



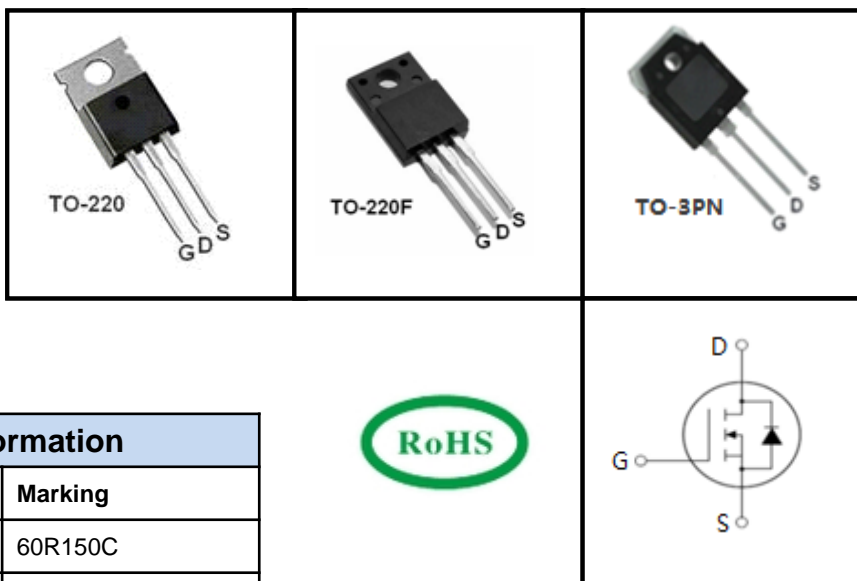
600V Super-Junction Power MOSFET

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	Package	Marking
TPP60R150C	TO-220	60R150C
TPA60R150C	TO-220F	60R150C
TPV60R150C	TO-3P	60R150C

Absolute Maximum Ratings $T_C = 25^\circ\text{C}$, unless otherwise noted					
Parameter	Symbol	Value			Unit
		TO-220	TO-3P	TO-220F	
Drain-Source Voltage ($V_{GS} = 0\text{V}$)	V_{DSS}	600			V
Continuous Drain Current	I_D	20			A
Pulsed Drain Current (note1)	I_{DM}	60			A
Gate-Source Voltage	V_{GSS}	± 30			V
Single Pulse Avalanche Energy (note2)	E_{AS}	240			mJ
Avalanche Current (note1)	I_{AR}	7			A
Repetitive Avalanche Energy (note1)	E_{AR}	0.75			mJ
Power Dissipation ($T_C = 25^\circ\text{C}$)	P_D	176		34	W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55~+150			$^\circ\text{C}$

Thermal Resistance					
Parameter	Symbol	Value			Unit
		TO-220	TO-3P	TO-220F	
Thermal Resistance, Junction-to-Case	R_{thJC}	0.71			$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62		80	



Specifications $T_J = 25^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	600	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 600V, V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	1	μA
		$V_{DS} = 600V, V_{GS} = 0V, T_J = 150^\circ\text{C}$	--	--	100	
Gate-Source Leakage	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	V
Drain-Source On-Resistance (Note3)	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 10A$	--	0.13	0.15	Ω
Forward Transconductance (Note3)	g_{fs}	$V_{DS} = 10V, I_D = 10A$	--	18.8	--	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0V,$ $V_{DS} = 50V,$ $f = 1.0\text{MHz}$	--	1605	--	μF
Output Capacitance	C_{oss}		--	225	--	
Reverse Transfer Capacitance	C_{rss}		--	17	--	
Total Gate Charge	Q_g	$V_{DD} = 480V, I_D = 20A,$ $V_{GS} = 10V$	--	41	--	nC
Gate-Source Charge	Q_{gs}		--	7.5	--	
Gate-Drain Charge	Q_{gd}		--	15	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 400V, I_D = 20A,$ $R_G = 25\Omega$	--	13	--	ns
Turn-on Rise Time	t_r		--	13	--	
Turn-off Delay Time	$t_{d(off)}$		--	96	--	
Turn-off Fall Time	t_f		--	8	--	
Drain-Source Body Diode Characteristics						
Continuous Body Diode Current	I_S	$T_C = 25^\circ\text{C}$	--	--	20.6	A
Pulsed Diode Forward Current	I_{SM}		--	--	70	
Body Diode 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}	$V_R = 480V, I_F = I_S,$ $di_F/dt = 100A/\mu s$	--	460	--	ns
Reverse Recovery Charge	Q_{rr}		--	8.2	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	35	--	A

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS} = 7A, V_{DD} = 50V, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}$
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

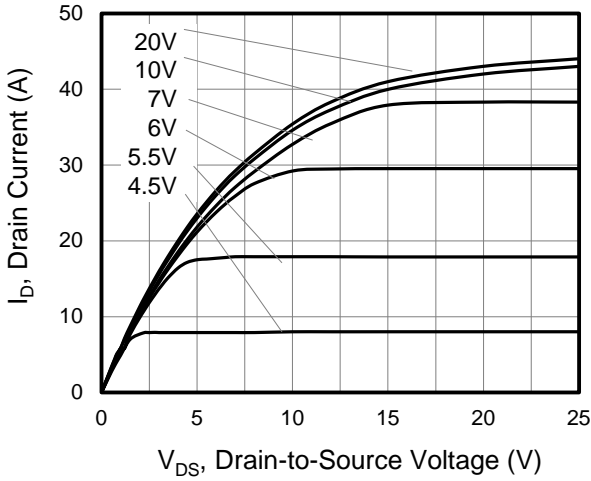


Figure 2. Transfer Characteristics

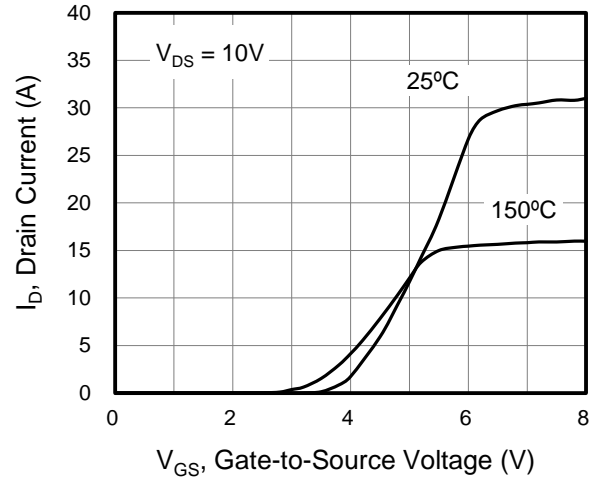


Figure 3. On-Resistance vs. Drain Current

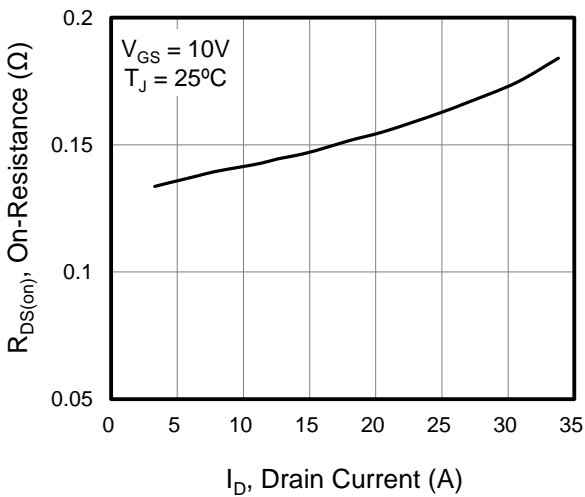


Figure 4. Capacitance

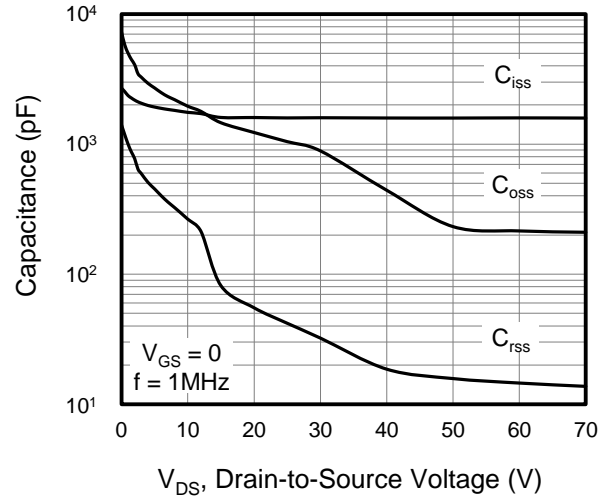


Figure 5. Gate Charge

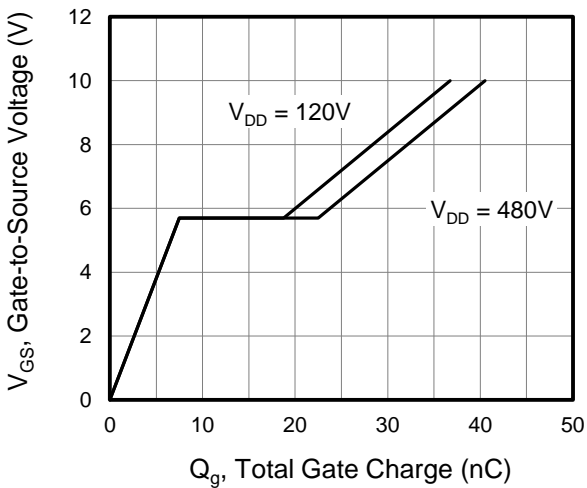
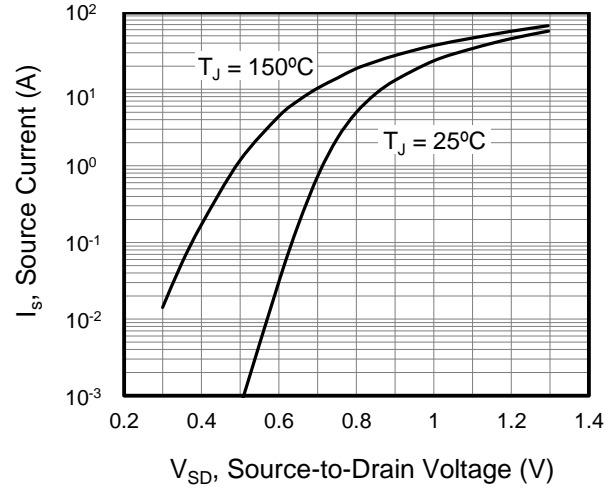


Figure 6. Body Diode Forward Voltage





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

Figure 7. On-Resistance vs. Junction Temperature

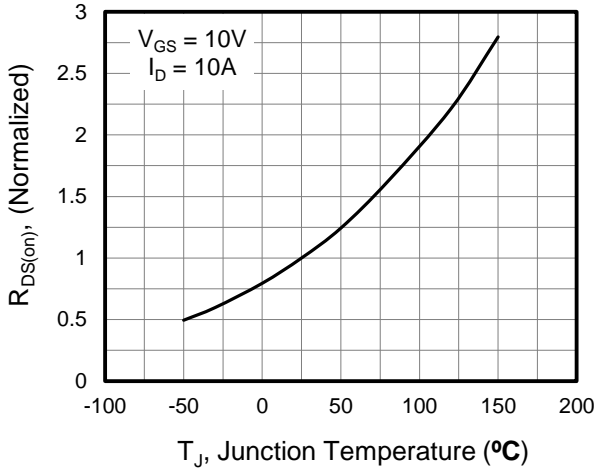


Figure 8. Threshold Voltage vs. Junction Temperature

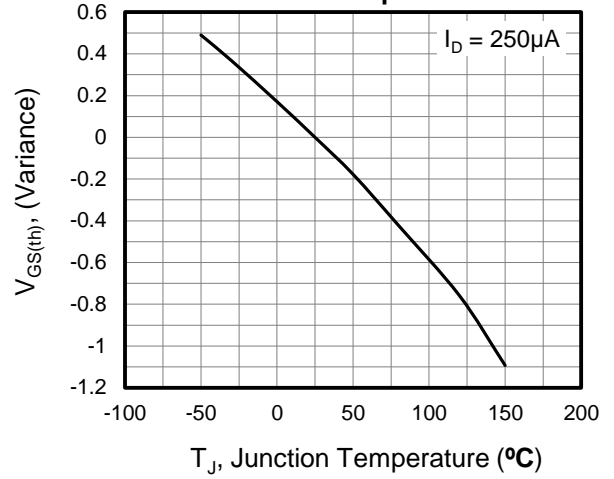


Figure 9. Transient Thermal Impedance TO-220/TO-3P

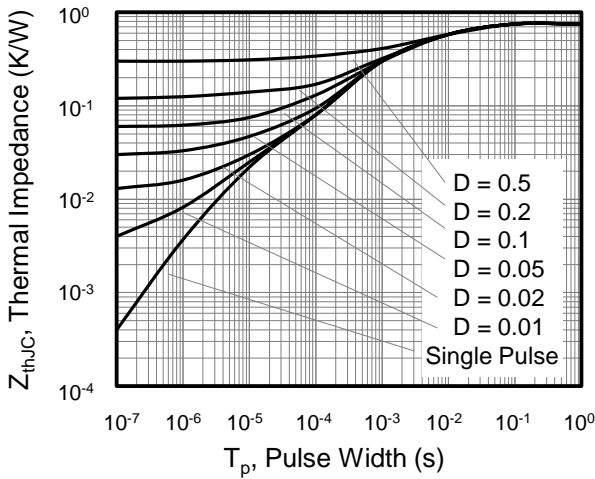


Figure 10. Transient Thermal Impedance TO-220F

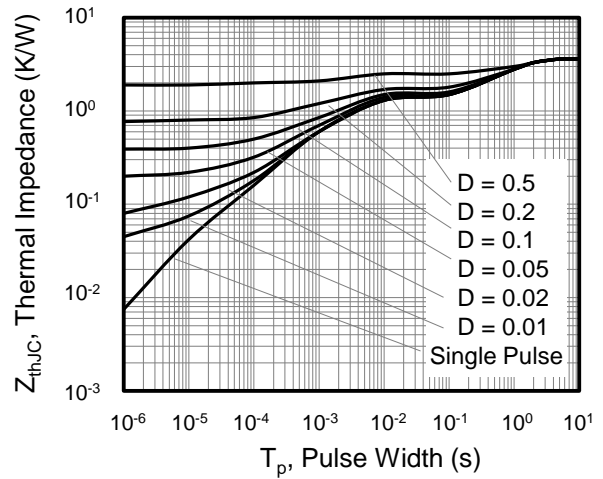




Figure A: Gate Charge Test Circuit and Waveform

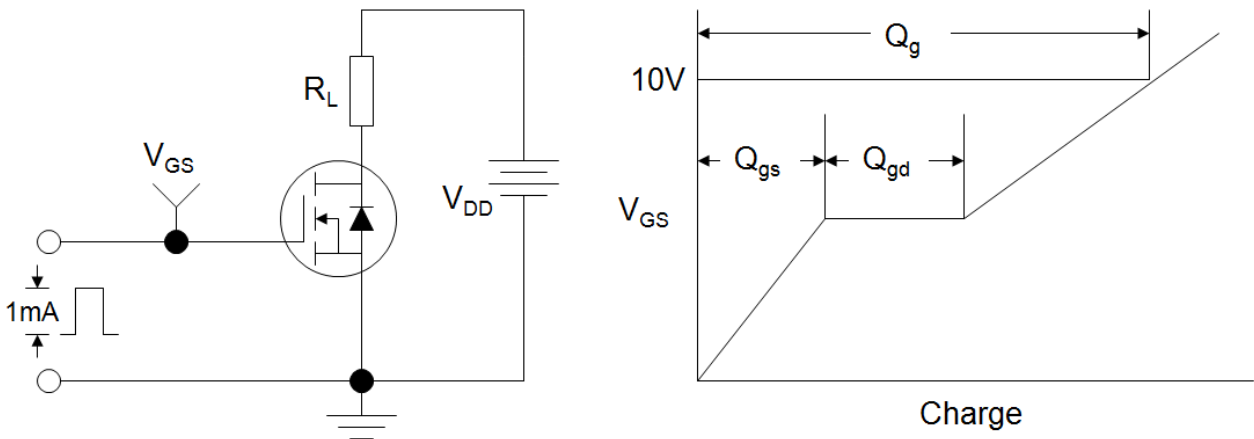


Figure B: Resistive Switching Test Circuit and Waveform

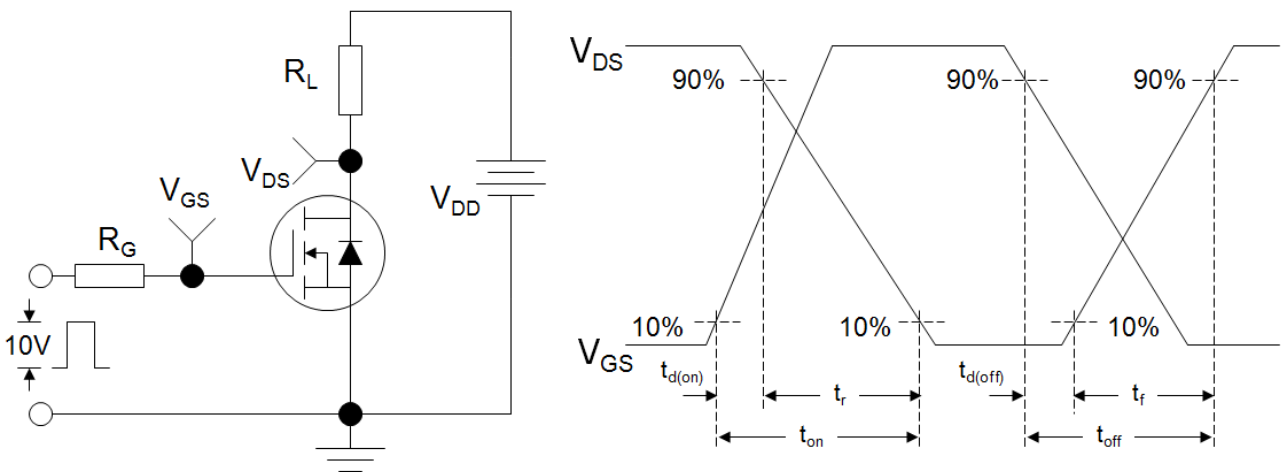
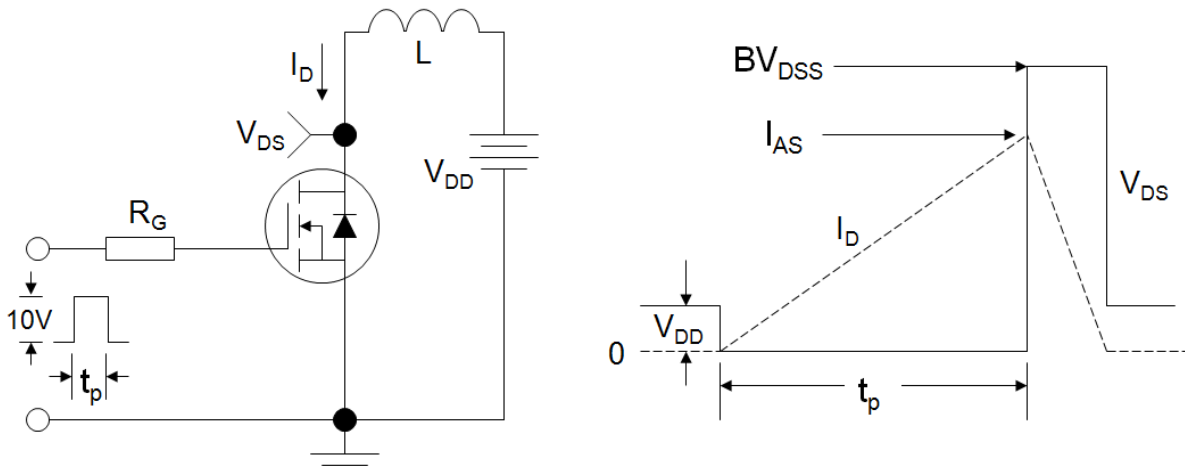
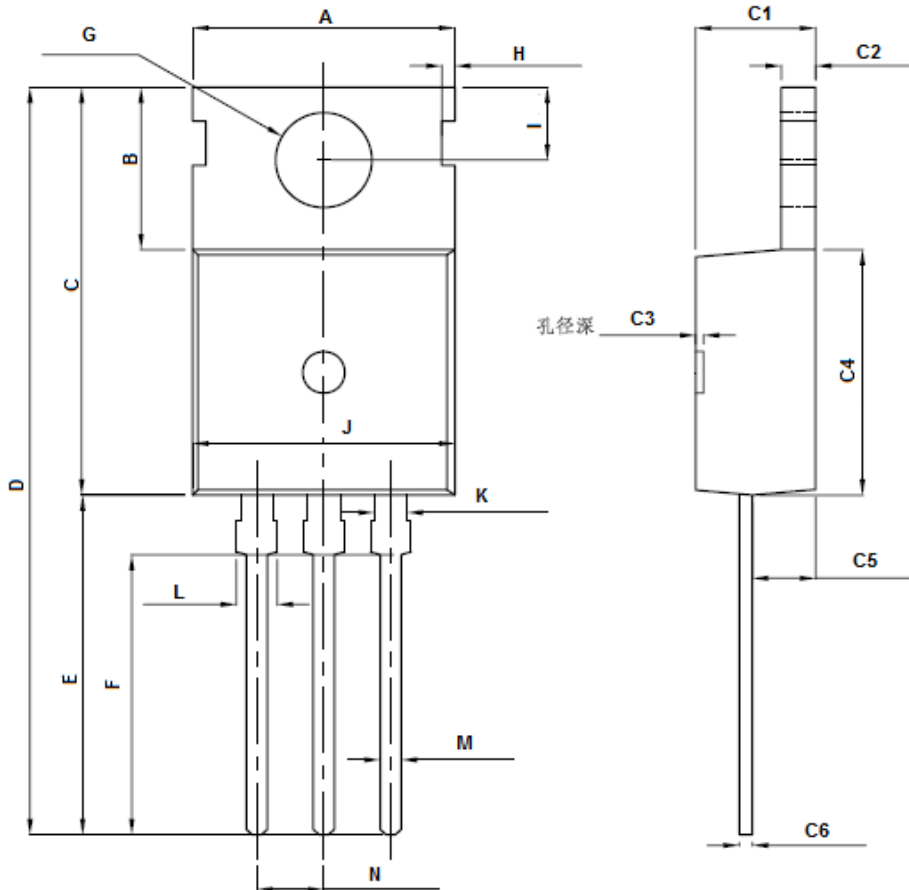


Figure C: Unclamped Inductive Switching Test Circuit and Waveform





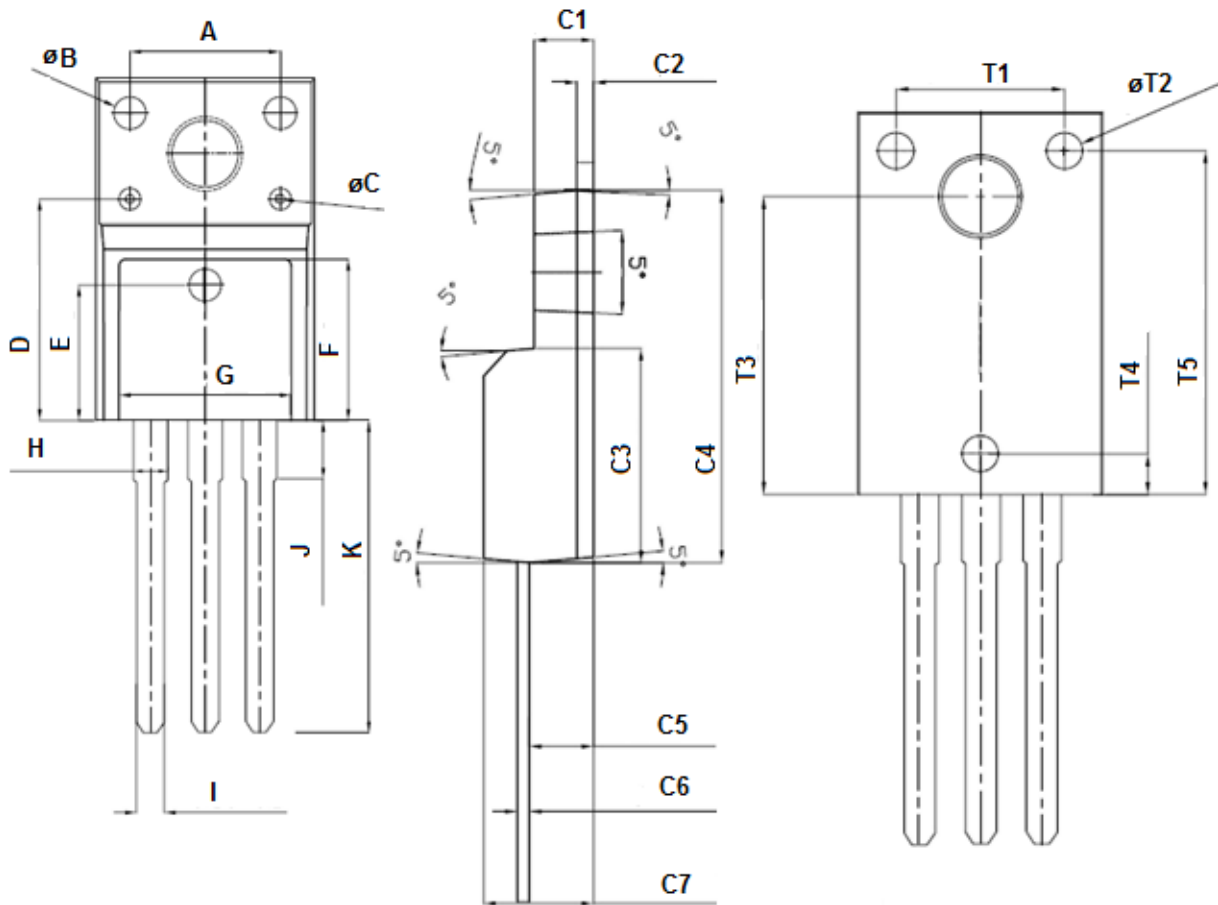
TO-220



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

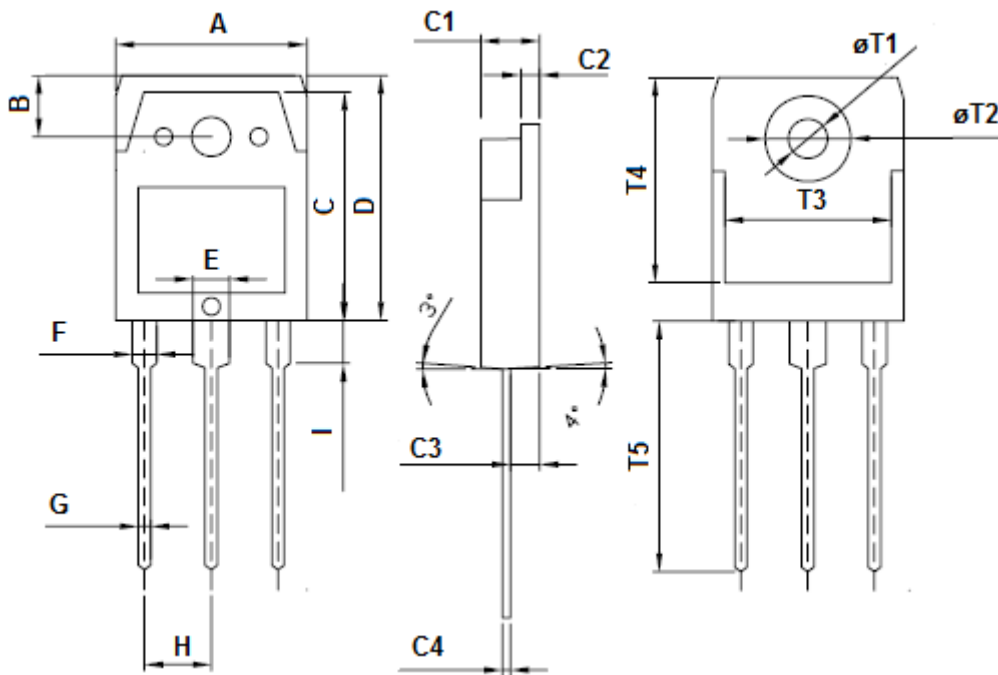


Unit: mm		
Symbol	Min.	Max.
A	6.80	7.20
B	1.40	1.60
C	0.50	0.70
D	10.10	10.50
E	6.10	6.50
F	7.30	7.70
G	7.80	8.20
H	1.30	1.50
I	0.70	0.90
J	3.00	3.40
K	12.95	13.35

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-3PN



Unit: MM		
Symbol	Min.	Max.
A	15.40	15.80
B	4.80	5.20
C	18.50	18.90
D	19.70	20.10
E	2.80	3.20
F	1.80	2.20
G	0.80	1.20
H	5.45	5.45
I	3.30	3.70

Unit: MM		
Symbol	Min.	Max.
C1	4.60	5.00
C2	1.35	1.55
C3	1.90	2.90
C4	0.55	0.75
T1	3.20	3.40
T2	6.80	7.20
T3	13.40	13.80
T4	16.56	16.96
T5	19.70	20.30



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