


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit

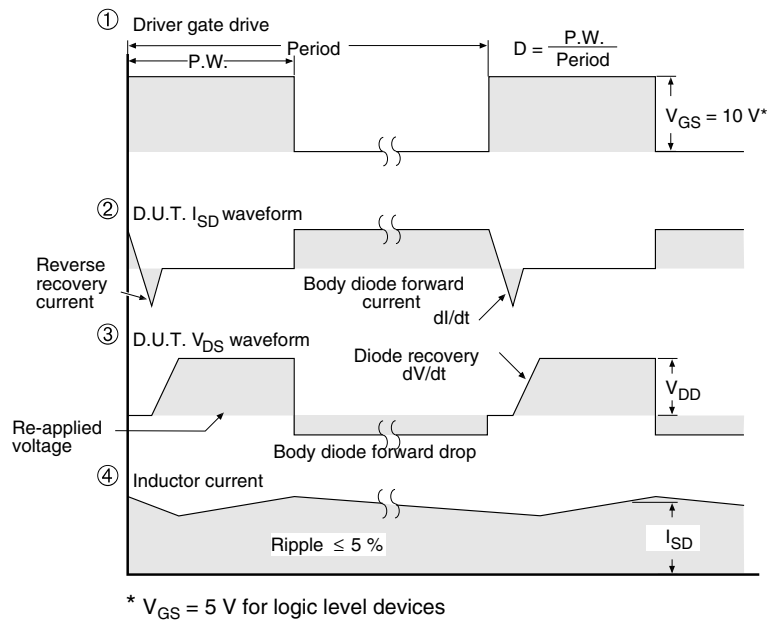
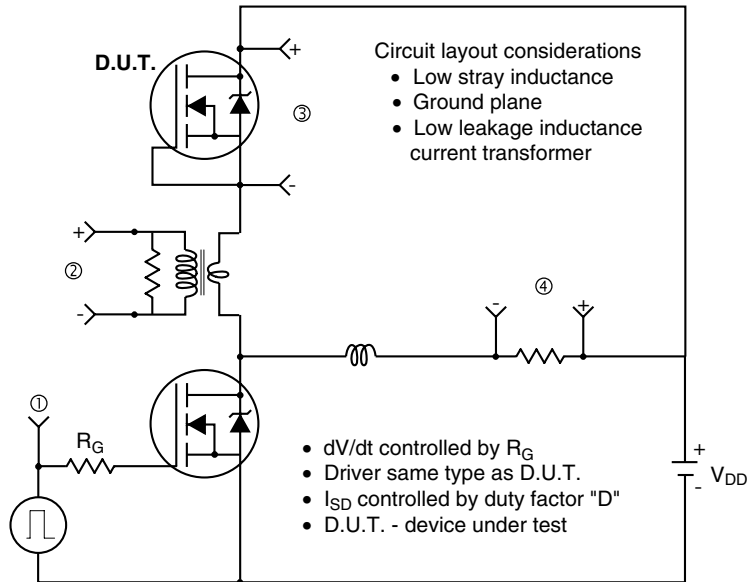


Fig. 14 - For N-Channel

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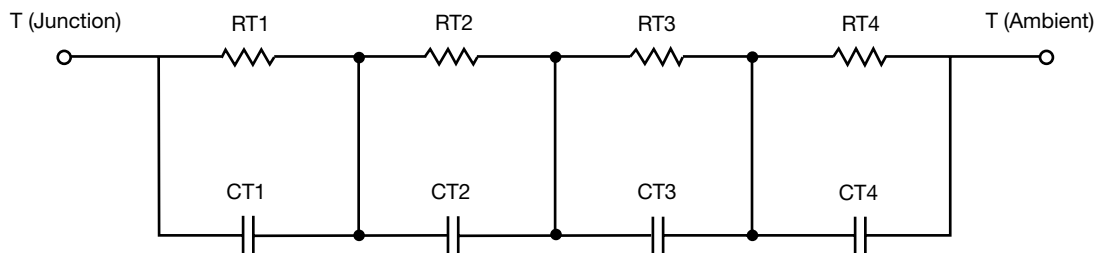
R-C Thermal Model Parameters

DESCRIPTION

The parametric values in the R-C thermal model have been derived using curve-fitting techniques. R-C values for the electrical circuit in the Foster/tank and Cauer/filter configurations are included. When implemented in P-SPICE, these values have matching characteristic curves to the single-pulse transient thermal impedance curves for the MOSFET.

These RC values can be used in the P-SPICE simulation to evaluate the thermal behavior of the MOSFET junction temperature under a defined power profile. These techniques are described in application note AN609, "Thermal Simulation of Power MOSFETs on the P-SPICE Platform".

R-C THERMAL MODEL FOR TANK CONFIGURATION

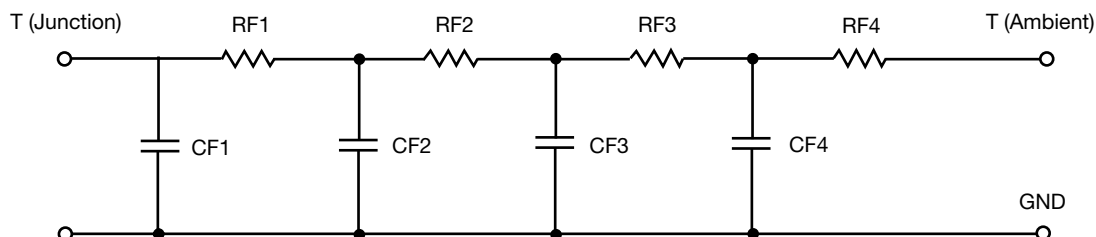


R-C VALUES FOR TANK CONFIGURATION			
THERMAL RESISTANCE (°C/W)			
Junction to	Ambient	Case	Foot
RT1	N/A	214.8550 m	N/A
RT2	N/A	82.6069 m	N/A
RT3	N/A	168.8390 m	N/A
RT4	N/A	33.6991 m	N/A
THERMAL CAPACITANCE (Joules/°C)			
Junction to	Ambient	Case	Foot
CT1	N/A	272.5951 m	N/A
CT2	N/A	25.4829 m	N/A
CT3	N/A	74.5477 m	N/A
CT4	N/A	3.1156 m	N/A

Note

N/A indicates not applicable

This document is intended as a SPICE modeling guideline and does not constitute a commercial product datasheet. Designers should refer to the appropriate datasheet of the same number for guaranteed specification limits.

R-C THERMAL MODEL FOR FILTER CONFIGURATION**R-C VALUES FOR FILTER CONFIGURATION**

THERMAL RESISTANCE (°C/W)			
Junction to	Ambient	Case	Foot
RF1	N/A	77.2676 m	N/A
RF2	N/A	198.2483 m	N/A
RF3	N/A	58.6953 m	N/A
RF4	N/A	165.7888 m	N/A
THERMAL CAPACITANCE (Joules/°C)			
Junction to	Ambient	Case	Foot
CF1	N/A	4.1555 m	N/A
CF2	N/A	29.9698 m	N/A
CF3	N/A	15.5676 m	N/A
CF4	N/A	278.9895 m	N/A

Note

N/A indicates not applicable

