

## NCE N-Channel Enhancement Mode Power MOSFET

### Description

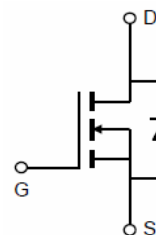
The NCE4012S uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

### General Features

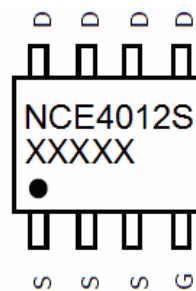
- $V_{DS} = 40V, I_D = 12A$   
 $R_{DS(ON)} < 12m\Omega @ V_{GS} = 10V$  (Typ. 8.4 m $\Omega$ )  
 $R_{DS(ON)} < 18m\Omega @ V_{GS} = 4.5V$  (Typ. 12.3 m $\Omega$ )
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

### Application

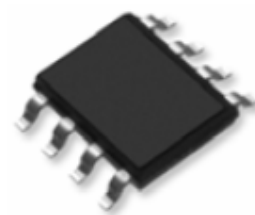
- Load switching
- Hard switched and high frequency circuits
- Uninterruptible power supply



Schematic diagram



Marking and pin Assignment



SOP-8 top view

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCE4012S	NCE4012S	SOP-8	Ø330mm	12mm	4000 units

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	12	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	8.5	A
Pulsed Drain Current	$I_{DM}$	60	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-Ambient <sup>(Note 2)</sup>	$R_{\theta JA}$	41.7	$^\circ C/W$
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### Electrical Characteristics ( $T_A = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	40	45	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 40V, V_{GS} = 0V$	-	-	1	$\mu A$

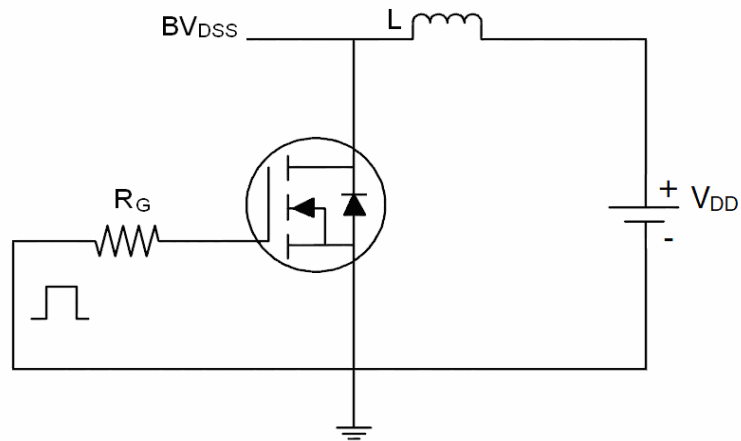
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.2	1.6	2.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=10A$	-	8.4	12	m $\Omega$
		$V_{GS}=4.5V, I_D=8A$	-	12.3	18	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=10A$		75	-	S
<b>Dynamic Characteristics</b> (Note4)						
Input Capacitance	$C_{iss}$	$V_{DS}=20V, V_{GS}=0V,$ $F=1.0MHz$	-	1780	-	PF
Output Capacitance	$C_{oss}$		-	209	-	PF
Reverse Transfer Capacitance	$C_{riss}$		-	160	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=20V, R_L=2\Omega$ $V_{GS}=10V, R_G=3\Omega$	-	6.4	-	nS
Turn-on Rise Time	$t_r$		-	17.2	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	29.6	-	nS
Turn-Off Fall Time	$t_f$		-	16.8	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=20V, I_D=10A,$ $V_{GS}=10V$	-	38.2		nC
Gate-Source Charge	$Q_{gs}$		-	5.6		nC
Gate-Drain Charge	$Q_{gd}$		-	7.4		nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=10A$	-		1.2	V
Diode Forward Current (Note 2)	$I_S$		-	-	12	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^\circ C, I_F = 10A$ $di/dt = 100A/\mu s$ (Note3)	-	29	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	26	-	nC

### Notes:

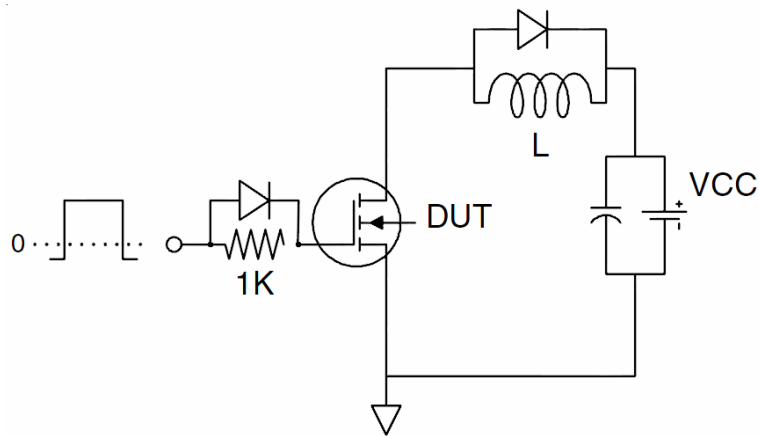
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production

## Test circuit

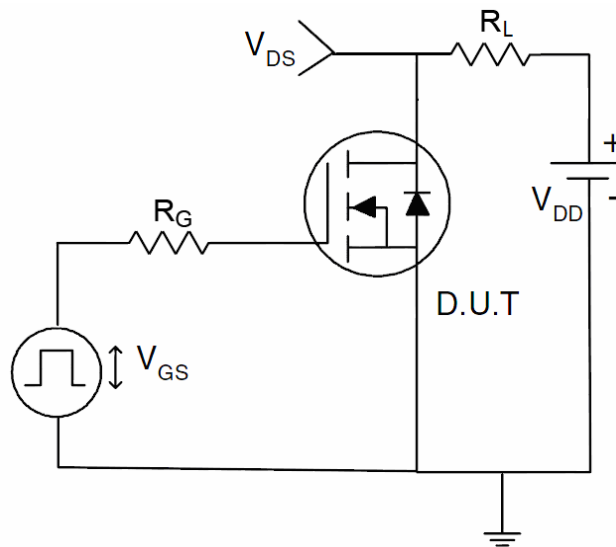
### 1) $E_{AS}$ Test Circuit



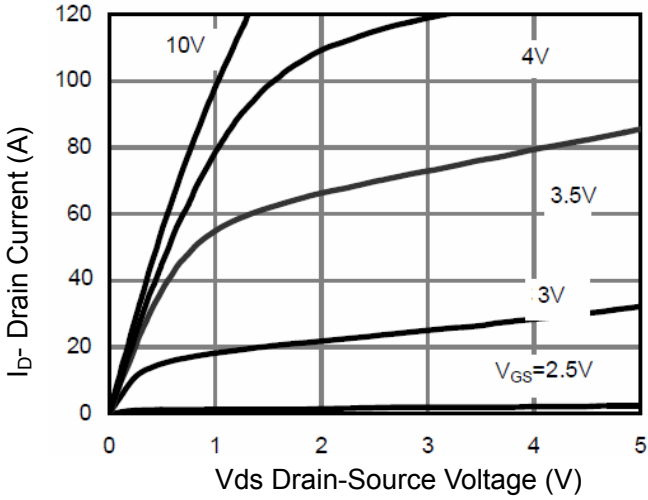
### 2) Gate Charge Test Circuit



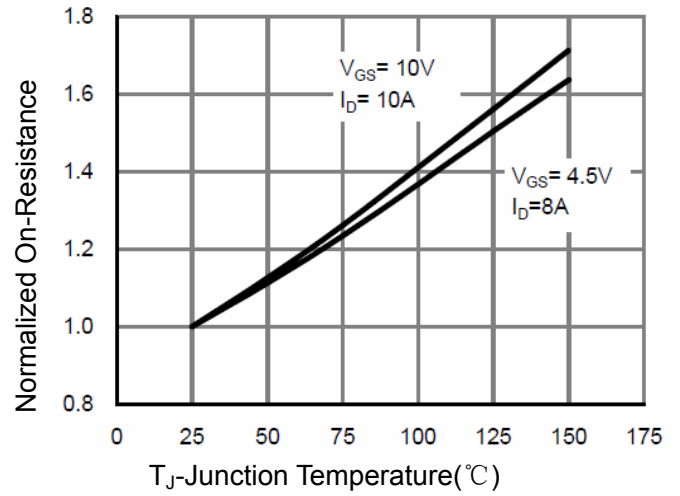
### 3) Switch Time Test Circuit



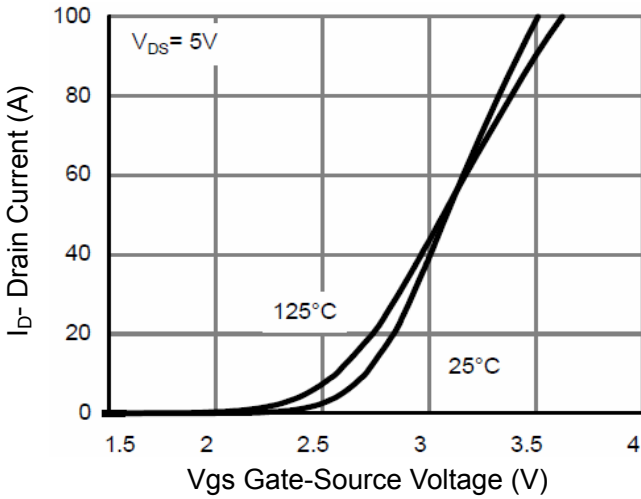
## Typical Electrical and Thermal Characteristics (Curves)



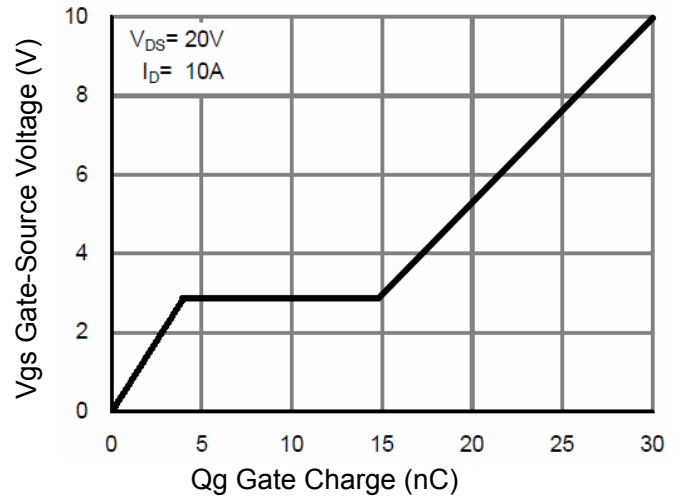
**Figure 1 Output Characteristics**



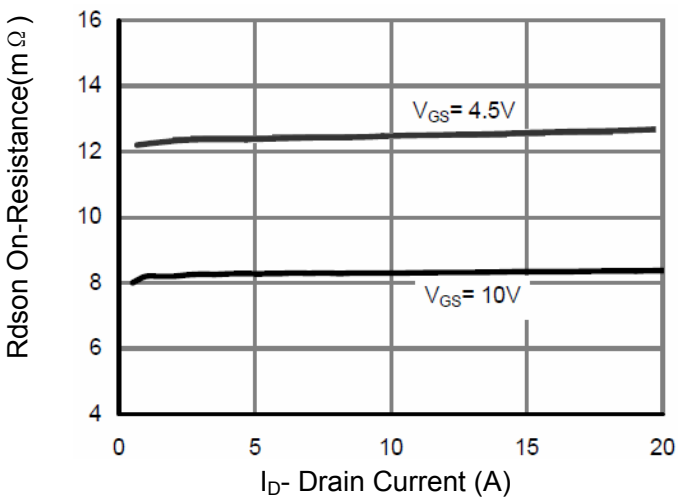
**Figure 4  $R_{dson}$ -Junction Temperature**



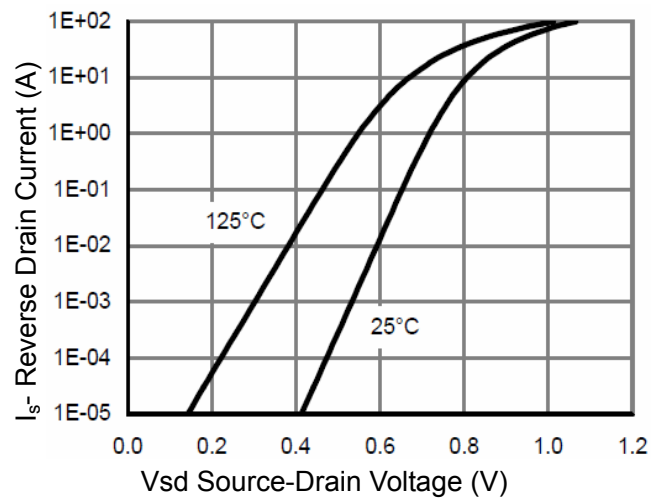
**Figure 2 Transfer Characteristics**



**Figure 5 Gate Charge**



**Figure 3  $R_{dson}$ - Drain Current**



**Figure 6 Source- Drain Diode Forward**

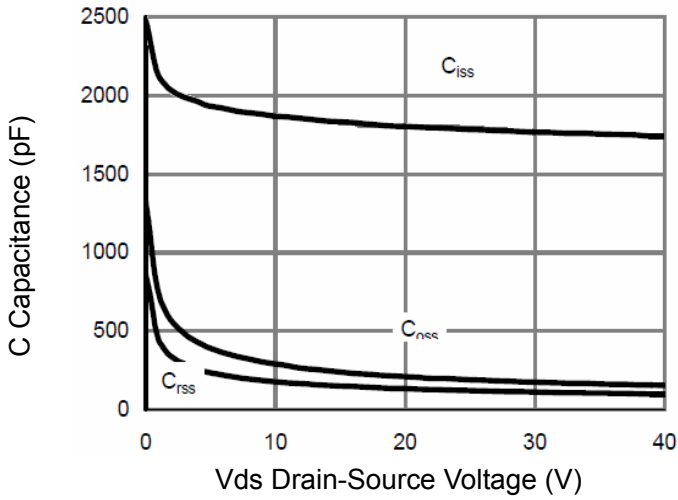


Figure 7 Capacitance vs Vds

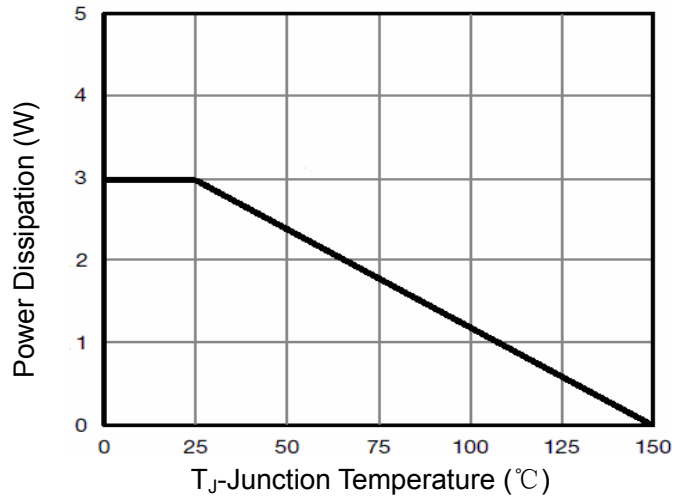


Figure 9 Power De-rating

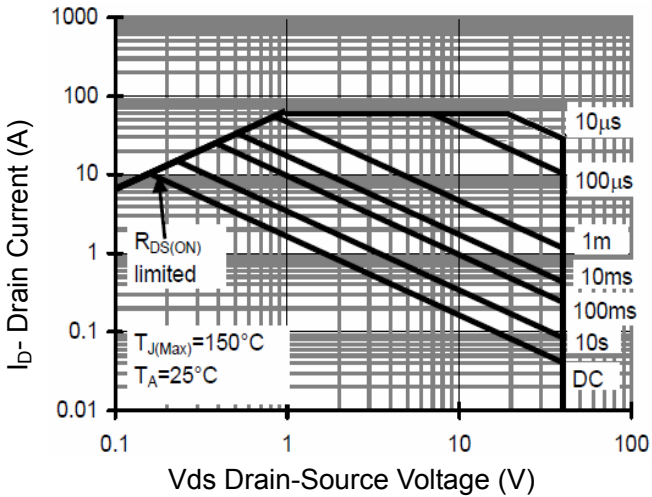


Figure 8 Safe Operation Area

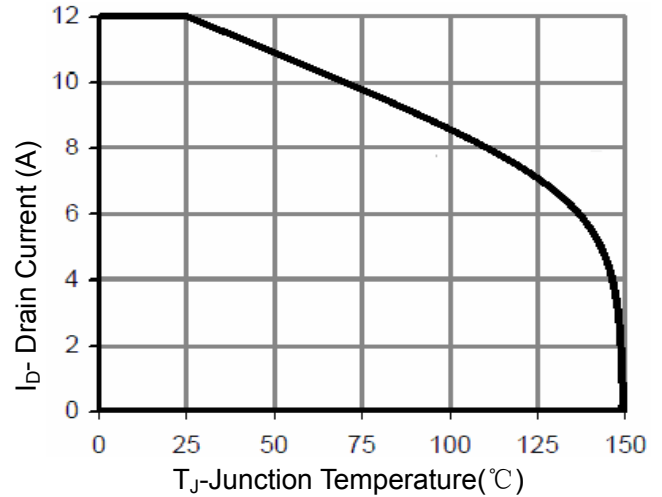


Figure 10 Current De-rating

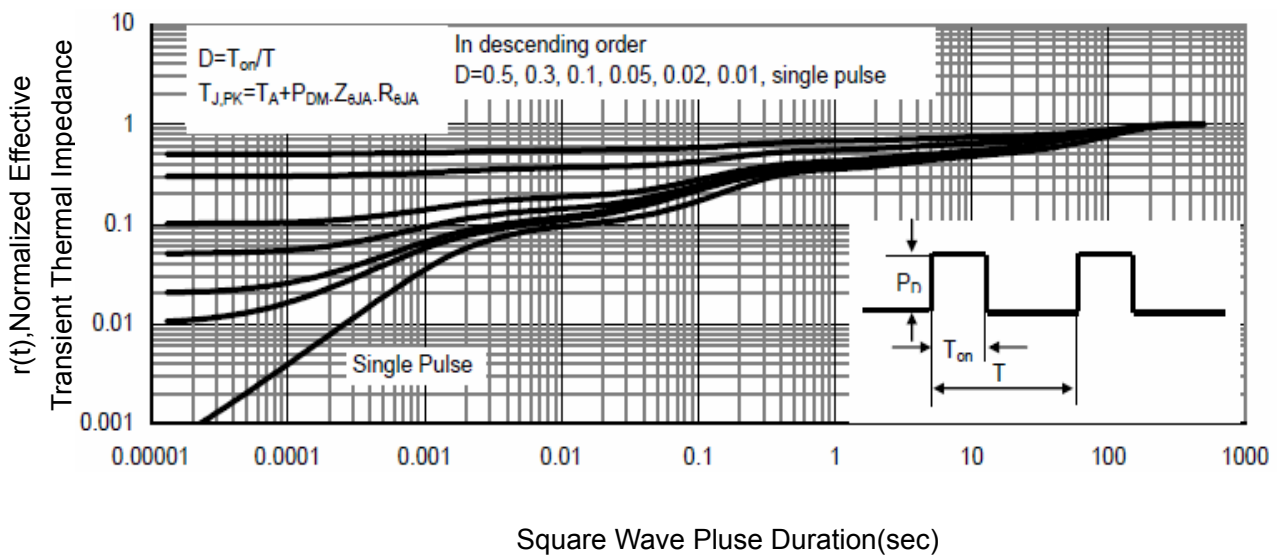
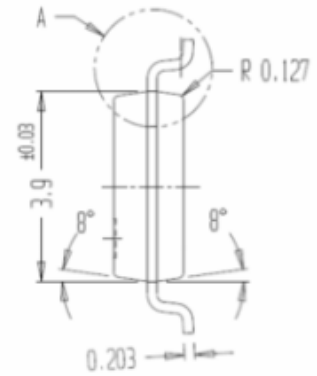
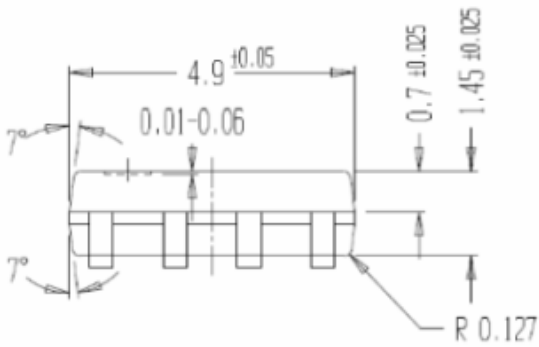
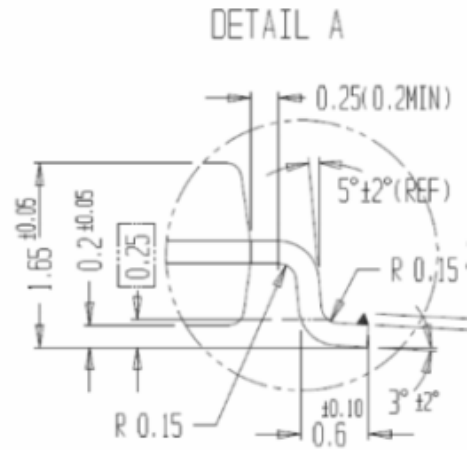
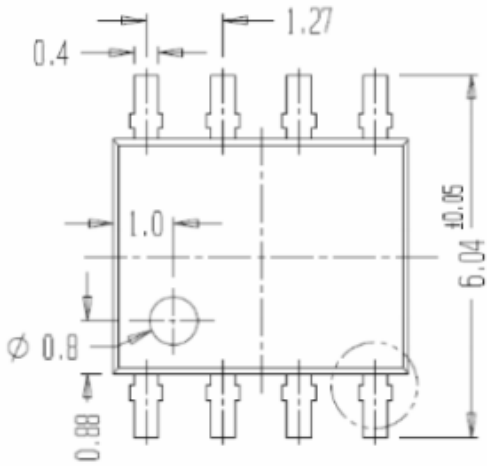


Figure 11 Normalized Maximum Transient Thermal Impedance

## SOP-8 Package Information



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