



# 800V Super-junction Power MOSFET

## Description

### 800V Super-junction Power MOSFET

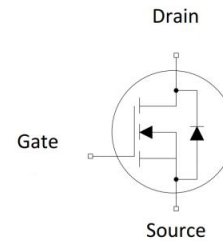
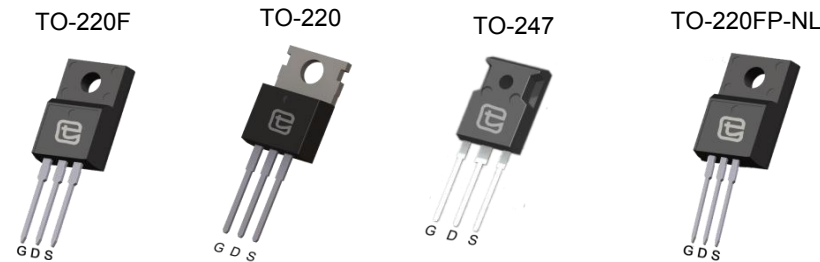
Super-junction power MOSFET is a revolutionary technology for high voltage power MOSFETs, designed according to the SJ principle. The deep trench SJ MOSFET provide an extremely low switching, commutation and conduction losses device with highest robustness make especially resonant switching applications more reliable, more efficient, lighter and cooler, designed by Wuxi Unigroup Microelectronics Company.

## Features

- Very low FOM  $R_{DS(on)} \times Q_g$
- 100% avalanche tested
- Easy to use/drive
- RoHS compliant

## Applications

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)
- Low Power Chargers and Adapters



## Device Marking and Package Information

Device	Package	Marking
TPA80R250A	TO-220F	80R250A
TPP80R250A	TO-220	80R250A
TPR80R250A	TO-220F-NL	80R250A
TPW80R250A	TO-247	80R250A

## Key Performance Parameters

Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	850	V
$R_{DS(on),max}$	0.28	$\Omega$
$Q_{g,typ}$	62.3	nC
$I_D$	18	A
$I_{D,pulse}$	54	A
$E_{OSS} @ 400V$	7.21	$\mu J$



<b>Absolute Maximum Ratings</b> $T_C = 25^\circ\text{C}$ , unless otherwise noted				
Parameter		Symbol	Values	Unit
Continuous Drain Current	$T_C = 25^\circ\text{C}$	$I_D$	18	A
	$T_C = 100^\circ\text{C}$		10.8	
Pulsed Drain Current	(note1)	$I_{D,pulse}$	54	A
Gate-Source Voltage		$V_{GSS}$	$\pm 30\text{V}$	V
Single Pulse Avalanche Energy	(note2)	$E_{AS}$	280	mJ
Repetitive Avalanche Energy	(note2)	$E_{AR}$	0.5	mJ
Avalanche Current		$I_{AR}$	7.5	A
MOSFET dv/dt Ruggedness, $V_{DS} = 0 \dots 480\text{V}$		dv/dt	50	V/ns
Power Dissipation For TO-220F, TO-220F-NL		$P_D$	34	W
Power Dissipation For TO-220, TO-247			240	
Continuous Diode Forward Current $I_F$		$I_S$	18	A
Diode Pulsed Current	(note1)	$I_{S,pulse}$	54	
Reverse Diode dv/dt	(note3)	dv/dt	15	V/ns
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	-55~+150	$^\circ\text{C}$

<b>Thermal Resistance For TO-220F, TO-220F-NL</b>			
Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	$R_{thJC}$	3.67	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient	$R_{thJA}$	80	

<b>Thermal Resistance For TO-220, TO-247</b>			
Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	$R_{thJC}$	0.52	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient	$R_{thJA}$	62	



Electrical Characteristics $T_J = 25^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
<b>Static Characteristics</b>						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu\text{A}$	800	--	--	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 800V, V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 800V, V_{GS} = 0V, T_J = 150^\circ\text{C}$	--	--	100	
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS} = \pm 30V$	--	--	$\pm 100$	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	2.5	--	4.5	V
Drain-Source On-State-Resistance	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 9A$	--	0.24	0.28	$\Omega$
Gate Resistance	$R_G$	$f = 1.0\text{MHz}$ open drain	--	1	--	$\Omega$
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0V,$ $V_{DS} = 50V,$ $f = 1.0\text{MHz}$	--	3871	--	$\text{pF}$
Output Capacitance	$C_{oss}$		--	217	--	
Reverse Transfer Capacitance	$C_{rss}$		--	17.1	--	
Total Gate Charge	$Q_g$	$V_{DD} = 640V, I_D = 18A,$ $V_{GS} = 10V$	--	62.3	--	nC
Gate-Source Charge	$Q_{gs}$		--	14.5	--	
Gate-Drain Charge	$Q_{gd}$		--	23	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 400V, I_D = 9A,$ $R_G = 25\Omega$	--	49	--	ns
Turn-on Rise Time	$t_r$		--	42.6	--	
Turn-off Delay Time	$t_{d(off)}$		--	166	--	
Turn-off Fall Time	$t_f$		--	13	--	
<b>Drain-Source Body Diode Characteristics</b>						
Body Diode Forward Voltage	$V_{SD}$	$T_J = 25^\circ\text{C}, I_{SD} = 18A, V_{GS} = 0V$	--	0.9	1.2	V
Reverse Recovery Time	$t_{rr}$	$V_R = 400V, I_F = I_S,$ $di_F/dt = 100A/\mu\text{s}$	--	400	--	ns
Reverse Recovery Charge	$Q_{rr}$		--	4	--	$\mu\text{C}$
Peak Reverse Recovery Current	$I_{rrm}$		--	20	--	A

**Notes**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $I_D = 10A, V_{DD} = 50V, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3. Identical low side and high side switch with identical  $R_G$



Typical Characteristics  $T_J = 25^\circ\text{C}$ , unless otherwise noted

Figure 1. Output Characteristics

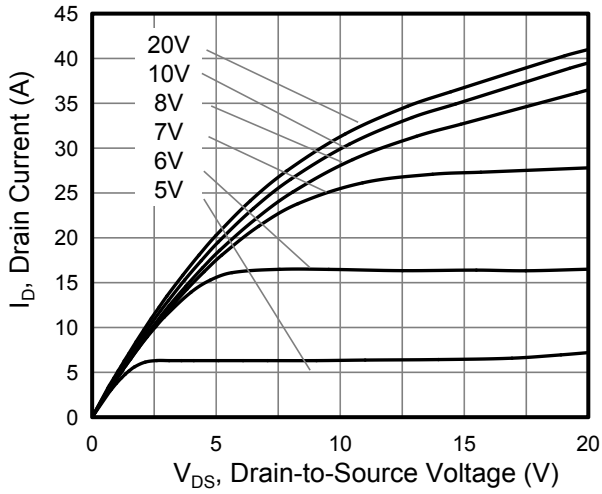


Figure 2. Transfer Characteristics

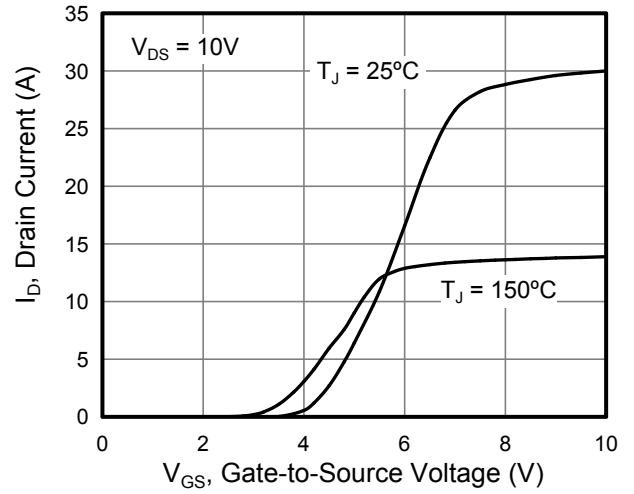


Figure 3. On-Resistance vs. Drain Current

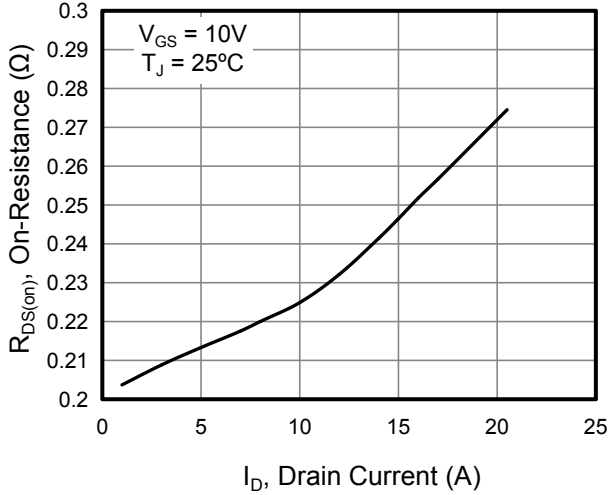


Figure 4. Capacitance

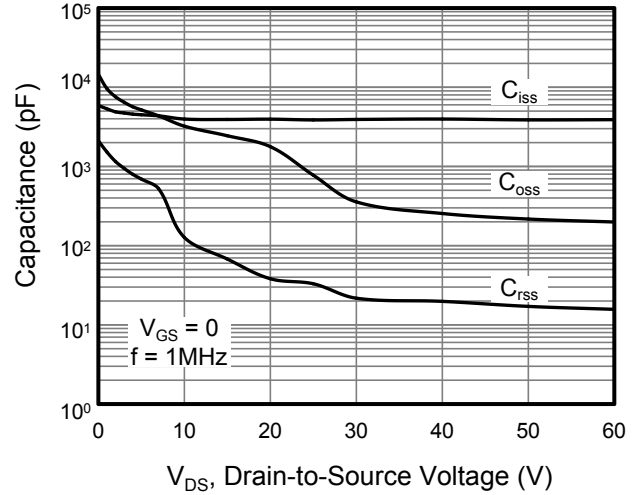


Figure 5. Gate Charge

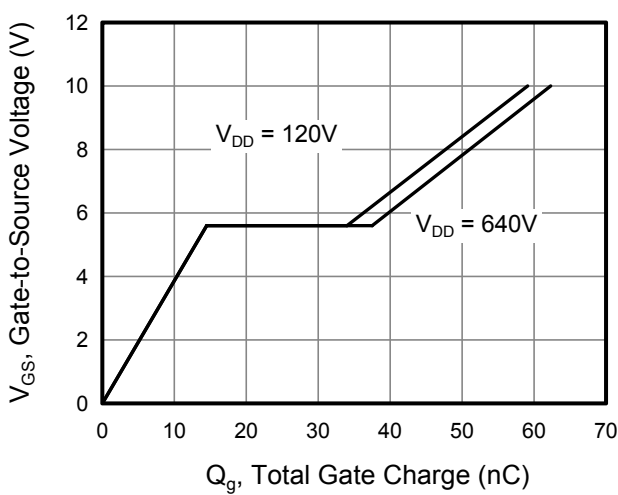
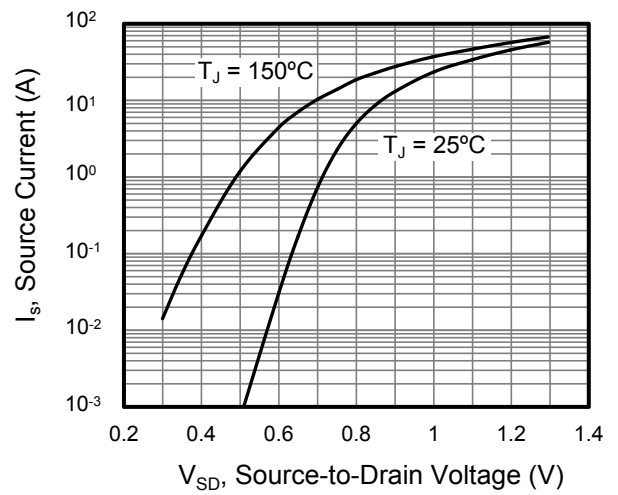


Figure 6. Body Diode Forward Voltage





Typical Characteristics  $T_J = 25^\circ\text{C}$ , unless otherwise noted

Figure 7. On-Resistance vs. Junction Temperature

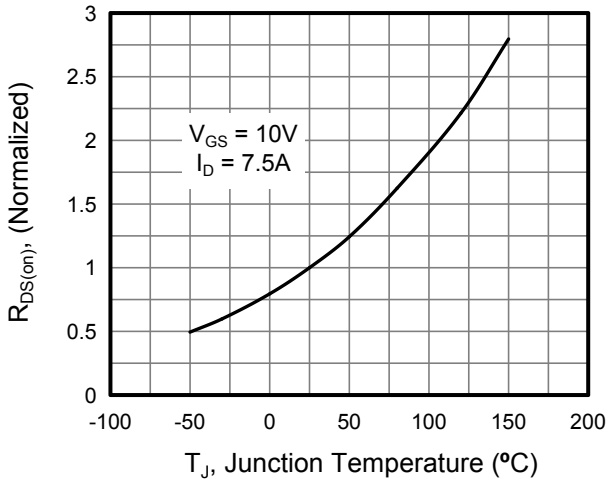


Figure 8. Breakdown voltage vs. Junction Temperature

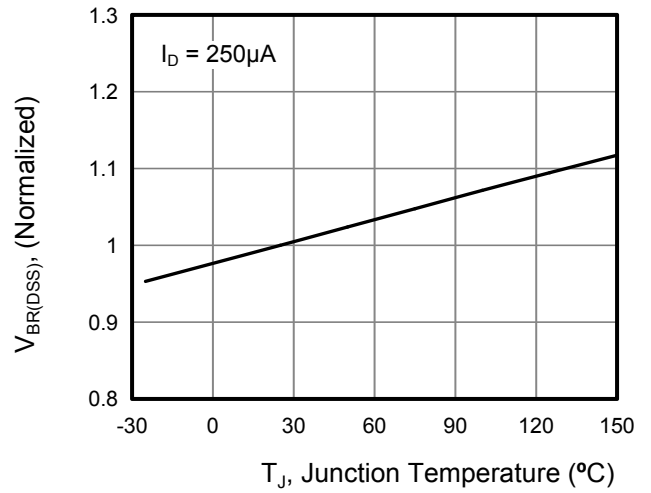


Figure 9. Transient Thermal Impedance For TO-220F/TO-220F-NL

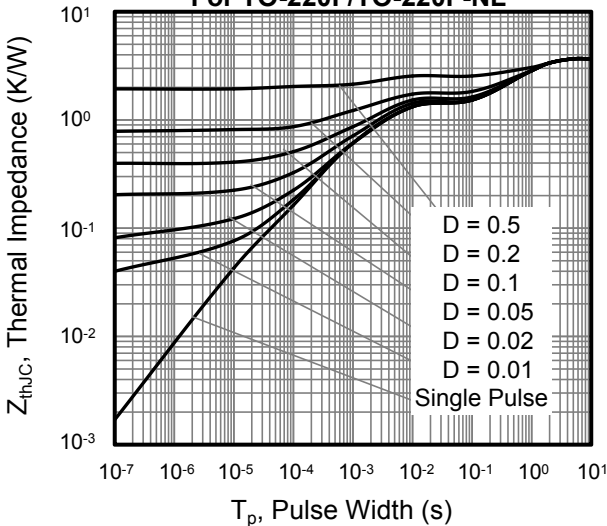


Figure 10. Safe Operation Area For TO-220F/TO-220F-NL

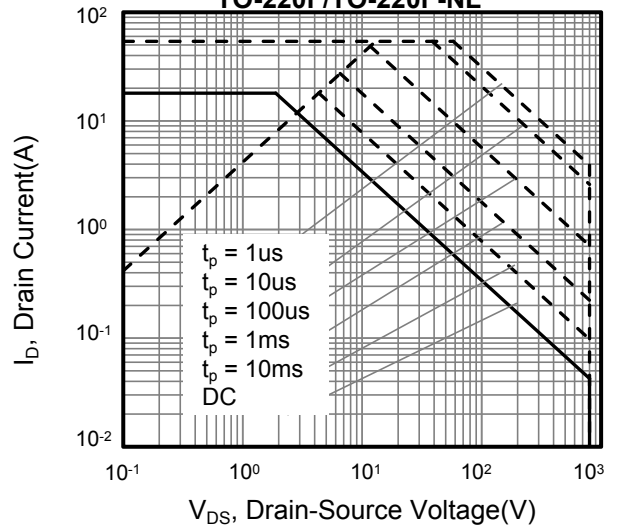


Figure 11. Transient Thermal Impedance For TO-220/TO-247

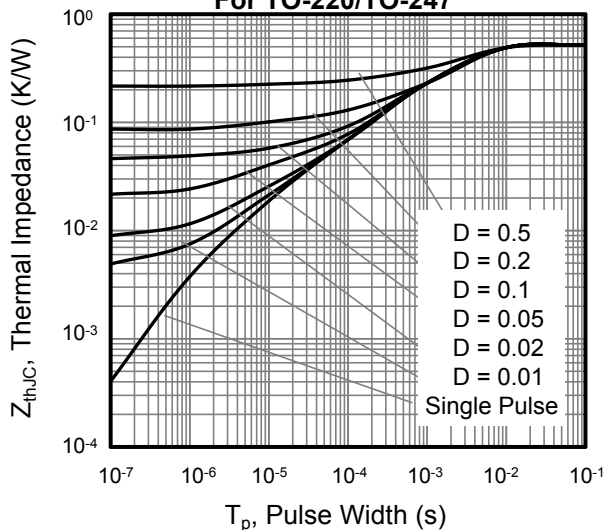
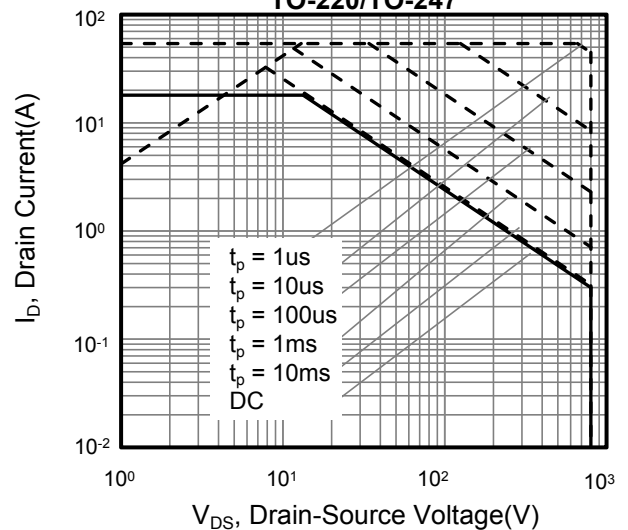


Figure 12. Safe Operation Area For TO-220/TO-247





Typical Characteristics  $T_J = 25^\circ\text{C}$ , unless otherwise noted

Figure 13. Typ. Coss Stored Energy

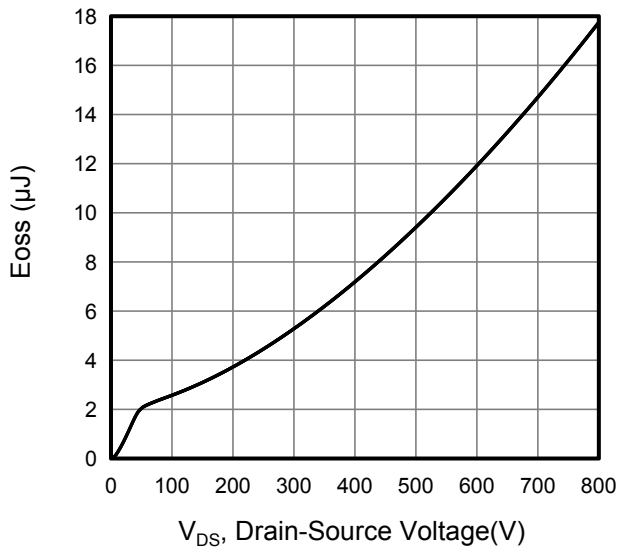




Figure A: Gate Charge Test Circuit and Waveform

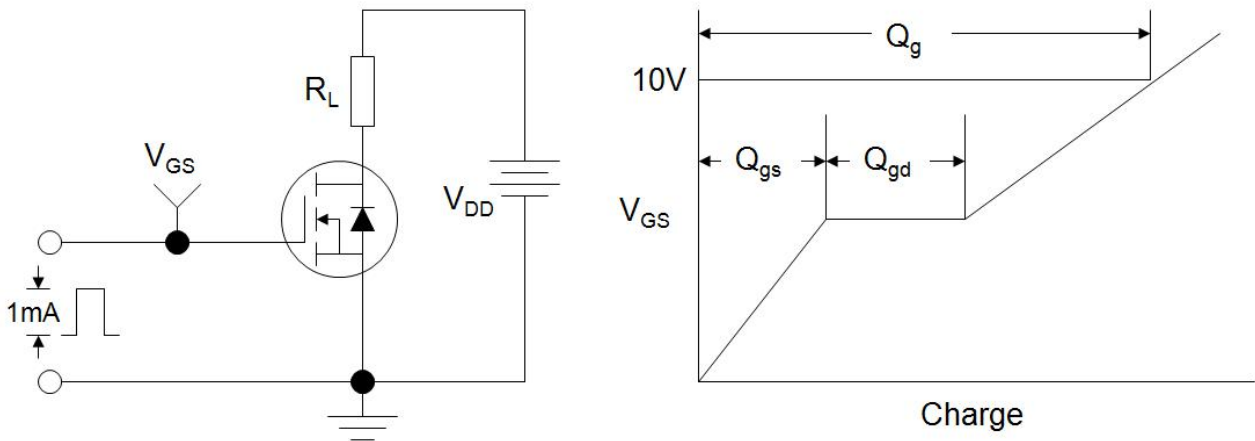


Figure B: Resistive Switching Test Circuit and Waveform

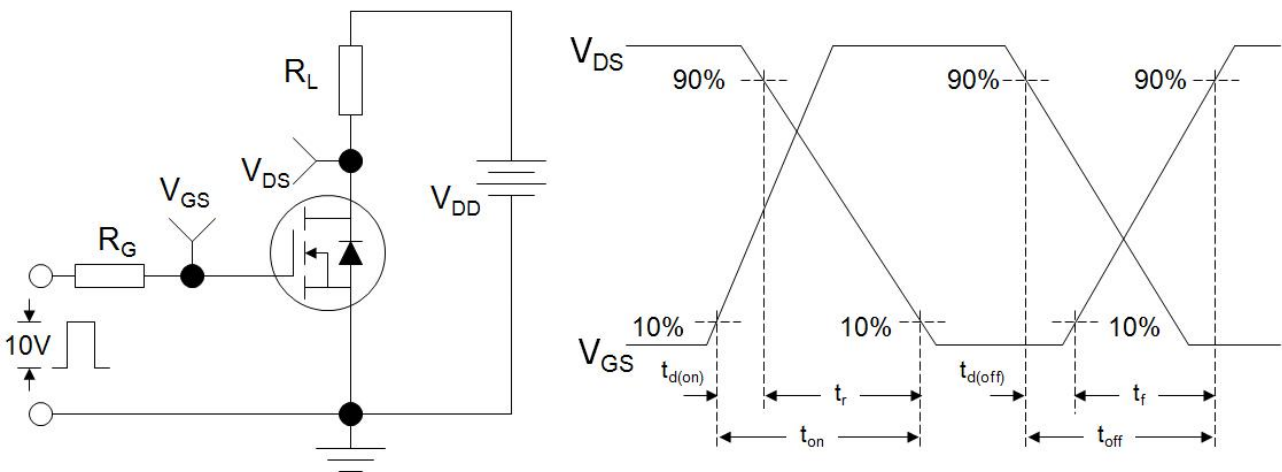
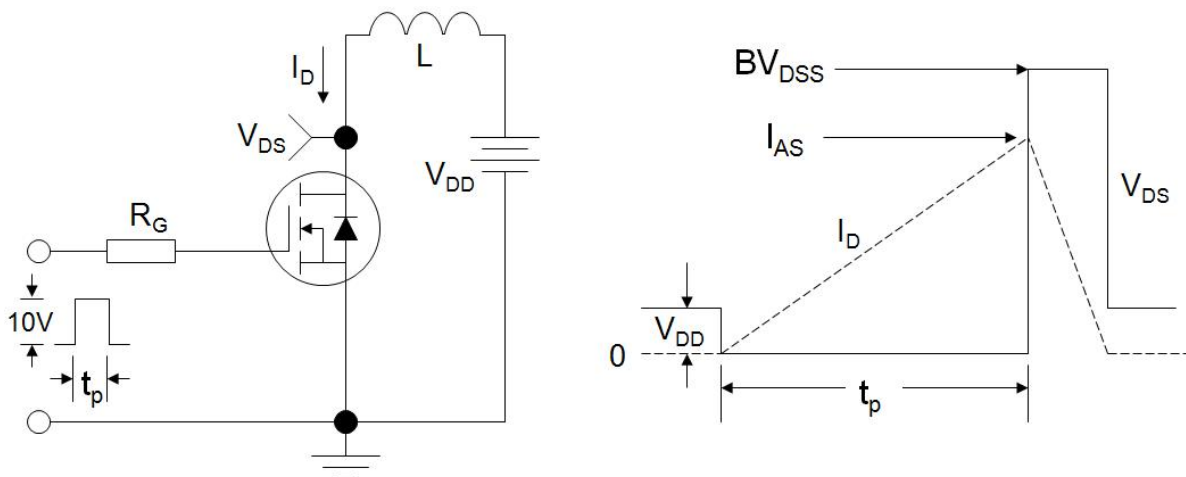
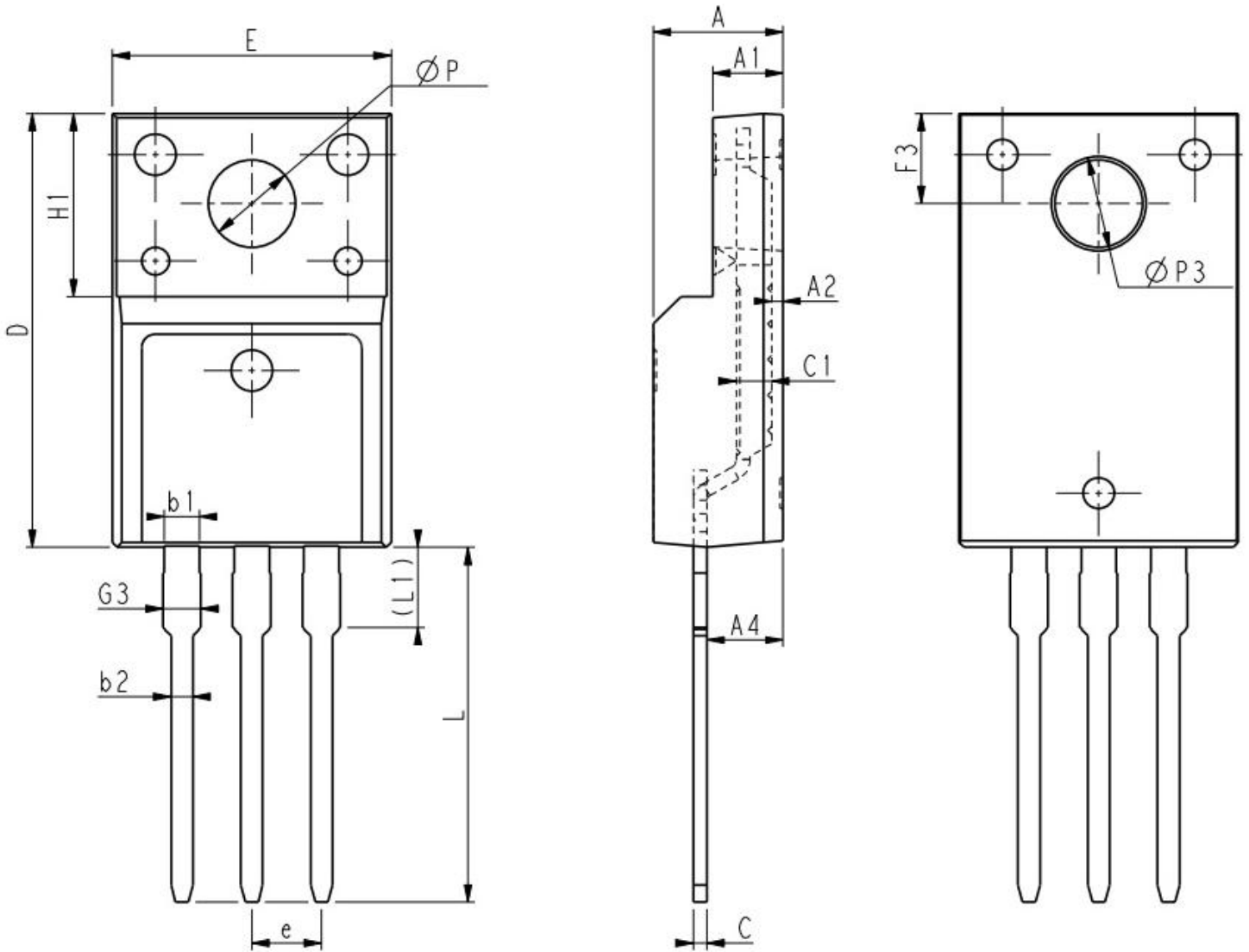


Figure C: Unclamped Inductive Switching Test Circuit and Waveform





**TO-220F (封装厂 H)**



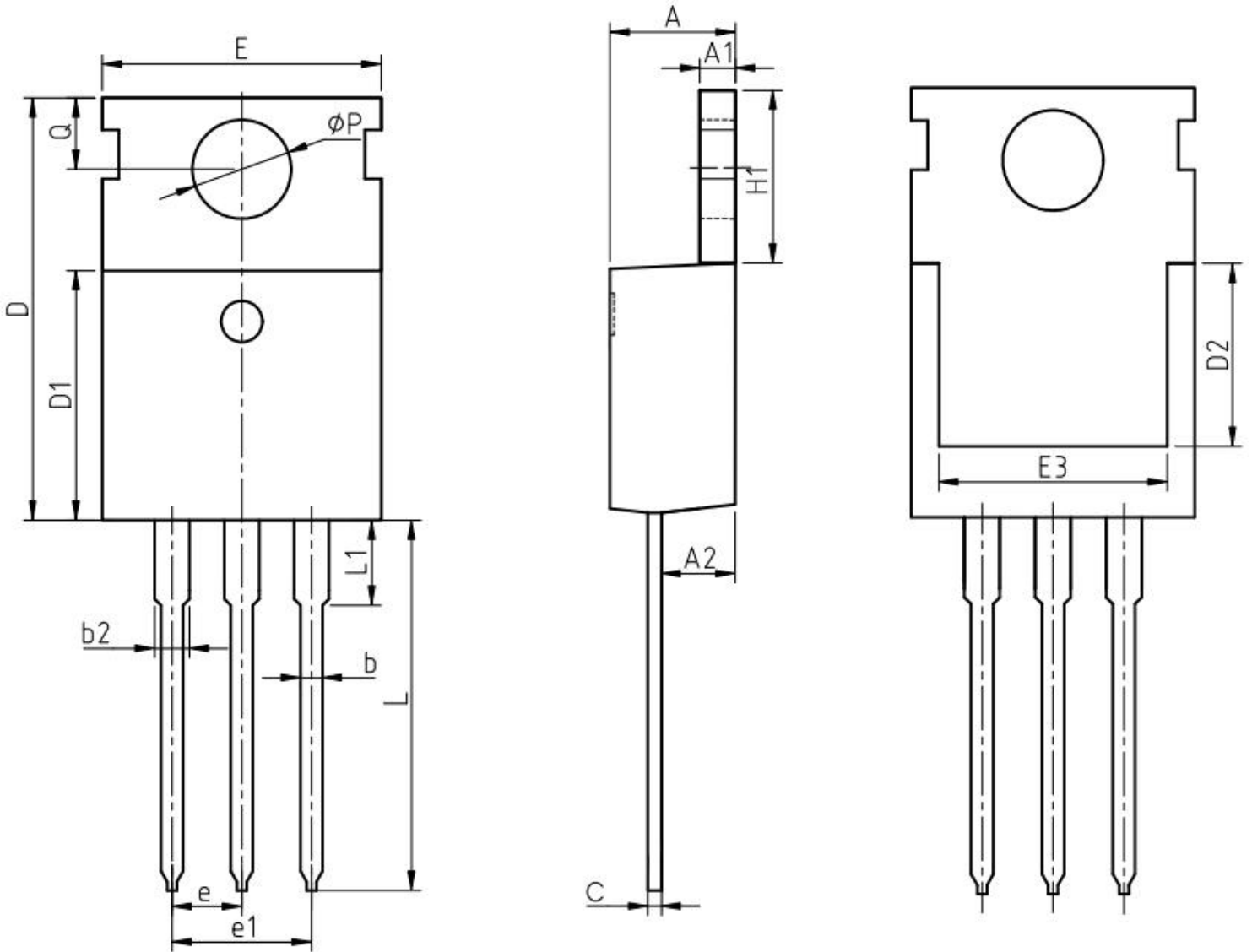
Unit:mm			
Symbol	Min.	Nom	Max.
E	9.96	10.16	10.36
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	0.30	0.45	0.60
A4	2.56	2.76	2.96
c	0.40	0.50	0.65
c1	1.20	1.30	1.35
D	15.57	15.87	16.17
H1	6.70REF		

Unit:mm			
Symbol	Min.	Nom	Max.
e	2.54BSC		
L	12.68	12.98	13.28
L1	2.93	3.03	3.13
$\Phi P$	3.03	3.18	3.38
$\Phi P3$	3.15	3.45	3.65
F3	3.15	3.30	3.45
G3	1.25	1.35	1.55
b1	1.18	1.28	1.43
b2	0.70	0.80	0.95





TO-220 (封装厂 H)

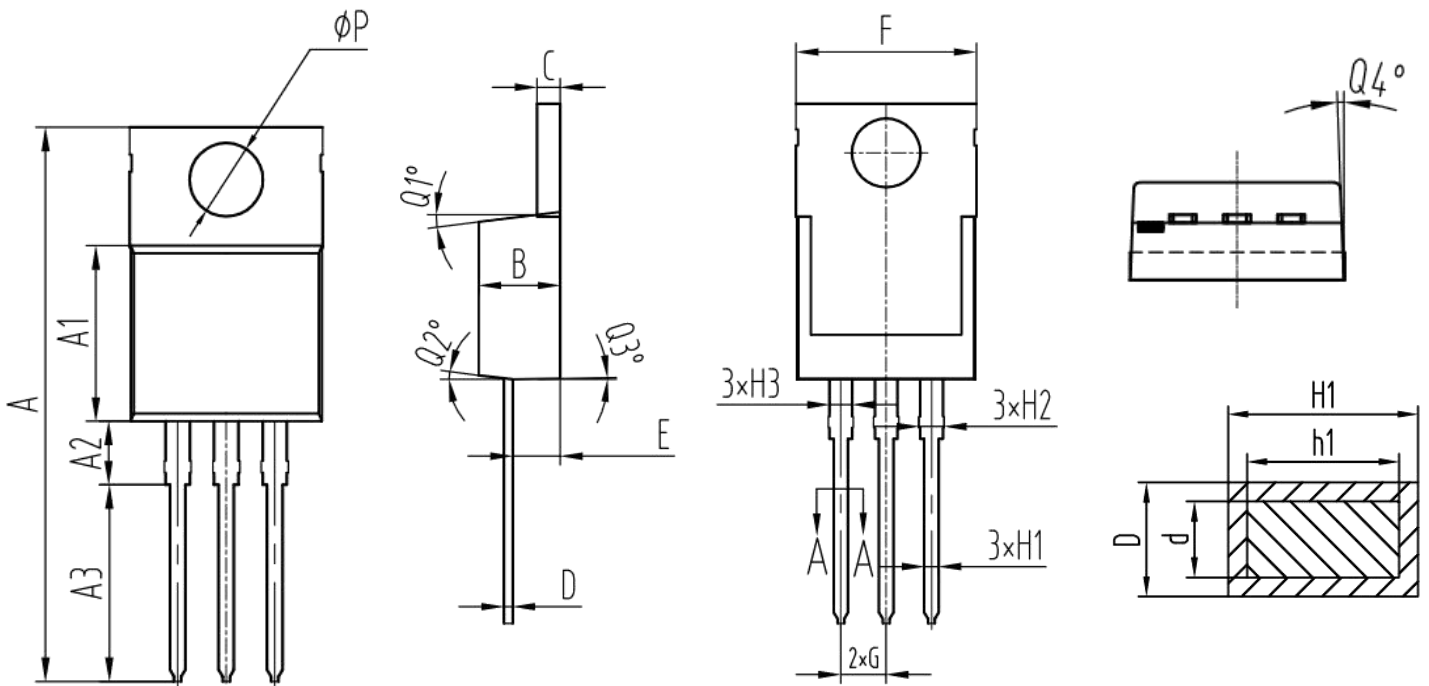


Unit:mm			
Symbol	Min.	Nom	Max.
A	4.37	4.57	4.77
A1	1.25	1.30	1.40
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b2	1.17	1.27	1.47
c	0.45	0.50	0.60
D	15.10	15.60	16.10
D1	8.80	9.10	9.40
D2	5.50	-	-

Unit:mm			
Symbol	Min.	Nom	Max.
E	9.70	10.00	10.30
E3	7.00	-	-
e	2.54 BSC		
e1	5.08 BSC		
H1	6.25	6.50	6.85
L	12.75	13.50	13.80
L1	-	3.10	3.40
phi P	3.40	3.60	3.80
Q	2.60	2.80	3.00



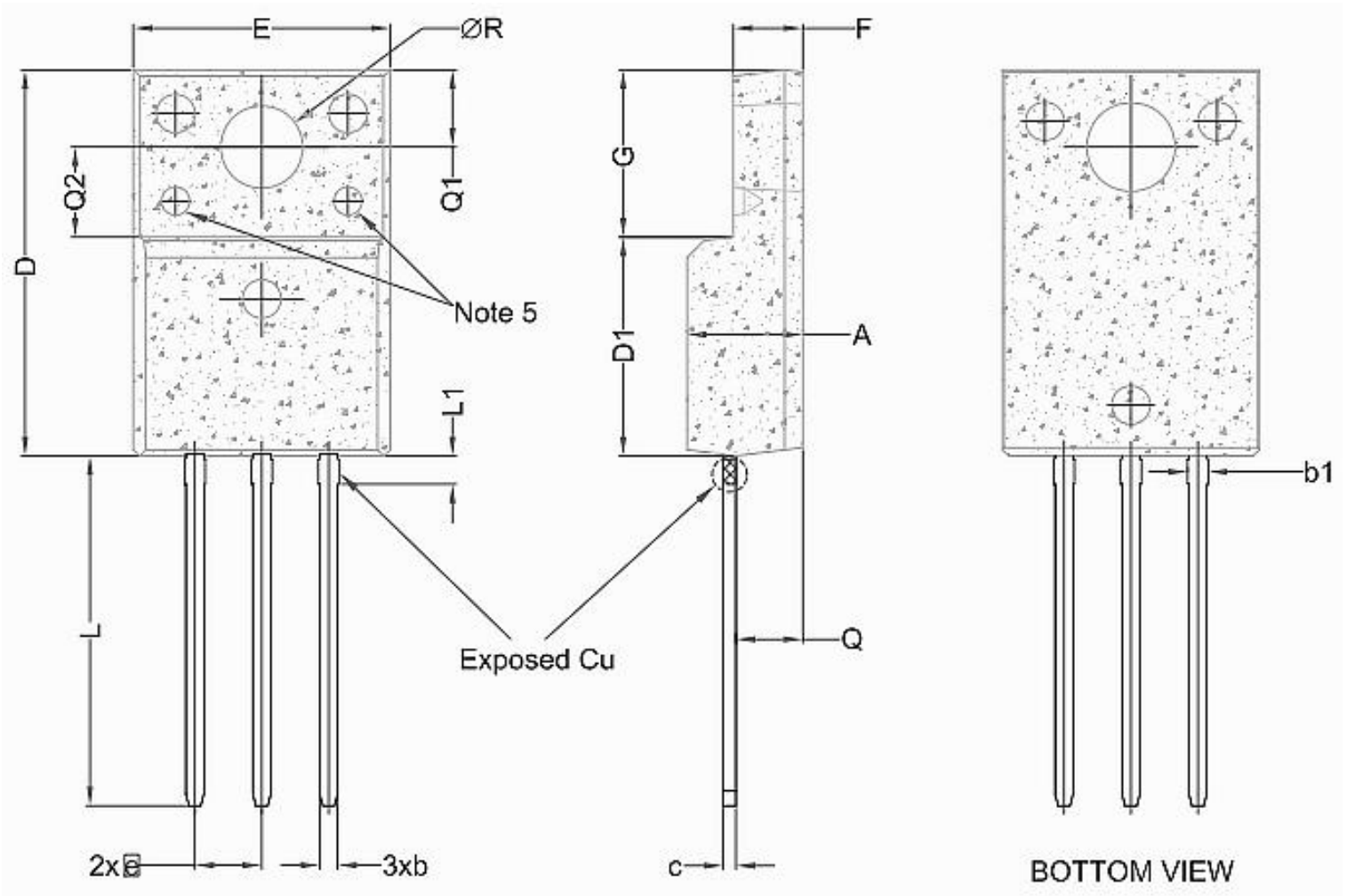
TO-220 (封装厂 T)



SYMBOL	MIN	NOM	MAX
A	18.60	18.80	19.00
A1	9.10	9.20	9.30
A2	3.40	3.60	3.80
A3	9.60	9.80	10.00
B	4.45	4.55	4.65
C	1.25	1.30	1.35
D	0.41	—	0.61
d	0.40	0.50	0.60
E	2.52	2.67	2.82
F	9.90	10.10	10.30
G	2.44	2.54	2.64
H1	0.71	—	0.91
h1	0.70	0.80	0.90
H2	1.25	1.35	1.45
H3	1.20	1.27	1.35
$\phi P$	3.74	3.84	3.94



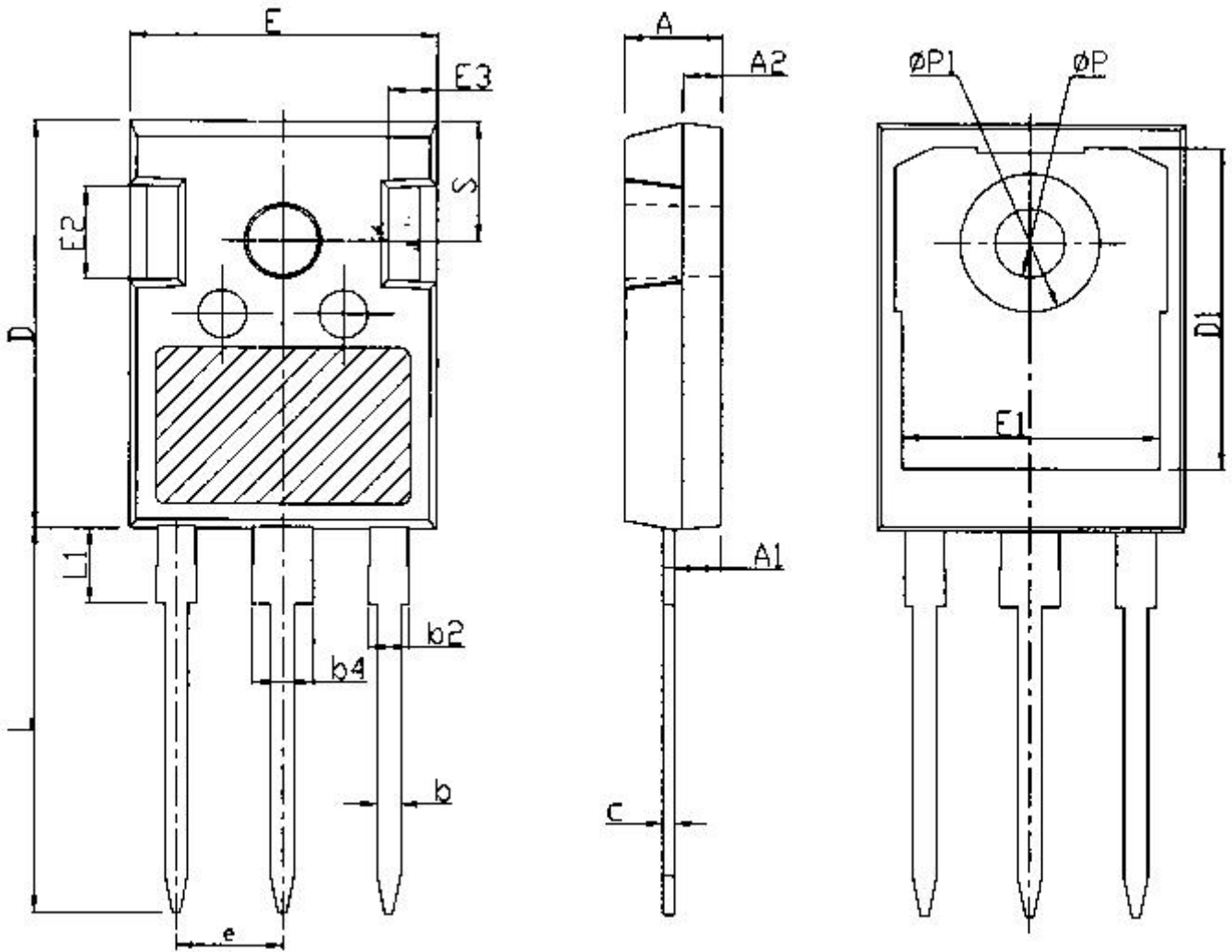
### TO-220FP-NL (封装厂 M)



Unit:mm				Unit:mm			
Symbol	Min.	Nom	Max.	Symbol	Min.	Nom	Max.
A	4.30	4.50	4.70	F	2.50	2.70	2.90
b	0.60	0.70	0.80	G	6.30	6.50	6.70
b1	0.60	0.80	0.90	L	13.40	13.60	13.80
c	0.45	0.50	0.60	L1	1.00	1.10	1.20
D	14.70	15.00	15.30	Q	2.50	2.60	2.70
D1	8.50 REF			Q1	2.90	3.00	3.10
e	2.60BSC			Q2	3.50 REF		
E	9.70	10.00	10.30	ΦR	3.00	3.20	3.40



TO-247 (封装厂 H)

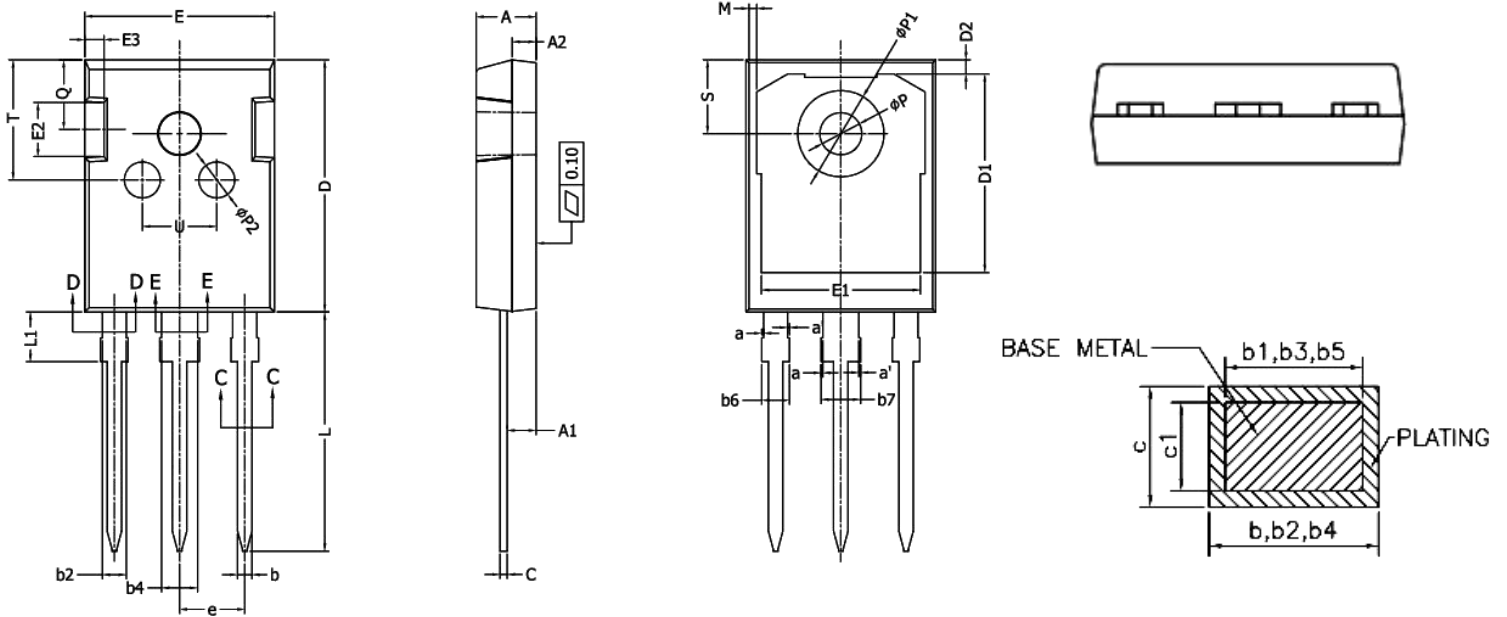


Unit:mm			
Symbol	Min.	Nom	Max.
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.70	21.00	21.30
D1	16.25	16.55	16.85

Unit:mm			
Symbol	Min.	Nom.	Max.
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44BSC		
L	19.62	19.92	20.22
L1	-	-	4.30
ΦP	3.40	3.60	3.80
ΦP1	-	-	7.30
S	6.15BSC		



### TO-247 (封装厂 I)



SYMBOL	MIN	NOM	MAX
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
a	0	---	0.15
a'	0	---	0.15
b	1.16	---	1.26
b1	1.15	1.2	1.22
b2	1.96	---	2.06
b3	1.95	2.00	2.02
b4	2.96	---	3.06
b5	2.96	3.00	3.02
b6	---	---	2.25
b7	---	---	3.25
c	0.59	---	0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.17	1.35
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.40	4.50	4.60
E3	2.40	2.50	2.60
e	5.436 BSC		
L	19.80	19.92	20.10
L1	---	---	4.30
M	0.35	---	0.95
P	3.40	3.50	3.60
P1	7.00	---	7.40
P2	2.40	2.50	2.60
Q	5.60	---	6.00
S	6.05	6.15	6.25
T	9.80	---	10.20
U	6.00	---	6.40



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