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# FDV305N

## 20V N-Channel PowerTrench® MOSFET

### General Description

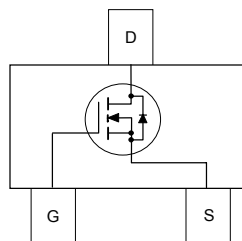
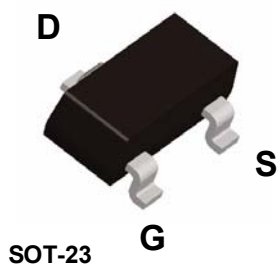
This 20V N-Channel MOSFET uses Fairchild's high voltage PowerTrench process. It has been optimized for power management applications.

### Applications

- Load switch
- Battery protection
- Power management

### Features

- 0.9 A, 20 V  $R_{DS(ON)} = 220 \text{ m}\Omega @ V_{GS} = 4.5 \text{ V}$   
 $R_{DS(ON)} = 300 \text{ m}\Omega @ V_{GS} = 2.5 \text{ V}$
- Low gate charge
- Fast switching speed
- High performance trench technology for extremely low  $R_{DS(ON)}$



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

| Symbol         | Parameter  | Ratings         | Units            |
|----------------|--|-----------------|------------------|
| $V_{DSS}$      | Drain-Source Voltage                             | 20              | V                |
| $V_{GSS}$      | Gate-Source Voltage                              | $\pm 12$        | V                |
| $I_D$          | Drain Current – Continuous                       | 0.9             | A                |
|                |  | 2               |                  |
| $P_D$          | Maximum Power Dissipation                        | 0.35            | W                |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range | $-55$ to $+150$ | $^\circ\text{C}$ |

### Thermal Characteristics

|                 |   |     |                    |
|-----------------|---|-----|--------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 357 | $^\circ\text{C/W}$ |
|-----------------|---|-----|--------------------|

### Package Marking and Ordering Information

| Device Marking | Device  | Reel Size | Tape width | Quantity   |
|----------------|---------|-----------|------------|------------|
| 305            | FDV305N | 7"        | 8mm        | 3000 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            | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$               | 20 |    |      | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$ |    | 15 |      | 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, Forward                | $V_{GS} = 12\text{ V}, V_{DS} = 0\text{ V}$                 |    |    | 100  | nA                   |
| $I_{GSSR}$                           | Gate–Body Leakage, Reverse                | $V_{GS} = -12\text{ V}, V_{DS} = 0\text{ V}$                |    |    | -100 | nA                   |

**On Characteristics** (Note 2)

|  |  |  |     |                   |                   |                      |
|--|--|--|-----|-------------------|-------------------|----------------------|
| $V_{GS(th)}$                           | Gate Threshold Voltage                         | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$  | 0.6 | 1                 | 1.5               | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$  |     | -3                |                   | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$                           | Static Drain–Source On–Resistance              | $V_{GS} = 4.5\text{ V}, I_D = 0.9\text{ A}$<br>$V_{GS} = 2.5\text{ V}, I_D = 0.7\text{ A}$<br>$V_{GS} = 4.5\text{ V}, I_D = 0.9\text{ A}, T_J = 125^\circ\text{C}$ |     | 164<br>235<br>220 | 220<br>300<br>303 | m $\Omega$           |
| $I_{D(on)}$                            | On–State Drain Current                         | $V_{GS} = 4.5\text{ V}, V_{DS} = 5\text{ V}$   | 1   |                   |                   | A                    |
| $g_{FS}$                               | Forward Transconductance                       | $V_{DS} = 5\text{ V}, I_D = 0.9\text{ A}$  |     | 3                 |                   | S                    |

**Dynamic Characteristics**

|           |                              |  |  |     |  |    |
|-----------|------------------------------|--|--|-----|--|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V},$ |  | 109 |  | pF |
| $C_{oss}$ | Output Capacitance           | $f = 1.0\text{ MHz}$                         |  | 30  |  | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |  |  | 14  |  | pF |

**Switching Characteristics** (Note 2)

|              |                     |  |  |      |     |    |
|--------------|---------------------|--|--|------|-----|----|
| $t_{d(on)}$  | Turn–On Delay Time  | $V_{DD} = 10\text{ V}, I_D = 1\text{ A},$    |  | 4.5  | 9   | ns |
| $t_r$        | Turn–On Rise Time   | $V_{GS} = 4.5\text{ V}, R_{GEN} = 6\ \Omega$ |  | 7    | 14  | ns |
| $t_{d(off)}$ | Turn–Off Delay Time |  |  | 8    | 16  | ns |
| $t_f$        | Turn–Off Fall Time  |  |  | 1.4  | 2.8 | ns |
| $Q_g$        | Total Gate Charge   | $V_{DS} = 10\text{ V}, I_D = 0.9\text{ A},$  |  | 1.1  | 1.5 | nC |
| $Q_{gs}$     | Gate–Source Charge  | $V_{GS} = 4.5\text{ V}$                      |  | 0.26 |     | nC |
| $Q_{gd}$     | Gate–Drain Charge   |  |  | 0.26 |     | nC |

**Drain–Source Diode Characteristics and Maximum Ratings**

|          |   |  |  |      |      |    |
|----------|---|--|--|------|------|----|
| $I_S$    | Maximum Continuous Drain–Source Diode Forward Current |  |  |      | 0.29 | A  |
| $V_{SD}$ | Drain–Source Diode Forward Voltage                    | $V_{GS} = 0\text{ V}, I_S = 0.29\text{ A}$ |  | 0.75 | 1.2  | V  |
| $t_{rr}$ | Diode Reverse Recovery Time                           | $I_F = 0.9\text{ A},$                      |  | 7.4  |      | nS |
| $Q_{rr}$ | Diode Reverse Recovery Charge                         | $dI_F/dt = 100\text{ A}/\mu\text{s}$       |  | 2.2  |      | nC |

**Notes:**

1. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$

Typical Characteristics

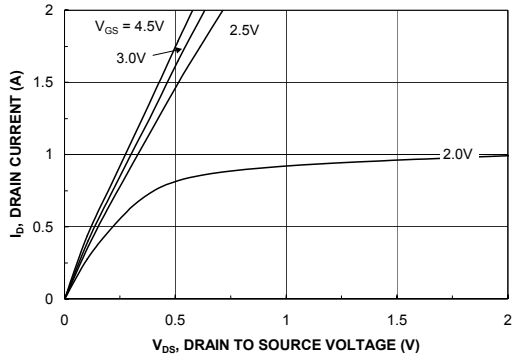


Figure 1. On-Region Characteristics.

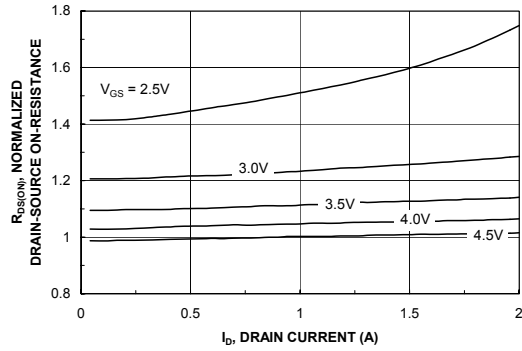


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

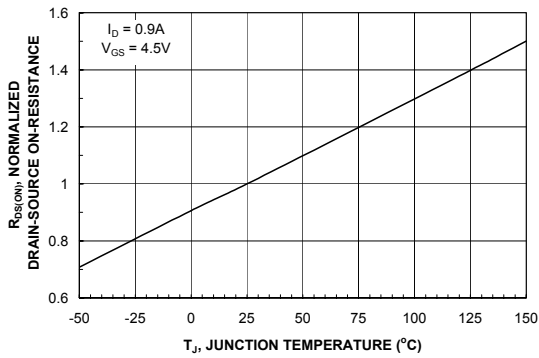


Figure 3. On-Resistance Variation with Temperature.

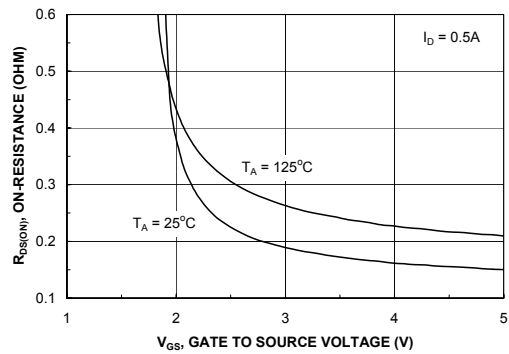


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

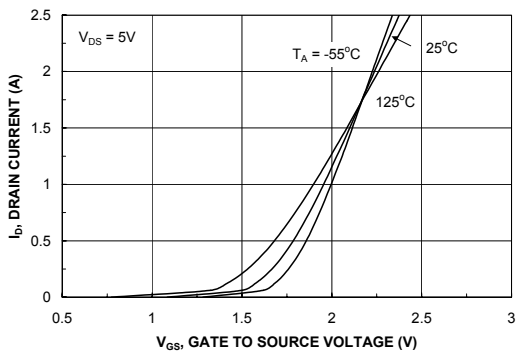


Figure 5. Transfer Characteristics.

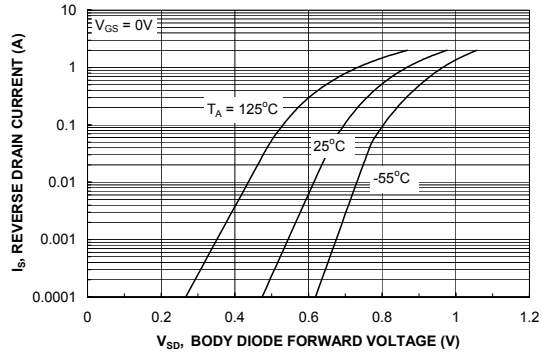


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

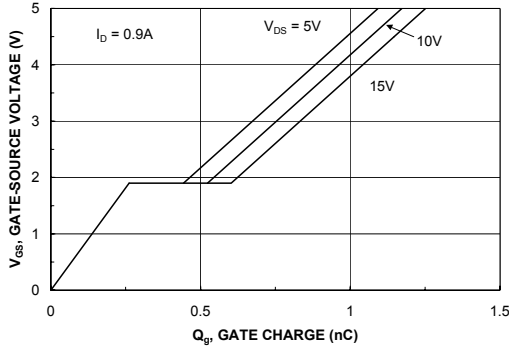


Figure 7. Gate Charge Characteristics.

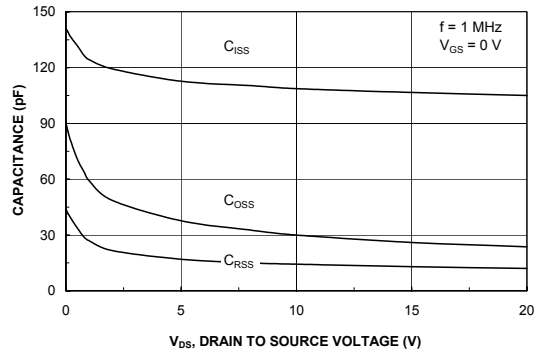


Figure 8. Capacitance Characteristics.

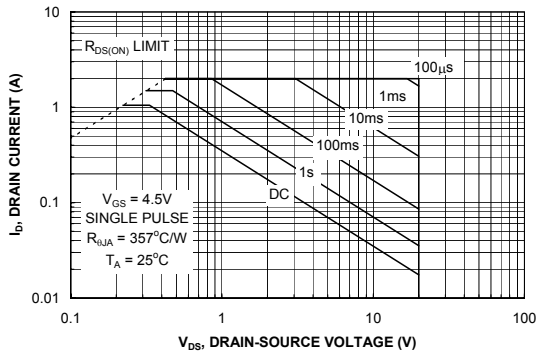


Figure 9. Maximum Safe Operating Area.

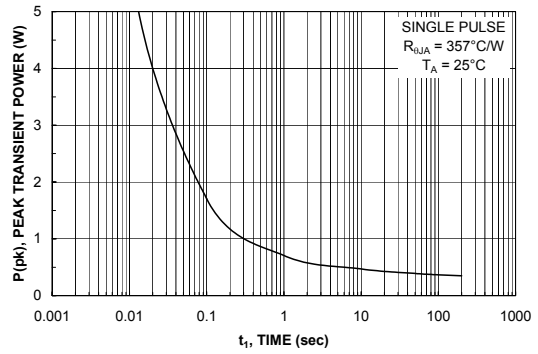


Figure 10. Single Pulse Maximum Power Dissipation.

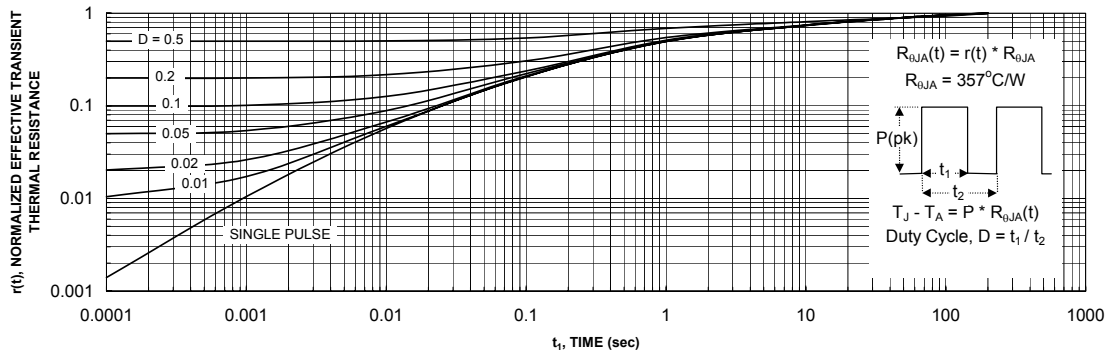


Figure 11. Transient Thermal Response Curve.

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