



TT060U065FQ

主要参数 MAIN CHARACTERISTICS

| | |
|------------------------|------|
| I _c | 60A |
| V _{GES} | 650V |
| V _{cesat-typ} | 1.7V |

用途

- PFC
- 储能

APPLICATIONS

- Power factor corrector (PFC)
- Energy Storage

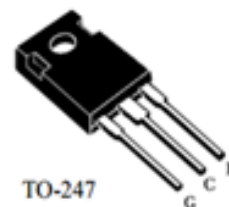
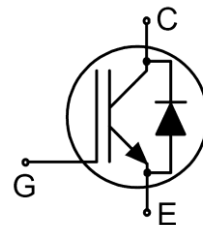
产品特性

- 低栅极电荷
- Trench FS 技术,
- RoHS 产品
- 快开关速度
- 低开关损耗
- VCE(sat)正温度系数

FEATURES

- Low gate charge
- Trench FS Technology,
- RoHS product
- Fast switching speed
- Low switching losses
- VCE(sat) 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 | | |
| TT060U065FQ-GE-BR | TT060U065FQ | TO-247 |

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-Emmitter Voltage | V_{CES} | 650 | V |
| *连续集电极电流 Collector Current-continuous | I_C | 120($T_C=25^{\circ}\text{C}$) | A |
| | | 60($T_C=100^{\circ}\text{C}$) | A |
| 最大脉冲集电极极电流 (注1) Collector Current – pulse (note 1) | I_{CM} | 240 | A |
| *二极管正向测试电流 Diode RMS forward current | I_F | 120 ($T_C=25^{\circ}\text{C}$) | A |
| | | 60 ($T_C=100^{\circ}\text{C}$) | 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} | 240 | A |
| 最高栅极发射极电压 Gate-Emmitter Voltage | V_{GES} | ± 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_{GES} | ± 30 | V |
| 安全工作区 Turn-off safe area $V_{CE} \leq 650\text{V}$, $T_{vj} \leq 175^{\circ}\text{C}$, $t_p=1\mu\text{s}$ | - | 240 | A |
| 耗散功率(TO-247) Power Dissipation | P_D $T_C=25^{\circ}\text{C}$ | 375 | W |
| | P_D $T_C=100^{\circ}\text{C}$ | 187 | |
| 耗散功率(TO-3PH) Power Dissipation | P_D $T_C=25^{\circ}\text{C}$ | 90 | W |
| | P_D $T_C=100^{\circ}\text{C}$ | 45 | |
| 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 |
|---|---------------|--|-----------|------------|-----------|-------------|
| 关态特性 Off –Characteristics | | | | | | |
| 集电极-发射极击穿电压 Collector-Emmitter 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} | $V_{CE}=650V, V_{GE}=0V, T_{vj}=25^\circ C$ | - | - | 80 | μA |
| 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 |
| 通态特性 On-Characteristics | | | | | | |
| 阈值电压 Gate Threshold Voltage | $V_{GE(th)}$ | $V_{CE} = V_{GE}, I_C=0.6mA$ | 3.5 | 4.5 | 5.5 | V |
| 饱和压降 Collector-Emmitter saturation Voltage | V_{CESAT} | $V_{GE}=15V, I_C=60A$ $T_{vj}=25^\circ C$ $T_{vj}=150^\circ C$ | - - | 1.7 2.1 | 2.1 - | V |
| 动态特性 Dynamic Characteristics | | | | | | |
| 输入电容 Input capacitance | C_{ies} | $V_{CE}=25V$ $V_{GE}=0V$ $f=1.0MHz$ | - | 2062 | - | pF |
| 输出电容 Output capacitance | C_{oes} | | - | 213 | - | pF |
| 反向传输电容 Reverse transfer capacitance | C_{res} | | - | 36 | - | pF |
| 栅极电荷总量 Total Gate Charge | Q_g | $V_{CC}=480V, I_C=60A, V_{GE}=15V$ | - | 128 | - | nC |
| 栅极-反射极 Gate to emitter charge | Q_{ge} | | - | 21 | - | |
| 栅极-集电极 Gate to collector charge | Q_{gc} | | - | 71 | - | |



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 | $t_{d(on)}$ | $V_{CC}=400V, I_c=60A, R_G=5\Omega$ $V_{GE}=15V$ $T_{vj}=25^\circ C$ | - | 12 | - | ns |
| 上升时间 Turn-on rise time | t_r | | - | 80 | - | ns |
| 关断延迟时间 Turn-off delay time | $t_{d(off)}$ | | - | 98 | - | ns |
| 下降时间 Turn-off Fall time | t_f | | - | 82 | - | ns |
| 开通损耗 Turn-on energy | E_{on} | | - | 1.46 | - | mJ |
| 关断损耗 Turn-off energy | E_{off} | | - | 1.34 | - | mJ |
| 总开关损耗 Total switching energy | E_{tot} | | - | 2.80 | - | mJ |
| 开启延迟时间 Turn-on delay time | $t_{d(on)}$ | $V_{CC}=400V, I_c=60A, R_G=5\Omega$ $V_{GE}=15V$ $T_{vj}=150^\circ C$ | - | 14 | - | ns |
| 上升时间 Turn-on rise time | t_r | | - | 80 | - | ns |
| 关断延迟时间 Turn-off delay time | $t_{d(off)}$ | | - | 122 | - | ns |
| 下降时间 Turn-off Fall time | t_f | | - | 112 | - | ns |
| 开通损耗 Turn-on energy | E_{on} | | - | 1.60 | - | mJ |
| 关断损耗 Turn-off energy | E_{off} | | - | 1.84 | - | mJ |
| 总开关损耗 Total switching energy | E_{tot} | | - | 3.44 | - | mJ |

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

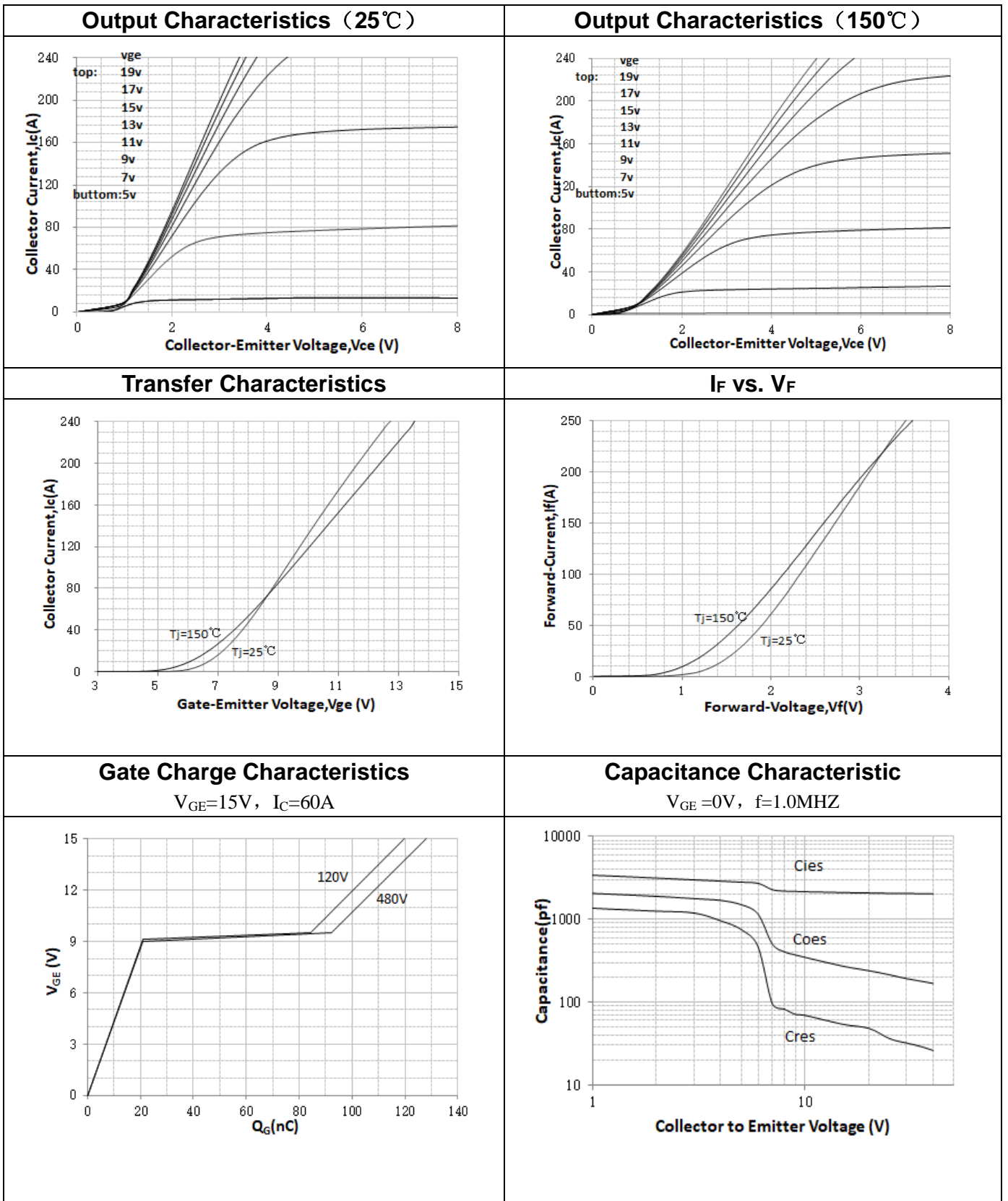
| | | | | | | |
|--|-----------|---|---|------|-----|----|
| 正向压降 Diode Forward Voltage | V_F | $I_F=60A, T_{vj}=25^\circ C$ | - | 1.6 | 2.0 | V |
| 反向恢复时间 Diode Reverse recovery time | t_{rr} | $V_R=200V, I_F=50A$ $dI_F/dt=200A/\mu s$ $T_{vj}=25^\circ C$ | - | 160 | - | ns |
| 反向恢复电荷 Diode Reverse recovery charge | Q_{rr} | | - | 0.79 | - | nC |
| 反向恢复电流 Diode Reverse recovery Current | I_{rrm} | | - | 8.0 | - | A |
| 反向恢复时间 Diode Reverse recovery time | t_{rr} | $V_R=200V, I_F=50A$ $dI_F/dt=200A/\mu s$ $T_{vj}=150^\circ C$ | - | 270 | - | ns |
| 反向恢复电荷 Diode Reverse recovery charge | Q_{rr} | | - | 3.1 | - | nC |
| 反向恢复电流 Diode Reverse recovery Current | I_{rrm} | | - | 17 | - | A |

| 项 目 Parameter | 符 号 Symbol | MAX | 单 位 Unit |
|--------------------------------|---------------|-----|--------------|
| 结到管壳的热阻 Junction to Case IGBT | $R_{th(j-c)}$ | 0.4 | $^\circ C/W$ |
| 结到管壳的热阻 Junction to Case Diode | $R_{th(j-c)}$ | 0.6 | $^\circ C/W$ |
| 结到环境的热阻 Junction to Ambient | $R_{th(j-A)}$ | 40 | $^\circ C/W$ |





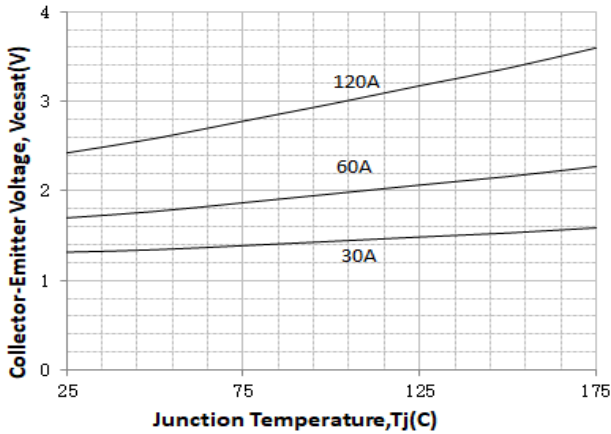
特征曲线 ELECTRICAL CHARACTERISTICS (curves)





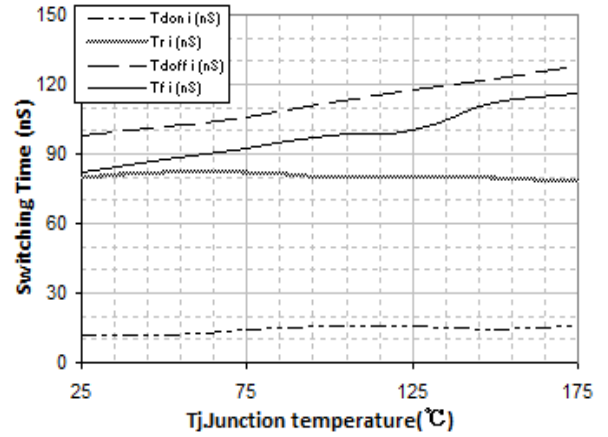
Vcesat vs. Tj

$V_{GE}=15V, I_C=30A, 60A, 120A$



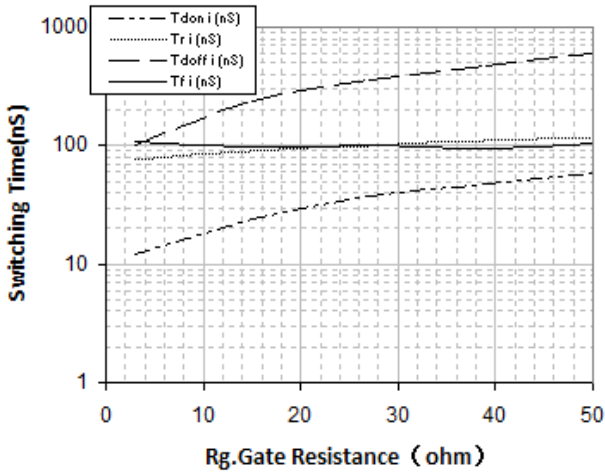
Switching Time vs. Tj

$V_{GE}=15V, V_{GE}=400V, I_C=60A, R_G=5\Omega$



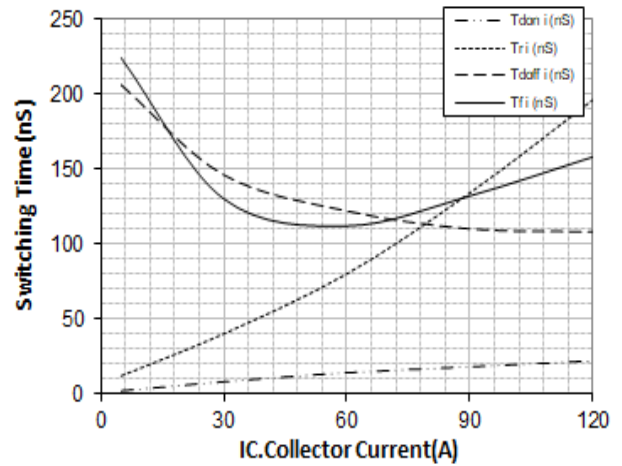
Switching Time vs. Rg(150°C)

$V_{GE}=15V, V_{CE}=400V, I_C=60A$



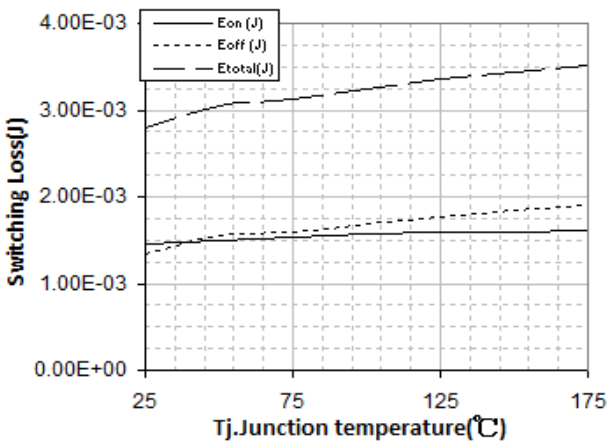
Switching Time vs. Ic(150°C)

$V_{CE}=400V, V_{GE}=15V, R_G=5\Omega$



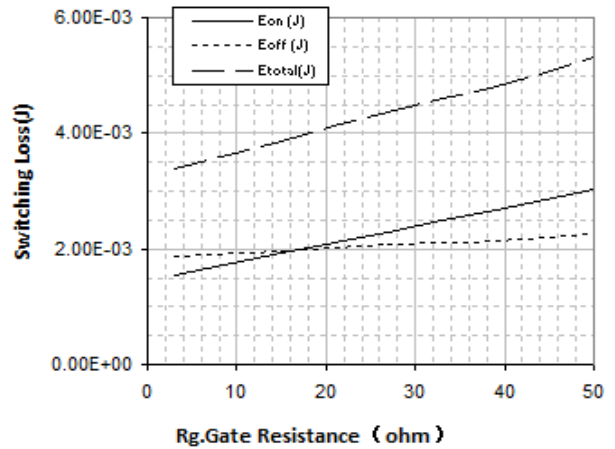
Switching Loss vs. Tj

$V_{GE}=15V, V_{CE}=400V, I_C=60A, R_G=5\Omega$



Switching Loss vs. Rg(150°C)

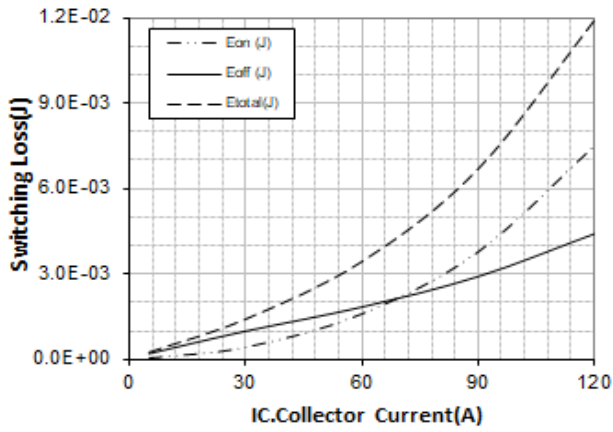
$V_{GE}=15V, V_{CE}=400V, I_C=60A$



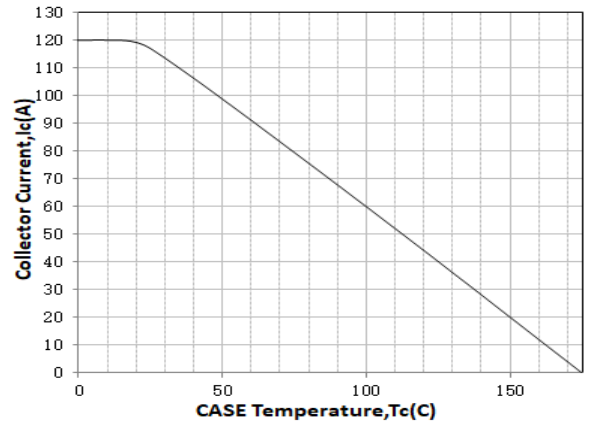


Switching Loss vs. $I_c(150^{\circ}\text{C})$

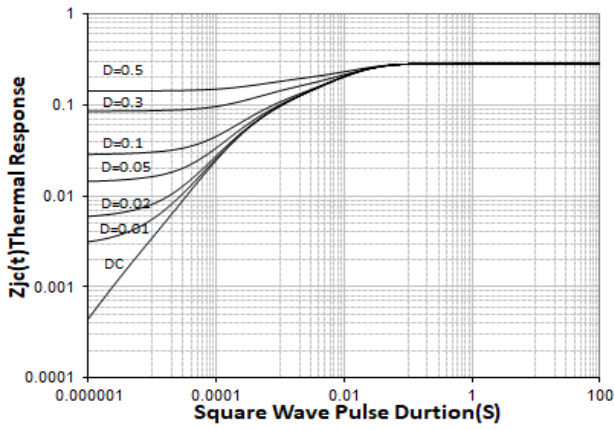
$V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $R_G=5\Omega$



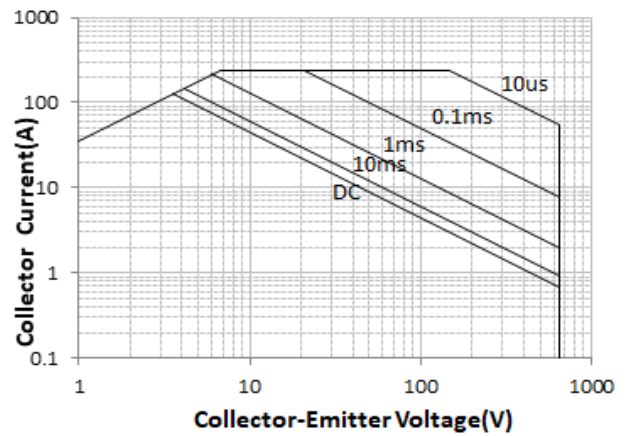
Collector current vs. case temperature



Transient Thermal Impedance for IGBT TO-247



Forward Bias Safe Operating Area TO-247

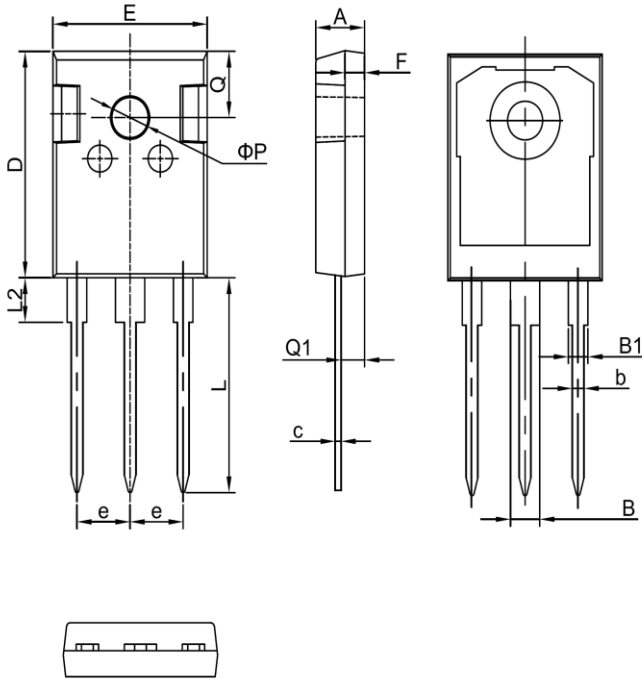




外形尺寸 PACKAGE MECHANICAL DATA

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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联系方式

吉林华微电子股份有限公司

公司地址：吉林省吉林市深圳街 99 号

邮编：132013

总机：86-432-64678411

传真：86-432-64665812

网址：www.hwdz.com.cn

CONTACT

JILIN SINO-MICROELECTRONICS CO., LTD.

ADD: No.99 Shenzhen Street, Jilin City, Jilin Province, China.

Post Code: 132013

Tel: 86-432-64678411

Fax: 86-432-64665812

Web Site: www.hwdz.com.cn