

## FDP5680/FDB5680

### 60V N-Channel PowerTrench™ MOSFET

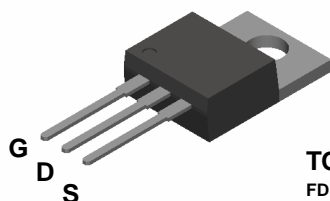
#### General Description

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.

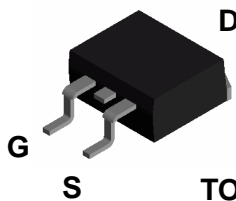
These MOSFETs feature faster switching and lower gate charge than other MOSFETs with comparable  $R_{DS(ON)}$  specifications resulting in DC/DC power supply designs with higher overall efficiency.

#### Features

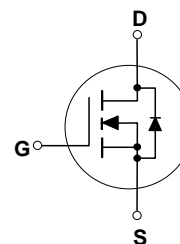
- 40 A, 60 V.  $R_{DS(ON)} = 0.020 \Omega @ V_{GS} = 10 \text{ V}$   
 $R_{DS(ON)} = 0.023 \Omega @ V_{GS} = 6 \text{ V}$ .
- Critical DC electrical parameters specified at elevated temperature.
- Rugged internal source-drain diode can eliminate the need for an external Zener diode transient suppressor.
- High performance trend 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	FDP5680	FDB5680	Units
$V_{DSS}$	Drain-Source Voltage	60		V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$		V
$I_D$	Maximum Drain Current - Continuous - Pulsed	40		A
		120		
$P_D$	Total Power Dissipation @ $T_C = 25^\circ\text{C}$	65		W
	Derate above $25^\circ\text{C}$	0.43		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	2.3	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	$^\circ\text{C/W}$

#### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
FDB5680	FDB5680	13"	24mm	800
FDP5680	FDP5680	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	$V_{DD} = 30\text{ V}, I_D = 40\text{ A}$			90	mJ
$I_{AR}$	Maximum Drain-Source Avalanche Current				40	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 $25^\circ\text{C}$		60		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	2.5	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	$V_{GS} = 10\text{ V}, I_D = 20\text{ A}$ , $V_{GS} = 10\text{ V}, I_D = 20\text{ A}, T_J = 125^\circ\text{C}$ $V_{GS} = 6\text{ V}, I_D = 19\text{ A}$		0.016 0.022 0.018	0.020 0.035 0.023	$\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$	20			A
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{ V}, I_D = 20\text{ A}$		43		S

#### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}$ , $f = 1.0\text{ MHz}$		1850		pF
$C_{oss}$	Output Capacitance			230		pF
$C_{riss}$	Reverse Transfer Capacitance			95		pF

#### Switching Characteristics (Note 1)

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\text{ V}, I_D = 1\text{ A}$ , $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$		15	27	ns
$t_r$	Turn-On Rise Time			9	18	ns
$t_{d(off)}$	Turn-Off Delay Time			35	56	ns
$t_f$	Turn-Off Fall Time			16	26	ns
$Q_g$	Total Gate Charge	$V_{DS} = 30\text{ V}, I_D = 20\text{ A}$ , $V_{GS} = 10\text{ V}$		33	46	nC
$Q_{gs}$	Gate-Source Charge			6.5		nC
$Q_{gd}$	Gate-Drain Charge			7.5		nC

#### Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current (Note 1)				40	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 20\text{ A}$ (Note 1)		0.9	1.2	V

**Note:**

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

Typical Characteristics

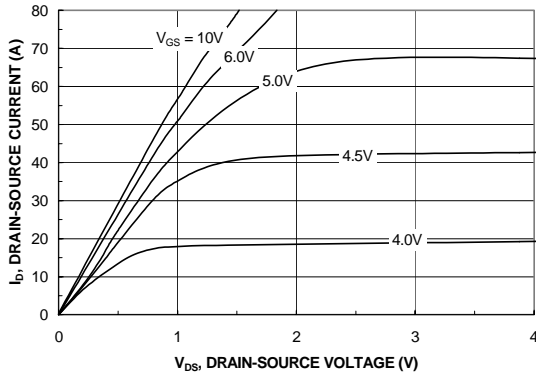


Figure 1. On-Region Characteristics.

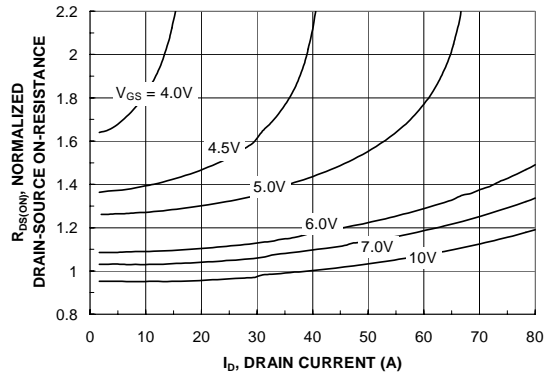


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

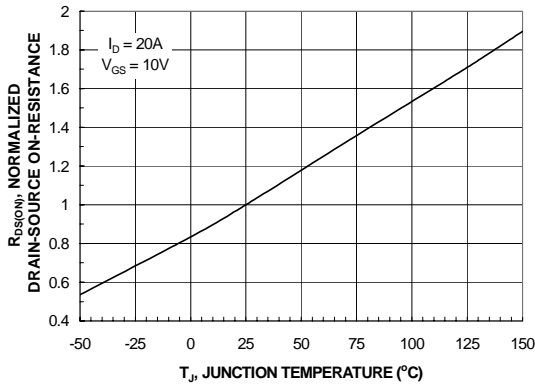


Figure 3. On-Resistance Variation with Temperature.

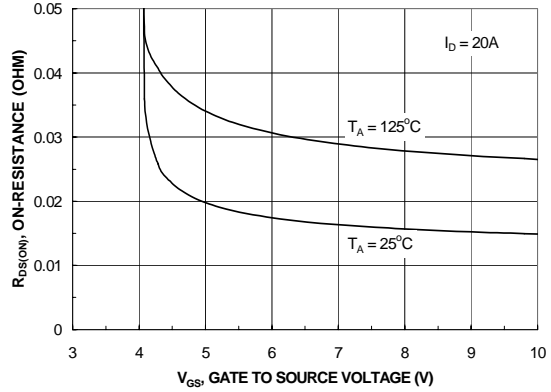


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

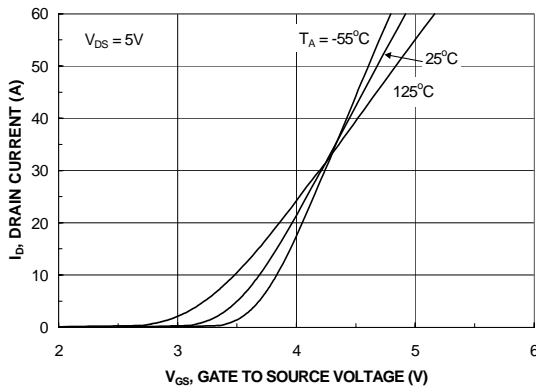


Figure 5. Transfer Characteristics.

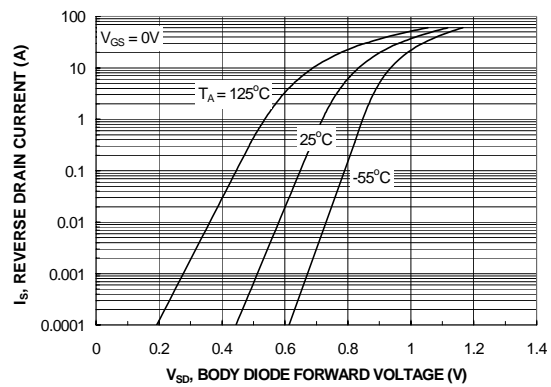
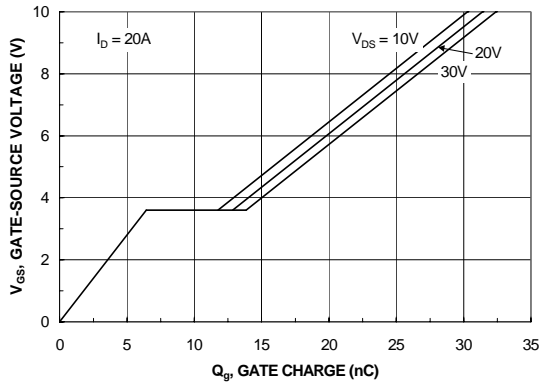
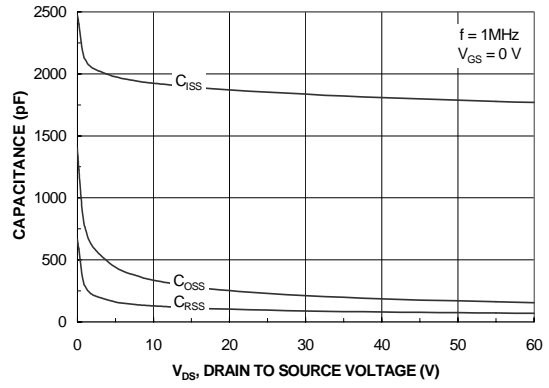


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

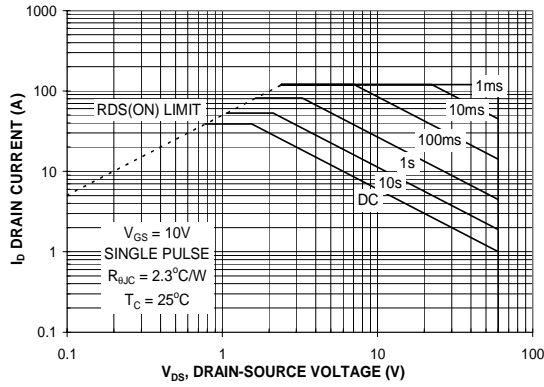
**Typical Characteristics** (continued)



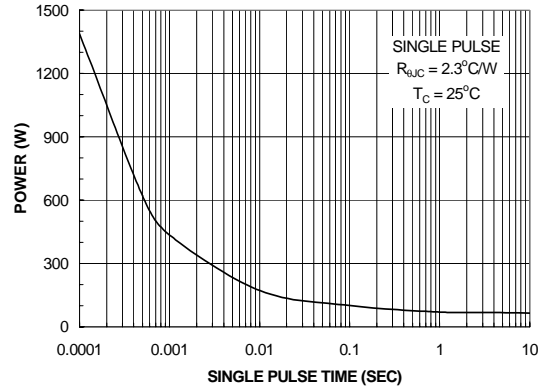
**Figure 7. Gate-Charge Characteristics.**



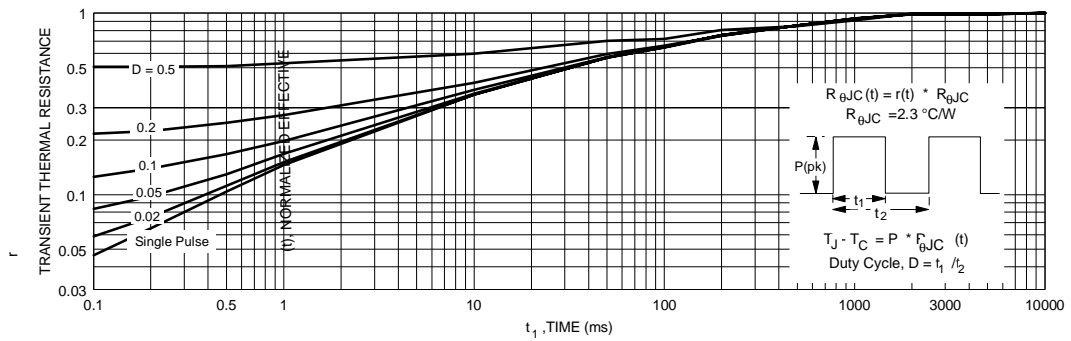
**Figure 8. Capacitance Characteristics.**



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



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



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

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