N-Channel Super Junction Power MOSFET Ⅲ

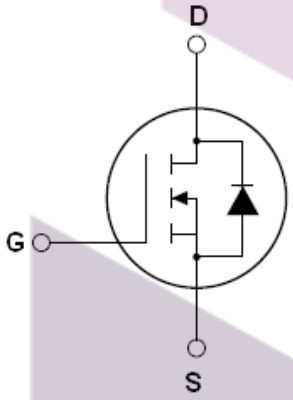
General Description

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}	650	V
$R_{DS(ON)TYP}$	110	mΩ
I_D	28	A

Features

- Optimized body diode reverse recovery performance
- Low on-resistance and low conduction losses
- Small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested
- ROHS compliant



Schematic diagram

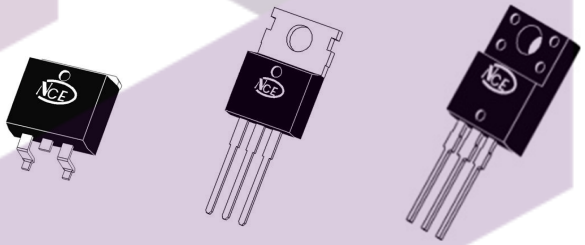
Application

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

✧ **Intrinsic fast-recovery body diode**

Package Marking And Ordering Information

Device	Device Package	Marking
NCE65TF130D	TO-263	NCE65TF130D
NCE65TF130	TO-220	NCE65TF130
NCE65TF130F	TO-220F	NCE65TF130F



TO-263 TO-220 TO-220F

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

Parameter	Symbol	NCE65TF130D NCE65TF130	NCE65TF130F	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	$I_{D\ (DC)}$	28	28*	A
Continuous Drain Current at Tc=100°C	$I_{D\ (DC)}$	18	18*	A
Pulsed drain current **(Note 1)**	$I_{DM\ (pluse)}$	112	112*	A
Maximum Power Dissipation(Tc=25℃) Derate above 25°C	P_D	260 2.08	35 0.28	W W/°C
Single pulse avalanche energy **(Note 2)**	E_{AS}	676		mJ
Avalanche current **(Note 1)**	I_{AR}	5.2		A
Repetitive Avalanche energy ， t_{AR} limited by T_{jmax} **(Note 1)**	E_{AR}	3.2		mJ

Parameter	Symbol	NCE65TF130D NCE65TF130	NCE65TF130F	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	50		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	NCE65TF130D NCE65TF130	NCE65TF130F	Unit
Thermal Resistance，Junction-to-Case（Maximum）	R_{thJC}	0.48	3.57	℃ /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			100	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	3.5	4	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=14A		110	130	mΩ
Dynamic Characteristics						
Input Capacitance	C_{lss}	V_{DS}=50V,V_{GS}=0V, F=1.0MHz		2070		pF
Output Capacitance	C_{oss}			120		pF
Reverse Transfer Capacitance	C_{rss}			0.5		pF
Total Gate Charge	Q_g	V_{DS}=480V,I_D=28A, V_{GS}=10V		37.5		nC
Gate-Source Charge	Q_{gs}			13		nC
Gate-Drain Charge	Q_{gd}			11.5		nC
Switching times						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=380V,I_D=14A, R_G=2.3Ω,V_{GS}=10V		14		nS
Turn-on Rise Time	t_r			12		nS
Turn-Off Delay Time	$t_{d(off)}$			65		nS
Turn-Off Fall Time	t_f			11		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	T_C=25°C			28	A
Pulsed Source-drain current(Body Diode)	I_{SDM}				112	A
Forward On Voltage	V_{SD}	Tj=25°C,I_{SD}=28A,V_{GS}=0V		0.9	1.2	V
Reverse Recovery Time	t_{rr}	Tj=25°C,I_F=14A,di/dt=100A/μs		190		nS
Reverse Recovery Charge	Q_{rr}			2		uC
Peak Reverse Recovery Current	I_{rrm}			21		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

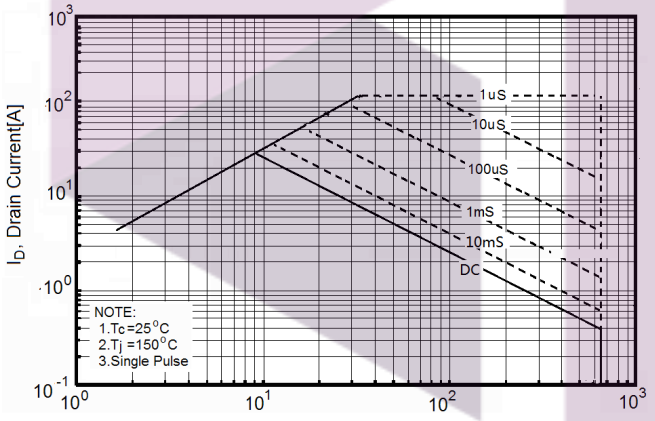


Figure2. Safe operating area for TO-220F

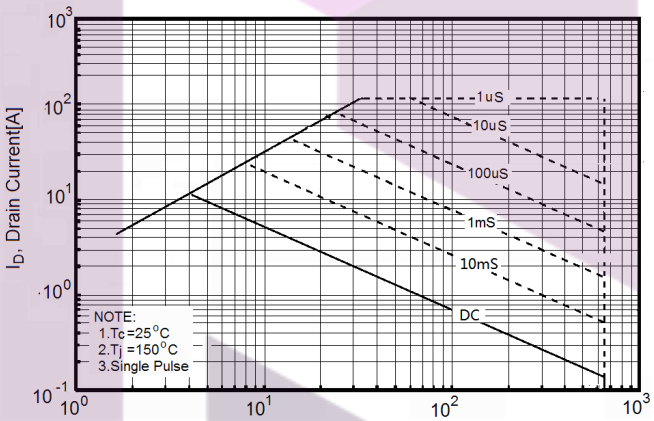


Figure3. Source-Drain Diode Forward Voltage

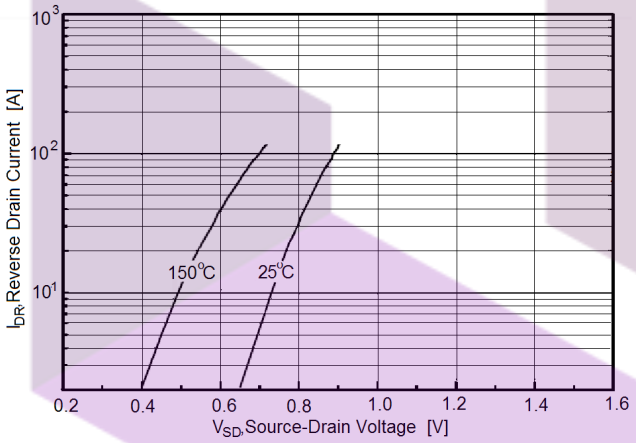


Figure4. Output characteristics

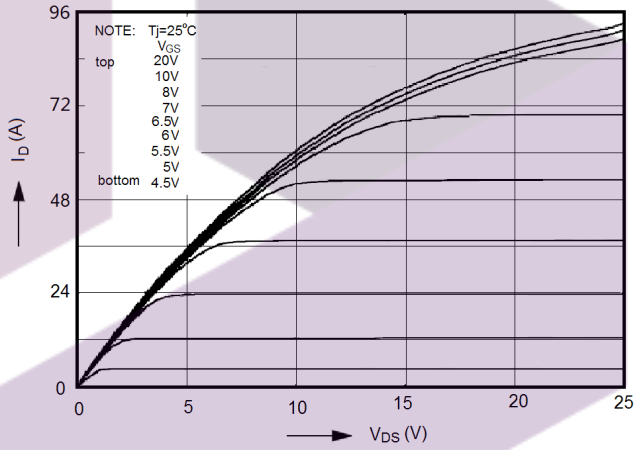


Figure5. Transfer characteristics

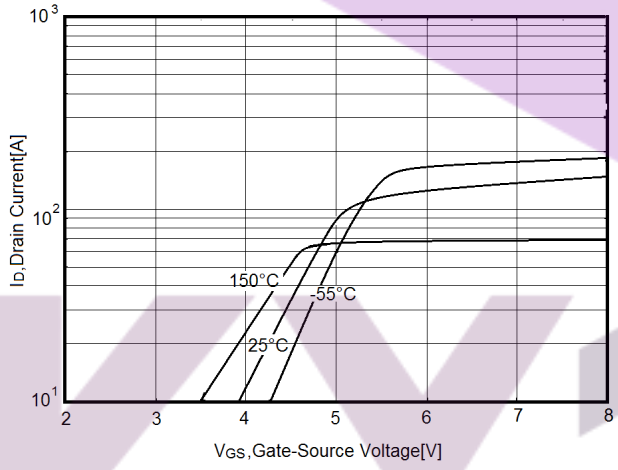


Figure6. Static drain-source on resistance

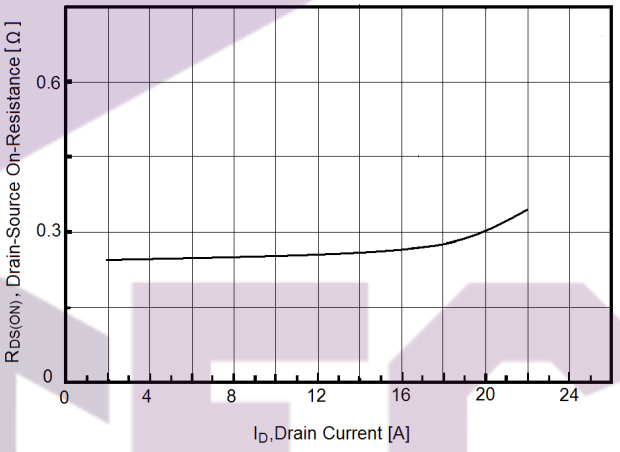


Figure7. $R_{DS(ON)}$ vs Junction Temperature

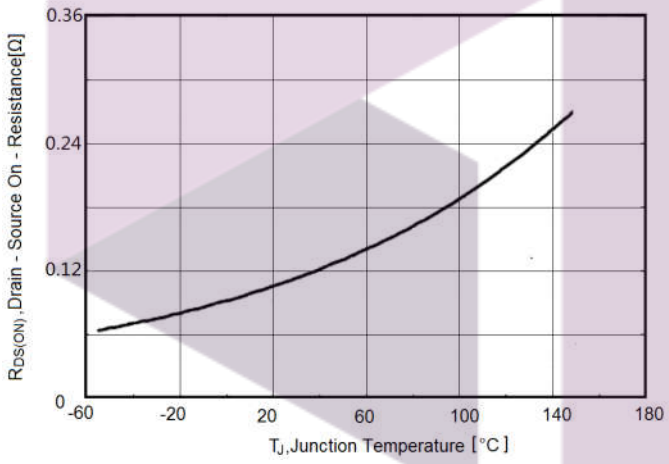


Figure8. BV_{DSS} vs Junction Temperature

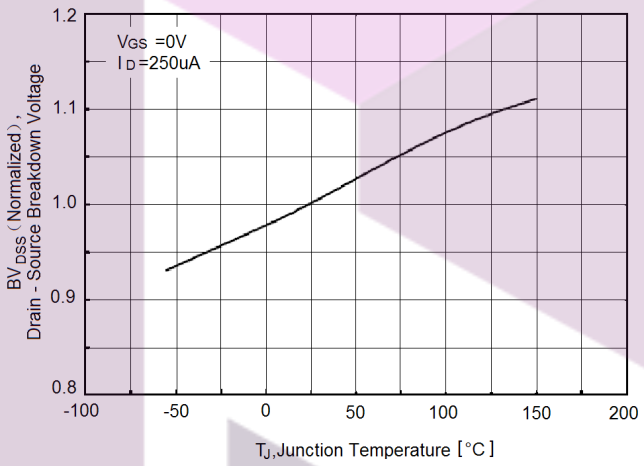


Figure9. Maximum I_D vs Junction Temperature

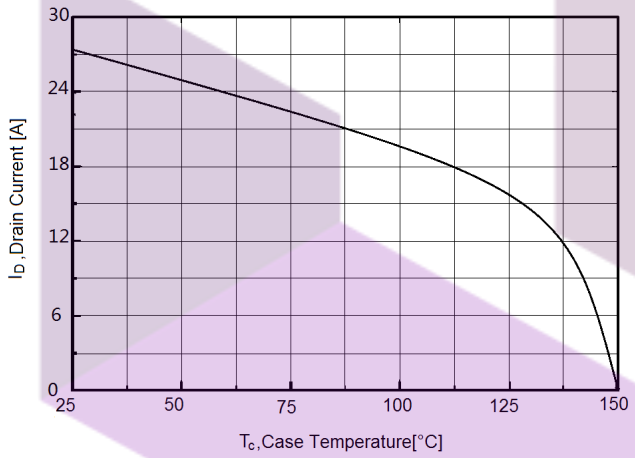


Figure10. Gate charge waveforms

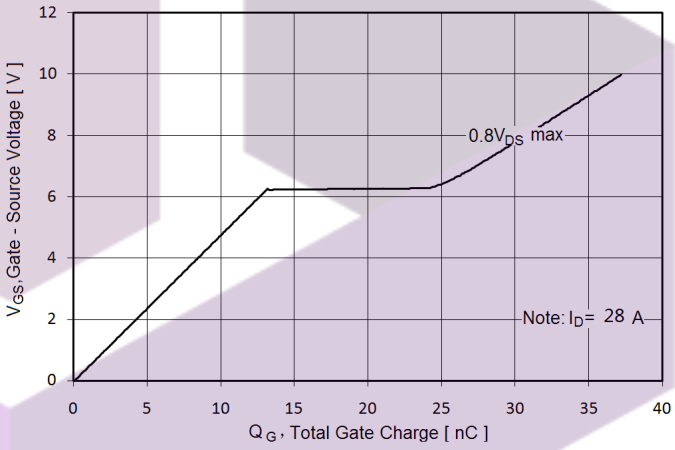


Figure11. Capacitance

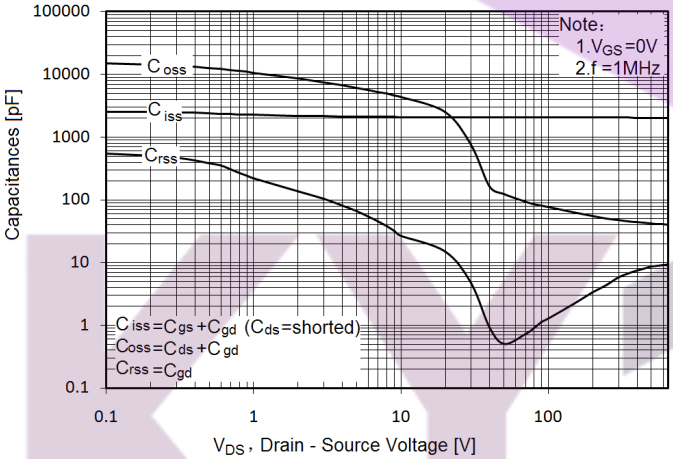


Figure12. Transient Thermal Impedance

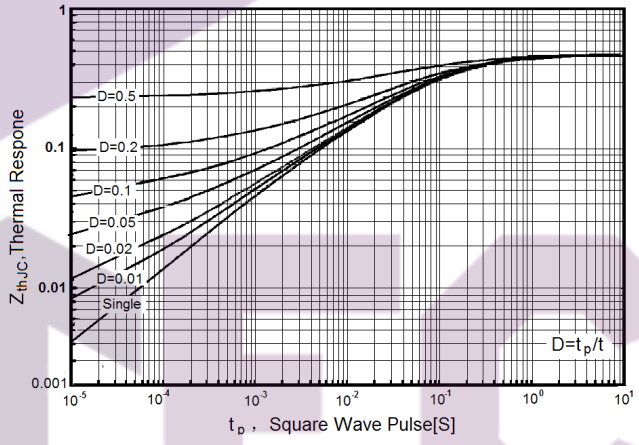
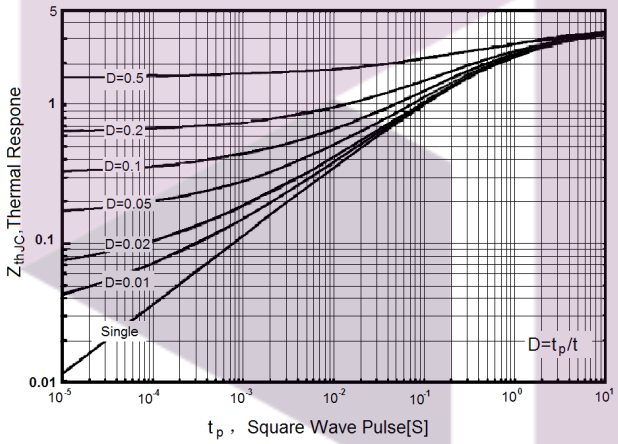
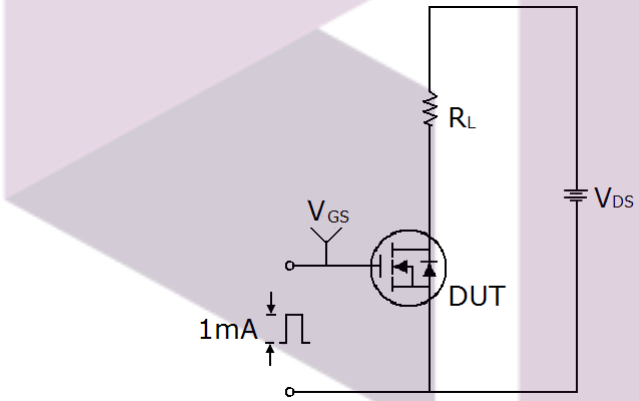


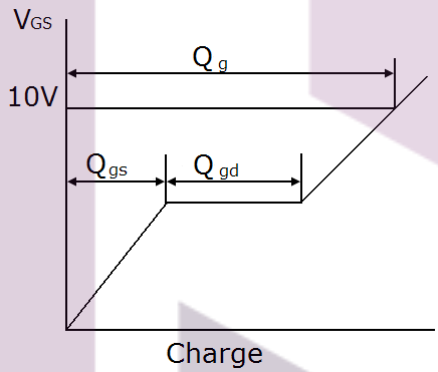
Figure13. Transient Thermal Impedance for TO-220F



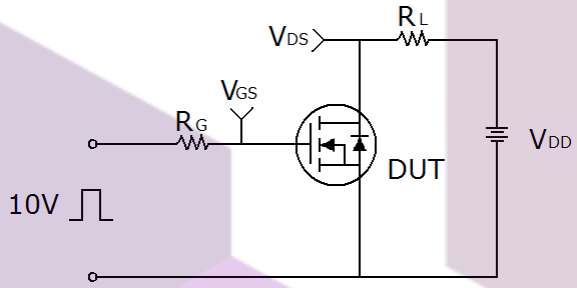
Test circuit

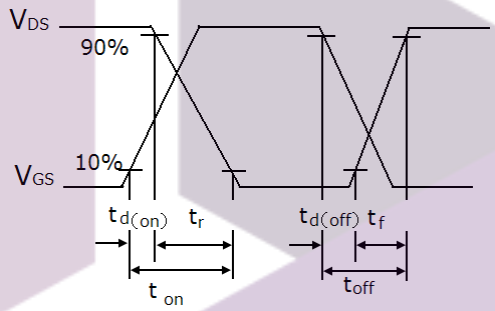
1）Gate charge test circuit & Waveform



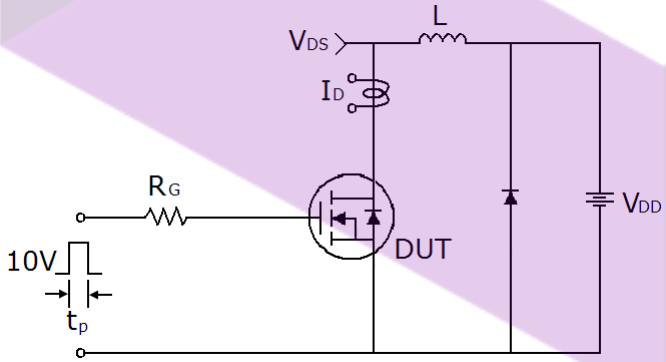


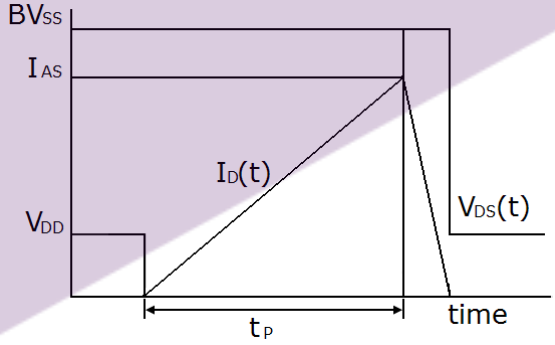
2）Switch Time Test Circuit:



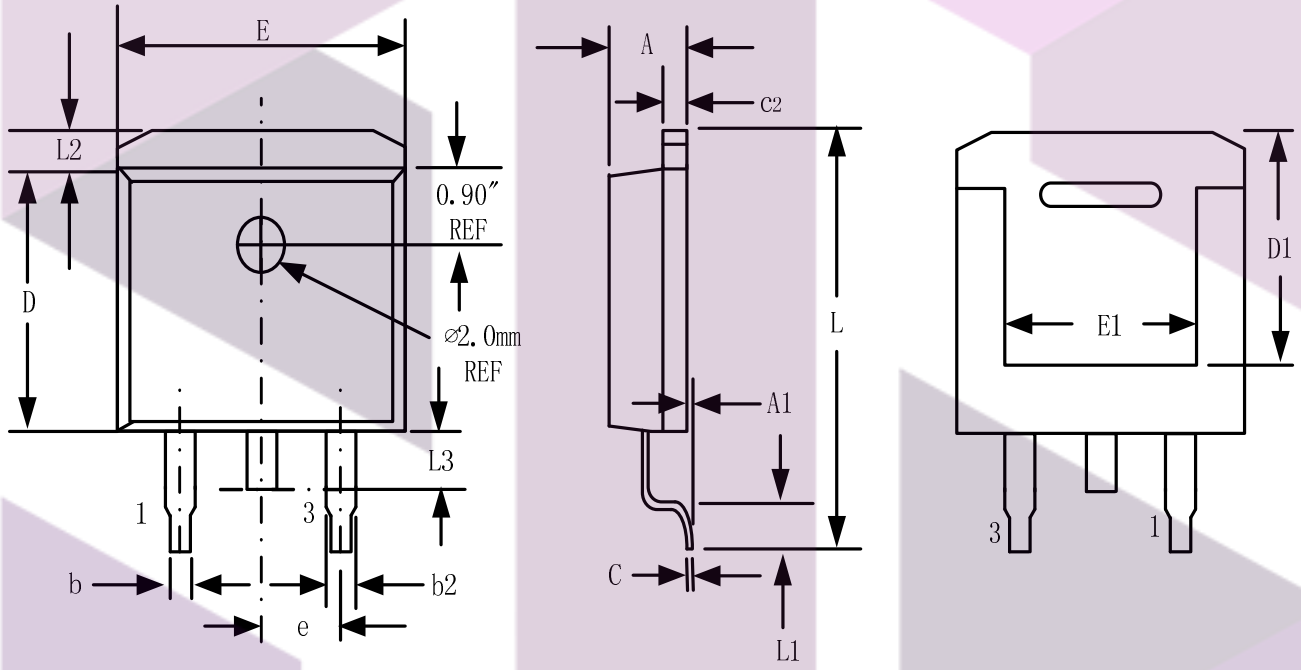


3）Unclamped Inductive Switching Test Circuit & Waveforms



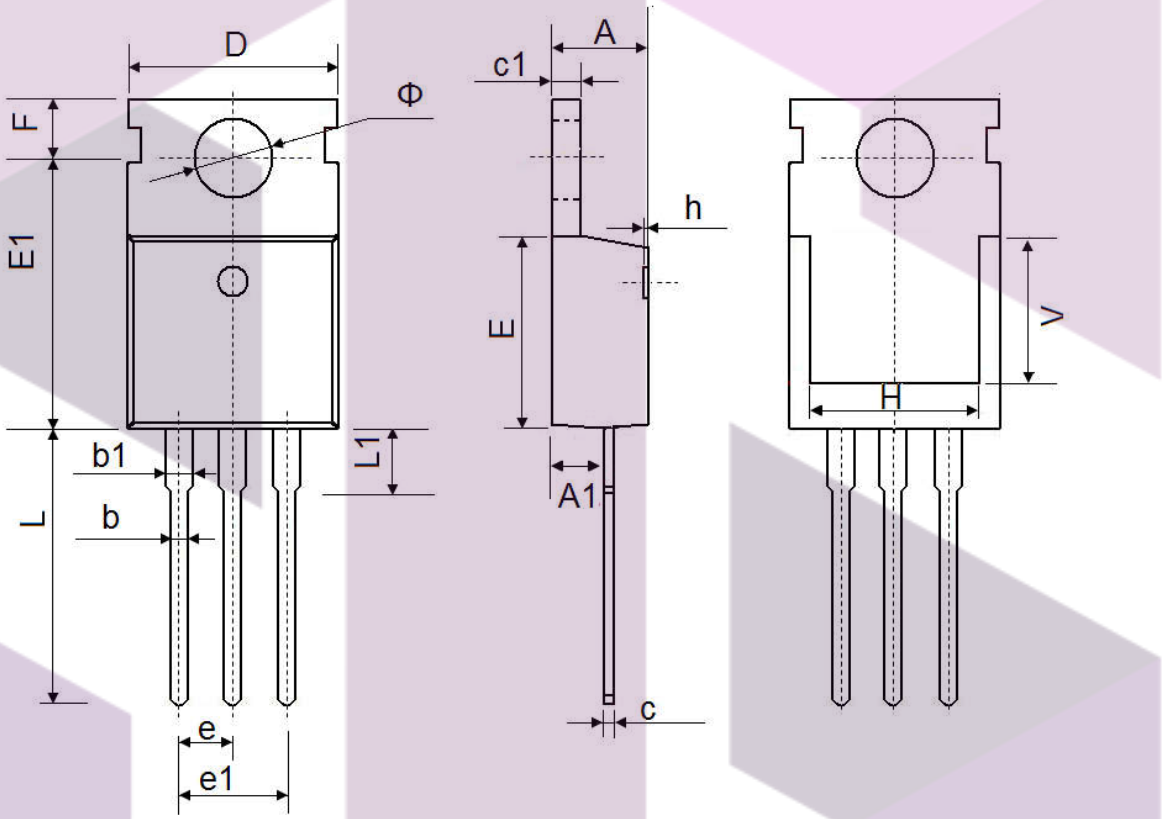


TO-263-3L Package Information



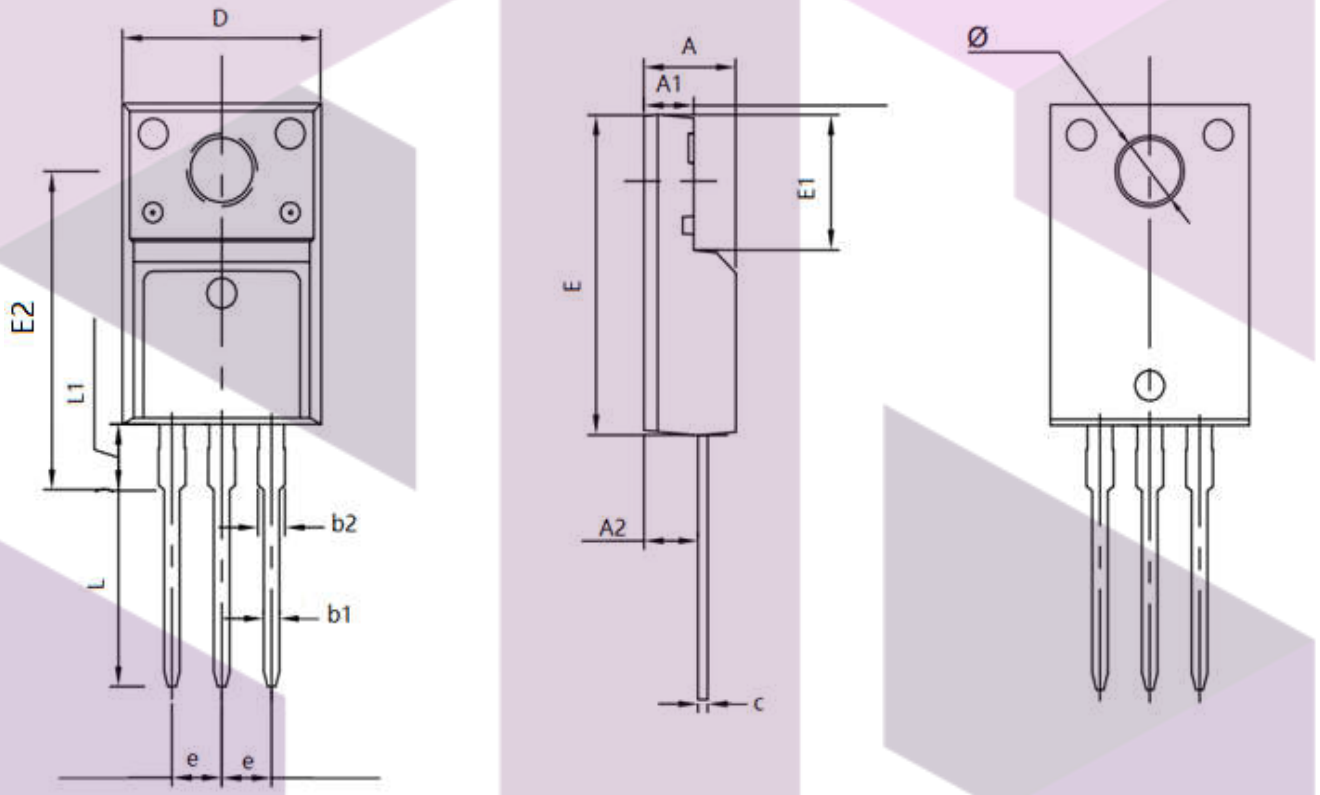
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.32	4.57	0.170	0.180
A1	-	0.25		0.010
b	0.71	0.94	0.028	0.037
b2	1.15	1.40	0.045	0.055
c	0.46	0.61	0.018	0.024
c2	1.22	1.40	0.048	0.055
D	8.89	9.40	0.350	0.370
D1	8.01	8.23	0.315	0.324
E	10.04	10.28	0.395	0.405
E1	7.88	8.08	0.310	0.318
e	2.54 BSC		0.100 BSC	
L	14.73	15.75	0.580	0.620
L1	2.29	2.79	0.090	0.110
L2	1.15	1.39	0.045	0.055
L3	1.27	1.77	0.050	0.070

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



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.500	4.900	0.177	0.193
A1	2.340	2.740	0.092	0.108
A2	2.560	2.960	0.101	0.117
b1	0.700	0.900	0.028	0.035
b2	1.180	1.580	0.046	0.062
c	0.400	0.600	0.016	0.024
D	9.960	10.360	0.392	0.408
E	15.670	15.970	0.617	0.629
E1	6.500	6.900	0.256	0.272
E2	15.500	16.100	0.610	0.634
e	2.540 TYP		0.100 TYP	
Φ	3.080	3.280	0.121	0.129
L	12.640	13.240	0.498	0.521
L1	3.030	3.430	0.119	0.135

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