ON Semiconductor®

# FDN5630

## 60V N-Channel PowerTrench® MOSFET

### General Description

This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers.

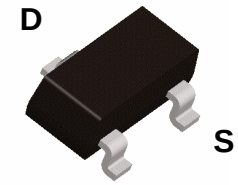
This MOSFET features very low $R_{DS(ON)}$ in a small SOT23 footprint. ON Semiconductor's PowerTrench technology provides faster switching than other MOSFETs with comparable $R_{DS(ON)}$ specifications. The result is higher overall efficiency with less board space.

### Features

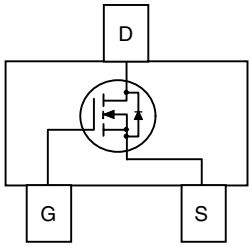
- 1.7 A, 60 V. $R_{DS(ON)}$ = 0.100 Ω @ $V_{GS}$ = 10 V
  $R_{DS(ON)}$ = 0.120 Ω @ $V_{GS}$ = 6 V.
- Optimized for use in high frequency DC/DC converters.
- Low gate charge.
- Very fast switching.
- SuperSOT™ - 3 provides low $R_{DS(ON)}$ in SOT23 footprint.

### Applications

- DC/DC converter
- Motor drives




SuperSOT™-3




## Absolute Maximum Ratings $T_A$ = 25 C unless otherwise noted

| Symbol | Parameter | | Ratings | Units |
|---|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | | 60 | V |
| $V_{GSS}$ | Gate-Source Voltage | | ±20 | V |
| $I_D$ | Drain Current - Continuous | (Note 1a) | 1.7 | A |
| | - Pulsed | | 10 | |
| $P_D$ | Power Dissipation for Single Operation | (Note 1a) | 0.5 | W |
| | | (Note 1b) | 0.46 | |
| $T_J$, $T_{stg}$ | Operating and Storage Junction Temperature Range | | -55 to +150 | °C |

## Thermal Characteristics

| | | | | |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | (Note 1a) | 250 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case | (Note 1) | 75 | °C/W |

## Package Marking and Ordering Information

| Device Marking | Device | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|
| 5630 | FDN5630 | 7 | 8mm | 3000 units |

## Electrical Characteristics

$T_A$ = 25 C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_D$ = 250 µA | 60 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 µA,Referenced to 25°C | | 63 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 48 V, $V_{GS}$ = 0 V | | | 1 | µA |
| $I_{GSSF}$ | Gate-Body Leakage Current, Forward | $V_{GS}$ = 20 V, $V_{DS}$ = 0 V | | | 100 | nA |
| $I_{GSSR}$ | Gate-Body Leakage Current, Reverse | $V_{GS}$ = -20 V, $V_{DS}$ = 0 V | | | -100 | nA |
| **On Characteristics** (Note 2) | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 1 | 2.4 | 3 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D$ = 250 µA,Referenced to 25°C | | -6.9 | | mV/°C |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$ = 10 V, $I_D$ = 1.7 A<br>$V_{GS}$ = 10 V, $I_D$ = 1.7 A, $T_J$ = 125°C<br>$V_{GS}$ = 6 V, $I_D$ = 1.6 A | | 0.073<br>0.127<br>0.083 | 0.100<br>0.180<br>0.120 | Ω |
| $I_{D(on)}$ | On-State Drain Current | $V_{GS}$ = 10 V, $V_{DS}$ = 1.7 V | 5 | | | A |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 10 V, $I_D$ = 1.7 A | | 6 | | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 15 V, $V_{GS}$ = 0 V, f = 1.0 MHz | | 400 | 560 | pF |
| $C_{oss}$ | Output Capacitance | | | 65 | 95 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 27 | 40 | pF |
| **Switching Characteristics** (Note 2) | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = 30 V, $I_D$ = 1 A, $V_{GS}$ = 10 V, $R_{GEN}$ = 6 Ω | | 10 | 20 | ns |
| $t_r$ | Turn-On Rise Time | | | 6 | 15 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 15 | 28 | ns |
| $t_f$ | Turn-Off Fall Time | | | 5 | 15 | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = 20 V, $I_D$ = 1.7 A, $V_{GS}$ = 10 V, | | 7 | 10 | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 1.6 | | nC |
| $Q_{gd}$ | Gate-Drain Charge | | | 1.2 | | nC |
| **Drain-Source Diode Characteristics and Maximum Ratings** | | | | | | |
| $I_S$ | Maximum Continuous Drain-Source Diode Forward Current | | | | 0.42 | A |
| $V_{SD}$ | Drain-Source Diode Forward Voltage | $V_{GS}$ = 0 V, $I_S$ = 0.42 A (Note 2) | | 0.72 | 1.2 | V |

**Notes:**

**1:** $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design.

a) 250°C/W when mounted on a 0.02 $in^2$ Pad of 2 oz. Cu.

b) 270°C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

**2:** Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%

## Typical Characteristics

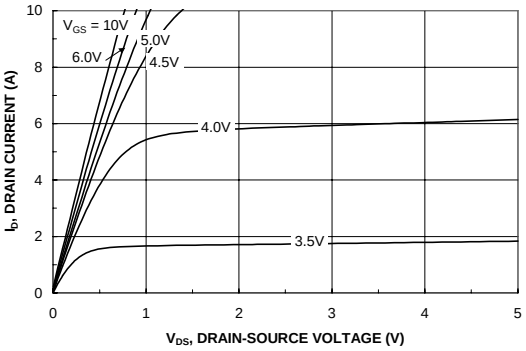



Figure 1. On-Region Characteristics.

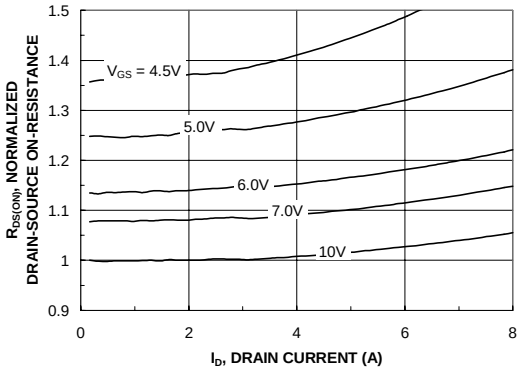



Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

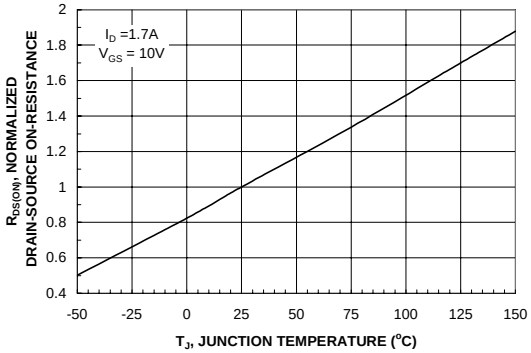



Figure 3. On-Resistance Variation with Temperature.

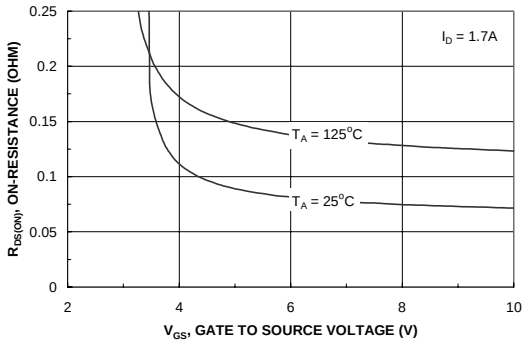



Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

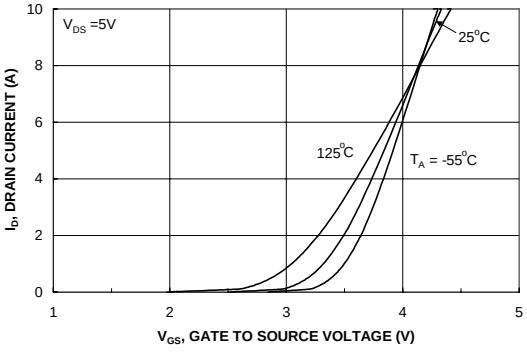



Figure 5. Transfer Characteristics.

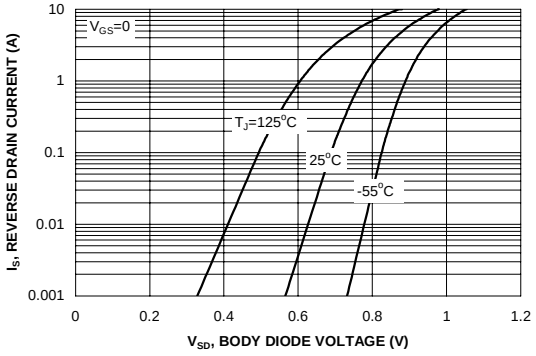



Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Characteristics (continued)

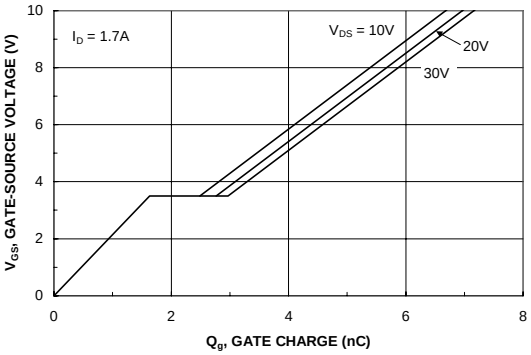



**Figure 7. Gate Charge Characteristics.**

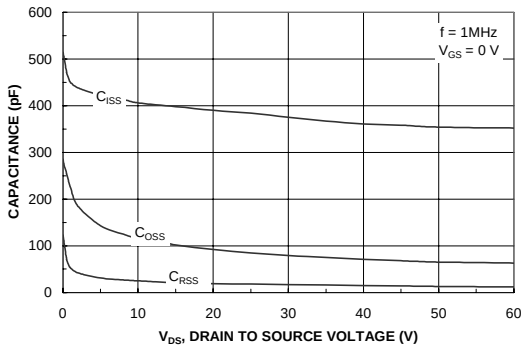



**Figure 8. Capacitance Characteristics.**

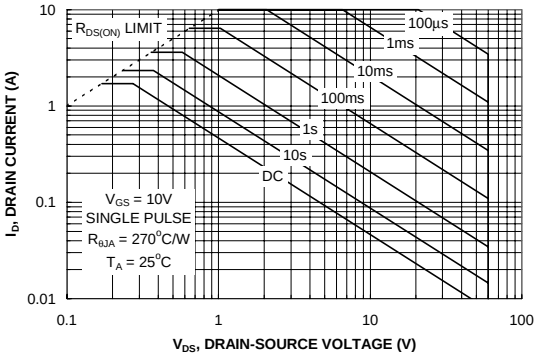



**Figure 9. Maximum Safe Operating Area.**

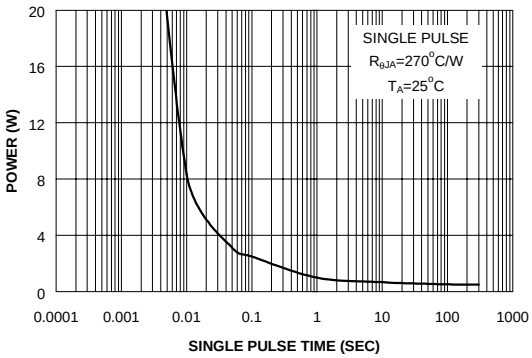



**Figure 10. Single Pulse Maximum Power Dissipation.**

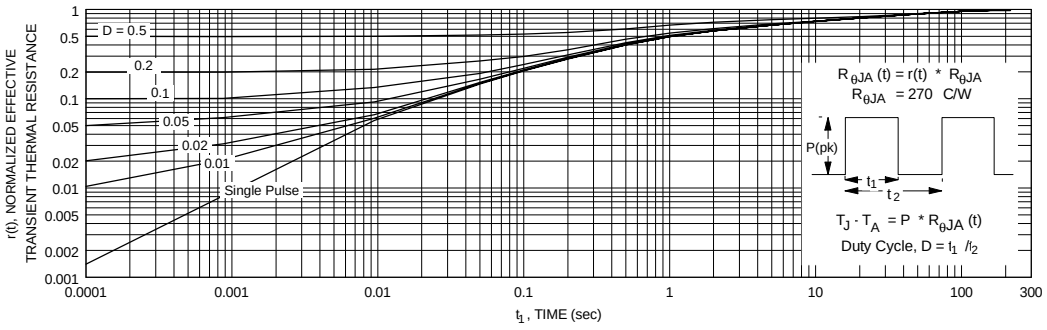



**Figure 11. Transient Thermal Response Curve.**

Thermal characterization performed using the conditions described in Note 1b.
Transient themal response will change depending on the circuit board design.