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# FDP054N10

## N-Channel PowerTrench® MOSFET

100 V, 144 A, 5.5 mΩ

### Features

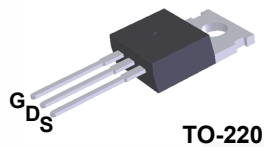
- $R_{DS(on)} = 4.6 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 75 \text{ A}$
- Fast Switching Speed
- Low Gate Charge
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- High Power and Current Handling Capability
- RoHS Compliant

### Description

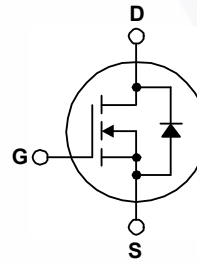
This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process that has been tailored to minimize the on-state resistance while maintaining superior switching performance.

### Applications

- Synchronous Rectification for ATX / Server / Telecom PSU
- Battery Protection Circuit
- Motor Drives and Uninterruptible Power Supplies
- Micro Solar Inverter



TO-220



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

| Symbol         | Parameter  | FDP054N10   | Unit             |
|----------------|--|---|------------------|
| $V_{DSS}$      | Drain to Source Voltage  | 100   | V                |
| $V_{GSS}$      | Gate to Source Voltage   | $\pm 20$  | V                |
| $I_D$          | Drain Current  | - Continuous ( $T_C = 25^\circ\text{C}$ , Silicon Limited)  | 144              |
|                |  | - Continuous ( $T_C = 100^\circ\text{C}$ , Silicon Limited) | 102              |
|                |  | - Continuous ( $T_C = 25^\circ\text{C}$ , Package Limited)  | 120              |
| $I_{DM}$       | Drain Current  | - Pulsed (Note 1)   | 576              |
| $E_{AS}$       | Single Pulsed Avalanche Energy                                       | (Note 2)  | 1153             |
| $dv/dt$        | Peak Diode Avalanche Energy  | (Note 3)  | 6                |
| $P_D$          | Power Dissipation  | ( $T_C = 25^\circ\text{C}$ )                                | 263              |
|                |  | - Derate Above $25^\circ\text{C}$                           | 1.75             |
| $T_J, T_{STG}$ | 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                                     | FDP054N10 | Unit                      |
|-----------------|---|-----------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max.    | 0.57      | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | 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 |
|-------------|-----------|---------|----------------|-----------|------------|----------|
| FDP054N10   | FDP054N10 | 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 $25^\circ\text{C}$                    | -   | 0.01 | -         | $\text{V}/^\circ\text{C}$ |
| $I_{DSS}$                      | 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 | $V_{GS} = 10 \text{ V}$ , $I_D = 75 \text{ A}$ | -   | 4.6 | 5.5 | $\text{m}\Omega$ |
| $g_{FS}$     | Forward Transconductance             | $V_{GS} = 10 \text{ V}$ , $I_D = 75 \text{ A}$ | -   | 192 | -   | S                |

### Dynamic Characteristics

|                   |                               |   |          |      |       |    |
|-------------------|-------------------------------|---|----------|------|-------|----|
| $C_{iss}$         | Input Capacitance             | $V_{DS} = 25 \text{ V}$ , $V_{GS} = 0 \text{ V}$ ,<br>$f = 1 \text{ MHz}$   | -        | 9985 | 13280 | pF |
| $C_{oss}$         | Output Capacitance            |   | -        | 935  | 1245  | pF |
| $C_{rss}$         | Reverse Transfer Capacitance  |   | -        | 390  | 585   | pF |
| $Q_g(\text{tot})$ | Total Gate Charge at 10V      | $V_{DS} = 80 \text{ V}$ , $I_D = 75 \text{ A}$ ,<br>$V_{GS} = 10 \text{ V}$ | -        | 156  | 203   | nC |
| $Q_{gs}$          | Gate to Source Gate Charge    |   | -        | 53   | -     | nC |
| $Q_{gd}$          | Gate to Drain "Miller" Charge |   | (Note 4) | -    | 48    | -  |

### Switching Characteristics

|              |                     |  |          |    |     |    |
|--------------|---------------------|--|----------|----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = 50 \text{ V}$ , $I_D = 75 \text{ A}$ ,<br>$V_{GS} = 10 \text{ V}$ , $R_G = 4.7 \Omega$ | -        | 44 | 98  | ns |
| $t_r$        | Turn-On Rise Time   |  | -        | 92 | 194 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time |  | -        | 80 | 170 | ns |
| $t_f$        | Turn-Off Fall Time  |  | (Note 4) | -  | 39  | 88 |

### Drain-Source Diode Characteristics

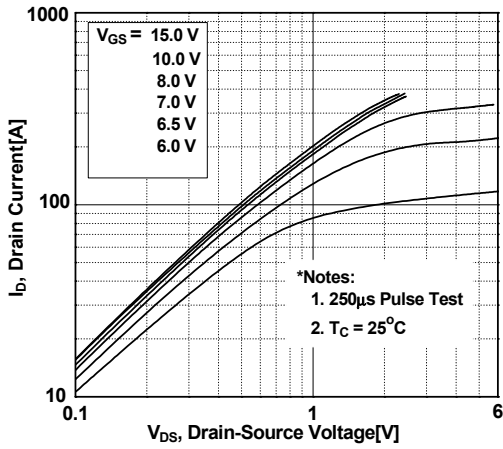
|          |  |  |   |     |     |    |
|----------|--|--|---|-----|-----|----|
| $I_S$    | Maximum Continuous Drain to Source Diode Forward Current | -  | - | 144 | A   |    |
| $I_{SM}$ | Maximum Pulsed Drain to Source Diode Forward Current     | -  | - | 576 | A   |    |
| $V_{SD}$ | Drain to Source Diode Forward Voltage                    | $V_{GS} = 0 \text{ V}$ , $I_{SD} = 75 \text{ A}$   | - | -   | 1.3 | V  |
| $t_{rr}$ | Reverse Recovery Time                                    | $V_{GS} = 0 \text{ V}$ , $I_{SD} = 75 \text{ A}$ , | - | 57  | -   | ns |
| $Q_{rr}$ | Reverse Recovery Charge                                  | $di_F/dt = 100 \text{ A}/\mu\text{s}$              | - | 121 | -   | nC |

#### Notes:

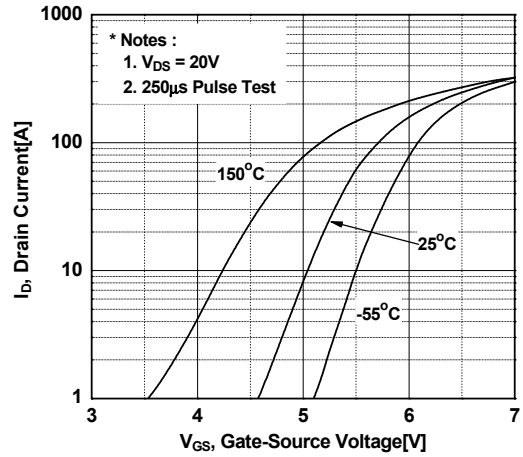
- 1: Repetitive rating; pulse-width limited by maximum junction temperature.
- 2:  $L = 0.41 \text{ mH}$ ,  $I_{AS} = 75 \text{ A}$ ,  $V_{DD} = 50 \text{ V}$ ,  $R_G = 25 \Omega$ , starting  $T_J = 25^\circ\text{C}$ .
- 3:  $I_{SD} \leq 75 \text{ A}$ ,  $di/dt \leq 200 \text{ A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
- 4: Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

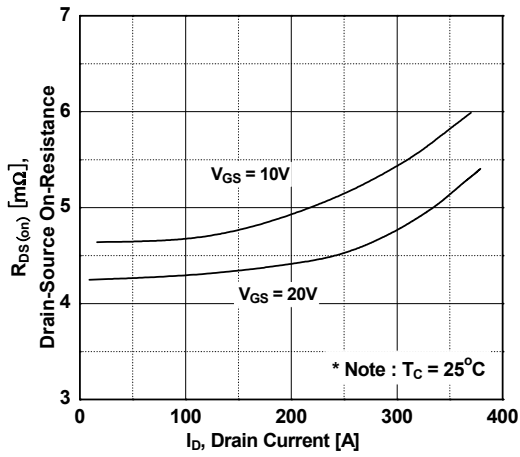
**Figure 1. On-Region Characteristics**



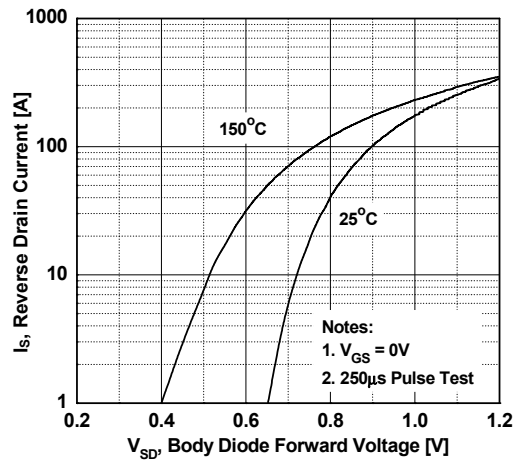
**Figure 2. Transfer Characteristics**



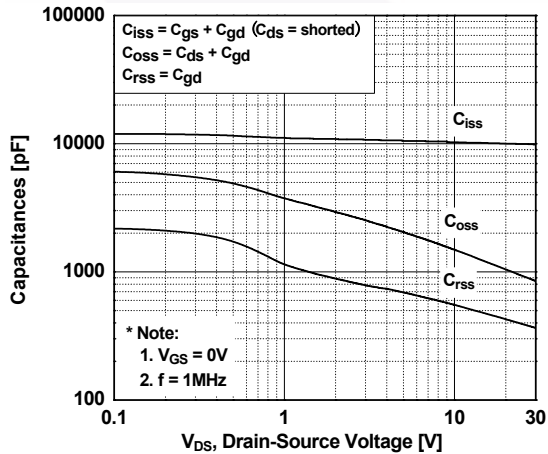
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



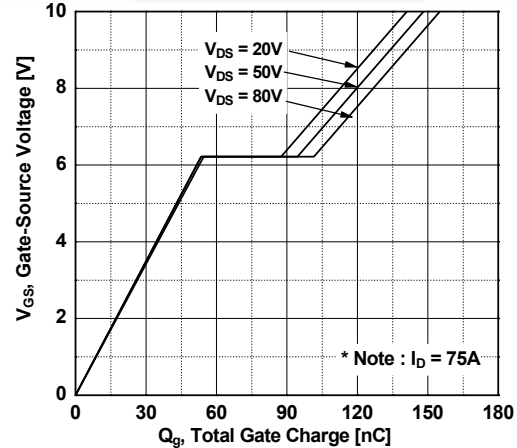
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

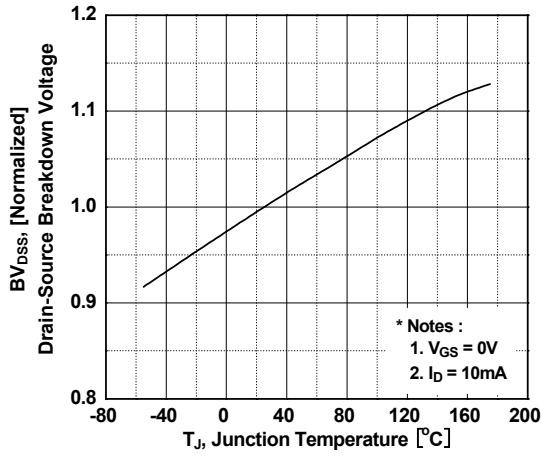


**Figure 6. Gate Charge Characteristics**

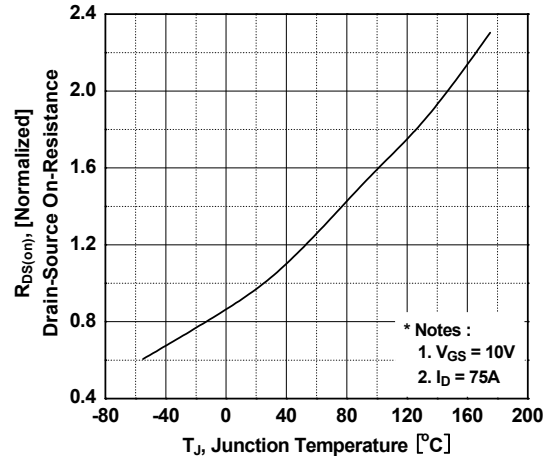


## Typical Performance Characteristics (Continued)

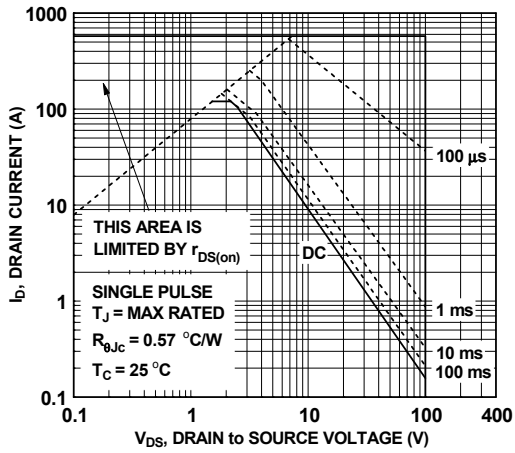
**Figure 7. Breakdown Voltage Variation vs. Temperature**



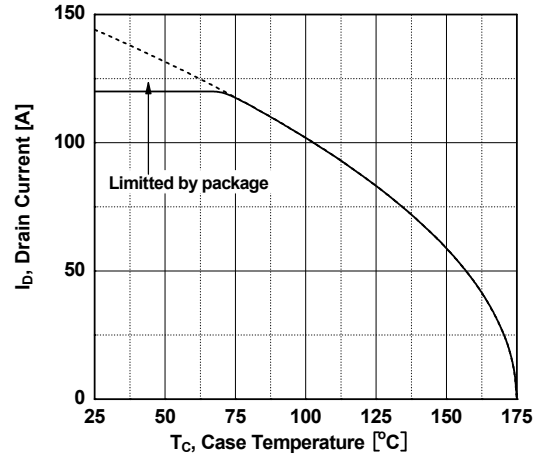
**Figure 8. On-Resistance Variation vs. Temperature**



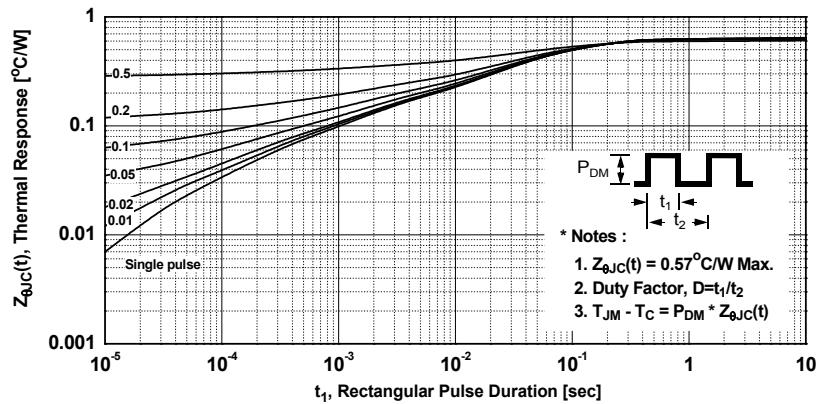
**Figure 9. Maximum Safe Operating Area**



**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



### NOTES:

- A) CONFORMS TO JEDEC TO-220 VARIATION AB EXCEPT WHERE NOTED
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- D) DRAWING FILE/REVISION: MKT-TO220Y03REV1

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

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| <b>F</b> ®               | MicroPak™                                       |                            | <b>µ</b> SerDes™ |
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