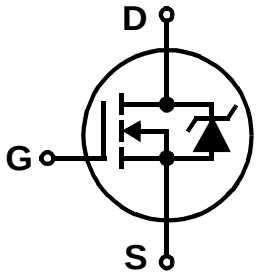
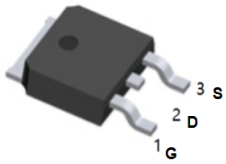
### Applications

- 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 |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>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, $I_{AS}$=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

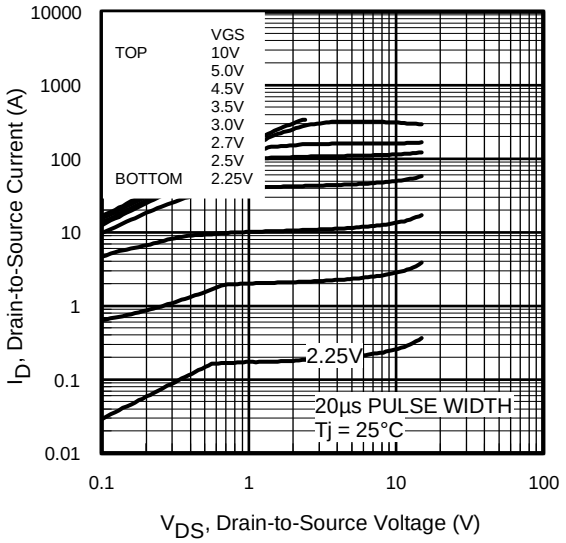



**Fig 1.** Typical Output Characteristics

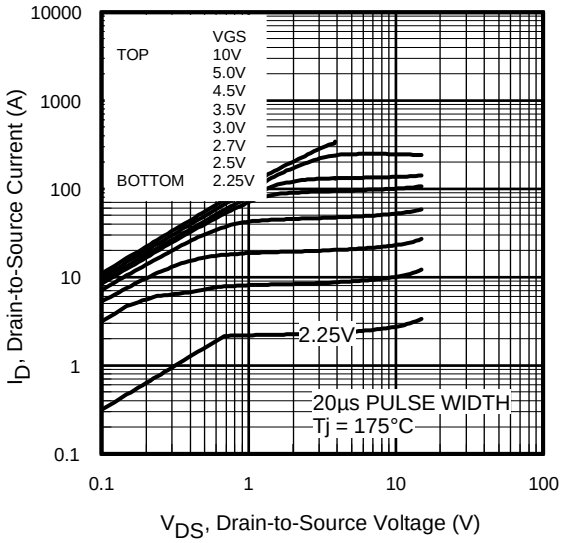



**Fig 2.** Typical Output Characteristics

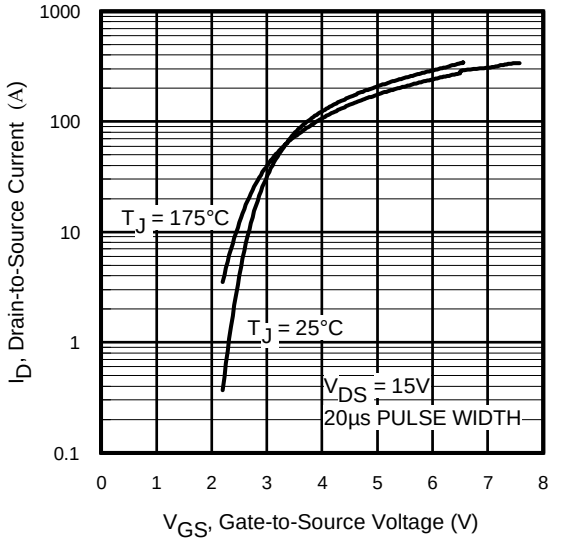



**Fig 3.** Typical Transfer Characteristics

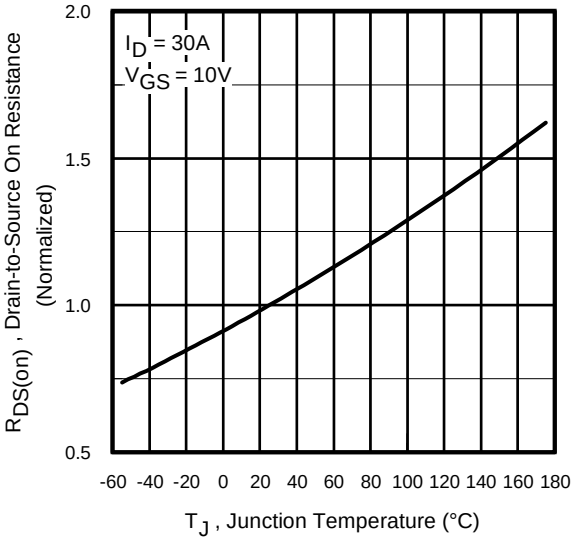



**Fig 4.** Normalized On-Resistance vs. Temperature

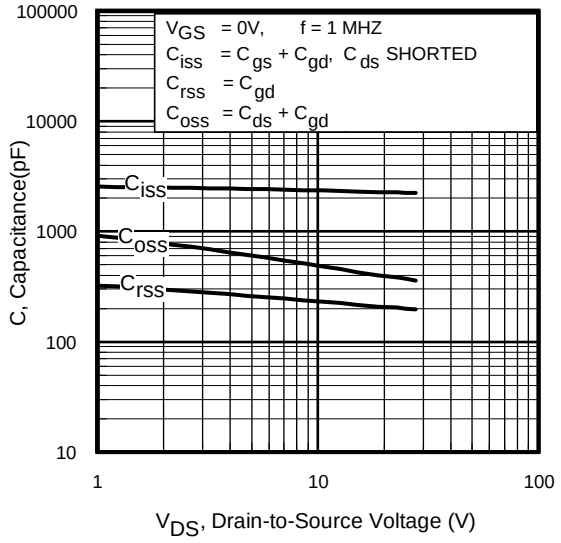



**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage

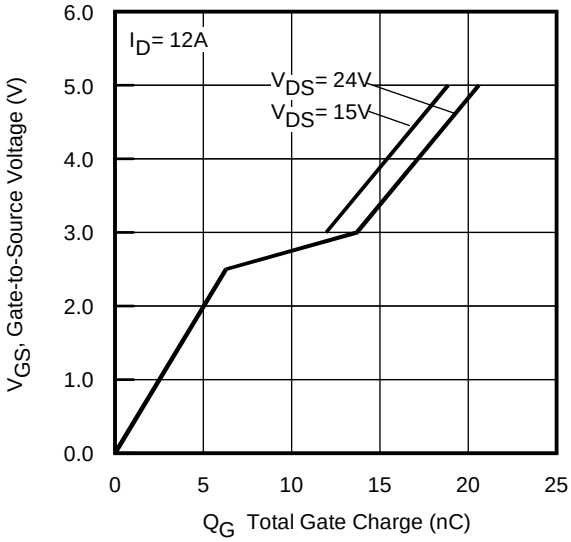



**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage

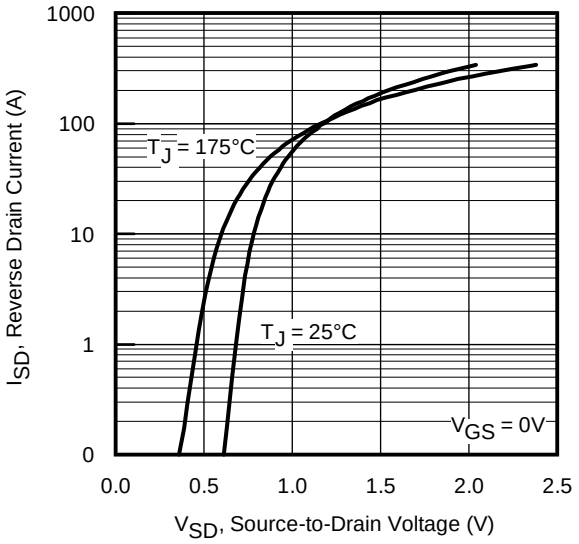



**Fig 7.** Typical Source-Drain Diode Forward Voltage

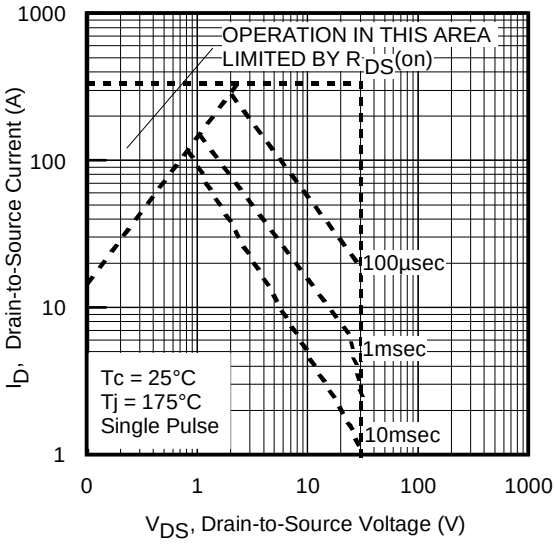



**Fig 8.** Maximum Safe Operating Area

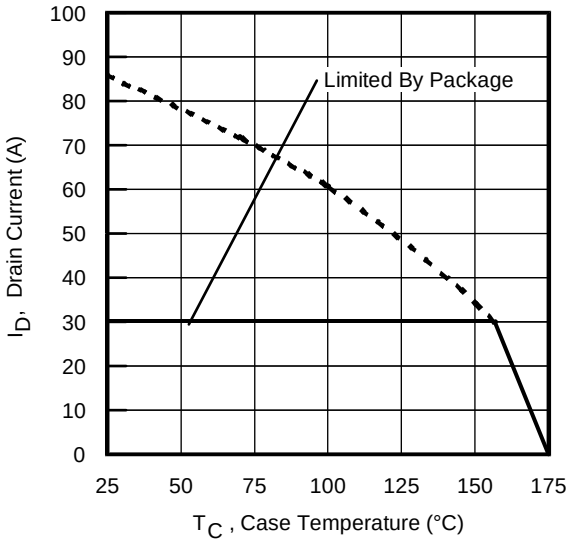



**Fig 9.** Maximum Drain Current vs. Case Temperature

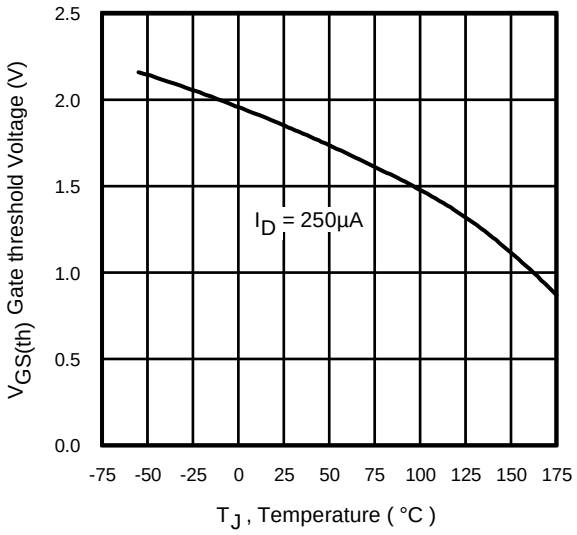



**Fig 10.** Threshold Voltage vs. Temperature

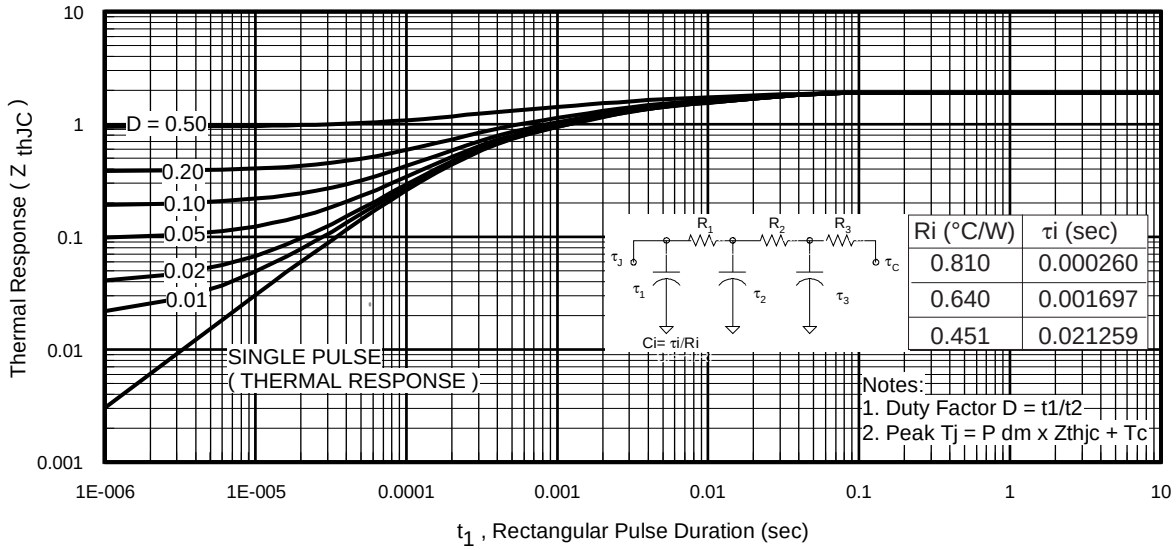



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

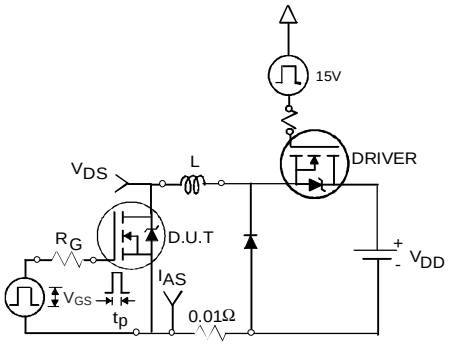



**Fig 12a.** Unclamped Inductive Test Circuit

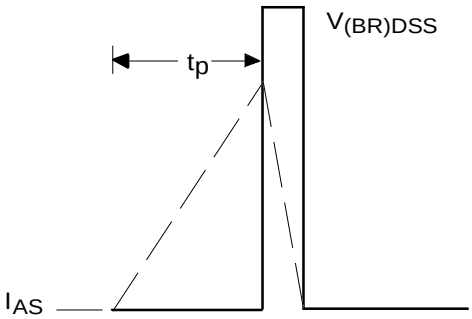



**Fig 12b.** Unclamped Inductive Waveforms

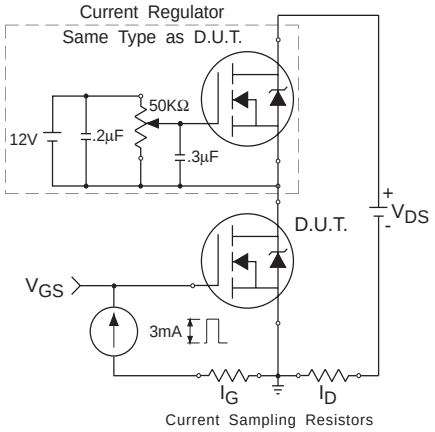



**Fig 13.** Gate Charge Test Circuit

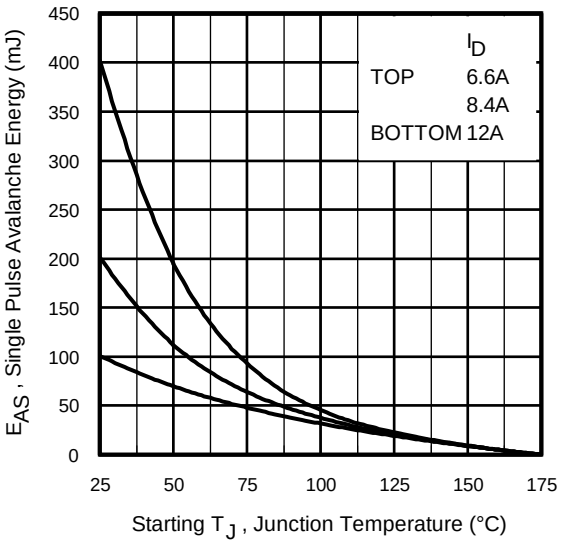



**Fig 12c.** Maximum Avalanche Energy vs. Drain Current

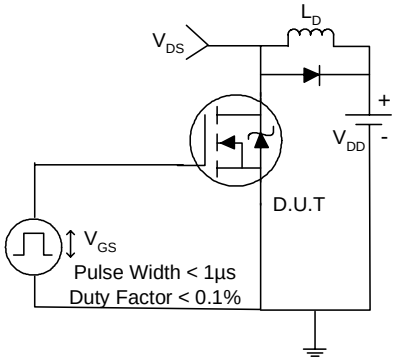



**Fig 14a.** Switching Time Test Circuit

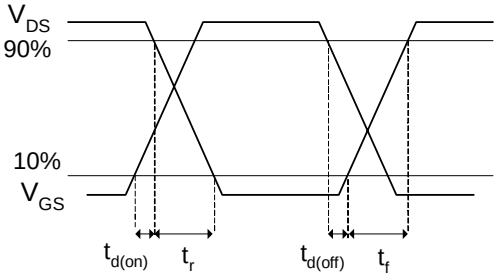
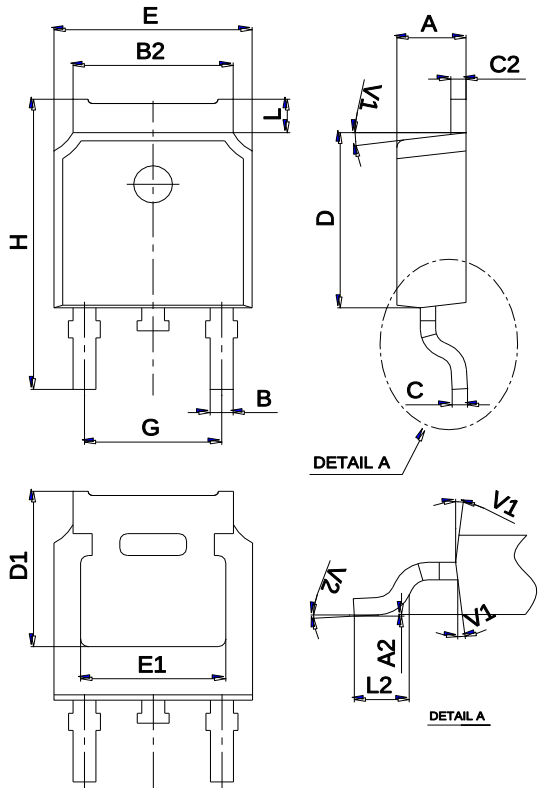



**Fig 14b.** Switching Time Waveforms

## 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 |