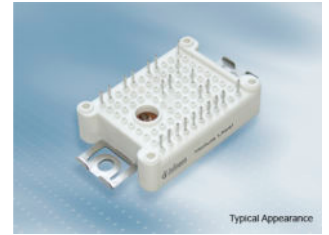


## Preliminary

### 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



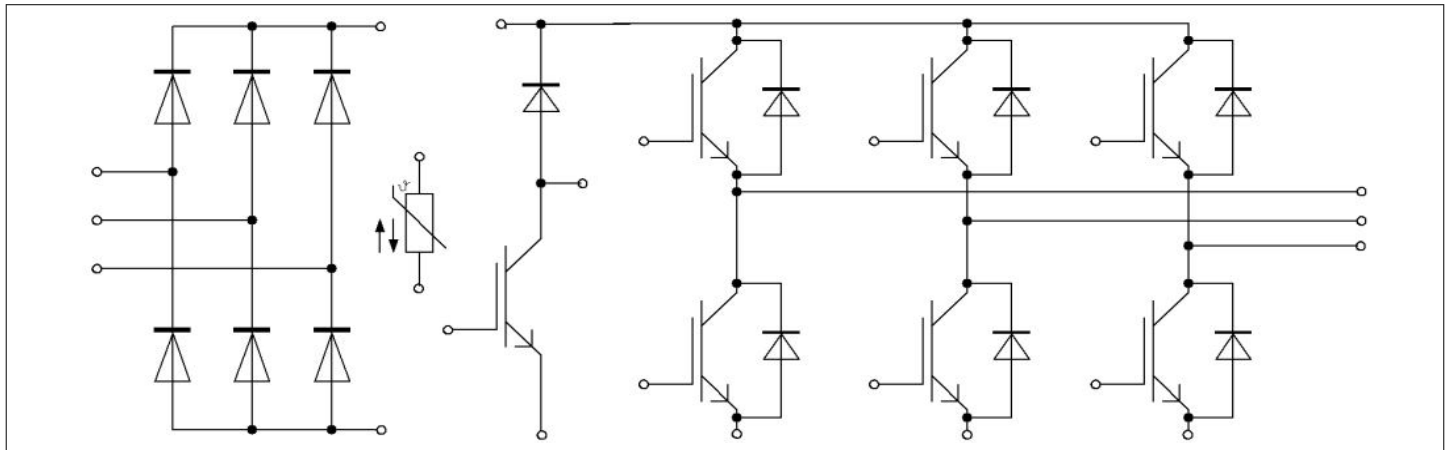
#### Potential applications

- Auxiliary inverters
- Air conditioning
- Motor drives

#### Product validation

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

#### Description



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**1 Package**

## 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)**

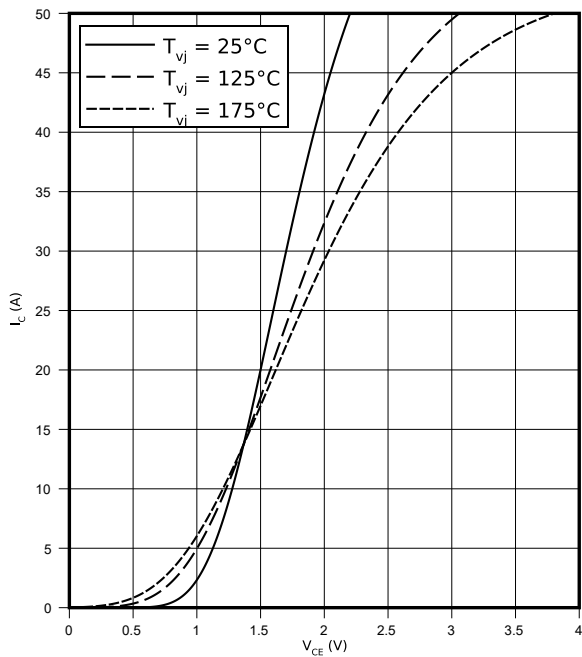
| Parameter              | Symbol       | Note or test condition                                       | Values |      |      | Unit |
|------------------------|--------------|--------------------------------------------------------------|--------|------|------|------|
|                        |              |                                                              | 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

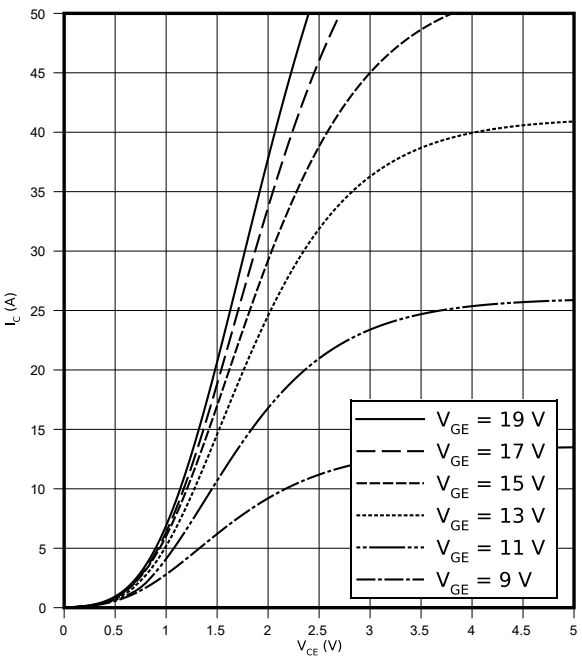
output characteristic (typical), IGBT, Inverter

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



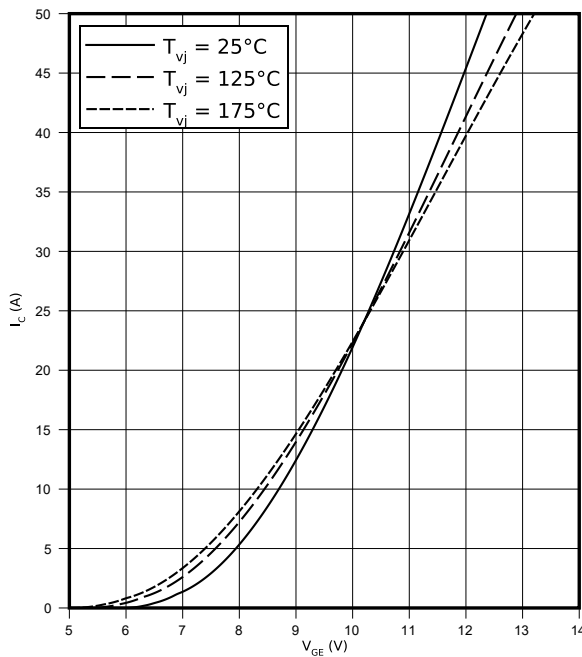
output characteristic (typical), IGBT, Inverter

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



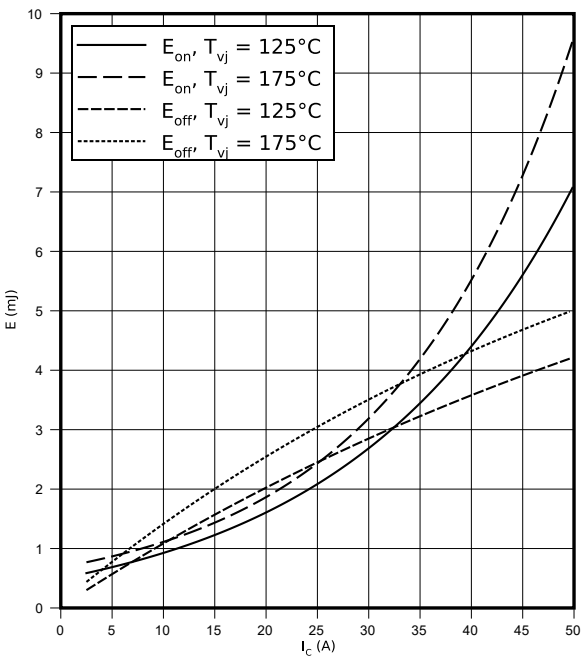
transfer characteristic (typical), IGBT, Inverter

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



switching losses (typical), IGBT, Inverter

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

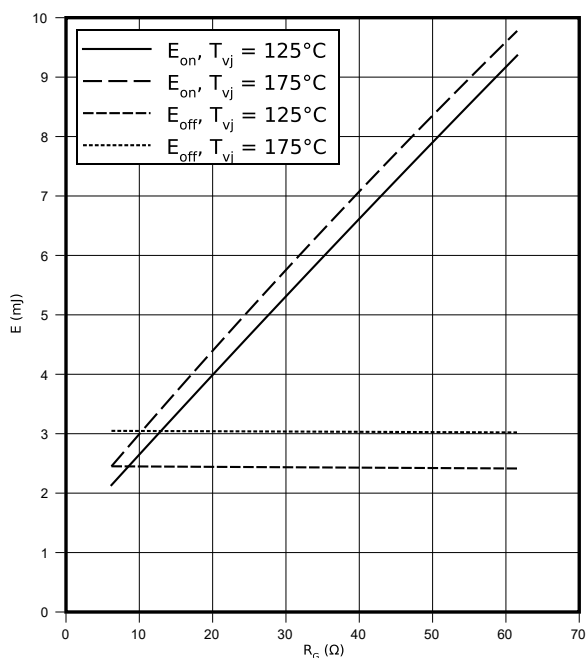


8 Characteristics diagrams

**switching losses (typical), IGBT, Inverter**

$$E = f(R_G)$$

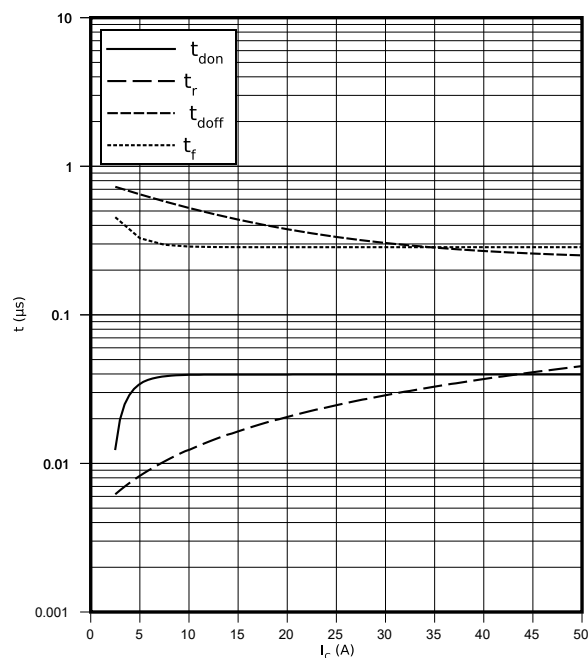
$$I_C = 25 \text{ A}, V_{CE} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}$$



**switching times (typical), IGBT, Inverter**

$$t = f(I_C)$$

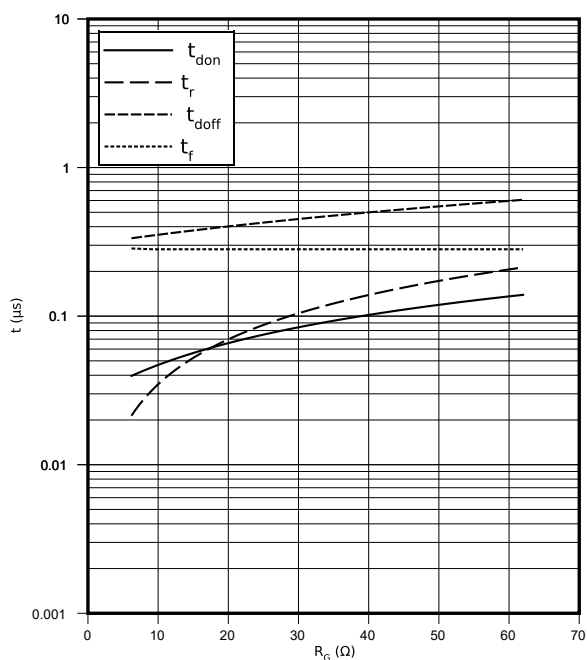
$$R_{Goff} = 6.2 \Omega, R_{Gon} = 6.2 \Omega, V_{CE} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}, T_{vj} = 175^\circ\text{C}$$



**switching times (typical), IGBT, Inverter**

$$t = f(R_G)$$

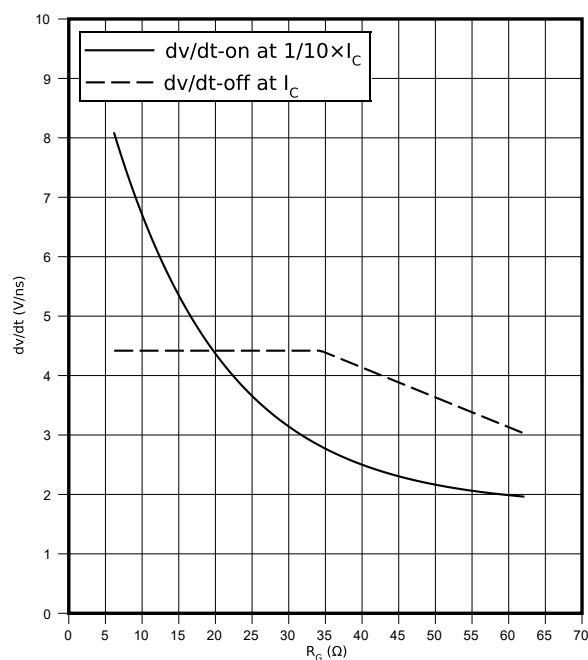
$$I_C = 25 \text{ A}, V_{CE} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}, T_{vj} = 175^\circ\text{C}$$



**dv/dt (typical), IGBT, Inverter**

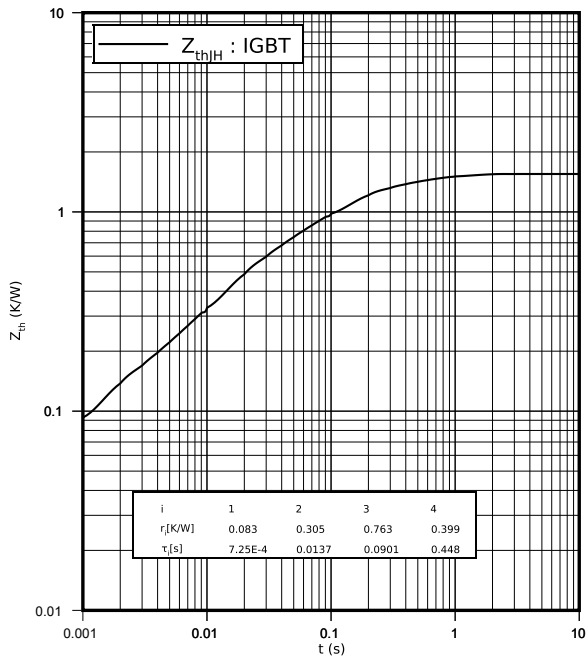
$$dv/dt = f(R_G)$$

$$I_C = 25 \text{ A}, V_{CE} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}, T_{vj} = 25^\circ\text{C}$$

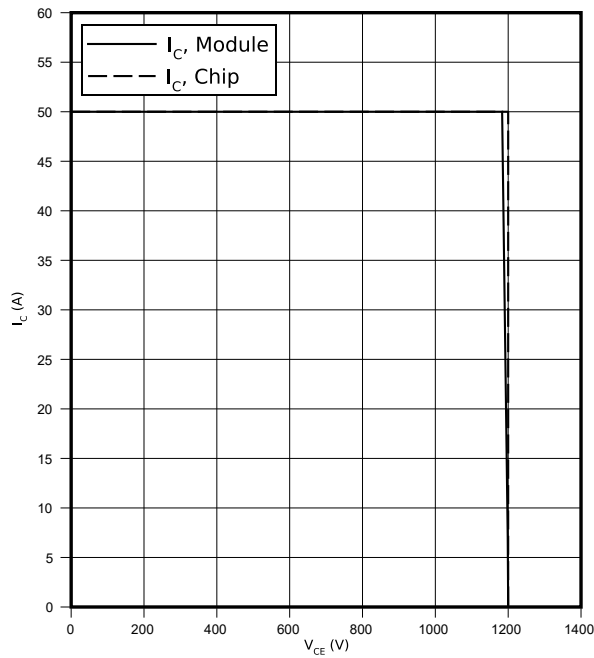


8 Characteristics diagrams

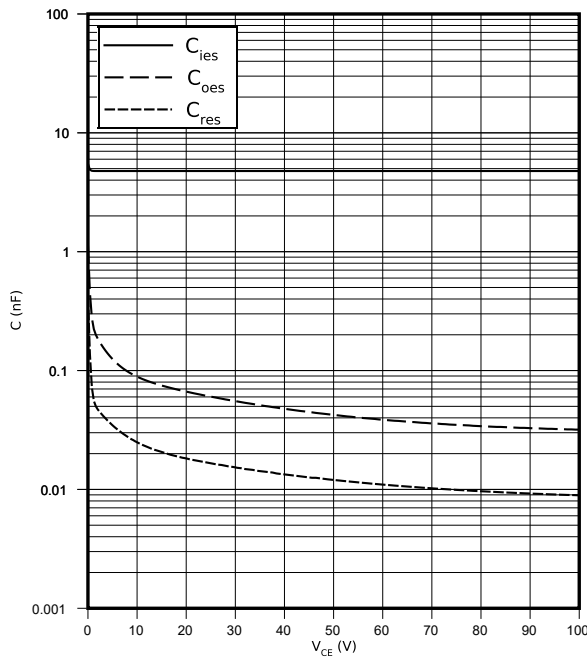
transient thermal impedance , IGBT, Inverter  
 $Z_{th} = f(t)$



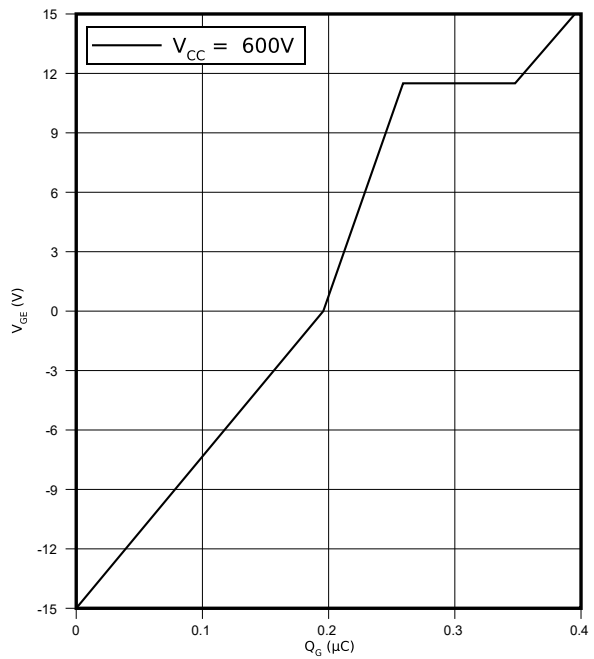
reverse bias safe operating area (RBSOA), IGBT, Inverter  
 $I_C = f(V_{CE})$   
 $R_{Goff} = 6.2 \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  $T_{vj} = 175 \text{ }^\circ\text{C}$



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



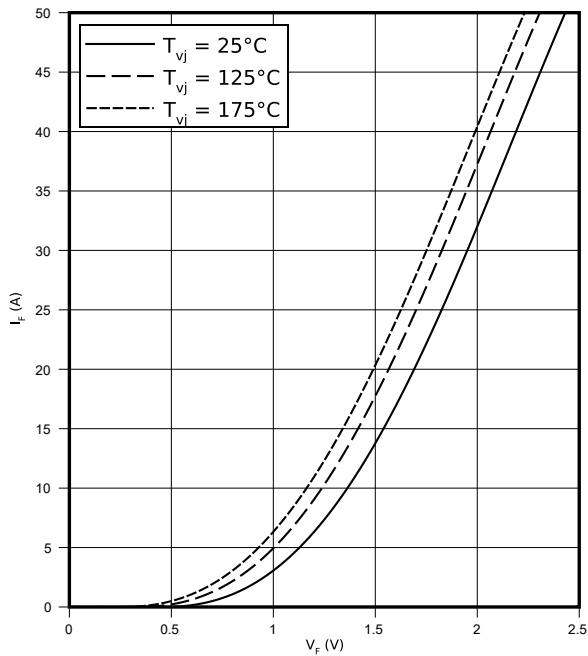
gate charge characteristic (typical), IGBT, Inverter  
 $V_{GE} = f(Q_G)$   
 $I_C = 25 \text{ A}$ ,  $T_{vj} = 25 \text{ }^\circ\text{C}$



8 Characteristics diagrams

forward characteristic (typical), Diode, Inverter

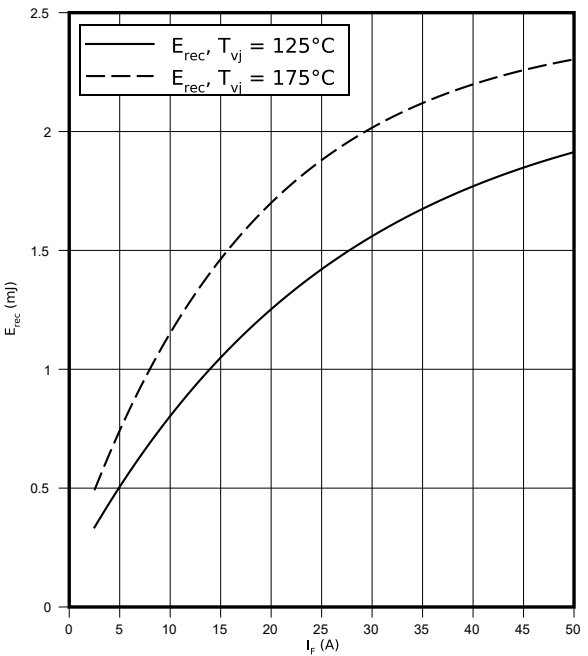
$I_F = f(V_F)$



switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

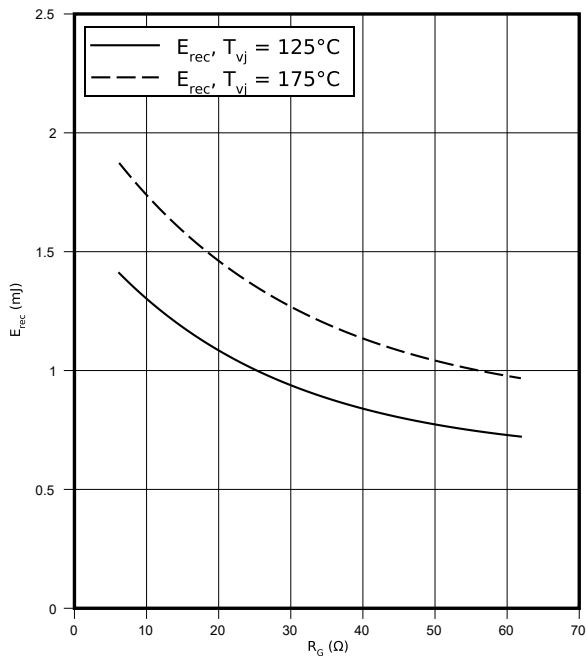
$R_{Gon} = 6.2\ \Omega, V_{CE} = 600\ \text{V}$



switching losses (typical), Diode, Inverter

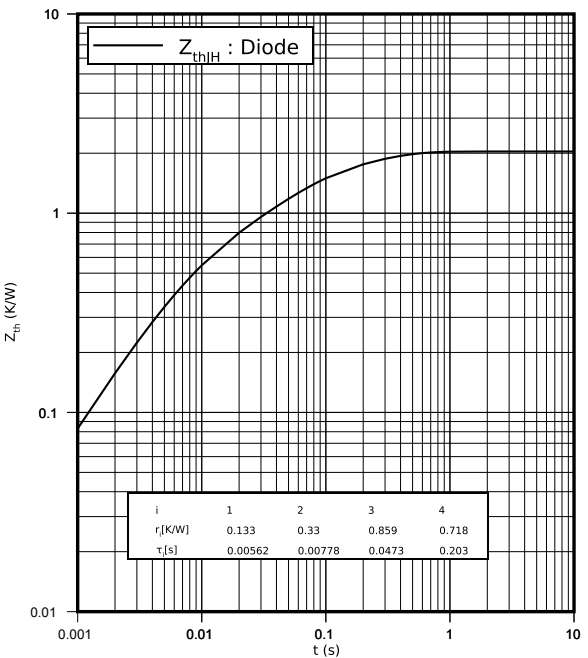
$E_{rec} = f(R_G)$

$V_{CE} = 600\ \text{V}, I_F = 25\ \text{A}$



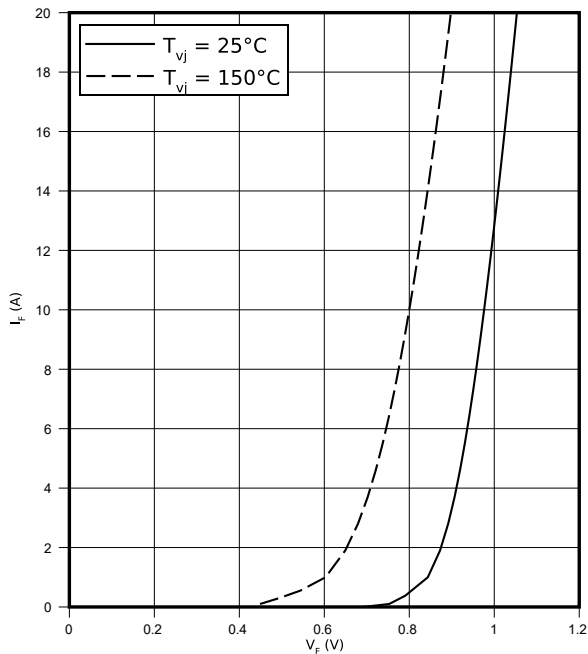
transient thermal impedance , Diode, Inverter

$Z_{th} = f(t)$

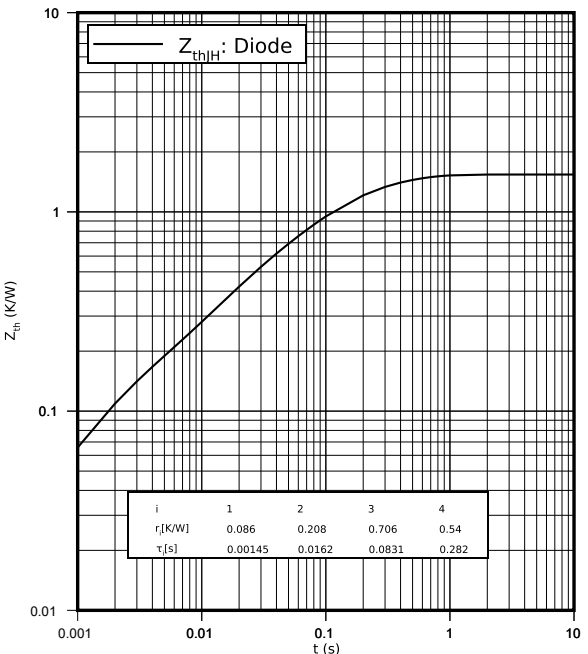


8 Characteristics diagrams

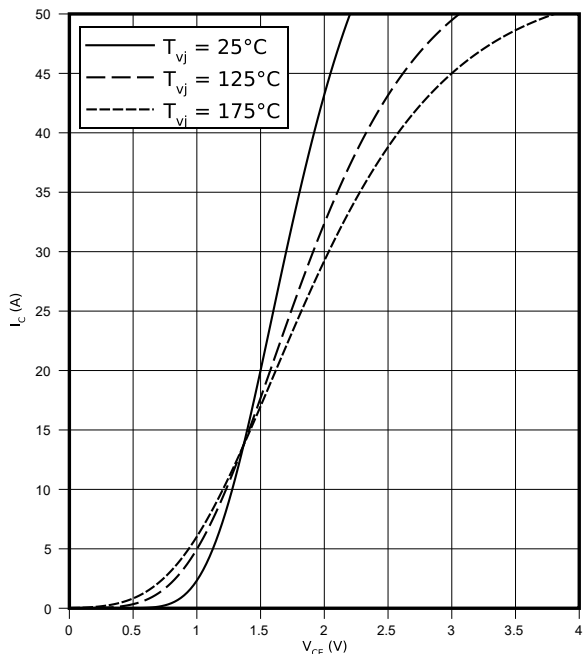
forward characteristic (typical), Diode, Rectifier  
 $I_F = f(V_F)$



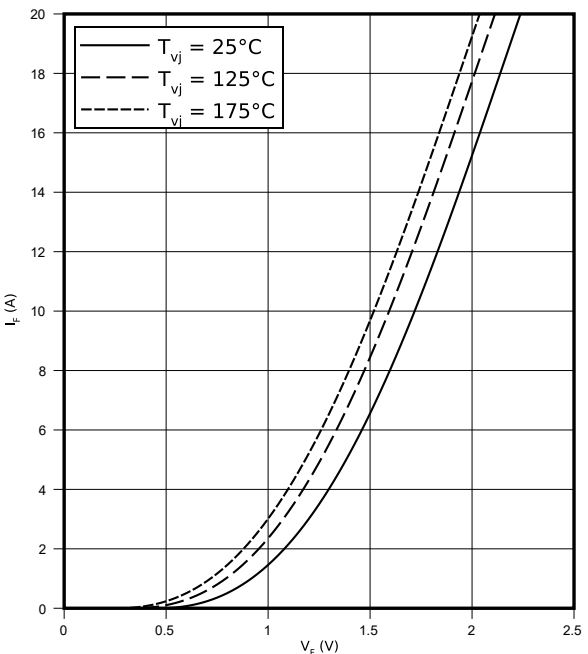
transient thermal impedance , Diode, Rectifier  
 $Z_{th} = f(t)$



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



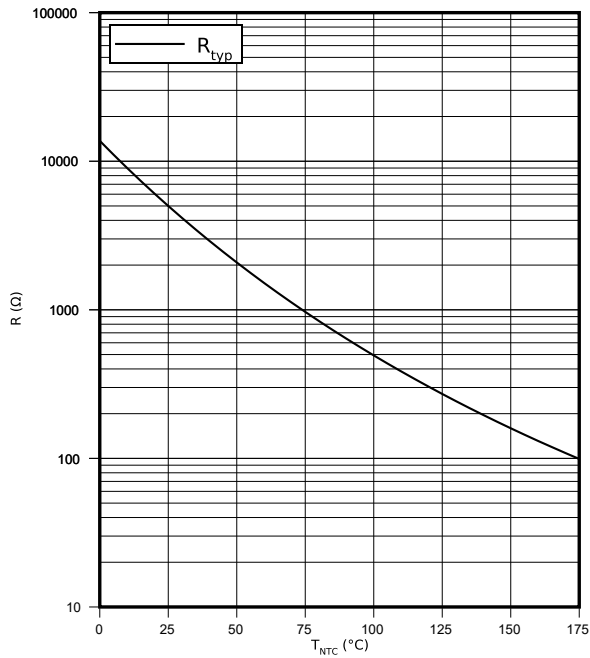
forward characteristic (typical), Diode, Brake-Chopper  
 $I_F = f(V_F)$



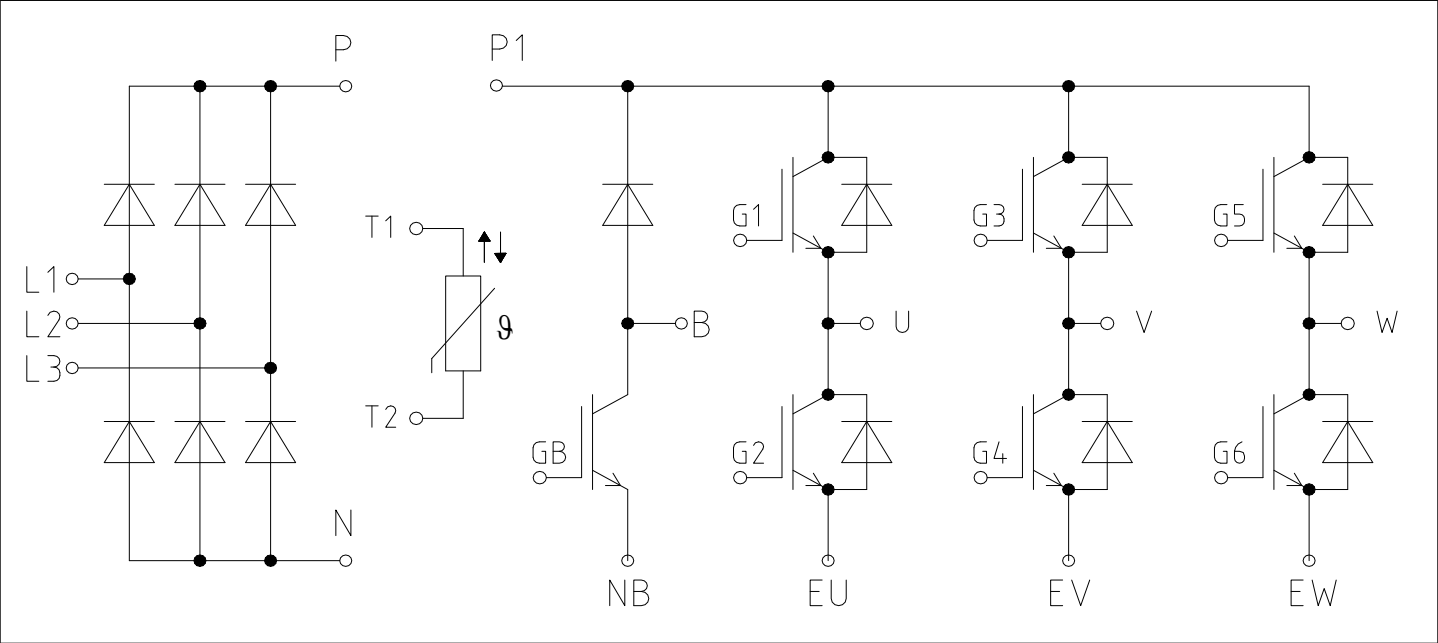
8 Characteristics diagrams

temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$

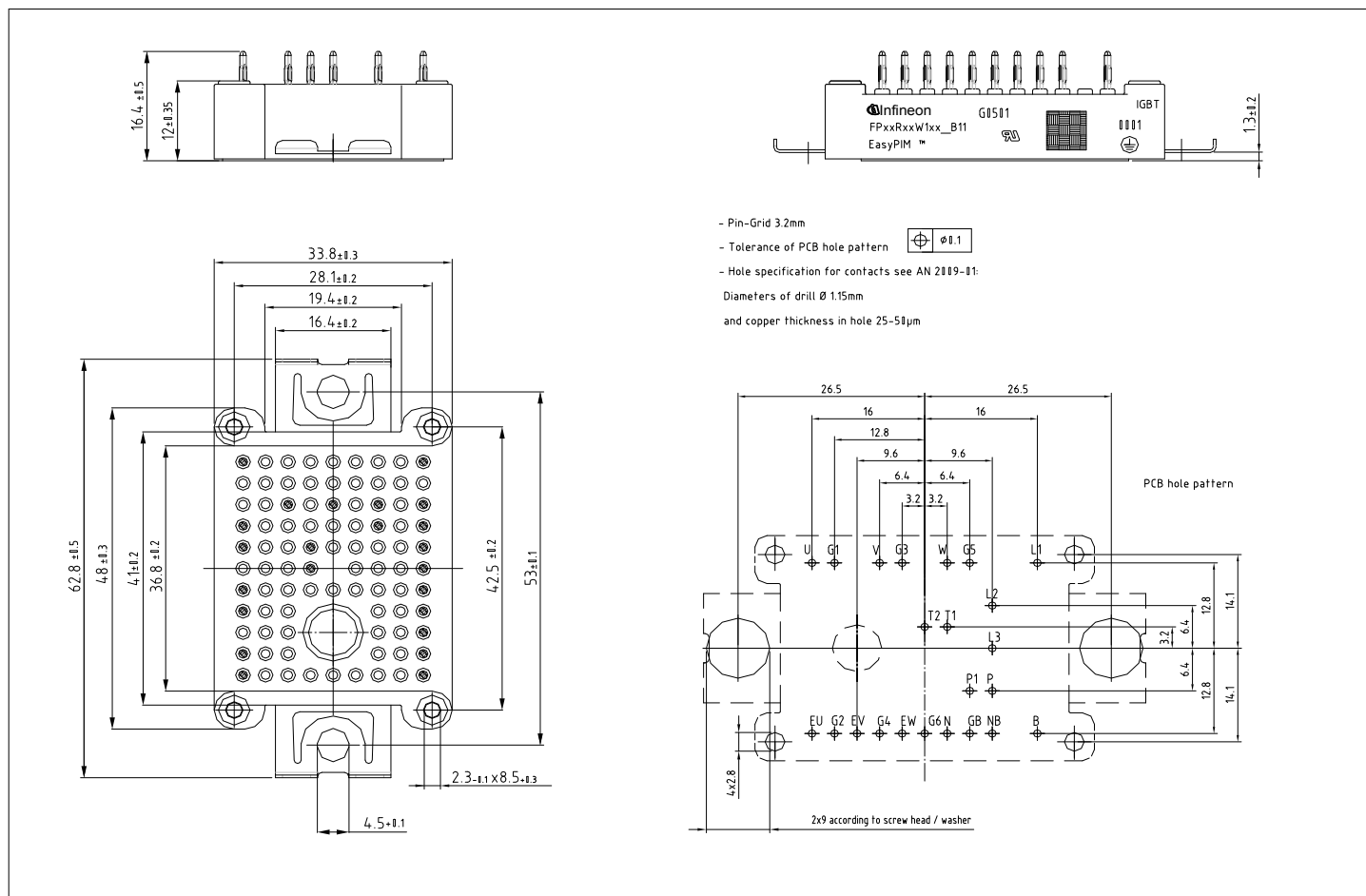


9      **Circuit diagram**



**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

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