FAIRCHILD SEMICONDUCTOR®

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FDS6294

30V N-Channel Fast Switching PowerTrench® MOSFET

General Description

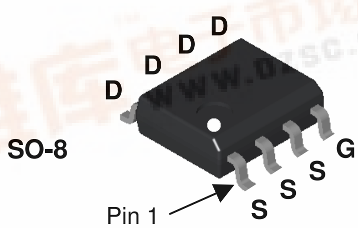
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $R_{DS(ON)}$ and fast switching speed.

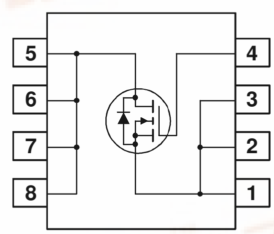
Applications

- DC/DC converter
- Power management
- Load switch

Features

- 13 A, 30 V. $R_{DS(ON)}$ = 11.3 mΩ @ V_{GS} = 10 V
  $R_{DS(ON)}$ = 14.4 mΩ @ V_{GS} = 4.5 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°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-Source Voltage		30	V
V_{GSS}	Gate-Source Voltage		± 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
		(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 +175	°C

Thermal Characteristics

Symbol	Parameter		Ratings	Units
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	50	°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

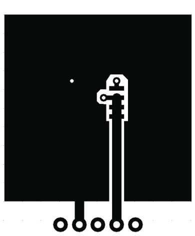
Electrical Characteristics

T_A = 25°C unless otherwise noted

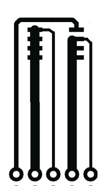
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain–Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C		27		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V			1	μA
I_{GSS}	Gate–Body Leakage	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	1.8	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C		–5		mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	V_{GS} = 10 V, I_D = 13 A V_{GS} = 4.5 V, I_D = 12 A V_{GS}= 10 V, I_D = 13 A, T_J=125°C		9.4 11.5 13.5	11.3 14.4 16.5	mΩ
$I_{D(on)}$	On–State Drain Current	V_{GS} = 10 V, V_{DS} = 5 V	50			A
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 13 A		48		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1.0 MHz		1205		pF
C_{oss}	Output Capacitance			323		pF
C_{rss}	Reverse Transfer Capacitance			102		pF
R_G	Gate Resistance	V_{GS} = 15 mV, f = 1.0 MHz		0.9		Ω
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = 15 V, I_D = 1 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		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 V, I_D = 13 A, V_{GS} = 5 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_S	Maximum Continuous Drain–Source Diode Forward Current				2.1	A
V_{SD}	Drain–Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 2.1 A (Note 2)		0.74	1.2	V
t_{rr}	Diode Reverse Recovery Time	I_F = 13 A, d_{iF}/d_t = 100 A/µs		25		nS
Q_{rr}	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°C/W when mounted on a 1in^2 pad of 2 oz copper



b) 125°C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

2. Test: Pulse Width < 300µs, Duty Cycle < 2.0%

3. Starting TJ = 25°C, L = 3mH, I_{AS} = 11A,V_{DD} = 30V, V_{GS} = 10V

Typical Characteristics

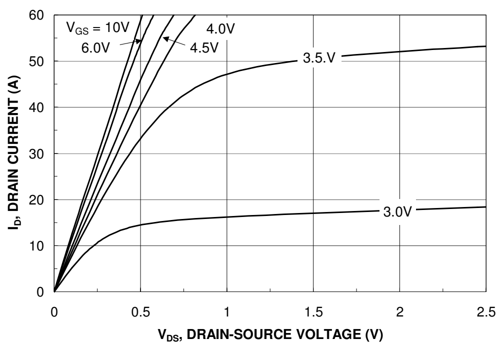


Figure 1. On-Region Characteristics.

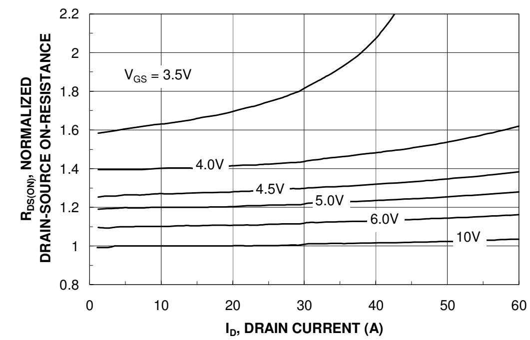


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

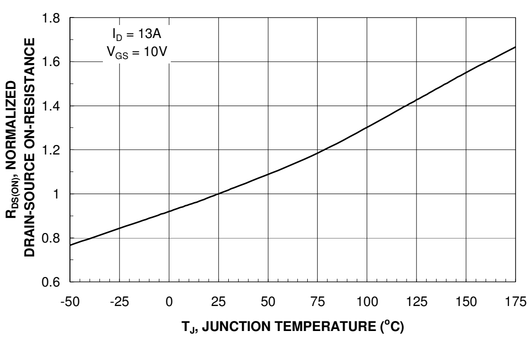


Figure 3. On-Resistance Variation with Temperature.

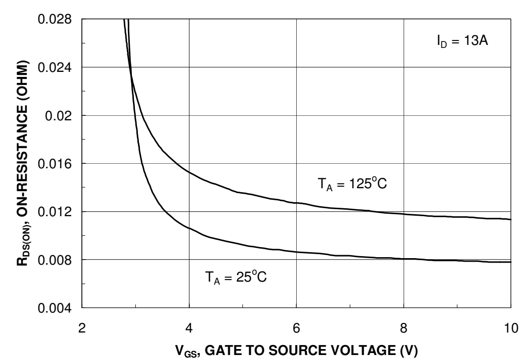


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

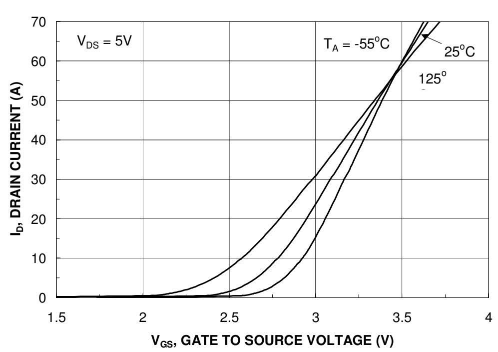


Figure 5. Transfer Characteristics.

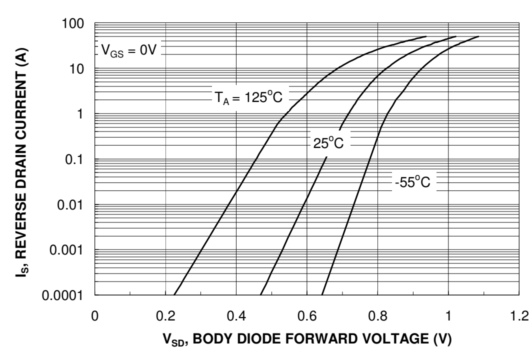


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

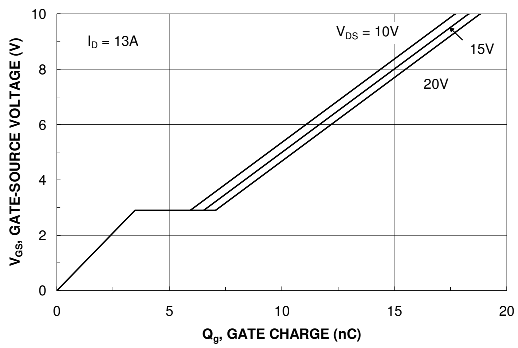


Figure 7. Gate Charge Characteristics.

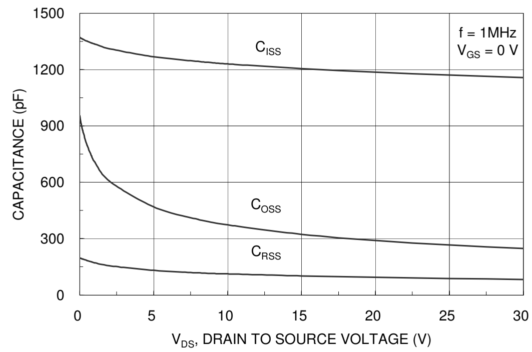


Figure 8. Capacitance Characteristics.

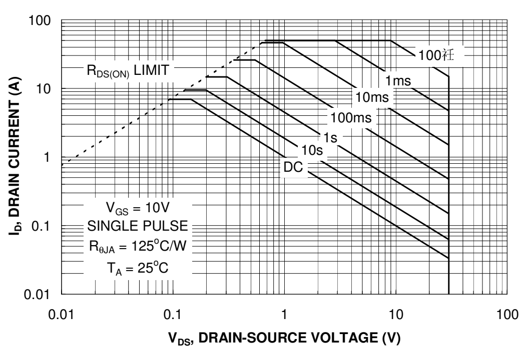


Figure 9. Maximum Safe Operating Area.

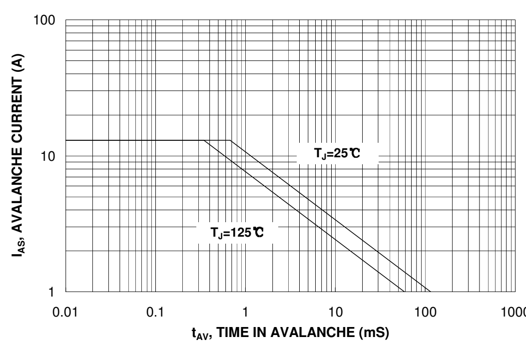
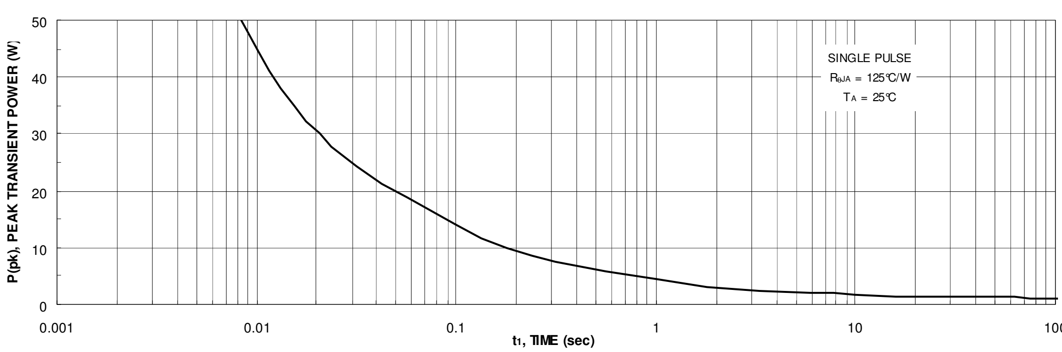


Figure 10. Unclamped Inductive Switching Capability Figure



11. Single Pulse Maximum Power Dissipation.

Typical Characteristics

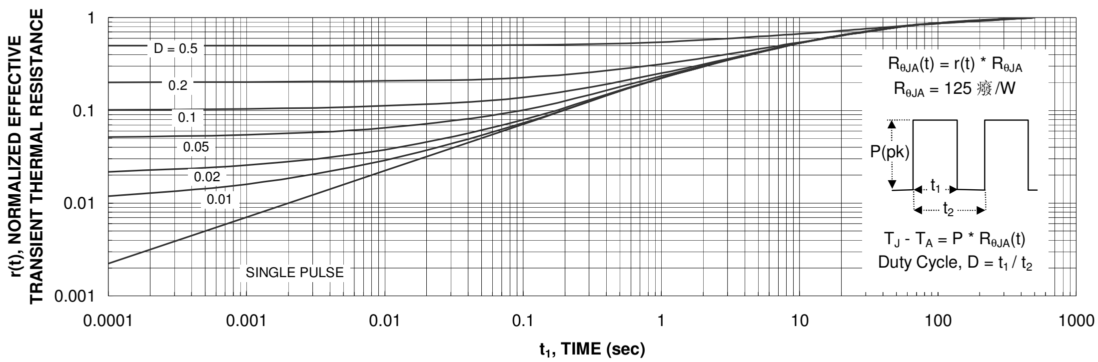


Figure 12. Transient Thermal Response Curve.

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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