

## N- and P-Channel 30 V (D-S) MOSFET

PRODUCT SUMMARY				
	V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (mΩ)(Typ.)	I <sub>D</sub> (A) <sup>a</sup>	Q <sub>g</sub> (Typ.)
N-Channel	30	11 at V <sub>GS</sub> = 10 V	11	10.3
		14 at V <sub>GS</sub> = 4.5 V	10	
P-Channel	- 30	21 at V <sub>GS</sub> = - 10 V	- 10.5	13
		27 at V <sub>GS</sub> = - 4.5 V	- 9.5	

### FEATURES

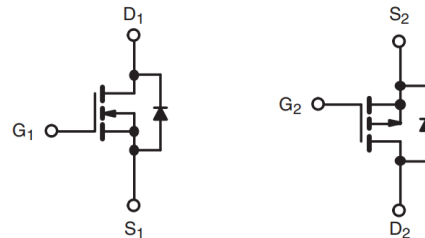
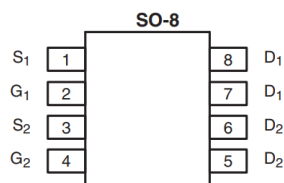
- DT-Trench Power MOSFET
- 100 % R<sub>G</sub> and UIS Tested
- Compliant to RoHS Directive 2002/95/EC



**RoHS**  
COMPLIANT

### APPLICATIONS

- Motor Drive



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>	30	- 30	V	
Gate-Source Voltage	V <sub>GS</sub>	± 20	± 20		
Continuous Drain Current (T <sub>J</sub> = 150 °C)	I <sub>D</sub>	T <sub>C</sub> = 25 °C	11	- 10.5	A
		T <sub>C</sub> = 70 °C	9.8	- 8.8	
		T <sub>A</sub> = 25 °C	8.8 <sup>b, c</sup>	- 7.6 <sup>b, c</sup>	
		T <sub>A</sub> = 70 °C	7.4 <sup>b, c</sup>	- 6.3 <sup>b, c</sup>	
Pulsed Drain Current (10 μs Pulse Width)	I <sub>DM</sub>	43	- 40	A	
Source-Drain Current Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	11		- 10.5
		T <sub>A</sub> = 25 °C	1.6 <sup>b, c</sup>	- 1.6 <sup>b, c</sup>	
Pulsed Source-Drain Current	I <sub>SM</sub>	43	- 40	mJ	
Single Pulse Avalanche Current	I <sub>AS</sub>	20	- 20		
Single Pulse Avalanche Energy	E <sub>AS</sub>	5	20	W	
Maximum Power Dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C	6.1		5.2
		T <sub>C</sub> = 70 °C	3		3.1
		T <sub>A</sub> = 25 °C	3 <sup>b, c</sup>		3 <sup>b, c</sup>
		T <sub>A</sub> = 70 °C	2.28 <sup>b, c</sup>	2.28 <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	N-Channel		P-Channel		Unit	
		Typ.	Max.	Typ.	Max.		
Maximum Junction-to-Ambient <sup>b, d</sup>	R <sub>thJA</sub>	20	32.5	27	32.5	°C/W	
Maximum Junction-to-Foot (Drain)	R <sub>thJF</sub>	10	20	19	28		

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> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)							
Parameter	Symbol	Test Conditions	Min.	Typ. <sup>a</sup>	Max.	Unit	
<b>Static</b>							
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	N-Ch	30		V	
		$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	P-Ch	-30			
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$	N-Ch		30	mV/ $^\circ\text{C}$	
		$I_D = -250\text{ }\mu\text{A}$	P-Ch		-24		
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	$I_D = 250\text{ }\mu\text{A}$	N-Ch		-4.1		
		$I_D = -250\text{ }\mu\text{A}$	P-Ch		5		
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	N-Ch	1	2.2	V	
		$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	P-Ch	-0.9	-2.5		
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$	N-Ch		$\pm 100$	nA	
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$	P-Ch		$\pm 100$		
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$	N-Ch		1	$\mu\text{A}$	
		$V_{DS} = -30\text{ V}, V_{GS} = 0\text{ V}$	P-Ch		-1		
		$V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$	N-Ch		10		
		$V_{DS} = -24\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$	P-Ch		-10		
On-State Drain Current <sup>b</sup>	$I_{D(on)}$	$V_{DS} = 5\text{ V}, V_{GS} = 10\text{ V}$	N-Ch	11		A	
		$V_{DS} = -5\text{ V}, V_{GS} = -10\text{ V}$	P-Ch	-10.5			
Drain-Source On-State Resistance <sup>b</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 5\text{ A}$	N-Ch		11	m $\Omega$	
		$V_{GS} = -10\text{ V}, I_D = -3\text{ A}$	P-Ch		21		
		$V_{GS} = 4.5\text{ V}, I_D = 4.5\text{ A}$	N-Ch		14		18
		$V_{GS} = -4.5\text{ V}, I_D = -2.5\text{ A}$	P-Ch		27		31
Forward Transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = 15\text{ V}, I_D = 5\text{ A}$	N-Ch		37	S	
		$V_{DS} = -15\text{ V}, I_D = -3\text{ A}$	P-Ch		35		
<b>Dynamic<sup>a</sup></b>							
Input Capacitance	$C_{iss}$	N-Channel $V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$  P-Channel $V_{DS} = -15\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	N-Ch		436	pF	
			P-Ch		1190		
Output Capacitance	$C_{oss}$		N-Ch		67		
			P-Ch		147		
Reverse Transfer Capacitance	$C_{rss}$		N-Ch		62		
			P-Ch		137		
Total Gate Charge	$Q_g$	N-Channel $V_{DS} = 15\text{ V}, V_{GS} = 10\text{ V}, I_D = 5\text{ A}$  P-Channel $V_{DS} = -15\text{ V}, V_{GS} = -10\text{ V}, I_D = -3\text{ A}$	N-Ch		10	nC	
			P-Ch		22		
Gate-Source Charge	$Q_{gs}$		N-Ch		2		
			P-Ch		6		
Gate-Drain Charge	$Q_{gd}$		N-Ch		6		
			P-Ch		9		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$	N-Ch		2	$\Omega$	
			P-Ch		6		

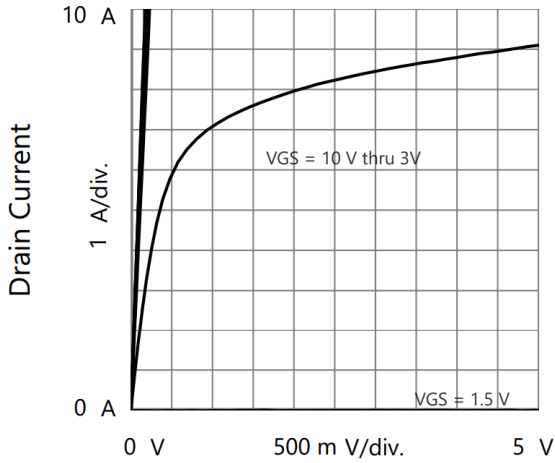
<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)							
Parameter	Symbol	Test Conditions	Min.	Typ. <sup>a</sup>	Max.	Unit	
<b>Dynamic<sup>a</sup></b>							
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 15\text{ V}, R_L = 3.7\ \Omega$ $I_D \equiv 5\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\ \Omega$	N-Ch		5	ns	
Rise Time	$t_r$		P-Ch		10		
Turn-Off Delay Time	$t_{d(off)}$	P-Channel $V_{DD} = -15\text{ V}, R_L = 2\ \Omega$ $I_D \equiv -3\text{ A}, V_{GEN} = -10\text{ V}, R_g = 1\ \Omega$	N-Ch		10		
			P-Ch		9		
Fall Time	$t_f$		N-Ch		16		
			P-Ch		50		
Turn-On Delay Time	$t_{d(on)}$		N-Channel $V_{DD} = 15\text{ V}, R_L = 3.7\ \Omega$ $I_D \equiv 4.5\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\ \Omega$	N-Ch			11
				P-Ch			42
Rise Time	$t_r$			N-Ch		12	
				P-Ch		40	
Turn-Off Delay Time	$t_{d(off)}$	N-Ch			17		
		P-Ch			40		
Fall Time	$t_f$	N-Ch			7		
		P-Ch			18		
<b>Drain-Source Body Diode Characteristics</b>							
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$	N-Ch		11	A	
			P-Ch		- 10.5		
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$		N-Ch		43	A	
			P-Ch		- 40		
Body Diode Voltage	$V_{SD}$		$I_S = 5\text{ A}$	N-Ch	0.81	1.2	V
			$I_S = -3\text{ A}$	P-Ch	- 0.77	- 1.2	
Body Diode Reverse Recovery Time	$t_{rr}$		N-Channel $I_F = 5\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$	N-Ch	17		ns
	P-Ch			41			
Body Diode Reverse Recovery Charge	$Q_{rr}$		P-Channel $I_F = -3\text{ A}, di/dt = -100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$	N-Ch	10		nC
				P-Ch	32		
Reverse Recovery Fall Time	$t_a$	N-Ch		10		ns	
		P-Ch		15			
Reverse Recovery Rise Time	$t_b$	N-Ch		7			
		P-Ch		26			

Notes:

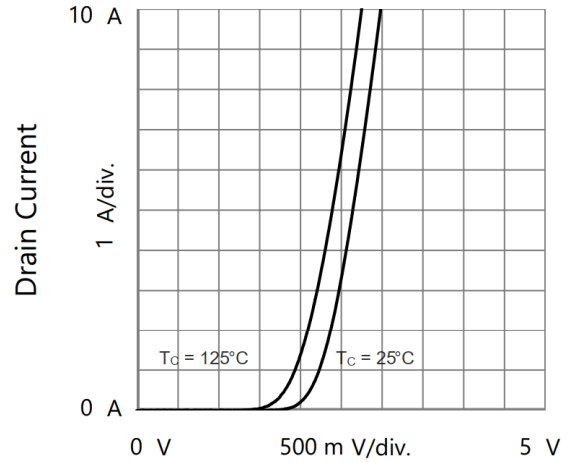
- a. Guaranteed by design, not subject to production testing.  
b. Pulse test; pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

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.

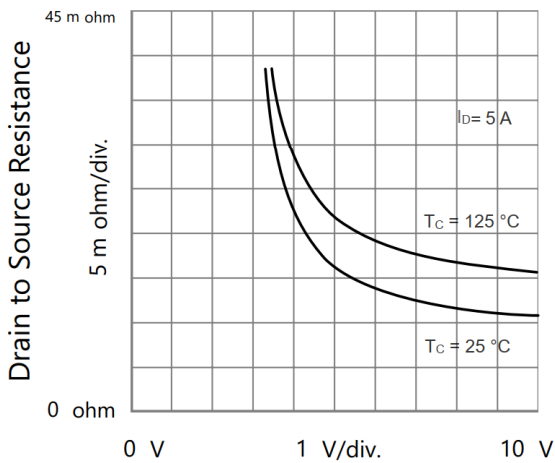
**N-CHANNEL TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



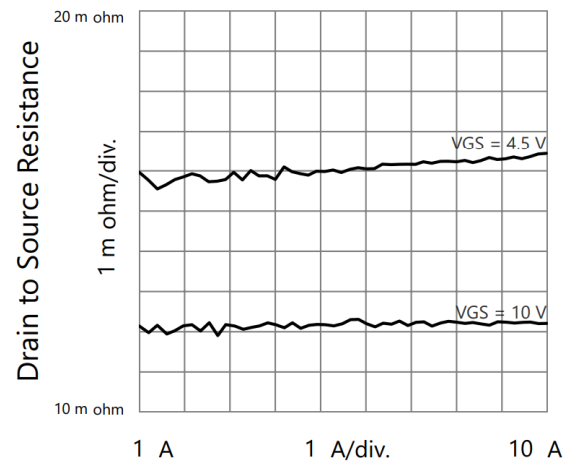
Drain to Source Voltage  
Output Characteristics



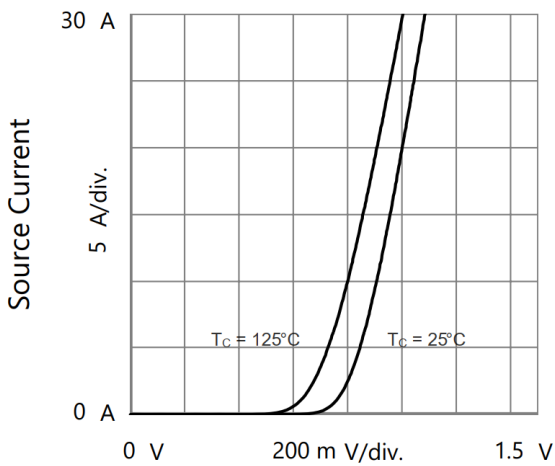
Gate to Source Voltage  
Transfer Characteristics



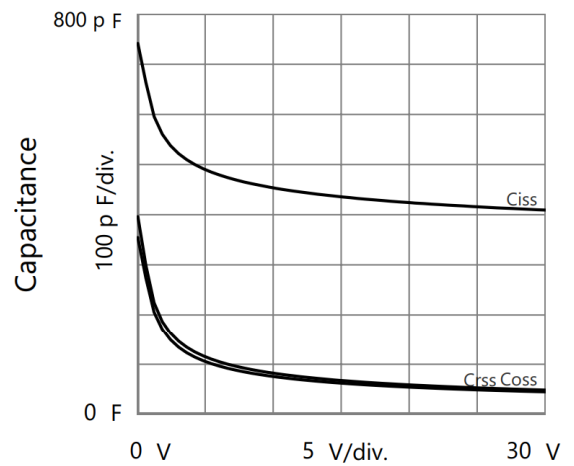
Gate to Source Voltage  
Drain to Source Resistance vs. Gate to Source Voltage



Drain Current  
Drain to Source Resistance vs. Drain Current

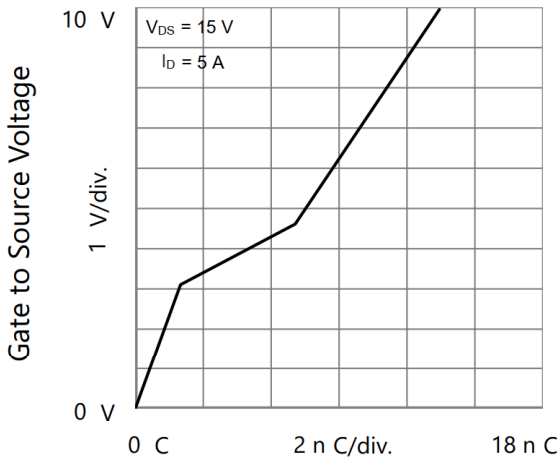


Source to Drain Voltage  
Body Diode Forward Characteristics

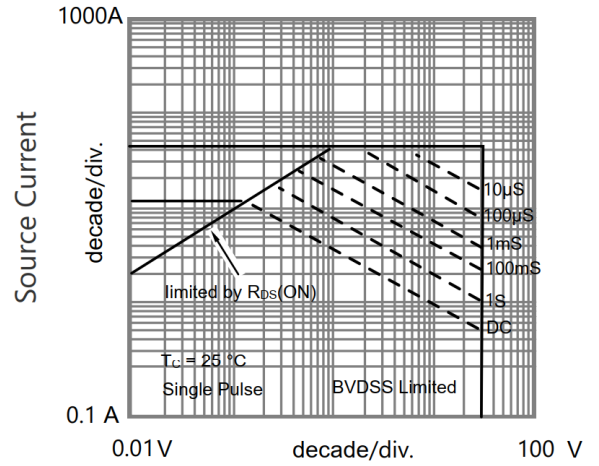


Drain to Source Voltage  
Capacitances

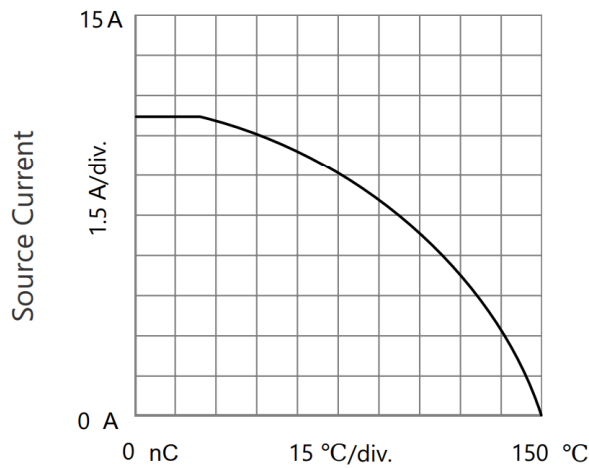
**N-CHANNEL TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



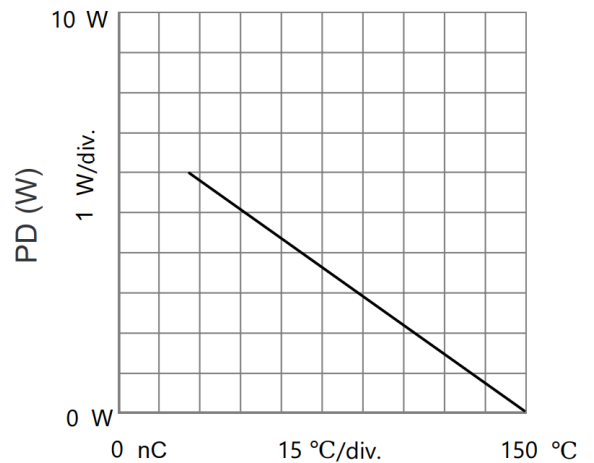
**Gate Charge**  
Gate to Source Voltage vs. GateCharge



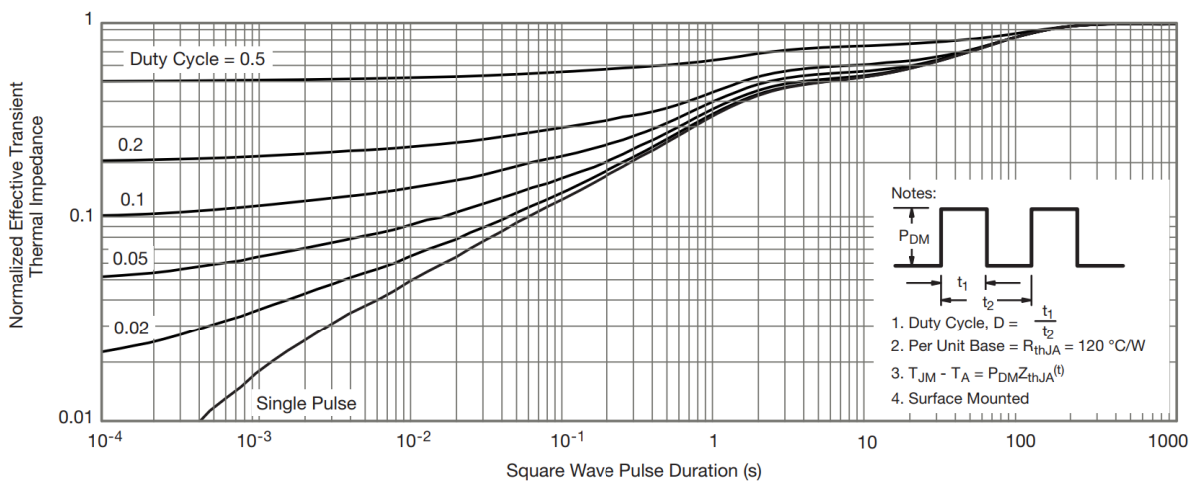
**Source to Drain Voltage**  
Safe Operating Area, Junction-to-Ambient



**$T_C$  - Case Temperature**  
Current Derating

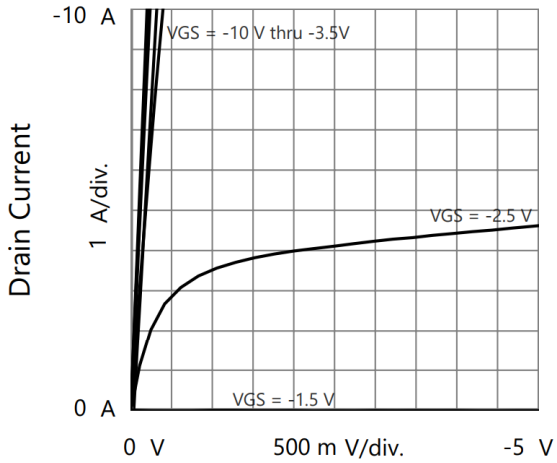


**$T_C$  - Case Temperature**  
Power Derating

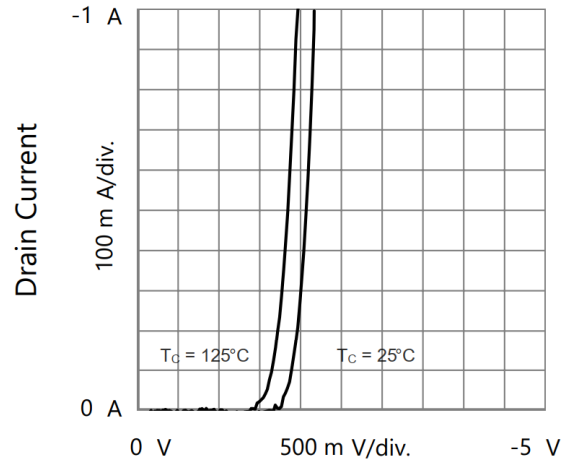


**Normalized Thermal Transient Impedance, Junction-to-Ambient**

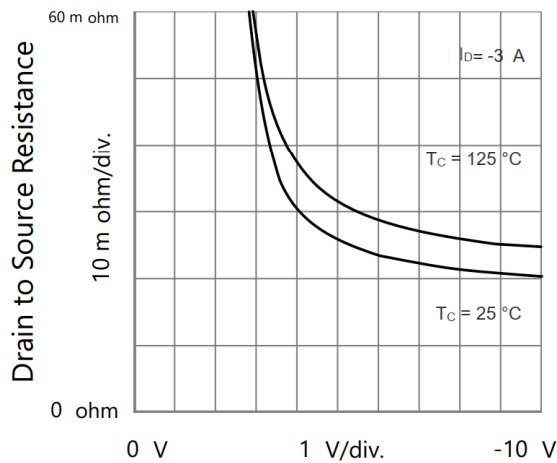
**P-CHANNEL TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



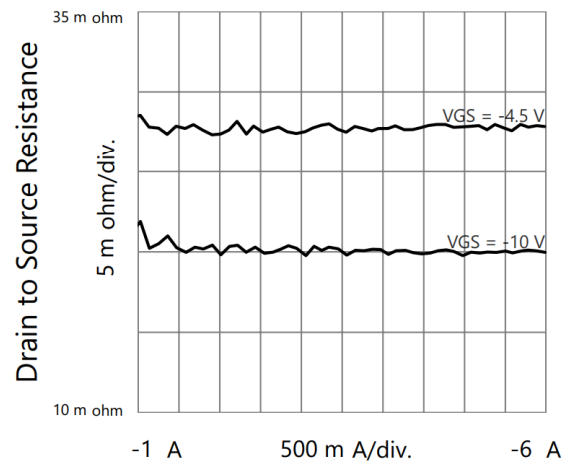
Drain to Source Voltage  
Output Characteristics



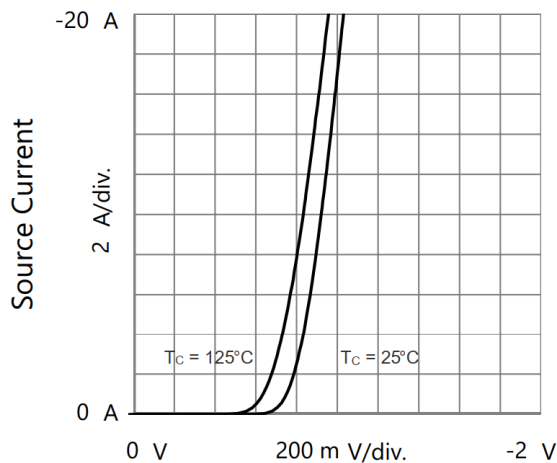
Gate to Source Voltage  
Transfer Characteristics



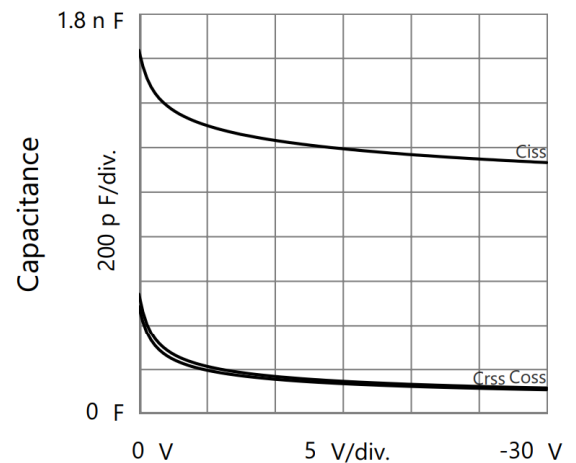
Gate to Source Voltage  
Drain to Source Resistance vs. Gate to Source Voltage



Drain Current  
Drain to Source Resistance vs. Drain Current

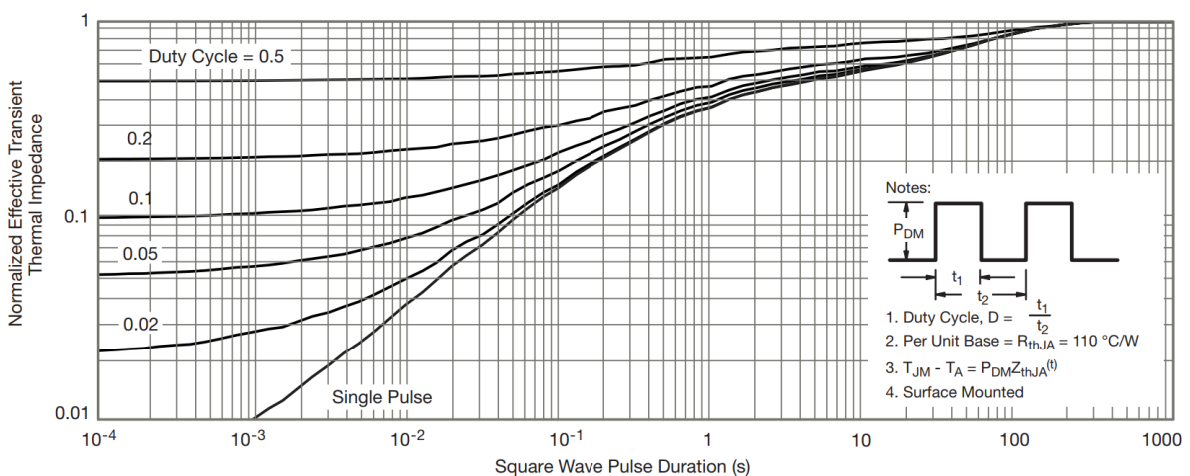
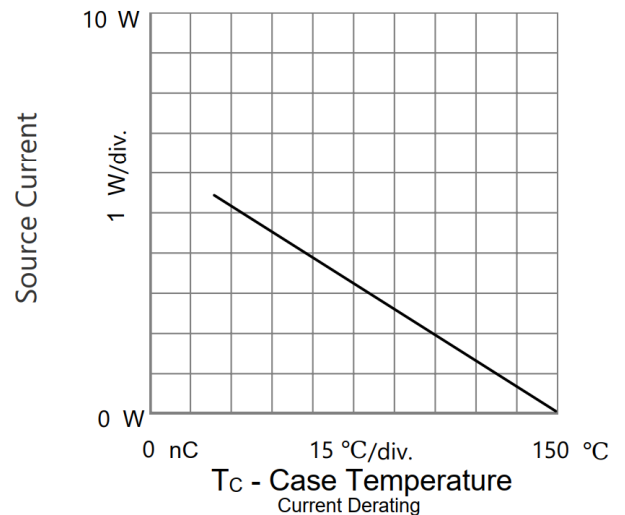
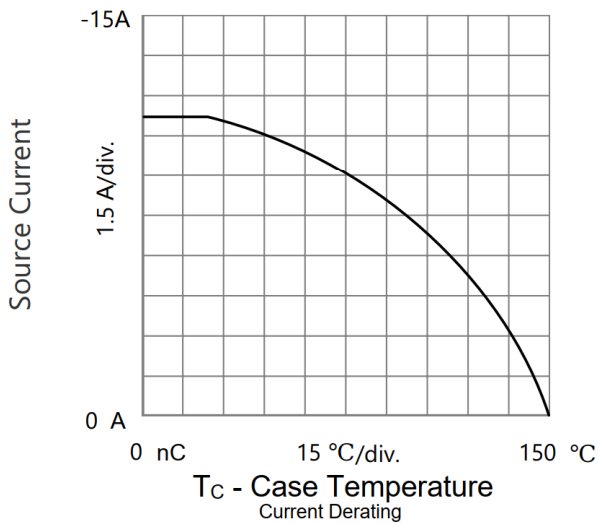
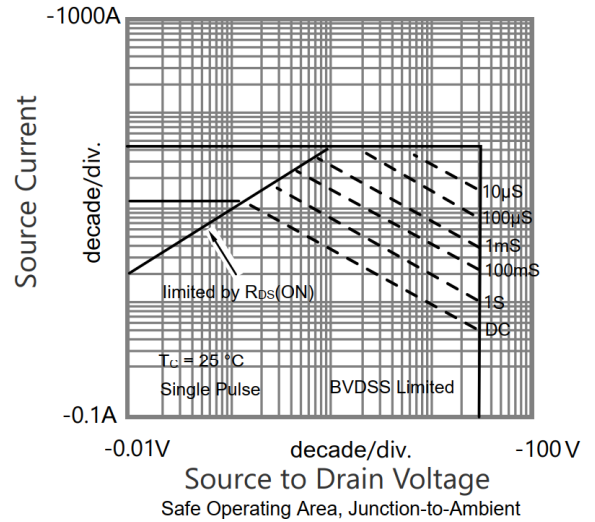
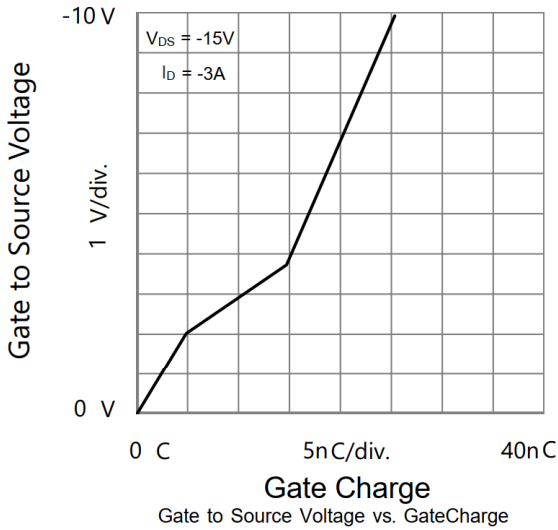


Source to Drain Voltage  
Body Diode Forward Characteristics



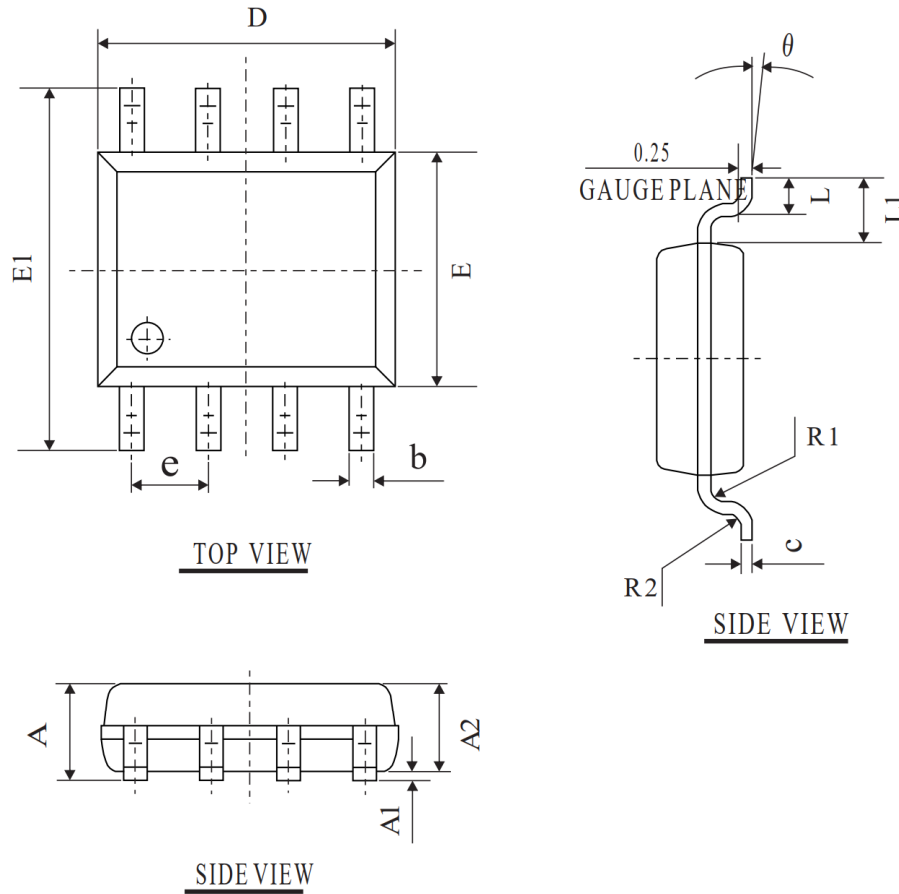
Drain to Source Voltage  
Capacitances

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



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

## SOP-8 PACKAGE OUTLINE



COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	TYP	MAX
A	1.30	1.60	1.85
A1	0.03	0.15	0.28
A2	1.20	1.45	1.70
b	0.26	0.40	0.54
C	0.132	0.203	0.273
D	4.50	4.90	5.30
E	3.50	3.00	4.30
E1	5.50	6.00	6.50
L	0.30	0.70	1.10
$\theta$	2°	4°	6°
L1	1.04REF		
e	1.27BSC		
R1	0.07TYP		
R2	0.07TYP		



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