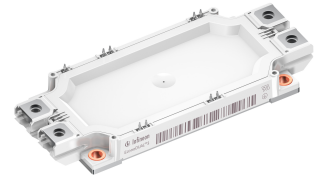


## Final datasheet

### EconoDUAL™3 module with Trench/Fieldstop IGBT4 and emitter controlled 3 diode

#### Features

- Electrical features
  - $V_{CES} = 1700\text{ V}$
  - $I_{C\text{ nom}} = 150\text{ A} / I_{CRM} = 300\text{ A}$
  - High DC stability
  - High short-circuit capability
  - Low  $V_{CE,sat}$
  - $T_{vj,op} = 150^{\circ}\text{C}$
  - Trench IGBT 4
  - $V_{CE,sat}$  with positive temperature coefficient
  - Suitable Infineon gate drivers can be found under <https://www.infineon.com/gdfinder>
- Mechanical features
  - $\text{Al}_2\text{O}_3$  substrate with low thermal resistance
  - High power density
  - Isolated base plate
  - PressFIT contact technology



#### Potential applications

- High-power converters
- Medium-voltage converters
- Wind turbines

#### Product validation

- Qualified for industrial applications according to the relevant tests of IEC 60747, 60749 and 60068

#### Description

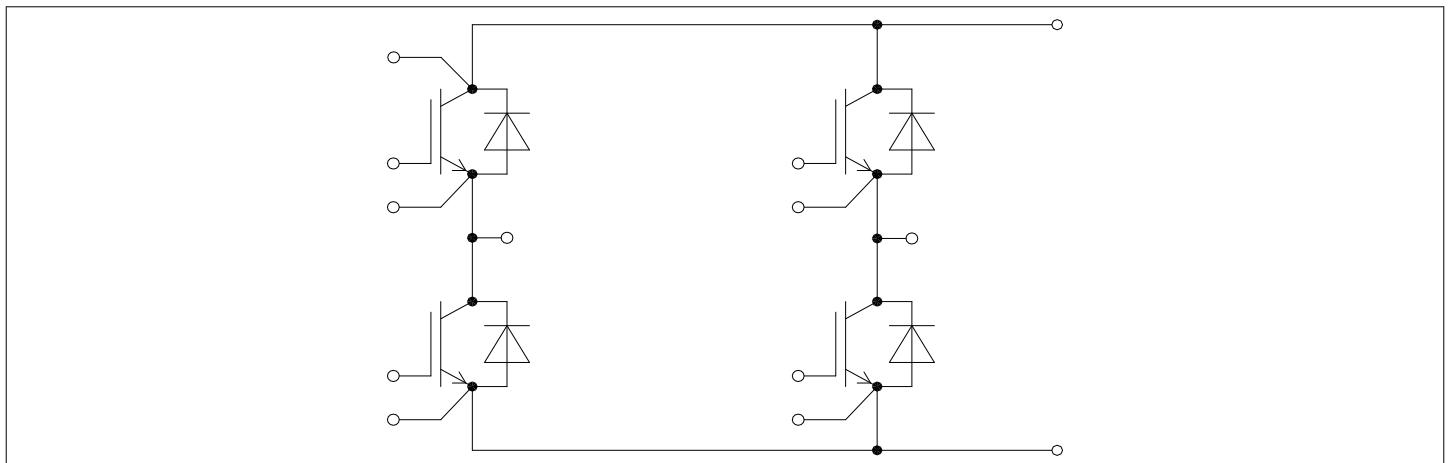




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## 1 Package

**Table 1** Insulation coordination

| Parameter                           | Symbol                  | Note or test condition                                   | Values    | Unit |
|-------------------------------------|-------------------------|----------------------------------------------------------|-----------|------|
| Isolation test voltage              | $V_{ISOL}$              | RMS, $f = 50 \text{ Hz}$ , $t = 1 \text{ min}$           | 3.4       | kV   |
| Material of module baseplate        |                         |                                                          | Cu        |      |
| Internal isolation                  |                         | basic insulation (class 1, IEC 61140)                    | $Al_2O_3$ |      |
| Creepage distance                   | $d_{Creep \text{ nom}}$ | terminal to baseplate, nom., (PD2, IEC 60664-1, Ed. 3.0) | > 15      | mm   |
| Creepage distance                   | $d_{Creep \text{ min}}$ | terminal to baseplate, min., (PD2, IEC 60664-1, Ed. 3.0) | 14.7      | mm   |
| Creepage distance                   | $d_{Creep \text{ nom}}$ | terminal to terminal, nom., (PD2, IEC 60664-1, Ed. 3.0)  | 12.1      | mm   |
| Creepage distance                   | $d_{Creep \text{ min}}$ | terminal to terminal, min., (PD2, IEC 60664-1, Ed. 3.0)  | 11.5      | mm   |
| Clearance                           | $d_{Clear \text{ nom}}$ | terminal to baseplate, nom.                              | > 12.5    | mm   |
| Clearance                           | $d_{Clear \text{ min}}$ | terminal to baseplate, min.                              | 12.5      | mm   |
| Clearance                           | $d_{Clear \text{ nom}}$ | terminal to terminal, nom.                               | 10.0      | mm   |
| Clearance                           | $d_{Clear \text{ min}}$ | terminal to terminal, min.                               | 9.6       | mm   |
| Comparative tracking index          | $CTI$                   |                                                          | > 200     |      |
| Relative thermal index (electrical) | $RTI$                   | housing                                                  | 140       | °C   |

**Table 2** Characteristic values

| Parameter                           | Symbol    | Note or test condition                         | Values |      |      | Unit |
|-------------------------------------|-----------|------------------------------------------------|--------|------|------|------|
|                                     |           |                                                | Min.   | Typ. | Max. |      |
| Stray inductance module             | $L_{sCE}$ |                                                |        | 26   |      | nH   |
| Storage temperature                 | $T_{stg}$ |                                                | -40    |      | 125  | °C   |
| Mounting torque for module mounting | $M$       | - Mounting according to valid application note | 3      |      | 6    | Nm   |
| Terminal connection torque          | $M$       | - Mounting according to valid application note | 3      |      | 6    | Nm   |
| Weight                              | $G$       |                                                |        | 345  |      | g    |

**Note:** The labels AC and DC on the housing do not have relevance.

## 2 IGBT, Inverter

**Table 3** Maximum rated values

| Parameter                         | Symbol    | Note or test condition              |                         | Values   | Unit |
|-----------------------------------|-----------|-------------------------------------|-------------------------|----------|------|
| Collector-emitter voltage         | $V_{CES}$ |                                     | $T_{vj} = 25\text{ °C}$ | 1700     | V    |
| Continuous DC collector current   | $I_{CDC}$ | $T_{vj\text{ max}} = 175\text{ °C}$ | $T_C = 100\text{ °C}$   | 150      | A    |
| Repetitive peak collector current | $I_{CRM}$ | $t_p$ limited by $T_{vj\text{ op}}$ |                         | 300      | A    |
| Gate-emitter peak voltage         | $V_{GES}$ |                                     |                         | $\pm 20$ | V    |

**Table 4** Characteristic values

| Parameter                            | Symbol              | Note or test condition                                                                                           |                          | Values |       |      | Unit          |
|--------------------------------------|---------------------|------------------------------------------------------------------------------------------------------------------|--------------------------|--------|-------|------|---------------|
|                                      |                     |                                                                                                                  |                          | Min.   | Typ.  | Max. |               |
| Collector-emitter saturation voltage | $V_{CE\text{ sat}}$ | $I_C = 150\text{ A}$ , $V_{GE} = 15\text{ V}$                                                                    | $T_{vj} = 25\text{ °C}$  |        | 1.95  | 2.30 | V             |
|                                      |                     |                                                                                                                  | $T_{vj} = 125\text{ °C}$ |        | 2.35  |      |               |
|                                      |                     |                                                                                                                  | $T_{vj} = 150\text{ °C}$ |        | 2.45  |      |               |
| Gate threshold voltage               | $V_{GETh}$          | $I_C = 6\text{ mA}$ , $V_{CE} = V_{GE}$ , $T_{vj} = 25\text{ °C}$                                                |                          | 5.20   | 5.80  | 6.40 | V             |
| Gate charge                          | $Q_G$               | $V_{GE} = \pm 15\text{ V}$ , $V_{CC} = 900\text{ V}$                                                             |                          |        | 1.55  |      | $\mu\text{C}$ |
| Internal gate resistor               | $R_{Gint}$          | $T_{vj} = 25\text{ °C}$                                                                                          |                          |        | 5     |      | $\Omega$      |
| Input capacitance                    | $C_{ies}$           | $f = 1000\text{ kHz}$ , $T_{vj} = 25\text{ °C}$ , $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$                 |                          |        | 12    |      | nF            |
| Reverse transfer capacitance         | $C_{res}$           | $f = 1000\text{ kHz}$ , $T_{vj} = 25\text{ °C}$ , $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$                 |                          |        | 0.39  |      | nF            |
| Collector-emitter cut-off current    | $I_{CES}$           | $V_{CE} = 1700\text{ V}$ , $V_{GE} = 0\text{ V}$                                                                 | $T_{vj} = 25\text{ °C}$  |        |       | 3    | mA            |
| Gate-emitter leakage current         | $I_{GES}$           | $V_{CE} = 0\text{ V}$ , $V_{GE} = 20\text{ V}$ , $T_{vj} = 25\text{ °C}$                                         |                          |        |       | 400  | nA            |
| Turn-on delay time (inductive load)  | $t_{don}$           | $I_C = 150\text{ A}$ , $V_{CC} = 900\text{ V}$ ,<br>$V_{GE} = \pm 15\text{ V}$ , $R_{Gon} = 0.51\text{ }\Omega$  | $T_{vj} = 25\text{ °C}$  |        | 0.190 |      | $\mu\text{s}$ |
|                                      |                     |                                                                                                                  | $T_{vj} = 125\text{ °C}$ |        | 0.210 |      |               |
|                                      |                     |                                                                                                                  | $T_{vj} = 150\text{ °C}$ |        | 0.220 |      |               |
| Rise time (inductive load)           | $t_r$               | $I_C = 150\text{ A}$ , $V_{CC} = 900\text{ V}$ ,<br>$V_{GE} = \pm 15\text{ V}$ , $R_{Gon} = 0.51\text{ }\Omega$  | $T_{vj} = 25\text{ °C}$  |        | 0.040 |      | $\mu\text{s}$ |
|                                      |                     |                                                                                                                  | $T_{vj} = 125\text{ °C}$ |        | 0.050 |      |               |
|                                      |                     |                                                                                                                  | $T_{vj} = 150\text{ °C}$ |        | 0.050 |      |               |
| Turn-off delay time (inductive load) | $t_{doff}$          | $I_C = 150\text{ A}$ , $V_{CC} = 900\text{ V}$ ,<br>$V_{GE} = \pm 15\text{ V}$ , $R_{Goff} = 0.51\text{ }\Omega$ | $T_{vj} = 25\text{ °C}$  |        | 0.410 |      | $\mu\text{s}$ |
|                                      |                     |                                                                                                                  | $T_{vj} = 125\text{ °C}$ |        | 0.570 |      |               |
|                                      |                     |                                                                                                                  | $T_{vj} = 150\text{ °C}$ |        | 0.610 |      |               |

(table continues...)

**Table 4** (continued) Characteristic values

| Parameter                              | Symbol      | Note or test condition                                                                                                                                                                                            | Values                                                   |        |       | Unit          |
|----------------------------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|--------|-------|---------------|
|                                        |             |                                                                                                                                                                                                                   | Min.                                                     | Typ.   | Max.  |               |
| Fall time (inductive load)             | $t_f$       | $I_C = 150 \text{ A}$ , $V_{CC} = 900 \text{ V}$ ,<br>$V_{GE} = \pm 15 \text{ V}$ , $R_{Goff} = 0.51 \Omega$                                                                                                      | $T_{vj} = 25 \text{ °C}$                                 | 0.090  |       | $\mu\text{s}$ |
|                                        |             |                                                                                                                                                                                                                   | $T_{vj} = 125 \text{ °C}$                                | 0.160  |       |               |
|                                        |             |                                                                                                                                                                                                                   | $T_{vj} = 150 \text{ °C}$                                | 0.170  |       |               |
| Turn-on energy loss per pulse          | $E_{on}$    | $I_C = 150 \text{ A}$ , $V_{CC} = 900 \text{ V}$ ,<br>$L_\sigma = 35 \text{ nH}$ , $V_{GE} = \pm 15 \text{ V}$ ,<br>$R_{Gon} = 0.51 \Omega$ , $di/dt = 2900 \text{ A}/\mu\text{s}$ ( $T_{vj} = 150 \text{ °C}$ )  | $T_{vj} = 25 \text{ °C}$                                 | 39.5   |       | mJ            |
|                                        |             |                                                                                                                                                                                                                   | $T_{vj} = 125 \text{ °C}$                                | 52.5   |       |               |
|                                        |             |                                                                                                                                                                                                                   | $T_{vj} = 150 \text{ °C}$                                | 56.5   |       |               |
| Turn-off energy loss per pulse         | $E_{off}$   | $I_C = 150 \text{ A}$ , $V_{CC} = 900 \text{ V}$ ,<br>$L_\sigma = 35 \text{ nH}$ , $V_{GE} = \pm 15 \text{ V}$ ,<br>$R_{Goff} = 0.51 \Omega$ , $dv/dt = 3000 \text{ V}/\mu\text{s}$ ( $T_{vj} = 150 \text{ °C}$ ) | $T_{vj} = 25 \text{ °C}$                                 | 29     |       | mJ            |
|                                        |             |                                                                                                                                                                                                                   | $T_{vj} = 125 \text{ °C}$                                | 45.5   |       |               |
|                                        |             |                                                                                                                                                                                                                   | $T_{vj} = 150 \text{ °C}$                                | 53     |       |               |
| SC data                                | $I_{SC}$    | $V_{GE} \leq 15 \text{ V}$ , $V_{CC} = 1000 \text{ V}$ ,<br>$V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$                                                                                                           | $t_p \leq 10 \mu\text{s}$ ,<br>$T_{vj} = 150 \text{ °C}$ | 630    |       | A             |
| Thermal resistance, junction to case   | $R_{thJC}$  | per IGBT                                                                                                                                                                                                          |                                                          |        | 0.158 | K/W           |
| Thermal resistance, case to heat sink  | $R_{thCH}$  | per IGBT, $\lambda_{grease} = 1 \text{ W}/(\text{m} \cdot \text{K})$                                                                                                                                              |                                                          | 0.0930 |       | K/W           |
| Temperature under switching conditions | $T_{vj op}$ |                                                                                                                                                                                                                   | -40                                                      |        | 150   | °C            |

### 3 Diode, Inverter

**Table 5** Maximum rated values

| Parameter                       | Symbol    | Note or test condition                      |                           | Values | Unit                 |
|---------------------------------|-----------|---------------------------------------------|---------------------------|--------|----------------------|
| Repetitive peak reverse voltage | $V_{RRM}$ |                                             | $T_{vj} = 25 \text{ °C}$  | 1700   | V                    |
| Continuous DC forward current   | $I_F$     |                                             |                           | 150    | A                    |
| Repetitive peak forward current | $I_{FRM}$ | $t_p = 1 \text{ ms}$                        |                           | 300    | A                    |
| $I^2t$ - value                  | $I^2t$    | $t_p = 10 \text{ ms}$ , $V_R = 0 \text{ V}$ | $T_{vj} = 125 \text{ °C}$ | 4250   | $\text{A}^2\text{s}$ |
|                                 |           |                                             | $T_{vj} = 150 \text{ °C}$ | 6150   |                      |

**Table 6**                      **Characteristic values**

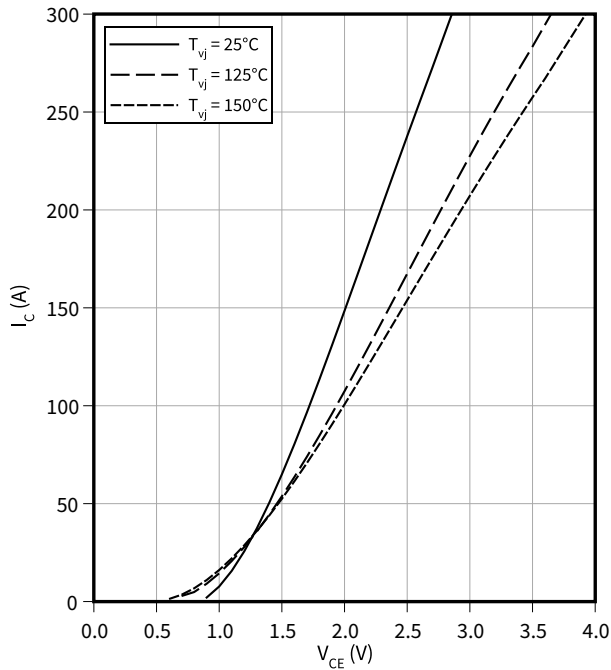
| Parameter                              | Symbol             | Note or test condition                                                                                                                                 |                           | Values |       |       | Unit          |
|----------------------------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------|-------|-------|---------------|
|                                        |                    |                                                                                                                                                        |                           | Min.   | Typ.  | Max.  |               |
| Forward voltage                        | $V_F$              | $I_F = 150 \text{ A}$ , $V_{GE} = 0 \text{ V}$                                                                                                         | $T_{vj} = 25 \text{ °C}$  |        | 1.80  | 2.20  | V             |
|                                        |                    |                                                                                                                                                        | $T_{vj} = 125 \text{ °C}$ |        | 1.90  |       |               |
|                                        |                    |                                                                                                                                                        | $T_{vj} = 150 \text{ °C}$ |        | 1.95  |       |               |
| Peak reverse recovery current          | $I_{RM}$           | $V_{CC} = 900 \text{ V}$ , $I_F = 150 \text{ A}$ ,<br>$V_{GE} = -15 \text{ V}$ , $-di_F/dt = 2900 \text{ A}/\mu\text{s}$ ( $T_{vj} = 150 \text{ °C}$ ) | $T_{vj} = 25 \text{ °C}$  |        | 160   |       | A             |
|                                        |                    |                                                                                                                                                        | $T_{vj} = 125 \text{ °C}$ |        | 170   |       |               |
|                                        |                    |                                                                                                                                                        | $T_{vj} = 150 \text{ °C}$ |        | 175   |       |               |
| Recovered charge                       | $Q_r$              | $V_{CC} = 900 \text{ V}$ , $I_F = 150 \text{ A}$ ,<br>$V_{GE} = -15 \text{ V}$ , $-di_F/dt = 2900 \text{ A}/\mu\text{s}$ ( $T_{vj} = 150 \text{ °C}$ ) | $T_{vj} = 25 \text{ °C}$  |        | 35.5  |       | $\mu\text{C}$ |
|                                        |                    |                                                                                                                                                        | $T_{vj} = 125 \text{ °C}$ |        | 64.5  |       |               |
|                                        |                    |                                                                                                                                                        | $T_{vj} = 150 \text{ °C}$ |        | 72    |       |               |
| Reverse recovery energy                | $E_{rec}$          | $V_{CC} = 900 \text{ V}$ , $I_F = 150 \text{ A}$ ,<br>$V_{GE} = -15 \text{ V}$ , $-di_F/dt = 2900 \text{ A}/\mu\text{s}$ ( $T_{vj} = 150 \text{ °C}$ ) | $T_{vj} = 25 \text{ °C}$  |        | 16.5  |       | mJ            |
|                                        |                    |                                                                                                                                                        | $T_{vj} = 125 \text{ °C}$ |        | 35.5  |       |               |
|                                        |                    |                                                                                                                                                        | $T_{vj} = 150 \text{ °C}$ |        | 40.5  |       |               |
| Thermal resistance, junction to case   | $R_{thJC}$         | per diode                                                                                                                                              |                           |        |       | 0.332 | K/W           |
| Thermal resistance, case to heat sink  | $R_{thCH}$         | per diode, $\lambda_{grease} = 1 \text{ W}/(\text{m}\cdot\text{K})$                                                                                    |                           |        | 0.110 |       | K/W           |
| Temperature under switching conditions | $T_{vj\text{ op}}$ |                                                                                                                                                        |                           | -40    |       | 150   | °C            |

4 Characteristics diagrams

Output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

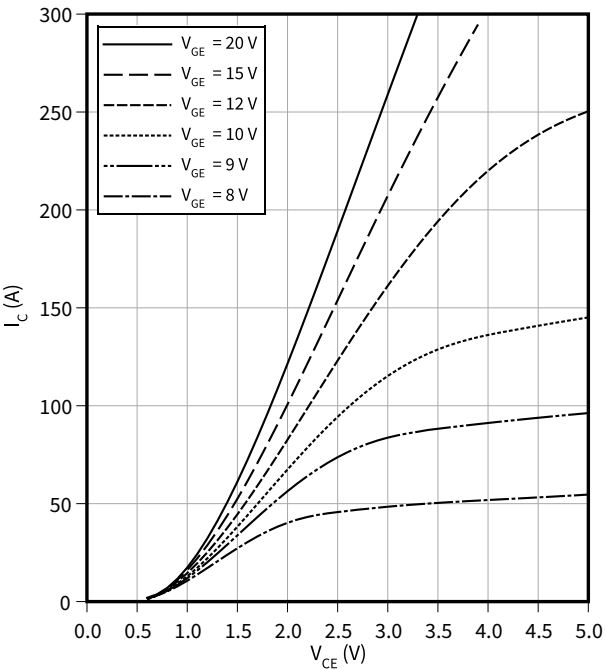
$V_{GE} = 15\text{ V}$



Output characteristic field (typical), IGBT, Inverter

$I_C = f(V_{CE})$

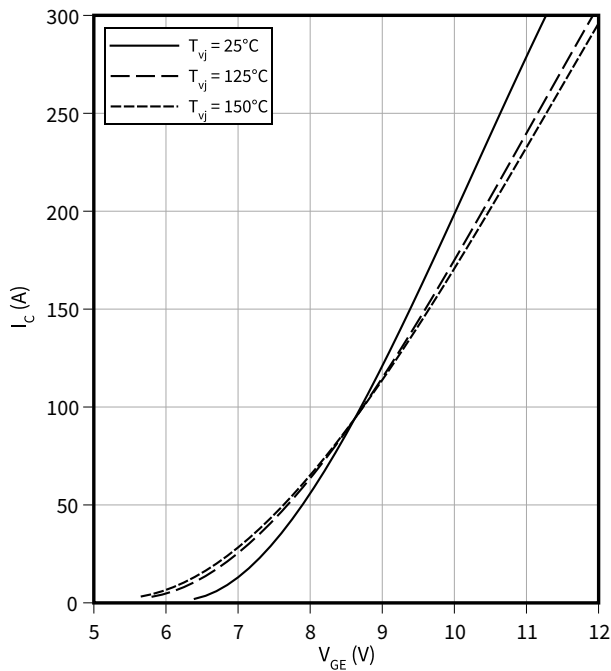
$T_{vj} = 150\text{ °C}$



Transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

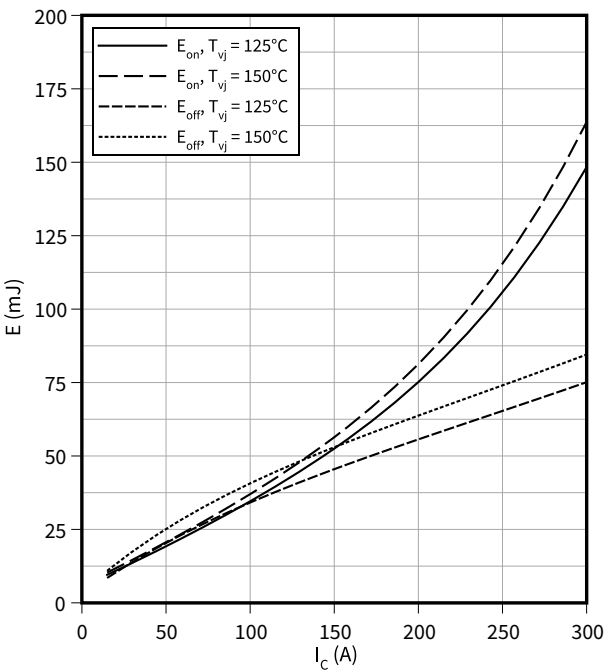
$V_{CE} = 20\text{ V}$



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

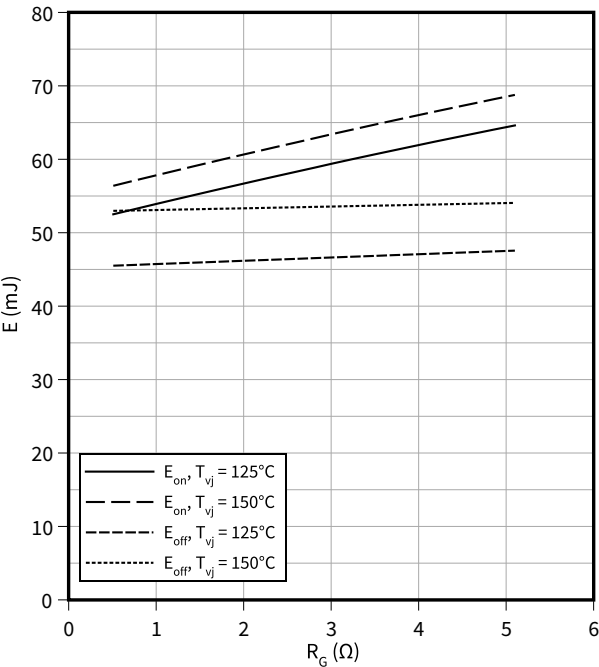
$R_{Goff} = 0.51\text{ }\Omega$ ,  $R_{Gon} = 0.51\text{ }\Omega$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $V_{CC} = 900\text{ V}$



4 Characteristics diagrams

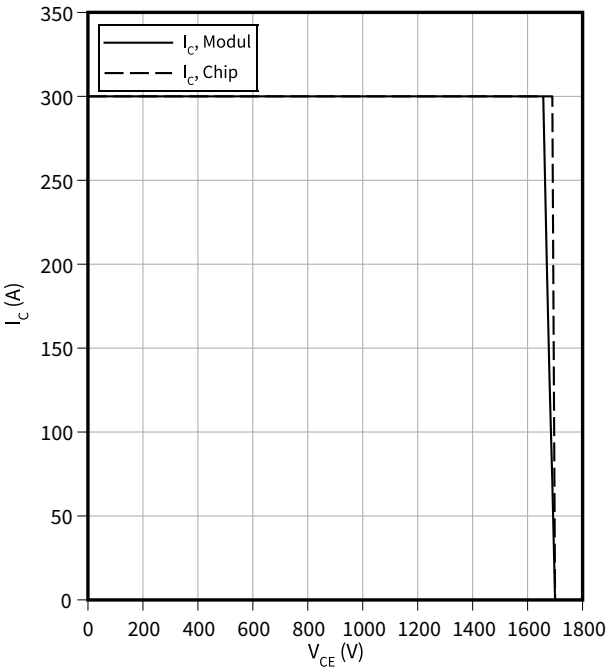
Switching losses (typical), IGBT, Inverter

$E = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 150\text{ A}$ ,  $V_{CC} = 900\text{ V}$



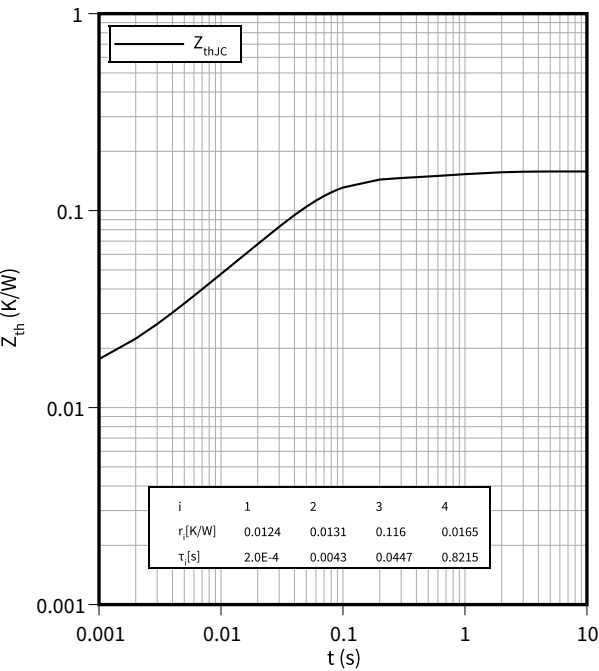
Reverse bias safe operating area (RBSOA), IGBT, Inverter

$I_C = f(V_{CE})$   
 $R_{Goff} = 0.51\text{ }\Omega$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $T_{vj} = 150\text{ }^\circ\text{C}$



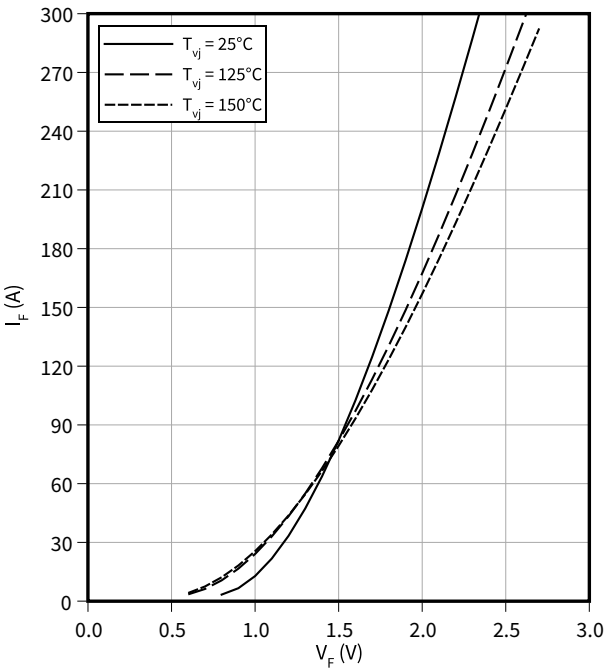
Transient thermal impedance, IGBT, Inverter

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, Inverter

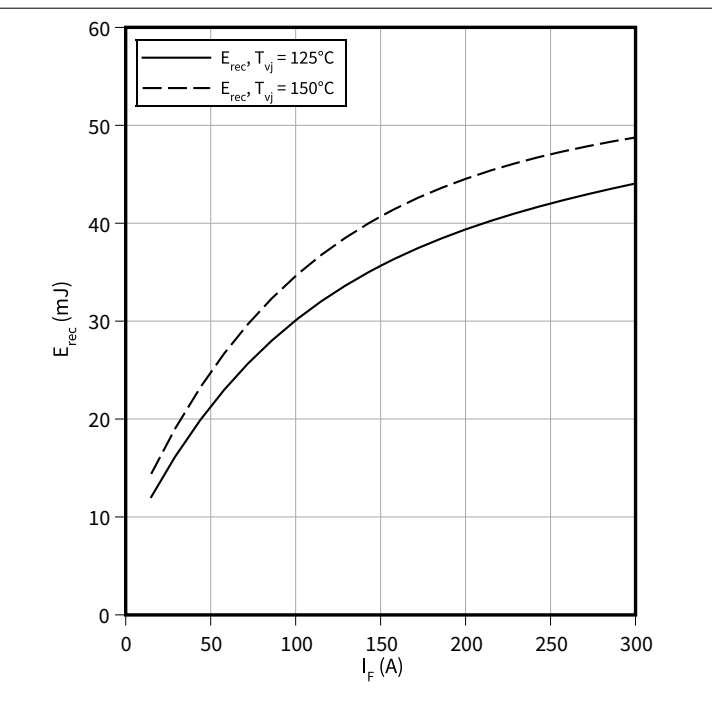
$I_F = f(V_F)$



4 Characteristics diagrams

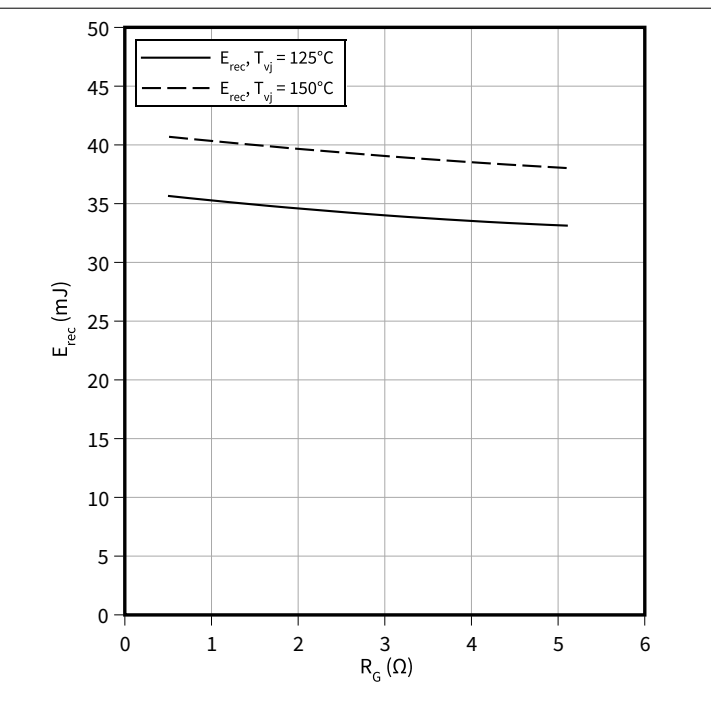
Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$   
 $V_{CE} = 900\text{ V}, R_G = 0.51\ \Omega$



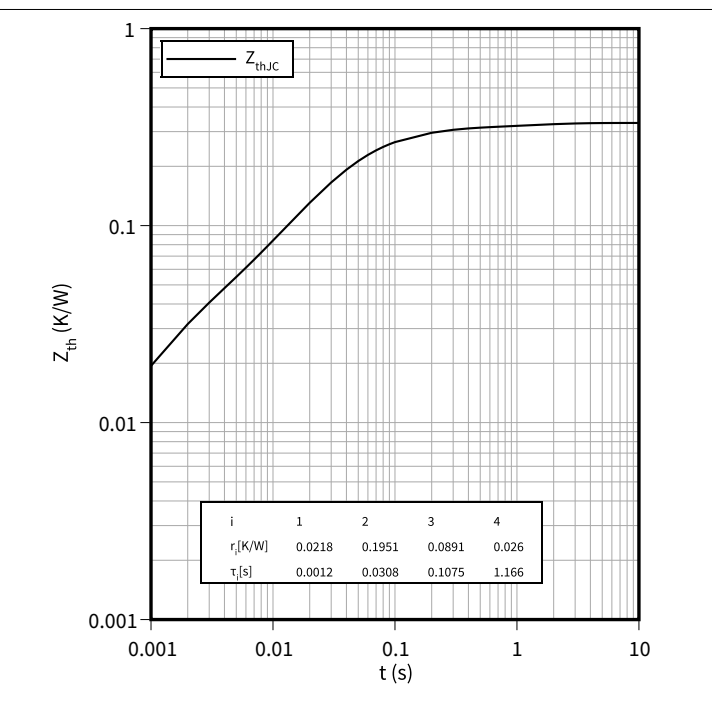
Switching losses (typical), Diode, Inverter

$E_{rec} = f(R_G)$   
 $V_{CE} = 900\text{ V}, I_F = 150\text{ A}$



Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



5 Circuit diagram

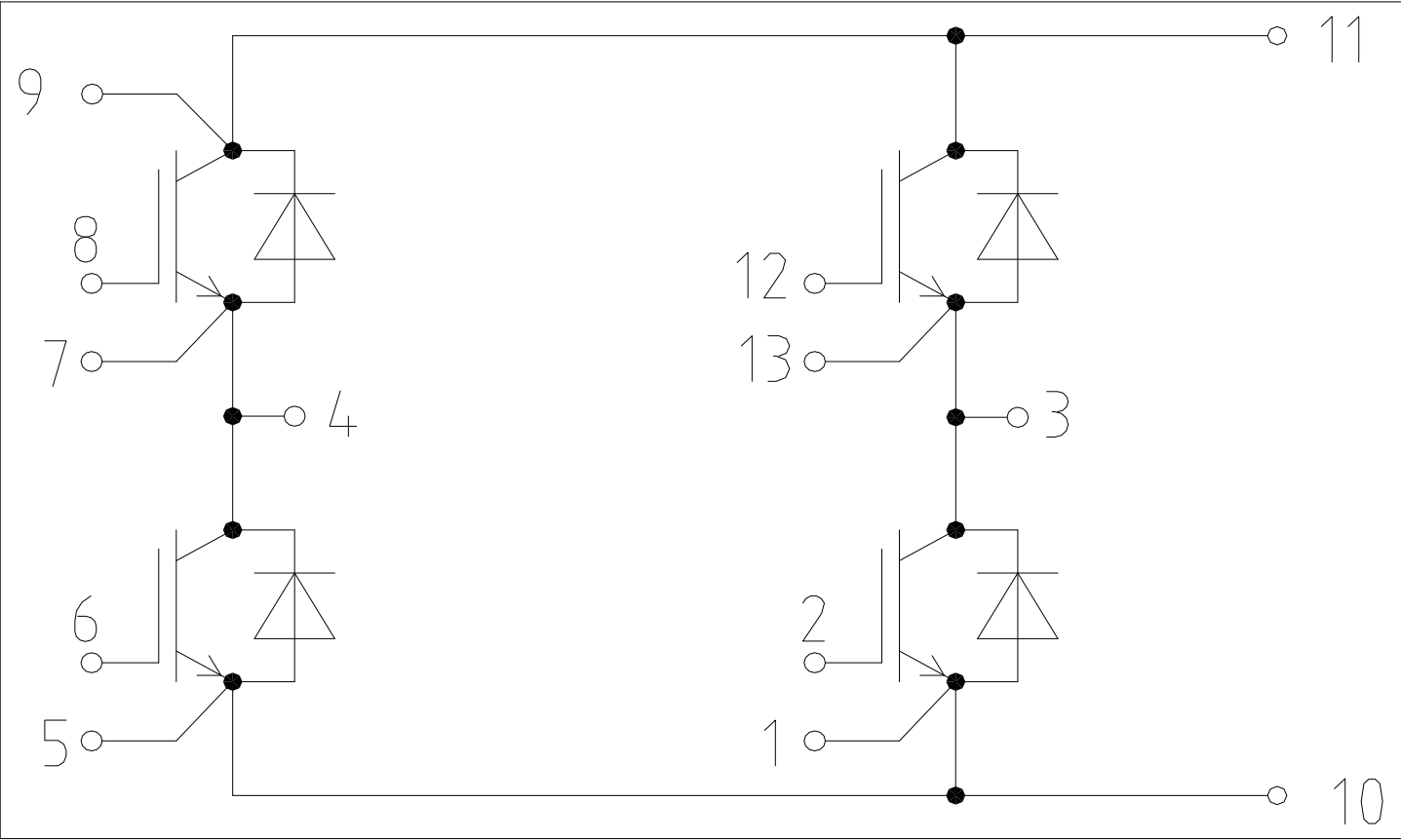


Figure 1



7 Module label code

| Module label code |                                                                                                                                                                                                                                           |         |                 |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------------|
| Code format       | Data Matrix                                                                                                                                                                                                                               |         | Barcode Code128 |
| Encoding          | ASCII text                                                                                                                                                                                                                                |         | Code Set A      |
| Symbol size       | 16x16                                                                                                                                                                                                                                     |         | 23 digits       |
| Standard          | IEC24720 and IEC16022                                                                                                                                                                                                                     |         | IEC8859-1       |
| Code content      | Content                                                                                                                                                                                                                                   | Digit   | Example         |
|                   | Module serial number                                                                                                                                                                                                                      | 1 – 5   | 71549           |
|                   | Module material number                                                                                                                                                                                                                    | 6 - 11  | 142846          |
|                   | Production order number                                                                                                                                                                                                                   | 12 - 19 | 55054991        |
|                   | Date code (production year)                                                                                                                                                                                                               | 20 – 21 | 15              |
|                   | Date code (production week)                                                                                                                                                                                                               | 22 – 23 | 30              |
| Example           | <div><div>7154914284655054991153071549142846550549911530</div></div> |         |                 |

Figure 3



Revision history

Revision history

| Document revision | Date of release | Description of changes                                                                                                                              |
|-------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| V1.0              | 2012-10-17      | Target datasheet                                                                                                                                    |
| V1.1              | 2013-01-07      | Target datasheet                                                                                                                                    |
| V1.2              | 2014-08-07      | Target datasheet                                                                                                                                    |
| V1.3              | 2015-03-12      | Target datasheet                                                                                                                                    |
| V1.4              | 2015-12-02      | Target datasheet                                                                                                                                    |
| V3.0              | 2016-04-18      | Final datasheet                                                                                                                                     |
| V3.1              | 2017-09-07      | Final datasheet                                                                                                                                     |
| V3.2              | 2017-09-18      | Final datasheet                                                                                                                                     |
| n/a               | 2020-09-01      | Datasheet migrated to a new system with a new layout and new revision number schema: target or preliminary datasheet = 0.xy; final datasheet = 1.xy |
| 1.10              | 2024-03-12      | Package outlines drawing updated                                                                                                                    |

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**Edition 2024-03-12**

**Published by**

**Infineon Technologies AG**  
**81726 Munich, Germany**

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**IFX-AAX183-009**

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