

# FCI7N60 600V N-Channel MOSFET

## Features

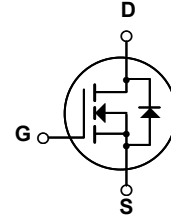
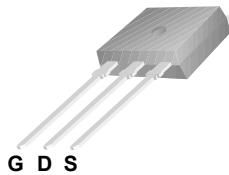
- 650V @ $T_J = 150^\circ\text{C}$
- Typ.  $R_{DS(on)} = 0.53\Omega$
- Ultra Low Gate Charge (typ.  $Q_g = 25\text{nC}$ )
- Low Effective Output Capacitance (typ.  $C_{oss\text{eff.}} = 60\text{pF}$ )
- 100% Avalanche Tested
- RoHS Compliant



## Description

SuperFET™ is, Fairchild's proprietary, new generation of high voltage MOSFET family that is utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance.

This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. Consequently, SuperFET is very suitable for various AC/DC power conversion in switching mode operation for system miniaturization and higher efficiency.



## Absolute Maximum Ratings

| Symbol         | Parameter   | FCI7N60                                    | Unit                |
|----------------|---|--|---------------------|
| $V_{DSS}$      | Drain-Source Voltage  | 600  | V                   |
| $I_D$          | Drain Current   | - Continuous ( $T_C = 25^\circ\text{C}$ )  | 7                   |
|                |   | - Continuous ( $T_C = 100^\circ\text{C}$ ) | 4.4                 |
| $I_{DM}$       | Drain Current - Pulsed (Note 1)   | 21   | A                   |
| $V_{GSS}$      | Gate-Source voltage   | $\pm 30$                                   | V                   |
| $E_{AS}$       | Single Pulsed Avalanche Energy (Note 2)   | 230  | mJ                  |
| $I_{AR}$       | Avalanche Current (Note 1)  | 7  | A                   |
| $E_{AR}$       | Repetitive Avalanche Energy (Note 1)  | 8.3  | mJ                  |
| dv/dt          | Peak Diode Recovery dv/dt (Note 3)  | 4.5  | V/ns                |
| $P_D$          | Power Dissipation ( $T_C = 25^\circ\text{C}$ )<br>- Derate above $25^\circ\text{C}$ | 83   | W                   |
|                |   | 0.67                                       | W/ $^\circ\text{C}$ |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range   | -55 to +150                                | $^\circ\text{C}$    |
| $T_L$          | Maximum Lead Temperature for Soldering Purpose,<br>1/8" from Case for 5 Seconds     | 300  | $^\circ\text{C}$    |

## Thermal Characteristics

| Symbol          | Parameter                               | FCI7N60 | Unit               |
|-----------------|---|---------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case    | 1.5     | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 62.5    | $^\circ\text{C/W}$ |

## Package Marking and Ordering Information

| Device Marking | Device  | Package             | Reel Size | Tape Width | Quantity |
|----------------|---------|---------------------|-----------|------------|----------|
| FCI7N60        | FCI7N60 | I <sup>2</sup> -PAK | --        | --         | 50       |

## Electrical Characteristics T<sub>C</sub> = 25°C unless otherwise noted

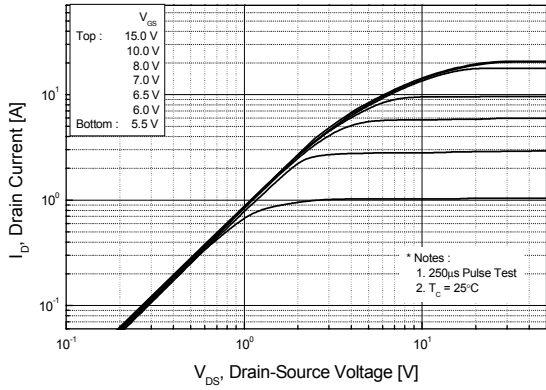
| Symbol  | Parameter   | Conditions  | Min         | Typ  | Max  | Units |
|---|---|---|-------------|------|------|-------|
| <b>Off Characteristics</b>                                    |   |   |             |      |      |       |
| BV <sub>DSS</sub>   | Drain-Source Breakdown Voltage                        | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA, T <sub>J</sub> = 25°C   | 600         | --   | --   | V     |
|   |   | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA, T <sub>J</sub> = 150°C  | --          | 650  | --   | V     |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$                          | Breakdown Voltage Temperature Coefficient             | I <sub>D</sub> = 250μA, Referenced to 25°C                            | --          | 0.6  | --   | V/°C  |
| BV <sub>DS</sub>  | Drain-Source Avalanche Breakdown Voltage              | V <sub>GS</sub> = 0V, I <sub>D</sub> = 7A                             | --          | 700  | --   | V     |
| I <sub>DSS</sub>  | Zero Gate Voltage Drain Current                       | V <sub>DS</sub> = 600V, V <sub>GS</sub> = 0V                          | --          | --   | 1    | μA    |
|   |   | V <sub>DS</sub> = 480V, T <sub>C</sub> = 125°C                        | --          | --   | 10   | μA    |
| I <sub>GSSF</sub>   | Gate-Body Leakage Current, Forward                    | V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V                           | --          | --   | 100  | nA    |
| I <sub>GSSR</sub>   | Gate-Body Leakage Current, Reverse                    | V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V                          | --          | --   | -100 | nA    |
| <b>On Characteristics</b>                                     |   |   |             |      |      |       |
| V <sub>GS(th)</sub>   | Gate Threshold Voltage                                | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA            | 3.0         | --   | 5.0  | V     |
| R <sub>DS(on)</sub>   | Static Drain-Source On-Resistance                     | V <sub>GS</sub> = 10V, I <sub>D</sub> = 3.5A                          | --          | 0.53 | 0.6  | Ω     |
| g <sub>FS</sub>   | Forward Transconductance                              | V <sub>DS</sub> = 40V, I <sub>D</sub> = 3.5A (Note 4)                 | --          | 6    | --   | S     |
| <b>Dynamic Characteristics</b>                                |   |   |             |      |      |       |
| C <sub>iss</sub>  | Input Capacitance                                     | V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz               | --          | 710  | 920  | pF    |
| C <sub>oss</sub>  | Output Capacitance                                    |   | --          | 380  | 500  | pF    |
| C <sub>rss</sub>  | Reverse Transfer Capacitance                          |   | --          | 34   | --   | pF    |
| C <sub>oss</sub>  | Output Capacitance                                    | V <sub>DS</sub> = 480V, V <sub>GS</sub> = 0V, f = 1.0MHz              | --          | 22   | 29   | pF    |
| C <sub>oss eff.</sub>   | Effective Output Capacitance                          | V <sub>DS</sub> = 0V to 400V, V <sub>GS</sub> = 0V                    | --          | 60   | --   | pF    |
| <b>Switching Characteristics</b>                              |   |   |             |      |      |       |
| t <sub>d(on)</sub>  | Turn-On Delay Time                                    | V <sub>DD</sub> = 300V, I <sub>D</sub> = 7A<br>R <sub>G</sub> = 25Ω   | --          | 35   | 80   | ns    |
| t <sub>r</sub>  | Turn-On Rise Time                                     |   | --          | 55   | 120  | ns    |
| t <sub>d(off)</sub>   | Turn-Off Delay Time                                   |   | --          | 75   | 160  | ns    |
| t <sub>f</sub>  | Turn-Off Fall Time                                    |   | (Note 4, 5) | --   | 32   | 75    |
| Q <sub>g</sub>  | Total Gate Charge                                     | V <sub>DS</sub> = 480V, I <sub>D</sub> = 7A<br>V <sub>GS</sub> = 10V  | --          | 23   | 30   | nC    |
| Q <sub>gs</sub>   | Gate-Source Charge                                    |   | --          | 4.2  | 5.5  | nC    |
| Q <sub>gd</sub>   | Gate-Drain Charge                                     |   | (Note 4, 5) | --   | 11.5 | --    |
| <b>Drain-Source Diode Characteristics and Maximum Ratings</b> |   |   |             |      |      |       |
| I <sub>S</sub>  | Maximum Continuous Drain-Source Diode Forward Current |   | --          | --   | 7    | A     |
| I <sub>SM</sub>   | Maximum Pulsed Drain-Source Diode Forward Current     |   | --          | --   | 21   | A     |
| V <sub>SD</sub>   | Drain-Source Diode Forward Voltage                    | V <sub>GS</sub> = 0V, I <sub>S</sub> = 7A                             | --          | --   | 1.4  | V     |
| t <sub>rr</sub>   | Reverse Recovery Time                                 | V <sub>GS</sub> = 0V, I <sub>S</sub> = 7A<br>di/dt = 100A/μs (Note 4) | --          | 360  | --   | ns    |
| Q <sub>rr</sub>   | Reverse Recovery Charge                               |   | --          | 4.5  | --   | μC    |

### NOTES:

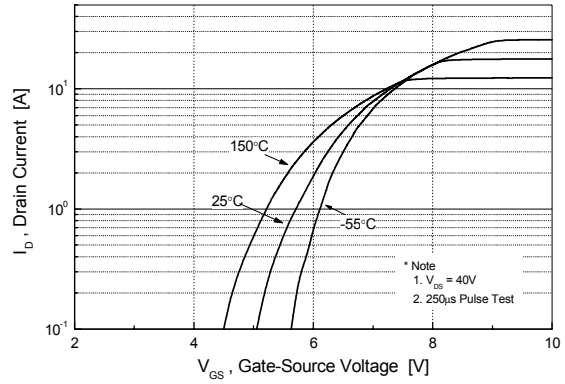
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I<sub>AS</sub> = 3.5A, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25Ω, Starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ 7A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

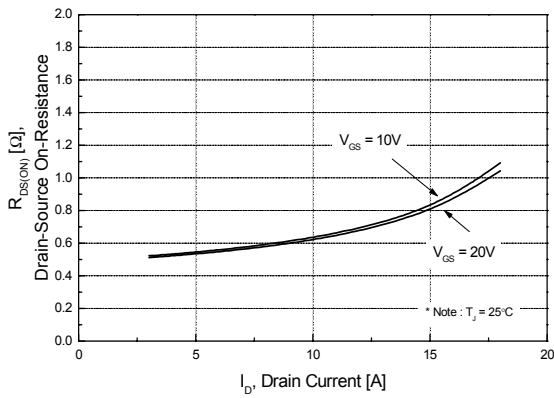
**Figure 1. On-Region Characteristics**



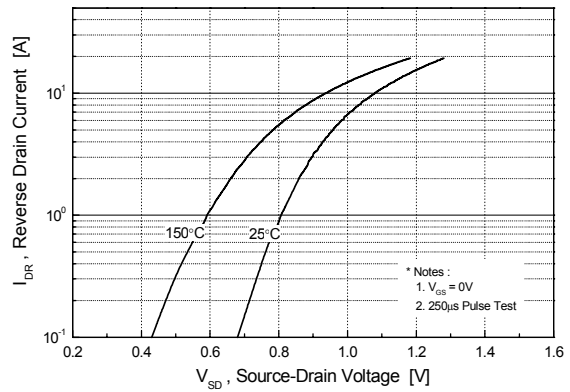
**Figure 2. Transfer Characteristics**



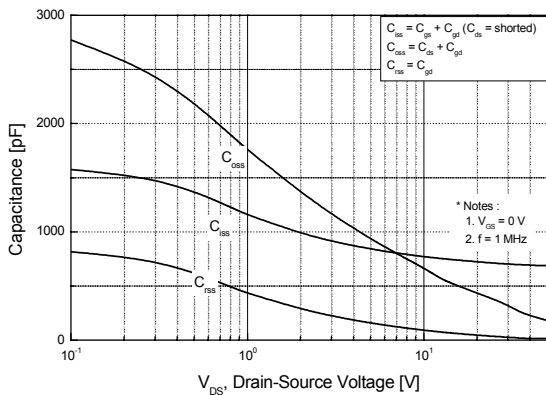
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



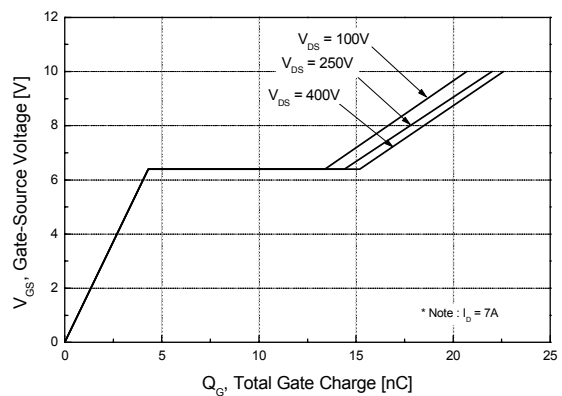
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

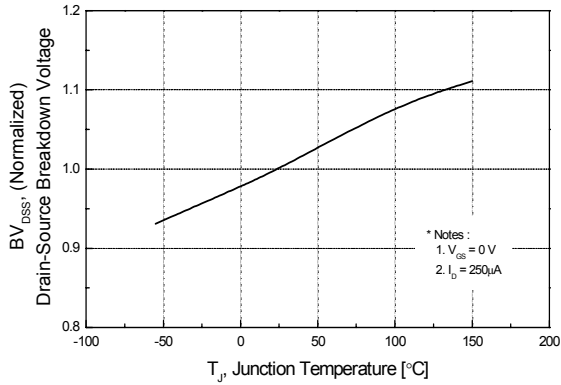


**Figure 6. Gate Charge Characteristics**

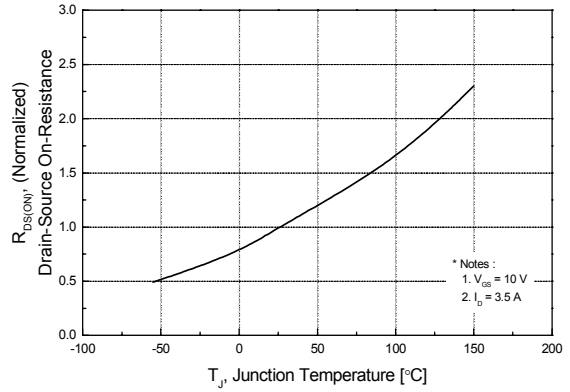


**Typical Performance Characteristics** (Continued)

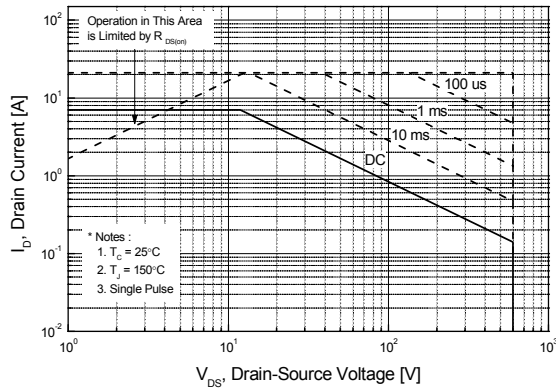
**Figure 7. Breakdown Voltage Variation vs. Temperature**



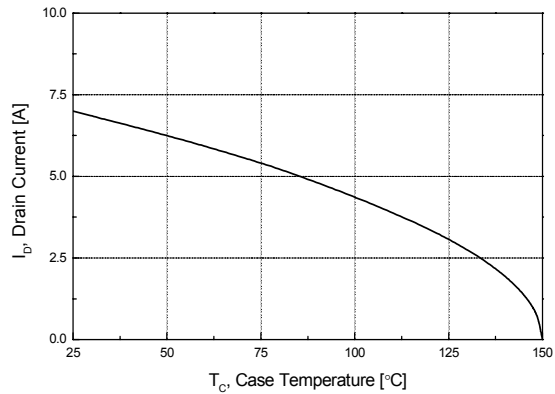
**Figure 8. On-Resistance Variation vs. Temperature**



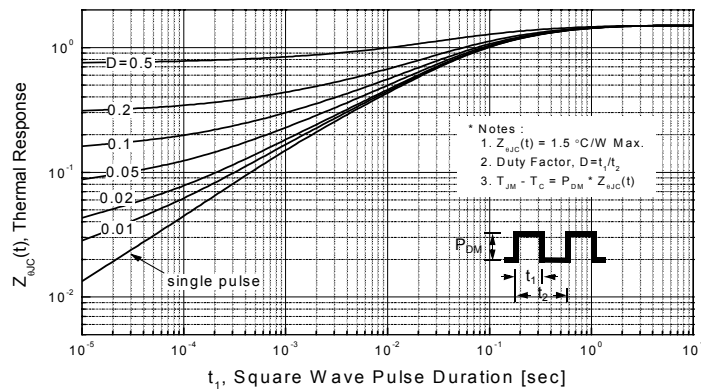
**Figure 9. Maximum Safe Operating Area**



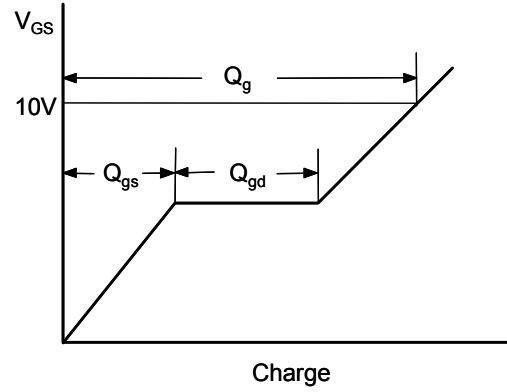
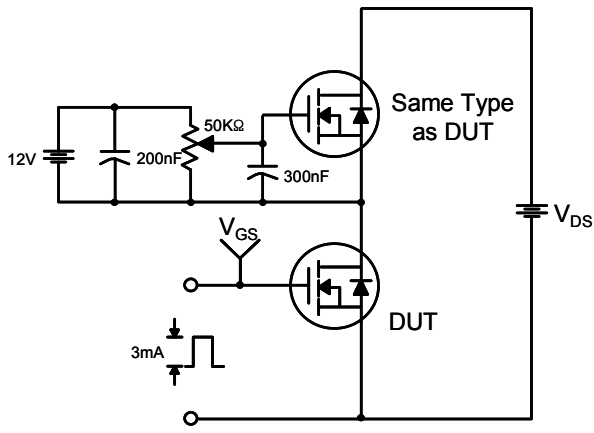
**Figure 10. Maximum Drain Current vs. Case Temperature**



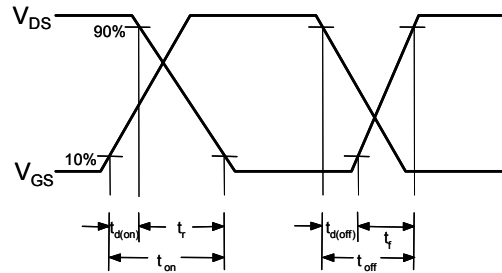
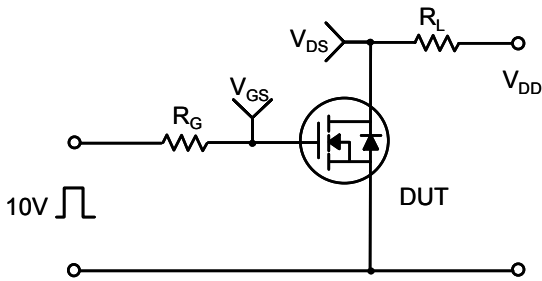
**Figure 10. Transient Thermal Response Curve**



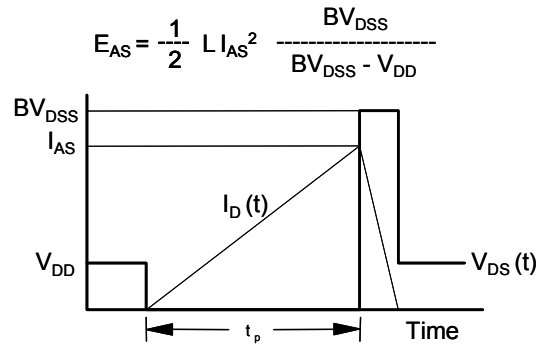
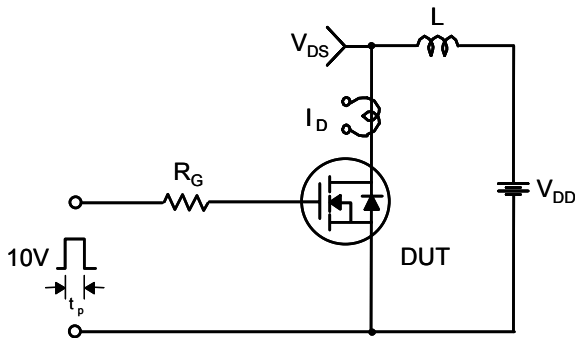
**Gate Charge Test Circuit & Waveform**



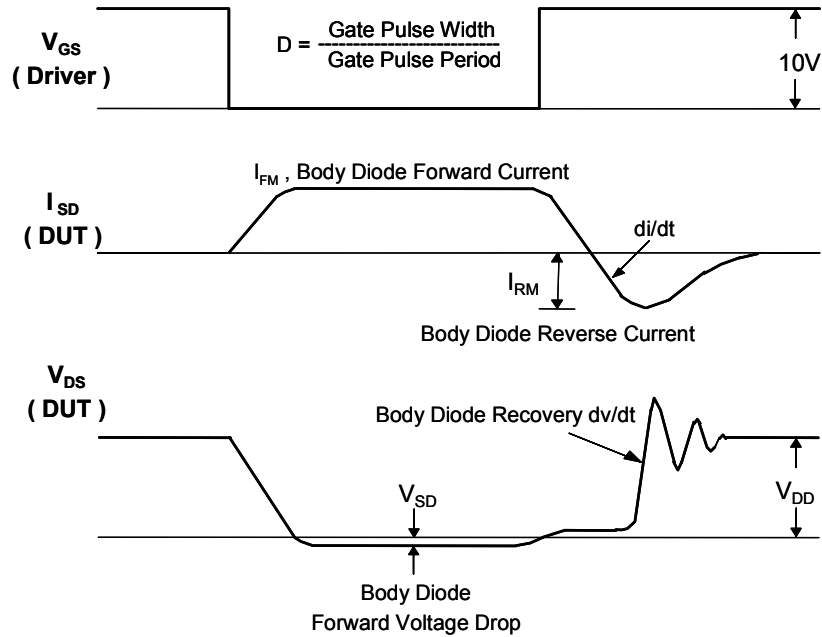
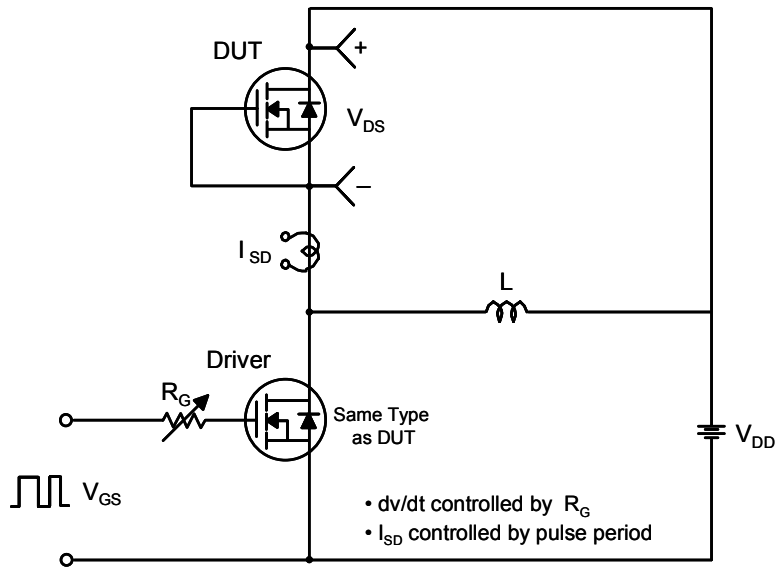
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

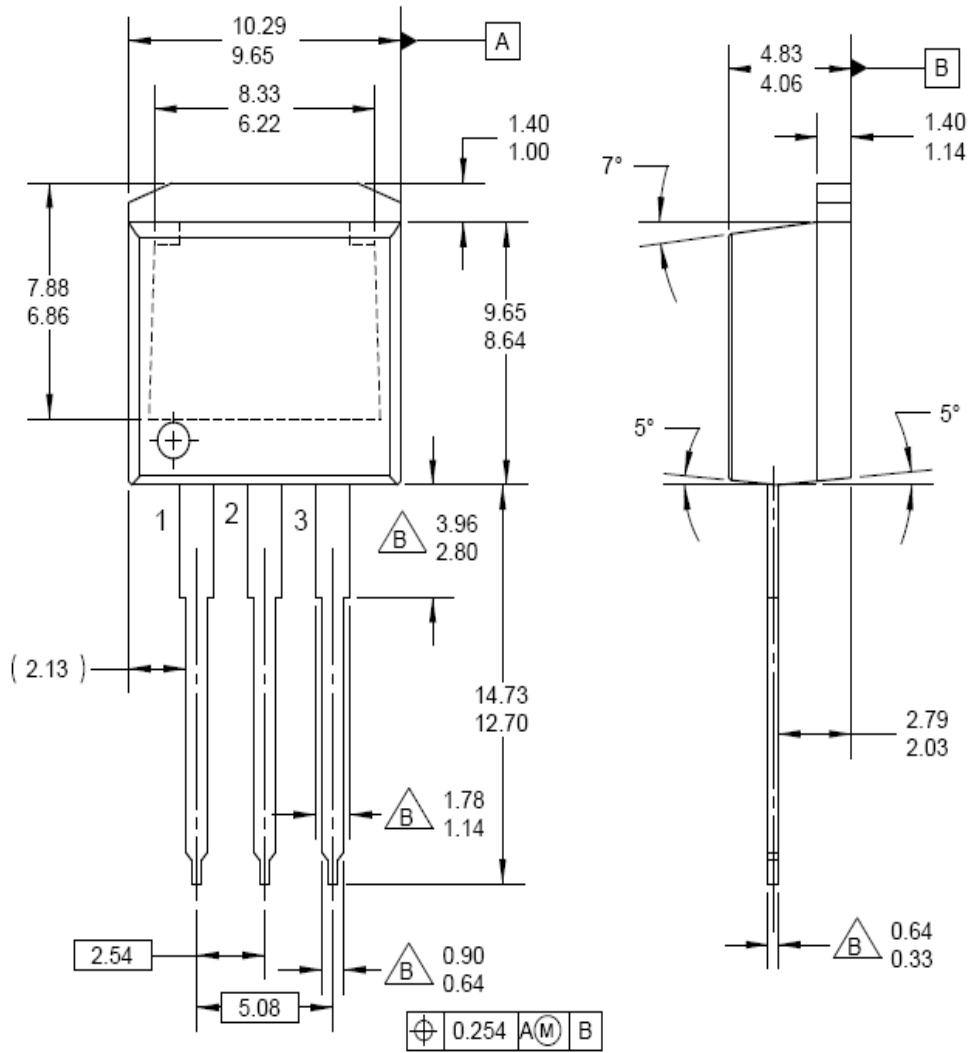


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

I<sup>2</sup>-PAK



Dimensions in Millimeters


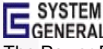


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