

## N-Channel 60 V (D-S) MOSFET

PRODUCT SUMMARY			
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A) <sup>d</sup>	Q <sub>g</sub> (Typ.)
60	0.0065 at V <sub>GS</sub> = 10 V	18	13.5 nC
	0.0085 at V <sub>GS</sub> = 4.5 V		

### FEATURES

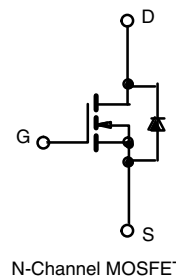
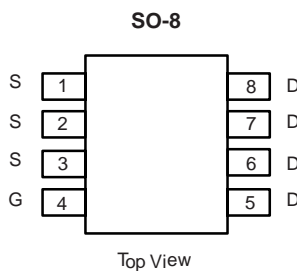
- DT-Trench Power MOSFET
- 100 % R<sub>g</sub> and UIS tested

### APPLICATIONS

- DC/DC converters
- Power supplies
- Motor drive control
- Battery and load switch



**RoHS**  
COMPLIANT



ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	V <sub>DS</sub>	60	V
Gate-source voltage	V <sub>GS</sub>	± 20	
Continuous drain current (T <sub>J</sub> = 150 °C)	I <sub>D</sub>	T <sub>C</sub> = 25 °C	A
		T <sub>C</sub> = 70 °C	
		T <sub>A</sub> = 25 °C	
		T <sub>A</sub> = 70 °C	
Pulsed drain current (t = 100 μs)	I <sub>DM</sub>	72	A
Continuous source-drain diode current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	
		T <sub>A</sub> = 25 °C	
Single pulse avalanche current	I <sub>AS</sub>	70	mJ
Single pulse avalanche energy	E <sub>AS</sub>	90	
Maximum power dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C	W
		T <sub>C</sub> = 70 °C	
		T <sub>A</sub> = 25 °C	
		T <sub>A</sub> = 70 °C	
Operating junction and storage temperature range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C
Soldering recommendations (peak temperature) <sup>c</sup>		260	

THERMAL RESISTANCE RATINGS					
PARAMETER		SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum junction-to-ambient <sup>a</sup>	t ≤ 10 s	R <sub>thJA</sub>	30	50	°C/W
Maximum junction-to-foot (drain)	Steady state	R <sub>thJF</sub>	18	25	

### Notes

- Surface mounted on 1" x 1" FR4 board
- t = 10 s
- Maximum under steady state conditions is 85 °C/W

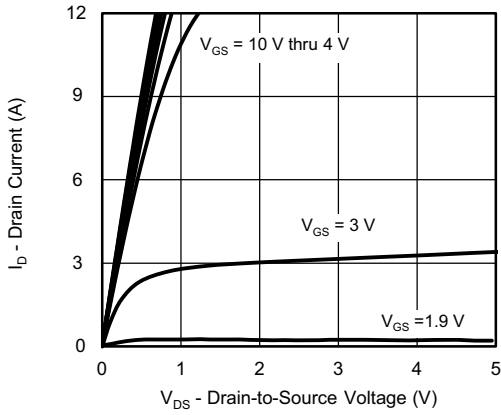
<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-source breakdown voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	60	-	-	V
$V_{DS}$ temperature coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$	-	33	-	mV/ $^\circ\text{C}$
$V_{GS(th)}$ temperature coefficient	$\Delta V_{GS(th)}/T_J$		-	-4.8	-	
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1	-	3	V
Gate-source leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$	-	-	100	nA
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}, T_J = 70\text{ }^\circ\text{C}$	-	-	10	
On-state drain current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	12	-	-	
Drain-source on-state resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 10\text{ A}$	-	0.0065	0.0080	$\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 5\text{ A}$	-	0.0085	0.0110	
Forward transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 10\text{ V}, I_D = 10\text{ A}$	-	39	-	S
<b>Dynamic <sup>b</sup></b>						
Input capacitance	$C_{ISS}$	$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	4090	-	pF
Output capacitance	$C_{OSS}$		-	1030	-	
Reverse transfer capacitance	$C_{RSS}$		-	75	-	
Total gate charge	$Q_g$	$V_{DS} = 48\text{ V}, V_{GS} = 10\text{ V}, I_D = 5\text{ A}$	-	13.5	-	nC
		$V_{DS} = 48\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 5\text{ A}$	-	7.4	-	
$Q_{gs}$	-		3.9	-		
$Q_{gd}$	-		2.1	-		
Gate resistance	$R_g$	$f = 1\text{ MHz}$	-	3	-	$\Omega$
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 48\text{ V}, R_L = 6\text{ }\Omega, I_D \cong 5\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$	-	8	-	ns
Rise time	$t_r$		-	22	-	
Turn-off delay time	$t_{d(off)}$		-	11	-	
Fall time	$t_f$		-	10	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 48\text{ V}, R_L = 6\text{ }\Omega, I_D \cong 5\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$	-	14	-	
Rise time	$t_r$		-	27	-	
Turn-off delay time	$t_{d(off)}$		-	11	-	
Fall time	$t_f$		-	24	-	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous source-drain diode current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$	-	-	18	A
Pulse diode forward current	$I_{SM}$		-	-	72	
Body diode voltage	$V_{SD}$	$I_S = 5\text{ A}, V_{GS} = 0\text{ V}$	-	0.70	1.2	V
Body diode reverse recovery time	$t_{rr}$	$I_F = 5\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$	-	30	62	ns
Body diode reverse recovery charge	$Q_{rr}$		-	60	125	nC
Reverse recovery fall time	$t_a$		-	15	-	ns
Reverse recovery rise time	$t_b$		-	15	-	

**Notes**

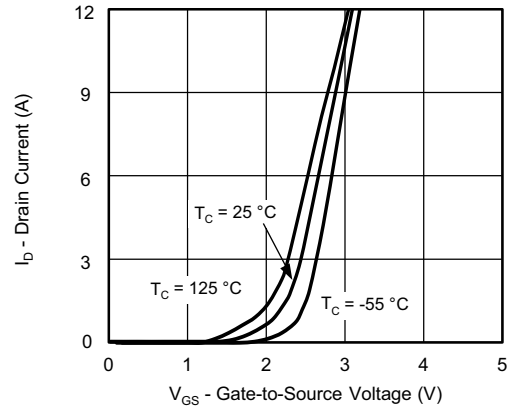
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$   
 b. Guaranteed by design, not subject to production testing

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.

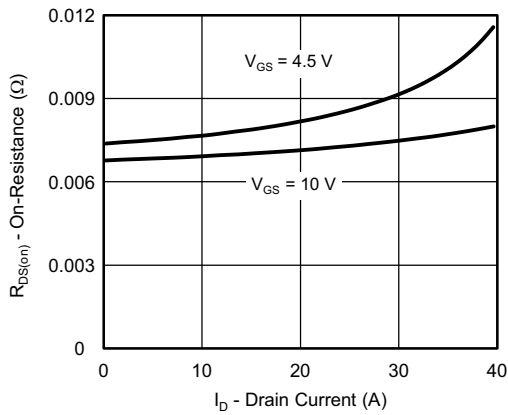
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



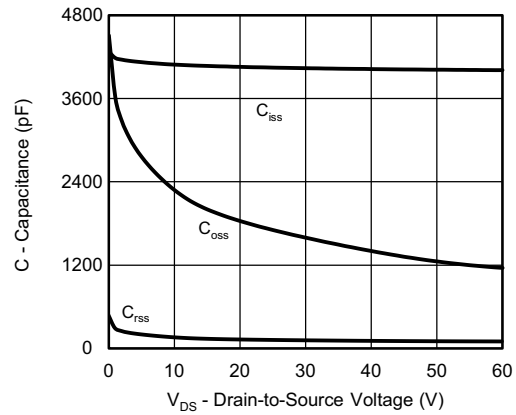
**Output Characteristics**



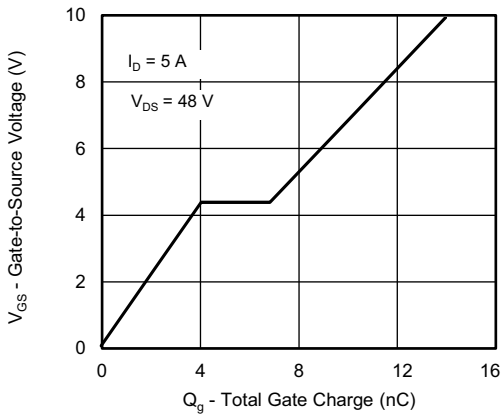
**Transfer Characteristics**



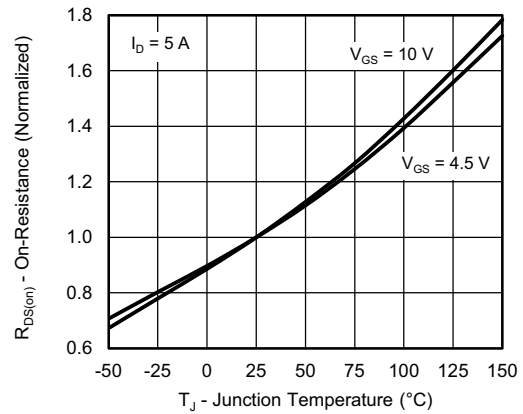
**On-Resistance vs. Drain Current and Gate Voltage**



**Capacitance**

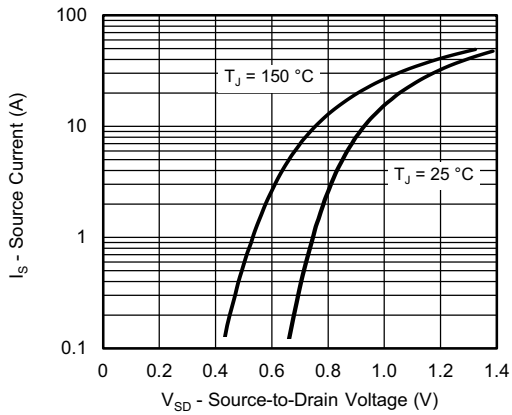


**Gate Charge**

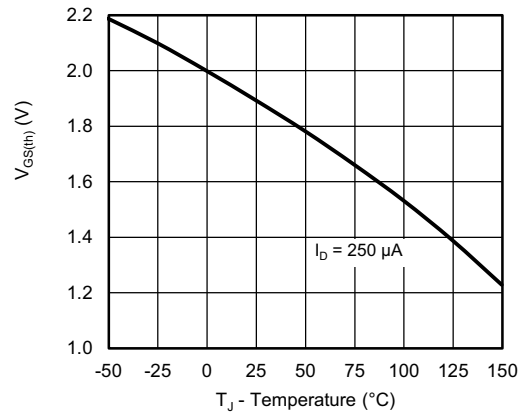


**On-Resistance vs. Junction Temperature**

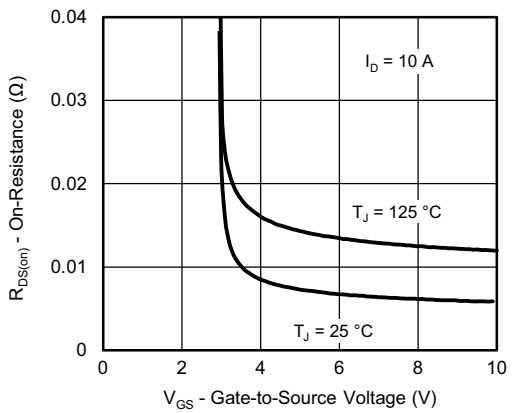
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



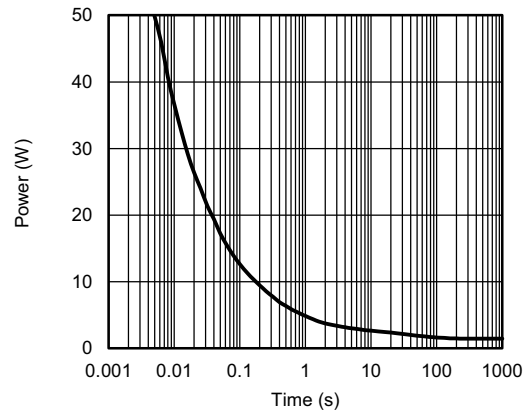
**Source-Drain Diode Forward Voltage**



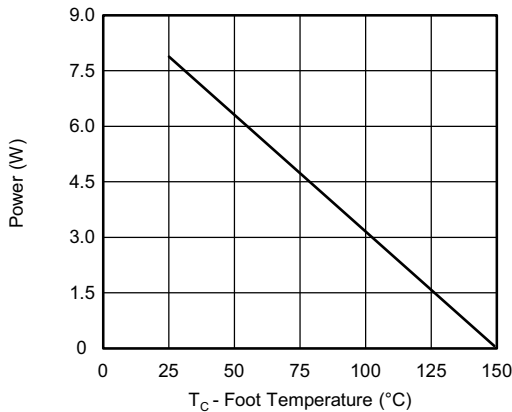
**Threshold Voltage**



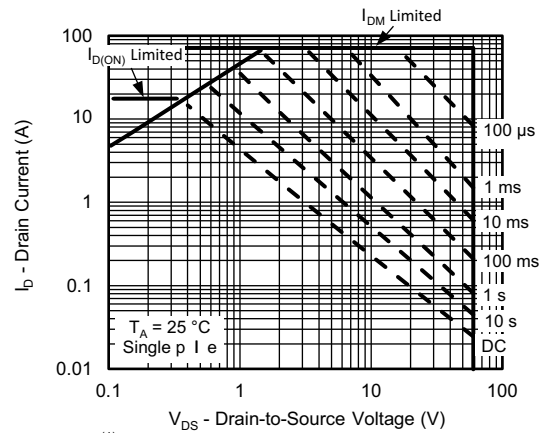
**On-Resistance vs. Gate-to-Source Voltage**



**Single Pulse Power, Junction-to-Ambient**



**Power, Junction-to-Foot**

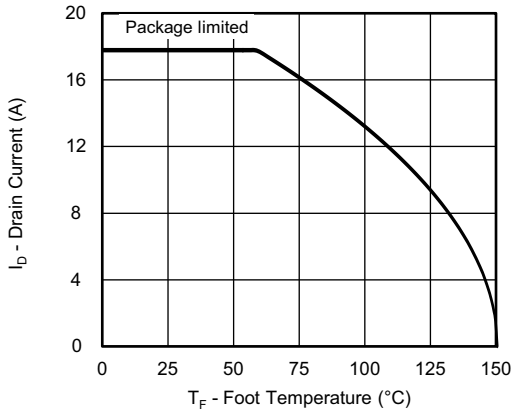


(1)  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

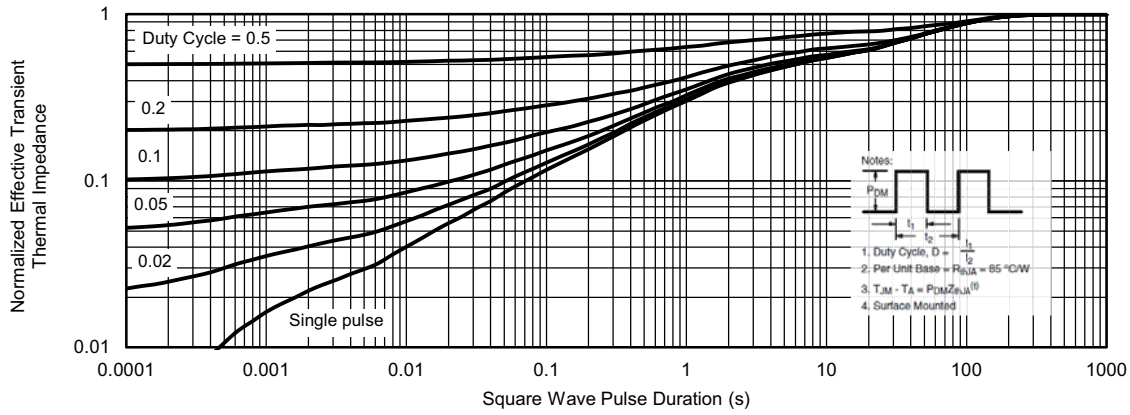
**Safe Operating Area, Junction-to-Ambient**

Limited by  $R_{DS(on)}$

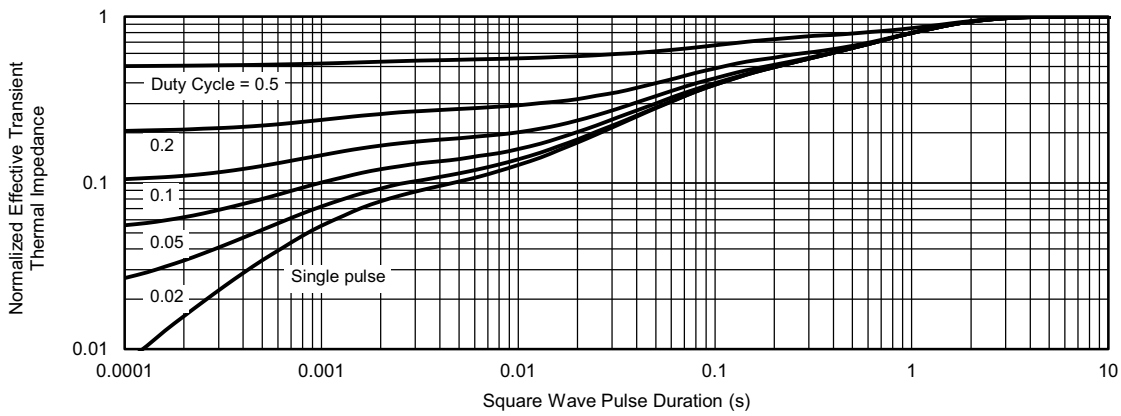
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



**Current Derating <sup>a</sup>**

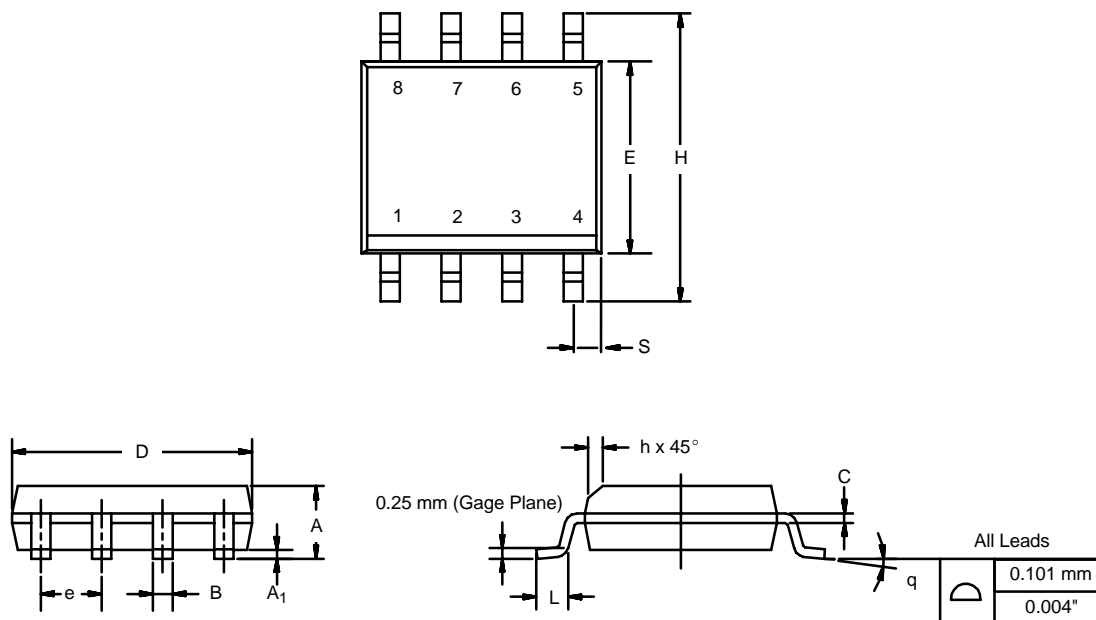


**Normalized Thermal Transient Impedance, Junction-to-Ambient**



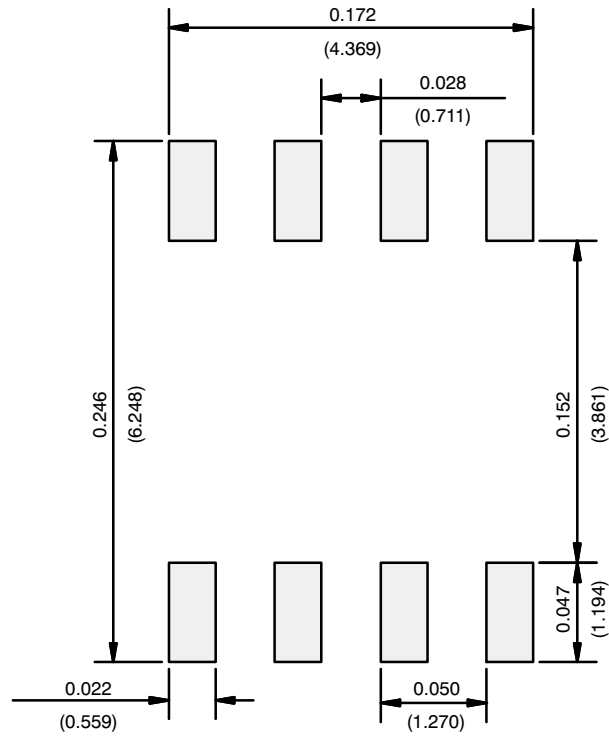
**Normalized Thermal Transient Impedance, Junction-to-Foot**

**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 <sub>1</sub>	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

**RECOMMENDED MINIMUM PADS FOR SO-8**



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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