FAIRCHILD SEMICONDUCTOR™

September 2000

FDP4020P/FDB4020P

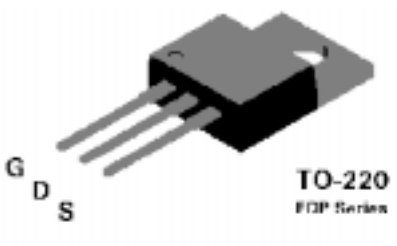
P-Channel 2.5V Specified Enhancement Mode Field Effect Transistor

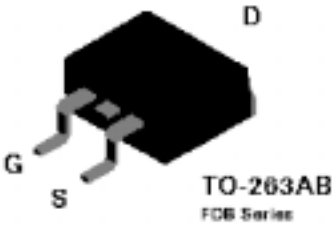
General Description

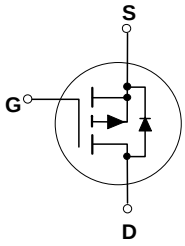
This P-Channel low threshold MOSFET has been designed for use as a linear pass element for low voltage outputs. In addition, the part may be used as a low voltage load switch when switching outputs on or off for power management.The part may also be used in conjunction with DC-DC converters requiring P-Channel.

Features

- -16 A, -20 V. $R_{DS(on)}$ = 0.08 Ω @ V_{GS} = -4.5 V
  $R_{DS(on)}$ = 0.11 Ω @ V_{GS} = -2.5 V.
- Critical DC electrical parameters specified at elevated temperature.
- High density cell design for extremely low $R_{DS(on)}$.
- TO-220 and TO-263 (D^2PAK) package for both through hole and surface mount applications.
- 175°C maximum junction temperature rating.







Absolute Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter	FDP4020P	FDB4020P	Units
V_{DSS}	Drain-Source Voltage	-20		V
V_{GSS}	Gate-Source Voltage	±8		V
I_D	Drain Current - Continuous	-16		A
	- Pulsed	-48		
P_D	Total Power Dissipation @ T_C = 25°C	37.5		W
	Derate above 25°C	0.25		W/°C
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-65 to +175		°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to- Case	4		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to- Ambient (Note 1)	62.5	40	°C/W

Package Outlines and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
FDP4020P	FDP4020P	13''	12mm	2500 units

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Electrical Characteristics

T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = -250 μA	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = -250 μA, Referenced to 25°C		-28		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = -16 V, V_{GS} = 0 V			-1	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 8 V, V_{DS} = 0 V			100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -8 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	-0.4	-0.58	-1	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = -250 μA, Referenced to 25°C		2		mV/°C
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = -4.5 V,I_D = -8 A, V_{GS} = -4.5 V,I_D = -8 A,T_J=125°C V_{GS} = -2.5 V,I_D = -7 A		0.068 0.098 0.096	0.08 0.13 0.110	Ω
$I_{D(on)}$	On-State Drain Current	V_{GS} = -4.5 V, V_{DS} = -5 V	-20			A
g_{FS}	Forward Transconductance	V_{DS} = -5 V, I_D = -8 A		14		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = -10 V, V_{GS} = 0 V, f = 1.0 MHz		665		pF
C_{oss}	Output Capacitance			270		pF
C_{rss}	Reverse Transfer Capacitance			70		pF
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = -5 V, I_D = -1 A, V_{GS} = -4.5 V, R_{GEN} = 6 Ω		8	16	ns
t_r	Turn-On Rise Time			24	38	ns
$t_{d(off)}$	Turn-Off Delay Time			50	80	ns
t_f	Turn-Off Fall Time			29	45	ns
Q_g	Total Gate Charge	V_{DS} = -5 V, I_D = -16 A, V_{GS} = -4.5 V		9.5	13	nC
Q_{gs}	Gate-Source Charge			1.3		nC
Q_{gd}	Gate-Drain Charge			2.2		nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current (Note 2)				-16	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current (Note 2)				-48	
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = -16 A (Note 2)			-1.2	V

Notes:

1. $R_{\theta JA}$ is the sum of the juntion-to-case and case-to-ambient thermal resistance.For T0-263 the device is mounted on circuit board with a 1in^2 pad of 2 oz. copper.
2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%

Typical Characteristics

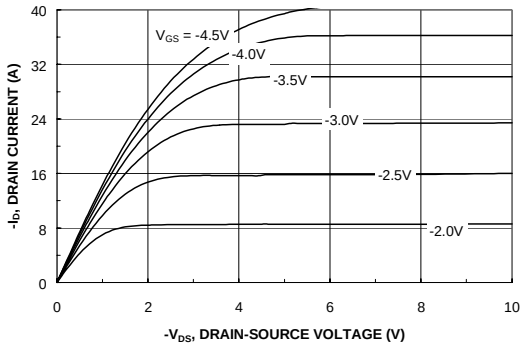

Figure 1. On-Region Characteristics.

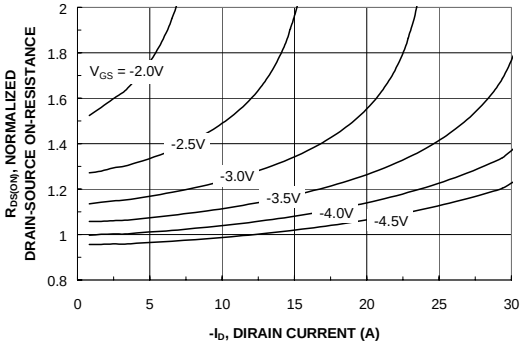

Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

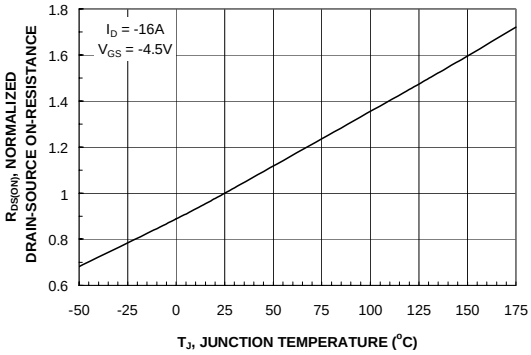

Figure 3. On-Resistance Variation with Temperature.

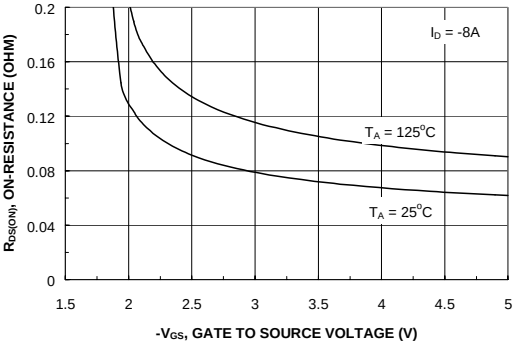

Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

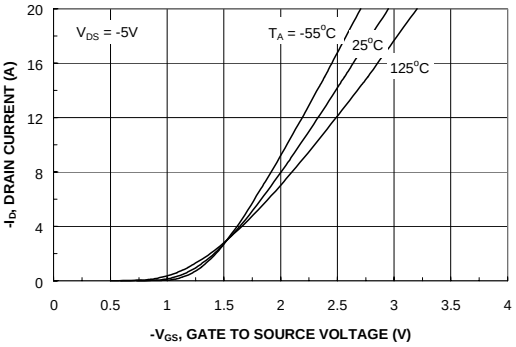

Figure 5. Transfer Characteristics.

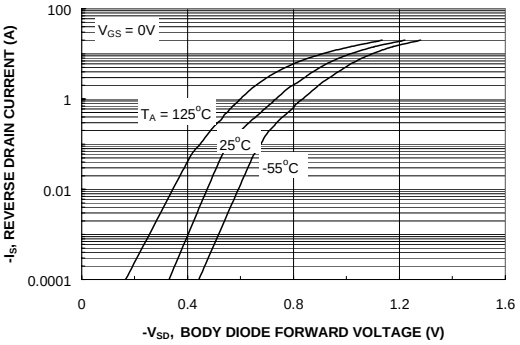

Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics (continued)

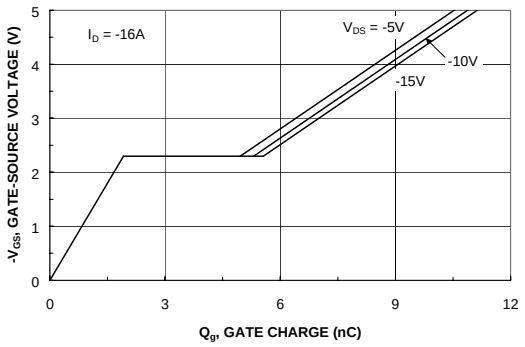

Figure 7. Gate-Charge Characteristics.

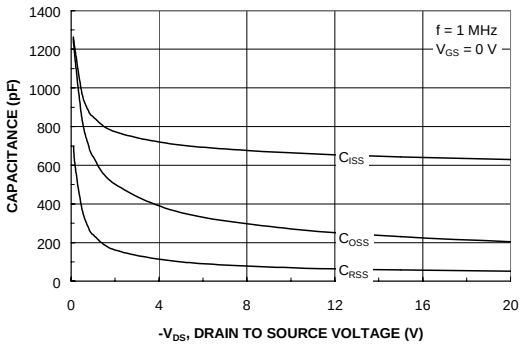

Figure 8. Capacitance Characteristics.

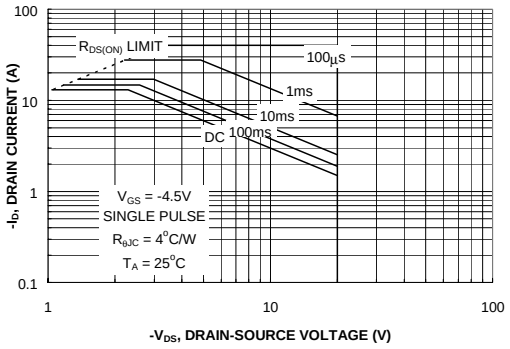

Figure 9. Maximum Safe Operating Area.

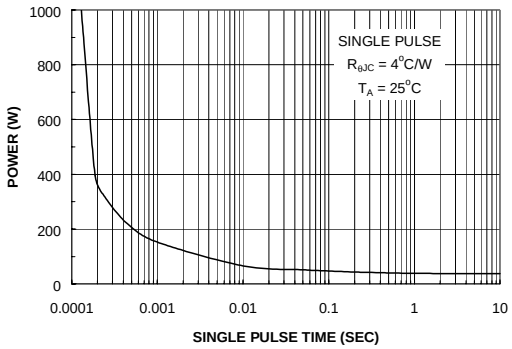

Figure 10. Single Pulse Maximum Power Dissipation.

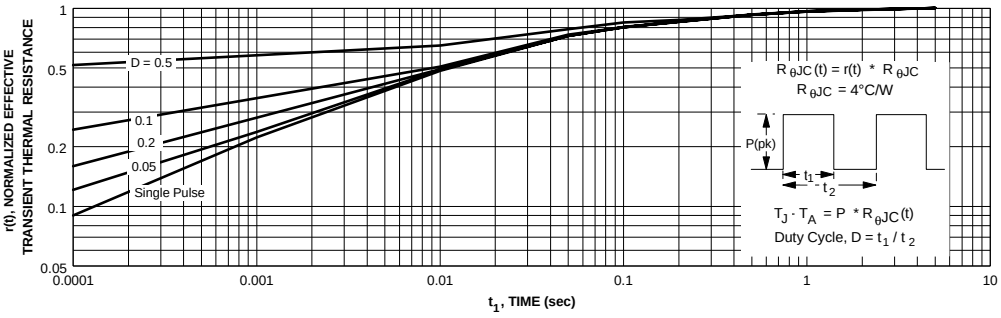

Figure 11. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1.
Transient themal response will change depending on the circuit board design.

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manager28@tradeelectronics.ru

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