

## P-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY			
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A)	Q <sub>g</sub> (Typ.)
- 20	0.075 at V <sub>GS</sub> = - 4.5 V	- 6.6 <sup>a</sup>	12.5 nC
	0.081 at V <sub>GS</sub> = - 3.6 V	- 6 <sup>a</sup>	
	0.090 at V <sub>GS</sub> = - 2.5 V	- 6 <sup>a</sup>	

### FEATURES

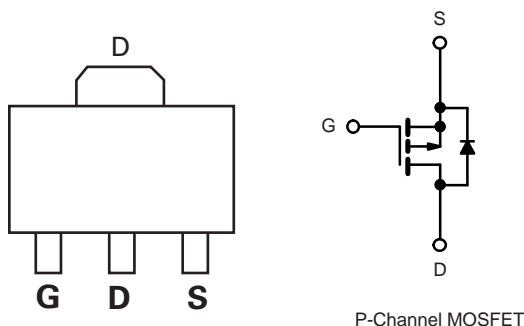
- DT-Trench Power MOSFET
- 100 % R<sub>g</sub> Tested
- Compliant to RoHS Directive 2002/95/EC



**RoHS**  
COMPLIANT

### APPLICATIONS

- Portable Devices
  - Load Switch
  - Charger Switch
  - Battery Switch
  - DC/DC Converter



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

Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	V <sub>DS</sub>	- 20	V	
Gate-Source Voltage	V <sub>GS</sub>	± 12		
Continuous Drain Current (T <sub>J</sub> = 150 °C)	I <sub>D</sub>	T <sub>C</sub> = 25 °C	- 6.6 <sup>a</sup>	A
		T <sub>C</sub> = 70 °C	- 6 <sup>a</sup>	
		T <sub>A</sub> = 25 °C	- 6 <sup>a, b, c</sup>	
		T <sub>A</sub> = 70 °C	- 5.2 <sup>b, c</sup>	
Pulsed Drain Current	I <sub>DM</sub>	- 20		
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	- 4.8	
		T <sub>A</sub> = 25 °C	- 1.9 <sup>b, c</sup>	
Maximum Power Dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C	5.7	W
		T <sub>C</sub> = 70 °C	3	
		T <sub>A</sub> = 25 °C	2.3 <sup>b, c</sup>	
		T <sub>A</sub> = 70 °C	1.2 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C	
Soldering Recommendations (Peak Temperature)		260		

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient	R <sub>thJA</sub>	45	55	°C/W
Maximum Junction-to-Foot (Drain)	R <sub>thJF</sub>	18	22	

Notes:

- Package limited.
- Surface mounted on 1" x 1" FR4 board.
- t = 5 s.

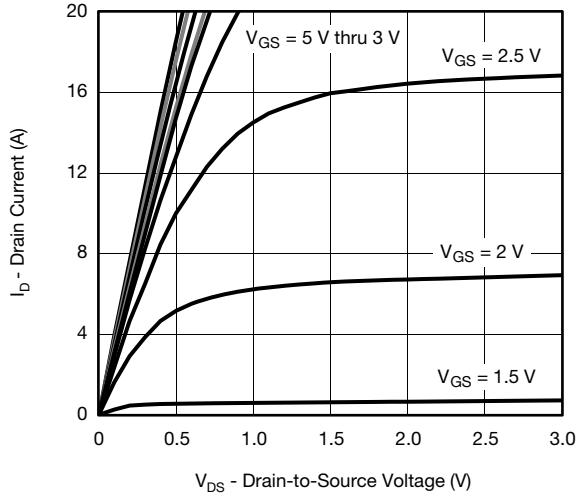
<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	- 20			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$		- 14		mV/ $^\circ\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			3.2		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	- 0.6		- 1.4	V
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 12\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$			- 1	$\mu\text{A}$
		$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}, T_J = 85\text{ }^\circ\text{C}$			- 5	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \leq -5\text{ V}, V_{GS} = -4.5\text{ V}$	- 20			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -4.9\text{ A}$		0.060	0.075	$\Omega$
		$V_{GS} = -3.6\text{ V}, I_D = -4.6\text{ A}$		0.076	0.081	
		$V_{GS} = -2.5\text{ V}, I_D = -2.0\text{ A}$		0.083	0.090	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -10\text{ V}, I_D = -4.9\text{ A}$		16		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		1000		pF
Output Capacitance	$C_{oss}$			225		
Reverse Transfer Capacitance	$C_{rss}$			195		
Total Gate Charge	$Q_g$	$V_{DS} = -10\text{ V}, V_{GS} = -10\text{ V}, I_D = -6.5\text{ A}$		25	38	nC
		$V_{DS} = -10\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -6.5\text{ A}$		12.5	19	
Gate-Source Charge	$Q_{gs}$			2		
Gate-Drain Charge	$Q_{gd}$			4		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$	0.9	4.6	9.2	$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}, R_L = 1.9\text{ }\Omega$ $I_D \cong -5.2\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 1\text{ }\Omega$		25	50	ns
Rise Time	$t_r$			20	40	
Turn-Off Delay Time	$t_{d(off)}$			30	60	
Fall Time	$t_f$			12	25	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}, R_L = -1.9\text{ }\Omega$ $I_D \cong -5.2\text{ A}, V_{GEN} = -10\text{ V}, R_g = 1\text{ }\Omega$		10	20	
Rise Time	$t_r$			10	20	
Turn-Off Delay Time	$t_{d(off)}$			27	55	
Fall Time	$t_f$			12	25	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$			- 6	A
Pulse Diode Forward Current	$I_{SM}$				- 20	
Body Diode Voltage	$V_{SD}$	$I_S = -5.2\text{ A}, V_{GS} = 0\text{ V}$		- 0.8	- 1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = -5.2\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		20	40	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			10	20	nC
Reverse Recovery Fall Time	$t_a$			10		ns
Reverse Recovery Rise Time	$t_b$			10		

Notes:

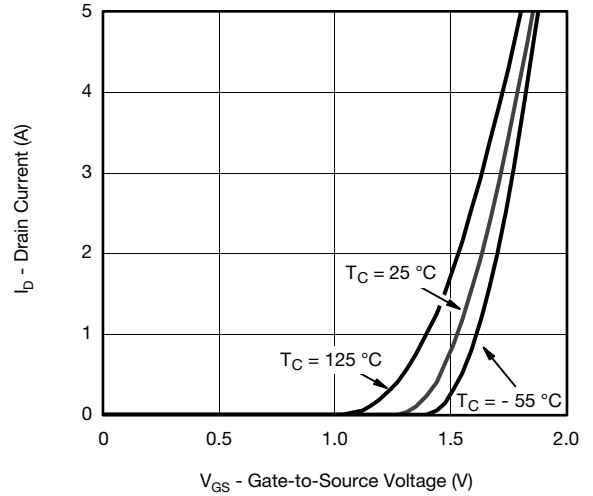
- Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Guaranteed by design, not subject to production testing.

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.

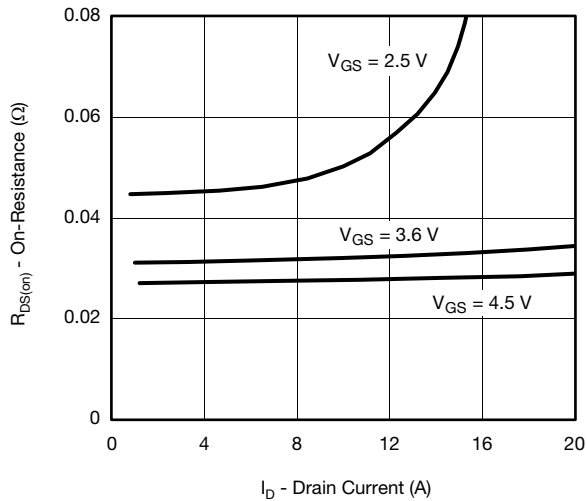
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



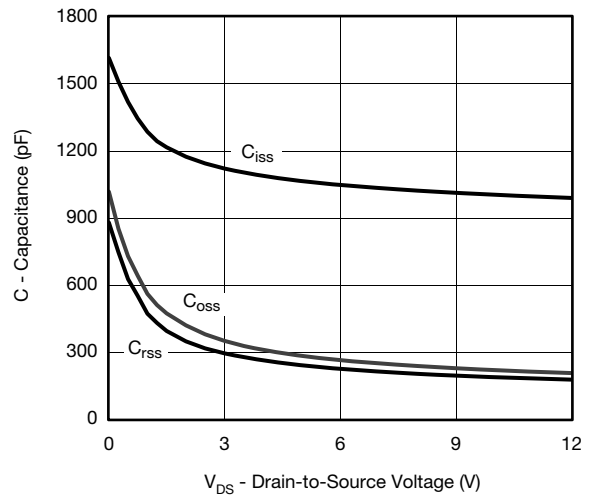
**Output Characteristics**



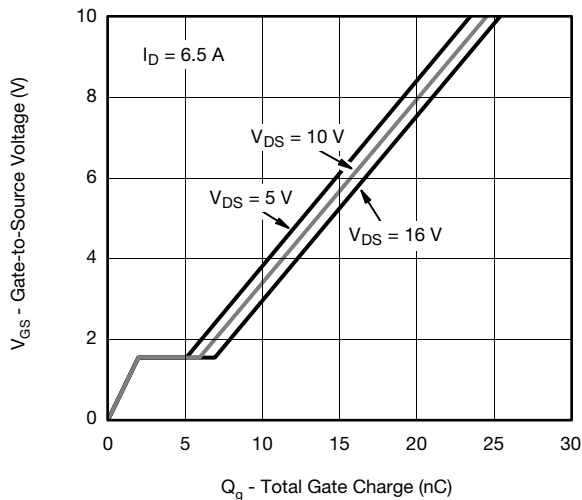
**Transfer Characteristics**



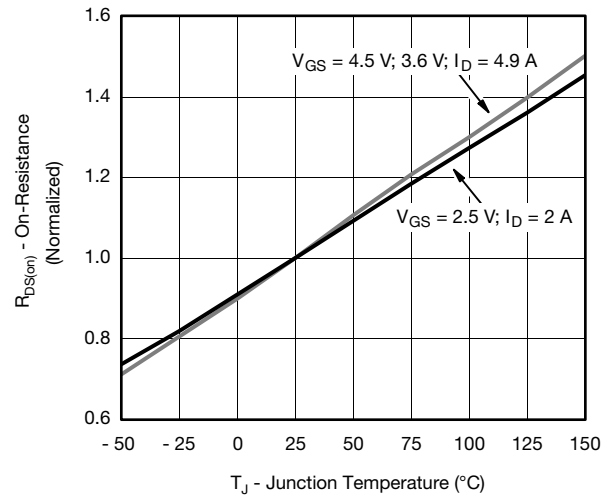
**On Resistance vs. Drain Current**



**Capacitance**

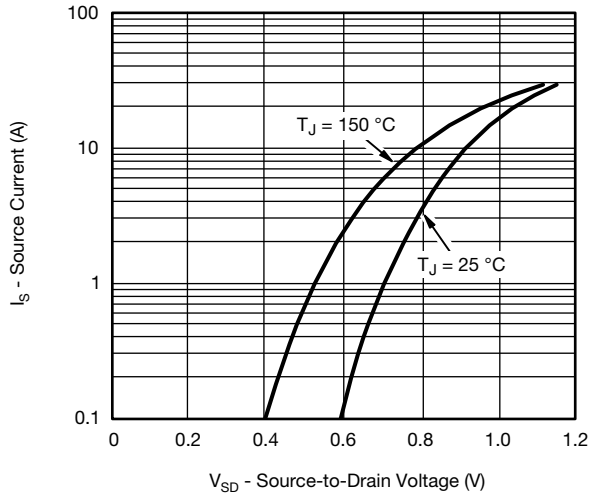


**Gate Charge**

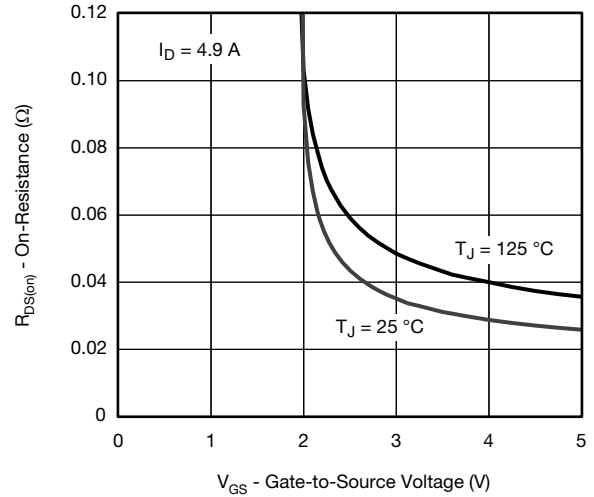


**On-Resistance vs. Junction Temperature**

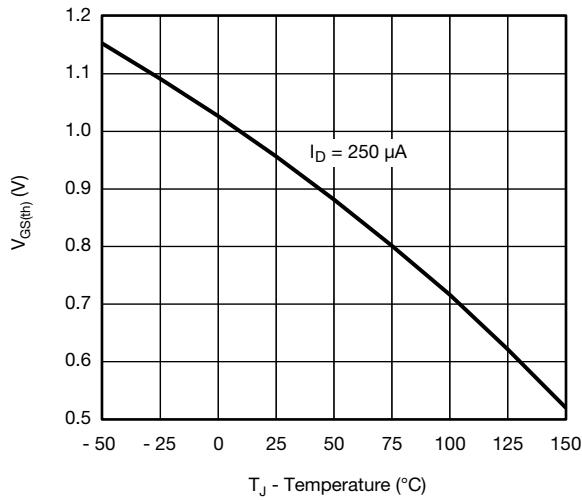
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



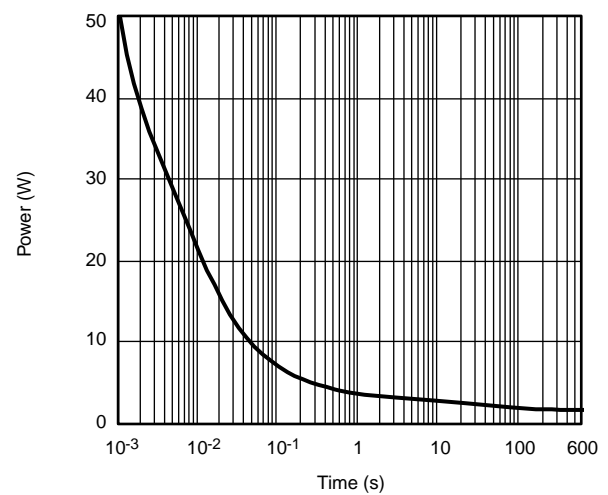
**Forward Diode Voltage vs. Temperature**



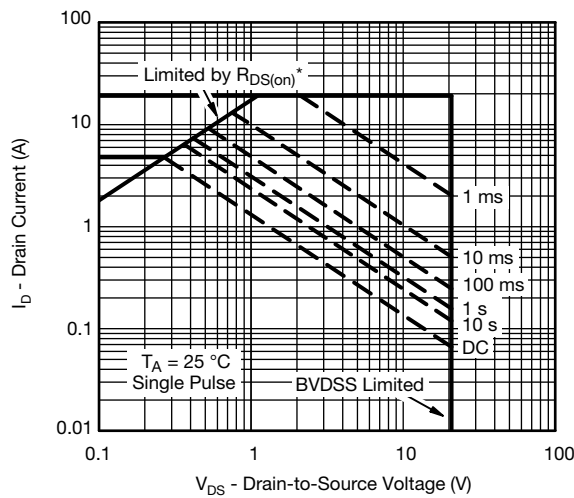
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**



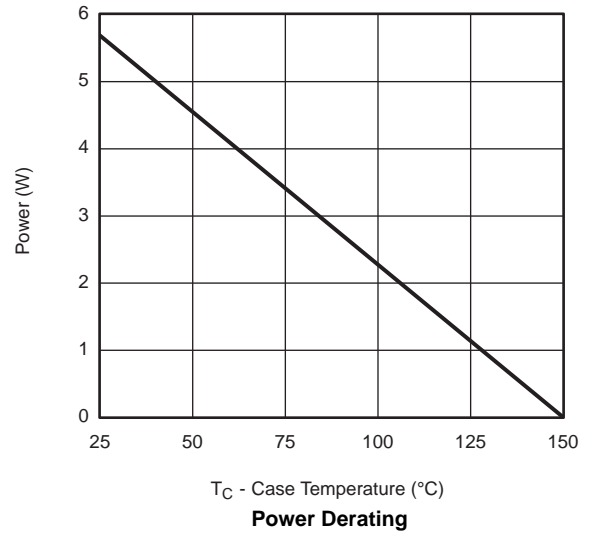
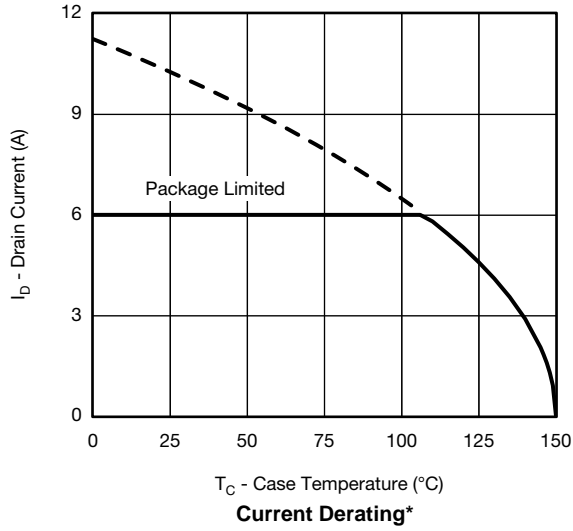
**Single Pulse Power**



\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

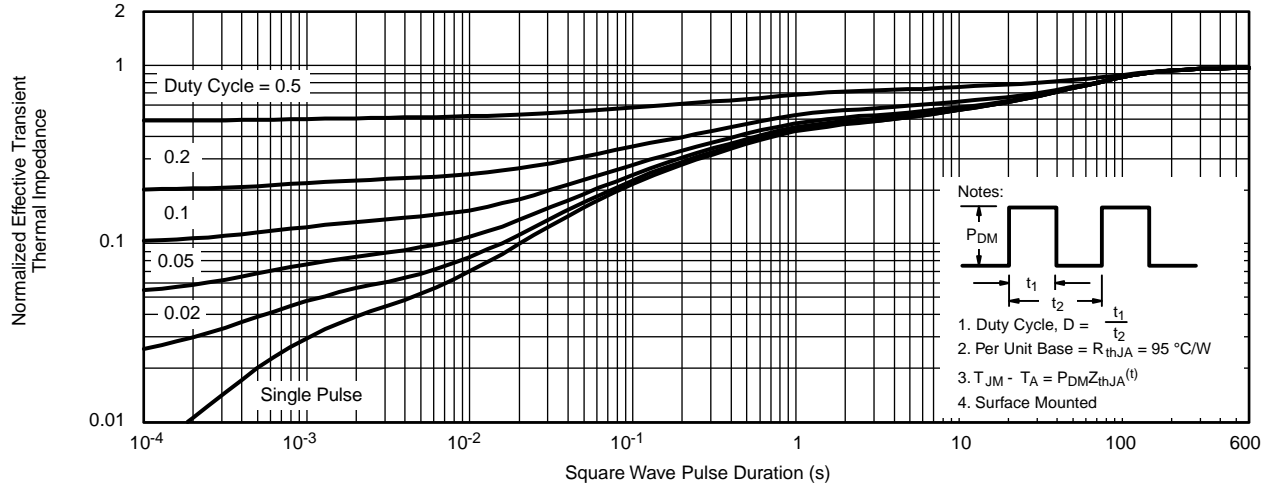
**Safe Operating Area, Junction-to-Ambient**

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

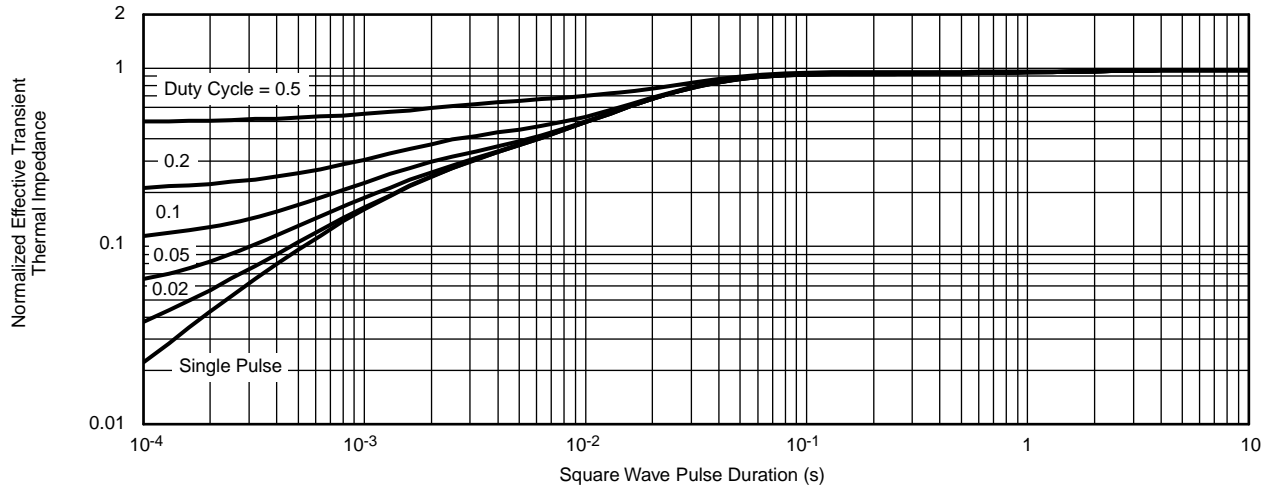


\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150\text{ °C}$ , using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the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

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

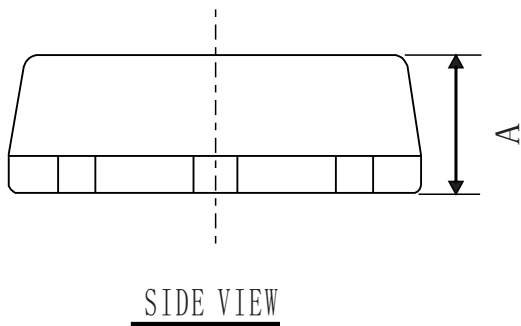
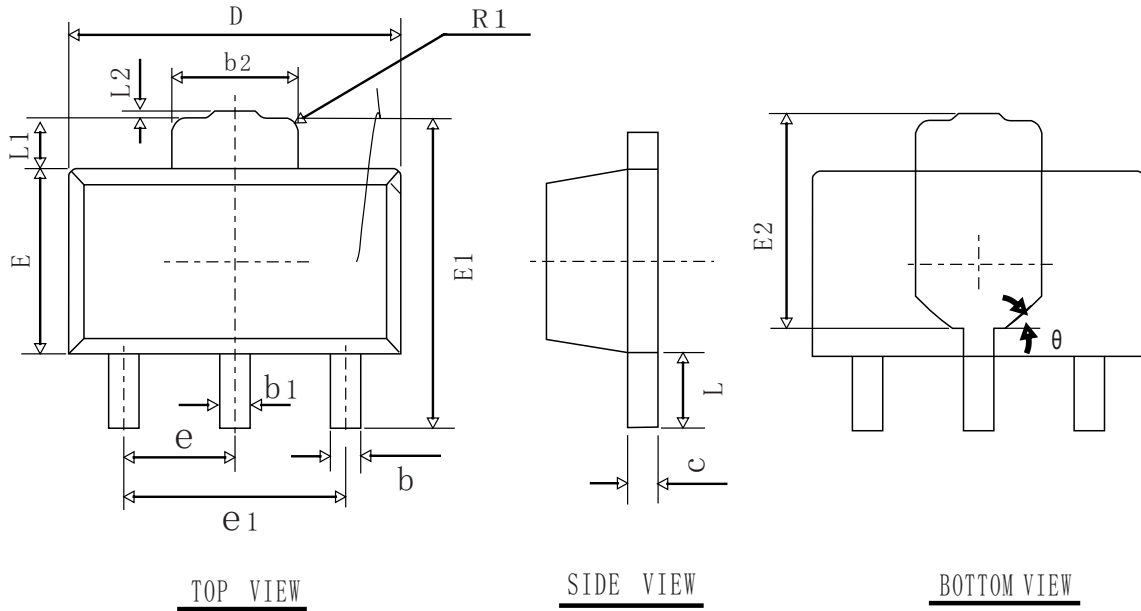


**Normalized Thermal Transient Impedance, Junction-to-Ambient**



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

## SOT-89 PACKAGE OUTLINE



COMMON DIMENSIONS  
(UNITS OF MEASURE=mm)

SYMBOL	MIN	NOM	MAX
A	1.30	1.50	1.70
b	0.30	0.40	0.53
b1	0.40	0.48	0.62
b2	1.55	1.70	1.85
c	0.30	0.40	0.50
D	4.20	4.50	4.80
E	2.20	2.50	2.80
E1	3.80	4.20	4.60
E2	2.55	2.85	3.15
e1	2.80	3.00	3.20
L	0.80	1.00	1.20
L1	0.60	0.70	0.80
L2	0.075 REF		
R1	0.2 BSC		
$\theta$	45° TYP		
e	1.5 BSC		

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