

# NDT456P-VB Datasheet

## P-Channel 35V (D-S) MOSFET

PRODUCT SUMMARY			
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A) <sup>d</sup>	Q <sub>g</sub> (Typ.)
- 35	0.040 at V <sub>GS</sub> = - 10 V	- 6.2	9.8 nC
	0.048 at V <sub>GS</sub> = - 4.5 V	- 5.1	

### FEATURES

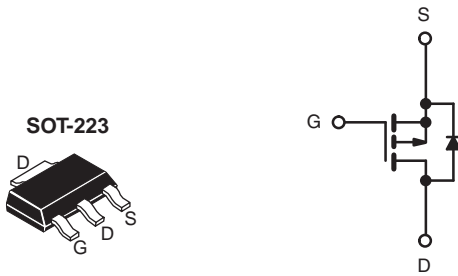
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET<sup>®</sup> Power MOSFET
- 100 % R<sub>g</sub> Tested
- 100 % UIS Tested
- Compliant to RoHS Directive 2002/95/EC



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### APPLICATIONS

- Load Switches, Adaptor Switch
- Notebook PCs



P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted)				
Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V <sub>DS</sub>	- 35	V
Gate-Source Voltage		V <sub>GS</sub>	± 20	
Continuous Drain Current (T <sub>J</sub> = 150 °C)	T <sub>C</sub> = 25 °C	I <sub>D</sub>	- 6.2	A
	T <sub>C</sub> = 70 °C		- 4.8	
	T <sub>A</sub> = 25 °C		- 4.5 <sup>a, b</sup>	
	T <sub>A</sub> = 70 °C		- 3.4 <sup>a, b</sup>	
Pulsed Drain Current		I <sub>DM</sub>	- 20	
Continuous Source-Drain Diode Current	T <sub>C</sub> = 25 °C	I <sub>S</sub>	- 3.5	
	T <sub>A</sub> = 25 °C		- 2.1 <sup>a, b</sup>	
Avalanche Current		I <sub>AS</sub>	- 10	
Single-Pulse Avalanche Energy	L = 0.1 mH	E <sub>AS</sub>	5	mJ
Maximum Power Dissipation	T <sub>C</sub> = 25 °C	P <sub>D</sub>	4.2	W
	T <sub>C</sub> = 70 °C		2.7	
	T <sub>A</sub> = 25 °C		2.5 <sup>a, b</sup>	
	T <sub>A</sub> = 70 °C		1.6 <sup>a, b</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>a, c</sup>	t ≤ 10 s	R <sub>thJA</sub>	40	50	°C/W
Maximum Junction-to-Foot	Steady State	R <sub>thJF</sub>	24	30	

Notes:

- a. Surface mounted on 1" x 1" FR4 board.
- b. t = 10 s.
- c. Maximum under steady state conditions is 85 °C/W.
- d. Based on T<sub>C</sub> = 25 °C.

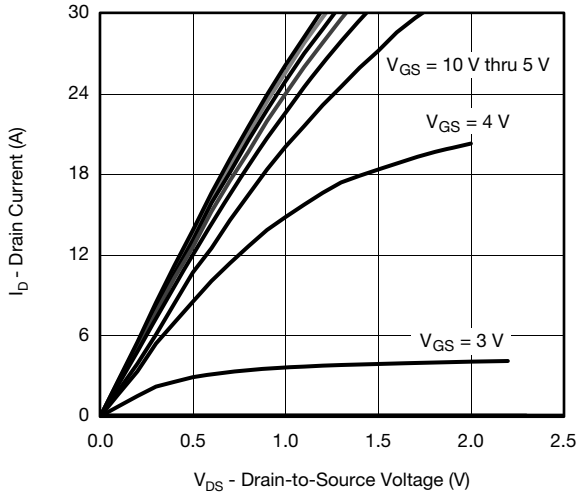
SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = - 250 μA	- 35			V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = - 250 μA		- 42		mV/°C
V <sub>GS(th)</sub> Temperature Coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>			4.6		
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = - 250 μA	- 0.6		- 1.8	V
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = - 35 V, V <sub>GS</sub> = 0 V			- 1	μA
		V <sub>DS</sub> = - 35 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C			- 5	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≥ - 10 V, V <sub>GS</sub> = - 10 V	- 10			A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 5 A		0.040		Ω
		V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 4 A		0.048		
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = - 10 V, I <sub>D</sub> = - 5 A		14		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = - 20 V, V <sub>GS</sub> = 0 V, f = 1 MHz		970		pF
Output Capacitance	C <sub>oss</sub>			120		
Reverse Transfer Capacitance	C <sub>rss</sub>			95		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = - 20 V, V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 5 A		23	35	nC
		V <sub>DS</sub> = - 20 V, V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 5 A		9.8	16	
Gate-Source Charge	Q <sub>gs</sub>			3		
Gate-Drain Charge	Q <sub>gd</sub>		5.2			
Gate Resistance	R <sub>g</sub>	f = 1 MHz	1.0	5.5	11	Ω
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = - 20 V, R <sub>L</sub> = 4 Ω I <sub>D</sub> ≅ - 5 A, V <sub>GEN</sub> = - 10 V, R <sub>g</sub> = 1 Ω		7	14	ns
Rise Time	t <sub>r</sub>			12	24	
Turn-Off Delay Time	t <sub>d(off)</sub>			30	60	
Fall Time	t <sub>f</sub>			9	18	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = - 20 V, R <sub>L</sub> = 4 Ω I <sub>D</sub> ≅ - 5 A, V <sub>GEN</sub> = - 4.5 V, R <sub>g</sub> = 1 Ω		44	80	
Rise Time	t <sub>r</sub>			33	60	
Turn-Off Delay Time	t <sub>d(off)</sub>			28	55	
Fall Time	t <sub>f</sub>			13	25	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			- 3.5	A
Pulse Diode Forward Current	I <sub>SM</sub>				- 20	
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = - 2 A, V <sub>GS</sub> = 0 V		- 0.76	- 1.2	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = - 2 A, di/dt = 100 A/μs, T <sub>J</sub> = 25 °C		27	50	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			19	35	nC
Reverse Recovery Fall Time	t <sub>a</sub>			14		ns
Reverse Recovery Rise Time	t <sub>b</sub>			13		

Notes:

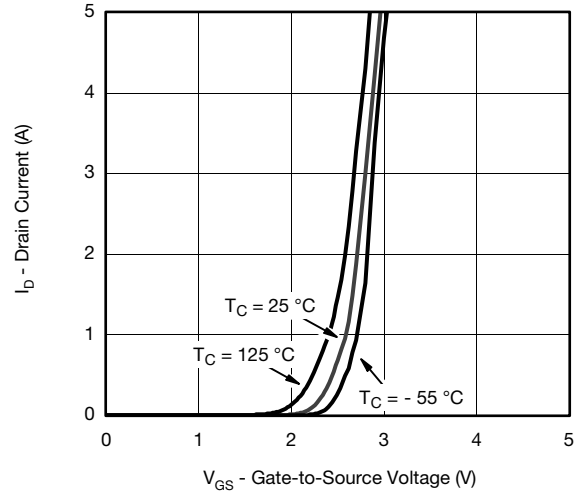
- a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %.
- b. Guaranteed by design, not subject to production testing.

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.

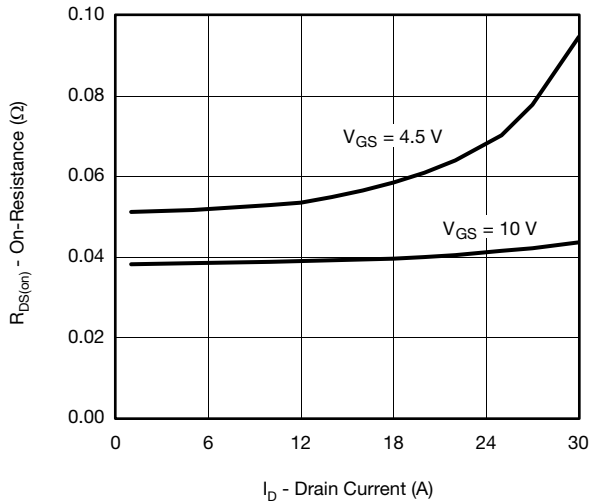
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



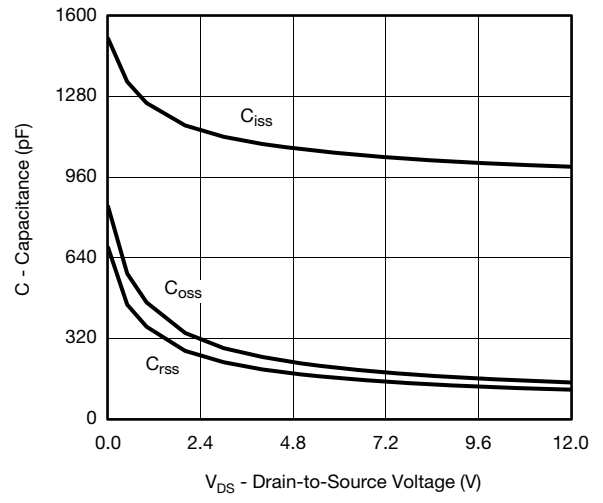
**Output Characteristics**



**Transfer Characteristics**



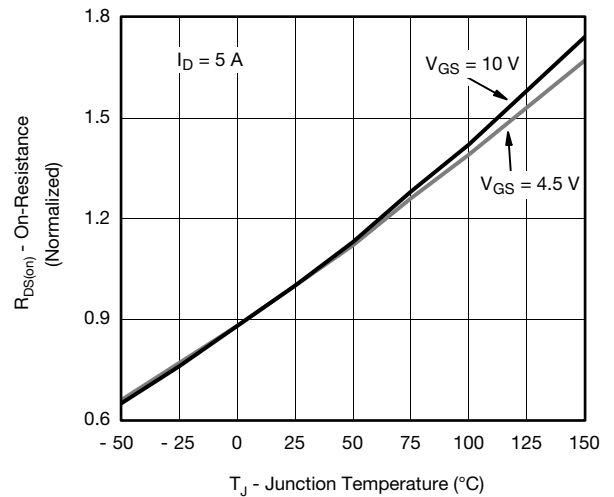
**On-Resistance vs. Drain Current**



**Capacitance**

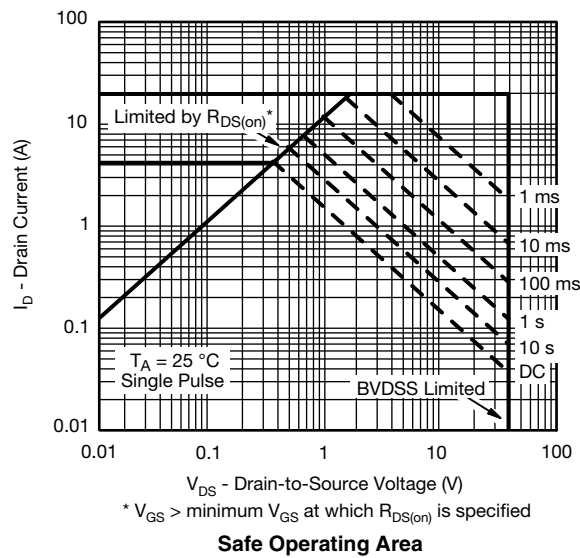
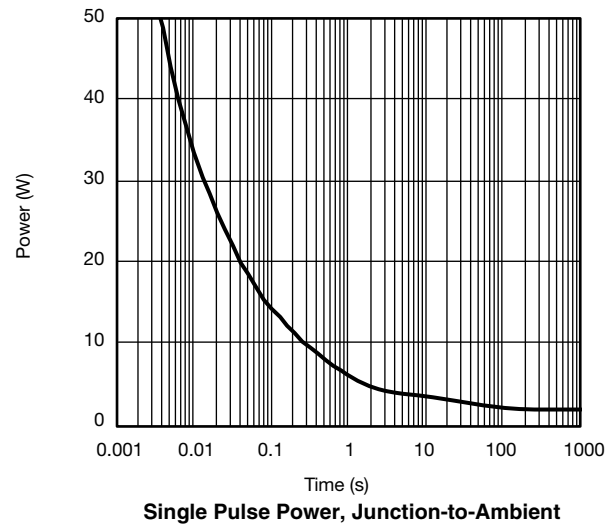
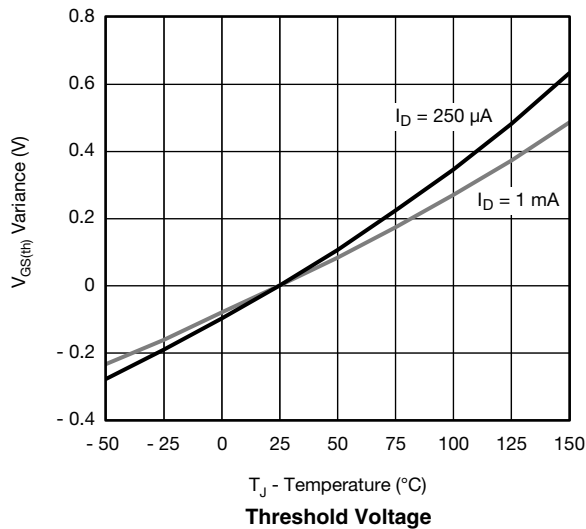
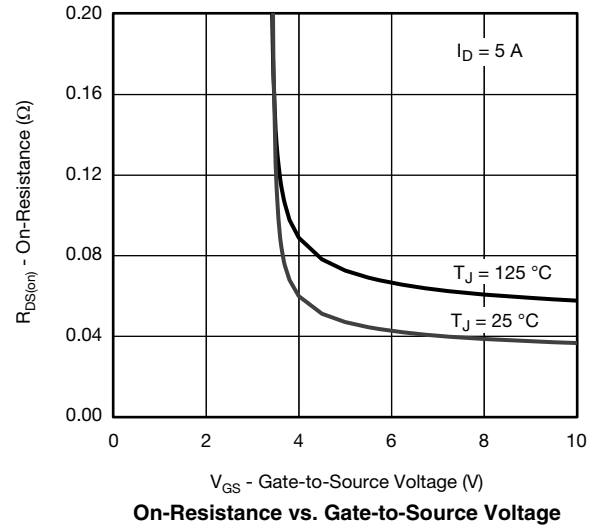
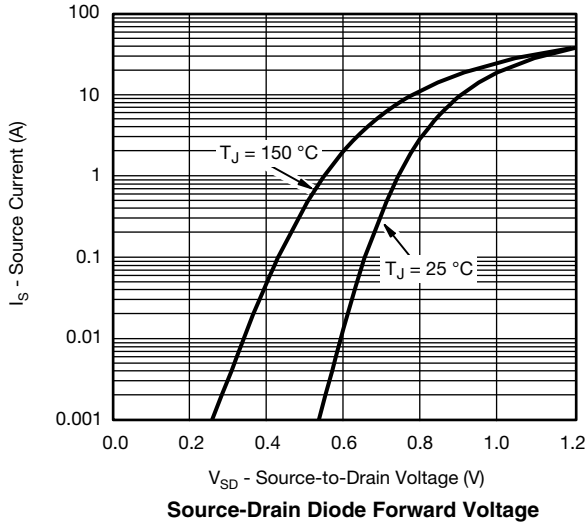


**Gate Charge**

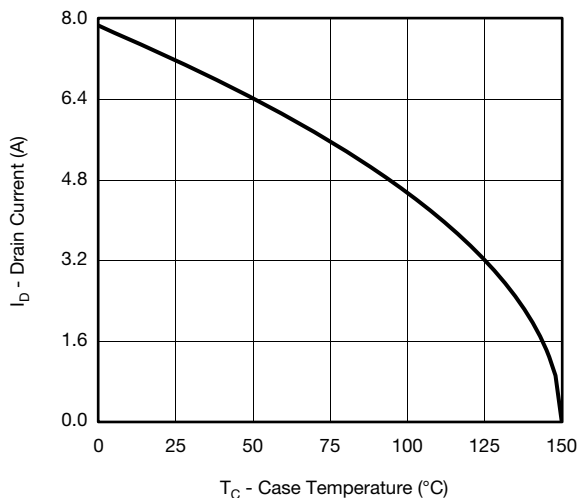


**On-Resistance vs. Junction Temperature**

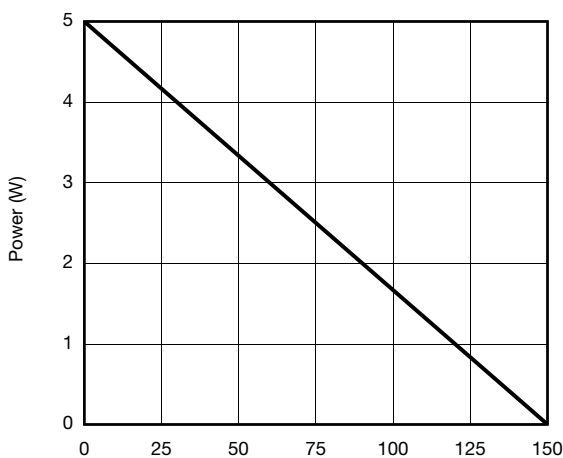
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



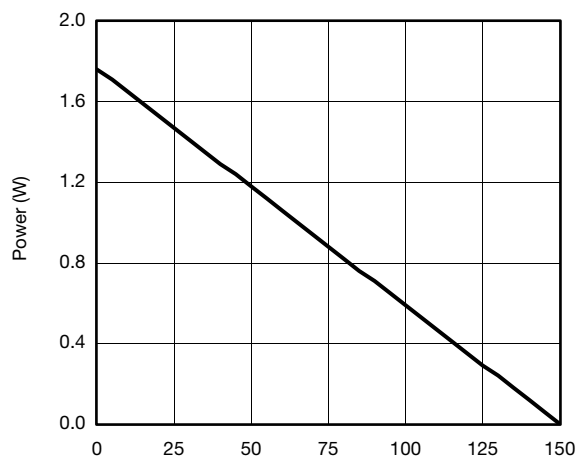
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



**Current Derating\***



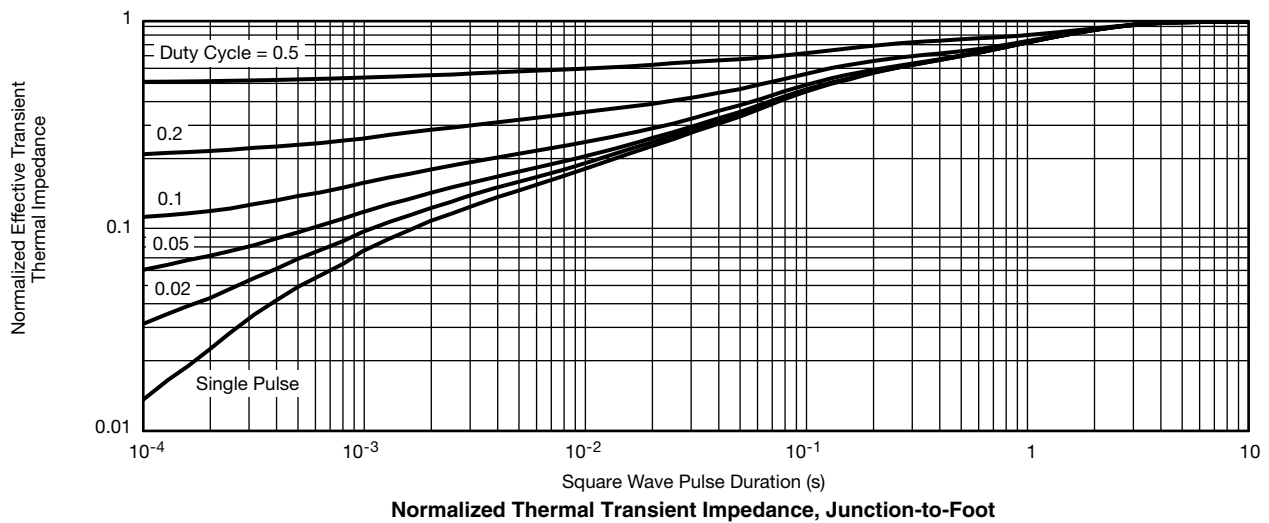
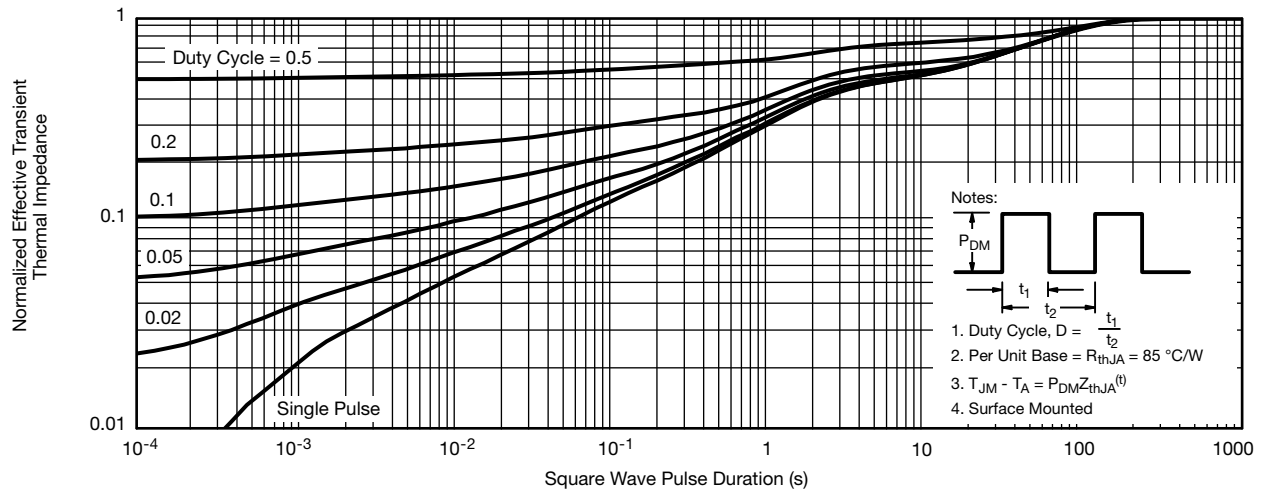
**Power, Junction-to-Foot**



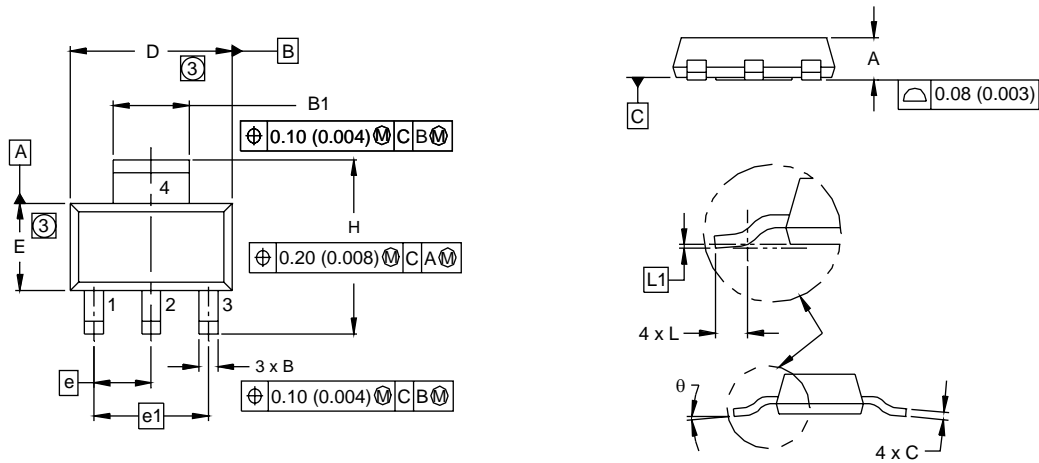
**Power Derating, Junction-to-Ambient**

\* 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)



**SOT-223 (HIGH VOLTAGE)**



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	1.55	1.80	0.061	0.071
B	0.65	0.85	0.026	0.033
B1	2.95	3.15	0.116	0.124
C	0.25	0.35	0.010	0.014
D	6.30	6.70	0.248	0.264
E	3.30	3.70	0.130	0.146
e	2.30 BSC		0.0905 BSC	
e1	4.60 BSC		0.181 BSC	
H	6.71	7.29	0.264	0.287
L	0.91	-	0.036	-
L1	0.061 BSC		0.0024 BSC	
$\theta$	-	10'	-	10'

ECN: S-82109-Rev. A, 15-Sep-08  
DWG: 5969

**Notes**

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimensions are shown in millimeters (inches).
3. Dimension do not include mold flash.
4. Outline conforms to JEDEC outline TO-261AA.

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