

## TRENCHSTOP™ IGBT 7

## 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>$T_c = 25^{\circ}\text{C}$ value limited by bondwire<br>$T_c = 100^{\circ}\text{C}$   | $I_C$       | 40.0<br>27.5         | A                  |
| Pulsed collector current, $t_p$ limited by $T_{vjmax}$ <sup>1)</sup>  | $I_{Cpuls}$ | 60.0                 | A                  |
| Turn off safe operating area<br>$V_{CE} \leq 650\text{V}$ , $T_{vj} \leq 175^{\circ}\text{C}$ , $t_p = 1\mu\text{s}$ <sup>2)</sup>  | -           | 60.0                 | A                  |
| Diode forward current, limited by $T_{vjmax}$<br>$T_c = 25^{\circ}\text{C}$ value limited by bondwire<br>$T_c = 100^{\circ}\text{C}$  | $I_F$       | 40.0<br>27.5         | A                  |
| Diode pulsed current, $t_p$ limited by $T_{vjmax}$ <sup>1)</sup>  | $I_{Fpuls}$ | 60.0                 | 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>$V_{GE} = 15.0\text{V}$ , $V_{CC} \leq 400\text{V}$<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                    | $\mu\text{s}$      |
| Short circuit withstand time<br>$V_{GE} = 15.0\text{V}$ , $V_{CC} \leq 330\text{V}$<br>Allowed number of short circuits < 1000<br>Time between short circuits: $\geq 1.0\text{s}$<br>$T_{vj} = 100^{\circ}\text{C}$ | $t_{SC}$    | 5                    | $\mu\text{s}$      |
| Power dissipation $T_c = 25^{\circ}\text{C}$<br>Power dissipation $T_c = 100^{\circ}\text{C}$   | $P_{tot}$   | 136.0<br>68.0        | W                  |
| Operating junction temperature  | $T_{vj}$    | -40...+175           | $^{\circ}\text{C}$ |
| Storage temperature   | $T_{stg}$   | -55...+150           | $^{\circ}\text{C}$ |
| Soldering temperature,<br>wave soldering 1.6mm (0.063in.) from case for 10s   |             | 260                  | $^{\circ}\text{C}$ |
| Mounting torque, M3 screw<br>Maximum of mounting processes: 3   | $M$         | 0.6                  | Nm                 |

## Thermal Resistance

| Parameter                                    | Symbol        | Conditions | Value |      |      | Unit |
|--|---------------|------------|-------|------|------|------|
|  |               |            | min.  | typ. | max. |      |
| <b>R<sub>th</sub> Characteristics</b>        |               |            |       |      |      |      |
| IGBT thermal resistance,<br>junction - case  | $R_{th(j-c)}$ |            | -     | -    | 1.10 | K/W  |
| Diode thermal resistance,<br>junction - case | $R_{th(j-c)}$ |            | -     | -    | 1.40 | K/W  |
| Thermal resistance<br>junction - ambient     | $R_{th(j-a)}$ |            | -     | -    | 40   | K/W  |

<sup>1)</sup> Defined by design. Not subject to production test.

<sup>2)</sup> Clamped inductive load current test for each device,  $I_C=60\text{A}$ ,  $V_{CC}=400\text{V}$ ,  $T_c=25^{\circ}\text{C}$ ,  $V_{GE}=20\text{V}$ ,  $L=80\mu\text{H}$ ,  $R_G=10\Omega$ .

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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 | $V_{CEsat}$  | $V_{GE} = 15.0\text{V}$ , $I_C = 20.0\text{A}$<br>$T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 175^{\circ}\text{C}$ | -     | 1.35 | 1.65 | V             |
| Diode forward voltage                | $V_F$        | $V_{GE} = 0\text{V}$ , $I_F = 20.0\text{A}$<br>$T_{vj} = 25^{\circ}\text{C}$<br>$T_{vj} = 125^{\circ}\text{C}$<br>$T_{vj} = 175^{\circ}\text{C}$    | -     | 1.65 | 2.00 | V             |
| Gate-emitter threshold voltage       | $V_{GE(th)}$ | $I_C = 0.20\text{mA}$ , $V_{CE} = V_{GE}$   | 4.3   | 5.0  | 5.7  | 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>$T_{vj} = 175^{\circ}\text{C}$                                    | -     | -    | 40   | $\mu\text{A}$ |
| Gate-emitter leakage current         | $I_{GES}$    | $V_{CE} = 0\text{V}$ , $V_{GE} = 20\text{V}$  | -     | -    | 100  | nA            |
| Transconductance                     | $g_{fs}$     | $V_{CE} = 20\text{V}$ , $I_C = 20.0\text{A}$  | -     | 10.0 | -    | 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>$f = 1000\text{kHz}$  | -     | 1310  | -    | pF   |
| Output capacitance   | $C_{oes}$   |   | -     | 42    | -    |      |
| Reverse transfer capacitance   | $C_{res}$   |   | -     | 13    | -    |      |
| Gate charge  | $Q_G$       | $V_{CC} = 520\text{V}$ , $I_C = 20.0\text{A}$ ,<br>$V_{GE} = 15\text{V}$  | -     | 128.0 | -    | nC   |
| Internal emitter inductance measured 5mm (0.197 in.) from case   | $L_E$       |   | -     | 13.0  | -    | nH   |
| Short circuit collector current <sup>1)</sup><br>Max. 1000 short circuits<br>Time between short circuits: $\geq 1.0\text{s}$ | $I_{C(SC)}$ | $V_{GE} = 15.0\text{V}$ , $V_{CC} \leq 400\text{V}$ ,<br>$t_{SC} \leq 3\mu\text{s}$<br>$T_{vj} = 150^{\circ}\text{C}$ | -     | 110   | -    | A    |

## Switching Characteristic, Inductive Load

| Parameter | Symbol | Conditions | Value |      |      | Unit |
|-----------|--------|------------|-------|------|------|------|
|           |        |            | min.  | typ. | max. |      |

IGBT Characteristic, at  $T_{vj} = 25^{\circ}\text{C}$ 

|                        |              |  |   |      |   |    |
|------------------------|--------------|--|---|------|---|----|
| Turn-on delay time     | $t_{d(on)}$  | $T_{vj} = 25^{\circ}\text{C}$ ,  | - | 16   | - | ns |
| Rise time              | $t_r$        | $V_{CC} = 400\text{V}$ , $I_C = 20.0\text{A}$ ,<br>$V_{GE} = 0.0/15.0\text{V}$ ,       | - | 10   | - | ns |
| Turn-off delay time    | $t_{d(off)}$ | $R_{G(on)} = 12.0\Omega$ , $R_{G(off)} = 12.0\Omega$ ,                                 | - | 210  | - | ns |
| Fall time              | $t_f$        | $L\sigma = 32\text{nH}$ , $C\sigma = 30\text{pF}$<br>$L\sigma$ , $C\sigma$ from Fig. E | - | 20   | - | ns |
| Turn-on energy         | $E_{on}$     | Energy losses include "tail" and diode reverse recovery.                               | - | 0.36 | - | mJ |
| Turn-off energy        | $E_{off}$    |  | - | 0.36 | - | mJ |
| Total switching energy | $E_{ts}$     |  | - | 0.72 | - | mJ |

<sup>1)</sup> Allowed number of short circuits: <1000; time between short circuits >1s.