

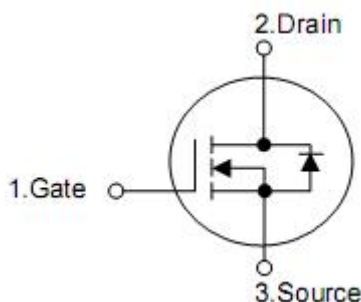
## 1. Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficient switched mode power supplies, active power factor correction, electronic lamp ballast based on half bridge to pology.

## 2. Features

- n 9A, 900V,  $R_{DS(on)}=1.12\Omega$  @  $V_{GS}=10\text{ V}$
- n Low gate charge ( typical 70 nC)
- n Low  $C_{rss}$  ( typical 14pF)
- n Fast switching
- n 100% avalanche tested
- n Improved dv/dt capability
- n RoHS compliant

## 3. Pin configuration



| Pin | Function |
|-----|----------|
| 1   | Gate     |
| 2   | Drain    |
| 3   | Source   |

#### 4. Absolute maximum ratings

( $T_C = 25^\circ\text{C}$ , unless otherwise specified)

| Parameter                                                                        | Symbol         | Ratings                                 | Units               |
|----------------------------------------------------------------------------------|----------------|-----------------------------------------|---------------------|
| Drain-source voltage                                                             | $V_{DSS}$      | 900                                     | V                   |
| Drain current                                                                    | $I_D$          | $T_C=25^\circ\text{C}$<br>9.0           | A                   |
|                                                                                  |                | $T_C=100^\circ\text{C}$<br>5.7          | A                   |
| Drain current (note1)                                                            | $I_{DM}$       | 36                                      | A                   |
| Gate-source Voltage                                                              | $V_{GSS}$      | $\pm 30$                                | V                   |
| Single pulsed avalanche energy (note2)                                           | $E_{AS}$       | 900                                     | mJ                  |
| Avalanche current (note1)                                                        | $I_{AR}$       | 9.0                                     | A                   |
| Repetitive avalanche energy (note1)                                              | $E_{AR}$       | 28                                      | mJ                  |
| Peak diode recovery dv/dt (note 3)                                               | dv/dt          | 4.0                                     | V/ns                |
| Power dissipation                                                                | $P_D$          | $T_C=25^\circ\text{C}$<br>280           | W                   |
|                                                                                  |                | Derate above $25^\circ\text{C}$<br>2.22 | W/ $^\circ\text{C}$ |
| Operating and storage temperature range                                          | $T_J, T_{STG}$ | -55 to +150                             | $^\circ\text{C}$    |
| Maximum lead temperature for soldering purposes,<br>1/8" from case for 5 seconds | $T_L$          | 300                                     | $^\circ\text{C}$    |

#### 5. Thermal characteristics

| Parameter                               | Symbol          | Typ  | Max  | Units              |
|-----------------------------------------|-----------------|------|------|--------------------|
| Thermal resistance, junction-to-case    | $R_{\theta JC}$ | -    | 0.45 | $^\circ\text{C/W}$ |
| Thermal resistance, case-to-sink        | $R_{\theta CS}$ | 0.24 | -    | $^\circ\text{C/W}$ |
| Thermal resistance, junction-to-ambient | $R_{\theta JA}$ | -    | 40   | $^\circ\text{C/W}$ |

## 6. Electrical characteristics

(T<sub>C</sub>=25°C, unless otherwise notes)

| Parameter                                              |         | Symbol                              | Test Conditions                                                                      | Min | Typ  | Max  | Units |
|--------------------------------------------------------|---------|-------------------------------------|--------------------------------------------------------------------------------------|-----|------|------|-------|
| Off characteristics                                    |         |                                     |                                                                                      |     |      |      |       |
| Drain-source breakdown voltage                         |         | BV <sub>DSS</sub>                   | V <sub>GS</sub> =0V,I <sub>D</sub> =250μA                                            | 900 | -    | -    | V     |
| Zero gate voltage drain current                        |         | I <sub>DSS</sub>                    | V <sub>DS</sub> =900V,V <sub>GS</sub> =0V                                            | -   | -    | 10   | μA    |
|                                                        |         |                                     | V <sub>DS</sub> =720V,T <sub>C</sub> =125°C                                          | -   | -    | 100  | μA    |
| Gate-body leakage current                              | Forward | I <sub>GSS</sub>                    | V <sub>GS</sub> =30V,V <sub>DS</sub> =0V                                             | -   | -    | 100  | nA    |
|                                                        | Reverse |                                     | V <sub>GS</sub> =-30V,V <sub>DS</sub> =0V                                            | -   | -    | -100 | nA    |
| Breakdown voltage temperature coefficient              |         | ΔBV <sub>DSS</sub> /ΔT <sub>J</sub> | I <sub>D</sub> =250μA<br>Referenced to 25°C                                          | -   | 0.9  | -    | V/°C  |
| On characteristics                                     |         |                                     |                                                                                      |     |      |      |       |
| Gate threshold voltage                                 |         | V <sub>GS(th)</sub>                 | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                             | 3.0 | -    | 5.0  | V     |
| Static drain-source on-resistance                      |         | R <sub>DS(on)</sub>                 | V <sub>GS</sub> =10V,I <sub>D</sub> =4.5A                                            | -   | 1.12 | 1.4  | Ω     |
| Forward transconductance                               |         | g <sub>FS</sub>                     | V <sub>DS</sub> =40V,I <sub>D</sub> =4.5A<br>(note4)                                 | -   | 9.0  | -    | S     |
| Dynamic characteristics                                |         |                                     |                                                                                      |     |      |      |       |
| Input capacitance                                      |         | C <sub>ISS</sub>                    | V <sub>DS</sub> =25V,V <sub>GS</sub> =0V,<br>f=1MHz                                  | -   | 2780 |      | pF    |
| Output capacitance                                     |         | C <sub>OSS</sub>                    |                                                                                      | -   | 228  |      | pF    |
| Reverse transfer capacitance                           |         | C <sub>RSS</sub>                    |                                                                                      | -   | 28   |      | pF    |
| Switching characteristics                              |         |                                     |                                                                                      |     |      |      |       |
| Turn-on delay time                                     |         | t <sub>D(ON)</sub>                  | V <sub>DD</sub> =450V,I <sub>D</sub> =9.0A,<br>R <sub>G</sub> =25Ω (note4, 5)        | -   | 55   |      | ns    |
| Rise time                                              |         | t <sub>R</sub>                      |                                                                                      | -   | 130  |      | ns    |
| Turn-off delay time                                    |         | t <sub>D(OFF)</sub>                 |                                                                                      | -   | 110  |      | ns    |
| Fall time                                              |         | t <sub>F</sub>                      |                                                                                      | -   | 80   |      | ns    |
| Total gate charge                                      |         | Q <sub>G</sub>                      | V <sub>DS</sub> =720V, I <sub>D</sub> =9.0A,<br>V <sub>GS</sub> =10V (note4, 5)      | -   | 70   |      | nC    |
| Gate-source charge                                     |         | Q <sub>GS</sub>                     |                                                                                      | -   | 13.5 | -    | nC    |
| Gate-drain charge                                      |         | Q <sub>GD</sub>                     |                                                                                      | -   | 27   | -    | nC    |
| Drain-source diode characteristics and maximum ratings |         |                                     |                                                                                      |     |      |      |       |
| Maximum continuous drain-source diode forward current  |         | I <sub>S</sub>                      |                                                                                      | -   | -    | 9.0  | A     |
| Maximum pulsed drain-source diode forward current      |         | I <sub>SM</sub>                     |                                                                                      | -   | -    | 36.0 | A     |
| Drain-source diode forward voltage                     |         | V <sub>SD</sub>                     | V <sub>GS</sub> =0V,I <sub>S</sub> =9.0A                                             | -   | -    | 1.4  | V     |
| Reverse recovery time                                  |         | t <sub>RR</sub>                     | V <sub>GS</sub> =0V,I <sub>S</sub> =9.0A,<br>dI <sub>F</sub> /dt=100A/μs<br>(note 4) | -   | 850  | -    | ns    |
| Reverse recovery charge                                |         | Q <sub>RR</sub>                     |                                                                                      | -   | 10   | -    | μC    |

Note: 1. Repetitive rating : pulse width limited by maximum junction temperature  
2. L=21mH, I<sub>AS</sub>= 9.0A, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, starting T<sub>J</sub>=25°C  
3. I<sub>SD</sub>≤9.0A, di/dt≤200A/μs, V<sub>DD</sub>≤BV<sub>DSS</sub>, Starting T<sub>J</sub>=25°C  
4. Pulse test : pulse width≤300μs, duty cycle≤2%  
5. Essentially independent of operating temperature

## 7. Test circuits and waveforms

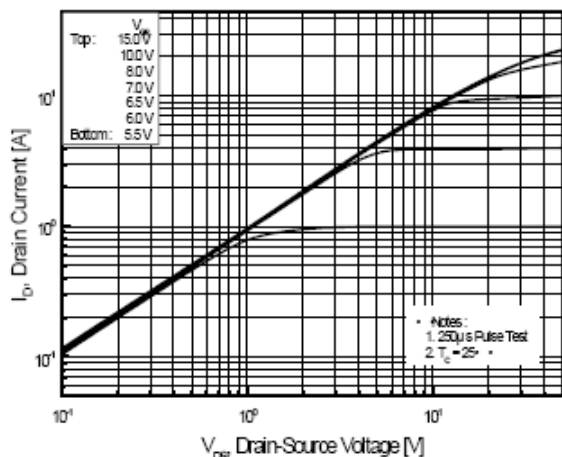


Figure 1. On-Region Characteristics

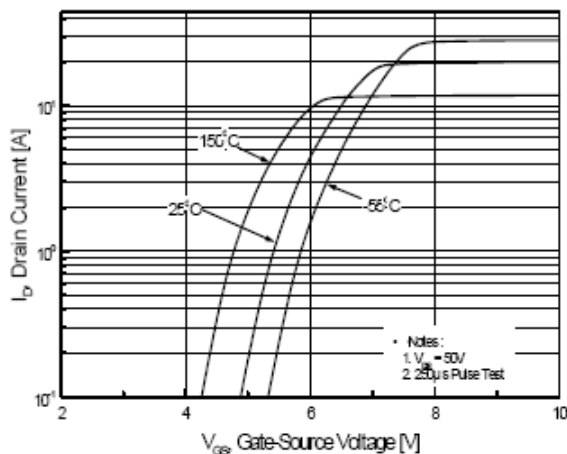


Figure 2. Transfer Characteristics

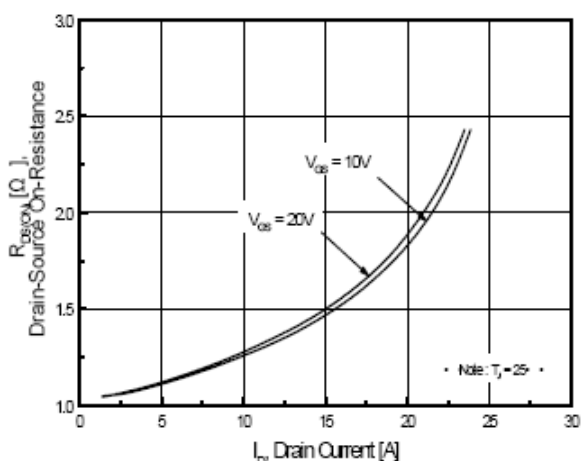


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

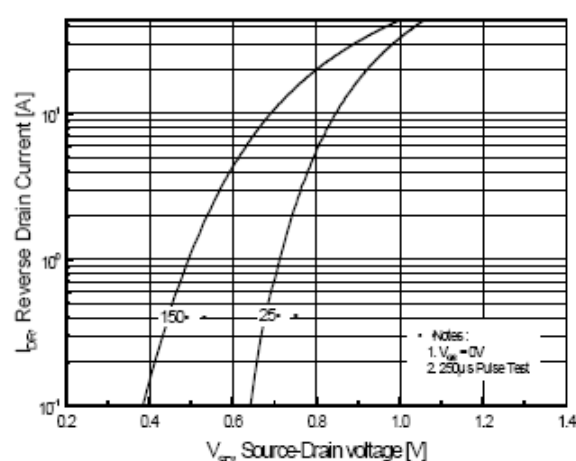


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

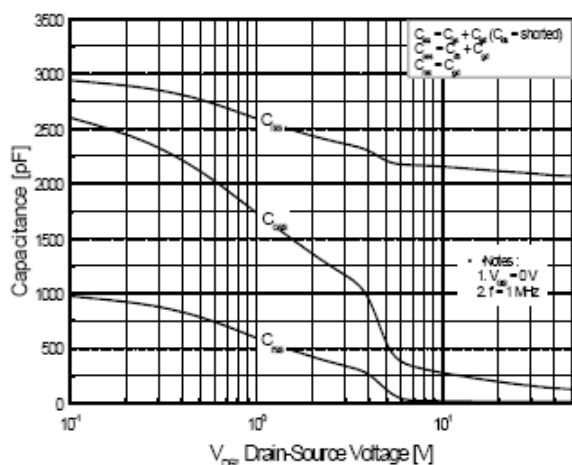


Figure 5. Capacitance Characteristics

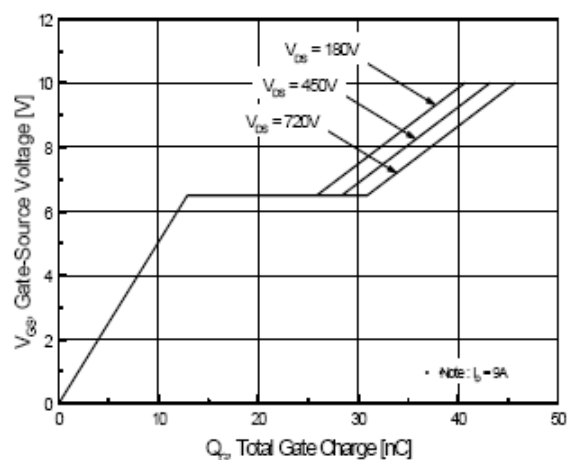


Figure 6. Gate Charge Characteristics

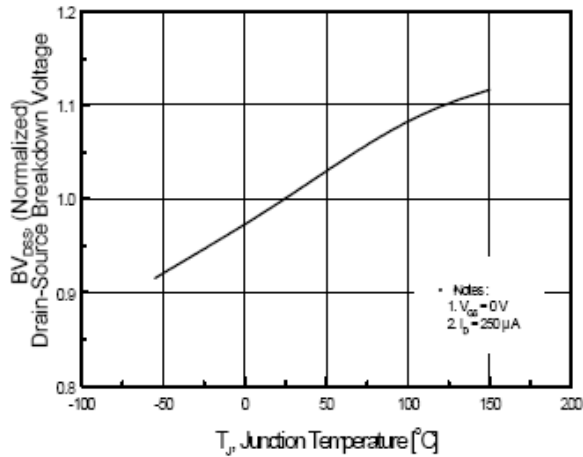


Figure 7. Breakdown Voltage Variation vs. Temperature

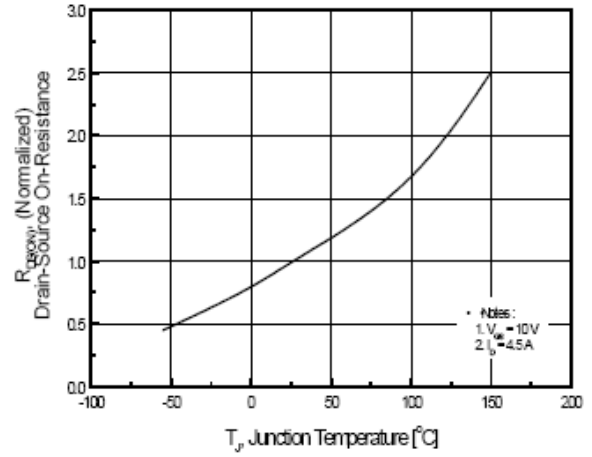


Figure 8. On-Resistance Variation vs. Temperature

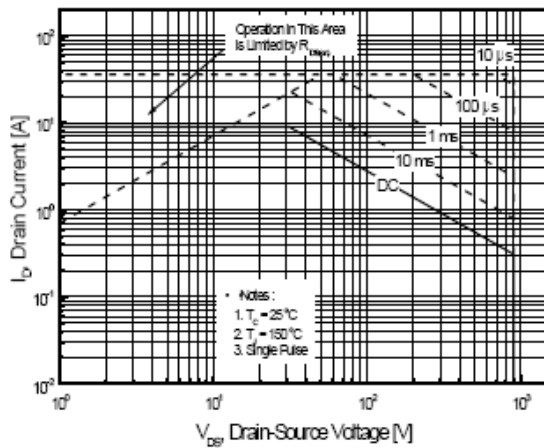


Figure 9. Maximum Safe Operating Area

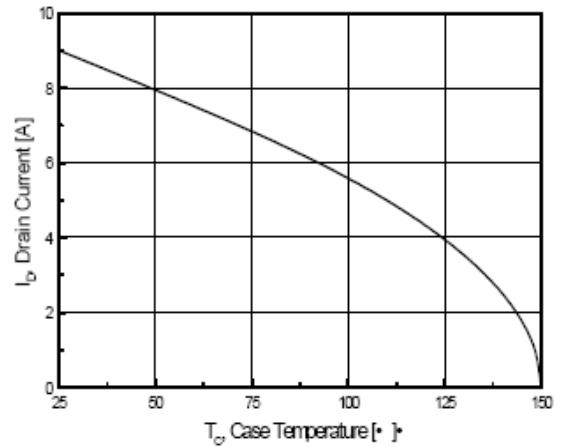


Figure 10. Maximum Drain Current vs. Case Temperature

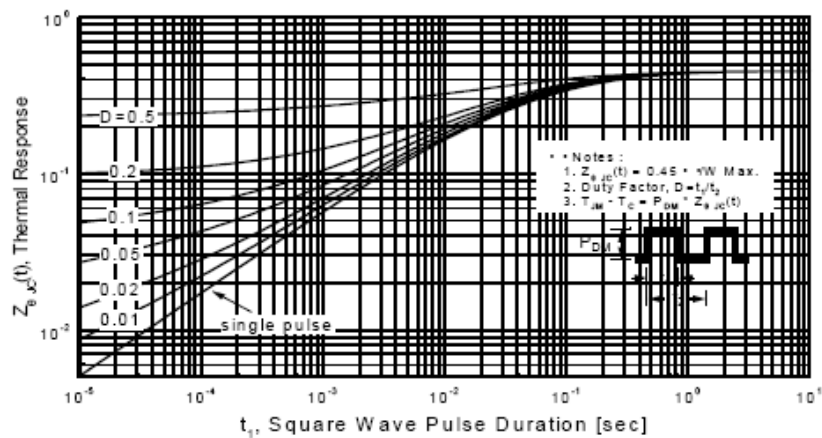
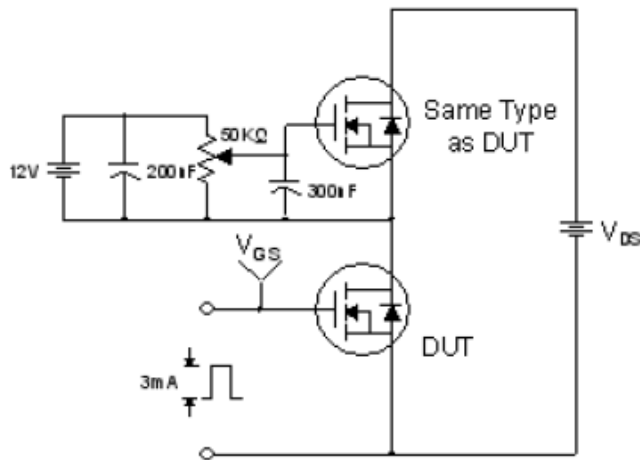
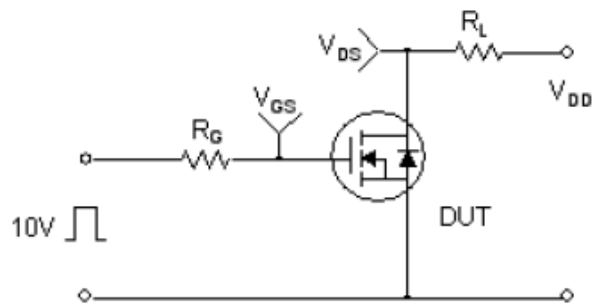


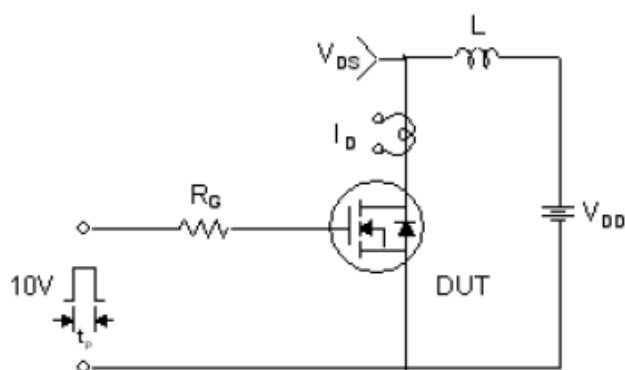
Figure 11. Transient Thermal Response Curve



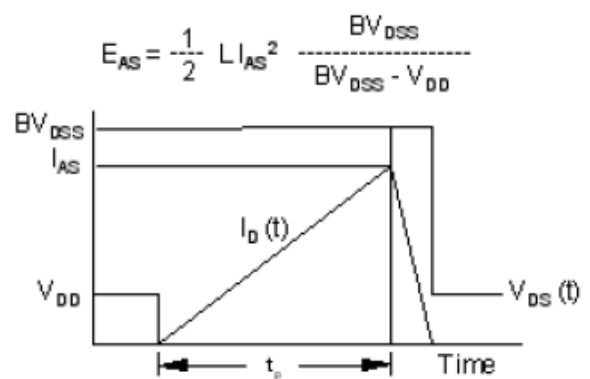
Gate Charge Test Circuit & Waveform



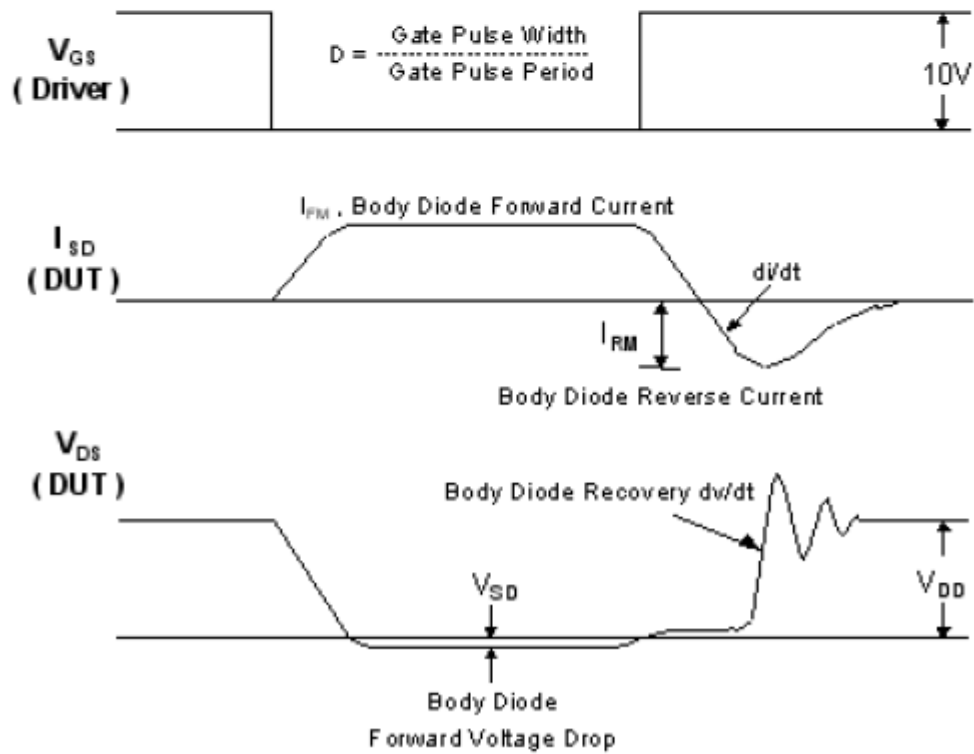
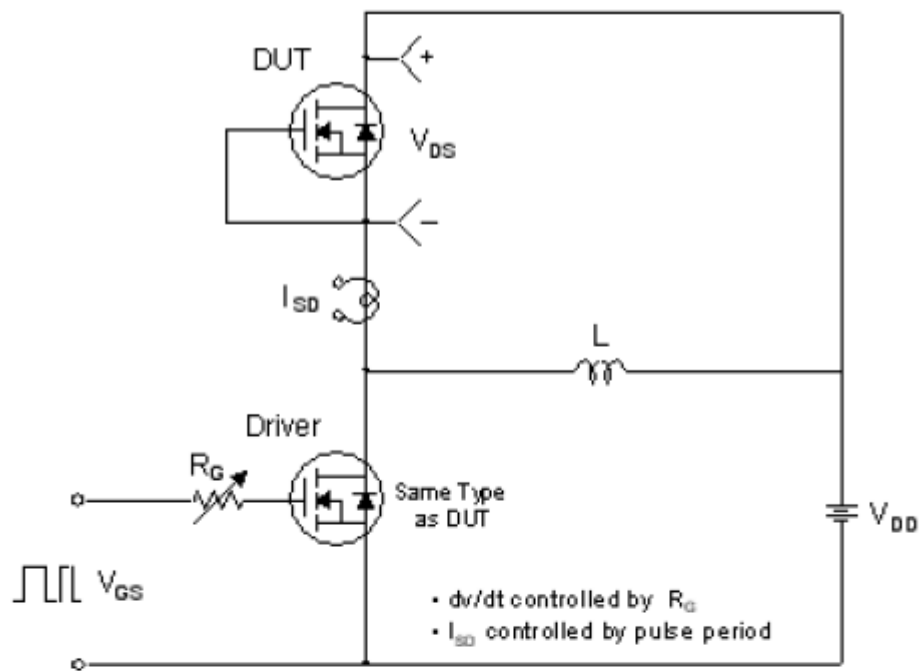
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$


The waveform shows  $V_{DS}$  and  $I_D(t)$  vs. Time. The gate voltage  $V_{GS}$  is a square wave between 0V and 10V. The drain voltage  $V_{DS}$  is a square wave between 0V and  $V_{DD}$ . The drain current  $I_D(t)$  is a triangular wave that rises linearly from 0A to  $I_{AS}$  and then falls linearly to 0A. The switching time  $t_p$  is indicated.



Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms