

# FDD86102

## N-Channel Shielded Gate PowerTrench® MOSFET

100 V, 36 A, 24 mΩ

### Features

- Shielded Gate MOSFET Technology
- Max  $r_{DS(on)}$  = 24 mΩ at  $V_{GS} = 10$  V,  $I_D = 8$  A
- Max  $r_{DS(on)}$  = 38 mΩ at  $V_{GS} = 6$  V,  $I_D = 6$  A
- High performance trench technology for extremely low  $r_{DS(on)}$
- High power and current handling capability in a widely used surface mount package
- Very low  $Q_g$  and  $Q_{gd}$  compared to competing trench technologies
- Fast switching speed
- 100% UIL tested
- RoHS Compliant

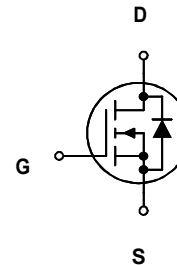
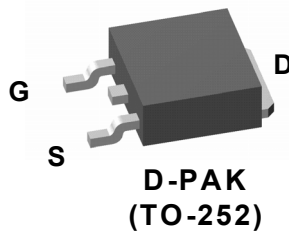


### General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process that incorporates Shielded Gate technology. This process has been optimized for  $r_{DS(on)}$ , switching performance and ruggedness.

### Application

- DC - DC Conversion



### MOSFET Maximum Ratings $T_C = 25$ °C unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	100	V
$V_{GS}$	Gate to Source Voltage	±20	V
$I_D$	Drain Current -Continuous $T_C = 25$ °C	36	A
	-Continuous $T_A = 25$ °C (Note 1a)	8	
	-Pulsed (Note 4)	75	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	121	mJ
$P_D$	Power Dissipation $T_C = 25$ °C	62	W
	Power Dissipation $T_A = 25$ °C (Note 1a)	3.1	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	2.0	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	40	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD86102	FDD86102	D-PAK(TO-252)	13 "	12 mm	2500 units

## Electrical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}, V_{GS} = 0\text{ V}$	100			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		67		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 80\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$			$\pm 100$	nA

### On Characteristics (Note 2)

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	2	3.1	4	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		-8.5		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 8\text{ A}$		19	24	m $\Omega$
		$V_{GS} = 6\text{ V}, I_D = 6\text{ A}$		26	38	
		$V_{GS} = 10\text{ V}, I_D = 8\text{ A}, T_J = 125\text{ }^\circ\text{C}$		33	44	
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 8\text{ A}$		21		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$		780	1035	pF
$C_{oss}$	Output Capacitance			180	240	pF
$C_{riss}$	Reverse Transfer Capacitance			15	25	pF
$R_g$	Gate Resistance			0.4		$\Omega$

### Switching Characteristics

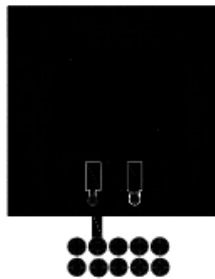
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 50\text{ V}, I_D = 8\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$		7.6	15	ns	
$t_r$	Rise Time			3	10	ns	
$t_{d(off)}$	Turn-Off Delay Time			13.4	24	ns	
$t_f$	Fall Time			2.9	10	ns	
$Q_g$	Total Gate Charge		$V_{GS} = 0\text{ V to } 10\text{ V}$		13.4	19	nC
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V to } 5\text{ V}$	$V_{DD} = 50\text{ V},$ $I_D = 8\text{ A}$		7.6	11	nC
$Q_{gs}$	Gate to Source Gate Charge				4.0		nC
$Q_{gd}$	Gate to Drain "Miller" Charge				3.7		nC

### Drain-Source Diode Characteristics

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 8\text{ A}$ (Note 2)		0.8	1.3	V
		$V_{GS} = 0\text{ V}, I_S = 2.6\text{ A}$ (Note 2)		0.7	1.2	
$t_{rr}$	Reverse Recovery Time	$I_F = 8\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		43	68	ns
$Q_{rr}$	Reverse Recovery Charge			43	68	nC

#### Notes:

- $R_{\theta JA}$  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.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta JA}$  is determined by the user's board design.



a.  $40\text{ }^\circ\text{C/W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper.



b.  $96\text{ }^\circ\text{C/W}$  when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width <  $300\text{ }\mu\text{s}$ , Duty cycle < 2.0%.

3.  $E_{AS}$  121 mJ is based on starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 3\text{ mH}$ ,  $I_{AS} = 9\text{ A}$ ,  $V_{DD} = 100\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% test at  $L = 0.1\text{ mH}$ ,  $I_{AS} = 30\text{ A}$ .

4. Pulsed Drain current is tested at  $300\text{ }\mu\text{s}$  with 2% duty cycle. For repetitive pulses, the pulse width is limited by the maximum junction temperature.

**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted

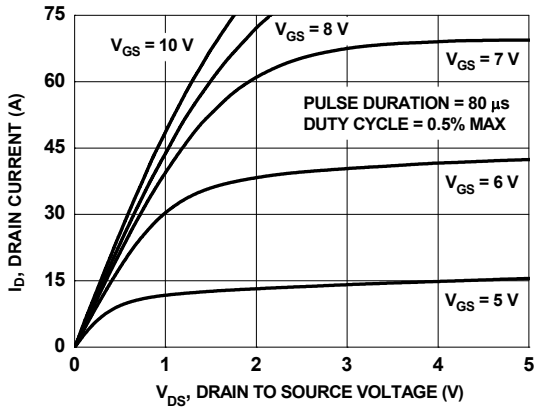


Figure 1. On-Region Characteristics

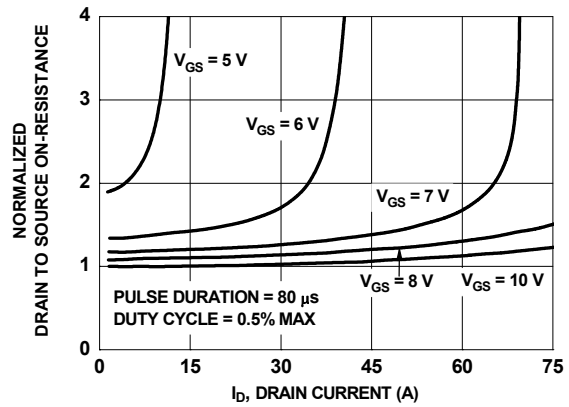


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

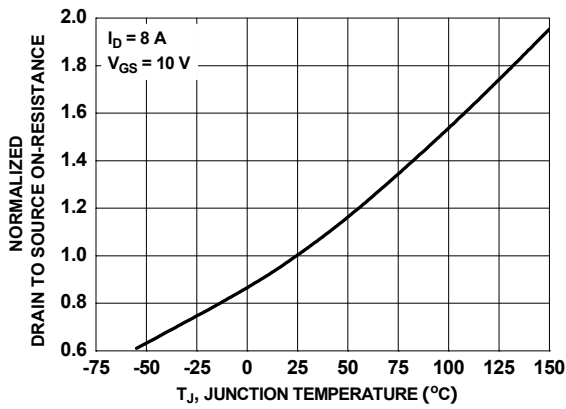


Figure 3. Normalized On-Resistance vs Junction Temperature

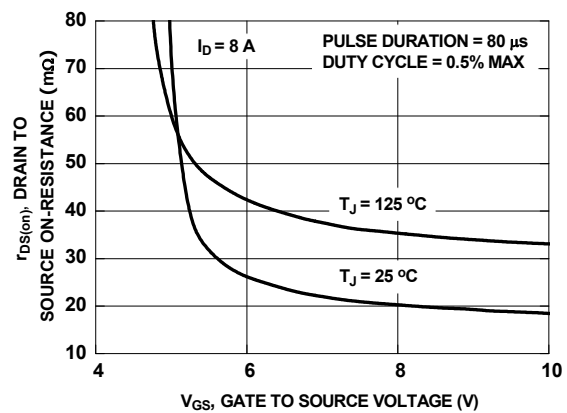


Figure 4. On-Resistance vs Gate to Source Voltage

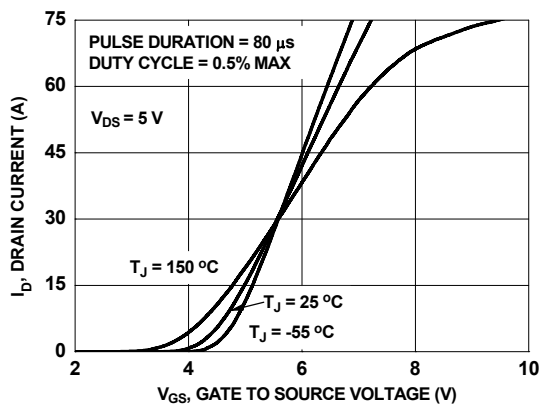


Figure 5. Transfer Characteristics

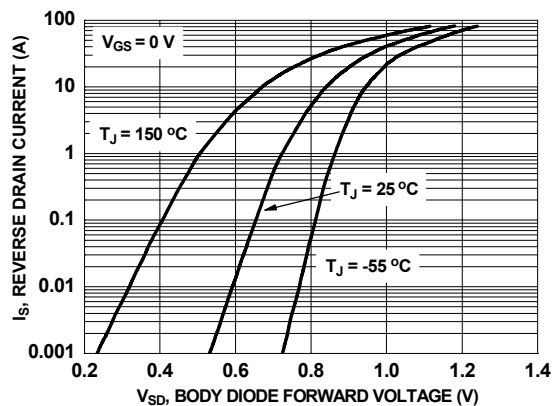
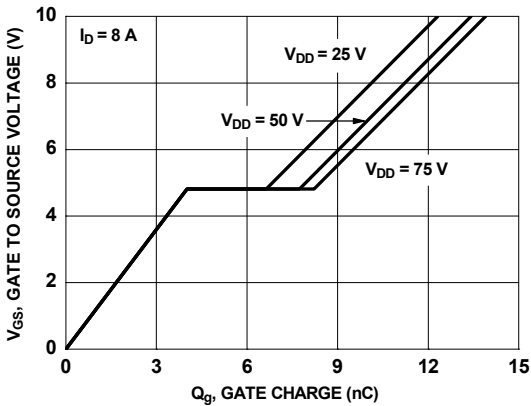
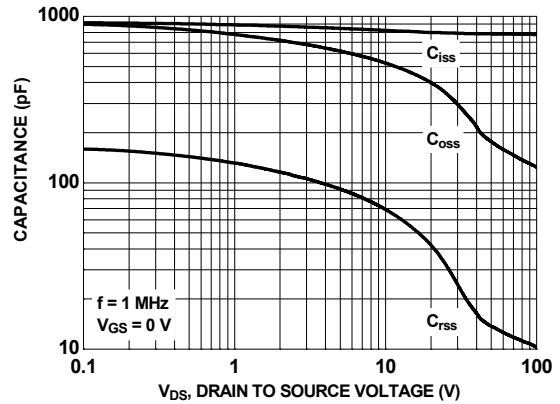


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

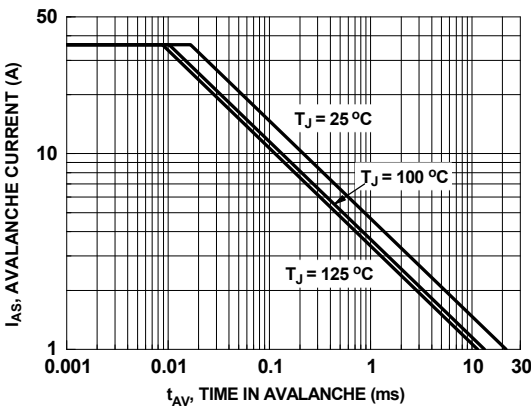
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



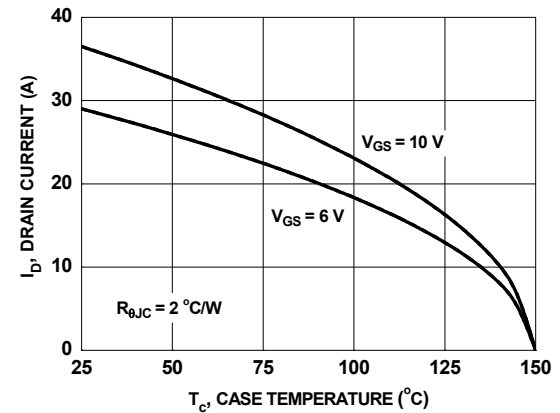
**Figure 7. Gate Charge Characteristics**



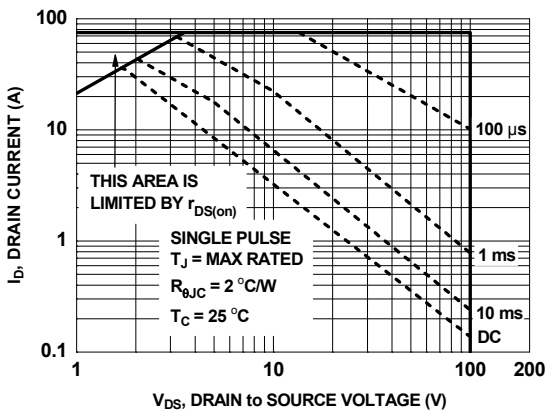
**Figure 8. Capacitance vs Drain to Source Voltage**



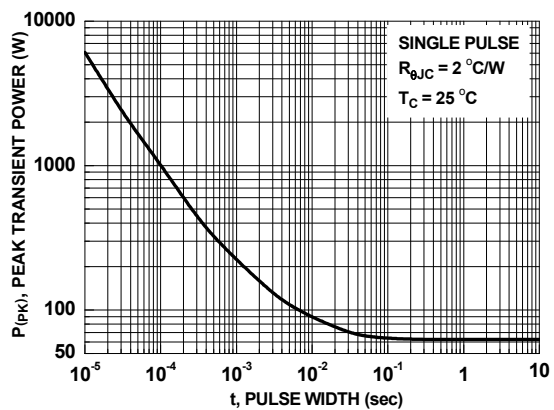
**Figure 9. Unclamped Inductive Switching Capability**



**Figure 10. Maximum Continuous Drain Current vs Case Temperature**

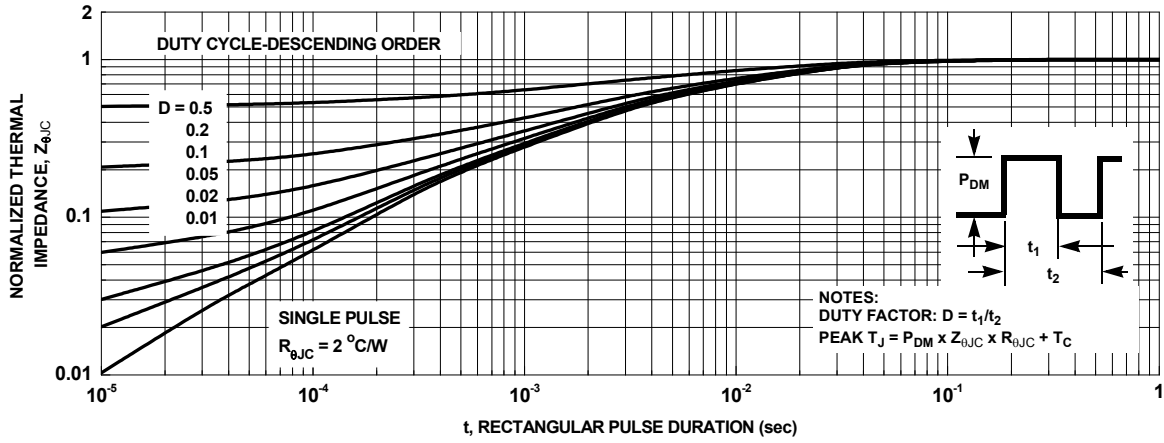


**Figure 11. Forward Bias Safe Operating Area**



**Figure 12. Single Pulse Maximum Power Dissipation**

**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted




**Figure 13. Junction-to-Case Transient Thermal Response Curve**



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