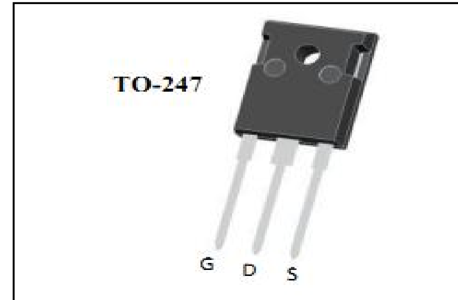
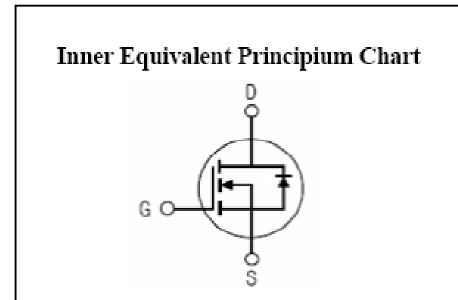
Silicon N-Channel Power MOSFET

®

HPF650R099PF-G

$V_{DSS(Tjmax)}$	700	V
I_D	40	A
$P_D(T_C=25℃)$	338	W
$R_{DS(ON)Typ}$	85	mΩ
Eoss@400V	5.2	uJ





General Description:

HPF650R099PF-G, the silicon N-channel Enhanced MOSFETs, is obtained by the super junction technology which reduces 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 type is TO-247, which accords with the RoHS standard.

Features:

- **Fast Switching**
- **Low Gate Charge**
- **Low Reverse transfer capacitances**
- **100% Single Pulse avalanche energy Test**
- **Halogen Free**

Applications:

PC、Server power.

Absolute（T_J= 25℃ unless otherwise specified）:

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage($V_{GS=}$0V)	650	V
I_D [a1]	Continuous Drain Current(Tc=25°C)	40	A
I_{DM} [a2]	Pulsed Drain Current(Tc=25°C)	120	A
V_{GSS}	Gate-to-Source Voltage	±30	V
E_{AS} [a3]	Single Pulse Avalanche Energy	1000	mJ
dv/dt [a4]	Peak Diode Recovery dv/dt	50	V/ns
dv/dt	MOSFET dv/dt ruggedness	100	V/ns
di_f/dt	Maximum diode communication speed	500	A/us
P_D	Power Dissipation(Tc=25°C)	338	W
T_J, T_{stg}	Operating and Storage Temperature Range	–55…+150	℃
T_L	Maximum Temperature for Soldering	300	℃

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	650	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Bvdss Temperature Coefficient	ID=250uA,Reference25℃	--	0.74	--	V/℃
I_{DSS}	Drain to Source Leakage Current	V_{DS} = 650V, V_{GS}= 0V, T_J = 25℃	--	--	10	μA
		V_{DS} =520V, V_{GS}= 0V, T_J = 125℃	--	--	500	
$I_{GSS(F)}$	Gate to Source Forward Leakage	V_{GS} =+30V V_{DS}= 0V,	--	--	100	nA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	V_{GS} =-30V V_{DS}= 0V,	--	--	-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=16A	--	85	99	mΩ
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	3.0		5.0	V
Pulse width tp≤300μs, δ ≤2%						

Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
R_g	Gate resistance	f = 1.0MHz	--	3.1	--	Ω
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 100V f = 1.0MHz	--	3040	--	pF
C_{oss}	Output Capacitance		--	104	--	
C_{rss}	Reverse Transfer Capacitance		--	2.8	--	

Resistive Switching Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	I_D =20A V_{DD} =400V R_G =10Ω	--	31	--	ns
tr	Rise Time		--	28	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	110	--	
t_f	Fall Time		--	55	--	
Q_g	Total Gate Charge	I_D =20A V_{DD} =480V V_{GS} = 10V	--	70	--	nC
Q_{gs}	Gate to Source Charge		--	17	--	
Q_{gd}	Gate to Drain (“Miller”)Charge		--	32	--	
$V_{plateau}$	Gate Plateau Voltage		--	6.2	--	V

Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)	T_C=25℃	--	--	40	A
I_{SM}	Maximum Pulsed Current (Body Diode)		--	--	120	A
V_{SD}	Diode Forward Voltage	I_S=20A, V_{GS}=0V	--	--	1.2	V
T_{rr}	Reverse Recovery Time	I_S=20A, T_j = 25°C dI$_F$/dt=100A/us, V_{GS}=0V	--	140	--	ns
Q_{rr}	Reverse Recovery Charge		--	750	--	nC
I_{rrm}	Reverse Recovery Current		--	11	--	A

Thermal Restistance

Symbol	Parameter	Max.	Units
$R_{\theta JC}$	Junction-to-Case	0.37	℃/W
$R_{\theta JA}$	Junction-to-Ambient	55	℃/W

[a1]: Limited by Tjmax Maximum duty cycle D=0.75
[a2]: Repetitive rating; pulse width limited by maximum junction temperature
[a3]: L=20.0mH, Rg=25 Ω, Vdd=50V, Start T_J=25℃
[a4]: identical low side and high side switch with identical Rg

Characteristics Curve:

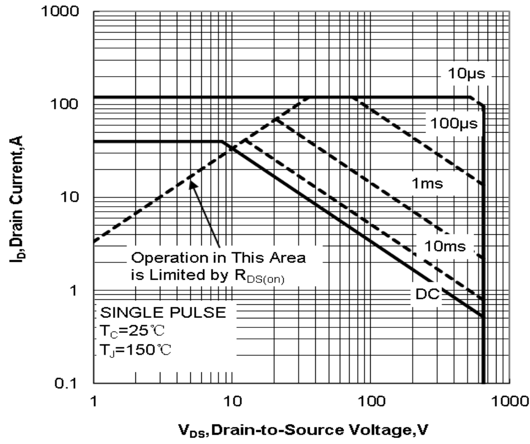


Figure.1 Maximum Forward Bias Safe Operating Area

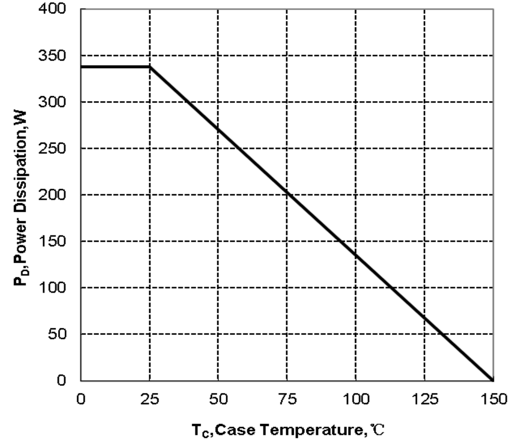


Figure.2 Maximum Power Dissipation vs Case Temperature

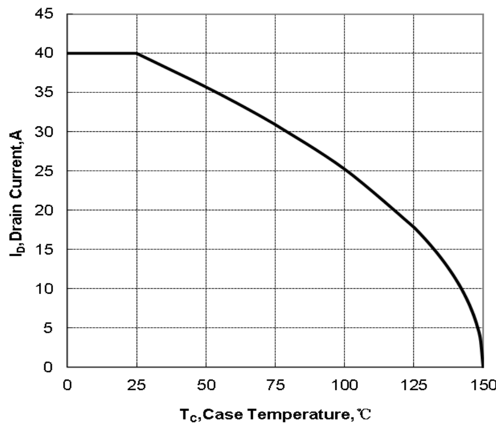


Figure.3 Maximum Continuous Drain Current vs Case Temperature

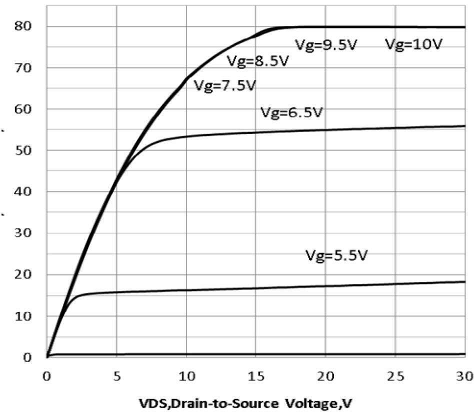


Figure.4 Typical Output Characteristics

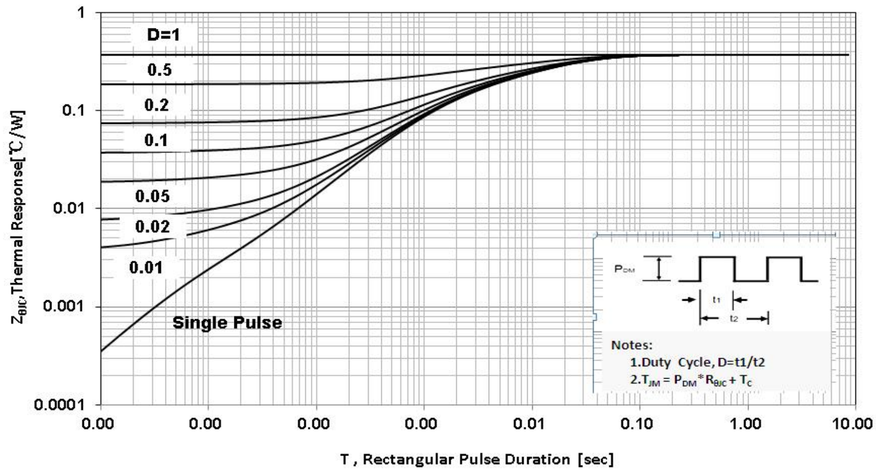


Figure.5 Maximum Effective Thermal Impedance , Junction to Case

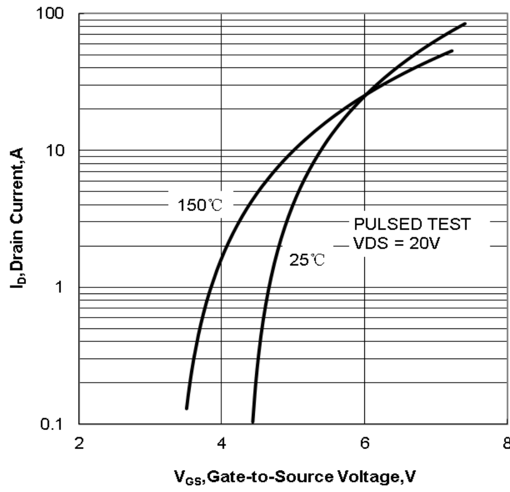


Figure.6 Typical Transfer Characteristics

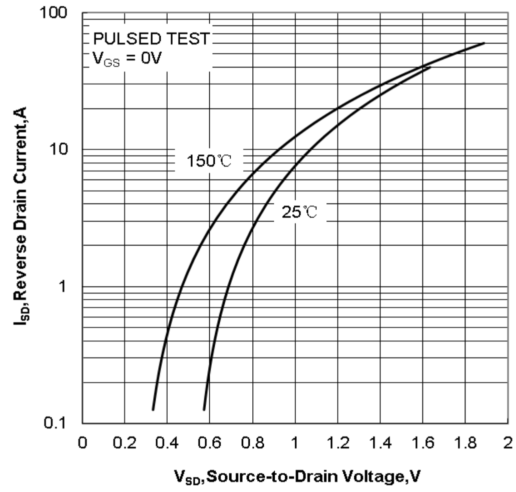


Figure.7 Typical Body Diode Transfer Characteristics

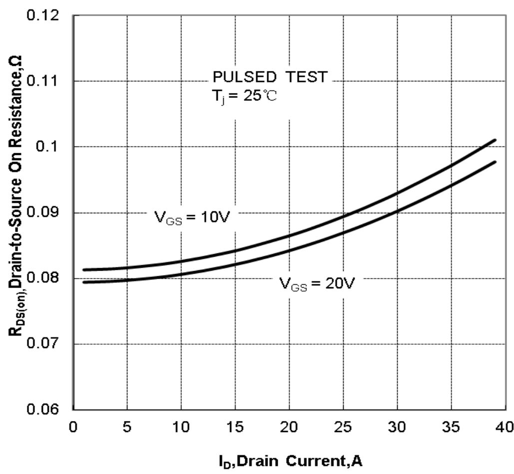


Figure.8 Typical Drain to Source ON Resistance vs Drain Current

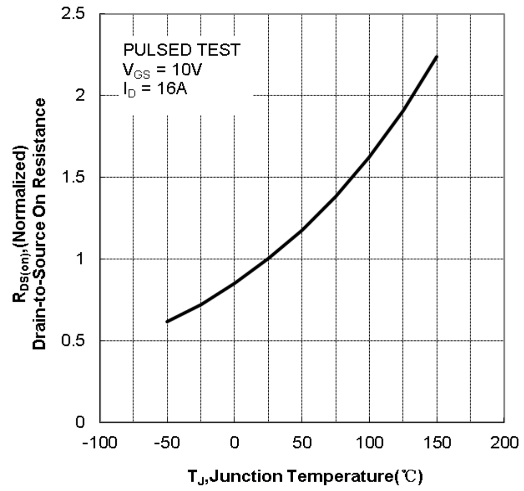


Figure.9 Typical Drian to Source on Resistance vs Junction Temperature

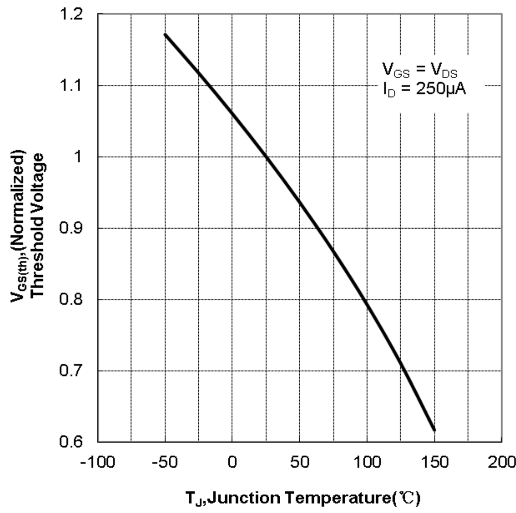


Figure.10 Typical Theshold Voltage vs Junction Temperatu

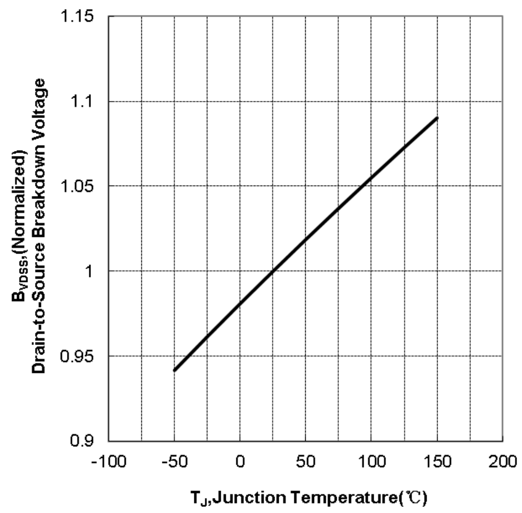


Figure 11 Typical Breakdown Voltage vs Junction Temperature

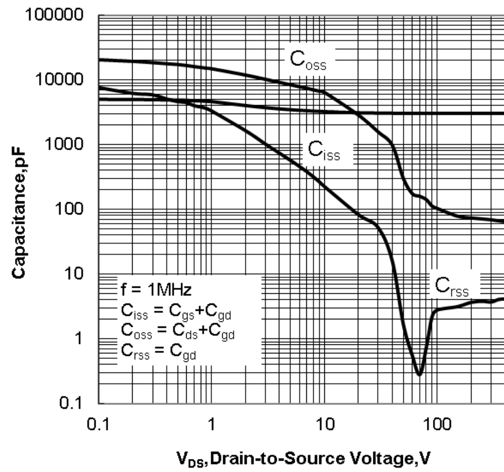


Figure.12 Typical Capacitance vs Drain to Source Voltage

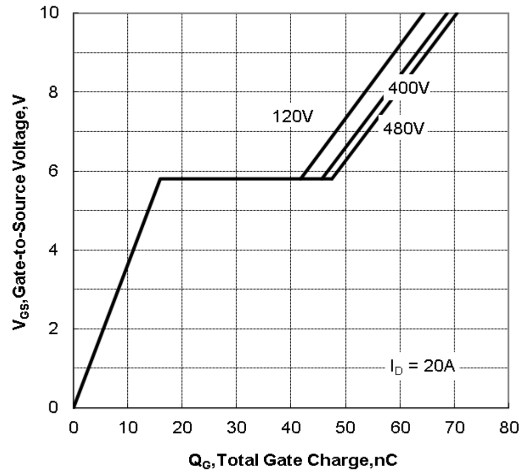


Figure.13 Typical Gate Charge vs Gate to Source Voltage

Test Circuit and Waveform

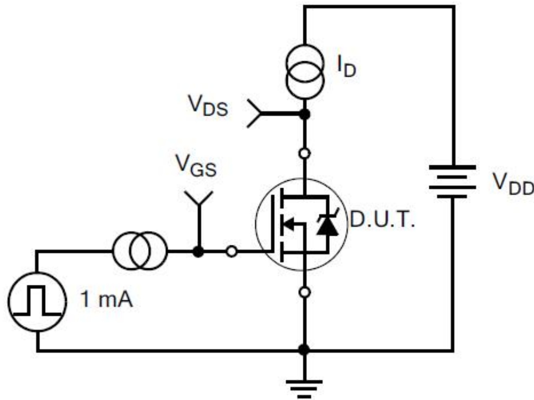


Figure 14. Gate Charge Test Circuit

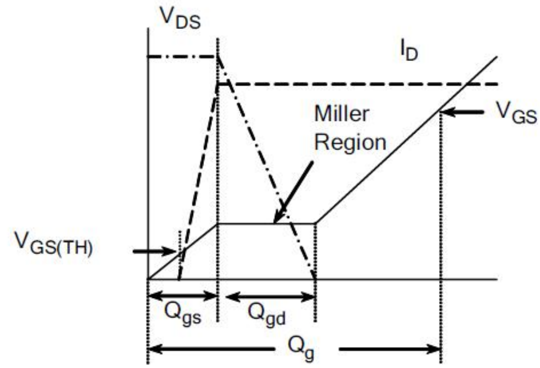


Figure 15. Gate Charge Waveforms

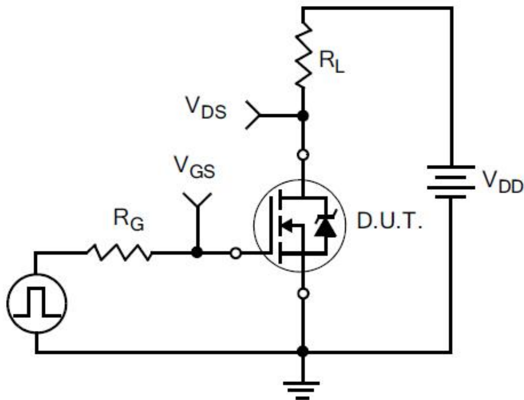


Figure 16. Resistive Switching Test Circuit

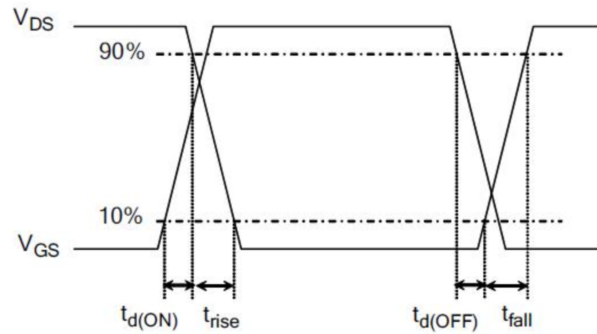
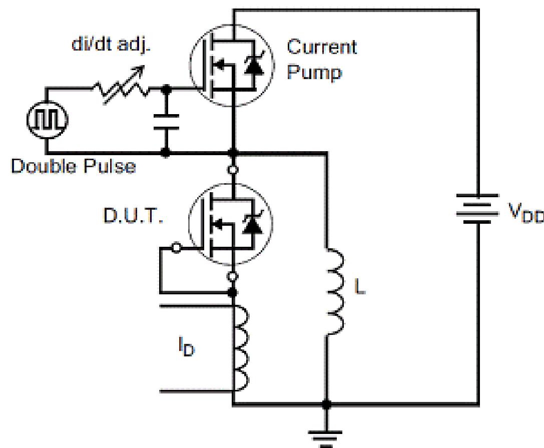


Figure 17. Resistive Switching Waveforms



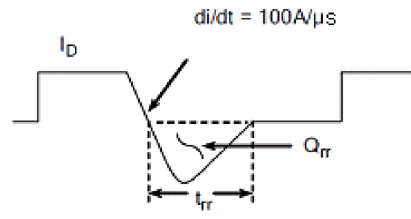
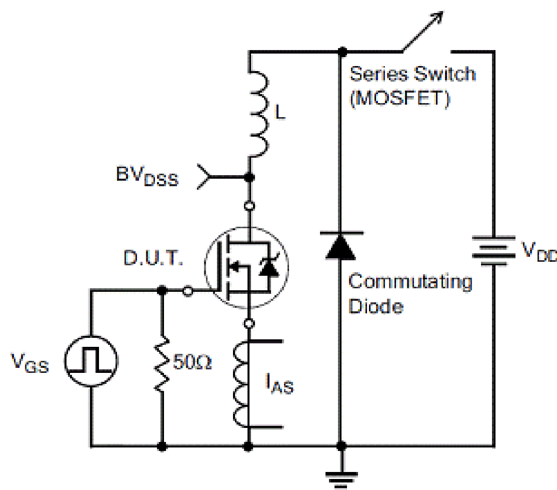


Figure 18. Diode Reverse Recovery Test Circuit

Figure 19. Diode Reverse Recovery Waveform



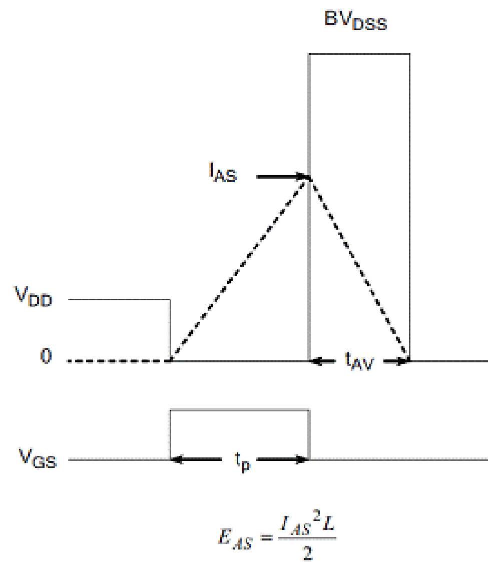
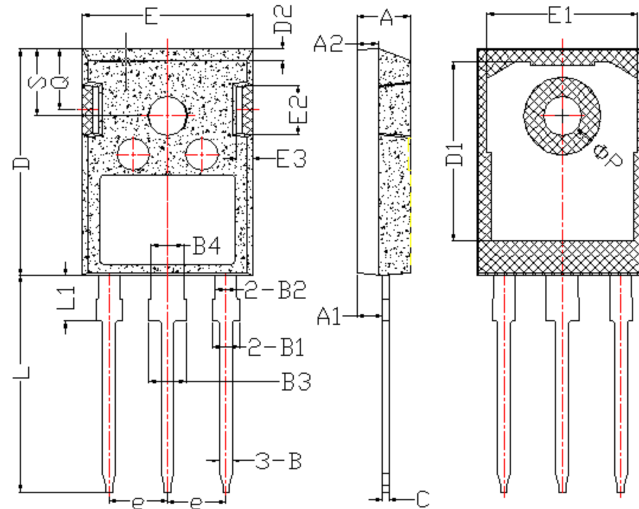


Figure20.Unclamped Inductive Switching Test Circuit

Figure21.Unclamped Inductive Switching Waveform

Package Information



<table>
<tr><th rowspan="2">项　目</th><th colspan="2">规范(mm)</th></tr>
<tr><th>MIN</th><th>MAX</th></tr>
<tr><td>A</td><td>4.6</td><td>5.2</td></tr>
<tr><td>A1</td><td>2,2</td><td>2.6</td></tr>
<tr><td>B</td><td>0.9</td><td>1.4</td></tr>
<tr><td>B1</td><td>1.75</td><td>2.35</td></tr>
<tr><td>B2</td><td>1.75</td><td>2.15</td></tr>
<tr><td>B3</td><td>2.8</td><td>3.35</td></tr>
<tr><td>B4</td><td>2.8</td><td>3.15</td></tr>
<tr><td>C</td><td>0.5</td><td>0.7</td></tr>
<tr><td>D</td><td>20.60</td><td>21.30</td></tr>
<tr><td>D1</td><td>16</td><td>18</td></tr>
<tr><td>E</td><td>15.5</td><td>16.10</td></tr>
<tr><td>E1</td><td>13</td><td>14.7</td></tr>
<tr><td>E2</td><td>3.80</td><td>5.3</td></tr>
<tr><td>E3</td><td>0.8</td><td>2.60</td></tr>
<tr><td>e</td><td>5.2</td><td>5.7</td></tr>
<tr><td>L</td><td>19</td><td>20.5</td></tr>
<tr><td>L1</td><td>3.9</td><td>4.6</td></tr>
<tr><td>ΦP</td><td>3.3</td><td>3.70</td></tr>
<tr><td>Q</td><td>5.2</td><td>6.00</td></tr>
<tr><td>S</td><td>5.8</td><td>6.6</td></tr>
</table>

TO-247 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 heat sink, please pay attention to the torsional moment and the smoothness of the heatsink.
3. VDMOSFET 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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