

TSM2312CX RF-VB Datasheet

N-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^e	Q_g (Typ.)
20	0.022 at $V_{GS} = 4.5$ V	6 ^a	8.8 nC
	0.028 at $V_{GS} = 2.5$ V	6 ^a	
	0.039 at $V_{GS} = 1.8$ V	5.6	

FEATURES

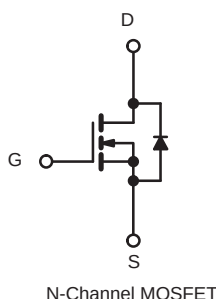
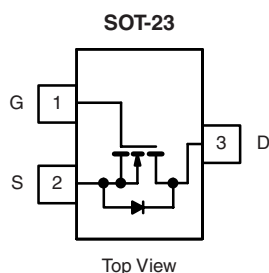
- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- 100 % R_g Tested
- Compliant to RoHS Directive 2002/95/EC



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- DC/DC Converters
- Load Switch for Portable Applications



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)	$T_C = 25$ °C	6 ^a	A
	$T_C = 70$ °C	5.1	
	$T_A = 25$ °C	5 ^{b, c}	
	$T_A = 70$ °C	4 ^{b, c}	
Pulsed Drain Current	I_{DM}	20	
Continuous Source-Drain Diode Current	$T_C = 25$ °C	1.75	
	$T_A = 25$ °C	1.04 ^{b, c}	
Maximum Power Dissipation	$T_C = 25$ °C	2.1	W
	$T_C = 70$ °C	1.3	
	$T_A = 25$ °C	1.25 ^{b, c}	
	$T_A = 70$ °C	0.8 ^{b, c}	
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 ^{b, d}	R_{thJA}	80	100	°C/W
Maximum Junction-to-Foot (Drain)	R_{thJF}	40	60	

Notes:

- Package limited
- Surface Mounted on 1" x 1" FR4 board.
- $t = 5$ s.
- Maximum under steady state conditions is 125 °C/W.
- Based on $T_C = 25$ °C.

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	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$		25		$\text{mV}/^{\circ}\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			- 2.6		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	0.45		1.0	V
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8\text{ V}$			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$			1	μA
		$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, T_J = 70\text{ }^{\circ}\text{C}$			10	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \leq 5\text{ V}, V_{GS} = 4.5\text{ V}$	20			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = 4.5\text{ V}, I_D = 5.0\text{ A}$		0.022		Ω
		$V_{GS} = 2.5\text{ V}, I_D = 4.7\text{ A}$		0.028		
		$V_{GS} = 1.8\text{ V}, I_D = 4.3\text{ A}$		0.039		
Forward Transconductance ^a	g_{fs}	$V_{DS} = 10\text{ V}, I_D = 5.0\text{ A}$		24		S
Dynamic ^b						
Input Capacitance	C_{iss}	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		865		pF
Output Capacitance	C_{oss}			105		
Reverse Transfer Capacitance	C_{rss}			55		
Total Gate Charge	Q_g	$V_{DS} = 10\text{ V}, V_{GS} = 5\text{ V}, I_D = 5.0\text{ A}$		12	18	nC
Gate-Source Charge	Q_{gs}	$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 5.0\text{ A}$		8.8	14	
Gate-Drain Charge	Q_{gd}			1.1		
Gate Resistance	R_g			0.7		
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 10\text{ V}, R_L = 2.2\text{ }\Omega$ $I_D \cong 4\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$	0.5	2.4	4.8	Ω
Rise Time	t_r			8	16	ns
Turn-Off Delay Time	$t_{d(off)}$			17	26	
Fall Time	t_f			31	47	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 10\text{ V}, R_L = 2.2\text{ }\Omega$ $I_D \cong 4\text{ A}, V_{GEN} = 5\text{ V}, R_g = 1\text{ }\Omega$		8	16	
Rise Time	t_r			5	10	
Turn-Off Delay Time	$t_{d(off)}$			13	20	
Fall Time	t_f			21	32	
				6	12	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^{\circ}\text{C}$			1.75	A
Pulse Diode Forward Current	I_{SM}				20	
Body Diode Voltage	V_{SD}	$I_S = 4\text{ A}, V_{GS} = 0\text{ V}$		0.75	1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 4\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^{\circ}\text{C}$		12	20	ns
Body Diode Reverse Recovery Charge	Q_{rr}			5	10	nC
Reverse Recovery Fall Time	t_a			7		ns
Reverse Recovery Rise Time	t_b			5		

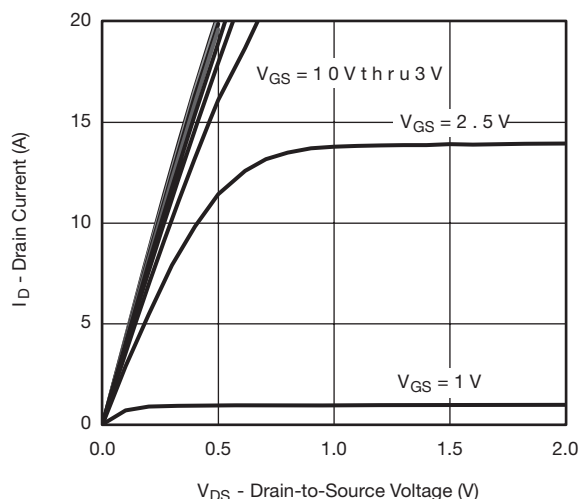
Notes:

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

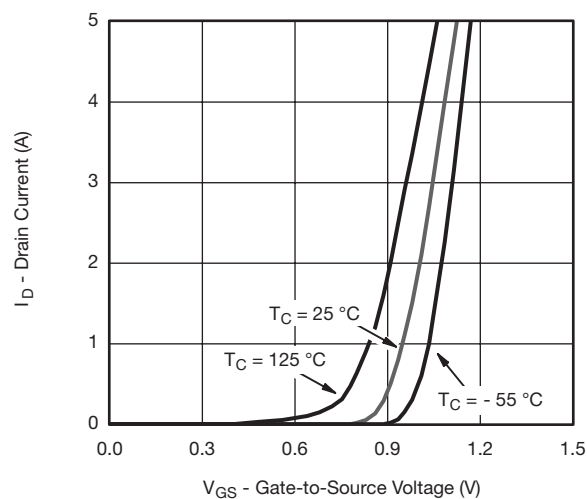
b. Guaranteed by design, not subject to production testing.

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.

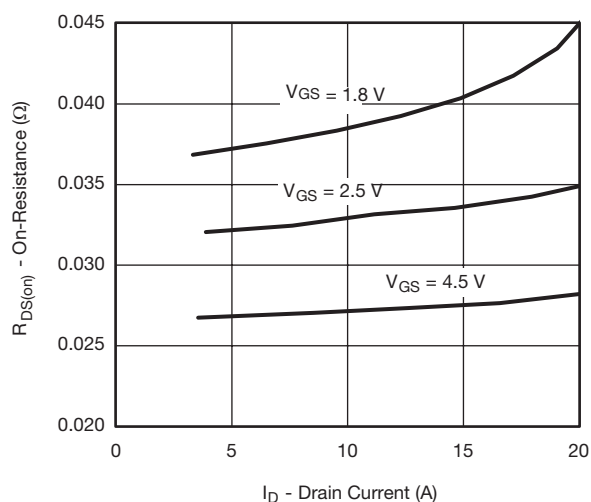
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



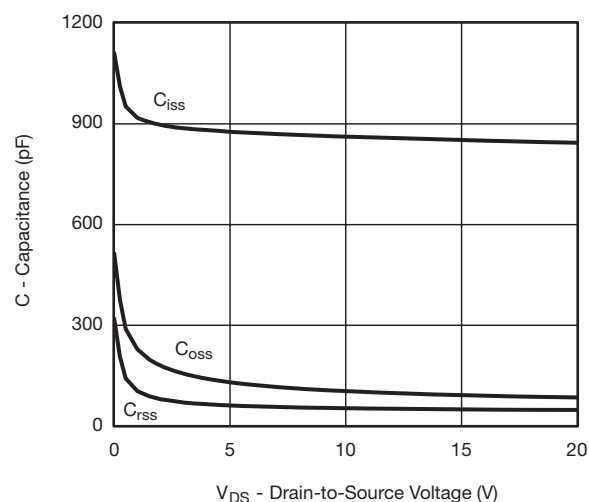
Output Characteristics



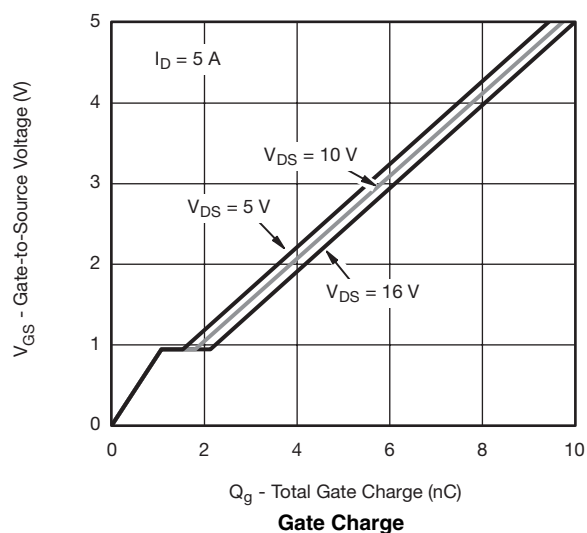
Transfer Characteristics



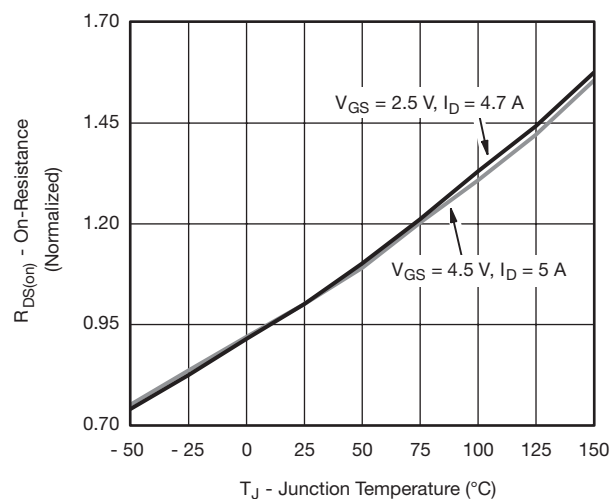
On-Resistance vs. Drain Current and Gate Voltage



Capacitance

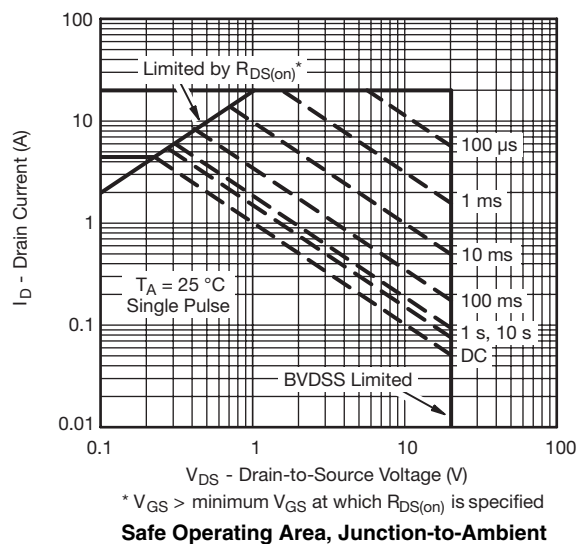
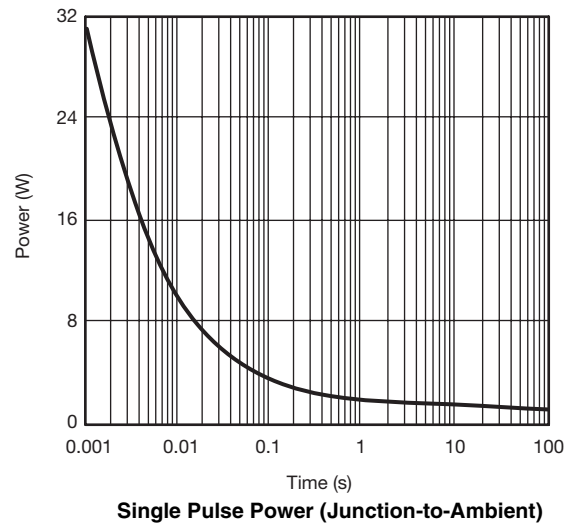
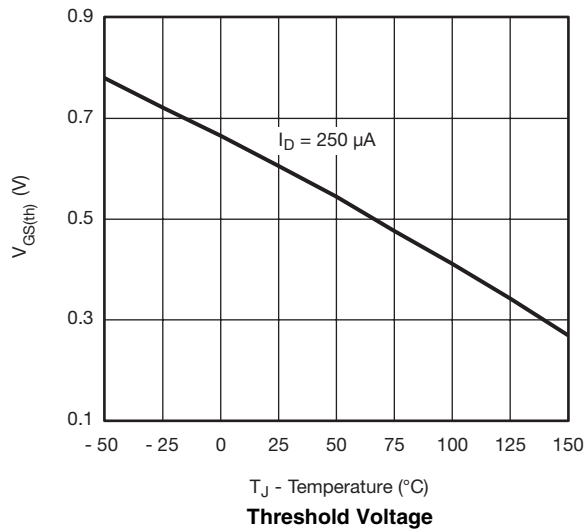
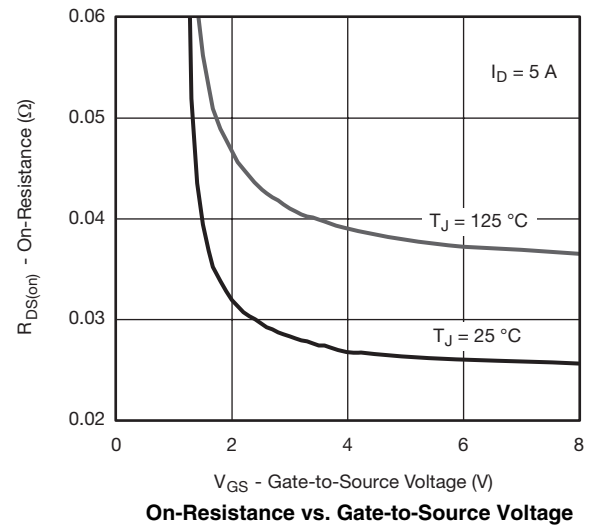
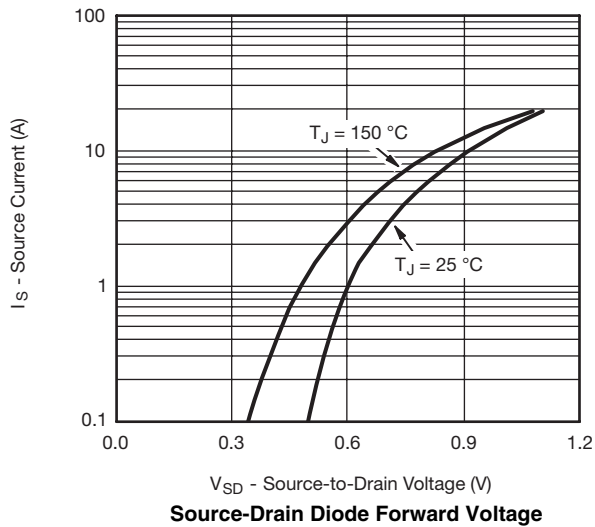


Gate Charge

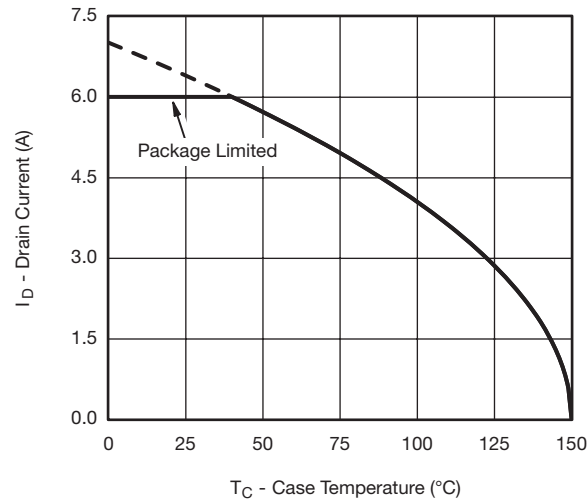


On-Resistance vs. Junction Temperature

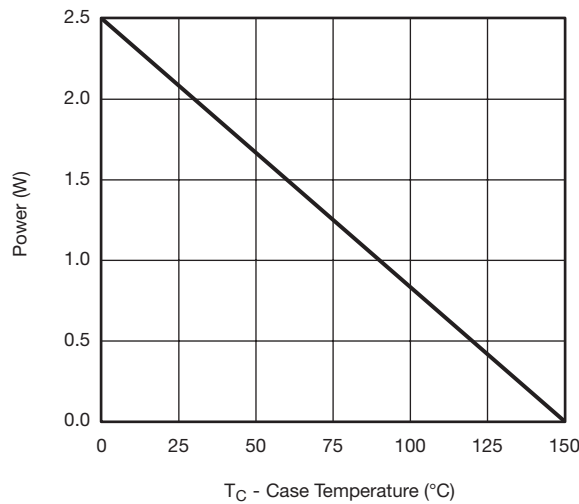
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



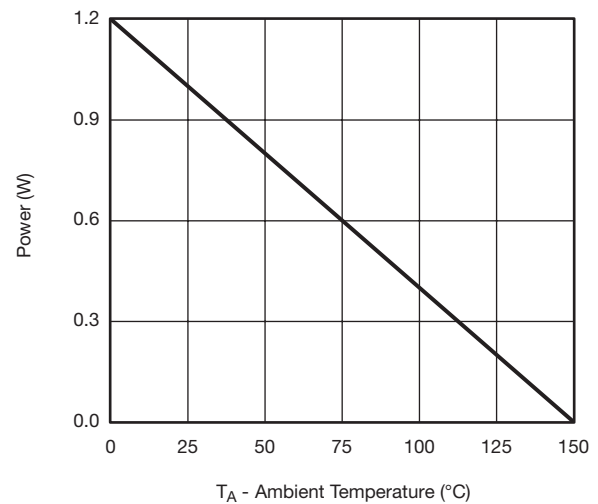
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



Current Derating*



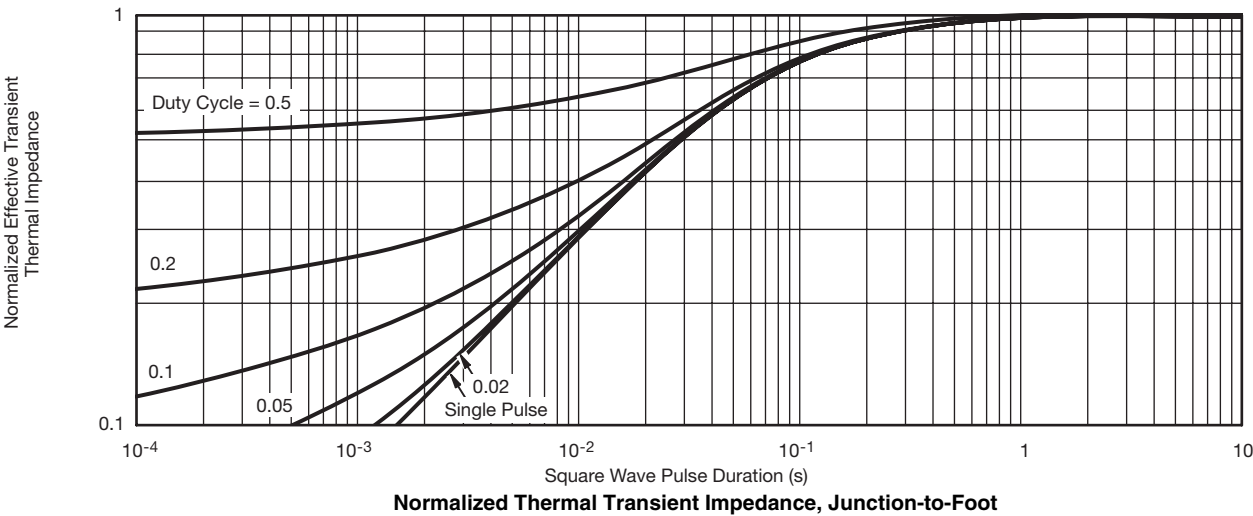
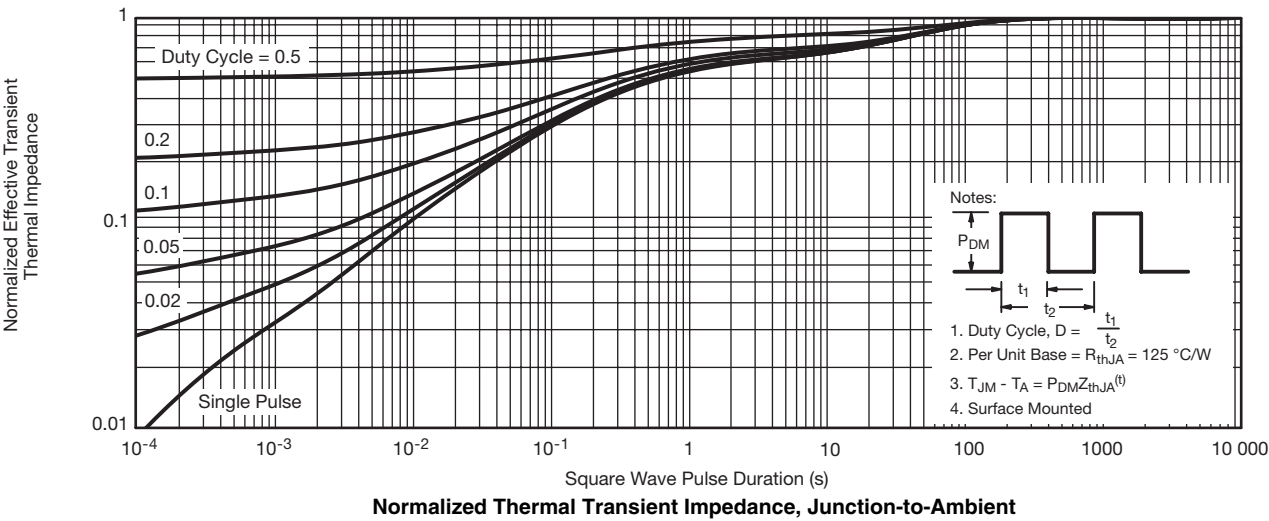
Power Derating, Junction-to-Foot

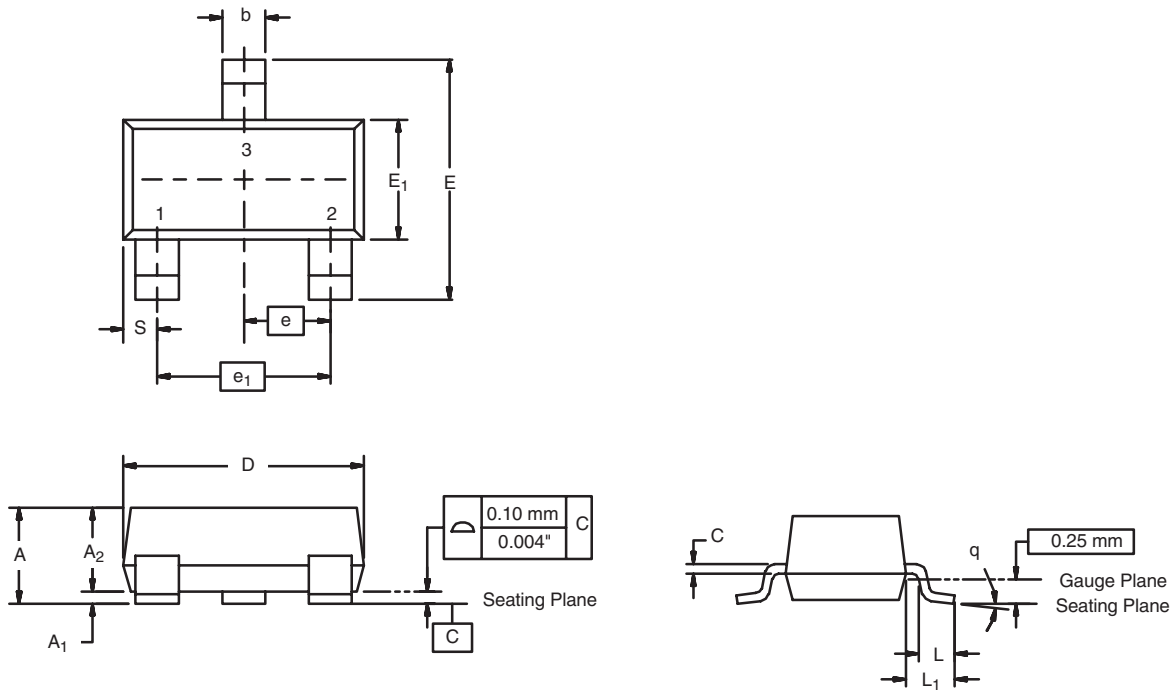


Power Derating, Junction-to-Ambient

* 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.

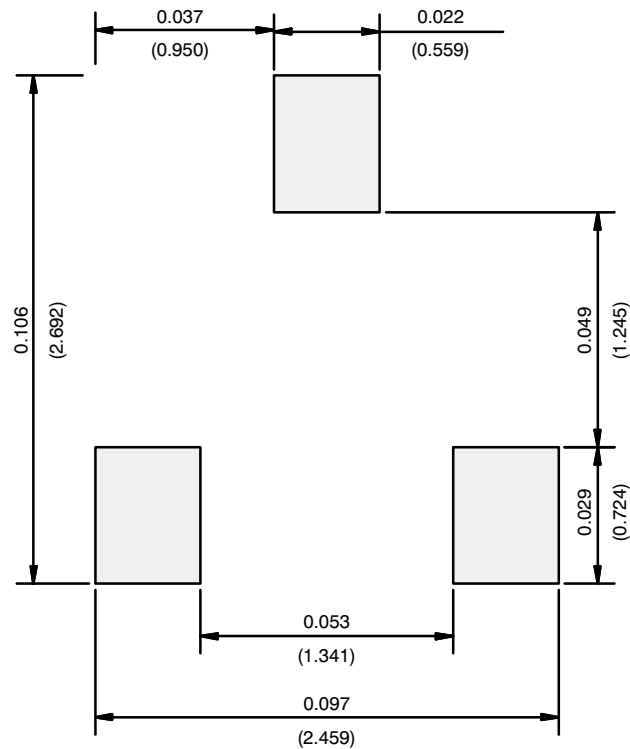
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



SOT-23 (TO-236): 3-LEAD

Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	0.89	1.12	0.035	0.044
A ₁	0.01	0.10	0.0004	0.004
A ₂	0.88	1.02	0.0346	0.040
b	0.35	0.50	0.014	0.020
c	0.085	0.18	0.003	0.007
D	2.80	3.04	0.110	0.120
E	2.10	2.64	0.083	0.104
E ₁	1.20	1.40	0.047	0.055
e	0.95 BSC		0.0374 Ref	
e ₁	1.90 BSC		0.0748 Ref	
L	0.40	0.60	0.016	0.024
L ₁	0.64 Ref		0.025 Ref	
S	0.50 Ref		0.020 Ref	
q	3°	8°	3°	8°
ECN: S-03946-Rev. K, 09-Jul-01 DWG: 5479				

RECOMMENDED MINIMUM PADS FOR SOT-23



Recommended Minimum Pads
Dimensions in Inches/(mm)

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