

## QIAOXIN 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.

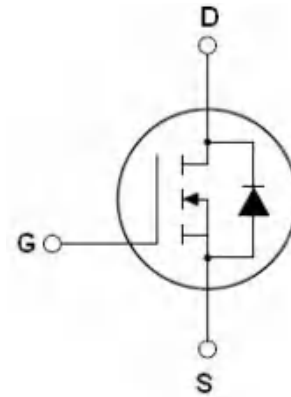
### Features

- 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)

$V_{DS}$	700	V
$R_{DS(ON)TYP}$	260	m $\Omega$
$I_D$	15	A



Schematic diagram

### Package Marking And Ordering Information

Device	Device Package	Marking
VCRR 70T260D	TO-263	VCRR70T260D
VCRR 70T260	TO-220	VCRR 70T260
VCRR70T260F	TO-220F	VCRR70T260F



TO-263



TO-220



TO-220F

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

Parameter	Symbol			Unit
Drain-Source Voltage ( $V_{GS}=0V$ )	$V_{DS}$	700		V
Gate-Source Voltage ( $V_{DS}=0V$ ) AC ( $f>1$ Hz)	$V_{GS}$	$\pm 30$		V
Continuous Drain Current at $T_c=25^\circ\text{C}$	$I_{D(DC)}$	15	15*	A
Continuous Drain Current at $T_c=100^\circ\text{C}$	$I_{D(DC)}$	10	10*	A
Pulsed drain current (Note 1)	$I_{DM(pluse)}$	60	60*	A
Maximum Power Dissipation( $T_c=25^\circ\text{C}$ )	$P_D$	131	33.2	W
Derate above $25^\circ\text{C}$		1.05	0.265	W/ $^\circ\text{C}$
Single pulse avalanche energy (Note 2)	EAS	304		mJ
Avalanche current(Note 1)	$I_{AR}$	3		A
Repetitive Avalanche energy , $t_{AR}$ limited by $T_{jmax}$ (Note 1)	$E_{AR}$	1.6		mJ

Parameter	Symbol		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			Unit
Thermal Resistance, Junction-to-Case (Maximum)	$R_{thJC}$	0.95	3.76	°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
<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( $T_C=125^\circ C$ )	$I_{DSS}$	$V_{DS}=700V, V_{GS}=0V$			100	$\mu A$
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	3.5	4	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=8A$		260	290	m $\Omega$
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=50V, V_{GS}=0V,$ $F=1.0MHz$		1210	1400	pF
Output Capacitance	$C_{oss}$			74		pF
Reverse Transfer Capacitance	$C_{rss}$			0.2		pF
Total Gate Charge	$Q_g$	$V_{DS}=480V, I_D=15A,$ $V_{GS}=10V$		24.7	42	nC
Gate-Source Charge	$Q_{gs}$			8.2		nC
Gate-Drain Charge	$Q_{gd}$			8.5		nC
<b>Switching times</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=420V, I_D=8A,$ $R_G=2.3\Omega, V_{GS}=10V$		15		nS
Turn-on Rise Time	$t_r$			10		nS
Turn-Off Delay Time	$t_{d(off)}$			57		nS
Turn-Off Fall Time	$t_f$			9		nS
<b>Source- Drain Diode Characteristics</b>						
Source-drain current(Body Diode)	$I_{SD}$	$T_C=25^\circ C$			15	A
Pulsed Source-drain current(Body Diode)	$I_{SDM}$				60	A
Forward On Voltage	$V_{SD}$	$T_J=25^\circ C, I_{SD}=15A, V_{GS}=0V$		0.9	1.2	V
Reverse Recovery Time	$t_{rr}$	$T_J=25^\circ C, I_F=7.5A, di/dt=100A/\mu s$		240		nS
Reverse Recovery Charge	$Q_{rr}$			2		$\mu C$
Peak Reverse Recovery Current	$I_{rm}$			17		A

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

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

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure1. Safe operating area

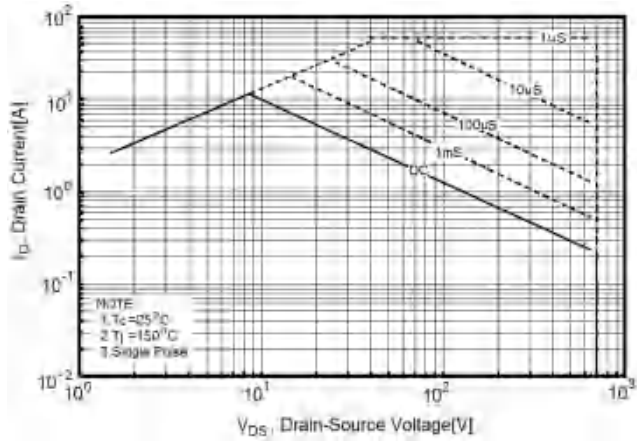


Figure2. Safe operating area for TO-220F

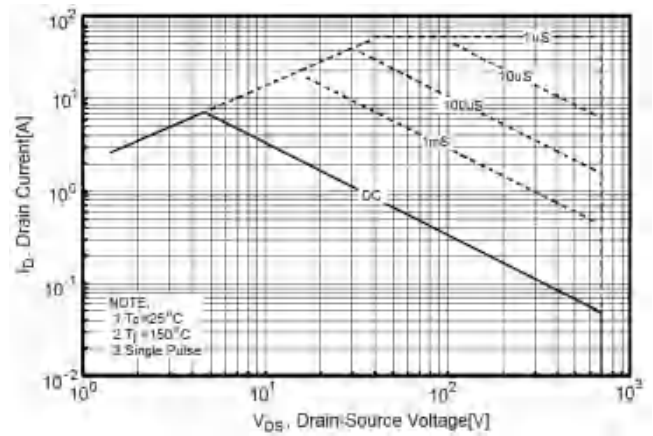


Figure3. Source-Drain Diode Forward Voltage

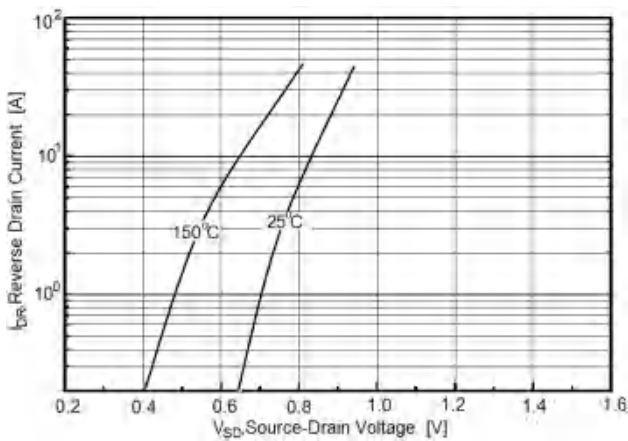


Figure4. Output characteristics

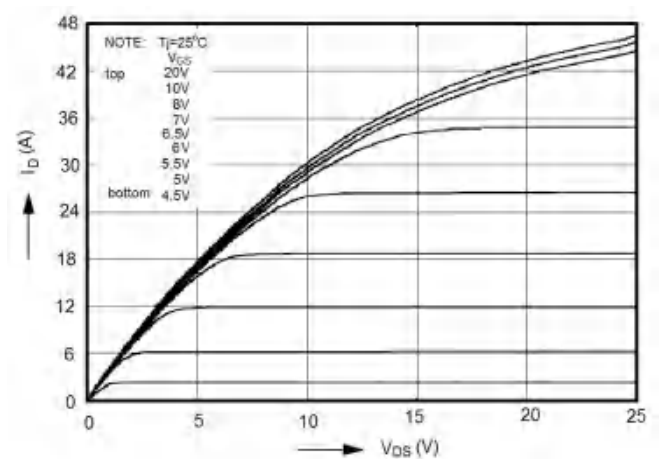


Figure5. Transfer characteristics

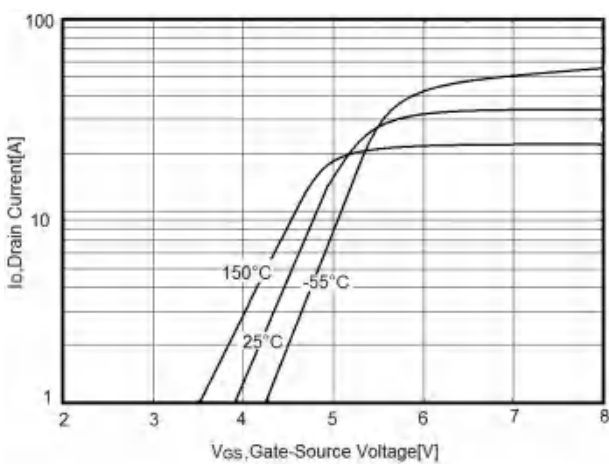
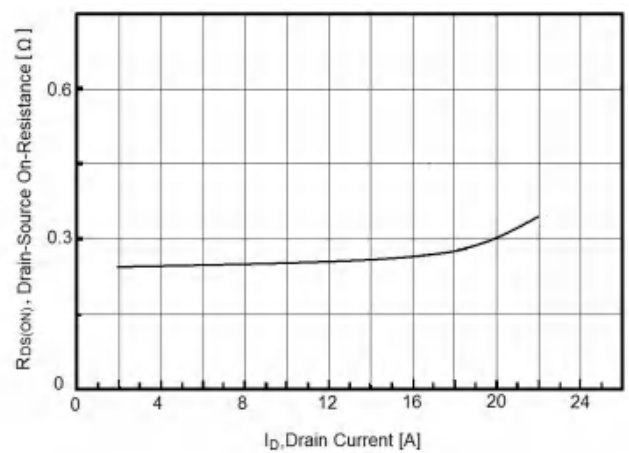
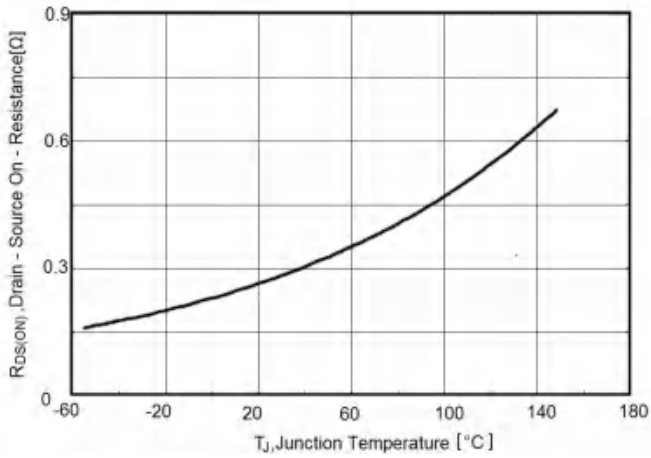


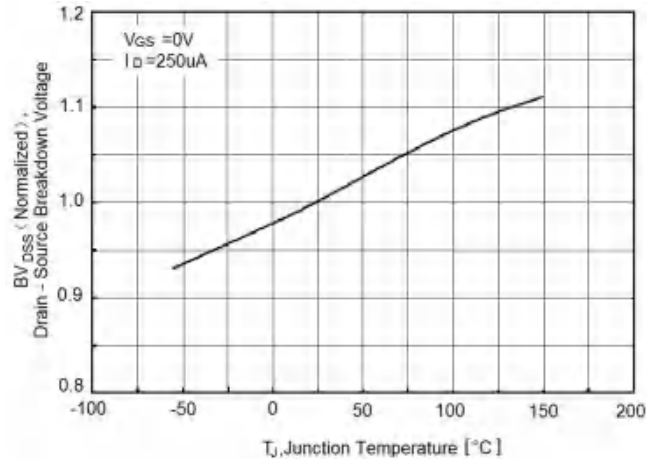
Figure6. Static drain-source on resistance



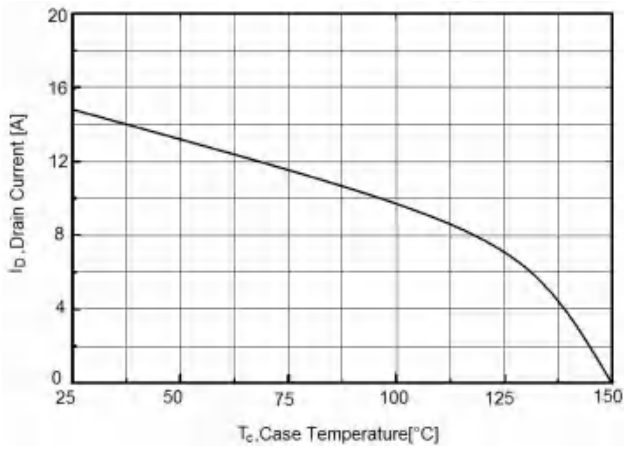
**Figure7.  $R_{DS(ON)}$  vs Junction Temperature**



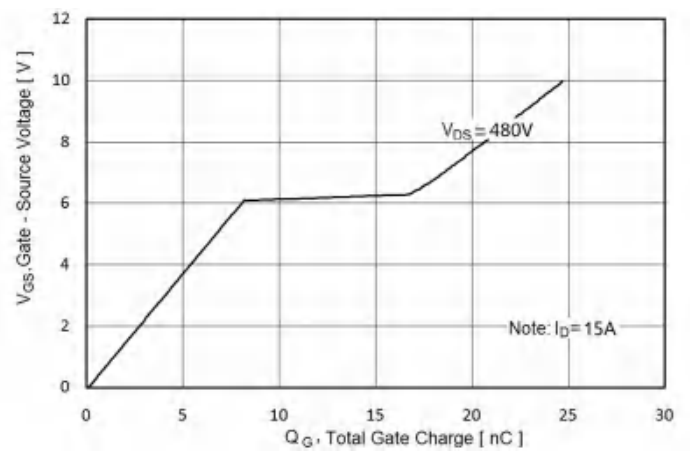
**Figure8.  $BV_{DSS}$  vs Junction Temperature**



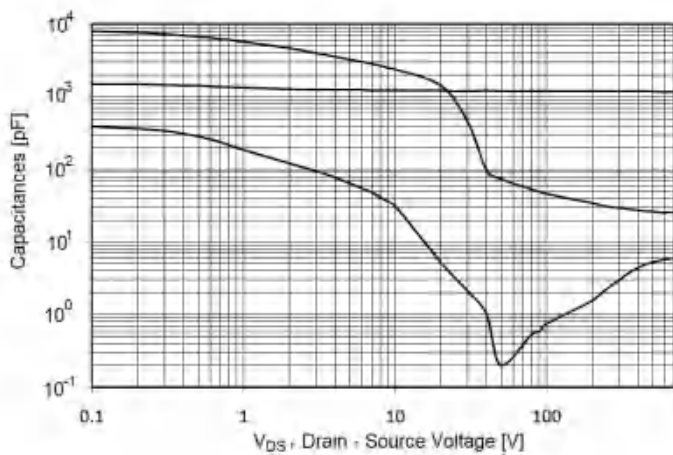
**Figure9. Maximum  $I_D$  vs Junction Temperature**



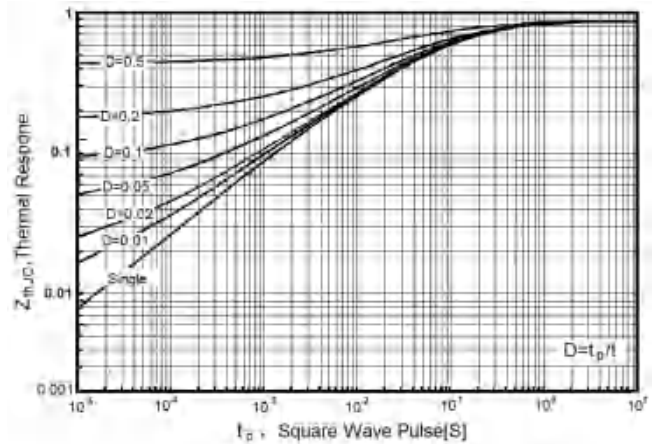
**Figure10. Gate charge waveforms**



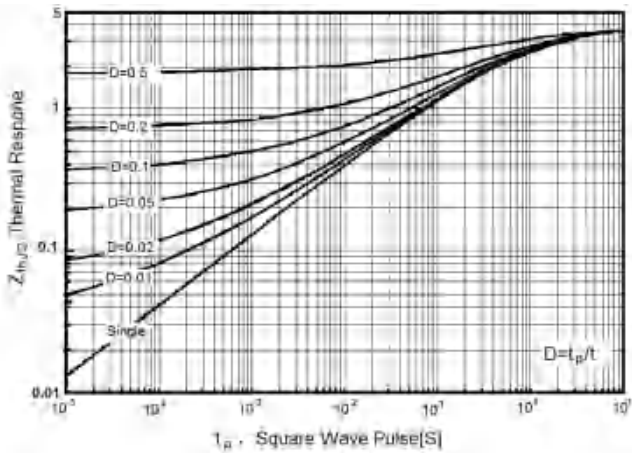
**Figure11. Capacitance**



**Figure12. Transient Thermal Impedance**

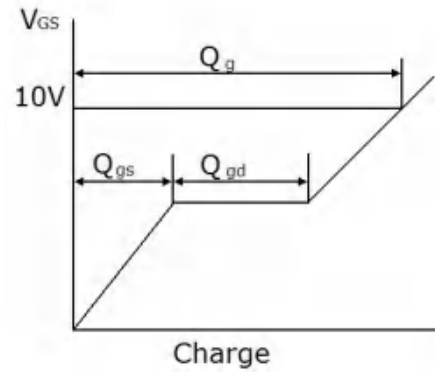
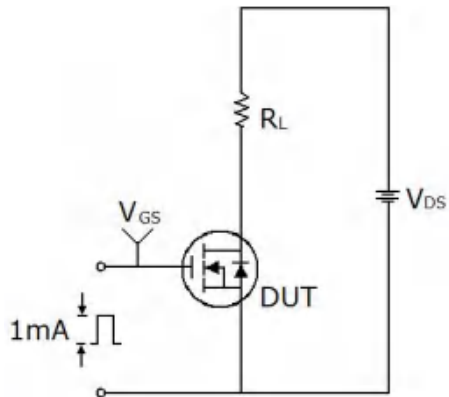


**Figure13. Transient Thermal Impedance for TO-220F**

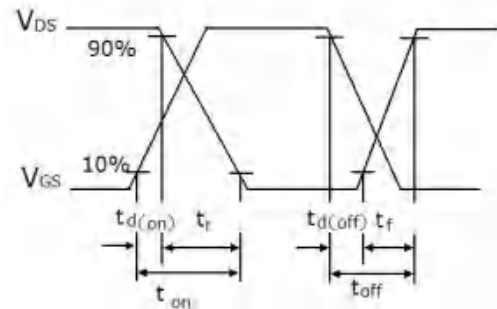
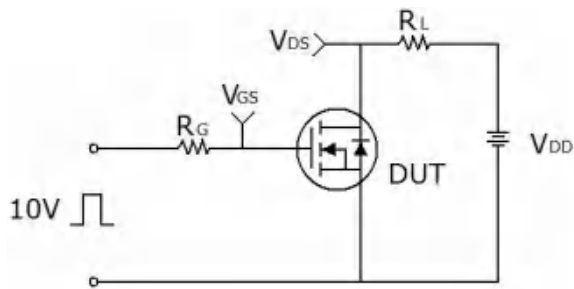


## Test circuit

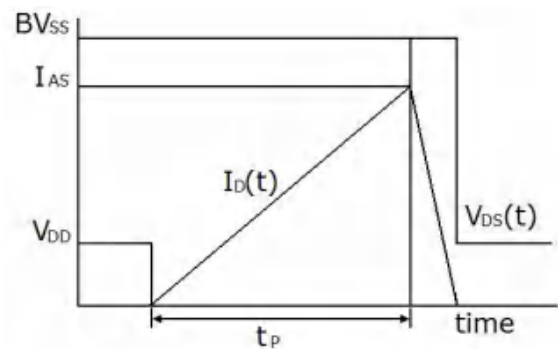
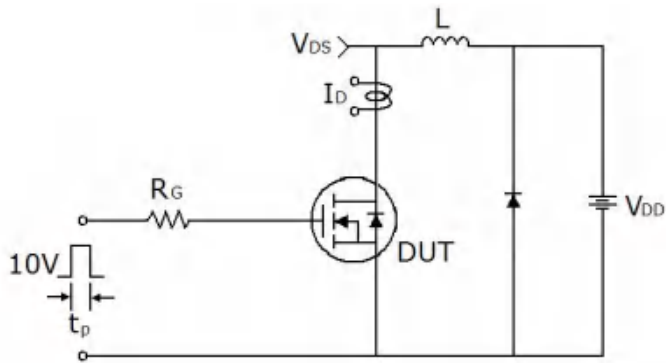
### 1) Gate charge test circuit & Waveform



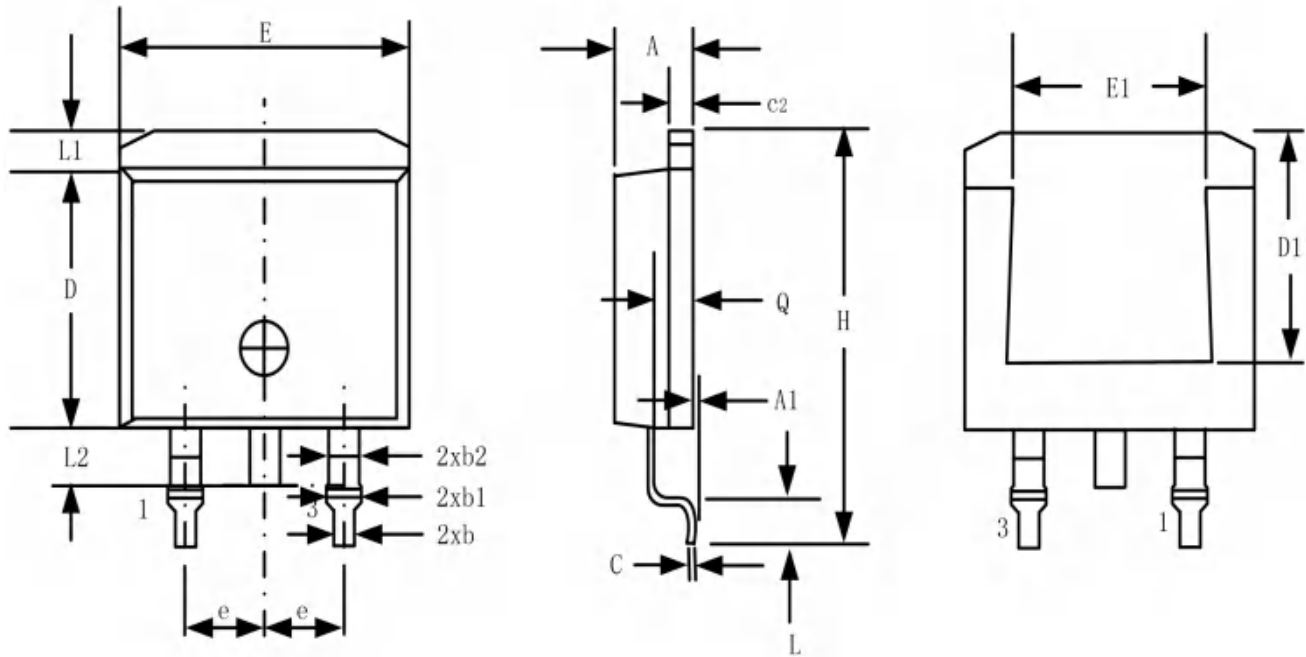
### 2) Switch Time Test Circuit:



### 3) Unclamped Inductive Switching Test Circuit & Waveforms

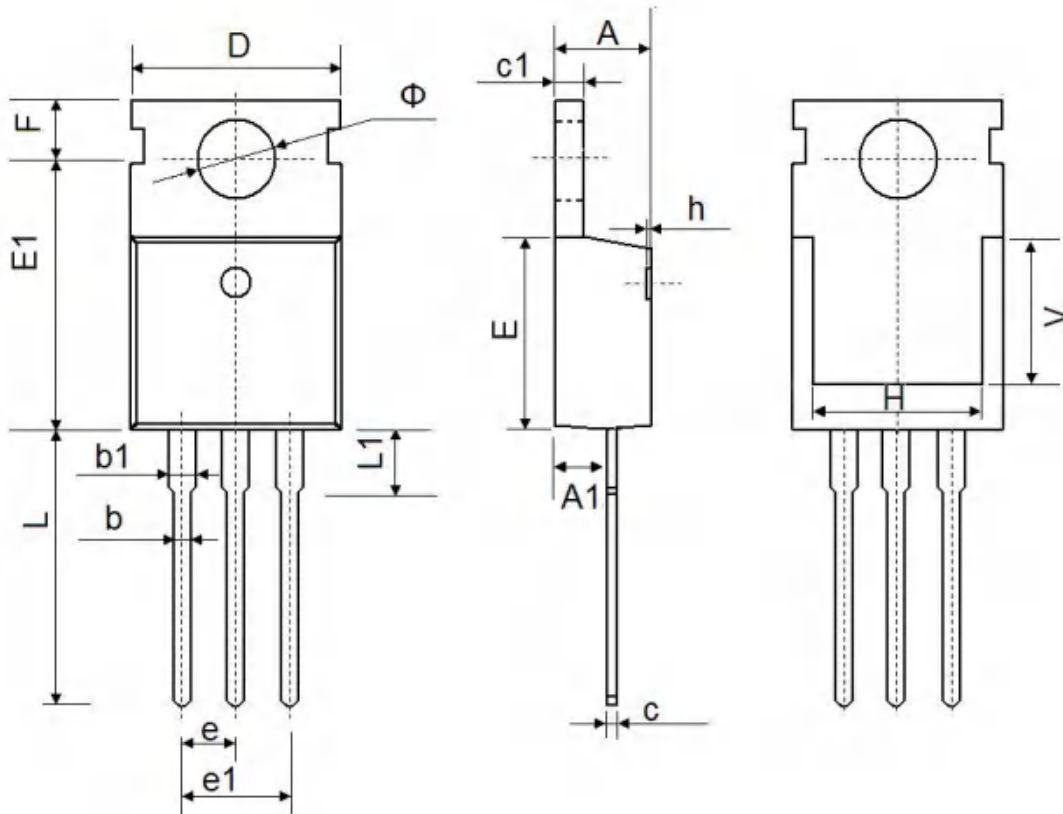


## TO-263-3L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.24	4.64	0.167	0.183
A1	0.00	0.15	0.000	0.006
b	0.70	0.90	0.028	0.035
b1	1.20	1.75	0.047	0.069
b2	1.20	1.70	0.047	0.067
C	0.40	0.60	0.016	0.024
c2	1.15	1.40	0.045	0.055
D	8.82	9.02	0.347	0.355
D1	6.86	--	0.270	--
E	9.96	10.36	0.392	0.408
E1	6.89	7.89	0.271	0.311
e	2.54 BSC		0.10 BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1	1.36 REF		0.054 REF	
L2	1.50 REF		0.059 REF	
L3	0.25 REF		0.010 REF	
Q	2.30	2.70	0.091	0.106

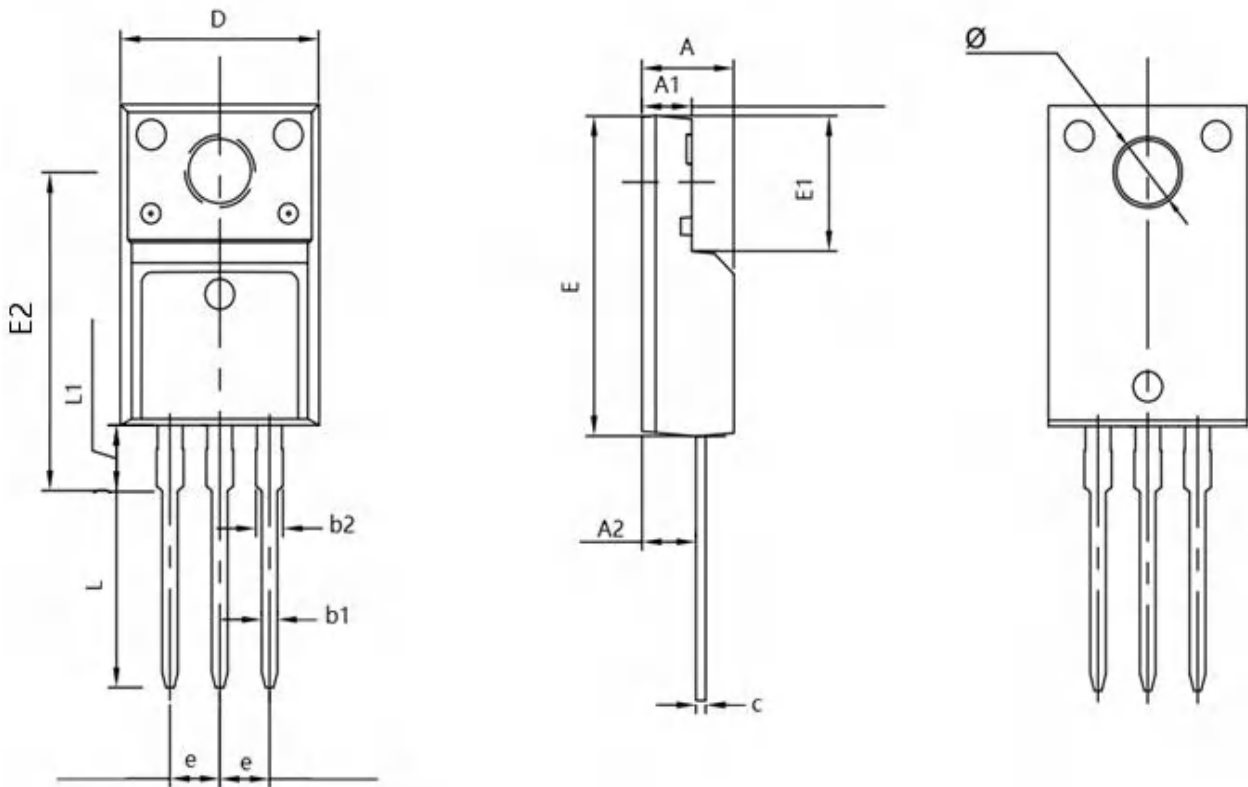
## TO-220-3L-C Package Information



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.	
$\Phi$	3.400	3.800	0.134	0.150

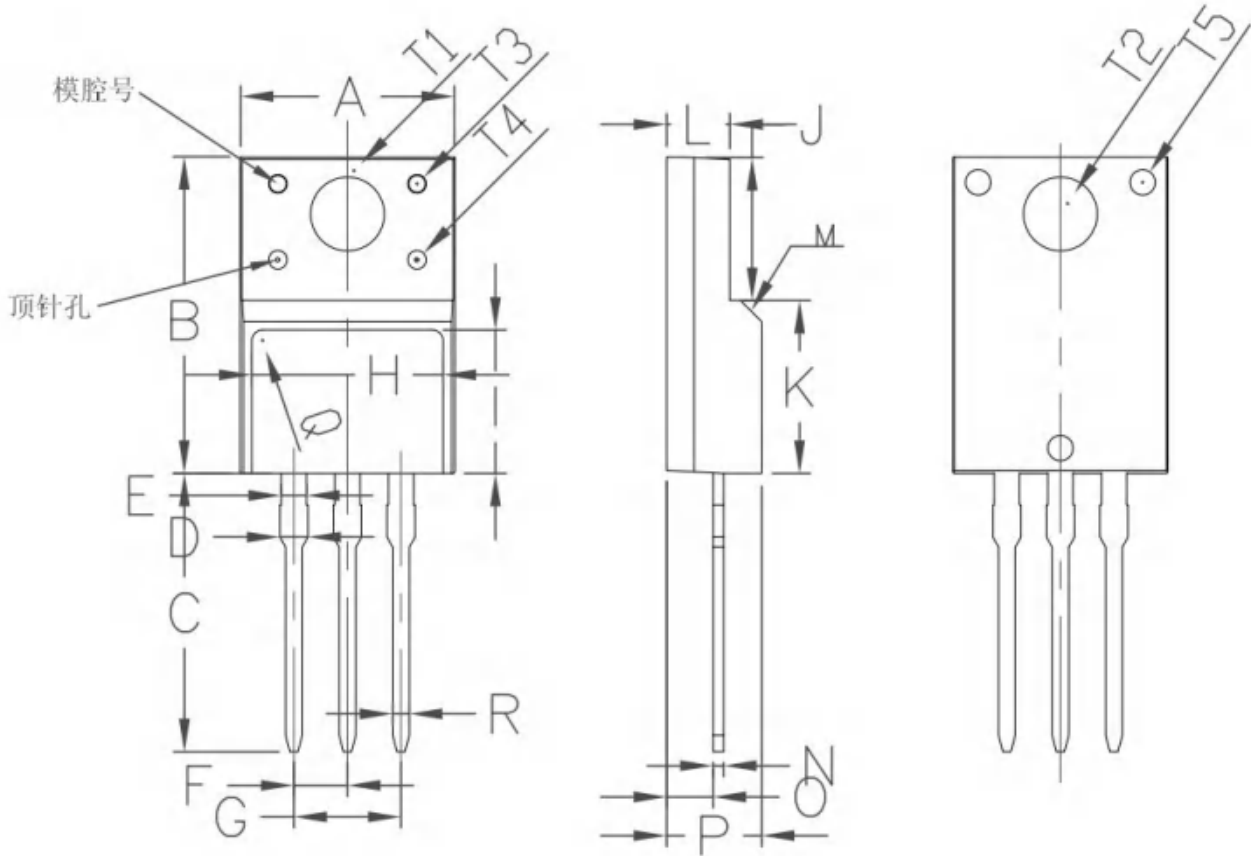


## TO-220F 集佳 Package Information



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	
$\varnothing$	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

# TO-220F 尊阳 Package Information



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Non	Max.	Min.	Non	Max.
A	9.860	10.160	10.460	0.388	0.400	0.412
B	15.670	15.870	16.070	0.617	0.625	0.633
C	13.140	13.340	13.540	0.517	0.525	0.533
D	1.200	1.300	1.400	0.047	0.051	0.055
F	2.540 TYP			0.10 TYP		
J	6.480	6.680	6.880	0.255	0.263	0.271
L	2.440	2.540	2.640	0.096	0.100	0.104
N	0.400	0.500	0.600	0.016	0.020	0.024
O	2.150	2.350	2.550	0.085	0.093	0.100
P	4.500	4.700	4.900	0.177	0.185	0.193
T2	3.100	3.300	3.500	0.122	0.130	0.138
R	0.770	0.800	0.830	0.030	0.031	0.033

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