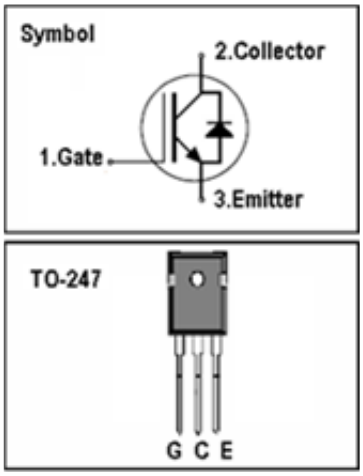
## *IGBT*




## Features

- 650V,60A
- $V_{CE(sat)(typ.)}$=1.9V@$V_{GE}$=15V,$I_C$=60A
- High speed switching
- Higher system efficiency
- Soft current turn-off waveforms
- Square RBSOA

## General Description

JIAEN Trench IGBTs offer lower losses and higher energy efficiency for application such as UPS, Induction converters, Uninterruptible power supplies and other soft switching applications.

## Absolute Maximum Ratings

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage | 650 | V |
| $V_{GES}$ | Gate-Emitter Voltage | ±20 | 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) | 240 | A |
| $I_F$ | Diode Continuous Forward Current ( $T_C$=100 ℃) | 60 | A |
| $I_{FM}$ | Diode Maximum Forward Current (Note 1) | 240 | A |
| $P_D$ | Maximum Power Dissipation ( $T_C$=25 ℃) | 394 | W |
| | Maximum Power Dissipation ( $T_C$=100℃) | 197 | W |
| $T_J$ | Operating Junction Temperature Range | -40 to +175 | ℃ |
| $T_{STG}$ | Storage Temperature Range | -55 to +150 | ℃ |

## Thermal Characteristics

| Symbol | Parameter | Max. | Units |
|---|---|---|---|
| $R_{th\ j\text{-}c}$ | Thermal Resistance, Junction to case for IGBT | 0.38 | ℃/ W |
| $R_{th\ j\text{-}c}$ | Thermal Resistance, Junction to case for Diode | 0.5 | ℃/ 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 | - | - | 50 | uA |
| $I_{GES}$ | Gate Leakage Current, Forward | $V_{GE}$=±20V, $V_{CE}$= 0V | - | - | ±100 | nA |
| $V_{GE(th)}$ | Gate Threshold Voltage | $V_{GE}$= $V_{CE}$, $I_C$= 1mA | 5.0 | - | 6.0 | V |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $V_{GE}$=15V, $I_C$= 60A | - | 1.9 | - | V |
| $Q_g$ | Total Gate Charge | $V_{CC}$=520V<br>$V_{GE}$=15V<br>$I_C$=60A | - | 120 | - | nC |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{CC}$=400V<br>$V_{GE}$=15V<br>$I_C$=60A<br>$R_G$=10Ω<br>Inductive Load<br>$T_C$=25 ℃ | - | 44 | - | ns |
| $t_r$ | Turn-on Rise Time | | - | 100 | - | ns |
| $t_{d(off)}$ | Turn-off Delay Time | | - | 166 | - | ns |
| $t_f$ | Turn-off Fall Time | | - | 75 | - | ns |
| Eon | Turn-on Switching Loss | | - | 2.3 | - | mJ |
| Eoff | Turn-off Switching Loss | | - | 1.3 | - | mJ |
| Ets | Total Switching Loss | | - | 3.6 | - | mJ |
| $C_{ies}$ | Input Capacitance | $V_{CE}$=30V<br>$V_{GE}$=0V<br>f = 1MHz | - | 3860 | - | pF |
| $C_{oes}$ | Output Capacitance | | - | 170 | - | pF |
| $C_{res}$ | Reverse Transfer Capacitance | | - | 30 | - | 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 | - | 1.7 | - | V |
| $t_{rr}$ | Diode Reverse Recovery Time | $V_{CE}$ = 400V<br>$I_F$= 60A<br>dif/dt= 450A/ns | - | 78 | - | ns |
| $I_{rr}$ | Diode peak Reverse Recovery Current | | - | 14 | - | A |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | - | 600 | - | nC |

**Notes:**

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

## Typical performance characteristics

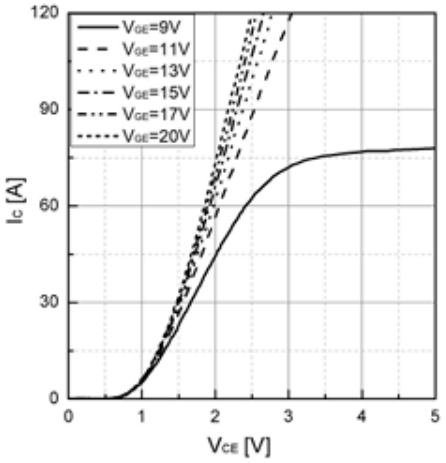



Fig 1. Typical output characteristic ($T_{vj}$=25℃)

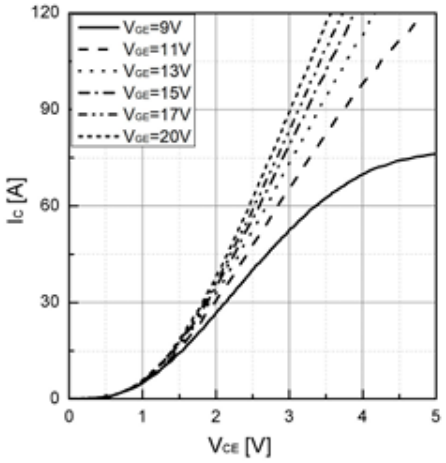



Fig 2. Typical output characteristic($T_{vj}$=175℃)

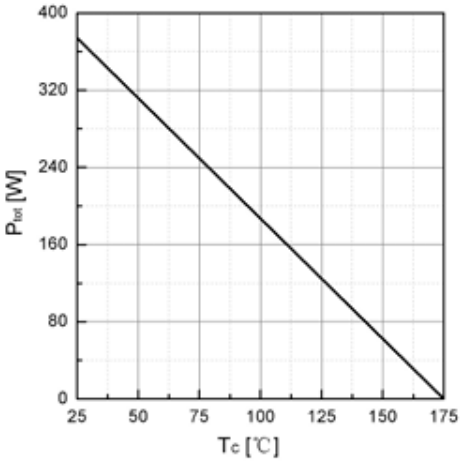



Fig 3. Power dissipation as a function of $T_C$

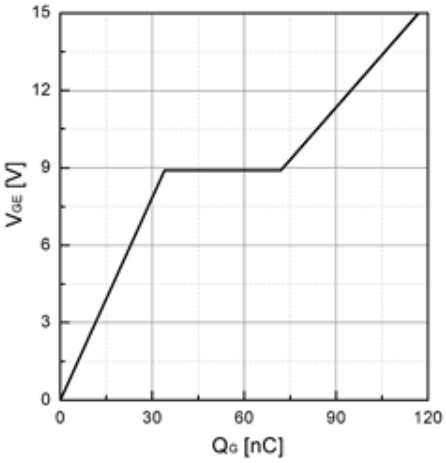



Fig 4. Typical Gate charge

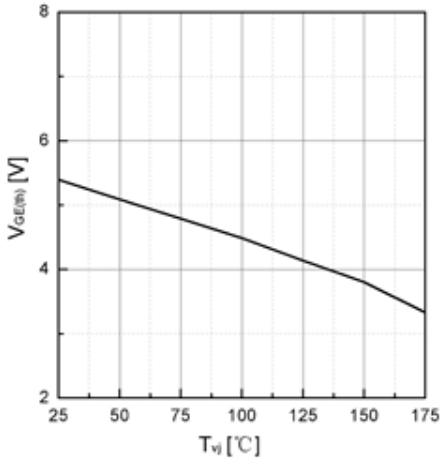



Fig 5. Typical $V_{GE(th)}$ as a function of $T_{vj}$ ($I_C$=1mA)

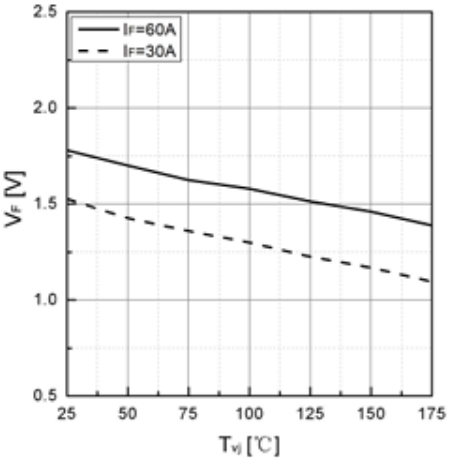



Fig 6. Typical $V_F$ as a function of $T_{vj}$

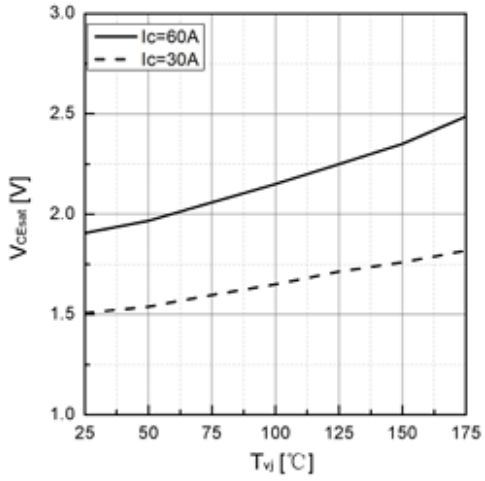



Fig 7. Typical $V_{CEsat}$ as a function of $T_{vj}$

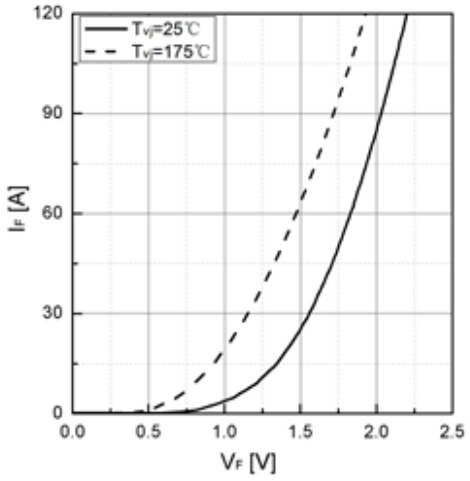



Fig 8. Typical $I_F$ as a function of $V_F$

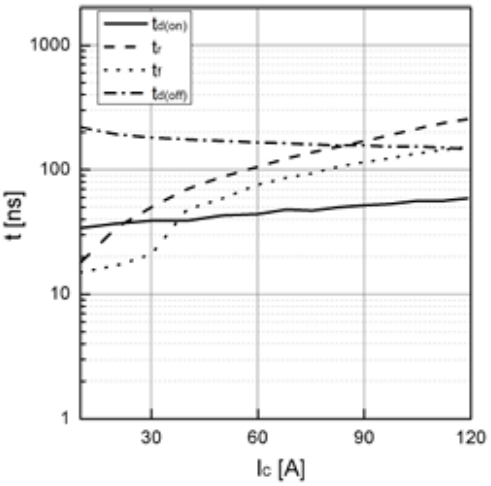



Fig 9. Typical switching time as a function of $I_C$

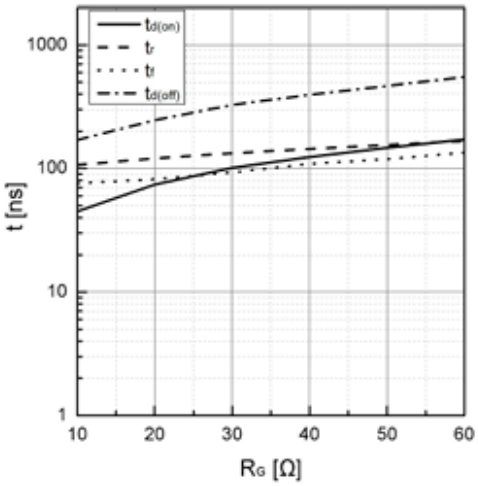



Fig 10. Typical switching times as a function of $R_G$

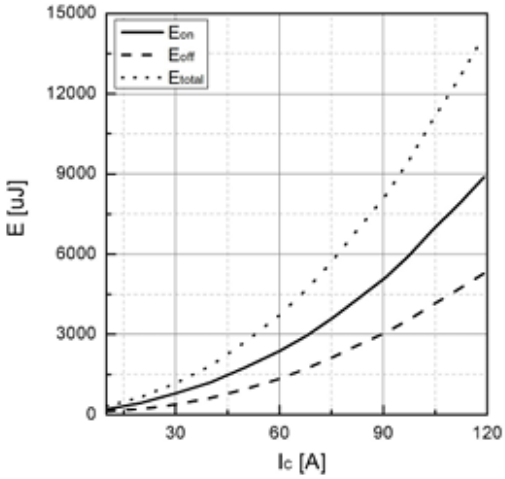



Fig 11. Typical switching energy losses as a function of $I_C$

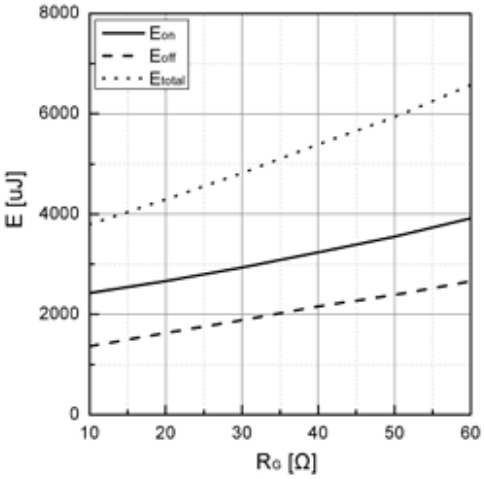



Fig 12. Typical switching energy losses as a function of $R_G$

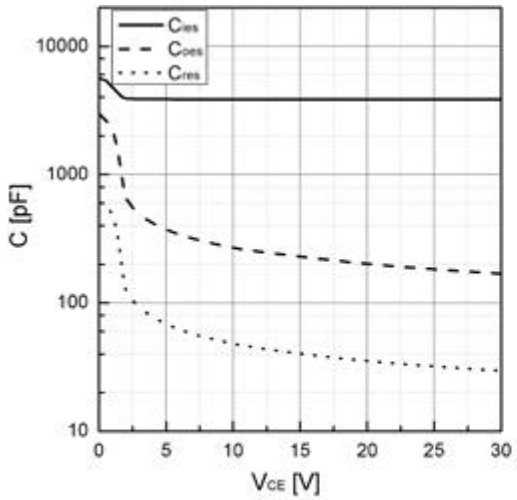



Fig 13. Typical capacitance as a function of $V_{CE}$
(f=1Mhz, $V_{GE}$=0V)

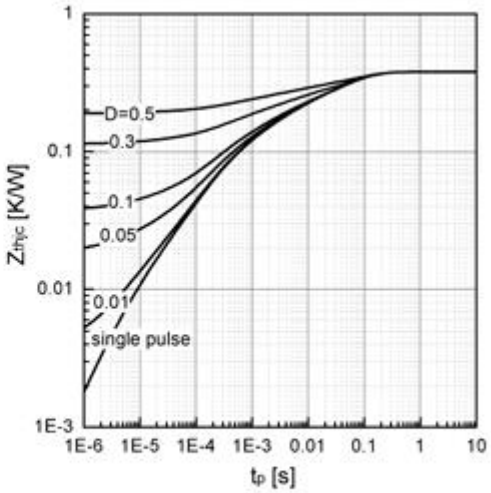
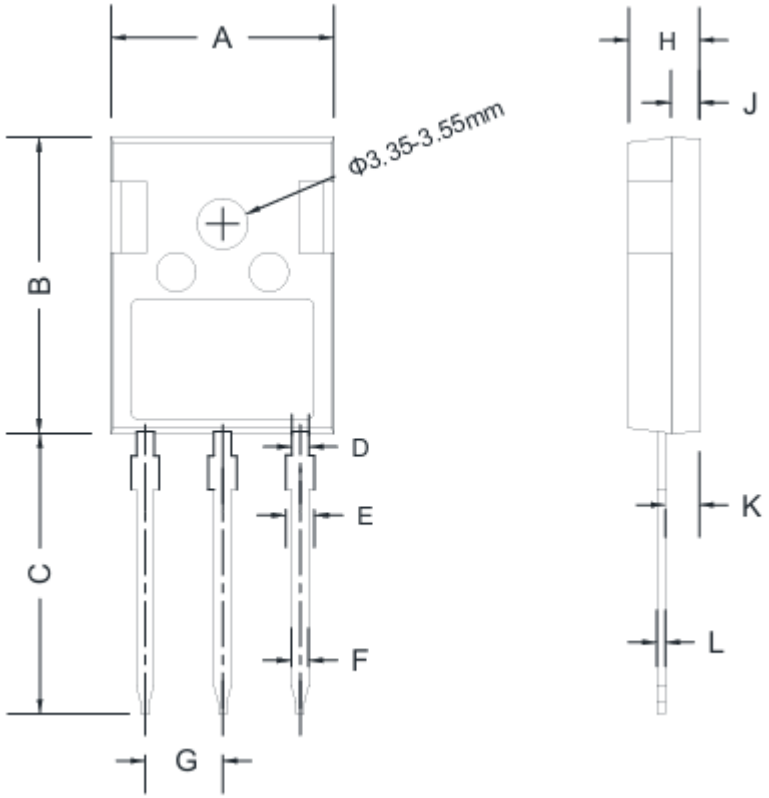



Fig 14. Transient thermal impedance of IGBT

## TO-247 PACKAGE OUTLINE




| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 15.50 | 15.80 | 16.10 | 0.610 | 0.622 | 0.634 |
| B | 20.80 | 21.00 | 22.20 | 0.819 | 0.827 | 0.835 |
| C | 19.70 | 20.00 | 20.30 | 0.776 | 0.787 | 0.799 |
| D | 1.80 | 2.00 | 2.20 | 0.071 | 0.079 | 0.087 |
| E | 1.90 | 2.10 | 2.30 | 0.075 | 0.083 | 0.091 |
| F | 1.00 | 1.20 | 1.40 | 0.039 | 0.047 | 0.055 |
| G | - | 5.44 | - | - | 0.214 | - |
| H | 4.80 | 5.00 | 5.20 | 0.189 | 0.197 | 0.205 |
| J | 1.90 | 2.00 | 2.10 | 0.075 | 0.079 | 0.083 |
| K | 2.20 | 2.35 | 2.50 | 0.087 | 0.093 | 0.098 |
| L | 0.41 | 0.60 | 0.79 | 0.016 | 0.024 | 0.031 |

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