



600V Super-junction Power MOSFET

Description

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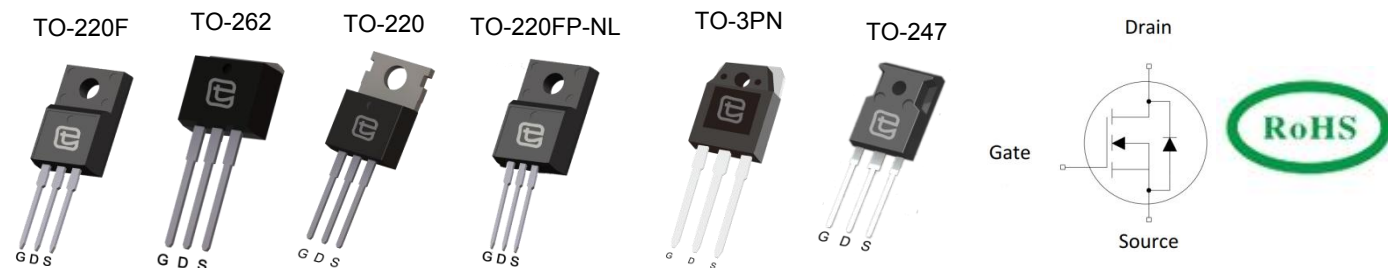
Super-junction power MOSFET is a revolutionary technology for high voltage power MOSFETs, designed according to the SJ principle. The deep trench SJ MOSFET provide an extremely low switching, communication and conduction losses device with highest robustness make especially resonant switching applications 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)
- Charger



Device Marking and Package Information

Device	Package	Marking
TPA60R150C	TO-220F	60R150C
TPC60R150C	TO-262	60R150C
TPP60R150C	TO-220	60R150C
TPR60R150C	TO-220FP-NL	60R150C
TPV60R150C	TO-3PN	60R150C
TPW60R150C	TO-247	60R150C

Key Performance Parameters

Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	650	V
$R_{DS(on),max}$	0.15	Ω
$Q_{g,typ}$	46	nC
I_D	20	A
$I_{D,pulse}$	60	A



Absolute Maximum Ratings $T_C = 25^{\circ}\text{C}$, unless otherwise noted				
Parameter		Symbol	Values	Unit
Continuous Drain Current	$T_C = 25^{\circ}\text{C}$	I_D	20	A
Pulsed Drain Current	(note1)	$I_{D,pulse}$	60	A
Gate-Source Voltage		V_{GSS}	$\pm 30\text{V}$	V
Single Pulse Avalanche Energy	(note2)	E_{AS}	480	mJ
Repetitive Avalanche Energy	(note2)	E_{AR}	0.75	mJ
Avalanche Current		I_{AR}	4	A
Power Dissipation For TO-220F,TO-220FP-NL		P_D	34	W
Power Dissipation For TO-262,TO-220,TO-3PN,TO-247			151	
Continuous Diode Forward Current		I_S	20	A
Diode Pulsed Current	(note1)	$I_{S,pulse}$	60	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	$-55\sim+150$	$^{\circ}\text{C}$

Thermal Resistance For TO-220F,TO-220FP-NL			
Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	R_{thJC}	3.7	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient	R_{thJA}	80	

Thermal Resistance For TO-262,TO-220,TO-3PN,TO-247			
Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	R_{thJC}	0.83	$^{\circ}\text{C}/\text{W}$
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.	
Static Characteristics						
Drain-Source Breakdown Voltage	V _{(BR)DSS}	V _{GS} = 0V, I _D = 250μA	600	--	--	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 600V, V _{GS} = 0V, T _J = 25°C	--	--	1	μA
		V _{DS} = 600V, V _{GS} = 0V, T _J = 150°C	--	--	100	
Gate-Source Leakage Current	I _{GSS}	V _{GS} = ±30V	--	--	±100	nA
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250μA	2.5	--	4.0	V
Drain-Source On-State-Resistance	R _{DS(on)}	V _{GS} = 10V, I _D = 10A	--	0.13	0.15	Ω
Forward Transconductance (Note3)	g _{fs}	V _{DS} = 10V, I _D = 10A	--	18.8	--	S
Dynamic Characteristics						
Input Capacitance	C _{iss}	V _{GS} = 0V, V _{DS} = 50V, f = 1.0MHz	--	2328	--	pF
Output Capacitance	C _{oss}		--	116	--	
Reverse Transfer Capacitance	C _{rss}		--	7	--	
Total Gate Charge	Q _g	V _{DD} = 480V, I _D = 20A, V _{GS} = 10V	--	46	--	nC
Gate-Source Charge	Q _{gs}		--	11	--	
Gate-Drain Charge	Q _{gd}		--	13	--	
Turn-on Delay Time	t _{d(on)}	V _{DD} = 400V, I _D = 20A, R _G = 25Ω	--	43	--	ns
Turn-on Rise Time	t _r		--	14	--	
Turn-off Delay Time	t _{d(off)}		--	150	--	
Turn-off Fall Time	t _f		--	7	--	
Drain-Source Body Diode Characteristics						
Body Diode Forward Voltage	V _{SD}	T _J = 25°C, I _{SD} = 20A, V _{GS} = 0V	--	0.9	1.2	V
Reverse Recovery Time	t _{rr}	V _R = 480V, I _F = I _S , di _F /dt = 100A/μs	--	460	--	ns
Reverse Recovery Charge	Q _{rr}		--	3.8	--	μC
Peak Reverse Recovery Current	I _{rrm}		--	35	--	A

Notes

1. Repetitive Rating: Pulse Width limited by maximum junction temperature
2. $I_{AS} = 4A, V_{DD} = 50V, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 1\%$



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

Figure 1. Output Characteristics

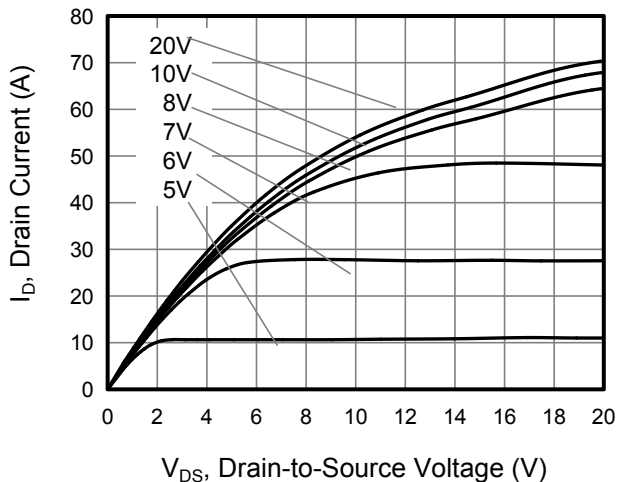


Figure 2. Transfer Characteristics

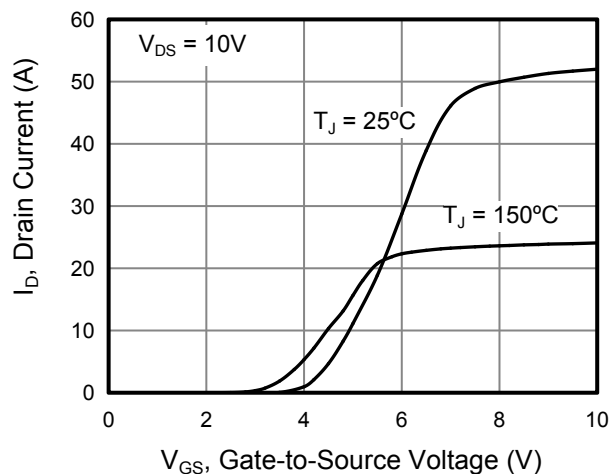


Figure 3. On-Resistance vs. Drain Current

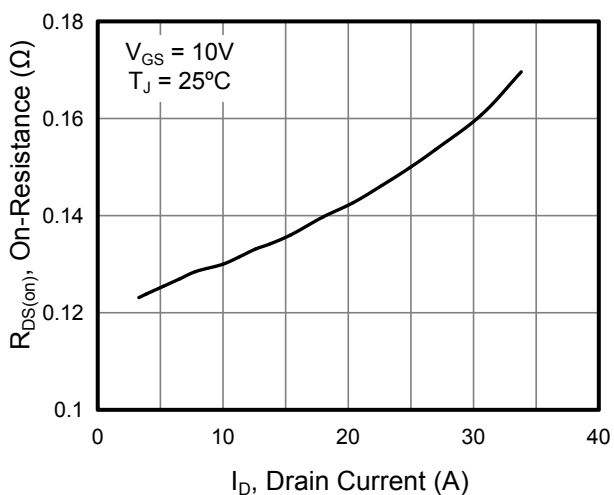


Figure 4. Capacitance

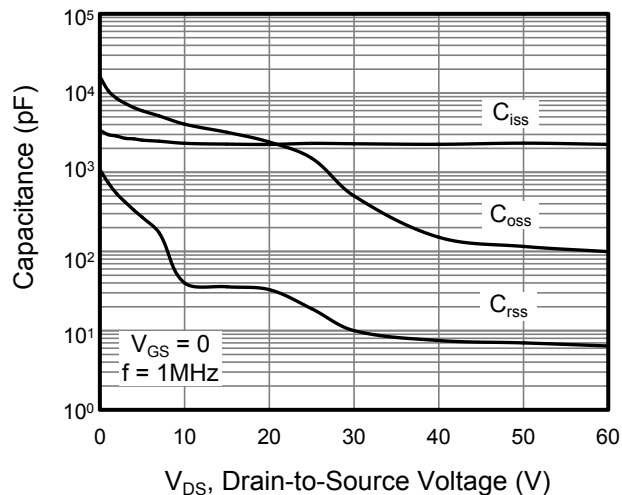


Figure 5. Gate Charge

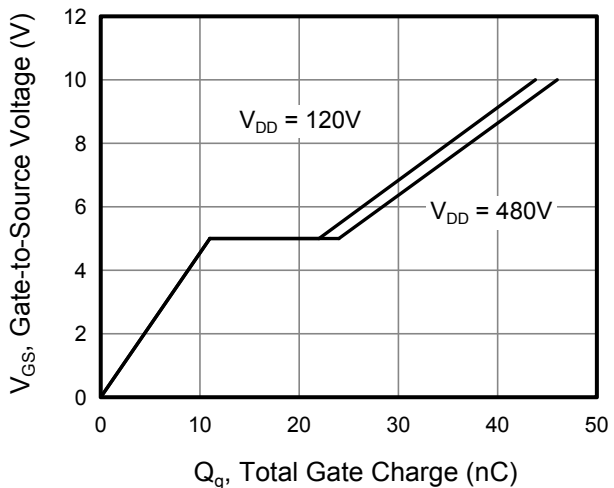
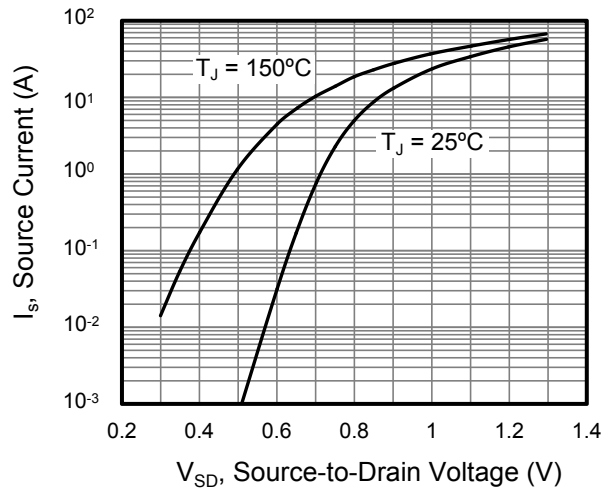


Figure 6. Body Diode Forward Voltage





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

Figure 7. On-Resistance vs.
Junction Temperature

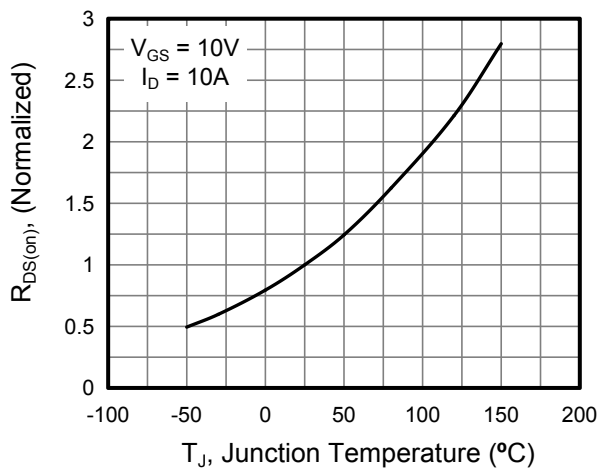


Figure 8. Threshold Voltage vs.
Junction Temperature

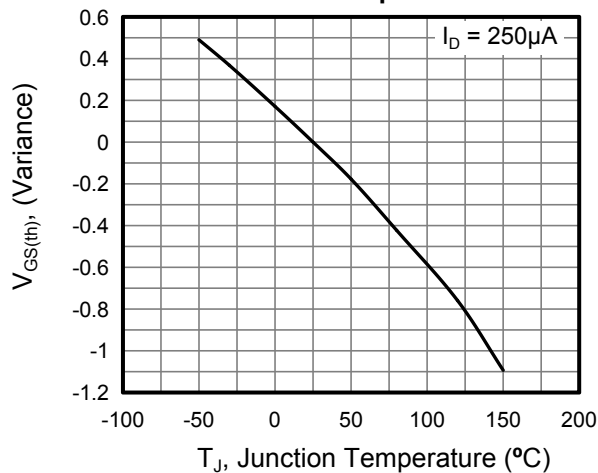


Figure 9. Transient Thermal Impedance
For TO-262/TO-220/TO-3PN/TO-247

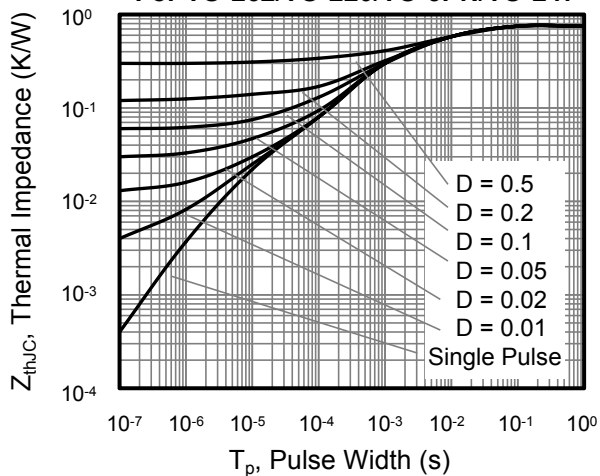


Figure 10. Transient Thermal Impedance
For TO-220F/TO-220FP-NL

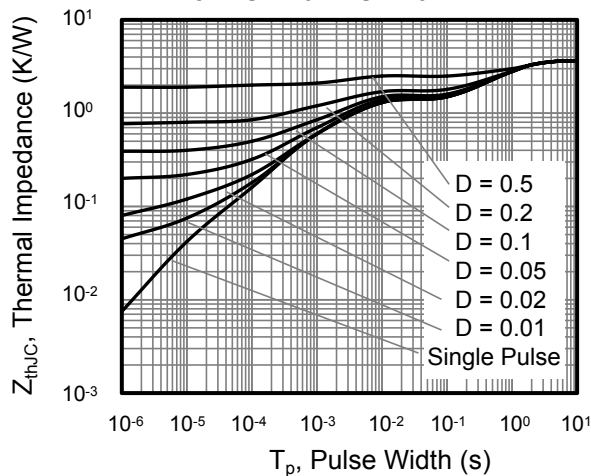




Figure A: Gate Charge Test Circuit and Waveform

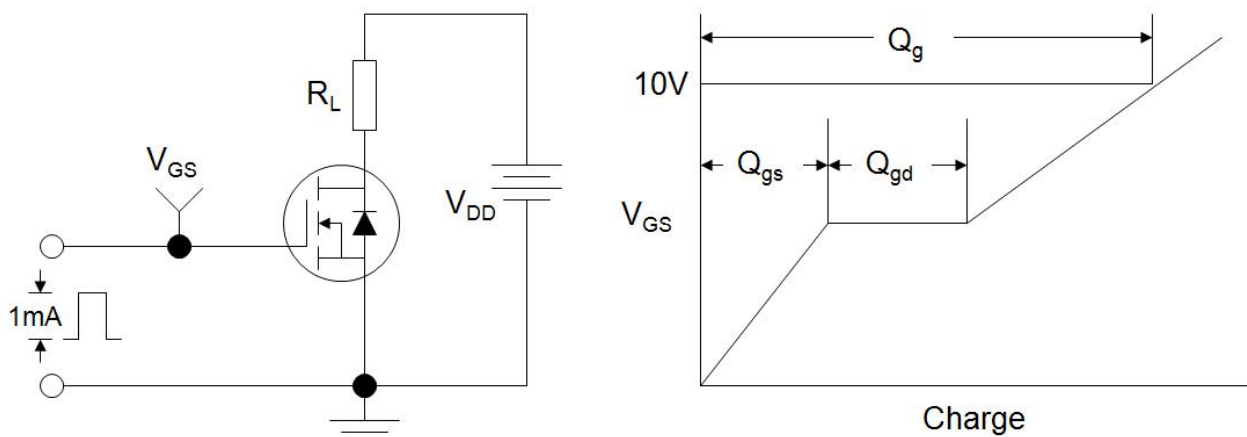


Figure B: Resistive Switching Test Circuit and Waveform

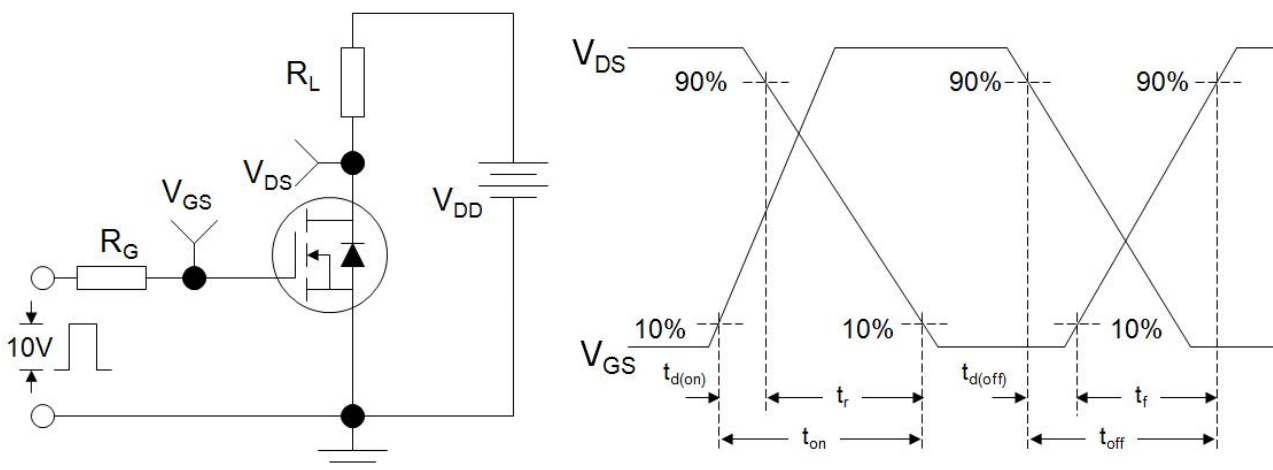
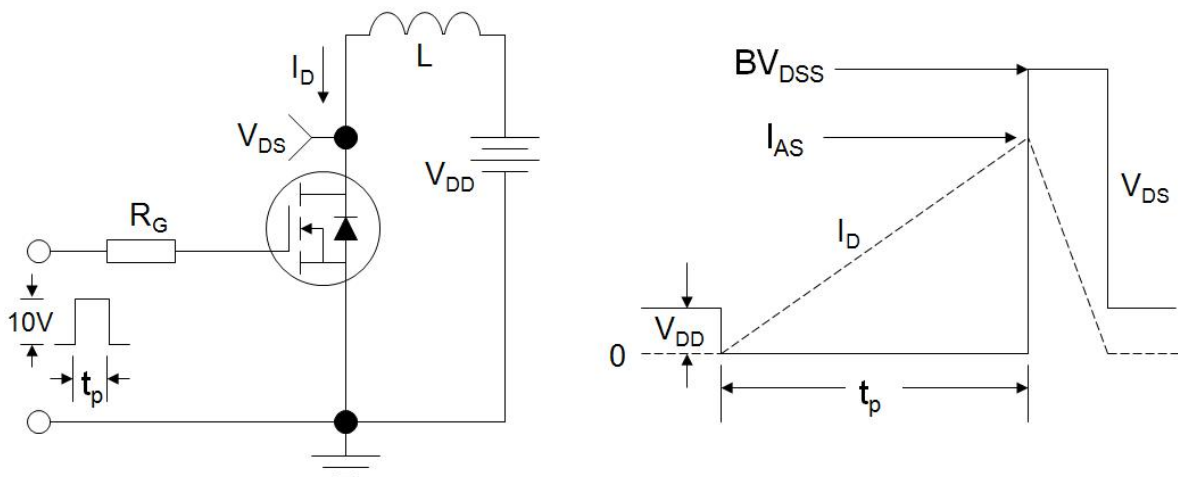
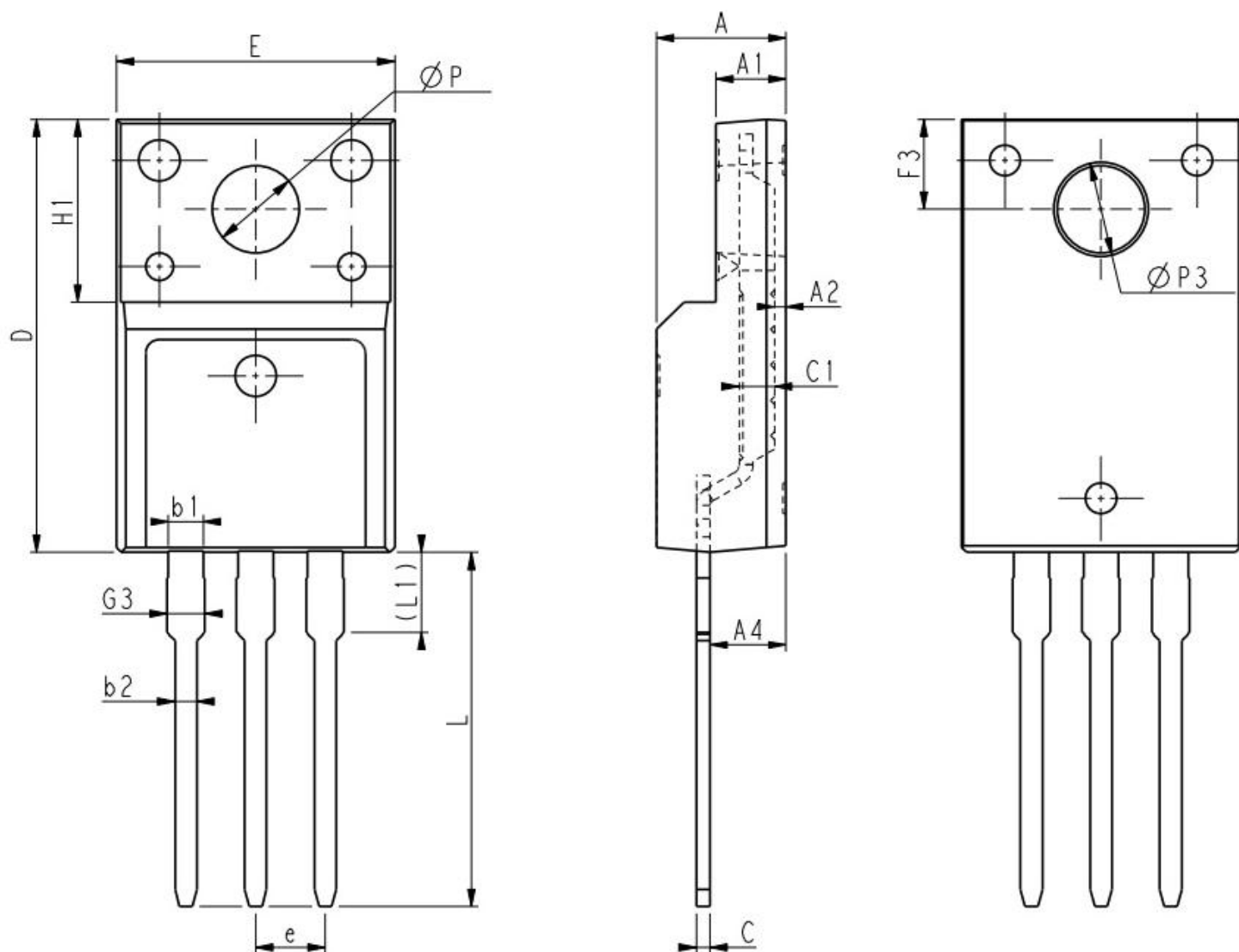


Figure C: Unclamped Inductive Switching Test Circuit and Waveform





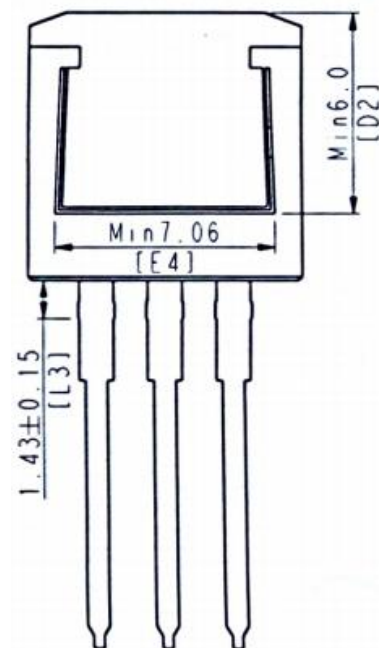
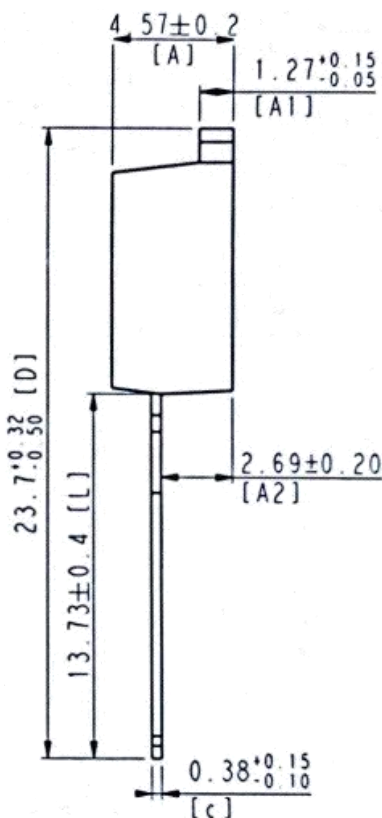
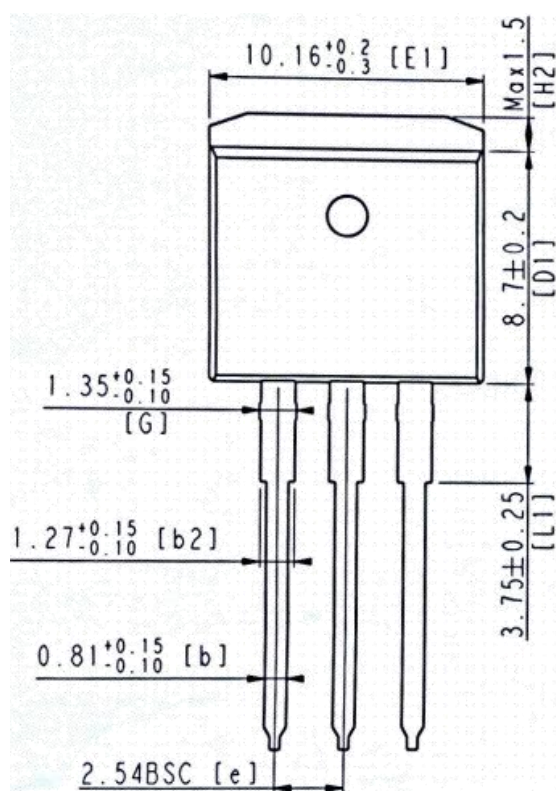
TO-220F (封装厂 H)



Unit:mm				Unit:mm			
Symbol	Min.	Nom	Max.	Symbol	Min.	Nom	Max.
E	9.96	10.16	10.36	e	2.54BSC		
A	4.50	4.70	4.90	L	12.68	12.98	13.28
A1	2.34	2.54	2.74	L1	2.93	3.03	3.13
A2	0.30	0.45	0.60	ΦP	3.03	3.18	3.38
A4	2.56	2.76	2.96	$\Phi P3$	3.15	3.45	3.65
c	0.40	0.50	0.65	F3	3.15	3.30	3.45
c1	1.20	1.30	1.35	G3	1.25	1.35	1.55
D	15.57	15.87	16.17	b1	1.18	1.28	1.43
H1	6.70REF			b2	0.70	0.80	0.95

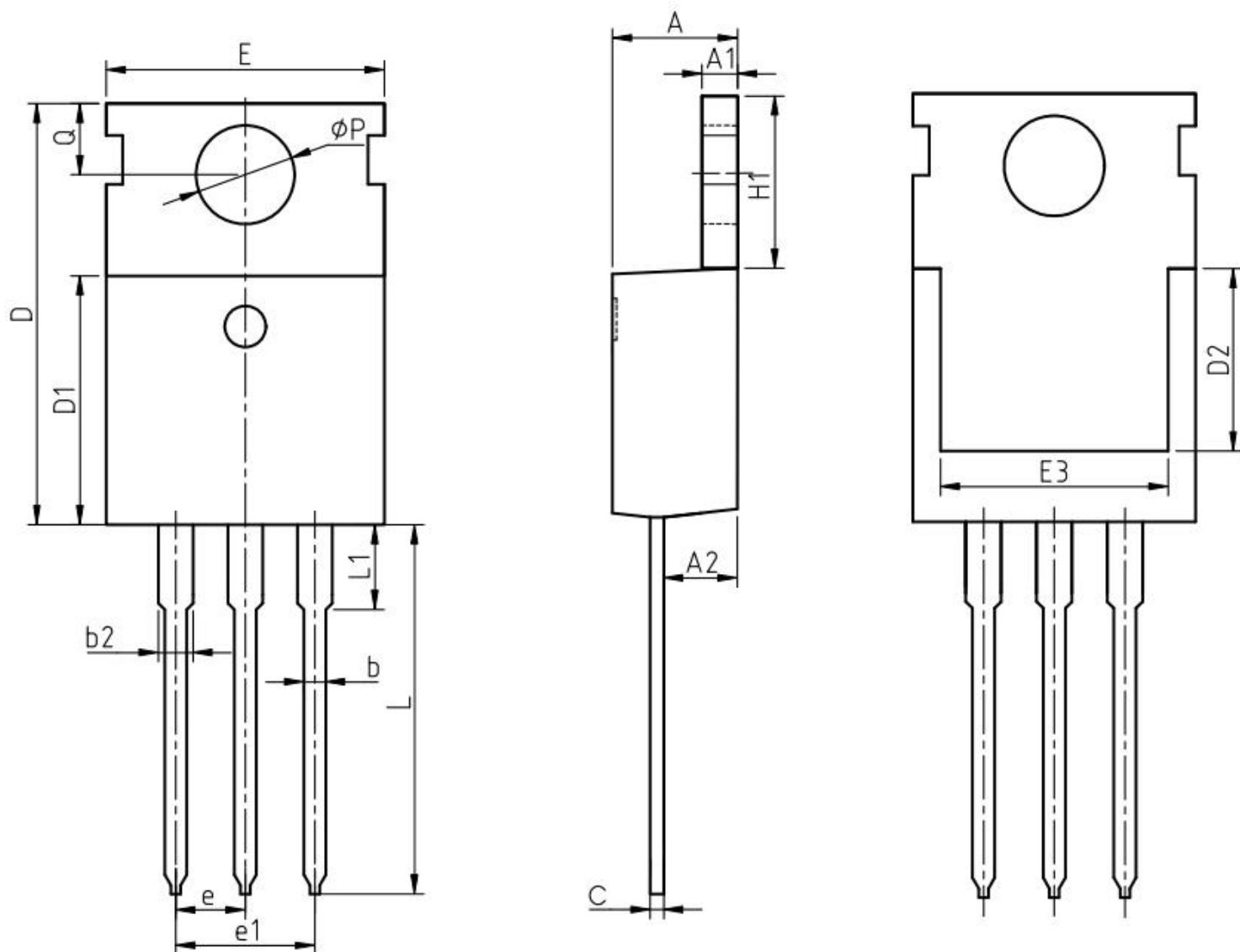


TO-262 (封装厂 H)





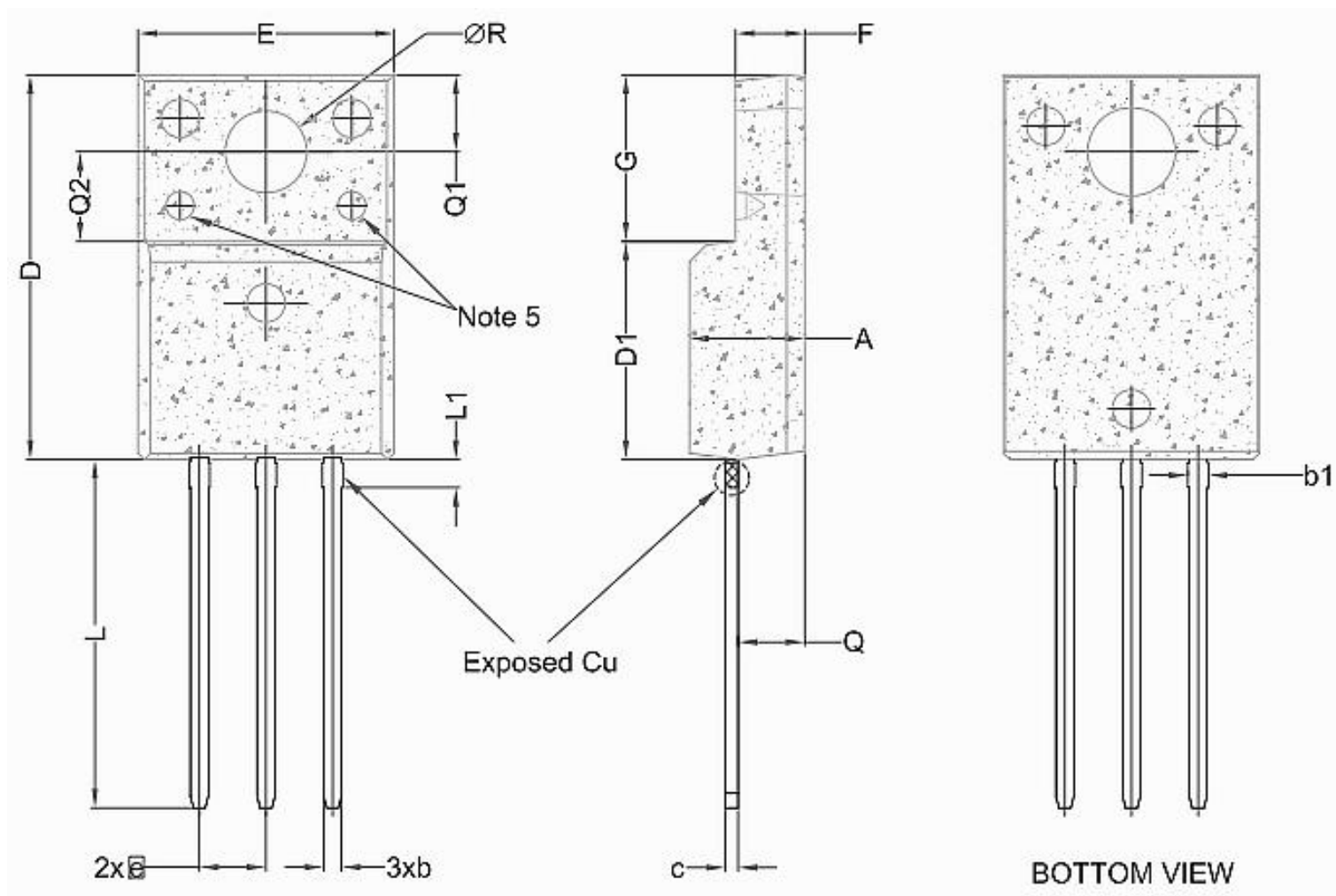
TO-220 (封装厂 H)



Unit:mm				Unit:mm			
Symbol	Min.	Nom	Max.	Symbol	Min.	Nom	Max.
A	4.37	4.57	4.70	E	9.70	10.00	10.30
A1	1.25	1.30	1.40	E3	7.00	-	-
A2	2.20	2.40	2.60	e	2.54 BSC		
b	0.70	0.80	0.95	e1	5.08 BSC		
b2	1.17	1.27	1.47	H1	6.25	6.50	6.85
c	0.45	0.50	0.60	L	12.75	13.50	13.80
D	15.10	15.60	16.10	L1	-	3.10	3.40
D1	8.80	9.10	9.40	ϕP	3.40	3.60	3.80
D2	5.50	-	-	Q	2.60	2.80	3.00



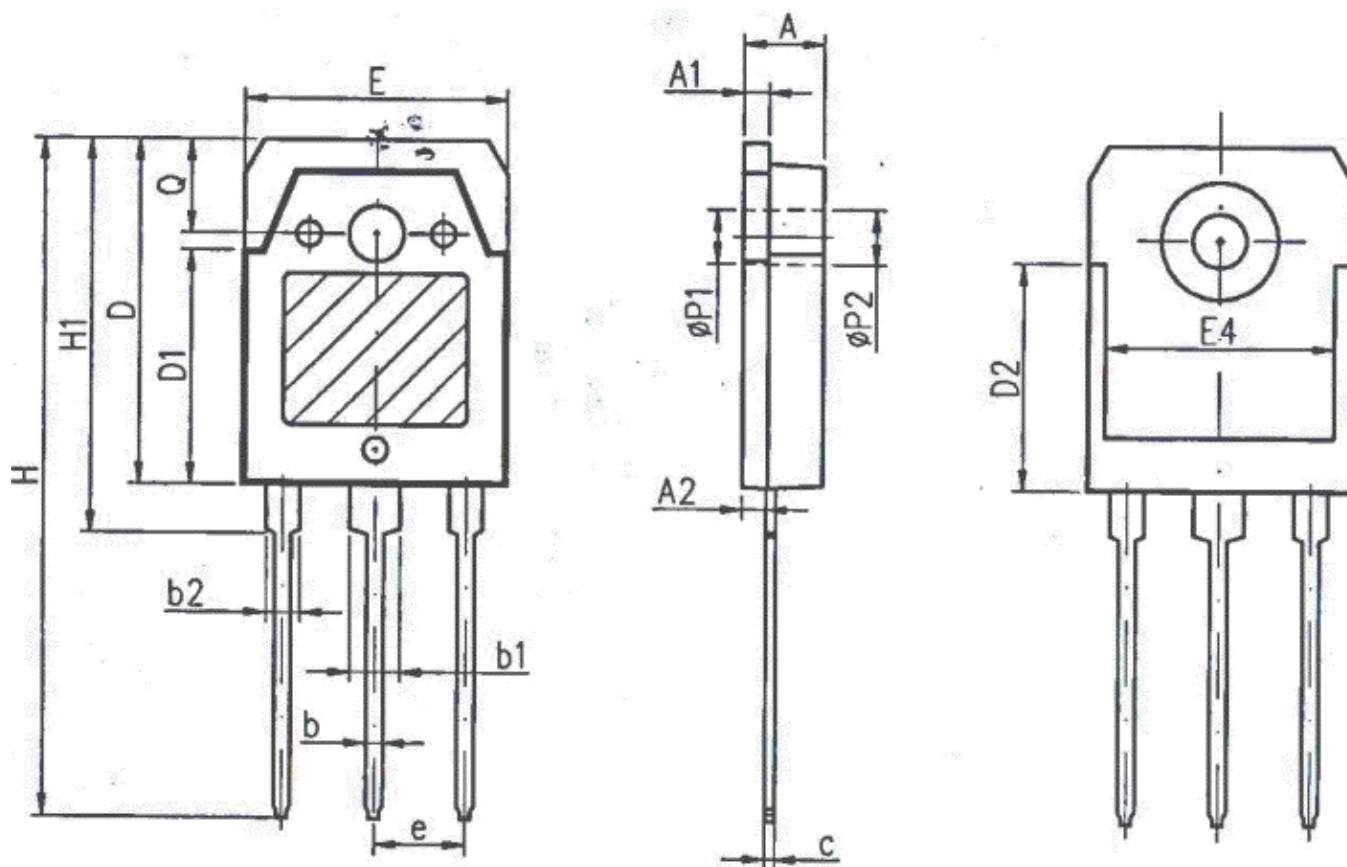
TO-220FP-NL（封装厂 M）



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



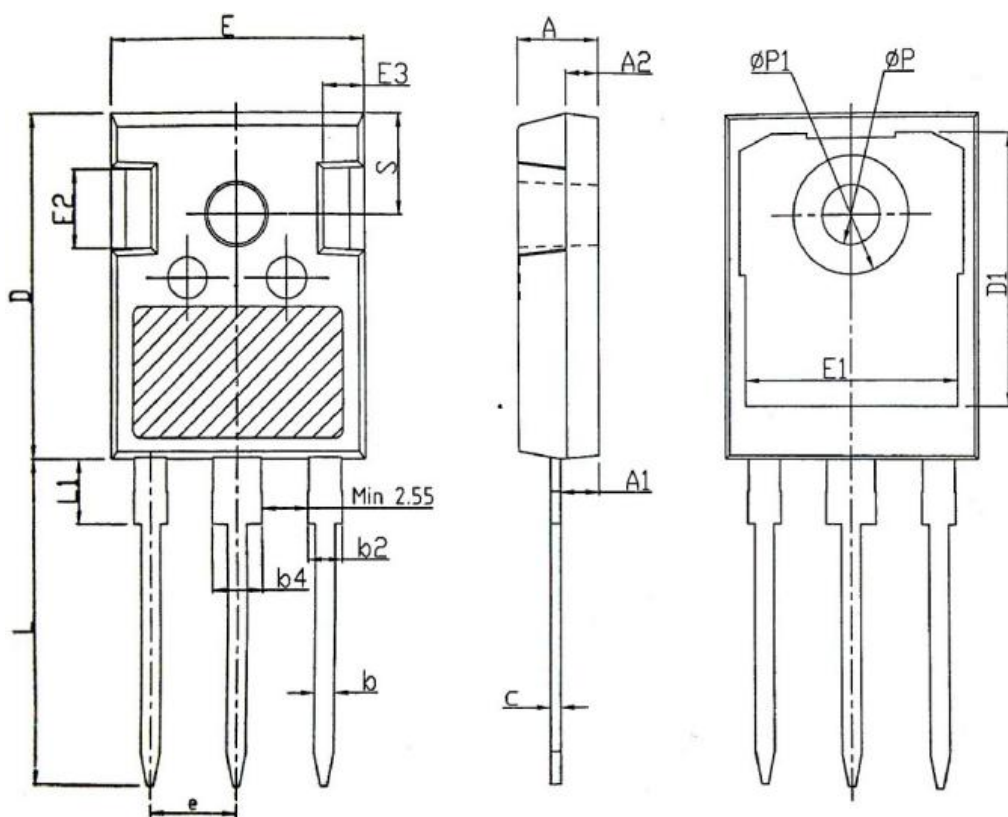
TO-3PN (封装厂 H)



SYMBOL	mm		
	MIN	NOM	MAX
A	4.60	4.80	5.00
A1	1.40	1.50	1.65
A2	1.18	1.38	1.58
b	0.80	1.00	1.20
b1	2.80	3.00	3.20
b2	1.80	2.00	2.20
c	0.50	0.60	0.75
D	19.60	19.90	20.20
D1	13.55	13.90	14.25
D2	12.90 REF		
E	15.35	15.60	15.85
E4	12.60	-	-
e	5.45 TYP		
H	40.10	40.50	40.90
H1	23.15	23.40	23.65
ΦP1	3.20 REF		
ΦP2	3.50 REF		



TO-247 (封装厂 H)



SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
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	20.80	21.00	21.30
D1	16.25	16.55	16.85
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	19.82	19.92	20.22
L1	-	-	4.30
ΦP	3.40	3.60	3.80
ΦP1	-	-	7.30
S	6.15BSC		



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