

General Description:

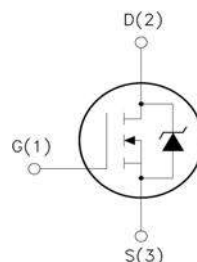
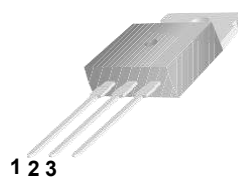
60N12, the silicon N-channel Enhanced VDMOSFETs, is obtained by advanced Trench Technology which reduce the conduction loss, improve switching performance and enhance the avalanche energy. The transistor can be used in various power switching circuit for system miniaturization and higher efficiency. The package form is TO-220AB, which accords with the RoHS standard.

V_{DSS}	120	V
I_D	60	A
$P_D(T_C=25^\circ\text{C})$	198	W
$R_{DS(ON)Typ}$	15	m Ω

Features:

- I **Fast Switching**
- I **Low ON Resistance**($R_{dson} \leq 20\text{m}\Omega$)
- I **Low Gate Charge**
- I **Low Reverse transfer capacitances**(Typical:112.9pF)
- I **100% Single Pulse avalanche energy Test**

TO-220AB



- 1.Gate (G)
- 2.Drain (D)
- 3.Source (S)

Applications:

Power switch circuit of adaptor and charger.

Absolute ($T_J = 25^\circ\text{C}$ unless otherwise specified):

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	120	V
I_D	Continuous Drain Current $T_C = 25^\circ\text{C}$	60	A
	Continuous Drain Current $T_C = 100^\circ\text{C}$	41	A
I_{DM}^{a1}	Pulsed Drain Current $T_C = 25^\circ\text{C}$	240	A
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}^{a2}	Single Pulse Avalanche Energy	397.8	mJ
P_D	Power Dissipation $T_C = 25^\circ\text{C}$	198	W
	Derating Factor above 25°C	1.584	W/ $^\circ\text{C}$
T_J, T_{stg}	Operating Junction and Storage Temperature Range	150, -55 to 150	$^\circ\text{C}$
T_L	Maximum Temperature for Soldering	300	$^\circ\text{C}$

Electrical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise specified):

OFF Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
V_{DSS}	Drain to Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	120	--	--	V
I_{DSS}	Drain to Source Leakage Current	$V_{DS}=120V, V_{GS}=0V, T_J=25^\circ\text{C}$	--	--	1	μA
		$V_{DS}=96V, V_{GS}=0V, T_J=125^\circ\text{C}$	--	--	100	μA
$I_{GSS(F)}$	Gate to Source Forward Leakage	$V_{GS}=+20V$	--	--	100	nA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	$V_{GS}=-20V$	--	--	-100	nA

ON Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$R_{DS(ON)}$	Drain-to-Source On-Resistance	$V_{GS}=10V, I_D=25A$	--	15	20	m Ω
		$V_{GS}=4.5V, I_D=15A$		15.5	23	m Ω
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	1.0	--	2.5	V
Pulse width $t_p \leq 300\mu s, \delta \leq 2\%$						

Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
R_g	Gate resistance	$V_{GS}=0V, V_{DS}=0V, f=1\text{MHz}$	--	1.2	--	Ω
C_{iss}	Input Capacitance	$V_{GS}=0V, V_{DS}=60V, f=1.0\text{MHz}$	--	4281	--	pF
C_{oss}	Output Capacitance		--	188.2	--	
C_{rss}	Reverse Transfer Capacitance		--	112.9	--	

Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	$V_{GS}=10V, R_G=4.7\Omega, V_{DD}=60V, I_D=30A$	--	20.5	--	ns
t_r	Rise Time		--	15	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	97	--	
t_f	Fall Time		--	105	--	
Q_g	Total Gate Charge	$V_{GS}=10V, V_{DD}=96V, I_D=30A$	--	96.8	--	nC
Q_{gs}	Gate to Source Charge		--	10.2	--	
Q_{gd}	Gate to Drain ("Miller") Charge		--	25.7	--	

Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)		--	--	60	A
I_{SM}	Maximum Pulsed Current (Body Diode)		--	--	240	A
V_{SD}	Diode Forward Voltage	$I_S=25A, V_{GS}=0V$	--	--	1.2	V
t_{rr}	Reverse Recovery Time	$I_S=30A, T_J = 25^\circ C$ $dI_F/dt=100A/\mu s,$	--	54	--	ns
Q_{rr}	Reverse Recovery Charge		--	97.7	--	nC
I_{RRM}	Reverse Recovery Current		--	3.6	--	A
Pulse width $t_p \leq 300\mu s, \delta \leq 2\%$						

Symbol	Parameter	Max.	Units
$R_{\theta JC}$	Junction-to-Case	0.63	$^\circ C/W$
$R_{\theta JA}$	Junction-to-Ambient	62.5	$^\circ C/W$

^{a1}: Repetitive rating; pulse width limited by maximum junction temperature

^{a2}: $L=0.5mH, I_D=39.89A, \text{Start } T_J=25^\circ C$

Characteristics Curve:

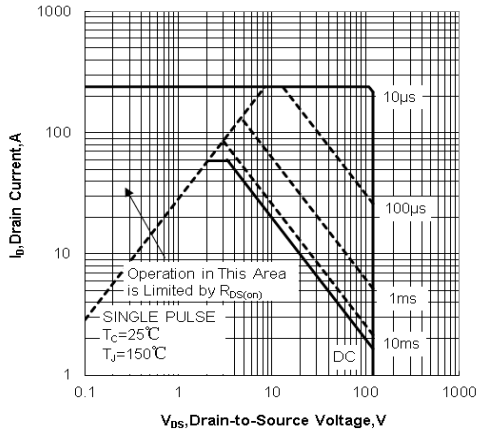


Figure1. Maximum Forward Bias Safe Operating Area

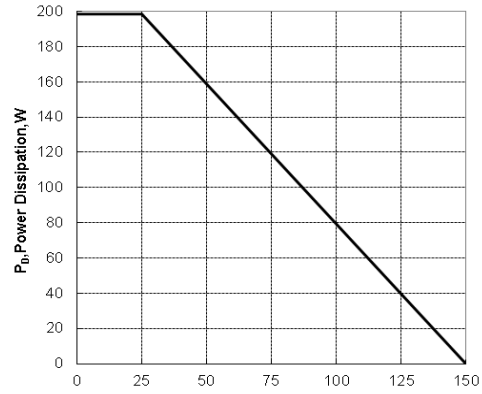


Figure2. Maximum Power Dissipation vs Case Temperature

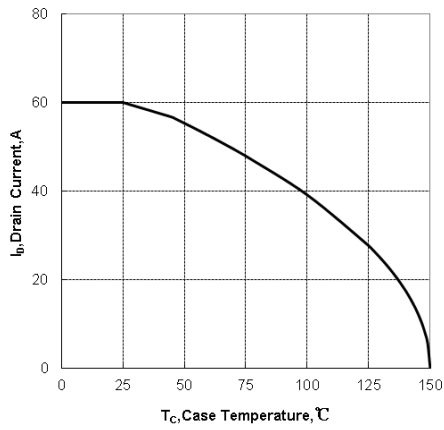


Figure3. Maximum Continuous Drain Current vs Case Temperature

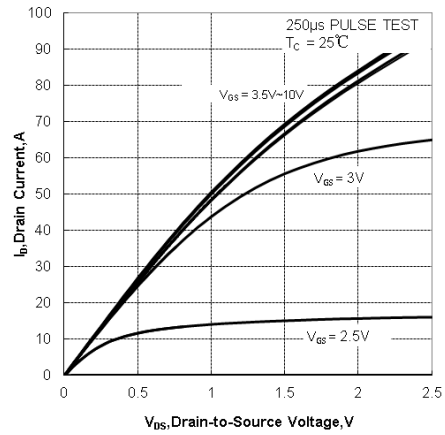


Figure 4. Typical Output Characteristics

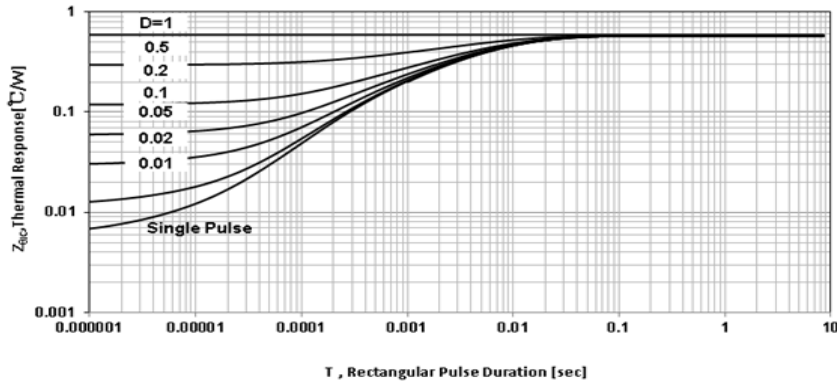


Figure5 Maximum Effective Transient Thermal Impedance, Junction-to-Case

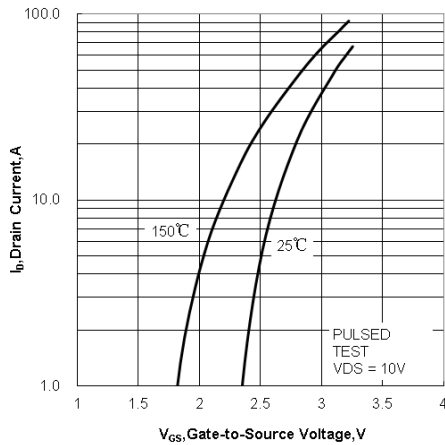


Figure 6. Typical Transfer Characteristics

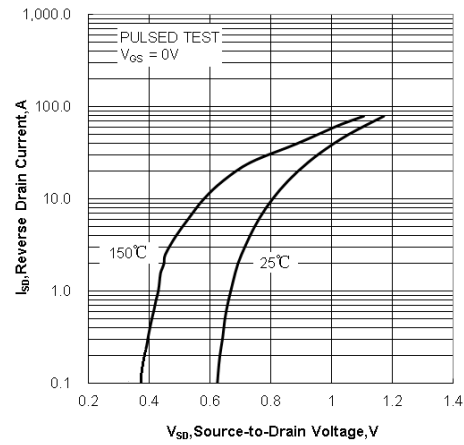


Figure 7. Typical Body Diode Transfer Characteristics

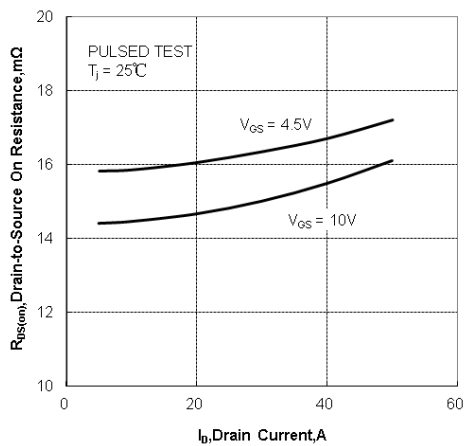


Figure 8. Drain-to-Source On Resistance vs Drain Current

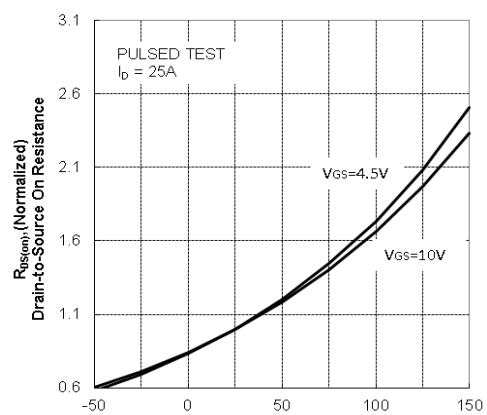


Figure 9. Normalized on Resistance vs Junction Temperature

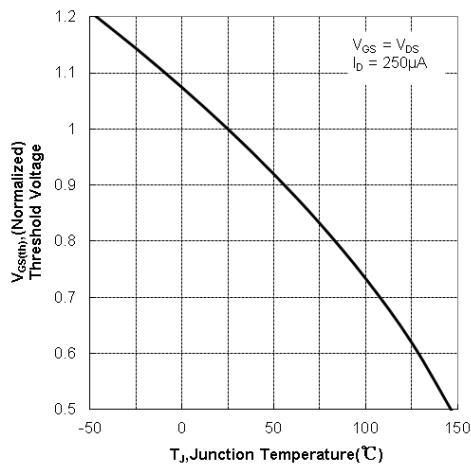


Figure 10. Normalized Threshold Voltage vs Junction Temperature

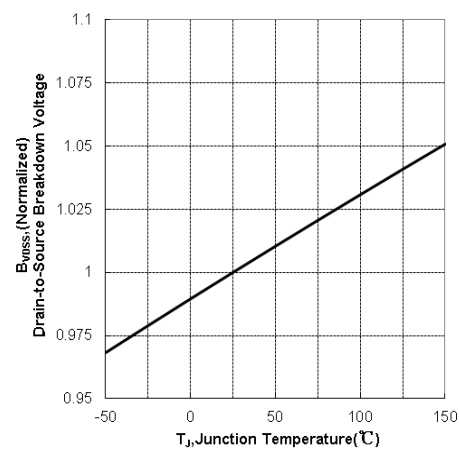


Figure 11. Normalized Breakdown Voltage vs Junction Temperature

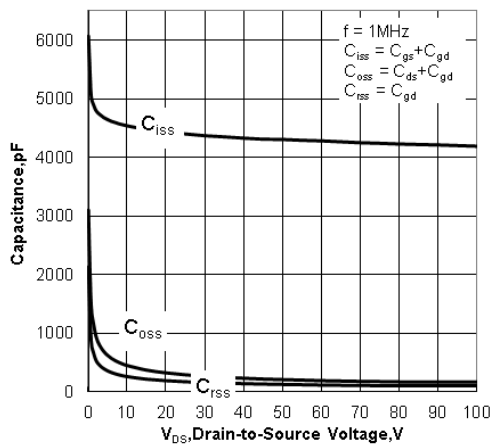


Figure12. Capacitance Characteristics

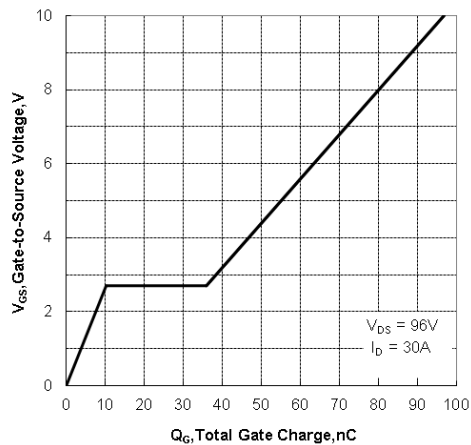


Figure13. Typical Gate Charge vs Gate to Source Voltage

Test Circuit and Waveform

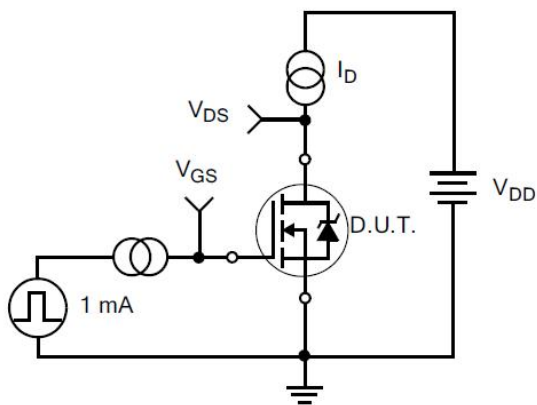


Figure 14. Gate Charge Test Circuit

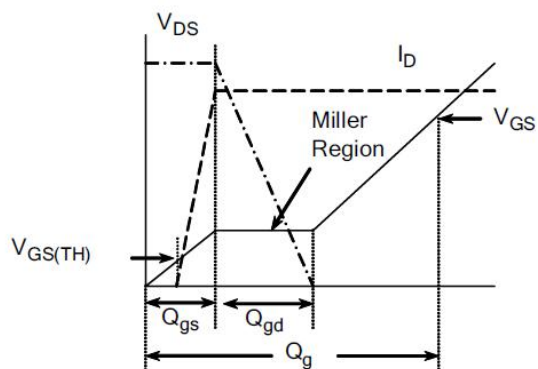


Figure 15. Gate Charge Waveforms

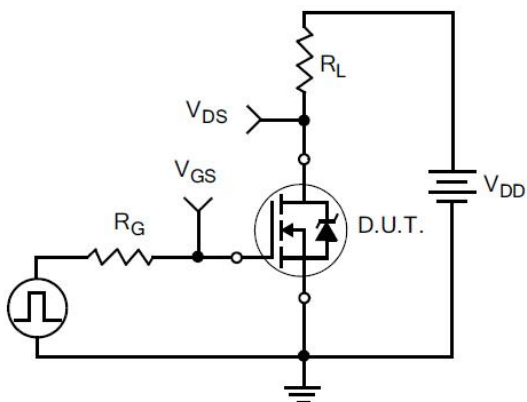


Figure 16. Resistive Switching Test Circuit

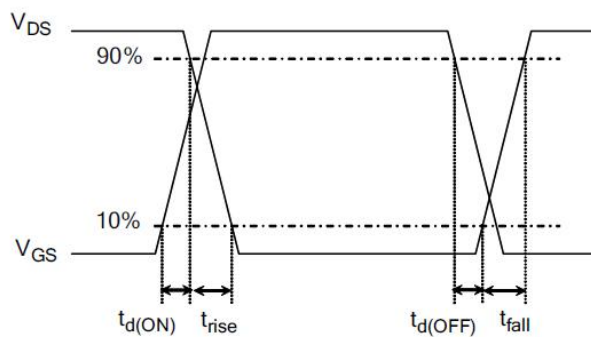


Figure 17. Resistive Switching Waveforms

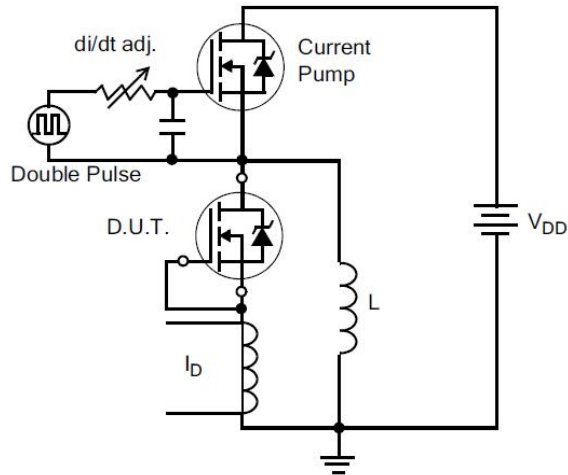


Figure 18. Diode Reverse Recovery Test Circuit

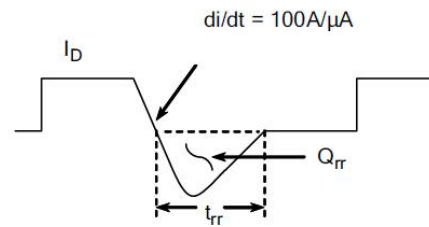


Figure 19. Diode Reverse Recovery Waveform

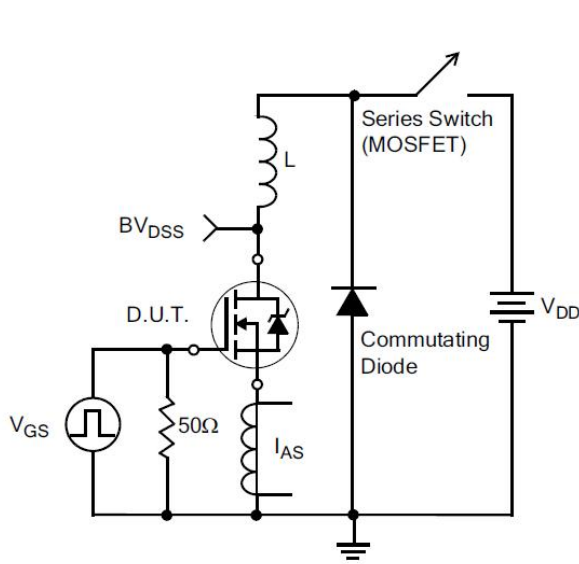


Figure 20. Unclamped Inductive Switching Test Circuit

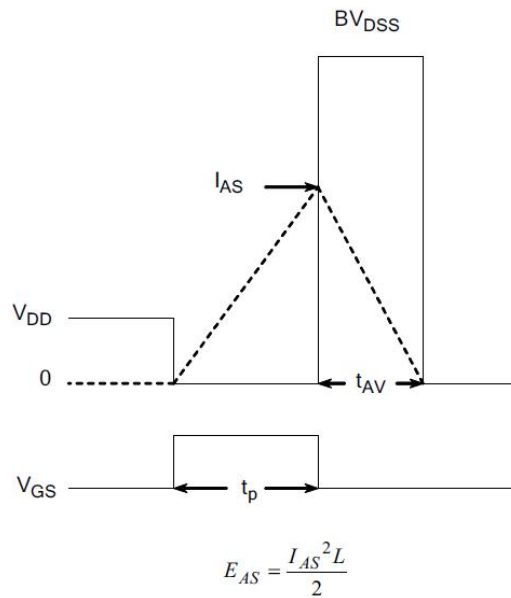
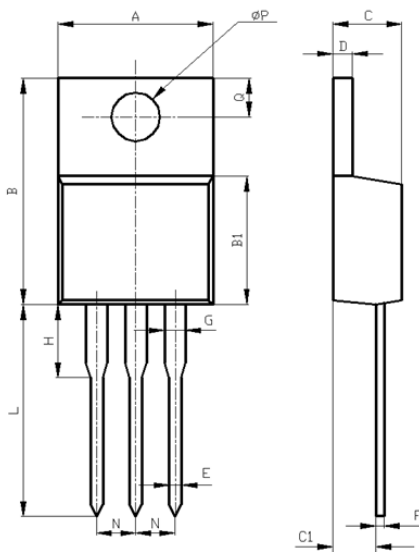


Figure 21. Unclamped Inductive Switching Waveform

Package Information:


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

*adjustable

TO-220AB Package