

Silicon N-Channel Power MOSFET

Description

MP9N20, the silicon N-channel Enhanced MOSFETs, is obtained by advanced MOSFET technology which reduce the conduction loss, improve switching performance and enhance the avalanche energy. The transistor is suitable device for SMPS, high speed switching and general purpose applications.

KEY CHARACTERISTICS

- ① $V_{DS}=200V, I_D=9A$ $R_{DS(ON)}<320m\Omega@V_{GS}=10V$
- ② Fast Switching
- ③ Low C_{rss}
- ④ 100% avalanche tested
- ⑤ Improved dv/dt capability
- ⑥ RoHS product

APPLICATIONS

High frequency switching mode power supply

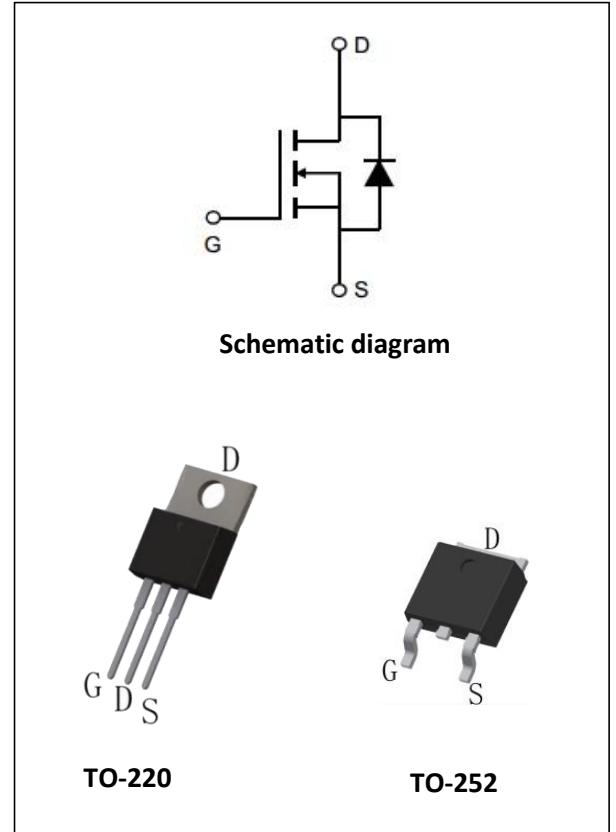
ORDERING INFORMATION

Ordering Codes	Package	Product Code	Packing
MP9N20	TO-220	MP9N20	Tube
MDT9N20	TO-252	MDT9N20	Tube/Reel

ABSOLUTE RATINGS

at $T_C = 25^\circ C$, unless otherwise specified

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	200	V
I_D	Continuous Drain Current	9	A
	Continuous Drain Current $T_C = 100^\circ C$	5.5	A
I_{DM}	Pulsed Drain Current(Note1)	36	A
V_{GS}	Gate-to-Source Voltage	± 30	V
E_{AS}	Single Pulse Avalanche Energy(Note2)	200	mJ
dv/dt	Peak Diode Recovery dv/dt (Note3)	5.0	V/ns



P _D	Power Dissipation TO-220, TO-251, TO-252	75	W
	Derating Factor above 25°C	0.6	W/°C
P _D	Power Dissipation TO-220F	30	W
	Derating Factor above 25°C	0.24	W/°C
T _J , T _{stg}	Operating Junction and Storage Temperature Range	150, -55 to 150	°C
T _L	Maximum Temperature for Soldering	300	°C

Thermal characteristics

Thermal characteristics (No FullPAK) TO-220\TO-251\TO-252

Symbol	Parameter	RATINGS	Units
R _{θJC}	Junction-to-Case	1.67	°C/W
R _{θJA}	Junction-to-Ambient	62.5	°C/W

Thermal characteristics (FullPAK) TO-220F

Symbol	Parameter	RATINGS	Units
R _{θJC}	Junction-to-Case	4.17	°C/W
R _{θJA}	Junction-to-Ambient	62.5	°C/W

Electrical Characteristics

at TC = 25°C, unless otherwise specified

OFF Characteristics						
Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
V _{DSS}	Drain to Source Breakdown Voltage	V _{GS} =0V, I _D =250μA	200	--	--	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Bvdss Temperature Coefficient	I _D =250uA, Reference 25°C	--	0.25	--	V/°C
I _{DSS}	Drain to Source Leakage Current	V _{DS} =200V, V _{GS} = 0V, T _J = 25°C	--	--	1	μA
		V _{DS} =160V, V _{GS} = 0V, T _J = 125°C	--	--	100	μA
I _{GSS(F)}	Gate to Source Forward Leakage	V _{GS} =+30V	--	--	100	nA



I _{GSS(R)}	Gate to Source Reverse Leakage	V _{GS} = -30V	--	--	100	nA
ON Characteristics						
Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
R _{DS(ON)}	Drain-to-Source On-Resistance	V _{GS} =10V, I _D =4A(Note4)	--	0.27	0.32	Ω
V _{GS(TH)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA(Note4)	2.0	--	4.0	V
Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
R _g	Gate resistance	f = 1.0MHz	--	3.5	--	Ω
C _{iss}	Input Capacitance	V _{GS} = 0V V _{DS} = 25V f = 1.0MHz	--	550	--	PF
C _{oss}	Output Capacitance		--	90	--	
C _{rss}	Reverse Transfer Capacitance		--	8.6	--	
Switching Characteristics						
Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
t _{d(ON)}	Turn-on Delay Time	I _D =9A V _{DD} = 100V V _{GS} = 10V R _G =5Ω	--	10	--	ns
t _r	Rise Time		--	5	--	
t _{d(OFF)}	Turn-Off Delay Time		--	20	--	
t _f	Fall Time		--	7	--	
Q _g	Total Gate Charge	I _D =9A V _{DD} =160V V _{GS} = 10V	--	12	--	nC
Q _{gs}	Gate to Source Charge		--	3	--	
Q _{gd}	Gate to Drain (“Miller”)Charge		--	6	--	
Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
I _S	Continuous Source Current (Body Diode)	TC=25 °C	--	--	9	A
I _{SM}	Maximum Pulsed Current (Body Diode)		--	--	36	A
V _{SD}	Diode Forward Voltage	I _S =9A, V _{GS} =0V(Note4)	--	--	1.2	V



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MP9N20

T_{rr}	Reverse Recovery Time	IS=9A, Tj = 25°C dIF/dt=100A/us, VGS=0V	--	110	--	ns
Qrr	Reverse Recovery Charge		--	465	--	nC

Note1: Pulse width limited by maximum junction temperature

Note2: L=20mH, VDS=50V, Start TJ=25°C

Note3: ISD =9A, di/dt ≤100A/us, VDD≤BVDS, Start TJ=25°C

Note4: Pulse width tp≤300μs, δ≤2%

Characteristics Curves

Figure 1a Safe Operating Area (No FullPAK)

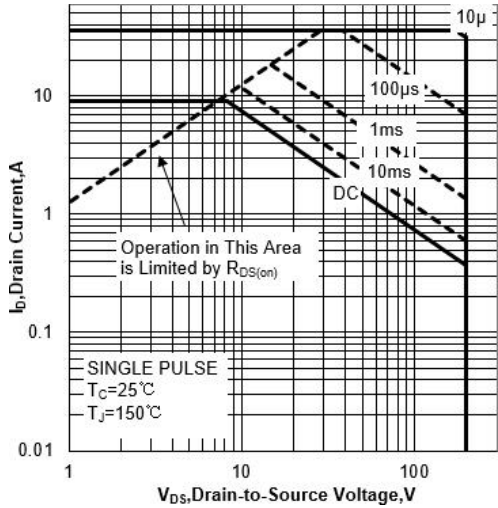


Figure 1b Safe Operating Area (FullPAK)

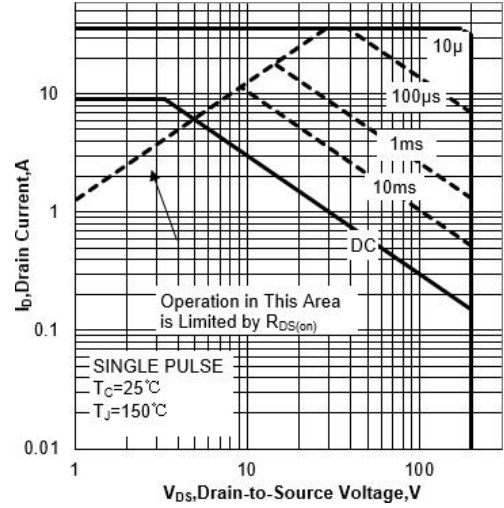


Figure 2a Power Dissipation (No FullPAK)

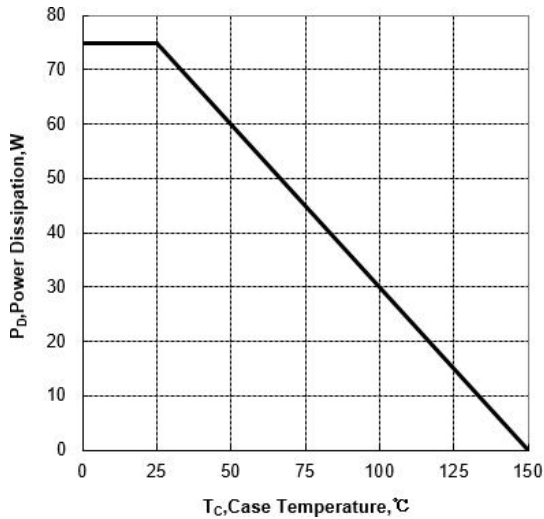


Figure 2b Power Dissipation (FullPAK)

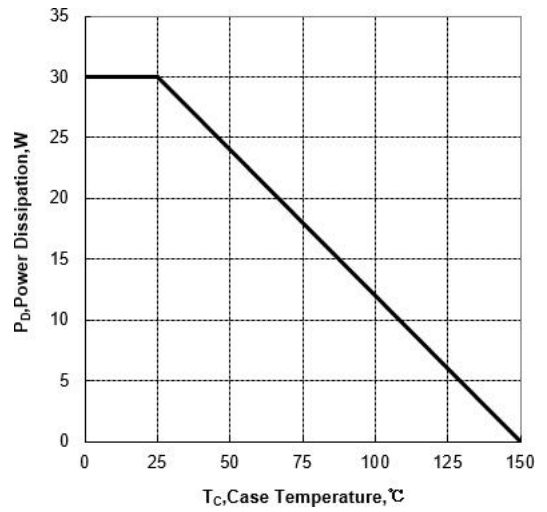


Figure 3a Max Thermal Impedance (No FullPAK)

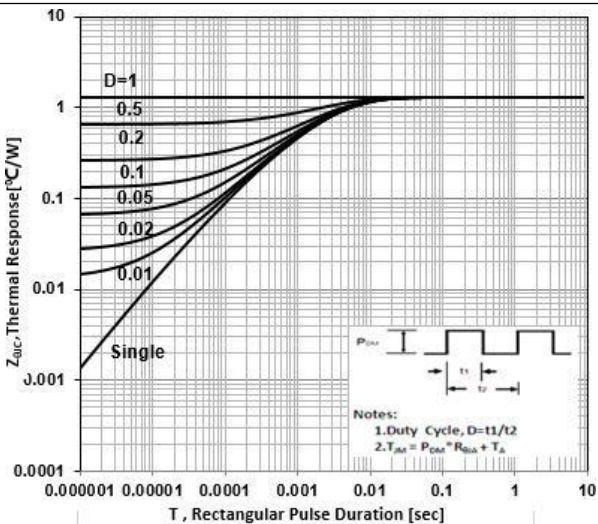


Figure 3b Max Thermal Impedance (FullPAK)

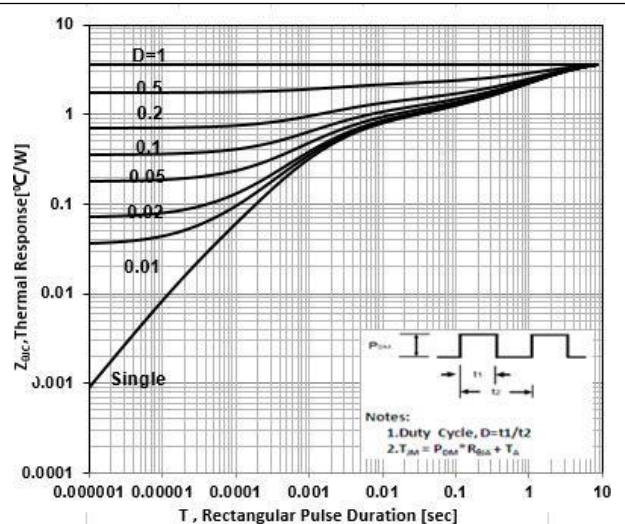


Figure 4 Typical Output Characteristics

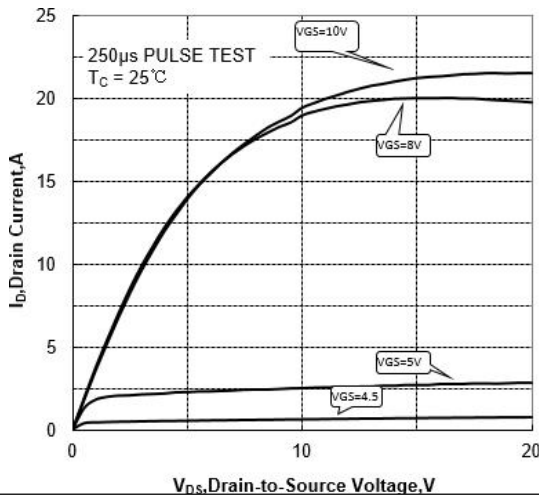


Figure 5 Typical Transfer Characteristics

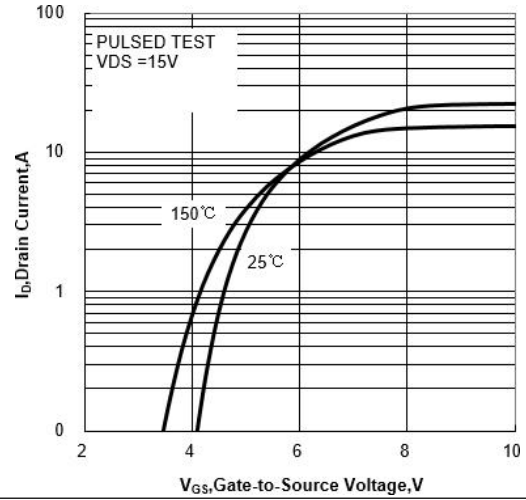


Figure 6 Typical Drain to Source ON Resistance vs Drain Current

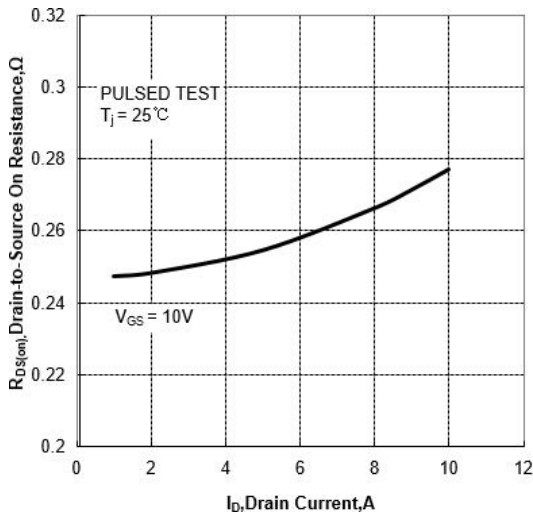


Figure 7 Typical Drain to Source on Resistance vs Junction Temperature

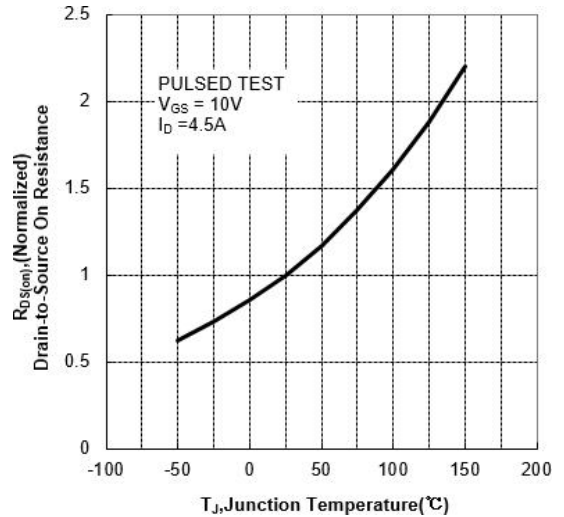


Figure 8 Typical Theshold Voltage vs Junction Temperature

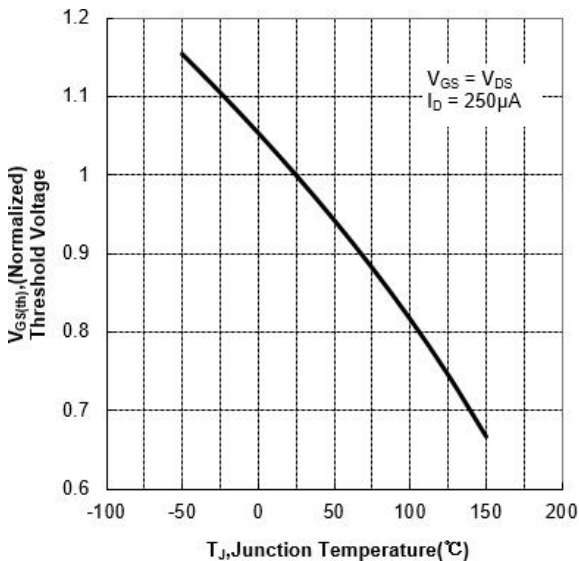


Figure 9 Typical Breakdown Voltage vs Junction Temperature

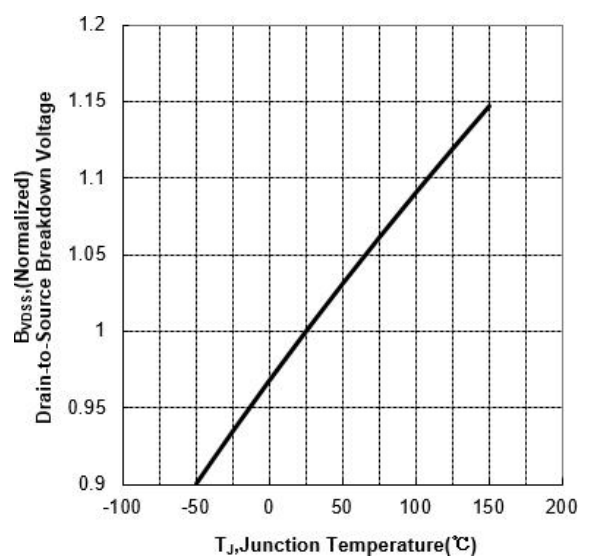


Figure 10 Typical Theshold Voltage vs Junction Temperature

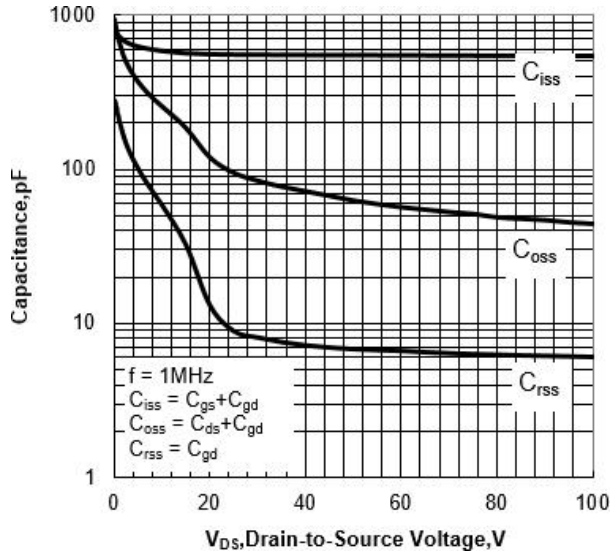
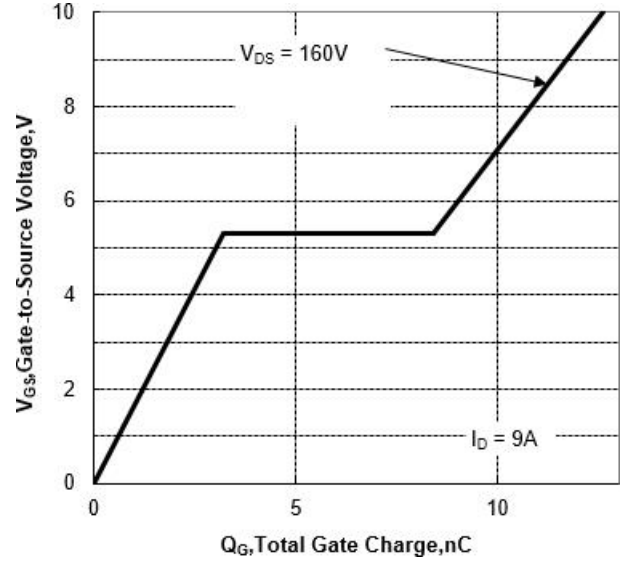


Figure 11 Typical Breakdown Voltage vs Junction Temperature



Test Circuit and Waveform

Figure 12 Gate Charge Test Circuit

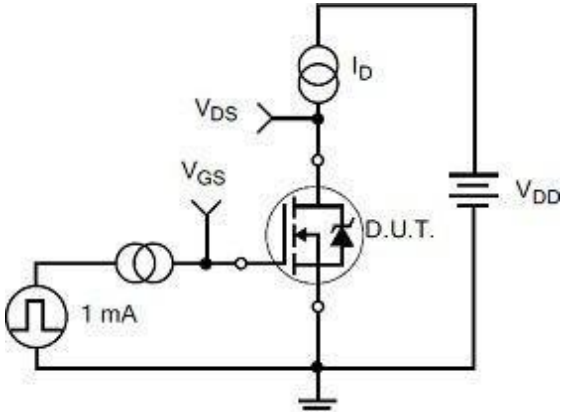


Figure 13 Gate Charge Waveforms

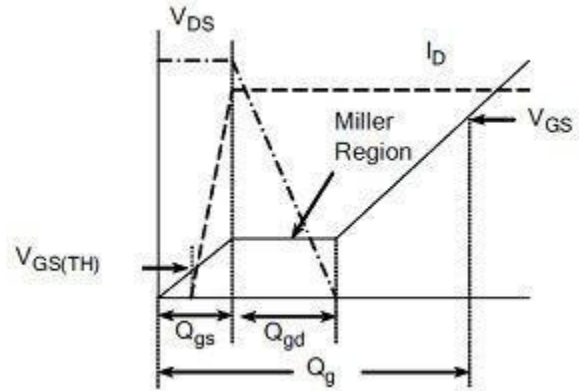


Figure 14 Resistive Switching Test Circuit

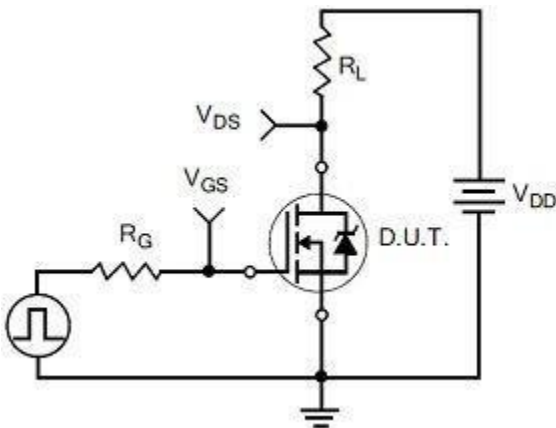


Figure 15 Resistive Switching Waveforms

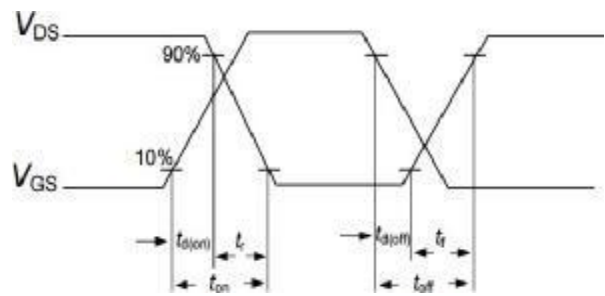


Figure 16 Diode Reverse Recovery Test Circuit

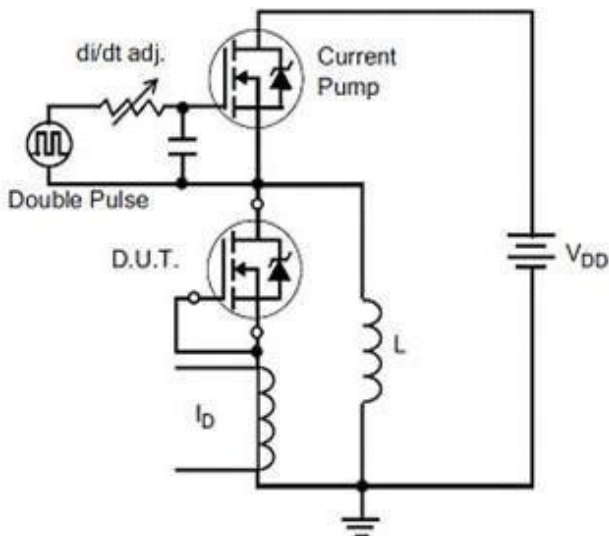


Figure 17 Diode Reverse Recovery Waveform

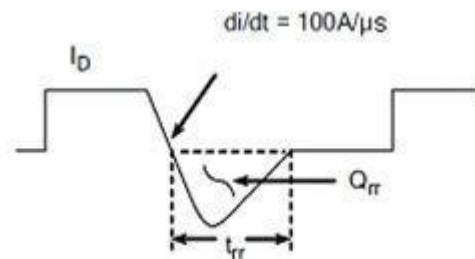


Figure 18 Unclamped Inductive Switching Test Circuit

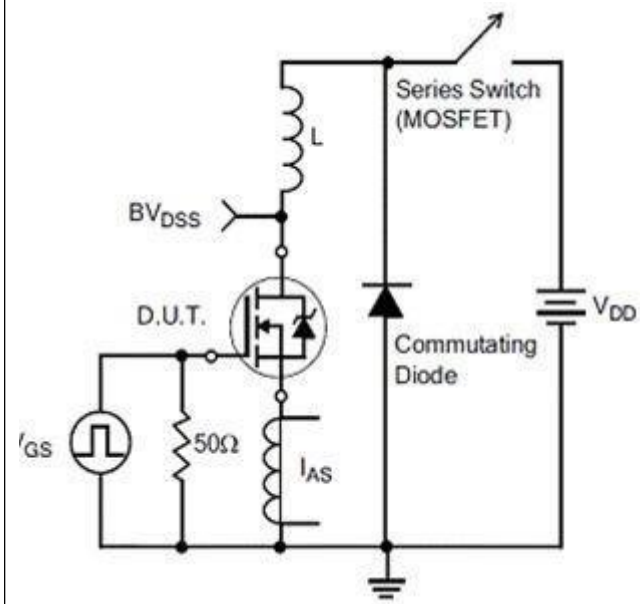
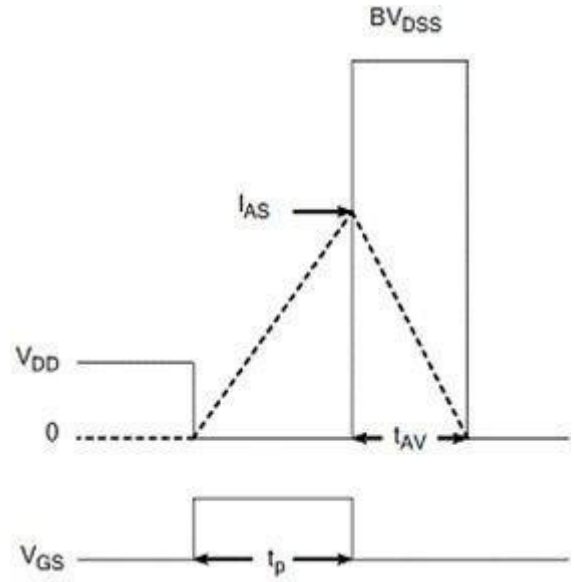
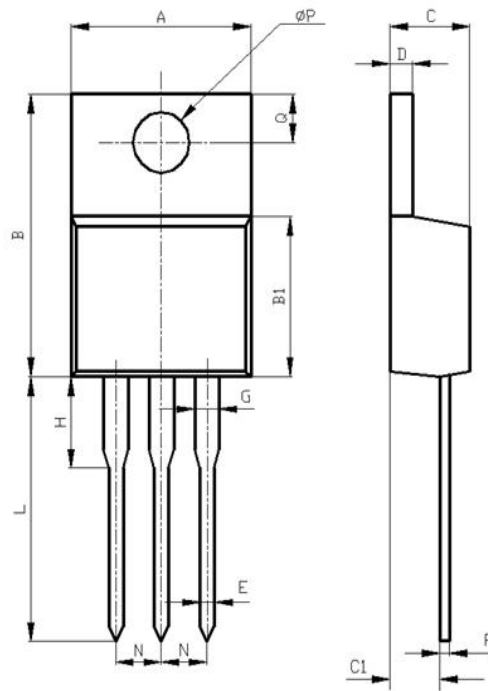


Figure 19 Unclamped Inductive Switching Waveform

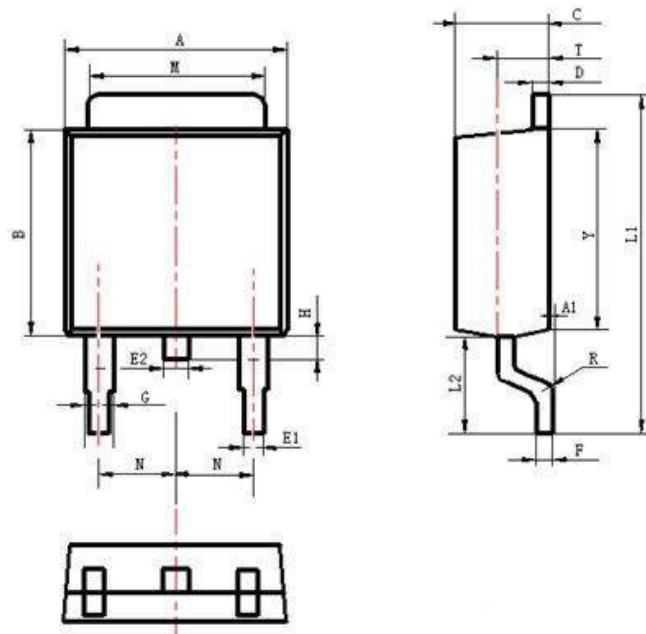


Package Description



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
ϕP	3.50	3.90

TO-220 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



NOTE:

1. Exceeding the maximum ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. Please do not exceed the absolute maximum ratings of the device when circuit designing.
2. When installing the heat sink, please pay attention to the torsional moment and the smoothness of the heat sink.
3. MOSFETs is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.
4. Shenzhen Minos reserves the right to make changes in this specification sheet and is subject to change without prior notice.

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