

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

### PRODUCT SUMMARY

V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω) Max.	I <sub>D</sub> (A) <sup>a</sup>	Q <sub>g</sub> (Typ.)
60	0.0033 at V <sub>GS</sub> = 10 V	95	51 nC

### FEATURES

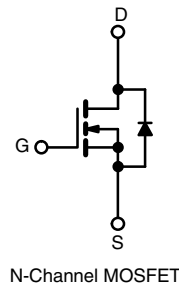
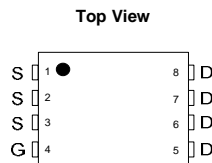
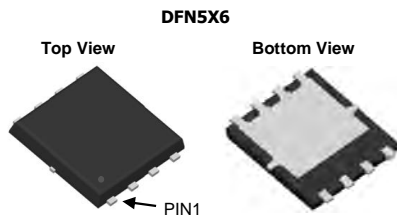
- DT-Trench Power MOSFET
- 100 % R<sub>g</sub> and UIS Tested

### APPLICATIONS

- Primary Side Switch
- Synchronous Rectifier
- DC/DC Converter
- DC/AC Inverters



**RoHS**  
COMPLIANT



### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25 °C, unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V <sub>DS</sub>	60	V
Gate-Source Voltage	V <sub>GS</sub>	± 20	
Continuous Drain Current (T <sub>J</sub> = 150 °C)	I <sub>D</sub>	T <sub>C</sub> = 25 °C	95 <sup>a</sup>
		T <sub>C</sub> = 70 °C	88 <sup>a</sup>
		T <sub>A</sub> = 25 °C	36.5 <sup>b, c</sup>
		T <sub>A</sub> = 70 °C	27 <sup>b, c</sup>
Pulsed Drain Current (t = 300 μs)	I <sub>DM</sub>	360	A
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	
		T <sub>A</sub> = 25 °C	10.3 <sup>b, c</sup>
Single Pulse Avalanche Current	I <sub>AS</sub>	93	mJ
Single Pulse Avalanche Energy	E <sub>AS</sub>	295	
Maximum Power Dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C	173
		T <sub>C</sub> = 70 °C	120
		T <sub>A</sub> = 25 °C	5.4 <sup>b, c</sup>
		T <sub>A</sub> = 70 °C	3.3 <sup>b, c</sup>
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>b, d</sup>	R <sub>thJA</sub>	14	23	°C/W
Maximum Junction-to-Case (Drain)	R <sub>thJC</sub>	0.8	1.5	

Notes:

- Package limited.
- Surface mounted on 1" x 1" FR4 board.
- t = 10 s.
- Maximum under steady state conditions is 65 °C/W.

**SPECIFICATIONS** ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)

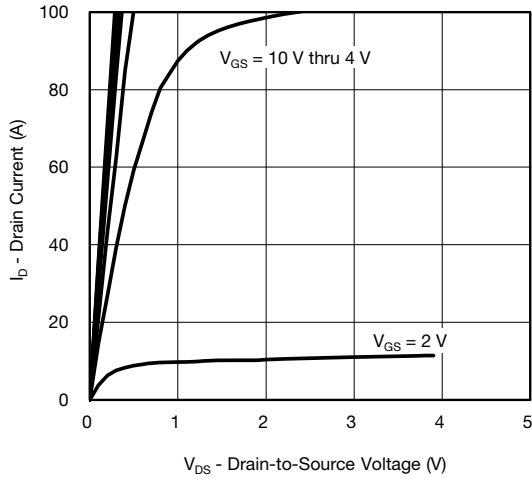
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	60			V
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	$I_D = 250\text{ }\mu\text{A}$		- 6		mV/ $^\circ\text{C}$
Gate-Source 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	$I_{DSS}$	$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	125			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 20\text{ A}$		0.0033	0.0042	$\Omega$
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 15\text{ V}, I_D = 20\text{ A}$		70		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		3115		pF
Output Capacitance	$C_{oss}$			1350		
Reverse Transfer Capacitance	$C_{rss}$			98		
Total Gate Charge	$Q_g$	$V_{DS} = 30\text{ V}, V_{GS} = 10\text{ V}, I_D = 10\text{ A}$		51		nC
				22		
Gate-Source Charge	$Q_{gs}$	$V_{DS} = 30\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 10\text{ A}$		8.2		nC
Gate-Drain Charge	$Q_{gd}$			4.5		
Gate Resistance	$R_g$		$f = 1\text{ MHz}$		2.2	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 30\text{ V}, R_L = 3\text{ }\Omega$ $I_D \cong 10\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$		17		ns
Rise Time	$t_r$			8		
Turn-Off Delay Time	$t_{d(off)}$			30		
Fall Time	$t_f$			8		
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 30\text{ V}, R_L = 3\text{ }\Omega$ $I_D \cong 10\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$		43		ns
Rise Time	$t_r$			120		
Turn-Off Delay Time	$t_{d(off)}$			32		
Fall Time	$t_f$			9		
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$			95	A
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$				360	
Body Diode Voltage	$V_{SD}$	$I_S = 5\text{ A}$		0.74	1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = 10\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		40	86	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			33	74	nC
Reverse Recovery Fall Time	$t_a$			17		ns
Reverse Recovery Rise Time	$t_b$			26		

Notes:

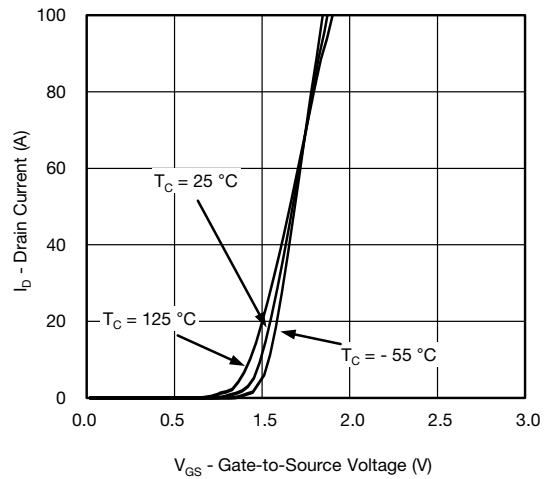
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
 b. Guaranteed by design, not subject to production testing.

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.

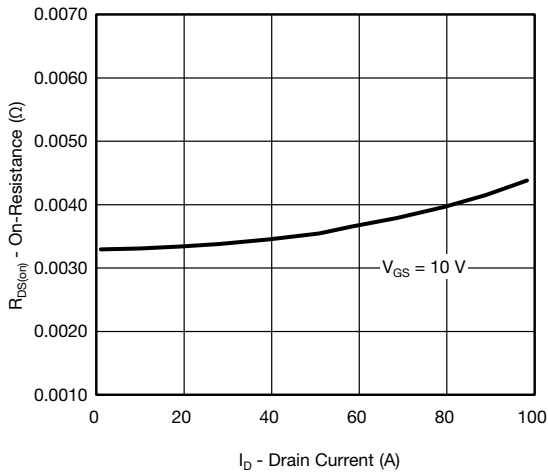
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



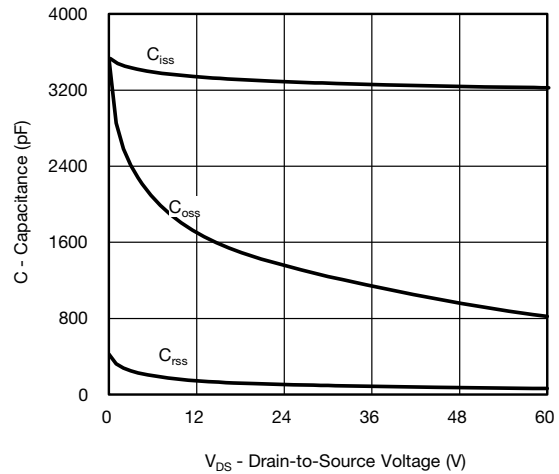
**Output Characteristics**



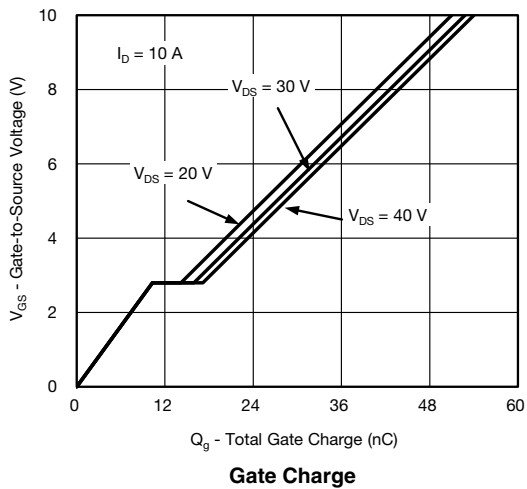
**Transfer Characteristics**



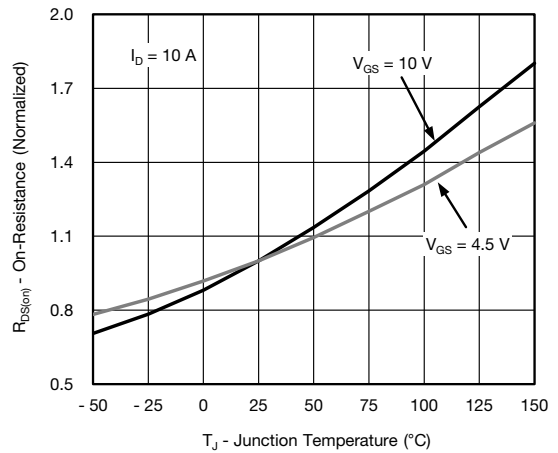
**On-Resistance vs. Drain Current and Gate Voltage**



**Capacitance**

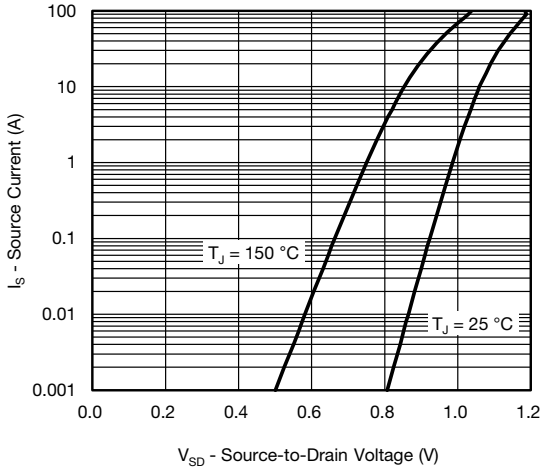


**Gate Charge**

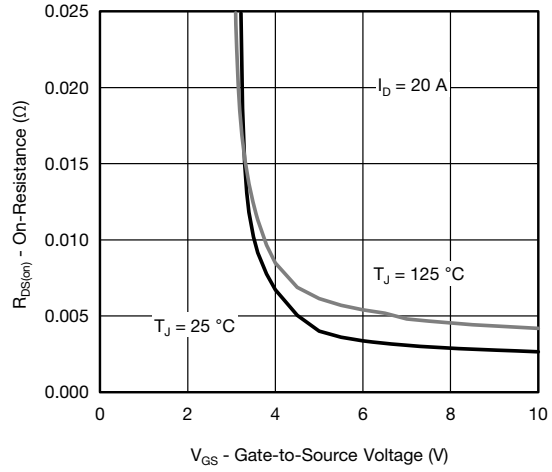


**On-Resistance vs. Junction Temperature**

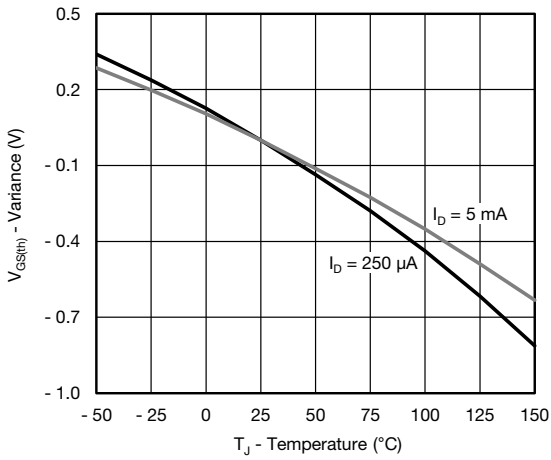
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



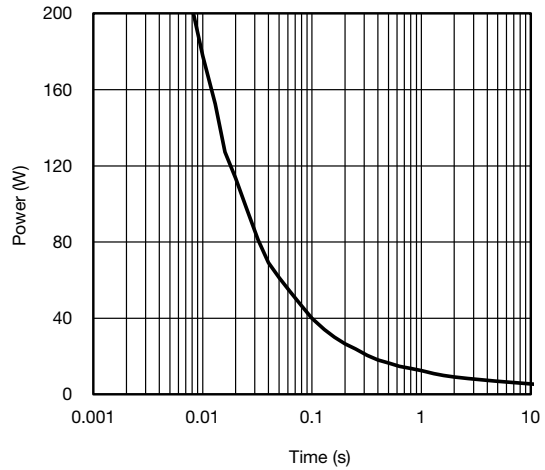
**Source-Drain Diode Forward Voltage**



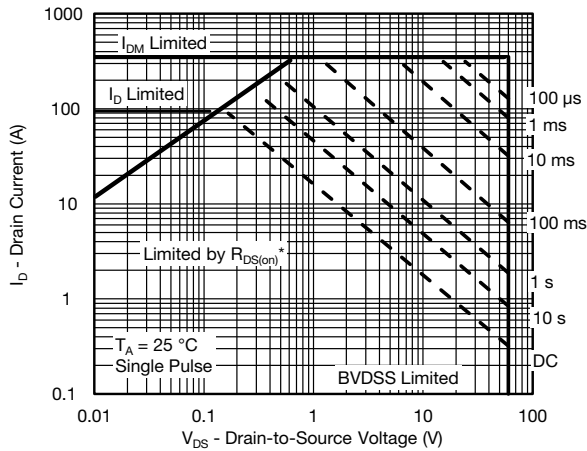
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**

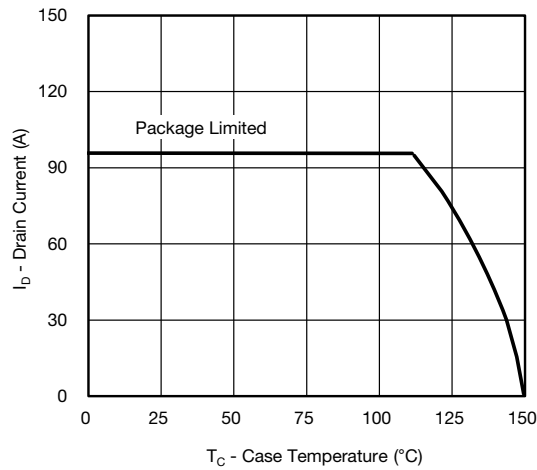


**Single Pulse Power, Junction-to-Ambient**

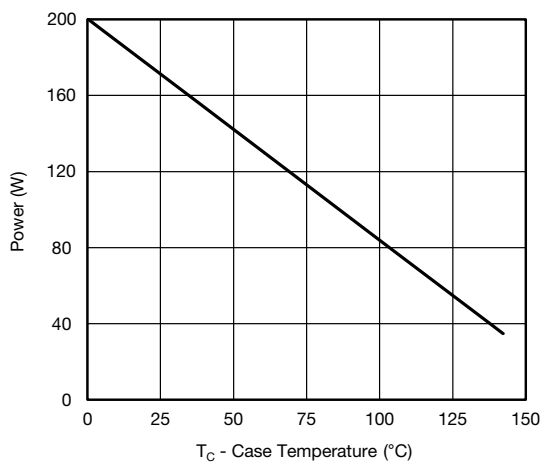


**Safe Operating Area, Junction-to-Ambient**  
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

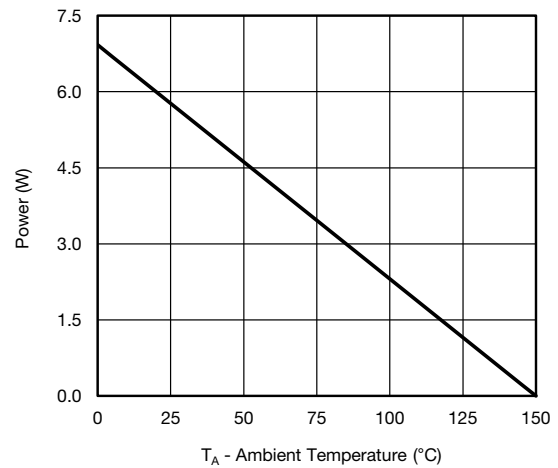
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



**Current Derating\***



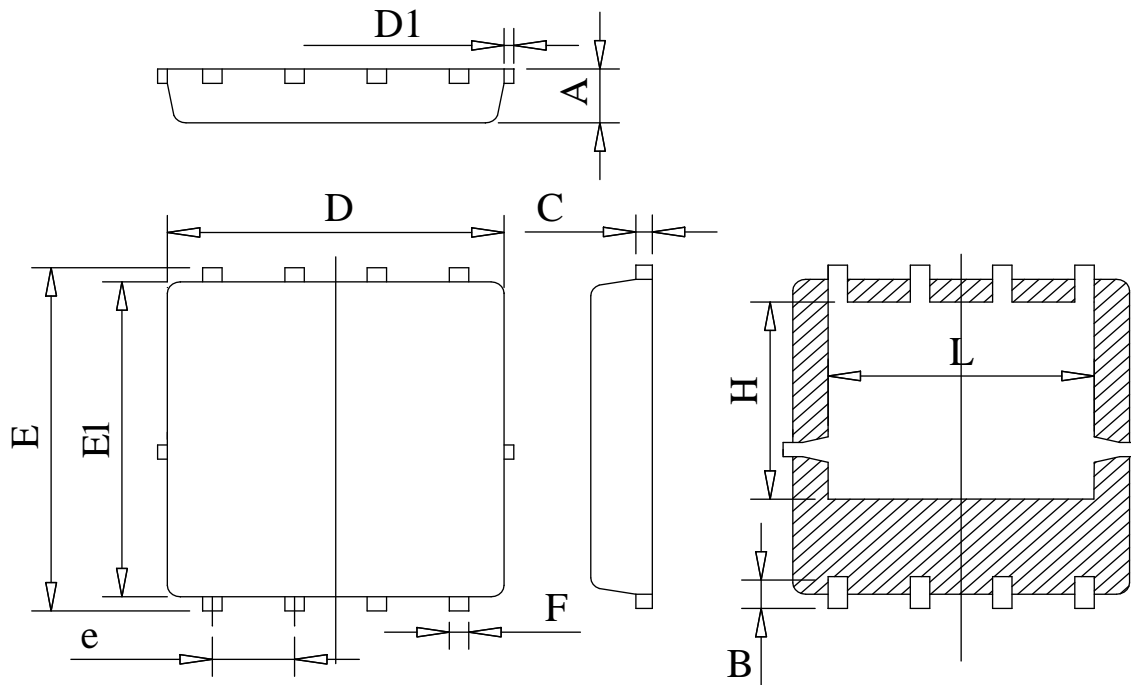
**Power, Junction-to-Case**



**Power, Junction-to-Ambient**

\* 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.

DFN5X6-8L PACKAGE OUTLINE



COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

Unit : mm

Symbol	Min	Typ	Max
A	0.78	0.95	1.12
B	0.45	0.58	0.78
C	0.18	0.254	0.36
D	4.70	5.20	5.45
D1			0.18
E	5.85	6.05	6.25
E1	5.38	5.55	5.98
e	1.15	1.27	1.40
F	0.18	0.30	0.52
H	3.25	3.47	3.70
L	3.75	4.00	4.25

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