

**Applications**

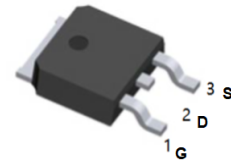
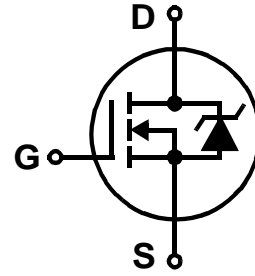
- High Frequency Synchronous Buck Converters for Computer Processor Power
- High Frequency Isolated DC-DC Converters with Synchronous Rectification for Telecom and Industrial Use
- Lead-Free

**Benefits**

- Very Low R<sub>DS(on)</sub> at 4.5V V<sub>GS</sub>
- Ultra-Low Gate Impedance
- Fully Characterized Avalanche Voltage and Current

**Features**

V<sub>DS</sub> (V) = 30V  
 I<sub>D</sub> = 9.4A (V<sub>GS</sub> = 10V)  
 R<sub>DS(ON)</sub> < 6.5 mΩ (V<sub>GS</sub> = 10V)



TO-252(DPAK) top view

**Absolute Maximum Ratings**

|   | Parameter  | Max.                  | Units |
|---|--|-----------------------|-------|
| V <sub>DS</sub>                         | Drain-to-Source Voltage                          | 30                    | V     |
| V <sub>GS</sub>                         | Gate-to-Source Voltage                           | ± 20                  |       |
| I <sub>D</sub> @ T <sub>C</sub> = 25°C  | Continuous Drain Current, V <sub>GS</sub> @ 10V  | 86 <sup>④</sup>       | A     |
| I <sub>D</sub> @ T <sub>C</sub> = 100°C | Continuous Drain Current, V <sub>GS</sub> @ 10V  | 61 <sup>④</sup>       |       |
| I <sub>DM</sub>                         | Pulsed Drain Current <sup>①</sup>                | 340                   |       |
| P <sub>D</sub> @ T <sub>C</sub> = 25°C  | Maximum Power Dissipation                        | 79                    | W     |
| P <sub>D</sub> @ T <sub>C</sub> = 100°C | Maximum Power Dissipation                        | 39                    |       |
|   | Linear Derating Factor                           | 0.53                  | W/°C  |
| T <sub>J</sub>                          | Operating Junction and Storage Temperature Range | -55 to + 175          | °C    |
| T <sub>STG</sub>                        | Soldering Temperature, for 10 seconds            | 300 (1.6mm from case) |       |

**Thermal Resistance**

|                  | Parameter                                    | Typ. | Max. | Units |
|------------------|--|------|------|-------|
| R <sub>θJC</sub> | Junction-to-Case                             | —    | 1.9  | °C/W  |
| R <sub>θJA</sub> | Junction-to-Ambient (PCB Mount) <sup>⑤</sup> | —    | 50   |       |
| R <sub>θJA</sub> | Junction-to-Ambient                          | —    | 110  |       |

**Notes:**

- ① Repetitive rating; pulse width limited by max.junction temperature.
- ② Starting T=25°C, CL=1.4mH, R<sub>θG</sub>=25Ω, I<sub>AS</sub>=12A.
- ③ Pulse width ≤ 400us; 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

**Static @ T<sub>J</sub> = 25°C (unless otherwise specified)**

|                                       | Parameter   | Min. | Typ. | Max. | Units | Conditions  |
|---------------------------------------|---|------|------|------|-------|---|
| BV <sub>DSS</sub>                     | Drain-to-Source Breakdown Voltage                   | 30   | —    | —    | V     | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA  |
| ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>   | Breakdown Voltage Temp. Coefficient                 | —    | 22   | —    | mV/°C | Reference to 25°C, I <sub>D</sub> = 1mA   |
| R <sub>DS(on)</sub>                   | Static Drain-to-Source On-Resistance                | —    | 5.2  | 6.5  | mΩ    | V <sub>GS</sub> = 10V, I <sub>D</sub> = 15A ③   |
|                                       |   | —    | 6.5  | 8.2  |       | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 12A ③  |
| V <sub>GS(th)</sub>                   | Gate Threshold Voltage                              | 1.35 | 1.80 | 2.25 | V     | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA  |
| ΔV <sub>GS(th)</sub> /ΔT <sub>J</sub> | Gate Threshold Voltage Coefficient                  | —    | -5.6 | —    | mV/°C |   |
| I <sub>DSS</sub>                      | Drain-to-Source Leakage Current                     | —    | —    | 1.0  | μA    | V <sub>DS</sub> = 24V, V <sub>GS</sub> = 0V   |
|                                       |   | —    | —    | 150  |       | V <sub>DS</sub> = 24V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 150°C                               |
| I <sub>GSS</sub>                      | Gate-to-Source Forward Leakage                      | —    | —    | 100  | nA    | V <sub>GS</sub> = 20V   |
|                                       | Gate-to-Source Reverse Leakage                      | —    | —    | -100 |       | V <sub>GS</sub> = -20V  |
| g <sub>fs</sub>                       | Forward Transconductance                            | 51   | —    | —    | S     | V <sub>DS</sub> = 15V, I <sub>D</sub> = 12A   |
| Q <sub>g</sub>                        | Total Gate Charge                                   | —    | 17   | 26   | nC    | V <sub>DS</sub> = 15V<br>V <sub>GS</sub> = 4.5V<br>I <sub>D</sub> = 12A<br>See Fig. 16            |
| Q <sub>gs1</sub>                      | Pre-V <sub>th</sub> Gate-to-Source Charge           | —    | 4.7  | —    |       |   |
| Q <sub>gs2</sub>                      | Post-V <sub>th</sub> Gate-to-Source Charge          | —    | 1.6  | —    |       |   |
| Q <sub>gd</sub>                       | Gate-to-Drain Charge                                | —    | 5.7  | —    |       |   |
| Q <sub>godr</sub>                     | Gate Charge Overdrive                               | —    | 5.0  | —    |       |   |
| Q <sub>sw</sub>                       | Switch Charge (Q <sub>gs2</sub> + Q <sub>gd</sub> ) | —    | 7.3  | —    |       |   |
| Q <sub>oss</sub>                      | Output Charge                                       | —    | 10   | —    | nC    | V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V   |
| t <sub>d(on)</sub>                    | Turn-On Delay Time                                  | —    | 12   | —    | ns    | V <sub>DD</sub> = 16V, V <sub>GS</sub> = 4.5V ③<br>I <sub>D</sub> = 12A<br>Clamped Inductive Load |
| t <sub>r</sub>                        | Rise Time   | —    | 12   | —    |       |   |
| t <sub>d(off)</sub>                   | Turn-Off Delay Time                                 | —    | 15   | —    |       |   |
| t <sub>f</sub>                        | Fall Time   | —    | 3.9  | —    |       |   |
| C <sub>iss</sub>                      | Input Capacitance                                   | —    | 2330 | —    | pF    | V <sub>GS</sub> = 0V<br>V <sub>DS</sub> = 15V<br>f = 1.0MHz                                       |
| C <sub>oss</sub>                      | Output Capacitance                                  | —    | 460  | —    |       |   |
| C <sub>rss</sub>                      | Reverse Transfer Capacitance                        | —    | 230  | —    |       |   |

**Avalanche Characteristics**

|                 | Parameter                                  | Typ. | Max. | Units |
|-----------------|--|------|------|-------|
| E <sub>AS</sub> | Single Pulse Avalanche Energy <sup>②</sup> | —    | 100  | mJ    |
| I <sub>AR</sub> | Avalanche Current ①                        | —    | 12   | A     |
| E <sub>AR</sub> | Repetitive Avalanche Energy ①              | —    | 7.9  | mJ    |

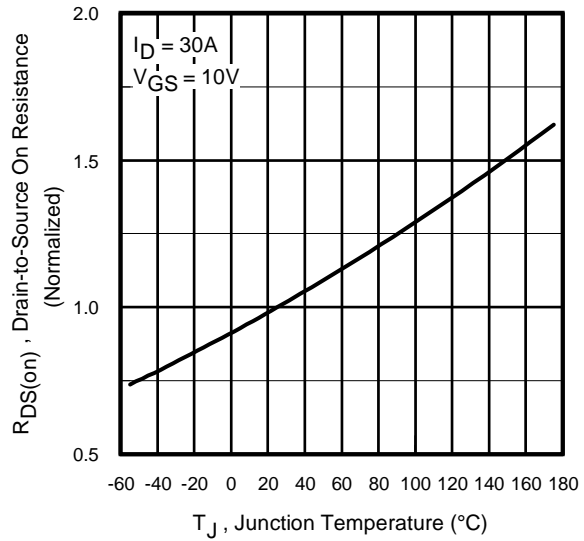
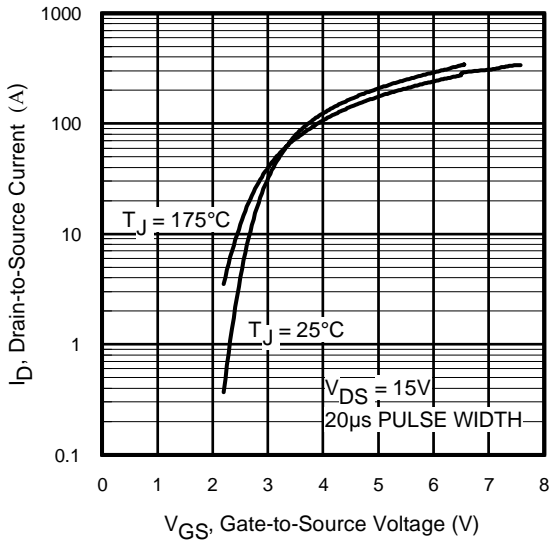
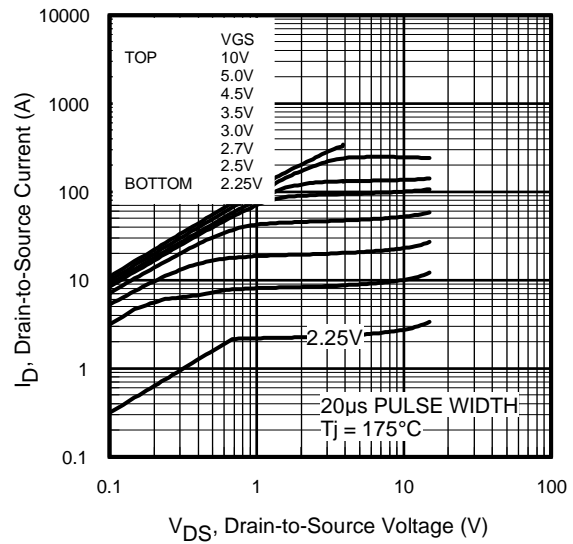
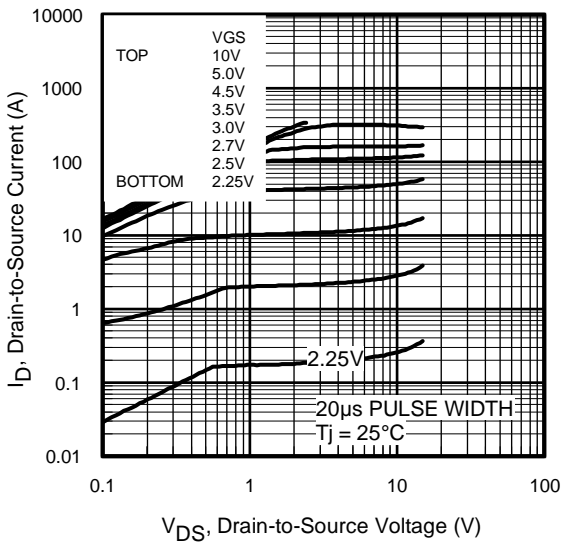
**Diode Characteristics**

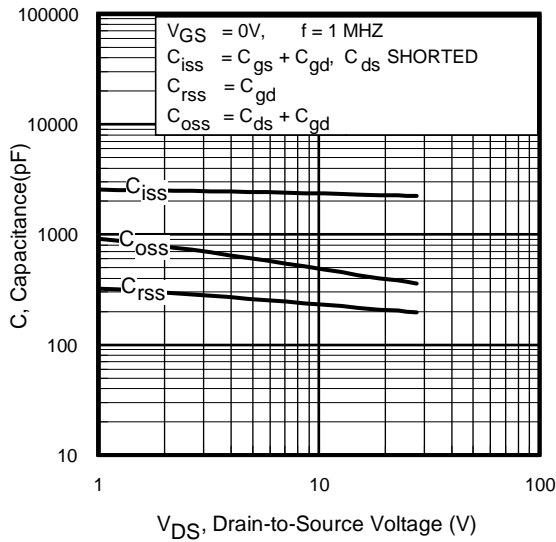
|                 | Parameter                                 | Min.   | Typ. | Max.            | Units | Conditions  |
|-----------------|---|--|------|-----------------|-------|---|
| I <sub>S</sub>  | Continuous Source Current<br>(Body Diode) | —  | —    | 86 <sup>④</sup> | A     | MOSFET symbol<br>showing the<br>integral reverse<br>p-n junction diode. |
| I <sub>SM</sub> | Pulsed Source Current<br>(Body Diode) ①   | —  | —    | 340             |       |   |
| V <sub>SD</sub> | Diode Forward Voltage                     | —  | —    | 1.0             | V     | T <sub>J</sub> = 25°C, I <sub>S</sub> = 12A, V <sub>GS</sub> = 0V ③     |
| t <sub>rr</sub> | Reverse Recovery Time                     | —  | 29   | 44              | ns    | T <sub>J</sub> = 25°C, I <sub>F</sub> = 12A, V <sub>DD</sub> = 15V      |
| Q <sub>rr</sub> | Reverse Recovery Charge                   | —  | 25   | 37              | nC    | di/dt = 100A/μs ③   |
| t <sub>on</sub> | Forward Turn-On Time                      | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) |      |                 |       |   |

**Notes:**

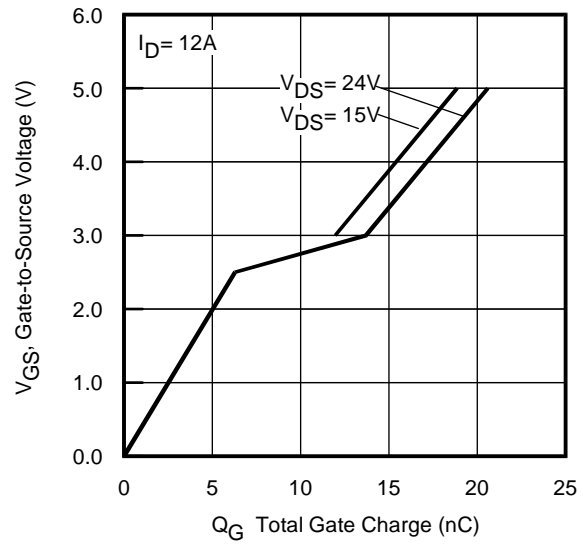
- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting T = 25°C, CL = 1.4mHRG = 25Ω, I<sub>AS</sub> = 12A.
- ③ Pulse width ≤ 400μs; duty cycle ≤ 2%

- 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

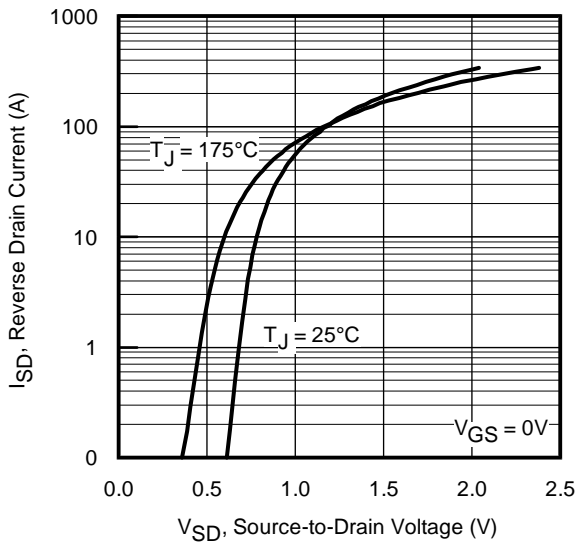




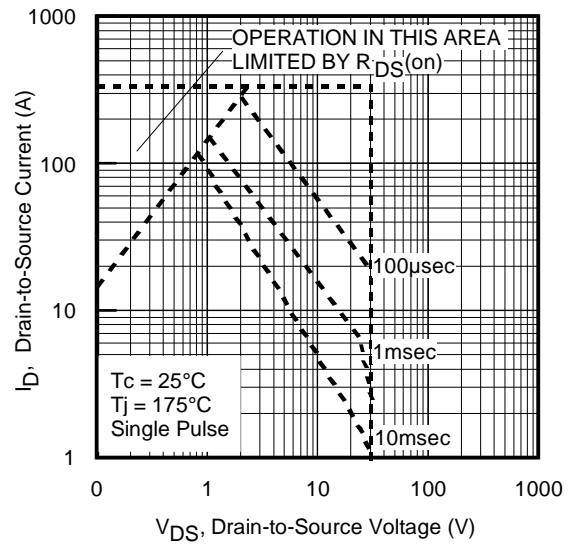
**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage



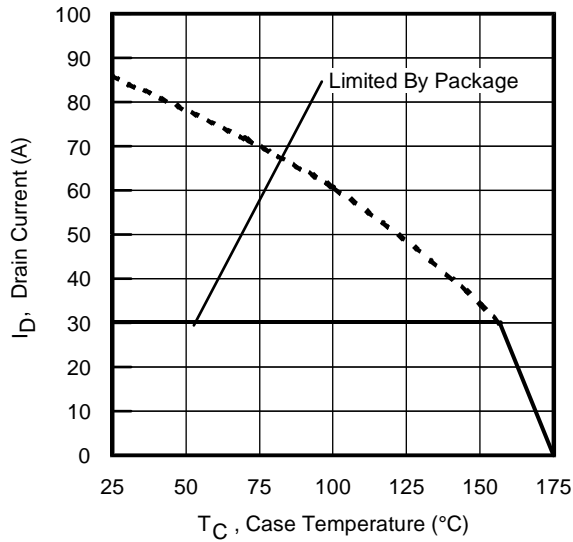
**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage



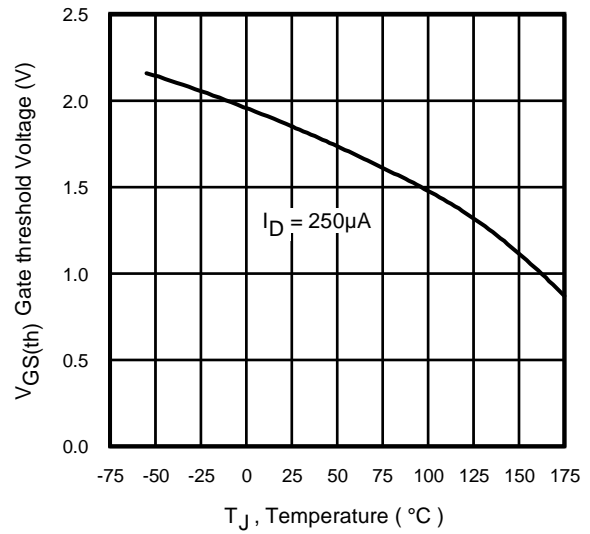
**Fig 7.** Typical Source-Drain Diode Forward Voltage



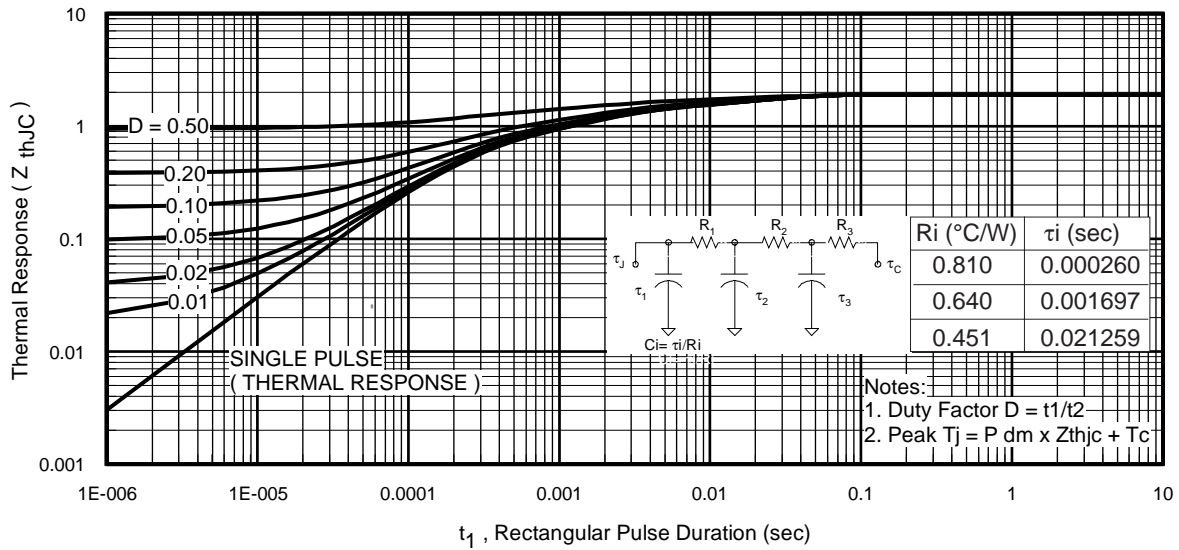
**Fig 8.** Maximum Safe Operating Area



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



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



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

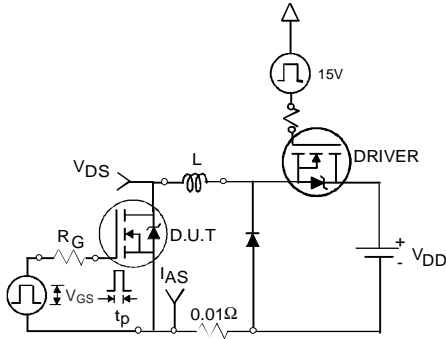


Fig 12a. Unclamped Inductive Test Circuit

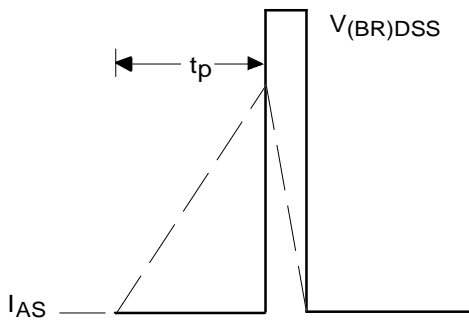


Fig 12b. Unclamped Inductive Waveforms

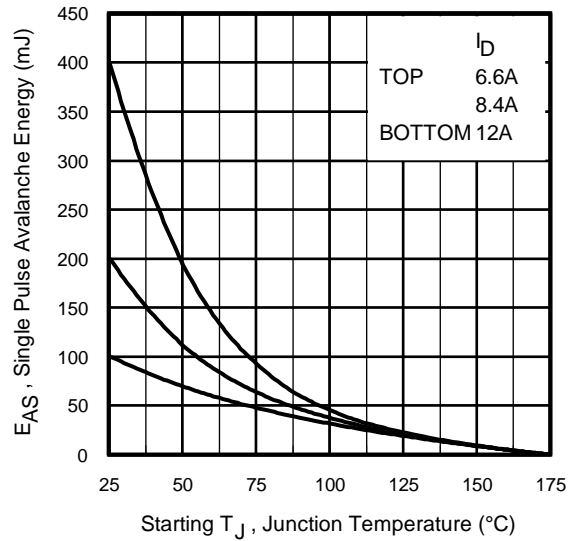


Fig 12c. Maximum Avalanche Energy vs. Drain Current

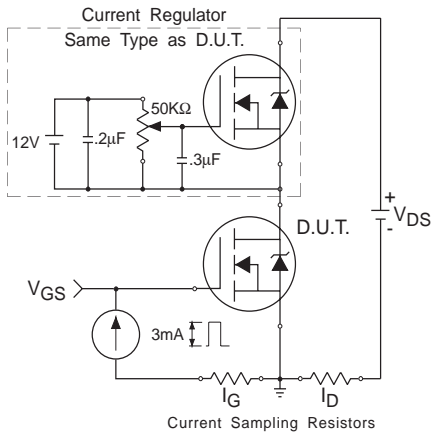


Fig 13. Gate Charge Test Circuit

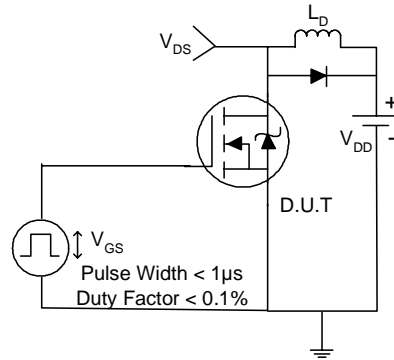


Fig 14a. Switching Time Test Circuit

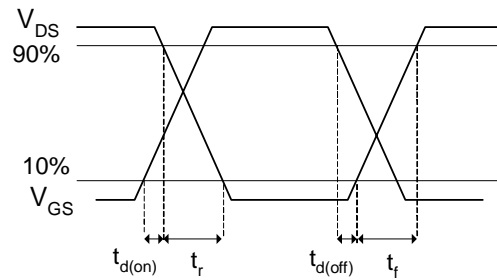
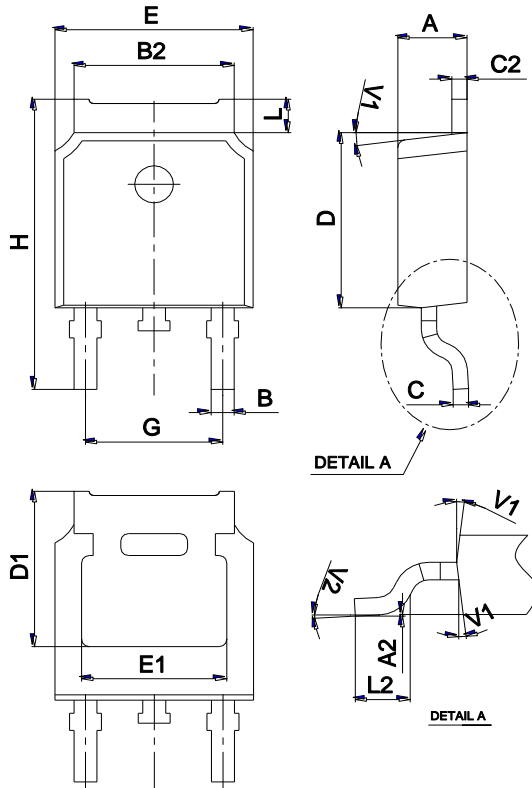


Fig 14b. Switching Time Waveforms

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 |