

## N-Channel 60-V (D-S) MOSFET

PRODUCT SUMMARY	
$V_{DS}$ (V)	60
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 10$ V	0.024
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 4.5$ V	0.028
$Q_g$ typ. (nC)	5.2
$I_D$ (A)	15 <sup>a, g</sup>
Configuration	Single

### FEATURES

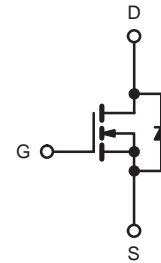
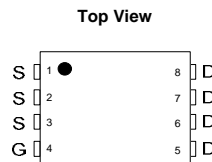
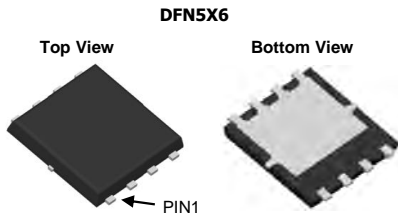
- Halogen-free According to IEC 61249-2-21 Available
- TrenchFET<sup>®</sup> Power MOSFET
- 100 %  $R_g$  Tested
- 100 % UIS Tested



RoHS  
COMPLIANT

### APPLICATIONS

- Battery Switch
- DC/DC Converter



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	$V_{DS}$	60	V
Gate-source voltage	$V_{GS}$	$\pm 20$	
Continuous drain current ( $T_J = 150$ °C)	$I_D$	$T_C = 25$ °C	15 <sup>a</sup>
		$T_C = 70$ °C	9 <sup>a</sup>
		$T_A = 25$ °C	10.3 <sup>b, c</sup>
		$T_A = 70$ °C	8.1 <sup>b, c</sup>
Pulsed drain current ( $t = 100$ $\mu$ s)	$I_{DM}$	40	A
Continuous source-drain diode current	$I_S$	$T_C = 25$ °C	
		$T_A = 25$ °C	3 <sup>b, c</sup>
Single pulse avalanche current	$I_{AS}$	15	mJ
Single pulse avalanche energy	$E_{AS}$	11.3	
Maximum power dissipation	$P_D$	$T_C = 25$ °C	35.7
		$T_C = 70$ °C	22.9
		$T_A = 25$ °C	3.6 <sup>b, c</sup>
		$T_A = 70$ °C	2.3 <sup>b, c</sup>
Operating junction and storage temperature range	$T_J, T_{stg}$	-55 to +150	°C
Soldering recommendations (peak temperature) <sup>c</sup>		260	

THERMAL RESISTANCE RATINGS					
PARAMETER		SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum junction-to-ambient <sup>b</sup>	$t \leq 10$ s	$R_{thJA}$	25	35	°C/W
Maximum junction-to-case (drain)	Steady state	$R_{thJC}$	2.7	3.5	

**Notes**

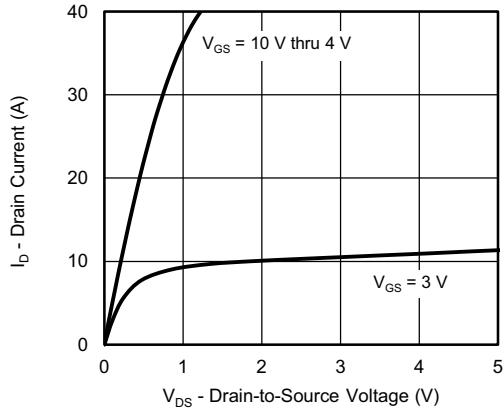
- a. Package limited
- b. Surface mounted on 1" x 1" FR4 board
- c.  $t = 10$  s

<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	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	60	-	-	V	
$V_{DS}$ temperature coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$	-	33	-	mV/ $^\circ\text{C}$	
$V_{GS(th)}$ temperature coefficient	$\Delta V_{GS(th)}/T_J$		-	-4.8	-		
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1	-	2.8	V	
Gate-source leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$	-	-	100	nA	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$	-	-	1	$\mu\text{A}$	
		$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}, T_J = 70\text{ }^\circ\text{C}$	-	-	10		
On-state drain current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	10	-	-	A	
Drain-source on-state resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 10\text{ A}$	-	0.024	-	$\Omega$	
		$V_{GS} = 4.5\text{ V}, I_D = 5\text{ A}$	-	0.028	-		
Forward transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 10\text{ V}, I_D = 10\text{ A}$	-	39	-	S	
<b>Dynamic <sup>b</sup></b>							
Input capacitance	$C_{iss}$	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	790	-	pF	
Output capacitance	$C_{oss}$		-	330	-		
Reverse transfer capacitance	$C_{rss}$		-	14	-		
Total gate charge	$Q_g$	$V_{DS} = 30\text{ V}, V_{GS} = 10\text{ V}, I_D = 5\text{ A}$	-	11.1	17	nC	
Gate-source charge	$Q_{gs}$	$V_{DS} = 30\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 5\text{ A}$	-	5.2	8		
Gate-drain charge	$Q_{gd}$		-	2.2	-		
Gate resistance	$R_g$		-	1.1	-		
Turn-on delay time	$t_{d(on)}$	$f = 1\text{ MHz}$	0.1	0.6	1.2	$\Omega$	
Rise time	$t_r$		$V_{DD} = 30\text{ V}, R_L = 6\text{ }\Omega, I_D \cong 5\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$	-	7	15	ns
Turn-off delay time	$t_{d(off)}$			-	21	40	
Fall time	$t_f$	-		10	20		
Turn-on delay time	$t_{d(on)}$	-		10	20		
Rise time	$t_r$	-		13	25		
Turn-off delay time	$t_{d(off)}$	-		25	50		
Fall time	$t_f$	$V_{DD} = 30\text{ V}, R_L = 6\text{ }\Omega, I_D \cong 5\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$	-	10	20		
Turn-on delay time	$t_{d(on)}$		-	22	45		
Rise time	$t_r$		-	-	-		
Fall time	$t_f$		-	-	-		
<b>Drain-Source Body Diode Characteristics</b>							
Continuous source-drain diode current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$	-	15	-	A	
Pulse diode forward current	$I_{SM}$		-	-	40		
Body diode voltage	$V_{SD}$	$I_S = 5\text{ A}, V_{GS} = 0\text{ V}$	-	0.79	1.2	V	
Body diode reverse recovery time	$t_{rr}$	$I_F = 5\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$	-	30	60	ns	
Body diode reverse recovery charge	$Q_{rr}$		-	60	120	nC	
Reverse recovery fall time	$t_a$		-	15	-	ns	
Reverse recovery rise time	$t_b$		-	15	-		

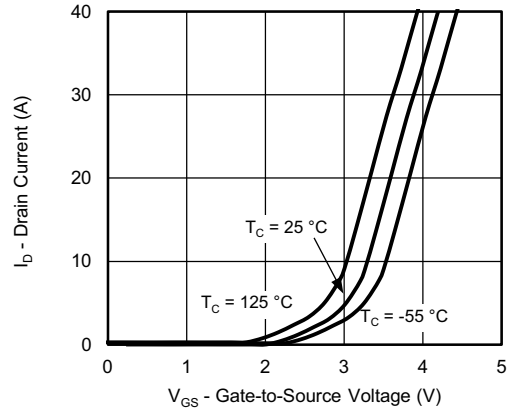
**Notes**

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

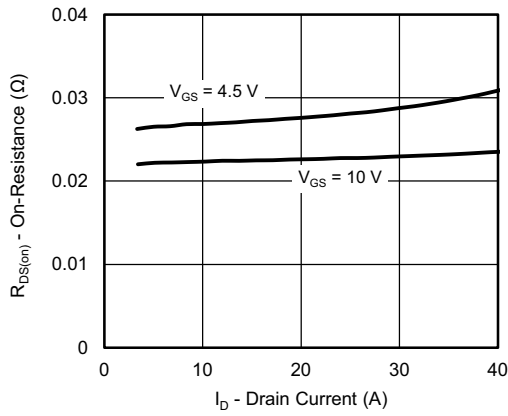
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



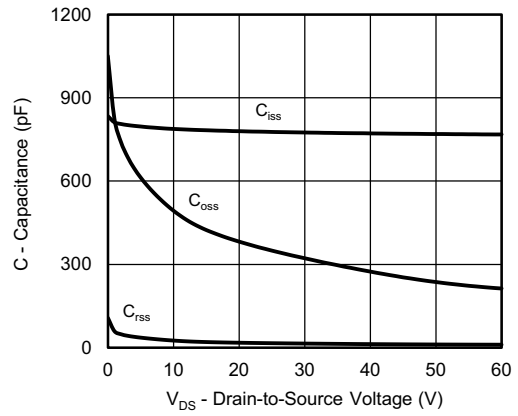
**Output Characteristics**



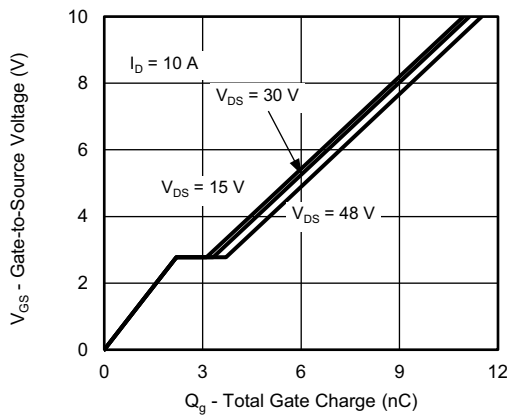
**Transfer Characteristics**



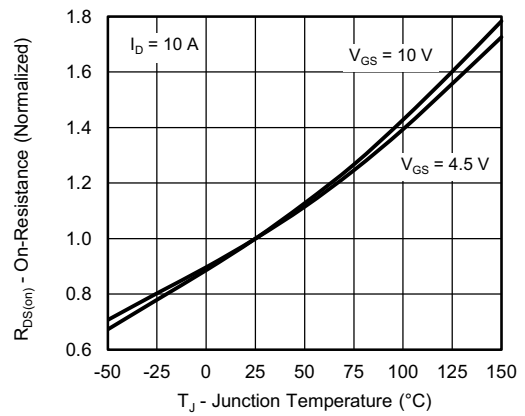
**On-Resistance vs. Drain Current and Gate Voltage**



**Capacitance**

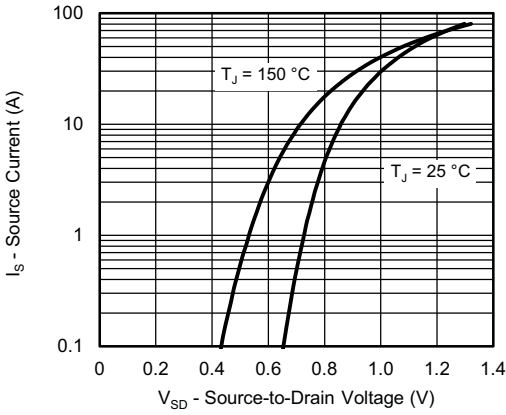


**Gate Charge**

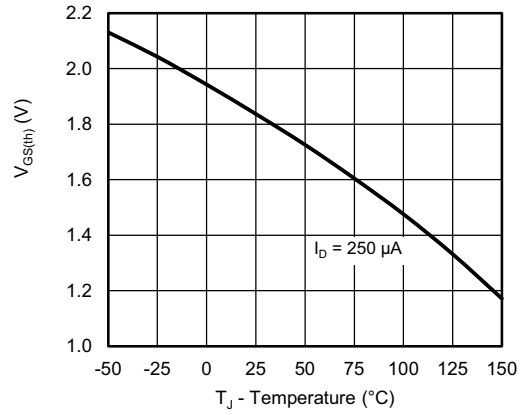


**On-Resistance vs. Junction Temperature**

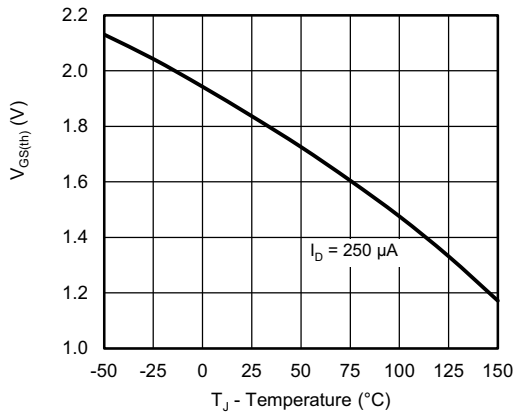
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



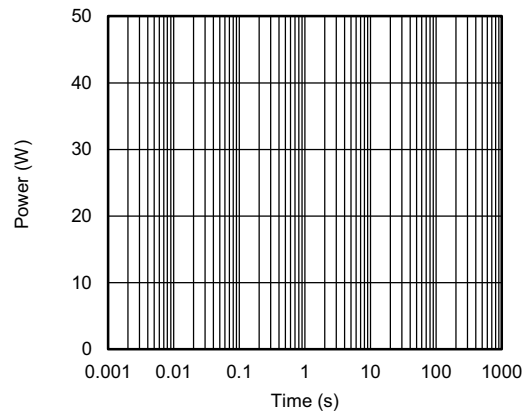
**Source-Drain Diode Forward Voltage**



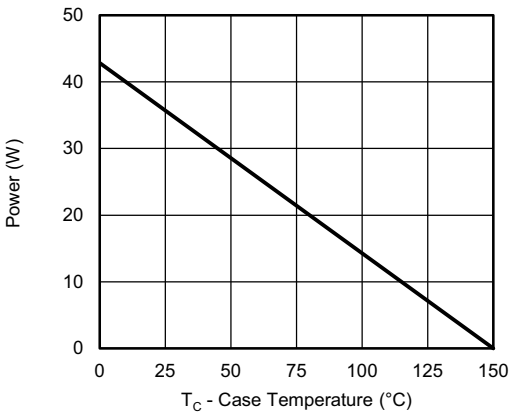
**Threshold Voltage**



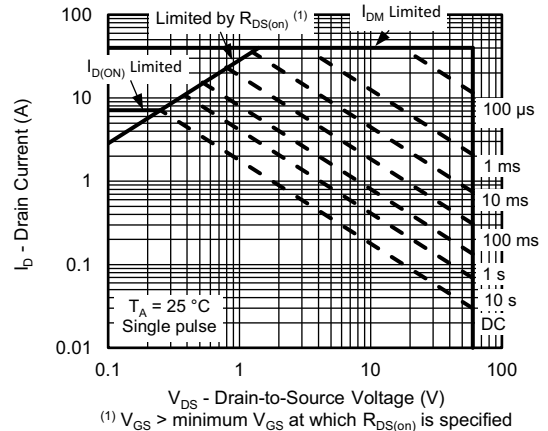
**Threshold Voltage**



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

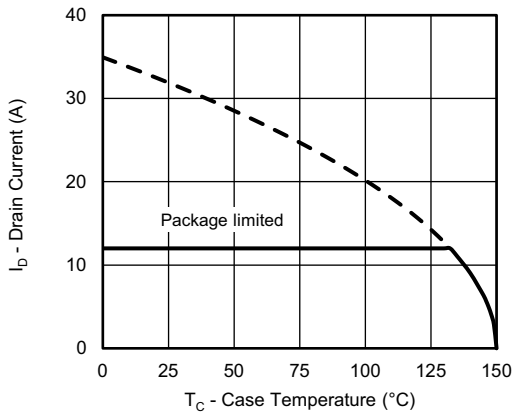


**Power, Junction-to-Case**



**Safe Operating Area, Junction-to-Ambient**

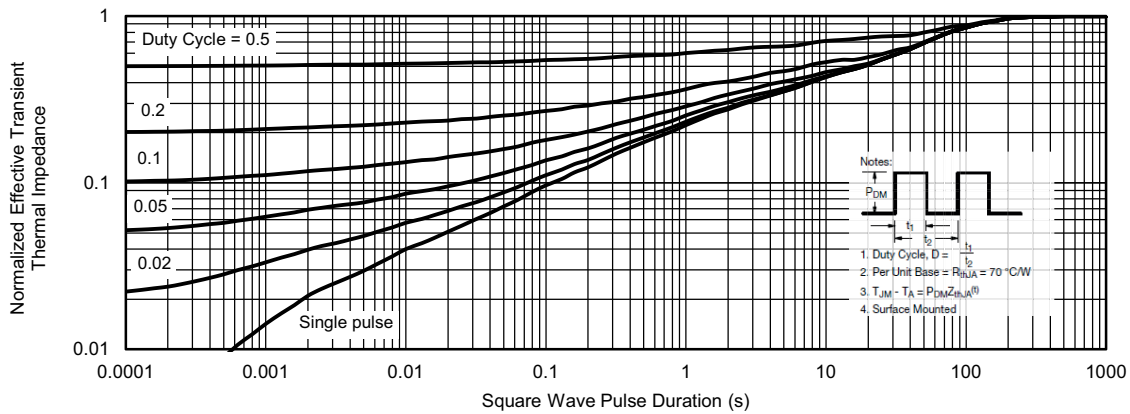
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



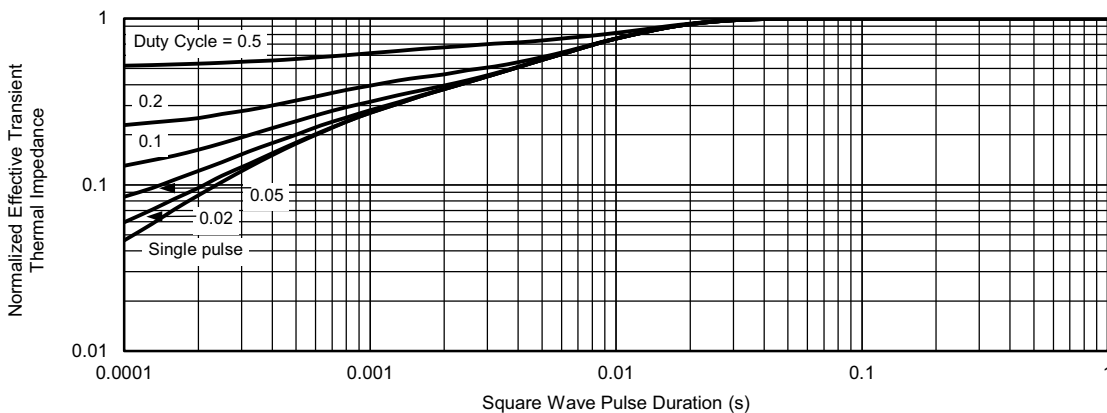
**Note**

- 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

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



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



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

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DFN5x6\_8L\_EP1\_P PACKAGE OUTLIN



RECOMMENDED LAND PATTERN



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.85	0.95	1.00	0.033	0.037	0.039
A1	0.00	---	0.05	0.000	---	0.002
b	0.30	0.40	0.50	0.012	0.016	0.020
c	0.15	0.20	0.25	0.006	0.008	0.010
D	5.10	5.20	5.30	0.201	0.205	0.209
D1	4.25	4.35	4.45	0.167	0.171	0.175
E	5.45	5.55	5.65	0.215	0.219	0.222
E1	5.95	6.05	6.15	0.234	0.238	0.242
E2	3.525	3.625	3.725	0.139	0.143	0.147
E3	1.175	1.275	1.375	0.046	0.050	0.054
e	1.27 BSC			0.050 BSC		
L	0.45	0.55	0.65	0.018	0.022	0.026
L1	0	---	0.15	0	---	0.006
L2	0.68 REF			0.027 REF		
$\theta$	0°	---	10°	0°	---	10°

NOTE

UNIT: mm

- PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS.  
MOLD FLASH AT THE NON-LEAD SIDES SHOULD BE LESS THAN 6 MILS EACH.
- CONTROLLING DIMENSION IS MILLIMETER.  
CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT

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