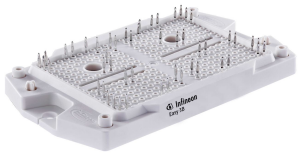
# EasyPACK™ module with TRENCHSTOP™ 5 and Emitter Controlled 3 diode and PressFIT / NTC



## Features

- Electrical features
  - $V_{CES}$ = 650 V
  - $I_{C\ nom}$ = 200 A / $I_{CRM}$ = 400 A
  - Low switching losses
- Mechanical features
  - $Al_2O_3$ substrate with low thermal resistance
  - Compact design
  - PressFIT contact technology
  - Integrated NTC temperature sensor
  - High power density

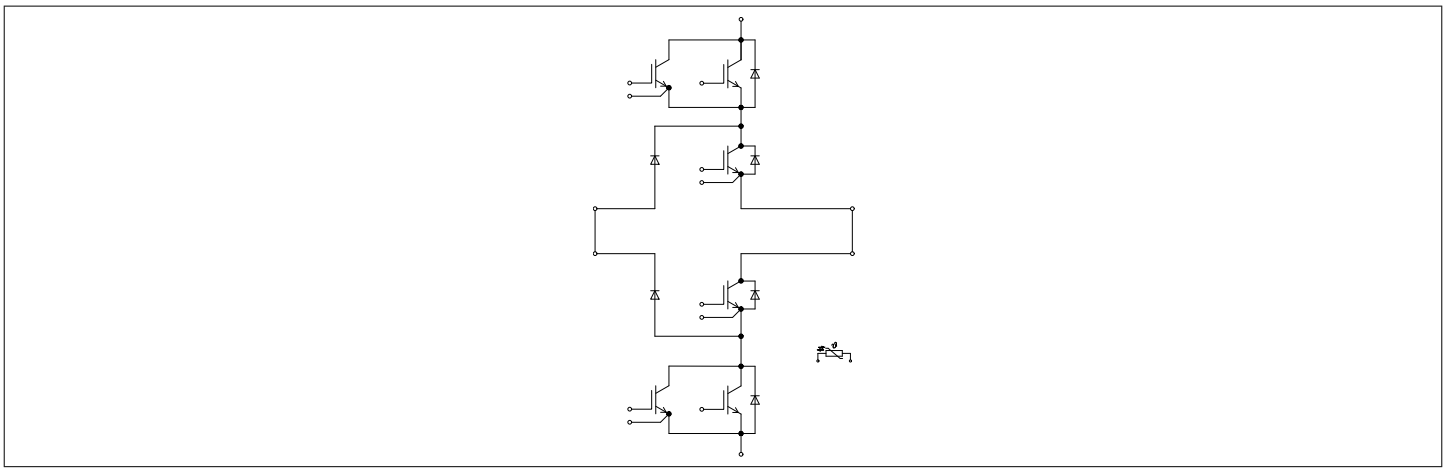
## Potential applications

- Solar applications
- 3-level-applications

## Product validation

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

## Description



# Table of contents

# 1 Package

**Table 1 Insulation coordination**

| Parameter | Symbol | Note or test condition | Values | Unit |
|---|---|---|---|---|
| Isolation test voltage | $V_{ISOL}$ | RMS, f = 50 Hz, *t* = 1 min | 3.2 | kV |
| Internal Isolation | | basic insulation (class 1, IEC 61140) | $Al_2O_3$ | |
| Creepage distance | $d_{Creep}$ | terminal to heatsink | 11.2 | mm |
| Creepage distance | $d_{Creep}$ | terminal to terminal | 6.8 | mm |
| Clearance | $d_{Clear}$ | terminal to heatsink | 9.4 | mm |
| Clearance | $d_{Clear}$ | terminal to terminal | 5.5 | mm |
| Comparative tracking index | *CTI* | | > 400 | |
| RTI Elec. | *RTI* | housing | 140 | °C |

**Table 2 Characteristic values**

| Parameter | Symbol | Note or test condition | | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Stray inductance module | $L_{sCE}$ | | | | 12 | | nH |
| Storage temperature | $T_{stg}$ | | | -40 | | 125 | °C |
| Mounting torque for modul mounting | *M* | - Mounting according to valid application note | M5, Screw | 1.3 | | 1.5 | Nm |
| Weight | *G* | | | | 78 | | g |

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

# 2 IGBT, T1.1 / T1.2 / T4.1 / T4.2

**Table 3 Maximum rated values**

| Parameter | Symbol | Note or test condition | | Values | Unit |
|---|---|---|---|---|---|
| Collector-emitter voltage | $V_{CES}$ | | $T_{vj}$ = 25 °C | 650 | V |
| Implemented collector current | $I_{CN}$ | | | 200 | A |
| Continous DC collector current | $I_{CDC}$ | $T_{vj\,max}$ = 175 °C | $T_H$ = 65 °C | 130 | A |
| Repetitive peak collector current | $I_{CRM}$ | $t_P$ = 1 ms | | 400 | 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 | $V_{CE\,sat}$ | $I_C$ = 100 A, $V_{GE}$ = 15 V | $T_{vj}$ = 25 °C | | 1.17 | 1.50 | V |
| | | | $T_{vj}$ = 125 °C | | 1.20 | | |
| | | | $T_{vj}$ = 150 °C | | 1.21 | | |
| Gate threshold voltage | $V_{GEth}$ | $I_C$ = 2 mA, $V_{CE}$ = $V_{GE}$, $T_{vj}$ = 25 °C | | 3.25 | 4 | 4.75 | V |
| Gate charge | $Q_G$ | $V_{GE}$ = ±15 V, $V_{CE}$ = 400 V | | | 0.84 | | µC |
| Internal gate resistor | $R_{Gint}$ | $T_{vj}$ = 25 °C | | | 0 | | Ω |
| Input capacitance | $C_{ies}$ | $f$ = 100 kHz, $T_{vj}$ = 25 °C, $V_{CE}$ = 25 V, $V_{GE}$ = 0 V | | | 14.3 | | nF |
| Reverse transfer capacitance | $C_{res}$ | $f$ = 100 kHz, $T_{vj}$ = 25 °C, $V_{CE}$ = 25 V, $V_{GE}$ = 0 V | | | 0.05 | | nF |
| Collector-emitter cut-off current | $I_{CES}$ | $V_{CE}$ = 650 V, $V_{GE}$ = 0 V | $T_{vj}$ = 25 °C | | | 0.019 | mA |
| Gate-emitter leakage current | $I_{GES}$ | $V_{CE}$ = 0 V, $V_{GE}$ = 20 V, $T_{vj}$ = 25 °C | | | | 100 | nA |
| Turn-on delay time (inductive load) | $t_{don}$ | $I_C$ = 100 A, $V_{CE}$ = 300 V, $V_{GE}$ = ±15 V, $R_{Gon}$ = 4.7 Ω | $T_{vj}$ = 25 °C | | 0.022 | | µs |
| | | | $T_{vj}$ = 125 °C | | 0.021 | | |
| | | | $T_{vj}$ = 150 °C | | 0.021 | | |
| Rise time (inductive load) | $t_r$ | $I_C$ = 100 A, $V_{CE}$ = 300 V, $V_{GE}$ = ±15 V, $R_{Gon}$ = 4.7 Ω | $T_{vj}$ = 25 °C | | 0.013 | | µs |
| | | | $T_{vj}$ = 125 °C | | 0.015 | | |
| | | | $T_{vj}$ = 150 °C | | 0.015 | | |
| Turn-off delay time (inductive load) | $t_{doff}$ | $I_C$ = 100 A, $V_{CE}$ = 300 V, $V_{GE}$ = ±15 V, $R_{Goff}$ = 4.7 Ω | $T_{vj}$ = 25 °C | | 0.117 | | µs |
| | | | $T_{vj}$ = 125 °C | | 0.145 | | |
| | | | $T_{vj}$ = 150 °C | | 0.158 | | |
| Fall time (inductive load) | $t_f$ | $I_C$ = 100 A, $V_{CE}$ = 300 V, $V_{GE}$ = ±15 V, $R_{Goff}$ = 4.7 Ω | $T_{vj}$ = 25 °C | | 0.044 | | µs |
| | | | $T_{vj}$ = 125 °C | | 0.046 | | |
| | | | $T_{vj}$ = 150 °C | | 0.047 | | |
| Turn-on energy loss per pulse | $E_{on}$ | $I_C$ = 100 A, $V_{CE}$ = 300 V, $L_\sigma$ = 35 nH, $V_{GE}$ = ±15 V, $R_{Gon}$ = 4.7 Ω, di/dt = 12.5 kA/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 1 | | mJ |
| | | | $T_{vj}$ = 125 °C | | 1.4 | | |
| | | | $T_{vj}$ = 150 °C | | 1.49 | | |
| Turn-off energy loss per pulse | $E_{off}$ | $I_C$ = 100 A, $V_{CE}$ = 300 V, $L_\sigma$ = 35 nH, $V_{GE}$ = ±15 V, $R_{Goff}$ = 4.7 Ω, dv/dt = 4400 V/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 0.78 | | mJ |
| | | | $T_{vj}$ = 125 °C | | 1.28 | | |
| | | | $T_{vj}$ = 150 °C | | 1.4 | | |
| Thermal resistance, junction to heatsink | $R_{thJH}$ | per IGBT, $\lambda_{grease}$= 3.3 W/(m*K) | | | 0.478 | | K/W |
| Temperature under switching conditions | $T_{vj\,op}$ | | | -40 | | 150 | °C |

# 3 IGBT, T2 / T3

**Table 5 Maximum rated values**

| Parameter | Symbol | Note or test condition | | Values | Unit |
|---|---|---|---|---|---|
| Collector-emitter voltage | $V_{CES}$ | | $T_{vj}$ = 25 °C | 650 | V |
| Implemented collector current | $I_{CN}$ | | | 300 | A |
| Continous DC collector current | $I_{CDC}$ | $T_{vj\,max}$ = 175 °C | $T_H$ = 65 °C | 255 | A |
| Repetitive peak collector current | $I_{CRM}$ | $t_P$ = 1 ms | | 600 | A |
| Gate-emitter peak voltage | $V_{GES}$ | | | ±20 | V |

**Table 6 Characteristic values**

| Parameter | Symbol | Note or test condition | | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Collector-emitter saturation voltage | $V_{CE\,sat}$ | $I_C$ = 100 A, $V_{GE}$ = 15 V | $T_{vj}$ = 25 °C | | 0.88 | 1.13 | V |
| | | | $T_{vj}$ = 125 °C | | 0.80 | | |
| | | | $T_{vj}$ = 150 °C | | 0.77 | | |
| Gate threshold voltage | $V_{GEth}$ | $I_C$ = 4 mA, $V_{CE}$ = 20 V, $T_{vj}$ = 25 °C | | 4.25 | 5 | 5.75 | V |
| Gate charge | $Q_G$ | $V_{GE}$ = ±15 V, $V_{CE}$ = 400 V | | | 3.7 | | µC |
| Internal gate resistor | $R_{Gint}$ | $T_{vj}$ = 25 °C | | | 0 | | Ω |
| Input capacitance | $C_{ies}$ | $f$ = 100 kHz, $T_{vj}$ = 25 °C, $V_{CE}$ = 25 V, $V_{GE}$ = 0 V | | | 47.1 | | nF |
| Reverse transfer capacitance | $C_{res}$ | $f$ = 100 kHz, $T_{vj}$ = 25 °C, $V_{CE}$ = 25 V, $V_{GE}$ = 0 V | | | 0.168 | | nF |
| Collector-emitter cut-off current | $I_{CES}$ | $V_{CE}$ = 650 V, $V_{GE}$ = 0 V | $T_{vj}$ = 25 °C | | | 0.019 | mA |
| Gate-emitter leakage current | $I_{GES}$ | $V_{CE}$ = 0 V, $V_{GE}$ = 20 V, $T_{vj}$ = 25 °C | | | | 100 | nA |
| Turn-on delay time (inductive load) | $t_{don}$ | $I_C$ = 100 A, $V_{CE}$ = 300 V, $V_{GE}$ = ±15 V, $R_{Gon}$ = 6.8 Ω | $T_{vj}$ = 25 °C | | 0.128 | | µs |
| | | | $T_{vj}$ = 125 °C | | 0.108 | | |
| | | | $T_{vj}$ = 150 °C | | 0.103 | | |
| Rise time (inductive load) | $t_r$ | $I_C$ = 100 A, $V_{CE}$ = 300 V, $V_{GE}$ = ±15 V, $R_{Gon}$ = 6.8 Ω | $T_{vj}$ = 25 °C | | 0.025 | | µs |
| | | | $T_{vj}$ = 125 °C | | 0.030 | | |
| | | | $T_{vj}$ = 150 °C | | 0.031 | | |
| Turn-off delay time (inductive load) | $t_{doff}$ | $I_C$ = 100 A, $V_{CE}$ = 300 V, $V_{GE}$ = ±15 V, $R_{Goff}$ = 6.8 Ω | $T_{vj}$ = 25 °C | | 0.693 | | µs |
| | | | $T_{vj}$ = 125 °C | | 0.821 | | |
| | | | $T_{vj}$ = 150 °C | | 0.853 | | |

**Table 6 Characteristic values (continued)**

| Parameter | Symbol | Note or test condition | | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Fall time (inductive load) | $t_f$ | $I_C$ = 100 A, $V_{CE}$ = 300 V, $V_{GE}$ = ±15 V, $R_{Goff}$ = 6.8 Ω | $T_{vj}$ = 25 °C | | 0.129 | | µs |
| | | | $T_{vj}$ = 125 °C | | 0.213 | | |
| | | | $T_{vj}$ = 150 °C | | 0.234 | | |
| Turn-on energy loss per pulse | $E_{on}$ | $I_C$ = 100 A, $V_{CE}$ = 300 V, $L_\sigma$ = 35 nH, $V_{GE}$ = ±15 V, $R_{Gon}$ = 6.8 Ω, di/dt = 2700 A/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 1.06 | | mJ |
| | | | $T_{vj}$ = 125 °C | | 1.44 | | |
| | | | $T_{vj}$ = 150 °C | | 1.54 | | |
| Turn-off energy loss per pulse | $E_{off}$ | $I_C$ = 100 A, $V_{CE}$ = 300 V, $L_\sigma$ = 35 nH, $V_{GE}$ = ±15 V, $R_{Goff}$ = 6.8 Ω, dv/dt = 760 V/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 5.24 | | mJ |
| | | | $T_{vj}$ = 125 °C | | 8.18 | | |
| | | | $T_{vj}$ = 150 °C | | 8.84 | | |
| Thermal resistance, junction to heatsink | $R_{thJH}$ | per IGBT, $\lambda_{grease}$= 3.3 W/(m*K) | | | 0.300 | | K/W |
| Temperature under switching conditions | $T_{vj\,op}$ | | | -40 | | 150 | °C |

# 4 Diode, D1 / D4

**Table 7 Maximum rated values**

| Parameter | Symbol | Note or test condition | | Values | Unit |
|---|---|---|---|---|---|
| Repetitive peak reverse voltage | $V_{RRM}$ | | $T_{vj}$ = 25 °C | 650 | V |
| Implemented forward current | $I_{FN}$ | | | 225 | A |
| Continous DC forward current | $I_F$ | | | 100 | A |
| Repetitive peak forward current | $I_{FRM}$ | $t_P$ = 1 ms | | 450 | A |
| $I^2t$ - value | $I^2t$ | $V_R$ = 0 V, $t_P$ = 10 ms | $T_{vj}$ = 125 °C | 3030 | $A^2s$ |
| | | | $T_{vj}$ = 150 °C | 2760 | |

**Table 8 Characteristic values**

| Parameter | Symbol | Note or test condition | | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Forward voltage | $V_F$ | $I_F$ = 100 A, $V_{GE}$ = 0 V | $T_{vj}$ = 25 °C | | 1.26 | 1.55 | V |
| | | | $T_{vj}$ = 125 °C | | 1.16 | | |
| | | | $T_{vj}$ = 150 °C | | 1.11 | | |

**Table 8 Characteristic values (continued)**

| Parameter | Symbol | Note or test condition | | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Peak reverse recovery current | $I_{RM}$ | $I_F$ = 100 A, $V_R$ = 300 V, $V_{GE}$ = -15 V, -di$_F$/dt = 2700 A/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 105 | | A |
| | | | $T_{vj}$ = 125 °C | | 141 | | |
| | | | $T_{vj}$ = 150 °C | | 151 | | |
| Recovered charge | $Q_r$ | $I_F$ = 100 A, $V_R$ = 300 V, $V_{GE}$ = -15 V, -di$_F$/dt = 2700 A/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 5.94 | | µC |
| | | | $T_{vj}$ = 125 °C | | 11.6 | | |
| | | | $T_{vj}$ = 150 °C | | 13.5 | | |
| Reverse recovery energy | $E_{rec}$ | $I_F$ = 100 A, $V_R$ = 300 V, $V_{GE}$ = -15 V, -di$_F$/dt = 2700 A/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 1.3 | | mJ |
| | | | $T_{vj}$ = 125 °C | | 2.58 | | |
| | | | $T_{vj}$ = 150 °C | | 3.01 | | |
| Thermal resistance, junction to heatsink | $R_{thJH}$ | per diode, $\lambda_{grease}$= 3.3 W/(m*K) | | | 0.431 | | K/W |
| Temperature under switching conditions | $T_{vj\,op}$ | | | -40 | | 150 | °C |

# 5 Diode, D2 / D3

**Table 9 Maximum rated values**

| Parameter | Symbol | Note or test condition | | Values | Unit |
|---|---|---|---|---|---|
| Repetitive peak reverse voltage | $V_{RRM}$ | | $T_{vj}$ = 25 °C | 650 | V |
| Implemented forward current | $I_{FN}$ | | | 225 | A |
| Continous DC forward current | $I_F$ | | | 100 | A |
| Repetitive peak forward current | $I_{FRM}$ | $t_P$ = 1 ms | | 450 | A |
| $I^2t$ - value | $I^2t$ | $V_R$ = 0 V, $t_P$ = 10 ms | $T_{vj}$ = 125 °C | 3030 | $A^2s$ |
| | | | $T_{vj}$ = 150 °C | 2760 | |

**Table 10 Characteristic values**

| Parameter | Symbol | Note or test condition | | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Forward voltage | $V_F$ | $I_F$ = 100 A, $V_{GE}$ = 0 V | $T_{vj}$ = 25 °C | | 1.26 | 1.55 | V |
| | | | $T_{vj}$ = 125 °C | | 1.16 | | |
| | | | $T_{vj}$ = 150 °C | | 1.11 | | |

**Table 10 Characteristic values (continued)**

| Parameter | Symbol | Note or test condition | | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Peak reverse recovery current | $I_{RM}$ | $I_F$ = 100 A, $V_R$ = 300 V, $V_{GE}$ = -15 V, -di$_F$/dt = 2700 A/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 105 | | A |
| | | | $T_{vj}$ = 125 °C | | 141 | | |
| | | | $T_{vj}$ = 150 °C | | 151 | | |
| Recovered charge | $Q_r$ | $I_F$ = 100 A, $V_R$ = 300 V, $V_{GE}$ = -15 V, -di$_F$/dt = 2700 A/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 5.94 | | µC |
| | | | $T_{vj}$ = 125 °C | | 11.6 | | |
| | | | $T_{vj}$ = 150 °C | | 13.5 | | |
| Reverse recovery energy | $E_{rec}$ | $I_F$ = 100 A, $V_R$ = 300 V, $V_{GE}$ = -15 V, -di$_F$/dt = 2700 A/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 1.3 | | mJ |
| | | | $T_{vj}$ = 125 °C | | 2.58 | | |
| | | | $T_{vj}$ = 150 °C | | 3.01 | | |
| Thermal resistance, junction to heatsink | $R_{thJH}$ | per diode, $\lambda_{grease}$= 3.3 W/(m*K) | | | 0.390 | | K/W |
| Temperature under switching conditions | $T_{vj\,op}$ | | | -40 | | 150 | °C |

# 6 Diode, D5 / D6

**Table 11 Maximum rated values**

| Parameter | Symbol | Note or test condition | | Values | Unit |
|---|---|---|---|---|---|
| Repetitive peak reverse voltage | $V_{RRM}$ | | $T_{vj}$ = 25 °C | 650 | V |
| Implemented forward current | $I_{FN}$ | | | 300 | A |
| Continous DC forward current | $I_F$ | | | 100 | A |
| Repetitive peak forward current | $I_{FRM}$ | $t_P$ = 1 ms | | 600 | A |
| $I^2t$ - value | $I^2t$ | $V_R$ = 0 V, $t_P$ = 10 ms | $T_{vj}$ = 125 °C | 6610 | $A^2s$ |
| | | | $T_{vj}$ = 150 °C | 6050 | |

**Table 12 Characteristic values**

| Parameter | Symbol | Note or test condition | | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Forward voltage | $V_F$ | $I_F$ = 100 A, $V_{GE}$ = 0 V | $T_{vj}$ = 25 °C | | 1.19 | 1.47 | V |
| | | | $T_{vj}$ = 125 °C | | 1.07 | | |
| | | | $T_{vj}$ = 150 °C | | 1.02 | | |

**Table 12 Characteristic values (continued)**

| Parameter | Symbol | Note or test condition | | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Peak reverse recovery current | $I_{RM}$ | $I_F$ = 100 A, $V_R$ = 300 V, $V_{GE}$ = -15 V, -di$_F$/dt = 12.5 kA/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 135 | | A |
| | | | $T_{vj}$ = 125 °C | | 186 | | |
| | | | $T_{vj}$ = 150 °C | | 199 | | |
| Recovered charge | $Q_r$ | $I_F$ = 100 A, $V_R$ = 300 V, $V_{GE}$ = -15 V, -di$_F$/dt = 12.5 kA/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 5.05 | | µC |
| | | | $T_{vj}$ = 125 °C | | 12 | | |
| | | | $T_{vj}$ = 150 °C | | 14.4 | | |
| Reverse recovery energy | $E_{rec}$ | $I_F$ = 100 A, $V_R$ = 300 V, $V_{GE}$ = -15 V, -di$_F$/dt = 12.5 kA/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 0.931 | | mJ |
| | | | $T_{vj}$ = 125 °C | | 2.64 | | |
| | | | $T_{vj}$ = 150 °C | | 3.26 | | |
| Thermal resistance, junction to heatsink | $R_{thJH}$ | per diode, $\lambda_{grease}$= 3.3 W/(m*K) | | | 0.479 | | K/W |
| Temperature under switching conditions | $T_{vj\,op}$ | | | -40 | | 150 | °C |

# 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 °C | | 5 | | kΩ |
| Deviation of $R_{100}$ | $\Delta R/R$ | $T_{NTC}$ = 100 °C, $R_{100}$ = 493 Ω | -5 | | 5 | % |
| Power dissipation | $P_{25}$ | $T_{NTC}$ = 25 °C | | | 20 | mW |
| B-value | $B_{25/50}$ | $R_2 = R_{25} \exp[B_{25/50}(1/T_2\text{-}1/(298{,}15\ K))]$ | | 3375 | | K |
| B-value | $B_{25/80}$ | $R_2 = R_{25} \exp[B_{25/80}(1/T_2\text{-}1/(298{,}15\ K))]$ | | 3411 | | K |
| B-value | $B_{25/100}$ | $R_2 = R_{25} \exp[B_{25/100}(1/T_2\text{-}1/(298{,}15\ K))]$ | | 3433 | | K |

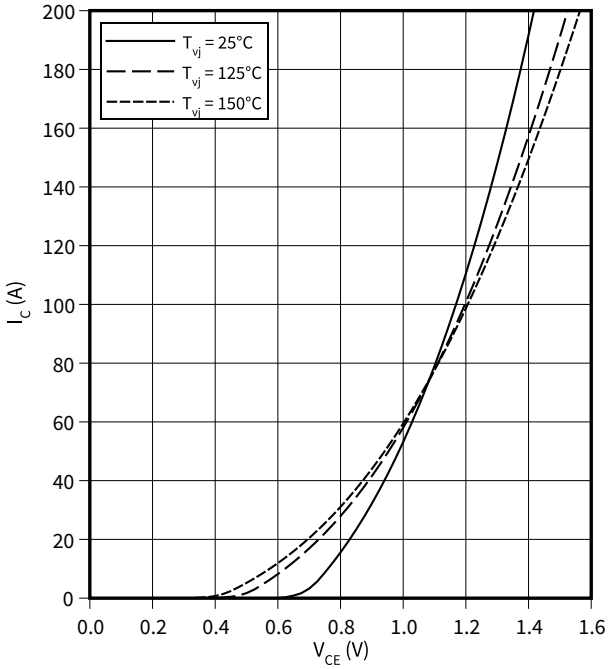
*Note: Specification according to the valid application note.*

# 8 Characteristics diagrams

**output characteristic (typical), IGBT, T1.1 / T1.2 / T4.1 / T4.2**

$I_C = f(V_{CE})$

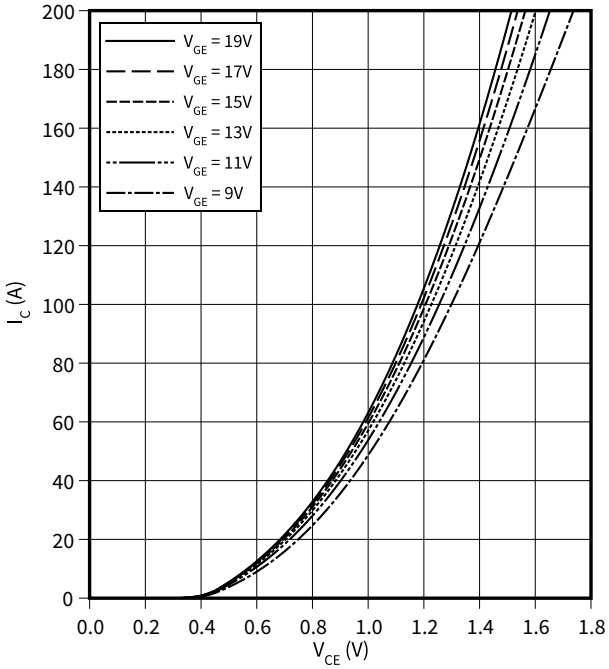
$V_{GE}$ = 15 V




**output characteristic (typical), IGBT, T1.1 / T1.2 / T4.1 / T4.2**

$I_C = f(V_{CE})$

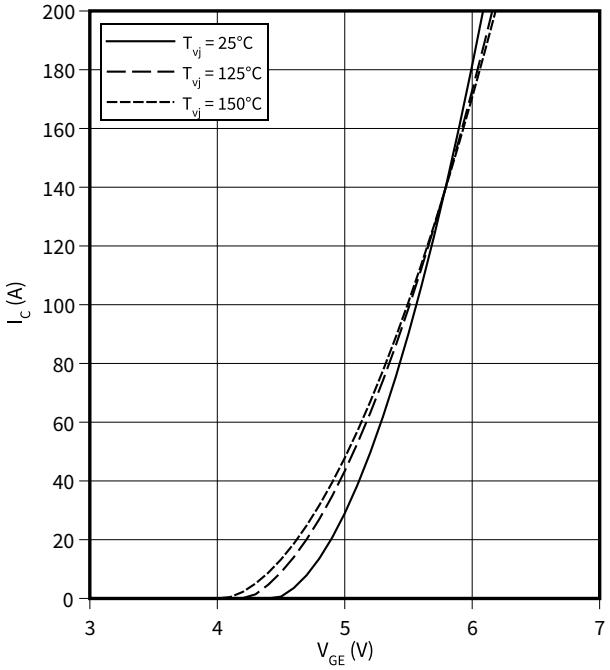
$T_{vj}$ = 150 °C




**transfer characteristic (typical), IGBT, T1.1 / T1.2 / T4.1 / T4.2**

$I_C = f(V_{GE})$

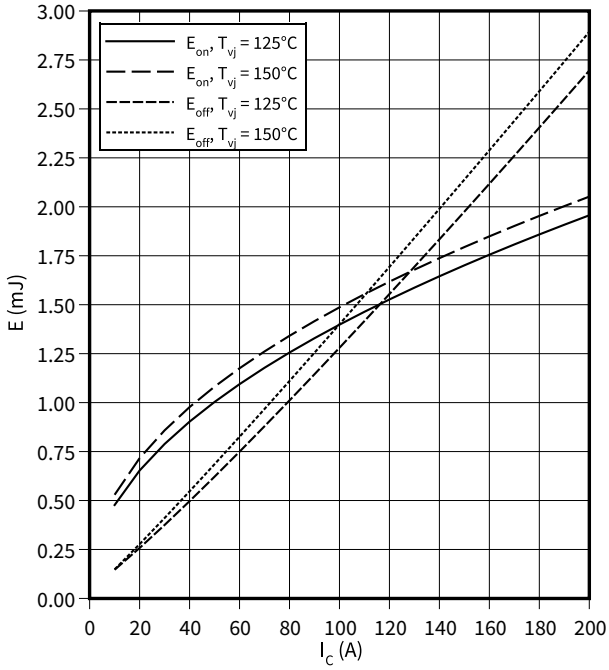
$V_{CE}$ = 20 V




**switching losses (typical), IGBT, T1.1 / T1.2 / T4.1 / T4.2**

$E = f(I_C)$

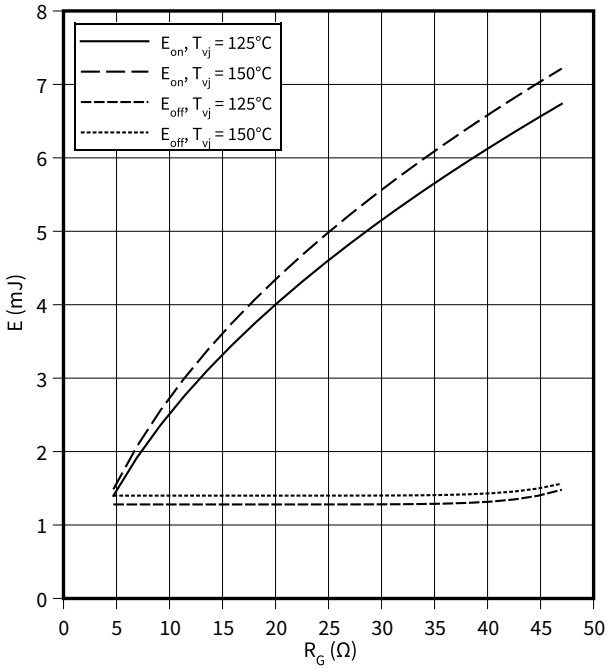
$R_{Goff}$ = 4.7 Ω, $R_{Gon}$ = 4.7 Ω, $V_{CE}$ = 300 V, $V_{GE}$ = ± 15 V



### switching losses (typical), IGBT, T1.1 / T1.2 / T4.1 / T4.2

$E = f(R_G)$

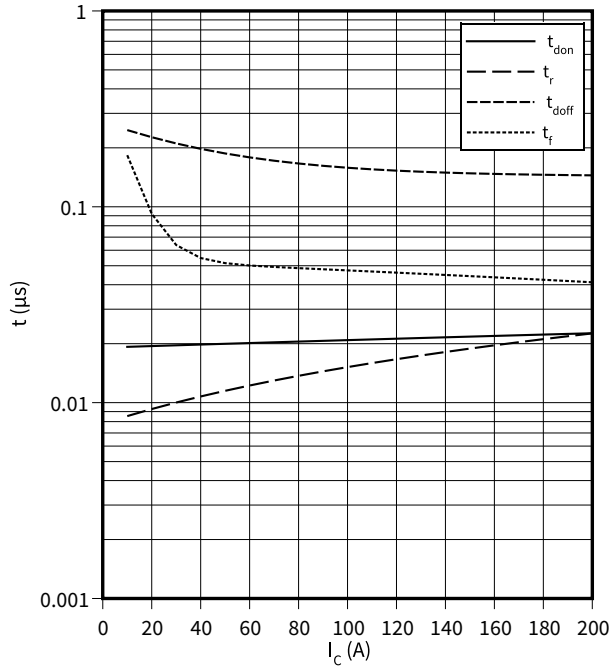
$I_C = 100\ A$, $V_{CE} = 300\ V$, $V_{GE} = \pm 15\ V$




### switching times (typical), IGBT, T1.1 / T1.2 / T4.1 / T4.2

$t = f(I_C)$

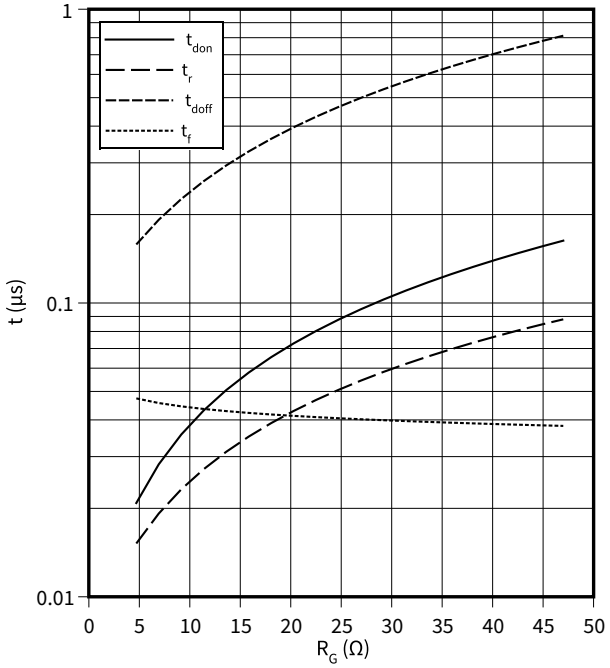
$R_{Goff} = 4.7\ \Omega$, $R_{Gon} = 4.7\ \Omega$, $V_{CE} = 300\ V$, $V_{GE} = \pm 15\ V$, $T_{vj} = 150\ °C$




### switching times (typical), IGBT, T1.1 / T1.2 / T4.1 / T4.2

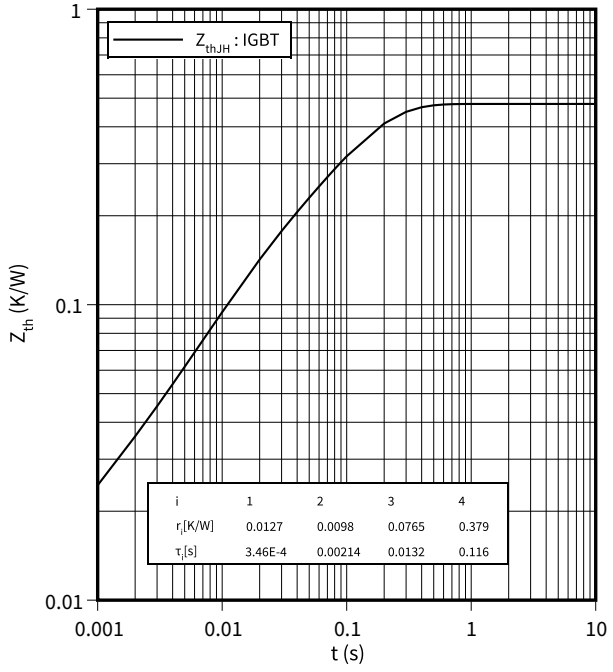
$t = f(R_G)$

$I_C = 100\ A$, $V_{CE} = 300\ V$, $V_{GE} = \pm 15\ V$, $T_{vj} = 150\ °C$




### transient thermal impedance , IGBT, T1.1 / T1.2 / T4.1 / T4.2

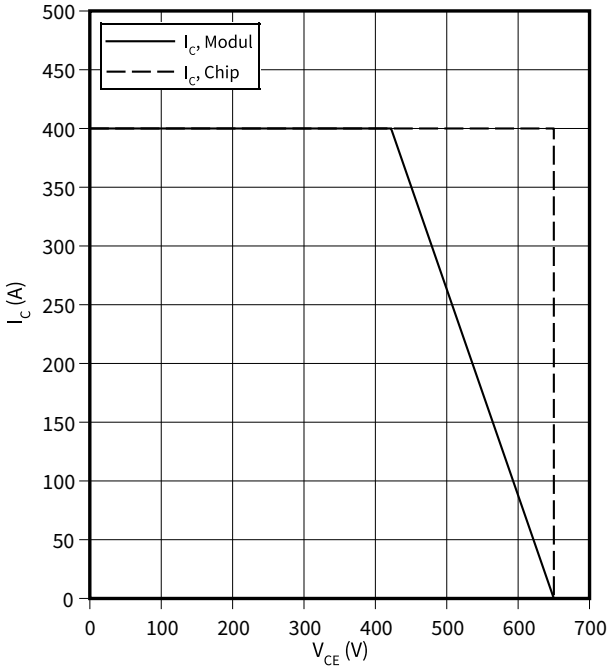
$Z_{th} = f(t)$



### reverse bias safe operating area (RBSOA), IGBT, T1.1 / T1.2 / T4.1 / T4.2

$I_C = f(V_{CE})$

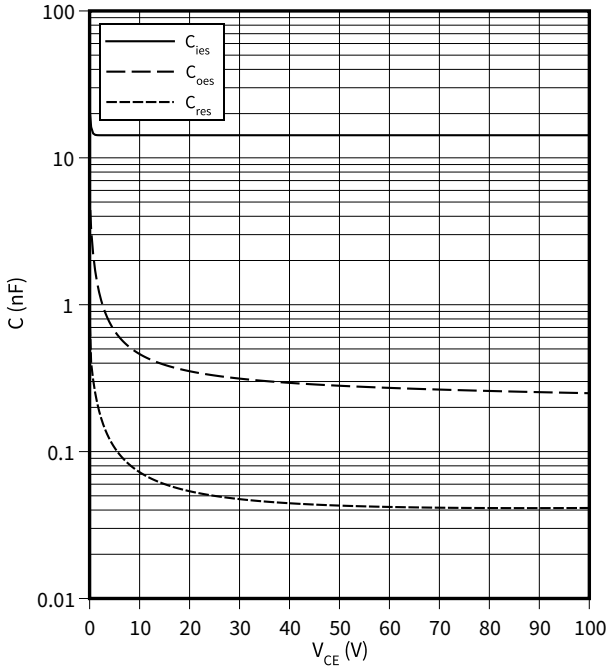
$R_{Goff} = 4.7\ \Omega$, $V_{GE} = \pm 15$ V, $T_{vj} = 150$ °C




### capacity characteristic (typical), IGBT, T1.1 / T1.2 / T4.1 / T4.2

$C = f(V_{CE})$

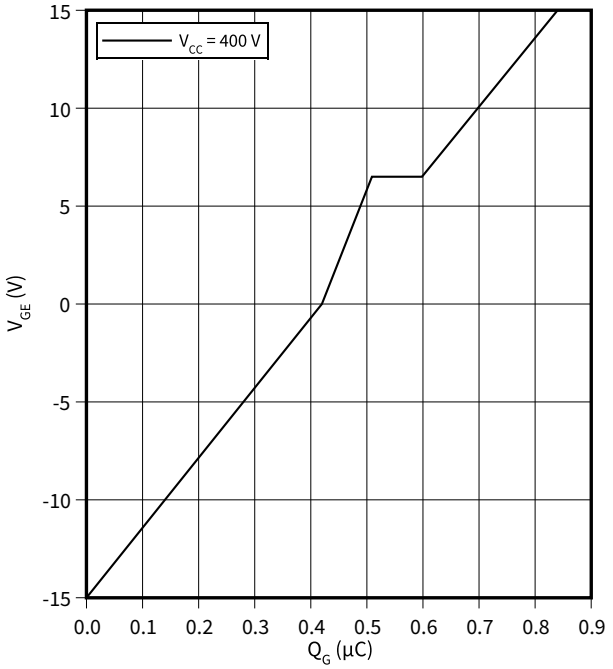
$f = 100$ kHz, $V_{GE} = 0$ V, $T_{vj} = 25$ °C




### gate charge characteristic (typical), IGBT, T1.1 / T1.2 / T4.1 / T4.2

$V_{GE} = f(Q_G)$

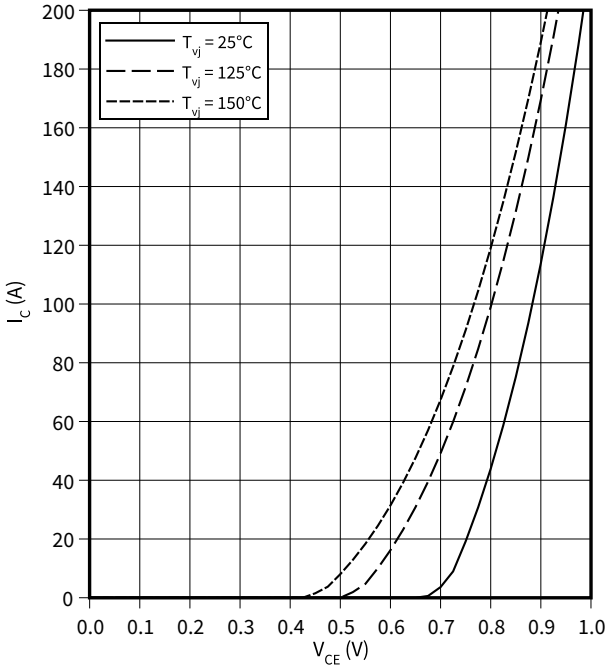
$I_C = 200$ A, $T_{vj} = 25$ °C




### output characteristic (typical), IGBT, T2 / T3

$I_C = f(V_{CE})$

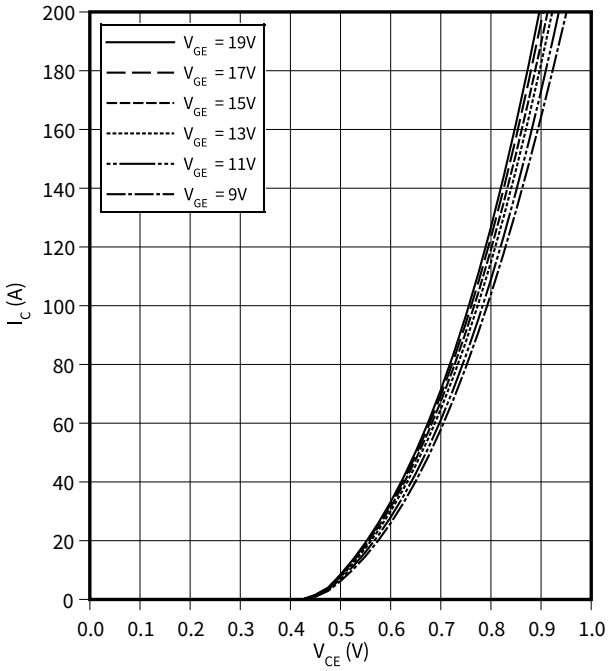
$V_{GE} = 15$ V



**output characteristic (typical), IGBT, T2 / T3**

$I_C = f(V_{CE})$

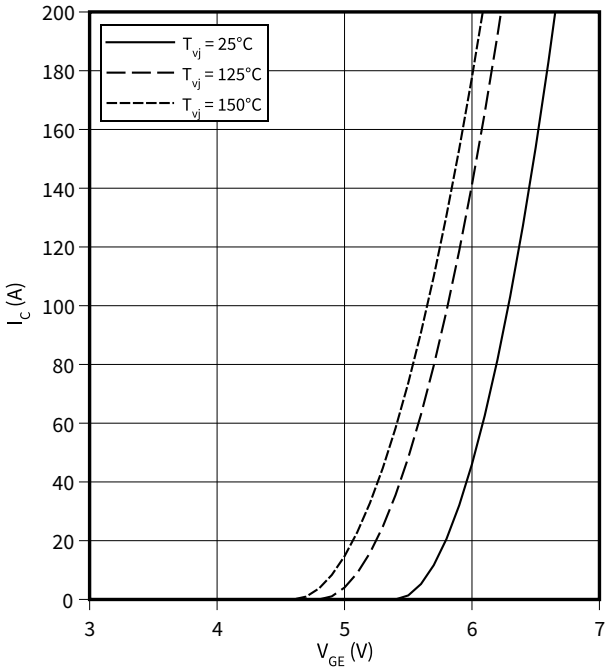
$T_{vj} = 150\ °C$




**transfer characteristic (typical), IGBT, T2 / T3**

$I_C = f(V_{GE})$

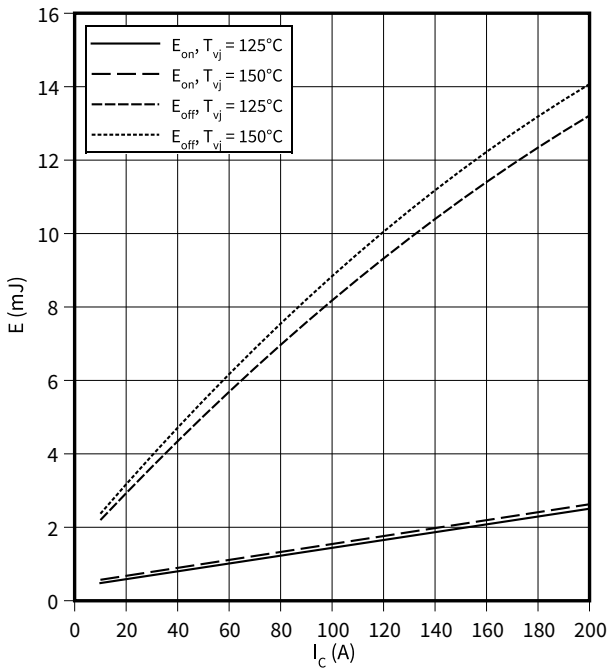
$V_{CE} = 20\ V$




**switching losses (typical), IGBT, T2 / T3**

$E = f(I_C)$

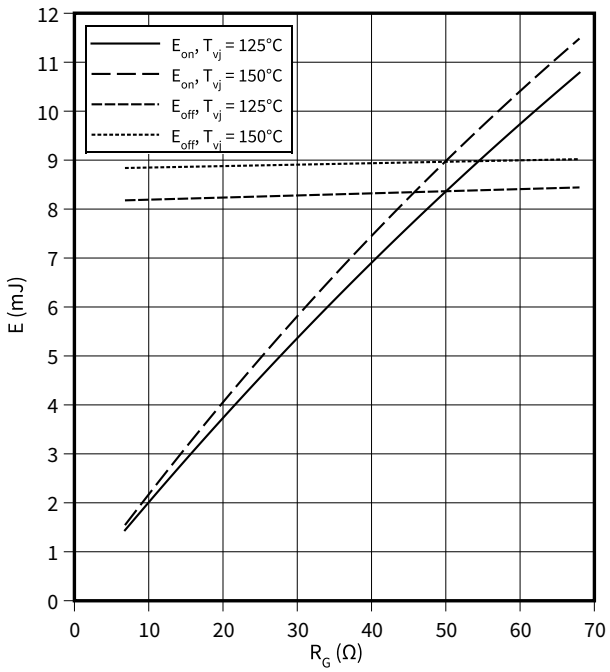
$R_{Goff} = 6.8\ \Omega$, $R_{Gon} = 6.8\ \Omega$, $V_{CE} = 300\ V$, $V_{GE} = \pm 15\ V$




**switching losses (typical), IGBT, T2 / T3**

$E = f(R_G)$

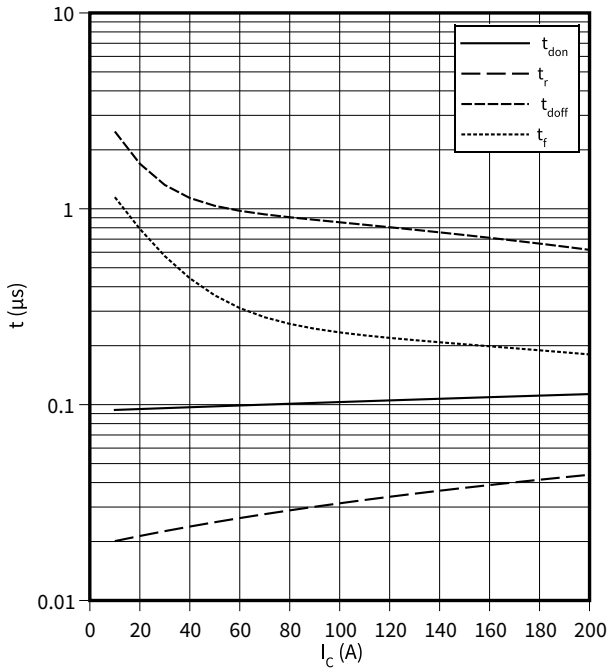
$I_C = 100\ A$, $V_{CE} = 300\ V$, $V_{GE} = \pm 15\ V$



### switching times (typical), IGBT, T2 / T3

$t = f(I_C)$

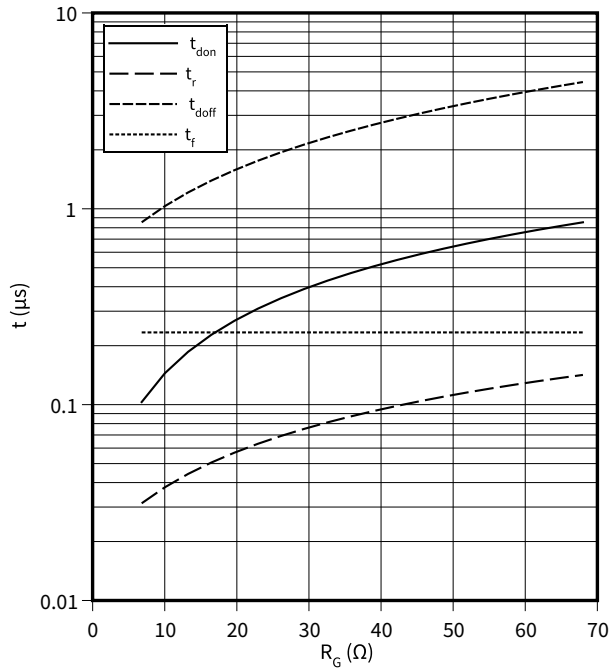
$R_{Goff} = 6.8\ \Omega$, $R_{Gon} = 6.8\ \Omega$, $V_{CE} = 300$ V, $V_{GE} = \pm 15$ V, $T_{vj} = 150$ °C




### switching times (typical), IGBT, T2 / T3

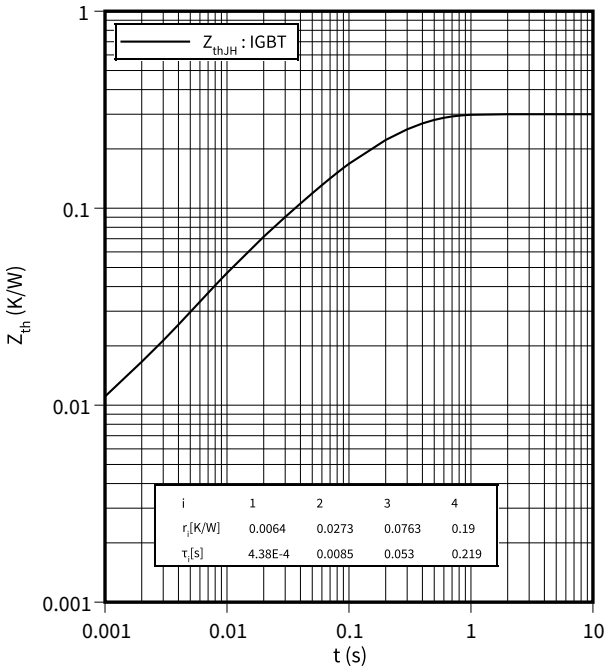
$t = f(R_G)$

$I_C = 100$ A, $V_{CE} = 300$ V, $V_{GE} = \pm 15$ V, $T_{vj} = 150$ °C




### transient thermal impedance , IGBT, T2 / T3

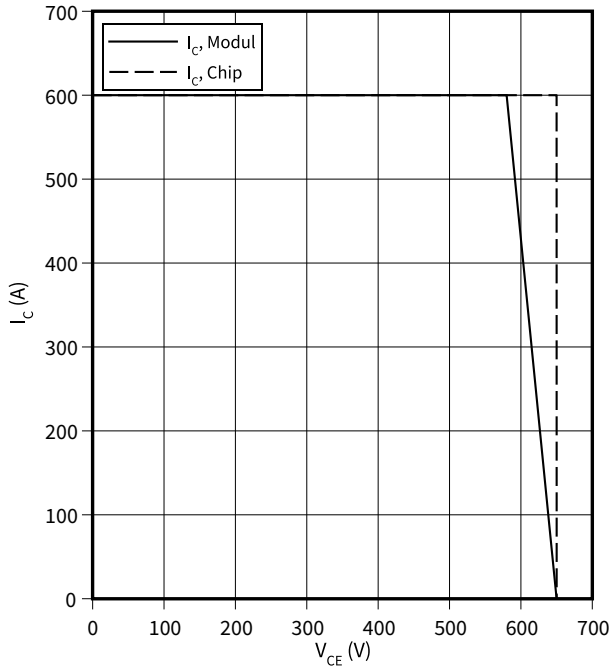
$Z_{th} = f(t)$




### reverse bias safe operating area (RBSOA), IGBT, T2 / T3

$I_C = f(V_{CE})$

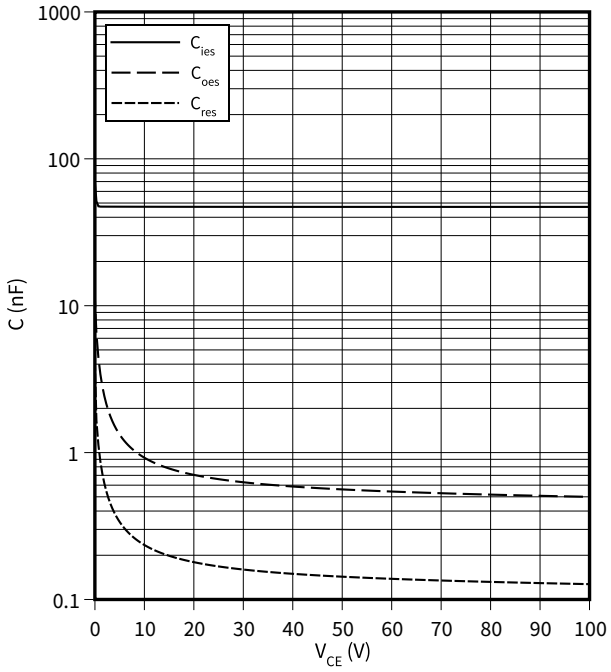
$R_{Goff} = 6.8\ \Omega$, $V_{GE} = \pm 15$ V, $T_{vj} = 150$ °C



**capacity characteristic (typical), IGBT, T2 / T3**

$C = f(V_{CE})$

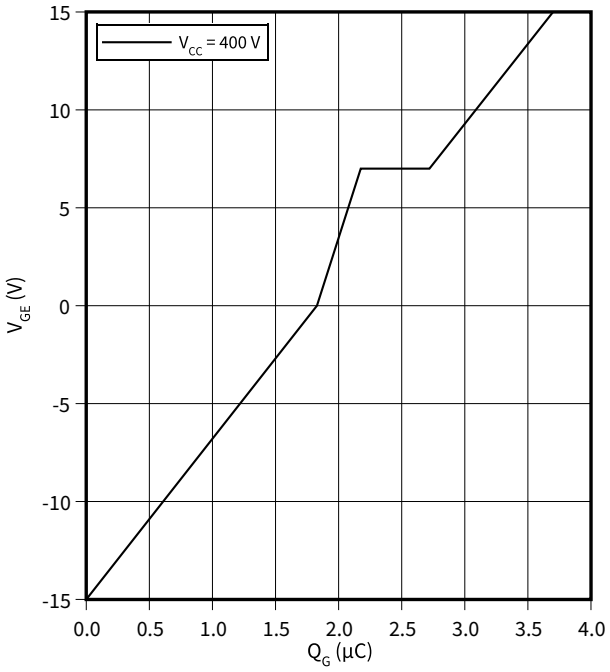
$f = 100\ kHz$, $V_{GE} = 0\ V$, $T_{vj} = 25\ °C$




**gate charge characteristic (typical), IGBT, T2 / T3**

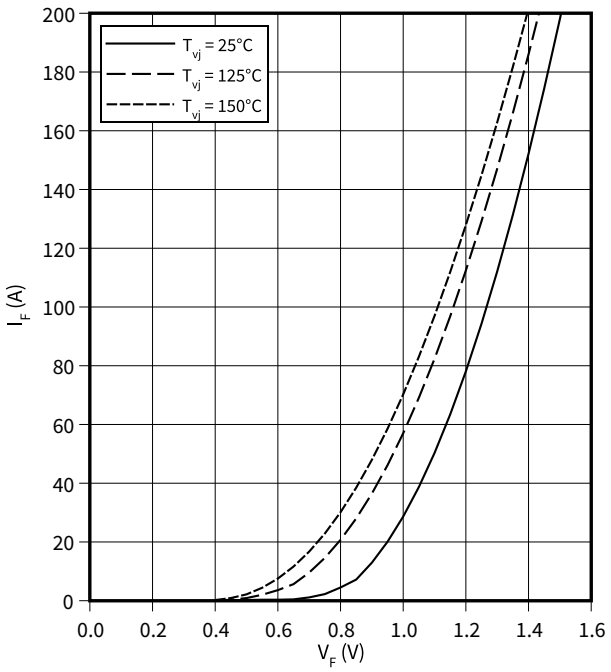
$V_{GE} = f(Q_G)$

$I_C = 200\ A$, $T_{vj} = 25\ °C$




**forward characteristic (typical), Diode, D1 / D4**

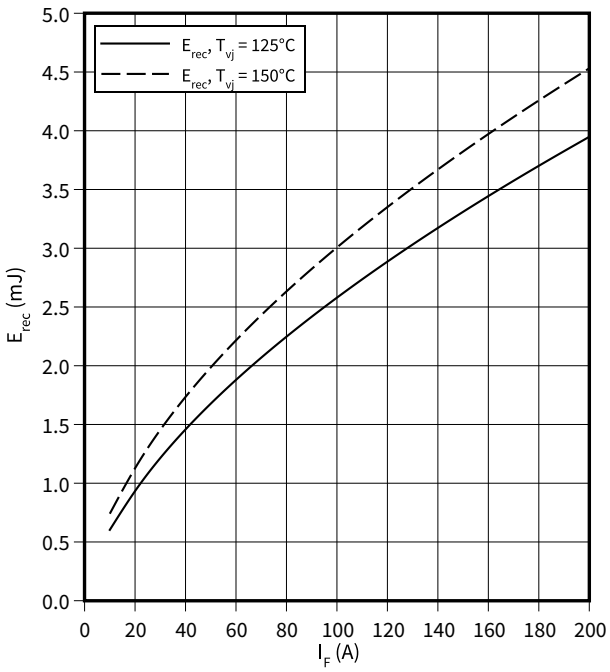
$I_F = f(V_F)$




**switching losses (typical), Diode, D1 / D4**

$E_{rec} = f(I_F)$

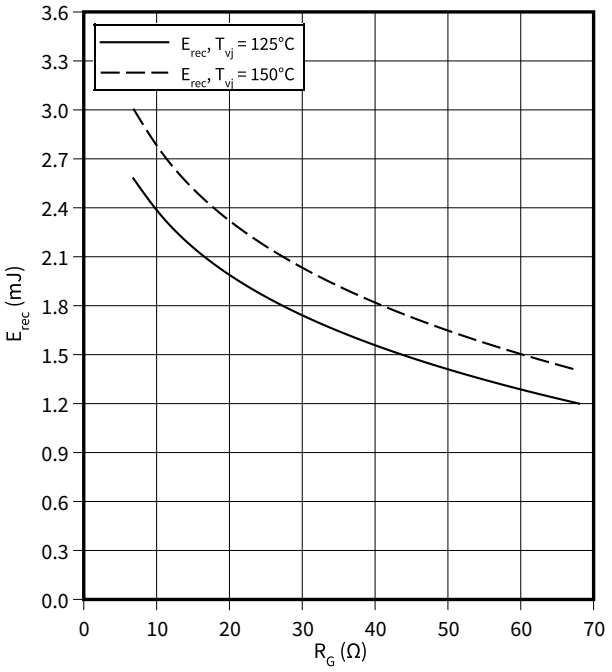
$R_{Gon} = 6.8\ \Omega$, $V_{CE} = 300\ V$



### switching losses (typical), Diode, D1 / D4

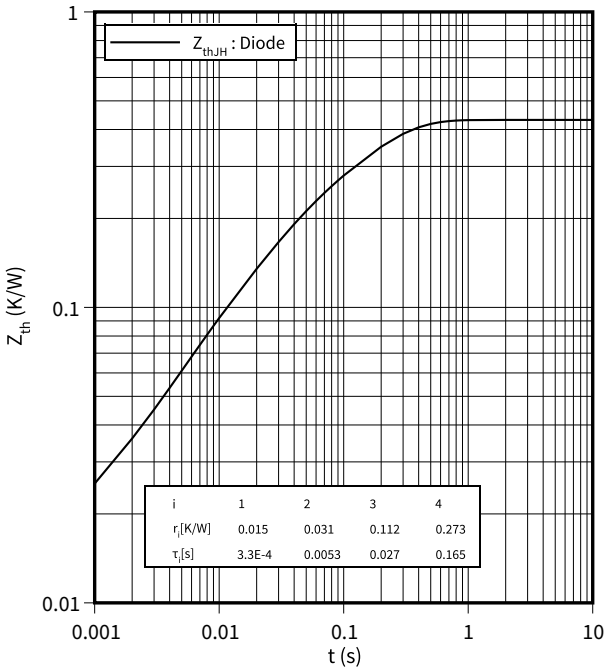
$E_{rec} = f(R_G)$

$V_{CE} = 300\ V$, $I_F = 100\ A$



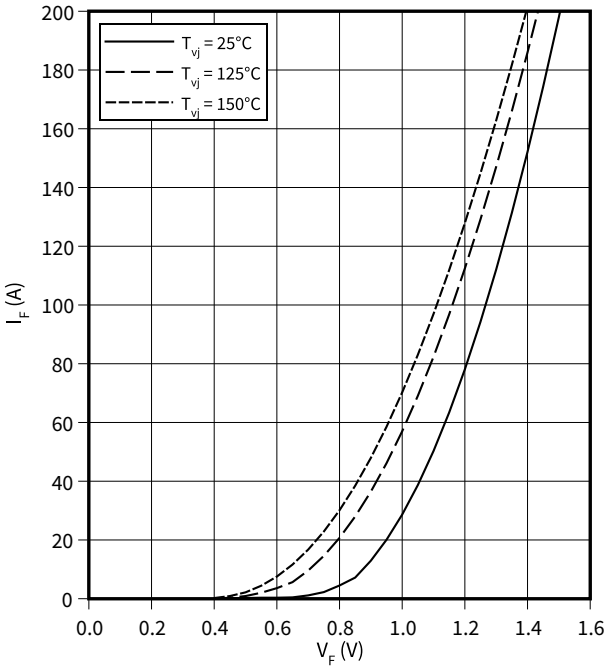

### transient thermal impedance , Diode, D1 / D4

$Z_{th} = f(t)$




### forward characteristic (typical), Diode, D2 / D3

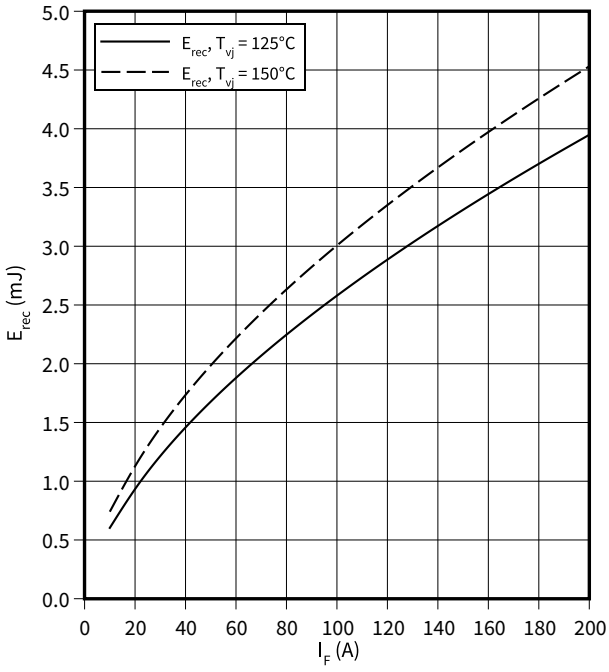
$I_F = f(V_F)$




### switching losses (typical), Diode, D2 / D3

$E_{rec} = f(I_F)$

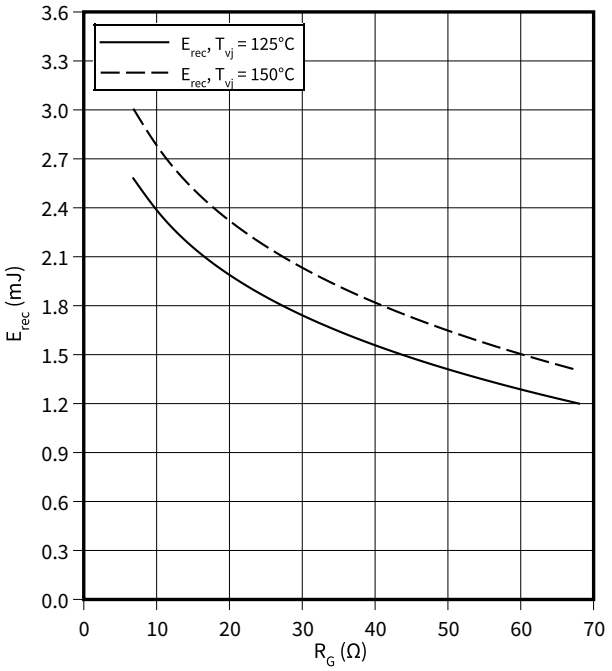
$R_{Gon} = 6.8\ \Omega$, $V_{CE} = 300\ V$



### switching losses (typical), Diode, D2 / D3

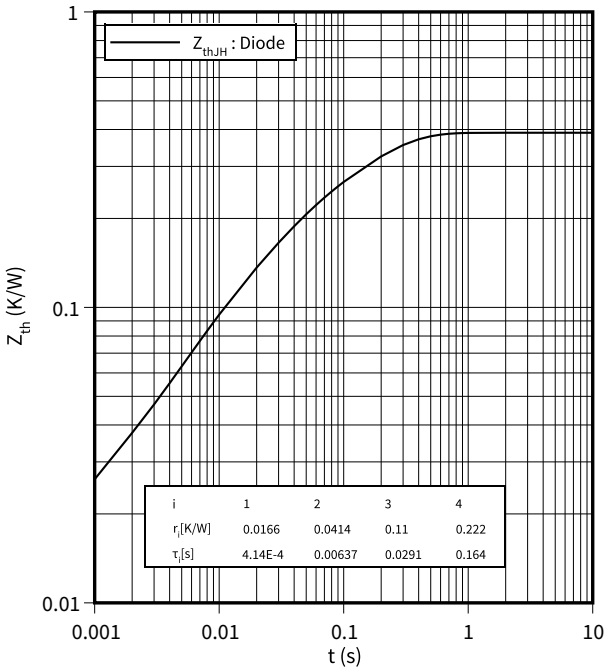
$E_{rec} = f(R_G)$

$V_{CE} = 300\ V$, $I_F = 100\ A$



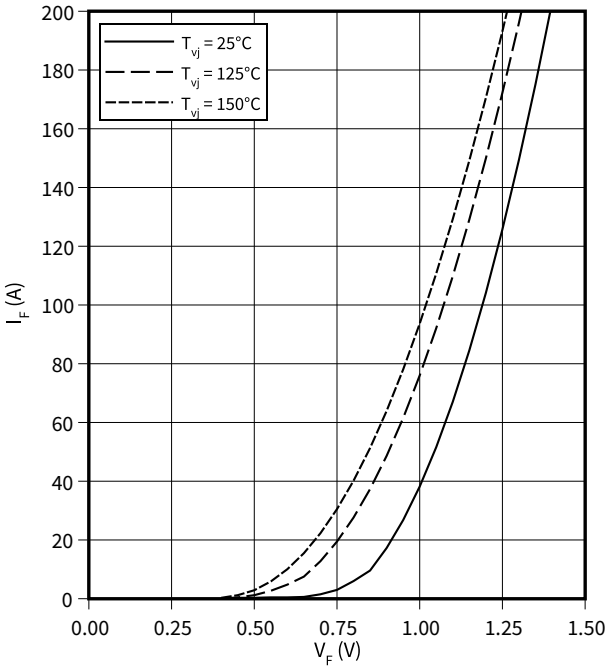

### transient thermal impedance , Diode, D2 / D3

$Z_{th} = f(t)$




### forward characteristic of (typical), Diode, D5 / D6

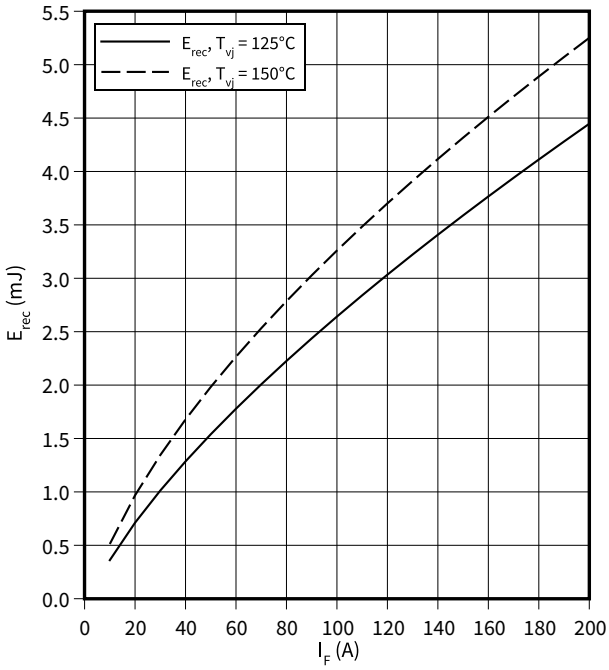
$I_F = f(V_F)$




### switching losses (typical), Diode, D5 / D6

$E_{rec} = f(I_F)$

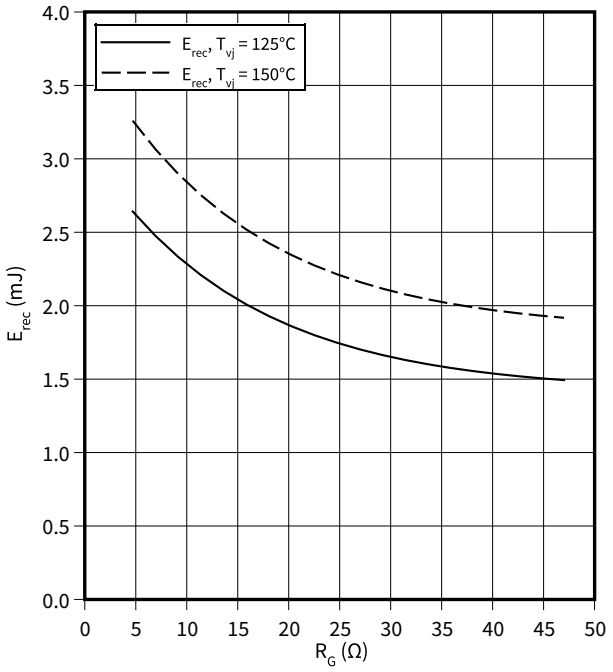
$R_{Gon} = 4.7\ \Omega$, $V_{CE} = 300\ V$



**switching losses (typical), Diode, D5 / D6**

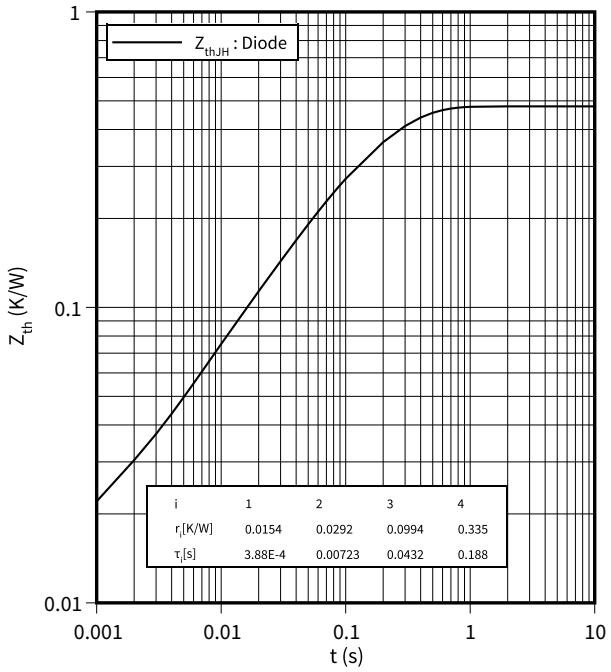
$E_{rec} = f(R_G)$

$V_{CE} = 300\ V$, $I_F = 100\ A$



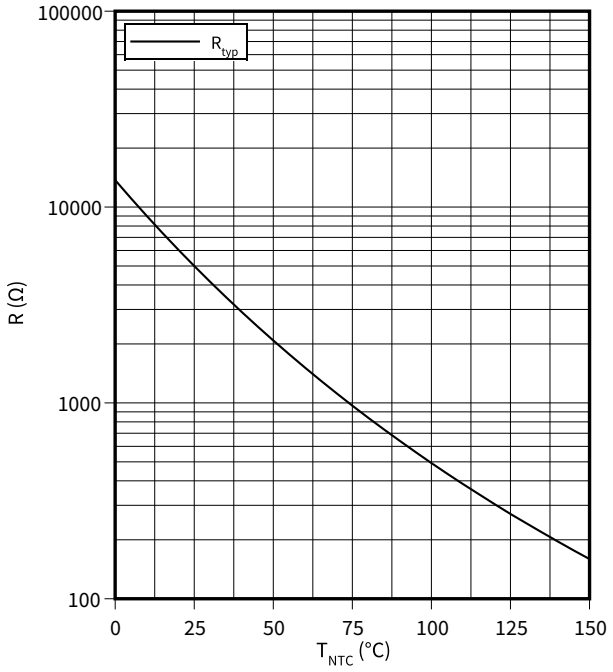

**transient thermal impedance , Diode, D5 / D6**

$Z_{th} = f(t)$




**temperature characteristic (typical), NTC-Thermistor**

$R = f(T_{NTC})$



# 9 Circuit diagram

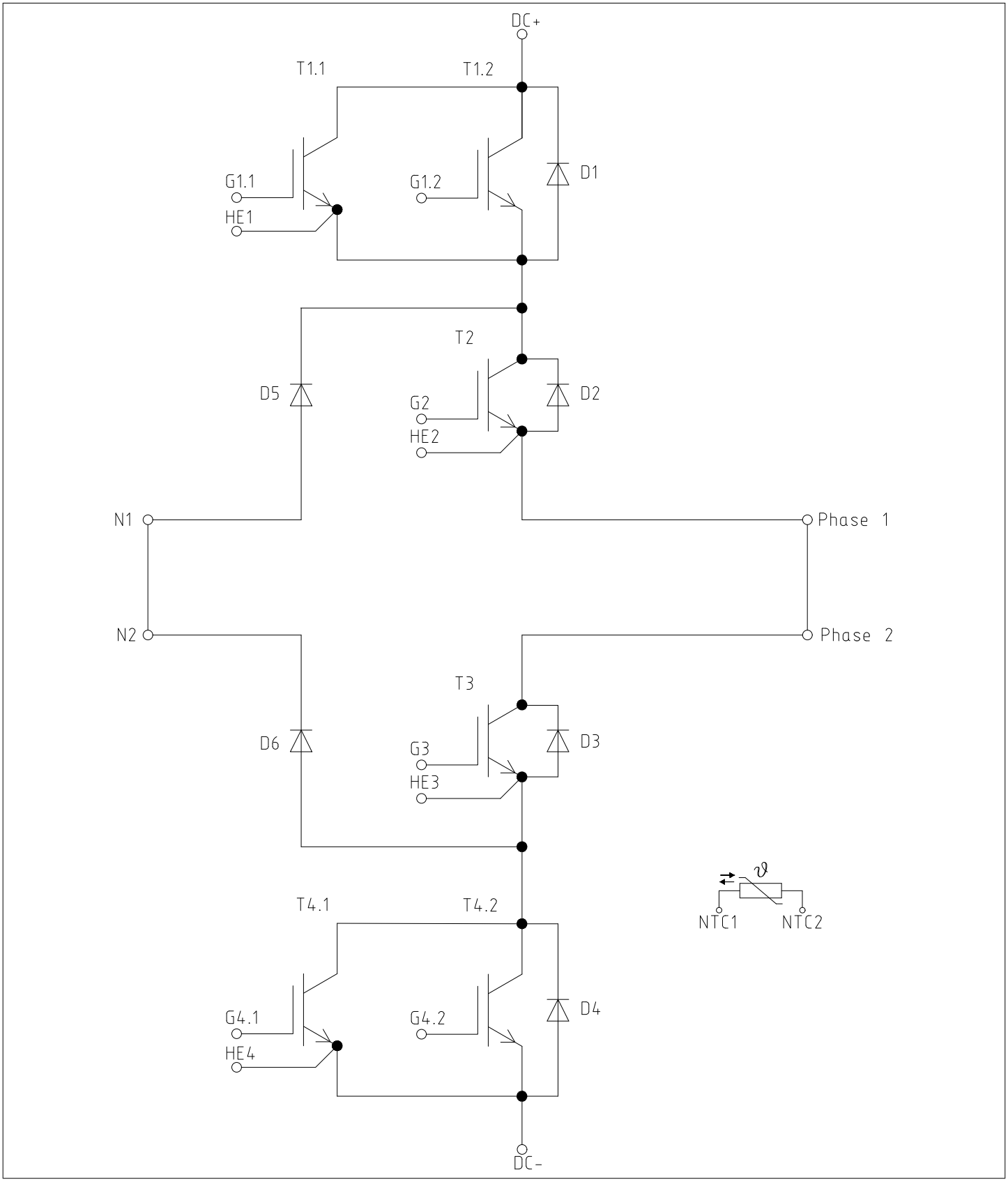



**Figure 2**

# 10 Package outlines

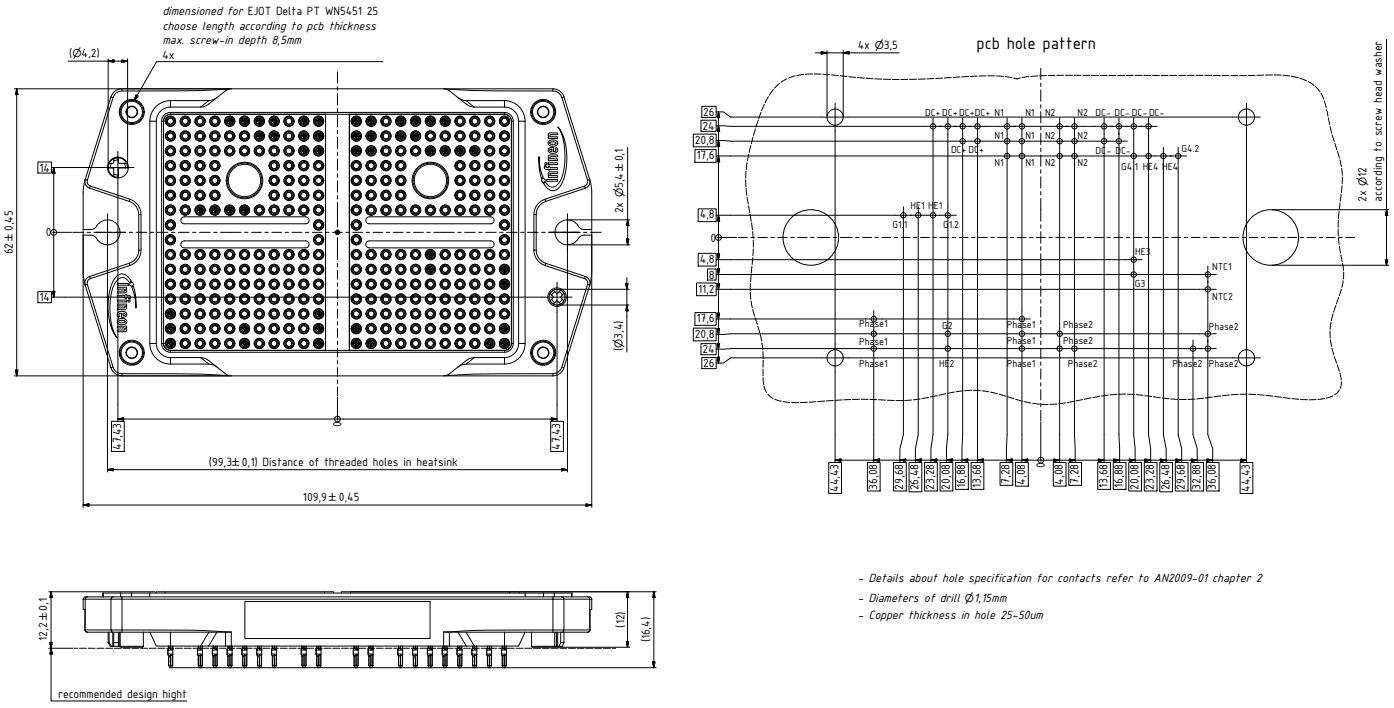



**Figure 3**

# 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 | *Content*<br>Module serial number<br>Module material number<br>Production order number<br>Date code (production year)<br>Date code (production week) | *Digit*<br>1 – 5<br>6 - 11<br>12 - 19<br>20 – 21<br>22 – 23 | *Example*<br>71549<br>142846<br>55054991<br>15<br>30 |
| Example | 715491428465505499115 30 | | 715491428465505499115 30 |

**Figure 4**

# Revision history

| Document revision | Date of release | Description of changes |
|---|---|---|
| 0.10 | 2021-04-28 | Target datasheet |
| 1.00 | 2021-06-25 | Final datasheet |