



超结金属氧化物半导体场效应晶体管

Super Junction Power MOSFET

FHA60R043AF

主要参数 MAIN CHARACTERISTICS

ID	78A
V _{DS} , min@ T _J (max)	650V
R _{dson} -typ (@V _{gs} =10V)	36mΩ
Q _g -typ	112nC

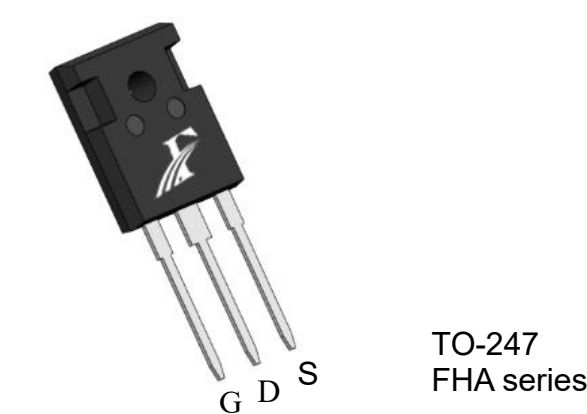
用途 APPLICATIONS

工业电源	Industrial power supplies
电动车充电器	EV-Charger
LLC半桥/全桥电路	LLC half-bridge/full bridge
电脑电源	PC power
通信/服务器电源	Telecom / Server power

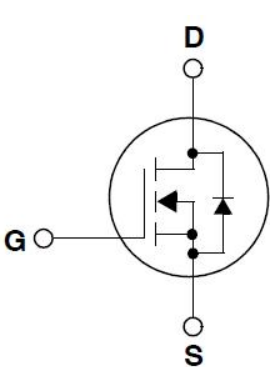
产品特性 FEATURES

低栅极电荷	Low gate charge
低 Crss (典型值 5.9pF)	Low Crss (typical 5.9pF)
低导通内阻	Low drain-source On resistance
开关速度快	Fast switching
100%经过雪崩测试	100% avalanche tested
100%经过热阻测试	100% DVDS tested
100%经过 Rg 测试	100% Rg tested
高抗 dv/dt 能力	Improved dv/dt capability
内置快恢复二极管	ultra fast body diode
符合 ROHS 标准和满足无卤要求	RoHS compliant device and Halogen-free device
多层外延工艺	Multi-Epi process SJ-FET technology

封装形式 Package



等效电路 Equivalent Circuit



绝对最大额定值 ABSOLUTE RATINGS (T_c=25℃)

项目 Parameter	符号 Symbol	数值 Value	单位 Unit
		FHA60R043AF	
最高漏极-源极直流电压 Drain-Source Voltage	V _{DS}	600	V
连续漏极电流* Drain Current -continuous *	I _D (T _c =25℃)	78	A
	I _D (T _c =100℃)	48	A
最大脉冲漏极电流 (注 1) Drain Current – pulse (note 1)	I _{DM}	234	A
最高栅源电压 Gate-Source Voltage	V _{GS}	±30	V
单脉冲雪崩能量 (注 2) Single Pulsed Avalanche Energy (note 2)	E _{AS}	2645	mJ
雪崩电流 (注 1) Avalanche Current (note 1)	I _{AR}	23	A
二极管反向恢复最大电压变化速率 (注 3) Peak Diode Recovery dv/dt (note 3)	dv/dt	15	V/ns
耗散功率 Power Dissipation	P _D (T _C =25℃)	500	W
	-Derate above 25℃	3.9	W/℃
最高结温及存储温度 Operating and Storage Temperature Range	T _J , T _{STG}	150, -55 to 150	℃
引线最高焊接温度 Maximum Lead Temperature for Soldering Purposes	T _L	300	℃

*漏极电流由最高结温限制

*Drain current limited by maximum junction temperature

电特性 ELECTRICAL CHARACTERISTICS

项目 Parameter	符号 Symbol	测试条件 Tests conditions	最小 Min	典型 Typ	最大 Max	单位 Units
关态特性 Off –Characteristics						
漏－源击穿电压 Drain-Source Voltage	BV _{DSS}	I _D =1mA, V _{GS} =0V	600	-	-	V
		I _D =1mA, V _{GS} =0V T _j =150℃	650	-	-	
零栅压下漏极漏电流 Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =600V,V _{GS} =0V, T _c =25℃	-	-	10	μA
栅极体漏电流 Gate-body leakage current	I _{GSS} (F/R)	V _{DS} =0V, V _{GS} =±30V	-	-	±100	nA
通态特性 On-Characteristics						
阈值电压 Gate Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D =1mA	3.0	4.1	5.0	V
静态导通电阻 Static Drain-Source On-Resistance	R _{DS(ON)}	V _{GS} =10V , I _D =39A	-	36	43	mΩ
动态特性 Dynamic Characteristics						
栅极电阻 Gate resistance	R _g	f = 1.0MHz	-	0.8	-	Ω
输入电容 Input capacitance	C _{iss}	V _{DS} =40V, V _{GS} =0V, f=1.0MHz	-	5586	-	pF
输出电容 Output capacitance	C _{oss}		-	431	-	
反向传输电容 Reverse transfer capacitance	C _{rss}		-	5.9	-	
开关特性 Switching Characteristics						
延迟时间 Turn-On delay time	t _{d(on)}	V _{DS} =480V, I _D =39A, R _G =25Ω V _{GS} =10V (note 4, 5)	-	54	-	ns
上升时间 Turn-On rise time	t _r		-	37	-	ns
延迟时间 Turn-Off delay time	t _{d(off)}		-	127	-	ns
下降时间 Turn-Off Fall time	t _f		-	5	-	ns
栅极电荷总量 Total Gate Charge	Q _g	V _{DS} =480V , I _D =39A , V _{GS} =10V (note 4, 5)	-	112	-	nC
栅－源电荷 Gate-Source charge	Q _{gs}		-	24	-	nC
栅－漏电荷 Gate-Drain charge	Q _{gd}		-	50	-	nC
漏－源二极管特性及最大额定值 Drain-Source Diode Characteristics and Maximum Ratings						
正向最大连续电流 Maximum Continuous Drain -Source Diode Forward Current	I _S		-	-	78	A
正向最大脉冲电流 Maximum Pulsed Drain-Source Diode Forward Current	I _{SM}		-	-	234	A
正向压降 Drain-Source Diode Forward Voltage	V _{SD}	V _{GS} =0V, I _S =39A	-	0.9	1.2	V
反向恢复时间 Reverse recovery time	t _{rr}	V _{GS} =0V, I _S =39A ,dI _F /dt=100A/μs (note 4)	-	190	-	ns
反向恢复电荷 Reverse recovery charge	Q _{rr}		-	1.79	-	μC

热特性 THERMAL CHARACTERISTIC

项目 Parameter	符号 Symbol	FHA60R043AF	单位 Unit
结到管壳的热阻 Thermal Resistance, Junction to Case	Rth(j-c)	0.29	℃/W
结到环境的热阻 Thermal Resistance, Junction to Ambient	Rth(j-A)	40	℃/W

注释：
1：脉冲宽度由最高结温限制
2： L=10mH, IAS=23A, VDD=50V, RG=25 Ω,起始结温 TJ=25℃
3： ISD ≤78A,di/dt ≤100A/μs,VDD≤BV_{DSS},起始结温 TJ=25℃
4： 脉冲测试： 脉冲宽度 ≤300μs,占空比≤2％
5： 基本与工作温度无关

Notes:
1: Pulse width limited by maximum junction temperature
2: L=10mH, IAS=23A, VDD=50V, RG=25 Ω ,Start TJ=25℃;
3: ISD ≤78A,di/dt ≤100A/μs,VDD≤BV_{DSS}, Starting TJ=25℃
4: Pulse Test: Pulse Width ≤300μs,Duty Cycle≤2％
5: Essentially independent of operating temperature

特性曲线

(ELECTRICAL CHARACTERISTICS (curves))

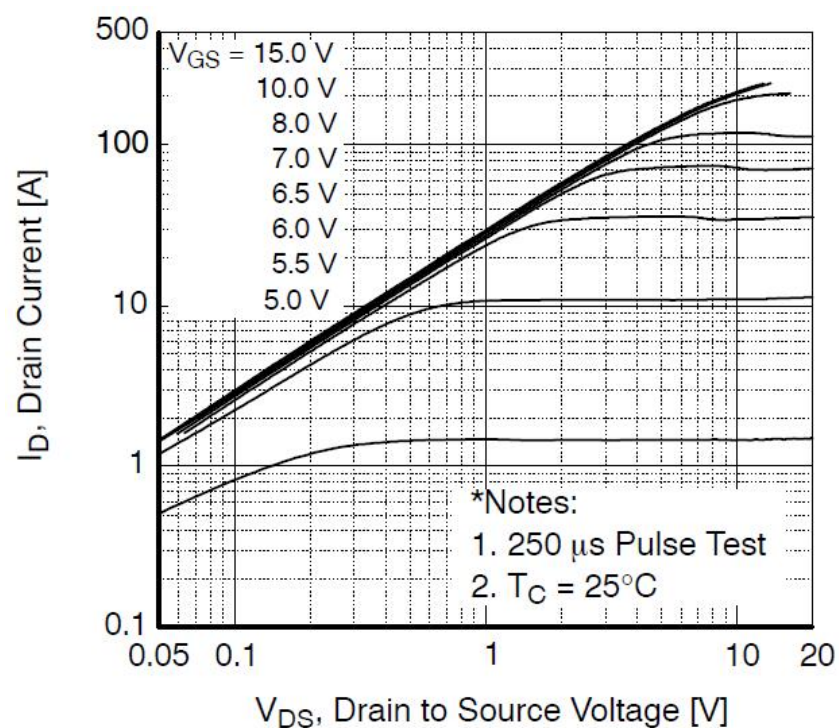


Figure 1. On-Region Characteristics

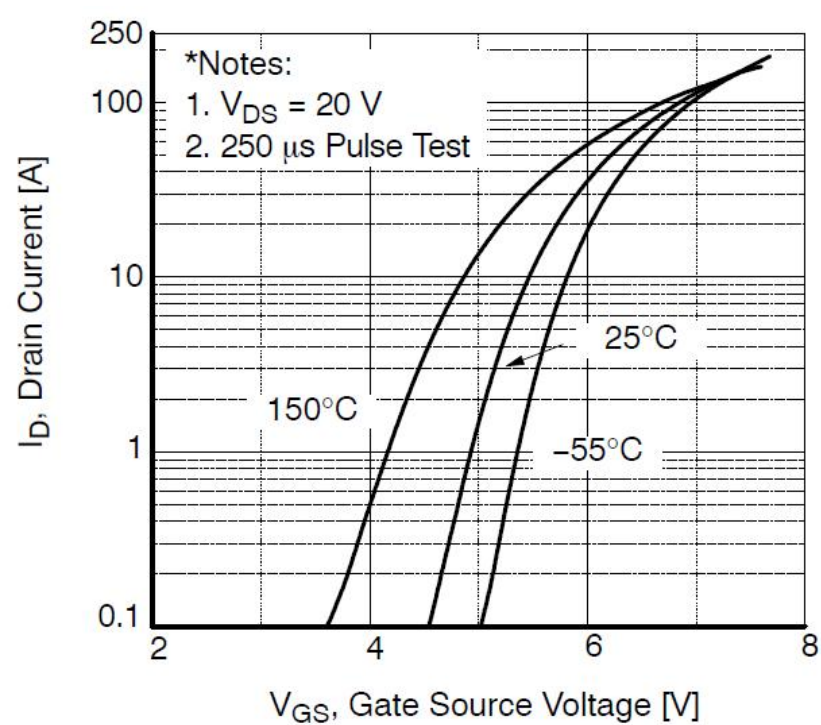


Figure 2. Transfer Characteristics

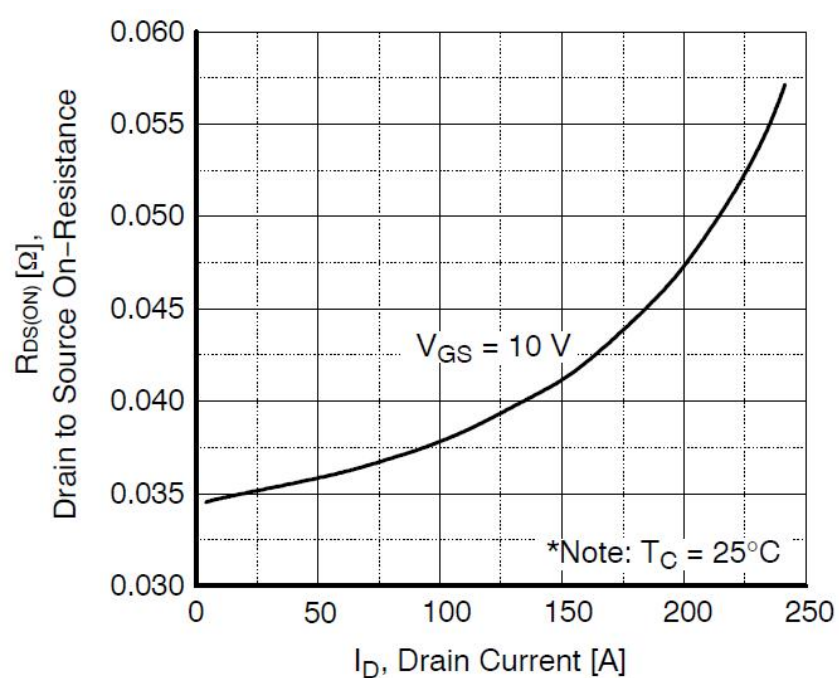


Figure 3. On-Resistance Variation vs. Drain Current

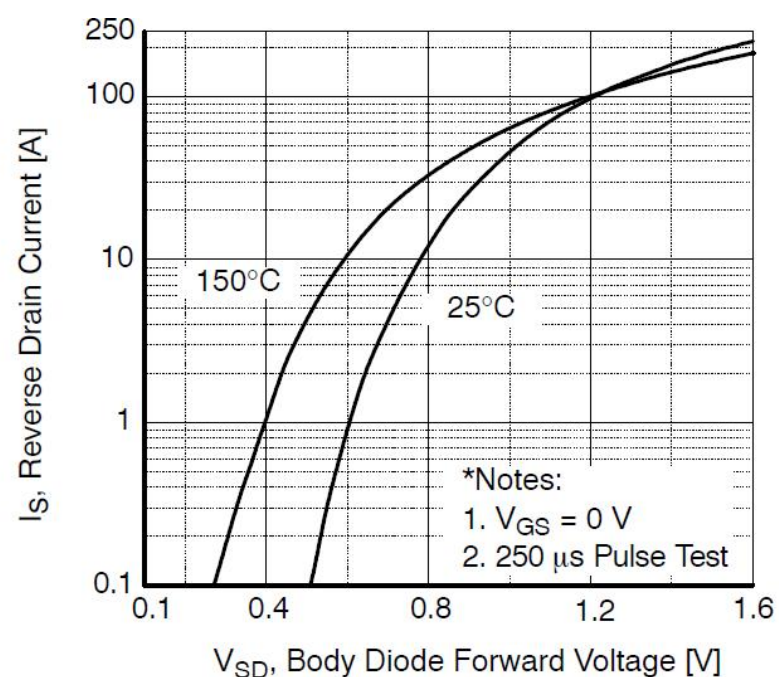


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

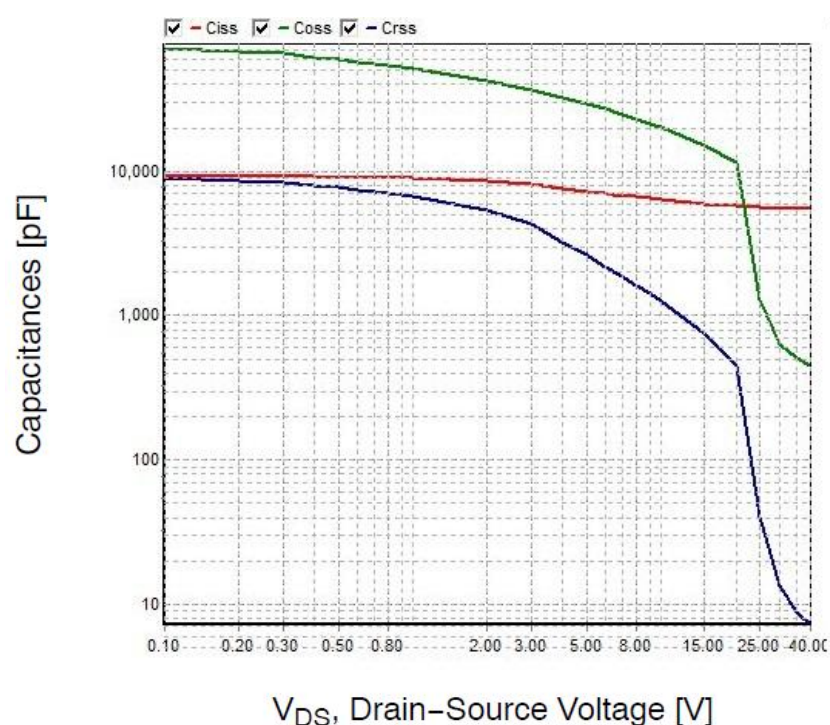


Figure 5. Capacitance Characteristics

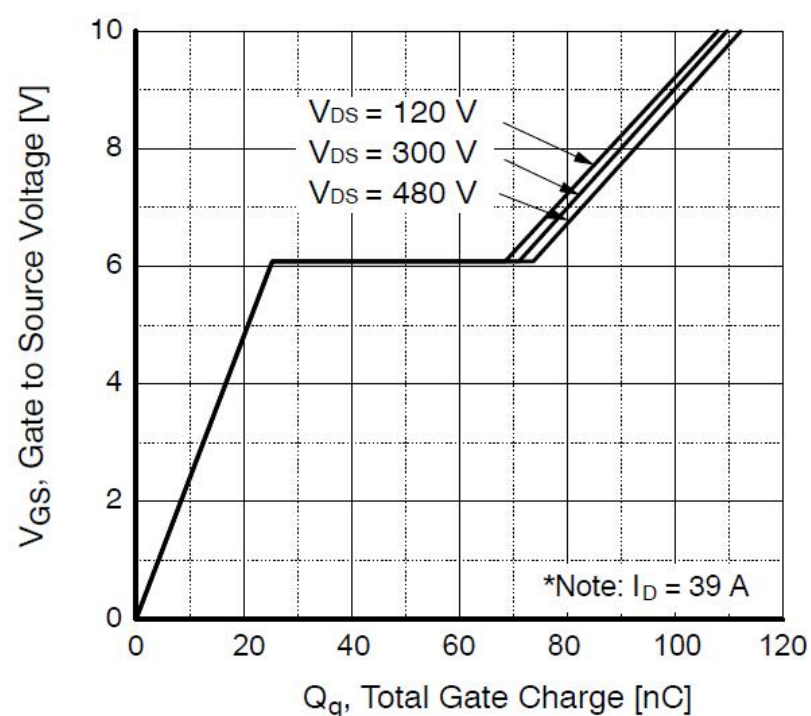


Figure 6. Gate Charge Characteristics

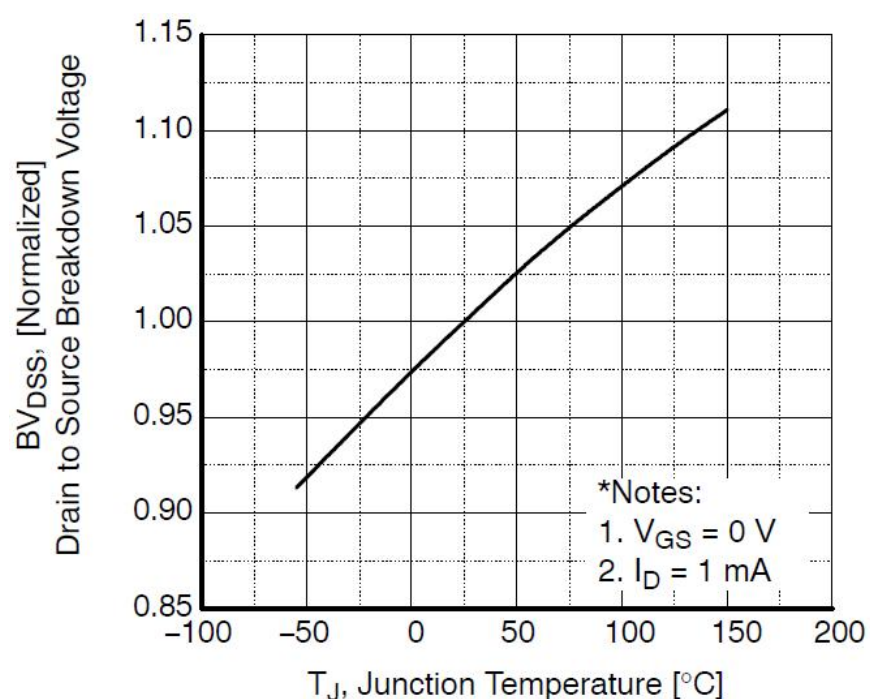


Figure 7. Breakdown Voltage Variation vs. Temperature

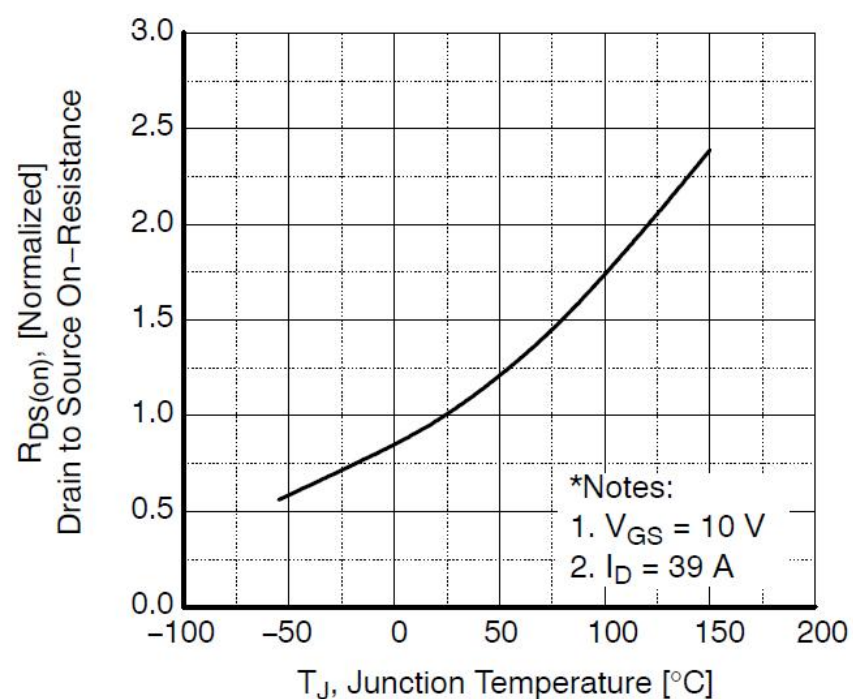


Figure 8. On-Resistance Variation vs. Temperature

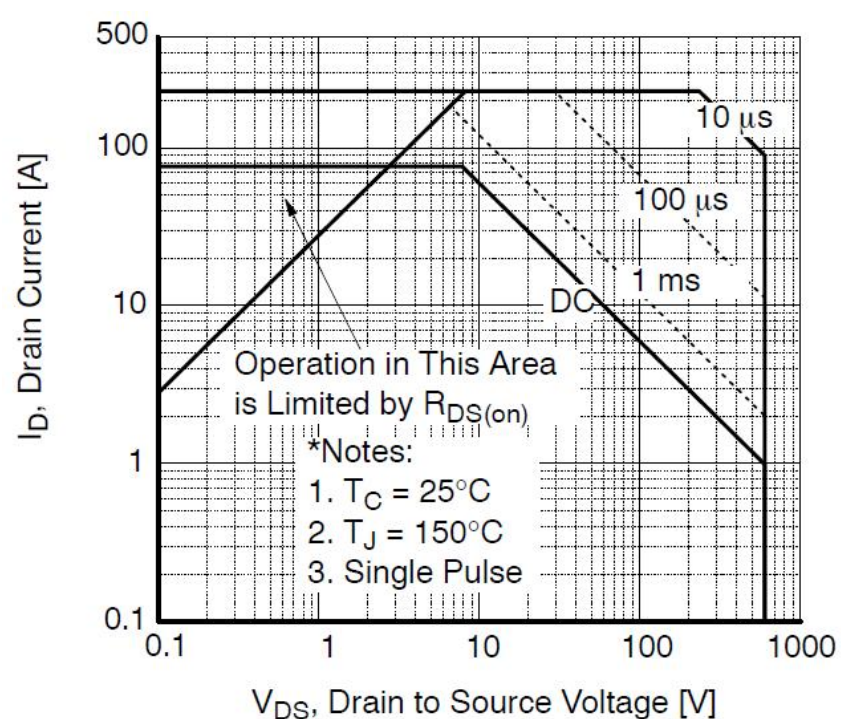


Figure 9. Maximum Safe Operation Area

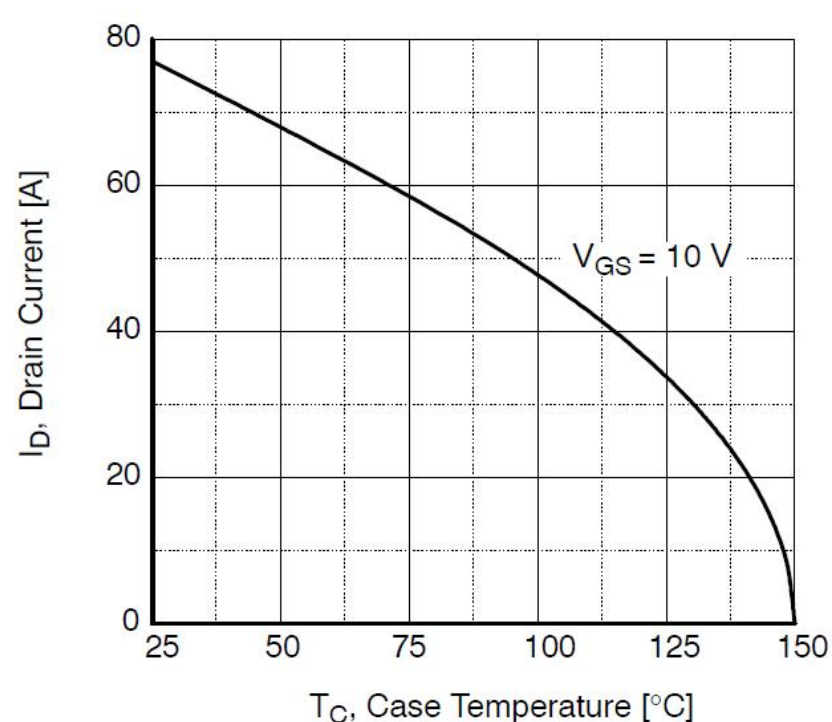


Figure 10. Maximum Drain Current vs. Case Temperature

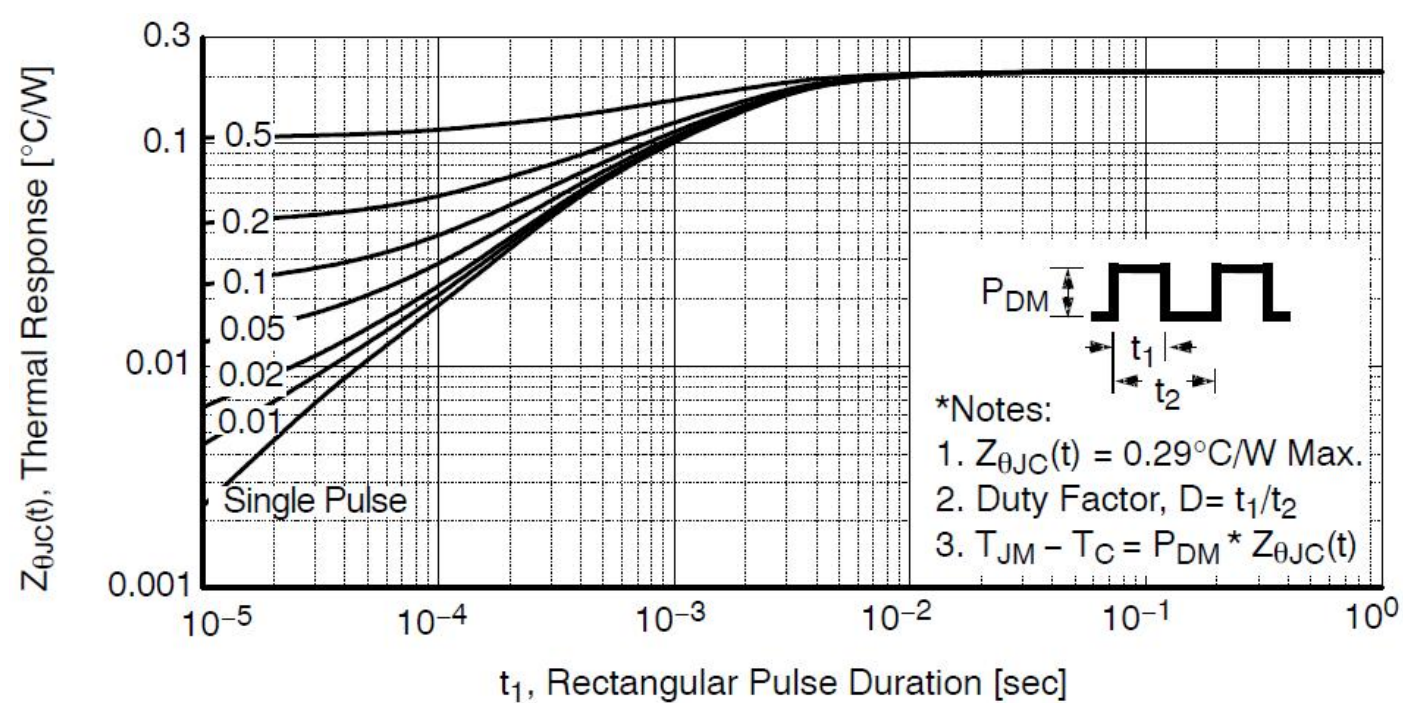


Figure 11. Transient Thermal Response Curve

Test circuits and waveforms

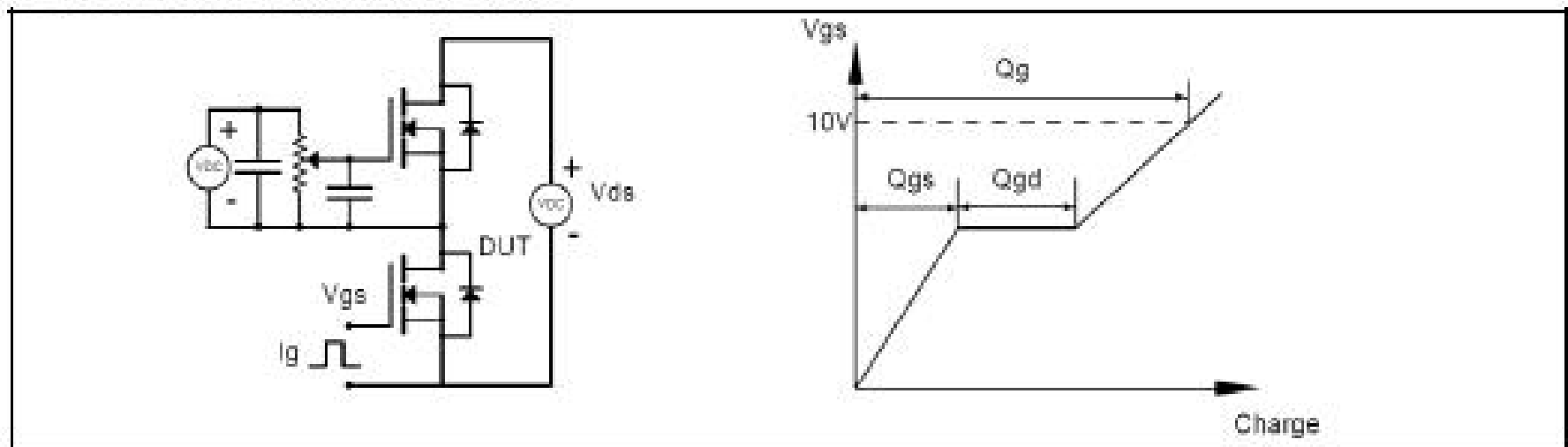


Figure 1. Gate charge test circuit & waveform

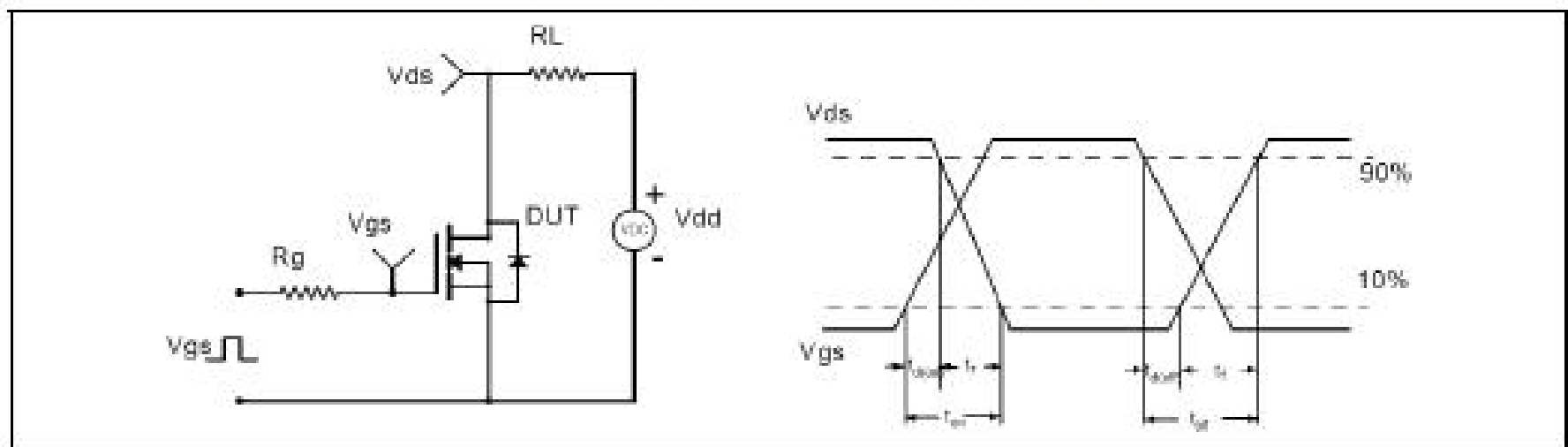


Figure 2. Switching time test circuit & waveforms

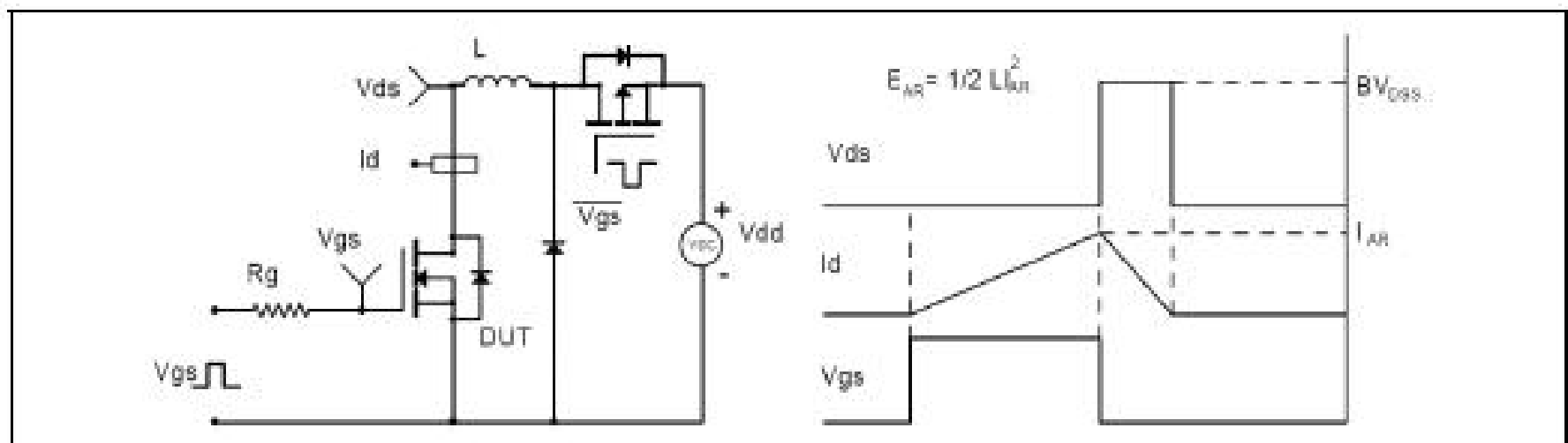


Figure 3. Unclamped inductive switching (UIS) test circuit & waveforms

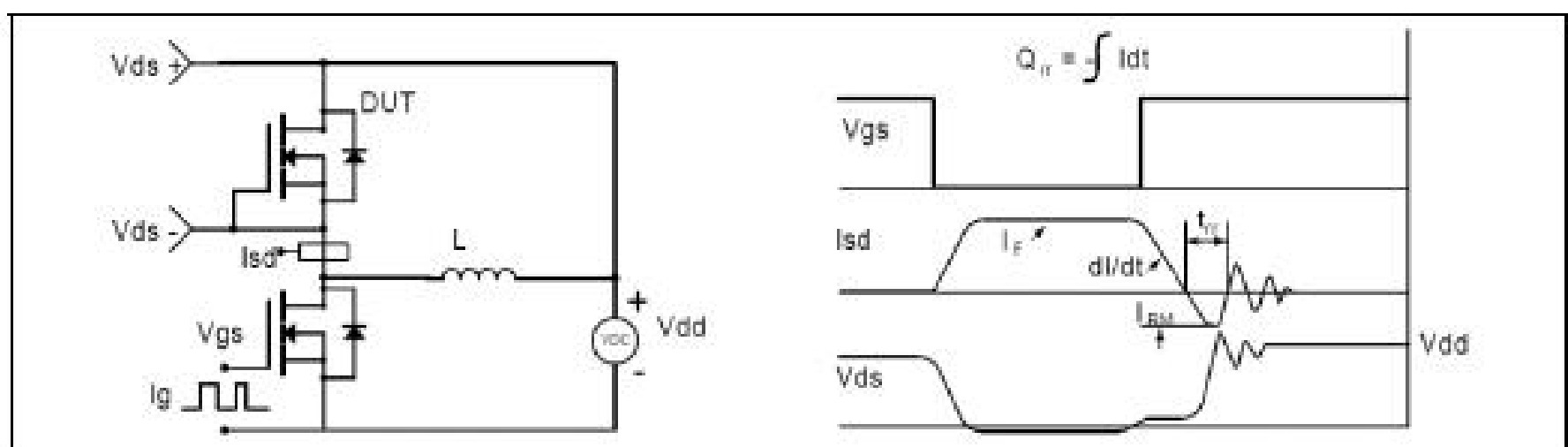
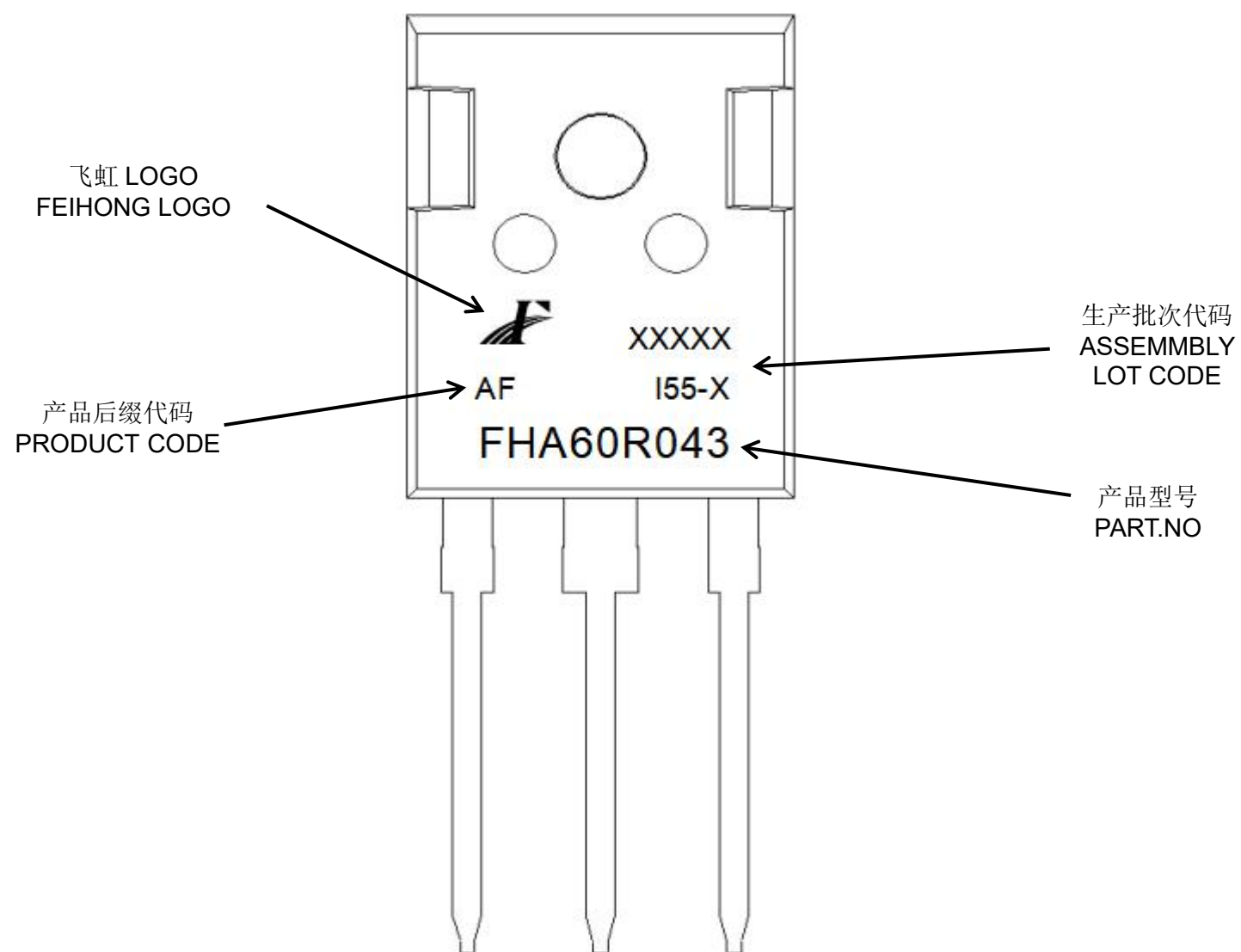


Figure 4. Diode reverse recovery test circuit & waveforms

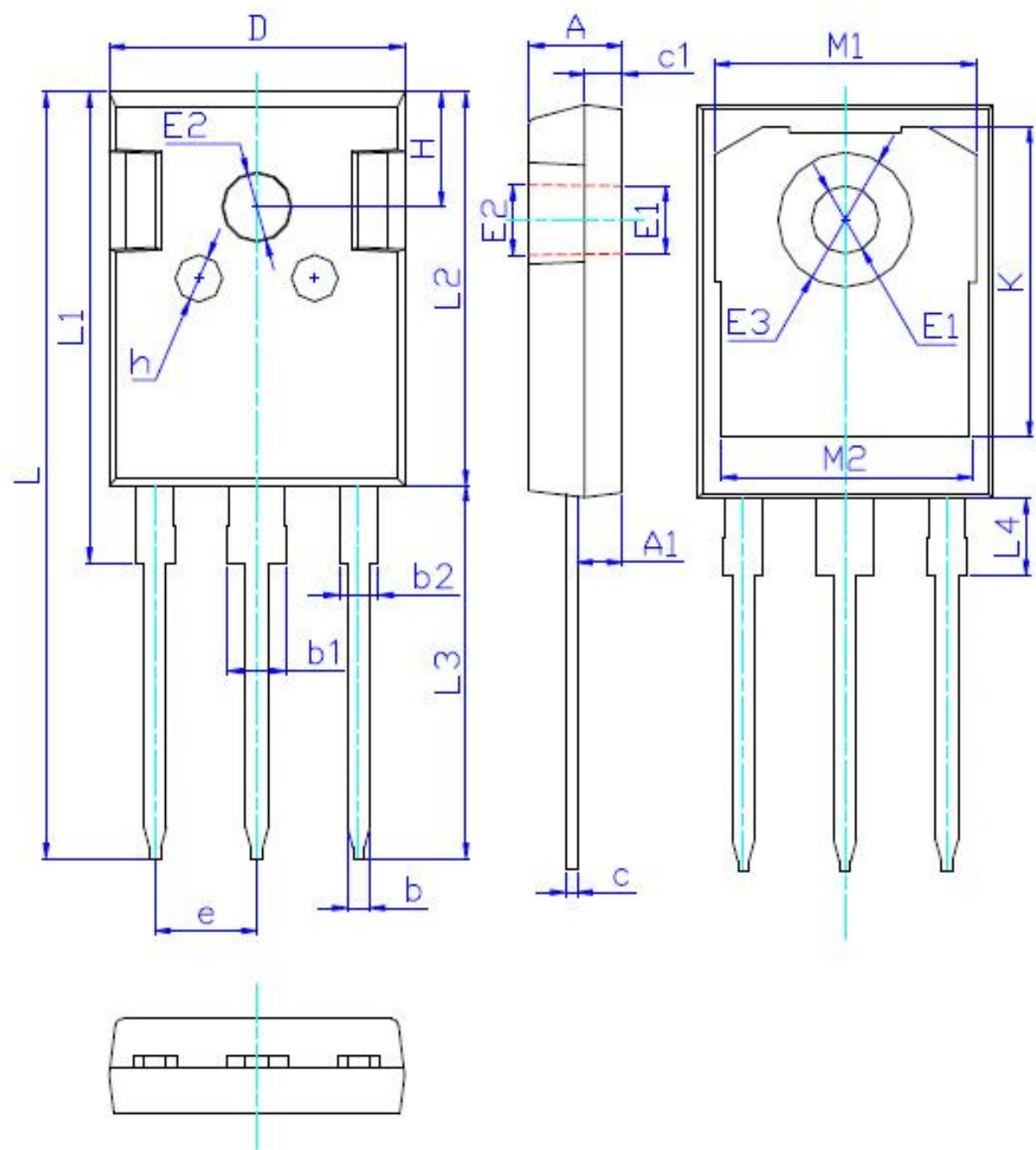
印记 Marking:



外形尺寸:

Package Dimension:

TO-247



标注	尺寸(mm)
A	5.00±0.20
A1	2.41±0.15
b	1.2±0.10
b1	3.10±0.10
b2	2.10±0.10
c	0.60±0.10
c1	2.00±0.15
D	15.80±0.20
E1	3.60±0.15
E2	3.70±0.15
E3	7.19±0.15
L	40.92±0.25
L1	24.95±0.15
L2	21.00±0.20
L3	19.92±0.20
L4	4.10±0.15
e	5.44±0.15
H	6.15±0.15
h	2.50±0.15
K	16.45±0.20
M1	14.00±0.20
M2	13.30±0.20