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ON Semiconductor®

## FDD4685-F085

### P-Channel PowerTrench® MOSFET

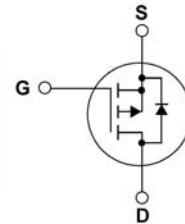
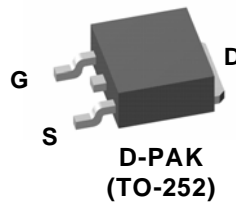
-40 V, -32 A, 35 mΩ

#### Features

- Typical  $R_{DS(on)}$  = 23 mΩ at  $V_{GS} = -10V$ ,  $I_D = -8.4 A$
- Typical  $R_{DS(on)}$  = 30 mΩ at  $V_{GS} = -4.5V$ ,  $I_D = -7 A$
- Typical  $Q_g(tot)$  = 19 nC at  $V_{GS} = -5V$ ,  $I_D = -8.4 A$
- UIS Capability
- RoHS Compliant
- Qualified to AEC Q101

#### Applications

- Inverter
- Power Supplies



#### MOSFET Maximum Ratings $T_J = 25^\circ C$ 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 ( $T_C < 90^\circ C$ , $V_{GS}=10$ ) (Note 1)	-32	A
	Pulsed Drain Current	See Figure 4	
$E_{AS}$	Single Pulse Avalanche Energy (Note 2)	121	mJ
$P_D$	Power Dissipation	83	W
	Derate Above $25^\circ C$	0.56	W/ $^\circ C$
$T_J, T_{STG}$	Operating and Storage Temperature	-55 to + 175	$^\circ C$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	1.8	$^\circ C/W$
$R_{\theta JA}$	Maximum Thermal Resistance, Junction to Ambient (Note 3)	40	$^\circ C/W$

#### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDD4685	FDD4685-F085	D-PAK(TO-252)	13"	12mm	2500units

#### Notes:

1. Current is limited by bondwire configuration.
2. Starting  $T_J = 25^\circ C$ ,  $L = 3mH$ ,  $I_{AS} = 9A$ ,  $V_{DD} = 40V$  during inductor charging and  $V_{DD} = 0V$  during time in avalanche.
3.  $R_{\theta JA}$  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 board design. The maximum rating presented here is based on mounting on a 1 in<sup>2</sup> pad of 2oz copper.
4. A suffix as "...F085P" has been temporarily introduced in order to manage a double source strategy as ON Semiconductor has officially announced in Aug 2014.

## 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

$B_{VDSS}$	Drain-to-Source Breakdown Voltage	$I_D = -250\mu\text{A}, V_{GS} = 0\text{V}$	-40	-	-	V
$\frac{\Delta B_{VDSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$	-	-33	-	mV/ $^\circ\text{C}$
$I_{DSS}$	Drain-to-Source Leakage Current	$V_{DS} = -32\text{V}$	-	-	-1	$\mu\text{A}$
$I_{GSS}$	Gate-to-Source Leakage Current	$V_{GS} = \pm 20\text{V}$	-	-	$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = -250\mu\text{A}$	-1	-1.6	-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 $25^\circ\text{C}$	-	4.9	-	mV/ $^\circ\text{C}$
$R_{DS(on)}$	Drain to Source On Resistance	$I_D = -8.4\text{A}, V_{GS} = -10\text{V}$	-	23	27	m $\Omega$
		$I_D = -7\text{A}, V_{GS} = -4.5\text{V}$	-	30	35	
		$I_D = -8.4\text{A}, V_{GS} = -10\text{V}, T_J = 150^\circ\text{C}$	-	38	45	
$g_{FS}$	Forward Transconductance	$I_D = -8.4\text{A}, V_{DS} = -5\text{V}$	-	23	-	s

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -20\text{V}, V_{GS} = 0\text{V},$ $f = 1\text{MHz}$	-	1790	2380	pF
$C_{oss}$	Output Capacitance		-	260	345	pF
$C_{rss}$	Reverse Transfer Capacitance		-	140	205	pF
$R_g$	Gate Resistance	$f = 1\text{MHz}$	-	4	-	$\Omega$
$Q_{g(ToT)}$	Total Gate Charge	$V_{DD} = -20\text{V}, V_{GS} = -5\text{V},$ $I_D = -8.4\text{A}$	-	19	27	nC
$Q_{gs}$	Gate-to-Source Gate Charge		-	5.6	-	nC
$Q_{gd}$	Gate-to-Drain "Miller" Charge		-	6.1	-	nC

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay	$V_{DD} = -20\text{V}, I_D = -8.4\text{A},$ $V_{GS} = -10\text{V}, R_{GEN} = 6\Omega$	-	8	16	ns
$t_r$	Rise Time		-	15	27	ns
$t_{d(off)}$	Turn-Off Delay		-	34	55	ns
$t_f$	Fall Time		-	14	26	ns

### Drain-Source Diode Characteristics

$V_{SD}$	Source-to-Drain Diode Voltage	$I_{SD} = -8.4\text{A}, V_{GS} = 0\text{V}$	-	-0.85	-1.2	V
$t_{rr}$	Reverse-Recovery Time	$I_{SD} = -8.4\text{A}, dI_{SD}/dt = 100\text{A}/\mu\text{s}$	-	30	45	ns
$Q_{rr}$	Reverse-Recovery Charge		-	31	47	nC

## Typical Characteristics

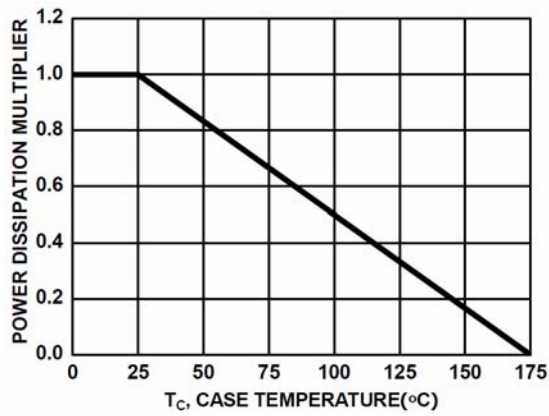


Figure 1. Normalized Power Dissipation vs. Case Temperature

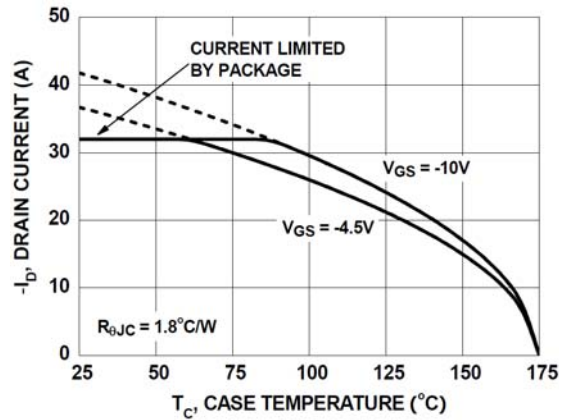


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

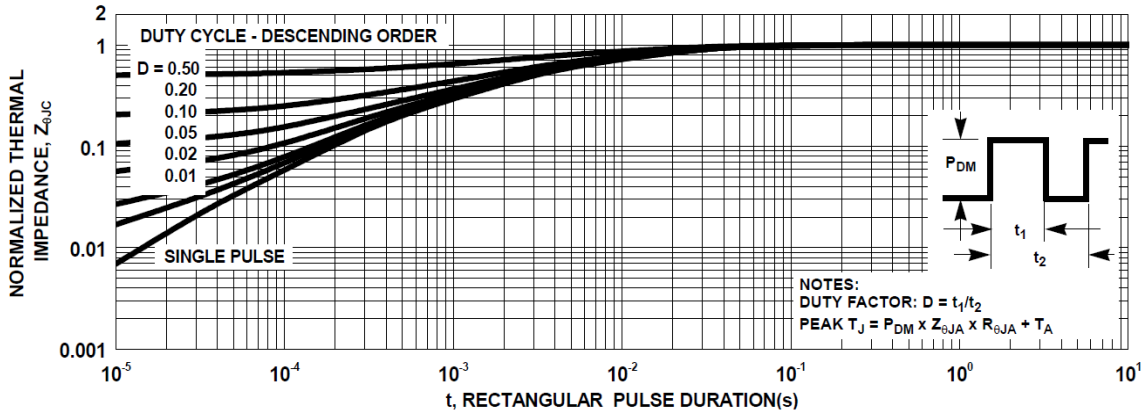


Figure 3. Normalized Maximum Transient Thermal Impedance

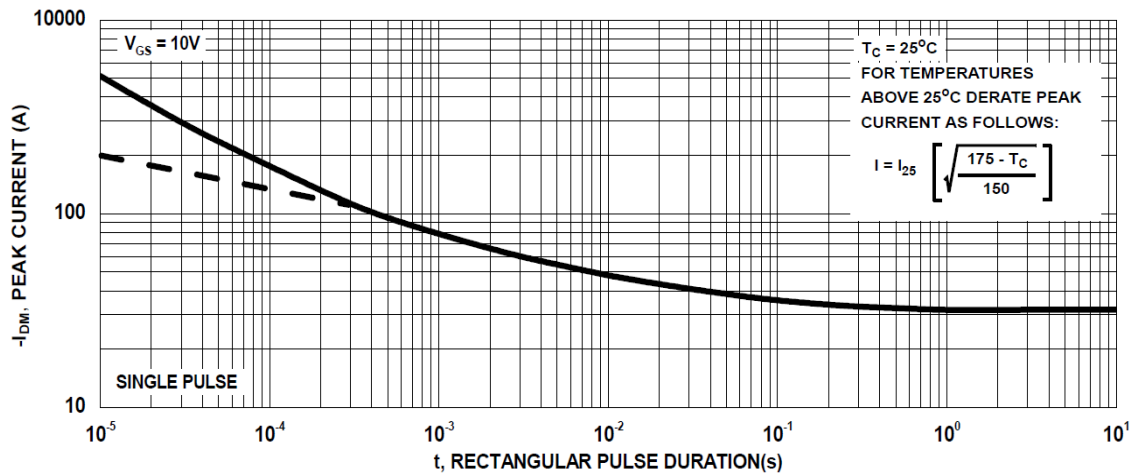


Figure 4. Peak Current Capability

### Typical Characteristics

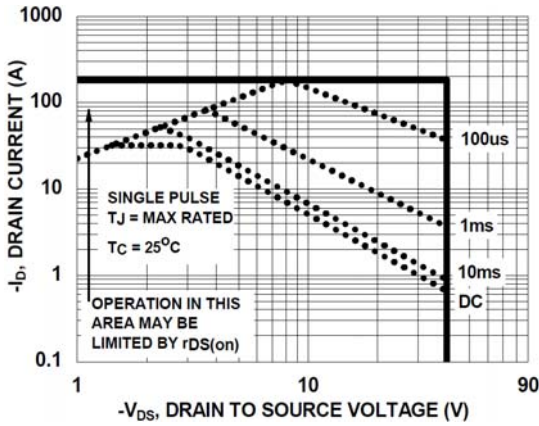
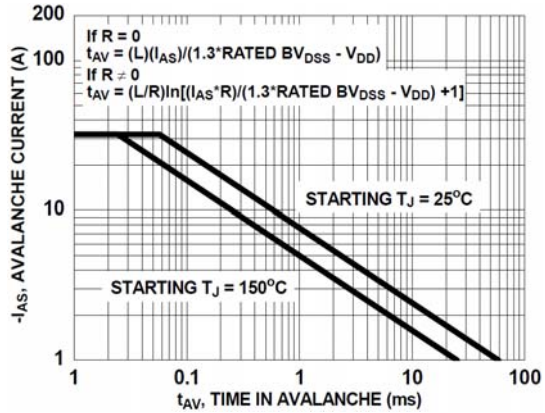


Figure 5. Forward Bias Safe Operating Area



NOTE: Refer to ON Semiconductor Application Notes AN7514 and AN7515

Figure 6. Unclamped Inductive Switching Capability

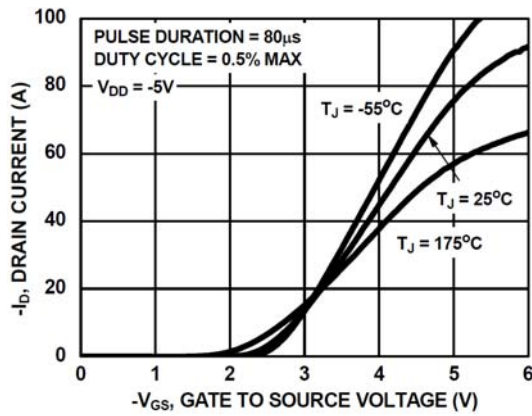


Figure 7. Transfer Characteristics

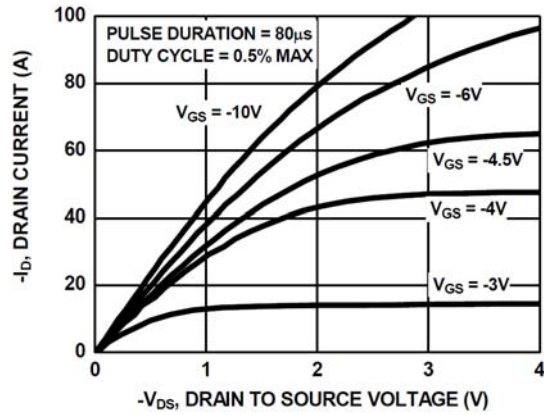


Figure 8. Saturation Characteristics

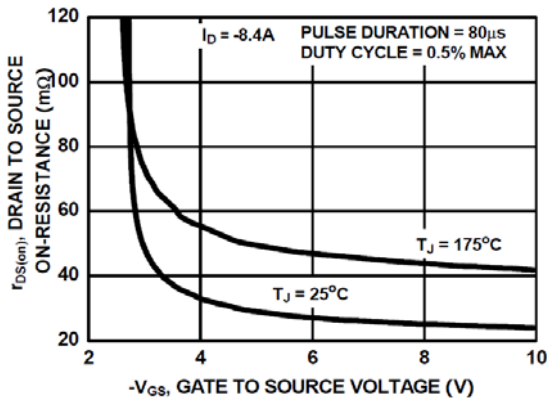


Figure 9. Drain to Source On-Resistance Variation vs. Gate to Source Voltage

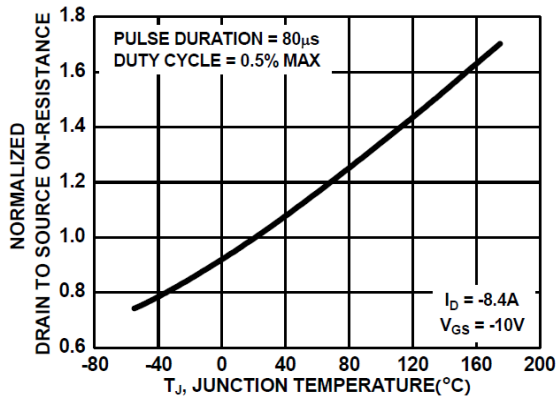
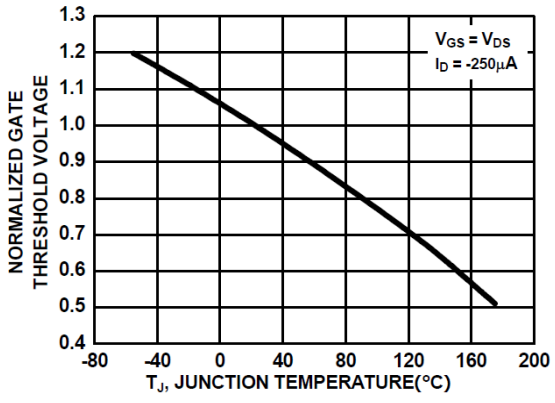
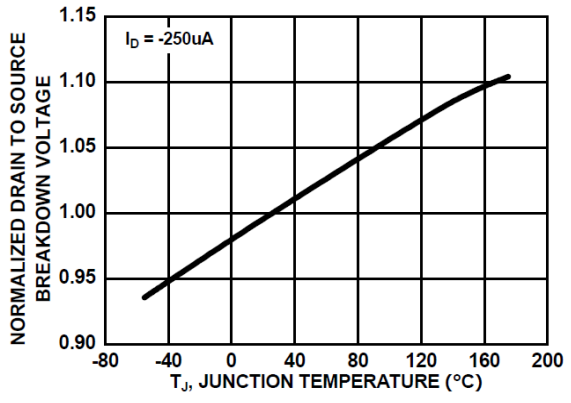


Figure 10. Normalized Drain to Source On-Resistance vs. Junction Temperature

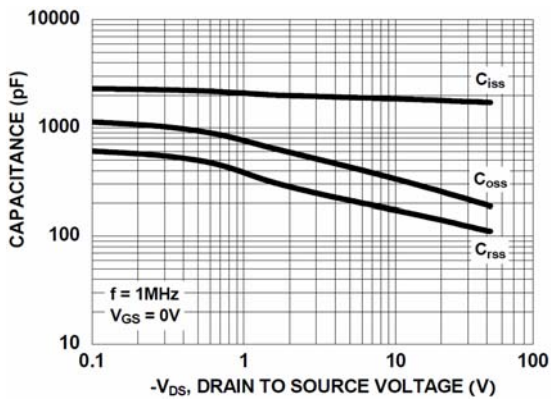
**Typical Characteristics**



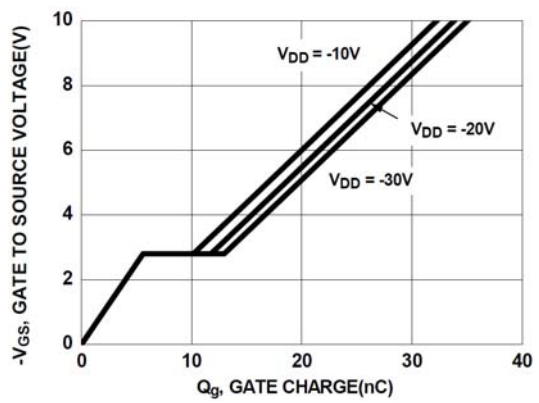
**Figure 11. Normalized Gate Threshold Voltage vs. Junction Temperature**



**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**

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