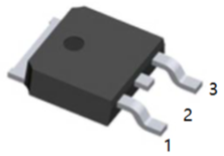
Features

- $V_{DS\ (V)}$=60V
- $R_{DS(ON)}$ < 15.8mΩ (V_{GS} = 10V)



1.G 2.D 3.S

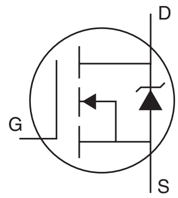
TO-252(DPAK) top view

Applications

- High Efficiency Synchronous Rectification in SMPS
- Uninterruptible Power Supply
- High Speed Power Switching
- Hard Switched and High Frequency Circuits

Benefits

- Improved Gate, Avalanche and Dynamic dv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche SOA
- Enhanced body diode dV/dt and dI/dt Capability



Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, VGS @ 10V	43	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	31	
I_{DM}	Pulsed Drain Current ①	170	
P_D @T_C = 25°C	Maximum Power Dissipation	71	W
	Linear Derating Factor	0.47	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
dv/dt	Peak Diode Recovery ③	24	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 175	°C
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	

Avalanche Characteristics

E_{AS} (Thermally limited)	Single Pulse Avalanche Energy ②	73	mJ
I_{AR}	Avalanche Current ①	25	A
E_{AR}	Repetitive Avalanche Energy ④	7.1	mJ

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑧		2.12	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat Greased Surface	0.50		
$R_{\theta JA}$	Junction-to-Ambient ⑦⑧		62	

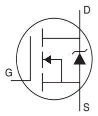
Static @ T_J = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	60			V	V_{GS} = 0V, I_D = 250μA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient		0.075		V/°C	Reference to 25°C, I_D = 5mA①
$R_{DS(on)}$	Static Drain-to-Source On-Resistance		12.6	15.8	mΩ	V_{GS} = 10V, I_D = 25A ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0		4.0	V	V_{DS} = V_{GS}, I_D = 50μA
I_{DSS}	Drain-to-Source Leakage Current			20	μA	V_{DS} = 60V, V_{GS} = 0V
				250		V_{DS} = 48V, V_{GS} = 0V, T_J = 125°C
I_{GSS}	Gate-to-Source Forward Leakage			100	nA	V_{GS} = 20V
	Gate-to-Source Reverse Leakage			-100		V_{GS} = -20V

Dynamic @ T_J = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
gfs	Forward Transconductance	41			S	V_{DS} = 10V, I_D = 25A
Q_g	Total Gate Charge		22	30	nC	I_D = 25A
Q_{gs}	Gate-to-Source Charge		5.0			V_{DS} = 30V
Q_{gd}	Gate-to-Drain ("Miller") Charge		6.3			V_{GS} = 10V ④
Q_{sync}	Total Gate Charge Sync. (Q_g - Q_{gd})		28.3			I_D = 25A, V_{DS} =0V, V_{GS} = 10V
$R_{G(int)}$	Internal Gate Resistance		0.79		Ω	
$t_{d(on)}$	Turn-On Delay Time		6.3		ns	V_{DD} = 39V
t_r	Rise Time		40			I_D = 25A
$t_{d(off)}$	Turn-Off Delay Time		49			R_G = 20Ω
t_f	Fall Time		47			V_{GS} = 10V ④
C_{iss}	Input Capacitance		1150		pF	V_{GS} = 0V
C_{oss}	Output Capacitance		130			V_{DS} = 50V
C_{rss}	Reverse Transfer Capacitance		67			f = 1.0MHz
C_{oss} eff. (ER)	Effective Output Capacitance (Energy Related)⑥		190			V_{GS} = 0V, V_{DS} = 0V to 60V ⑥
C_{oss} eff. (TR)	Effective Output Capacitance (Time Related)⑤		230			V_{GS} = 0V, V_{DS} = 0V to 60V ⑤

Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)			43	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①			170		
V_{SD}	Diode Forward Voltage			1.3	V	T_J = 25°C, I_S = 25A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time		22	33	ns	T_J = 25°C V_R = 51V,
			26	39		T_J = 125°C I_F = 25A
Q_{rr}	Reverse Recovery Charge		17	26	nC	T_J = 25°C di/dt = 100A/μs ④
			24	36		T_J = 125°C
I_{RRM}	Reverse Recovery Current		1.4		A	T_J = 25°C
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

Notes:

① Repetitive rating; pulse width limited by max. junction temperature.

② Limited by T_{Jmax}, starting T_J = 25°C, L = 0.23mH R_G = 25Ω, I_{AS} = 25A, V_{GS} =10V. Part not recommended for use above this value.

③ $I_{SD} \le$ 25A, di/dt $\le$ 1580A/μs, $V_{DD} \le V_{(BR)DSS}$, $T_J \le$ 175°C.

④ Pulse width $\le$ 400μs; duty cycle $\le$ 2%.

⑤ C_{oss} eff. (TR) is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

⑥ C_{oss} eff. (ER) is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

⑦ When mounted on 1" square PCB (FR-4 or G-10 Material). For recom mended footprint and soldering techniques refer to application note #AN-994.

⑧ R_θ is measured at T_J approximately 90°C.

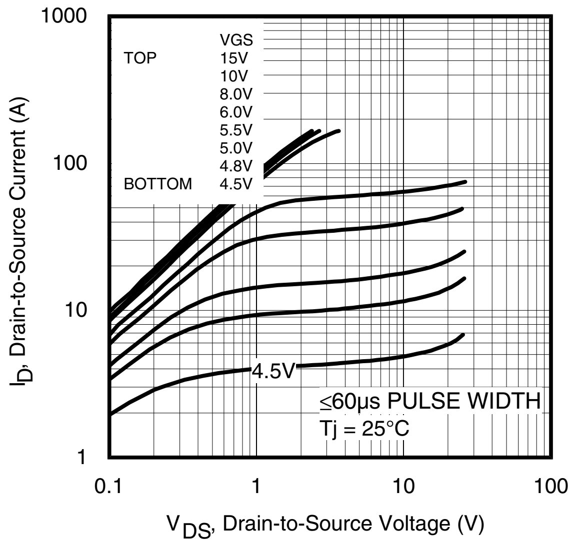


Fig 1. Typical Output Characteristics

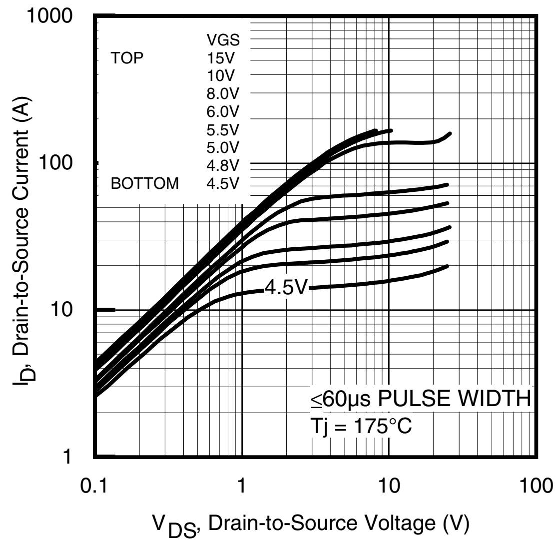


Fig 2. Typical Output Characteristics

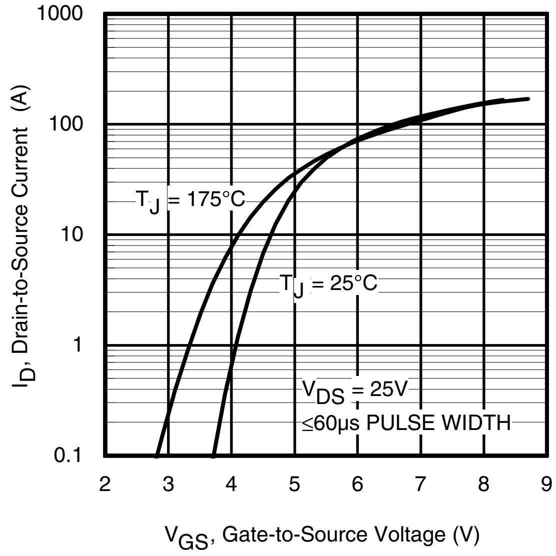


Fig 3. Typical Transfer Characteristics

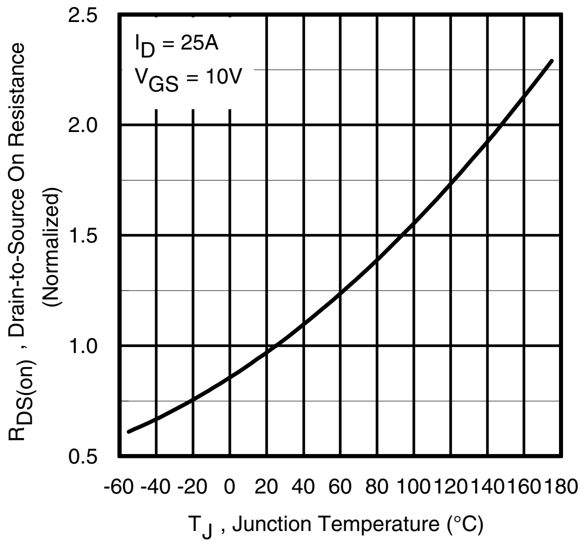


Fig 4. Normalized On-Resistance vs. Temperature

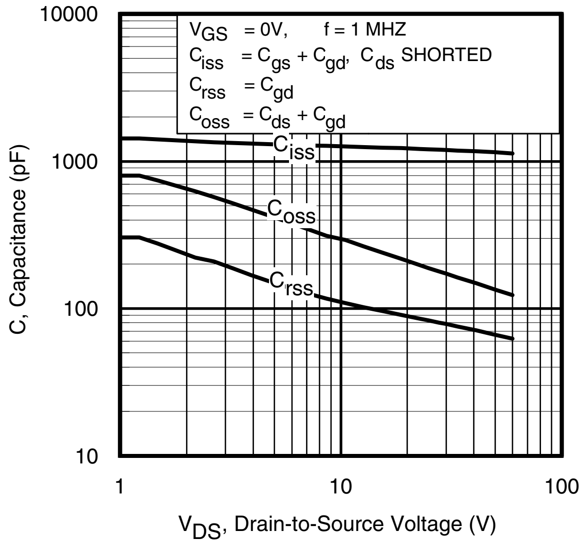


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

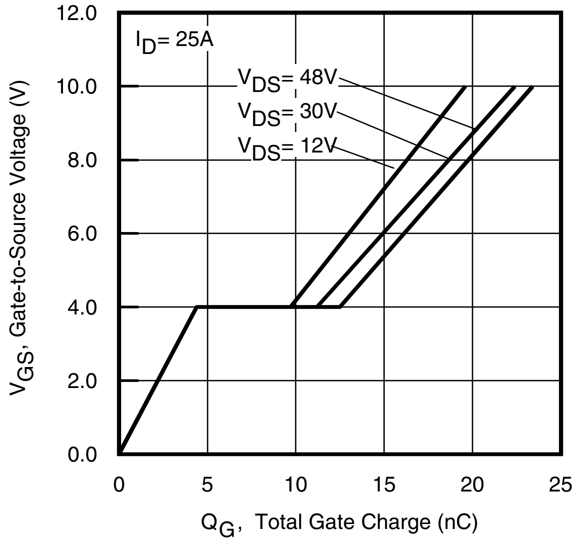


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

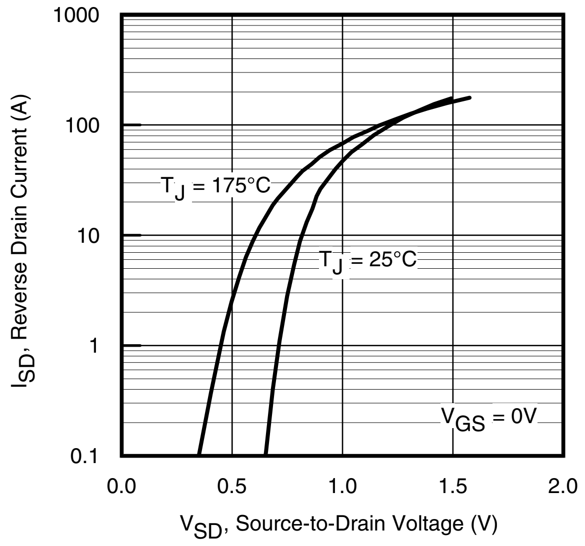


Fig 7. Typical Source-Drain Diode Forward Voltage

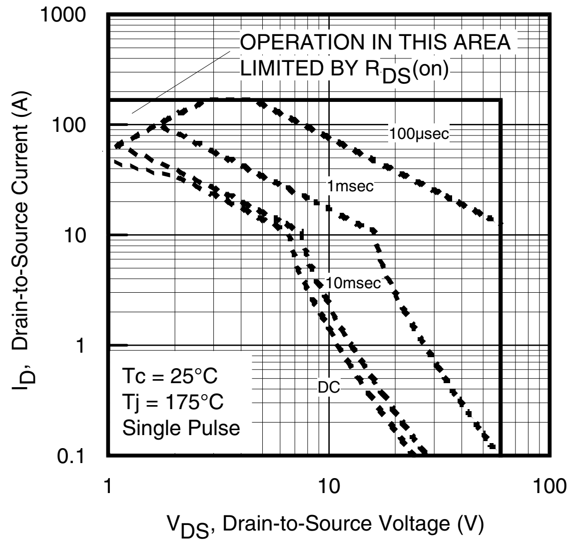


Fig 8. Maximum Safe Operating Area

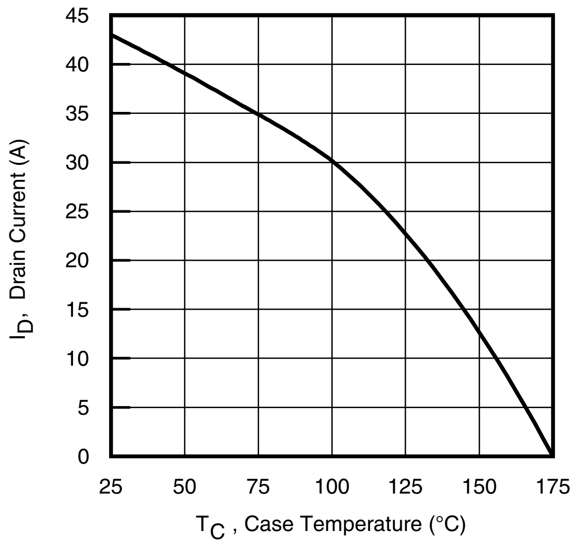


Fig 9. Maximum Drain Current vs. Case Temperature

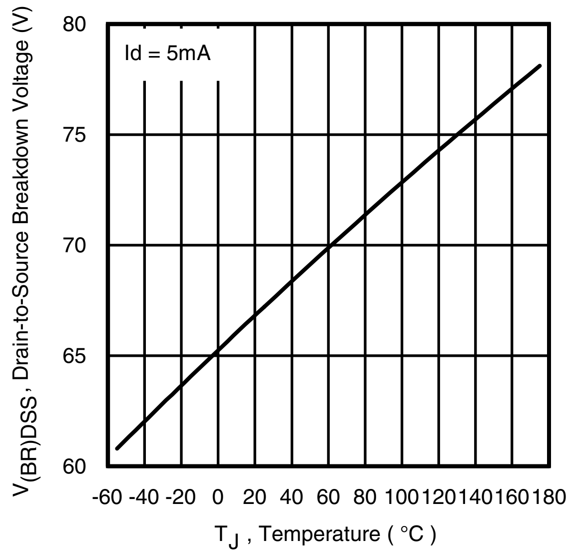


Fig 10. Drain-to-Source Breakdown Voltage

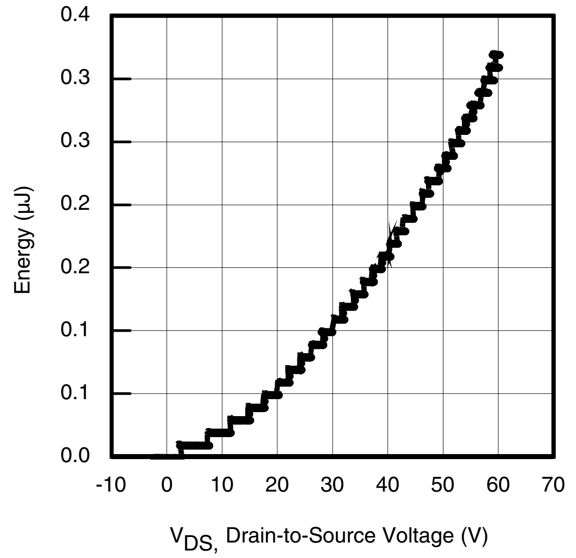


Fig 11. Typical C_{OSS} Stored Energy

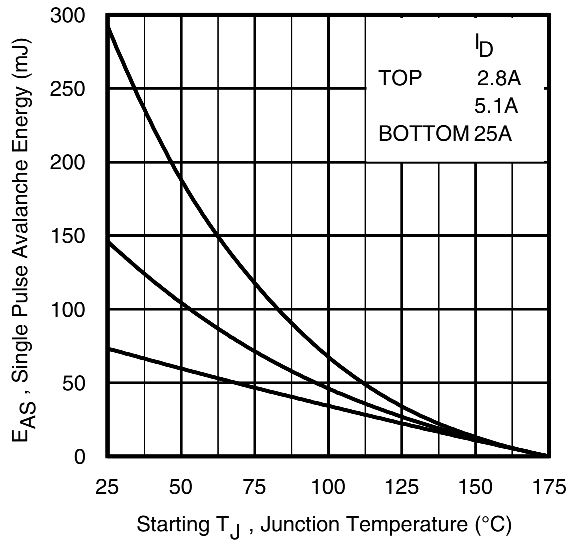


Fig 12. Maximum Avalanche Energy vs. DrainCurrent

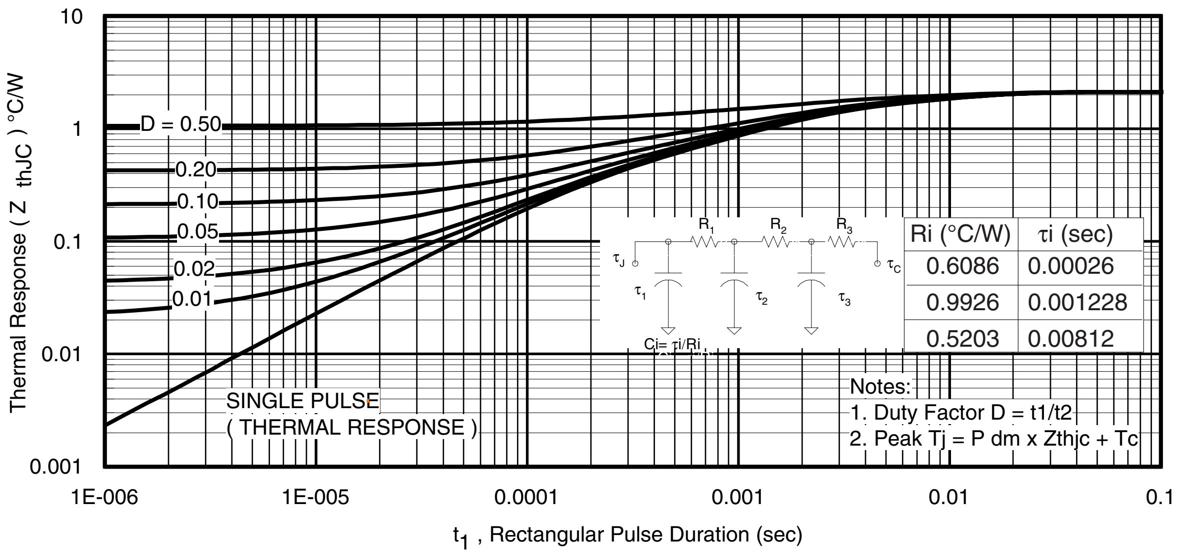


Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case

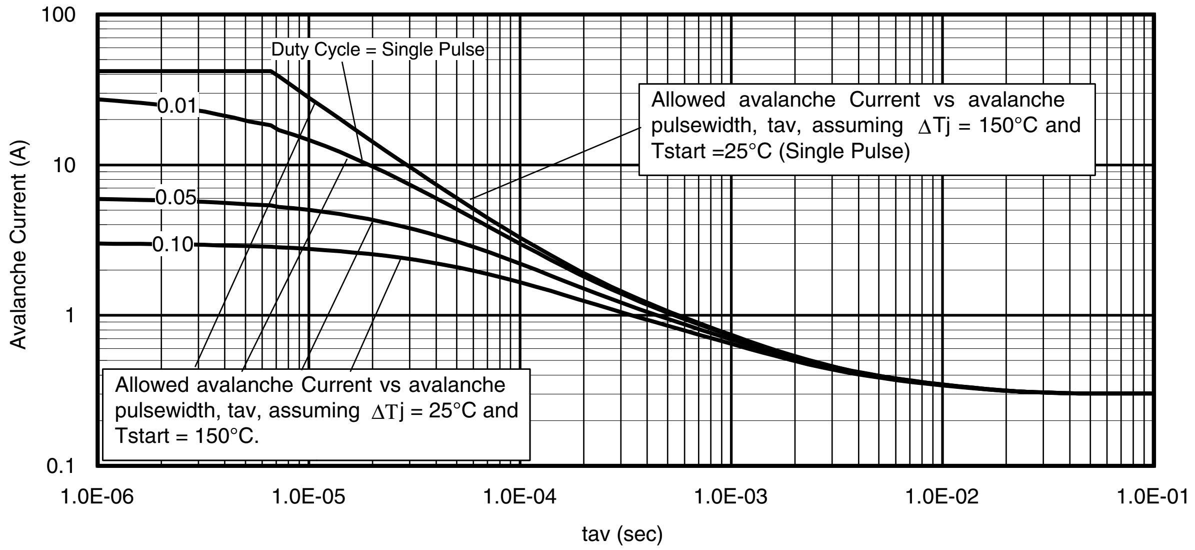


Fig 14. Typical Avalanche Current vs.Pulsewidth

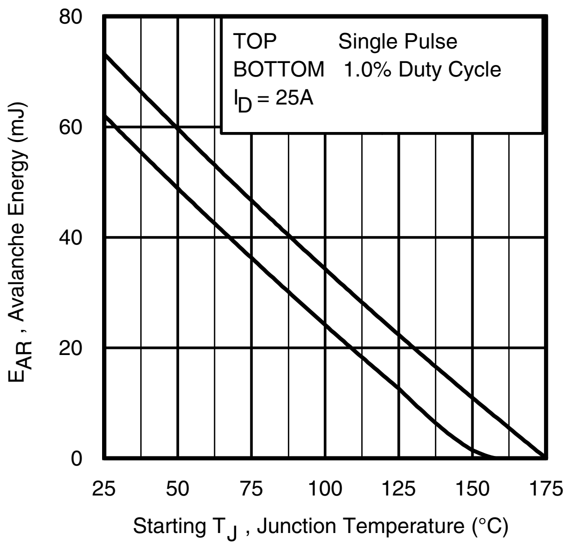


Fig 15. Maximum Avalanche Energy vs. Temperature

Notes on Repetitive Avalanche Curves , Figures 14, 15:
(For further info, see AN-1005 at www.irf.com)

1. Avalanche failures assumption:
   Purely a thermal phenomenon and failure occurs at a temperature far in excess of T_{jmax}. This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as T_{jmax} is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 16a, 16b.
4. $P_{D\ (ave)}$ = Average power dissipation per single avalanche pulse.
5. BV = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
6. I_{av} = Allowable avalanche current.
7. ΔT = Allowable rise in junction temperature, not to exceed T_{jmax} (assumed as 25°C in Figure 14, 15).
   t_{av} = Average time in avalanche.
   D = Duty cycle in avalanche = $t_{av} \cdot f$
   $Z_{thJC}(D, t_{av})$ = Transient thermal resistance, see Figures 13)

$$P_{D\ (ave)} = 1/2\ (1.3 \cdot BV \cdot I_{av}) = \Delta T / Z_{thJC}$$
$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$$
$$E_{AS\ (AR)} = P_{D\ (ave)} \cdot t_{av}$$

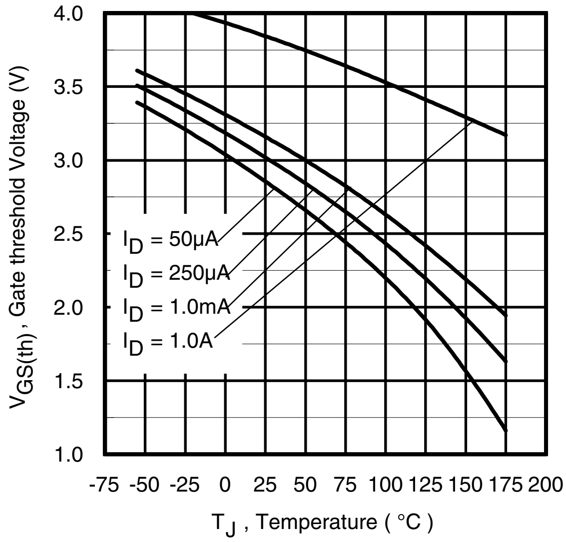


Fig 16. Threshold Voltage vs. Temperature

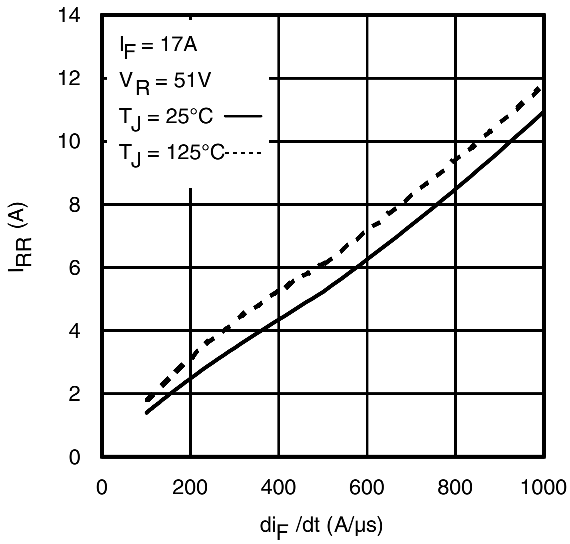


Fig. 17 - Typical Recovery Current vs. di_f/dt

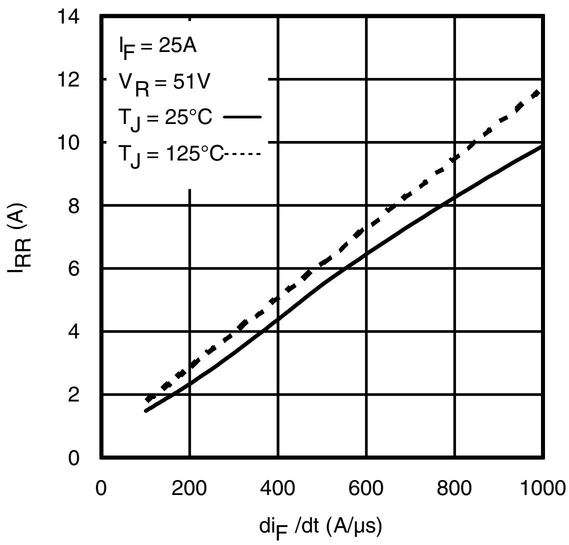


Fig. 18 - Typical Recovery Current vs. di_f/dt

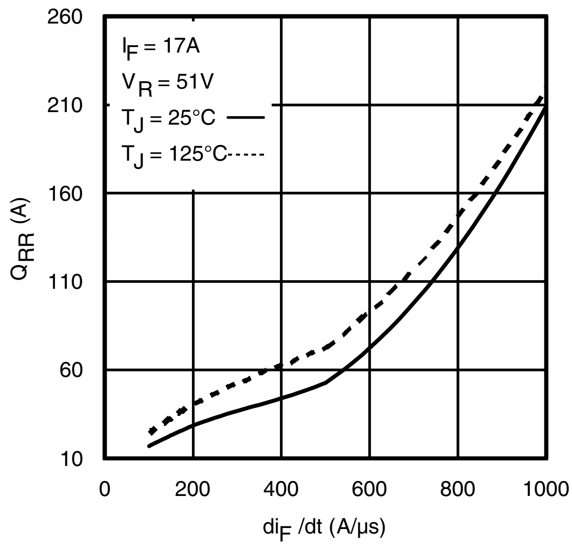


Fig. 19 - Typical Stored Charge vs. di_f/dt

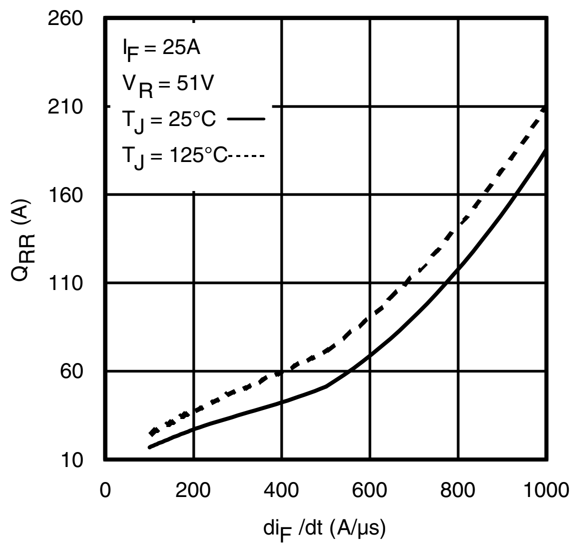
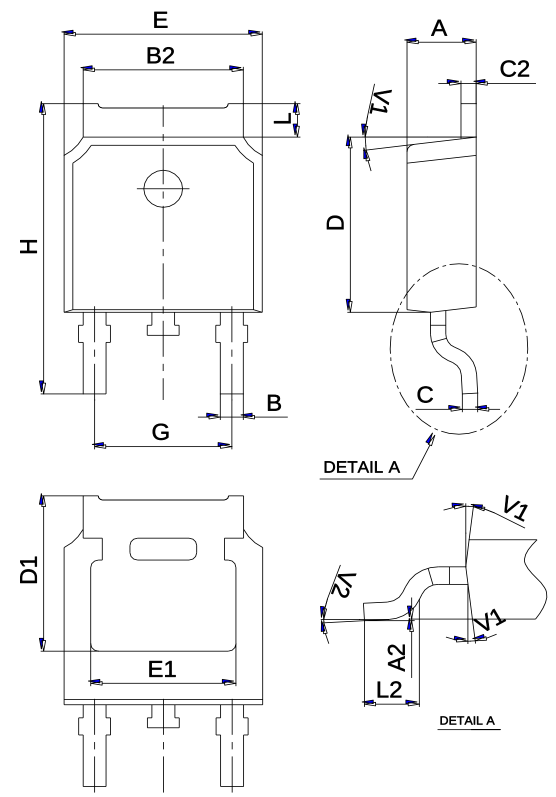


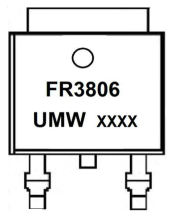
Fig. 20 - Typical Stored Charge vs. di_f/dt

Package Mechanical Data TO-252



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.10		2.50	0.083		0.098
A2	0		0.10	0		0.004
B	0.66		0.86	0.026		0.034
B2	5.18		5.48	0.202		0.216
C	0.40		0.60	0.016		0.024
C2	0.44		0.58	0.017		0.023
D	5.90		6.30	0.232		0.248
D1	5.30REF			0.209REF		
E	6.40		6.80	0.252		0.268
E1	4.63			0.182		
G	4.47		4.67	0.176		0.184
H	9.50		10.70	0.374		0.421
L	1.09		1.21	0.043		0.048
L2	1.35		1.65	0.053		0.065
V1		7°			7°	
V2	0°		6°	0°		6°

Marking



Ordering information

Order code	Package	Baseqty	Deliverymode
UMW IRFR3806TR	TO-252	2500	Tape and reel