

主要参数 MAIN CHARACTERISTICS

ID	20 A
VDSS	600 V
Rdson-typ (@Vgs=10V)	162 mΩ
Qg-typ	33 nC

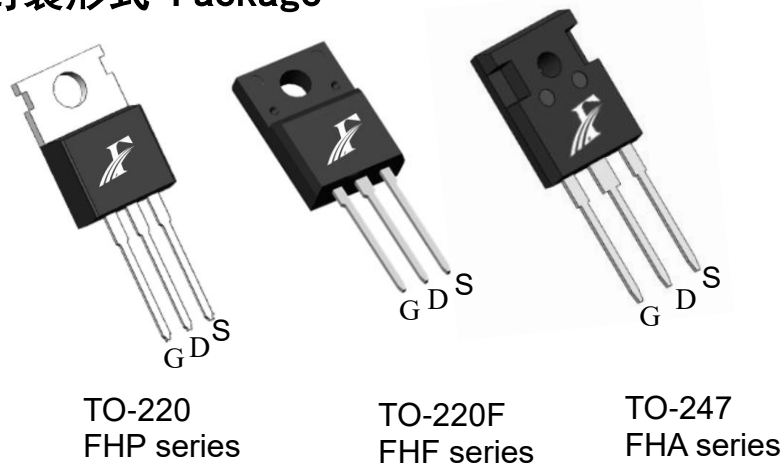
用途 APPLICATIONS

高频开关电源	High efficiency switch mode power supplies
功率因数校正	Power Factor Correction
LLC半桥	LLC half-bridge
锂电池充电器	Lithium battery charger

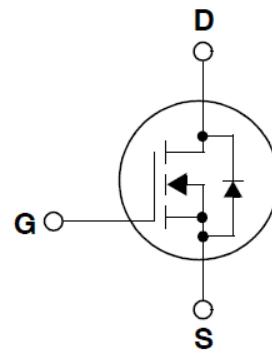
产品特性 FEATURES

多层外延工艺	Multi-Epi process SJ-FET
低栅极电荷	Low gate charge
低 Crss (典型值 2.1 pF)	Low Crss (typical 2.1 pF)
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
RoHS 产品	RoHS product
内置 FRD	Built-in fast recovery diode

封装形式 Package



等效电路 Equivalent Circuit



绝对最大额定值 ABSOLUTE RATINGS (Tc=25℃)

项目 Parameter	符号 Symbol	数值 Value			单位 Unit
		FHP60R190AF	FHF60R190AF	FHA60R190AF	
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℃)	20			A
	I _D (T _C =100℃)	12.6			A
最大脉冲漏极电流 (注 1) Drain Current – pulse (note 1)	I _{DM}	80			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}	80			mJ
雪崩电流 (注 1) Avalanche Current (note 1)	I _{AR}	4			A
重复雪崩能量 (注 1) Repetitive Avalanche Current (note 1)	E _{AR}	20			mJ
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℃)	150	34	190	W
	-Derate above 25℃	1.2	0.27	1.52	W/℃
最高结温及存储温度 Operating and Storage Temperature Range	T _J , T _{STG}	-55~+150			℃
引线最高焊接温度 Maximum Lead Temperature for Soldering Purposes	T _L	260			℃

*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 =250μA, V _{GS} =0V	600	-	-	V
击穿电压温度特性 Breakdown Voltage Temperature Coefficient	ΔBV _{DSS} /Δ T _J	I _D =250μA, referenced to 25℃	-	0.6	-	V/℃
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
		V _{DS} =480V,V _{GS} =0V, T _C =125℃	-	300	-	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 =250μA	3.0	4.0	5.0	V
静态导通电阻 Static Drain-Source On-Resistance	R _{DS(ON)}	V _{GS} =10V , I _D =10A	-	162	190	mΩ
正向跨导 Forward Transconductance	g _{fs}	V _{DS} = 10V, I _D =10A (note 4)	-	28	-	S
动态特性 Dynamic Characteristics						
栅电阻 Gate Resistance	R _g	f=1.0MHz,V _{DS} =OPEN	-	1.3	-	Ω
输入电容 Input capacitance	C _{iss}	V _{DS} =100V, V _{GS} =0V, f=1.0MHz	-	1505	-	pF
输出电容 Output capacitance	C _{oss}		-	68	-	
反向传输电容 Reverse transfer capacitance	C _{rss}		-	2.1	-	
开关特性 Switching Characteristics						
延迟时间 Turn-On delay time	t _{d(on)}	V _{DS} =400V, I _D =10A, R _G =3.3Ω V _{GS} =10V (note 4, 5)	-	38	-	ns
上升时间 Turn-On rise time	t _r		-	39	-	ns
延迟时间 Turn-Off delay time	t _{d(off)}		-	170	-	ns
下降时间 Turn-Off Fall time	t _f		-	47	-	ns
栅极电荷总量 Total Gate Charge	Q _g	V _{DS} =480V , I _D =10A , V _{GS} =10V (note 4, 5)	-	33	-	nC
栅—源电荷 Gate-Source charge	Q _{gs}		-	8.7	-	nC
栅—漏电荷 Gate-Drain charge	Q _{gd}		-	12.5	-	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		-	-	20	A
正向最大脉冲电流 Maximum Pulsed Drain-Source Diode Forward Current	I _{SM}		-	-	80	A
正向压降 Drain-Source Diode Forward Voltage	V _{SD}	V _{GS} =0V, I _S =10A	-	0.9	1.2	V
反向恢复时间 Reverse recovery time	t _{rr}	V _{GS} =0V, I _S =10A ,dI _F /dt=100A/μs (note 4)	-	120	-	ns
反向恢复电荷 Reverse recovery charge	Q _{rr}		-	0.6	-	μC
反向恢复峰值电流 Peak reverse recovery current	I _{rrm}		-	25	-	A

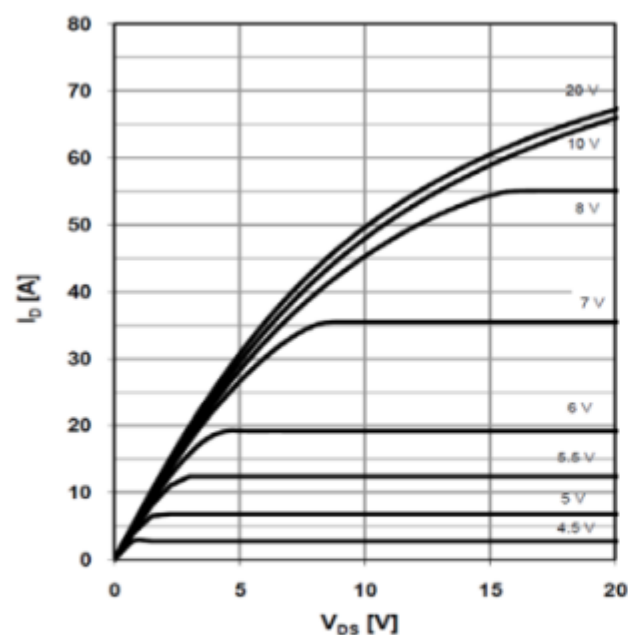
热特性 THERMAL CHARACTERISTIC

项目 Parameter	符号 Symbol	FHP60R190AF	FHF60R190AF	FHA60R190AF	单位 Unit
结到管壳的热阻 Thermal Resistance, Junction to Case	Rth(j-c)	0.83	3.67	0.65	℃/W
结到环境的热阻 Thermal Resistance, Junction to Ambient	Rth(j-A)	62.5	62.5	50	℃/W

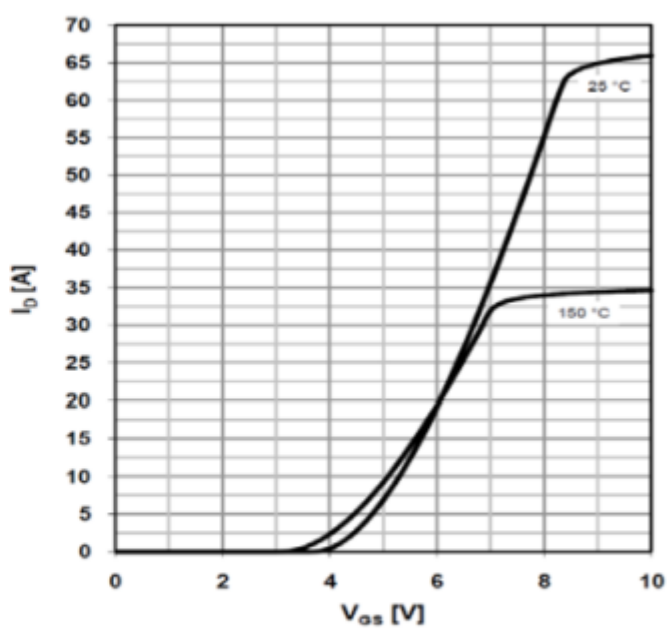
- 注释:
- 1: 脉冲宽度由最高结温限制
 - 2: L=10mH, IAS=4A, VDD=50V, RG=25 Ω,起始结温 TJ=25℃
 - 3: ISD ≤20A,di/dt ≤200A/μs,VDD≤BVDSS,起始结温 TJ=25℃
 - 4: 脉冲测试: 脉冲宽度 ≤300μs,占空比≤2%
 - 5: 基本与工作温度无关

- Notes:
- 1: Pulse width limited by maximum junction temperature
 - 2: L=10mH, IAS=4A, VDD=50V, RG=25 Ω,Starting TJ=25℃
 - 3: ISD ≤20A,di/dt ≤200A/μs,VDD≤BVDSS, Starting TJ=25℃
 - 4: Pulse Test: Pulse Width ≤300μs,Duty Cycle≤2%
 - 5: Essentially independent of operating temperature

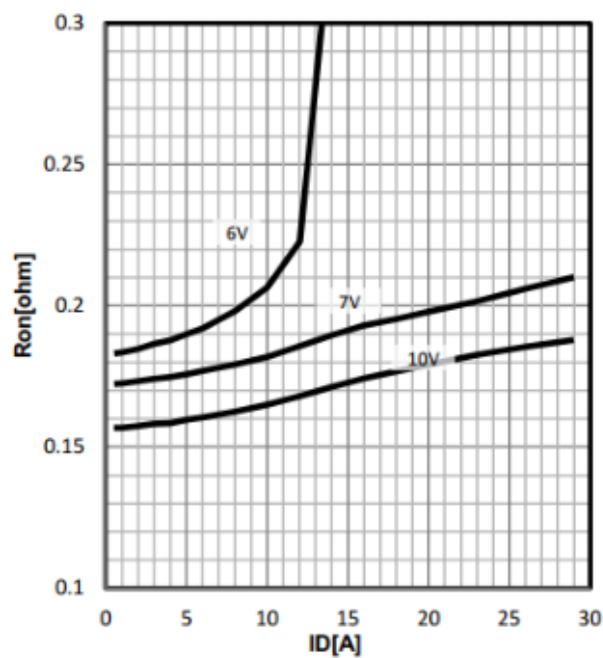
Typical Characteristics



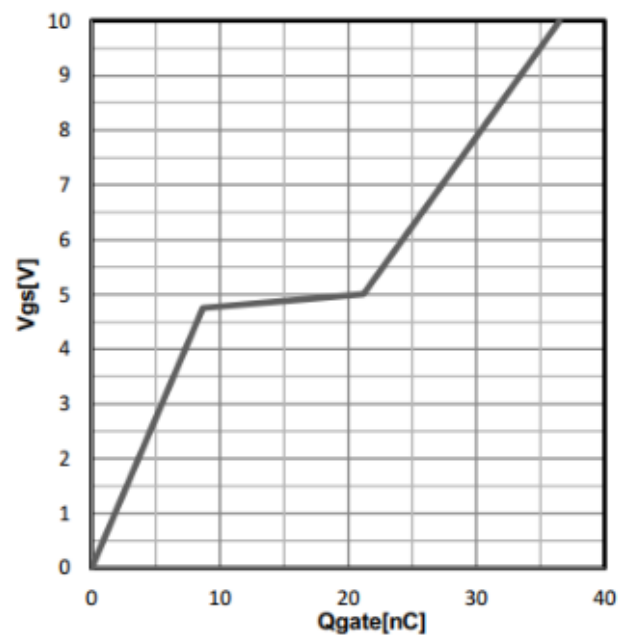
Typ. output characteristics $T_J=25\text{ }^{\circ}\text{C}$
parameter: V_{GS}



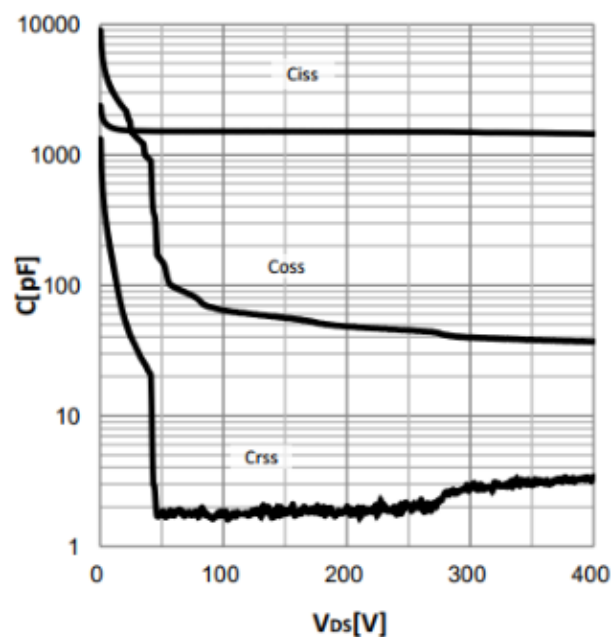
Typ. transfer characteristics



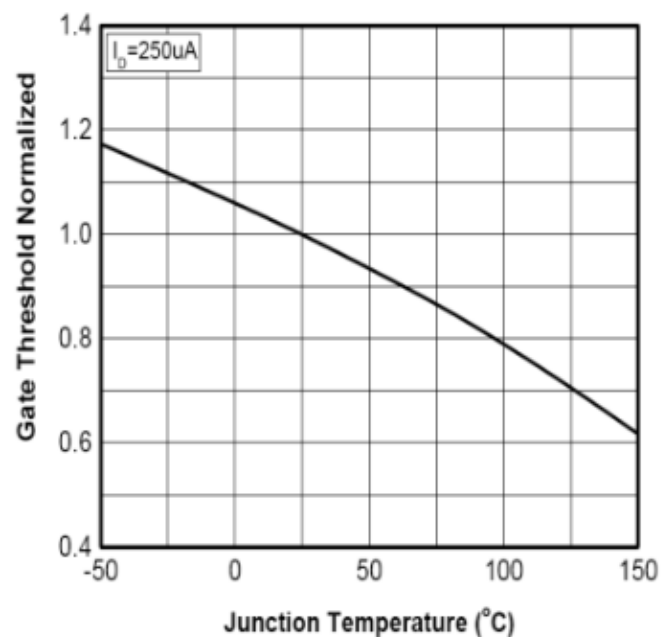
Typ. drain-source on-state resistance
parameter: V_{GS}



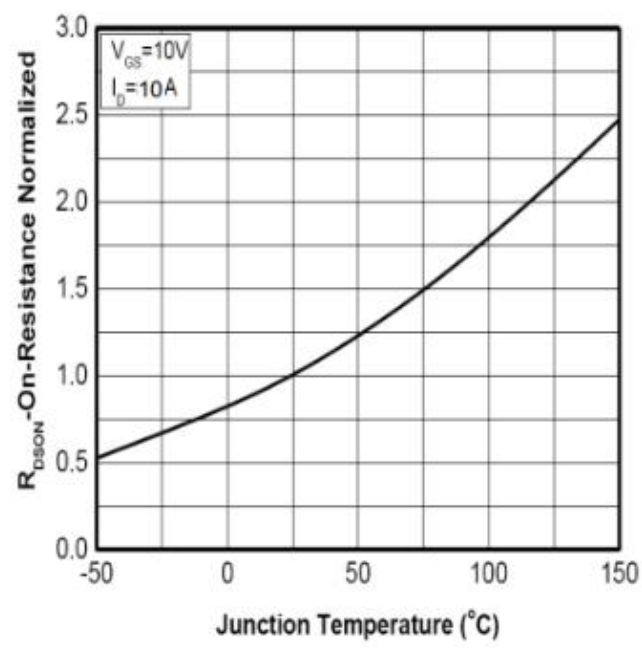
Typ. gate charge characteristics



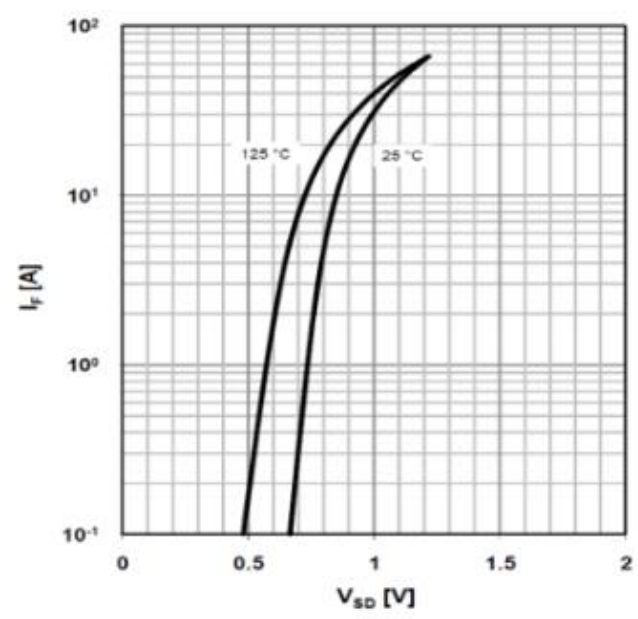
Typ. capacitances



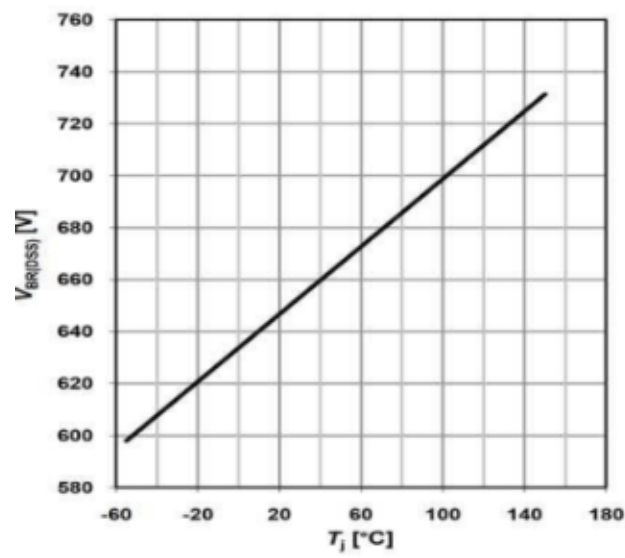
Normalized $V_{GS(th)}$ characteristics



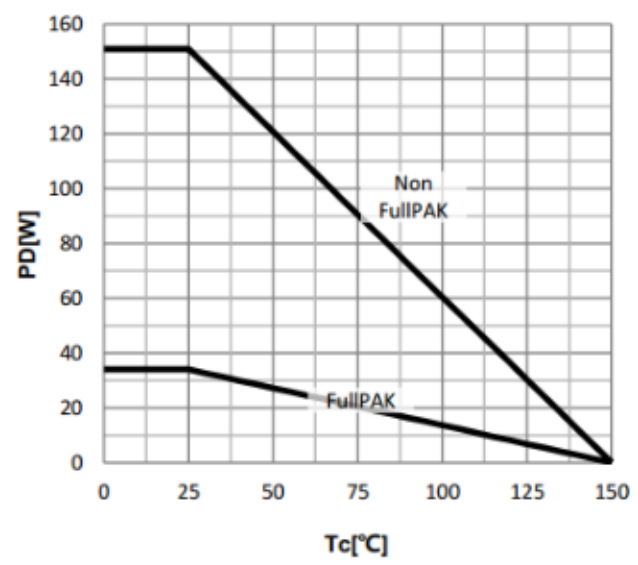
Normalized on resistance vs temperature



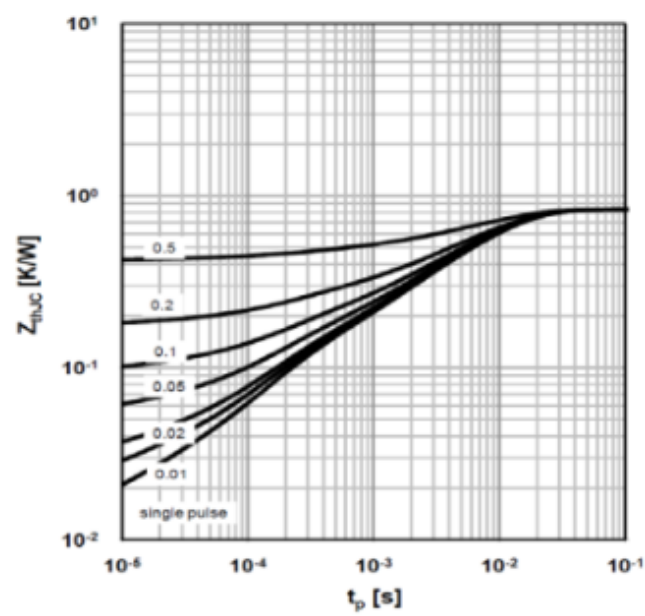
Forward characteristics of reverse diode



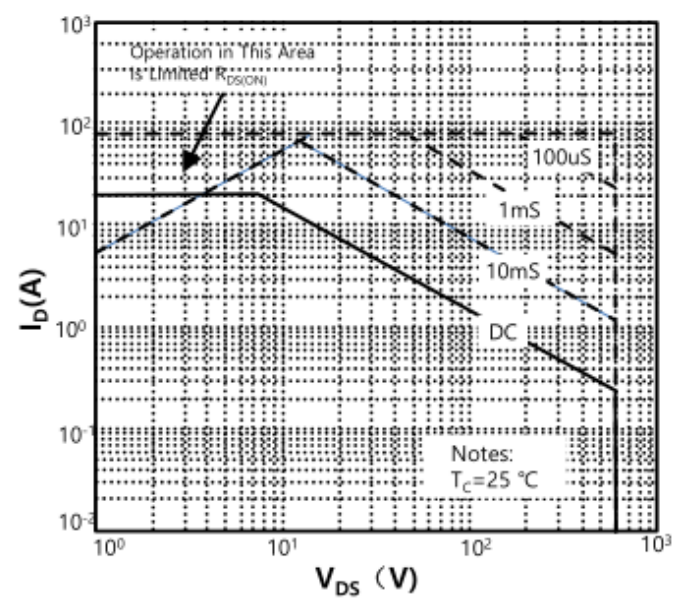
Drain-source breakdown voltage



Power dissipation



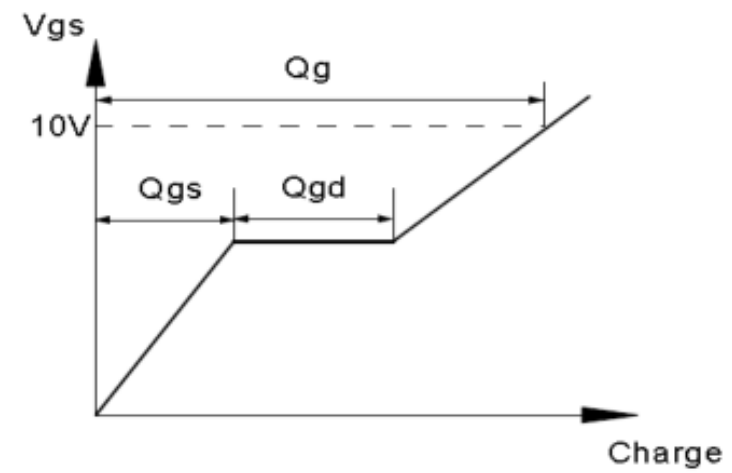
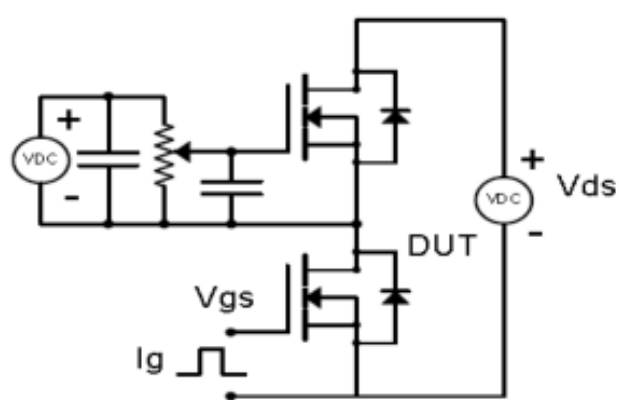
Max. transient thermal impedance



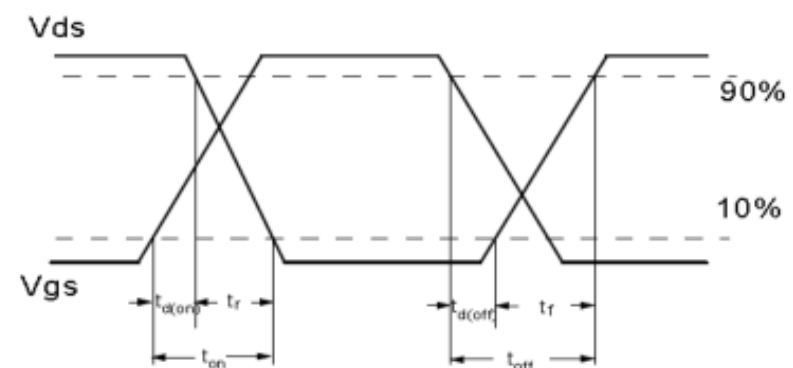
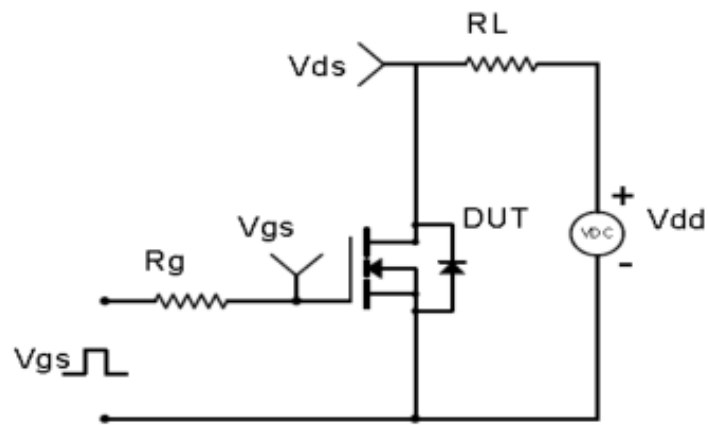
Safe operating area $T_C=25^{\circ}\text{C}$

Test Circuit & Waveform

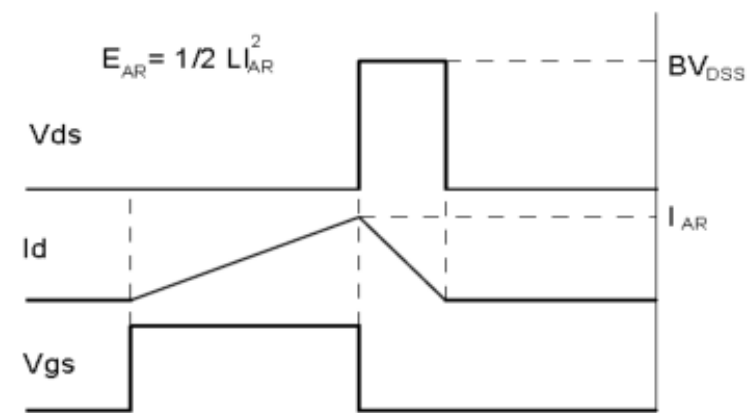
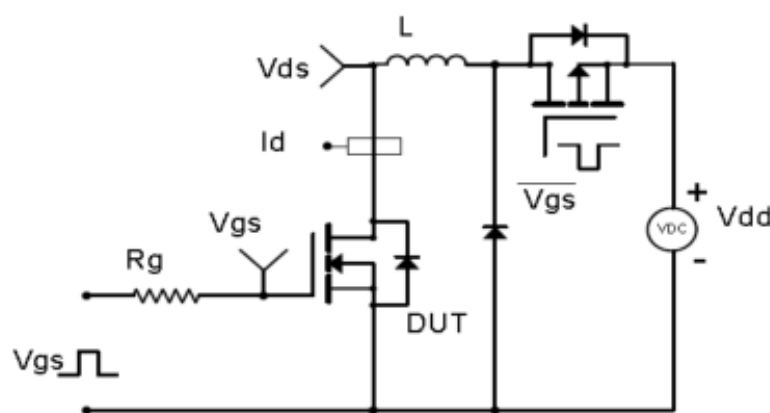
Gate Charge Test Circuit & Waveform



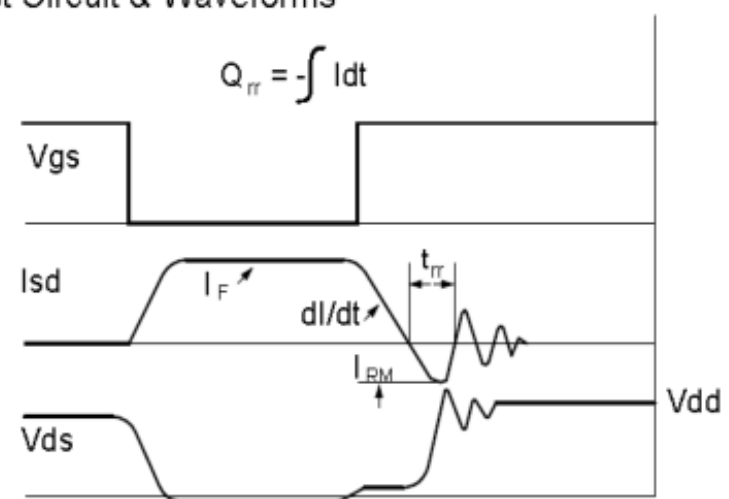
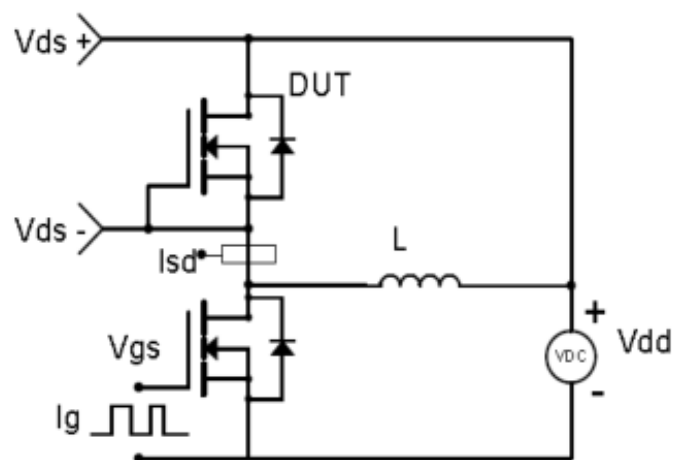
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



印记 Marking:



产品代码
PRODUCT CODE

产品型号
PART.NO

生产批次代码
ASSEMBLY
LOT CODE



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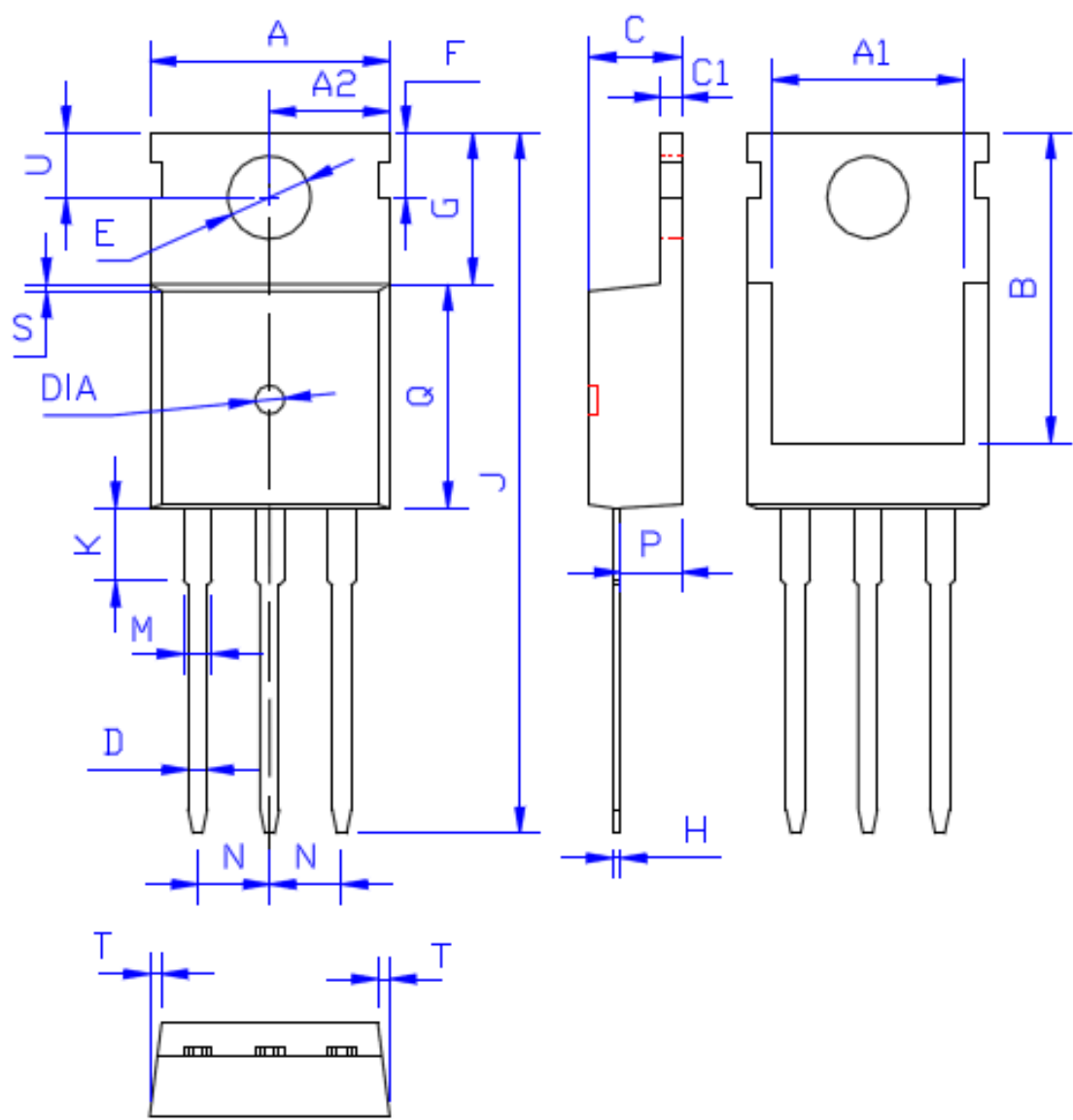
产品型号
PART.NO

生产批次代码
ASSEMBLY
LOT CODE

外形尺寸:

Package Dimension:

TO-220



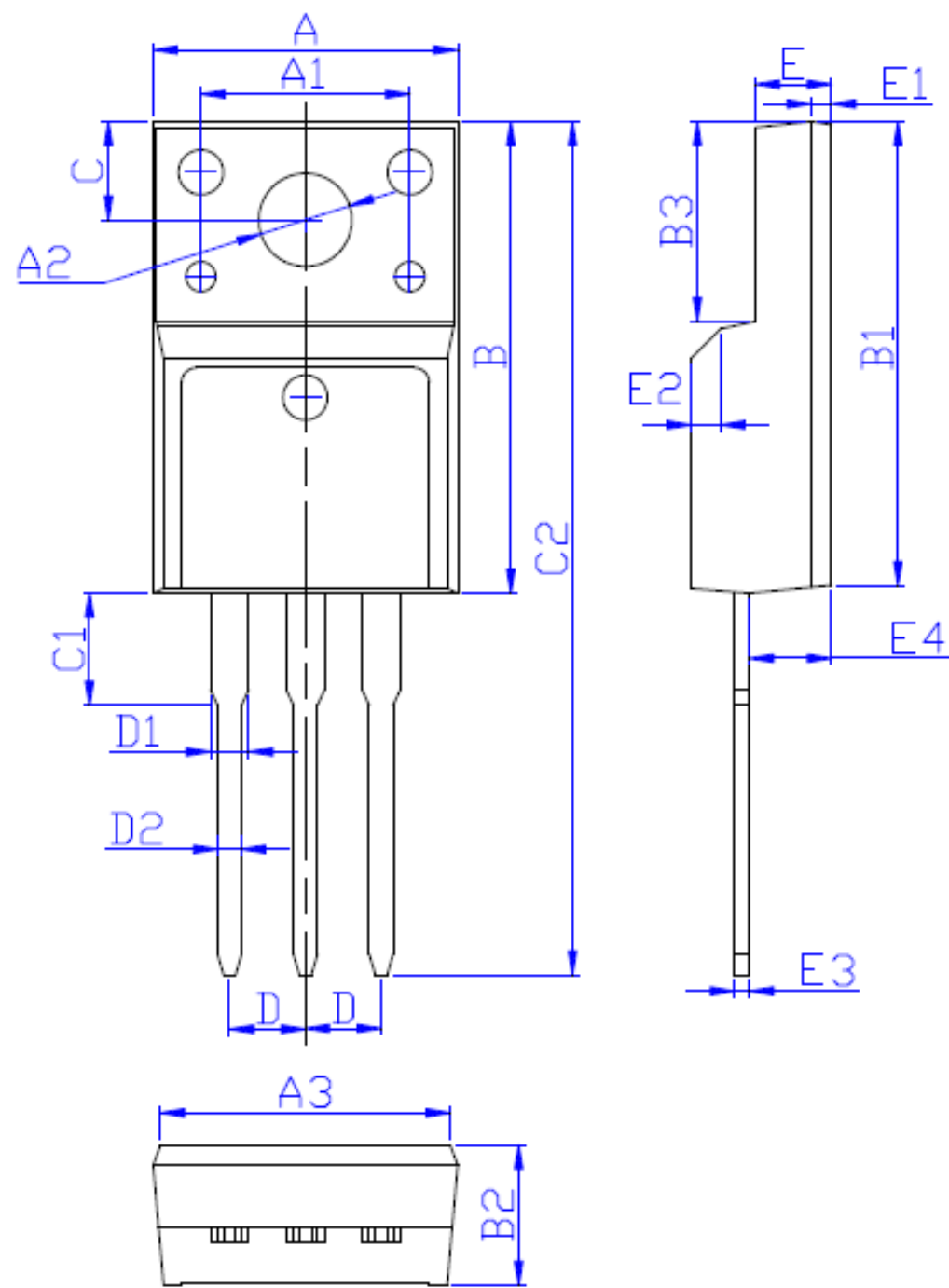
DIM	MILLIMETERS
A	10.00±0.30
A1	8.00±0.30
A2	5.00±0.30
B	13.20±0.40
C	4.50±0.20
C1	1.30±0.20
D	0.80±0.20
E	3.60±0.20
F	3.00±0.30
G	6.60±0.40
H	0.50±0.20
J	28.88±0.50
K	3.00±0.30
M	1.30±0.30
N	Typical 2.54
P	2.40±0.40
Q	9.20±0.40
S	0.25±0.15
T	0.25±0.15
U	2.80±0.30
DIA	宽 1.50±0.10 深 0.50 MAX

(Unit: mm)

外形尺寸:

Package Dimension:

TO-220F



DIM	MILLIMETERS
A	10.16±0.30
A1	7.00±0.20
A2	3.12±0.20
A3	9.70±0.30
B	15.90±0.50
B1	15.60±0.50
B2	4.70±0.30
B3	6.70±0.30
C	3.30±0.25
C1	3.25±0.30
C2	28.70±0.50
D	Typical 2.54
D1	1.47 (MAX)
D2	0.80±0.20
E	2.55±0.25
E1	0.70±0.25
E2	1.0×45°
E3	0.50±0.20
E4	2.75±0.30

(Unit:mm)

Package Dimension:

标注	尺寸(mm)
A	5.00 ± 0.05
A1	2.41 ± 0.05
b	1.2 ± 0.05
b1	3.05 ± 0.05
b2	2.05 ± 0.05
c	0.60 ± 0.05
c1	2.00 ± 0.05
D	15.80 ± 0.10
E1	3.60 ± 0.05
E2	3.70 ± 0.05
E3	7.19 ± 0.05
L	40.92 ± 0.10
L1	24.95 ± 0.10
L2	21.00 ± 0.10
L3	19.92 ± 0.10
L4	4.10 ± 0.05
e	5.44 ± 0.05
H	6.15 ± 0.05
h	2.50 ± 0.05
K	16.45 ± 0.10
M1	14.00 ± 0.10
M2	13.30 ± 0.10