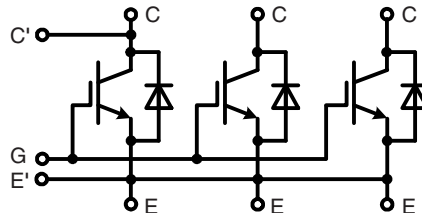


# IGBT Module

## Single switch

Short Circuit SOA Capability  
Square RBSOA

$$\begin{aligned} I_{C80} &= 1200 \text{ A} \\ V_{CES} &= 2500 \text{ V} \\ V_{CE(sat) \text{ typ.}} &= 2.5 \text{ V} \end{aligned}$$



### IGBT

| Symbol    | Conditions                                                                                                                        | Maximum Ratings |               |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------|
| $V_{CES}$ | $V_{GE} = 0 \text{ V}$                                                                                                            | 2500            | V             |
| $V_{GES}$ |                                                                                                                                   | $\pm 20$        | V             |
| $I_{C80}$ | $T_C = 80^\circ\text{C}$                                                                                                          | 1200            | A             |
| $I_{CM}$  | $t_p = 1 \text{ ms}; T_C = 80^\circ\text{C}$                                                                                      | 2400            | A             |
| $t_{SC}$  | $V_{CC} = 1800 \text{ V}; V_{CEM \text{ CHIP}} \leq 2500 \text{ V};$<br>$V_{GE} \leq 15 \text{ V}; T_{VJ} \leq 125^\circ\text{C}$ | 10              | $\mu\text{s}$ |

| Symbol                                                                 | Conditions                                                                                                                                                               | Characteristic Values<br>( $T_{VJ} = 25^\circ\text{C}$ , unless otherwise specified) |                                          |                                  |
|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------|----------------------------------|
|                                                                        |                                                                                                                                                                          | min.                                                                                 | typ.                                     | max.                             |
| $V_{CE(sat)} \star$                                                    | $I_C = 1200 \text{ A}; V_{GE} = 15 \text{ V}; T_{VJ} = 25^\circ\text{C}$<br>$T_{VJ} = 125^\circ\text{C}$                                                                 |                                                                                      | 2.5<br>3.1                               | V<br>V                           |
| $V_{GE(th)}$                                                           | $I_C = 240 \text{ mA}; V_{CE} = V_{GE}$                                                                                                                                  | 6                                                                                    |                                          | 7.5 V                            |
| $I_{CES}$                                                              | $V_{CE} = 2500 \text{ V}; V_{GE} = 0 \text{ V}; T_{VJ} = 125^\circ\text{C}$                                                                                              |                                                                                      |                                          | 120 mA                           |
| $I_{GES}$                                                              | $V_{CE} = 0 \text{ V}; V_{GE} = \pm 20 \text{ V}; T_{VJ} = 125^\circ\text{C}$                                                                                            |                                                                                      |                                          | 500 nA                           |
| $t_{d(on)}$<br>$t_r$<br>$t_{d(off)}$<br>$t_f$<br>$E_{on}$<br>$E_{off}$ | Inductive load; $T_{VJ} = 125^\circ\text{C}; V_{GE} = \pm 15 \text{ V};$<br>$V_{CC} = 1250 \text{ V}; I_C = 1200 \text{ A}; R_G = 1.5 \Omega; L_\sigma = 100 \text{ nH}$ |                                                                                      | 365<br>250<br>980<br>345<br>1150<br>1250 | ns<br>ns<br>ns<br>ns<br>mJ<br>mJ |
| $C_{ies}$<br>$C_{oes}$<br>$C_{res}$                                    |                                                                                                                                                                          |                                                                                      | 186<br>13.7<br>3.0                       | nF<br>nF<br>nF                   |
| $Q_{ge}$                                                               |                                                                                                                                                                          |                                                                                      | 12.2                                     | $\mu\text{C}$                    |
| $R_{thJC}$                                                             |                                                                                                                                                                          |                                                                                      |                                          | 0.009 K/W                        |

★ Collector emitter saturation voltage is given at chip level

IXYS reserves the right to change limits, test conditions and dimensions.

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### Features

- NPT<sup>3</sup> IGBT
  - Low-loss
  - Smooth switching waveforms for good EMC
- Industry standard package
  - High power density
  - AISiC base-plate for high power cycling capacity
  - AlN substrate for low thermal resistance

### Typical Applications

- AC power converters for
  - industrial drives
  - windmills
  - traction
- LASER pulse generator

## Diode

| Symbol    | Conditions                                                                               | Maximum Ratings |   |
|-----------|------------------------------------------------------------------------------------------|-----------------|---|
| $I_{F80}$ | $T_C = 80^\circ\text{C}$                                                                 | 1200            | A |
| $I_{FSM}$ | $V_R = 0\text{ V}; T_{VJ} = 125^\circ\text{C}; t_p = 10\text{ ms}; \text{half-sinewave}$ | 11000           | A |

| Symbol                                        | Conditions                                                                                                                                                                | Characteristic Values |                            |                                |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------------|--------------------------------|
|                                               |                                                                                                                                                                           | min.                  | typ.                       | max.                           |
| $V_F *$                                       | $I_F = 1200\text{ A}; T_{VJ} = 25^\circ\text{C}$<br>$T_{VJ} = 125^\circ\text{C}$                                                                                          |                       | 1.75<br>1.8                | V<br>V                         |
| $I_{RM}$<br>$t_{rr}$<br>$Q_{RR}$<br>$E_{rec}$ | $V_{CC} = 1250\text{ V}; I_C = 1200\text{ A};$<br>$V_{GE} = \pm 15\text{ V}; R_G = 1.5\ \Omega; T_{VJ} = 125^\circ\text{C}$<br>Inductive load; $L_\sigma = 100\text{ nH}$ |                       | 1180<br>970<br>1150<br>990 | A<br>ns<br>$\mu\text{C}$<br>mJ |
| $R_{thJC}$                                    |                                                                                                                                                                           |                       |                            | 0.017 K/W                      |

\* Forward voltage is given at chip level

## Module

| Symbol     | Conditions                | Maximum Ratings                                       |                       |
|------------|---------------------------|-------------------------------------------------------|-----------------------|
| $T_{JM}$   | max. junction temperature | +150                                                  | $^\circ\text{C}$      |
| $T_{VJ}$   | Operating temperature     | -40...+125                                            | $^\circ\text{C}$      |
| $T_{stg}$  | Storage temperature       | -40...+125                                            | $^\circ\text{C}$      |
| $V_{ISOL}$ | 50 Hz                     | 5000                                                  | V~                    |
| $M_d$      | Mounting torque           | Base-heatsink, M6 screws<br>Main terminals, M8 screws | 4 - 6 Nm<br>8 - 10 Nm |

| Symbol               | Conditions                                     | Characteristic Values                    |          |            |
|----------------------|------------------------------------------------|------------------------------------------|----------|------------|
|                      |                                                | min.                                     | typ.     | max.       |
| $d_A$                | Clearance distance                             | terminal to base<br>terminal to terminal | 23<br>19 | mm<br>mm   |
| $d_S$                | Surface creepage distance                      | terminal to base<br>terminal to terminal | 33<br>33 | mm<br>mm   |
| $L_\sigma$           | Module stray inductance, C to E terminal       |                                          | 10       | nH         |
| $R_{term-chip}^{*)}$ | Resistance terminal to chip                    |                                          | 0.085    | m $\Omega$ |
| $R_{thCH}$           | per module; $\lambda$ grease = 1 W/m $\cdot$ K |                                          | 0.006    | K/W        |
| Weight               |                                                |                                          | 1500     | g          |

\*)  $V = V_{CE(sat)} + R_{term-chip} \cdot I_C$  resp.  $V = V_F + R_{term-chip} \cdot I_F$

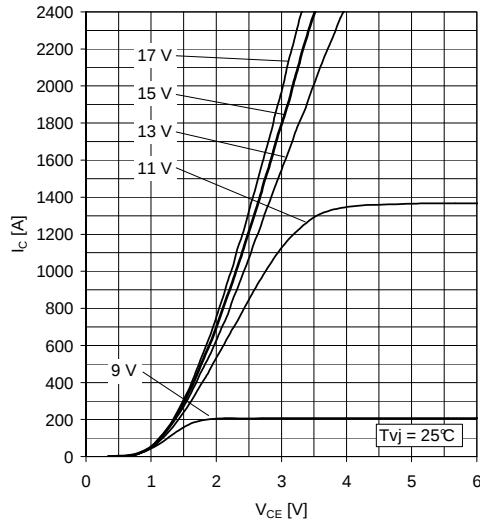


Fig. 1 Typical output characteristics, chip level

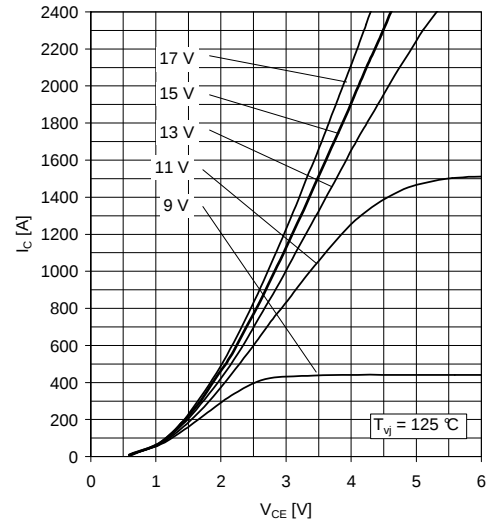


Fig. 2 Typical output characteristics, chip level

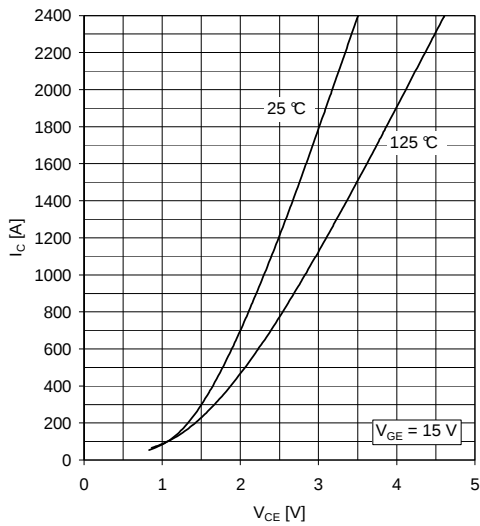


Fig. 3 Typical onstate characteristics, chip level

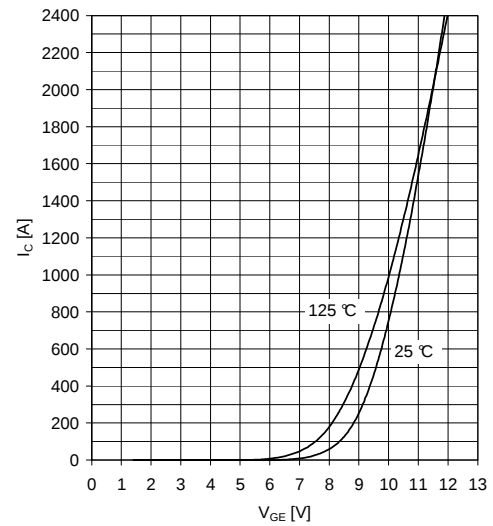


Fig. 4 Typical transfer characteristics, chip level

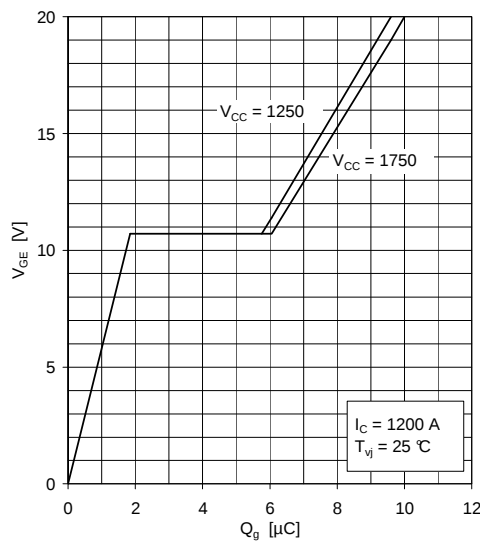


Fig. 5 Typical gate charge characteristics

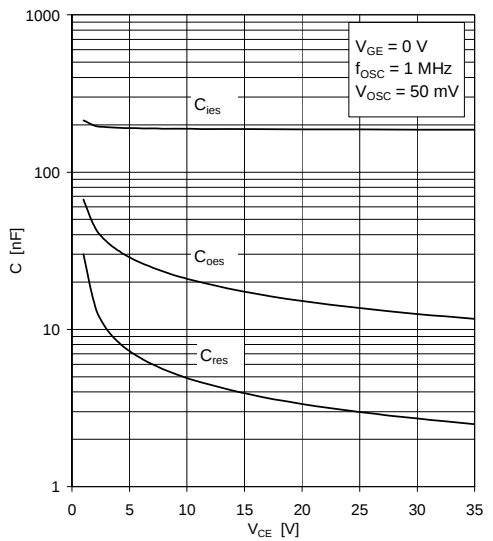


Fig. 6 Typical capacitances vs collector-emitter voltage

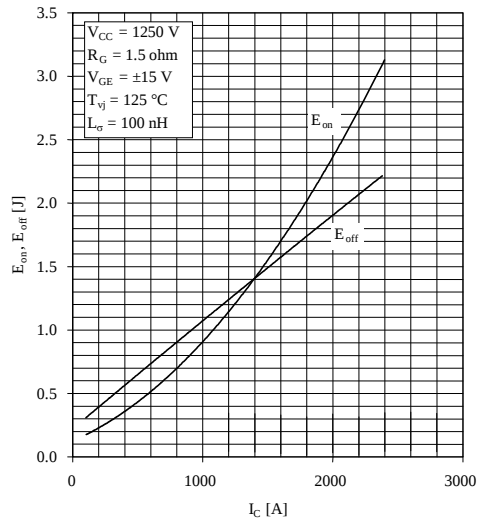


Fig. 7 Typical switching energies per pulse vs collector current

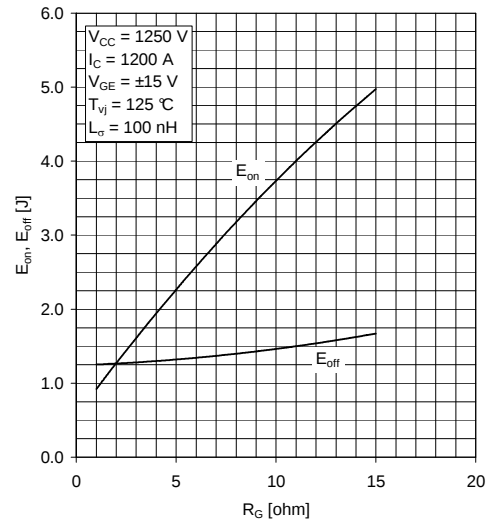


Fig. 8 Typical switching energies per pulse vs gate resistor

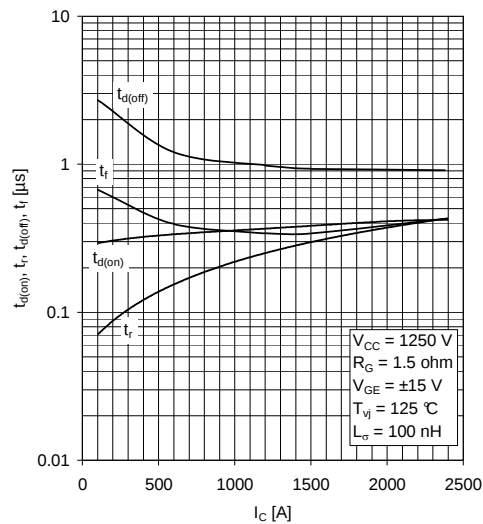


Fig. 9 Typical switching times vs collector current

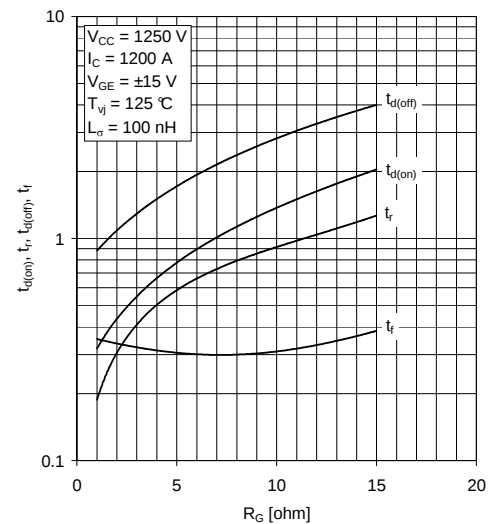


Fig. 10 Typical switching times vs gate resistor

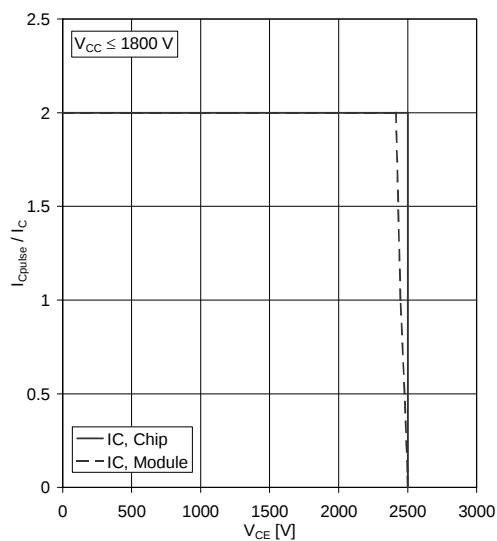


Fig. 11 Turn-off safe operating area (RBSOA)

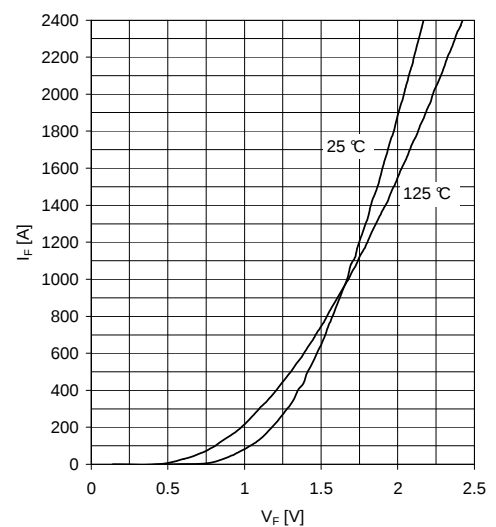


Fig. 12 Typical diode forward characteristics, chip level

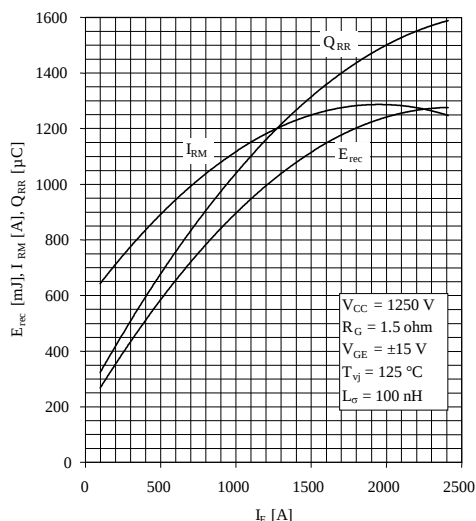


Fig. 13 Typical reverse recovery characteristics vs forward current

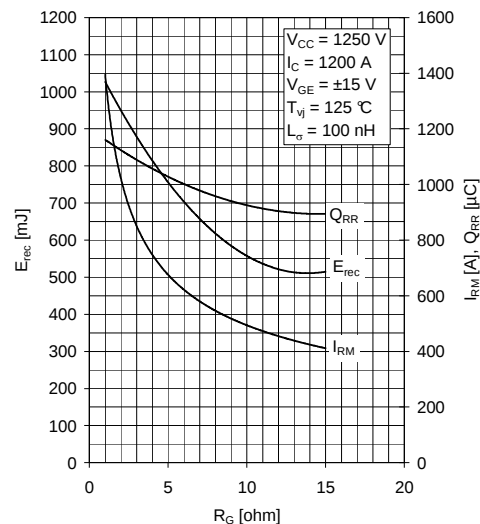


Fig. 14 Typical reverse recovery characteristics vs gate resistor

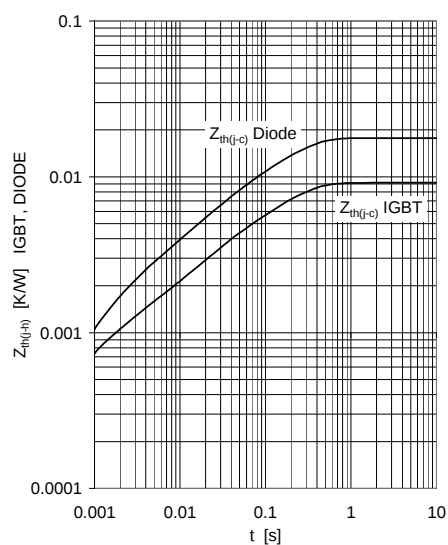


Fig. 15 Thermal impedance vs time

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

|       |  | i             | 1    | 2    | 3     | 4     |
|-------|--|---------------|------|------|-------|-------|
| IGBT  |  | Ri(K/kW)      | 5.97 | 1.99 | 0.619 | 0.465 |
|       |  | $\tau_i$ (ms) | 179  | 22   | 2.4   | 0.54  |
| DIODE |  | Ri(K/kW)      | 11.1 | 3.36 | 1.27  | 1.34  |
|       |  | $\tau_i$ (ms) | 189  | 30   | 7.4   | 1.4   |

Note: all dimensions are shown in mm