Silicon N-Channel Power MOSFET

CS1404 A8

General Description:

CS1404 A8, the silicon N-channel Enhanced VDMOSFETs, 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.

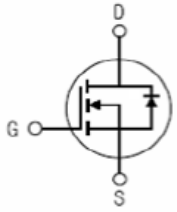
V_{DSS}	40	V
I_D（Silicon limited current）	202	A
P_D(T_C=25℃)	271	W
$R_{DS(ON)Typ}$	3.5	mΩ

TO-220AB



1.Gate 2. Drain 3. Source

Inner Equivalent Principium Chart



Features:

- **Fast Switching**
- **Low ON Resistance(Rdson≤4.5mΩ)**
- **Low Gate Charge (Typical Data:103.6nC)**
- **Low Reverse transfer capacitances(Typical:170pF)**
- **100% Single Pulse avalanche energy Test**

Applications:

Power switch circuit of adaptor and charger.

Absolute（Tc= 25℃ unless otherwise specified）:

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	40	V
I_D	Continuous Drain Current	202	A
	Continuous Drain Current T_C = 100 °C	143	A
I_{DM}[a1]	Pulsed Drain Current	808	A
V_{GS}	Gate-to-Source Voltage	±20	V
E_{AS}[a2]	Single Pulse Avalanche Energy	519	mJ
P_D	Power Dissipation	271	W
	Derating Factor above 25°C	2.16	W/℃
T_J, T_{stg}	Operating Junction and Storage Temperature Range	150，–55 to 150	℃
T_L	Maximum Temperature for Soldering	300	℃

Electrical Characteristics（Tc= 25℃ 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=250μA	40	--	--	V
I_{DSS}	Drain to Source Leakage Current	V_{DS} =40V, V_{GS}= 0V, T_a = 25℃	--	--	1	μA
		V_{DS} =32V, V_{GS}= 0V, T_a = 125℃	--	--	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=81A	--	3.5	4.5	mΩ
$V_{GS(TH)}$	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.	
C_{iss}	Input Capacitance	VGS=0V，VDS=25V f=1.0MHz	--	5431	--	pF
C_{oss}	Output Capacitance		--	1542	--	
C_{rss}	Reverse Transfer Capacitance		--	170	--	

Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	VGS=10V，RG=2.5Ω VDD=20V，ID=81A	--	29.1	--	ns
tr	Rise Time		--	27.5	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	85.3	--	
t_f	Fall Time		--	35.7	--	
Q_g	Total Gate Charge	VGS=10V，VDD=32V ID=81A	--	103.6	--	nC
Q_{gs}	Gate to Source Charge		--	20	--	
Q_{gd}	Gate to Drain (“Miller”)Charge		--	33.2	--	

Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)		--	--	202	A
I_{SM}	Maximum Pulsed Current (Body Diode)		--	--	808	A
V_{SD}	Diode Forward Voltage	I_S=95A,V_{GS}=0V	--	--	1.5	V
trr	Reverse Recovery Time	I_S=10A,T_j = 25℃ dI$_F$/dt=100A/us, V_{GS}=0V	--	1708	--	ns
Qrr	Reverse Recovery Charge		--	4.36	--	uC
I_{RRM}	Reverse Recovery Current		--	5.1	--	A
Pulse width tp≤300μs, δ ≤2%						

Symbol	Parameter	Max.	Units
$R_{\theta JC}$	Junction-to-Case	0.46	℃/W
$R_{\theta JA}$	Junction-to-Ambient	62.5	℃/W

[a1]: Repetitive rating; pulse width limited by maximum junction temperature
[a2]: L=0.12mH, I_D=95A, Start T_J=25℃

Characteristics Curve:

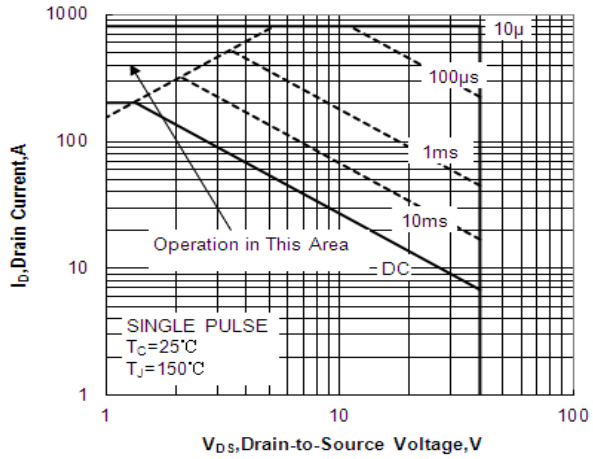


Figure 1 Maximum Forward Bias Safe Operating Area

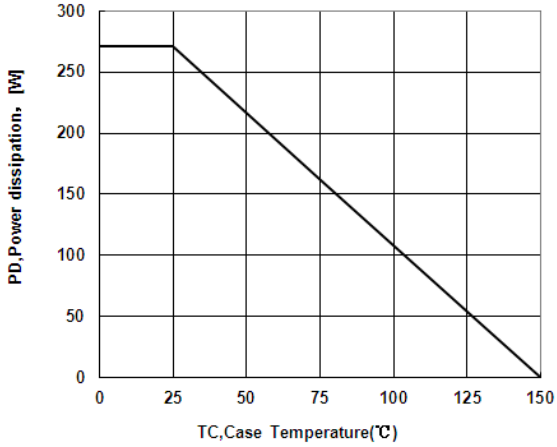


Figure 2 Maximum Power Dissipation vs Case Temperature

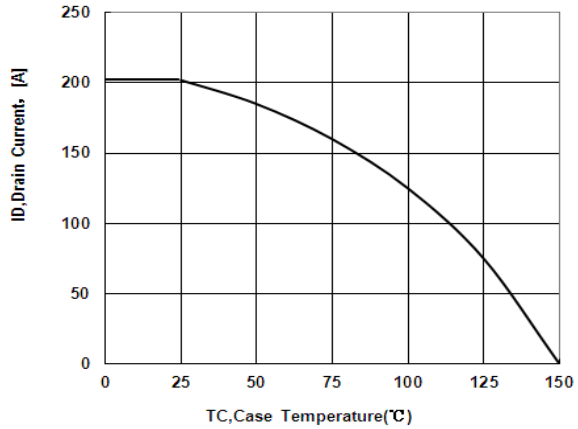


Figure 3 Maximum Continuous Drain Current vs Case Temperature

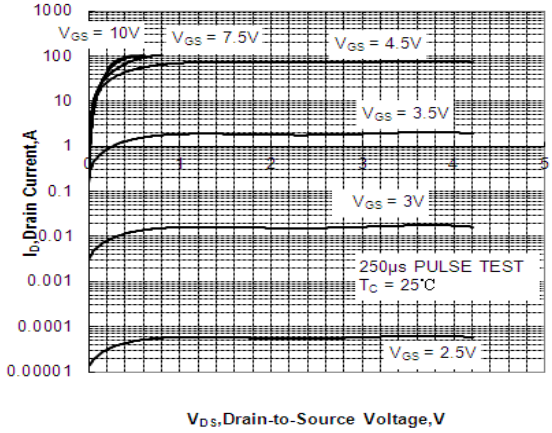


Figure 4 Typical Output Characteristics

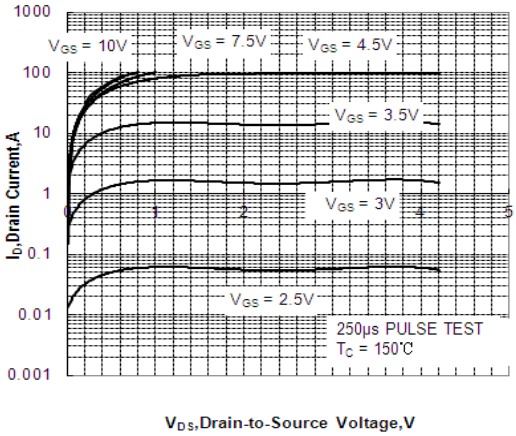


Figure 5 Typical Output Characteristics

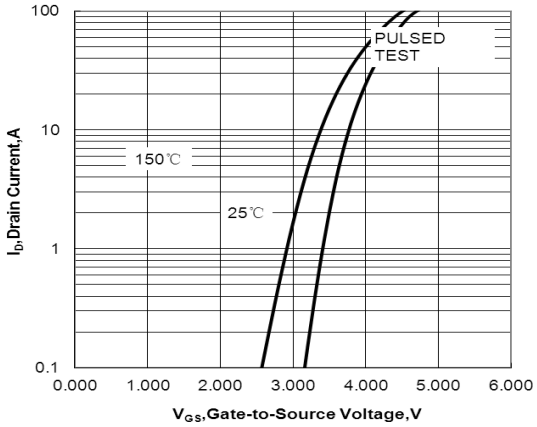


Figure 6 Typical Transfer Characteristics

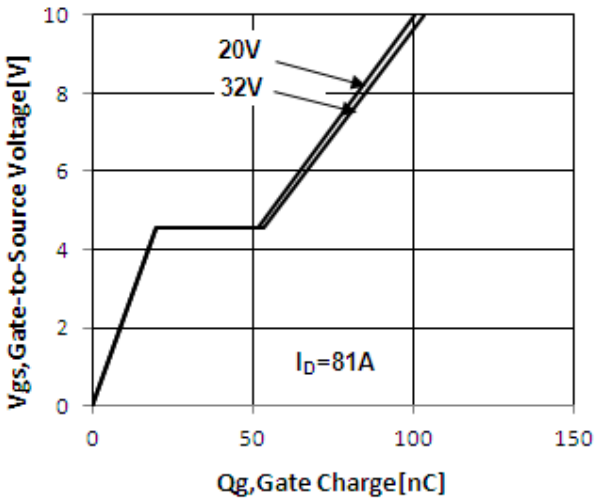


Figure 7 Typical Gate Charge vs Gate to Source Voltage

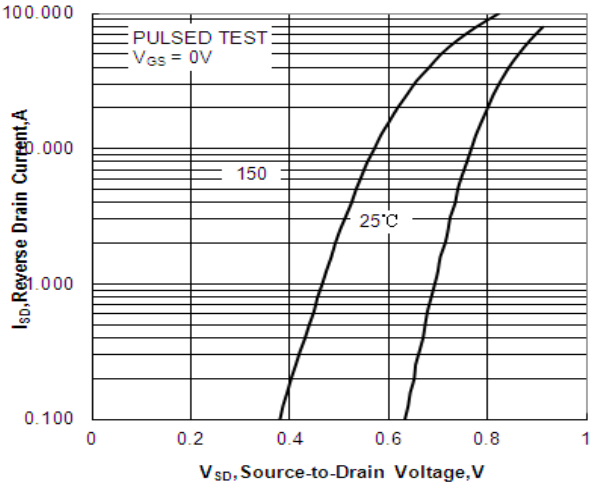


Figure 8 Typical Body Diode Transfer Characteristics

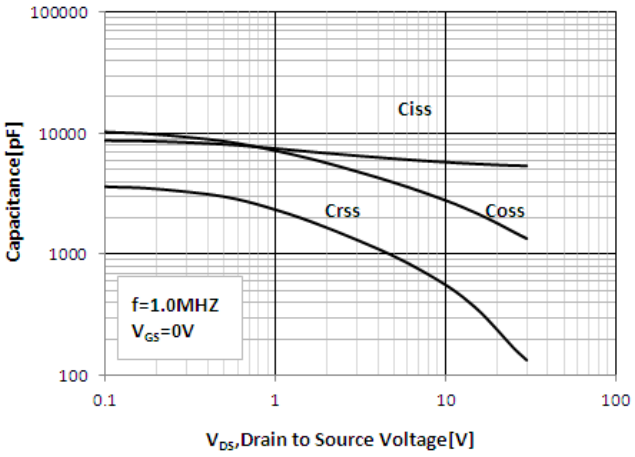


Figure 9 Typical Capacitance vs Drain to Source Voltage

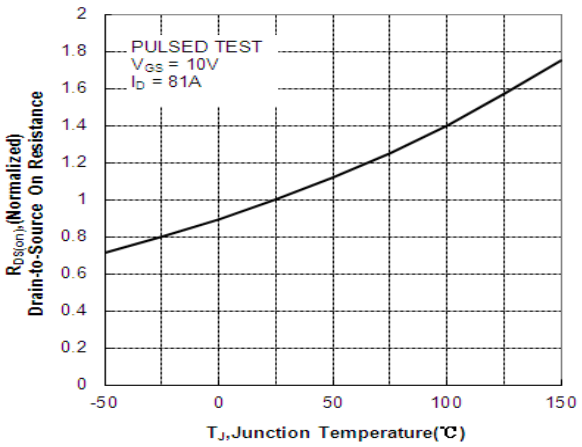


Figure 10 Typical Drian to Source on Resistance vs Junction Temperature

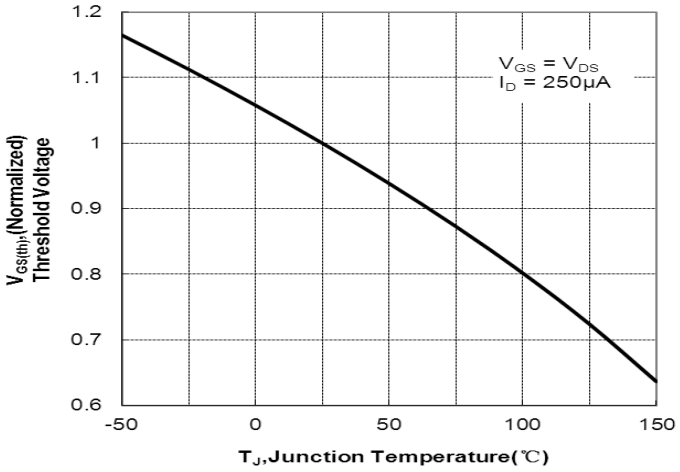


Figure 11 Typical Theshold Voltage vs Junction Temperature

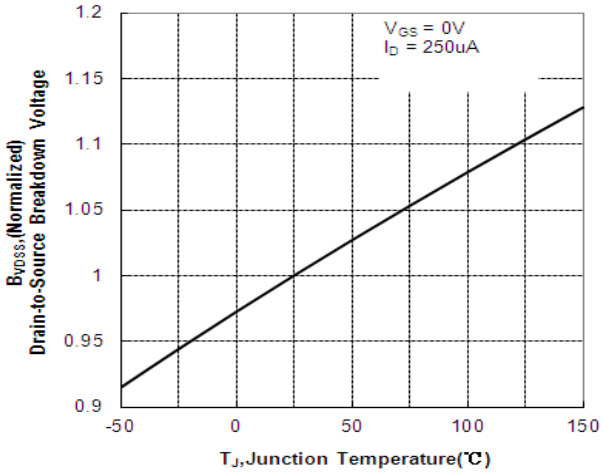


Figure 12 Typical Breakdown Voltage vs Junction Temperature

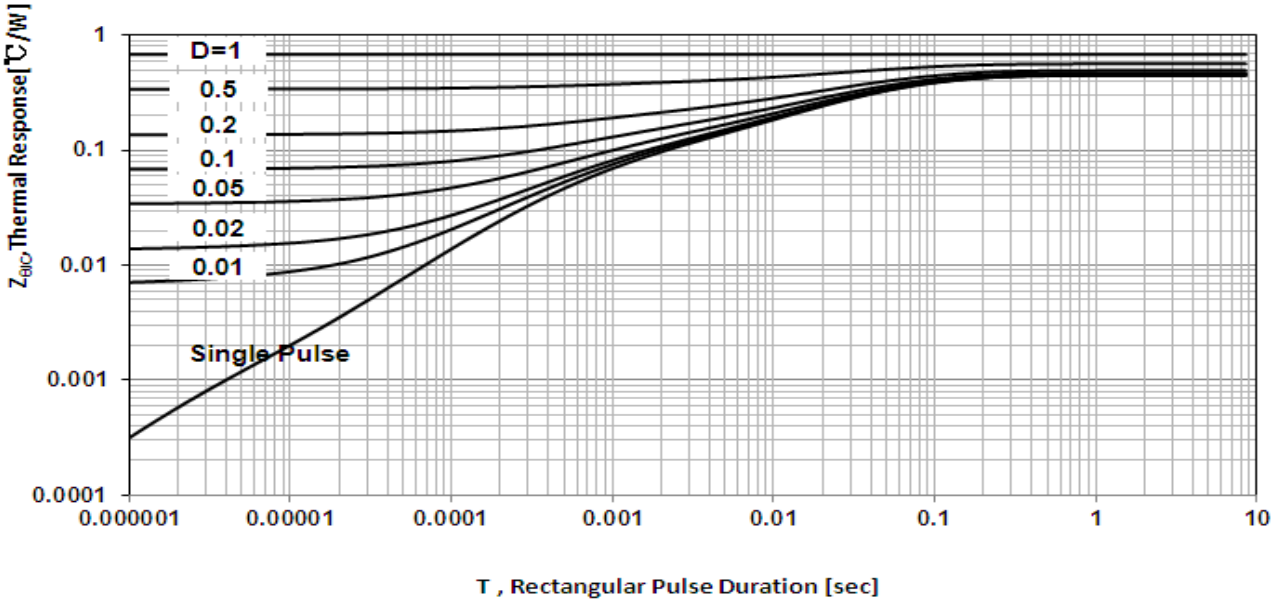


Figure 13 Maximum Effective Transient Thermal Impedance, Junction-to-Case

Test Circuit and Waveform

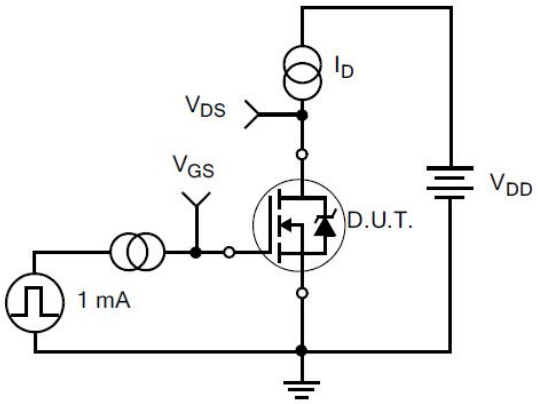


Figure 17. Gate Charge Test Circuit

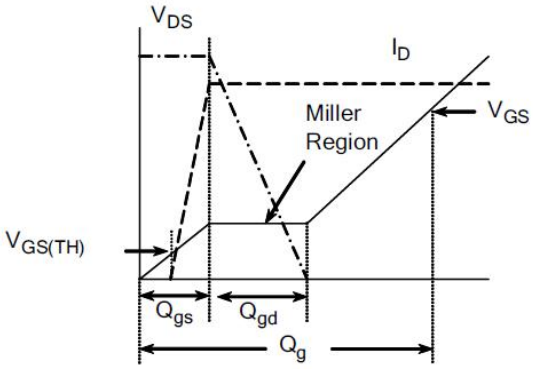


Figure 18. Gate Charge Waveform

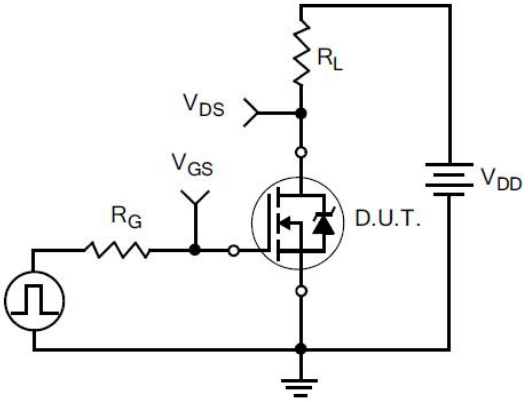


Figure 19. Resistive Switching Test Circuit

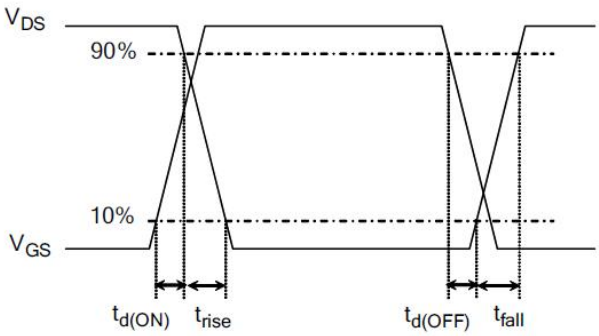


Figure 20. Resistive Switching Waveforms

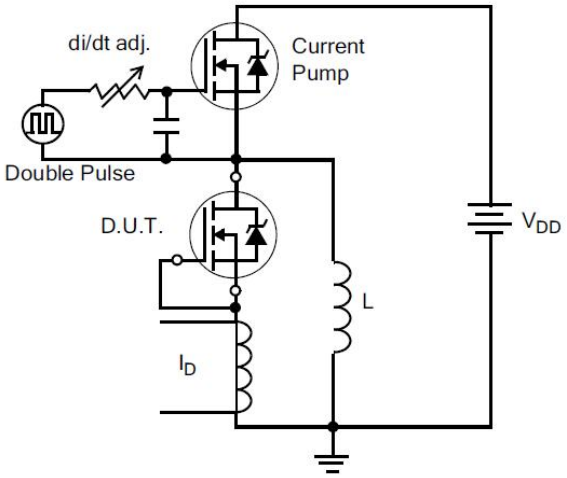


Figure 21. Diode Reverse Recovery Test Circuit

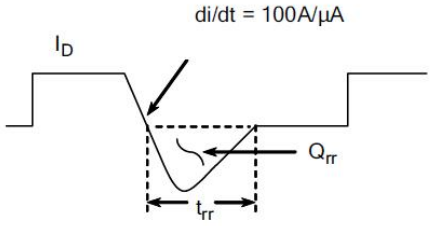


Figure 22. Diode Reverse Recovery Waveform

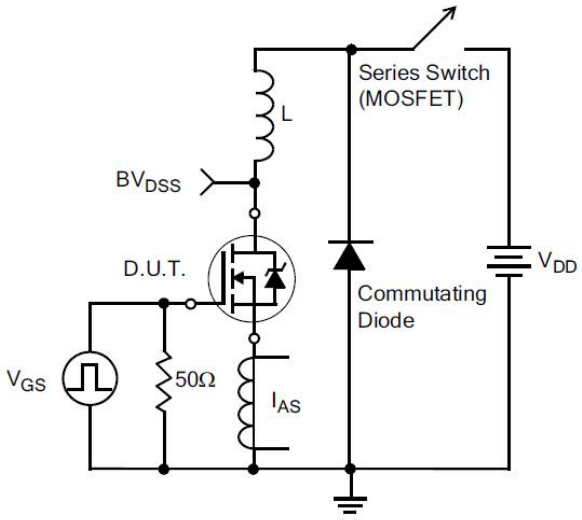
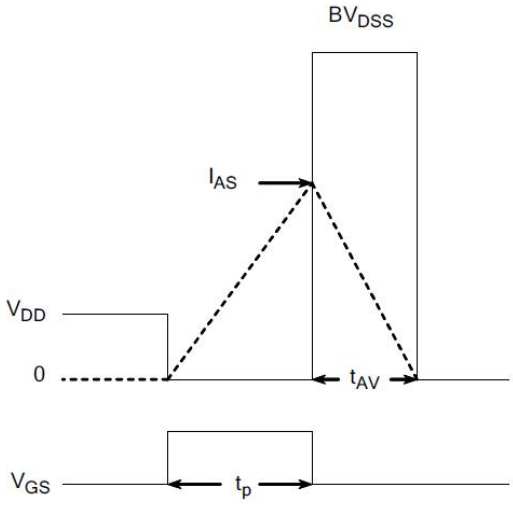


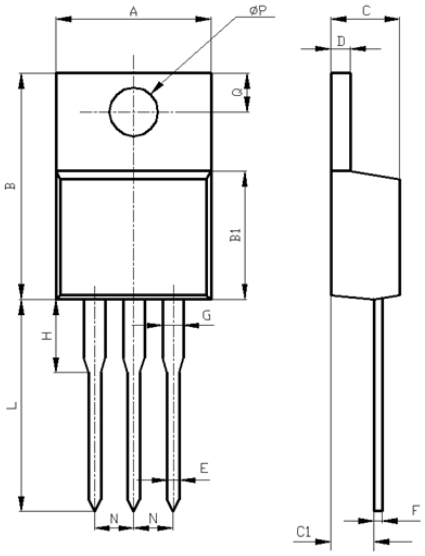
Figure 23. Unclamped Inductive Switching Test Circuit



$$E_{AS} = \frac{I_{AS}^2 L}{2}$$

Figure 24. Unclamped Inductive Switching Waveforms

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

The name and content of poisonous and harmful material in products

	Hazardous Substance									
	Pb	Hg	Cd	Cr(VI)	PBB	PBDE	DIBP	DEHP	DBP	BBP
Limit	≤0.1%	≤0.1%	≤ 0.01%	≤0.1%	≤0.1%	≤0.1%	≤0.1%	≤0.1%	≤0.1%	≤0.1%
Lead Frame	○	○	○	○	○	○	○	○	○	○
Molding	○	○	○	○	○	○	○	○	○	○
Chip	○	○	○	○	○	○	○	○	○	○
Wire Bonding	○	○	○	○	○	○	○	○	○	○
Solder	×	○	○	○	○	○	○	○	○	○
Note	○：Means the hazardous material is under the criterion of 2011/65/EU. ×：Means the hazardous material exceeds the criterion of 2011/65/EU. The plumbum element of solder exist in products presently, but within the allowed range of Eurogroup's RoHS.									

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 heatsink, please pay attention to the torsional moment and the smoothness of the heatsink.
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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