

绝对最大额定值 ABSOLUTE RATINGS ($T_c=25^\circ\text{C}$)

项 目 Parameter	符 号 Symbol	数 值 Value	单 位 Unit
最高集电极-发射极直流电压 Collector-Emitter Voltage	V_{ce}	1200	V
*连续集电极电流 Collector Current-continuous	I_c	80($T_c=25^\circ\text{C}$)	A
		40($T_c=100^\circ\text{C}$)	A
最大脉冲集电极极电流 (注1) Collector Current – pulse (note 1)	I_{CM}	160	A
二极管正向电流 Diode RMS forward current	I_F	80($T_c=25^\circ\text{C}$)	A
		40($T_c=100^\circ\text{C}$)	A
二极管正向不重复峰值电流 (浪涌电流) Surge non repetitive forward current $t_p=10\text{ ms}$ sinusoidal	I_{FSM}	160	A
栅极发射极电压 Gate-Emitter Voltage	V_{GE}	± 20	V
瞬态栅极发射极电压 Transient Gate-emitter voltage ($t_p \leq 10\mu\text{s}$, $D < 0.010$)	V_{GE}	± 25	V
安全工作区 Turn-off safe area	-	160	A
耗散功率 Power Dissipation	P_D $T_c=25^\circ\text{C}$	595	W
存储温度 Storage Temperature Range	T_{STG}	$-55 \sim +150$	$^\circ\text{C}$
最高结温 Max Junction Temperature Range	T_{VJ}	175	$^\circ\text{C}$
引线最高焊接温度 Maximum Lead Temperature for Soldering Purposes	T_L	300	$^\circ\text{C}$

*连续集电极电流由最高结温限制

*Collector current limited by maximum junction temperature

注释:

1: 脉冲宽度由最高结温限制

Notes:

1: Pulse width 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-Emitter Voltage	BV_{CES}	$I_C=250\mu A, V_{GE}=0V$	1200	-	-	V
击穿电压温度特性 Breakdown Voltage Temperature Coefficient	$\Delta BV_{CES}/\Delta T_J$	$I_C=0.5mA$, referenced to $25^\circ C$	-	0.6	-	V/ $^\circ C$
零栅压下集电极漏电流 Zero Gate Voltage Collector Current	I_{CES}	$V_{CE}=1200V, V_{GE}=0V, T_C=25^\circ C$	-	-	0.2	mA
		$V_{CE}=1200V, V_{GE}=0V, T_C=175^\circ C$	-	-	2	mA
正向栅极体漏电流 Gate-body leakage current, forward	I_{GESF}	$V_{CE}=0V, V_{GE}=20V$	-	-	200	nA
反向栅极体漏电流 Gate-body leakage current, reverse	I_{GESR}	$V_{CE}=0V, V_{GE}=-20V$	-	-	-200	nA
通态特性 On-Characteristics						
阈值电压 Gate Threshold Voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C=250\mu A$	4.5	-	6.5	V
饱和压降 Collector-Emitter saturation Voltage	V_{CESAT}	$V_{GE}=15V, I_C=40A, T_C=25^\circ C$	-	1.8	2.2	V
		$V_{GE}=15V, I_C=40A, T_C=175^\circ C$	-	2.4	-	V
动态特性 Dynamic Characteristics						
输入电容 Input capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1.0MHz$	4200	4604	5000	pF
输出电容 Output capacitance	C_{oes}		150	200	250	pF
反向传输电容 Reverse transfer capacitance	C_{res}		40	49	60	pF
栅极电荷总量 Total Gate Charge	Q_g	$V_{CC}=960V, I_C=40A, V_{GE}=15V, T_C=25^\circ C$	150	165	180	nC
栅极-发射极电荷 Gate to emitter charge	Q_{ge}		-	46	-	
栅极-集电极电荷 Gate to collector charge	Q_{gc}		-	69	-	
栅极电阻-Gate resistance	R_g	$f=1MHz$, open collector	1.2	2.6	7.5	Ω
短路电流-short current	I_{sc}	$V_{GE}=15V, V_{CE}=600V, t_{sc} < 10\mu s$	-	260	-	A





电特性 ELECTRICAL CHARACTERISTICS

开关特性 Switching 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
开启延迟时间 Turn-On delay time	$t_{d(on)}$	$V_{CC}=600V, I_c=40A, R_G=12\Omega$ $V_{GE}=15V$, Parasitic ductance= $75nH$ $T_C=25^\circ C$	48.8	59	74.8	ns
上升时间 Turn-On rise time	t_r		83.7	99	116.6	ns
关断延迟时间 Turn-Off delay time	$t_{d(off)}$		155.7	193	231	ns
下降时间 Turn-Off Fall time	t_f		108.9	196	277.2	ns
开通损耗 Turn-On energy	E_{on}		1.77	2.03	2.31	mJ
关断损耗 Turn-Off energy	E_{off}		1.67	2.21	2.80	mJ
总开关损耗 Total switching energy	E_{tot}		3.52	4.25	5.01	mJ
开启延迟时间 Turn-On delay time	$t_{d(on)}$	$V_{CC}=600V, I_c=40A, R_G=12\Omega$ $V_{GE}=15V$, Parasitic ductance= $75nH$ $T_C=175^\circ C$	44.1	55	66	ns
上升时间 Turn-On rise time	t_r		81	100	121	ns
关断延迟时间 Turn-Off delay time	$t_{d(off)}$		194.4	236	286	ns
下降时间 Turn-Off Fall time	t_f		272.7	358	479.6	ns
开通损耗 Turn-On energy	E_{on}		1.93	2.24	2.6	mJ
关断损耗 Turn-Off energy	E_{off}		2.8	3.50	4.47	mJ
总开关损耗 Total switching energy	E_{tot}		4.8	5.74	6.95	mJ
反并联二极管特性及最大额定值 Anti-Parallel Diode Characteristics and Maximum Ratings						
正向压降 Diode Forward Voltage	V_F	$V_{GE}=0V, I_F=40A, T_C=25^\circ C$	-	1.81	2.7	V
		$V_{GE}=0V, I_F=40A, T_C=175^\circ C$	-	1.45	-	V
反向恢复时间 Diode Reverse recovery time	t_{rr}	$V_{GE}=0V, V_R=600V, I_F=40A$ $di_F/dt=200A/\mu s$ $T_C=25^\circ C$	-	264	-	ns
反向恢复电荷 Diode Reverse recovery charge	Q_{rr}		-	1548	-	nC
反向恢复电流 Diode Reverse recovery Current	I_{RRM}		-	9	-	A
反向恢复时间 Diode Reverse recovery time	t_{rr}		$V_{GE}=0V, V_R=600V, I_F=40A$ $di_F/dt=200A/\mu s$ $T_C=175^\circ C$	-	538	-
反向恢复电荷 Diode Reverse recovery charge	Q_{rr}	-		7309	-	nC
反向恢复电流 Diode Reverse recovery Current	I_{RRM}	-		24	-	A



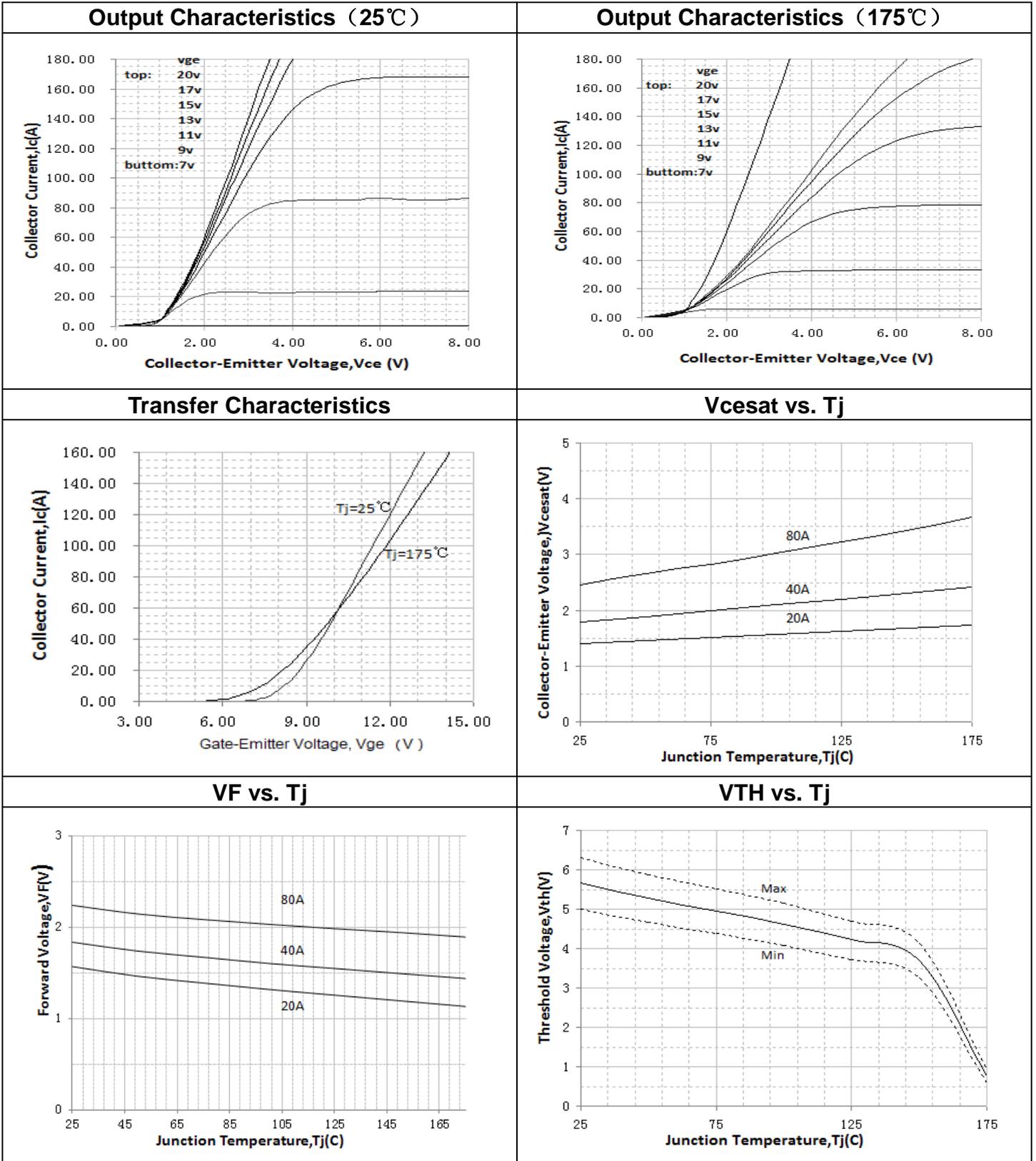
TT040K120EQ

项 目 Parameter	符 号 Symbol	典型 Typ	最大值 MAX	单 位 Unit
		TT040K120EQ		
结到管壳的热阻 IGBT Thermal Resistance, Junction to Case	$R_{th(j-c)}$	0.185	0.252	$^{\circ}C/W$
结到管壳的热阻 FRD Thermal Resistance, Junction to Case	$R_{th(j-c)}$	0.476	0.612	$^{\circ}C/W$
结到环境的热阻 Thermal Resistance, Junction to Ambient	$R_{th(j-A)}$		40.0	$^{\circ}C/W$



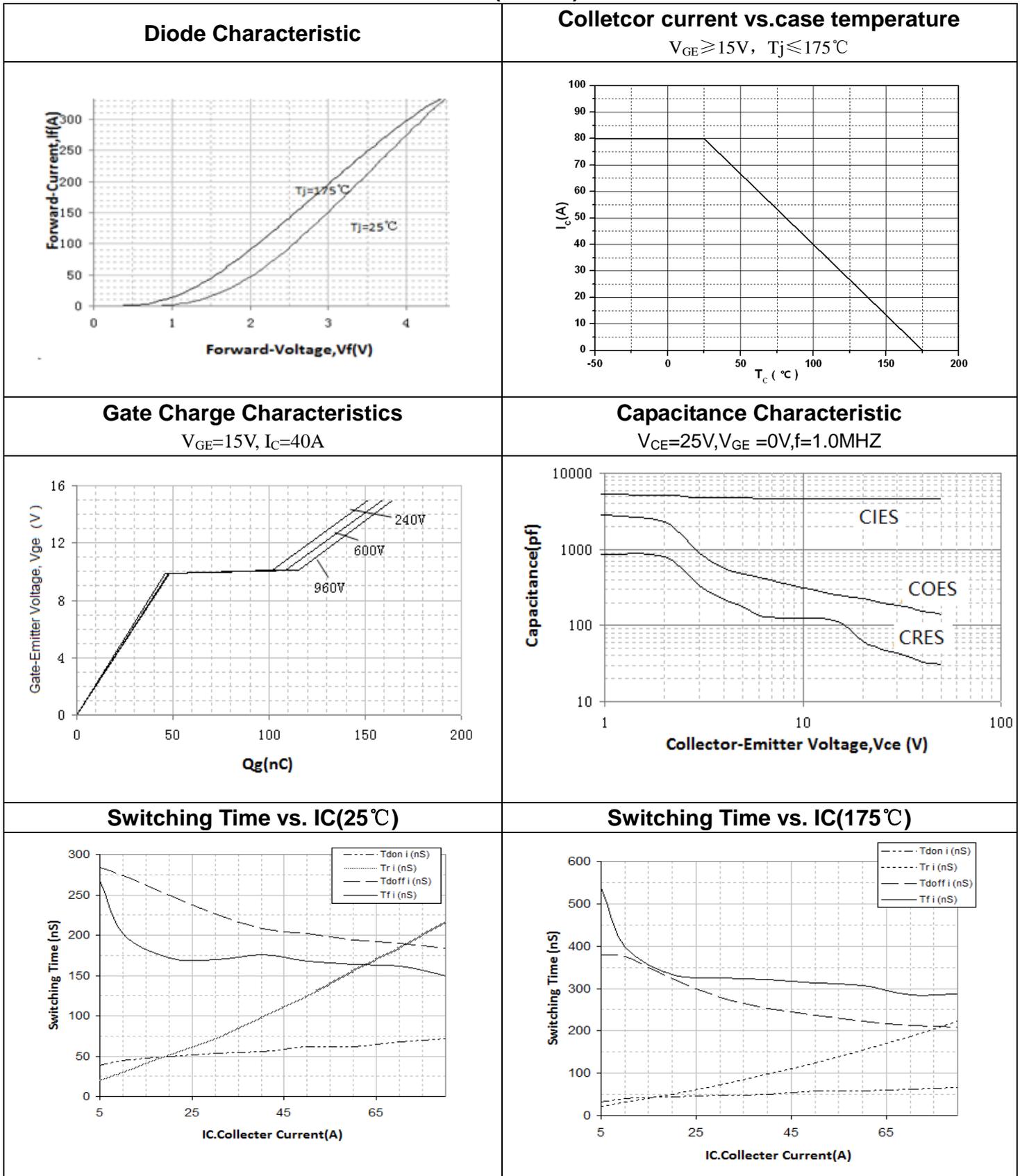


特征曲线 ELECTRICAL CHARACTERISTICS (curves)





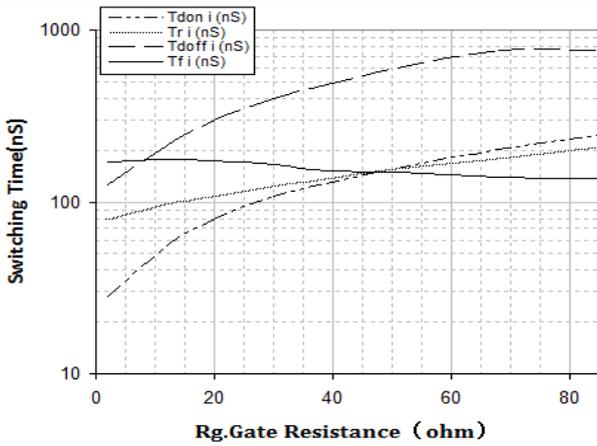
特征曲线 ELECTRICAL CHARACTERISTICS (curves)





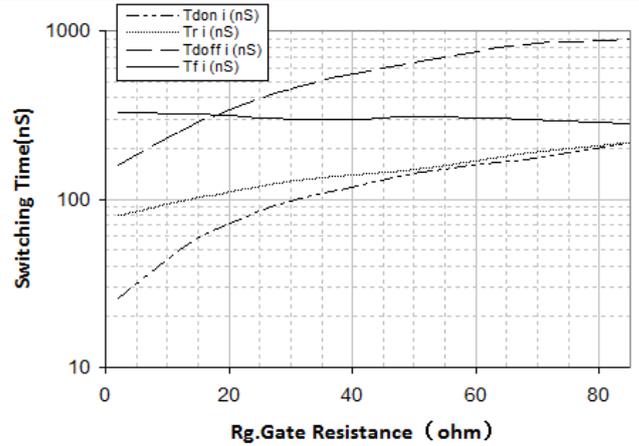
Switching Time vs. Rg(25°C)

$V_{GE}=15V, V_{CE}=600V, I_C=40A$



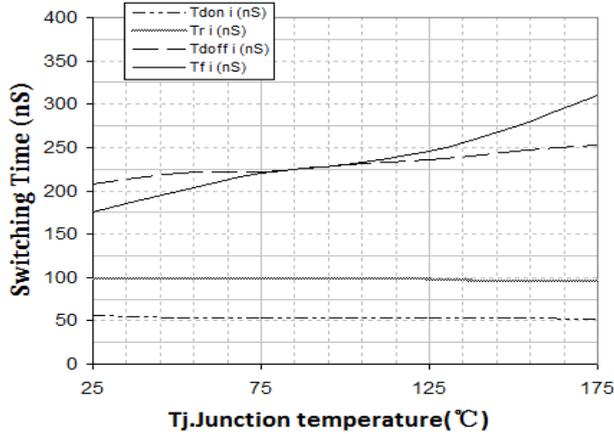
Switching Time vs. Rg(175°C)

$V_{GE}=15V, V_{CE}=600V, I_C=40A$



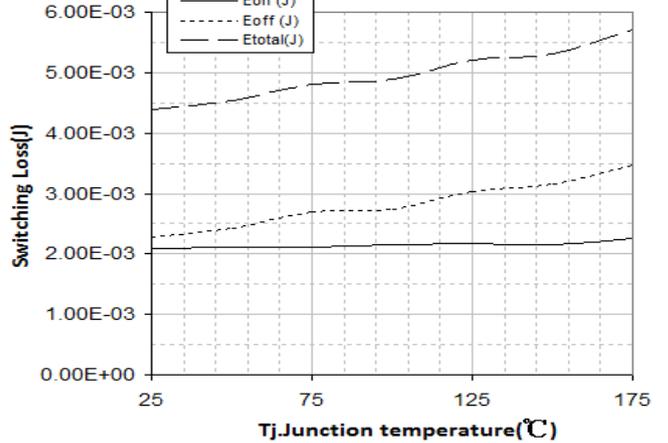
Switching Time vs. Tj

$V_{GE}=15V, V_{CE}=600V, I_C=40A, R_g=12\Omega$



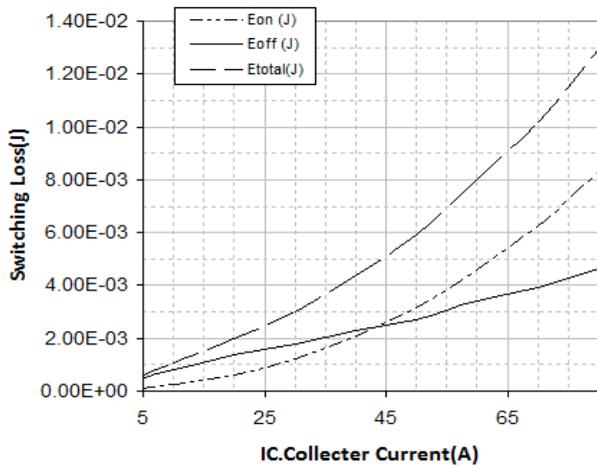
Switching Loss vs. Tj

$V_{GE}=15V, V_{CE}=600V, I_C=40A, R_g=12\Omega$



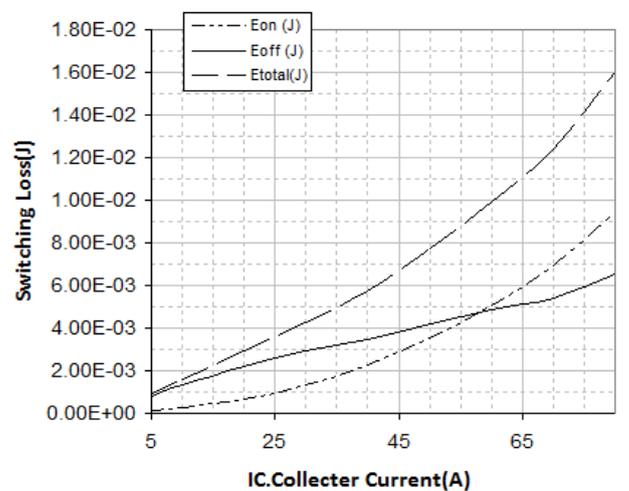
Switching Loss vs. IC(25°C)

$V_{GE}=15V, V_{CE}=600V, R_g=12\Omega$



Switching Loss vs. IC(175°C)

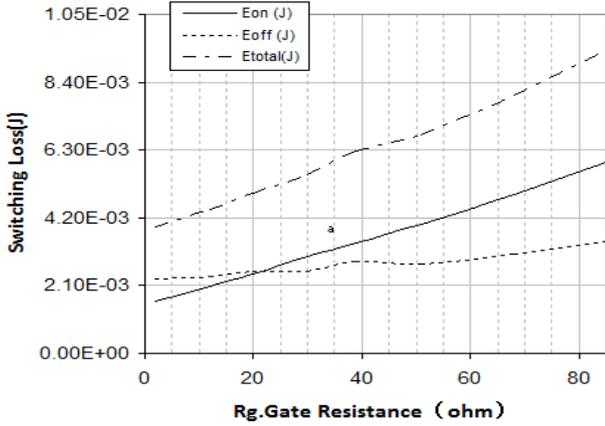
$V_{GE}=15V, V_{CE}=600V, R_g=12\Omega$





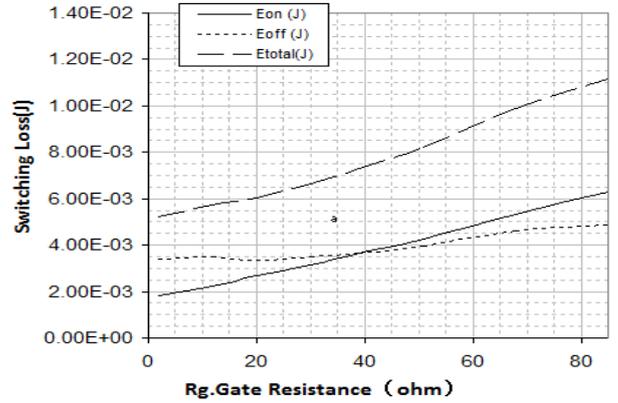
Switching Loss vs. Rg(25°C)

$V_{GE}=15V, V_{CE}=600V, I_C=40A$



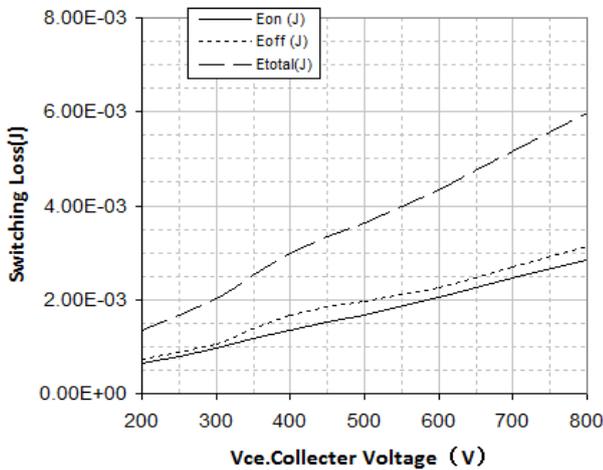
Switching Loss vs. Rg(175°C)

$V_{GE}=15V, V_{CE}=600V, I_C=40A$



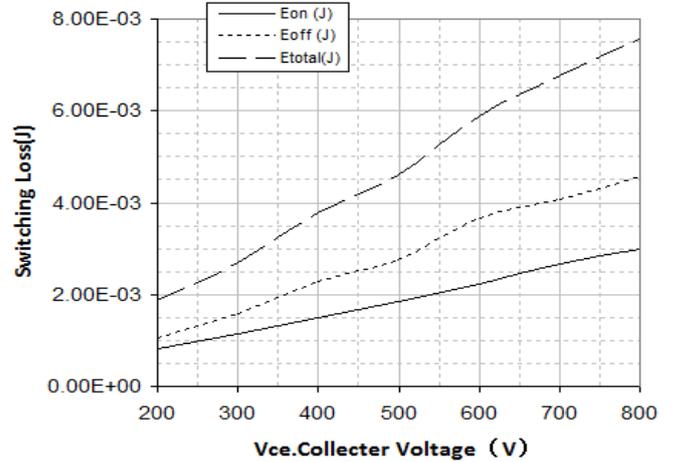
Switching Loss vs. VCE(25°C)

$V_{GE}=15V, I_C=40A, R_g=12\Omega$



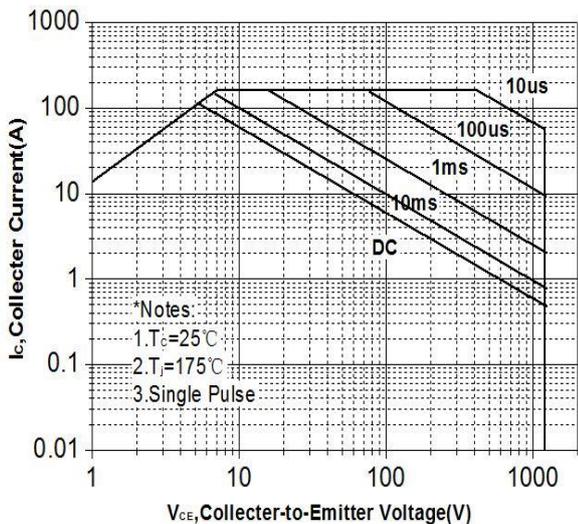
Switching Loss vs. VCE(175°C)

$V_{GE}=15V, I_C=40A, R_g=12\Omega$

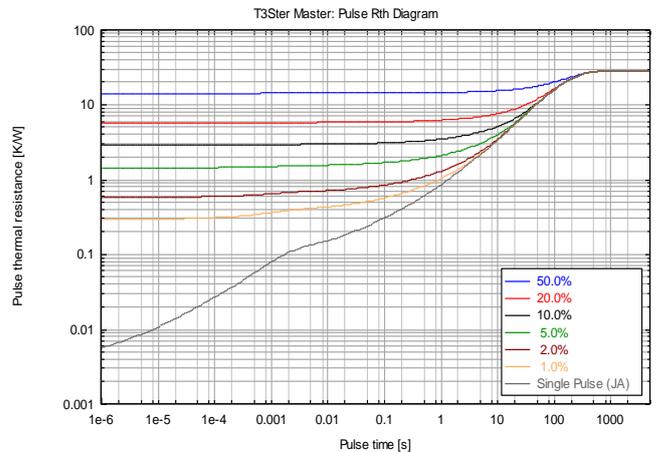


Forward Bias SOA

$T_c=25\text{ }^\circ\text{C}, V_{GE}=15V, T_j \leq 175\text{ }^\circ\text{C}$

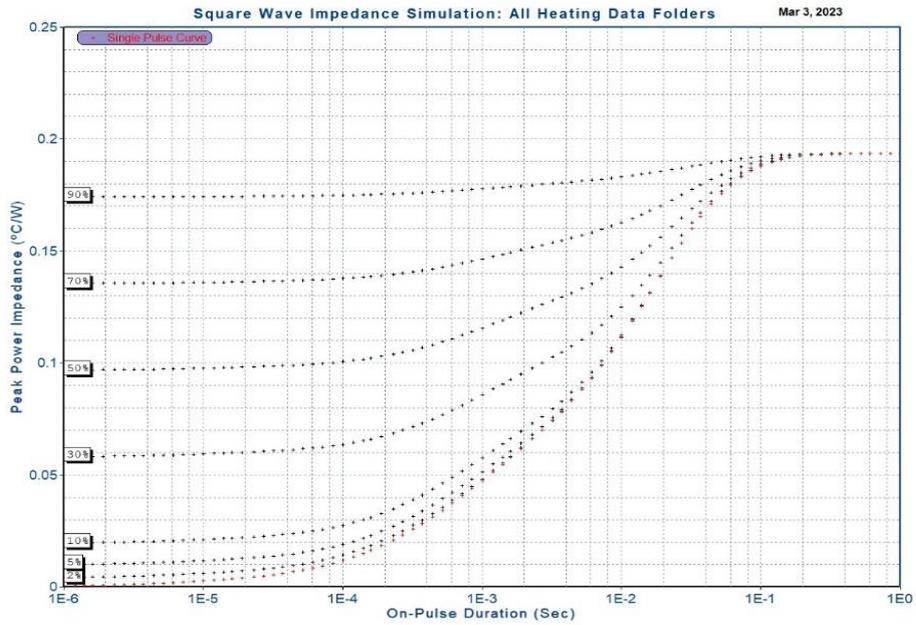


Normalized Maximum Transient Thermal Impedance for IGBT(RJA)



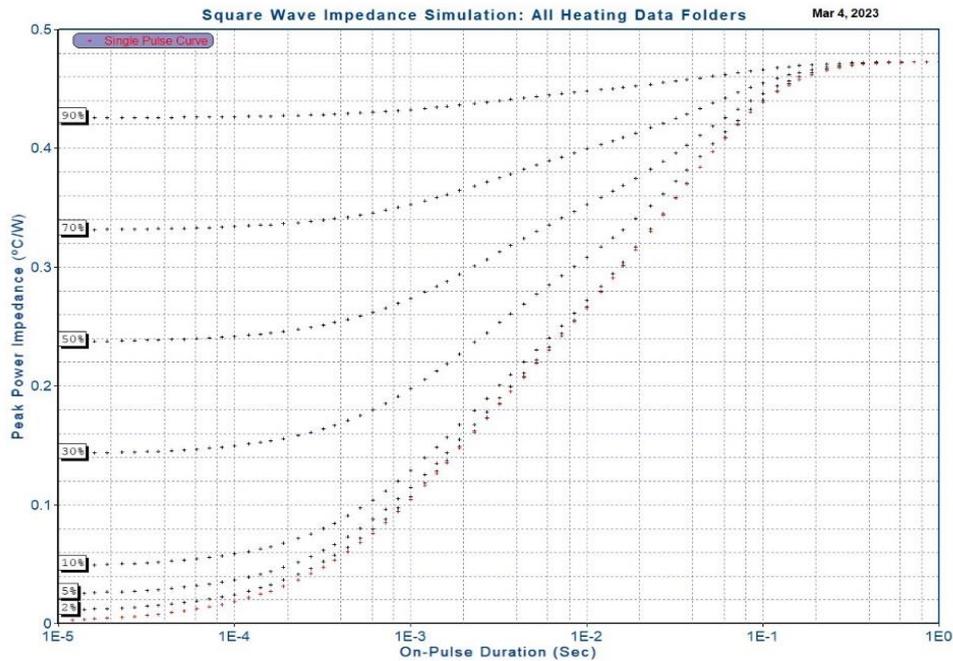


Normalized TYP Transient Thermal Impedance for IGBT(RJC)



v2.7.4

Normalized TYP Transient Thermal Impedance for FRD(RJC)

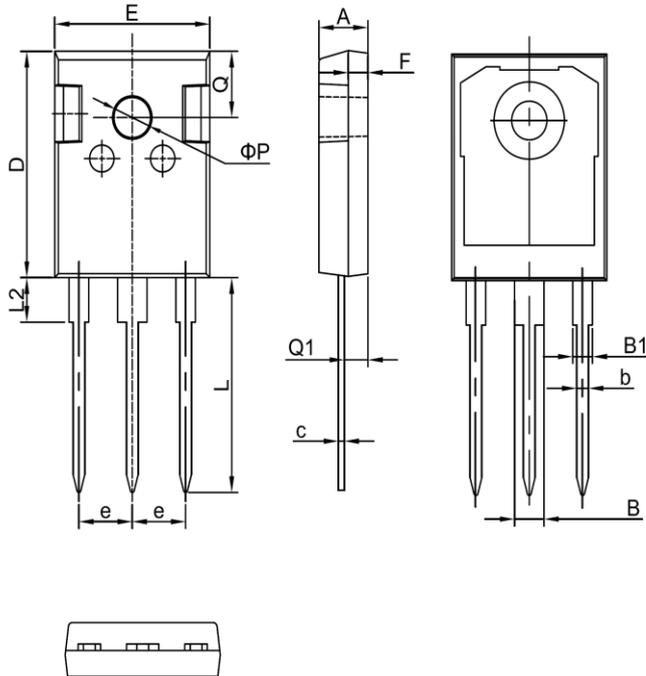


v2.4.6



TO-247

单位 Unit : mm



符号 symbol	MIN	MAX
A	4.90	5.10
B	2.95	3.35
B1	1.95	2.35
b	1.15	1.35
c	0.50	0.70
D	20.90	21.10
E	15.70	15.90
e	5.34	5.54
F	1.90	2.10
L	19.40	20.40
L2	4.03	4.23
Q	6.00	6.40
Q1	2.30	2.50
P	3.50	3.70



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