

NCE P-Channel Enhancement Mode Power MOSFET

Description

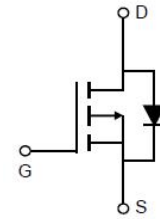
The NCE60P04R uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This device is well suited for use as a load switch or in PWM applications.

General Features

- $V_{DS} = -60V, I_D = -4.3A$
 $R_{DS(ON)} < 120m\Omega @ V_{GS} = -10V$
 $R_{DS(ON)} < 170m\Omega @ V_{GS} = -4.5V$
- High density cell design for ultra low R_{dson}
- Fully characterized avalanche voltage and current
- Excellent package for good heat dissipation

Application

- Load switch
- PWM application



Schematic diagram



SOT-223 top view

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCE60P04R	NCE60P04R	SOT-223-3L	Ø330mm	12mm	2500 units

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	-60	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current-Continuous	I_D	-4.3	A
Pulsed Drain Current	I_{DM}	-20	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 ^(Note 2)	$R_{\theta JA}$	40.3	$^\circ C/W$
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Electrical Characteristics ($T_c = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS} = 0V, I_D = -250\mu A$	-60	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -60V, V_{GS} = 0V$	-	-	-1	μA

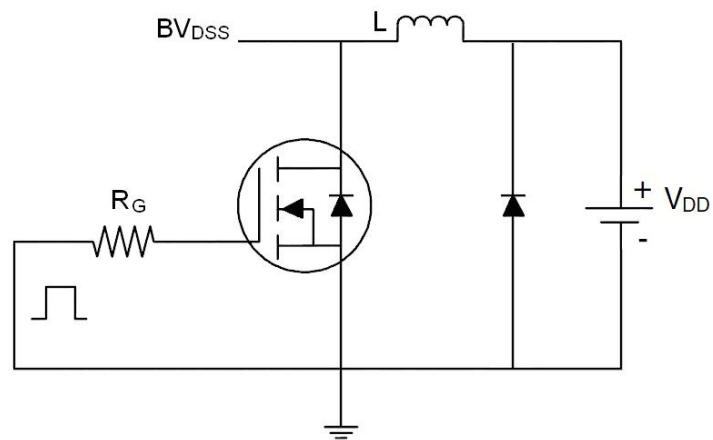
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V,V _{DS} =0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} ,I _D =-250μA	-1.0		-2.5	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =-10V, I _D =-4A	-	106	120	mΩ
		V _{GS} =-4.5V, I _D =-3A	-	135	170	mΩ
Forward Transconductance	g _{FS}	V _{DS} =-5V,I _D =-4A	-	10	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =-30V,V _{GS} =0V, F=1.0MHz	-	930	-	PF
Output Capacitance	C _{oss}		-	85	-	PF
Reverse Transfer Capacitance	C _{rss}		-	35	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =-30V, R _L =7.5Ω, V _{GS} =-10V,R _G =3Ω	-	8	-	nS
Turn-on Rise Time	t _r		-	4	-	nS
Turn-Off Delay Time	t _{d(off)}		-	32	-	nS
Turn-Off Fall Time	t _f		-	7	-	nS
Total Gate Charge	Q _g	V _{DS} =-30,I _D =-4A, V _{GS} =-10V	-	25	-	nC
Gate-Source Charge	Q _{gs}		-	3	-	nC
Gate-Drain Charge	Q _{gd}		-	7	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V,I _S =-4A	-		-1.2	V
Diode Forward Current (Note 2)	I _S		-	-	-4.3	A
Reverse Recovery Time	t _{rr}	T _J = 25°C, I _F =- 4A	-	25		nS
Reverse Recovery Charge	Q _{rr}	di/dt = -100A/μs(Note3)	-	31		nC

Notes:

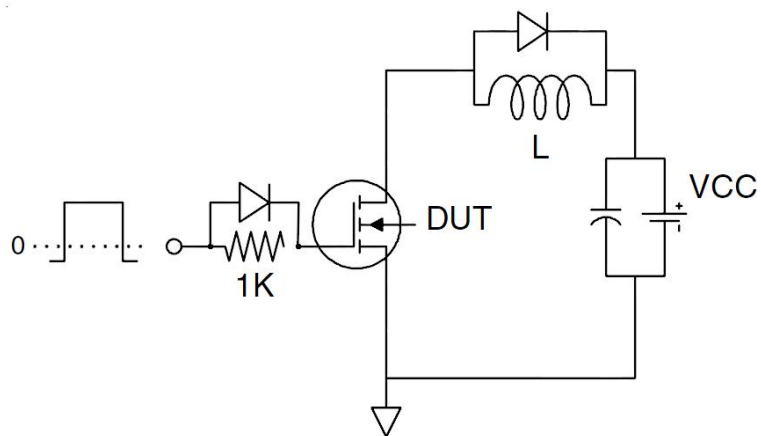
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, $t \leq 10$ sec.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production

Test Circuit

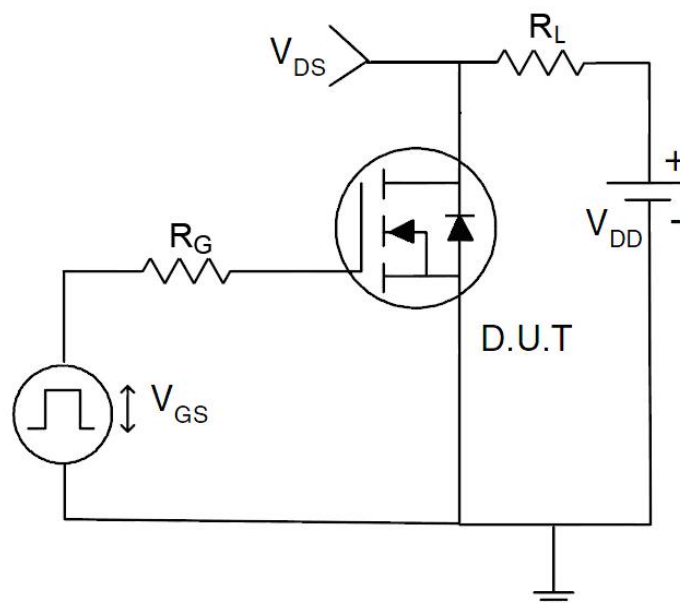
1) E_{AS} test Circuit



2) Gate charge test Circuit



3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics (Curves)

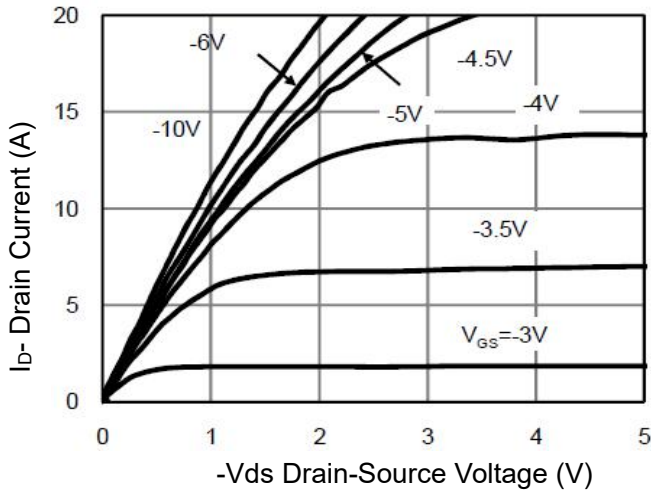


Figure 1 Output Characteristics

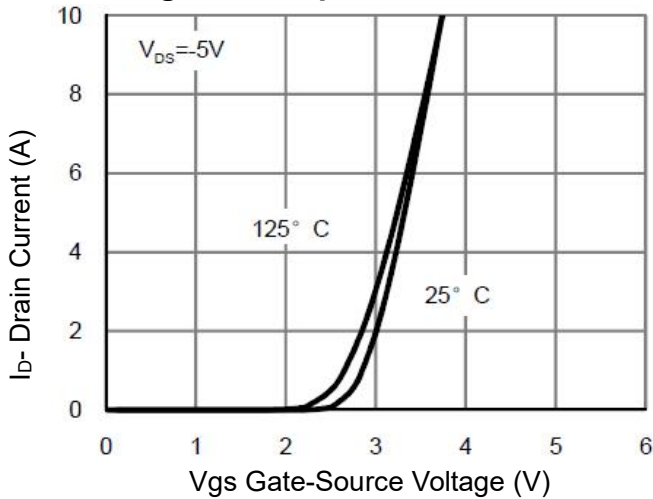


Figure 2 Transfer Characteristics

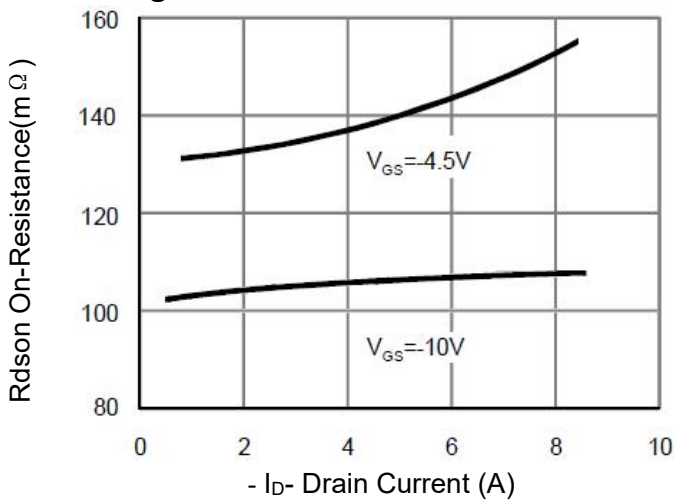


Figure 3 $R_{DS(on)}$ - Drain Current

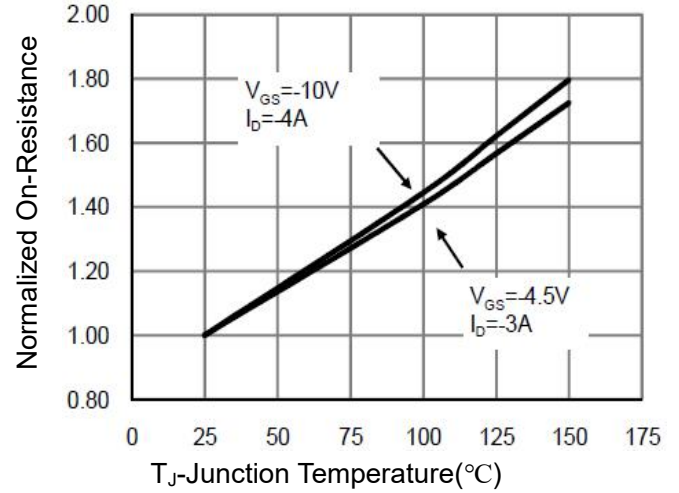


Figure 4 $R_{DS(on)}$ -Junction Temperature

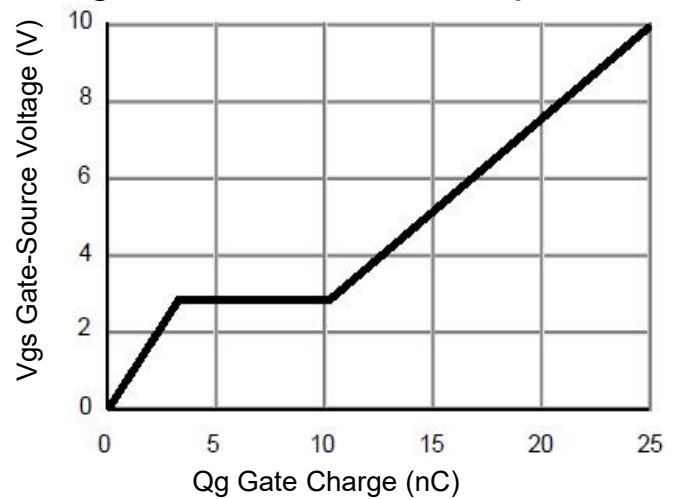


Figure 5 Gate Charge

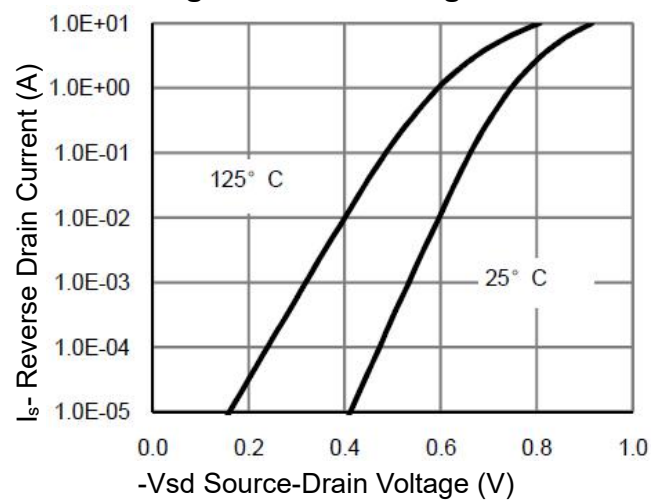


Figure 6 Source- Drain Diode Forward

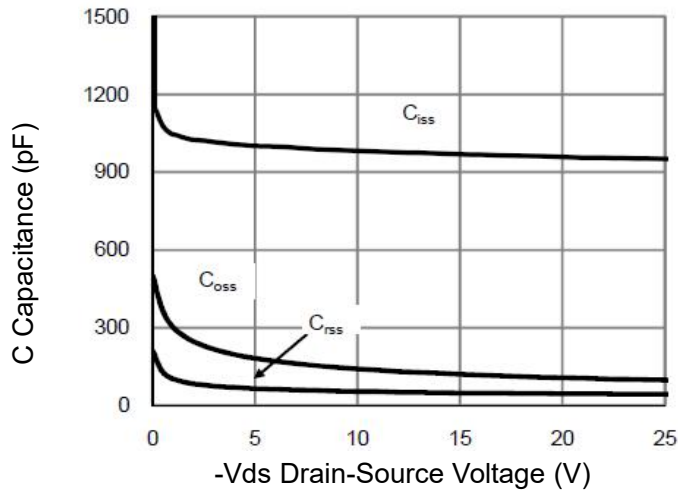


Figure 7 Capacitance vs Vds

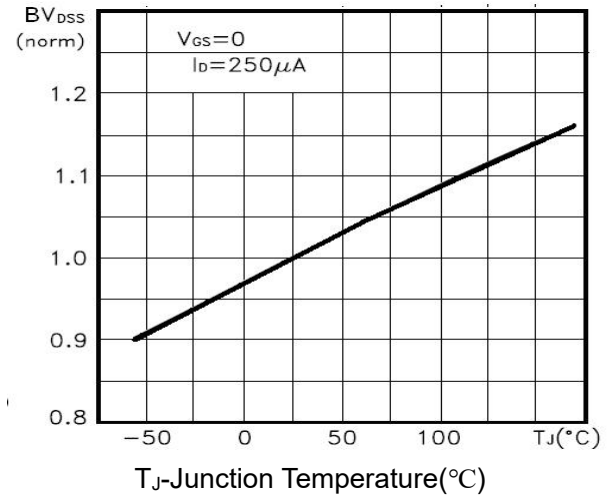


Figure 9 BV_{DSS} vs Junction Temperature

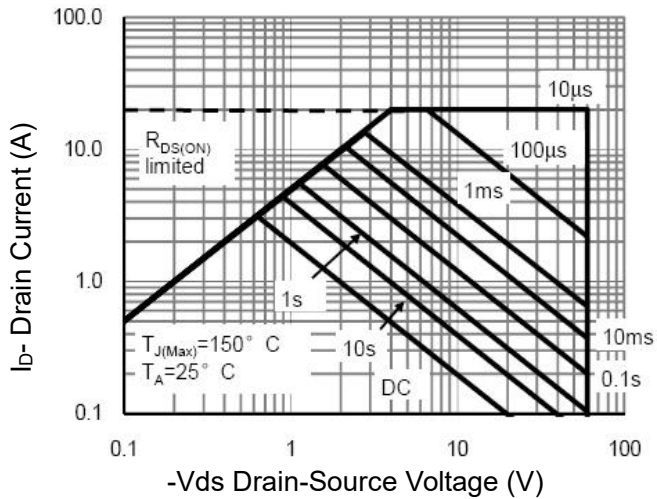


Figure 8 Safe Operation Area

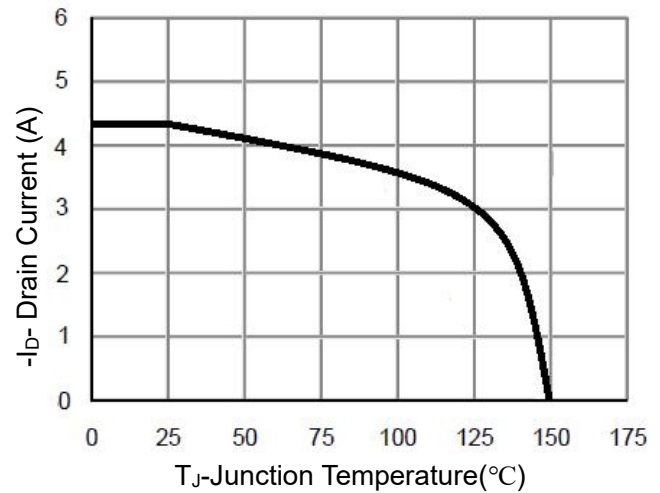


Figure 10 I_D Current De-rating

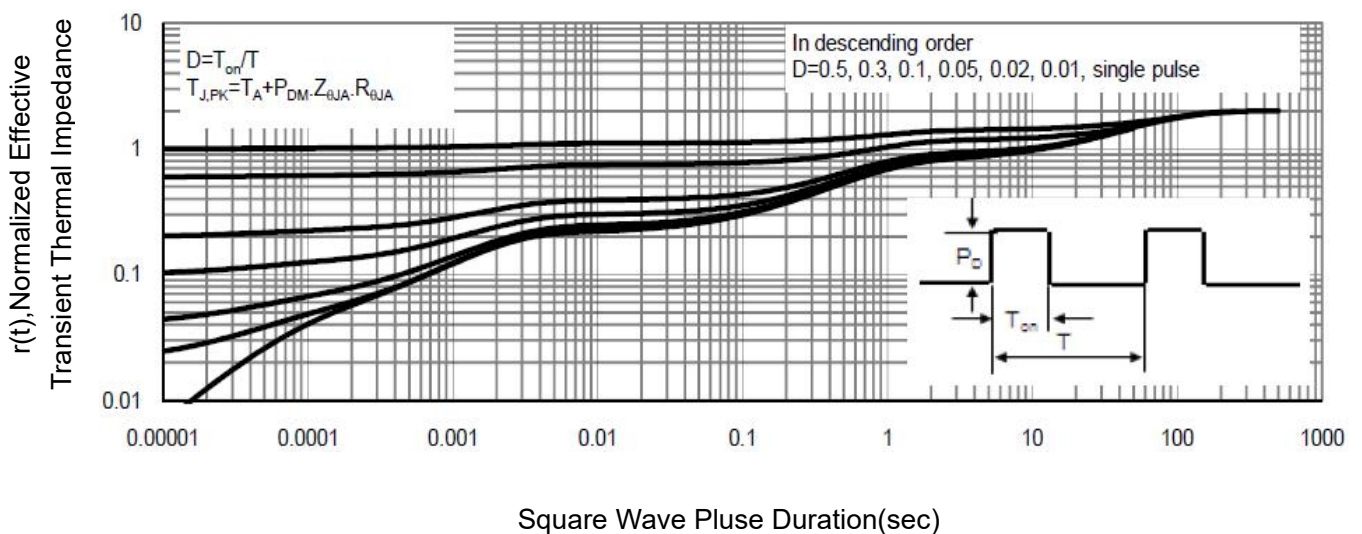
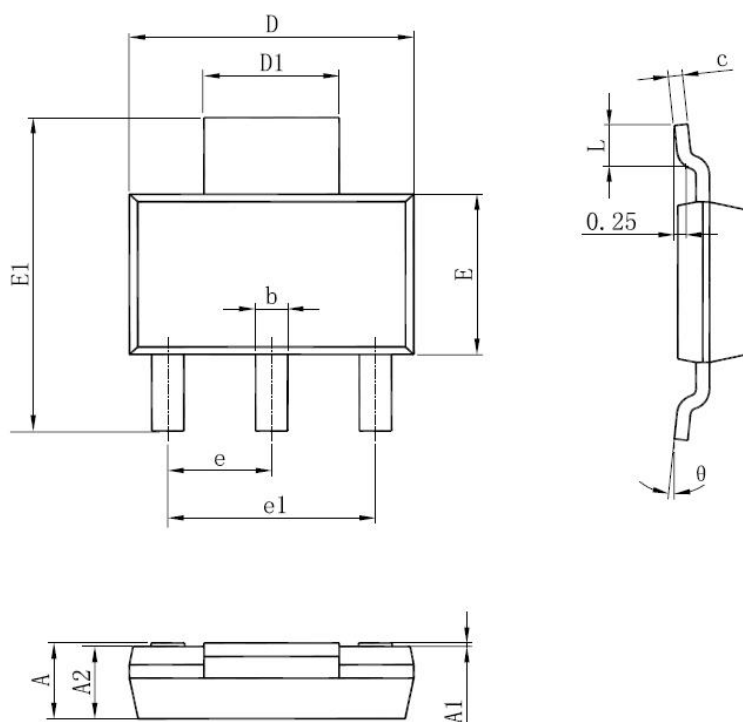


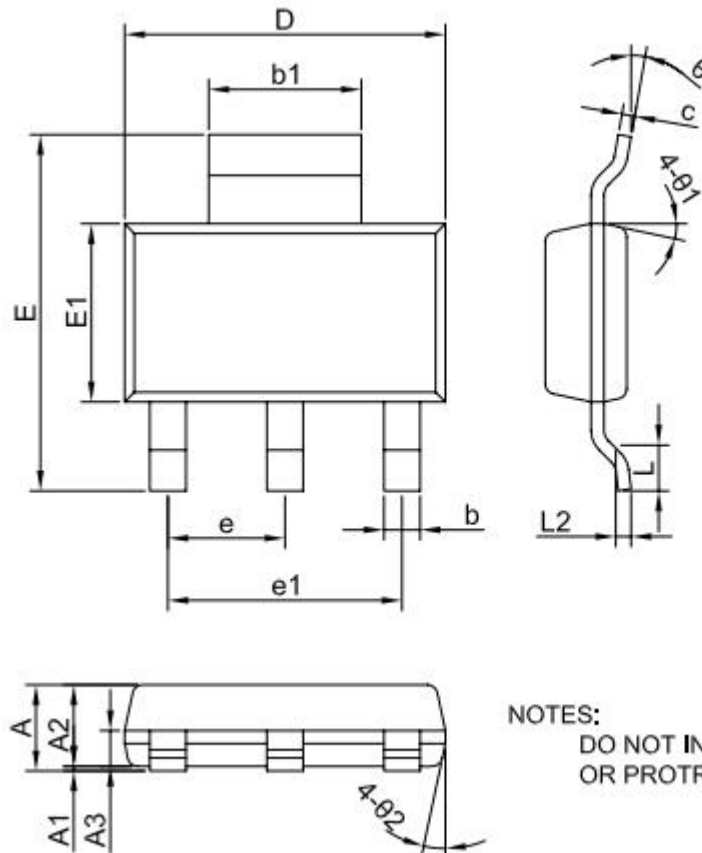
Figure 11 Normalized Maximum Transient Thermal Impedance

SOT-223 Package Information(C)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.520	1.800	0.060	0.071
A1	0.000	0.100	0.000	0.004
A2	1.500	1.700	0.059	0.067
b	0.660	0.820	0.026	0.032
c	0.250	0.350	0.010	0.014
D	6.200	6.400	0.244	0.252
D1	2.900	3.100	0.114	0.122
E	3.300	3.700	0.130	0.146
E1	6.830	7.070	0.269	0.278
e	2.300(BSC)		0.091(BSC)	
e1	4.500	4.700	0.177	0.185
L	0.900	1.150	0.035	0.045
θ	0°	10°	0°	10°

SOT-223 Package Information(X)



NOTES:
DO NOT INCLUDE MOLD FLASH
OR PROTRUSIONS

SYMBOL	MIN	NOM	MAX
A	1.55	—	1.80
A1	0.02	—	0.12
A2	1.45	1.60	1.75
A3	0.60	0.70	0.80
b	0.60	—	0.80
b1	2.90	—	3.10
c	0.24	—	0.32
D	6.20	6.30	6.50
E	6.70	7.00	7.30
E1	3.30	3.50	3.70
e	2.299REF		
e1	4.598REF		
L	0.90MIN		
L2	0.30BSC		
θ	0°	—	10°
θ ₁	10°	12°	14°
θ ₂	10°	12°	14°

Notes

1. All dimensions are in millimeters.
2. Tolerance $\pm 0.10\text{mm}$ (4 mil) unless otherwise specified
3. Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 5 mils.
4. Dimension L is measured in gauge plane.
5. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

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