

**200V(D-S) N-Channel Enhancement Mode Power MOS FET**

**General Features**

- $V_{DS} = 200V, I_D = 3.9A$   
 $R_{DS(ON)} < 79m\Omega @ V_{GS}=10V$  (Typ:  $56m\Omega$ )
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Low gate to drain charge to reduce switching losses



**Lead Free**

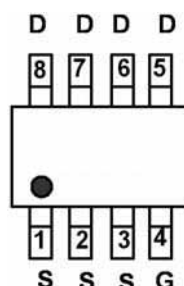
**Application**

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply

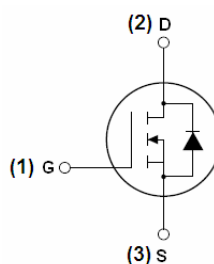
**PIN Configuration**



**SOP-8 top view**



**Marking and pin assignment**



**Schematic diagram**

**Package Marking and Ordering Information**

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
MSN2004W	MSN2004W	SOP-8	Ø330mm	12mm	2500 units

**Absolute Maximum Ratings ( $T_A=25^{\circ}C$  unless otherwise noted)**

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	200	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	3.9	A
Drain Current-Continuous( $T_C=100^{\circ}C$ )	$I_D (100^{\circ}C)$	3	A
Pulsed Drain Current	$I_{DM}$	30	A
Maximum Power Dissipation	$P_D$	3	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	$^{\circ}C$

**Thermal Characteristic**

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	41.7	$^{\circ}C/W$
--	-----------------	------	---------------

**Electrical Characteristics ( $T_A=25^{\circ}\text{C}$  unless otherwise noted)**

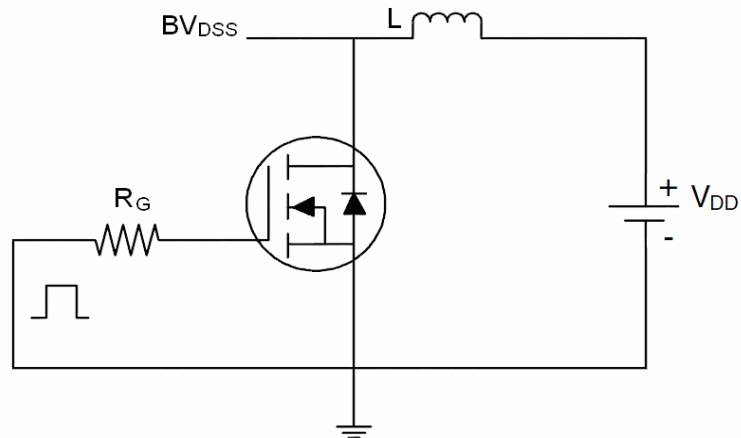
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	200	215	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=200V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2	3	4	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=3.7A$	-	56	79	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=50V, I_D=3.9A$	7	-	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	$C_{ISS}$	$V_{DS}=25V, V_{GS}=0V,$ $F=1.0MHz$		4200		PF
Output Capacitance	$C_{OSS}$			163		PF
Reverse Transfer Capacitance	$C_{RSS}$			75		PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=100V, I_D=2.2A$ $V_{GS}=10V, R_{GEN}=6.5\Omega$	-	15	-	nS
Turn-on Rise Time	$t_r$		-	13	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	26	-	nS
Turn-Off Fall Time	$t_f$		-	14	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=100V, I_D=2.2A,$ $V_{GS}=10V$	-	38	-	nC
Gate-Source Charge	$Q_{gs}$		-	9	-	nC
Gate-Drain Charge	$Q_{gd}$		-	15	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=3.7A$	-	-	1.2	V
Diode Forward Current (Note 2)	$I_S$		-	-	4	A

**Notes:**

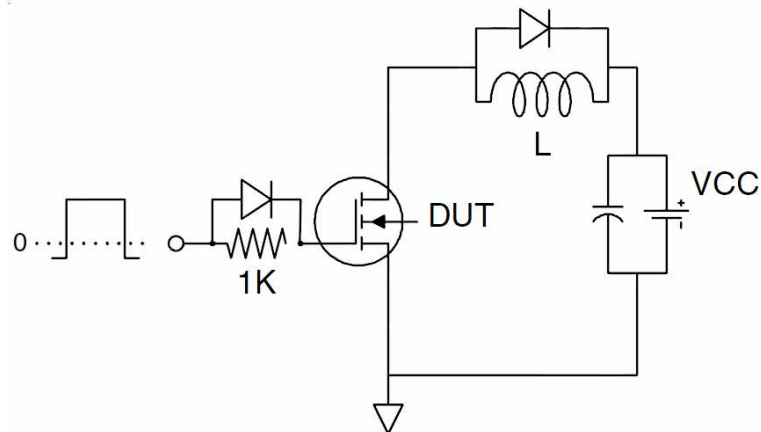
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production

## Test Circuit

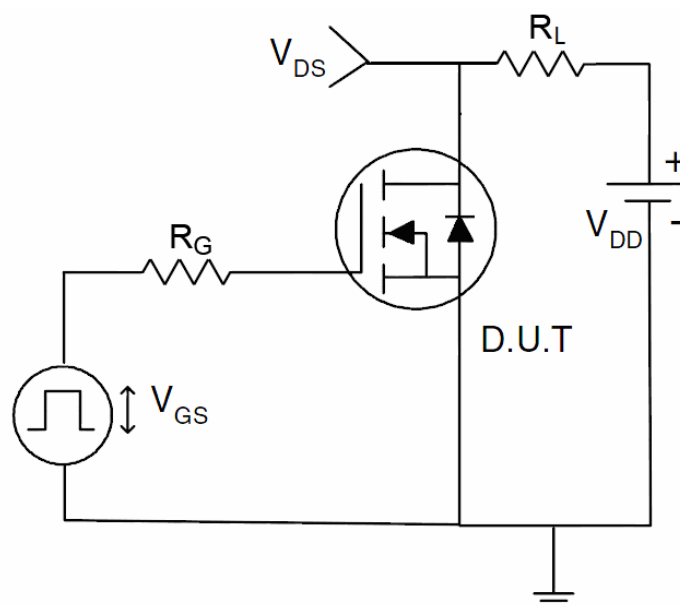
### 1) $E_{AS}$ test Circuit



### 2) Gate charge test Circuit



### 3) Switch Time Test Circuit



## Typical Electrical and Thermal Characteristics (Curves)

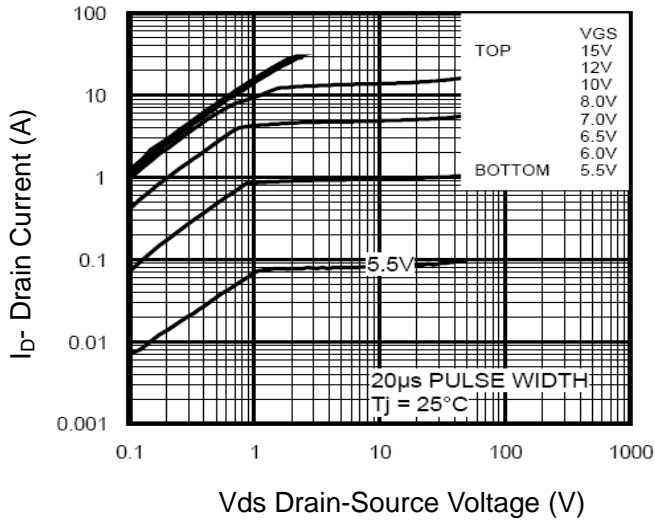


Figure 1 Output Characteristics

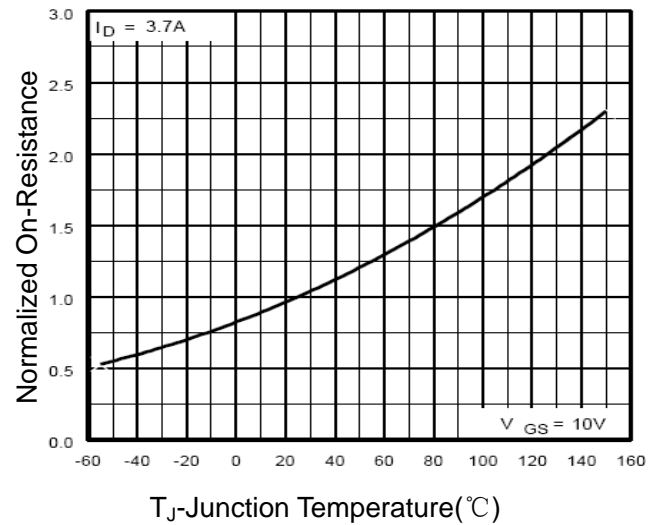


Figure 4 Rdson-Junction Temperature

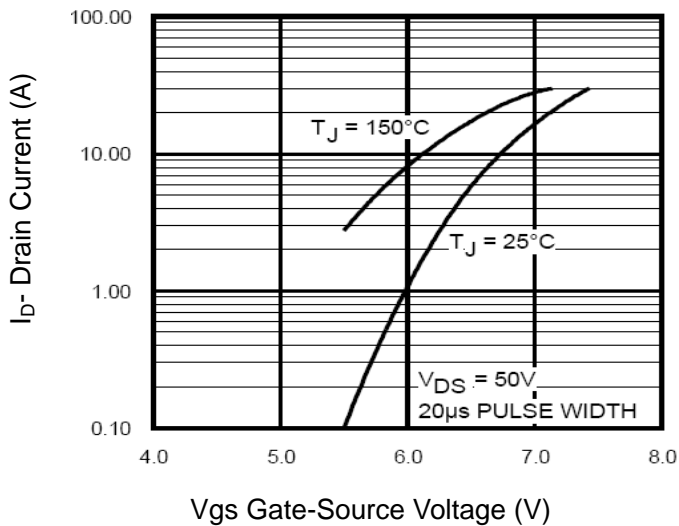


Figure 2 Transfer Characteristics

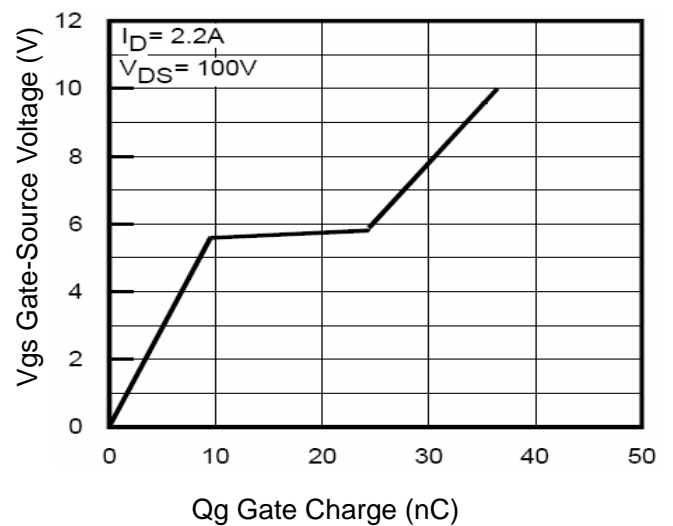


Figure 5 Gate Charge

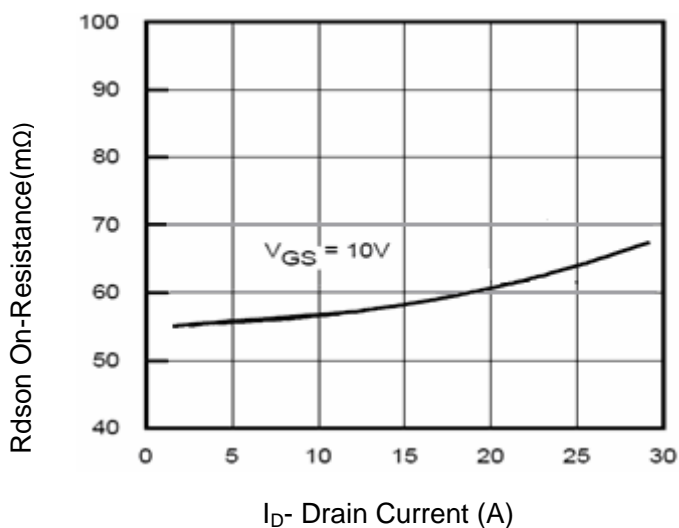


Figure 3 Rdson- Drain Current

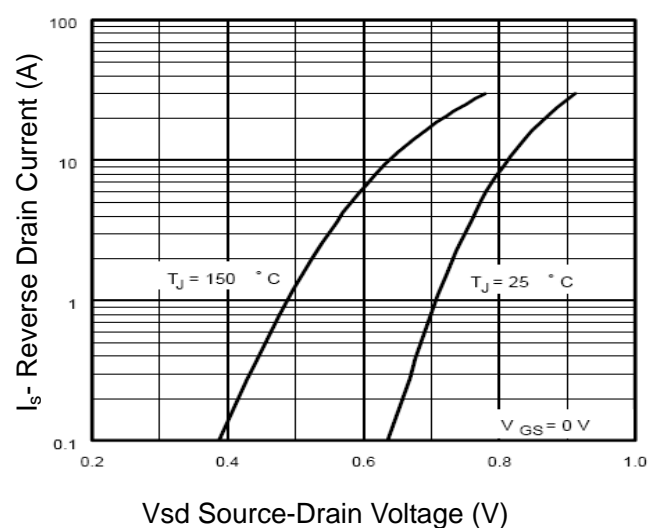


Figure 6 Source- Drain Diode Forward

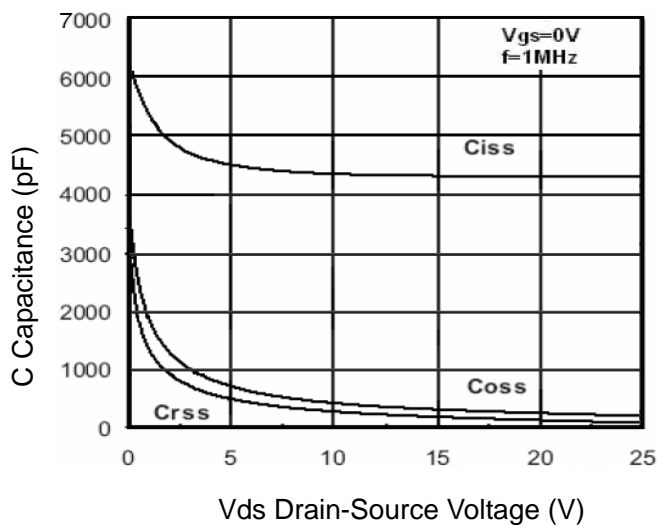


Figure 7 Capacitance vs  $V_{DS}$

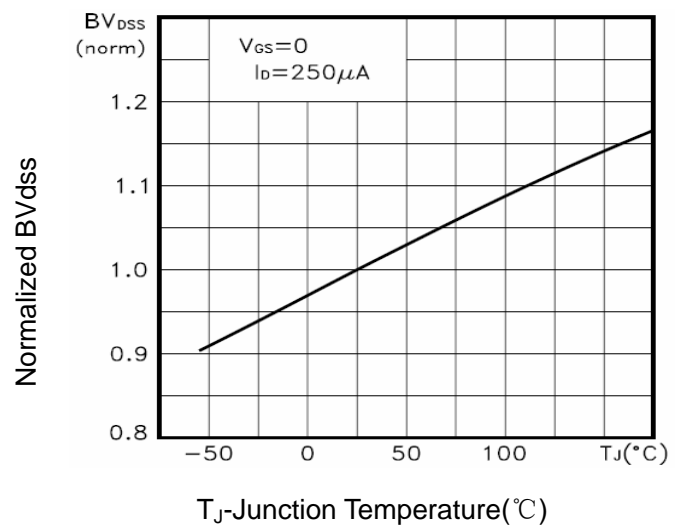


Figure 9  $BV_{DSS}$  vs Junction Temperature

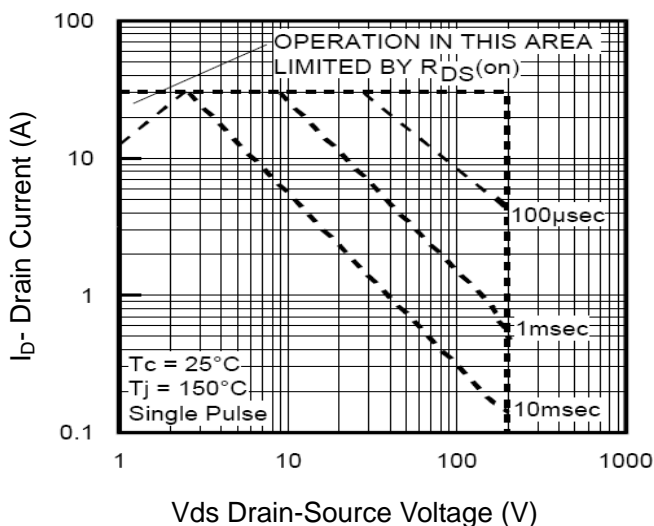


Figure 8 Safe Operation Area

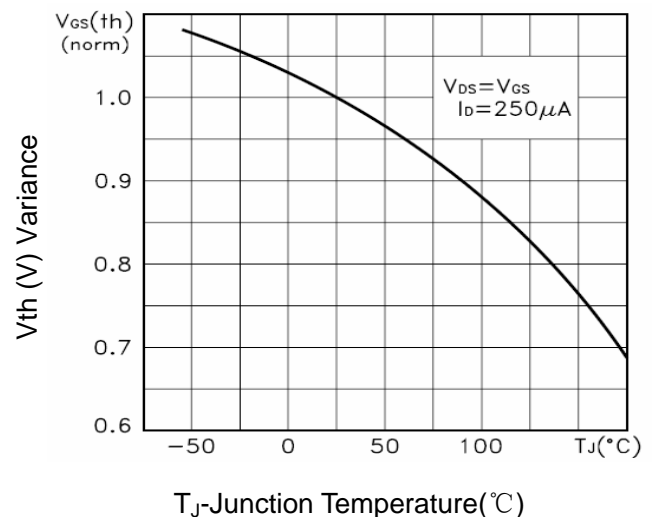


Figure 10  $V_{GS(th)}$  vs Junction Temperature

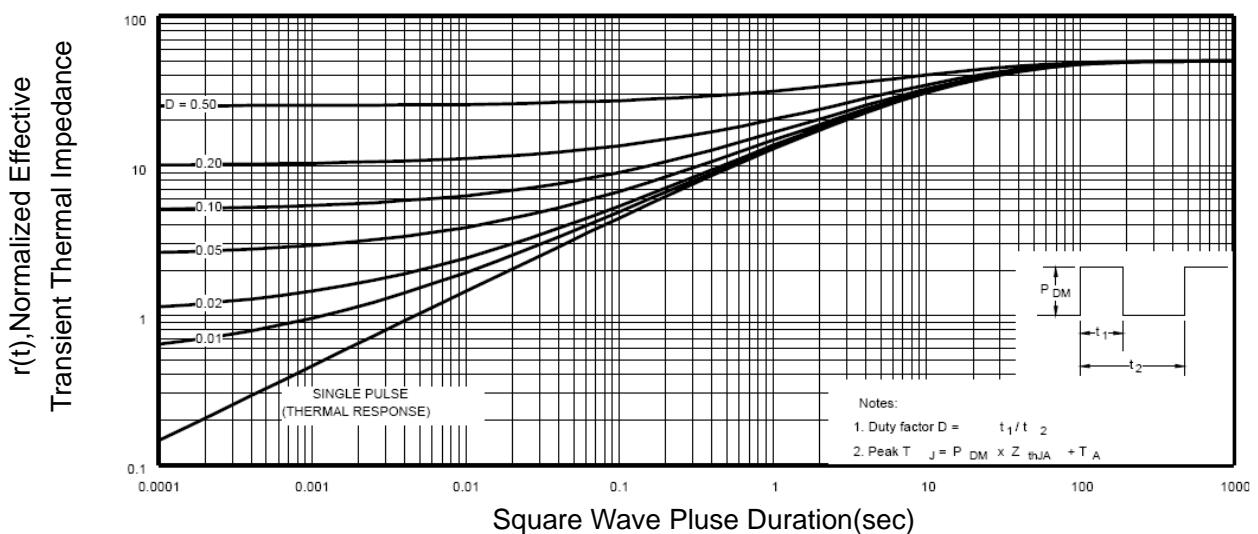
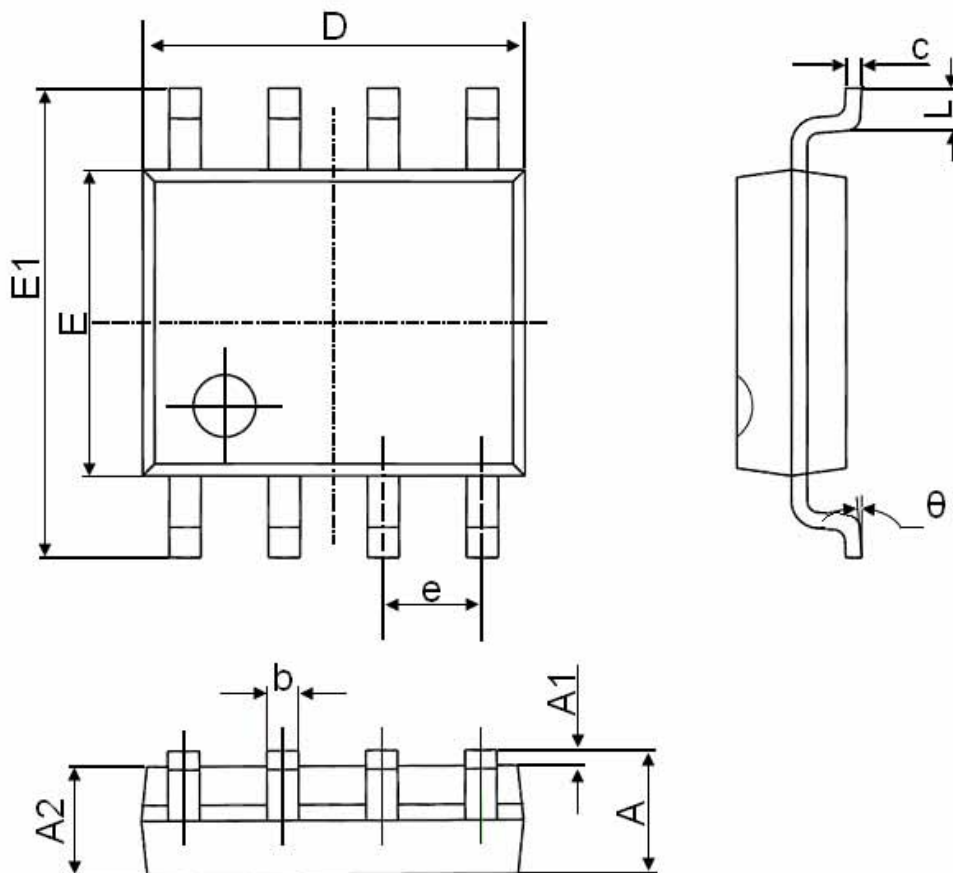


Figure 11 Normalized Maximum Transient Thermal Impedance

**SOP-8 Package Information**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°