

### Description

JRS420R70, the silicon N-channel Enhanced MOSFETs, is obtained by advanced Super Junction technology which reduce the conduction loss, improve switching performance. The transistor is suitable device for SMPS, high speed switching and general purpose applications

### FEATURES

- Fast Switching
- 100% avalanche tested
- Improved dv/dt capability

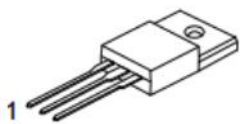
### Product Summary

Parameter	Value	Units
$V_{DS@T_j,max}$	700	V
$I_D$	11	A
$R_{DS(ON),Typ@V_{GS}=10V}$	0.35	$\Omega$

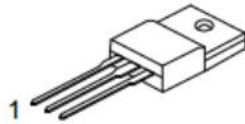
### APPLICATIONS

- High frequency switching mode power supply

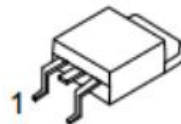
100% DVDS Tested!  
100% Avalanche Tested!



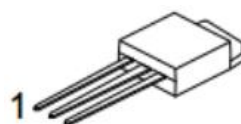
TO-220F



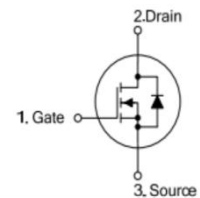
TO-220



TO-252



TO-251



Schematic Diagram

### Ordering Information

Device	Device Package	Product Code	Packing
JRS420R70-P	TO-220	S420R70	Tube
JRS420R70-A	TO-220F	S420R70	Tube
JRS420R70-U	TO-251	S420R70	Tube
JRS420R70-D	TO-252	S420R70	Tape Reel
JRS420R70-B	TO-263	S420R70	Tape Reel

## Absolute Maximum Ratings( $T_C=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Rating	Units
Drain-to-Source Voltage	$V_{DSS}$	700	V
Continuous Drain Current	$I_D$	11	A
Continuous Drain Current $T_C = 100^{\circ}\text{C}$		6.93	A
Pulsed Drain Current(Note1)	$I_{DM}$	33	A
Gate-to-Source Voltage	$V_{GS}$	$\pm 30$	V
Single Pulse Avalanche Energy(Note2)	$E_{AS}$	220	mJ
Peak Diode Recovery $dv/dt$ (Note3)	$dv/dt$	15	V/ns
Power Dissipation TO-251\TO-252\TO-220\TO-263	PD	100	W
Derating Factor above $25^{\circ}\text{C}$		0.8	W/ $^{\circ}\text{C}$
Power Dissipation TO-220F	$P_D$	29	W
Derating Factor above $25^{\circ}\text{C}$		0.23	W/ $^{\circ}\text{C}$
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	150, $-55$ to $150$	$^{\circ}\text{C}$
Maximum Temperature for Soldering	$T_L$	300	$^{\circ}\text{C}$

## Thermal characteristics

### Thermal characteristics TO-251\TO-252\TO-220\TO-263

Parameter	Symbol	Rating	Units
Junction-to-Case	$R_{\theta JC}$	1.25	$^{\circ}\text{C}/\text{W}$
Junction-to-Ambient	$R_{\theta JA}$	62.5	$^{\circ}\text{C}/\text{W}$

### Thermal characteristics TO-220F

Parameter	Symbol	Rating	Units
Junction-to-Case	$R_{\theta JC}$	4.3	$^{\circ}\text{C}/\text{W}$
Junction-to-Ambient	$R_{\theta JA}$	80	$^{\circ}\text{C}/\text{W}$

## Electrical Characteristics (TC=25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Values			Units
			Min	Typ	Max	
<b>OFF Characteristics</b>						
Drain to Source Breakdown Voltage	$V_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	700	-	-	V
Bvdss Temperature Coefficient	$\frac{\Delta B_{VDSS}}{\Delta T_J}$	$I_D=250\mu A$ , Reference 25°C	-	0.73	-	V/°C
Drain to Source Leakage Current	$I_{DSS}$	$V_{DS} = 700V$ , $V_{GS} = 0V$ , $T_j = 25^\circ C$	-	-	1	$\mu A$
		$V_{DS} = 560V$ , $V_{GS} = 0V$ , $T_j = 125^\circ C$	-	-	100	$\mu A$
Gate to Source Forward Leakage	$I_{GSS(F)}$	$V_{GS} = +30V$	-	-	100	nA
Gate to Source Reverse Leakage	$I_{GSS(R)}$	$V_{GS} = -30V$	-	-	-100	nA
<b>ON Characteristics</b>						
Drain-to-Source OnResistance	$R_{DS(ON)}$	$V_{GS}=10V$ , $I_D=3.8A$ (Note4)	-	0.35	0.42	$\Omega$
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}$ , $I_D= 250\mu A$ (Note4)	2.0	-	4.0	V
<b>Dynamic Characteristics</b>						
Gate resistance	$R_g$	$f = 1.0MHz$	-	9.5	-	$\Omega$
Output Capacitance	$C_{iss}$	$V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1.0MHz$	-	760	-	PF
Input Capacitance	$C_{oss}$		-	500	-	
Reverse Transfer Capacitance	$C_{rss}$		-	25	-	

Note1: Pulse width limited by maximum junction temperature

Note2: L=20mH,  $V_{DS}=50V$ , Start  $T_J=25^\circ C$

Note3:  $I_{SD} = 4.8A, di/dt \leq 100A/\mu s, V_{DD} \leq BV_{DS}$ , Start  $T_J=25^\circ C$

Note4: Pulse width  $t_p \leq 300\mu s, \delta \leq 2\%$

## Switching Characteristics, at $T_J = 25\text{ }^\circ\text{C}$

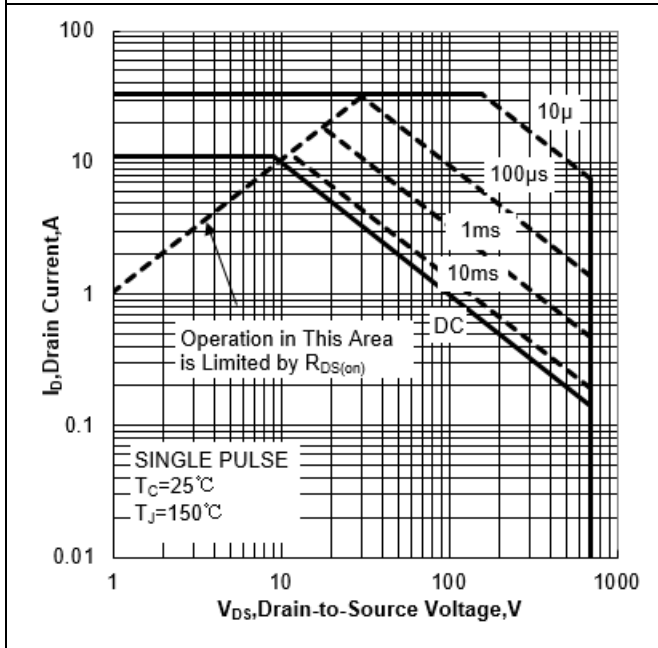
Parameter	Symbol	Test Conditions	Values			Units
			Min.	Typ.	Max.	
Turn-on Delay Time	$t_{d(on)}$	$I_D = 4.8\text{A}$ $V_{DD} = 400\text{V}$ $V_{GS} = 10\text{V}$ $R_G = 5\Omega$	-	12	-	ns
Rise Time	$t_r$		-	9	-	
Turn-Off Delay Time	$t_{d(off)}$		-	39	-	
Fall Time	$t_f$		-	8	-	
Total Gate Charge	Qg	$I_D = 4.8\text{A}$ $V_{DD} = 520\text{V}$ $V_{GS} = 10\text{V}$	-	22	-	nC
Gate to Source Charge	Qgs		-	4.8	-	
Gate to Drain ("Miller") Charge	Qgd		-	8	-	

## Source-Drain Diode Characteristics

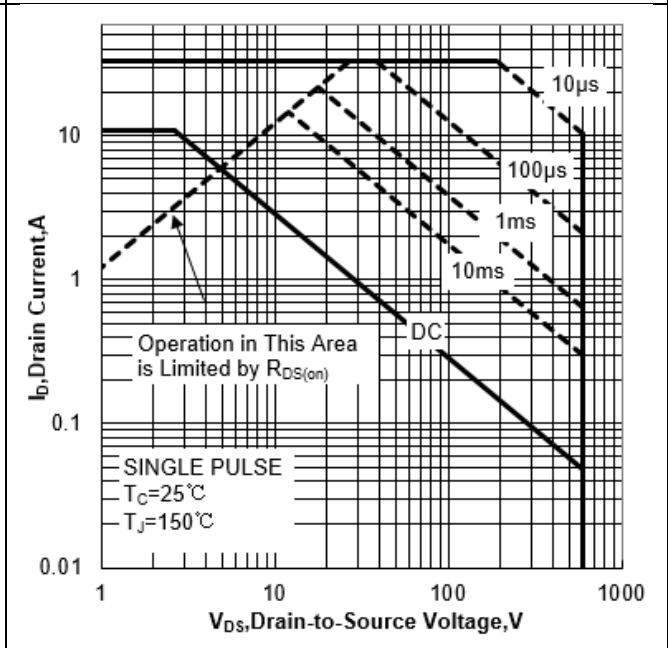
Parameter	Symbol	Test Conditions	Values			Units
			Min.	Typ.	Max.	
Continuous Source Current (Body Diode)	$I_S$	TC=25 °C	-	-	11	A
Maximum Pulsed Current (Body Diode)	$I_{SM}$		-	-	33	A
Diode Forward Voltage	$V_{SD}$	$I_S = 4.8\text{A}$ , $V_{GS} = 0\text{V}$ (Note4)	-	-	0.9	V
Reverse Recovery Time	$T_{rr}$	$I_S = 4.8\text{A}$ , $T_J = 25^\circ\text{C}$ $dI_F/dt = 100\text{A}/\mu\text{s}$ , $V_{GS} = 0\text{V}$	-	285	-	ns
Reverse Recovery Charge	$Q_{rr}$		-	3278	-	nC
Reverse Recovery Current	$I_{rrm}$		-	23	-	A

## Characteristics Curves

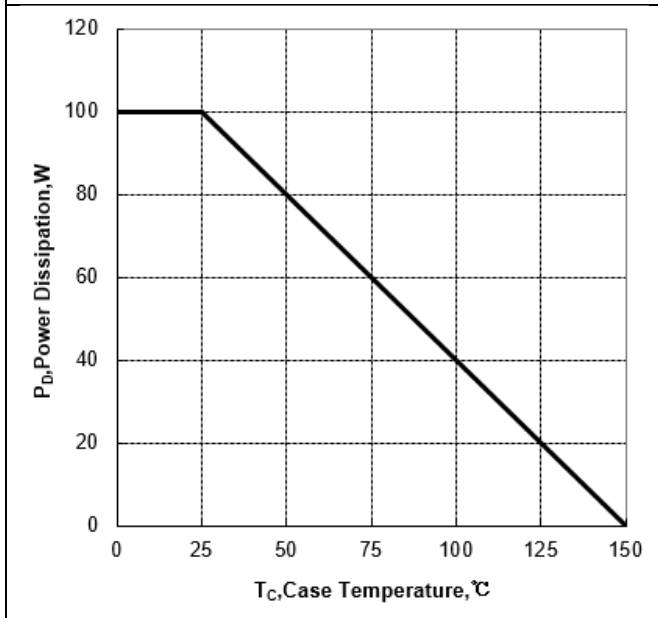
**Figure 1a Safe Operating Area (No FullPAK)**



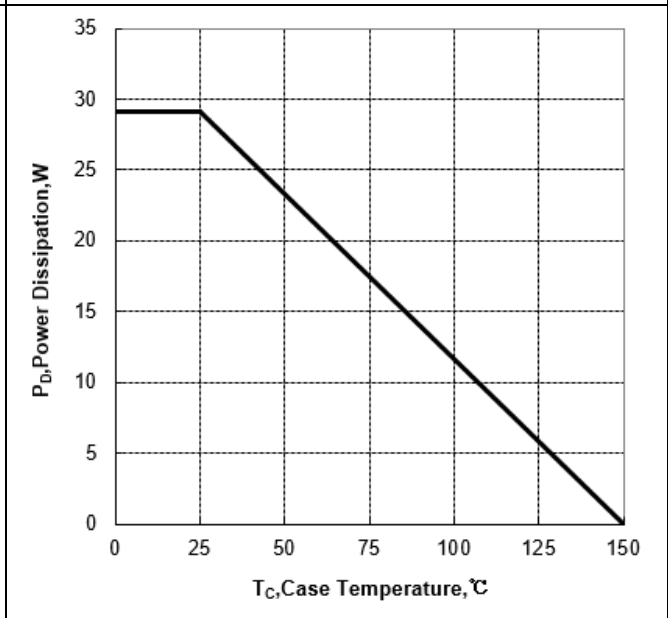
**Figure 1b Safe Operating Area (FullPAK)**



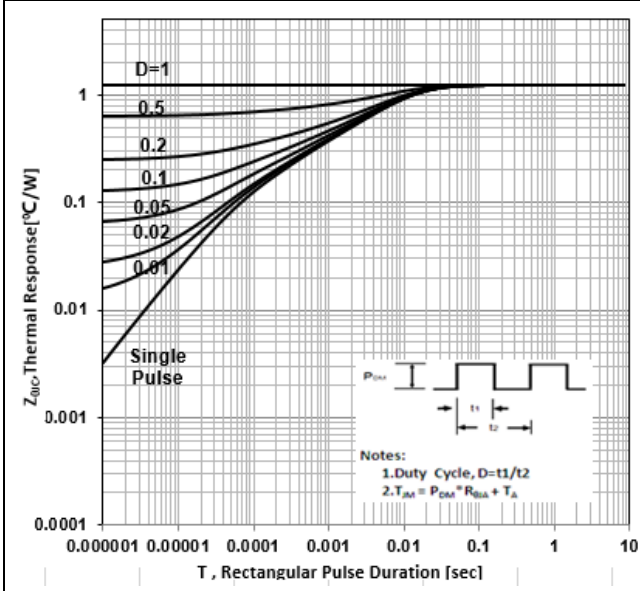
**Figure 2a Power Dissipation (No FullPAK)**



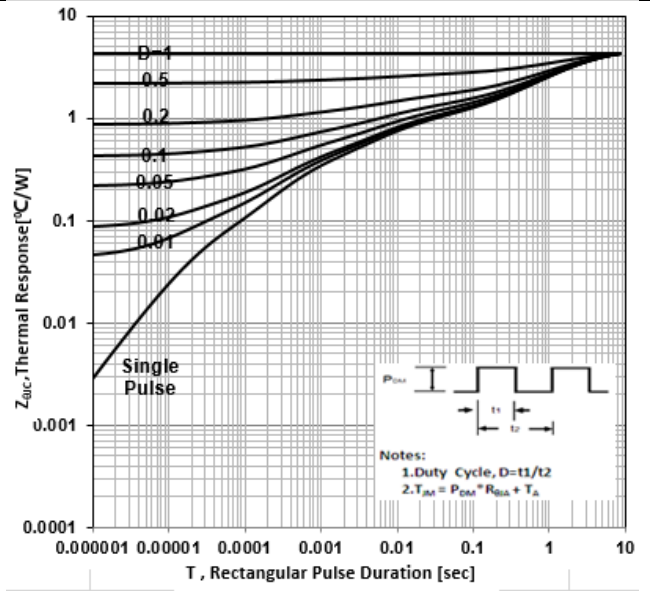
**Figure 2b Power Dissipation (FullPAK)**



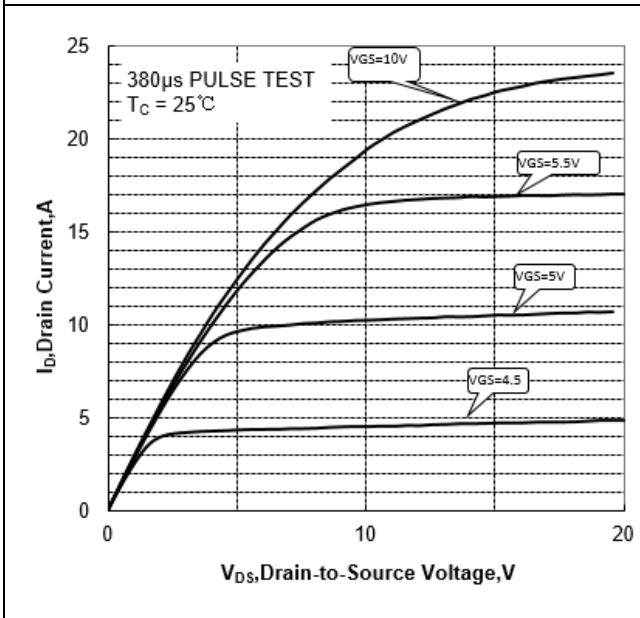
**Figure 3a Max Thermal Impedance (No FullPAK)**



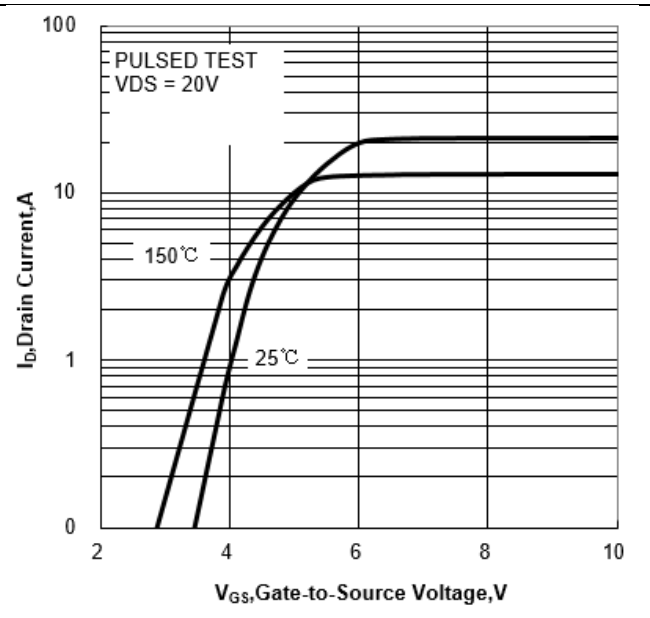
**Figure 3b Max Thermal Impedance (FullPAK)**



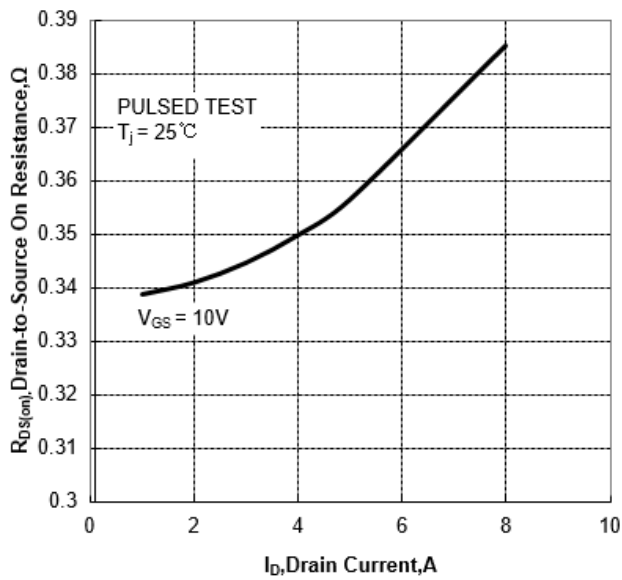
**Figure 4 Typical Output Characteristics**



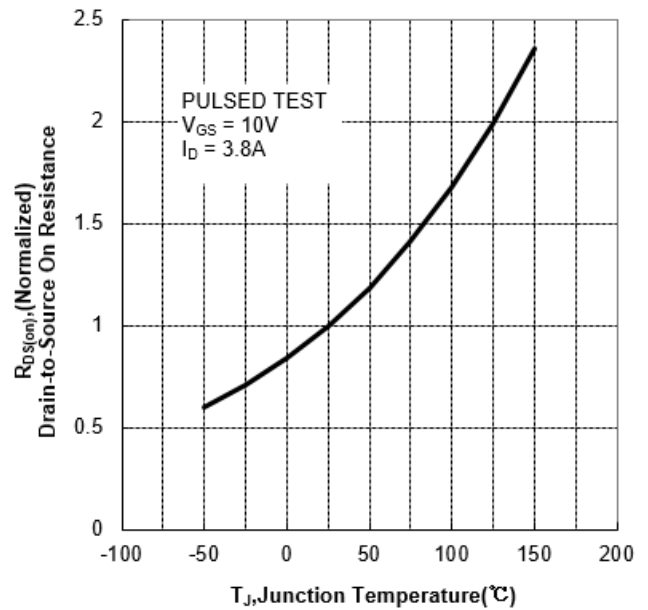
**Figure 5 Typical Transfer Characteristics**



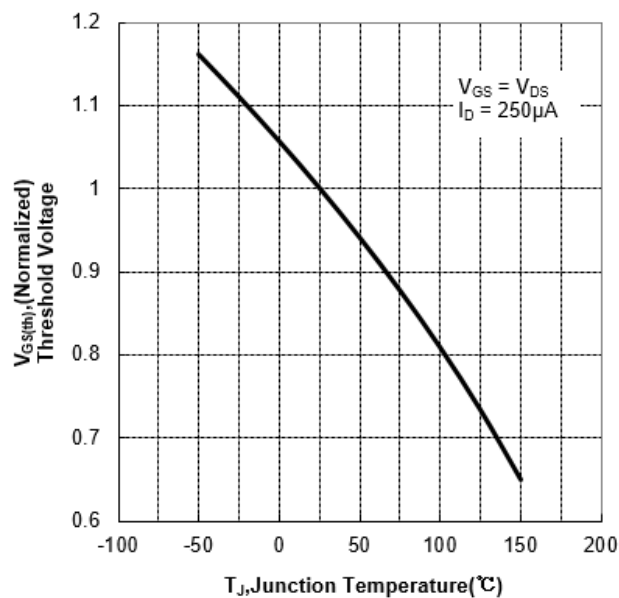
**Figure 6 Typical Drain to Source ON Resistance vs Drain Current**



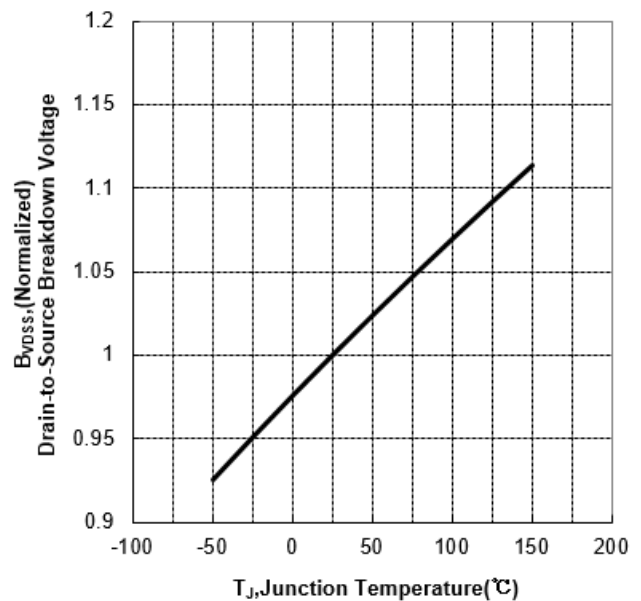
**Figure 7 Typical Drain to Source on Resistance vs Junction Temperature**



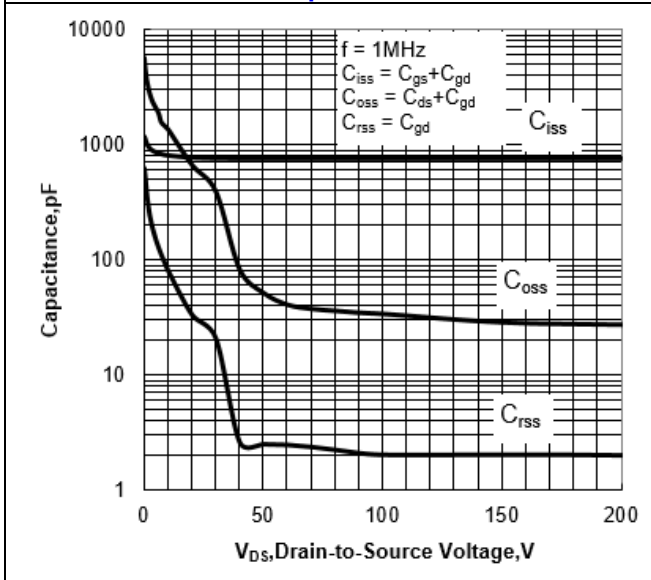
**Figure 8 Typical Threshold Voltage vs Junction Temperature**



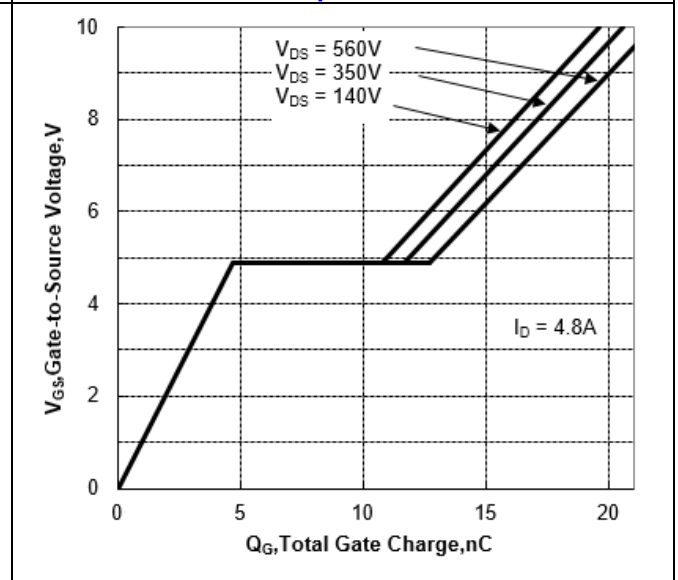
**Figure 9 Typical Breakdown Voltage vs Junction Temperature**



**Figure 10 Typical Theshold Voltage vs Junction Temperature**



**Figure 11 Typical Breakdown Voltage vs Junction Temperature**





## 6. Test Circuit and Waveform

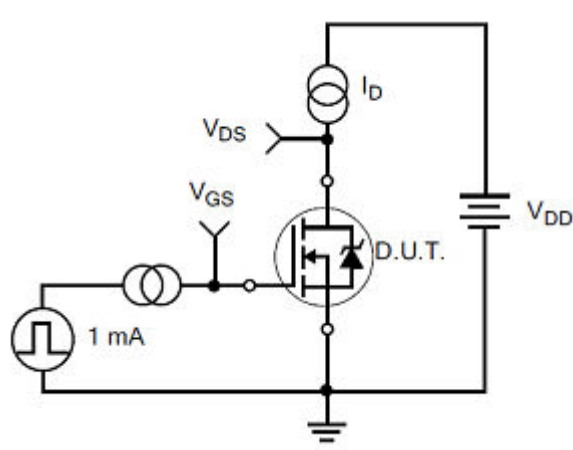
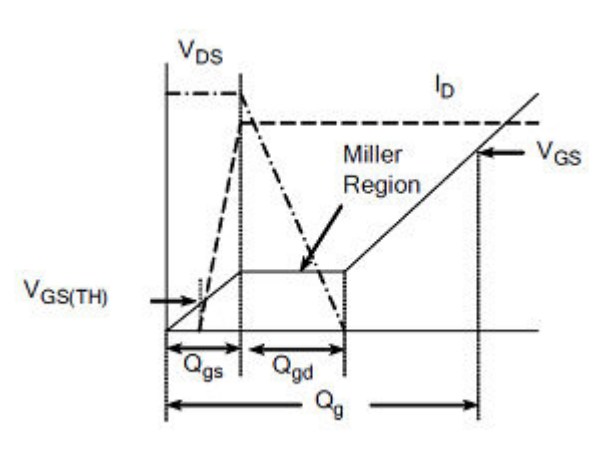
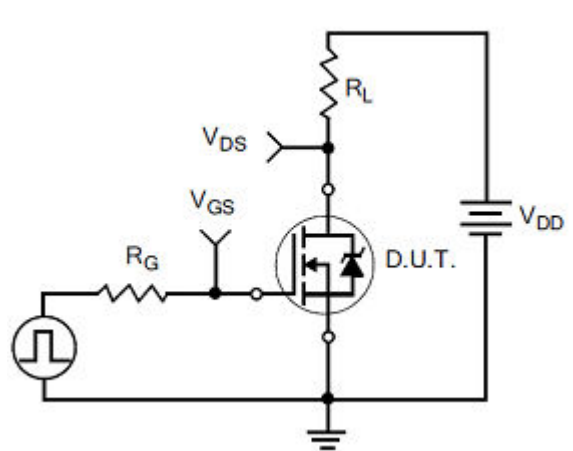
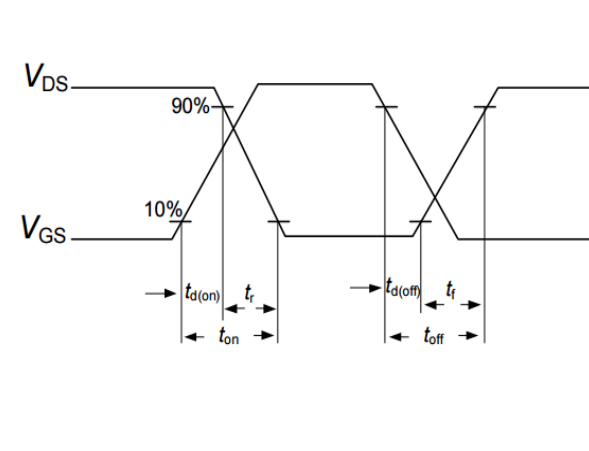
<p><b>Figure 12 Gate Charge Test Circuit</b></p> 	<p><b>Figure 13 Gate Charge Waveforms</b></p> 
<p><b>Figure 14 Resistive Switching Test Circuit</b></p> 	<p><b>Figure 15 Resistive Switching Waveforms</b></p> 

Figure 16 Diode Reverse Recovery Test Circuit

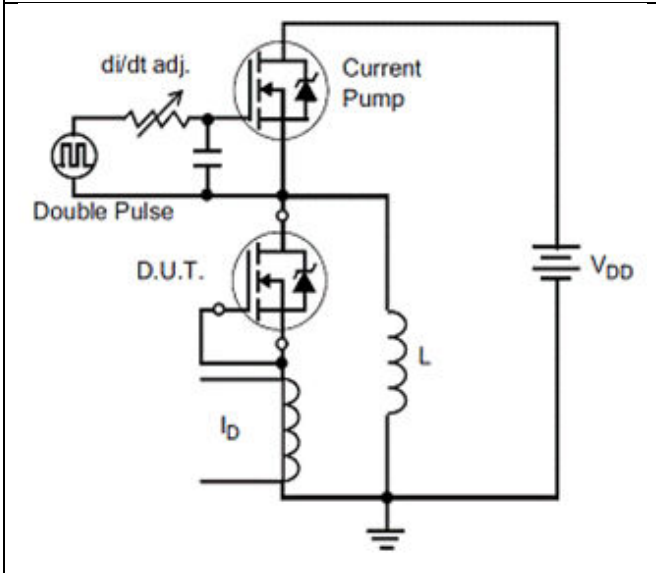


Figure 17 Diode Reverse Recovery Waveform

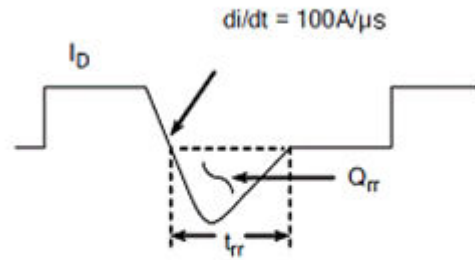


Figure 18 Unclamped Inductive Switching Test Circuit

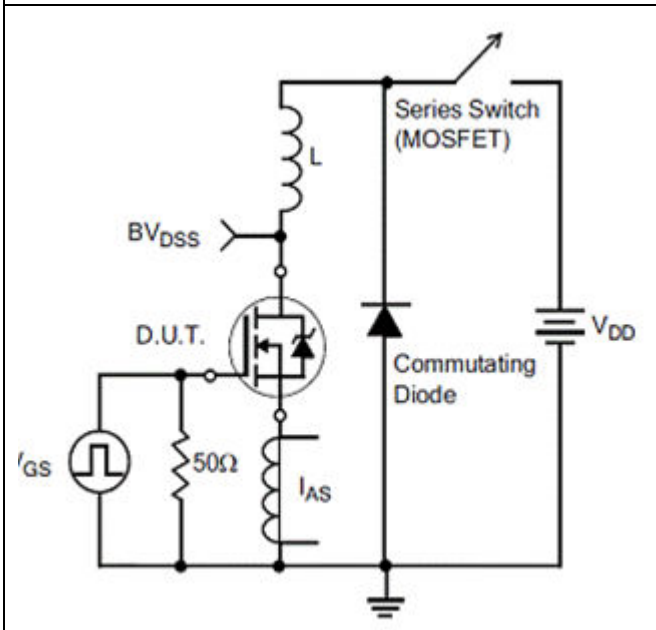
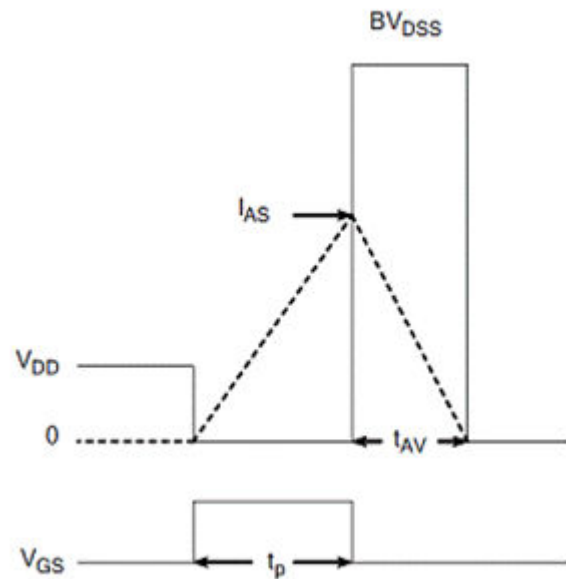
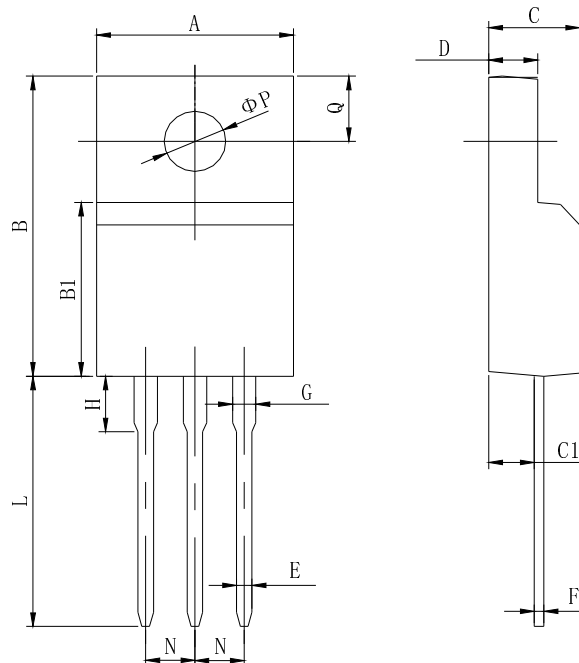


Figure 19 Unclamped Inductive Switching Waveform

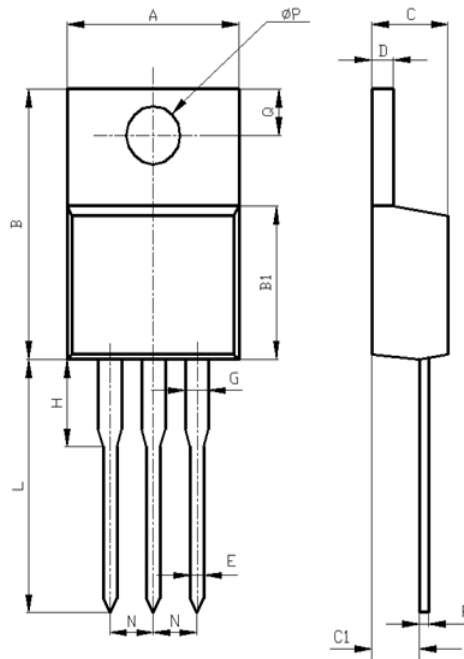


## 7. Package Description



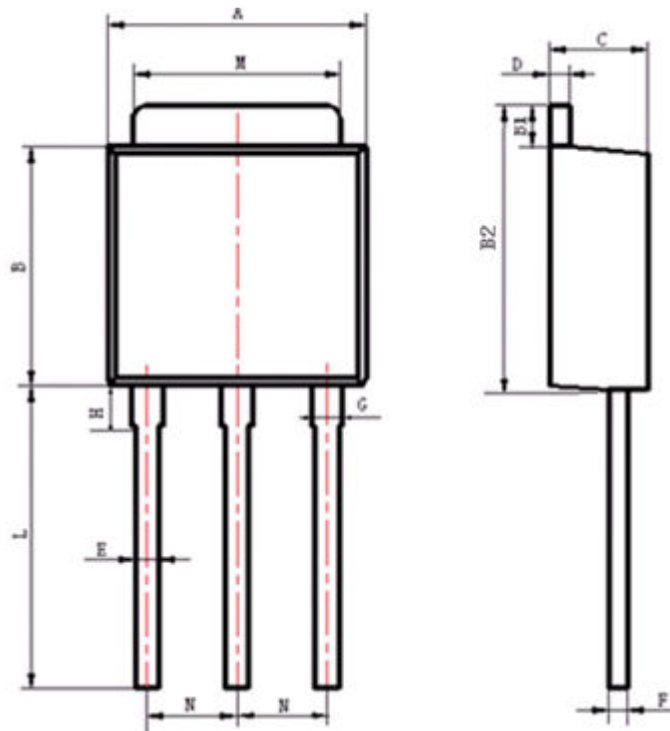
Items	Values(mm)	
	MIN	MAX
A	9.60	10.4
B	15.4	16.2
B1	8.90	9.50
C	4.30	4.90
C1	2.10	3.00
D	2.40	3.00
E	0.60	1.00
F	0.30	0.60
G	1.12	1.42
H	3.40	3.80
	1.60	2.90
L	12.0	14.0
N	2.34	2.74
Q	3.15	3.55
$\phi P$	2.90	3.30

TO-220F Package



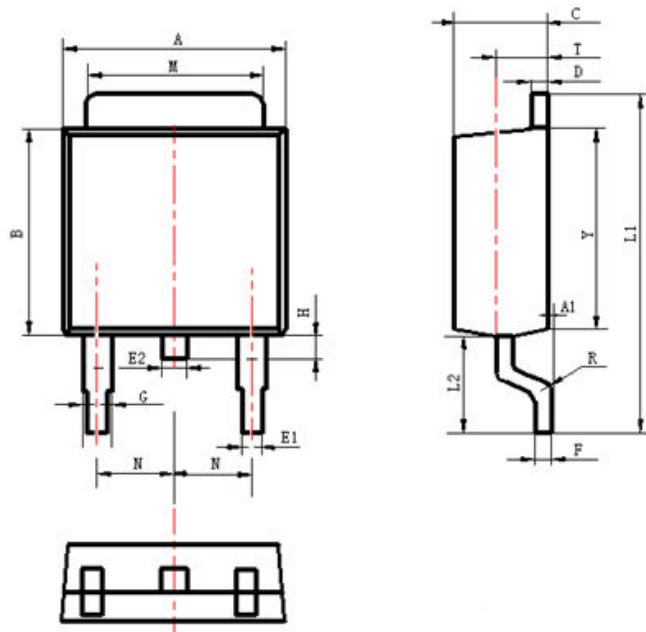
Items	Values(mm)	
	MIN	MAX
A	9.60	10.6
B	15.0	16.0
B1	8.90	9.50
C	4.30	4.80
C1	2.30	3.10
D	1.20	1.40
E	0.70	0.90
F	0.30	0.60
G	1.17	1.37
H	2.70	3.80
L	12.6	14.8
N	2.34	2.74
Q	2.40	3.00
Ø P	3.50	3.90

## TO-220 Package



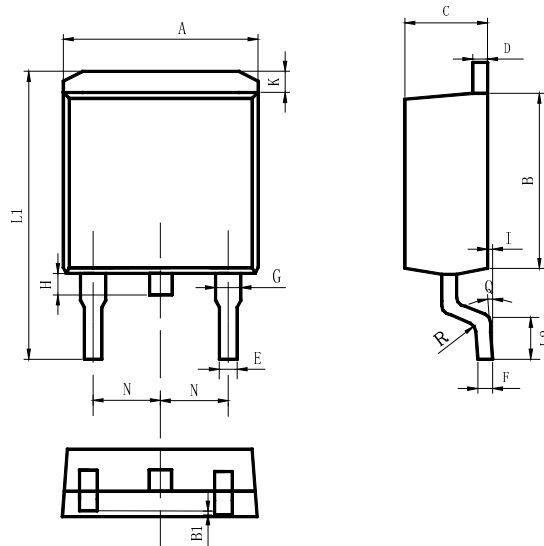
Items	Values(mm)	
	MIN	MAX
A	6.30	6.90
B	5.70	6.30
B1	1.00	1.20
B2	6.80	7.40
C	2.10	2.50
D	0.30	0.60
E	0.50	0.70
F	0.30	0.60
G	0.70	1.00
H	1.60	2.40
L	3.9	4.3
M	5.10	5.50
N	2.09	2.49

## TO-251 Package



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	1.20
L1	9.60	10.50
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-252 Package



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

## TO-263 Package