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# FDS6294

## 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.

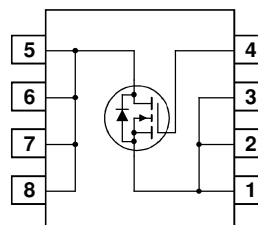
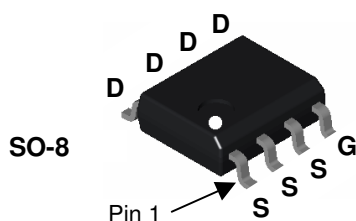
### Applications

- DC/DC converter
- Power management
- Load switch



### Features

- 13 A, 30 V.  $R_{DS(ON)} = 11.3 \text{ m}\Omega @ V_{GS} = 10 \text{ V}$   
 $R_{DS(ON)} = 14.4 \text{ m}\Omega @ V_{GS} = 4.5 \text{ V}$
- Low gate charge (10 nC typical)
- High performance trench technology for extremely low  $R_{DS(ON)}$
- High power and current handling capability.
- RoHS Compliant



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

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain-Source Voltage	30	V
$V_{GS}$	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) (Note 1b)	3.0	W
		1.2	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	181	mJ
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	$-55$ to $+175$	$^\circ\text{C}$

### 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	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	25	

### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDS6294	FDS6294	13"	12mm	2500 units

**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	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$		27		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	1.8	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	$V_{GS} = 10\text{ V}, I_D = 13\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 12\text{ A}$ $V_{GS} = 10\text{ V}, I_D = 13\text{ A}, T_J = 125^\circ\text{C}$		9.4 11.5 13.5	11.3 14.4 16.5	m $\Omega$
$I_{D(on)}$	On–State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$	50			A
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 13\text{ A}$		48		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		1205		pF
$C_{oss}$	Output Capacitance			323		pF
$C_{rss}$	Reverse Transfer Capacitance			102		pF
$R_G$	Gate Resistance	$V_{GS} = 15\text{ mV}, f = 1.0\text{ MHz}$		0.9		$\Omega$

**Switching Characteristics (Note 2)**

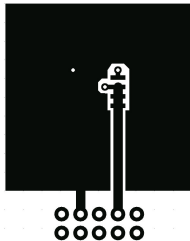
$t_{d(on)}$	Turn–On Delay Time	$V_{DD} = 15\text{ V}, I_D = 1\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$		9	18	ns
$t_r$	Turn–On Rise Time			4	8	ns
$t_{d(off)}$	Turn–Off Delay Time			24	48	ns
$t_f$	Turn–Off Fall Time			6	12	ns
$Q_g$	Total Gate Charge	$V_{DS} = 15\text{ V}, I_D = 13\text{ A},$ $V_{GS} = 5\text{ V}$		10	14	nC
$Q_{gs}$	Gate–Source Charge			3.5		nC
$Q_{gd}$	Gate–Drain Charge			3		nC

**Drain–Source Diode Characteristics and Maximum Ratings**

I <sub>S</sub>	Maximum Continuous Drain–Source Diode Forward Current				2.1	A
V <sub>SD</sub>	Drain–Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 2.1 A (Note 2)		0.74	1.2	V
t <sub>rr</sub>	Diode Reverse Recovery Time	I <sub>F</sub> = 13 A, d <sub>I</sub> F/d <sub>t</sub> = 100 A/μs		25		nS
Q <sub>rr</sub>	Diode Reverse Recovery Charge			14		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)  $50^\circ\text{C}/\text{W}$  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

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

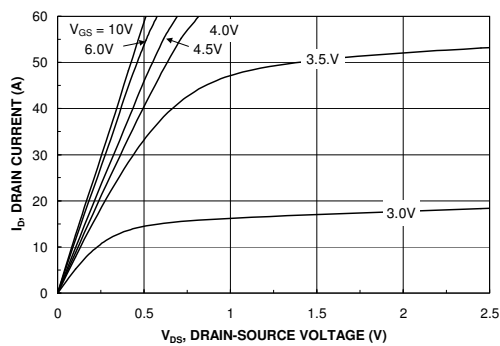


Figure 1. On-Region Characteristics.

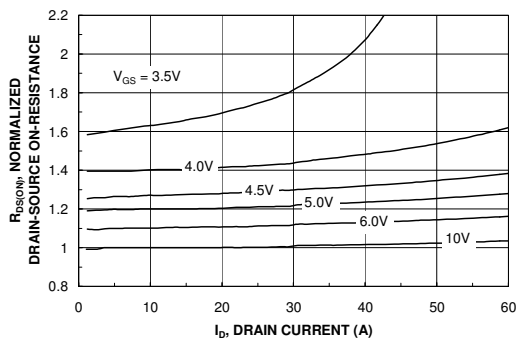


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

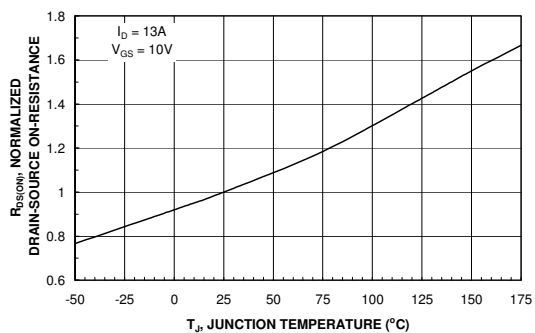


Figure 3. On-Resistance Variation with Temperature.

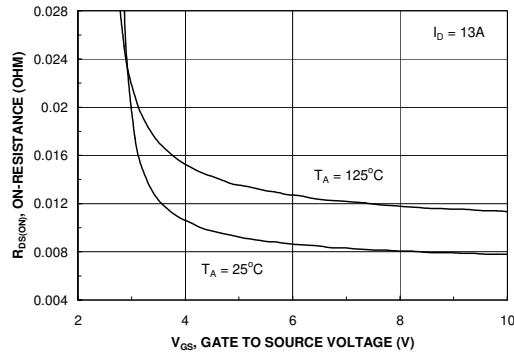


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

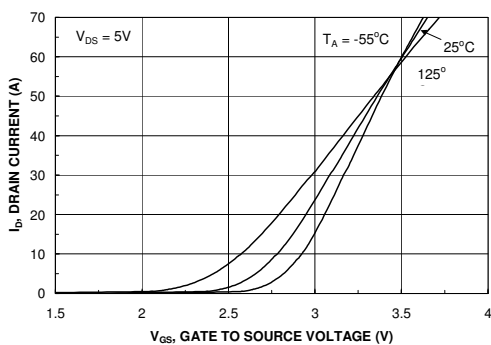


Figure 5. Transfer Characteristics.

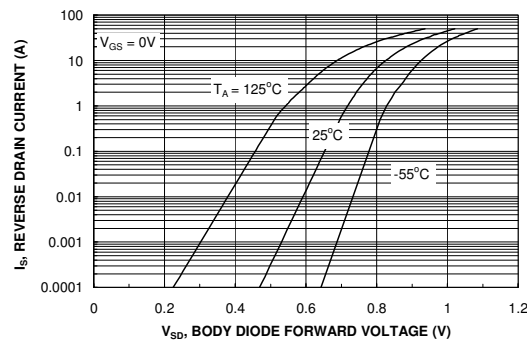


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Characteristics

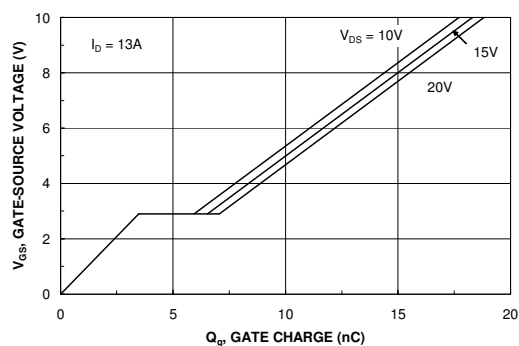


Figure 7. Gate Charge Characteristics.

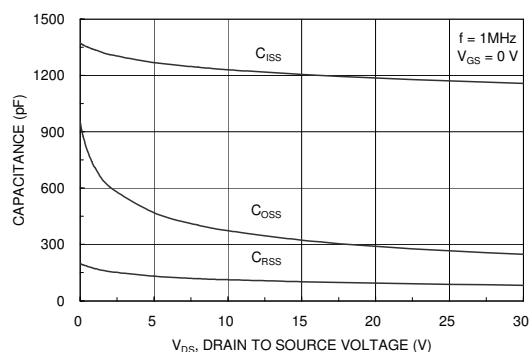


Figure 8. Capacitance Characteristics.

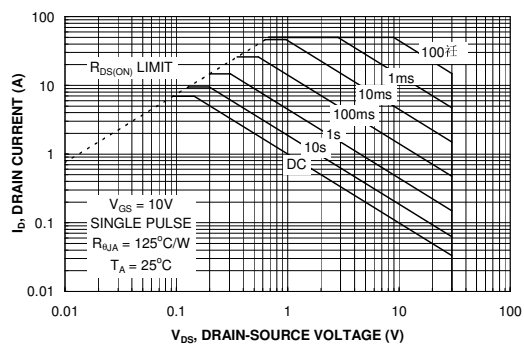


Figure 9. Maximum Safe Operating Area.

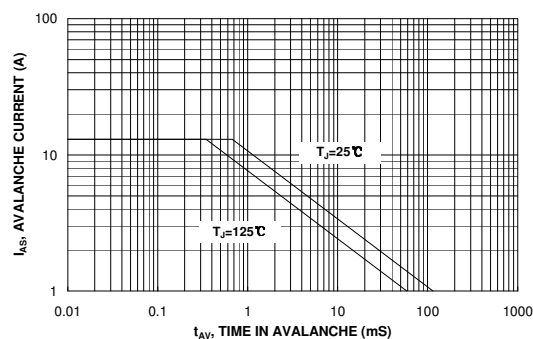
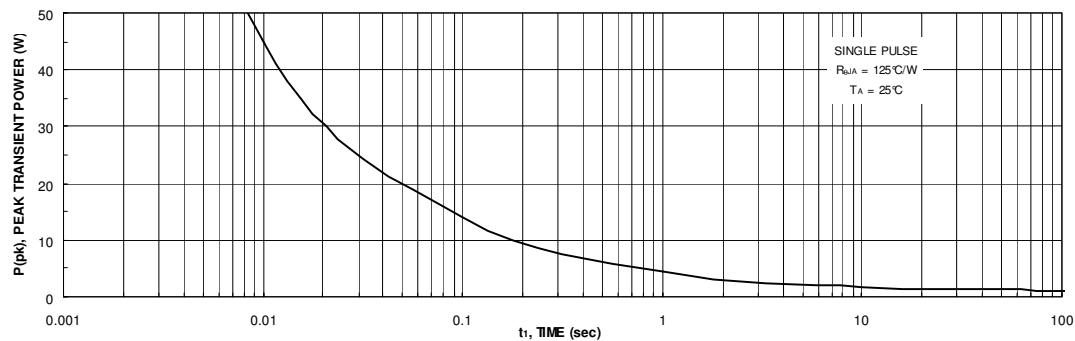
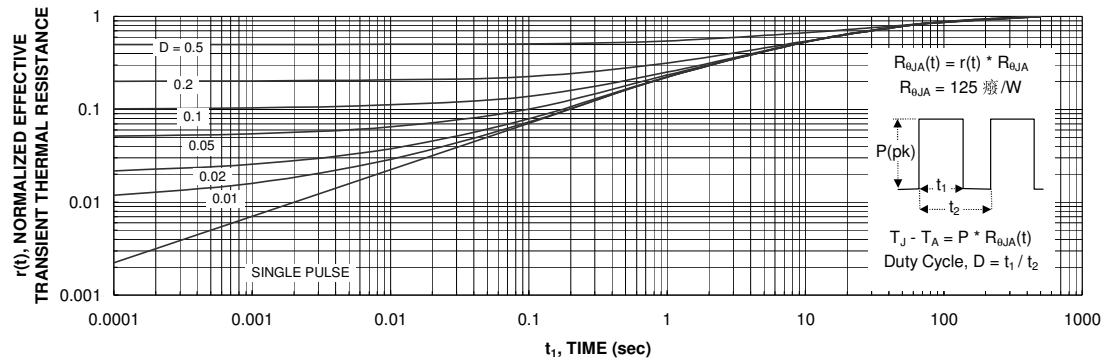


Figure 10. Unclamped Inductive Switching Capability Figure



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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