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# FDP120N10

## N-Channel PowerTrench® MOSFET

### 100 V, 74 A, 12 mΩ

### Features

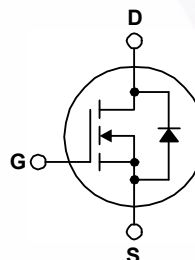
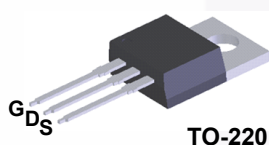
- $R_{DS(on)} = 9.7 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 74 \text{ A}$
- Fast Switching Speed
- Low Gate Charge
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

### 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
- Micor Solar Inverter



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

| Symbol         | Parameter                                                            | FDP120N10                                  | Unit                |
|----------------|----------------------------------------------------------------------|--------------------------------------------|---------------------|
| $V_{DSS}$      | Drain to Source Voltage                                              | 100                                        | V                   |
| $V_{GSS}$      | Gate to Source Voltage                                               | $\pm 20$                                   | V                   |
| $I_D$          | Drain Current                                                        | - Continuous ( $T_C = 25^\circ\text{C}$ )  | A                   |
|                |                                                                      | - Continuous ( $T_C = 100^\circ\text{C}$ ) |                     |
| $I_{DM}$       | Drain Current                                                        | - Pulsed (Note 1)                          | A                   |
| $E_{AS}$       | Single Pulsed Avalanche Energy                                       | (Note 2)                                   | mJ                  |
| $dv/dt$        | Peak Diode Recovery $dv/dt$                                          | (Note 3)                                   | V/ns                |
| $P_D$          | Power Dissipation                                                    | ( $T_C = 25^\circ\text{C}$ )               | W                   |
|                |                                                                      | - Derate Above $25^\circ\text{C}$          | 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                                        | $^\circ\text{C}$    |

### Thermal Characteristics

| Symbol          | Parameter                                     | FDP120N10 | Unit               |
|-----------------|-----------------------------------------------|-----------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max.    | 0.88      | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max. | 62.5      |                    |

## Package Marking and Ordering Information

| Part Number | Top Mark  | Package | Packing Method | Reel Size | Tape Width | Quantity |
|-------------|-----------|---------|----------------|-----------|------------|----------|
| FDP120N10   | FDP120N10 | TO-220  | 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         | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0\ \text{V}$ , $T_C = 25^\circ\text{C}$  | 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 | -   | 4.5 | V          |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 10\ \text{V}$ , $I_D = 74\ \text{A}$ | -   | 9.7 | 12  | m $\Omega$ |
| $g_{FS}$     | Forward Transconductance             | $V_{DS} = 10\ \text{V}$ , $I_D = 74\ \text{A}$ | -   | 105 | -   | S          |

### Dynamic Characteristics

|              |                               |                                                                                         |   |      |      |    |
|--------------|-------------------------------|-----------------------------------------------------------------------------------------|---|------|------|----|
| $C_{iss}$    | Input Capacitance             | $V_{DS} = 25\ \text{V}$ , $V_{GS} = 0\ \text{V}$ ,<br>$f = 1\ \text{MHz}$               | - | 4215 | 5605 | pF |
| $C_{oss}$    | Output Capacitance            |                                                                                         | - | 405  | 540  | pF |
| $C_{rss}$    | Reverse Transfer Capacitance  |                                                                                         | - | 170  | 255  | pF |
| $Q_{g(tot)}$ | Total Gate Charge at 10V      | $V_{DS} = 80\ \text{V}$ , $I_D = 74\ \text{A}$ ,<br>$V_{GS} = 10\ \text{V}$<br>(Note 4) | - | 66   | 86   | nC |
| $Q_{gs}$     | Gate to Source Gate Charge    |                                                                                         | - | 26   | -    | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |                                                                                         | - | 20   | -    | nC |

### Switching Characteristics

|              |                     |                                                                                                               |   |     |     |    |
|--------------|---------------------|---------------------------------------------------------------------------------------------------------------|---|-----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = 50\ \text{V}$ , $I_D = 74\ \text{A}$ ,<br>$V_{GS} = 10\ \text{V}$ , $R_G = 4.7\ \Omega$<br>(Note 4) | - | 27  | 64  | ns |
| $t_r$        | Turn-On Rise Time   |                                                                                                               | - | 105 | 220 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time |                                                                                                               | - | 39  | 88  | ns |
| $t_f$        | Turn-Off Fall Time  |                                                                                                               | - | 15  | 40  | ns |

### Drain-Source Diode Characteristics

|                 |                                                          |                                                                                  |   |    |     |    |
|-----------------|----------------------------------------------------------|----------------------------------------------------------------------------------|---|----|-----|----|
| I <sub>S</sub>  | Maximum Continuous Drain to Source Diode Forward Current |                                                                                  | - | -  | 74  | A  |
| I <sub>SM</sub> | Maximum Pulsed Drain to Source Diode Forward Current     |                                                                                  | - | -  | 296 | A  |
| V <sub>SD</sub> | Drain to Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 74 A                                    | - | -  | 1.3 | V  |
| t <sub>rr</sub> | Reverse Recovery Time                                    | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 74 A,<br>dI <sub>F</sub> /dt = 100 A/μs | - | 44 | -   | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge                                  |                                                                                  | - | 67 | -   | nC |

#### Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2.  $L = 0.11\ \text{mH}$ ,  $I_{AS} = 60\ \text{A}$ ,  $V_{DD} = 50\ \text{V}$ ,  $R_G = 25\ \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 74\ \text{A}$ ,  $dI/dt \leq 200\ \text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature typical characteristics.

# Typical Performance Characteristics

Figure 1. On-Region Characteristics

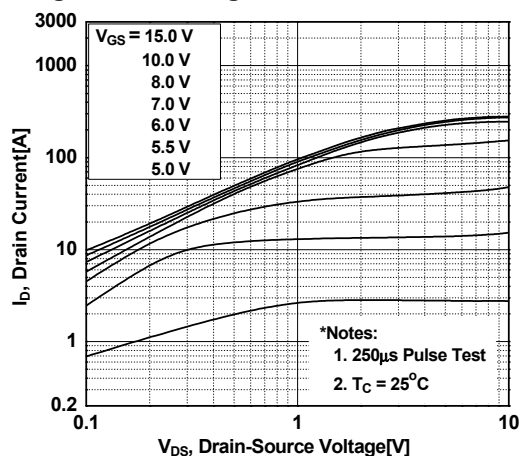


Figure 2. Transfer Characteristics

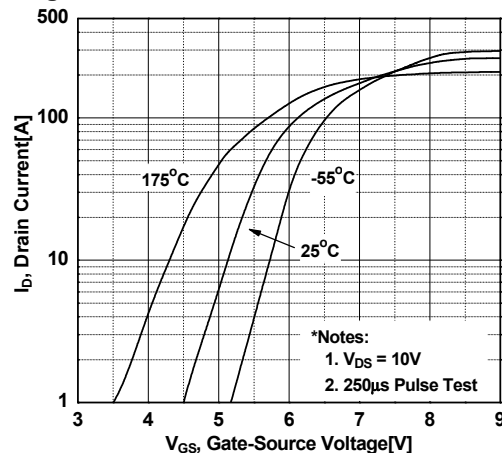


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

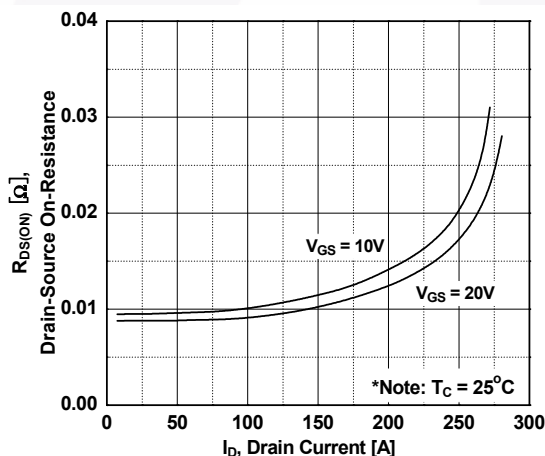


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

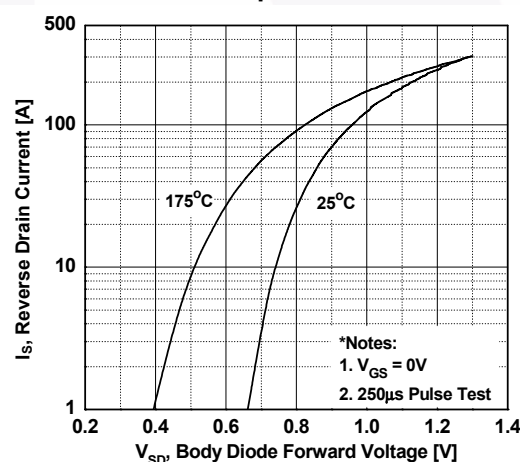


Figure 5. Capacitance Characteristics

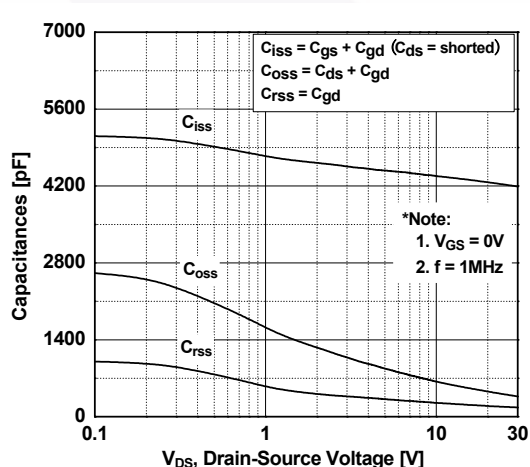
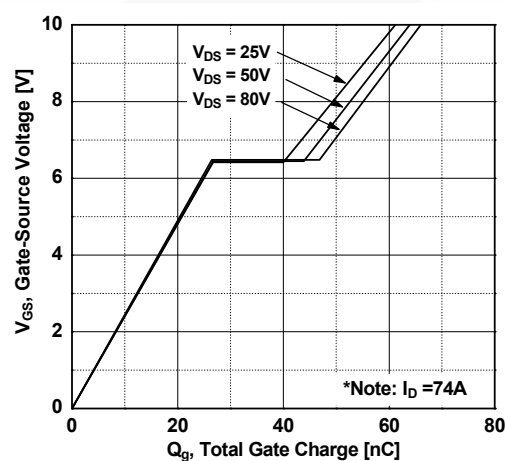


Figure 6. Gate Charge Characteristics



# Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

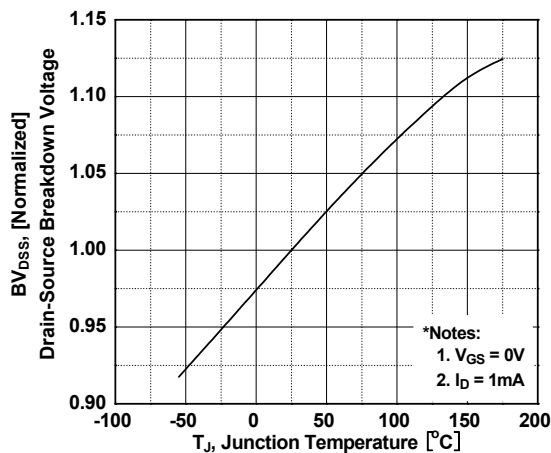


Figure 8. On-Resistance Variation vs. Temperature

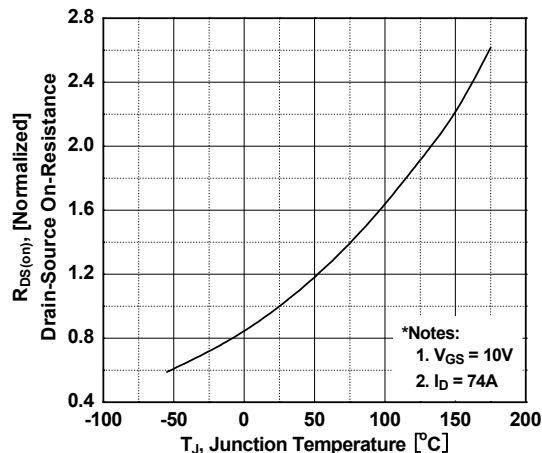


Figure 9. Maximum Safe Operating Area

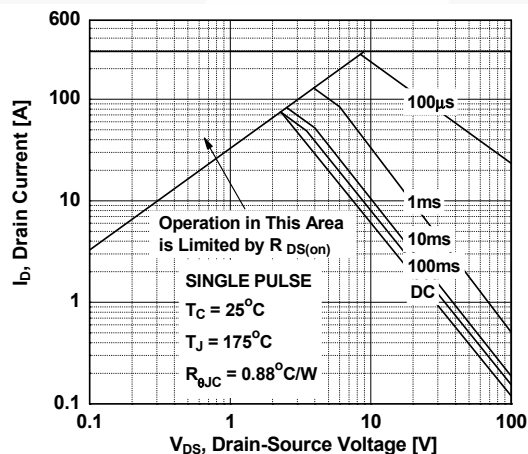


Figure 10. Maximum Drain Current vs. Case Temperature

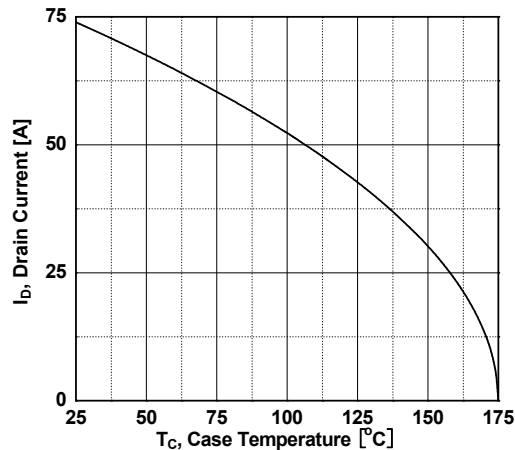
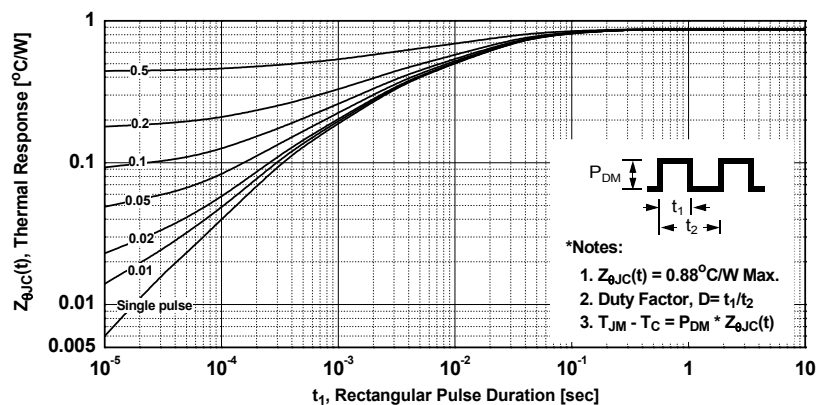


Figure 11. Transient Thermal Response Curve



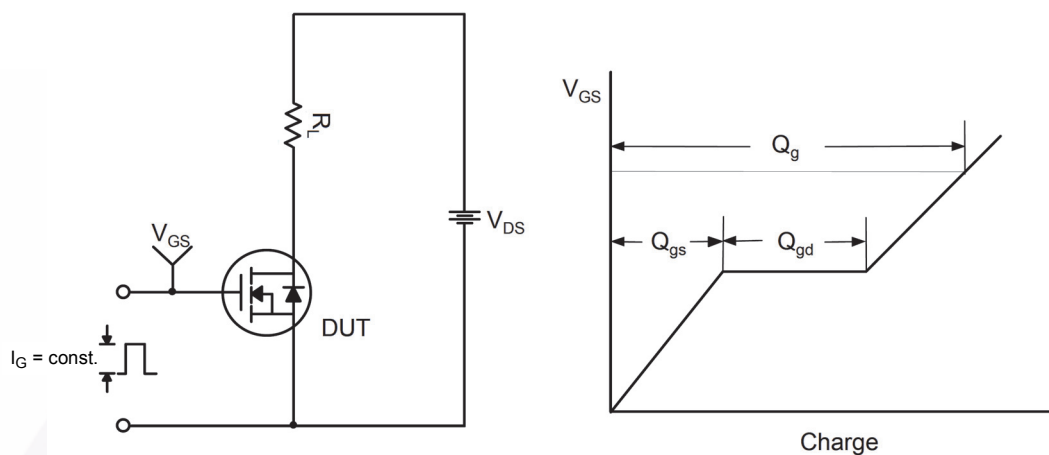


Figure 12. Gate Charge Test Circuit & Waveform

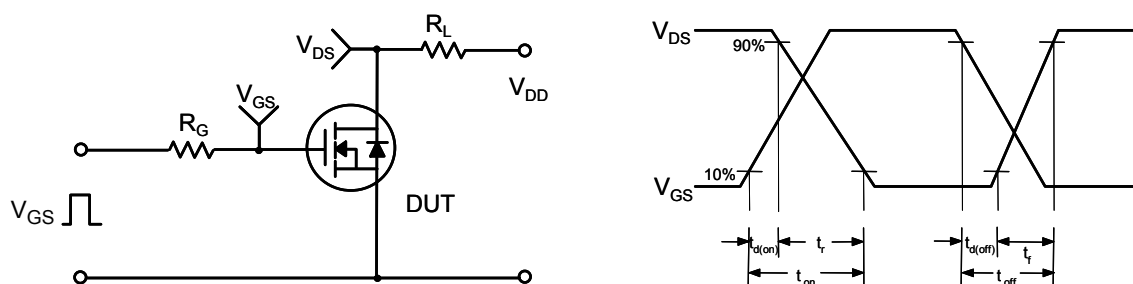


Figure 13. Resistive Switching Test Circuit & Waveforms

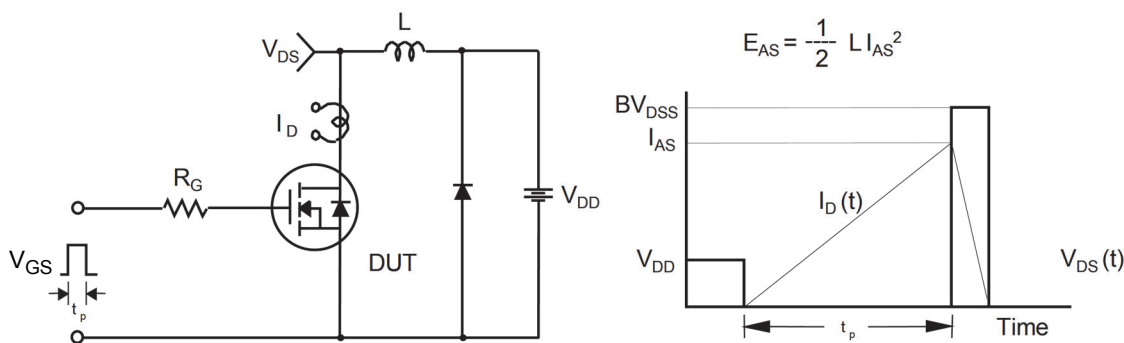
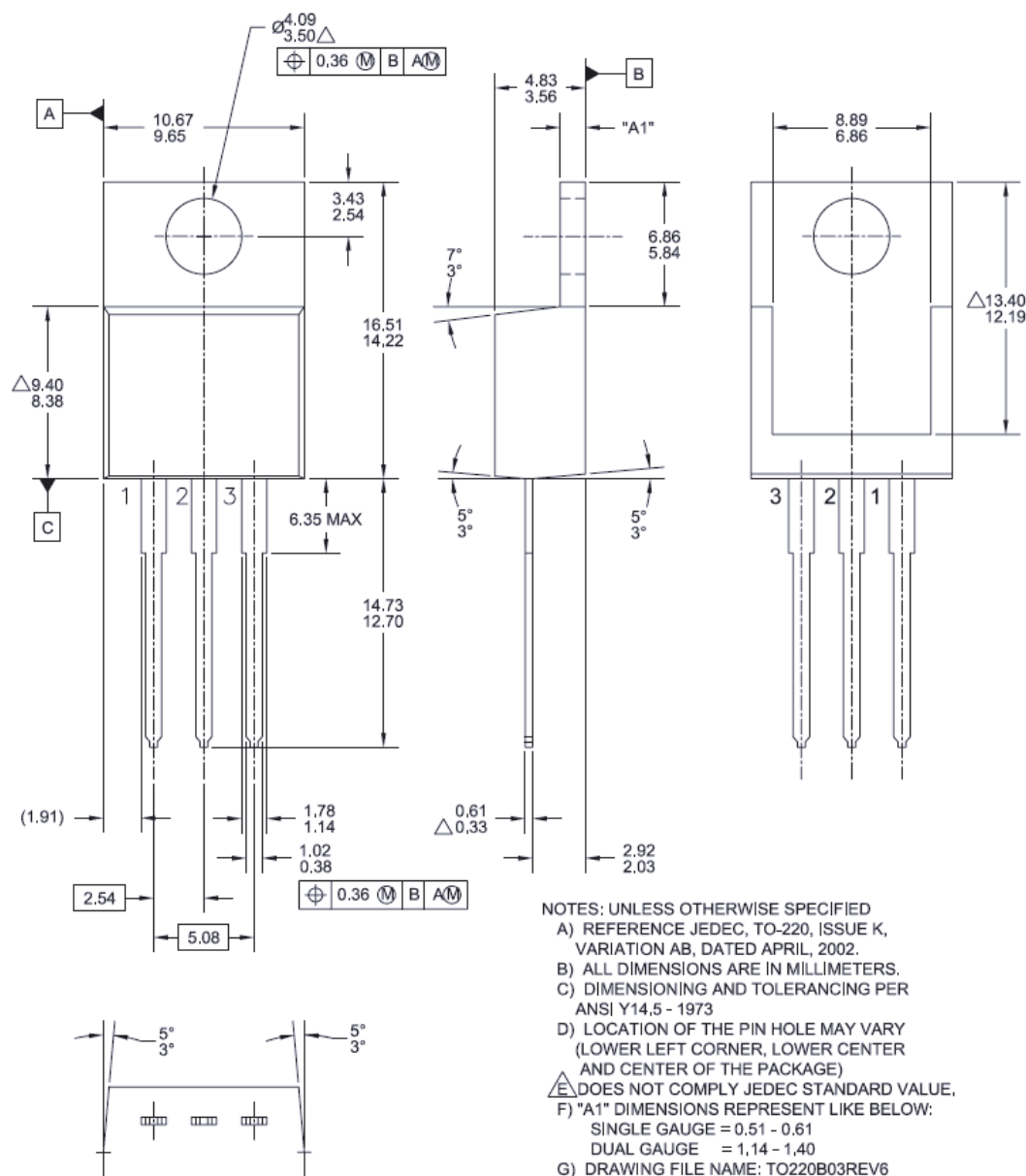


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



# Mechanical Dimensions



**Figure 16. TO-220, Molded, 3-Lead, Jedec Variation AB**

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