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# FDB047N10

## N-Channel PowerTrench® MOSFET

100 V, 164 A, 4.7 mΩ

### Features

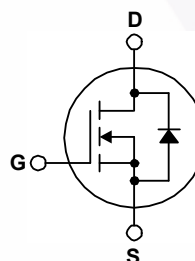
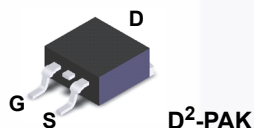
- $R_{DS(on)} = 3.9 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 75 \text{ A}$
- Fast Switching Speed
- Low Gate Charge
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

### Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process that has been tailored to minimize the on-state resistance while maintaining superior switching performance.

### Applications

- Synchronous Rectification for ATX / Server / Telecom PSU
- Battery Protection Circuit
- Motor Drives and Uninterruptible Power Supplies
- Micro Solar Inverter



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

| Symbol         | Parameter                                                                                                                                                                                                                                                                                      | FDB047N10   | Unit                |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------|
| $V_{DSS}$      | Drain to Source Voltage                                                                                                                                                                                                                                                                        | 100         | V                   |
| $V_{GSS}$      | Gate to Source Voltage                                                                                                                                                                                                                                                                         | $\pm 20$    | V                   |
| $I_D$          | Drain Current <ul style="list-style-type: none"> <li>- Continuous (<math>T_C = 25^\circ\text{C}</math>, Silicon Limited)</li> <li>- Continuous (<math>T_C = 100^\circ\text{C}</math>, Silicon Limited)</li> <li>- Continuous (<math>T_C = 25^\circ\text{C}</math>, Package Limited)</li> </ul> | 164*        | A                   |
|                |                                                                                                                                                                                                                                                                                                | 116*        | A                   |
|                |                                                                                                                                                                                                                                                                                                | 120         | A                   |
| $I_{DM}$       | Drain Current - Pulsed (Note 1)                                                                                                                                                                                                                                                                | 656*        | A                   |
| $E_{AS}$       | Single Pulsed Avalanche Energy (Note 2)                                                                                                                                                                                                                                                        | 1153        | mJ                  |
| $dv/dt$        | Peak Diode Recovery $dv/dt$ (Note 3)                                                                                                                                                                                                                                                           | 6.0         | V/ns                |
| $P_D$          | Power Dissipation ( $T_C = 25^\circ\text{C}$ )                                                                                                                                                                                                                                                 | 375         | W                   |
|                |                                                                                                                                                                                                                                                                                                | 2.5         | W/ $^\circ\text{C}$ |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range                                                                                                                                                                                                                                                        | -55 to +175 | $^\circ\text{C}$    |
| $T_L$          | Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds                                                                                                                                                                                                                           | 300         | $^\circ\text{C}$    |

\*Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 120A.

### Thermal Characteristics

| Symbol          | Parameter                                                                            | FDB047N10 | Unit               |
|-----------------|--------------------------------------------------------------------------------------|-----------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max.                                           | 0.4       | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Minimum Pad of 2-oz Copper), Max.           | 62.5      |                    |
|                 | Thermal Resistance, Junction to Ambient (1 in <sup>2</sup> Pad of 2-oz Copper), Max. | 40        |                    |

## Package Marking and Ordering Information

| Part Number | Top Mark  | Package             | Packing Method | Reel Size | Tape Width | Quantity  |
|-------------|-----------|---------------------|----------------|-----------|------------|-----------|
| FDB047N10   | FDB047N10 | D <sup>2</sup> -PAK | Tape and Reel  | 330 mm    | 24 mm      | 800 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         | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0\ \text{V}$ , $T_J = 25^\circ\text{C}$  | 100 | -   | -         | V                  |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$                   | -   | 0.1 | -         | $V/^\circ\text{C}$ |
| $I_{DSS}$                      | Zero Gate Voltage Drain Current           | $V_{DS} = 100\ \text{V}$ , $V_{GS} = 0\ \text{V}$                             | -   | -   | 1         | $\mu\text{A}$      |
|                                |                                           | $V_{DS} = 100\ \text{V}$ , $V_{GS} = 0\ \text{V}$ , $T_C = 150^\circ\text{C}$ | -   | -   | 500       |                    |
| $I_{GSS}$                      | Gate to Body Leakage Current              | $V_{GS} = \pm 20\ \text{V}$ , $V_{DS} = 0\ \text{V}$                          | -   | -   | $\pm 100$ | nA                 |

### On Characteristics

|              |                                      |                                                |     |     |     |            |
|--------------|--------------------------------------|------------------------------------------------|-----|-----|-----|------------|
| $V_{GS(th)}$ | Gate Threshold Voltage               | $V_{GS} = V_{DS}$ , $I_D = 250\ \mu\text{A}$   | 2.5 | 3.5 | 4.5 | V          |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 10\ \text{V}$ , $I_D = 75\ \text{A}$ | -   | 3.9 | 4.7 | m $\Omega$ |
| $g_{FS}$     | Forward Transconductance             | $V_{DS} = 10\ \text{V}$ , $I_D = 75\ \text{A}$ | -   | 170 | -   | S          |

### Dynamic Characteristics

|           |                              |                                                                           |   |       |       |    |
|-----------|------------------------------|---------------------------------------------------------------------------|---|-------|-------|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 25\ \text{V}$ , $V_{GS} = 0\ \text{V}$ ,<br>$f = 1\ \text{MHz}$ | - | 11500 | 15265 | pF |
| $C_{oss}$ | Output Capacitance           |                                                                           | - | 1120  | 1500  | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                           | - | 455   | 680   | pF |

### Switching Characteristics

|              |                               |                                                                                                  |   |     |     |    |
|--------------|-------------------------------|--------------------------------------------------------------------------------------------------|---|-----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = 50\ \text{V}$ , $I_D = 75\ \text{A}$ ,<br>$V_{GS} = 10\ \text{V}$ , $R_G = 25\ \Omega$ | - | 174 | 358 | ns |
| $t_r$        | Turn-On Rise Time             |                                                                                                  | - | 386 | 782 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time           |                                                                                                  | - | 344 | 698 | ns |
| $t_f$        | Turn-Off Fall Time            |                                                                                                  | - | 244 | 499 | ns |
| $Q_{g(tot)}$ | Total Gate Charge at 10V      | $V_{DS} = 80\ \text{V}$ , $I_D = 75\ \text{A}$ ,<br>$V_{GS} = 10\ \text{V}$                      | - | 160 | 210 | nC |
| $Q_{gs}$     | Gate to Source Gate Charge    |                                                                                                  | - | 56  | -   | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |                                                                                                  | - | 36  | -   | nC |

### Drain-Source Diode Characteristics

|                 |                                                          |                                                                                  |   |      |      |    |
|-----------------|----------------------------------------------------------|----------------------------------------------------------------------------------|---|------|------|----|
| I <sub>S</sub>  | Maximum Continuous Drain to Source Diode Forward Current | -                                                                                | - | 164* | A    |    |
| I <sub>SM</sub> | Maximum Pulsed Drain to Source Diode Forward Current     | -                                                                                | - | 656  | A    |    |
| V <sub>SD</sub> | Drain to Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 75 A                                    | - | -    | 1.25 | V  |
| t <sub>rr</sub> | Reverse Recovery Time                                    | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 75 A,<br>dI <sub>F</sub> /dt = 100 A/μs | - | 88   | -    | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge                                  |                                                                                  | - | 245  | -    | nC |

#### Notes:

1. Repetitive rating; pulse-width limited by maximum junction temperature.
2.  $L = 0.41\ \text{mH}$ ,  $I_{AS} = 75\ \text{A}$ ,  $V_{DD} = 50\ \text{V}$ ,  $R_G = 25\ \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 75\ \text{A}$ ,  $di/dt \leq 200\ \text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

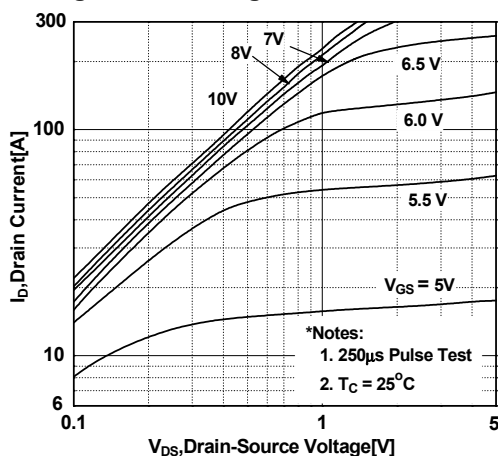


Figure 2. Transfer Characteristics

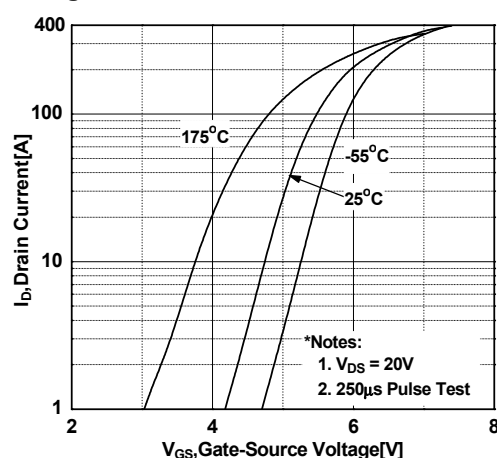


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

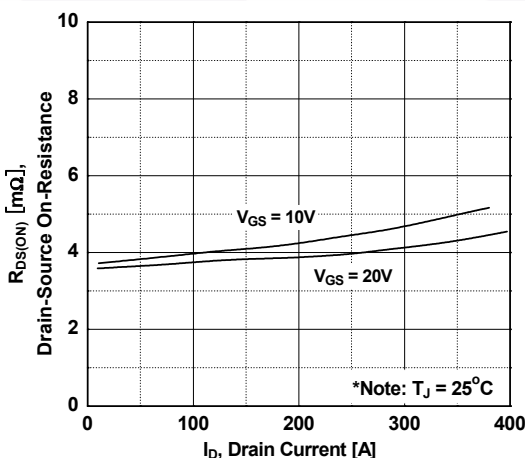


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

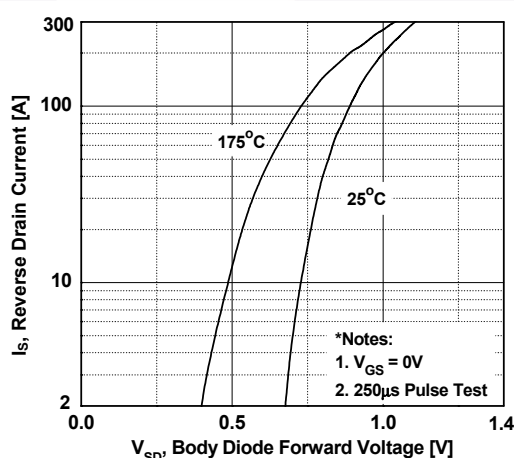


Figure 5. Capacitance Characteristics

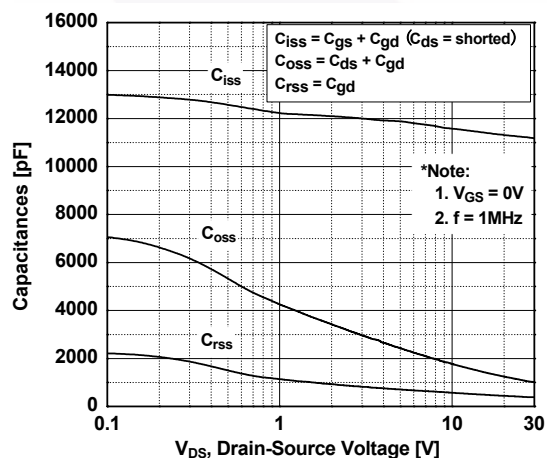
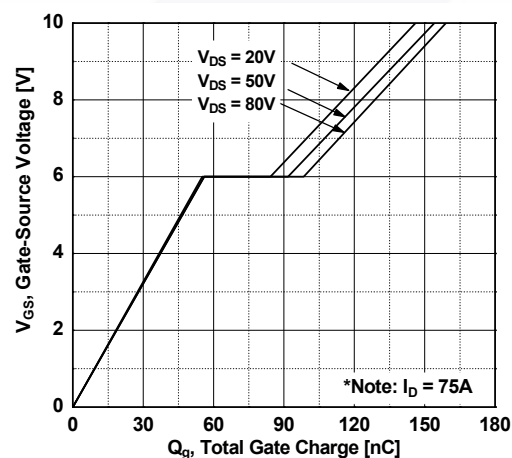


Figure 6. Gate Charge Characteristics



## Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

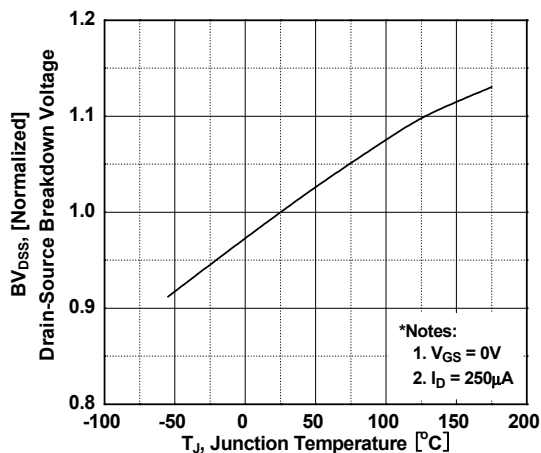


Figure 8. On-Resistance Variation vs. Temperature

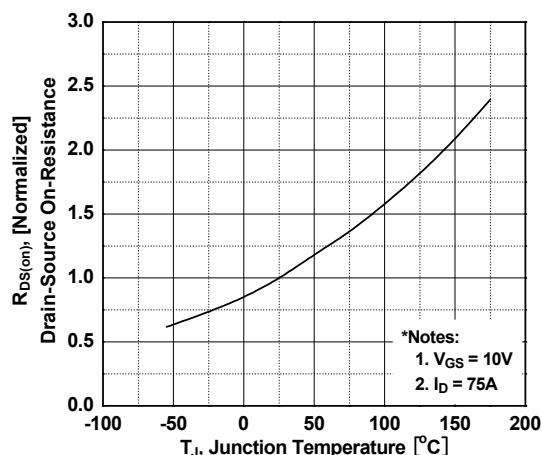


Figure 9. Maximum Safe Operating Area

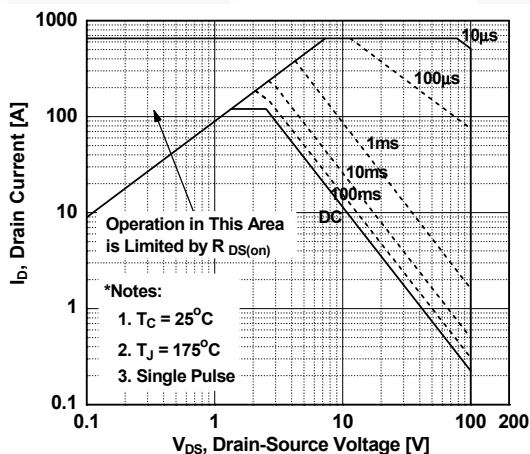


Figure 10. Maximum Drain Current vs. Case Temperature

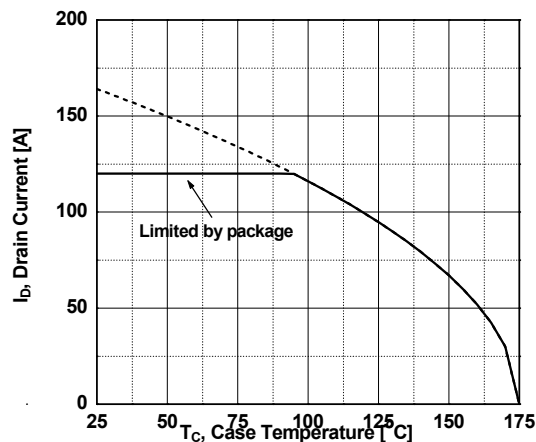
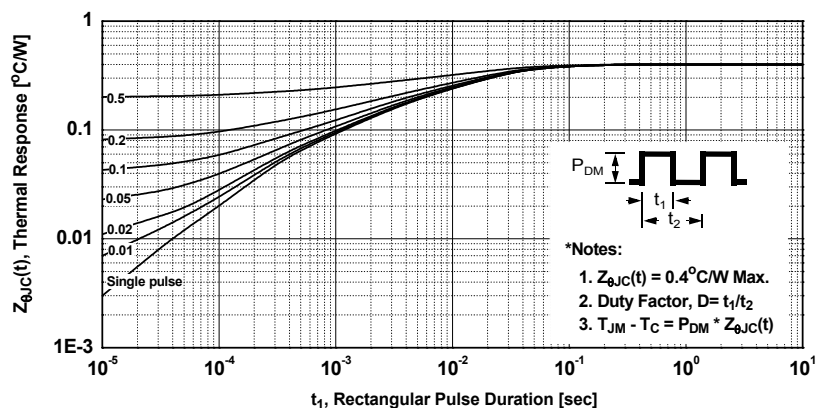


Figure 11. Transient Thermal Response Curve



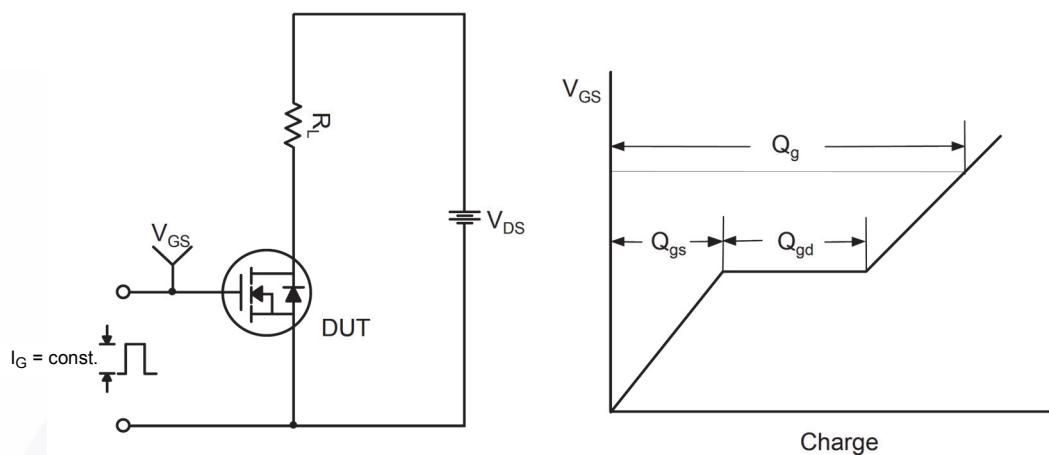


Figure 12. Gate Charge Test Circuit & Waveform

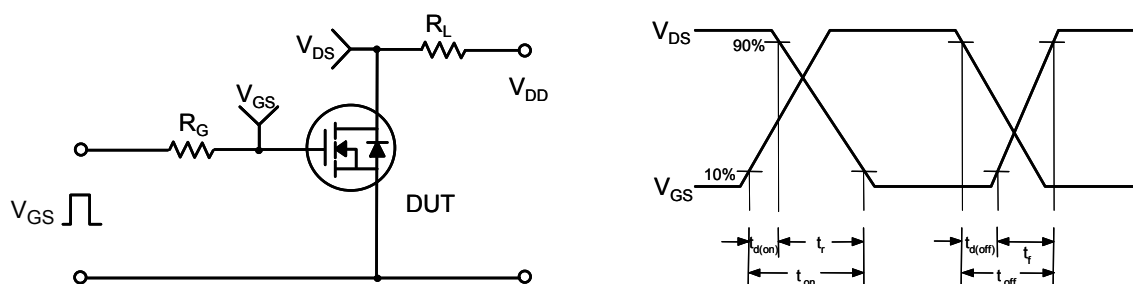


Figure 13. Resistive Switching Test Circuit & Waveforms

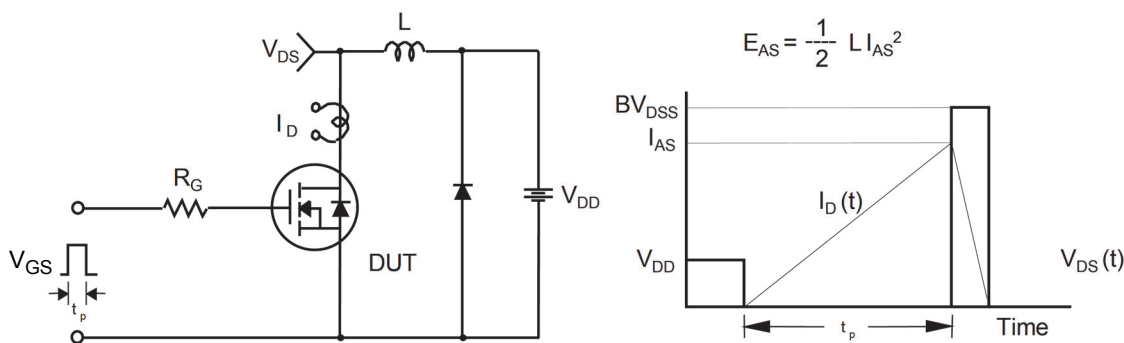


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

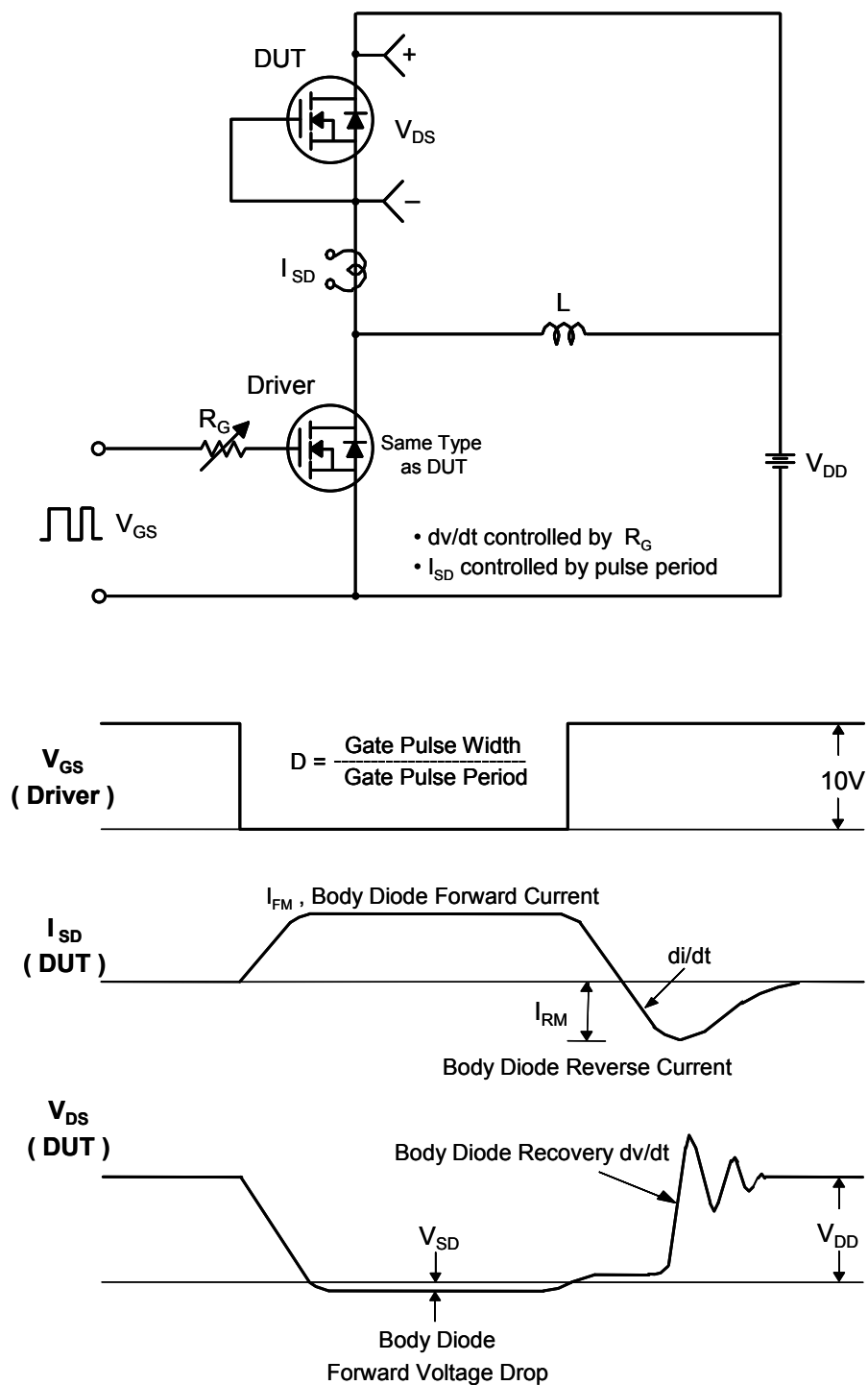
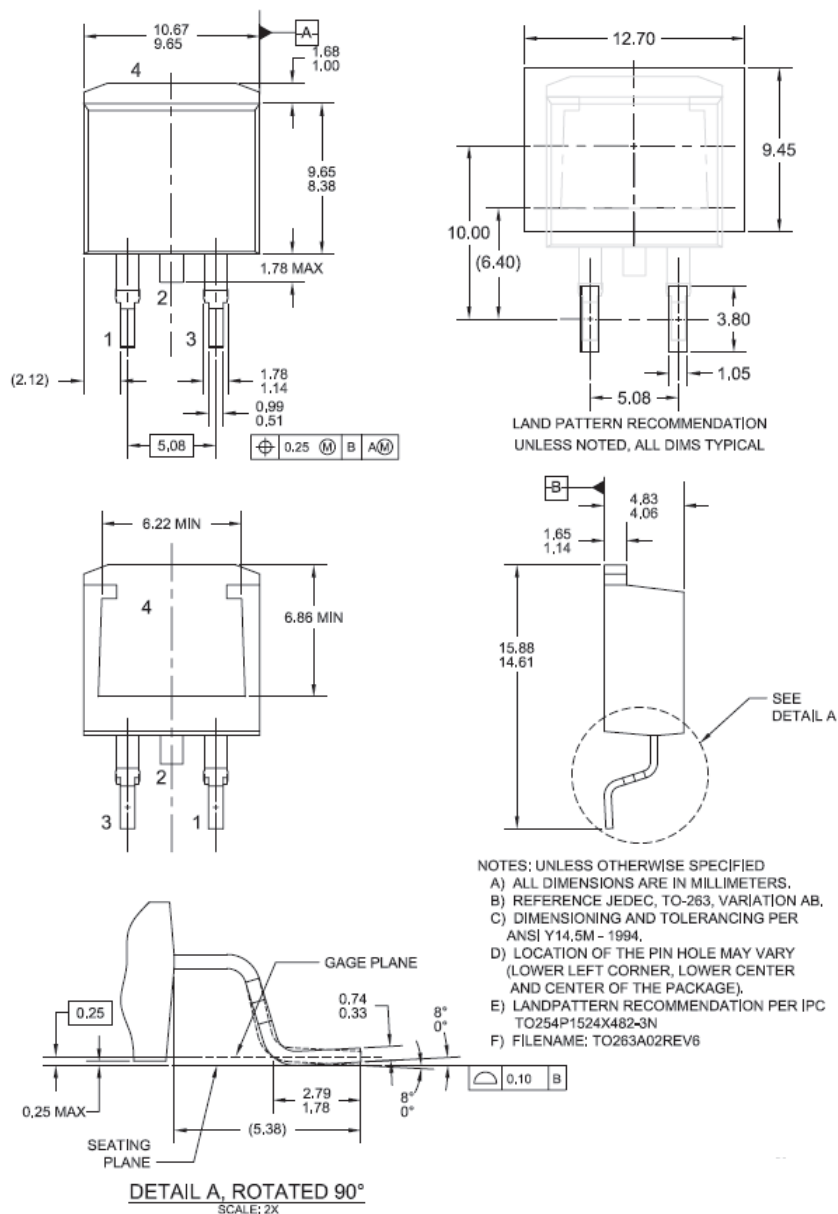


Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

# Mechanical Dimensions



**Figure 16. TO263 (D<sup>2</sup>PAK), Molded, 2-Lead, Surface Mount**

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| Build it Now™                                                                     | GreenBridge™                                    | QFET®                     | TinyBuck®                                                                           |
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