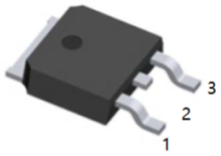
30V N -Channel MOSFET

Applications

- High Frequency Synchronous Buck Converters for Computer Processor Power



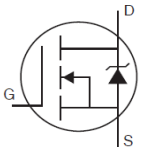
1.G 2.D 3.S

TO-252(DPAK) top view

Benefits

- Very Low $R_{DS(on)}$ at 4.5V V_{GS}
- Ultra - Low Gate Impedance
- Fully Characterized Avalanche Voltage and Current
- Lead-Free

- V_{DSS}= 30V
- $R_{DS(on)}$ max=9.5mΩ
- Qg = 9.6nC



Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
V_{DS}	Drain -to-Source Voltage	30	V
V_{GS}	Gate-to-Source Voltage	± 20	V
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	56④	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	39④	
I_{DM}	Pulsed Drain Current ①	220	
P_D @T_C = 25°C	Maximum Power Dissipation	50	W
P_D @T_C = 100°C	Maximum Power Dissipation	25	W
	Linear Derating Factor	0.33	W/°C
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 175	°C
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case		3.0	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount) ⑤		50	
$R_{\theta JA}$	Junction-to-Ambient		110	

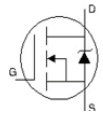
Static @ T_J= 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	30			V	V_{GS} = 0V, I_D = 250μA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient			0.023	V/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance		7.5	9.5	mΩ	V_{GS} = 10V, I_D = 15A ③
			10	12.5		V_{GS} = 4.5V, I_D = 12A ③
$V_{GS(th)}$	Gate Threshold Voltage	1.0	1.70	2.50	V	V_{DS} = V_{GS}, I_D = 25μA
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Temp. Coefficient		-5.0		mV/°C	
I_{DSS}	Drain-to-Source Leakage Current			1.0	μA	V_{DS} = 24V, V_{GS} = 0V
				150		V_{DS} = 24V,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 Trans conductance	71			S	V_{DS} = 15V, I_D = 12A
Q_g	Total Gate Charge		9.6	14	nC	V_{DS} = 15V V_{GS} = 4.5V I_D = 12A See Fig. 16
Q_{gs1}	Pre-Vth Gate-to-Source Charge		2.6			
Q_{gs2}	Post-Vth Gate-to-Source Charge		0.90			
Q_{gd}	Gate-to-Drain Charge		3.5			
Q_{godr}	Gate Charge Overdrive		2.6			
Q_{sw}	Switch Charge (Q_{gs2} + Q_{gd})		4.4			
Q_{oss}	Output Charge		5.8		nC	V_{DS} = 15V, V_{GS} = 0V
$t_{d(on)}$	Turn-On Delay Time		8.0		ns	V_{DD} = 16V,V_{GS} = 4.5V ③ I_D = 12A Clamped Inductive Load
t_r	Rise Time		11			
$t_{d(off)}$	Turn-Off Delay Time		12			
t_f	Fall Time		3.3			
C_{iss}	Input Capacitance		1150		pF	V_{GS} = 0V V_{DS} = 15V f = 1.0MHz
C_{oss}	Output Capacitance		260			
C_{rss}	Reverse Transfer Capacitance		120			

Avalanche Characteristics

	Parameter	Max.	Units
E_{AS}	Single Pulse Avalanche Energy ②	42	mJ
I_{AR}	Avalanche Current ①	12	A
E_{AR}	Repetitive Avalanche Energy ①	5.0	mJ

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)			56④	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①			220		
V_{SD}	Diode Forward Voltage			1.0	V	T_J = 25°C,I_S = 12A,V_{GS} = 0V③
t_{rr}	Reverse Recovery Time		25	38	ns	T_J = 25°C ,I_F = 12A, V_{DS} = 15V
Q_{rr}	Reverse Recovery Charge		17	26	nC	di/dt = 100A/μs ③
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

Notes:

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

② starting T_J = 25°C, L = 0.58mH, R_G = 25Ω, I_{AS} = 12A.

③ Pulse width ≤ 400μs; duty cycle ≤ 2%.

④ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 30A.

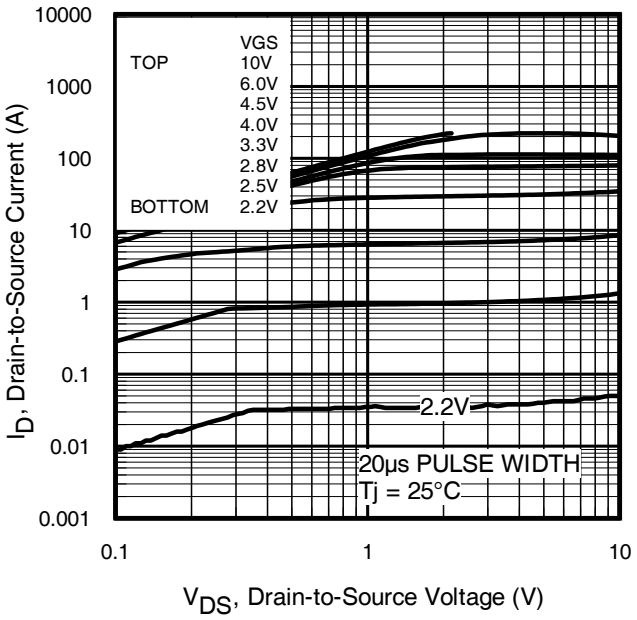


Fig. 1 Typical Output Characteristics

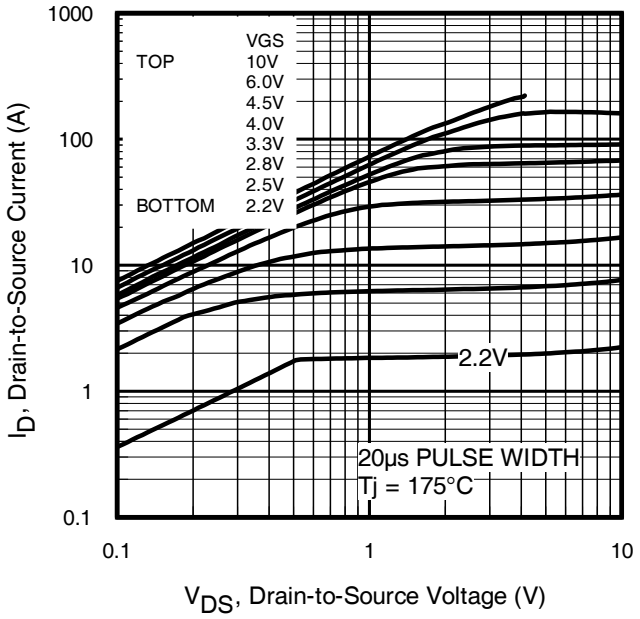


Fig. 2 Typical Output Characteristics

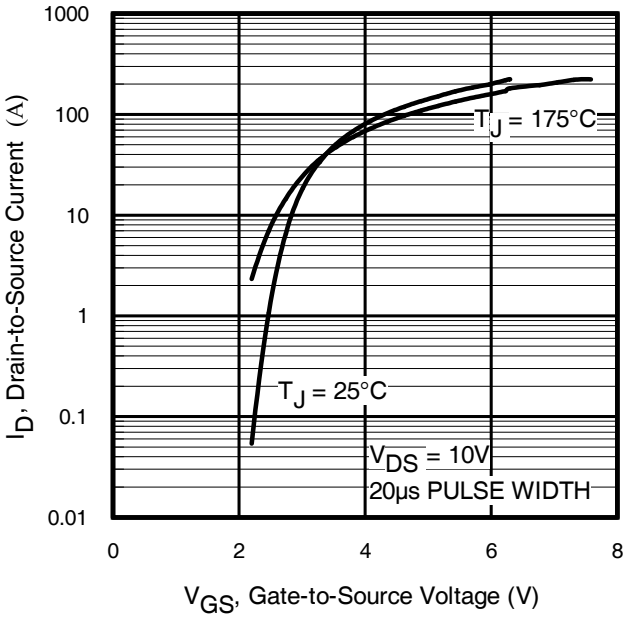


Fig. 3 Typical Transfer Characteristics

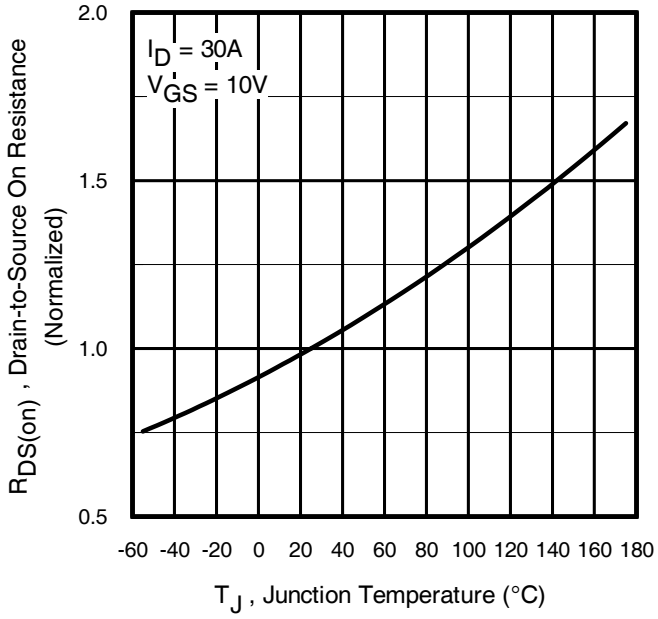


Fig. 4 Normalized On-Resistance vs. Temperature

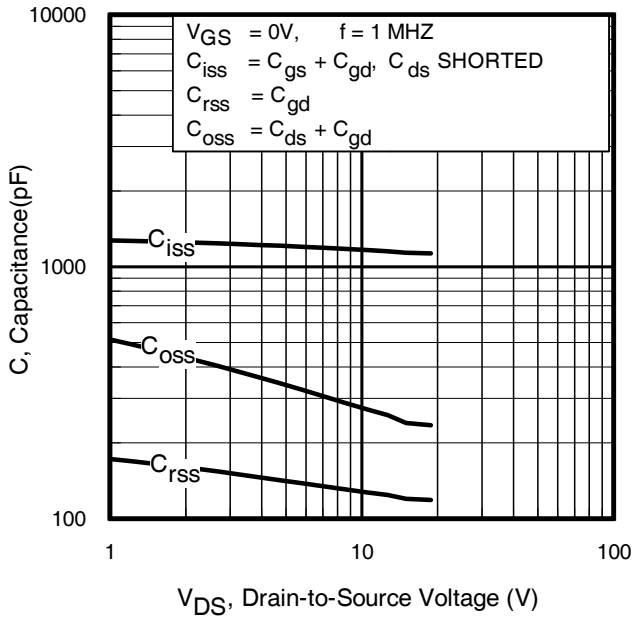


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

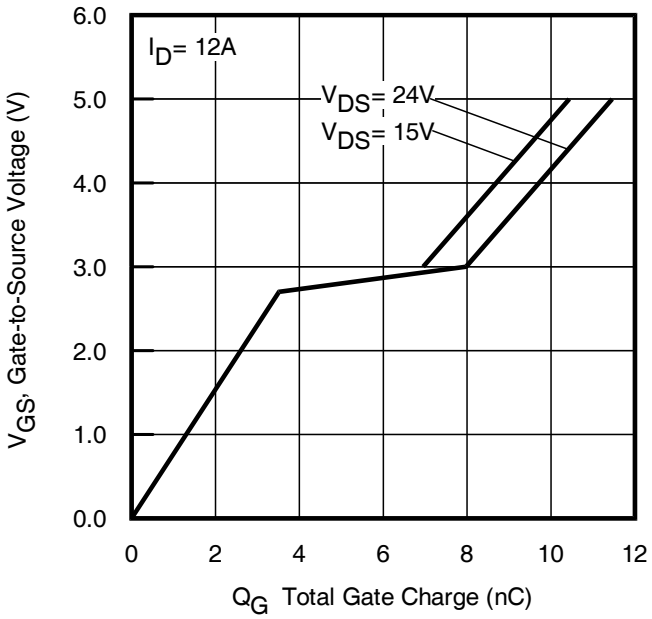


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

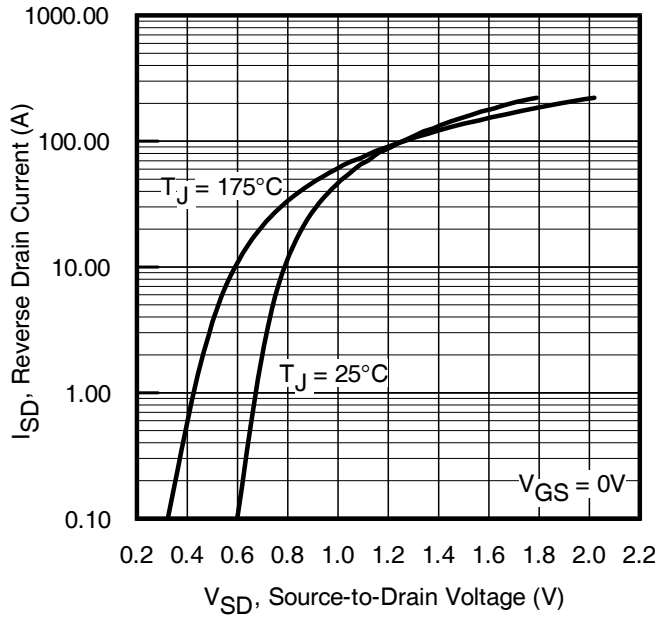


Fig. 7 Typical Source-to-Drain Diode Forward Voltage

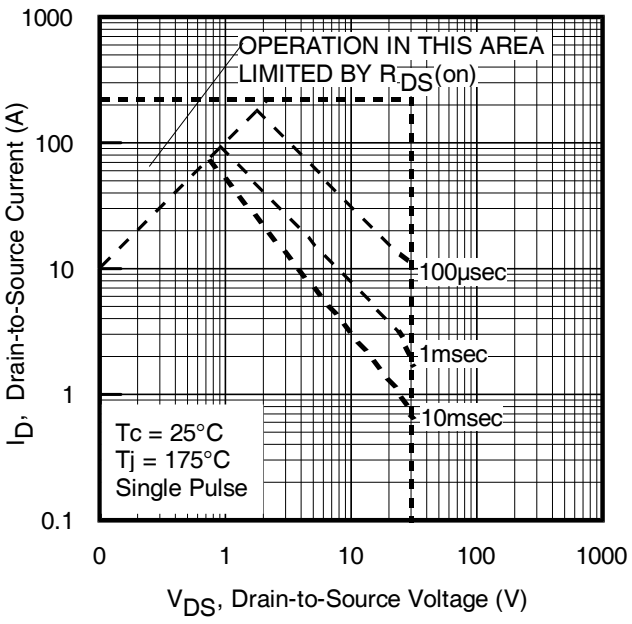


Fig 8. Maximum Safe Operating Area

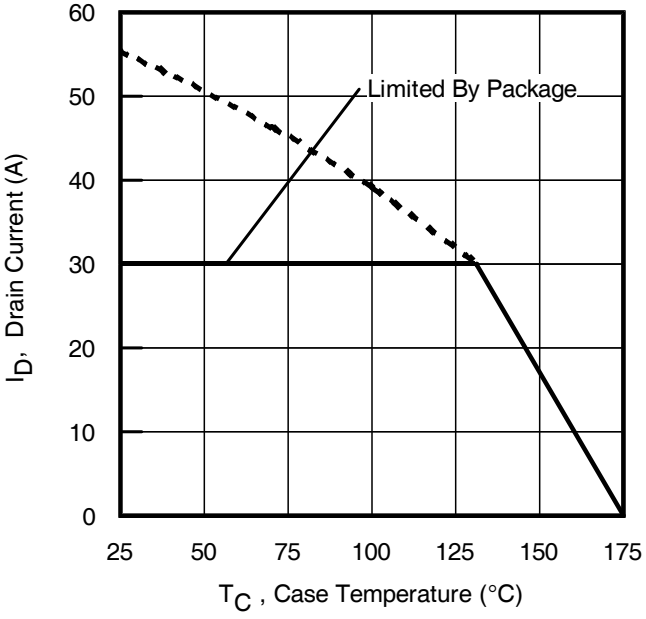


Fig 9. Maximum Drain Current vs. Case Temperature

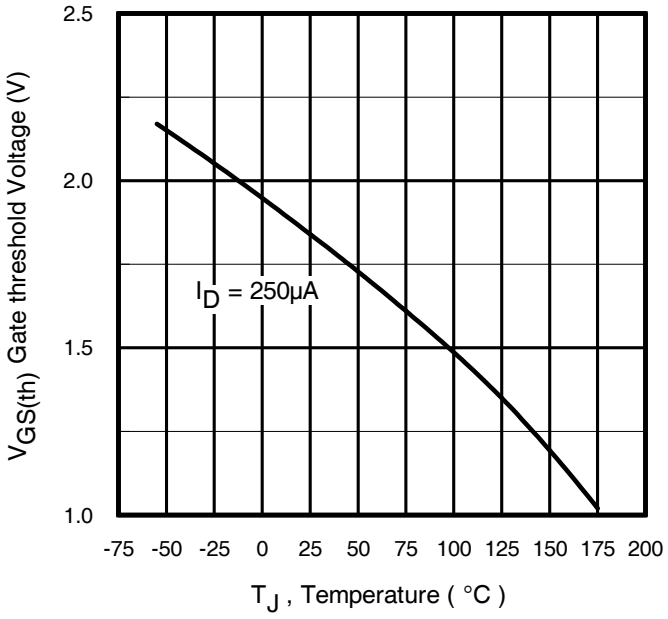


Fig 10. Threshold Voltage vs. Temperature

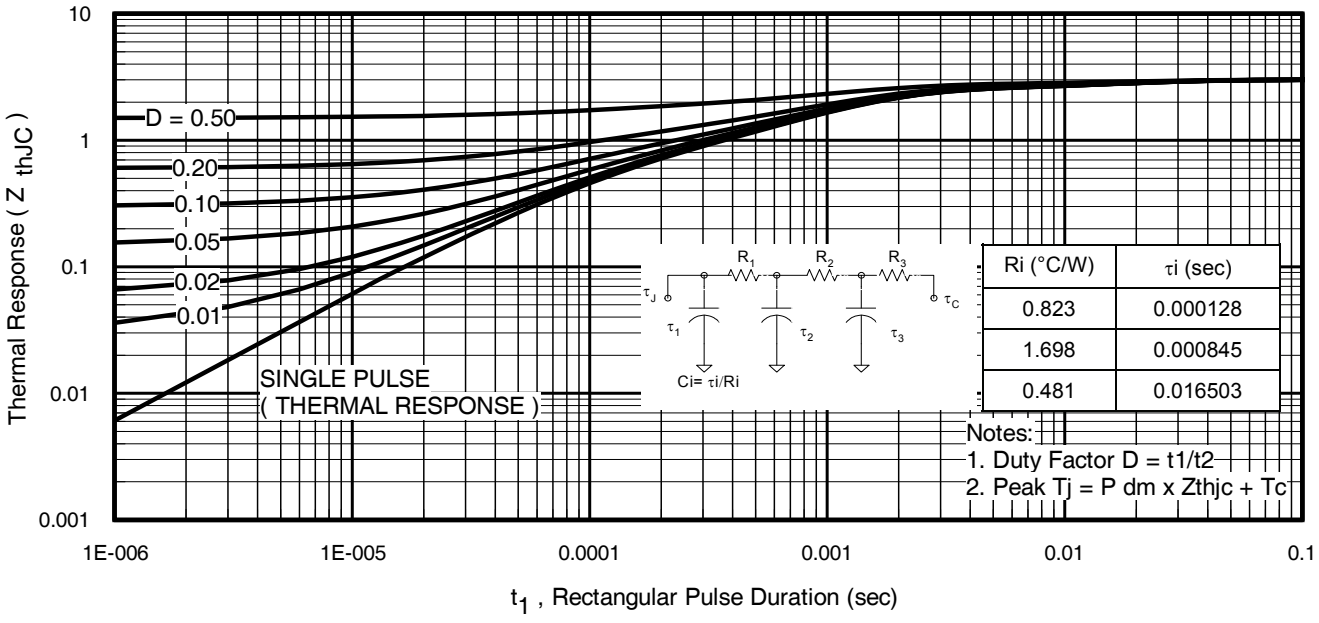


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

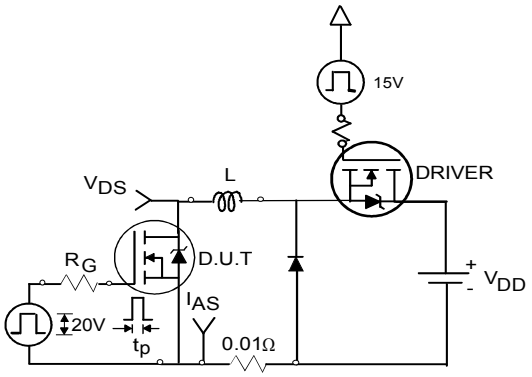


Fig 12a. Unclamped Inductive Test Circuit

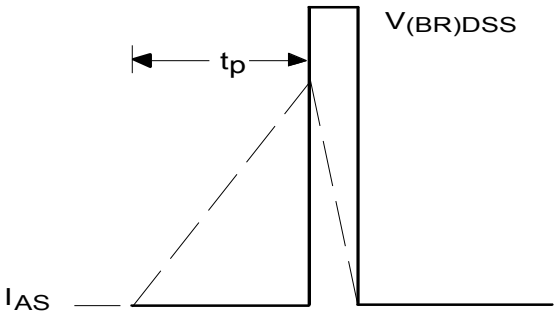


Fig 12b. Unclamped Inductive Waveforms

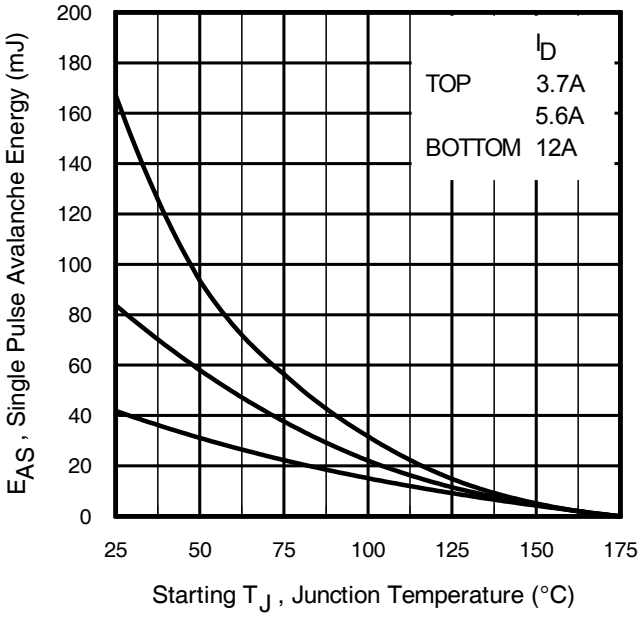


Fig 12c. Maximum Avalanche Energy vs. Drain Current

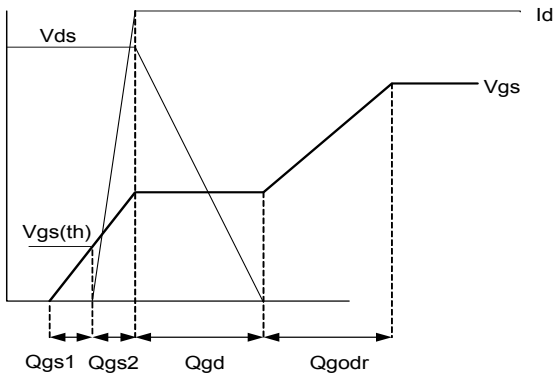


Fig 13a. Gate Charge Waveform

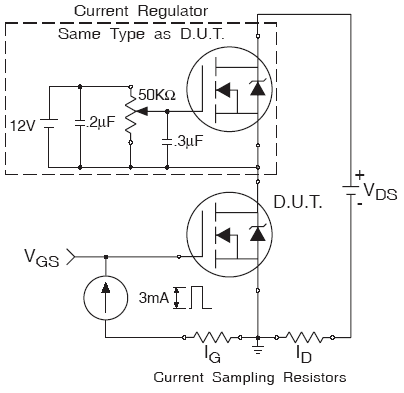


Fig 13b. Gate Charge Test Circuit

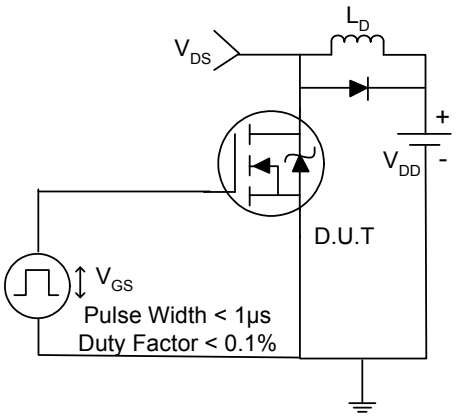


Fig 14a. Switching Time Test Circuit

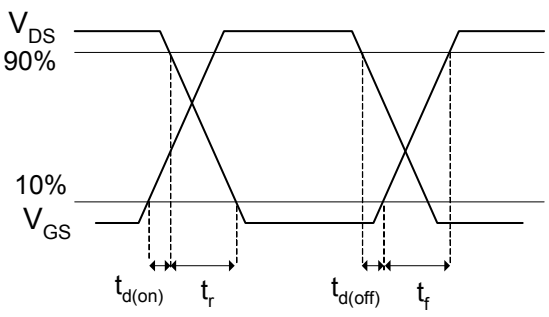
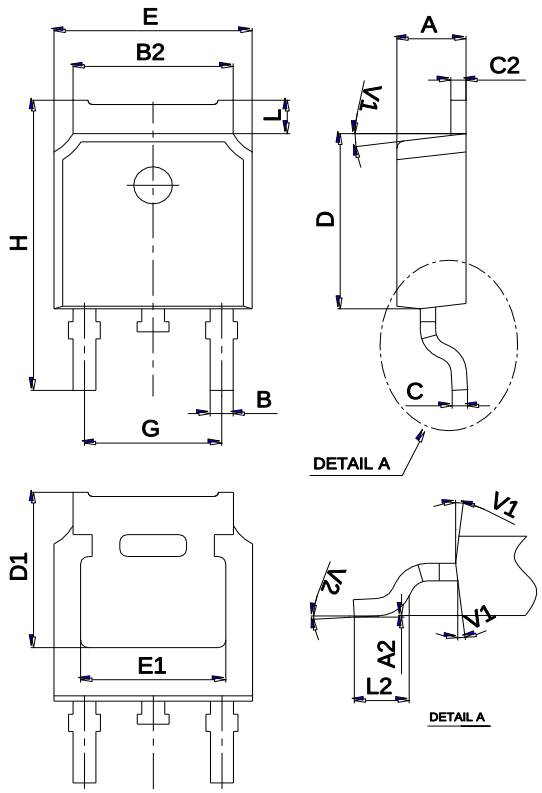


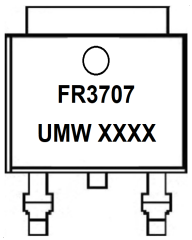
Fig 14b. Switching Time Waveforms

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 IRFR3707ZTR	TO-252	2500	Tape and reel

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