

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

### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ.)
- 20	0.034 at $V_{GS} = - 4.5$ V	- 4	12.5 nC
	0.045 at $V_{GS} = - 2.5$ V	- 4	
	0.067 at $V_{GS} = - 1.8$ V	- 4	

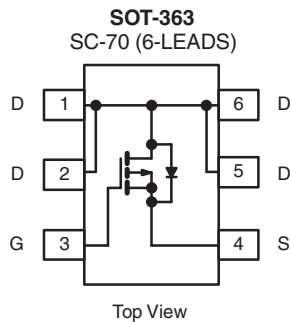
### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- 100 %  $R_g$  Tested
- Compliant to RoHS Directive 2002/95/EC


**RoHS**  
 COMPLIANT

### APPLICATIONS

- Load Switch for Portable Devices
  - Cellular Phone
  - DSC
  - Portable Game Console
  - MP3
  - GPS



### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	- 20	V
Gate-Source Voltage	$V_{GS}$	$\pm 12$	
Continuous Drain Current ( $T_J = 150$ °C)	$T_C = 25$ °C	- 4 <sup>a</sup>	A
	$T_C = 70$ °C	- 4	
	$T_A = 25$ °C	- 4 <sup>a, b, c</sup>	
	$T_A = 70$ °C	- 4 <sup>a, b, c</sup>	
Pulsed Drain Current ( $t = 300$ $\mu$ s)	$I_{DM}$	- 25	
Continuous Source-Drain Diode Current	$T_C = 25$ °C	- 2.3	
	$T_A = 25$ °C	- 1.3 <sup>b, c</sup>	
Maximum Power Dissipation	$T_C = 25$ °C	2.8	W
	$T_C = 70$ °C	1.8	
	$T_A = 25$ °C	1.6 <sup>b, c</sup>	
	$T_A = 70$ °C	1.0 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150	°C
Soldering Recommendations (Peak Temperature)		260	

### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>b, d</sup>	$R_{thJA}$	60	80	°C/W
Maximum Junction-to-Foot (Drain)	$R_{thJF}$	34	45	

Notes:

a. Package limited.

b. Surface mounted on 1" x 1" FR4 board.

 c.  $t = 5$  s.

d. Maximum under steady state conditions is 125 °C/W.

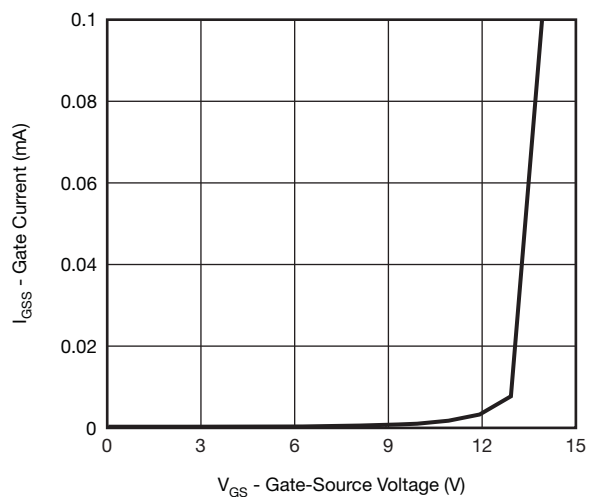
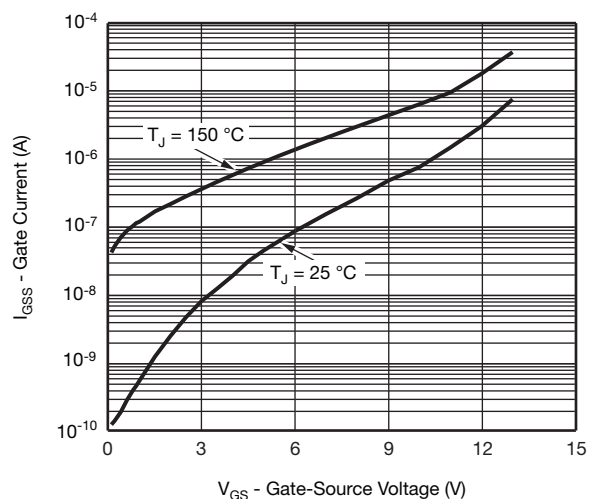
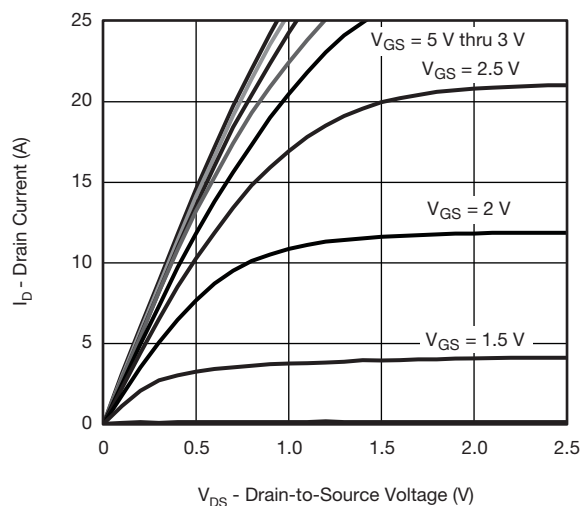
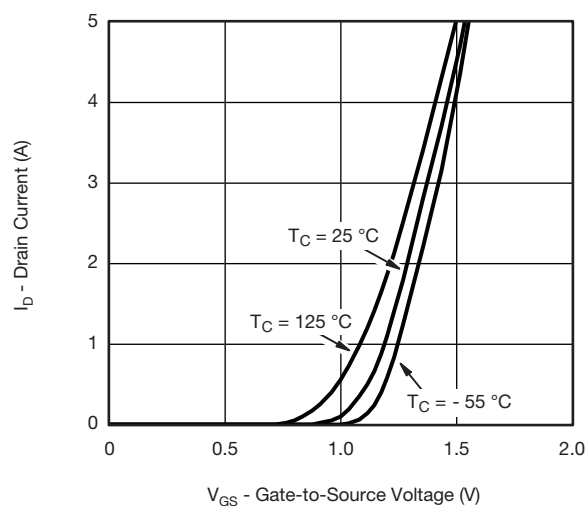
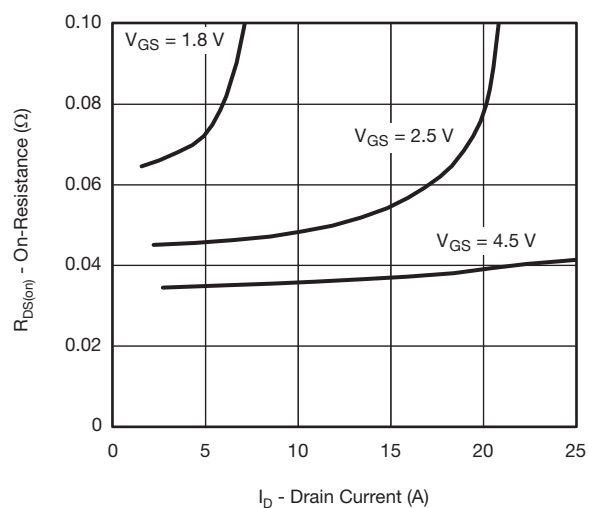
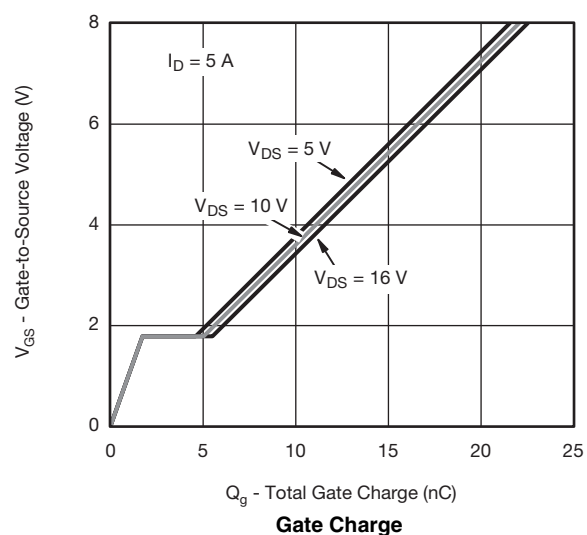
SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = - 250 μA	- 20			V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = - 250 μA		- 11		mV/°C
V <sub>GS(th)</sub> Temperature Coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>			2.6		
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = - 250 μA	- 0.4		- 1	V
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 10 V			± 8	μA
		V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 4.5 V			± 1	
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = - 20 V, V <sub>GS</sub> = 0 V			- 1	
		V <sub>DS</sub> = - 20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C			- 10	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≤ - 5 V, V <sub>GS</sub> = - 10 V	- 15			A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 5 A		0.034		Ω
		V <sub>GS</sub> = - 2.5 V, I <sub>D</sub> = - 4.4 A		0.045		
		V <sub>GS</sub> = - 1.8 V, I <sub>D</sub> = - 1 A		0.067		
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = - 10 V, I <sub>D</sub> = - 5 A		16		S
Dynamic <sup>b</sup>						
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = - 10 V, V <sub>GS</sub> = - 8 V, I <sub>D</sub> = - 5 A		22	33	nC
Gate-Source Charge		V <sub>DS</sub> = - 10 V, V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 5 A		12.5	19	
	Q <sub>gs</sub>			1.8		
Gate-Drain Charge	Q <sub>gd</sub>			3.3		
Gate Resistance	R <sub>g</sub>	f = 1 MHz	0.08	0.43	0.86	kΩ
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = - 10 V, R <sub>L</sub> = 1.4 Ω I <sub>D</sub> ≅ - 4 A, V <sub>GEN</sub> = - 4.5 V, R <sub>g</sub> = 1 Ω		150	225	ns
Rise Time	t <sub>r</sub>			300	450	
Turn-Off Delay Time	t <sub>d(off)</sub>			1620	2430	
Fall Time	t <sub>f</sub>			560	840	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = - 10 V, R <sub>L</sub> = 1.4 Ω I <sub>D</sub> ≅ - 4 A, V <sub>GEN</sub> = - 10 V, R <sub>g</sub> = 1 Ω		50	100	
Rise Time	t <sub>r</sub>			90	180	
Turn-Off Delay Time	t <sub>d(off)</sub>			2500	3750	
Fall Time	t <sub>f</sub>			600	900	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			- 2.3	A
Pulse Diode Forward Current	I <sub>SM</sub>				- 25	
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = - 4 A, V <sub>GS</sub> = 0 V		- 0.85	- 1.2	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = - 4 A, dI/dt = 100 A/μs, T <sub>J</sub> = 25 °C		18	36	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			8	16	nC
Reverse Recovery Fall Time	t <sub>a</sub>			18		ns
Reverse Recovery Rise Time	t <sub>b</sub>			10		

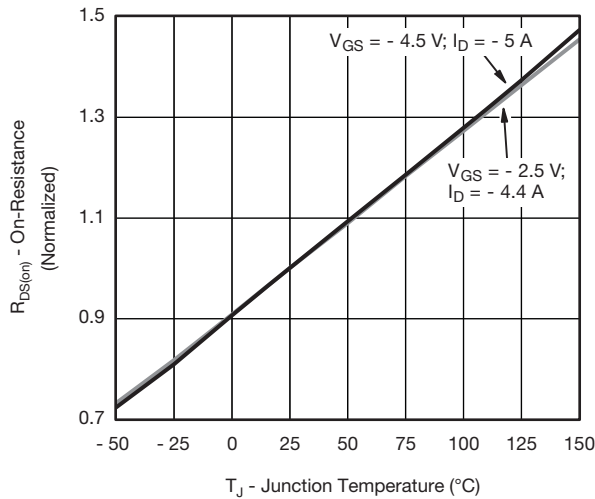
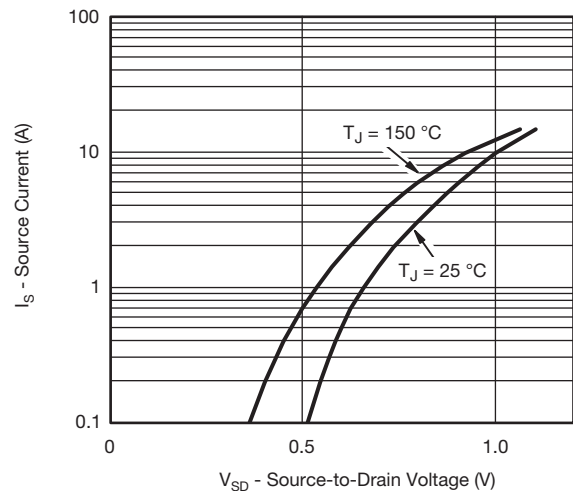
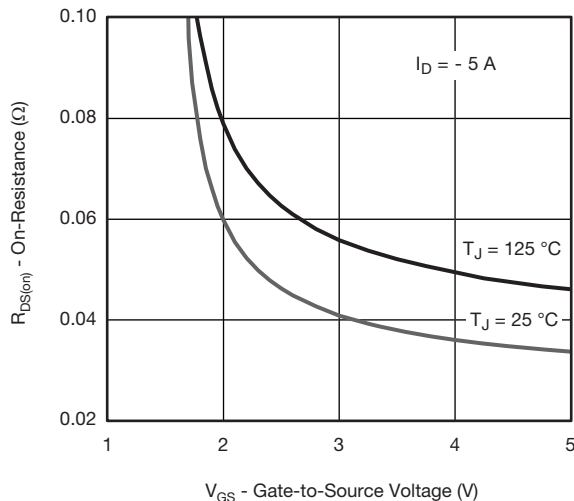
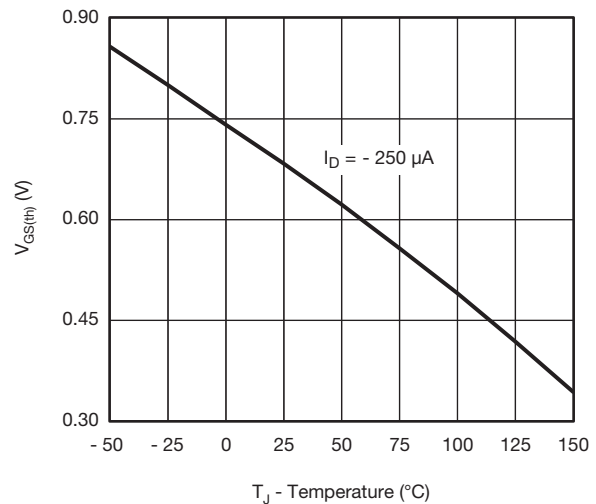
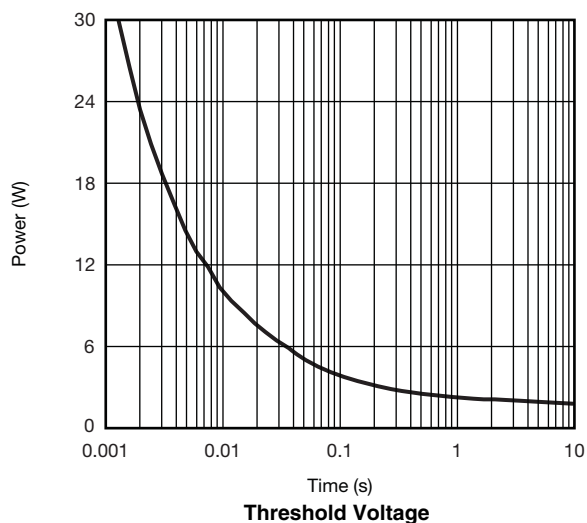
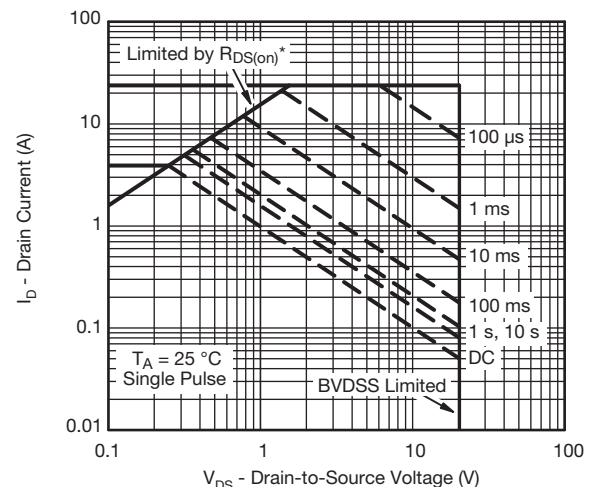
Notes:

a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

b. Guaranteed by design, not subject to production testing.

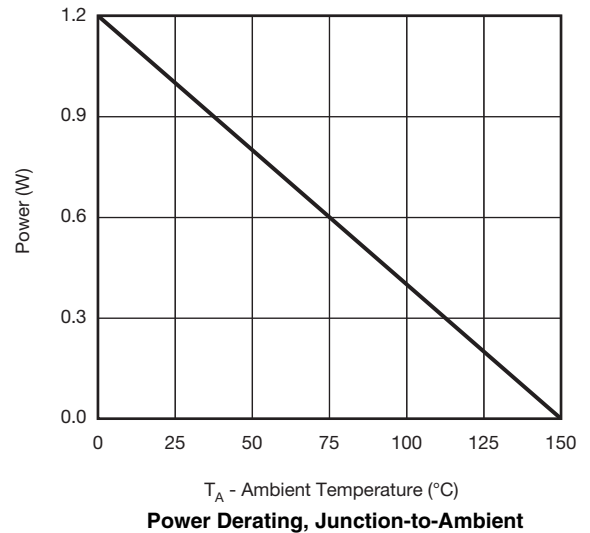
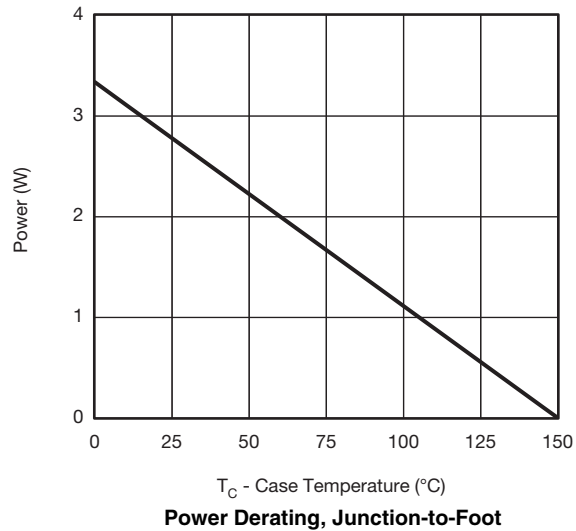
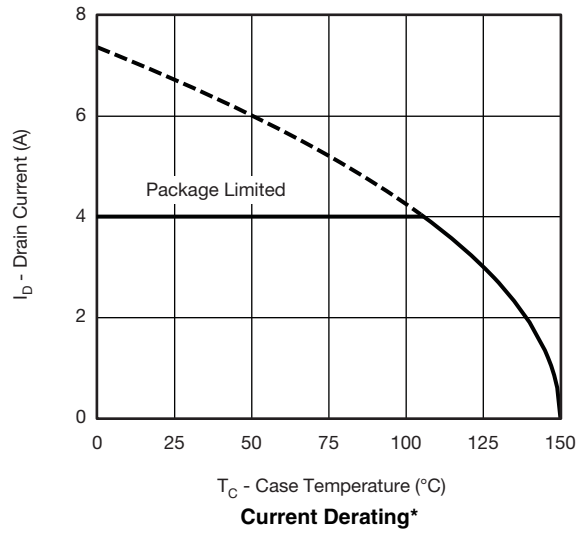
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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

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

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

**Output Characteristics**

**Transfer Characteristics**

**On-Resistance vs. Drain Current**

**Gate Charge**

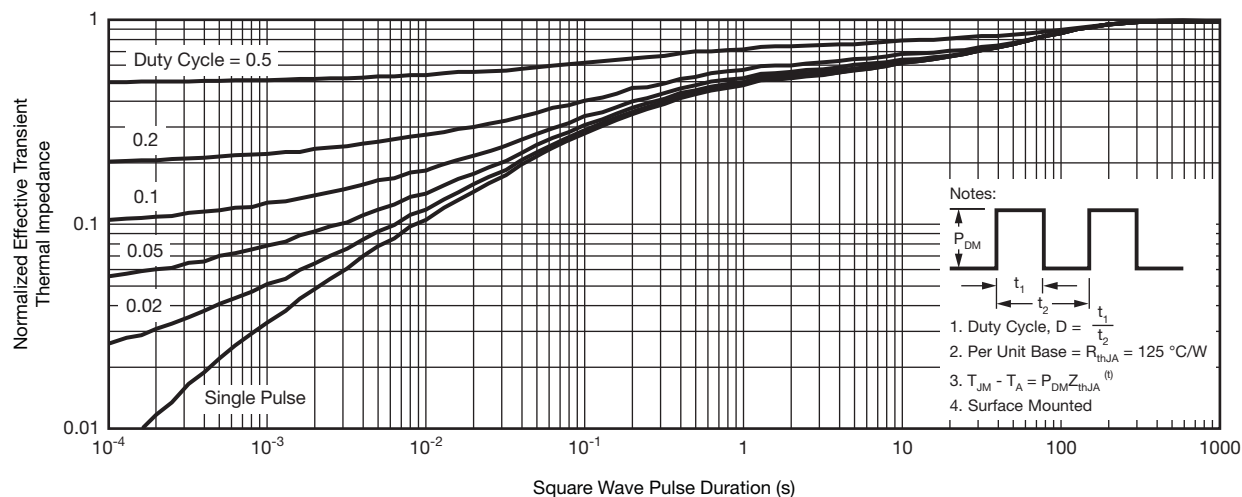
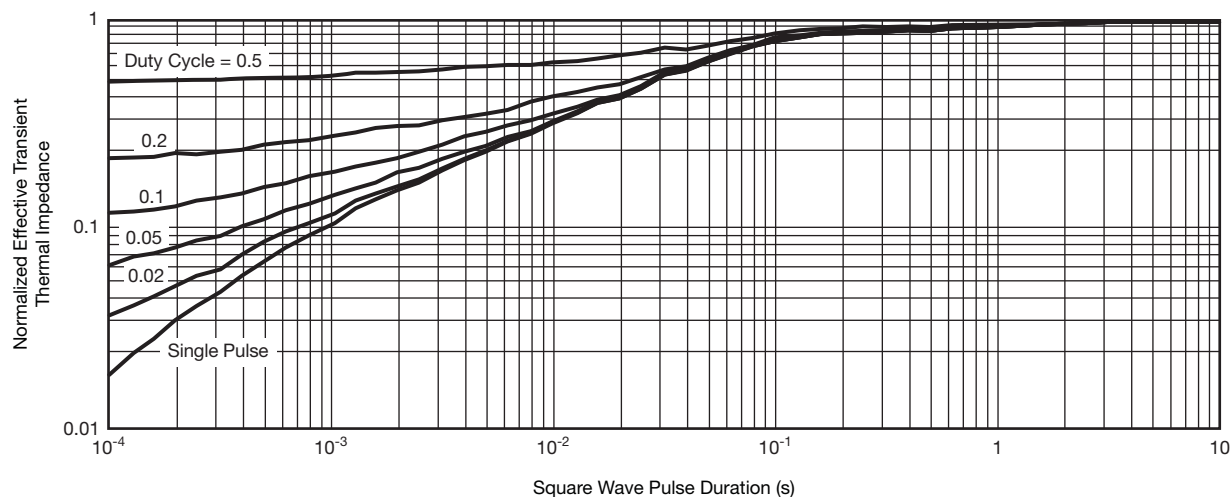
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**On-Resistance vs. Junction Temperature**

**Source-Drain Diode Forward Voltage**

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

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

**Threshold Voltage**


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

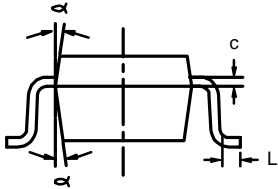
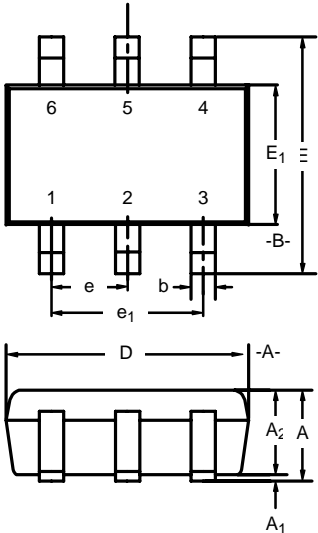
**Safe Operating Area, Junction-to-Ambient**

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


\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °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.

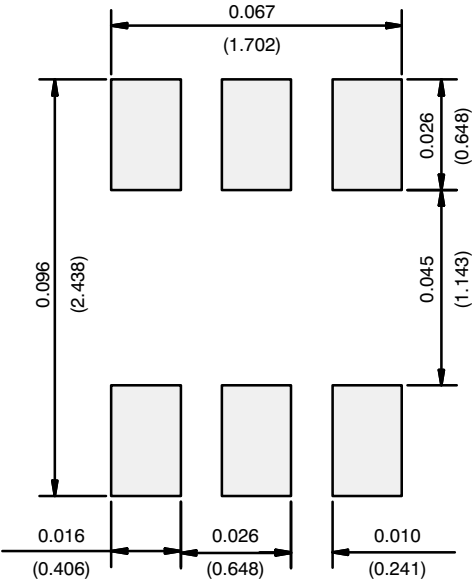
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**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		
ECN: S-03946—Rev. B, 09-Jul-01						
DWG: 5550						

RECOMMENDED MINIMUM PADS FOR SC-70: 6-Lead



Recommended Minimum Pads  
Dimensions in Inches/(mm)



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