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ON Semiconductor®

# FDD4141-F085

## P-Channel PowerTrench® MOSFET -40V, -50A, 12.3mΩ

### Features

- Max  $r_{DS(on)}$  = 12.3mΩ at  $V_{GS} = -10V$ ,  $I_D = -12.7A$
- Max  $r_{DS(on)}$  = 18.0mΩ at  $V_{GS} = -4.5V$ ,  $I_D = -10.4A$
- High performance trench technology for extremely low  $r_{DS(on)}$
- Qualified to AEC Q101
- RoHS Compliant

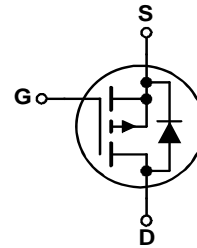
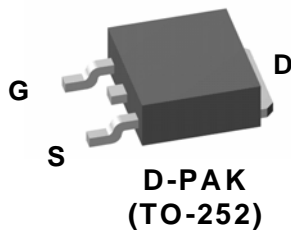


### General Description

This P-Channel MOSFET has been produced using ON Semiconductor's proprietary PowerTrench® technology to deliver low  $r_{DS(on)}$  and optimized Bvdss capability to offer superior performance benefit in the applications. and optimized switching performance capability reducing power dissipation losses in converter/inverter applications.

### Applications

- Inverter
- Power Supplies



### MOSFET Maximum Ratings $T_C = 25^\circ C$ unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	-40	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current -Continuous (Package limited) $T_C = 25^\circ C$	-50	A
	-Continuous (Silicon limited) $T_C = 25^\circ C$	-58	
	-Continuous $T_A = 25^\circ C$ (Note 1a)	-10.8	
	-Pulsed	-100	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	337	mJ
$P_D$	Power Dissipation $T_C = 25^\circ C$	69	W
	Power Dissipation $T_A = 25^\circ C$ (Note 1a)	2.4	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +175	$^\circ C$

### Thermal Characteristics

$R_{\theta JC}$	Maximum Thermal Resistance, Junction to Case	1.8	$^\circ C/W$
$R_{\theta JA}$	Maximum Thermal Resistance, Junction to Ambient (Note 1a)	52	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD4141	FDD4141-F085	D-PAK (TO-252)	13"	16mm	2500 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	$I_D = -250\mu\text{A}, V_{GS} = 0\text{V}$	-40	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$	-	-29	-	mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -32\text{V}, V_{GS} = 0\text{V}$	-	-	-1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$	-	-	$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = -250\mu\text{A}$	-1	-1.8	-3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$	-	5.8	-	mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -10\text{V}, I_D = -12.7\text{A}$	-	10.1	12.3	m $\Omega$
		$V_{GS} = -4.5\text{V}, I_D = -10.4\text{A}$	-	14.5	18.0	
		$V_{GS} = -10\text{V}, I_D = -12.7\text{A}, T_J = 175^\circ\text{C}$	-	17.3	19.4	
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{V}, I_D = -12.7\text{A}$	-	38	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -20\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$	-	2085	2775	pF
$C_{oss}$	Output Capacitance		-	360	480	pF
$C_{rss}$	Reverse Transfer Capacitance		-	210	310	pF
$R_g$	Gate Resistance	$f = 1\text{MHz}$	-	4.6	-	$\Omega$

### Switching Characteristics

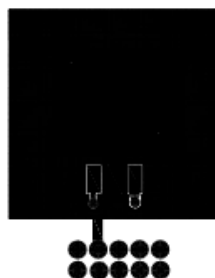
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -20\text{V}, I_D = -12.7\text{A}, V_{GS} = -10\text{V}, R_{GEN} = 6\Omega$	-	10	19	ns
$t_r$	Rise Time		-	7	13	ns
$t_{d(off)}$	Turn-Off Delay Time		-	38	60	ns
$t_f$	Fall Time		-	15	27	ns
$Q_g$	Total Gate Charge		$V_{GS} = 0\text{V to } -10\text{V}$	-	36	50
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{V to } -5\text{V}$	-	19	27	nC
$Q_{gs}$	Gate to Source Charge	$V_{DD} = -20\text{V}, I_D = -12.7\text{A}$	-	7	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		-	8	-	nC

### Drain-Source Diode Characteristics

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = -12.7\text{A}$ (Note 2)	-	-0.8	-1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = -12.7\text{A}, di/dt = 100\text{A}/\mu\text{s}$	-	29	44	ns
$Q_{rr}$	Reverse Recovery Charge		-	26	40	nC

Notes:

- 1:  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta JA}$  is determined by the user's board design.



a)  $52^\circ\text{C}/\text{W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper

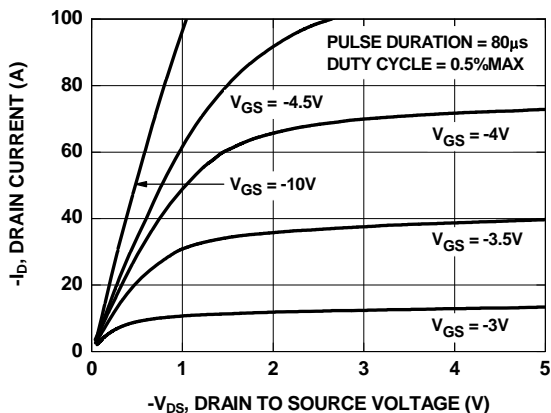


b)  $100^\circ\text{C}/\text{W}$  when mounted on a minimum pad.

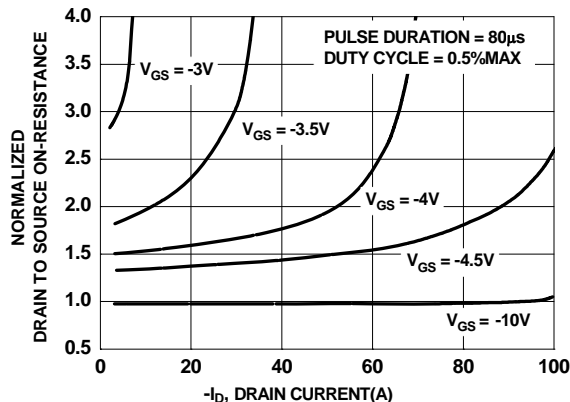
2: Pulse Test: Pulse Width  $< 300\mu\text{s}$ , Duty cycle  $< 2.0\%$ .

3: Starting  $T_J = 25^\circ\text{C}$ ,  $L = 3\text{mH}$ ,  $I_{AS} = 15\text{A}$ ,  $V_{DD} = 40\text{V}$ ,  $V_{GS} = 10\text{V}$ .

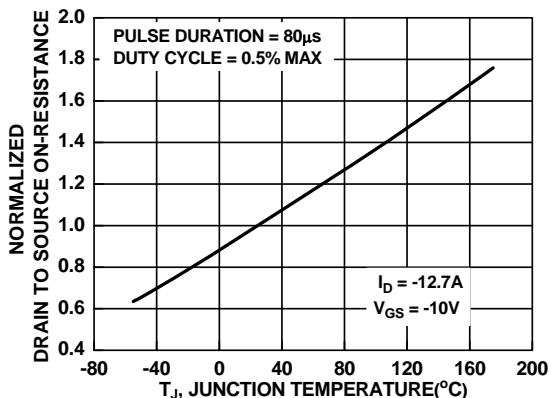
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



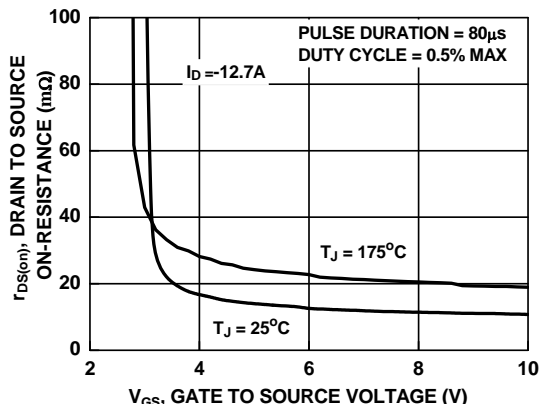
**Figure 1. On-Region Characteristics**



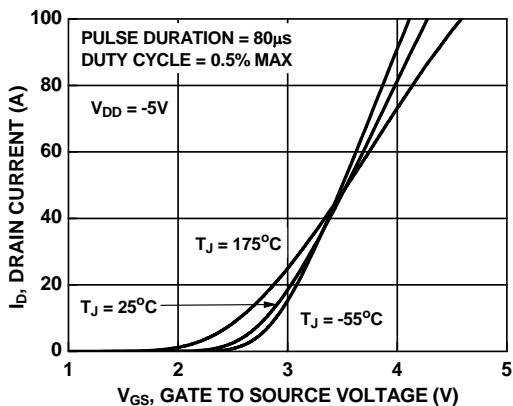
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



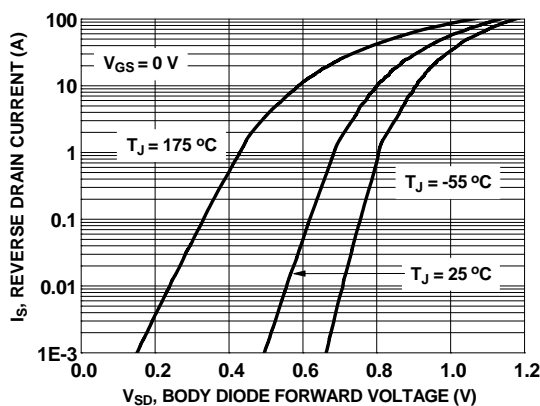
**Figure 3. Normalized On-Resistance vs Junction Temperature**



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

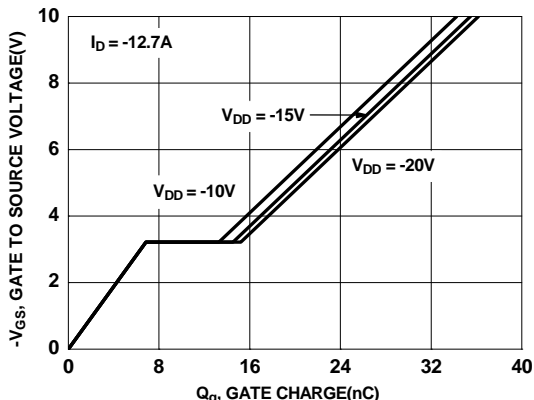


**Figure 5. Transfer Characteristics**

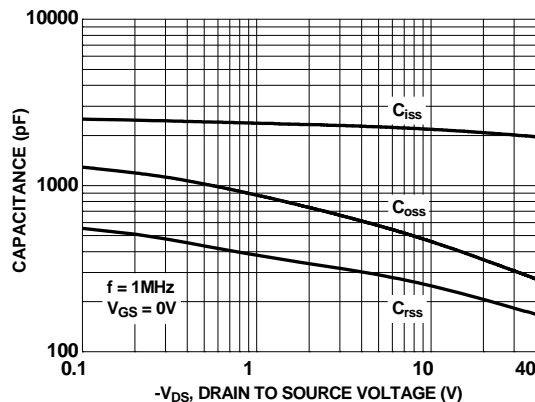


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

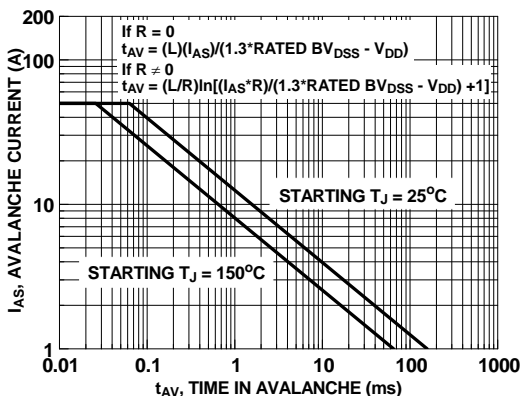
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



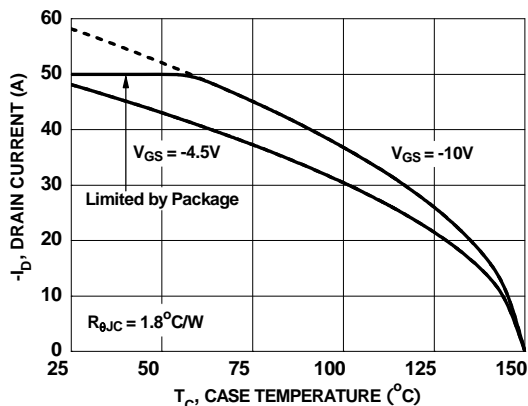
**Figure 7. Gate Charge Characteristics**



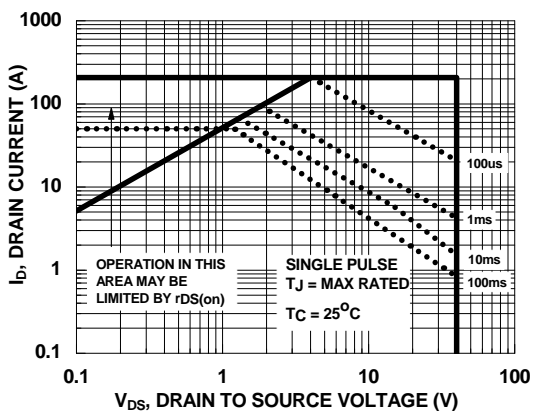
**Figure 8. Capacitance vs Drain to Source Voltage**



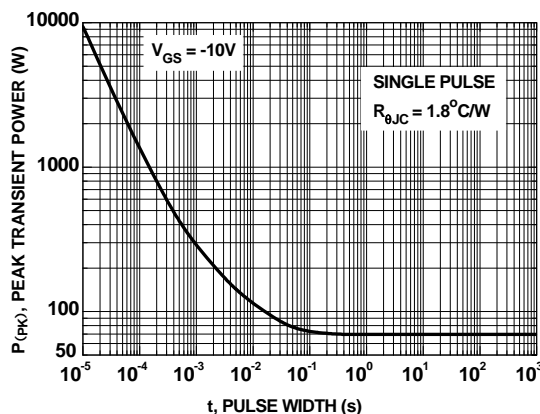
**Figure 9. Unclamped Inductive Switching Capability**



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

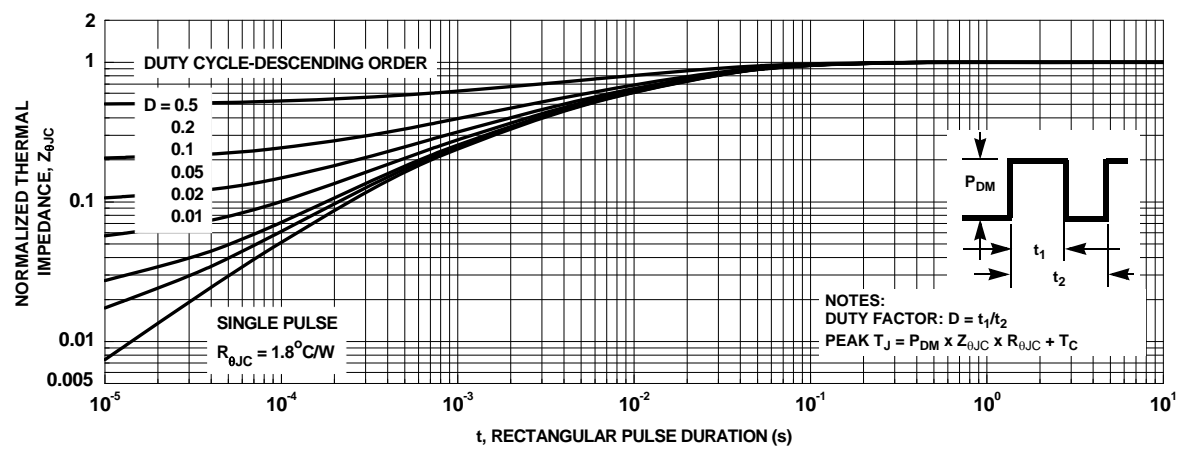


**Figure 11. Forward Bias Safe Operating Area**



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

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



**Figure 13. Transient Thermal Response Curve**

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