Silicon N-Channel Power MOSFET

CS3205 A8

V_{DSS}	60	V
I_D (Silicon limited current)	120	A
P_D (T_C=25℃)	230	W
$R_{DS(ON)Typ}$	7	mΩ

General Description：

CS3205 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.

Features：

- **Fast Switching**
- **Low ON Resistance(Rdson≤8mΩ)**
- **Low Gate Charge (Typical Data:75nC)**
- **Low Reverse transfer capacitances(Typical:75pF)**
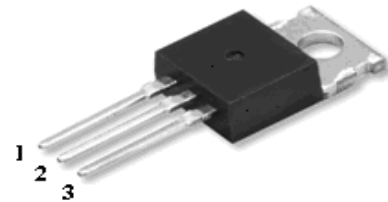- **100% Single Pulse avalanche energy Test**

Applications：

Power switch circuit of adaptor and charger.

TO-220AB

1.Gate 2. Drain 3. Source

Inner Equivalent Principium Chart

Absolute（Tc= 25℃ unless otherwise specified）：

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	60	V
I_D	Continuous Drain Current	120 [a1]	A
	Continuous Drain Current T_C = 100 ℃	84	A
I_{DM} [a2]	Pulsed Drain Current	480	A
V_{GS}	Gate-to-Source Voltage	±20	V
E_{AS} [a3]	Single Pulse Avalanche Energy	1300	mJ
dv/dt [a4]	Peak Diode Recovery dv/dt	3	V/ns
P_D	Power Dissipation	230	W
	Derating Factor above 25 ℃	1.4	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	60	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Bvdss Temperature Coefficient	ID=250uA,Reference25℃	--	0.08		V/℃
I_{DSS}	Drain to Source Leakage Current	V_{DS} =60V, V_{GS}= 0V, T_a = 25℃	--		1	μA
		V_{DS} =48V, V_{GS}= 0V, T_a = 125℃	--		125	
$I_{GSS(F)}$	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=50A	--	7	8	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.	
g_{fs}	Forward Trans conductance	V_{DS}=15V, I_D =50.0A	--	80	--	S
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1.0MHz	--	4000	--	pF
C_{oss}	Output Capacitance		--	750	--	
C_{rss}	Reverse Transfer Capacitance		--	75	--	

Resistive Switching Characteristics

Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	I_D =50.0A V_{DD} = 30V V_{GS} = 10V R_G = 3.6Ω	--	17	--	ns
tr	Rise Time		--	82	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	58	--	
t_f	Fall Time		--	30	--	
Q_g	Total Gate Charge	I_D =50.0A V_{DD} =30V V_{GS} = 10V	--	75		nC
Q_{gs}	Gate to Source Charge		--	18	--	
Q_{gd}	Gate to Drain ("Miller")Charge		--	26	--	

Source-Drain Diode Characteristics

Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)		--	--	120	A
I_{SM}	Maximum Pulsed Current (Body Diode)		--	--	480	A
V_{SD}	Diode Forward Voltage	I_S=50.0A,V_{GS}=0V	--	--	1.5	V
trr	Reverse Recovery Time	I_S=50.0A,T_j = 25°C	--	135	--	ns
Qrr	Reverse Recovery Charge	dI_F/dt=100A/us, V_{GS}=0V	--	360	--	nC
Pulse width tp≤300μs, δ ≤2%						

Symbol	Parameter	Max.	Units
$R_{\theta JC}$	Junction-to-Case	0.65	℃/W
$R_{\theta JA}$	Junction-to-Ambient	62.5	℃/W

[a1]：Drain Current limited by Maximum Package Current Rating, 75 Amps

[a2]：Repetitive rating; pulse width limited by maximum junction temperature

[a3]：L=260uH, I_D=101.5A, Start T_J=25℃

[a4]： I_{SD} =50A,di/dt ≤100A/us,V_{DD}≤$BV_{DS,}$ Start T_J=25℃

Characteristics Curve：

Figure 1. Maximum Effective Thermal Impedance, Junction-to-Case
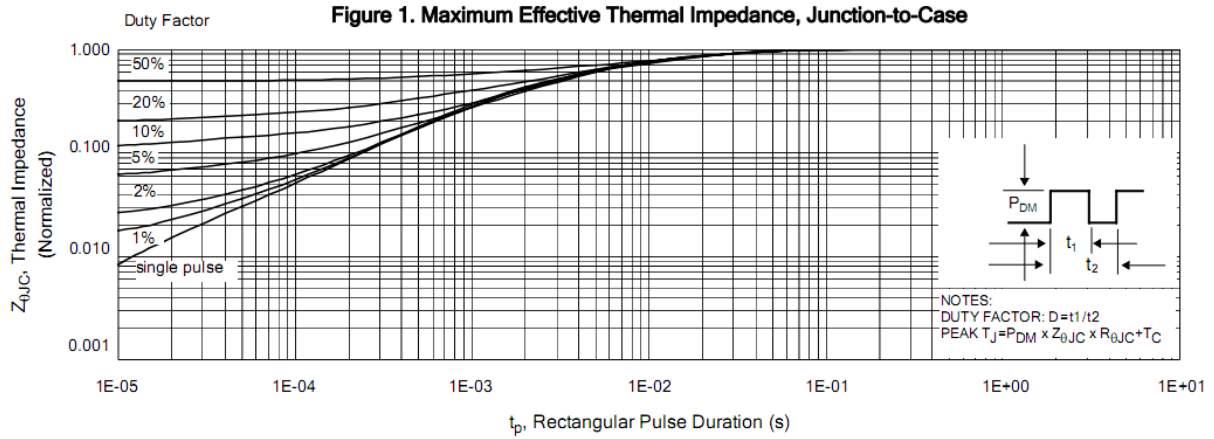
Figure 2. Maximum Power Dissipation vs Case Temperature

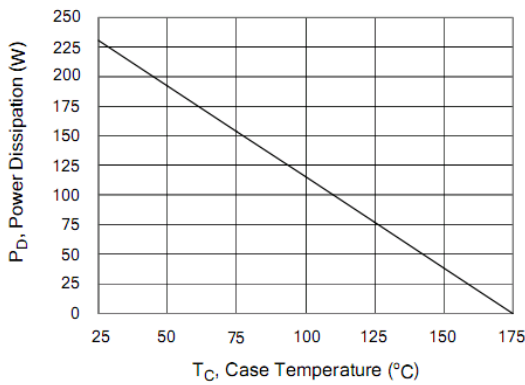

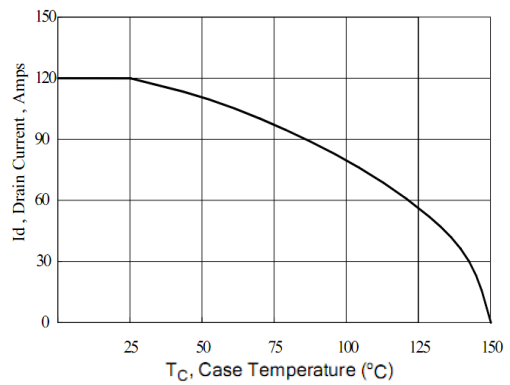Figure3. Maximum Continuous Drain Current vs Case Temperature
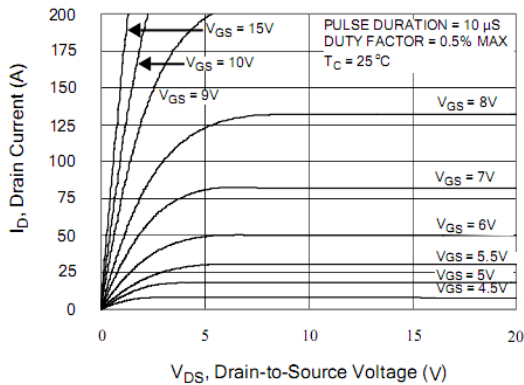

Figure 4. Typical Output Characteristics

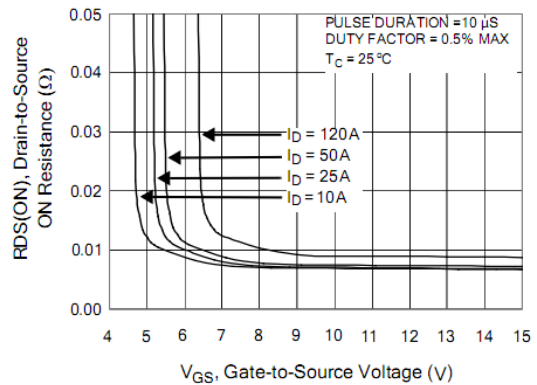Figure5. Typical Drain-to-Source ON Resistance vs Gate Voltage and Drain Current
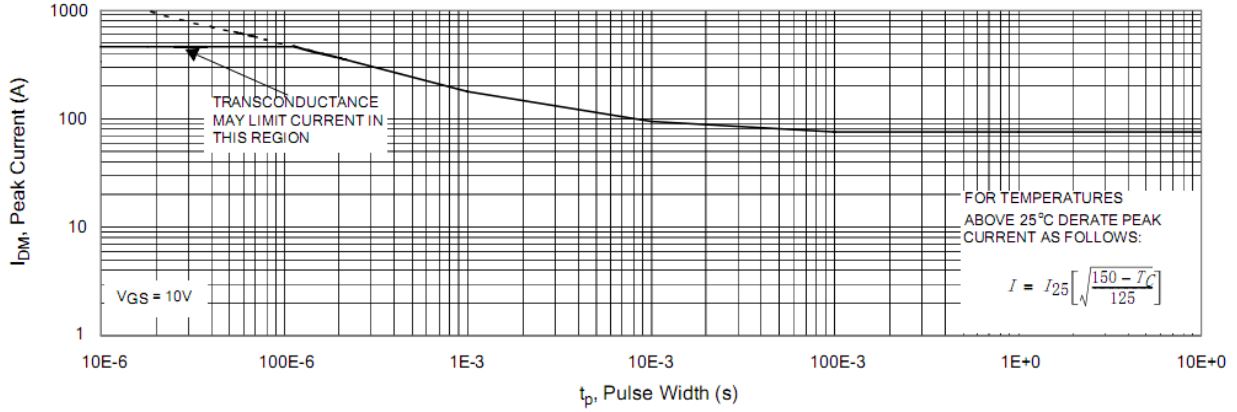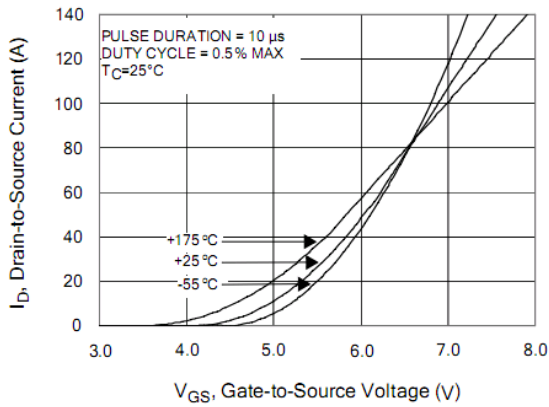
Figure 6. Maximum Peak Current Capability

TRANSCONDUCTANCE MAY LIMIT CURRENT IN THIS REGION

FOR TEMPERATURES ABOVE 25°C DERATE PEAK CURRENT AS FOLLOWS:

$$I = I_{25}\left[\sqrt{\frac{150 - T_C}{125}}\right]$$

V_{GS} = 10V

I_{DM}, Peak Current (A)

t_p, Pulse Width (s)

Figure 7. Typical Transfer Characteristics

PULSE DURATION = 10 μs
DUTY CYCLE = 0.5 % MAX
T_C = 25°C

+175 °C
+25 °C
−55 °C

I_D, Drain-to-Source Current (A)

V_{GS}, Gate-to-Source Voltage (V)

Figure 8. Unclamped Inductive Switching Capability

STARTING T_J = 25°C

STARTING T_J = 150°C

If R= 0: t_{AV} = (L×I_{AS})/(1.3BV$_{DSS}$-V$_{DD}$)
If R≠0: t_{AV} = (L/R) ln[I_{AS}×R)/(1.3BV$_{DSS}$-V$_{DD}$)+1]
Requals total Series resistance of Drain circuit

I_{AS}, Avalanche Current (A)

t_{AV}, Time in Avalanche (s)
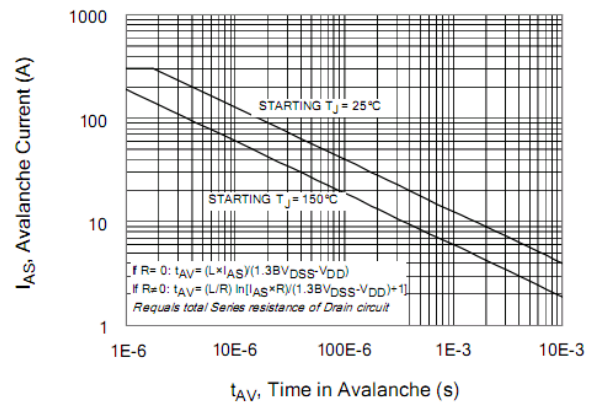
Figure 9. Typical Drain-to-Source ON Resistance vs Drain Current

PULSE DURATION = 10 μs
DUTY CYCLE = 0.5 % MAX
T_C = 25°C

V_{GS} = 10V

$R_{DS(ON)}$, Drain-to-Source ON Resistance (Ω)

I_D, Drain Current (A)
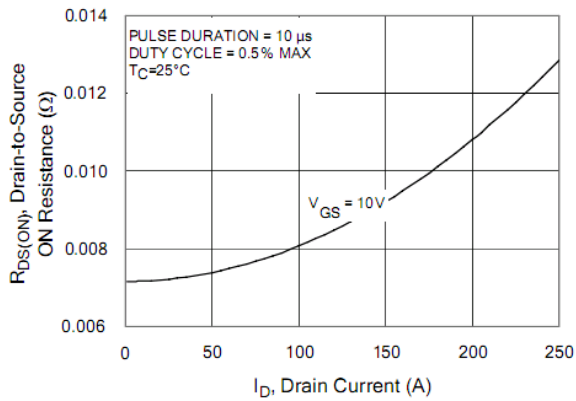
Figure 10. Typical Drain-to-Source ON Resistance vs Junction Temperature

PULSE DURATION = 10 μs
DUTY CYCLE = 0.5 % MAX
V_{GS} = 10V, I_D = 50A

$R_{DS(ON)}$, Drain-to-Source Resistance (Normalized)

T_J, Junction Temperature (°C)
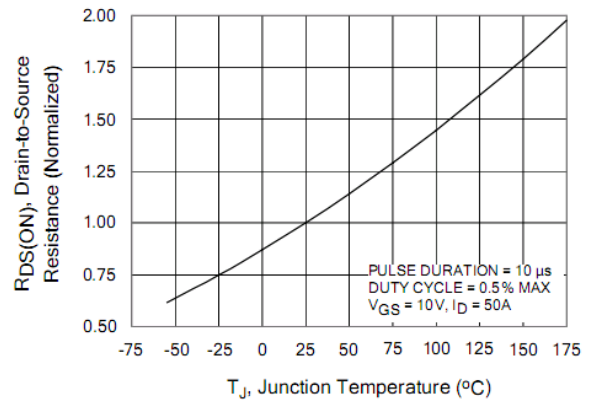
Figure 11. Typical Breakdown Voltage vs Junction Temperature

$V_{GS} = 0V$
$I_D = 250 \mu A$

T$_J$, Junction Temperature (°C)

BV$_{DSS}$, Drain-to-Source Breakdown Voltage (Normalized)
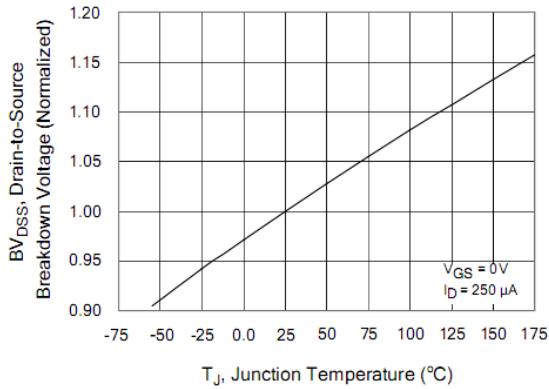
Figure 12. Typical Threshold Voltage vs Junction Temperature

$V_{GS} = V_{DS}$
$I_D = 250 \mu A$

T$_J$, Junction Temperature (°C)

V$_{GS(TH)}$, Threshold Voltage (Normalized)
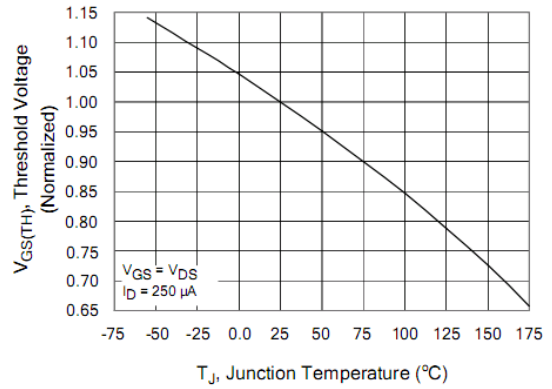
Figure 13. Maximum Forward Bias Safe Operating Area

10 μs
100 μs
1ms
10ms
DC

OPERATION IN THIS AREA MAY BE LIMITED BY R$_{DS(ON)}$
T$_J$=MAX RATED
T$_C$=25°C Single Pulse

Id, Drain Current, Amps

V$_{DS}$, Drain-to-Source Voltage (V)
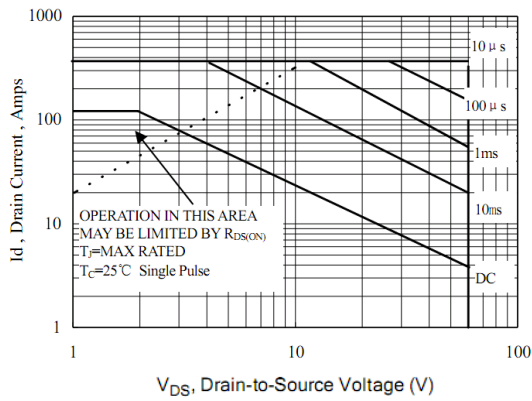
Figure 14. Typical Capacitance vs Drain-to-Source Voltage

C$_{iss}$
C$_{oss}$
C$_{rss}$

$V_{GS} = 0V, f = 1MHz$
$C_{iss} = C_{gs} + C_{gd}$
$C_{oss} \cong C_{ds} + C_{gd}$
$C_{rss} = C_{gd}$

C, Capacitance (pF)

V$_{DS}$, Drain Voltage (V)
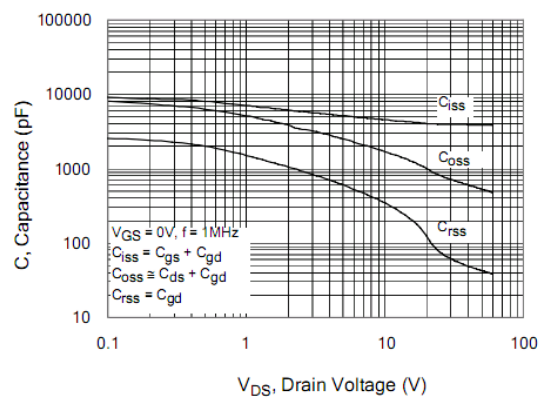
Figure 15. Typical Gate Charge vs Gate-to-Source Voltage

$V_{DS} = 15V$
$V_{DS} = 30V$
$V_{DS} = 45V$

$I_D = 75A$

V$_{GS}$, Gate-to-Source Voltage (V)

Q$_G$, Total Gate Charge (nC)
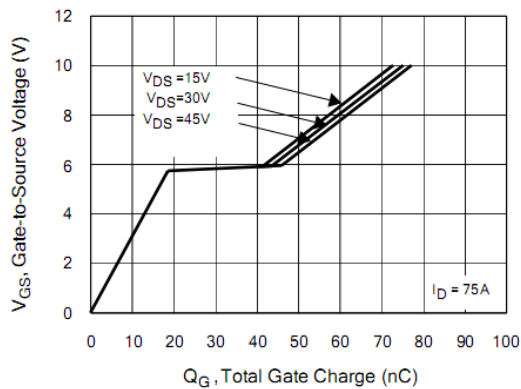
Figure 16. Typical Body Diode Transfer Characteristics

175°C
25°C

$V_{GS} = 0V$

I$_{SD}$, Reverse Drain Current (A)

V$_{SD}$, Source-to-Drain Voltage (V)
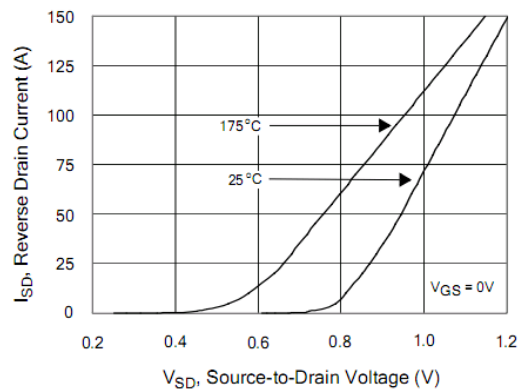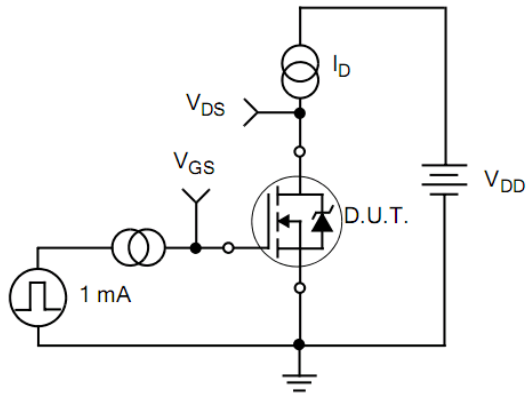
Test Circuit and Waveform
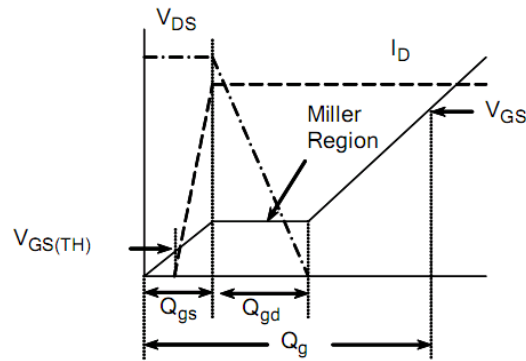

Figure 17. Gate Charge Test Circuit

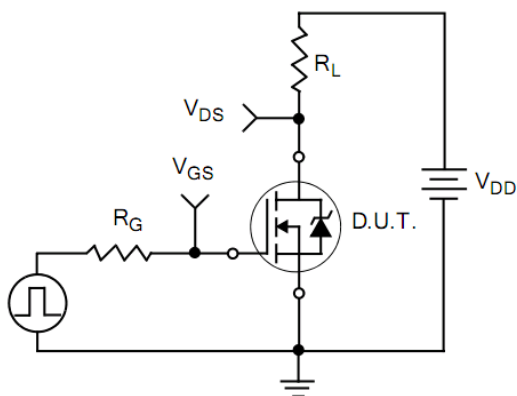Figure 18. Gate Charge Waveform

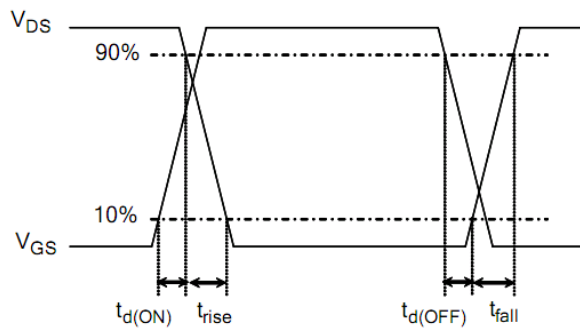Figure 19. Resistive Switching Test Circuit

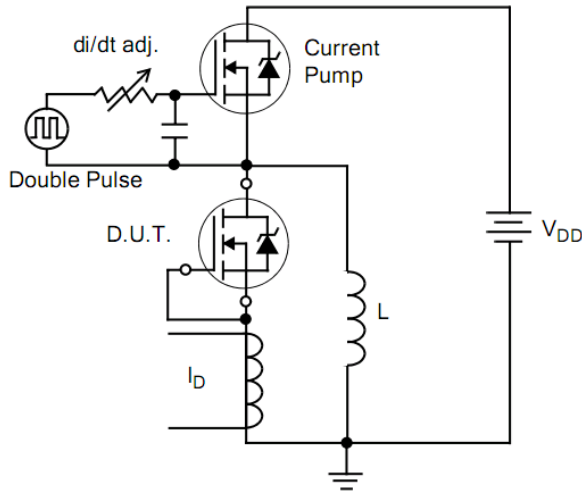Figure 20. Resistive Switching Waveforms

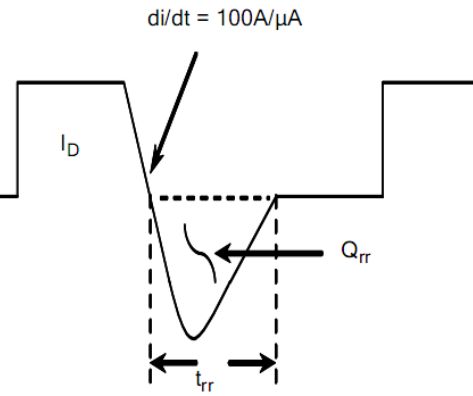Figure 21. Diode Reverse Recovery Test Circuit

Figure 22. Diode Reverse Recovery Waveform

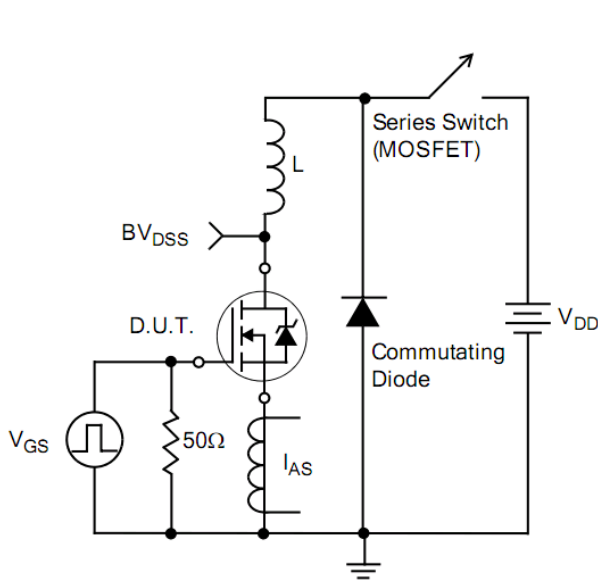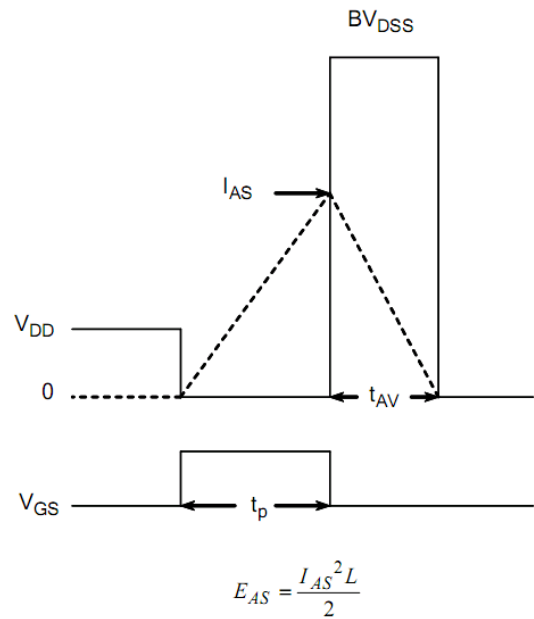Figure 23. Unclamped Inductive Switching Test Circuit

Figure 24. Unclamped Inductive Switching Waveforms

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

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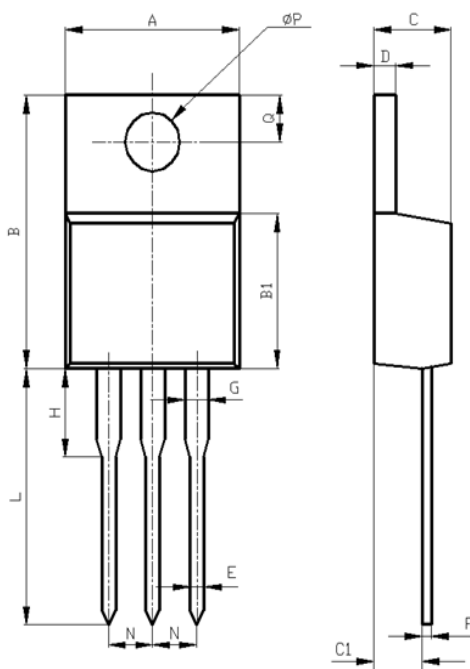
Items	Values(mm)	
	MIN	MAX
A	9.60	10.6
B	15.0	16.0
B1	8.90	9.50
C	4.30	4.80
C1	2.30	3.10
D	1.20	1.40
E	0.70	0.90
F	0.30	0.60
G	1.17	1.37
H	2.70	3.80
L*	12.6	14.8
N	2.34	2.74
Q	2.40	3.00
ΦP	3.50	3.90

*adjustable

TO-220AB Package

The name and content of poisonous and harmful material in products

Part's Name	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.