

## 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	16 at V <sub>GS</sub> = 10 V	8 <sup>e</sup>	6.5
		18 at V <sub>GS</sub> = 8 V	8 <sup>e</sup>	
		20 at V <sub>GS</sub> = 4.5 V	8	
P-Channel	- 30	29 at V <sub>GS</sub> = - 10 V	- 8 <sup>e</sup>	21.7
		35 at V <sub>GS</sub> = - 8 V	- 8 <sup>e</sup>	
		39 at V <sub>GS</sub> = - 4.5 V	- 7.5	

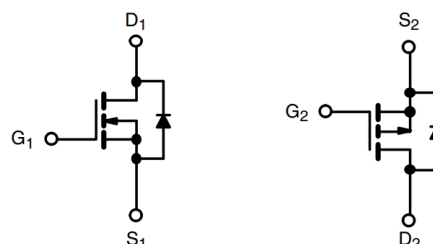
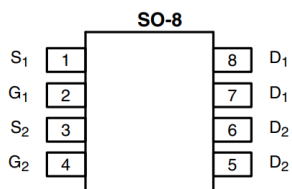
### FEATURES

- DT-Trench Power MOSFET
- 100 % R<sub>g</sub> and UIS Tested
- Compliant to RoHS Directive 2002/95/EC
- AEC-Q101 Qualified for Automotive Applications



### 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	8 <sup>e</sup>	- 8 <sup>e</sup>	A
		T <sub>C</sub> = 70 °C	6.8	- 6.8	
		T <sub>A</sub> = 25 °C	6.8 <sup>b, c</sup>	- 6.6 <sup>b, c</sup>	
		T <sub>A</sub> = 70 °C	5.4 <sup>b, c</sup>	- 5.3 <sup>b, c</sup>	
Pulsed Drain Current (10 μs Pulse Width)	I <sub>DM</sub>	40	- 40	A	
Source-Drain Current Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	2.6		- 2.6
		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>	40	- 40	mJ	
Single Pulse Avalanche Current	I <sub>AS</sub>	10	- 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	3.1		3.2
		T <sub>C</sub> = 70 °C	2		2.1
		T <sub>A</sub> = 25 °C	2 <sup>b, c</sup>		2 <sup>b, c</sup>
		T <sub>A</sub> = 70 °C	1.28 <sup>b, c</sup>	1.28 <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>	R <sub>thJA</sub>	50	62.5	47	62.5	°C/W	
Maximum Junction-to-Foot (Drain)	R <sub>thJF</sub>	30	40	29	38		

Notes:

- Based on T<sub>C</sub> = 25 °C.
- Surface mounted on 1" x 1" FR4 board.
- t = 10 s.
- Maximum under steady state conditions is 120 °C/W (n-channel) and 110 °C/W (p-channel).
- Package limited.

<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	-1.2	-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		
		$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$	N-Ch		10		
		$V_{DS} = -30\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$	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	20		A	
		$V_{DS} = -5\text{ V}, V_{GS} = -10\text{ V}$	P-Ch	-20			
Drain-Source On-State Resistance <sup>b</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 6.8\text{ A}$	N-Ch		16	18	m $\Omega$
		$V_{GS} = -10\text{ V}, I_D = -8\text{ A}$	P-Ch		29	32	
		$V_{GS} = 8\text{ V}, I_D = 6.7\text{ A}$	N-Ch		18	20	
		$V_{GS} = -8\text{ V}, I_D = -6.5\text{ A}$	P-Ch		35	39	
		$V_{GS} = 4.5\text{ V}, I_D = 6.6\text{ A}$	N-Ch		20	22	
		$V_{GS} = -4.5\text{ V}, I_D = -5\text{ A}$	P-Ch		39	43	
Forward Transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = 15\text{ V}, I_D = 6.8\text{ A}$	N-Ch		27	S	
		$V_{DS} = -15\text{ V}, I_D = -6.7\text{ A}$	P-Ch		25		
<b>Dynamic<sup>a</sup></b>							
Input Capacitance	$C_{iss}$	N-Channel $V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	N-Ch		600	pF	
Output Capacitance	$C_{oss}$		P-Ch		1010		
Reverse Transfer Capacitance	$C_{rss}$		N-Ch		115		
		P-Channel $V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	P-Ch		240		
			N-Ch		41		
Total Gate Charge	$Q_g$	$V_{DS} = 20\text{ V}, V_{GS} = 10\text{ V}, I_D = 7\text{ A}$	N-Ch		13.3	20	nC
		$V_{DS} = -20\text{ V}, V_{GS} = -10\text{ V}, I_D = -7\text{ A}$	P-Ch		41.5	63	
Gate-Source Charge	$Q_{gs}$	N-Channel $V_{DS} = 20\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 7\text{ A}$	N-Ch		6.5	10	
			P-Ch		21.7	33	
Gate-Drain Charge	$Q_{gd}$	P-Channel $V_{DS} = -20\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -7\text{ A}$	N-Ch		2.3		
			P-Ch		5.6		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$	N-Ch	0.3	1.3	2.6	$\Omega$
			P-Ch	1.3	6.4	12.8	

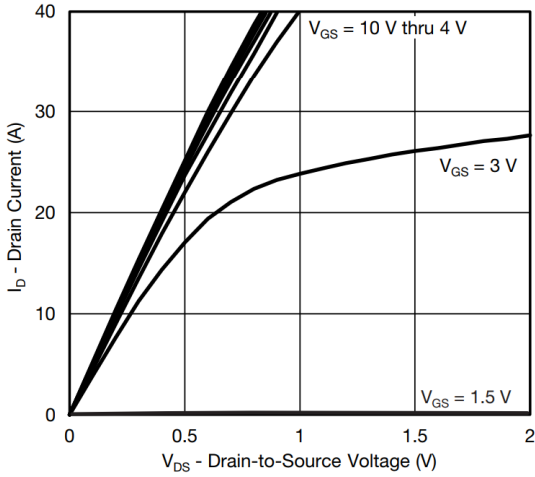
<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)							
Parameter	Symbol	Test Conditions	Min.	Typ. <sup>a</sup>	Max.	Unit	
<b>Dynamic<sup>a</sup></b>							
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 20\text{ V}$ , $R_L = 3.7\ \Omega$ $I_D \equiv 5.4\text{ A}$ , $V_{GEN} = 10\text{ V}$ , $R_g = 1\ \Omega$	N-Ch		5	10	ns
Rise Time	$t_r$		P-Ch		10	20	
Turn-Off Delay Time	$t_{d(off)}$	P-Channel $V_{DD} = -20\text{ V}$ , $R_L = 2\ \Omega$ $I_D \equiv -7\text{ A}$ , $V_{GEN} = -10\text{ V}$ , $R_g = 1\ \Omega$	N-Ch		10	20	
			P-Ch		9	18	
Fall Time	$t_f$		N-Ch		16	25	
			P-Ch		50	90	
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 20\text{ V}$ , $R_L = 3.7\ \Omega$ $I_D \equiv 5.4\text{ A}$ , $V_{GEN} = 4.5\text{ V}$ , $R_g = 1\ \Omega$	N-Ch		7	14	
			P-Ch		13	26	
Rise Time	$t_r$		N-Ch		11	22	
			P-Ch		42	75	
Turn-Off Delay Time	$t_{d(off)}$	P-Channel $V_{DD} = -20\text{ V}$ , $R_L = 2\ \Omega$ $I_D \equiv -7\text{ A}$ , $V_{GEN} = -4.5\text{ V}$ , $R_g = 1\ \Omega$	N-Ch		12	22	
			P-Ch		40	70	
Fall Time	$t_f$		N-Ch		17	26	
			P-Ch		40	70	
Turn-On Delay Time	$t_{d(on)}$		N-Ch		7	14	
			P-Ch		18	35	
<b>Drain-Source Body Diode Characteristics</b>							
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$	N-Ch			2.6	A
			P-Ch			-2.6	
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$		N-Ch			40	A
			P-Ch			-40	
Body Diode Voltage	$V_{SD}$	$I_S = 5.4\text{ A}$	N-Ch		0.81	1.2	V
		$I_S = -2\text{ A}$	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	34	ns
			P-Ch		41	80	
Body Diode Reverse Recovery Charge	$Q_{rr}$	P-Channel $I_F = -5\text{ A}$ , $di/dt = -100\text{ A}/\mu\text{s}$ , $T_J = 25\text{ }^\circ\text{C}$	N-Ch		10	20	nC
			P-Ch		32	65	
Reverse Recovery Fall Time	$t_a$		N-Ch		10		ns
Reverse Recovery Rise Time	$t_b$		P-Ch		15		
		N-Ch		7			
		P-Ch		26			

**Notes:**

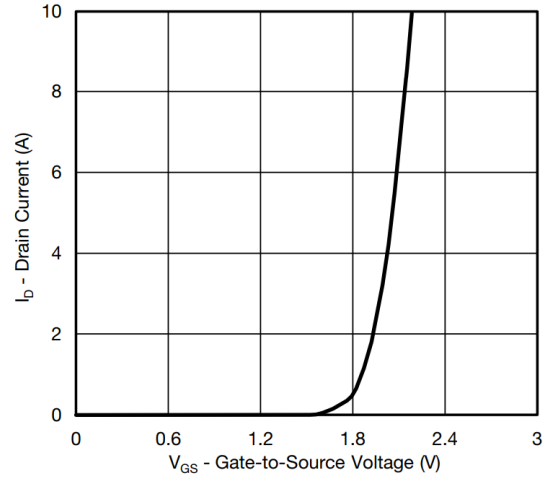
- a. Guaranteed by design, not subject to production testing.  
 b. Pulse test; pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

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.

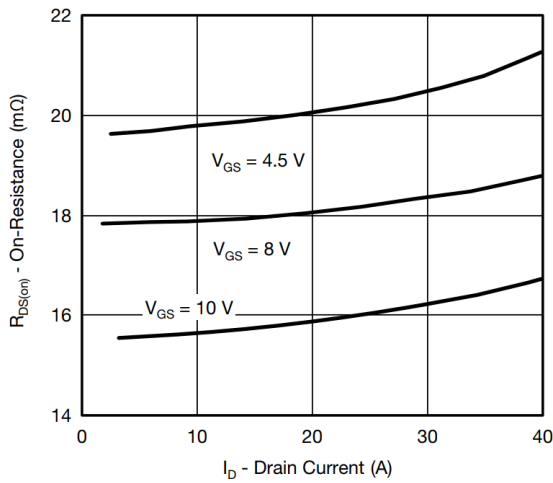
**N-CHANNEL TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



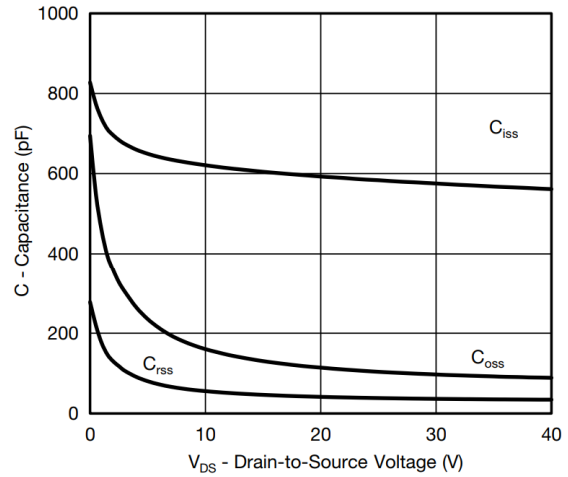
**Output Characteristics**



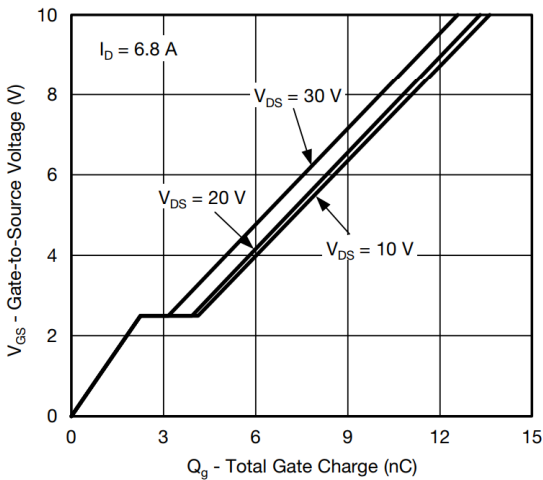
**Transfer Characteristics**



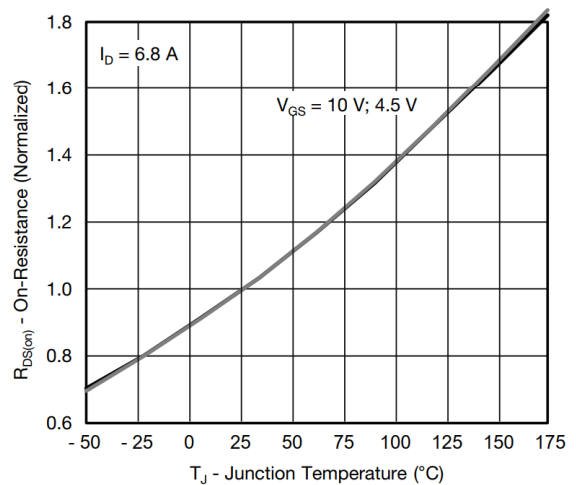
**On-Resistance vs. Drain Current and Gate Voltage**



**Capacitance**

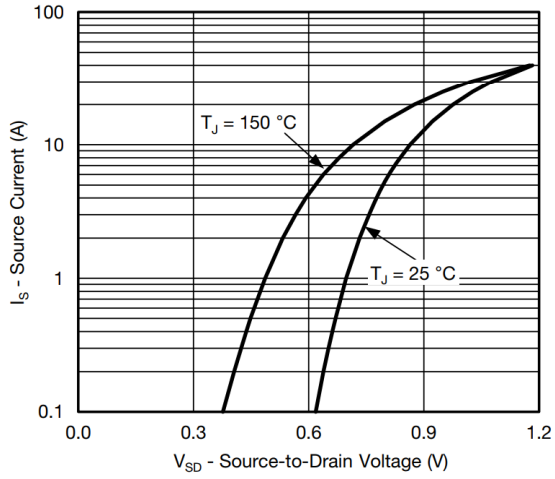


**Gate Charge**

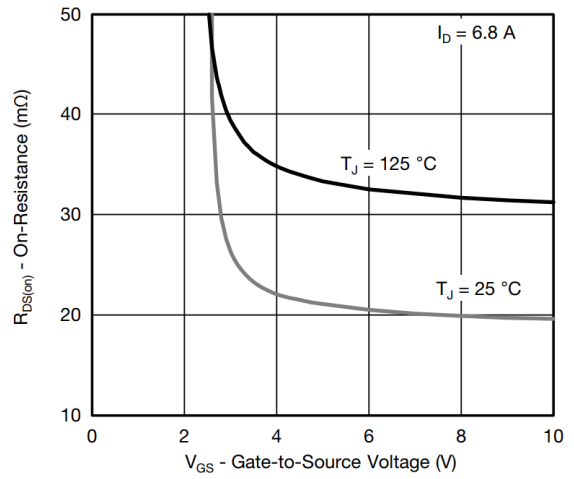


**On-Resistance vs. Junction Temperature**

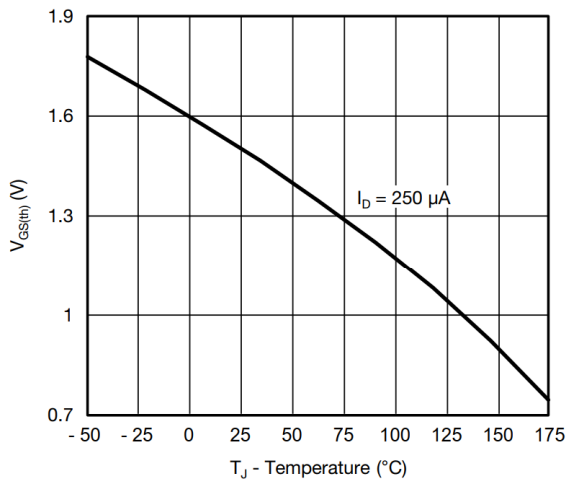
**N-CHANNEL TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



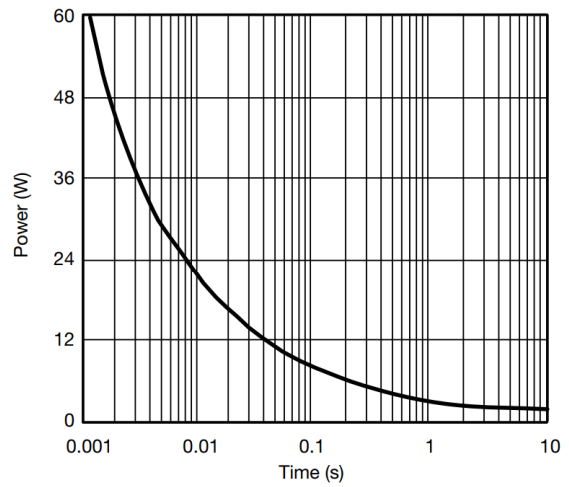
**Source-Drain Diode Forward Voltage**



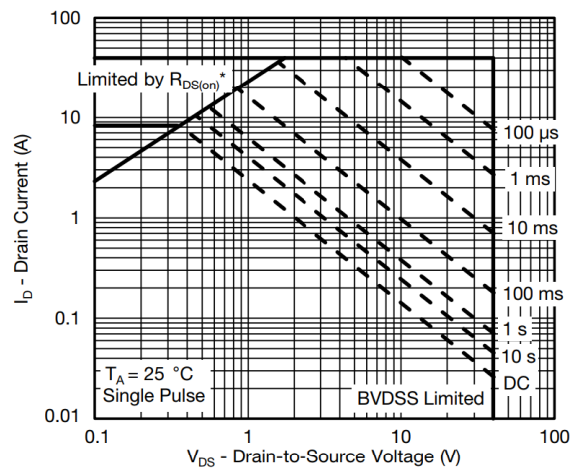
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**

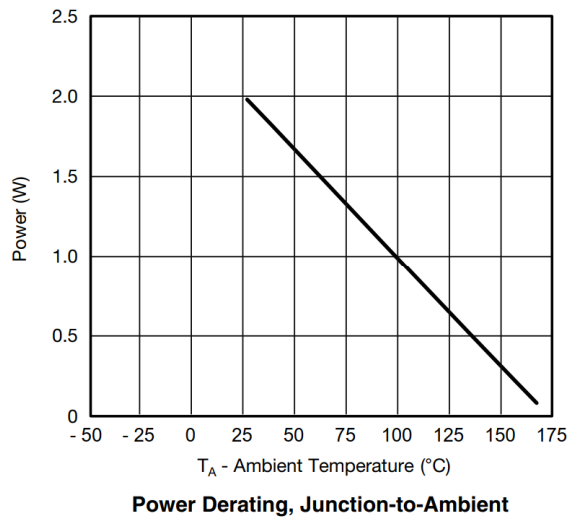
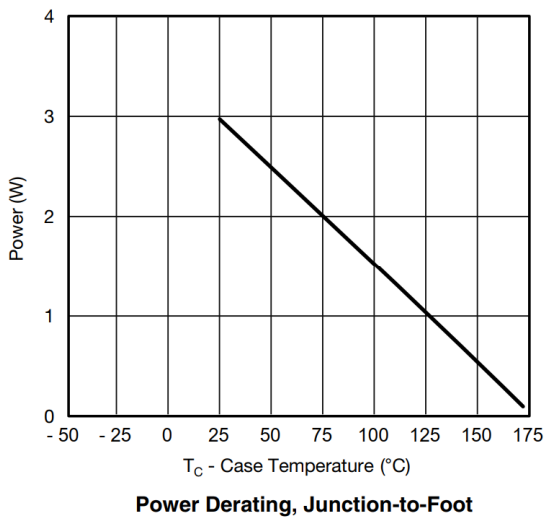
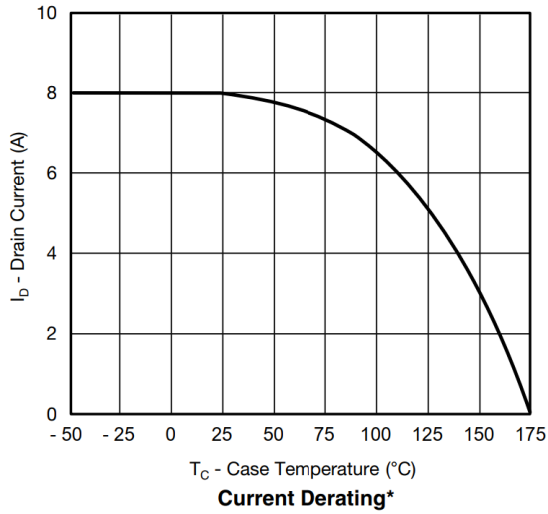


**Single Pulse Power, Junction-to-Ambient**



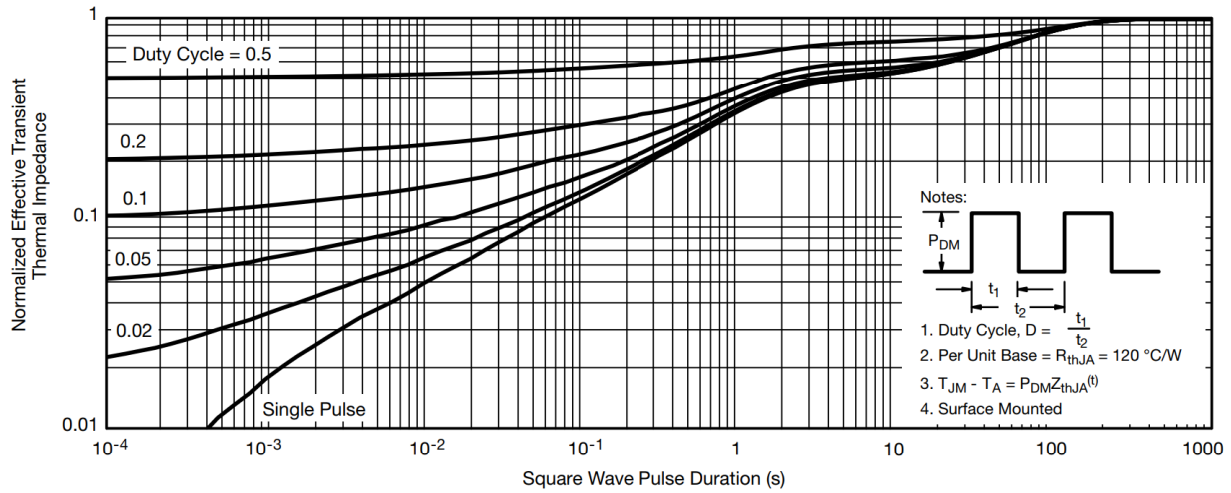
**Safe Operating Area, Junction-to-Ambient**  
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

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

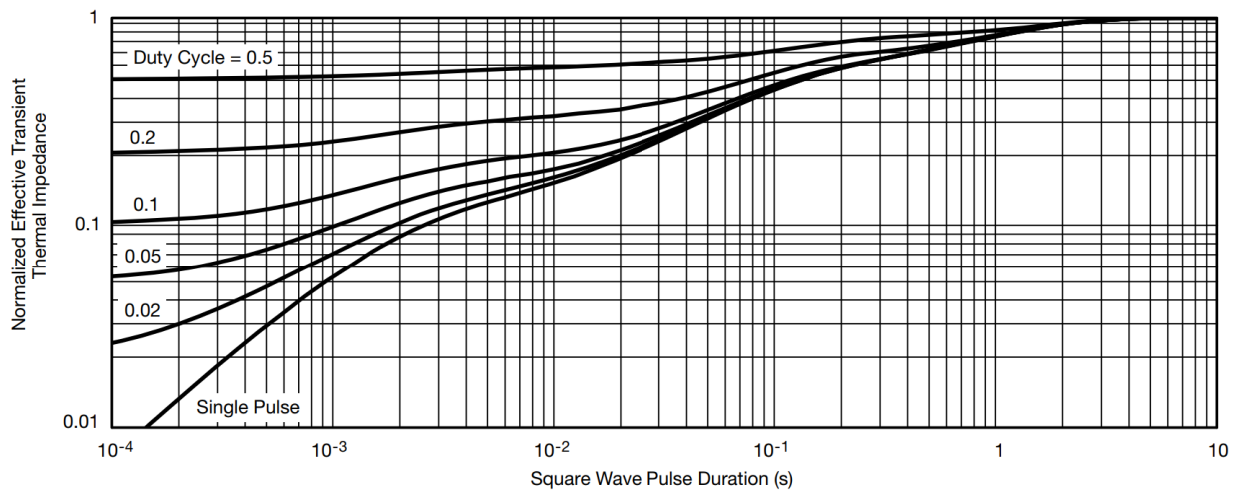


\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package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

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

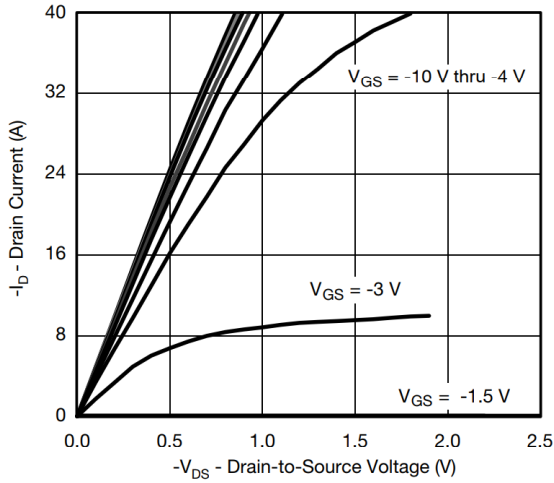


**Normalized Thermal Transient Impedance, Junction-to-Ambient**

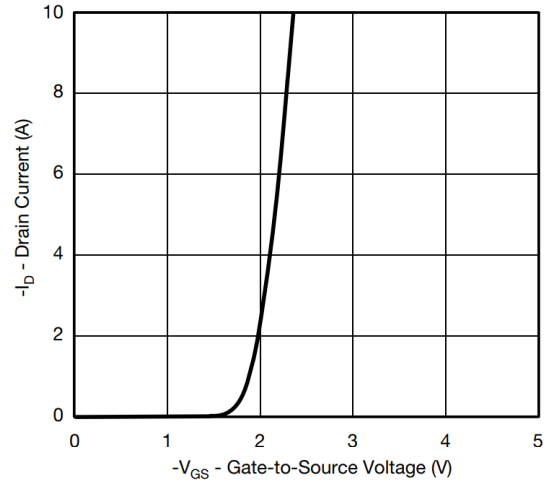


**Normalized Thermal Transient Impedance, Junction-to-Foot**

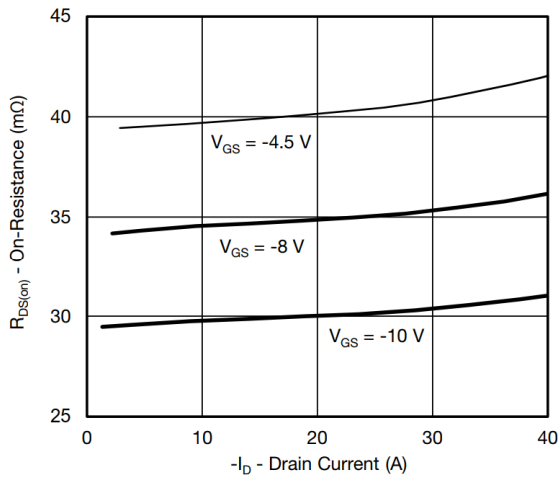
**P-CHANNEL TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



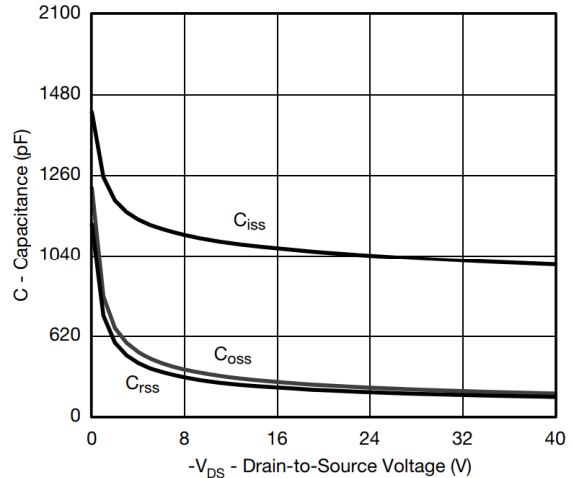
**Output Characteristics**



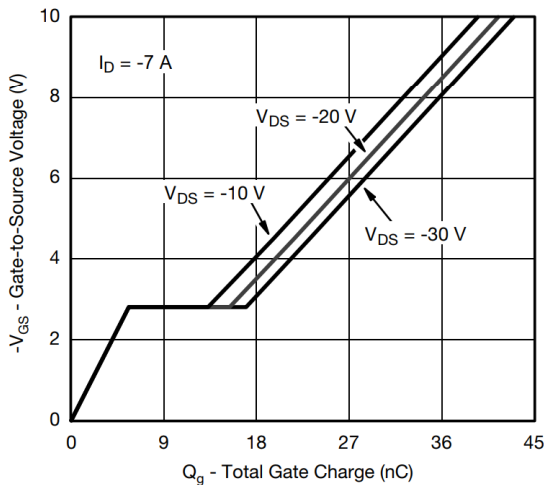
**Transfer Characteristics**



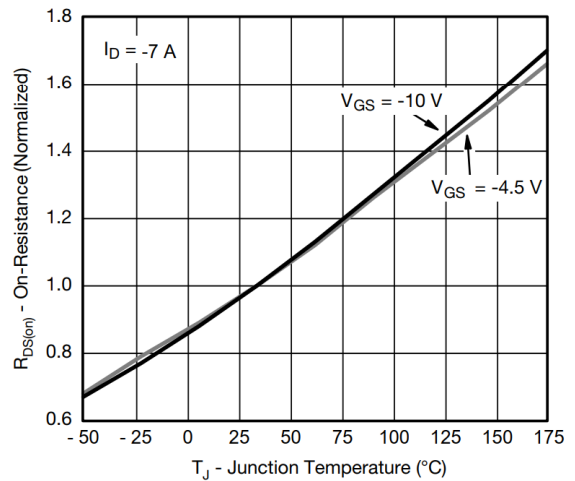
**On-Resistance vs. Drain Current and Gate Voltage**



**Capacitance**



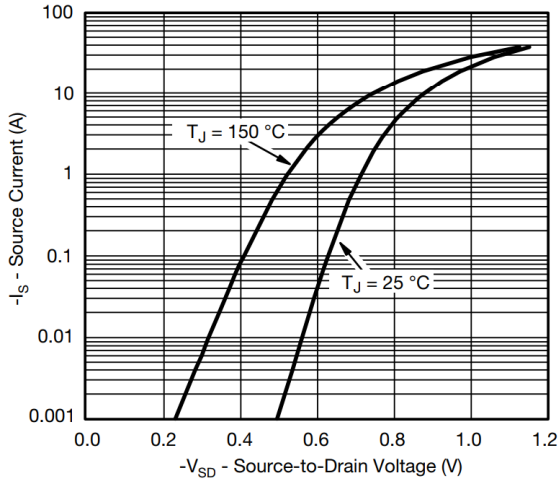
**Gate Charge**



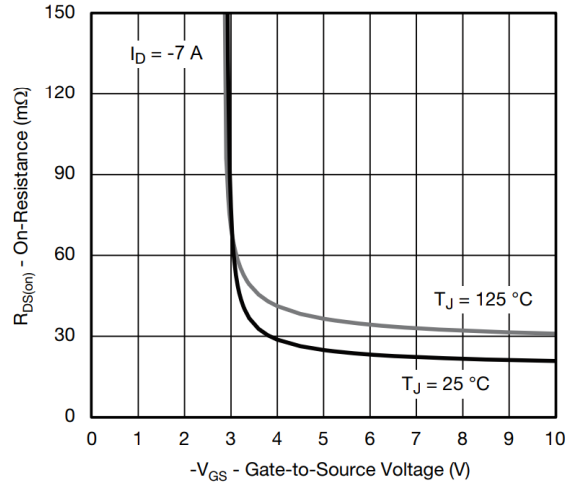
**On-Resistance vs. Junction Temperature**



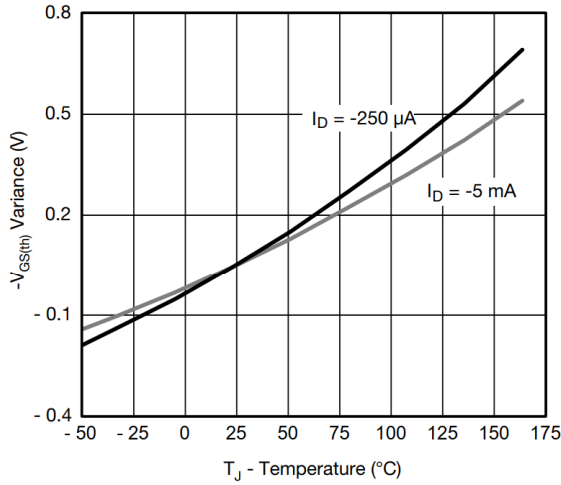
**P-CHANNEL TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



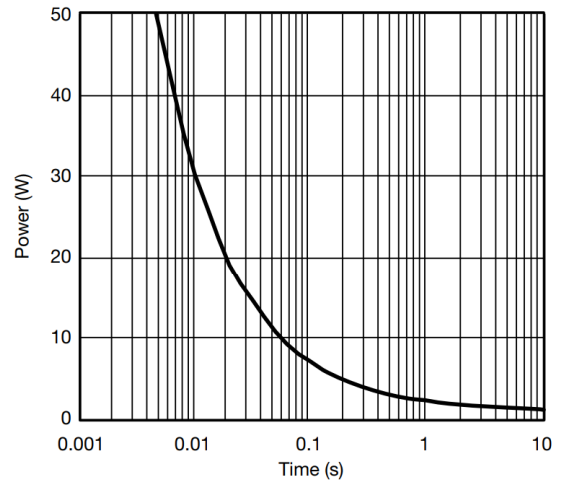
Source-Drain Diode Forward Voltage



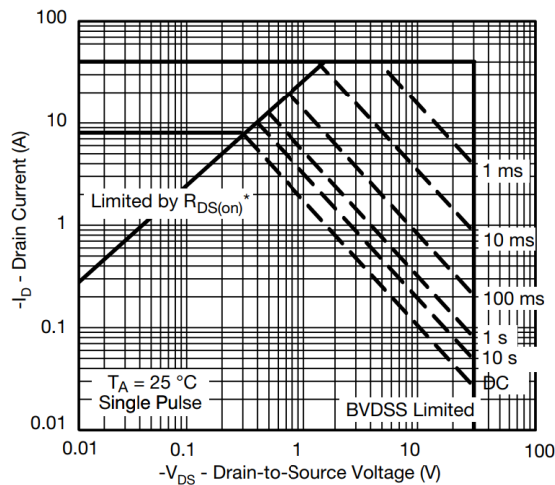
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

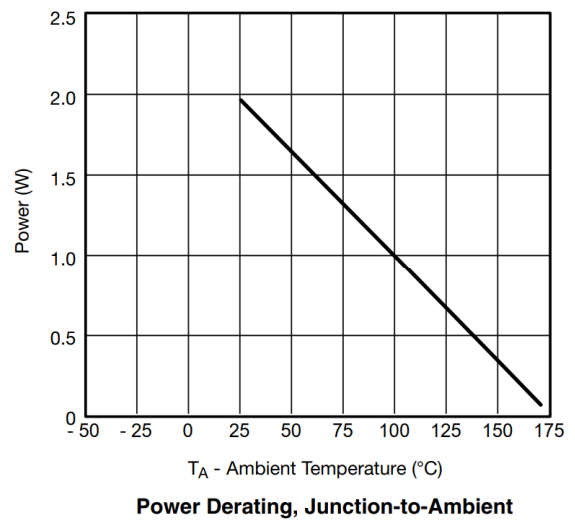
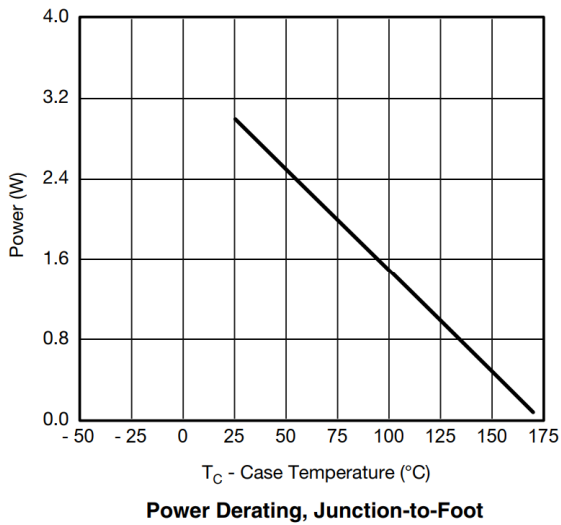
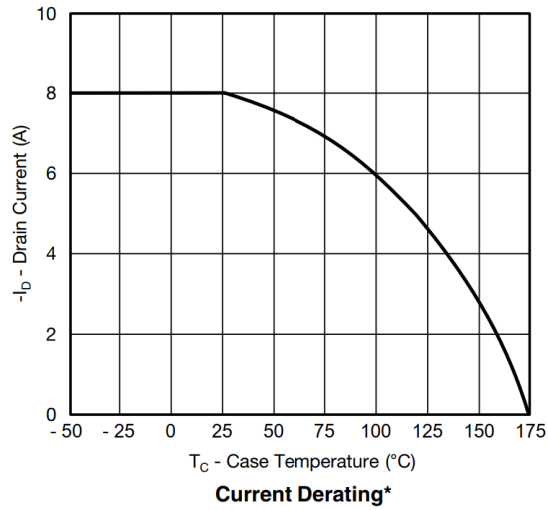


Single Pulse Power, Junction-to-Ambient



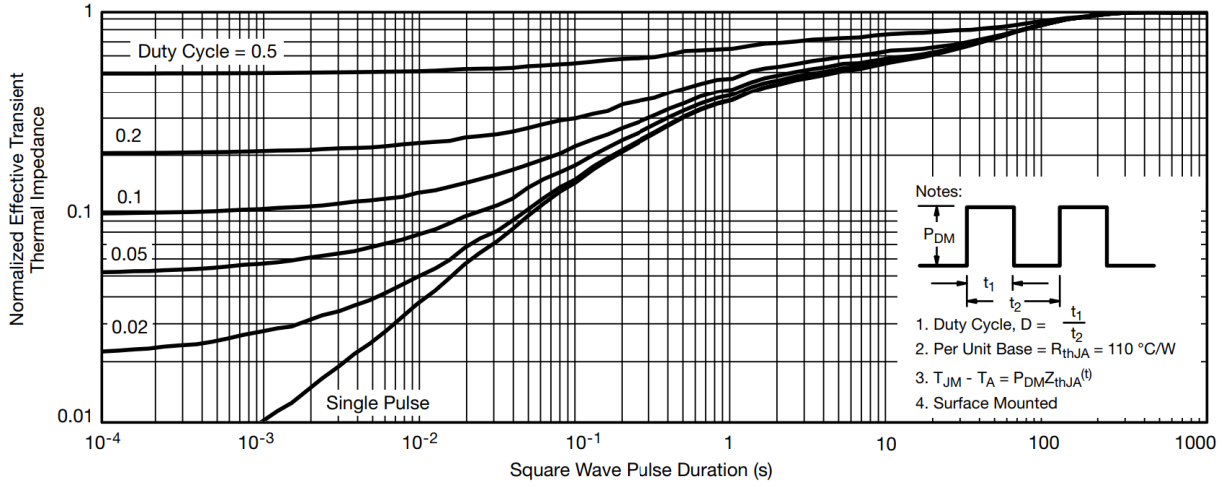
Safe Operating Area, Junction-to-Ambient  
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

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

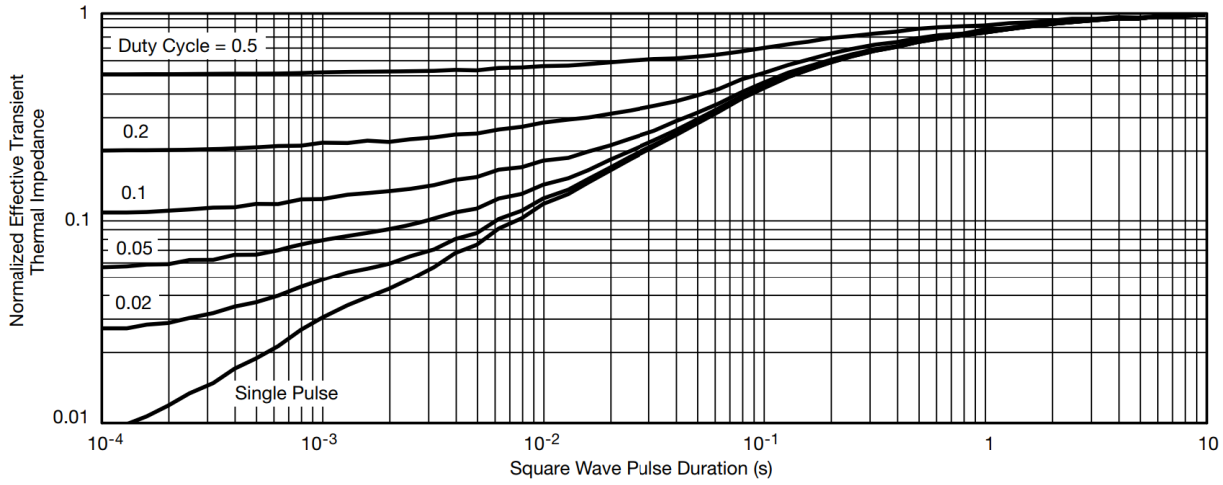


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**P-CHANNEL TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

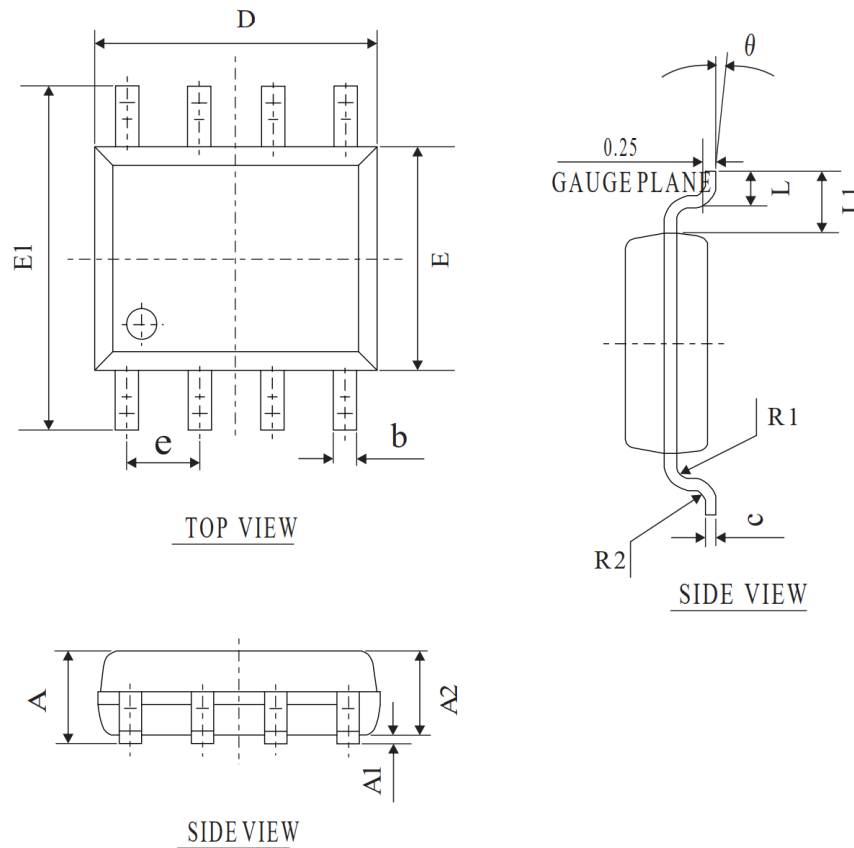


**Normalized Thermal Transient Impedance, Junction-to-Ambient**



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

**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
θ	2°	4°	6°
L1	1.04REF		
e	1.27BSC		
R1	0.07TYP		
R2	0.07TYP		

## Disclaimer

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