

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

MOSFET PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^a	Q_g (Typ.)
- 20	0.034 at $V_{GS} = - 10$ V	- 6 ^e	10 nC
	0.045 at $V_{GS} = - 4.5$ V	- 6 ^e	
	0.067 at $V_{GS} = - 2.5$ V	- 5.2	

FEATURES

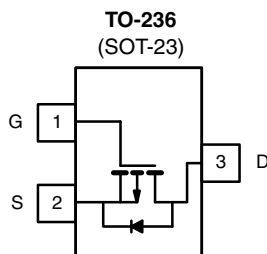
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFET
- 100 % R_g Tested
- Compliant to RoHS Directive 2002/95/EC



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Load Switch
- PA Switch
- DC/DC Converters



Top View
Si2399DS (O1)*
* Marking Code

Ordering Information: Si2399DS-T1-GE3 (Lead (Pb)-free and Halogen-free)

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 ^e	A
	$T_C = 70$ °C	- 5.8	
	$T_A = 25$ °C	- 5.1 ^{b, c}	
	$T_A = 70$ °C	- 4.1 ^{b, c}	
Pulsed Drain Current	I_{DM}	- 20	A
Continuous Source-Drain Diode Current	$T_C = 25$ °C	- 2.1	
	$T_A = 25$ °C	- 1.0 ^{b, c}	
Maximum Power Dissipation	$T_C = 25$ °C	2.5	W
	$T_C = 70$ °C	1.6	
	$T_A = 25$ °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

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient ^{b, d}	R_{thJA}	75	100	°C/W
Maximum Junction-to-Foot (Drain)	R_{thJF}	40	50	

Notes:

- Based on $T_C = 25$ °C.
- Surface mounted on 1" x 1" FR4 board.
- $t = 5$ s.
- Maximum under steady state conditions is 166 °C/W.
- Package limited.

MOSFET 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}	$V_{DS} = 0\text{ V}$, $I_D = -250\text{ }\mu\text{A}$	-20			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$		-13.4		mV/ $^{\circ}\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			2.9		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = -250\text{ }\mu\text{A}$	-0.6		-1.5	V
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 12\text{ V}$			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -20\text{ V}$, $V_{GS} = 0\text{ V}$			-1	μA
		$V_{DS} = -20\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 55\text{ }^{\circ}\text{C}$			-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	$R_{DS(on)}$	$V_{GS} = -10\text{ V}$, $I_D = -5.1\text{ A}$		0.028	0.034	Ω
		$V_{GS} = -4.5\text{ V}$, $I_D = -4.5\text{ A}$		0.037	0.045	
		$V_{GS} = -2.5\text{ V}$, $I_D = -3.7\text{ A}$		0.055	0.067	
Forward Transconductance ^a	g_{fs}	$V_{DS} = -5\text{ V}$, $I_D = -5.1\text{ A}$		15		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{DS} = -10\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$		835		pF
Output Capacitance	C_{oss}			180		
Reverse Transfer Capacitance	C_{rss}			155		
Total Gate Charge	Q_g	$V_{DS} = -10\text{ V}$, $V_{GS} = -4.5\text{ V}$, $I_D = -5.1\text{ A}$		10	20	nC
Gate-Source Charge	Q_{gs}	$V_{DS} = -10\text{ V}$, $V_{GS} = -2.5\text{ V}$, $I_D = -5.1\text{ A}$		6.4	9.6	
Gate-Drain Charge	Q_{gd}			1.7		
Gate Resistance	R_g			3.4		
Turn-On Delay Time	$t_{d(on)}$	$f = 1\text{ MHz}$ $V_{DD} = -10\text{ V}$, $R_L = 2.4\text{ }\Omega$ $I_D = -4.1\text{ A}$, $V_{GEN} = -4.5\text{ V}$, $R_g = 1\text{ }\Omega$	0.9	4.4	8.8	Ω
Rise Time	t_r			22	33	
Turn-Off Delay Time	$t_{d(off)}$			20	30	
Fall Time	t_f			28	42	
				9	18	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^{\circ}\text{C}$			-2.1	A
Pulse Diode Forward Current ^a	I_{SM}				-20	
Body Diode Voltage	V_{SD}	$I_S = -4.1\text{ A}$		-0.8	-1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = -4.1\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $T_J = 25\text{ }^{\circ}\text{C}$		23	35	ns
Body Diode Reverse Recovery Charge	Q_{rr}			12	20	nC
Reverse Recovery Fall Time	t_a			15		ns
Reverse Recovery Rise Time	t_b			8		

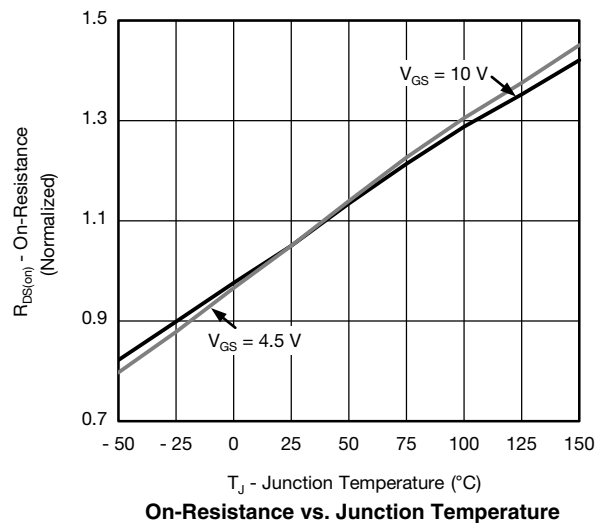
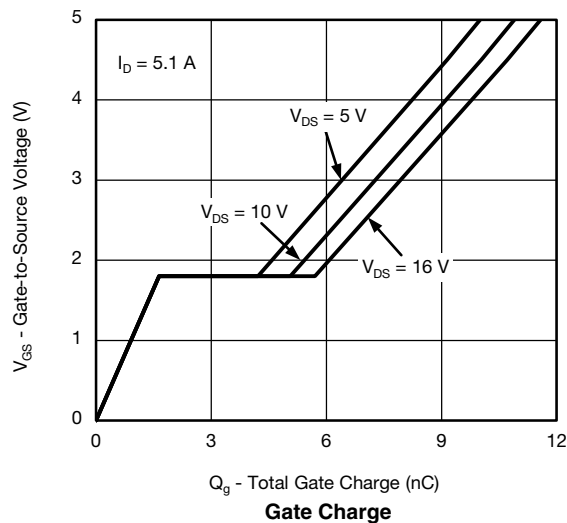
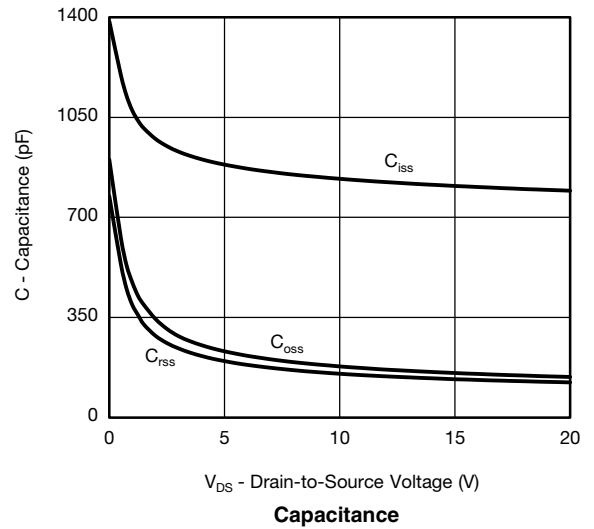
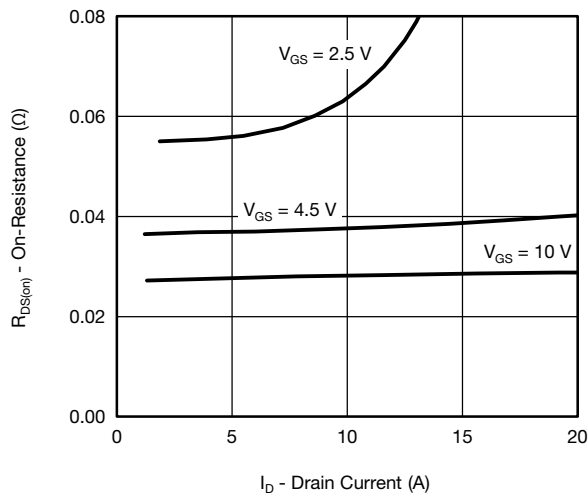
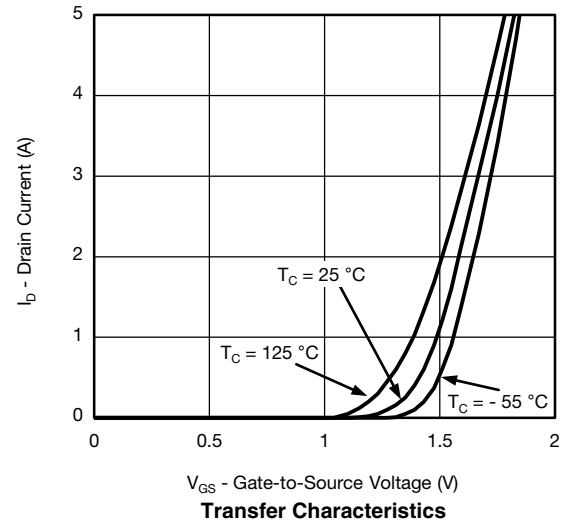
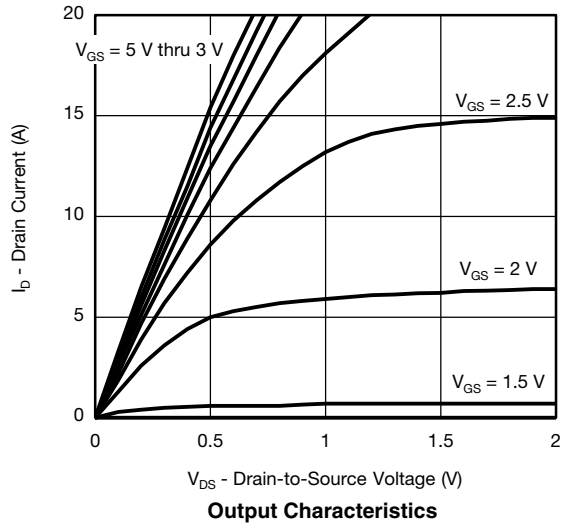
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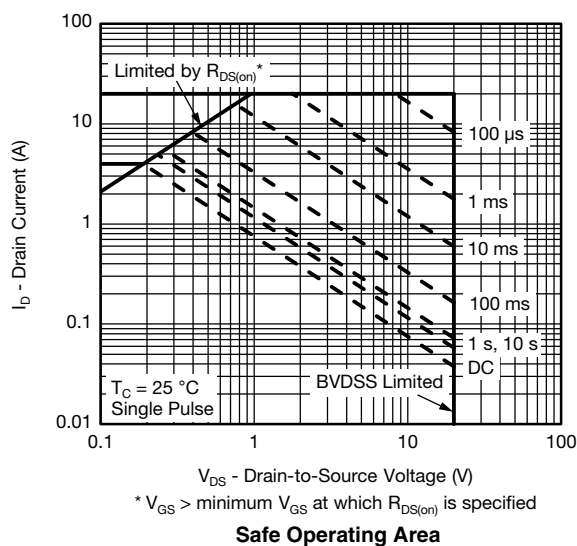
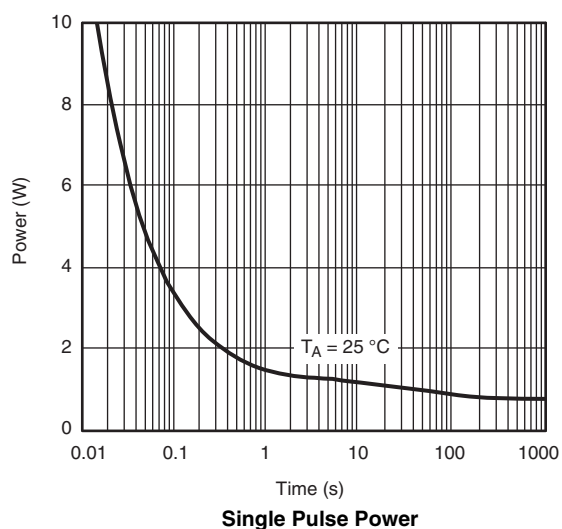
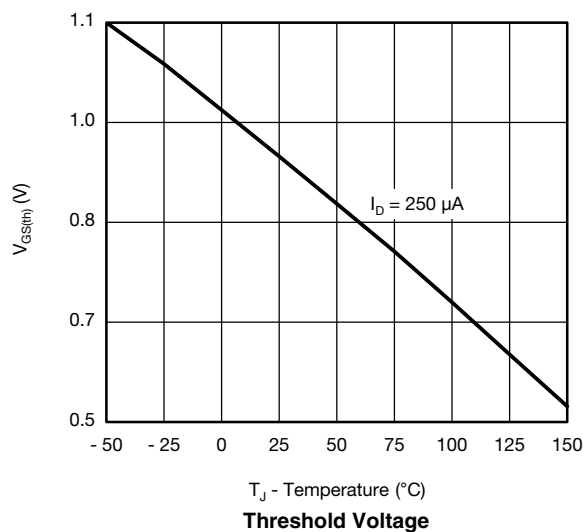
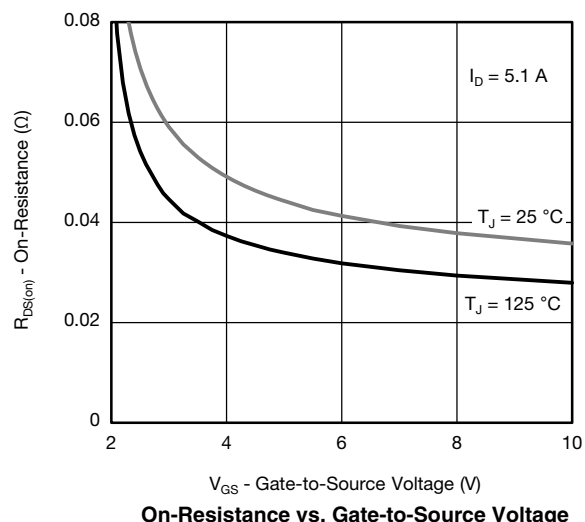
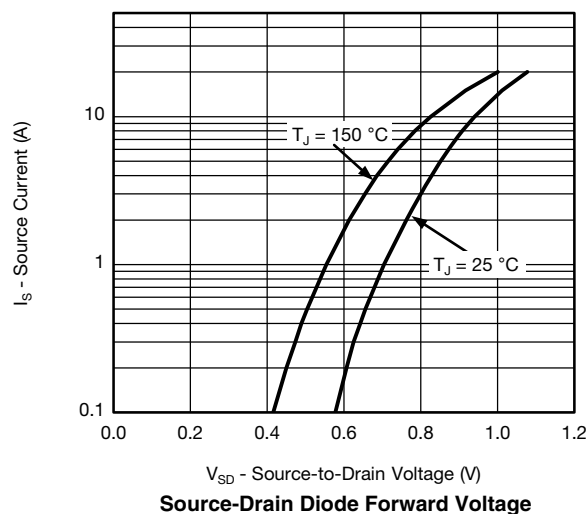
a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

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

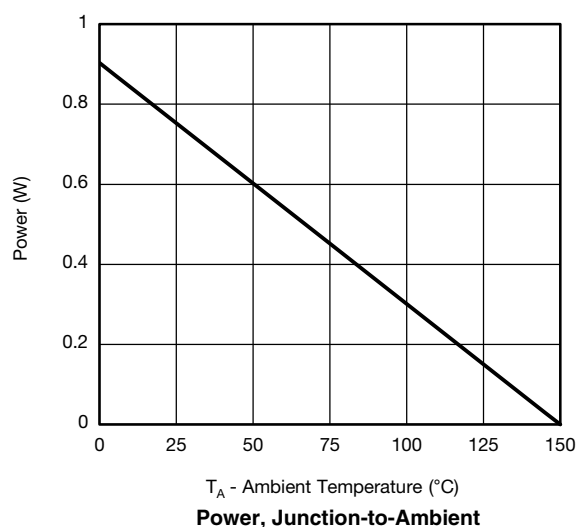
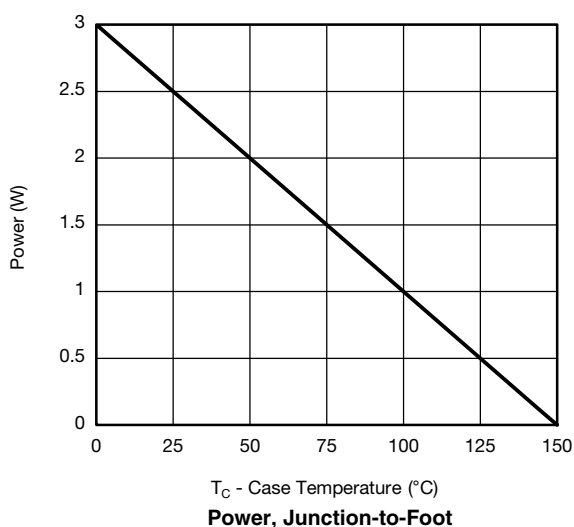
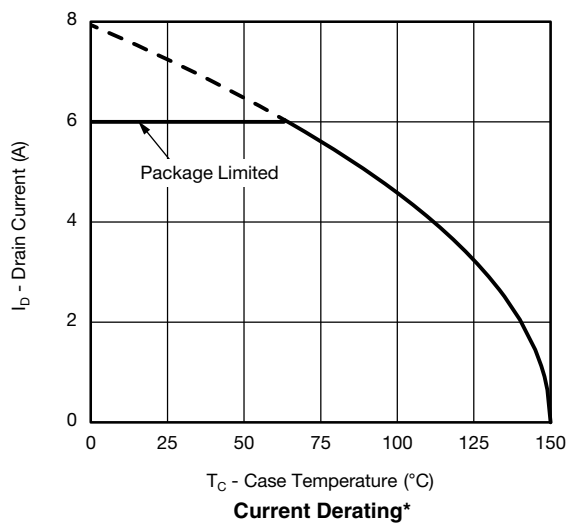
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

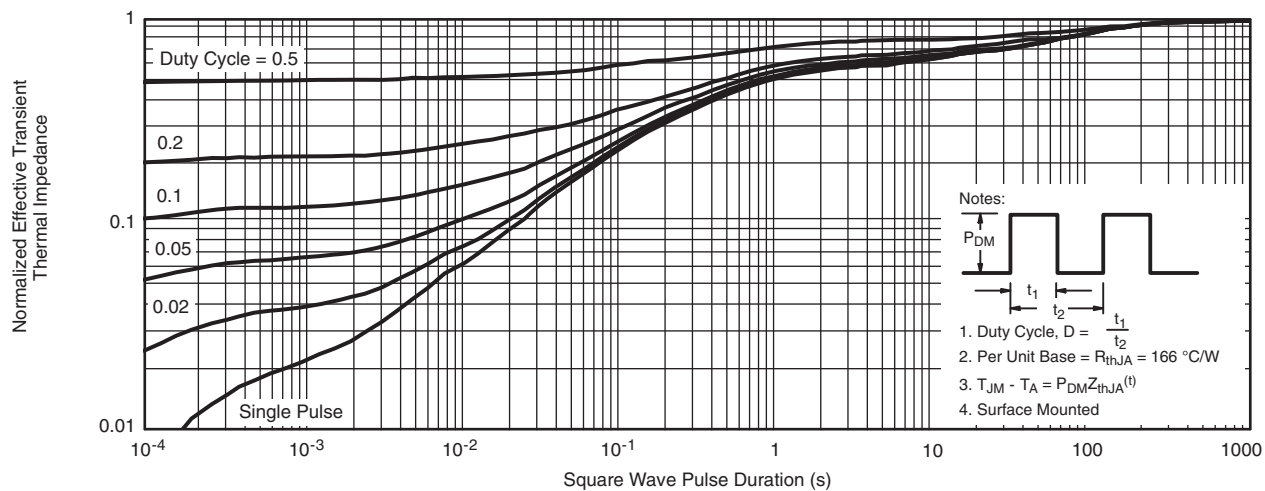
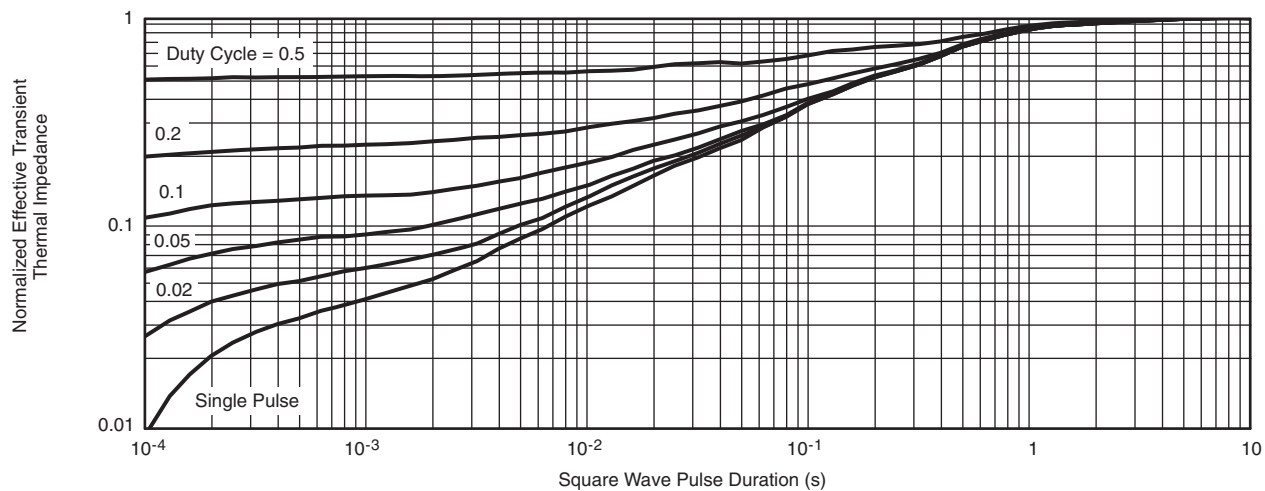


TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

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* 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**

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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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