

# FDMC86570L

## N-Channel Shielded Gate PowerTrench® MOSFET

60 V, 56 A, 4.3 mΩ

### Features

- Shielded Gate MOSFET Technology
- Max  $r_{DS(on)}$  = 4.3 mΩ at  $V_{GS}$  = 10 V,  $I_D$  = 18 A
- Max  $r_{DS(on)}$  = 6.5 mΩ at  $V_{GS}$  = 4.5 V,  $I_D$  = 15 A
- High performance technology for extremely low  $r_{DS(on)}$
- Termination is Lead-free
- RoHS Compliant

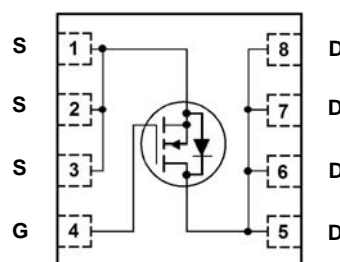
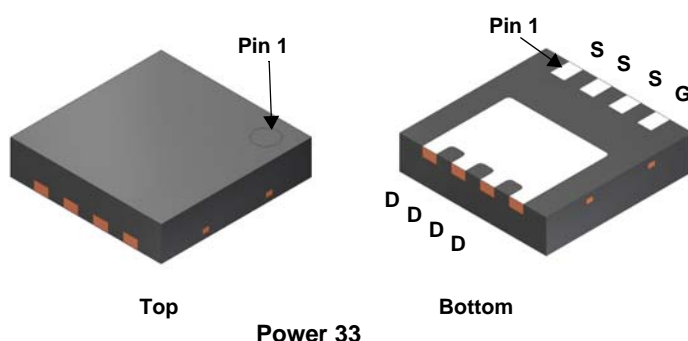


### General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process that incorporates Shielded Gate technology. This process has been optimized for the on-state resistance and yet maintain superior switching performance.

### Application

- DC-DC Conversion



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

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	60	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current -Continuous $T_C = 25^\circ\text{C}$	56	A
	-Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	18	
	-Pulsed (Note 4)	200	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	253	mJ
$P_D$	Power Dissipation $T_C = 25^\circ\text{C}$	54	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	2.3	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case (Note 1)	2.3	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	53	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMC86570L	FDMC86570L	Power33	13 "	12 mm	3000 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	$I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$	60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^{\circ}\text{C}$		30		mV/ $^{\circ}\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 48\text{ V}$ , $V_{GS} = 0\text{ V}$			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**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250\text{ }\mu\text{A}$	1.0	1.8	3.0	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 $25\text{ }^{\circ}\text{C}$		-7		mV/ $^{\circ}\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}$ , $I_D = 18\text{ A}$		3.1	4.3	m $\Omega$
		$V_{GS} = 4.5\text{ V}$ , $I_D = 15\text{ A}$		4.7	6.5	
		$V_{GS} = 10\text{ V}$ , $I_D = 18\text{ A}$ , $T_J = 125\text{ }^{\circ}\text{C}$		5.0	6.9	
$g_{FS}$	Forward Transconductance	$V_{DD} = 5\text{ V}$ , $I_D = 18\text{ A}$		75		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 30\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		4790	6705	pF
$C_{oss}$	Output Capacitance			821	1150	pF
$C_{rss}$	Reverse Transfer Capacitance			19	30	pF
$R_g$	Gate Resistance		0.1	0.9	2.7	$\Omega$

**Switching Characteristics**

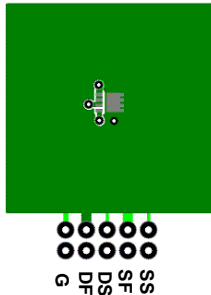
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\text{ V}$ , $I_D = 18\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$		19	34	ns
$t_r$	Rise Time			6.2	12	ns
$t_{d(off)}$	Turn-Off Delay Time			38	61	ns
$t_f$	Fall Time			3.9	10	ns
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\text{ V to } 10\text{ V}$	$V_{DD} = 30\text{ V}$ , $I_D = 18\text{ A}$	63	88	nC
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\text{ V to } 4.5\text{ V}$		29	41	nC
$Q_{gs}$	Gate to Source Charge			14		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			6.3		nC

**Drain-Source Diode Characteristics**

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 18\text{ A}$ (Note 2)		0.8	1.3	V
		$V_{GS} = 0\text{ V}$ , $I_S = 1.9\text{ A}$ (Note 2)		0.7	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = 18\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		43	69	ns
$Q_{rr}$	Reverse Recovery Charge			26	42	nC

Notes:

1.  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a. 53  $^{\circ}\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b. 125  $^{\circ}\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper

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

3.  $E_{AS}$  of 253 mJ is based on starting  $T_J = 25\text{ }^{\circ}\text{C}$ ,  $L = 3\text{ mH}$ ,  $I_{AS} = 13\text{ A}$ ,  $V_{DD} = 60\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% test at  $L = 0.1\text{ mH}$ ,  $I_{AS} = 43\text{ A}$ .

4. Pulsed  $I_d$  limited by junction temperature,  $t_d \leq 100\text{ }\mu\text{s}$ , please refer to SOA curve for more details.

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

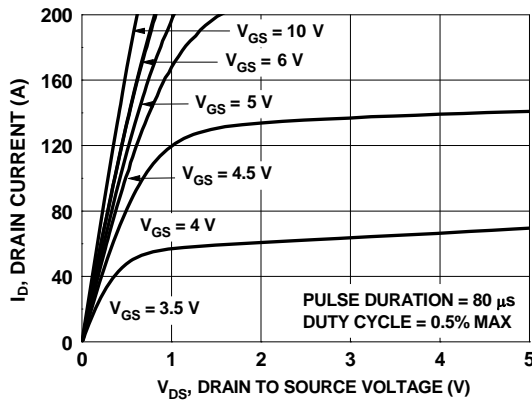


Figure 1. On-Region Characteristics

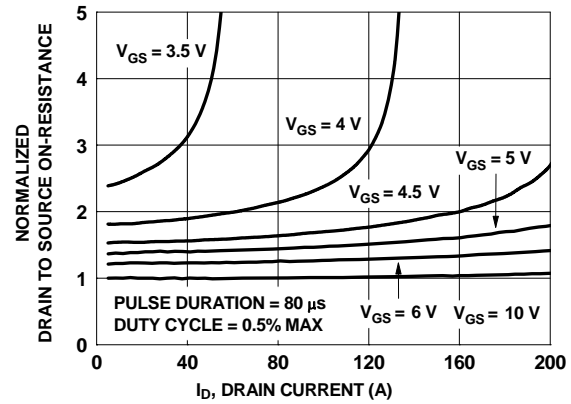


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

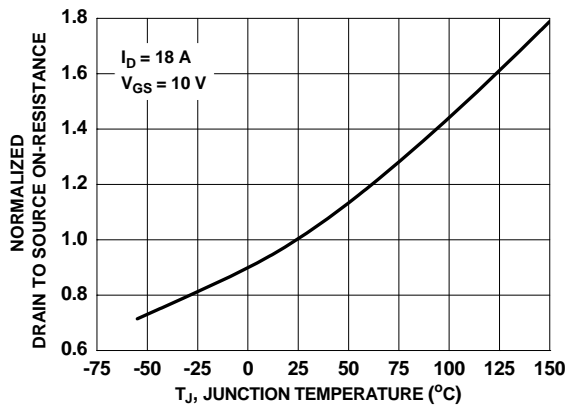


Figure 3. Normalized On-Resistance vs Junction Temperature

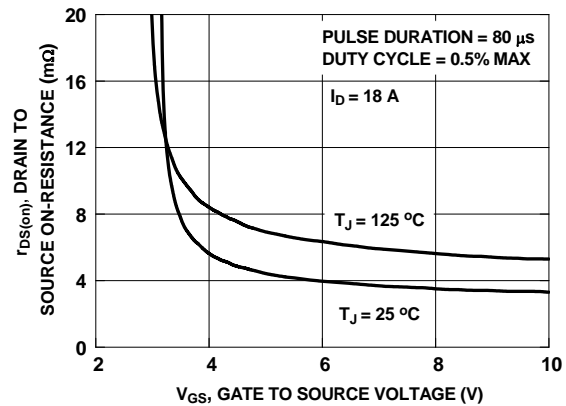


Figure 4. On-Resistance vs Gate to Source Voltage

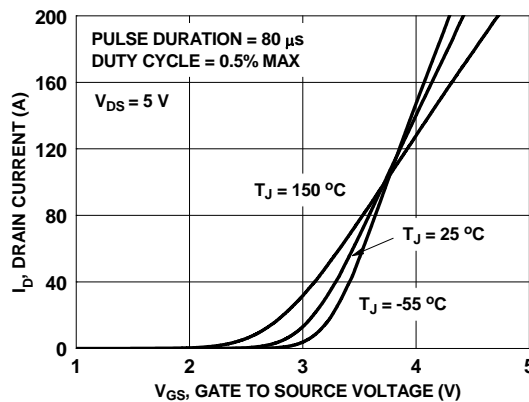


Figure 5. Transfer Characteristics

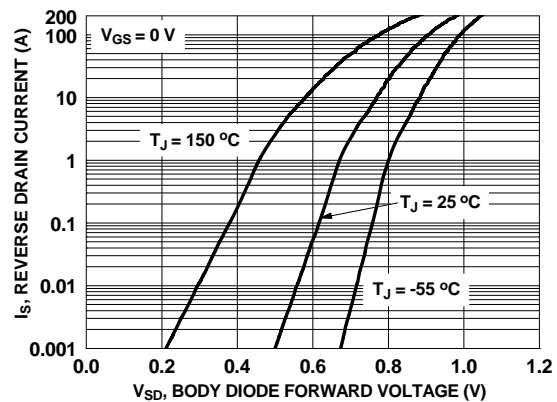


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

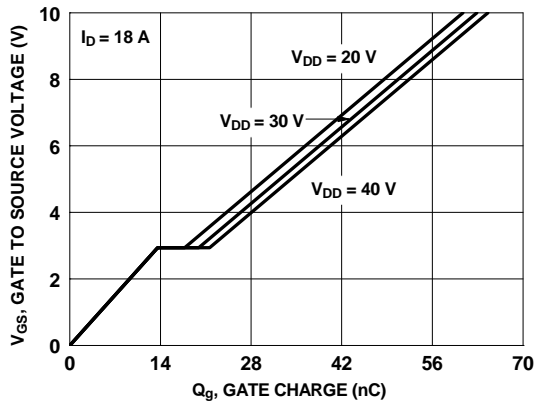


Figure 7. Gate Charge Characteristics

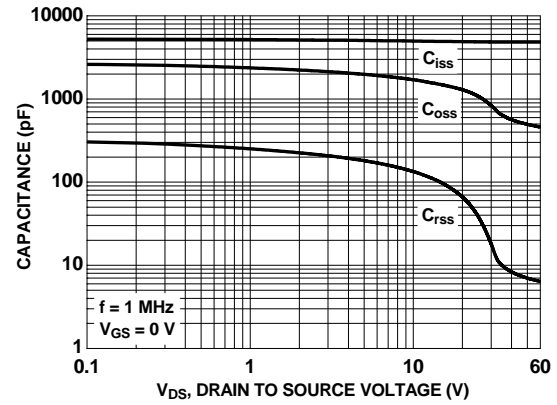


Figure 8. Capacitance vs Drain to Source Voltage

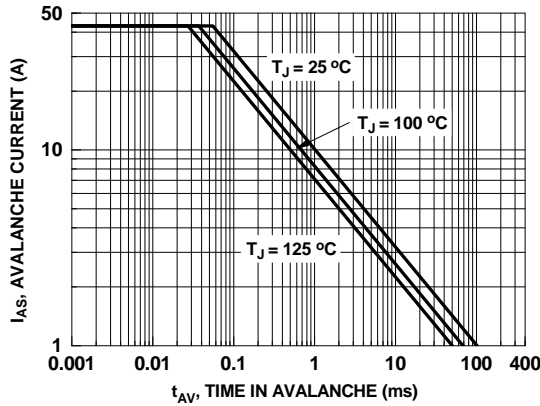


Figure 9. Unclamped Inductive Switching Capability

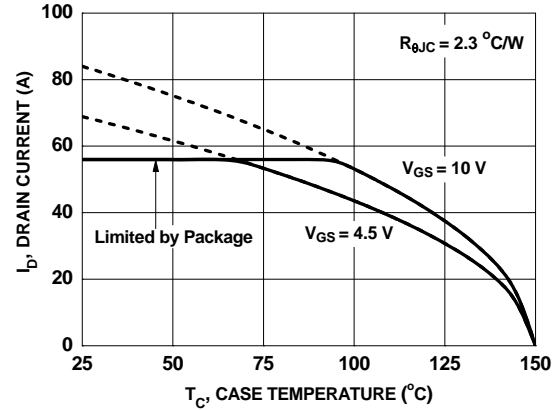


Figure 10. Maximum Continuous Drain Current vs Case Temperature

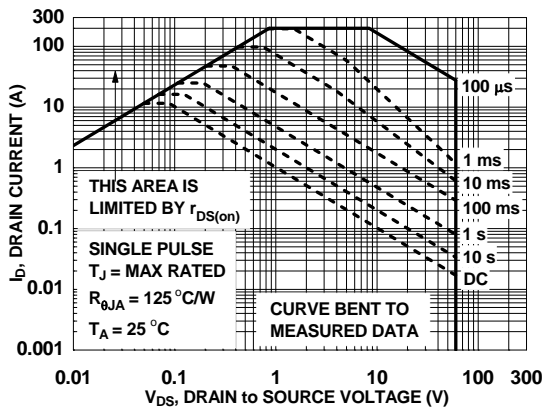


Figure 11. Forward Bias Safe Operating Area

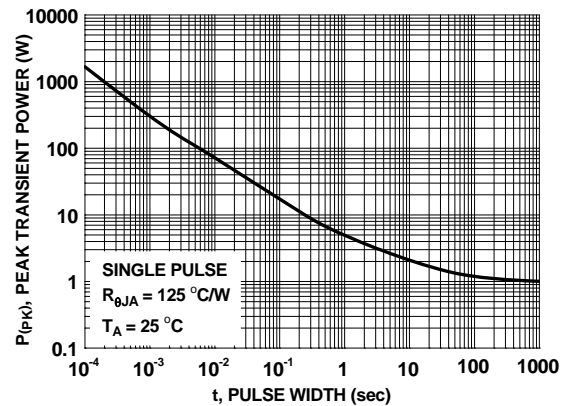
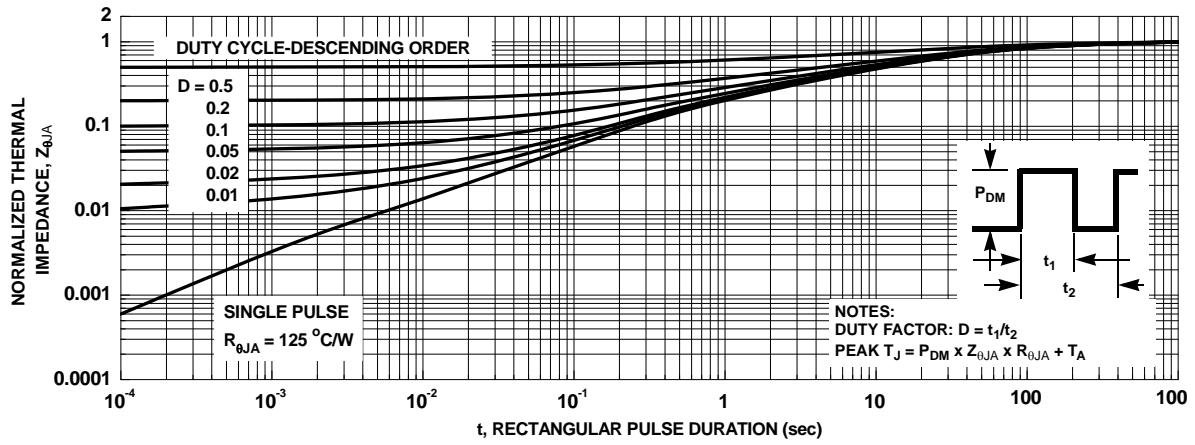


Figure 12. Single Pulse Maximum Power Dissipation





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





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