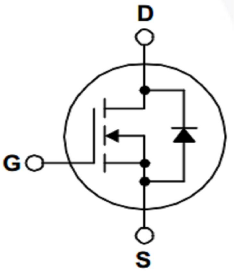
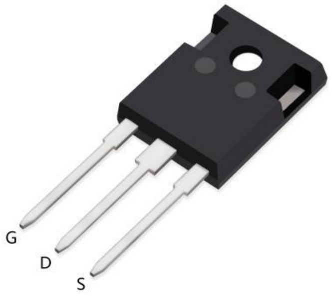
Silicon N-Channel Super Junction Power MOSFET

Description

The TH60R090DAK utilizes the latest Super Junction processing techniques to achieve low on-resistance per silicon area. Additional features of this MOSFET are 150℃ operating junction temperature and high repetitive peak current capability. These features combine to make this MOSFET a highly efficient, robust and reliable device. It can be used in a wide variety of applications.





THUNDER TO-247

General Features

- ● V_{DS}=650V,I_D=47A
- ● Low ON Resistance,$R_{DS(on),max}$=90mΩ@V_{GS}=10V,I_D=20A
- ● Low reverse transfer capacitance
- ● Low Qg for fast response
- ● Short fall & rise times for fast switching
- ● 100% single pulse avalanche energy Test

Application

- ● Power switching application
- ● Digital amplifier
- ● Adapter and charger

Product Summary

V_{DS}	650V
$R_{DS(on),max}$	90mΩ
I_D	47A

1 Maximum ratings

at T_j = 25°C, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current[1)]	I_D	-	-	47	A	T_C=25°C
Continuous drain current[1)]	I_D	-	-	30	A	T_C=100°C
Pulsed drain current[2)]	$I_{D,pulse}$	-	-	141	A	T_C=25°C

Avalanche energy,single pulse	E_{AS}	-	-	885	mJ	T_C=25℃, V_{DD}=50V, L=10mH, R_G=25Ω
Avalanche current,single pulse	I_{AR}	-	-	13.3	A	T_C=25℃, V_{DD}=50V, L=10mH, R_G=25Ω
Gate source voltage (static)	V_{GS}	-20	-	20	V	static;
Power dissipation	P_{tot}	-	-	191	W	T_C=25°C
Storage temperature	T_{stg}	-55	-	150	℃	
Operating junction temperature	T_j	-55	-	150	℃	

[1] Limited by $T_{j,max}$. Maximum Duty Cycle D = 0.50

[2] Pulse width t_p limited by $T_{j,max}$

[3] Identical low side and high side switch with identical R_G

2 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance,junction – case.	R_{thJC}	-	-	0.65	℃/W	-
Thermal resistance,junction – ambient	R_{thJA}	-	-	62	℃/W	device on PCB,minimal footprint

3 Electrical characteristics

at Tj=25°C, unless otherwise specified

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	605	-	-	V	V_{GS}=0V, I_D=250uA
Gate threshold voltage	$V_{GS(th)}$	3	-	5	V	V_{DS}=V_{GS}, I_D=250uA
Zero gate voltage drain current	I_{DSS}	-	-	5	μA	V_{DS}=600V,V_{GS}=0V,T_j=25℃
Gate-source leakage current	I_{GSS}	-	-	±100	nA	V_{GS}=±30V, V_{DS}=0V
Drain-source on-state resistance	$R_{DS(on)}$	-	80	92	mΩ	V_{GS}=10V, I_D=20A, T_j=25℃
Gate resistance	R_G	-	0.9	-	Ω	f=1MHz,open drain

Table 5 Dynamic characteristics

Input Capacitance	C_{iss}	-	3291	-	pF	V_{GS}=0V, V_{DS}=50V, f=10kHz
Output Capacitance	C_{oss}	-	298.1	-		
Reverse Transfer Capacitance	C_{rss}	-	10.7			
Turn-on delay time	$t_{d(on)}$	-	12.1	-	ns	V_{DD}=400V, V_{GS}=13V, I_D=25.8A, R_G=1.7Ω
Rise time	t_r	-	4.4	-		
Turn-off delay time	$t_{d(off)}$	-	39.1	-		
Fall time	t_f	-	4.3	-		

Table 6 Gate charge characteristics

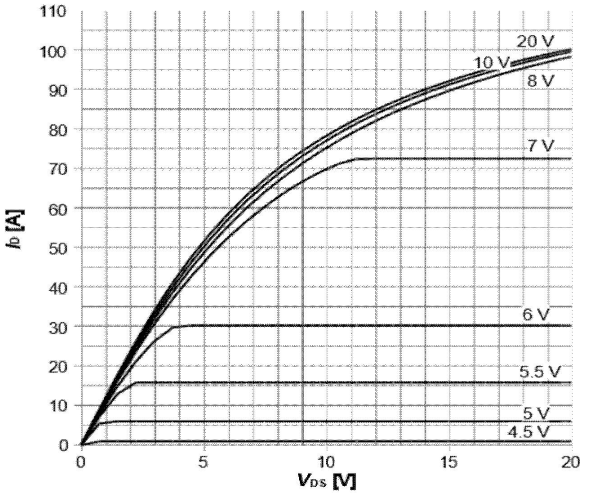
Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	18.16	-	nC	V_{DD}=400V, I_D=25.8A, V_{GS}=0 to 10V
Gate to drain charge	Q_{gd}	-	22.93	-		
Gate charge total	Q_g	-	65.32	-		

Table 7 Reverse diode characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode forward voltage	V_{SD}	-	0.66	-	V	V_{GS}=0V, I_F=1A, T_j=25℃
Reverse recovery time	t_{rr}	-	147.8	-	ns	V_R=400V, I_F=9.6A, di_F/dt=100A/us
Reverse recovery charge	Q_{rr}	-	0.96	-	μC	
Peak reverse recovery current	I_{rrm}	-	12.27	-	A	

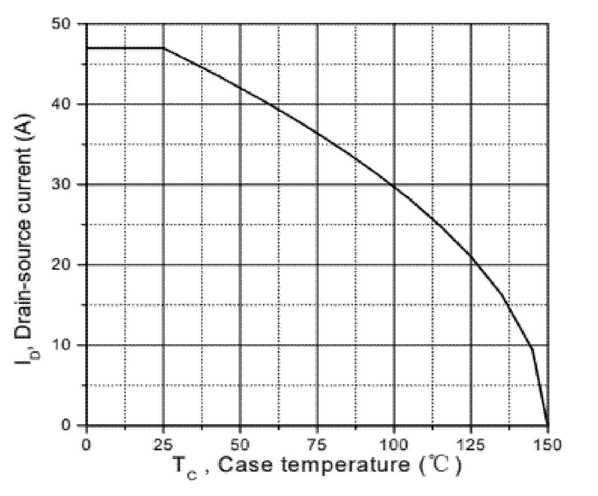
4 Typical Performance Characteristics

Diagram 1: Typ. Output characteristics



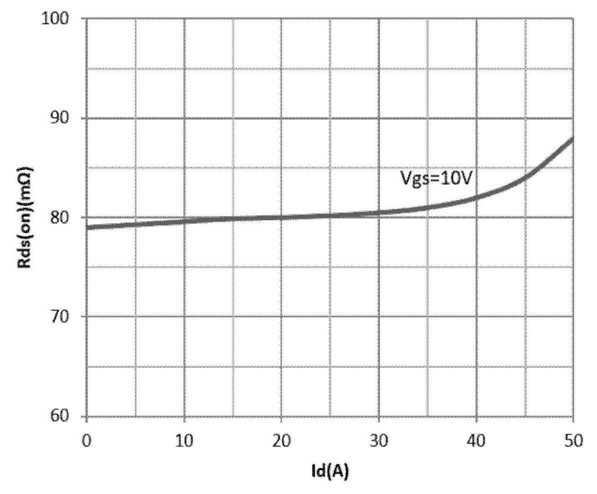
I_D=f(V_{DS});T_j=25 °C; parameter: V_{GS}

Diagram 2: Typ. Drain Current De-rating



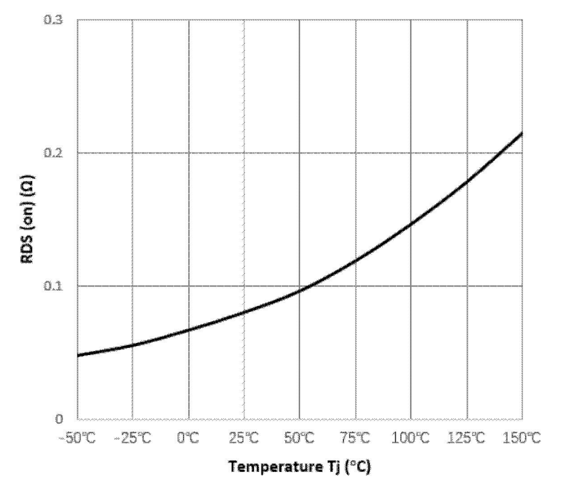
Id=f(T_C);

Diagram 3: Typ. Rdson vs. Drain Current



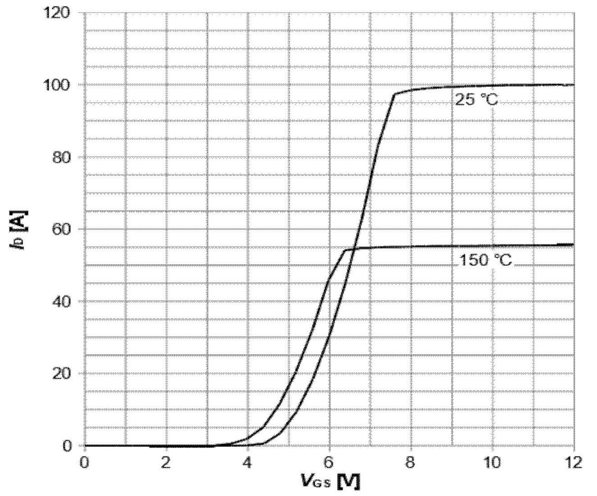
$R_{ds(on)}$=f(Id);Vgs=10V

Diagram 4: Typ. Rdson – Junction Temperature



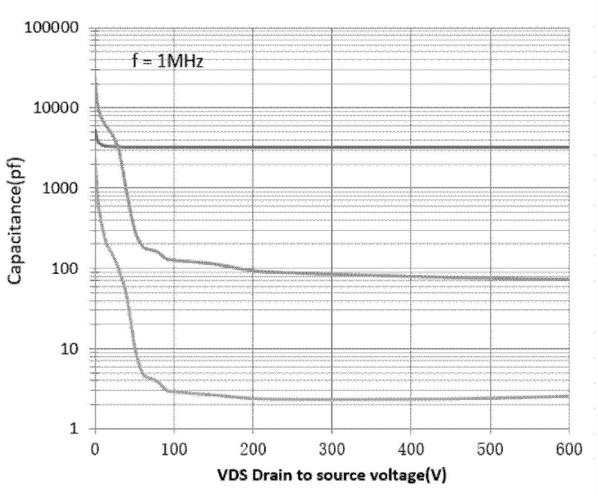
$R_{ds(on)}$=f(T_j);Vgs=10V/I_D=20A

Diagram 5: Typ. transfer characteristics



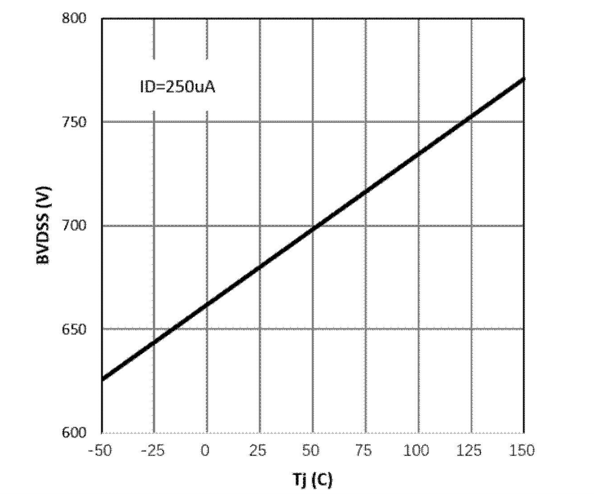
I_D=f(V_{GS}); V_{DS}=20V; parameter: T_j

Diagram 6: Typ. Capacitance vs. Vds



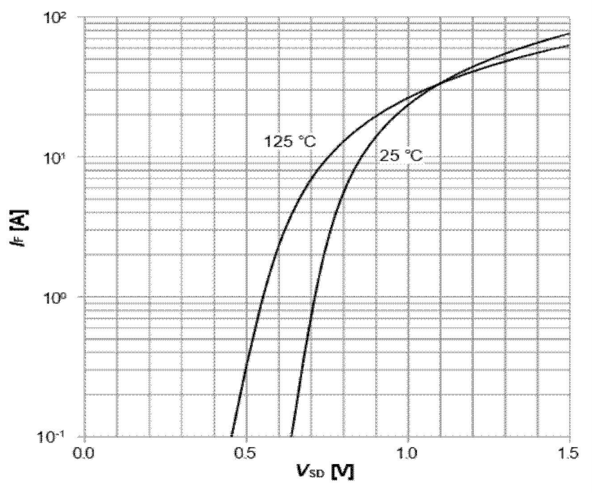
C=f(V_{DS});V_{GS}=0V; f=1MHz

Diagram 7: Typ. BVDSS voltage vs. Temperature



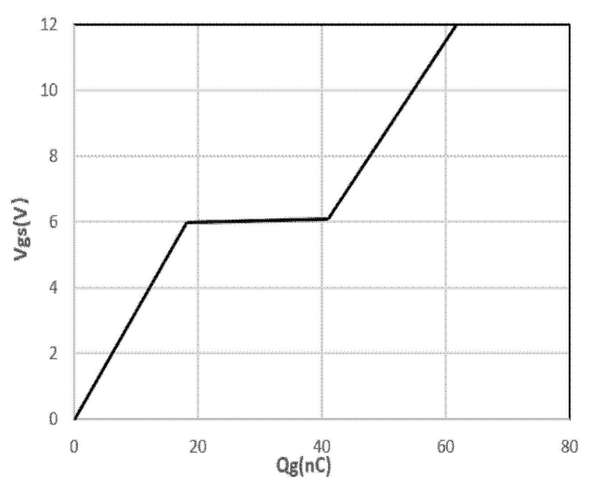
V_{GS}=f(T_j);I_D=250uA

Diagram 8: Typ. Source-Drain Diode Forward



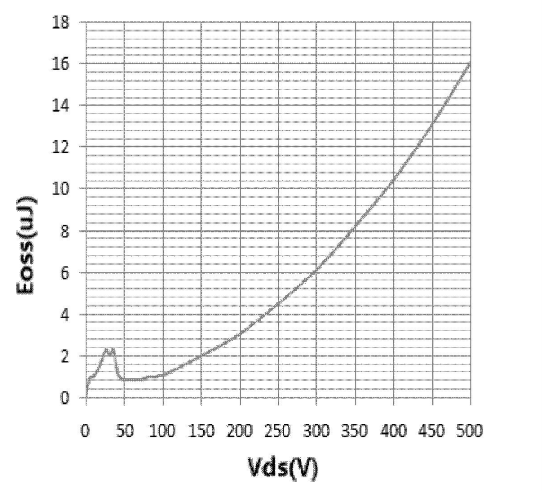
I_{SD}=f(V_{DS}); T_C=25 °C;

Diagram 9: Typ. Gate charge



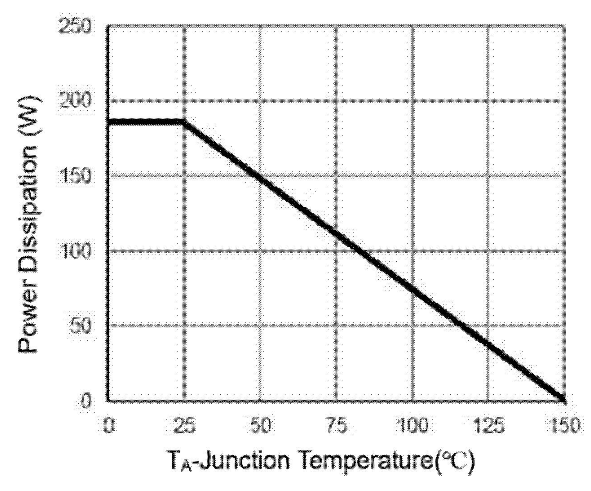
V_{GS}=f(Q_{gate});I_D=25.8A pulsed; parameter: V_{DD}

Diagram 10: Typ. Coss stored energy



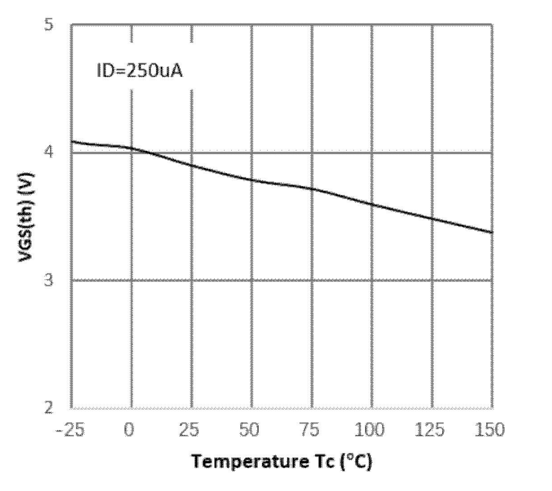
E_{oss}=f(V_{DS})

Diagram 11: Typ. Power Dissipation

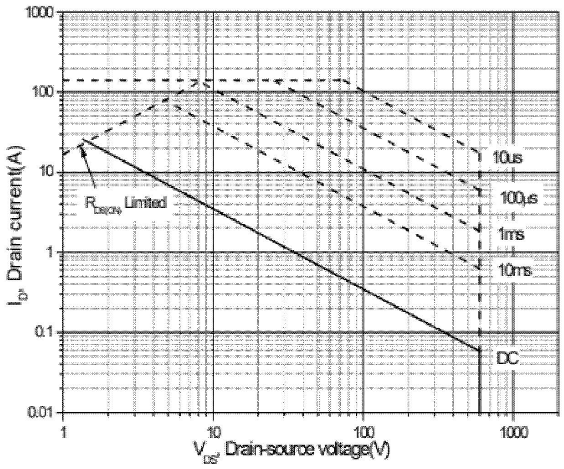
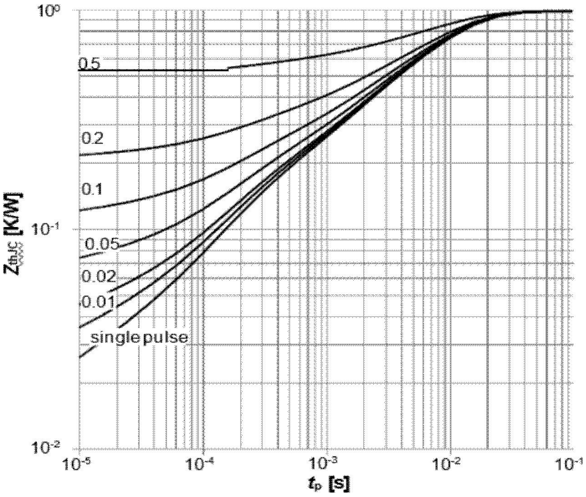


P_{tot}=f(T_C);

Diagram 12: Typ. Threshold voltage



V_{th}=f(T_C);

Diagram 13: Typ. Maximum Safe Operating Area	**Diagram 14: Normalized Transient Impedance**
	
I_D=f(V_{DS}); T_C=25 °C; V_{GS}> 7V; D=0; parameter tp	Z_{thJC} =f(t_P); parameter: $D=t_p/T$

5 Test Circuit

Table 8 Diode characteristics

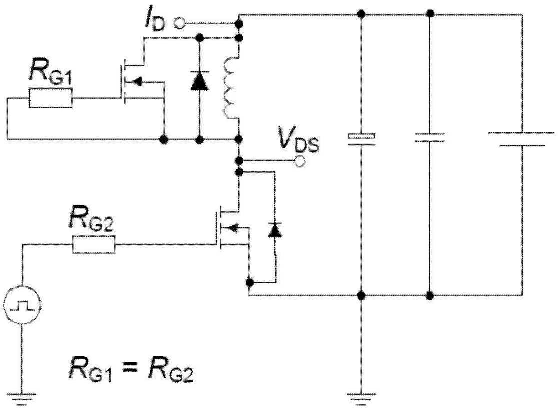
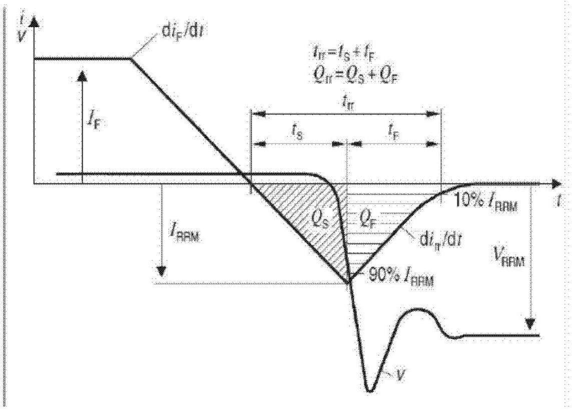
Test circuit for diode characteristics	Diode recovery waveform
	

Table 9 Switching times

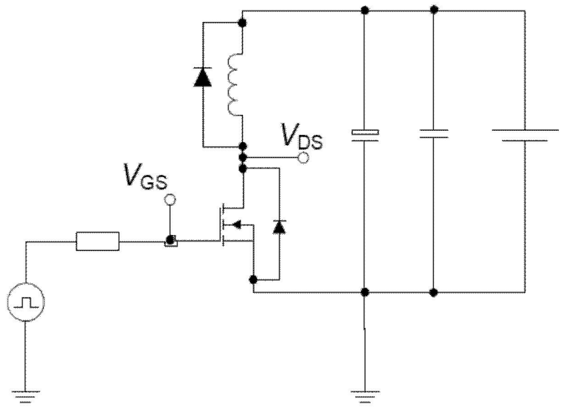
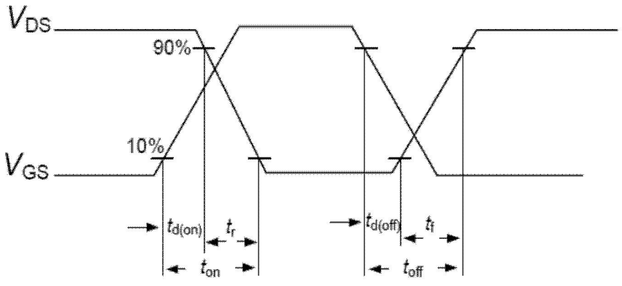
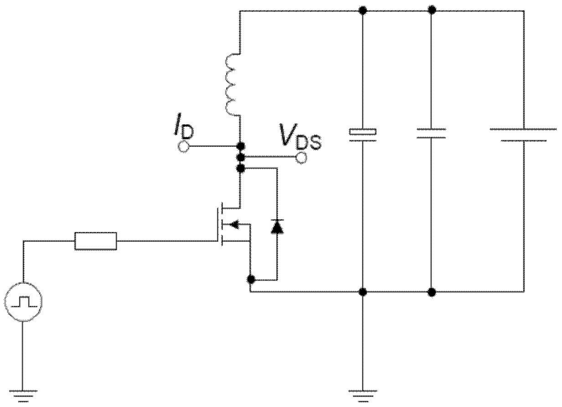
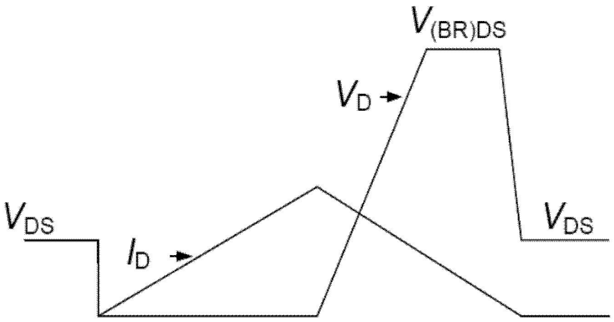
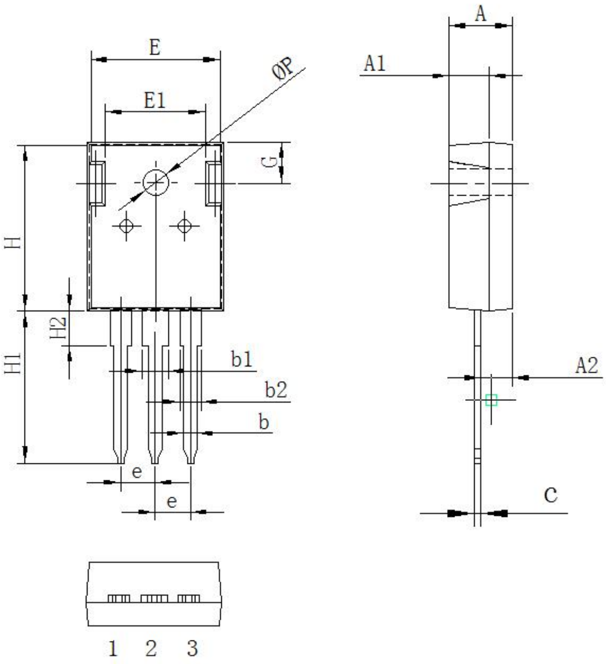
Switching times test circuit for inductive load	Switching times waveform
	

Table 10 Unclamped inductive load

Unclamped inductive load test circuit	Unclamped inductive waveform
	

Package Information

TO-247 PACKAGE



基本尺寸

Symbol	单位 mm		
	Min	Nom	Max
A	4.8	5.00	5.20
A1	3.3	3.5	3.7
A2	2.20	2.40	2.60
b	1.00	1.2	1.40
b1	2.90	3.10	3.30
b2	1.90	2.10	2.30
c	0.50	0.60	0.70
e	5.25	5.45	5.65
E	15.2	15.7	16.2
E1	10.2	10.7	11.2
H	20.8	21	21.2
H1	19.5	20.0	20.5
H2	4.00	4.20	4.40
G	5.60	5.80	6.00
ΦP	3.50	3.70	3.90

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-Headquarters

WuXi Thunder Microelectronics Incorporated Limited

Building E1-9, No.200 LingHu Road, XinWu district,WuXi,China 214135

Tel:+86-510-85160109 Fax:+86-510-85160109