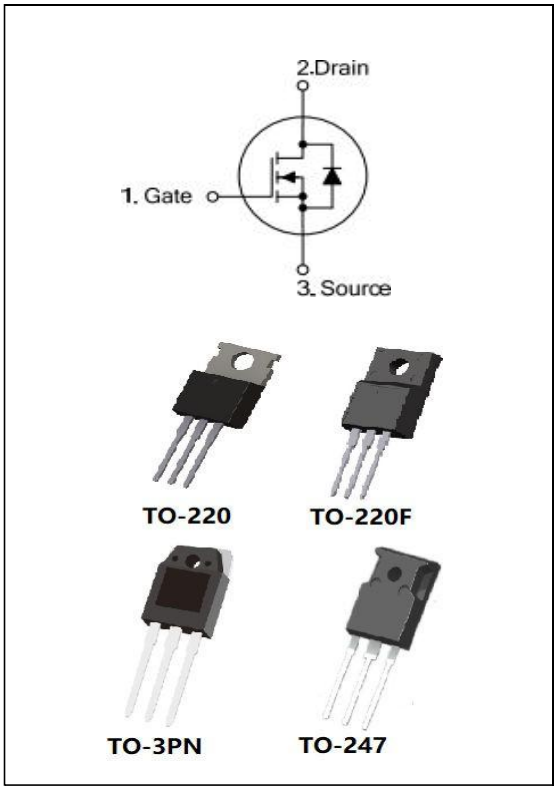
迈诺斯科技

MD23N50

Power MOSFET

1. Description

MD23N50, 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

Parameter	Value	Unit
$V_{DS@Tj.max}$	500	V
I_D	23	A
$R_{DS(ON).Typ}$	0.23	Ω
$Q_{g.Typ}$	56	nC

FEATURES

- Fast Switching
- Low Crss (typical 18pF)
- 100% avalanche tested
- Improved dv/dt capability
- RoHS product

APPLICATIONS

- High frequency switching mode power supply

ORDERING INFORMATION

Ordering Codes	Package	Product Code	Packing
MP23N50	TO-220	23N50	Tube
MPF23N50	TO-220F		Tube
MD23N50	TO-3PN		Tube
MD23N50	TO-247		Tube

20N50-A

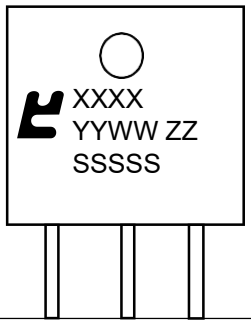
(2) Package type

(1) Chip name

(1)23N50:500V 23A

(2) A:TO-220F P:TO-220

W:TO-3PN F:TO-247



XXXX：Product Code

YYWW：Year&Week

ZZ：Assembly Code

SSSSS：Lot Code

2. ABSOLUTE RATINGS

at T_C = 25°C, unless otherwise specified

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	500	V
I_D	Continuous Drain Current	23	A
	Continuous Drain Current T_C = 100 °C	12.6	A
I_{DM}	Pulsed Drain Current(Note1)	80	A
V_{GS}	Gate-to-Source Voltage	±30	V
E_{AS}	Single Pulse Avalanche Energy(Note2)	1200	mJ
dv/dt	Peak Diode Recovery dv/dt(Note3)	5.0	V/ns
P_D	Power Dissipation TO-220, TO-3PN	230	W
	Derating Factor above 25°C	1.85	W/℃
P_D	Power Dissipation TO-220F，TO-3PF	48	W
	Derating Factor above 25°C	0.38	W/℃
T_J，T_{stg}	Operating Junction and Storage Temperature Range	150，–55 to 150	℃
T_L	Maximum Temperature for Soldering	300	℃

3. Thermal characteristics

Thermal characteristics (No FullPAK) TO-220\TO-3PN

Symbol	Parameter	RATINGS	Units
$R_{\theta JC}$	Junction-to-Case	0.54	℃/W
$R_{\theta JA}$	Junction-to-Ambient	62.5	℃/W

Thermal characteristics (FullPAK) TO-220F\TO-3PF

Symbol	Parameter	RATINGS	Units
$R_{\theta JC}$	Junction-to-Case	2.6	℃/W
$R_{\theta JA}$	Junction-to-Ambient	62.5	℃/W

4. Electrical Characteristics

at T_C = 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	500	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Bvdss Temperature Coefficient	ID=250uA, Reference25℃	--	0.6	--	V/℃
I_{DSS}	Drain to Source Leakage Current	V_{DS} =500V, V_{GS}= 0V, Tj = 25℃	--	--	10	μA
		V_{DS} =400V, V_{GS}= 0V, Tj = 125℃	--	--	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	VGS=10V, ID=10A(Note4)	--	0.23	0.28	Ω
$V_{GS(TH)}$	Gate Threshold Voltage	VDS = VGS, ID = 250μA(Note4)	2.0	--	4.0	V
g_{fs}	Forward Transconductance	VDS=20V, ID =10A(Note4)	--	12	--	S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
R_g	Gate resistance	f = 1.0MHz	--	1.5	--	Ω
C_{iss}	Input Capacitance	VGS = 0V VDS = 25V f = 1.0MHz	--	1920	--	PF
C_{oss}	Output Capacitance		--	290	--	
C_{rss}	Reverse Transfer Capacitance		--	18	--	

Switching Characteristics

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	ID =23A VDD = 250V VGS = 10V RG =20Ω	--	33	--	ns
tr	Rise Time		--	75	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	91	--	
t_f	Fall Time		--	83	--	
Q_g	Total Gate Charge	ID =23A VDD =400V VGS = 10V	--	56	--	nC
Q_{gs}	Gate to Source Charge		--	13	--	
Q_{gd}	Gate to Drain (“Miller”)Charge		--	20	--	

Source-Drain Diode Characteristics

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)	TC=25 °C	--	--	23	A
I_{SM}	Maximum Pulsed Current (Body Diode)		--	--	80	A
V_{SD}	Diode Forward Voltage	IS=20A, VGS=0V(Note4)	--	--	1.2	V
T_{rr}	Reverse Recovery Time	IS=20A, Tj = 25°C dIF/dt=100A/us, VGS=0V	--	536	--	ns
Q_{rr}	Reverse Recovery Charge		--	5668	--	nC
I_{rrm}	Reverse Recovery Current		--	21.1	--	A

Note1: Pulse width limited by maximum junction temperature

Note2: L=10mH, VDs=50V, Start TJ=25℃

Note3: ISD =23A,di/dt ≤100A/us,VDD≤BVDS, Start TJ=25℃

Note4: Pulse width tp≤300μs, δ≤2%

5. Characteristics Curves

Figure 1a Safe Operating Area (No FullPAK)

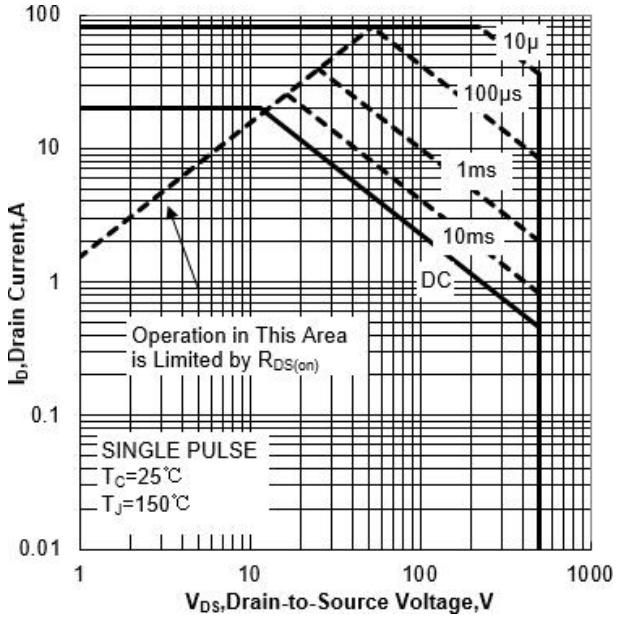


Figure 1b Safe Operating Area (FullPAK)

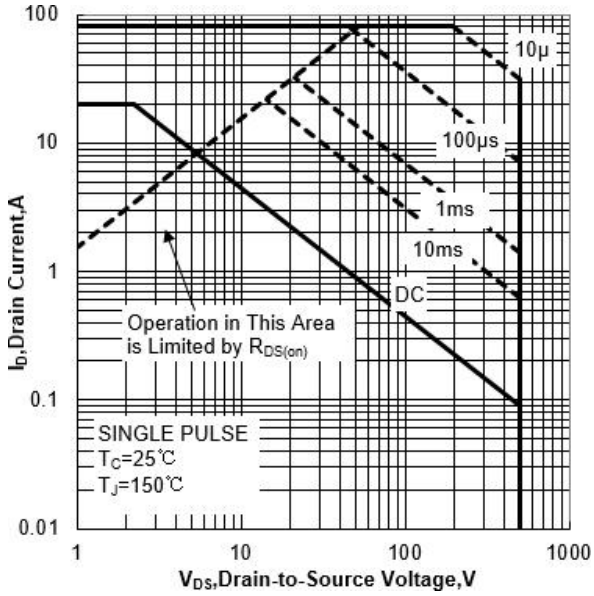


Figure 2a Power Dissipation (No FullPAK)

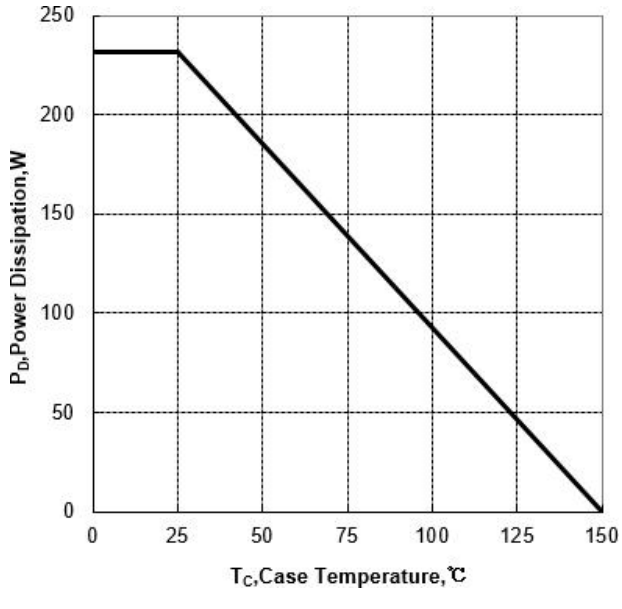


Figure 2b Power Dissipation (FullPAK)

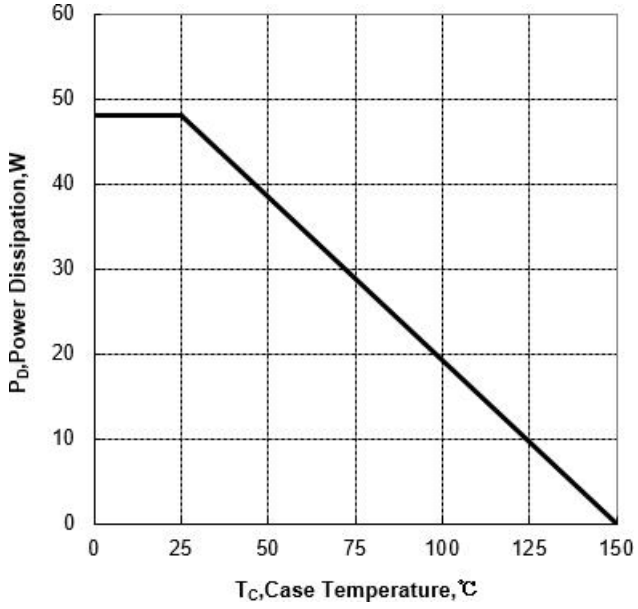


Figure 3a Max Thermal Impendance (No FullPAK)

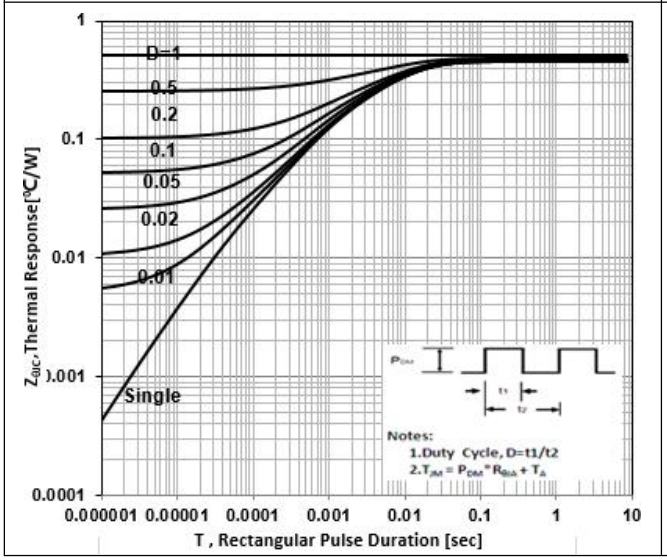


Figure 3b Max Thermal Impendance (FullPAK)

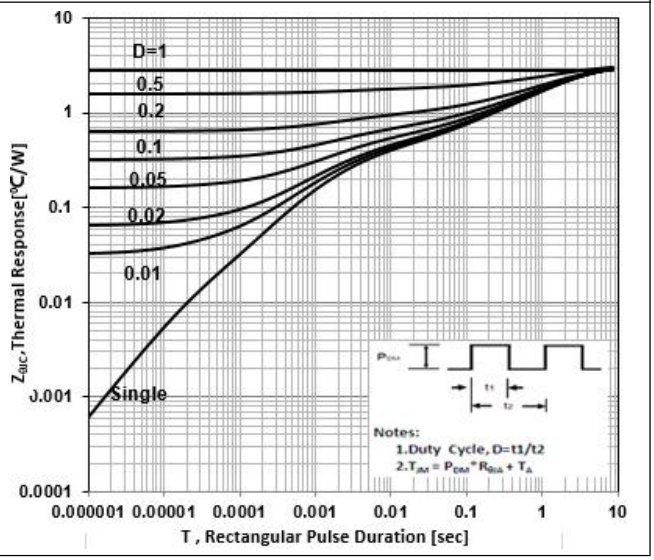


Figure 4 Typical Output Characteristics

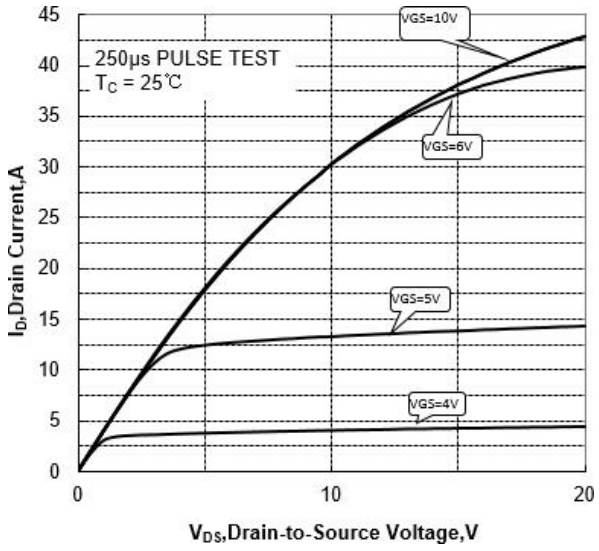


Figure 5 Typical Transfer Characteristics

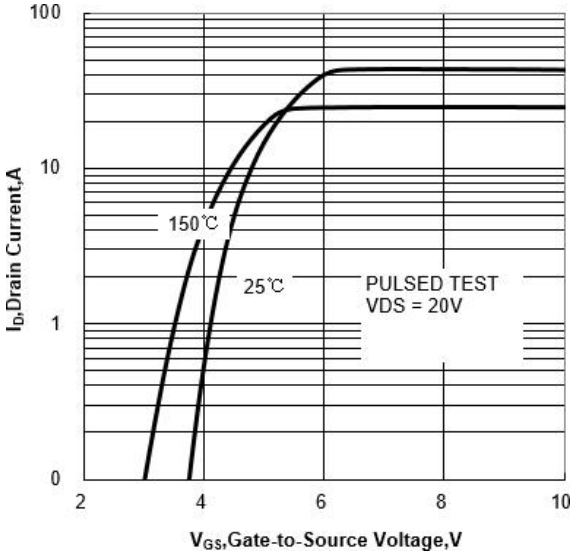


Figure 6 Typical Drain to Source ON Resistance vs Drain Current

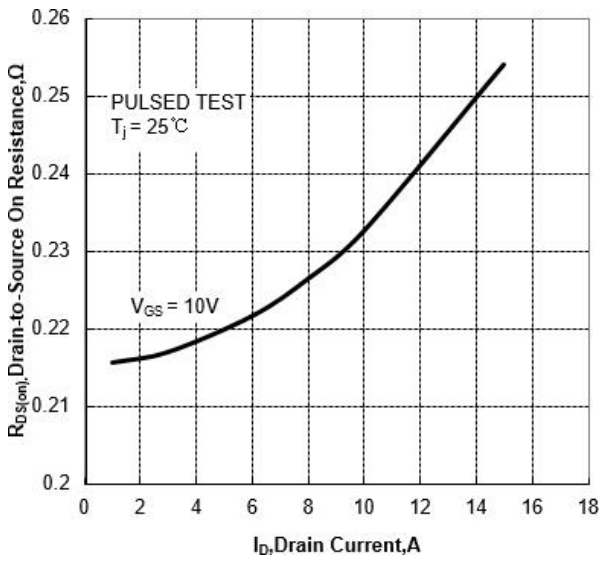


Figure 7 Typical Drian to Source on Resistance vs Junction Temperature

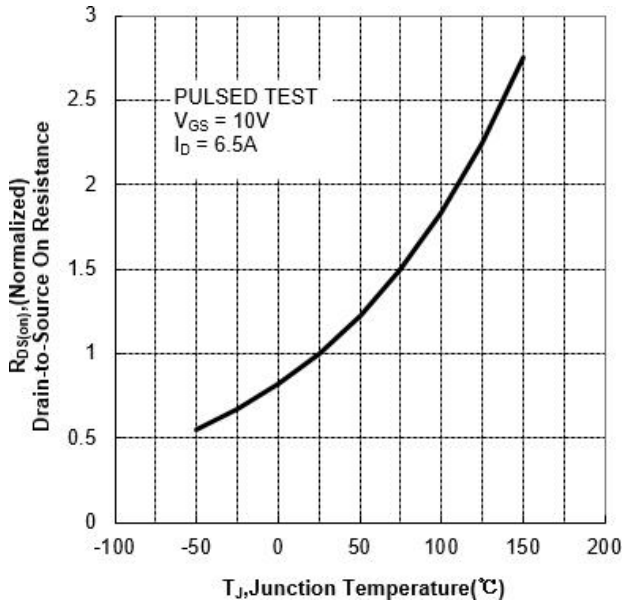


Figure 8 Typical Theshold Voltage vs Junction Temperature

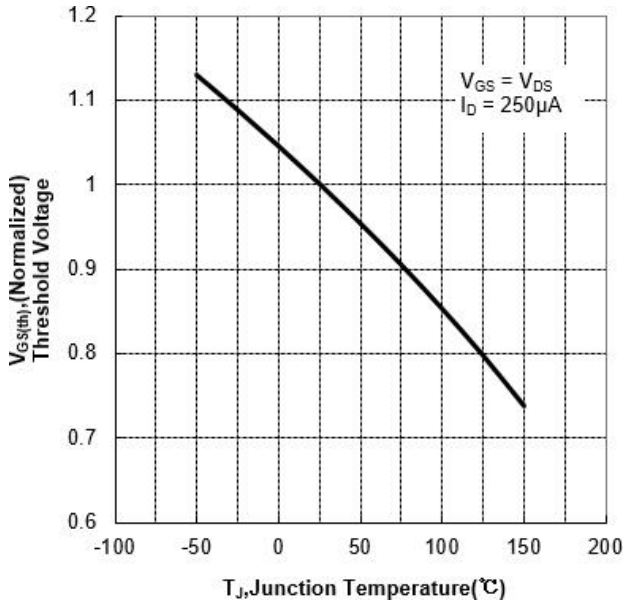


Figure 9 Typical Breakdown Voltage vs Junction Temperature

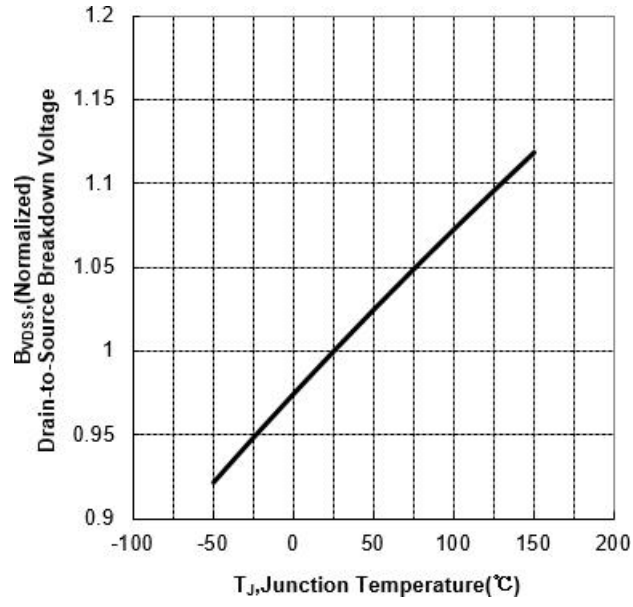


Figure 10 Typical Capacitance vs Drain to Source Voltage

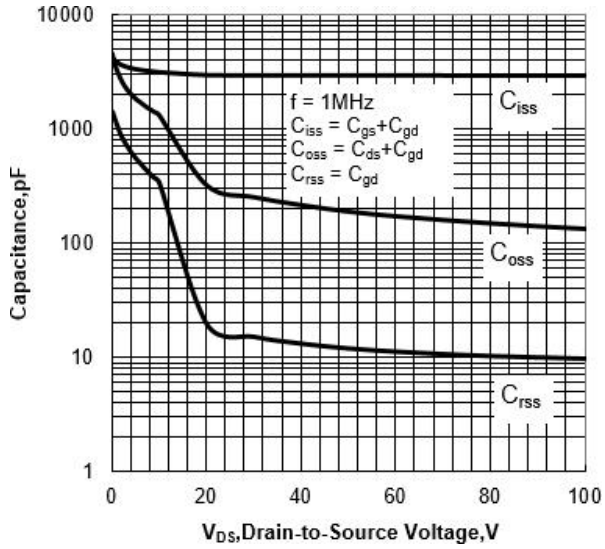
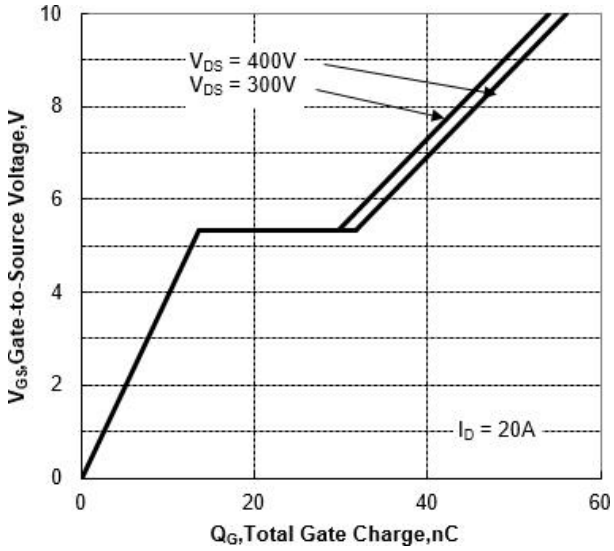


Figure 11 Typical Gate Charge vs Gate to Source Voltage



6. Test Circuit and Waveform

Figure 12 Gate Charge Test Circuit

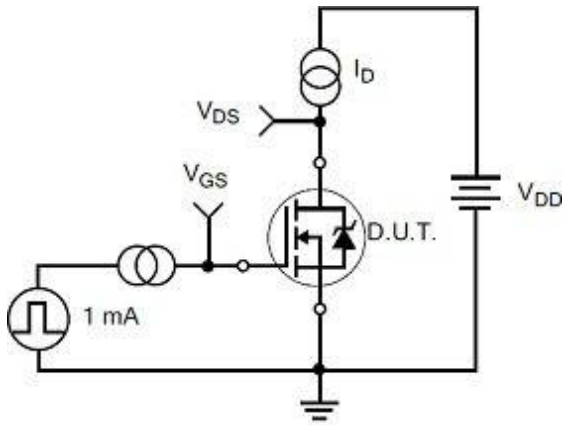


Figure 13 Gate Charge Waveforms

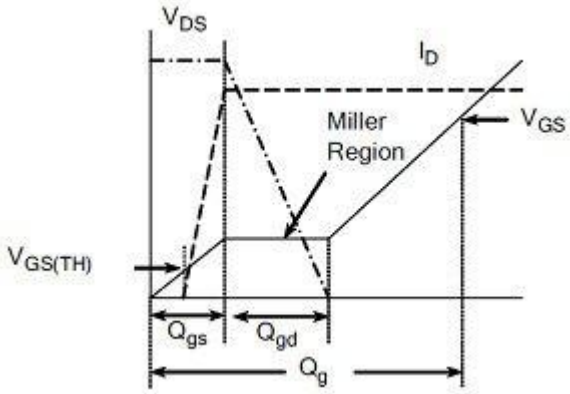


Figure 14 Resistive Switching Test Circuit

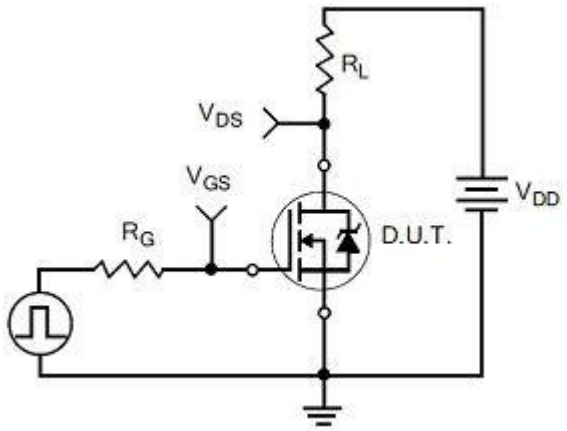


Figure 15 Resistive Switching Waveforms

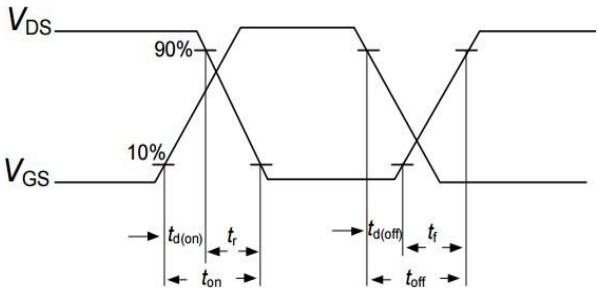


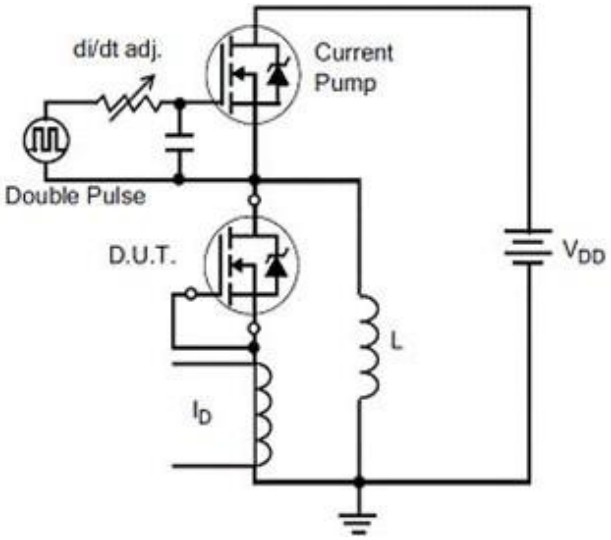
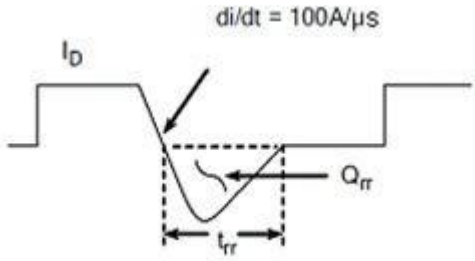
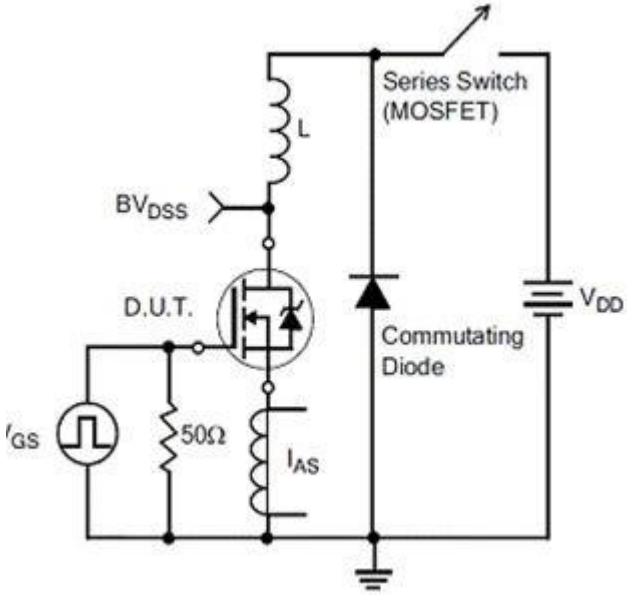
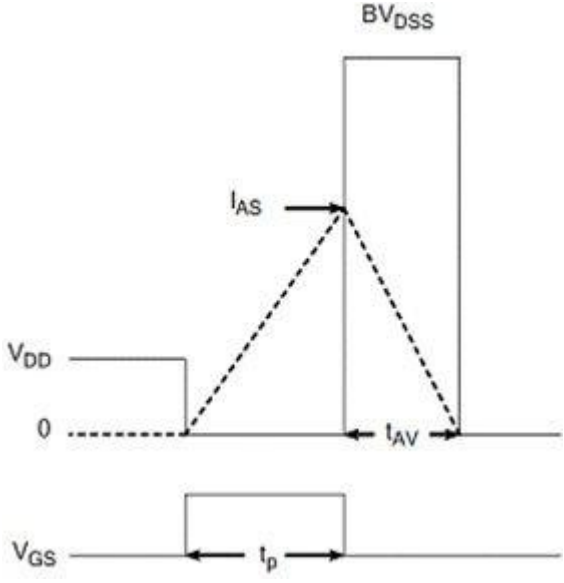
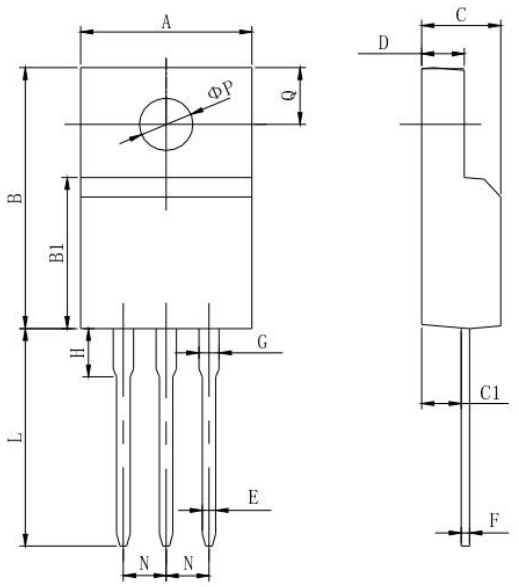
Figure 16 Diode Reverse Recovery Test Circuit	Figure 17 Diode Reverse Recovery Waveform
	

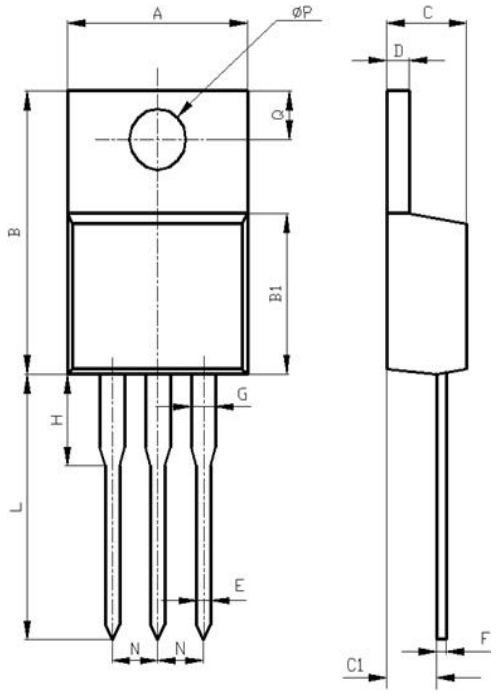
Figure 18 Unclamped Inductive Switching Test Circuit	Figure 19 Unclamped Inductive Switching Waveform
	

7. Package Description



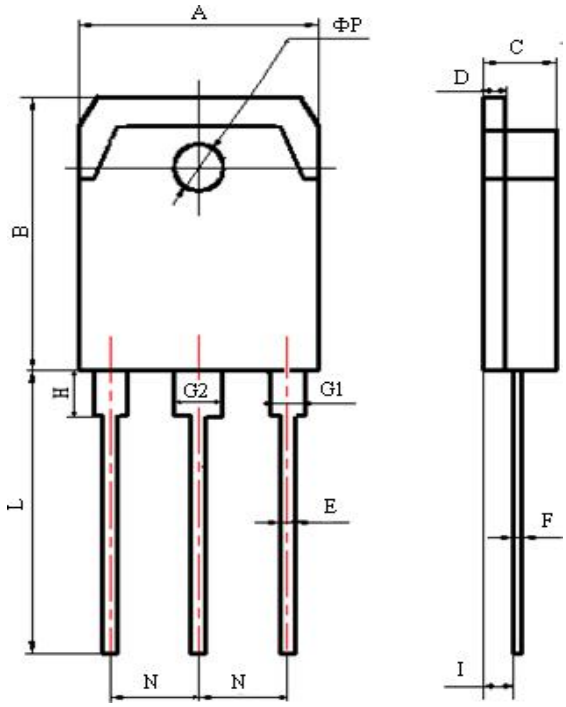
Items	Values(mm)	
	MIN	MAX
A	9.60	10.4
B	15.4	16.2
B1	8.90	9.50
C	4.30	4.90
C1	2.10	3.00
D	2.40	3.00
E	0.60	1.00
F	0.30	0.60
G	1.12	1.42
H	3.40	3.80
	1.60	2.90
L	12.0	14.0
N	2.34	2.74
Q	3.15	3.55
ϕ P	2.90	3.30

TO-220F Package



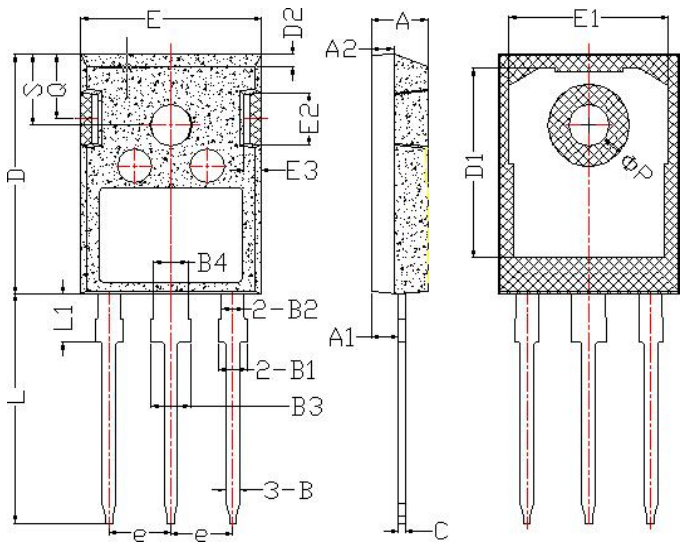
Items	Values(mm)	
	MIN	MAX
A	9.60	10.6
B	15.0	16.0
B1	8.90	9.50
C	4.30	4.80
C1	2.30	3.10
D	1.20	1.40
E	0.70	0.90
F	0.30	0.60
G	1.17	1.37
H	2.70	3.80
L	12.6	14.8
N	2.34	2.74
Q	2.40	3.00
Φ P	3.50	3.90

TO-220 Package



Items	Values(mm) MIN	MAX
A	15.00	16.00
B	19.20	20.60
C	4.60	5.00
D	1.40	1.60
E	0.90	1.10
F	0.50	0.70
G1	2.00	2.20
G2	3.00	3.20
H	3.00	3.70
I	1.20	1.70
	2.70	2.90
L	19.00	21.00
N	5.25	5.65
Φ P	3.10	3.30

TO-3PN Package



Items	Values(mm)	
	MIN	MAX
A	4.6	5.2
A1	2,2	2.6
B	0.9	1.4
B1	1.75	2.35
B2	1.75	2.15
B3	2.8	3.35
B4	2.8	3.15
C	0.5	0.7
D	20.60	21.30
D1	16	18
E	15.5	16.10
E1	13	14.7
E2	3.80	5.3
E3	0.8	2.60
e	5.2	5.7
L	19	20.5
L1	3.9	4.6
ΦP	3.3	3.70
Q	5.2	6.00
S	5.8	6.6

TO-247 Package