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March 2015

FDD6296/FDU6296

30V N-Channel Fast Switching PowerTrench^O MOSFET

General Description

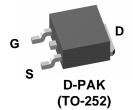
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low R_{DS(ON)} and fast switching speed.

Applications

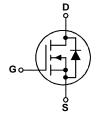
- DC/DC converter
- Power management

Features

- 50A, 30 V $R_{DS(ON)} = 8.8 \ m\Omega \ @ \ V_{GS} = 10 \ V$ $R_{DS(ON)} = 11.3 \ m\Omega \ @ \ V_{GS} = 4.5 \ V$
- · Low gate charge
- · Fast switching
- High performance trench technology for extremely low $R_{\mbox{\scriptsize DS(ON)}}$







Absolute Maximum Ratings TA=25°C unless otherwise noted

Symbol	Parameter		Ratings	Units	
V _{DSS}	Drain-Source Voltage			30	V
V _{GSS}	Gate-Source Voltage			± 20	
I _D	Continuous Drain Current	@T _C =25°C	(Note 3)	50	А
		@T _A =25°C	(Note 1a)	15	
		Pulsed	(Note 1a)	100	
P _D	Power Dissipation	@T _C =25°C	(Note 3)	52	W
		@T _A =25°C	(Note 1a)	3.8	
		@T _A =25°C	(Note 1b)	1.6	
T _J , T _{STG}	Operating and Storage Ju	nction Tempera	ture Range	-55 to +175	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	(Note 1)	2.9	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	40	
	Thermal Resistance, Junction-to-Ambient	(Note 1b)	96	

Package Marking and Ordering Information

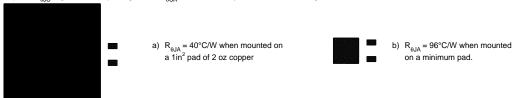
Device Marking	Device	Package	Reel Size	Tape width	Quantity
FDD6296	FDD6296	D-PAK (TO-252)	13"	16mm	2500 units
FDU6296	FDU2696	I-PAK (TO-251)	Tube	N/A	75

Symbol	Parameter	Test Conditions	Min	Тур	Max	Units
Drain-So	urce Avalanche Ratings (Note	e 2)		1		I
E _{AS}	Drain-Source Avalanche Energy	Single Pulse, $V_{DD} = 15 \text{ V}$, $I_D = 15 \text{ A}$			165	mJ
I _{AS}	Drain-Source Avalanche Current				15	Α
Off Chara	acteristics					
BV _{DSS}	Drain–Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, \qquad I_{D} = 250 \mu\text{A}$	30			V
<u>ΔBV_{DSS}</u> ΔT _J	Breakdown Voltage Temperature Coefficient	I_D = 250 μ A, Referenced to 25°C		29		mV/°(
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 24 V, V _{GS} = 0 V			1	μΑ
I _{GSS}	Gate-Body Leakage	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$			± 100	nA
On Chara	acteristics (Note 2)		•			
V _{GS(th)}	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250 \mu A$	1	1.7	3	V
$\Delta V_{GS(th)} \over \Delta T_J$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 μ A, Referenced to 25°C		-0.5		mV/°
R _{DS(on)}	Static Drain–Source On–Resistance	$\begin{array}{c} V_{GS} = 10 \; V, & I_D = 15 \; A \\ V_{GS} = 4.5 \; V, & I_D = 13 \; A \\ V_{GS} = 10 \; V, & I_D = 15 \; A, \; T_J = 125 ^{\circ} C \end{array}$		7.5 9.0 9.3	8.8 11.3 15.0	mΩ
g FS	Forward Transconductance	$V_{DS} = 5 \text{ V}, \qquad I_{D} = 15 \text{ A}$		58		S
Dynamic	Characteristics					
C _{iss}	Input Capacitance	$V_{DS} = 15 \text{ V}, \qquad V_{GS} = 0 \text{ V},$		1440		pF
C _{oss}	Output Capacitance	f = 1.0 MHz		400		pF
C _{rss}	Reverse Transfer Capacitance			140		pF
R _G	Gate Resistance	$V_{GS} = 15 \text{ mV}, \qquad f = 1.0 \text{ MHz}$		1.3		Ω
Switching	Characteristics (Note 2)					
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15 \text{ V}, \qquad I_D = 1 \text{ A},$		11	19	ns
t _r	Turn-On Rise Time	$V_{GS} = 10 \text{ V}, \qquad R_{GEN} = 6 \Omega$		6	11	ns
t _{d(off)}	Turn-Off Delay Time			29	46	ns
t _f	Turn-Off Fall Time			13	23	ns
Qg	Total Gate Charge	$V_{DS} = 15V, I_D = 15 A, V_{GS} = 10 V$		22.5	31.5	nC
Q _g	Total Gate Charge	$V_{DS} = 15V$, $I_{D} = 15 A$,		12.2	17	nC
Q_{gs}	Gate-Source Charge	$V_{GS} = 5 V$		4		nC
Q_{gd}	Gate-Drain Charge			3.5		nC
Drain-So	urce Diode Characteristics	and Maximum Ratings				
Is	Maximum Continuous Drain-Source	ce Diode Forward Current			3.2	Α
V_{SD}	Drain–Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}, I_S = 3.2 \text{ A} \text{(Note 2)}$		0.74	1.2	V
t _{rr}	Diode Reverse Recovery Time	I _F = 15 A,		25		nS
Q _{rr}	Diode Reverse Recovery Charge	$d_{iF}/d_t = 100 \text{ A/}\mu\text{s}$		13		nC

Electrical Characteristics (cont'd)

Notes:

1. R_{BUA} 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_{BUC} is guaranteed by design while R_{BCA} is determined by the user's board design.



Scale 1 : 1 on letter size paper

- 2. Pulse Test: Pulse Width < 300µs, Duty Cycle < 2.0%
- 3. Maximum current is calculated as: current limitation is 21A

 $\sqrt{\frac{P_D}{R_{DS(ON)}}}$

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

Typical Characteristics

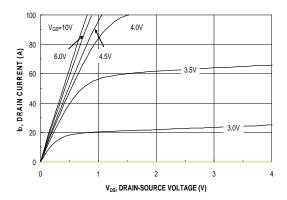


Figure 1. On-Region Characteristics

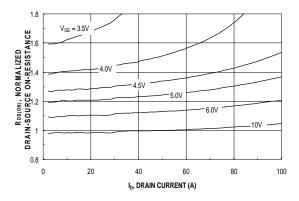


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

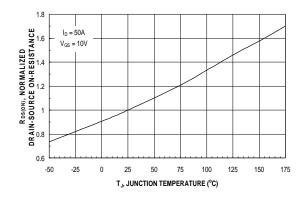


Figure 3. On-Resistance Variation with Temperature

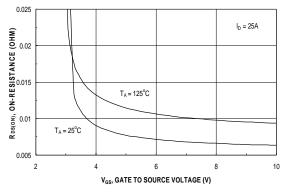


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

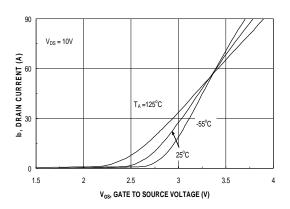


Figure 5. Transfer Characteristics

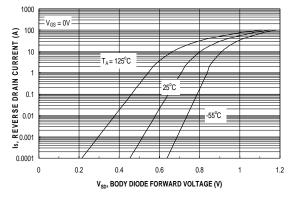
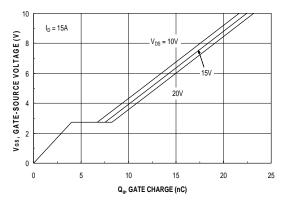


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

Typical Characteristics



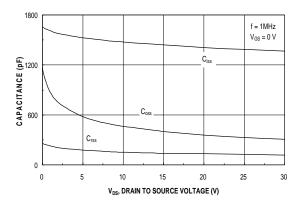
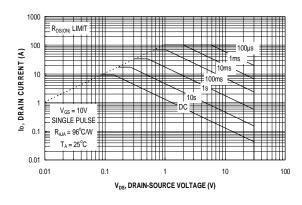


Figure 7. Gate Charge Characteristics

Figure 8. Capacitance Characteristics



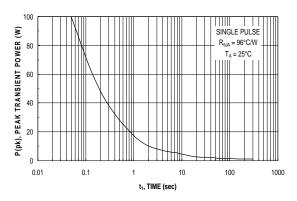


Figure 9. Maximum Safe Operating Area

Figure 10. Single Pulse Maximum Power Dissipation

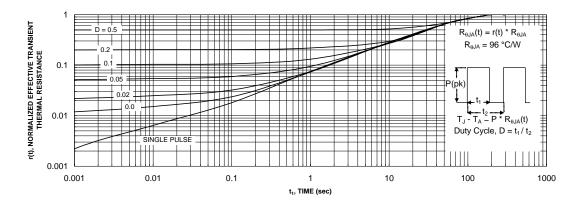
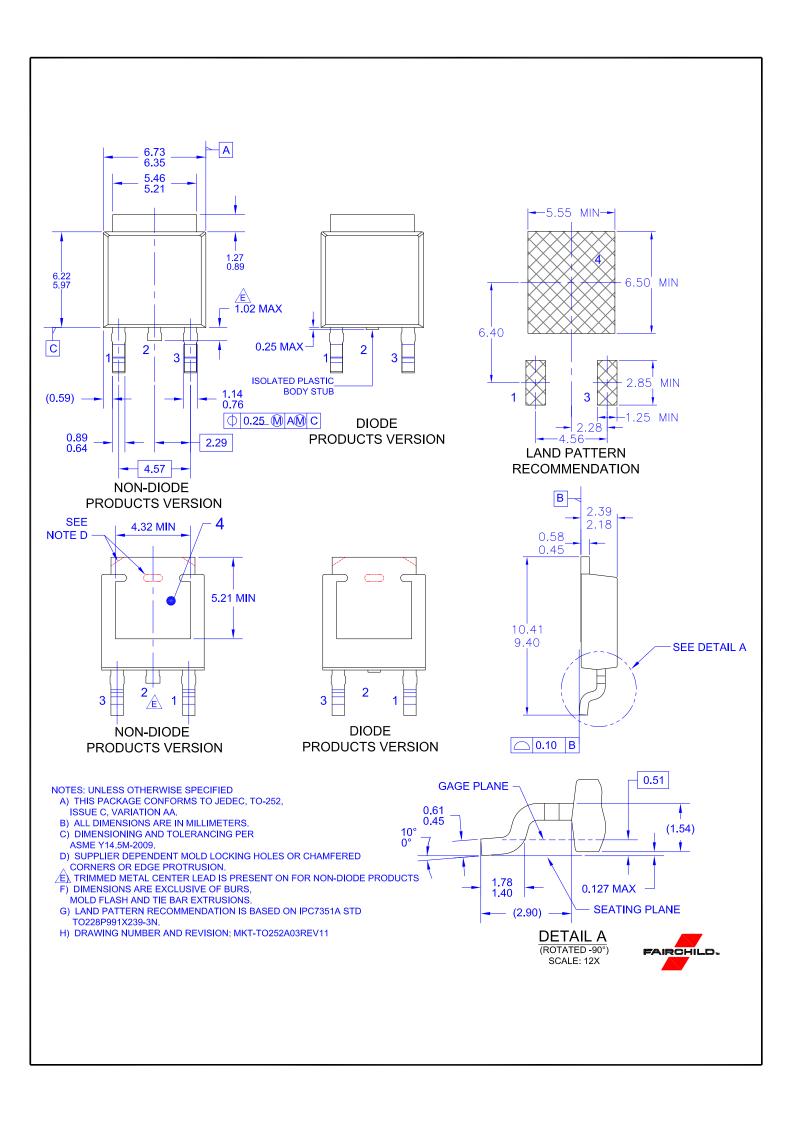


Figure 11. Transient Thermal Response Curve

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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