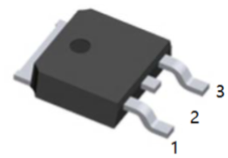
60V N-Channel MOSFET

Applications

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

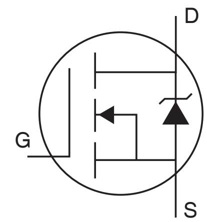


1.G 2.D 3.S

TO-252(DPAK) top view

Benefits

- V_{DS}(V) = 60V
- I_D =47A (V_{GS}= 10V)
- $R_{DS(ON)}$ <8.4mΩ (V_{GS} = 10V)
- 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

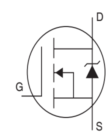
Symbol	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)	79①	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)	56①	A
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V (Wire Bond Limited)	56	A
I_{DM}	Pulsed Drain Current ②	315	A
P_D @T_C = 25°C	Maximum Power Dissipation	110	W
	Linear Derating Factor	0.76	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
dv/dt	Peak Diode Recovery ④	21	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 ③	88	mJ
I_{AR}	Avalanche Current ②	47	A
E_{AR}	Repetitive Avalanche Energy ⑤	11	mJ

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑨		1.32	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount) ⑧⑨		50	°C/W
$R_{\theta JA}$	Junction-to-Ambient ⑨		110	°C/W

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		0.073		V/°C	Reference to 25°C, I_D = 5mA②
$R_{DS(on)}$	Static Drain-to-Source On-Resistance		7.1	8.4	mΩ	V_{GS} = 10V, I_D = 47A ⑤
$V_{GS(th)}$	Gate Threshold Voltage	2.0		4.0	V	V_{DS} = V_{GS}, I_D = 100μA
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
gfs	Forward Transconductance	110			S	V_{DS} = 50V, I_D = 47A
Q_g	Total Gate Charge		46	69	nC	I_D = 47A
Q_{gs}	Gate-to-Source Charge		10			V_{DS} = 30V
Q_{gd}	Gate-to-Drain ("Miller") Charge		12			V_{GS} = 10V ⑤
Q_{sync}	Total Gate Charge Sync. (Q_g - Q_{gd})		34			I_D = 47A, V_{DS} =0V, V_{GS} = 10V
$R_{G(int)}$	Internal Gate Resistance		0.73		Ω	
$t_{d(on)}$	Turn-On Delay Time		13		ns	V_{DD} = 39V
t_r	Rise Time		35			I_D = 47A
$t_{d(off)}$	Turn-Off Delay Time		55			R_G = 10Ω
t_f	Fall Time		46			V_{GS} = 10V ⑤
C_{iss}	Input Capacitance		2290		pF	V_{GS} = 0V
C_{oss}	Output Capacitance		270			V_{DS} = 50V
C_{rss}	Reverse Transfer Capacitance		130			ƒ = 1.0MHz
C_{oss} eff. (ER)	Effective Output Capacitance (Energy Related)⑥		390			V_{GS} = 0V, V_{DS} = 0V to 60V ⑦
C_{oss} eff. (TR)	Effective Output Capacitance (Time Related)⑤		630			V_{GS} = 0V, V_{DS} = 0V to 60V ⑥
I_S	Continuous Source Current (Body Diode)		79①	A		MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ②			315		
V_{SD}	Diode Forward Voltage			1.3	V	T_J = 25°C, I_S = 47A, V_{GS} = 0V ⑤
t_{rr}	Reverse Recovery Time		26	39	ns	T_J = 25°C V_R = 51V,
			31	47		T_J = 125°C I_F = 47A
Q_{rr}	Reverse Recovery Charge		24	36	nC	T_J = 25°C di/dt = 100A/μs ⑤
			35	53		T_J = 125°C
I_{RRM}	Reverse Recovery Current		1.8		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 Calculated continuous current based on maximum allowable junction temperature. Bond wire current limit is 56A. Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements.

② Repetitive rating; pulse width limited by max. junction temperature.

③ Limited by T_{Jmax}, starting T_J = 25°C, L = 0.08mH R_G = 25Ω, I_{AS} = 47A, V_{GS} =10V. Part not recommended for use above this value.

④ I_{SD} ≤ 47A, di/dt ≤ 1668A/μs, V_{DD} ≤ $V_{(BR)DSS}$, T_J ≤ 175°C.

⑤ Pulse width ≤ 400μs; duty cycle ≤ 2%.

⑥ 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}.

⑦ 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}.

⑧ 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.

⑨ R_θ is measured at T_J approximately 90°C.

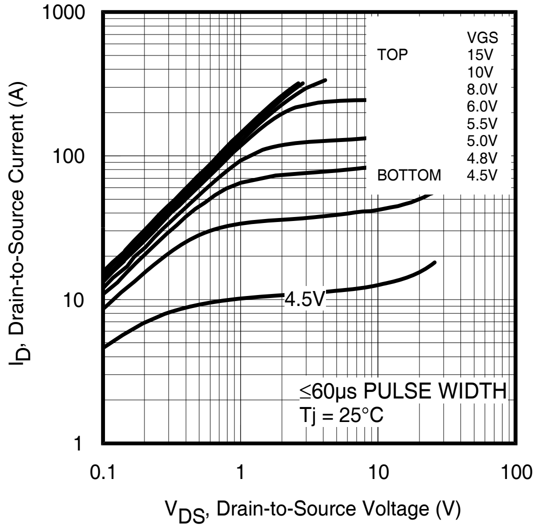


Fig 1. Typical Output Characteristics

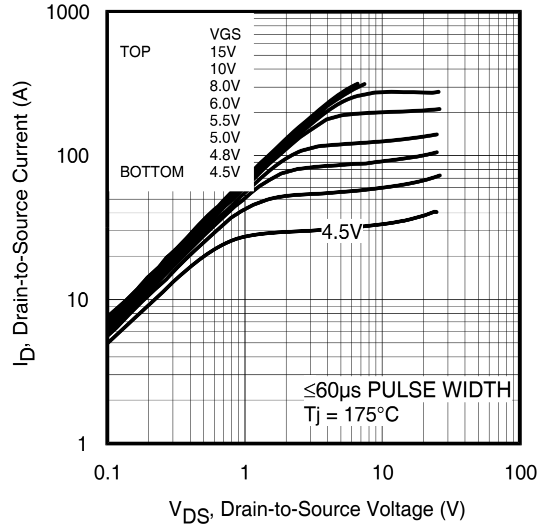


Fig 2. Typical Output Characteristics

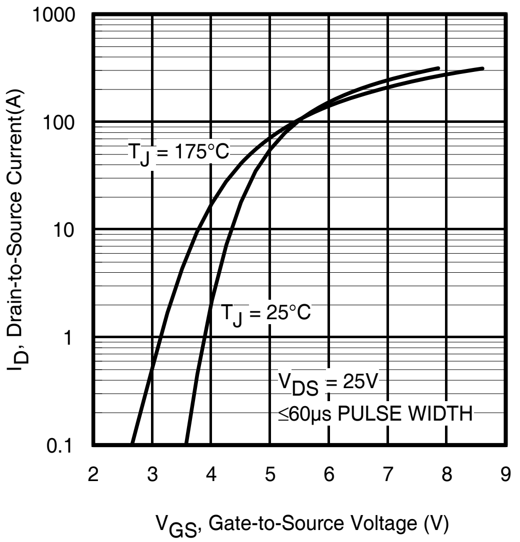


Fig 3. Typical Transfer Characteristics

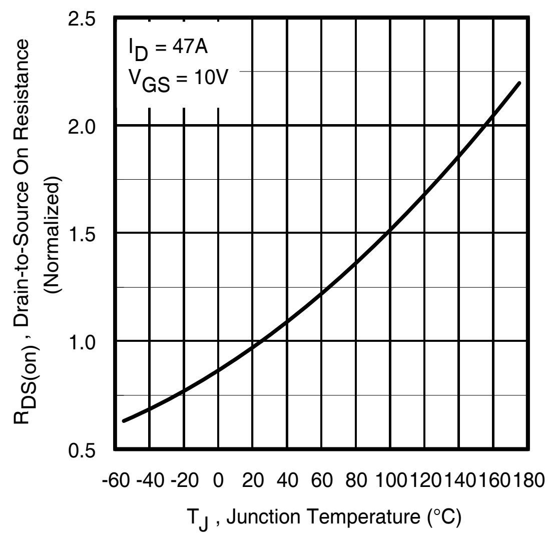


Fig 4. Normalized On-Resistance vs. Temperature

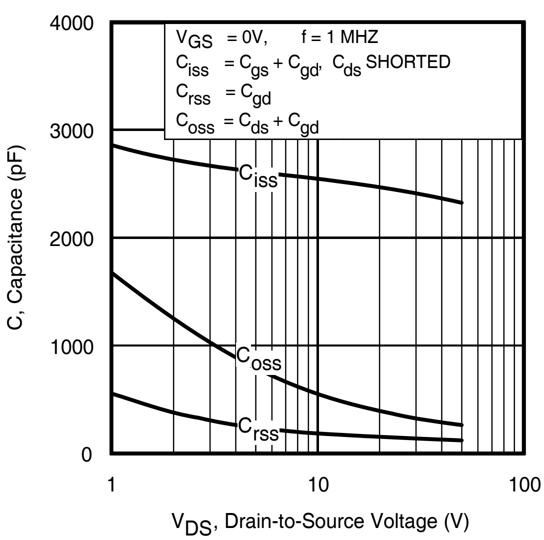


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

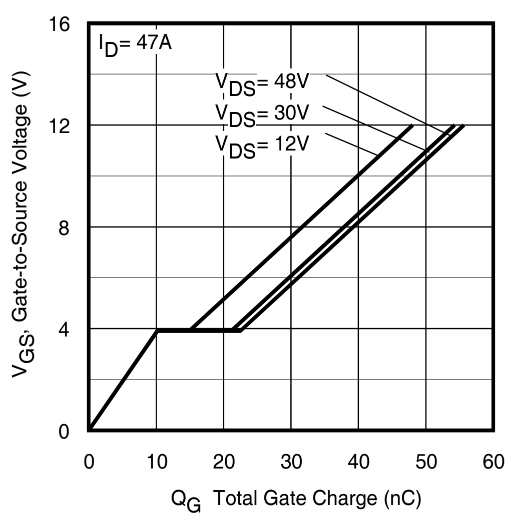


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

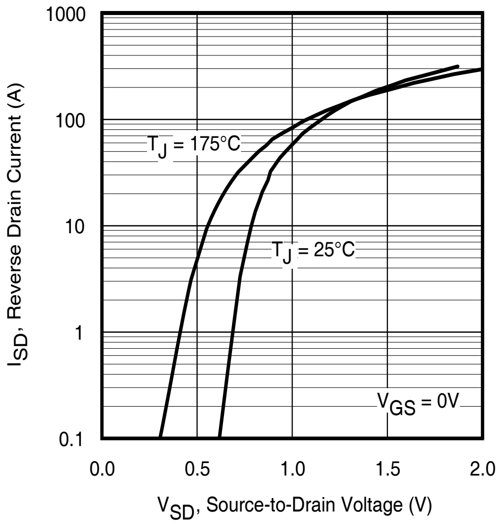


Fig 7. Typical Source-Drain Diode Forward Voltage

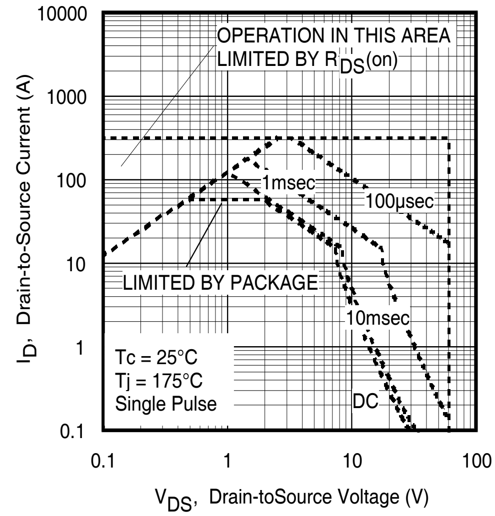


Fig 8. Maximum Safe Operating Area

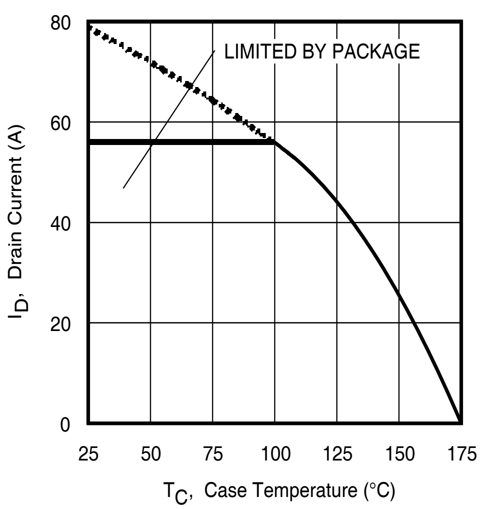


Fig 9. Maximum Drain Current vs. Case Temperature

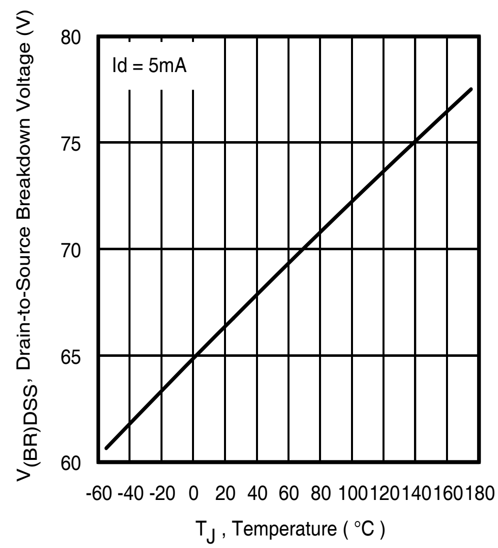


Fig 10. Drain-to-Source Breakdown Voltage

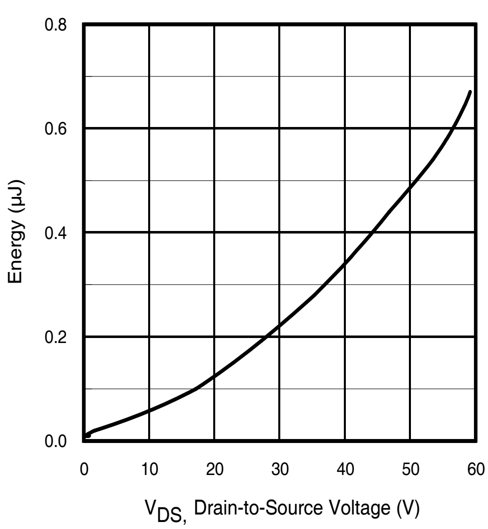


Fig 11. Typical C_{OSS} Stored Energy

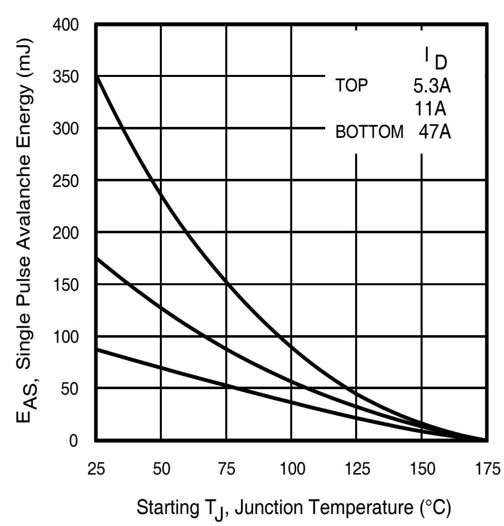


Fig 12. Maximum Avalanche Energy vs. DrainCurrent

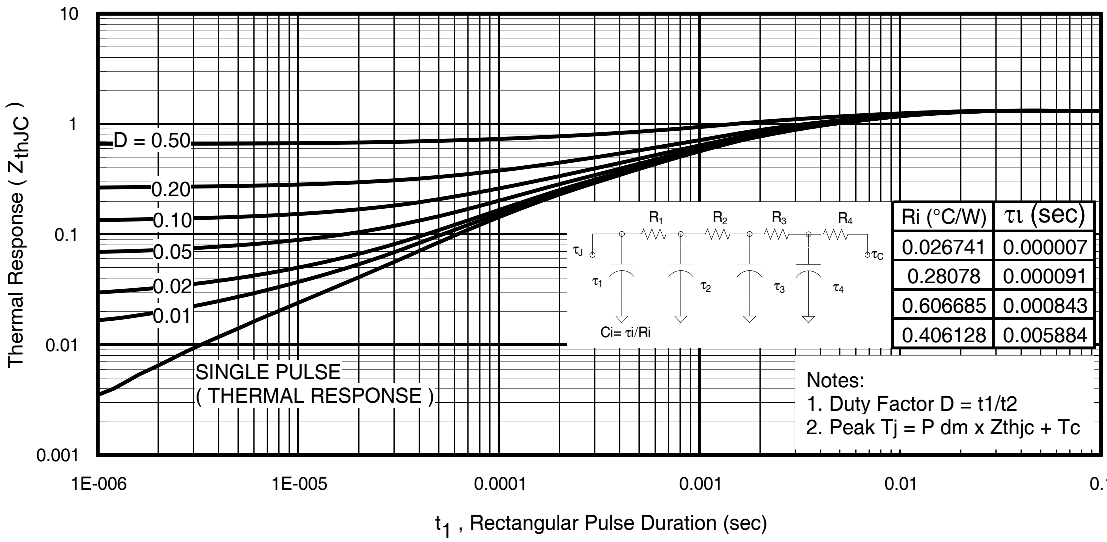


Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case

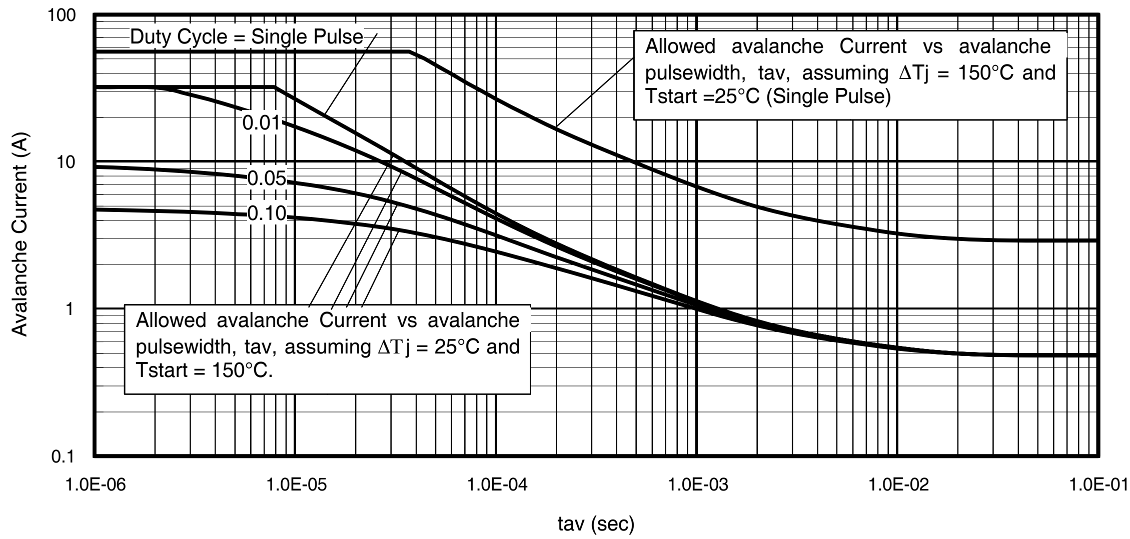


Fig 14. Typical Avalanche Current vs.Pulsewidth

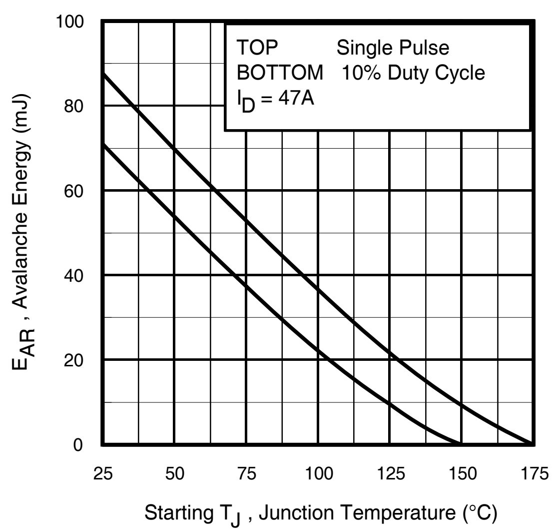


Fig 15. Maximum Avalanche Energy vs. Temperature

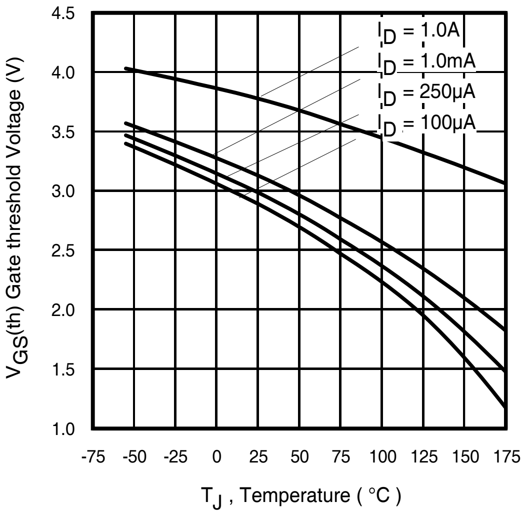


Fig 16. Threshold Voltage vs. Temperature

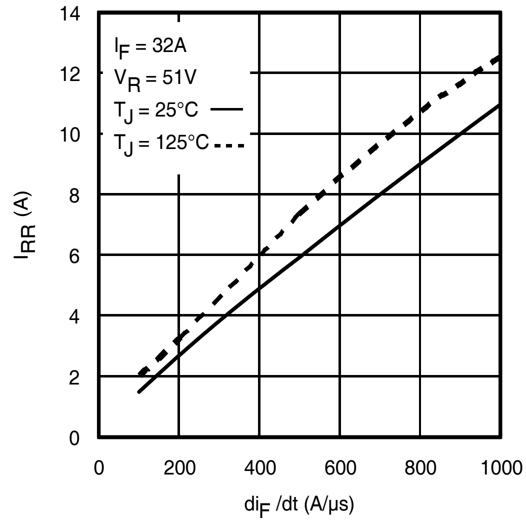


Fig 17. - Typical Recovery Current vs. dif/dt

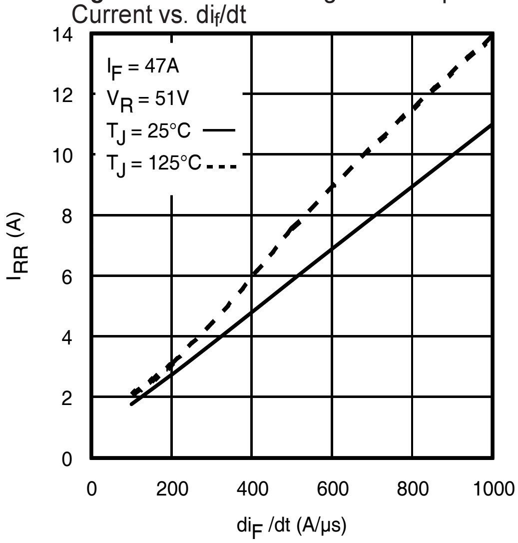


Fig 18. - Typical Recovery Current vs. dif/dt

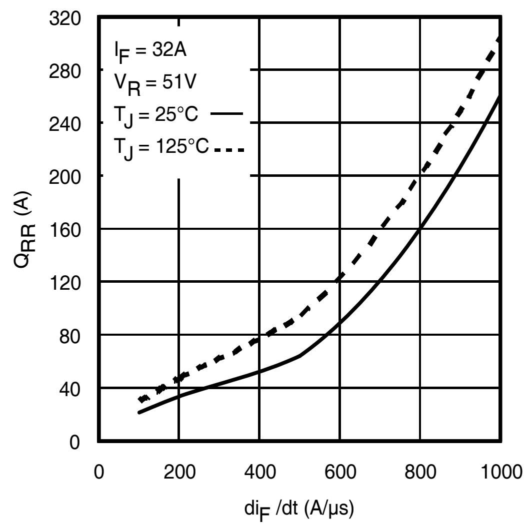


Fig 19.- Typical Stored Charge vs. dif/dt

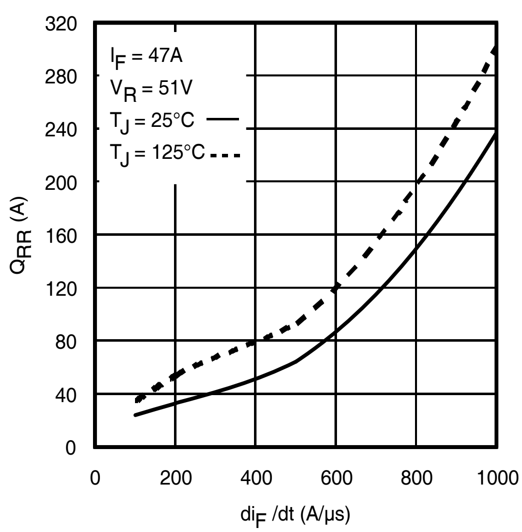
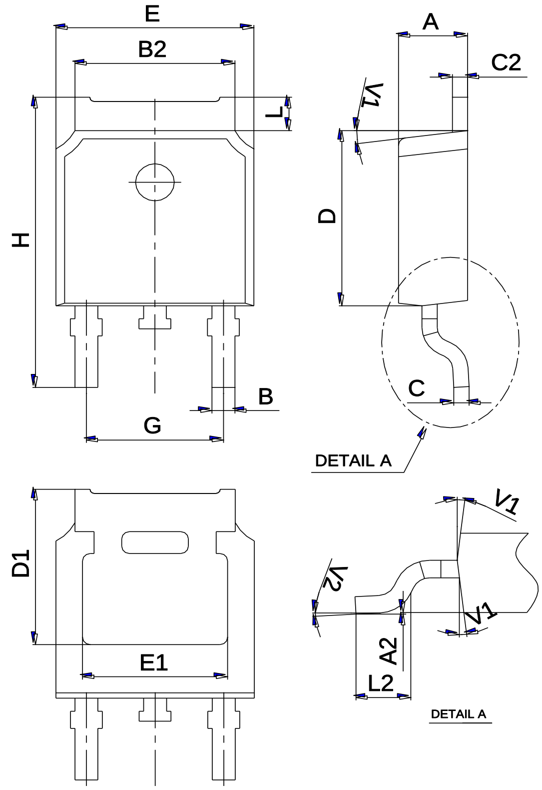
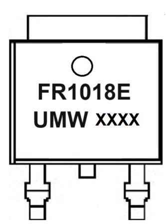


Fig 20. - Typical Stored Charge vs. dif/dt

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°



Ordering information

Order code	Package	Baseqty	Deliverymode
UMW IRFR1018ETR	TO-252	2500	Tape and reel