ON Semiconductor®

FDS4141-F085
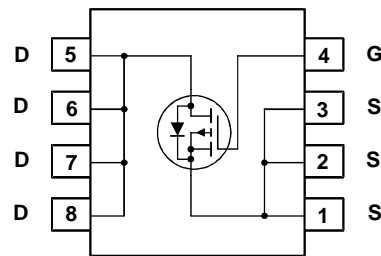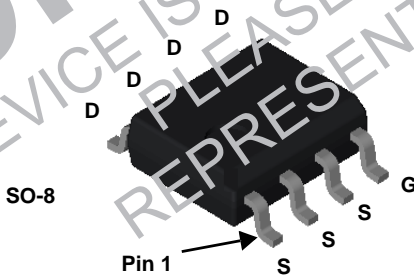
P-Channel PowerTrench® MOSFET
-40V, -10.8A, 19.0mΩ

Features

- Typ $r_{DS(on)}$ = 10.5mΩ at V_{GS} = -10V, I_D = -10.5A

- Typ $r_{DS(on)}$ = 14.8mΩ at V_{GS} = -4.5V, I_D = -8.4A

- Typ $Q_{g(TOT)}$ = 35nC at V_{GS} = -10V

- High performance trench technology for extremely low $r_{DS(on)}$

- RoHS Compliant

- Qualified to AEC Q101

Applications

- Control switch in synchronous & non-synchronous buck

- Load switch

- Inverter

SO-8

Pin 1

D
D
D
D

S
S
S

G

D	5			4	G
D	6			3	S
D	7			2	S
D	8			1	S

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

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain to Source Voltage	-40	V
V_{GS}	Gate to Source Voltage	±20	V
I_D	Drain Current Continuous ($V_{GS} = 10V$)	-10.8	A
	Pulsed	-36	
E_{AS}	Single Pulse Avalanche Energy	229	mJ
P_D	Power Dissipation	1.6	W
T_J, T_{STG}	Operating and Storage Temperature	-55 to +150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance Junction to Case		°C/W
$R_{\theta JA}$	Thermal Resistance Junction to Ambient SO-8, 1in^2 copper pad area	81	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	... idth	Quantity
FDS4141	FDS4141-F085	SO-8	1...	12mm	2500 units

Electrical Characteristics $T_A = 25$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units

Off Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
B_{VDSS}	Drain to Source Breakdown Voltage	$I_D = -250\mu A$, $V_{GS} = 0V$	40	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -32V$,	-	-	-1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = ±20V$,	-	-	±100	nA

On Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = -250\mu A$	-1.0	-1.7	-3.0	V
$R_{DS(on)}$	Drain to Source On Resistance	$I_D = -10.5A$, $V_{GS} = -10V$	-	10.5	13.0	mΩ
		$I_D = -8.4A$, $V_{GS} = -4.5V$	-	14.8	19.0	
		$I_D = -10.5A$, $V_{GS} = -10V$, $T_J = 125°C$	-	15.3	19.0	
g_{FS}	Forward Transconductance	$I_D = -10.5A$, $V_{DD} = -5V$		34		S

Dynamic Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
C_{iss}	Input Capacitance	$V_{DS} = -20V$, $V_{GS} = 0V$, f = 1MHz		-	2005	-	pF
C_{oss}	Output Capacitance			-	355	-	pF
C_{rss}	Reverse Transfer Capacitance			-	190	-	pF
R_g	Gate Resistance	f = 1MHz		-	5.0	-	Ω
$Q_{g(TOT)}$	Total Gate Charge at -10V	$V_{GS} = 0$ to $-10V$		-	35	45	nC
$Q_{g(-5)}$	Total Gate Charge at -5V	$V_{GS} = 0$ to $-5V$	$V_{DD} = -20V$ $I_D = -10.5A$	-	18.6	24.2	nC
Q_{gs}	Gate to Source Gate Charge			-	5.2	-	nC
Q_{gd}	Gate to Drain "Miller" Charge			-	6.6	-	nC

Electrical Characteristics T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units

Switching Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
t_{on}	Turn-On Time	V_{DD} = -20V, I_D = -10.5A V_{GS} = -10V, R_{GEN} = 6Ω	-	-	25	ns
$t_{d(on)}$	Turn-On Delay Time		-	9.7	-	ns
t_r	Rise Time		-	4.4	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	41	-	ns
t_f	Fall Time		-	11.6	-	ns
t_{off}	Turn-Off Time		-	-	84	ns

Drain-Source Diode Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V_{SD}	Source to Drain Diode Voltage	I_{SD} = -10.5A	-	-0.8	-1.	V
		I_{SD} = -2.1A		.7	.2	
t_{rr}	Reverse Recovery Time	I_F = -10.5A, d_{SD}/dt = 100A/μs	-	26	34	ns
Q_{rr}	Reverse Recovery Charge			3.4	17.	nC

Notes:

1: Starting T_J = 25°C, L = 6.2mH, I_{AS} = -8.6A

Typical Characteristics
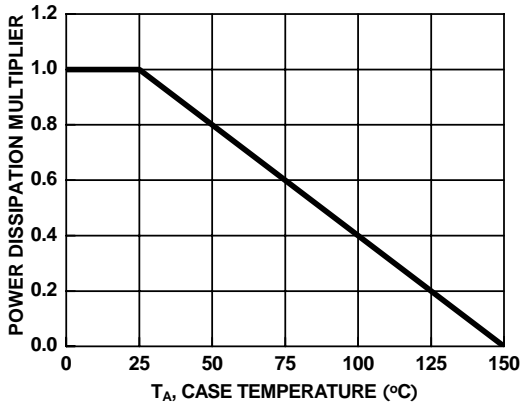
Figure 1. Normalized Power Dissipation vs Ambient Temperature
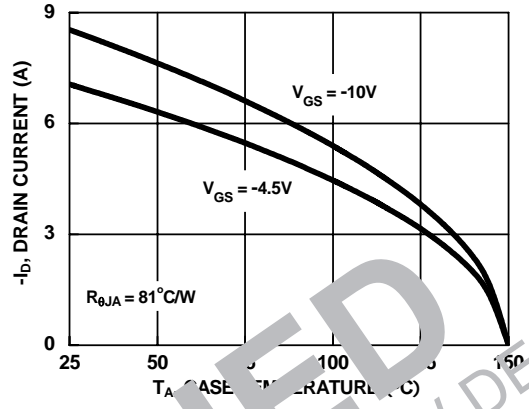
Figure 2. Maximum Continuous Drain Current vs Ambient Temperature

NOTES:
DUTY FACTOR: $D = t_1/t_2$
PEAK $T_J = P_{DM} \times Z_{\theta JA} \times R_{\theta JA} + T_A$
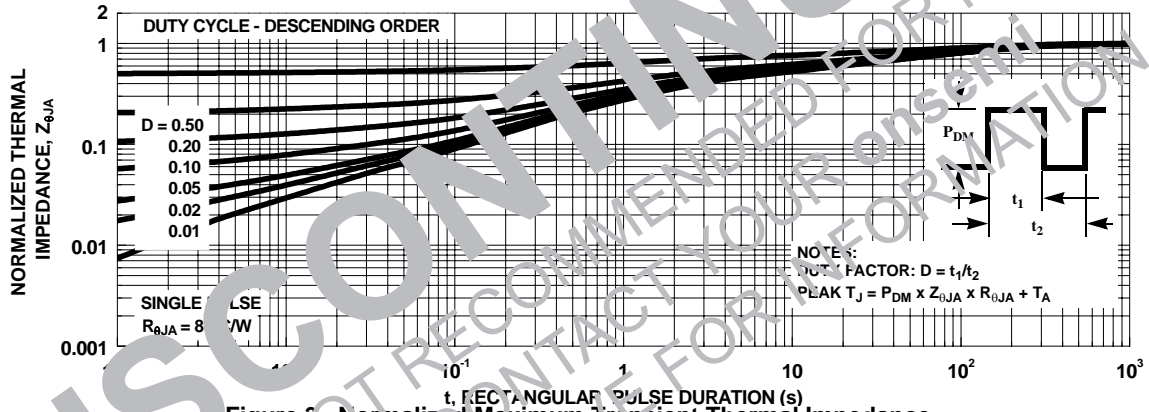
Figure 3. Normalized Maximum Transient Thermal Impedance

$T_A = 25^oC$
FOR TEMPERATURES ABOVE 25°C DERATE PEAK CURRENT AS FOLLOWS:

$$I = I_{25} \left[\sqrt{\frac{150 - T_A}{125}} \right]$$
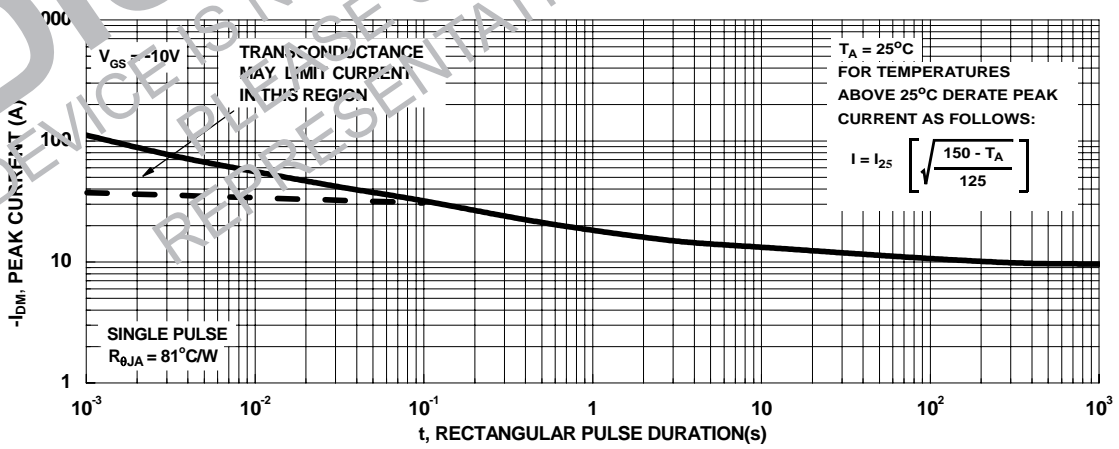
Figure 4. Peak Current Capability

Typical Characteristics
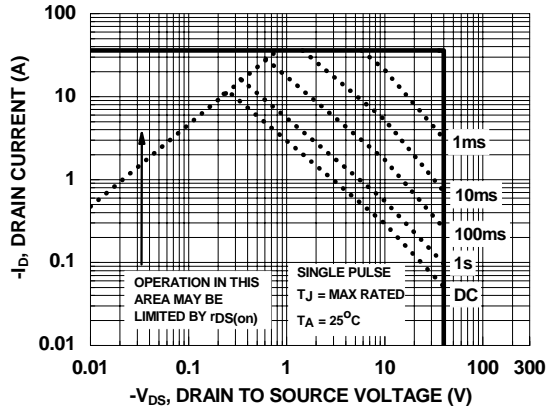
Figure 5. Forward Bias Safe Operating Area

$$t_{AV} = (L)(I_{AS})/(1.3*RATED\ BV_{DSS} - V_{DD})$$

If R = 0
$t_{AV} = (L)(I_{AS})/(1.3*RATED\ BV_{DSS} - V_{DD})$
If R ≠ 0
$t_{AV} = (L/R)In[(I_{AS}*R)/(1.3*RATED\ BV_{DSS} - V_{DD}) +1]$

STARTING $T_J = 25^oC$

STARTING $T_J = 150^oC$
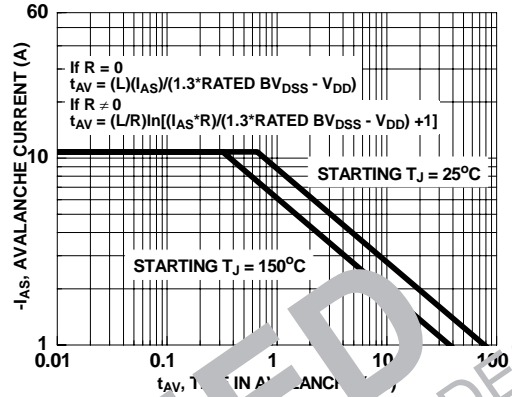
NOTE: Refer to ON Semiconductor application notes AN7514 and AN7515

Figure 6. Unclamped Inductive Switching

PULSE DURATION = 80µs
DUTY CYCLE = 0.5% MAX
$V_{DD} = -5V$

$T_J = 150^oC$

$T_J = -55^oC$

$T_J = 25^oC$
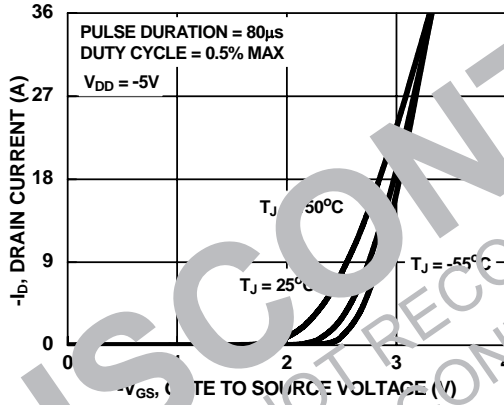
Figure 7. Transfer Characteristics

PULSE DURATION = 80µs
DUTY CYCLE = 0.5% MAX

$V_{GS} = -10V$
$V_{GS} = -4.5V$
$V_{GS} = -4V$
$V_{GS} = -3.5V$
$V_{GS} = -3V$
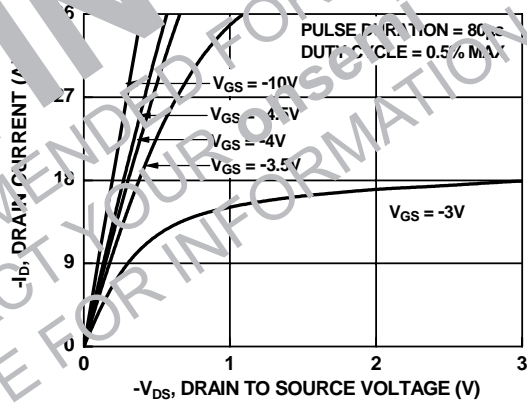
Figure 8. Saturation Characteristics

$I_D = -10.5A$ PULSE DURATION = 80µs
DUTY CYCLE = 0.5% MAX

$T_J = 150^oC$

$T_J = 25^oC$
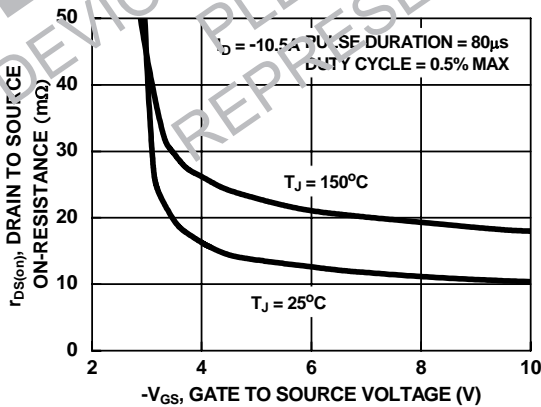
Figure 9. Drain to Source On-Resistance Variation vs Gate to Source Voltage

PULSE DURATION = 80µs
DUTY CYCLE = 0.5% MAX

$I_D = -10.5A$
$V_{GS} = -10V$
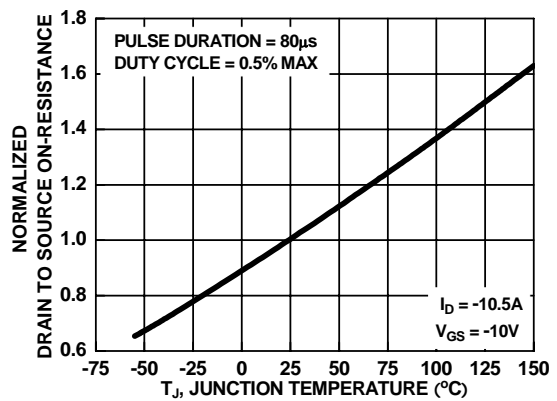
Figure 10. Normalized Drain to Source On Resistance vs Junction Temperature

Typical Characteristics
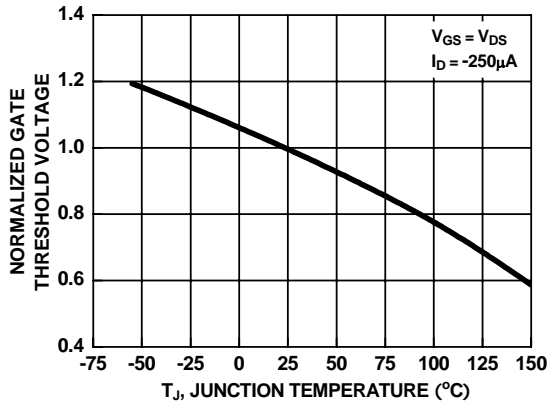
Figure 11. Normalized Gate Threshold Voltage vs Junction Temperature
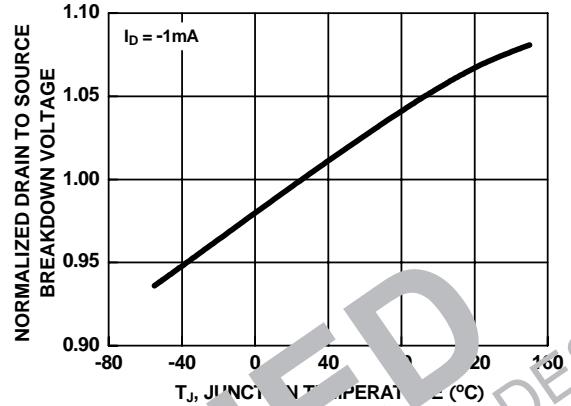
Figure 12. Normalized Drain to Source Breakdown Voltage vs Junction Temperature
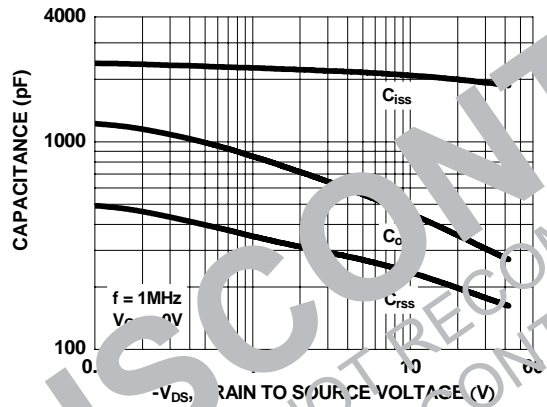
Figure 13. Capacitance vs Drain to Source Voltage
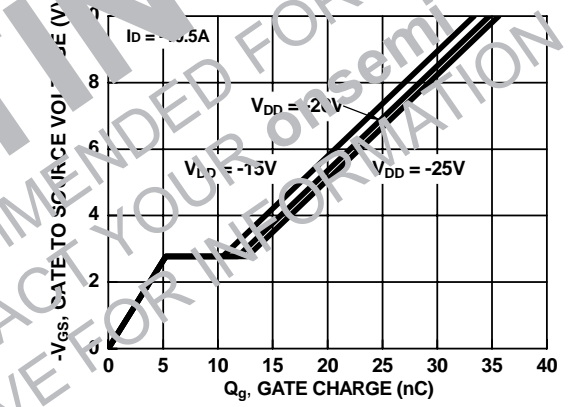
Figure 14. Gate Charge vs Gate to Source Voltage

PUBLICATION ORDERING INFORMATION

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