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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

100% RoHS COMPLIANT

SO-8

Pin 1

D — 5   4 — G
D — 6   3 — S
D — 7   2 — S
D — 8   1 — S
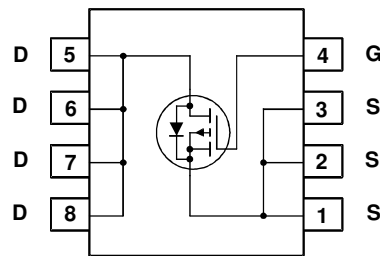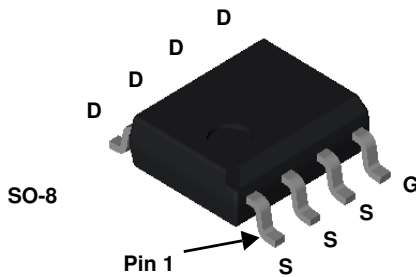
MOSFET Maximum Ratings T_A = 25°C unless otherwise noted

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	30	°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	Tape Width	Quantity
FDS4141	FDS4141-F085	SO-8	13"	12mm	2500 units

Electrical Characteristics T_A = 25°C 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 = -250µA, 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 = -250µA	-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	V_{DD} = -20V I_D = -10.5A		-	35	45	nC
$Q_{g(-5)}$	Total Gate Charge at -5V	V_{GS} = 0 to -5V			-	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						
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						
V_{SD}	Source to Drain Diode Voltage	I_{SD} = -10.5A	-	-0.8	-1.3	V
		I_{SD} = -2.1A	-	-0.7	-1.2	
t_{rr}	Reverse Recovery Time	I_F = -10.5A, d_{SD}/dt = 100A/μs	-	26	34	ns
Q_{rr}	Reverse Recovery Charge		-	13.4	17.4	nC

Notes:

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

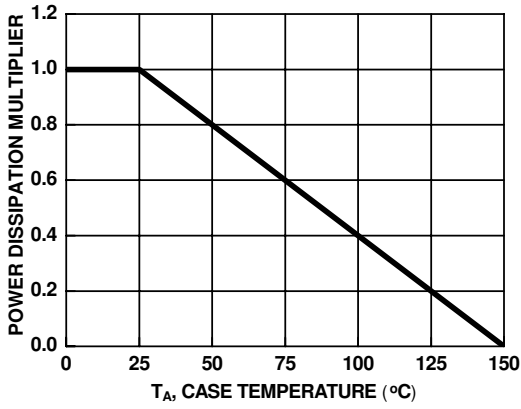**FDS4141-F085 P-Channel PowerTrench® MOSFET**

Typical Characteristics

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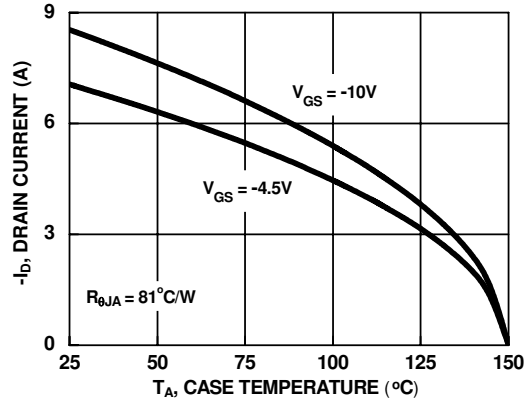
Figure 2. Maximum Continuous Drain Current vs Ambient Temperature
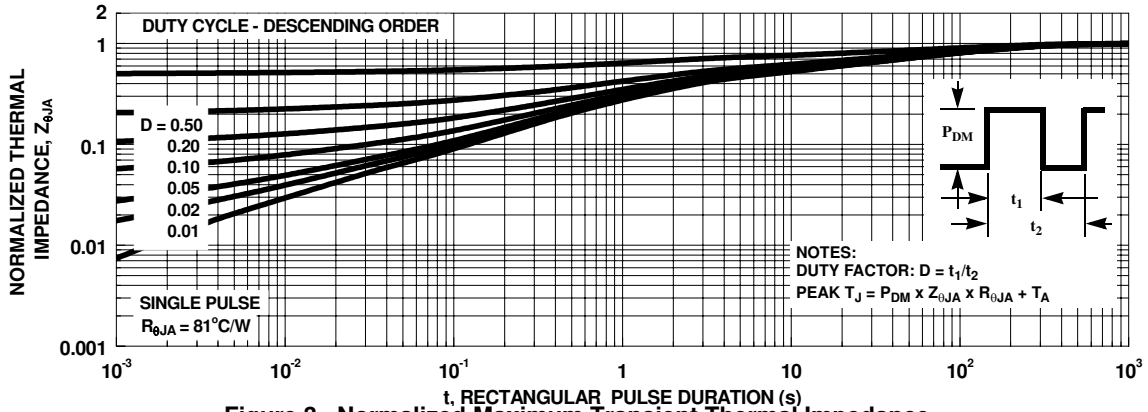

DUTY CYCLE - DESCENDING ORDER

D = 0.50
0.20
0.10
0.05
0.02
0.01

SINGLE PULSE
$R_{\theta JA} = 81°C/W$

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

$V_{GS} = -10V$

TRANSCONDUCTANCE MAY LIMIT CURRENT IN THIS REGION

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

$$I = I_{25} \left[\sqrt{\frac{150 - T_A}{125}} \right]$$

SINGLE PULSE
$R_{\theta JA} = 81°C/W$
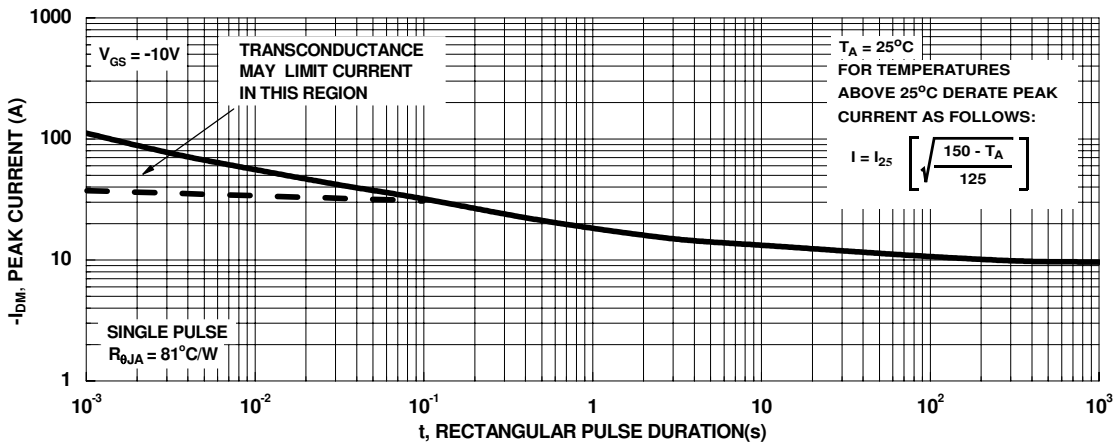
Figure 4. Peak Current Capability

Typical Characteristics
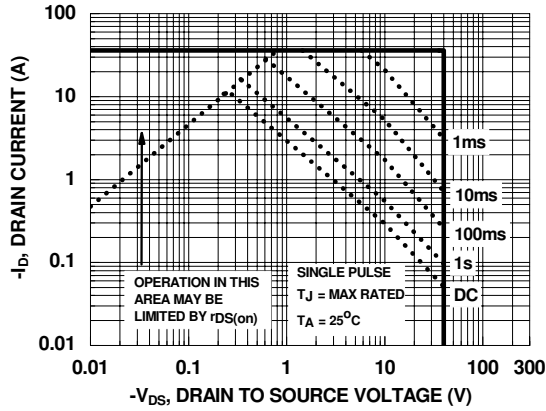
Figure 5. Forward Bias Safe Operating Area

-I$_D$, DRAIN CURRENT (A)

-V$_{DS}$, DRAIN TO SOURCE VOLTAGE (V)

1ms
10ms
100ms
1s
DC

SINGLE PULSE
T$_J$ = MAX RATED
T$_A$ = 25°C

OPERATION IN THIS AREA MAY BE LIMITED BY r$_{DS(on)}$

Figure 6. Unclamped Inductive Switching

-I$_{AS}$, AVALANCHE CURRENT (A)

t$_{AV}$, TIME IN AVALANCHE (ms)

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

STARTING T$_J$ = 25°C

STARTING T$_J$ = 150°C
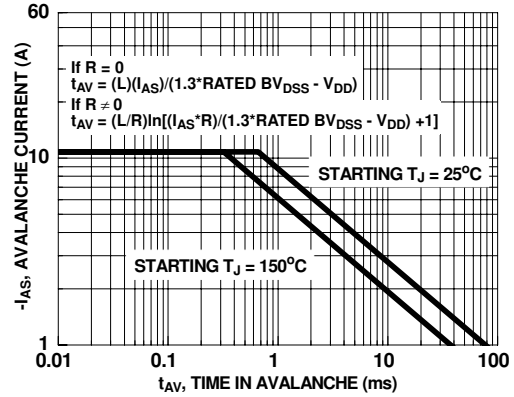
NOTE: Refer to ON Semiconductor Application Notes AN7514 and AN7515
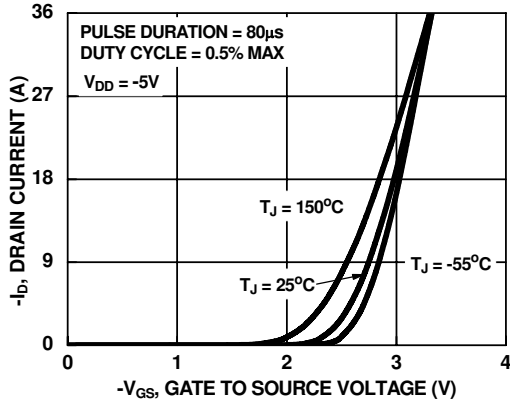
Figure 7. Transfer Characteristics

-I$_D$, DRAIN CURRENT (A)

-V$_{GS}$, GATE TO SOURCE VOLTAGE (V)

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

T$_J$ = 150°C
T$_J$ = 25°C
T$_J$ = -55°C
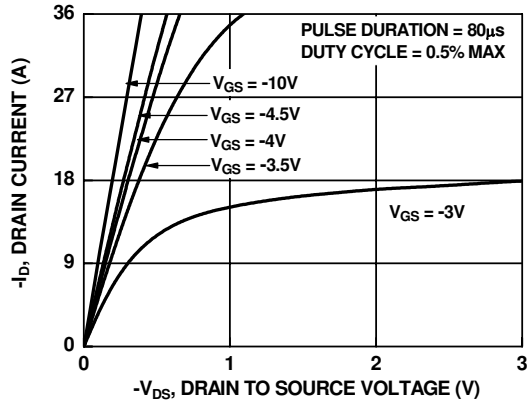
Figure 8. Saturation Characteristics

-I$_D$, DRAIN CURRENT (A)

-V$_{DS}$, DRAIN TO SOURCE VOLTAGE (V)

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
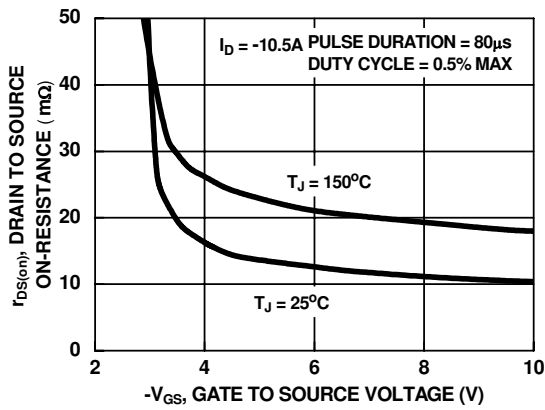
Figure 9. Drain to Source On-Resistance Variation vs Gate to Source Voltage

r$_{DS(on)}$, DRAIN TO SOURCE ON-RESISTANCE (mΩ)

-V$_{GS}$, GATE TO SOURCE VOLTAGE (V)

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

T$_J$ = 150°C
T$_J$ = 25°C
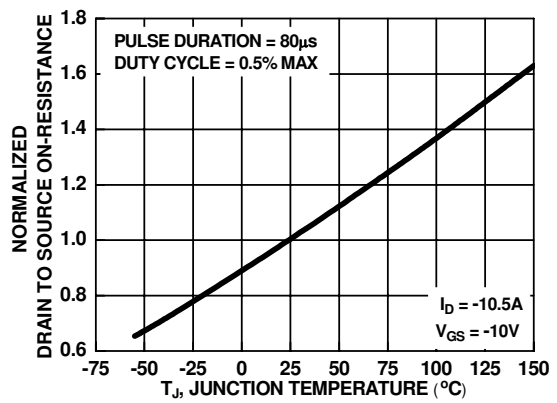
Figure 10. Normalized Drain to Source On Resistance vs Junction Temperature

NORMALIZED DRAIN TO SOURCE ON-RESISTANCE

T$_J$, JUNCTION TEMPERATURE (°C)

PULSE DURATION = 80μs
DUTY CYCLE = 0.5% MAX

I$_D$ = -10.5A
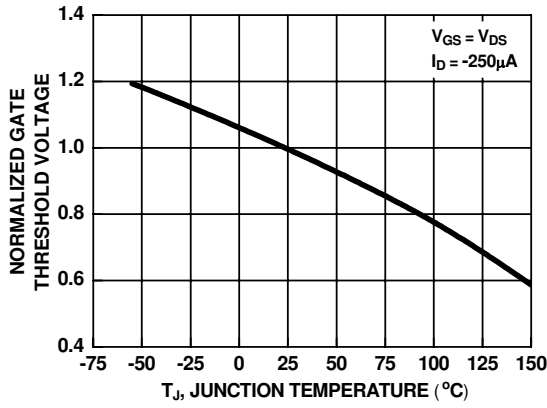V$_{GS}$ = -10V

Typical Characteristics

Figure 11. Normalized Gate Threshold Voltage vs Junction Temperature
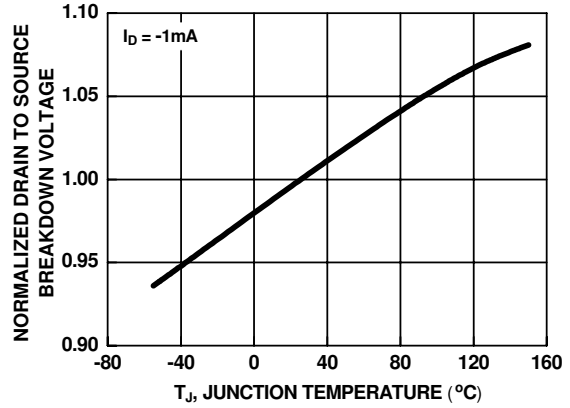

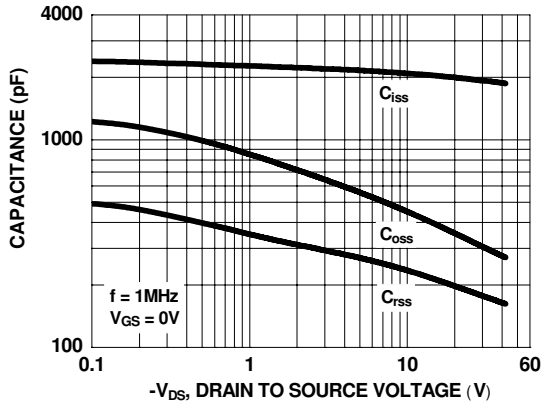**Figure 12. Normalized Drain to Source Breakdown Voltage vs Junction Temperature**

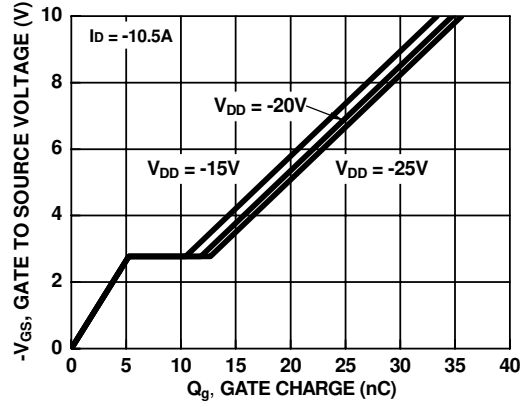
Figure 13. Capacitance vs Drain to Source Voltage

Figure 14. Gate Charge vs Gate to Source Voltage

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