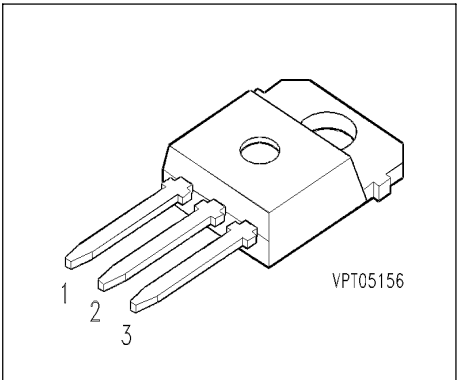


IGBT

- Low forward voltage drop
- High switching speed
- Low tail current
- Latch-up free
- Avalanche rated



| Pin 1 | Pin 2 | Pin 3 |
|-------|-------|-------|
| G     | C     | E     |

| Type    | $V_{CE}$ | $I_C$ | Package   | Ordering Code   |
|---------|----------|-------|-----------|-----------------|
| BUP 312 | 1200V    | 12A   | TO-218 AB | Q67040-A4209-A2 |

Maximum Ratings

| Parameter                                                                 | Symbol      | Values        | Unit               |
|---------------------------------------------------------------------------|-------------|---------------|--------------------|
| Collector-emitter voltage                                                 | $V_{CE}$    | 1200          | V                  |
| Collector-gate voltage                                                    | $V_{CGR}$   | 1200          |                    |
| $R_{GE} = 20\text{ k}\Omega$                                              |             |               |                    |
| Gate-emitter voltage                                                      | $V_{GE}$    | $\pm 20$      |                    |
| DC collector current                                                      | $I_C$       | 12            | A                  |
| $T_C = 25\text{ }^{\circ}\text{C}$                                        |             |               |                    |
| $T_C = 90\text{ }^{\circ}\text{C}$                                        |             |               |                    |
| Pulsed collector current, $t_p = 1\text{ ms}$                             | $I_{Cpuls}$ | 24            |                    |
| $T_C = 25\text{ }^{\circ}\text{C}$                                        |             |               |                    |
| $T_C = 90\text{ }^{\circ}\text{C}$                                        |             |               |                    |
| Avalanche energy, single pulse                                            | $E_{AS}$    | 10            | mJ                 |
| $I_C = 5\text{ A}$ , $V_{CC} = 24\text{ V}$ , $R_{GE} = 25\text{ }\Omega$ |             |               |                    |
| $L = 3.3\text{ mH}$ , $T_j = 25\text{ }^{\circ}\text{C}$                  |             |               |                    |
| Power dissipation                                                         | $P_{tot}$   | 125           | W                  |
| $T_C = 25\text{ }^{\circ}\text{C}$                                        |             |               |                    |
| Chip or operating temperature                                             | $T_j$       | -55 ... + 150 | $^{\circ}\text{C}$ |
| Storage temperature                                                       | $T_{stg}$   | -55 ... + 150 |                    |

## Maximum Ratings

| Parameter                           | Symbol | Values        | Unit |
|-------------------------------------|--------|---------------|------|
| DIN humidity category, DIN 40 040   | -      | E             | -    |
| IEC climatic category, DIN IEC 68-1 | -      | 55 / 150 / 56 |      |

## Thermal Resistance

|                               |            |          |     |
|-------------------------------|------------|----------|-----|
| Thermal resistance, chip case | $R_{thJC}$ | $\leq 1$ | K/W |
|-------------------------------|------------|----------|-----|

## Electrical Characteristics, at $T_j = 25\text{ °C}$ , unless otherwise specified

| Parameter | Symbol | Values |      |      | Unit |
|-----------|--------|--------|------|------|------|
|           |        | min.   | typ. | max. |      |

## Static Characteristics

|                                                                                                          |               |     |     |     |               |
|----------------------------------------------------------------------------------------------------------|---------------|-----|-----|-----|---------------|
| Gate threshold voltage<br>$V_{GE} = V_{CE}, I_C = 0.3\text{ mA}, T_j = 25\text{ °C}$                     | $V_{GE(th)}$  | 4.5 | 5.5 | 6.5 | V             |
| Collector-emitter saturation voltage<br>$V_{GE} = 15\text{ V}, I_C = 5\text{ A}, T_j = 25\text{ °C}$     | $V_{CE(sat)}$ | -   | 2.8 | 3.3 |               |
| $V_{GE} = 15\text{ V}, I_C = 5\text{ A}, T_j = 125\text{ °C}$                                            |               | -   | 3.8 | 4.3 |               |
| $V_{GE} = 15\text{ V}, I_C = 5\text{ A}, T_j = 150\text{ °C}$                                            |               | -   | 4   | 4.5 |               |
| Zero gate voltage collector current<br>$V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}, T_j = 25\text{ °C}$ | $I_{CES}$     | -   | 1   | 100 | $\mu\text{A}$ |
| $V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}, T_j = 125\text{ °C}$                                       |               | -   | -   | 300 |               |
| Gate-emitter leakage current<br>$V_{GE} = 20\text{ V}, V_{CE} = 0\text{ V}$                              | $I_{GES}$     | -   | 0.1 | 100 | nA            |

## AC Characteristics

|                                                                                               |           |     |     |     |    |
|-----------------------------------------------------------------------------------------------|-----------|-----|-----|-----|----|
| Transconductance<br>$V_{CE} = 20\text{ V}, I_C = 1.5\text{ A}$                                | $g_{fs}$  | 1.7 | 2.5 | -   | S  |
| Input capacitance<br>$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$            | $C_{iss}$ | -   | 650 | 870 | pF |
| Output capacitance<br>$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$           | $C_{oss}$ | -   | 50  | 80  |    |
| Reverse transfer capacitance<br>$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$ | $C_{rss}$ | -   | 20  | 30  |    |

**Electrical Characteristics**, at  $T_j = 25\text{ °C}$ , unless otherwise specified

| Parameter | Symbol | Values |      |      | Unit |
|-----------|--------|--------|------|------|------|
|           |        | min.   | typ. | max. |      |

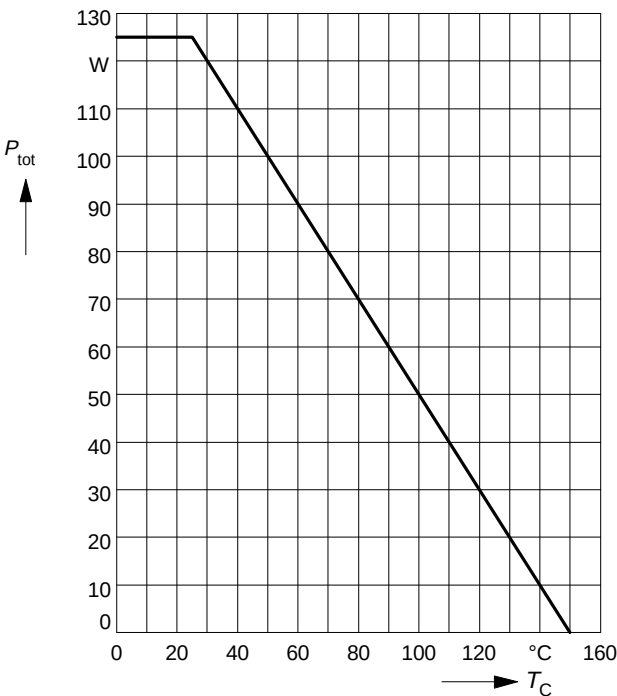
**Switching Characteristics, Inductive Load at  $T_j = 125\text{ °C}$**

|                                                                                                                                                              |              |   |     |     |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---|-----|-----|-----|
| Turn-on delay time<br>$V_{CC} = 600\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 5\text{ A}$<br>$R_{Gon} = 68\text{ }\Omega$                                  | $t_{d(on)}$  | - | 30  | 50  | ns  |
| Rise time<br>$V_{CC} = 600\text{ V}$ , $V_{GE} = 15\text{ V}$ , $I_C = 5\text{ A}$<br>$R_{Gon} = 68\text{ }\Omega$                                           | $t_r$        | - | 20  | 30  |     |
| Turn-off delay time<br>$V_{CC} = 600\text{ V}$ , $V_{GE} = -15\text{ V}$ , $I_C = 5\text{ A}$<br>$R_{Goff} = 68\text{ }\Omega$                               | $t_{d(off)}$ | - | 180 | 270 |     |
| Fall time<br>$V_{CC} = 600\text{ V}$ , $V_{GE} = -15\text{ V}$ , $I_C = 5\text{ A}$<br>$R_{Goff} = 68\text{ }\Omega$                                         | $t_f$        | - | 15  | 25  |     |
| Total turn-off loss energy<br>$V_{CC} = 600\text{ V}$ , $V_{GE} = -15\text{ V}$ , $I_C = 5\text{ A}$<br>$R_{Goff} = 68\text{ }\Omega$ , $T_j = 25\text{ °C}$ | $E_{off}$    | - | 0.7 | -   | mWs |

### Power dissipation

$$P_{\text{tot}} = f(T_C)$$

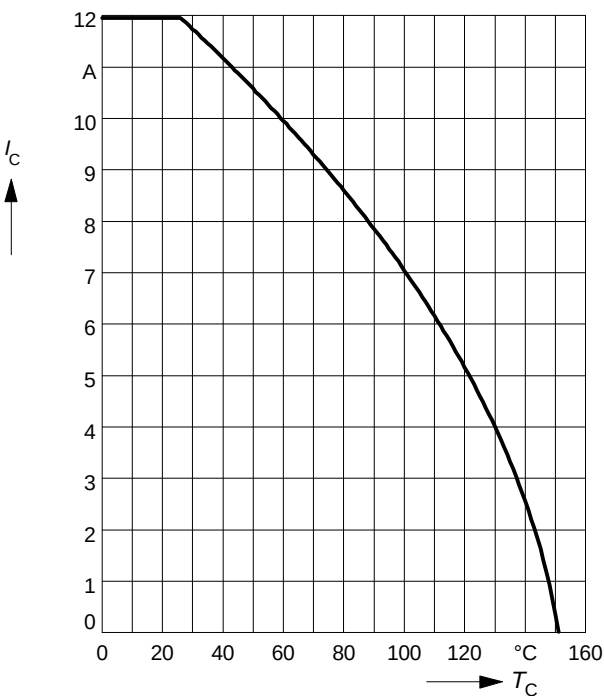
parameter:  $T_j \leq 150^\circ\text{C}$



### Collector current

$$I_C = f(T_C)$$

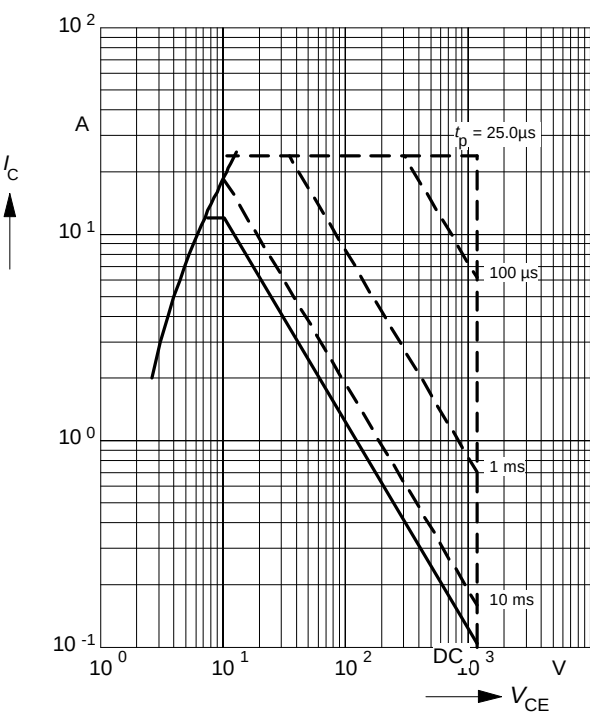
parameter:  $V_{\text{GE}} \geq 15\text{ V}$ ,  $T_j \leq 150^\circ\text{C}$



### Safe operating area

$$I_C = f(V_{\text{CE}})$$

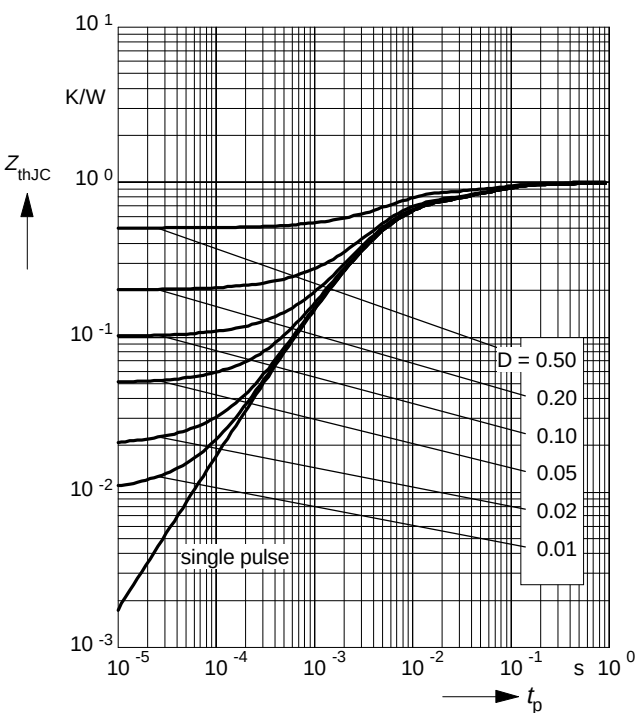
parameter:  $D = 0$ ,  $T_C = 25^\circ\text{C}$ ,  $T_j \leq 150^\circ\text{C}$



### Transient thermal impedance IGBT

$$Z_{\text{thJC}} = f(t_p)$$

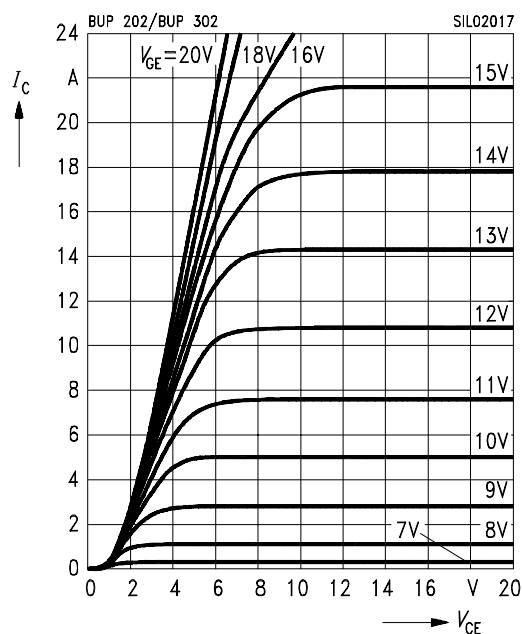
parameter:  $D = t_p / T$



## Typ. output characteristics

$$I_C = f(V_{CE})$$

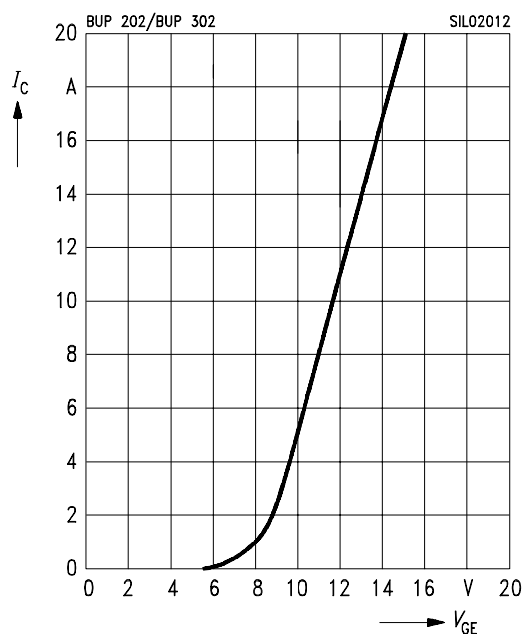
parameter:  $t_p = 80 \mu s$ ,  $T_j = 125^\circ C$



## Typ. transfer characteristics

$$I_C = f(V_{GE})$$

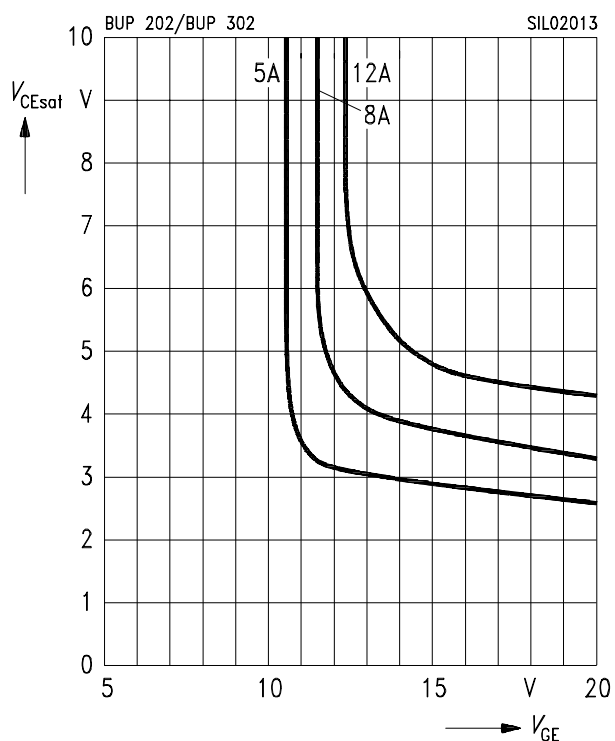
parameter:  $t_p = 80 \mu s$ ,  $V_{CE} = 20 V$ ,  $T_j = 25^\circ C$



## Typ. saturation characteristics

$$V_{CE(sat)} = f(V_{GE})$$

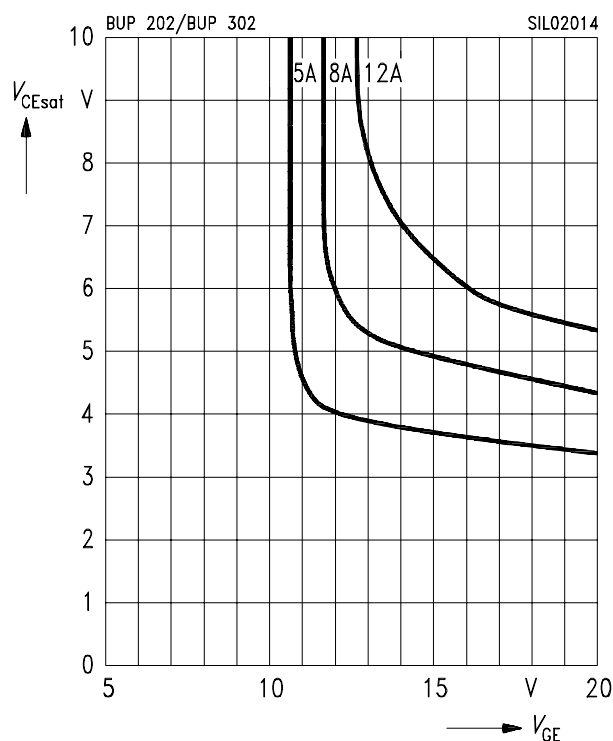
parameter:  $T_j = 25^\circ C$



## Typ. saturation characteristics

$$V_{CE(sat)} = f(V_{GE})$$

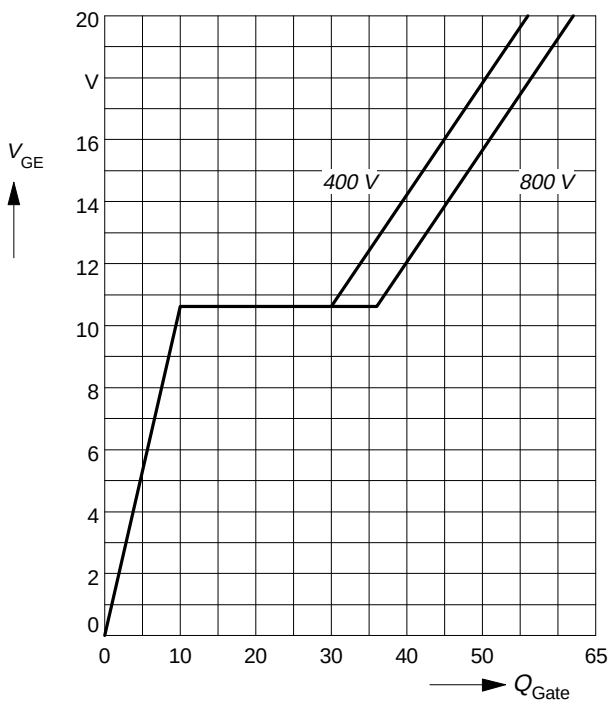
parameter:  $T_j = 125^\circ C$



## Typ. gate charge

$$V_{GE} = f(Q_{Gate})$$

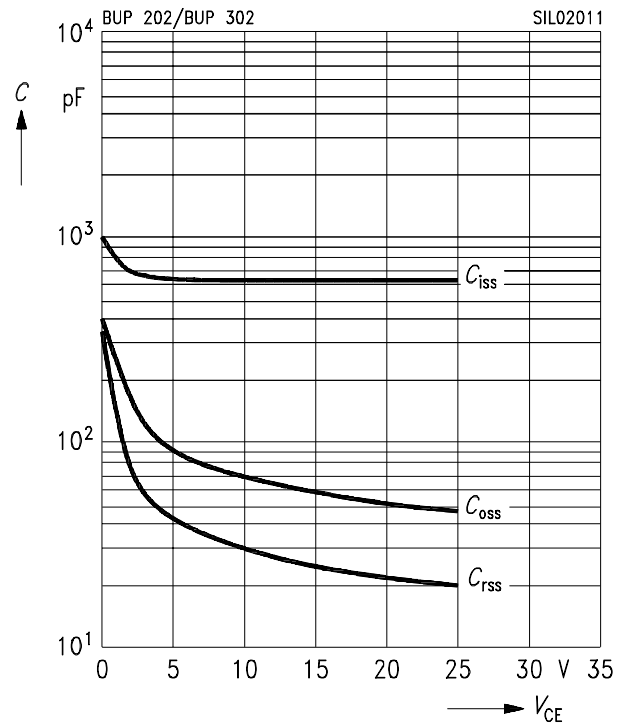
parameter:  $I_{C\ puls} = 6\ A$



## Typ. capacitances

$$C = f(V_{CE})$$

parameter:  $V_{GE} = 0\ V$ ,  $f = 1\ MHz$



## Typ. switching time

$t = f(R_G)$ , inductive load,  $T_j = 125\ ^\circ C$

parameter:  $V_{CE} = 600\ V$ ,  $V_{GE} = \pm 15\ V$ ,  $I_C = 5\ A$

