N-Channel 40 V (D-S) MOSFET

PRODUCT SUMMARY			
V_{DS} (V)	$R_{DS(on)}$ (Ω) Max.	I_D (A)[a]	Q_g (Typ.)
40	0.051 at V_{GS} = 10 V	4.3	3.8 nC
	0.054 at V_{GS} = 4.5 V	4.1	
	0.070 at V_{GS} = 2.5 V	3.6	

FEATURES

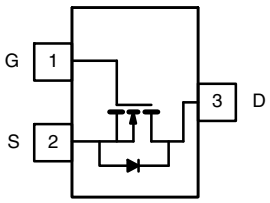
- TrenchFET® Power MOSFET
- 100 % R_g Tested
- Material categorization:
  For definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

- DC/DC Converter
- Load Switch
- LED Backlighting
- Power Management

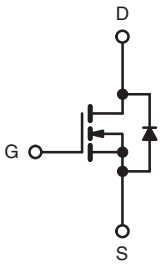
TO-236 (SOT-23)



Top View

Si2356DS (E9)*

* Marking Code



N-Channel MOSFET

Ordering Information:
Si2356DS-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}	40	V
Gate-Source Voltage		V_{GS}	± 12	
Continuous Drain Current (T_J = 150 °C)	T_C = 25 °C	I_D	4.3	A
	T_C = 70 °C		3.4	
	T_A = 25 °C		3.2 [a,b]	
	T_A = 70 °C		2.6 [a,b]	
Pulsed Drain Current (t = 100 µs)		I_{DM}	20	
Continuous Source-Drain Diode Current	T_C = 25 °C	I_S	1.4	
	T_A = 25 °C		0.8 [a,b]	
Maximum Power Dissipation	T_C = 25 °C	P_D	1.7	W
	T_C = 70 °C		1.1	
	T_A = 25 °C		0.96 [a,b]	
	T_A = 70 °C		0.62 [a,b]	
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 [a,c]	t ≤ 5 s	R_{thJA}	100	130	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	R_{thJF}	60	75	

Notes:
a. Surface mounted on 1" x 1" FR4 board.
b. t = 5 s.
c. Maximum under steady state conditions is 175 °C/W.

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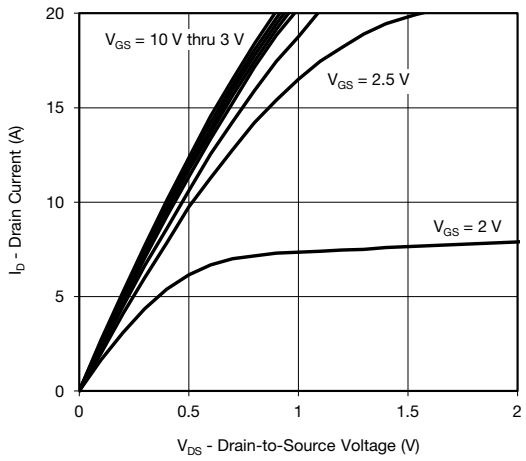
SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)						
Parameter	**Symbol**	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Static						
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA	40			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	I_D = 250 µA		43		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			- 3.8		
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS} , I_D = 250 µA	0.6		1.5	V
Gate-Source Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 12 V			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 40 V, V_{GS} = 0 V			1	µA
		V_{DS} = 40 V, V_{GS} = 0 V, T_J = 55 °C			10	
On-State Drain Current[a]	$I_{D(on)}$	$V_{DS} \geq$ 5 V, V_{GS} = 10 V	10			A
Drain-Source On-State Resistance[a]	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 3.2 A		0.042	0.051	Ω
		V_{GS} = 4.5 V, I_D = 3.1 A		0.045	0.054	
		V_{GS} = 2.5 V, I_D = 2 A		0.056	0.070	
Forward Transconductance[a]	g_{fs}	V_{DS} = 15 V, I_D = 3.2 A		13		S
Dynamic[b]						
Input Capacitance	C_{iss}	V_{DS} = 20 V, V_{GS} = 0 V, f = 1 MHz		370		pF
Output Capacitance	C_{oss}			50		
Reverse Transfer Capacitance	C_{rss}			17		
Total Gate Charge	Q_g	V_{DS} = 20 V, V_{GS} = 10 V, I_D = 3.2 A		8.1	13	nC
		V_{DS} = 20 V, V_{GS} = 4.5 V, I_D = 3.2 A		3.8	5.7	
Gate-Source Charge	Q_{gs}			0.72		
Gate-Drain Charge	Q_{gd}			0.81		
Gate Resistance	R_g	f = 1 MHz	0.2	0.7	1.4	Ω
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 20 V, R_L = 7.7 Ω $I_D \cong$ 2.6 A, V_{GEN} = 10 V, R_g = 1 Ω		6	12	ns
Rise Time	t_r			12	20	
Turn-Off Delay Time	$t_{d(off)}$			13	20	
Fall Time	t_f			6	12	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 20 V, R_L = 7.7 Ω $I_D \cong$ 2.6 A, V_{GEN} = 4.5 V, R_g = 1 Ω		10	20	
Rise Time	t_r			52	78	
Turn-Off Delay Time	$t_{d(off)}$			18	27	
Fall Time	t_f			53	80	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	T_C = 25 °C			1.4	A
Pulse Diode Forward Current (t = 100 µs)	I_{SM}				20	
Body Diode Voltage	V_{SD}	I_S = 2.6 A, V_{GS} = 0 V		0.8	1.2	V
Body Diode Reverse Recovery Time	t_{rr}	I_F = 2.6 A, dI/dt = 100 A/µs, T_J = 25 °C		12	20	ns
Body Diode Reverse Recovery Charge	Q_{rr}			5	10	nC
Reverse Recovery Fall Time	t_a			8.5		ns
Reverse Recovery Rise Time	t_b			3.5		

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

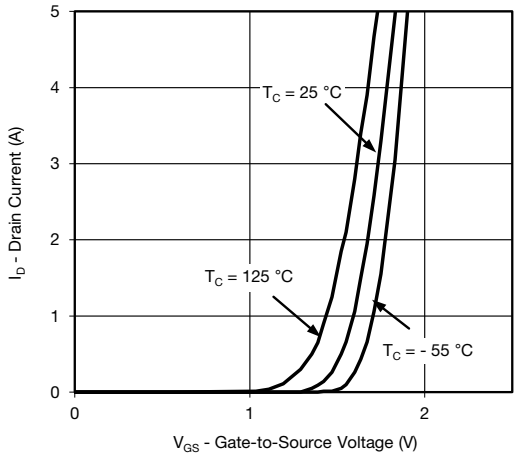
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

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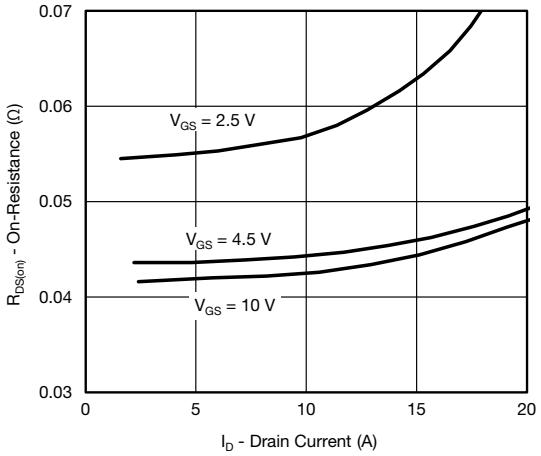
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



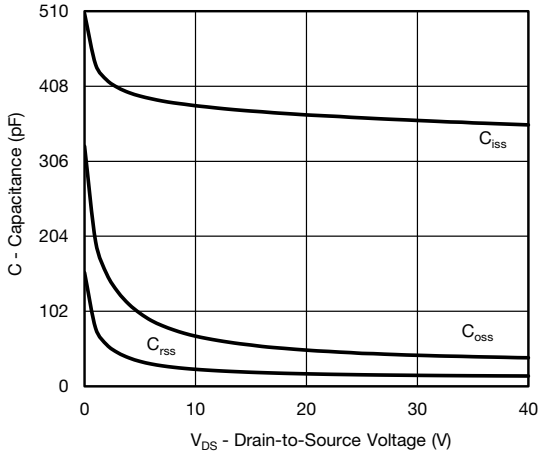
Output Characteristics



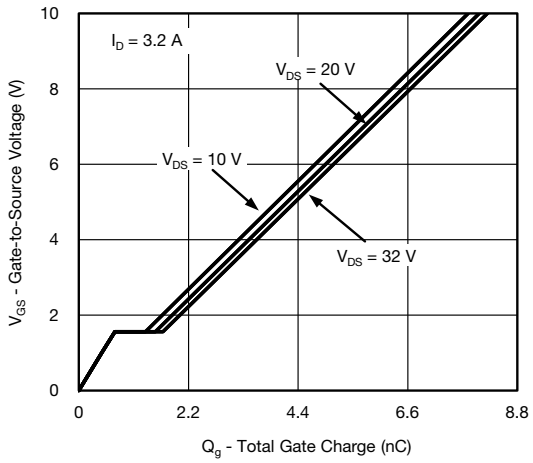
Transfer Characteristics



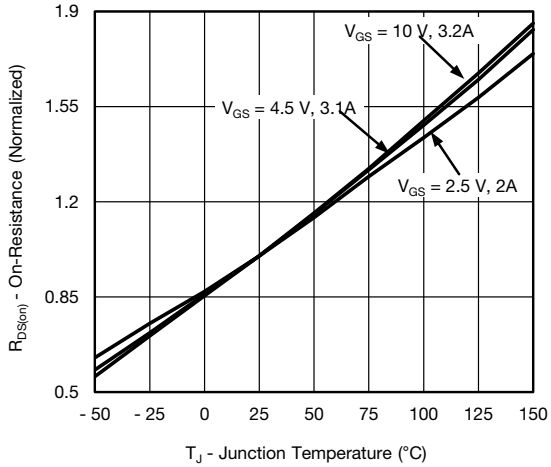
On-Resistance vs. Drain Current and Gate Voltage



Capacitance



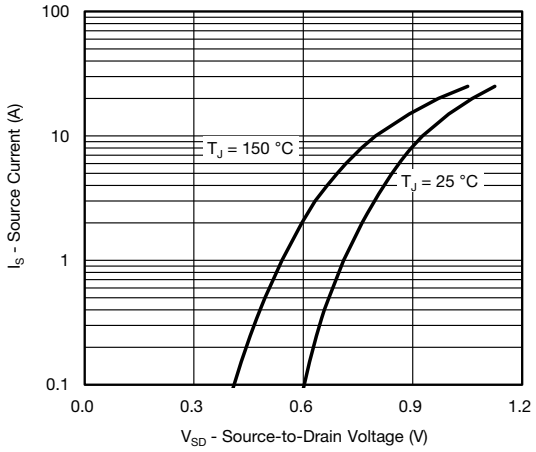
Gate Charge



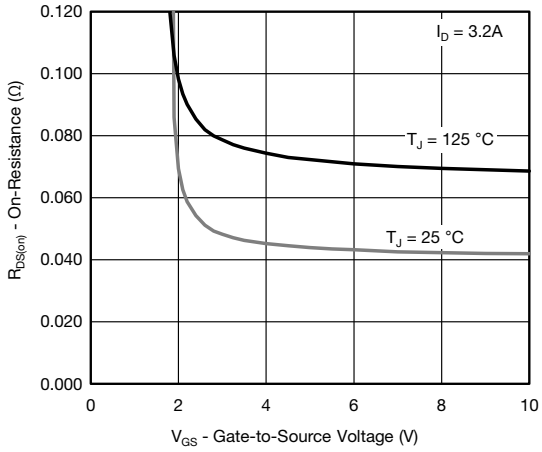
On-Resistance vs. Junction Temperature

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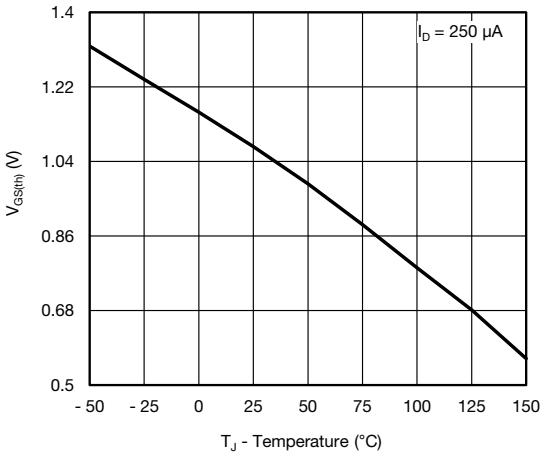
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



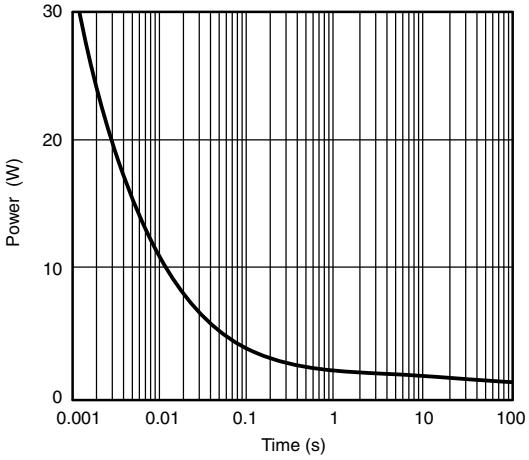
Source-Drain Diode Forward Voltage



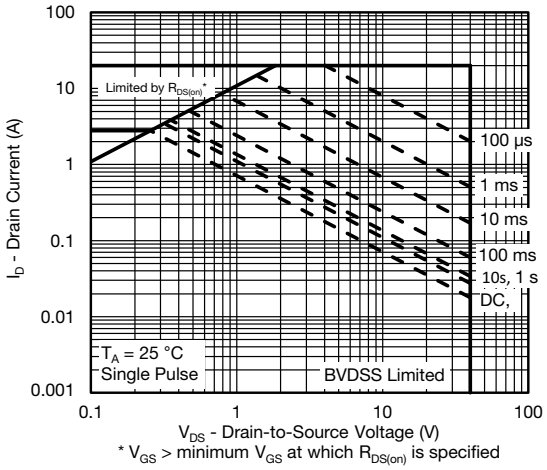
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power (Junction-to-Ambient)

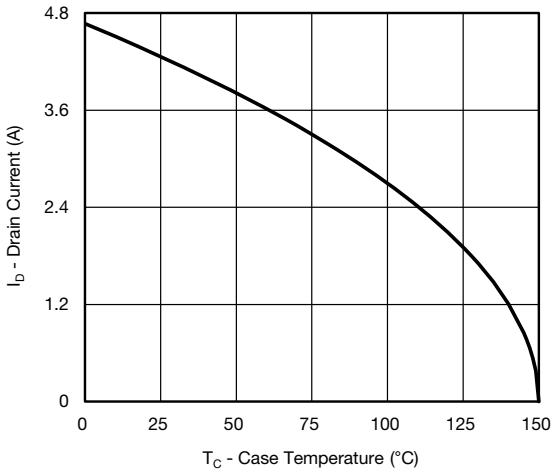


* V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified

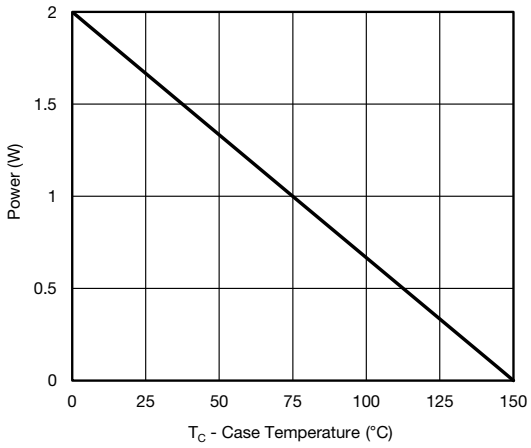
Safe Operating Area, Junction-to-Ambient

For technical questions, contact: pmostechsupport@vishay.com
Document Number: 62893
S13-1814-Rev. A, 12-Aug-13
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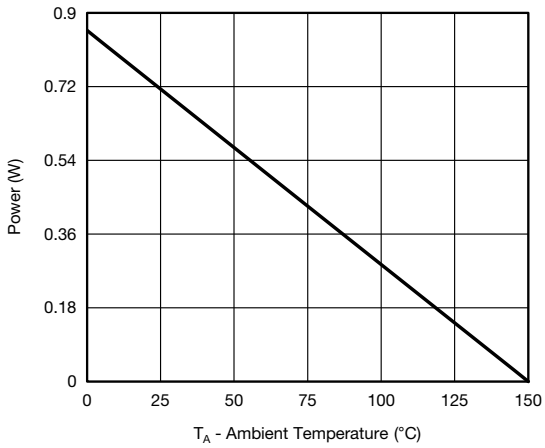
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating*



Power Junction-to-Foot

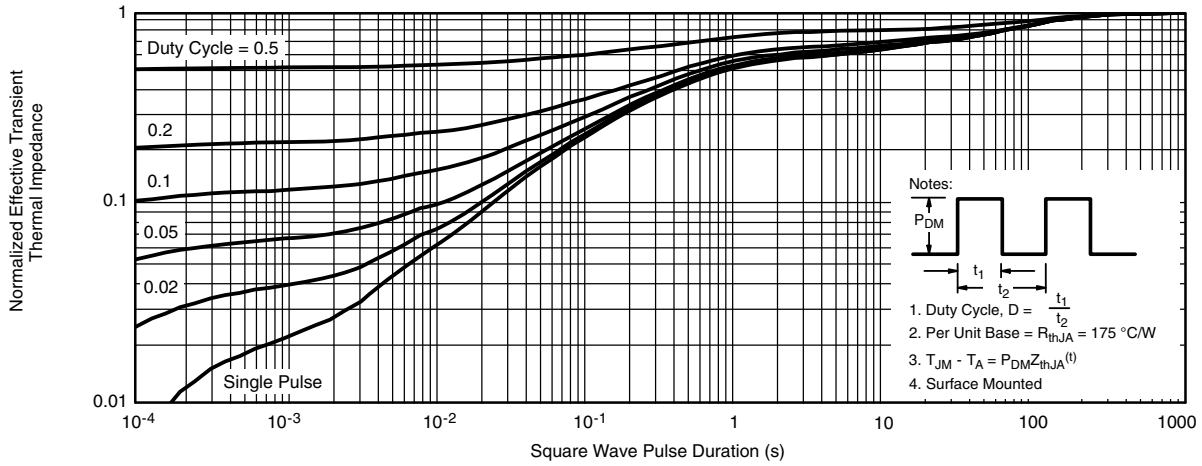


Power Junction-to-Ambient

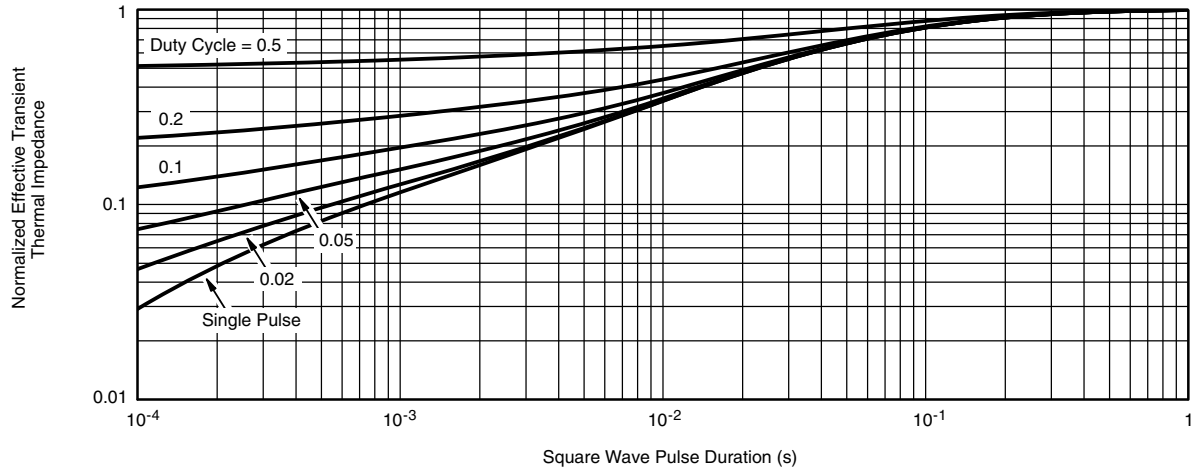
* The power dissipation P_D is based on $T_{J(max.)}$ = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

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TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient

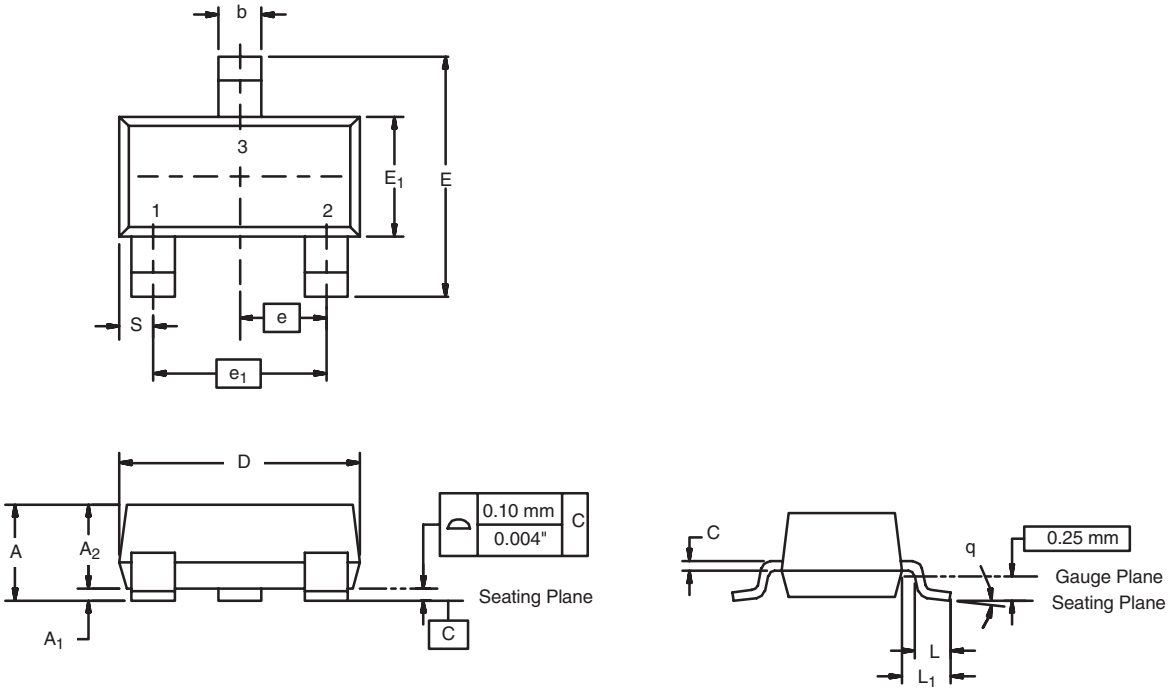


Normalized Thermal Transient Impedance, Junction-to-Foot

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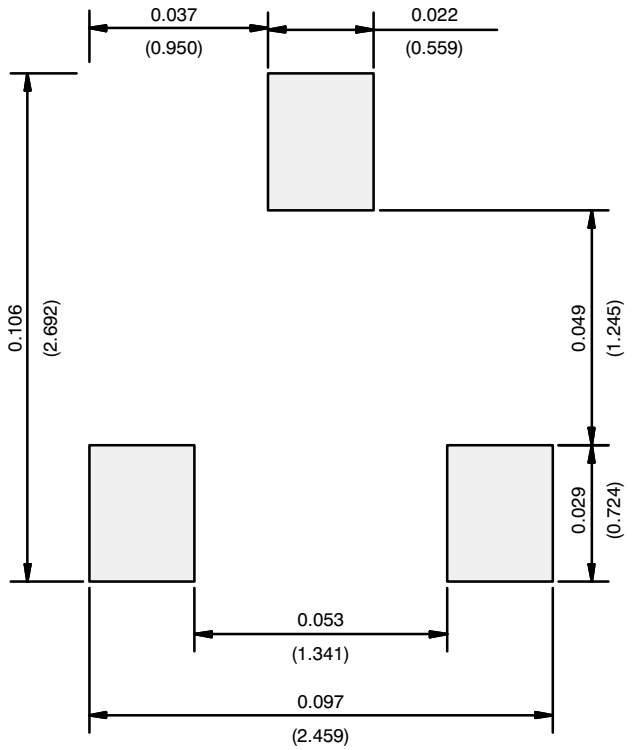
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SOT-23 (TO-236): 3-LEAD



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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APPLICATION NOTE

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