



600V Super-junction Power MOSFET

Description

600V Super-junction Power MOSFET

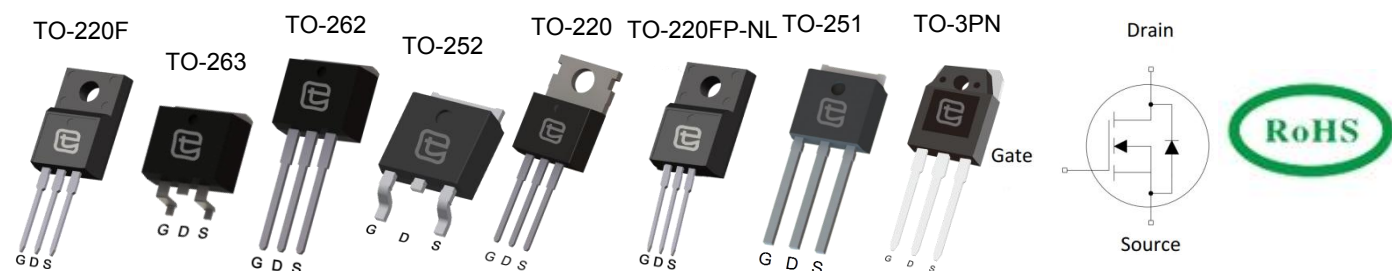
Super-junction power MOSFET is a revolutionary technology for high voltage power MOSFETs, designed according to the SJ principle. The deep trench SJ MOSFET provide an extremely low switching, communication and conduction losses device with highest robustness make especially resonant switching applications 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 $T_C = 25^{\circ}\text{C}$, unless otherwise noted				
Parameter		Symbol	Values	Unit
Continuous Drain Current	$T_C = 25^{\circ}\text{C}$	I_D	11	A
Pulsed Drain Current	(note1)	$I_{D,pulse}$	33	A
Gate-Source Voltage		V_{GSS}	$\pm 30\text{V}$	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}	$-55\sim+150$	$^{\circ}\text{C}$

Thermal Resistance For TO-220F,TO-220FP-NL			
Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	R_{thJC}	4.0	$^{\circ}\text{C/W}$
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	$^{\circ}\text{C/W}$
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.	
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	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 = 25°C, 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. $I_{AS} = 1.6A, V_{DD} = 50V, R_G = 25\Omega$, 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

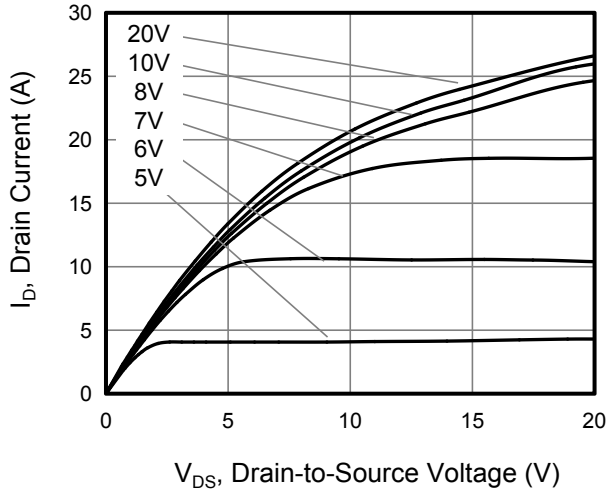


Figure 2. Transfer Characteristics

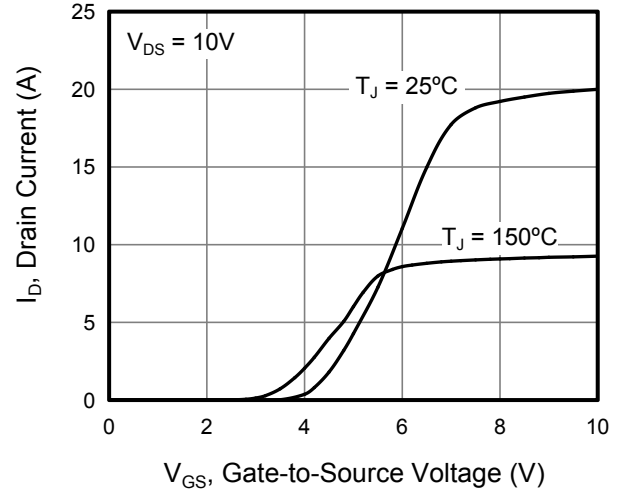


Figure 3. On-Resistance vs. Drain Current

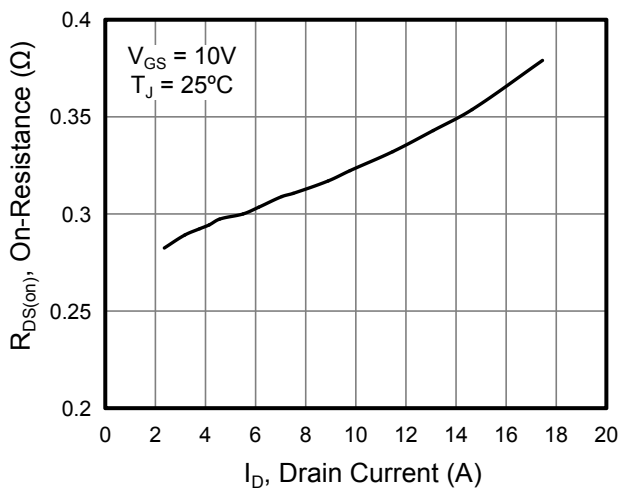


Figure 4. Capacitance

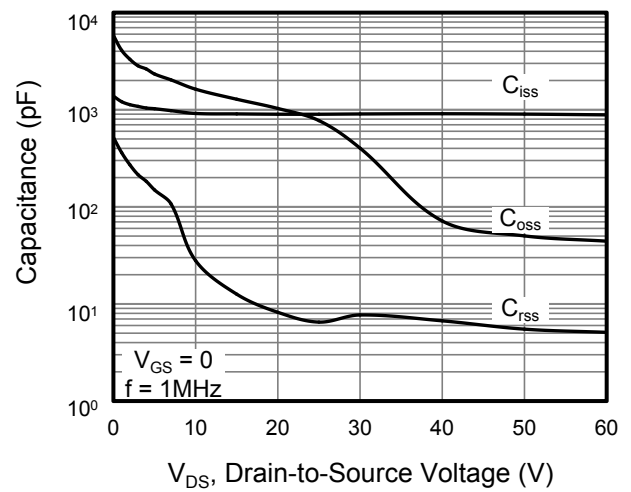


Figure 5. Gate Charge

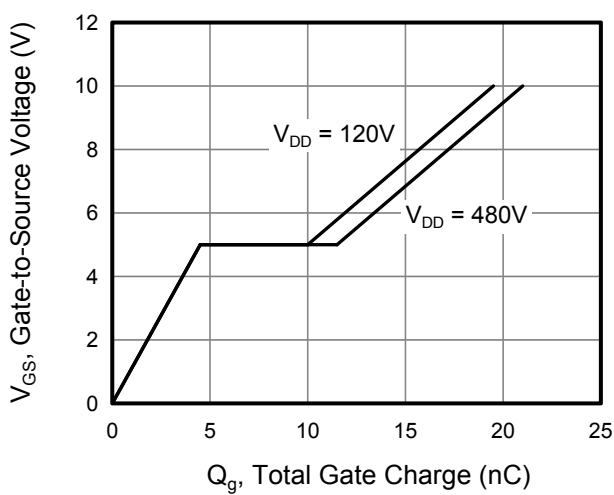
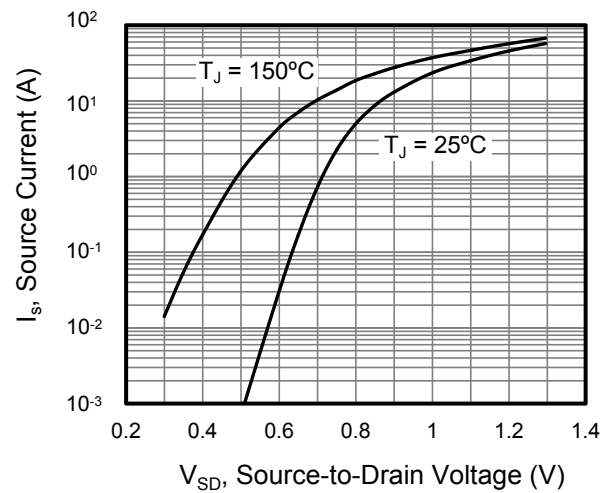


Figure 6. Body Diode Forward Voltage





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

Figure 7. On-Resistance vs. Junction Temperature

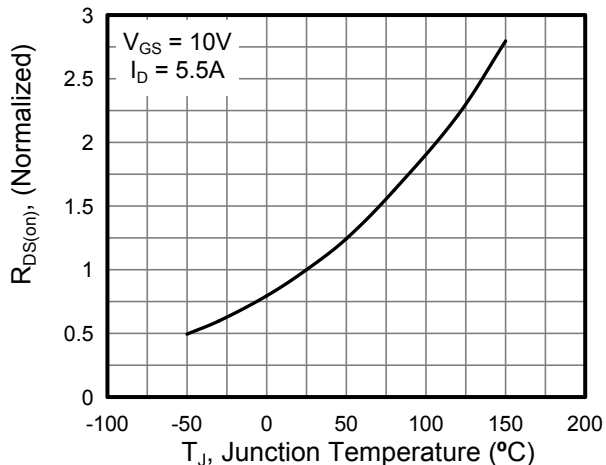


Figure 8. Threshold Voltage vs. Junction Temperature

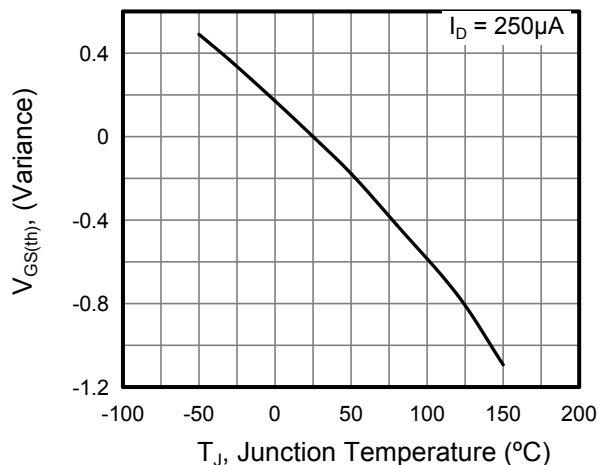


Figure 9. Transient Thermal Impedance For TO-263/TO-262/TO-252/TO-220/TO-251/TO-3PN

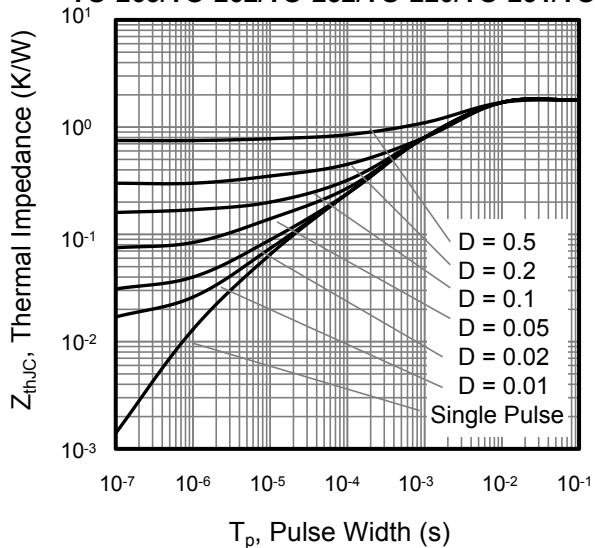


Figure 10. Transient Thermal Impedance For TO-220F/TO-220FP-NL

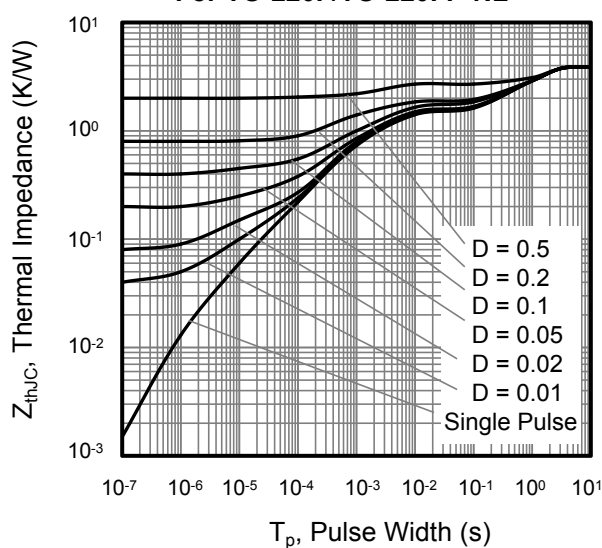




Figure A: Gate Charge Test Circuit and Waveform

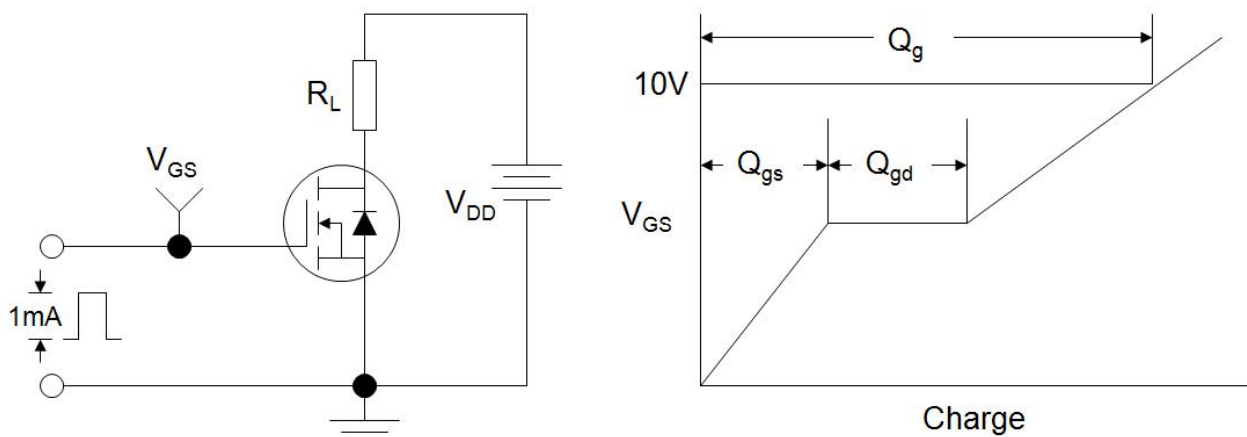


Figure B: Resistive Switching Test Circuit and Waveform

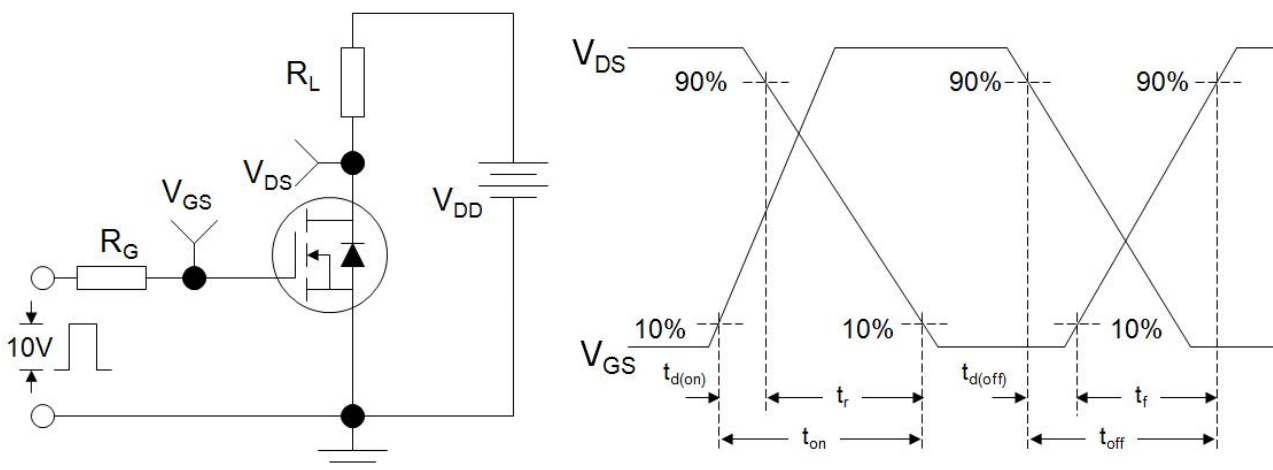
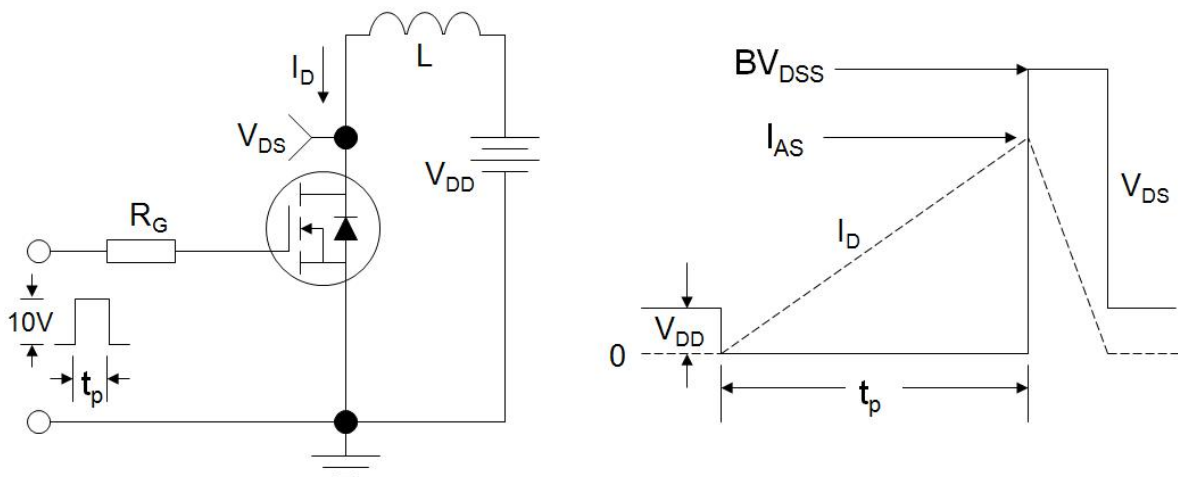
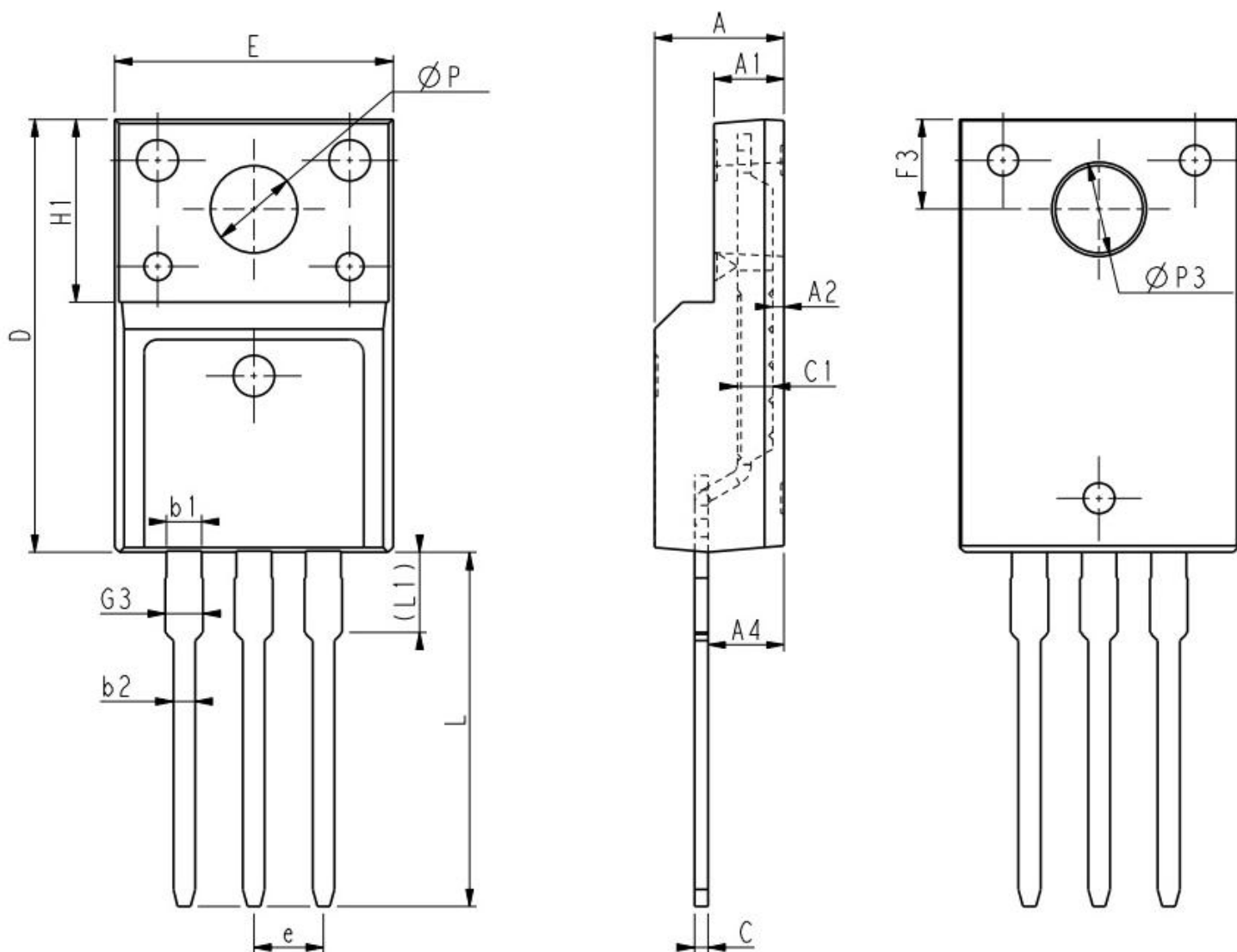


Figure C: Unclamped Inductive Switching Test Circuit and Waveform





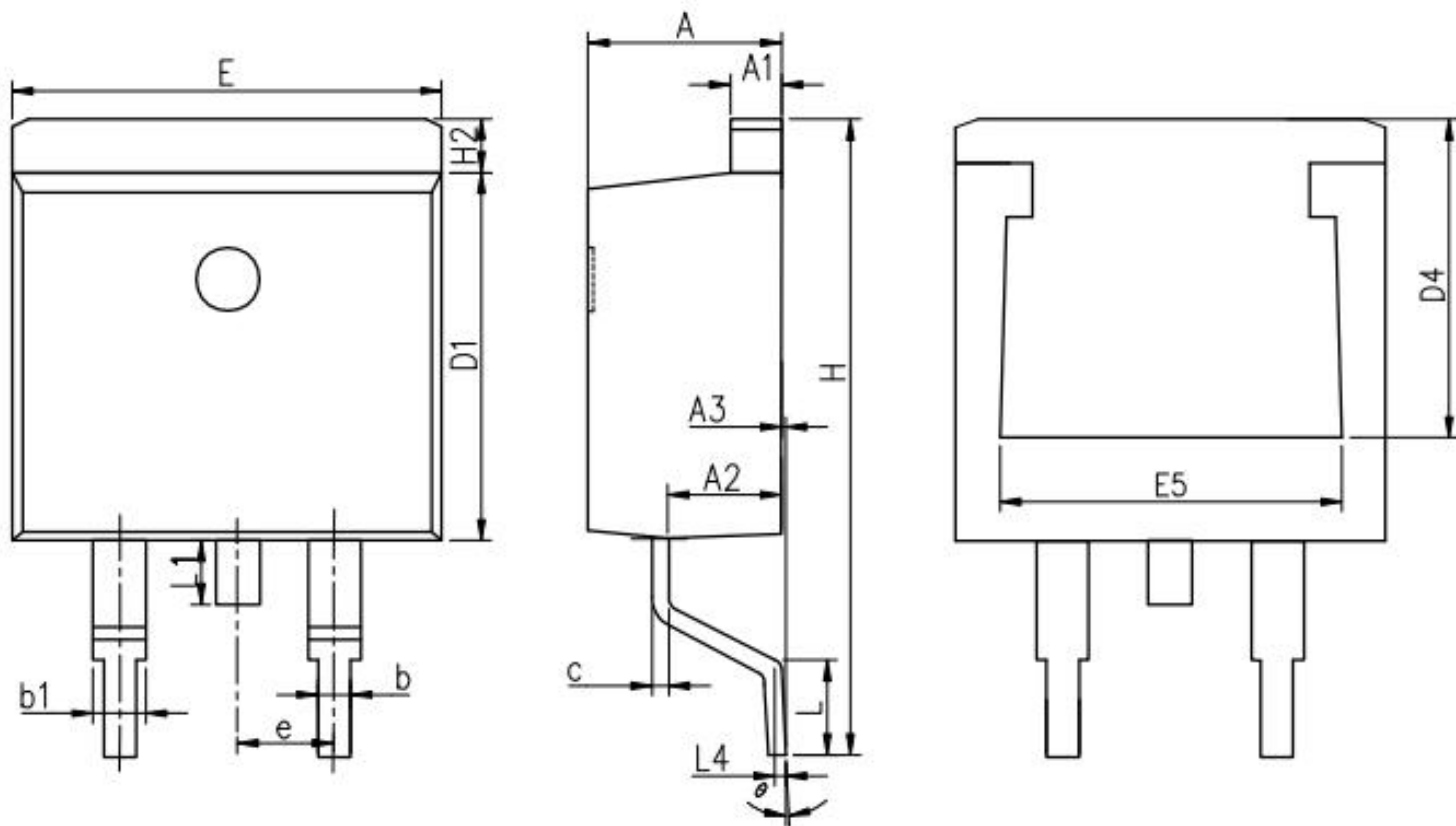
TO-220F（封装厂 H）



Unit:mm				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



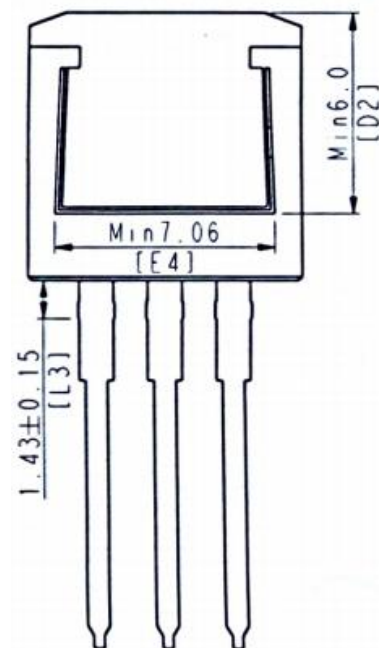
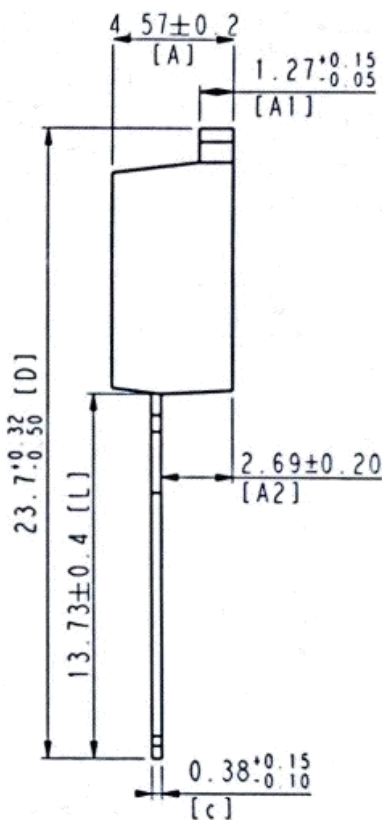
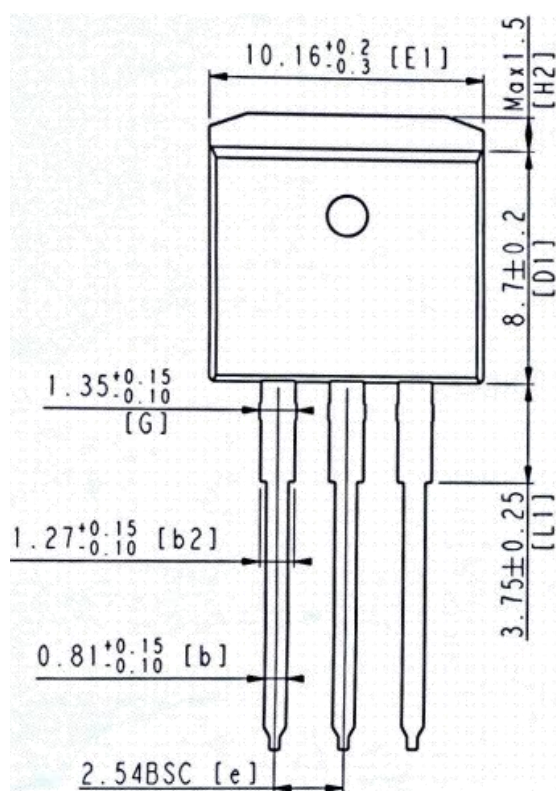
TO-263（封装厂 H）



Unit:mm				Unit:mm			
Symbol	Min.	Nom	Max.	Symbol	Min.	Nom	Max.
A	4.37	4.57	4.77	E	9.86	10.16	10.36
A1	1.22	1.27	1.42	E5	7.06	-	-
A2	2.49	2.69	2.89	e	2.54BSC		
A3	0.00	0.13	0.25	H	14.70	15.10	15.50
b	0.70	0.81	0.96	H2	1.07	1.27	1.47
b1	1.17	1.27	1.47	L	2.00	2.30	2.60
c	0.30	0.38	0.53	L1	1.40	1.55	1.70
D1	8.50	8.70	8.90	L4	0.25BSC		
D4	6.60	-	-	θ	0°	5°	9°

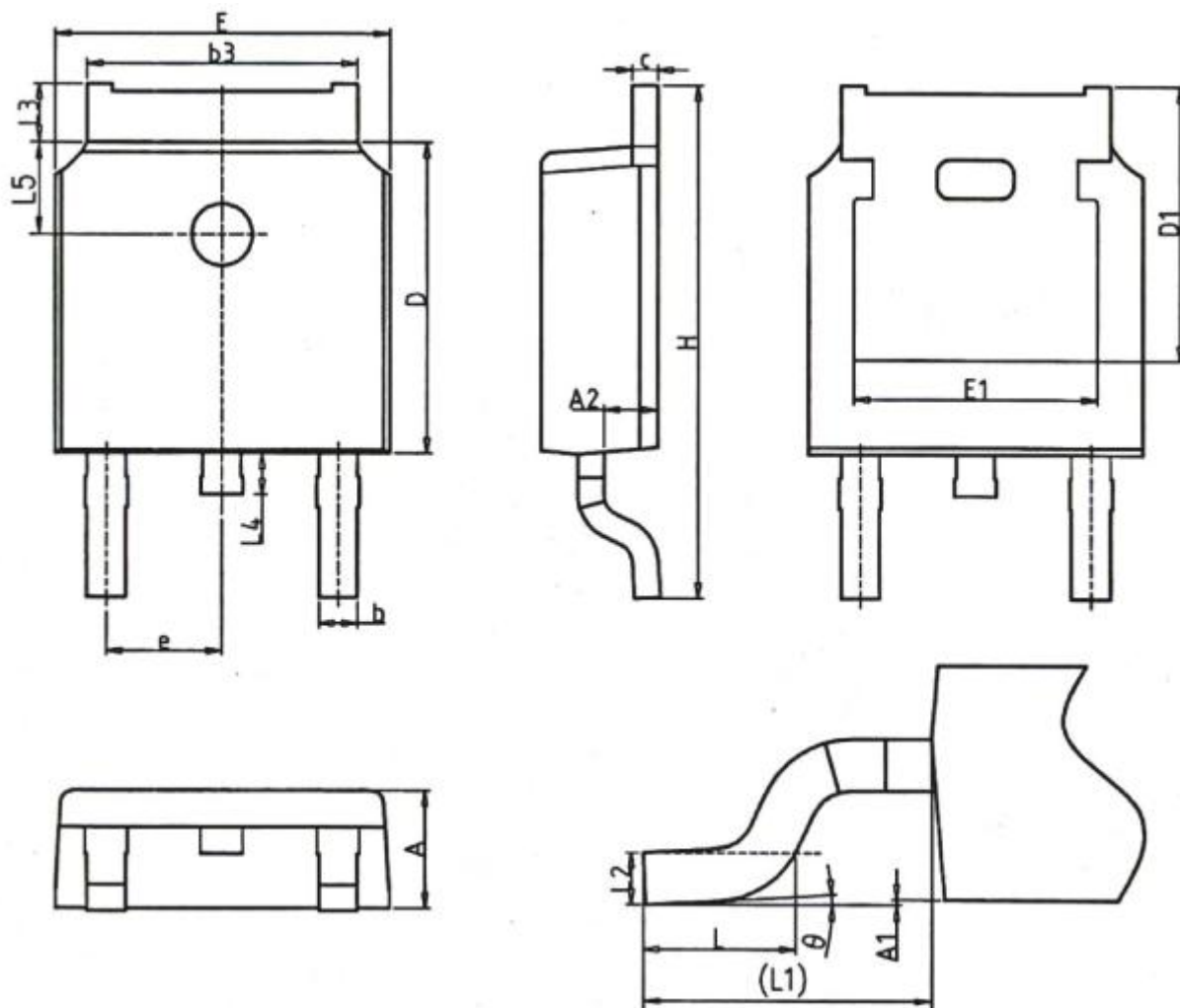


TO-262 (封装厂 H)





TO-252 (封装厂 H)

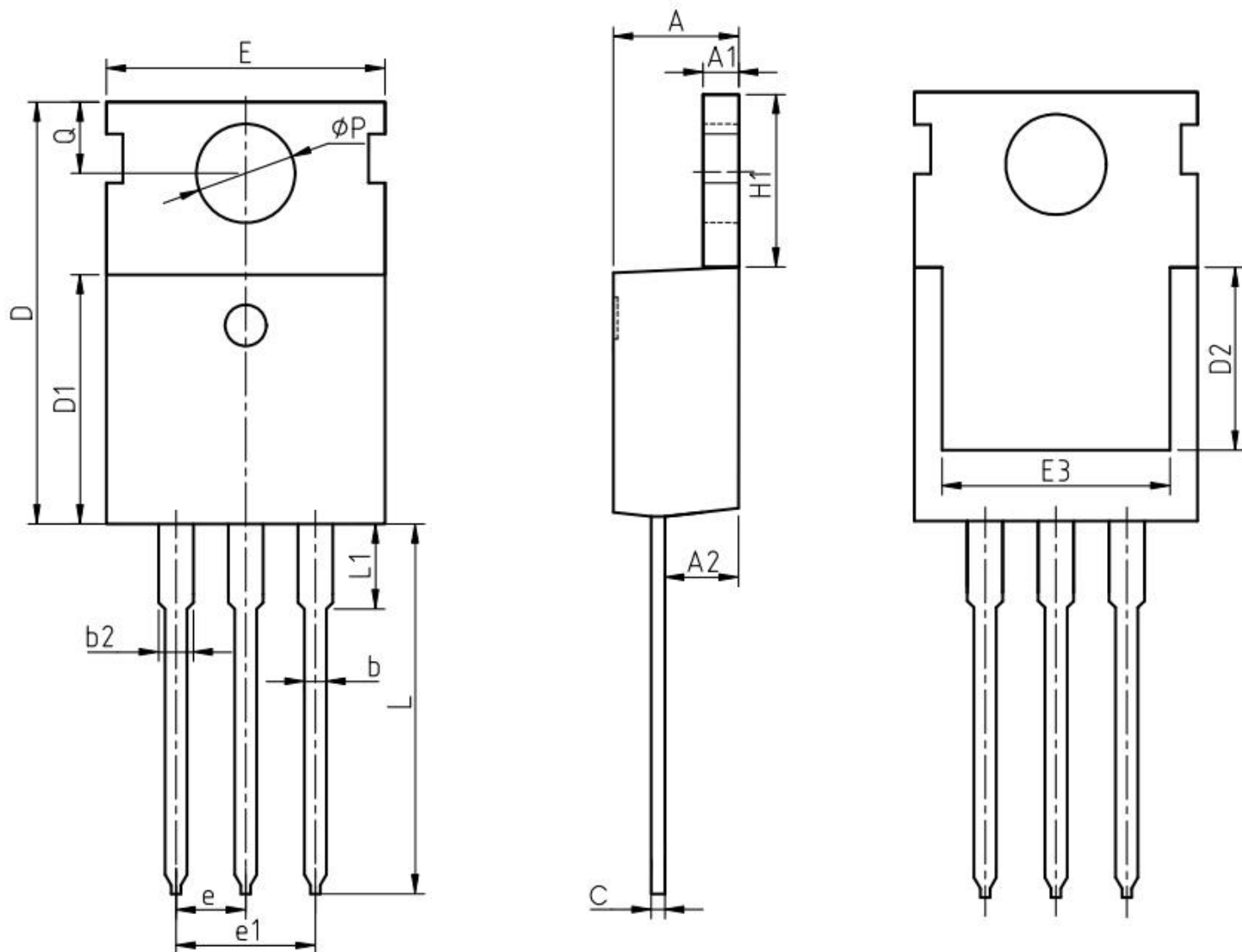


Unit:mm			
Symbol	Min.	Nom	Max.
A	2.20	2.30	2.38
A1	0.00	-	0.20
A2	0.97	1.07	1.17
b	0.68	0.78	0.90
b3	5.20	5.33	5.46
c	0.43	0.53	0.61
D	5.98	6.10	6.22
D1	5.30 REF		
E	6.40	6.60	6.73
E1	4.63	-	-

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°



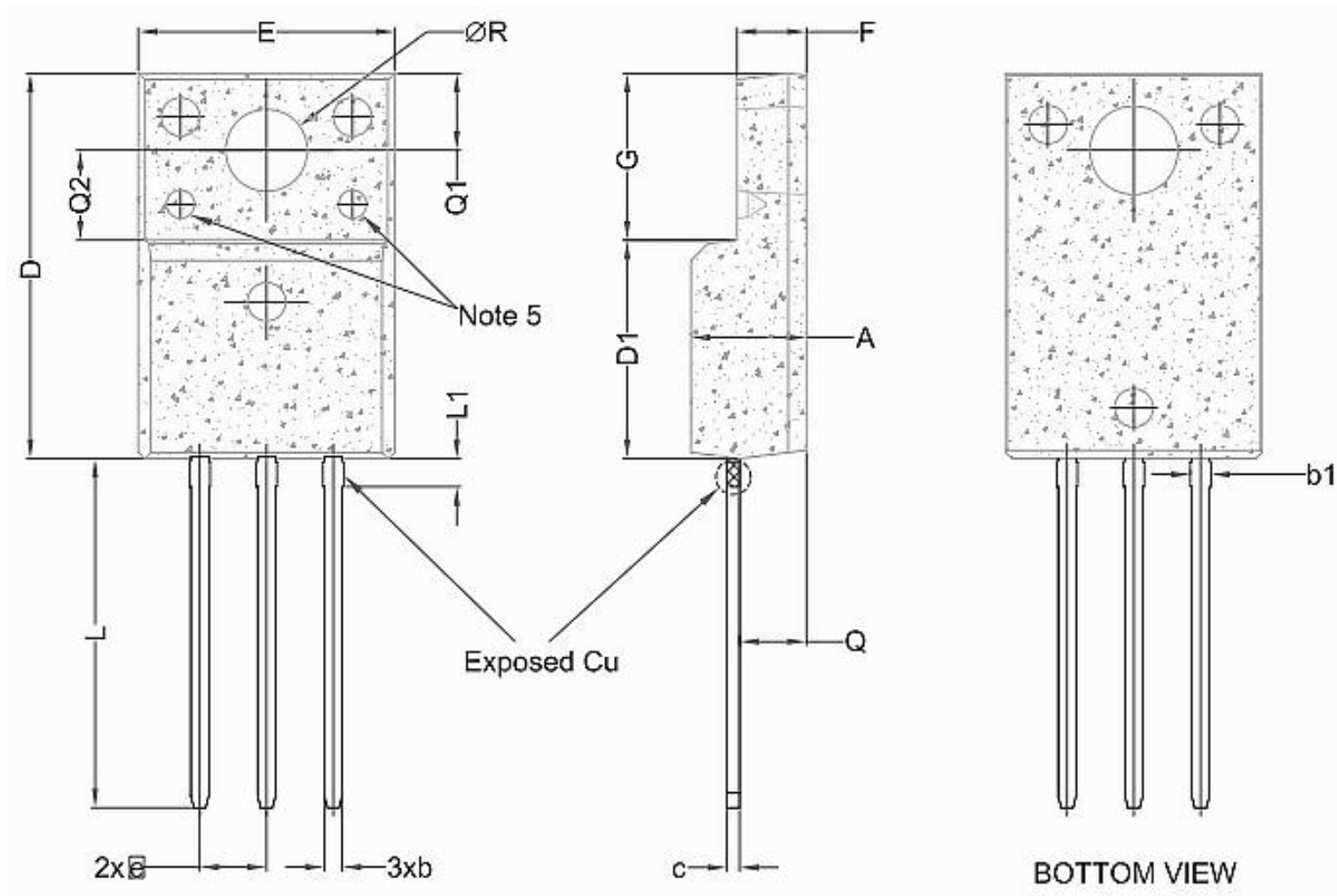
TO-220 (封装厂 H)



Unit:mm				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



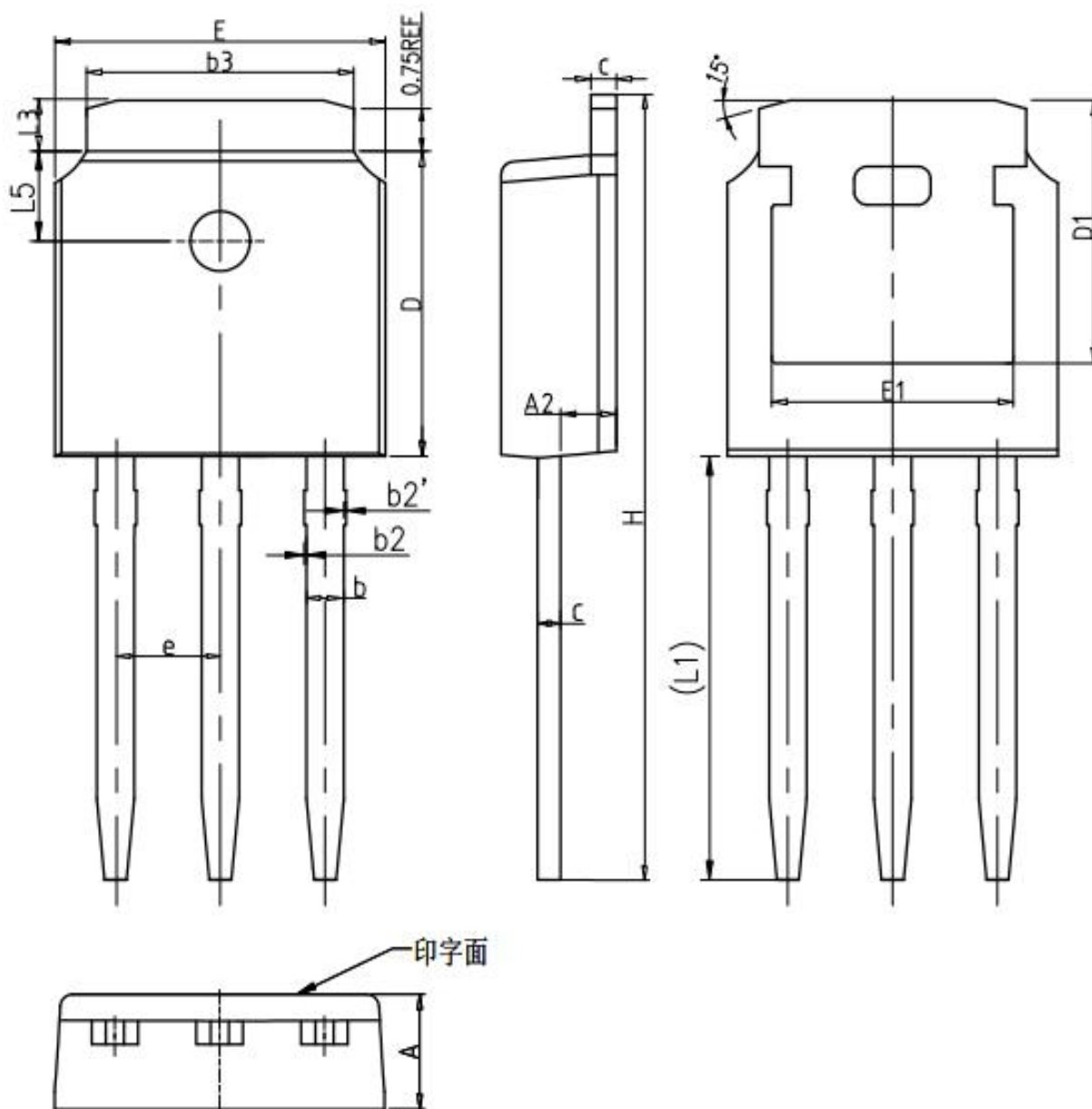
TO-220FP-NL（封装厂 M）



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



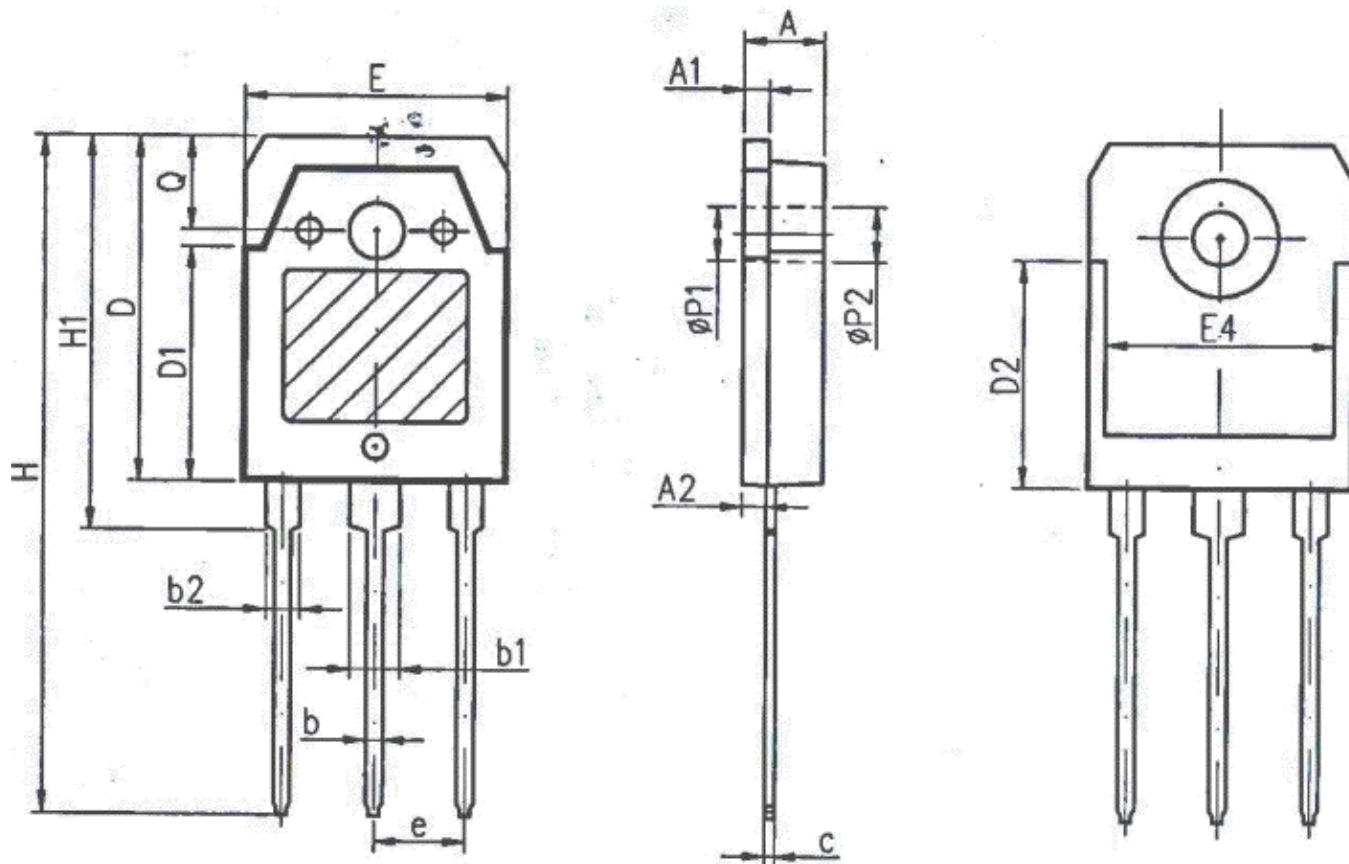
TO-251（封装厂 H）



Unit:mm				Unit:mm			
Symbol	Min.	Nom	Max.	Symbol	Min.	Nom	Max.
A	2.20	2.30	2.40	D1	5.30 REF		
A2	0.97	1.07	1.17	E	6.40	6.60	6.80
b	0.68	0.78	0.90	E1	4.63	-	-
b2	0.00	0.04	0.10	e	2.286 BSC		
b2'	0.00	0.04	0.10	H	16.22	16.52	16.82
b3	5.20	5.33	5.50	L1	9.15	9.40	9.65
c	0.43	0.53	0.63	L3	0.88	1.02	1.28
D	5.98	6.10	6.22	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
Φ P1	3.20 REF		
Φ P2	3.50 REF		



Disclaimer

All product specifications and data are subject to change without notice.

For documents and material available from this datasheet, Wuxi Unigroup does not warrant or assume any legal liability or responsibility for the accuracy, completeness of any product or technology disclosed hereunder.

No license, express or implied, by estoppels or otherwise, to any intellectual property rights is granted by this document or by any conduct of Wuxi Unigroup.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling Wuxi Unigroup products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Wuxi Unigroup for any damages arising or resulting from such use or sale.

Wuxi Unigroup disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Wuxi Unigroup's terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

Wuxi Unigroup Microelectronics CO., LTD. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.

In the event that any or all Wuxi Unigroup products (including technical data, services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.

Information (including circuit diagrams and circuit parameters) herein is for example only. It is not guaranteed for volume production. Wuxi Unigroup believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.