

NTS4409NT1G-VB Datasheet

N-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY			
V _{DS} (V)	R _{DS(on)} (Ω)	I _D (A) ^a	Q _g (Typ.)
20	0.036 at V _{GS} = 10 V	4	4 nC
	0.040 at V _{GS} = 4.5 V	3.8	
	0.048 at V _{GS} = 2.5 V	3.6	

FEATURES

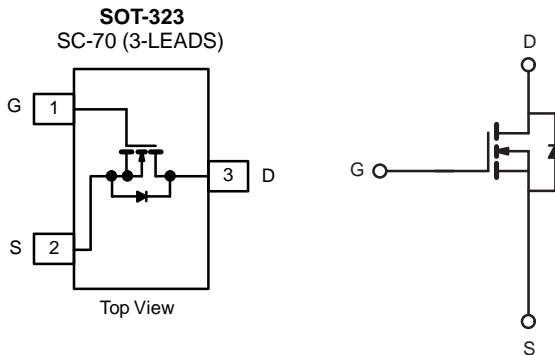
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET[®] Power MOSFET
- Typical ESD Protection 2000 V HBM
- 100 % R_g Tested
- Compliant to RoHS Directive 2002/95/EC



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Portable Devices
 - Load Switch
 - Battery Switch
- Load Switch for Motors, Relays and Solenoids



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}	± 12	
Continuous Drain Current (T _J = 150 °C)	I _D	T _C = 25 °C	4 ^a
		T _C = 70 °C	3.6 ^a
		T _A = 25 °C	4 ^{a, b, c}
		T _A = 70 °C	3.7 ^{b, c}
Pulsed Drain Current (t = 300 μs)	I _{DM}	20	A
Continuous Source-Drain Diode Current	I _S	T _C = 25 °C	
		T _A = 25 °C	1.3 ^{b, c}
Maximum Power Dissipation	P _D	T _C = 25 °C	2.8
		T _C = 70 °C	1.8
		T _A = 25 °C	1.56 ^{b, c}
		T _A = 70 °C	1.0 ^{b, c}
Operating Junction and Storage Temperature Range	T _J , T _{stg}	- 55 to 150	°C

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient ^{b, d}	R _{thJA}	60	80	°C/W
Maximum Junction-to-Foot (Drain)	R _{thJF}	34	45	

Notes:

- a. Package limited, T_C = 25 °C.
- b. Surface mounted on 1" x 1" FR4 board.
- c. t = 5 s.
- d. Maximum under steady state conditions is 125 °C/W.

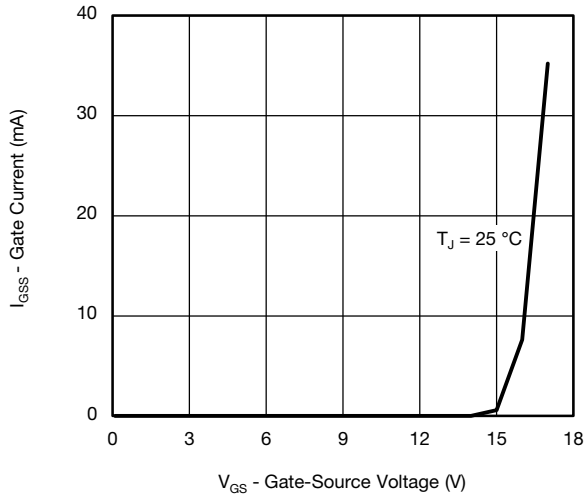
SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	20			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$		23		mV/°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		1.3	V
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 4.5\text{ V}$			± 0.5	μA
		$V_{DS} = 0\text{ V}, V_{GS} = \pm 12\text{ V}$			± 25	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$			1	
		$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			10	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 4.5\text{ V}$	15			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 3.7\text{ A}$		0.036		Ω
		$V_{GS} = 4.5\text{ V}, I_D = 3.6\text{ A}$		0.040		
		$V_{GS} = 2.5\text{ V}, I_D = 1.5\text{ A}$		0.048		
Forward Transconductance ^a	g_{fs}	$V_{DS} = 15\text{ V}, I_D = 3.7\text{ A}$		17		S
Dynamic^b						
Total Gate Charge	Q_g	$V_{DS} = 15\text{ V}, V_{GS} = 10\text{ V}, I_D = 3.7\text{ A}$		8.8	13.5	nC
		$V_{DS} = 15\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 3.7\text{ A}$		4	6	
Gate-Source Charge	Q_{gs}		0.9			
Gate-Drain Charge	Q_{gd}		1.1			
Gate Resistance	R_g	$f = 1\text{ MHz}$	0.4	2	4	k Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 15\text{ V}, R_L = 4.1\text{ }\Omega$ $I_D \approx 3.7\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$		0.29	0.58	μs
Rise Time	t_r			0.4	0.8	
Turn-Off Delay Time	$t_{d(off)}$			1.9	3.8	
Fall Time	t_f			0.75	1.5	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 15\text{ V}, R_L = 4.1\text{ }\Omega$ $I_D \approx 3.7\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$		0.1	0.2	
Rise Time	t_r			0.15	0.3	
Turn-Off Delay Time	$t_{d(off)}$			3	6	
Fall Time	t_f			0.75	1.5	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^\circ\text{C}$			2.3	A
Pulse Diode Forward Current	I_{SM}				20	
Body Diode Voltage	V_{SD}	$I_S = 3.7\text{ A}, V_{GS} = 0\text{ V}$		0.85	1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 3.7\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		12	25	ns
Body Diode Reverse Recovery Charge	Q_{rr}			5	10	nC
Reverse Recovery Fall Time	t_a			6.5		ns
Reverse Recovery Rise Time	t_b			5.5		

Notes:

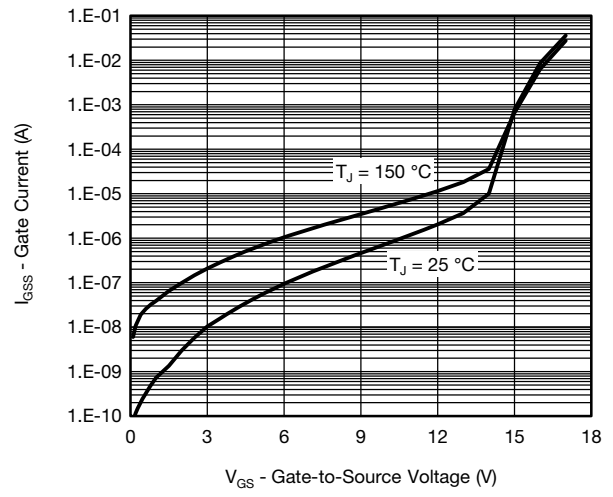
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
- b. Guaranteed by design, not subject to production testing.

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.

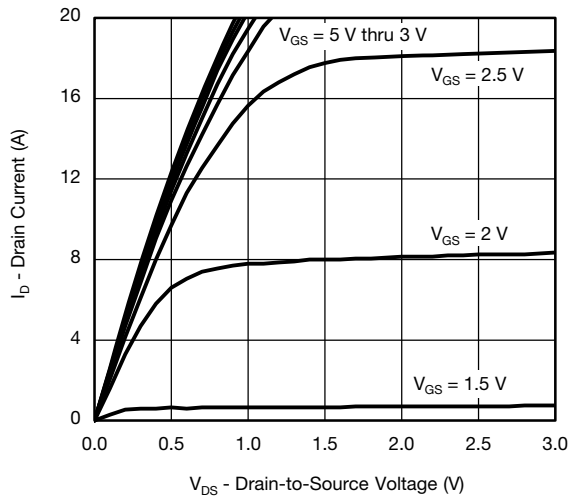
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



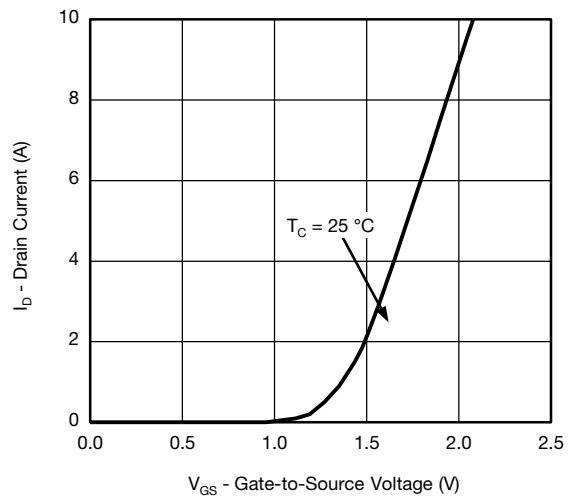
Gate Current vs. Gate-to-Source Voltage



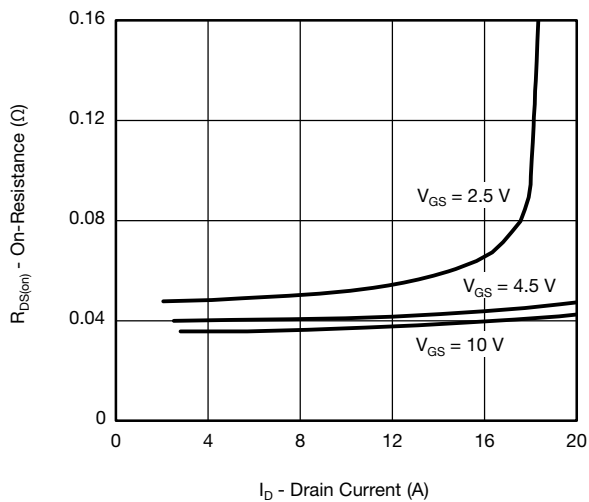
Gate Current vs. Gate-to-Source Voltage



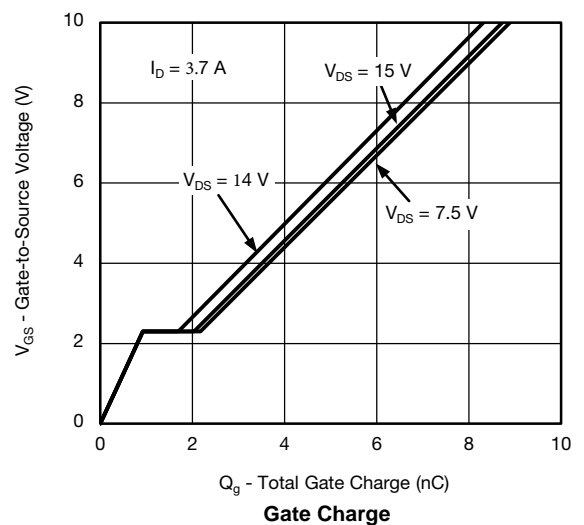
Output Characteristics



Transfer Characteristics

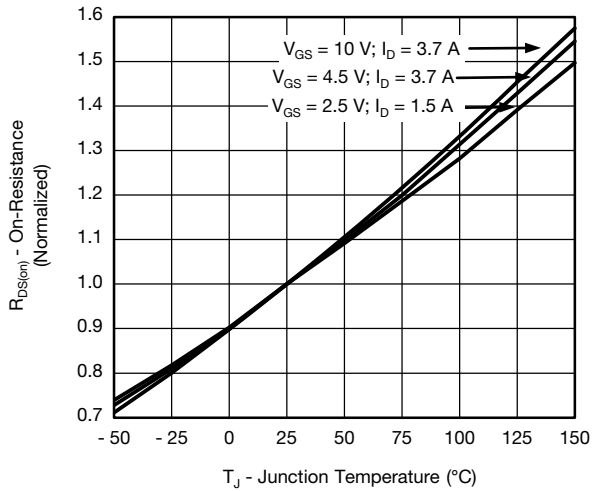


On-Resistance vs. Drain Current

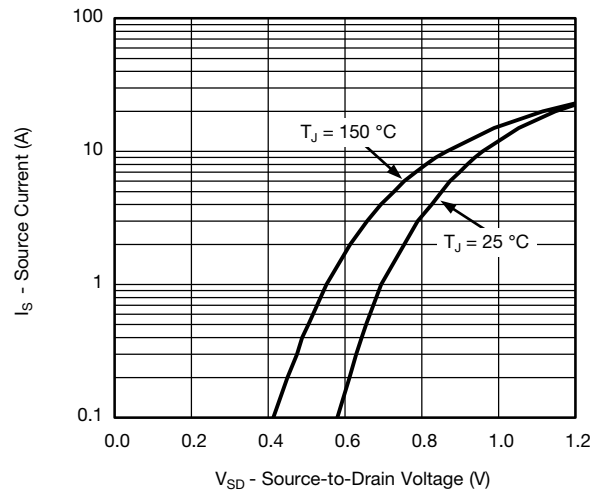


Gate Charge

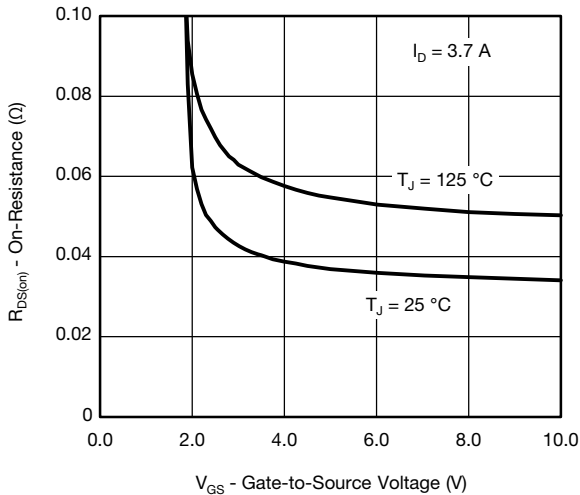
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



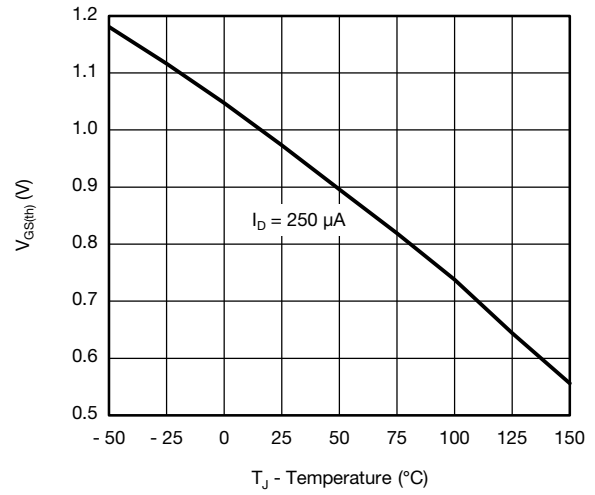
Normalized On-Resistance vs. Junction Temperature



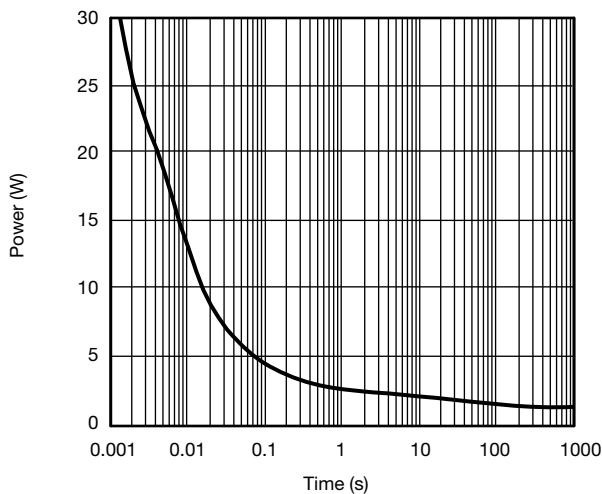
Source-Drain Diode Forward Voltage



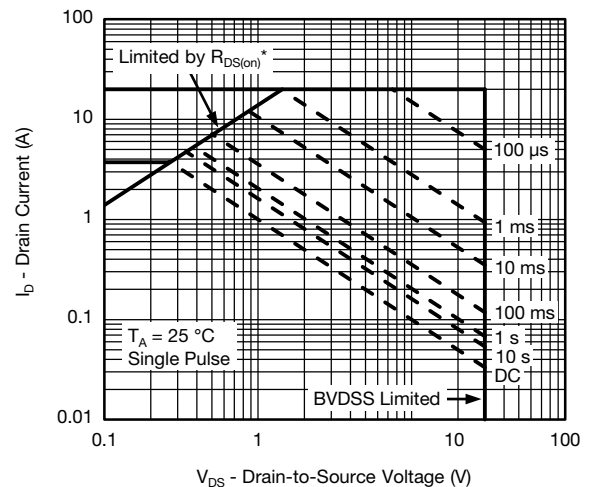
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

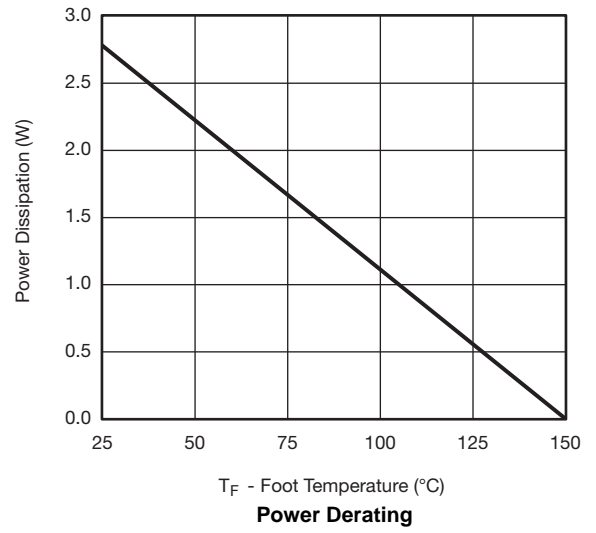
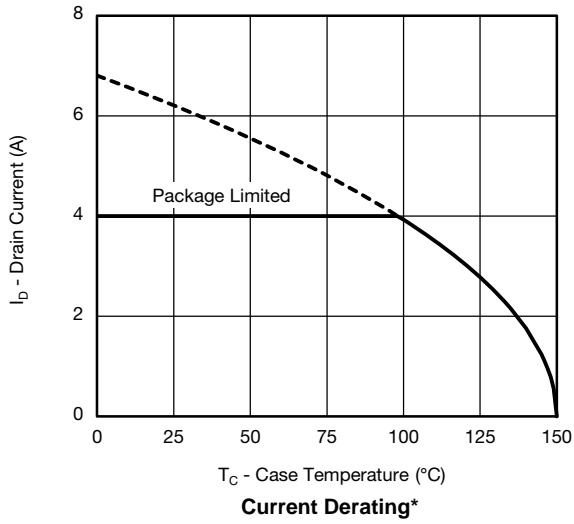


Single Pulse Power, Junction-to-Ambient



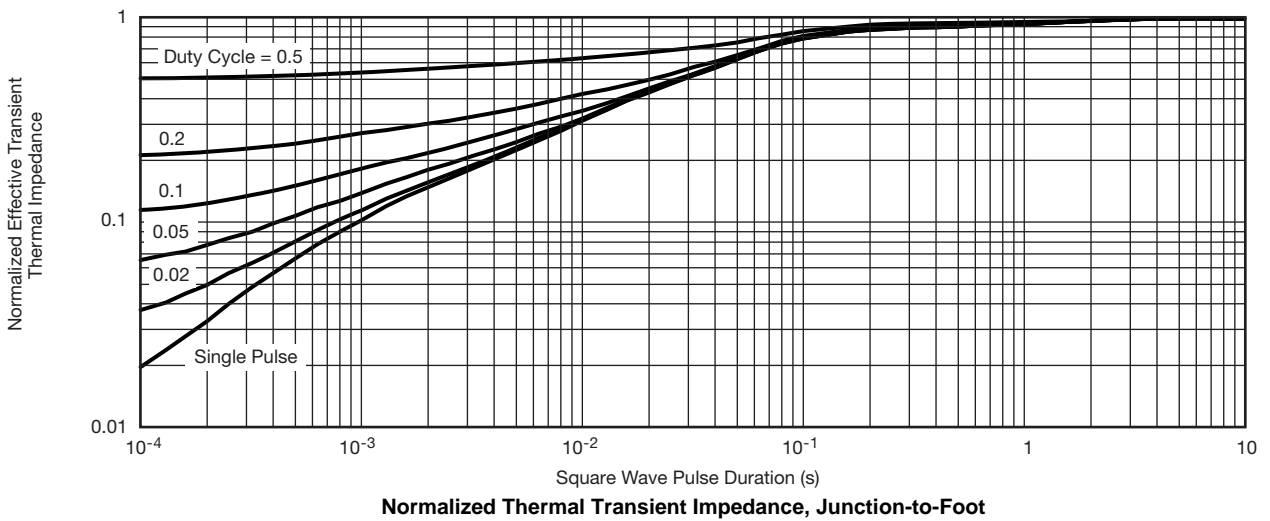
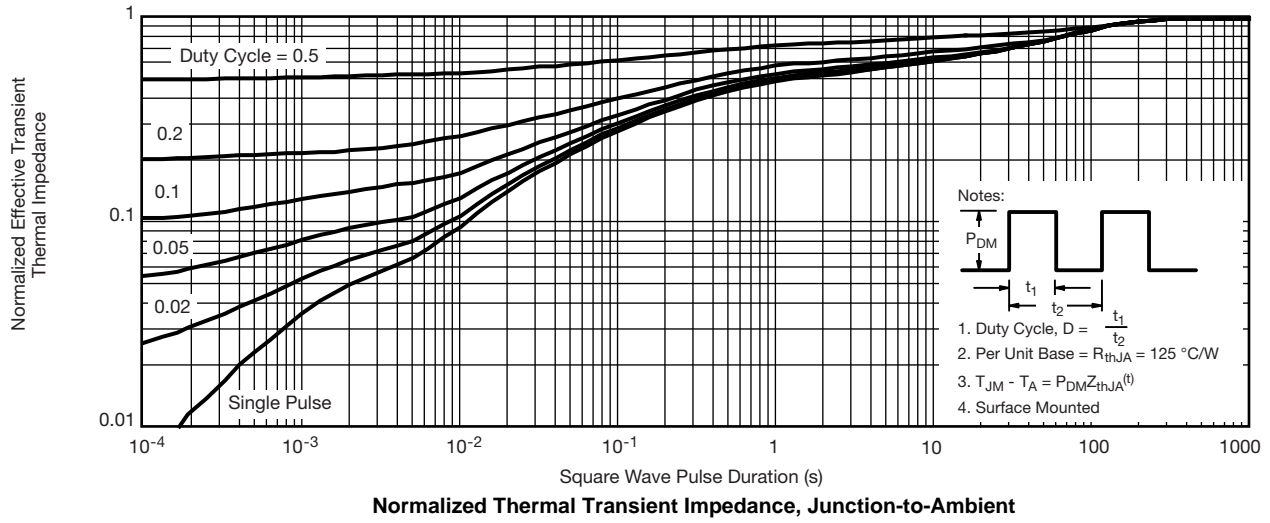
Safe Operating Area, Junction-to-Ambient
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)

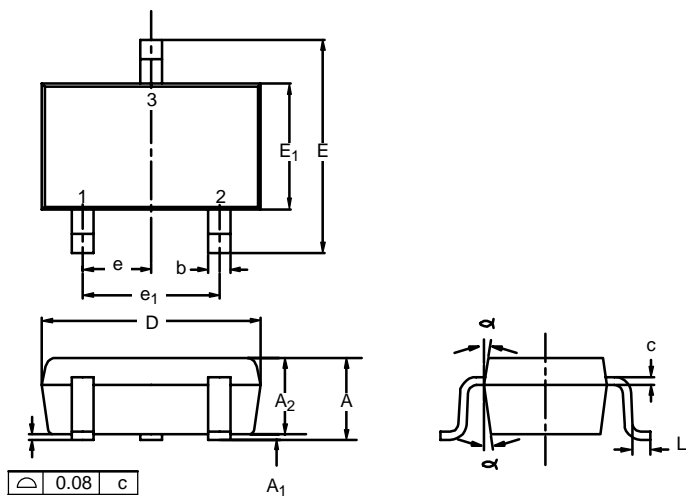


* The power dissipation P_D is based on $T_{J(max)} = 150\text{ }^\circ\text{C}$, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below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

TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



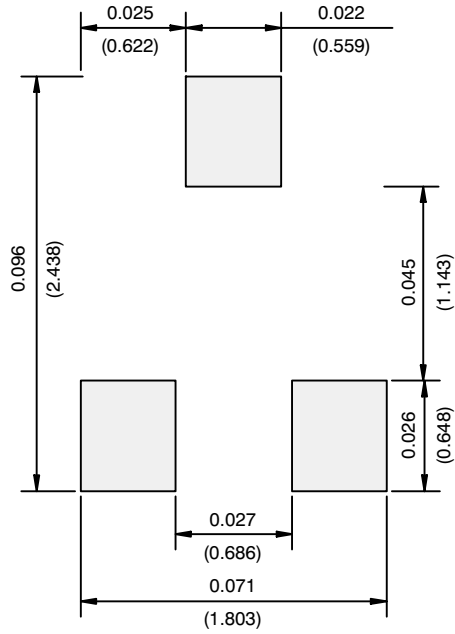
SC-70: 3-LEADS



Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.90	-	1.10	0.035	-	0.043
A ₁	-	-	0.10	-	-	0.004
A ₂	0.80	-	1.00	0.031	-	0.039
b	0.25	-	0.40	0.010	-	0.016
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 ₁	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65BSC			0.026BSC		
e ₁	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. C, 09-Jul-01
DWG: 5549

RECOMMENDED MINIMUM PADS FOR SC-70: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

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