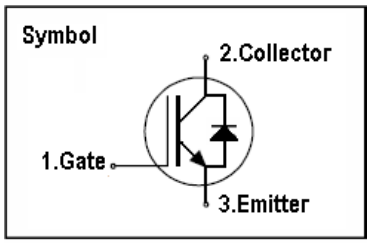
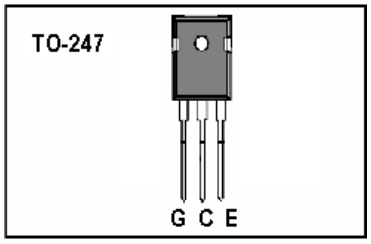
佳恩半导体
JIAENSEMI

# JNG60T65HYU1

## IGBT

## Features




- 650V,60A
- $V_{CE(sat)(typ.)}$=1.7V@$V_{GE}$=15V,$I_C$=60A
- High speed switching
- Higher system efficiency
- Soft current turn-off waveforms
-

## General Description

JIAEN FS IGBTs offer lower losses and higher energy efficiency for application such as IH (induction heating),UPS, general inverter and other soft switching applications.

## Absolute Maximum Ratings

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage | 650 | V |
| $V_{GES}$ | Gate-Emitter Voltage | ± 30 | V |
| $I_C$ | Continuous Collector Current ( $T_C$=25 ℃) | 120 | A |
| | Continuous Collector Current ( $T_C$=100℃) | 60 | A |
| $I_{CM}$ | Pulsed Collector Current (Note 1) | 180 | A |
| $I_F$ | Diode Continuous Forward Current ( $T_C$=100 ℃) | 60 | A |
| $I_{FM}$ | Diode Maximum Forward Current (Note 1) | 180 | A |
| $t_{sc}$ | Short Circuit Withstand Time | 5 | us |
| $P_D$ | Maximum Power Dissipation ( $T_C$=25 ℃) | 312 | W |
| | Maximum Power Dissipation ( $T_C$=100℃) | 156 | W |
| $T_J$ | Operating Junction Temperature Range | -45~175 | ℃ |
| $T_{STG}$ | Storage Temperature Range | -55~150 | ℃ |

## Thermal Characteristics

| Symbol | Parameter | Max. | Units |
|---|---|---|---|
| $R_{th\ j\text{-}c}$ | Thermal Resistance, Junction to case for IGBT | 0.48 | ℃/ W |
| $R_{th\ j\text{-}c}$ | Thermal Resistance, Junction to case for Diode | 1.1 | ℃/ W |
| $R_{th\ j\text{-}a}$ | Thermal Resistance, Junction to Ambient | 40 | ℃/ W |

## Electrical Characteristics ($T_C$=25℃ unless otherwise noted )

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $BV_{CES}$ | Collector-Emitter Breakdown Voltage | $V_{GE}$= 0V, $I_C$= 250uA | 650 | - | - | V |
| $I_{CES}$ | Collector-Emitter Leakage Current | $V_{CE}$= 650V, $V_{GE}$= 0V | - | - | 100 | uA |
| $I_{GES}$ | Gate Leakage Current | $V_{GE}$=±20V, $V_{CE}$= 0V | - | - | ±100 | nA |
| $V_{GE(th)}$ | Gate Threshold Voltage | $V_{GE}$= $V_{CE}$, $I_C$= 250uA | 4.3 | - | 6.3 | V |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $V_{GE}$=15V, $I_C$= 60A | - | 1.7 | 2.1 | V |
| Qg | Total Gate Charge | $V_{CC}$=480V<br>$V_{GE}$=15V<br>$I_C$=60A | - | 117 | | nC |
| Qge | Gate-Emitter Charge | | - | 20.5 | | nC |
| Qgc | Gate-Collector Charge | | - | 64.3 | | nC |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{CC}$=400V<br>$V_{GE}$=15V<br>$I_C$=60A<br>$R_G$=15Ω<br>Inductive Load<br>$T_C$=25 ℃ | - | 57 | - | ns |
| $t_r$ | Turn-on Rise Time | | - | 114 | - | ns |
| $t_{d(off)}$ | Turn-off Delay Time | | - | 220 | - | ns |
| $t_f$ | Turn-off Fall Time | | - | 65 | - | ns |
| Eon | Turn-on Switching Loss | | - | 2.53 | - | mJ |
| Eoff | Turn-off Switching Loss | | - | 1.67 | - | mJ |
| Ets | Total Switching Loss | | - | 4.2 | - | mJ |
| Cies | Input Capacitance | $V_{CE}$=25V<br>$V_{GE}$=0V<br>f = 1MHz | - | 3641 | - | pF |
| Coes | Output Capacitance | | - | 291.6 | - | pF |
| Cres | Reverse Transfer Capacitance | | - | 62.8 | - | pF |

## Electrical Characteristics of Diode ($T_C$=25℃ unless otherwise noted)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $V_F$ | Diode Forward Voltage | $I_F$=60A | - | 1.45 | 1.9 | V |
| $t_{rr}$ | Diode Reverse Recovery Time | $V_{CE}$ = 400V<br>$I_F$= 60A<br>Rg=15Ω | - | 248 | | ns |
| $I_{rr}$ | Diode peak Reverse Recovery Current | | - | 16.8 | | A |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | - | 1238 | | nC |

**Notes：**

1. Repetitive Rating: Pulse width limited by maximum junction temperature

## Typical Performance Characteristics

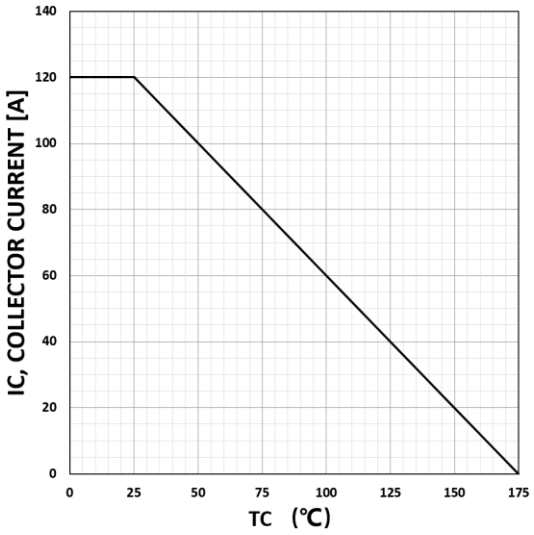



Figure 1. Maximum DC collector current VS. case temperature

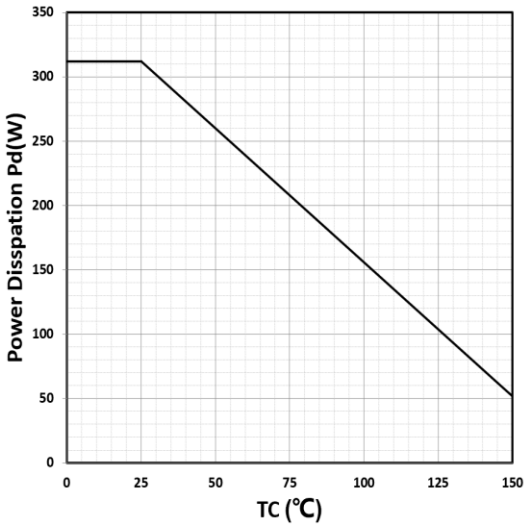



Figure 2. Power dissipation VS. case temperature

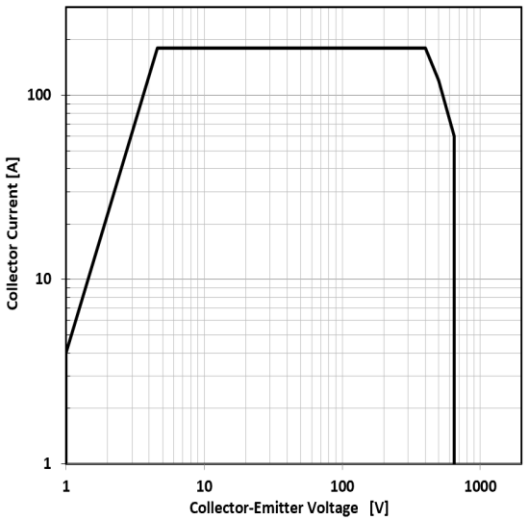



Figure 3. Reverse bias SOA, Tj=125℃,Vge=15V

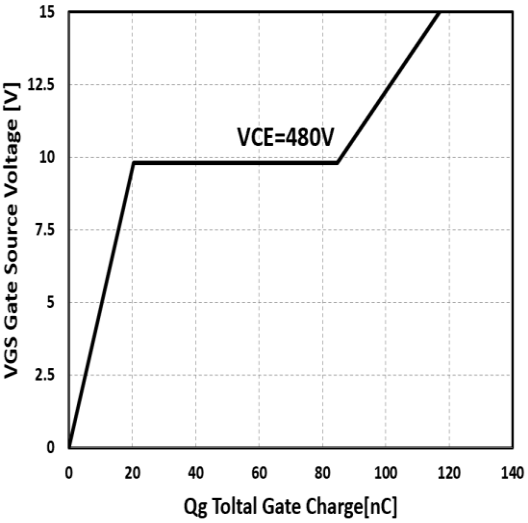



Figure4:Typical gate charge VS. VGE,IC=60A

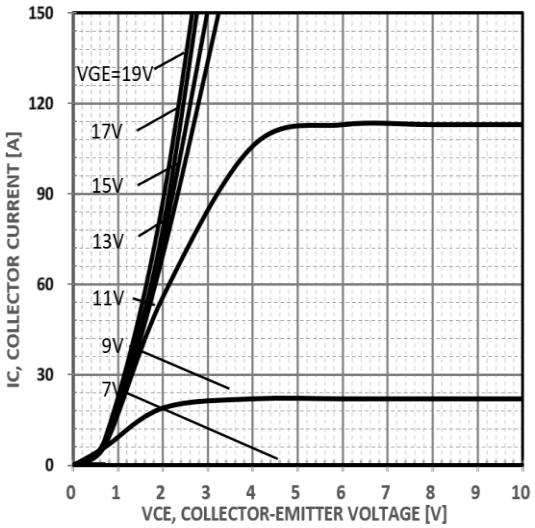



Figure 5. Typical output characteristics
tp=300us Tc=25℃

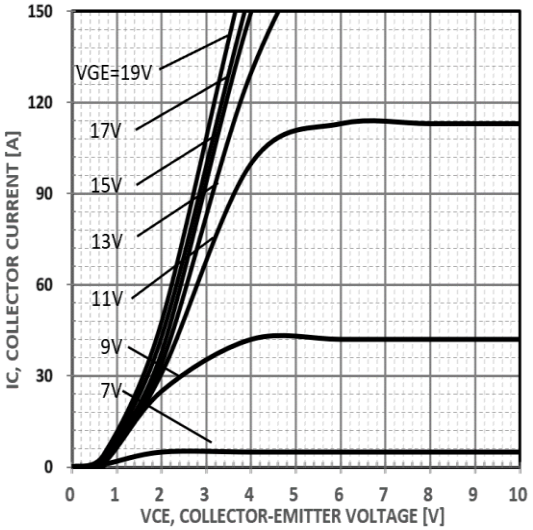



Figure 6. Typical output characteristics
tp=300us Tc=150℃

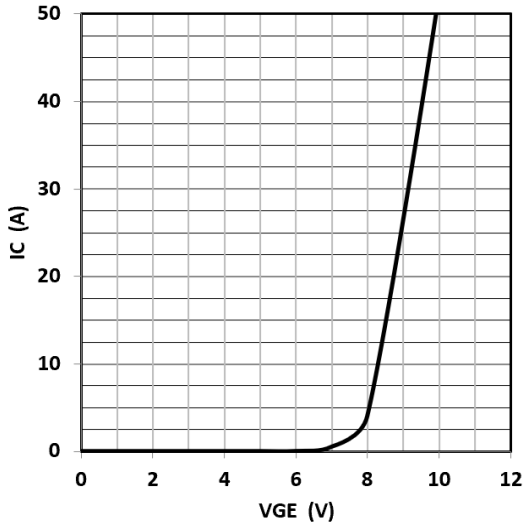



Figure 7. Typical gate threshold voltage

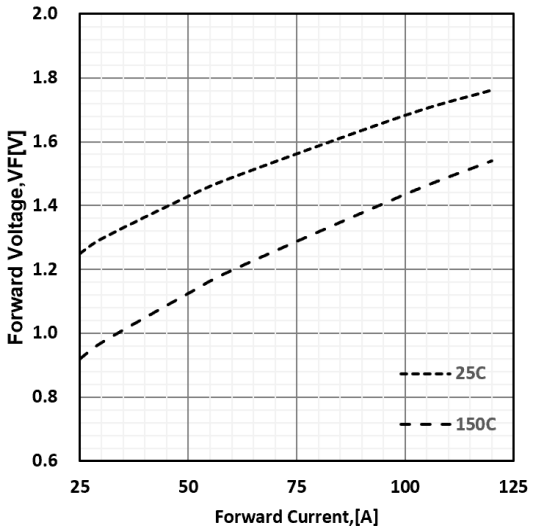



Figure 8. Typical forward voltage vs IF

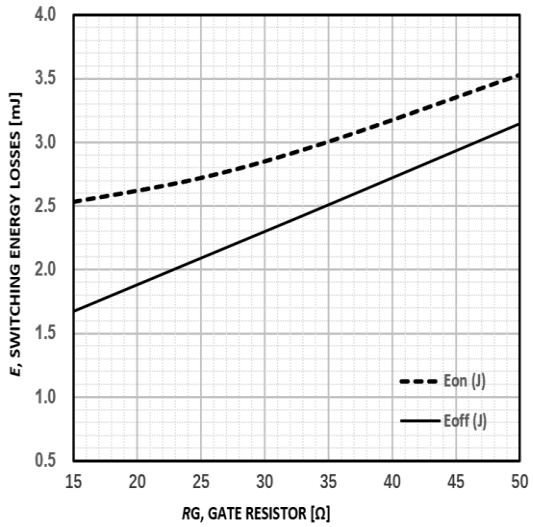



Figure9: Typical energy loss VS. Rg,TC=25℃,

VCE=400V, VGE=15V ,IC=60A

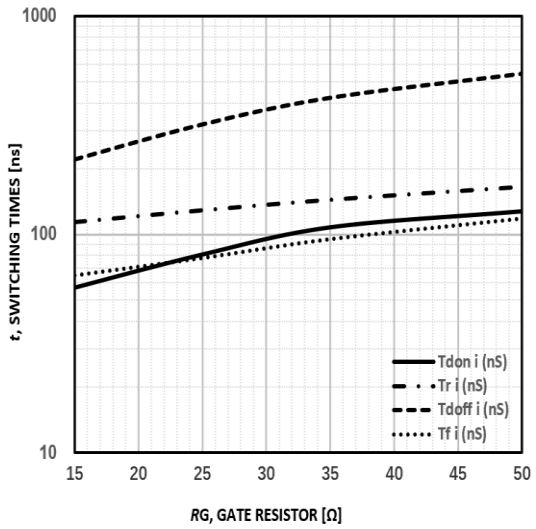



Figure10: Typical switching time VS. Rg,TC=25℃,

VCE=400V, VGE=15V ,IC=60A

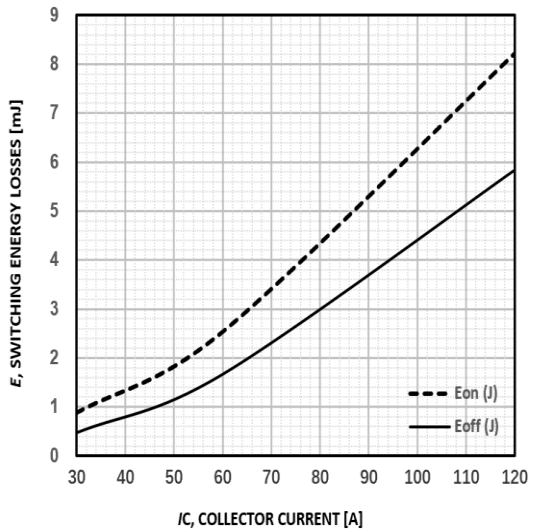



Figure11: Typical energy loss VS. IC, TC=25℃,

VCE=400V, VGE=15V ,RG=15Ω

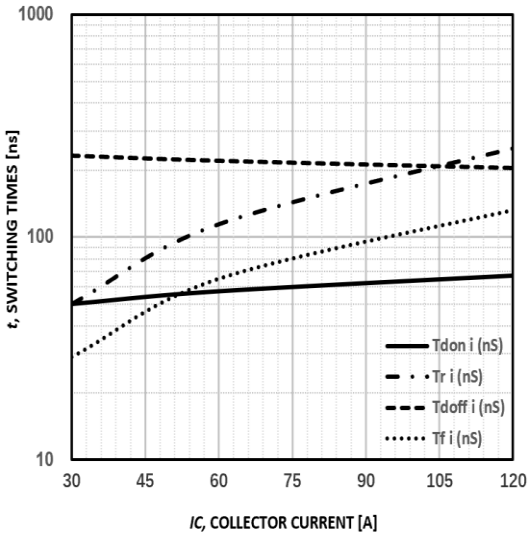



Figure12: Typical switching time VS. IC, TC=25℃,

VCE=400V, VGE=15V,RG=15Ω

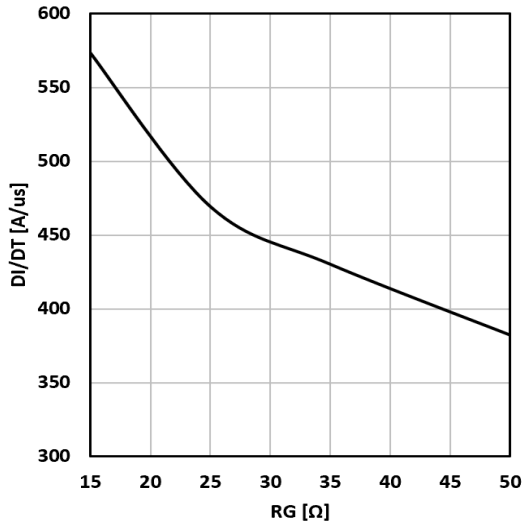



Figure 13. Typical diode di/dt vs rg Tc=25℃
VCE=400V VGE=15V IF=60A

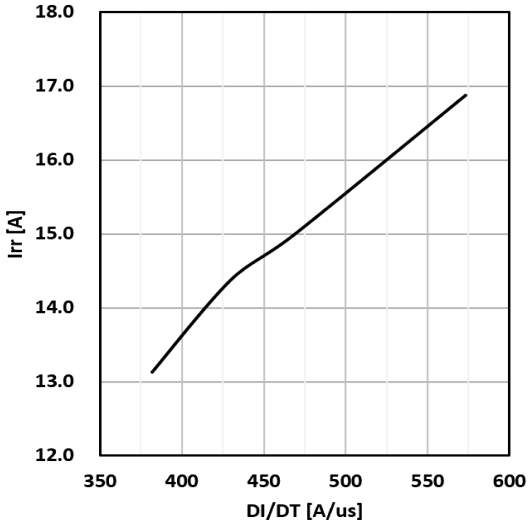



Figure 14. Typical diode irr vs di/dt Tc=25℃
VCE=400V VGE=15V IF=60A

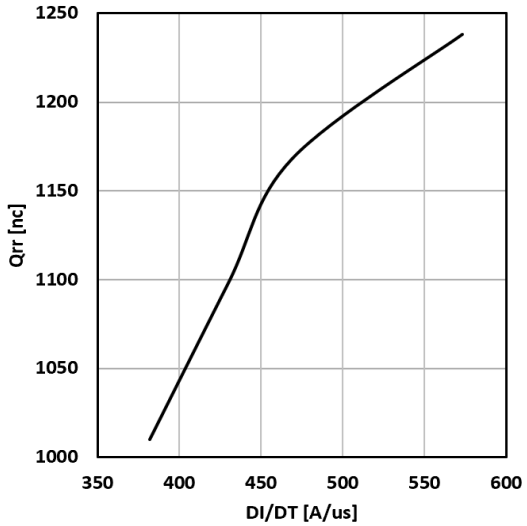



Figure 15. Typical diode Qrr vs di/dt Tc=25℃
VCE=400V VGE=15V IF=60A

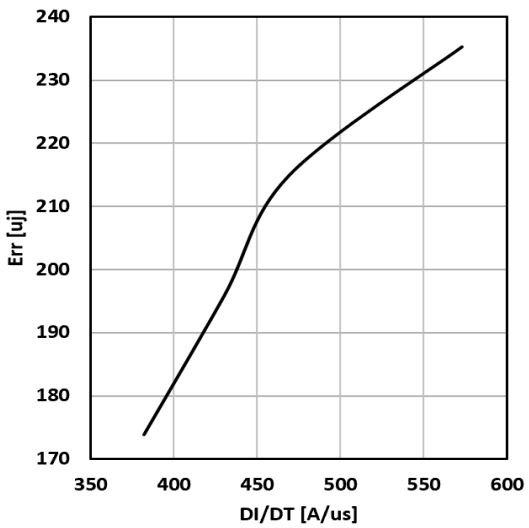



Figure 16. Typical diode Err vs di/dt Tc=25℃
VCC=400V VGE=15V IF=60A

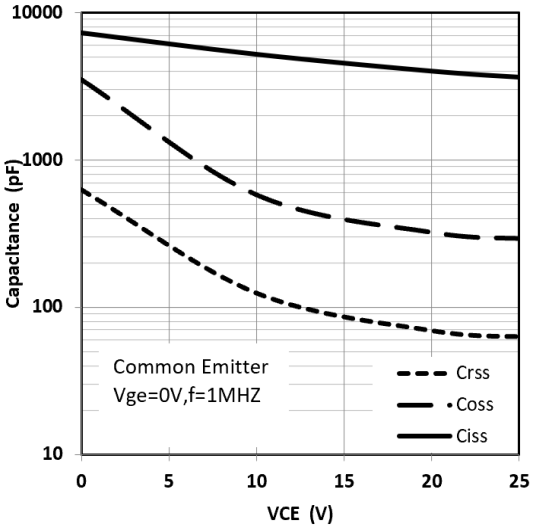



Figure17:Typical capacitance VS. VCE, VGE=0V,f=1MHz

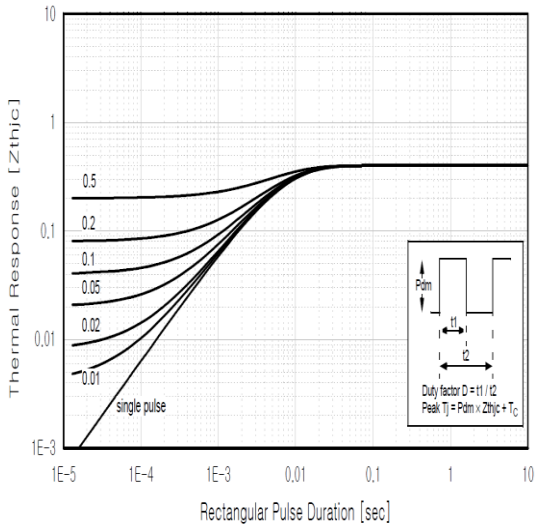
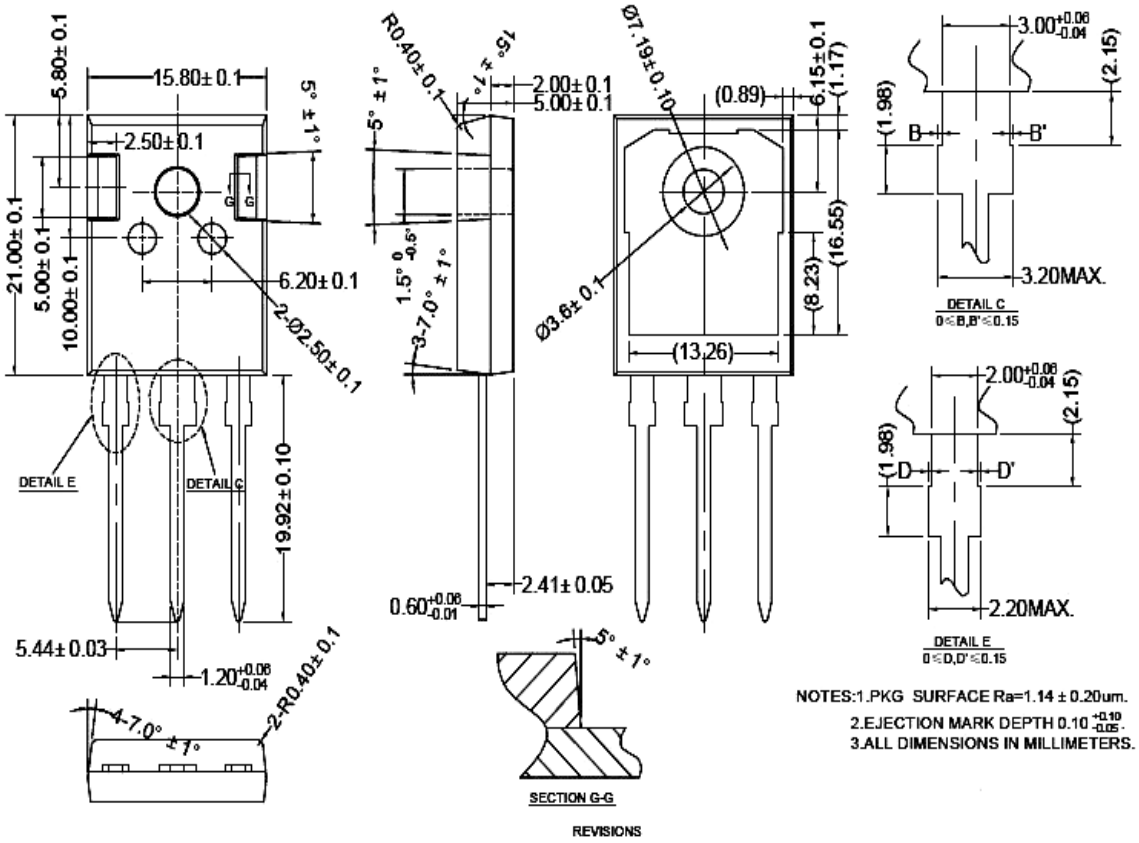



Figure18. normalized transient thermal impedance, junction-to-case

## TO247 PACKAGE OUTLINE




| 公差标注 | 公差值 | 表面粗糙度 |
|---|---|---|
| 0 | ±0.2 | Ra3.2~6.3 |
| 0.0 | ±0.1 | Ra1.6~3.2 |
| 0.00 | ±0.01 | Ra0.8~1.6 |
| 0.000 | ±0.005 | Ra0.4~0.8 |
| 0.0000 | ±0.002 | Ra0.2~0.4 |

0≤D,D'≤0.15

NOTES:1.PKG SURFACE Ra=1.14 ± 0.20um.
2.EJECTION MARK DEPTH 0.10 +0.10 -0.05.
3.ALL DIMENSIONS IN MILLIMETERS.

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