ON Semiconductor®

FDMC86520L

N-Channel Power Trench® MOSFET

60 V, 22 A, 7.9 mΩ

Features

- Max $r_{DS(on)}$ = 7.9 mΩ at V_{GS} = 10 V, I_D = 13.5 A
- Max $r_{DS(on)}$ = 11.7 mΩ at V_{GS} = 4.5 V, I_D = 11.5 A
- Low Profile - 1 mm max in Power 33
- 100% UIL Tested
- RoHS Compliant

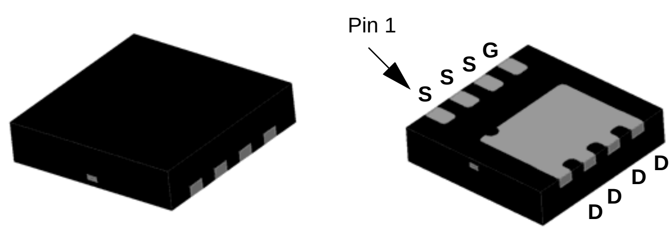
General Description

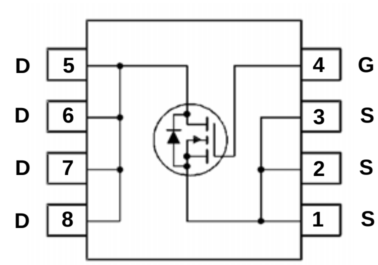
This N-Channel MOSFET has been designed specifically to improve the overall efficiency and to minimize switch node ringing of DC/DC converters using either synchronous or conventional switching PWM controllers.It has been optimized for low gate charge, low $r_{DS(on)}$, fast switching speed and body diode reverse recovery performance.

Applications

- Primary Switch in isolated DC-DC
- Synchronous Rectifier
- Load Switch

Top Bottom





MLP 3.3x3.3

MOSFET Maximum Ratings T_A = 25 °C unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DS}	Drain to Source Voltage	60	V
V_{GS}	Gate to Source Voltage	±20	V
I_D	Drain Current -Continuous T_C = 25 °C	22	A
	-Continuous T_A = 25 °C (Note 1a)	13.5	
	-Pulsed	60	
E_{AS}	Single Pulse Avalanche Energy (Note 3)	79	mJ
P_D	Power Dissipation T_C = 25 °C	40	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

Symbol	Parameter	Ratings	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	3.1	°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
FDMC86520L	FDMC86520L	Power 33	13 ”	12 mm	3000 units

Electrical Characteristics T_J = 25 °C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units

Off Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V	60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25 °C		29		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 48 V, V_{GS} = 0 V			1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20 V, V_{DS} = 0 V			±100	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, I_D = 250 μA	1	1.7	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250 μA, referenced to 25 °C		-7		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10 V, I_D = 13.5 A		6.5	7.9	mΩ
		V_{GS} = 4.5 V, I_D = 11.5 A		9.1	11.7	
		V_{GS} = 10 V, I_D = 13.5 A, T_J = 125 °C		9	11	
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 13.5 A		49		S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = 30 V, V_{GS} = 0 V, f = 1 MHz		3420	4550	pF
C_{oss}	Output Capacitance			638	850	pF
C_{rss}	Reverse Transfer Capacitance			25	40	pF
R_g	Gate Resistance			0.5		Ω

Switching Characteristics

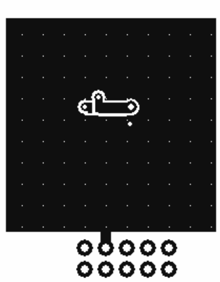
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 30 V, I_D = 13.5 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		15	30	ns
t_r	Rise Time			5.2	10	ns
$t_{d(off)}$	Turn-Off Delay Time			32	55	ns
t_f	Fall Time			3.4	10	ns
$Q_{g(TOT)}$	Total Gate Charge	V_{GS} = 0 V to 10 V; V_{DD} = 30 V, I_D = 13.5 A		45	64	nC
$Q_{g(TOT)}$	Total Gate Charge	V_{GS} = 0 V to 4.5 V; V_{DD} = 30 V, I_D = 13.5 A		21	30	nC
Q_{gs}	Total Gate Charge	V_{DD} = 30 V, I_D = 13.5 A		9.6		nC
Q_{gd}	Gate to Drain “Miller” Charge			4.9		nC

Drain-Source Diode Characteristics

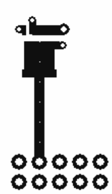
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_S = 13.5 A (Note 2)		0.82	1.3	V
		V_{GS} = 0 V, I_S = 2 A (Note 2)		0.71	1.2	
t_{rr}	Reverse Recovery Time	I_F = 13.5 A, di/dt = 100 A/μs		38	62	ns
Q_{rr}	Reverse Recovery Charge			21	34	nC

NOTES:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in^2 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.



53 °C/W when mounted on a 1 in^2 pad of 2 oz copper



125 °C/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 °C; N-ch: L = 0.3 mH, I_{AS} = 23 A, V_{DD} = 54 V, V_{GS} = 10 V.

Typical Characteristics T_J = 25 °C unless otherwise noted

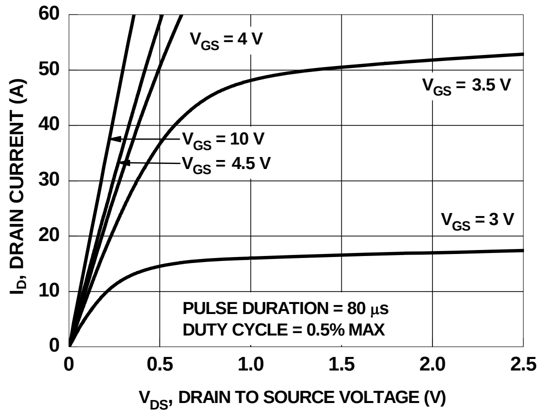


Figure 1. On Region Characteristics

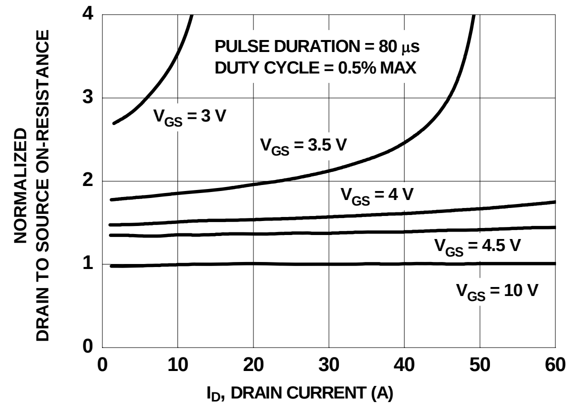


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

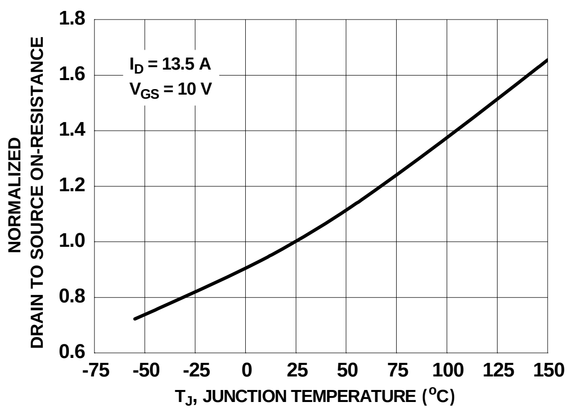


Figure 3. Normalized On Resistance vs. Junction Temperature

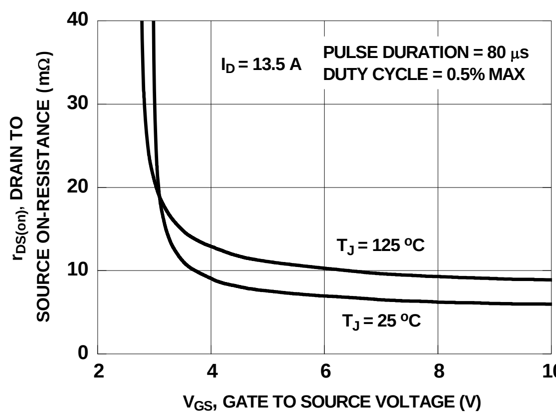


Figure 4. On-Resistance vs. Gate to Source Voltage

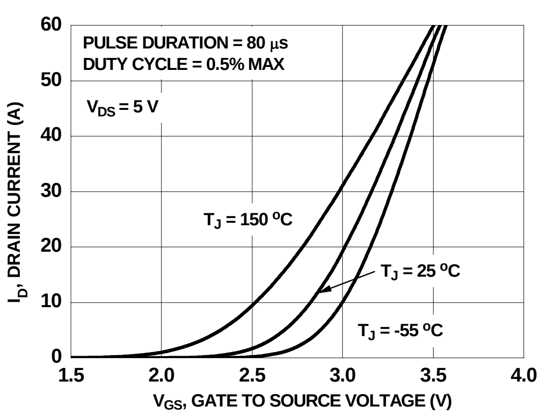


Figure 5. Transfer Characteristics

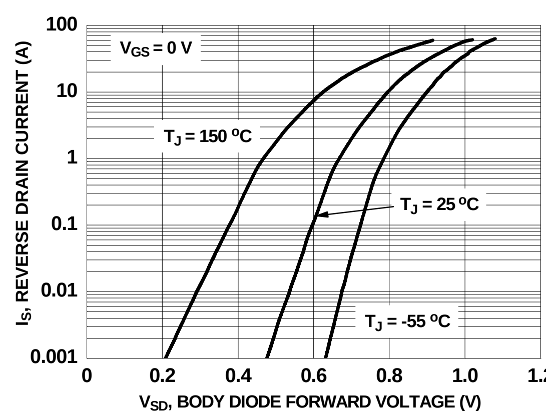


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

Typical Characteristics T_J = 25 °C unless otherwise noted

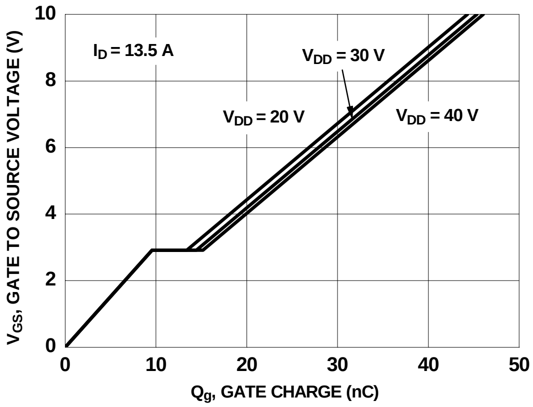


Figure 7. Gate Charge Characteristics

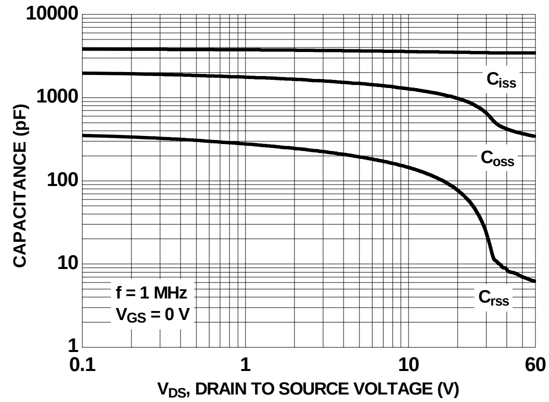


Figure 8. Capacitance vs. Drain to Source Voltage

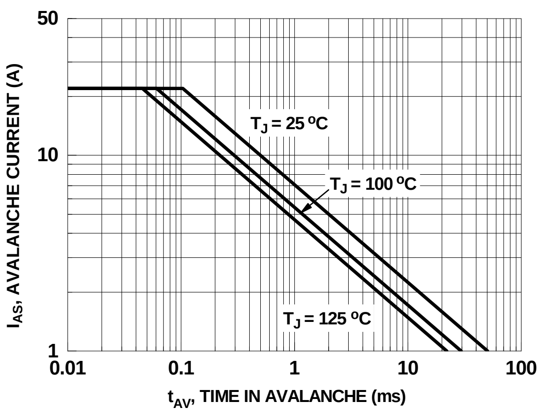


Figure 9. Unclamped Inductive Switching Capability

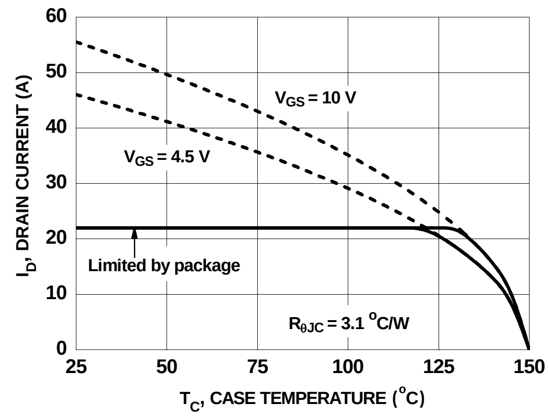


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

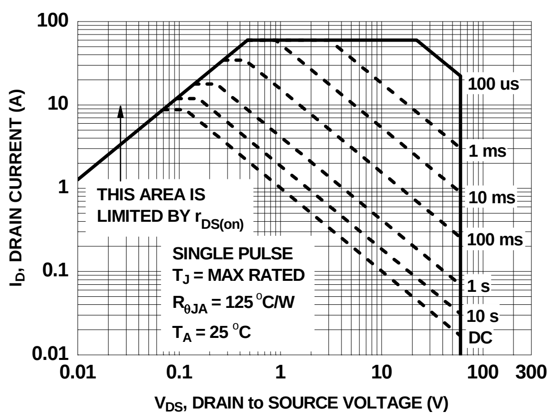


Figure 11. Forward Bias Safe Operating Area

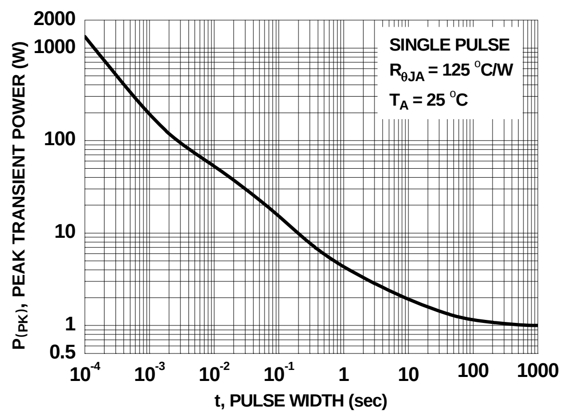


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25 °C unless otherwise noted

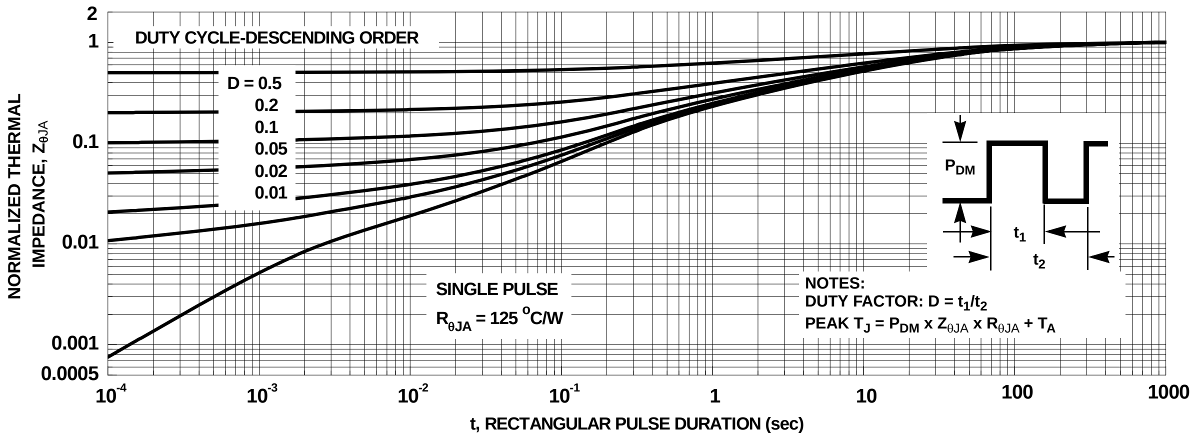
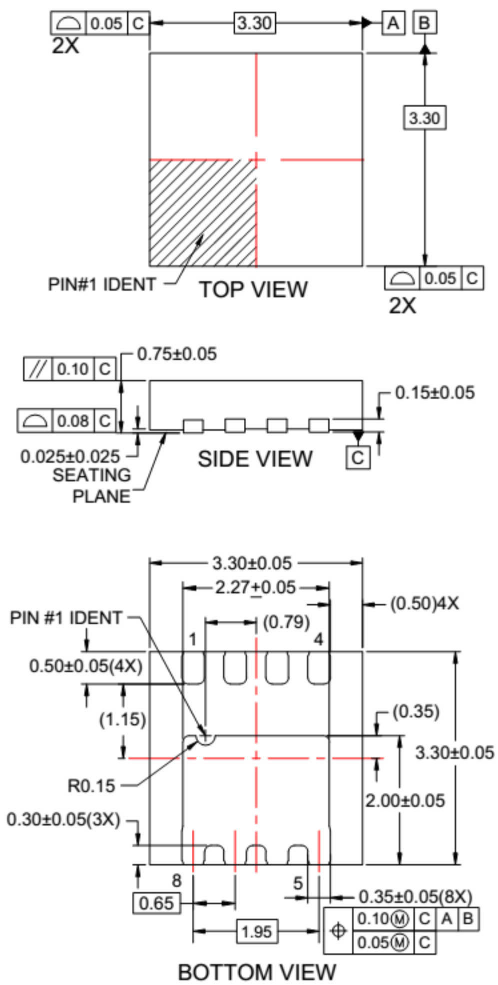
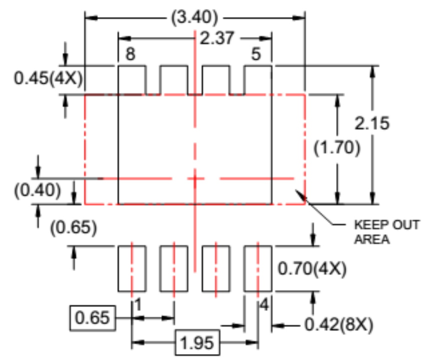


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

Dimensional Outline and Pad Layout





RECOMMENDED LAND PATTERN

NOTES:

A. DOES NOT CONFORM TO JEDEC REGISTRATION MO-229

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 2009.

D. LAND PATTERN RECOMMENDATION IS EXISTING INDUSTRY LAND PATTERN.

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