



# 1200V Super-junction Power MOSFET

## Description

### 1200V 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)
- Low Power Chargers and Adapters

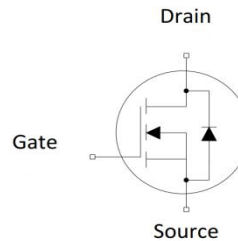
TO-220F



TO-263



TO-247



## Device Marking and Package Information

Device	Package	Marking
TPA120R800A	TO-220F	120R800A
TPB120R800A	TO-263	120R800A
TPW120R800A	TO-247	120R800A

## Key Performance Parameters

Parameter	Value	Unit
$V_{DS}$	1200	V
$R_{DS(on),max}$	0.8	$\Omega$
$Q_{g,typ}$	60	nC
$I_D$	12	A
$I_{D,pulse}$	36	A



Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ , unless otherwise noted				
Parameter		Symbol	Value	Unit
Continuous Drain Current	$T_C = 25^\circ\text{C}$	$I_D$	12	A
	$T_C = 100^\circ\text{C}$		7.2	
Pulsed Drain Current	(note1)	$I_{D,pulse}$	36	A
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V
Single Pulse Avalanche Energy	(note2)	$E_{AS}$	180	mJ
Avalanche Current		$I_{AR}$	6	A
MOSFET dv/dt ruggedness, $V_{DS} = 0 \dots 960\text{V}$		dv/dt	50	V/ns
Power Dissipation For TO-220F		$P_D$	34	W
Power Dissipation For TO-263,TO-247			151	
Continuous Diode Forward Current		$I_S$	12	A
Diode Pulsed Current	(note1)	$I_{S,pulse}$	36	
Reverse Diode dv/dt	(note3)	dv/dt	5	A/us
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	$-55 \sim +150$	$^\circ\text{C}$

Thermal Resistance TO-220F				
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		

Thermal Resistance TO-263,TO-247				
Parameter	Symbol	Value	Unit	
Thermal Resistance, Junction-to-Case	$R_{thJC}$	0.83	$^\circ\text{C/W}$	
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	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	1200	--	--	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 1200V, V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	1	$\mu A$
		$V_{DS} = 1200V, V_{GS} = 0V, T_J = 150^\circ\text{C}$	--	--	100	
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS} = \pm 30V$	--	--	$\pm 100$	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.5	--	4.5	V
Drain-Source On-State-Resistance	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 6A$	--	0.62	0.8	$\Omega$
Forward Transconductance (Note3)	$g_{fs}$	$V_{DS} = 10V, I_D = 6A$	--	10	--	S
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0V,$ $V_{DS} = 100V,$ $f = 1.0\text{MHz}$	--	2573	--	$\mu F$
Output Capacitance	$C_{oss}$		--	66	--	
Reverse Transfer Capacitance	$C_{rss}$		--	2.3	--	
Total Gate Charge	$Q_g$	$V_{DD} = 960V, I_D = 12A,$ $V_{GS} = 10V$	--	60	--	nC
Gate-Source Charge	$Q_{gs}$		--	14	--	
Gate-Drain Charge	$Q_{gd}$		--	22	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 400V, I_D = 12A,$ $R_G = 25\Omega$	--	51	--	ns
Turn-on Rise Time	$t_r$		--	71	--	
Turn-off Delay Time	$t_{d(off)}$		--	154	--	
Turn-off Fall Time	$t_f$		--	67	--	
<b>Drain-Source Body Diode Characteristics</b>						
Body Diode Forward Voltage	$V_{SD}$	$T_J = 25^\circ\text{C}, I_{SD} = 4A, V_{GS} = 0V$	--	0.9	1.2	V
Reverse Recovery Time	$t_{rr}$	$V_R = 400V, I_F = I_S,$ $di_F/dt = 100A/\mu s$	--	675	--	ns
Reverse Recovery Charge	$Q_{rr}$		--	9	--	$\mu C$
Peak Reverse Recovery Current	$I_{rrm}$		--	25	--	A

**Notes**

1. Repetitive Rating: Pulse Width limited by maximum junction temperature
2.  $V_{DD} = 50V, R_G = 25\Omega$ , 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

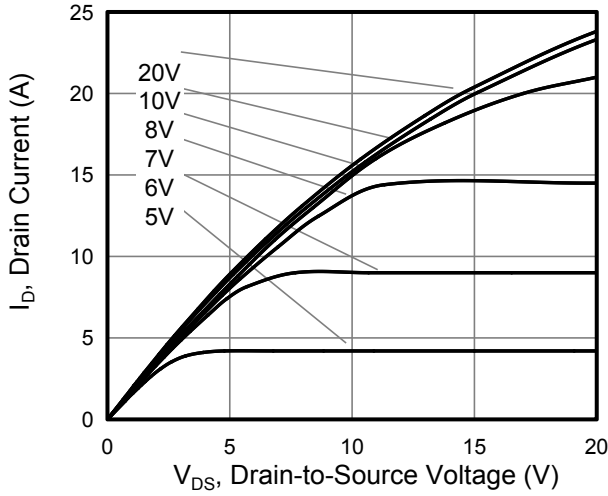


Figure 2. Transfer Characteristics

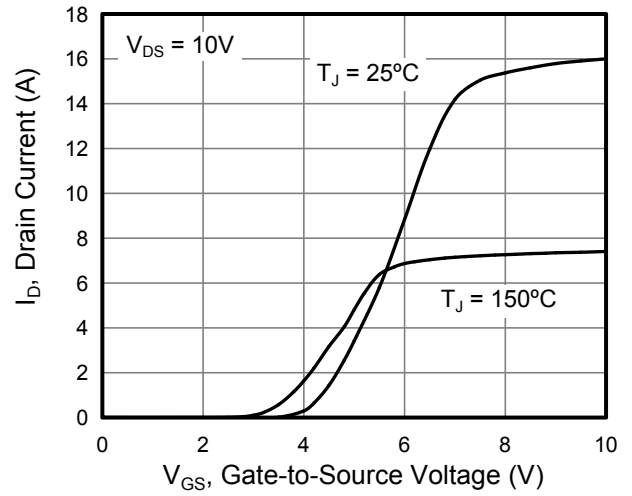


Figure 3. On-Resistance vs. Drain Current

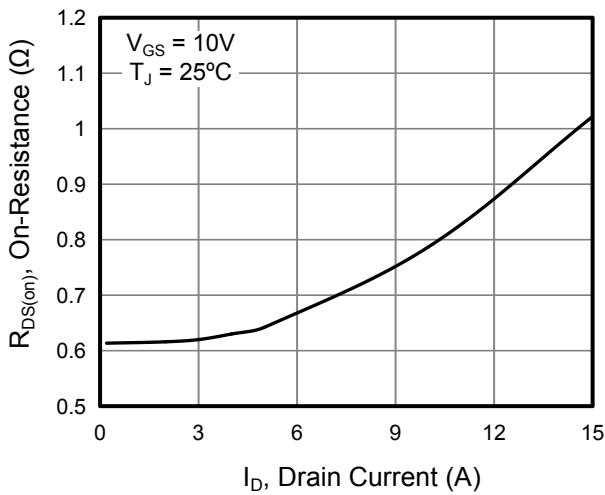


Figure 4. Capacitance

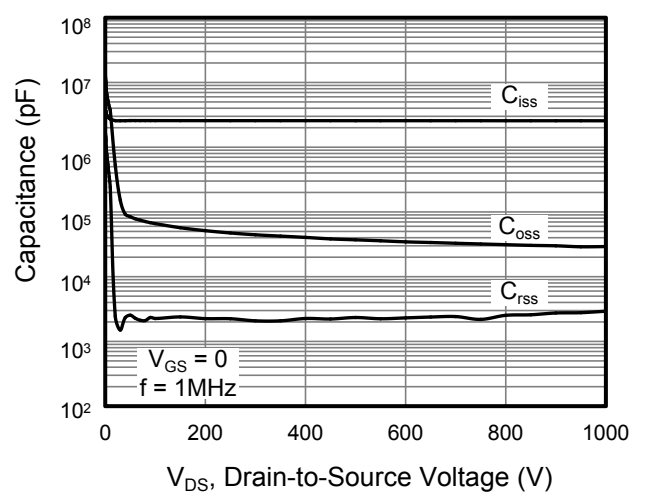


Figure 5. Gate Charge

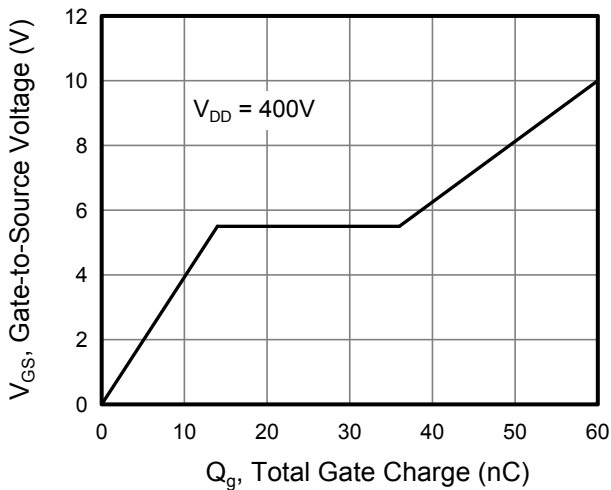
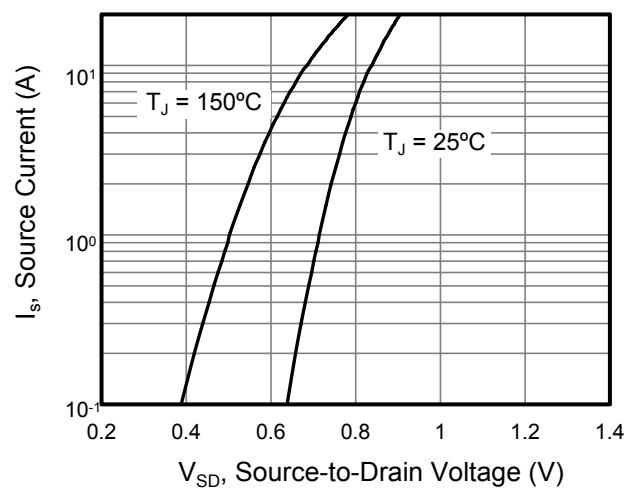


Figure 6. Body Diode Forward Voltage





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

Figure 7. On-Resistance vs. Junction Temperature

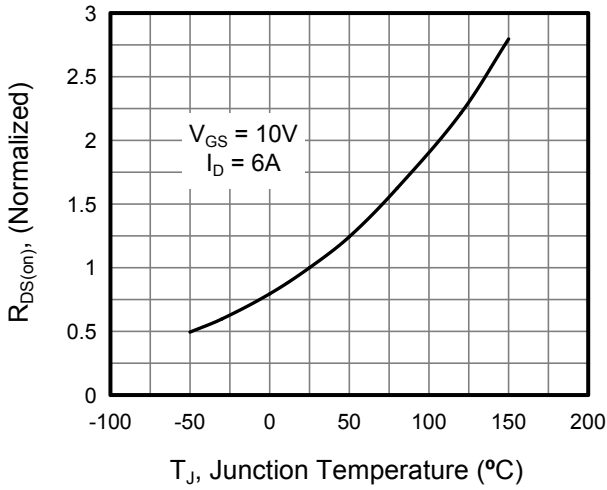


Figure 8. Breakdown voltage vs. Junction Temperature

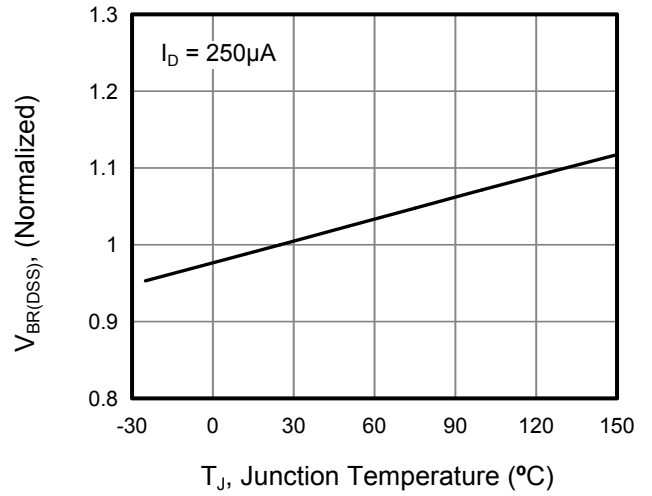


Figure 9. Transient Thermal Impedance For TO-220F

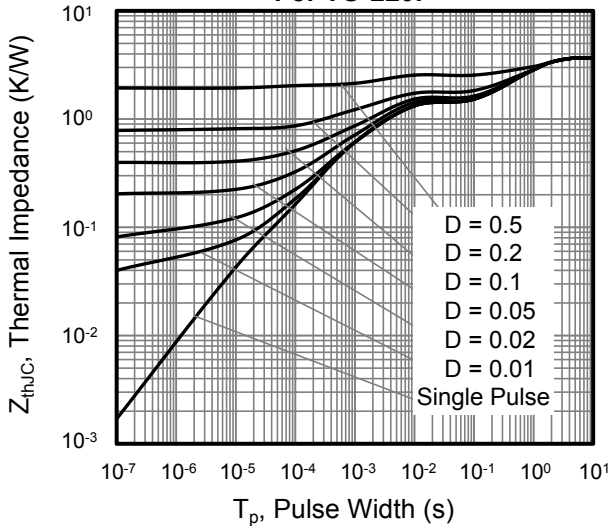


Figure 10. Transient Thermal Impedance For TO-263, TO-247

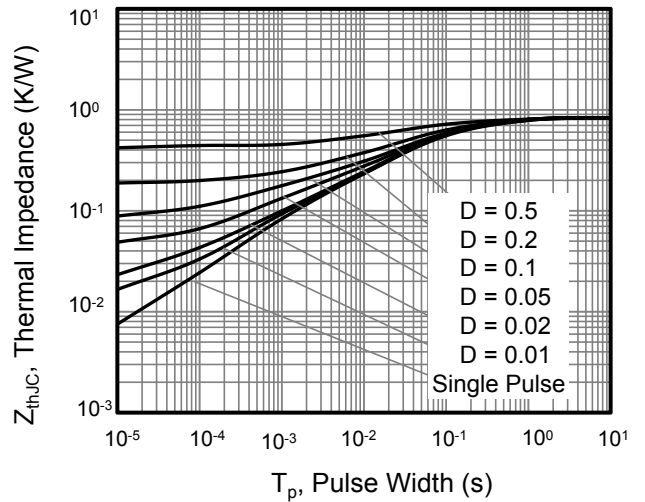


Figure 11. Safe Operation Area For TO-220F

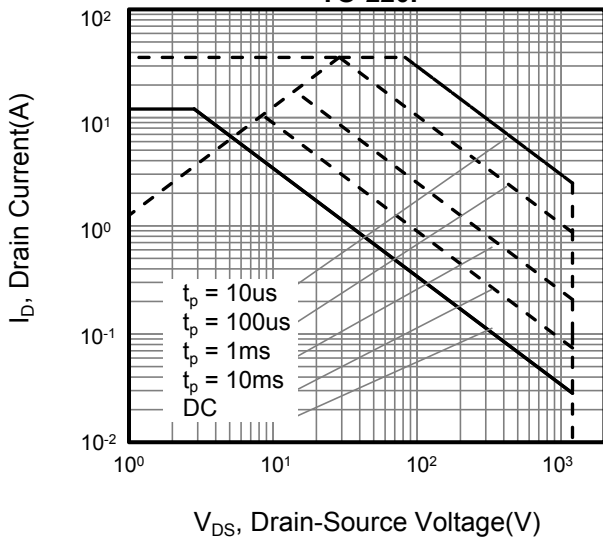


Figure 12. Safe Operation Area For TO-263, TO-247

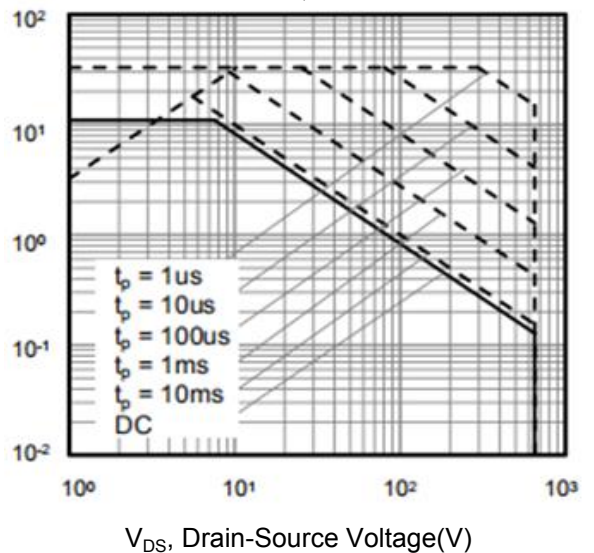




Figure A: Gate Charge Test Circuit and Waveform

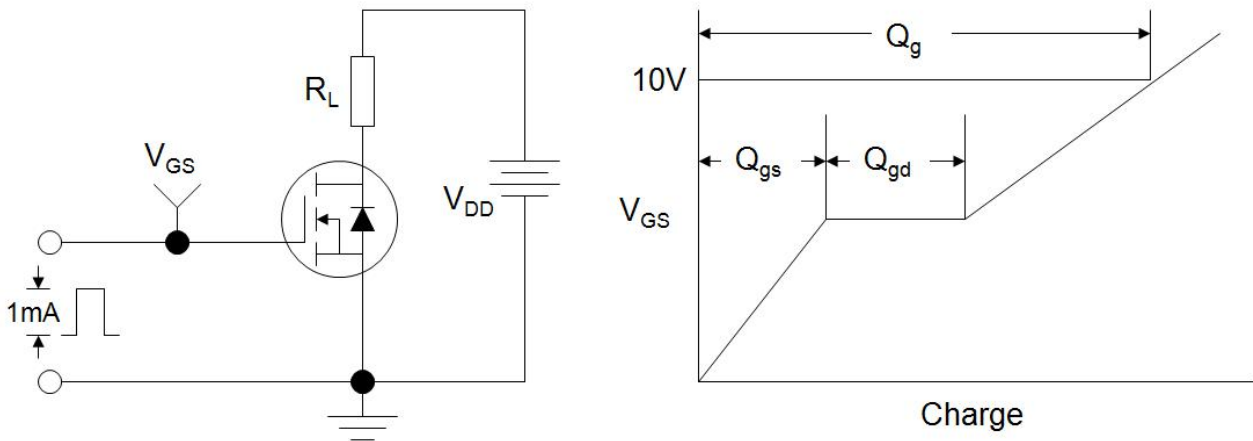


Figure B: Resistive Switching Test Circuit and Waveform

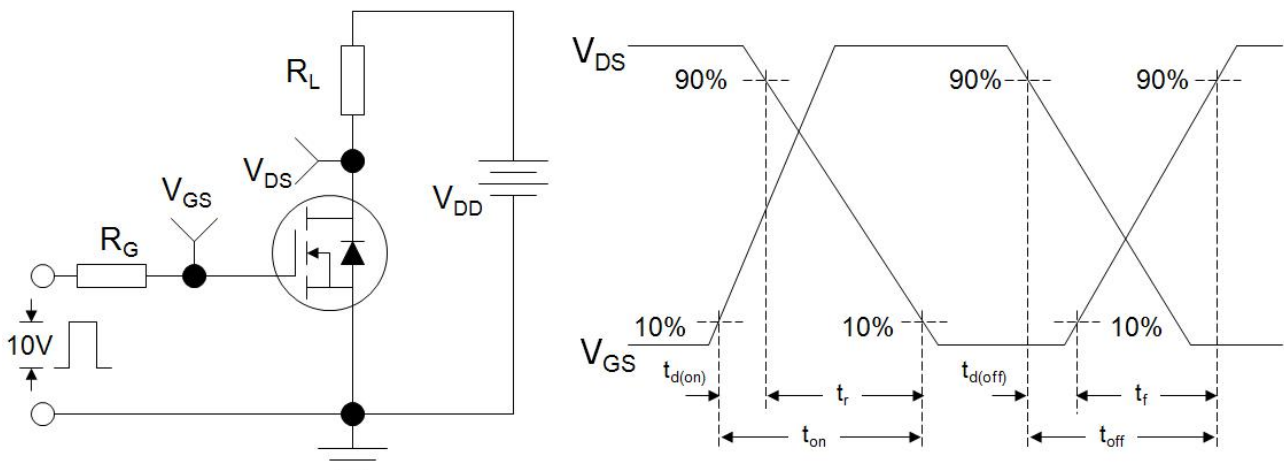
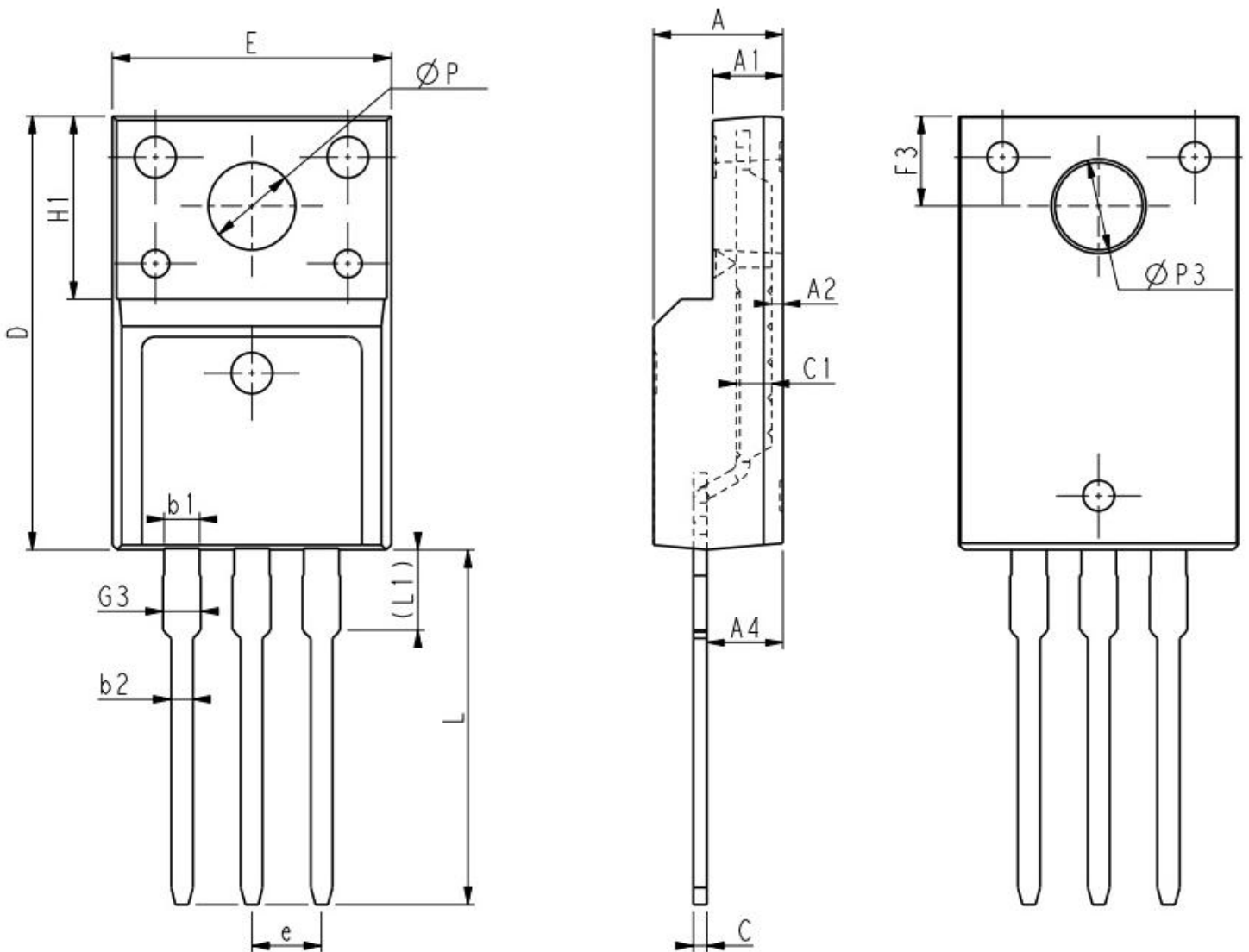


Figure C: Unclamped Inductive Switching Test Circuit and Waveform





TO-220F (华羿)

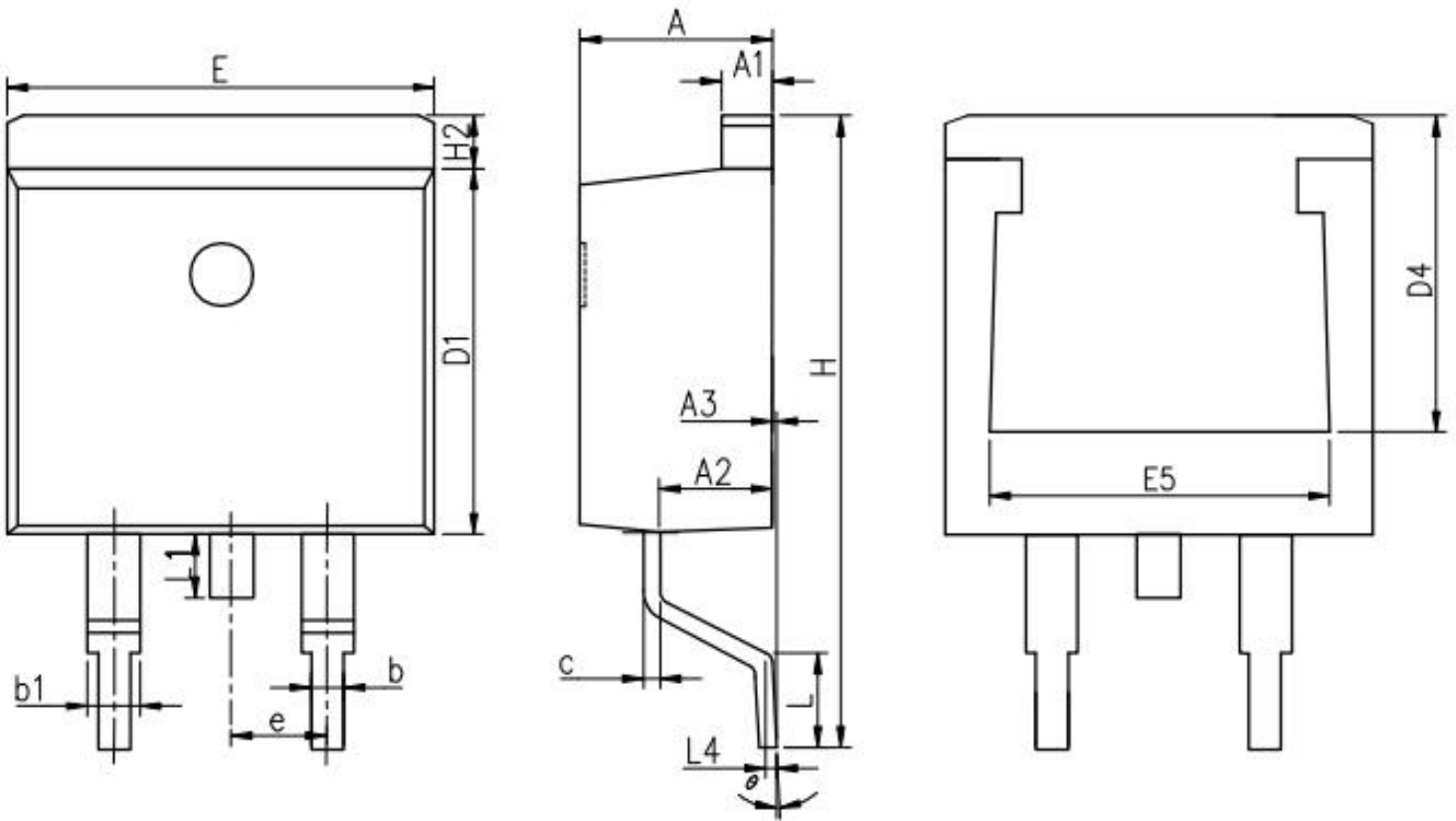


Unit:mm			
Symbol	Min.	Nom	Max.
E	9.96	10.16	10.36
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	0.30	0.45	0.60
A4	2.56	2.76	2.96
c	0.40	0.50	0.65
c1	1.20	1.30	1.35
D	15.57	15.87	16.17
H1	6.70REF		

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-263 (华羿)

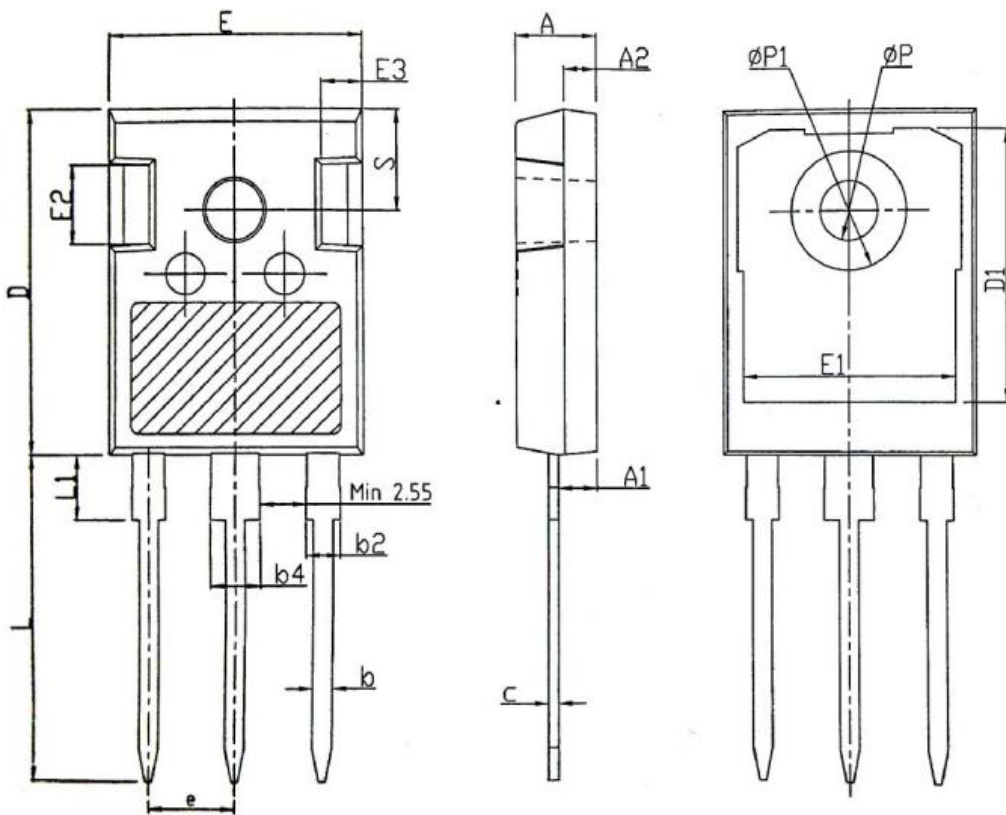


Unit:mm				Unit:mm			
Symbol	Min.	Nom	Max.	Symbol	Min.	Nom	Max.
A	4.37	4.57	4.77	E	9.86	10.16	10.36
A1	1.22	1.27	1.42	E5	7.06	-	-
A2	2.49	2.69	2.89	e	2.54BSC		
A3	0.00	0.13	0.25	H	14.70	15.10	15.50
b	0.70	0.81	0.96	H2	1.07	1.27	1.47
b1	1.17	1.27	1.47	L	2.00	2.30	2.60
c	0.30	0.38	0.53	L1	1.40	1.55	1.70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





TO-247 (华羿)



SYMBOL	DIMENSIONS (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
$\phi P$	3.40	3.60	3.80
$\phi P1$	-	-	7.30
S	6.15BSC		



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