N 沟道绝缘栅双极晶体管
N-CHANNEL IGBT
FHP15T65A/FHS15T65A/FHF15T65A

主要参数 MAIN CHARACTERISTICS

I_C	15 A
V_{CES}	650 V
V_{cesat}-typ（ @I_C=15A）	1.41 V

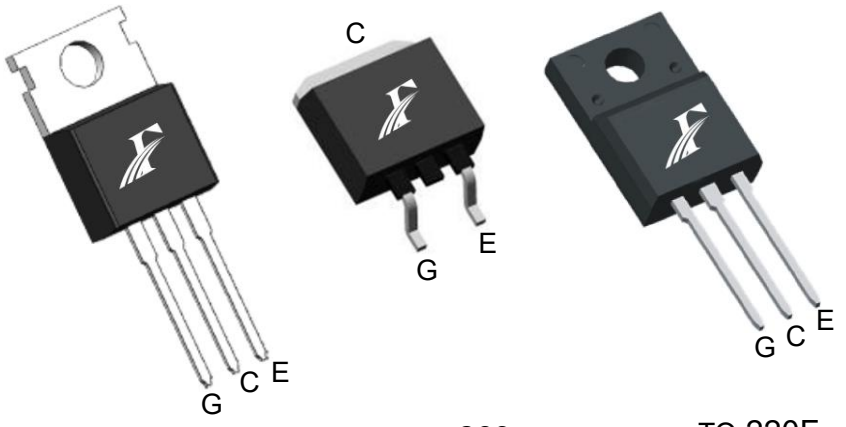
产品特性 FEATURES

低栅极电荷	Low gate charge
FS 技术	Trench field stop technology
低 V_{CEsat}	Low V_{CEsat}
正温度系数	Positive temperature coefficient
具有反并行快速恢复二极管	With anti-parallel fast recovery diode
高可靠性	High reliability
符合 RoHS 标准	ROHS compliant

用途 APPLICATIONS

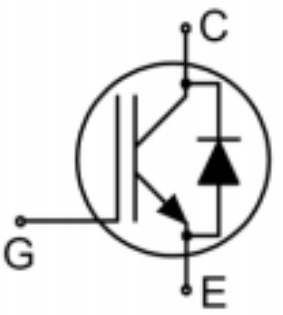
逆变电源	Power management for inverter systems
电机驱动	Motor drive
空调	Air condition
功率因数校正	Power factor correction
变频器	Variable-frequency drive

封装形式 Package



TO-220 FHP series　　TO-263 FHS 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**
			FHP/S15T65A	FHF15T65A	
最高集电极－发射极直流电压 Collector-Emmiter Voltage	V_{CE}		650		V
连续集电极极电流 Collector Current-continuous	I_C	（T_C=25℃）	30		A
		（TC=100℃）	15		
最大脉冲集电极极电流（注1） Collector Current – pulse （note 1）	I_{CM}		60		A
二极管连续正向电流 Diode Continuous Forward Current	I_F	（T_C=25℃）	30		A
		（T_C=25℃）	15		
二极管最大正向电流 Diode Maximum Forward Current	I_{FM}		60		A
最高栅极发射极电压 Gate-Emmiter Voltage	V_{GE}		±30		V
短路耐受时间 Short circuit withstand time VGE=15V, VCC≤400V, Allowed number of short circuits<1000, Times between short circuits: ≥ 1.0s,T_J ≤ 175°C	t_{SC}		5.0		us
耗散功率 Power Dissipation (TC=25℃)	PD		136	41	W
最高结温及存储温度 Operating and Storage Temperature Range	TJ，T_{STG}		175,-55～+175		℃
引线最高焊接温度 Maximum Lead Temperature for Soldering Purposes	TL		260		℃

注1：集极电流由最高结温限制
Note1:Collector 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**						
集电极－发射极击穿电压 Collector-Emmiter Voltage	BV_{CES}	V_{GE}=0V,I_C=250uA	650	-	-	V
击穿电压温度特性 Breakdown Voltage Temperature Coefficient	$\Delta BV_{CES}/\Delta TJ$	IC=1mA, referenced to 25℃	-	0.65	-	V/℃
零栅压下集电极漏电流 Zero Gate Voltage Collector Current	I_{CES}	V_{CE}=650V,V_{GE} =0V	-	-	4	μA
栅极体漏电流 Gate-Emitter leakage current	$I_{GES(F/R)}$	VCE=0V, VGE =±20V	-	-	±200	nA
通态特性**On-Characteristics**						
阈值电压 Gate-Emmiter Threshold Voltage	$V_{GE(th)}$	VCE = VGE , IC=1mA	4.8	5.8	6.5	V
饱和压降 Collector-Emmiter saturation Voltage	V_{CESAT}	VGE=15V ,IC=15A	-	1.41	1.8	V
动态特性 Dynamic Characteristics						
开启延迟时间 Turn-On delay time	td(on)	VGE=15V, V_{CC}=400V, I_C=15A, R_G=10Ω, T_C=25℃ Inductive Load	-	21	-	ns
上升时间 Turn-On rise time	tr		-	40	-	ns
关断延迟时间 Turn-Off delay time	td(off)		-	95	-	ns
下降时间 Turn-Off Fall time	tf		-	105	-	ns
开启损耗 Turn-on energy	Eon		-	0.34	-	mJ
关断损耗 Turn-off energy	Eoff		-	0.24	-	
总的开关损耗 Total switching energy	Etotal		-	0.58	-	
栅极电荷总量 Total Gate Charge	Qg	VCE=520V, IC=15A, VGE =15V	-	44	-	nC
栅极-发射极电荷 Gate-emitter charge	Qge		-	15	-	
栅极-集电极电荷 Gate-collector charge	Qgc		-	20	-	
集电极短路电流 Short circuit collector current (最大值 100sc；短路时间间隔：≥1.0s)	Ic(sc)	V_{GE}=15V, V_{CC}≤400V， t_{SC}≤5us, TJ≤175℃	-	110	-	A
输入电容 Input capacitance	Cies	VCE=25V, VGE =0V, f=1.0MHz	-	892	-	pF
输出电容 Output capacitance	Coes		-	43	-	
反向传输电容 Reverse transfer capacitance	Cres		-	10	-	

二极管特性Diode 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**
正向压降 Diode Forward Voltage	V_{FM}	IF=8A	-	1.46	1.7	V
反向恢复时间 Reverse recovery time	trr	VGE=0V,IF=15A ,dI/dt=20A/μs	-	72	-	ns
反向恢复电流 Reverse recovery current	Irr		-	5.2	-	A
反向恢复电荷 Reverse recovery charge	Qrr		-	214	-	nC

热特性 THERMAL CHARACTERISTIC

项目 **Parameter**	符号 **Symbol**	FHP/S15T65A	FHF15T65A	单位 **Unit**
结到管壳的热阻 (IGBT) Thermal Resistance, Junction to Case	Rth(j-c)	1.1	3.6	℃/W
结到管壳的热阻 (Diode) Thermal Resistance, Junction to Case (Diode)	Rth(j-c)	2.1	3.9	℃/W
结到环境的热阻 Thermal Resistance, Junction to Ambient	Rth(j-A)	62.5	78	℃/W

特性曲线
（ELECTRICAL CHARACTERISTICS (curves)）

Figure 1. Forward Bias Safe Operating Area for TO220/TO263

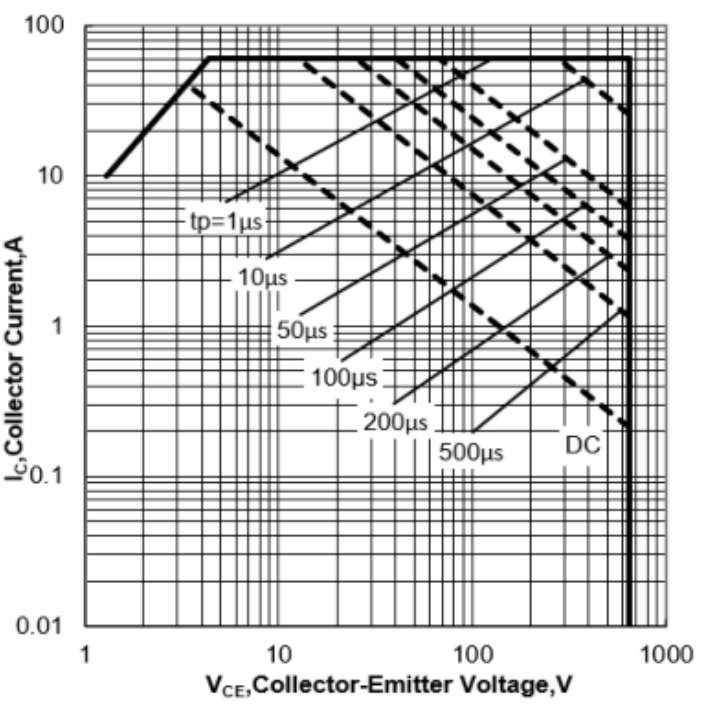


Figure 2. Forward Bias Safe Operating Area for TO220F

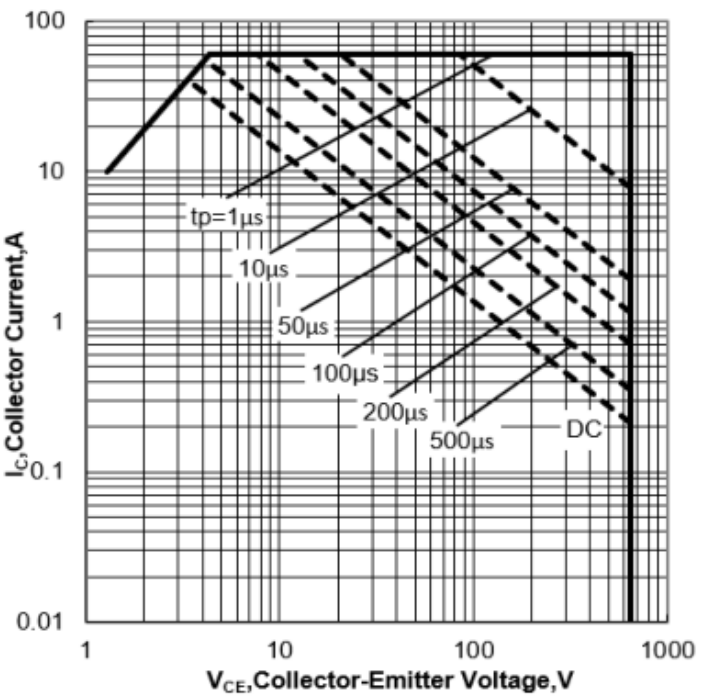


Figure 3. Power Dissipation vs Case Temperature for TO220/TO263

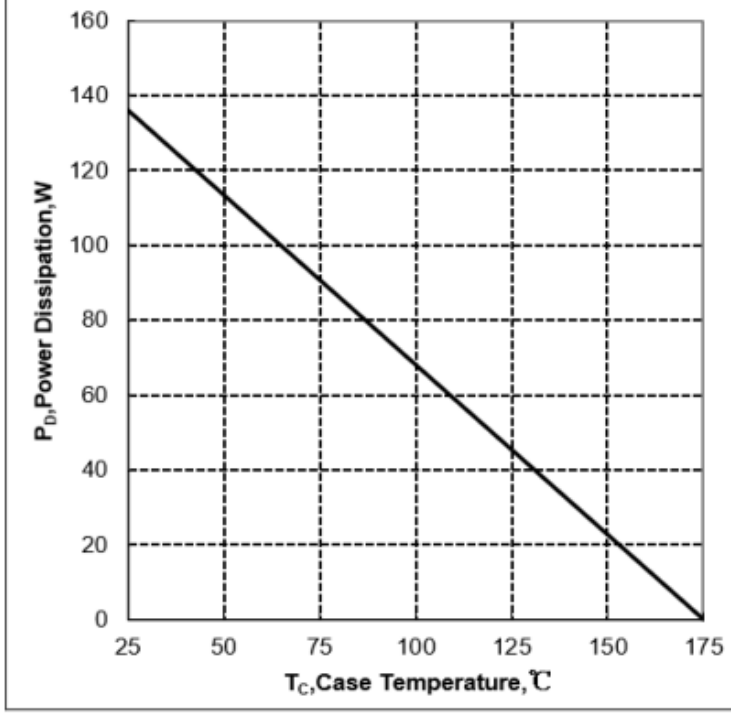


Figure 4. Power Dissipation vs Case Temperature for TO220F

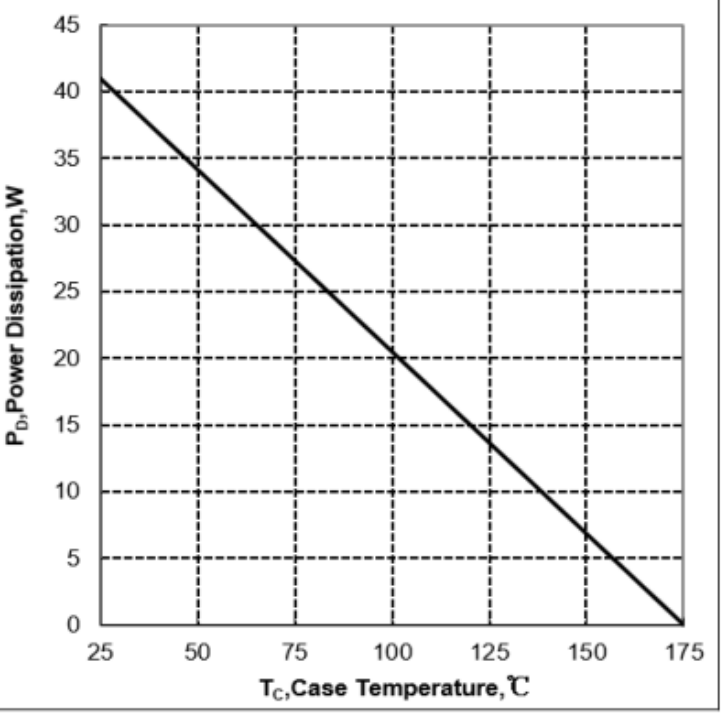


Figure 5. Collector Current vs Case Temperature

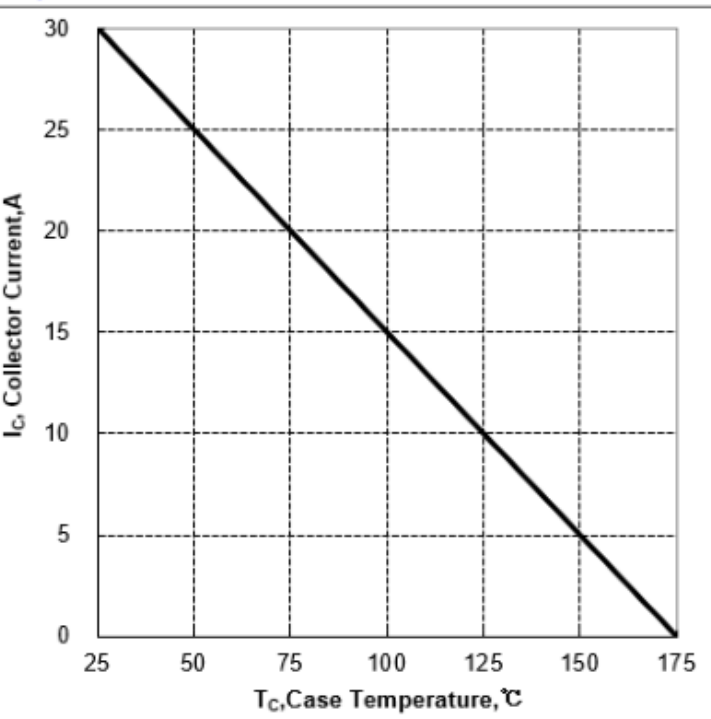


Figure 6. Typical Transfer Characteristics

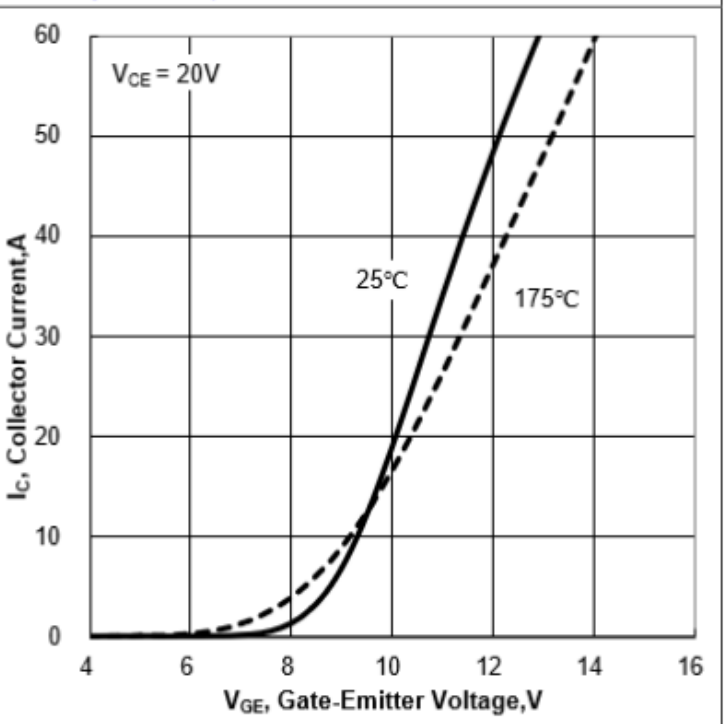


Figure 7. Typical Output Characteristics (T_C=25℃)

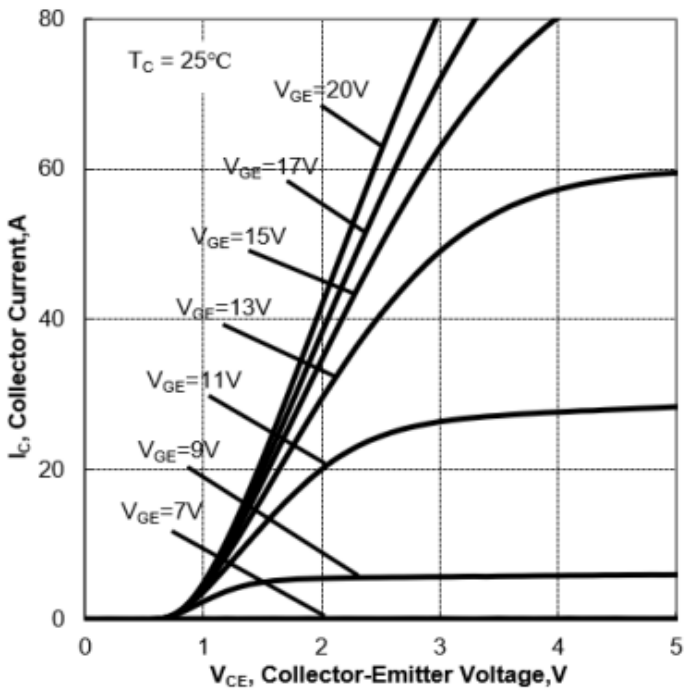


Figure 8. Typical Output Characteristics (T_C=175℃)

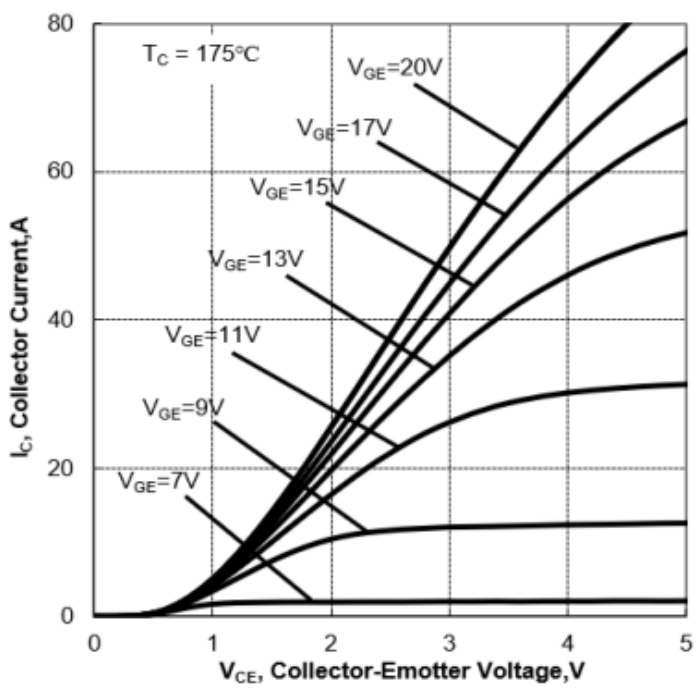


Figure 9. Typical Collector-Emitter Saturation Voltage vs Case Temperature

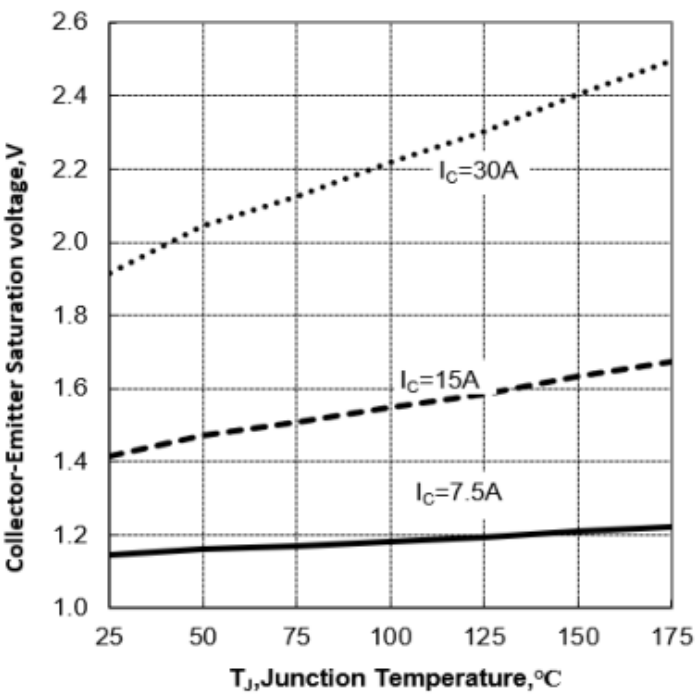


Figure 10. Typical Gate-Emitter Threshold Voltage vs Case Temperature

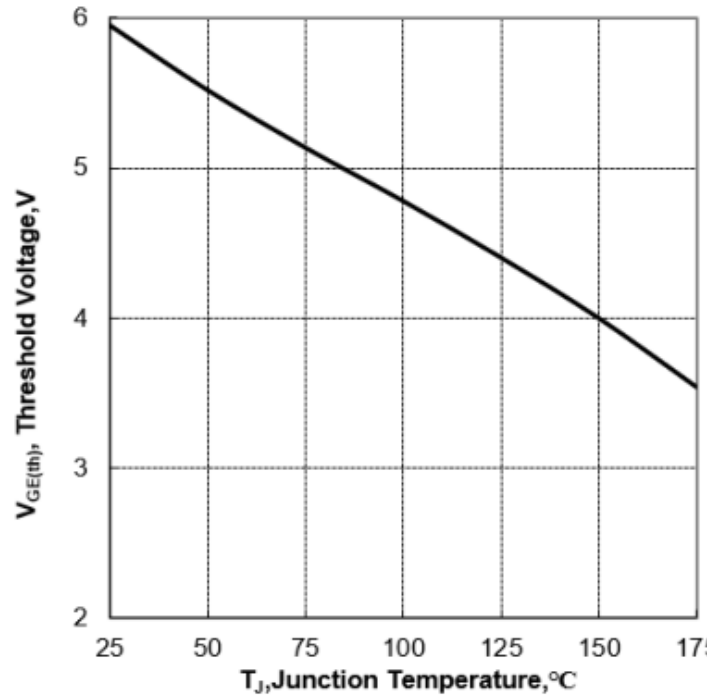


Figure 11. Typical Switching Times vs Gate Resistor (T_J=25℃, V_{CE}=400V, V_{GE}=15/0V, Ic=15A)

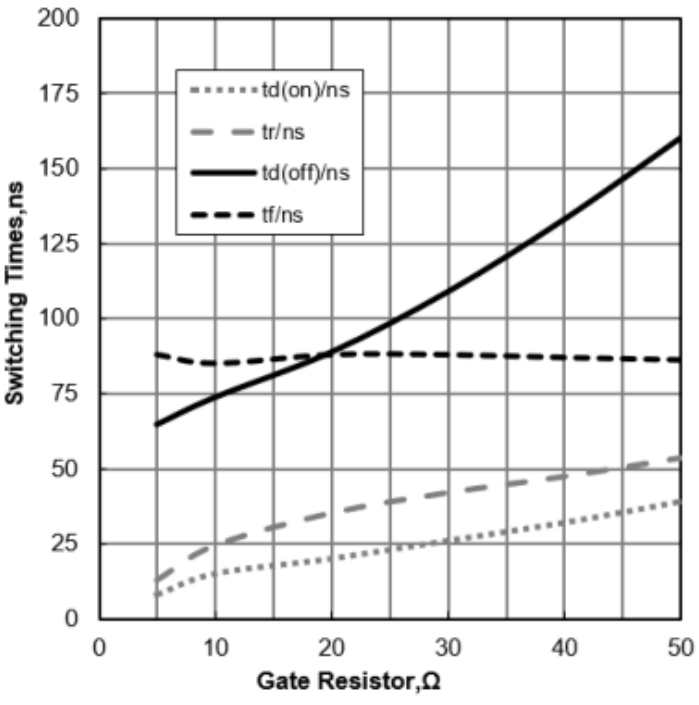


Figure 12. Typical Switching Energy vs Gate Resistor (T_J=25℃, V_{CE}=400V, V_{GE}=15/0V, Ic=15A)

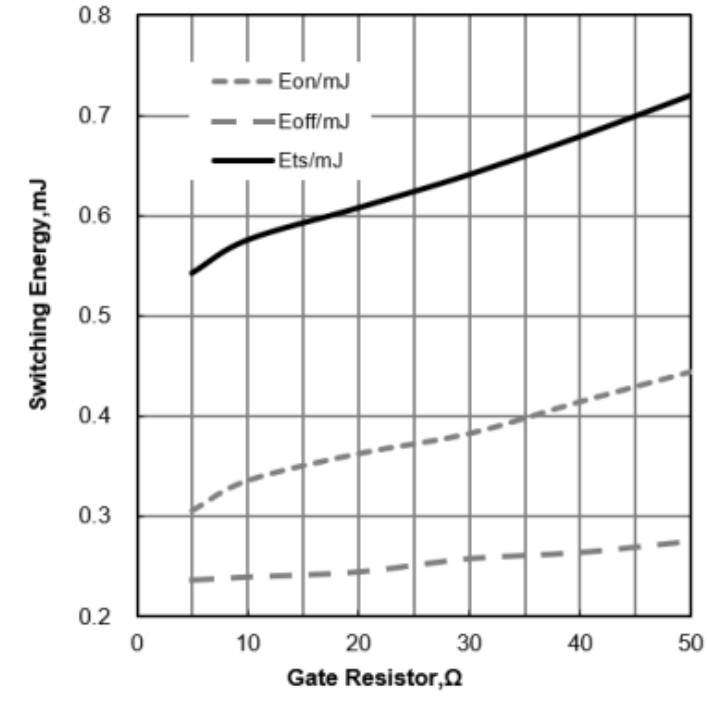


Figure 13. Typical Switching Times vs Case Temperature (V_{CE}=400V, V_{GE}=15/0V, Ic=15A)

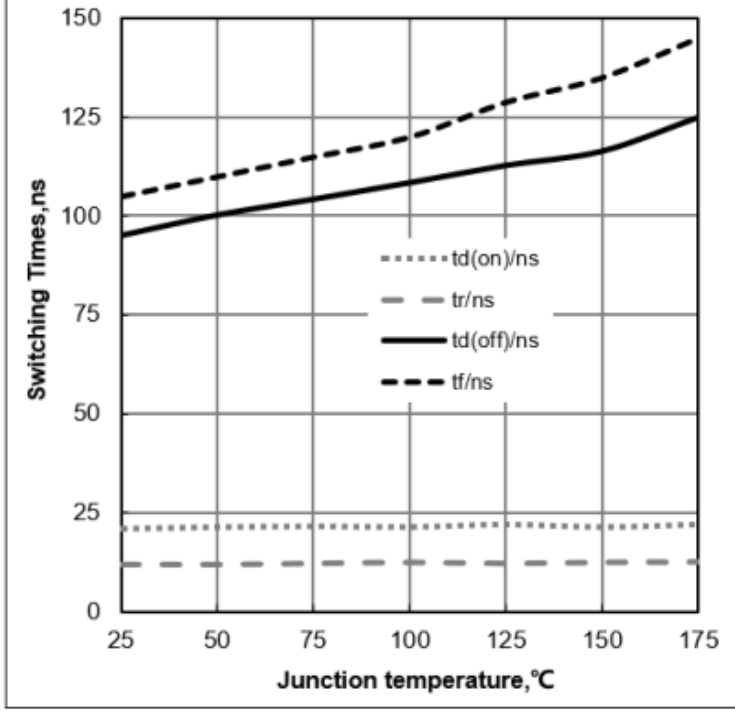


Figure 14. Typical Switching Energy vs Case Temperature (V_{CE}=400V, V_{GE}=15/0V, Ic=15A)

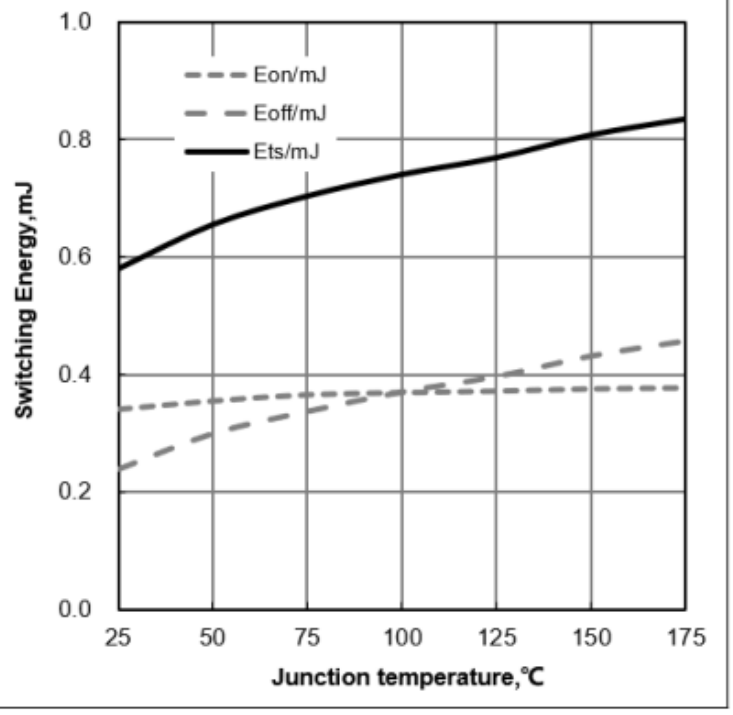


Figure 15. Typical Switching Times vs Collector Current (Tc=25℃, V_{CE}=400V, V_{GE}=15/0V)

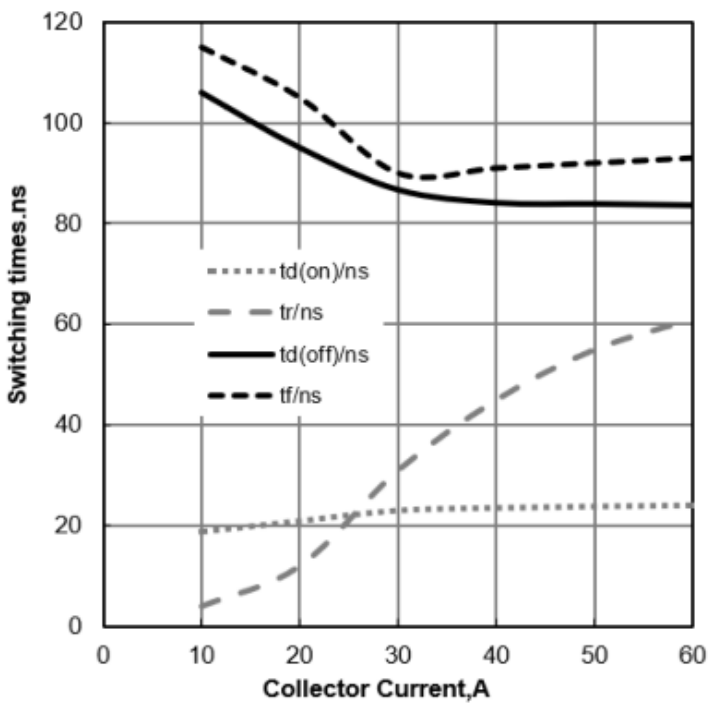


Figure 16. Typical Switching Energy vs Collector Current (Tc=25℃, V_{CE}=400V, V_{GE}=15/0V)

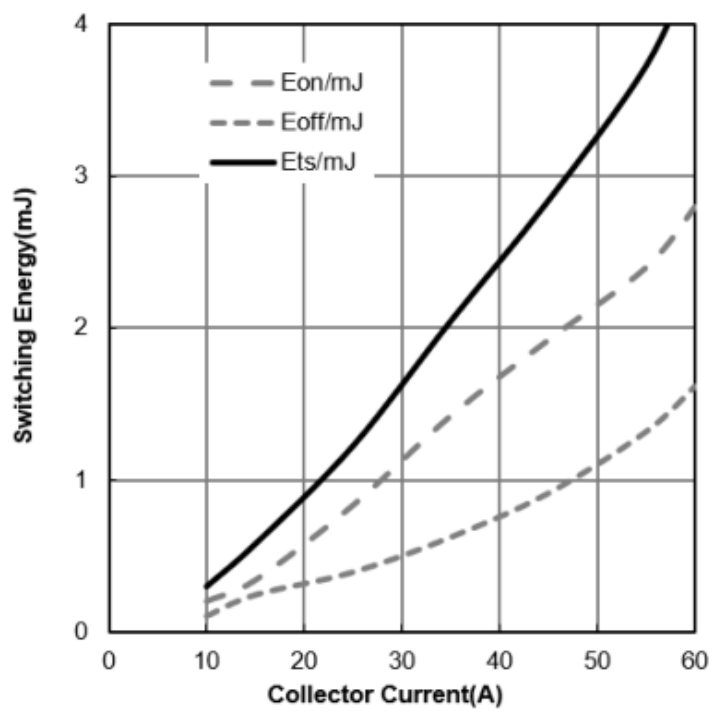


Figure 17. Typical Switching Times vs V_{CE} (Tc=25℃, V_{GE}=15/0V, Ic=15A)

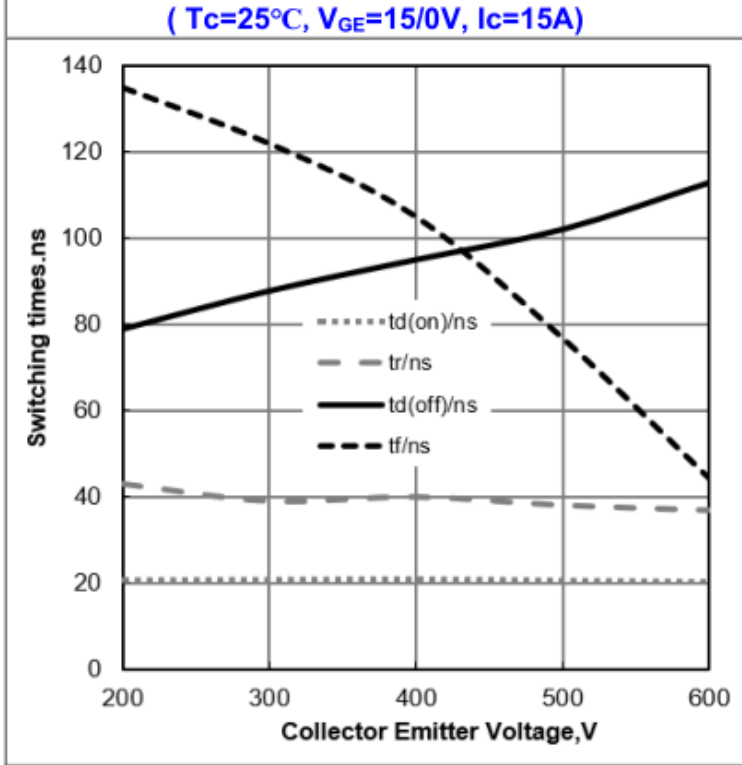


Figure 18. Typical Switching Energy vs vs V_{CE} (Tc=25℃, V_{GE}=15/0V, Ic=15A)

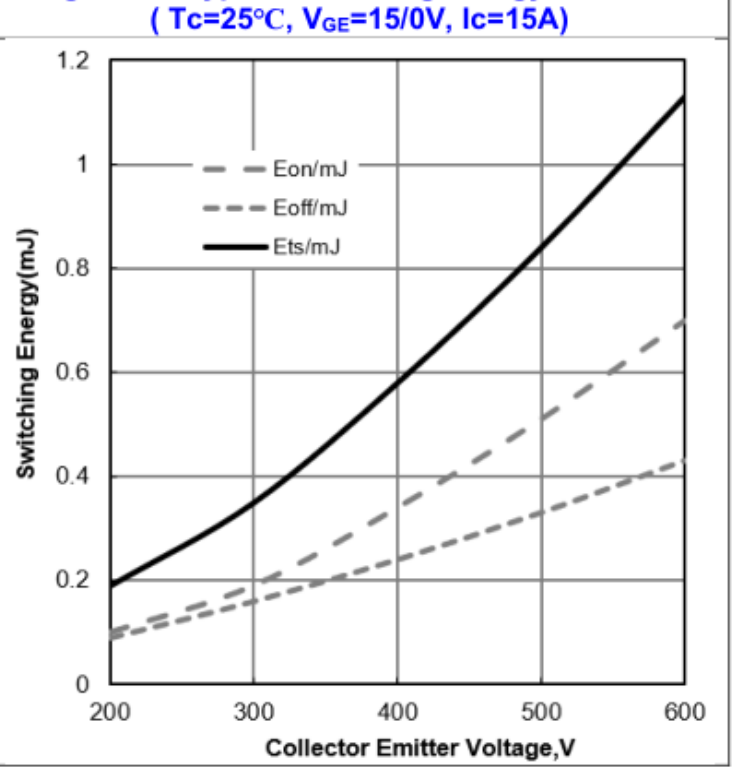


Figure 19. Typical Gate Charge

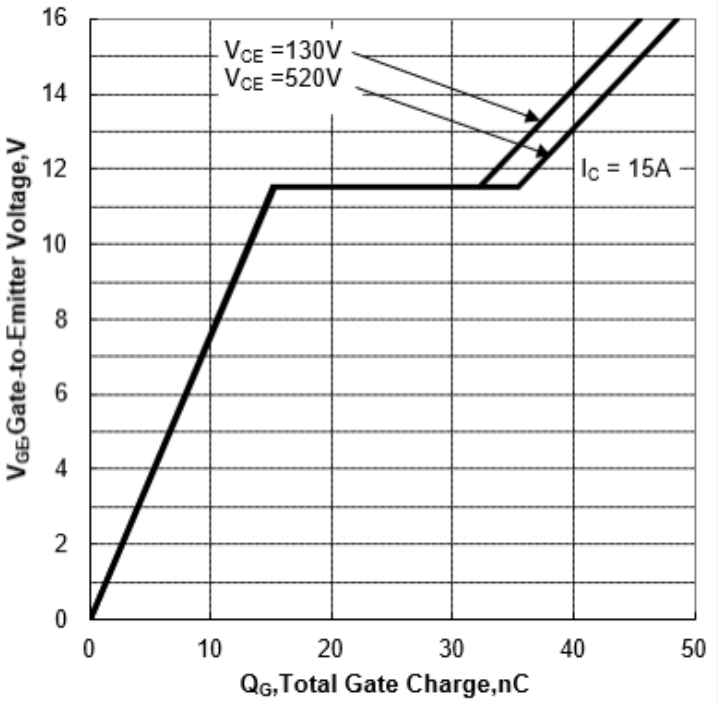


Figure 20. Typical Gate Charge

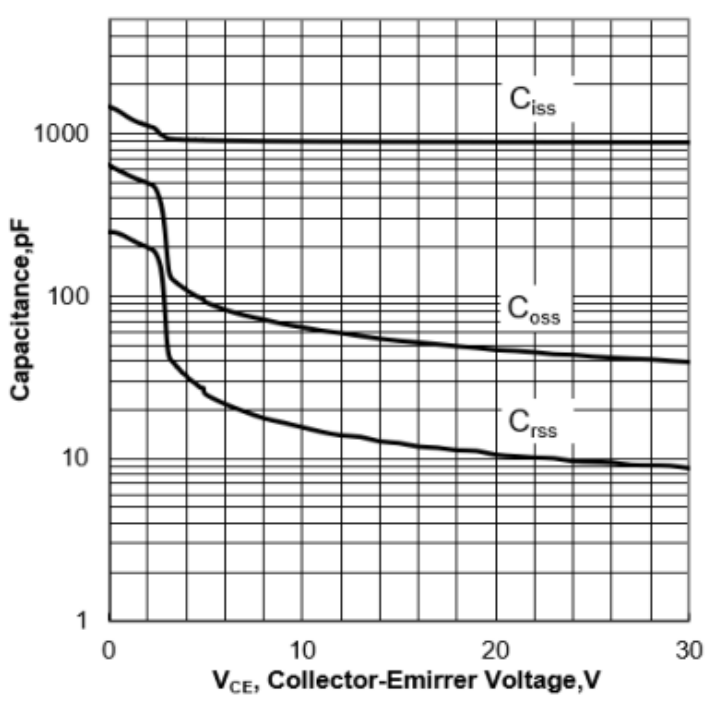


Figure 21. IGBT Transient Thermal Impedance vs Pulse Width(TO220/TO263)

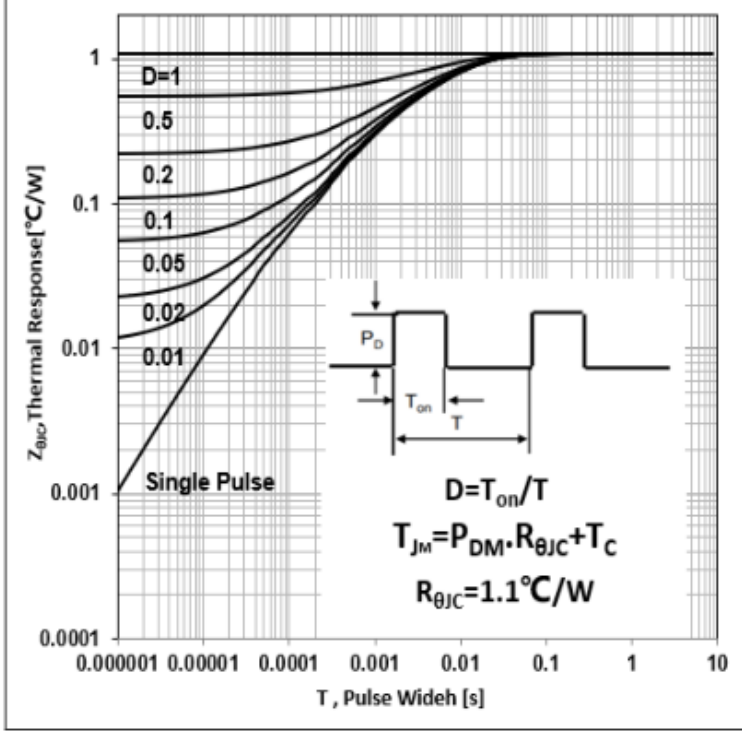


Figure 22. IGBT Transient Thermal Impedance vs Pulse Width(TO220F)

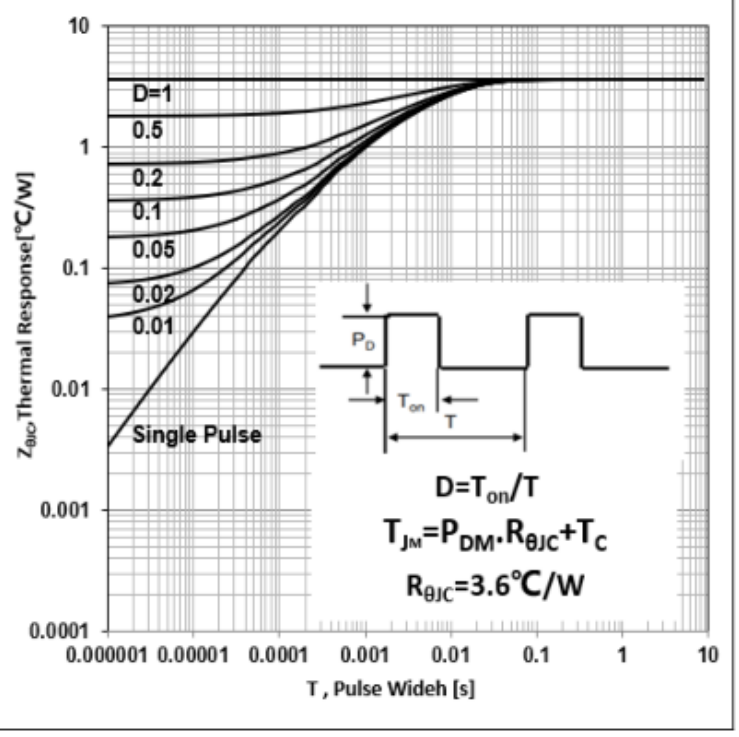


Figure 23. Diode Transient Thermal Impedance vs Pulse Width(TO220/TO263)

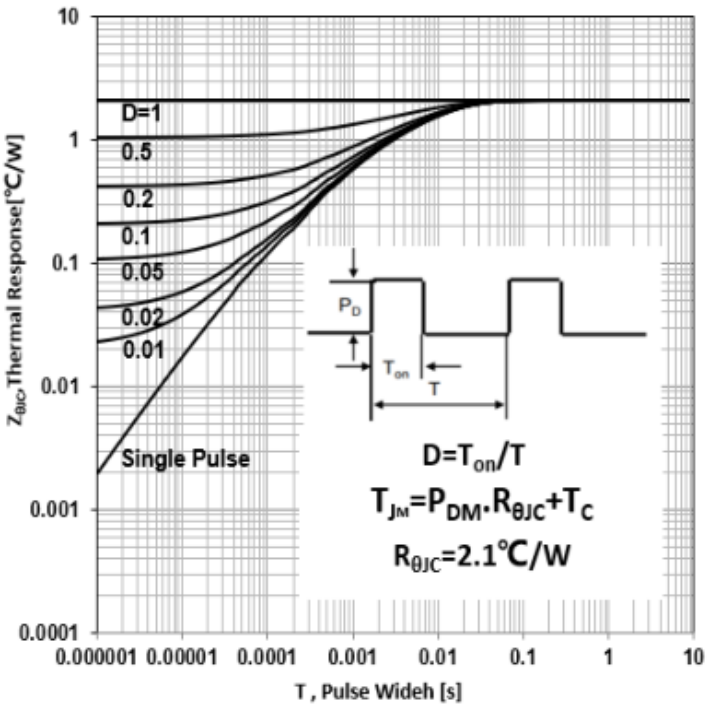


Figure 24. Diode Transient Thermal Impedance vs Pulse Width(TO220F)

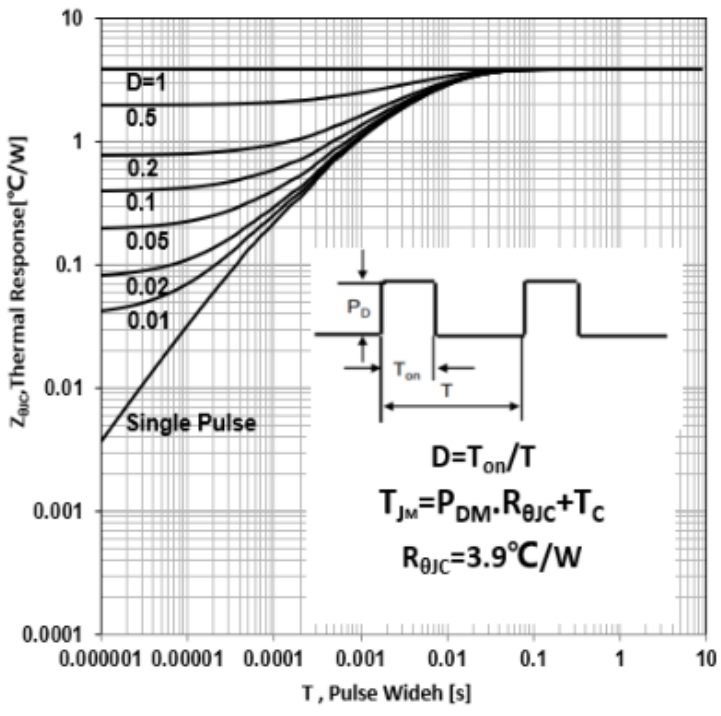
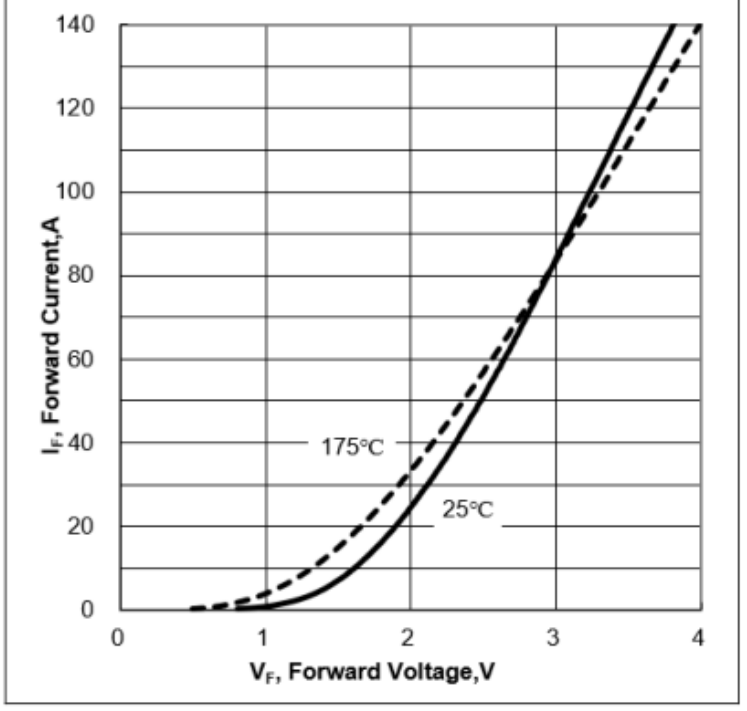


Figure 25. Typical Diode Forward Current vs Forward Voltage



Test Circuit and Waveform

Figure 26. Inductive Switching Test Circuit

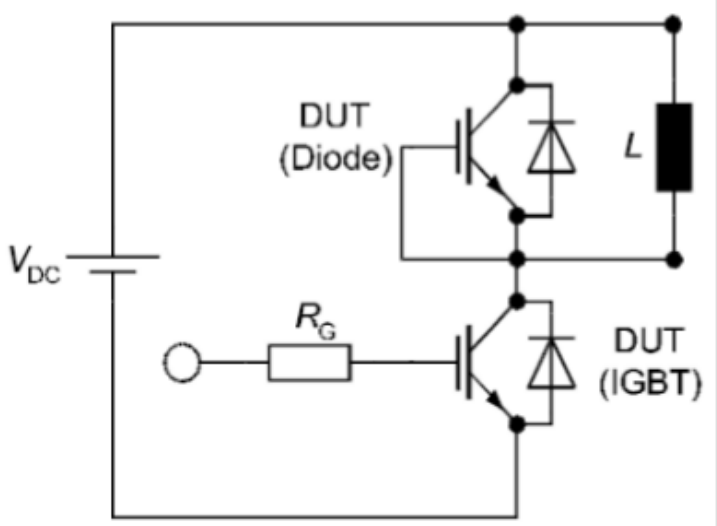


Figure 27. Definition of switching times

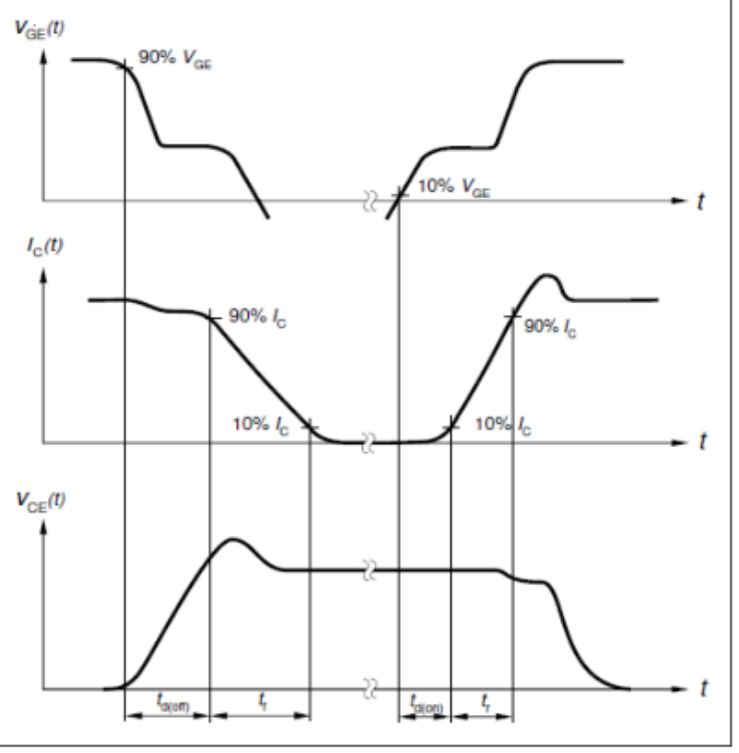


Figure 28. Definition of switching losses

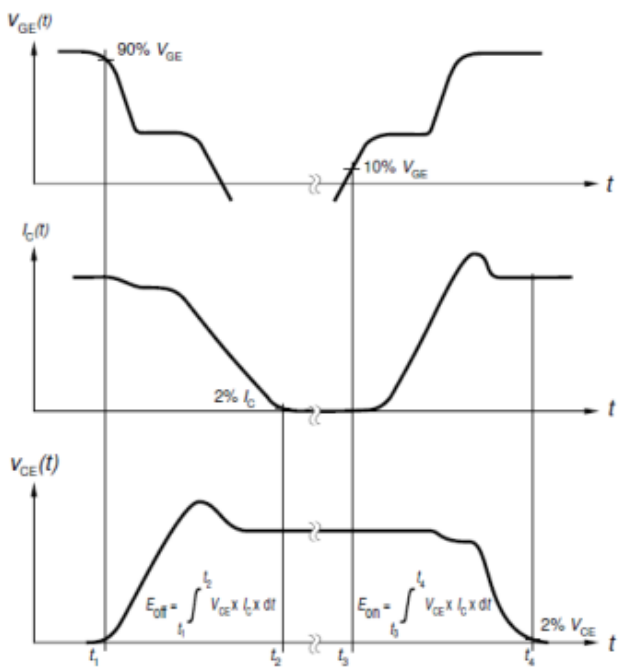
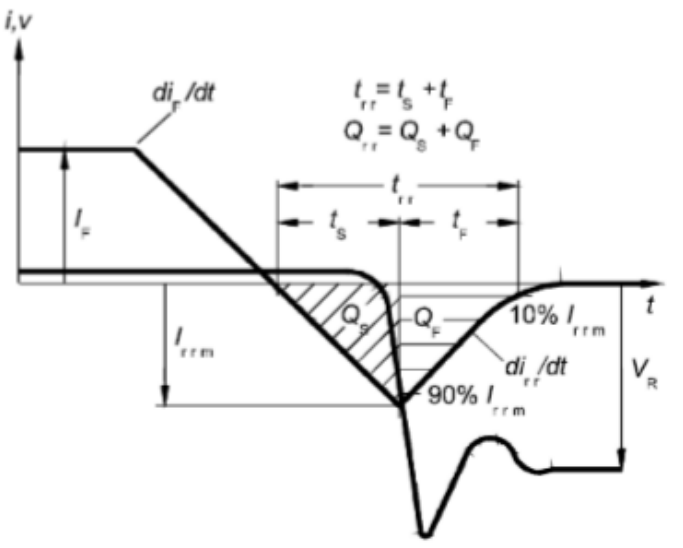
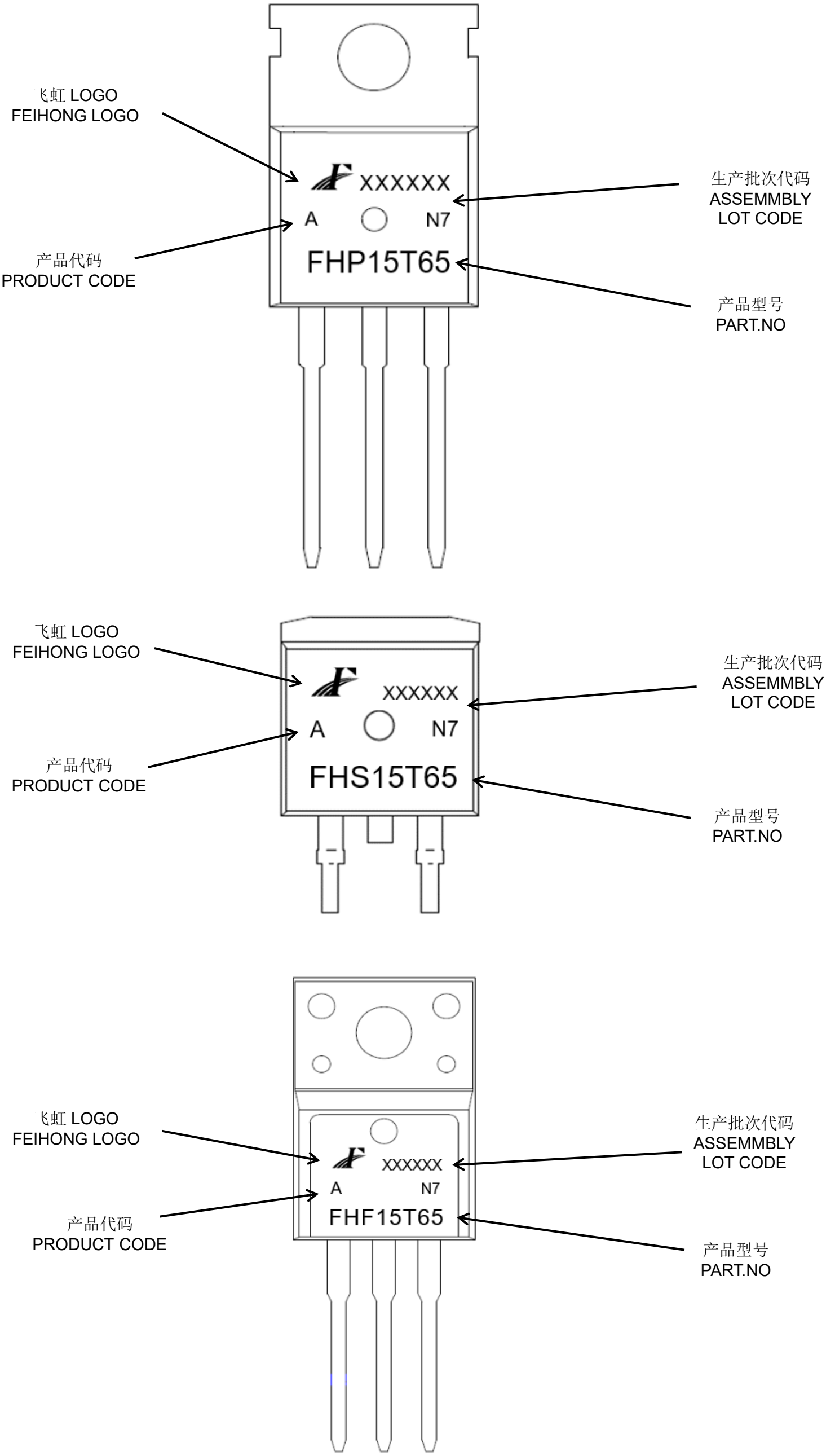


Figure 29. Definition of diode switching characteristics



印记 Marking:


飞虹 LOGO
FEIHONG LOGO
XXXXXX
A
N7
FHP15T65
生产批次代码
ASSEMMBLY
LOT CODE
产品代码
PRODUCT CODE
产品型号
PART.NO
飞虹 LOGO
FEIHONG LOGO
XXXXXX
A
N7
FHS15T65
生产批次代码
ASSEMMBLY
LOT CODE
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FEIHONG LOGO
XXXXXX
A
N7
FHF15T65
生产批次代码
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产品代码
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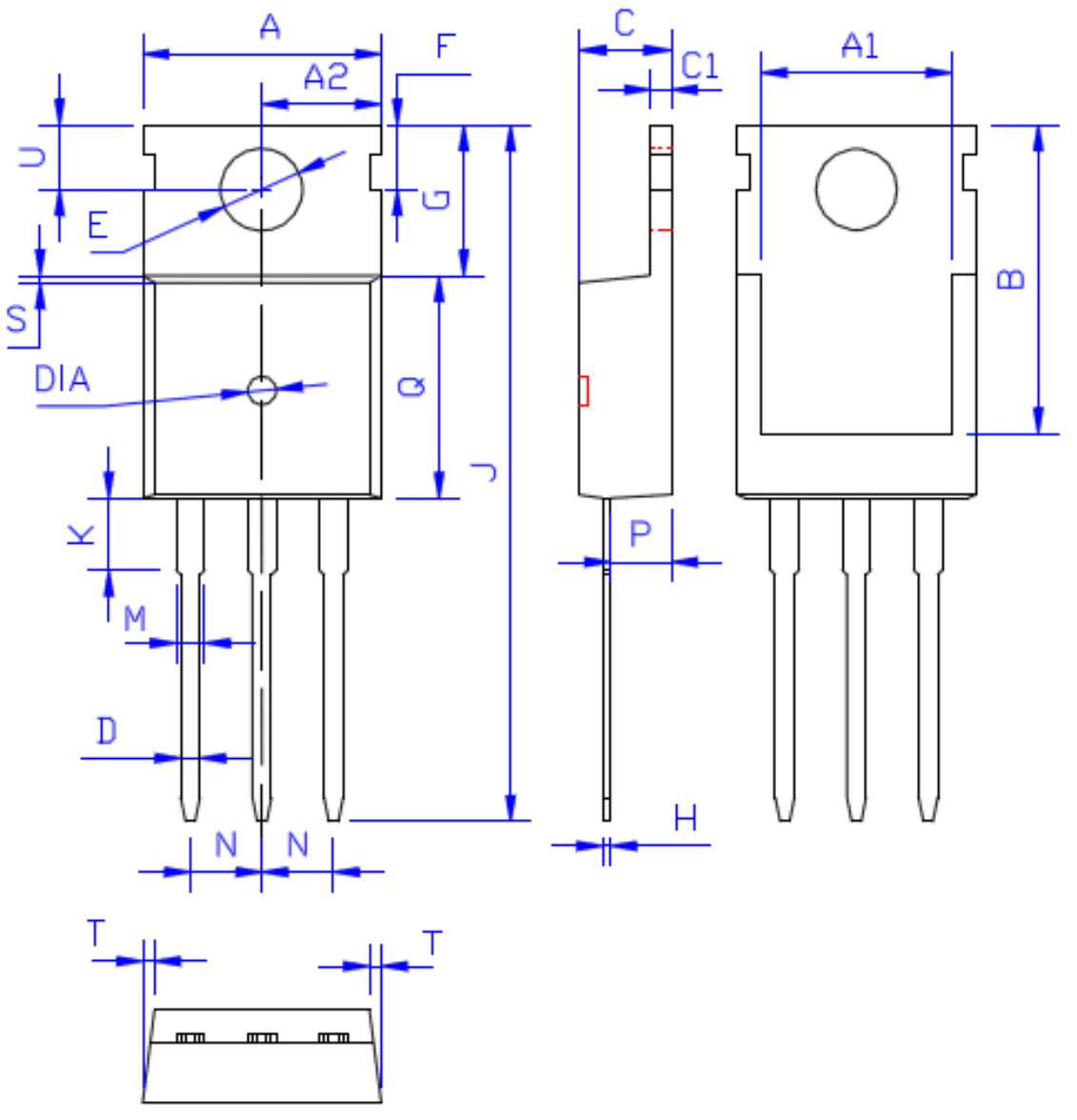
PART.NO

外形尺寸：

Package Dimension：

TO-220



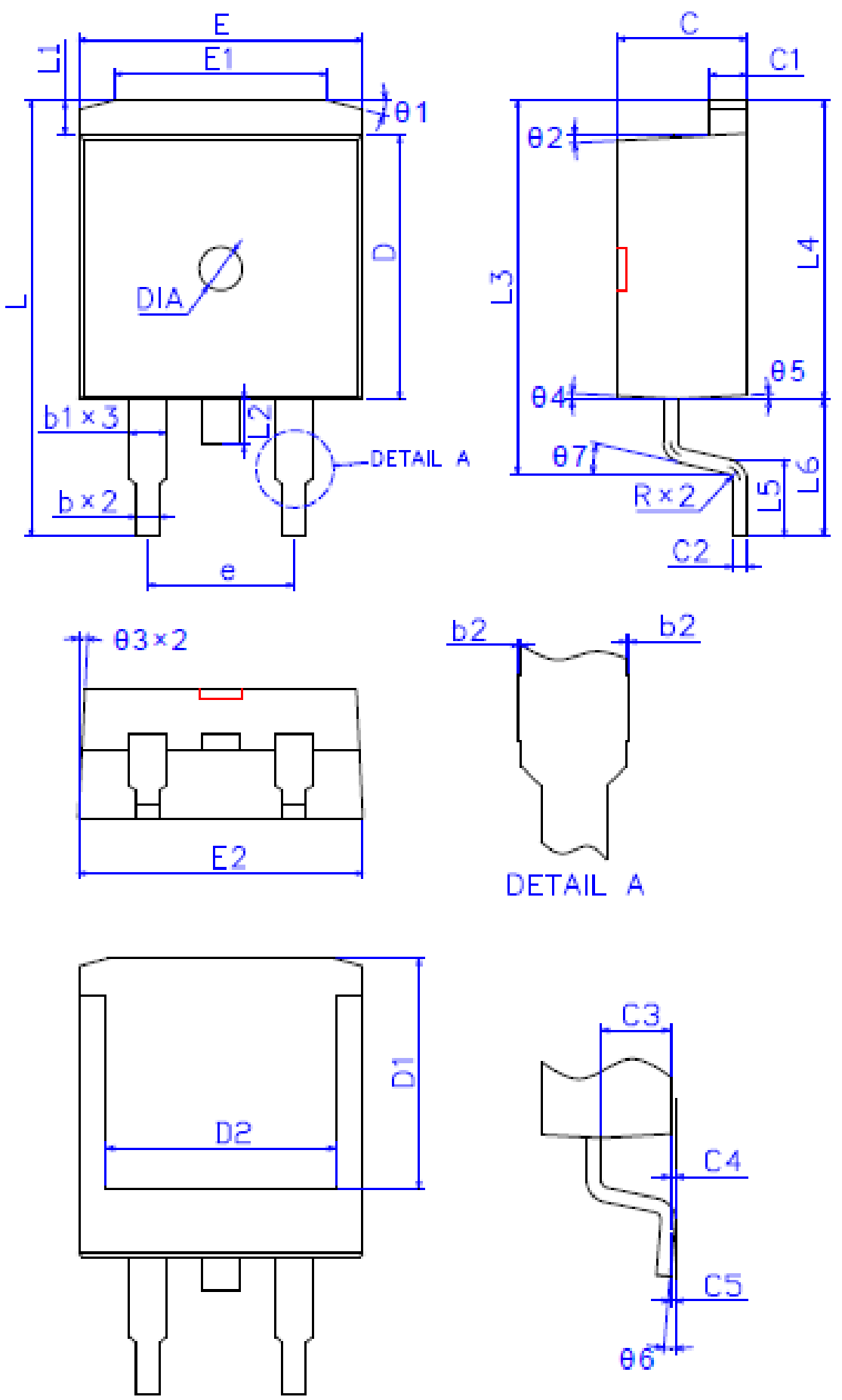
DIM	MILLIMETERS
A	10.00±0.30
A1	8.00±0.30
A2	5.00±0.30
B	13.20±0.40
C	4.50±0.20
C1	1.30±0.20
D	0.80±0.20
E	3.60±0.20
F	3.00±0.30
G	6.60±0.40
H	0.50±0.20
J	28.88±0.50
K	3.00±0.30
M	1.30±0.30
N	Typical 2.54
P	2.40±0.40
Q	9.20±0.40
S	0.25±0.15
T	0.25±0.15
U	2.80±0.30
DIA	宽 1.50±0.10 深 0.50 MAX

（Unit：mm）

外形尺寸：

Package Dimension：

TO-263

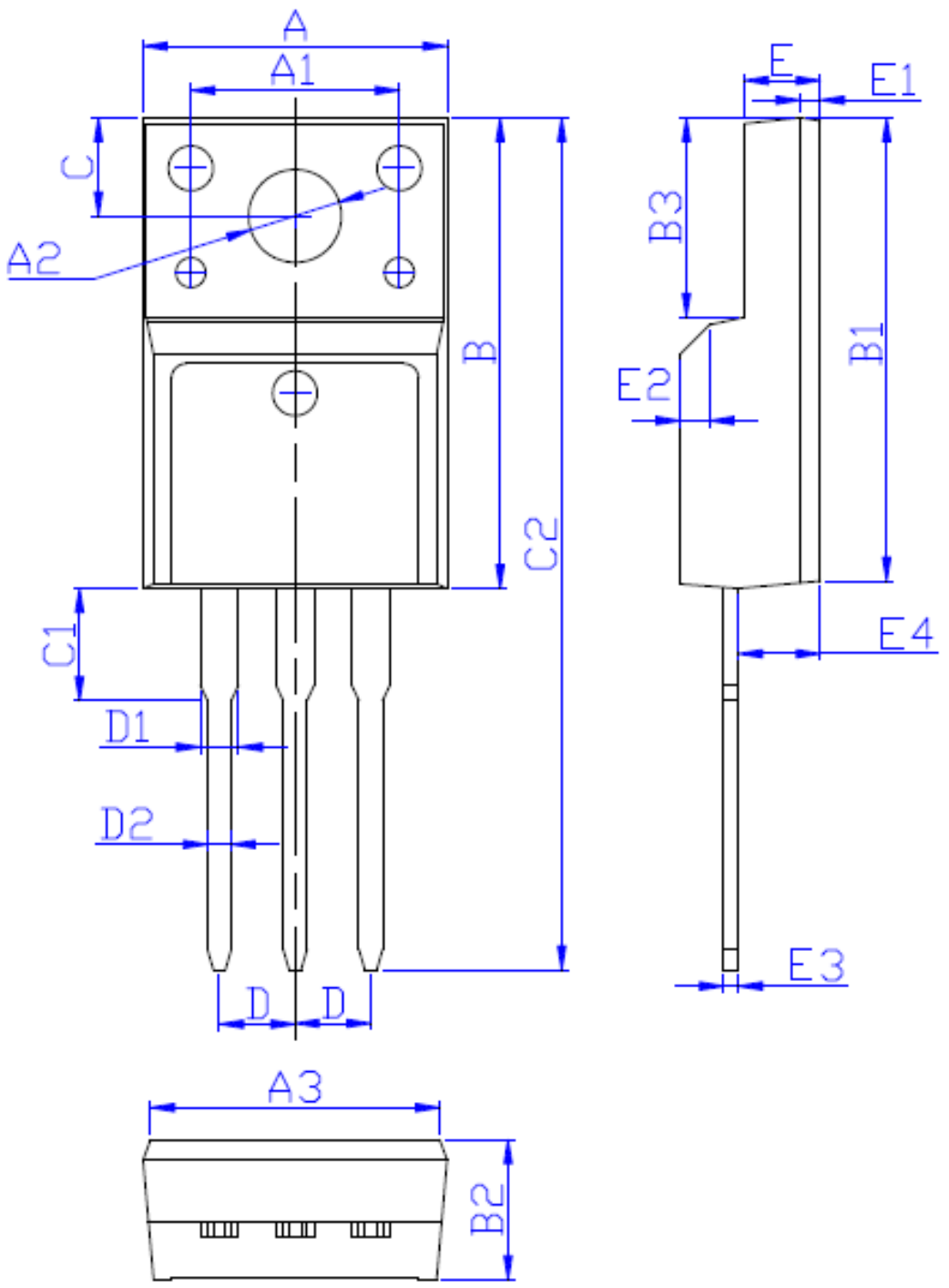


标注	尺寸(mm)
E	9.88±0.10
E1	7.40±0.20
E2	9.90±0.15
L	15.20±0.25
L1	1.30±0.15
L2	1.60±0.10
L3	13.00±0.20
L4	10.40±0.15
L5	2.60±0.15
L6	4.80±0.20
b	0.80±0.07
b1	1.27±0.07
b2	0.05±0.07
C	4.48±0.10
C1	1.30±0.07
C2	0.50±0.07
C3	2.40±0.06
C4	0.10±0.08
C5	0.10±0.08
D	9.20±0.10
D1	8.00±0.10
D2	8.00±0.10
R	0.50±0.10
θ1	15° ±2°
θ2	3° ±2°
θ3	3° ±2°
θ4	3° ±2°
θ5	3° ±2°
θ6	0° ~6°
θ7	13° ±2°
e	5.08±0.10
DIA	宽 1.50±0.10 深 0.30±0.15

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）