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# FDPF680N10T

## N-Channel PowerTrench® MOSFET

100 V, 12 A, 68 mΩ

### Features

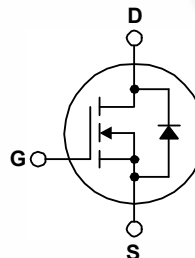
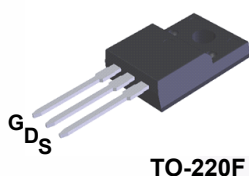
- $R_{DS(on)} = 54 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 6 \text{ A}$
- Fast Switching Speed
- Low Gate Charge
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

### Description

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

### Applications

- Consumer Appliances
- LCD/LED/PDP TV
- Synchronous Rectification
- Uninterruptible Power Supply
- Micro Solar Inverter



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

| Symbol         | Parameter                                                            | FDPF680N10T                                | 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 +150                                | $^\circ\text{C}$   |
| $T_L$          | Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds | 300                                        | $^\circ\text{C}$   |

### Thermal Characteristics

| Symbol          | Parameter                                     | FDPF680N10T | Unit               |
|-----------------|-----------------------------------------------|-------------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max.    | 5.2         | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | 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 |
|-------------|-------------|---------|----------------|-----------|------------|----------|
| FDPF680N10T | FDPF680N10T | 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         | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0\ \text{V}$ , $T_C = 25^\circ\text{C}$  | 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 | 3.5 | 4.5 | V                |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 10\ \text{V}$ , $I_D = 6\ \text{A}$  | -   | 54  | 68  | $\text{m}\Omega$ |
| $g_{FS}$     | Forward Transconductance             | $V_{DS} = 10\ \text{V}$ , $I_D = 12\ \text{A}$ | -   | 26  | -   | S                |

### Dynamic Characteristics

|              |                               |                                                                             |   |     |      |    |
|--------------|-------------------------------|-----------------------------------------------------------------------------|---|-----|------|----|
| $C_{iss}$    | Input Capacitance             | $V_{DS} = 50\ \text{V}$ , $V_{GS} = 0\ \text{V}$ ,<br>$f = 1\ \text{MHz}$   | - | 750 | 1000 | pF |
| $C_{oss}$    | Output Capacitance            |                                                                             | - | 60  | 80   | pF |
| $C_{rss}$    | Reverse Transfer Capacitance  |                                                                             | - | 25  | 40   | pF |
| $Q_{g(tot)}$ | Total Gate Charge             | $V_{DS} = 80\ \text{V}$ , $I_D = 12\ \text{A}$ ,<br>$V_{GS} = 10\ \text{V}$ | - | 13  | 17   | nC |
| $Q_{gs}$     | Gate to Source Gate Charge    |                                                                             | - | 4   | -    | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |                                                                             | - | 4   | -    | nC |

(Note 4)

### Switching Characteristics

|              |                     |                                                                                                  |   |    |    |    |
|--------------|---------------------|--------------------------------------------------------------------------------------------------|---|----|----|----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = 50\ \text{V}$ , $I_D = 12\ \text{A}$ ,<br>$V_{GS} = 10\ \text{V}$ , $R_G = 10\ \Omega$ | - | 13 | 36 | ns |
| $t_r$        | Turn-On Rise Time   |                                                                                                  | - | 19 | 48 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time |                                                                                                  | - | 18 | 46 | ns |
| $t_f$        | Turn-Off Fall Time  |                                                                                                  | - | 6  | 22 | ns |

(Note 4)

### Drain-Source Diode Characteristics

|                 |                                                          |                                                                                  |   |    |     |    |
|-----------------|----------------------------------------------------------|----------------------------------------------------------------------------------|---|----|-----|----|
| I <sub>S</sub>  | Maximum Continuous Drain to Source Diode Forward Current | -                                                                                | - | 12 | A   |    |
| I <sub>SM</sub> | Maximum Pulsed Drain to Source Diode Forward Current     | -                                                                                | - | 48 | A   |    |
| V <sub>SD</sub> | Drain to Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 12 A                                    | - | -  | 1.3 | V  |
| t <sub>rr</sub> | Reverse Recovery Time                                    | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 12 A,<br>dI <sub>F</sub> /dt = 100 A/μs | - | 29 | -   | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge                                  |                                                                                  | - | 35 | -   | nC |

#### Notes:

1. Repetitive rating; pulse-width limited by maximum junction temperature.
2.  $L = 0.7\ \text{mH}$ ,  $I_{AS} = 12\ \text{A}$ ,  $V_{DD} = 50\ \text{V}$ ,  $R_G = 25\ \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
3.  $I_{SD} \leq 12\ \text{A}$ ,  $di/dt \leq 200\ \text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
4. Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

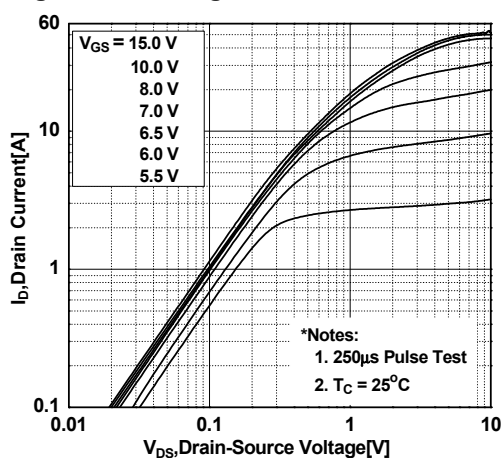


Figure 2. Transfer Characteristics

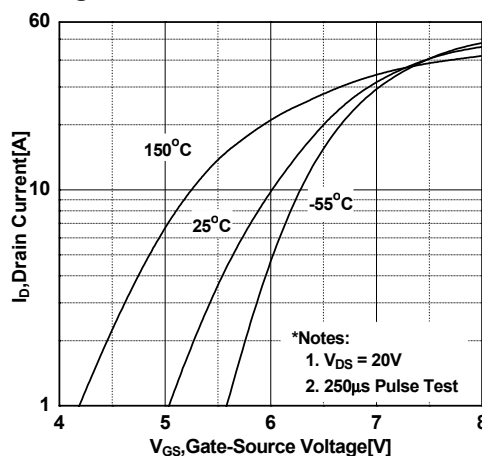


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

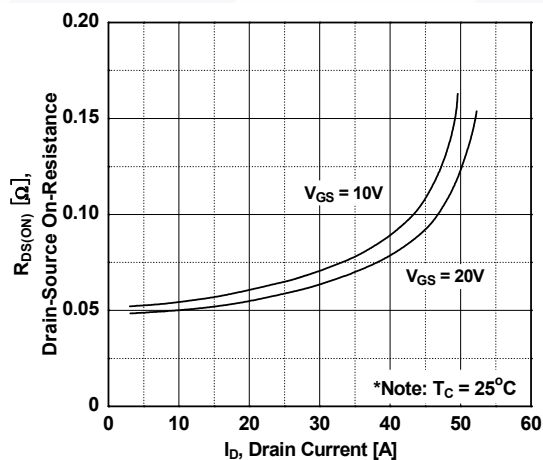


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

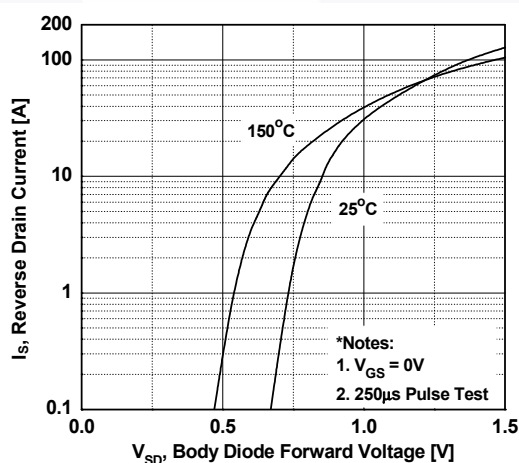


Figure 5. Capacitance Characteristics

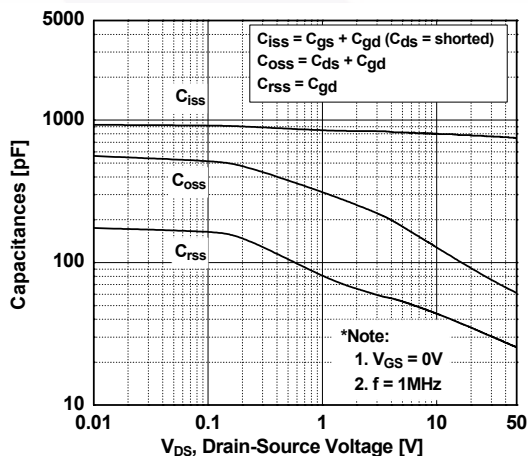
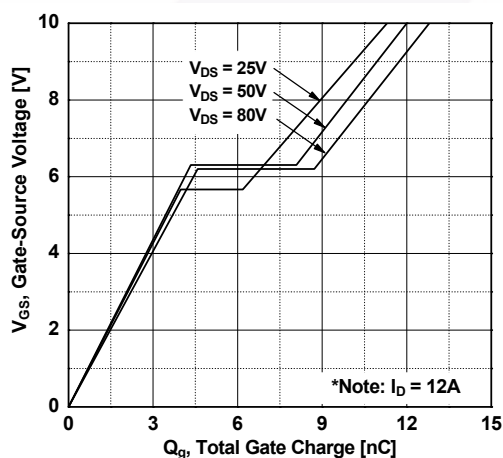
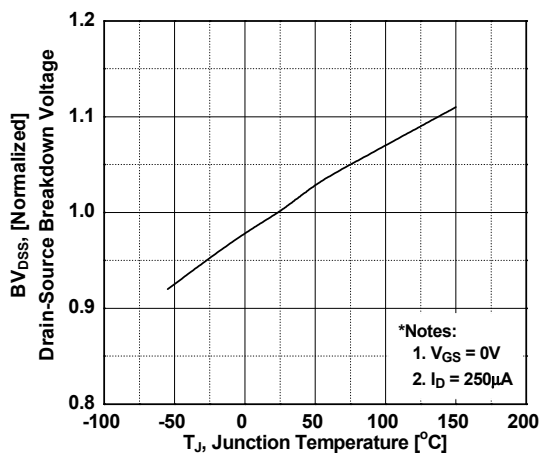


Figure 6. Gate Charge Characteristics

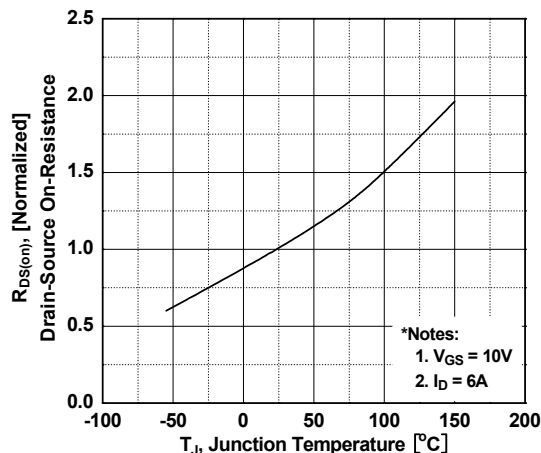


# Typical Performance Characteristics (Continued)

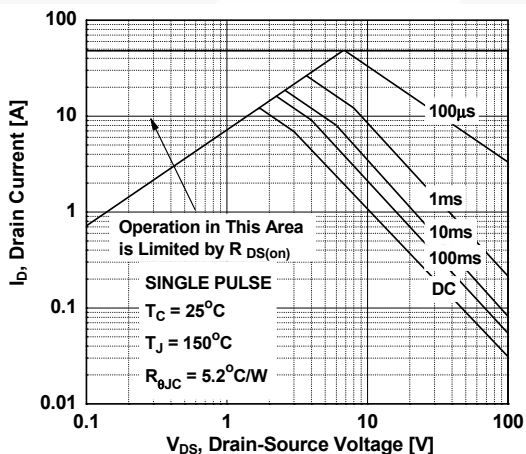
**Figure 7. Breakdown Voltage Variation vs. Temperature**



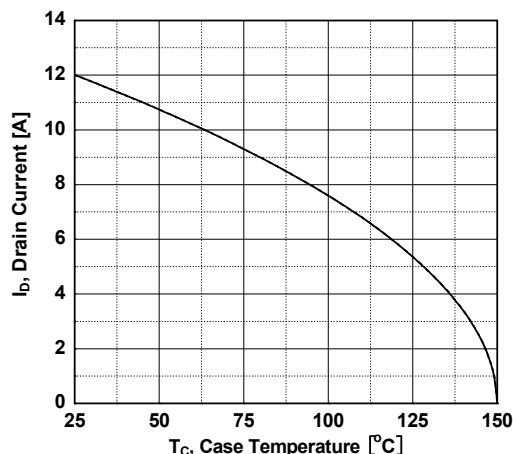
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**



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



**Figure 11. Transient Thermal Response Curve**

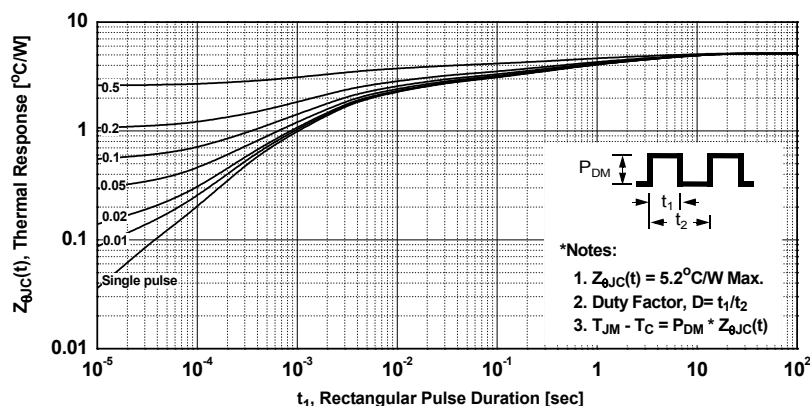




Figure 12. Gate Charge Test Circuit & Waveform



Figure 13. Resistive Switching Test Circuit & Waveforms

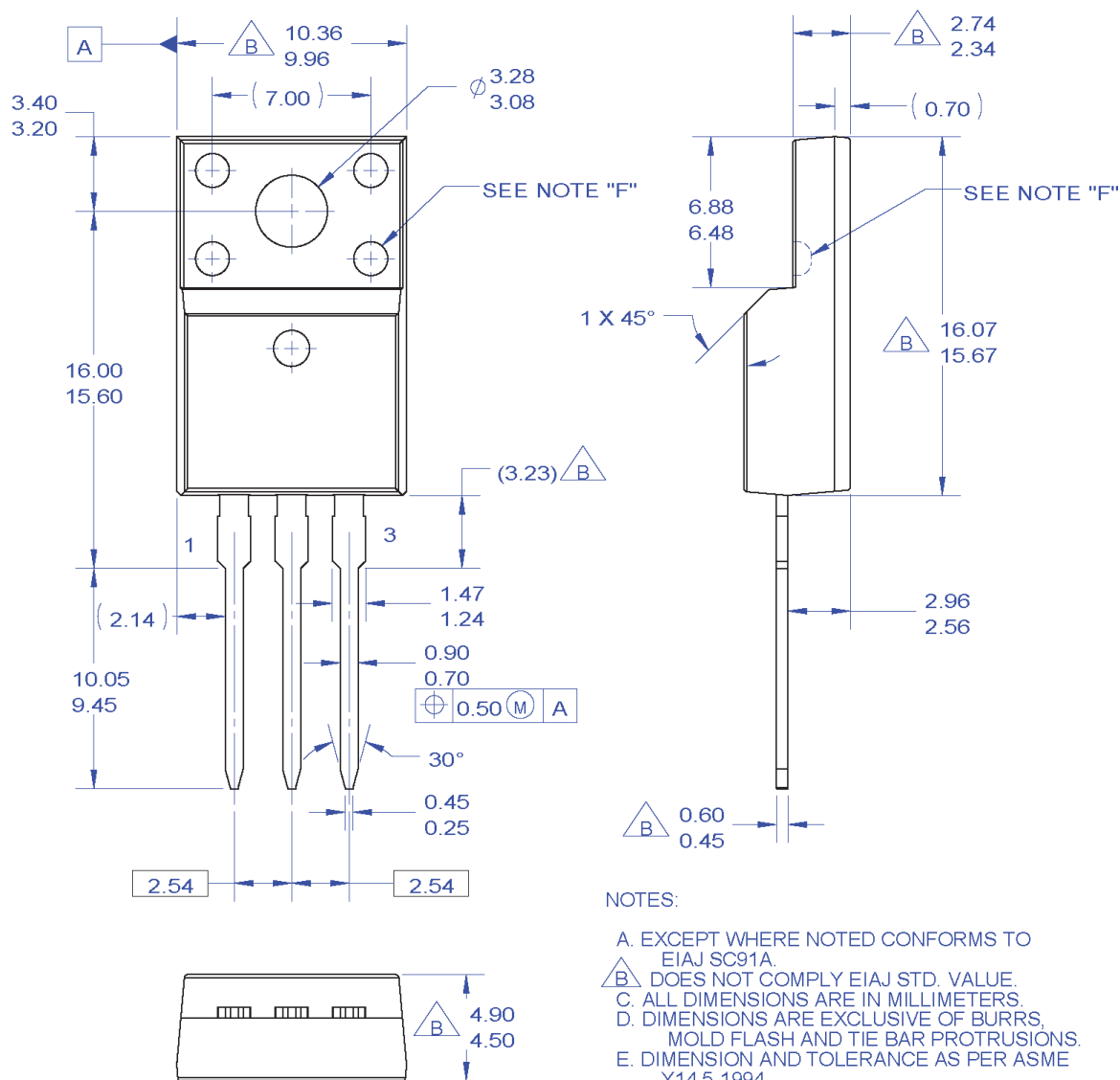


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



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

# Mechanical Dimensions



**Figure 16. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead**

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