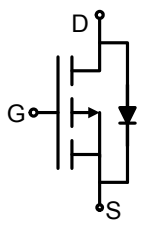

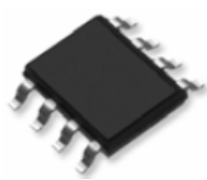


## NCE P-Channel Enhancement Mode Power MOSFET

<p><b>Description</b></p> <p>The NCE4435 uses advanced trench technology to provide excellent <math>R_{DS(ON)}</math>, low gate charge and operation with gate voltages as low as 4.5V.</p> <p><b>General Features</b></p> <ul style="list-style-type: none"> <li>● <math>V_{DS} = -30V, I_D = -9.1A</math></li> <li>● <math>R_{DS(ON)} &lt; 35m\Omega @ V_{GS} = -4.5V</math></li> <li>● <math>R_{DS(ON)} &lt; 20m\Omega @ V_{GS} = -10V</math></li> <li>● High power and current handling capability</li> <li>● Lead free product is acquired</li> <li>● Surface mount package</li> </ul> <p><b>Application</b></p> <ul style="list-style-type: none"> <li>● Battery Switch</li> <li>● Load switch</li> <li>● Power management</li> </ul>	<div style="text-align: center;">  <p><b>Schematic diagram</b></p> </div> <div style="text-align: center;">  <p><b>Marking and pin assignment</b></p> </div> <div style="text-align: center;">  <p><b>SOP-8 top view</b></p> </div>
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### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCE4435	NCE4435	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
Continuous Drain Current ( $T_J = 150^\circ C$ )	$T_C = 25^\circ C$	$I_D$	-11	A
	$T_C = 70^\circ C$		-9	
	$T_A = 25^\circ C$		-9.1	
	$T_A = 70^\circ C$		-7.2	
Drain Current-Pulsed <sup>(Note 1)</sup>		$I_{DM}$	-50	A
Maximum Power Dissipation		$P_D$	3.1	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>	$R_{\theta JA}$	40	$^\circ C/W$
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## Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =-250μA	-30	-33	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-30V, 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
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	-1	-1.5	-3	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-9.1A	-	16	20	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-6.9A	-	21	35	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =-15V, I <sub>D</sub> =-9.1A	10	-	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V, F=1.0MHz	-	1600	-	PF
Output Capacitance	C <sub>OSS</sub>		-	350	-	PF
Reverse Transfer Capacitance	C <sub>RSS</sub>		-	300	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =-15V, I <sub>D</sub> =-1A, V <sub>GS</sub> =-10V, R <sub>GEN</sub> =6Ω	-	10	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	15	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	110	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	70	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =-15V, I <sub>D</sub> =-9.1A V <sub>GS</sub> =-10V	-	30	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	5.5	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	8	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =-9.1A	-	-	-1.2	V

### Notes:

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

Typical Electrical and Thermal Characteristics



Figure 1: Switching Test Circuit

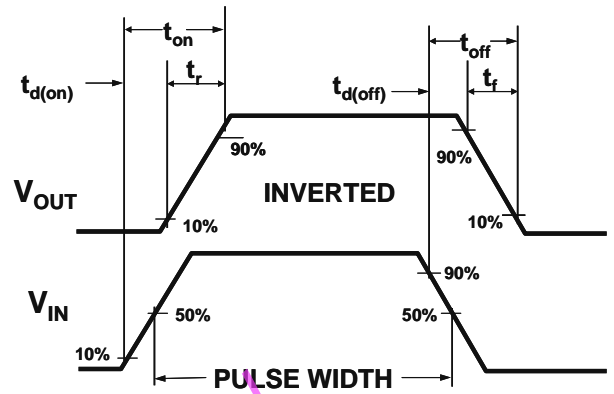


Figure 2: Switching Waveforms

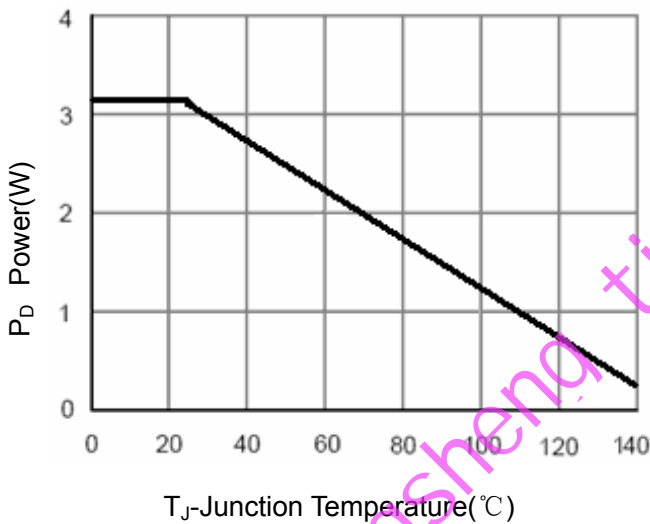


Figure 3 Power Dissipation

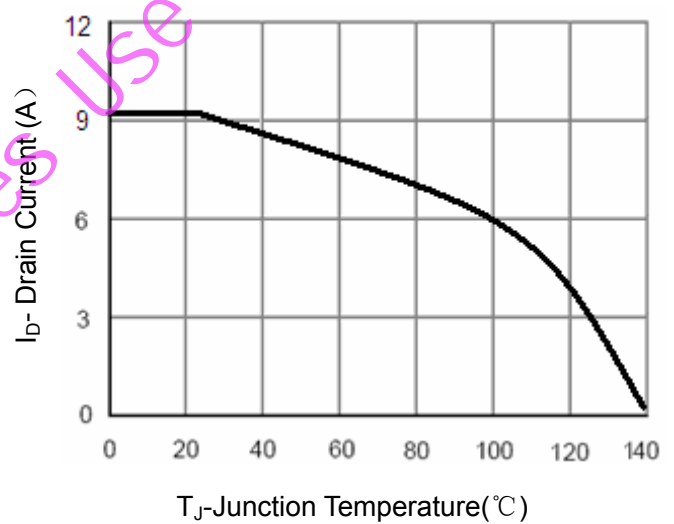


Figure 4 Drain Current

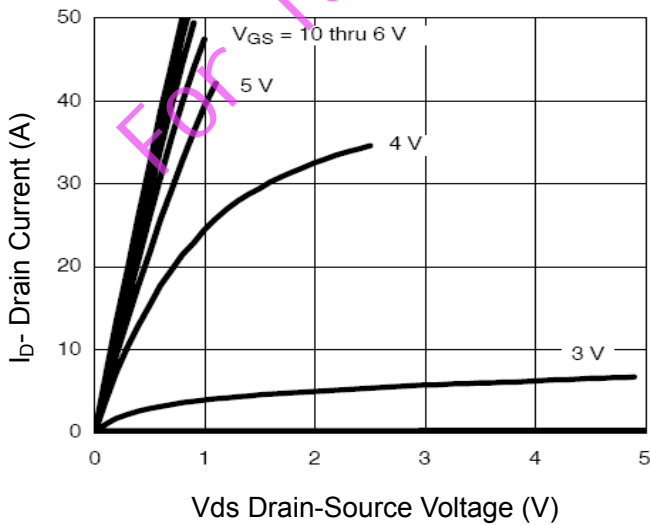


Figure 5 Output Characteristics

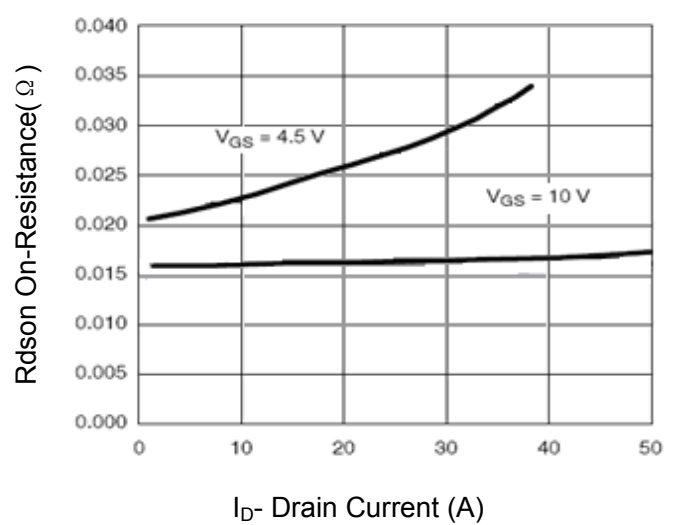
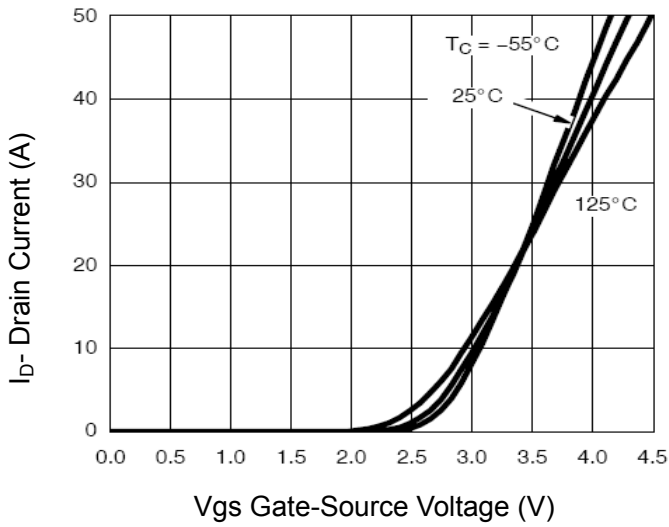
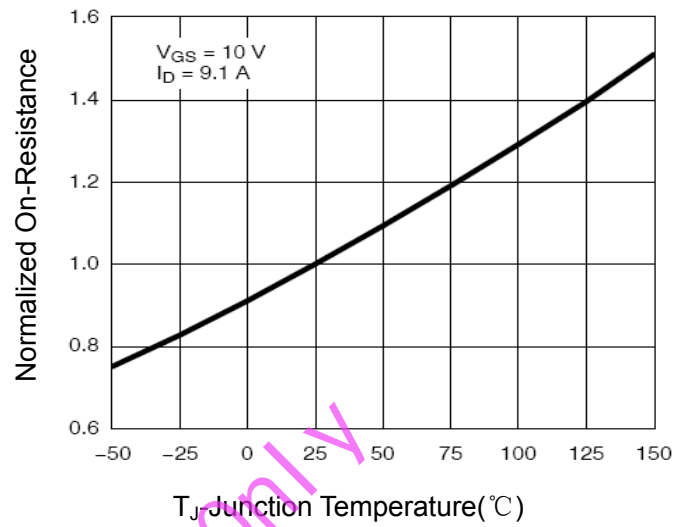


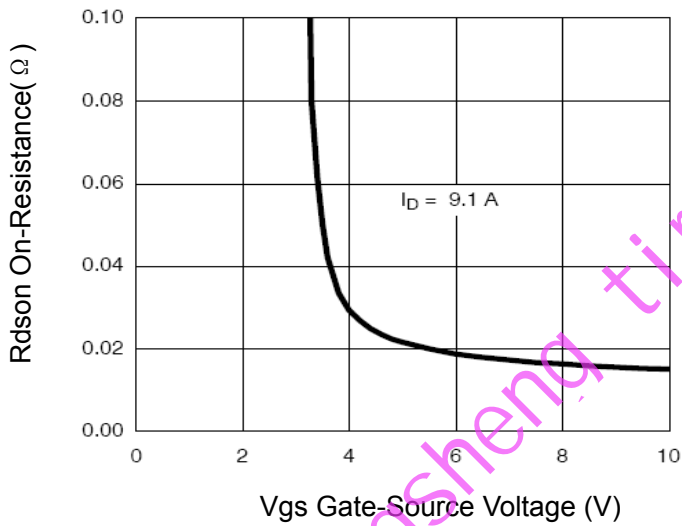
Figure 6 Drain-Source On-Resistance



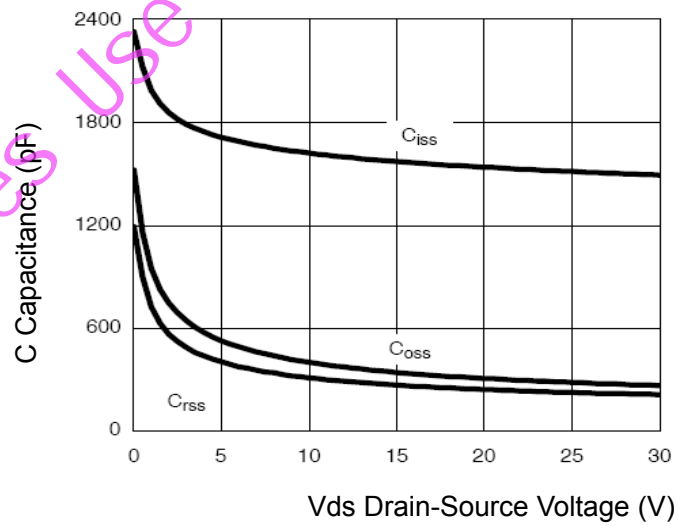
**Figure 7 Transfer Characteristics**



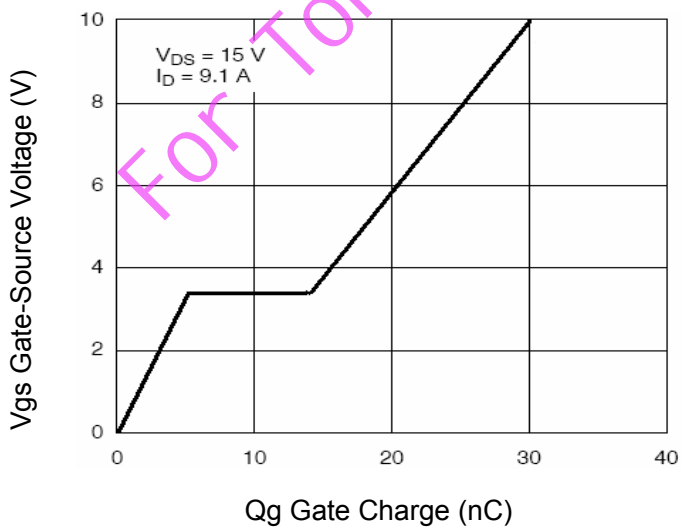
**Figure 8 Drain-Source On-Resistance**



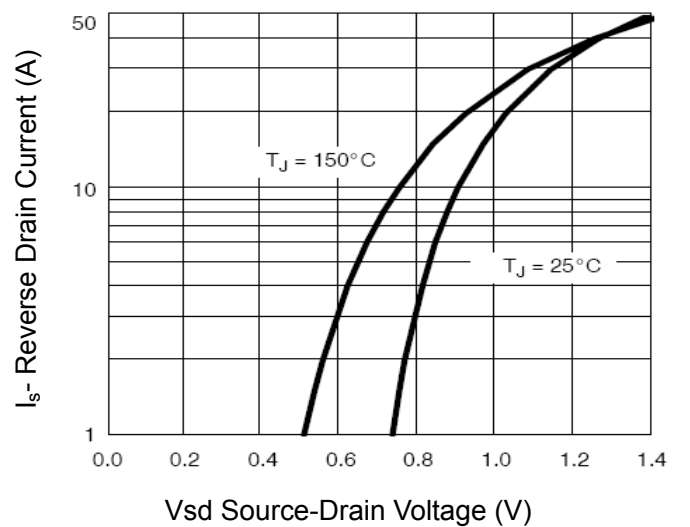
**Figure 9  $R_{DS(on)}$  vs  $V_{GS}$**



**Figure 10 Capacitance vs  $V_{DS}$**



**Figure 11 Gate Charge**



**Figure 12 Source- Drain Diode Forward**

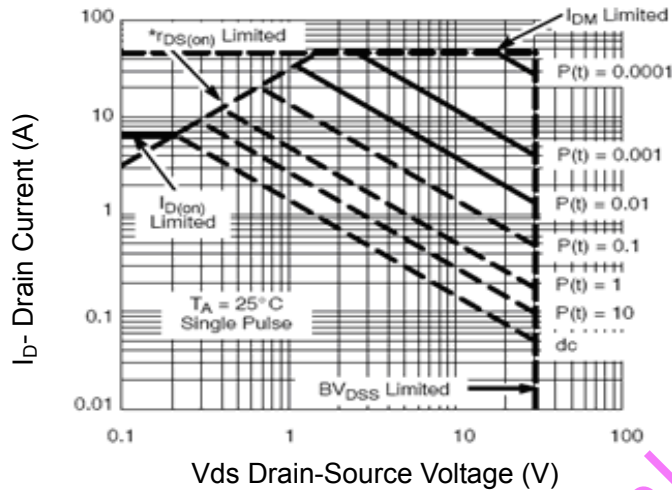


Figure 13 Safe Operation Area

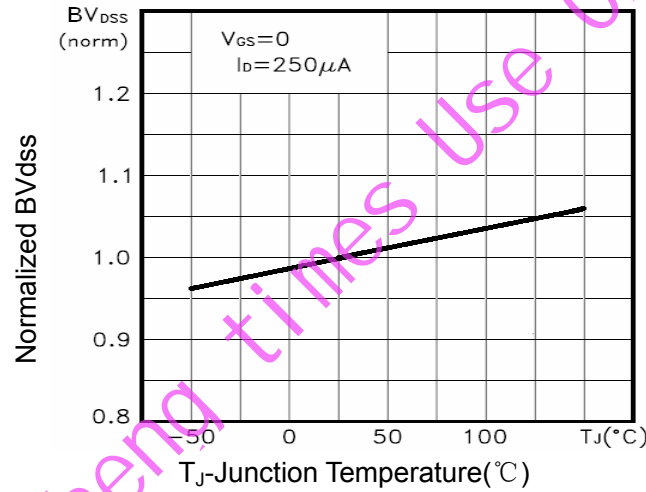


Figure 14  $BV_{DSS}$  vs Junction Temperature

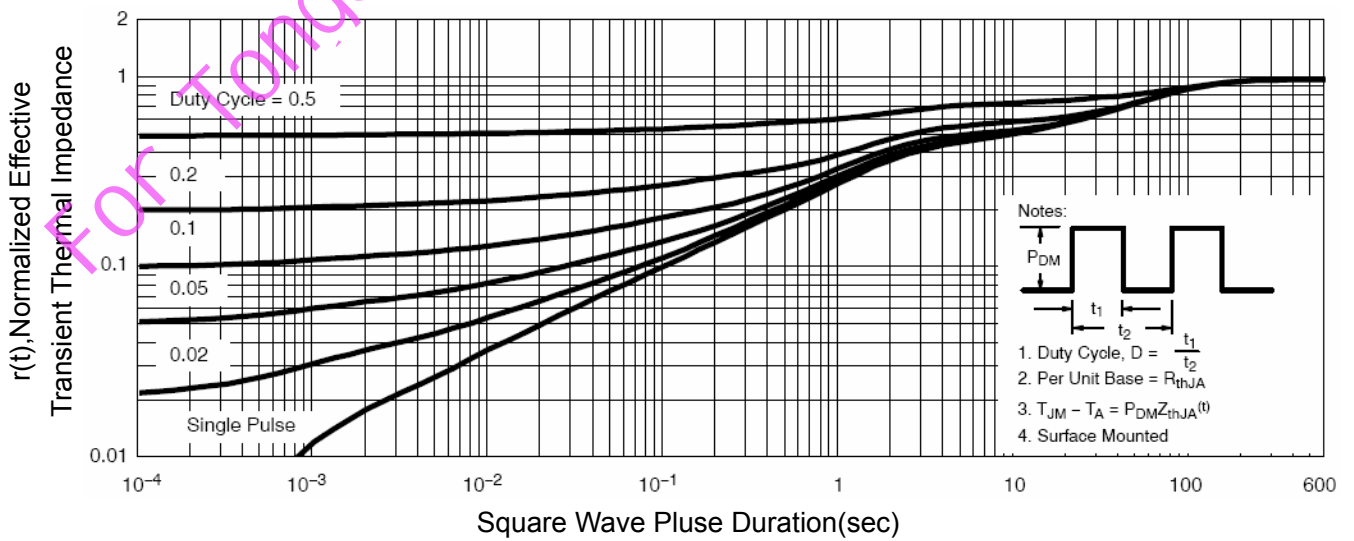
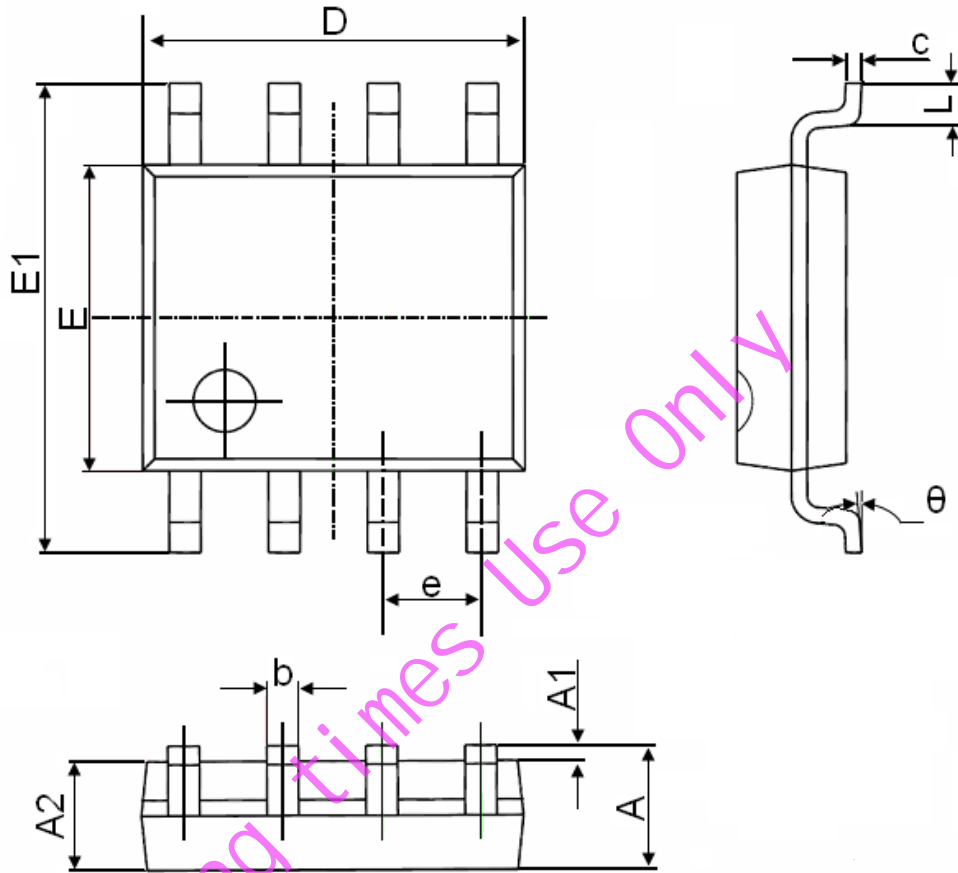


Figure 15 Normalized Maximum Transient Thermal Impedance

## 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
$\theta$	0°	8°	0°	8°

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