

# FDP4020P/FDB4020P

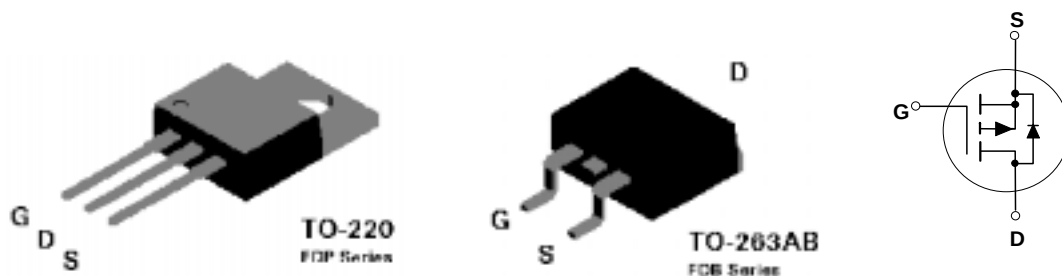
## P-Channel 2.5V Specified Enhancement Mode Field Effect Transistor

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

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

### Thermal Characteristics

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

### 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 |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

**Off Characteristics**

|                                      |                                           |                                                                    |     |     |      |                      |
|--------------------------------------|-------------------------------------------|--------------------------------------------------------------------|-----|-----|------|----------------------|
| $BV_{DSS}$                           | Drain-Source Breakdown Voltage            | $V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$               | -20 |     |      | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = -250\text{ }\mu\text{A}$ , 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                         | $V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$                                                                                                                     | -0.4 | -0.58                   | -1                    | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D = -250\text{ }\mu\text{A}$ , Referenced to $25^\circ\text{C}$                                                                                                   |      | 2                       |                       | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$                           | Static Drain-Source On-Resistance              | $V_{GS} = -4.5\text{ V}, I_D = -8\text{ A}$ ,<br>$V_{GS} = -4.5\text{ V}, I_D = -8\text{ A}, T_J = 125^\circ\text{C}$<br>$V_{GS} = -2.5\text{ V}, I_D = -7\text{ A}$ |      | 0.068<br>0.098<br>0.096 | 0.08<br>0.13<br>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            | $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}$ ,<br>$f = 1.0\text{ MHz}$ |  | 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  | $V_{DD} = -5\text{ V}, I_D = -1\text{ A}$ ,<br>$V_{GS} = -4.5\text{ V}, R_{GEN} = 6\text{ }\Omega$ |  | 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   | $V_{DS} = -5\text{ V}$ ,<br>$I_D = -16\text{ A}, V_{GS} = -4.5\text{ V}$                           |  | 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  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$

## Typical Characteristics

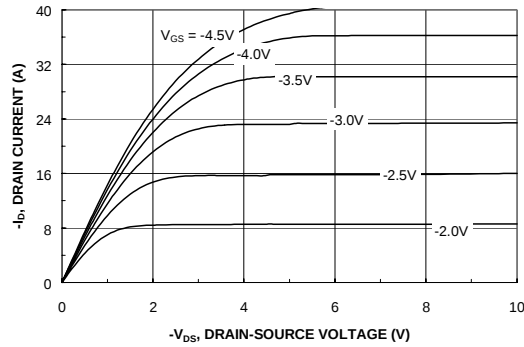


Figure 1. On-Region Characteristics.

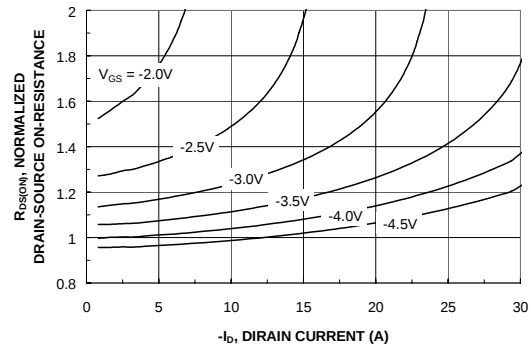


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

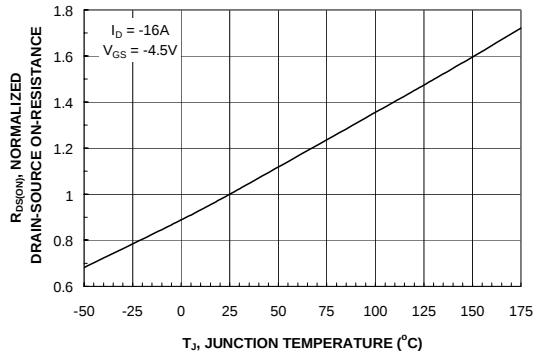


Figure 3. On-Resistance Variation with Temperature.

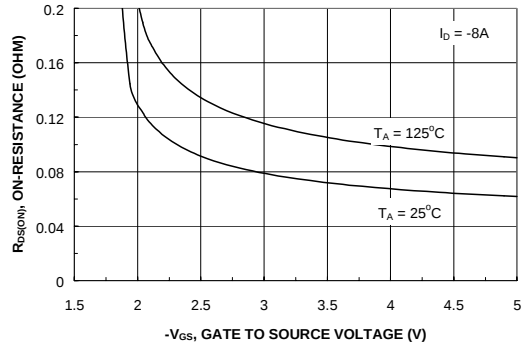


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

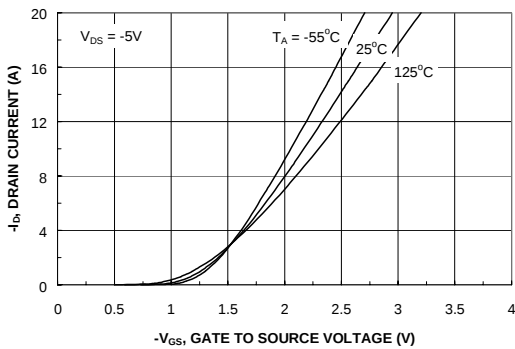


Figure 5. Transfer Characteristics.

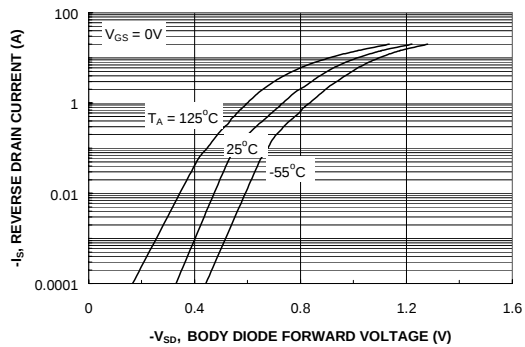


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Characteristics (continued)

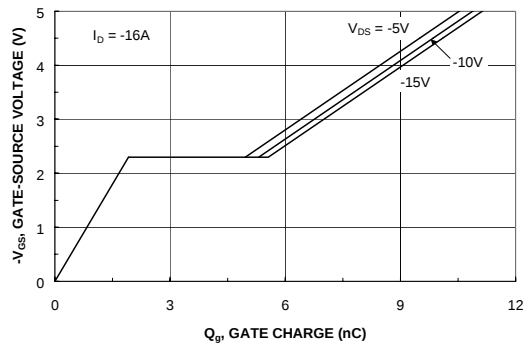


Figure 7. Gate-Charge Characteristics.

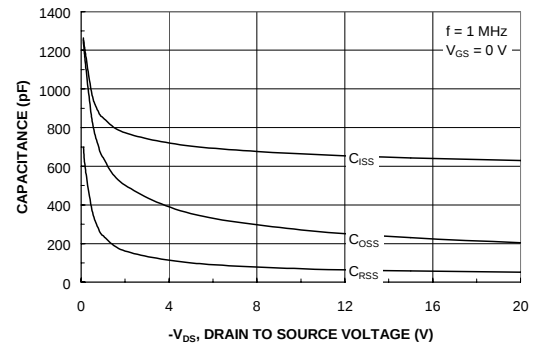


Figure 8. Capacitance Characteristics.

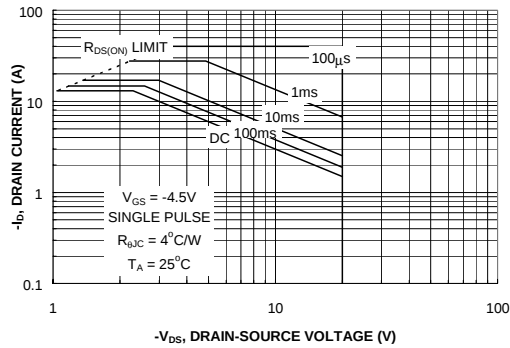


Figure 9. Maximum Safe Operating Area.

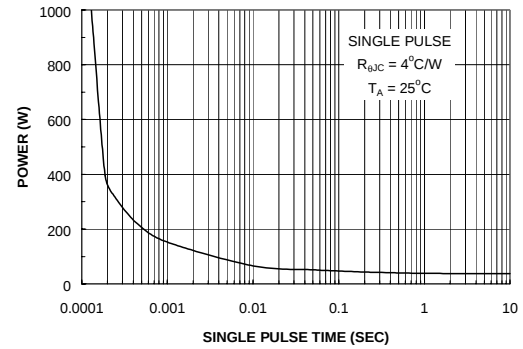


Figure 10. Single Pulse Maximum Power Dissipation.

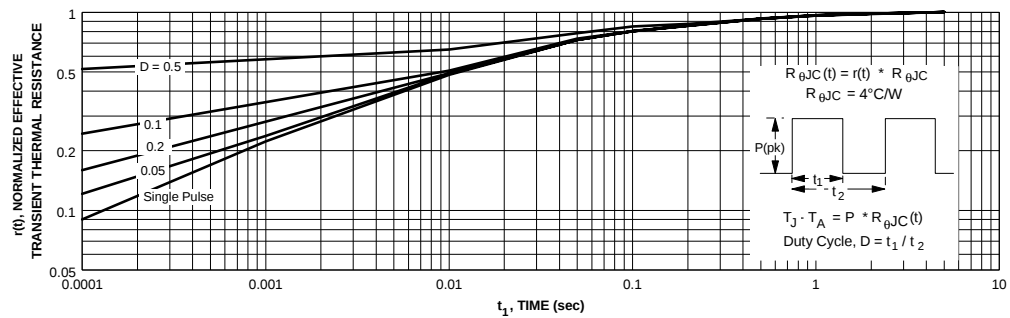


Figure 11. Transient Thermal Response Curve.

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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