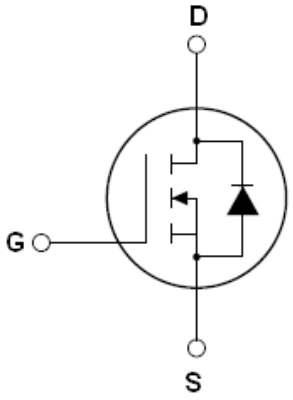
N-Channel Super Junction Power MOSFET Ⅲ

General Description

The series of devices use advanced trench gate super junction technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

V_{DS}	650	V
$R_{DS(ON)TYP.}$	950	mΩ
I_D	4	A



Schematic diagram

Features

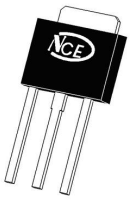
- New technology for high voltage device
- Low on-resistance and low conduction losses
- Small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested
- ROHS compliant

Application

- Power factor correction（PFC）
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply（UPS）

Package Marking And Ordering Information

Device	Device Package	Marking
NCE65T1K2I	TO-251	NCE65T1K2I
NCE65T1K2K	TO-252	NCE65T1K2K



TO-251

TO-252

Table 1. Absolute Maximum Ratings (T_C=25℃)

Parameter	Symbol	Value	Unit
Drain-Source Voltage (V_{GS}=0V)	V_{DS}	650	V
Gate-Source Voltage (V_{DS}=0V) ,AC (f>1 Hz)	V_{GS}	±30	V
Continuous Drain Current at Tc=25°C	$I_{D\ (DC)}$	4	A
Continuous Drain Current at Tc=100°C	$I_{D\ (DC)}$	2.5	A
Pulsed drain current **(Note 1)**	$I_{DM\ (pluse)}$	16	A
Maximum Power Dissipation(Tc=25℃) Derate above 25°C	P_D	41 0.328	W W/°C
Single pulse avalanche energy **(Note2)**	E_{AS}	27	mJ
Avalanche current **(Note 1)**	I_{AR}	0.7	A
Repetitive Avalanche energy , t_{AR} limited by T_{jmax} **(Note 1)**	E_{AR}	0.1	mJ

Parameter	Symbol	Value	Unit
Drain Source voltage slope, V_{DS} ≤480 V,	dv/dt	50	V/ns
Reverse diode dv/dt， V_{DS} ≤480 V,I_{SD}<I_D	dv/dt	15	V/ns
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55...+150	°C

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance，Junction-to-Case（Maximum）	R_{thJC}	3.0	°C /W
Thermal Resistance，Junction-to-Ambient （Maximum）	R_{thJA}	62	°C /W

Table 3. Electrical Characteristics (TA=25℃unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
On/off states						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V I_D=250μA	650			V
Zero Gate Voltage Drain Current(Tc=25℃)	I_{DSS}	V_{DS}=650V,V_{GS}=0V			1	μA
Zero Gate Voltage Drain Current(Tc=125℃)	I_{DSS}	V_{DS}=650V,V_{GS}=0V			50	μA
Gate-Body Leakage Current	I_{GSS}	V_{GS}=±20V,V_{DS}=0V			±100	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=250μA	3		4	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=2A		950	1100	mΩ
Dynamic Characteristics						
Input Capacitance	C_{lss}	V_{DS}=50V,V_{GS}=0V, F=1.0MHz		304		pF
Output Capacitance	C_{oss}			18		pF
Reverse Transfer Capacitance	C_{rss}			0.6		pF
Total Gate Charge	Q_g	V_{DS}=480V,I_D=4A, V_{GS}=10V		8.8	12	nC
Gate-Source Charge	Q_{gs}			2.3		nC
Gate-Drain Charge	Q_{gd}			4		nC
Switching times						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=380V,I_D=2.5A, R_G=5Ω,V_{GS}=10V		8		nS
Turn-on Rise Time	t_r			4		nS
Turn-Off Delay Time	$t_{d(off)}$			52	70	nS
Turn-Off Fall Time	t_f			9	18	nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	T_C=25°C			4	A
Pulsed Source-drain current(Body Diode)	I_{SDM}				16	A
Forward On Voltage	V_{SD}	Tj=25°C,I_{SD}=4A,V_{GS}=0V		0.9	1.2	V
Reverse Recovery Time	t_{rr}	Tj=25°C,I_F=2A,di/dt=100A/μs		200		nS
Reverse Recovery Charge	Q_{rr}			0.6		uC
Peak reverse recovery current	I_{rrm}			6		A

Notes: 1.Repetitive Rating: Pulse width limited by maximum junction temperature

2. Tj=25℃,VDD=50V,VG=10V, R_G=25Ω

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure1. Safe operating area

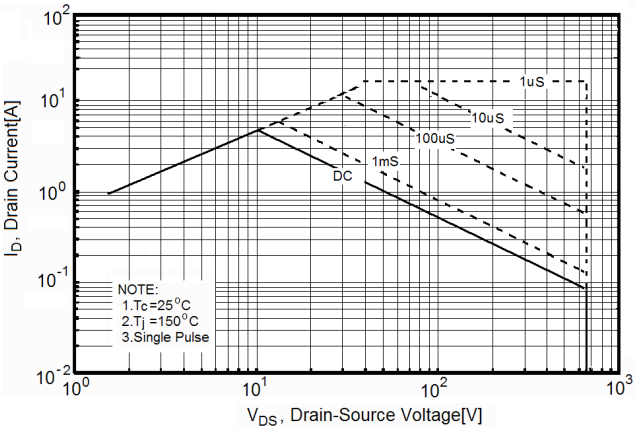


Figure2. Source-Drain Diode Forward Voltage

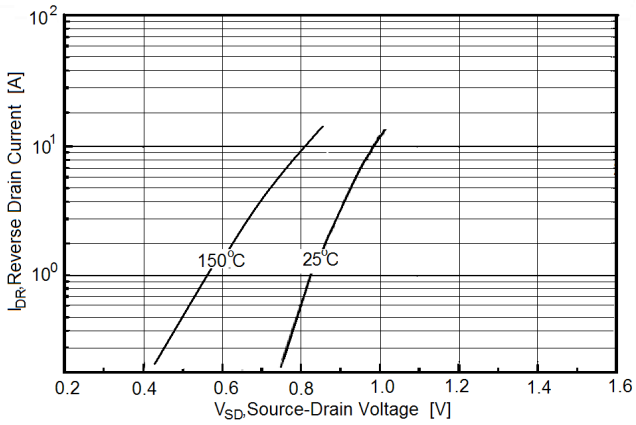


Figure3. Output characteristics

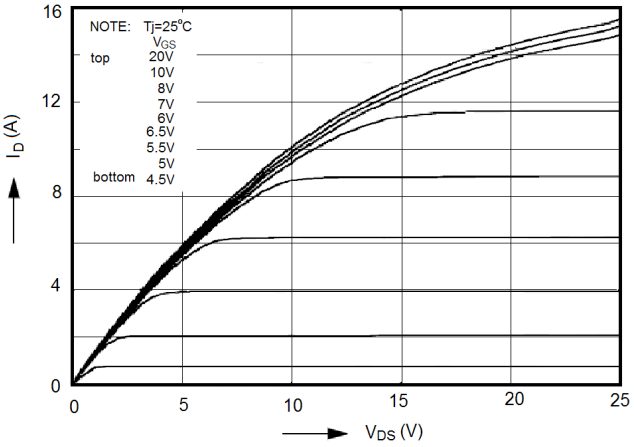


Figure4. Transfer characteristics

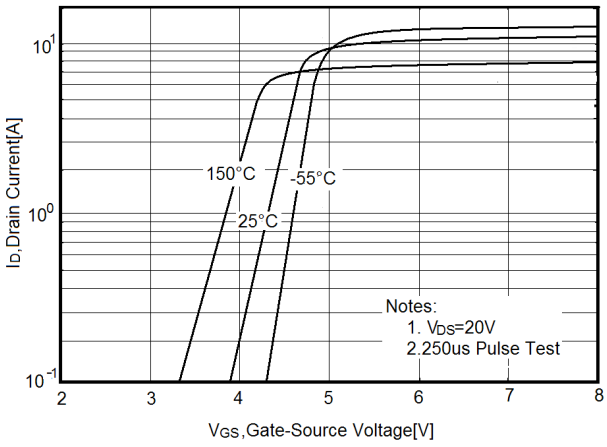


Figure5. Static drain-source on resistance

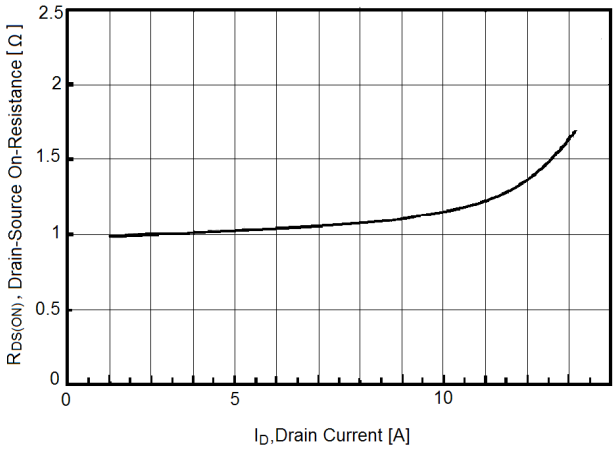


Figure6. $R_{DS(ON)}$ vs Junction Temperature

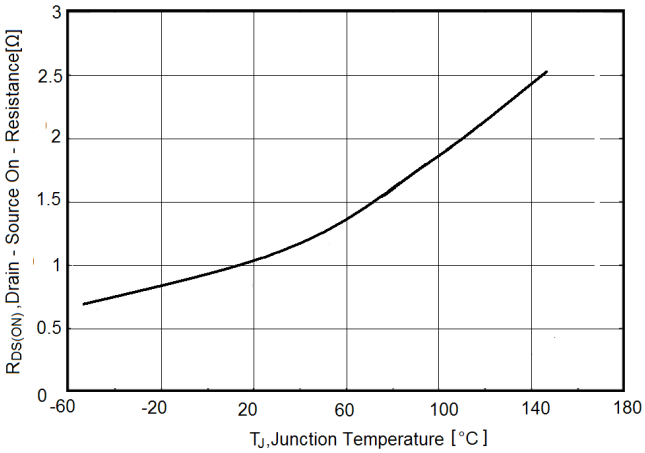


Figure7. BV_{DSS} vs Junction Temperature

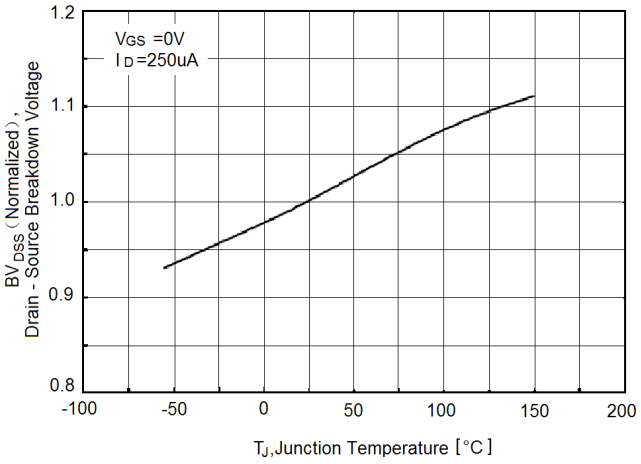


Figure8. Maximum I_D vs Junction Temperature

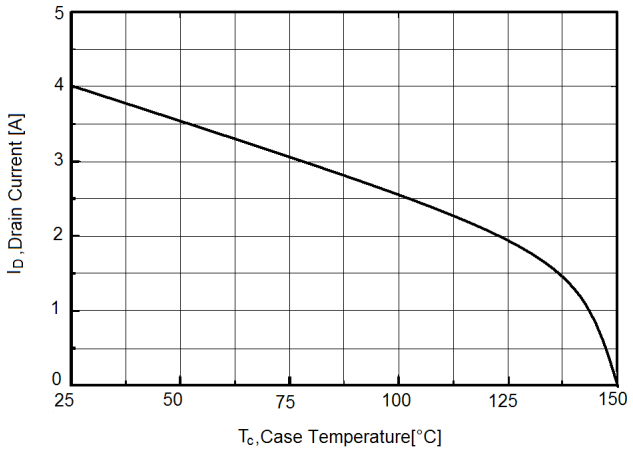


Figure9. Gate charge waveforms

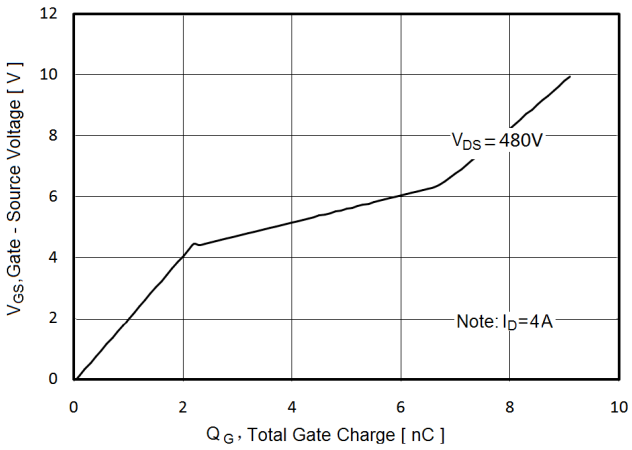


Figure10. Capacitance

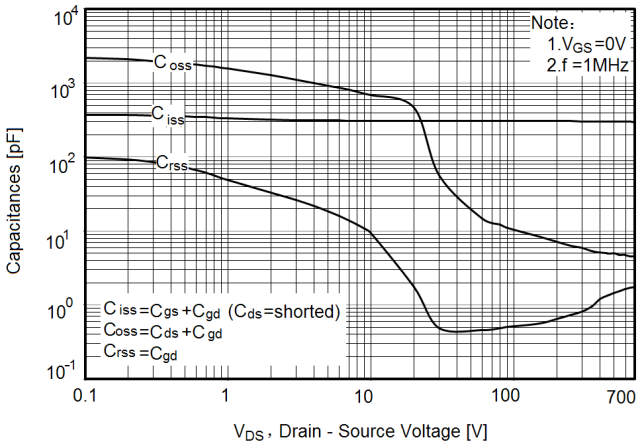
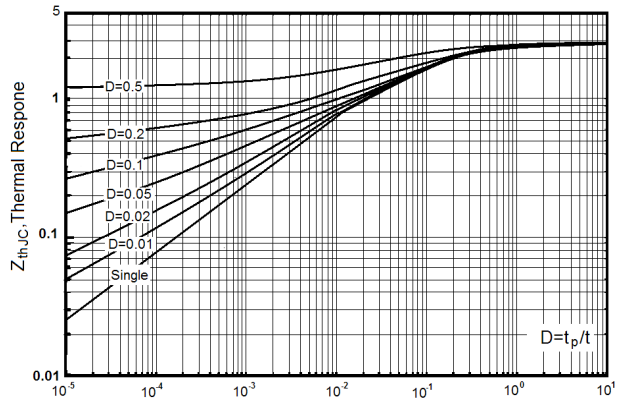
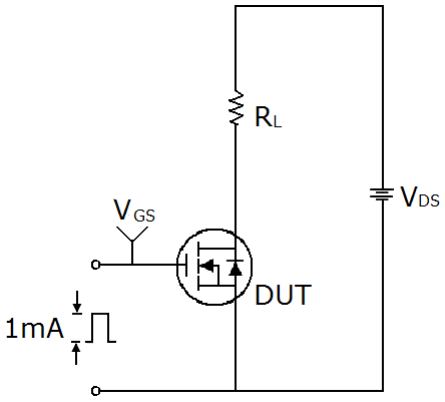


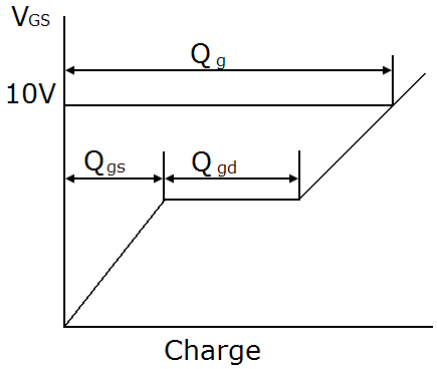
Figure11. Transient Thermal Impedance



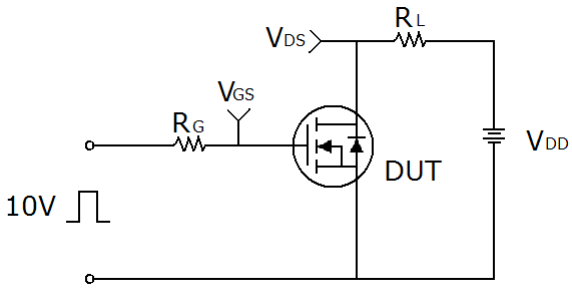
Test circuit

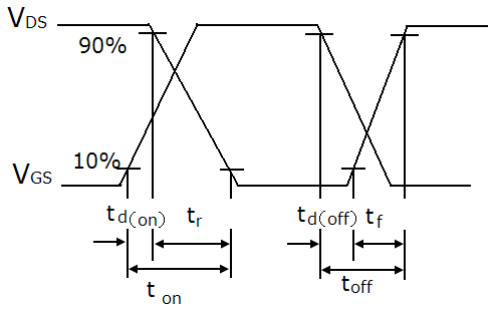
1）Gate charge test circuit & Waveform



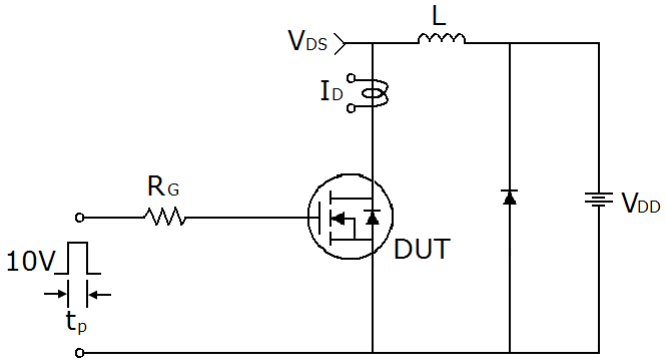


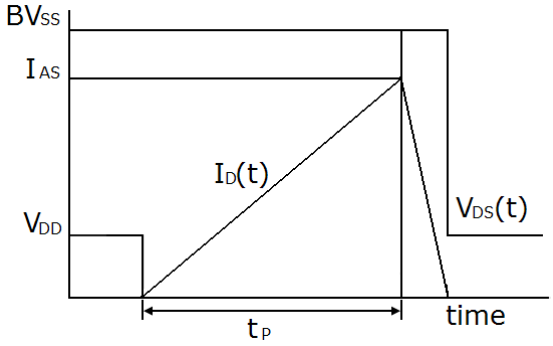
2）Switch Time Test Circuit:



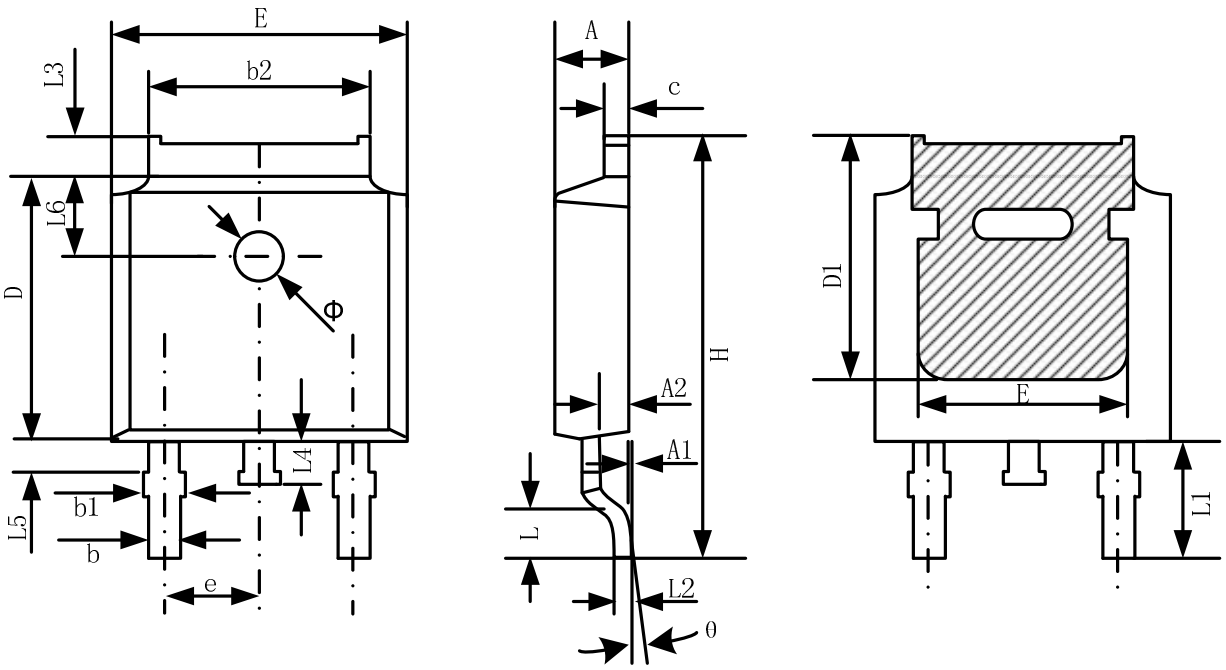


3）Unclamped Inductive Switching Test Circuit & Waveforms



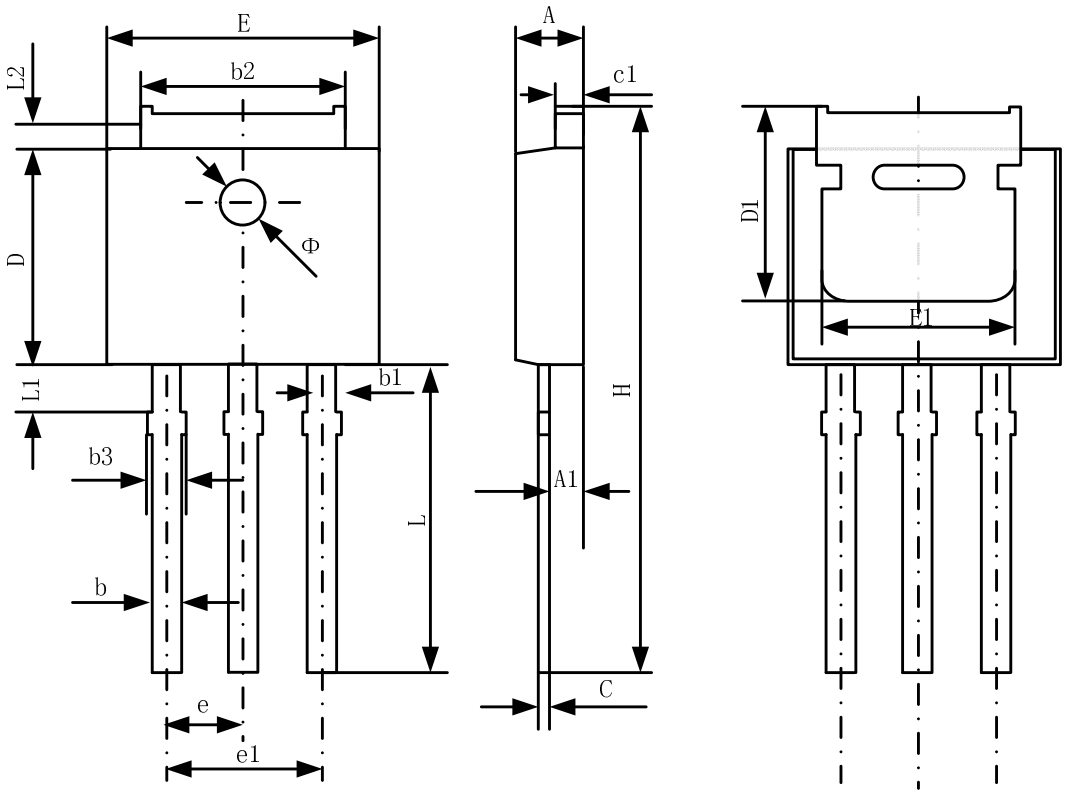


TO-252-2 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.20	2.38	0.087	0.094
A1	0.00	0.10	0.000	0.004
A2	0.90	1.10	0.035	0.043
b	0.72	0.85	0.028	0.033
b1	0.72	0.90	0.028	0.035
b2	5.13	5.46	0.202	0.215
c	0.47	0.60	0.019	0.024
D	6.00	6.20	0.236	0.244
D1	5.25	--	0.207	--
E	6.50	6.70	0.256	0.264
E1	4.70	--	0.185	--
e	2.19	2.39	0.086	0.094
H	9.80	10.40	0.386	0.409
L	1.40	1.70	0.055	0.067
L1	2.90 REF		0.114 REF	
L2	0.508 BSC		0.020 BSC	
L3	0.90	1.25	0.035	0.049
L4	0.60	1.00	0.024	0.039
L5	0.15	0.75	0.006	0.030
L6	1.80 REF		0.071 REF	
Φ	1.20	1.40	0.047	0.055
θ	0°	8°	0°	8°

TO-251 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.20	2.35	0.087	0.093
A1	0.90	1.10	0.035	0.043
b	0.56	0.69	0.022	0.027
b1	0.77	0.90	0.030	0.035
b2	5.23	5.43	0.206	0.214
b3		1.05	0.000	0.041
C	0.46	0.59	0.018	0.023
c1	0.46	0.59	0.018	0.023
D	6.00	6.20	0.236	0.244
D1	5.20		0.205	
E	6.50	6.70	0.256	0.264
E1	4.60	5.00	0.181	
e	2.24	2.34	0.088	0.092
e1	4.47	4.67	0.176	0.184
H	16.18	16.78	0.637	0.661
L	9.00	9.60	0.354	0.378
L1	0.95	1.35	0.037	0.053
L2	0.90	1.25	0.035	0.049

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