

## NCE P-Channel Enhancement Mode Power MOSFET

### Description

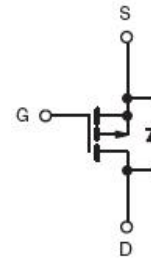
The NCE4435B uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a load switch or in PWM applications.

### General Features

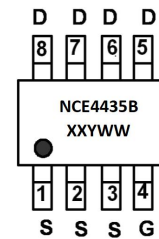
- $V_{DS} = -30V, I_D = -12A$   
 $R_{DS(ON)} < 11m\Omega @ V_{GS} = -4.5V$   
 $R_{DS(ON)} < 16m\Omega @ V_{GS} = -10V$
- High Power and current handing capability
- Lead free product is acquired
- Surface mount package

### Application

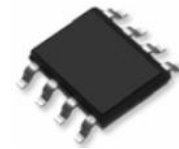
- PWM applications
- Load switch
- Power management



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
NCE4435B	NCE4435B	SOP-8	Ø330mm	12mm	4000 units

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous ( $T_A=25^\circ C$ )	$I_D$	-12	A
Drain Current-Continuous ( $T_A=100^\circ C$ )		-8.4	
Drain Current-Pulsed (Note 1)	$I_{DM}$	-48	A
Maximum Power Dissipation ( $T_A=25^\circ C$ )	$P_D$	3	W
Maximum Power Dissipation ( $T_A=100^\circ C$ )		1.3	
Single pulse avalanche energy (Note 5)	$E_{AS}$	125	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	$^\circ C$

### Thermal Characteristic

Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	41.67	$^\circ C/W$
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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	$BV_{DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-30	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=-30V, V_{GS}=0V$	-	-	-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	-1.6	-2.2	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=-10V, I_D=-10A$	-	9	11	m $\Omega$
		$V_{GS}=-4.5V, I_D=-7A$	-	12.2	16	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=-10V, I_D=-10A$	-	20	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	$C_{iss}$	$V_{DS}=-15V, V_{GS}=0V,$ $F=1.0MHz$	-	2151	-	PF
Output Capacitance	$C_{oss}$		-	217	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	187	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=-15V, I_D=-10A,$ $V_{GS}=-10V, R_{GEN}=1\Omega$	-	12	-	nS
Turn-on Rise Time	$t_r$		-	10	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	25	-	nS
Turn-Off Fall Time	$t_f$		-	13	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=-15V, I_D=-10A, V_{GS}=-10V$	-	41.5	-	nC
Gate-Source Charge	$Q_{gs}$		-	5.5	-	nC
Gate-Drain Charge	$Q_{gd}$		-	8.2	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Current (Note 2)	$I_S$		-	-	-12	A
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=-10A$	-	-	-1.2	V

### 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. EAS condition:  $T_j=25^\circ C, V_{DD}=-15V, V_G=10V, L=0.5mH, R_g=25\Omega$

Typical Electrical and Thermal Characteristics

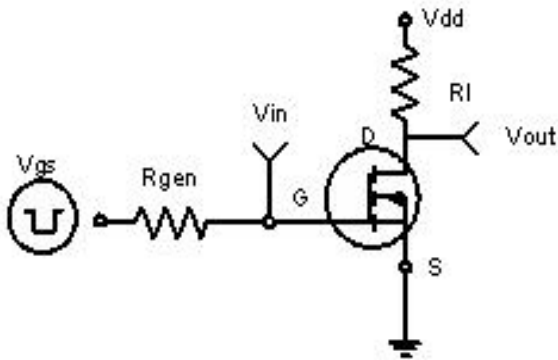


Figure 1: Switching Test Circuit

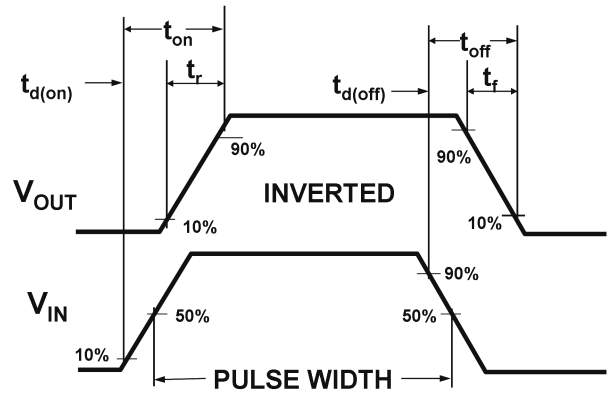


Figure 2: Switching Waveforms

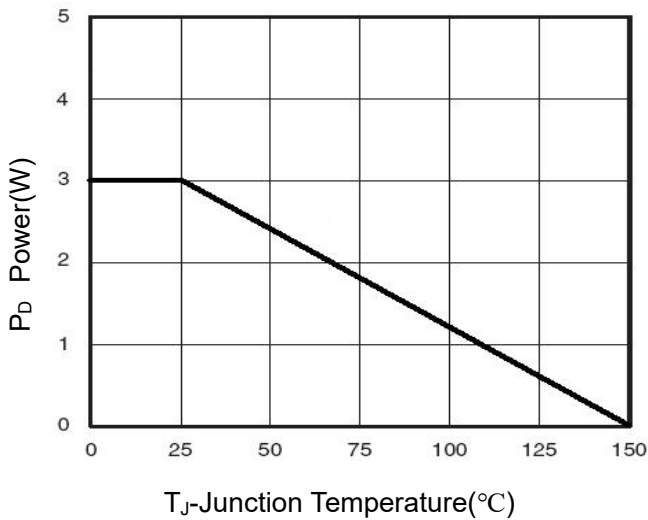


Figure 3 Power Dissipation

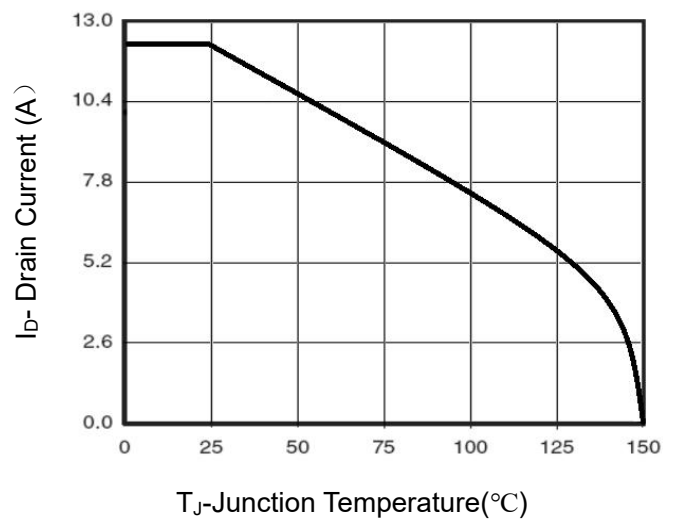


Figure 4 Drain Current

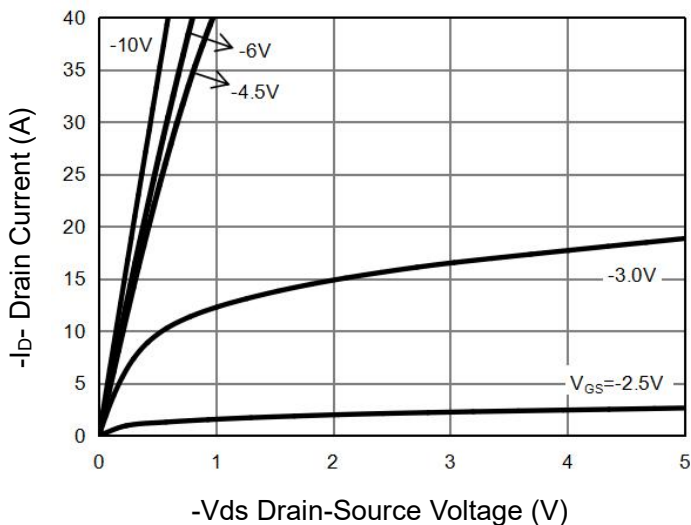


Figure 5 Output Characteristics

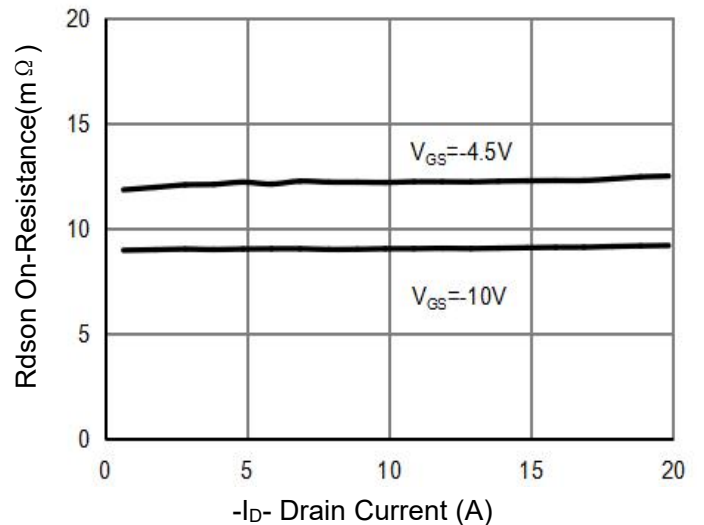


Figure 6 Drain-Source On-Resistance

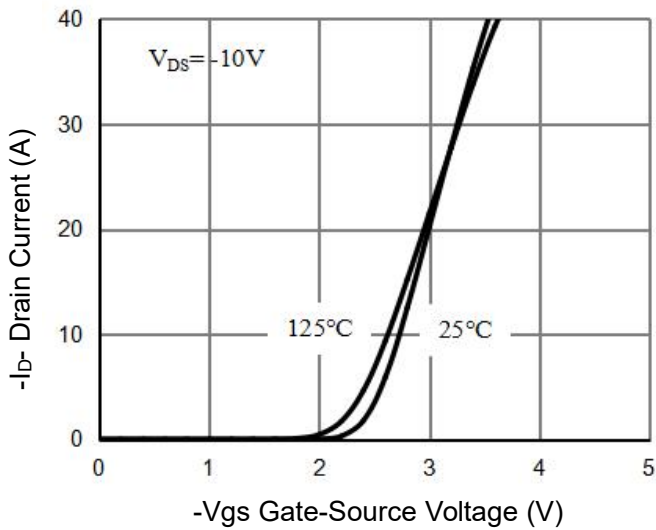


Figure 7 Transfer Characteristics

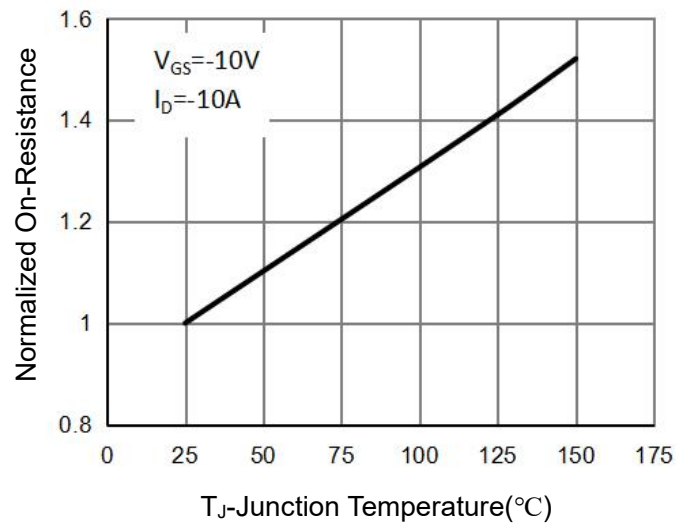


Figure 8 Drain-Source On-Resistance

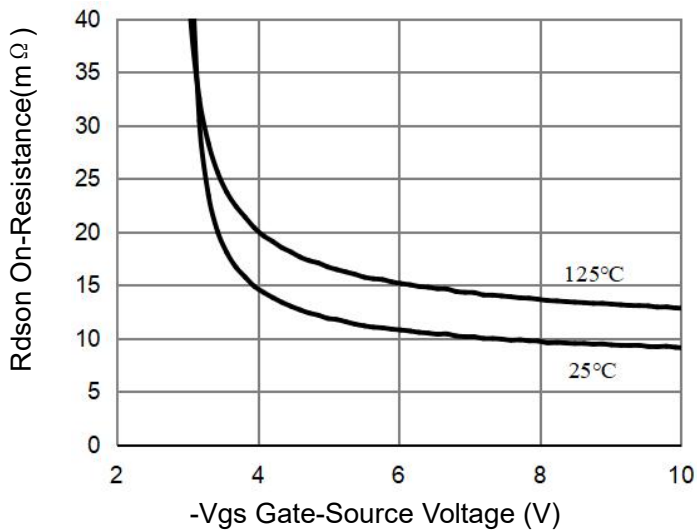


Figure 9 R<sub>DS(on)</sub> vs V<sub>GS</sub>

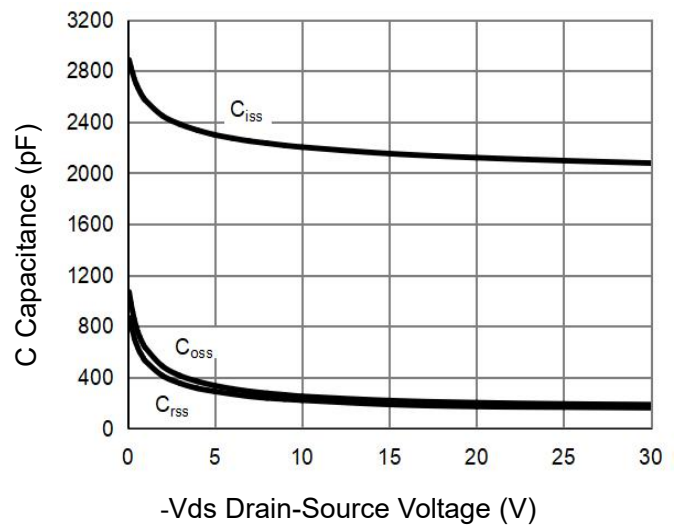


Figure 10 Capacitance vs V<sub>DS</sub>

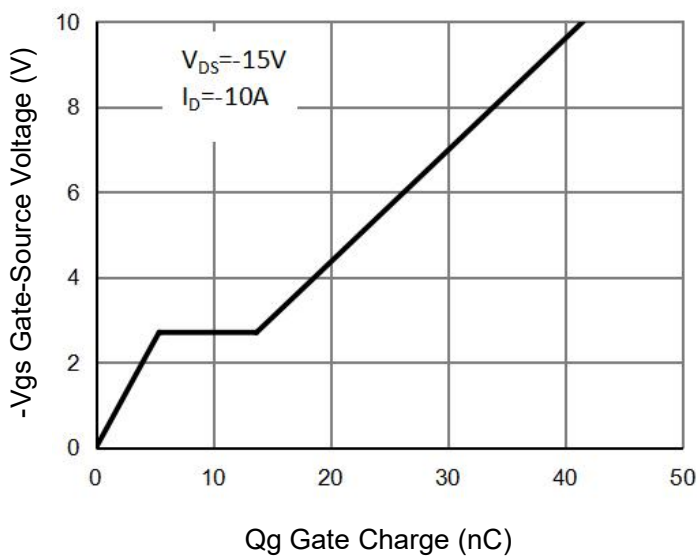


Figure 11 Gate Charge

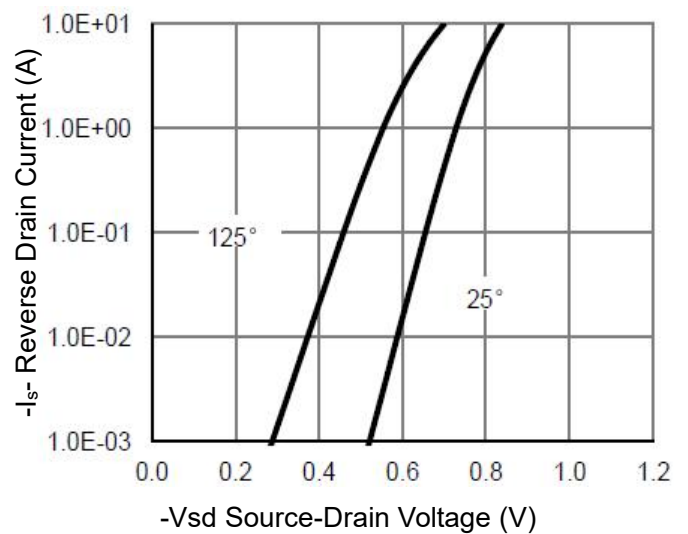
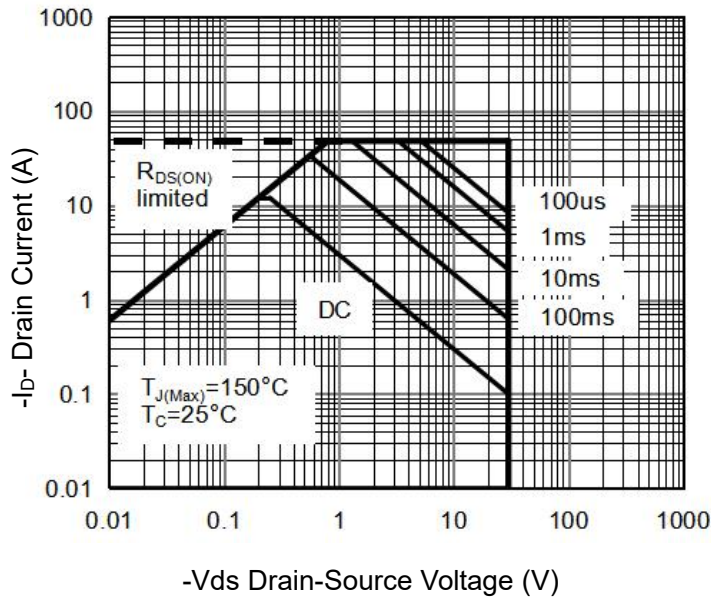
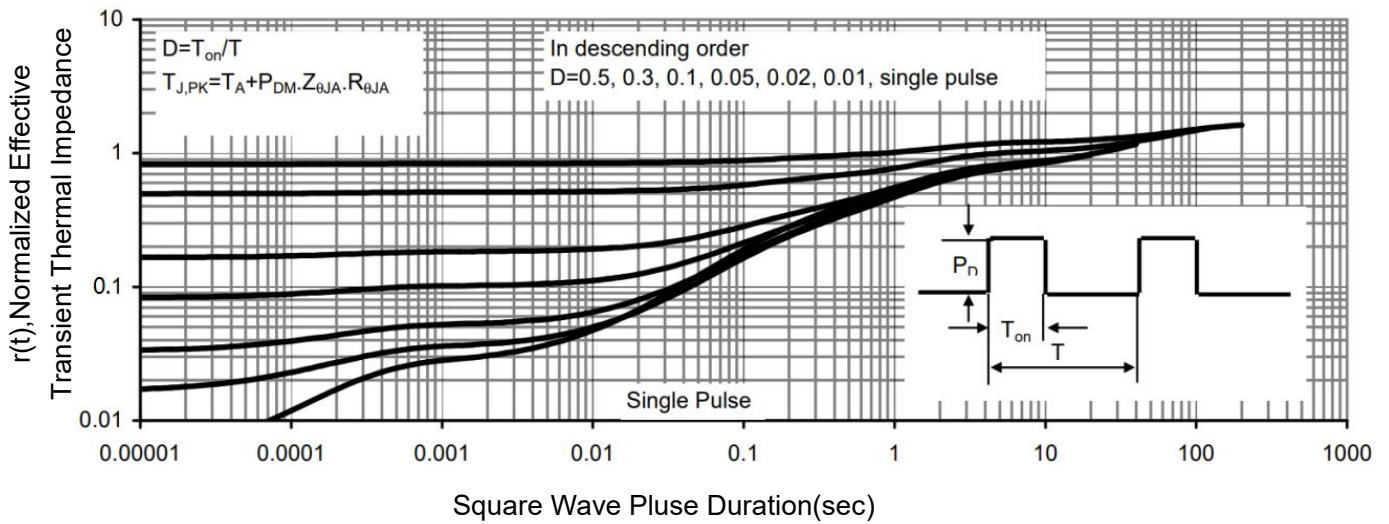


Figure 12 Source- Drain Diode Forward

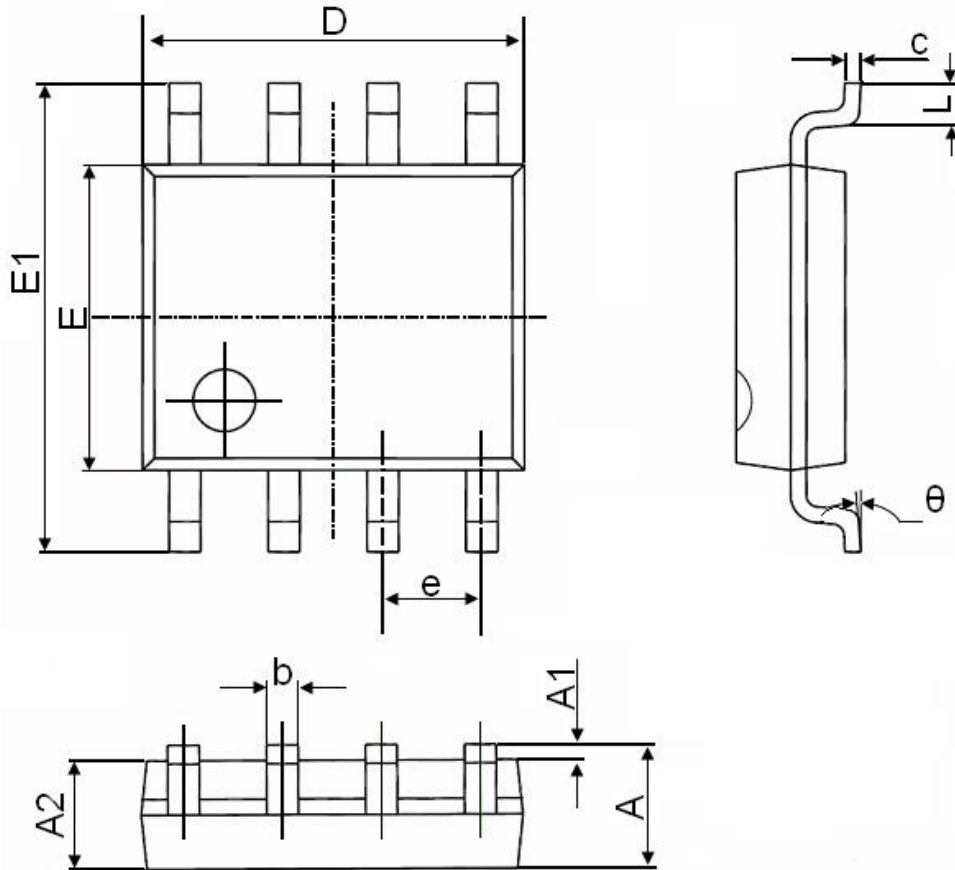


**Figure 13 Safe Operation Area**



**Figure 14 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°

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