FAIRCHILD SEMICONDUCTOR TM

July 1998

FDP6035AL/FDB6035AL
N-Channel Logic Level PowerTrench™ MOSFET

General Description

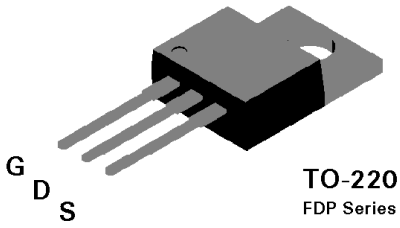
This N-Channel Logic Level MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers.

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

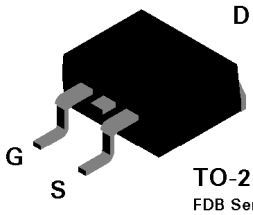
The result is a MOSFET that is easy and safer to drive (even at very high frequencies), and DC/DC power supply designs with higher overall efficiency.

Features

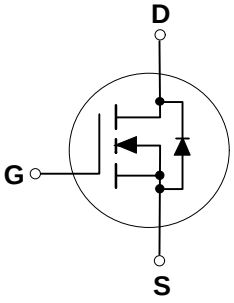
- 48A, 30 V. $R_{DS(ON)}$ = 0.0125 Ω @ V_{GS} = 10 V,
  $R_{DS(ON)}$ = 0.017 Ω @ V_{GS} = 4.5 V.
- Critical DC electrical parameters specified at elevated temperature.
- Rugged internal source-drain diode can eliminate the need for an external Zener diode transient suppressor.
- High performance trench 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°C unless otherwise noted

Symbol	Parameter	FDP6035AL	FDB6035AL	Units
V_{DSS}	Drain-Source Voltage	30		V
V_{GSS}	Gate-Source Voltage	±20		V
I_D	Drain Current - Continuous (Note 1)	48		A
	- Pulsed (Note 1)	150		
P_D	Total Power Dissipation @ T_C = 25°C	58		W
	Derate above 25°C	0.4		W/°C
T_J,T_{STG}	Operating and Storage 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	2.6		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5		°C/W

Electrical Characteristics (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
DRAIN-SOURCE AVALANCHE RATINGS (Note 1)						
W_{DSS}	Single Pulse Drain-Source Avalanche Energy	V_{DD} = 15 V, I_D = 48 A			130	mJ
I_{AR}	Maximum Drain-Source Avalanche Current				48	A
OFF CHARACTERISTICS						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	30			V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	I_D = 250 µA, Referenced to 25 °C		22		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V			1	µA
I_{GSSF}	Gate - Body Leakage, Forward	V_{GS} = 20 V, V_{DS} = 0 V			100	nA
I_{GSSR}	Gate - Body Leakage, Reverse	V_{GS} = -20 V, V_{DS} = 0 V			-100	nA
ON CHARACTERISTICS (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 µA	1	1.5	3	V
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Temp.Coefficient	I_D = 250 µA, Referenced to 25 °C		-5		mV/°C
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 24 A		0.011	0.0125	Ω
		T_J = 125°C		0.017	0.021	
		V_{GS} = 4.5 V, I_D = 20 A		0.015	0.017	
$I_{D(on)}$	On-State Drain Current	V_{GS} = 10 V, V_{DS} = 10 V	48			A
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 24 A		33		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1.0 MHz		1650		pF
C_{oss}	Output Capacitance			365		pF
C_{rss}	Reverse Transfer Capacitance			170		pF
SWITCHING CHARACTERISTICS (Note 1)						
$t_{D(on)}$	Turn - On Delay Time	V_{DD} = 15 V, I_D = 1 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		10	18	nS
t_r	Turn - On Rise Time			12	22	nS
$t_{D(off)}$	Turn - Off Delay Time			35	56	nS
t_f	Turn - Off Fall Time			10	18	nS
Q_g	Total Gate Charge	V_{DS} = 15 V , I_D = 48 A, V_{GS} = 5 V		17	23	nC
Q_{gs}	Gate-Source Charge			6.2		nC
Q_{gd}	Gate-Drain Charge			6.8		nC
DRAIN-SOURCE DIODE CHARACTERISTICS						
I_S	Maximum Continuous Drain-Source Diode Forward Current (Note 1)				48	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current (Note 1)				150	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 24 A (Note1)		1.05	1.3	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_F = 30 A, dI_F/dt = 100 A/µs		23	40	ns
I_{rr}	Reverse Recovery Current			0.74	1.3	A

Notes

1. Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%.

Typical Electrical Characteristics

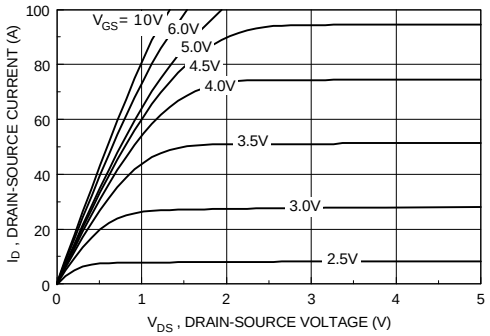


Figure 1. On-Region Characteristics.

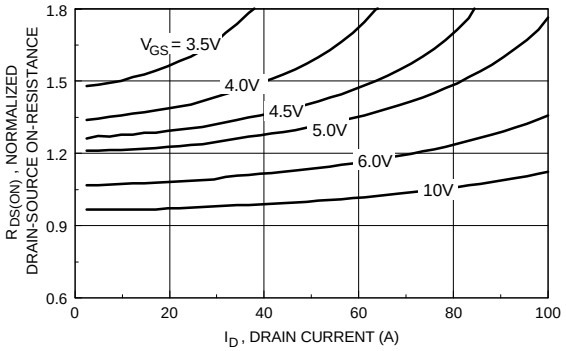


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

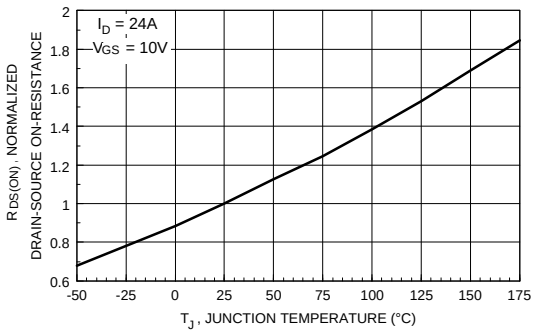


Figure 3. On-Resistance Variation with Temperature.

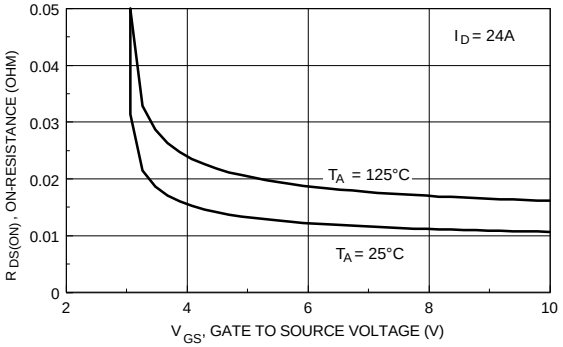


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

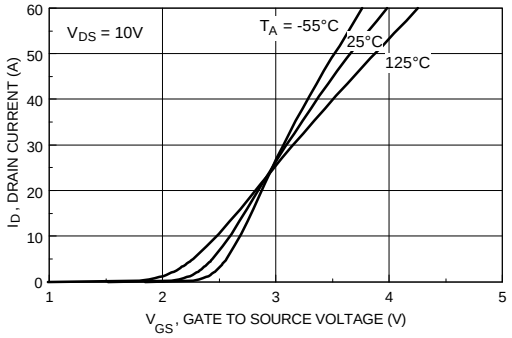


Figure 5. Transfer Characteristics.

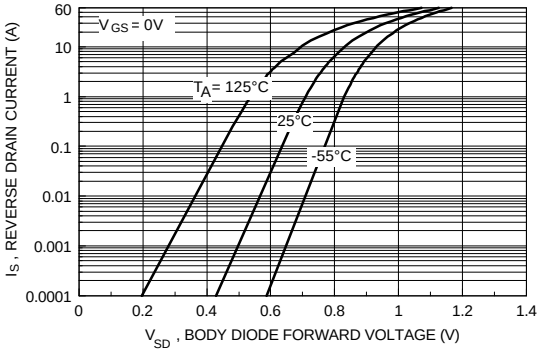


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Electrical Characteristics (continued)

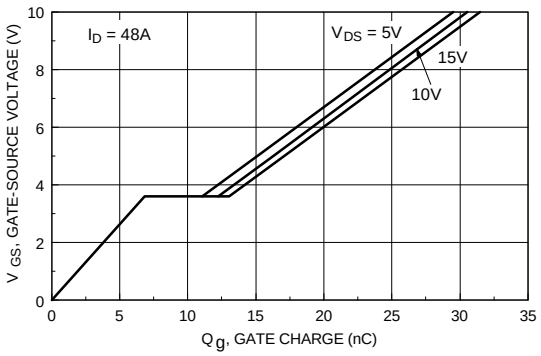


Figure 7. Gate Charge Characteristics.

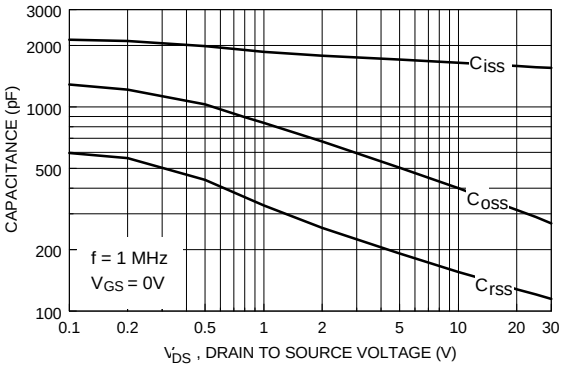


Figure 8. Capacitance Characteristics.

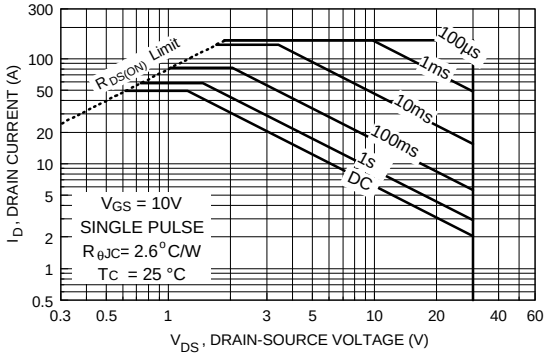


Figure 9. Maximum Safe Operating Area.

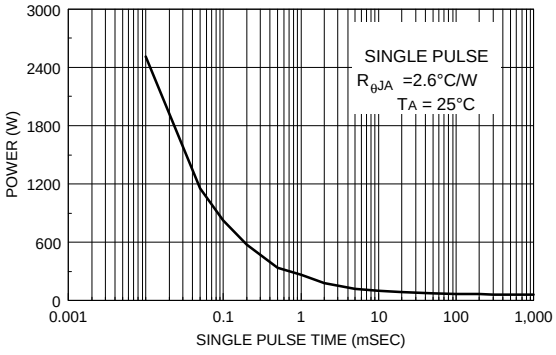


Figure 10. Single Pulse Maximum Power Dissipation.

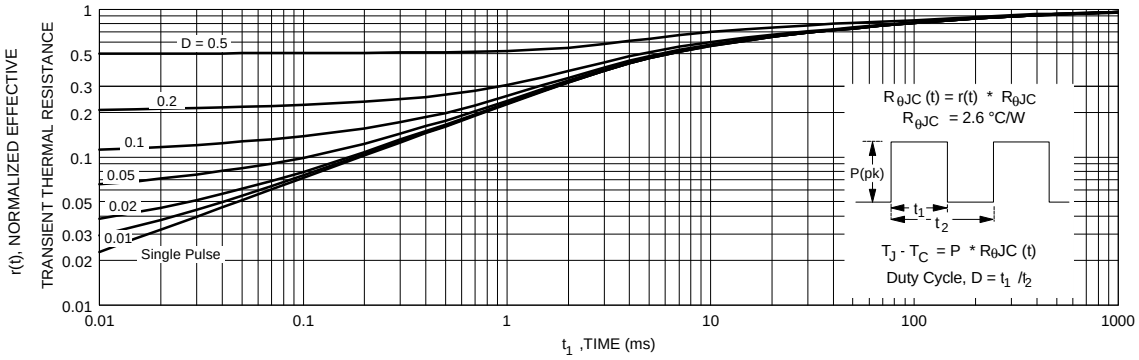


Figure 11. Transient Thermal Response Curve.

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