

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

<b>PRODUCT SUMMARY</b>				
	<b>V<sub>DS</sub> (V)</b>	<b>R<sub>DS(on)</sub> (mΩ)(Typ.)</b>	<b>I<sub>D</sub> (A)<sup>a</sup></b>	<b>Q<sub>g</sub> (Typ.)</b>
N-Channel	40	5.8 at V <sub>GS</sub> = 10 V	55	42.6
		6.8 at V <sub>GS</sub> = 4.5 V		
P-Channel	- 40	9 at V <sub>GS</sub> = - 10 V	- 52	25
		14 at V <sub>GS</sub> = - 4.5 V		

### FEATURES

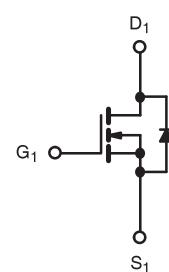
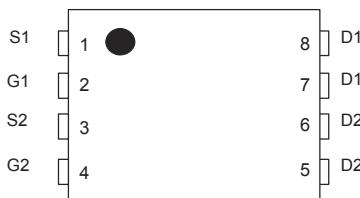
- DT-Trench Power MOSFET
- 100 % R<sub>g</sub> and UIS Tested



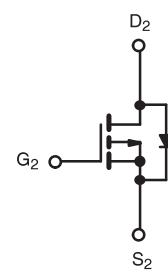
### APPLICATIONS

- DC/DC for portable applications
- Load switch

Top View



N-Channel MOSFET



P-Channel MOSFET

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

Parameter	Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage	V <sub>DS</sub>	40	-40	V
Gate-Source Voltage	V <sub>GS</sub>	± 20	± 10	
Continuous Drain Current (T <sub>J</sub> = 150 °C)	I <sub>D</sub>	55	- 52	A
		49.5	- 43	
		18 <sup>b, c</sup>	- 15 <sup>b, c</sup>	
		11 <sup>b, c</sup>	- 8 <sup>b, c</sup>	
Pulsed Drain Current (10 µs Pulse Width)	I <sub>DM</sub>	220	- 200	A
Source-Drain Current Diode Current	I <sub>S</sub>	55	- 52	
		18 <sup>b, c</sup>	- 15 <sup>b, c</sup>	
Pulsed Source-Drain Current	I <sub>SM</sub>	220	- 200	
Single Pulse Avalanche Current	I <sub>AS</sub>	50	- 48	mJ
Single Pulse Avalanche Energy	E <sub>AS</sub>	105	86	
Maximum Power Dissipation	P <sub>D</sub>	43	32	W
		27	20.5	
		5.8 <sup>b, c</sup>	4.6 <sup>b, c</sup>	
		3 <sup>b, c</sup>	2.2 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 175		°C

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	N-Channel		P-Channel		Unit
		Typ.	Max.	Typ.	Max.	
Maximum Junction-to-Ambient <sup>b, d</sup>	t ≤ 10 s	R <sub>thJA</sub>	25	35	47	80
Maximum Junction-to-Foot (Drain)	Steady State	R <sub>thJF</sub>	3	5	3.5	5

Notes:

- a. Based on T<sub>C</sub> = 25 °C.
- b. Surface Mounted on 1" x 1" FR4 board.
- c. t = 10 s.
- d. Maximum under Steady State conditions is 120 °C/W (N-Channel) and 110 °C/W (P-Channel).

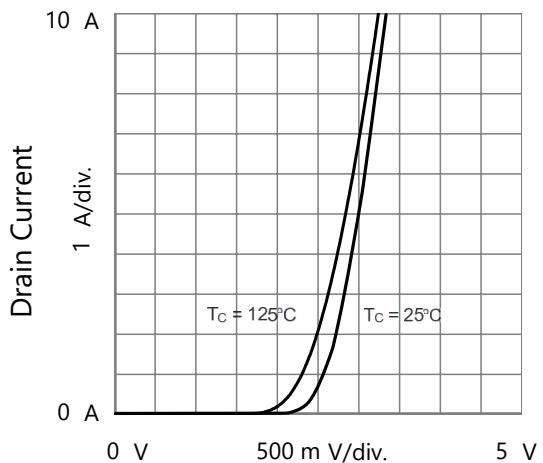
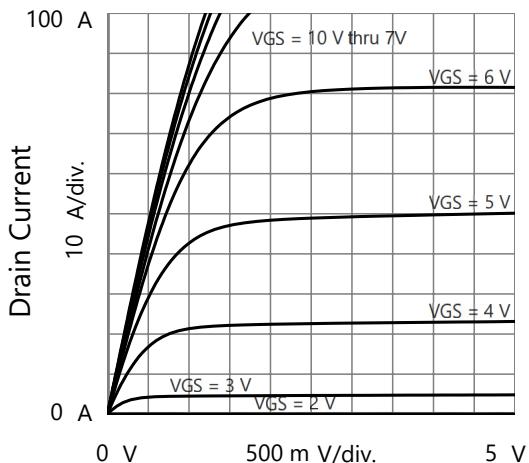
<b>SPECIFICATIONS</b> $T_J = 25^\circ\text{C}$ , unless otherwise noted							
Parameter	Symbol	Test Conditions			Min.	Typ. <sup>a</sup>	Max.
<b>Static</b>							
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$		N-Ch	40		
		$V_{GS} = 0 \text{ V}, I_D = - 250 \mu\text{A}$		P-Ch	- 40		
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250 \mu\text{A}$		N-Ch		45	
		$I_D = - 250 \mu\text{A}$		P-Ch		- 40	
$V_{GS(\text{th})}$ Temperature Coefficient	$\Delta V_{GS(\text{th})}/T_J$	$I_D = 250 \mu\text{A}$		N-Ch		- 4.1	
		$I_D = - 250 \mu\text{A}$		P-Ch		5	
Gate Threshold Voltage	$V_{GS(\text{th})}$	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$		N-Ch	1		
		$V_{DS} = V_{GS}, I_D = - 250 \mu\text{A}$		P-Ch	- 1		- 3
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$		N-Ch		$\pm 100$	
		$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$		P-Ch		$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 40 \text{ V}, V_{GS} = 0 \text{ V}$		N-Ch		1	
		$V_{DS} = - 40 \text{ V}, V_{GS} = 0 \text{ V}$		P-Ch		- 1	
		$V_{DS} = 32 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 55^\circ\text{C}$		N-Ch		10	
		$V_{DS} = - 32 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 55^\circ\text{C}$		P-Ch		- 10	
On-State Drain Current <sup>b</sup>	$I_{D(\text{on})}$	$V_{DS} = 24 \text{ V}, V_{GS} = 10 \text{ V}$		N-Ch	60		
		$V_{DS} = - 24 \text{ V}, V_{GS} = - 10 \text{ V}$		P-Ch	- 55		
Drain-Source On-State Resistance <sup>b</sup>	$R_{DS(\text{on})}$	$V_{GS} = 10 \text{ V}, I_D = 12 \text{ A}$		N-Ch	5.8	7	
		$V_{GS} = - 10 \text{ V}, I_D = - 10 \text{ A}$		P-Ch	9	12	
		$V_{GS} = 4.5 \text{ V}, I_D = 10 \text{ A}$		N-Ch	6.8	8.5	
		$V_{GS} = - 4.5 \text{ V}, I_D = 8 \text{ A}$		P-Ch	14	18	
Forward Transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = 24 \text{ V}, I_D = 12 \text{ A}$		N-Ch	45		
		$V_{DS} = - 24 \text{ V}, I_D = - 10 \text{ A}$		P-Ch	41		
<b>Dynamic<sup>a</sup></b>							
Input Capacitance	$C_{iss}$	N-Channel $V_{DS} = 20 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$ P-Channel $V_{DS} = - 20 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$			N-Ch	2320	
					P-Ch	3700	
Output Capacitance	$C_{oss}$			N-Ch	204		
				P-Ch	273		
Reverse Transfer Capacitance	$C_{rss}$			N-Ch	192		
				P-Ch	260		
Total Gate Charge	$Q_g$	N-Channel $V_{DS} = 20 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 12 \text{ A}$ P-Channel $V_{DS} = - 20 \text{ V}, V_{GS} = - 10 \text{ V}, I_D = - 10 \text{ A}$			N-Ch	42.6	
		P-Ch	25				
Gate-Source Charge	$Q_{gs}$			N-Ch	4.5		
				P-Ch	4.1		
Gate-Drain Charge	$Q_{gd}$			N-Ch	8.5		
				P-Ch	3.5		
Gate Resistance	$R_g$	$f = 1 \text{ MHz}$			N-Ch	2.5	
		P-Ch	10				

<b>SPECIFICATIONS</b> $T_J = 25^\circ\text{C}$ , unless otherwise noted							
Parameter	Symbol	Test Conditions			Min.	Typ. <sup>a</sup>	Max.
<b>Dynamic<sup>a</sup></b>							
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 20 \text{ V}, R_L = 2 \Omega$ $I_D \geq 12 \text{ A}, V_{GEN} = 10 \text{ V}, R_g = 1 \Omega$  P-Channel $V_{DD} = -20 \text{ V}, R_L = 2 \Omega$ $I_D \geq -10 \text{ A}, V_{GEN} = -10 \text{ V}, R_g = 1 \Omega$	N-Ch		11		ns
Rise Time	$t_r$		P-Ch		10		
Turn-Off Delay Time	$t_{d(off)}$		N-Ch		5		
Fall Time	$t_f$		P-Ch		7		
Turn-On Delay Time	$t_{d(on)}$		N-Ch		23		
Rise Time	$t_r$		P-Ch		45		
Turn-Off Delay Time	$t_{d(off)}$		N-Ch		9		
Fall Time	$t_f$		P-Ch		15		
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25^\circ\text{C}$  N-Channel $V_{DD} = 20 \text{ V}, R_L = 2 \Omega$ $I_D \geq 12 \text{ A}, V_{GEN} = 4.5 \text{ V}, R_g = 1 \Omega$  P-Channel $V_{DD} = -20 \text{ V}, R_L = 2 \Omega$ $I_D \geq -10 \text{ A}, V_{GEN} = -4.5 \text{ V}, R_g = 1 \Omega$	N-Ch		14		A
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$		P-Ch		35		
Body Diode Voltage	$V_{SD}$		N-Ch		10		
Body Diode Reverse Recovery Time	$t_{rr}$		P-Ch		42		
Body Diode Reverse Recovery Charge	$Q_{rr}$		N-Ch		25		
Reverse Recovery Fall Time	$t_a$		P-Ch		40		
Reverse Recovery Rise Time	$t_b$		N-Ch		13		
			P-Ch		15		
<b>Drain-Source Body Diode Characteristics</b>							
Notes:							

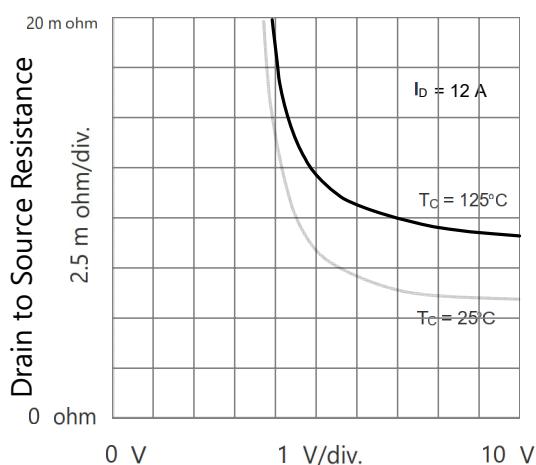
- a. Guaranteed by design, not subject to production testing.  
 b. Pulse test; pulse width  $\leq 300 \mu\text{s}$ , duty cycle  $\leq 2\%$ .

*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.*

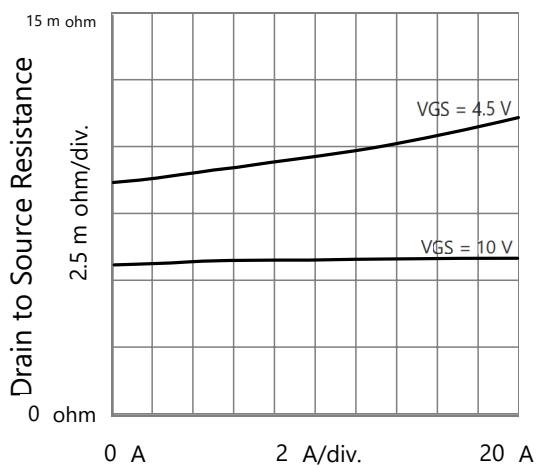
**N-CHANNEL TYPICAL CHARACTERISTICS** (25°C, unless otherwise noted)



Drain to Source Voltage  
Output Characteristics

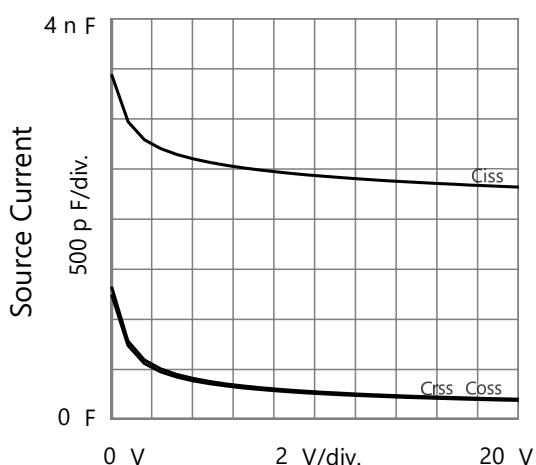


Gate to Source Voltage  
Transfer Characteristics

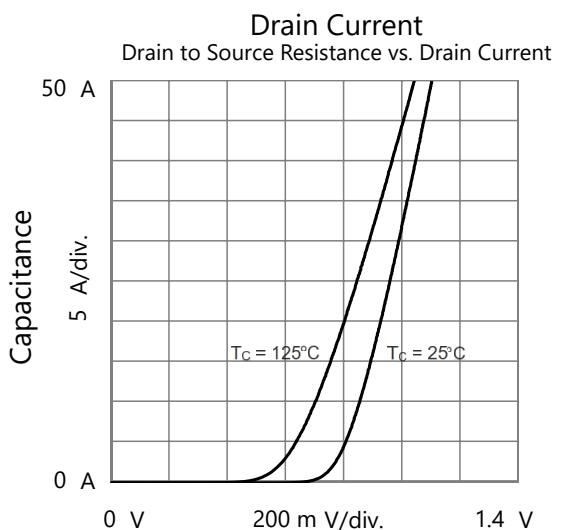


Gate to Source Voltage

Drain to Source Resistance vs. Gate to Source Voltage

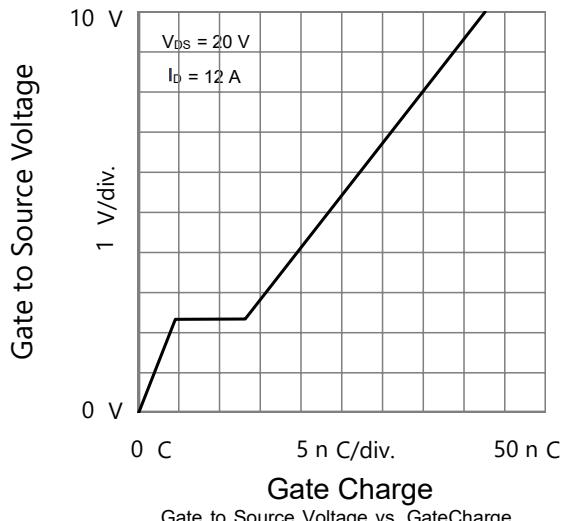


Drain to Source Voltage  
Capacitances



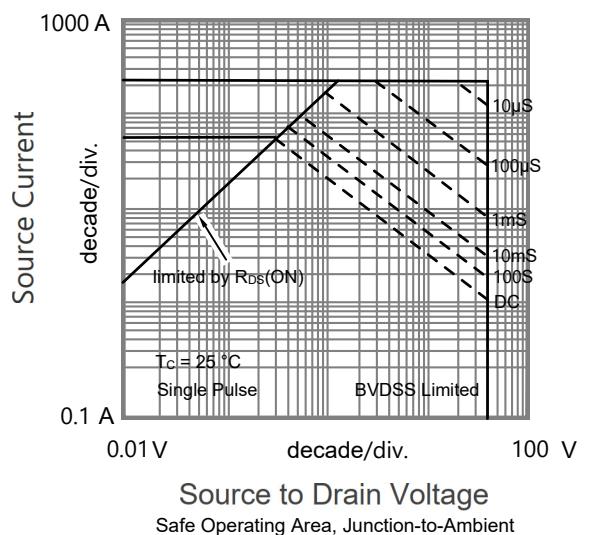
Source to Drain Voltage  
Body Diode Forward Characteristics

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



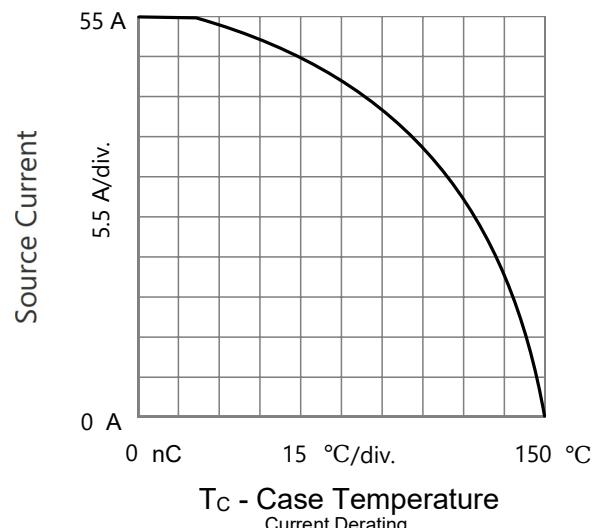
Gate Charge

Gate to Source Voltage vs. Gate Charge



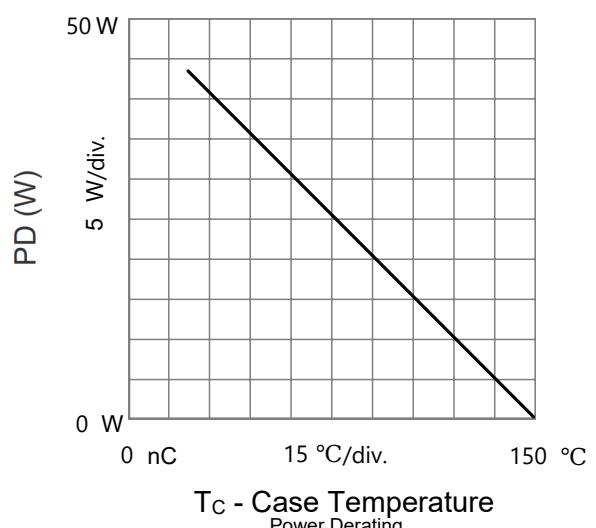
Source to Drain Voltage

Safe Operating Area, Junction-to-Ambient



$T_c - \text{Case Temperature}$

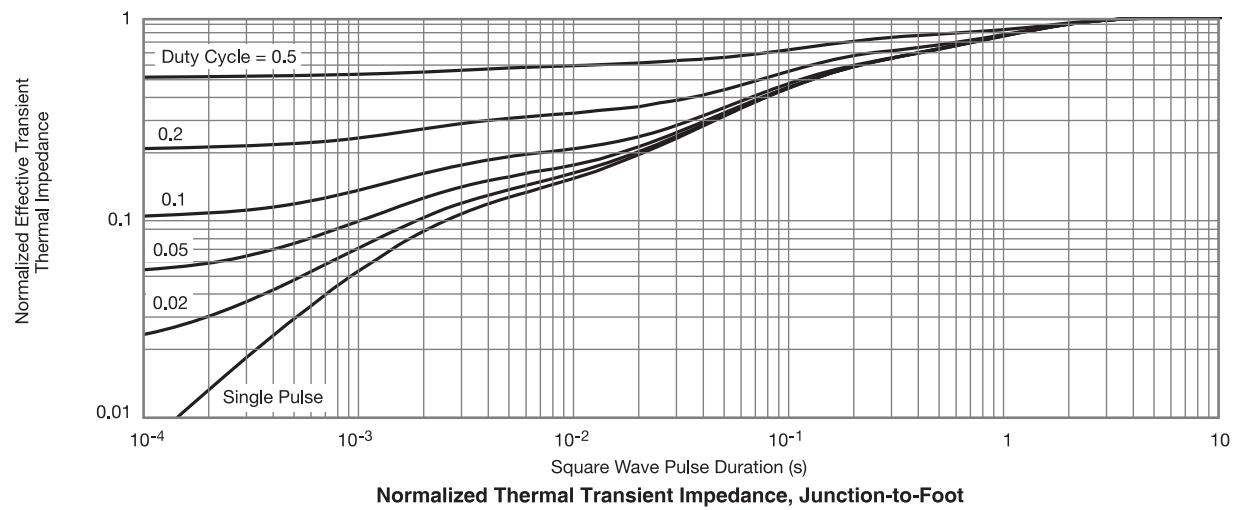
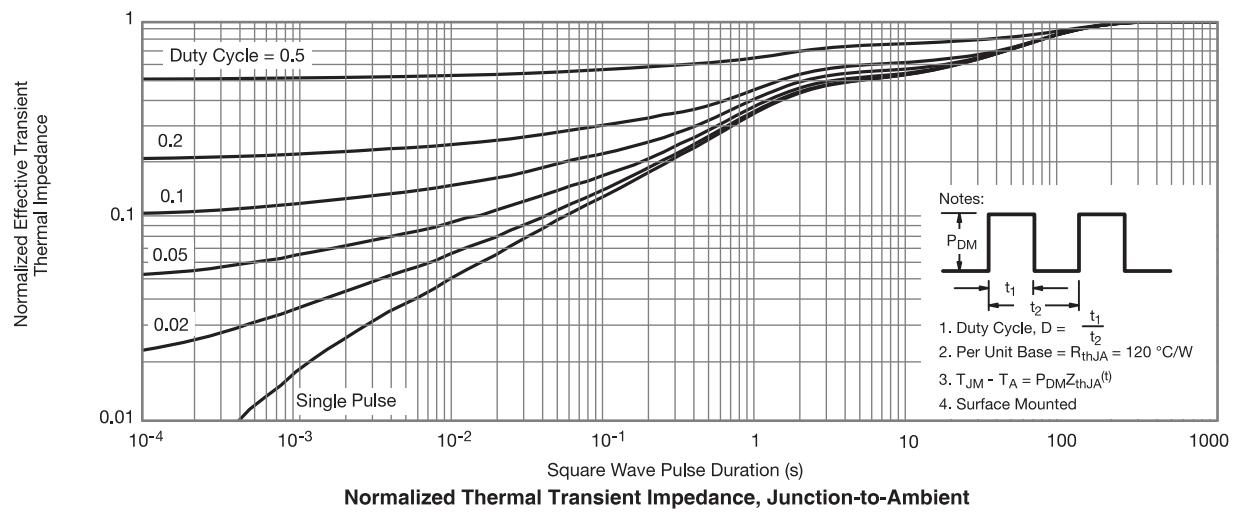
Current Derating



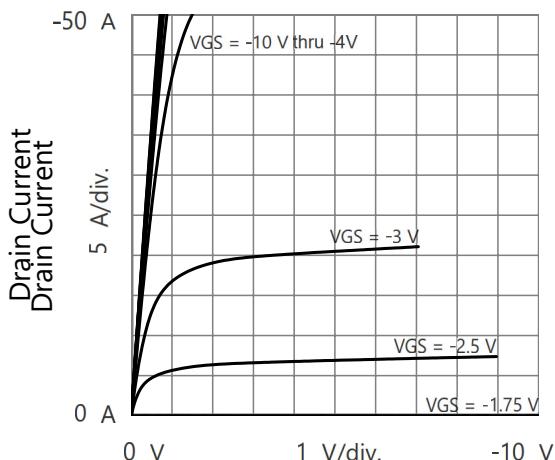
$T_c - \text{Case Temperature}$

Power Derating

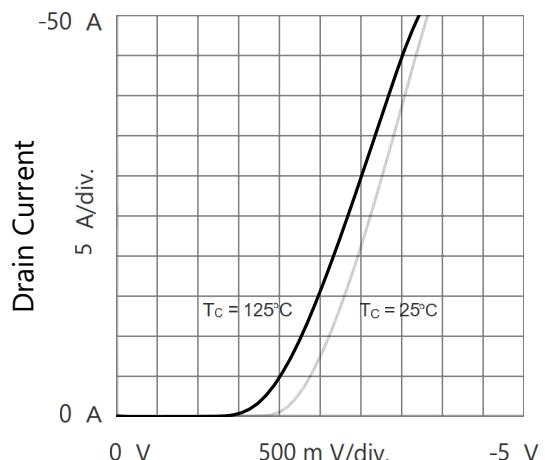
**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



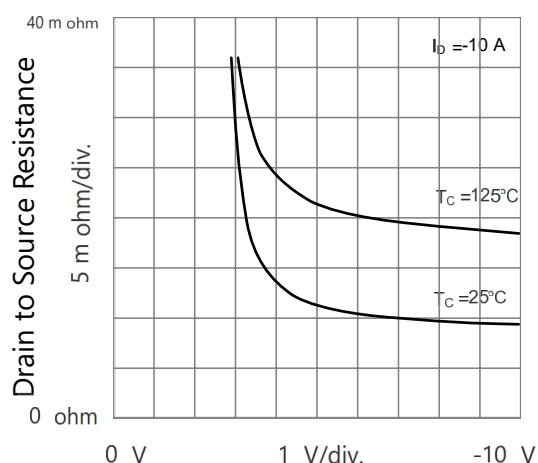
**P-CHANNEL TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



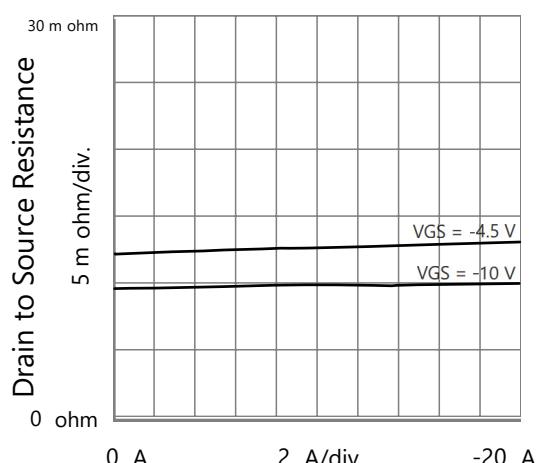
Drain to Source Voltage  
Output Characteristics



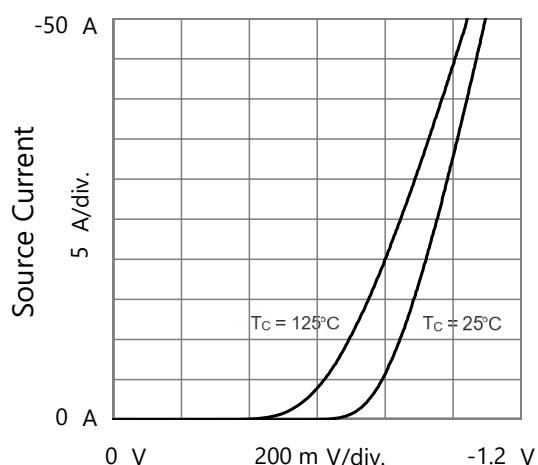
Gate to Source Voltage  
Transfer Characteristics



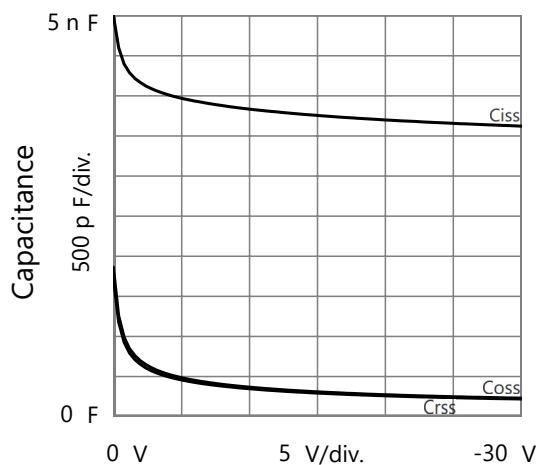
Gate to Source Voltage  
Drain to Source Resistance vs. Gate to Source Voltage



Drain Current  
Drain to Source Resistance vs. Drain Current

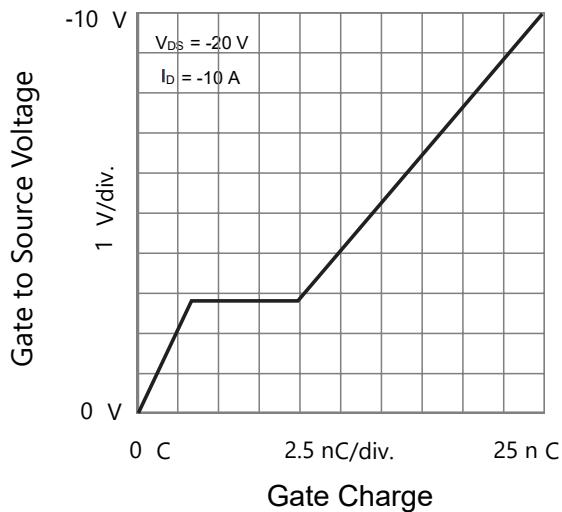


Source to Drain Voltage  
Body Diode Forward Characteristics

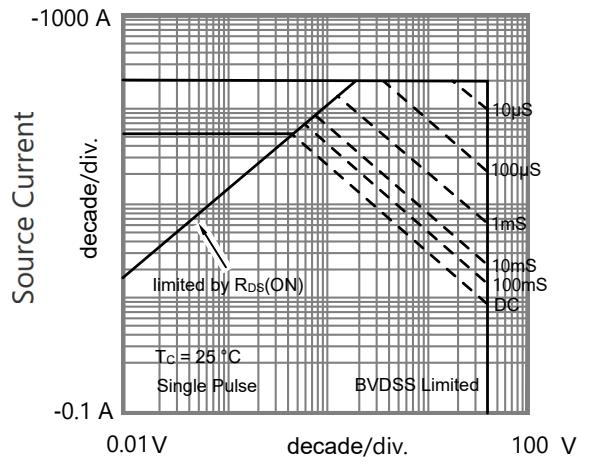


Drain to Source Voltage  
Capacitances

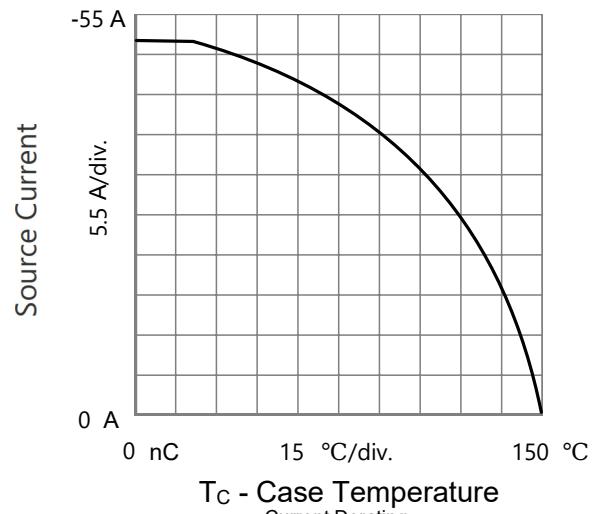
**P-C CHANNEL TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



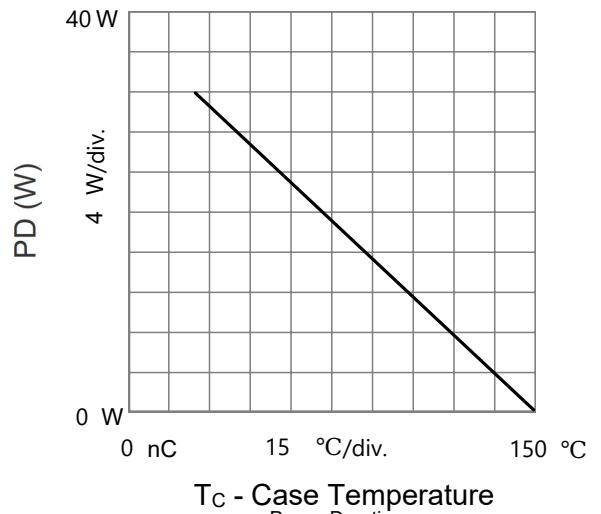
**Gate Charge**  
Gate to Source Voltage vs. Gate Charge



**Source to Drain Voltage**  
Safe Operating Area, Junction-to-Ambient

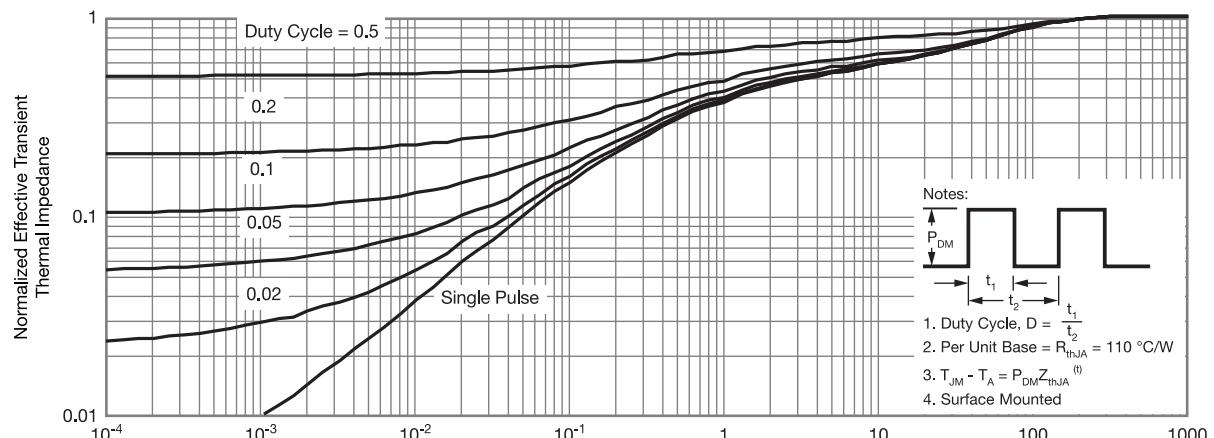


**T<sub>C</sub> - Case Temperature**  
Current Derating

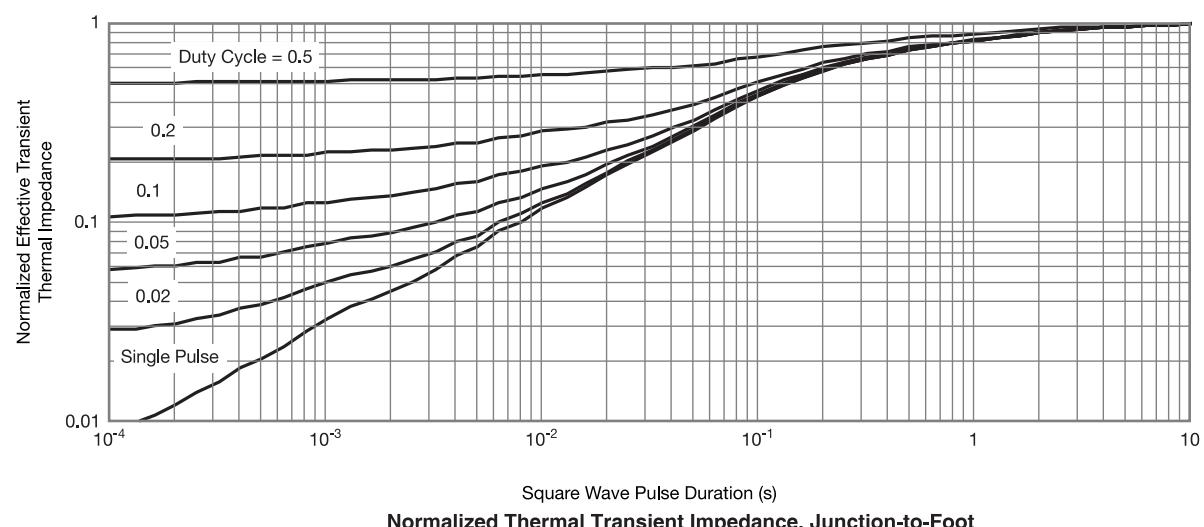


**T<sub>C</sub> - Case Temperature**  
Power Derating

**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

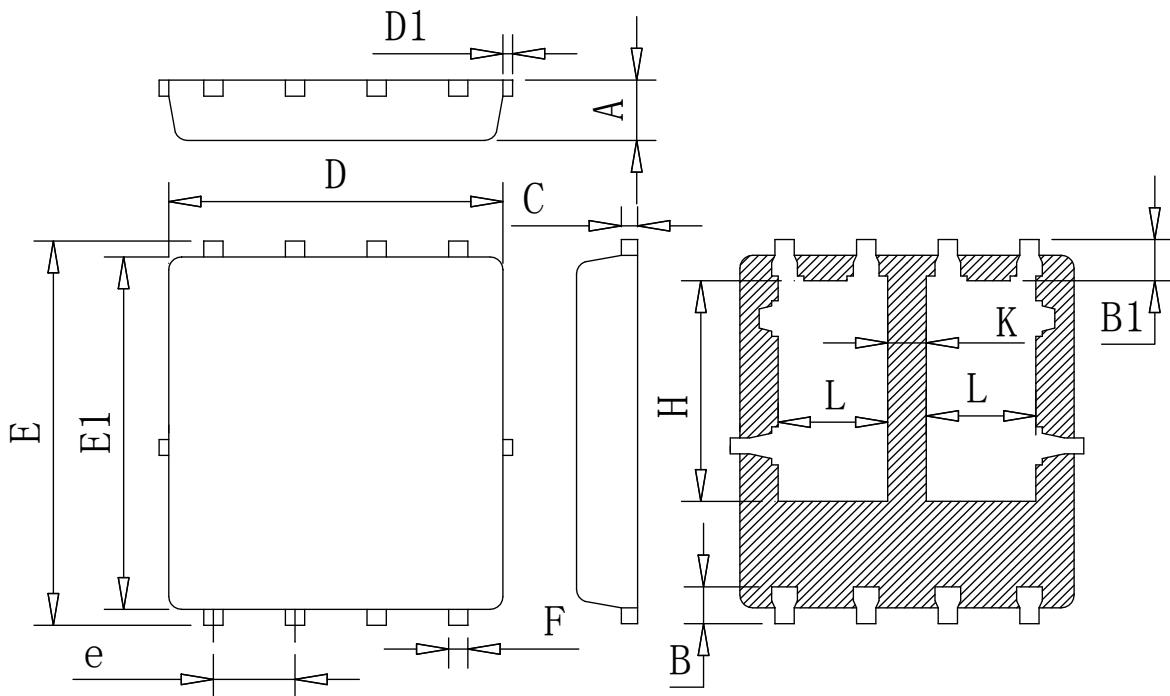


**Normalized Thermal Transient Impedance, Junction-to-Ambient**



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

## DFN5X6-8L-D PACKAGE OUTLINE



COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

Symbol	Min	Typ	Max
A	0.85	0.95	1.05
B	0.46	0.58	0.73
B1	0.52	0.65	0.78
C	0.18	0.254	0.32
D	4.70	5.20	5.50
D1	-	-	0.18
E	5.75	6.05	6.35
E1	5.35	5.65	5.85
e	1.15	1.27	1.50
F	0.15	0.30	0.50
H	3.15	3.47	3.80
L	1.35	1.70	2.10
K	0.35	0.60	1.00

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