

## TRENCHSTOP™ IGBT6

## Maximum Ratings

For optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.

| Parameter   | Symbol      | Value                | Unit               |
|---|-------------|----------------------|--------------------|
| Collector-emitter voltage, $T_{vj} \geq 25^{\circ}\text{C}$   | $V_{CE}$    | 650                  | V                  |
| DC collector current, limited by $T_{vjmax}$<br>$T_c = 25^{\circ}\text{C}$<br>$T_c = 100^{\circ}\text{C}$   | $I_C$       | 9.0<br>6.0           | A                  |
| Pulsed collector current, $t_p$ limited by $T_{vjmax}$  | $I_{Cpuls}$ | 18.0                 | A                  |
| Turn off safe operating area $V_{CE} \leq 650\text{V}$ , $T_{vj} \leq 175^{\circ}\text{C}$  | -           | 18.0                 | A                  |
| Diode forward current, limited by $T_{vjmax}$<br>$T_c = 25^{\circ}\text{C}$<br>$T_c = 100^{\circ}\text{C}$  | $I_F$       | 11.0<br>6.0          | A                  |
| Diode pulsed current, $t_p$ limited by $T_{vjmax}$  | $I_{Fpuls}$ | 18.0                 | A                  |
| Gate-emitter voltage<br>Transient Gate-emitter voltage ( $t_p \leq 10\mu\text{s}$ , $D < 0.010$ )   | $V_{GE}$    | $\pm 20$<br>$\pm 30$ | V                  |
| Short circuit withstand time<br>$V_{GE} = 15.0\text{V}$ , $V_{CC} \leq 360\text{V}$<br>Allowed number of short circuits < 1000<br>Time between short circuits: $\geq 1.0\text{s}$<br>$T_{vj} = 150^{\circ}\text{C}$ | $t_{SC}$    | 3                    | $\mu\text{s}$      |
| Power dissipation $T_c = 25^{\circ}\text{C}$<br>Power dissipation $T_c = 100^{\circ}\text{C}$   | $P_{tot}$   | 31.0<br>15.0         | W                  |
| Operating junction temperature  | $T_{vj}$    | -40...+175           | $^{\circ}\text{C}$ |
| Storage temperature   | $T_{stg}$   | -55...+150           | $^{\circ}\text{C}$ |
| Soldering temperature,<br>reflow soldering (MSL1 according to JEDEC J-STA-020)  |             | 260                  | $^{\circ}\text{C}$ |

## Thermal Resistance

| Parameter   | Symbol        | Conditions | Value |      |      | Unit |
|---|---------------|------------|-------|------|------|------|
|   |               |            | min.  | typ. | max. |      |
| <b><math>R_{th}</math> Characteristics</b>                              |               |            |       |      |      |      |
| IGBT thermal resistance,<br>junction - case                             | $R_{th(j-c)}$ |            | -     | -    | 4.90 | K/W  |
| Diode thermal resistance,<br>junction - case                            | $R_{th(j-c)}$ |            | -     | -    | 6.40 | K/W  |
| Thermal resistance, min. footprint<br>junction - ambient                | $R_{th(j-a)}$ |            | -     | -    | 75   | K/W  |
| Thermal resistance, 6cm <sup>2</sup> Cu on<br>PCB<br>junction - ambient | $R_{th(j-a)}$ |            | -     | -    | 50   | K/W  |

## TRENCHSTOP™ IGBT6

Electrical Characteristic, at  $T_{vj} = 25^{\circ}\text{C}$ , unless otherwise specified

| Parameter                            | Symbol       | Conditions   | Value |      |      | Unit          |
|--------------------------------------|--------------|--|-------|------|------|---------------|
|                                      |              |  | min.  | typ. | max. |               |
| <b>Static Characteristic</b>         |              |  |       |      |      |               |
| Collector-emitter saturation voltage | $V_{CEsat}$  | $V_{GE} = 15.0\text{V}$ , $I_C = 3.0\text{A}$<br>$T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$ | -     | 1.50 | 1.90 | V             |
| Diode forward voltage                | $V_F$        | $V_{GE} = 0\text{V}$ , $I_F = 3.0\text{A}$<br>$T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$    | -     | 1.36 | 1.75 | V             |
| Gate-emitter threshold voltage       | $V_{GE(th)}$ | $I_C = 0.10\text{mA}$ , $V_{CE} = V_{GE}$  | 4.8   | 5.6  | 6.4  | V             |
| Zero gate voltage collector current  | $I_{CES}$    | $V_{CE} = 650\text{V}$ , $V_{GE} = 0\text{V}$<br>$T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 150^{\circ}\text{C}$                                   | -     | -    | 30   | $\mu\text{A}$ |
| Gate-emitter leakage current         | $I_{GES}$    | $V_{CE} = 0\text{V}$ , $V_{GE} = 20\text{V}$   | -     | -    | 100  | nA            |
| Transconductance                     | $g_{fs}$     | $V_{CE} = 20\text{V}$ , $I_C = 3.0\text{A}$  | -     | 2.1  | -    | S             |

Electrical Characteristic, at  $T_{vj} = 25^{\circ}\text{C}$ , unless otherwise specified

| Parameter  | Symbol      | Conditions  | Value |      |      | Unit |
|--|-------------|---|-------|------|------|------|
|  |             |   | min.  | typ. | max. |      |
| <b>Dynamic Characteristic</b>  |             |   |       |      |      |      |
| Input capacitance  | $C_{ies}$   | $V_{CE} = 25\text{V}$ , $V_{GE} = 0\text{V}$<br>$f = 1000\text{kHz}$  | -     | 283  | -    | pF   |
| Output capacitance   | $C_{oes}$   |   | -     | 22   | -    |      |
| Reverse transfer capacitance   | $C_{res}$   |   | -     | 5    | -    |      |
| Gate charge  | $Q_G$       | $V_{CC} = 520\text{V}$ , $I_C = 3.0\text{A}$ ,<br>$V_{GE} = 15\text{V}$   | -     | 13.7 | -    | nC   |
| Short circuit collector current<br>Max. 1000 short circuits<br>Time between short circuits: $\geq 1.0\text{s}$ | $I_{C(SC)}$ | $V_{GE} = 15.0\text{V}$ , $V_{CC} \leq 360\text{V}$ ,<br>$t_{SC} \leq 3\mu\text{s}$<br>$T_{vj} = 150^{\circ}\text{C}$ | -     | 35   | -    | A    |

## Switching Characteristic, Inductive Load

| Parameter   | Symbol       | Conditions  | Value |      |      | Unit |
|---|--------------|---|-------|------|------|------|
|   |              |   | min.  | typ. | max. |      |
| <b>IGBT Characteristic, at <math>T_{vj} = 25^{\circ}\text{C}</math></b> |              |   |       |      |      |      |
| Turn-on delay time  | $t_{d(on)}$  | $T_{vj} = 25^{\circ}\text{C}$ ,<br>$V_{CC} = 400\text{V}$ , $I_C = 3.0\text{A}$ ,<br>$V_{GE} = 0.0/15.0\text{V}$ ,<br>$R_{G(on)} = 47.0\Omega$ , $R_{G(off)} = 47.0\Omega$ ,<br>$L_{\sigma} = 30\text{nH}$ , $C_{\sigma} = 30\text{pF}$<br>$L_{\sigma}$ , $C_{\sigma}$ from Fig. E<br>Energy losses include "tail" and<br>diode reverse recovery. | -     | 15   | -    | ns   |
| Rise time   | $t_r$        |   | -     | 8    | -    | ns   |
| Turn-off delay time   | $t_{d(off)}$ |   | -     | 35   | -    | ns   |
| Fall time   | $t_f$        |   | -     | 47   | -    | ns   |
| Turn-on energy  | $E_{on}$     |   | -     | 0.06 | -    | mJ   |
| Turn-off energy   | $E_{off}$    |   | -     | 0.03 | -    | mJ   |
| Total switching energy  | $E_{ts}$     |   | -     | 0.09 | -    | mJ   |