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# FDS8690 N-Channel PowerTrench® MOSFET

30V, 14A, 7.6mΩ

## General Description

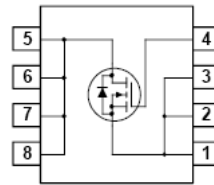
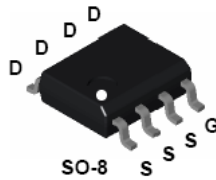
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low  $r_{DS(on)}$  and fast switching speed.

## Applications

- Notebook CPU power supply
- Synchronous rectifier

## Features

- Max  $r_{DS(on)}$  = 7.6mΩ,  $V_{GS} = 10V$ ,  $I_D = 14A$
- Max  $r_{DS(on)}$  = 11.4mΩ,  $V_{GS} = 4.5V$ ,  $I_D = 11.5A$
- High performance trench technology for extremely low  $r_{DS(on)}$  and fast switching
- Very low gate charge
- High power and current handling capability
- 100%  $R_G$  tested
- RoHS Compliant



## Absolute Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise Noted

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	30	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current -Continuous (Note 1a)	14	A
	-Pulsed	100	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	210	mJ
$P_D$	Power Dissipation for Single Operation (Note 1a)	2.5	W
	(Note 1b)	1.2	
	(Note 1c)	1.0	
$T_J, T_{STG}$	Operating and Storage Temperature	-55 to +150	$^\circ\text{C}$

## Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	50	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case (Note 1)	25	$^\circ\text{C/W}$

## Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
FDS8690	FDS8690	13"	12mm	2500 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Off Characteristics**

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$		34.3		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{V}, V_{GS} = 0\text{V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$			$\pm 100$	nA

**On Characteristics (Note 2)**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	1	1.6	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$		- 4.5		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 14\text{A}$		6.3	7.6	m $\Omega$
		$V_{GS} = 4.5\text{V}, I_D = 11.5\text{A}$		8.6	11.4	
		$V_{GS} = 10\text{V}, I_D = 14\text{A}, T_J = 125^\circ\text{C}$		9.0	10.9	

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$		1260	1680	pF
$C_{oss}$	Output Capacitance			535	715	pF
$C_{rss}$	Reverse Transfer Capacitance			80	120	pF
$R_G$	Gate Resistance	$f = 1\text{MHz}$		1.1		$\Omega$

**Switching Characteristics (Note 2)**

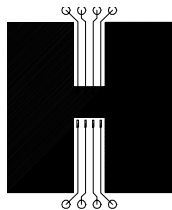
$t_{d(on)}$	Turn-On Delay Time	$V_{DS} = 15\text{V}, I_D = 1\text{A}, V_{GS} = 10\text{V}, R_{GS} = 6\Omega$		8.0	16	ns
$t_r$	Rise Time			1.8	10	ns
$t_{d(off)}$	Turn-Off Delay Time			26	42	ns
$t_f$	Fall Time			19	35	ns
$Q_g$	Total Gate Charge	$V_{DS} = 15\text{V}, V_{GS} = 10\text{V}, I_D = 14\text{A}$		18.8	27	nC
$Q_g$	Total Gate Charge	$V_{DS} = 15\text{V}, V_{GS} = 5\text{V}, I_D = 14\text{A}$		10	14	nC
$Q_{gs}$	Gate to Source Gate Charge			3.5		nC
$Q_{gd}$	Gate to Drain Charge			2.9		nC

**Drain-Source Diode Characteristics**

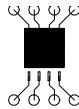
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = 2.1\text{A}$		0.7	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = 14\text{A}, di/dt = 100\text{A}/\mu\text{s}$			45	ns
$Q_{rr}$	Reverse Recovery Charge	$I_F = 14\text{A}, di/dt = 100\text{A}/\mu\text{s}$			33	nC

**Notes:**

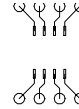
1.  $R_{thJA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{thJC}$  is guaranteed by design while  $R_{thCA}$  is determined by the user's board design.



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

2. The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.  
 3. Starting  $T_J = 25^\circ\text{C}, L = 3\text{mH}, I_{AS} = 11.8\text{A}, V_{DD} = 24\text{V}, V_{GS} = 10\text{V}$ .

**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted

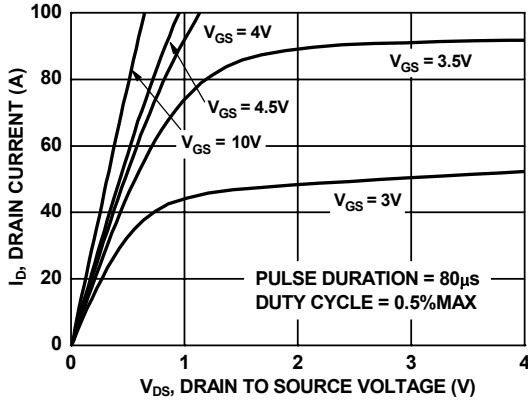


Figure 1. On Region Characteristics

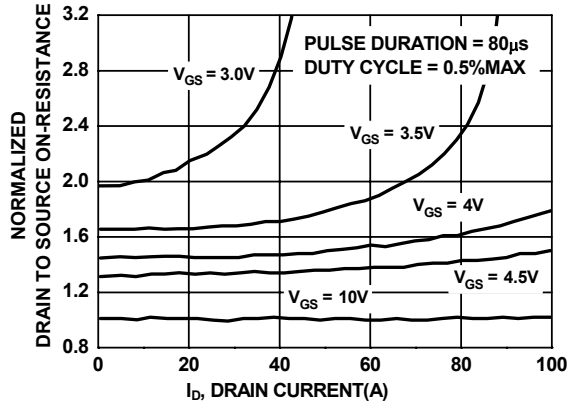


Figure 2. Normal On-Resistance vs Drain Current and Gate Voltage

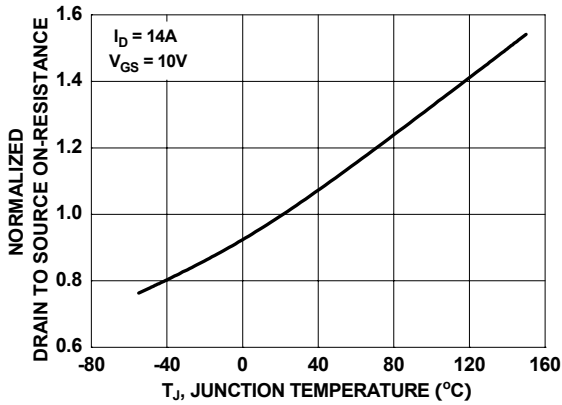


Figure 3. Normalized On Resistance vs Junction Temperature

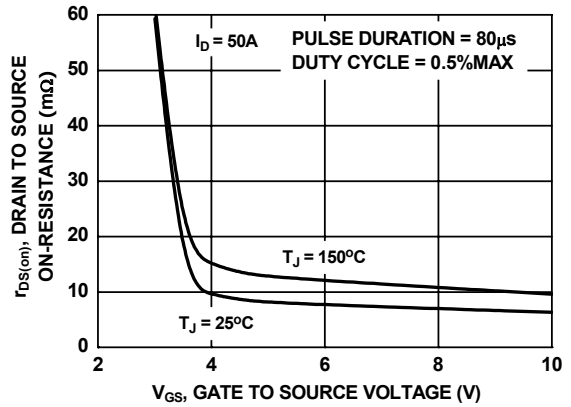


Figure 4. On-Resistance vs Gate to Source Voltage

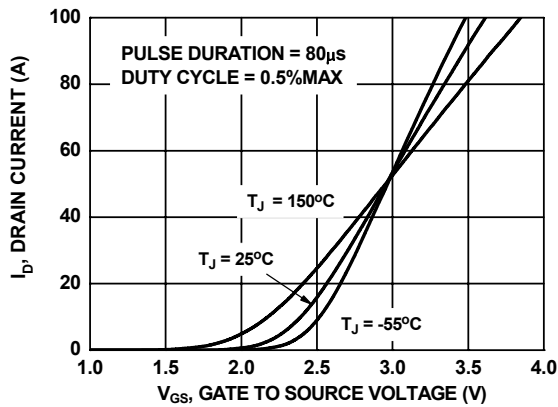


Figure 5. Transfer Characteristics

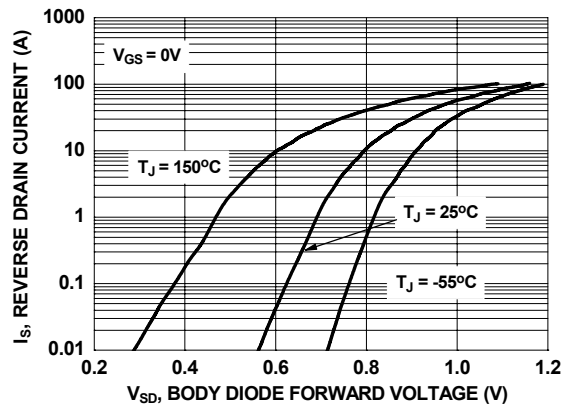


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted

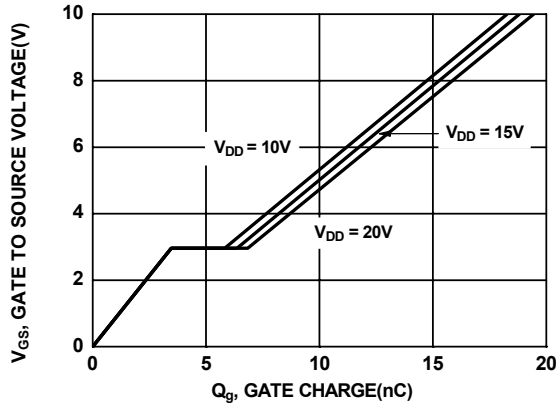


Figure 7. Gate Charge Characteristics

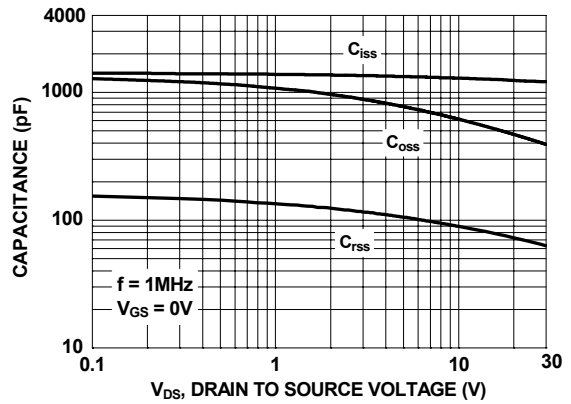


Figure 8. Capacitance vs Drain to Source Voltage

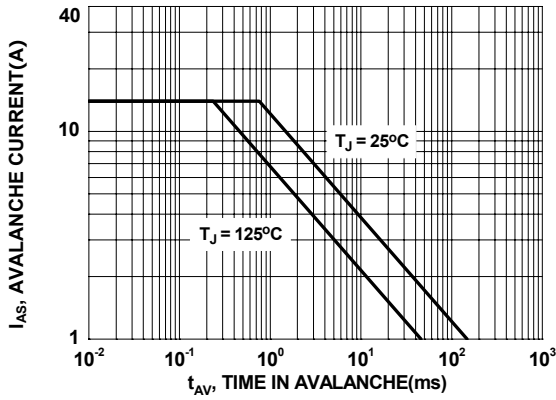


Figure 9. Unclamped Inductive Switching Capability

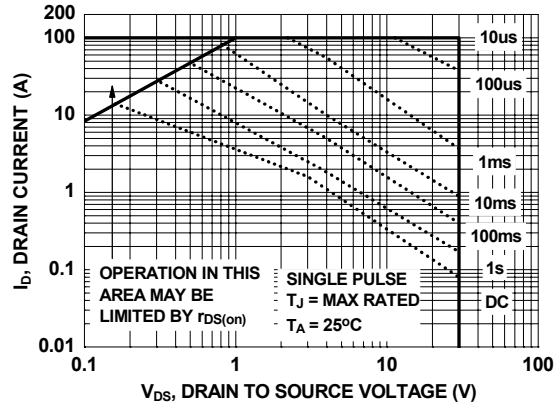


Figure 10. Forward Bias Safe Operating Area

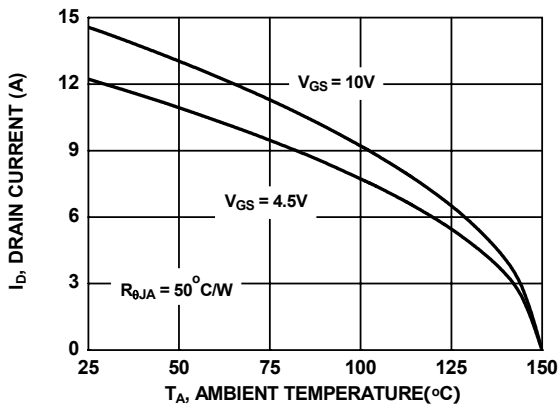


Figure 11. Maximum Continuous Drain Current vs Ambient Temperature

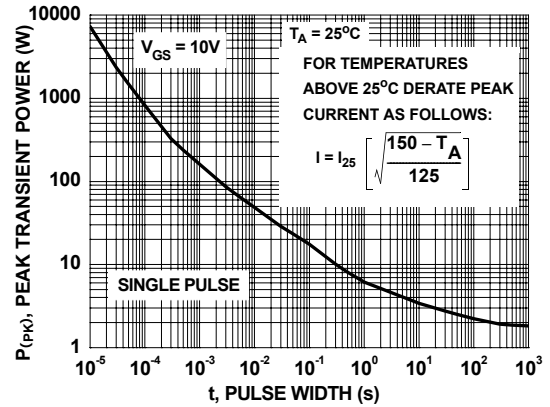
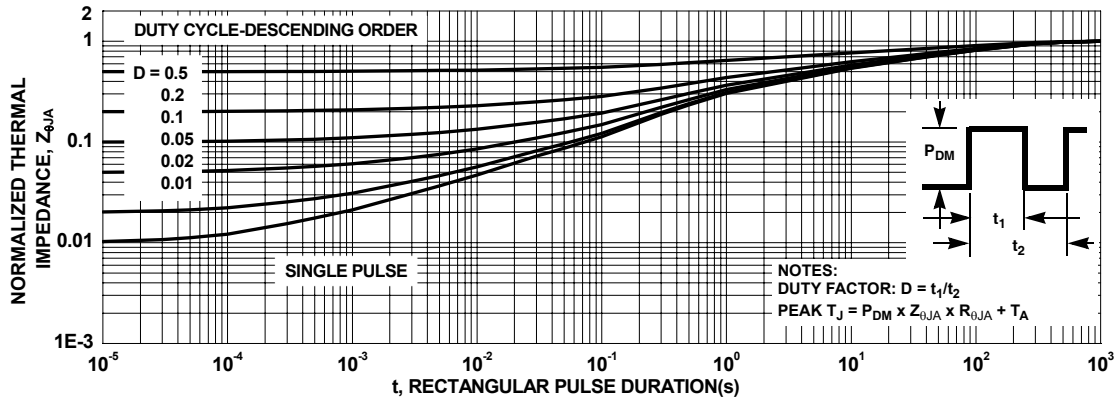


Figure 12. Single Pulse Maximum Power Dissipation

**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



**Figure 13. Transient Thermal Response Curve**

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