

## NCE P-Channel Enhancement Mode Power MOSFET

### DESCRIPTION

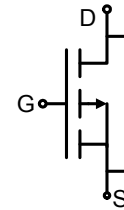
The NCE9435 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a load switch or in PWM applications.

### GENERAL FEATURES

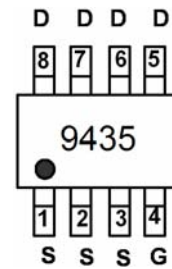
- $V_{DS} = -30V, I_D = -5.1A$   
 $R_{DS(ON)} < 85m\Omega @ V_{GS} = -4.5V$   
 $R_{DS(ON)} < 53m\Omega @ V_{GS} = -10V$
- High Power and current handing capability
- Lead free product is acquired
- Surface Mount Package

### Application

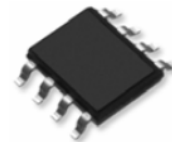
- PWM applications
- Load switch
- Power management



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
9435	NCE9435	SOP-8	Ø330mm	12mm	2500 units

### Absolute Maximum Ratings (TA=25°C unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-30	V
Gate-Source Voltage	$V_{GS}$	±20	V
Drain Current-Continuous	$I_D$	-5.1	A
Drain Current-Pulsed (Note 1)	$I_{DM}$	-20	A
Maximum Power Dissipation	$P_D$	2.5	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	°C

### Thermal Characteristic

Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	50	°C/W
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### Electrical Characteristics (TA=25°C unless otherwise noted)

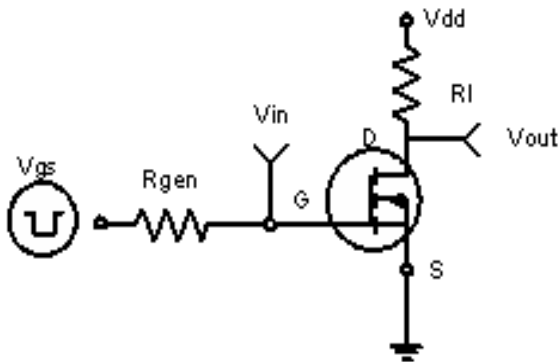
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-30			V

Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-24V,V <sub>GS</sub> =0V			-1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V,V <sub>DS</sub> =0V			±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =-250μA	-1		-3	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-5.1A		46	53	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-4.2A		70	85	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =-15V,I <sub>D</sub> =-4.5A	4	7		S
Dynamic Characteristics (Note4)						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =-15V,V <sub>GS</sub> =0V, F=1.0MHz		1040		PF
Output Capacitance	C <sub>OSS</sub>			420		PF
Reverse Transfer Capacitance	C <sub>RSS</sub>			150		PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =-15V, ID=-1A, V <sub>GS</sub> =-10V,R <sub>GEN</sub> =6Ω		15		nS
Turn-on Rise Time	t <sub>r</sub>			13		nS
Turn-Off Delay Time	t <sub>d(off)</sub>			58		nS
Turn-Off Fall Time	t <sub>f</sub>			21		nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =-15V,I <sub>D</sub> =-5.1A,V <sub>GS</sub> =-10V		12		nC
Gate-Source Charge	Q <sub>gs</sub>			2.2		nC
Gate-Drain Charge	Q <sub>gd</sub>			3		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V,I <sub>S</sub> =-1.7A			-1.2	V

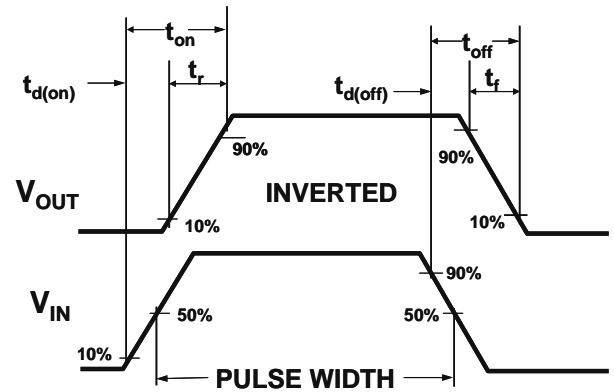
## Notes:

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

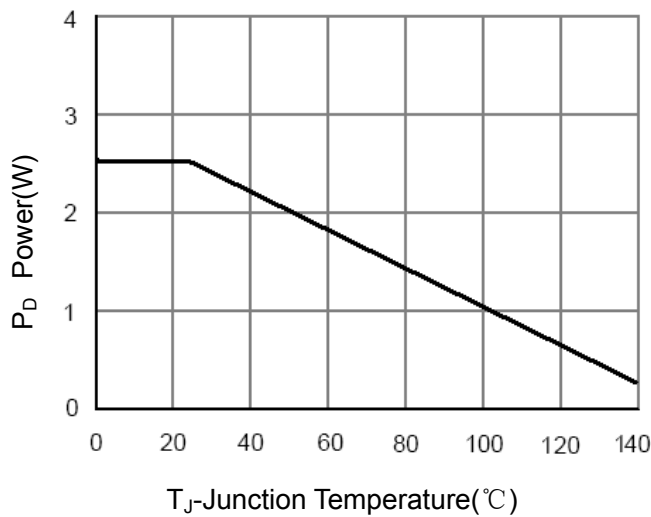
## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



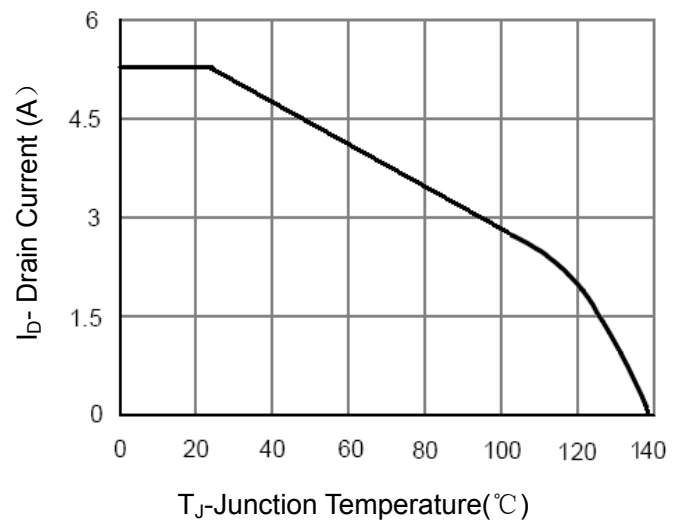
**Figure 1: Switching Test Circuit**



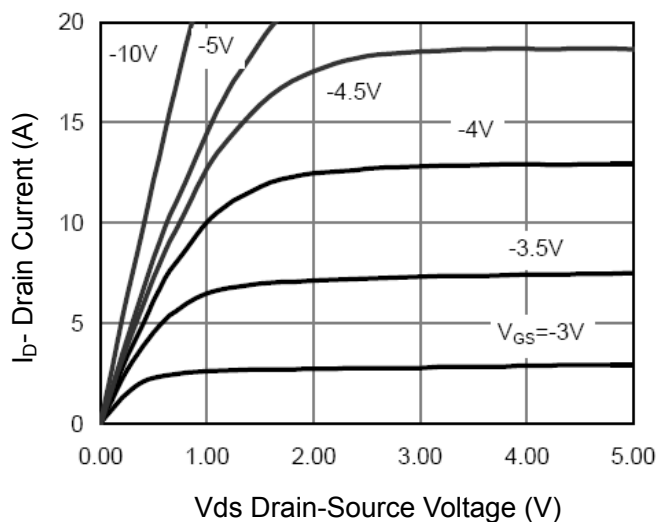
**Figure 2: Switching Waveforms**



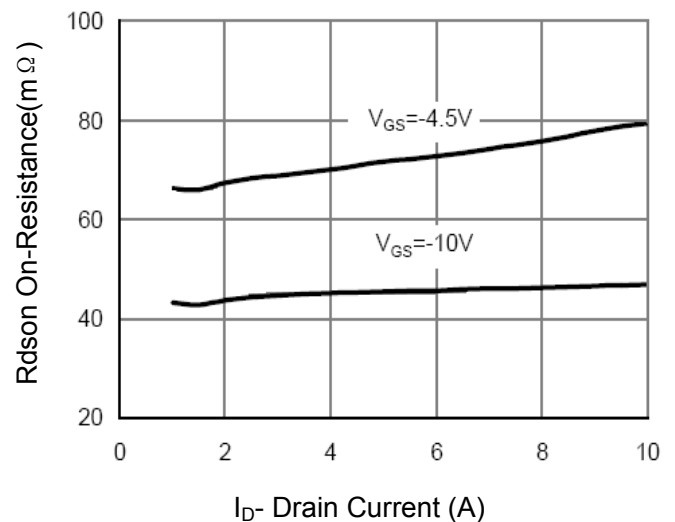
**Figure 3 Power Dissipation**



**Figure 4 Drain Current**



**Figure 5 Output CHARACTERISTICS**



**Figure 6 Drain-Source On-Resistance**

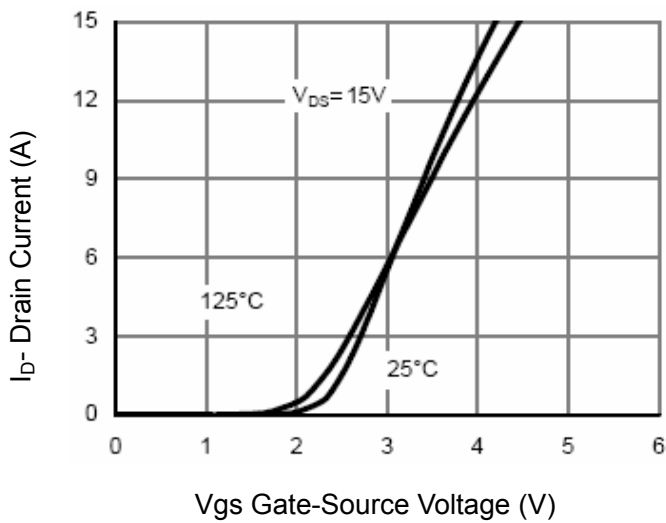


Figure 7 Transfer Characteristics

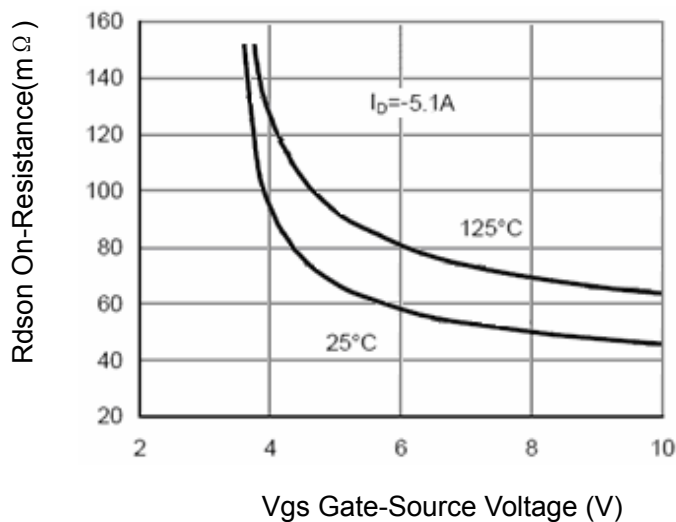


Figure 9 Rdson vs Vgs

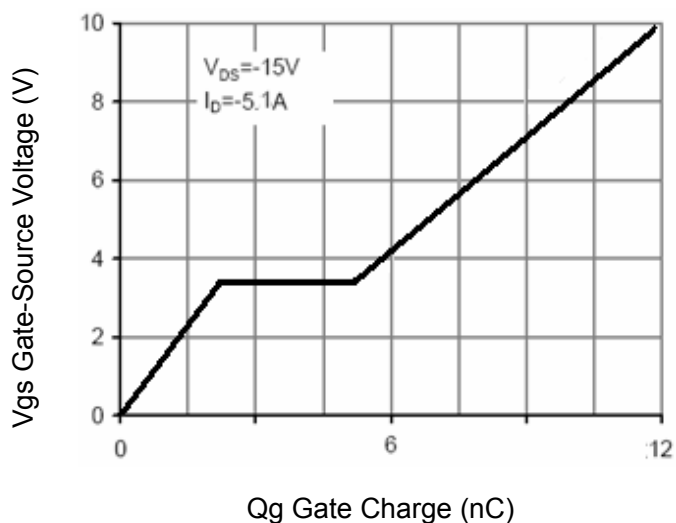


Figure 11 Gate Charge

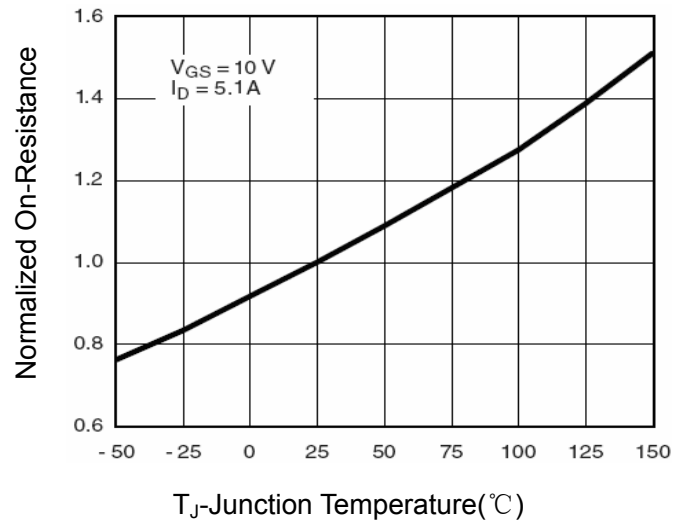


Figure 8 Drain-Source On-Resistance

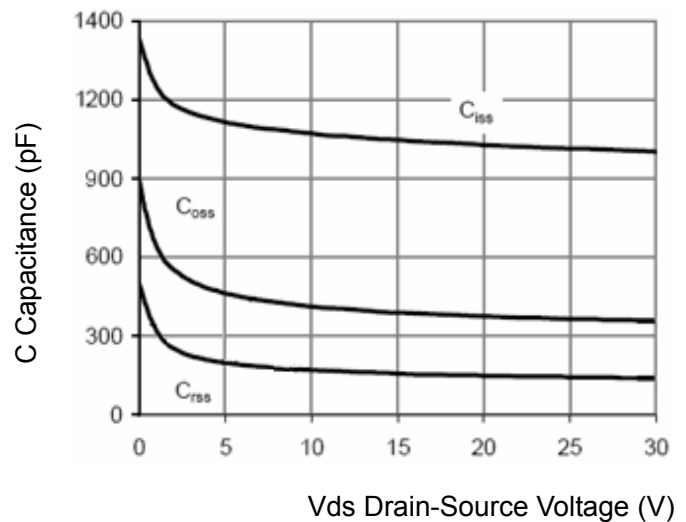


Figure 10 Capacitance vs Vds

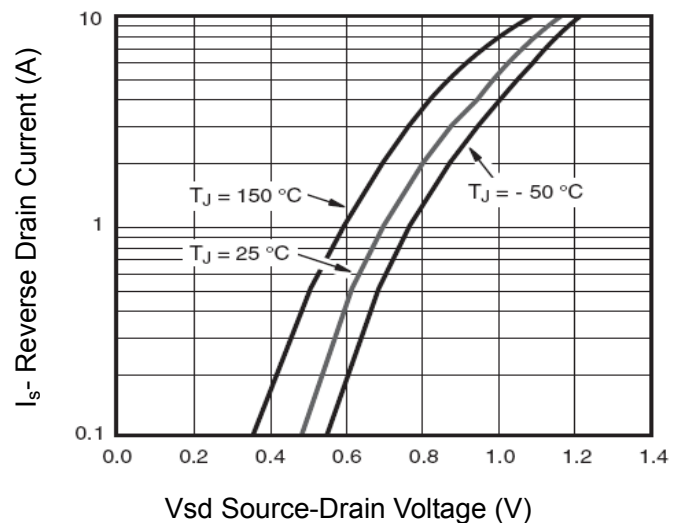
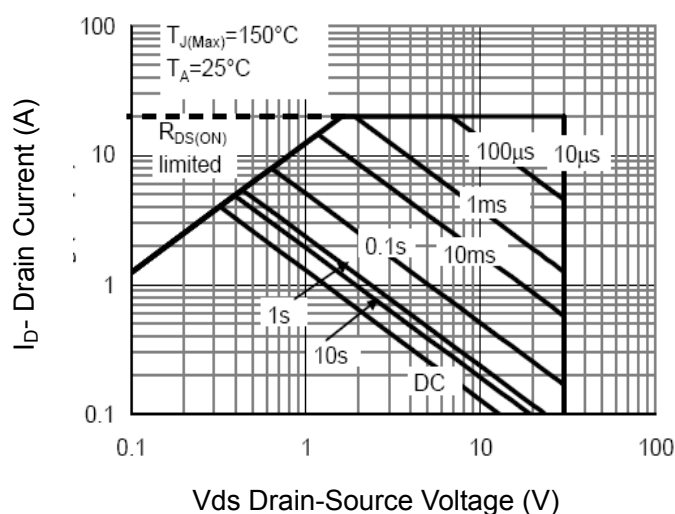
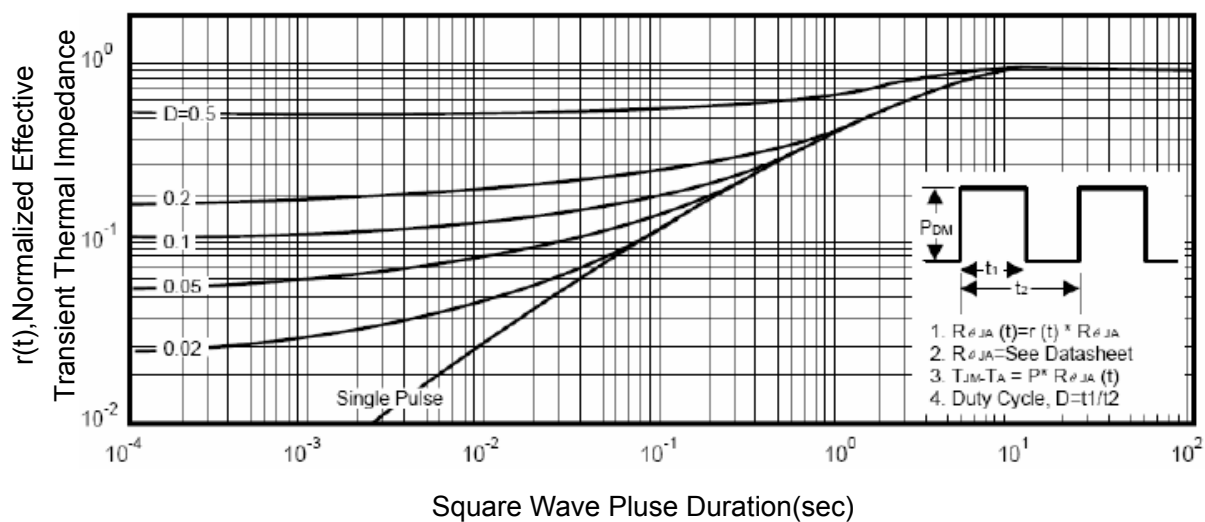


Figure 12 Source- Drain Diode Forward

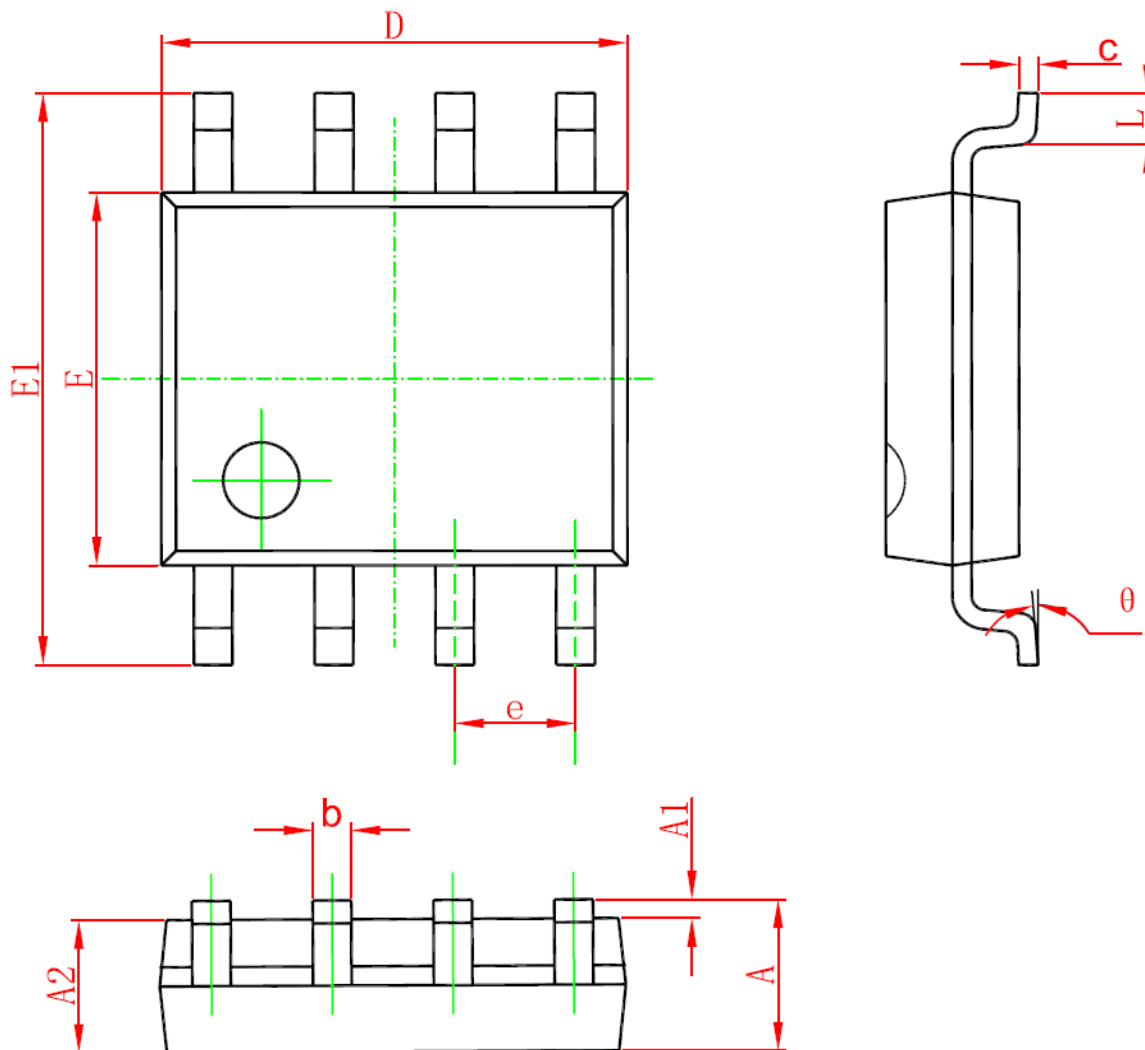


**Figure 13 Safe Operation Area**



**Figure 14 Normalized Maximum Transient Thermal Impedance**

## SOP-8 PACKAGE IN FORMATION



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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