Wuxi Unigroup Microelectronics Co.,Ltd

600V Super-junction Power MOSFET

Description

600V 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, 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
TPA60R350C	TO-220F	60R350C
TPB60R350C	TO-263	60R350C
TPC60R350C	TO-262	60R350C
TPD60R350C	TO-252	60R350C
TPP60R350C	TO-220	60R350C
TPR60R350C	TO-220FP-NL	60R350C
TPU60R350C	TO-251	60R350C
TPV60R350C	TO-3PN	60R350C

Key Performance Parameters

Parameter	Value	Unit
V_{DS} @ $T_{j,max}$	650	V
$R_{DS(on),max}$	0.35	Ω
$Q_{g,typ}$	21	nC
I_D	11	A
$I_{D,pulse}$	33	A

Absolute Maximum Ratings T_C = 25ºC, unless otherwise noted				
Parameter		**Symbol**	**Values**	**Unit**
Continuous Drain Current	T_C = 25ºC	I_D	11	A
Pulsed Drain Current	(note1)	$I_{D,pulse}$	33	A
Gate-Source Voltage		V_{GSS}	±30V	V
Single Pulse Avalanche Energy	(note2)	E_{AS}	211	mJ
Repetitive Avalanche Energy	(note2)	E_{AR}	0.32	mJ
Avalanche Current		I_{AR}	1.6	A
Power Dissipation For TO-220F,TO-220FP-NL		P_D	31.3	W
Power Dissipation For TO-263,TO-262,TO-252,TO-220,TO-251,TO-3PN			78	
Continuous Diode Forward Current		I_S	11	A
Diode Pulsed Current	(note1)	$I_{S,pulse}$	33	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55~+150	ºC

Thermal Resistance For TO-220F,TO-220FP-NL			
Parameter	**Symbol**	**Value**	**Unit**
Thermal Resistance, Junction-to-Case	R_{thJC}	4.0	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	80	

Thermal Resistance For TO-263,TO-262,TO-252,TO-220,TO-251,TO-3PN			
Parameter	**Symbol**	**Value**	**Unit**
Thermal Resistance, Junction-to-Case	R_{thJC}	1.6	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62	

Electrical Characteristics T_J = 25ºC, 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 = 25ºC	--	--	1	μA
		V_{DS} = 600V, V_{GS} = 0V, T_J = 150ºC	--	--	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	V
Drain-Source On-State-Resistance	$R_{DS(on)}$	V_{GS} = 10V, I_D = 5.5A	--	0.30	0.35	Ω
Forward Transconductance (Note3)	g_{fs}	V_{DS} = 10V, I_D = 5.5A	--	7.8	--	S
Dynamic Characteristics						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} = 50V, f = 1.0MHz	--	901	--	pF
Output Capacitance	C_{oss}		--	50	--	
Reverse Transfer Capacitance	C_{rss}		--	5.5	--	
Total Gate Charge	Q_g	V_{DD} = 480V, I_D = 11A, V_{GS} = 10V	--	21	--	nC
Gate-Source Charge	Q_{gs}		--	4.5	--	
Gate-Drain Charge	Q_{gd}		--	7	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 400V, I_D = 11A, R_G = 25Ω	--	41	--	ns
Turn-on Rise Time	t_r		--	20	--	
Turn-off Delay Time	$t_{d(off)}$		--	123	--	
Turn-off Fall Time	t_f		--	6.4	--	
Drain-Source Body Diode Characteristics						
Body Diode Forward Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 11A, 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	--	280	--	ns
Reverse Recovery Charge	Q_{rr}		--	2.8	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	17	--	A

Notes

1. Repetitive Rating: Pulse Width limited by maximum junction temperature
2. I_{AS} = 1.6A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 1%

Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 1. Output Characteristics

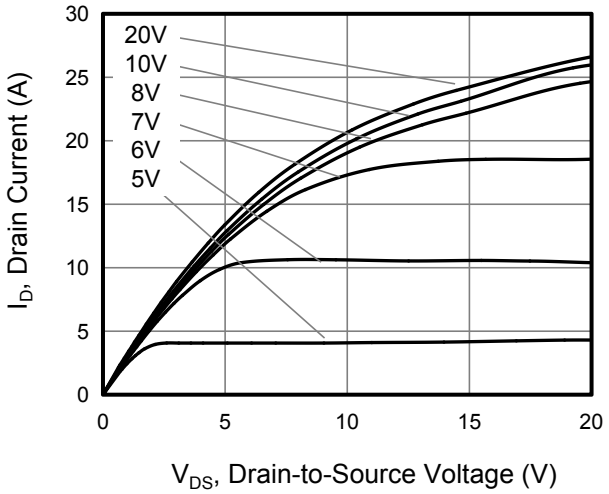


Figure 2. Transfer Characteristics

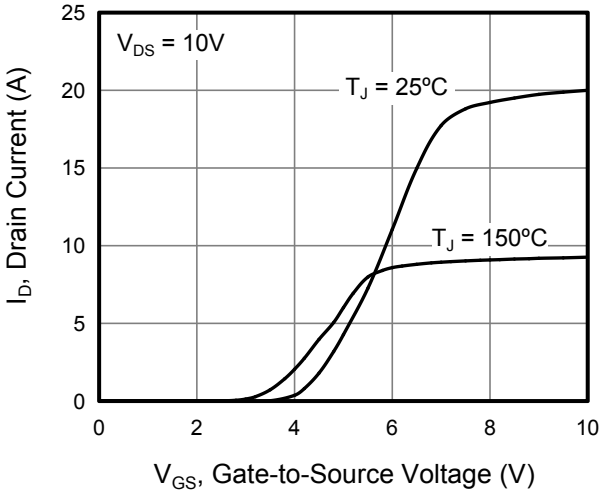


Figure 3. On-Resistance vs. Drain Current

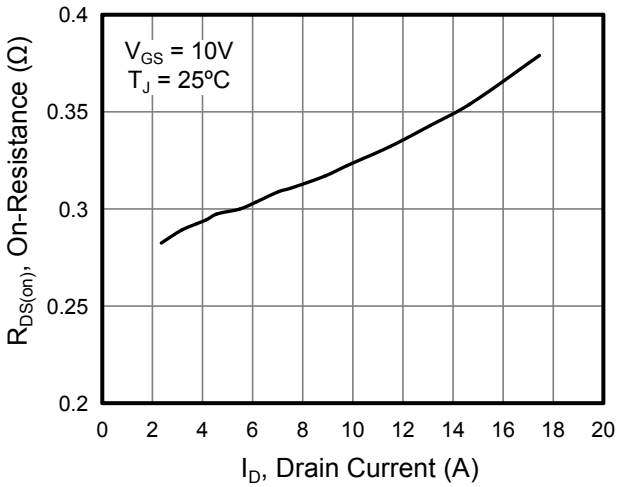


Figure 4. Capacitance

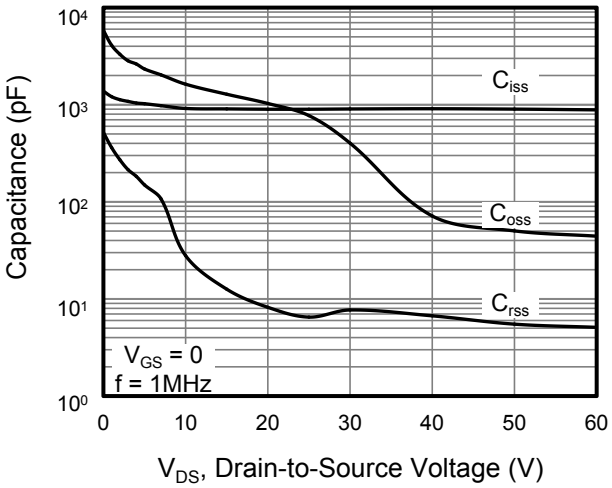


Figure 5. Gate Charge

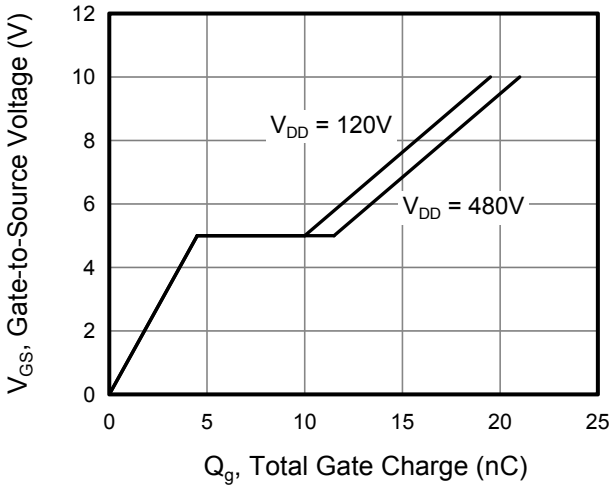
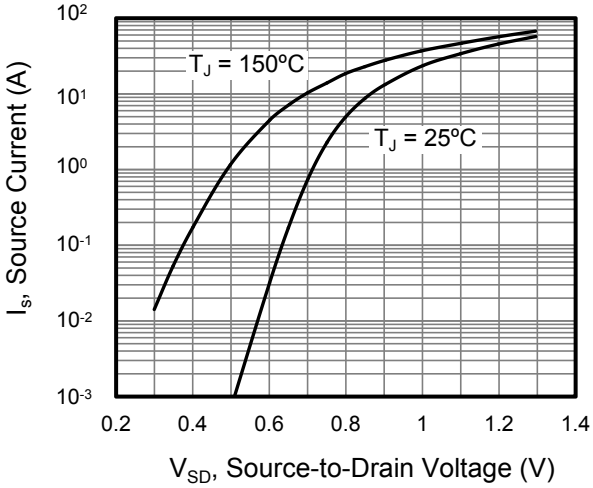


Figure 6. Body Diode Forward Voltage



Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 7. On-Resistance vs. Junction Temperature

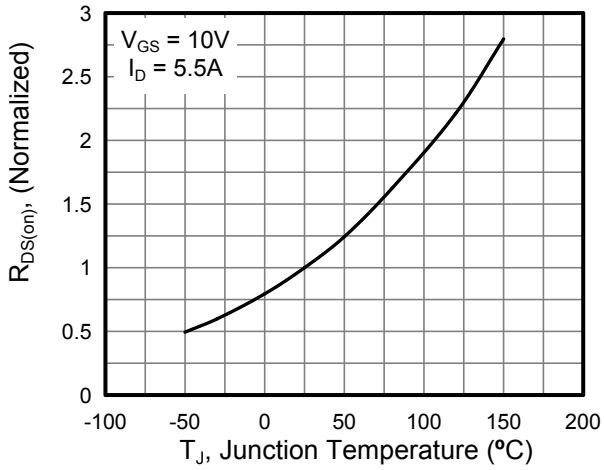


Figure 8. Threshold Voltage vs. Junction Temperature

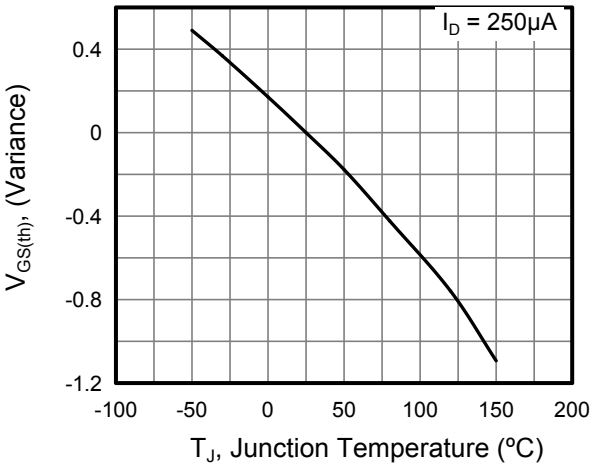


Figure 9. Transient Thermal Impedance For TO-263/TO-262/TO-252/TO-220/TO-251/TO-3PN

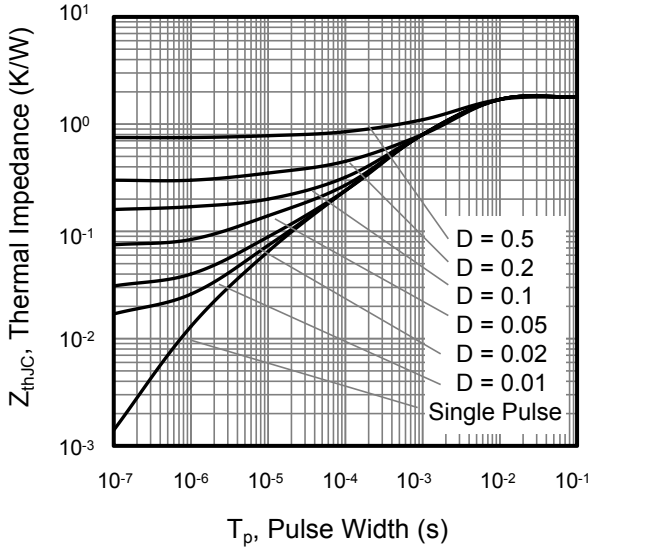


Figure 10. Transient Thermal Impedance For TO-220F/TO-220FP-NL

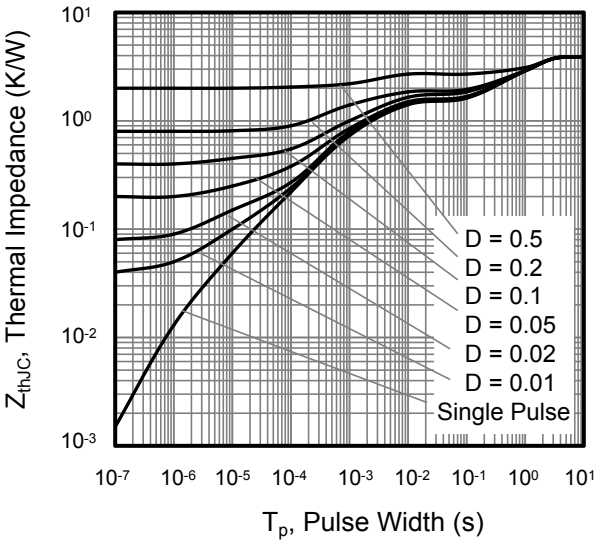


Figure A：Gate Charge Test Circuit and Waveform

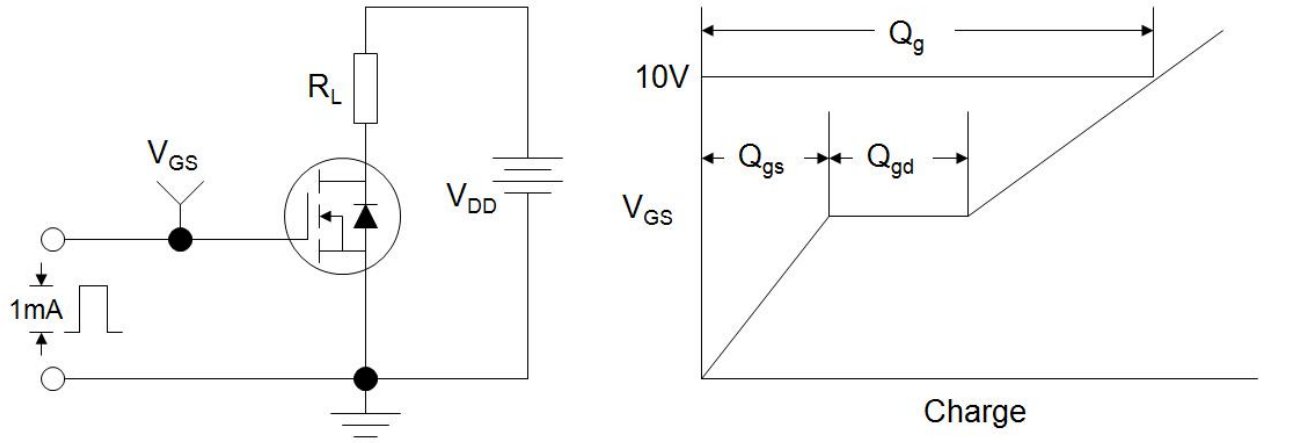


Figure B：Resistive Switching Test Circuit and Waveform

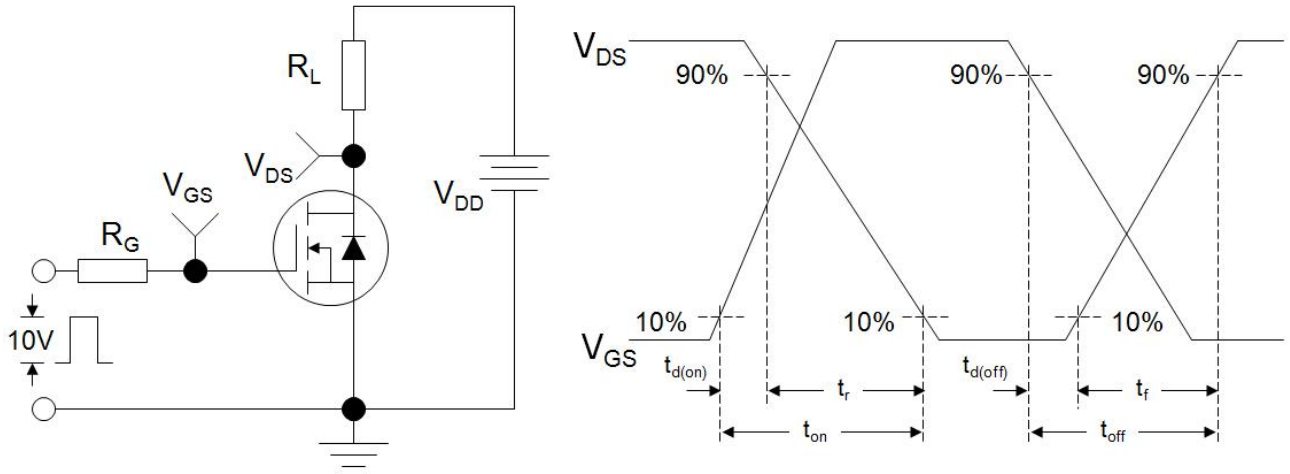
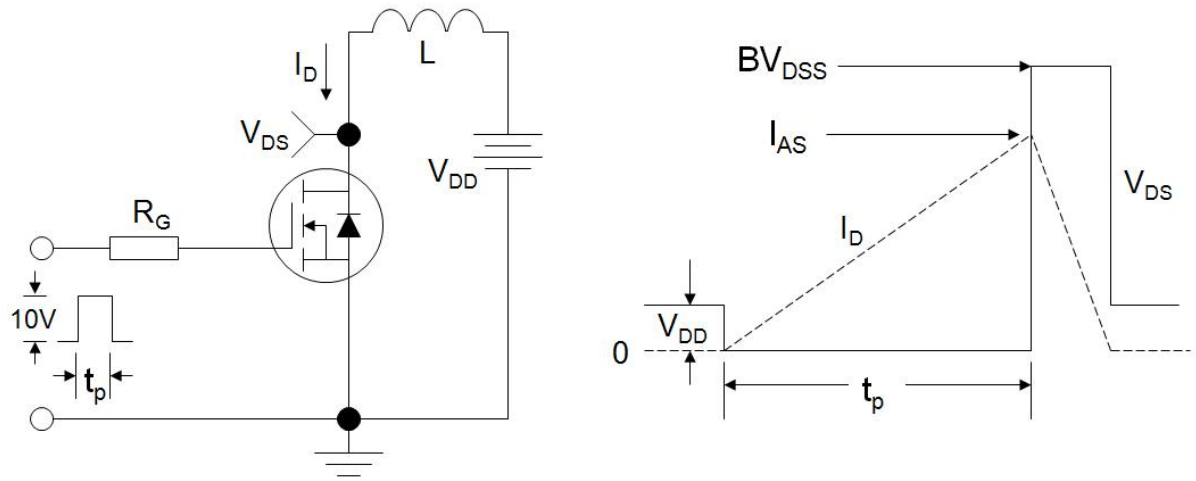
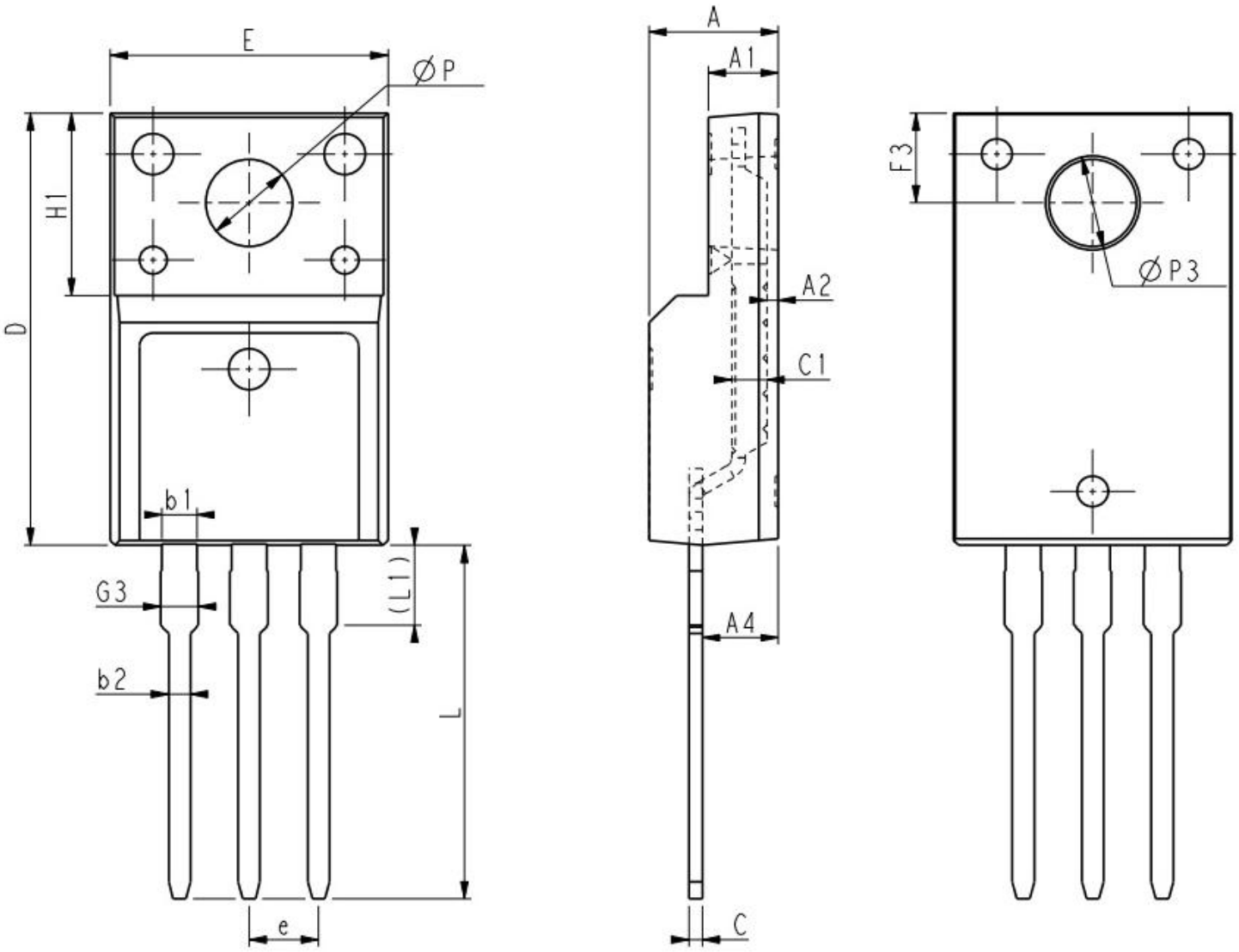


Figure C：Unclamped Inductive Switching Test Circuit and Waveform



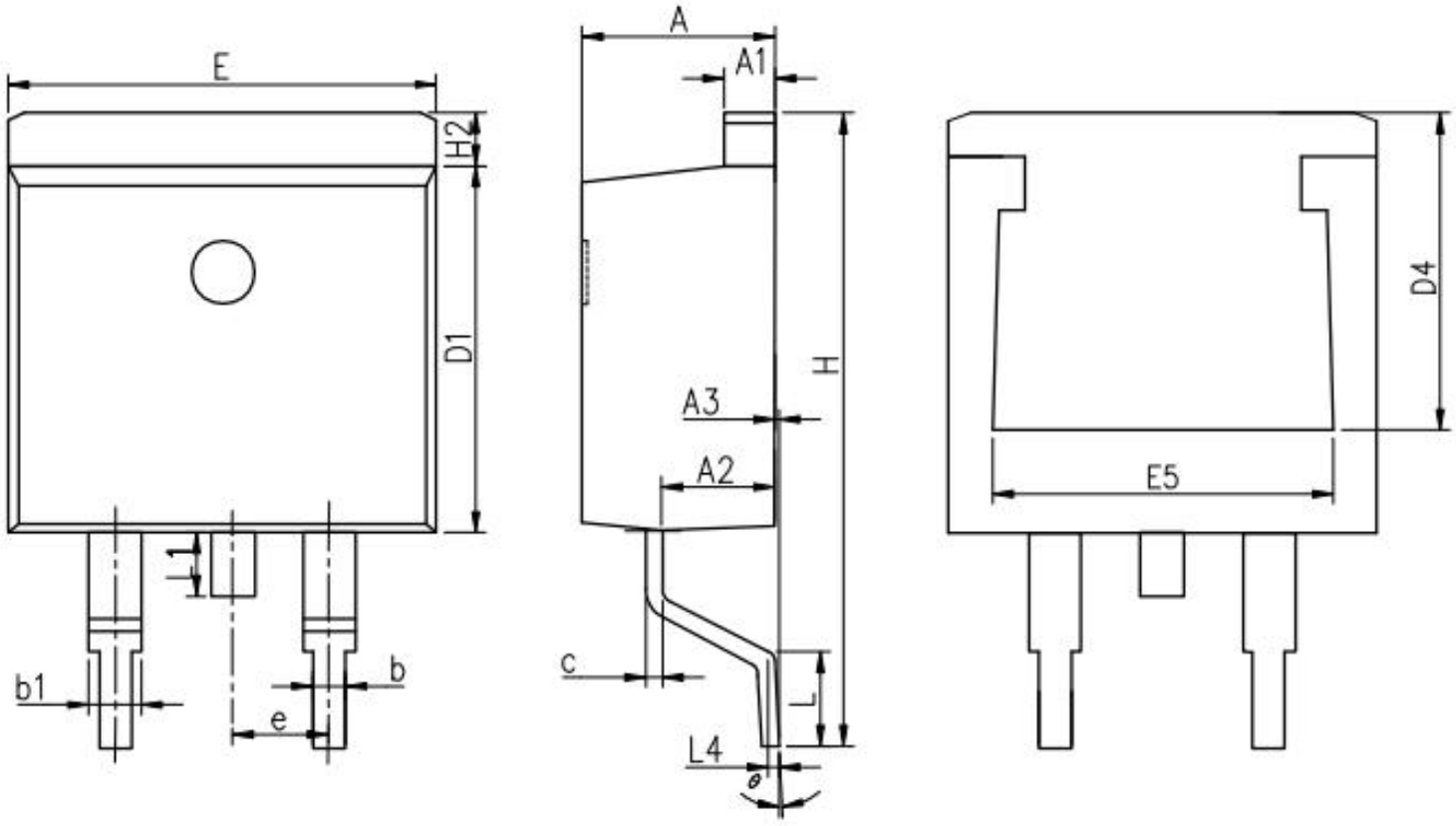
TO-220F（封装厂 H）



Unit:mm			
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
ΦP	3.03	3.18	3.38
ΦP3	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

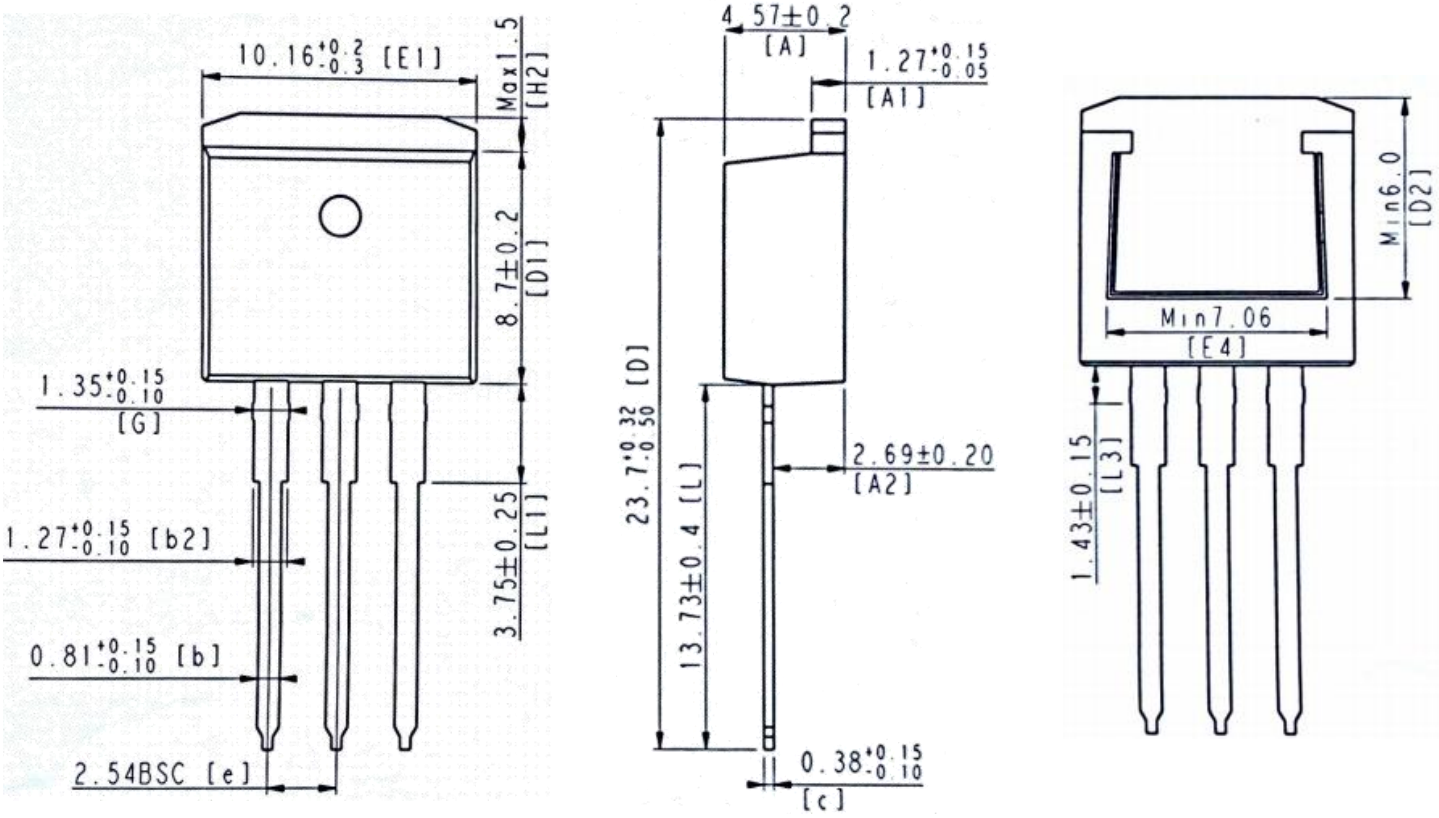
TO-263（封装厂 H）



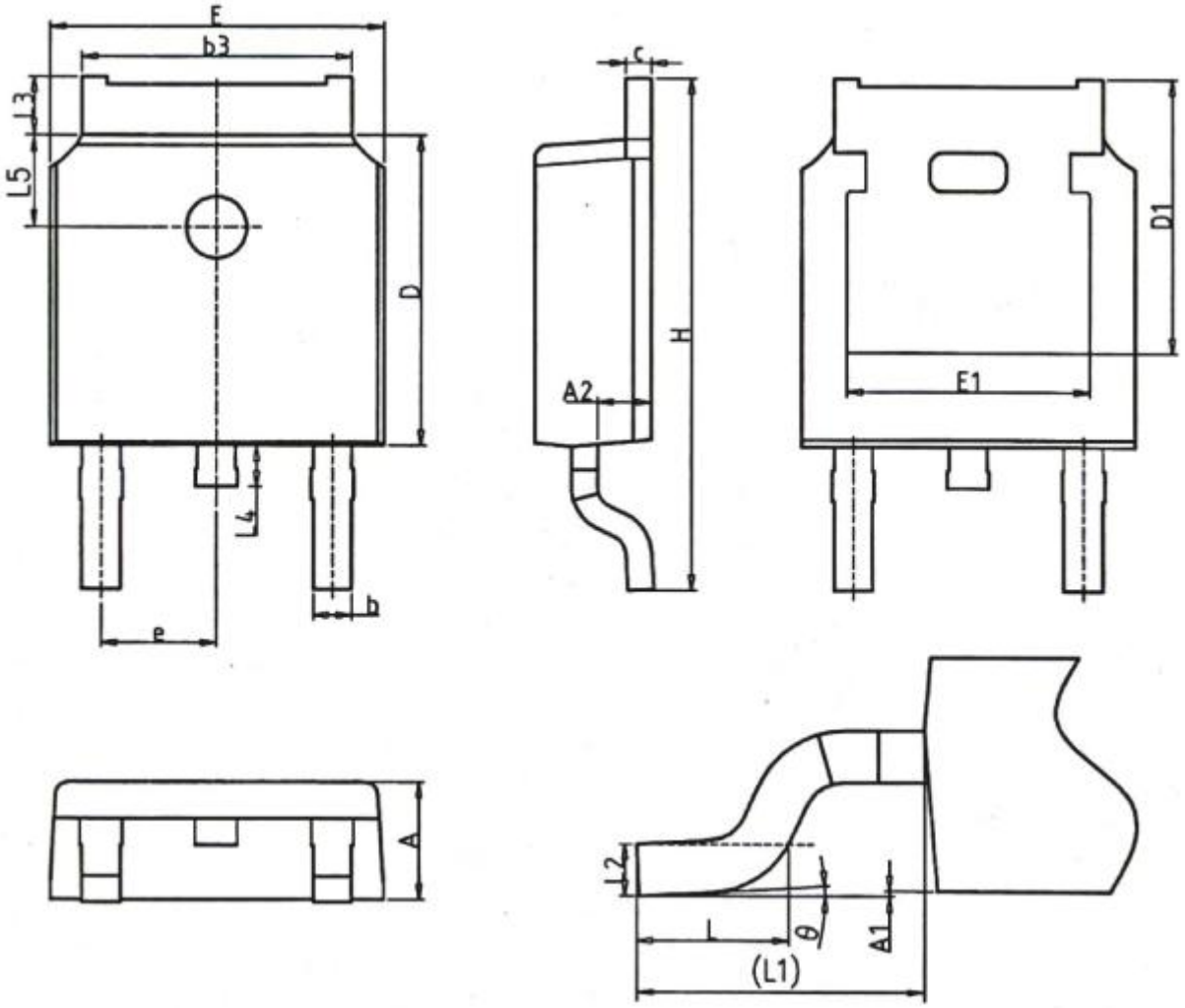
Unit:mm			
Symbol	Min.	Nom	Max.
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
A3	0.00	0.13	0.25
b	0.70	0.81	0.96
b1	1.17	1.27	1.47
c	0.30	0.38	0.53
D1	8.50	8.70	8.90
D4	6.60	-	-

Unit:mm			
Symbol	Min.	Nom	Max.
E	9.86	10.16	10.36
E5	7.06	-	-
e	2.54BSC		
H	14.70	15.10	15.50
H2	1.07	1.27	1.47
L	2.00	2.30	2.60
L1	1.40	1.55	1.70
L4	0.25BSC		
θ	0°	5°	9°

TO-262（封装厂 H）


10.16+0.2 -0.3 [E1]
Max1.5 [H2]
8.7±0.2 [D1]
1.35+0.15 -0.10 [G]
3.75±0.25 [L1]
1.27+0.15 -0.10 [b2]
0.81+0.15 -0.10 [b]
2.54BSC [e]
4.57±0.2 [A]
1.27+0.15 -0.05 [A1]
23.7+0.32 -0.50 [D]
13.73±0.4 [L]
2.69±0.20 [A2]
0.38+0.15 -0.10 [c]
Min6.0 [D2]
Min7.06 [E4]
1.43±0.15 [L3]

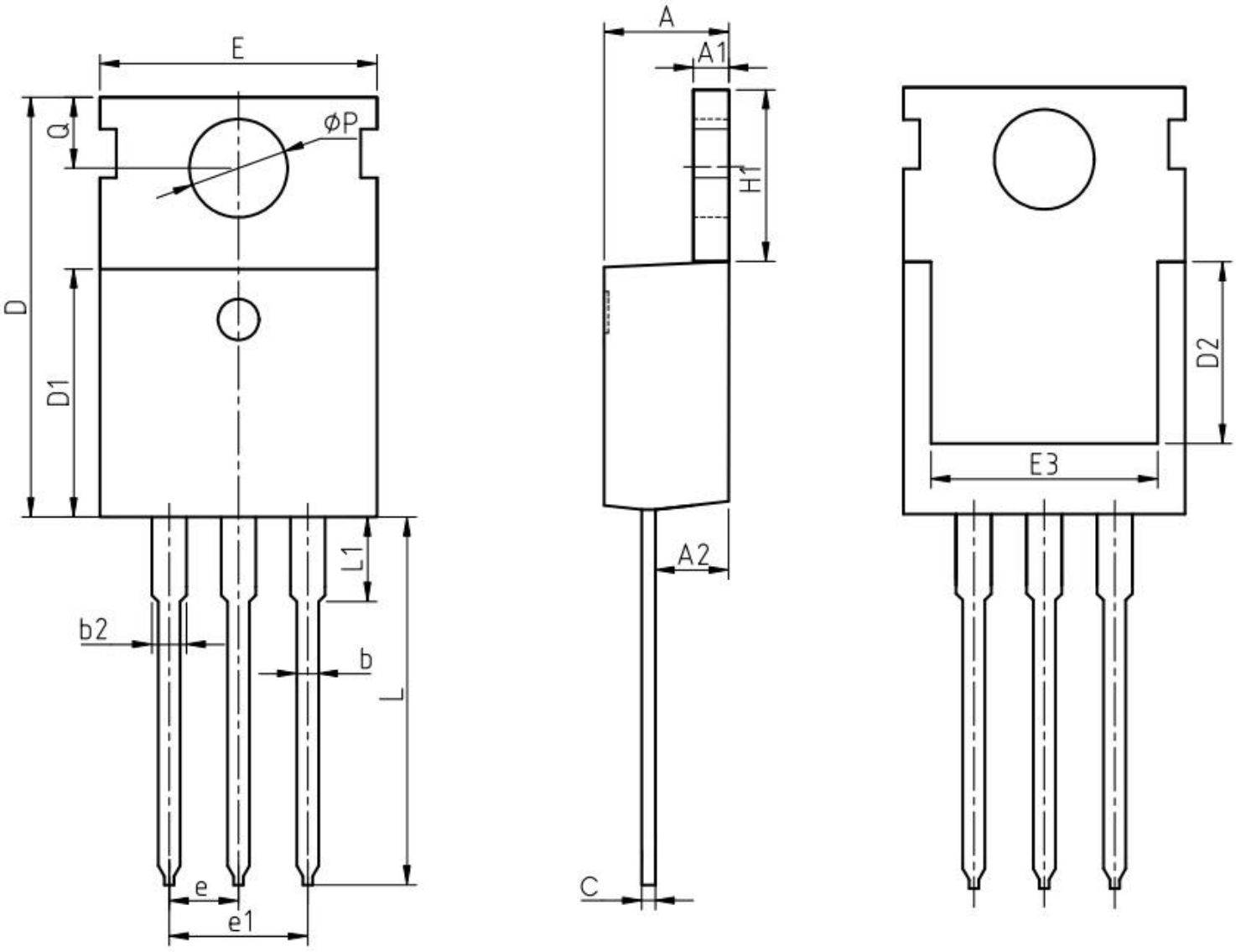
TO-252（封装厂 H）



Unit:mm			
Symbol	Min.	Nom	Max.
A	2.20	2.30	2.38
A1	0.00	-	0.20
A2	0.97	1.07	1.17
b	0.68	0.78	0.90
b3	5.20	5.33	5.46
c	0.43	0.53	0.61
D	5.98	6.10	6.22
D1	5.30 REF		
E	6.40	6.60	6.73
E1	4.63	-	-

Unit:mm			
Symbol	Min.	Nom	Max.
e	2.286 BSC		
H	9.40	10.10	10.50
L	1.38	1.50	1.75
L1	2.90 REF		
L2	0.51 BSC		
L3	0.88	-	1.28
L4	0.50	-	1.00
L5	1.65	1.80	1.95
θ	0°	-	8°

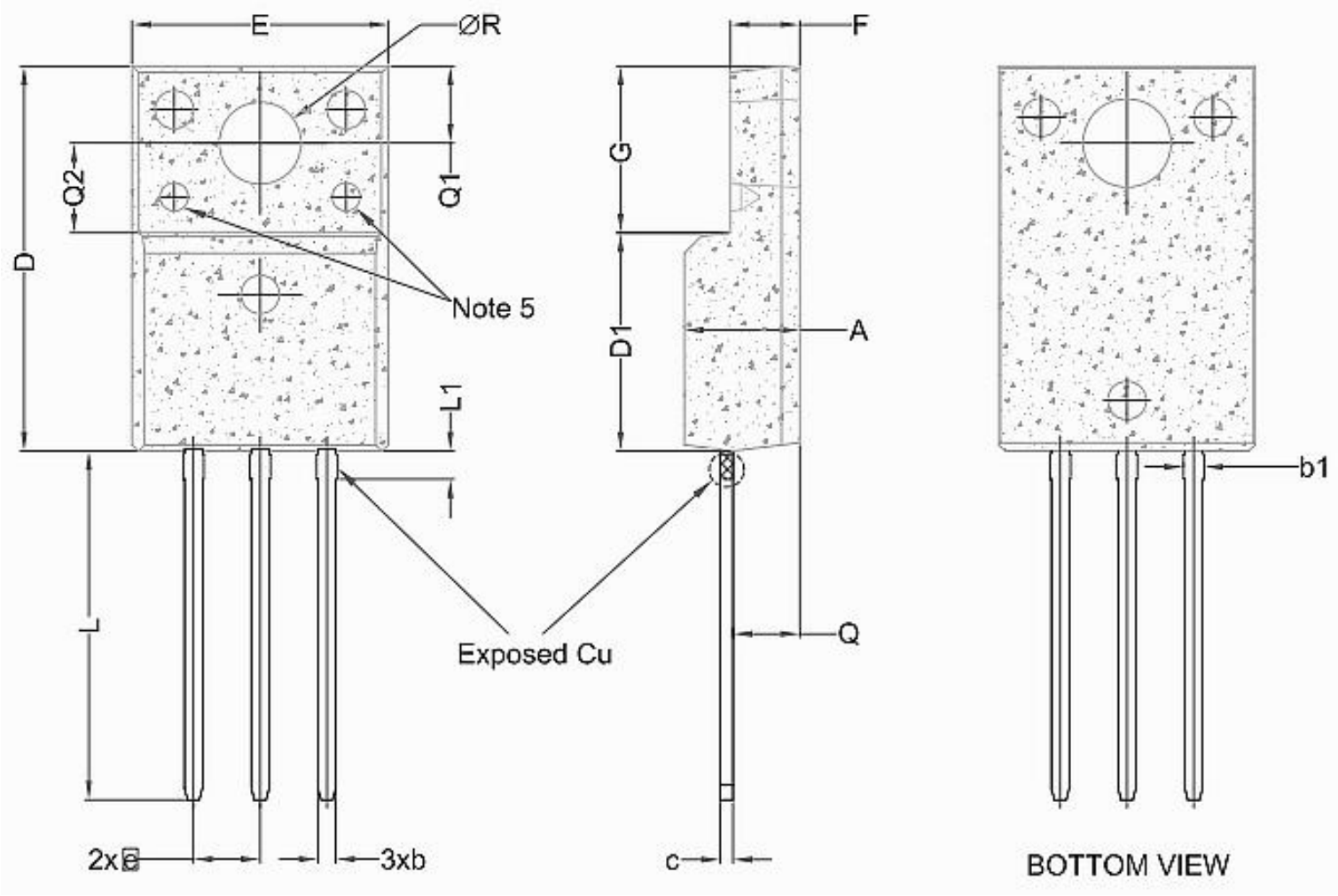
TO-220（封装厂 H）



Unit:mm			
Symbol	Min.	Nom	Max.
A	4.37	4.57	4.70
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
ΦP	3.40	3.60	3.80
Q	2.60	2.80	3.00

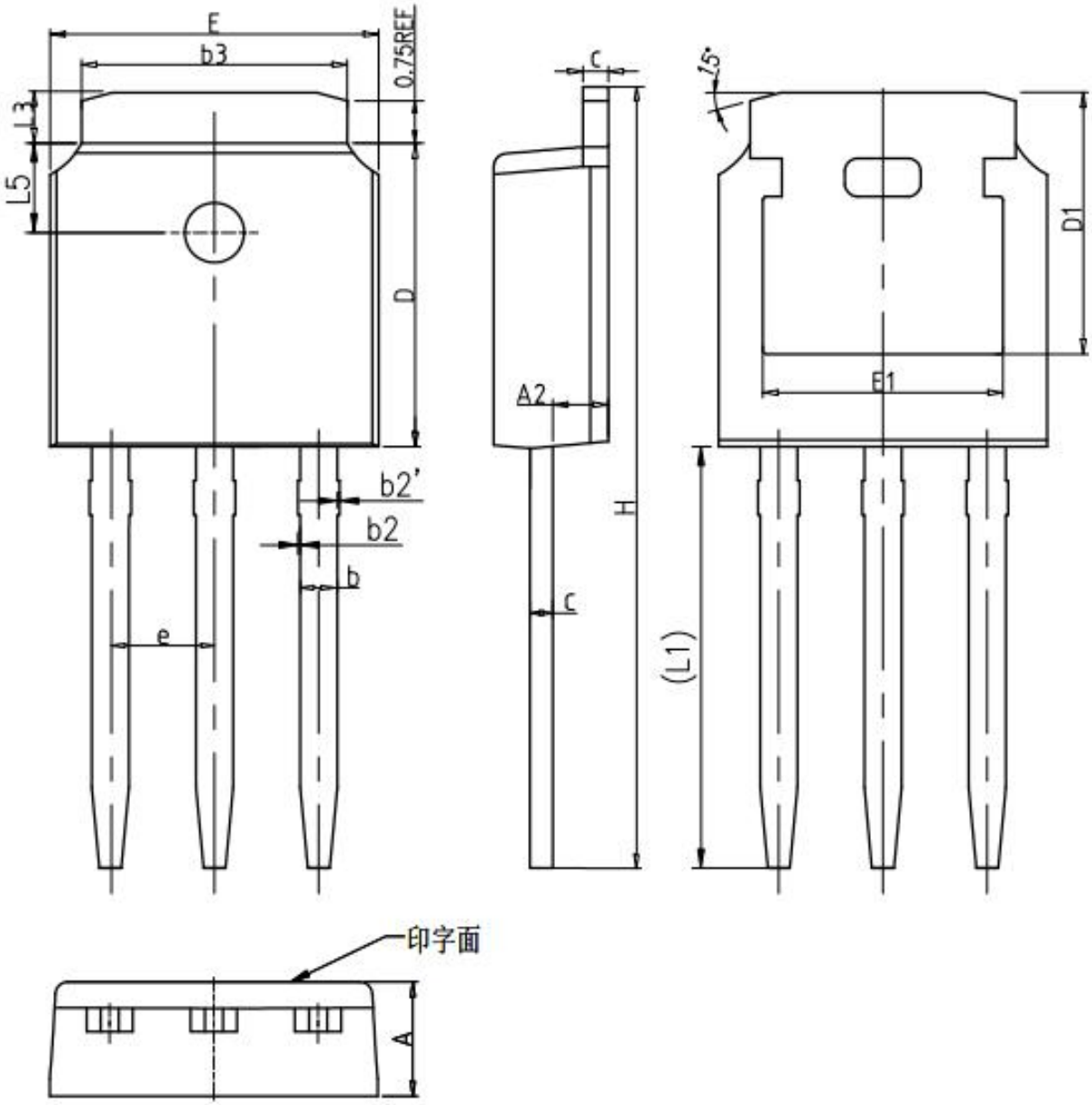
TO-220FP-NL（封装厂 M）



Unit:mm			
Symbol	Min.	Nom	Max.
A	4.30	4.50	4.70
b	0.60	0.70	0.80
b1	0.60	0.80	0.90
c	0.45	0.50	0.60
D	14.70	15.00	15.30
D1	8.50 REF		
e	2.60BSC		
E	9.70	10.00	10.30

Unit:mm			
Symbol	Min.	Nom	Max.
F	2.50	2.70	2.90
G	6.30	6.50	6.70
L	13.40	13.60	13.80
L1	1.00	1.10	1.20
Q	2.50	2.60	2.70
Q1	2.90	3.00	3.10
Q2	3.50 REF		
ΦR	3.00	3.20	3.40

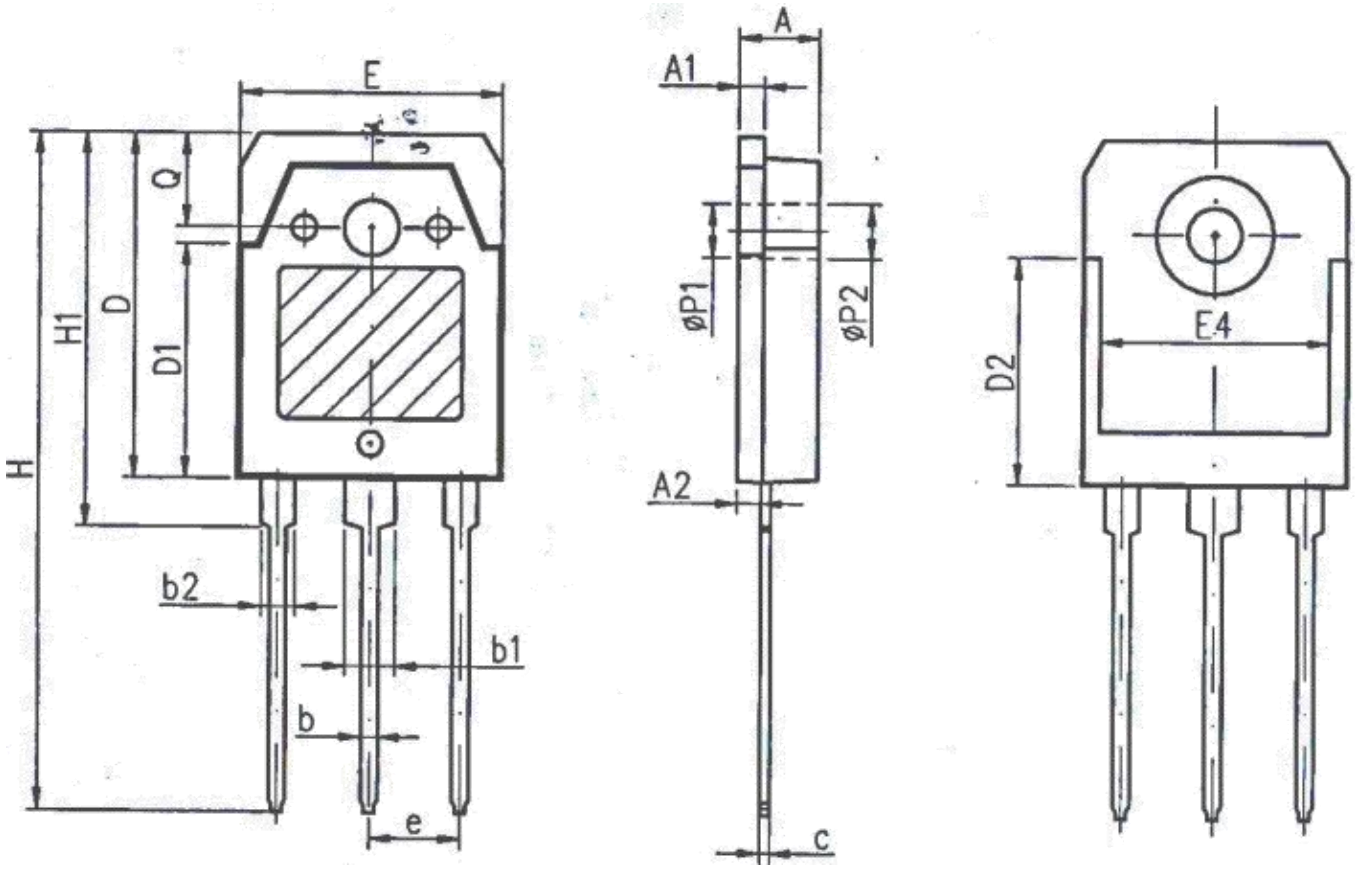
TO-251（封装厂 H）



Unit:mm			
Symbol	Min.	Nom	Max.
A	2.20	2.30	2.40
A2	0.97	1.07	1.17
b	0.68	0.78	0.90
b2	0.00	0.04	0.10
b2′	0.00	0.04	0.10
b3	5.20	5.33	5.50
c	0.43	0.53	0.63
D	5.98	6.10	6.22

Unit:mm			
Symbol	Min.	Nom	Max.
D1	5.30 REF		
E	6.40	6.60	6.80
E1	4.63	-	-
e	2.286 BSC		
H	16.22	16.52	16.82
L1	9.15	9.40	9.65
L3	0.88	1.02	1.28
L5	1.65	1.80	1.95

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	

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