UMW FDD6680AS

30V N-Channel MOSFET

1.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.

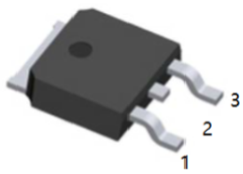
2.Features

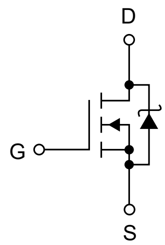
- $V_{DS(V)}$ =30V
- I_D=55A
- $R_{DS(ON)}$<10.5mΩ (V_{GS}=5V)
- $R_{DS(ON)}$ <13mΩ (V_{GS}=4.5V)
- Includes SyncFET Schottky body diode
- Low gate charge (21nC typical)
- High performance trench technology for extremely low $R_{DS(ON)}$
- High power and current handling capability

3.Pinning information

Pin	Symbol	Description
1	G	GATE
2	D	DRAIN
3	S	SOURCE

TO-252(DPAK) top view





4.Absolute Maximum Ratings T_A= 25°C

Parameter		Symbol	Rating	Units
Drain-Source Voltage		V_{DSS}	30	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current - Continuous	(Note 3)	I_D	55	A
-Pulsed	(Note 1a)		100	A
Power Dissipation for Single Operation	(Note 1)	P_D	60	W
	(Note 1a)		3.1	W
	(Note 1b)		1.3	W
Operating and Storage Junction Temperature Range		T_J, T_{STG}	-55 to 150	°C

5.Thermal Characteristics

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

6.Electrical Characteristic (T$_A$=25°C unless otherwise noted)

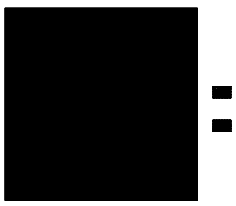
Parameter	Symbol	Conditions	Min	Typ	Max	Units
Drain-Source Avalanche Energy	W_{DSS}	Single Pulse,V_{DD}=15V, I_D=13.5A		54	205	mJ
Drain-Source Avalanche Current	I_{AR}				13.5	A
Drain–Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_D=1mA	30			V
Breakdown Voltage Temperature Coefficient	$\frac{\Delta BV_{DSS}}{\Delta T_J}$	I_D=1mA Referenced to 25°C		29		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=24V, V_{GS}=0V			500	μA
Gate–Body Leakage	I_{GSS}	V_{GS}=±20V, V_{DS}=0V			±100	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=1mA	1	1.4	3	V
Gate Threshold Voltage Temperature Coefficient	$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	I_D=1mA Referenced to 25°C		-3		mV/°C
Static Drain–Source On–Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=12.5A		8.6	10.5	mΩ
		V_{GS}=4.5V, I_D=10A		10.3	13	mΩ
On–State Drain Current	$I_{D(ON)}$	V_{GS}=10V, V_{DS}=5V	50			A
Forward Transconductance	g_{FS}	V_{DS}=15V, I_D=12.5A		44		S
Input Capacitance	C_{iss}	V_{DS}=15V, V_{GS}=0V, f=1MHz		1200		pF
Output Capacitance	C_{oss}			350		pF
Reverse Transfer Capacitance	C_{rss}			120		pF
Gate Resistance	R_g	V_{GS}=15mV, f=1MHz		1.6		Ω
Turn–On Delay Time	$t_{D(on)}$	V_{DD}=15V, I_D=1A V_{GS}=10V, R_{GEN}=6Ω		10	20	ns
Turn–On Rise Time	t_r			6	12	ns
Turn–Off Delay Time	$t_{D(off)}$			28	45	ns
Turn–Off Fall Time	t_f			12	22	ns
Turn–On Delay Time	$t_{D(on)}$	V_{DD}=15V, I_D=1A V_{GS}=4.5V, R_{GEN}=6Ω		14	25	ns
Turn–On Rise Time	t_r			13	23	ns
Turn–Off Delay Time	$t_{D(off)}$			20	32	ns
Turn–Off Fall Time	t_f			11	20	ns

Total Gate Charge, V_{GS}=10V	$Q_{g(TOT)}$	V_{DS}=15V,I_D=12.5A		21	29	nC
Total Gate Charge, V_{GS}=5V	Q_g			11	15	nC
Gate–Source Charge	Q_{gs}			3		nC
Gate–Drain Charge	Q_{gd}			4		nC
Maximum Continuous Drain–Source Diode Forward Current	I_S				4.4	A
Drain–Source Diode Forward Voltage	V_{SD}	V_{GS}=0V, I_S=4.4A (Note 2)		0.5	0.7	V
		V_{GS}=0V, I_S=7A (Note 2)		0.6	0.7	V
Diode Reverse Recovery Time	t_{rr}	I_F=12.5A		17		ns
Diode Reverse Recovery Charge	Q_{rr}	dIF/dt=300A/μs (Note 3)		11		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) $R_{\theta JA}$=40°C/W when mounted on a 1in^2 pad of 2oz 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.

7.1Typical characteristic

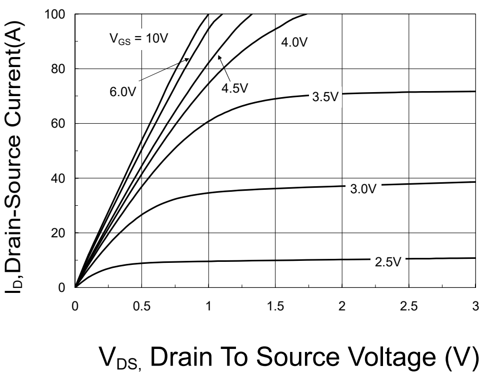


Figure 1: On-Region Characteristics

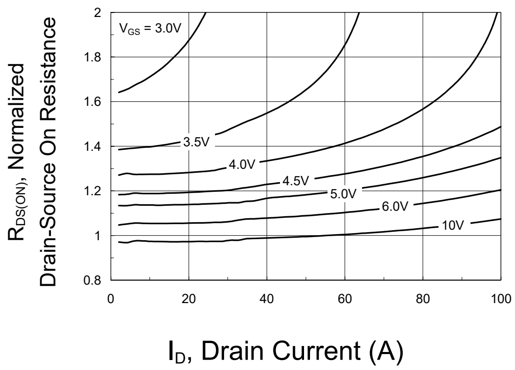


Figure 2: On-Resistance Variation
with Drain Current and Gate Voltage

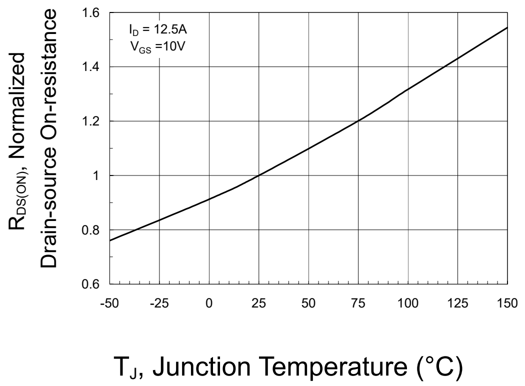


Figure 3: On-Resistance Variation
with Temperature

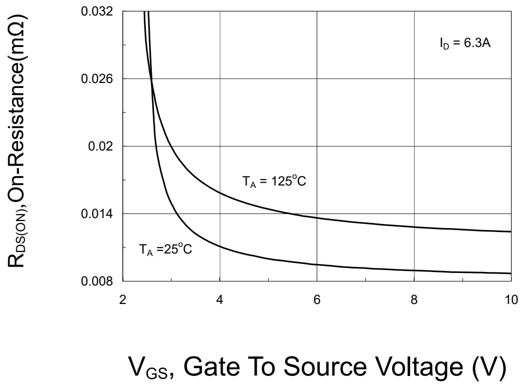


Figure 4: On-Resistance Variation
with Gate-to-Source Voltage

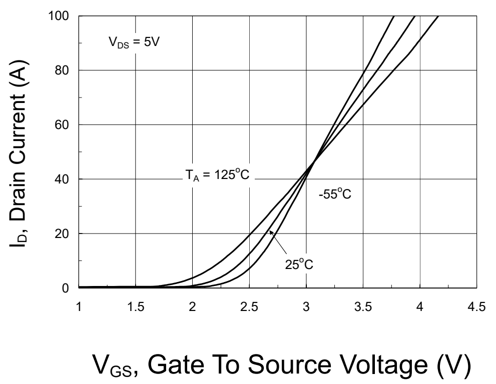


Figure 5: Transfer Characteristics

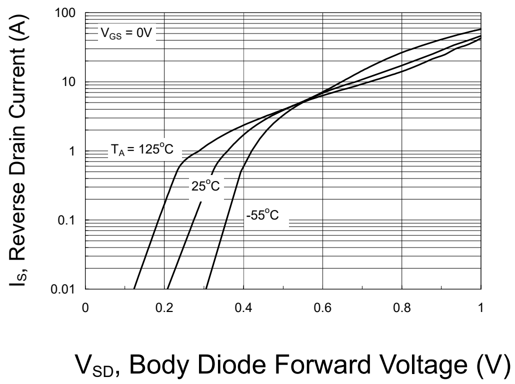


Figure 6: . Body Diode Forward Voltage
Variation with Source Currentand Temperature

7.2Typical characteristic

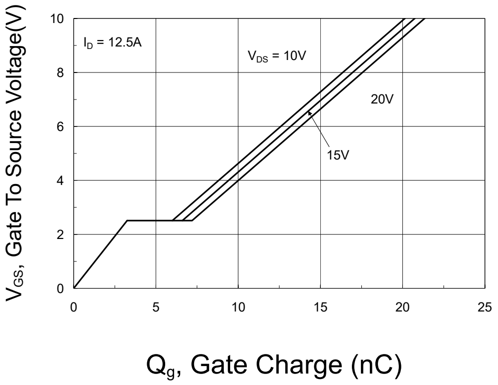


Figure 7: Gate Charge Characteristics

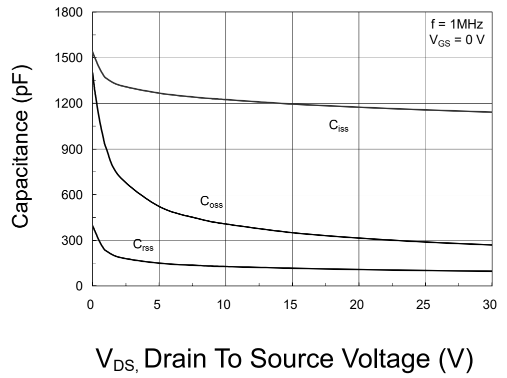


Figure 8: Capacitance Characteristics

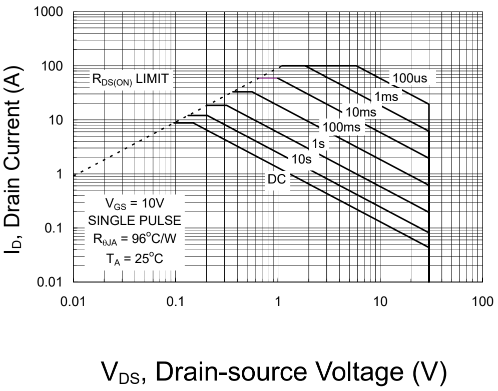


Figure 9: Maximum Safe Operating Area

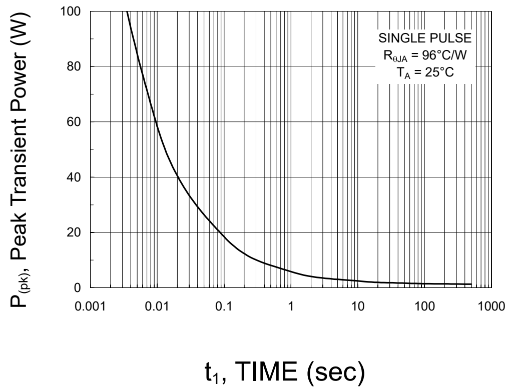


Figure 10: Single Pulse Maximum Power Dissipation

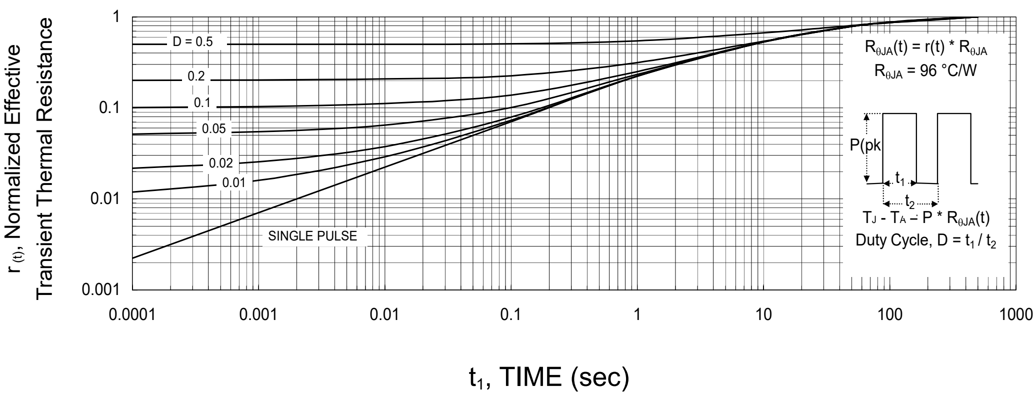


Figure 11: Transient Thermal Response Curve

7.3Typical characteristic

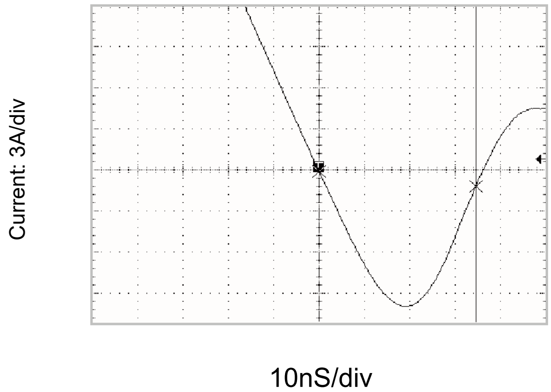


Figure 12: FDD6680AS SyncFET body diode reverse recovery characteris

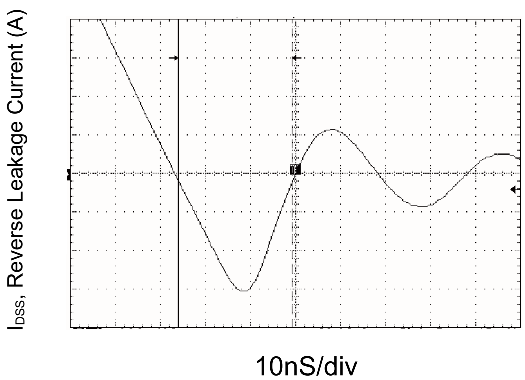


Figure 13: Non-SyncFET (FDD6680) body diode reverse recovery characteristic

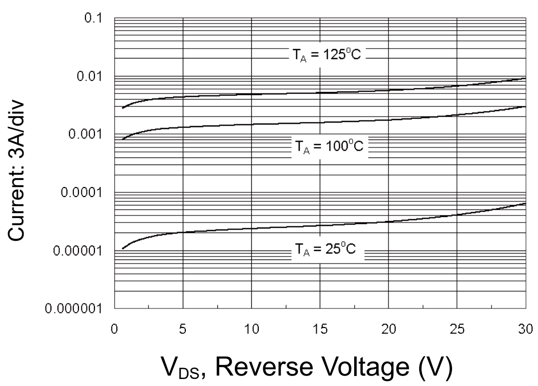


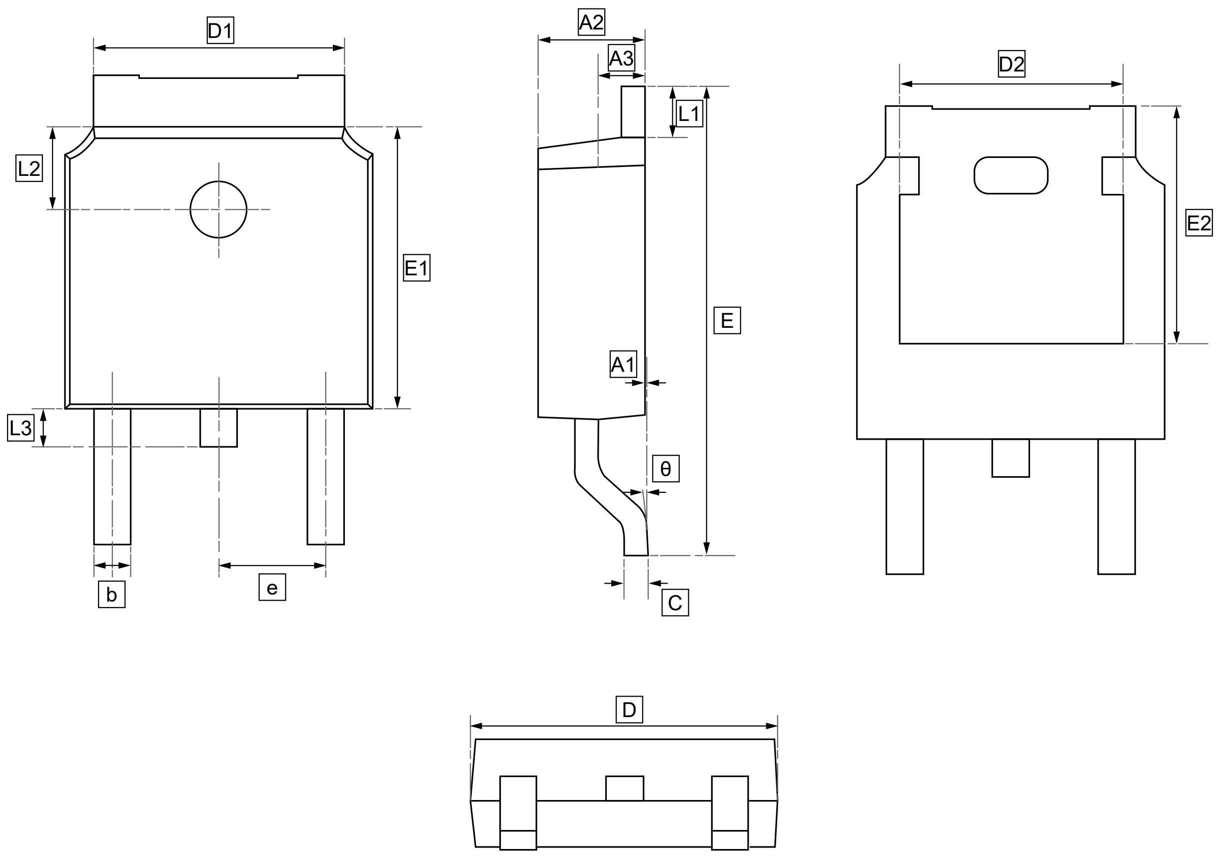
Figure 14: SyncFET body diode reverse leakage versus drain-source voltage and temperature

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.

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

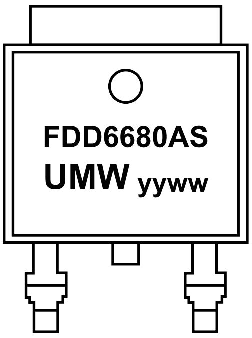
8.TO-252 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A1	A2	A3	b	c	D	D1	D2	E	E1	E2	e	L1	L2	L3	θ
Min	0.00	2.18	0.90	0.65	0.46	6.35	4.95	4.32	9.40	5.97	5.21	2.286	0.89	1.70	0.60	0.00
Max	0.13	2.39	1.10	0.85	0.61	6.73	5.46	4.90	10.41	6.22	5.38	BSC	1.27	1.90	1.00	8.00

9.Ordering information



yy: Year Code
ww: Week Code

Order Code	Package	Base QTY	Delivery Mode
UMW FDD6680AS	TO-252	2500	Tape and reel

10.Disclaimer

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