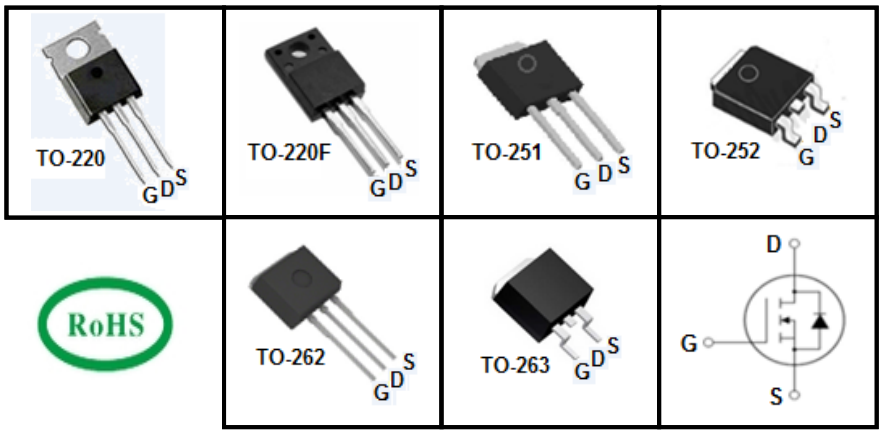
500V Super-Junction Power MOSFET

FEATURES

- Very low FOM $R_{DS(on)} \times Q_g$
- 100% avalanche tested
- RoHS compliant

APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)



Device Marking and Package Information

Device	TPP50R400C	TPA50R400C	TPU50R400C	TPD50R400C	TPC50R400C	TPB50R400C
Package	TO-220	TO-220F	TO-251	TO-252	TO-262	TO-263
Marking	50R400C	50R400C	50R400C	50R400C	50R400C	50R400C

Absolute Maximum Ratings T_C = 25ºC, unless otherwise noted

Parameter	Symbol	Value		Unit
		TO-220, TO-251, TO-252 TO-262, TO-263	TO-220F	
Drain-Source Voltage (V_{GS} = 0V)	V_{DSS}	500		V
Continuous Drain Current	I_D	7		A
Pulsed Drain Current (note1)	I_{DM}	21		A
Gate-Source Voltage	V_{GSS}	±30		V
Single Pulse Avalanche Energy (note2)	E_{AS}	160		mJ
Avalanche Current (note1)	I_{AR}	2.5		A
Repetitive Avalanche Energy (note1)	E_{AR}	0.2		mJ
Power Dissipation (T_C = 25ºC)	P_D	62.5	27.8	W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55~+150		ºC

Thermal Resistance

Parameter	Symbol	Value		Unit
		TO-220, TO-251, TO-252 TO-262, TO-263	TO-220F	
Thermal Resistance, Junction-to-Case	R_{thJC}	2.0	4.5	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62	80	

Specifications T_J = 25ºC, unless otherwise noted						
Parameter	**Symbol**	**Test Conditions**	**Value**			**Unit**
			Min.	**Typ.**	**Max.**	
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D = 250μA	500	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 500V, V_{GS} = 0V, T_J = 25ºC	--	--	1	μA
		V_{DS} = 500V, V_{GS} = 0V, T_J = 150ºC	--	--	100	
Gate-Source Leakage	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-Resistance (Note3)	$R_{DS(on)}$	V_{GS} = 10V, I_D = 3.5A	--	0.32	0.36	Ω
Forward Transconductance (Note3)	g_{fs}	V_{DS} = 10V, I_D = 3.5A	--	5	--	S
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} = 50V, f = 1.0MHz	--	450	--	pF
Output Capacitance	C_{oss}		--	82	--	
Reverse Transfer Capacitance	C_{rss}		--	4	--	
Total Gate Charge	Q_g	V_{DD} = 400V, I_D = 7A, V_{GS} = 10V	--	10	--	nC
Gate-Source Charge	Q_{gs}		--	2.5	--	
Gate-Drain Charge	Q_{gd}		--	4.5	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 400V, I_D = 7A, R_G = 25Ω	--	12	--	ns
Turn-on Rise Time	t_r		--	9	--	
Turn-off Delay Time	$t_{d(off)}$		--	80	--	
Turn-off Fall Time	t_f		--	13	--	
Drain-Source Body Diode Characteristics						
Continuous Body Diode Current	I_S	T_C = 25ºC	--	--	6.3	A
Pulsed Diode Forward Current	I_{SM}		--	--	19	
Body Diode Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 7A, V_{GS} = 0V	--	0.9	1.2	V
Reverse Recovery Time	t_{rr}	V_R = 400V, I_F = I_S, di_F/dt = 100A/μs	--	250	--	ns
Reverse Recovery Charge	Q_{rr}		--	2.1	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	16	--	A

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 2.5A, 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

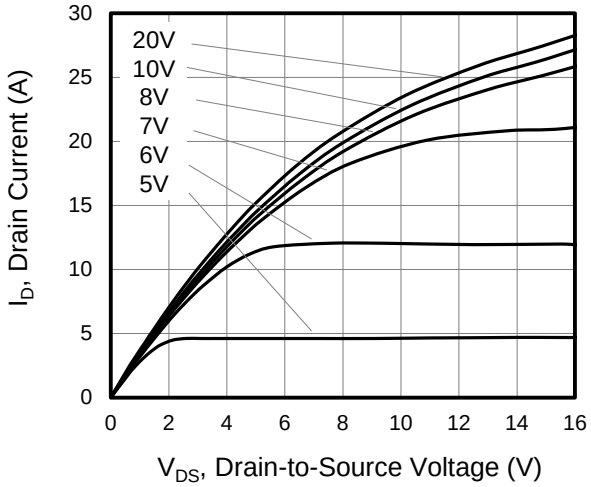


Figure 2. Transfer Characteristics

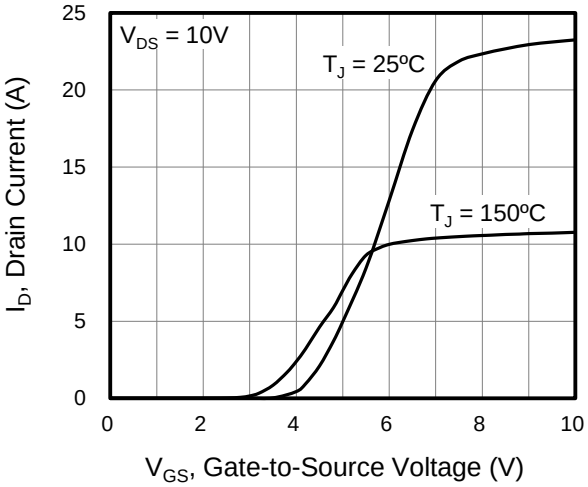


Figure 3. On-Resistance vs. Drain Current

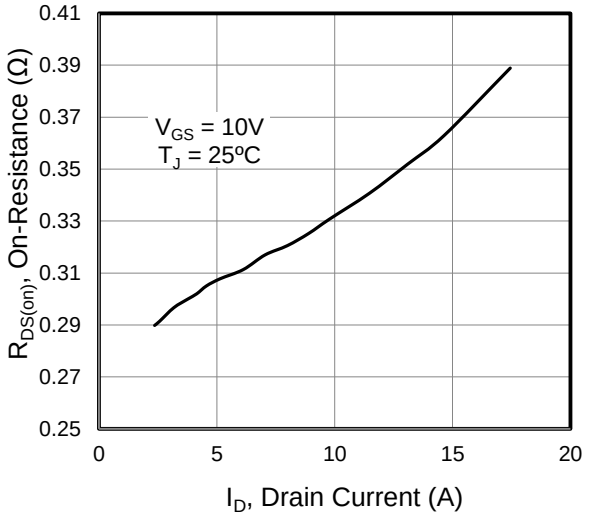


Figure 4. Capacitance

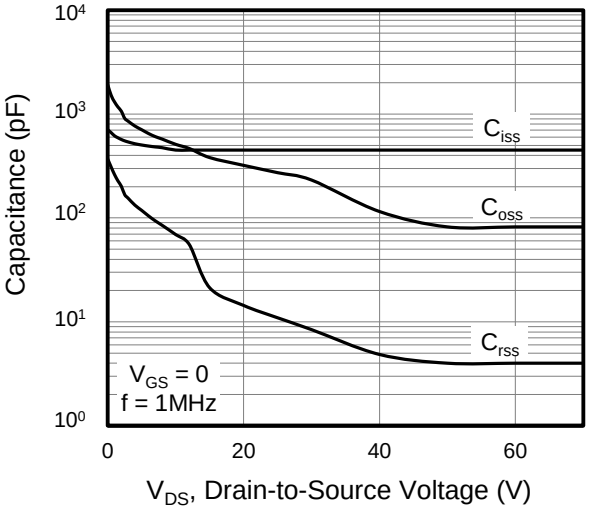


Figure 5. Gate Charge

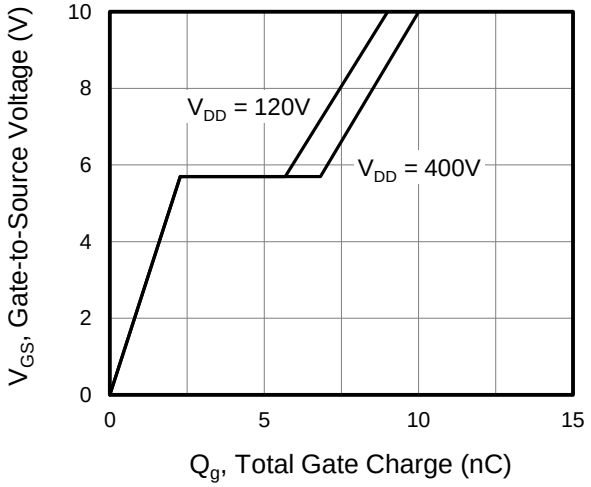
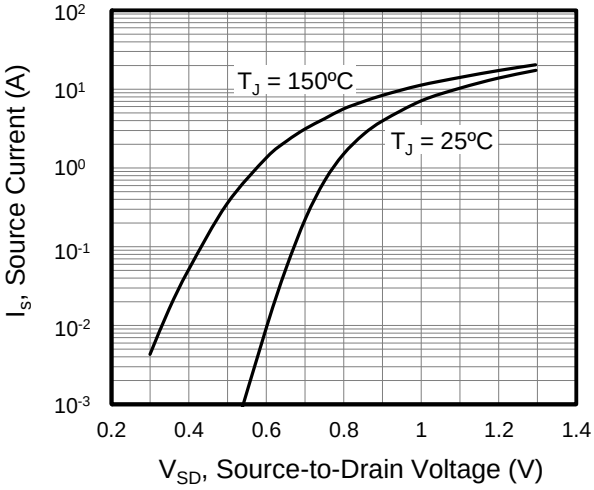


Figure 6. Body Diode Forward Voltage



Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 7. On-Resistance vs. Junction Temperature

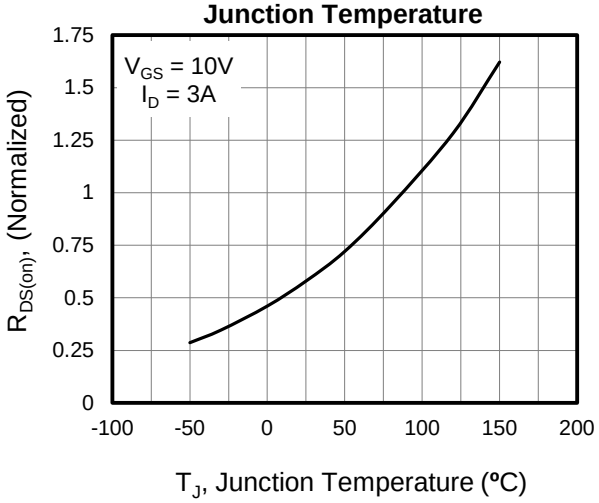


Figure 8. Threshold Voltage vs. Junction Temperature

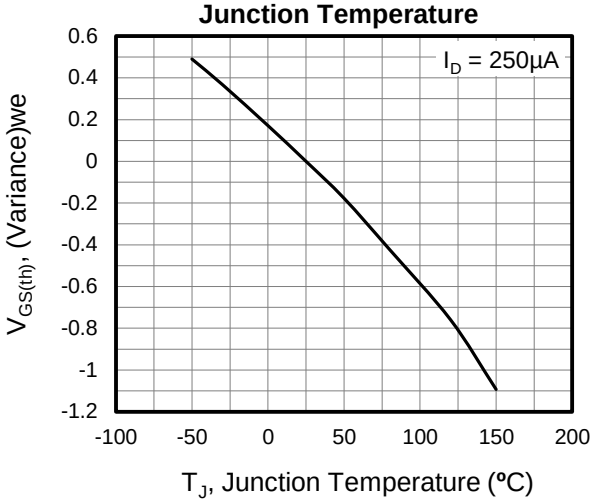


Figure 9. Transient Thermal Impedance TO-220,TO-251,TO-252, TO-262,TO-263

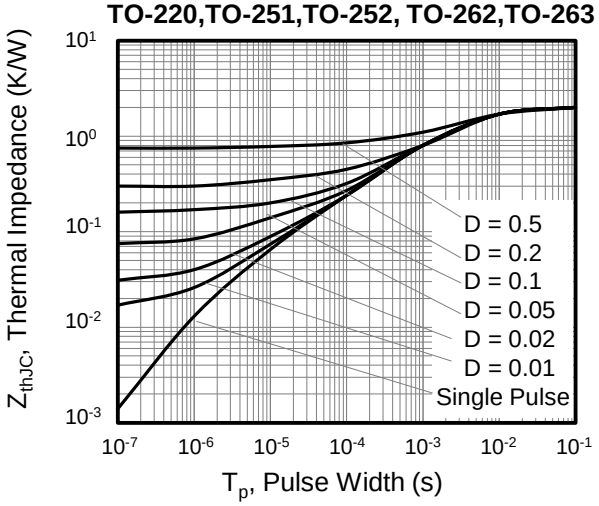


Figure 10. Transient Thermal Impedance TO-220F

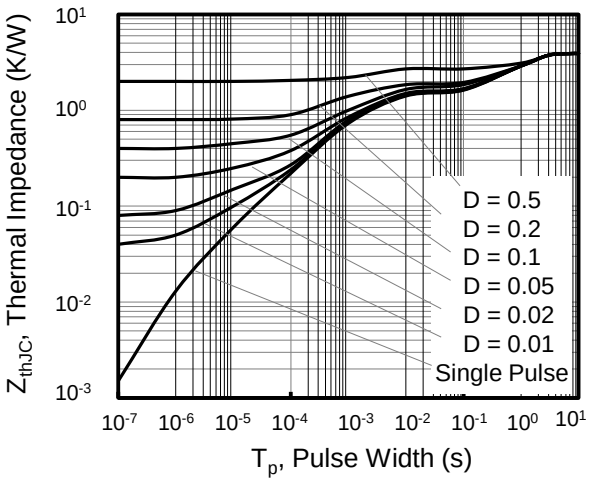


Figure A：Gate Charge Test Circuit and Waveform

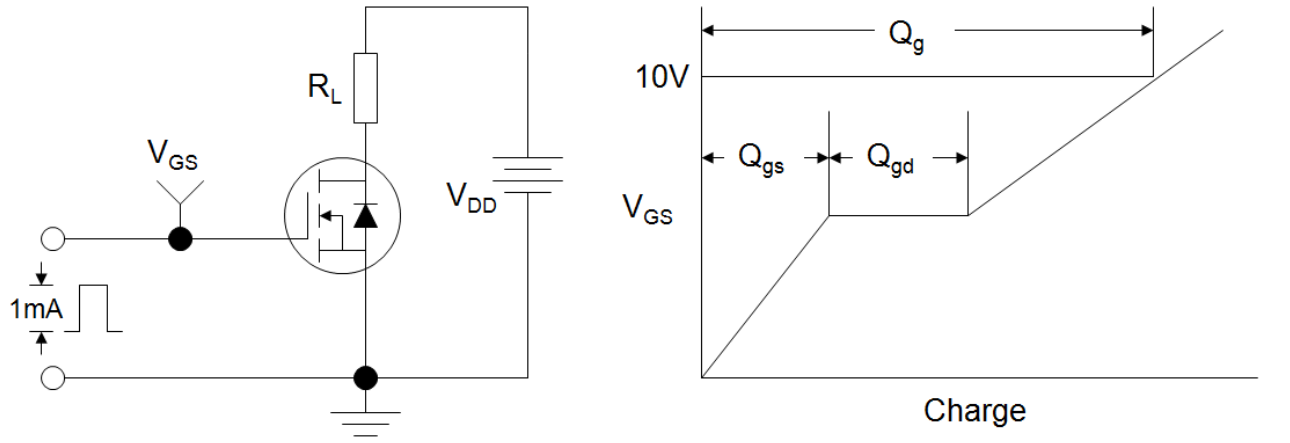


Figure B：Resistive Switching Test Circuit and Waveform

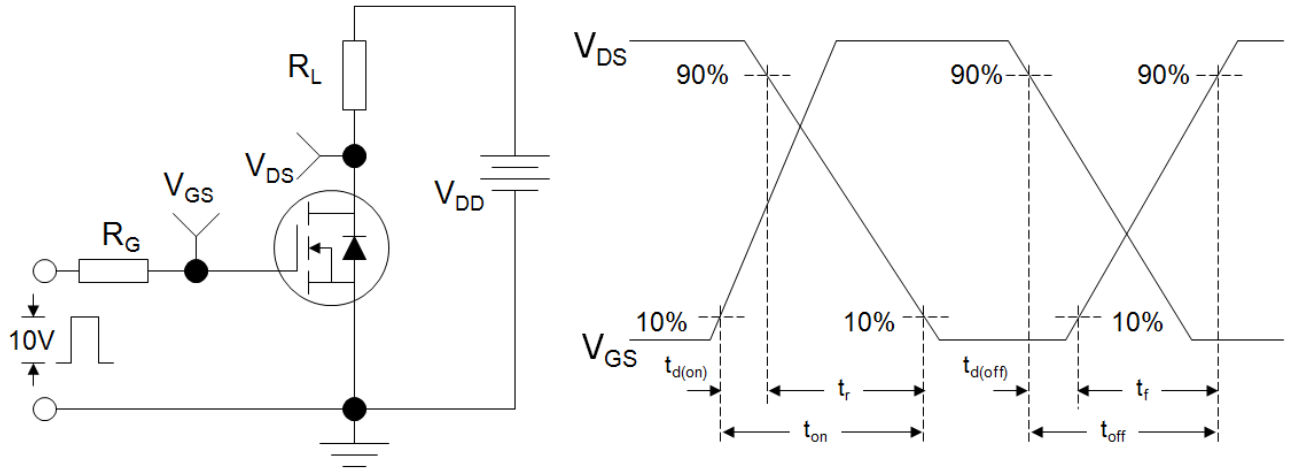
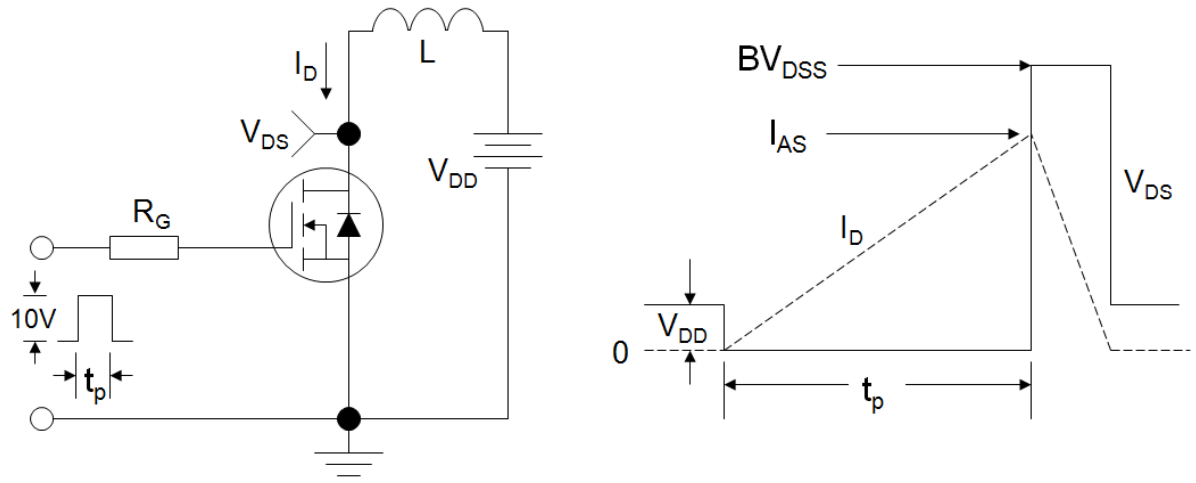
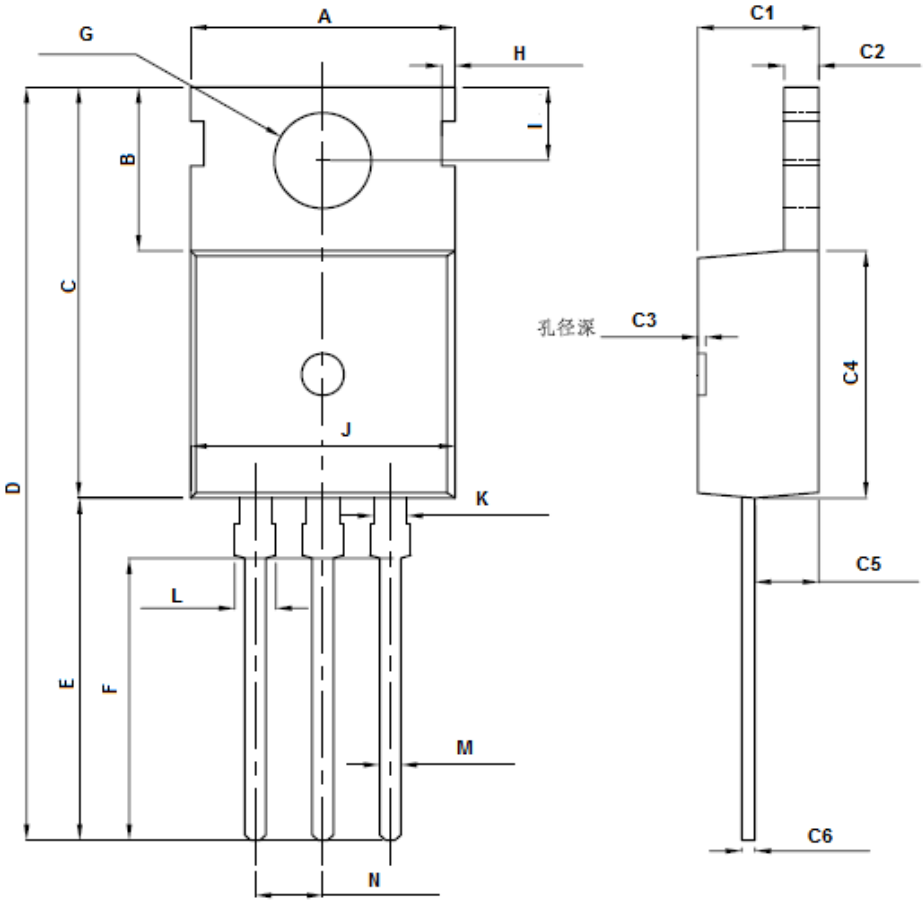


Figure C：Unclamped Inductive Switching Test Circuit and Waveform

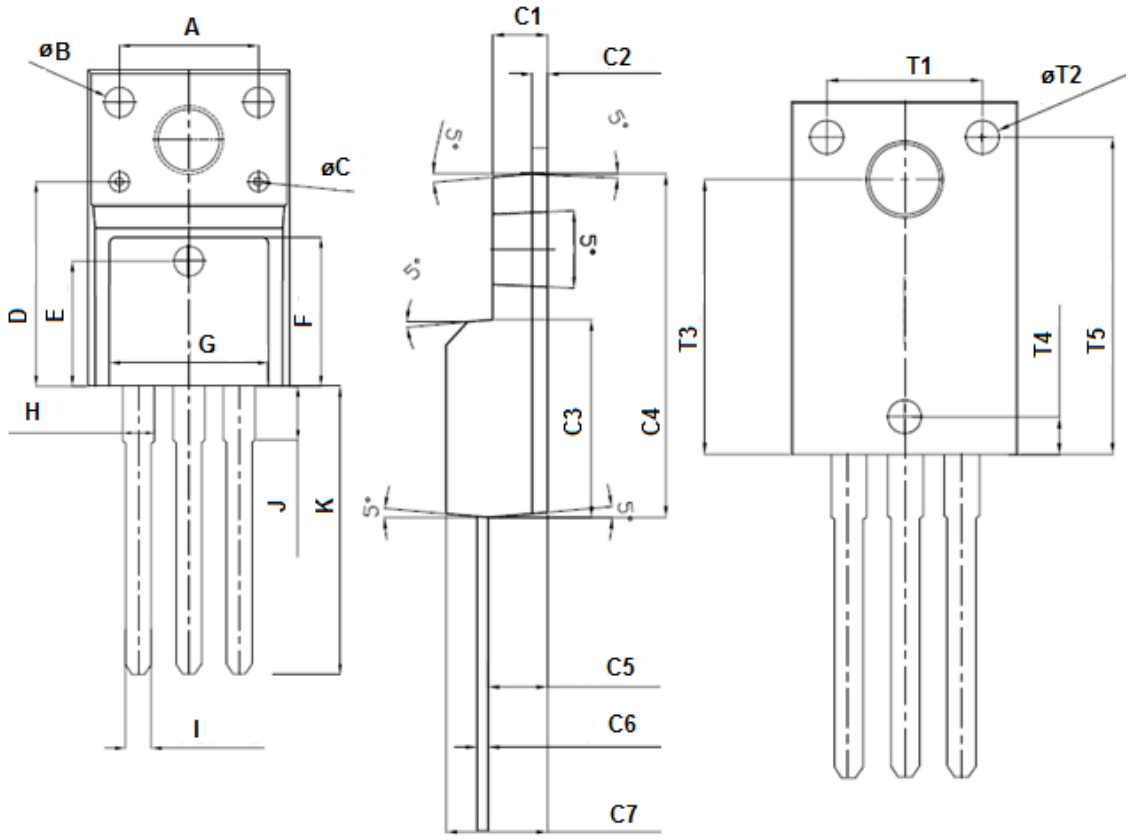


TO-220



Unit: mm		
Symbol	Min.	Max.
A	9.78	9.98
B	6.05	6.45
C	15.50	15.90
D	28.58	28.98
E	12.88	13.28
F	9.88	10.28
G	3.55	3.75
H	0.50	0.70
I	2.70	2.90
J	9.60	10.00
K	1.14	1.34
L	1.24	1.39
M	0.70	0.90
C1	4.40	4.70
C2	1.20	1.40
C3	0.00	0.30
C4	9.25	9.65
C5	2.30	2.50
C6	0.40	0.60

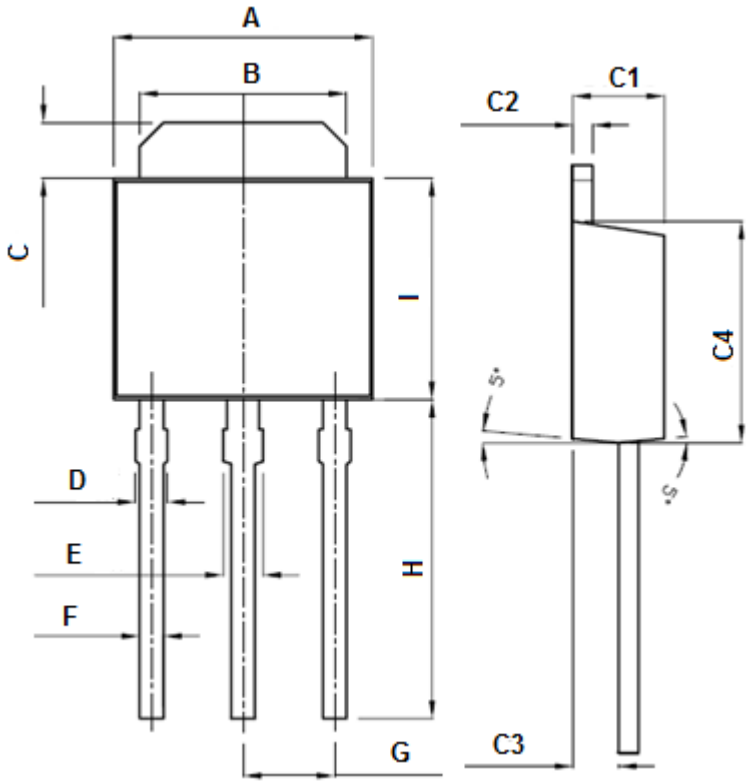
TO-220F



Unit: mm		
Symbol	Min.	Max.
A	6.80	7.20
B	1.40	1.60
C	0.50	0.70
D	10.10	10.50
E	6.10	6.50
F	7.30	7.70
G	7.80	8.20
H	1.30	1.50
I	0.70	0.90
J	3.00	3.40
K	12.95	13.35

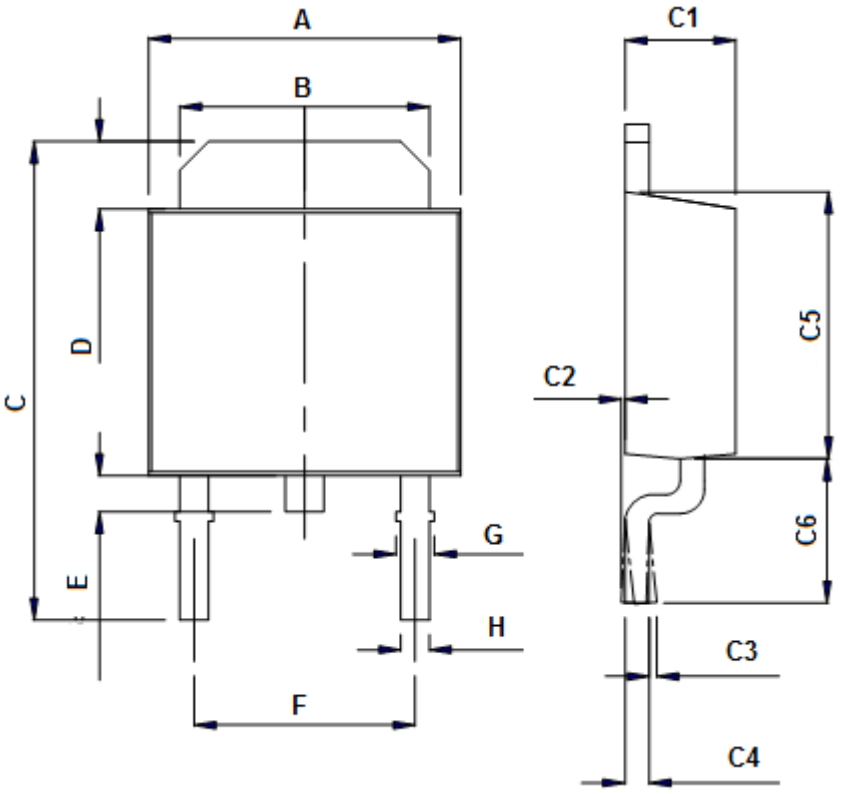
Unit: mm		
Symbol	Min.	Max.
C1	2.37	2.77
C2	0.50	0.90
C3	8.95	9.35
C4	15.70	16.10
C5	2.80	3.20
C6	0.40	0.60
C7	4.50	4.90
T1	6.80	7.20
T2	1.40	1.60
T3	12.30	12.50
T4	1.40	1.80
T5	14.10	14.50

TO-251



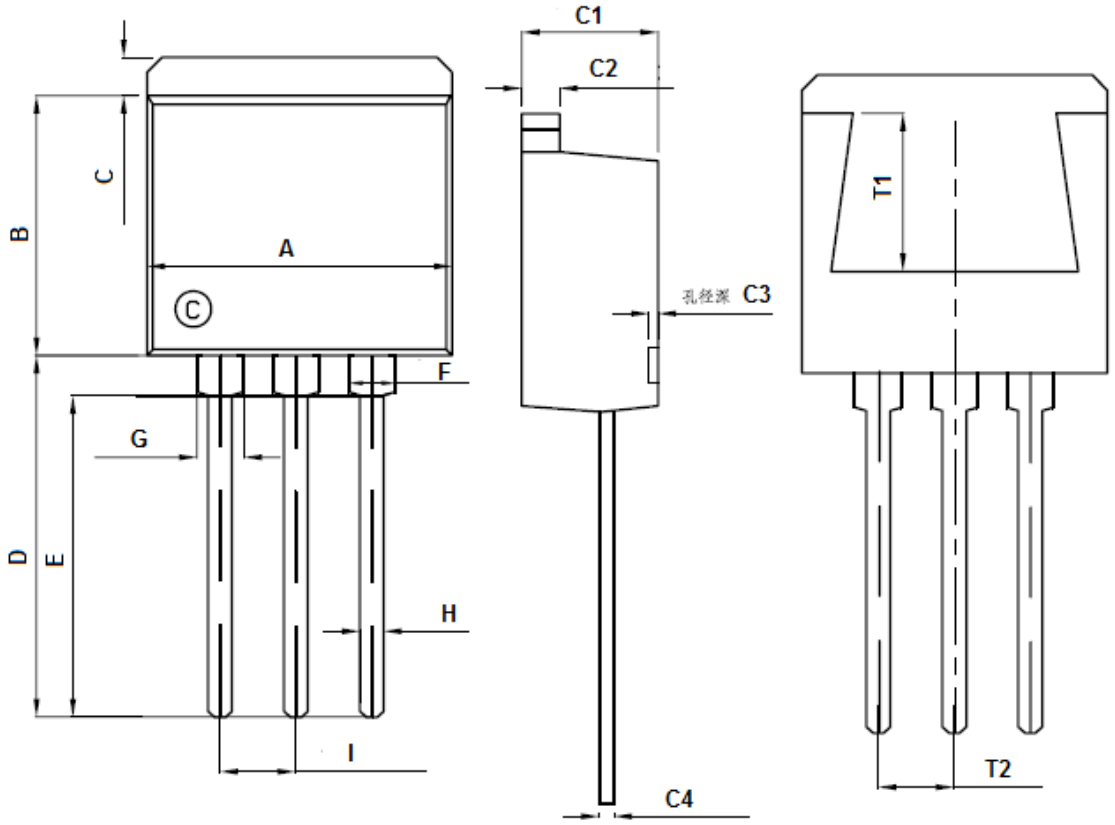
Unit: mm		
Symbol	Min.	Max.
A	6.30	6.70
B	5.10	5.30
C	1.20	1.60
D	0.60	0.75
E	0.80	0.95
F	0.50	0.70
G	2.25	2.35
H	7.80	8.20
I	5.35	5.75
C1	2.20	2.40
C2	0.40	0.60
C3	1.05	1.25
C4	5.35	5.75

TO-252



Unit: mm		
Symbol	Min.	Max.
A	6.30	6.70
B	5.10	5.30
C	9.50	9.90
D	1.20	1.60
E	0.60	0.90
F	4.50	4.70
G	0.60	0.75
H	0.40	0.80
C1	2.20	2.40
C2	0.00	0.10
C3	0.00	0.05
C4	0.40	0.60
C5	5.35	5.75
C6	2.55	2.95

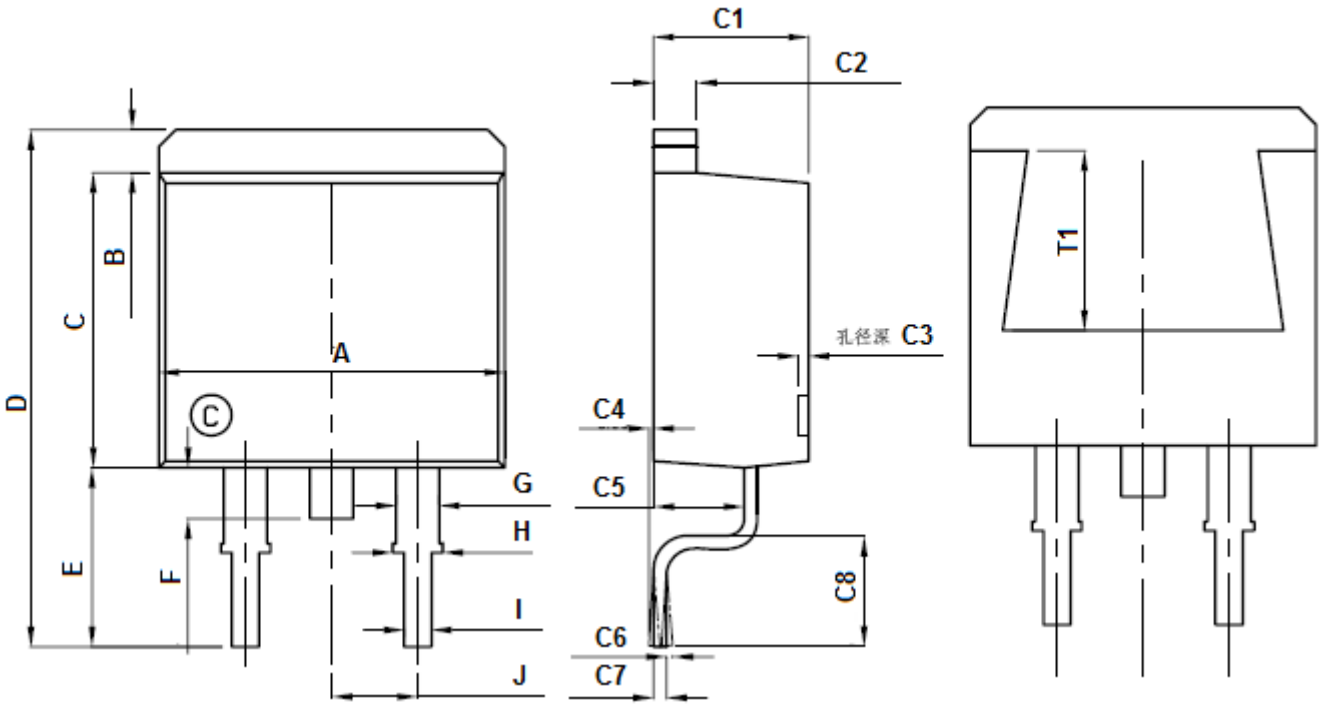
TO-262



Unit: mm		
Symbol	Min.	Max.
A	9.90	10.30
B	8.50	8.90
C	1.17	1.37
D	13.30	13.70
E	9.88	10.28
F	1.14	1.34
G	1.24	1.39
H	0.70	0.90
I	2.49	2.59

Unit: mm		
Symbol	Min.	Max.
C1	4.47	4.67
C2	1.17	1.37
C3	0.00	0.30
C4	0.40	0.60
T1	5.60REF	
T2	2.49	2.59

TO-263



Unit: mm		
Symbol	Min.	Max.
A	9.90	10.30
B	1.17	1.37
C	8.50	8.90
D	15.05	15.45
E	5.08	5.48
F	1.30	1.70
G	1.17	1.37
H	1.27	1.42
I	0.61	1.02
J	2.49	2.59

Unit: mm		
Symbol	Min.	Max.
C1	4.47	4.67
C2	1.17	1.37
C3	0.00	0.30
C4	0.00	0.15
C5	2.60	2.80
C6	0.00	0.10
C7	0.28	0.49
C8	2.45	2.75
T1	5.60REF	

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