

# FDPF035N06B

## N-Channel PowerTrench® MOSFET

60 V, 88 A, 3.5 mΩ

### Features

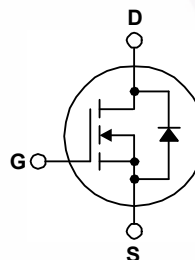
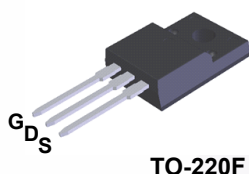
- $R_{DS(on)} = 2.91 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 88 \text{ A}$
- Low FOM  $R_{DS(on)} \cdot Q_G$
- Low Reverse Recovery Charge,  $Q_{rr}$
- Soft Reverse Recovery Body Diode
- Enables Highly Efficiency in Synchronous Rectification
- Fast Switching Speed
- 100% UIL Tested
- 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



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

| Symbol         | Parameter  | FDPF035N06B_F152  | Unit                            |
|----------------|--|---|---------------------------------|
| $V_{DSS}$      | Drain to Source Voltage  | 60  | V                               |
| $V_{GSS}$      | Gate to Source Voltage   | $\pm 20$  | V                               |
| $I_D$          | Drain Current  | - Continuous ( $T_C = 25^\circ\text{C}$ , Silicon Limited)  | A                               |
|                |  | - Continuous ( $T_C = 100^\circ\text{C}$ , Silicon Limited) |                                 |
| $I_{DM}$       | 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 $25^\circ\text{C}$                           | $0.31 \text{ W}/^\circ\text{C}$ |
| $T_J, T_{STG}$ | 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                                     | FDPF035N06B_F152 | Unit                      |
|-----------------|---|------------------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max.    | 3.24             | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | 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 |
|------------------|-------------|---------|----------------|-----------|------------|----------|
| FDPF035N06B_F152 | FDPF035N06B | TO-220F | 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         | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0\ \text{V}$           | 60 | -    | -         | V                         |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$ | -  | 0.03 | -         | $\text{V}/^\circ\text{C}$ |
| $I_{DSS}$                      | Zero Gate Voltage Drain Current           | $V_{DS} = 48\ \text{V}$ , $V_{GS} = 0\ \text{V}$            | -  | -    | 1         | $\mu\text{A}$             |
| $I_{GSS}$                      | 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 | -    | 4   | V          |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 10\ \text{V}$ , $I_D = 88\ \text{A}$ | - | 2.91 | 3.5 | m $\Omega$ |
| $g_{FS}$     | Forward Transconductance             | $V_{DS} = 10\ \text{V}$ , $I_D = 88\ \text{A}$ | - | 176  | -   | S          |

### Dynamic Characteristics

|               |                                    |  |   |      |      |          |
|---------------|------------------------------------|--|---|------|------|----------|
| $C_{iss}$     | Input Capacitance                  | $V_{DS} = 30\ \text{V}$ , $V_{GS} = 0\ \text{V}$ ,<br>$f = 1\ \text{MHz}$    | - | 6035 | 8030 | pF       |
| $C_{oss}$     | Output Capacitance                 |  | - | 1685 | 2240 | pF       |
| $C_{rss}$     | Reverse Transfer Capacitance       |  | - | 55   | -    | pF       |
| $C_{oss(er)}$ | Energy Related Output Capacitance  | $V_{DS} = 30\ \text{V}$ , $V_{GS} = 0\ \text{V}$                             | - | 2619 | -    | pF       |
| $Q_{g(tot)}$  | Total Gate Charge at 10V           | $V_{DS} = 30\ \text{V}$ , $I_D = 100\ \text{A}$ ,<br>$V_{GS} = 10\ \text{V}$ | - | 76   | 99   | nC       |
| $Q_{gs}$      | Gate to Source Gate Charge         |  | - | 29   | -    | nC       |
| $Q_{gd}$      | Gate to Drain "Miller" Charge      |  | - | 12   | -    | nC       |
| $V_{plateau}$ | Gate Plateau Voltage               |  | - | 5.2  | -    | V        |
| $Q_{sync}$    | Total Gate Charge Sync.            | $V_{DS} = 0\ \text{V}$ , $I_D = 50\ \text{A}$                                | - | 67.3 | -    | nC       |
| $Q_{oss}$     | Output Charge                      | $V_{DS} = 30\ \text{V}$ , $V_{GS} = 0\ \text{V}$                             | - | 92.4 | -    | nC       |
| ESR           | Equivalent Series Resistance (G-S) | $f = 1\ \text{MHz}$  | - | 2.0  | -    | $\Omega$ |

### Switching Characteristics

|              |                     |  |   |    |     |    |
|--------------|---------------------|--|---|----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = 30\ \text{V}$ , $I_D = 100\ \text{A}$ ,<br>$V_{GS} = 10\ \text{V}$ , $R_G = 4.7\ \Omega$ | - | 32 | 74  | ns |
| $t_r$        | Turn-On Rise Time   |  | - | 33 | 76  | ns |
| $t_{d(off)}$ | Turn-Off Delay Time |  | - | 56 | 122 | ns |
| $t_f$        | Turn-Off Fall Time  |  | - | 23 | 56  | ns |

### Drain-Source Diode Characteristics

|                 |  |   |   |     |      |    |
|-----------------|--|---|---|-----|------|----|
| I <sub>S</sub>  | Maximum Continuous Drain to Source Diode Forward Current | -   | - | 88  | A    |    |
| I <sub>SM</sub> | Maximum Pulsed Drain to Source Diode Forward Current     | -   | - | 352 | A    |    |
| V <sub>SD</sub> | Drain to Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 88 A                                     | - | -   | 1.25 | V  |
| t <sub>rr</sub> | Reverse Recovery Time                                    | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 100 A,<br>dI <sub>F</sub> /dt = 100 A/μs | - | 71  | -    | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge                                  |   | - | 78  | -    | nC |

#### Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2.  $L = 3\ \text{mH}$ ,  $I_{AS} = 20\ \text{A}$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 100\ \text{A}$ ,  $di/dt \leq 200\ \text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature typical characteristics.

# Typical Performance Characteristics

Figure 1. On-Region Characteristics

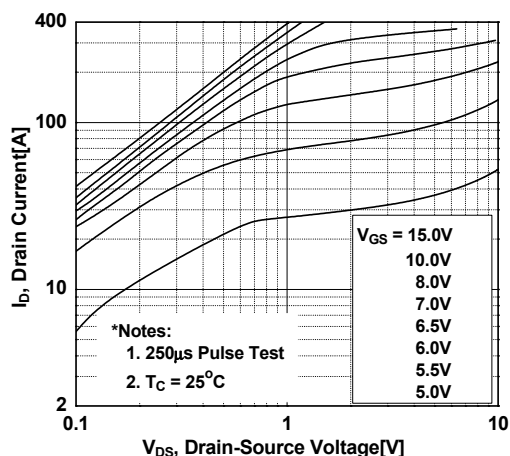


Figure 2. Transfer Characteristics

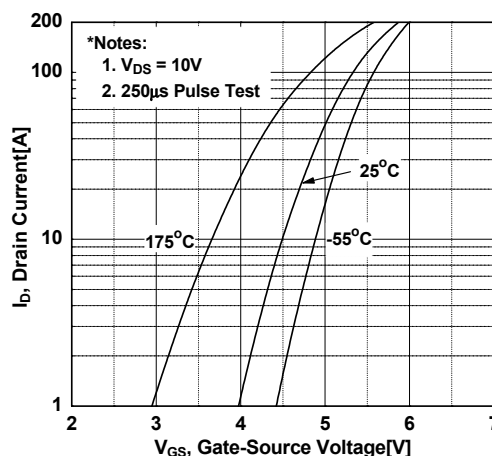


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

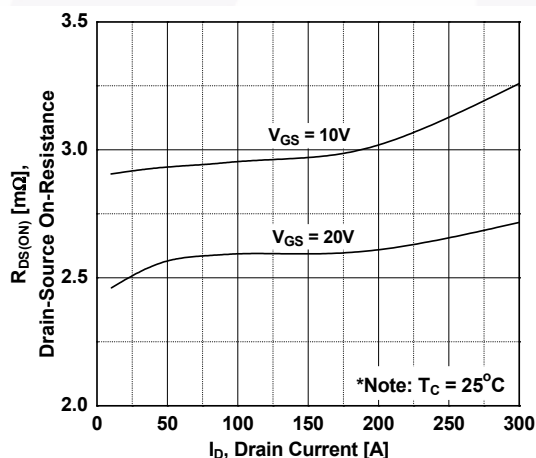


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

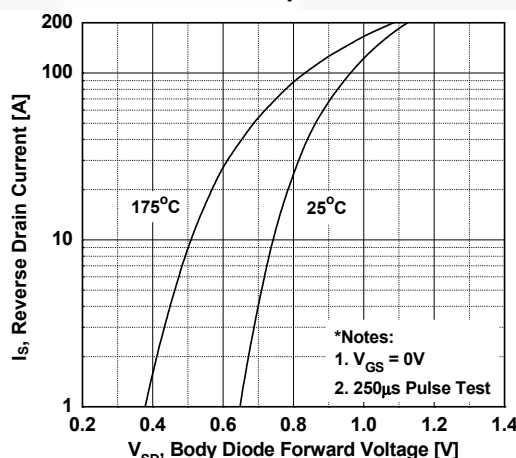


Figure 5. Capacitance Characteristics

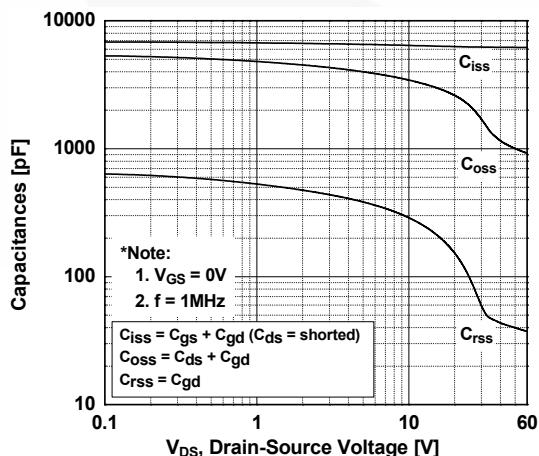
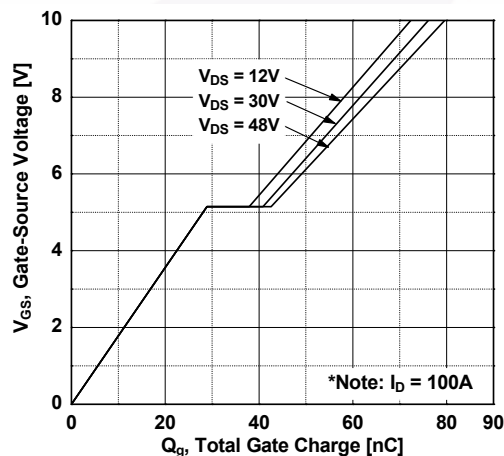
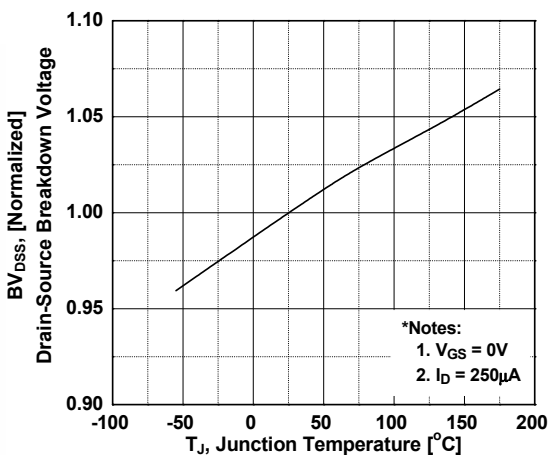


Figure 6. Gate Charge Characteristics

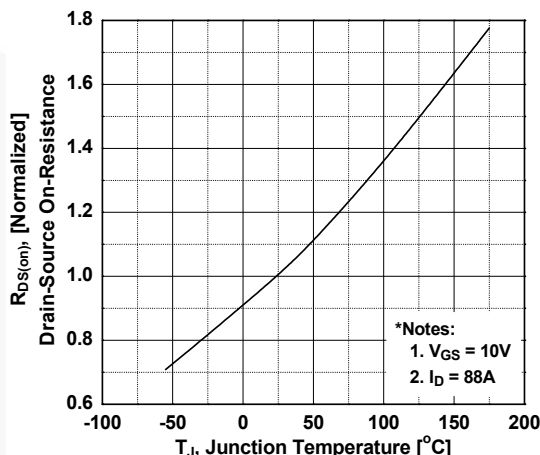


# Typical Performance Characteristics (Continued)

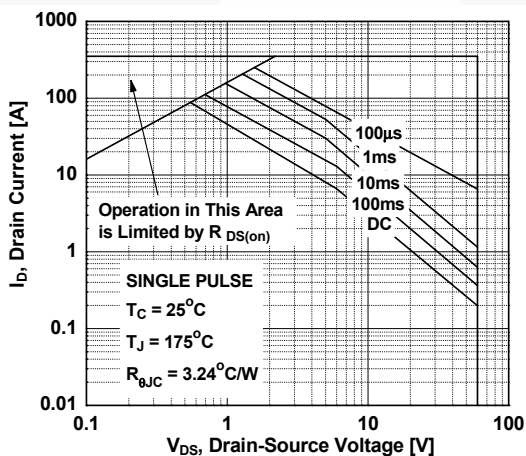
**Figure 7. Breakdown Voltage Variation vs. Temperature**



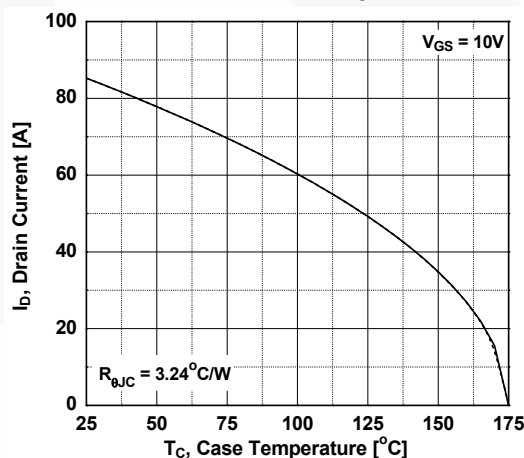
**Figure 8. On-Resistance Variation vs. Temperature**



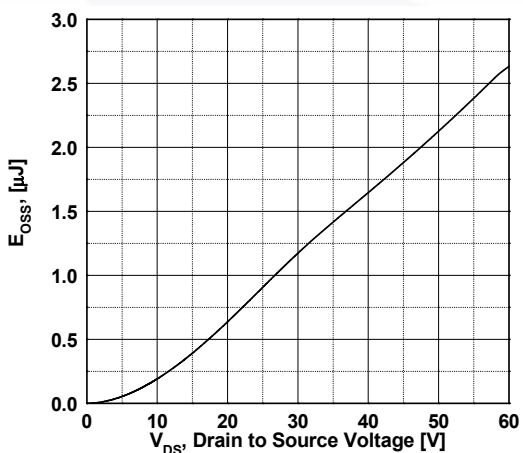
**Figure 9. Maximum Safe Operating Area**



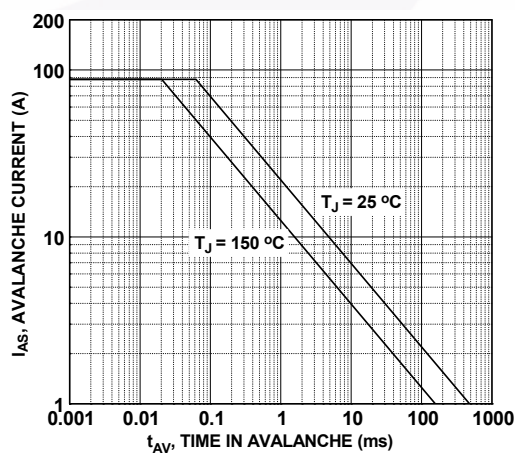
**Figure 10. Maximum Drain Current vs. Case Temperature**



**Figure 11. Eoss vs. Drain to Source Voltage**



**Figure 12. Unclamped Inductive Switching Capability**



# Typical Performance Characteristics (Continued)

Figure 13. Transient Thermal Response Curve

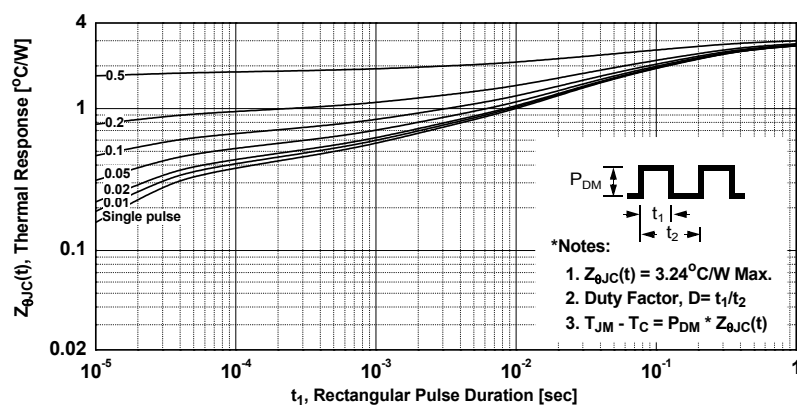




Figure 14. Gate Charge Test Circuit & Waveform



Figure 15. Resistive Switching Test Circuit & Waveforms



Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms



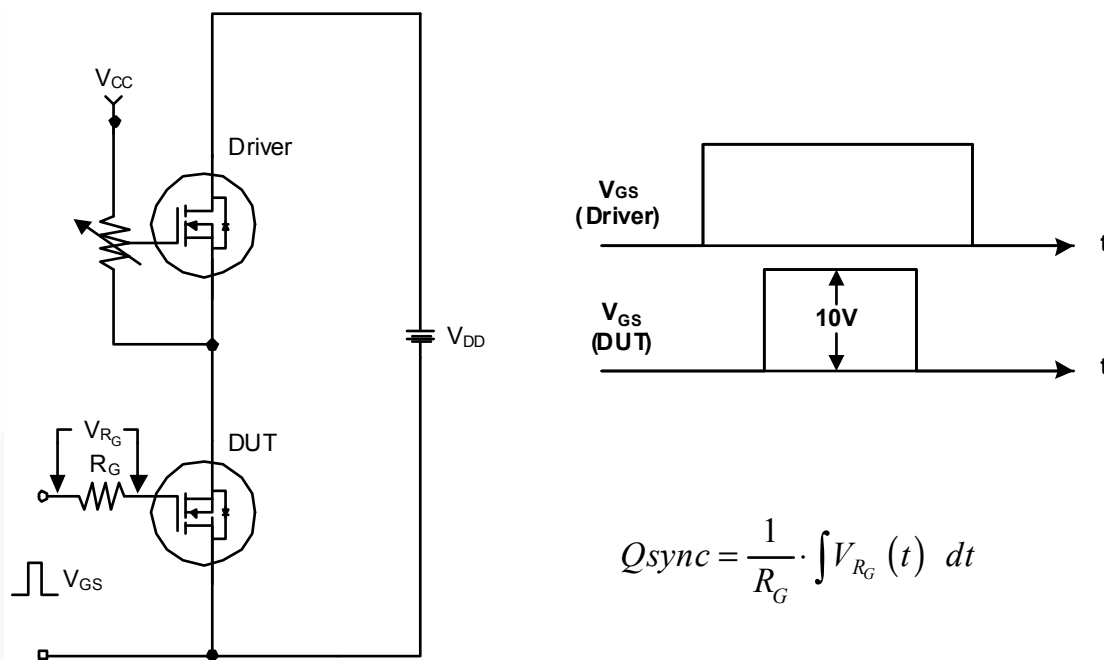
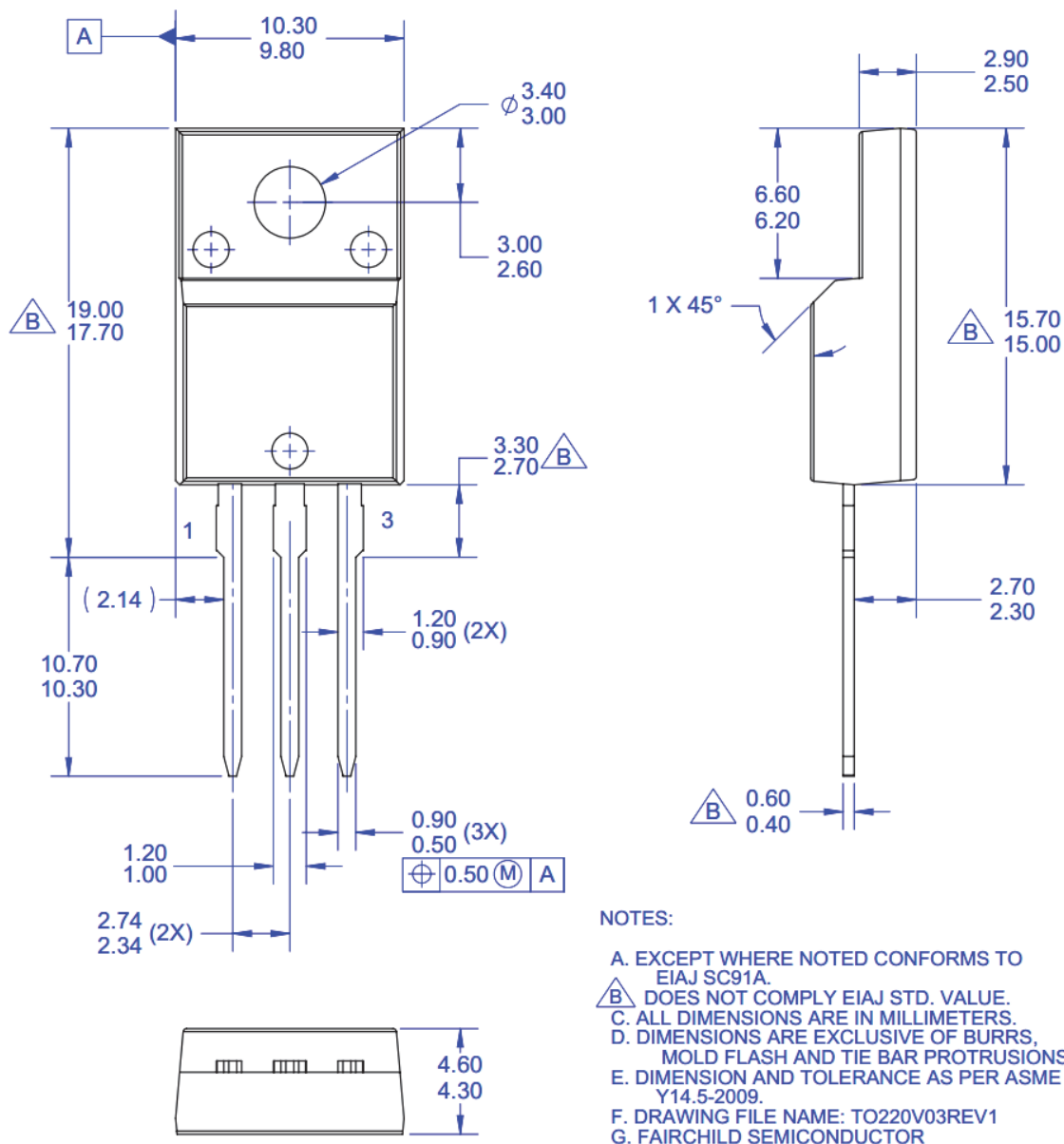


Figure 18. Total Gate Charge  $Q_{sync}$ . Test Circuit & Waveforms



# Mechanical Dimensions



**Figure 19. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Takcheong**

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|  | MicroPak™                                       |                            |  |
| Fairchild®  | MicroPak2™                                      |                            | UHC®  |
| Fairchild Semiconductor®  | MillerDrive™                                    |                            | Ultra FRFET™  |
| FACT Quiet Series™  | MotionMax™                                      |                            | UniFET™   |
| FACT®   | mWSaver®  |                            | VCX™  |
| FAST®   | OptoHiT™  |                            | VisualMax™  |
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| FETBench™   | OPTOPLANAR®                                     |                            | XS™   |
| FPS™  |   |                            |   |

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