FAIRCHILD
SEMICONDUCTOR TM

October 1997

# FDV302P
# Digital FET, P-Channel

## General Description

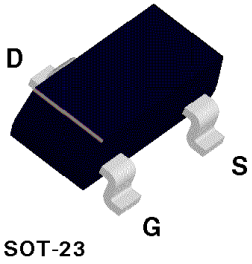
This P-Channel logic level enhancement mode field effect transistor is produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process is especially tailored to minimize on-state resistance. This device has been designed especially for low voltage applications as a replacement for digital transistors. Since bias resistors are not required, this one P-channel FET can replace several digital transistors with different bias resistors such as the DTCx and DCDx series.

## Features

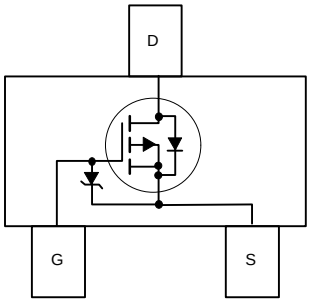
- -25 V, -0.12 A continuous, -0.5 A Peak.
  $R_{DS(ON)}$ = 13 Ω @ $V_{GS}$= -2.7 V
  $R_{DS(ON)}$ = 10 Ω @ $V_{GS}$ = -4.5 V.
- Very low level gate drive requirements allowing direct operation in 3V circuits. $V_{GS(th)}$ < 1.5V.
- Gate-Source Zener for ESD ruggedness. >6kV Human Body Model
- Compact industry standard SOT-23 surface mount package.
- Replace many PNP digital transistors (DTCx and DCDx) with one DMOS FET.

| SOT-23 | SuperSOT™-6 | SuperSOT™-8 | SO-8 | SOT-223 | SOIC-16 |
|---|---|---|---|---|---|

**Mark:302**




SOT-23




## Absolute Maximum Ratings $T_A$ = 25°C unless otherwise noted

| Symbol | Parameter | FDV302P | Units |
|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | -25 | V |
| $V_{GSS}$ | Gate-Source Voltage | -8 | V |
| $I_D$ | Drain Current - Continuous | -0.12 | A |
| | - Pulsed | -0.5 | |
| $P_D$ | Maximum Power Dissipation | 0.35 | W |
| $T_J$,$T_{STG}$ | Operating and Storage Temperature Range | -55 to 150 | °C |
| ESD | Electrostatic Discharge Rating MIL-STD-883D Human Body Model (100pf / 1500 Ohm) | 6.0 | kV |
| **THERMAL CHARACTERISTICS** | | | |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 357 | °C/W |

## Electrical Characteristics ($T_A$ = 25 °C unless otherwise noted )

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0 V, $I_D$ = -250 µA | -25 | | | V |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | $I_D$ = -250 µA, Referenced to 25 °C | | -20 | | mV /°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = -20 V, $V_{GS}$ = 0 V | | | -1 | µA |
| | | $T_J$ = 55°C | | | -10 | µA |
| $I_{GSS}$ | Gate - Body Leakage Current | $V_{GS}$ = -8 V, $V_{DS}$ = 0 V | | | -100 | nA |
| **ON CHARACTERISTICS** (Note) | | | | | | |
| $\Delta V_{GS(th)}/\Delta T_J$ | Gate Threshold Voltage Temp. Coefficient | $I_D$ = -250 µA, Referenced to 25 °C | | 1.9 | | mV /°C |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = -250 µA | -0.65 | -1 | -1.5 | V |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$ = -2.7 V, $I_D$ = -0.05 A | | 10.6 | 13 | Ω |
| | | $V_{GS}$ = -4.5 V, $I_D$ = -0.2 A | | 7.9 | 10 | |
| | | $T_J$ =125°C | | 12 | 18 | |
| $I_{D(ON)}$ | On-State Drain Current | $V_{GS}$ = -2.7 V, $V_{DS}$ = -5 V | -0.05 | | | A |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = -5 V, $I_D$ = -0.2 A | | 0.135 | | S |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = -10 V, $V_{GS}$ = 0 V, f = 1.0 MHz | | 11 | | pF |
| $C_{oss}$ | Output Capacitance | | | 7 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 1.4 | | pF |
| **SWITCHING CHARACTERISTICS** (Note) | | | | | | |
| $t_{D(on)}$ | Turn - On Delay Time | $V_{DD}$ = -6 V, $I_D$ = -0.2 A, $V_{GS}$ = -4.5 V, $R_{GEN}$ = 50 Ω | | 5 | 12 | ns |
| $t_r$ | Turn - On Rise Time | | | 8 | 16 | ns |
| $t_{D(off)}$ | Turn - Off Delay Time | | | 9 | 18 | ns |
| $t_f$ | Turn - Off Fall Time | | | 5 | 10 | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = -5 V, $I_D$ = -0.2 A, $V_{GS}$ = -4.5 V | | 0.22 | 0.31 | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 0.11 | | nC |
| $Q_{gd}$ | Gate-Drain Charge | | | 0.04 | | nC |
| **DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS** | | | | | | |
| $I_S$ | Maximum Continuous Drain-Source Diode Forward Current | | | | -0.2 | A |
| $V_{SD}$ | Drain-Source Diode Forward Voltage | $V_{GS}$ = 0 V, $I_S$ = -0.2 A (Note) | | -1 | -1.5 | V |

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

## Typical Electrical Characteristics

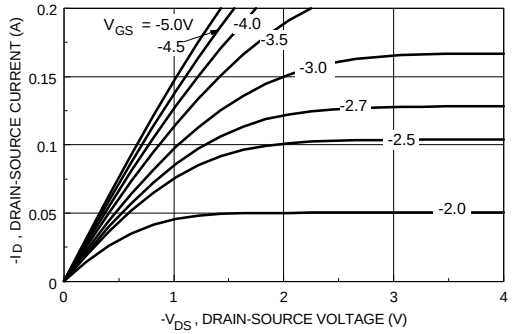



**Figure 1. On-Region Characteristics**.

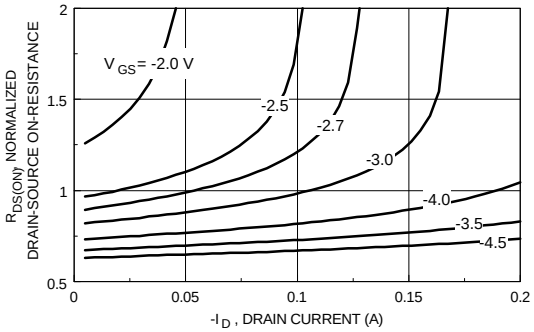



**Figure 2. On-Resistance Variation with Drain Current and Gate Voltage**.

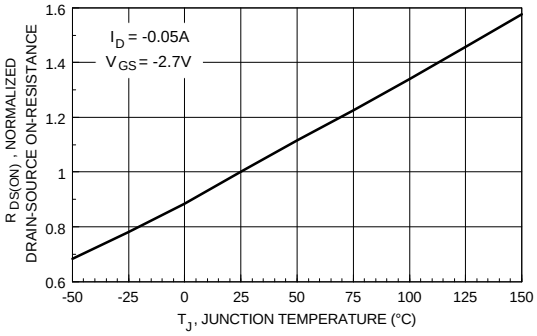



**Figure 3. On-Resistance Variation with Temperature**.

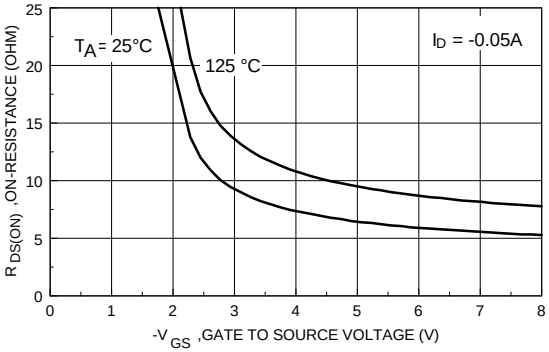



**Figure 4. On Resistance Variation with Gate-To- Source Voltage.**

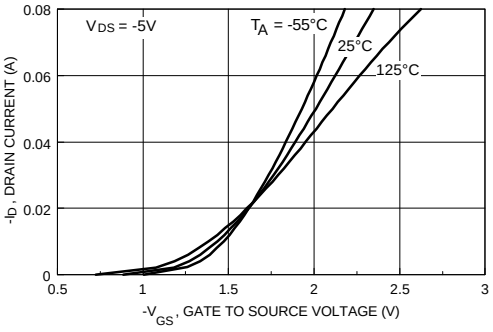



**Figure 5. Transfer Characteristics.**

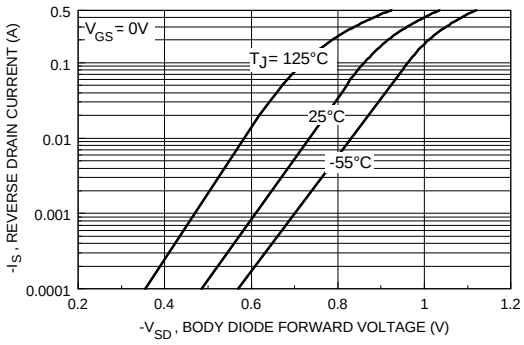



**Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.**

## Typical Electrical And Thermal Characteristics

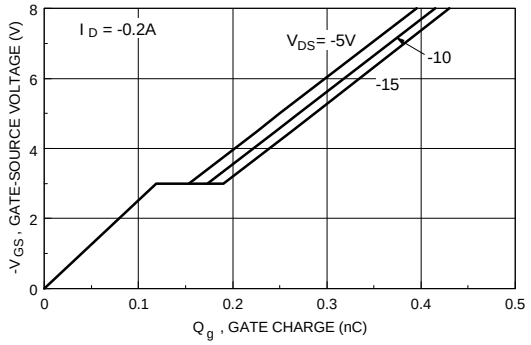



**Figure 7. Gate Charge Characteristics.**

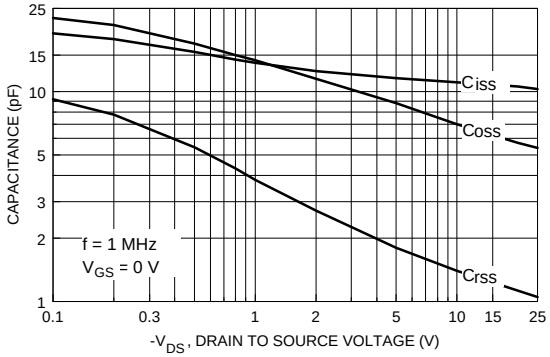



**Figure 8. Capacitance Characteristics**.

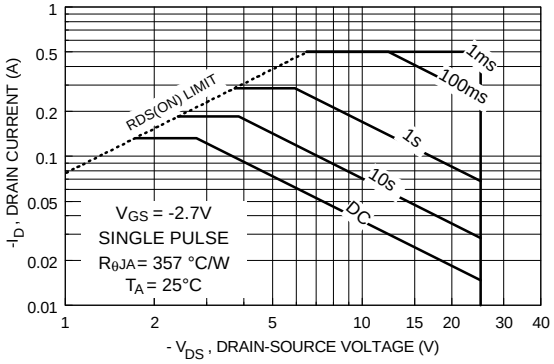



**Figure 9. Maximum Safe Operating Area.**

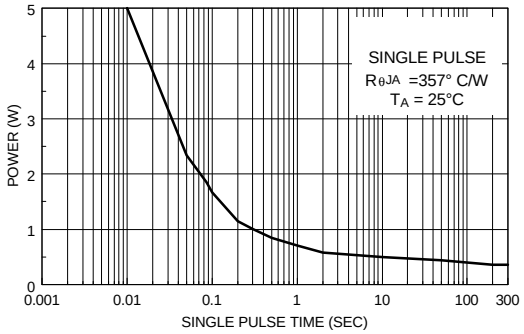



**Figure 10. Single Pulse Maximum Power Dissipation.**

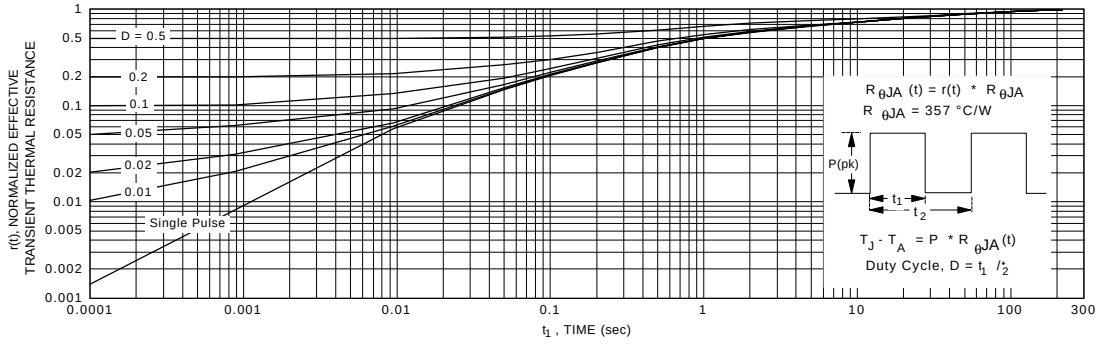



**Figure 11. Transient Thermal Response Curve**.