# Trench Field Stop Fast IGBT Co-packed with Thin SiC Schottky Diode

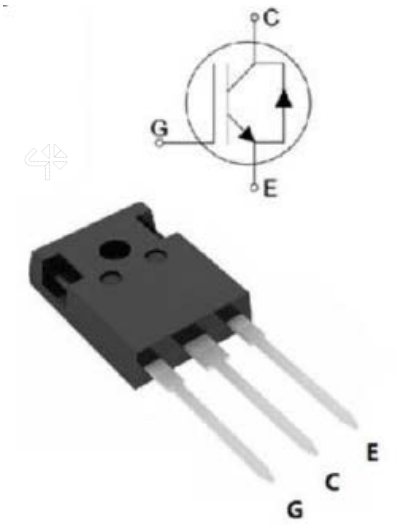
| Type | $V_{CE}$ | $I_C$ | $V_{CEsat}$, $T_{vj}$=25°C | $T_{vjmax}$ | Package |
|---|---|---|---|---|---|
| SKIS75N120-T7 | 1200V | 75A | 2V | 150°C | TO247 |

## Features and Benefits

- Low switching losses due to the combination of trench field stop fast IGBT and thin SiC Schottky Diode
- Better efficiency and cost balance than SiC MOSFET solution
- High ruggedness

## Applications

- Charger
- Solar inverter
- Energy storage
- Industrial UPS




| | **Parameter** | | **Unit** |
|---|---|---|---|
| $V_{CE}$ | Max Collector-Emitter Voltage | 1200 | V |
| $I_{C(Nominal)}$ | Max DC Collector Current | 75 | A |
| $V_f$ | SiC Schottky Diode Typical Forward Voltage at 40A | 1.75 | V |
| $Q_c$ | SiC Schottky Diode Total Capacitive Charge | 123 | nC |

## Maximum Ratings

| | Parameter | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| $V_{(BR)CES}$ | Collector-to-Emitter Breakdown Voltage | 1200 | — | — | V |
| $I_C$ | DC collector current limited by $T_{jmax}$<br>$T_c$ = 25°C<br>$T_c$ = 100°C | <br>—<br>— | <br>—<br>— | <br>100<br>75 | <br>A<br>A |
| $I_F$ | Diode Forward current, limited by $T_{jmax}$<br>$T_c$ = 25°C<br>$T_c$ = 100°C | <br>—<br>— | <br>—<br>— | <br>75<br>35 | <br>A<br>A |
| $V_{GE}$ | Continuous Gate-emitter voltage | -20 | — | 20 | V |
| $V_{GE}$ | Transient Gate-emitter voltage | -30 | — | 30 | V |
| $I_{Fpulse}$ | Diode Pulsed Current, $t_p$ limited by $T_{jmax}$<br>$t_P$ = 10 ms, Half Sine Wave | — | — | 170 | A |
| $P_{tot}$ | Power dissipation , $T_j$=25°C | — | — | 312 | W |
| $T_{vj}$ | Operating junction temperature | -40 | — | 150 | °C |
| $T_{stg}$ | Storage temperature - | -55 | — | 150 | °C |

## Thermal Resistance

| Parameter | Symbol | Max. Value | Unit |
|---|---|---|---|
| IGBT thermal resistance<br>junction - case | $R_{\theta(j-c)}$ | 0.4 | K/W |
| Diode thermal resistance,<br>junction - case | $R_{\theta(j-c)}$ | 0.7 | K/W |
| Thermal resistance,<br>junction - ambient | $R_{\theta(j-a)}$ | 38 | K/W |

## Static Characteristics. $T_J$=25°C

| | Parameter | Min. | Typ. | Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| $V_{CE(sat)}$ | Collector-to-Emitter Saturated Voltage | <br>—<br>— | <br>2<br>2.5 | <br>—<br>— | V | $V_{GE}$ = 15V, $I_C$ =75A<br>$T_J$=25°C<br>$T_J$=150°C |
| $V_{GE(th)}$ | Gate-Emitter Threshold Voltage | 4.8 | 5.5 | 6.2 | V | $I_C$ =250uA , $V_{GE}$ = $V_{CE}$ |
| $I_{CES}$ | Zero Gate Voltage Collector Current | —<br>— | | <br>1<br>5 | mA | $V_{CE}$ = 1200V, $V_{GE}$ = 0V,<br>$T_j$=25°C<br>$T_j$=150°C |
| $I_{GES}$ | Gate Emitter Leakage Current | — | — | 200 | nA | $V_{CE}$ = 0V, $V_{GE}$ =20V |
| $C_{ies}$ | Input Capacitance | — | 4600 | — | pF | $V_{GE}$ = 0V, $V_{CE}$=25V, f=1MHz |
| $C_{oes}$ | Output Capacitance | — | 210 | — | | |
| $C_{res}$ | Reverse Transfer Capacitance | — | 25 | — | | |
| $Q_g$ | Gate charge | — | 128 | — | nC | $V_{CC}$=960V,$I_C$=75A,$V_{GE}$=15V |

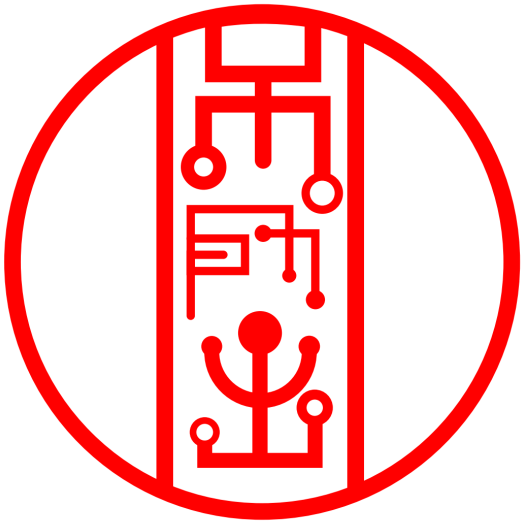
## Switching Characteristic, Inductive Load

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| Turn-on delay time | $t_{d(on)}$ | — | 79 | — | ns | $V_{CC}$ = 600V, $I_C$ = 75A, $V_{GE}$ = 0/15V, $R_g$=20Ω $T_{VJ}$=25℃ |
| Rise time | $t_r$ | — | 131 | — | ns | |
| Turn-off delay time | $t_{d(off)}$ | — | 211 | — | ns | |
| Fall time | $t_f$ | — | 81 | — | ns | |
| Turn-on energy Eon | $E_{on}$ | — | 5.25 | — | mJ | |
| Turn-off energy | $E_{off}$ | — | 3.68 | — | mJ | |
| Total switching energy | $E_{ts}$ | — | 8.93 | — | mJ | |

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| Turn-on delay time | $t_{d(on)}$ | — | 72 | — | ns | $V_{CC}$ = 600V, $I_C$ = 75A, $V_{GE}$ = 0/15V, $R_g$=20Ω $T_{VJ}$=150℃ |
| Rise time | $t_r$ | — | 134 | — | ns | |
| Turn-off delay time | $t_{d(off)}$ | — | 240 | — | ns | |
| Fall time | $t_f$ | — | 110 | — | ns | |
| Turn-on energy Eon | $E_{on}$ | — | 5.65 | — | mJ | |
| Turn-off energy | $E_{off}$ | — | 4.56 | — | mJ | |
| Total switching energy | $E_{ts}$ | — | 10.2 | — | mJ | |

## Diode Characteristic

| | Parameter | Min. | Typ. | Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| $V_f$ | Forward Voltage | — | 1.75 | — | V | $I_F$=40A, $T_J$ = 25°C |
| | | — | 2.53 | — | | $I_F$=40A, $T_J$ = 150°C |
| $Q_c$ | Total Capacitive Charge | — | 123 | — | nC | $V_R$=800V |
| C | Total Capacitance | — | 1794 | — | pF | $V_R$=0V, $T_J$=25°C, f=1MHz |
| | | — | 120 | — | | $V_R$=400V, $T_J$=25°C, f=1MHz |
| | | — | 75 | — | | $V_R$=800V, $T_J$=25°C, f=1MHz |



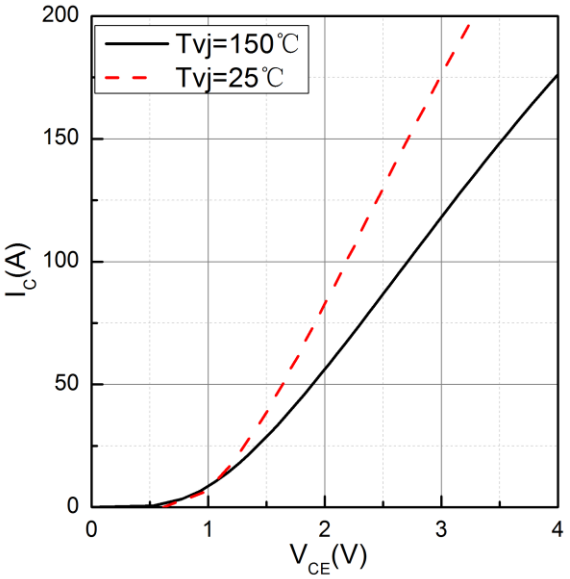



Figure 2. Typical output characersitic($V_{GE}$=15V)

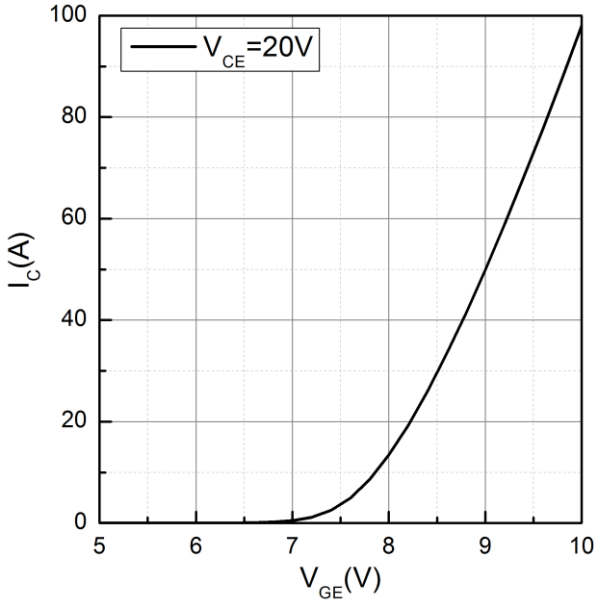



Figure3. Transfer characersitic(Tvj=25℃)

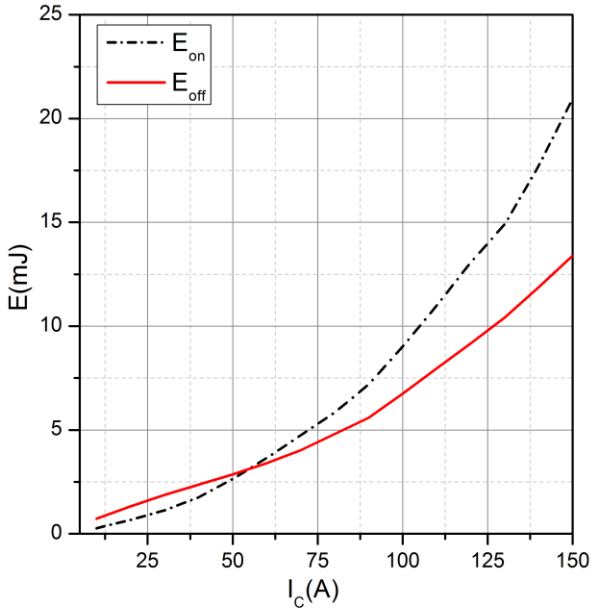
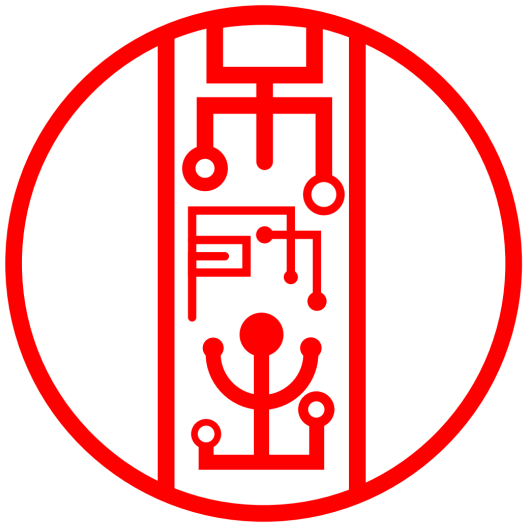



Figure 4. Typical energy losses as function of collector current(inductive load,$T_{vj}$=150℃,$V_{CE}$=600V, $V_{GE}$=15/0V,$R_G$=10Ω,Dynamic test circuit in figure E)



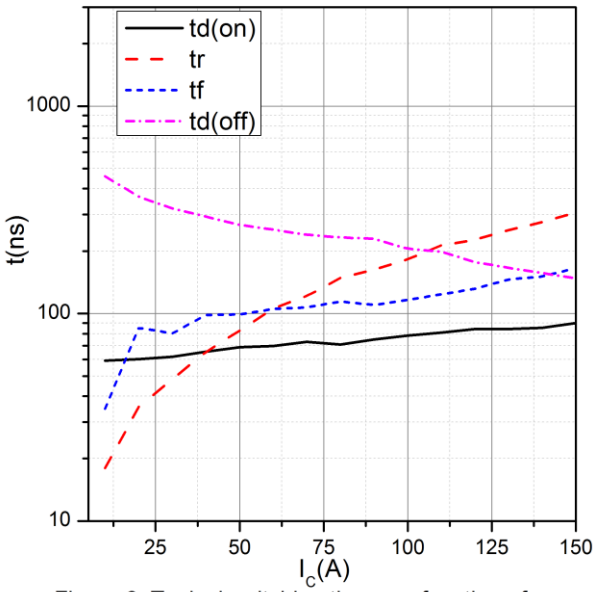



Figure 6. Typical switching times as function of collector current(inductive load,$T_{vj}$=150℃,$V_{CE}$=600V, $V_{GE}$=15/0V,$R_G$=10Ω,Dynamic test circuit in figure E)

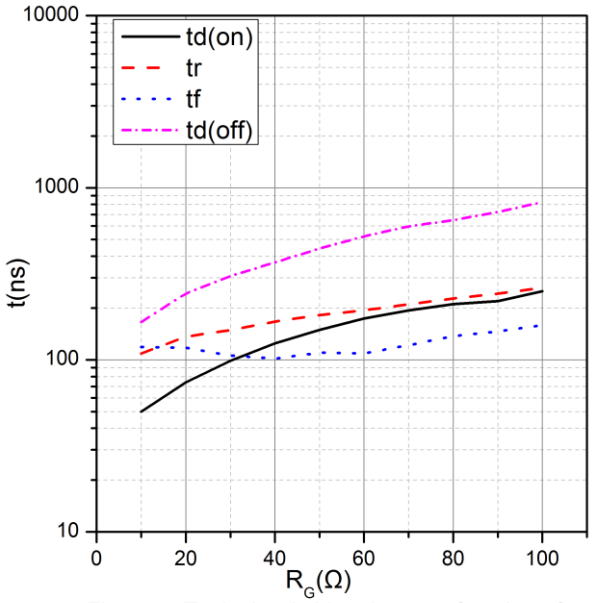



Figure 7. Typical switching times as function of gate resistor(inductive load,$T_{vj}$=150℃,$V_{CE}$=600V, $V_{GE}$=15/0V,$I_C$=40A,Dynamic test circuit in figure E)

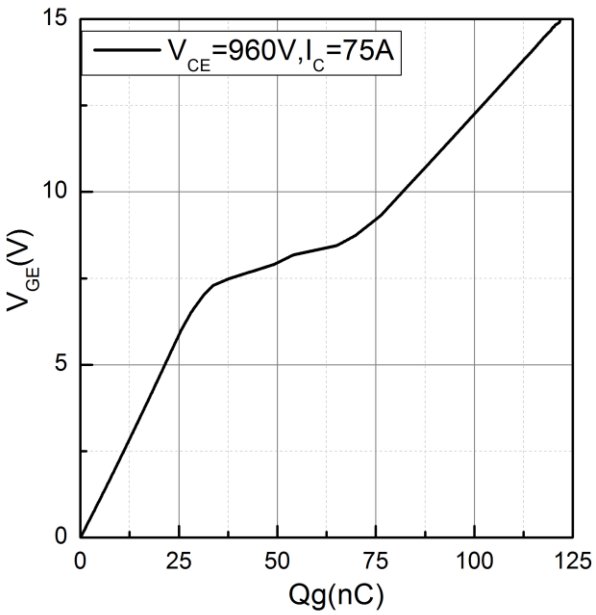



Figure 8. Gate charge characteristic

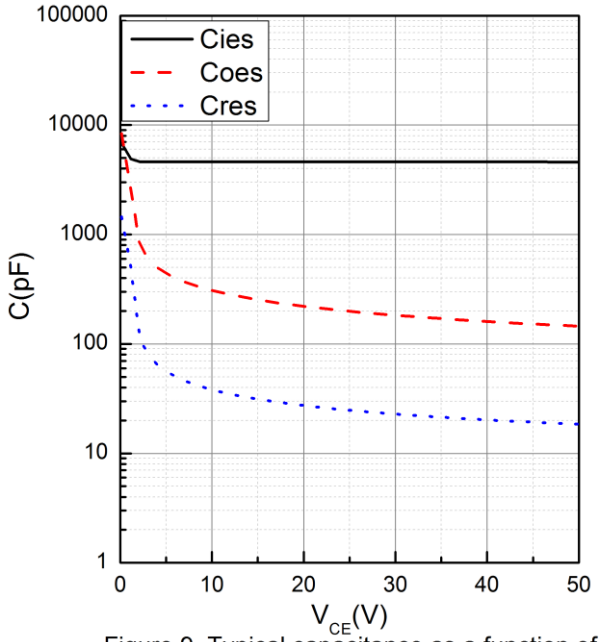



Figure 9. Typical capacitance as a function of collector-emitter voltage($V_{GE}$=0V,f=1MHz)

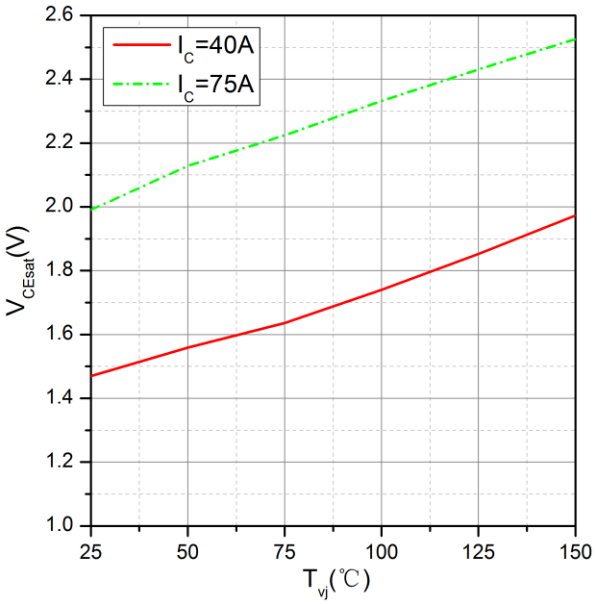



Figure 10. Typical collector-emitter saturation voltage as a function of junction temperature(VGE=15V)

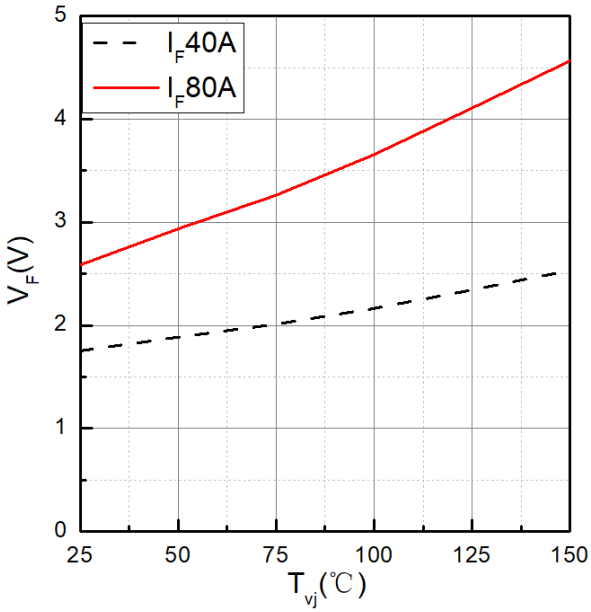



Figure 12. Typical diode forward voltage as a function of junction temperature

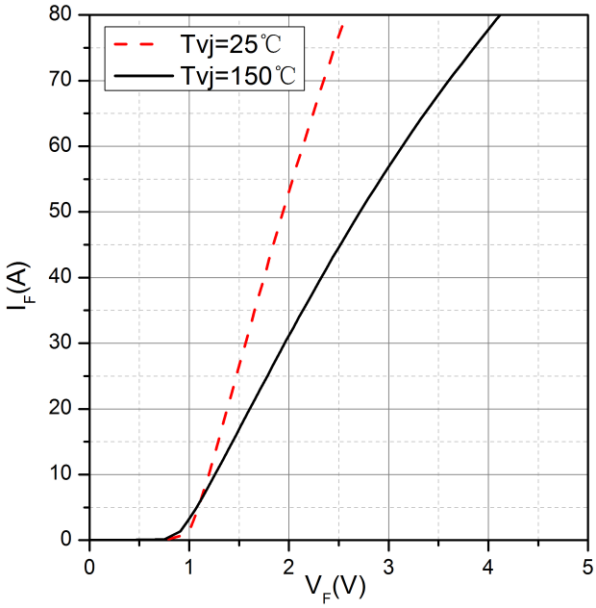



Figure 12. Typical diode forward current as a function of forward voltage

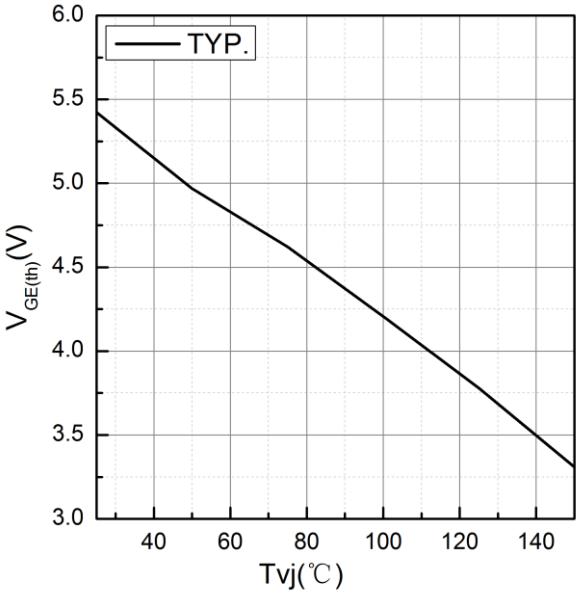



Figure 13. Gate-emitter threshold voltage as a function of junction temperature($I_C$=0.25mA)