



700V Super-junction Power MOSFET

Description

700V 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)
- Charger

TO-220F



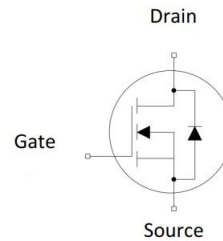
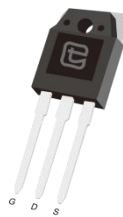
TO-262



TO-220



TO-3PN



Device Marking and Package Information

Device	Package	Marking
TPA70R190C	TO-220F	70R190C
TPC70R190C	TO-262	70R190C
TPP70R190C	TO-220	70R190C
TPV70R190C	TO-3PN	70R190C

Key Performance Parameters

Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	750	V
$R_{DS(on),max}$	0.21	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
	$T_C = 100^\circ\text{C}$		12	
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		P_D	34	W
Power Dissipation For TO-262,TO-220,TO-3PN			198	
Continuous Diode Forward Current		I_S	20.6	A
Diode Pulsed Current	(note1)	$I_{S,pulse}$	70	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55~+150	$^\circ\text{C}$

Thermal Resistance For TO-220F			
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			
Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	R_{thJC}	0.63	$^\circ\text{C}/\text{W}$
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	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	700	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 700V, V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	1	μA
		$V_{DS} = 700V, V_{GS} = 0V, T_J = 150^\circ\text{C}$	--	--	100	
Gate-Source Leakage Current	I_{GSS}	$V_{GS} = \pm 30V$	--	--	± 100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.5	--	4.0	V
Drain-Source On-State-Resistance	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 10A$	--	0.19	0.21	Ω
Forward Transconductance (Note3)	g_{fs}	$V_{DS} = 10V, I_D = 10A$	--	18.8	--	S
Dynamic Characteristics						
Input Capacitance	C_{iss}	$V_{GS} = 0V,$ $V_{DS} = 50V,$ $f = 1.0\text{MHz}$	--	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	$t_{d(on)}$	$V_{DD} = 300V, I_D = 20A,$ $R_G = 25\Omega$	--	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}	$T_J = 25^\circ\text{C}, I_{SD} = 20A, V_{GS} = 0V$	--	0.95	1.2	V
Reverse Recovery Time	t_{rr}	$V_R = 560V, I_F = I_S,$ $di_F/dt = 100A/\mu s$	--	410	--	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. $I_D = 10A, V_{DD} = 50V, R_G = 25\Omega$, 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

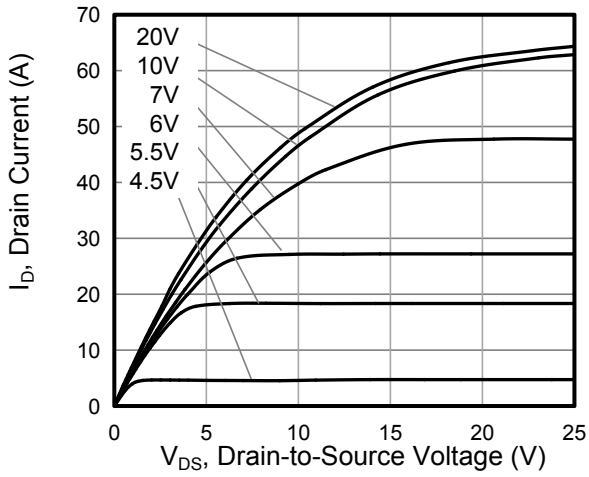


Figure 2. Transfer Characteristics

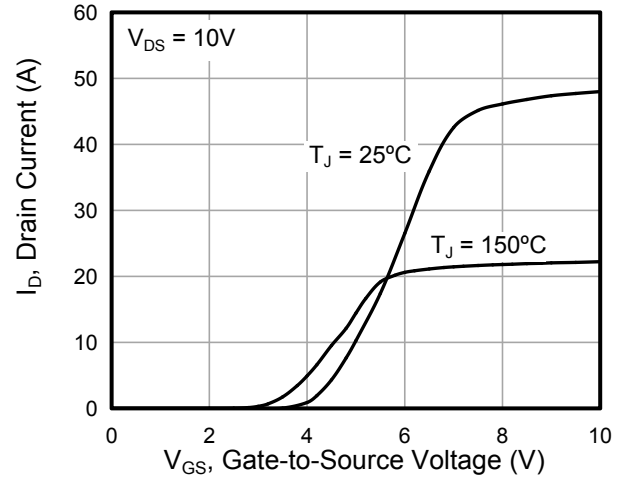


Figure 3. On-Resistance vs. Drain Current

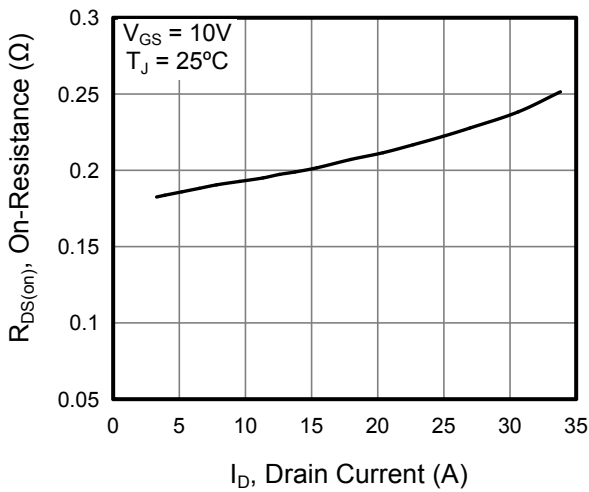


Figure 4. Capacitance

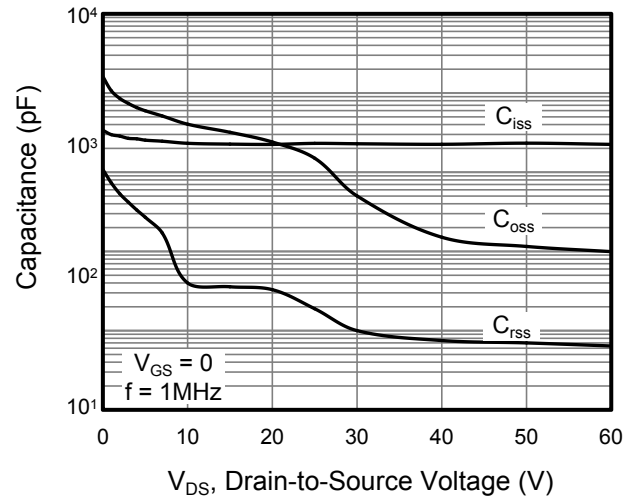


Figure 5. Gate Charge

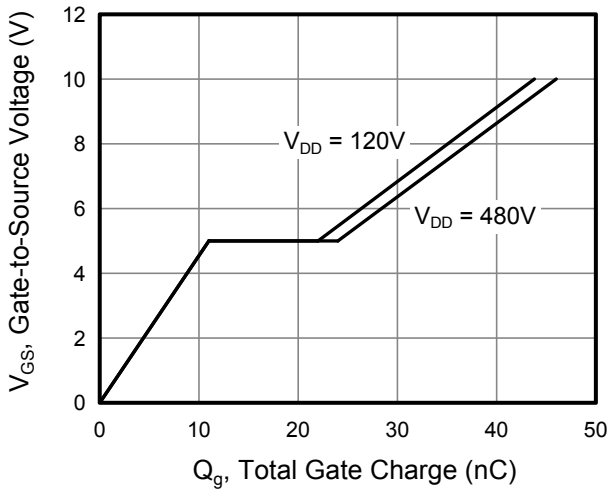
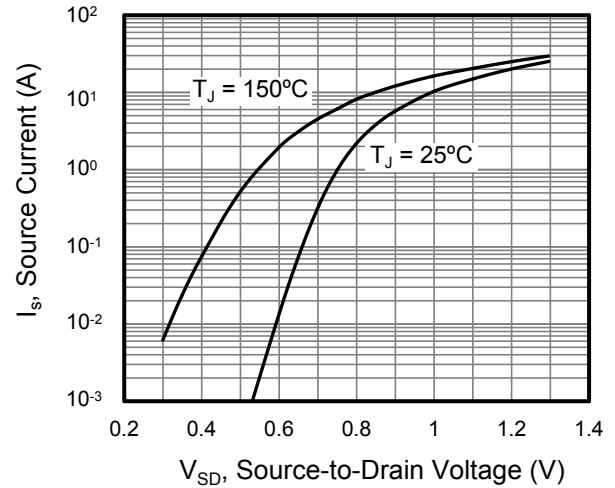


Figure 6. Body Diode Forward Voltage





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

Figure 7. On-Resistance vs. Junction Temperature

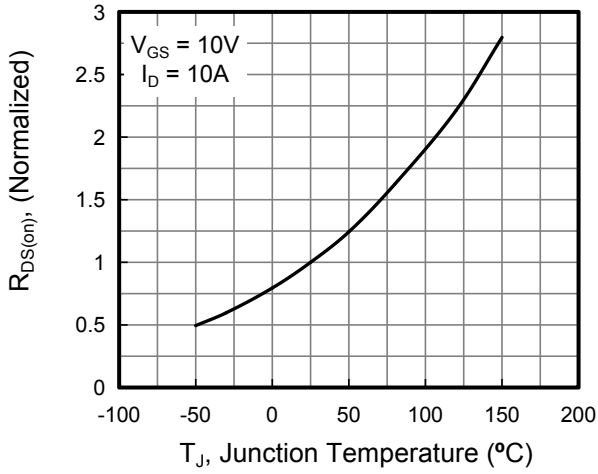


Figure 8. Threshold Voltage vs. Junction Temperature

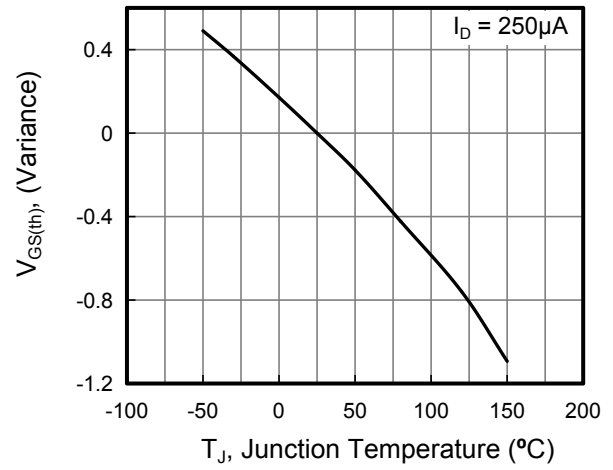


Figure 9. Transient Thermal Impedance For TO-262/TO-220/TO-3PN

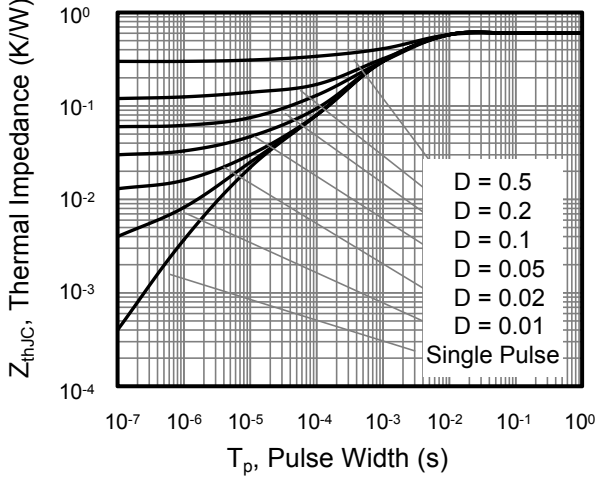


Figure 10. Transient Thermal Impedance For TO-220F

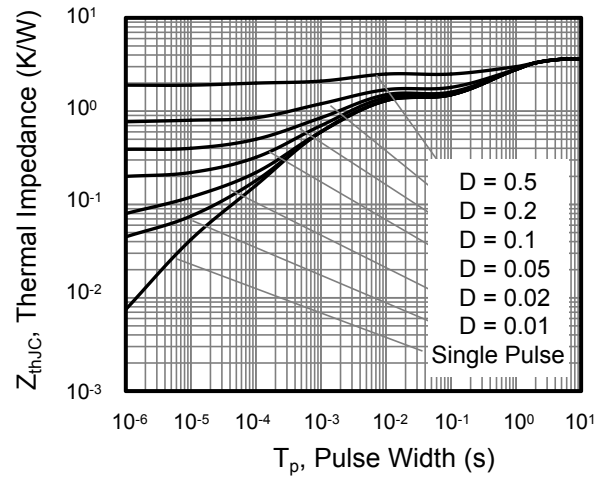




Figure A: Gate Charge Test Circuit and Waveform

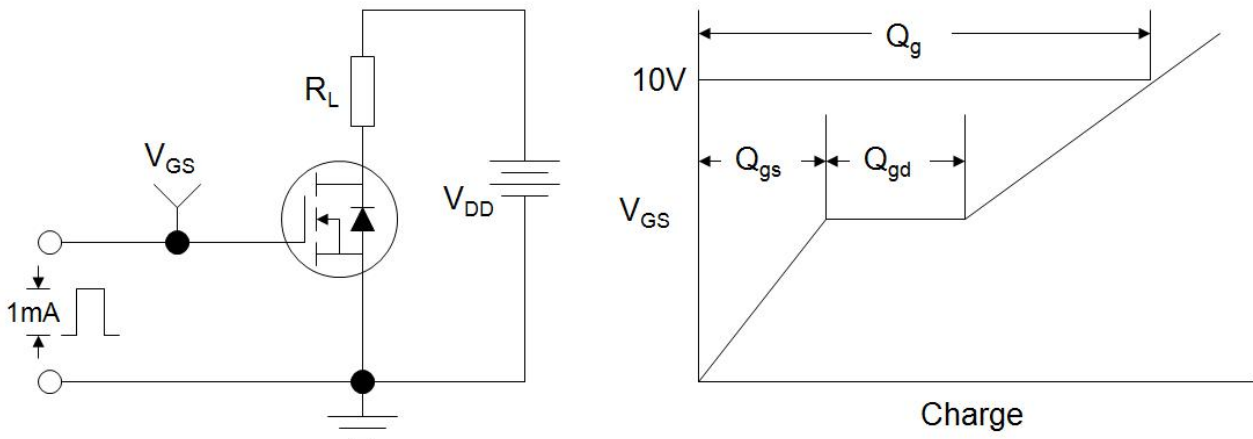


Figure B: Resistive Switching Test Circuit and Waveform

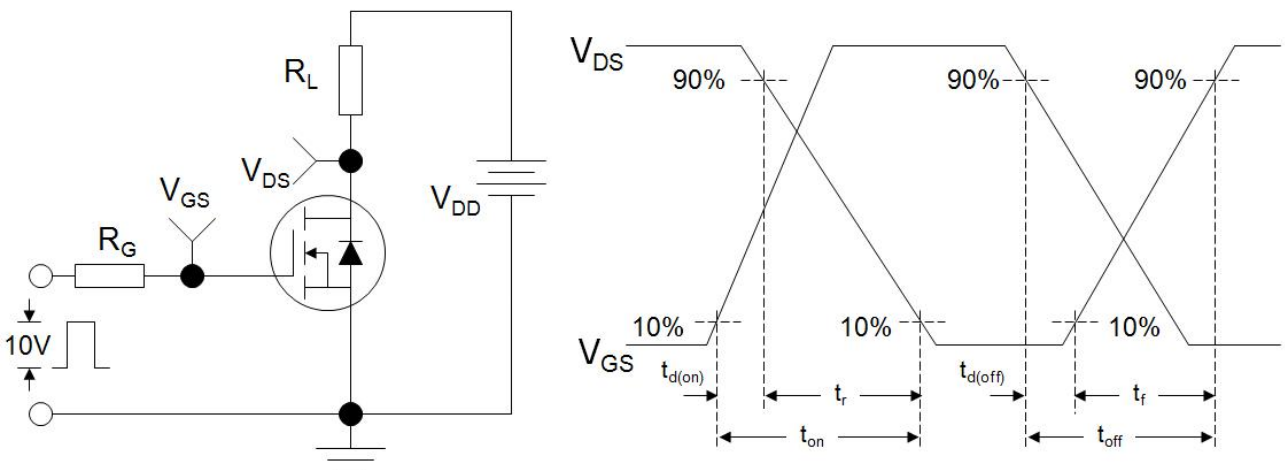
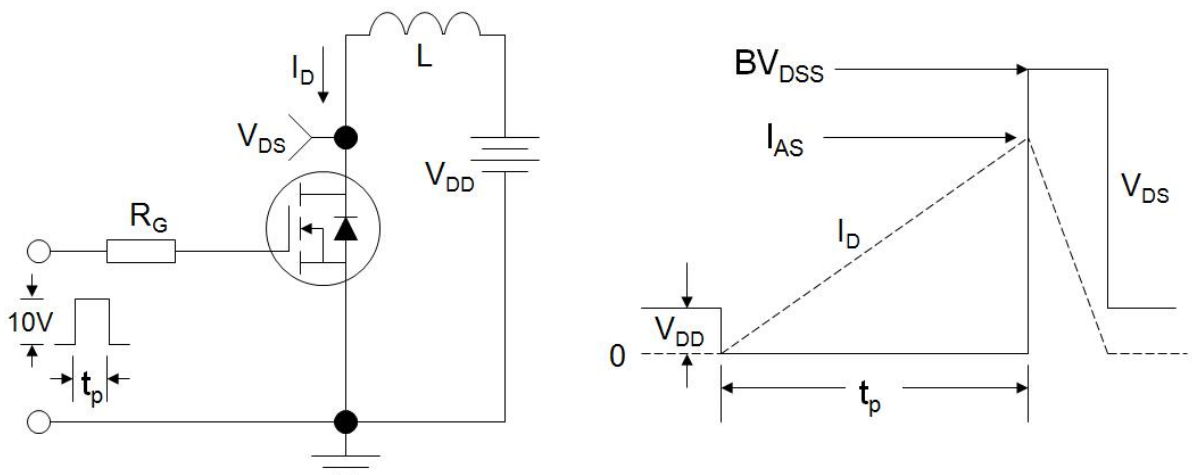
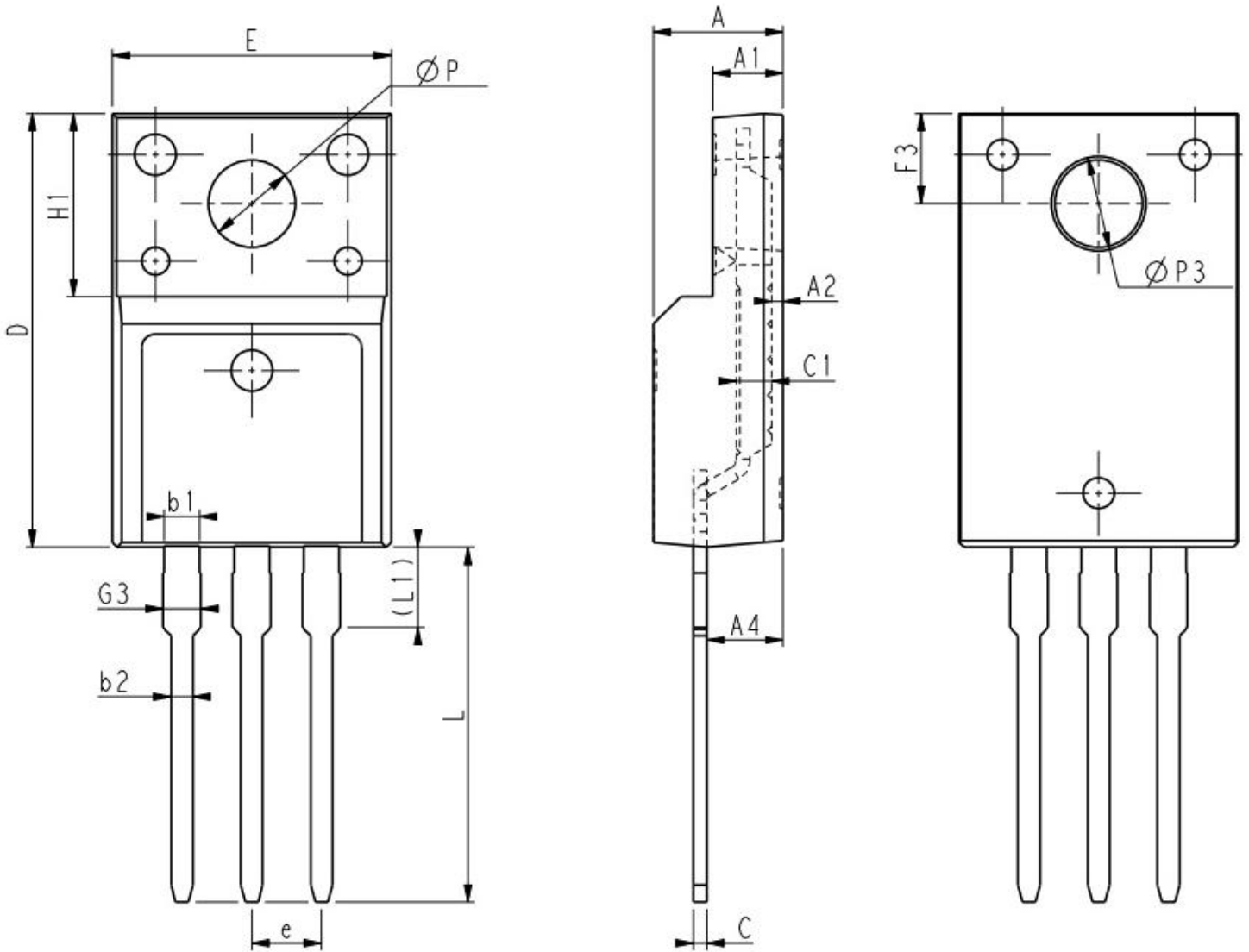


Figure C: Unclamped Inductive Switching Test Circuit and Waveform





TO-220F (华羿)

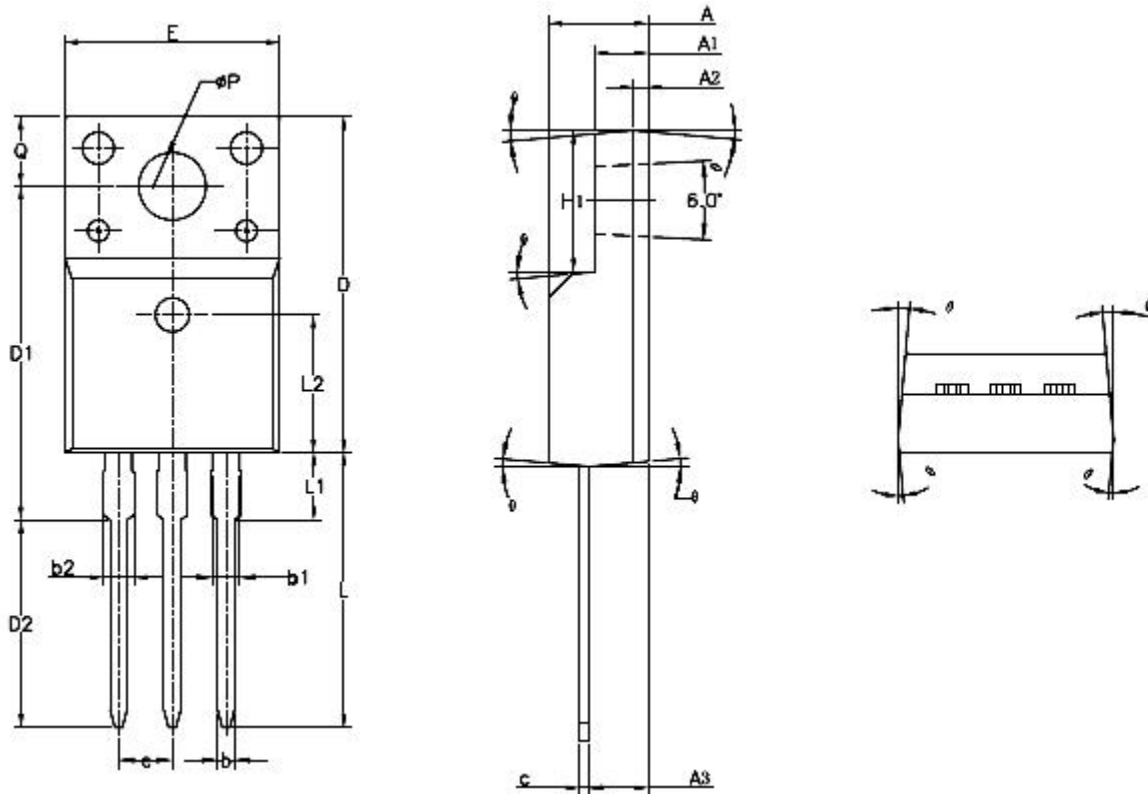


Unit:mm			
Symbol	Min.	Nom	Max.
E	9.96	10.16	10.36
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	0.30	0.45	0.60
A4	2.56	2.76	2.96
c	0.40	0.50	0.65
c1	1.20	1.30	1.35
D	15.57	15.87	16.17
H1	6.70REF		

Unit:mm			
Symbol	Min.	Nom	Max.
e	2.54BSC		
L	12.68	12.98	13.28
L1	2.93	3.03	3.13
ΦP	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



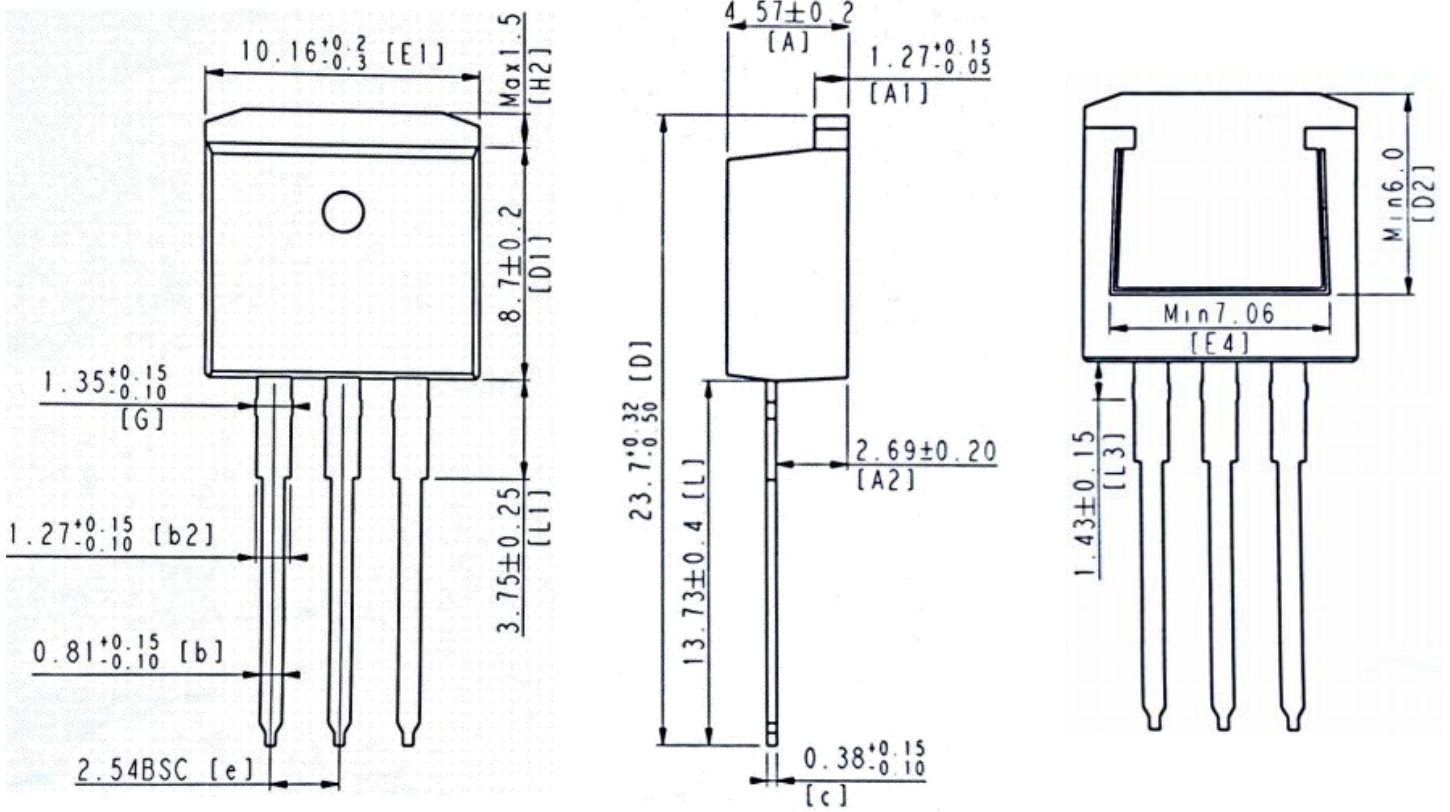
TO-220F (集佳)



SYMBOL	MIN	NOM	MAX
A	4.50	4.70	4.83
A1	2.34	2.54	2.74
A2	0.70 REF		
A3	2.56	2.76	2.93
b	0.70	—	0.90
b1	1.18	—	1.38
b2	—	—	1.47
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.55	15.75	15.95
D2	9.60	9.80	10.0
E	9.96	10.16	10.36
e	2.54BSC		
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	—	—	3.50
L2	6.50REF		
ϕP	3.08	3.18	3.28
Q	3.20	—	3.40
$\theta 1$	1°	3°	5°

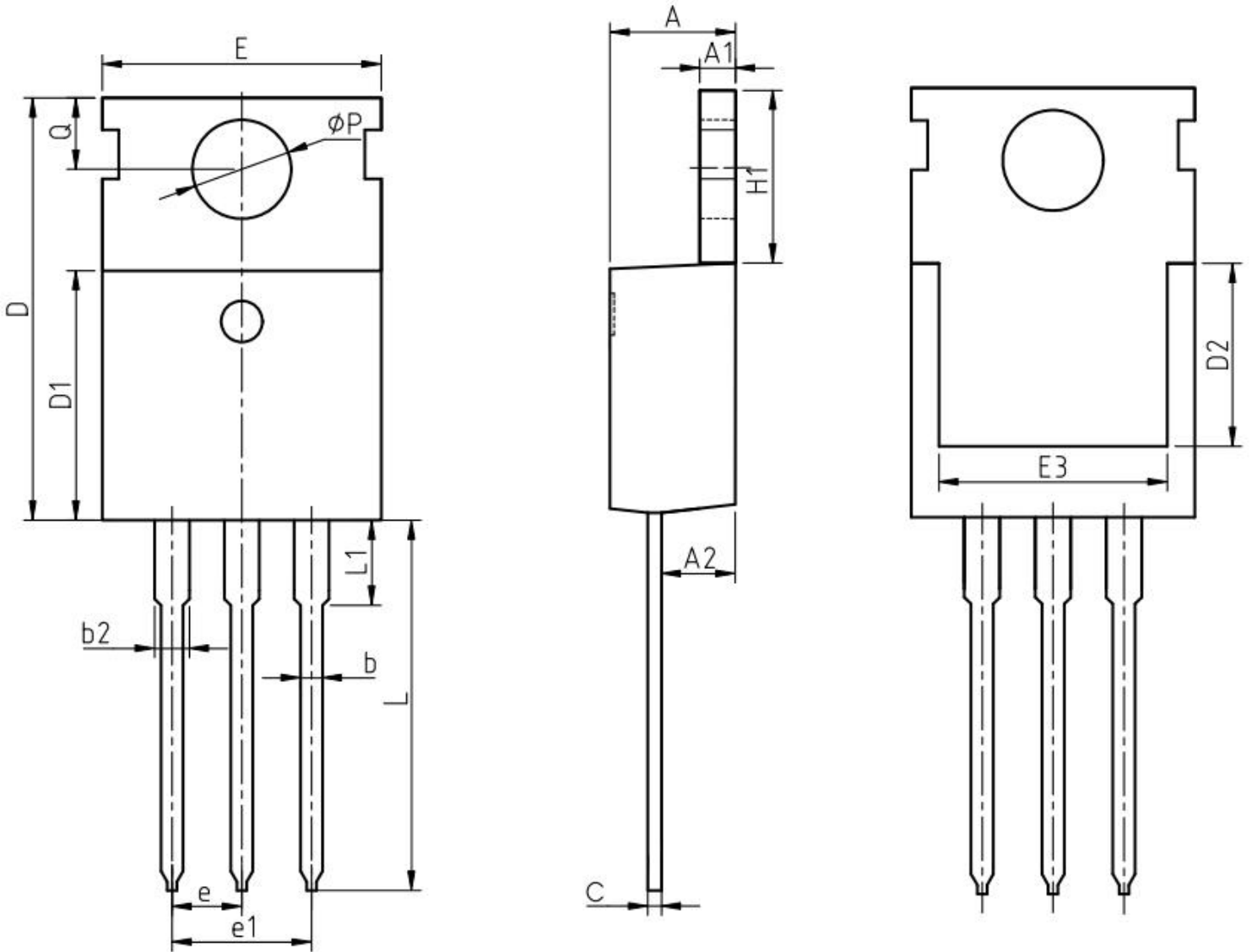


TO-262 (华羿)





TO-220 (华羿)

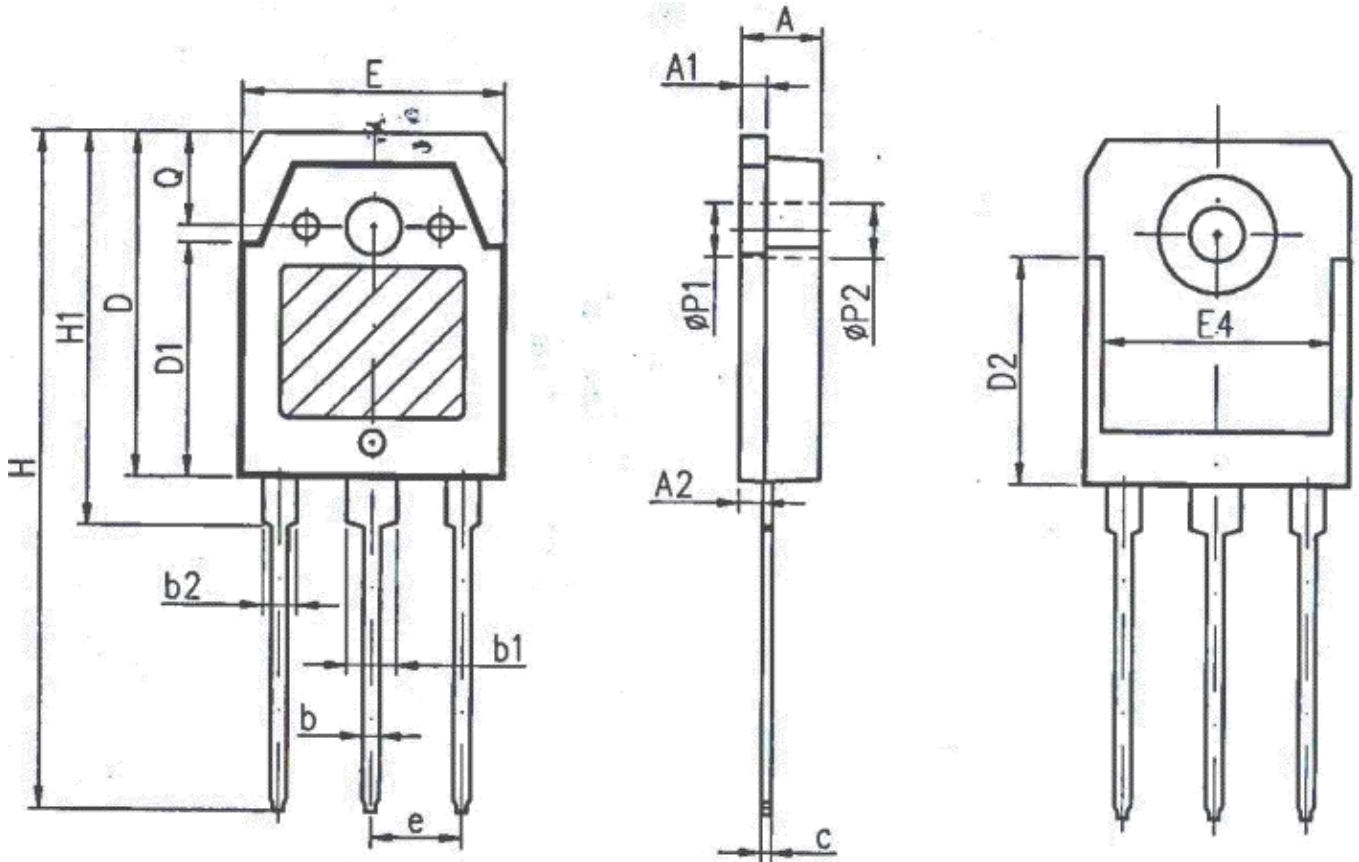


Unit:mm			
Symbol	Min.	Nom	Max.
A	4.37	4.57	4.70
A1	1.25	1.30	1.40
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b2	1.17	1.27	1.47
c	0.45	0.50	0.60
D	15.10	15.60	16.10
D1	8.80	9.10	9.40
D2	5.50	-	-

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-3PN (华羿)



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
$\phi P1$	3.20 REF		
$\phi P2$	3.50 REF		



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