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.

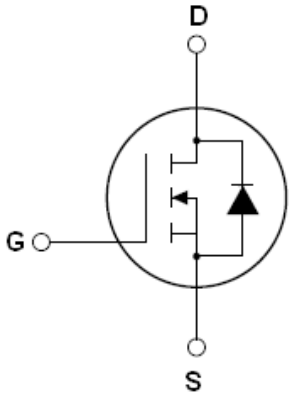
Features

- 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）

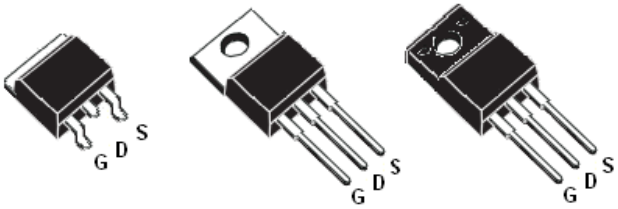
V_{DS}	650	V
$R_{DS(ON)\ MAX}$	1200	mΩ
I_D	4	A



Schematic diagram

Package Marking And Ordering Information

Device	Device Package	Marking
NCE65R1K2	TO-220	NCE65R1K2
NCE65R1K2D	TO-263	NCE65R1K2D
NCE65R1K2F	TO-220F	NCE65R1K2F



TO-263 **TO-220** **TO-220F**

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

Parameter	Symbol	NCE65R1K2 NCE65R1K2D	NCE65R1K2F	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 Tc=25°C	$I_{D\ (DC)}$	4	4*	A
Continuous Drain Current at Tc=100°C	$I_{D\ (DC)}$	2.5	2.5	A
Pulsed drain current **(Note 1)**	$I_{DM\ (pluse)}$	12	12	A
Maximum Power Dissipation(Tc=25℃) Derate above 25°C	P_D	46 0.37	28.5 0.23	W W/°C
Single pulse avalanche energy **(Note2)**	E_{AS}	130		mJ
Avalanche current **(Note 1)**	I_{AR}	2		A
Repetitive Avalanche energy ， t_{AR} limited by T_{jmax} **(Note 1)**	E_{AR}	0.2		mJ

Parameter	Symbol	NCE65R1K2 NCE65R1K2D	NCE65R1K2F	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		℃

* limited by maximum junction temperature

Table 2. Thermal Characteristic

Parameter	Symbol	Value		Unit
Thermal Resistance，Junction-to-Case（Maximum）	R_{thJC}	2.7	4.4	℃ /W
Thermal Resistance，Junction-to-Ambient （Maximum）	R_{thJA}	62	80	℃ /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}=±30V,V_{DS}=0V			±100	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=250μA	2.5	3	3.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=2.5A		1000	1200	mΩ
Dynamic Characteristics						
Forward Transconductance	g_{FS}	V_{DS} = 20V, I_D = 2.5A		4		S
Input Capacitance	C_{lss}	V_{DS}=50V,V_{GS}=0V, F=1.0MHz		280		PF
Output Capacitance	C_{oss}			26		PF
Reverse Transfer Capacitance	C_{rss}			2.3		PF
Total Gate Charge	Q_g	V_{DS}=480V,I_D=4A, V_{GS}=10V		6.5	10	nC
Gate-Source Charge	Q_{gs}			1.3		nC
Gate-Drain Charge	Q_{gd}			2.5		nC
Intrinsic gate resistance	R_G	f = 1 MHz open drain		2.5		Ω
Switching times						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=380V,I_D=2.5A, R_G=20Ω,V_{GS}=10V		6		nS
Turn-on Rise Time	t_r			3		nS
Turn-Off Delay Time	$t_{d(off)}$			48	60	nS
Turn-Off Fall Time	t_f			8	15	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}				12	A
Forward On Voltage	V_{SD}	Tj=25°C,I_{SD}=4A,V_{GS}=0V		1	1.3	V
Reverse Recovery Time	t_{rr}	Tj=25°C,I_F=4A,di/dt=100A/μs		150		nS
Reverse Recovery Charge	Q_{rr}			0.85		uC
Peak reverse recovery current	I_{rrm}			11		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 for TO-220,TO-263

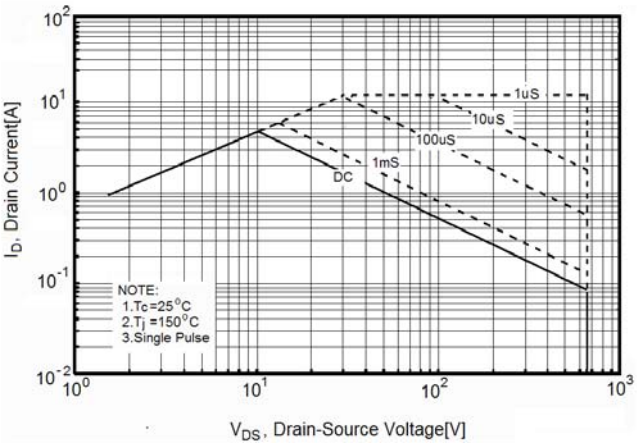


Figure2. Source-Drain Diode Forward Voltage

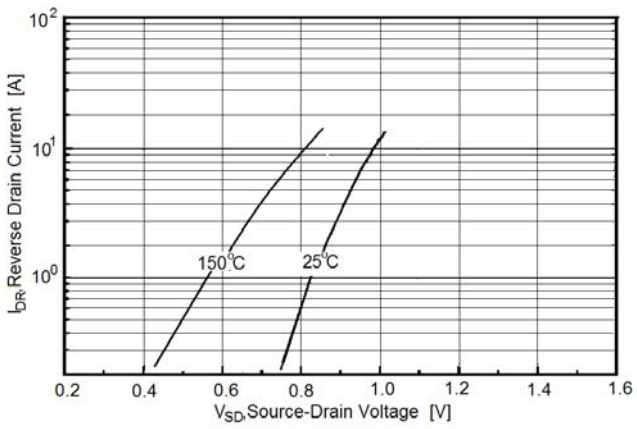


Figure3. Output characteristics

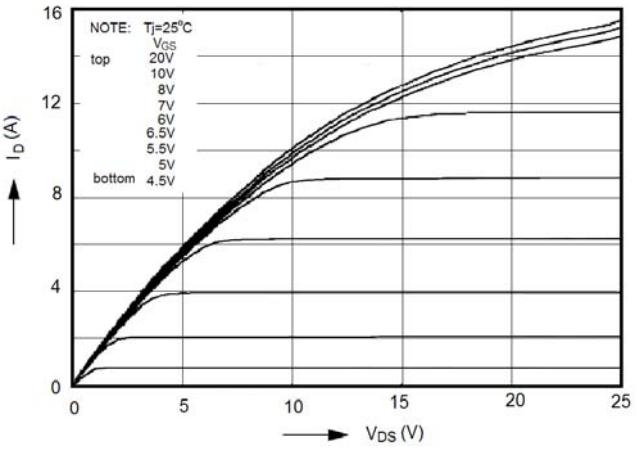


Figure4. Transfer characteristics

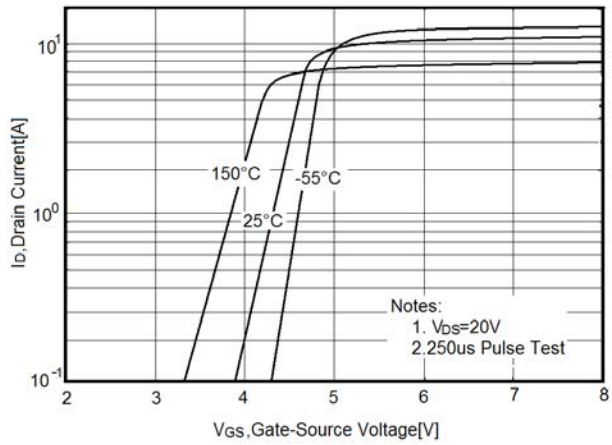


Figure5. Static drain-source on resistance

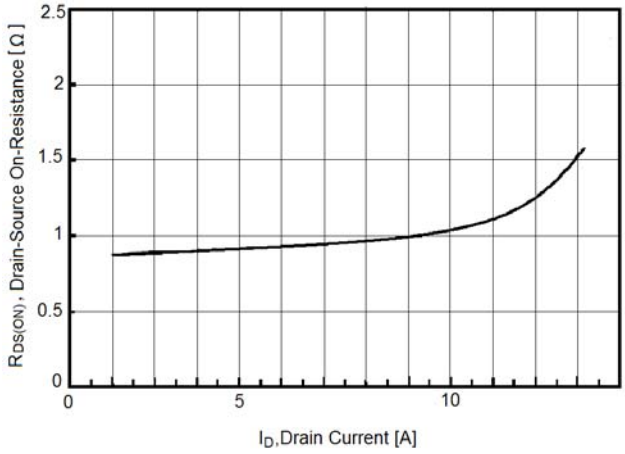


Figure6. $R_{DS(ON)}$ vs Junction Temperature

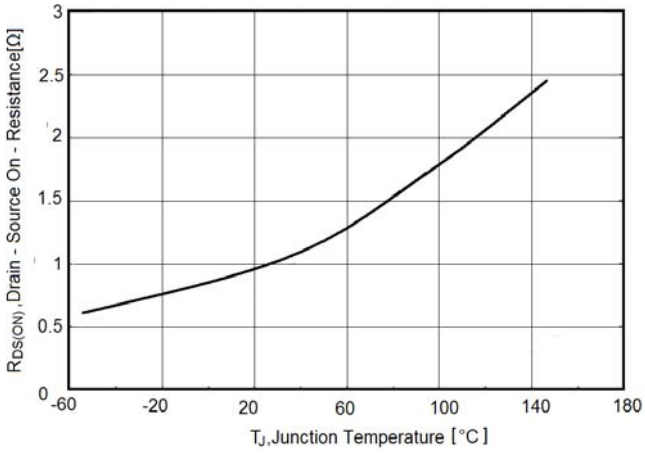


Figure7. BV_{DSS} vs Junction Temperature

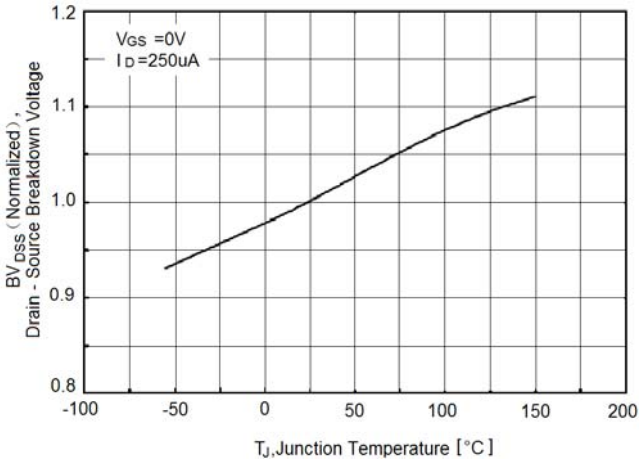


Figure8. Maximum I_D vs Junction Temperature

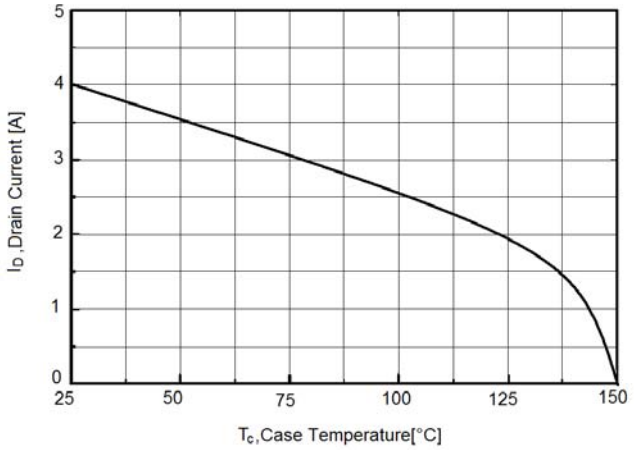


Figure9. Gate charge waveforms

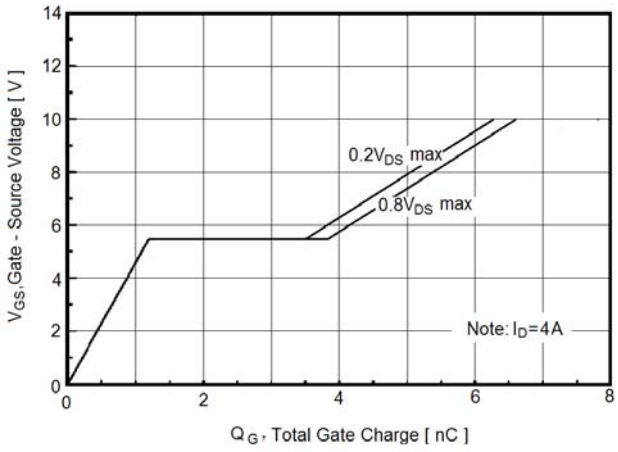


Figure10. Capacitance

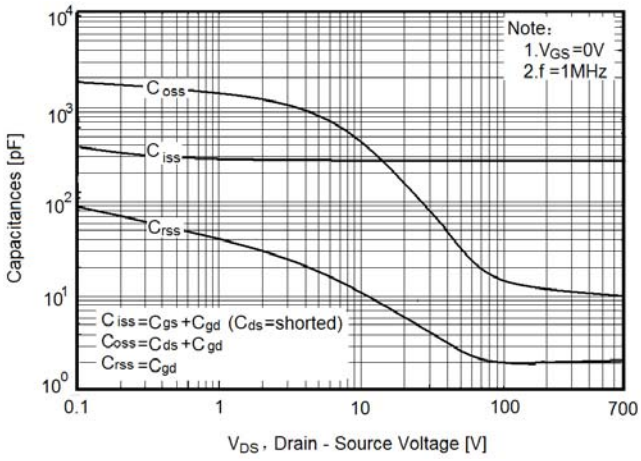


Figure11. Transient Thermal Impedance for TO-220,TO-263

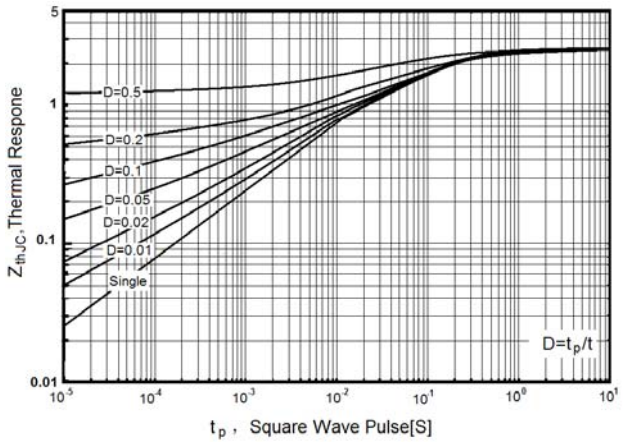


Figure12. Safe operating area for TO-220F

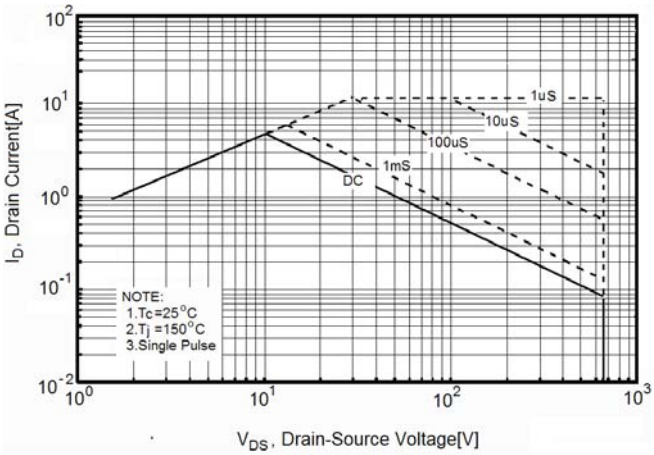
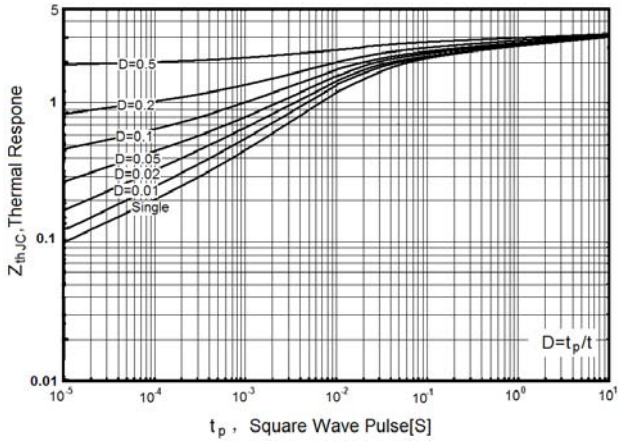
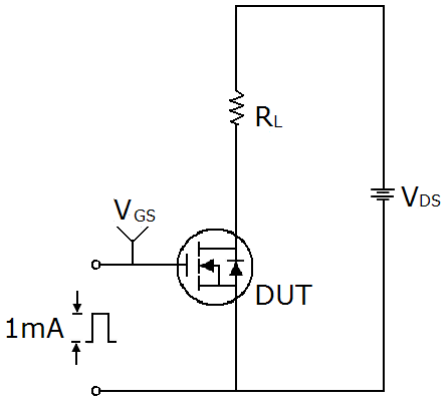


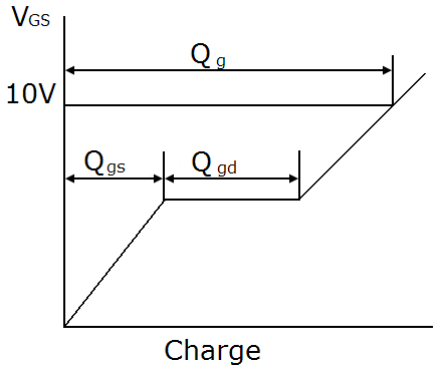
Figure13. Transient Thermal Impedance for TO-220F



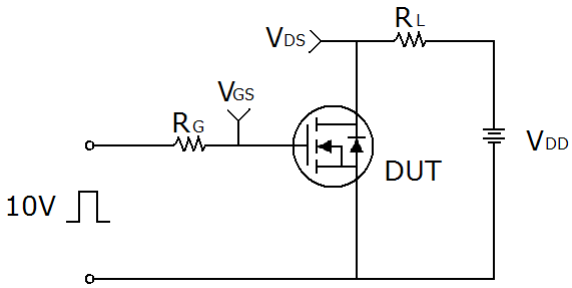
Test circuit

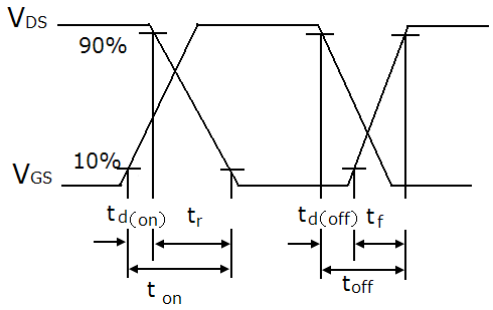
1）Gate charge test circuit & Waveform



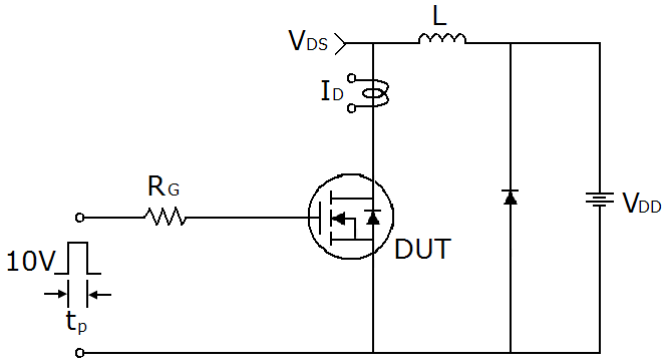


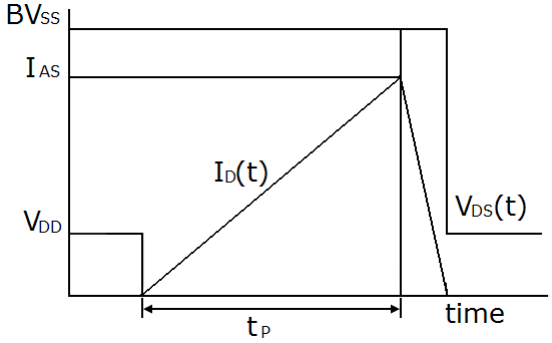
2）Switch Time Test Circuit：



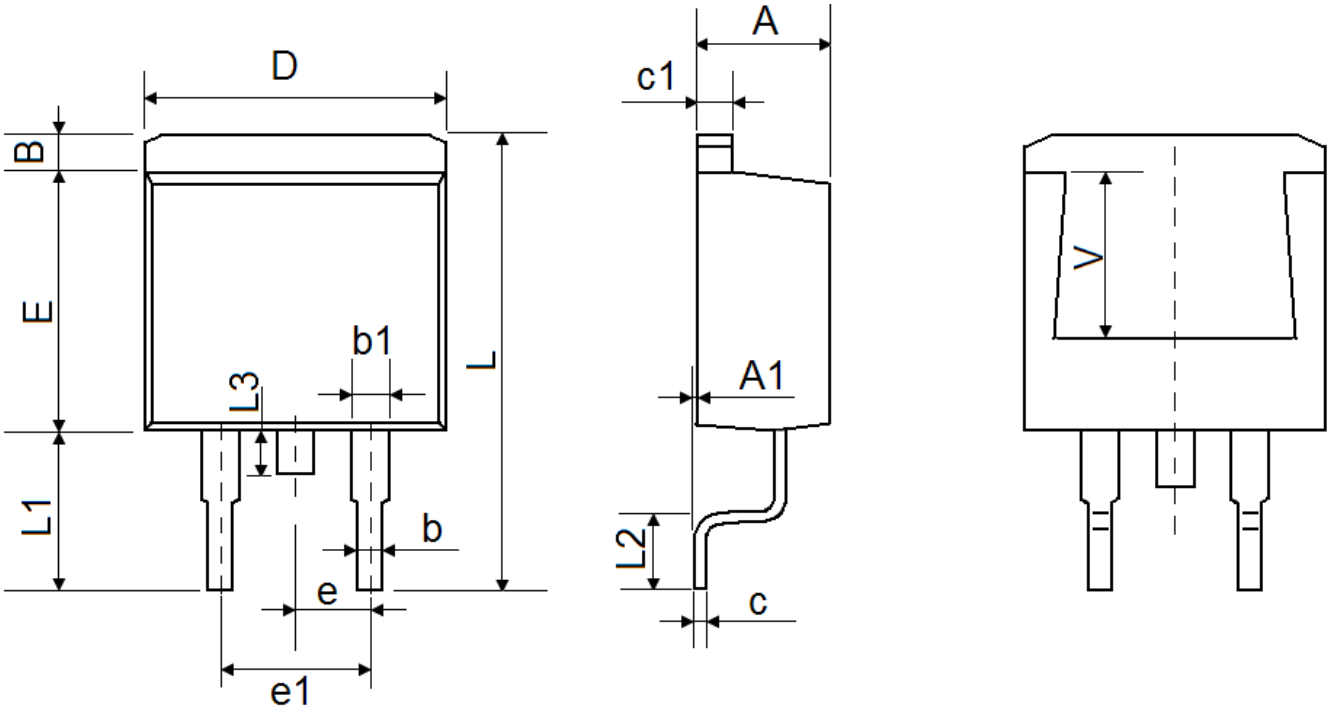


3）Unclamped Inductive Switching Test Circuit & Waveforms



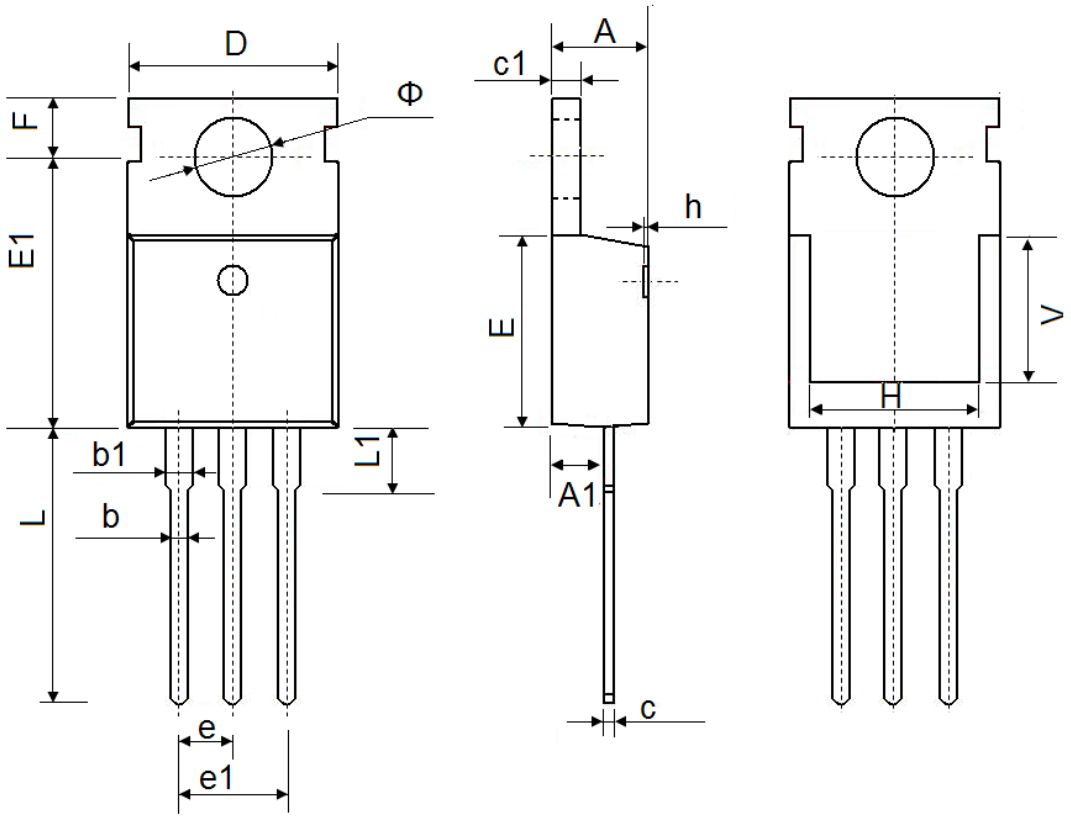


TO-263-2L Package Information



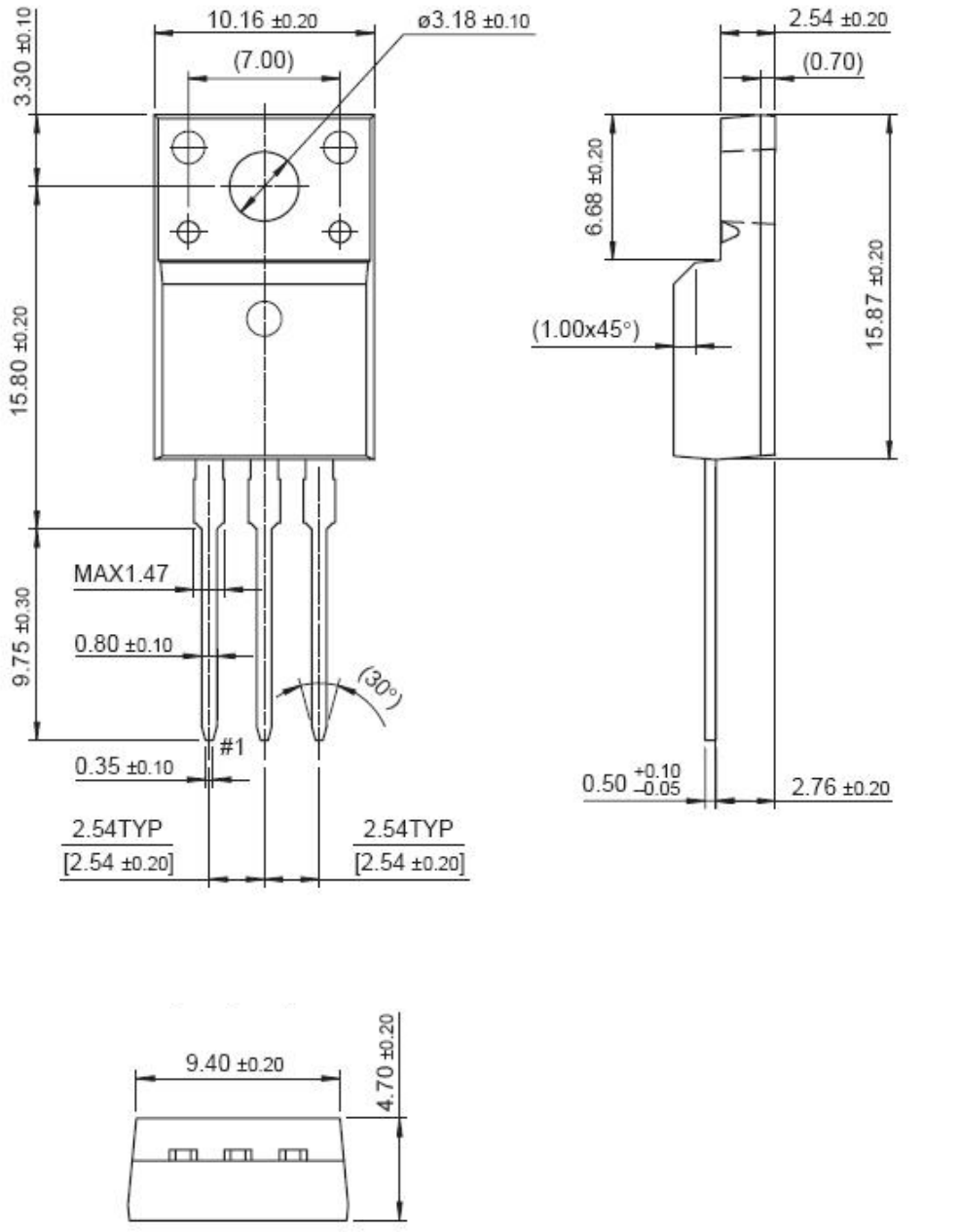
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.470	4.670	0.176	0.184
A1	0.000	0.150	0.000	0.006
B	1.170	1.370	0.046	0.054
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.310	0.530	0.012	0.021
c1	1.170	1.370	0.046	0.054
D	10.010	10.310	0.394	0.406
E	8.500	8.900	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

TO-220F Package Information



Dimensions in Millimeters

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