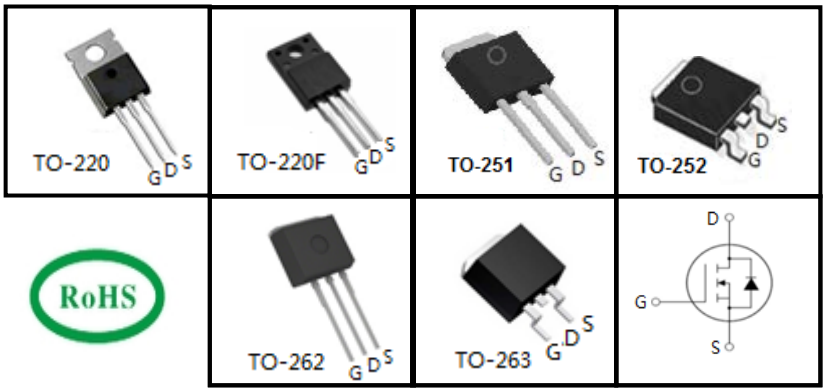
700V Super-Junction Power MOSFET

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	TPP70R1K4C	TPA70R1K4C	TPU70R1K4C	TPD70R1K4C	TPC70R1K4C	TPB70R1K4C
Package	TO-220	TO-220F	TO-251	TO-252	TO-262	TO-263
Marking	70R1K4C	70R1K4C	70R1K4C	70R1K4C	70R1K4C	70R1K4C

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}	700		V
Continuous Drain Current	I_D	4		A
Pulsed Drain Current (note1)	I_{DM}	12		A
Gate-Source Voltage	V_{GSS}	±30		V
Single Pulse Avalanche Energy (note2)	E_{AS}	120		mJ
Avalanche Current (note1)	I_{AR}	2		A
Repetitive Avalanche Energy (note1)	E_{AR}	0.09		mJ
Power Dissipation (T_C = 25ºC)	P_D	36.8	31.3	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}	3.4	4.0	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	75	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	700	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 700V, V_{GS} = 0V, T_J = 25ºC	--	--	1	μA
		V_{DS} = 700V, 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 = 2A	--	1.16	1.35	Ω
Forward Transconductance (Note3)	g_{fs}	V_{DS} = 10V, I_D = 2A	--	3	--	S
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} = 50V, f = 1.0MHz	--	350	--	pF
Output Capacitance	C_{oss}		--	40	--	
Reverse Transfer Capacitance	C_{rss}		--	3.5	--	
Total Gate Charge	Q_g	V_{DD} = 560V, I_D = 4A, V_{GS} = 10V	--	7	--	nC
Gate-Source Charge	Q_{gs}		--	1.5	--	
Gate-Drain Charge	Q_{gd}		--	2.5	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 400V, I_D = 4A, R_G = 25Ω	--	7.7	--	ns
Turn-on Rise Time	t_r		--	5.9	--	
Turn-off Delay Time	$t_{d(off)}$		--	33	--	
Turn-off Fall Time	t_f		--	18.2	--	
Drain-Source Body Diode Characteristics						
Continuous Body Diode Current	I_S	T_C = 25ºC	--	--	2.8	A
Pulsed Diode Forward Current	I_{SM}		--	--	8.3	
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 = 560V, I_F = I_S, di_F/dt = 100A/μs	--	220	--	ns
Reverse Recovery Charge	Q_{rr}		--	0.9	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	8	--	A

Notes

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

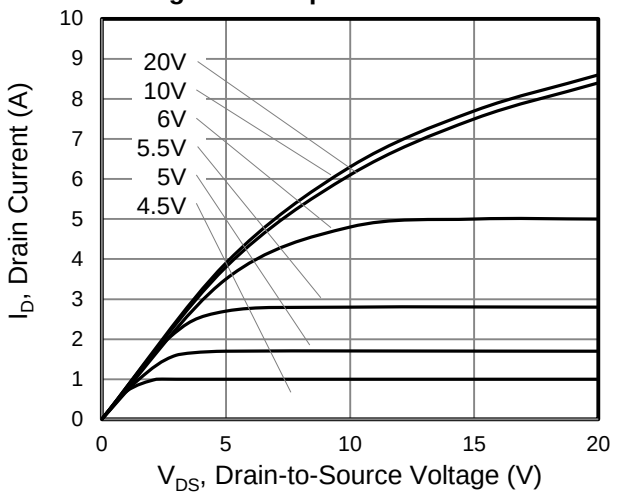


Figure 2. Transfer Characteristics

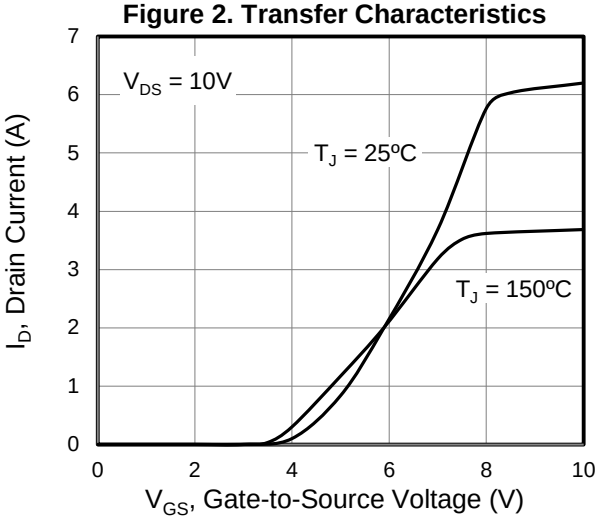


Figure 3. On-Resistance vs. Drain Current

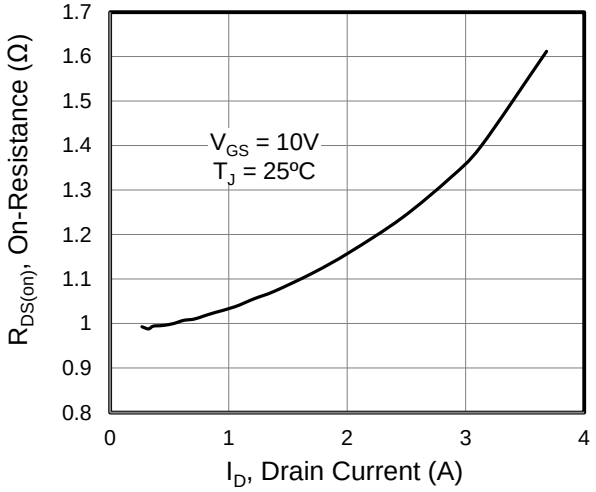


Figure 4. Capacitance

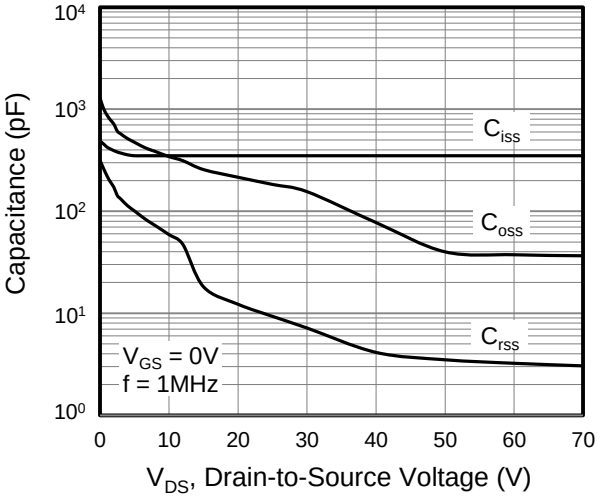


Figure 5. Gate Charge

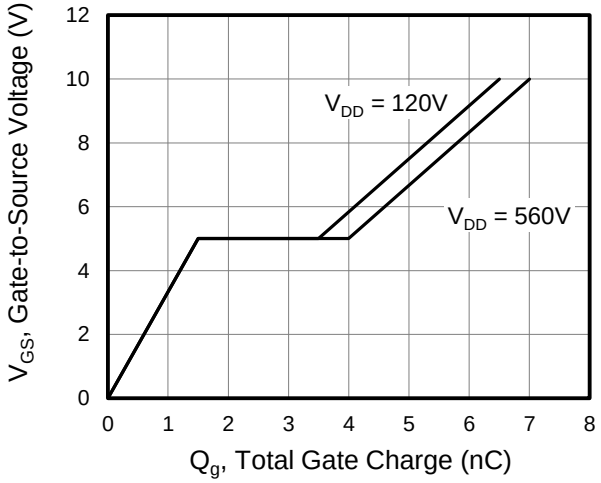
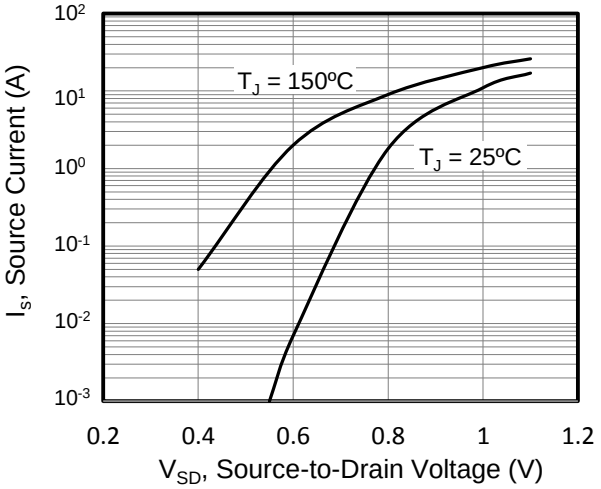


Figure 6. Body Diode Forward Voltage



Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 7. On-Resistance vs. Junction Temperature

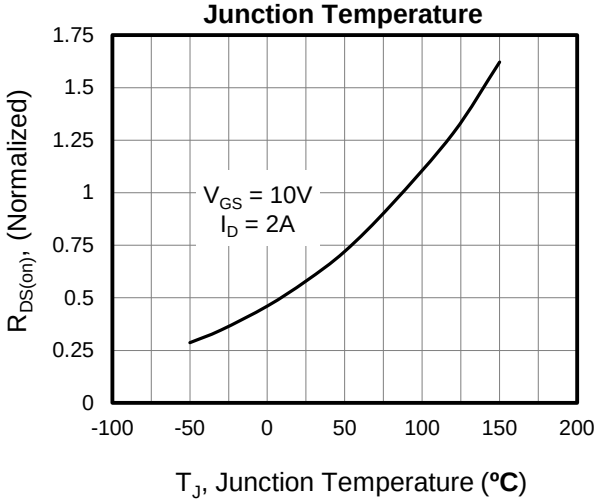


Figure 8. Threshold Voltage vs. Junction Temperature

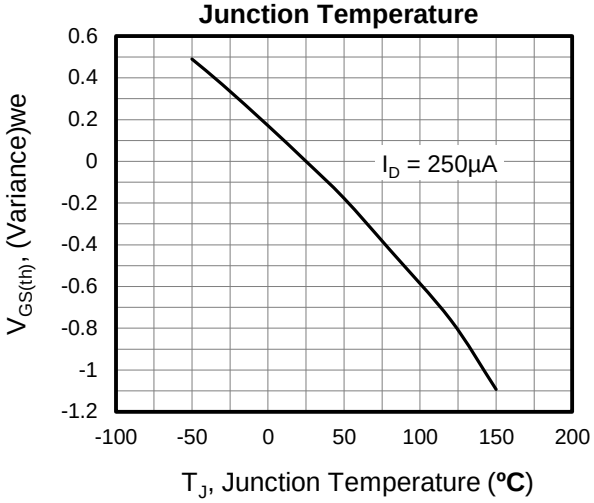


Figure 9. Transient Thermal Impedance TO-220,TO-251,TO-252,TO-262,TO-263

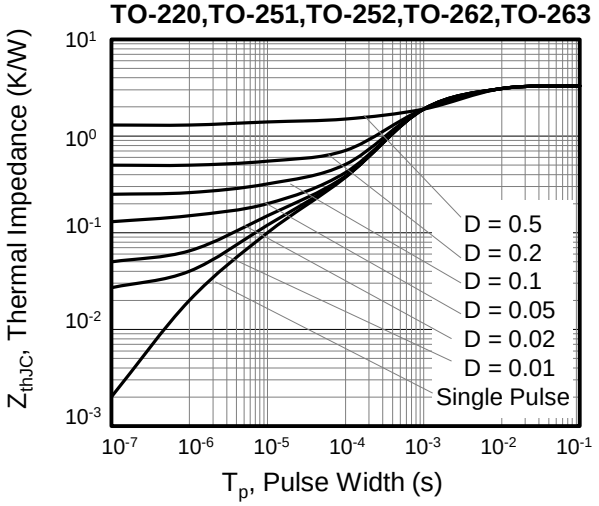


Figure 10. Transient Thermal Impedance TO-220F

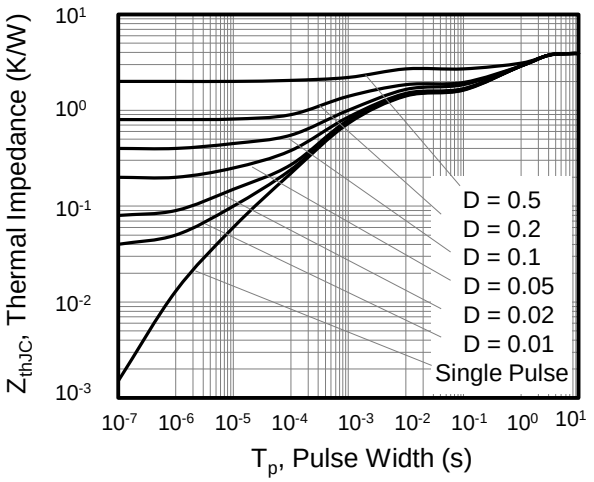


Figure A：Gate Charge Test Circuit and Waveform

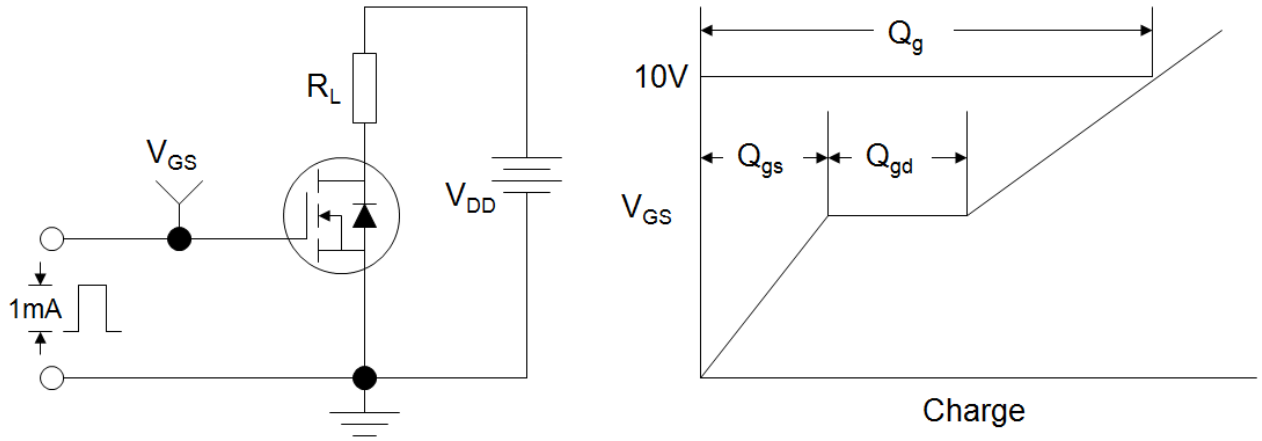


Figure B：Resistive Switching Test Circuit and Waveform

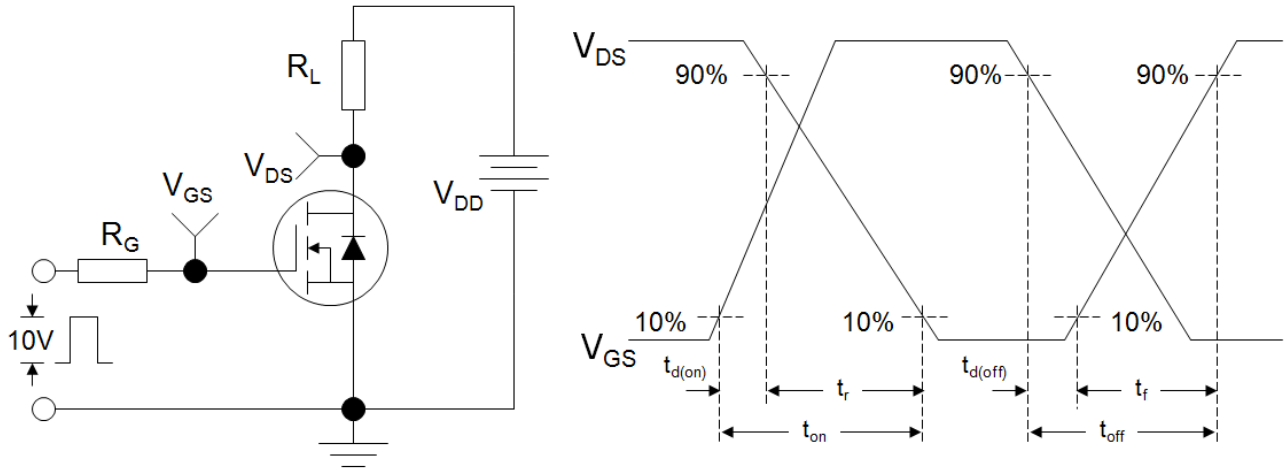
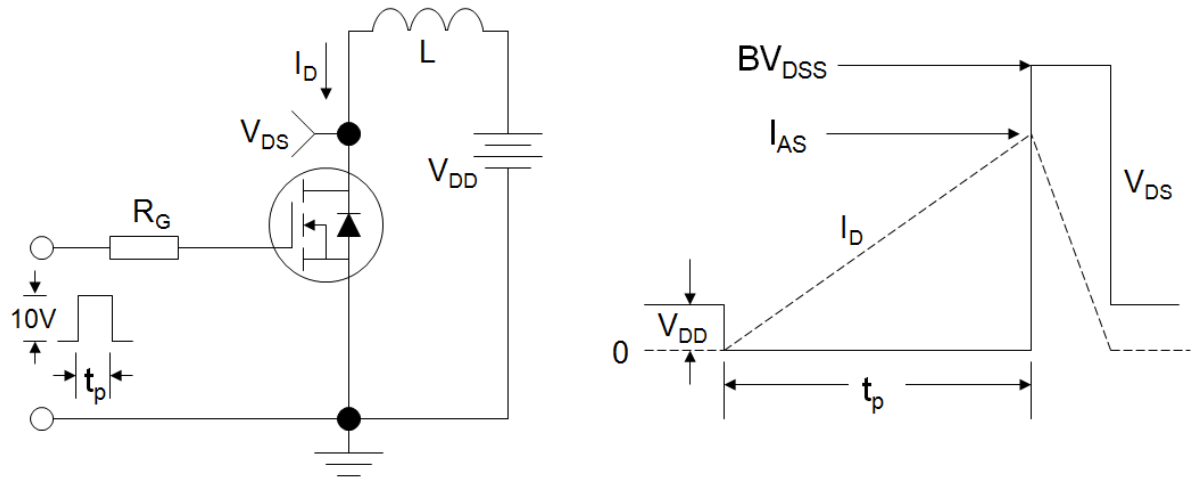
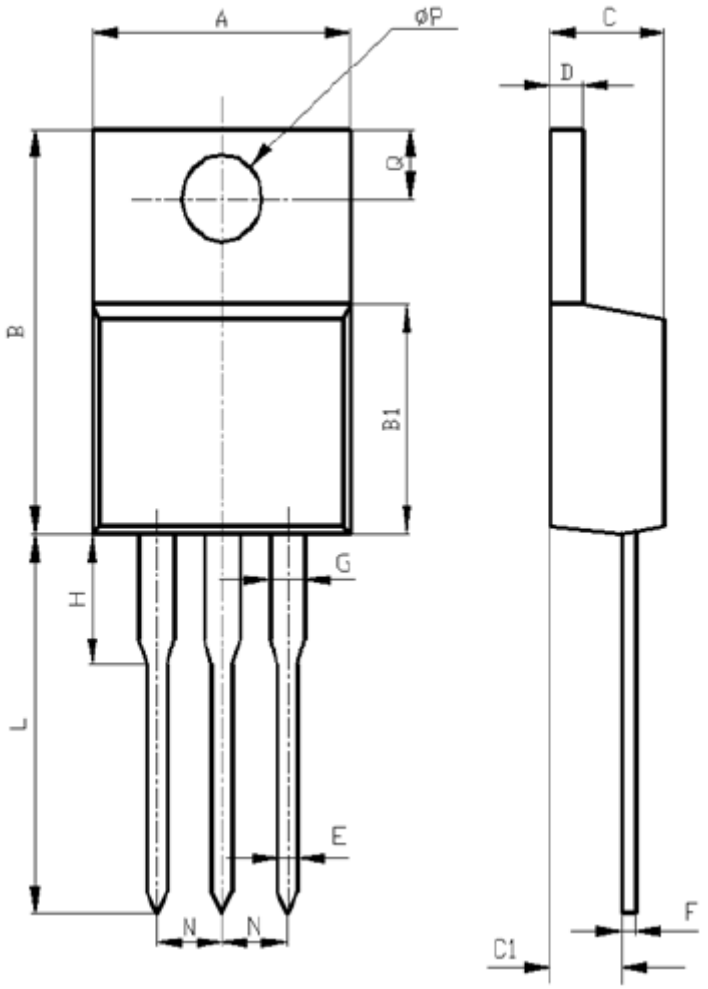


Figure C：Unclamped Inductive Switching Test Circuit and Waveform

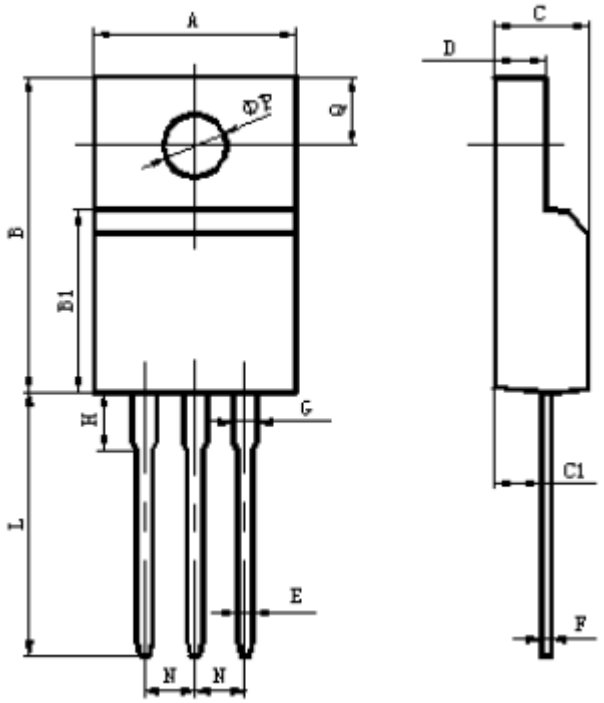


TO-220



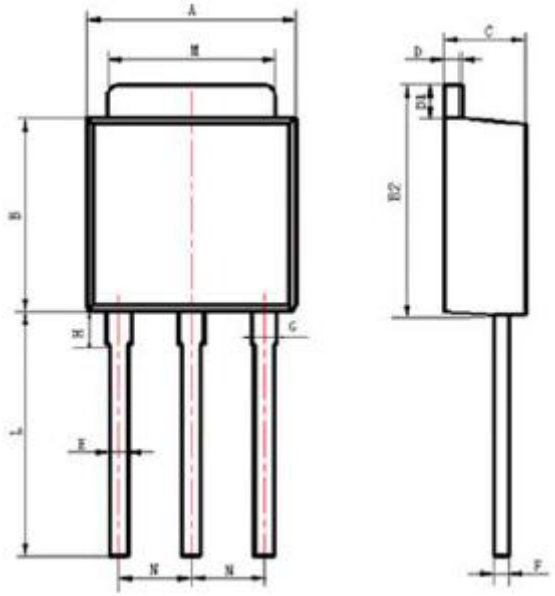
Items	Values(mm)	
	MIN	MAX
A	10.00	10.60
B	15.0	16.0
B1	8.90	9.50
C	4.30	4.80
C1	2.30	3.10
D	1.20	1.40
E	0.70	0.90
F	0.30	0.60
G	1.17	1.37
H	3.30	3.80
L	6.40	7.50
	6.70	7.90
	7.20	8.00
	7.50	8.60
	12.7	14.7
N	2.34	2.74
Q	2.40	3.00
ϕP	3.50	3.90

TO-220F



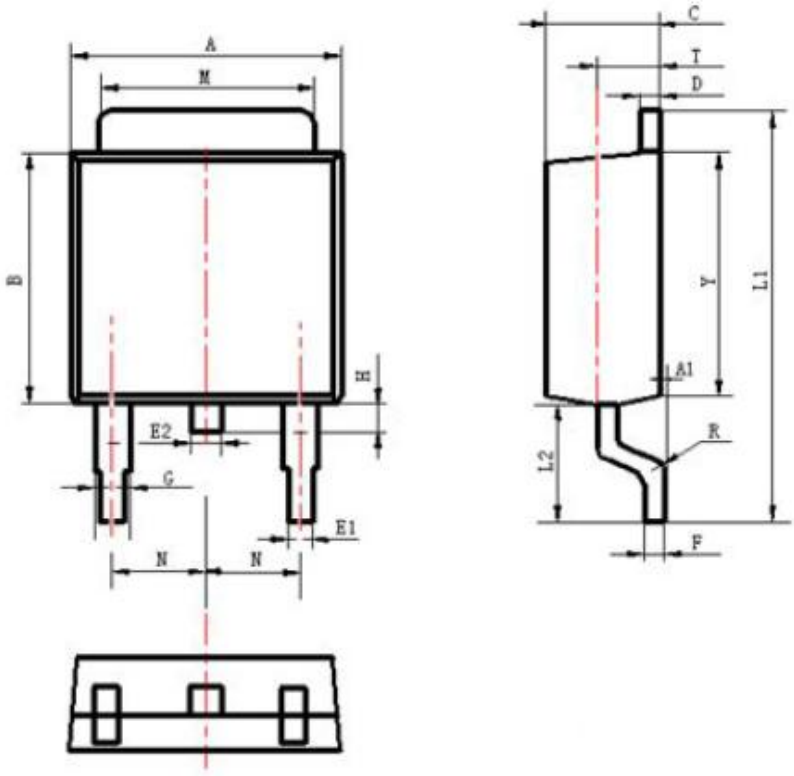
Items	Values(mm)	
	MIN	MAX
A	9.60	10.40
B	15.40	16.20
B1	8.90	9.50
C	4.30	4.90
C1	2.10	3.00
D	2.40	3.00
E	0.60	1.00
F	0.30	0.60
G	1.12	1.42
H	3.40	3.80
	2.00	2.40
L	12.00	14.00
	6.30	7.70
N	2.34	2.74
Q	3.15	3.55
ϕ P	3.00	3.30

TO-251



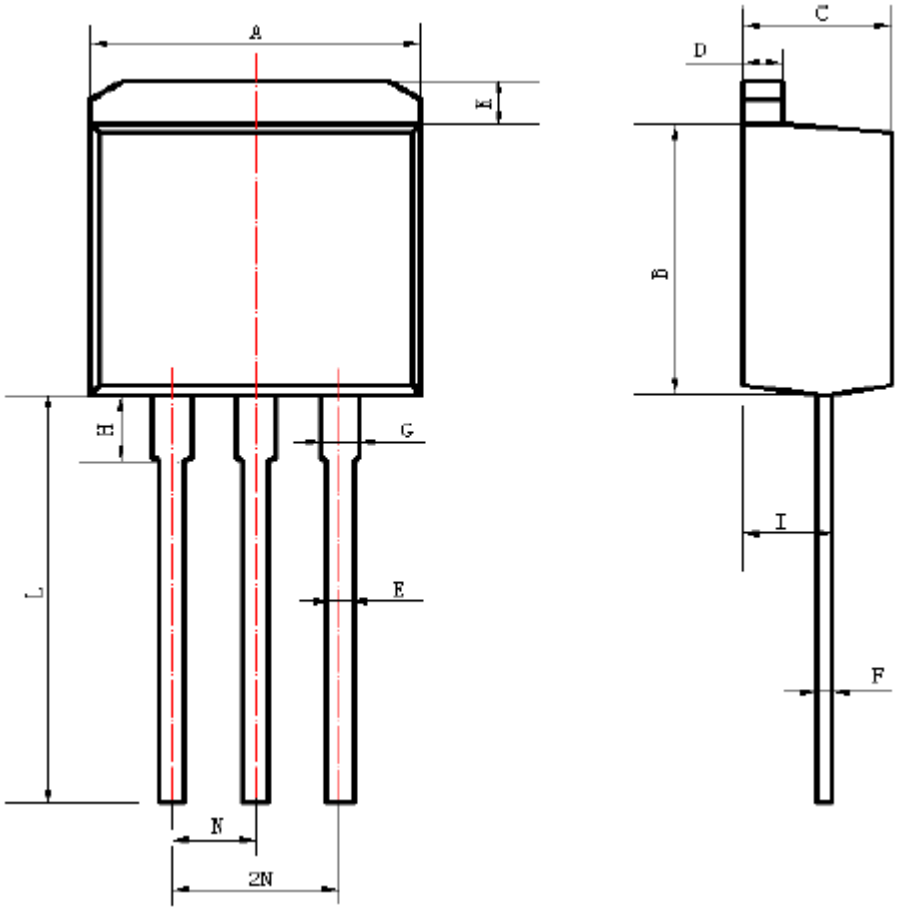
Items	Values(mm)	
	MIN	MAX
A	6.30	6.90
B	5.70	6.30
B1	1.00	1.20
B2	6.80	7.40
C	2.10	2.50
D	0.30	0.60
E	0.50	0.70
F	0.30	0.60
G	0.70	1.00
H	1.60	2.40
L	7.70	9.80
	5.90	6.50
	4.40	5.80
	2.10	3.90
M	5.10	5.50
N	2.09	2.49

TO-252



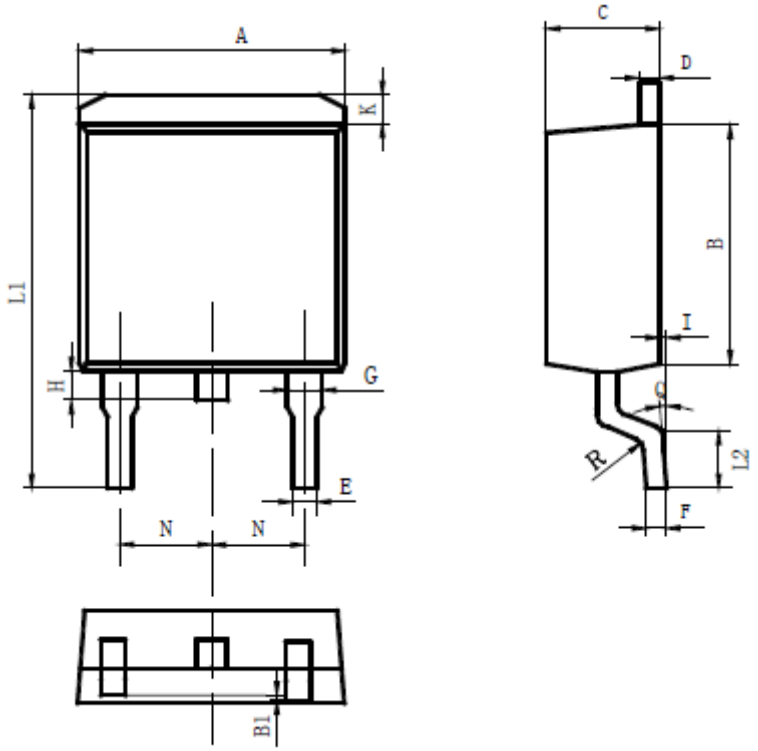
Items	Values(mm)	
	MIN	MAX
A	6.30	6.90
A1	0	0.13
B	5.70	6.30
C	2.10	2.50
D	0.30	0.60
E1	0.60	0.90
E2	0.70	1.00
F	0.30	0.60
G	0.70	1.00
L1	9.60	10.30
L2	2.70	3.10
H	0.60	1.00
M	5.10	5.50
N	2.09	2.49
R	0.3	
T	1.40	1.60
Y	5.10	6.30

TO-262



Items	Values(mm)	
	MIN	MAX
A	9.80	10.40
B	8.90	9.50
C	4.30	4.80
D	1.15	1.40
E	0.70	0.91
F	0.28	0.55
G	1.07	1.47
H	3.37	3.77
I	2.50	2.90
K	0.90	1.40
L	12.7	14.7
N	2.35	2.70

TO-263



Items	Values(mm)	
	MIN	MAX
A	9.80	10.40
B	8.90	9.50
B1	0	0.10
C	4.40	4.80
D	1.16	1.37
E	0.70	0.95
F	0.30	0.60
G	1.07	1.47
H	1.30	1.80
K	0.95	1.37
L1	14.50	16.50
L2	1.60	2.30
I	0	0.2
Q	0°	8°
R	0.4	
N	2.39	2.69

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