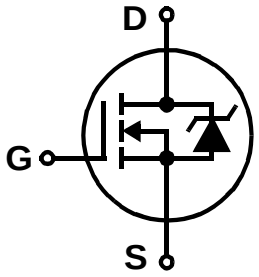
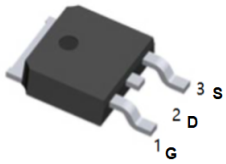
Applications

- 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





TO-252(DPAK) top view

Features

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

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°C	Continuous Drain Current, V_{GS} @ 10V	86④	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	61④	
I_{DM}	Pulsed Drain Current ①	340	
P_D @T_C = 25°C	Maximum Power Dissipation	79	W
P_D @T_C = 100°C	Maximum Power Dissipation	39	
	Linear Derating Factor	0.53	W/°C
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 175	°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	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount) ⑤	—	50	
$R_{\theta JA}$	Junction-to-Ambient	—	110	

Notes:

①Repetitive rating; pulse width limited by max.junction temperature.
②StartingT=25°CL=1.4mHRG=25Ω, IAS=12A.
③ Pulse width ≤ 400us; duty cycle ≤ 2%
④ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is30A
⑤ When mounted on 1"sauare 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
$\Delta BV_{DSS}/\Delta T_J$	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
$\Delta V_{GS(th)}/\Delta T_J$	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
gfs	Forward Transconductance	51	—	—	S	V_{DS} = 15V, I_D = 12A
Q_g	Total Gate Charge	—	17	26		
Q_{gs1}	Pre-Vth Gate-to-Source Charge	—	4.7	—		V_{DS} = 15V
Q_{gs2}	Post-Vth Gate-to-Source Charge	—	1.6	—	nC	V_{GS} = 4.5V
Q_{gd}	Gate-to-Drain Charge	—	5.7	—		I_D = 12A
Q_{godr}	Gate Charge Overdrive	—	5.0	—		See Fig. 16
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	—		V_{DD} = 16V, V_{GS} = 4.5V ③
t_r	Rise Time	—	12	—		I_D = 12A
$t_{d(off)}$	Turn-Off Delay Time	—	15	—	ns	Clamped Inductive Load
t_f	Fall Time	—	3.9	—		
C_{iss}	Input Capacitance	—	2330	—		V_{GS} = 0V
C_{oss}	Output Capacitance	—	460	—	pF	V_{DS} = 15V
C_{rss}	Reverse Transfer Capacitance	—	230	—		f = 1.0MHz

Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy②	—	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)	—	—	86④	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:

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

②StartingT=25°CL=1.4mHRG=25Ω, IAS=12A.

③ Pulse width ≤ 400us; duty cycle ≤ 2%

④ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is30A

⑤ When mounted on 1"sauare PCB(FR-4 or G-10 Material) For recommended footprint and soldering techniques refer to

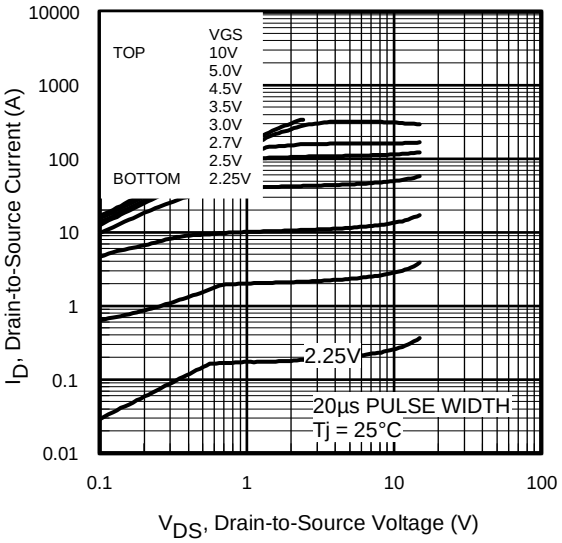


Fig 1. Typical Output Characteristics

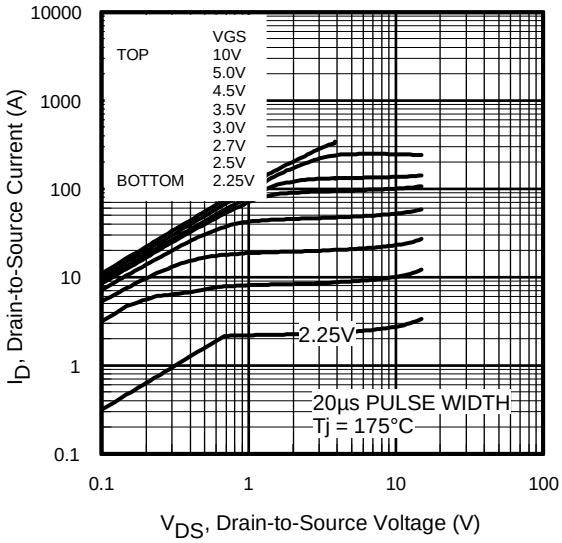


Fig 2. Typical Output Characteristics

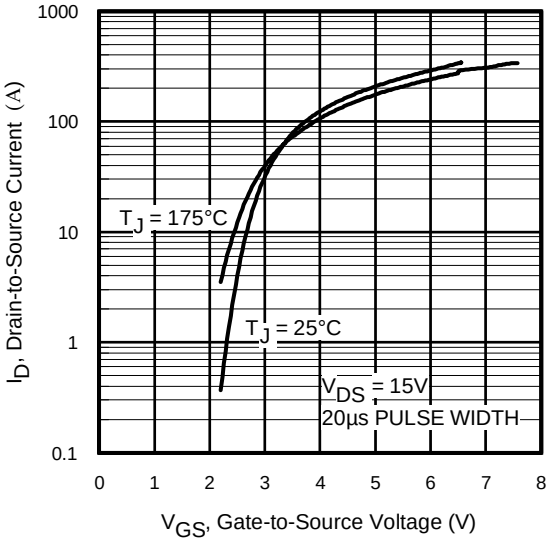


Fig 3. Typical Transfer Characteristics

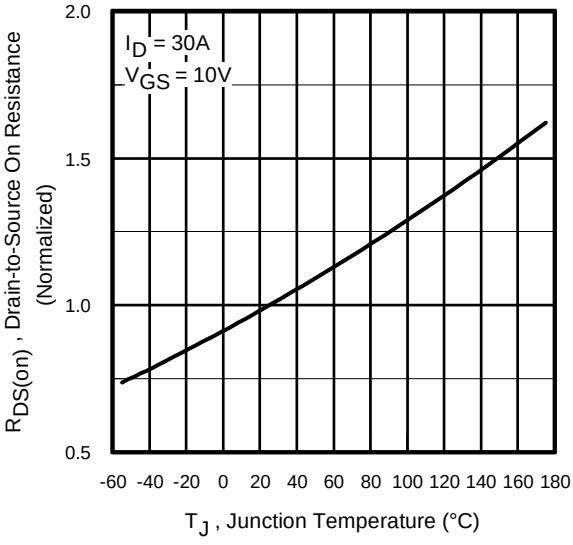


Fig 4. Normalized On-Resistance vs. Temperature

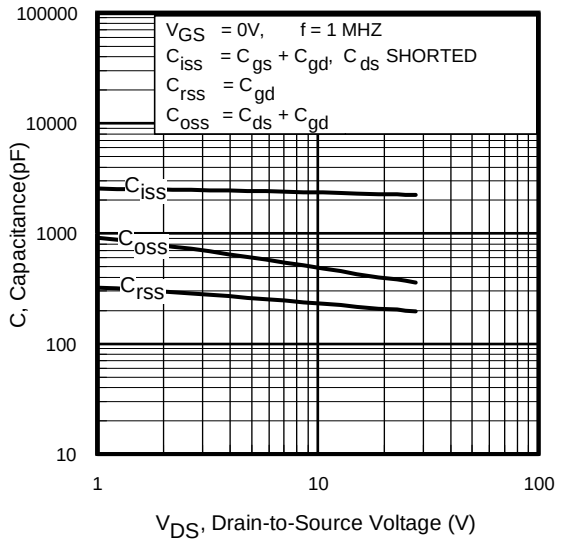


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

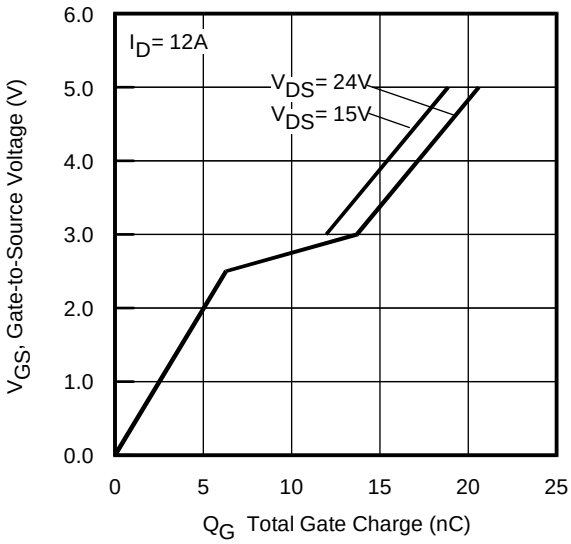


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

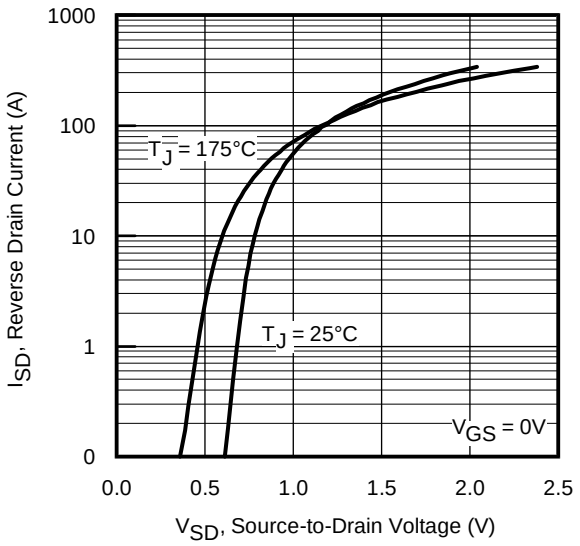


Fig 7. Typical Source-Drain Diode Forward Voltage

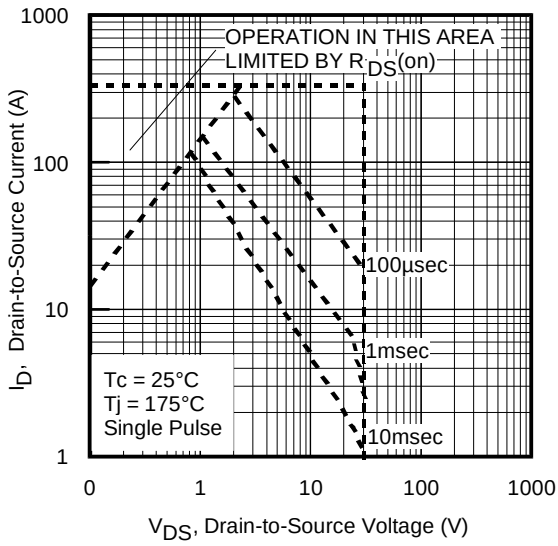


Fig 8. Maximum Safe Operating Area

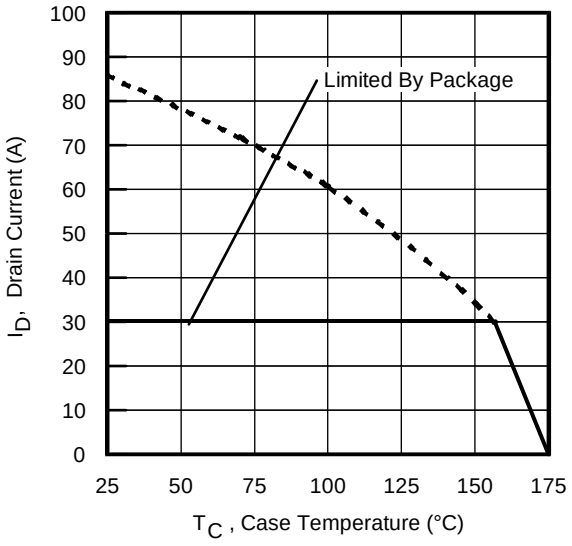


Fig 9. Maximum Drain Current vs. Case Temperature

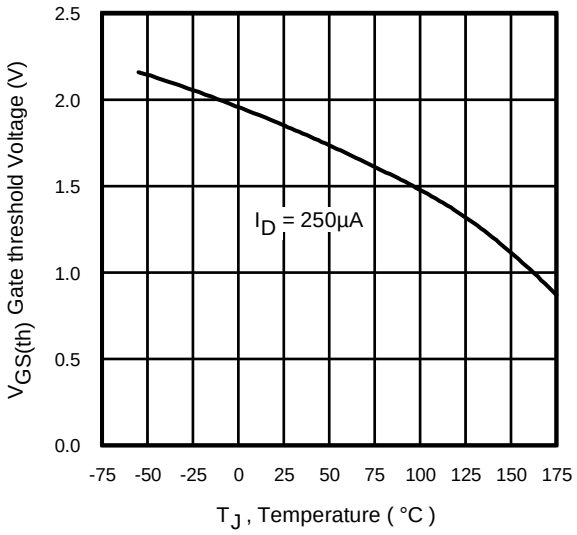


Fig 10. Threshold Voltage vs. Temperature

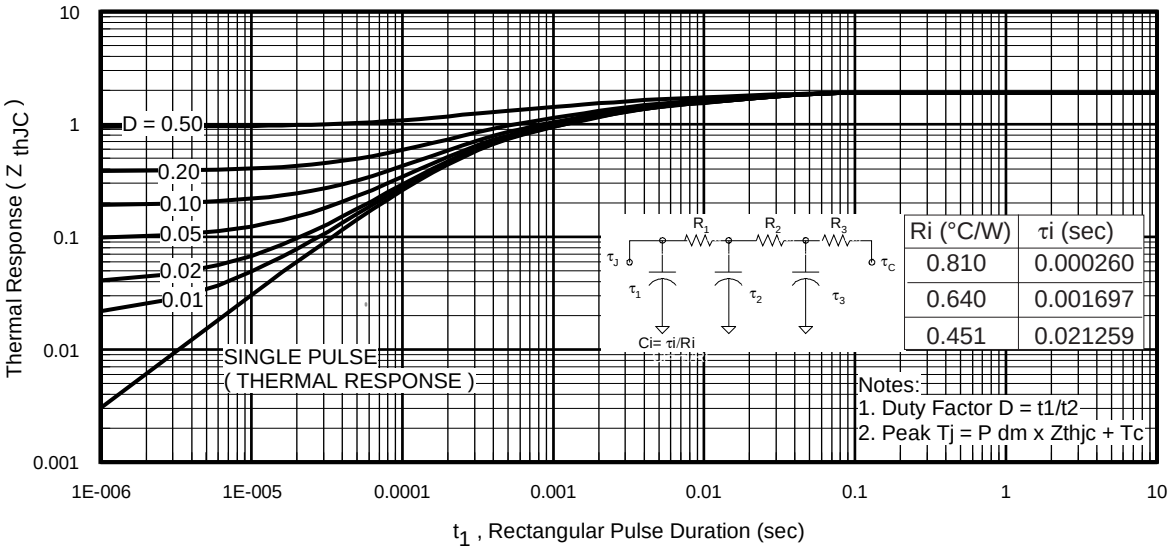


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

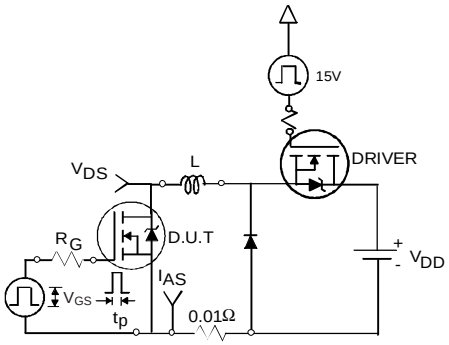


Fig 12a. Unclamped Inductive Test Circuit

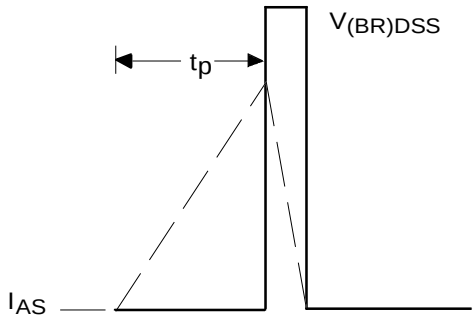


Fig 12b. Unclamped Inductive Waveforms

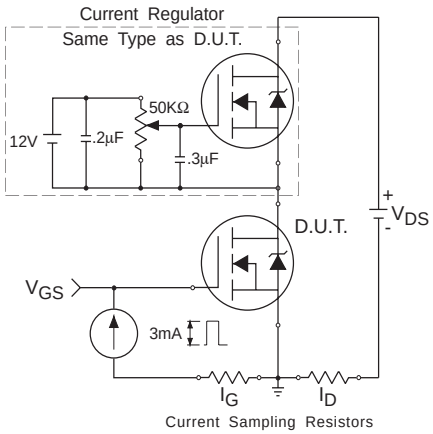


Fig 13. Gate Charge Test Circuit

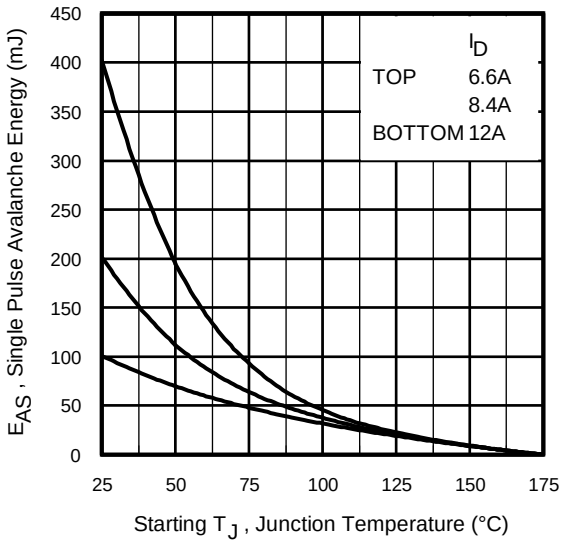


Fig 12c. Maximum Avalanche Energy vs. Drain Current

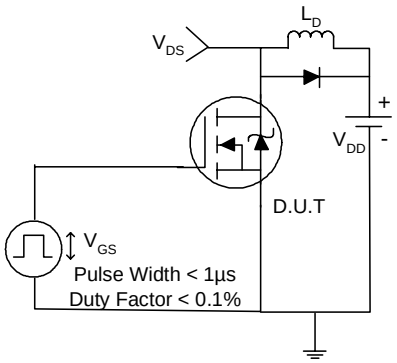


Fig 14a. Switching Time Test Circuit

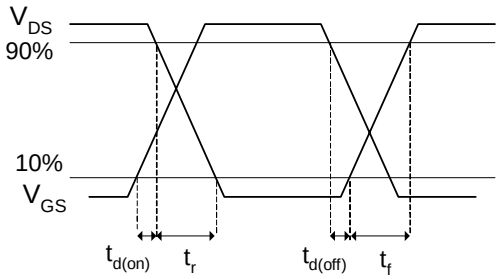
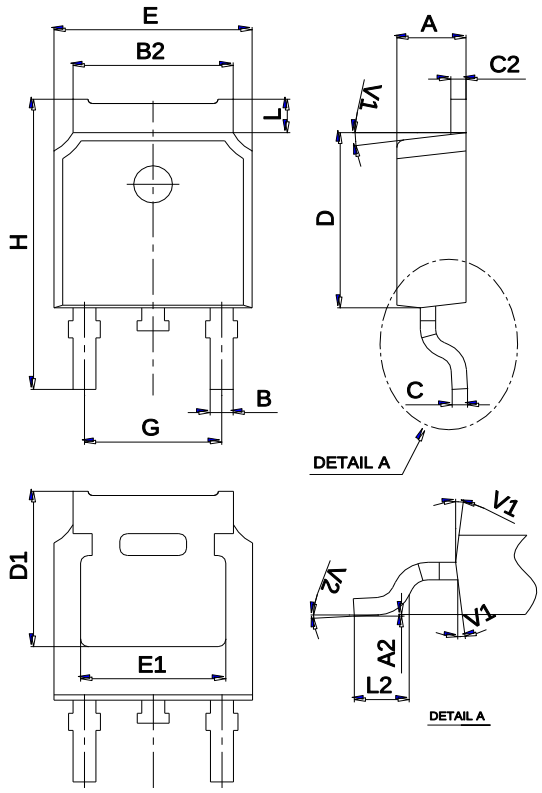


Fig 14b. Switching Time Waveforms

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
IRFR3709ZTR	TO-252	2500	Tape and reel