



January 2003

# FDV305N

## 20V N-Channel PowerTrench<sup>®</sup> MOSFET

### General Description

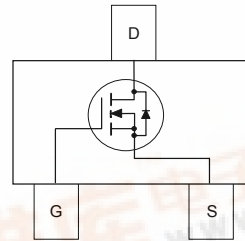
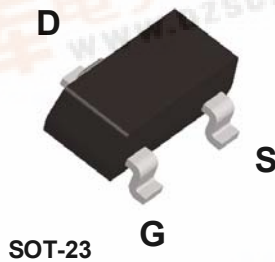
This 20V N-Channel MOSFET uses Fairchild's high voltage PowerTrench process. It has been optimized for power management applications.

### 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<sub>A</sub>=25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
V <sub>DSS</sub>	Drain-Source Voltage	20	V
V <sub>GSS</sub>	Gate-Source Voltage	± 12	V
I <sub>D</sub>	Drain Current – Continuous	0.9	A
	– Pulsed	2	
P <sub>D</sub>	Maximum Power Dissipation	0.35	W
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient	357	°C/W
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### 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
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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 $25^\circ\text{C}$		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	$V_{GS} = 4.5\text{ V}, I_D = 0.9\text{ A}$ $V_{GS} = 2.5\text{ V}, I_D = 0.7\text{ A}$ $V_{GS} = 4.5\text{ V}, I_D = 0.9\text{ A}, T_J = 125^\circ\text{C}$		164 235 220	220 300 303	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

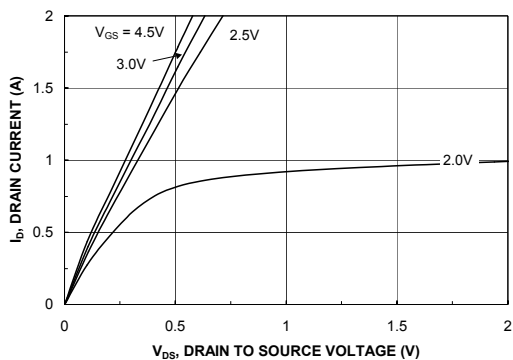


Figure 1. On-Region Characteristics.

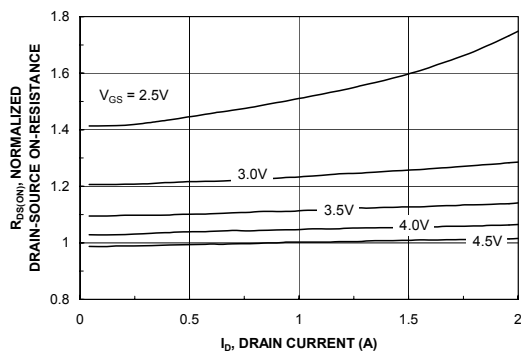


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

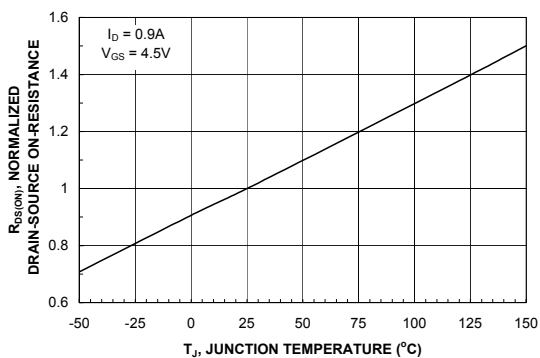


Figure 3. On-Resistance Variation with Temperature.

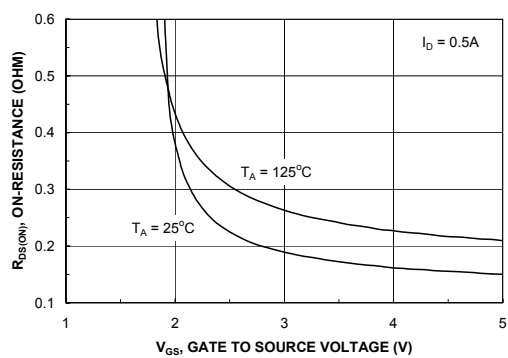


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

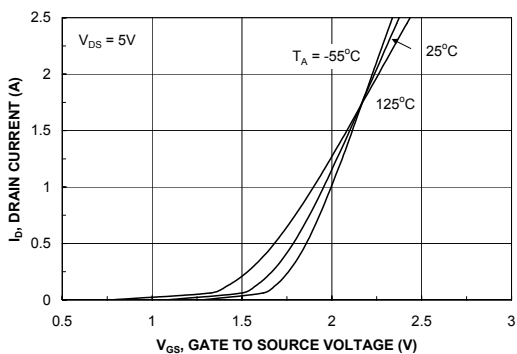


Figure 5. Transfer Characteristics.

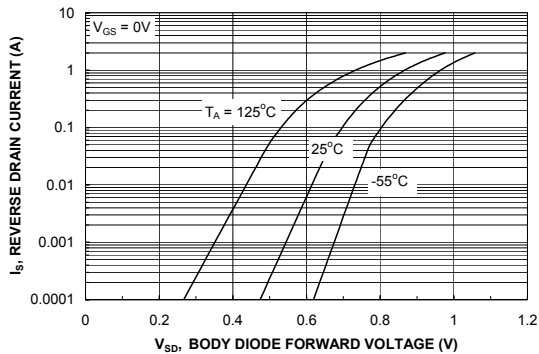


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Characteristics

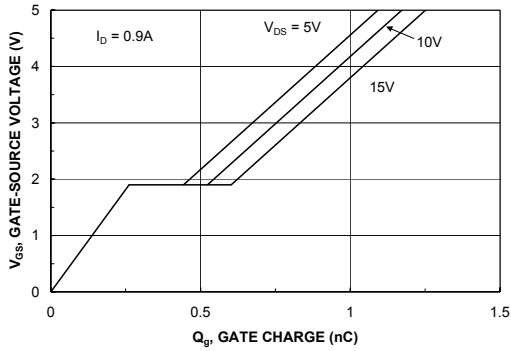


Figure 7. Gate Charge Characteristics.

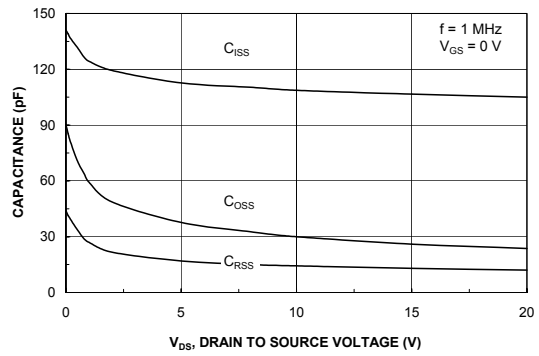


Figure 8. Capacitance Characteristics.

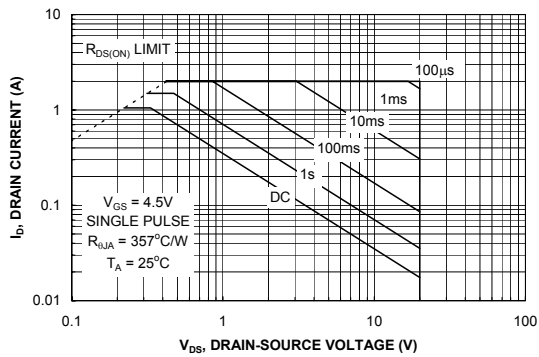


Figure 9. Maximum Safe Operating Area.

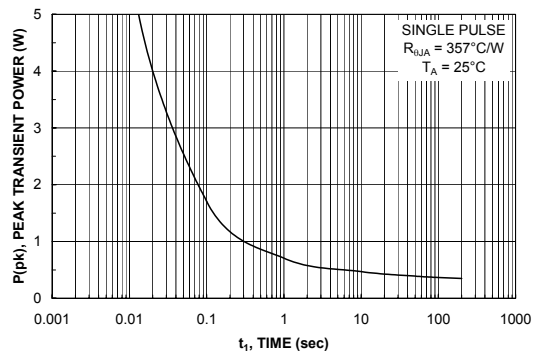


Figure 10. Single Pulse Maximum Power Dissipation.

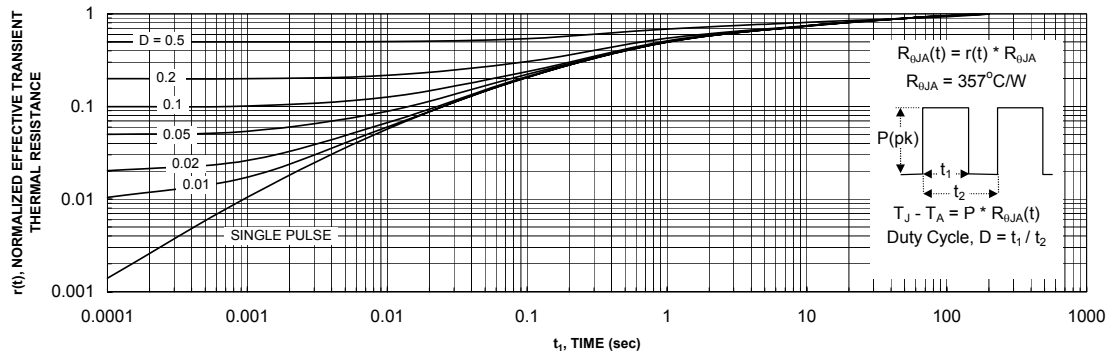


Figure 11. Transient Thermal Response Curve.

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