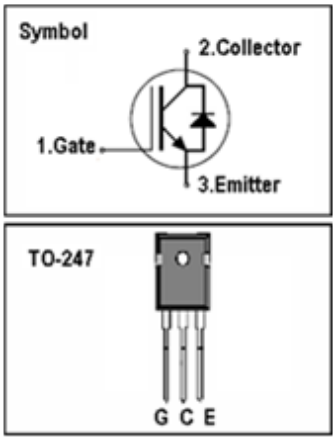
## *IGBT*




## Features

- 650V,50A
- $V_{CE(sat)(typ.)}$=1.65V@$V_{GE}$=15V,$I_C$=50A
- High speed switching
- Positive temperature coefficient
- Reliable and Rugged
- Low VCE(sat)

## General Description

JIAEN Trench IGBTs reduces the conduction loss, improves switching performance and enhances the avalanche energy. Used in motor drives, UPS, Boost, Portable power station, 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 ℃) | 100 | A |
| | Continuous Collector Current ( $T_C$=100℃) | 50 | A |
| $I_{CM}$ | Pulsed Collector Current (Note 1) | 150 | A |
| $I_F$ | Diode Continuous Forward Current ( $T_C$=100 ℃) | 50 | A |
| $I_{FM}$ | Diode Maximum Forward Current (Note 1) | 150 | A |
| $t_{sc}$ | Short Circuit Withstand Time | 8 | us |
| $P_D$ | Maximum Power Dissipation ( $T_C$=25 ℃) | 250 | W |
| | Maximum Power Dissipation ( $T_C$=100℃) | 125 | W |
| $T_J$ | Operating Junction Temperature Range | -55 to +175 | ℃ |
| $T_{STG}$ | Storage Temperature Range | -55 to +175 | ℃ |

## Thermal Characteristics

| Symbol | Parameter | Max. | Units |
|---|---|---|---|
| $R_{th\ j\text{-}c}$ | Thermal Resistance, Junction to case for IGBT | 0.60 | ℃/ W |
| $R_{th\ j\text{-}c}$ | Thermal Resistance, Junction to case for Diode | 0.55 | ℃/ 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, Forward | $V_{GE}$=±20V, $V_{CE}$= 0V | - | - | ±200 | nA |
| $V_{GE(th)}$ | Gate Threshold Voltage | $V_{GE}$= $V_{CE}$, $I_C$= 1mA | 4.3 | - | 6.3 | V |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $V_{GE}$=15V, $I_C$= 50A | - | 1.65 | 2.2 | V |
| $Q_g$ | Total Gate Charge | $V_{CC}$=520V<br>$V_{GE}$=15V<br>$I_C$=50A | - | 183 | | nC |
| $Q_{ge}$ | Gate-Emitter Charge | | - | 26 | | nC |
| $Q_{gc}$ | Gate-Collector Charge | | - | 83 | | nC |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{CC}$=400V<br>$V_{GE}$=15V<br>$I_C$=50A<br>$R_G$=5Ω<br>Inductive Load<br>$T_C$=25 ℃ | - | 24 | - | ns |
| $t_r$ | Turn-on Rise Time | | - | 88 | - | ns |
| $t_{d(off)}$ | Turn-off Delay Time | | - | 124 | - | ns |
| $t_f$ | Turn-off Fall Time | | - | 73 | - | ns |
| Eon | Turn-on Switching Loss | | - | 1.4 | - | mJ |
| Eoff | Turn-off Switching Loss | | - | 1.2 | - | mJ |
| Ets | Total Switching Loss | | - | 2.6 | - | mJ |
| $C_{ies}$ | Input Capacitance | $V_{CE}$=25V<br>$V_{GE}$=0V<br>f = 1MHz | - | 3356 | - | pF |
| $C_{oes}$ | Output Capacitance | | - | 179 | - | pF |
| $C_{res}$ | Reverse Transfer Capacitance | | - | 93 | - | pF |

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

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $V_F$ | Diode Forward Voltage | $I_F$=50A | - | 1.53 | 1.85 | V |
| $t_{rr}$ | Diode Reverse Recovery Time | $V_{CE}$ = 400V<br>$I_F$= 50A<br>dif/dt= 200A/ns | - | 136 | | ns |
| $I_{rr}$ | Diode peak Reverse Recovery Current | | - | 6.9 | | A |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | - | 350 | | nC |

**Notes：**

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

## Typical Performance Characteristics

Figure 1: Power Dissipation

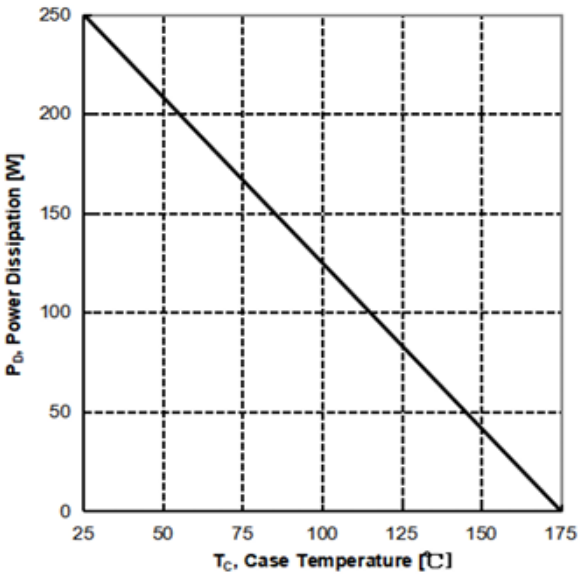



Figure 2: Collector Current vs. Case Temperature

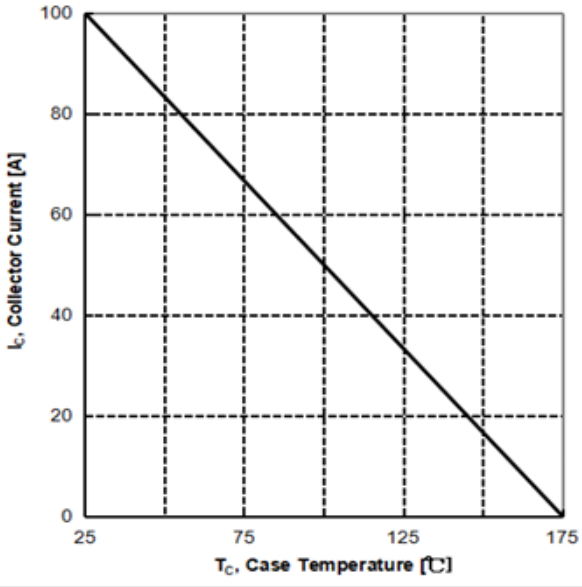



Figure 3: Safe Operation Area

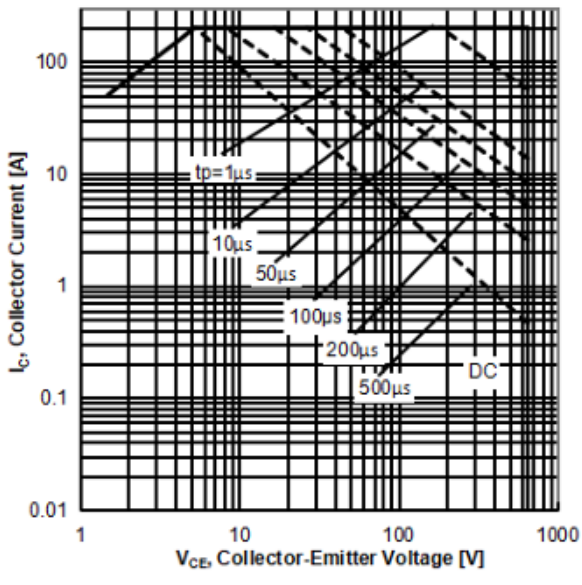



Figure 4: Typical Transfer Characteristics

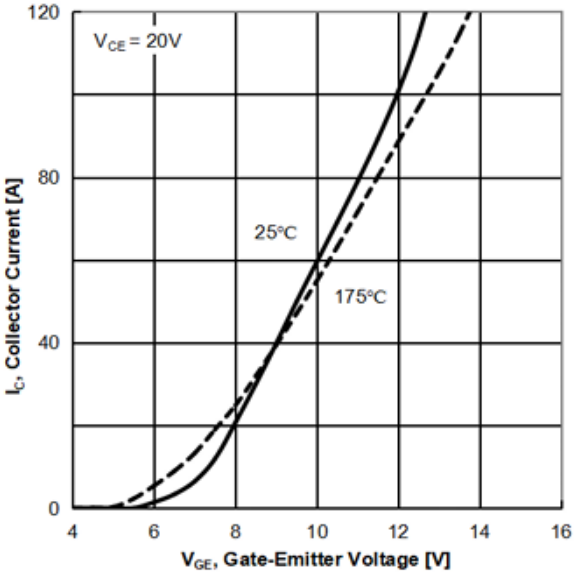


**Figure 5: Typical Output Characteristics**

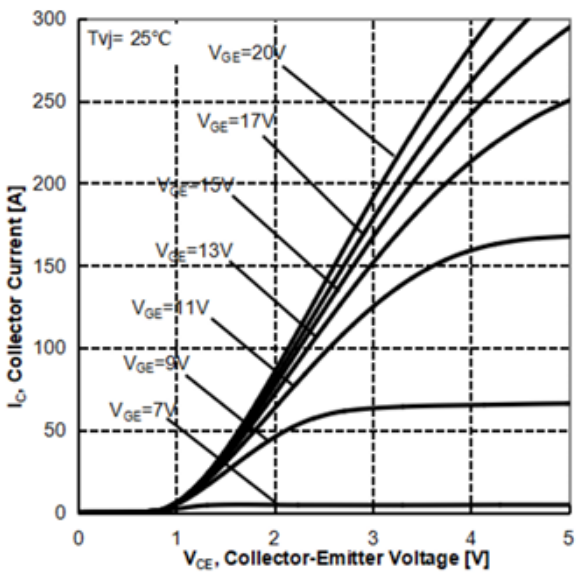



**Figure 6: Typical Output Characteristics**

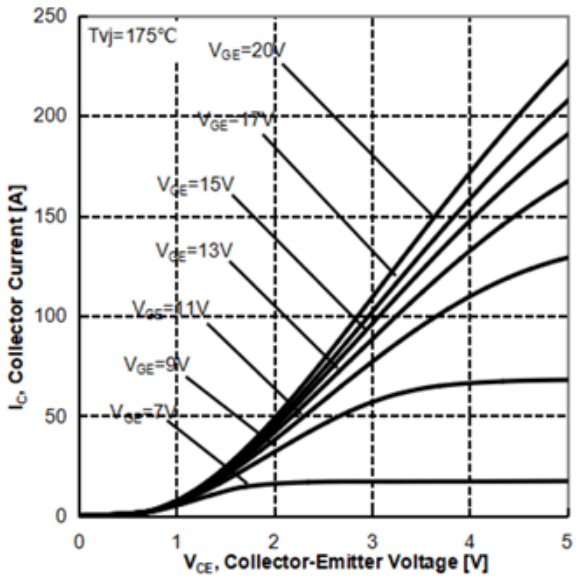



**Figure 7: Typical Collector-Emitter Saturation Voltage vs. Junction Temperature**

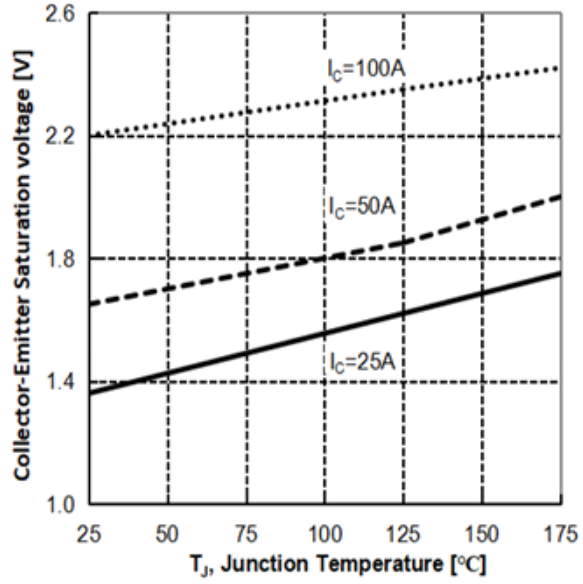



**Figure 8: Typical Gate-Emitter Threshold Voltage vs. Junction Temperature**

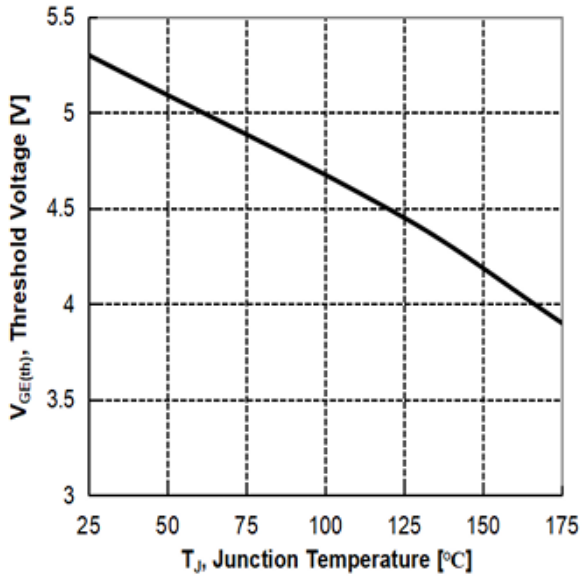


**Figure 9: Typical Switching Times vs. Gate Resistor ($T_J$=25℃, $V_{CE}$=400V, $V_{GE}$=15V, $I_C$=50A)**

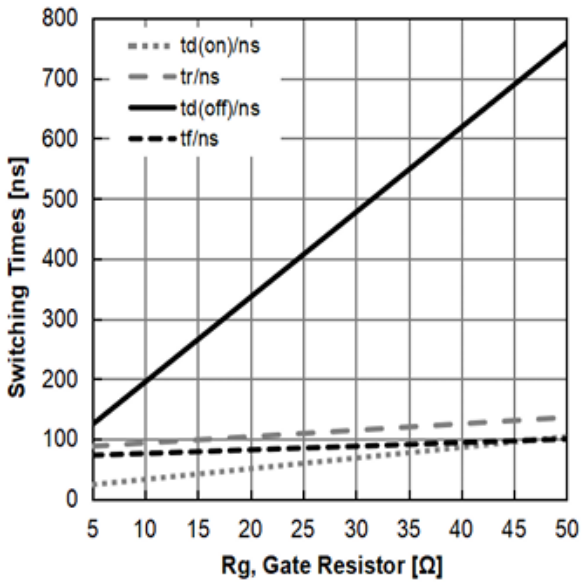



**Figure 10: Typical Switching Energy vs. Gate Resistor ($T_J$=25℃, $V_{CE}$=400V, $V_{GE}$=15V, $I_C$=50A)**

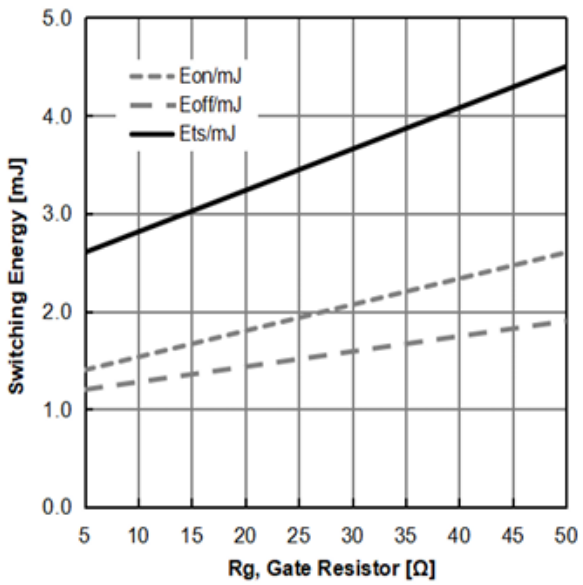



**Figure 11: Typical Switching Times vs. Junction Temperature ( $V_{CE}$=400V, $V_{GE}$=15V, $I_C$=50A,Rg=5Ω)**

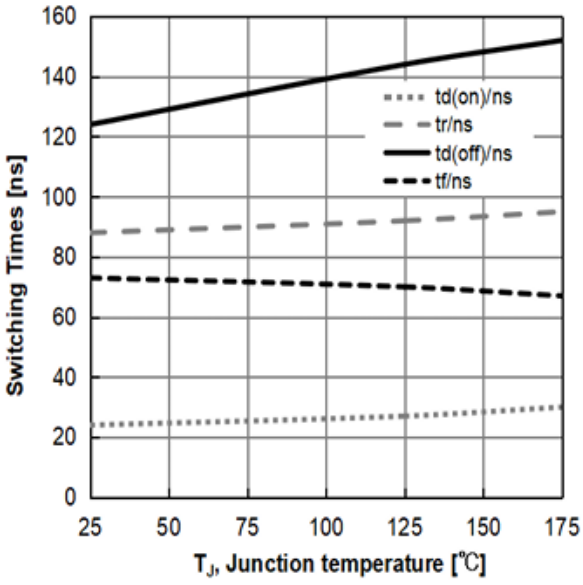



**Figure 12: Typical Switching Energy vs. Junction Temperature ($V_{CE}$=400V, $V_{GE}$=15V, $I_C$=50A,Rg=5Ω)**

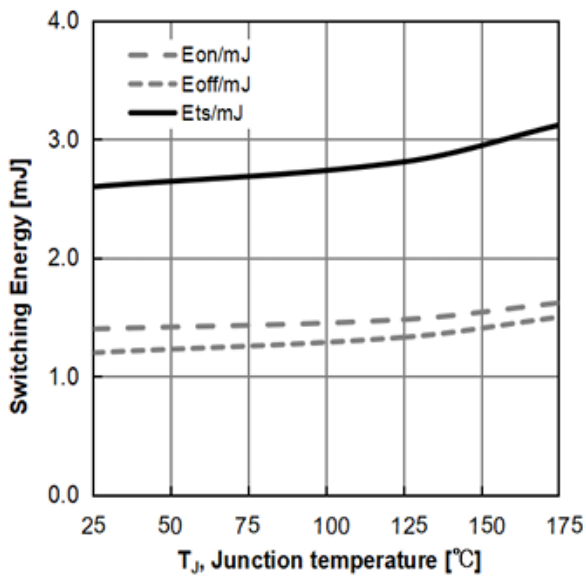


Figure 13: Typical Switching Times vs. Collector Current ($T_J$=25℃, $V_{CE}$=400V, $V_{GE}$=15V,Rg=5Ω)

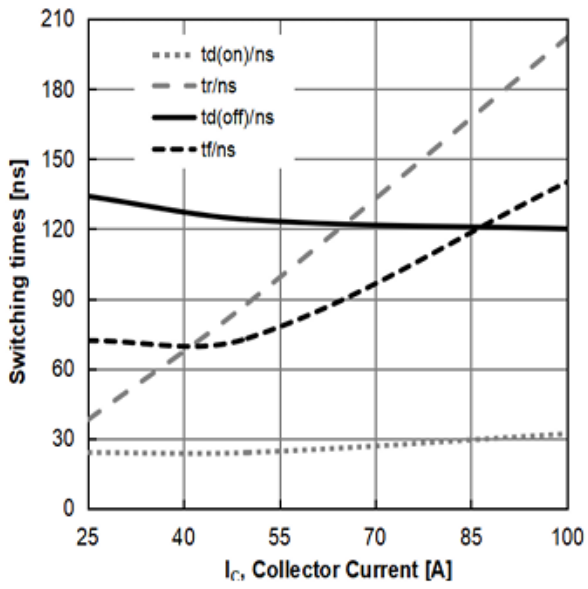



Figure 14: Typical Switching Energy vs. Collector Current ($T_J$=25℃, $V_{CE}$=400V, $V_{GE}$=15V,Rg=5Ω)

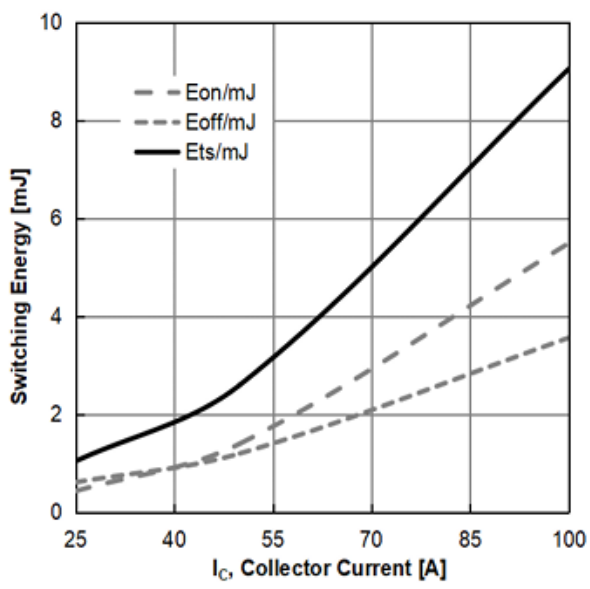



Figure 15: Typical Switching Times vs. VCE ( $T_J$=25℃, $V_{GE}$=15V, $I_C$=50A,Rg=5Ω)

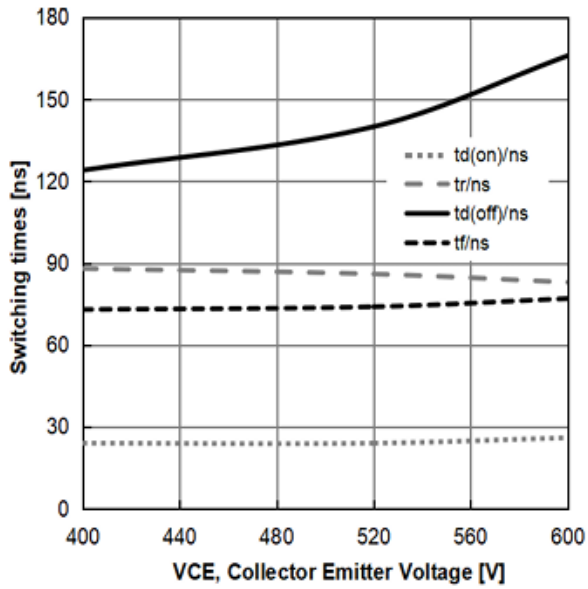



Figure 16: Typical Switching Energy vs. VCE ( $T_J$=25℃, $V_{GE}$=15V, $I_C$=50A,Rg=5Ω)

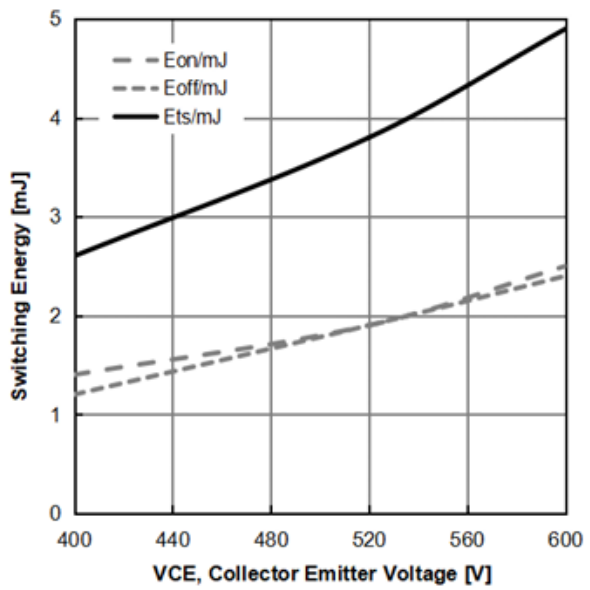


**Figure 17: Typical Capacitance vs. Collector- Emitter Voltage**

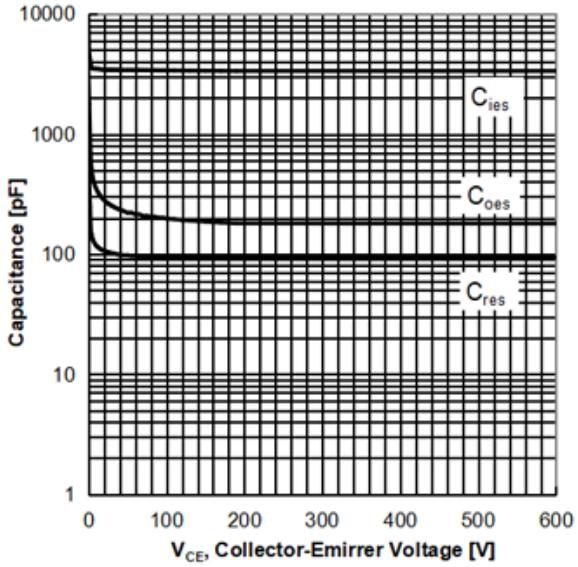



**Figure 18: Typical Gate Charge**

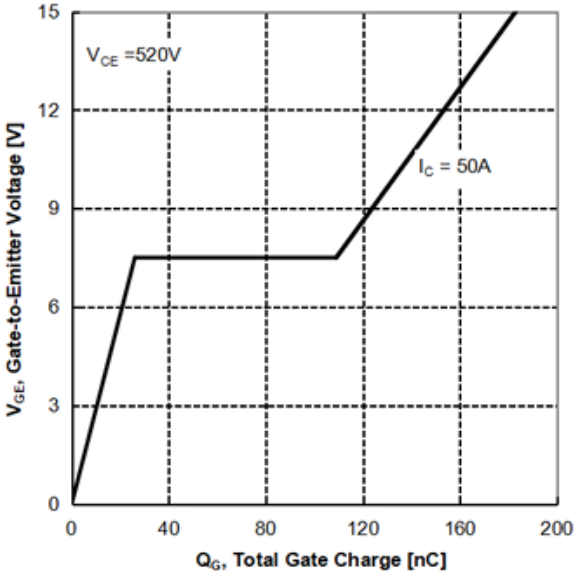



**Figure 19: IGBT Transient Thermal Impedance vs. Pulse Width**

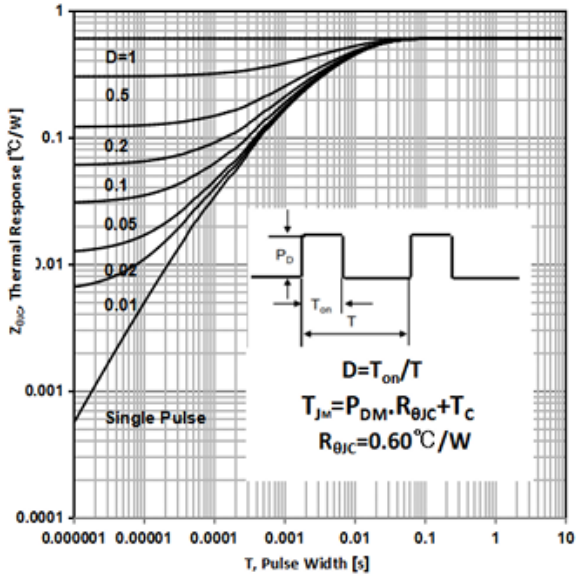



**Figure 20: Diode Transient Thermal Impedance vs. Pulse Width**

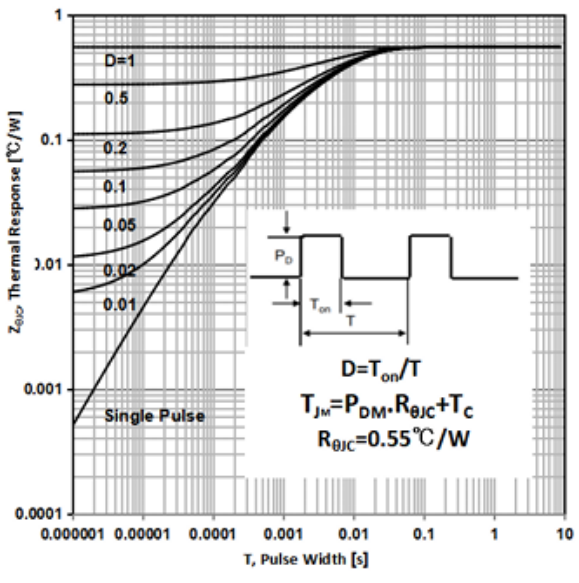
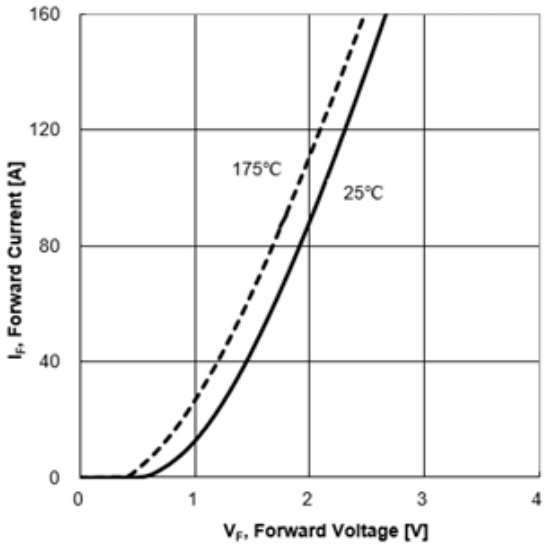
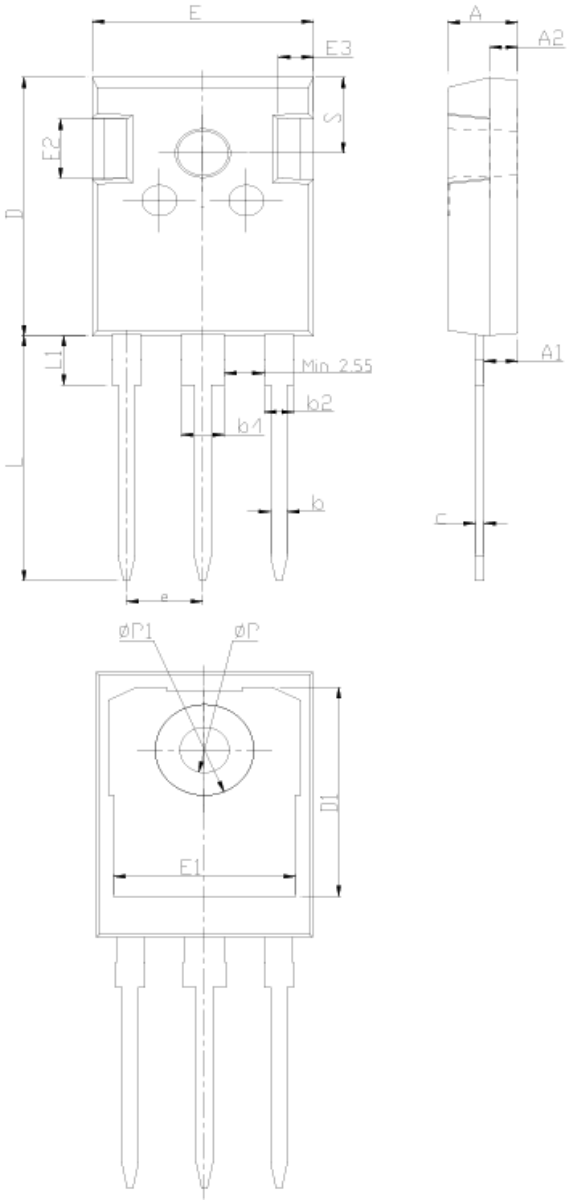


**Figure 21: Typical Diode Forward Current vs. Forward Voltage**



## TO-247 PACKAGE OUTLINE




COMMON DIMENSIONS

| SYMBOL | mm | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 4.80 | 5.00 | 5.20 |
| A1 | 2.21 | 2.41 | 2.59 |
| A2 | 1.85 | 2.00 | 2.15 |
| b | 1.11 | 1.21 | 1.36 |
| b2 | 1.91 | 2.01 | 2.21 |
| b4 | 2.91 | 3.01 | 3.21 |
| c | 0.51 | 0.61 | 0.75 |
| D | 20.70 | 21.00 | 21.30 |
| D1 | 16.25 | 16.55 | 16.85 |
| E | 15.50 | 15.80 | 16.10 |
| E1 | 13.00 | 13.30 | 13.60 |
| E2 | 4.80 | 5.00 | 5.20 |
| E3 | 2.30 | 2.50 | 2.70 |
| e | | 5.44BSC | |
| L | 19.62 | 19.92 | 20.22 |
| L1 | - | - | 4.30 |
| ΦP | 3.40 | 3.60 | 3.80 |
| ΦP1 | - | - | 7.30 |
| S | | 6.15BSC | |

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