RECTRON SEMICONDUCTOR
TECHNICAL SPECIFICATION

RM5N650IP
RM5N650LD

N-Channel Super Junction Power MOSFET Ⅱ

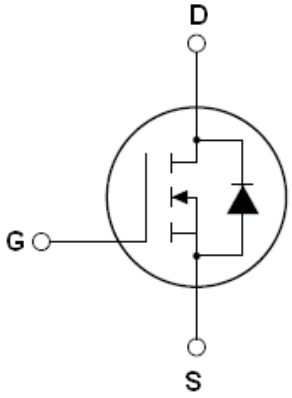
General Description

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.

V_{DS}	650	V
$R_{DS(ON)TYP.}$	750	mΩ
I_D	5	A

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）
- RoHS Compliant

Package Marking And Ordering Information

Device	Device Package	Marking
RM5N650IP	TO-251	5N650
RM5N650LD	TO-252	5N650

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	$I_{D\ (DC)}$	5	A
Continuous Drain Current at Tc 100°C	$I_{D\ (DC)}$	3	A
Pulsed drain current **(Note 1)**	$I_{DM\ (pluse)}$	20	A
Maximum Power Dissipation(Tc 25℃) Derate above 25°C	P_D	46 0.37	W W/°C
Single pulse avalanche energy **(Note2)**	E_{AS}	52	mJ
Avalanche current**(Note 1)**	I_{AR}	0.9	A
Repetitive Avalanche energy ， t_{AR} limited by T_{jmax} **(Note 1)**	E_{AR}	0.14	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	℃

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance，Junction-to-Case（Maximum）	R_{thJC}	2.72	℃ /W
Thermal Resistance，Junction-to-Ambient （Maximum）	R_{thJA}	75	℃ /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 2.5A		750	900	mΩ
Dynamic Characteristics						
Input Capacitance	C_{lss}	V_{DS} 50V,V_{GS} 0V, F 1.0MHz		370		pF
Output Capacitance	C_{oss}			25		pF
Reverse Transfer Capacitance	C_{rss}			0.5		pF
Total Gate Charge	Q_g	V_{DS} 480V,I_D 5A, V_{GS} 10V		10.5	15	nC
Gate-Source Charge	Q_{gs}			2.6		nC
Gate-Drain Charge	Q_{gd}			5.3		nC
Switching times						
Turn-on Delay Time	$t_{d(on)}$	V_{DD} 380V,I_D 3A, R_G 5Ω,V_{GS} 10V		7		nS
Turn-on Rise Time	t_r			3		nS
Turn-Off Delay Time	$t_{d(off)}$			52	62	nS
Turn-Off Fall Time	t_f			10	16	nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	T_C 25°C			5	A
Pulsed Source-drain current(Body Diode)	I_{SDM}				20	A
Forward on voltage	V_{SD}	Tj 25°C,I_{SD} 5A,V_{GS} 0V		0.9	1.2	V
Reverse Recovery Time	t_{rr}	Tj 25°C,I_F 2.5A,di/dt 100A/μs		210		nS
Reverse Recovery Charge	Q_{rr}			0.66		uC
Peak reverse recovery current	I_{rrm}			6.5		A

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

2. Tj 25℃,VDD 50V,VG 10V, R_G 25Ω,L 73mH

RATING AND CHARACTERISTICS CURVES (RM5N650IP/LD)

Figure1. Safe operating area

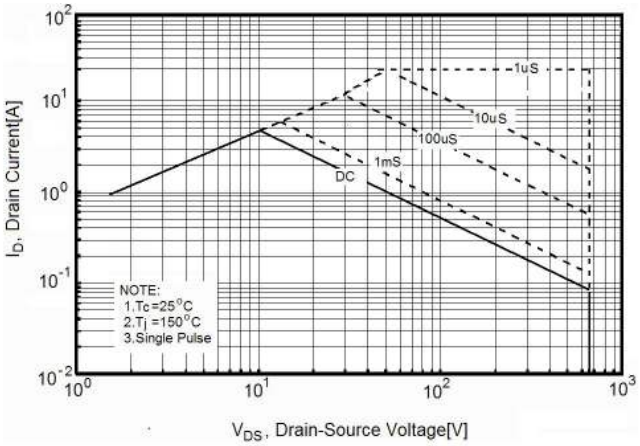


Figure2. Source-Drain Diode Forward Voltage

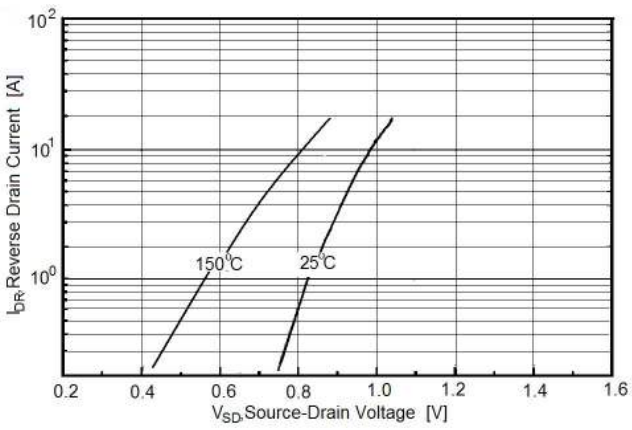


Figure3. Output characteristics

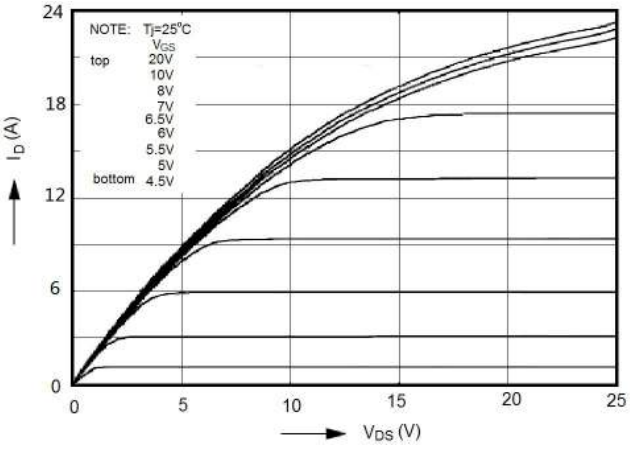


Figure4. Transfer characteristics

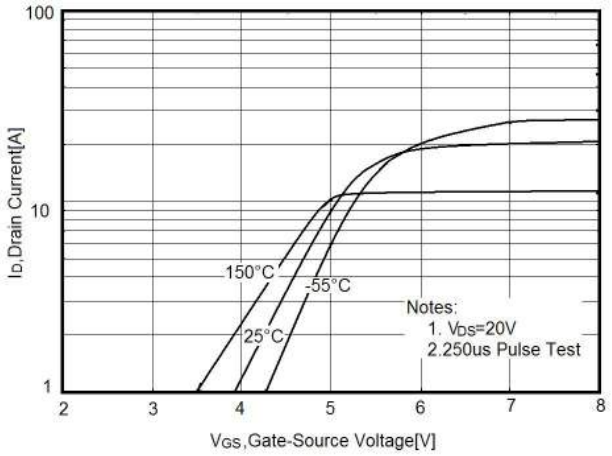


Figure5. Static drain-source on resistance

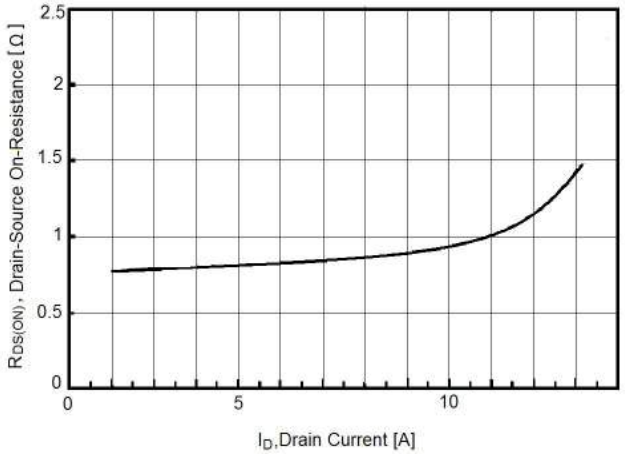
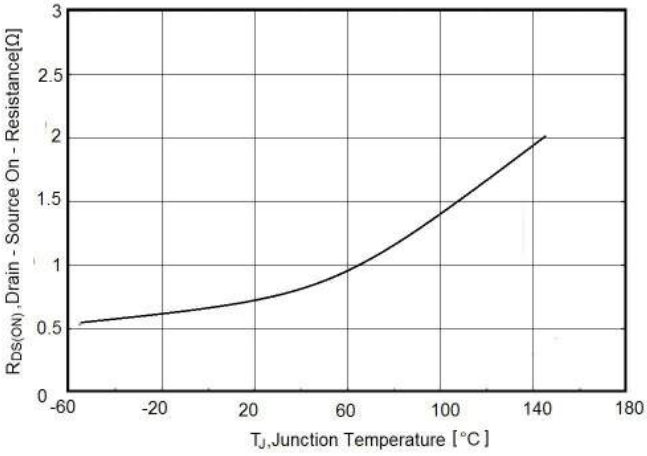


Figure6. $R_{DS(ON)}$ vs Junction Temperature



RATING AND CHARACTERISTICS CURVES (RM5N650IP/LD)

Figure7. BV_{DSS} vs Junction Temperature

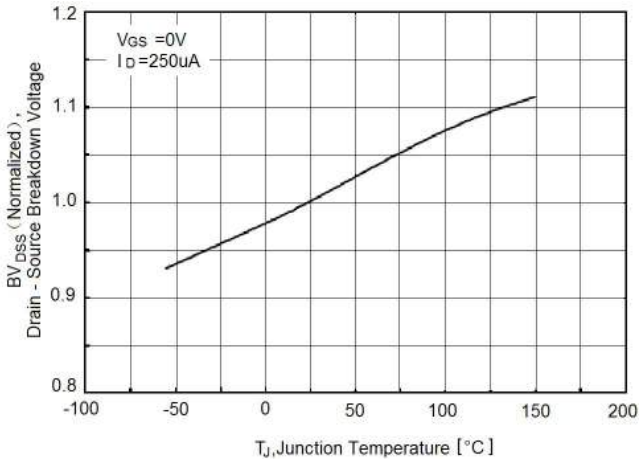


Figure8. Maximum I_D vs Junction Temperature

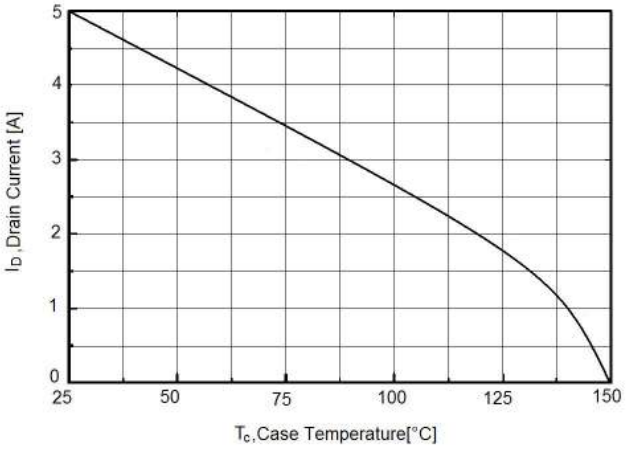


Figure9. Gate charge waveforms

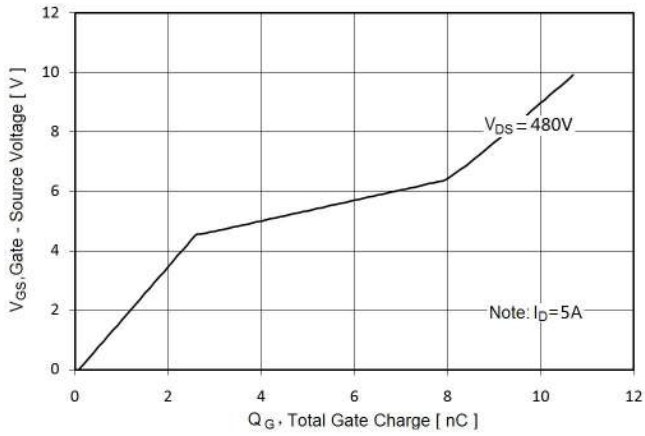


Figure10. Capacitance

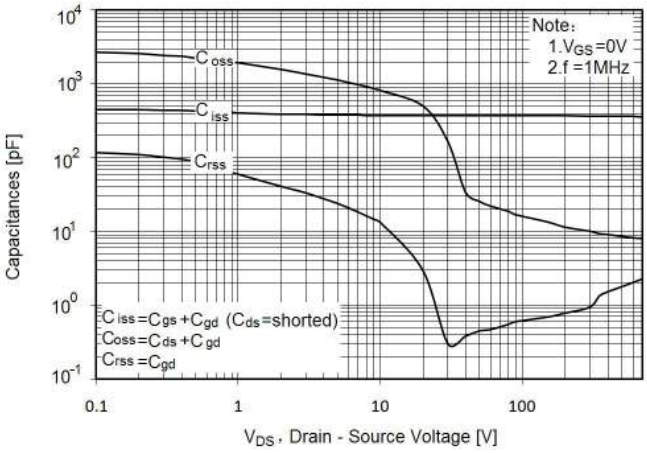
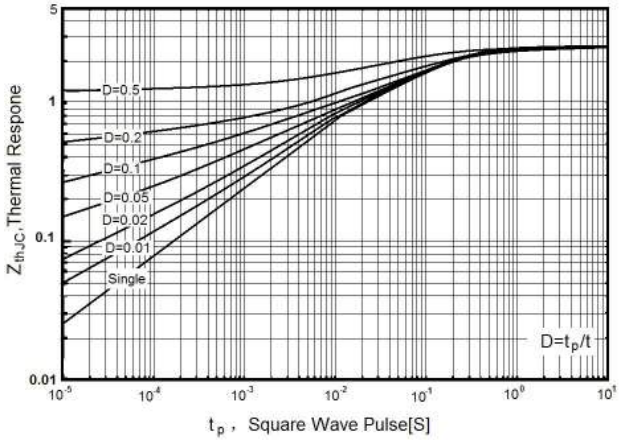
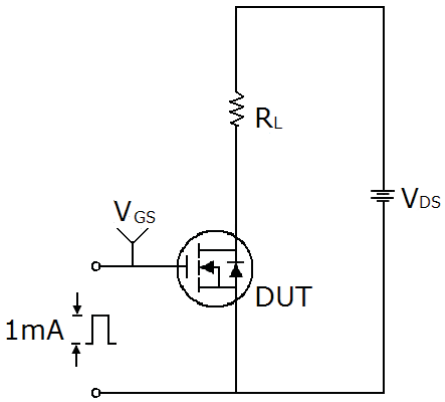


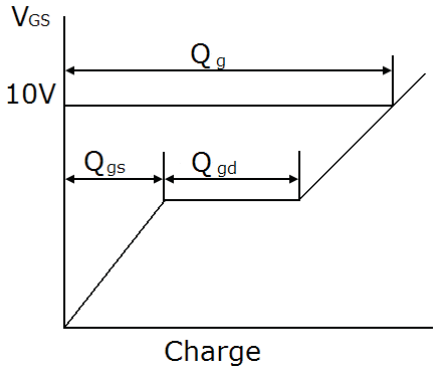
Figure11. Transient Thermal Impedance



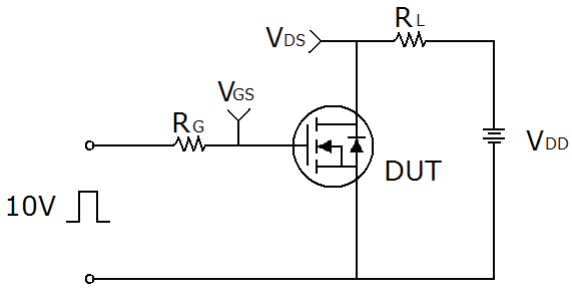
Test circuit

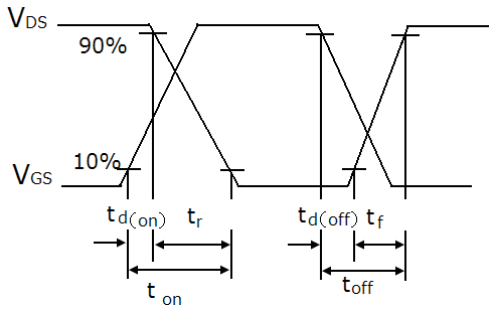
1）Gate charge test circuit & Waveform



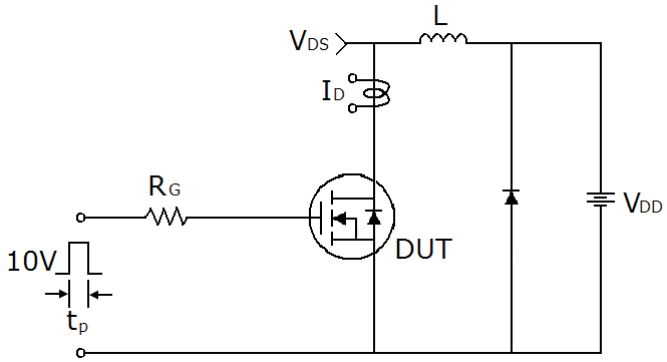


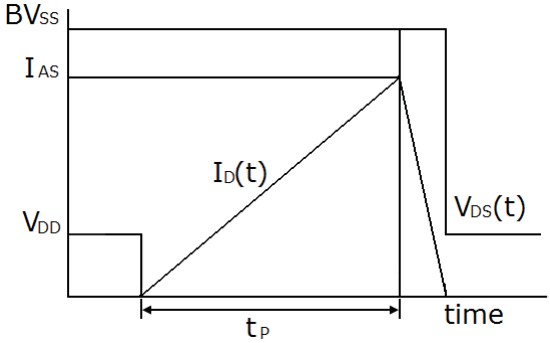
2）Switch Time Test Circuit：



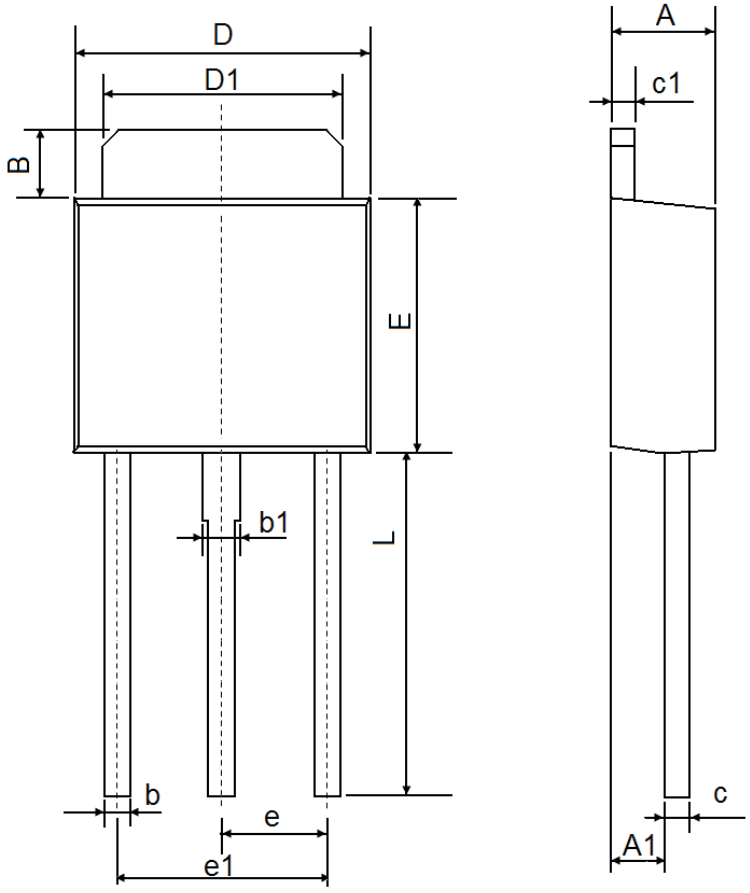


3）Unclamped Inductive Switching Test Circuit & Waveforms



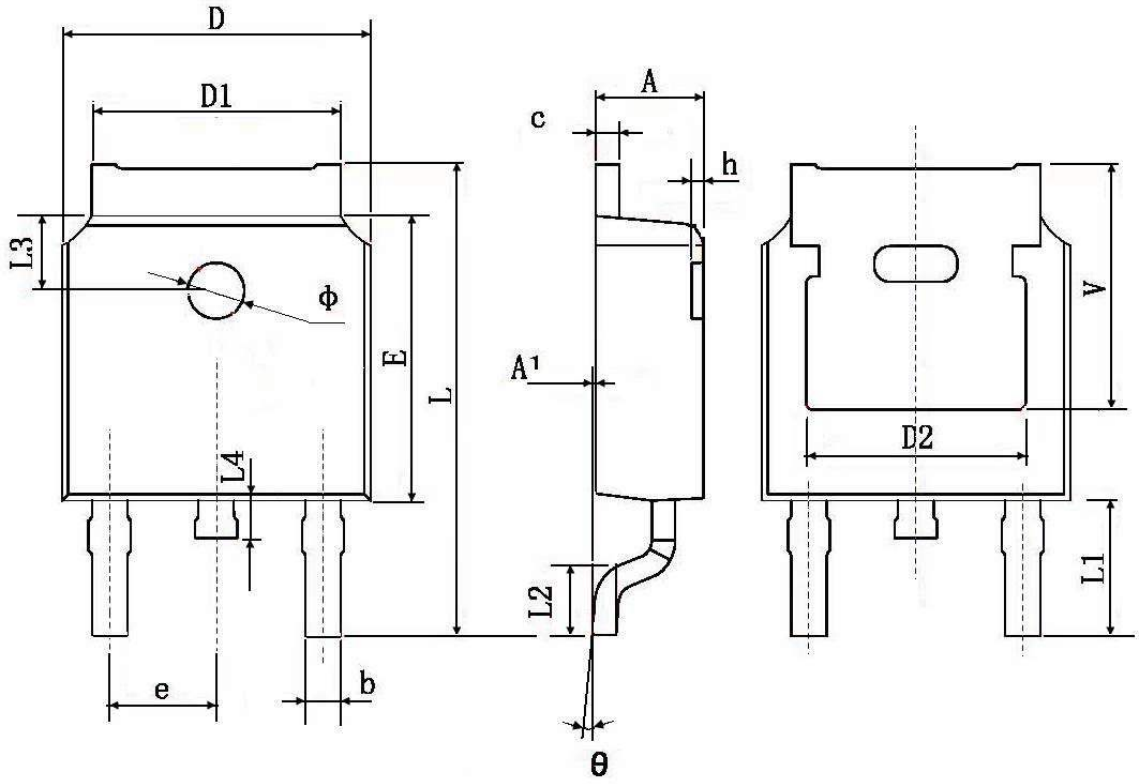


TO-251 Package Information



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.	

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