

## N-Channel Super Junction Power MOSFET

### General Description

The series of devices use advanced 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.

### 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

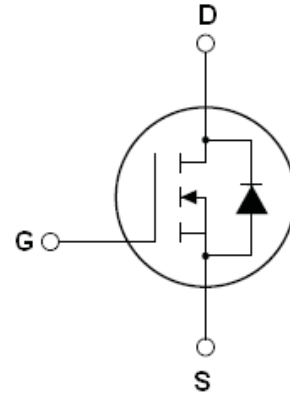
### Application

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

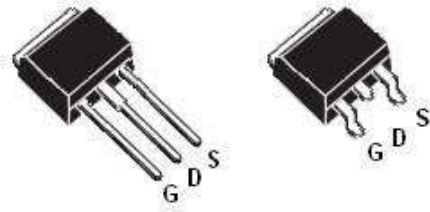
### Package Marking And Ordering Information

Device	Device Package	Marking
RM4N700IP	TO-251	4N700
RM4N700LD	TO-252	4N700

$V_{DS}$	700	V
$R_{DS(ON)TYP.}$	1100	m $\Omega$
$I_D$	4	A



### Schematic diagram



TO-251

TO-252

**Table 1. Absolute Maximum Ratings ( $T_c=25^\circ\text{C}$ )**

Parameter	Symbol	Value	Unit
Drain-Source Voltage ( $V_{GS}=0V$ )	$V_{DS}$	700	V
Gate-Source Voltage ( $V_{DS}=0V$ ), AC ( $f>1\text{ Hz}$ )	$V_{GS}$	$\pm 30$	V
Continuous Drain Current at $T_c=25^\circ\text{C}$	$I_{D(DC)}$	4	A
Continuous Drain Current at $T_c=100^\circ\text{C}$	$I_{D(DC)}$	2.5	A
Pulsed drain current <b>(Note 1)</b>	$I_{DM (pulse)}$	16	A
Maximum Power Dissipation ( $T_c=25^\circ\text{C}$ )	$P_D$	41	W
Derate above $25^\circ\text{C}$		0.328	W/ $^\circ\text{C}$
Single pulse avalanche energy <b>(Note2)</b>	$E_{AS}$	27	mJ
Avalanche current <b>(Note 1)</b>	$I_{AR}$	0.7	A
Repetitive Avalanche energy, $t_{AR}$ limited by $T_{jmax}$ <b>(Note 1)</b>	$E_{AR}$	0.1	mJ

Parameter	Symbol	Value	Unit
Drain Source voltage slope, $V_{DS} \leq 480V$ ,	dv/dt	50	V/ns
Reverse diode dv/dt, $V_{DS} \leq 480V, I_{SD} < I_D$	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°C unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>On/off states</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	700			V
Zero Gate Voltage Drain Current( $T_C=25^\circ C$ )	$I_{DSS}$	$V_{DS}=700V, V_{GS}=0V$			1	$\mu A$
Zero Gate Voltage Drain Current( $T_C=125^\circ C$ )	$I_{DSS}$	$V_{DS}=700V, V_{GS}=0V$			50	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$			$\pm 100$	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	3		4	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=2A$		1100	1300	m $\Omega$
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=50V, V_{GS}=0V,$ $F=1.0MHz$		304		PF
Output Capacitance	$C_{oss}$			17		PF
Reverse Transfer Capacitance	$C_{rss}$			0.5		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
<b>Switching times</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=380V, I_D=2.5A,$ $R_G=5\Omega, V_{GS}=10V$		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
<b>Source- Drain Diode Characteristics</b>						
Source-drain current(Body Diode)	$I_{SD}$	$T_C=25^\circ C$			4	A
Pulsed Source-drain current(Body Diode)	$I_{SDM}$				16	A
Forward On Voltage	$V_{SD}$	$T_J=25^\circ C, I_{SD}=4A, V_{GS}=0V$		0.9	1.2	V
Reverse Recovery Time	$t_{rr}$	$T_J=25^\circ C, I_F=2A, di/dt=100A/\mu s$		200		nS
Reverse Recovery Charge	$Q_{rr}$			0.6		$\mu C$
Peak reverse recovery current	$I_{rrm}$			6		A

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

2.  $T_J=25^\circ C, V_{DD}=50V, V_G=10V, R_G=25\Omega$

# RATING AND CHARACTERISTICS CURVES (RM4N700IP/LD)

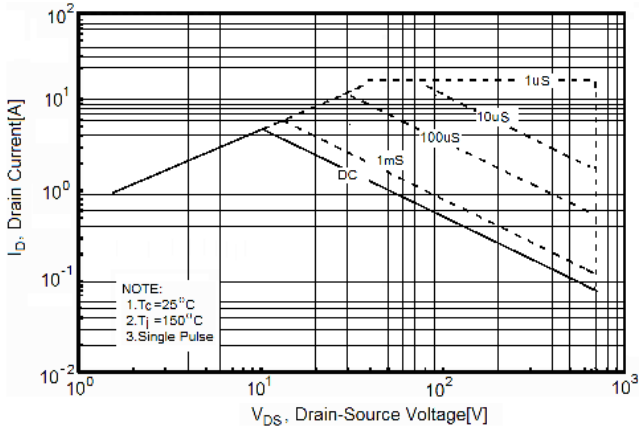


Figure1. Safe operating area

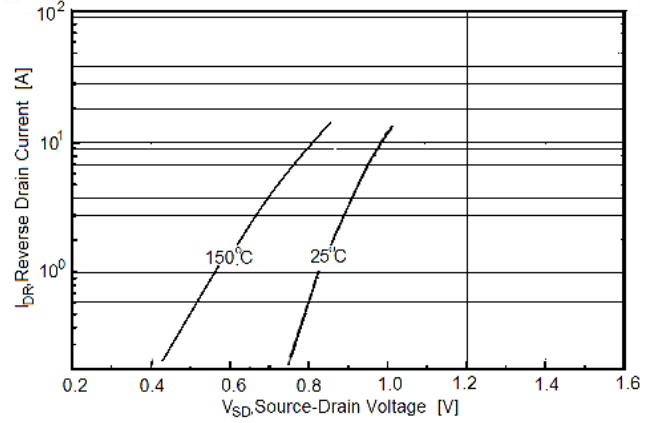


Figure2. Source-Drain Diode Forward Voltage

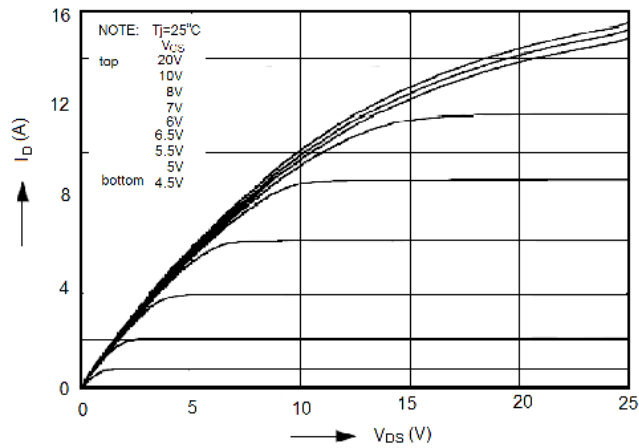


Figure3. Output characteristics

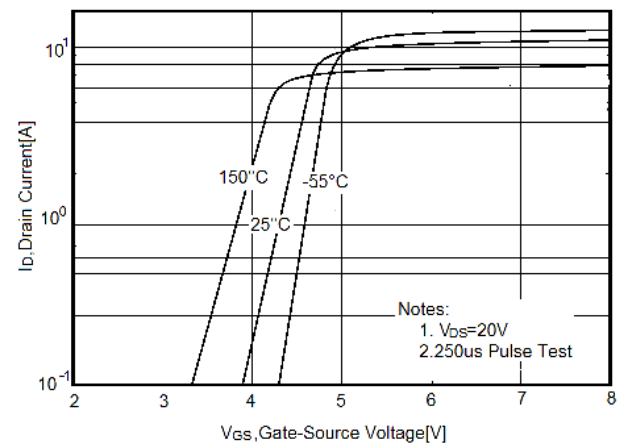


Figure4. Transfer characteristics

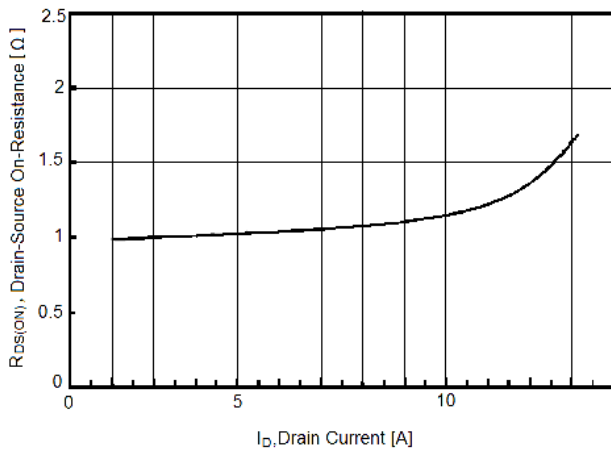


Figure5. Static drain-source on resistance

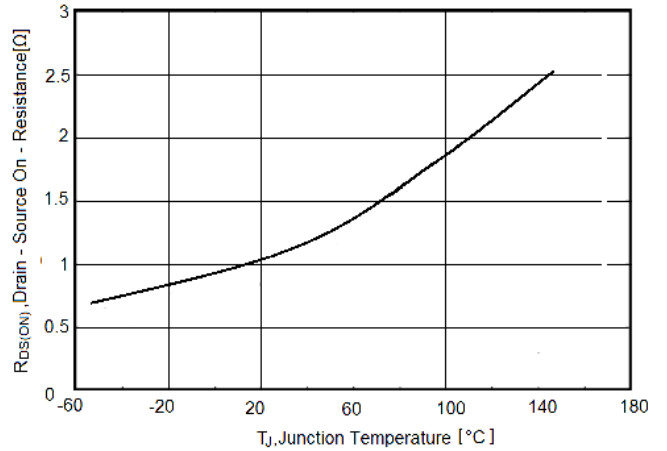


Figure6.  $R_{DS(ON)}$  vs Junction Temperature

# RATING AND CHARACTERISTICS CURVES (RM4N700IP/LD)

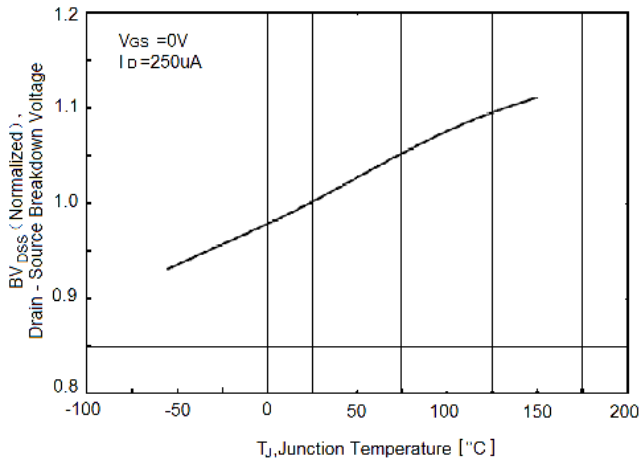


Figure 7.  $BV_{DSS}$  vs Junction Temperature

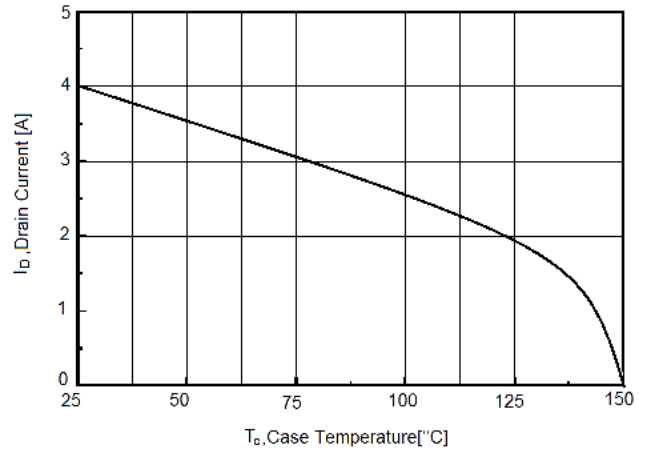


Figure 8. Maximum  $I_D$  vs Junction Temperature

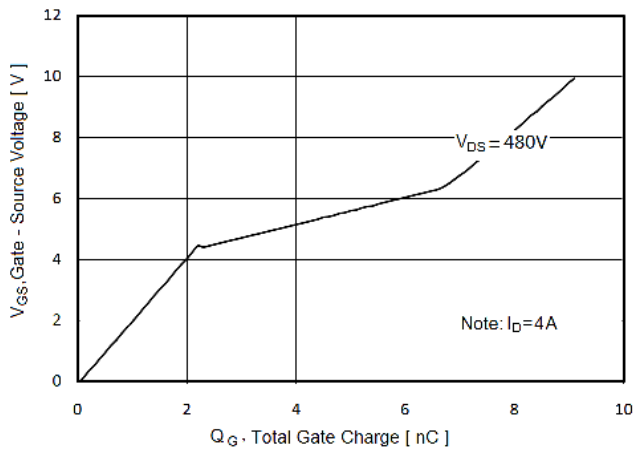


Figure 9. Gate charge waveforms

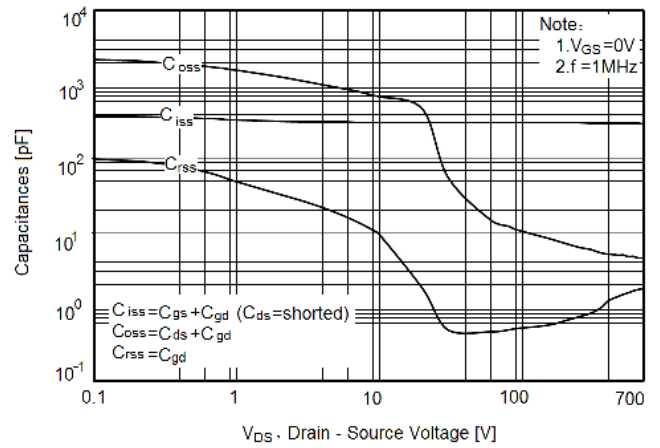


Figure 10. Capacitance

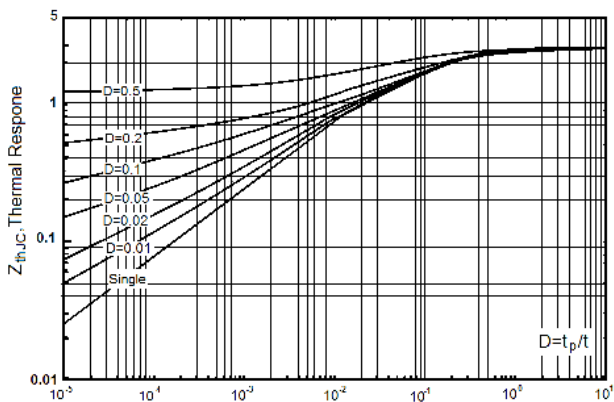
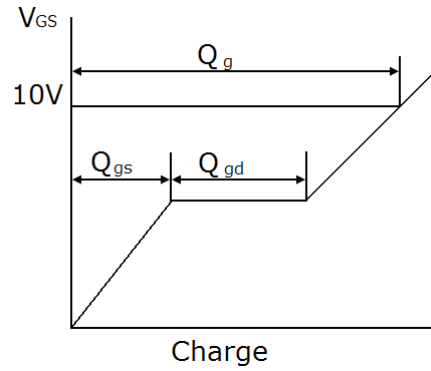
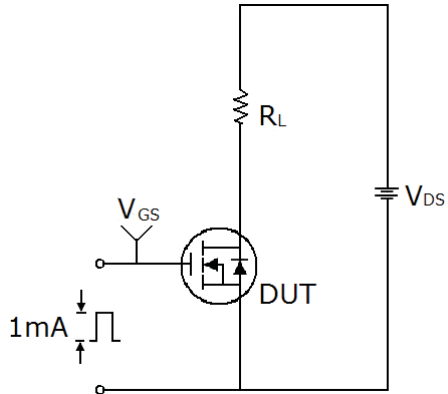


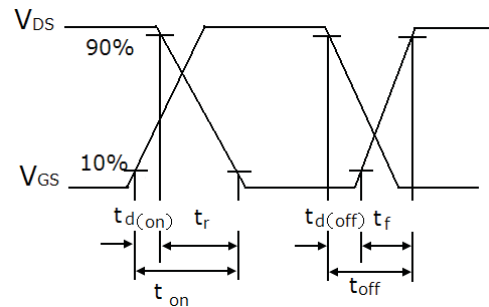
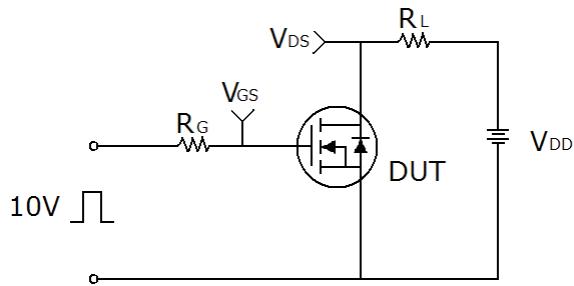
Figure 11. Transient Thermal Impedance

# Test circuit

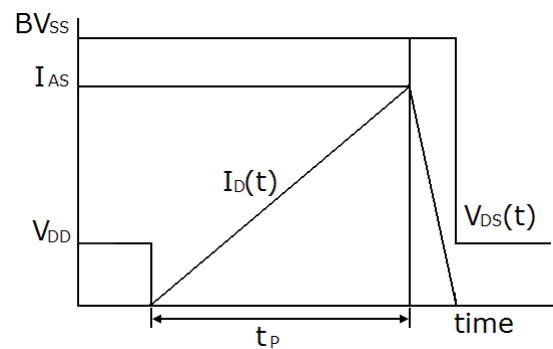
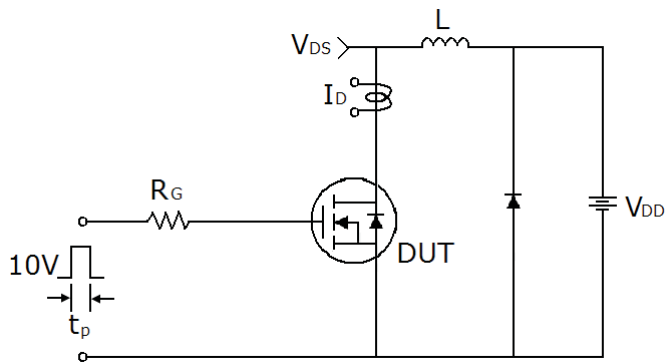
## 1) Gate charge test circuit & Waveform



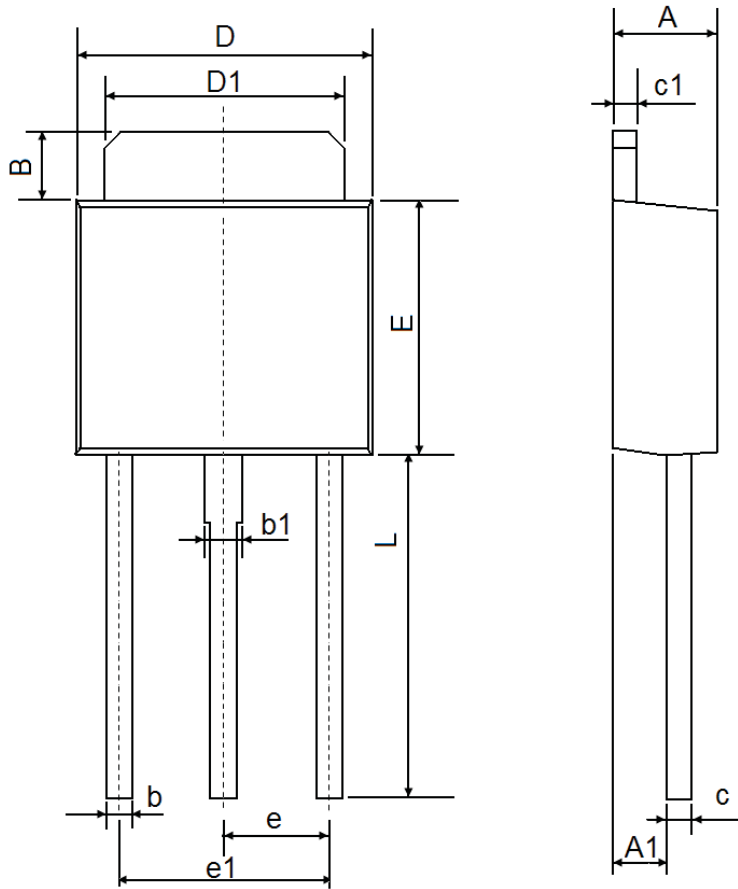
## 2) Switch Time Test Circuit:



## 3) Unclamped Inductive Switching Test Circuit & Waveforms

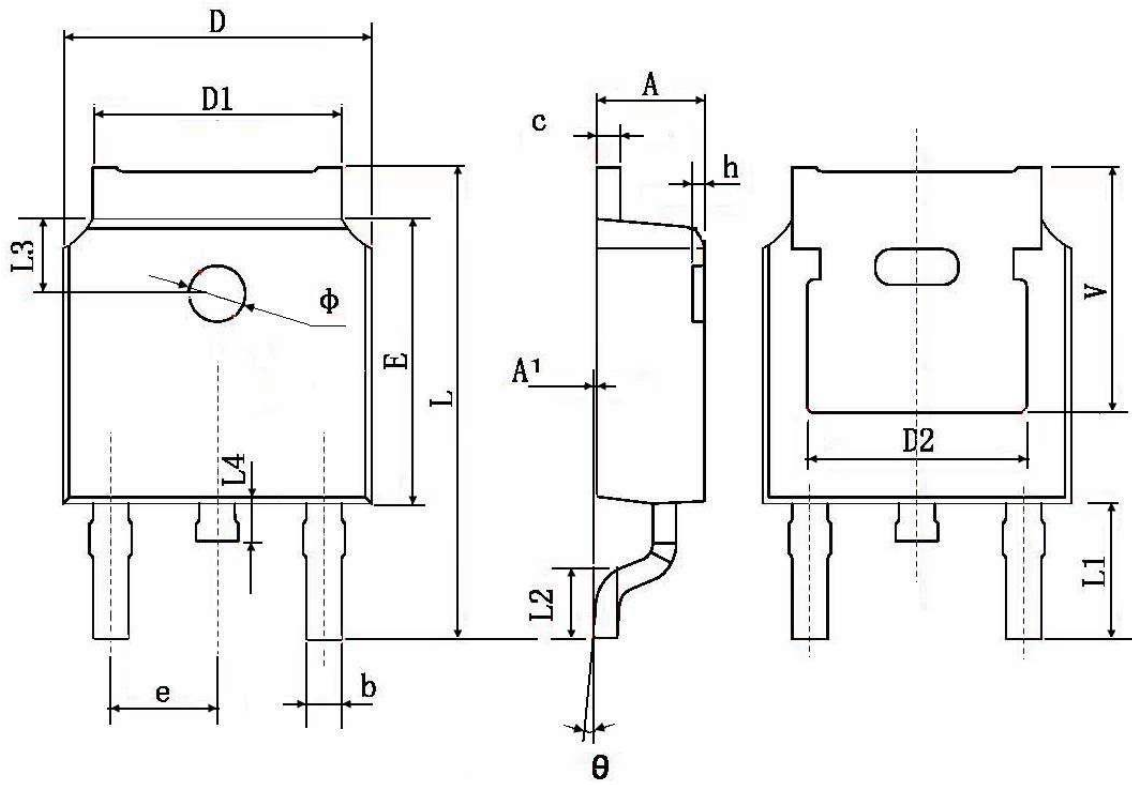


# TO-251 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	1.050	1.350	0.042	0.054
B	1.350	1.650	0.053	0.065
b	0.500	0.700	0.020	0.028
b1	0.700	0.900	0.028	0.035
c	0.430	0.580	0.017	0.023
c1	0.430	0.580	0.017	0.023
D	6.350	6.650	0.250	0.262
D1	5.200	5.400	0.205	0.213
E	5.400	5.700	0.213	0.224
e	2.300 TYP.		0.091 TYP.	
e1	4.500	4.700	0.177	0.185
L	7.500	7.900	0.295	0.311

# TO-252 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	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
c	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	4.830 TYP.		0.190 TYP.	
E	6.000	6.200	0.236	0.244
e	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 TYP.		0.063 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.	

## DISCLAIMER NOTICE

Rectron Inc reserves the right to make changes without notice to any product specification herein, to make corrections, modifications, enhancements or other changes. Rectron Inc or anyone on its behalf assumes no responsibility or liability for any errors or inaccuracies. Data sheet specifications and its information contained are intended to provide a product description only. "Typical" parameters which may be included on RECTRON data sheets and/ or specifications can and do vary in different applications and actual performance may vary over time. Rectron Inc does not assume any liability arising out of the application or use of any product or circuit.

Rectron products are not designed, intended or authorized for use in medical, life-saving implant or other applications intended for life-sustaining or other related applications where a failure or malfunction of component or circuitry may directly or indirectly cause injury or threaten a life without expressed written approval of Rectron Inc. Customers using or selling Rectron components for use in such applications do so at their own risk and shall agree to fully indemnify Rectron Inc and its subsidiaries harmless against all claims, damages and expenditures.