

# FDP4020P/FDB4020P

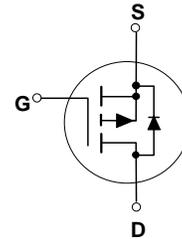
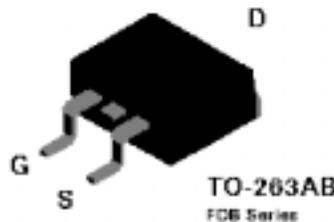
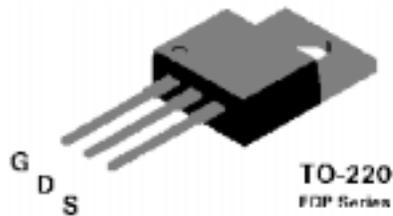
## P-Channel 2.5V Specified Enhancement Mode Field Effect Transistor

### 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.  $R_{DS(on)} = 0.08 \Omega @ V_{GS} = -4.5 \text{ V}$   
 $R_{DS(on)} = 0.11 \Omega @ V_{GS} = -2.5 \text{ V}$ .
- Critical DC electrical parameters specified at elevated temperature.
- High density cell design for extremely low  $R_{DS(on)}$ .
- TO-220 and TO-263 (D<sup>2</sup>PAK) package for both through hole and surface mount applications.
- 175°C maximum junction temperature rating.



### Absolute Maximum Ratings T<sub>A</sub> = 25°C unless otherwise noted

Symbol	Parameter	FDP4020P	FDB4020P	Units
V <sub>DSS</sub>	Drain-Source Voltage	-20		V
V <sub>GSS</sub>	Gate-Source Voltage	±8		V
I <sub>D</sub>	Drain Current - Continuous	-16		A
	- Pulsed	-48		
P <sub>D</sub>	Total Power Dissipation @ T <sub>C</sub> = 25°C	37.5		W
	Derate above 25°C	0.25		W/°C
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Junction Temperature Range	-65 to +175		°C

### Thermal Characteristics

Symbol	Parameter	FDP4020P	FDB4020P	Units
R <sub>θJC</sub>	Thermal Resistance, Junction-to- Case	4		°C/W
R <sub>θJA</sub>	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

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Off Characteristics**

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		-28		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 8\text{ V}, V_{DS} = 0\text{ V}$			100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -8\text{ V}, V_{DS} = 0\text{ V}$			-100	nA

**On Characteristics** (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	-0.4	-0.58	-1	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		2		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = -4.5\text{ V}, I_D = -8\text{ A}$ , $V_{GS} = -4.5\text{ V}, I_D = -8\text{ A}, T_J = 125^\circ\text{C}$ $V_{GS} = -2.5\text{ V}, I_D = -7\text{ A}$		0.068 0.098 0.096	0.08 0.13 0.110	$\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = -4.5\text{ V}, V_{DS} = -5\text{ V}$	-20			A
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{ V}, I_D = -8\text{ A}$		14		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}$ , $f = 1.0\text{ MHz}$		665		pF
$C_{oss}$	Output Capacitance			270		pF
$C_{riss}$	Reverse Transfer Capacitance			70		pF

**Switching Characteristics** (Note 2)

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -5\text{ V}, I_D = -1\text{ A}$ , $V_{GS} = -4.5\text{ V}, R_{GEN} = 6\ \Omega$		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	$V_{DS} = -5\text{ V}$ , $I_D = -16\text{ A}, V_{GS} = -4.5\text{ V}$		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	$V_{GS} = 0\text{ V}, I_S = -16\text{ A}$ (Note 2)			-1.2	V

**Notes:**

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

## Typical Characteristics

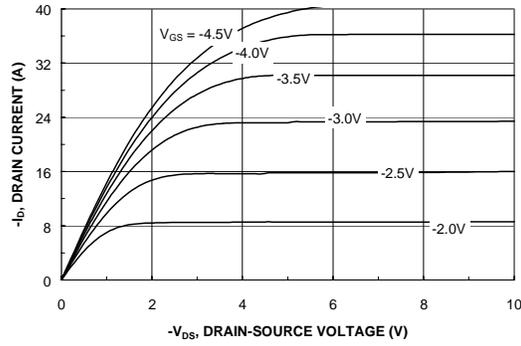


Figure 1. On-Region Characteristics.

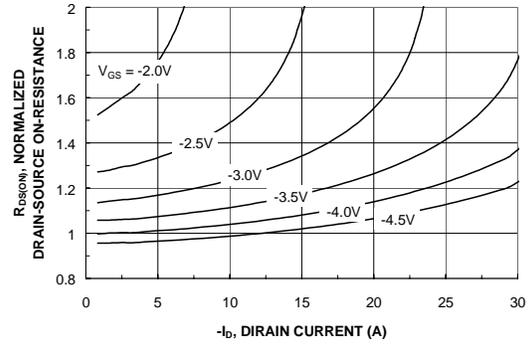


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

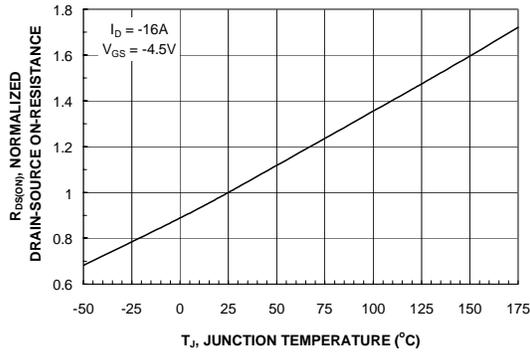


Figure 3. On-Resistance Variation with Temperature.

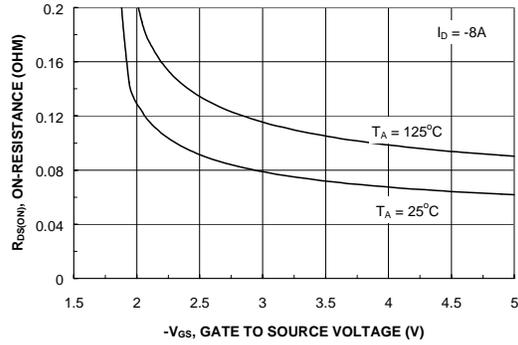


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

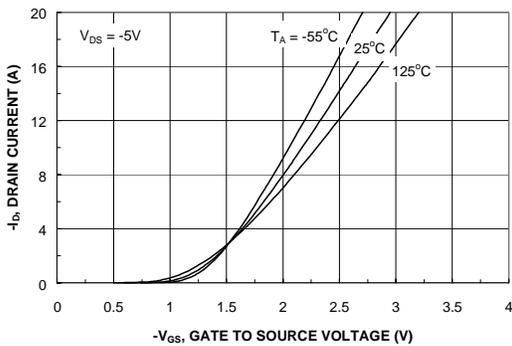


Figure 5. Transfer Characteristics.

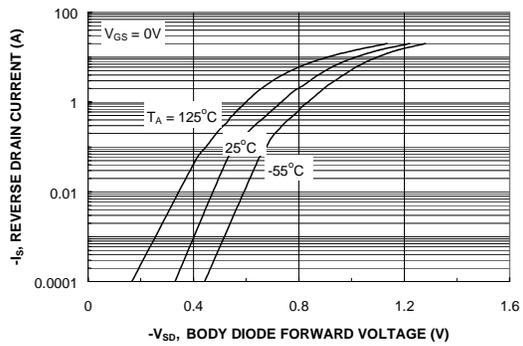
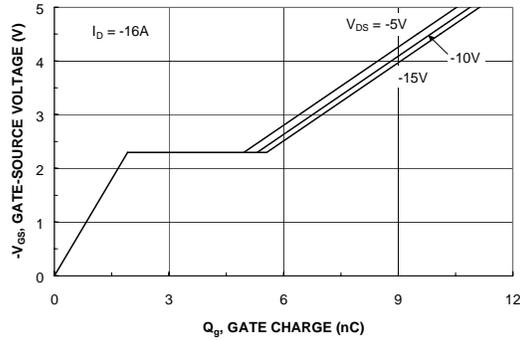
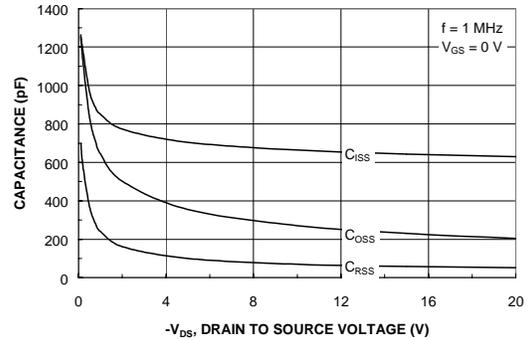


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

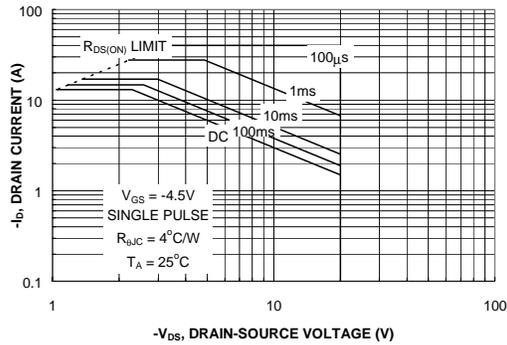
**Typical Characteristics** (continued)



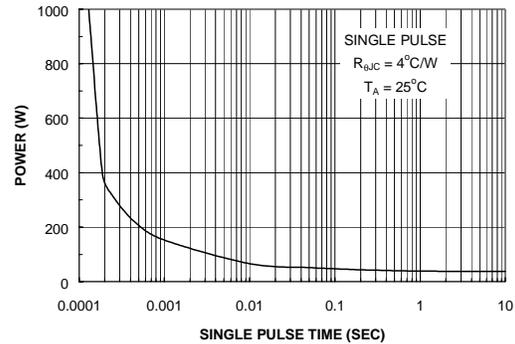
**Figure 7. Gate-Charge Characteristics.**



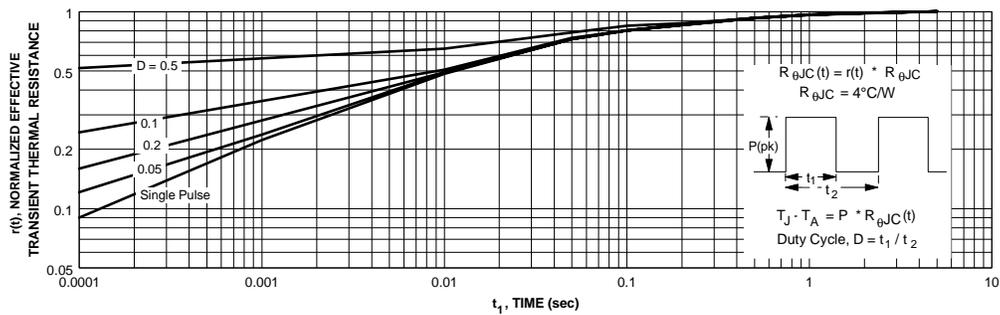
**Figure 8. Capacitance Characteristics.**



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



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



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

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

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