## General Description：

Using owner proprietary trench design and advanced Field Stop (FS) technology, offering superior conduction and Switching performances. RoHS Compliant. Dielectric encapsulation of chip.

| | | |
|---|---|---|
| $V_{CES}$ | 650 | V |
| $I_C$ | 60 | A |
| $P_{tot}$ ($T_C$=25℃) | 132 | W |
| $V_{CE(sat)}$ | 1.6 | V |

Outline ： TO-247D-3

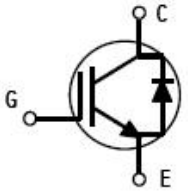


## Features：

- FS Trench Technology, Positive temperature coefficient
- Low saturation voltage：

  $V_{CE(sat)}$,TYP=1.6V @$I_C$=60A,$V_{GE}$=15V；

Inner Circuit:




## Applications

- Solar Inverter
- Charger
- UPS

## Package Parameters

| Type | Marking | Package | Packing |
|---|---|---|---|
| CRG60T65BQE5SDZ | G60T65BQE5SDZ | TO-247D-3 | Tube |

## Absolute Maximum Ratings（$T_C$= 25℃ unless otherwise specified）:

| Symbol | Parameter | Rating | Unit |
|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage | 650 | V |
| $V_{GES}$ | Gate- Emitter Voltage | ±20 | V |
| $V_{GES}$ | Gate- Emitter Voltage（tp≤10us,D<0.01） | ±30 | V |
| $I_C$ | Collector Current @$T_C$ = 25 °C | 60 | A |
| | Collector Current @$T_C$ = 100 °C | 60 | |
| $I_{CM}$[a1] | Pulsed Collector Current | 200 | A |
| $I_F$ | Diode Continuous Forward Current @$T_C$ =25 °C | 60 | A |
| | Diode Continuous Forward Current @$T_C$ = 100 °C | 60 | |
| $I_{FM}$ | Diode Maximum Forward Current | 200 | A |
| $P_D$ | Power Dissipation @ $T_C$ = 25°C | 132 | W |
| | Power Dissipation @ $T_C$ = 100°C | 66 | W |
| $T_{vjop}$[a2] | Operating Junction temperature range | -40～175 | ℃ |
| $T_{stg}$ | Storage Temperature Range | -55～150 | ℃ |
| $T_L$ | Maximum Temperature for Soldering | 270 | ℃ |

## Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R\theta_{JC}$ | Thermal Resistance, Junction to case for IGBT | -- | 1.14 | ℃/W |
| $R\theta_{JC}$ | Thermal Resistance, Junction to case for Diode | -- | 1.48 | ℃/W |
| $R\theta_{JA}$ | Thermal Resistance, Junction to Ambient | -- | 40 | ℃/W |

## Electrical Characteristics of the IGBT（$T_C$= 25℃ unless otherwise specified）:

| Symbol | Parameter | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| **OFF Characteristics** | | | | | | |
| $V_{(BR)CES}$ | Collector-Emitter Breakdown Voltage | $V_{GE}$=0V,$I_{CE}$=250uA | 650 | -- | -- | V |
| $I_{CES}$ | Collector Cut-off Current | $V_{GE}$=0V,$V_{CE}$=650V | -- | -- | 1 | mA |
| $I_{GES(F)}$ | Gate-Emitter Forward Leakage Current | $V_{GE}$=+20V | -- | -- | +250 | nA |
| $I_{GES(R)}$ | Gate-Emitter Reverse Leakage Current | $V_{GE}$ =-20V | -- | -- | -250 | nA |
| **ON Characteristics** | | | | | | |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_C$=60A ,$V_{GE}$=15V @ $T_C$ = 25°C | -- | 1.6 | 2.2 | V |
| | | $I_C$=60A ,$V_{GE}$=15V @ $T_C$ =175°C | -- | 2.1 | -- | V |
| $V_{GE(th)}$ | Gate - Emitter Threshold Voltage | $I_C$=250uA ,$V_{CE}$=$V_{GE}$ | 3.5 | | 6.5 | V |
| Pulse width tp≤300μs,δ≤2% | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Dynamic Characteristics** | | | | | | |
| $C_{ies}$ | Input Capacitance | $V_{CE}$=30V,$V_{GE}$=0V f=1MHz | -- | 3412 | -- | pF |
| $C_{oes}$ | Output Capacitance | | -- | 151 | -- | |
| $C_{res}$ | Reverse Transfer Capacitance | | -- | 20 | -- | |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{CE}$=400V,$I_C$=60A, $R_g$=10Ω,$V_{GE}$=15V, Inductive Load, $T_J$=25℃, | -- | 34 | -- | ns |
| $t_r$ | Rise Time | | -- | 50 | -- | |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 150 | -- | |
| $t_f$ | Fall Time | | -- | 58 | -- | |
| $E_{on}$ | Turn-On Switching Loss | | -- | 1.66 | -- | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | -- | 1.01 | -- | |
| $E_{ts}$ | Total Switching Loss | | -- | 2.67 | -- | |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{CE}$=400V,$I_C$=60A, $R_g$=10Ω,$V_{GE}$=15V, Inductive Load, $T_J$=175℃ | -- | 31 | -- | ns |
| $t_r$ | Rise Time | | -- | 51 | -- | |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 180 | -- | |
| $t_f$ | Fall Time | | -- | 65 | -- | |
| $E_{on}$ | Turn-On Switching Loss | | -- | 1.81 | -- | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | -- | 1.25 | -- | |
| $E_{ts}$ | Total Switching Loss | | -- | 3.06 | -- | |
| Qg | Total Gate Charge | $V_{CE}$=520V,$I_C$=60A, $V_{GE}$=15V, | -- | 77 | -- | nC |
| Qge | Gate to Emitter Charge | | -- | 24 | -- | |
| Qgc | Gate to Collector Charge | | -- | 37 | -- | |
| **Electrical Characteristics of the DIODE** | | | | | | |
| $V_F$ | Diode Forward Voltage | $I_F$=60A TC=25℃ | -- | 1.6 | 2.4 | V |
| | | $I_F$=60A TC=175℃ | -- | 1.43 | -- | V |
| $t_{rr}$ | Reverse Recovery Time | $I_F$=60A di/dt=200A/μs | -- | 236.18 | -- | ns |
| $I_{rrm}$ | Reverse Recovery Current | | -- | 8.74 | -- | A |
| $Q_{rr}$ | Reverse Recovery Charge | | -- | 1030 | -- | nC |

Notes：

a1：Repetitive rating; pulse width limited by maximum junction temperature；

a2：Overload condition, it is allowed to operate under the maximum junction temperature Tvjop = 175℃, the maximum duty cycle is less than 20% (lasting for 60s at most)；

## Typical Performance Characteristics

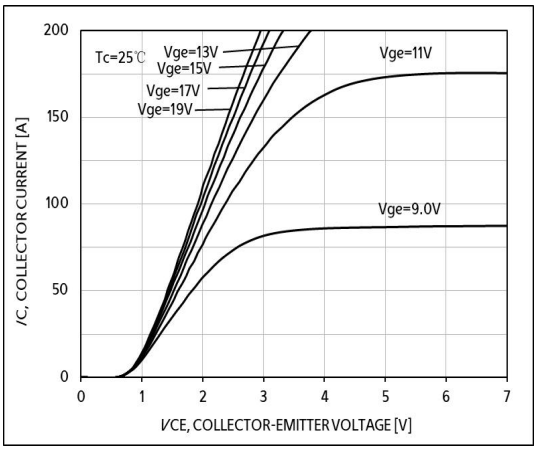



Figure 1. Output Characteristics

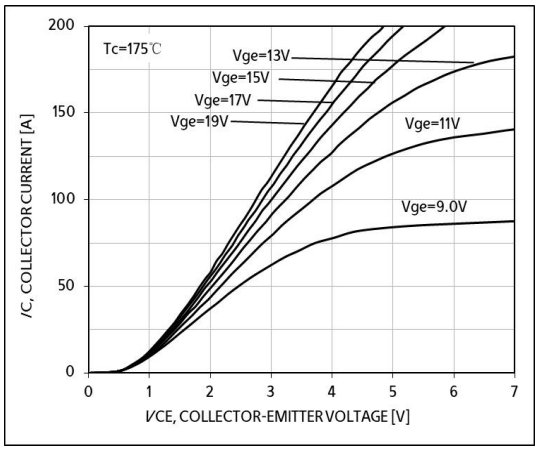



Figure 2. Output Characteristics

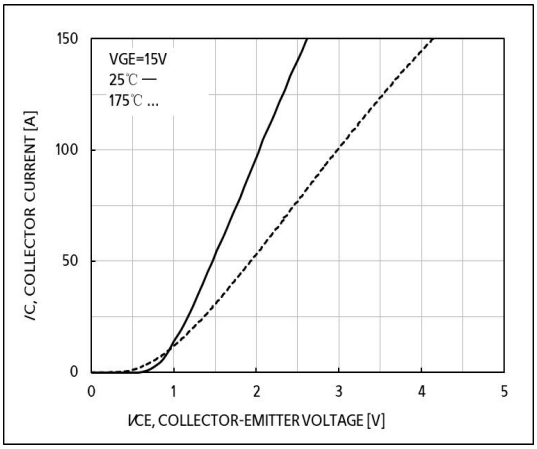



Figure 3. Saturation Voltage Characteristics

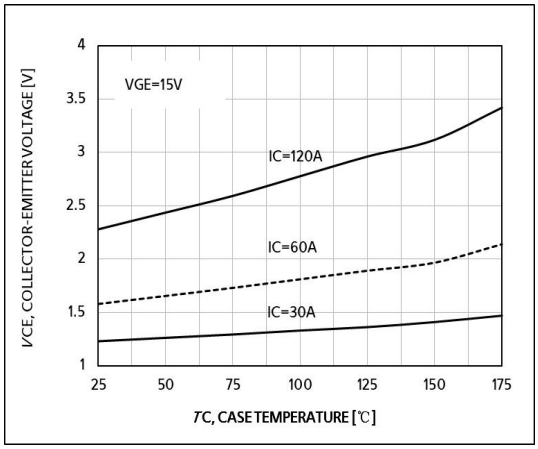



Figure 4. Saturation Voltage -$T_C$ Characteristics

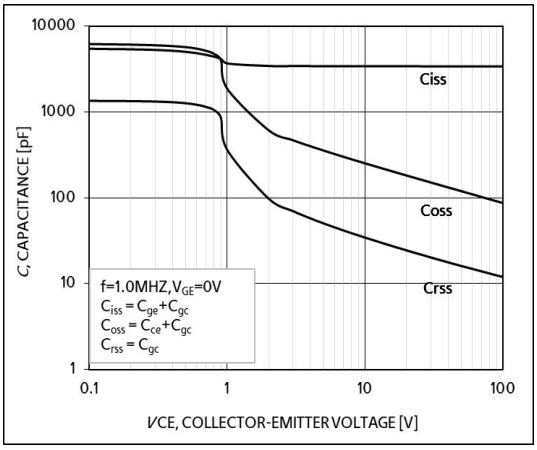



Figure 5. Capacitance Characteristics

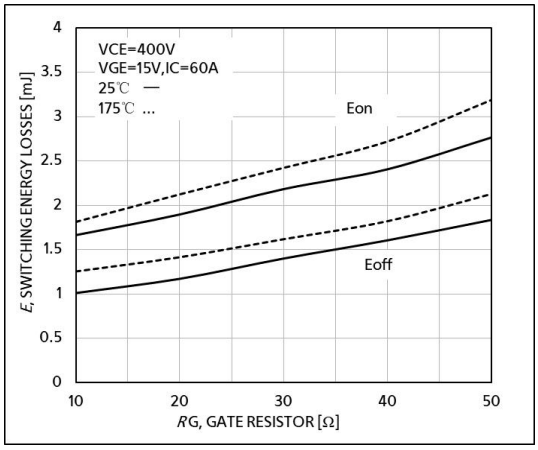



Figure 6. Switching Loss-$R_G$ Characteristics

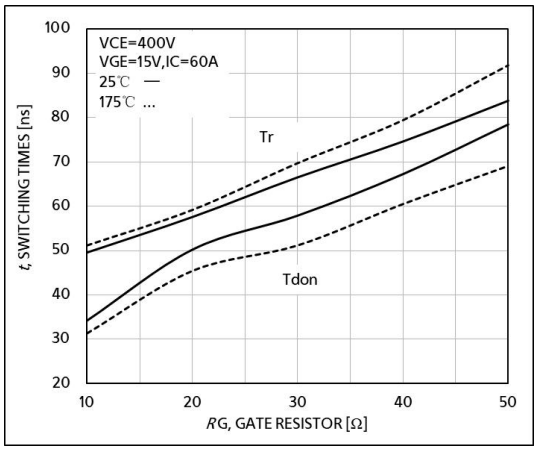



Figure 7. Switching Time-$R_G$ Characteristics

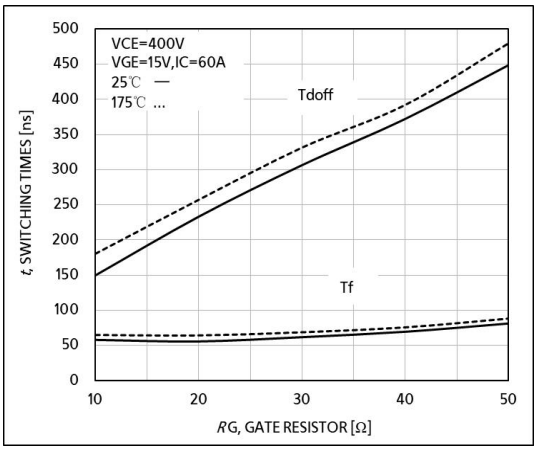



Figure 8. Switching Time-$R_G$ Characteristics

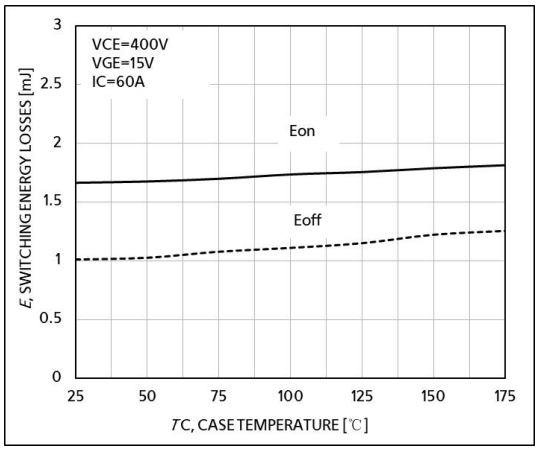



Figure 9. Switching Loss-Tc Characteristics

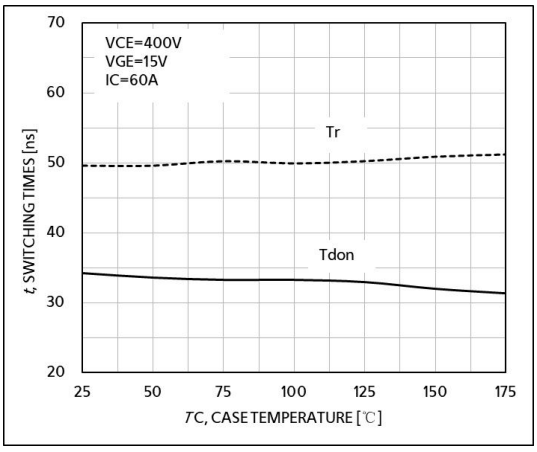



Figure 10. Switching Time-Tc Characteristics

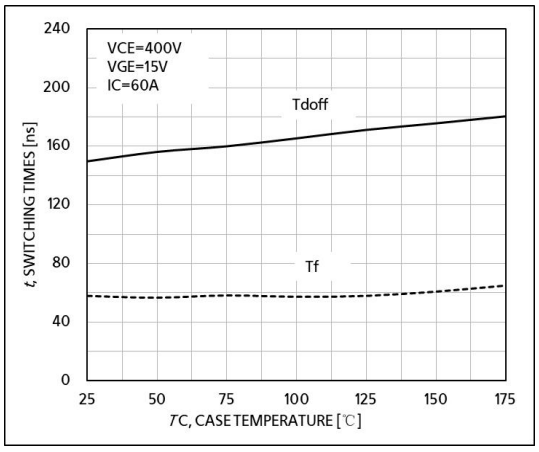



Figure 11. Switching Time-Tc Characteristics

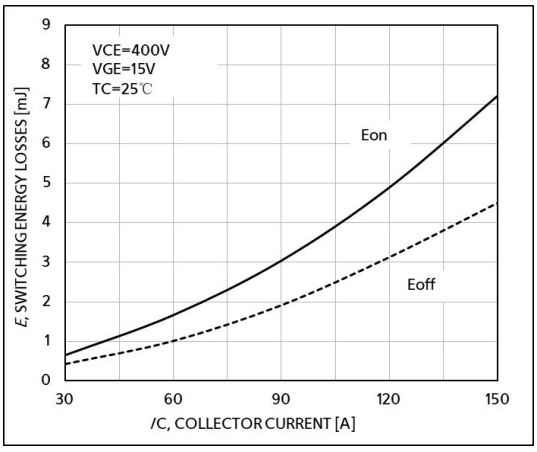



Figure 12. Switching Loss-$I_C$ Characteristics

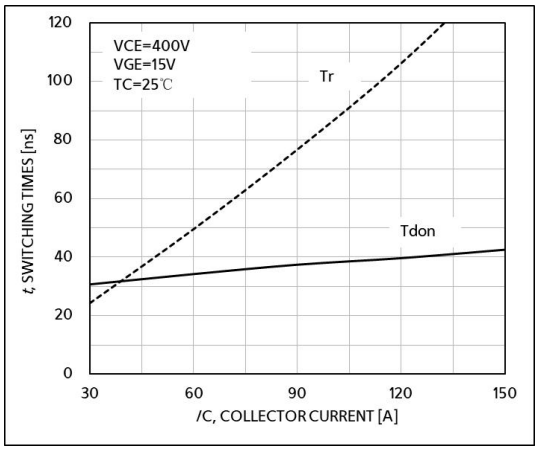



Figure 13. Switching Time-IC Characteristics

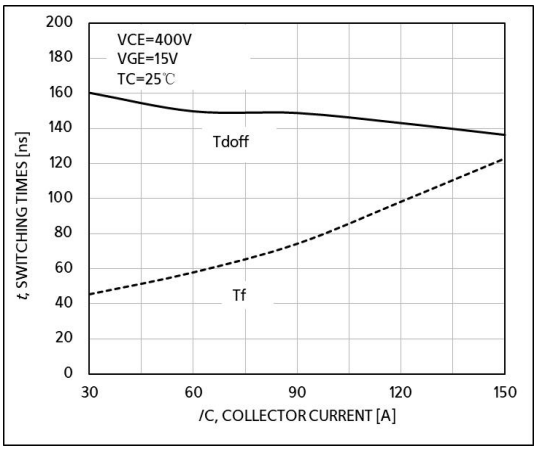



Figure 14. Switching Time-IC Characteristics

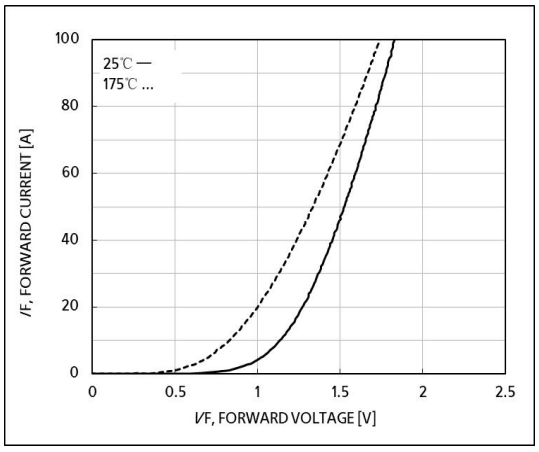



Figure 15. Diode Forward Characteristics

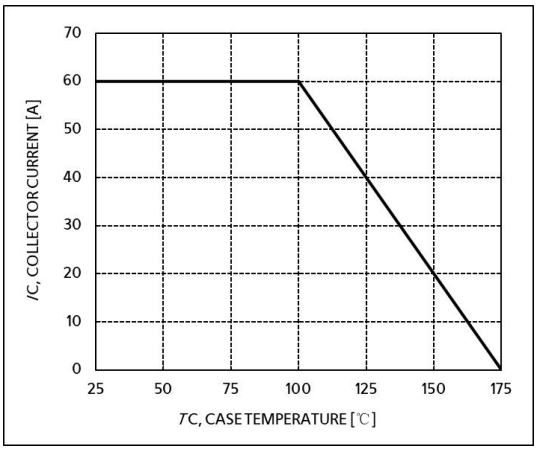



Figure 16. Collector Current-Tc Characteristics
(Tj ≤175℃)

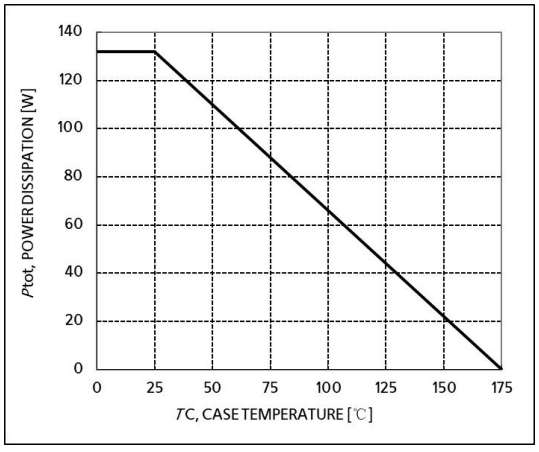



Figure 17. Power Dissipation-Tc Characteristics
(Tj ≤175℃)

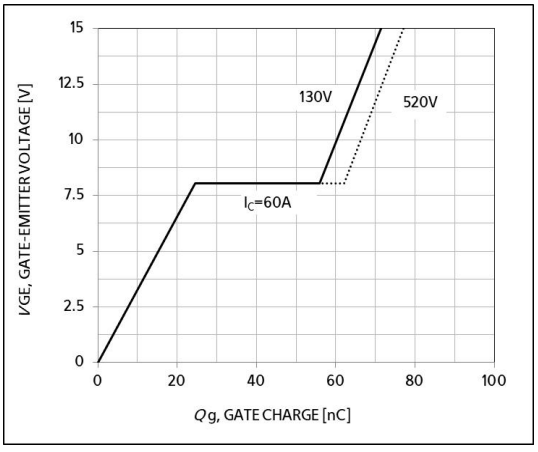



Figure 18. Gate Charge Characteristics

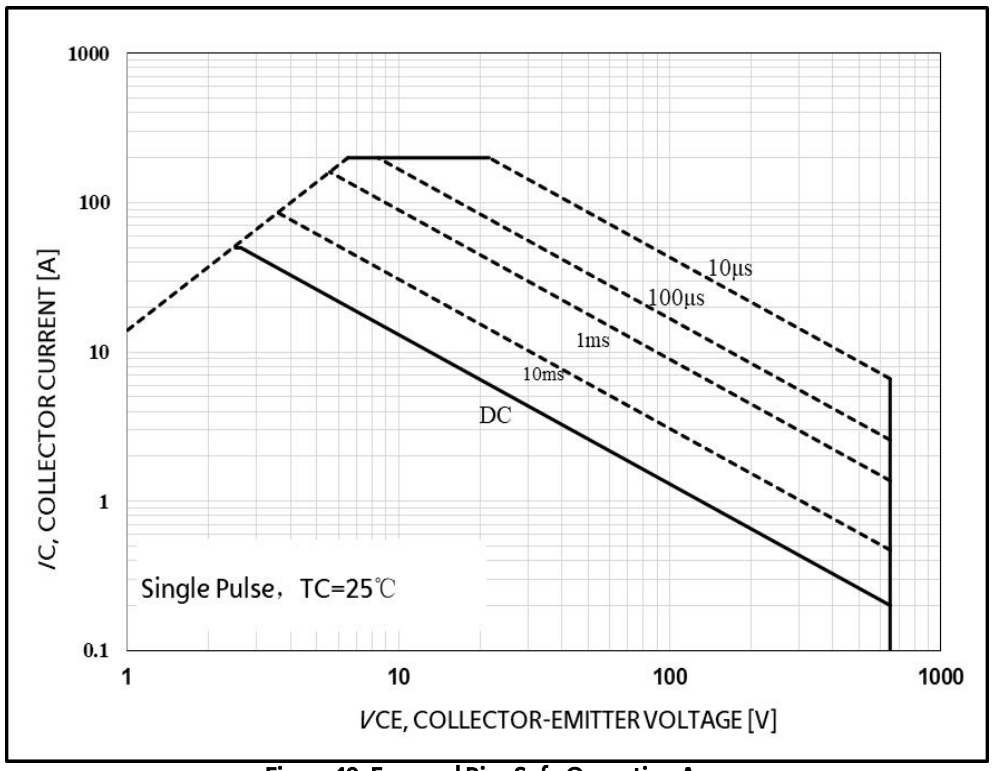



Figure 19. Forward Bias Safe Operating Area

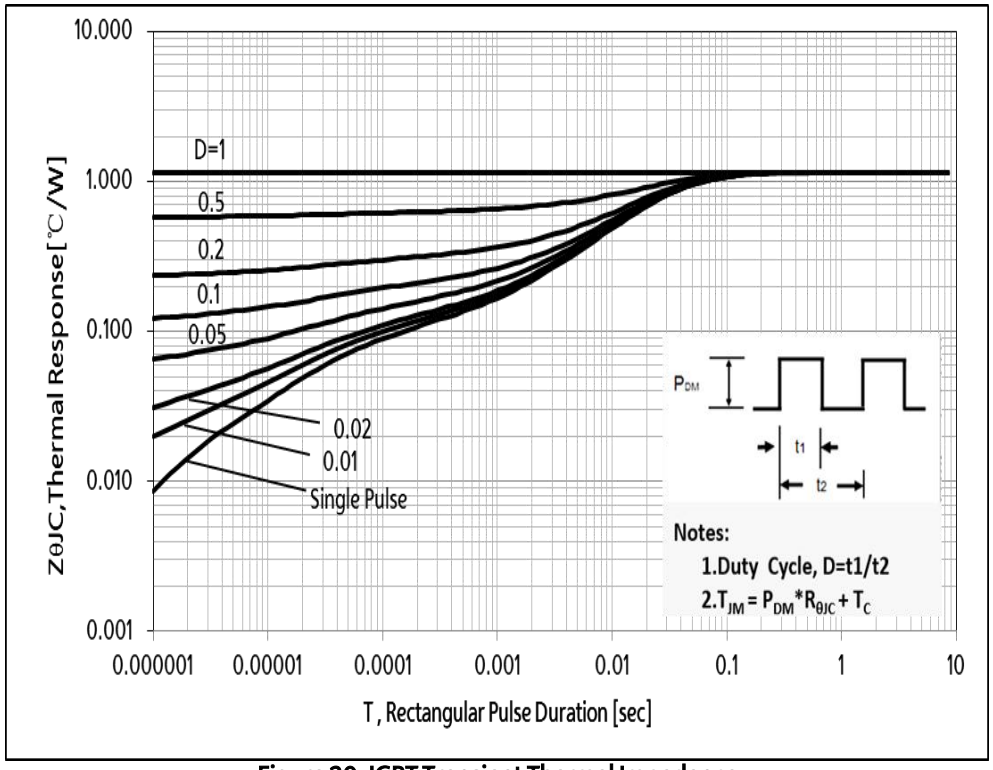
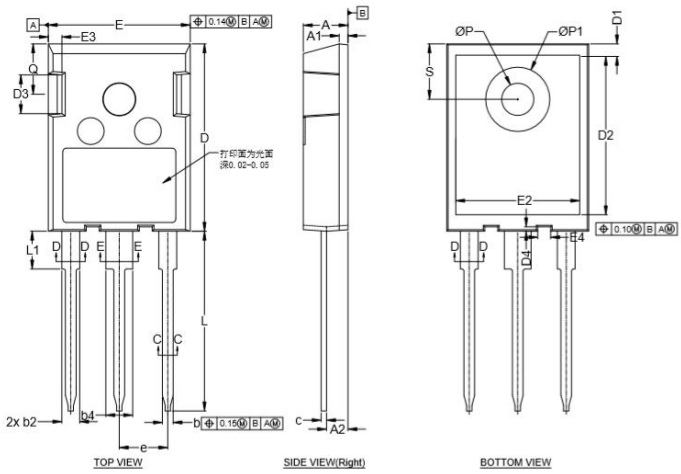



Figure 20. IGBT Transient Thermal Impedance

## Package Information




| Items | Values(mm) | |
|---|---|---|
| | MIN | MAX |
| A | 4.85 | 5.15 |
| A1 | 0.85 | 1.10 |
| A2 | 2.30 | 2.50 |
| b | 1.10 | 1.35 |
| b2 | 1.93 | 2.15 |
| c | 0.50 | 0.75 |
| D | 20.80 | 21.10 |
| D1 | 1.25 | 1.55 |
| D2 | 16.80 | 18.90 |
| D3 | 4.20 | 4.45 |
| D4 | 0.40 | 0.60 |
| E | 15.75 | 16.05 |
| E2 | 12.90 | 14.90 |
| E3 | 1.40 | 1.65 |
| E4 | 1.35 | 1.55 |
| e | 5.436 BSC. | |
| L | 19.80 | 20.40 |
| L1 | 4.00 | 4.45 |
| ΦP | 3.50 | 3.70 |
| ΦP1 | 7.00 | 7.30 |
| Q | 5.40 | 5.85 |
| S | 6.00 | 6.40 |

TO-247D-3 Package

## The name and content of poisonous and harmful material in products

| Part's Name Limit | Hazardous Substance | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pb | Hg | Cd | Cr(VI) | PBB | PBDE | DIBP | DEHP | DBP | BBP |
| | ⩽ 0.1% | ⩽ 0.1% | ⩽ 0.01 % | ⩽ 0.1% | ⩽ 0.1% | ⩽ 0.1% | ⩽ 0.1% | ⩽ 0.1% | ⩽ 0.1% | ⩽ 0.1% |
| Lead Frame | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Molding | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Chip | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Wire Bonding | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Solder | × | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Note | ○：Means the hazardous material is under the criterion of 2011/65/EU.<br>×：Means the hazardous material exceeds the criterion of 2011/65/EU.<br>The plumbum element of solder exist in products presently, but within the allowed range of Eurogroup's RoHS. | | | | | | | | | |

## Warnings

1. Exceeding the maximum ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. It is suggested to be used under 80 percent of the maximum ratings of the device.
2. When installing the heat sink, please pay attention to the torsional moment and the smoothness of the heat sink.
3. IGBTs is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.
4. This publication is made by Huajing Microelectronics and subject to regular change without notice.

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| Revison History | | |
|---|---|---|
| Revision | Date | Major changes |
| 1.0 | 2025/6/13 | Initial release |