



# TT040U065FB

## 主要参数 MAIN CHARACTERISTICS

I <sub>c</sub>	40A
V <sub>CE</sub>	650V
V <sub>CEsat-typ</sub>	1.9V

### 用途

- PFC
- 储能

### APPLICATIONS

- Power factor corrector
- Energy Storage

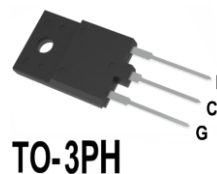
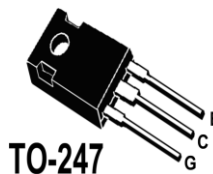
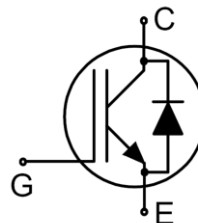
### 产品特性

- 低栅极电荷
- Trench FS 技术
- RoHS 产品
- 快开关速度
- 低开关损耗
- V<sub>CE(sat)</sub> 正温度系数

### FEATURES

- Low gate charge
- Trench FS Technology
- RoHS product
- Fast switching speed
- Low switching losses
- V<sub>CE(sat)</sub> with positive temperature coefficient

## 封装 Package



## 订货信息 ORDER MESSAGE

订货型号 Order codes	印 记 Marking	封 装 Package
无卤-条管 Halogen-Free-Tube		
TT040U065FB-GE-BR	TT040U065FB	TO-247
TT040U065FB-GA-BR	TT040U065FB	TO-3PH



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	$V_{CE}$	650	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
*二极管正向测试电流 Diode RMS forward current	$I_F$	40 ( $T_C=25^{\circ}\text{C}$ )	A
		20 ( $T_C=100^{\circ}\text{C}$ )	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	$I_{FSM}$	100	A
最高栅极发射极电压 Gate-emitter voltage	$V_{GE}$	$\pm 20$	V
瞬态栅极发射极电压 Transient gate-emitter voltage ( $t_p \leq 10\mu\text{s}$ , $D < 0.010$ )	$V_{GE}$	$\pm 30$	V
安全工作区 Turn-off safe area $V_{CE} \leq 650\text{V}$ , $T_{vj} \leq 175^{\circ}\text{C}$ , $t_p = 1\mu\text{s}$	-	160	A
耗散功率(TO-247) Power dissipation	$P_D$ $T_C=25^{\circ}\text{C}$ $P_D$ $T_C=100^{\circ}\text{C}$	294	W
		147	
耗散功率(TO-3PH) Power dissipation	$P_D$ $T_C=25^{\circ}\text{C}$ $P_D$ $T_C=100^{\circ}\text{C}$	83	W
		41	
工作结温 (注2) Operating junction temperature range	$T_{vj}$	$-40 \sim +175$	$^{\circ}\text{C}$
存储温度 Storage temperature	$T_{STG}$	$-55 \sim +150$	$^{\circ}\text{C}$
引线最高焊接温度 Maximum lead temperature for soldering purposes	$T_L$	260	$^{\circ}\text{C}$

\*连续集电极电流由最高结温限制。

\*Collector current limited by maximum junction temperature.

For optimum lifetime and reliability, JSMC recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet

注释:

1: 脉冲宽度由最高结温限制。

2: 过载工况时, 允许在最高结温  $T_{vjop}=175^{\circ}\text{C}$  下运行, 最大占空比 < 20% (最多持续 60s)

Notes:

1: Pulse width limited by maximum junction temperature.

2: Under overload condition, it is allowed to operate at the maximum junction temperature  $T_{vjop}=175^{\circ}\text{C}$ , and the maximum duty ratio is less than 20% (lasting for 60 s at most)





## 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
<b>关态特性 Off –Characteristics</b>						
集电极-发射极击穿电压 Collector-emitter voltage	$BV_{CES}$	$I_C=250\mu A, V_{GE}=0V$	650	-	-	V
零栅压下集电极漏电流 Zero gate voltage collector current	$I_{CES}$	$V_{CE}=650V, V_{GE}=0V, T_{vj}=25^\circ C$	-	-	50	$\mu A$
正向栅极体漏电流 Gate-body leakage current,forward	$I_{GESF}$	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^\circ C$	-	-	200	nA
反向栅极体漏电流 Gate-body leakage current,reverse	$I_{GESR}$	$V_{CE}=0V, V_{GE}=-20V, T_{vj}=25^\circ C$	-	-	-200	nA
<b>通态特性 On-Characteristics</b>						
阈值电压 Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C=0.4mA$	3.5	4.5	5.5	V
饱和压降 Collector-emitter saturation voltage	$V_{CESAT}$	$V_{GE}=15V, I_C=40A$ $T_{vj}=25^\circ C$ $T_{vj}=150^\circ C$	- -	1.9 2.2	2.3 -	V
<b>动态特性 Dynamic Characteristics</b>						
输入电容 Input capacitance	$C_{ies}$	$V_{CE}=25V$ $V_{GE}=0V$ $f=1.0MHz$	-	2240	-	pF
输出电容 Output capacitance	$C_{oes}$		-	145	-	pF
反向传输电容 Reverse transfer capacitance	$C_{res}$		-	40	-	pF
栅极电荷总量 Total gate charge	$Q_g$	$V_{CC}=400V, I_C=40A, V_{GE}=15V$	-	88	-	nC
栅极-发射极 Gate to emitter charge	$Q_{ge}$		-	14	-	
栅极-集电极 Gate to collector charge	$Q_{gc}$		-	48	-	



## 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	$t_{d(on)}$	$V_{CC}=400V, I_c=40A, R_G=5\Omega$ $V_{GE}=15V$ $T_{vj}=25^\circ C$	-	10	-	ns
上升时间 Turn-on rise time	$t_r$		-	52	-	ns
关断延迟时间 Turn-off delay time	$t_{d(off)}$		-	88	-	ns
下降时间 Turn-off fall time	$t_f$		-	50	-	ns
开通损耗 Turn-on energy	Eon		-	0.71	-	mJ
关断损耗 Turn-off energy	Eoff		-	0.62	-	mJ
总开关损耗 Total switching energy	Etot		-	1.33	-	mJ
开启延迟时间 Turn-on delay time	$t_{d(on)}$	$V_{CC}=400V, I_c=40A, R_G=5\Omega$ $V_{GE}=15V$ $T_{vj}=150^\circ C$	-	14	-	ns
上升时间 Turn-on rise time	$t_r$		-	52	-	ns
关断延迟时间 Turn-off delay time	$t_{d(off)}$		-	112	-	ns
下降时间 Turn-off fall time	$t_f$		-	85	-	ns
开通损耗 Turn-on energy	Eon		-	0.77	-	mJ
关断损耗 Turn-off energy	Eoff		-	1.1	-	mJ
总开关损耗 Total switching energy	Etot		-	1.87	-	mJ

## 反并联二极管特性及最大额定值 Anti-Parallel Diode Characteristics and Maximum Ratings

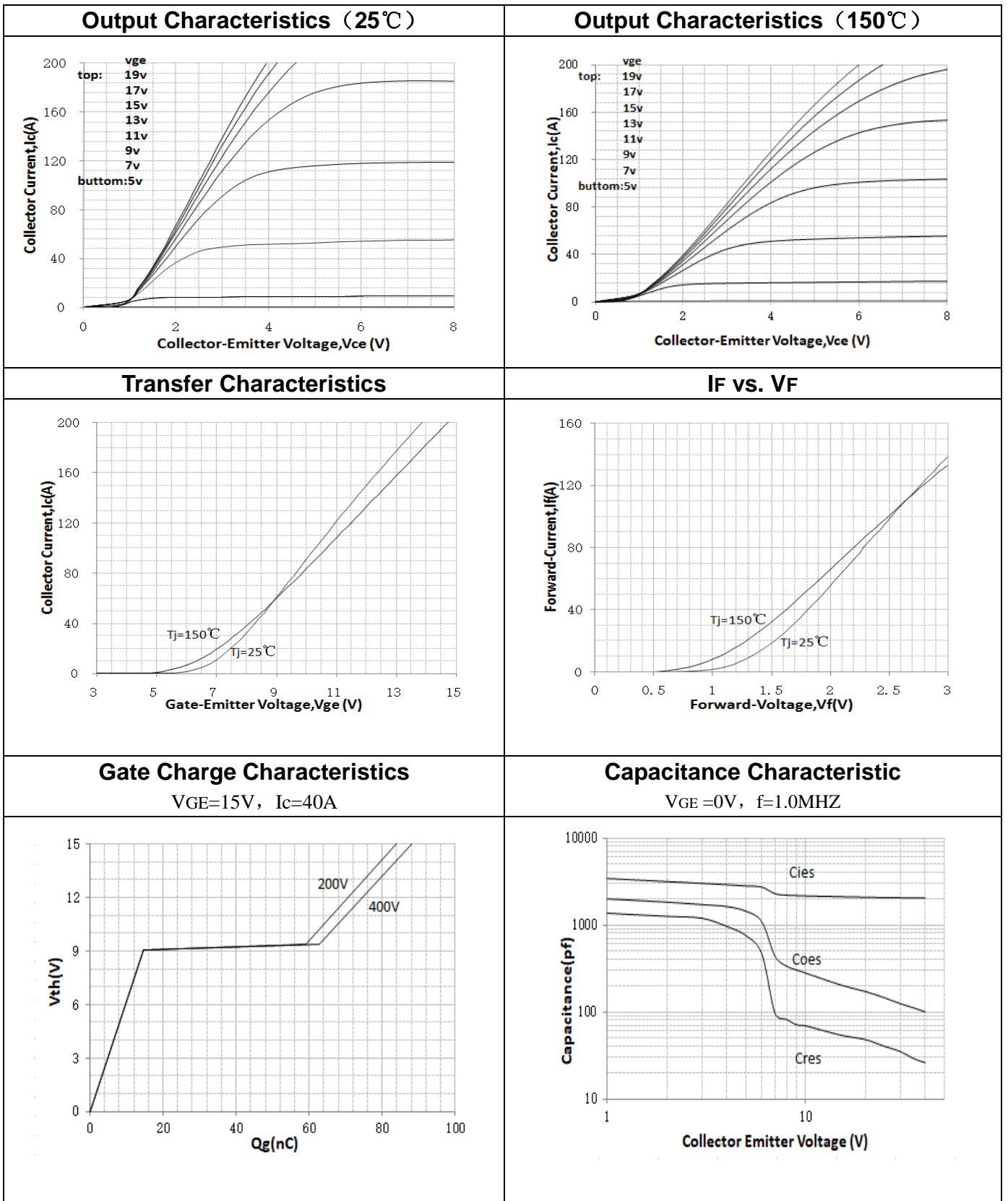
正向压降 Diode forward voltage	$V_F$	$I_F=20A, T_{vj}=25^\circ C$ $T_{vj}=150^\circ C$	-	1.55 1.3	2.0 -	V
反向恢复时间 Reverse recovery time	$t_{rr}$	$V_R=400V, I_F=20A$ $dI_F/dt=200A/\mu s$ $T_{vj}=25^\circ C$	-	150	-	ns
反向恢复电荷 Diode reverse recovery charge	$Q_{rr}$		-	424	-	nC
反向恢复电流 Diode reverse recovery current	$I_{rrm}$		-	4.2	-	A
反向恢复时间 Diode reverse recovery time	$t_{rr}$	$V_R=400V, I_F=20A$ $dI_F/dt=200A/\mu s$ $T_{vj}=150^\circ C$	-	237	-	ns
反向恢复电荷 Diode reverse recovery charge	$Q_{rr}$		-	1470	-	nC
反向恢复电流 Diode reverse recovery current	$I_{rrm}$		-	10.4	-	A

项 目 Parameter	符 号 Symbol	MAX		单 位 Unit
		TO-247	TO-3PH	
结到管壳的热阻 Junction to case IGBT	$R_{th(j-c)}$	0.51	1.8	$^\circ C/W$
结到管壳的热阻 Junction to case Diode	$R_{th(j-c)}$	1.4	2.8	$^\circ C/W$
结到环境的热阻 Junction to ambient	$R_{th(j-a)}$	40	40	$^\circ C/W$





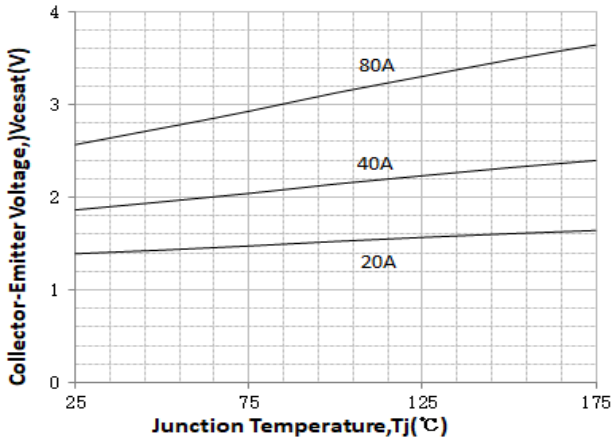
特征曲线 ELECTRICAL CHARACTERISTICS (curves)





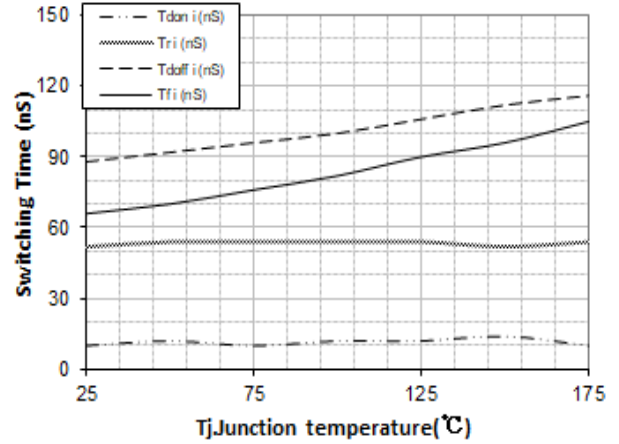
### V<sub>CEsat</sub> vs. T<sub>j</sub>

V<sub>GE</sub>=15V, I<sub>c</sub>=20A, 40A, 80A



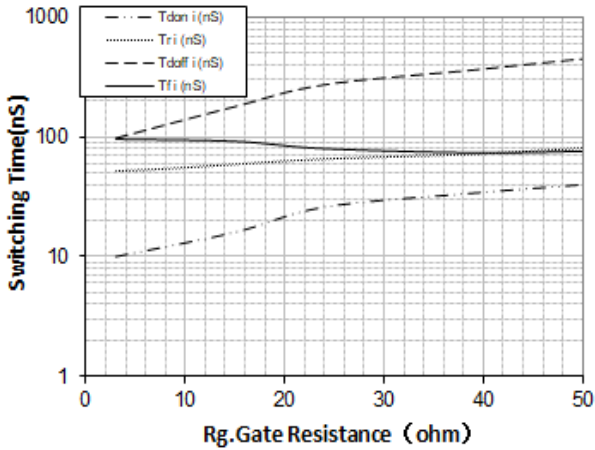
### Switching Time vs. T<sub>j</sub>

V<sub>GE</sub>=15V, V<sub>CE</sub>=400V, I<sub>c</sub>=40A, R<sub>G</sub>=5Ω



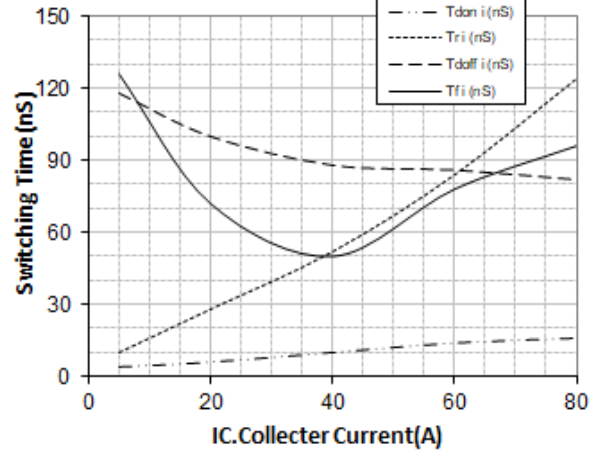
### Switching Time vs. R<sub>G</sub>(150°C)

V<sub>GE</sub>=15V, V<sub>CE</sub>=400V, I<sub>c</sub>=40A



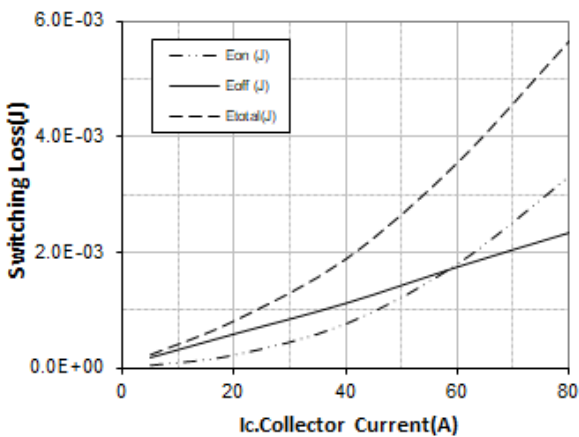
### Switching Time vs. I<sub>c</sub>(150°C)

V<sub>CE</sub>=400V, V<sub>GE</sub>=15V, R<sub>G</sub>=5Ω



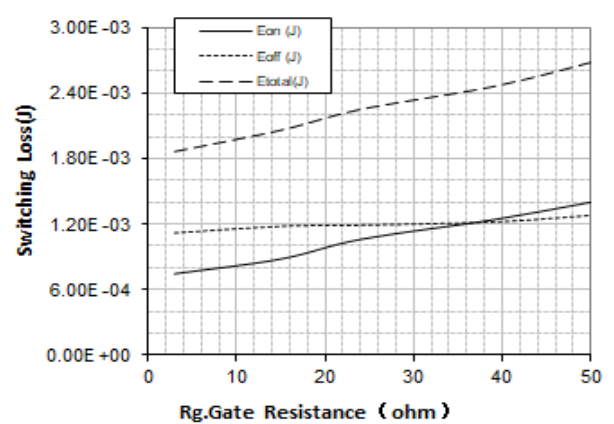
### Switching Loss vs. T<sub>j</sub>

V<sub>GE</sub>=15V, V<sub>CE</sub>=400V, I<sub>c</sub>=40A, R<sub>G</sub>=5Ω



### Switching Loss vs. R<sub>G</sub>(150°C)

V<sub>GE</sub>=15V, V<sub>CE</sub>=400V, I<sub>c</sub>=40A

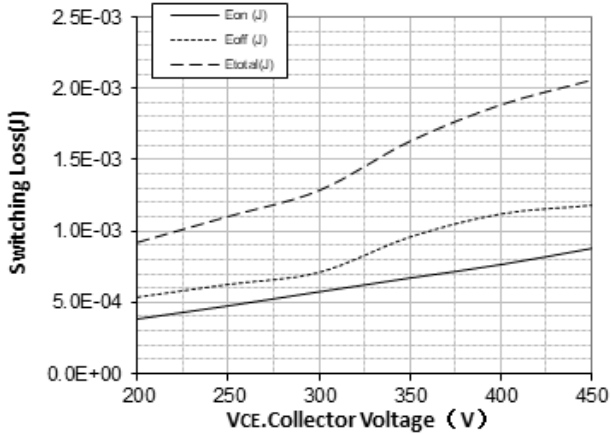




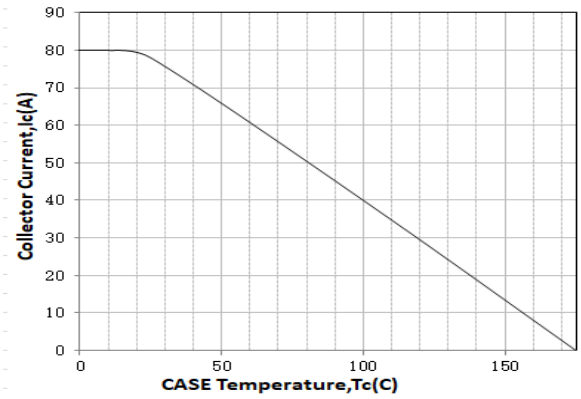


### Switching Loss vs. VCE(150°C)

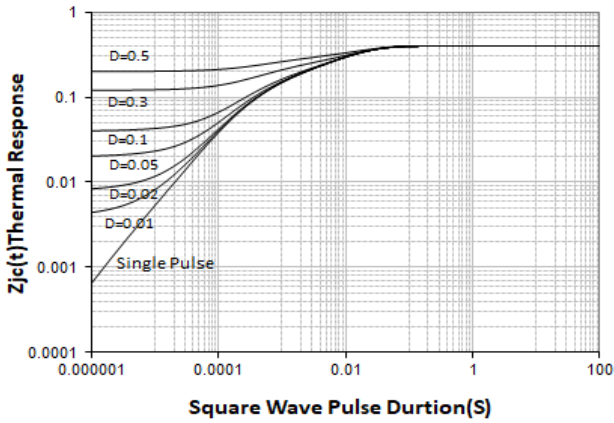
VGE=15V, Ic=40A, RG=5Ω



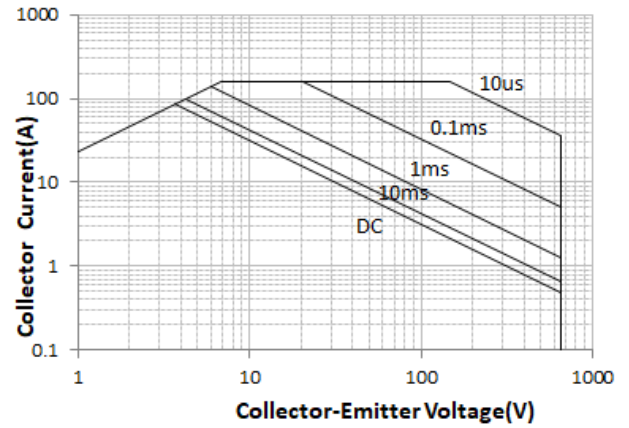
### Collector Current vs. Case temperature



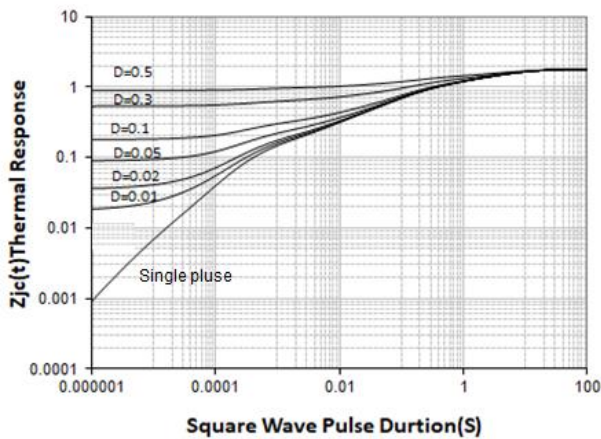
### Transient Thermal Impedance for IGBT TO-247



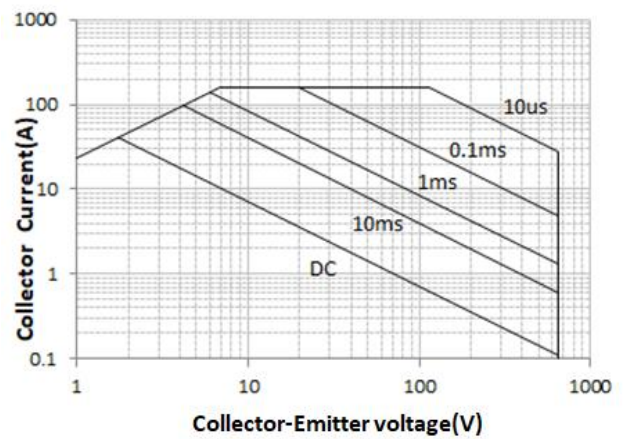
### Forward Bias Safe Operating Area TO-247



### Transient Thermal Impedance for IGBT TO-3PH



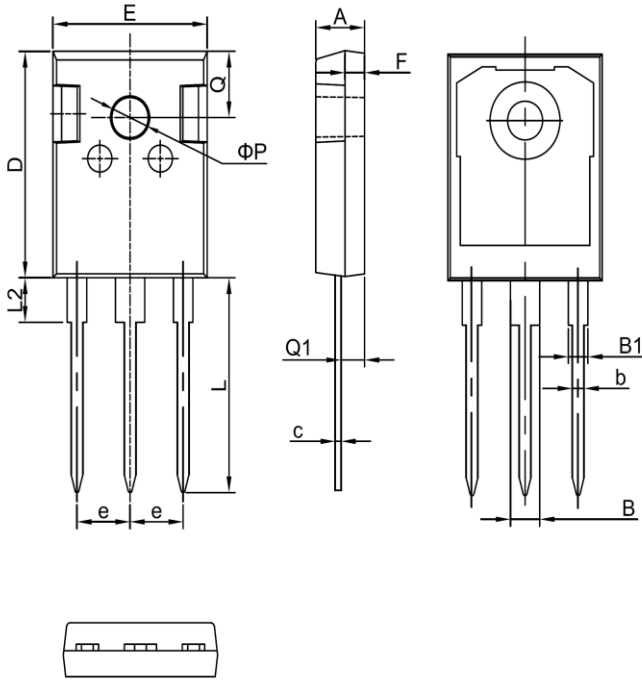
### Forward Bias Safe Operating Area TO-3PH





TO-247

单位 Unit: mm



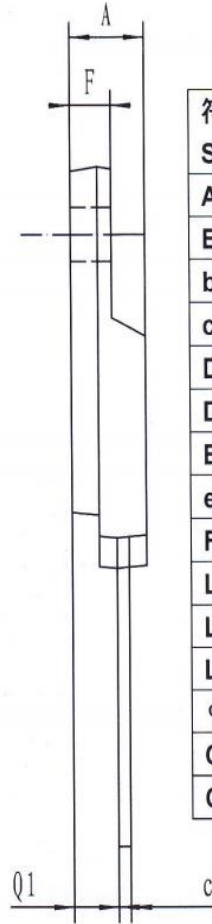
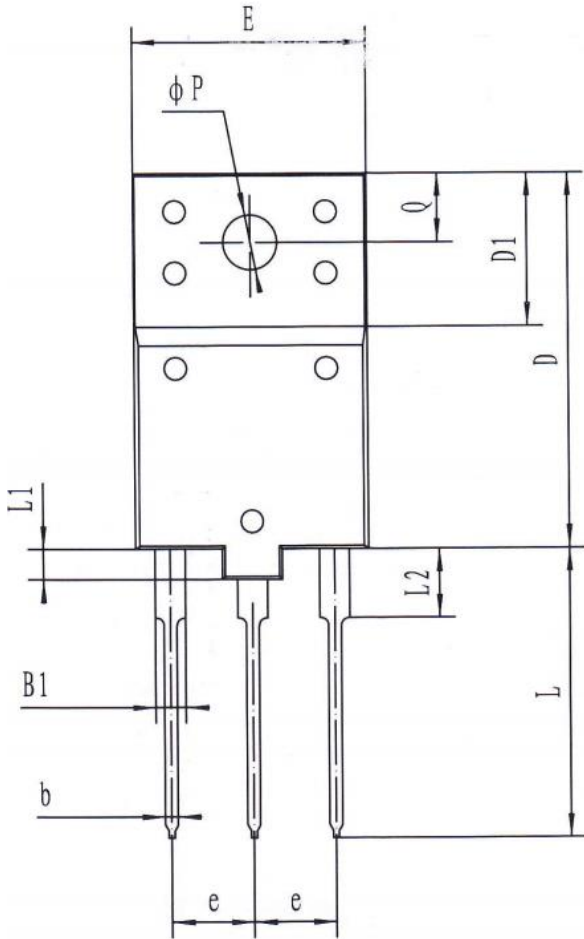
符号 symbol	MIN	MAX
A	4.90	5.10
B	2.95	3.35
B1	1.95	2.35
b	1.15	1.35
c	0.50	0.70
D	20.90	21.10
E	15.70	15.90
e	5.34	5.54
F	1.90	2.10
L	19.40	20.40
L2	4.03	4.23
Q	6.00	6.40
Q1	2.30	2.50
P	3.50	3.70





TO-3PH

单位 Unit: mm



符号 Symbol	Min	Max
A	5.2	5.8
B1	1.8	2.2
b	0.75	1.05
c	0.8	1.1
D	24.0	25.0
D1	9.8	10.2
E	15.0	16.0
e	5.45 (typ)	
F	2.7	3.3
L	18.5	19.5
L1	1.8	2.2
L2	4.3	4.7
$\phi P$	3.4	3.8
Q	4.3	4.7
Q1	3.1	3.5



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3. Please do not exceed the absolute maximum ratings of the device when circuit designing.
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