

5SJA 3000L520300

StakPak BIGT Module

$$V_{CE} = 5200 \text{ V}$$

$$I_C = 3000 \text{ A}$$

Low-loss, rugged BIGT chip
 Optimized for low switching frequency
 Smooth switching for good EMC
 High tolerance to uneven mounting pressure
 Explosion resistant package
 Remains in low impedance state for up to 1 minute
 after failure*



Maximum rated values ¹⁾

| Parameter | Symbol | Conditions | min | max | Unit |
|----------------------------------|--------------|--|-----|-------|--------------------|
| Collector-emitter voltage | V_{CES} | $V_{GE} = 0 \text{ V}$, $T_{vj} \geq 25 \text{ °C}$ | | 5200 | V |
| DC collector current | I_C | $T_C = 108 \text{ °C}$, $T_{vj} = 125 \text{ °C}$ | | 3000 | A |
| Peak collector current | I_{CM} | $t_p = 1 \text{ ms}$ | | 6000 | A |
| Gate-emitter voltage | V_{GES} | | -20 | 20 | V |
| Total power dissipation | P_{tot} | $T_C = 25 \text{ °C}$, $T_{vj} = 125 \text{ °C}$ | | 55500 | W |
| DC forward current | I_F | | | 3000 | A |
| Peak forward current | I_{FRM} | $t_p = 1 \text{ ms}$ | | 6000 | A |
| Peak diode recovery power | P_{prec} | $V_{CC} \leq 3400 \text{ V}$, $V_{CEM \text{ CHIP}} \leq 5200 \text{ V}$, $T_{vj} = 125 \text{ °C}$, $di/dt = 7.5 \text{ kA}/\mu\text{s}$, $L_G = 150 \text{ nH}$, inductive load | | 7.5 | MW |
| Surge current | I_{FSM} | $V_R = 0 \text{ V}$, $T_{vj} = 125 \text{ °C}$, $V_{GE} = 0 \text{ V}$, $t_p = 10 \text{ ms}$, half-sinewave, 3 times during lifetime | | 42000 | A |
| BIGT turn off SOA (IGBT mode) | RBSOA | $V_{CC} \leq 3400 \text{ V}$, $V_{CEM \text{ CHIP}} \leq 5200 \text{ V}$, $T_{vj} = 125 \text{ °C}$, $V_{GE} = 15 \text{ V}$, $R_G = 1.2 \text{ }\Omega$, $C_{GE} = 330 \text{ nF}$, $L_G = 150 \text{ nH}$, inductive load | | 6000 | A |
| BIGT turn off SOA (IGBT mode) | RBSOA | $V_{CC} \leq 3800 \text{ V}$, $V_{CEM \text{ CHIP}} \leq 5200 \text{ V}$, $T_{vj} = 125 \text{ °C}$, $V_{GE} = 15 \text{ V}$, $R_G = 1.2 \text{ }\Omega$, $C_{GE} = 330 \text{ nF}$, $L_G = 150 \text{ nH}$, inductive load | | 3000 | A |
| BIGT short circuit SOA | t_{psc} | $V_{CC} = 3400 \text{ V}$, $V_{CEM \text{ CHIP}} \leq 5200 \text{ V}$ $V_{GE} \leq 15 \text{ V}$, $T_{vj} \leq 125 \text{ °C}$ | | 10 | μs |
| Junction temperature | T_{vj} | | 5 | 150 | $^{\circ}\text{C}$ |
| Junction operating temperature | $T_{vj(op)}$ | | 5 | 125 | $^{\circ}\text{C}$ |
| Case temperature | T_C | | 5 | 70 | $^{\circ}\text{C}$ |
| Storage temperature | T_{stg} | | -40 | 70 | $^{\circ}\text{C}$ |
| Mounting force ^{2) 3)} | F_M | | 60 | 90 | kN |

¹⁾ Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747

²⁾ For detailed mounting instructions refer to ABB document no. 5SYA 2037-02

³⁾ All electrical characteristics are valid only when the module is clamped

* Functionality is load profile dependent and needs to be agreed upon

IGBT characteristic values ⁴⁾

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|--|----------------------|--|---------------------------------------|-------|-----|---------------|
| Collector (-emitter) breakdown voltage | $V_{(BR)CES}$ | $V_{GE} = 0 \text{ V}$, $I_C = 10 \text{ mA}$, $T_{vj} = 25 \text{ }^\circ\text{C}$ | 5200 | | | V |
| Collector-emitter ⁵⁾ saturation voltage | $V_{CE \text{ sat}}$ | $I_C = 3000 \text{ A}$, $V_{GE} = 15 \text{ V}$ | $T_{vj} = 25 \text{ }^\circ\text{C}$ | 2.73 | | V |
| | | | $T_{vj} = 125 \text{ }^\circ\text{C}$ | 3.13 | | V |
| Collector cut-off current | I_{CES} | $V_{CE} = 5200 \text{ V}$, $V_{GE} = 0 \text{ V}$ | $T_{vj} = 25 \text{ }^\circ\text{C}$ | | 1 | mA |
| | | | $T_{vj} = 125 \text{ }^\circ\text{C}$ | 60 | 120 | mA |
| Gate leakage current | I_{GES} | $V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$, $T_{vj} = 25 \text{ }^\circ\text{C}$ | -750 | | 750 | nA |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $I_C = 480 \text{ mA}$, $V_{CE} = V_{GE}$, $T_{vj} = 25 \text{ }^\circ\text{C}$ | 5.2 | | 7.2 | V |
| Gate charge | Q_G | $I_C = 3000 \text{ A}$, $V_{CE} = 2800 \text{ V}$, $V_{GE} = -15 \text{ V} \dots 15 \text{ V}$ | | 25.5 | | μC |
| Input capacitance | C_{ies} | $V_{CE} = 25 \text{ V}$, $V_{GE} = 0 \text{ V}$, $f = 1 \text{ MHz}$, $T_{vj} = 25 \text{ }^\circ\text{C}$ | | 439 | | nF |
| Output capacitance | C_{oes} | | | 19.9 | | nF |
| Reverse transfer capacitance | C_{res} | | | 30.0 | | nF |
| Internal gate resistor | R_{Gint} | | | 0.104 | | Ω |
| Turn-on delay time | $t_{d(on)}$ | $V_{CC} = 2800 \text{ V}$, $I_C = 3000 \text{ A}$, $R_G = 1.2 \text{ } \Omega$, $C_{GE} = 330 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_\sigma = 150 \text{ nH}$, inductive load | $T_{vj} = 25 \text{ }^\circ\text{C}$ | 760 | | ns |
| | | | $T_{vj} = 125 \text{ }^\circ\text{C}$ | 880 | | ns |
| Rise time | t_r | $V_{CC} = 2800 \text{ V}$, $I_C = 3000 \text{ A}$, $R_G = 1.2 \text{ } \Omega$, $C_{GE} = 330 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_\sigma = 150 \text{ nH}$, inductive load | $T_{vj} = 25 \text{ }^\circ\text{C}$ | 420 | | ns |
| | | | $T_{vj} = 125 \text{ }^\circ\text{C}$ | 420 | | ns |
| Turn-off delay time | $t_{d(off)}$ | $V_{CC} = 2800 \text{ V}$, $I_C = 3000 \text{ A}$, $R_G = 1.2 \text{ } \Omega$, $C_{GE} = 330 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_\sigma = 150 \text{ nH}$, inductive load | $T_{vj} = 25 \text{ }^\circ\text{C}$ | 2760 | | ns |
| | | | $T_{vj} = 125 \text{ }^\circ\text{C}$ | 3040 | | ns |
| Fall time | t_f | $V_{CC} = 2800 \text{ V}$, $I_C = 3000 \text{ A}$, $R_G = 1.2 \text{ } \Omega$, $C_{GE} = 330 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_\sigma = 150 \text{ nH}$, inductive load | $T_{vj} = 25 \text{ }^\circ\text{C}$ | 860 | | ns |
| | | | $T_{vj} = 125 \text{ }^\circ\text{C}$ | 980 | | ns |
| Turn-on switching energy | E_{on} | $V_{CC} = 2800 \text{ V}$, $I_C = 3000 \text{ A}$, $R_G = 1.2 \text{ } \Omega$, $C_{GE} = 330 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_\sigma = 150 \text{ nH}$, inductive load | $T_{vj} = 25 \text{ }^\circ\text{C}$ | 11100 | | mJ |
| | | | $T_{vj} = 125 \text{ }^\circ\text{C}$ | 14200 | | mJ |
| Turn-off switching energy | E_{off} | $V_{CC} = 2800 \text{ V}$, $I_C = 3000 \text{ A}$, $R_G = 1.2 \text{ } \Omega$, $C_{GE} = 330 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_\sigma = 150 \text{ nH}$, inductive load | $T_{vj} = 25 \text{ }^\circ\text{C}$ | 14100 | | mJ |
| | | | $T_{vj} = 125 \text{ }^\circ\text{C}$ | 18500 | | mJ |
| Short circuit current | I_{SC} | $t_{psc} \leq 10 \text{ } \mu\text{s}$, $V_{GE} = 15 \text{ V}$, $V_{CC} = 3400 \text{ V}$, $V_{CEM \text{ CHIP}} \leq 5200 \text{ V}$ | $T_{vj} = 125 \text{ }^\circ\text{C}$ | 18000 | | A |

⁴⁾ Characteristic values according to IEC 60747 - 9

⁵⁾ Collector-emitter saturation voltage is given at chip level

Diode characteristic values ⁶⁾

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|-------------------------------|------------------|---|--------------------------|-------|-----|------|
| Forward voltage ⁷⁾ | V _F | I _F = 3000 A, V _{GE} = 0 V | T _{vj} = 25 °C | 2.29 | | V |
| | | | T _{vj} = 125 °C | 2.52 | | V |
| | | I _F = 3000 A, V _{GE} = 15 V | T _{vj} = 25 °C | 3.47 | | V |
| | | | T _{vj} = 125 °C | 3.63 | | V |
| Peak reverse recovery current | I _{RM} | | T _{vj} = 25 °C | 3800 | | A |
| | | | T _{vj} = 125 °C | 4500 | | A |
| Recovered charge | Q _r | V _{CC} = 2800 V, I _F = 3000 A, V _{GE} = ±15 V, R _G = 1.2 Ω, C _{GE} = 330 nF, di/dt = 6.9 kA/μs L _σ = 150 nH, inductive load | T _{vj} = 25 °C | 5100 | | μC |
| | | | T _{vj} = 125 °C | 7600 | | μC |
| Reverse recovery time | t _{rr} | | T _{vj} = 25 °C | 2680 | | ns |
| | | | T _{vj} = 125 °C | 2840 | | ns |
| Reverse recovery energy | E _{rec} | | T _{vj} = 25 °C | 9500 | | mJ |
| | | | T _{vj} = 125 °C | 14500 | | mJ |

⁶⁾ Characteristic values according to IEC 60747 - 2

⁷⁾ Forward voltage is given at chip level

Package properties

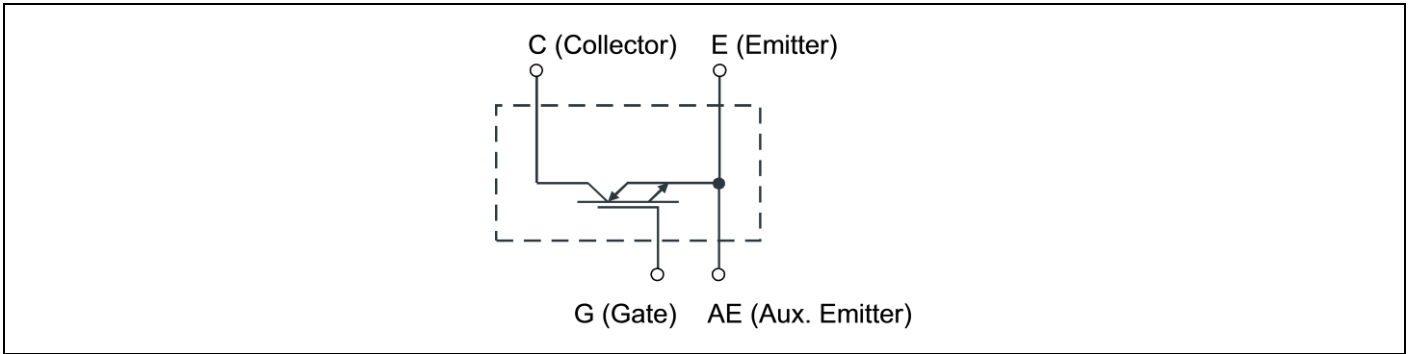
| Parameter | Symbol | Conditions | min | typ | max | Unit |
|--|--------------------------|---|-----|------|------|------|
| BIGT thermal resistance junction to case | R _{th(j-c)IGBT} | | | | 2.10 | K/kW |
| BIGT thermal resistance ²⁾ case to heatsink | R _{th(c-h)IGBT} | Heatsink flatness : Complete module area < 100 μm Each submodule area < 20 μm Roughness : < 1.6 μm | | 0.55 | | K/kW |
| Comparative tracking index | CTI | | 600 | | | |

²⁾ for detailed mounting instructions refer to ABB Document No. 5SYA 2037-02

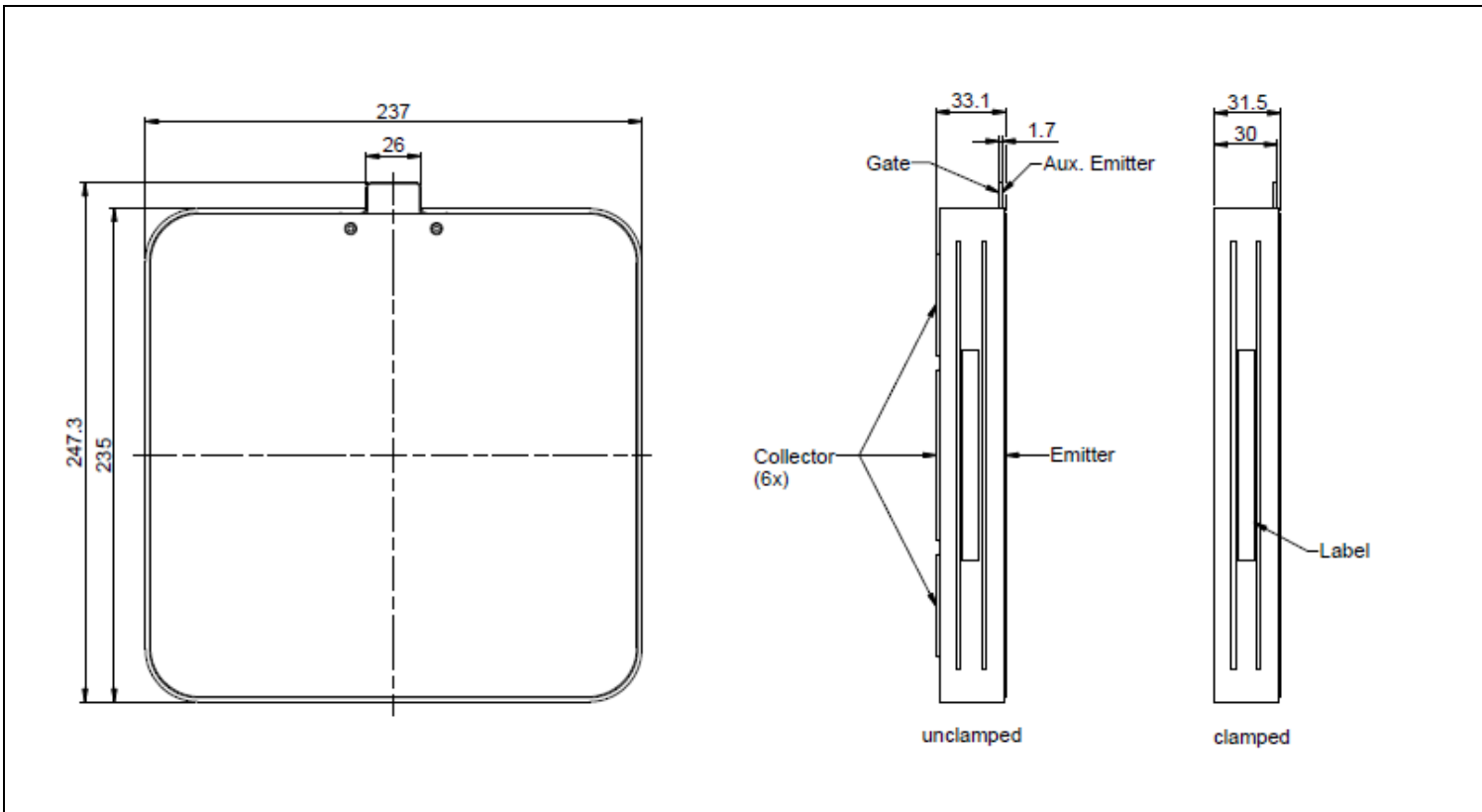
Mechanical properties

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---------------------------|----------------|---|------------------|------------------|-----|------|
| Dimensions | L x W x H | Typical | device clamped | 237 x 250 x 31.5 | | mm |
| | | | device unclamped | 237 x 250 x 33.2 | | |
| Clearance distance in air | d _a | according to IEC 60664-1 and EN 50124-1 | 23 | | | mm |
| Surface creepage distance | d _s | according to IEC 60664-1 and EN 50124-1 | 30 | | | mm |
| Mass | m | | | 4030 | | g |

Electrical configuration



Outline drawing ²⁾



Note: all dimensions are shown in millimeters

²⁾ For detailed mounting instructions refer to ABB Document No. 5SYA 2039

This is an electrostatic sensitive device; please observe the international standard IEC 60747-1, chap. VIII.
This product has been designed and qualified for Industrial Level.

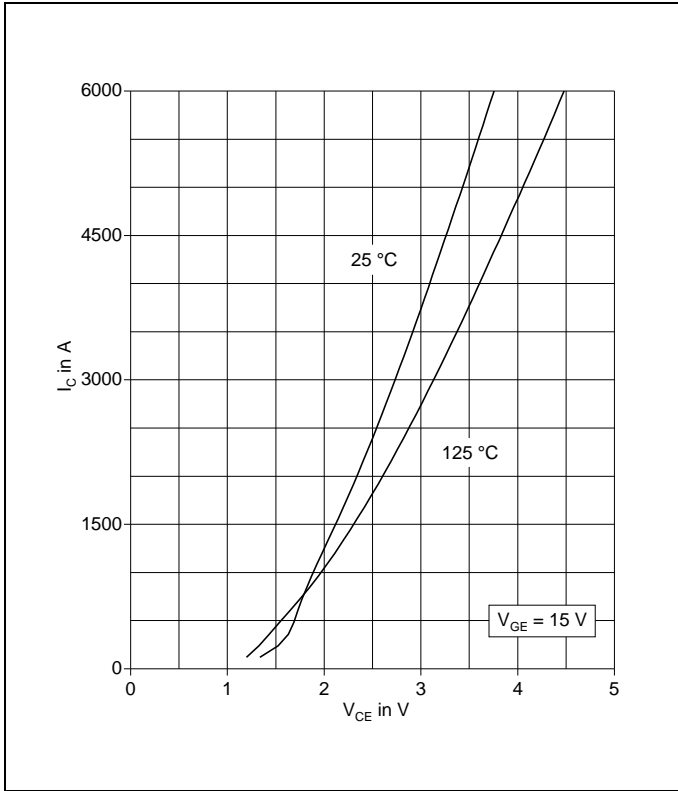


Fig. 1 Typical on-state characteristics, chip level

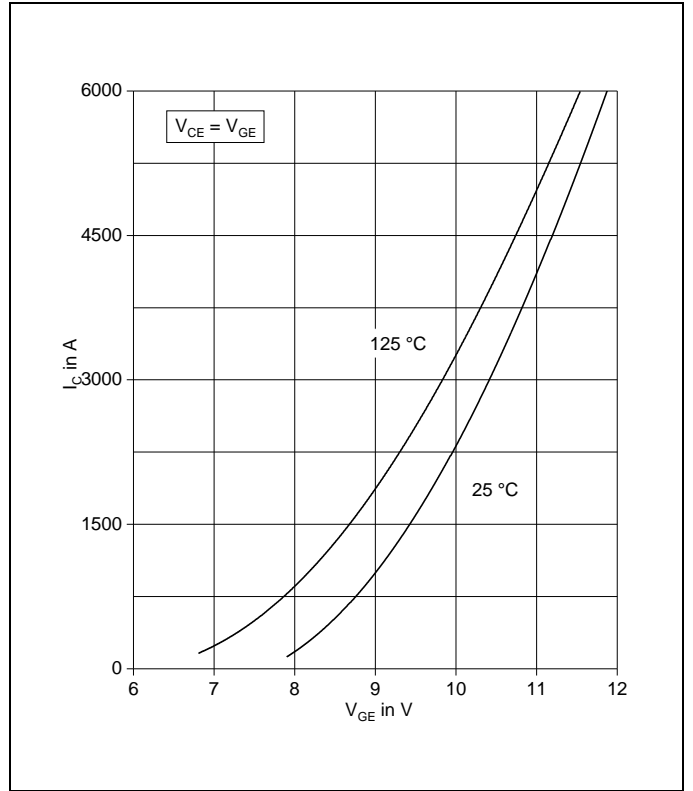


Fig. 2 Typical transfer characteristics, chip level

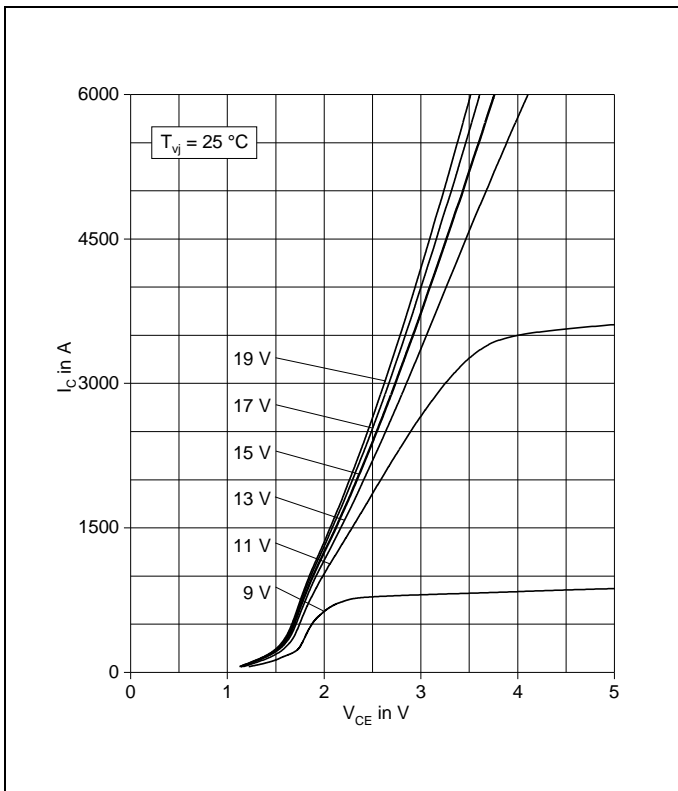


Fig. 3 Typical output characteristics, chip level

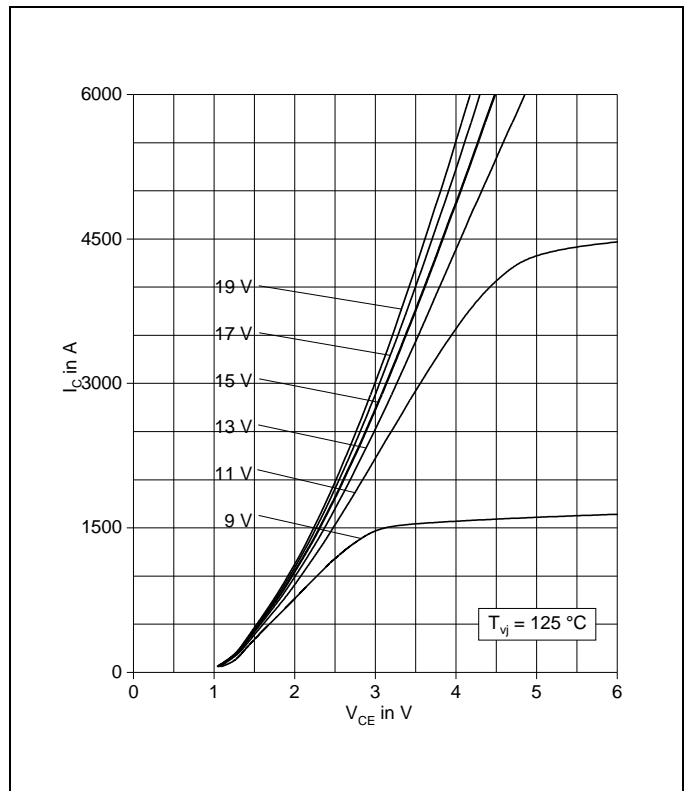


Fig. 4 Typical output characteristics, chip level

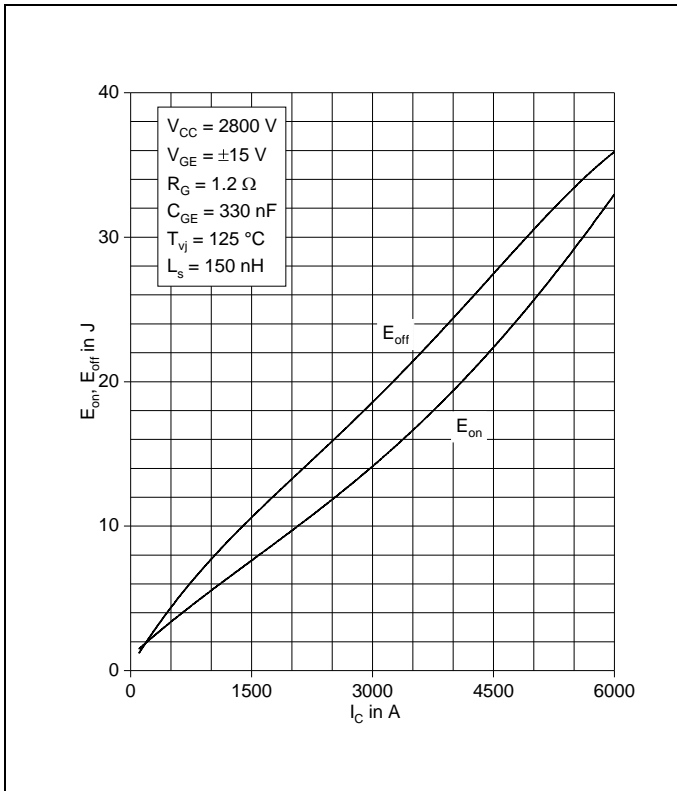


Fig. 5 Typical switching energies per pulse vs. collector current

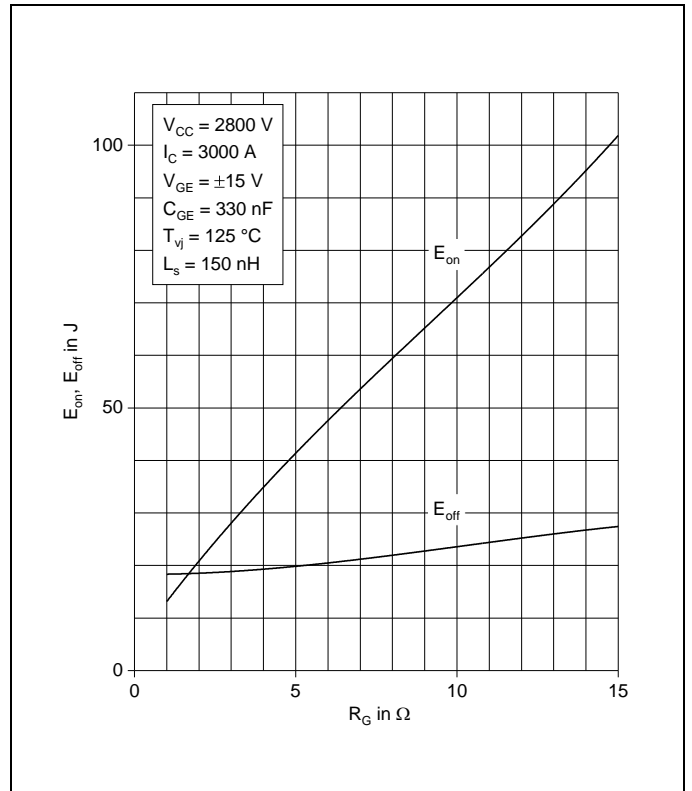


Fig. 6 Typical switching energies per pulse vs. gate resistor

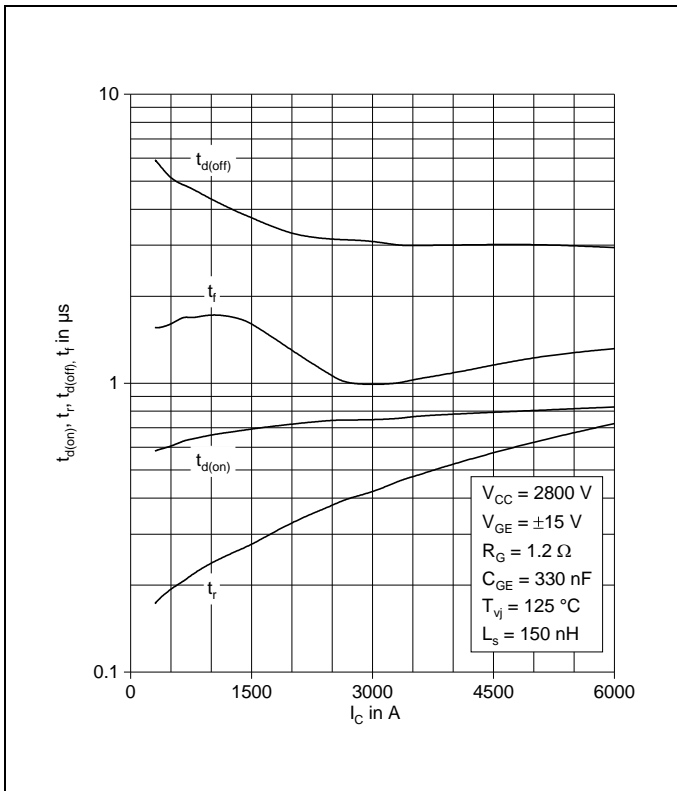


Fig. 7 Typical switching times vs. collector current

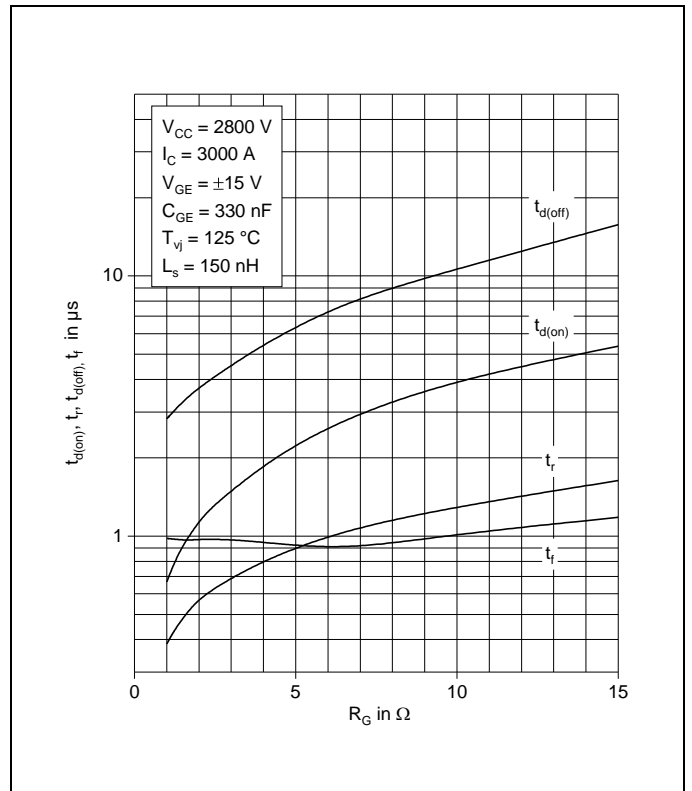


Fig. 8 Typical switching times vs. gate resistor

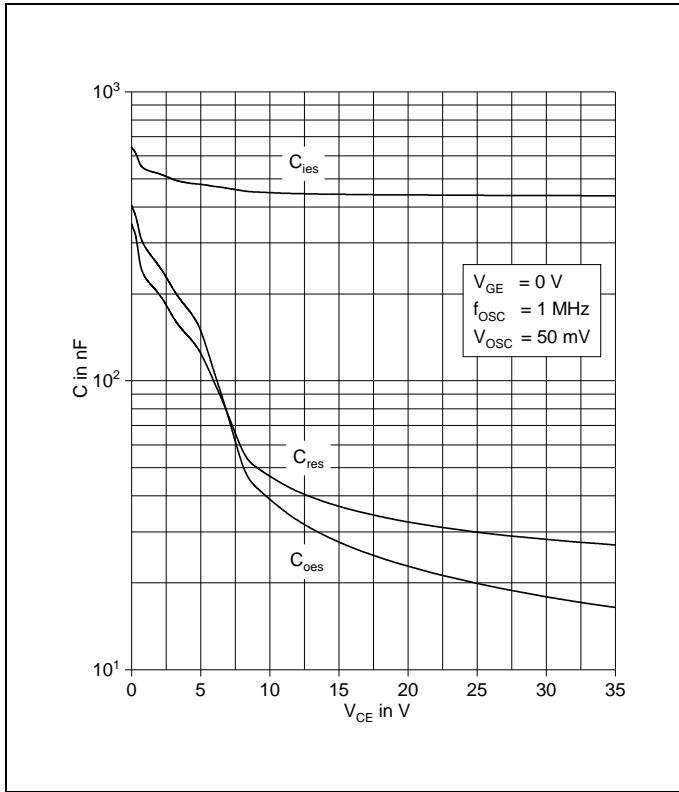


Fig. 9 Typical capacitances vs. collector-emitter voltage

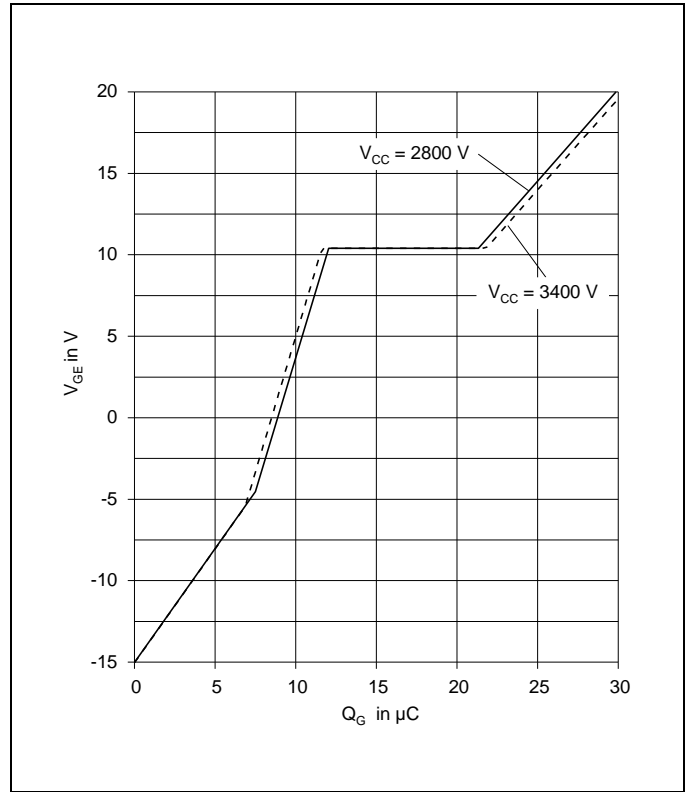


Fig. 10 Typical gate charge characteristics

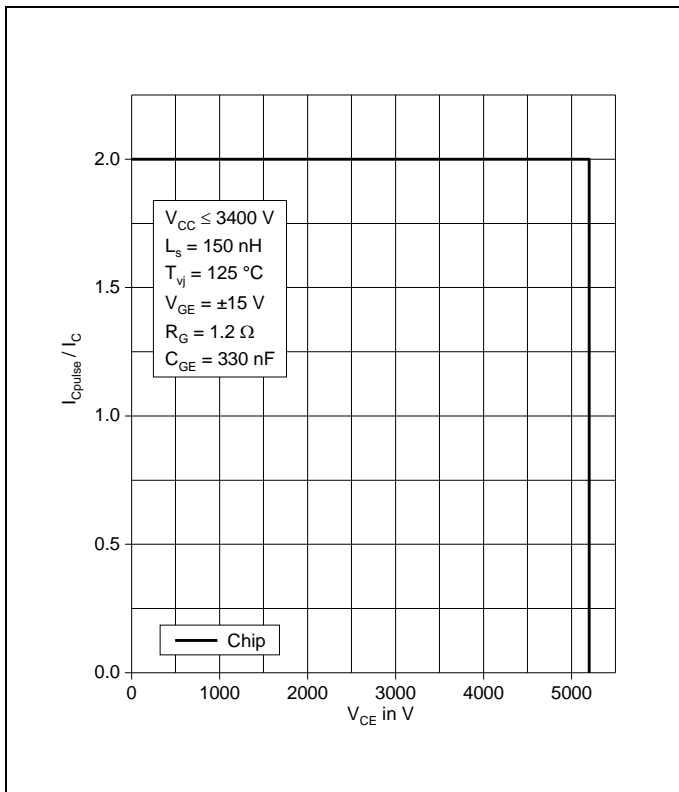


Fig. 11 Turn-off safe operating area (RBSOA)

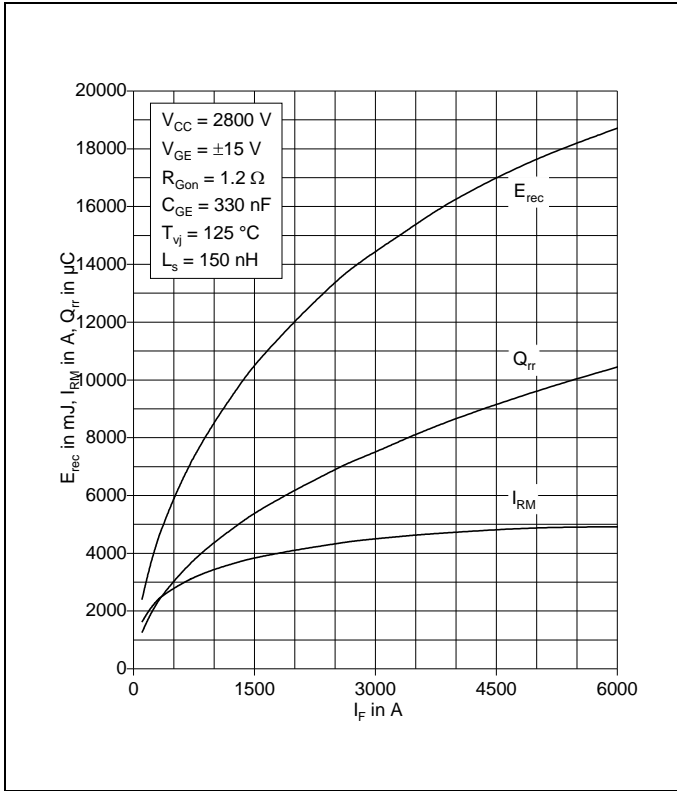


Fig. 12 Typical reverse recovery characteristics vs. forward current

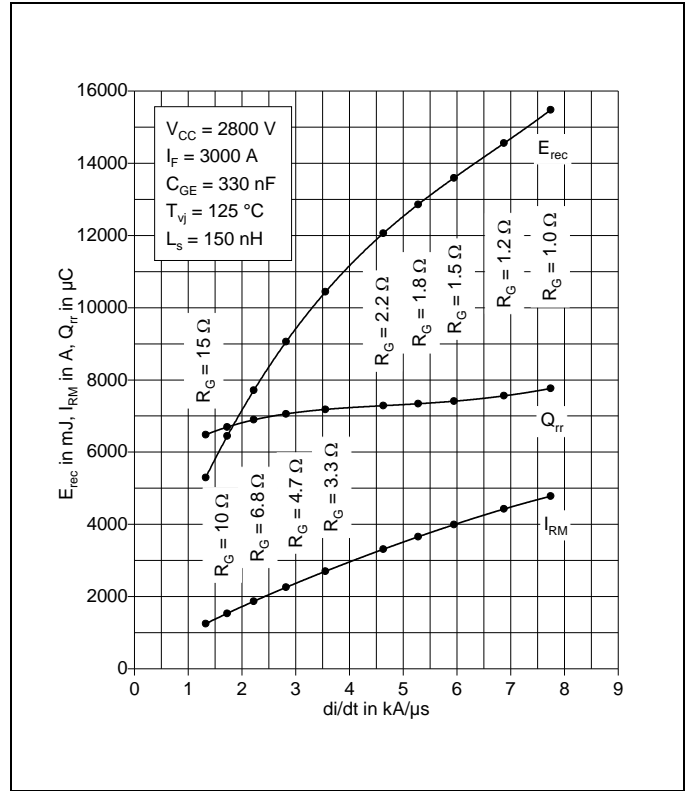


Fig. 13 Typical reverse recovery characteristics vs. di/dt

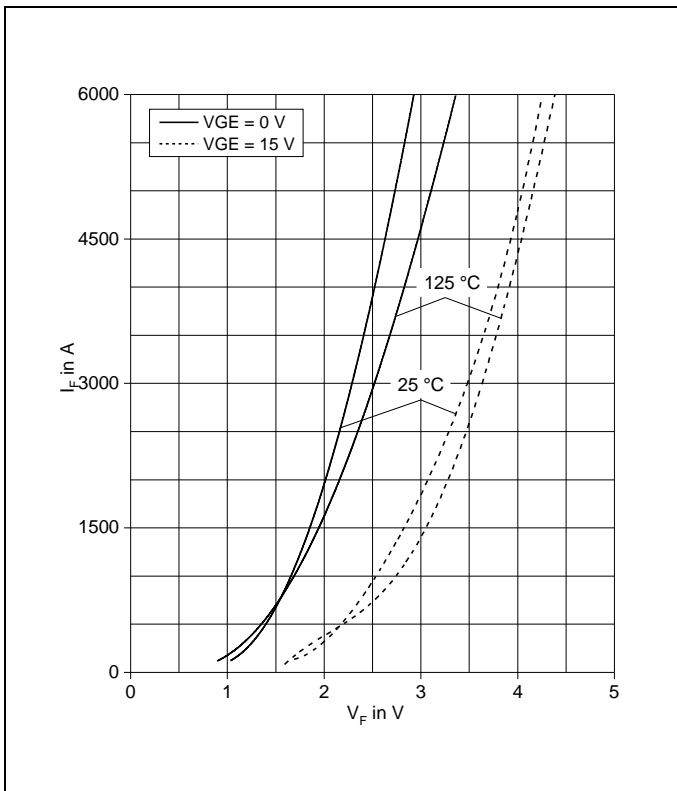


Fig. 14 Typical diode forward characteristics chip level

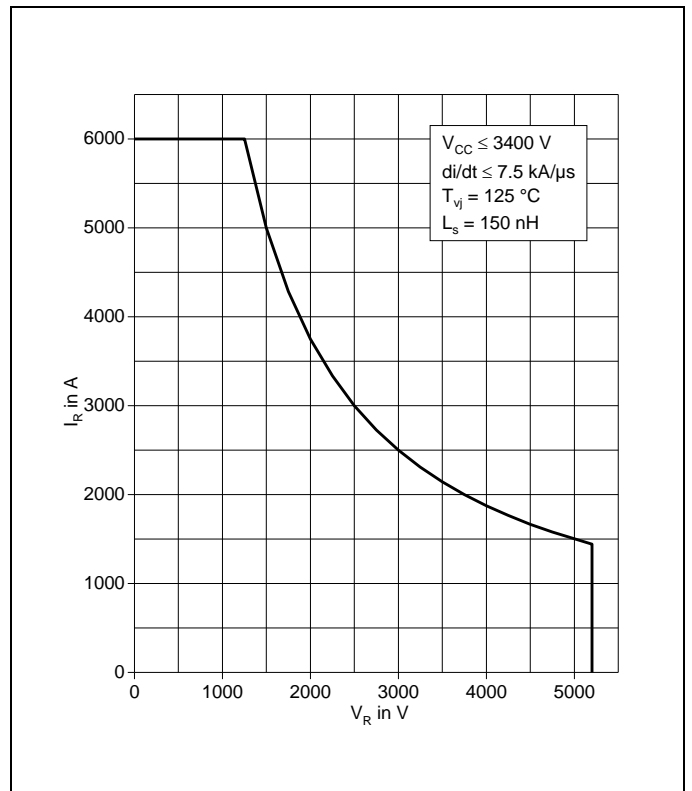


Fig. 15 Safe operating area diode (SOA)

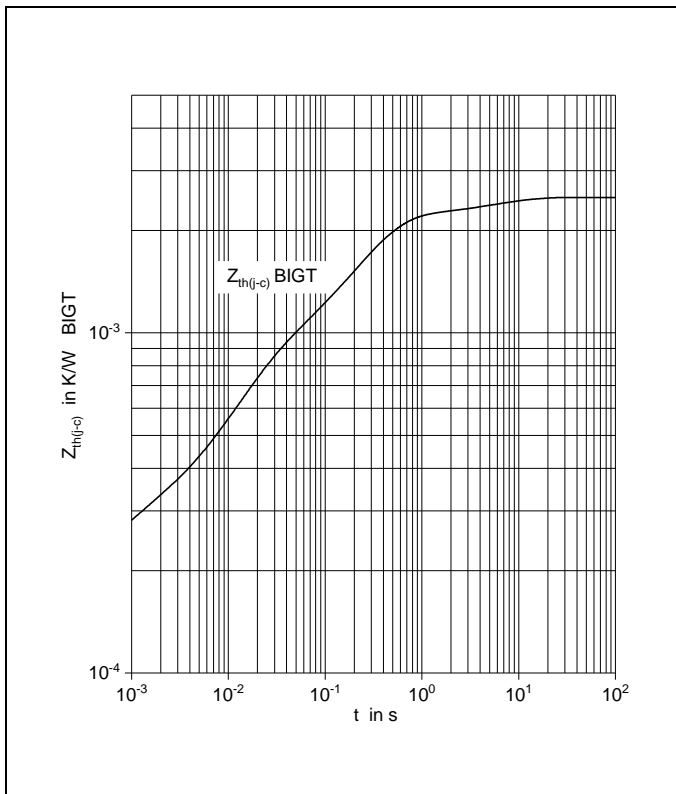


Fig. 16 Thermal impedance vs. time

Analytical function for transient thermal impedance:

$$Z_{th(j-c)}(t) = \sum_{i=1}^n R_i (1 - e^{-t/\tau_i})$$

| i | 1 | 2 | 3 | 4 |
|------------------------|--------|--------|--------|--------|
| R _i in K/kW | 0.265 | 0.546 | 1.393 | 0.299 |
| τ _i in s | 0.0004 | 0.0168 | 0.2862 | 6.0189 |

Related documents:

- 5SYA 2045 Thermal runaway during blocking
- 5SYA 2053 Applying IGBT
- 5SYA 2093 Thermal design of IGBT modules

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[FD401R17KF6C_B2](#) [FD-DF80R12W1H3_B52](#) [FF200R06YE3](#) [FF450R12ME4P](#) [FF600R12IP4V](#) [FP06R12W1T4_B3](#) [FP10R06W1E3_B11](#)
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[FS150R17PE4](#)