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ON Semiconductor®

# FDS6298

## 30V N-Channel Fast Switching 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. It has been optimized for low gate charge, low  $R_{DS(ON)}$  and fast switching speed.

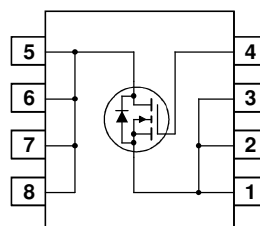
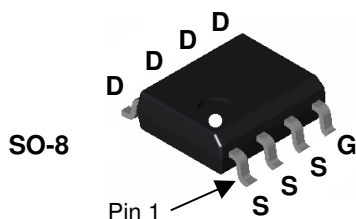
### Applications

- Control Switch for DC-DC Buck converters
- Notebook Vcore
- Telecom / Networking Point of Load



### Features

- 13 A, 30 V.  $R_{DS(ON)} = 9\text{ m}\Omega @ V_{GS} = 10\text{ V}$   
 $R_{DS(ON)} = 12\text{ m}\Omega @ V_{GS} = 4.5\text{ V}$
- Low gate charge (10nC @  $V_{GS}=5\text{V}$ )
- Very low Miller Charge (3nC)
- Low  $R_g$  (1 Ohm)
- ROHS Compliant



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

| Symbol         | Parameter  | Ratings         | Units            |
|----------------|--|-----------------|------------------|
| $V_{DSS}$      | Drain-Source Voltage                             | 30              | V                |
| $V_{GSS}$      | Gate-Source Voltage                              | $\pm 20$        | V                |
| $I_D$          | Drain Current – Continuous (Note 1a)             | 13              | A                |
|                | – Pulsed   | 50              |                  |
| $P_D$          | Power Dissipation for Single Operation (Note 1a) | 3.0             | W                |
|                | Power Dissipation for Single Operation (Note 1b) | 1.2             |                  |
| $E_{AS}$       | Single Pulse Avalanche Energy (Note 3)           | 181             | mJ               |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range | $-55$ to $+150$ | $^\circ\text{C}$ |

### Thermal Characteristics

|                 |   |     |                    |
|-----------------|---|-----|--------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1a) | 50  | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1b) | 125 | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case (Note 1)     | 25  | $^\circ\text{C/W}$ |

### Package Marking and Ordering Information

| Device Marking | Device  | Reel Size | Tape width | Quantity   |
|----------------|---------|-----------|------------|------------|
| FDS6298        | FDS6298 | 13"       | 12mm       | 2500 units |

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

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

**Off Characteristics**

|                                     |   |   |    |    |           |                      |
|-------------------------------------|---|---|----|----|-----------|----------------------|
| $BV_{DS}$                           | Drain–Source Breakdown Voltage            | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$               | 30 | -  | -         | V                    |
| $\frac{\Delta BV_{DS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$ | -  | 30 | -         | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                           | Zero Gate Voltage Drain Current           | $V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$                       | -  | -  | 1         | $\mu\text{A}$        |
| $I_{GSS}$                           | Gate–Body Leakage                         | $V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$                   | -  | -  | $\pm 100$ | nA                   |

**On Characteristics (Note 2)**

|  |  |   |   |                  |               |                      |
|--|--|---|---|------------------|---------------|----------------------|
| $V_{GS(th)}$                           | Gate Threshold Voltage                         | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$   | 1 | 1.7              | 3             | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$   | - | -5               | -             | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$                           | Static Drain–Source On–Resistance              | $V_{GS} = 10\text{ V}, I_D = 13\text{ A}$<br>$V_{GS} = 4.5\text{ V}, I_D = 12\text{ A}$<br>$V_{GS} = 10\text{ V}, I_D = 13\text{ A}, T_J = 125^\circ\text{C}$ | - | 7.4<br>9.4<br>11 | 9<br>12<br>15 | m $\Omega$           |
| $g_{FS}$                               | Forward Transconductance                       | $V_{DS} = 10\text{ V}, I_D = 13\text{ A}$   | - | 58               | -             | S                    |

**Dynamic Characteristics**

|           |                              |  |     |      |     |          |
|-----------|------------------------------|--|-----|------|-----|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$ | -   | 1108 | -   | pF       |
| $C_{oss}$ | Output Capacitance           |  | -   | 310  | -   | pF       |
| $C_{rss}$ | Reverse Transfer Capacitance |  | -   | 109  | -   | pF       |
| $R_G$     | Gate Resistance              | $V_{GS} = 15\text{ mV}, f = 1.0\text{ MHz}$                          | 0.3 | 1    | 1.7 | $\Omega$ |

**Switching Characteristics (Note 2)**

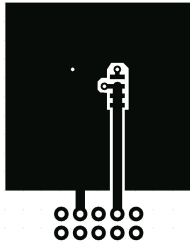
|              |                     |  |   |    |    |    |
|--------------|---------------------|--|---|----|----|----|
| $t_{d(on)}$  | Turn–On Delay Time  | $V_{DD} = 15\text{ V}, I_D = 1\text{ A},$<br>$V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$ | - | 11 | 20 | ns |
| $t_r$        | Turn–On Rise Time   |  | - | 5  | 10 | ns |
| $t_{d(off)}$ | Turn–Off Delay Time |  | - | 27 | 43 | ns |
| $t_f$        | Turn–Off Fall Time  |  | - | 7  | 14 | ns |
| $Q_g$        | Total Gate Charge   | $V_{DS} = 15\text{ V}, I_D = 13\text{ A},$<br>$V_{GS} = 5\text{ V}$                            | - | 10 | 14 | nC |
| $Q_{gs}$     | Gate–Source Charge  |  | - | 3  | -  | nC |
| $Q_{gd}$     | Gate–Drain Charge   |  | - | 3  | -  | nC |

**Drain–Source Diode Characteristics**

|          |                                    |   |   |      |     |    |
|----------|------------------------------------|---|---|------|-----|----|
| $V_{SD}$ | Drain–Source Diode Forward Voltage | $V_{GS} = 0\text{ V}, I_S = 2.1\text{ A}$ (Note 2)      | - | 0.74 | 1.2 | V  |
| $t_{rr}$ | Diode Reverse Recovery Time        | $I_F = 13\text{ A}, dI_F/dt = 100\text{ A}/\mu\text{s}$ | - | 27   | -   | ns |
| $Q_{rr}$ | Diode Reverse Recovery Charge      |   | - | 13   | -   | nC |

**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  $R_{\theta CA}$  is determined by the user's board design.



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



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

Scale 1 : 1 on letter size paper

2. Test: Pulse Width <  $300\mu\text{s}$ , Duty Cycle < 2.0%  
3. Starting  $T_J = 25^\circ\text{C}$ ,  $L = 3\text{ mH}$ ,  $I_{AS} = 11\text{ A}$ ,  $V_{DD} = 30\text{ V}$ ,  $V_{GS} = 10\text{ V}$

## Typical Characteristics

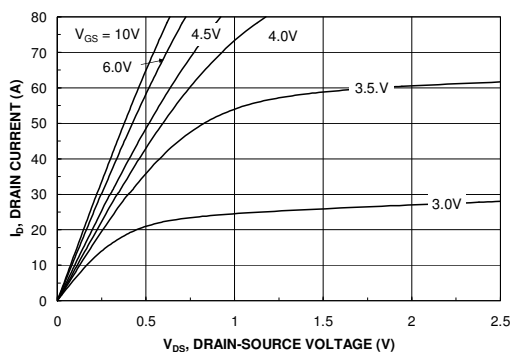


Figure 1. On-Region Characteristics.

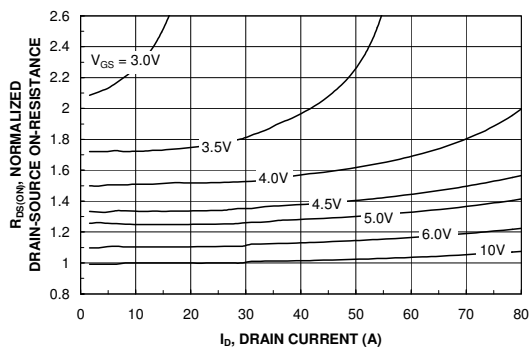


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

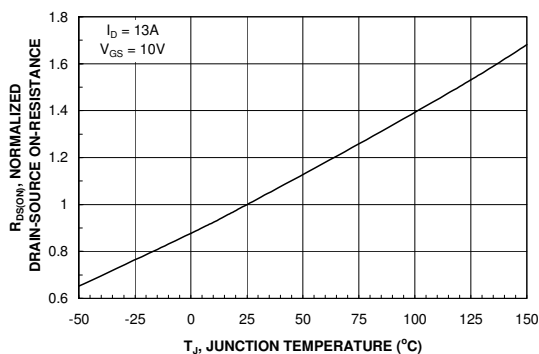


Figure 3. On-Resistance Variation with Temperature.

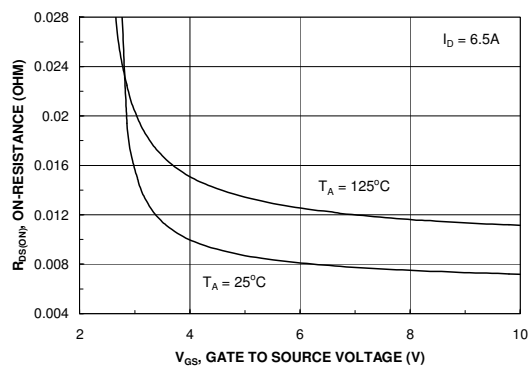


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

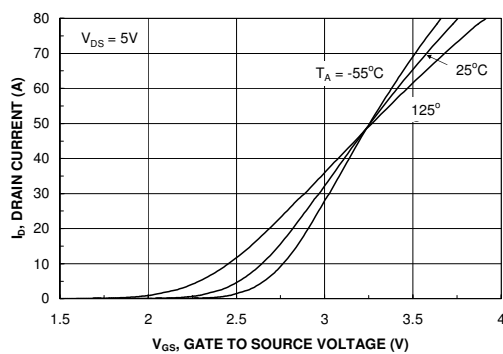


Figure 5. Transfer Characteristics.

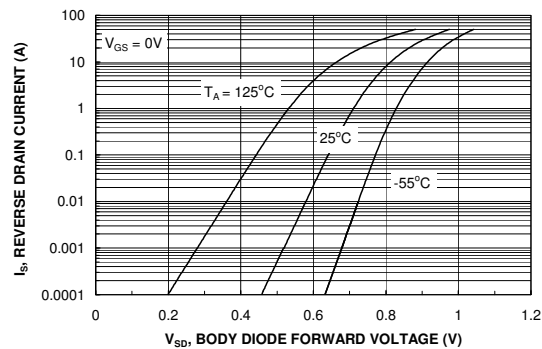


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Characteristics

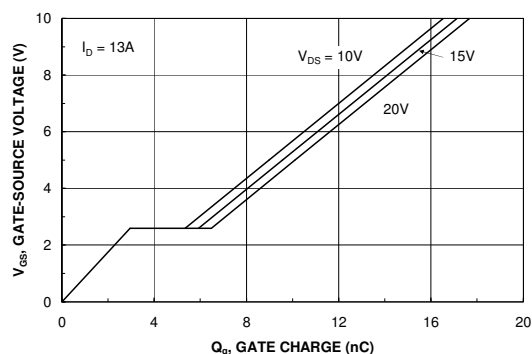


Figure 7. Gate Charge Characteristics.

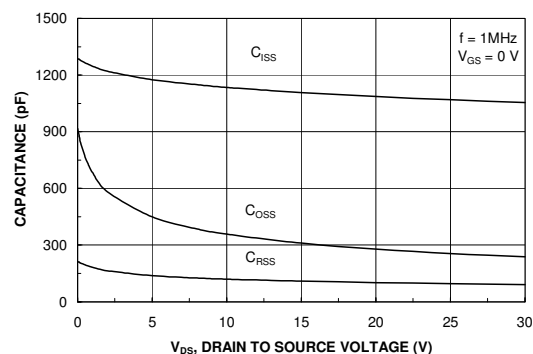


Figure 8. Capacitance Characteristics.

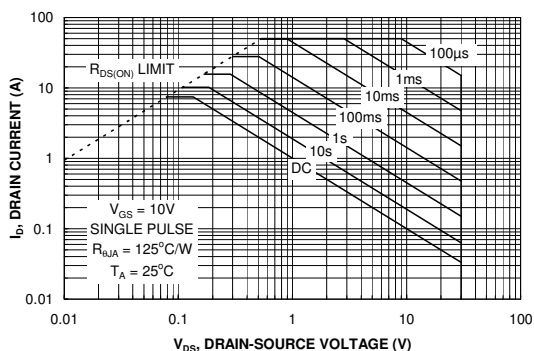


Figure 9. Maximum Safe Operating Area.

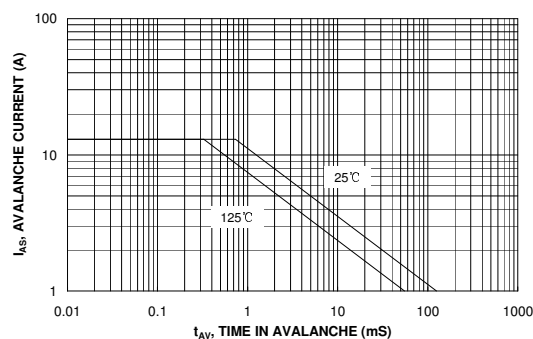


Figure 10. Unclamped Inductive Switching Capability

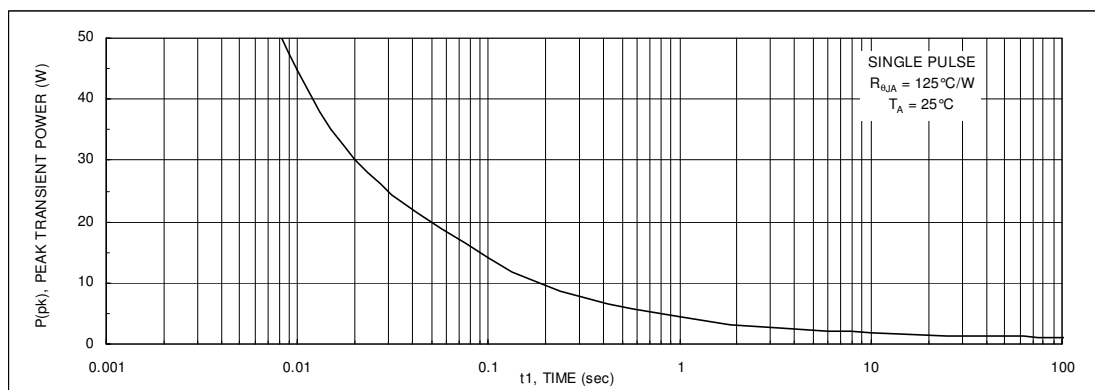
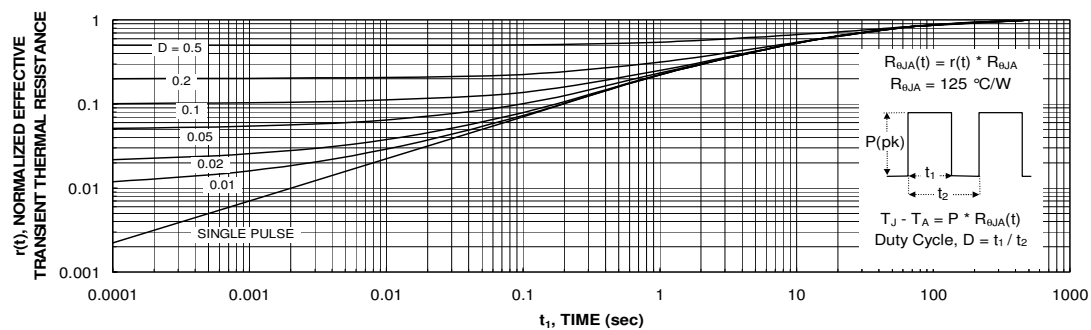


Figure 11. Single Pulse Maximum Power Dissipation.

## Typical Characteristics



**Figure 12. Transient Thermal Response Curve.**

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

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