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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.

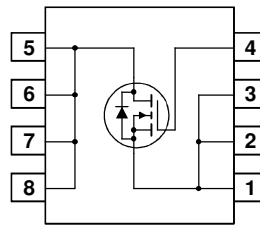
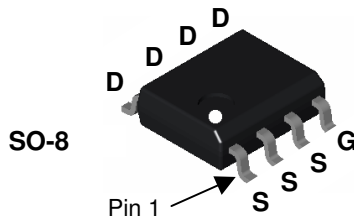
### Applications

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

### Package Marking and Ordering Information

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

FDS6298 30V N-Channel Fast Switching PowerTrench® MOSFET

## Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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### Off Characteristics

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	30	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	30	-	$\text{mV}/^\circ\text{C}$
$I_{DSS}$	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	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	1	1.7	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	-	-5	-	$\text{mV}/^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 13\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 12\text{ A}$ $V_{GS} = 10\text{ V}, I_D = 13\text{ A}, T_J = 125^\circ\text{C}$	-	7.4 9.4 11	9 12 15	$\text{m}\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 13\text{ A}$	-	58	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	-	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)

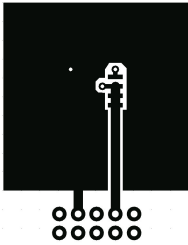
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{ V}, I_D = 1\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$	-	11	20	ns
$t_r$	Turn-On Rise Time		-	5	10	ns
$t_{d(off)}$	Turn-Off Delay Time		-	27	43	ns
$t_f$	Turn-Off Fall Time		-	7	14	ns
$Q_g$	Total Gate Charge		-	10	14	nC
$Q_{gs}$	Gate-Source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

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



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

Scale 1 : 1 on letter size paper

- Test: Pulse Width <  $300\ \mu\text{s}$ , Duty Cycle < 2.0%
- 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

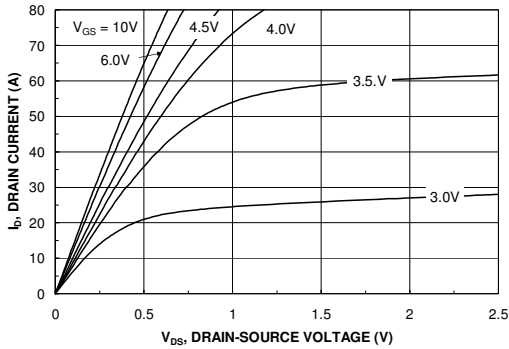


Figure 1. On-Region Characteristics.

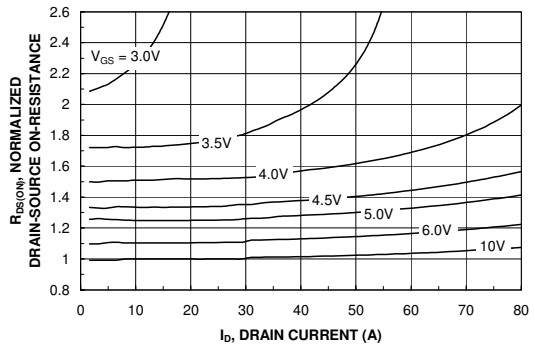


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

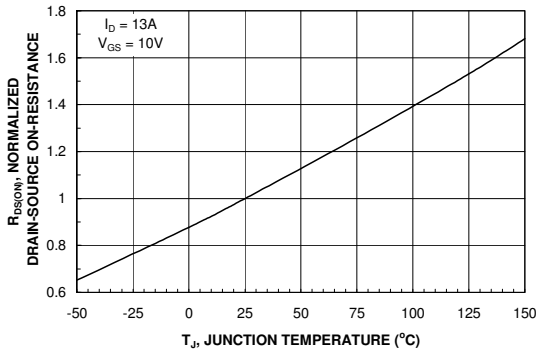


Figure 3. On-Resistance Variation with Temperature.

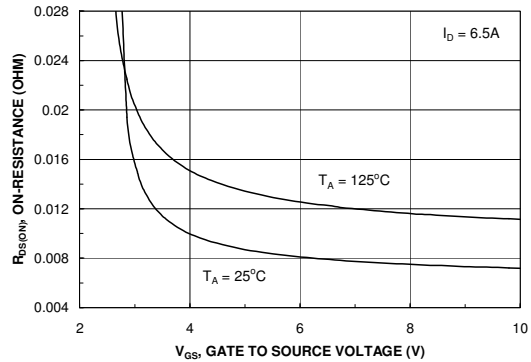


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

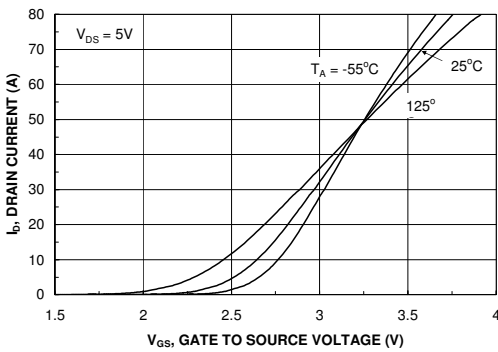


Figure 5. Transfer Characteristics.

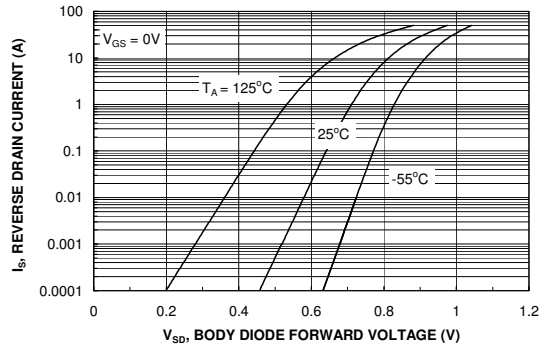


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Characteristics

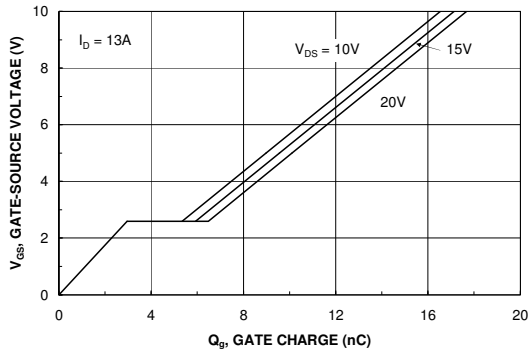


Figure 7. Gate Charge Characteristics.

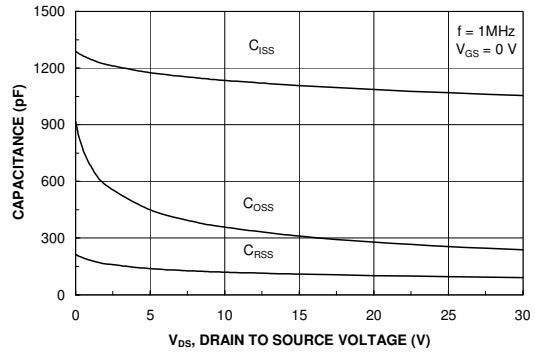


Figure 8. Capacitance Characteristics.

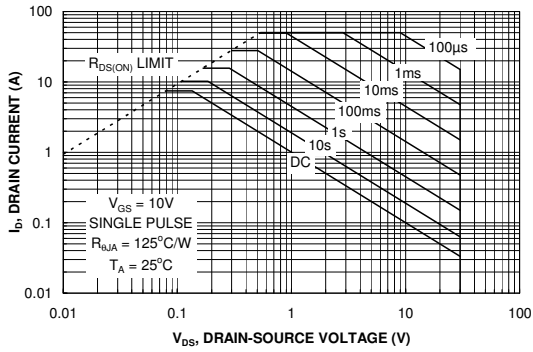


Figure 9. Maximum Safe Operating Area.

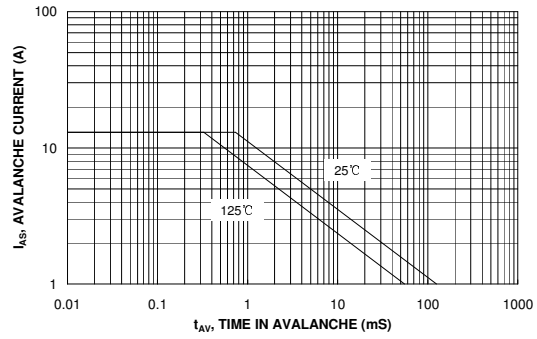


Figure 10. Unclamped Inductive Switching Capability

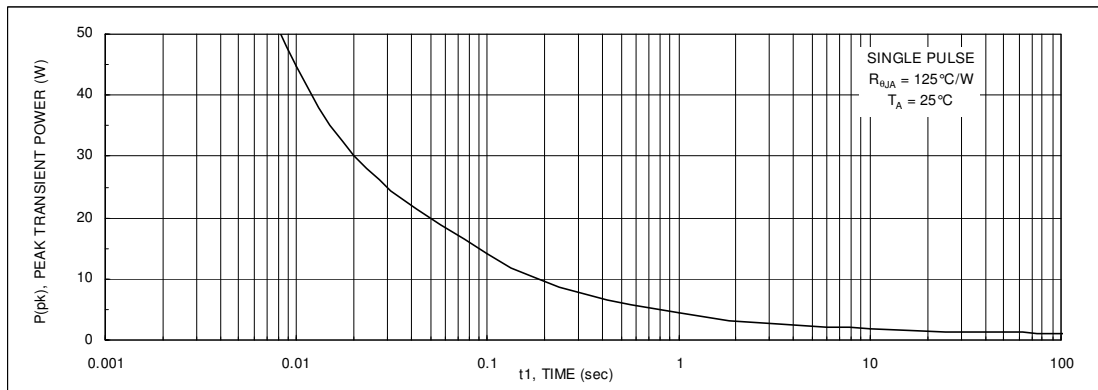
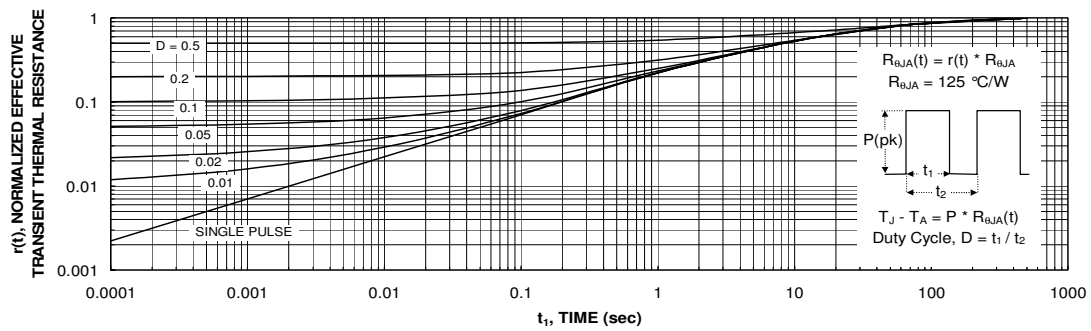


Figure 11. Single Pulse Maximum Power Dissipation.

## 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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