超结-场效应晶体管

Super Junction -MOSFET

FHP65R190A/FHA65R190A/FHF65R190A

主要参数 MAIN CHARACTERISTICS

ID	20A
VDSS	650 V
Rdson-typ（ @Vgs=10V）	0.16Ω
Qg-typ	36.5nC

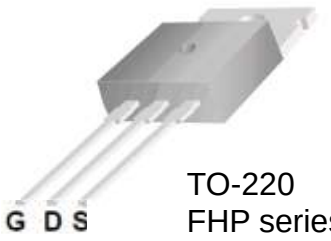
产品特性 FEATURES

低栅极电荷	Low gate charge
低 Crss (典型值 2.1pF)	Low Crss (typical 2.1pF)
开关速度快	Fast switching
100%经过雪崩测试	100% avalanche tested
高抗 dv/dt 能力	Improved dv/dt capability
RoHS 产品	RoHS product

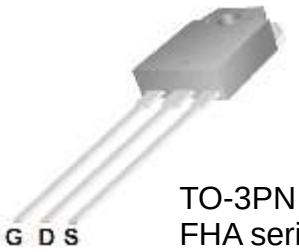
用途 APPLICATIONS

高频开关电源	High efficiency switch mode power supplies

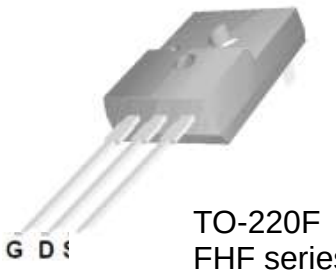
封装形式 Package



TO-220
FHP series

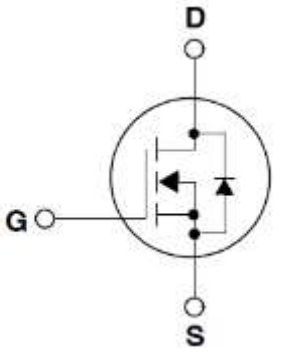


TO-3PN
FHA series



TO-220F
FHF series

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**
		FHP65R190A	**FHF65R190A**	**FHA65R190A**	
最高漏极一源极直流电压 Drain-Source Voltage	V_{DS}	650			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}	65			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}	485			mJ
雪崩电流（注 1） Avalanche Current（note 1）	I_{AR}	9.5			A
重复雪崩能量（注 1） Repetitive Avalanche Current（note 1）	E_{AR}	25			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 （TC=25℃）	150	34	208	W
	-Derate above 25℃	1.2	0.26	3.06	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	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**						
漏一源击穿电压 Drain-Source Voltage	BV_{DSS}	I_D=250μA, V_{GS}=0V	650	-	-	V
击穿电压温度特性 Breakdown Voltage Temperature Coefficient	$\Delta BV_{DSS}/\Delta TJ$	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}=650V,V_{GS}=0V, T_C=25℃	-	-	1	μA
		V_{DS}=480V, T_C=125℃	-	-	100	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} = VGS , I_D=250μA	2.0	3.0	4.0	V
静态导通电阻 Static Drain-Source On-Resistance	$R_{DS(ON)}$	V_{GS} =10V , I_D=10.0A	-	0.16	0.19	Ω
正向跨导 Forward Transconductance	gfs	V_{DS} = 10V, I_D=20A（note 4）	-	18.8	-	S
动态特性 **Dynamic Characteristics**						
输入电容 Input capacitance	Ciss	V_{DS}=100V, V_{GS} =0V, f=1.0MHz	-	1505	-	pF
输出电容 Output capacitance	Coss		-	68	-	
反向传输电容 Reverse transfer capacitance	Crss		-	2.1	-	
开关特性 **Switching Characteristics**						
栅电阻 Gate Resistance	Rg	f=1.0MHz, V_{DS} OPEN	-	9.8	-	Ω
延迟时间 Turn-On delay time	td(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	tr		-	39	-	ns
延迟时间 Turn-Off delay time	td(off)		-	170	-	ns
下降时间 Turn-Off Fall time	tf		-	47	-	ns
栅极电荷总量 Total Gate Charge	Qg	V_{DS} =480V , I_D=10A , V_{GS} =10V （note 4，5）	-	36.5	-	nC
栅一源电荷 Gate-Source charge	Qgs		-	8.7	-	nC
栅一漏电荷 Gate-Drain charge	Qgd		-	12.5	-	nC
漏一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}		-	-	65	A
正向压降 Drain-Source Diode Forward Voltage	V_{SD}	V_{GS}=0V, I_S=20A	-	0.9	1.4	V
反向恢复时间 Reverse recovery time	trr	V_{GS}=0V, I_S=10A ,dI_F/dt=100A/μs (note 4)	-	318	-	ns
反向恢复电荷 Reverse recovery charge	Qrr		-	5.5	-	μC

热特性 THERMAL CHARACTERISTIC

项目 Parameter	符号 Symbol	**FHP65R190A**	**FHA65R190A**	**FHF65R190A**	单位 Unit
结到管壳的热阻 Thermal Resistance, Junction to Case	Rth(j-c)	0.83	0.6	3.7	℃/W
结到环境的热阻 Thermal Resistance, Junction to Ambient	Rth(j-A)	62	40	80	℃/W

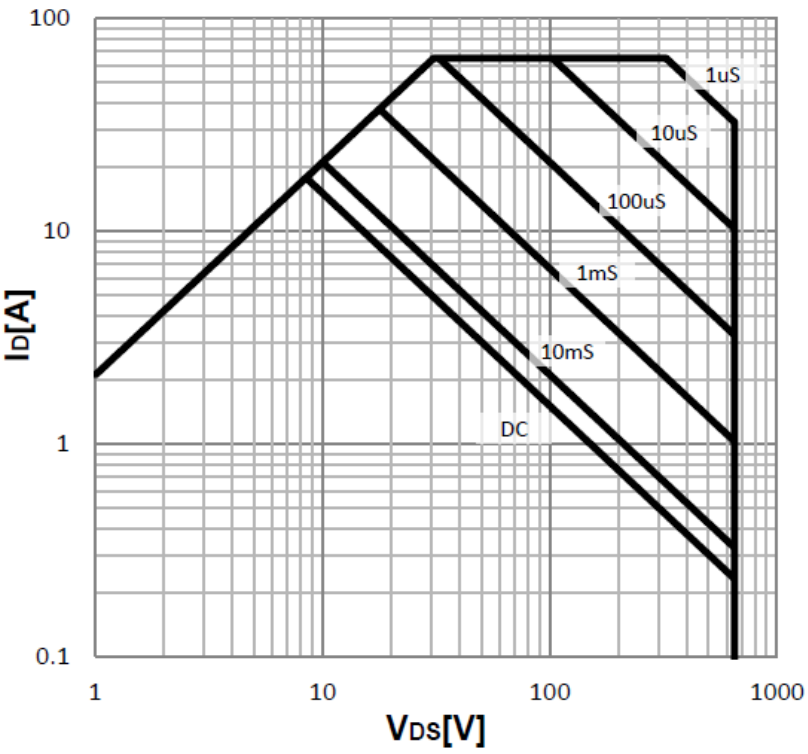
注释：
1：脉冲宽度由最高结温限制
2：L=10mH, I_{AS}=9.5A, V_{DD}=50V, R_G=25 Ω,起始结温 T_J=25℃
3：I_{SD} ≤20A,di/dt ≤200A/μs,V_{DD}≤BV_{DSS},起始结温 T_J=25℃
4：脉冲测试：脉冲宽度 ≤300μs,占空比≤2%
5：基本与工作温度无关

Notes:
1：Pulse width limited by maximum junction temperature
2：L=10mH, I_{AS}=9.5A, V_{DD}=50V, R_G=25 Ω,Starting T_J=25℃
3：I_{SD} ≤20A,di/dt ≤200A/μs,V_{DD}≤BV_{DSS}, Starting T_J=25℃
4：Pulse Test：Pulse Width ≤300μs,Duty Cycle≤2%
5：Essentially independent of operating temperatur

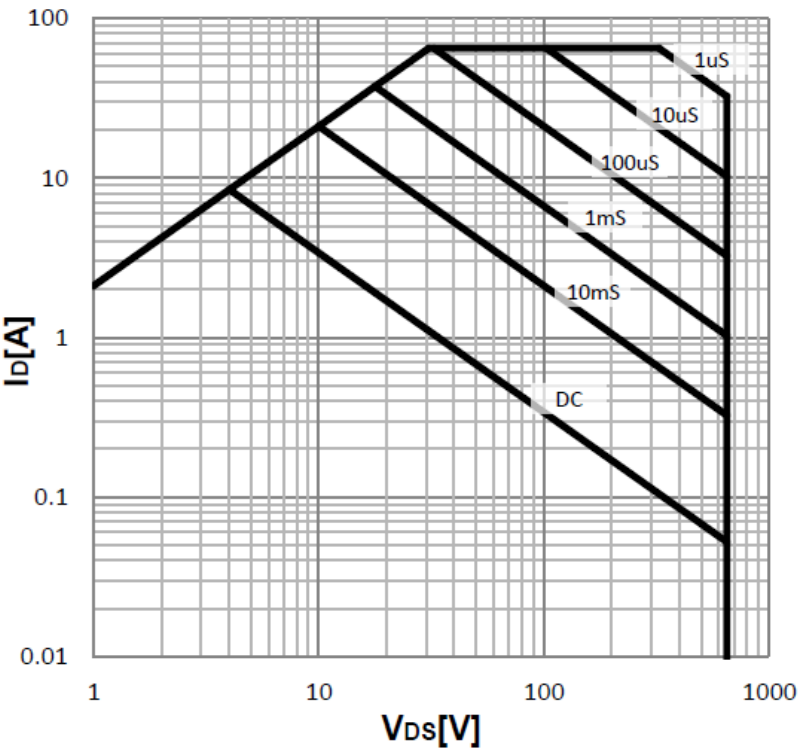
典型特性曲线

ELECTRICAL CHARACTERISTIC CURVE

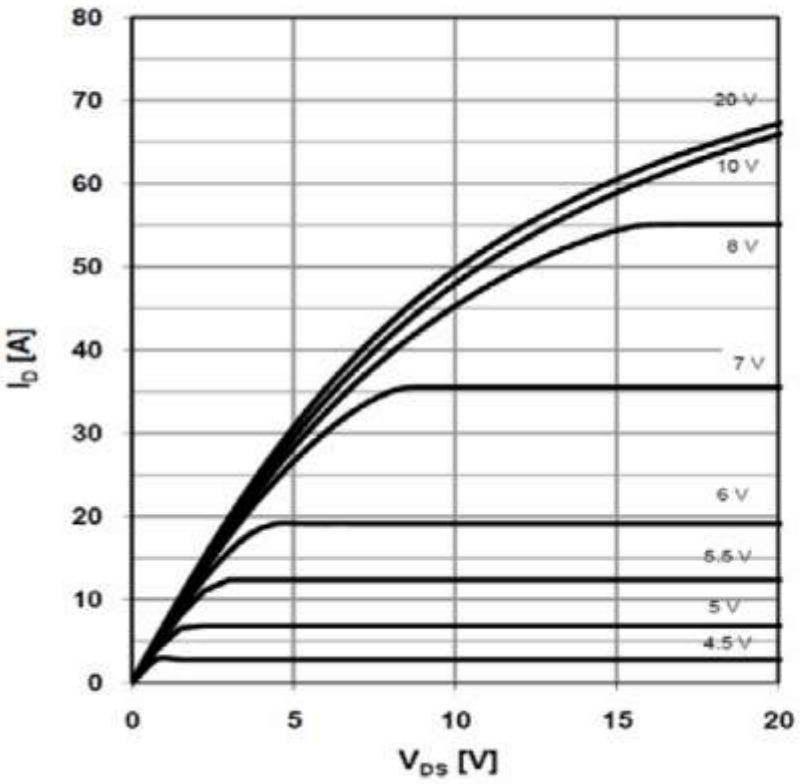
Safe operating area TC=25 °C
parameter: tp; TO-220, TO-3PN



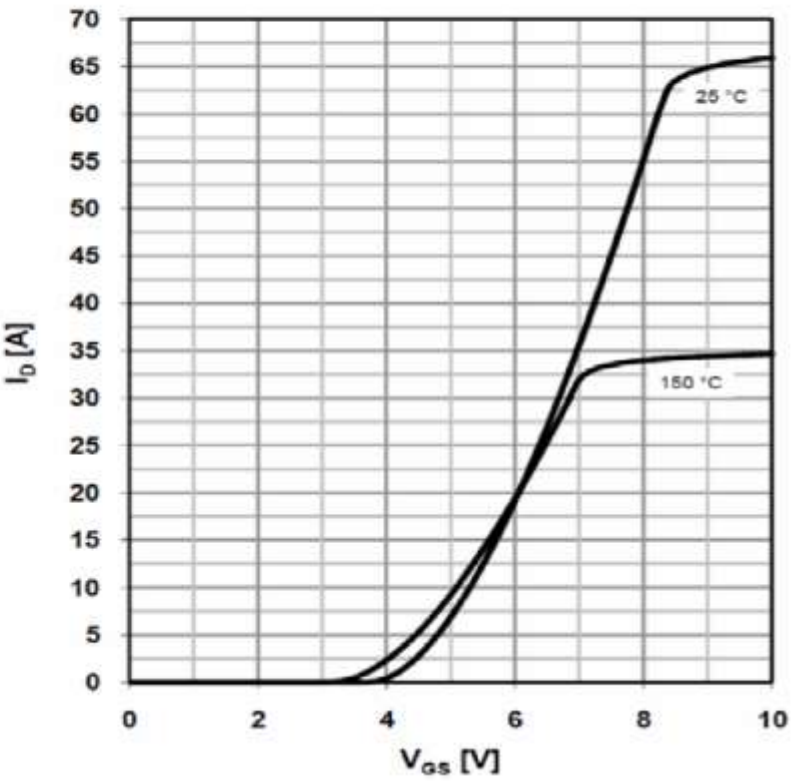
Safe operating area TC=25 °C
parameter: tp; TO-220FullPAK



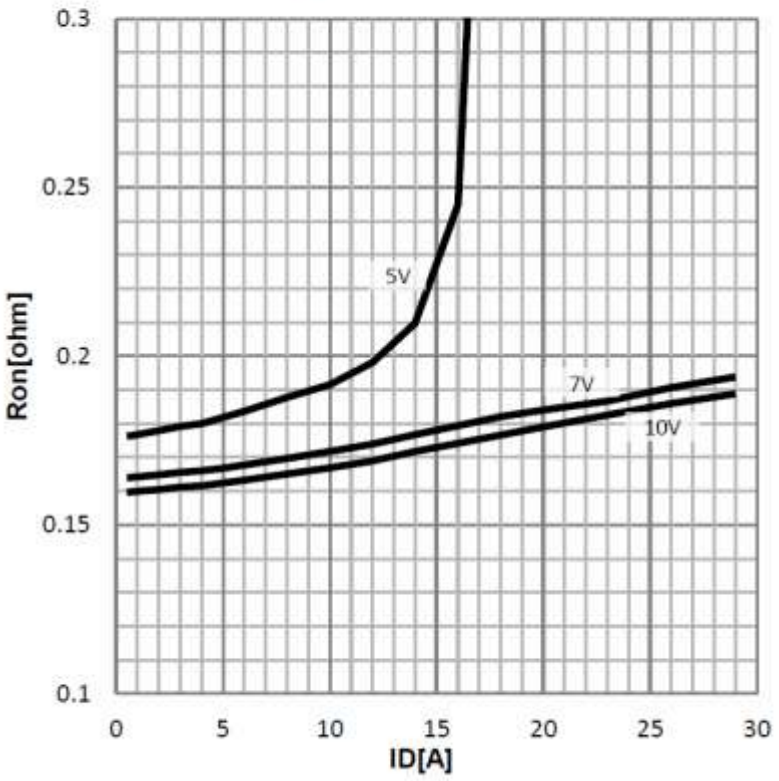
Typ. output characteristics T_j=25 °C
parameter: VGS



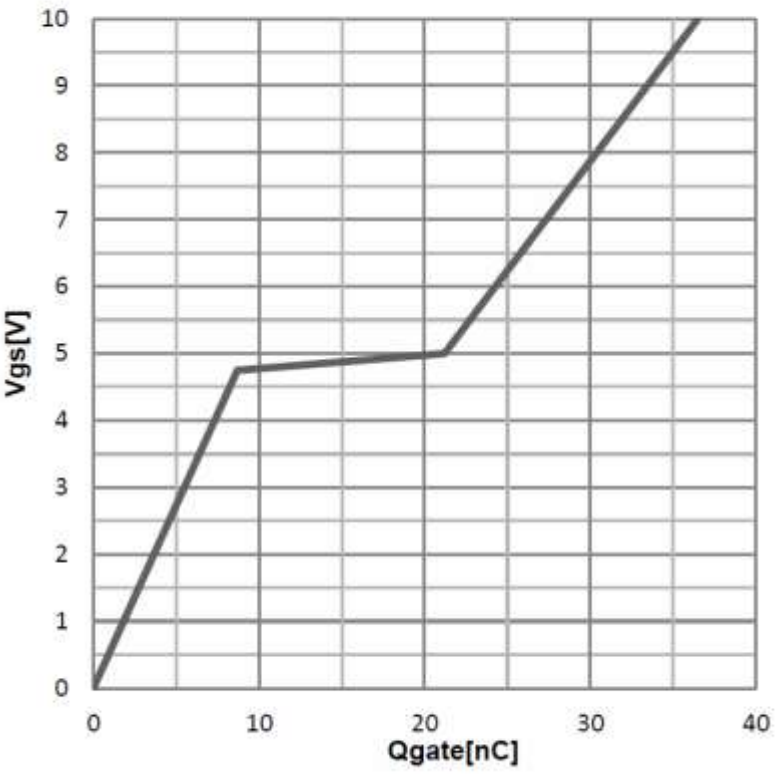
Typ. transfer characteristics



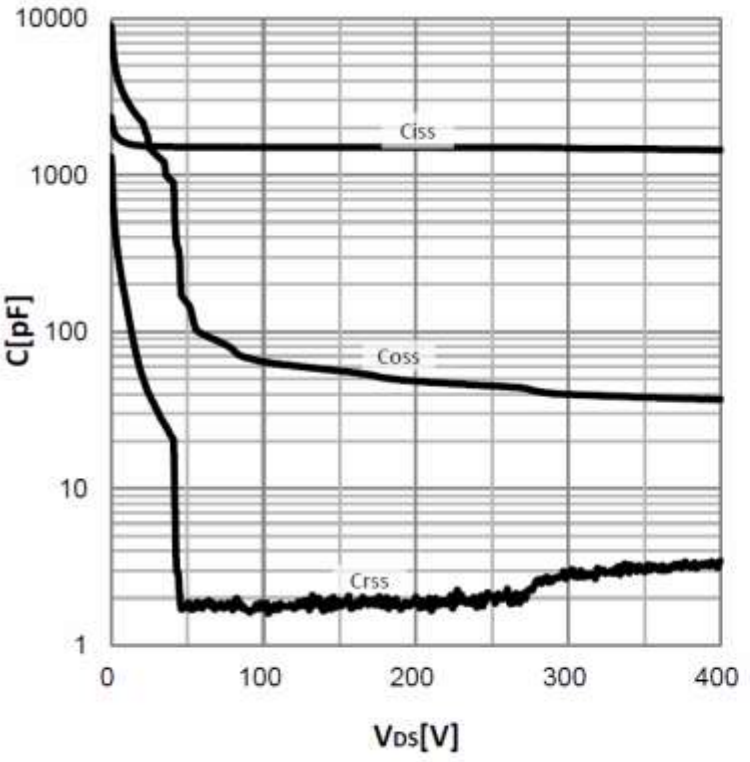
Typ. drain-source on-state resistance
parameter : V_{GS}



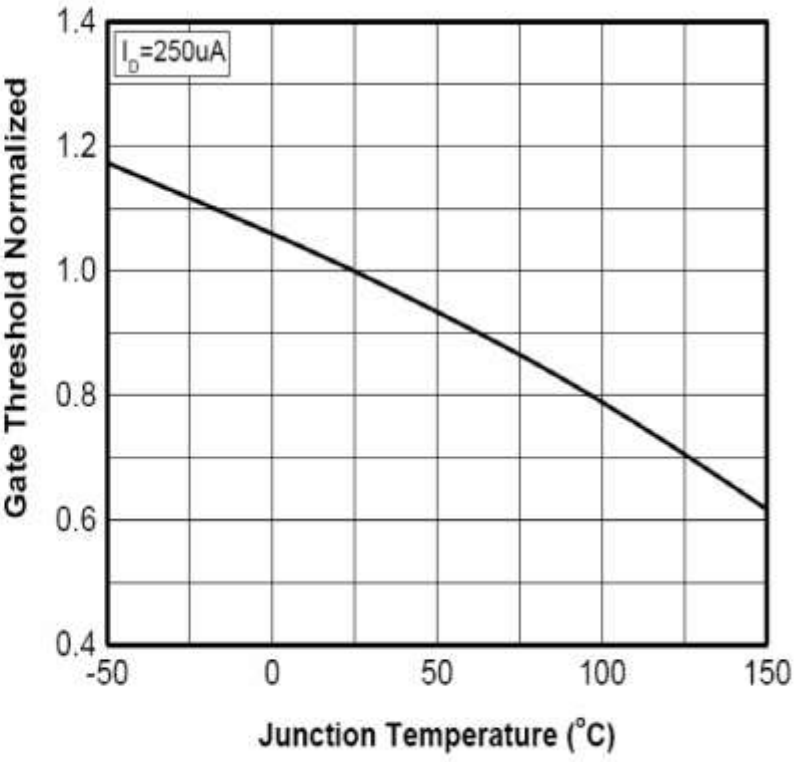
Typ. gate charge characteristics



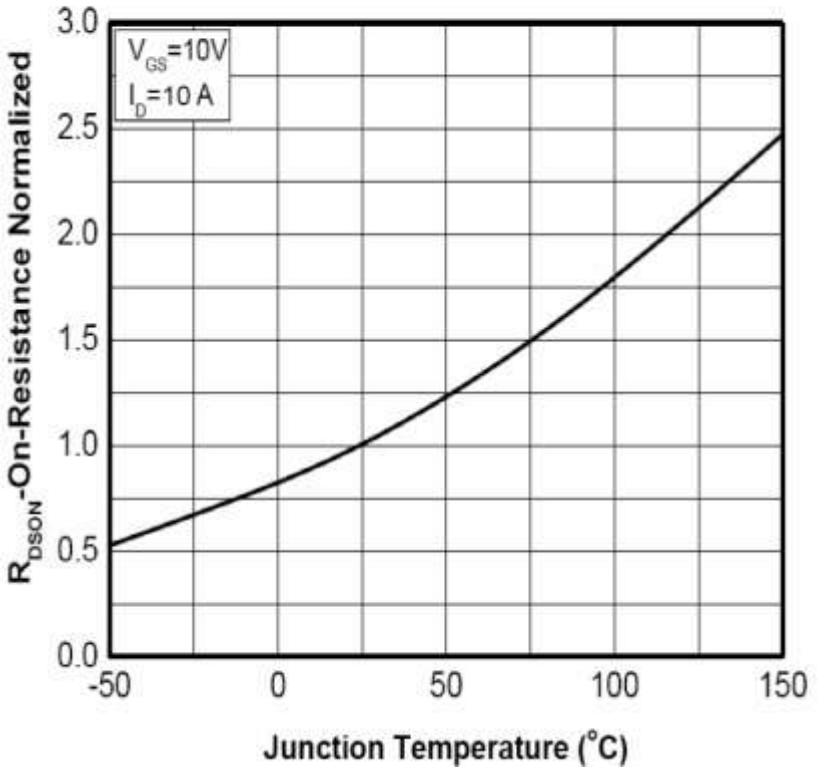
Typ. capacitances



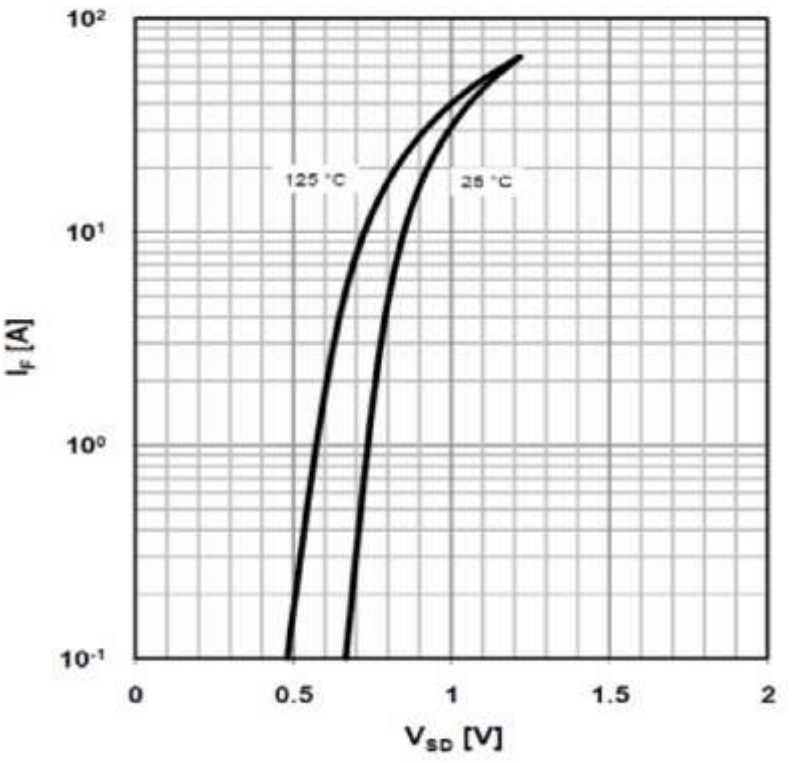
Normalized $V_{GS(th)}$ characteristics



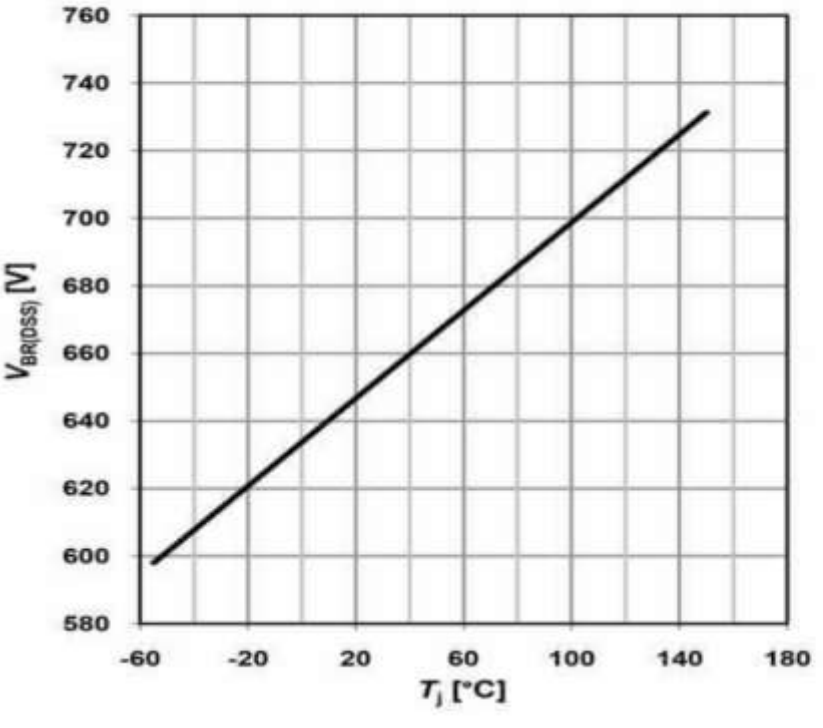
Normalized on resistance vs temperature



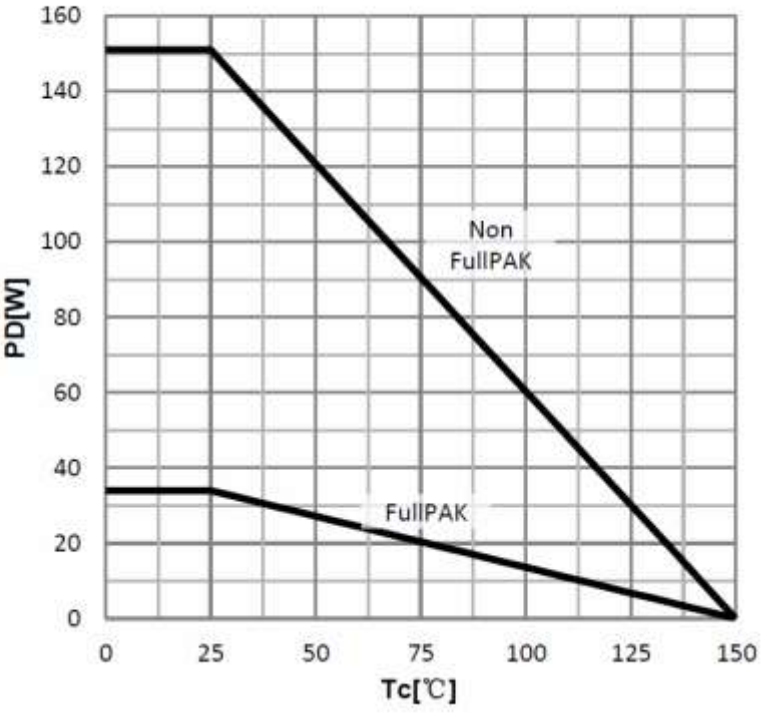
Forward characteristics of reverse diode



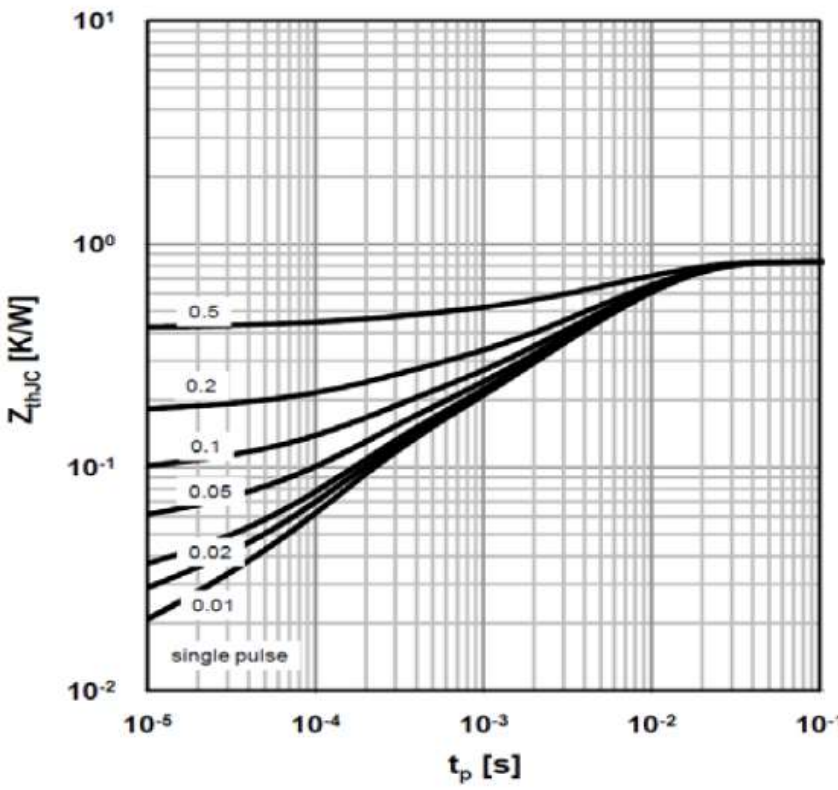
Drain-source breakdown voltage



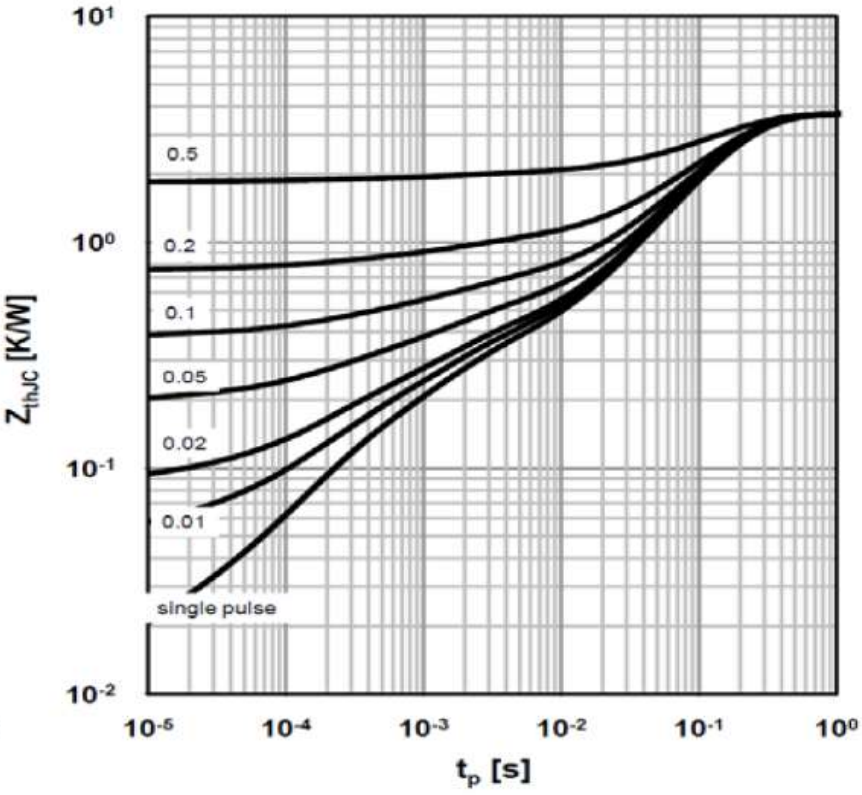
Power dissipation



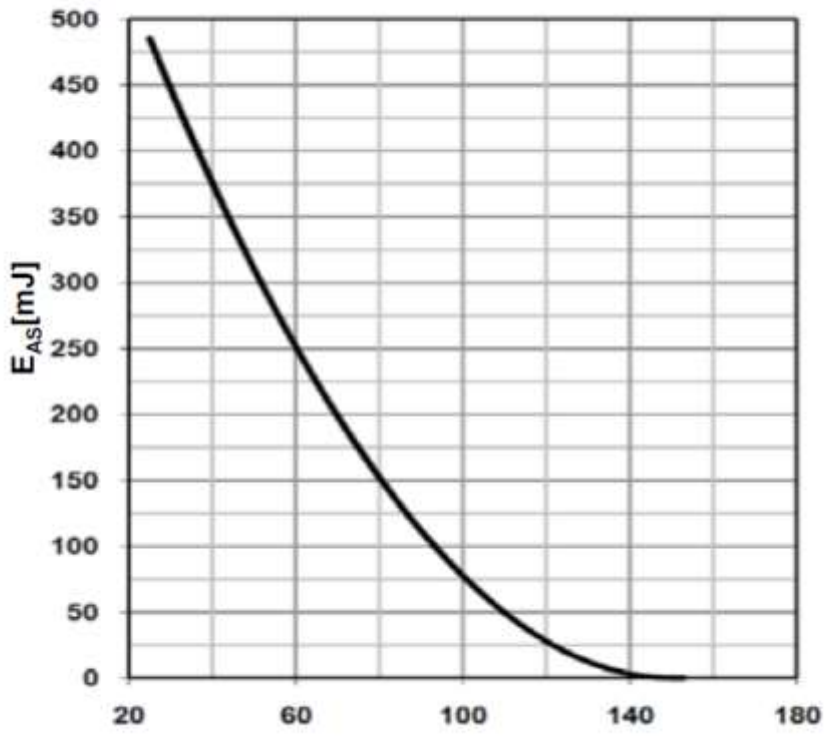
Max. transient thermal impedance parameter: D=tp/T; TO-220, TO-3PN



Max. transient thermal impedance parameter: D=tp/T; TO-220FullPAK

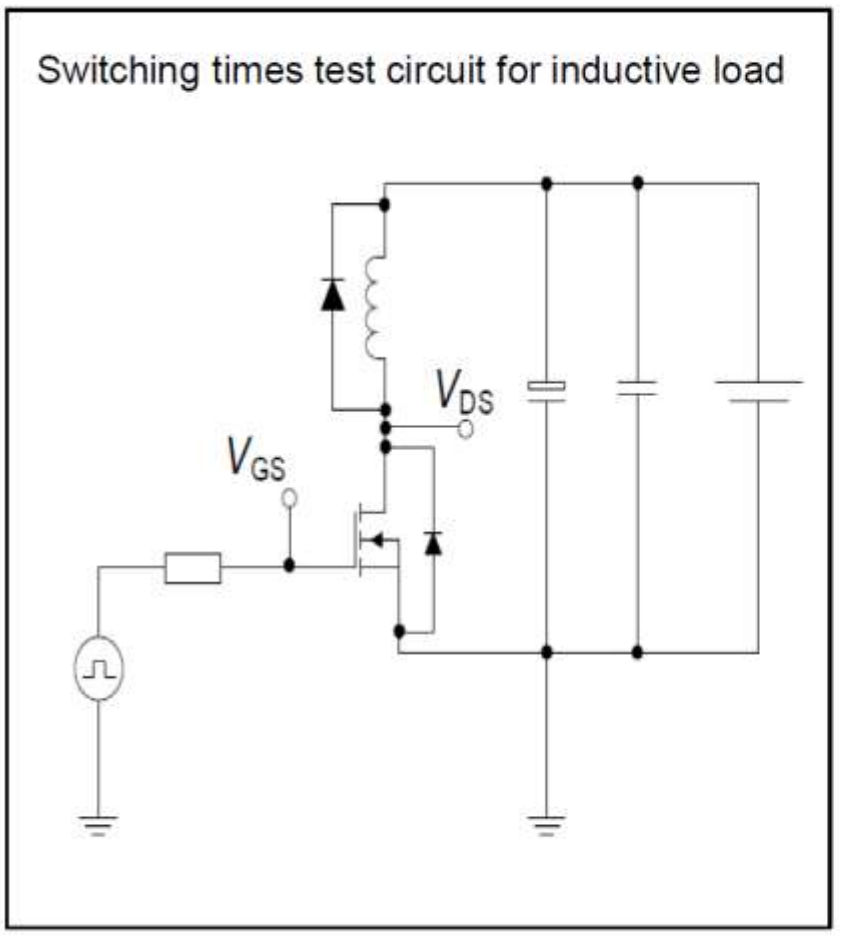


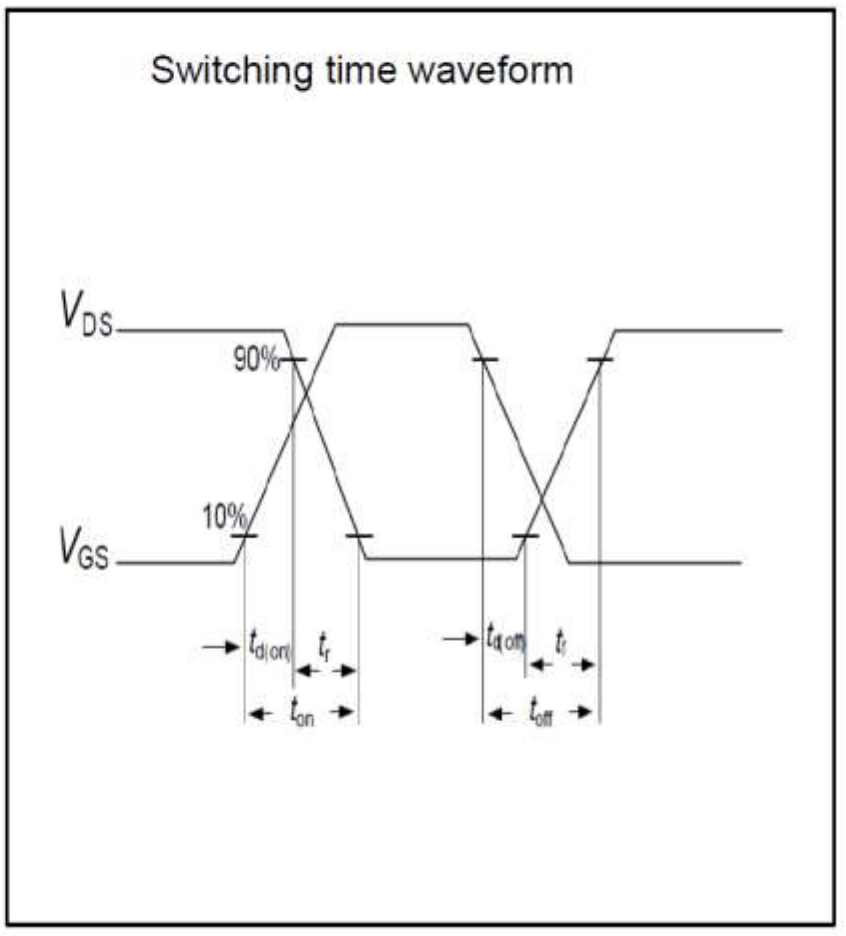
Avalanche energy



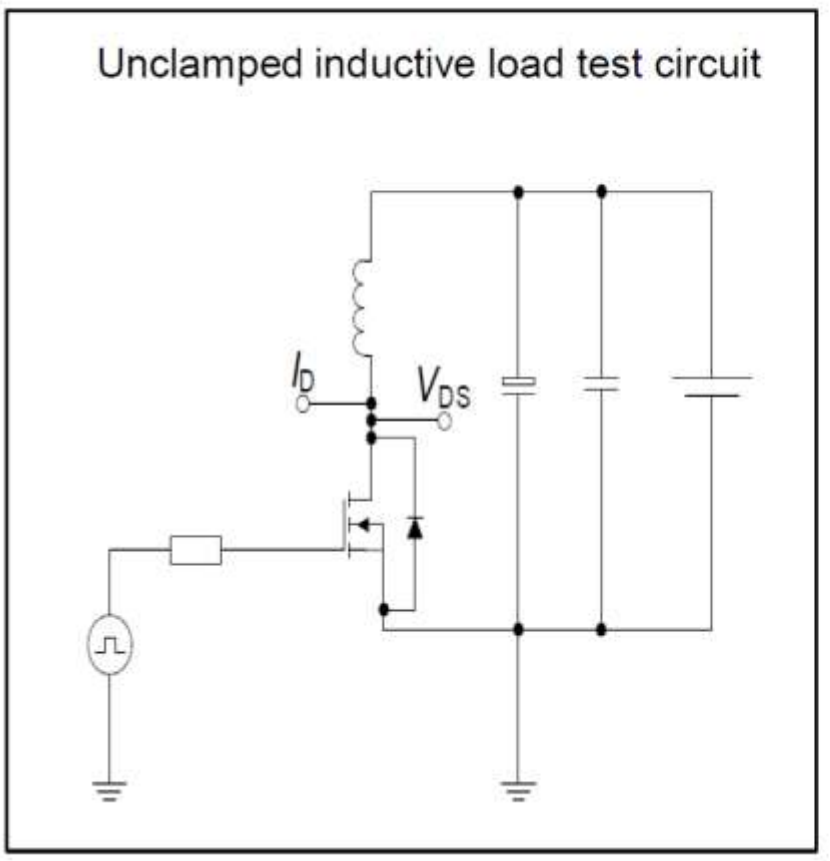
测试电路 **Test circuits**

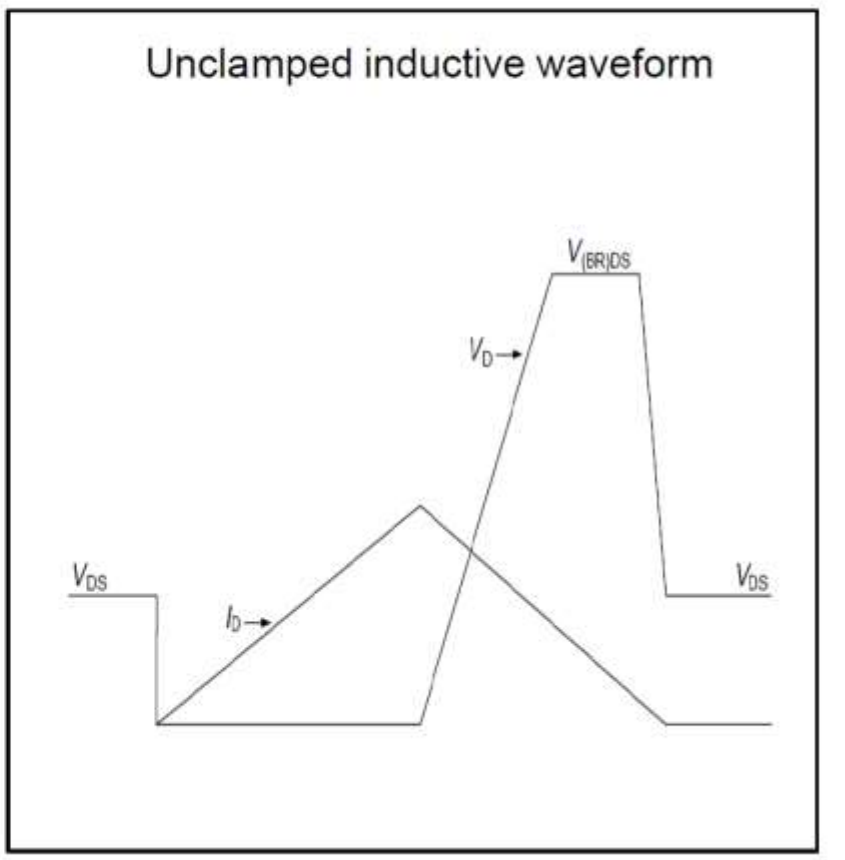
Switching times test circuit and waveform for inductive load





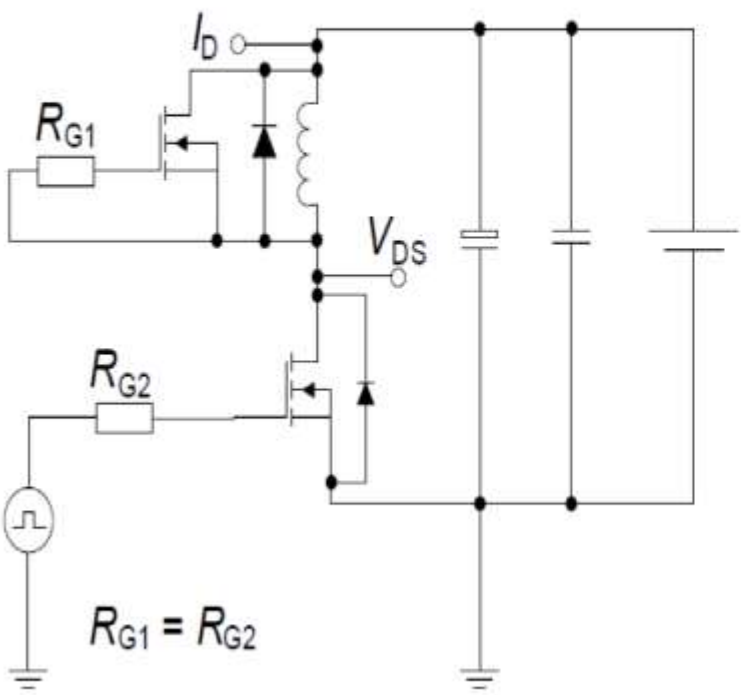
Unclamped inductive load test circuit and waveform



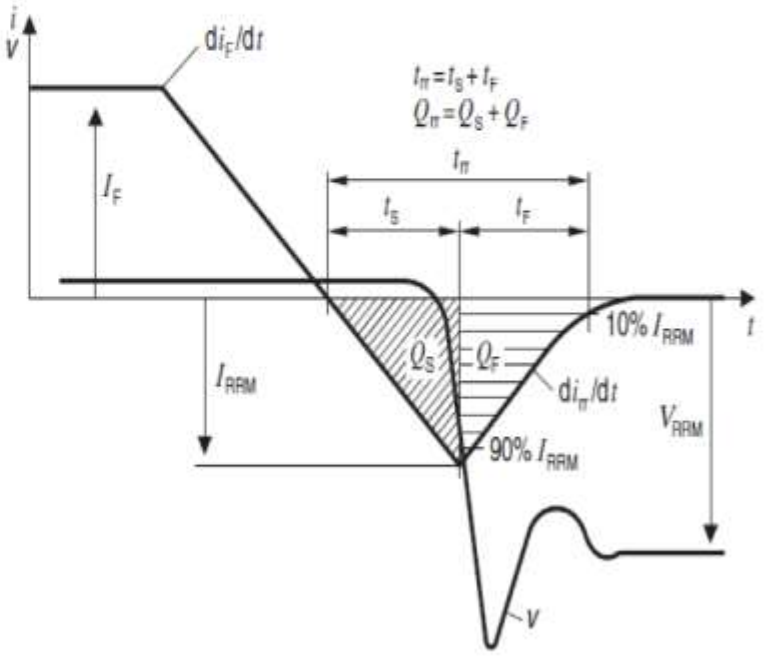


Test circuit and waveform for diode characteristics

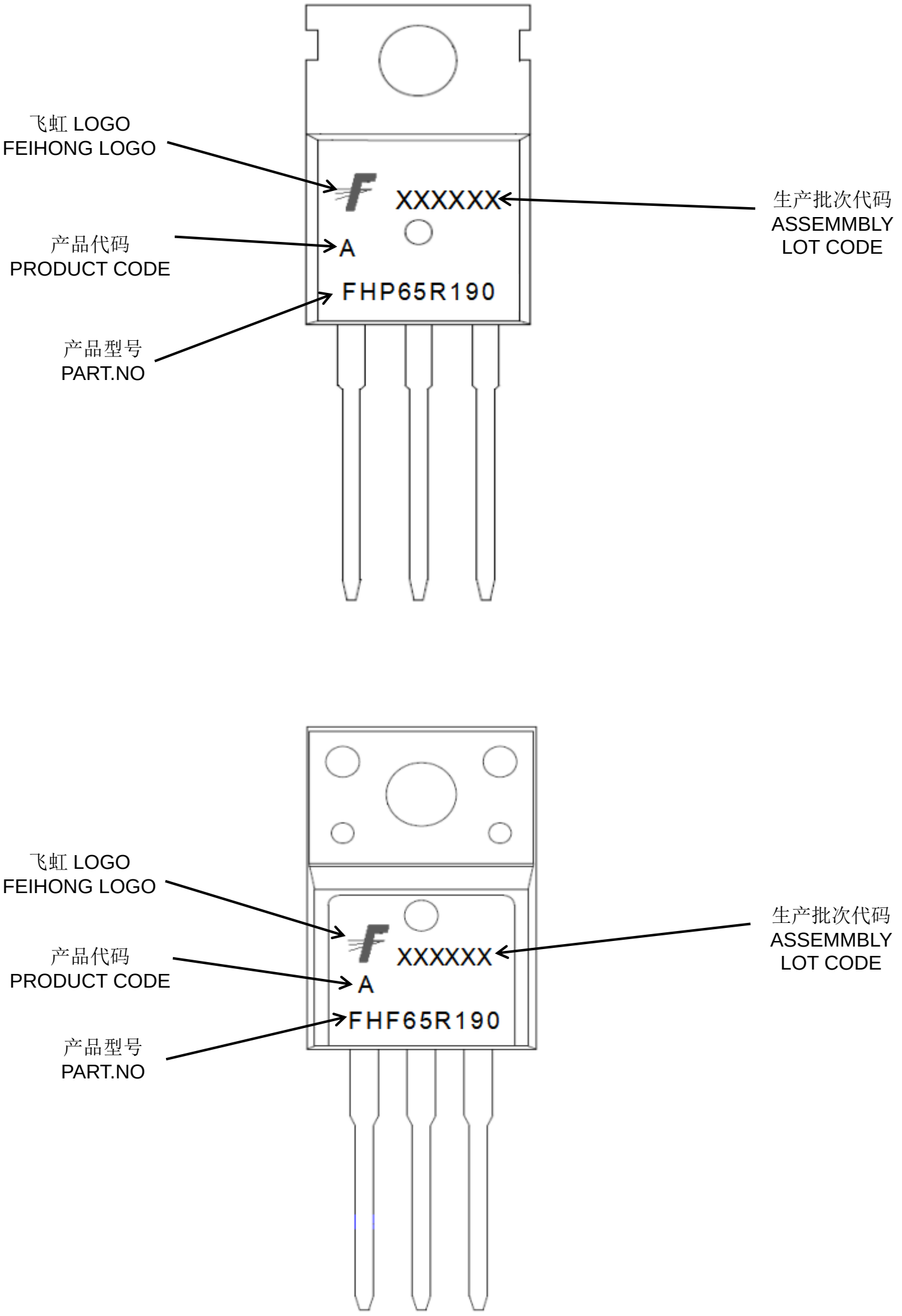
Test circuit for diode characteristics



Diode recovery waveform



印记 Marking:


飞虹 LOGO
FEIHONG LOGO
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PRODUCT CODE
产品型号
PART.NO
XXXXXX
A
FHP65R190
生产批次代码
ASSEMMBLY
LOT CODE
飞虹 LOGO
FEIHONG LOGO
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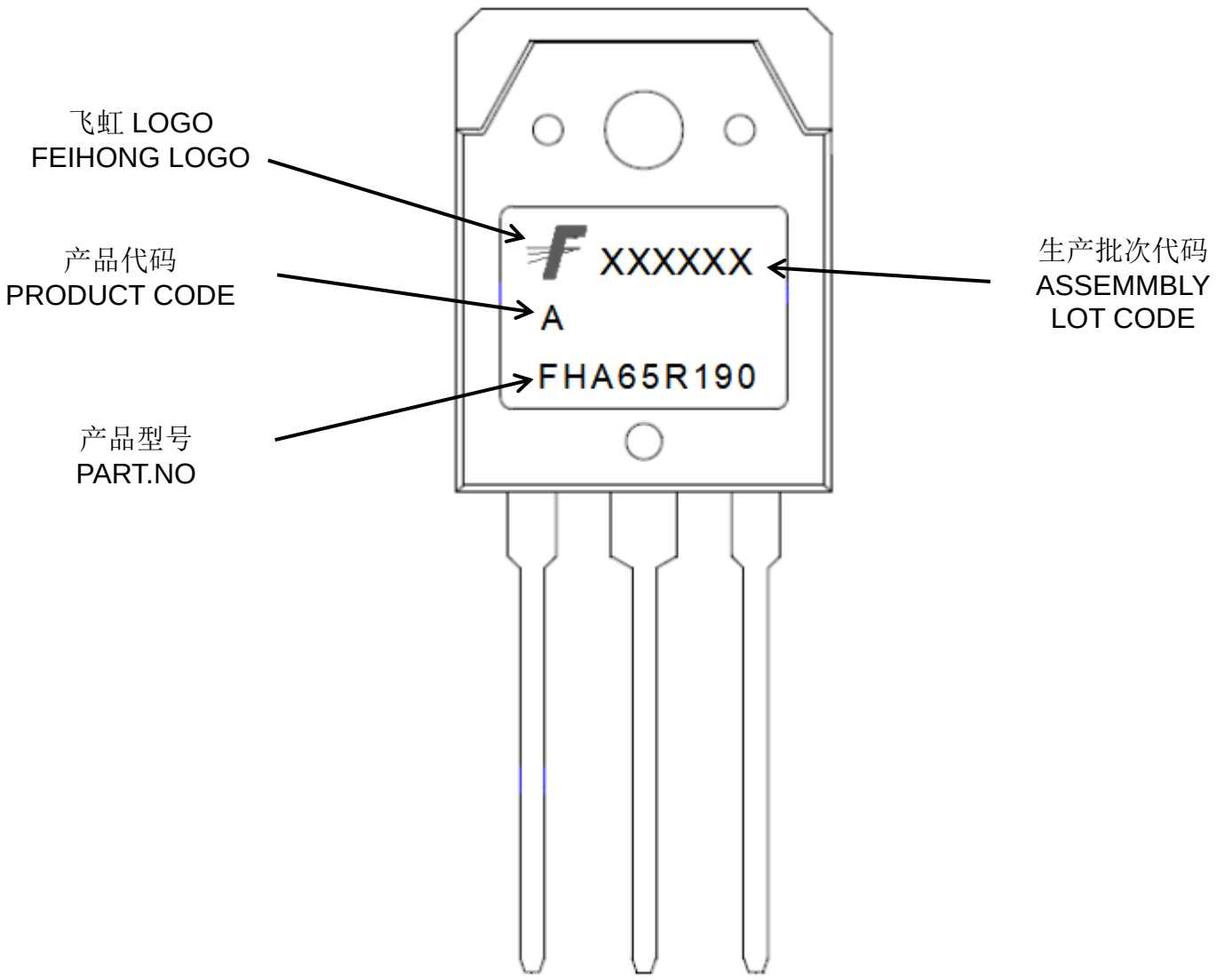
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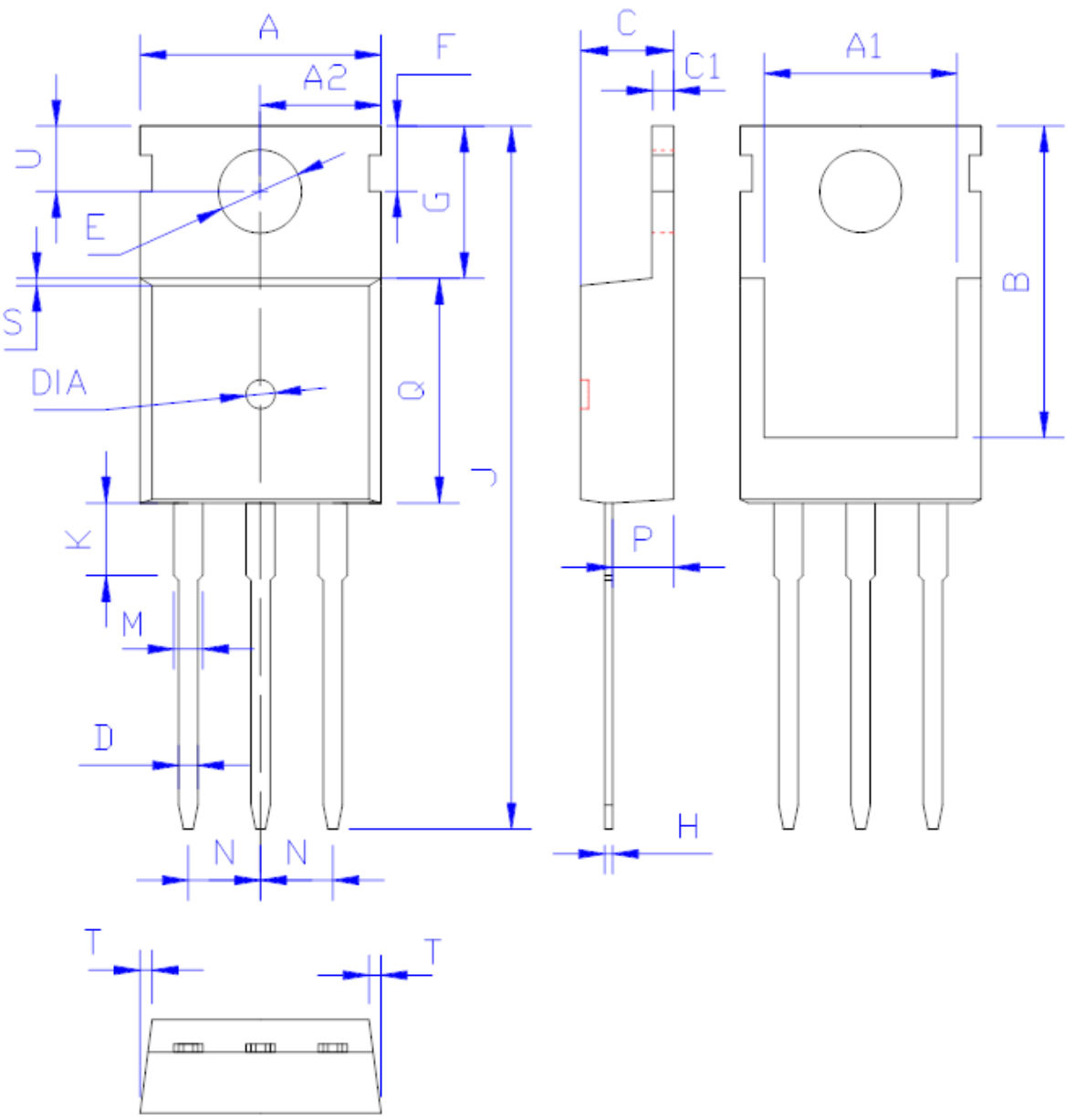
LOT CODE

外形尺寸：Package Dimension：

TO-220



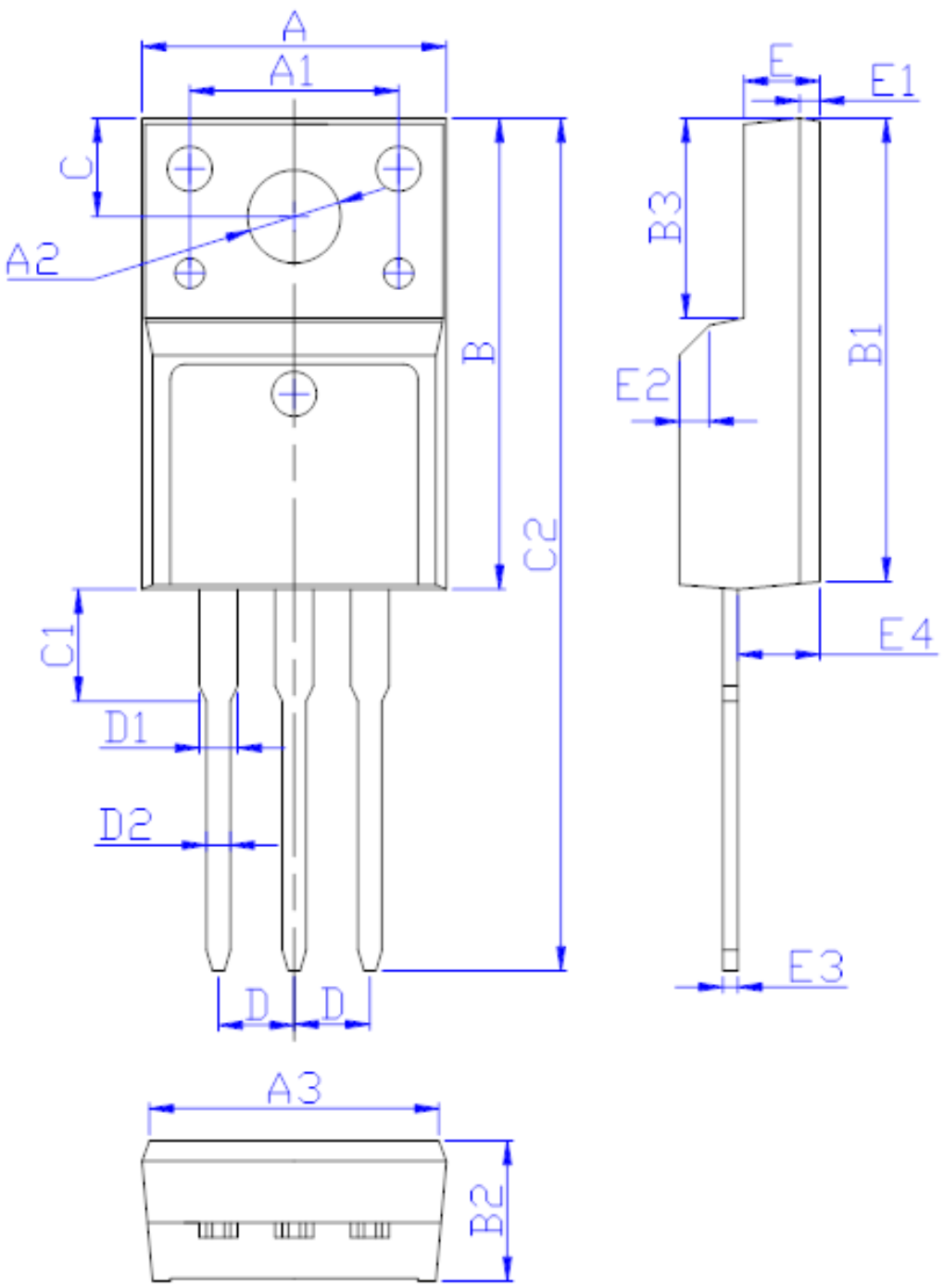
DIM	MILLIMETERS
A	10.00±0.30
A1	8.00±0.30
A2	5.00±0.30
B	13.20±0.40
C	4.50±0.20
C1	1.30±0.20
D	0.80±0.20
E	3.60±0.20
F	3.00±0.30
G	6.60±0.40
H	0.50±0.20
J	28.88±0.50
K	3.00±0.30
M	1.30±0.30
N	Typical 2.54
P	2.40±0.40
Q	9.20±0.40
S	0.25±0.15
T	0.25±0.15
U	2.80±0.30
DIA	宽 1.50±0.10 深 0.50 MAX

(Units：mm)

外形尺寸：

Package Dimension：

TO-220F

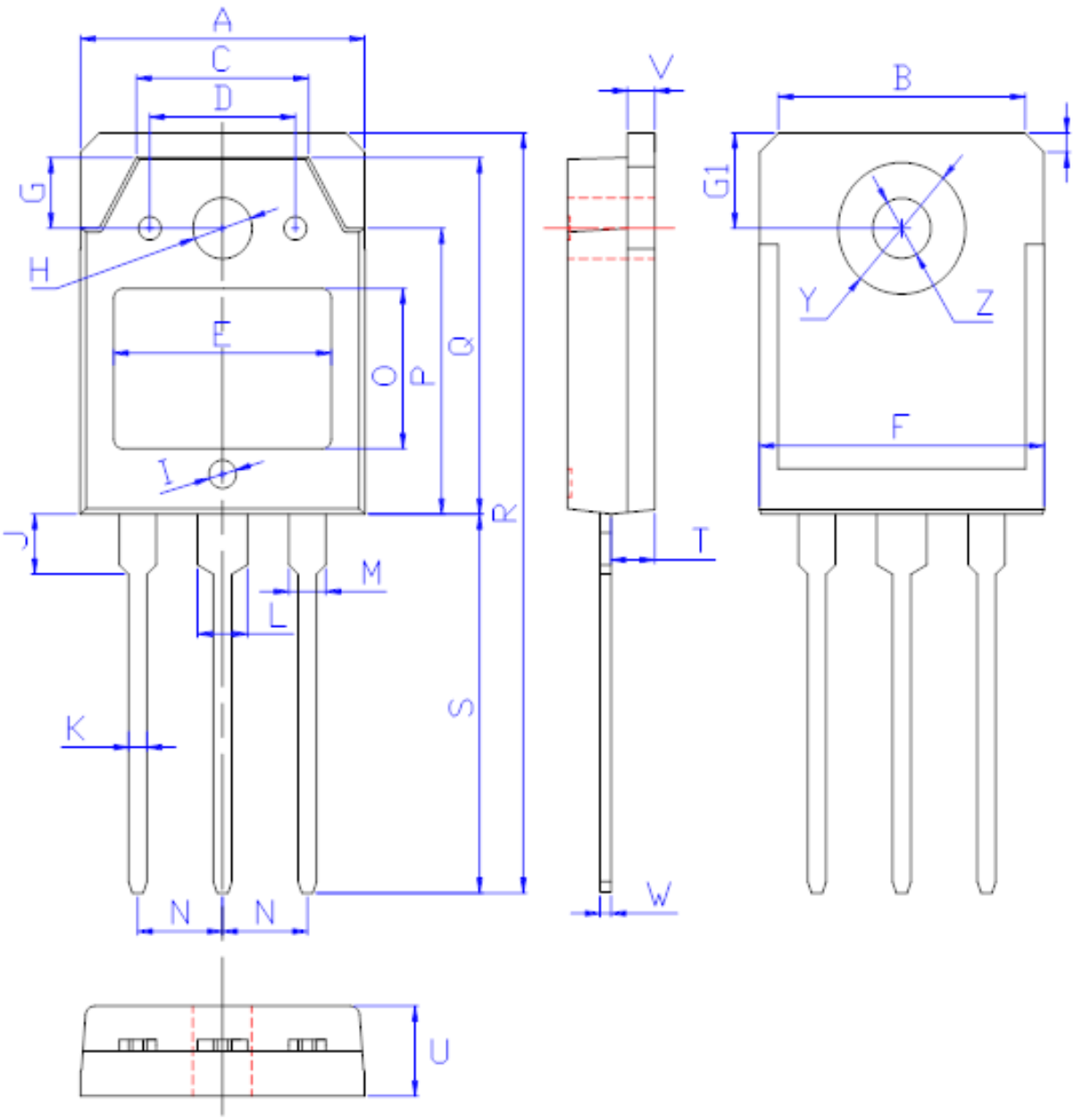


DIM	MILLIMETERS
A	10.16±0.30
A1	7.00±0.20
A2	3.12±0.20
A3	9.70±0.30
B	15.90±0.50
B1	15.60±0.50
B2	4.70±0.30
B3	6.70±0.30
C	3.30±0.25
C1	3.25±0.30
C2	28.70±0.50
D	Typical 2.54
D1	1.47（MAX）
D2	0.80±0.20
E	2.55±0.25
E1	0.70±0.25
E2	1.0×45°
E3	0.50±0.20
E4	2.75±0.30

(Units：mm)

外形尺寸：Package Dimension：

TO-3PN



DIM	MILLIMETERS
A	15.60±0.30
B	13.60±0.30
C	9.50±0.30
D	8.00±0.30
E	11.85±0.30
F	15.65±0.30
G	3.80±0.30
G1	5.00±0.30
H	Φ3.50±0.30
I	Φ1.50±0.30 深 0.15±0.15
J	3.20±0.30
K	1.00±0.15
L	3.10±0.15
M	2.10±0.15
N	5.45±0.30
O	8.40±0.30
P	13.90±0.30
Q	18.70±0.30
R	40.00±0.60
S	20.00±0.40
T	2.40±0.30
U	4.80±0.30
V	1.50±0.15
W	0.60±0.15
X	1.80±0.40
Y	7.00±0.30
Z	3.20±0.30

(Units：mm)