Dual N-Channel 60-V (D-S) 175 °C MOSFET

PRODUCT SUMMARY

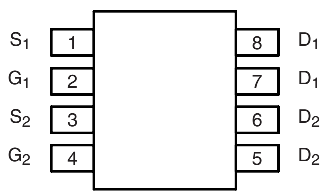
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)	Q_g (Typ.)
60	0.041 at V_{GS} = 10 V	6.5	9.2 nC
	0.052 at V_{GS} = 4.5 V	5.8	

FEATURES

- **Halogen-free According to IEC 61249-2-21 Definition**
- TrenchFET® Power MOSFET
- 175 °C Maximum Junction Temperature
- 100 % R_g Tested
- Compliant to RoHS directive 2002/95/EC

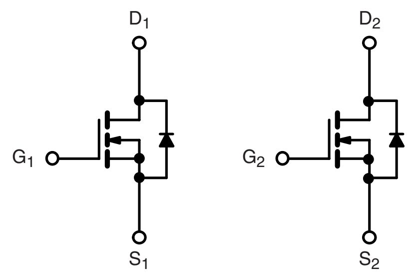
Pb-free
RoHS COMPLIANT
HALOGEN FREE Available

SO-8



Top View

Ordering Information: Si4946BEY-T1-E3 (Lead (Pb)-free)
Si4946BEY-T1-GE3 (Lead (Pb)-free and Halogen-free)



N-Channel MOSFET   N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS T_A = 25 °C, unless otherwise noted

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V_{DS}	60	V
Gate-Source Voltage		V_{GS}	± 20	
Continuous Drain Current (T_J = 150 °C)	T_C = 25 °C	I_D	6.5	A
	T_C = 70 °C		5.5	
	T_A = 25 °C		5.3[a, b]	
	T_A = 70 °C		4.4[a, b]	
Pulsed Drain Current		I_{DM}	30	
Continuous Source Drain Diode Current	T_C = 25 °C	I_S	3.1	
	T_A = 25 °C		2[a, b]	
Avalanche Current	L = 0 1 mH	I_{AS}	12	
Single-Pulse Avalanche Energy		E_{AS}	7.2	mJ
Maximum Power Dissipation	T_C = 25 °C	P_D	3.7	W
	T_C = 70 °C		2.6	
	T_A = 25 °C		2.4[a, b]	
	T_A = 70 °C		1.7[a, b]	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 175	°C

THERMAL RESISTANCE RATINGS

Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient[a, c]	t ≤ 10 s	R_{thJA}	50	62.5	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	R_{thJF}	33	41	

Notes:
a. Surface Mounted on 1" x 1" FR4 board.
b. t = 10 s.
c. Rework Conditions: manual soldering with a soldering iron is not recommended for leadless components.
d. Maximum under Steady State conditions is 110 °C/W.

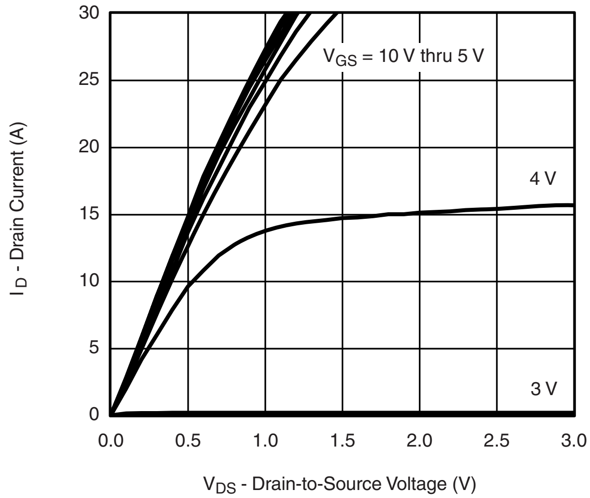
SPECIFICATIONS T_J = 25 °C, unless otherwise noted

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA	60			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	I_D = 250 µA		53		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			- 6.7		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, I_D = 250 µA	1.0	2.4	3.0	V
Gate-Source Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 60 V, V_{GS} = 0 V			1	µA
		V_{DS} = 60 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	30			A
Drain-Source On-State Resistance[a]	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 5.3 A		0.033	0.041	Ω
		V_{GS} = 4.5 V, I_D = 4.7 A		0.041	0.052	
Forward Transconductance[a]	g_{fs}	V_{DS} = 15 V, I_D = 5.3 A		24		S
Dynamic[b]						
Input Capacitance	C_{iss}	V_{DS} = 30 V, V_{GS} = 0 V, f = 1 MHz		840		pF
Output Capacitance	C_{oss}			71		
Reverse Transfer Capacitance	C_{rss}			44		
Total Gate Charge	Q_g	V_{DS} = 30 V, V_{GS} = 10 V, I_D = 5.3 A		17	25	nC
		V_{DS} = 30 V, V_{GS} = 5 V, I_D = 5.3 A		9.2	12	
Gate-Source Charge	Q_{gs}			3.3		
Gate-Drain Charge	Q_{gd}			3.7		
Gate Resistance	R_g	f = 1 MHz	3.1	6.5	9.5	Ω
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 30 V, R_L = 6.8 Ω $I_D \cong 4.4$ A, V_{GEN} = 4.5 V, R_g = 1 Ω		20	30	ns
Rise Time	t_r			120	180	
Turn-Off Delay Time	$t_{d(off)}$			20	30	
Fall Time	t_f			30	45	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 30 V, R_L = 6.8 Ω $I_D \cong 4.4$ A, V_{GEN} = 10 V, R_g = 1 Ω		10	15	
Rise Time	t_r			12	20	
Turn-Off Delay Time	$t_{d(off)}$			25	40	
Fall Time	t_f			10	15	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	T_C = 25 °C			3.1	A
Pulse Diode Forward Current[a]	I_{SM}				30	
Body Diode Voltage	V_{SD}	I_S = 2 A		0.8	1.2	V
Body Diode Reverse Recovery Time	t_{rr}	I_F = 4.4 A, dI/dt = 100 A/µs, T_J = 25 °C		25	50	ns
Body Diode Reverse Recovery Charge	Q_{rr}			25	50	nC
Reverse Recovery Fall Time	t_a			18		ns
Reverse Recovery Rise Time	t_b			7		

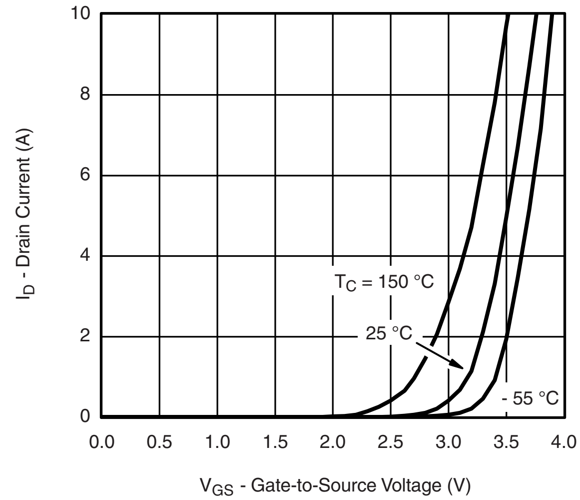
Notes:
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.

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.

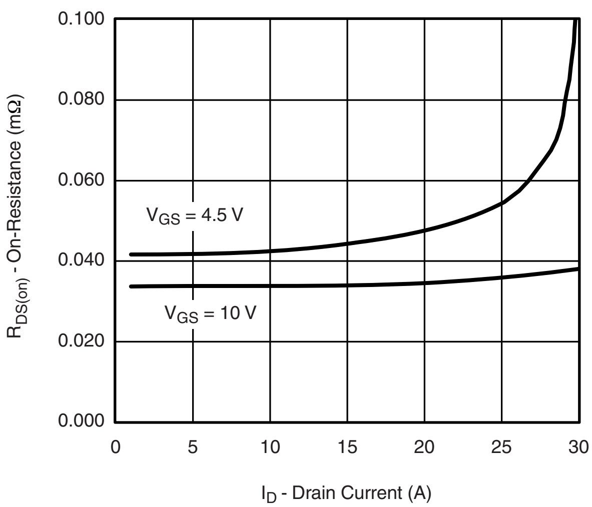
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



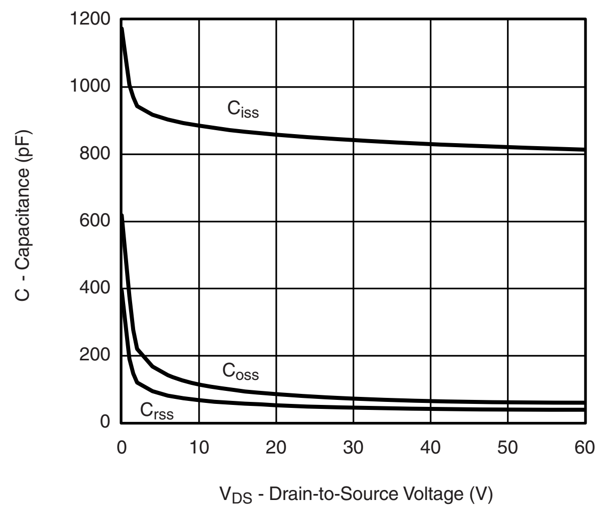
Output Characteristics



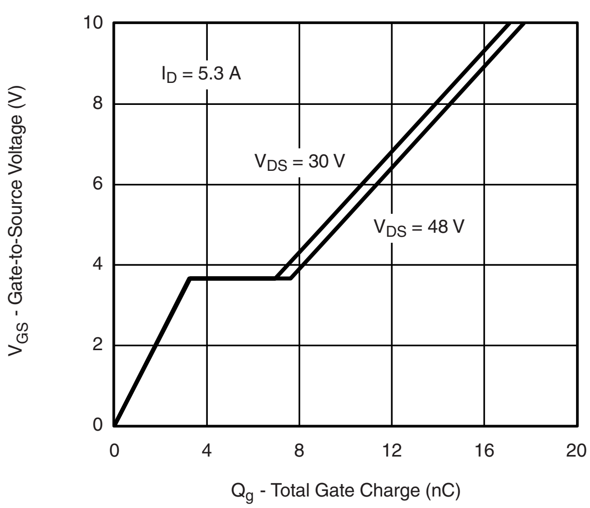
Transfer Characteristics



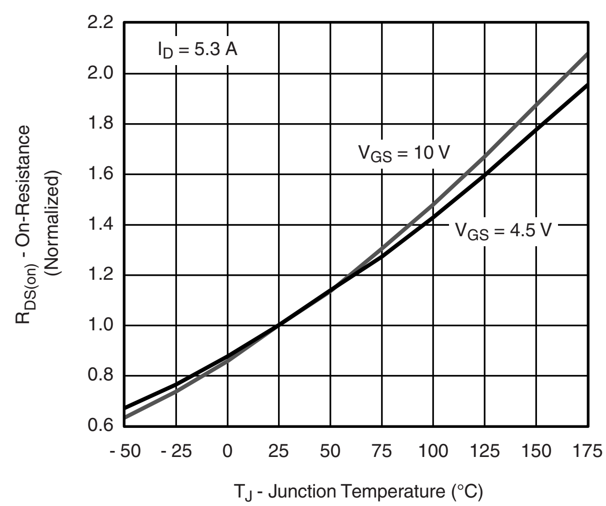
On-Resistance vs. Drain Current and Gate Voltage



Capacitance

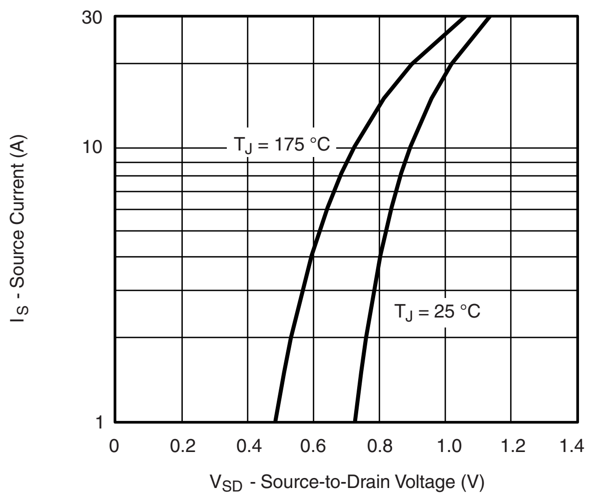


Gate Charge

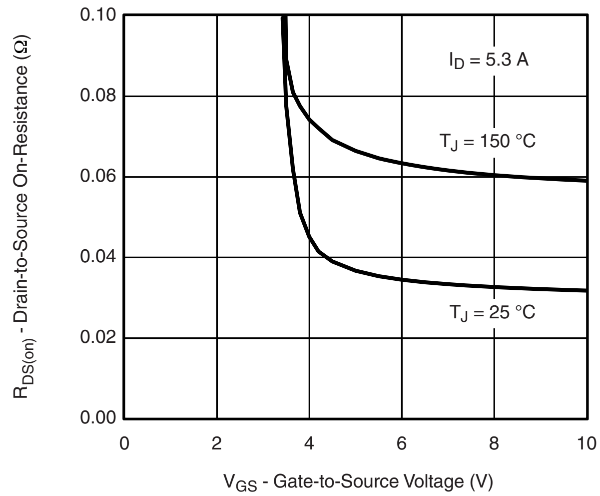


On-Resistance vs. Junction Temperature

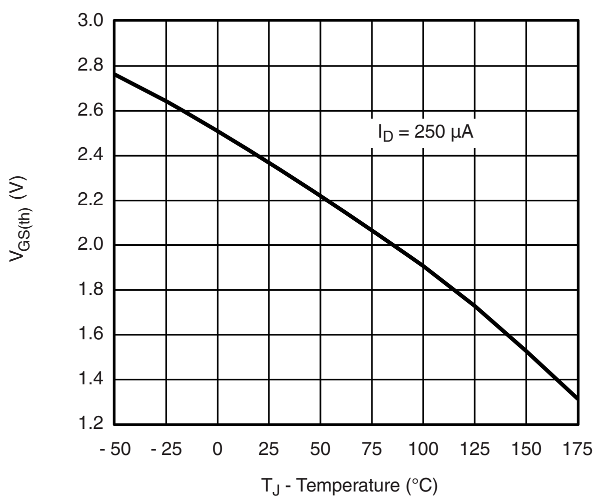
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



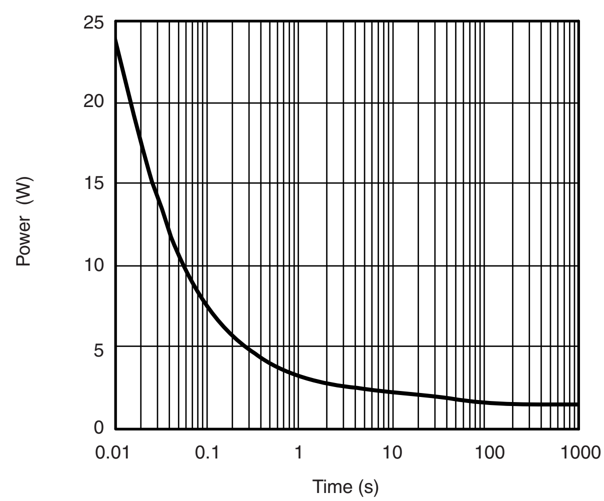
Source-Drain Diode Forward Voltage



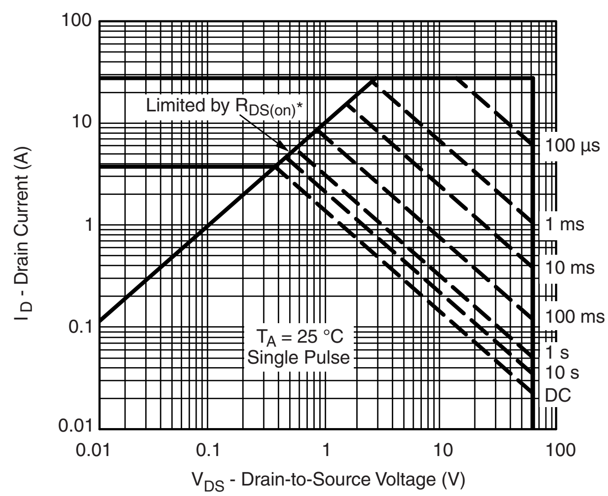
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



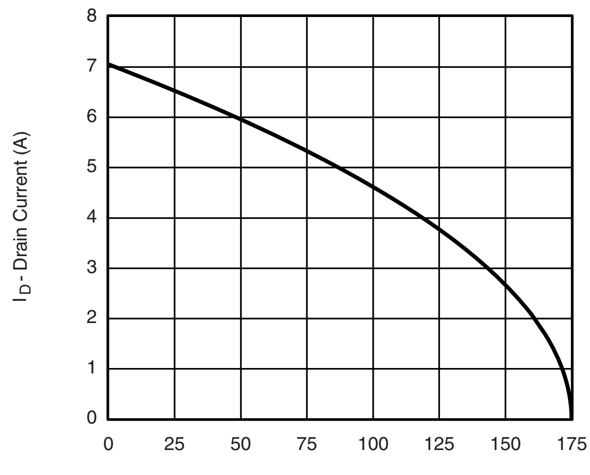
Single Pulse Power, Junction-to-Ambient



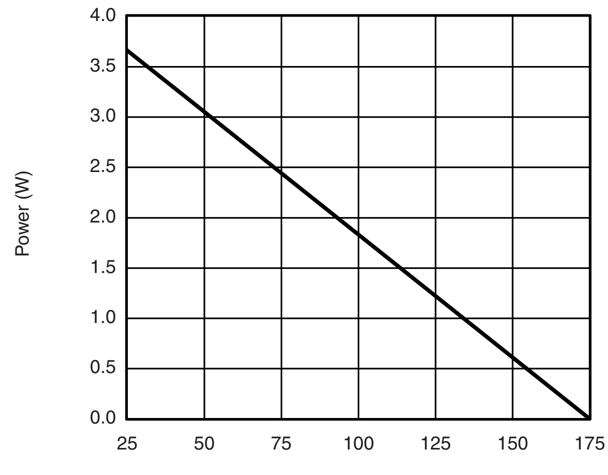
* V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

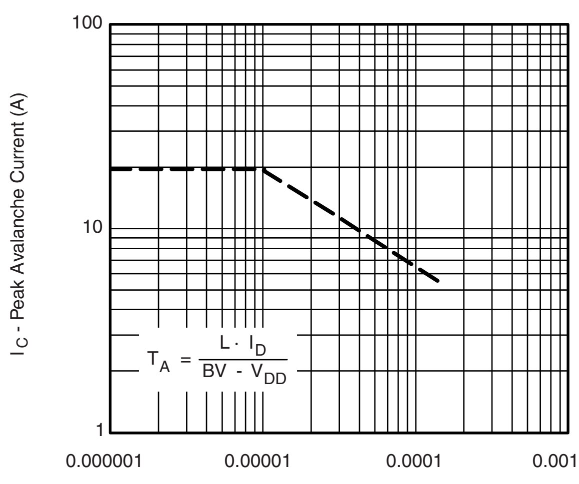
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



Current Derating*



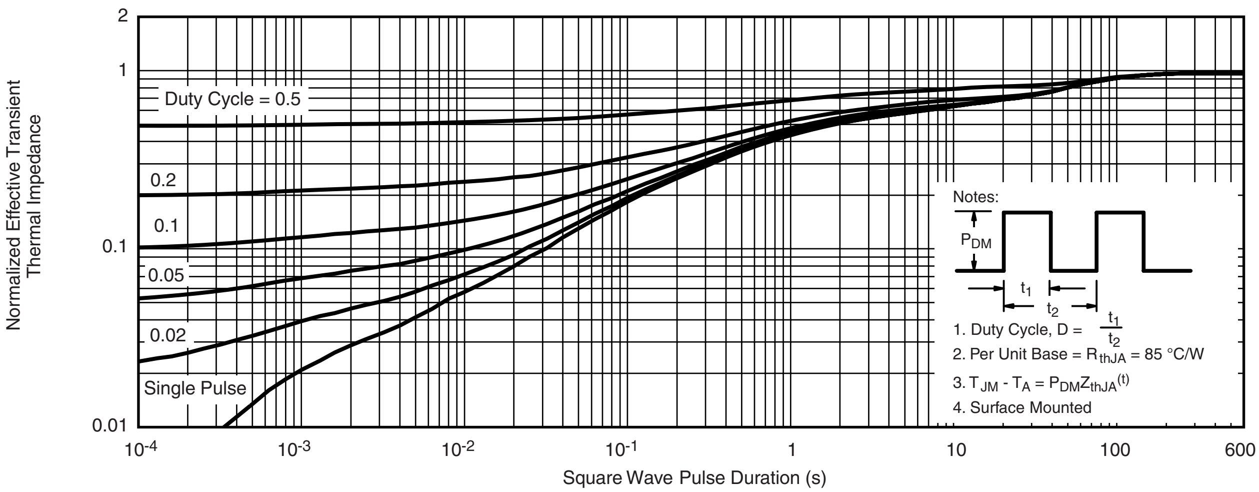
Power, Junction-to-Case



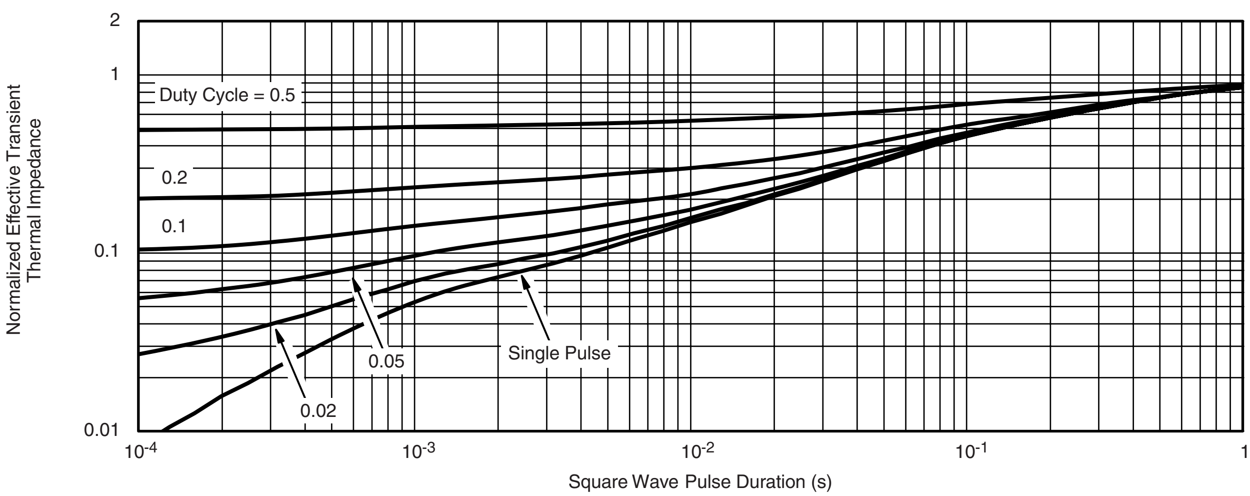
Single Pulse Avalanche Capability

* The power dissipation P_D is based on $T_{J(max)}$ = 175 °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-Case

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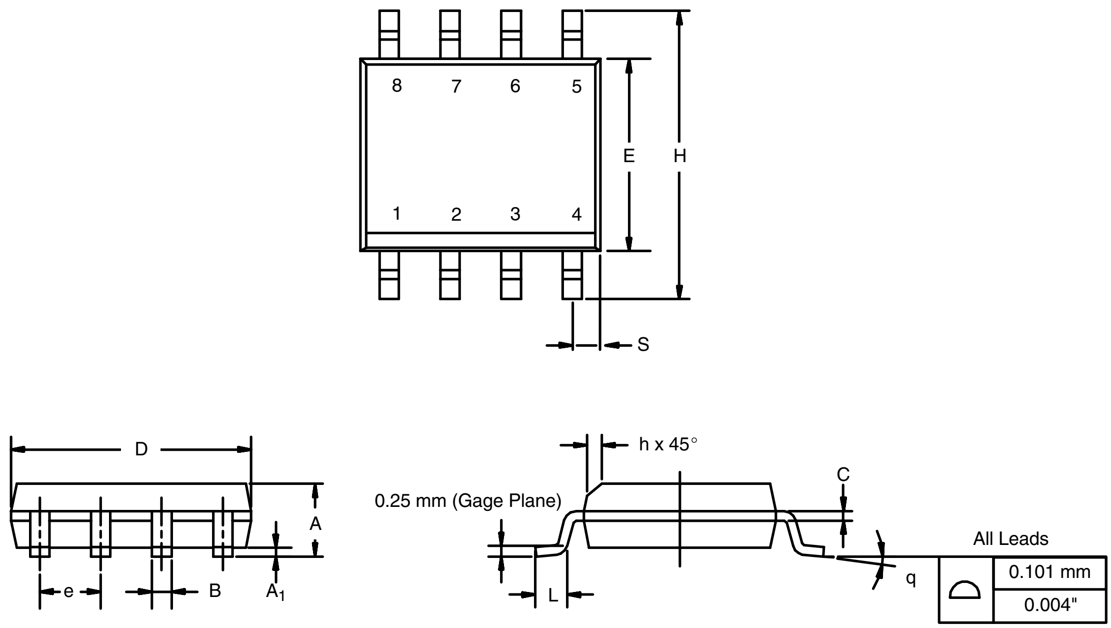
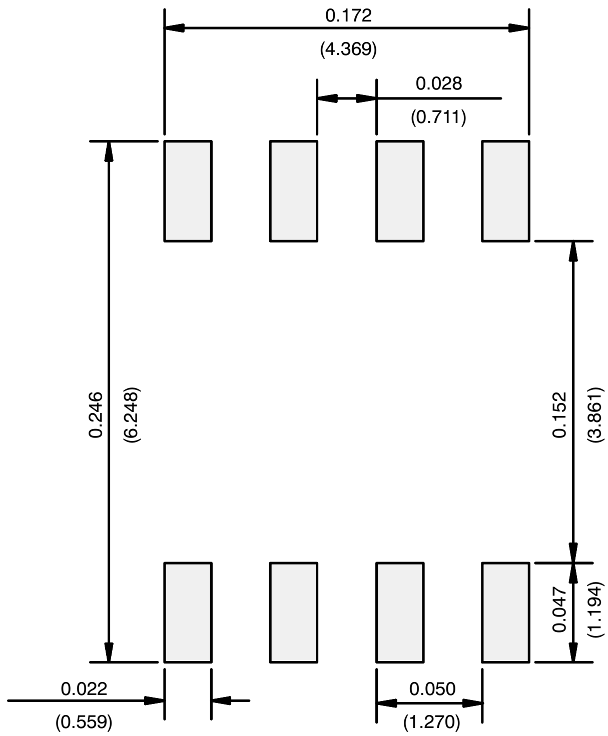
Document Number: 73411
S09-2434-Rev. C, 16-Nov-09

SOIC (NARROW): 8-LEAD
JEDEC Part Number: MS-012



DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A_1	0.10	0.20	0.004	0.008
B	0.35	0.51	0.014	0.020
C	0.19	0.25	0.0075	0.010
D	4.80	5.00	0.189	0.196
E	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.020
L	0.50	0.93	0.020	0.037
q	0°	8°	0°	8°
S	0.44	0.64	0.018	0.026
ECN: C-06527-Rev. I, 11-Sep-06 DWG: 5498				

RECOMMENDED MINIMUM PADS FOR SO-8



Recommended Minimum Pads
Dimensions in Inches/(mm)

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