July 2000

FDP5690/FDB5690



FDP5690/FDB5690 60V N-Channel PowerTrench™MOSFET

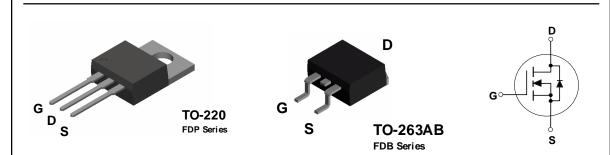
General Description

Features

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.

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



Absolute Maximum Ratings T_c = 25°C unless otherwise noted

Symbol	Parameter	FDP5690	FDB5690	Units
V _{DSS}	Drain-Source Voltage	60		V
V _{GSS}	Gate-Source Voltage	±20		V
ID	Maximum Drain Current - Continuous	32		А
	- Pulsed	1	00	
PD	Total Power Dissipation @ T _C = 25°C	58		W
	Derate above 25°C	0.4		W/°C
T _J , T _{STG}	Operating and Storage Junction Temperature Range	-65 to	o +175	°C
Therma	Characteristics			
R _e JC	Thermal Resistance, Junction-to-Case	2.6		°C/W
$R_{_{ heta}JA}$	Thermal Resistance, Junction-to-Ambient	62.5		°C/W

Package Marking and Ordering Information

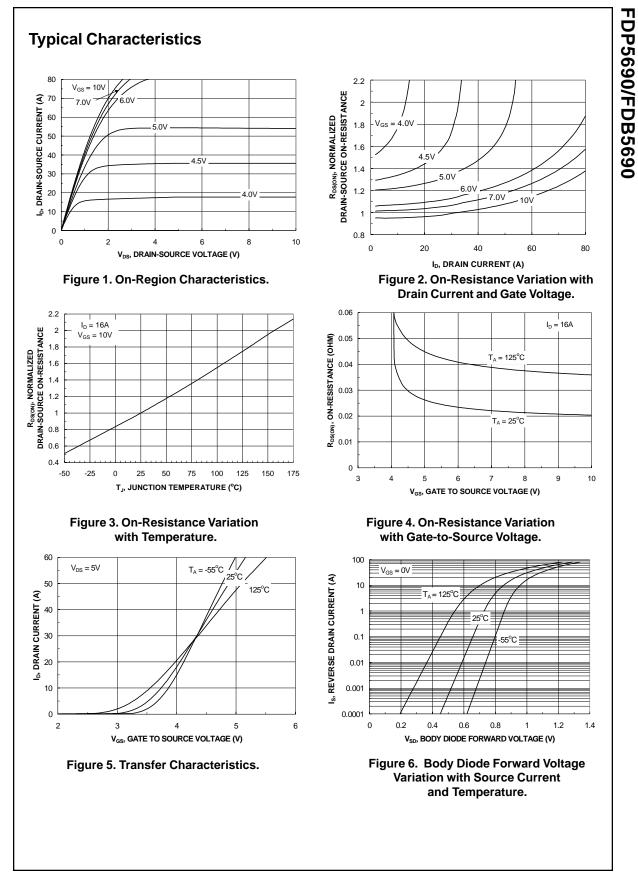
Device Marking	Device	Reel Size	Tape Width	Quantity
FDB5690	FDB5690	13"	24mm	800
FDP5690	FDP5690	Tube	N/A	45

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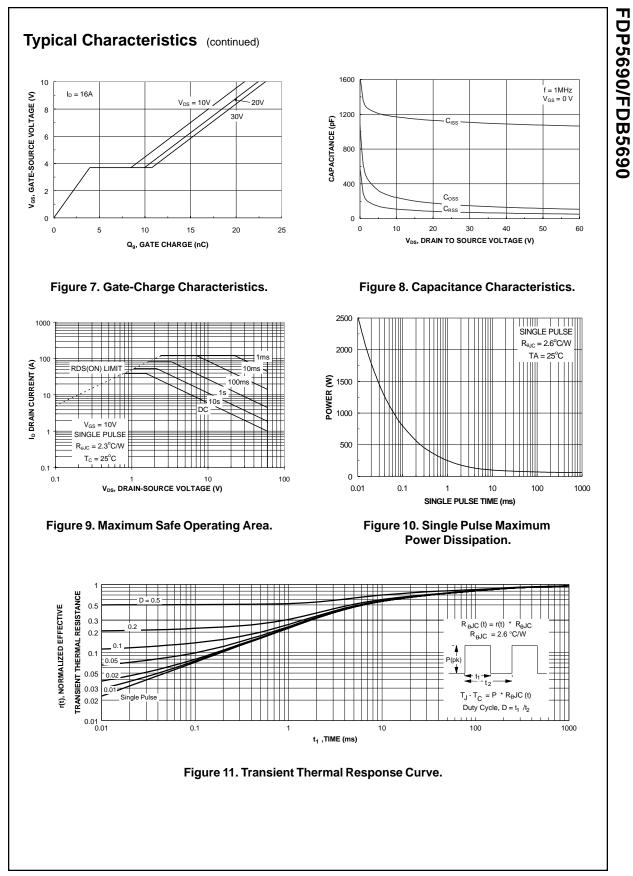
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Symbol	Parameter	Test Conditions	Min	Тур	Max	Units
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Drain-Sc	ource Avalanche Ratings (N	ote1)				
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		Single Pulse Drain-Source				80	mJ
	AR	Maximum Drain-Source Avalanche	Current			32	Α
	Off Char	acteristics					
NBL/DOS AT_Breakdown Voltage Temperature CoefficientIb = 250 μ A, Referenced to 25°C611DSSZero Gate Voltage Drain Current, ForwardVos = 48 V, Vos = 0 V100Gate-Body Leakage Current, ReverseVos = 20 V, Vos = 0 V100Gate-Body Leakage Current, ReverseVos = -20 V, Vos = 0 V-100CostGate Threshold Voltage Temperature CoefficientVos = -20 V, Vos = 0 V-100CostGate Threshold Voltage Temperature CoefficientVos = -20 V, Vos = 0 V-100Ausun Ausun AusunGate Threshold Voltage Temperature CoefficientVos = -20 μ A, Referenced to 25°C-6.4-1Ausun Ausun Ausun Ausun Ausun (ate Drain-Source On-ResistanceVos = 10 V, Ib = 16 A, Vos = 10 V, Ib = 16 A, Vos = 5 V, Ib = 16 A0.0210.027On-State Drain Current Vos = 10 V, Vos = 5 V, Vos = 0 V, Vos = 5 V, Vos = 0 V,50Optimic Characteristics Com ComeVos = 5 V, Vos = 0 V, Vos = 5 V, Vos = 0 V,1120-Output Capacitance Vos = 10 V, Vos = 5 V, Vos = 0 V, Vos = 5 V, Vos = 0 V, Turn-On Rise TimeVos = 30 V, Ib = 1 A, Vos = 10 V, Ib = 16 A32-Output Capacitance Vos = 10 V, RGEN = 6 Ω 918-Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun Ausun			$V_{GS} = 0 V, I_{D} = 250 \mu A$	60			V
$\begin{array}{c c c c c c c c c c c c c c c c c c c $. .			61		mV/∘C
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		Zero Gate Voltage Drain Current	V _{DS} = 48 V, V _{GS} = 0 V			1	μA
GSSR Reverse VGS 20 V, VGS = 0 V -100 On Characteristics (Note 1) (Mathematical Stress of the state of	GSSF	,	$V_{GS} = 20 \text{ V}, V_{DS} = 0 \text{ V}$			100	nA
	GSSR	_ , ,	$V_{GS} = -20 \text{ V}, \text{ V}_{DS} = 0 \text{ V}$			-100	nA
	<u> On</u> Char	acteristics (Note 1)					
$ \begin{array}{c c c c c c c } \hline \begin{tabular}{ c c c c c c } \hline \begin{tabular}{ c c c c c } \hline \begin{tabular}{ c c c c c } \hline \begin{tabular}{ c c c c c c } \hline \begin{tabular}{ c c c c c c } \hline \begin{tabular}{ c c c c c c c } \hline \begin{tabular}{ c c c c c c c } \hline \begin{tabular}{ c c c c c c c } \hline \begin{tabular}{ c c c c c c c } \hline \begin{tabular}{ c c c c c c c c } \hline \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$			$V_{DS} = V_{GS}, I_D = 250 \ \mu A$	2	2.4	4	V
Static Drain-Source On-Resistance $V_{GS} = 10 \text{ V}, \text{ I}_D = 16 \text{ A}, \text{T}_J = 125^{\circ}\text{C}$ 0.042 0.055 D(m) On-State Drain Current $V_{GS} = 10 \text{ V}, \text{ V}_{DS} = 5 \text{ V}$ 50 0.024 0.032 D(m) On-State Drain Current $V_{GS} = 10 \text{ V}, \text{ V}_{DS} = 5 \text{ V}$ 50 0.024 0.032 D(m) On-State Drain Current $V_{GS} = 10 \text{ V}, \text{ V}_{DS} = 5 \text{ V}$ 50 0.024 0.032 D(m) On-State Drain Current $V_{GS} = 10 \text{ V}, \text{ V}_{DS} = 5 \text{ V}$ 50 0.024 0.032 D(m) On-State Drain Current $V_{GS} = 10 \text{ V}, \text{ V}_{DS} = 5 \text{ V}$ 0.042 0.055 0.024 0.032 D(m) Characteristics V_{DS} $25 \text{ V}, \text{ I}_D = 16 \text{ A}$ 32 1120 1120 1120 1120 1160 100 18 Crass Reverse Transfer Capacitance V_{DD} = 30 \text{ V}, \text{ I}_D = 1 \text{ A}, \text{ V}_{GS} = 10 \text{ V} 100 18 224 39 18 d(off) Turn-On Rise Time $V_{DS} = 15 \text{ V}, \text{ I}_D = 16 \text{ A}, \text{ V}_{GS} = 10 \text{ V}$	VGS(th)	5			-6.4		mV/∘C
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	R _{DS(on)}	Static Drain-Source					Ω
JFSForward Transconductance $V_{DS} = 5 \text{ V}, I_D = 16 \text{ A}$ 32Opnamic CharacteristicsInput Capacitance $V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V}, f = 1.0 \text{ MHz}$ 1120CossOutput Capacitance $f = 1.0 \text{ MHz}$ 160CrssReverse Transfer CapacitanceVDD = 30 V, ID = 1 A, VGS = 0 V, GS = 0 V, GS = 0 V, ID = 1 A, VGS = 10 V, RGEN = 6 \Omega100Switching Characteristics (Note 1)VDD = 30 V, ID = 1 A, VGS = 10 V, RGEN = 6 \Omega10018AddifiTurn-On Rise TimeVDD = 30 V, RGEN = 6 \Omega918AddifiTurn-Off Delay TimeVDS = 15 V, ID = 16 A, VGS = 10 V2333AgaGate-Drain ChargeVDS = 15 V, ID = 16 A, VGS = 10 V3.910018Orain-Source Diode Characteristics and Maximum Ratings6.81032Maximum Continuous Drain-Source Diode Forward Current (Note 1)3232Value VoltageVGS = 0 V, IS = 16 A (Note 1)32VerterVGS = 0 V, IS = 16 A (Note 1)0.921.2							
Dynamic CharacteristicsClassInput Capacitance $V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V}, f = 1.0 \text{ MHz}$ 1120ClassOutput Capacitancef = 1.0 \text{ MHz}160ClassReverse Transfer Capacitance80Switching Characteristics(Note 1)d(on)Turn-On Delay Time $V_{DD} = 30 \text{ V}, \text{ Ib} = 1 \text{ A}, V_{GS} = 10 \text{ V}, R_{GEN} = 6 \Omega$ d(off)Turn-Off Delay Time $V_{DS} = 10 \text{ V}, R_{GEN} = 6 \Omega$ 9d(off)Turn-Off Fall Time1018d(off)Turn-Off Fall Time1018 Q_{qa} Gate-Charge $V_{DS} = 15 \text{ V}, I_{D} = 16 \text{ A}, V_{GS} = 10 \text{ V}$ 23 Q_{qd} Gate-Drain Charge $V_{DS} = 15 \text{ V}, I_{D} = 16 \text{ A}, V_{GS} = 10 \text{ V}$ 3.9Characteristics and Maximum RatingssMaximum Continuous Drain-Source Diode Forward Current (Note 1)32 V_{SD} Drain-Source Diode Forward $V_{GS} = 0 \text{ V}, I_S = 16 \text{ A}$ (Note 1)0.92 V_{OLAge} VoltageV_{SS} = 0 \text{ V}, I_S = 16 \text{ A} (Note 1)0.92	D(on)	On-State Drain Current	$V_{GS} = 10 \text{ V}, V_{DS} = 5 \text{ V}$	50			A
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	FS	Forward Transconductance	$V_{DS} = 5 V, I_D = 16 A$		32		S
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Dvnamic	Characteristics					
2_{OSS} Output Capacitance160 C_{rss} Reverse Transfer Capacitance80Switching Characteristics (Note 1) 10 18 $d(on)$ Turn-On Delay Time $V_{DD} = 30 \text{ V}, I_D = 1 \text{ A}, V_{GS} = 10 \text{ V}, R_{GEN} = 6 \Omega$ 9 $d(off)$ Turn-Off Delay Time 24 39 $d(off)$ Turn-Off Fall Time1018 Q_{q} Total Gate Charge $V_{DS} = 15 \text{ V}, I_D = 16 \text{ A}, V_{GS} = 10 \text{ V}$ 23 Q_{qd} Gate-Drain Charge $I_D = 16 \text{ A}, V_{GS} = 10 \text{ V}$ 3.9 O_{qd} Gate-Drain Charge 6.8 0 $O_{rain-Source Diode Characteristics and Maximum Ratings32SMaximum Continuous Drain-Source Diode Forward Current (Note 1)32V_{SD}V_{OItage}V_{GS} = 0 \text{ V}, I_S = 16 \text{ A} (Note 1)0.92I_{SD}V_{OItage}V_{GS} = 0 \text{ V}, I_S = 16 \text{ A} (Note 1)0.92$	-		$V_{DS} = 25 V, V_{GS} = 0 V,$		1120		pF
CressReverse Transfer Capacitance80Switching Characteristics(Note 1) $d(on)$ Turn-On Delay Time $V_{DD} = 30 V, I_D = 1 A, V_{GS} = 10 V, R_{GEN} = 6 \Omega$ 1018 $d(off)$ Turn-On Rise Time $V_{GS} = 10 V, R_{GEN} = 6 \Omega$ 918 $d(off)$ Turn-Off Delay Time1018 $d(off)$ Turn-Off Fall Time1018 Q_{q} Total Gate Charge $V_{DS} = 15 V, I_D = 16 A, V_{GS} = 10 V$ 23 Q_{qd} Gate-Source Charge $I_D = 16 A, V_{GS} = 10 V$ 3.9Orain-Source Diode Characteristics and Maximum Ratings S_{S} Maximum Continuous Drain-Source Diode Forward Current(Note 1)32 V_{SD} Drain-Source Diode Forward $V_{GS} = 0 V, I_S = 16 A$ (Note 1)0.92 V_{SD} Drain-Source Diode Forward $V_{GS} = 0 V, I_S = 16 A$ (Note 1)0.921.2 V_{SD} Drain-Source Diode Forward $V_{GS} = 0 V, I_S = 16 A$ (Note 1)0.921.2	Coss	Output Capacitance	f = 1.0 MHz		160		pF
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		Reverse Transfer Capacitance			80		pF
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Switchin	a Characteristics (Note 1)					
rTurn-On Rise Time doff) $V_{GS} = 10 \text{ V}, R_{GEN} = 6 \Omega$ 918 d_{doff} Turn-Off Delay Time f2439 f_{doff} Turn-Off Fall Time Dag1018 Ω_{g} Total Gate Charge 		-	$V_{DD} = 30 \text{ V}, \text{ I}_{D} = 1 \text{ A},$		10	18	ns
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	<i>x i</i>		V_{GS} = 10 V, R_{GEN} = 6 Ω				ns
Turn-Off Fall Time1018 Q_g Total Gate Charge $V_{DS} = 15 \text{ V}$,2333 Q_{gs} Gate-Source Charge $I_D = 16 \text{ A}$, $V_{GS} = 10 \text{ V}$ 3.93.9 Q_{gd} Gate-Drain Charge6.86.8Drain-Source Diode Characteristics and Maximum RatingssMaximum Continuous Drain-Source Diode Forward Current(Note 1)32 V_{SD} Drain-Source Diode Forward $V_{GS} = 0 \text{ V}$, $I_S = 16 \text{ A}$ (Note 1)0.921.2wretter		Turn-Off Delay Time			24	39	ns
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		· · · · · · · · · · · · · · · · · · ·			10	18	ns
Qgs Gate-Source Charge Ip = 16 Å, VGS = 10 V 3.9 Qgd Gate-Drain Charge 6.8 6.8 Drain-Source Diode Characteristics and Maximum Ratings 3.9 3.9 S Maximum Continuous Drain-Source Diode Forward Current (Note 1) 32 VSD Drain-Source Diode Forward VGS = 0 V, IS = 16 Å (Note 1) 0.92 1.2 te: Contact Co		Total Gate Charge	V _{DS} = 15 V,		23	33	nC
Drain-Source Diode Characteristics and Maximum Ratings s Maximum Continuous Drain-Source Diode Forward Current (Note 1) 32 /SD Drain-Source Diode Forward V _{GS} = 0 V, I _S = 16 A (Note 1) 0.92 1.2 wre: Wret Wret Wret Wret Wret Wret			$I_D = 16 \text{ A}, V_{GS} = 10 \text{ V}$		3.9		nC
S Maximum Continuous Drain-Source Diode Forward Current (Note 1) 32 / _{SD} Drain-Source Diode Forward V _{GS} = 0 V, I _S = 16 A (Note 1) 0.92 1.2 voltage		Gate-Drain Charge			6.8		nC
S Maximum Continuous Drain-Source Diode Forward Current (Note 1) 32 / _{SD} Drain-Source Diode Forward V _{GS} = 0 V, I _S = 16 A (Note 1) 0.92 1.2 voltage	Jrain-Sc	urco Diodo Charactoristics	and Maximum Patings				
V_{SD} Drain-Source Diode Forward $V_{GS} = 0 \text{ V}, \text{ I}_{S} = 16 \text{ A}$ (Note 1) 0.92 1.2 the:			-			32	А
Voltage					0.92		V
		Voltage					
		Pulse Width \leq 300 μ s, Duty Cycle \leq 2.0%					

FDP5690/FDB5690

FDP5690/FDB5690 Rev. C



FDP5690/FDB5690 Rev. C



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