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# FCI7N60

## N-Channel SuperFET® MOSFET

600 V, 7 A, 600 mΩ

### Features

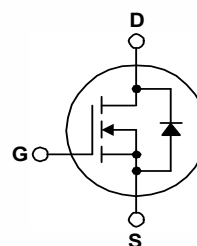
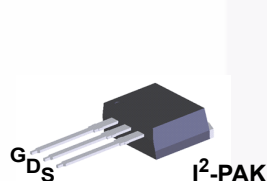
- 650V @  $T_J = 150^\circ\text{C}$
- Typ.  $R_{DS(on)} = 530\text{ m}\Omega$
- Ultra Low Gate Charge (Typ.  $Q_g = 23\text{ nC}$ )
- Low Effective Output Capacitance (Typ.  $C_{oss(eff.)} = 60\text{ pF}$ )
- 100% Avalanche Tested
- RoHS compliant

### Application

- Lighting
- Solar Inverter
- AC-DC Power Supply

### Description

SuperFET® MOSFET is Fairchild Semiconductor's first generation of high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance,  $dv/dt$  rate and higher avalanche energy. Consequently, SuperFET MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications.



### MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted.

| Symbol         | Parameter                                                            | FCI7N60                                    | Unit             |
|----------------|----------------------------------------------------------------------|--------------------------------------------|------------------|
| $V_{DSS}$      | Drain to 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               |
| $V_{GSS}$      | Gate to Source Voltage                                               | $\pm 30$                                   | V                |
| $E_{AS}$       | Single Pulsed Avalanche Energy                                       | (Note 2)                                   | 230              |
| $I_{AR}$       | Avalanche Current                                                    | (Note 1)                                   | 7                |
| $E_{AR}$       | Repetitive Avalanche Energy                                          | (Note 1)                                   | 8.3              |
| $dv/dt$        | Peak Diode Recovery $dv/dt$                                          | (Note 3)                                   | 4.5              |
| $P_D$          | Power Dissipation                                                    | ( $T_C = 25^\circ\text{C}$ )               | 83               |
|                |                                                                      | - Derate Above $25^\circ\text{C}$          | 0.67             |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range                              | -55 to +150                                | $^\circ\text{C}$ |
| $T_L$          | Maximum Lead Temperature for Soldering, 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, Max.    | 1.5     | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max. | 62.5    | $^\circ\text{C/W}$ |

## Package Marking and Ordering Information

| Part Number | Top Mark | Package             | Packing Method | Reel Size | Tape Width | Quantity |
|-------------|----------|---------------------|----------------|-----------|------------|----------|
| FCI7N60     | FCI7N60  | I <sup>2</sup> -PAK | Tube           | N/A       | N/A        | 50 units |

## Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted.

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------|-----------|-----------------|------|------|------|------|
|--------|-----------|-----------------|------|------|------|------|

### Off Characteristics

|                                |                                           |                                                                              |     |     |           |                     |
|--------------------------------|-------------------------------------------|------------------------------------------------------------------------------|-----|-----|-----------|---------------------|
| $BV_{DSS}$                     | Drain to Source Breakdown Voltage         | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}, T_C = 25^\circ\text{C}$  | 600 | -   | -         | V                   |
|                                |                                           | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}, T_C = 150^\circ\text{C}$ | -   | 650 | -         | V                   |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$            | -   | 0.6 | -         | V/ $^\circ\text{C}$ |
| $BV_{DS}$                      | Drain-Source Avalanche Breakdown Voltage  | $V_{GS} = 0\text{ V}, I_D = 7\text{ A}$                                      | -   | 700 | -         | V                   |
| $I_{DSS}$                      | Zero Gate Voltage Drain Current           | $V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$                                 | -   | -   | 1         | $\mu\text{A}$       |
|                                |                                           | $V_{DS} = 480\text{ V}, T_C = 125^\circ\text{C}$                             | -   | -   | 10        |                     |
| $I_{GSS}$                      | Gate to Body Leakage Current              | $V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$                              | -   | -   | $\pm 100$ | nA                  |

### On Characteristics

|              |                                      |                                                 |     |      |     |          |
|--------------|--------------------------------------|-------------------------------------------------|-----|------|-----|----------|
| $V_{GS(th)}$ | Gate Threshold Voltage               | $V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$ | 3.0 | -    | 5.0 | V        |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 10\text{ V}, I_D = 3.5\text{ A}$      | -   | 0.53 | 0.6 | $\Omega$ |
| $g_{FS}$     | Forward Transconductance             | $V_{DS} = 40\text{ V}, I_D = 3.5\text{ A}$      | -   | 6    | -   | S        |

### Dynamic Characteristics

|                 |                              |                                                                 |   |     |     |    |
|-----------------|------------------------------|-----------------------------------------------------------------|---|-----|-----|----|
| $C_{iss}$       | Input Capacitance            | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$ | - | 710 | 920 | pF |
| $C_{oss}$       | Output Capacitance           |                                                                 | - | 380 | 500 | pF |
| $C_{rss}$       | Reverse Transfer Capacitance |                                                                 | - | 34  | -   | pF |
| $C_{oss}$       | Output Capacitance           | $V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$  | - | 22  | 29  | pF |
| $C_{oss(eff.)}$ | Effective Output Capacitance | $V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$     | - | 60  | -   | pF |

### Switching Characteristics

|              |                               |                                                                                                     |   |      |     |    |
|--------------|-------------------------------|-----------------------------------------------------------------------------------------------------|---|------|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = 300\text{ V}, I_D = 7\text{ A}, V_{GS} = 10\text{ V}, R_G = 25\text{ }\Omega$<br>(Note 4) | - | 35   | 80  | ns |
| $t_r$        | Turn-On Rise Time             |                                                                                                     | - | 55   | 120 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time           |                                                                                                     | - | 75   | 160 | ns |
| $t_f$        | Turn-Off Fall Time            |                                                                                                     | - | 32   | 75  | ns |
| $Q_{g(tot)}$ | Total Gate Charge at 10V      | $V_{DS} = 480\text{ V}, I_D = 7\text{ A}, V_{GS} = 10\text{ V}$<br>(Note 4)                         | - | 23   | 30  | nC |
| $Q_{gs}$     | Gate to Source Gate Charge    |                                                                                                     | - | 4.2  | 5.5 | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |                                                                                                     | - | 11.5 | -   | nC |

### Drain-Source Diode Characteristics

|                 |                                                          |                                                                                 |   |     |     |    |
|-----------------|----------------------------------------------------------|---------------------------------------------------------------------------------|---|-----|-----|----|
| I <sub>S</sub>  | Maximum Continuous Drain to Source Diode Forward Current |                                                                                 | - | -   | 7   | A  |
| I <sub>SM</sub> | Maximum Pulsed Drain to Source Diode Forward Current     |                                                                                 | - | -   | 21  | A  |
| V <sub>SD</sub> | Drain to Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 7 A                                    | - | -   | 1.4 | V  |
| t <sub>rr</sub> | Reverse Recovery Time                                    | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 7 A,<br>dI <sub>F</sub> /dt = 100 A/μs | - | 360 | -   | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge                                  |                                                                                 | - | 4.5 | -   | μC |

#### Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2.  $I_{AS} = 3.5\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\text{ }\Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 7\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

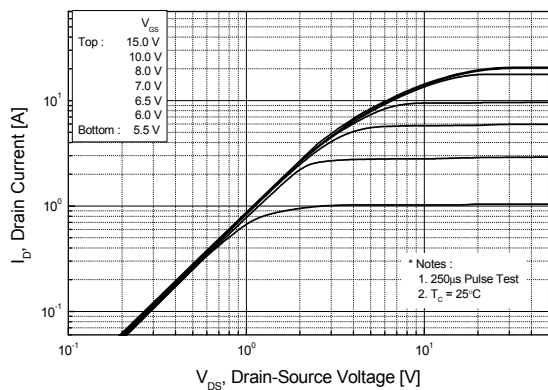


Figure 2. Transfer Characteristics

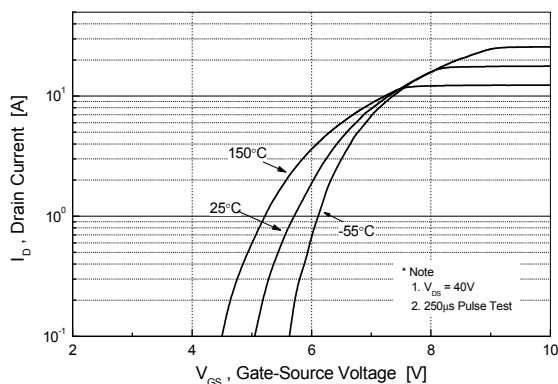


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

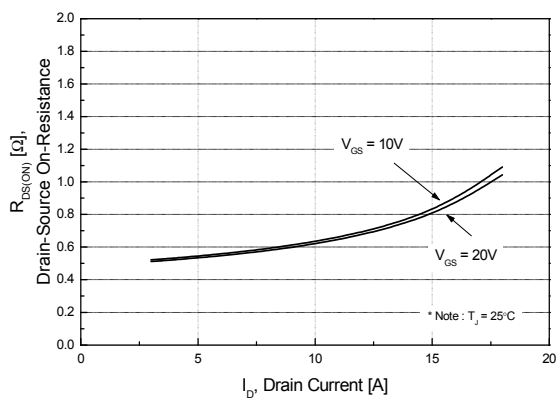


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

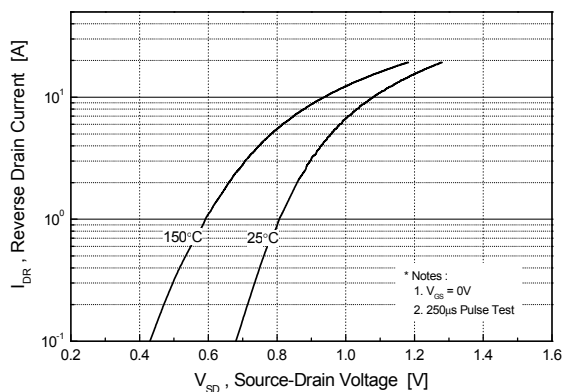


Figure 5. Capacitance Characteristics

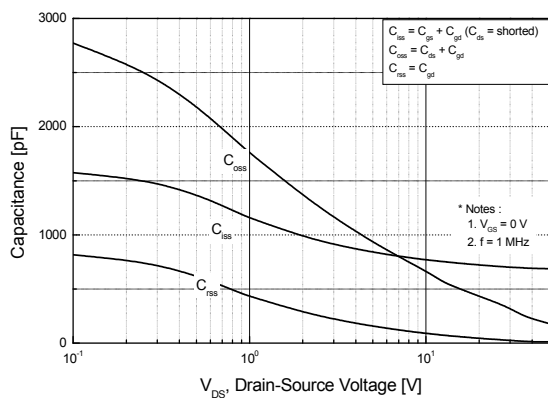
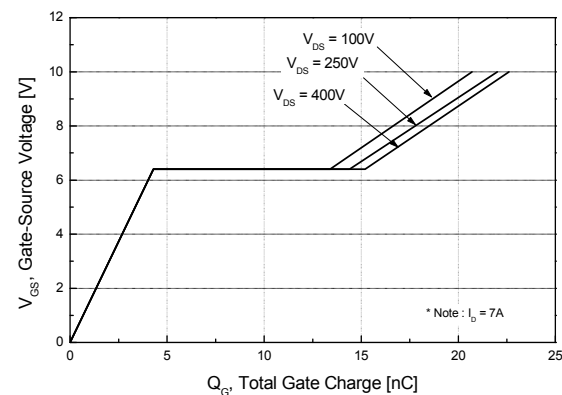
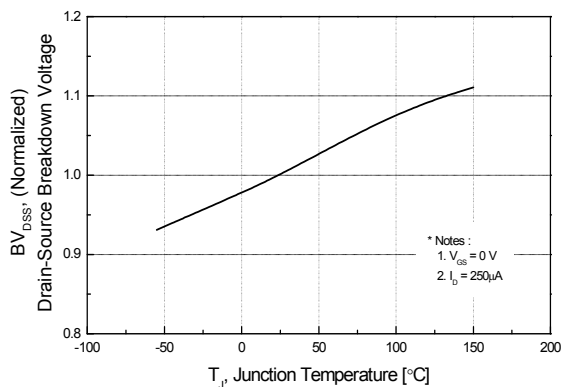


Figure 6. Gate Charge Characteristics

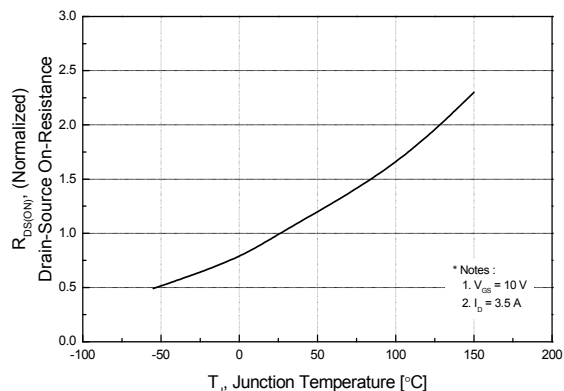


# Typical Performance Characteristics (Continued)

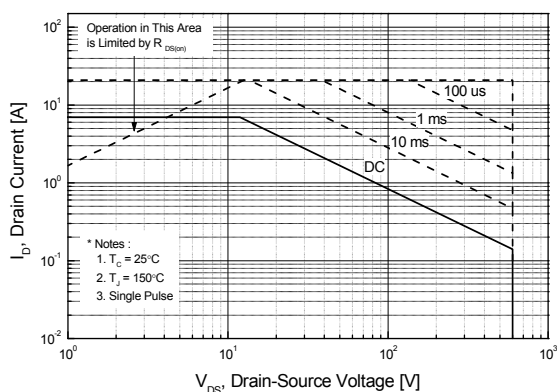
**Figure 7. Breakdown Voltage Variation vs. Temperature**



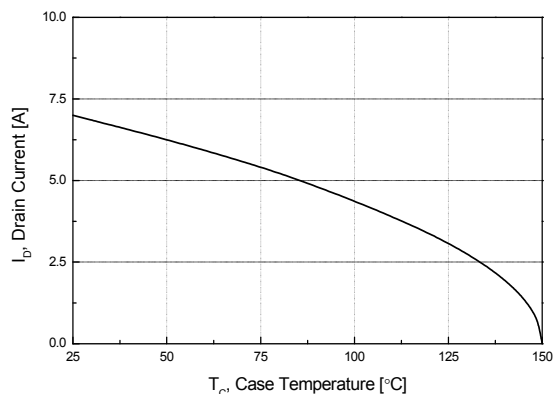
**Figure 8. On-Resistance Variation vs. Temperature**



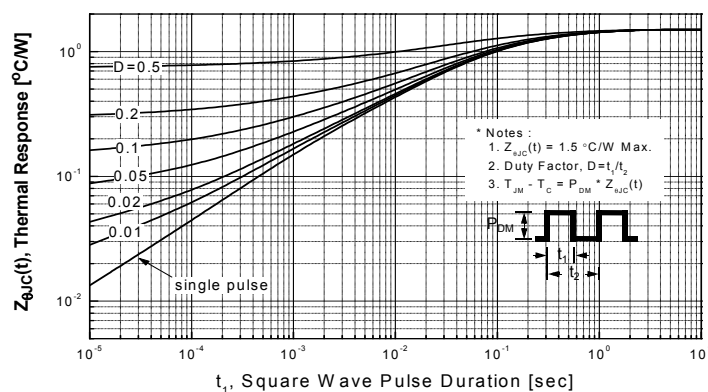
**Figure 9. Maximum Safe Operating Area**



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



**Figure 11. Transient Thermal Response Curve**



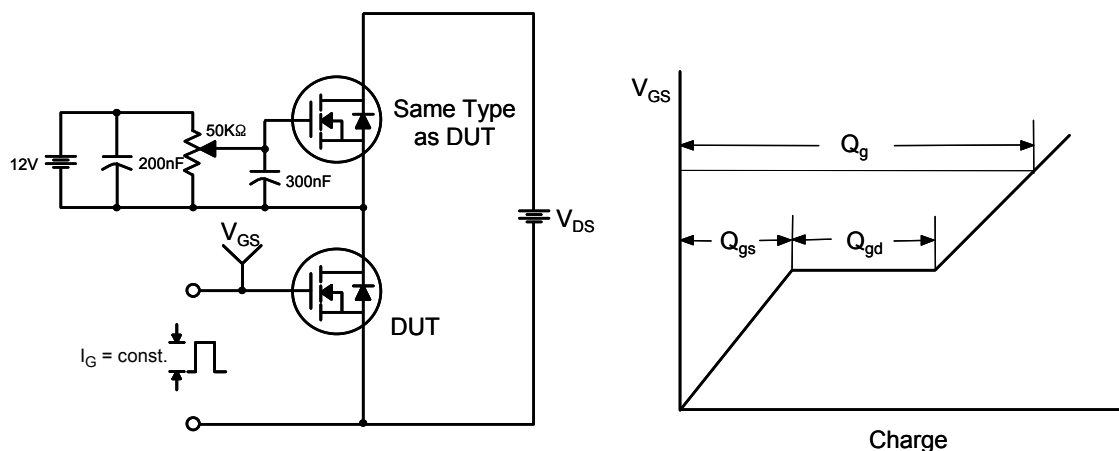


Figure 12. Gate Charge Test Circuit & Waveform

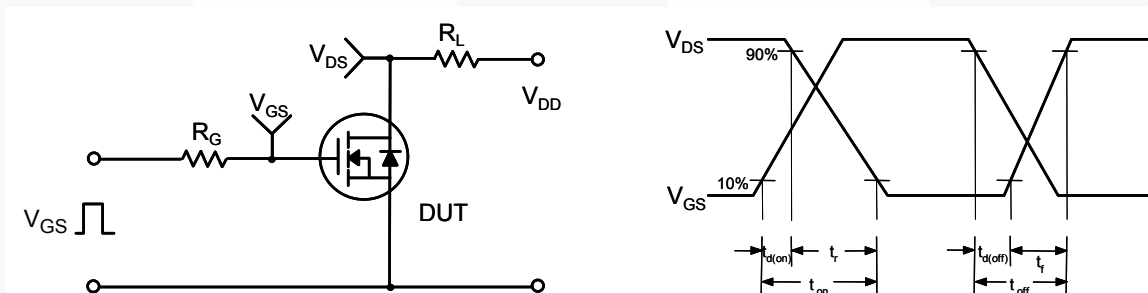


Figure 13. Resistive Switching Test Circuit & Waveforms

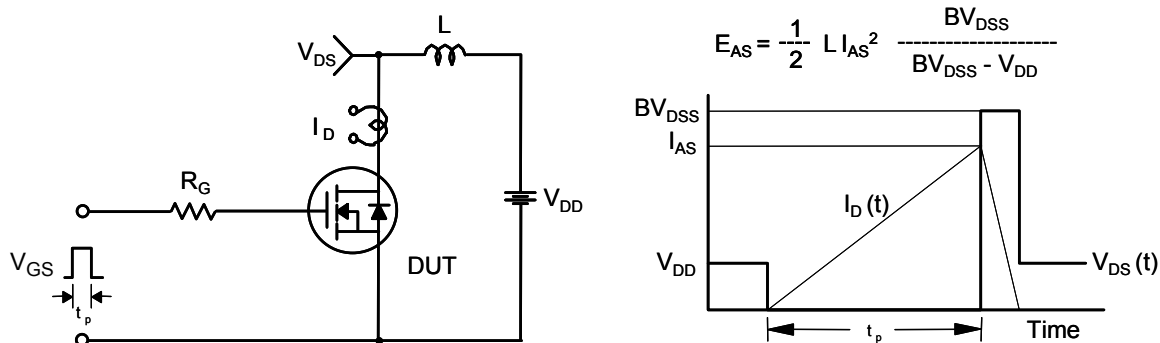


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

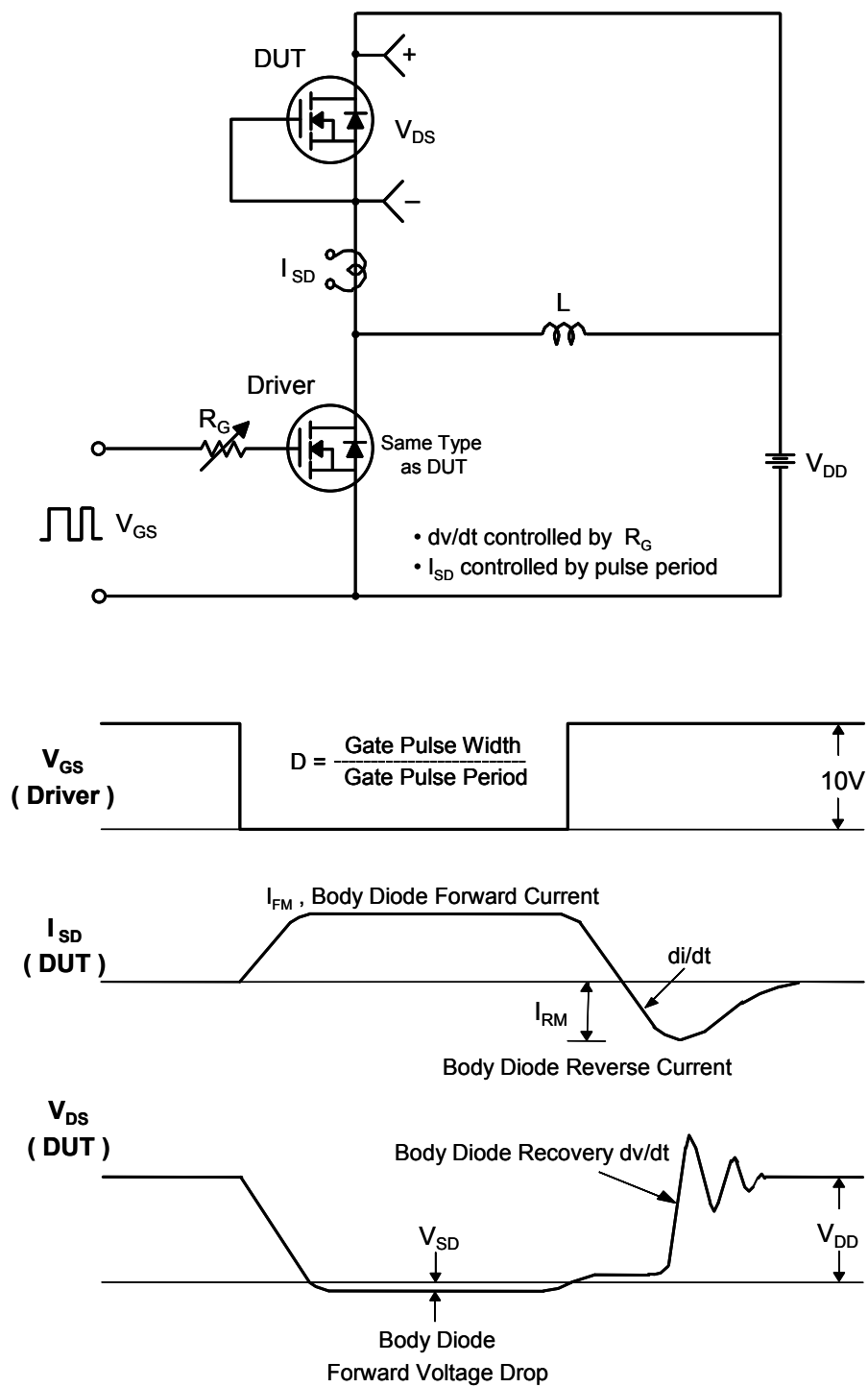
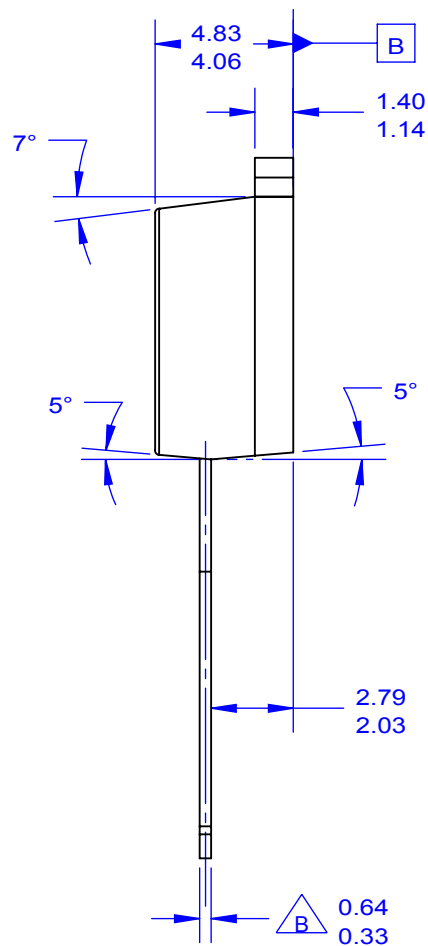
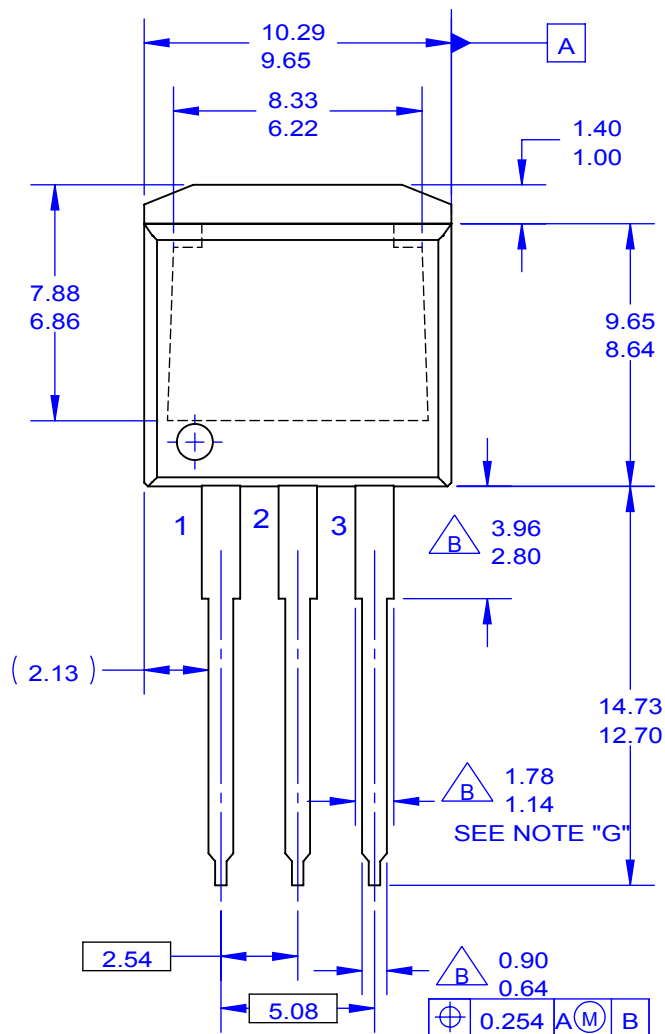


Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms



NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO TO262 JEDEC VARIATION AA.
- B. DOES NOT COMPLY JEDEC STD. VALUE.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- E. DIMENSION AND TOLERANCE AS PER ANSI Y14.5-1994.
- F. LOCATION OF PIN HOLE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF PACKAGE)
- G. MAXIMUM WIDTH FOR F102 DEVICE = 1.35 MAX.
- H. DRAWING FILE NAME: TO262A03REV6





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