

# FDD6692/FDU6692

## 30V N-Channel PowerTrench® MOSFET

### General Description

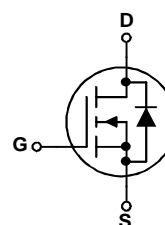
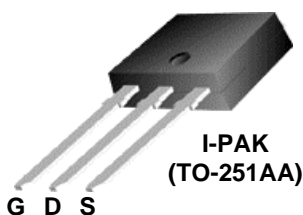
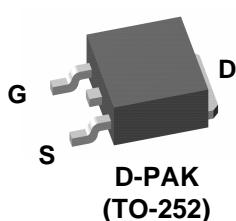
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low  $R_{DS(ON)}$  and fast switching speed.

### Applications

- DC/DC converter
- Motor drives

### Features

- 54 A, 30 V.  $R_{DS(ON)} = 12\text{ m}\Omega @ V_{GS} = 10\text{ V}$   
 $R_{DS(ON)} = 14.5\text{ m}\Omega @ V_{GS} = 4.5\text{ V}$
- Low gate charge (18 nC typical)
- Fast switching
- High performance trench technology for extremely low  $R_{DS(ON)}$



### Absolute Maximum Ratings T<sub>A</sub>=25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DSS}$	Drain-Source Voltage	30	V
$V_{GSS}$	Gate-Source Voltage	±16	V
$I_D$	Drain Current – Continuous (Note 3)	54	A
	– Pulsed (Note 1a)	162	
$P_D$	Power Dissipation for Single Operation (Note 1)	57	W
	(Note 1a)	3.8	
	(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)	2.6	°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

### Package Marking and Ordering Information

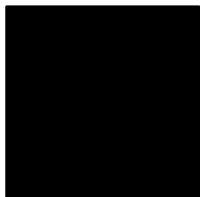
Device Marking	Device	Package	Reel Size	Tape width	Quantity
FDD6692	FDD6692	D-PAK (TO-252)	13"	12mm	2500 units
FDU6692	FDU6692	I-PAK (TO-251)	Tube	N/A	75

**Electrical Characteristics** $T_A = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Drain-Source Avalanche Ratings (Note 2)</b>						
$W_{DSS}$	Drain-Source Avalanche Energy	Single Pulse, $V_{DD} = 15\text{ V}$ , $I_D = 14\text{ A}$			165	mJ
$I_{AR}$	Drain-Source Avalanche Current				14	A
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}$ , $I_D = 250\ \mu\text{A}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		26		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}$ , $V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage, Forward	$V_{GS} = 16\text{ V}$ , $V_{DS} = 0\text{ V}$			100	nA
$I_{GSSR}$	Gate-Body Leakage, Reverse	$V_{GS} = -16\text{ V}$ , $V_{DS} = 0\text{ V}$			-100	nA
<b>On Characteristics (Note 2)</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$	1	1.6	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		-5		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}$ , $I_D = 14\text{ A}$ $V_{GS} = 4.5\text{ V}$ , $I_D = 13\text{ A}$ $V_{GS} = 10\text{ V}$ , $I_D = 14\text{ A}$ , $T_J = 125^\circ\text{C}$		9.5 11.5 16.5	12 14.5 18	m $\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}$ , $V_{DS} = 5\text{ V}$	50			A
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{ V}$ , $I_D = 14\text{ A}$		54		S
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{ V}$ , $V_{GS} = 0\text{ V}$ ,		2164		pF
$C_{oss}$	Output Capacitance	$f = 1.0\text{ MHz}$		357		pF
$C_{rss}$	Reverse Transfer Capacitance			138		pF
<b>Switching Characteristics (Note 2)</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{ V}$ , $I_D = 1\text{ A}$ ,		9	18	ns
$t_r$	Turn-On Rise Time	$V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\ \Omega$		5	10	ns
$t_{d(off)}$	Turn-Off Delay Time			35	56	ns
$t_f$	Turn-Off Fall Time			10	20	ns
$Q_g$	Total Gate Charge	$V_{DS} = 15\text{ V}$ , $I_D = 14\text{ A}$ ,		18	25	nC
$Q_{gs}$	Gate-Source Charge	$V_{GS} = 5\text{ V}$		5		nC
$Q_{gd}$	Gate-Drain Charge			5		nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain-Source Diode Forward Current				3.2	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 3.2\text{ A}$ (Note 2)		0.72	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)  $R_{\theta JA} = 40^{\circ}\text{C/W}$  when mounted on a  $1\text{in}^2$  pad of 2 oz copper



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

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < 300 $\mu\text{s}$ , 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  $T_C = 25^{\circ}\text{C}$  and  $R_{DS(on)}$  is at  $T_{J(max)}$  and  $V_{GS} = 10\text{V}$ . Package current limitation is 21A

### Typical Characteristics

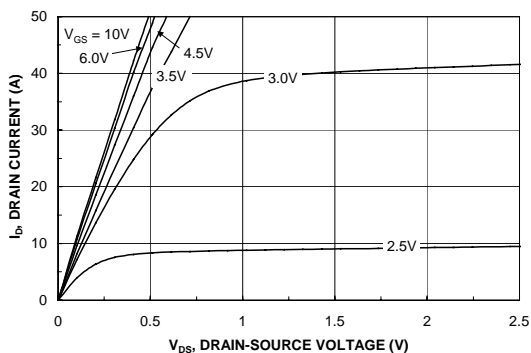


Figure 1. On-Region Characteristics.

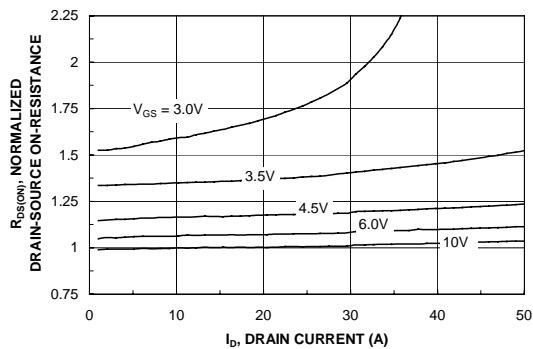


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

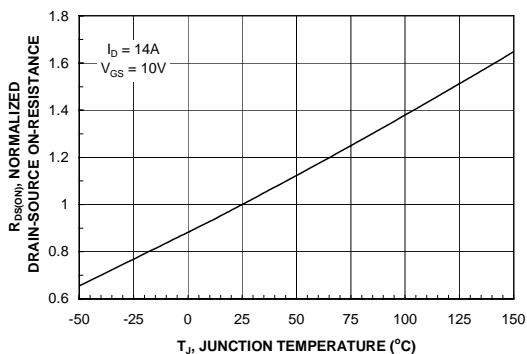


Figure 3. On-Resistance Variation with Temperature.

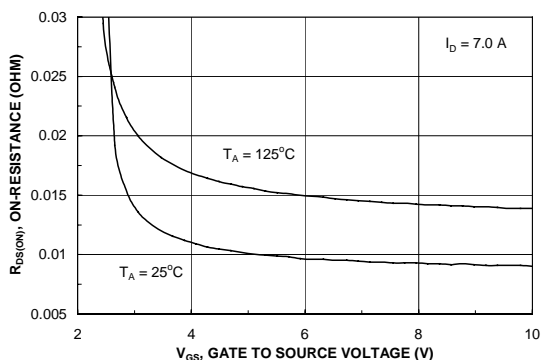


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

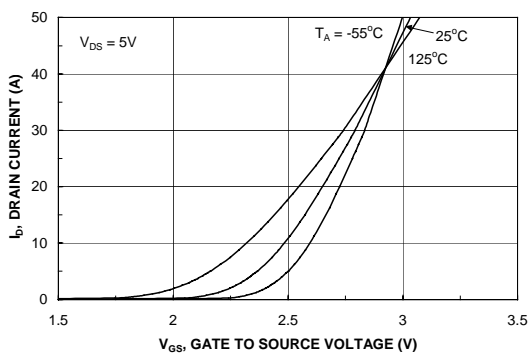


Figure 5. Transfer Characteristics.

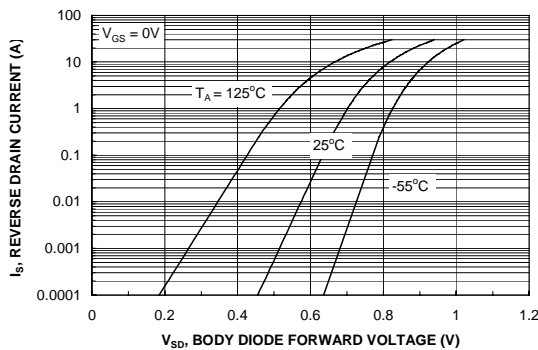
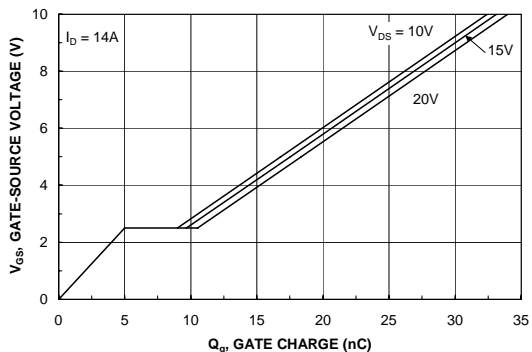
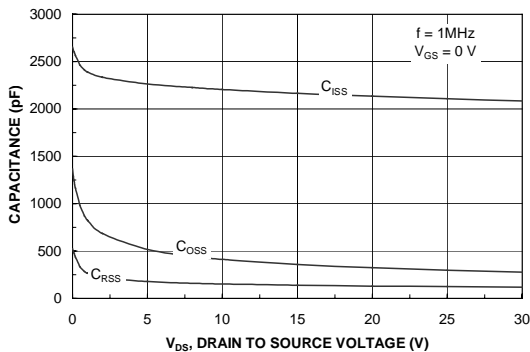


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

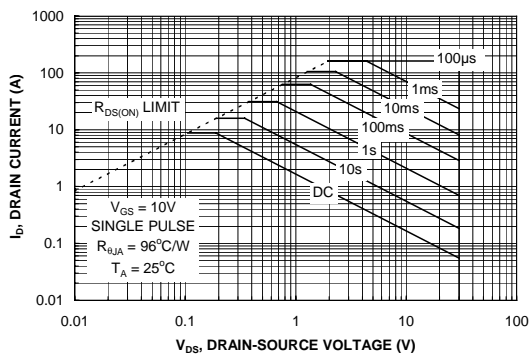
### Typical Characteristics



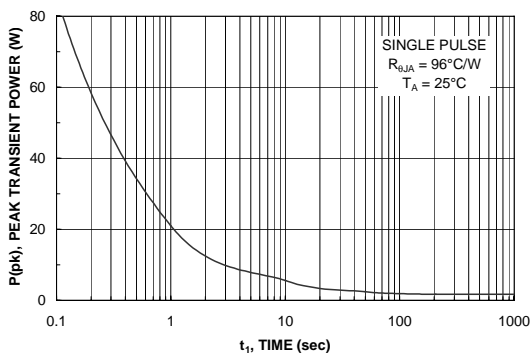
**Figure 7. Gate Charge Characteristics.**



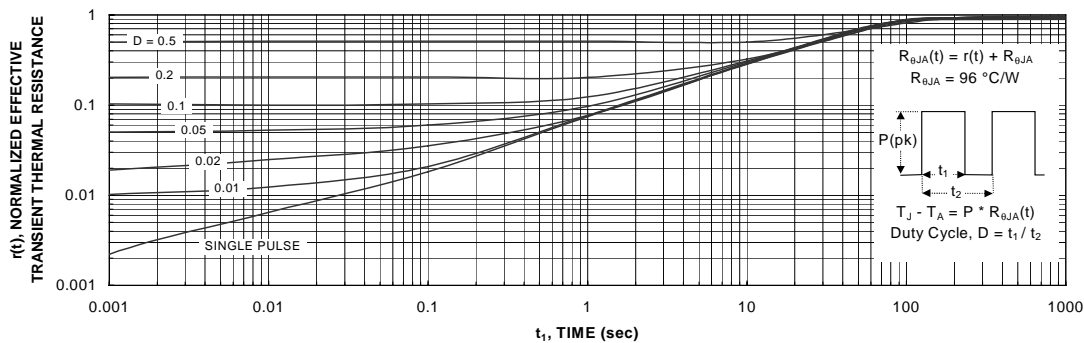
**Figure 8. Capacitance Characteristics.**



**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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