

# FDS5692Z

## N-Channel UltraFET Trench® MOSFET

### 50V, 5.8A, 24mΩ

#### General Description

This N-Channel UltraFET device 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.

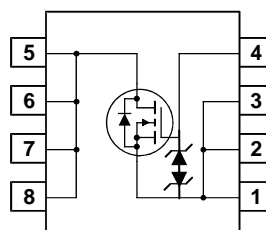
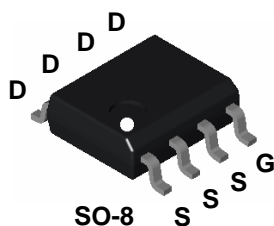
#### Applications

- DC/DC converter



#### Features

- Max  $r_{DS(on)}$  = 24mΩ at  $V_{GS} = 10V$ ,  $I_D = 5.8A$
- Max  $r_{DS(on)}$  = 33mΩ at  $V_{GS} = 4.5V$ ,  $I_D = 5.6A$
- ESD protection diode (note 3)
- Low Qgd
- Fast switching speed



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

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain-Source Voltage	50	V
$V_{GS}$	Gate-Source Voltage	± 20	V
$I_D$	Drain Current – Continuous (Note 1a)	5.8	A
	– Pulsed	40	
$E_{AS}$	Single Pulse Avalanche Energy	72	mJ
$P_D$	UltraFET Dissipation for Single Operation (Note 1a)	2.5	W
	(Note 1b)	1.2	
	(Note 1c)	1.1	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to 150	°C

#### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	50	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1c)	125	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	25	

#### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape width	Quantity
FDS5692Z	FDS5692Z	SO-8	13"	12mm	2500units

### Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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#### Drain-Source Avalanche Ratings

$E_{AS}$	Drain-Source Avalanche Energy (Single Pulse)	$V_{DD} = 50\text{ V}, I_D = 12\text{ A}, L = 1\text{ mH}$			72	mJ
$I_{AS}$	Drain-Source Avalanche Current			12		A

#### Off Characteristics

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	50			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		48		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate-Body Leakage	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$			$\pm 10$	$\mu\text{A}$

#### On Characteristics (Note 4)

$V_{GS(th)}$	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 $25^\circ\text{C}$		-6		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 5.8\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 5.6\text{ A}$ $V_{GS} = 10\text{ V}, I_D = 5.8\text{ A}, T_J = 125^\circ\text{C}$		20 26 32	24 33 41	m $\Omega$

#### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$		1025		pF
$C_{oss}$	Output Capacitance	$f = 1.0\text{ MHz}$		150		pF
$C_{rss}$	Reverse Transfer Capacitance			50		pF
$R_G$	Gate Resistance	$f = 1.0\text{ MHz}$		0.79		$\Omega$
$Q_{g(TOT)}$	Total Gate Charge, $V_{GS} = 10\text{ V}$			18	25	nC
$Q_{g(TOT)}$	Total Gate Charge, $V_{GS} = 5\text{ V}$	$V_{DS} = 25\text{ V}, I_D = 5.8\text{ A}$		10	14	nC
$Q_{gs}$	Gate-Source Gate Charge			2.8		nC
$Q_{gd}$	Gate-Drain Gate Charge			3.0		nC

#### Switching Characteristics (Note 4)

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 25\text{ V}, I_D = 5.8\text{ A},$		9	18	ns
$t_r$	Rise Time	$V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$		5	10	ns
$t_{d(off)}$	Turn-Off Delay Time			27	43	ns
$t_f$	Fall Time			6	12	ns

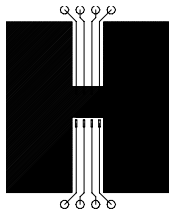
## Electrical Characteristics

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

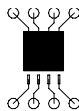
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Drain-Source Diode Characteristics</b>						
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}$ ,	$I_S = 5.8\text{ A}$	0.79	1.25	V
			$I_S = 2.9\text{ A}$	0.75	1.0	V
$t_{rr}$	Reverse Recovery Time	$I_F = 6\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$		24		ns
$Q_{rr}$	Reverse Recovery Charge			16		nC

### Notes:

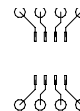
- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a)  $50^\circ\text{C}/\text{W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper



b)  $105^\circ\text{C}/\text{W}$  when mounted on a  $.04\text{ in}^2$  pad of 2 oz copper



c)  $125^\circ\text{C}/\text{W}$  when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

- Pulse Test: Pulse Width  $< 300\mu\text{s}$ , Duty Cycle  $< 2.0\%$

- The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.

## Typical Characteristics

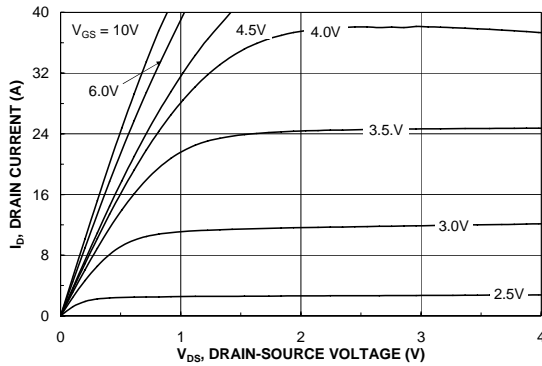


Figure 1. On-Region Characteristics.

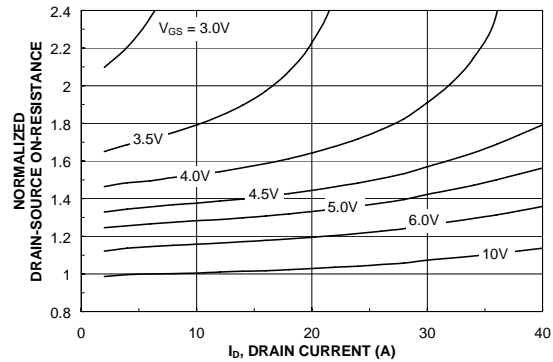


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

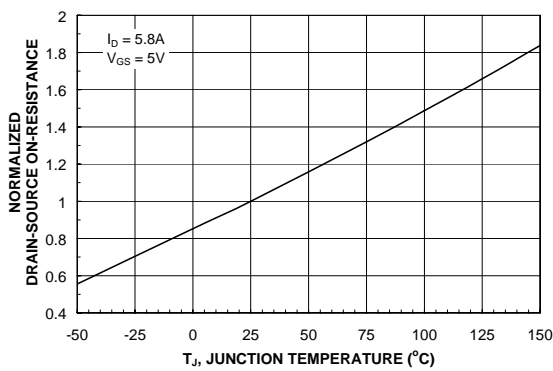


Figure 3. On-Resistance Variation with Temperature.

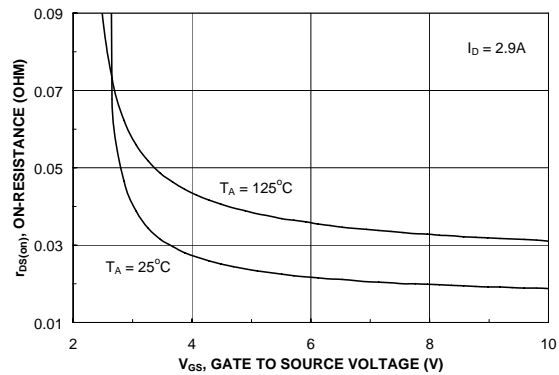


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

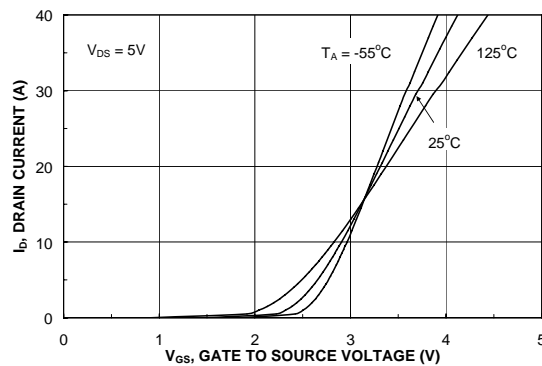


Figure 5. Transfer Characteristics.

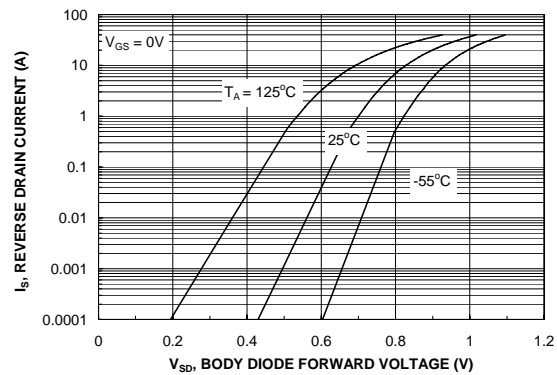


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Characteristics

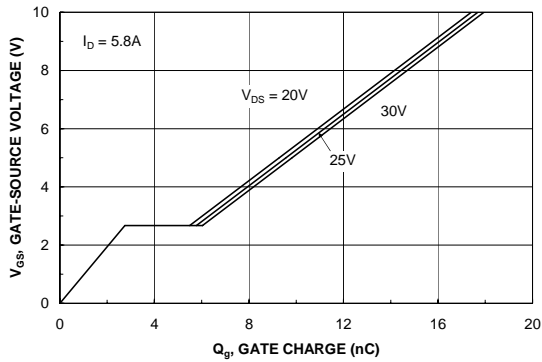


Figure 7. Gate Charge Characteristics.

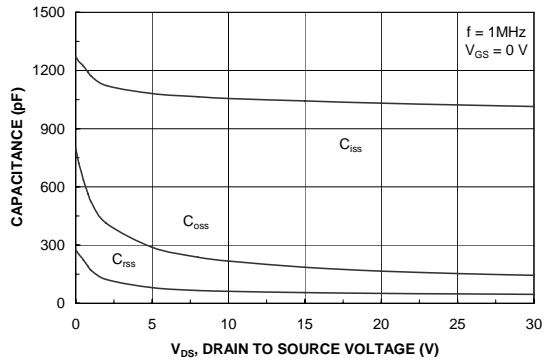


Figure 8. Capacitance Characteristics.

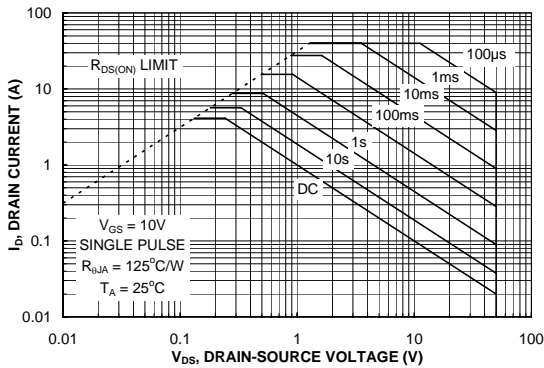


Figure 9. Maximum Safe Operating Area.

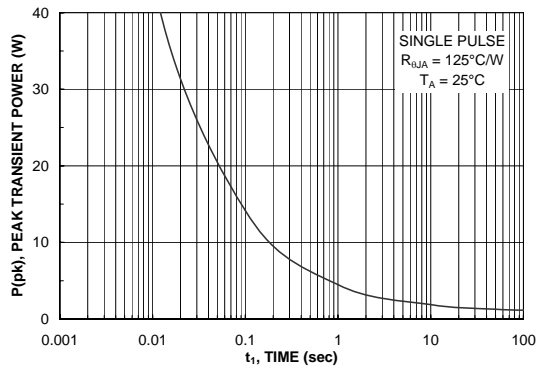


Figure 10. Single Pulse Maximum UltraFET Dissipation.

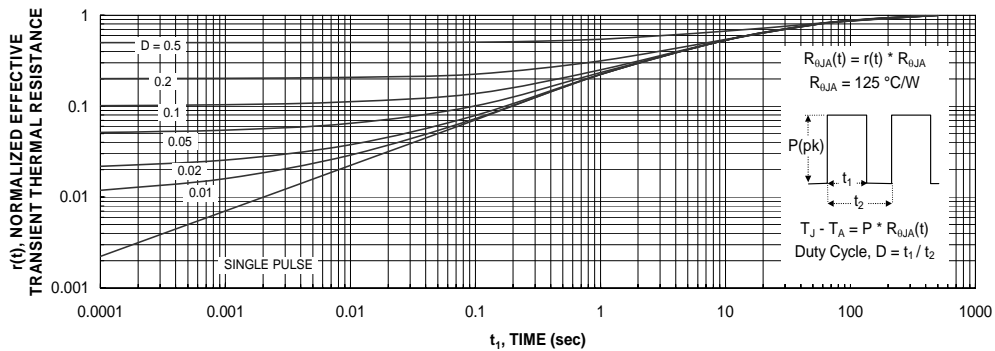


Figure 11. Transient Thermal Response Curve.

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

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