

## P-Channel 40 V (D-S) MOSFET

### PRODUCT SUMMARY

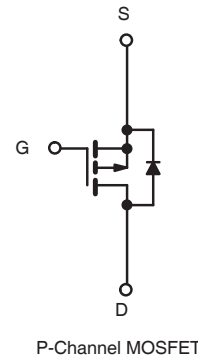
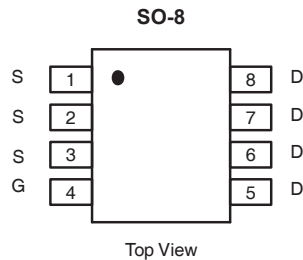
$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>d</sup>	$Q_g$ (Typ.)
- 40	0.035 at $V_{GS} = - 10$ V	- 8.2	23 nC
	0.048 at $V_{GS} = - 4.5$ V	- 7.2	

### FEATURES

- DT-Trench Power MOSFET
- 100 %  $R_g$  and UIS Tested

### APPLICATIONS

- Power management
- Load switch
- Battery protection


**RoHS**  
 COMPLIANT


### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage		$V_{DS}$	-40	V
Gate-source voltage		$V_{GS}$	$\pm 20$	
Continuous drain current ( $T_J = 150$ °C)	$T_C = 25$ °C	$I_D$	-8.2	A
	$T_C = 70$ °C		-6.8	
	$T_A = 25$ °C		-6.7 <sup>a, b</sup>	
	$T_A = 70$ °C		-5.6 <sup>a, b</sup>	
Pulsed drain current		$I_{DM}$	-30	
Continuous source-drain diode current	$T_C = 25$ °C	$I_S$	-8.2	
	$T_A = 25$ °C		-4.1 <sup>a, b</sup>	
Avalanche current		$I_{AS}$	-8	mJ
Single-pulse avalanche energy		$E_{AS}$	7.5	
Maximum power dissipation	$T_C = 25$ °C	$P_D$	5.3	W
	$T_C = 70$ °C		3.7	
	$T_A = 25$ °C		2.6 <sup>a, b</sup>	
	$T_A = 70$ °C		1.8 <sup>a, b</sup>	
Operating junction and storage temperature range		$T_J, T_{stg}$	-55 to +150	°C

### THERMAL RESISTANCE RATINGS

PARAMETER		SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum junction-to-ambient <sup>a, c</sup>	$t \leq 10$ s	$R_{thJA}$	35	50	°C/W
Maximum junction-to-foot	Steady state	$R_{thJF}$	20	30	

#### Notes

- Surface mounted on 1" x 1" FR4 board
- $t = 10$  s
- Maximum under steady state conditions is 85 °C/W
- Based on  $T_C = 25$  °C

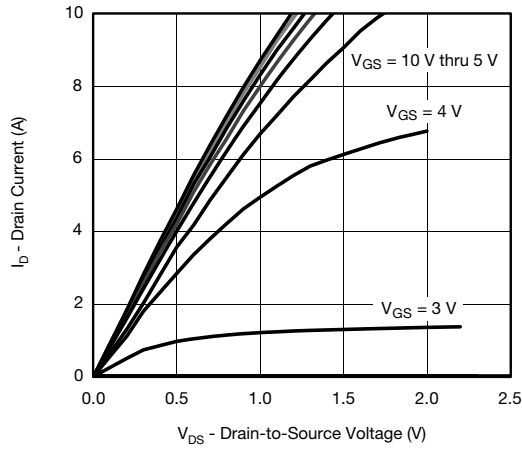
<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-source breakdown voltage	$V_{DS}$	$V_{GS} = 0\text{ V}$ , $I_D = -250\text{ }\mu\text{A}$	-40	-	-	V
$V_{DS}$ temperature coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$	-	-42	-	mV/ $^{\circ}\text{C}$
$V_{GS(th)}$ temperature coefficient	$\Delta V_{GS(th)}/T_J$		-	4.6	-	
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = -250\text{ }\mu\text{A}$	-1	-	-3	V
Gate-source leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$	-	-	$\pm 100$	nA
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = -32\text{ V}$ , $V_{GS} = 0\text{ V}$	-	-	-1	$\mu\text{A}$
		$V_{DS} = -32\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 55\text{ }^{\circ}\text{C}$	-	-	-5	
On-state drain current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq -10\text{ V}$ , $V_{GS} = -10\text{ V}$	-10	-	-	A
Drain-source on-state resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -10\text{ V}$ , $I_D = -5\text{ A}$	-	0.035	0.045	$\Omega$
		$V_{GS} = -4.5\text{ V}$ , $I_D = -4\text{ A}$	-	0.048	0.065	
Forward transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -10\text{ V}$ , $I_D = -5\text{ A}$	-	14	-	S
<b>Dynamic <sup>b</sup></b>						
Input capacitance	$C_{iss}$	$V_{DS} = -32\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$	-	1670	-	pF
Output capacitance	$C_{oss}$		-	380	-	
Reverse transfer capacitance	$C_{rss}$		-	105	-	
Total gate charge	$Q_g$	$V_{DS} = -32\text{ V}$ , $V_{GS} = -10\text{ V}$ , $I_D = -5\text{ A}$	-	23	-	nC
Gate-source charge		$V_{DS} = -32\text{ V}$ , $V_{GS} = -4.5\text{ V}$ , $I_D = -4\text{ A}$	-	10	-	
Gate-drain charge			-	4	-	
Gate resistance	$R_g$	$f = 1\text{ MHz}$	-	7	-	$\Omega$
Turn-on delay time	$t_{d(on)}$	$V_{DD} = -20\text{ V}$ , $R_L = 4\text{ }\Omega$ $I_D \cong -5\text{ A}$ , $V_{GEN} = -10\text{ V}$ , $R_g = 1\text{ }\Omega$	-	5	-	ns
Rise time	$t_r$		-	10	-	
Turn-off delay time	$t_{d(off)}$		-	15	-	
Fall time	$t_f$		-	33	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = -20\text{ V}$ , $R_L = 4\text{ }\Omega$ $I_D \cong -4\text{ A}$ , $V_{GEN} = -4.5\text{ V}$ , $R_g = 1\text{ }\Omega$	-	9	-	
Rise time	$t_r$		-	44	-	
Turn-off delay time	$t_{d(off)}$		-	33	-	
Fall time	$t_f$		-	58	-	
			-	25	-	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous source-drain diode current	$I_S$	$T_C = 25\text{ }^{\circ}\text{C}$	-	-	-8.2	A
Pulse diode forward current	$I_{SM}$		-	-	-30	
Body diode voltage	$V_{SD}$	$I_S = -2\text{ A}$ , $V_{GS} = 0\text{ V}$	-	-0.7	-1.2	V
Body diode reverse recovery time	$t_{rr}$	$I_F = -2\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $T_J = 25\text{ }^{\circ}\text{C}$	-	25	50	ns
Body diode reverse recovery charge	$Q_{rr}$		-	17	35	nC
Reverse recovery fall time	$t_a$		-	15	-	ns
Reverse recovery rise time	$t_b$		-	11	-	

**Notes**

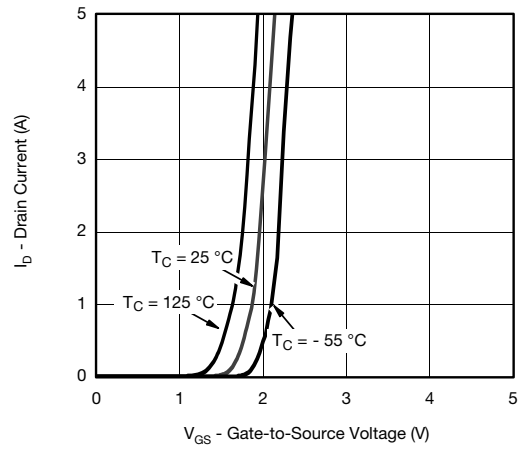
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$   
 b. Guaranteed by design, not subject to production testing

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

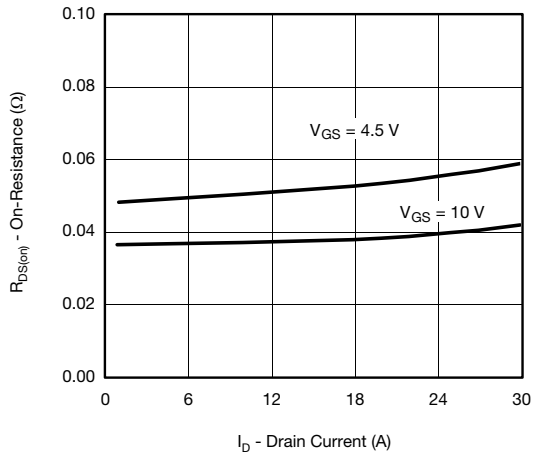
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



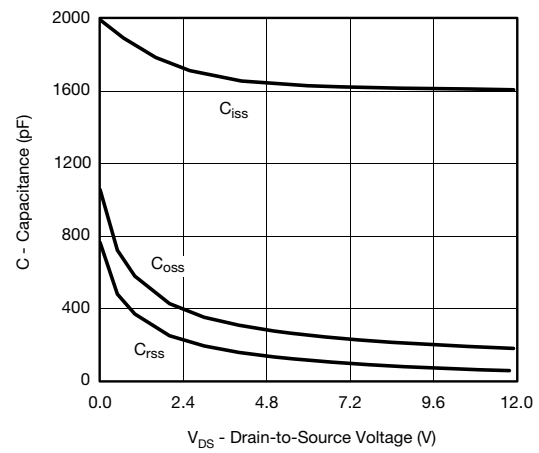
**Output Characteristics**



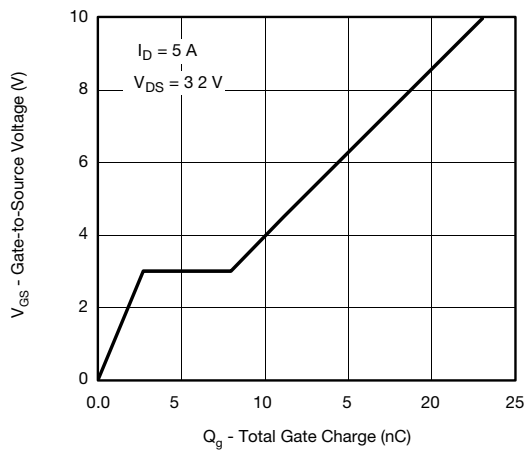
**Transfer Characteristics**



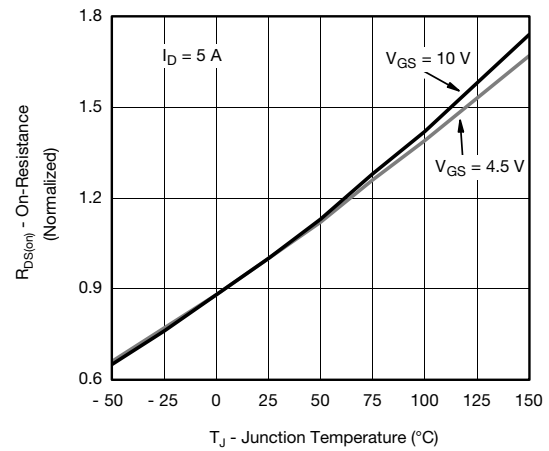
**On-Resistance vs. Drain Current**



**Capacitance**

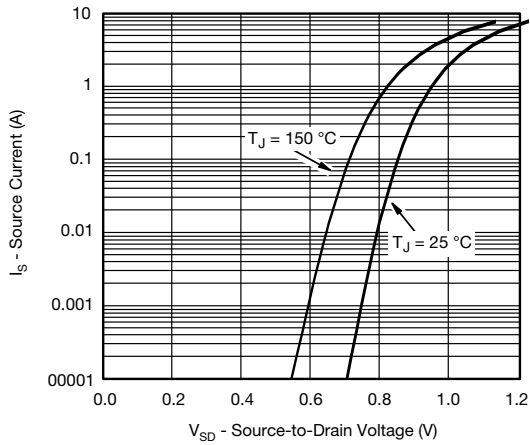


**Gate Charge**

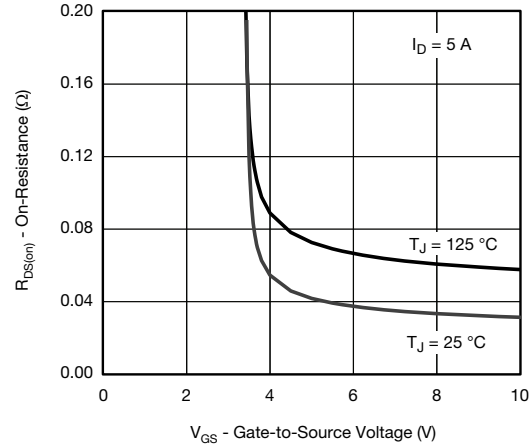


**On-Resistance vs. Junction Temperature**

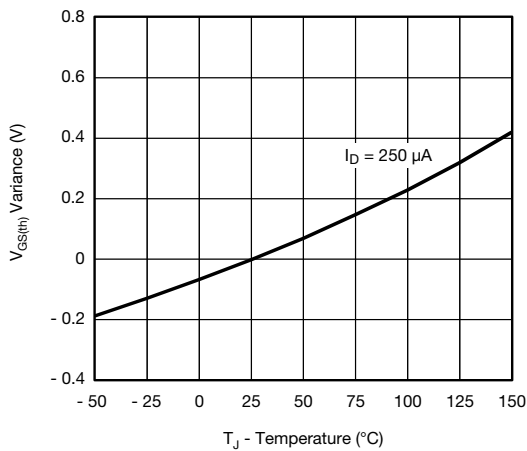
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



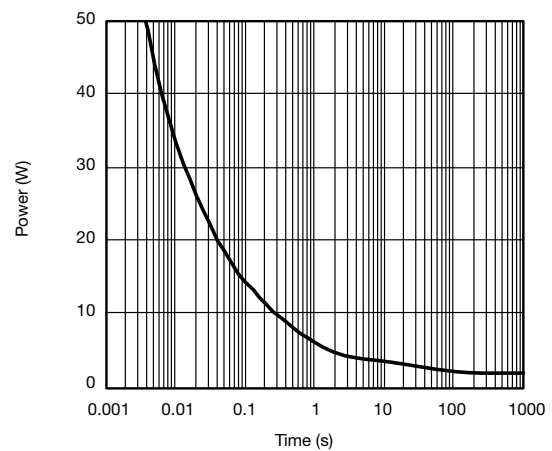
**Source-Drain Diode Forward Voltage**



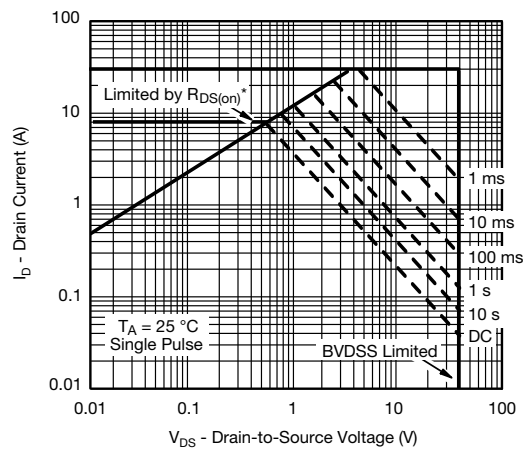
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**



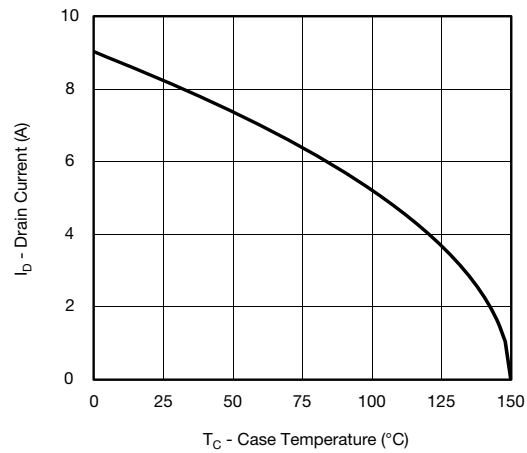
**Single Pulse Power, Junction-to-Ambient**



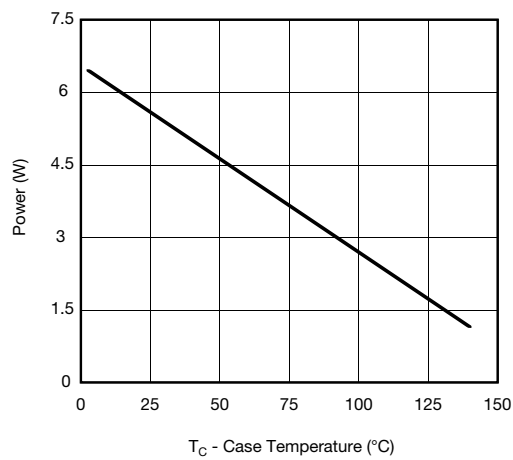
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

**Safe Operating Area**

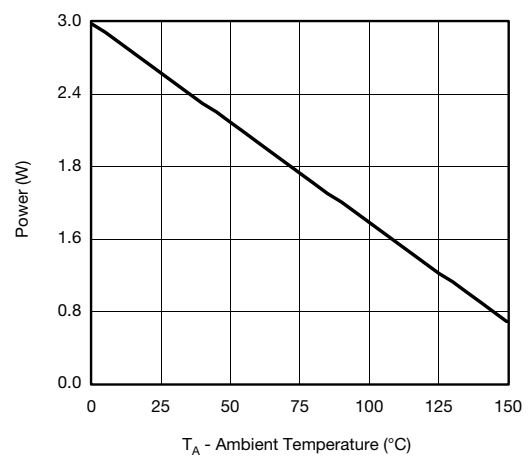
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



**Current Derating <sup>a</sup>**



**Power, Junction-to-Foot**



**Power Derating, Junction-to-Ambient**

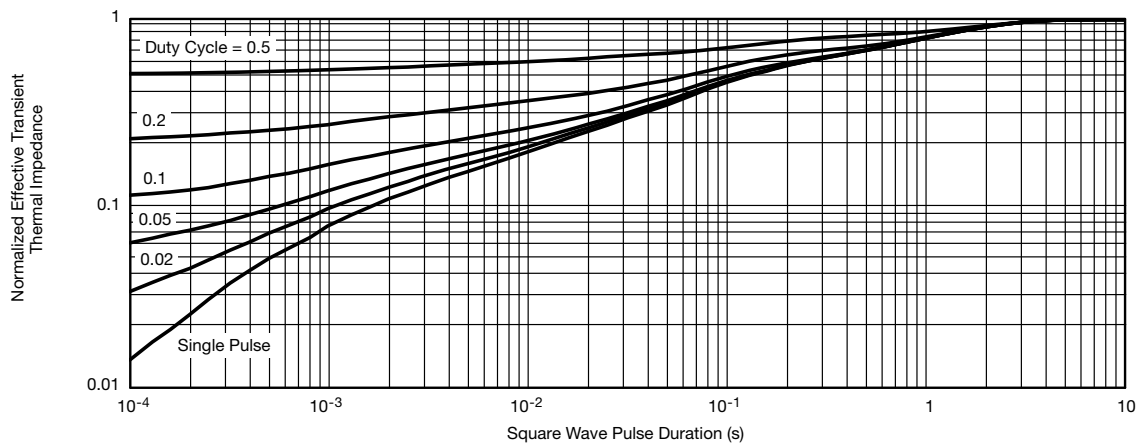
**Note**

- a. The power dissipation  $P_D$  is based on  $T_J$  max. = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



**Normalized Thermal Transient Impedance, Junction-to-Ambient**



**Normalized Thermal Transient Impedance, Junction-to-Foot**

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