July 2001

FAIRCHILD SEMICONDUCTOR®

FDD6530A

20V 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. It has been optimized for low gate charge, low $R_{DS(ON)}$ and fast switching speed.

Applications

- DC/DC converter
- Motor drives

Features

- 21 A, 20 V $R_{DS(ON)}$ = 32 mΩ @ V_{GS} = 4.5 V
  $R_{DS(ON)}$ = 47 mΩ @ V_{GS} = 2.5 V
- Low gate charge (6.5 nC typical)
- Fast switching
- High performance trench technology for extremely low $R_{DS(ON)}$

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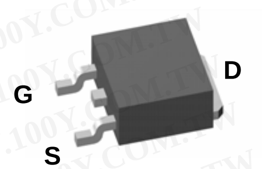

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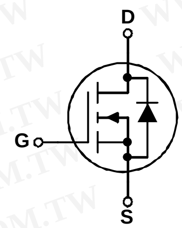

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-Source Voltage		20	V
V_{GSS}	Gate-Source Voltage		±8	V
I_D	Drain Current – Continuous	(Note 3)	21	A
	– Pulsed	(Note 1a)	100	
P_D	Power Dissipation	(Note 1)	33	W
		(Note 1a)	3.3	
		(Note 1b)	1.6	
T_J, T_{STG}	Operating and Storage Junction Temperature Range		–55 to +175	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	(Note 1)	4.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	45	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1b)	96	°C/W

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDD6530A	FDD6530A	13''	16mm	2500 units

Electrical Characteristics

T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Drain-Source Avalanche Ratings (Note 2)						
W_{DSS}	Drain-Source Avalanche Energy	Single Pulse, V_{DD} = 10 V			55	mJ
I_{AR}	Drain-Source Avalanche Current				8	A
Off Characteristics						
BV_{DSS}	Drain–Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C		15		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 16 V, V_{GS} = 0 V			1	µA
I_{GSSF}	Gate–Body Leakage, Forward	V_{GS} = 8 V, V_{DS} = 0 V			100	nA
I_{GSSR}	Gate–Body Leakage, Reverse	V_{GS} = –8 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	0.4	0.9	1.2	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 µA, Referenced to 25°C		–3		mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	V_{GS} = 4.5 V, I_D = 8 A V_{GS} = 2.5 V, I_D = 6.6 A V_{GS} = 4.5 V, I_D = 8 A, T_J = 125°C		26 36 36	32 47 48	mΩ
$I_{D(on)}$	On–State Drain Current	V_{GS} = 4.5 V, V_{DS} = 5 V	20			A
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 8 A		21		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 10 V, V_{GS} = 0 V, f = 1.0 MHz		710		pF
C_{oss}	Output Capacitance			173		pF
C_{rss}	Reverse Transfer Capacitance			84		pF
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = 10 V, I_D = 1 A, V_{GS} = 4.5 V, R_{GEN} = 6		8	16	ns
t_r	Turn–On Rise Time			7	14	ns
$t_{d(off)}$	Turn–Off Delay Time			18	32	ns
t_f	Turn–Off Fall Time			4	8	ns
Q_g	Total Gate Charge	V_{DS} = 10 V, I_D = 8 A, V_{GS} = 4.5 V		6.5	9	nC
Q_{gs}	Gate–Source Charge			1.3		nC
Q_{gd}	Gate–Drain Charge			1.9		nC
Drain–Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain–Source Diode Forward Current				2.7	A
V_{SD}	Drain–Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 2.7 A (Note 2)		0.8	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 $R_{\theta CA}$ is determined by the user's board design.

a) $R_{\theta JA}$ = 45°C/W when mounted on a 1in^2 pad of 2 oz copper

b) $R_{\theta JA}$ = 96°C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

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

3. Maximum current is calculated as: $\sqrt{\frac{P_D}{R_{DS(ON)}}}$

where P_D is maximum power dissipation at T_C = 25°C and $R_{DS(on)}$ is at $T_{J(max)}$ and V_{GS} = 10V. Package current limitation is 21A

Typical Characteristics

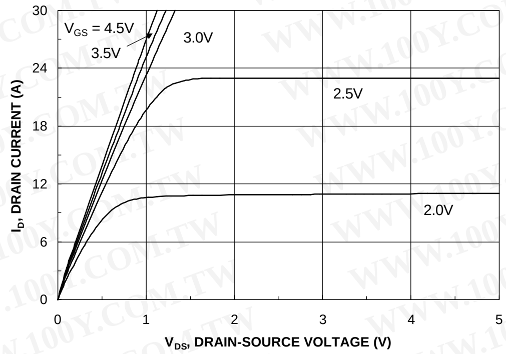

Figure 1. On-Region Characteristics.

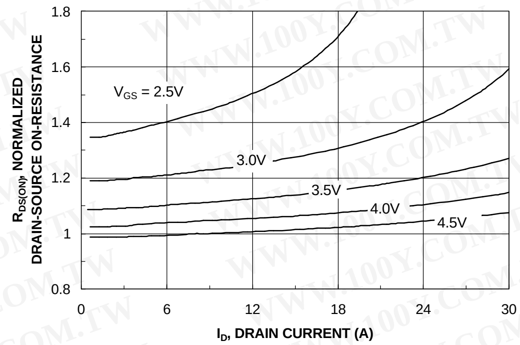

Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

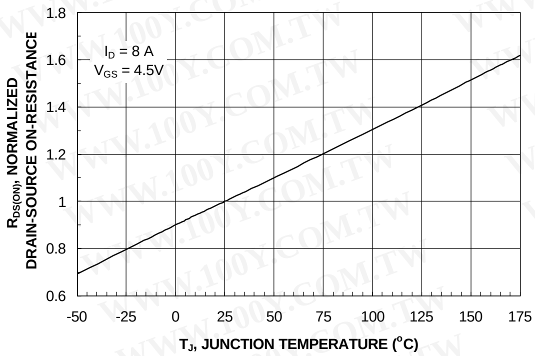

Figure 3. On-Resistance Variation with Temperature.

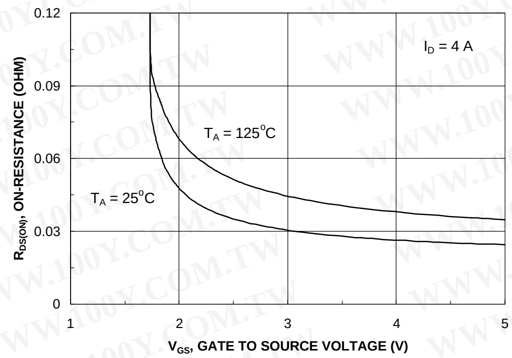

Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

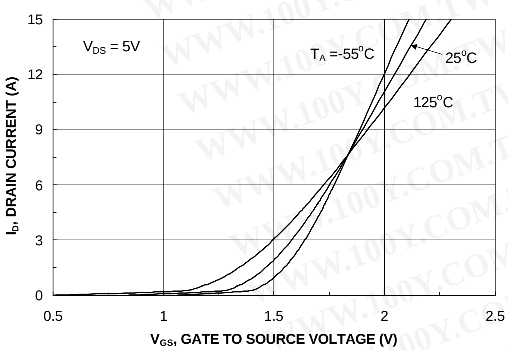

Figure 5. Transfer Characteristics.

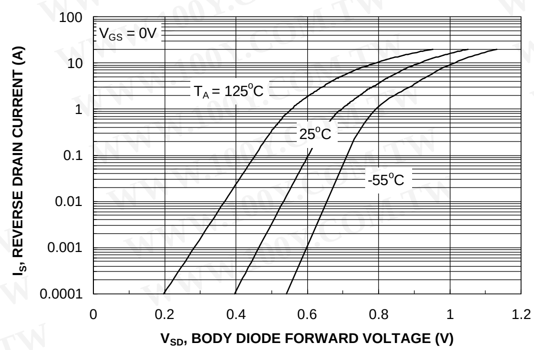

Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

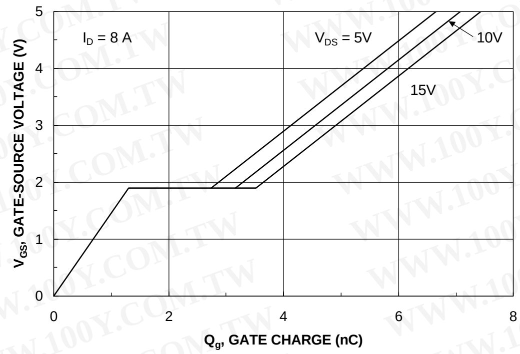

Figure 7. Gate Charge Characteristics.

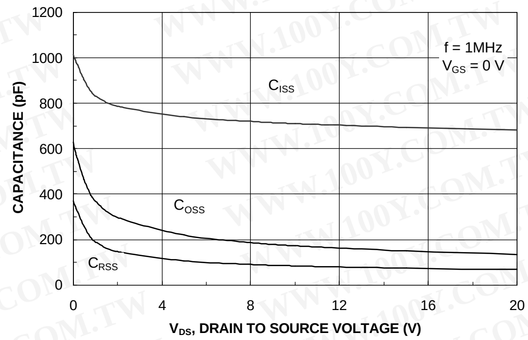

Figure 8. Capacitance Characteristics.

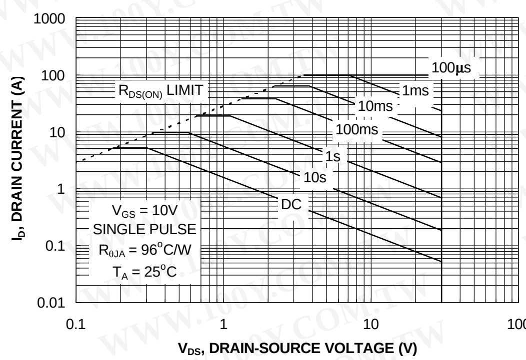

Figure 9. Maximum Safe Operating Area.

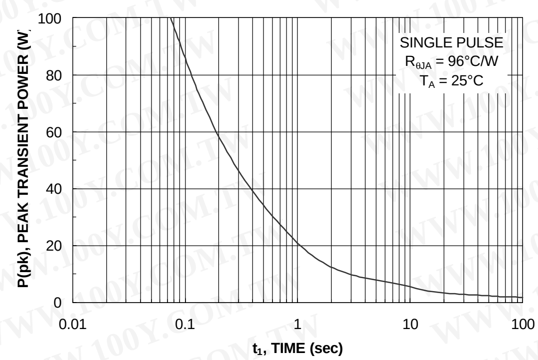

Figure 10. Single Pulse Maximum Power Dissipation.

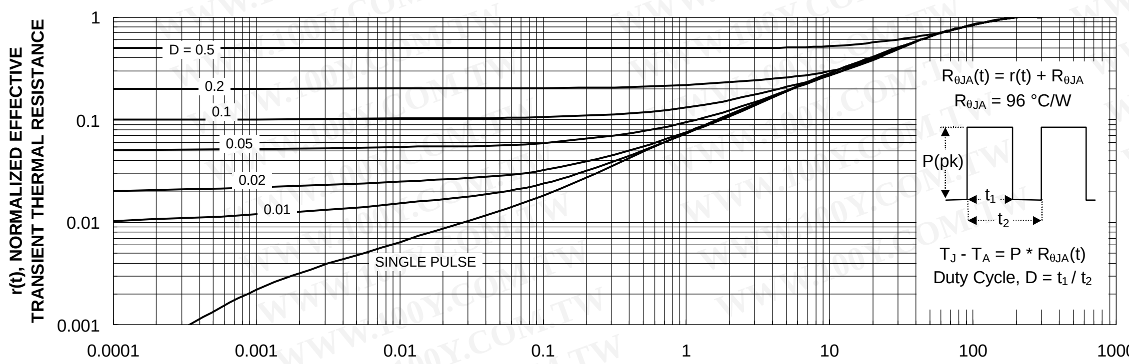

Figure 11. Transient Thermal Response Curve.

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

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