

## FDN359BN

### N-Channel Logic Level PowerTrench™ MOSFET

#### General Description

This N-Channel Logic Level MOSFET is produced using Fairchild's Semiconductor's advanced PowerTrench process that has been especially tailored to minimize on-state resistance and yet maintain superior switching performance.

These devices are well suited for low voltage and battery powered applications where low in-line power loss and fast switching are required.

#### Features

- 2.7 A, 30 V.  $R_{DS(ON)} = 0.046 \Omega$  @  $V_{GS} = 10$  V  
 $R_{DS(ON)} = 0.060 \Omega$  @  $V_{GS} = 4.5$  V
- Very fast switching speed.
- Low gate charge (5nC typical)
- High performance version of industry standard SOT-23 package. Identical pin out to SOT-23 with 30% higher power handling capability.



#### Absolute Maximum Ratings

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

Symbol	Parameter	Ratings	Units
$V_{DSS}$	Drain-Source Voltage	30	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Maximum Drain Current – Continuous – Pulsed	2.7	A
		15	
$P_D$	Maximum Power Dissipation (Note 1a) (Note 1b)	0.5	W
		0.46	
$T_J, T_{STG}$	Operating and Storage Temperature Range	–55 to +150	°C

#### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	250	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	75	°C/W

#### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
359B	FDN359BN	7"	8mm	3000 units

## Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain–Source Breakdown Voltage	$V_{GS} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$	30			V
$\Delta BV_{DSS}$ $\Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$		21		$\text{mV/}^\circ\text{C}$
$I_{BS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24 \text{ V}$ , $V_{GS} = 0 \text{ V}$		1		$\mu\text{A}$
			$T_J = -55^\circ\text{C}$		10	$\mu\text{A}$
$I_{GSS}$	Gate–Body Leakage	$V_{GS} = \pm 20 \text{ V}$ , $V_{DS} = 0 \text{ V}$			$\pm 100$	nA
<b>On Characteristics</b> (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = 250 \mu\text{A}$	1	1.8	3	V
$\Delta V_{GS(th)}$ $\Delta T_J$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$		-4		$\text{mV/}^\circ\text{C}$
$R_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = 10 \text{ V}$ , $I_D = 2.7 \text{ A}$		0.026	0.046	$\Omega$
		$V_{GS} = 4.5 \text{ V}$ , $I_D = 2.4 \text{ A}$		0.032	0.060	
		$V_{GS} = 10 \text{ V}$ , $I_D = 2.7 \text{ A}$ , $T_J = 125^\circ\text{C}$		0.033	0.075	
$I_{D(on)}$	On–State Drain Current	$V_{GS} = 10 \text{ V}$ , $V_{DS} = 5 \text{ V}$	15			A
$g_{FS}$	Forward Transconductance	$V_{DS} = 5 \text{ V}$ , $I_D = 2.7 \text{ A}$		11		S
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = 15 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1.0 \text{ MHz}$		485	650	pF
$C_{oss}$	Output Capacitance			105	140	pF
$C_{rss}$	Reverse Transfer Capacitance			65	100	pF
$R_G$	Gate Resistance	$f = 1.0 \text{ MHz}$		1.8		$\Omega$
<b>Switching Characteristics</b> (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	$V_{DD} = 15 \text{ V}$ , $I_D = 1 \text{ A}$ , $V_{GS} = 10 \text{ V}$ , $R_{GEN} = 6 \Omega$		7	14	ns
$t_r$	Turn–On Rise Time			5	10	ns
$t_{d(off)}$	Turn–Off Delay Time			20	35	ns
$t_f$	Turn–Off Fall Time			2	4	ns
$Q_g$	Total Gate Charge	$V_{DS} = 15 \text{ V}$ , $I_D = 2.7 \text{ A}$ , $V_{GS} = 5 \text{ V}$		5	7	nC
$Q_{gs}$	Gate–Source Charge			1.3		nC
$Q_{gd}$	Gate–Drain Charge			1.8		nC

## Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain-Source Diode Forward Current			0.42		A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}$ , $I_S = 0.42 \text{ A}$ (Note 2)		0.7	1.2	V
$t_{rr}$	Diode Reverse Recovery Time	$IF = 2.7 \text{ A}$ , $dI/F/dt = 100 \text{ A}/\mu\text{s}$		12	20	ns
$Q_{rr}$	Diode Reverse Recovery Charge			3	5	nC

**Notes:**

- $R_{iJA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{iJC}$  is guaranteed by design while  $R_{iCA}$  is determined by the user's board design.



a)  $250^\circ\text{C}/\text{W}$  when mounted on a  
0.02 in<sup>2</sup> pad of 2 oz. copper.



b)  $270^\circ\text{C}/\text{W}$  when mounted on a  
minimum pad.

Scale 1 : 1 on letter size paper

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

## Typical Characteristics

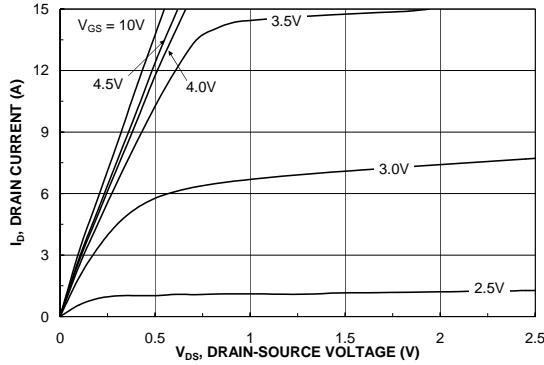


Figure 1. On-Region Characteristics.

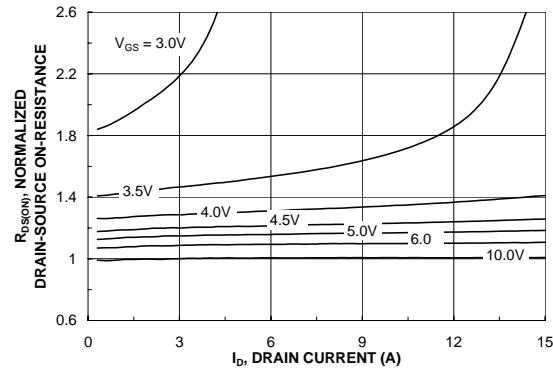


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

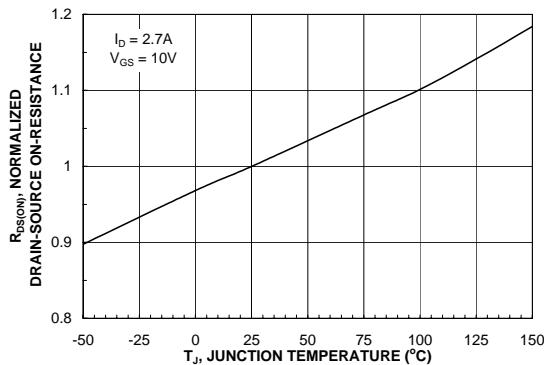


Figure 3. On-Resistance Variation with Temperature.

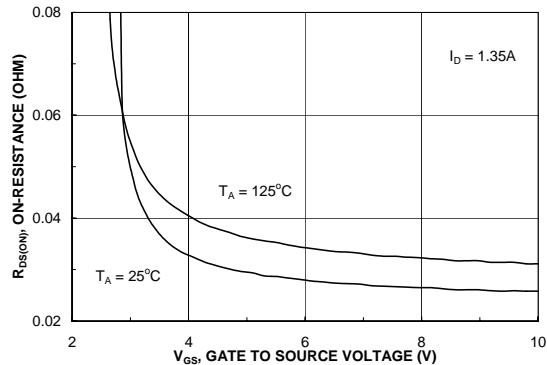


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

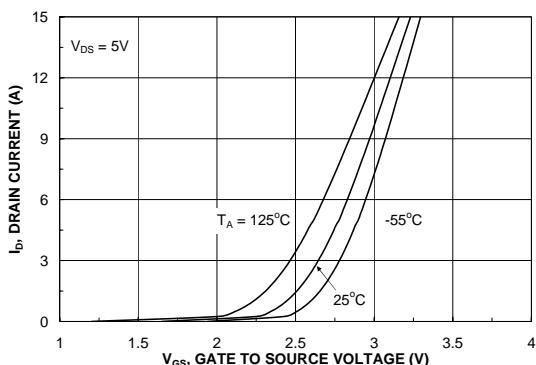


Figure 5. Transfer Characteristics.

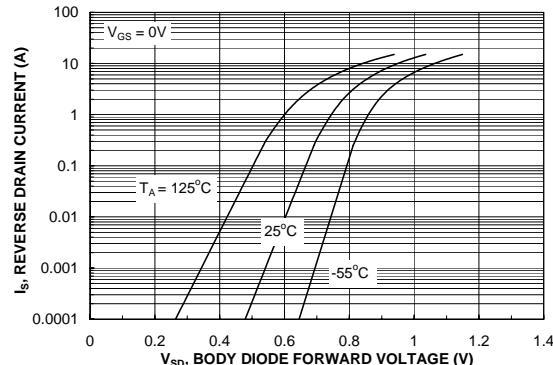


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Characteristics

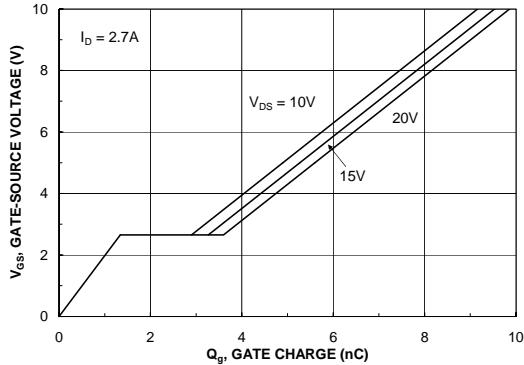


Figure 7. Gate Charge Characteristics.

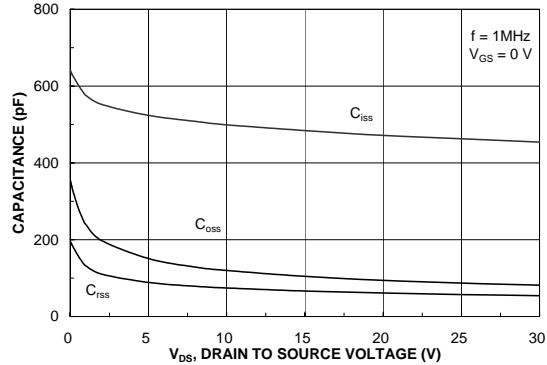


Figure 8. Capacitance Characteristics.

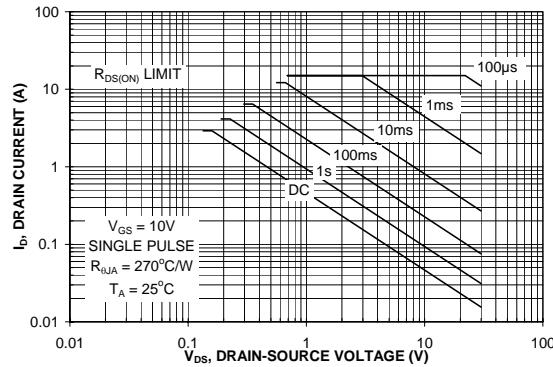


Figure 9. Maximum Safe Operating Area.

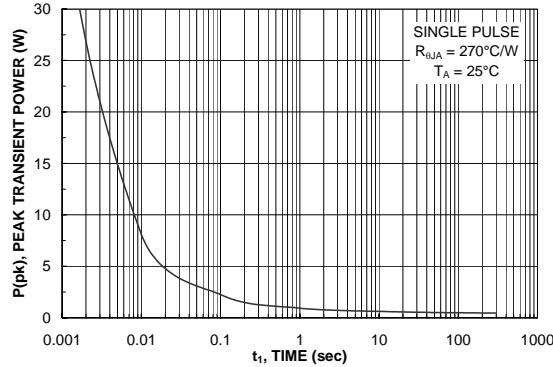


Figure 10. Single Pulse Maximum Power Dissipation.

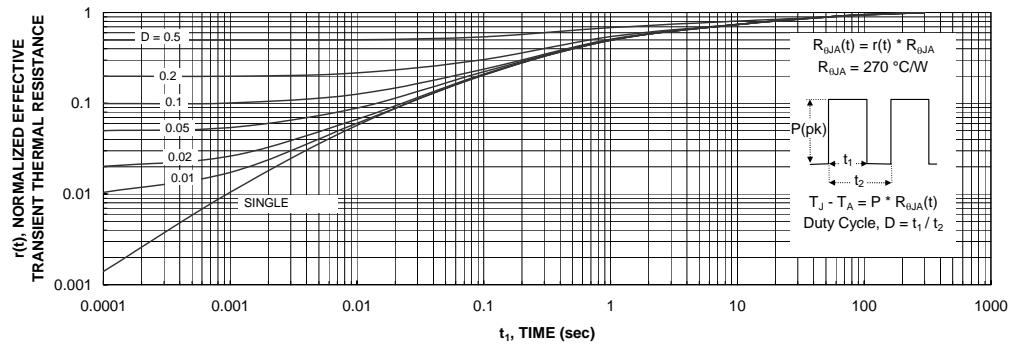


Figure 11. Transient Thermal Response Curve.

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

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