

FDP5645/FDB5645

60V N-Channel PowerTrench® MOSFET

General Description

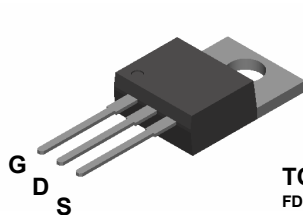
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers.

These MOSFETs feature faster switching and lower gate charge than other MOSFETs with comparable $R_{DS(ON)}$ specifications.

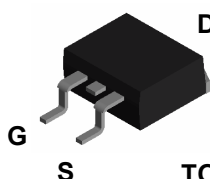
The result is a MOSFET that is easy and safer to drive (even at very high frequencies), and DC/DC power supply designs with higher overall efficiency.

Features

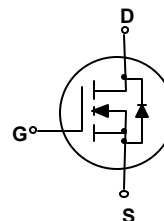
- 80 A, 60 V. $R_{DS(ON)} = 0.0095 \Omega @ V_{GS} = 10 \text{ V}$
 $R_{DS(ON)} = 0.011 \Omega @ V_{GS} = 6 \text{ V}$.
- Critical DC electrical parameters specified at elevated temperature.
- Rugged internal source-drain diode can eliminate the need for an external Zener diode transient suppressor.
- 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

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

Symbol	Parameter	FDP5645	FDB5645	Units
V_{DSS}	Drain-Source Voltage	60		V
V_{GSS}	Gate-Source Voltage	± 20		V
I_D	Maximum Drain Current – Continuous (note 3) – Pulsed	80 300		A
P_D	Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	125 0.83		W W/°C
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-65 to +175		°C
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	+275		°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.2	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	°C/W

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDB5645	FDB5645	13"	24mm	800 units
FDP5645	FDP5645	note 2		

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 (Note 1)

W_{DSS}	Single Pulse Drain-Source Avalanche Energy	$V_{DD} = 40\text{ V}, I_b = 80\text{ A}$			800	mJ
I_{AR}	Maximum Drain-Source Avalanche Current				80	A

Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_b = 250\text{ }\mu\text{A}$	60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_b = 250\text{ }\mu\text{A}$, Referenced to 25°C		64		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}$			1	μA
I_{GSSF}	Gate-Body Leakage, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			100	nA
I_{GSSR}	Gate-Body Leakage, Reverse	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			-100	nA

On Characteristics (Note 1)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_b = 250\text{ }\mu\text{A}$	2		4	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_b = 250\text{ }\mu\text{A}$, Referenced to 25°C		-7.8		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_b = 40\text{ A}$ $V_{GS} = 10\text{ V}, I_b = 40\text{ A}, T_J = 125^\circ\text{C}$ $V_{GS} = 6\text{ V}, I_b = 38\text{ A}$		8 13 9	9.5 18 11	m Ω
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 10\text{ V}$	60			A
g_{FS}	Forward Transconductance	$V_{DS} = 5\text{ V}, I_b = 40\text{ A}$		88		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V},$		4468		pF
C_{oss}	Output Capacitance	$f = 1.0\text{ MHz}$		810		pF
C_{rss}	Reverse Transfer Capacitance			198		pF

Switching Characteristics (Note 2)

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\text{ V}, I_b = 1\text{ A},$		21	30	ns
t_r	Turn-On Rise Time	$V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$		13	20	ns
$t_{d(off)}$	Turn-Off Delay Time			77	90	ns
t_f	Turn-Off Fall Time			42	50	ns
Q_g	Total Gate Charge	$V_{DS} = 30\text{ V}, I_b = 80\text{ A},$		76	107	nC
Q_{gs}	Gate-Source Charge	$V_{GS} = 10\text{ V}$		18		nC
Q_{gd}	Gate-Drain Charge			21		nC

Drain-Source Diode Characteristics and Maximum Ratings

I_S	Maximum Continuous Drain-Source Diode Forward Current				80	A
I_S	Maximum Pulsed Drain-Source Diode Forward Current				300	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 40\text{ A}$		0.9	1.3	V

Notes:

1. Pulse Test: Pulse Width < 300 μs , Duty Cycle < 2.0%
2. TO-220 package is supplied in tube / rail @ 45 pieces per rail.
3. Calculated continuous current based on maximum allowable junction temperature. Actual maximum continuous current limited by package constraints to 75A

Typical Characteristics

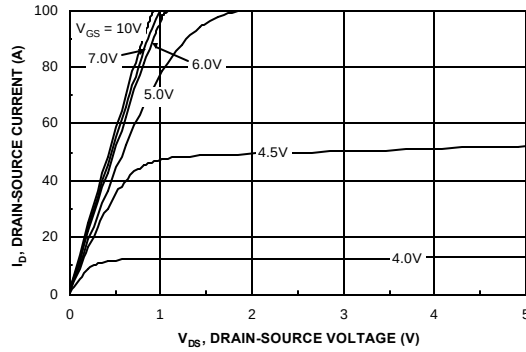


Figure 1. On-Region Characteristics.

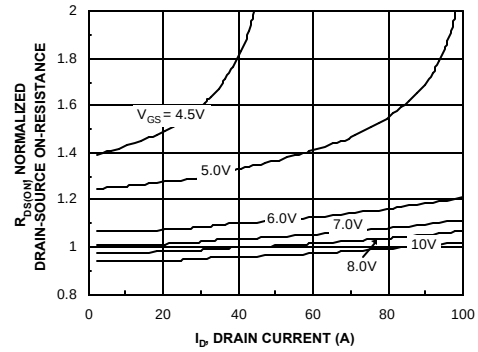


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

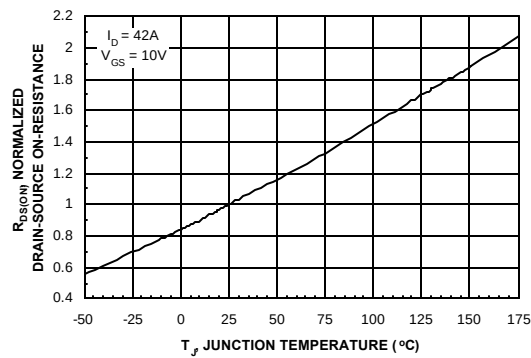


Figure 3. On-Resistance Variation with Temperature.

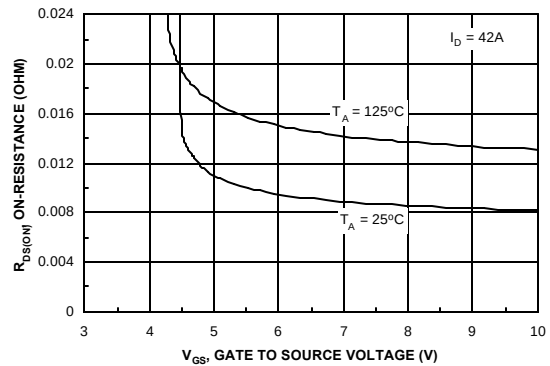


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

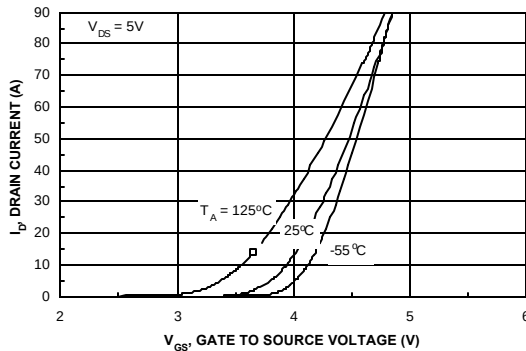


Figure 5. Transfer Characteristics.

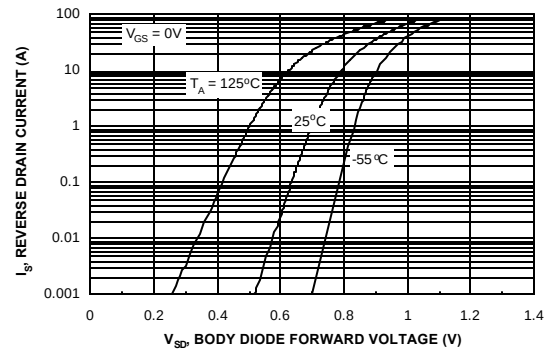


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

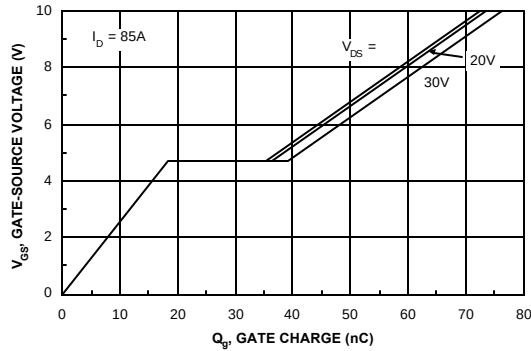


Figure 7. Gate Charge Characteristics.

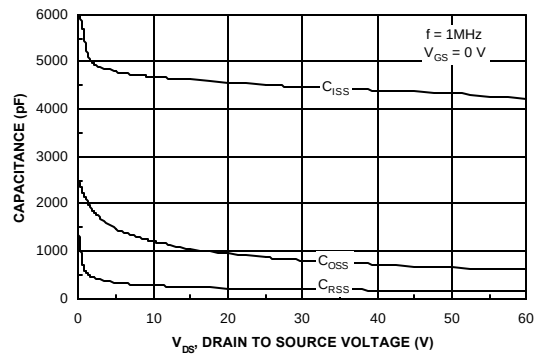


Figure 8. Capacitance Characteristics.

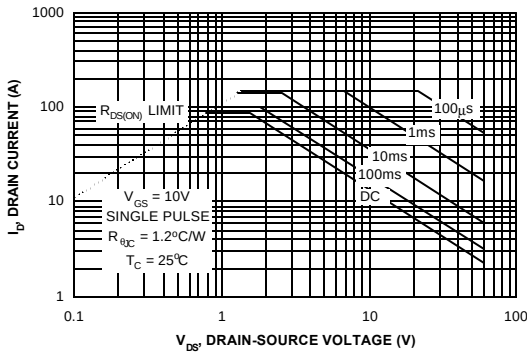


Figure 9. Maximum Safe Operating Area.

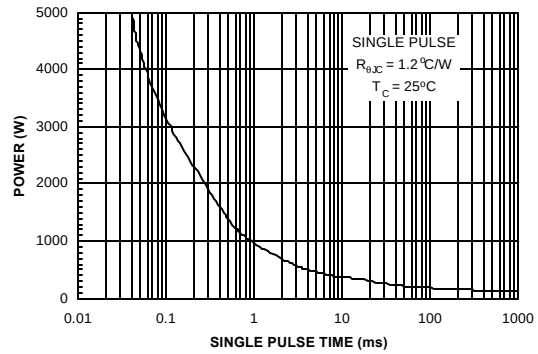


Figure 10. Single Pulse Maximum Power Dissipation.

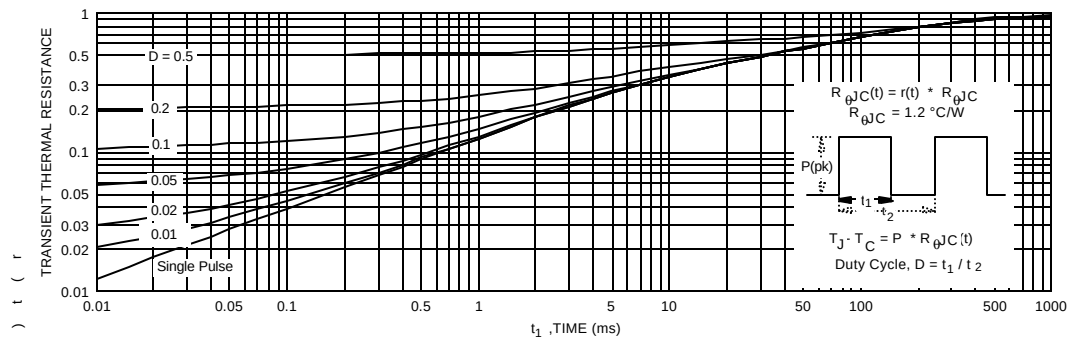


Figure 11. Transient Thermal Response Curve.

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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