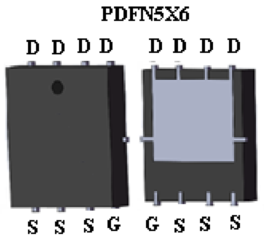
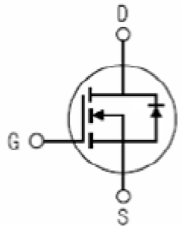
Silicon N-Channel Power MOSFET

CRTM021N04L2-G

V_{DSS}	40	V
I_D（Silicon limited current）	230	A
I_D（Package limited current）	60	A
P_D	178.5	W
$R_{DS(ON)Typ}$	1.65	mΩ



Inner Equivalent Principium Chart



General Description:

CRTM021N04L2-G, the silicon N-channel Enhanced VDMOSFETs, is obtained by the high density Trench technology which reduce the conduction loss, improve switching performance and enhance the avalanche energy. This device can be used in load switch and power switch applications. The package form is PDFN5*6, which accords with the RoHS standard.

Features:

- **Fast Switching**
- **Low ON Resistance（Rdson≤2.1mΩ）**
- **Low Gate Charge**
- **Low Reverse transfer capacitances**
- **100% Single Pulse avalanche energy Test**
- **Halogen Free**

Applications:

load switch and power switch applications.

Absolute（T_j= 25℃ unless otherwise specified）

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	40	V
I_D	Continuous Drain Current T_C = 25 ℃	230	A
	Continuous Drain Current T_C = 25 ℃（Package limited）	60	A
	Continuous Drain Current T_C = 100 ℃（Package limited）	60	A
I_{DM} [a1]	Pulsed Drain Current T_C = 25 ℃	240	A
V_{GS}	Gate-to-Source Voltage	±20	V
E_{AS} [a2]	Avalanche Energy	630	mJ
P_D	Power Dissipation T_C = 25 ℃	178.5	W
	Derating Factor above 25 ℃	1.4	W/℃
T_J，T_{stg}	Operating Junction and Storage Temperature Range	150，–55 to 150	℃

Electrical Characteristics（T_J= 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_J = 25℃	--	--	1	μA
		V_{DS} =32V, V_{GS}= 0V, T_J = 125℃	--	--	100	
$I_{GSS(F)}$	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=19A	--	1.65	2.1	mΩ
		V_{GS}=4.5V,I_D=19A	--	2.1	2.7	mΩ
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	1	1.4	2	V
Pulse width tp≤300μs, δ ≤2%						

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
R_g	Gate resistance	V_{GS}=0V,V_{DS}=0V,f=1MHz	--	2.5	--	Ω
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} =20V f = 1.0MHz	--	7247	--	pF
C_{oss}	Output Capacitance		--	670	--	
C_{rss}	Reverse Transfer Capacitance		--	637	--	

Resistive Switching Characteristics

Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	V_{GS}=10V，R_G=3Ω V_{DD}=20V，I_D=19A	--	19.2	--	ns
tr	Rise Time		--	26	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	114.6	--	
t_f	Fall Time		--	48.8	--	
Q_g	Total Gate Charge	I_D =19A V_{DD} =20V V_{GS} = 10V	--	134	--	nC
Q_{gs}	Gate to Source Charge		--	16	--	
Q_{gd}	Gate to Drain (“Miller”)Charge		--	29.75	--	

Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)	TC = 25℃	--	--	60	A
I_{SM}	Maximum Pulsed Current (Body Diode)		--	--	240	A
V_{SD}	Diode Forward Voltage	I_S=19A,V_{GS}=0V	--	--	1.2	V
trr	Reverse Recovery Time	di/dt=100A/us Is=19A	--	63.7	--	ns
Qrr	Reverse Recovery Charge		--	60.8	--	nC
Pulse width tp≤300μs, δ ≤2%						

Symbol	Parameter	Max.	Units
$R_{\theta JC}$	Junction-to-Case	0.7	℃/W
$R_{\theta JA}$	Junction-to-Ambition	62.5	℃/W

Notes:

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

[a2]: L=0.5mH, I_D=50.3A, Start T_J=25℃

[a3]: Recommend soldering temperature defined by IPC/JEDEC J-STD 020

Characteristics Curve:

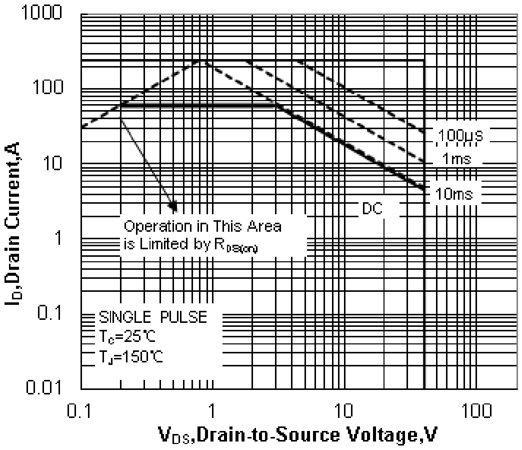


Figure 1 . Maximum Safe Operating Area

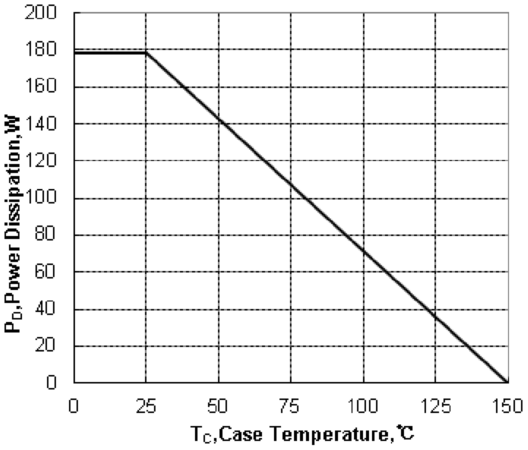


Figure 2. Maximum Power Dissipation vs Case Temperature

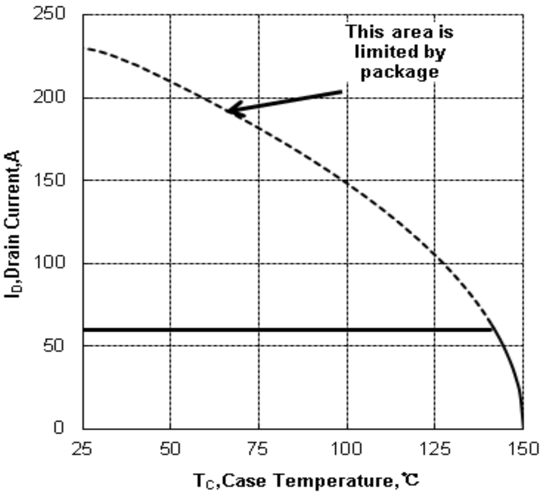


Figure 3. Maximum Continuous Drain Current vs Case Temperature

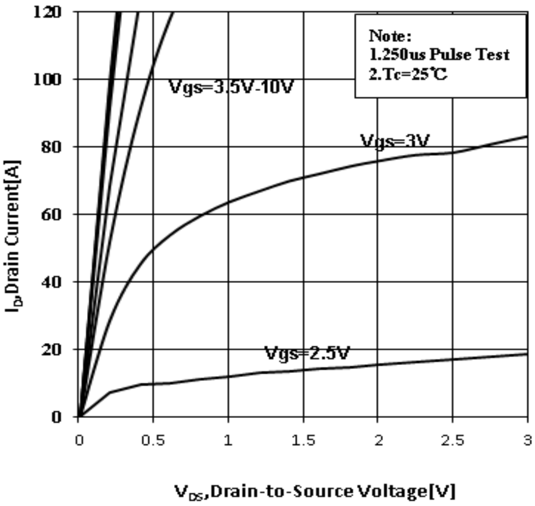


Figure 4. Typical output Characteristics

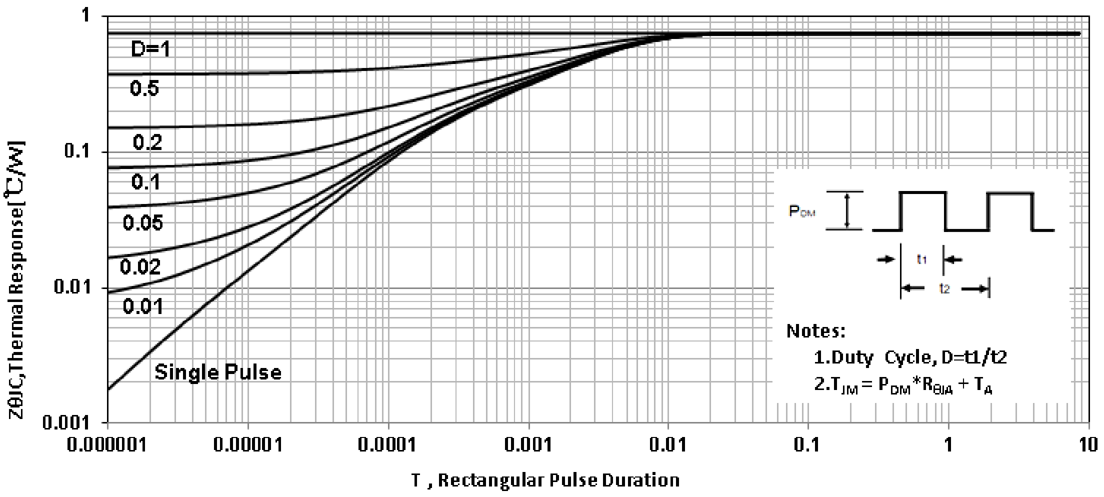


Figure 5 Maximum Effective Thermal Impedance , Junction to Case

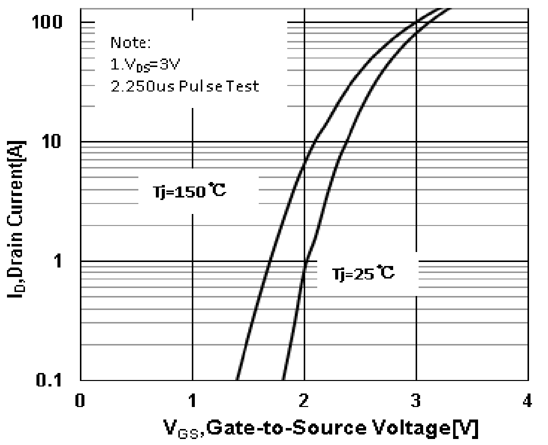


Figure 6 Typical Transfer Characteristics

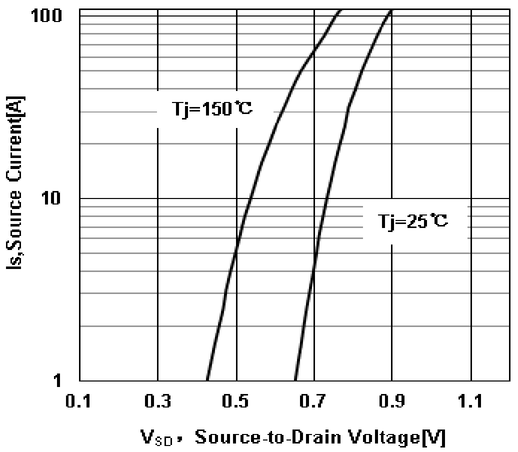


Figure 7 Typical Body Diode Transfer Characteristics

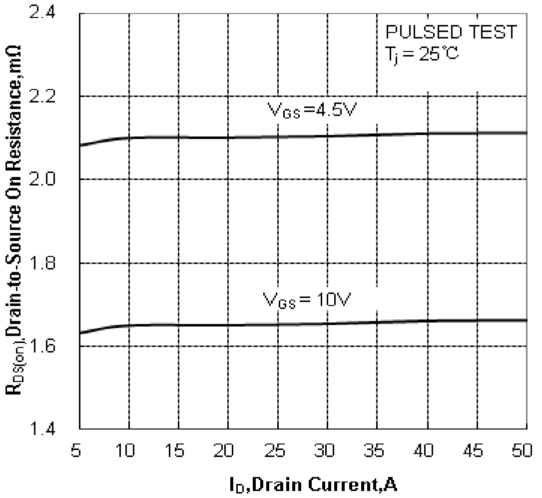


Figure 8. Drain-to-Source On Resistance vs Drain Current

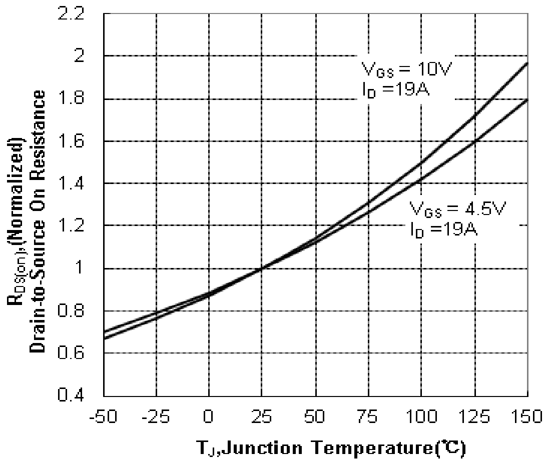


Figure 9. Normalized On Resistance vs Junction Temperature

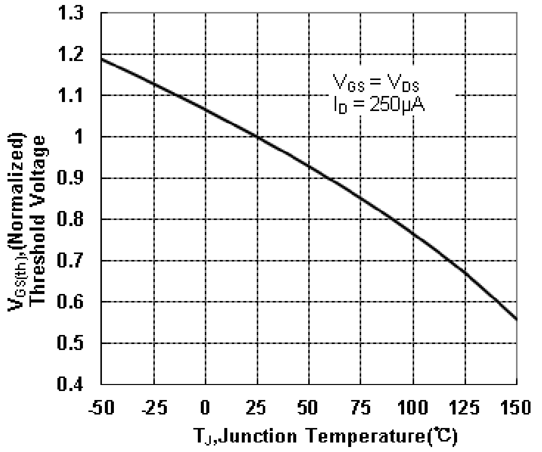


Figure10. Normalized Threshold Voltage vs Junction Temperature

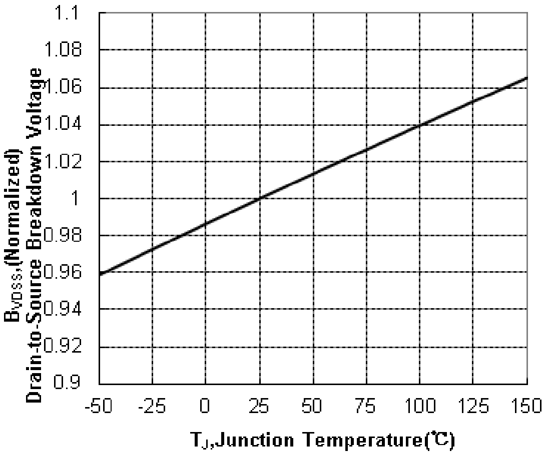


Figure 11. Normalized Breakdown Voltage vs Junction Temperature

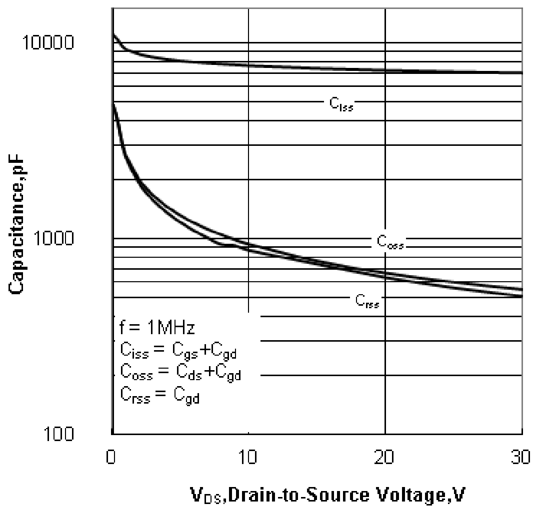


Figure 12. Capacitance Characteristics

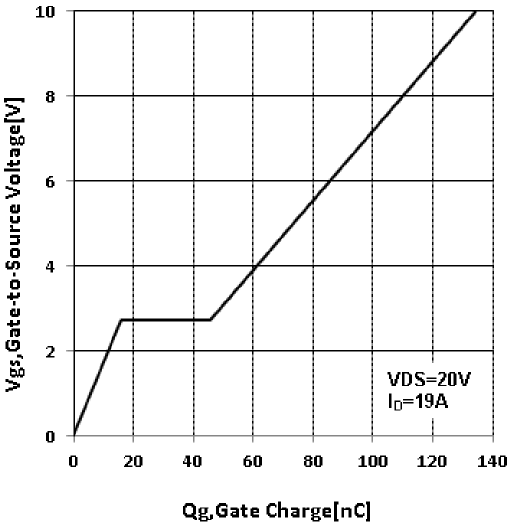


Figure 13 Typical Gate Charge vs Gate to Source Voltage

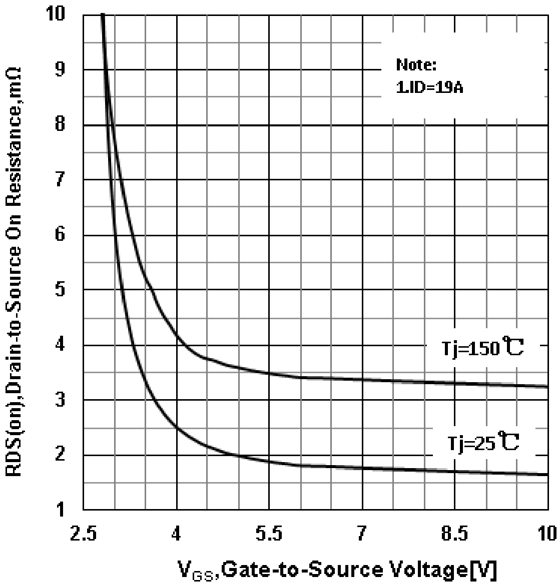


Figure 14 . Drain-to-Source On Resistance vs Gate Voltage

Test Circuit and Waveform:

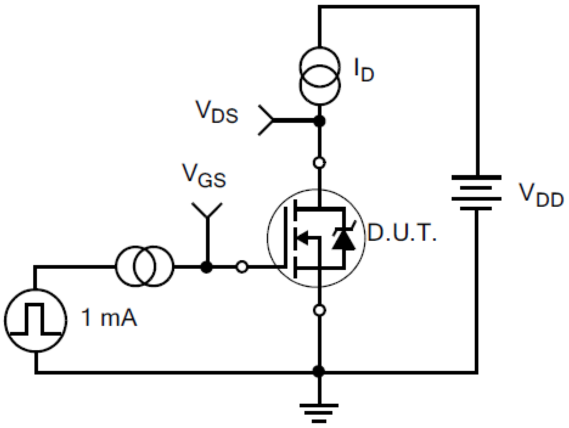


Figure 15. Gate Charge Test Circuit

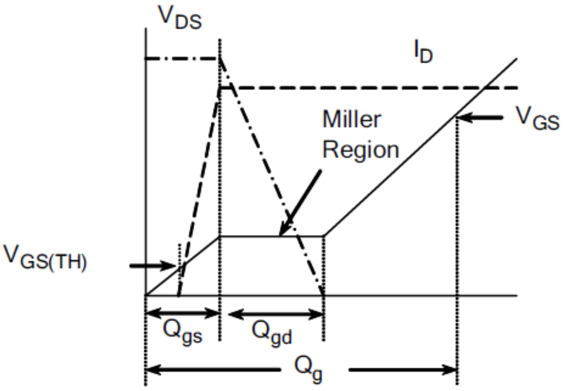


Figure 16. Gate Charge Waveforms

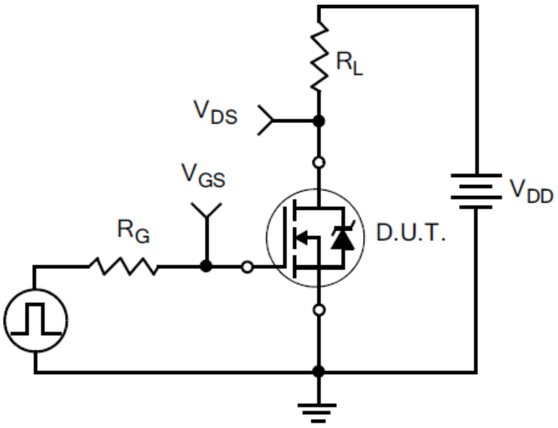


Figure 17. Resistive Switching Test Circuit

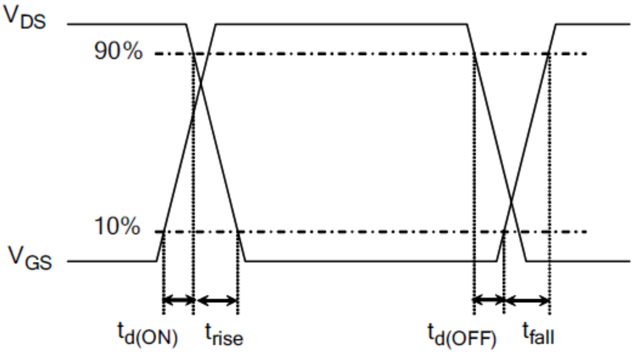


Figure 18. Resistive Switching Waveforms

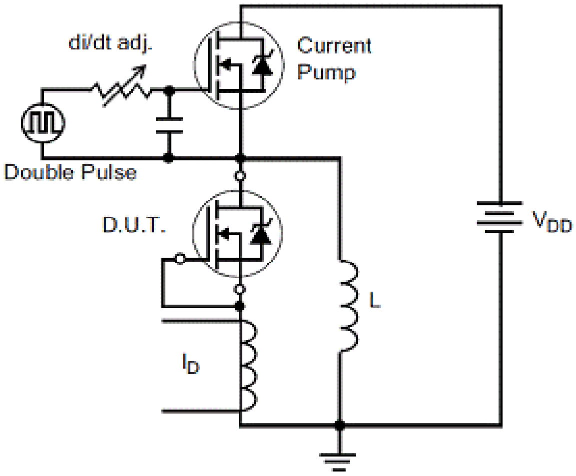


Figure 19. Diode Reverse Recovery Test Circuit

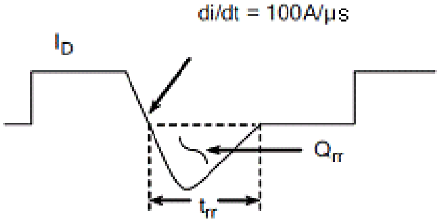


Figure 20. Diode Reverse Recovery Waveform

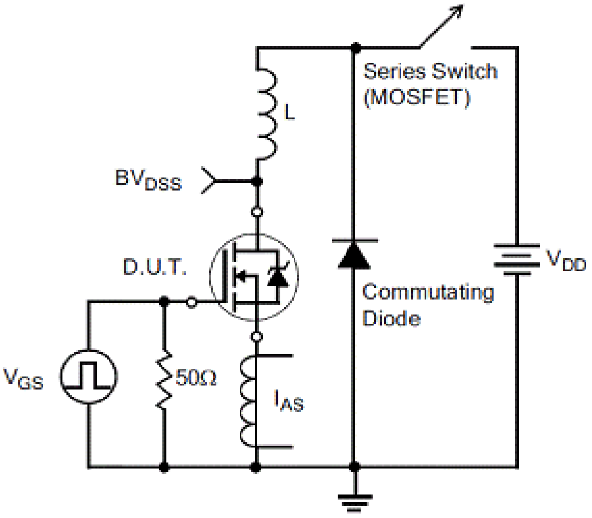
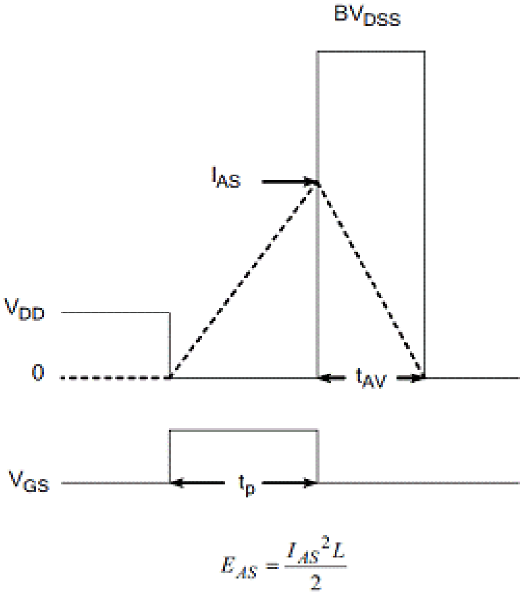


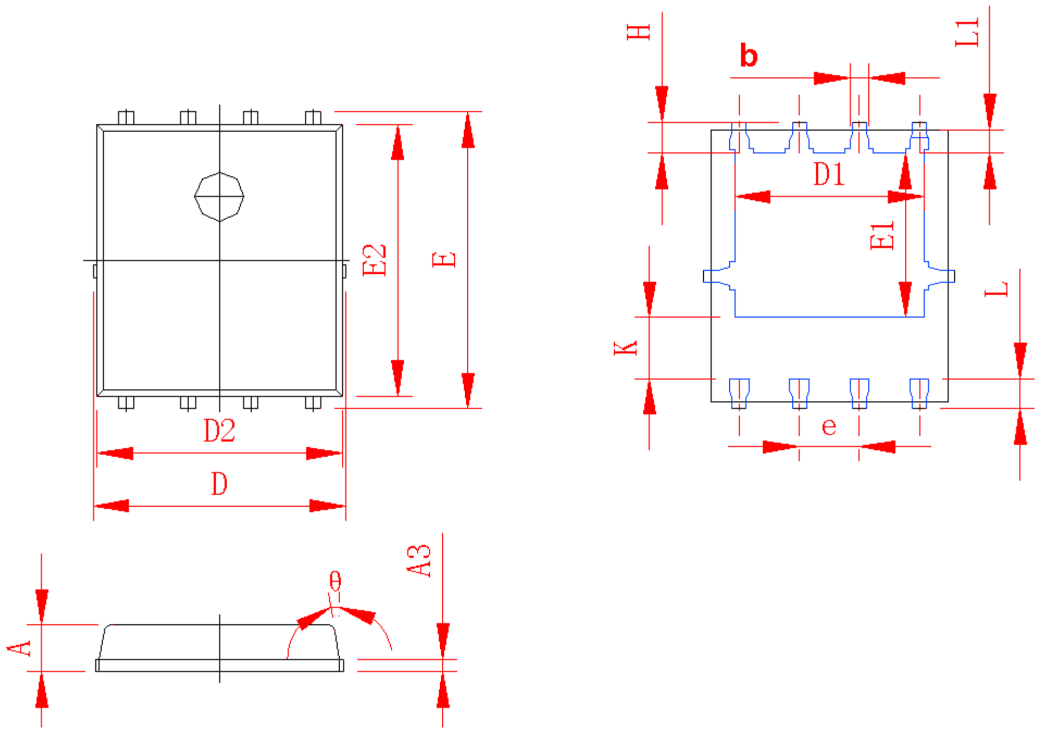
Figure21.Unclamped Inductive Switching Test Circuit



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

Figure22.Unclamped Inductive Switching Waveform

Package Information：



Symbol	**Values(mm)**	
	MIN	MAX
A	0.70	1.20
A3	0.15	0.35
D	4.85	5.35
E	5.77	6.32
D1	3.81	4.40
E1	3.33	3.90
D2	4.72	5.30
E2	5.57	6.05
k	1.09	1.50
b	0.20	0.60
e	1.07	1.47
L	0.40	0.82
L1	0.35	0.65
H	0.35	0.85
θ	8 °	12 °

PDFN5×6 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 d
2. evice.
3. When installing the heat sink, please pay attention to the torsional moment and the smoothness of the heat sink.
4. 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.
5. This publication is made by Huajing Microelectronics and subject to regular change without notice.

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