

General Description:

CS20N60A8R the silicon N-channel Enhanced VDMOSFET, is obtained by the self-aligned planar 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.

Features:

- **Fast Switching**
- **Low ON Resistance**($R_{DS(on)} \leq 0.45\Omega$)
- **Low Gate Charge** (Typical Data: 57nC)
- **Low Reverse transfer capacitances**(Typical: 23pF)
- **100% Single Pulse avalanche energy Test**

Applications:

Power switch circuit of adaptor and charger.

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

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	600	V
I_D	Continuous Drain Current	20	A
	Continuous Drain Current $T_C = 100^\circ\text{C}$	12.5	A
I_{DM}^{a1}	Pulsed Drain Current	80	A
V_{GS}	Gate-to-Source Voltage	± 30	V
E_{AS}^{a2}	Single Pulse Avalanche Energy	1200	mJ
dv/dt^{a3}	Peak Diode Recovery dv/dt	5.0	V/ns
P_D	Power Dissipation	250	W
	Derating Factor above 25°C	2	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	$^\circ\text{C}$

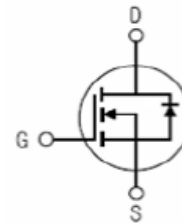
V_{DSS}	600	V
I_D	20	A
$P_D(T_C=25^\circ\text{C})$	250	W
$R_{DS(ON)Typ}$	0.35	Ω

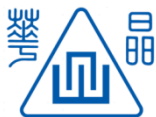
TO-220AB



1. Gate 2. Drain 3. Source

Inner Equivalent Principium Chart





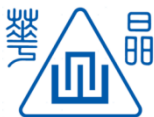
Electrical Characteristics (Tc= 25°C unless otherwise specified):

OFF Characteristics						
Symbol	Parameter	Test Conditions	Rating			Unit s
			Min.	Typ.	Max.	
V _{DSS}	Drain to Source Breakdown Voltage	V _{GS} =0V, I _D =250μA	600	--	--	V
ΔBV _{DSS} /ΔT _J	Bvdss Temperature Coefficient	ID=250uA, Reference 25°C	--	0.6	--	V/°C
I _{DSS}	Drain to Source Leakage Current	V _{DS} =600V, V _{GS} =0V, T _a =25°C	--	--	1	μA
		V _{DS} =480V, V _{GS} =0V, T _a =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	Rating			Units
			Min.	Typ.	Max.	
R _{DS(ON)}	Drain-to-Source On-Resistance	V _{GS} =10V, I _D =10A	--	0.35	0.45	Ω
V _{GS(TH)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA	2.0	--	4.0	V
Pulse width tp≤300μs, δ≤2%						

Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
g _{fs}	Forward Trans conductance	V _{DS} =15V, I _D =10A	--	18	--	S
C _{iss}	Input Capacitance	V _{GS} =0V V _{DS} =25V f=1.0MHz	--	2987	--	pF
C _{oss}	Output Capacitance		--	341	--	
C _{rss}	Reverse Transfer Capacitance		--	23	--	

Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
t _{d(ON)}	Turn-on Delay Time	I _D =20A V _{DD} =250V R _G =10Ω	--	36	--	ns
t _r	Rise Time		--	72	--	
t _{d(OFF)}	Turn-Off Delay Time		--	78.7	--	
t _f	Fall Time		--	52	--	
Q _g	Total Gate Charge	I _D =20A V _{DD} =400V V _{GS} =10V	--	57	--	nC
Q _{gs}	Gate to Source Charge		--	13.5	--	
Q _{gd}	Gate to Drain ("Miller") Charge		--	22.3	--	



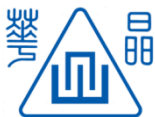
Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I _S	Continuous Source Current (Body Diode)		--	--	20	A
I _{SM}	Maximum Pulsed Current (Body Diode)		--	--	80	A
V _{SD}	Diode Forward Voltage	I _S =20A, V _{GS} =0V	--	--	1.5	V
trr	Reverse Recovery Time	I _S =20A, T _j = 25 °C dI _F /dt=100A/us, V _{GS} =0V	--	525	--	ns
Qrr	Reverse Recovery Charge		--	6091	--	nC
I _{RRM}	Reverse Recovery Current		--	23.4	--	A
Pulse width tp≤300μs, δ ≤2%						

Symbol	Parameter	Max.	Units
$R_{\theta JC}$	Junction-to-Case	0.5	$^\circ C/W$
$R_{\theta JA}$	Junction-to-Ambient	62.5	$^\circ C/W$

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

^{a2}: $L=10mH, I_D=15.5A$, Start $T_j=25^\circ C$

^{a3}: $I_{SD}=20A, di/dt \leq 100A/us, V_{DD} \leq BV_{DS}$, Start $T_j=25^\circ C$



Characteristics Curve:

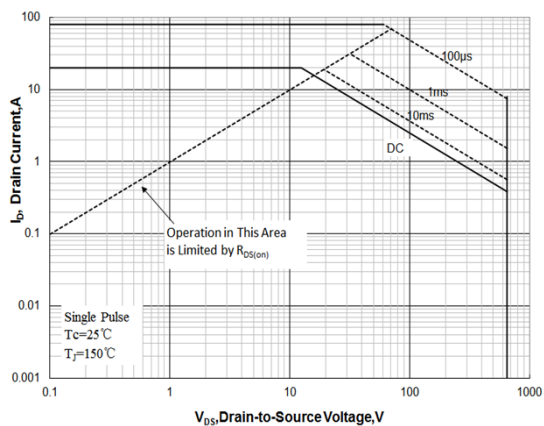


Figure 1 Maximum Forward Bias Safe Operating Area

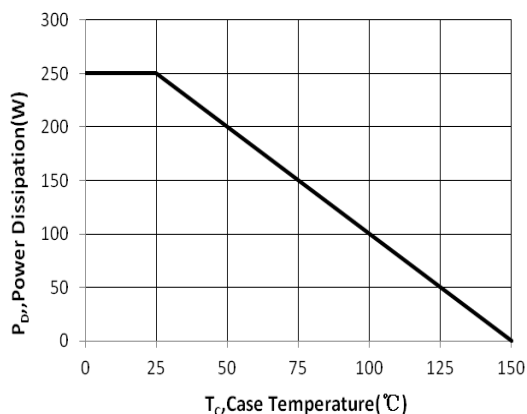


Figure 2 Maximum Power dissipation vs Case Temperature

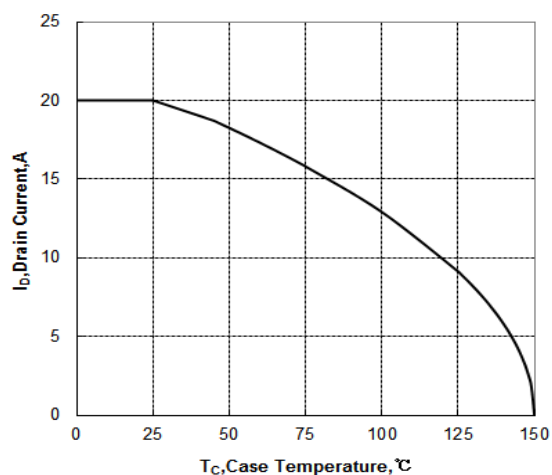


Figure 3 Maximum Continuous Drain Current vs Case

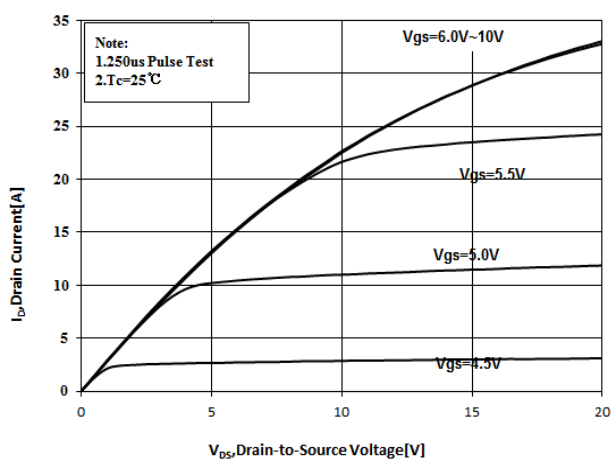


Figure 4 Typical Output Characteristics

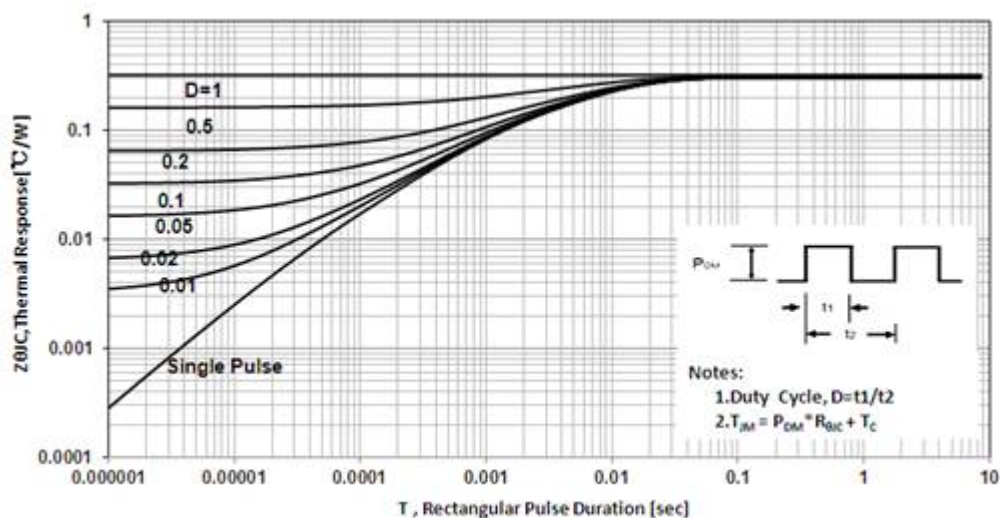


Figure 5 Maximum Effective Thermal Impedance , Junction to Case

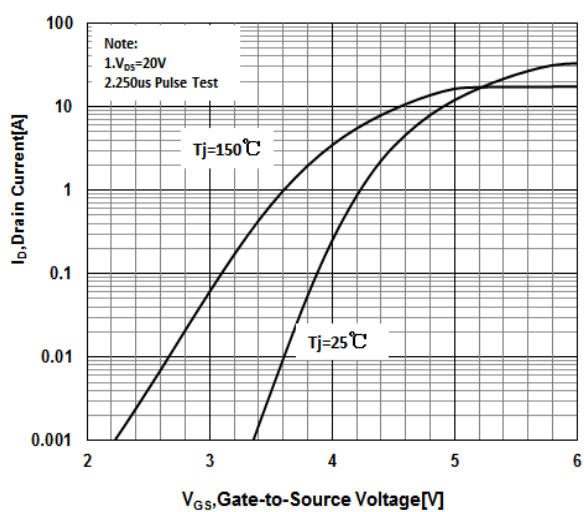
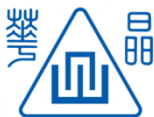


Figure 6 Typical Transfer Characteristics

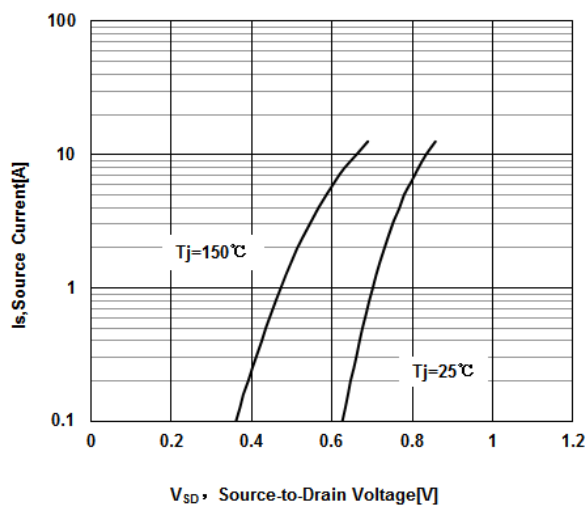


Figure 7 Typical Body Diode Transfer Characteristics

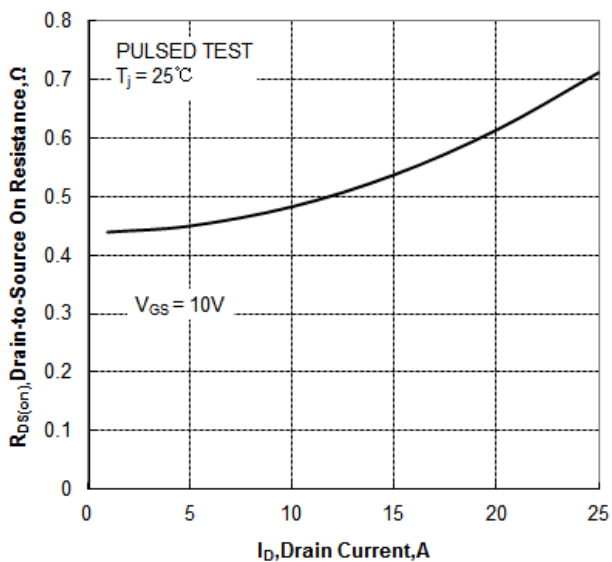


Figure 8 Typical Drain to Source ON Resistance vs Drain Current

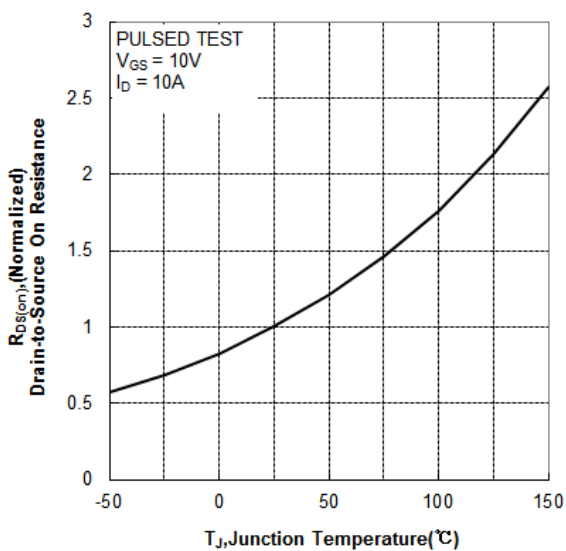


Figure 9 Typical Drain to Source on Resistance vs Junction Temperature

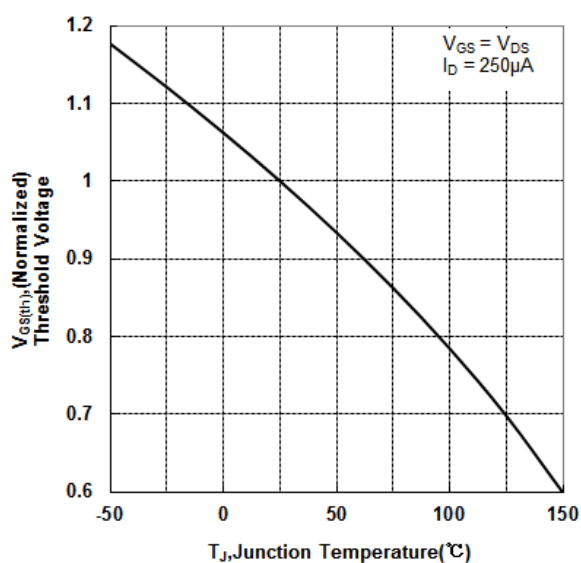
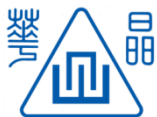


Figure 10 Typical Theshold Voltage vs Junction Temperature

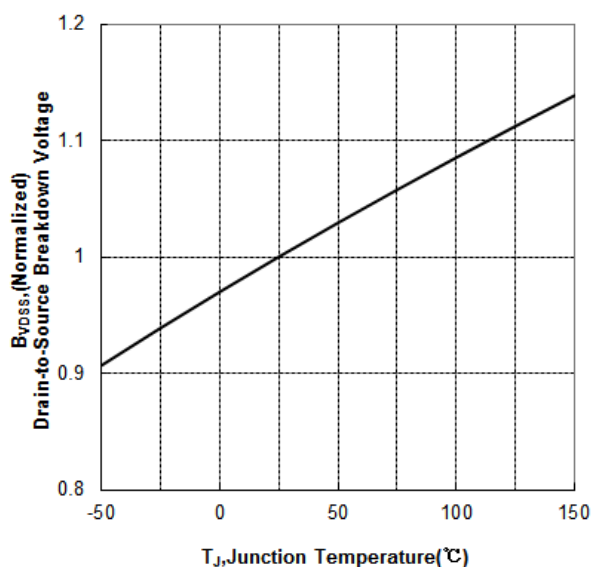


Figure 11 Typical Breakdown Voltage vs Junction Temperature

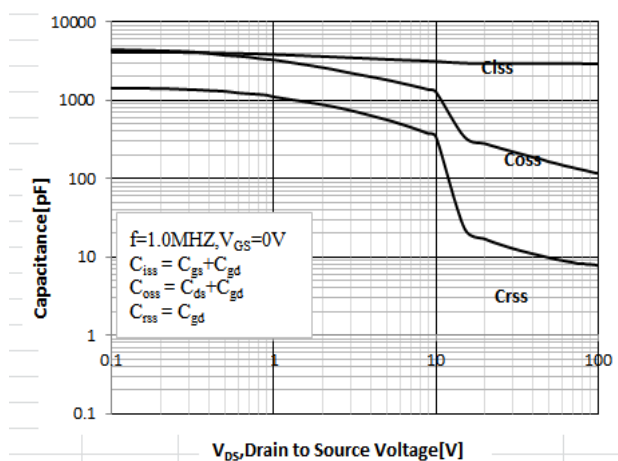


Figure 12 Typical Capacitance vs Drain to Source Voltage

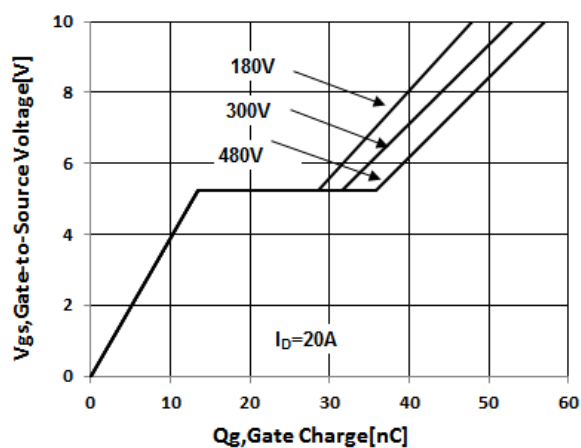
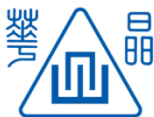


Figure 13 Typical Gate Charge vs Gate to Source Voltage



Test Circuit and Waveform:

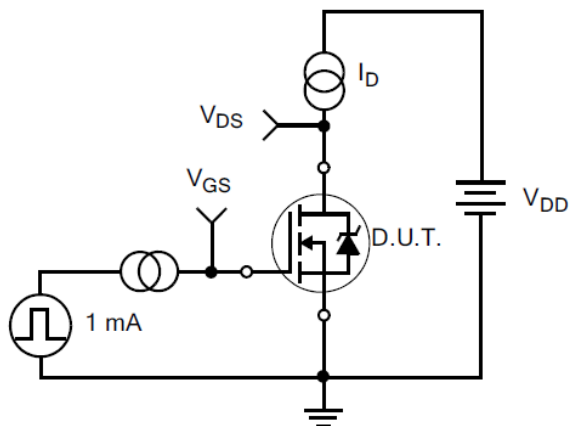


Figure 14. Gate Charge Test Circuit

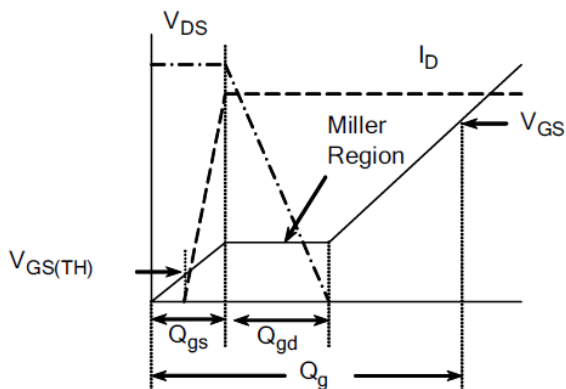


Figure 15. Gate Charge Waveforms

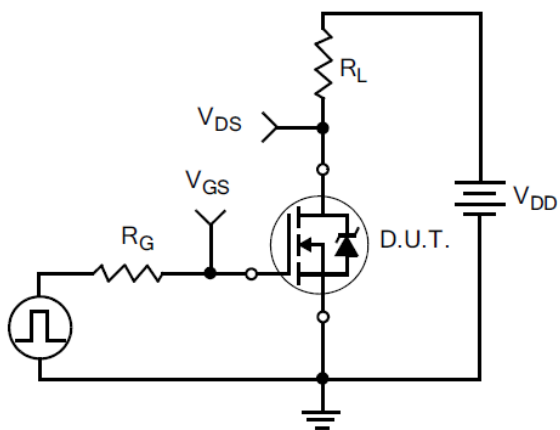


Figure 16. Resistive Switching Test Circuit

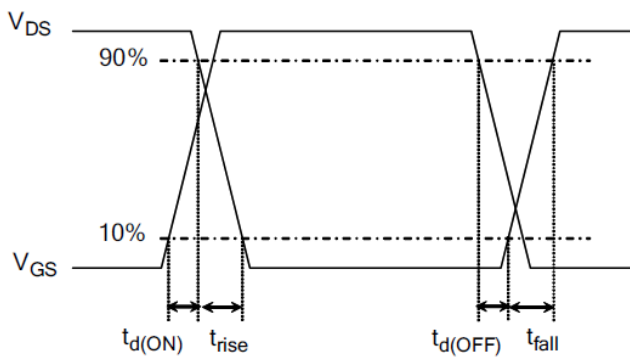


Figure 17. Resistive Switching Waveforms

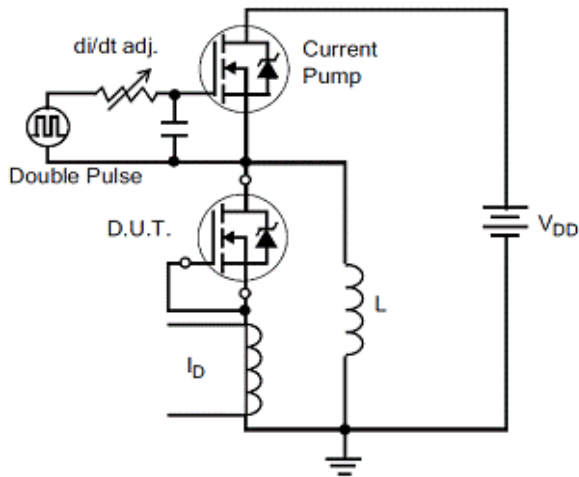


Figure 18. Diode Reverse Recovery Test Circuit

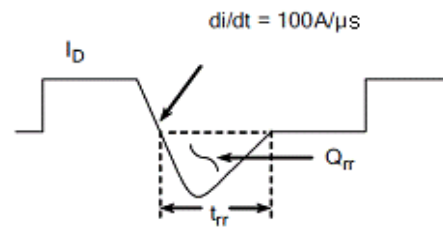


Figure 19. Diode Reverse Recovery Waveform

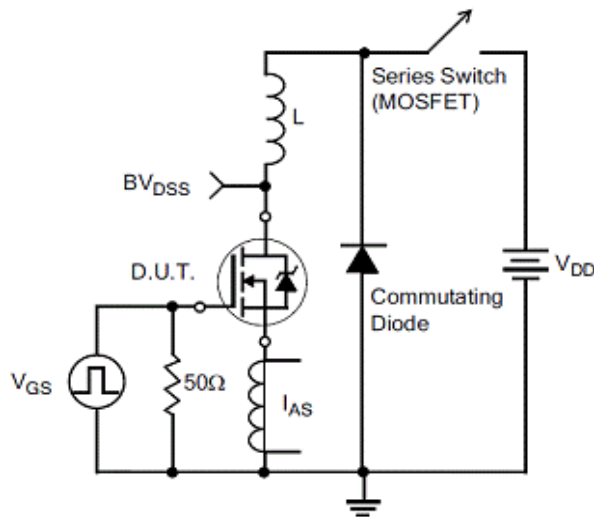


Figure20.Unclamped Inductive Switching Test Circuit

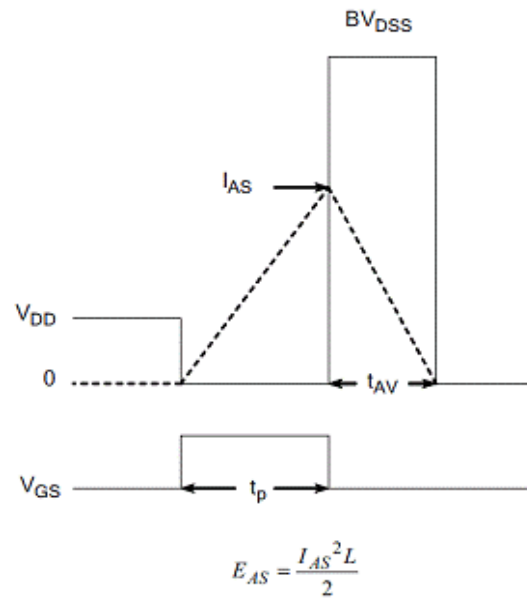
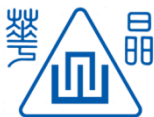
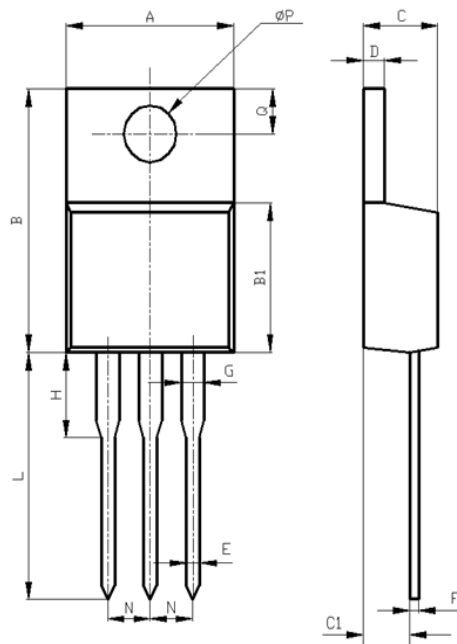


Figure21.Unclamped Inductive Switching Waveform



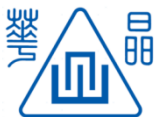
Package Information:



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
ϕP	3.50	3.90

*adjustable

TO-220AB Package



Warnings

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. It is suggested to be used under 80 percent of the maximum ratings of the device.
2. When installing the heat sink, please pay attention to the torsional moment and the smoothness of the heat sink.
3. VDMOSFETs 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. This publication is made by HuaJing Microelectronics and subject to regular change without notice.

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Revision History		
Revision	Date	Major changes
1.0	2026/4/28	Initial release