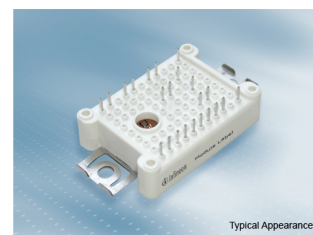


## Preliminary

### EasyPIM™ module with TRENCHSTOP™ IGBT7 and Emitter Controlled 7 diode and PressFIT / NTC

#### Features

- Electrical features
  - $V_{CES} = 1200\text{ V}$
  - $I_{C\text{ nom}} = 25\text{ A} / I_{CRM} = 50\text{ A}$
  - TRENCHSTOP™ IGBT7
  - Overload operation up to  $175^{\circ}\text{C}$
  - Low  $V_{CESat}$
- Mechanical features
  - High power density
  - PressFIT contact technology
  - 2.5 kV AC 1 min insulation
  - $\text{Al}_2\text{O}_3$  substrate with low thermal resistance
  - Compact design



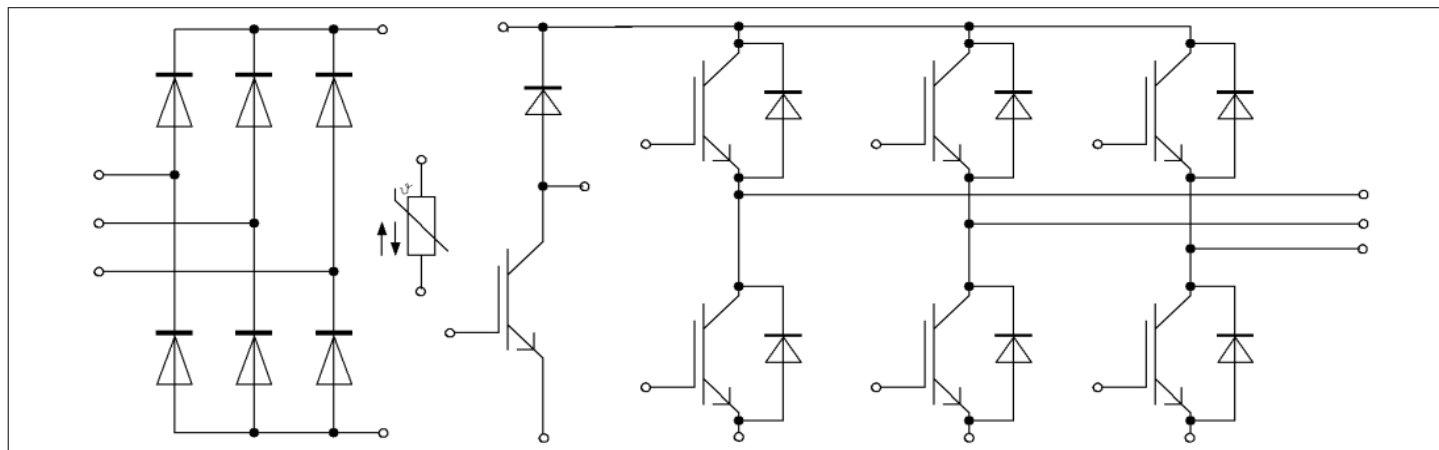
#### Potential applications

- Auxiliary inverters
- Air conditioning
- Motor drives

#### Product validation

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

#### Description



## Table of contents

|           |                                       |    |
|-----------|---------------------------------------|----|
|           | <b>Description</b> .....              | 1  |
|           | <b>Features</b> .....                 | 1  |
|           | <b>Potential applications</b> .....   | 1  |
|           | <b>Product validation</b> .....       | 1  |
|           | <b>Table of contents</b> .....        | 2  |
| <b>1</b>  | <b>Package</b> .....                  | 3  |
| <b>2</b>  | <b>IGBT, Inverter</b> .....           | 3  |
| <b>3</b>  | <b>Diode, Inverter</b> .....          | 5  |
| <b>4</b>  | <b>Diode, Rectifier</b> .....         | 7  |
| <b>5</b>  | <b>IGBT, Brake-Chopper</b> .....      | 7  |
| <b>6</b>  | <b>Diode, Brake-Chopper</b> .....     | 9  |
| <b>7</b>  | <b>NTC-Thermistor</b> .....           | 10 |
| <b>8</b>  | <b>Characteristics diagrams</b> ..... | 12 |
| <b>9</b>  | <b>Circuit diagram</b> .....          | 18 |
| <b>10</b> | <b>Package outlines</b> .....         | 19 |
| <b>11</b> | <b>Module label code</b> .....        | 20 |
|           | <b>Disclaimer</b> .....               | 21 |

## 1 Package

**Table 1** Insulation Coordination

| Parameter                  | Symbol      | Note or test condition                | Values    | Unit |
|----------------------------|-------------|---------------------------------------|-----------|------|
| Isolation test voltage     | $V_{ISOL}$  | RMS, $f = 50$ Hz,<br>$t = 1$ min      | 2.5       | kV   |
| Internal Isolation         |             | basic insulation (class 1, IEC 61140) | $Al_2O_3$ |      |
| Creepage distance          | $d_{Creep}$ | terminal to heatsink                  | 11.5      | mm   |
| Creepage distance          | $d_{Creep}$ | terminal to terminal                  | 6.3       | mm   |
| Clearance                  | $d_{Clear}$ | terminal to heatsink                  | 10.0      | mm   |
| Clearance                  | $d_{Clear}$ | terminal to terminal                  | 5.0       | mm   |
| Comperative tracking index | $CTI$       |                                       | > 200     |      |
| RTI Elec.                  | $RTI$       | housing                               | 140       | °C   |

**Table 2** Characteristic Values

| Parameter                                | Symbol        | Note or test condition                | Values |      |      | Unit |
|------------------------------------------|---------------|---------------------------------------|--------|------|------|------|
|                                          |               |                                       | Min.   | Typ. | Max. |      |
| Stray inductance module                  | $L_{SCE}$     |                                       |        | 30   |      | nH   |
| Module lead resistance, terminals - chip | $R_{AA'+CC'}$ | $T_H = 25^\circ\text{C}$ , per switch |        | 6    |      | mΩ   |
| Module lead resistance, terminals - chip | $R_{CC'+EE'}$ | $T_H = 25^\circ\text{C}$ , per switch |        | 8    |      | mΩ   |
| Storage temperature                      | $T_{stg}$     |                                       | -40    |      | 125  | °C   |
| Mounting force per clamp                 | $F$           |                                       | 20     |      | 50   | N    |
| Weight                                   | $G$           |                                       |        | 24   |      | g    |

Note: The current under continuous operation is limited to 25A rms per connector pin.

## 2 IGBT, Inverter

**Table 3** Maximum Rated Values

| Parameter                         | Symbol    | Note or test condition                                        | Values | Unit |
|-----------------------------------|-----------|---------------------------------------------------------------|--------|------|
| Collector-emitter voltage         | $V_{CES}$ | $T_{vj} = 25^\circ\text{C}$                                   | 1200   | V    |
| Continous DC collector current    | $I_{CDC}$ | $T_{vj\ max} = 175^\circ\text{C}$<br>$T_H = 60^\circ\text{C}$ | 25     | A    |
| Repetitive peak collector current | $I_{CRM}$ | $t_p = 1$ ms                                                  | 50     | 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 | $V_{CE\ sat}$ | $I_C = 25\ A,$<br>$V_{GE} = 15\ V$<br>$T_{vj} = 25\ ^\circ C$<br>$T_{vj} = 125\ ^\circ C$<br>$T_{vj} = 175\ ^\circ C$                                                        |        | 1.60  | TBD    | V        |
|                                      |               |                                                                                                                                                                              |        | 1.74  |        |          |
|                                      |               |                                                                                                                                                                              |        | 1.82  |        |          |
| Gate threshold voltage               | $V_{GEth}$    | $I_C = 0.525\ mA,$<br>$V_{CE} = V_{GE},$<br>$T_{vj} = 25\ ^\circ C$                                                                                                          | 5.15   | 5.80  | 6.45   | V        |
| Gate charge                          | $Q_G$         | $V_{GE} = \pm 15\ V,$<br>$V_{CE} = 600\ V$                                                                                                                                   |        | 0.395 |        | $\mu C$  |
| Internal gate resistor               | $R_{Gint}$    | $T_{vj} = 25\ ^\circ C$                                                                                                                                                      |        | 0     |        | $\Omega$ |
| Input capacitance                    | $C_{ies}$     | $f = 100\ kHz,$<br>$T_{vj} = 25\ ^\circ C,$<br>$V_{CE} = 25\ V,$<br>$V_{GE} = 0\ V$                                                                                          |        | 4.77  |        | nF       |
| Reverse transfer capacitance         | $C_{res}$     | $f = 100\ kHz,$<br>$T_{vj} = 25\ ^\circ C,$<br>$V_{CE} = 25\ V,$<br>$V_{GE} = 0\ V$                                                                                          |        | 0.017 |        | nF       |
| Collector-emitter cut-off current    | $I_{CES}$     | $V_{CE} = 1200\ V,$<br>$V_{GE} = 0\ V$<br>$T_{vj} = 25\ ^\circ C$                                                                                                            |        |       | 0.0056 | mA       |
| Gate-emitter leakage current         | $I_{GES}$     | $V_{CE} = 0\ V,$<br>$V_{GE} = 20\ V,$<br>$T_{vj} = 25\ ^\circ C$                                                                                                             |        |       | 100    | nA       |
| Turn-on delay time (inductive load)  | $t_{don}$     | $I_C = 25\ A,$<br>$V_{CE} = 600\ V,$<br>$V_{GE} = \pm 15\ V,$<br>$R_{Gon} = 6.2\ \Omega$<br>$T_{vj} = 25\ ^\circ C$<br>$T_{vj} = 125\ ^\circ C$<br>$T_{vj} = 175\ ^\circ C$  |        | 0.037 |        | $\mu s$  |
|                                      |               |                                                                                                                                                                              |        | 0.039 |        |          |
|                                      |               |                                                                                                                                                                              |        | 0.040 |        |          |
| Rise time (inductive load)           | $t_r$         | $I_C = 25\ A,$<br>$V_{CE} = 600\ V,$<br>$V_{GE} = \pm 15\ V,$<br>$R_{Gon} = 6.2\ \Omega$<br>$T_{vj} = 25\ ^\circ C$<br>$T_{vj} = 125\ ^\circ C$<br>$T_{vj} = 175\ ^\circ C$  |        | 0.020 |        | $\mu s$  |
|                                      |               |                                                                                                                                                                              |        | 0.024 |        |          |
|                                      |               |                                                                                                                                                                              |        | 0.025 |        |          |
| Turn-off delay time (inductive load) | $t_{doff}$    | $I_C = 25\ A,$<br>$V_{CE} = 600\ V,$<br>$V_{GE} = \pm 15\ V,$<br>$R_{Goff} = 6.2\ \Omega$<br>$T_{vj} = 25\ ^\circ C$<br>$T_{vj} = 125\ ^\circ C$<br>$T_{vj} = 175\ ^\circ C$ |        | 0.186 |        | $\mu s$  |
|                                      |               |                                                                                                                                                                              |        | 0.291 |        |          |
|                                      |               |                                                                                                                                                                              |        | 0.334 |        |          |

**Table 4** Characteristic Values (continued)

| Parameter                                | Symbol             | Note or test condition                                                                                                                                                                                            | Values |                                                              |      | Unit          |
|------------------------------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------------------------------|------|---------------|
|                                          |                    |                                                                                                                                                                                                                   | Min.   | Typ.                                                         | Max. |               |
| Fall time (inductive load)               | $t_f$              | $I_C = 25\text{ A},$<br>$V_{CE} = 600\text{ V},$<br>$V_{GE} = \pm 15\text{ V},$<br>$R_{Goff} = 6.2\ \Omega$                                                                                                       |        | $T_{vj} = 25\text{ °C}$<br>0.173                             |      | $\mu\text{s}$ |
|                                          |                    |                                                                                                                                                                                                                   |        | $T_{vj} = 125\text{ °C}$<br>0.220                            |      |               |
|                                          |                    |                                                                                                                                                                                                                   |        | $T_{vj} = 175\text{ °C}$<br>0.285                            |      |               |
| Turn-on energy loss per pulse            | $E_{on}$           | $I_C = 25\text{ A},$<br>$V_{CE} = 600\text{ V},$<br>$L_\sigma = 35\text{ nH},$<br>$V_{GE} = \pm 15\text{ V},$<br>$R_{Gon} = 6.2\ \Omega,$<br>$di/dt = 950\text{ A}/\mu\text{s}$<br>( $T_{vj} = 175\text{ °C}$ )   |        | $T_{vj} = 25\text{ °C}$<br>1.55                              |      | mJ            |
|                                          |                    |                                                                                                                                                                                                                   |        | $T_{vj} = 125\text{ °C}$<br>2.1                              |      |               |
|                                          |                    |                                                                                                                                                                                                                   |        | $T_{vj} = 175\text{ °C}$<br>2.45                             |      |               |
| Turn-off energy loss per pulse           | $E_{off}$          | $I_C = 25\text{ A},$<br>$V_{CE} = 600\text{ V},$<br>$L_\sigma = 35\text{ nH},$<br>$V_{GE} = \pm 15\text{ V},$<br>$R_{Goff} = 6.2\ \Omega,$<br>$dv/dt = 2900\text{ V}/\mu\text{s}$<br>( $T_{vj} = 175\text{ °C}$ ) |        | $T_{vj} = 25\text{ °C}$<br>1.58                              |      | mJ            |
|                                          |                    |                                                                                                                                                                                                                   |        | $T_{vj} = 125\text{ °C}$<br>2.45                             |      |               |
|                                          |                    |                                                                                                                                                                                                                   |        | $T_{vj} = 175\text{ °C}$<br>3.05                             |      |               |
| SC data                                  | $I_{SC}$           | $V_{GE} \leq 15\text{ V},$<br>$V_{CC} = 800\text{ V},$<br>$V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$                                                                                                             |        | $t_P \leq 8\ \mu\text{s},$<br>$T_{vj} = 150\text{ °C}$<br>80 |      | A             |
|                                          |                    |                                                                                                                                                                                                                   |        | $t_P \leq 7\ \mu\text{s},$<br>$T_{vj} = 175\text{ °C}$<br>75 |      |               |
| Thermal resistance, junction to heatsink | $R_{thJH}$         | per IGBT                                                                                                                                                                                                          |        | 1.55                                                         |      | K/W           |
| Temperature under switching conditions   | $T_{vj\text{ op}}$ |                                                                                                                                                                                                                   | -40    |                                                              | 175  | °C            |

Note:  $T_{vj\text{ op}} > 150\text{ °C}$  is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.

### 3 Diode, Inverter

**Table 5** Maximum Rated Values

| Parameter                       | Symbol    | Note or test condition  | Values | Unit |
|---------------------------------|-----------|-------------------------|--------|------|
| Repetitive peak reverse voltage | $V_{RRM}$ | $T_{vj} = 25\text{ °C}$ | 1200   | V    |
| Continuous DC forward current   | $I_F$     |                         | 25     | A    |

**Table 5 Maximum Rated Values (continued)**

| Parameter                       | Symbol    | Note or test condition                        | Values                            | Unit                 |
|---------------------------------|-----------|-----------------------------------------------|-----------------------------------|----------------------|
| Repetitive peak forward current | $I_{FRM}$ | $t_P = 1 \text{ ms}$                          | 50                                | A                    |
| $I^2t$ - value                  | $I^2t$    | $V_R = 0 \text{ V},$<br>$t_P = 10 \text{ ms}$ | $T_{vj} = 125 \text{ °C}$<br>72.5 | $\text{A}^2\text{s}$ |
|                                 |           |                                               | $T_{vj} = 175 \text{ °C}$<br>63   |                      |

**Table 6 Characteristic Values**

| Parameter                                | Symbol              | Note or test condition                                                                                                                                  | Values |                                   |      | Unit          |
|------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------|------|---------------|
|                                          |                     |                                                                                                                                                         | Min.   | Typ.                              | Max. |               |
| Forward voltage                          | $V_F$               | $I_F = 25 \text{ A},$<br>$V_{GE} = 0 \text{ V}$                                                                                                         |        | $T_{vj} = 25 \text{ °C}$<br>1.83  | TBD  | V             |
|                                          |                     |                                                                                                                                                         |        | $T_{vj} = 125 \text{ °C}$<br>1.70 |      |               |
|                                          |                     |                                                                                                                                                         |        | $T_{vj} = 175 \text{ °C}$<br>1.63 |      |               |
| Peak reverse recovery current            | $I_{RM}$            | $I_F = 25 \text{ A},$<br>$V_R = 600 \text{ V},$<br>$V_{GE} = -15 \text{ V},$<br>$-di_F/dt = 950 \text{ A}/\mu\text{s}$<br>( $T_{vj} = 175 \text{ °C}$ ) |        | $T_{vj} = 25 \text{ °C}$<br>24.2  |      | A             |
|                                          |                     |                                                                                                                                                         |        | $T_{vj} = 125 \text{ °C}$<br>32.4 |      |               |
|                                          |                     |                                                                                                                                                         |        | $T_{vj} = 175 \text{ °C}$<br>37.6 |      |               |
| Recovered charge                         | $Q_r$               | $I_F = 25 \text{ A},$<br>$V_R = 600 \text{ V},$<br>$V_{GE} = -15 \text{ V},$<br>$-di_F/dt = 950 \text{ A}/\mu\text{s}$<br>( $T_{vj} = 175 \text{ °C}$ ) |        | $T_{vj} = 25 \text{ °C}$<br>2.25  |      | $\mu\text{C}$ |
|                                          |                     |                                                                                                                                                         |        | $T_{vj} = 125 \text{ °C}$<br>3.82 |      |               |
|                                          |                     |                                                                                                                                                         |        | $T_{vj} = 175 \text{ °C}$<br>4.95 |      |               |
| Reverse recovery energy                  | $E_{rec}$           | $I_F = 25 \text{ A},$<br>$V_R = 600 \text{ V},$<br>$V_{GE} = -15 \text{ V},$<br>$-di_F/dt = 950 \text{ A}/\mu\text{s}$<br>( $T_{vj} = 175 \text{ °C}$ ) |        | $T_{vj} = 25 \text{ °C}$<br>0.65  |      | mJ            |
|                                          |                     |                                                                                                                                                         |        | $T_{vj} = 125 \text{ °C}$<br>1.41 |      |               |
|                                          |                     |                                                                                                                                                         |        | $T_{vj} = 175 \text{ °C}$<br>1.87 |      |               |
| Thermal resistance, junction to heatsink | $R_{thJH}$          | per diode                                                                                                                                               |        | 2.04                              |      | K/W           |
| Temperature under switching conditions   | $T_{vj \text{ op}}$ |                                                                                                                                                         | -40    |                                   | 175  | °C            |

**Note:**  $T_{vj \text{ op}} > 150 \text{ °C}$  is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.

## 4 Diode, Rectifier

**Table 7** Maximum Rated Values

| Parameter                               | Symbol      | Note or test condition                                                      | Values | Unit             |
|-----------------------------------------|-------------|-----------------------------------------------------------------------------|--------|------------------|
| Repetitive peak reverse voltage         | $V_{RRM}$   | $T_{vj} = 25\text{ °C}$                                                     | 1600   | V                |
| Maximum RMS forward current per chip    | $I_{FRMSM}$ | $T_H = 100\text{ °C}$                                                       | 25     | A                |
| Maximum RMS current at rectifier output | $I_{RMSM}$  | $T_H = 100\text{ °C}$                                                       | 25     | A                |
| Surge forward current                   | $I_{FSM}$   | $t_P = 10\text{ ms}$<br>$T_{vj} = 25\text{ °C}$<br>$T_{vj} = 150\text{ °C}$ | 300    | A                |
|                                         |             |                                                                             | 245    |                  |
| $I^2t$ - value                          | $I^2t$      | $t_P = 10\text{ ms}$<br>$T_{vj} = 25\text{ °C}$<br>$T_{vj} = 150\text{ °C}$ | 450    | A <sup>2</sup> s |
|                                         |             |                                                                             | 300    |                  |

**Table 8** Characteristic Values

| Parameter                                | Symbol       | Note or test condition                              | Values |      |      | Unit |
|------------------------------------------|--------------|-----------------------------------------------------|--------|------|------|------|
|                                          |              |                                                     | Min.   | Typ. | Max. |      |
| Forward voltage                          | $V_F$        | $T_{vj} = 150\text{ °C}$ ,<br>$I_F = 10\text{ A}$   |        | 0.80 |      | V    |
| Reverse current                          | $I_r$        | $T_{vj} = 150\text{ °C}$ ,<br>$V_R = 1600\text{ V}$ |        | 1    |      | mA   |
| Thermal resistance, junction to heatsink | $R_{thJH}$   | per diode                                           |        | 1.54 |      | K/W  |
| Temperature under switching conditions   | $T_{vj, op}$ |                                                     | -40    |      | 150  | °C   |

## 5 IGBT, Brake-Chopper

**Table 9** 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   | $I_{CDC}$ | $T_{vj\text{ max}} = 175\text{ °C}$<br>$T_H = 60\text{ °C}$ | 25     | A    |
| Repetitive peak collector current | $I_{CRM}$ | $t_P = 1\text{ ms}$                                         | 50     | A    |
| Gate-emitter peak voltage         | $V_{GES}$ |                                                             | ±20    | V    |

**Table 10**                      **Characteristic Values**

| Parameter                            | Symbol        | Note or test condition                                                                                                                                                      | Values |       |        | Unit     |
|--------------------------------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|--------|----------|
|                                      |               |                                                                                                                                                                             | Min.   | Typ.  | Max.   |          |
| Collector-emitter saturation voltage | $V_{CE\ sat}$ | $I_C = 25\ A,$<br>$V_{GE} = 15\ V$<br>$T_{vj} = 25\ ^\circ C$<br>$T_{vj} = 125\ ^\circ C$<br>$T_{vj} = 175\ ^\circ C$                                                       |        | 1.60  | TBD    | V        |
|                                      |               |                                                                                                                                                                             |        | 1.74  |        |          |
|                                      |               |                                                                                                                                                                             |        | 1.82  |        |          |
| Gate threshold voltage               | $V_{GEth}$    | $I_C = 0.525\ mA,$<br>$V_{CE} = V_{GE},$<br>$T_{vj} = 25\ ^\circ C$                                                                                                         | 5.15   | 5.80  | 6.45   | V        |
| Gate charge                          | $Q_G$         | $V_{GE} = \pm 15\ V,$<br>$V_{CE} = 600\ V$                                                                                                                                  |        | 0.395 |        | $\mu C$  |
| Internal gate resistor               | $R_{Gint}$    | $T_{vj} = 25\ ^\circ C$                                                                                                                                                     |        | 0     |        | $\Omega$ |
| Input capacitance                    | $C_{ies}$     | $f = 100\ kHz,$<br>$T_{vj} = 25\ ^\circ C,$<br>$V_{CE} = 25\ V,$<br>$V_{GE} = 0\ V$                                                                                         |        | 4.77  |        | nF       |
| Reverse transfer capacitance         | $C_{res}$     | $f = 100\ kHz,$<br>$T_{vj} = 25\ ^\circ C,$<br>$V_{CE} = 25\ V,$<br>$V_{GE} = 0\ V$                                                                                         |        | 0.017 |        | nF       |
| Collector-emitter cut-off current    | $I_{CES}$     | $V_{CE} = 1200\ V,$<br>$V_{GE} = 0\ V$<br>$T_{vj} = 25\ ^\circ C$                                                                                                           |        |       | 0.0056 | mA       |
| Gate-emitter leakage current         | $I_{GES}$     | $V_{CE} = 0\ V,$<br>$V_{GE} = 20\ V,$<br>$T_{vj} = 25\ ^\circ C$                                                                                                            |        |       | 100    | nA       |
| Turn-on delay time (inductive load)  | $t_{don}$     | $I_C = 25\ A,$<br>$V_{CE} = 600\ V,$<br>$V_{GE} = \pm 15\ V,$<br>$R_{Gon} = 10\ \Omega$<br>$T_{vj} = 25\ ^\circ C$<br>$T_{vj} = 125\ ^\circ C$<br>$T_{vj} = 175\ ^\circ C$  |        | 0.058 |        | $\mu s$  |
|                                      |               |                                                                                                                                                                             |        | 0.060 |        |          |
|                                      |               |                                                                                                                                                                             |        | 0.061 |        |          |
| Rise time (inductive load)           | $t_r$         | $I_C = 25\ A,$<br>$V_{CE} = 600\ V,$<br>$V_{GE} = \pm 15\ V,$<br>$R_{Gon} = 10\ \Omega$<br>$T_{vj} = 25\ ^\circ C$<br>$T_{vj} = 125\ ^\circ C$<br>$T_{vj} = 175\ ^\circ C$  |        | 0.055 |        | $\mu s$  |
|                                      |               |                                                                                                                                                                             |        | 0.057 |        |          |
|                                      |               |                                                                                                                                                                             |        | 0.058 |        |          |
| Turn-off delay time (inductive load) | $t_{doff}$    | $I_C = 25\ A,$<br>$V_{CE} = 600\ V,$<br>$V_{GE} = \pm 15\ V,$<br>$R_{Goff} = 10\ \Omega$<br>$T_{vj} = 25\ ^\circ C$<br>$T_{vj} = 125\ ^\circ C$<br>$T_{vj} = 175\ ^\circ C$ |        | 0.205 |        | $\mu s$  |
|                                      |               |                                                                                                                                                                             |        | 0.310 |        |          |
|                                      |               |                                                                                                                                                                             |        | 0.353 |        |          |

**Table 10** Characteristic Values (continued)

| Parameter                                | Symbol       | Note or test condition                                                                                                                                                                                           | Values |                                                              |      | Unit          |
|------------------------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------------------------------|------|---------------|
|                                          |              |                                                                                                                                                                                                                  | Min.   | Typ.                                                         | Max. |               |
| Fall time (inductive load)               | $t_f$        | $I_C = 25\text{ A},$<br>$V_{CE} = 600\text{ V},$<br>$V_{GE} = \pm 15\text{ V},$<br>$R_{Goff} = 10\ \Omega$                                                                                                       |        | $T_{vj} = 25\text{ °C}$<br>0.173                             |      | $\mu\text{s}$ |
|                                          |              |                                                                                                                                                                                                                  |        | $T_{vj} = 125\text{ °C}$<br>0.220                            |      |               |
|                                          |              |                                                                                                                                                                                                                  |        | $T_{vj} = 175\text{ °C}$<br>0.285                            |      |               |
| Turn-on energy loss per pulse            | $E_{on}$     | $I_C = 25\text{ A},$<br>$V_{CE} = 600\text{ V},$<br>$L_\sigma = 35\text{ nH},$<br>$V_{GE} = \pm 15\text{ V},$<br>$R_{Gon} = 10\ \Omega,$<br>$di/dt = 320\text{ A}/\mu\text{s}$<br>( $T_{vj} = 175\text{ °C}$ )   |        | $T_{vj} = 25\text{ °C}$<br>2.15                              |      | mJ            |
|                                          |              |                                                                                                                                                                                                                  |        | $T_{vj} = 125\text{ °C}$<br>2.65                             |      |               |
|                                          |              |                                                                                                                                                                                                                  |        | $T_{vj} = 175\text{ °C}$<br>2.9                              |      |               |
| Turn-off energy loss per pulse           | $E_{off}$    | $I_C = 25\text{ A},$<br>$V_{CE} = 600\text{ V},$<br>$L_\sigma = 35\text{ nH},$<br>$V_{GE} = \pm 15\text{ V},$<br>$R_{Goff} = 10\ \Omega,$<br>$dv/dt = 2900\text{ V}/\mu\text{s}$<br>( $T_{vj} = 175\text{ °C}$ ) |        | $T_{vj} = 25\text{ °C}$<br>1.58                              |      | mJ            |
|                                          |              |                                                                                                                                                                                                                  |        | $T_{vj} = 125\text{ °C}$<br>2.45                             |      |               |
|                                          |              |                                                                                                                                                                                                                  |        | $T_{vj} = 175\text{ °C}$<br>3.05                             |      |               |
| SC data                                  | $I_{SC}$     | $V_{GE} \leq 15\text{ V},$<br>$V_{CC} = 800\text{ V},$<br>$V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$                                                                                                            |        | $t_P \leq 8\ \mu\text{s},$<br>$T_{vj} = 150\text{ °C}$<br>80 |      | A             |
|                                          |              |                                                                                                                                                                                                                  |        | $t_P \leq 7\ \mu\text{s},$<br>$T_{vj} = 175\text{ °C}$<br>75 |      |               |
| Thermal resistance, junction to heatsink | $R_{thJH}$   | per IGBT                                                                                                                                                                                                         |        | 1.55                                                         |      | K/W           |
| Temperature under switching conditions   | $T_{vj\ op}$ |                                                                                                                                                                                                                  | -40    |                                                              | 175  | °C            |

Note:  $T_{vj\ op} > 150\text{ °C}$  is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.

## 6 Diode, Brake-Chopper

**Table 11** Maximum Rated Values

| Parameter                       | Symbol    | Note or test condition  | Values | Unit |
|---------------------------------|-----------|-------------------------|--------|------|
| Repetitive peak reverse voltage | $V_{RRM}$ | $T_{vj} = 25\text{ °C}$ | 1200   | V    |
| Continuous DC forward current   | $I_F$     |                         | 10     | A    |

**Table 11 Maximum Rated Values (continued)**

| Parameter                       | Symbol    | Note or test condition                        | Values                            | Unit   |
|---------------------------------|-----------|-----------------------------------------------|-----------------------------------|--------|
| Repetitive peak forward current | $I_{FRM}$ | $t_P = 1 \text{ ms}$                          | 20                                | A      |
| $I^2t$ - value                  | $I^2t$    | $V_R = 0 \text{ V},$<br>$t_P = 10 \text{ ms}$ | $T_{vj} = 125 \text{ °C}$<br>27.5 | $A^2s$ |
|                                 |           |                                               | $T_{vj} = 175 \text{ °C}$<br>24   |        |

**Table 12 Characteristic Values**

| Parameter                                | Symbol              | Note or test condition                                                                                                     | Values |                                   |      | Unit          |
|------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------|------|---------------|
|                                          |                     |                                                                                                                            | Min.   | Typ.                              | Max. |               |
| Forward voltage                          | $V_F$               | $I_F = 10 \text{ A},$<br>$V_{GE} = 0 \text{ V}$                                                                            |        | $T_{vj} = 25 \text{ °C}$<br>1.72  | TBD  | V             |
|                                          |                     |                                                                                                                            |        | $T_{vj} = 125 \text{ °C}$<br>1.59 |      |               |
|                                          |                     |                                                                                                                            |        | $T_{vj} = 175 \text{ °C}$<br>1.52 |      |               |
| Peak reverse recovery current            | $I_{RM}$            | $I_F = 10 \text{ A},$<br>$V_R = 600 \text{ V},$<br>$-di_F/dt = 300 \text{ A}/\mu\text{s}$<br>( $T_{vj} = 175 \text{ °C}$ ) |        | $T_{vj} = 25 \text{ °C}$<br>8.1   |      | A             |
|                                          |                     |                                                                                                                            |        | $T_{vj} = 125 \text{ °C}$<br>10.1 |      |               |
|                                          |                     |                                                                                                                            |        | $T_{vj} = 175 \text{ °C}$<br>11.7 |      |               |
| Recovered charge                         | $Q_r$               | $I_F = 10 \text{ A},$<br>$V_R = 600 \text{ V},$<br>$-di_F/dt = 300 \text{ A}/\mu\text{s}$<br>( $T_{vj} = 175 \text{ °C}$ ) |        | $T_{vj} = 25 \text{ °C}$<br>0.74  |      | $\mu\text{C}$ |
|                                          |                     |                                                                                                                            |        | $T_{vj} = 125 \text{ °C}$<br>1.37 |      |               |
|                                          |                     |                                                                                                                            |        | $T_{vj} = 175 \text{ °C}$<br>1.84 |      |               |
| Reverse recovery energy                  | $E_{rec}$           | $I_F = 10 \text{ A},$<br>$V_R = 600 \text{ V},$<br>$-di_F/dt = 300 \text{ A}/\mu\text{s}$<br>( $T_{vj} = 175 \text{ °C}$ ) |        | $T_{vj} = 25 \text{ °C}$<br>0.26  |      | mJ            |
|                                          |                     |                                                                                                                            |        | $T_{vj} = 125 \text{ °C}$<br>0.52 |      |               |
|                                          |                     |                                                                                                                            |        | $T_{vj} = 175 \text{ °C}$<br>0.72 |      |               |
| Thermal resistance, junction to heatsink | $R_{thJH}$          | per diode                                                                                                                  |        | 2.45                              |      | K/W           |
| Temperature under switching conditions   | $T_{vj \text{ op}}$ |                                                                                                                            | -40    |                                   | 175  | °C            |

Note:  $T_{vj \text{ op}} > 150 \text{ °C}$  is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.

## 7 NTC-Thermistor

**Table 13 Characteristic Values**

| Parameter        | Symbol   | Note or test condition    | Values |      |      | Unit |
|------------------|----------|---------------------------|--------|------|------|------|
|                  |          |                           | Min.   | Typ. | Max. |      |
| Rated resistance | $R_{25}$ | $T_{NTC} = 25 \text{ °C}$ |        | 5    |      | kΩ   |

**Table 13**                      **Characteristic Values (continued)**

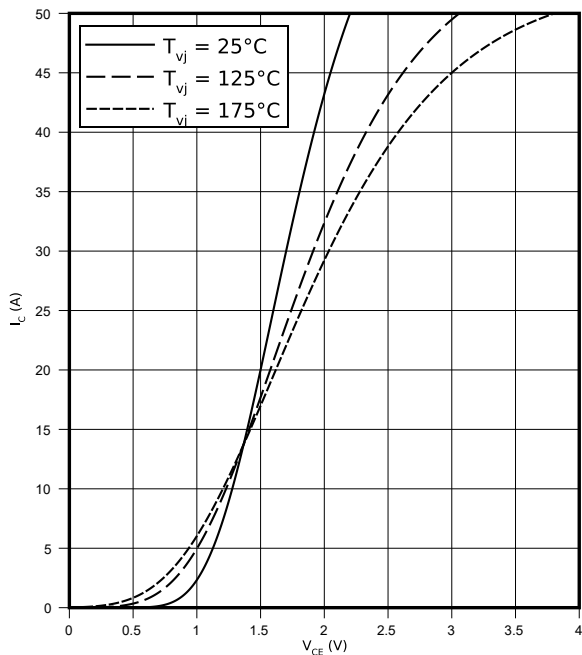
| Parameter              | Symbol       | Note or test condition                                       | Values |      |      | Unit |
|------------------------|--------------|--------------------------------------------------------------|--------|------|------|------|
|                        |              |                                                              | Min.   | Typ. | Max. |      |
| Deviation of $R_{100}$ | $\Delta R/R$ | $T_{NTC} = 100\text{ °C}$ ,<br>$R_{100} = 493\ \Omega$       | -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:*                      *Specification according to the valid application note.*

8 Characteristics diagrams

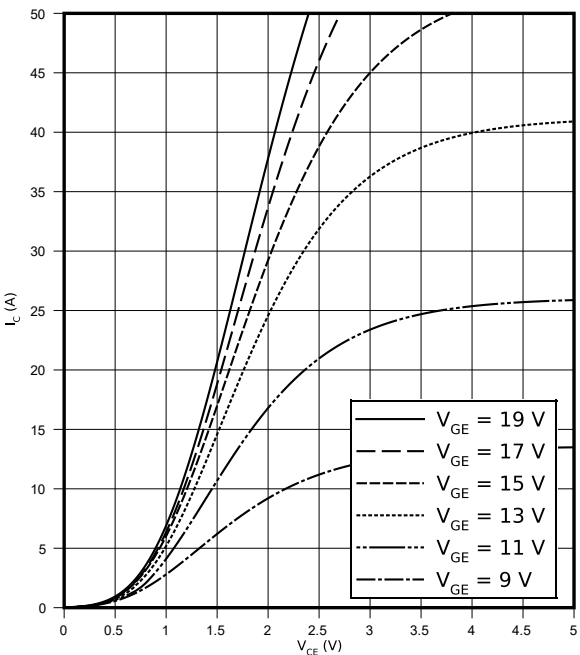
output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$   
 $V_{GE} = 15\text{ V}$



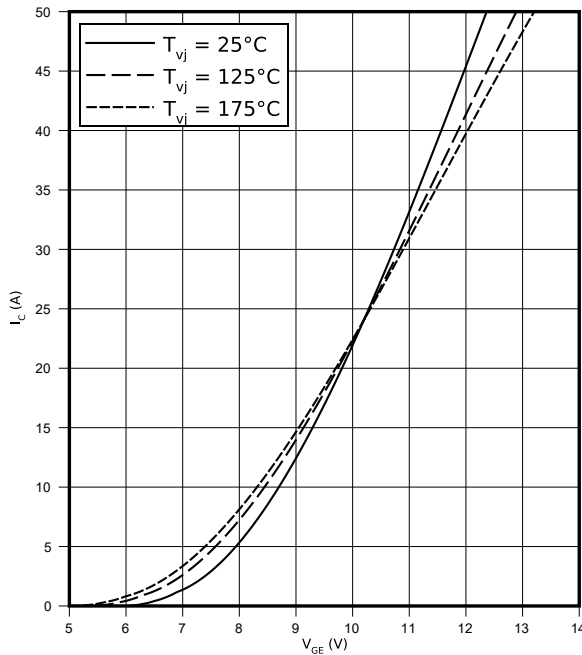
output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$   
 $T_{vj} = 175^\circ\text{C}$



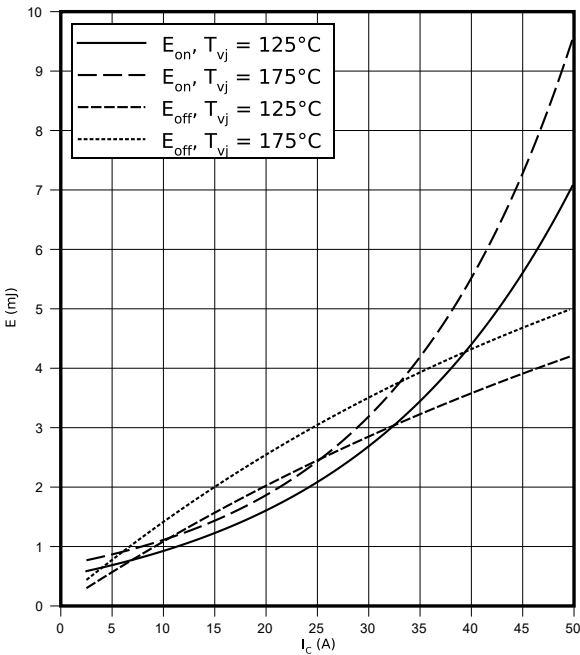
transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$   
 $V_{CE} = 20\text{ V}$



switching losses (typical), IGBT, Inverter

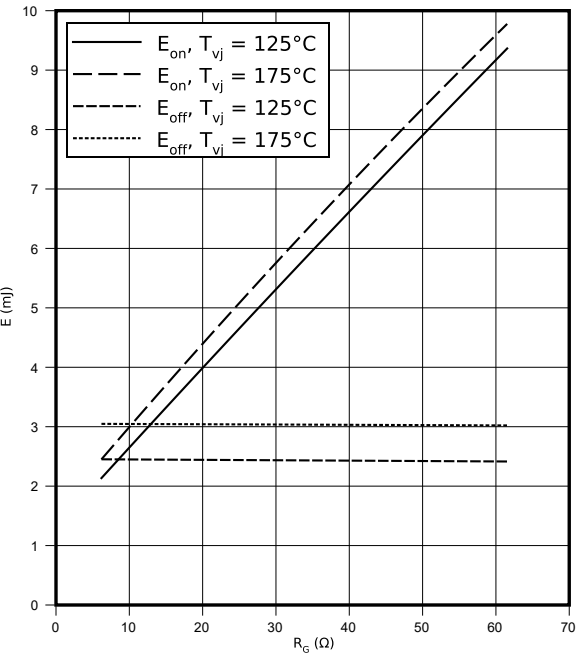
$E = f(I_C)$   
 $R_{Goff} = 6.2\ \Omega$ ,  $R_{Gon} = 6.2\ \Omega$ ,  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$



8 Characteristics diagrams

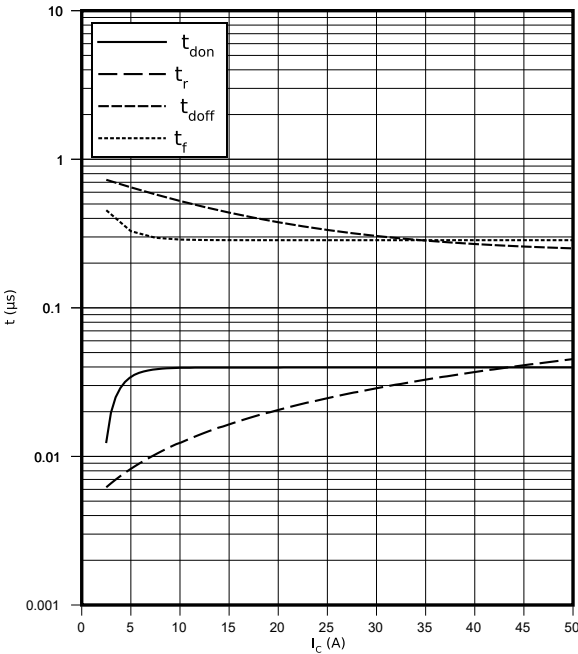
switching losses (typical), IGBT, Inverter

$E = f(R_G)$   
 $I_C = 25\text{ A}$ ,  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$



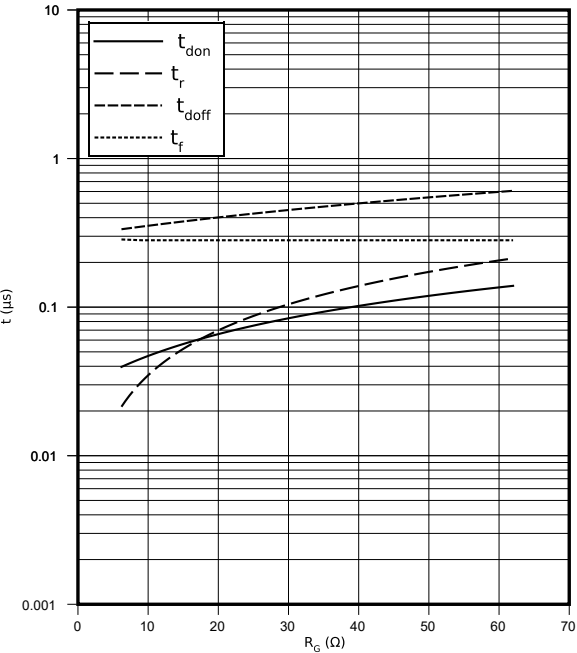
switching times (typical), IGBT, Inverter

$t = f(I_C)$   
 $R_{Goff} = 6.2\ \Omega$ ,  $R_{Gon} = 6.2\ \Omega$ ,  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $T_{vj} = 175^\circ\text{C}$



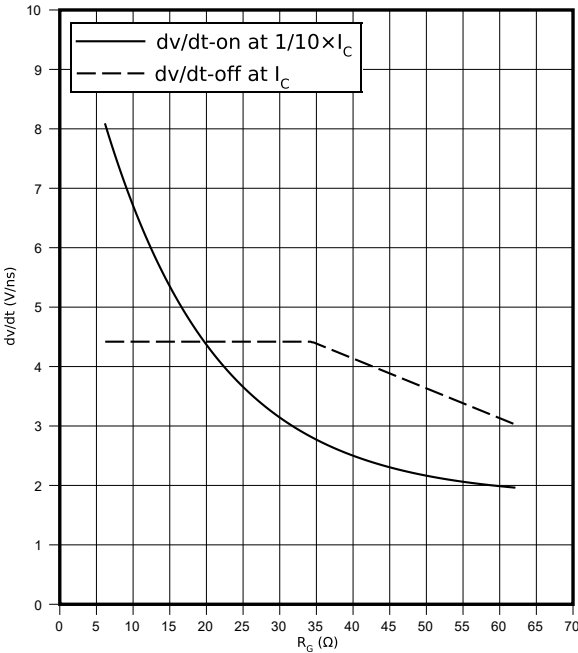
switching times (typical), IGBT, Inverter

$t = f(R_G)$   
 $I_C = 25\text{ A}$ ,  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $T_{vj} = 175^\circ\text{C}$



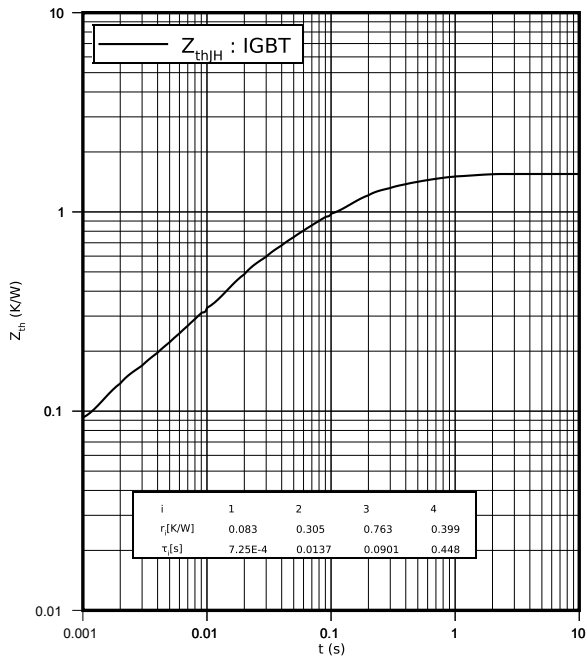
dv/dt (typical), IGBT, Inverter

$dv/dt = f(R_G)$   
 $I_C = 25\text{ A}$ ,  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $T_{vj} = 25^\circ\text{C}$

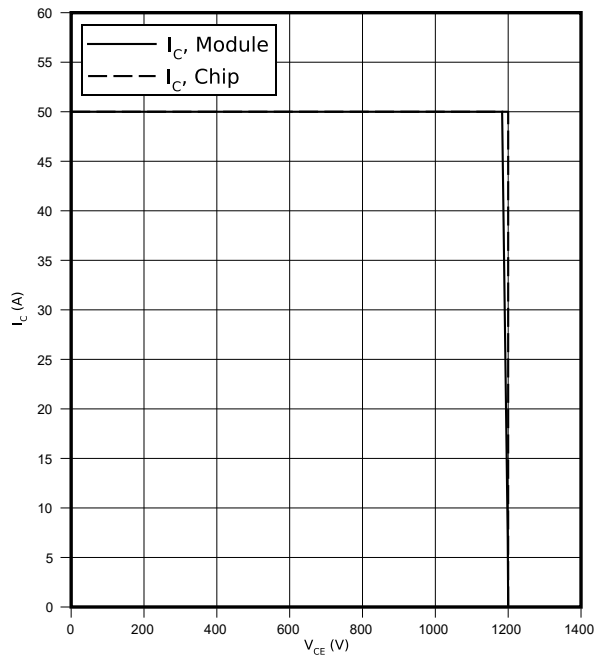


8 Characteristics diagrams

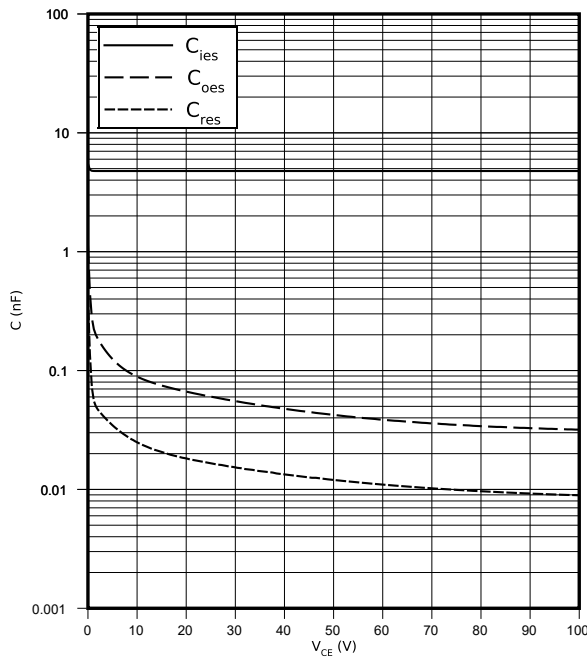
transient thermal impedance , IGBT, Inverter  
 $Z_{th} = f(t)$



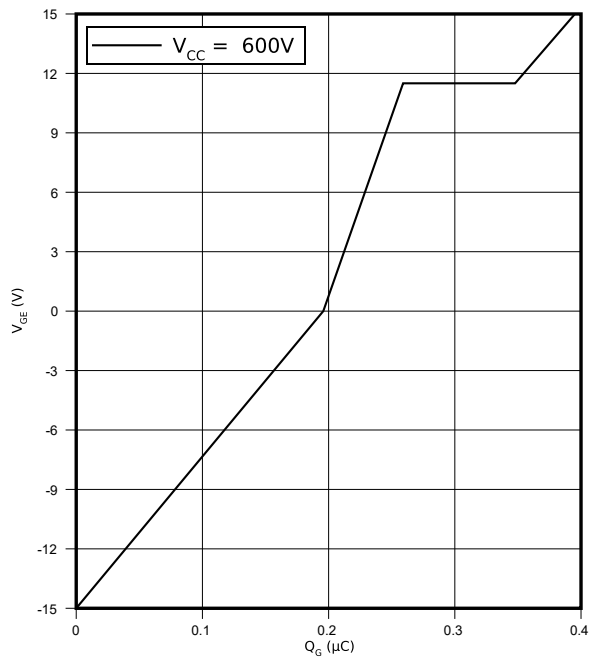
reverse bias safe operating area (RBSOA), IGBT, Inverter  
 $I_C = f(V_{CE})$   
 $R_{Goff} = 6.2 \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  $T_{vj} = 175 \text{ }^\circ\text{C}$



capacity characteristic (typical), IGBT, Inverter  
 $C = f(V_{CE})$   
 $V_{GE} = 0 \text{ V}$ ,  $f = 100 \text{ kHz}$ ,  $T_{vj} = 25 \text{ }^\circ\text{C}$

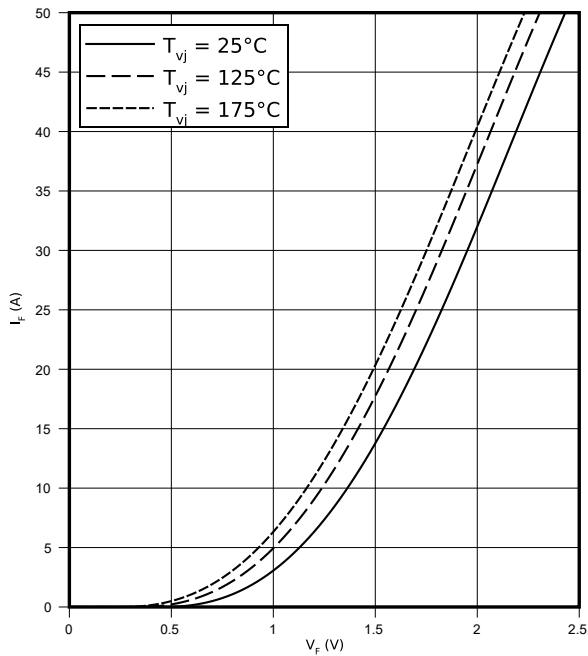


gate charge characteristic (typical), IGBT, Inverter  
 $V_{GE} = f(Q_G)$   
 $I_C = 25 \text{ A}$ ,  $T_{vj} = 25 \text{ }^\circ\text{C}$

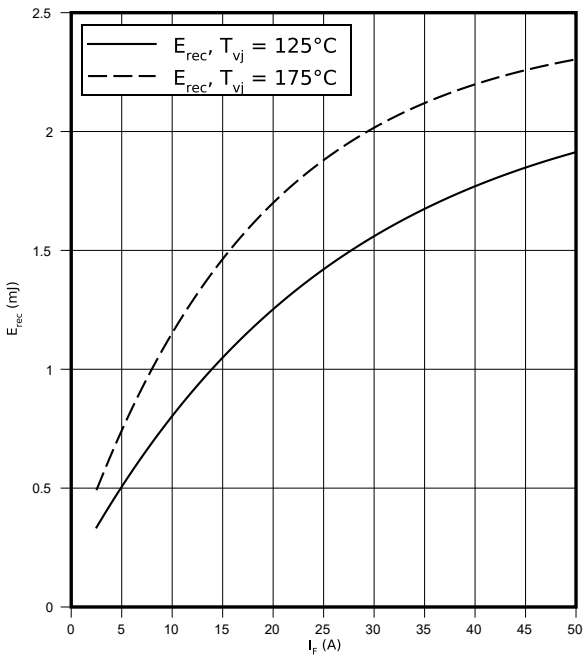


8 Characteristics diagrams

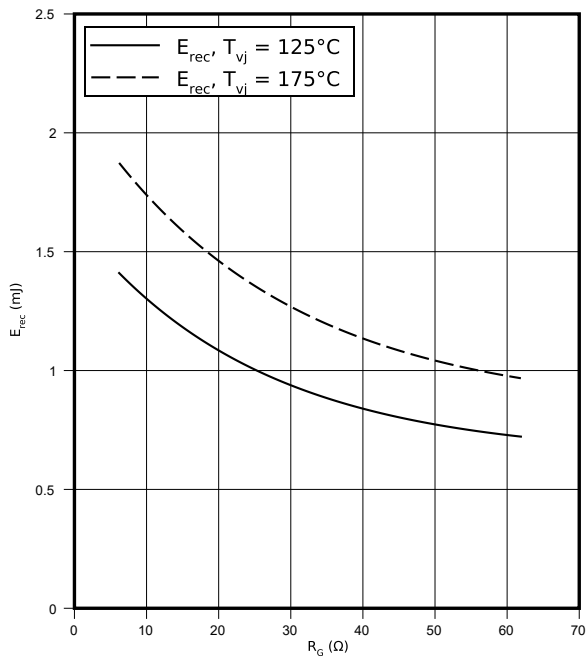
forward characteristic (typical), Diode, Inverter  
 $I_F = f(V_F)$



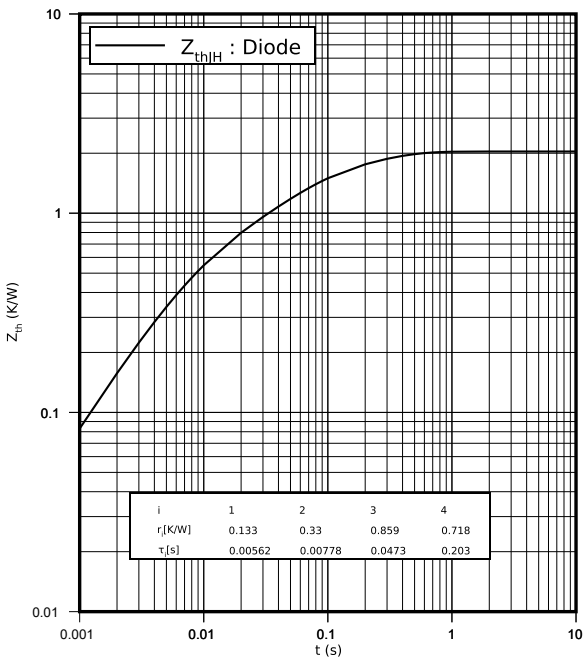
switching losses (typical), Diode, Inverter  
 $E_{rec} = f(I_F)$   
 $R_{Gon} = 6.2\ \Omega$ ,  $V_{CE} = 600\ \text{V}$



switching losses (typical), Diode, Inverter  
 $E_{rec} = f(R_G)$   
 $V_{CE} = 600\ \text{V}$ ,  $I_F = 25\ \text{A}$

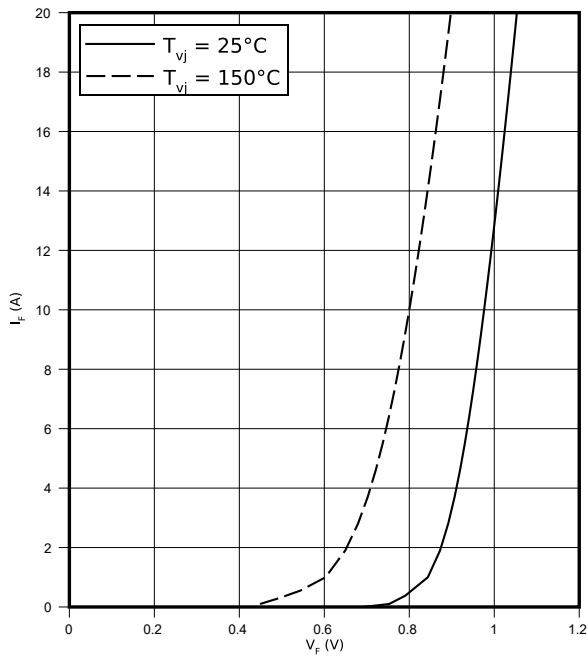


transient thermal impedance , Diode, Inverter  
 $Z_{th} = f(t)$

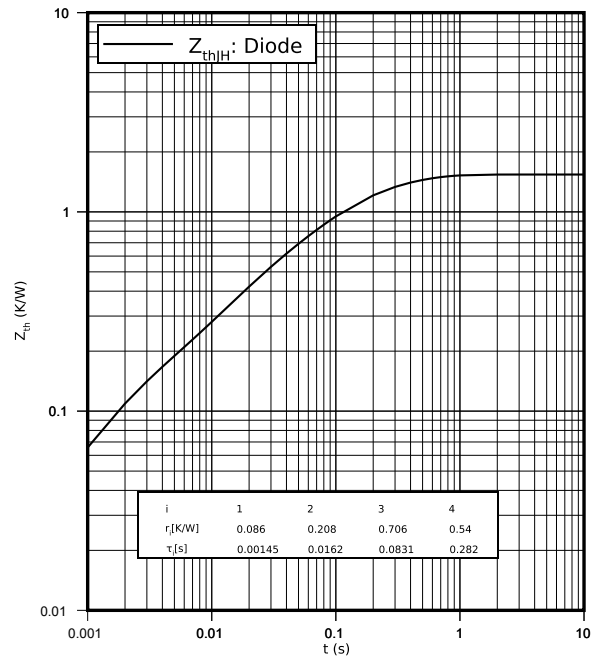


8 Characteristics diagrams

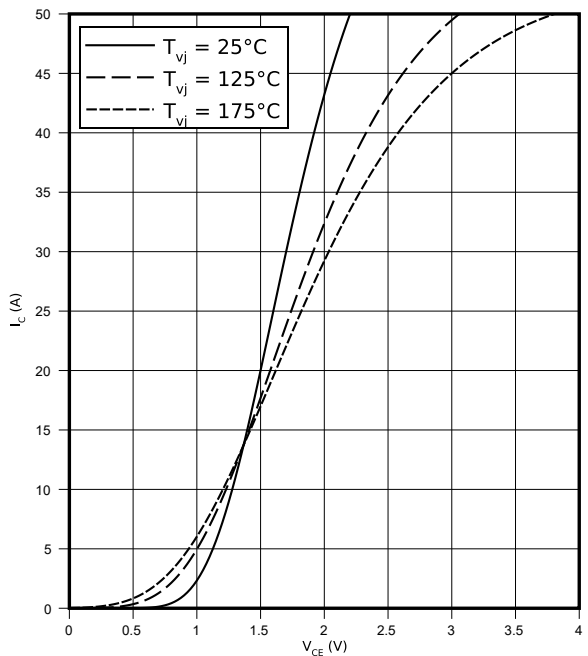
forward characteristic (typical), Diode, Rectifier  
 $I_F = f(V_F)$



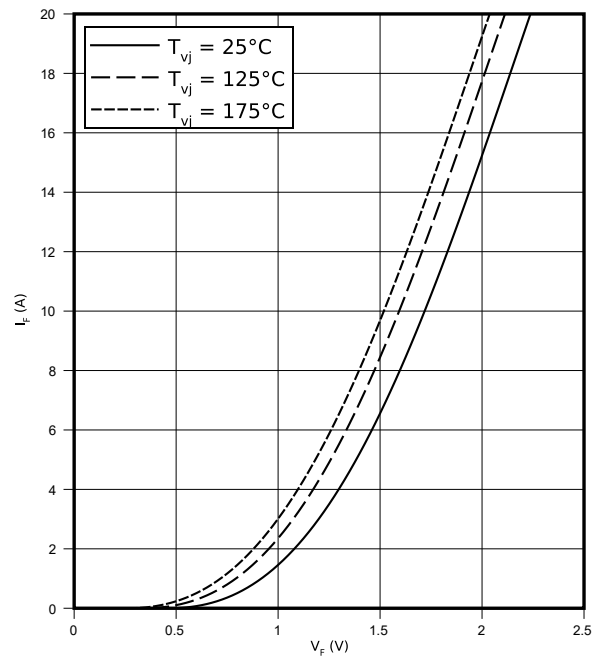
transient thermal impedance , Diode, Rectifier  
 $Z_{th} = f(t)$



output characteristic (typical), IGBT, Brake-Chopper  
 $I_C = f(V_{CE})$   
 $V_{GE} = 15$  V



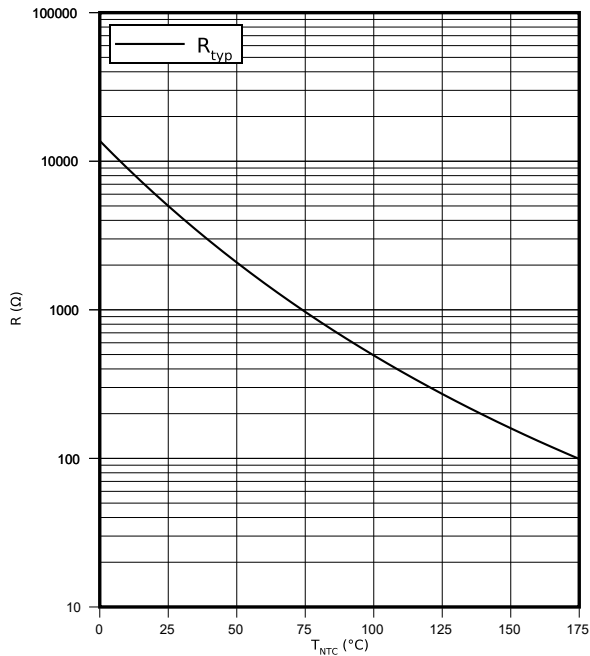
forward characteristic (typical), Diode, Brake-Chopper  
 $I_F = f(V_F)$



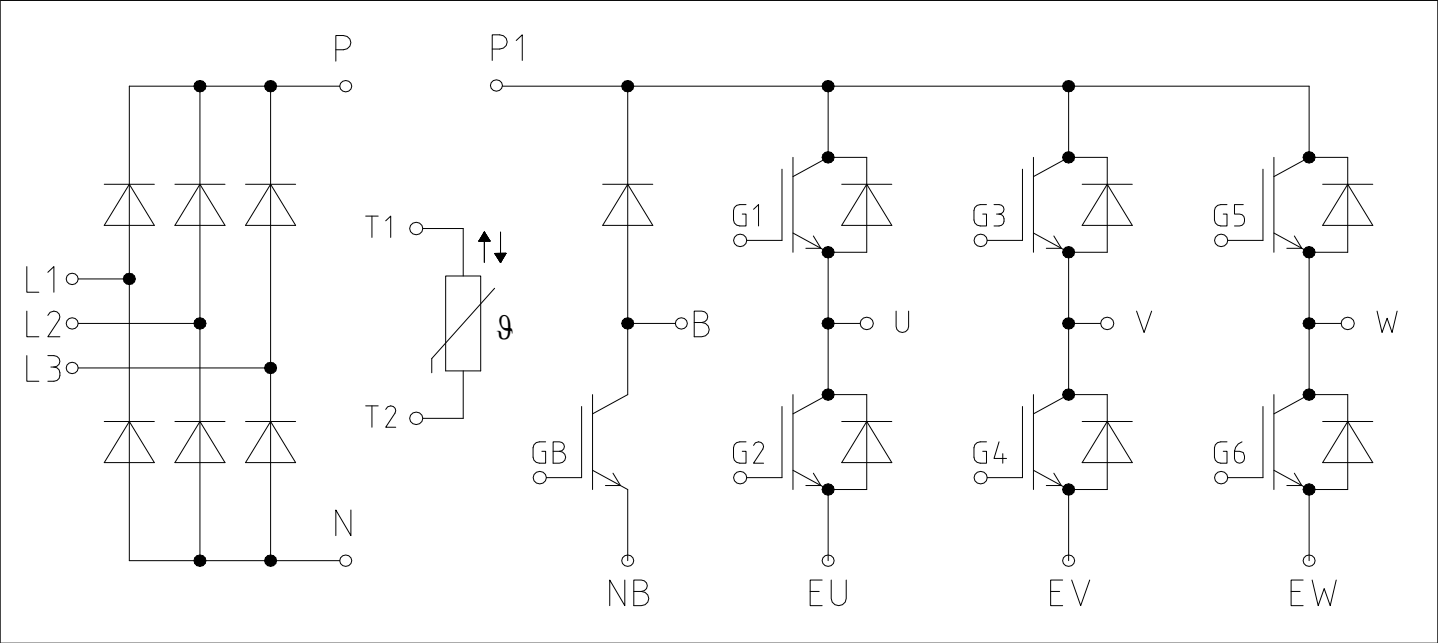
8 Characteristics diagrams

temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$

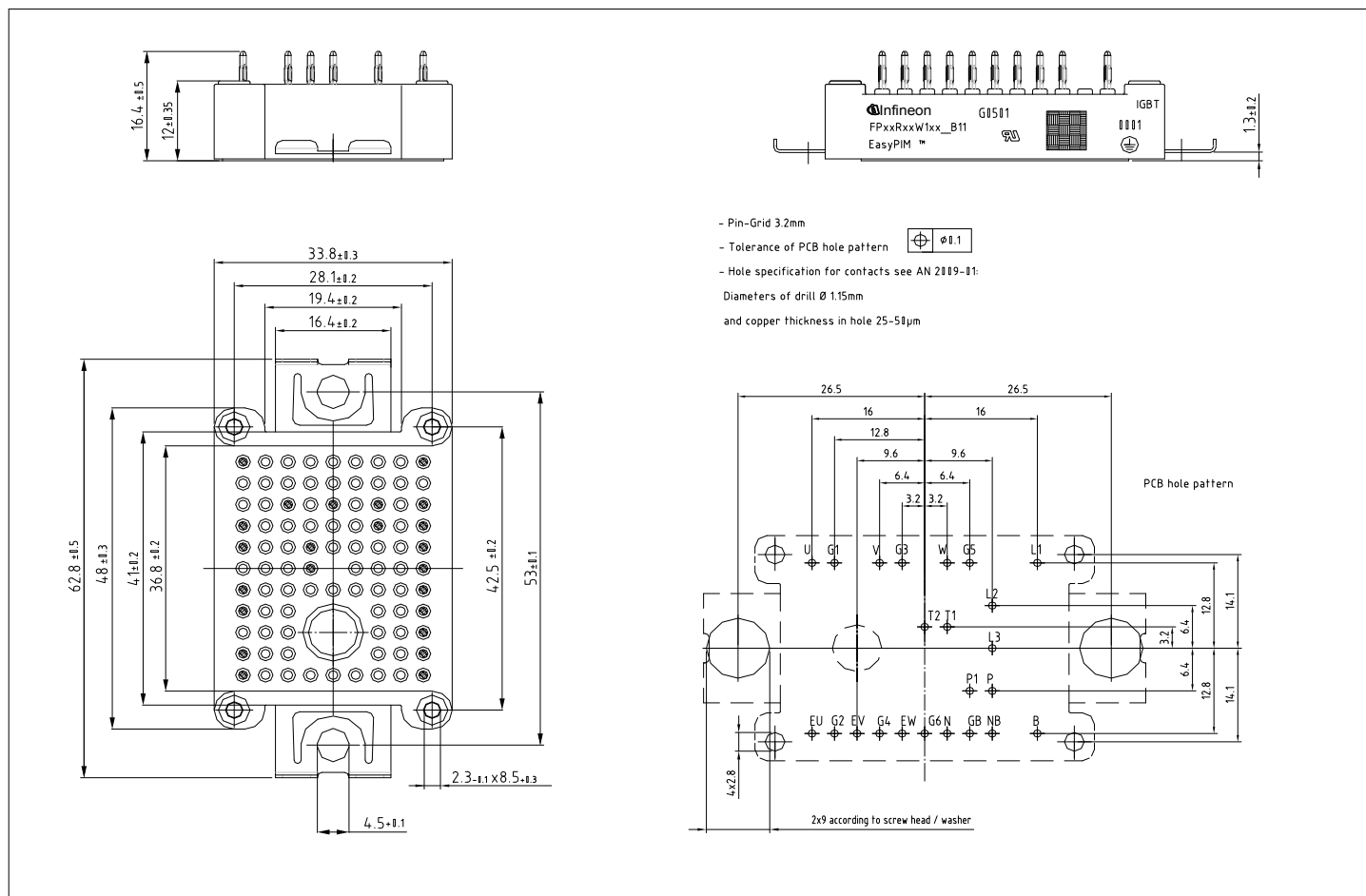


9      **Circuit diagram**



**Figure 2**

## 10 Package outlines



**Figure 3**

11 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                 |   |                         |                 |
|                         |  |                         |                 |
| 71549142846550549911530 |                                                                                     | 71549142846550549911530 |                 |

Figure 4

## Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

**Edition 2020-12-01**

**Published by**

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

**© 2020 Infineon Technologies AG**  
**All Rights Reserved.**

**Do you have a question about any aspect of this document?**

**Email:** [erratum@infineon.com](mailto:erratum@infineon.com)

**Document reference**  
**IFX-**

## IMPORTANT NOTICE

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenhheitsgarantie").

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

Please note that this product is not qualified according to the AEC Q100 or AEC Q101 documents of the Automotive Electronics Council.

## WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

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.