

## SM1600DSCS-VB Datasheet

### Dual N-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY			
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A) <sup>a</sup>	Q <sub>g</sub> (Typ.)
20	0.086 at V <sub>GS</sub> = 4.5 V	2.6 <sup>a</sup>	5.0 nC
	0.110 at V <sub>GS</sub> = 2.5 V	2.5 <sup>a</sup>	
	0.180 at V <sub>GS</sub> = 1.8 V	2.3 <sup>a</sup>	

#### FEATURES

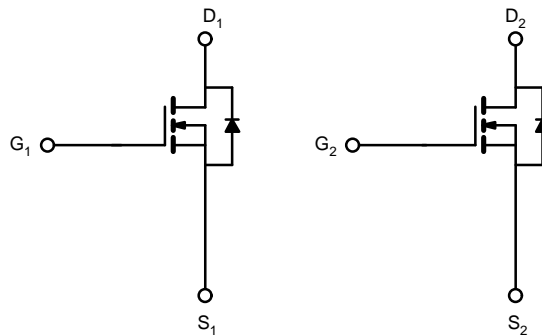
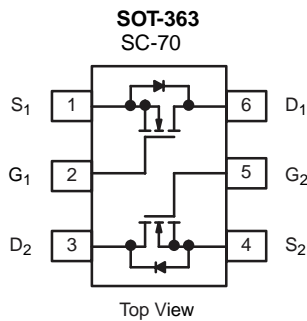
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET<sup>®</sup> Power MOSFET
- 100 % R<sub>g</sub> Tested
- Compliant to RoHS Directive 2002/95/EC



**RoHS**  
COMPLIANT

#### APPLICATIONS

- Load Switch for Portable Applications



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	2.6 <sup>a</sup>
		T <sub>C</sub> = 70 °C	2.2 <sup>a</sup>
		T <sub>A</sub> = 25 °C	2.3 <sup>a, b, c</sup>
		T <sub>A</sub> = 70 °C	1.8 <sup>b, c</sup>
Pulsed Drain Current	I <sub>DM</sub>	8	A
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	
		T <sub>A</sub> = 25 °C	2.10 <sup>b, c</sup>
Maximum Power Dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C	2.70
		T <sub>C</sub> = 70 °C	1.70
		T <sub>A</sub> = 25 °C	1.5 <sup>b, c</sup>
		T <sub>A</sub> = 70 °C	1.0 <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>	130	170	°C/W	
Maximum Junction-to-Foot (Drain)	R <sub>thJF</sub>	80	100		

Notes:

- a. Package limited.
- b. Surface mounted on 1" x 1" FR4 board.
- c. t = 5 s.
- d. Maximum under steady state conditions is 220 °C/W.

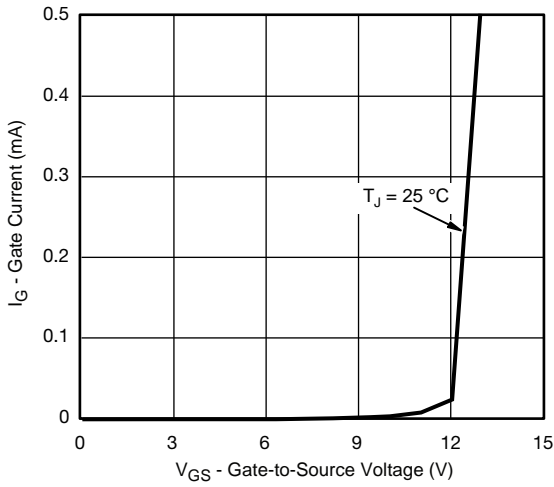
<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	20			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$		20		mV/ $^\circ\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			-2.3		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	0.5		2.0	V
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8\text{ V}$			$\pm 25$	$\mu\text{A}$
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 4.5\text{ V}$			1	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \leq 5\text{ V}, V_{GS} = 4.5\text{ V}$	4			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 4.5\text{ V}, I_D = 1\text{ A}$		0.086		$\Omega$
		$V_{GS} = 2.5\text{ V}, I_D = 1\text{ A}$		0.110		
		$V_{GS} = 1.8\text{ V}, I_D = 0.2\text{ A}$		0.180		
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 4\text{ V}, I_D = 1.5\text{ A}$		4		S
<b>Dynamic<sup>b</sup></b>						
Total Gate Charge	$Q_g$	$V_{DS} = 10\text{ V}, V_{GS} = 8\text{ V}, I_D = 1.5\text{ A}$		5.0		nC
		$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 1.5\text{ A}$		3.0		
Gate-Source Charge	$Q_{gs}$	$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 1.5\text{ A}$		1.0		nC
Gate-Drain Charge	$Q_{gd}$			2.0		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$	0.4	1.9	3.8	k $\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 10\text{ V}, R_L = 8.3\text{ }\Omega$ $I_D \cong 1.2\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$		43	65	ns
Rise Time	$t_r$			80	120	
Turn-Off Delay Time	$t_{d(off)}$			480	720	
Fall Time	$t_f$			220	330	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 10\text{ V}, R_L = 8.3\text{ }\Omega$ $I_D \cong 1.2\text{ A}, V_{GEN} = 8\text{ V}, R_g = 1\text{ }\Omega$		22	33	ns
Rise Time	$t_r$			46	70	
Turn-Off Delay Time	$t_{d(off)}$			645	968	
Fall Time	$t_f$			215	323	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$		2.6		A
Pulse Diode Forward Current	$I_{SM}$			4		
Body Diode Voltage	$V_{SD}$	$I_S = 1.2\text{ A}, V_{GS} = 0\text{ V}$		0.8	1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = 1.2\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		9	18	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			2	4	nC
Reverse Recovery Fall Time	$t_a$			5		ns
Reverse Recovery Rise Time	$t_b$			4		

Notes:

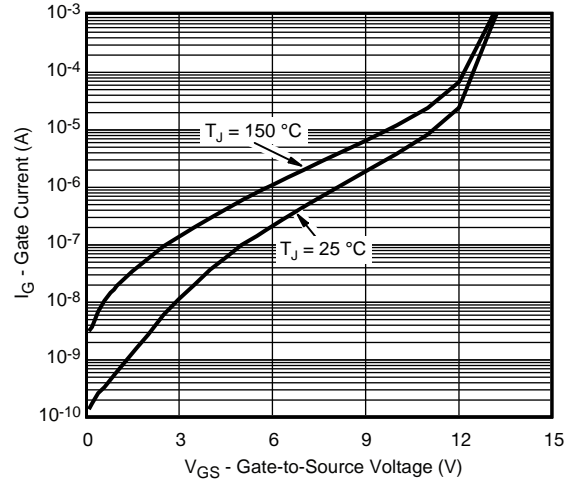
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
 b. Guaranteed by design, not subject to production testing.

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.

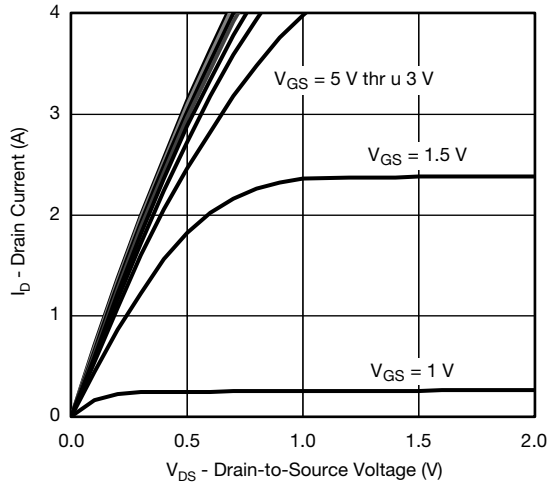
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



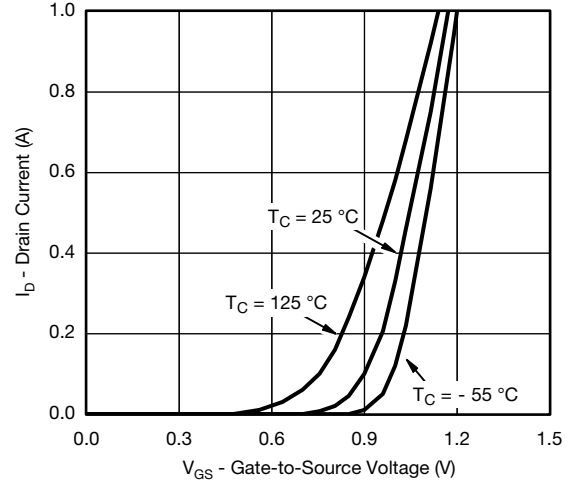
**Gate Current vs. Gate-to-Source Voltage**



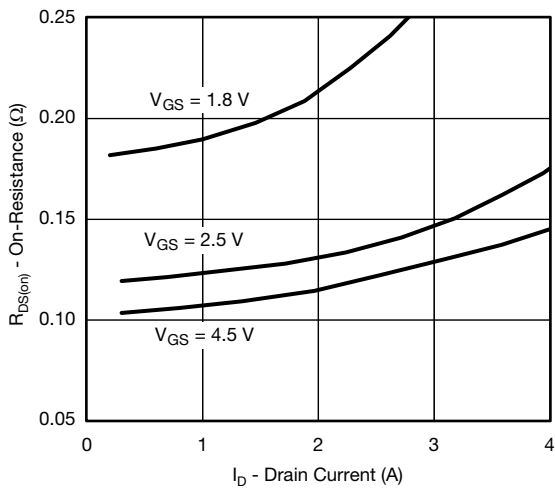
**Gate Current vs. Gate-to-Source Voltage**



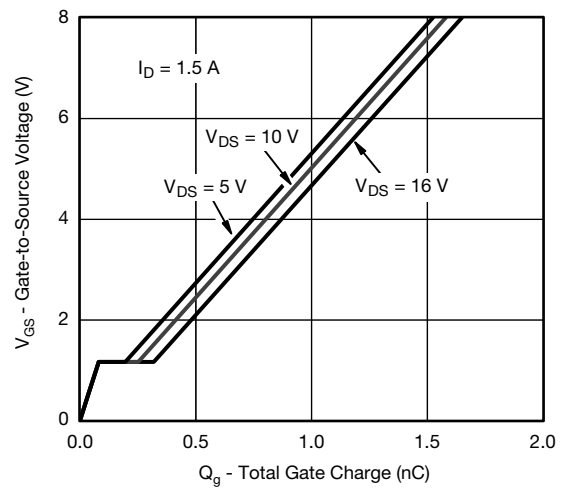
**Output Characteristics**



**Transfer Characteristics**

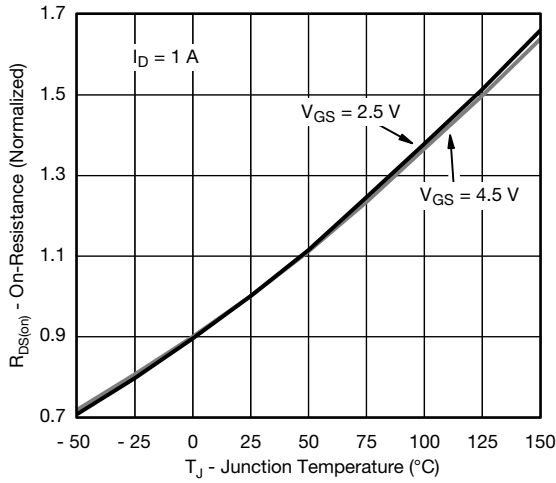


**On-Resistance vs. Drain Current**

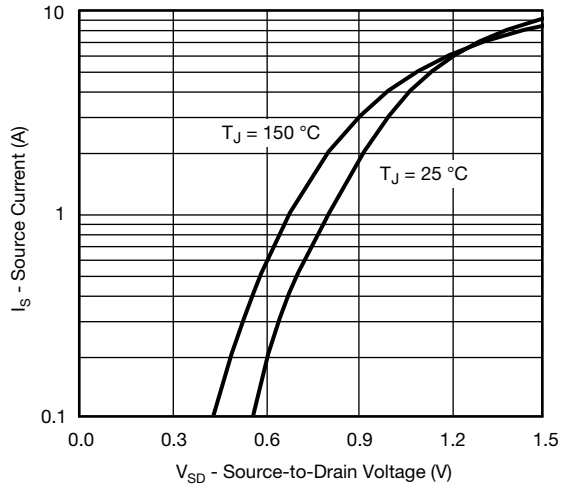


**Gate Charge**

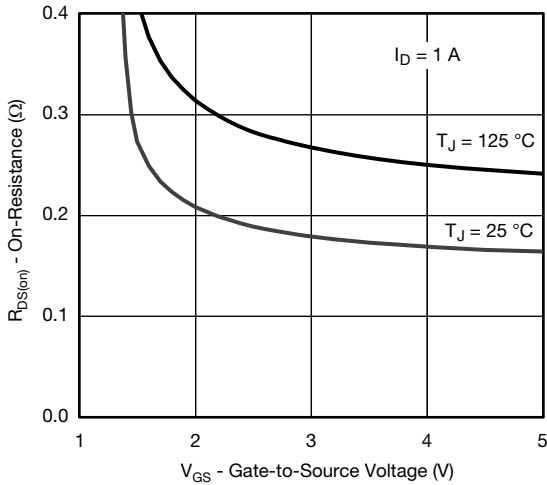
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



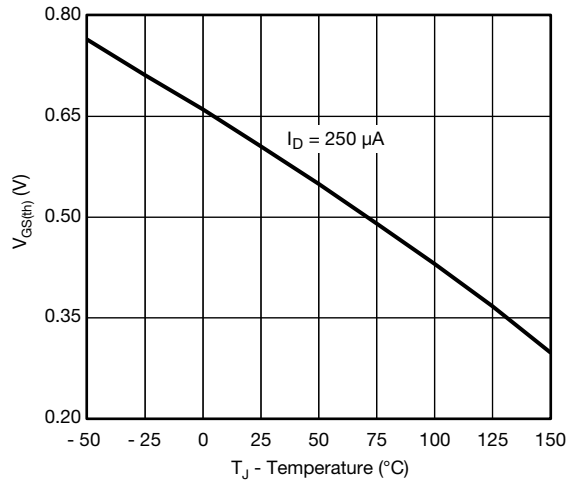
**On-Resistance vs. Junction Temperature**



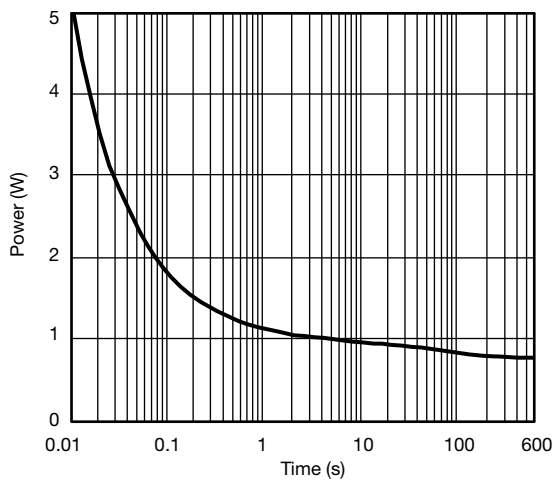
**Source-Drain Diode Forward Voltage**



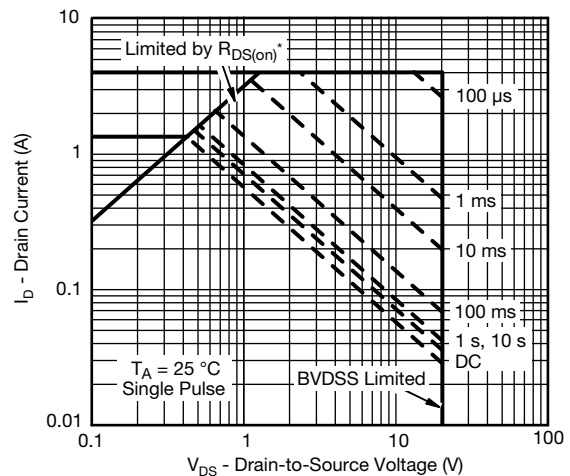
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**

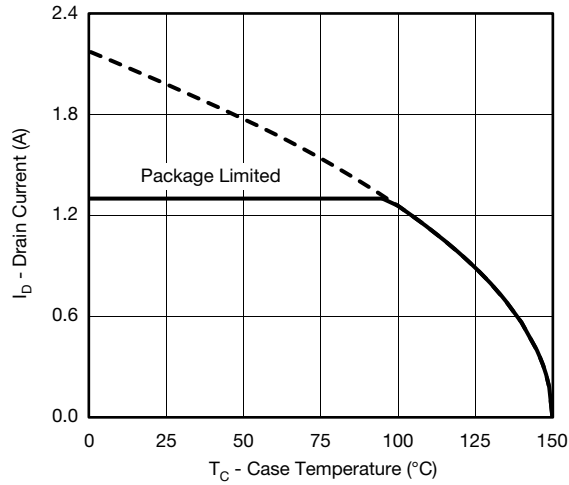


**Single Pulse Power, Junction-to-Ambient**

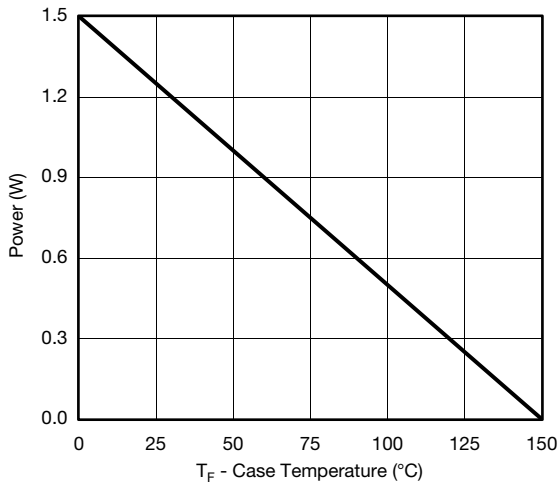


**Safe Operating Area, Junction-to-Ambient**  
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

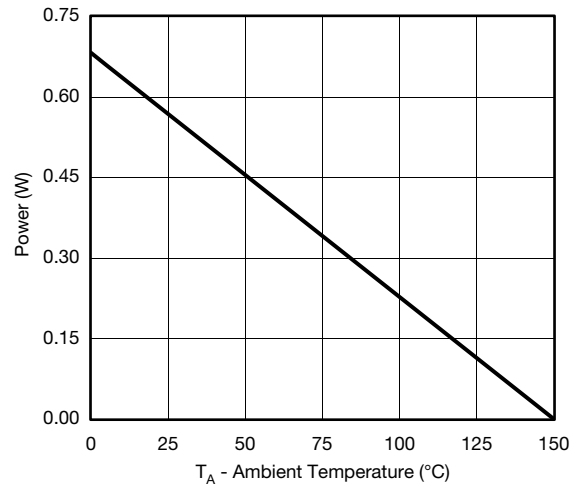
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



**Current Derating\***



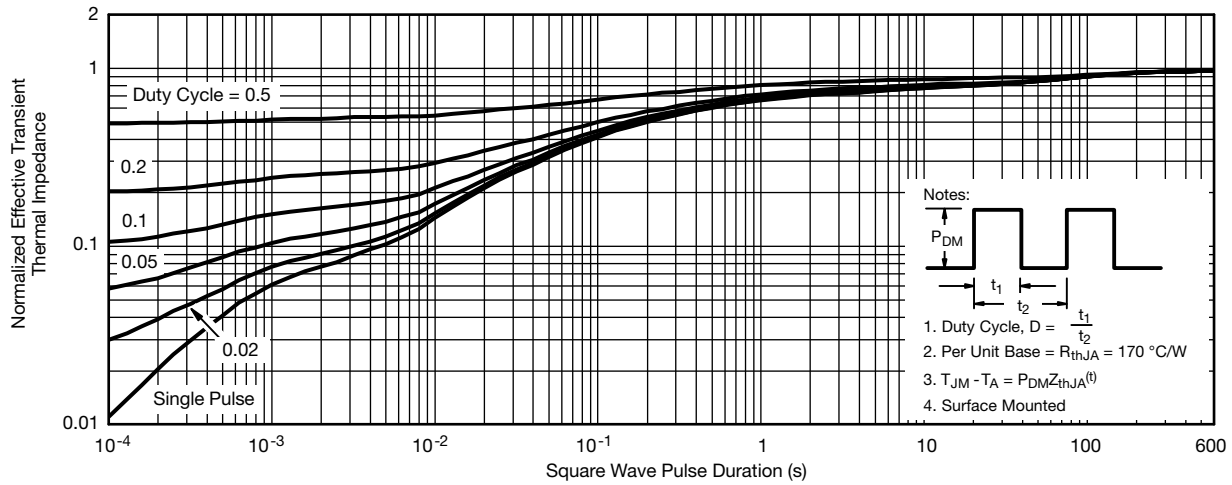
**Power, Junction-to-Foot**



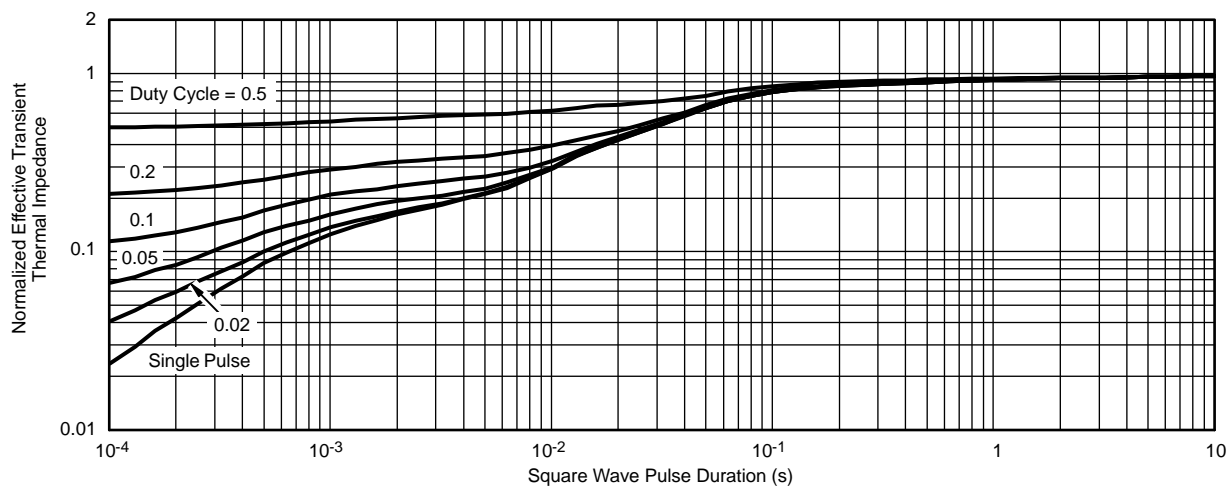
**Power, Junction-to-Ambient**

\* 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.

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

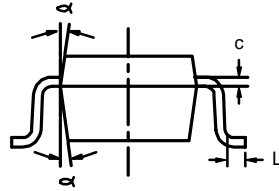
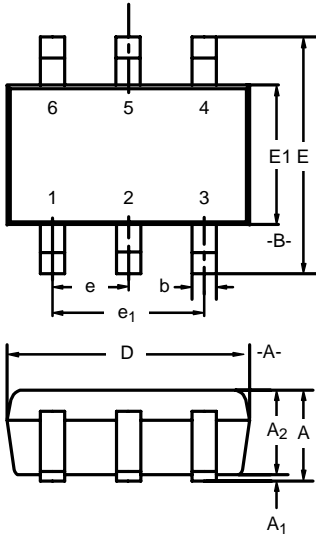


**Normalized Thermal Transient Impedance, Junction-to-Ambient**



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

**SC-70: 6-LEADS**



Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.90	-	1.10	0.035	-	0.043
A <sub>1</sub>	-	-	0.10	-	-	0.004
A <sub>2</sub>	0.80	-	1.00	0.031	-	0.039
b	0.15	-	0.30	0.006	-	0.012
c	0.10	-	0.25	0.004	-	0.010
D	1.80	2.00	2.20	0.071	0.079	0.087
E	1.80	2.10	2.40	0.071	0.083	0.094
E <sub>1</sub>	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65BSC			0.026BSC		
e <sub>1</sub>	1.20	1.30	1.40	0.047	0.051	0.055
L	0.10	0.20	0.30	0.004	0.008	0.012
α	7°Nom			7°Nom		

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