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# FCH47N60NF

## N-Channel SupreMOS® FRFET® MOSFET

600 V, 45.8 A, 65 mΩ

### Features

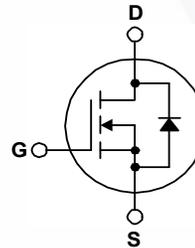
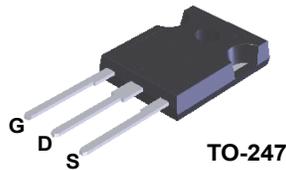
- 650 V @  $T_J = 150^\circ\text{C}$
- Typ.  $R_{DS(on)} = 57.5\text{ m}\Omega$
- Ultra Low Gate Charge (Typ.  $Q_g = 240\text{ nC}$ )
- Low Effective Output Capacitance (Typ.  $C_{oss(eff.)} = 420\text{ pF}$ )
- 100% Avalanche Tested
- RoHS Compliant

### Application

- Solar Inverter
- AC-DC Power Supply

### Description

The SupreMOS® MOSFET is Fairchild Semiconductor's next generation of high voltage super-junction (SJ) technology employing a deep trench filling process that differentiates it from the conventional SJ MOSFETs. This advanced technology and precise process control provides lowest  $R_{sp}$  on-resistance, superior switching performance and ruggedness. SupreMOS MOSFET is suitable for high frequency switching power converter applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications. SupreMOS FRFET® MOSFET's optimized body diode reverse recovery performance can remove additional component and improve system reliability.



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

| Symbol         | Parameter  | FCH47N60NF                                 | Unit             |
|----------------|--|--|------------------|
| $V_{DSS}$      | Drain to Source Voltage  | 600  | V                |
| $V_{GSS}$      | Gate to Source Voltage   | $\pm 30$                                   | V                |
| $I_D$          | Drain Current  | - Continuous ( $T_C = 25^\circ\text{C}$ )  | 45.8             |
|                |  | - Continuous ( $T_C = 100^\circ\text{C}$ ) | 28.9             |
| $I_{DM}$       | Drain Current  | - Pulsed (Note 1)                          | 137.4            |
| $E_{AS}$       | Single Pulsed Avalanche Energy                                       | (Note 2)                                   | 2926             |
| $I_{AR}$       | Avalanche Current  | (Note 1)                                   | 15.3             |
| $E_{AR}$       | Repetitive Avalanche Energy  | (Note 1)                                   | 3.7              |
| dv/dt          | MOSFET dv/dt   |  | 100              |
|                | Peak Diode Recovery dv/dt  | (Note 3)                                   | 50               |
| $P_D$          | Power Dissipation  | ( $T_C = 25^\circ\text{C}$ )               | 368              |
|                |  | - Derate Above $25^\circ\text{C}$          | 2.94             |
| $T_J, T_{STG}$ | 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  | $^\circ\text{C}$ |

\*Drain current limited by maximum junction temperature.

### Thermal Characteristics

| Symbol          | Parameter                                     | FCH47N60NF | Unit                      |
|-----------------|---|------------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max.    | 0.34       | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max. | 40         |                           |

## Package Marking and Ordering Information

| Part Number | Top Mark   | Package | Packing Method | Reel Size | Tape Width | Quantity |
|-------------|------------|---------|----------------|-----------|------------|----------|
| FCH47N60NF  | FCH47N60NF | TO-247  | Tube           | N/A       | N/A        | 30 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         | $I_D = 1\text{ mA}, V_{GS} = 0\text{ V}, T_C = 25^\circ\text{C}$      | 600 | -    | -         | V                         |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 1\text{ mA}$ , Referenced to $25^\circ\text{C}$                | -   | 0.78 | -         | $\text{V}/^\circ\text{C}$ |
| $I_{DSS}$                      | Zero Gate Voltage Drain Current           | $V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}$                          | -   | -    | 10        | $\mu\text{A}$             |
|                                |   | $V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, T_C = 125^\circ\text{C}$ | -   | -    | 100       |                           |
| $I_{GSS}$                      | 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               | $V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$   | 3 | -    | 5    | V          |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 10\text{ V}, I_D = 23.5\text{ A}$ | - | 57.5 | 65.0 | m $\Omega$ |
| $g_{FS}$     | Forward Transconductance             | $V_{DS} = 40\text{ V}, I_D = 23.5\text{ A}$ | - | 52   | 100  | S          |

### Dynamic Characteristics

|                 |                                   |  |   |      |      |          |
|-----------------|-----------------------------------|--|---|------|------|----------|
| $C_{iss}$       | Input Capacitance                 | $V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$                 | - | 4600 | 6120 | pF       |
| $C_{oss}$       | Output Capacitance                |  | - | 195  | 260  | pF       |
| $C_{rss}$       | Reverse Transfer Capacitance      |  | - | 3.0  | 5.0  | pF       |
| $C_{oss}$       | Output Capacitance                | $V_{DS} = 380\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$                 | - | 108  | -    | pF       |
| $C_{oss(eff.)}$ | Effective Output Capacitance      | $V_{DS} = 0\text{ V to } 380\text{ V}, V_{GS} = 0\text{ V}$                    | - | 492  | -    | pF       |
| $Q_{g(tot)}$    | Total Gate Charge at 10V          | $V_{DS} = 380\text{ V}, I_D = 23.5\text{ A}, V_{GS} = 10\text{ V}$<br>(Note 4) | - | 121  | 157  | nC       |
| $Q_{gs}$        | Gate to Source Gate Charge        |  | - | 23   | -    | nC       |
| $Q_{gd}$        | Gate to Drain "Miller" Charge     |  | - | 47   | -    | nC       |
| ESR             | Equivalent Series Resistance(G-S) | $f = 1\text{ MHz}$   | - | 0.9  | -    | $\Omega$ |

### Switching Characteristics

|              |                     |   |   |     |     |    |
|--------------|---------------------|---|---|-----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = 380\text{ V}, I_D = 23.5\text{ A}, R_G = 4.7\ \Omega$<br>(Note 4) | - | 34  | 78  | ns |
| $t_r$        | Turn-On Rise Time   |   | - | 22  | 54  | ns |
| $t_{d(off)}$ | Turn-Off Delay Time |   | - | 117 | 244 | ns |
| $t_f$        | Turn-Off Fall Time  |   | - | 4   | 18  | ns |

### Drain-Source Diode Characteristics

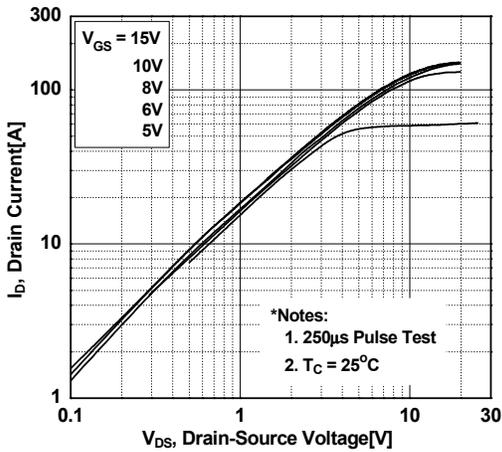
|          |  |   |   |     |     |               |
|----------|--|---|---|-----|-----|---------------|
| $I_S$    | Maximum Continuous Drain to Source Diode Forward Current | -   | - | 47  | A   |               |
| $I_{SM}$ | Maximum Pulsed Drain to Source Diode Forward Current     | -   | - | 141 | A   |               |
| $V_{SD}$ | Drain to Source Diode Forward Voltage                    | $V_{GS} = 0\text{ V}, I_{SD} = 23.5\text{ A}$ | - | -   | 1.2 | V             |
| $t_{rr}$ | Reverse Recovery Time                                    | $V_{GS} = 0\text{ V}, I_{SD} = 23.5\text{ A}$ | - | 169 | -   | ns            |
| $Q_{rr}$ | Reverse Recovery Charge                                  | $di_F/dt = 100\text{ A}/\mu\text{s}$          | - | 1.3 | -   | $\mu\text{C}$ |

#### Notes:

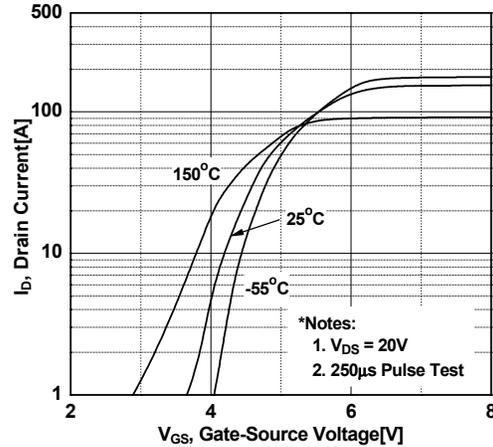
1. Repetitive rating: pulse-width limited by maximum junction temperature.
2.  $I_{AS} = 15.3\text{ A}, R_G = 25\ \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 45.8\text{ A}, di/dt \leq 1200\text{ A}/\mu\text{s}, V_{DD} \leq 380\text{ V}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

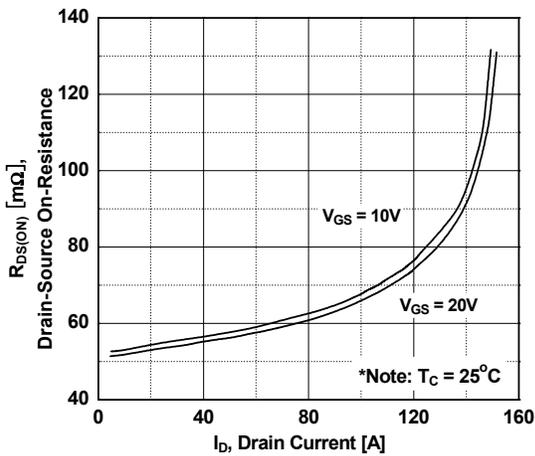
**Figure 1. On-Region Characteristics**



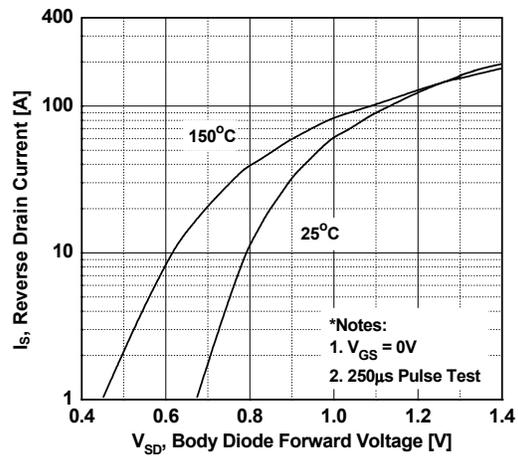
**Figure 2. Transfer Characteristics**



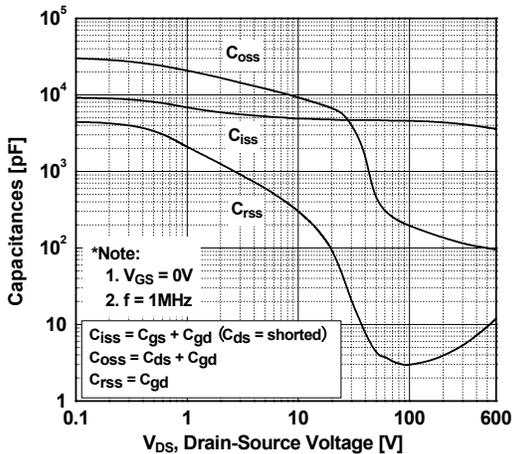
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



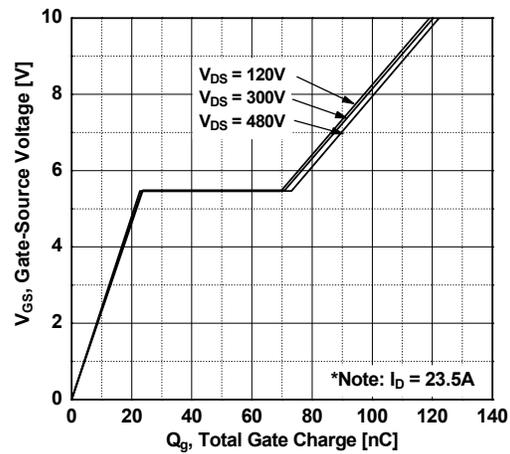
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**



**Figure 6. Gate Charge Characteristics**



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

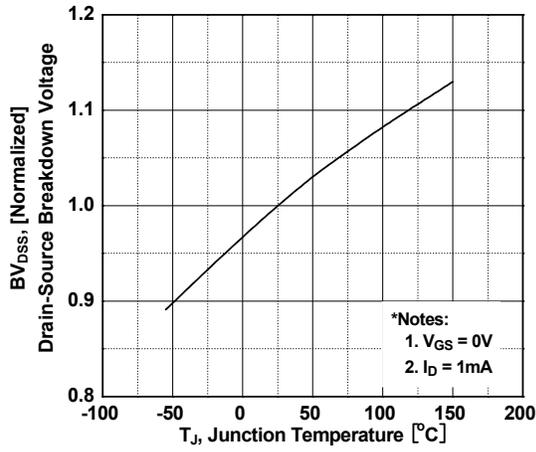


Figure 8. On-Resistance Variation vs. Temperature

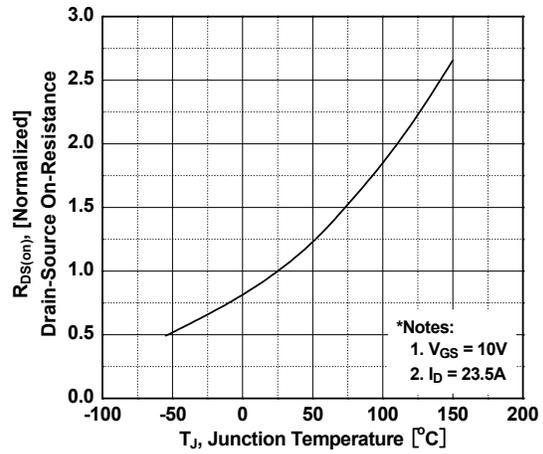


Figure 9. Maximum Safe Operating Area

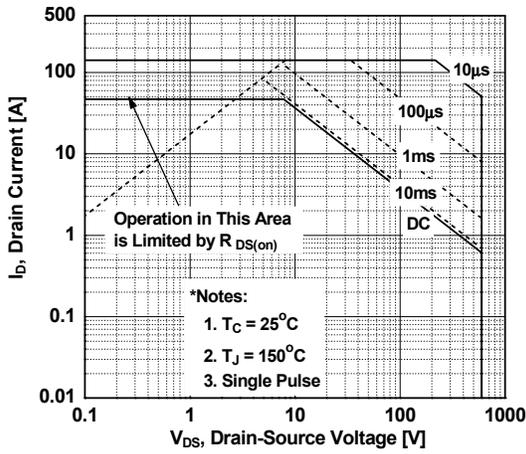


Figure 10. Maximum Drain Current vs. Case Temperature

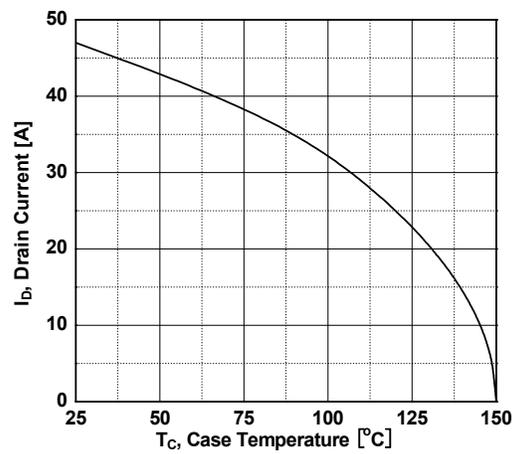
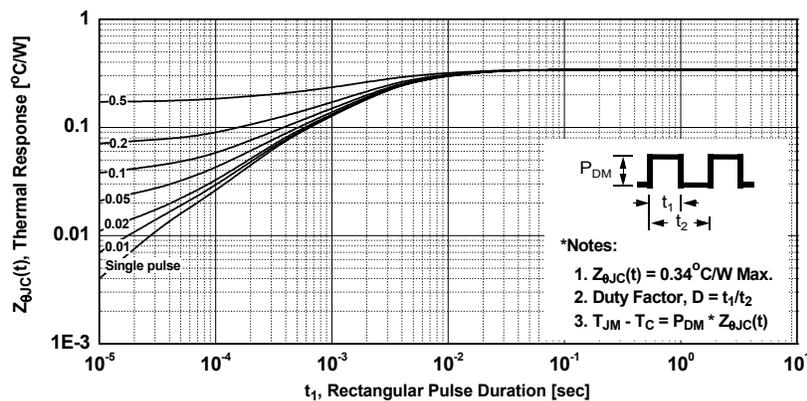


Figure 11. Transient Thermal Response Curve



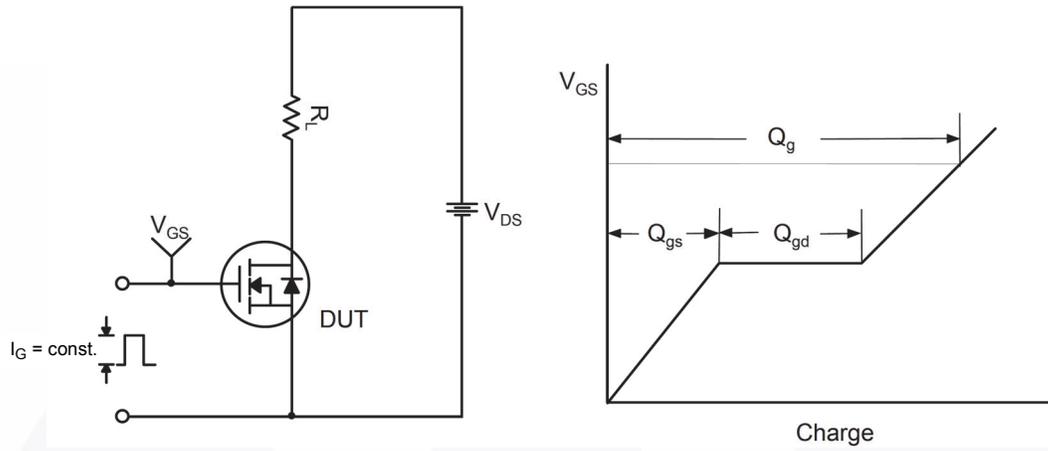


Figure 12. Gate Charge Test Circuit & Waveform

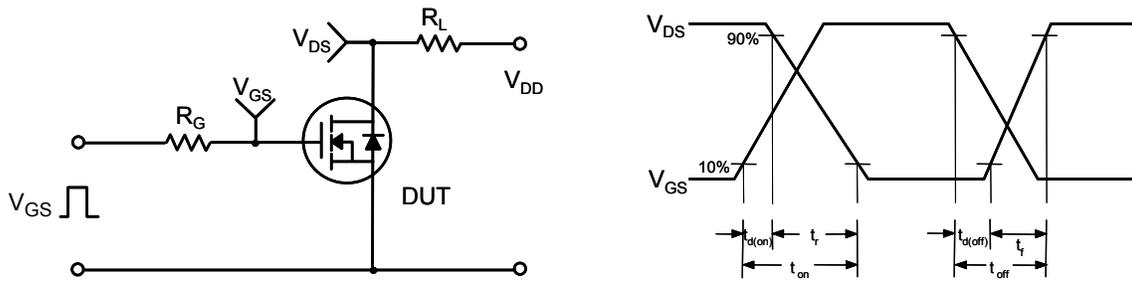


Figure 13. Resistive Switching Test Circuit & Waveforms

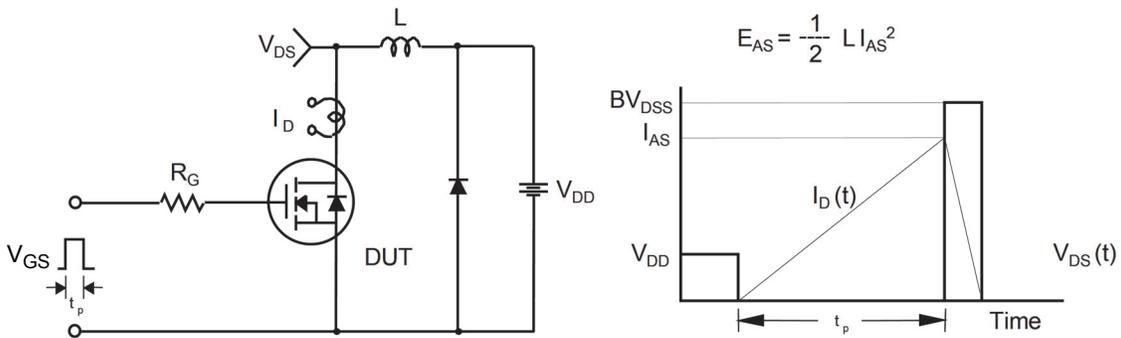


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

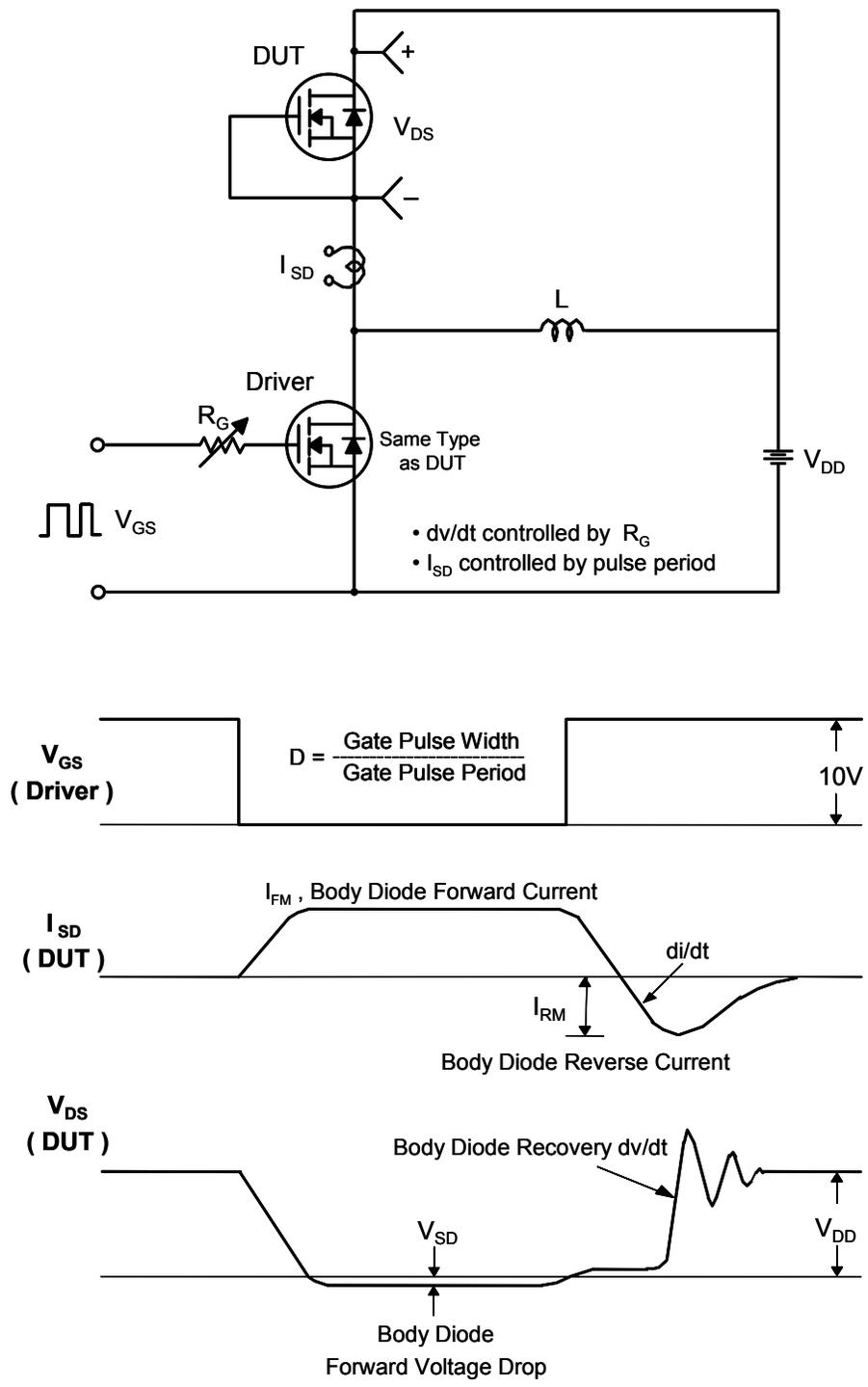
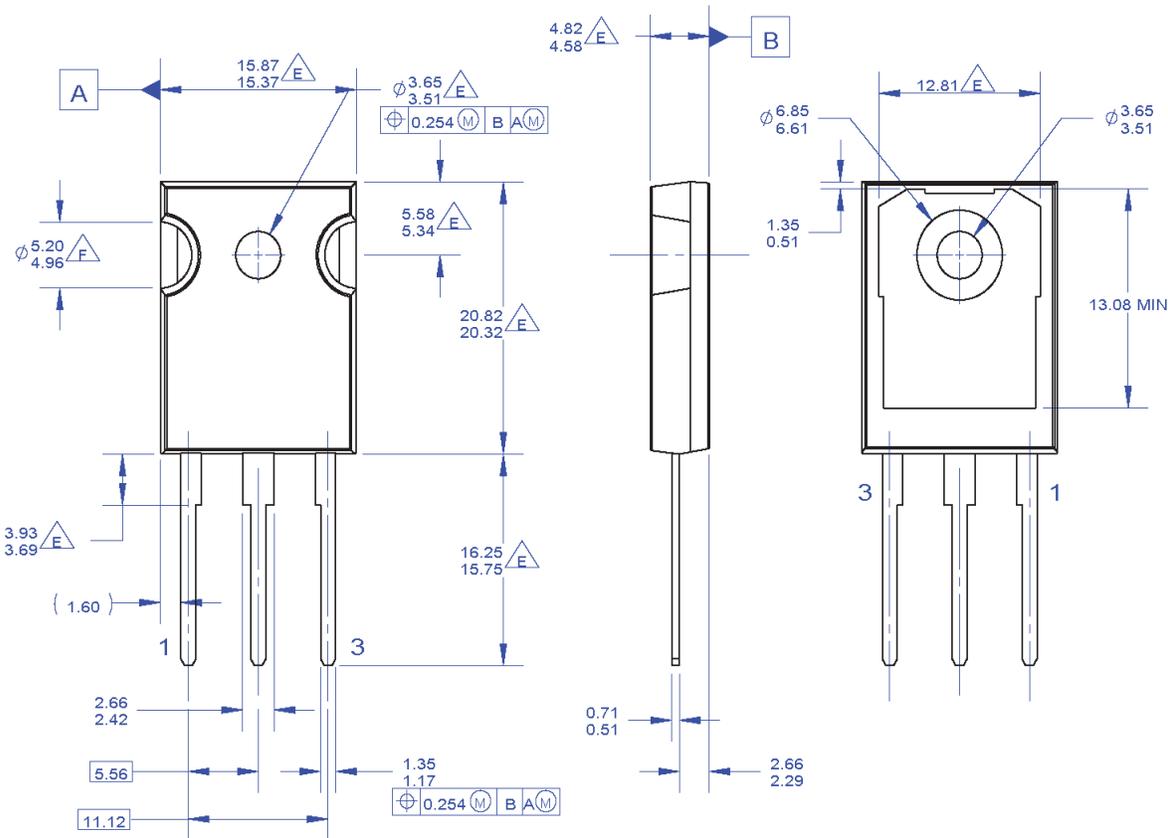


Figure 15. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms

## Mechanical Dimensions



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G. DRAWING FILENAME: MKT-TO247A03\_REV03

**Figure 16. TO-247, Molded, 3-Lead, Jedec Variation AB**

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| FAST®                    |                         | QFET®   | VisualMax™       |
| FastvCore™               |                         | QS™   | VoltagePlus™     |
| FETBench™                |                         | Quiet Series™                                   | XS™              |
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