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FAIRCHILD SEMICONDUCTOR®

November 2013

# FDP030N06

## N-Channel PowerTrench® MOSFET

**60 V, 193 A, 3.2 mΩ**

## Features

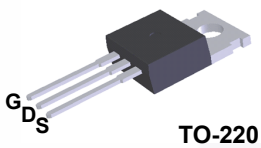
- $R_{DS(on)}$ = 2.6 mΩ (Typ.) @ $V_{GS}$ = 10 V, $I_D$ = 75 A
- Fast Switching Speed
- Low Gate Charge
- High Performance Trench Technology for Extremely Low $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

## Description

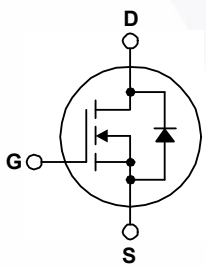
This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process that has been tailored to minimize the on-state resistance while maintaining superior switching performance.

## Applications

- Synchronous Rectification for ATX / Server / Telecom PSU
- Battery Protection Circuit
- Motor Drives and Uninterruptible Power Supplies
- Renewable system




TO-220




## MOSFET Maximum Ratings $T_C$ = 25°C unless otherwise noted.

| Symbol | Parameter | | FDP030N06 | Unit |
|---|---|---|---|---|
| $V_{DSS}$ | Drain to Source Voltage | | 60 | V |
| $V_{GSS}$ | Gate to Source Voltage | | ±20 | V |
| $I_D$ | Drain Current | - Continuous ($T_C$ = 25°C, Silicon Limited) | 193 | A |
| | | - Continuous ($T_C$ = 100°C, Silicon Limited) | 136 | |
| | | - Continuous ($T_C$ = 25°C, Package Limited) | 120 | |
| $I_{DM}$ | Drain Current | - Pulsed (Note 1) | 772 | A |
| $E_{AS}$ | Single Pulsed Avalanche Energy | (Note 2) | 1434 | mJ |
| dv/dt | Peak Diode Recovery dv/dt | (Note 3) | 6.0 | V/ns |
| $P_D$ | Power Dissipation | ($T_C$ = 25°C) | 231 | W |
| | | - Derate above 25°C | 1.54 | W/°C |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | | -55 to +175 | °C |
| $T_L$ | Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds | | 300 | °C |

## Thermal Characteristics

| Symbol | Parameter | FDP030N06 | Unit |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max. | 0.65 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max. | 62.5 | |

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## Package Marking and Ordering Information

| Part Number | Top Mark | Package | Packing Method | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|---|
| FDP030N06 | FDP030N06 | TO-220 | Tube | N/A | N/A | 50 units |

## Electrical Characteristics $T_C$ = 25°C unless otherwise noted.

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D$ = 250 μA, $V_{GS}$ = 0 V, $T_C$ = 25°C | 60 | - | - | V |
| $\Delta BV_{DSS}$ / $\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 1 mA, Referenced to 25°C | - | 0.05 | - | V/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 48 V, $V_{GS}$ = 0 V | - | - | 1 | μA |
| | | $V_{DS}$ = 48 V, $T_C$ = 150°C | - | - | 500 | |
| $I_{GSS}$ | Gate to Body Leakage Current | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 V | - | - | ±100 | nA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | 2.5 | 3.5 | 4.5 | V |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = 10 V, $I_D$ = 75 A | - | 2.6 | 3.2 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 10 V, $I_D$ = 75 A | - | 154 | - | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 25 V, $V_{GS}$ = 0 V, f = 1 MHz | - | 7380 | 9815 | pF |
| $C_{oss}$ | Output Capacitance | | - | 1095 | 1455 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 415 | 625 | pF |
| $Q_{g(tot)}$ | Total Gate Charge at 10V | $V_{DS}$ = 48 V, $I_D$ = 75 A, $V_{GS}$ = 10 V | - | 116 | 151 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | | - | 40 | - | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | (Note 4) | - | 35 | - | nC |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 30 V, $I_D$ = 75 A, $V_{GS}$ = 10 V, $R_G$ = 4.7 Ω | - | 39 | 87 | ns |
| $t_r$ | Turn-On Rise Time | | - | 178 | 366 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 54 | 118 | ns |
| $t_f$ | Turn-Off Fall Time | (Note 4) | - | 33 | 76 | ns |
| **Drain-Source Diode Characteristics** | | | | | | |
| $I_S$ | Maximum Continuous Drain to Source Diode Forward Current | | - | - | 193 | A |
| $I_{SM}$ | Maximum Pulsed Drain to Source Diode Forward Current | | - | - | 772 | A |
| $V_{SD}$ | Drain to Source Diode Forward Voltage | $V_{GS}$ = 0 V, $I_{SD}$ = 75 A | - | - | 1.3 | V |
| $t_{rr}$ | Reverse Recovery Time | $V_{GS}$ = 0 V, $I_{SD}$ = 75 A, $dI_F/dt$ = 100 A/μs | - | 46 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | - | 50 | - | nC |

**Notes:**

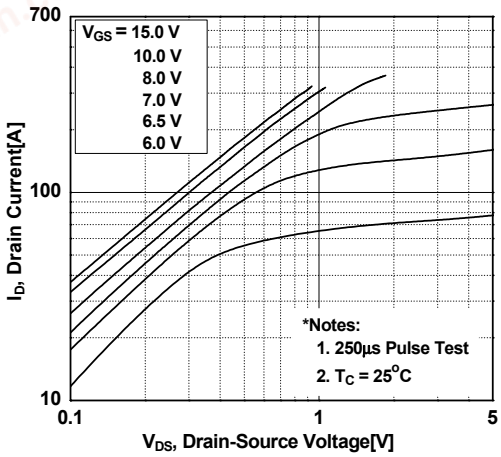
1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 0.51 mH, $I_{AS}$ = 75 A, $V_{DD}$ = 50 V, $R_G$ = 25 Ω, starting $T_J$ = 25°C.
3. $I_{SD}$ ≤ 75 A, di/dt ≤ 450 A/μs, $V_{DD}$ ≤ $BV_{DSS}$, starting $T_J$ = 25°C.
4. Essentially independent of operating temperature typical characteristics.

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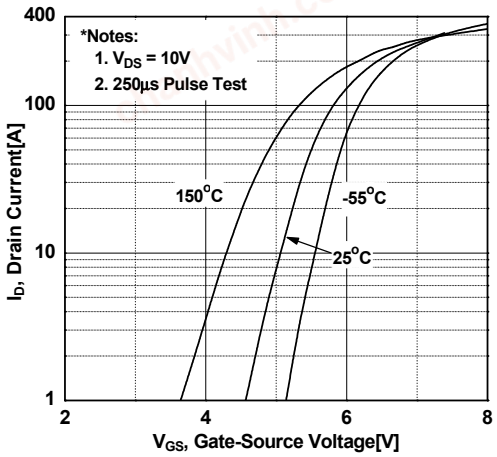


## Typical Performance Characteristics

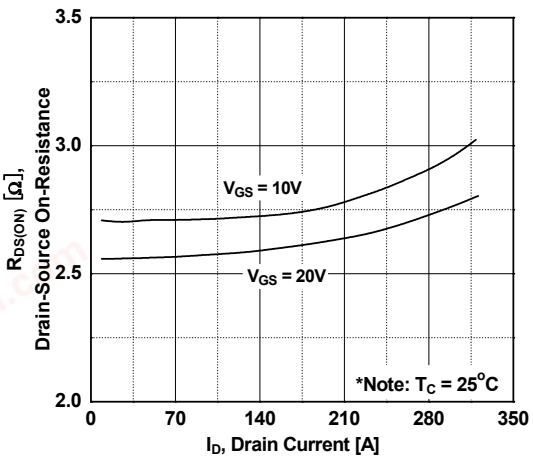
### Figure 1. On-Region Characteristics



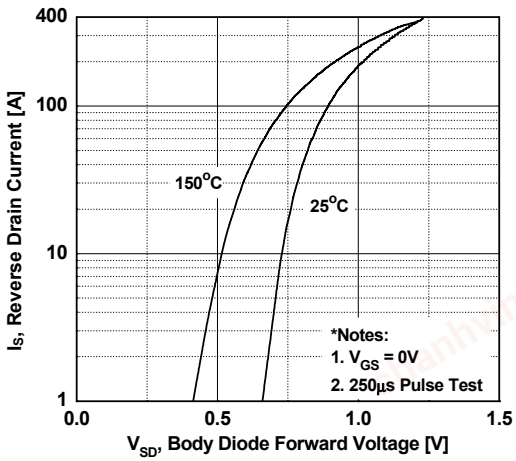

### Figure 2. Transfer Characteristics



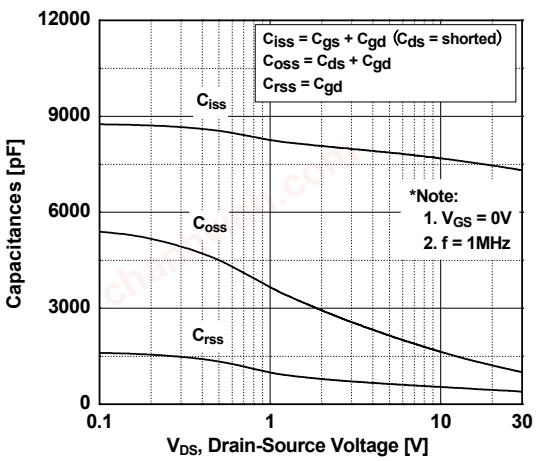

### Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage



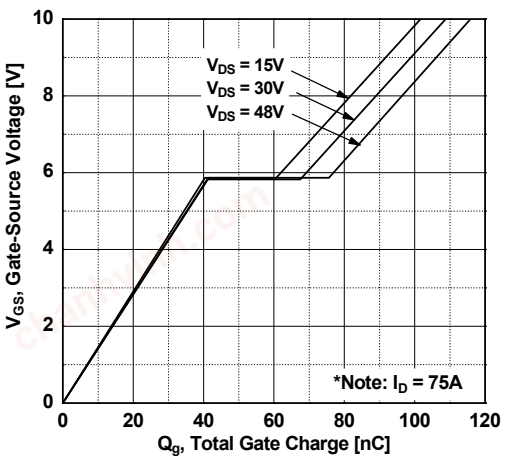

### Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature




### Figure 5. Capacitance Characteristics




### Figure 6. Gate Charge Characteristics



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## Typical Performance Characteristics (Continued)

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

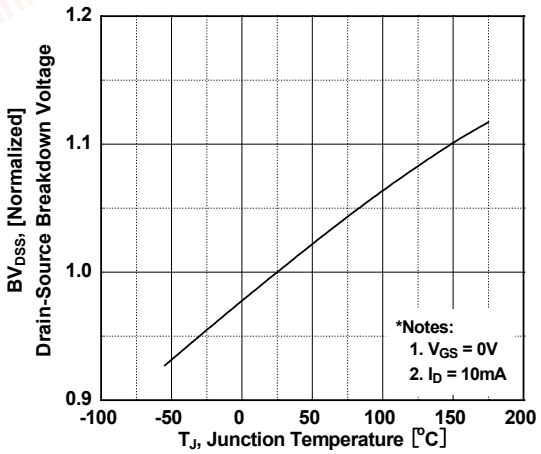



**Figure 8. On-Resistance Variation vs. Temperature**

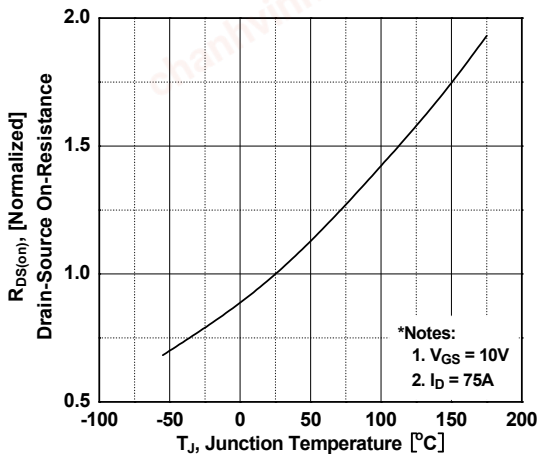



**Figure 9. Maximum Safe Operating Area**

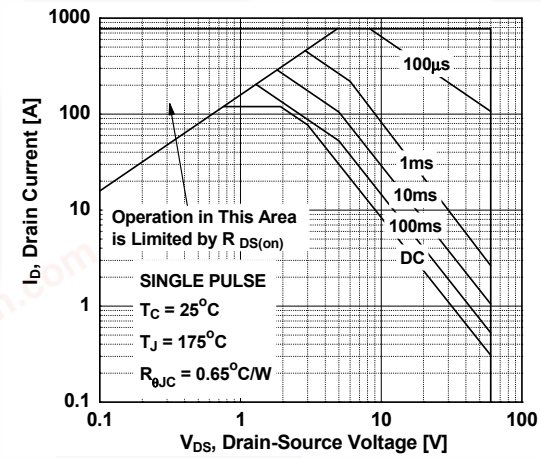



**Figure 10. Maximum Drain Current vs. Case Temperature**

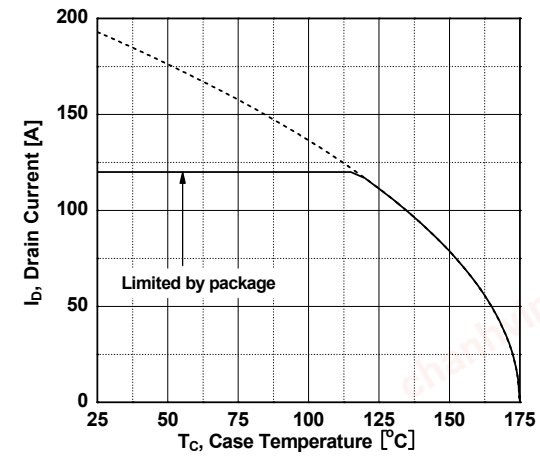
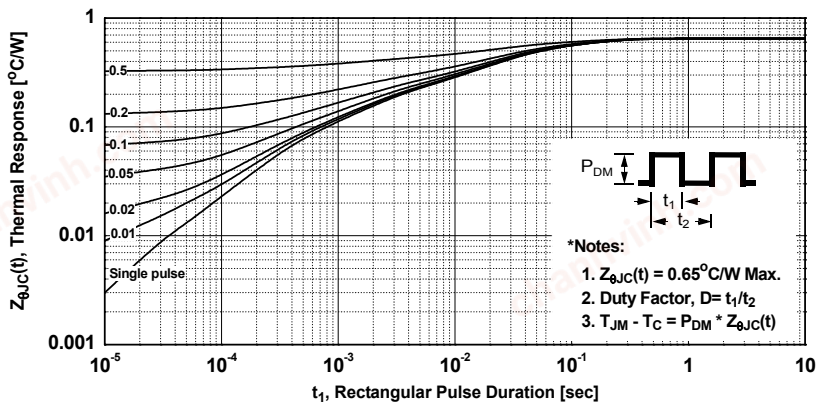



**Figure 11. Transient Thermal Response Curve**



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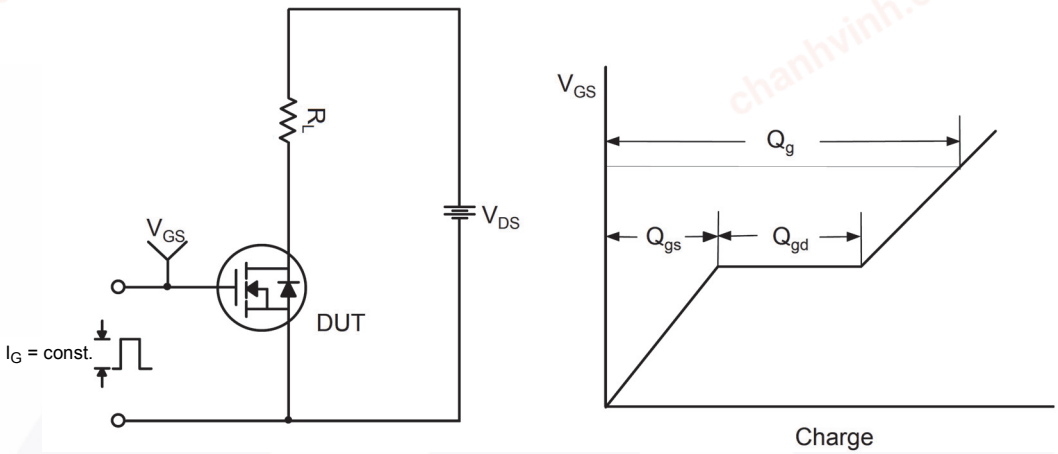



**Figure 12. Gate Charge Test Circuit & Waveform**

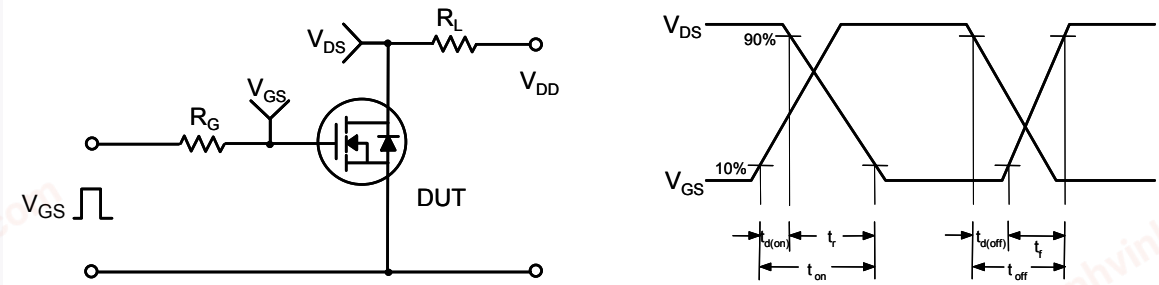



**Figure 13. Resistive Switching Test Circuit & Waveforms**

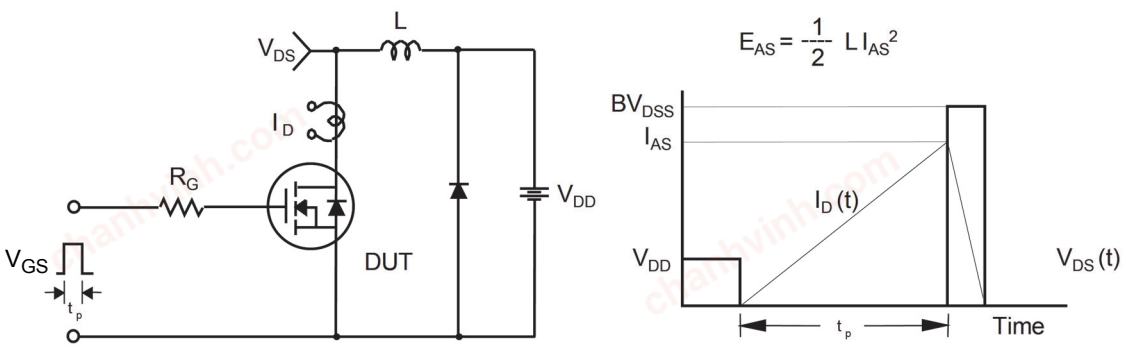



**Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms**

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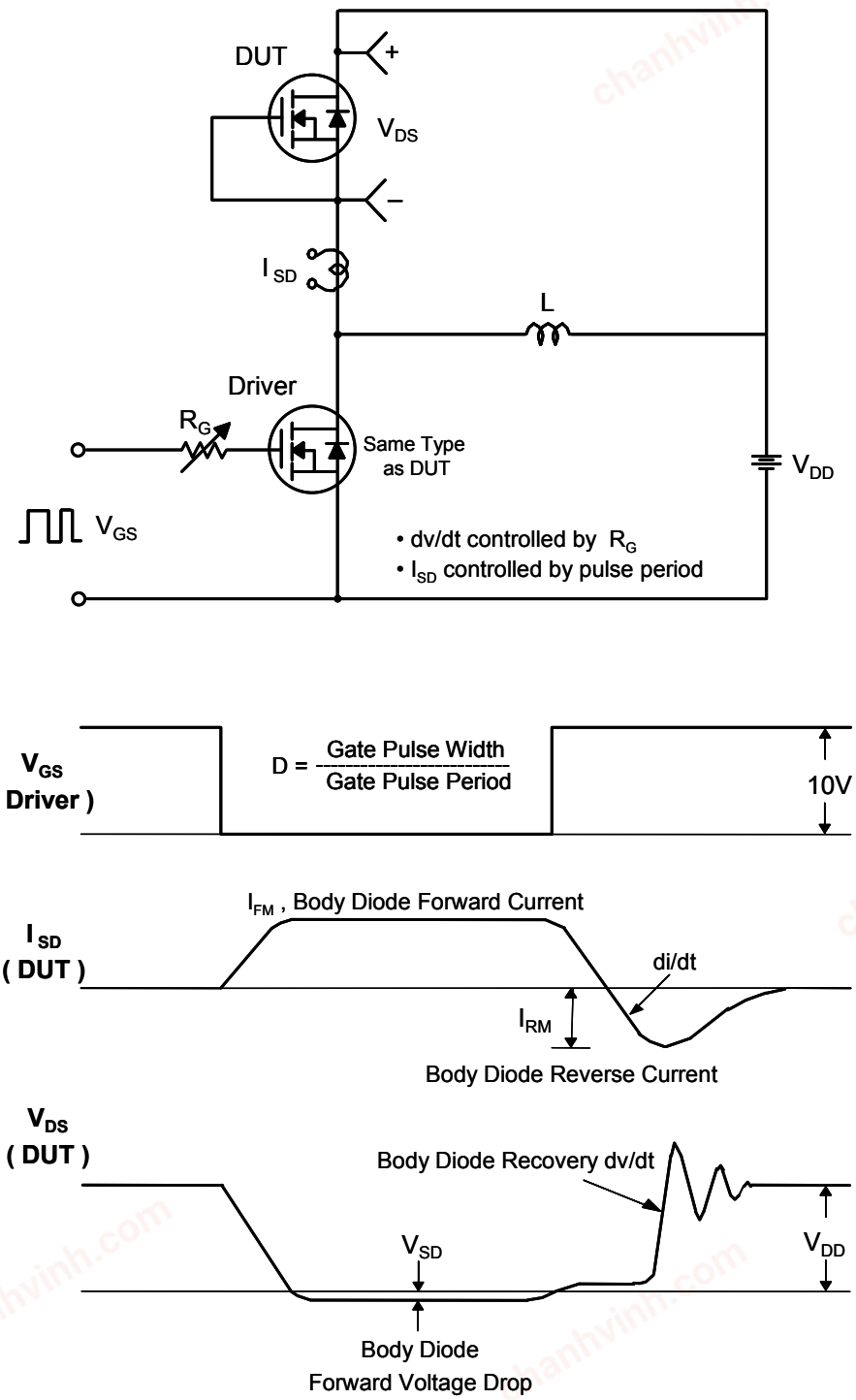



**Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms**

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## Mechanical Dimensions

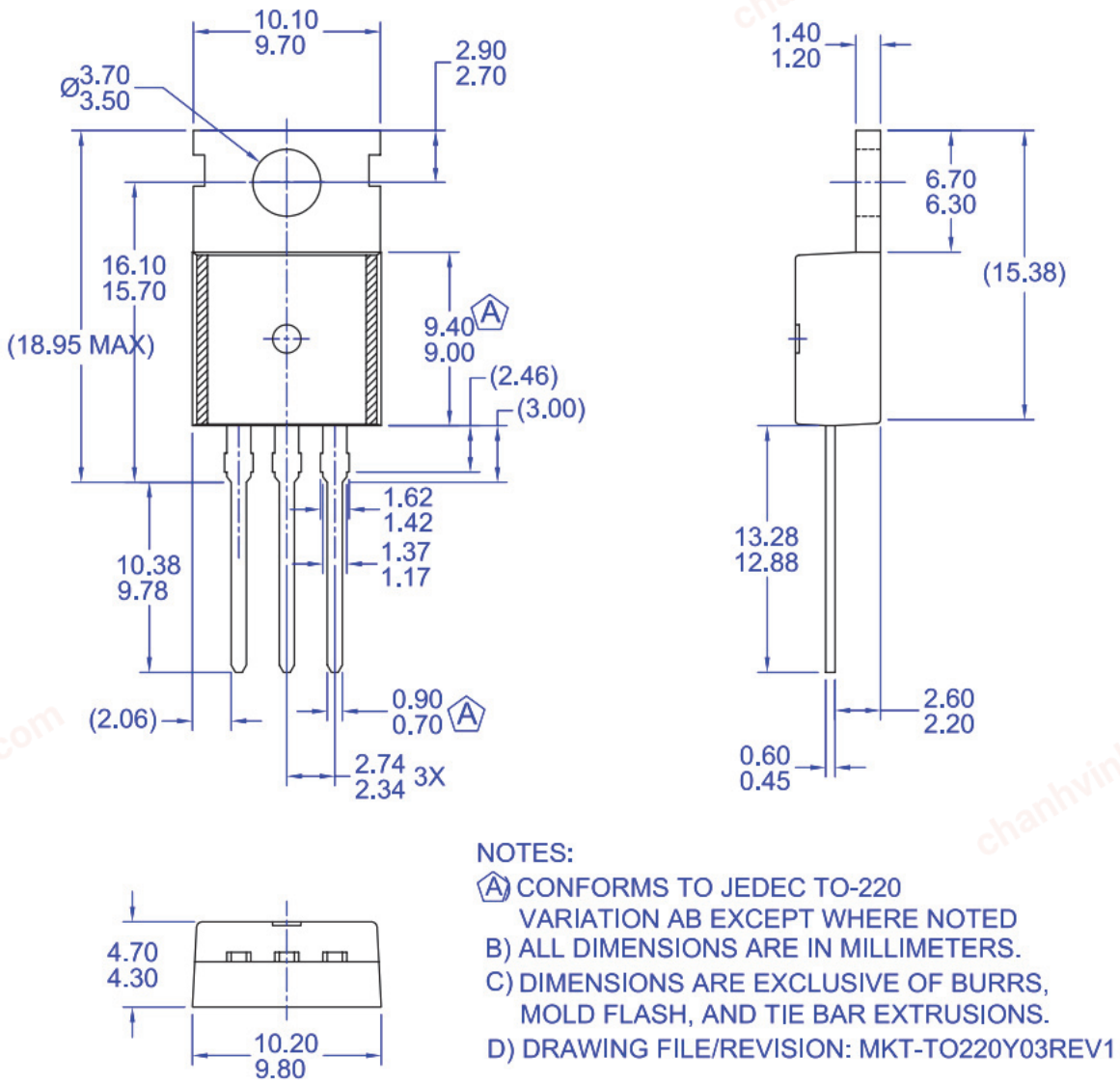



**Figure 16. TO220, Molded, 3-Lead, Non Jedec Variation AB**

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