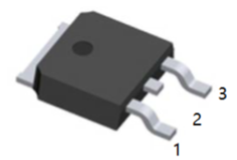
General Description

The FDD6680AS is designed to replace a single MOSFET and Schottky diode in synchronous DC:DC power supplies.

This 30V MOSFET is designed to maximize power conversion efficiency, providing a low $R_{DS(ON)}$ and low gate charge.

The performance of the FDD6680AS as the low-side switch in a synchronous rectifier is indistinguishable from the performance of the FDD6680A in parallel with a Schottky diode.

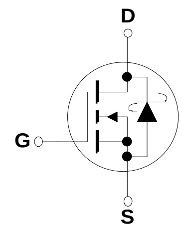


1.G 2.D 3.S

TO-252(DPAK) top view

Applications

- DC/DC converter
- Low side notebook



Features

- V_{DS}(V) = 30V
- I_D =50A (V_{GS}= 10V)
- $R_{DS(ON)}$ < 10.5mΩ (V_{GS} = 5V)
- $R_{DS(ON)}$ < 13.0mΩ (V_{GS} = 4.5V)
- Includes SyncFET Schottky body diode
- Low gate charge (21nC typical)
- High performance trench technology for extremely low $R_{DS(ON)}$
- High power and current handling capability

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 3)	55	A
	– Pulsed	(Note 1a)	100	
P_D	Power Dissipation	(Note 1)	60	W
		(Note 1a)	3.1	
		(Note 1b)	1.3	
T_J, T_{STG}	Operating and Storage Junction Temperature Range		–55 to +150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	(Note 1)	2.1	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	40	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1b)	96	°C/W

Electrical Characteristics

T_A = 25°C unless otherwise noted

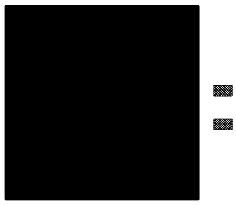
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
W_{DSS}	Drain-Source Avalanche Energy	Single Pulse, V_{DD} = 15 V, I_D=13.5A		54	205	mJ
I_{AR}	Drain-Source Avalanche Current				13.5	A
BV_{DSS}	Drain–Source Breakdown Voltage	V_{GS} = 0 V, I_D = 1 mA	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 1 mA, Referenced to 25°C		29		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V			500	μA
I_{GSS}	Gate–Body Leakage	V_{GS} = ±20 V, V_{DS} = 0 V			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 1 mA	1	1.4	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 1 mA, Referenced to 25°C		–3		mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	V_{GS} = 10 V, I_D = 12.5 A V_{GS} = 4.5 V, I_D = 10 A		8.6 10.3	10.5 13.0	mΩ
$I_{D(on)}$	On–State Drain Current	V_{GS} = 10 V, V_{DS} = 5 V	50			A
g_{FS}	Forward Transconductance	V_{DS} = 15 V, I_D = 12.5 A		44		S
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1.0 MHz		1200		pF
C_{oss}	Output Capacitance			350		pF
C_{rss}	Reverse Transfer Capacitance			120		pF
R_G	Gate Resistance	V_{GS} = 15 mV, f = 1.0 MHz		1.6		Ω
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = 15 V, I_D = 1 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		10	20	ns
t_r	Turn–On Rise Time			6	12	ns
$t_{d(off)}$	Turn–Off Delay Time			28	45	ns
t_f	Turn–Off Fall Time			12	22	ns
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = 15 V, I_D = 1 A, V_{GS} = 4.5 V, R_{GEN} = 6 Ω		14	25	ns
t_r	Turn–On Rise Time			13	23	ns
$t_{d(off)}$	Turn–Off Delay Time			20	32	ns
t_f	Turn–Off Fall Time			11	20	ns
$Q_{g(TOT)}$	Total Gate Charge at Vgs=10V	V_{DD} = 15 V, I_D = 12.5 A		21	29	nC
Q_g	Total Gate Charge at Vgs=5V			11	15	nC
Q_{gs}	Gate–Source Charge			3		nC
Q_{gd}	Gate–Drain Charge			4		nC
I_S	Maximum Continuous Drain–Source Diode Forward Current				4.4	A
V_{SD}	Drain–Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 4.4 A (Note 2) V_{GS} = 0 V, I_S = 7 A (Note 2)		0.5 0.6	0.7	V
t_{rr}	Diode Reverse Recovery Time	I_F = 12.5A, d_{iF}/d_t = 300 A/µs (Note 3)		17		nS
Q_{rr}	Diode Reverse Recovery Charge			11		nC

Electrical Characteristics

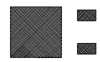
T_A = 25°C unless otherwise noted

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) $R_{\theta JA}$ = 40°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

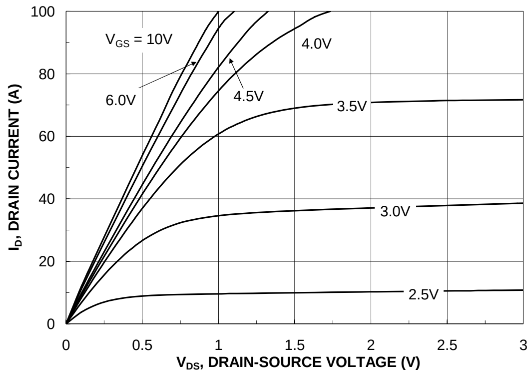


Figure 1. On-Region Characteristics.

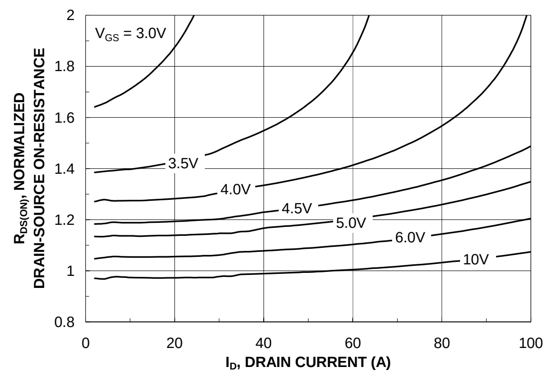


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

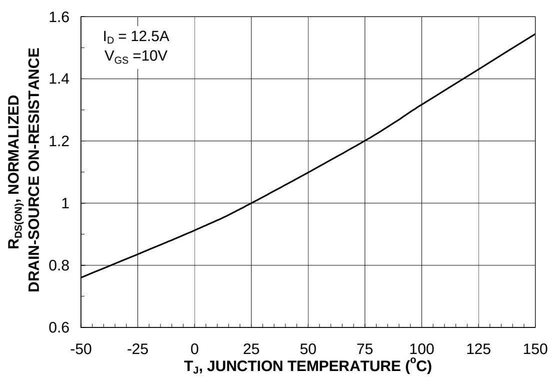


Figure 3. On-Resistance Variation with Temperature.

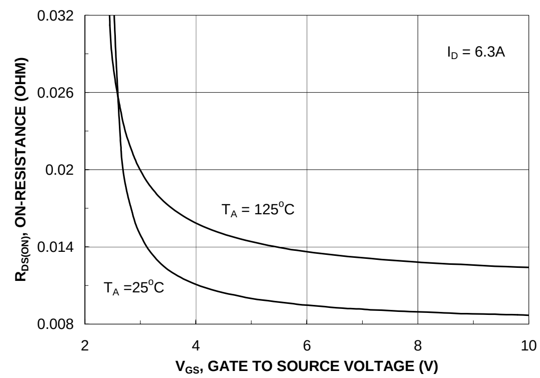


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

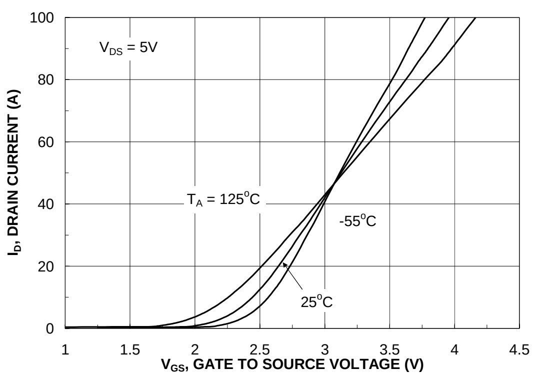


Figure 5. Transfer Characteristics.

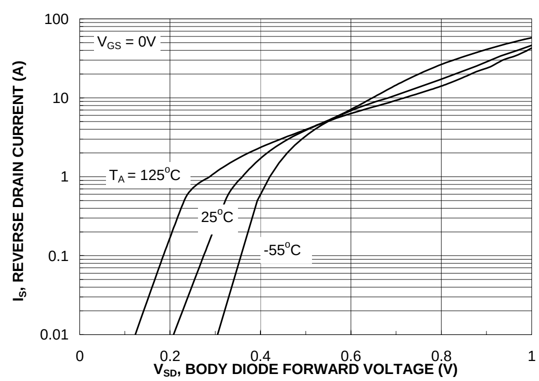


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics (continued)

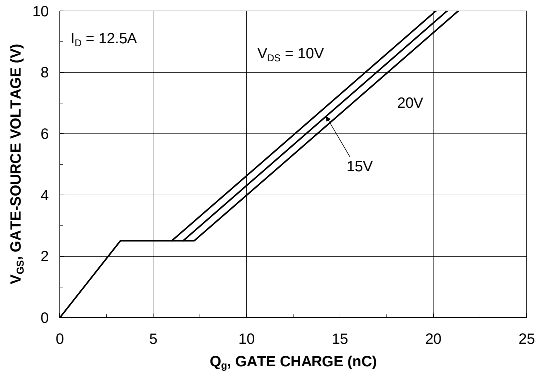


Figure 7. Gate Charge Characteristics.

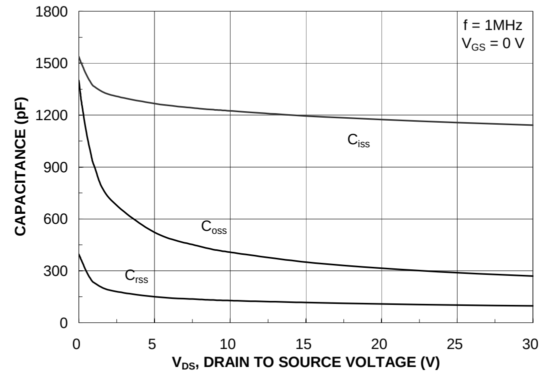


Figure 8. Capacitance Characteristics.

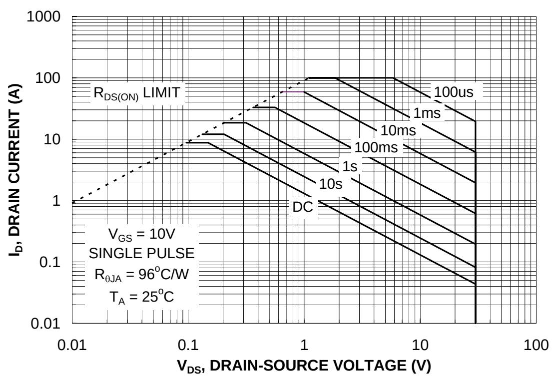


Figure 9. Maximum Safe Operating Area.

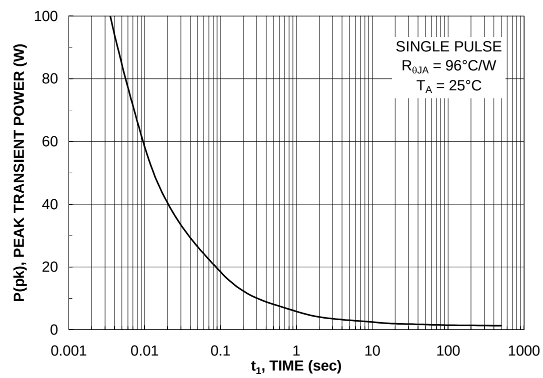


Figure 10. Single Pulse Maximum Power Dissipation.

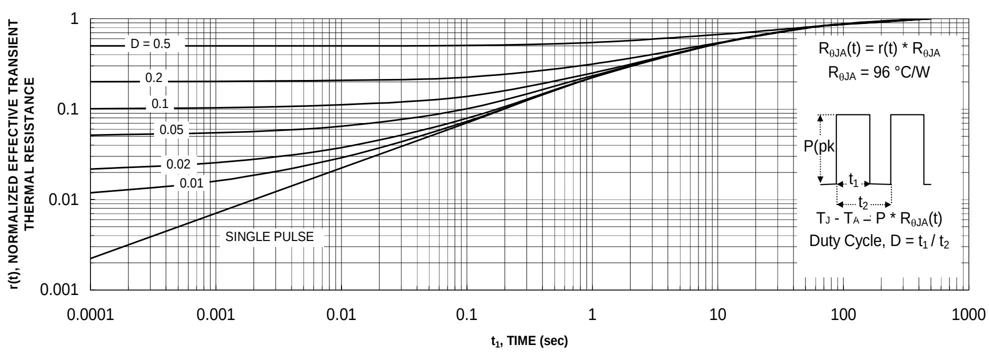


Figure 11. Transient Thermal Response Curve.

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

Typical Characteristics (continued)

This diode exhibits similar characteristics to a discrete external Schottky diode in parallel with a MOSFET. Figure 12 shows the reverse recovery characteristic of the FDD6680AS.

Schottky barrie diodes exhibit significant leakage at high temperature and high reverse voltage. This will increase the power in the device.

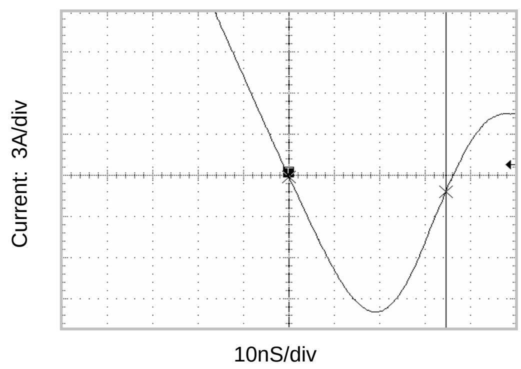


Figure 12. FDD6680AS SyncFET body diode reverse recovery characteris

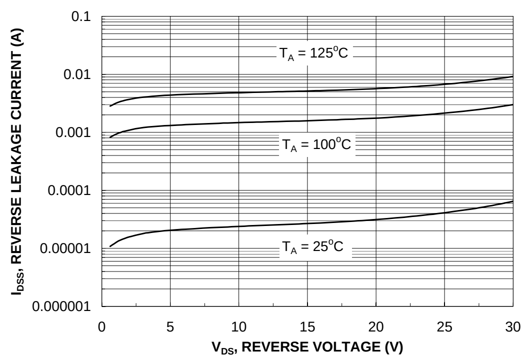


Figure 14. SyncFET body diode reverse leakage versus drain-source voltage and temperature.

For comparison purposes, Figure 13 shows the reverse recovery characteristics of the body diode of an equivalent size MOSFET produced without SyncFET (FDD6680).

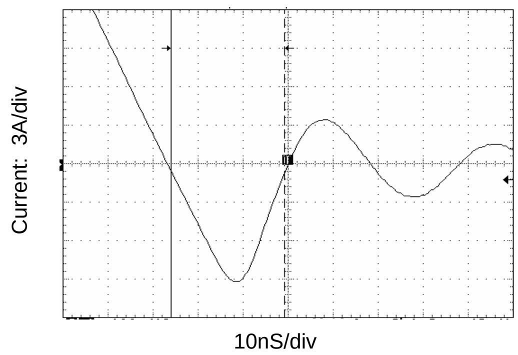
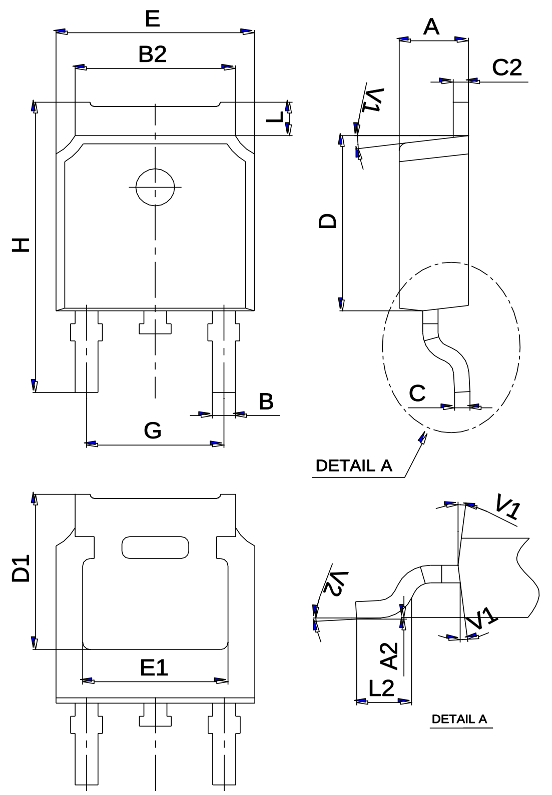


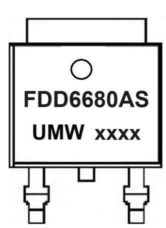
Figure 13. Non-SyncFET (FDD6680) body diode reverse recovery characteristic.

Package Mechanical Data TO-252



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.10		2.50	0.083		0.098
A2	0		0.10	0		0.004
B	0.66		0.86	0.026		0.034
B2	5.18		5.48	0.202		0.216
C	0.40		0.60	0.016		0.024
C2	0.44		0.58	0.017		0.023
D	5.90		6.30	0.232		0.248
D1	5.30REF			0.209REF		
E	6.40		6.80	0.252		0.268
E1	4.63			0.182		
G	4.47		4.67	0.176		0.184
H	9.50		10.70	0.374		0.421
L	1.09		1.21	0.043		0.048
L2	1.35		1.65	0.053		0.065
V1		7°			7°	
V2	0°		6°	0°		6°

Marking



Ordering information

Order code	Package	Baseqty	Deliverymode
UMW FDD6680AS	TO-252	2500	Tape and reel