

Applications

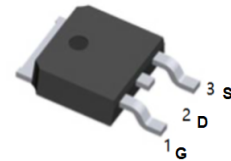
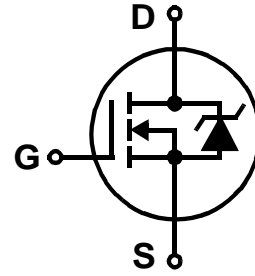
- High Frequency Synchronous Buck Converters for Computer Processor Power
- High Frequency Isolated DC-DC Converters with Synchronous Rectification for Telecom and Industrial Use
- Lead-Free

Benefits

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

Features

$V_{DS} (V) = 30V$
 $I_D = 9.4A (V_{GS} = 10V)$
 $R_{DS(ON)} < 6.5 m\Omega (V_{GS} = 10V)$



TO-252(DPAK) top view

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{DS}	Drain-to-Source Voltage	30	V
V_{GS}	Gate-to-Source Voltage	± 20	
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	86 ^④	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	61 ^④	
I_{DM}	Pulsed Drain Current ^①	340	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	79	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	39	
	Linear Derating Factor	0.53	W/ $^\circ C$
T_J	Operating Junction and Storage Temperature Range	-55 to + 175	$^\circ C$
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.9	$^\circ C/W$
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount) ^⑤	—	50	
$R_{\theta JA}$	Junction-to-Ambient	—	110	

Notes:

- ① Repetitive rating; pulse width limited by max.junction temperature.
- ② Starting $T = 25^\circ C$, $CL = 1.4mH$, $R_{\theta G} = 25\Omega$, $I_{AS} = 12A$.
- ③ Pulse width $\leq 400\mu s$; duty cycle $\leq 2\%$

- ④ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 30A
- ⑤ When mounted on 1" square PCB (FR-4 or G-10 Material)
For recommended footprint and soldering techniques refer to

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV _{DSS}	Drain-to-Source Breakdown Voltage	30	—	—	V	V _{GS} = 0V, I _D = 250μA
ΔBV _{DSS} /ΔT _J	Breakdown Voltage Temp. Coefficient	—	22	—	mV/°C	Reference to 25°C, I _D = 1mA
R _{DS(on)}	Static Drain-to-Source On-Resistance	—	5.2	6.5	mΩ	V _{GS} = 10V, I _D = 15A ③
		—	6.5	8.2		V _{GS} = 4.5V, I _D = 12A ③
V _{GS(th)}	Gate Threshold Voltage	1.35	1.80	2.25	V	V _{DS} = V _{GS} , I _D = 250μA
ΔV _{GS(th)} /ΔT _J	Gate Threshold Voltage Coefficient	—	-5.6	—	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 = 150°C
I _{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	V _{GS} = 20V
	Gate-to-Source Reverse Leakage	—	—	-100		V _{GS} = -20V
g _{fs}	Forward Transconductance	51	—	—	S	V _{DS} = 15V, I _D = 12A
Q _g	Total Gate Charge	—	17	26	nC	V _{DS} = 15V V _{GS} = 4.5V I _D = 12A See Fig. 16
Q _{gs1}	Pre-V _{th} Gate-to-Source Charge	—	4.7	—		
Q _{gs2}	Post-V _{th} Gate-to-Source Charge	—	1.6	—		
Q _{gd}	Gate-to-Drain Charge	—	5.7	—		
Q _{godr}	Gate Charge Overdrive	—	5.0	—		
Q _{sw}	Switch Charge (Q _{gs2} + Q _{gd})	—	7.3	—		
Q _{oss}	Output Charge	—	10	—	nC	V _{DS} = 16V, V _{GS} = 0V
t _{d(on)}	Turn-On Delay Time	—	12	—	ns	V _{DD} = 16V, V _{GS} = 4.5V ③ I _D = 12A Clamped Inductive Load
t _r	Rise Time	—	12	—		
t _{d(off)}	Turn-Off Delay Time	—	15	—		
t _f	Fall Time	—	3.9	—		
C _{iss}	Input Capacitance	—	2330	—	pF	V _{GS} = 0V V _{DS} = 15V f = 1.0MHz
C _{oss}	Output Capacitance	—	460	—		
C _{rss}	Reverse Transfer Capacitance	—	230	—		

Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E _{AS}	Single Pulse Avalanche Energy ^②	—	100	mJ
I _{AR}	Avalanche Current ①	—	12	A
E _{AR}	Repetitive Avalanche Energy ①	—	7.9	mJ

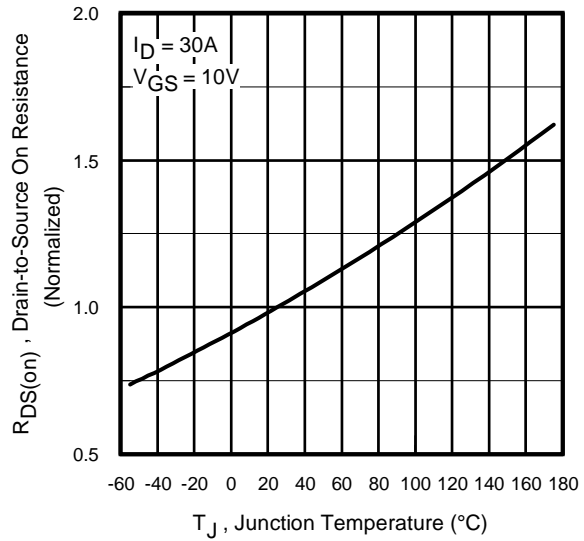
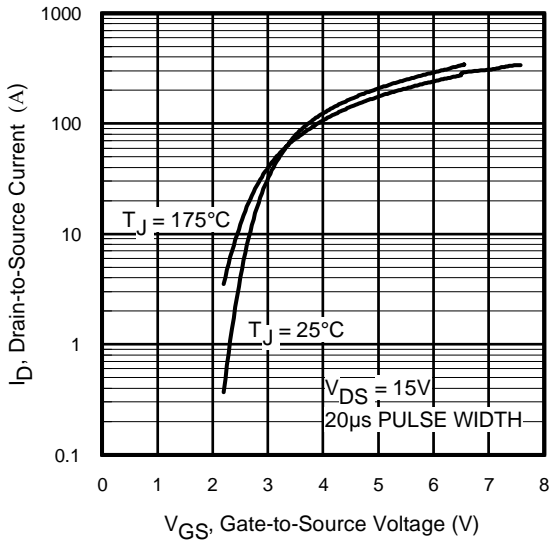
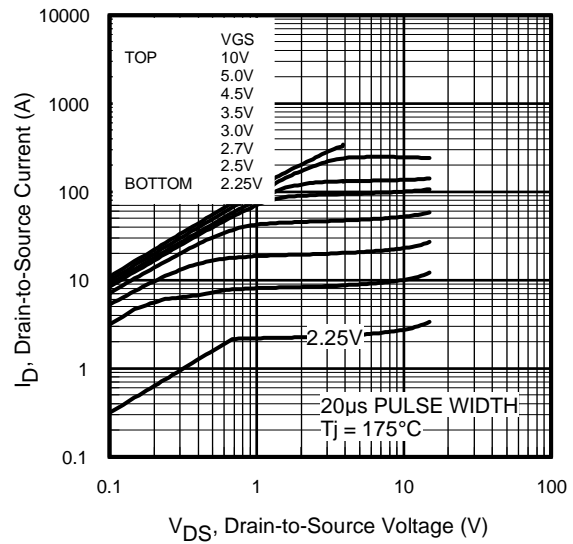
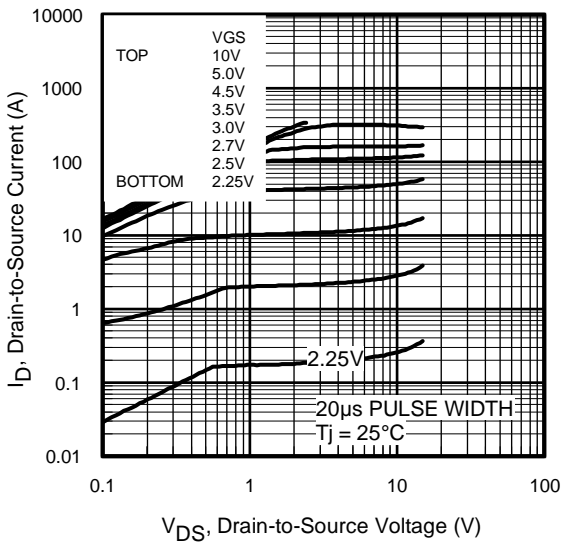
Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I _S	Continuous Source Current (Body Diode)	—	—	86 ^④	A	MOSFET symbol showing the integral reverse p-n junction diode.
I _{SM}	Pulsed Source Current (Body Diode) ①	—	—	340		
V _{SD}	Diode Forward Voltage	—	—	1.0	V	T _J = 25°C, I _S = 12A, V _{GS} = 0V ③
t _{rr}	Reverse Recovery Time	—	29	44	ns	T _J = 25°C, I _F = 12A, V _{DD} = 15V
Q _{rr}	Reverse Recovery Charge	—	25	37	nC	di/dt = 100A/μs ③
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 Starting T = 25°C, CL = 1.4mHRG = 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
- ⑤ When mounted on 1" square PCB (FR-4 or G-10 Material)
For recommended footprint and soldering techniques refer to



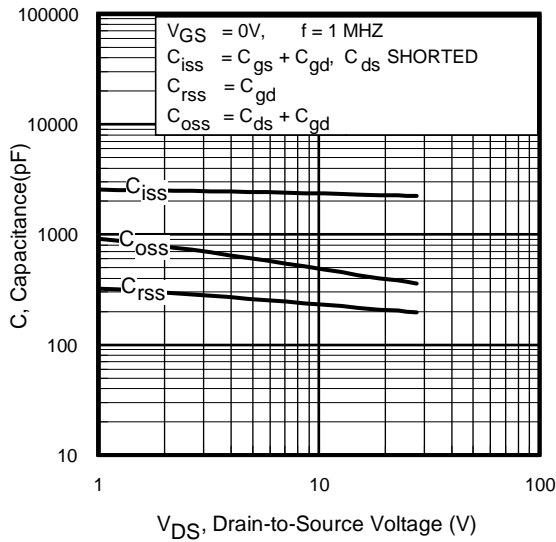


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

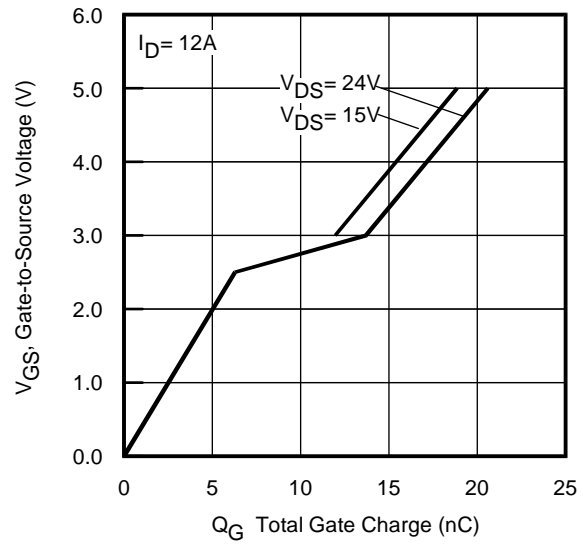


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

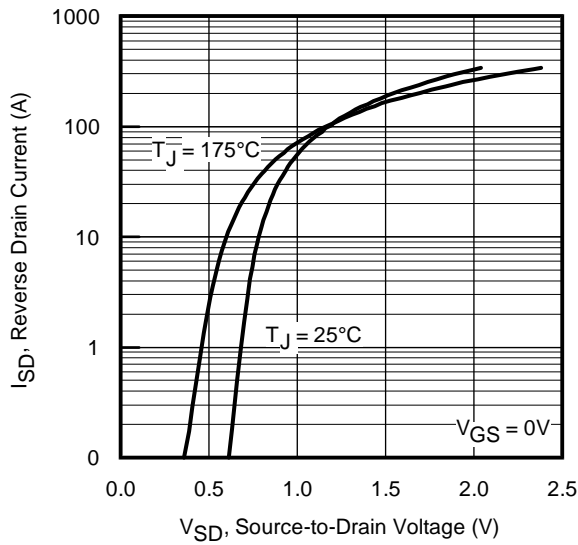


Fig 7. Typical Source-Drain Diode Forward Voltage

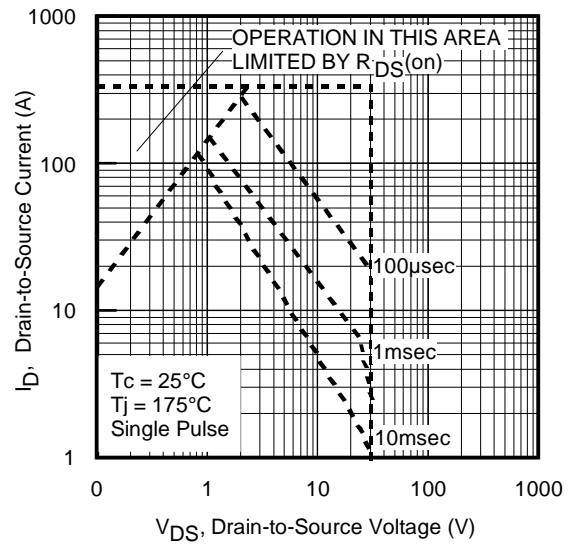


Fig 8. Maximum Safe Operating Area

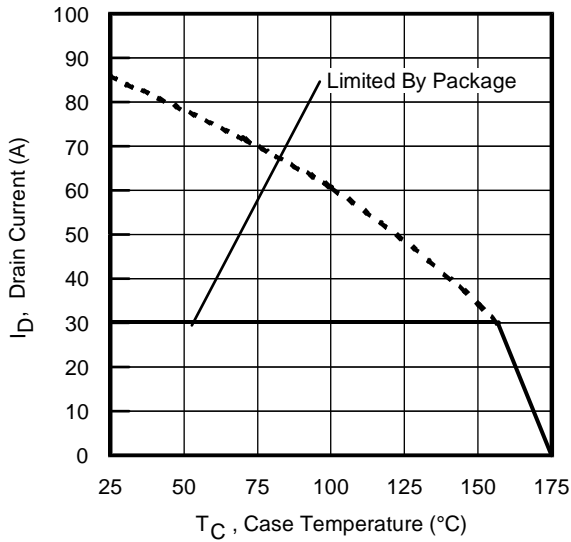


Fig 9. Maximum Drain Current vs. Case Temperature

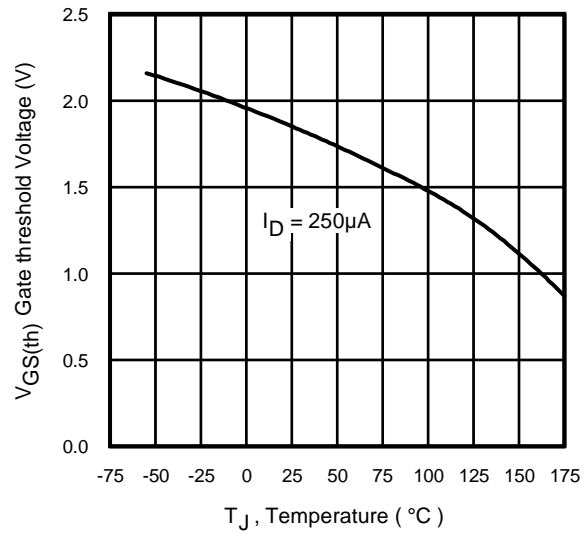


Fig 10. Threshold Voltage vs. Temperature

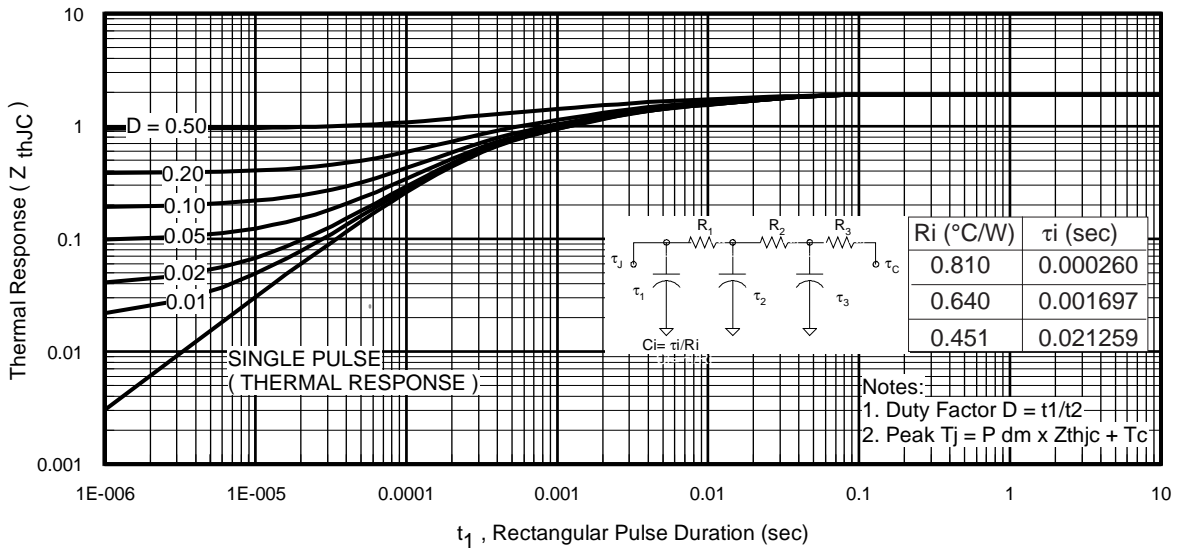


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

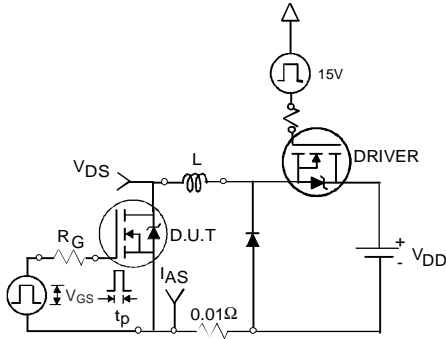


Fig 12a. Unclamped Inductive Test Circuit

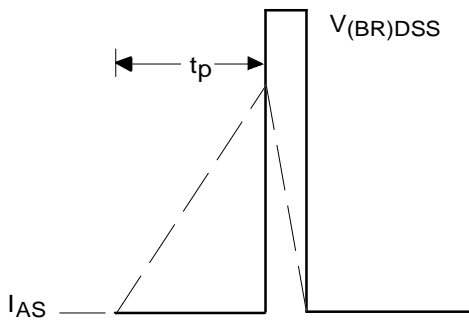


Fig 12b. Unclamped Inductive Waveforms

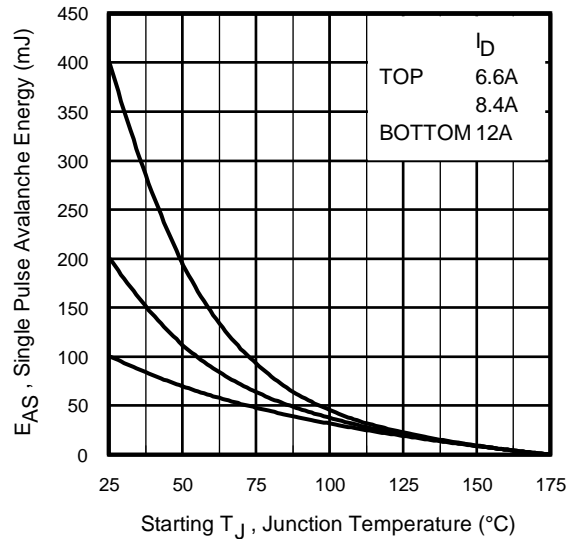


Fig 12c. Maximum Avalanche Energy vs. Drain Current

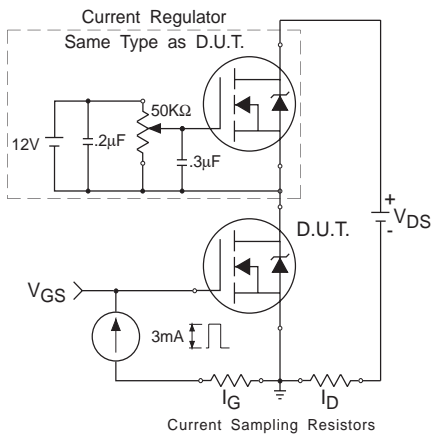


Fig 13. Gate Charge Test Circuit

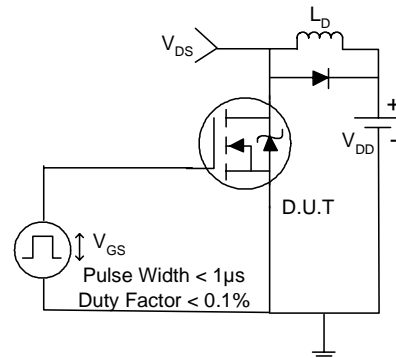


Fig 14a. Switching Time Test Circuit

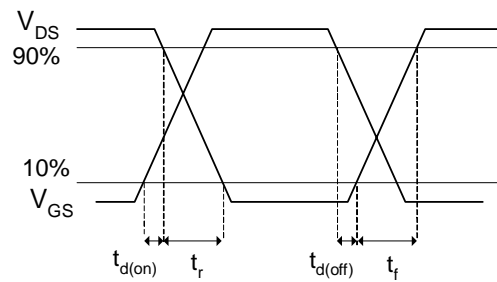
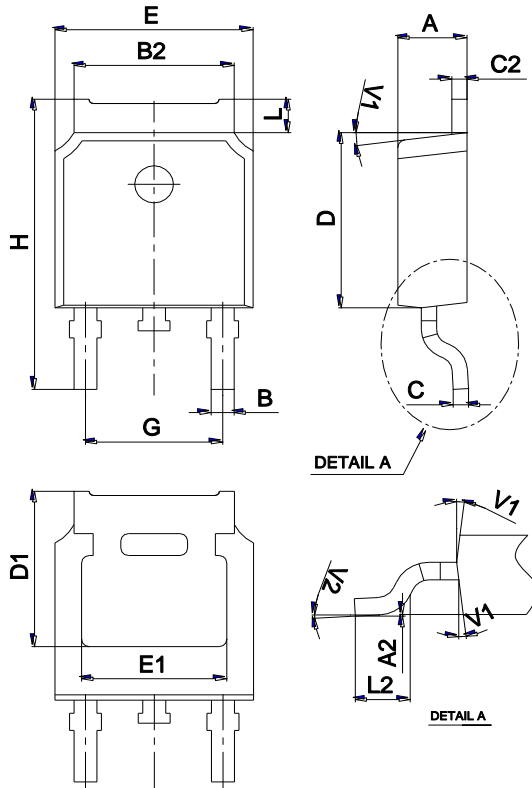


Fig 14b. Switching Time Waveforms

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°

Ordering information

Order code	Package	Baseqty	Delivery mode
UMW IRFR3709ZTR	TO-252	2500	Tape and reel