N-Channel Super Junction Power MOSFET Ⅳ

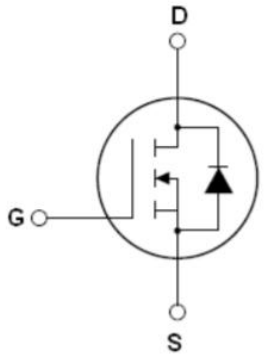
General Description

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.

$V_{DS\ min@Tjmax}$	550	V
$R_{DS(ON)TYP.}$	470	mΩ
I_D	7.5	A
Qg	13.3	nC

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



Schematic diagram

Application

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

Package Marking And Ordering Information

Device	Device Package	Marking
NCE50N540K	TO-252	NCE50N540K

TO-252

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage (V_{GS}=0V）	V_{DS}	500	V
Gate-Source Voltage (V_{DS}=0V) ,AC (f>1 Hz)	V_{GS}	±30	V
Gate-Source Voltage (V_{DS}=0V) ,DC	V_{GS}	±20	V
Continuous Drain Current at Tc=25°C	$I_{D\ (DC)}$	7.5	A
Continuous Drain Current at Tc=100°C	$I_{D\ (DC)}$	5.25	A
Pulsed drain current **(Note 1)**	$I_{DM\ (pluse)}$	22.5	A
Maximum Power Dissipation(Tc=25℃) Derate above 25°C	P_D	74 0.49	W W/°C
Single pulse avalanche current **(Note 2)**	I_{AS}	2	A
Reverse diode dv/dt，V_{DS} ≤480 V,I_{SD}<I_D	dv/dt	15	V/ns
Drain Source voltage slope，V_{DS} ≤480 V	dv/dt	50	V/ns
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55...+175	°C

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance，Junction-to-Case（Maximum）	R_{thJC}	2.02	°C /W
Thermal Resistance，Junction-to-Ambient （Maximum）	R_{thJA}	62	°C /W

Table 3. Electrical Characteristics (T_J=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=250uA	500			V
Zero Gate Voltage Drain Current(Tc=25℃)	I_{DSS}	V_{DS}=500V,V_{GS}=0V			1	μA
Zero Gate Voltage Drain Current(Tc=125℃)	I_{DSS}	V_{DS}=500V,V_{GS}=0V			50	μA
Gate-Body Leakage Current	I_{GSS}	V_{GS}=±20V,V_{DS}=0V			±200	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=250uA	3		4	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=3.5A		470	540	mΩ
Dynamic Characteristics						
Gate Resistance	Rg	F=1MHZ, D-S short		60		Ω
Input Capacitance	C_{lss}	V_{DS}=50V,V_{GS}=0V, F=1MHz		466		pF
Output Capacitance	C_{oss}			55		pF
Reverse Transfer Capacitance	C_{rss}			4.7		pF
Total Gate Charge	Q_g	V_{DS}=380V,I_D=3.5A, V_{GS}=10V		13.3	15	nC
Gate-Source Charge	Q_{gs}			4.4		nC
Gate-Drain Charge	Q_{gd}			4.3		nC
Gate plateau voltage	Vgp			5.5		V
Switching times						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=380V,I_D=4A, R_G=4Ω,V_{GS}=10V		8		nS
Turn-on Rise Time	t_r			10		nS
Turn-Off Delay Time	$t_{d(off)}$			41		nS
Turn-Off Fall Time	t_f			9		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	T_C=25°C			7.5	A
Pulsed-Source-drain current(Body Diode)	I_{SDM}				22.5	A
Forward on voltage	V_{SD}	Tj=25°C,I_{SD}=7.5A,V_{GS}=0V		1.0	1.2	V
Reverse Recovery Time	t_{rr}	Tj=25°C,I_F=3.5A， di/dt=100A/μs		185		nS
Reverse Recovery Charge	Q_{rr}			1.5		uC
Peak reverse recovery current	I_{rrm}			12		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

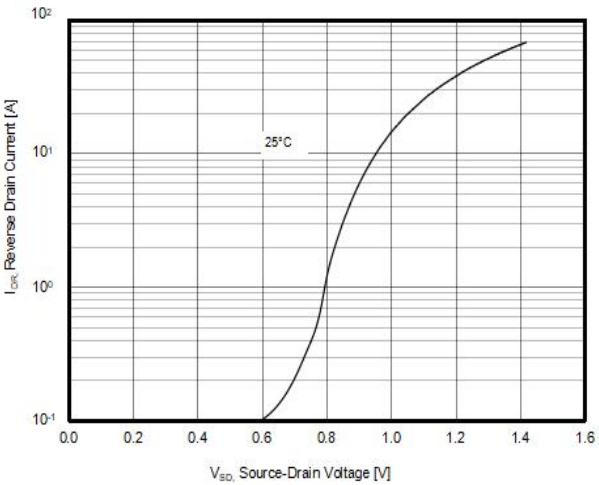


Figure3. Output characteristics

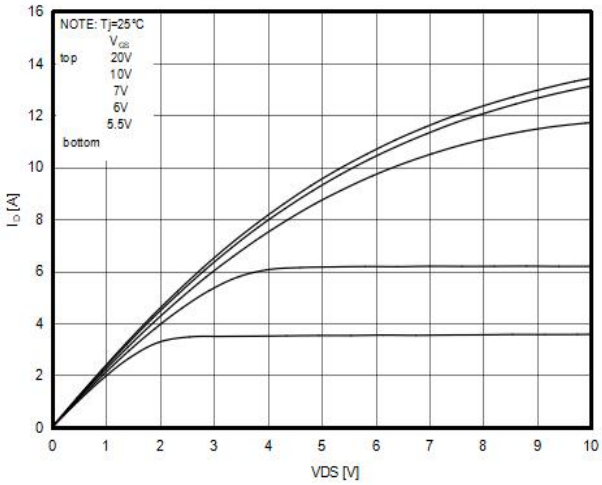


Figure4. Transfer characteristics

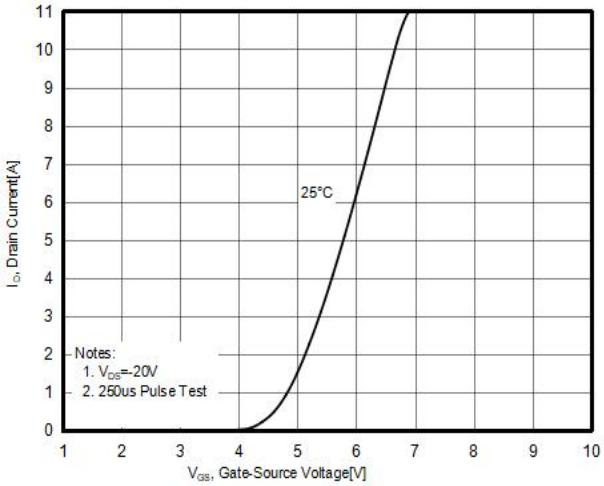


Figure5. Static drain-source on resistance

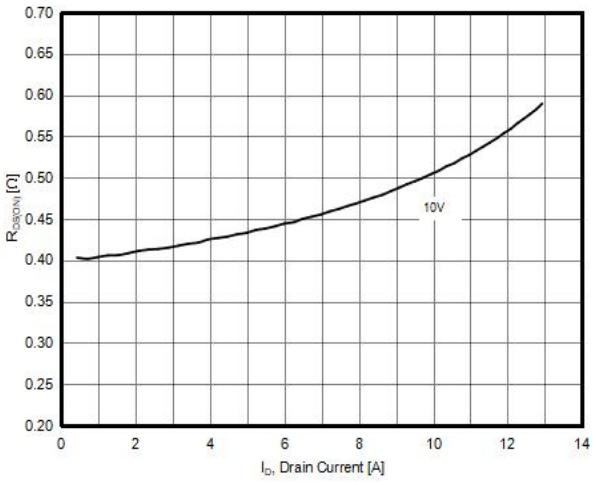


Figure6. $R_{DS(ON)}$ vs Junction Temperature

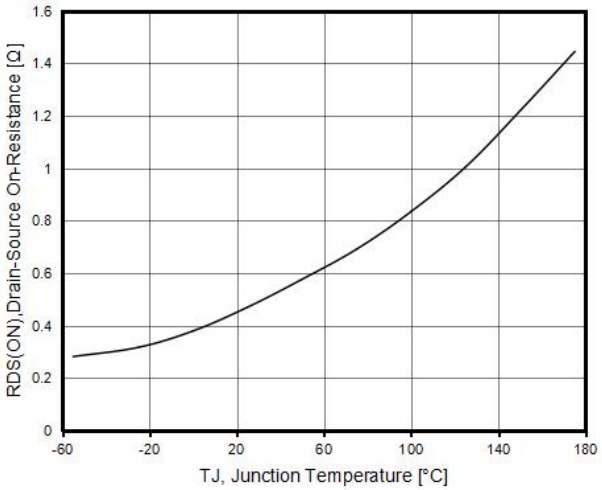


Figure7. BV_{DSS} vs Junction Temperature

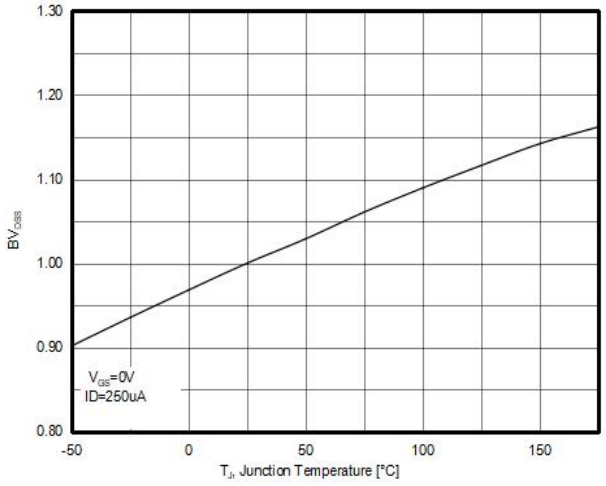


Figure8. Maximum I_D vs Junction Temperature

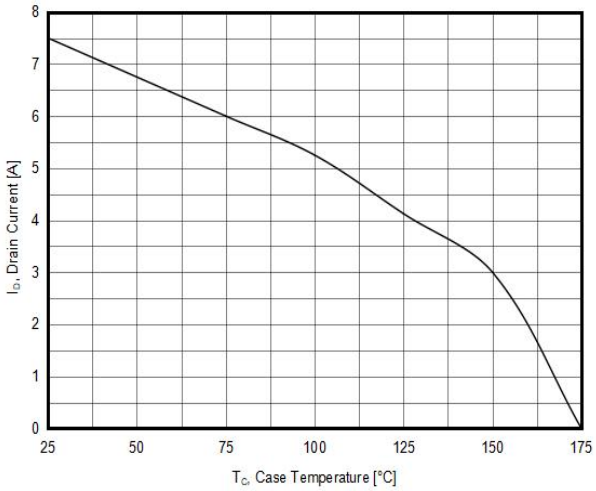


Figure9. Gate charge waveforms

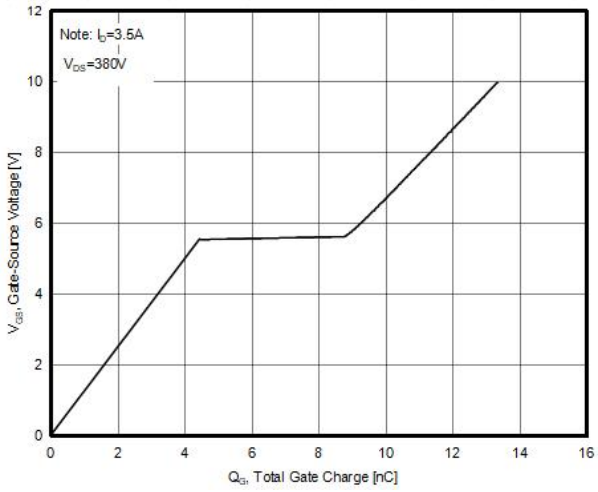
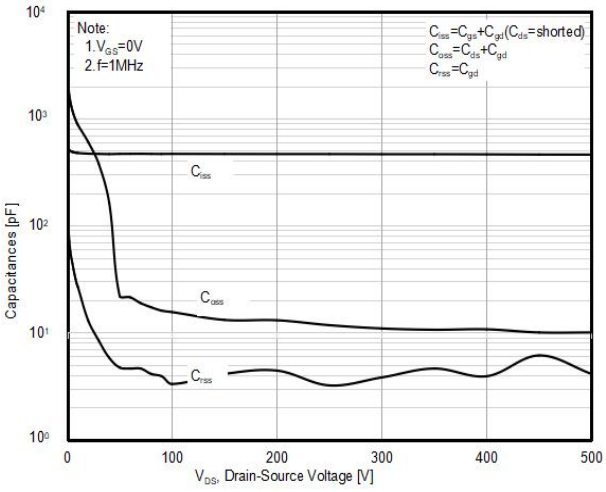
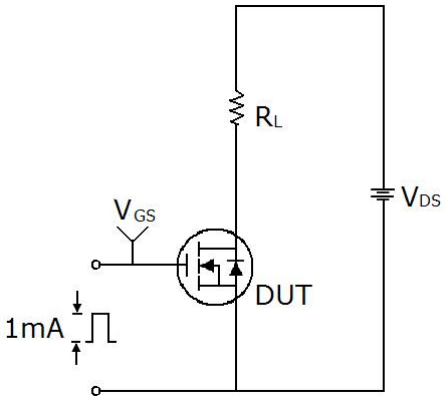


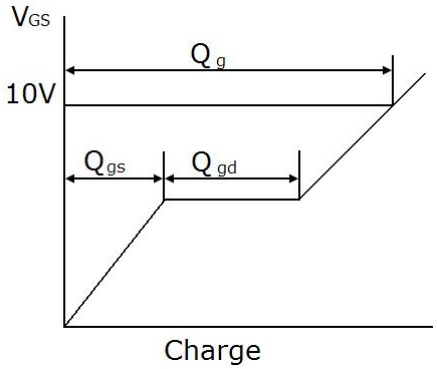
Figure10. Capacitance



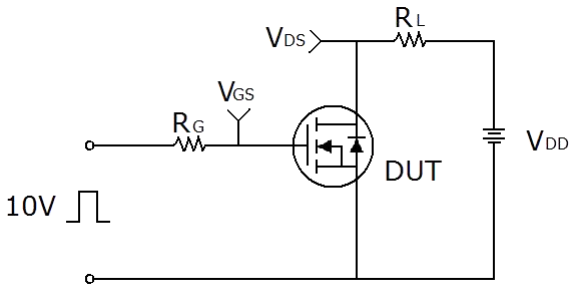
Test circuit

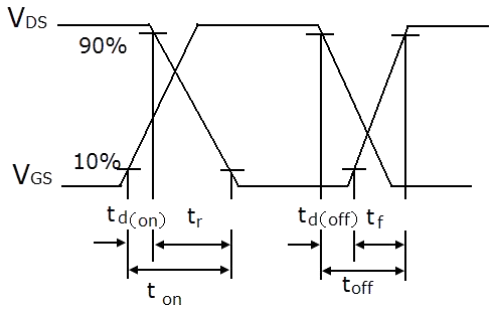
1）Gate charge test circuit & Waveform



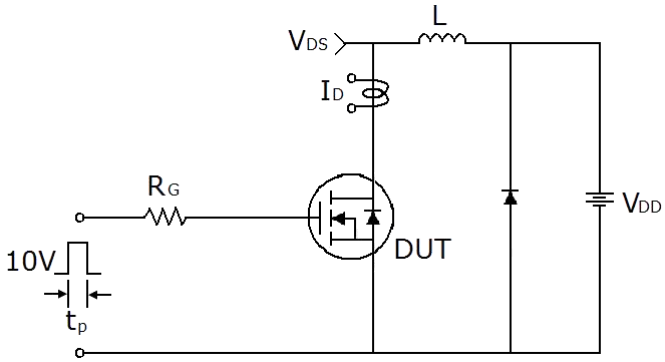


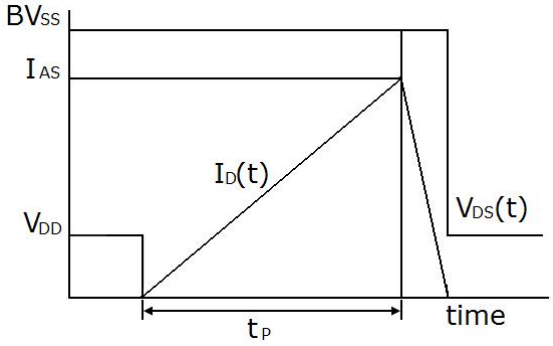
2）Switch Time Test Circuit：



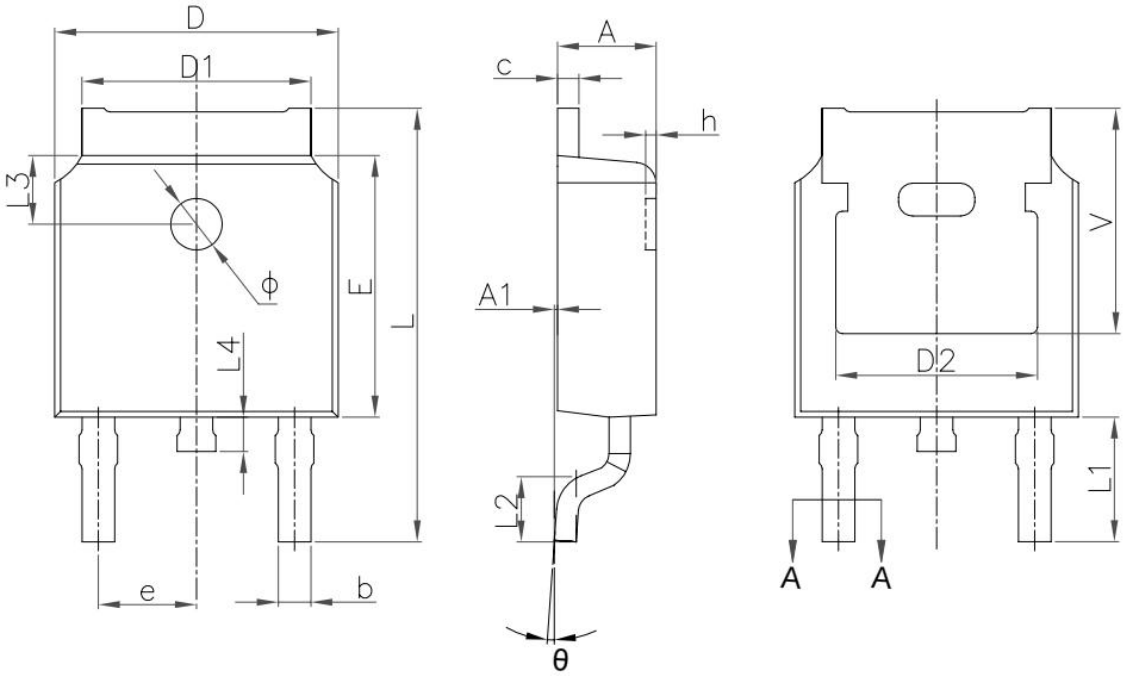


3）Unclamped Inductive Switching Test Circuit & Waveforms



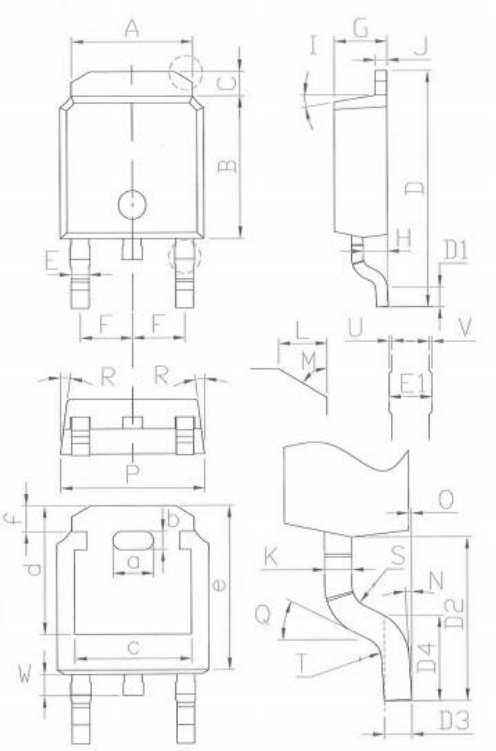


TO-252-E Package Information



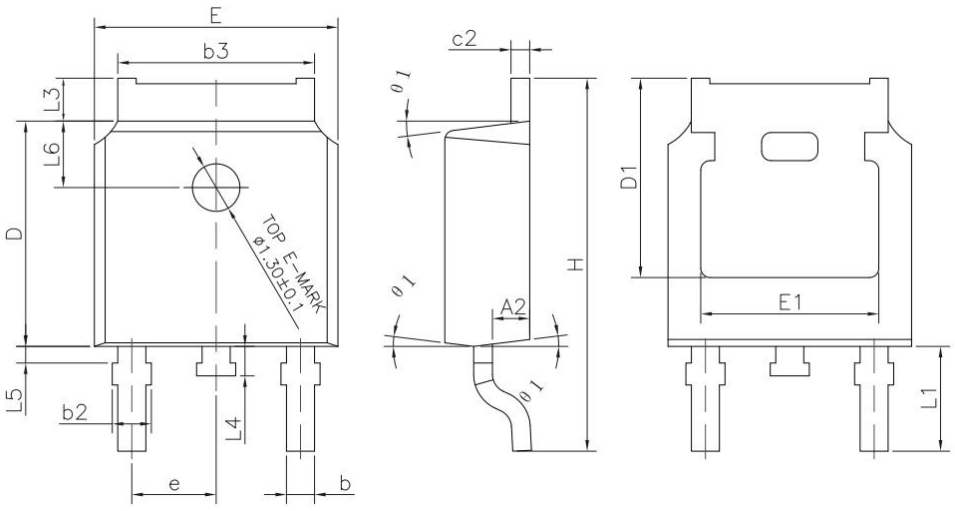
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.20	2.40	0.087	0.094
A1	0.00	0.13	0.000	0.005
b	0.66	0.86	0.026	0.033
b1	0.73	0.79	0.029	0.031
c	0.46	0.58	0.018	0.023
c1	0.50	0.52	0.020	0.020
D	6.50	6.70	0.256	0.264
D1	5.10	5.46	0.201	0.215
D2	4.83 REF		0.19REF	
E	6.00	6.20	0.236	0.244
e	2.19	2.39	0.086	0.094
L	9.80	10.40	0.386	0.409
L1	2.90 REF		0.11REF	
L2	1.40	1.70	0.055	
L3	1.60 REF		0.06REF	
L4	0.60	1.00	0.024	0.039
Φ	1.10	1.30	0.043	0.051
θ	0°	8°	0°	8°
h	0.00	0.30	0.000	0.012

TO-252-L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	5.14	5.54	0.202	0.218
B	5.80	6.20	0.228	0.244
C	0.85	1.25	0.033	0.049
D1	0.00	1.40	0.000	0.055
D2	2.75	3.05	0.108	0.120
D3	0.41	0.61	0.016	0.024
D4	1.35	1.65	0.053	0.065
E	0.66	0.86	0.026	0.034
E1	0.71	1.01	0.028	0.040
F	2.18	2.38	0.086	0.094
G	2.10	2.50	0.083	0.098
H	0.86	1.26	0.034	0.050
J	0.41	0.61	0.016	0.024
K	0.42	0.62	0.017	0.024
L	0.60	1.00	5.40	0.04
O	0.00	0.10	0.00	0.00
P	6.40	6.80	0.25	0.27
S	R0.40			
T	R0.40			
W	0.70	1.10	0.03	0.04

TO-252-P Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	2.2	2.38	0.087	0.094
A2	0.9	1.1	0.035	0.043
b	0.72	0.85	0.028	0.033
b1	0.71	0.81	0.028	0.032
b2	0.72	0.9	0.028	0.035
b3	5.13	5.46	0.202	0.215
c	0.47	0.6	0.019	0.024
c1	0.46	0.56	0.018	0.022
c2	0.47	0.6	0.019	0.024
D	6	6.2	0.236	0.244
D1	5.25		0.207	
E	6.5	6.7	0.256	0.264
E1	4.7		0.185	
e	2.186	2.386	0.086	0.094
H	9.8	10.4	0.386	0.409
L1	2.90 REF		0.114REF	
θ	0°	8°	0°	8°

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