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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)

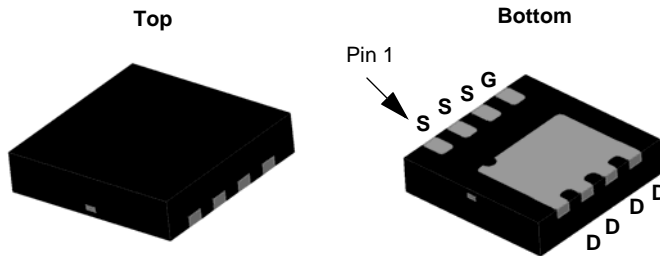


General Description

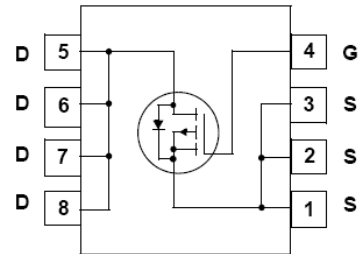
This P-Channel MOSFET is produced using ON Semiconductor's advanced Power Trench® process that has been optimized for $r_{DS(on)}$, switching performance and ruggedness.

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°C		-12		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -16\ \text{V}$, $V_{GS} = 0\ \text{V}$			-1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 8\ \text{V}$, $V_{DS} = 0\ \text{V}$			± 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°C		3		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -4.5\ \text{V}$, $I_D = -12\ \text{A}$		6.4	8.0	m Ω
		$V_{GS} = -2.5\ \text{V}$, $I_D = -10\ \text{A}$		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 in² 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 in² 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 μs , 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 $T_J = 25^\circ\text{C}$ unless otherwise noted

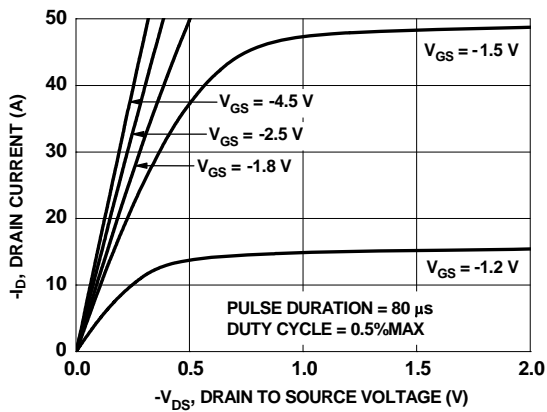


Figure 1. On Region Characteristics

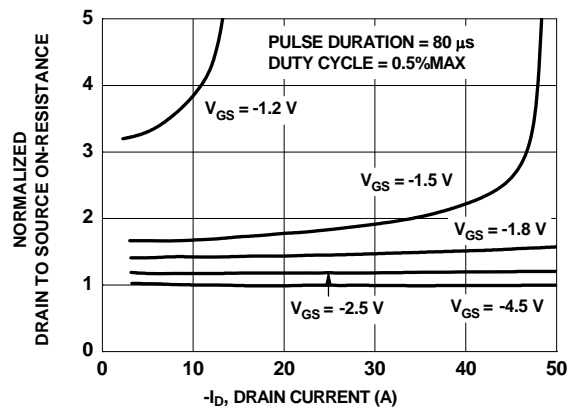


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

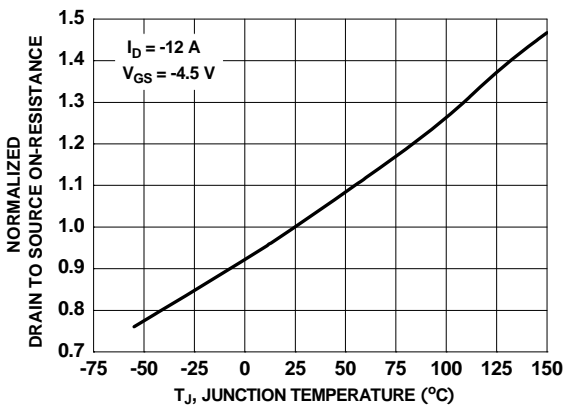


Figure 3. Normalized On Resistance vs. Junction Temperature

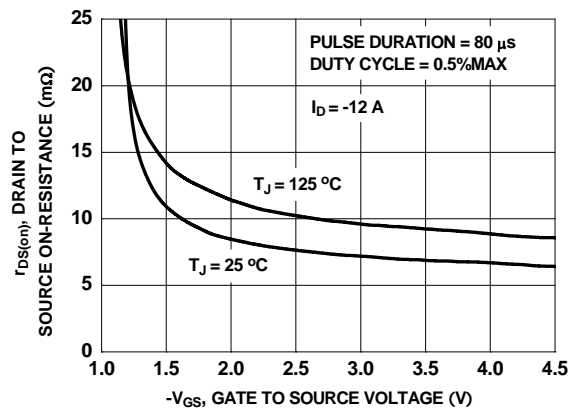


Figure 4. On-Resistance vs. Gate to Source Voltage

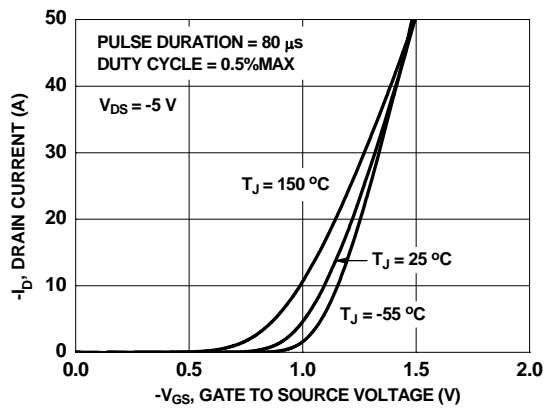


Figure 5. Transfer Characteristics

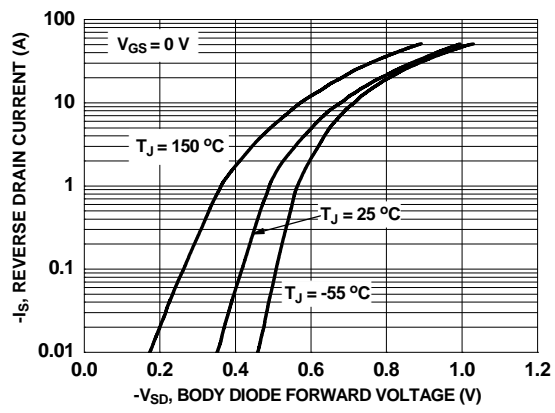


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

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

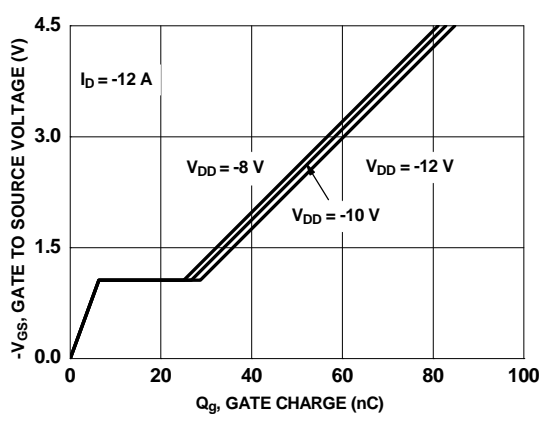


Figure 7. Gate Charge Characteristics

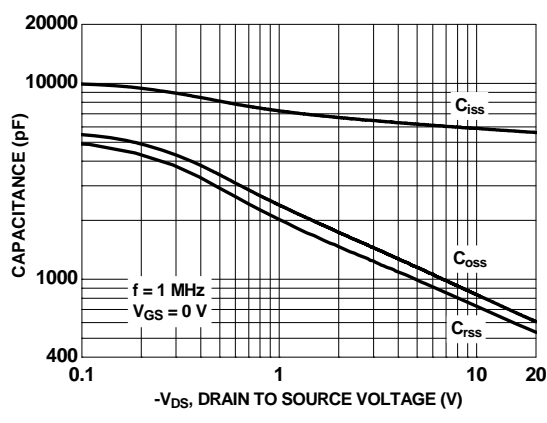


Figure 8. Capacitance vs. Drain to Source Voltage

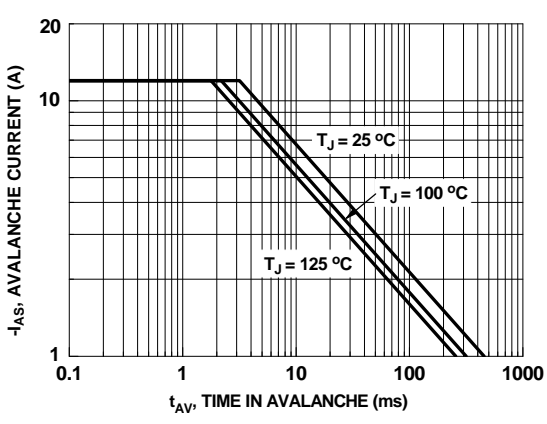


Figure 9. Unclamped Inductive Switching Capability

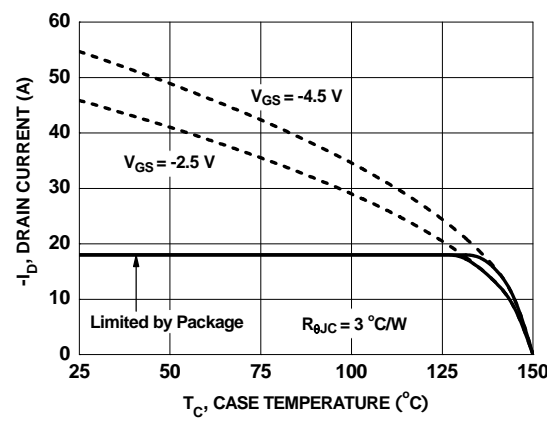


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

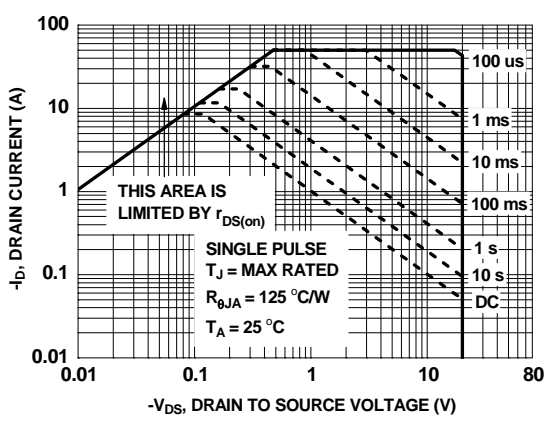


Figure 11. Forward Bias Safe Operating Area

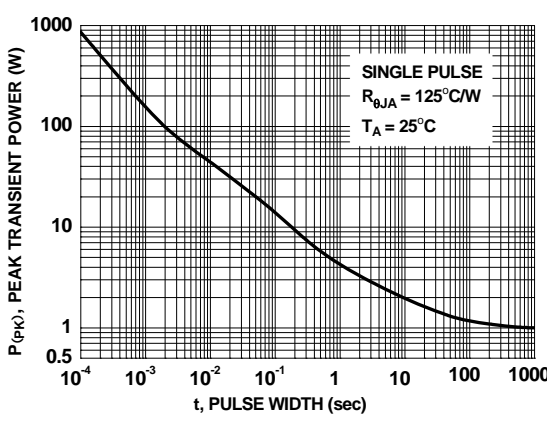


Figure 12. Single Pulse Maximum Power Dissipation

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

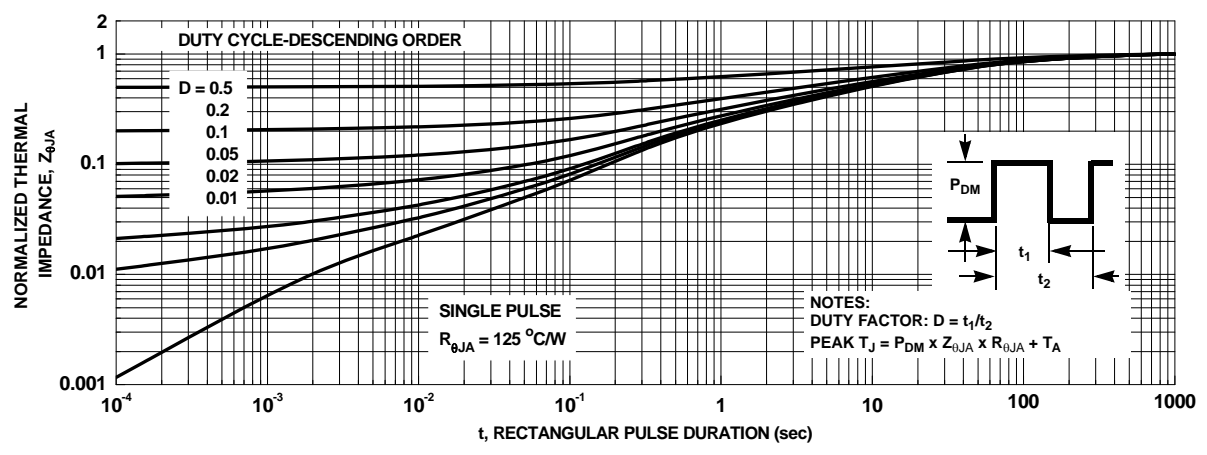


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

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