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ON Semiconductor®

# FDMC510P

## P-Channel PowerTrench® MOSFET

-20 V, -18 A, 8.0 mΩ

### Features

- Max  $r_{DS(on)}$  = 8.0 mΩ at  $V_{GS} = -4.5$  V,  $I_D = -12$  A
- Max  $r_{DS(on)}$  = 9.8 mΩ at  $V_{GS} = -2.5$  V,  $I_D = -10$  A
- Max  $r_{DS(on)}$  = 13 mΩ at  $V_{GS} = -1.8$  V,  $I_D = -9.3$  A
- Max  $r_{DS(on)}$  = 17 mΩ at  $V_{GS} = -1.5$  V,  $I_D = -8.3$  A
- High performance trench technology for extremely low  $r_{DS(on)}$
- High power and current handling capability in a widely used surface mount package
- 100% UIL Tested
- Termination is Lead-free and RoHS Compliant
- HBM ESD capability level >2 KV typical (Note 4)

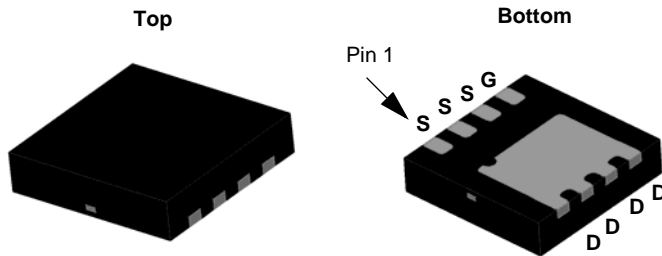


### General Description

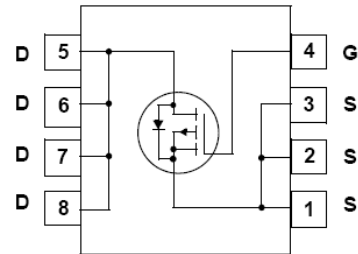
This P-Channel MOSFET is produced using ON Semiconductor's advanced Power Trench® process that has been optimized for  $r_{DS(on)}$ , switching performance and ruggedness.

### Applications

- Battery Management
- Load Switch



MLP 3.3x3.3



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

Symbol	Parameter	Rated	Units
$V_{DS}$	Drain to Source Voltage	-20	V
$V_{GS}$	Gate to Source Voltage	±8	V
$I_D$	Drain Current -Continuous $T_C = 25$ °C	-18	A
	-Continuous $T_A = 25$ °C (Note 1a)	-12	
	-Pulsed	-50	
$E_{AS}$	Single Pulse Avalanche Energy	37	mJ
$P_D$	Power Dissipation $T_C = 25$ °C	41	W
	Power Dissipation $T_A = 25$ °C (Note 1a)	2.3	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	3	°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
FDMC510P	FDMC510P	MLP 3.3X3.3	13 "	12 mm	3000 units

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

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

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = -250\ \mu\text{A}, V_{GS} = 0\ \text{V}$	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , referenced to $25^\circ\text{C}$		-12		mV/°C
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -16\ \text{V}, V_{GS} = 0\ \text{V}$			-1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 8\ \text{V}, V_{DS} = 0\ \text{V}$			$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$	-0.4	-0.5	-1.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , referenced to $25^\circ\text{C}$		3		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -4.5\ \text{V}, I_D = -12\ \text{A}$		6.4	8.0	m $\Omega$
		$V_{GS} = -2.5\ \text{V}, I_D = -10\ \text{A}$		7.6	9.8	
		$V_{GS} = -1.8\ \text{V}, I_D = -9.3\ \text{A}$		9.2	13	
		$V_{GS} = -1.5\ \text{V}, I_D = -8.3\ \text{A}$		11	17	
		$V_{GS} = -4.5\ \text{V}, I_D = -12\ \text{A}, T_J = 125^\circ\text{C}$		8.5	12	
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\ \text{V}, I_D = -12\ \text{A}$		75		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -10\ \text{V}, V_{GS} = 0\ \text{V},$ $f = 1\ \text{MHz}$		5910	7860	pF
$C_{oss}$	Output Capacitance			840	1120	pF
$C_{rss}$	Reverse Transfer Capacitance			738	1110	pF

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -10\ \text{V}, I_D = -12\ \text{A},$ $V_{GS} = -4.5\ \text{V}, R_{GEN} = 6\ \Omega$		15	27	ns	
$t_r$	Rise Time			34	55	ns	
$t_{d(off)}$	Turn-Off Delay Time			338	540	ns	
$t_f$	Fall Time			170	272	ns	
$Q_{g(TOT)}$	Total Gate Charge		$V_{GS} = 0\ \text{V}$ to $-4.5\ \text{V}$		83	116	nC
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $-2.5\ \text{V}$	$V_{DD} = -10\ \text{V},$ $I_D = -12\ \text{A}$		50	70	nC
$Q_{gs}$	Gate to Source Charge				6.3		nC
$Q_{gd}$	Gate to Drain "Miller" Charge				20.4		nC

### Drain-Source Diode Characteristics

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\ \text{V}, I_S = -12\ \text{A}$ (Note 2)		-0.70	-1.3	V
		$V_{GS} = 0\ \text{V}, I_S = -2\ \text{A}$ (Note 2)		-0.53	-1.2	
$t_{rr}$	Reverse Recovery Time	$I_F = -12\ \text{A}, di/dt = 100\ \text{A}/\mu\text{s}$		35	57	ns
$Q_{rr}$	Reverse Recovery Charge			20	32	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  $R_{\theta JA}$  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



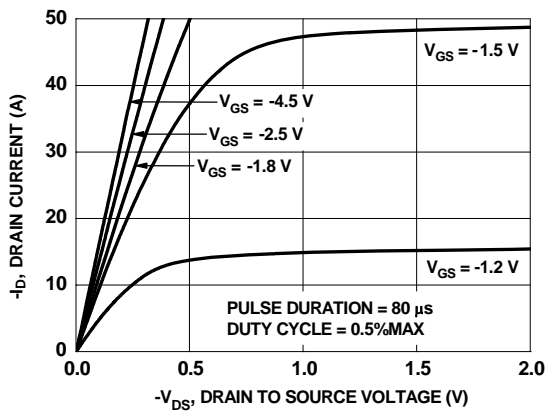
b.  $125^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper

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

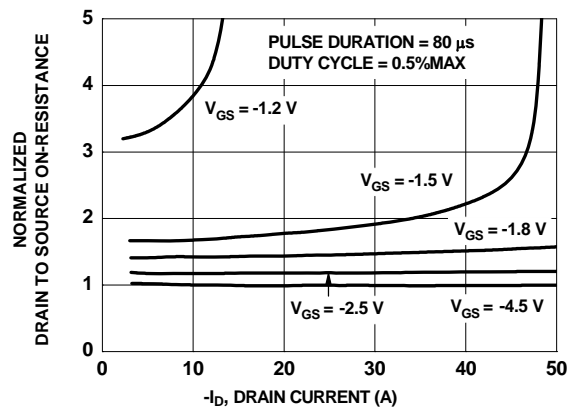
3: Starting  $T_J = 25^\circ\text{C}$ ; P-Ch:  $L = 3\ \text{mH}, I_{AS} = -5\ \text{A}, V_{DD} = -20\ \text{V}, V_{GS} = -4.5\ \text{V}$ .

4: No gate overvoltage rating is implied.

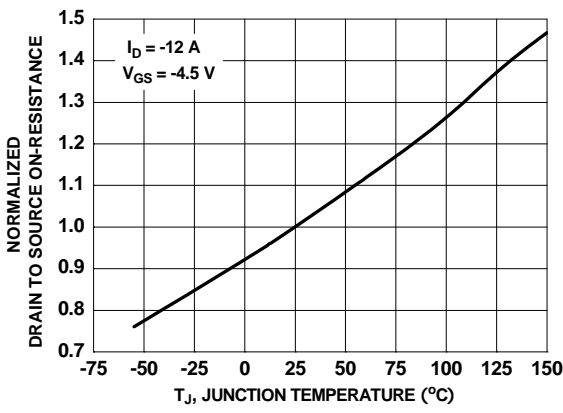
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



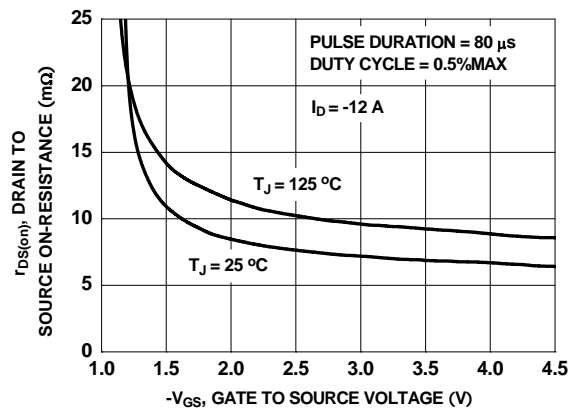
**Figure 1. On Region Characteristics**



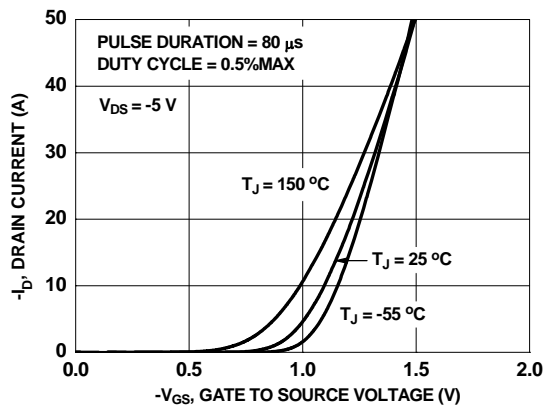
**Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage**



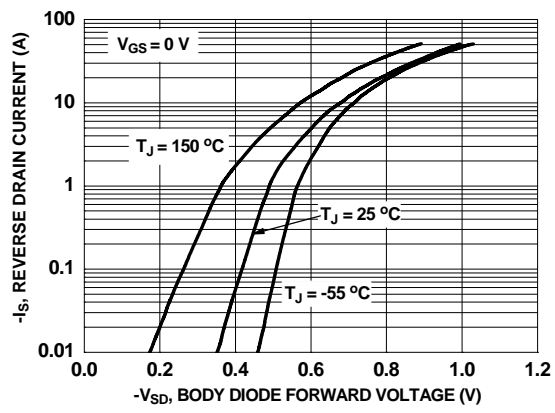
**Figure 3. Normalized On Resistance vs. Junction Temperature**



**Figure 4. On-Resistance vs. Gate to Source Voltage**

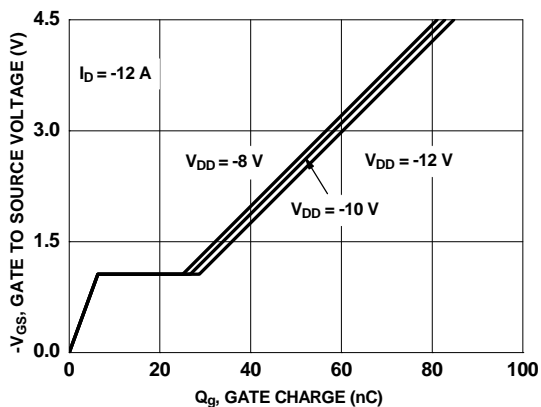


**Figure 5. Transfer Characteristics**

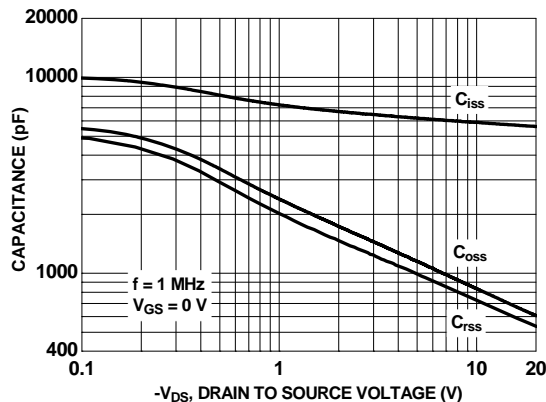


**Figure 6. Source to Drain Diode Forward Voltage vs. Source Current**

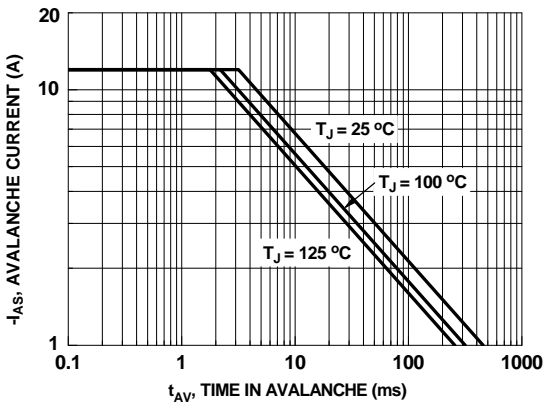
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



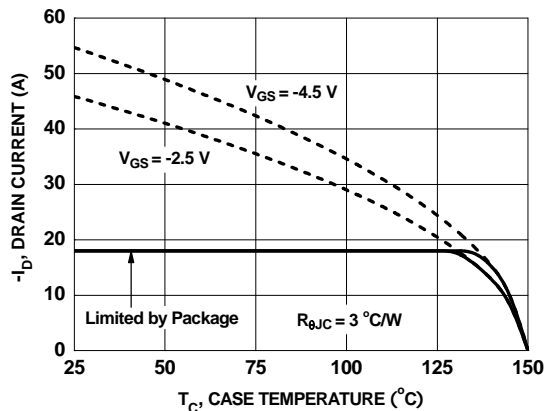
**Figure 7. Gate Charge Characteristics**



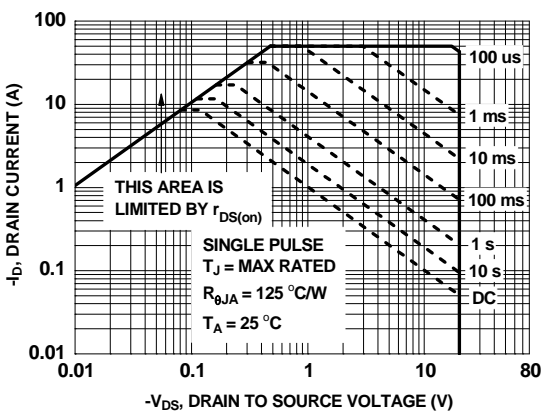
**Figure 8. Capacitance vs. Drain to Source Voltage**



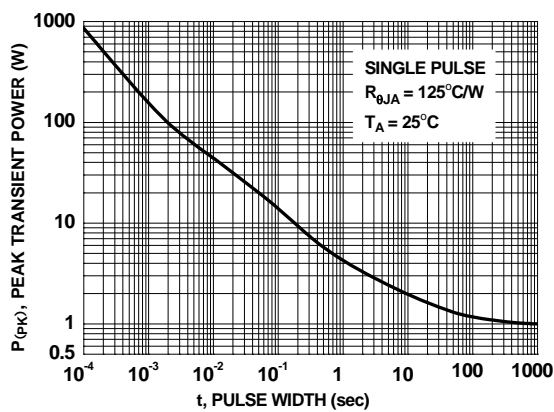
**Figure 9. Unclamped Inductive Switching Capability**



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

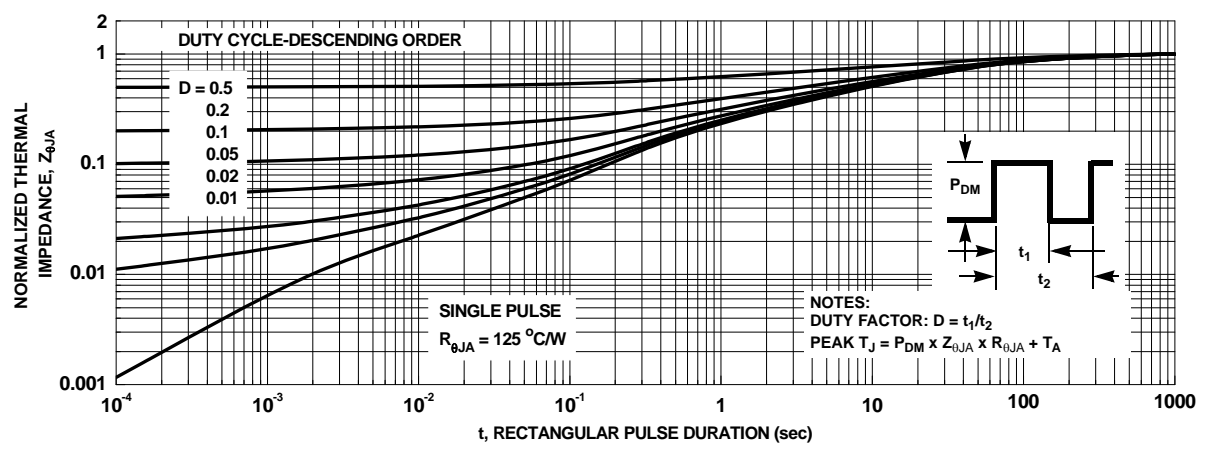


**Figure 11. Forward Bias Safe Operating Area**



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

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



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

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