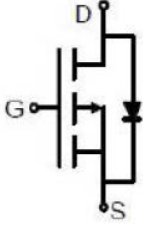
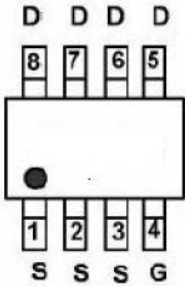



P-Channel Enhancement Mode Power MOSFET

<p><b>Description</b> The HM4421F uses advanced trench technology and design to provide excellent <math>R_{DS(ON)}</math> with low gate charge .This device is well suited for high current load applications.</p> <p><b>General Features</b></p> <ul style="list-style-type: none"> <li>● <math>V_{DS} = -60V, I_D = -7.5A</math>  <math>R_{DS(ON)} &lt; 45m\Omega @ V_{GS} = -10V</math>  <math>R_{DS(ON)} &lt; 60m\Omega @ V_{GS} = -4.5V</math></li> <li>● High density cell design for ultra low Rdson</li> <li>● Fully characterized avalanche voltage and current</li> <li>● Good stability and uniformity with high <math>E_{AS}</math></li> <li>● Excellent package for good heat dissipation</li> </ul> <p><b>Application</b></p> <ul style="list-style-type: none"> <li>● Load switch</li> </ul> <p style="text-align: center; color: red; font-weight: bold; margin-top: 20px;">100% UIS TESTED!</p> <p style="text-align: center; color: red; font-weight: bold; margin-top: 10px;">100% <math>\Delta V_{ds}</math> TESTED!</p>	 <p>Schematic diagram</p>  <p>Marking and pin Assignment</p>  <p>SOP-8 top view</p>
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**Package Marking and Ordering Information**

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
HM4421F	HM4421F	SOP8	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	-7.5	A
Drain Current-Continuous( $T_C=100^\circ C$ )	$I_D(100^\circ C)$	-5.2	A
Pulsed Drain Current	$I_{DM}$	-22.5	A
Maximum Power Dissipation	$P_D$	3	W
Derating factor		0.76	W/ $^\circ C$
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	722	mJ
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>	$R_{\theta JC}$	1.31	$^\circ C/W$
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**Electrical Characteristics ( $T_C=25^{\circ}\text{C}$  unless otherwise noted)**

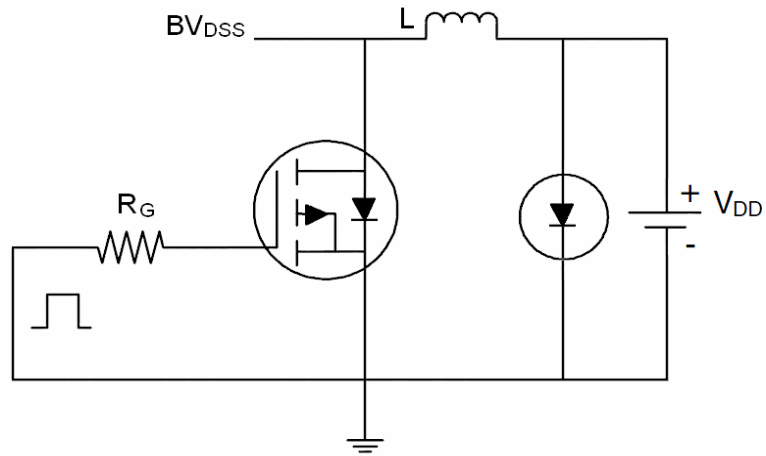
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-60	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=-60V, V_{GS}=0V$	-	-	-1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1.2		-2.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=-10V, I_D=-7.5A$	-		45	m $\Omega$
		$V_{GS}=-4.5V, I_D=-7.5A$	-		60	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=-10V, I_D=-7.5A$	-	25	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	$C_{iss}$	$V_{DS}=-25V, V_{GS}=0V,$ $F=1.0\text{MHz}$	-	6460	-	PF
Output Capacitance	$C_{oss}$		-	719	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	535	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=-30V, R_L=1.5\Omega,$ $V_{GS}=-10V, R_G=3\Omega$	-	15	-	nS
Turn-on Rise Time	$t_r$		-	17	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	40	-	nS
Turn-Off Fall Time	$t_f$		-	45	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=-30, I_D=-7.5A,$ $V_{GS}=-10V$	-	75		nC
Gate-Source Charge	$Q_{gs}$		-	16		nC
Gate-Drain Charge	$Q_{gd}$		-	19		nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=-7.5A$	-		-1.2	V
Diode Forward Current	$I_S$		-	-	-7.5	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}\text{C}, I_F = -7.5A$	-	50		nS
Reverse Recovery Charge	$Q_{rr}$	$di/dt = -100A/\mu s$ (Note 3)	-	59		nC
Forward Turn-On Time	$t_{on}$	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

**Notes:**

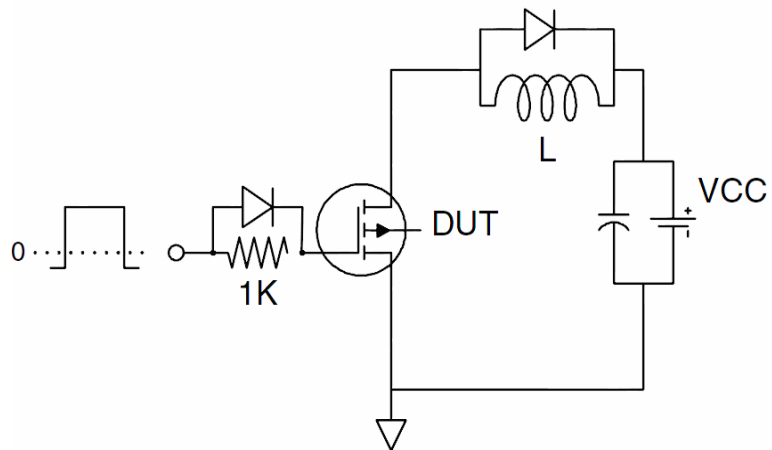
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5.  $E_{AS}$  condition:  $T_J=25^{\circ}\text{C}, V_{DD}=-20V, V_G=-10V, L=1\text{mH}, R_g=25\Omega, I_{AS}=38A$

Test Circuit

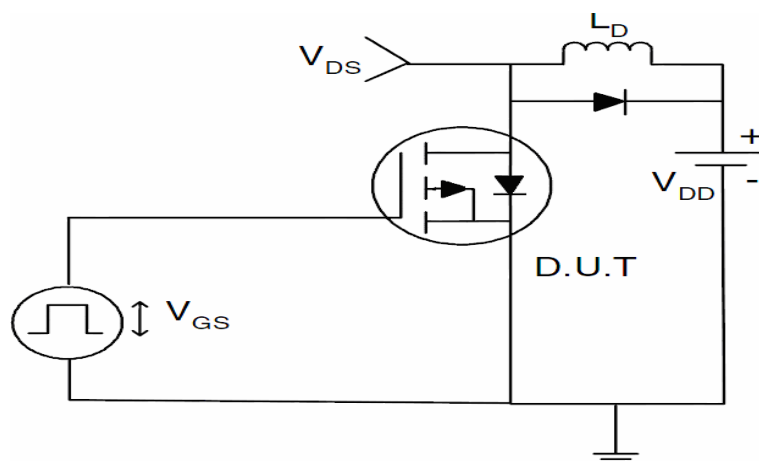
1)  $E_{AS}$  Test Circuit



2) Gate Charge Test Circuit



3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics (Curves)

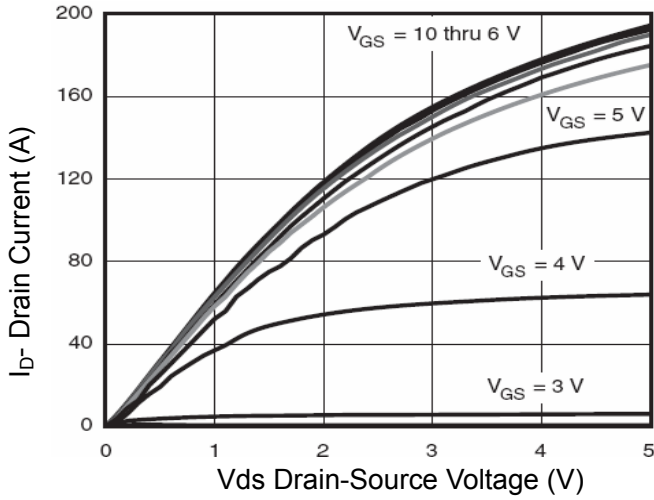


Figure 1 Output Characteristics

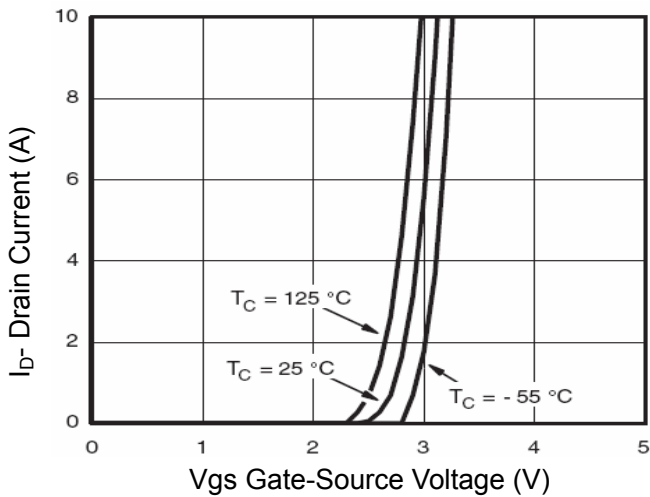


Figure 2 Transfer Characteristics

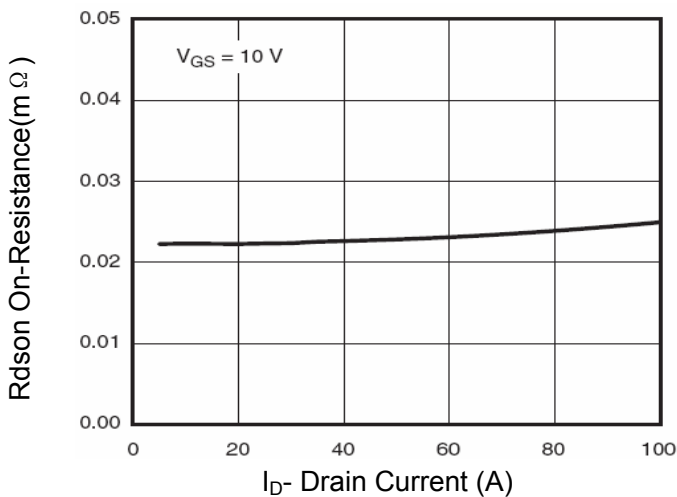


Figure 3 Rdson- Drain Current

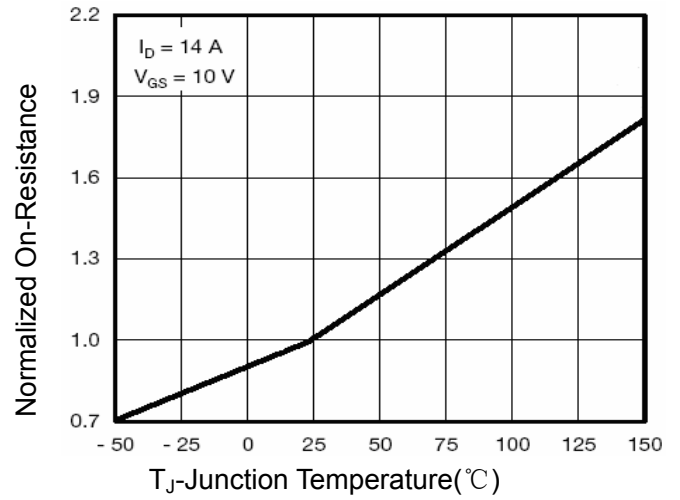


Figure 4 Rdson-Junction Temperature

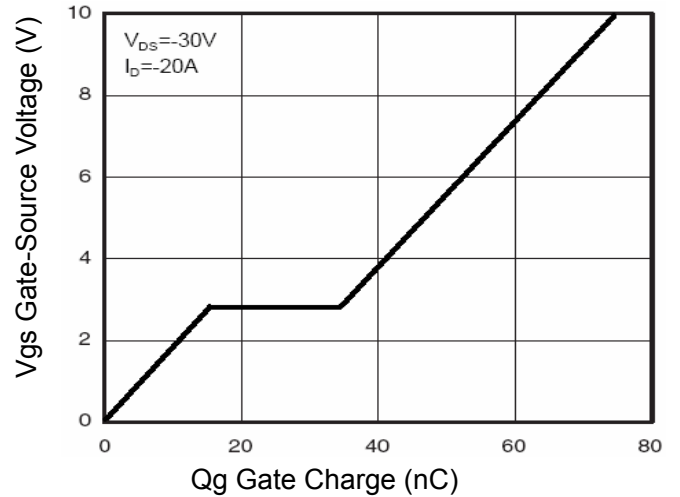


Figure 5 Gate Charge

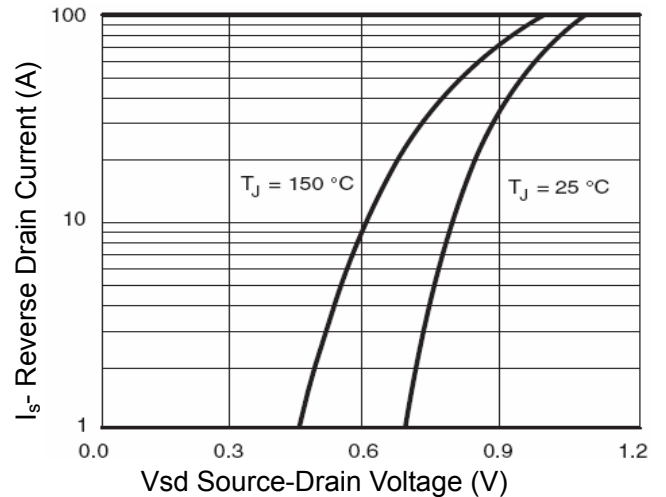


Figure 6 Source- Drain Diode Forward

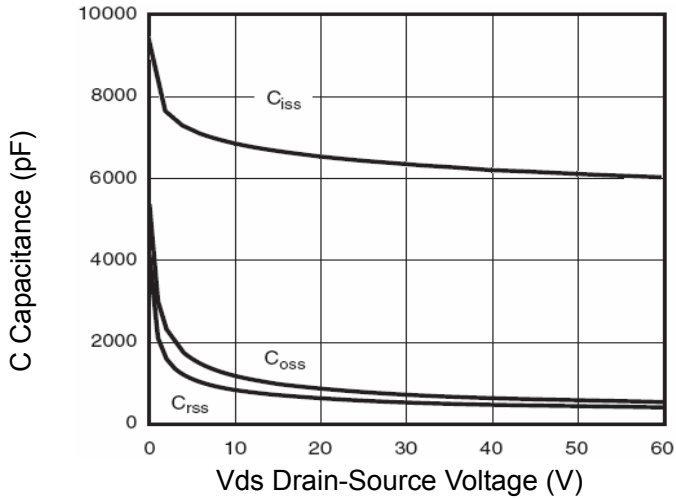


Figure 7 Capacitance vs Vds

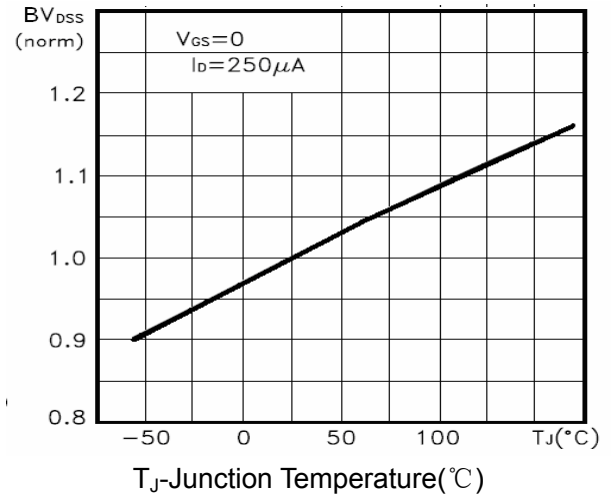


Figure 9 BV<sub>DSS</sub> vs Junction Temperature

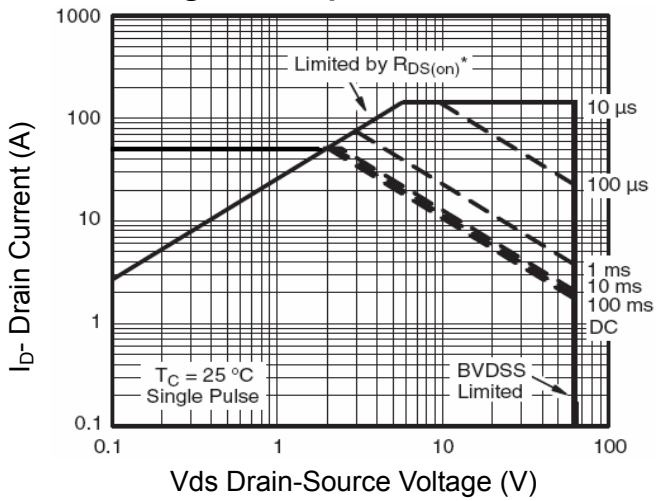


Figure 8 Safe Operation Area

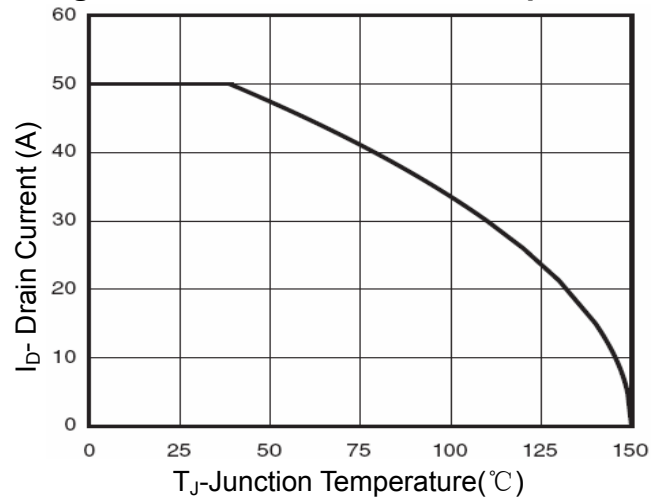


Figure 10 I<sub>D</sub> Current Derating vs Junction Temperature

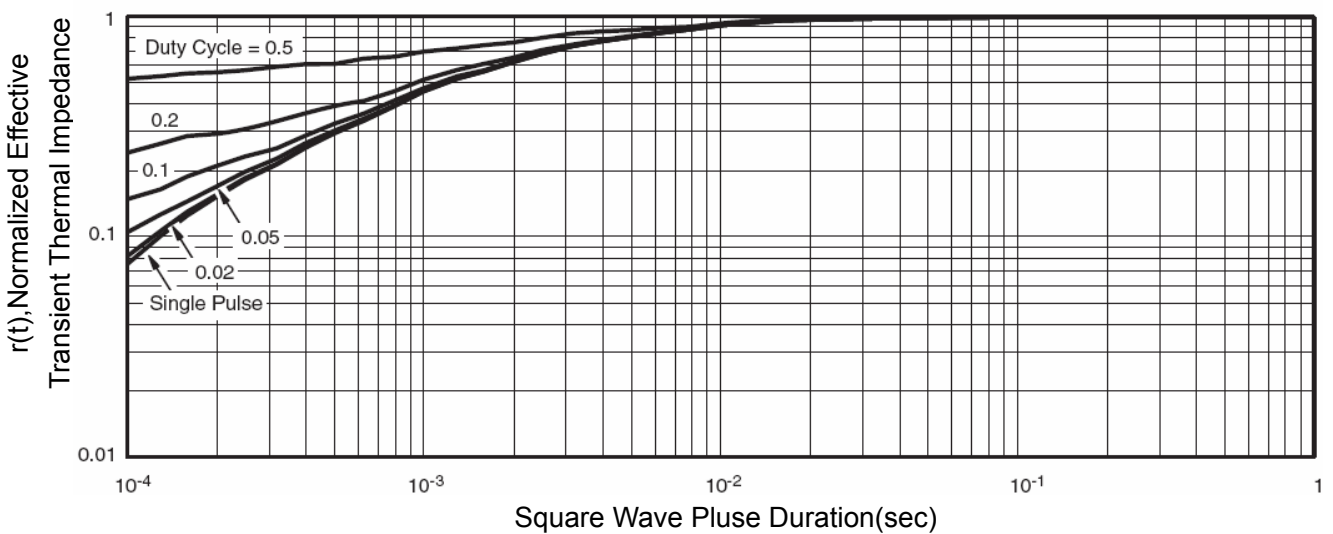
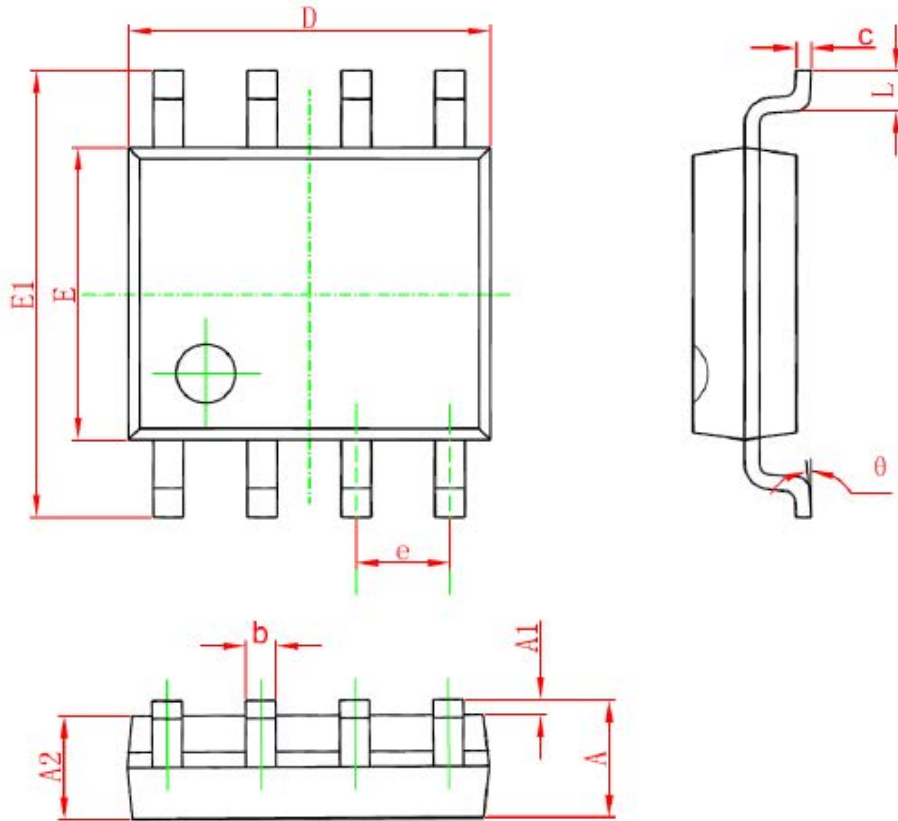


Figure 11 Normalized Maximum Transient Thermal Impedance

SOP-8 PACKAGE IN FORMATION



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	0.483 TYP.		0.190 TYP.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 TYP.		0.114 TYP.	
L2	1.400	1.700	0.055	0.067
L3	1.600 TYP.		0.063 TYP.	
L4	0.600	1.000	0.024	0.039
Φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 TYP.		0.211 TYP.	