Silicon N-Channel Power MOSFET

CS12N65 A0R

V_{DSS}	650	V
I_D	12	A
$P_D(T_C=25℃)$	150	W
$R_{DS(ON)Typ}$	0.66	Ω

General Description：

CS12N65 A0R, 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-263, which accords with the RoHS standard.

TO-263

Features：

- **Fast Switching**
- **Low ON Resistance(Rdson≤0.8Ω)**
- **Low Gate Charge** (Typical Data:40nC)
- **Low Reverse transfer capacitances(Typical:9.5pF)**
- **100% Single Pulse avalanche energy Test**

Applications：

Power switch circuit of adaptor and charger.

Inner Equivalent Principium Chart

Absolute （Tc= 25℃ unless otherwise specified）：
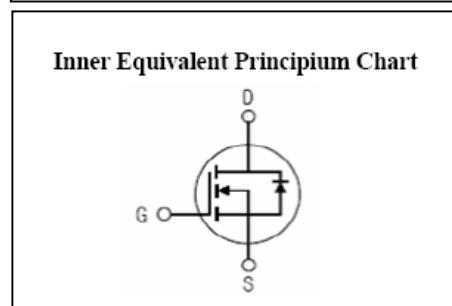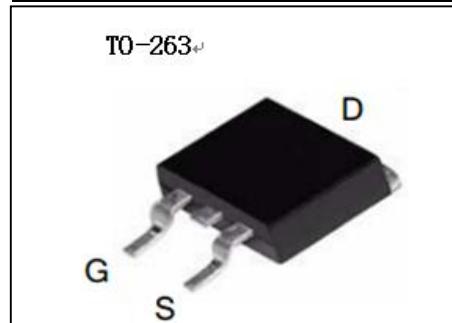
Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	650	V
I_D	Continuous Drain Current	12	A
	Continuous Drain Current $T_C = 100$ °C	7.5	A
I_{DM} a1	Pulsed Drain Current	48	A
V_{GS}	Gate-to-Source Voltage	± 30	V
E_{AS} a2	Single Pulse Avalanche Energy	550	mJ
dv/dt a3	Peak Diode Recovery dv/dt	5.0	V/ns
P_D	Power Dissipation	150	W
	Derating Factor above 25°C	1.2	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	650	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Bvdss Temperature Coefficient	ID=250uA,Reference25℃	--	0.7	--	V/℃
I_{DSS}	Drain to Source Leakage Current	V_{DS}=650V, V_{GS}= 0V, T_a = 25℃	--	--	1	μA
		V_{DS} =520V, V_{GS}= 0V, T_a = 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	Rating			Units
			Min.	Typ.	Max.	
$R_{DS(ON)}$	Drain-to-Source On-Resistance	V_{GS}=10V,I_D=6A	--	0.66	0.8	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 Transconductance	V_{DS}=15V, I_D =6A	--	12	--	S
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1.0MHz	--	1993	--	pF
C_{oss}	Output Capacitance		--	160	--	
C_{rss}	Reverse Transfer Capacitance		--	9.5	--	

Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	I_D =12A V_{DD} = 325V R_G =10Ω	--	28	--	ns
tr	Rise Time		--	26	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	64	--	
t_f	Fall Time		--	45	--	
Q_g	Total Gate Charge	I_D =12A V_{DD} =520V V_{GS} = 10V	--	40	--	nC
Q_{gs}	Gate to Source Charge		--	10	--	
Q_{gd}	Gate to Drain ("Miller")Charge		--	14	--	

Source-Drain Diode Characteristics

Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)		--	--	12	A
I_{SM}	Maximum Pulsed Current (Body Diode)		--	--	48	A
V_{SD}	Diode Forward Voltage	I_S=12A,V_{GS}=0V	--	--	1.5	V
trr	Reverse Recovery Time	I_S=12A,T_j = 25℃ dI$_F$/dt=100A/us, V_{GS}=0V	--	651	--	ns
Qrr	Reverse Recovery Charge		--	4297	--	nC
I_{RRM}	Reverse Recovery Current		--	13.2	--	A
Pulse width tp≤300μs, δ ≤2%						

Symbol	Parameter	Max.	Units
$R_{\theta JC}$	Junction-to-Case	0.83	℃/W
$R_{\theta JA}$	Junction-to-Ambient	62.5	℃/W

[a1]：Repetitive rating; pulse width limited by maximum junction temperature

[a2]：L=10mH, I_D=10.5A, Start T_J=25℃

[a3]：I_{SD} =12A,di/dt ≤100A/us,V_{DD}≤BV$_{DS,}$ Start T_J=25℃

Characteristics Curve：
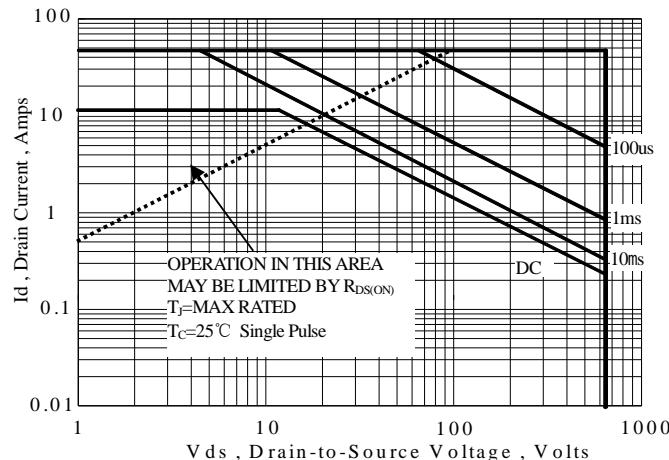
Figure　1　Maximum Forward Bias Safe Operating Area
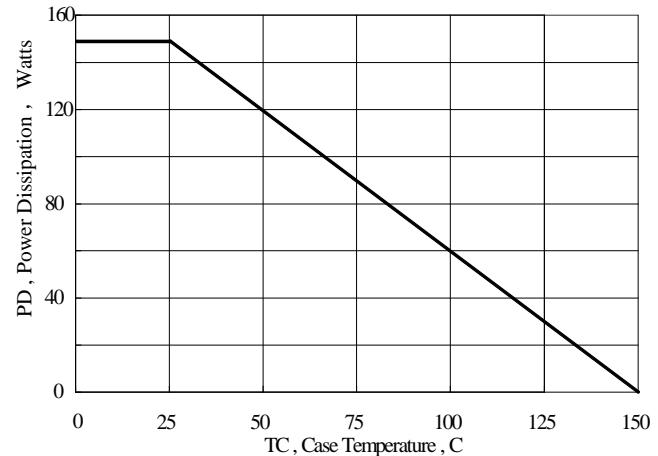
Figure　2　Maximum Power Dissipation vs Case Temperature
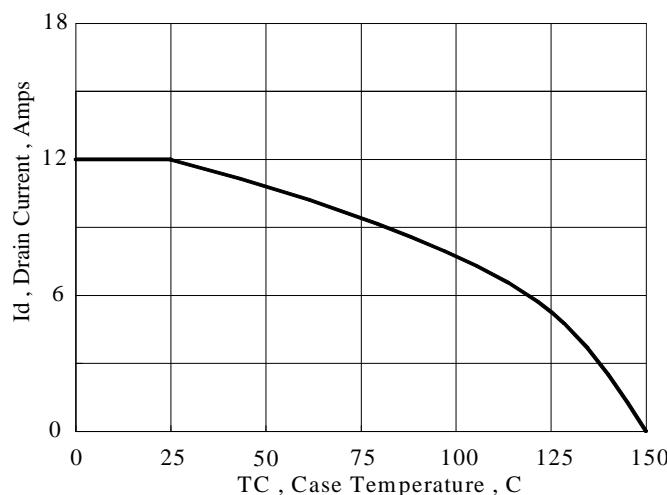
Figure　3　Maximum Continuous Drain Current vs Case Temperature
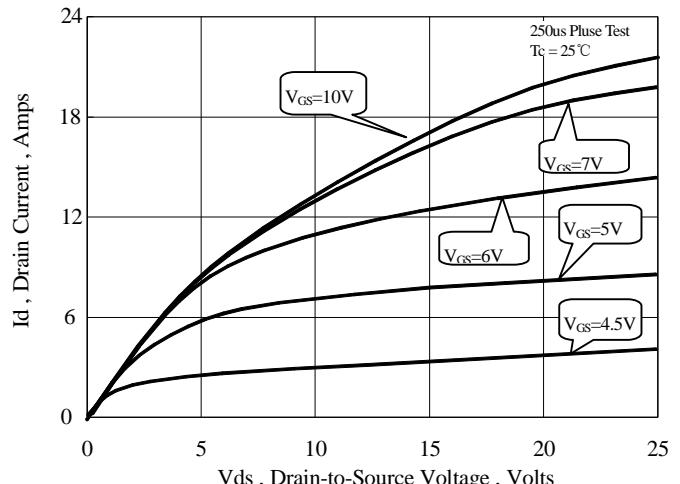
Figure　4　Typical Output Characteristics
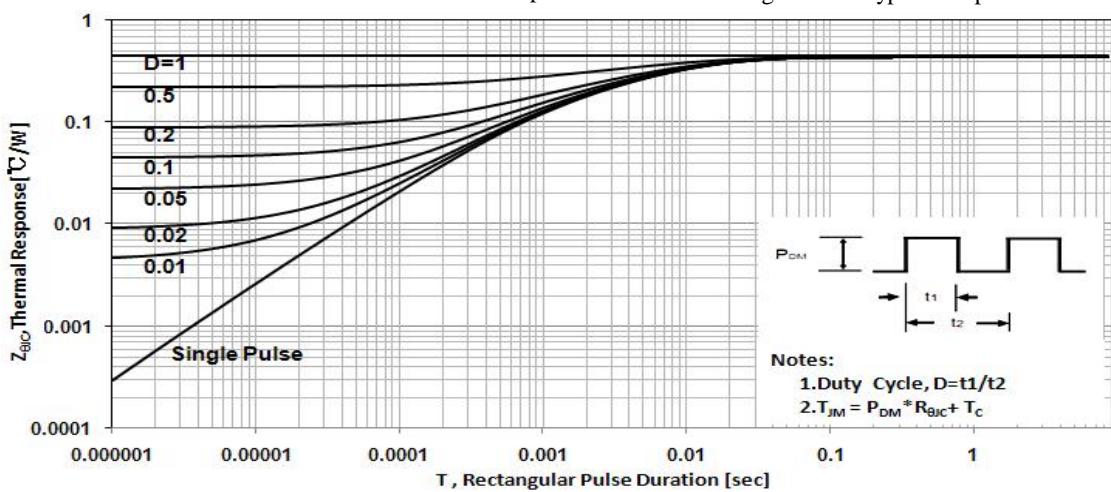
Figure　5　Maximum Effective Thermal Impendance , Junction to Case
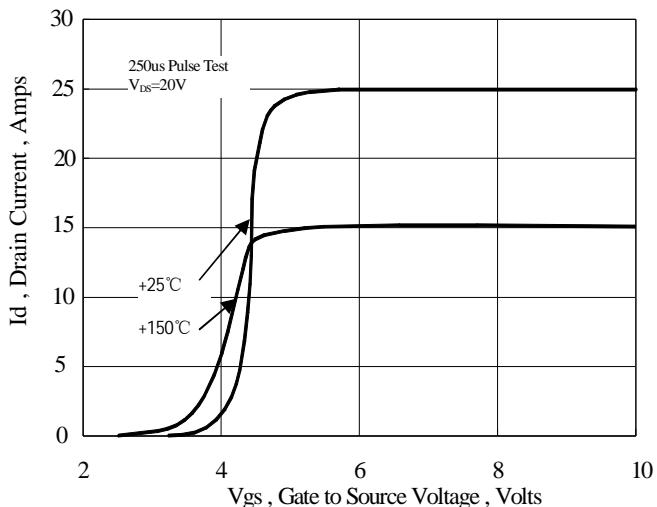
Figure 6 Typical Transfer Characteristics
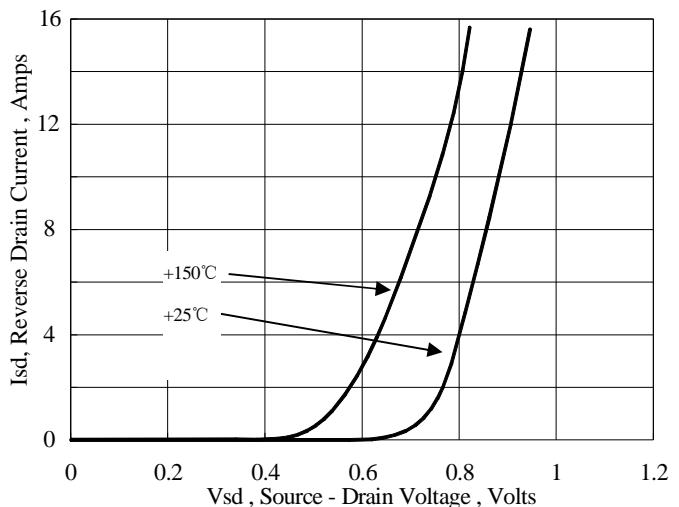
Figure 7 Typical Body Diode Transfer Characteristics
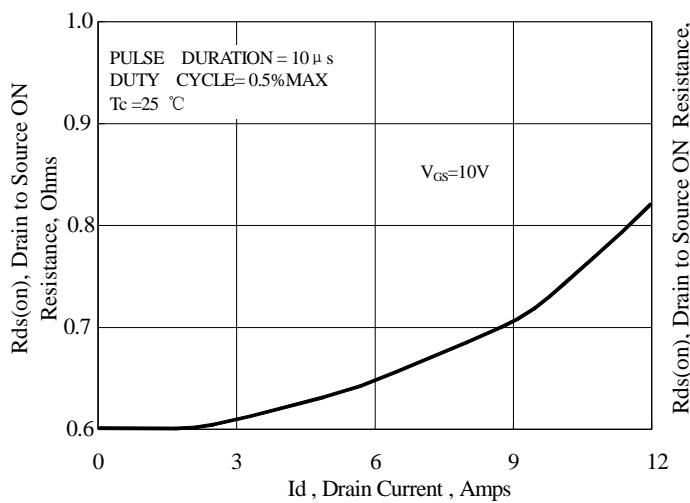
Figure 8 Typical Drain to Source ON Resistance
vs Drain Current
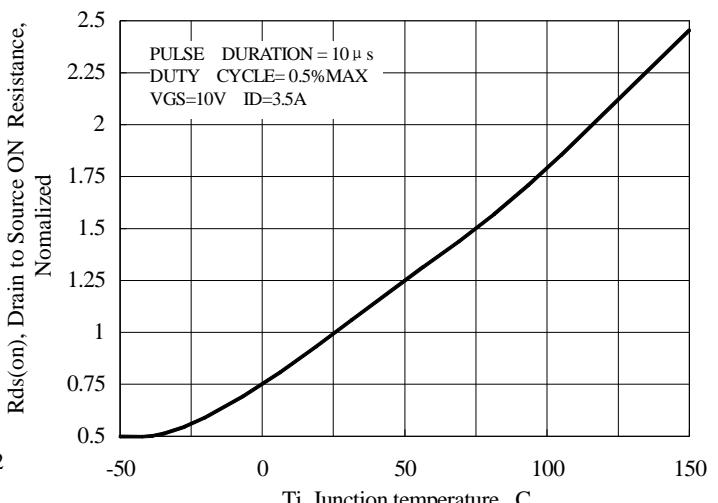
Figure 9 Typical Drian to Source on Resistance
vs Junction Temperature
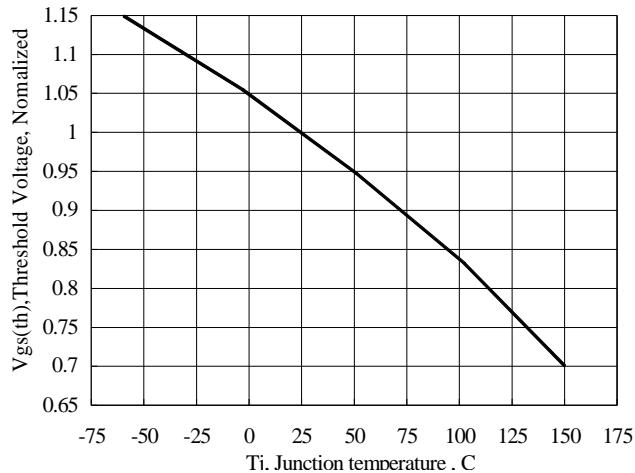
Figure 10 Typical Theshold Voltage vs Junction Temperature
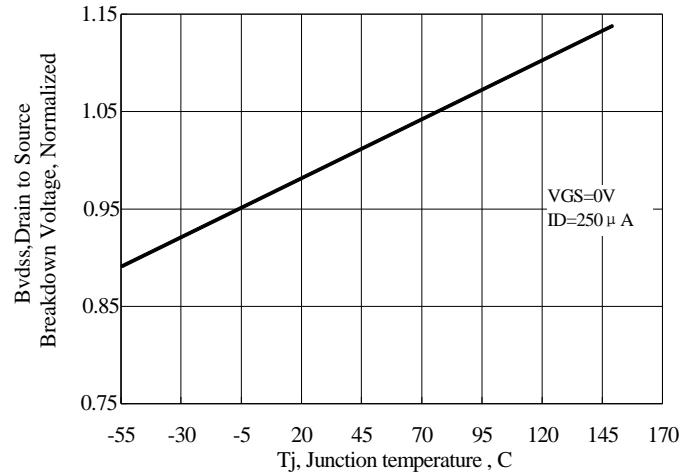
Figure 11 Typical Breakdown Voltage vs Junction Temperature
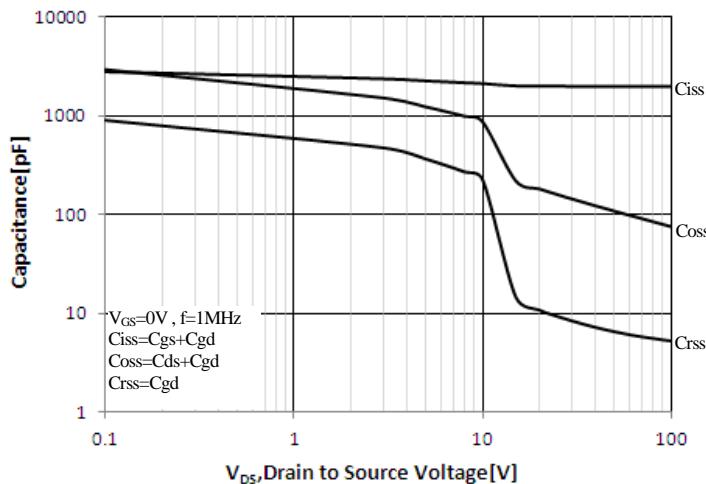
Figure 12 Typical Capacitance vs Drain to Source Voltage
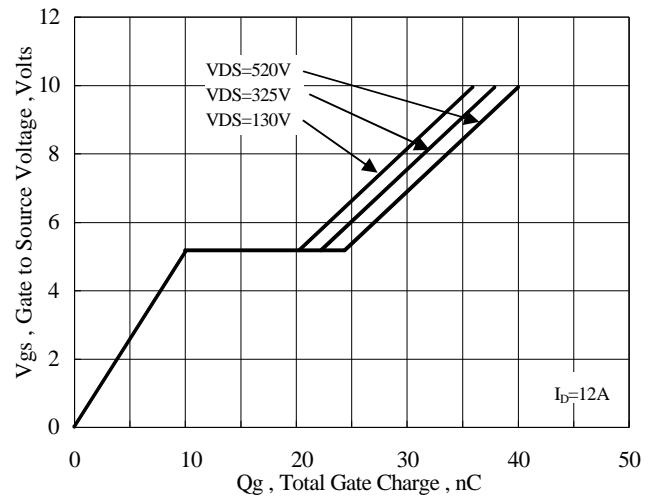
Figure 13 Typical Gate Charge vs Gate to Source Voltage

Test Circuit and Waveform
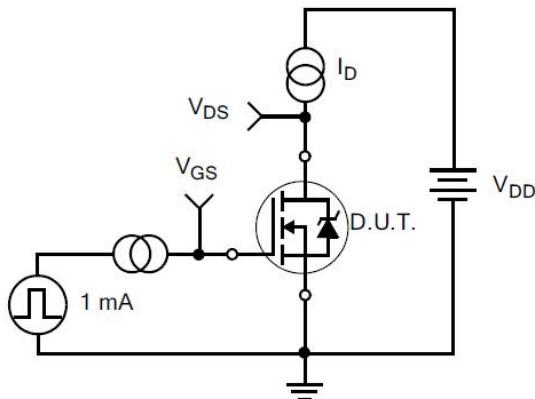

Figure 17. Gate Charge Test Circuit
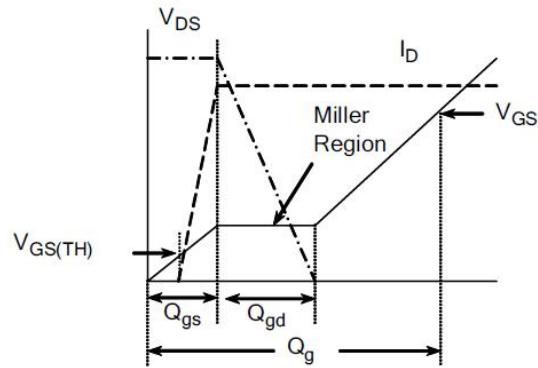

Figure 18. Gate Charge Waveform
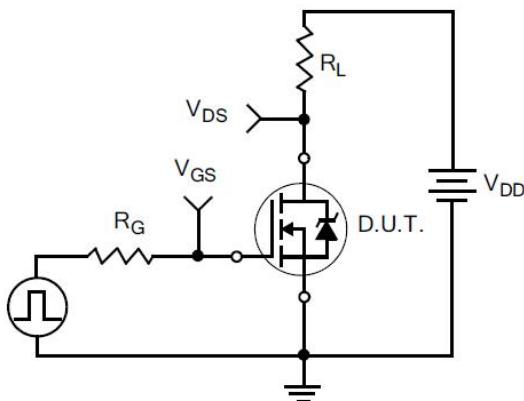
Figure 19. Resistive Switching Test Circuit
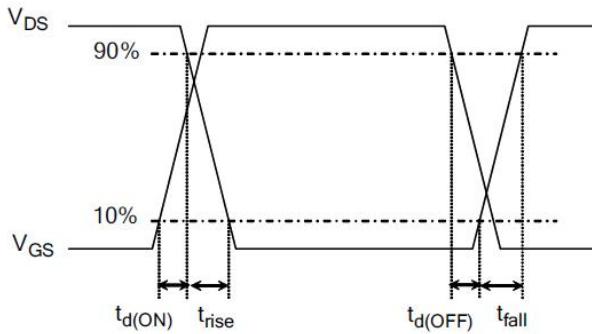
Figure 20. Resistive Switching Waveforms
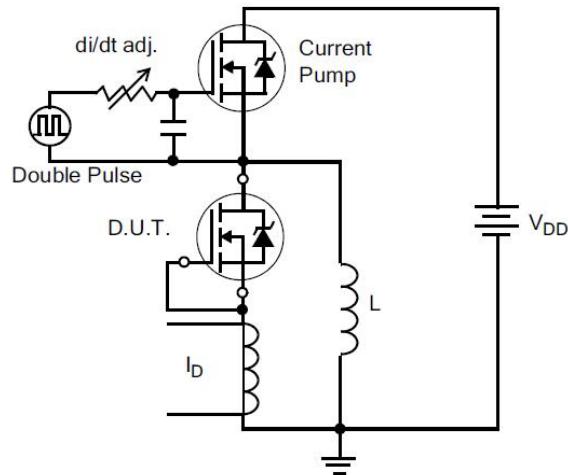
Figure 21. Diode Reverse Recovery Test Circuit
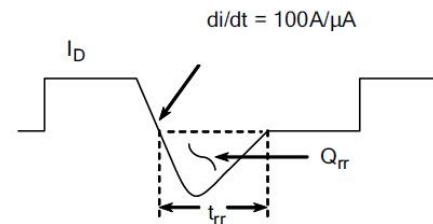
Figure 22. Diode Reverse Recovery Waveform
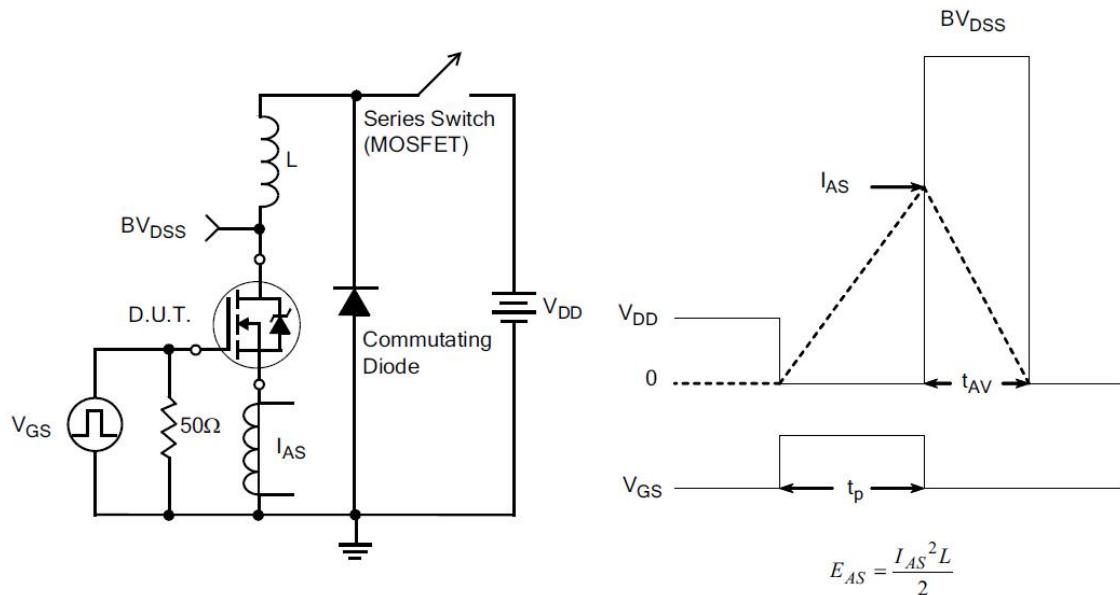
Figure 23. Unclamped Inductive Switching Test Circuit

$$E_{AS} = \frac{I_{AS}^2 L}{2}$$
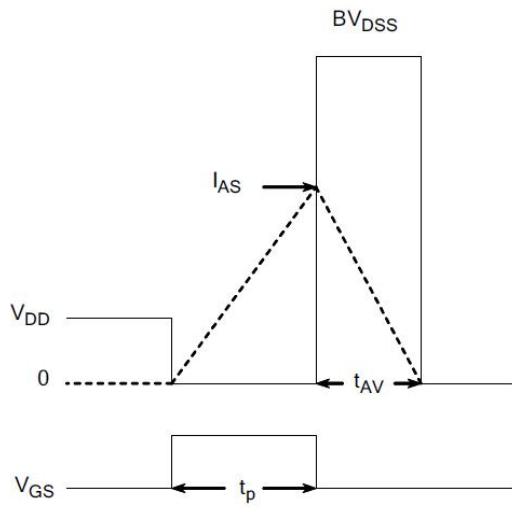
Figure 24. Unclamped Inductive Switching Waveforms

Package Information
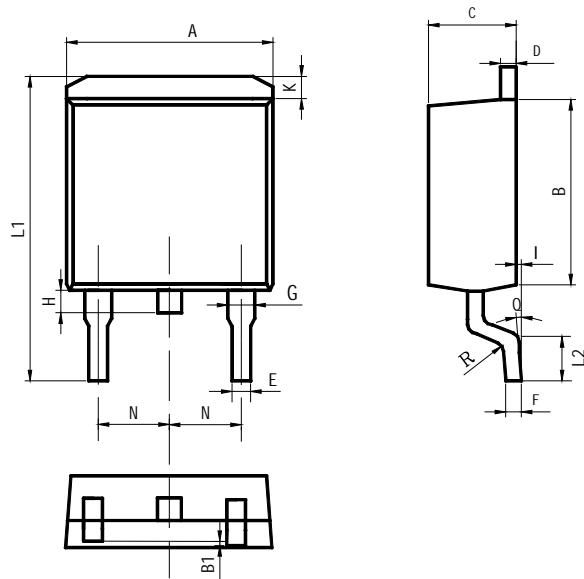
Items	Values(mm)	
	MIN	MAX
A	9.80	10.40
B	8.90	9.50
B1	0	0.10
C	4.40	4.80
D	1.16	1.37
E	0.70	0.95
F	0.30	0.60
G	1.07	1.47
H	1.30	1.80
K	0.95	1.37
L1	14.50	16.50
L2	1.60	2.30
I	0	0.2
Q	0°	**8°**
R	0.4	
N	2.39	2.69

TO-263Package

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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