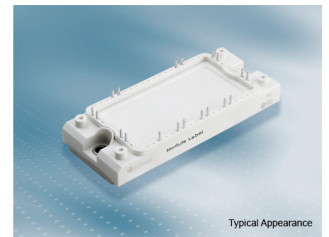


**EconoPIM™2 module with TRENCHSTOP™ IGBT7 and emitter controlled 7 diode and NTC / pre-applied thermal interface material**

**Features**

- Electrical features
  - $V_{CES} = 1200\text{ V}$
  - $I_{C\text{ nom}} = 50\text{ A} / I_{CRM} = 100\text{ A}$
  - TRENCHSTOP™ IGBT7
  - Low  $V_{CE,sat}$
  - Overload operation up to  $175^{\circ}\text{C}$
- Mechanical features
  - High power and thermal cycling capability
  - Integrated NTC temperature sensor
  - Copper base plate
  - $\text{Al}_2\text{O}_3$  substrate with low thermal resistance
  - Pre-applied thermal interface material
  - Solder contact technology



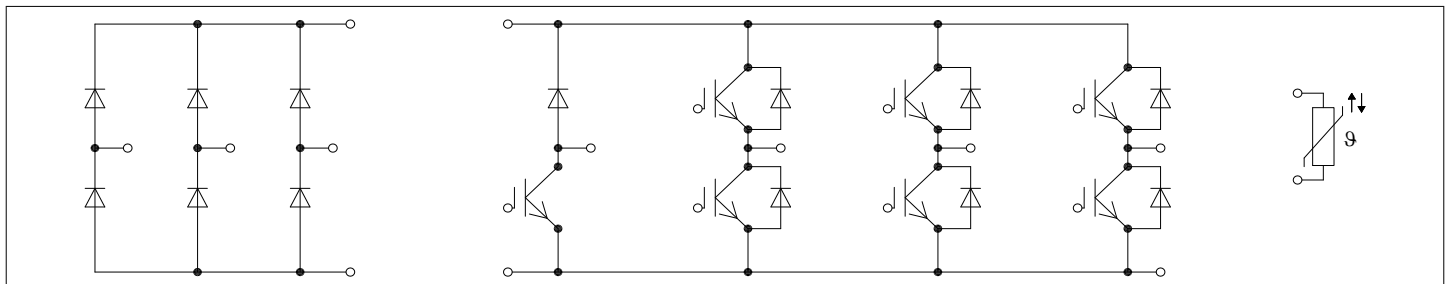
**Potential applications**

- Auxiliary inverters
- Motor drives
- Servo drives

**Product validation**

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

**Description**



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## 1 Package

**Table 1** Insulation coordination

| Parameter                           | Symbol      | Note or test condition                         | Values    | Unit |
|-------------------------------------|-------------|------------------------------------------------|-----------|------|
| Isolation test voltage              | $V_{ISOL}$  | RMS, $f = 50 \text{ Hz}$ , $t = 1 \text{ min}$ | 2.5       | kV   |
| Material of module baseplate        |             |                                                | Cu        |      |
| Internal isolation                  |             | basic insulation (class 1, IEC 61140)          | $Al_2O_3$ |      |
| Creepage distance                   | $d_{Creep}$ | terminal to heatsink                           | 10.0      | mm   |
| Clearance                           | $d_{Clear}$ | terminal to heatsink                           | 7.5       | mm   |
| Comparative tracking index          | $CTI$       |                                                | >200      |      |
| Relative thermal index (electrical) | $RTI$       | housing                                        | 140       | °C   |

**Table 2** Characteristic values

| Parameter                                | Symbol        | Note or test condition                         | Values    |      |      | Unit |
|------------------------------------------|---------------|------------------------------------------------|-----------|------|------|------|
|                                          |               |                                                | Min.      | Typ. | Max. |      |
| Stray inductance module                  | $L_{sCE}$     |                                                |           | 35   |      | nH   |
| Module lead resistance, terminals - chip | $R_{AA'+CC'}$ | $T_H = 25^\circ\text{C}$ , per switch          |           | 5.5  |      | mΩ   |
| Module lead resistance, terminals - chip | $R_{CC'+EE'}$ | $T_H = 25^\circ\text{C}$ , per switch          |           | 4.8  |      | mΩ   |
| Storage temperature                      | $T_{stg}$     |                                                | -40       |      | 125  | °C   |
| Maximum baseplate operation temperature  | $T_{BPmax}$   |                                                |           |      | 150  | °C   |
| Mounting torque for module mounting      | $M$           | - Mounting according to valid application note | M5, Screw | 3    | 6    | Nm   |
| Weight                                   | $G$           |                                                |           | 180  |      | g    |

*Note:* The current under continuous operation is limited to 50 A rms per connector pin.  
Storage and shipment of modules with TIM => see AN2012-07

## 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    |
| Continuous DC collector current | $I_{CDC}$ | $T_{vj\max} = 175^\circ\text{C}$ | $T_H = 90^\circ\text{C}$    | 50     | A    |

(table continues...)

**Table 3 (continued) Maximum rated values**

| Parameter                         | Symbol    | Note or test condition | Values   | Unit |
|-----------------------------------|-----------|------------------------|----------|------|
| Repetitive peak collector current | $I_{CRM}$ | $t_P = 1 \text{ ms}$   | 100      | A    |
| Gate-emitter peak voltage         | $V_{GES}$ |                        | $\pm 20$ | V    |

**Table 4 Characteristic values**

| Parameter                            | Symbol               | Note or test condition                                                                                                                                                                                    | Values                                |       |      | Unit          |
|--------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-------|------|---------------|
|                                      |                      |                                                                                                                                                                                                           | Min.                                  | Typ.  | Max. |               |
| Collector-emitter saturation voltage | $V_{CE \text{ sat}}$ | $I_C = 50 \text{ A}, V_{GE} = 15 \text{ V}$                                                                                                                                                               | $T_{vj} = 25 \text{ }^\circ\text{C}$  | 1.50  | 1.80 | V             |
|                                      |                      |                                                                                                                                                                                                           | $T_{vj} = 125 \text{ }^\circ\text{C}$ | 1.64  |      |               |
|                                      |                      |                                                                                                                                                                                                           | $T_{vj} = 175 \text{ }^\circ\text{C}$ | 1.72  |      |               |
| Gate threshold voltage               | $V_{GEth}$           | $I_C = 2 \text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25 \text{ }^\circ\text{C}$                                                                                                                                 | 5.15                                  | 5.80  | 6.45 | V             |
| Gate charge                          | $Q_G$                | $V_{GE} = \pm 15 \text{ V}, V_{CE} = 600 \text{ V}$                                                                                                                                                       |                                       | 0.92  |      | $\mu\text{C}$ |
| Internal gate resistor               | $R_{Gint}$           | $T_{vj} = 25 \text{ }^\circ\text{C}$                                                                                                                                                                      |                                       | 0     |      | $\Omega$      |
| Input capacitance                    | $C_{ies}$            | $f = 100 \text{ kHz}, T_{vj} = 25 \text{ }^\circ\text{C}, V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}$                                                                                                    |                                       | 11.1  |      | nF            |
| Reverse transfer capacitance         | $C_{res}$            | $f = 100 \text{ kHz}, T_{vj} = 25 \text{ }^\circ\text{C}, V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}$                                                                                                    |                                       | 0.039 |      | nF            |
| Collector-emitter cut-off current    | $I_{CES}$            | $V_{CE} = 1200 \text{ V}, V_{GE} = 0 \text{ V}$                                                                                                                                                           | $T_{vj} = 25 \text{ }^\circ\text{C}$  |       | 0.01 | mA            |
| Gate-emitter leakage current         | $I_{GES}$            | $V_{CE} = 0 \text{ V}, V_{GE} = 20 \text{ V}, T_{vj} = 25 \text{ }^\circ\text{C}$                                                                                                                         |                                       |       | 100  | nA            |
| Turn-on delay time (inductive load)  | $t_{don}$            | $I_C = 50 \text{ A}, V_{CE} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Gon} = 7.5 \text{ } \Omega$                                                                                                    | $T_{vj} = 25 \text{ }^\circ\text{C}$  | 0.059 |      | $\mu\text{s}$ |
|                                      |                      |                                                                                                                                                                                                           | $T_{vj} = 125 \text{ }^\circ\text{C}$ | 0.061 |      |               |
|                                      |                      |                                                                                                                                                                                                           | $T_{vj} = 175 \text{ }^\circ\text{C}$ | 0.062 |      |               |
| Rise time (inductive load)           | $t_r$                | $I_C = 50 \text{ A}, V_{CE} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Gon} = 7.5 \text{ } \Omega$                                                                                                    | $T_{vj} = 25 \text{ }^\circ\text{C}$  | 0.043 |      | $\mu\text{s}$ |
|                                      |                      |                                                                                                                                                                                                           | $T_{vj} = 125 \text{ }^\circ\text{C}$ | 0.047 |      |               |
|                                      |                      |                                                                                                                                                                                                           | $T_{vj} = 175 \text{ }^\circ\text{C}$ | 0.049 |      |               |
| Turn-off delay time (inductive load) | $t_{doff}$           | $I_C = 50 \text{ A}, V_{CE} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 7.5 \text{ } \Omega$                                                                                                   | $T_{vj} = 25 \text{ }^\circ\text{C}$  | 0.290 |      | $\mu\text{s}$ |
|                                      |                      |                                                                                                                                                                                                           | $T_{vj} = 125 \text{ }^\circ\text{C}$ | 0.380 |      |               |
|                                      |                      |                                                                                                                                                                                                           | $T_{vj} = 175 \text{ }^\circ\text{C}$ | 0.420 |      |               |
| Fall time (inductive load)           | $t_f$                | $I_C = 50 \text{ A}, V_{CE} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 7.5 \text{ } \Omega$                                                                                                   | $T_{vj} = 25 \text{ }^\circ\text{C}$  | 0.110 |      | $\mu\text{s}$ |
|                                      |                      |                                                                                                                                                                                                           | $T_{vj} = 125 \text{ }^\circ\text{C}$ | 0.200 |      |               |
|                                      |                      |                                                                                                                                                                                                           | $T_{vj} = 175 \text{ }^\circ\text{C}$ | 0.270 |      |               |
| Turn-on energy loss per pulse        | $E_{on}$             | $I_C = 50 \text{ A}, V_{CE} = 600 \text{ V}, L_\sigma = 35 \text{ nH}, V_{GE} = \pm 15 \text{ V}, R_{Gon} = 7.5 \text{ } \Omega, di/dt = 900 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ }^\circ\text{C})$ | $T_{vj} = 25 \text{ }^\circ\text{C}$  | 5.07  |      | mJ            |
|                                      |                      |                                                                                                                                                                                                           | $T_{vj} = 125 \text{ }^\circ\text{C}$ | 6.76  |      |               |
|                                      |                      |                                                                                                                                                                                                           | $T_{vj} = 175 \text{ }^\circ\text{C}$ | 7.72  |      |               |

(table continues...)

**Table 4** (continued) Characteristic values

| Parameter                                 | Symbol             | Note or test condition                                                                                                                                                                                     | Values                                                  |      |       | Unit |
|-------------------------------------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|------|-------|------|
|                                           |                    |                                                                                                                                                                                                            | Min.                                                    | Typ. | Max.  |      |
| Turn-off energy loss per pulse            | $E_{off}$          | $I_C = 50\text{ A}$ , $V_{CE} = 600\text{ V}$ ,<br>$L_\sigma = 35\text{ nH}$ , $V_{GE} = \pm 15\text{ V}$ ,<br>$R_{Goff} = 7.5\ \Omega$ , $dv/dt = 2900\text{ V}/\mu\text{s}$ ( $T_{vj} = 175\text{ °C}$ ) | $T_{vj} = 25\text{ °C}$                                 | 3.37 |       | mJ   |
|                                           |                    |                                                                                                                                                                                                            | $T_{vj} = 125\text{ °C}$                                | 5.31 |       |      |
|                                           |                    |                                                                                                                                                                                                            | $T_{vj} = 175\text{ °C}$                                | 6.58 |       |      |
| SC data                                   | $I_{SC}$           | $V_{GE} \leq 15\text{ V}$ , $V_{CC} = 800\text{ V}$ ,<br>$V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$                                                                                                       | $t_p \leq 8\ \mu\text{s}$ ,<br>$T_{vj} = 150\text{ °C}$ | 190  |       | A    |
|                                           |                    |                                                                                                                                                                                                            | $t_p \leq 7\ \mu\text{s}$ ,<br>$T_{vj} = 175\text{ °C}$ | 180  |       |      |
| Thermal resistance, junction to heat sink | $R_{thJH}$         | per IGBT, Valid with IFX pre-applied Thermal Interface Material                                                                                                                                            |                                                         |      | 0.777 | 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 | $V_{RRM}$ |                                           | $T_{vj} = 25\text{ }^{\circ}\text{C}$  | 1200   | V                    |
| Continuous DC forward current   | $I_F$     |                                           |                                        | 50     | A                    |
| Repetitive peak forward current | $I_{FRM}$ | $t_P = 1\text{ ms}$                       |                                        | 100    | A                    |
| $I^2t$ - value                  | $I^2t$    | $V_R = 0\text{ V}$ , $t_P = 10\text{ ms}$ | $T_{vj} = 125\text{ }^{\circ}\text{C}$ | 465    | $\text{A}^2\text{s}$ |
|                                 |           |                                           | $T_{vj} = 175\text{ }^{\circ}\text{C}$ | 420    |                      |

**Table 6** Characteristic values

| Parameter       | Symbol | Note or test condition                      | Values                   |      |      | Unit |
|-----------------|--------|---------------------------------------------|--------------------------|------|------|------|
|                 |        |                                             | Min.                     | Typ. | Max. |      |
| Forward voltage | $V_F$  | $I_F = 50\text{ A}$ , $V_{GE} = 0\text{ V}$ | $T_{vj} = 25\text{ °C}$  | 1.72 | 2.10 | V    |
|                 |        |                                             | $T_{vj} = 125\text{ °C}$ | 1.59 |      |      |
|                 |        |                                             | $T_{vj} = 175\text{ °C}$ | 1.52 |      |      |

(table continues...)

**Table 6** (continued) Characteristic values

| Parameter                                 | Symbol             | Note or test condition                                                                                                                       | Values                   |      |      | Unit          |
|-------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------|------|---------------|
|                                           |                    |                                                                                                                                              | Min.                     | Typ. | Max. |               |
| Peak reverse recovery current             | $I_{RM}$           | $I_F = 35\text{ A}$ , $V_R = 600\text{ V}$ ,<br>$V_{GE} = -15\text{ V}$ , $-di_F/dt = 900\text{ A}/\mu\text{s}$ ( $T_{vj} = 175\text{ °C}$ ) | $T_{vj} = 25\text{ °C}$  | 31   |      | A             |
|                                           |                    |                                                                                                                                              | $T_{vj} = 125\text{ °C}$ | 39   |      |               |
|                                           |                    |                                                                                                                                              | $T_{vj} = 175\text{ °C}$ | 45   |      |               |
| Recovered charge                          | $Q_r$              | $I_F = 50\text{ A}$ , $V_R = 600\text{ V}$ ,<br>$V_{GE} = -15\text{ V}$ , $-di_F/dt = 900\text{ A}/\mu\text{s}$ ( $T_{vj} = 175\text{ °C}$ ) | $T_{vj} = 25\text{ °C}$  | 3.96 |      | $\mu\text{C}$ |
|                                           |                    |                                                                                                                                              | $T_{vj} = 125\text{ °C}$ | 7.37 |      |               |
|                                           |                    |                                                                                                                                              | $T_{vj} = 175\text{ °C}$ | 9.89 |      |               |
| Reverse recovery energy                   | $E_{rec}$          | $I_F = 50\text{ A}$ , $V_R = 600\text{ V}$ ,<br>$V_{GE} = -15\text{ V}$ , $-di_F/dt = 900\text{ A}/\mu\text{s}$ ( $T_{vj} = 175\text{ °C}$ ) | $T_{vj} = 25\text{ °C}$  | 1.31 |      | mJ            |
|                                           |                    |                                                                                                                                              | $T_{vj} = 125\text{ °C}$ | 2.52 |      |               |
|                                           |                    |                                                                                                                                              | $T_{vj} = 175\text{ °C}$ | 3.46 |      |               |
| Thermal resistance, junction to heat sink | $R_{thJH}$         | per diode, Valid with IFX pre-applied Thermal Interface Material                                                                             |                          |      | 1.13 | 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    | $I_{FRMSM}$ | $T_H = 60\text{ °C}$    |                          | 70     | A                    |
| Maximum RMS current at rectifier output | $I_{RMSM}$  | $T_H = 60\text{ °C}$    |                          | 100    | A                    |
| Surge forward current                   | $I_{FSM}$   | $t_p = 10\text{ ms}$    | $T_{vj} = 25\text{ °C}$  | 560    | A                    |
|                                         |             |                         | $T_{vj} = 150\text{ °C}$ | 435    |                      |
| $I^2t$ - value                          | $I^2t$      | $t_p = 10\text{ ms}$    | $T_{vj} = 25\text{ °C}$  | 1570   | $\text{A}^2\text{s}$ |
|                                         |             |                         | $T_{vj} = 150\text{ °C}$ | 945    |                      |

**Table 8** Characteristic values

| Parameter       | Symbol | Note or test condition |                          | Values |      |      | Unit |
|-----------------|--------|------------------------|--------------------------|--------|------|------|------|
|                 |        |                        |                          | Min.   | Typ. | Max. |      |
| Forward voltage | $V_F$  | $I_F = 50\text{ A}$    | $T_{vj} = 150\text{ °C}$ |        | 1.05 |      | V    |

(table continues...)

**Table 8** (continued) Characteristic values

| Parameter                                 | Symbol       | Note or test condition                                           | Values |      |      | Unit |
|-------------------------------------------|--------------|------------------------------------------------------------------|--------|------|------|------|
|                                           |              |                                                                  | Min.   | Typ. | Max. |      |
| Reverse current                           | $I_r$        | $T_{vj} = 150\text{ °C}$ , $V_R = 1600\text{ V}$                 |        | 1    |      | mA   |
| Thermal resistance, junction to heat sink | $R_{thJH}$   | per diode, Valid with IFX pre-applied Thermal Interface Material |        |      | 1.10 | K/W  |
| Temperature under switching conditions    | $T_{vj, op}$ |                                                                  | -40    |      | 150  | °C   |

## 5 IGBT-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   | $I_{CDC}$ | $T_{vj\ max} = 175\text{ °C}$ | $T_H = 110\text{ °C}$   | 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 | $V_{CE\ sat}$ | $I_C = 25\text{ A}$ , $V_{GE} = 15\text{ V}$                                                          | $T_{vj} = 25\text{ °C}$  |        | 1.60  | 1.85  | V    |
|                                      |               |                                                                                                       | $T_{vj} = 125\text{ °C}$ |        | 1.74  |       |      |
|                                      |               |                                                                                                       | $T_{vj} = 175\text{ °C}$ |        | 1.82  |       |      |
| Gate threshold voltage               | $V_{GEth}$    | $I_C = 0.525\text{ mA}$ , $V_{CE} = V_{GE}$ , $T_{vj} = 25\text{ °C}$                                 |                          | 5.15   | 5.80  | 6.45  | V    |
| Gate charge                          | $Q_G$         | $V_{GE} = \pm 15\text{ V}$ , $V_{CE} = 600\text{ V}$                                                  |                          |        | 0.395 |       | μC   |
| Internal gate resistor               | $R_{Gint}$    | $T_{vj} = 25\text{ °C}$                                                                               |                          |        | 0     |       | Ω    |
| Input capacitance                    | $C_{ies}$     | $f = 100\text{ kHz}$ , $T_{vj} = 25\text{ °C}$ , $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$       |                          |        | 4.77  |       | nF   |
| Reverse transfer capacitance         | $C_{res}$     | $f = 100\text{ kHz}$ , $T_{vj} = 25\text{ °C}$ , $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$       |                          |        | 0.017 |       | nF   |
| Collector-emitter cut-off current    | $I_{CES}$     | $V_{CE} = 1200\text{ V}$ , $V_{GE} = 0\text{ V}$                                                      | $T_{vj} = 25\text{ °C}$  |        |       | 0.004 | mA   |
| Gate-emitter leakage current         | $I_{GES}$     | $V_{CE} = 0\text{ V}$ , $V_{GE} = 20\text{ V}$ , $T_{vj} = 25\text{ °C}$                              |                          |        |       | 100   | nA   |
| Turn-on delay time (inductive load)  | $t_{don}$     | $I_C = 25\text{ A}$ , $V_{CE} = 600\text{ V}$ , $V_{GE} = \pm 15\text{ V}$ , $R_{Gon} = 9.1\text{ Ω}$ | $T_{vj} = 25\text{ °C}$  |        | 0.041 |       | μs   |
|                                      |               |                                                                                                       | $T_{vj} = 125\text{ °C}$ |        | 0.043 |       |      |
|                                      |               |                                                                                                       | $T_{vj} = 175\text{ °C}$ |        | 0.044 |       |      |

(table continues...)

**Table 10** (continued) Characteristic values

| Parameter                                 | Symbol      | Note or test condition                                                                                                                                                                                          | Values                                                  |       |      | Unit          |
|-------------------------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|-------|------|---------------|
|                                           |             |                                                                                                                                                                                                                 | Min.                                                    | Typ.  | Max. |               |
| Rise time (inductive load)                | $t_r$       | $I_C = 25 \text{ A}$ , $V_{CE} = 600 \text{ V}$ ,<br>$V_{GE} = \pm 15 \text{ V}$ , $R_{Gon} = 9.1 \Omega$                                                                                                       | $T_{vj} = 25 \text{ °C}$                                | 0.025 |      | $\mu\text{s}$ |
|                                           |             |                                                                                                                                                                                                                 | $T_{vj} = 125 \text{ °C}$                               | 0.028 |      |               |
|                                           |             |                                                                                                                                                                                                                 | $T_{vj} = 175 \text{ °C}$                               | 0.030 |      |               |
| Turn-off delay time (inductive load)      | $t_{doff}$  | $I_C = 25 \text{ A}$ , $V_{CE} = 600 \text{ V}$ ,<br>$V_{GE} = \pm 15 \text{ V}$ , $R_{Goff} = 9.1 \Omega$                                                                                                      | $T_{vj} = 25 \text{ °C}$                                | 0.230 |      | $\mu\text{s}$ |
|                                           |             |                                                                                                                                                                                                                 | $T_{vj} = 125 \text{ °C}$                               | 0.320 |      |               |
|                                           |             |                                                                                                                                                                                                                 | $T_{vj} = 175 \text{ °C}$                               | 0.350 |      |               |
| Fall time (inductive load)                | $t_f$       | $I_C = 25 \text{ A}$ , $V_{CE} = 600 \text{ V}$ ,<br>$V_{GE} = \pm 15 \text{ V}$ , $R_{Goff} = 9.1 \Omega$                                                                                                      | $T_{vj} = 25 \text{ °C}$                                | 0.140 |      | $\mu\text{s}$ |
|                                           |             |                                                                                                                                                                                                                 | $T_{vj} = 125 \text{ °C}$                               | 0.220 |      |               |
|                                           |             |                                                                                                                                                                                                                 | $T_{vj} = 175 \text{ °C}$                               | 0.280 |      |               |
| Turn-on energy loss per pulse             | $E_{on}$    | $I_C = 25 \text{ A}$ , $V_{CE} = 600 \text{ V}$ ,<br>$L_\sigma = 35 \text{ nH}$ , $V_{GE} = \pm 15 \text{ V}$ ,<br>$R_{Gon} = 9.1 \Omega$ , $di/dt = 810 \text{ A}/\mu\text{s}$ ( $T_{vj} = 175 \text{ °C}$ )   | $T_{vj} = 25 \text{ °C}$                                | 1.47  |      | mJ            |
|                                           |             |                                                                                                                                                                                                                 | $T_{vj} = 125 \text{ °C}$                               | 2.05  |      |               |
|                                           |             |                                                                                                                                                                                                                 | $T_{vj} = 175 \text{ °C}$                               | 2.39  |      |               |
| Turn-off energy loss per pulse            | $E_{off}$   | $I_C = 25 \text{ A}$ , $V_{CE} = 600 \text{ V}$ ,<br>$L_\sigma = 35 \text{ nH}$ , $V_{GE} = \pm 15 \text{ V}$ ,<br>$R_{Goff} = 9.1 \Omega$ , $dv/dt = 3120 \text{ V}/\mu\text{s}$ ( $T_{vj} = 175 \text{ °C}$ ) | $T_{vj} = 25 \text{ °C}$                                | 1.65  |      | mJ            |
|                                           |             |                                                                                                                                                                                                                 | $T_{vj} = 125 \text{ °C}$                               | 2.58  |      |               |
|                                           |             |                                                                                                                                                                                                                 | $T_{vj} = 175 \text{ °C}$                               | 3.13  |      |               |
| SC data                                   | $I_{SC}$    | $V_{GE} \leq 15 \text{ V}$ , $V_{CC} = 800 \text{ V}$ ,<br>$V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$                                                                                                          | $t_p \leq 8 \mu\text{s}$ ,<br>$T_{vj} = 150 \text{ °C}$ | 90    |      | A             |
|                                           |             |                                                                                                                                                                                                                 | $t_p \leq 7 \mu\text{s}$ ,<br>$T_{vj} = 175 \text{ °C}$ | 85    |      |               |
| Thermal resistance, junction to heat sink | $R_{thJH}$  | per IGBT, Valid with IFX pre-applied Thermal Interface Material                                                                                                                                                 |                                                         |       | 1.19 | 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, 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   | $I_F$     |                          | 25     | A    |

(table continues...)

**Table 11** (continued) Maximum rated values

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

**Table 12** Characteristic values

| Parameter                                 | Symbol      | Note or test condition                                                                                                            | Values                    |      |      | Unit          |
|-------------------------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------|------|------|---------------|
|                                           |             |                                                                                                                                   | Min.                      | Typ. | Max. |               |
| Forward voltage                           | $V_F$       | $I_F = 25 \text{ A}, V_{GE} = 0 \text{ V}$                                                                                        | $T_{vj} = 25 \text{ °C}$  | 1.83 | 2.30 | V             |
|                                           |             |                                                                                                                                   | $T_{vj} = 125 \text{ °C}$ | 1.70 |      |               |
|                                           |             |                                                                                                                                   | $T_{vj} = 175 \text{ °C}$ | 1.63 |      |               |
| Peak reverse recovery current             | $I_{RM}$    | $I_F = 25 \text{ A}, V_R = 600 \text{ V}, V_{GE} = -15 \text{ V}, -di_F/dt = 810 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ °C})$ | $T_{vj} = 25 \text{ °C}$  | 21.7 |      | A             |
|                                           |             |                                                                                                                                   | $T_{vj} = 125 \text{ °C}$ | 26.7 |      |               |
|                                           |             |                                                                                                                                   | $T_{vj} = 175 \text{ °C}$ | 29.8 |      |               |
| Recovered charge                          | $Q_r$       | $I_F = 25 \text{ A}, V_R = 600 \text{ V}, V_{GE} = -15 \text{ V}, -di_F/dt = 810 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ °C})$ | $T_{vj} = 25 \text{ °C}$  | 1.69 |      | $\mu\text{C}$ |
|                                           |             |                                                                                                                                   | $T_{vj} = 125 \text{ °C}$ | 3.29 |      |               |
|                                           |             |                                                                                                                                   | $T_{vj} = 175 \text{ °C}$ | 4.29 |      |               |
| Reverse recovery energy                   | $E_{rec}$   | $I_F = 25 \text{ A}, V_R = 600 \text{ V}, V_{GE} = -15 \text{ V}, -di_F/dt = 810 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ °C})$ | $T_{vj} = 25 \text{ °C}$  | 0.63 |      | mJ            |
|                                           |             |                                                                                                                                   | $T_{vj} = 125 \text{ °C}$ | 1.28 |      |               |
|                                           |             |                                                                                                                                   | $T_{vj} = 175 \text{ °C}$ | 1.69 |      |               |
| Thermal resistance, junction to heat sink | $R_{thJH}$  | per diode, Valid with IFX pre-applied Thermal Interface Material                                                                  |                           |      | 1.63 | 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.

## 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   |
| Deviation of $R_{100}$ | $\Delta R/R$ | $T_{NTC} = 100 \text{ °C}, R_{100} = 493 \text{ Ω}$ | -5     |      | 5    | %    |
| Power dissipation      | $P_{25}$     | $T_{NTC} = 25 \text{ °C}$                           |        |      | 20   | mW   |

(table continues...)

**Table 13** (continued) Characteristic values

| Parameter | Symbol       | Note or test condition                                        | Values |      |      | Unit |
|-----------|--------------|---------------------------------------------------------------|--------|------|------|------|
|           |              |                                                               | Min.   | Typ. | Max. |      |
| 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    |

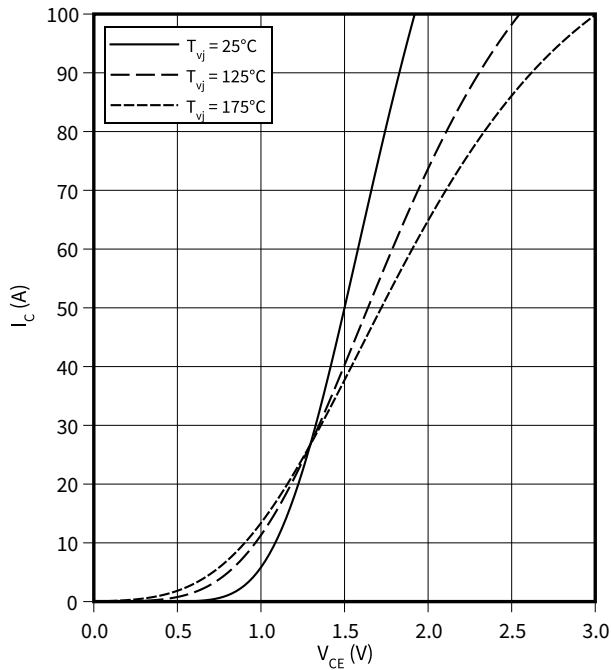
Note: Specification according to the valid application note.

8 Characteristics diagrams

Output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

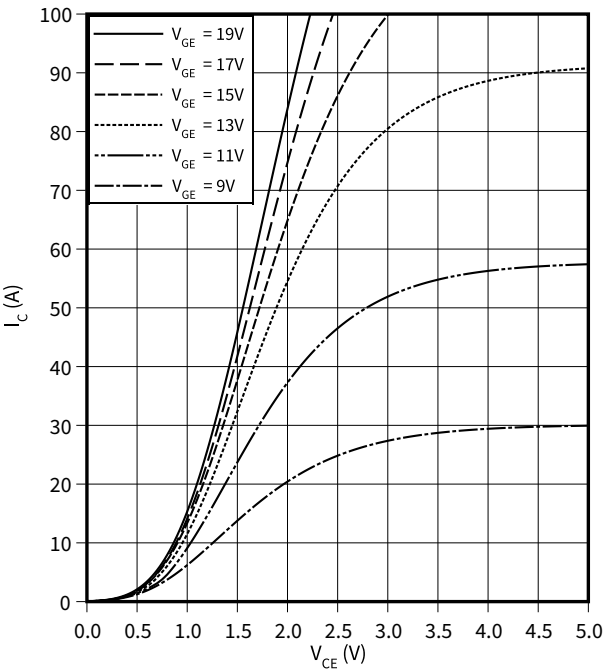
$V_{GE} = 15\text{ V}$



Output characteristic field (typical), IGBT, Inverter

$I_C = f(V_{CE})$

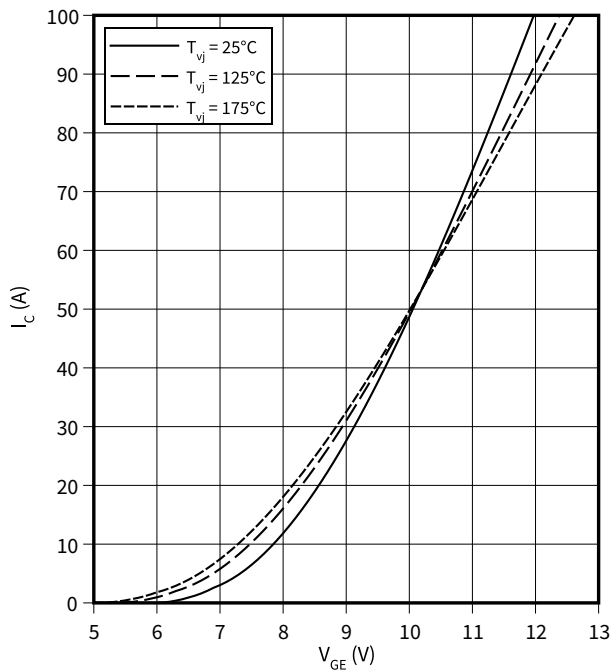
$T_{vj} = 175^\circ\text{C}$



Transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

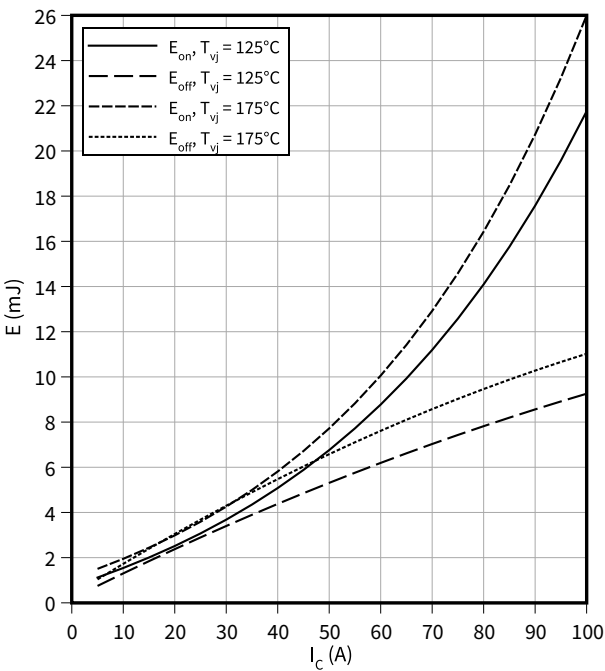
$V_{CE} = 20\text{ V}$



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

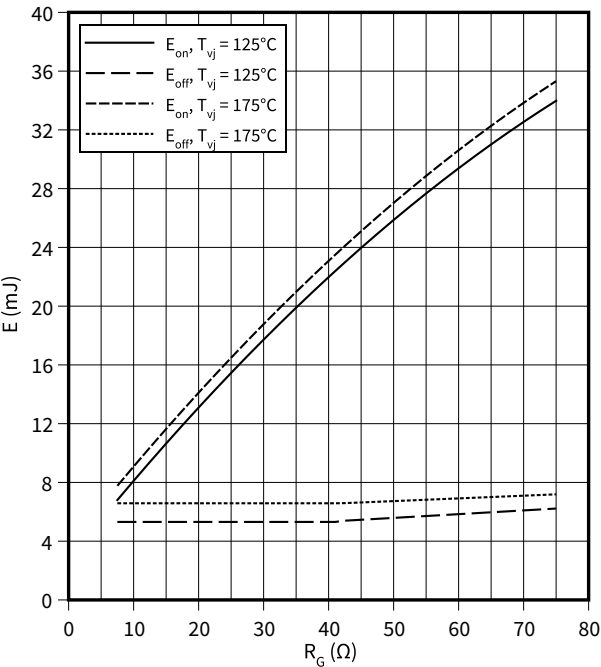
$R_{Goff} = 7.5\ \Omega$ ,  $R_{Gon} = 7.5\ \Omega$ ,  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$



8 Characteristics diagrams

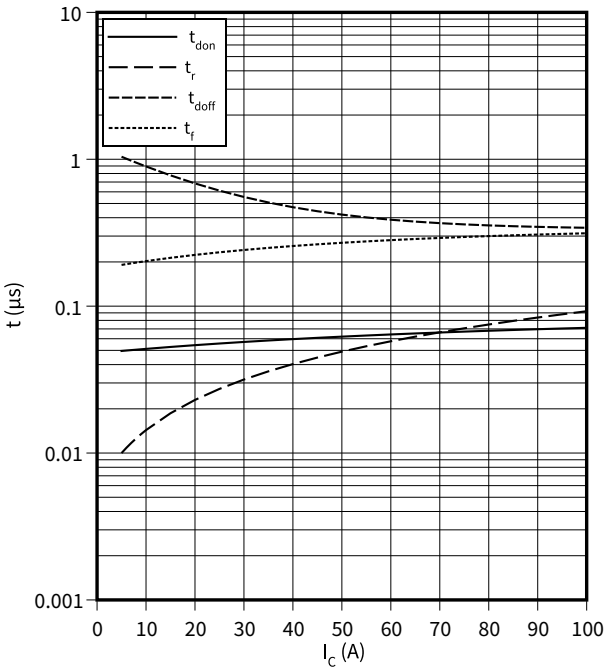
Switching losses (typical), IGBT, Inverter

$E = f(R_G)$   
 $I_C = 50\text{ A}$ ,  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$



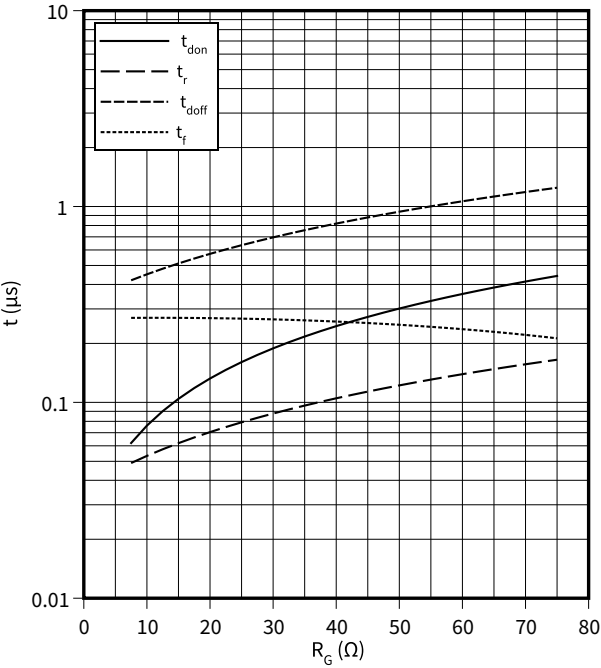
Switching times (typical), IGBT, Inverter

$t = f(I_C)$   
 $R_{Goff} = 7.5\ \Omega$ ,  $R_{Gon} = 7.5\ \Omega$ ,  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $T_{vj} = 175^\circ\text{C}$



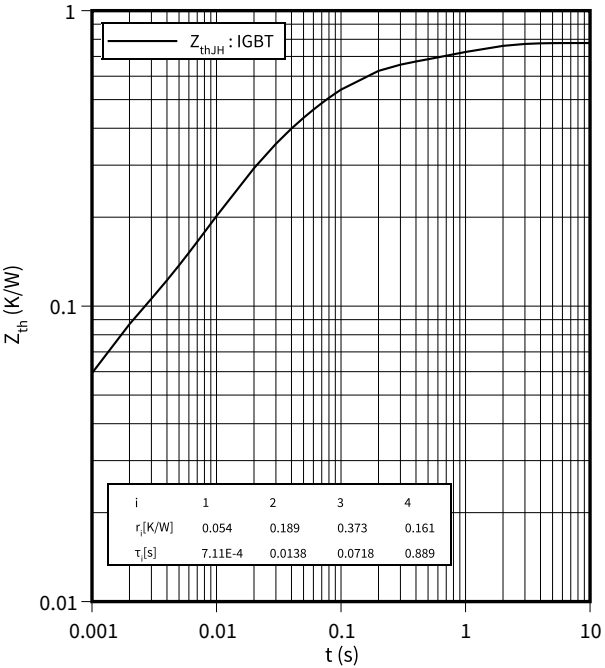
Switching times (typical), IGBT, Inverter

$t = f(R_G)$   
 $I_C = 50\text{ A}$ ,  $V_{CE} = 600\text{ V}$ ,  $V_{GE} = \pm 15\text{ V}$ ,  $T_{vj} = 175^\circ\text{C}$



Transient thermal impedance , IGBT, Inverter

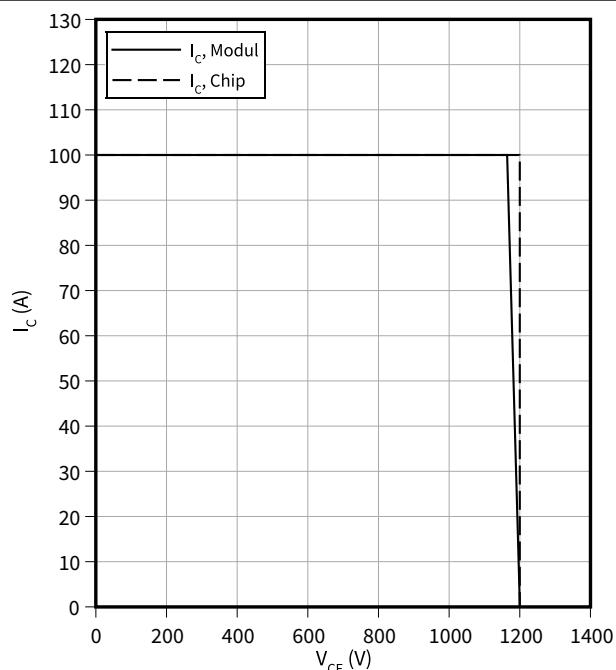
$Z_{th} = f(t)$



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

$$I_C = f(V_{CE})$$

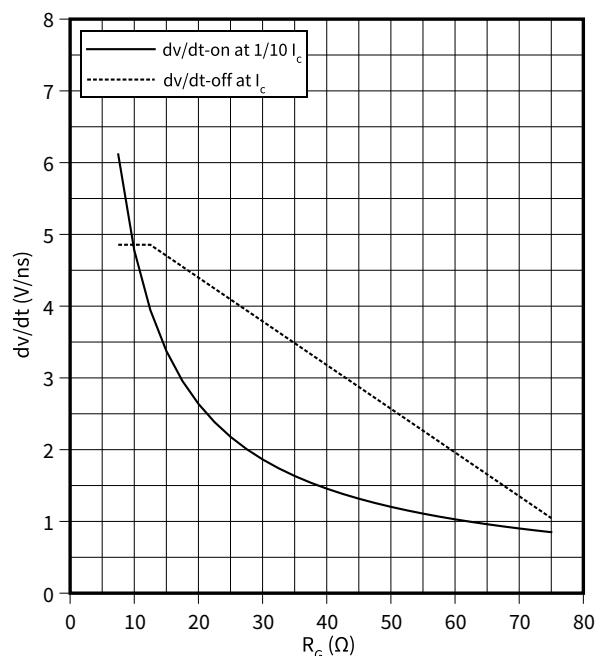
$$R_{Goff} = 7.5 \, \Omega, V_{GE} = \pm 15 \, V, T_{vj} = 175 \, ^\circ C$$



**Voltage slope (typical), IGBT, Inverter**

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

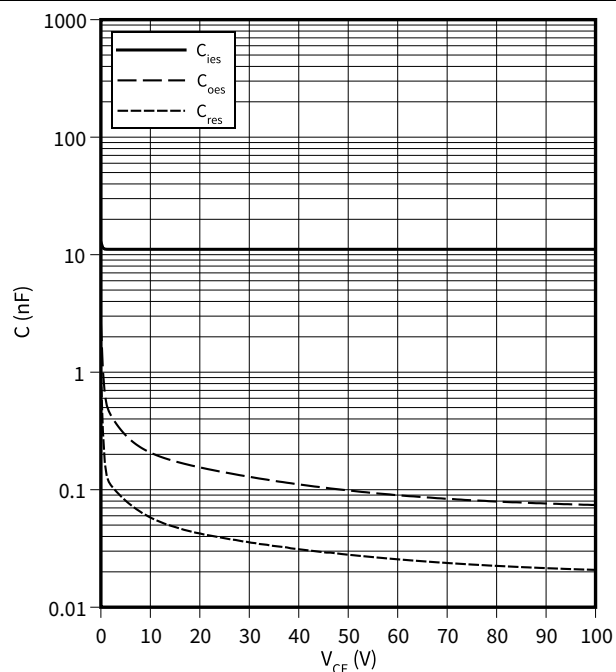
$$I_C = 50 \, A, V_{CE} = 600 \, V, V_{GE} = \pm 15 \, V, T_{vj} = 25 \, ^\circ C$$



**Capacity characteristic (typical), IGBT, Inverter**

$$C = f(V_{CE})$$

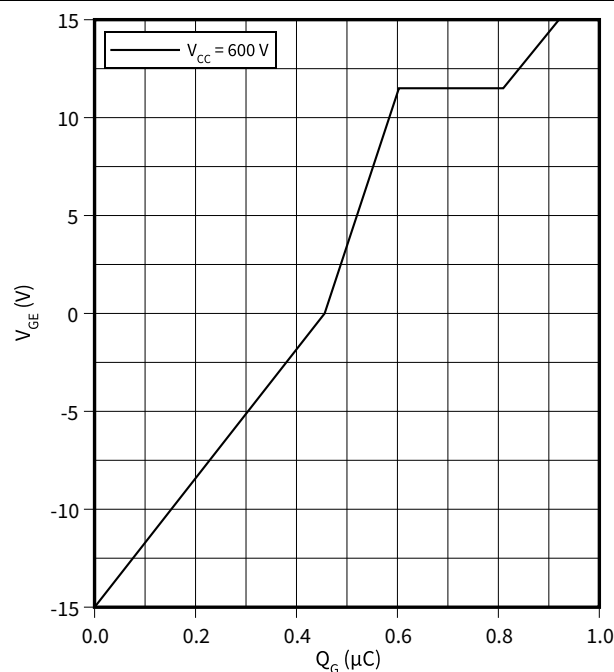
$$f = 100 \, kHz, V_{GE} = 0 \, V, T_{vj} = 25 \, ^\circ C$$



**Gate charge characteristic (typical), IGBT, Inverter**

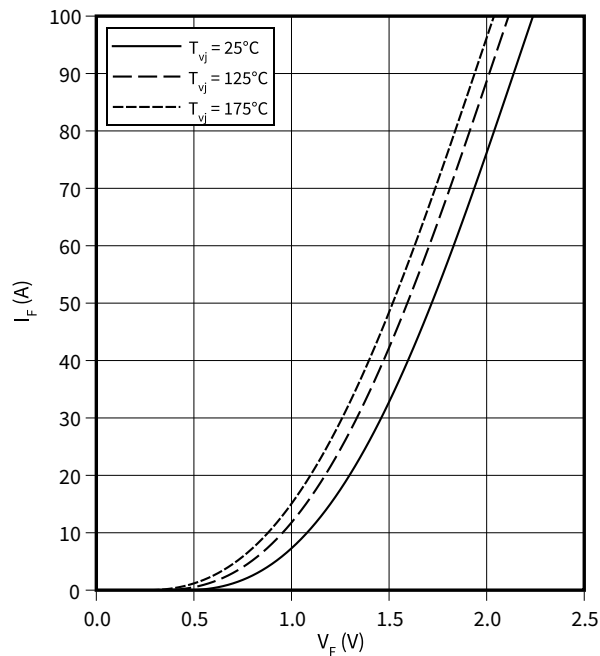
$$V_{GE} = f(Q_G)$$

$$I_C = 50 \, A, T_{vj} = 25 \, ^\circ C$$



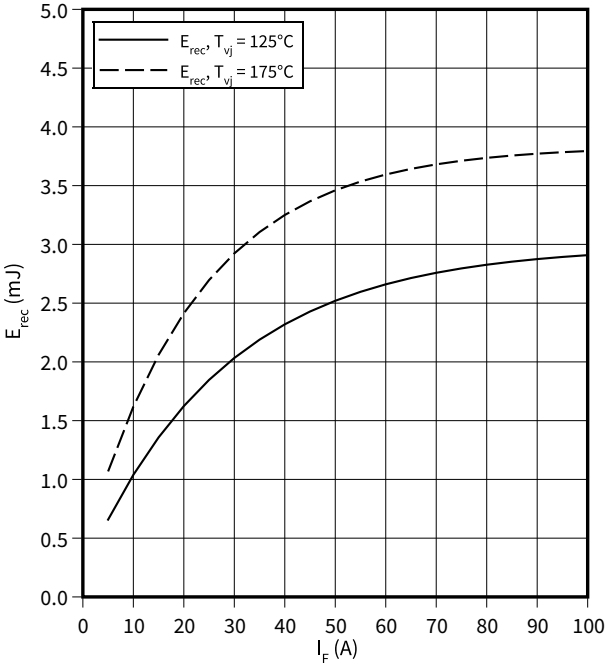
Forward characteristic (typical), Diode, Inverter

$I_F = f(V_F)$



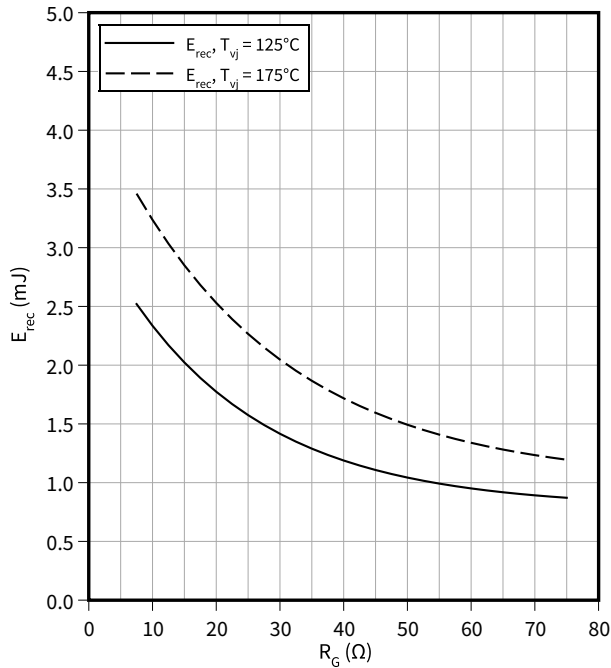
Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$   
 $V_{CE} = 600\text{ V}, R_{Gon} = 7.5\ \Omega$



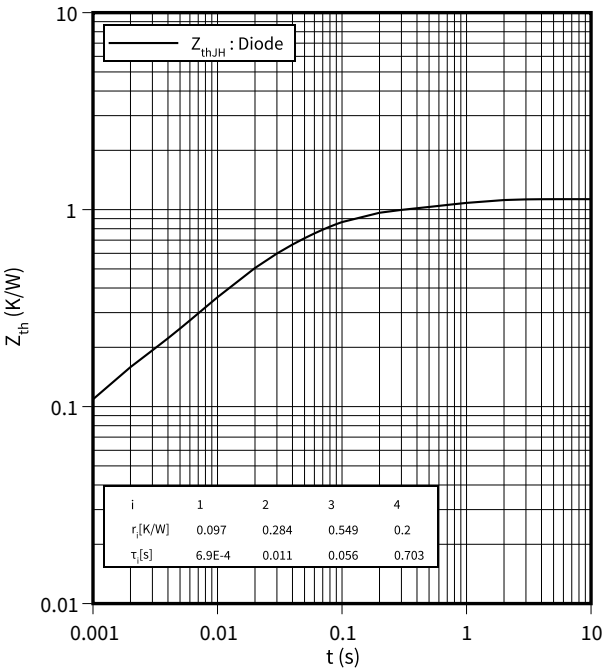
Switching losses (typical), Diode, Inverter

$E_{rec} = f(R_G)$   
 $V_{CE} = 600\text{ V}, I_F = 50\text{ A}$



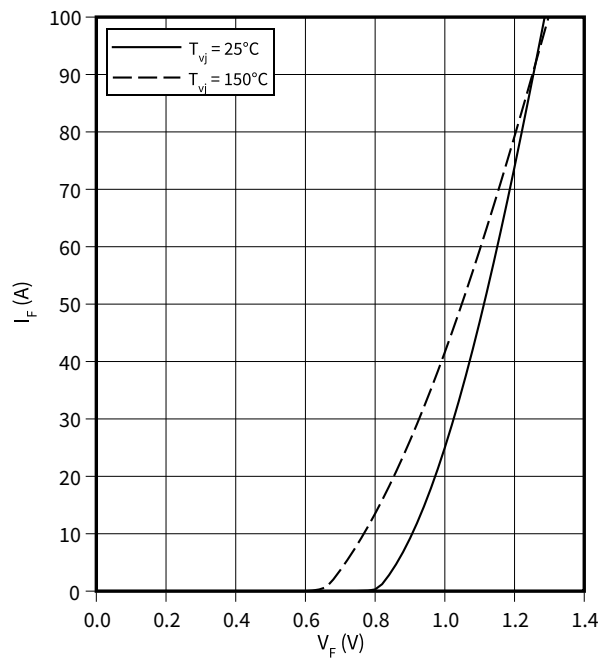
Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



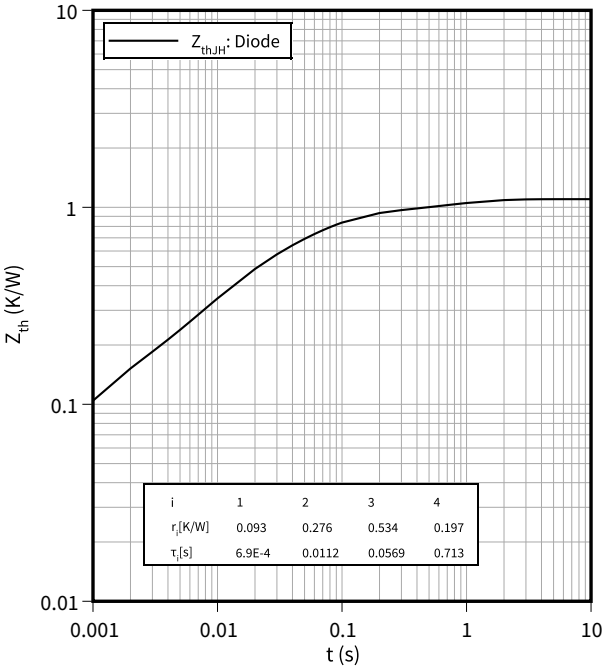
Forward characteristic (typical), Diode, Rectifier

$I_F = f(V_F)$



Transient thermal impedance, Diode, Rectifier

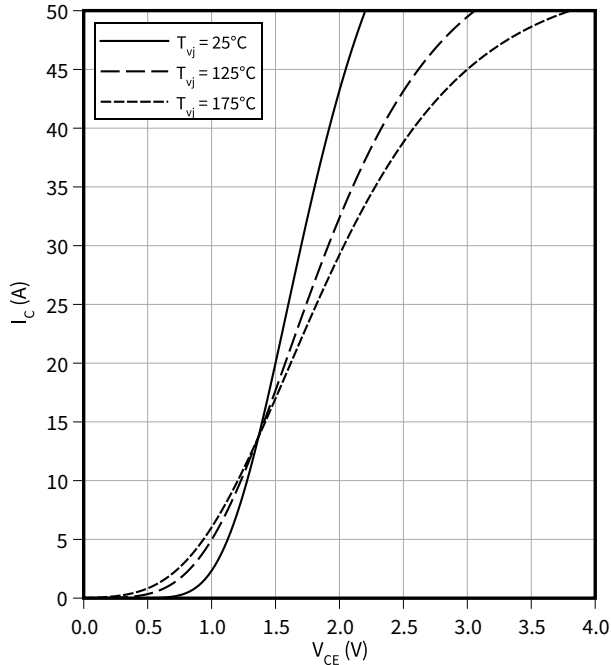
$Z_{th} = f(t)$



Output characteristic (typical), IGBT-Chopper

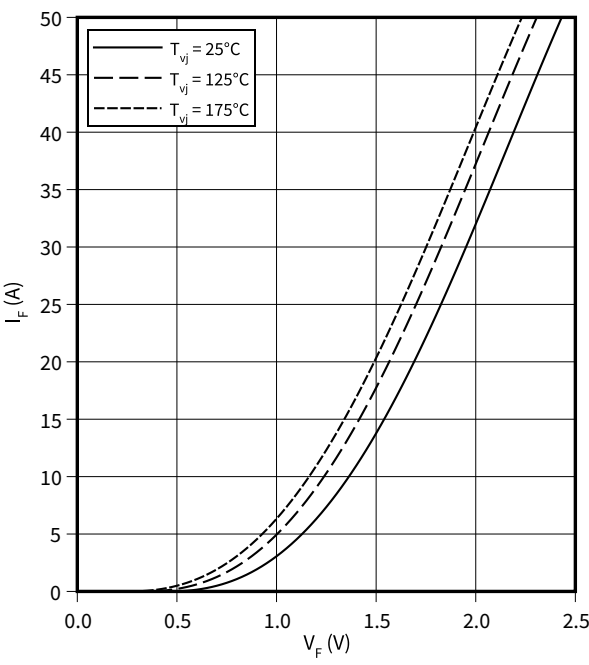
$I_C = f(V_{CE})$

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



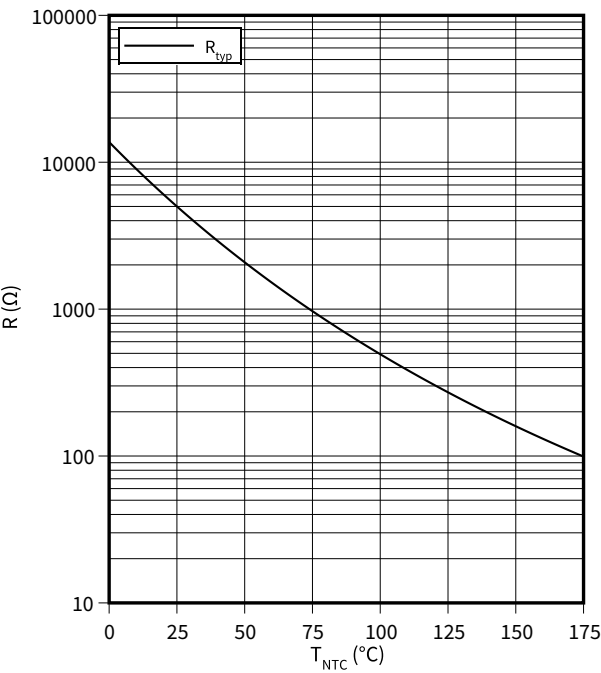
Forward characteristic (typical), Diode, Chopper

$I_F = f(V_F)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



9 Circuit diagram

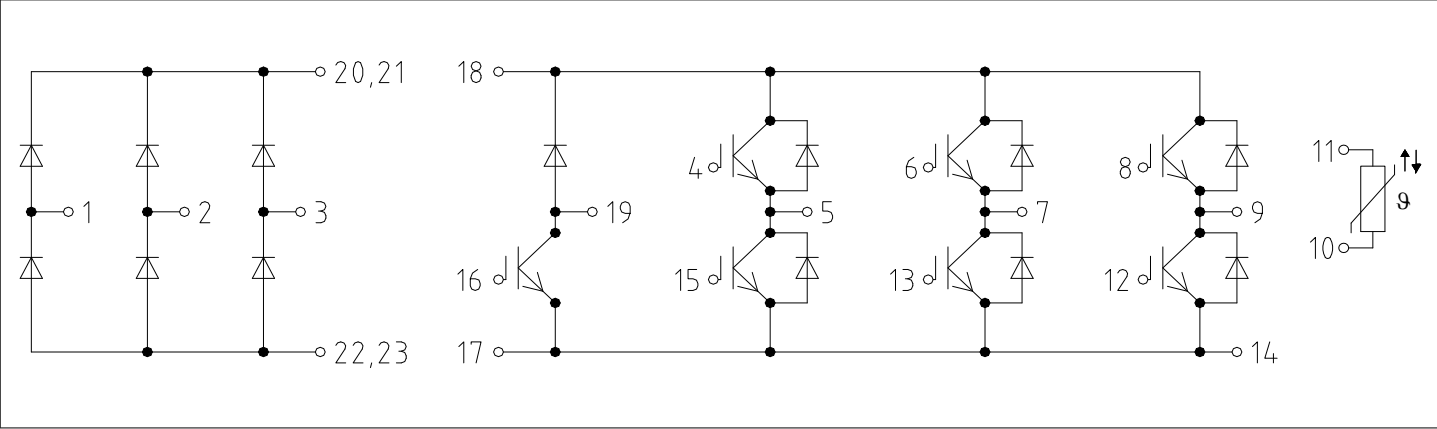


Figure 1

10 Package outlines

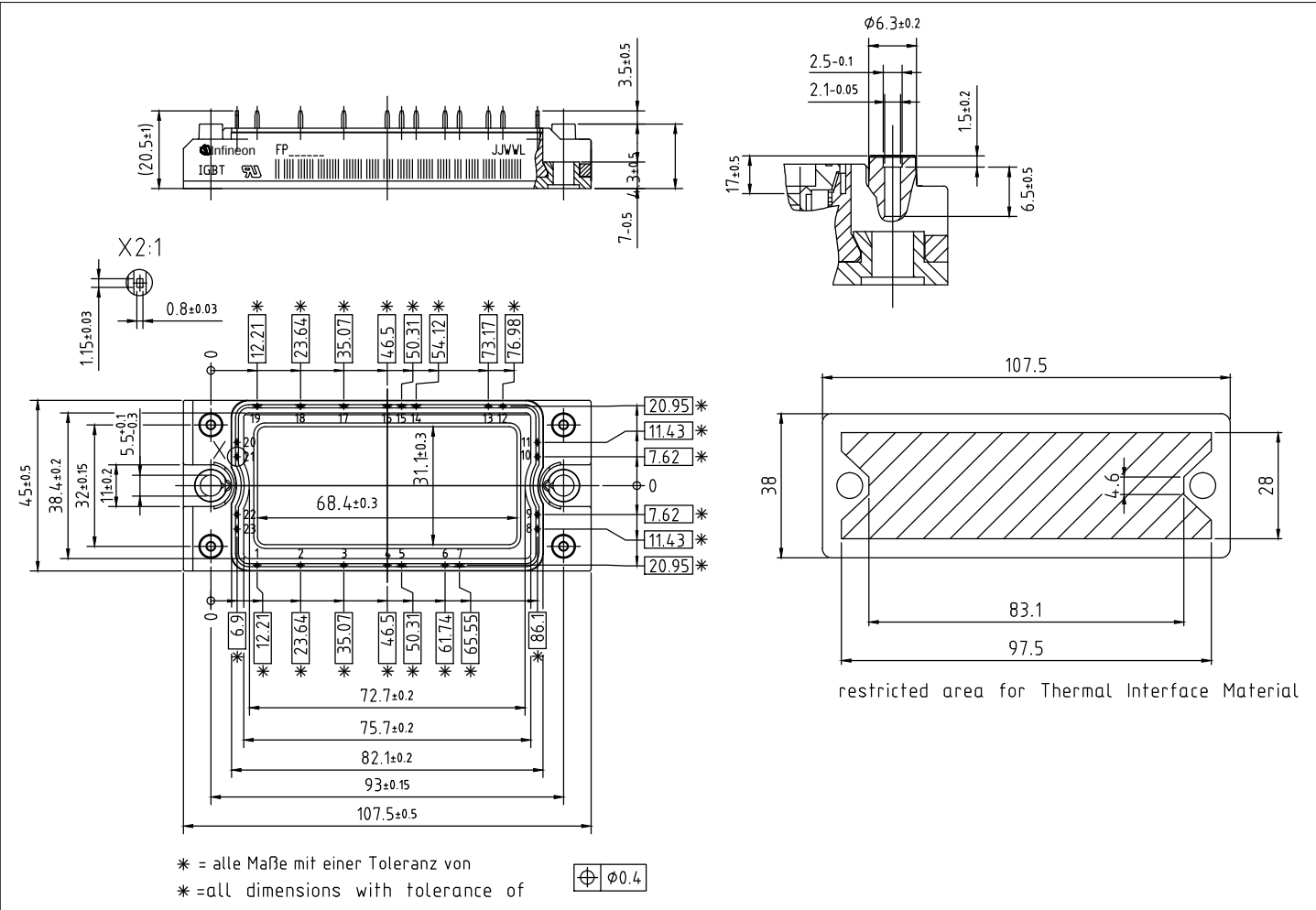


Figure 2

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 3

## Revision history

| Document revision | Date of release | Description of changes |
|-------------------|-----------------|------------------------|
| 1.00              | 2022-02-01      | Initial version        |

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