

## NCE P-Channel Enhancement Mode Power MOSFET

### Description

The NCE60P06S 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.

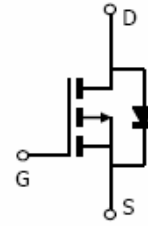
### General Features

- $V_{DS} = -60V, I_D = -6A$   
 $R_{DS(ON)} < 45m\Omega @ V_{GS} = -10V$

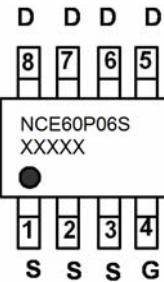
- High density cell design for ultra low  $R_{ds(on)}$
- Fully characterized avalanche voltage and current
- Excellent package for good heat dissipation

### Application

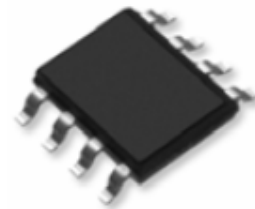
- Power switching application
- Hard switched and high frequency circuits
- DC-DC Converter



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
NCE60P06S	NCE60P06S	SOP-8	Ø330mm	12mm	4000 units

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	-6	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	-4.2	A
Pulsed Drain Current	$I_{DM}$	-30	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>	$R_{\theta JA}$	42	$^\circ C/W$
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## Electrical Characteristics ( $T_A=25^{\circ}\text{C}$ unless otherwise noted)

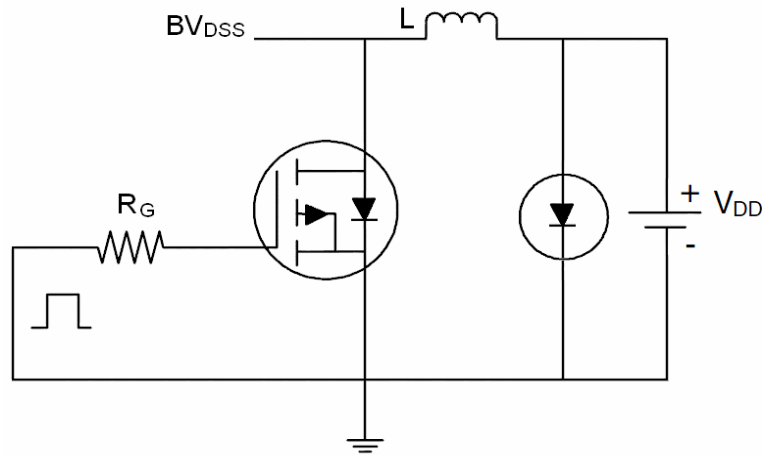
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =-250μA	-60	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-60V,V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V,V <sub>DS</sub> =0V	-	-	±100	nA
On Characteristics <sup>(Note 3)</sup>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =-250μA	-1.5	-2.6	-3.5	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-5A	-	40	45	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =-5V,I <sub>D</sub> =-5A	-	16	-	S
Dynamic Characteristics <sup>(Note4)</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =-30V,V <sub>GS</sub> =0V, F=1.0MHz	-	2578	-	PF
Output Capacitance	C <sub>oss</sub>		-	112	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	102	-	PF
Switching Characteristics <sup>(Note 4)</sup>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =-30V, ,R <sub>L</sub> =30Ω V <sub>GS</sub> =-10V,R <sub>GEN</sub> =6Ω	-	10	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	6	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	44	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	13	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =-30V,I <sub>D</sub> =-5A, V <sub>GS</sub> =-10V	-	46.2	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	8.6	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	10.4	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage <sup>(Note 3)</sup>	V <sub>SD</sub>	V <sub>GS</sub> =0V,I <sub>S</sub> =-6A	-	-	-1.2	V
Diode Forward Current <sup>(Note 2)</sup>	I <sub>S</sub>		-	-	-6	A

### Notes:

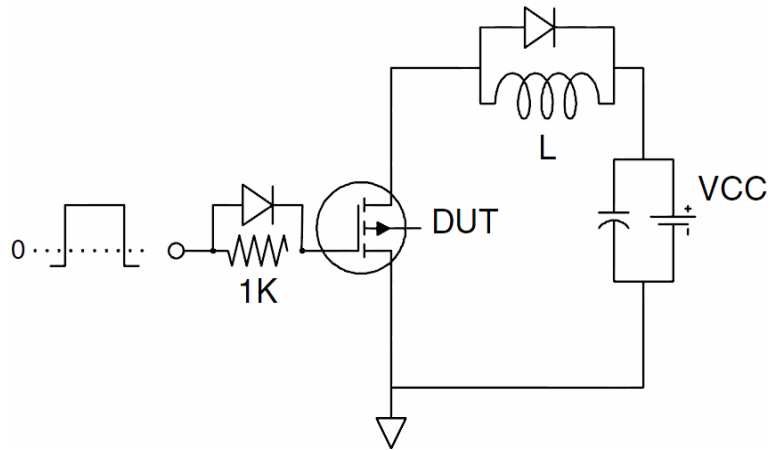
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production

## Test Circuit

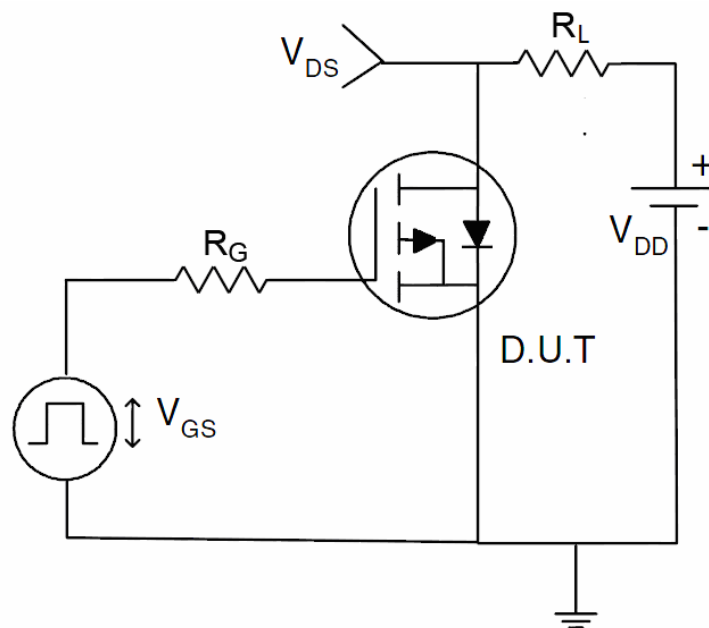
### 1) $E_{AS}$ Test Circuit



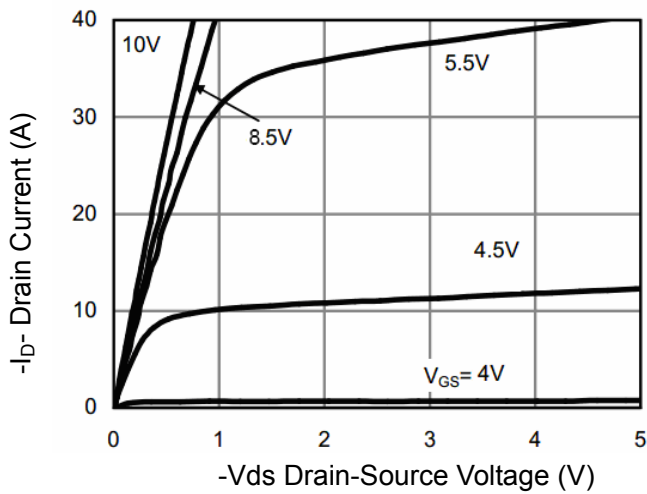
### 2) Gate Charge Test Circuit



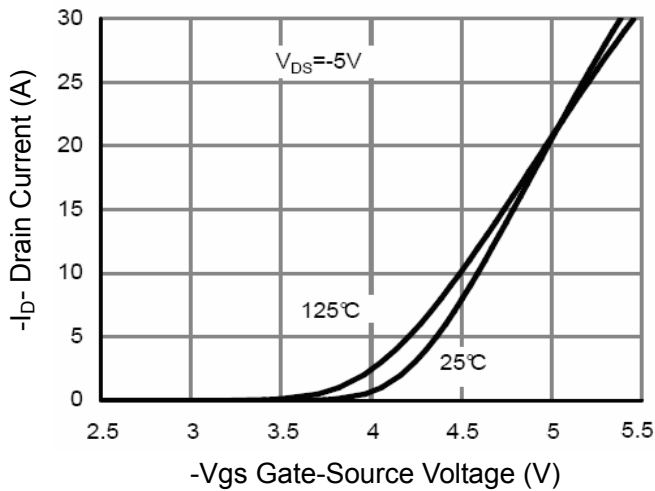
### 3) Switch Time Test Circuit



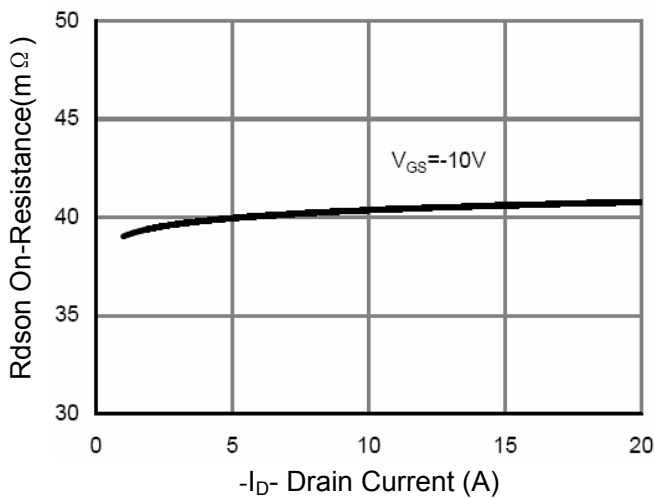
## Typical Electrical and Thermal Characteristics (Curves)



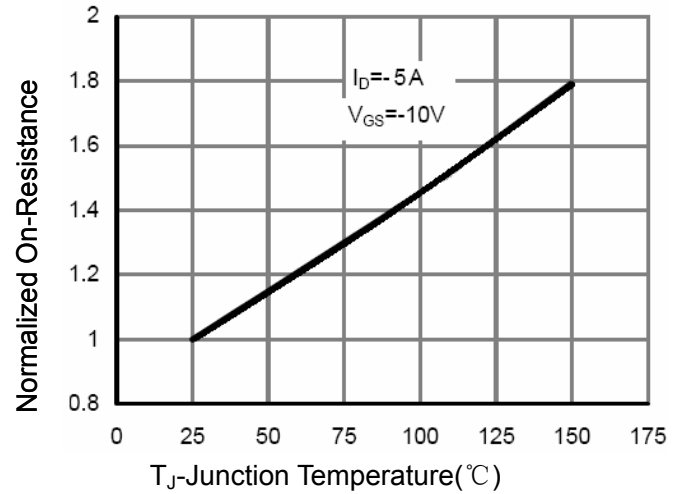
**Figure 1 Output Characteristics**



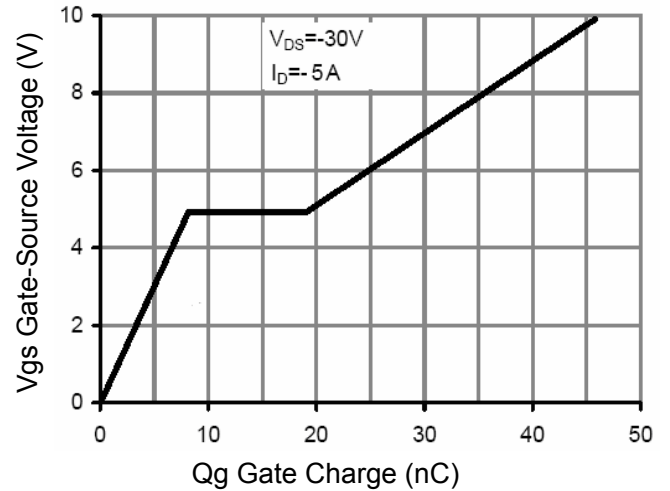
**Figure 2 Transfer Characteristics**



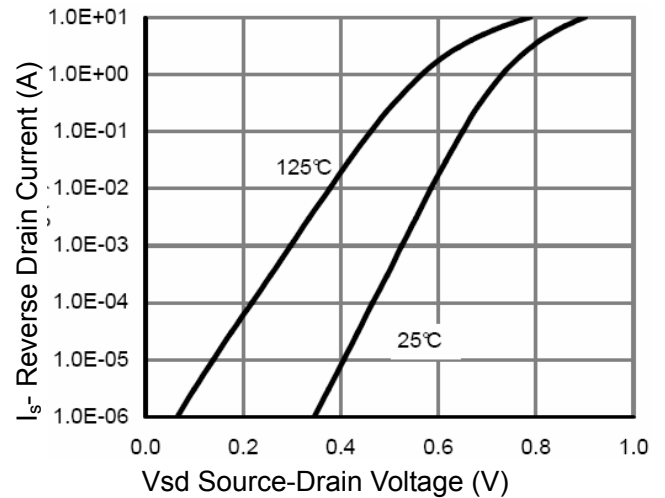
**Figure 3 Rdson- Drain Current**



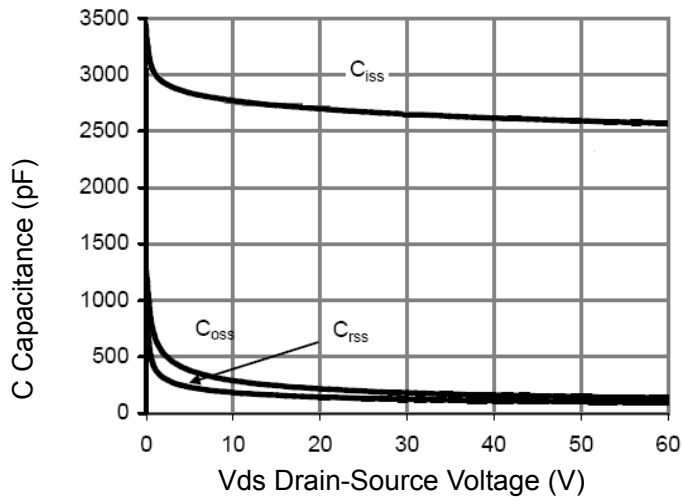
**Figure 4 Rdson-Junction Temperature**



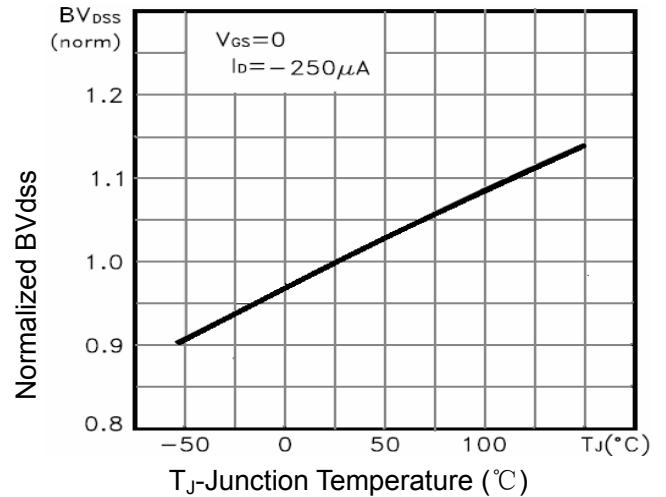
**Figure 5 Gate Charge**



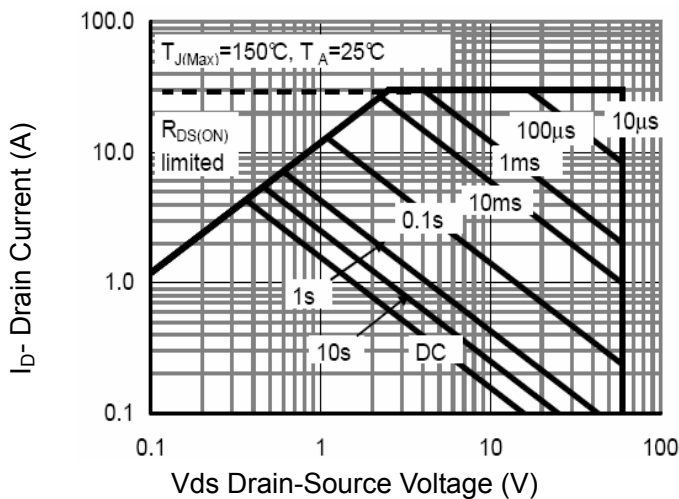
**Figure 6 Source- Drain Diode Forward**



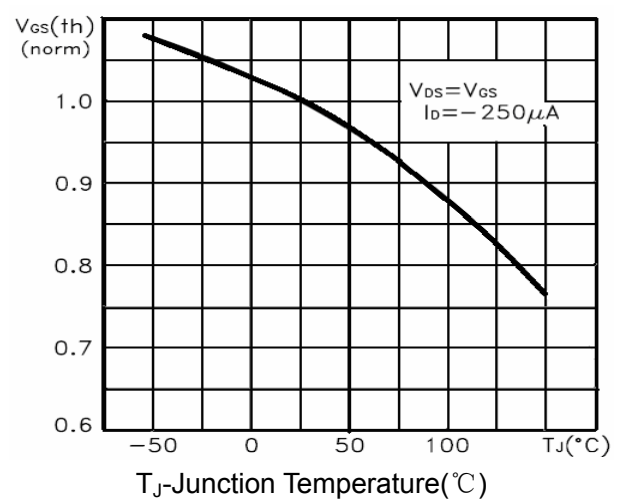
**Figure 7 Capacitance vs Vds**



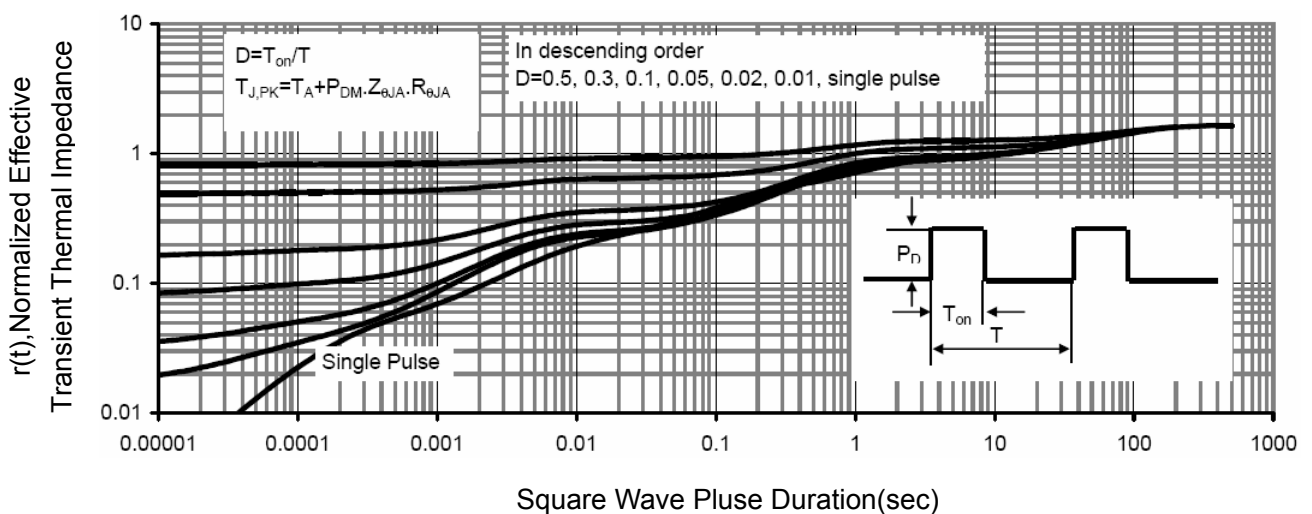
**Figure 9  $BV_{dss}$  vs Junction Temperature**



**Figure 8 Safe Operation Area**

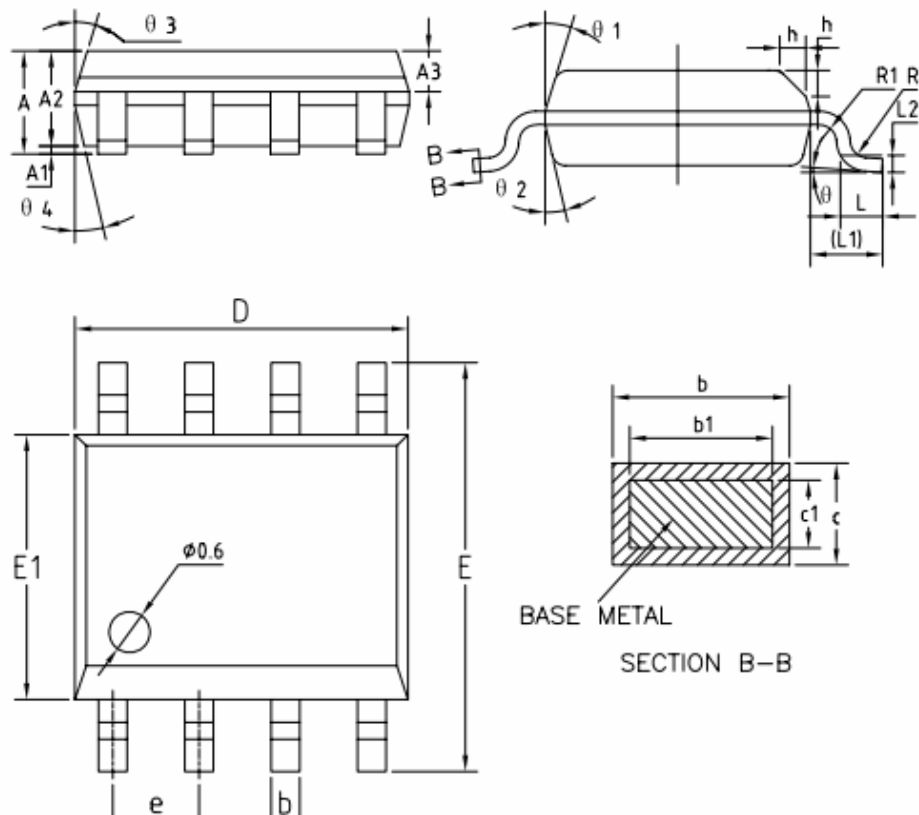


**Figure 10  $V_{GS(th)}$  vs Junction Temperature**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

## SOP-8 Package Information



COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.10	0.15	0.25
A2	1.25	1.40	1.65
A3	0.50	0.60	0.70
b	0.38	—	0.51
b1	0.37	0.42	0.47
c	0.18	—	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.17	1.27	1.37
L	0.45	0.60	0.80
L1	1.04REF		
L2	0.25BSC		
R	0.07	—	—
R1	0.07	—	—
h	0.30	0.40	0.50
$\theta$	0°	—	8°
$\theta 1$	15°	17°	19°
$\theta 2$	11°	13°	15°
$\theta 3$	15°	17°	19°
$\theta 4$	11°	13°	15°

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