

FDS4141

P-Channel PowerTrench® MOSFET

-40V, -10.8A, 13.0mΩ

Features

- Max $r_{DS(on)}$ = 13.0mΩ at $V_{GS} = -10V$, $I_D = -10.5A$
- Max $r_{DS(on)}$ = 19.0mΩ at $V_{GS} = -4.5V$, $I_D = -8.4A$
- High performance trench technology for extremely low $r_{DS(on)}$
- RoHS Compliant

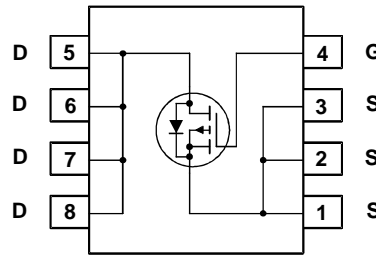
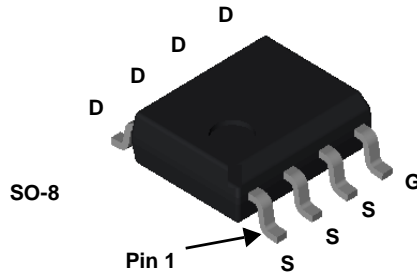


General Description

This P-Channel MOSFET has been produced using Fairchild Semiconductor's proprietary PowerTrench® technology to deliver low $r_{DS(on)}$ and optimized BV_{DSS} capability to offer superior performance benefit in the applications and optimized switching performance capability reducing power dissipation losses in converter/inverter applications.

Applications

- Control switch in synchronous & non-synchronous buck
- Load switch
- Inverter



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

| Symbol | Parameter | Ratings | Units |
|----------------|--|-------------|------------------|
| V_{DS} | Drain to Source Voltage | -40 | V |
| V_{GS} | Gate to Source Voltage | ± 20 | V |
| I_D | Drain Current -Continuous | -10.8 | A |
| | -Pulsed | -36 | |
| E_{AS} | Single Pulse Avalanche Energy (Note 3) | 294 | mJ |
| P_D | Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a) | 5 | W |
| | Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1b) | 2.5 | |
| T_J, T_{STG} | Operating and Storage Junction Temperature Range | -55 to +150 | $^\circ\text{C}$ |

Thermal Characteristics

| | | | |
|-----------------|---|----|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case (Note 1) | 25 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 50 | |

Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|----------------|---------|---------|-----------|------------|-----------|
| FDS4141 | FDS4141 | SO-8 | 13" | 12mm | 2500units |

Electrical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

Off Characteristics

| | | | | | | |
|--------------------------------------|---|--|-----|-----|-----------|----------------------------|
| BV_{DSS} | Drain to Source Breakdown Voltage | $I_D = -250\mu\text{A}, V_{GS} = 0\text{V}$ | -40 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = -250\mu\text{A}$, referenced to 25°C | | -33 | | $\text{mV}/^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = -32\text{V}$, | | | -1 | μA |
| I_{GSS} | Gate to Source Leakage Current | $V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$ | | | ± 100 | nA |

On Characteristics

| | | | | | | |
|--|--|--|------|------|------|----------------------------|
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS} = V_{DS}, I_D = -250\mu\text{A}$ | -1.0 | -1.6 | -3.0 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = -250\mu\text{A}$, referenced to 25°C | | 5.3 | | $\text{mV}/^\circ\text{C}$ |
| $r_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = -10\text{V}, I_D = -10.5\text{A}$ | | 11.0 | 13.0 | m Ω |
| | | $V_{GS} = -4.5\text{V}, I_D = -8.4\text{A}$ | | 15.2 | 19.0 | |
| | | $V_{GS} = -10\text{V}, I_D = -10.5\text{A}, T_J = 125^\circ\text{C}$ | | 16.8 | 19.9 | |
| g_{FS} | Forward Transconductance | $V_{DD} = -5\text{V}, I_D = -10.5\text{A}$ | | 37 | | S |

Dynamic Characteristics

| | | | | | | |
|------------|------------------------------|--|-------------------|------|------|----|
| C_{iss} | Input Capacitance | $V_{DS} = -20\text{V}, V_{GS} = 0\text{V},$ $f = 1\text{MHz}$ | | 2005 | 2670 | pF |
| C_{oss} | Output Capacitance | | | 355 | 475 | pF |
| C_{riss} | Reverse Transfer Capacitance | | | 190 | 285 | pF |
| R_g | Gate Resistance | | $f = 1\text{MHz}$ | | 5 | |

Switching Characteristics

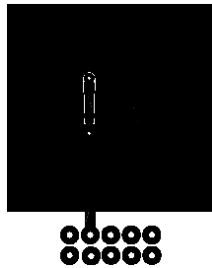
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|--------------|-------------------------------|---|--------------------------------------|--|----|----|----|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = -20\text{V}, I_D = -10.5\text{A},$ $V_{GS} = -10\text{V}, R_{GEN} = 6\Omega$ | | 10 | 20 | ns | |
| t_r | Rise Time | | | 5 | 10 | ns | |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 42 | 68 | ns | |
| t_f | Fall Time | | | 12 | 22 | ns | |
| Q_g | Total Gate Charge | | $V_{GS} = 0\text{V to } -10\text{V}$ | | 35 | 49 | nC |
| Q_g | Total Gate Charge | | $V_{GS} = 0\text{V to } -5\text{V}$ | $V_{DD} = -20\text{V},$ $I_D = -10.5\text{A}$ | 19 | 27 | nC |
| Q_{gs} | Gate to Source Charge | | | 6 | | nC | |
| Q_{gd} | Gate to Drain "Miller" Charge | | | 7 | | nC | |

Drain-Source Diode Characteristics

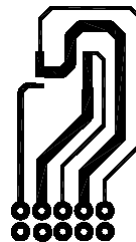
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|----------|---------------------------------------|--|--|------|------|----|
| V_{SD} | Source to Drain Diode Forward Voltage | $V_{GS} = 0\text{V}, I_S = -10.5\text{A}$ (Note 2) | | -0.8 | -1.3 | V |
| | | $V_{GS} = 0\text{V}, I_S = -2.1\text{A}$ (Note 2) | | -0.7 | -1.2 | |
| t_{rr} | Reverse Recovery Time | $I_F = -10.5\text{A}, di/dt = 100\text{A}/\mu\text{s}$ | | 26 | 42 | ns |
| Q_{rr} | Reverse Recovery Charge | | | 14 | 26 | nC |

NOTES:

1. $R_{\theta JA}$ is determined with the device mounted on a 1in^2 pad 2 oz copper pad on a $1.5 \times 1.5\text{in.}$ board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a) $50^\circ\text{C}/\text{W}$ when mounted on a 1in^2 pad of 2 oz copper.



b) $125^\circ\text{C}/\text{W}$ when mounted on a minimum pad.

2. Pulse Test: Pulse Width $< 300\mu\text{s}$, Duty cycle $< 2.0\%$.

3. UIL condition: Starting $T_J = 25^\circ\text{C}$, $L = 3\text{mH}$, $I_{AS} = -14\text{A}$, $V_{DD} = -40\text{V}$, $V_{GS} = -10\text{V}$.

Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

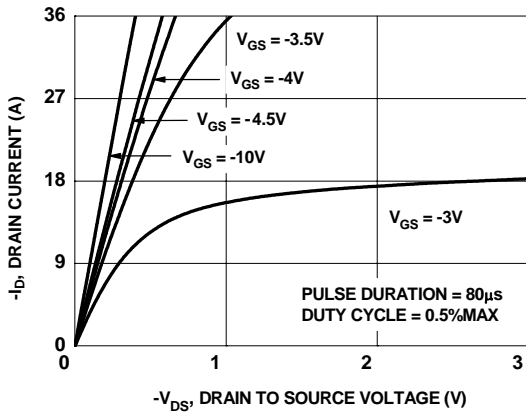


Figure 1. On-Region Characteristics

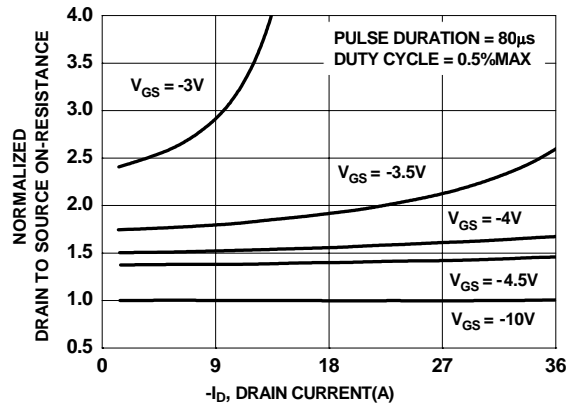


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

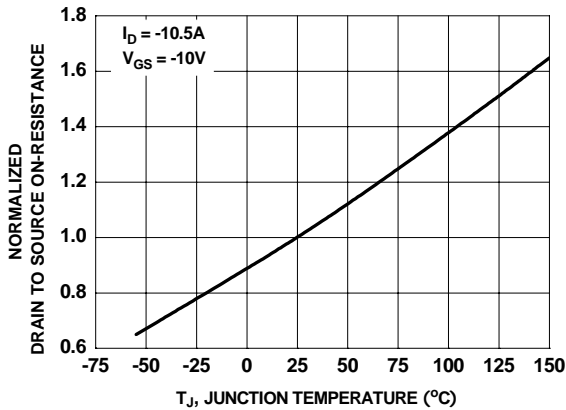


Figure 3. Normalized On-Resistance vs Junction Temperature

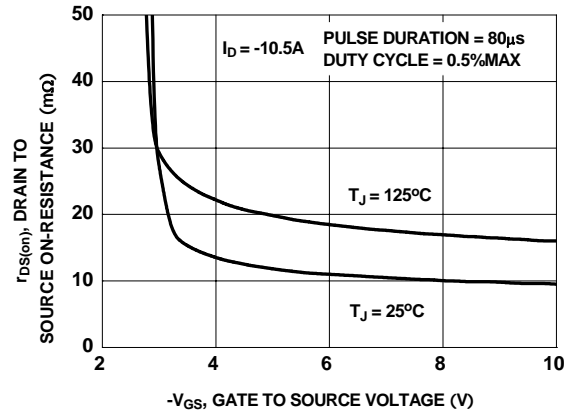


Figure 4. On-Resistance vs Gate to Source Voltage

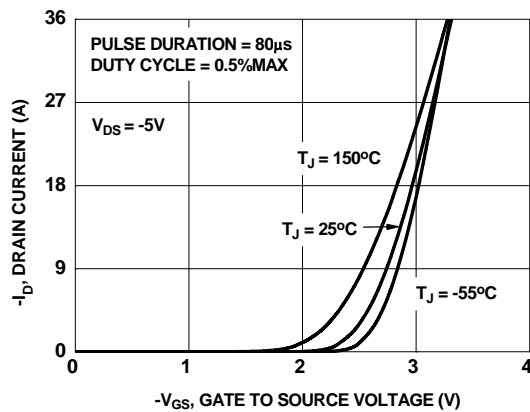


Figure 5. Transfer Characteristics

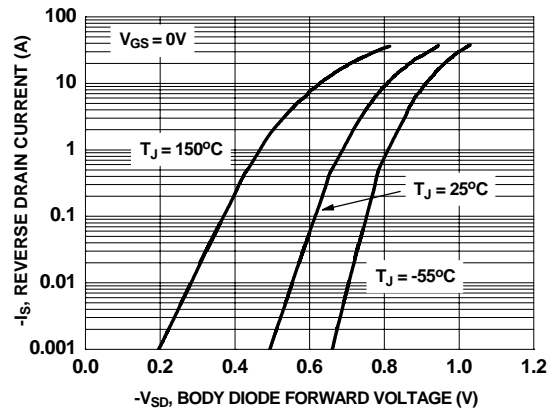


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

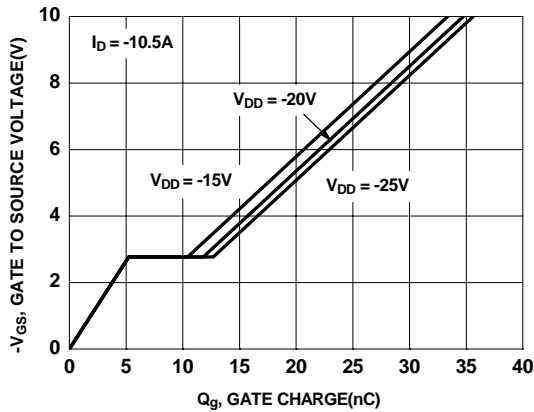


Figure 7. Gate Charge Characteristics

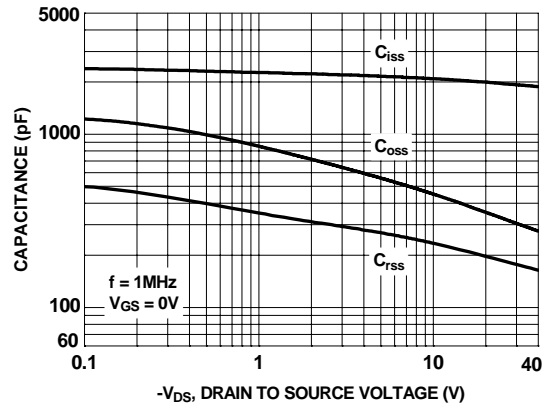


Figure 8. Capacitance vs Drain to Source Voltage

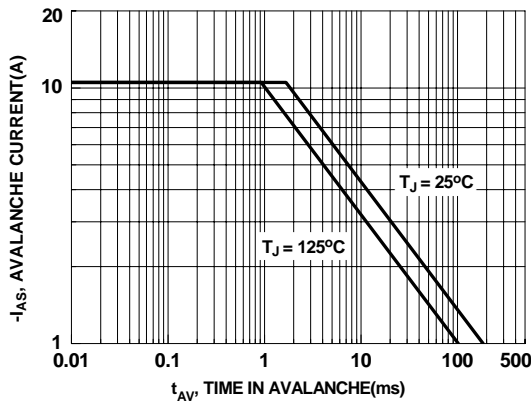


Figure 9. Unclamped Inductive Switching Capability

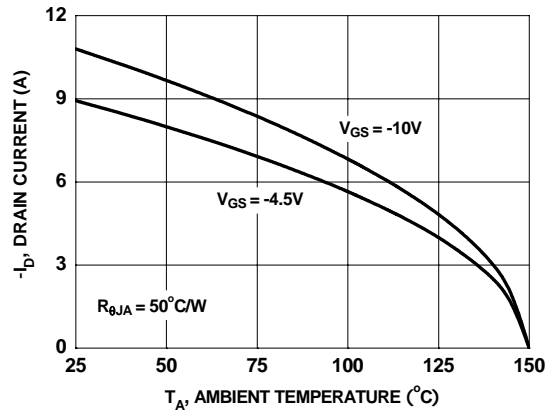


Figure 10. Maximum Continuous Drain Current vs Ambient Temperature

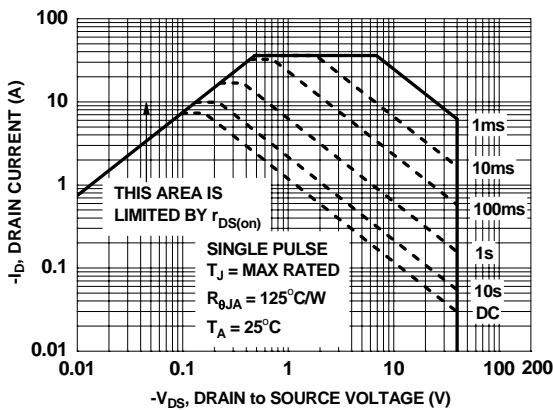


Figure 11. Forward Bias Safe Operating Area

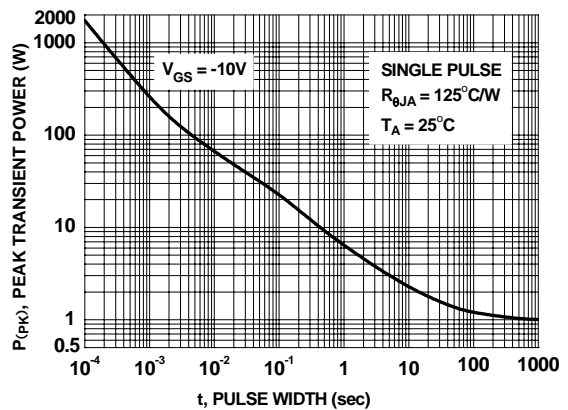


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

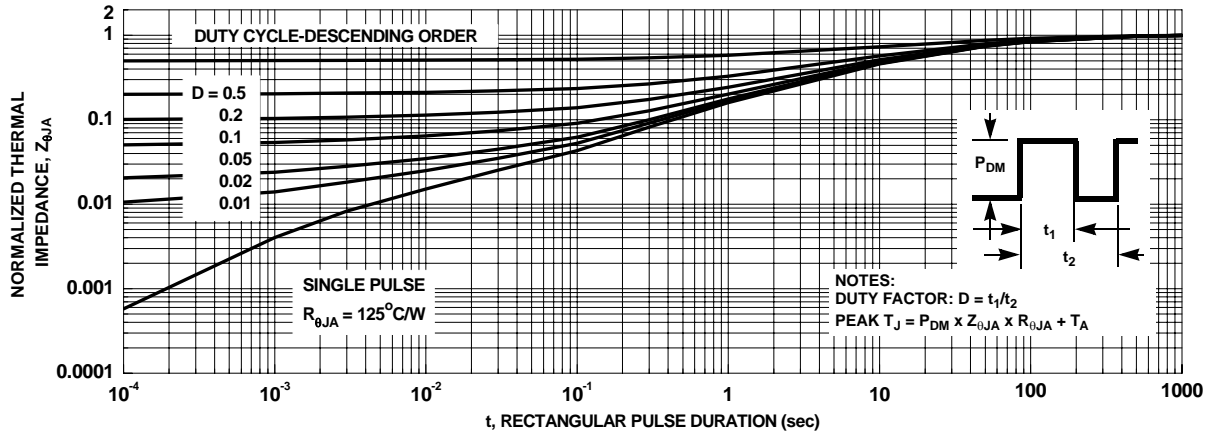


Figure 13. Transient Thermal Response Curve



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