

NCE N-Channel Enhancement Mode Power MOSFET

Description

The NCE60H10K uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This device is suitable for use in PWM, load switching and general purpose applications.

General Features

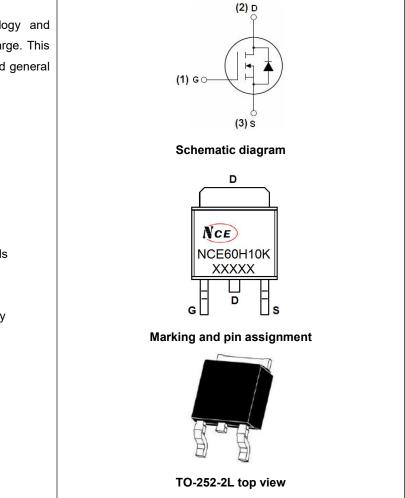
- V_{DS} =60V,I_D =100A
 R_{DS(ON)} < 5.2 mΩ @ V_{GS}=10V (Typ:4.5mΩ)
- High density cell design for ultra low Rdson
- Fully characterized avalanche voltage and current
- Special designed for convertors and power controls
- Good stability and uniformity with high E_{AS}
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

Application

- Power switching application
- Hard switched and High frequency circuits
- Uninterruptible power supply

100% UIS TESTED!

100% ΔVds TESTED!



Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCE60H10K	NCE60H10K	TO-252-2L	-	-	-

Absolute Maximum Ratings (T_A=25℃ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	VDS	60	V
Gate-Source Voltage	Vgs	±20	V
Drain Current-Continuous	Ι _D	100	А
Drain Current-Continuous(Tc=100 ℃)	I _D (100℃)	70	A
Pulsed Drain Current	Ідм	320	А
Maximum Power Dissipation	PD	170	W
Derating factor		1.13	W/℃
Single pulse avalanche energy ^(Note 5)	E _{AS}	812	mJ
Operating Junction and Storage Temperature Range	T _J ,T _{STG}	-55 To 175	°C



Thermal Characteristic

Thermal Resistance, Junction-to-Case ^(Note 2)	Rejc	0.88	°C/W
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Electrical Characteristics (T_A=25°C unless otherwise noted)

$\begin{array}{ c c c c c } \hline Off Characteristics \\ \hline Drain-Source Breakdown Voltage BV_{DS} V_{GS}=0V I_{D}=250 \mu A 60 - 0 1 \\ \hline Carbon Characteristics (Note 3) \\ \hline Carbon Characteristics (Note 4) \\ \hline Drain-Source On-State Resistance R_{DS(ON)} V_{GS}=10V, I_D=20A - 4.5 5.2 \\ \hline Forward Transconductance g_{FS} V_{DS}=5V, I_D=20A - 50 - 0 \\ \hline Dynamic Characteristics (Note4) \\ \hline Input Capacitance C_{GSS} \\ \hline Coss \\ \hline Reverse Transfer Capacitance C_{GSS} \\ \hline Curp Carbon Characteristics (Note 4) \\ \hline Turn-on Delay Time t_{d(orn)} \\ \hline Turn-On Delay Time t_{d(orn)} \\ \hline Turn-Off Delay Time t_{d(off)} \\ \hline Turn-Off Fall Time t_{t} \\ \hline Total Gate Charge Q_{g} \\ \hline Carbon Characteristics (Note 3) \\ \hline Carbon Characteristics (Note 3) \\ \hline Drain-Source Diode Characteristics Q_{gS} \\ \hline Carbon Characteristics (Note 3) \\ \hline Diode Forward Voltage (Note 3) \\ \hline V_{SD} \\ \hline V_{SS}=0V, I_S=20A - V_{SS}=0V \\ \hline Carbon Characteristics (Note 3) \\ \hline Carbon Characteristics (Note 4) \\ \hline Carbon Ch$	Unit	Max	Тур	Min	Condition	Symbol	Parameter
Zero Gate Voltage Drain CurrentIDSS $V_{DS}=60V, V_{GS}=0V$ -1Gate-Body Leakage CurrentIGSS $V_{GS}=\pm 20V, V_{DS}=0V$ - ± 100 On Characteristics (Note 3)Gate Threshold Voltage $V_{GS}(h)$ $V_{DS}=V_{GS}, I_D=250\muA$ 234Drain-Source On-State Resistance $R_{DS}(oN)$ $V_{GS}=10V, I_D=20A$ -4.55.2Forward Transconductance g_{FS} $V_{DS}=5V, I_D=20A$ -50-Dynamic Characteristics (Note4)Input Capacitance C_{ISS} $V_{DS}=25V, V_{GS}=0V, F=1.0MHz$ -4900-Output Capacitance C_{rss} $V_{DS}=25V, V_{GS}=0V, F=1.0MHz$ -4900-Switching Characteristics (Note 4) $V_{DS}=25V, V_{GS}=0V, F=1.0MHz$ -11-Turn-on Delay Time $t_{d(on)}$ $V_{DS}=25V, V_{GS}=10V, F=1.0MHz$ -11-Turn-on Rise Time t_r $V_{DD}=35V, RL=15\Omega, F=1.0MHz$ -11-Turn-Off Delay Time $t_{d(off)}$ $RG=2.5\Omega, VGS=10V, F=1.0M, F=1$			•				Off Characteristics
Gate-Body Leakage Current IGSS $V_{GS}=\pm 20V, V_{DS}=0V$ - ± 100 On Characteristics (Note 3) Gate Threshold Voltage $V_{GS}(th)$ $V_{DS}=V_{GS}, I_D=250 \mu A$ 2 3 4 Drain-Source On-State Resistance $R_{DS}(oh)$ $V_{GS}=10V, I_D=20A$ - 4.5 5.2 Forward Transconductance g_{FS} $V_{DS}=5V, I_D=20A$ - 50 - Dynamic Characteristics (Note4) Input Capacitance C_{ISS} $V_{DS}=25V, V_{GS}=0V,$ - 4900 - Output Capacitance C_{ISS} $V_{DS}=25V, V_{GS}=0V,$ - 380 - - Reverse Transfer Capacitance C_{ISS} $V_{DS}=25V, V_{GS}=0V,$ - 290 - - Switching Characteristics (Note 4) $F=1.0MHz$ - 11 - - Turn-on Dialy Time $t_{d(on)}$ $V_{DD}=35V, RL=15\Omega$ - 111 - - Turn-Off Delay Time $t_{d(off)}$ $V_{DS}=30V, I_D=20A,$ - 15 - - 100 - <td>V</td> <td>-</td> <td>-</td> <td>60</td> <td>V_{GS}=0V I_D=250µA</td> <td>BV_{DSS}</td> <td>Drain-Source Breakdown Voltage</td>	V	-	-	60	V _{GS} =0V I _D =250µA	BV _{DSS}	Drain-Source Breakdown Voltage
On Characteristics (Note 3) Gate Threshold Voltage $V_{GS(th)}$ $V_{DS}=V_{GS}, I_D=250 \mu A$ 234Drain-Source On-State Resistance $R_{DS(ON)}$ $V_{GS}=10V, I_D=20A$ -4.55.2Forward Transconductance g_{FS} $V_{DS}=5V, I_D=20A$ -50-Dynamic Characteristics (Note4)Input Capacitance C_{ISS} $V_{DS}=25V, V_{GS}=0V,$ $F=1.0MHz$ -4900-Output Capacitance C_{oss} $V_{DS}=25V, V_{GS}=0V,$ $F=1.0MHz$ -380-Reverse Transfer Capacitance C_{oss} $V_{DS}=25V, V_{GS}=0V,$ $F=1.0MHz$ -4900-Switching Characteristics (Note 4) $V_{DS}=25V, V_{GS}=0V,$ $F=1.0MHz$ -17-Turn-on Delay Time $t_{d(on)}$ $V_{DD}=35V, RL=15\Omega$ -11-Turn-Off Delay Time $t_{d(off)}$ $RG=2.5\Omega, VGS=10V$ -55-Turn-Off Fall Time t_t $V_{DS}=30V, I_D=20A,$ $V_{GS}=10V$ -150-Gate-Source Charge Q_{ga} $V_{OS}=30V, I_D=20A,$ $V_{GS}=10V$ -21-Dide Forward Voltage (Note 3) V_{SD} $V_{GS}=0V, I_S=20A$ 1.2	μA	1	-	-	V _{DS} =60V,V _{GS} =0V	I _{DSS}	Zero Gate Voltage Drain Current
$ \begin{array}{ c c c c c } \hline Gate Threshold Voltage & V_{GS(th)} & V_{DS}=V_{GS,ID}=250\mu A & 2 & 3 & 4 & \\ \hline Drain-Source On-State Resistance & R_{DS(ON)} & V_{GS}=10V, I_{D}=20A & . & 5.0 & . & \\ \hline Forward Transconductance & g_{FS} & V_{DS}=5V,I_{D}=20A & . & 5.0 & . & \\ \hline Dynamic Characteristics (Note4) & & & & & & \\ \hline Drain-Characteristics (Note4) & & & & & & & \\ \hline Dut Capacitance & C_{IsS} & & & & & & & & & \\ \hline Output Capacitance & C_{GSS} & & & & & & & & & & & \\ \hline Output Capacitance & C_{GS} & & & & & & & & & & & & \\ \hline Output Capacitance & C_{GS} & & & & & & & & & & & & \\ \hline Reverse Transfer Capacitance & C_{GS} & & & & & & & & & & & & \\ \hline Reverse Transfer Capacitance & C_{GS} & & & & & & & & & & & \\ \hline Switching Characteristics (Note 4) & & & & & & & & & & & \\ \hline Turn-on Delay Time & t_{d(on)} & & & & & & & & & & & & \\ \hline Turn-On Elay Time & t_{d(off)} & & & & & & & & & & & \\ \hline Turn-Off Delay Time & t_{d(off)} & & & & & & & & & & \\ \hline Turn-Off Fall Time & t_{f} & & & & & & & & & & \\ \hline Total Gate Charge & Q_{G} & & & & & & & & & & & \\ \hline Gate-Source Charge & Q_{Gg} & & & & & & & & & & & & & & \\ \hline Cate Charge & Q_{Gd} & & & & & & & & & & & & & & & & \\ \hline Drain-Source Diode Characteristics & & & & & & & & & & & & & \\ \hline Diode Forward Voltage (Note 3) & & & & & & & & & & & & & & & & & & $	nA	±100	-	-	V _{GS} =±20V,V _{DS} =0V	I _{GSS}	Gate-Body Leakage Current
Drain-Source On-State Resistance $R_{DS(ON)}$ $V_{GS}=10V, I_D=20A$ - 4.5 5.2 Forward Transconductance g_{FS} $V_{DS}=5V, I_D=20A$ - 50 - Dynamic Characteristics (Note4) $V_{DS}=25V, V_{GS}=0V, F=1.0MHz$ - 4900 - Output Capacitance C_{GSS} $V_{DS}=25V, V_{GS}=0V, F=1.0MHz$ - 380 - 1 Reverse Transfer Capacitance C_{GSS} $V_{DS}=25V, V_{GS}=0V, F=1.0MHz$ - 290 - 1 Switching Characteristics (Note 4) $V_{DS}=25V, V_{GS}=0V, F=1.0MHz$ - 100 - Turn-on Delay Time $t_{d(off)}$ $V_{DD}=35V, RL=15\Omega$ - 11 - Turn-Off Delay Time $t_{d(off)}$ VDS=30V, I_D=20A, V_{GS}=10V - 15 - - Total Gate Charge Q_{g} $V_{DS}=30V, I_D=20A, V_{GS}=10V$ - 100 - - Gate-Drain Charge Q_{gd} $V_{GS}=10V$ - 300 - - <t< td=""><td></td><td></td><td>L</td><td></td><td></td><td></td><td>On Characteristics (Note 3)</td></t<>			L				On Characteristics (Note 3)
Forward Transconductance g_{FS} $V_{DS}=5V, I_D=20A$ - 50 - Dynamic Characteristics (Note4) Unput Capacitance C_{ISS} $V_{DS}=25V, V_{GS}=0V, F=1.0MHZ$ - 4900 - - 4900 - - - 4900 - - - 4900 - - - 4900 - - - 4900 - - - 4900 - - - 4900 - - - 4900 - - 380 - - - 4900 - - 380 - - - 380 - - 380 - - 380 - - 380 - - 380 - - 380 - - 380 - - 380 - - - 17 - - 17 - - 11 - - 11 - - 12 -	V	4	3	2	$V_{DS}=V_{GS}$, $I_D=250\mu A$	V _{GS(th)}	Gate Threshold Voltage
Dynamic Characteristics (Note4)Input Capacitance C_{iss} $V_{DS}=25V, V_{GS}=0V,$ $F=1.0MHz$ -4900-Output Capacitance C_{css} $V_{DS}=25V, V_{GS}=0V,$ $F=1.0MHz$ -380Reverse Transfer Capacitance C_{rss} $F=1.0MHz$ -290Switching Characteristics (Note 4)-29017-Turn-on Delay Time $t_{d(on)}$ $VDD=35V, RL=15\Omega$ -11-1Turn-Off Delay Time $t_{d(off)}$ $RG=2.5\Omega, VGS=10V$ -55-1Turn-Off Fall Time t_r $V_{DS}=30V, I_D=20A,$ $V_{GS}=10V$ -100-1Gate-Drain Charge Q_{gd} $V_{GS}=0V, I_S=20A,$ -21-1Diode Forward Voltage (Note 3) V_{SD} $V_{GS}=0V, I_S=20A$ 1.2	mΩ	5.2	4.5	-	V _{GS} =10V, I _D =20A	R _{DS(ON)}	Drain-Source On-State Resistance
$ \begin{array}{ c c c c c c } \hline Input Capacitance & C_{iss} & V_{DS}=25V, V_{GS}=0V, & - & 4900 & - & - & 380 & - & - & 380 & - & - & - & 290 & - & - & - & - & 290 & - & - & - & - & - & - & - & - & - & $	S	-	50	-	V _{DS} =5V,I _D =20A	g⊧s	Forward Transconductance
$ \begin{array}{ c c c c c } \hline \mbox{Output Capacitance} & \mbox{C}_{oss} & \mbox{C}_{pss} = 25V, V_{GS} = 0V, \\ \hline \mbox{F} = 1.0 \mbox{MHz} & \mbox{F} = 1.0 \mbox{MHz} & \mbox{C}_{0} & \mbox{290} & 290$						l	Dynamic Characteristics (Note4)
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	PF	-	4900	-		Cliss	Input Capacitance
Reverse Transfer Capacitance Crss - 290 - Switching Characteristics (Note 4) - 290 - Turn-on Delay Time td(on)	PF	-	380	-		Coss	Output Capacitance
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	PF	-	290	-	F=1.0MHZ	Crss	Reverse Transfer Capacitance
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $						·	Switching Characteristics (Note 4)
$ \begin{array}{ c c c c c } \hline Turn-Off \ Delay \ Time & t_{d(off)} & RG=2.5\Omega, VGS=10V & - & 55 & - & \\ \hline Turn-Off \ Fall \ Time & t_{f} & & & & \\ \hline Total \ Gate \ Charge & Q_{g} & & & \\ \hline Gate-Source \ Charge & Q_{gs} & & & \\ \hline Gate-Drain \ Charge & Q_{gd} & & & \\ \hline Drain-Source \ Diode \ Characteristics & & & \\ \hline Diode \ Forward \ Voltage \ (Note \ 3) & V_{SD} & V_{GS}=0V, I_{S}=20A & - & & 1.2 \\ \hline \end{array} $	nS	-	17	-		t _{d(on)}	Turn-on Delay Time
Turn-Off Fall Time t_f -15-Total Gate Charge Q_g $V_{DS}=30V, I_D=20A,$ $V_{GS}=10V$ -100-Gate-Source Charge Q_{gs} $V_{GS}=10V$ -21-Gate-Drain Charge Q_{gd} $V_{GS}=10V$ -30-Drain-Source Diode CharacteristicsDiode Forward Voltage (Note 3) V_{SD} $V_{GS}=0V, I_S=20A$ 1.2	nS	-	11	-	VDD=35V,RL=15Ω	tr	Turn-on Rise Time
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	nS	-	55	-	RG=2.5Ω,VGS=10V	t _{d(off)}	Turn-Off Delay Time
Gate-Source Charge Qgs VDS=30V,ID=20A, VGS=10V - 21 - Gate-Drain Charge Qgd Qgd - 30 - 30 - Drain-Source Diode Characteristics VSD VGS=0V,IS=20A - - 1.2	nS	-	15	-		t _f	Turn-Off Fall Time
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	nC	-	100	-		Qg	Total Gate Charge
Gate-Drain Charge Q _{gd} - 30 - Drain-Source Diode Characteristics V VGS=0V, IS=20A - 1.2	nC	-	21	-		Q _{gs}	Gate-Source Charge
Diode Forward Voltage (Note 3) V _{SD} V _{GS} =0V,I _S =20A - 1.2	nC	-	30	-	V _{GS} =10V	Q _{gd}	Gate-Drain Charge
							Drain-Source Diode Characteristics
Diode Forward Current ^(Note 2) Is 100	V	1.2	-	-	V _{GS} =0V,I _S =20A	V _{SD}	Diode Forward Voltage (Note 3)
	А	100	-	-		ls	Diode Forward Current (Note 2)
Reverse Recovery Time t _{rr} Tj=25°C,I _F =100A - 37	nS	37		-	Tj=25℃,I _F =100A	trr	Reverse Recovery Time
Reverse Recovery Charge Qrr di/dt=100A/µs (Note3) - 58	nC	58		-	di/dt=100A/µs ^(Note3)	Qrr	Reverse Recovery Charge
Forward Turn-On Time ton Intrinsic turn-on time is negligible (turn-on is dominated by	LS+LD	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LI				t _{on}	Forward Turn-On Time

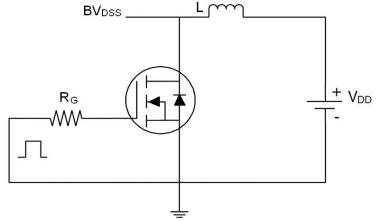
Notes:

- $\label{eq:constraint} \textbf{1.} \ \textbf{Repetitive Rating: Pulse width limited by maximum junction temperature.}$
- **2.** Surface Mounted on FR4 Board, $t \le 10$ sec.
- **3.** Pulse Test: Pulse Width \leq 300µs, Duty Cycle \leq 2%.
- 4. Guaranteed by design, not subject to production
- **5.** EAS condition: Tj=25 $^{\circ}$ C,V_{DD}=35V,V_G=10V,L=0.5mH,Rg=25 Ω

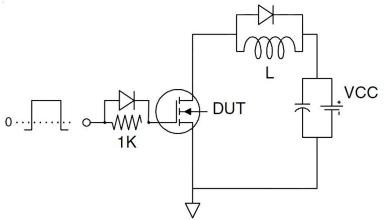


Test Circuit

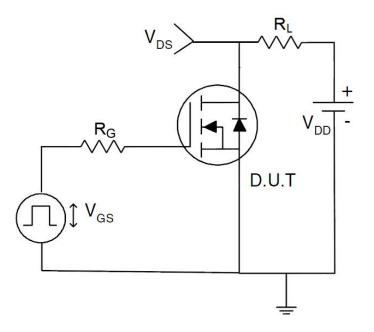
1) E_{AS} Test Circuits



2) Gate Charge Test Circuit

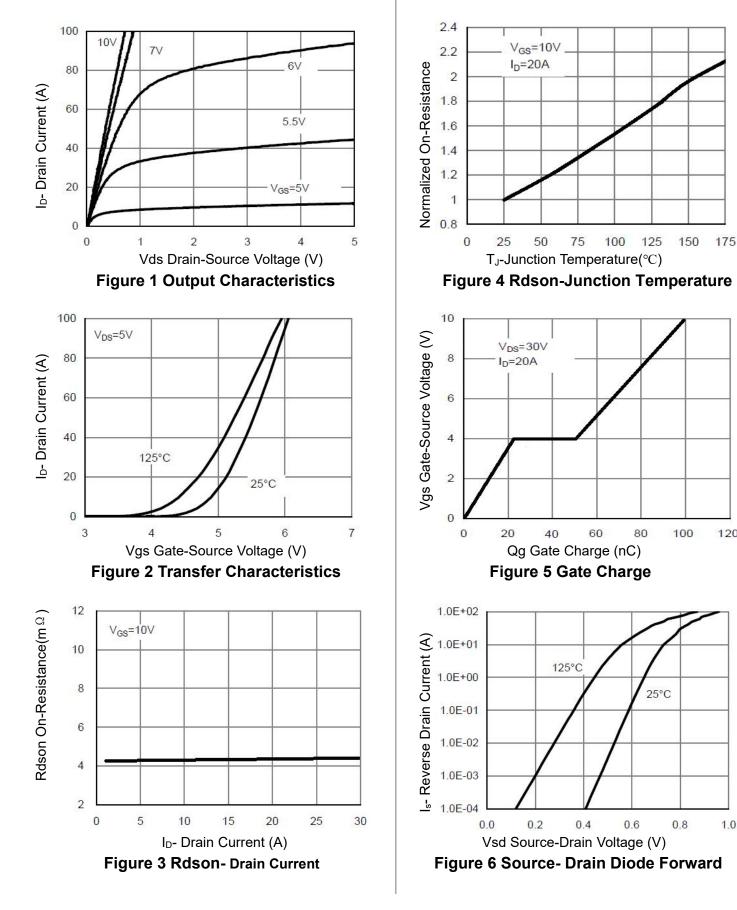


3) Switch Time Test Circuit





Typical Electrical and Thermal Characteristics (Curves

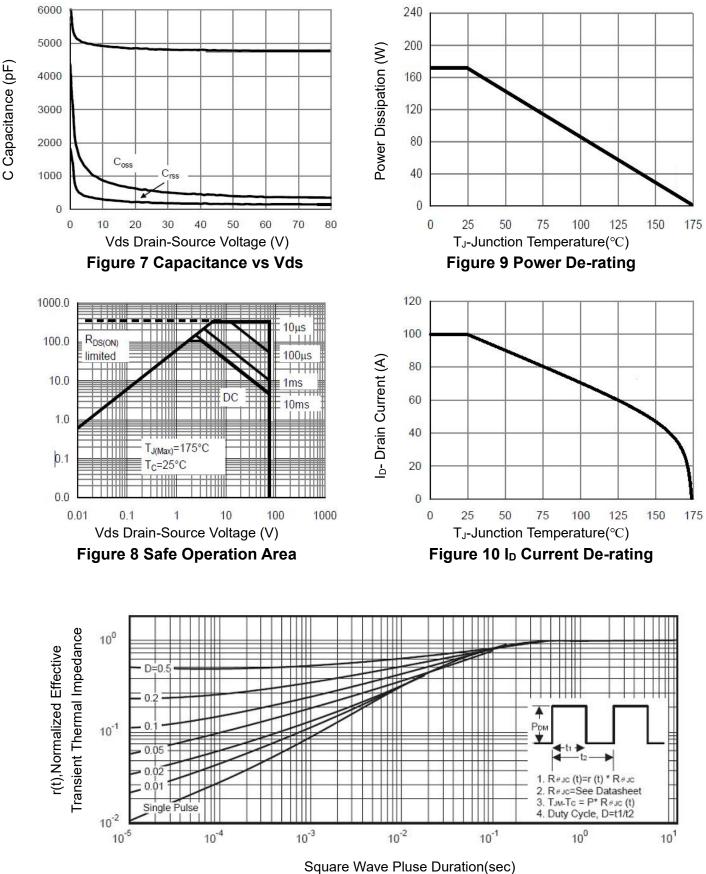


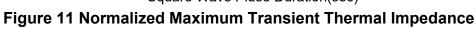
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120



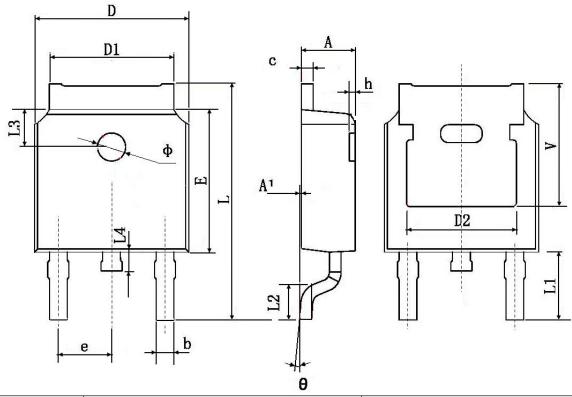
http://www.ncepower.com







TO-252 Package Information



Symphol	Dimensions	In Millimeters	Dimensions In Inches		
Symbol	Min.	Max.	Min.	Max.	
А	2.200	2.400	0.087	0.094	
A1	0.000	0.127	0.000	0.005	
b	0.660	0.860	0.026	0.034	
С	0.460	0.580	0.018	0.023	
D	6.500	6.700	0.256	0.264	
D1	5.100	5.460	0.201	0.215	
D2	0.483 TYP.		0.190 TYP.		
E	6.000	6.200	0.236	0.244	
е	2.186	2.386	0.086	0.094	
L	9.800	10.400	0.386	0.409	
L1	2.900 TYP.		0.114 TYP.		
L2	1.400	1.700	0.055	0.067	
L3	1.600	1.600 TYP.		TYP.	
L4	0.600	1.000	0.024	0.039	
Φ	1.100	1.300	0.043	0.051	
θ	0°	8°	0°	8°	
h	0.000	0.300	0.000	0.012	
V	5.350) TYP.	0.211 TYP.		



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