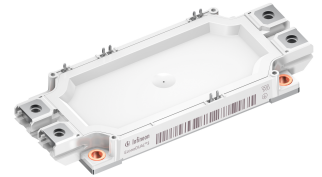


## Final datasheet

### EconoDUAL™3 module with Trench/Fieldstop IGBT3 and emitter controlled HE diode

#### Features

- Electrical features
  - $V_{CES} = 1200\text{ V}$
  - $I_{C\text{ nom}} = 300\text{ A} / I_{CRM} = 600\text{ A}$
  - Suitable Infineon gate drivers can be found under <https://www.infineon.com/gdfinder>
  - Integrated temperature sensor
- Mechanical features
  - Standard housing
  - Solder contact technology
  - Isolated base plate
  - High power density



#### Potential applications

- Medium-voltage converters
- Traction drives

#### Product validation

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

#### Description

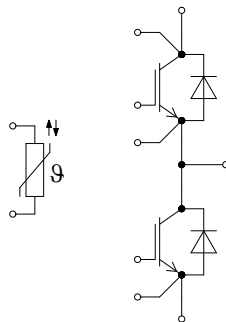


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## 1 Package

**Table 1** Insulation coordination

| Parameter                           | Symbol                  | Note or test condition                         | Values    | Unit |
|-------------------------------------|-------------------------|------------------------------------------------|-----------|------|
| Isolation test voltage              | $V_{ISOL}$              | RMS, $f = 50 \text{ Hz}$ , $t = 1 \text{ min}$ | 2.5       | kV   |
| Isolation test voltage NTC          | $V_{ISOL(NTC)}$         | RMS, $f = 50 \text{ Hz}$ , $t = 1 \text{ min}$ | 2.5       | 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.                    | > 15      | mm   |
| Creepage distance                   | $d_{Creep \text{ min}}$ | terminal to baseplate, min.                    | 14.7      | mm   |
| Creepage distance                   | $d_{Creep \text{ nom}}$ | terminal to terminal, nom.                     | > 19.3    | mm   |
| Creepage distance                   | $d_{Creep \text{ min}}$ | terminal to terminal, min.                     | 19.3      | 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      | mm   |
| Clearance                           | $d_{Clear \text{ min}}$ | terminal to terminal, min.                     | 9.6       | mm   |
| Comparative tracking index          | $CTI$                   |                                                | > 225     |      |
| Relative thermal index (electrical) | $RTI$                   | housing                                        | 140       | °C   |

**Table 2** Characteristic values

| Parameter                                | Symbol        | Note or test condition                            | Values |       |      | Unit |
|------------------------------------------|---------------|---------------------------------------------------|--------|-------|------|------|
|                                          |               |                                                   | Min.   | Typ.  | Max. |      |
| Thermal resistance, case to heat sink    | $R_{thCH}$    | $\lambda_{grease} = 1 \text{ W/(m}\cdot\text{K)}$ |        | 0.009 |      | K/W  |
| Stray inductance module                  | $L_{SCE}$     |                                                   |        | 20    |      | nH   |
| Module lead resistance, terminals - chip | $R_{CC'+EE'}$ | $T_C = 25 \text{ °C}$ , per switch                |        | 1.1   |      | mΩ   |
| 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    |

## 2 IGBT, Inverter

**Table 3** Maximum rated values

| Parameter                         | Symbol    | Note or test condition              |                         | Values | Unit |
|-----------------------------------|-----------|-------------------------------------|-------------------------|--------|------|
| Collector-emitter voltage         | $V_{CES}$ |                                     | $T_{vj} = 25\text{ °C}$ | 1200   | V    |
| Continuous DC collector current   | $I_{CDC}$ | $T_{vj\text{ max}} = 150\text{ °C}$ | $T_C = 80\text{ °C}$    | 300    | A    |
| Repetitive peak collector current | $I_{CRM}$ | $t_p$ limited by $T_{vj\text{ op}}$ |                         | 600    | A    |
| Gate-emitter peak voltage         | $V_{GES}$ |                                     |                         | ±20    | V    |

**Table 4** Characteristic values

| Parameter                            | Symbol              | Note or test condition                                                                                                                                                                       |                          | Values |       |      | Unit |
|--------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------|-------|------|------|
|                                      |                     |                                                                                                                                                                                              |                          | Min.   | Typ.  | Max. |      |
| Collector-emitter saturation voltage | $V_{CE\text{ sat}}$ | $I_C = 300\text{ A}$ , $V_{GE} = 15\text{ V}$                                                                                                                                                | $T_{vj} = 25\text{ °C}$  |        | 1.70  | 2.15 | V    |
|                                      |                     |                                                                                                                                                                                              | $T_{vj} = 125\text{ °C}$ |        | 2.00  |      |      |
| Gate threshold voltage               | $V_{GEth}$          | $I_C = 12\text{ mA}$ , $V_{CE} = V_{GE}$ , $T_{vj} = 25\text{ °C}$                                                                                                                           |                          | 5.00   | 5.80  | 6.50 | V    |
| Gate charge                          | $Q_G$               | $V_{GE} = \pm 15\text{ V}$ , $T_{vj} = 25\text{ °C}$                                                                                                                                         |                          |        | 2.7   |      | μC   |
| Internal gate resistor               | $R_{Gint}$          | $T_{vj} = 25\text{ °C}$                                                                                                                                                                      |                          |        | 2.5   |      | Ω    |
| Input capacitance                    | $C_{ies}$           | $f = 1000\text{ kHz}$ , $T_{vj} = 25\text{ °C}$ , $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$                                                                                             |                          |        | 21    |      | nF   |
| Reverse transfer capacitance         | $C_{res}$           | $f = 1000\text{ kHz}$ , $T_{vj} = 25\text{ °C}$ , $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$                                                                                             |                          |        | 1     |      | nF   |
| Collector-emitter cut-off current    | $I_{CES}$           | $V_{CE} = 1200\text{ V}$ , $V_{GE} = 0\text{ V}$                                                                                                                                             | $T_{vj} = 25\text{ °C}$  |        |       | 5    | 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)  | $t_{don}$           | $I_C = 300\text{ A}$ , $V_{CC} = 600\text{ V}$ , $V_{GE} = \pm 15\text{ V}$ , $R_{Gon} = 2.4\text{ Ω}$                                                                                       | $T_{vj} = 25\text{ °C}$  |        | 0.250 |      | μs   |
|                                      |                     |                                                                                                                                                                                              | $T_{vj} = 125\text{ °C}$ |        | 0.300 |      |      |
| Rise time (inductive load)           | $t_r$               | $I_C = 300\text{ A}$ , $V_{CC} = 600\text{ V}$ , $V_{GE} = \pm 15\text{ V}$ , $R_{Gon} = 2.4\text{ Ω}$                                                                                       | $T_{vj} = 25\text{ °C}$  |        | 0.090 |      | μs   |
|                                      |                     |                                                                                                                                                                                              | $T_{vj} = 125\text{ °C}$ |        | 0.100 |      |      |
| Turn-off delay time (inductive load) | $t_{doff}$          | $I_C = 300\text{ A}$ , $V_{CC} = 600\text{ V}$ , $V_{GE} = \pm 15\text{ V}$ , $R_{Goff} = 2.4\text{ Ω}$                                                                                      | $T_{vj} = 25\text{ °C}$  |        | 0.550 |      | μs   |
|                                      |                     |                                                                                                                                                                                              | $T_{vj} = 125\text{ °C}$ |        | 0.650 |      |      |
| Fall time (inductive load)           | $t_f$               | $I_C = 300\text{ A}$ , $V_{CC} = 600\text{ V}$ , $V_{GE} = \pm 15\text{ V}$ , $R_{Goff} = 2.4\text{ Ω}$                                                                                      | $T_{vj} = 25\text{ °C}$  |        | 0.130 |      | μs   |
|                                      |                     |                                                                                                                                                                                              | $T_{vj} = 125\text{ °C}$ |        | 0.160 |      |      |
| Turn-on energy loss per pulse        | $E_{on}$            | $I_C = 300\text{ A}$ , $V_{CC} = 600\text{ V}$ , $L_\sigma = 80\text{ nH}$ , $V_{GE} = \pm 15\text{ V}$ , $R_{Gon} = 2.4\text{ Ω}$ , $di/dt = 5200\text{ A/μs}$ ( $T_{vj} = 125\text{ °C}$ ) | $T_{vj} = 25\text{ °C}$  |        | 15    |      | mJ   |
|                                      |                     |                                                                                                                                                                                              | $T_{vj} = 125\text{ °C}$ |        | 22    |      |      |

(table continues...)

**Table 4** (continued) Characteristic values

| Parameter                              | Symbol             | Note or test condition                                                                                                                                                                                      | Values                                                   |      |       | Unit |
|----------------------------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|------|-------|------|
|                                        |                    |                                                                                                                                                                                                             | Min.                                                     | Typ. | Max.  |      |
| Turn-off energy loss per pulse         | $E_{off}$          | $I_C = 300\text{ A}$ , $V_{CC} = 600\text{ V}$ ,<br>$L_\sigma = 80\text{ nH}$ , $V_{GE} = \pm 15\text{ V}$ ,<br>$R_{Goff} = 2.4\ \Omega$ , $dv/dt = 3600\text{ V}/\mu\text{s}$ ( $T_{vj} = 125\text{ °C}$ ) | $T_{vj} = 25\text{ °C}$                                  | 29   |       | mJ   |
|                                        |                    |                                                                                                                                                                                                             | $T_{vj} = 125\text{ °C}$                                 | 43   |       |      |
| SC data                                | $I_{SC}$           | $V_{GE} \leq 15\text{ V}$ , $V_{CC} = 900\text{ V}$ ,<br>$V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$                                                                                                        | $t_P \leq 10\ \mu\text{s}$ ,<br>$T_{vj} = 125\text{ °C}$ | 1200 |       | A    |
| Thermal resistance, junction to case   | $R_{thJC}$         | per IGBT                                                                                                                                                                                                    |                                                          |      | 0.085 | K/W  |
| Thermal resistance, case to heat sink  | $R_{thCH}$         | per IGBT, $\lambda_{grease} = 1\text{ W}/(\text{m} \cdot \text{K})$                                                                                                                                         |                                                          | 0.03 |       | K/W  |
| Temperature under switching conditions | $T_{vj\text{ op}}$ |                                                                                                                                                                                                             | -40                                                      |      | 125   | °C   |

### 3 Diode, Inverter

**Table 5** Maximum rated values

| Parameter                       | Symbol    | Note or test condition                    |                                        | Values | Unit             |
|---------------------------------|-----------|-------------------------------------------|----------------------------------------|--------|------------------|
| Repetitive peak reverse voltage | $V_{RRM}$ |                                           | $T_{vj} = 25\text{ }^{\circ}\text{C}$  | 1200   | V                |
| Continuous DC forward current   | $I_F$     |                                           |                                        | 300    | A                |
| Repetitive peak forward current | $I_{FRM}$ | $t_P = 1\text{ ms}$                       |                                        | 600    | A                |
| $I^2t$ - value                  | $I^2t$    | $t_P = 10\text{ ms}$ , $V_R = 0\text{ V}$ | $T_{vj} = 125\text{ }^{\circ}\text{C}$ | 19000  | A <sup>2</sup> s |

**Table 6** Characteristic values

| Parameter                     | Symbol    | Note or test condition                                                                                                                            | Values                   |      |      | Unit          |
|-------------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------|------|---------------|
|                               |           |                                                                                                                                                   | Min.                     | Typ. | Max. |               |
| Forward voltage               | $V_F$     | $I_F = 300\text{ A}$ , $V_{GE} = 0\text{ V}$                                                                                                      | $T_{vj} = 25\text{ °C}$  | 1.65 | 2.15 | V             |
|                               |           |                                                                                                                                                   | $T_{vj} = 125\text{ °C}$ | 1.65 |      |               |
| Peak reverse recovery current | $I_{RM}$  | $V_{CC} = 600\text{ V}$ , $I_F = 300\text{ A}$ ,<br>$V_{GE} = -15\text{ V}$ , $-di_F/dt = 5200\text{ A}/\mu\text{s}$ ( $T_{vj} = 125\text{ °C}$ ) | $T_{vj} = 25\text{ °C}$  | 210  |      | A             |
|                               |           |                                                                                                                                                   | $T_{vj} = 125\text{ °C}$ | 270  |      |               |
| Recovered charge              | $Q_r$     | $V_{CC} = 600\text{ V}$ , $I_F = 300\text{ A}$ ,<br>$V_{GE} = -15\text{ V}$ , $-di_F/dt = 5200\text{ A}/\mu\text{s}$ ( $T_{vj} = 125\text{ °C}$ ) | $T_{vj} = 25\text{ °C}$  | 30   |      | $\mu\text{C}$ |
|                               |           |                                                                                                                                                   | $T_{vj} = 125\text{ °C}$ | 57   |      |               |
| Reverse recovery energy       | $E_{rec}$ | $V_{CC} = 600\text{ V}$ , $I_F = 300\text{ A}$ ,<br>$V_{GE} = -15\text{ V}$ , $-di_F/dt = 5200\text{ A}/\mu\text{s}$ ( $T_{vj} = 125\text{ °C}$ ) | $T_{vj} = 25\text{ °C}$  | 14   |      | mJ            |
|                               |           |                                                                                                                                                   | $T_{vj} = 125\text{ °C}$ | 26   |      |               |

(table continues...)

**Table 6** (continued) Characteristic values

| Parameter                              | Symbol     | Note or test condition                                       | Values |      |      | Unit |
|----------------------------------------|------------|--------------------------------------------------------------|--------|------|------|------|
|                                        |            |                                                              | Min.   | Typ. | Max. |      |
| Thermal resistance, junction to case   | $R_{thJC}$ | per diode                                                    |        |      | 0.15 | K/W  |
| Thermal resistance, case to heat sink  | $R_{thCH}$ | per diode, $\lambda_{grease} = 1 \text{ W/(m}\cdot\text{K)}$ |        | 0.05 |      | K/W  |
| Temperature under switching conditions | $T_{vjop}$ |                                                              | -40    |      | 125  | °C   |

## 4 NTC-Thermistor

**Table 7** Characteristic values

| Parameter              | Symbol       | Note or test condition                                        | Values |      |      | Unit |
|------------------------|--------------|---------------------------------------------------------------|--------|------|------|------|
|                        |              |                                                               | Min.   | Typ. | Max. |      |
| Rated resistance       | $R_{25}$     | $T_{NTC} = 25 \text{ °C}$                                     |        | 5    |      | kΩ   |
| Deviation of $R_{100}$ | $\Delta R/R$ | $T_{NTC} = 100 \text{ °C}$ , $R_{100} = 493 \text{ Ω}$        | -5     |      | 5    | %    |
| Power dissipation      | $P_{25}$     | $T_{NTC} = 25 \text{ °C}$                                     |        |      | 20   | mW   |
| B-value                | $B_{25/50}$  | $R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298,15 \text{ K}))]$  |        | 3375 |      | K    |
| B-value                | $B_{25/80}$  | $R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298,15 \text{ K}))]$  |        | 3411 |      | K    |
| B-value                | $B_{25/100}$ | $R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298,15 \text{ K}))]$ |        | 3433 |      | K    |

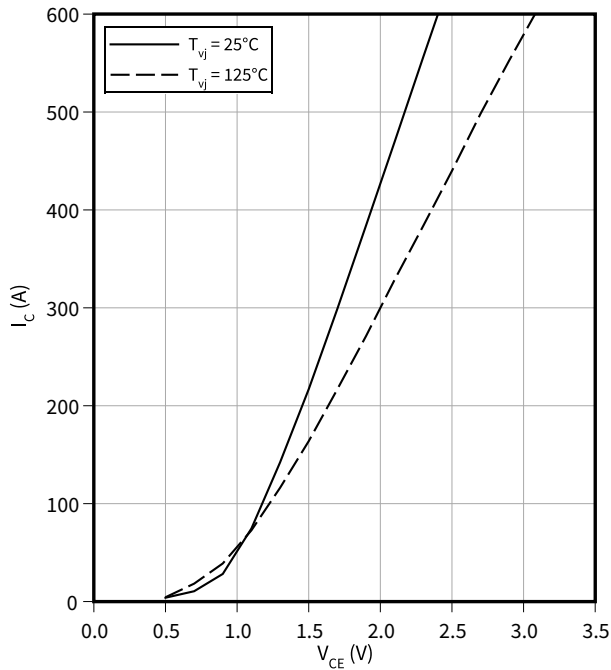
**Note:** For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4

5 Characteristics diagrams

Output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

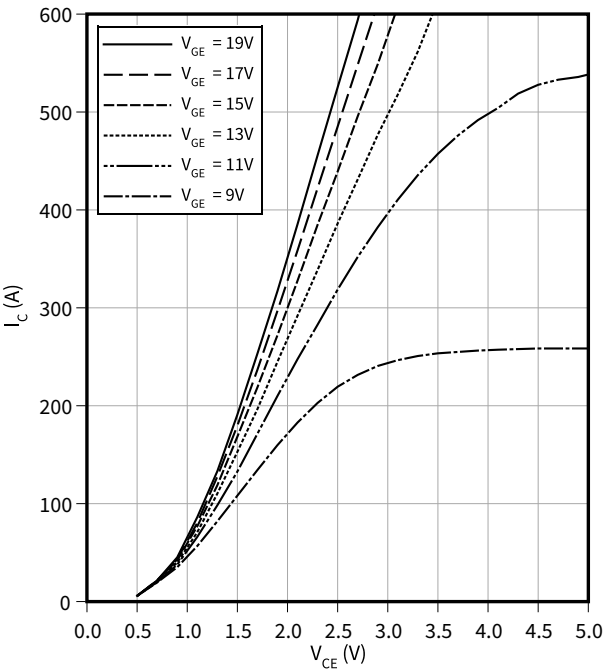
$V_{GE} = 15\text{ V}$



Output characteristic field (typical), IGBT, Inverter

$I_C = f(V_{CE})$

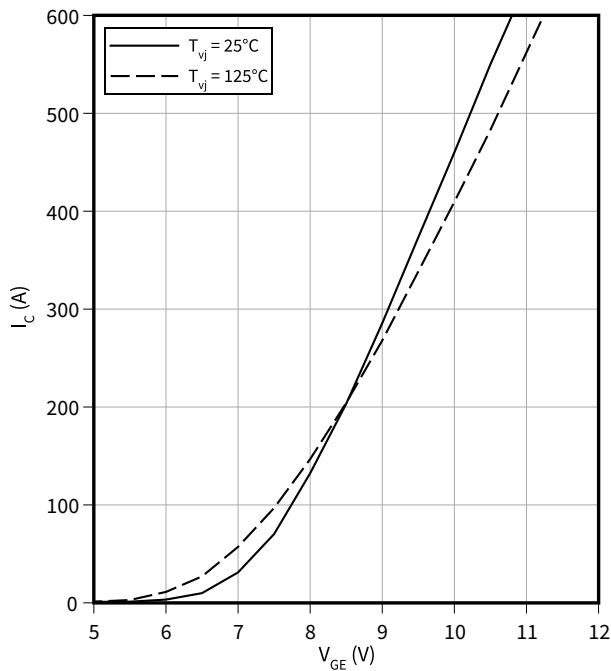
$T_{vj} = 125^\circ\text{C}$



Transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

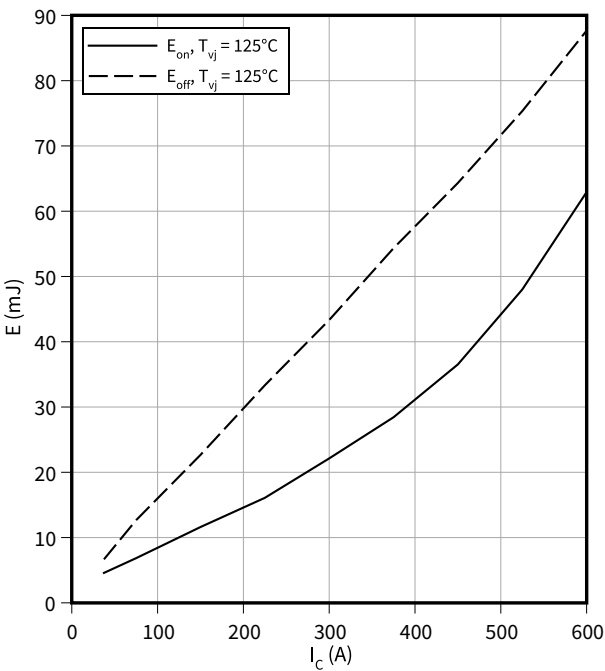
$V_{CE} = 20\text{ V}$



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

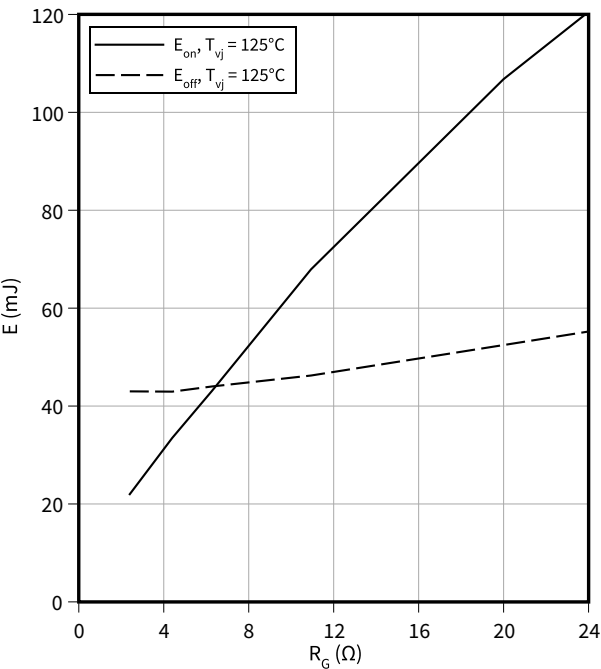
$R_{Goff} = 2.4\ \Omega$ ,  $R_{Gon} = 2.4\ \Omega$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $V_{CC} = 600\text{ V}$



5 Characteristics diagrams

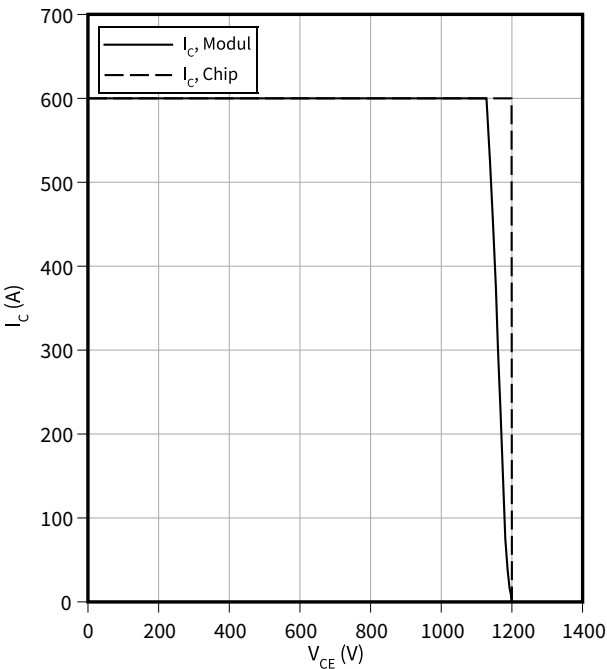
Switching losses (typical), IGBT, Inverter

$E = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 300\text{ A}$ ,  $V_{CC} = 600\text{ V}$



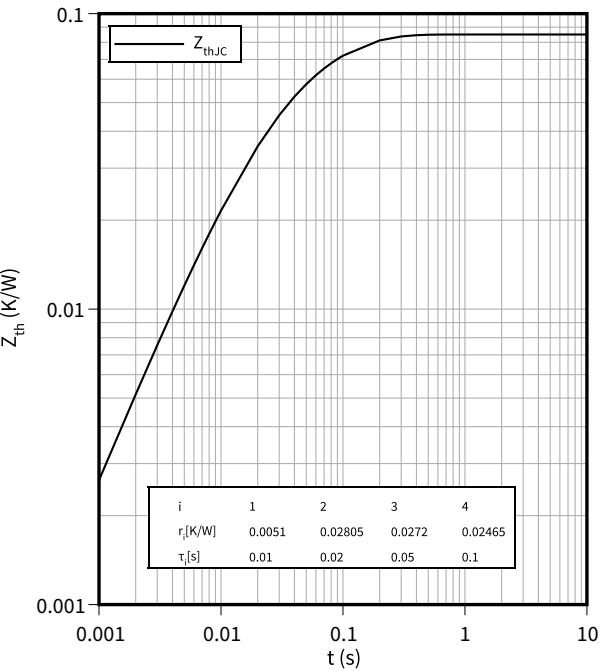
Reverse bias safe operating area (RBSOA), IGBT, Inverter

$I_C = f(V_{CE})$   
 $R_{Goff} = 2.4\ \Omega$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $T_{vj} = 125\text{ }^\circ\text{C}$



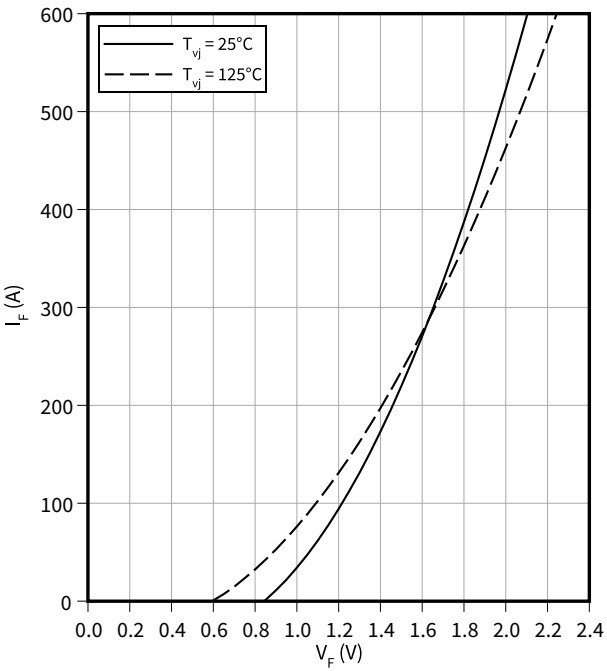
Transient thermal impedance, IGBT, Inverter

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, Inverter

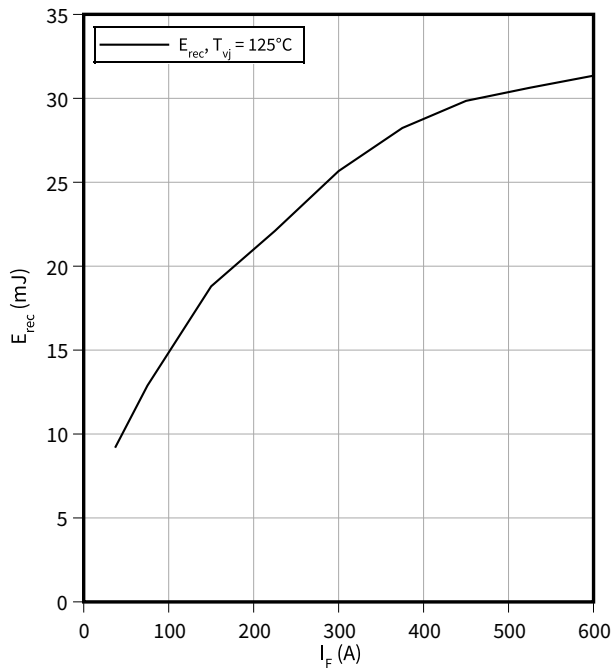
$I_F = f(V_F)$



5 Characteristics diagrams

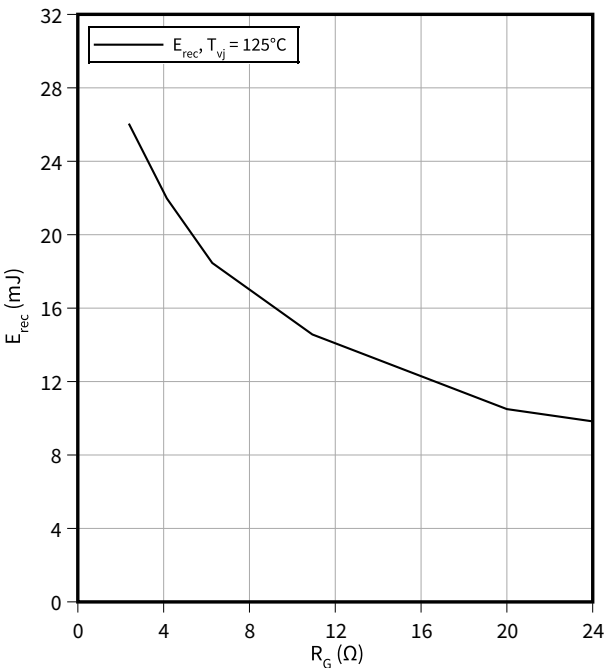
Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$   
 $R_{Gon} = 2.4\ \Omega, V_{CE} = 600\ V$



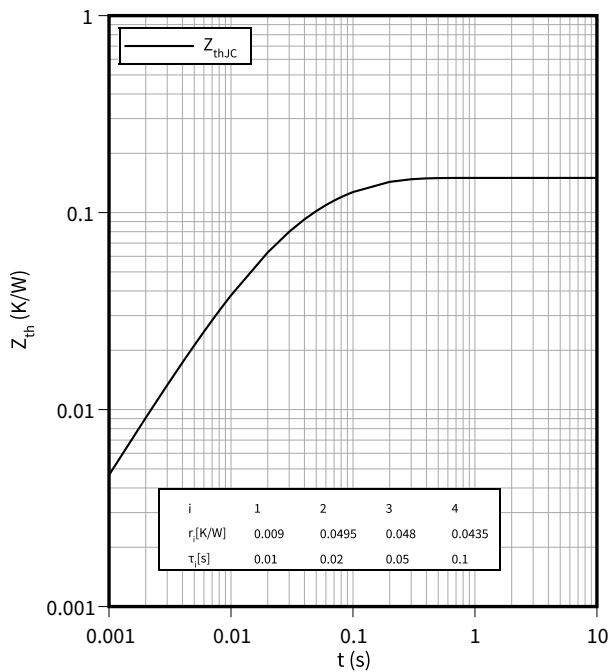
Switching losses (typical), Diode, Inverter

$E_{rec} = f(R_G)$   
 $V_{CE} = 600\ V, I_F = 300\ A$



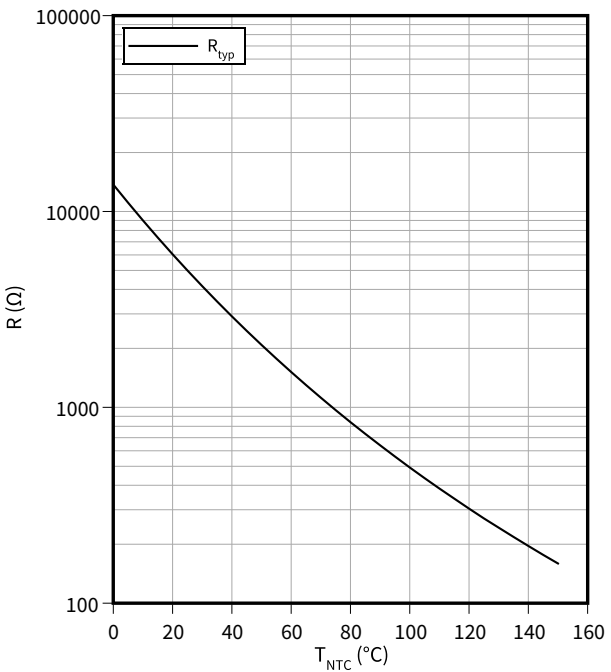
Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



6 Circuit diagram



Figure 1

7 Package outlines

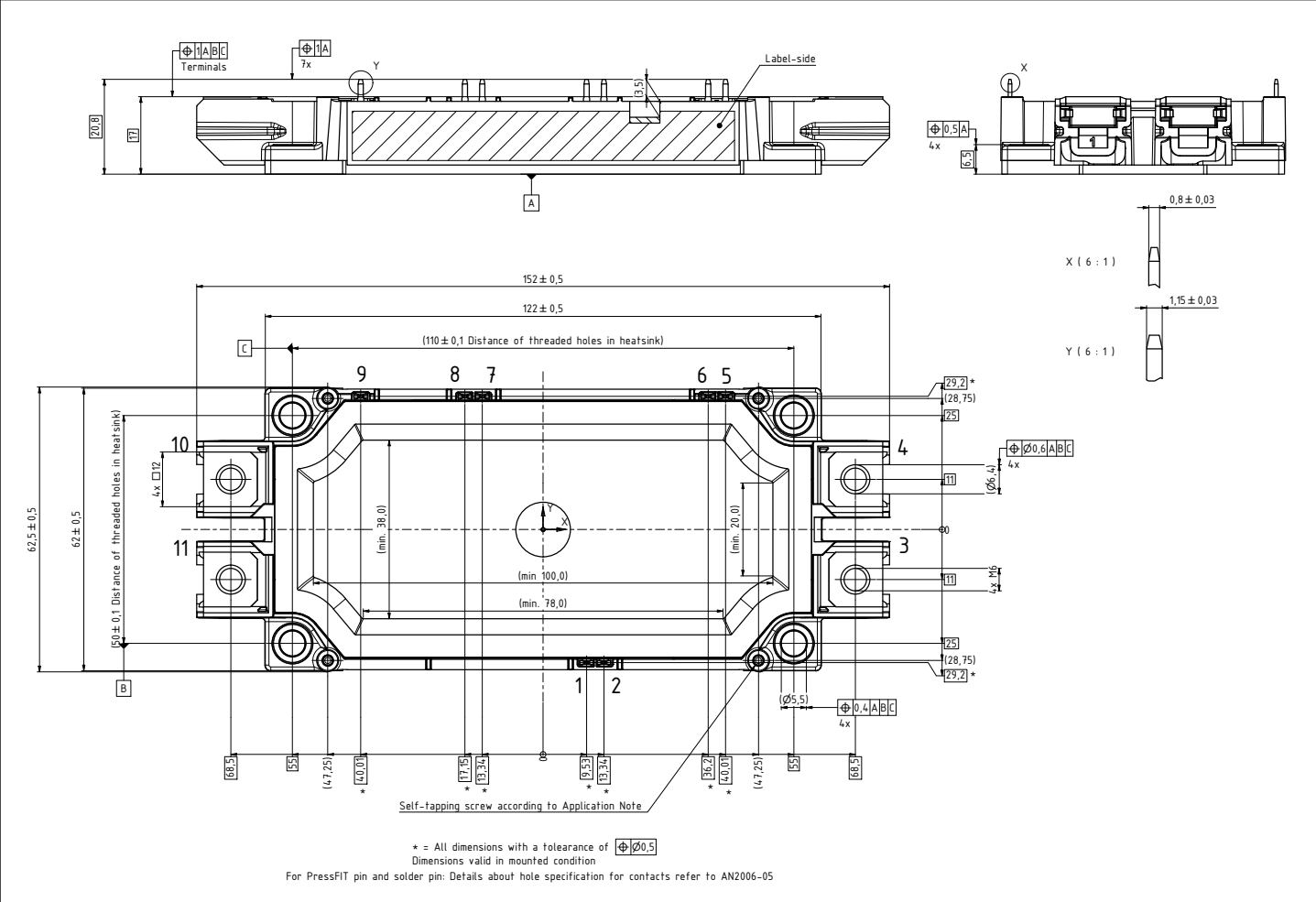


Figure 2

8 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      | <i>Content</i>                                                                                                                                                                                                                             | <i>Digit</i> | <i>Example</i>  |
|                   | 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> <div>7154914284655054991153071549142846550549911530</div> |              |                 |

Figure 3

## Revision history

| Document revision | Date of release | Description of changes                                                                                                                              |
|-------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| V1.0              | 2004-08-17      | Target datasheet                                                                                                                                    |
| V1.1              | 2004-12-03      | Target datasheet                                                                                                                                    |
| V2.0              | 2005-11-10      | Preliminary datasheet                                                                                                                               |
| V2.1              | 2007-06-04      | Preliminary datasheet                                                                                                                               |
| V2.2              | 2009-04-20      | Preliminary datasheet                                                                                                                               |
| V2.3              | 2011-03-01      | Preliminary 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 |
| 1.00              | 2025-10-17      | Final datasheet                                                                                                                                     |

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Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.