# GOSTONE

RoHS COMPLIANT

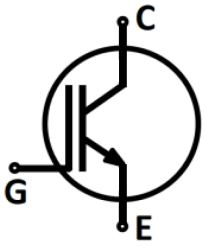
## 650V, 120A, Trench FS IGBT

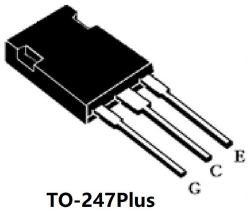
**GA120F06K3K**

### Product Summary

| Parameter | Value | Unit |
|---|---|---|
| $V_{CE}$ | 650 | V |
| $I_C$($T_C$=100℃) | 120 | A |
| $V_{CE\ (sat)}$ ($T_J$=25℃) | 1.53 | V |

**Equivalent circuit**



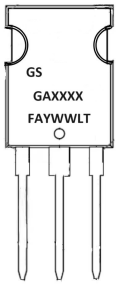

TO-247Plus

### Features

- Trench and field-stop technology.
- Easy parallel switching capability.
- High efficiency for inverters.
- High ruggedness performance.
- RoHS compliant.

### Application

- PFC applications
- Uninterruptible power supplies
- Solar inverters




**TO-247Plus**

NOTE:
LOGO - GS
GAXXXX - Part number code
F - Fab location code
A - Assembly location code
Y - Year code
WW - Week code
L&T - Assembly lot code

## Absolute Maximum ratings Ta = 25°C

| Symbol | Parameter | Values | Unit |
|---|---|---|---|
| $V_{CES}$ | Collector-emitter voltage | 650 | V |
| $V_{GES}$ | Gate-emitter voltage | ±20 | V |
| $I_C$ | Continuous collector current ($T_C$=25℃) | 160 | A |
| | Continuous collector current ($T_C$=100℃) | 120 | A |
| $I_{CM}$ | Pulsed collector current, $t_p$ limited by $T_{vjmax}$ | 480 | A |
| $P_{tot}$ | Power dissipation ($T_C$=25℃) | 536 | W |
| | Power dissipation ($T_C$=100℃) | 272 | W |
| $T_{vj}$ | Operating junction temperature range | -40 to +175 | ℃ |
| $T_{stg}$ | Storage temperature range | -55 to +150 | ℃ |

## Thermal Characteristic

| Symbol | Parameter | Values | | Unit |
|---|---|---|---|---|
| | | Typ. | Max. | |
| $R_{th(j-c)}$ | Thermal resistance, junction to case for IGBT | - | 0.28 | K/ W |
| $R_{th(j-a)}$ | Thermal resistance, junction to ambient | - | 40 | K/ W |

## Electrical characteristics of IGBT (Tvj=25℃ unless otherwise specified)

### Static characteristics

| Symbol | Parameter | Test condition | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| $BV_{CES}$ | Collector-emitter breakdown voltage | $V_{GE}$=0V, $I_C$=250μA | 650 | - | - | V |
| $I_{CES}$ | Collector-emitter leakage current | $V_{CE}$=650V, $V_{GE}$=0V | - | - | 250 | μA |
| $I_{GES}$ | Gate leakage current, forward | $V_{GE}$=20V, $V_{CE}$=0V | - | - | 200 | nA |
| | Gate leakage current, reverse | $V_{GE}$=-20V, $V_{CE}$=0V | - | - | -200 | nA |
| $V_{GE(th)}$ | Gate-emitter threshold voltage | $V_{GE}$=$V_{CE}$, $I_C$=1mA | 4.0 | 5.0 | 6.0 | V |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage | $V_{GE}$=15 V, $I_C$=120A | - | 1.53 | 1.85 | V |
| | | $V_{GE}$=15V, $I_C$=120A, $T_{vj}$=175℃ | - | 1.75 | - | V |

### Dynamic characteristics

| Symbol | Parameter | Test condition | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| $C_{ies}$ | Input capacitance | $V_{CE}$=25V<br>$V_{GE}$=0V<br>$f$=1MHz | - | 5120 | - | pF |
| $C_{oes}$ | Output capacitance | | - | 220 | - | pF |
| $C_{res}$ | Reverse transfer capacitance | | - | 48 | - | pF |
| $Q_g$ | Total gate charge | $V_{CC}$=300V<br>$V_{GE}$=15V<br>$I_C$=120A | - | 310 | - | nC |

## Switching characteristicsElectrical

| Symbol | Parameter | Test condition | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| $t_{d(on)}$ | Turn-on delay time | $V_{CC}$=400V<br>$V_{GE}$=0/15V<br>$I_C$=120A<br>$R_G$=10Ω<br>Inductive load | - | 70 | - | ns |
| $t_r$ | Rise time | | - | 145 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 183 | - | ns |
| $t_f$ | Fall time | | - | 110 | - | ns |
| $E_{on}$ | Turn-on energy | | - | 6.1 | - | mJ |
| $E_{off}$ | Turn-off energy | | - | 3.9 | - | mJ |
| $E_{ts}$ | Total switching energy | | - | 10.0 | - | mJ |
| $t_{d(on)}$ | Turn-on delay time | $V_{CC}$=400V<br>$V_{GE}$=0/15V<br>$I_C$=120A<br>$R_G$=10Ω<br>Inductive load<br>$T_{vj}$=150℃ | - | 68 | - | ns |
| $t_r$ | Rise time | | - | 133 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 210 | - | ns |
| $t_f$ | Fall time | | - | 172 | - | ns |
| $E_{on}$ | Turn-on energy | | - | 6.3 | - | mJ |
| $E_{off}$ | Turn-off energy | | - | 5.2 | - | mJ |
| $E_{ts}$ | Total switching energy | | - | 11.5 | - | mJ |

## Typical performance characteristics

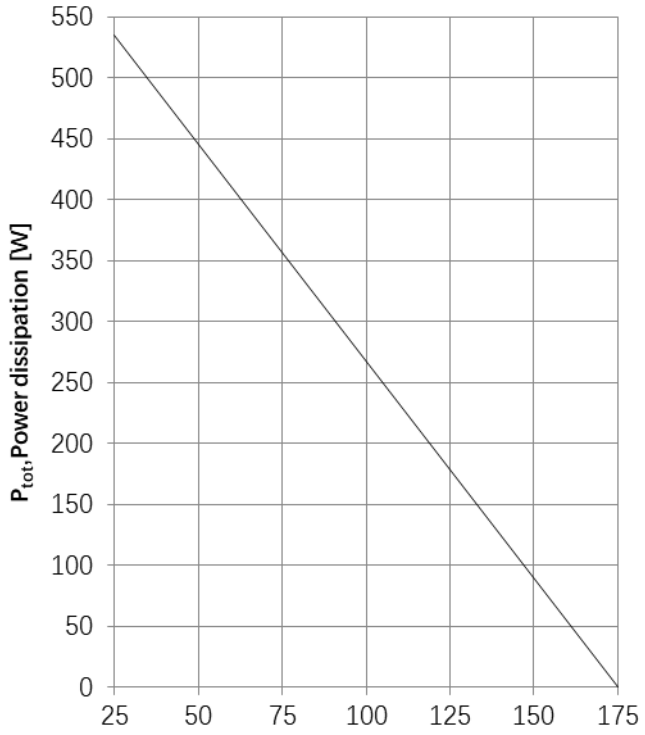



Fig1. Power dissipation as a function of case temperature (Tj≤175℃)

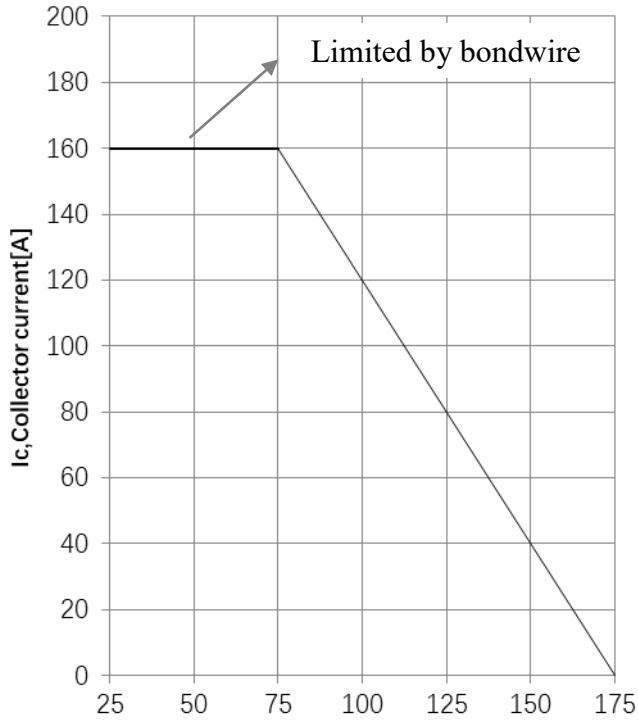



Fig2. Collector current as a function of case temperature(Vge≥15V, Tj≤175℃)

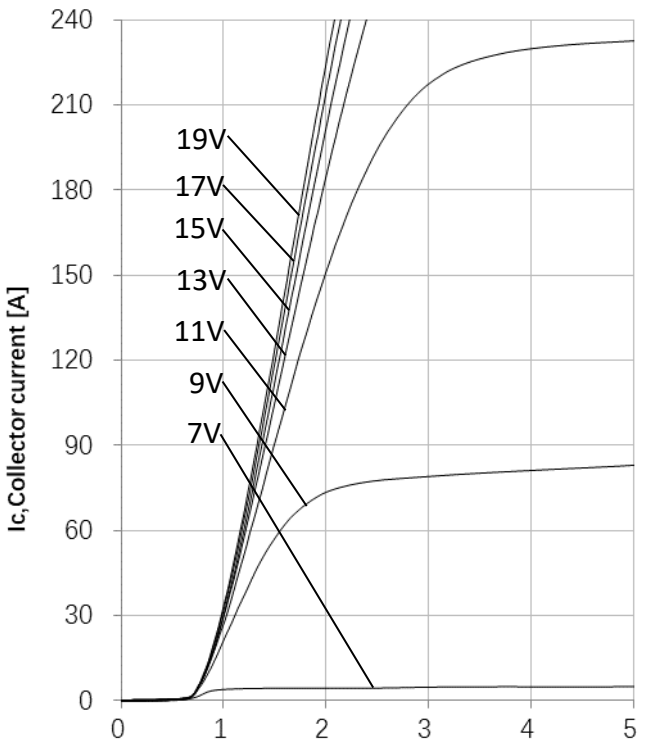



Fig3. Typical output characteristic (Tj=25℃)

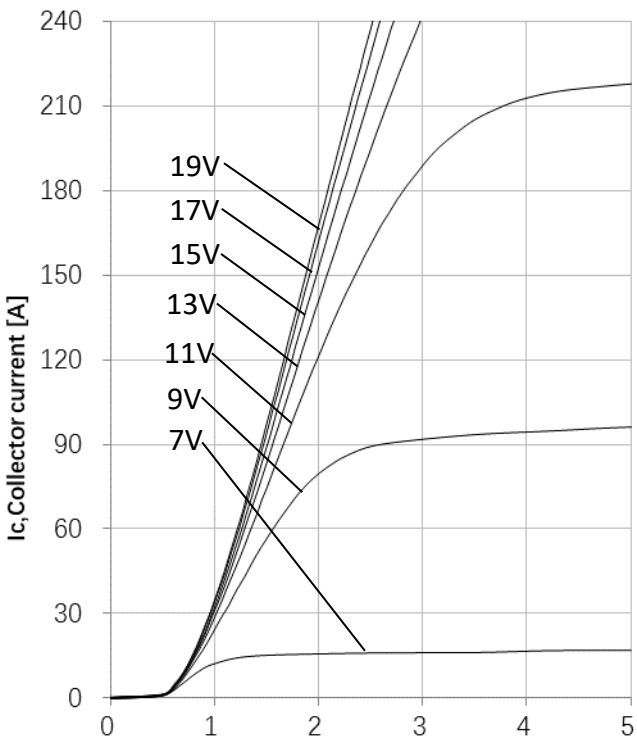



Fig4. Typical output characteristic (Tj=150℃)

## Typical performance characteristics

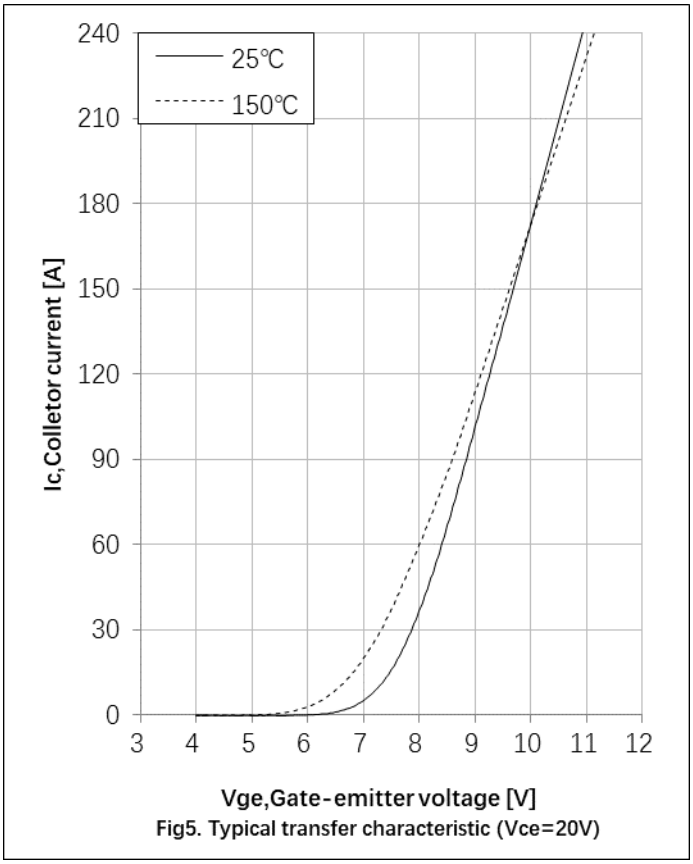



Fig5. Typical transfer characteristic (Vce=20V)

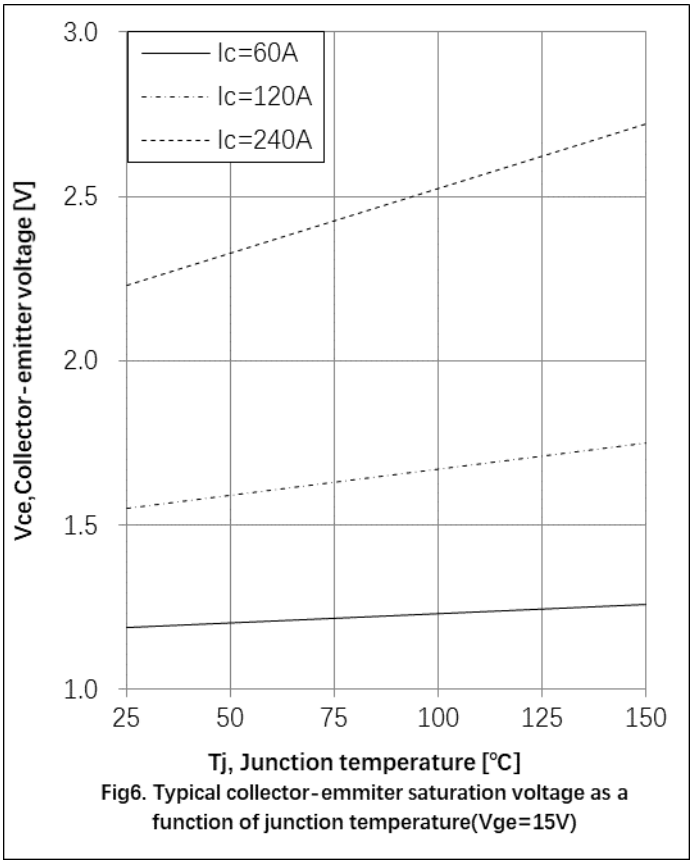



Fig6. Typical collector-emmiter saturation voltage as a function of junction temperature(Vge=15V)

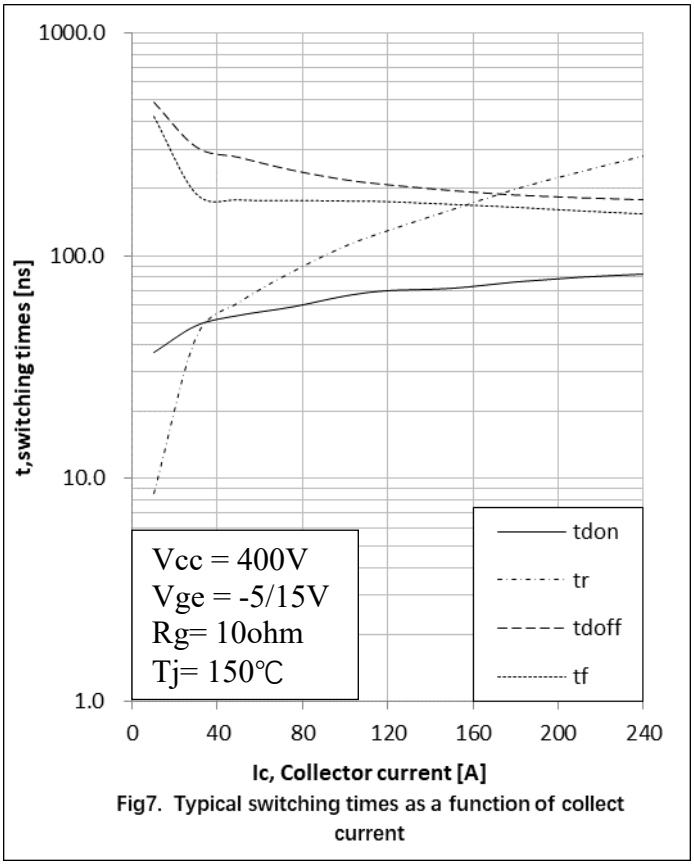



Fig7. Typical switching times as a function of collect current

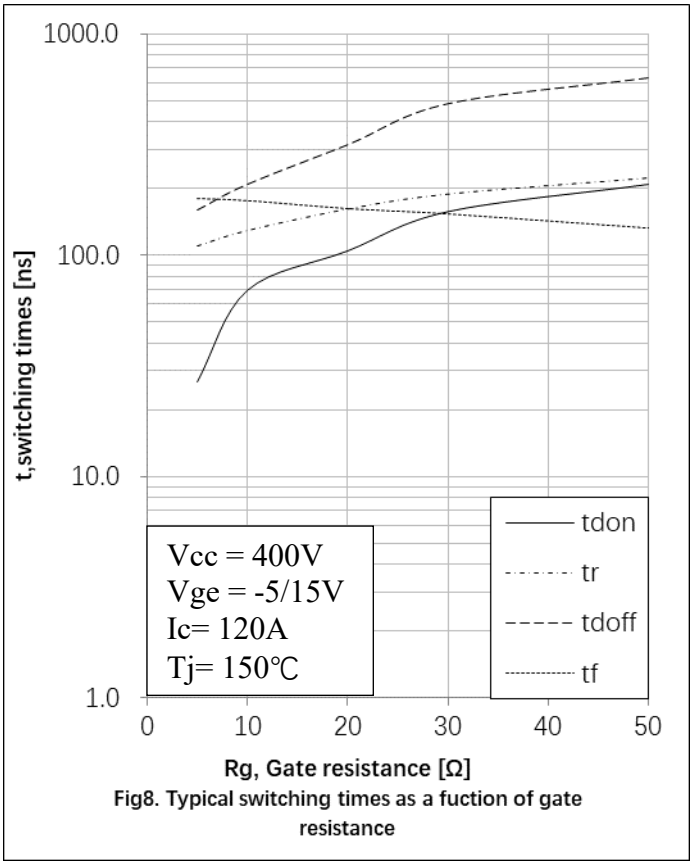



Fig8. Typical switching times as a fuction of gate resistance

## Typical performance characteristics

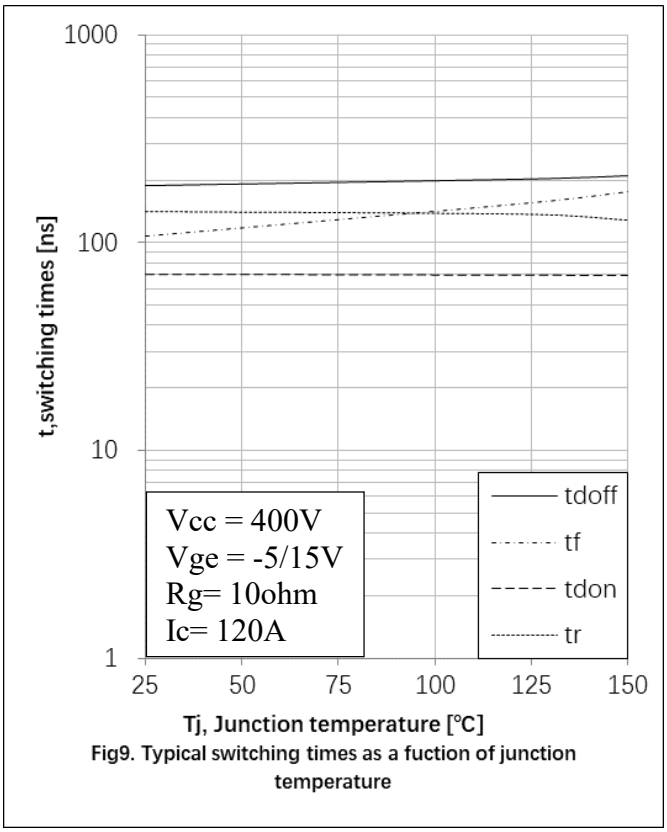



Fig9. Typical switching times as a fuction of junction temperature

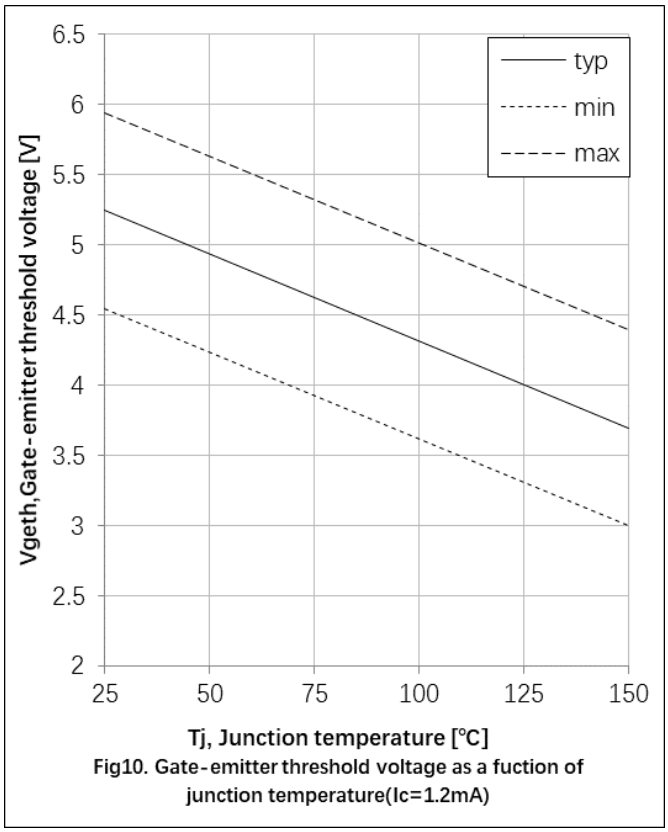



Fig10. Gate-emitter threshold voltage as a fuction of junction temperature(Ic=1.2mA)

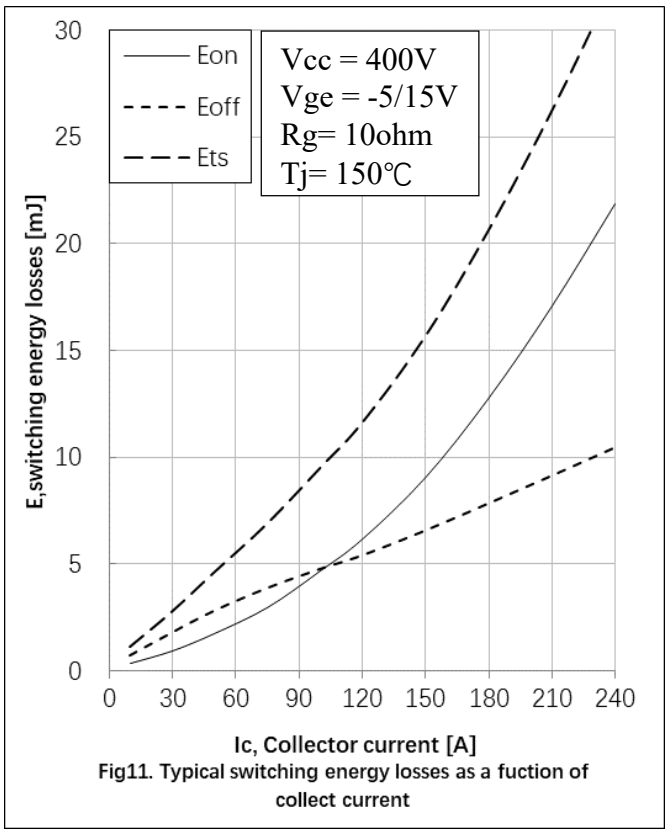



Fig11. Typical switching energy losses as a fuction of collect current

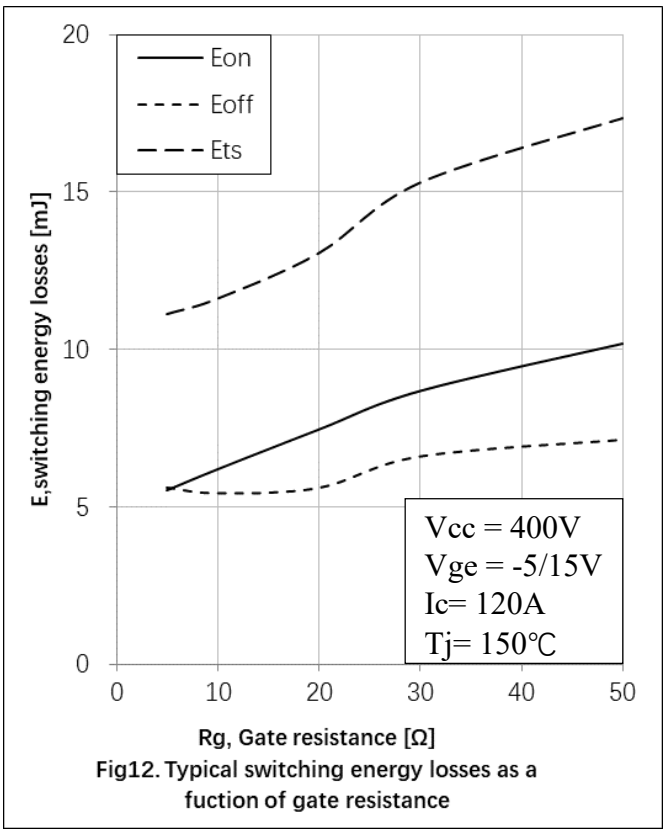



Fig12. Typical switching energy losses as a fuction of gate resistance

## Typical performance characteristics

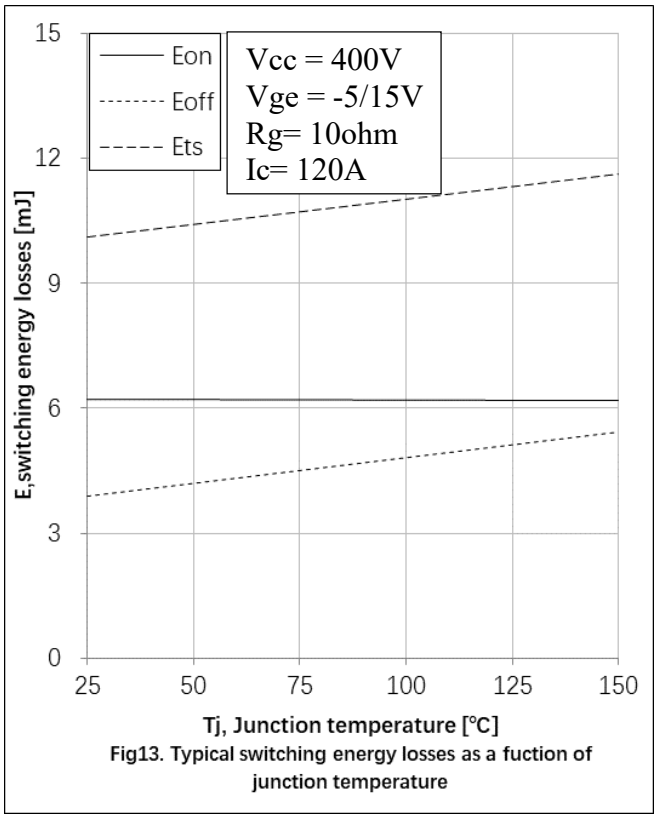



Fig13. Typical switching energy losses as a fuction of junction temperature

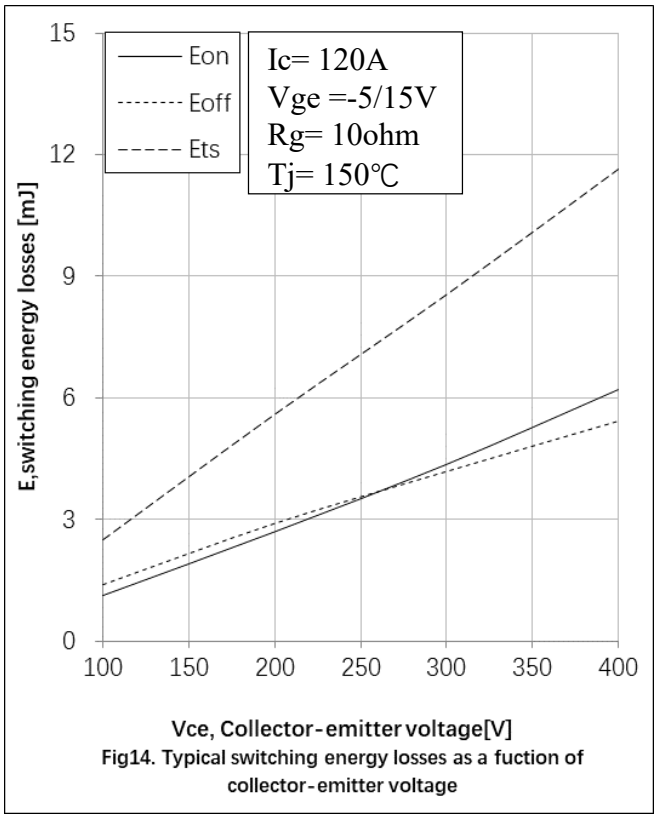



Fig14. Typical switching energy losses as a fuction of collector-emitter voltage

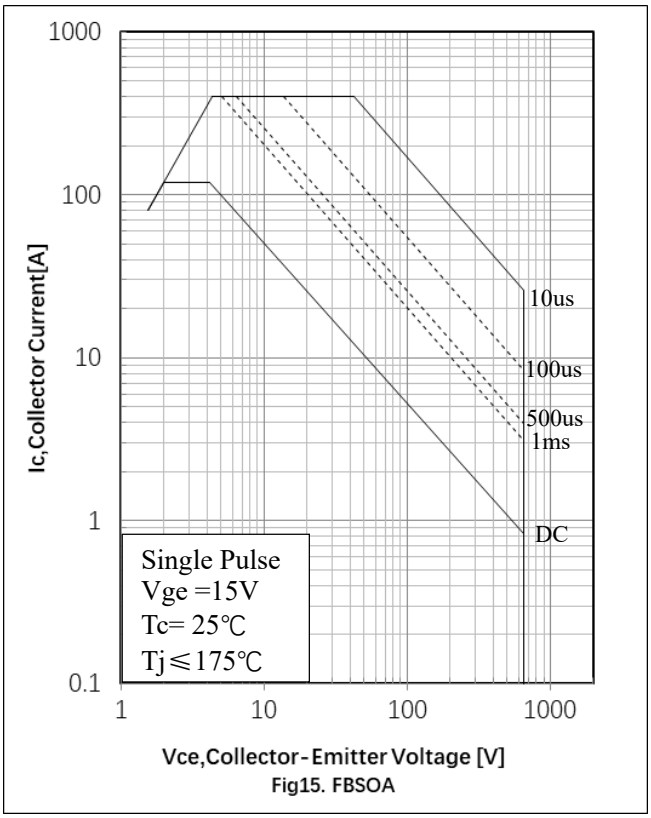



Fig15. FBSOA

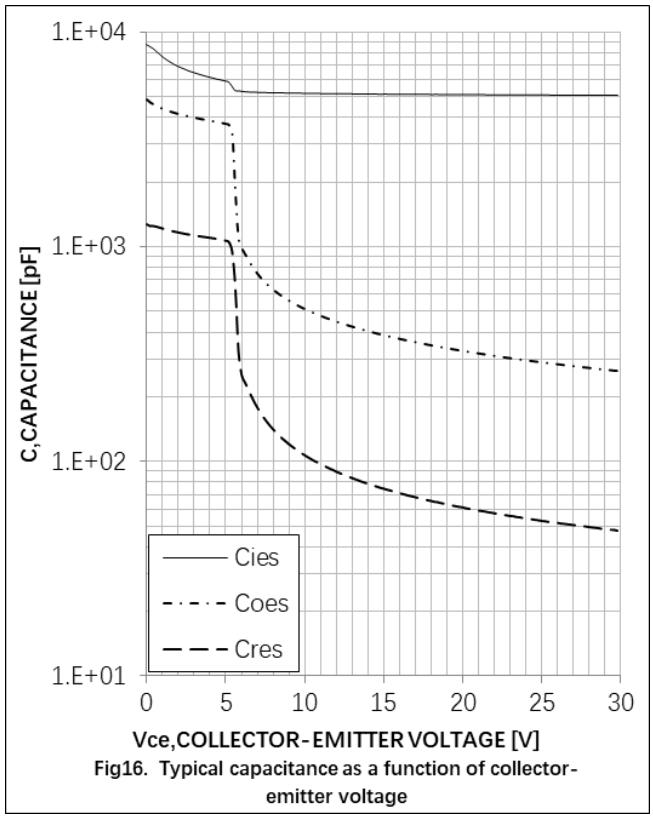
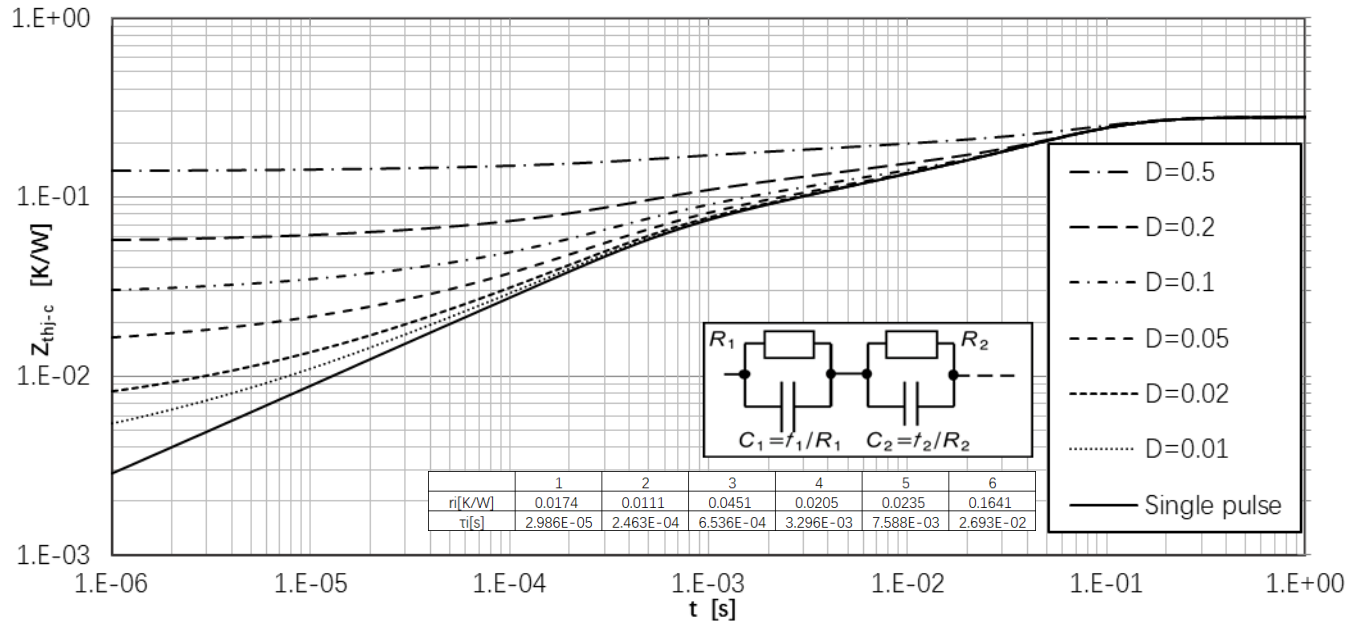



Fig16. Typical capacitance as a function of collector-emitter voltage

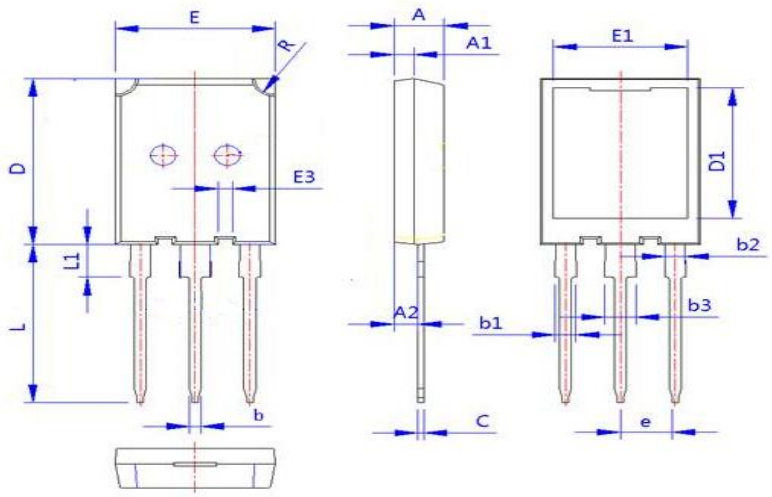
## Typical performance characteristics




| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| ri[K/W] | 0.0174 | 0.0111 | 0.0451 | 0.0205 | 0.0235 | 0.1641 |
| τi[s] | 2.986E-05 | 2.463E-04 | 6.536E-04 | 3.296E-03 | 7.588E-03 | 2.693E-02 |

Fig17. IGBT Transient Thermal Impedance

## Package Drawing TO-247Plus




| Items | Values(mm) | |
|---|---|---|
| | MIN | MAX |
| A | 4.85 | 5.15 |
| A1 | 1.85 | 2.15 |
| A2 | 2.15 | 2.65 |
| b | 1.07 | 1.33 |
| b1 | 1.90 | 2.46 |
| b2 | 1.90 | 2.16 |
| b3 | 2.82 | 3.43 |
| C | 0.55 | 0.70 |
| D | 20.75 | 21.15 |
| D1 | 16.20 | 16.90 |
| E | 15.50 | 16.10 |
| E1 | 13.01 | 13.51 |
| E3 | 1.25 | 1.65 |
| e | 5.44(BSC) | |
| R | 1.80 | 2.20 |
| L | 19.60 | 20.40 |
| L1 | 4.00 | 4.48 |

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