

# FDP5690/FDB5690

## 60V N-Channel PowerTrench™ MOSFET

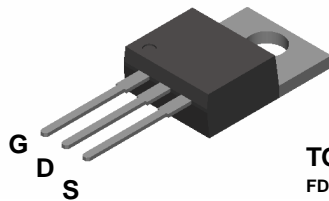
### General Description

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.

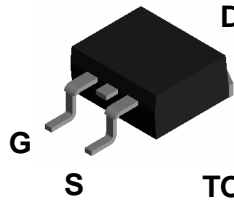
These MOSFETs feature faster switching and lower gate charge than other MOSFETs with comparable  $R_{DS(on)}$  specifications resulting in DC/DC power supply designs with higher overall efficiency.

### Features

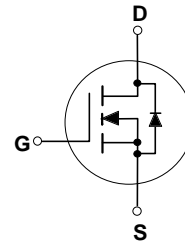
- 32 A, 60 V.  $R_{DS(on)} = 0.027 \Omega @ V_{GS} = 10 \text{ V}$   
 $R_{DS(on)} = 0.032 \Omega @ V_{GS} = 6 \text{ V}$ .
- Critical DC electrical parameters specified at elevated temperature.
- Rugged internal source-drain diode can eliminate the need for an external Zener diode transient suppressor.
- High performance trench technology for extremely low  $R_{DS(on)}$ .
- 175°C maximum junction temperature rating.



**TO-220**  
FDP Series



**TO-263AB**  
FDB Series



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

Symbol	Parameter	FDP5690	FDB5690	Units
$V_{DSS}$	Drain-Source Voltage	60		V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$		V
$I_D$	Maximum Drain Current - Continuous - Pulsed	32		A
		100		
$P_D$	Total Power Dissipation @ $T_C = 25^\circ\text{C}$	58		W
	Derate above $25^\circ\text{C}$	0.4		W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-65 to +175		$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	2.6	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	$^\circ\text{C/W}$

### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
FDB5690	FDB5690	13"	24mm	800
FDP5690	FDP5690	Tube	N/A	45

## Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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### Drain-Source Avalanche Ratings (Note1)

$W_{DSS}$	Single Pulse Drain-Source Avalanche Energy	$V_{DD} = 30\text{ V}, I_D = 32\text{ A}$			80	mJ
$I_{AR}$	Maximum Drain-Source Avalanche Current				32	A

### Off Characteristics

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		61		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$			-100	nA

### On Characteristics (Note 1)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2	2.4	4	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		-6.4		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 16\text{ A}$ , $V_{GS} = 10\text{ V}, I_D = 16\text{ A}, T_J = 125^\circ\text{C}$ $V_{GS} = 6\text{ V}, I_D = 15\text{ A}$		0.021 0.042 0.024	0.027 0.055 0.032	$\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$	50			A
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{ V}, I_D = 16\text{ A}$		32		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}$ , $f = 1.0\text{ MHz}$		1120		pF
$C_{oss}$	Output Capacitance			160		pF
$C_{rss}$	Reverse Transfer Capacitance			80		pF

### Switching Characteristics (Note 1)

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\text{ V}, I_D = 1\text{ A}$ , $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$		10	18	ns
$t_r$	Turn-On Rise Time			9	18	ns
$t_{d(off)}$	Turn-Off Delay Time			24	39	ns
$t_f$	Turn-Off Fall Time			10	18	ns
$Q_g$	Total Gate Charge	$V_{DS} = 15\text{ V}$ , $I_D = 16\text{ A}, V_{GS} = 10\text{ V}$		23	33	nC
$Q_{gs}$	Gate-Source Charge			3.9		nC
$Q_{gd}$	Gate-Drain Charge			6.8		nC

### Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current (Note 1)				32	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 16\text{ A}$ (Note 1)		0.92	1.2	V

**Note:**

1. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$

## Typical Characteristics

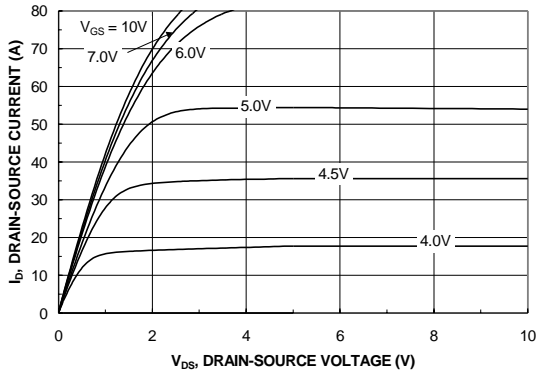


Figure 1. On-Region Characteristics.

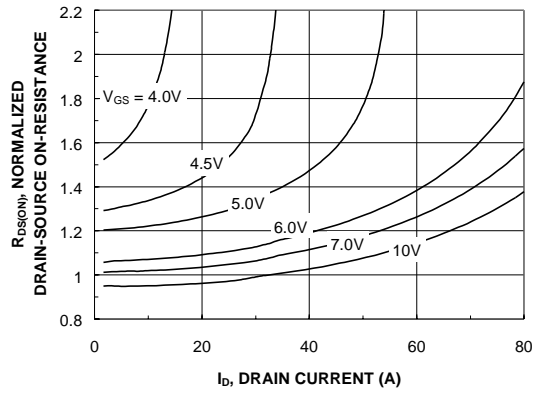


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

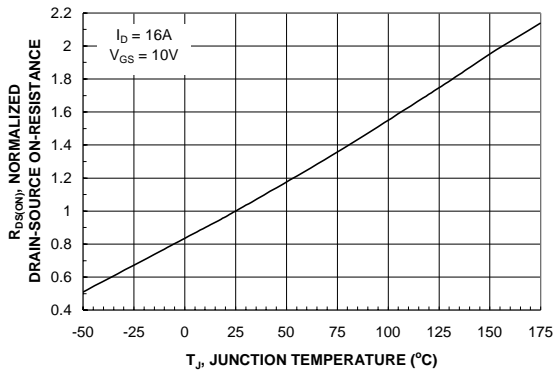


Figure 3. On-Resistance Variation with Temperature.

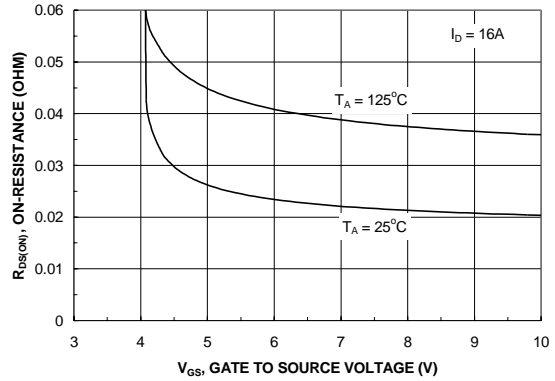


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

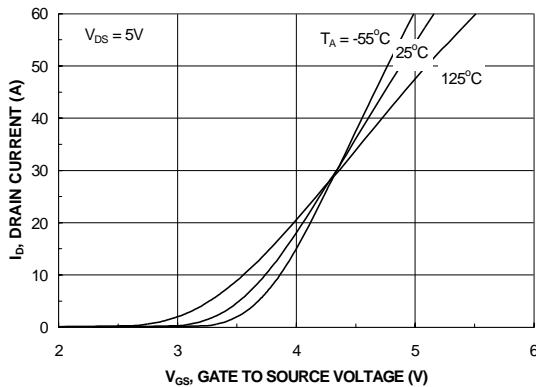


Figure 5. Transfer Characteristics.

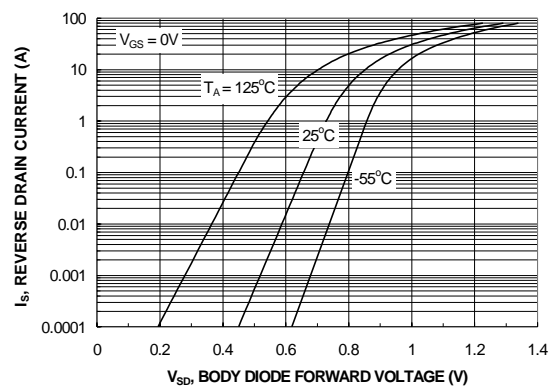
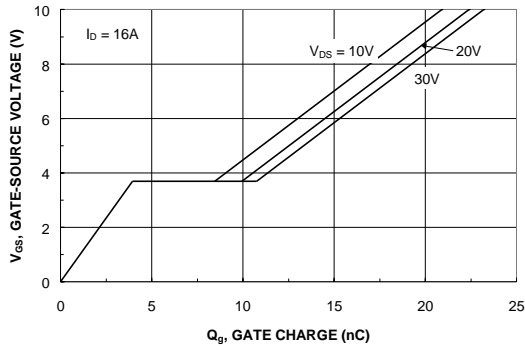
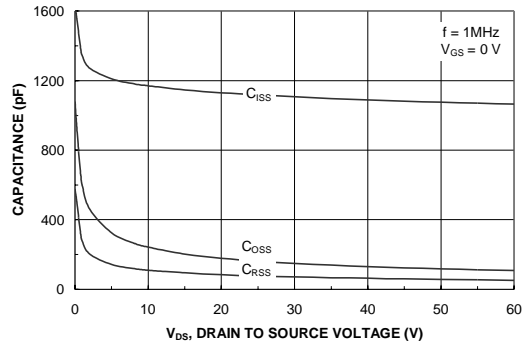


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

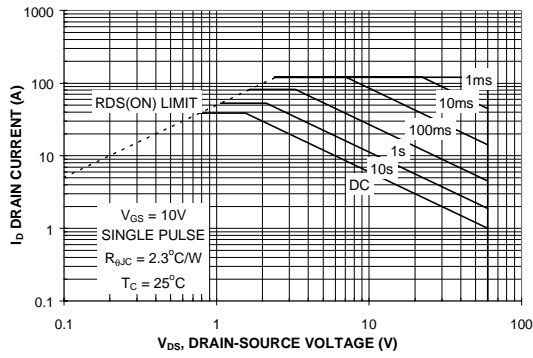
**Typical Characteristics** (continued)



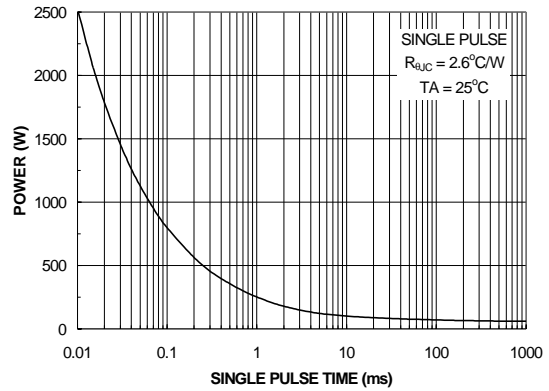
**Figure 7. Gate-Charge Characteristics.**



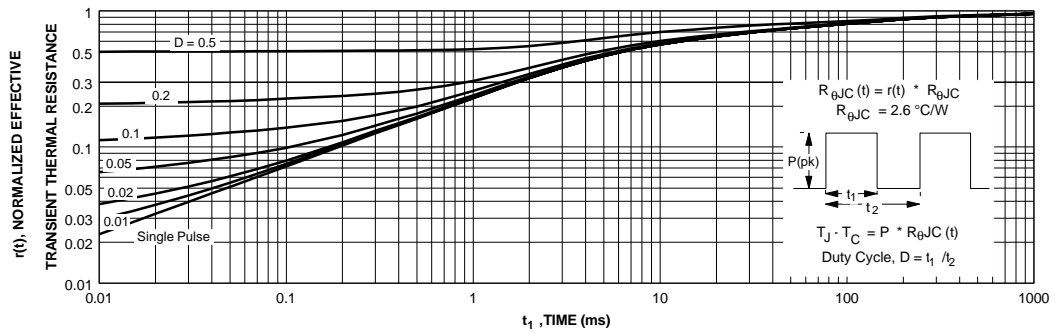
**Figure 8. Capacitance Characteristics.**



**Figure 9. Maximum Safe Operating Area.**



**Figure 10. Single Pulse Maximum Power Dissipation.**



**Figure 11. Transient Thermal Response Curve.**

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