

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.

Features

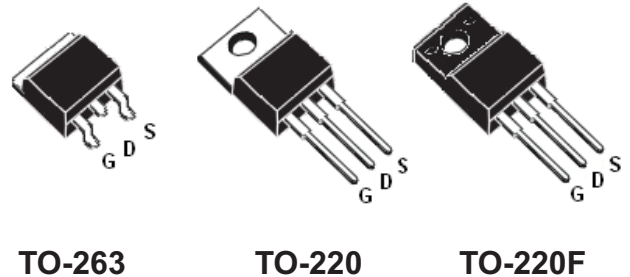
- New technology for high voltage device
- Low on-resistance and low conduction losses
- Small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested
- ROHS compliant

Application

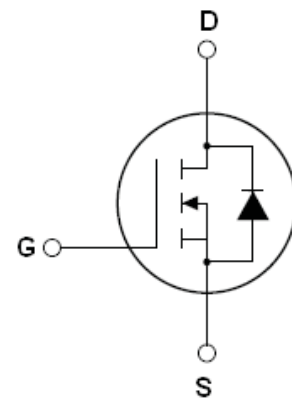
- Power factor correction (PFC)
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply (UPS)

Package Marking And Ordering Information

Device	Device Package	Marking
RM8N650HD	TO-263	8N650
RM8N650T2	TO-220	8N650
RM8N650T1	TO-220F	8N650



V_{DS}	650	V
$R_{DS(ON) MAX}$	540	m Ω
I_D	8	A



Schematic diagram

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

Parameter	Symbol	RM8N650HD RM8N650T2	RM8N650T1	Unit
Drain-Source Voltage ($V_{GS}=0V$)	V_{DS}	650		V
Gate-Source Voltage ($V_{DS}=0V$)	V_{GS}	± 30		V
Continuous Drain Current at $T_C=25^\circ\text{C}$	$I_{D(DC)}$	8	8*	A
Continuous Drain Current at $T_C=100^\circ\text{C}$	$I_{D(DC)}$	5.2	5.2*	A
Pulsed drain current (Note 1)	$I_{DM(pluse)}$	24	24*	A
Maximum Power Dissipation ($T_C=25^\circ\text{C}$)	P_D	80	31.7	W
Derate above 25°C		0.64	0.25	W/ $^\circ\text{C}$
Single pulse avalanche energy (Note 2)	E_{AS}	185		mJ
Avalanche current (Note 1)	I_{AR}	4		A
Repetitive Avalanche energy, t_{AR} limited by T_{jmax} (Note 1)	E_{AR}	0.4		mJ

Parameter	Symbol	RM8N650HD RM8N650T2	RM8N650T1	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

* limited by maximum junction temperature

Table 2. Thermal Characteristic

Parameter	Symbol	RM8N650HD RM8N650T2	RM8N650T1	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R_{thJC}	1.56	3.94	°C / W
Thermal Resistance, Junction-to-Ambient (Maximum)	R_{thJA}	62	80	°C / W

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
On/off states						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	650			V
Zero Gate Voltage Drain Current($T_c=25^\circ C$)	I_{DSS}	$V_{DS}=650V, V_{GS}=0V$			1	μA
Zero Gate Voltage Drain Current($T_c=125^\circ C$)	I_{DSS}	$V_{DS}=650V, V_{GS}=0V$			100	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 30V, V_{DS}=0V$			± 100	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.5	3	3.5	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=4A$		480	540	m Ω
Dynamic Characteristics						
Forward Transconductance	g_{FS}	$V_{DS} = 20V, I_D = 4A$		5.5		S
Input Capacitance	C_{iss}	$V_{DS}=50V, V_{GS}=0V,$ $F=1.0MHz$		680		pF
Output Capacitance	C_{oss}			58		pF
Reverse Transfer Capacitance	C_{rss}			4		pF
Total Gate Charge	Q_g	$V_{DS}=480V, I_D=8A,$ $V_{GS}=10V$		14.5	22	nC
Gate-Source Charge	Q_{gs}			2.8		nC
Gate-Drain Charge	Q_{gd}			5.5		nC
Intrinsic gate resistance	R_G	$f = 1 MHz$ open drain		2		Ω
Switching times						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=380V, I_D=4A,$ $R_G=12\Omega, V_{GS}=10V$		5.5		nS
Turn-on Rise Time	t_r			3.5		nS
Turn-Off Delay Time	$t_{d(off)}$			55	75	nS
Turn-Off Fall Time	t_f			6.5	10	nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	$T_c=25^\circ C$			8	A
Pulsed Source-drain current(Body Diode)	I_{SDM}				23.4	A
Forward On Voltage	V_{SD}	$T_j=25^\circ C, I_{SD}=8A, V_{GS}=0V$		0.9	1.2	V
Reverse Recovery Time	t_{rr}	$T_j=25^\circ C, I_F=8A, di/dt=100A/\mu s$		220		nS
Reverse Recovery Charge	Q_{rr}				2.2	μC
Peak Reverse Recovery Current	I_{rrm}				20	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 (RM8N650HD/T1/T2)

Figure1. Safe operating area

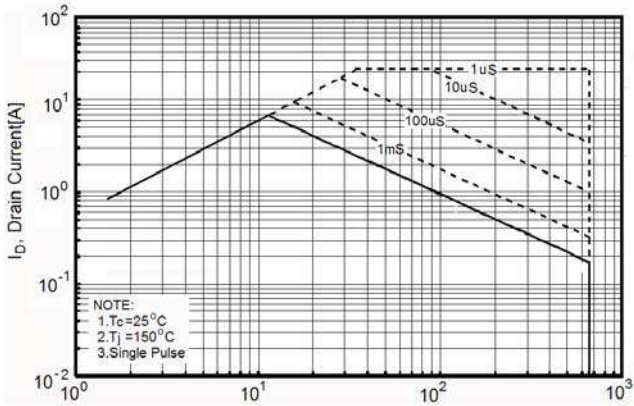


Figure2. Safe operating area for TO-220F

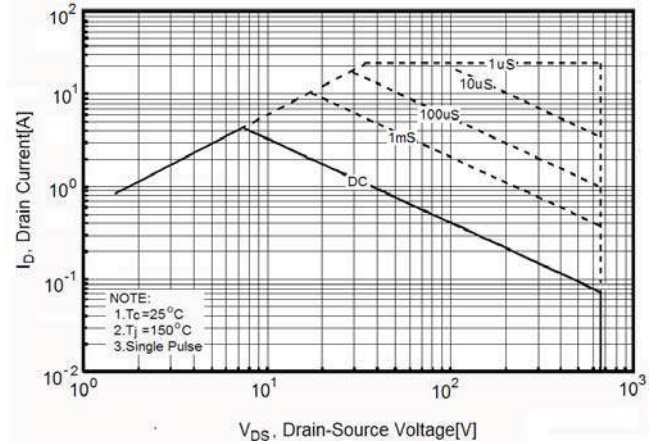


Figure3. Source-Drain Diode Forward Voltage

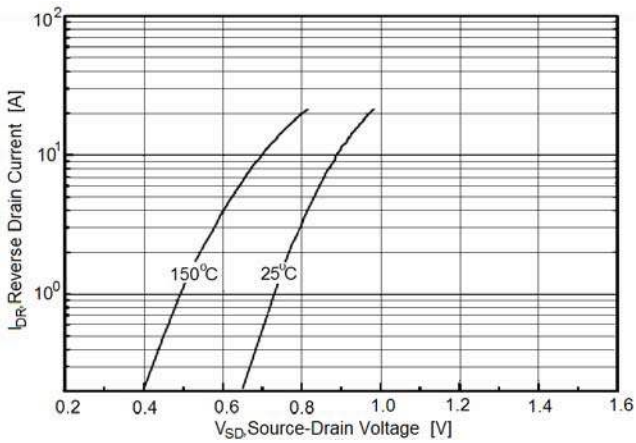


Figure4. Output characteristics

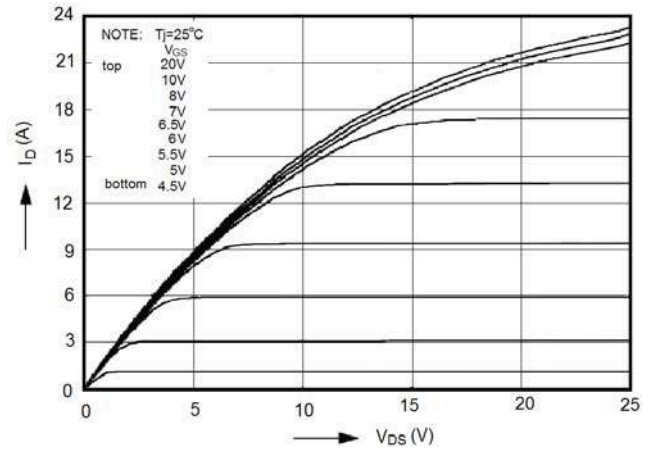


Figure5. Transfer characteristics

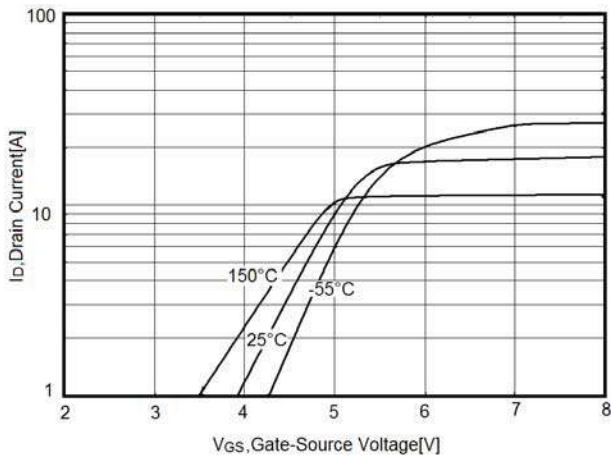
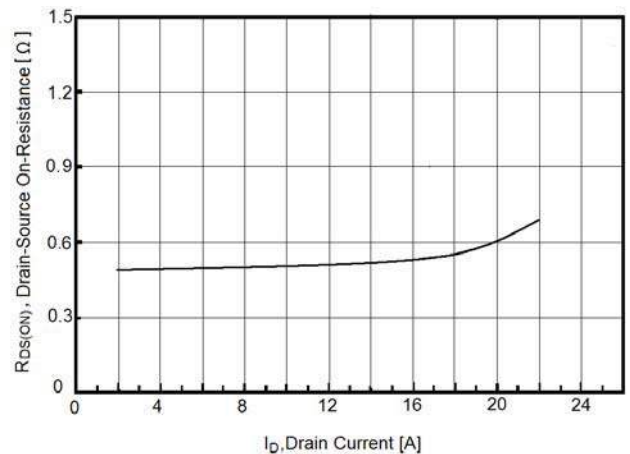


Figure6. Static drain-source on resistance



RATING AND CHARACTERISTICS CURVES (RM8N650HD/T1/T2)

Figure7. $R_{DS(ON)}$ vs Junction Temperature

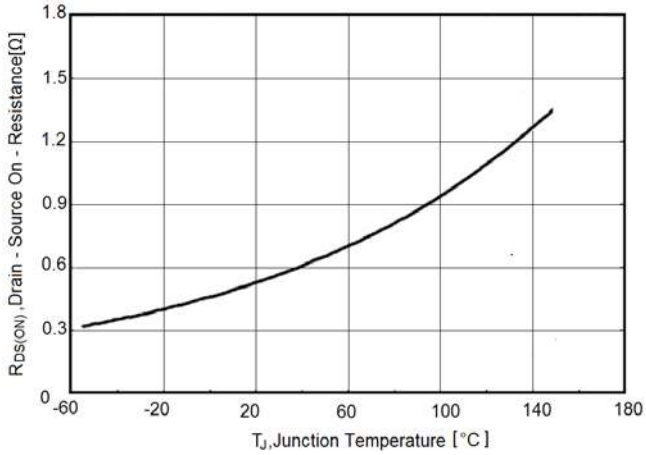


Figure8. BV_{DSS} vs Junction Temperature

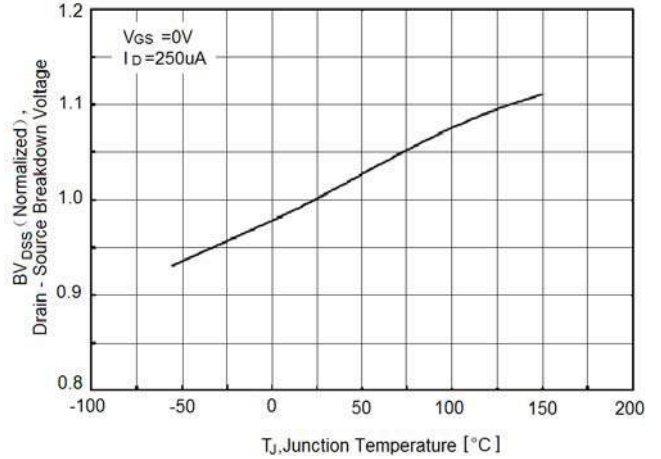


Figure9. Maximum I_D vs Junction Temperature

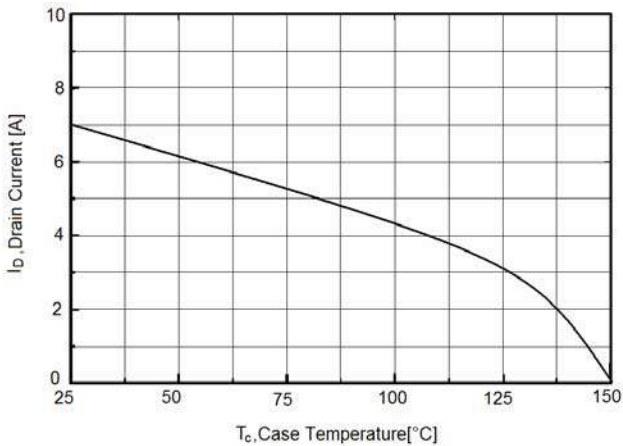


Figure10. Gate charge waveforms

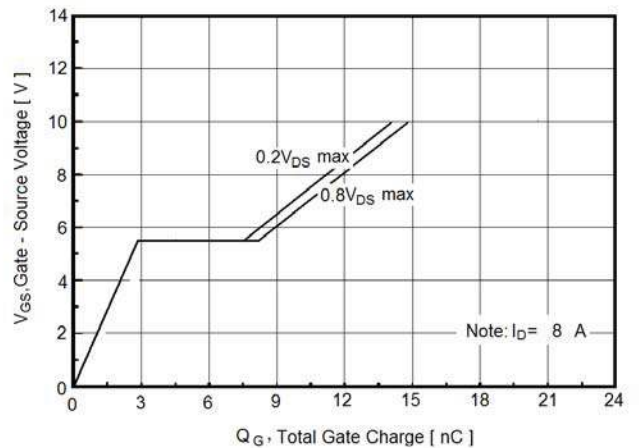


Figure11. Capacitance

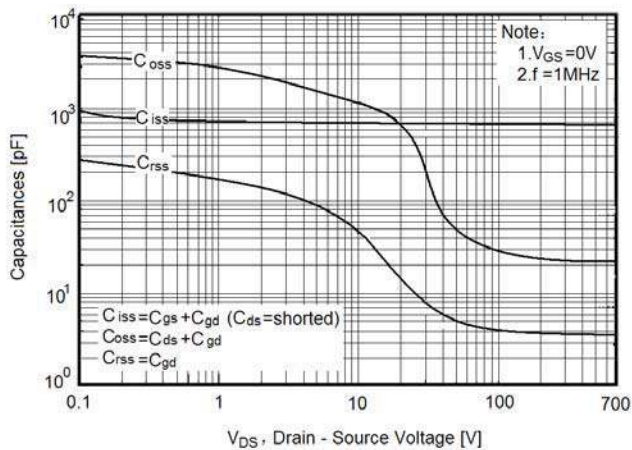
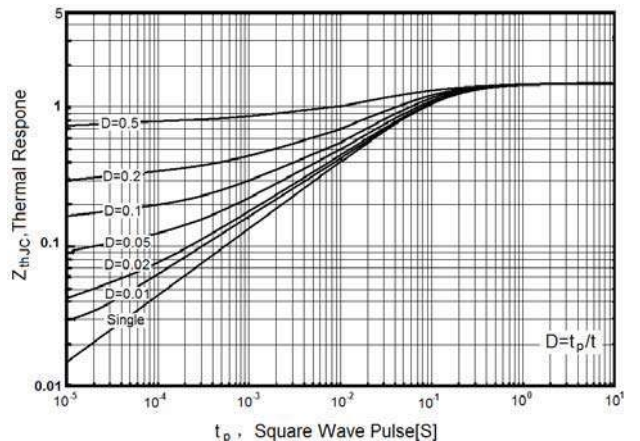
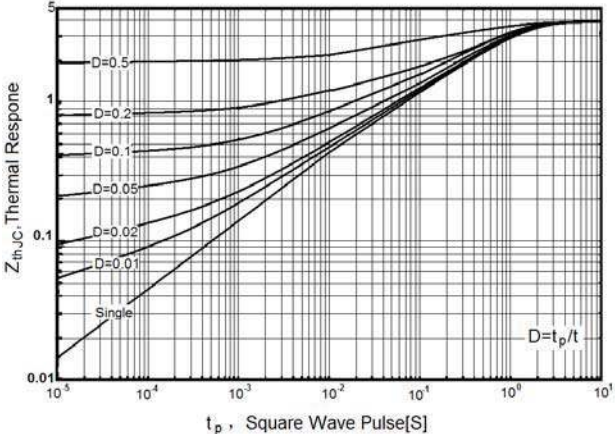


Figure12. Transient Thermal Impedance



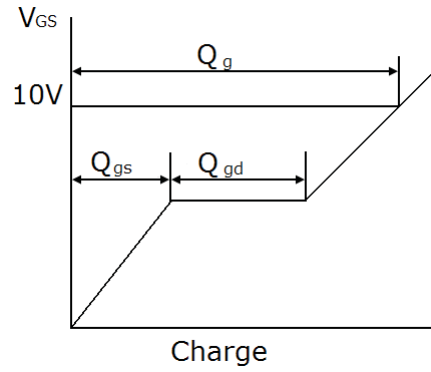
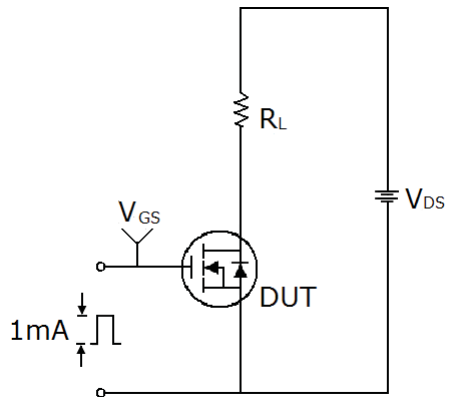
RATING AND CHARACTERISTICS CURVES (RM8N650HD/T1/T2)

Figure13. Transient Thermal Impedance for TO-220F

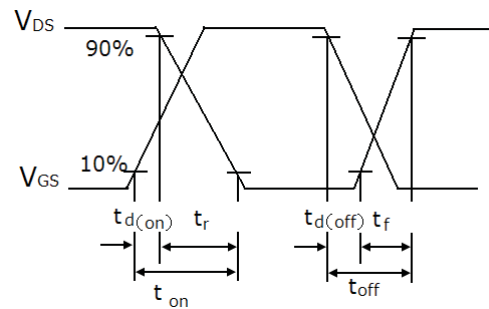
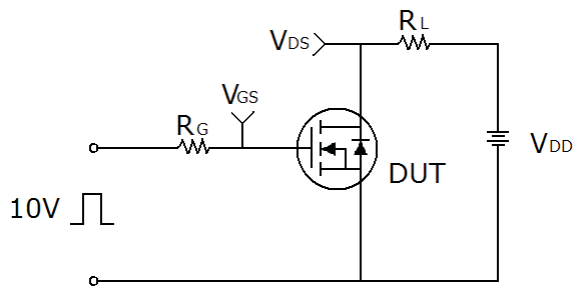


Test circuit

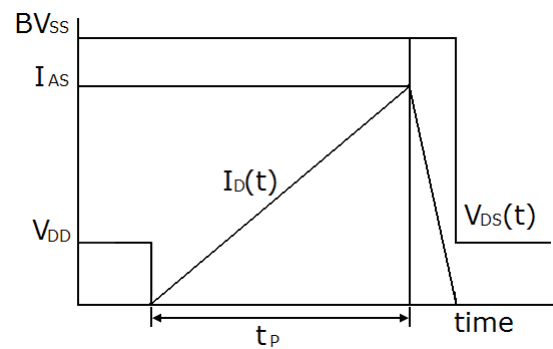
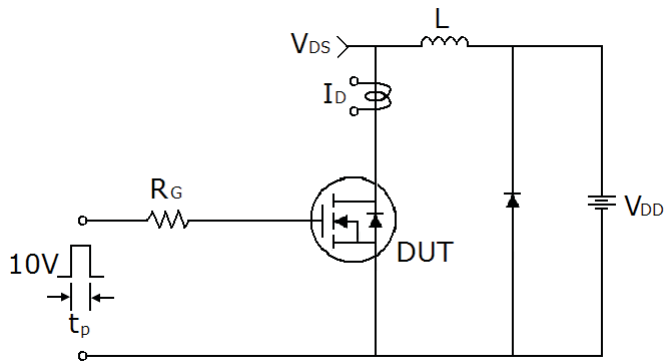
1) Gate charge test circuit & Waveform



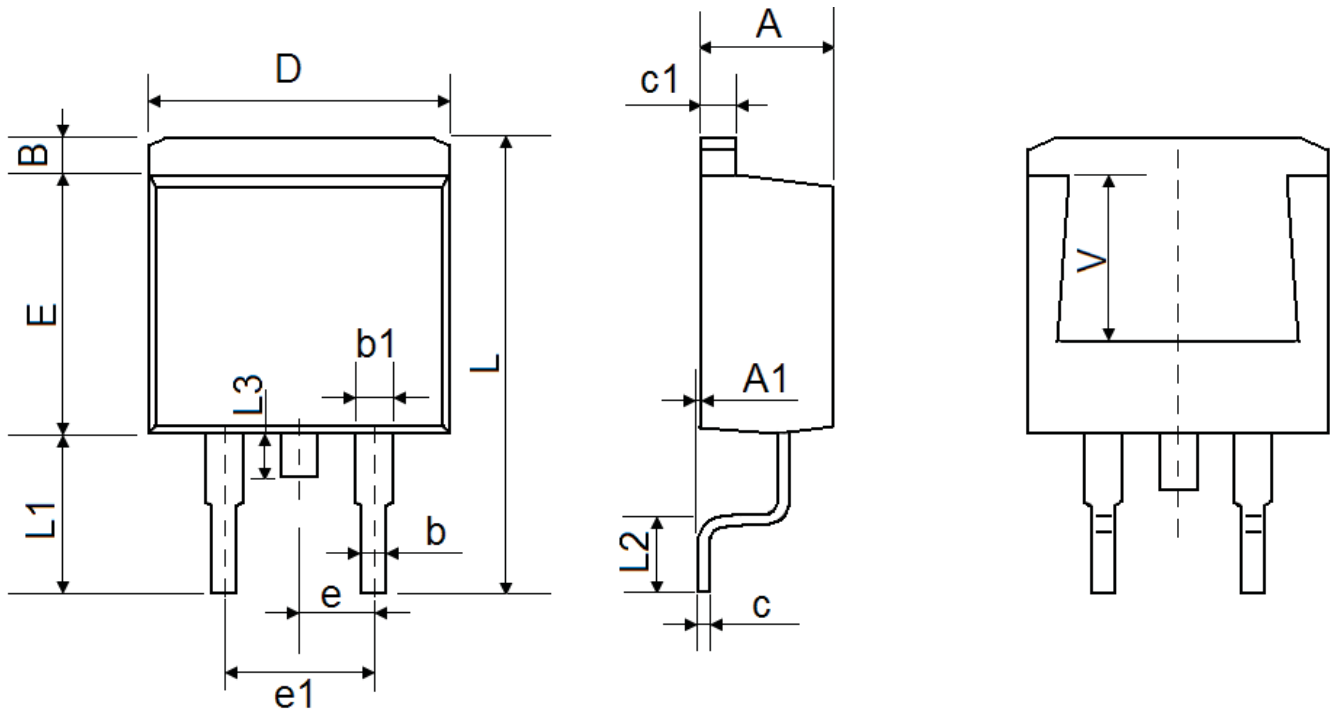
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms

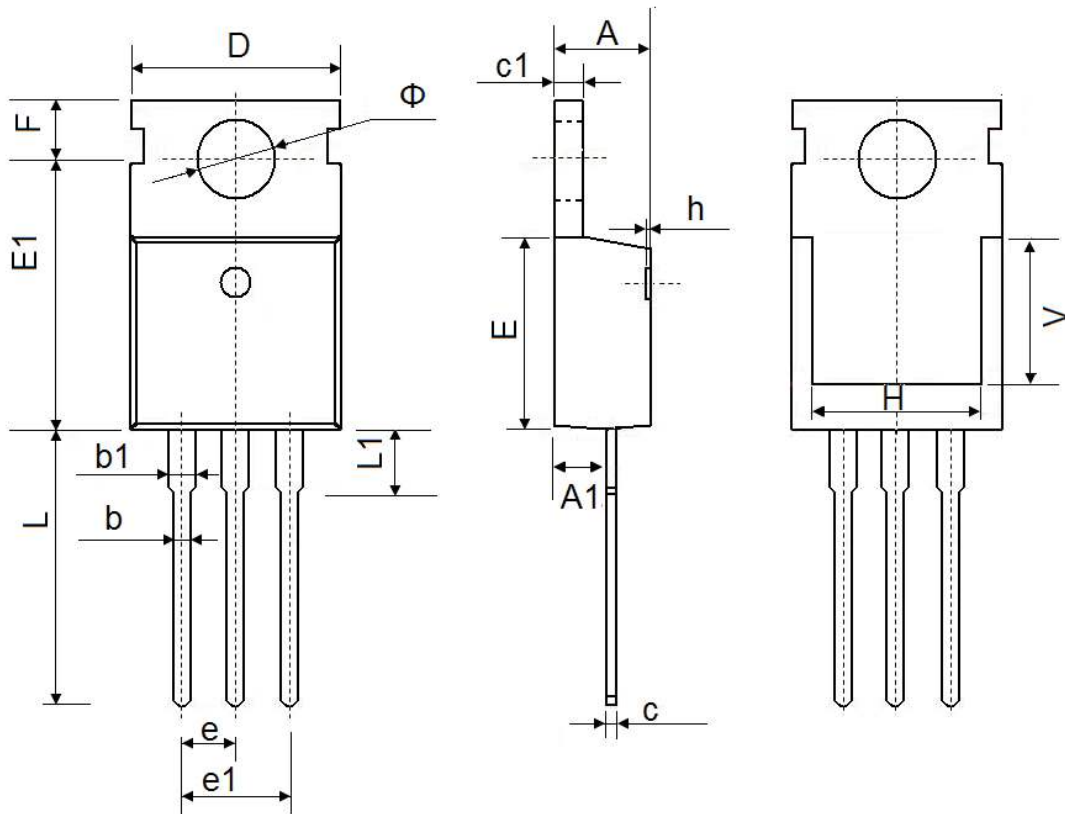


TO-263-2L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.470	4.670	0.176	0.184
A1	0.000	0.150	0.000	0.006
B	1.170	1.370	0.046	0.054
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.310	0.530	0.012	0.021
c1	1.170	1.370	0.046	0.054
D	10.010	10.310	0.394	0.406
E	8.500	8.900	0.335	0.350
e	2.540 TYP.		0.100 TYP.	
e1	4.980	5.180	0.196	0.204
L	15.050	15.450	0.593	0.608
L1	5.080	5.480	0.200	0.216
L2	2.340	2.740	0.092	0.108
L3	1.300	1.700	0.051	0.067
V	5.600 REF		0.220 REF	

TO-220-3L-C Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.400	4.600	0.173	0.181
A1	2.250	2.550	0.089	0.100
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.330	0.650	0.013	0.026
c1	1.200	1.400	0.047	0.055
D	9.910	10.250	0.390	0.404
E	8.9500	9.750	0.352	0.384
E1	12.650	12.950	0.498	0.510
e	2.540 TYP.		0.100 TYP.	
e1	4.980	5.180	0.196	0.204
F	2.650	2.950	0.104	0.116
H	7.900	8.100	0.311	0.319
h	0.000	0.300	0.000	0.012
L	12.900	13.400	0.508	0.528
L1	2.850	3.250	0.112	0.128
V	7.500 REF.		0.295 REF.	
Φ	3.400	3.800	0.134	0.150

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.