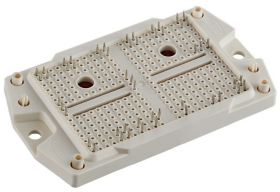
## EasyPACK™ module with TRENCHSTOP™ 5 and Emitter Controlled 3 diode and PressFIT / NTC

### Features



- Electrical features
  - $V_{CES}$ = 650 V
  - $I_{C\ nom}$ = 100 A / $I_{CRM}$ = 200 A
  - Low switching losses
- Mechanical features
  - $Al_2O_3$ substrate with low thermal resistance
  - Integrated NTC temperature sensor
  - PressFIT contact technology

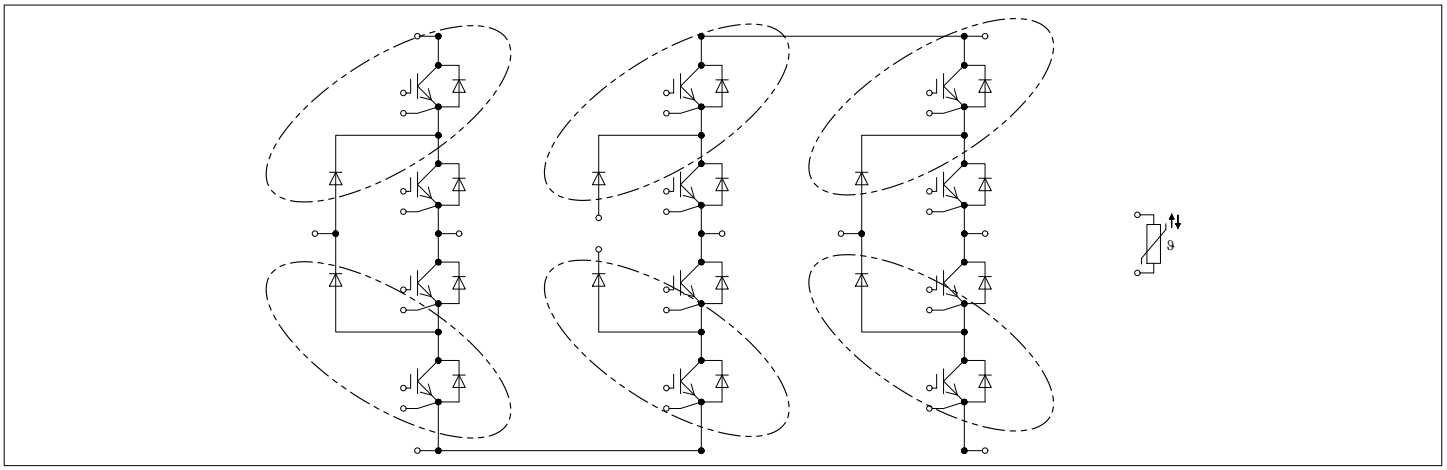
### Potential applications

- Solar applications
- 3-level-applications

### Product validation

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

### Description



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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 Hz, *t* = 1 min | 3.0 | kV |
| Internal Isolation | | basic insulation (class 1, IEC 61140) | $Al_2O_3$ | |
| Creepage distance | $d_{Creep}$ | terminal to heatsink | 9.6 | 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 | $L_{sCE}$ | | | | 28 | | nH |
| Module lead resistance, terminals - chip | $R_{CC'+EE'}$ | $T_H$=25°C, per switch | | | 1.6 | | mΩ |
| 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 25 A rms per connector pin.*

# 2 IGBT,3-Level

**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 | $I_{CN}$ | | | 100 | A |
| Continous DC collector current | $I_{CDC}$ | $T_{vj\,max}$ = 175 °C | $T_H$ = 65 °C | 70 | A |
| Repetitive peak collector current | $I_{CRM}$ | $t_P$ = 1 ms | | 200 | 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 | $V_{CE\,sat}$ | $I_C$ = 50 A, $V_{GE}$ = 15 V | $T_{vj}$ = 25 °C | | 1.17 | 1.38 | V |
| | | | $T_{vj}$ = 125 °C | | 1.20 | | |
| | | | $T_{vj}$ = 150 °C | | 1.21 | | |
| Gate threshold voltage | $V_{GEth}$ | $I_C$ = 1 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 | | | 0.42 | | 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 | | | 7.1 | | nF |
| Reverse transfer capacitance | $C_{res}$ | $f$ = 100 kHz, $T_{vj}$ = 25 °C, $V_{CE}$ = 25 V, $V_{GE}$ = 0 V | | | 0.025 | | nF |
| Collector-emitter cut-off current | $I_{CES}$ | $V_{CE}$ = 650 V, $V_{GE}$ = 0 V | $T_{vj}$ = 25 °C | | | 0.007 | 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) | $t_{don}$ | $I_C$ = 50 A, $V_{CE}$ = 300 V, $V_{GE}$ = ±15 V, $R_{Gon}$ = 8.2 Ω | $T_{vj}$ = 25 °C | | 0.026 | | µs |
| | | | $T_{vj}$ = 125 °C | | 0.028 | | |
| | | | $T_{vj}$ = 150 °C | | 0.028 | | |
| Rise time (inductive load) | $t_r$ | $I_C$ = 50 A, $V_{CE}$ = 300 V, $V_{GE}$ = ±15 V, $R_{Gon}$ = 8.2 Ω | $T_{vj}$ = 25 °C | | 0.011 | | µs |
| | | | $T_{vj}$ = 125 °C | | 0.012 | | |
| | | | $T_{vj}$ = 150 °C | | 0.012 | | |
| Turn-off delay time (inductive load) | $t_{doff}$ | $I_C$ = 50 A, $V_{CE}$ = 300 V, $V_{GE}$ = ±15 V, $R_{Goff}$ = 8.2 Ω | $T_{vj}$ = 25 °C | | 0.140 | | µs |
| | | | $T_{vj}$ = 125 °C | | 0.170 | | |
| | | | $T_{vj}$ = 150 °C | | 0.180 | | |
| Fall time (inductive load) | $t_f$ | $I_C$ = 50 A, $V_{CE}$ = 300 V, $V_{GE}$ = ±15 V, $R_{Goff}$ = 8.2 Ω | $T_{vj}$ = 25 °C | | 0.020 | | µs |
| | | | $T_{vj}$ = 125 °C | | 0.050 | | |
| | | | $T_{vj}$ = 150 °C | | 0.050 | | |
| Turn-on energy loss per pulse | $E_{on}$ | $I_C$ = 50 A, $V_{CE}$ = 300 V, $L_\sigma$ = 35 nH, $V_{GE}$ = ±15 V, $R_{Gon}$ = 8.2 Ω, di/dt = 2900 A/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 0.45 | | mJ |
| | | | $T_{vj}$ = 125 °C | | 0.66 | | |
| | | | $T_{vj}$ = 150 °C | | 0.72 | | |
| Turn-off energy loss per pulse | $E_{off}$ | $I_C$ = 50 A, $V_{CE}$ = 300 V, $L_\sigma$ = 35 nH, $V_{GE}$ = ±15 V, $R_{Goff}$ = 8.2 Ω, dv/dt = 4500 V/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 0.65 | | mJ |
| | | | $T_{vj}$ = 125 °C | | 0.92 | | |
| | | | $T_{vj}$ = 150 °C | | 1.02 | | |
| SC data | $I_{SC}$ | $V_{GE}$ ≤ 15 V, $V_{CC}$ = 360 V, $V_{CEmax}$=$V_{CES}$-$L_{sCE}$*di/dt | $t_P$ ≤ 0 µs, $T_{vj}$ = 150 °C | | 800 | | A |
| Thermal resistance, junction to heatsink | $R_{thJH}$ | per IGBT | | | 0.886 | | K/W |

**Table 4 Characteristic values (continued)**

| Parameter | Symbol | Note or test condition | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Temperature under switching conditions | $T_{vj\,op}$ | | -40 | | 150 | °C |

# 3 IGBT, Inverter

**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 | $I_{CN}$ | | | 75 | A |
| Continous DC collector current | $I_{CDC}$ | $T_{vj\,max}$ = 175 °C | $T_H$ = 65 °C | 75 | A |
| Repetitive peak collector current | $I_{CRM}$ | $t_P$ = 1 ms | | 150 | 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 | $V_{CE\,sat}$ | $I_C$ = 50 A, $V_{GE}$ = 15 V | $T_{vj}$ = 25 °C | | 0.99 | 1.43 | V |
| | | | $T_{vj}$ = 125 °C | | 0.94 | | |
| | | | $T_{vj}$ = 150 °C | | 0.91 | | |
| Gate threshold voltage | $V_{GEth}$ | $I_C$ = 1 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 | | | 0.92 | | 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 | | | 11.8 | | nF |
| Reverse transfer capacitance | $C_{res}$ | $f$ = 100 kHz, $T_{vj}$ = 25 °C, $V_{CE}$ = 25 V, $V_{GE}$ = 0 V | | | 0.042 | | nF |
| Collector-emitter cut-off current | $I_{CES}$ | $V_{CE}$ = 650 V, $V_{GE}$ = 0 V | $T_{vj}$ = 25 °C | | | 0.007 | 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) | $t_{don}$ | $I_C$ = 50 A, $V_{CE}$ = 300 V, $V_{GE}$ = ±15 V, $R_{Gon}$ = 8.2 Ω | $T_{vj}$ = 25 °C | | 0.053 | | µs |
| | | | $T_{vj}$ = 125 °C | | 0.049 | | |
| | | | $T_{vj}$ = 150 °C | | 0.048 | | |

**Table 6 Characteristic values (continued)**

| Parameter | Symbol | Note or test condition | | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Rise time (inductive load) | $t_r$ | $I_C$ = 50 A, $V_{CE}$ = 300 V, $V_{GE}$ = ±15 V, $R_{Gon}$ = 8.2 Ω | $T_{vj}$ = 25 °C | | 0.017 | | µs |
| | | | $T_{vj}$ = 125 °C | | 0.018 | | |
| | | | $T_{vj}$ = 150 °C | | 0.019 | | |
| Turn-off delay time (inductive load) | $t_{doff}$ | $I_C$ = 50 A, $V_{CE}$ = 300 V, $V_{GE}$ = ±15 V, $R_{Goff}$ = 8.2 Ω | $T_{vj}$ = 25 °C | | 0.330 | | µs |
| | | | $T_{vj}$ = 125 °C | | 0.370 | | |
| | | | $T_{vj}$ = 150 °C | | 0.380 | | |
| Fall time (inductive load) | $t_f$ | $I_C$ = 50 A, $V_{CE}$ = 300 V, $V_{GE}$ = ±15 V, $R_{Goff}$ = 8.2 Ω | $T_{vj}$ = 25 °C | | 0.130 | | µs |
| | | | $T_{vj}$ = 125 °C | | 0.210 | | |
| | | | $T_{vj}$ = 150 °C | | 0.240 | | |
| Turn-on energy loss per pulse | $E_{on}$ | $I_C$ = 50 A, $V_{CE}$ = 300 V, $L_\sigma$ = 35 nH, $V_{GE}$ = ±15 V, $R_{Gon}$ = 8.2 Ω, di/dt = 2400 A/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 0.29 | | mJ |
| | | | $T_{vj}$ = 125 °C | | 0.34 | | |
| | | | $T_{vj}$ = 150 °C | | 0.36 | | |
| Turn-off energy loss per pulse | $E_{off}$ | $I_C$ = 50 A, $V_{CE}$ = 300 V, $L_\sigma$ = 35 nH, $V_{GE}$ = ±15 V, $R_{Goff}$ = 8.2 Ω, dv/dt = 1600 V/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 2.48 | | mJ |
| | | | $T_{vj}$ = 125 °C | | 3.45 | | |
| | | | $T_{vj}$ = 150 °C | | 3.69 | | |
| SC data | $I_{SC}$ | $V_{GE}$ ≤ 15 V, $V_{CC}$ = 360 V, $V_{CEmax}$=$V_{CES}$-$L_{sCE}$*di/dt | $t_P$ ≤ 0 µs, $T_{vj}$ ≤ 150 °C | | 900 | | A |
| Thermal resistance, junction to heatsink | $R_{thJH}$ | per IGBT | | | 0.902 | | K/W |
| Temperature under switching conditions | $T_{vj\,op}$ | | | -40 | | 150 | °C |

# 4 Diode, 3-Level

**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 | $I_{FN}$ | | | 75 | A |
| Continous DC forward current | $I_F$ | | | 40 | A |
| Repetitive peak forward current | $I_{FRM}$ | $t_P$ = 1 ms | | 150 | A |

**Table 7 Maximum rated values (continued)**

| Parameter | Symbol | Note or test condition | | Values | Unit |
|---|---|---|---|---|---|
| $I^2t$ - value | $I^2t$ | $V_R$ = 0 V, $t_P$ = 10 ms | $T_{vj}$ = 125 °C | 370 | $A^2s$ |
| | | | $T_{vj}$ = 150 °C | 360 | |

**Table 8 Characteristic values**

| Parameter | Symbol | Note or test condition | | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Forward voltage | $V_F$ | $I_F$ = 40 A, $V_{GE}$ = 0 V | $T_{vj}$ = 25 °C | | 1.30 | 1.64 | V |
| | | | $T_{vj}$ = 125 °C | | 1.20 | | |
| | | | $T_{vj}$ = 150 °C | | 1.15 | | |
| Peak reverse recovery current | $I_{RM}$ | $I_F$ = 40 A, $V_R$ = 300 V, $V_{GE}$ = -15 V, -$di_F/dt$ = 2900 A/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 47 | | A |
| | | | $T_{vj}$ = 125 °C | | 60 | | |
| | | | $T_{vj}$ = 150 °C | | 66 | | |
| Recovered charge | $Q_r$ | $I_F$ = 40 A, $V_R$ = 300 V, $V_{GE}$ = -15 V, -$di_F/dt$ = 2900 A/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 2.13 | | µC |
| | | | $T_{vj}$ = 125 °C | | 4.18 | | |
| | | | $T_{vj}$ = 150 °C | | 4.9 | | |
| Reverse recovery energy | $E_{rec}$ | $I_F$ = 40 A, $V_R$ = 300 V, $V_{GE}$ = -15 V, -$di_F/dt$ = 2900 A/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 0.55 | | mJ |
| | | | $T_{vj}$ = 125 °C | | 1.04 | | |
| | | | $T_{vj}$ = 150 °C | | 1.23 | | |
| Thermal resistance, junction to heatsink | $R_{thJH}$ | per diode | | | 1.21 | | K/W |
| Temperature under switching conditions | $T_{vj\,op}$ | | | -40 | | 150 | °C |

# 5 Diode, Inverter

**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 | $I_{FN}$ | | | 75 | A |
| Continous DC forward current | $I_F$ | | | 40 | A |
| Repetitive peak forward current | $I_{FRM}$ | $t_P$ = 1 ms | | 150 | A |

**Table 9 Maximum rated values (continued)**

| Parameter | Symbol | Note or test condition | | Values | Unit |
|---|---|---|---|---|---|
| $I^2t$ - value | $I^2t$ | $V_R$ = 0 V, $t_P$ = 10 ms | $T_{vj}$ = 125 °C | 370 | $A^2s$ |
| | | | $T_{vj}$ = 150 °C | 360 | |

**Table 10 Characteristic values**

| Parameter | Symbol | Note or test condition | | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Forward voltage | $V_F$ | $I_F$ = 40 A, $V_{GE}$ = 0 V | $T_{vj}$ = 25 °C | | 1.30 | 1.64 | V |
| | | | $T_{vj}$ = 125 °C | | 1.20 | | |
| | | | $T_{vj}$ = 150 °C | | 1.15 | | |
| Peak reverse recovery current | $I_{RM}$ | $I_F$ = 40 A, $V_R$ = 300 V, $V_{GE}$ = -15 V, -$di_F/dt$ = 2400 A/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 42 | | A |
| | | | $T_{vj}$ = 125 °C | | 55 | | |
| | | | $T_{vj}$ = 150 °C | | 59 | | |
| Recovered charge | $Q_r$ | $I_F$ = 40 A, $V_R$ = 300 V, $V_{GE}$ = -15 V, -$di_F/dt$ = 2400 A/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 1.73 | | µC |
| | | | $T_{vj}$ = 125 °C | | 4.11 | | |
| | | | $T_{vj}$ = 150 °C | | 4.47 | | |
| Reverse recovery energy | $E_{rec}$ | $I_F$ = 40 A, $V_R$ = 300 V, $V_{GE}$ = -15 V, -$di_F/dt$ = 2400 A/µs ($T_{vj}$ = 150 °C) | $T_{vj}$ = 25 °C | | 0.21 | | mJ |
| | | | $T_{vj}$ = 125 °C | | 1.03 | | |
| | | | $T_{vj}$ = 150 °C | | 1.18 | | |
| Thermal resistance, junction to heatsink | $R_{thJH}$ | per diode | | | 1.04 | | K/W |
| Temperature under switching conditions | $T_{vj\,op}$ | | | -40 | | 150 | °C |

# 6 NTC-Thermistor

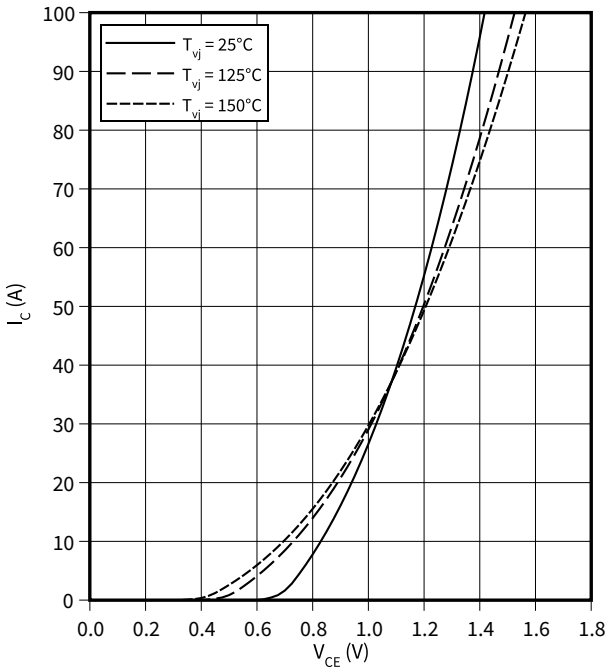
**Table 11 Characteristic values**

| 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 |

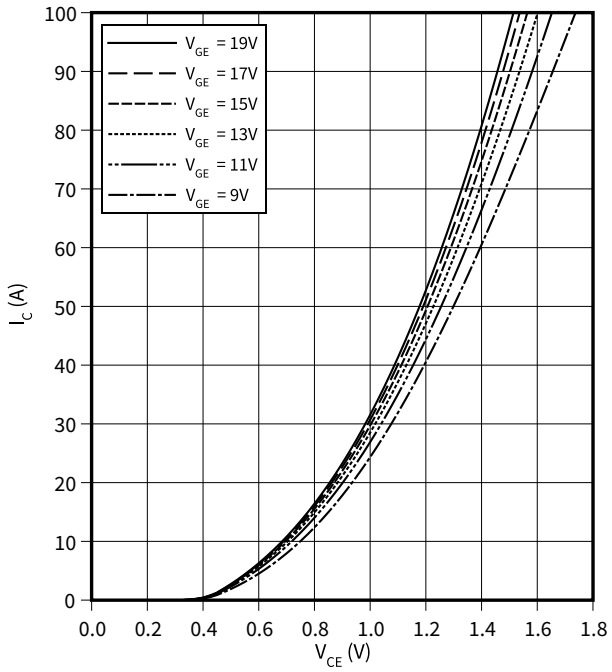
*Note: Specification according to the valid application note.*

# 7 Characteristics diagrams

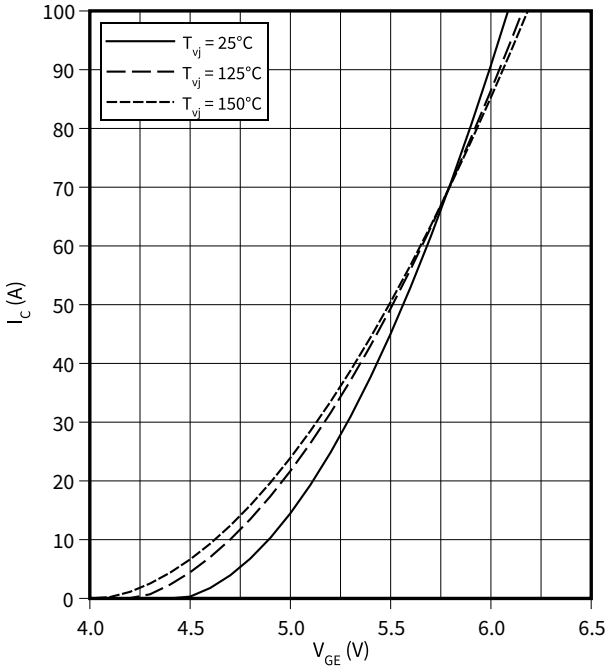
**output characteristic (typical), IGBT,3-Level**
$I_C = f(V_{CE})$
$V_{GE}$ = 15 V



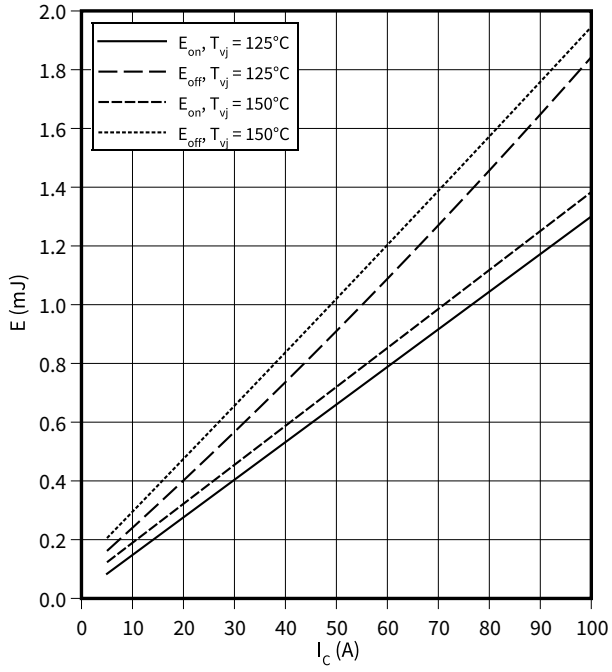

**output characteristic (typical), IGBT,3-Level**
$I_C = f(V_{CE})$
$T_{vj}$ = 150 °C




**transfer characteristic (typical), IGBT,3-Level**
$I_C = f(V_{GE})$
$V_{CE}$ = 20 V



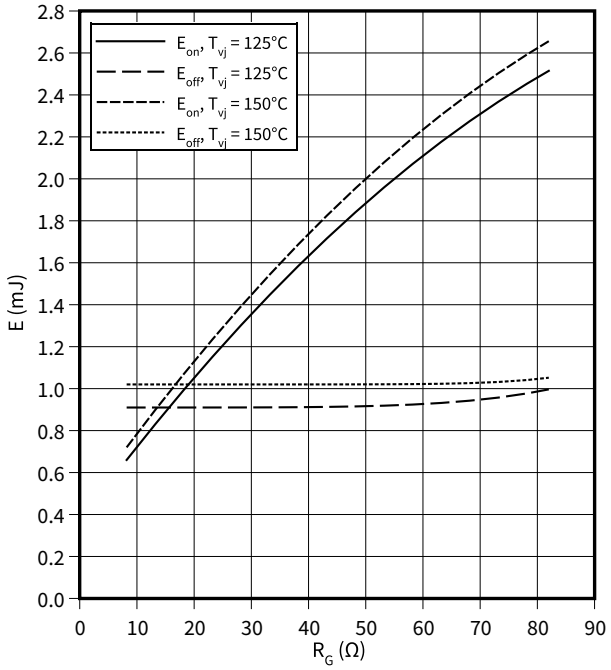

**switching losses (typical), IGBT,3-Level**
$E = f(I_C)$
$R_{Goff}$ = 8.2 Ω, $R_{Gon}$ = 8.2 Ω, $V_{CE}$ = 300 V, $V_{GE}$ = ± 15 V



### switching losses (typical), IGBT,3-Level

$E = f(R_G)$

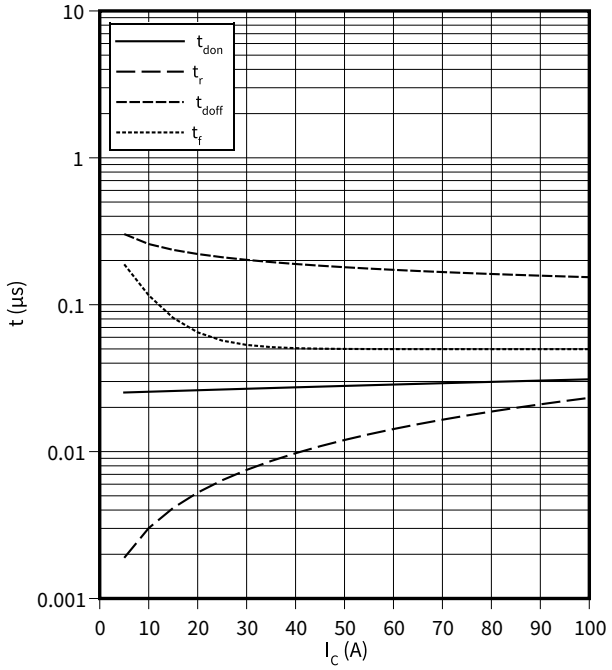
$I_C = 50$ A, $V_{CE} = 300$ V, $V_{GE} = \pm 15$ V




### switching times (typical), IGBT,3-Level

$t = f(I_C)$

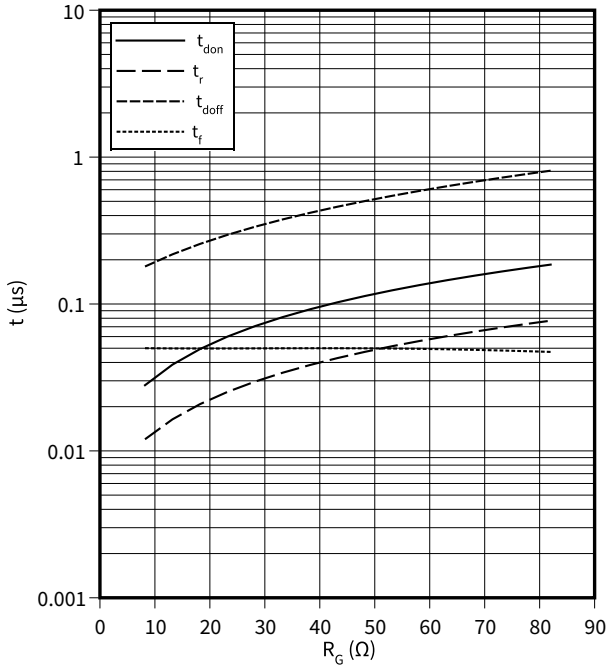
$R_{Goff} = 8.2\ \Omega$, $R_{Gon} = 8.2\ \Omega$, $V_{CE} = 300$ V, $V_{GE} = \pm 15$ V, $T_{vj} = 150$ °C




### switching times (typical), IGBT,3-Level

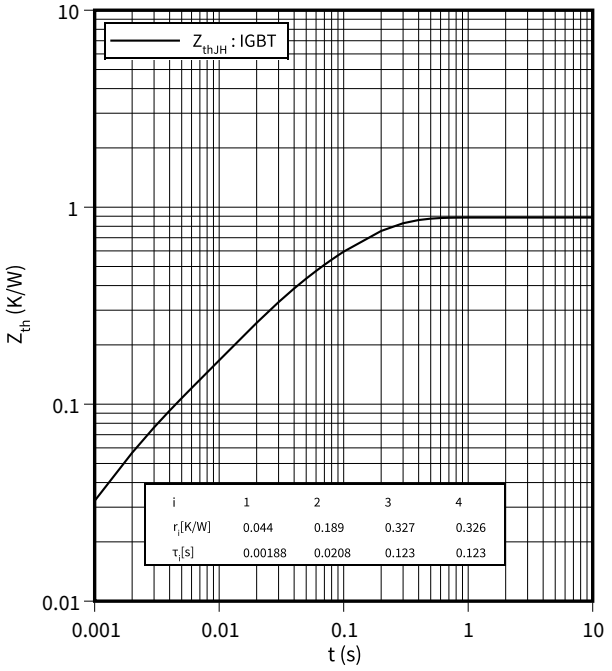
$t = f(R_G)$

$I_C = 50$ A, $V_{CE} = 300$ V, $V_{GE} = \pm 15$ V, $T_{vj} = 150$ °C




### transient thermal impedance , IGBT,3-Level

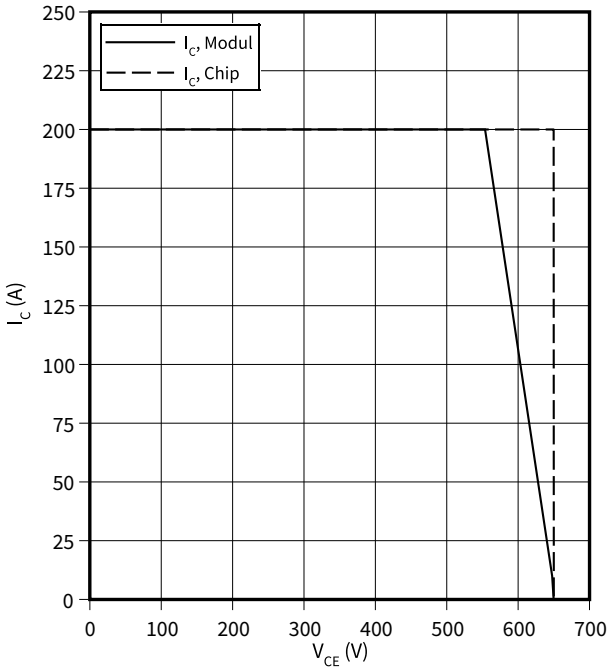
$Z_{th} = f(t)$



**reverse bias safe operating area (RBSOA), IGBT,3-Level**

$I_C = f(V_{CE})$

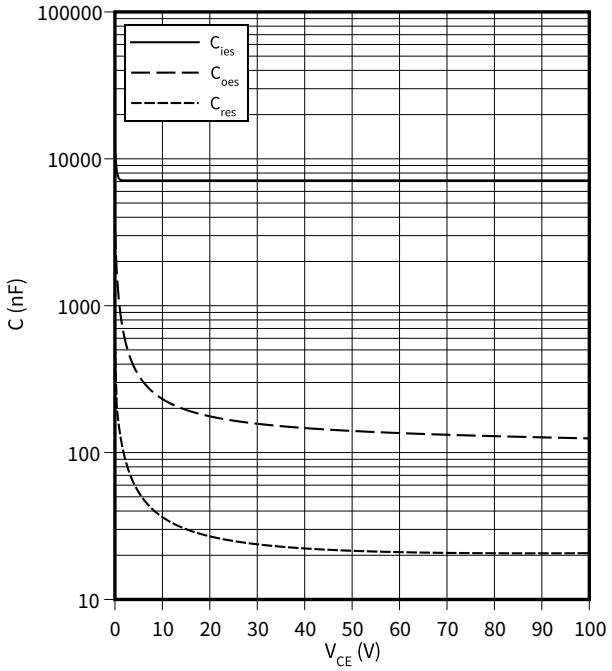
$R_{Goff} = 8.2\ \Omega$, $V_{GE} = \pm 15$ V, $T_{vj} = 150$ °C




**capacity characteristic (typical), IGBT,3-Level**

$C = f(V_{CE})$

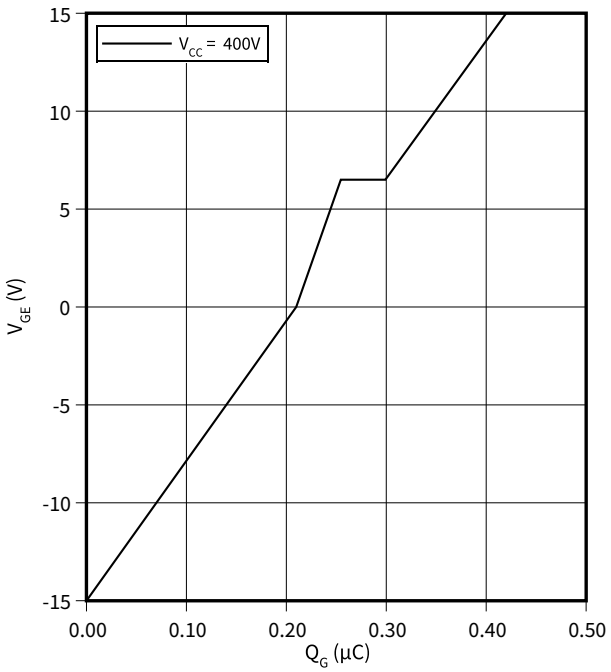
$f = 100$ kHz, $V_{GE} = 0$ V, $T_{vj} = 25$ °C




**gate charge characteristic (typical), IGBT,3-Level**

$V_{GE} = f(Q_G)$

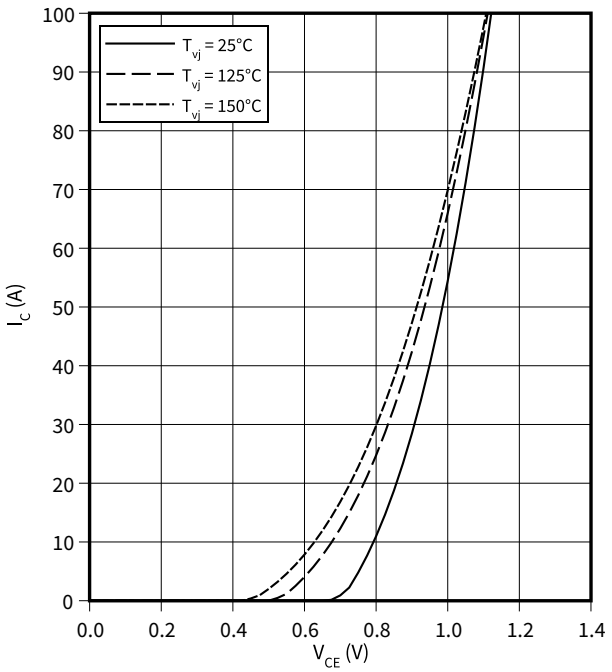
$I_C = 50$ A, $T_{vj} = 25$ °C




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

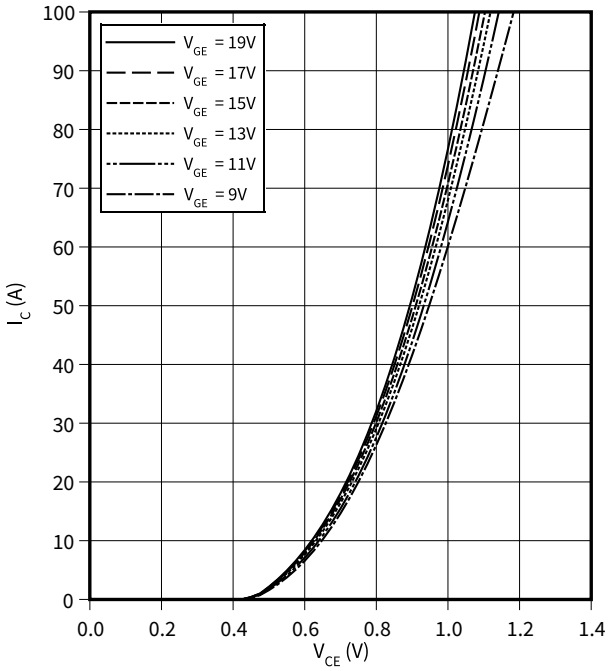
$I_C = f(V_{CE})$

$V_{GE} = 15$ V



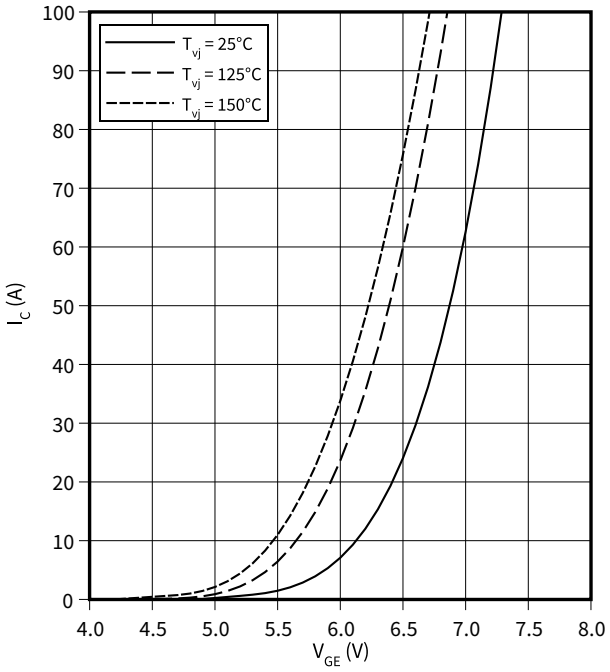
### output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$
$T_{vj} = 150\ °C$



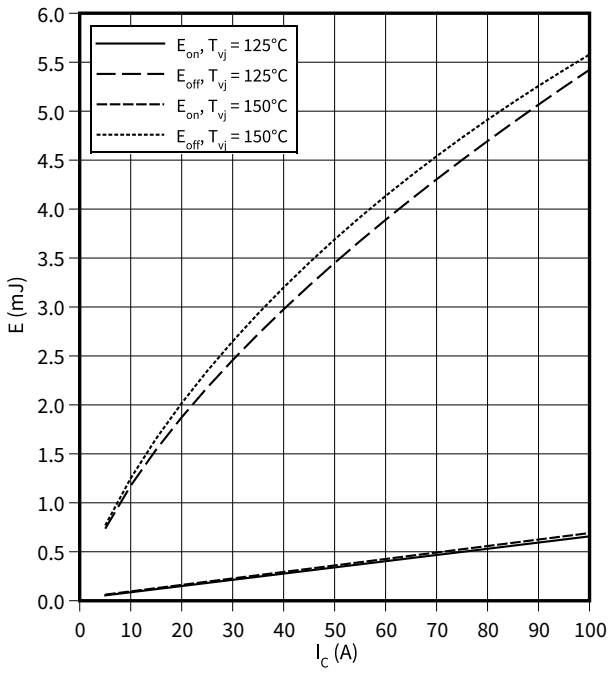

### transfer characteristic (typical), IGBT, Inverter

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



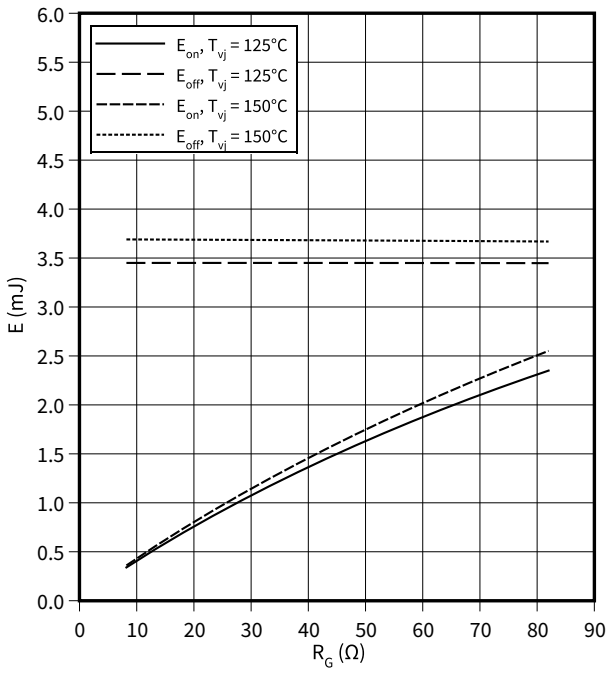

### switching losses (typical), IGBT, Inverter

$E = f(I_C)$
$R_{Goff} = 8.2\ \Omega$, $R_{Gon} = 8.2\ \Omega$, $V_{CE} = 300\ V$, $V_{GE} = \pm 15\ V$




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

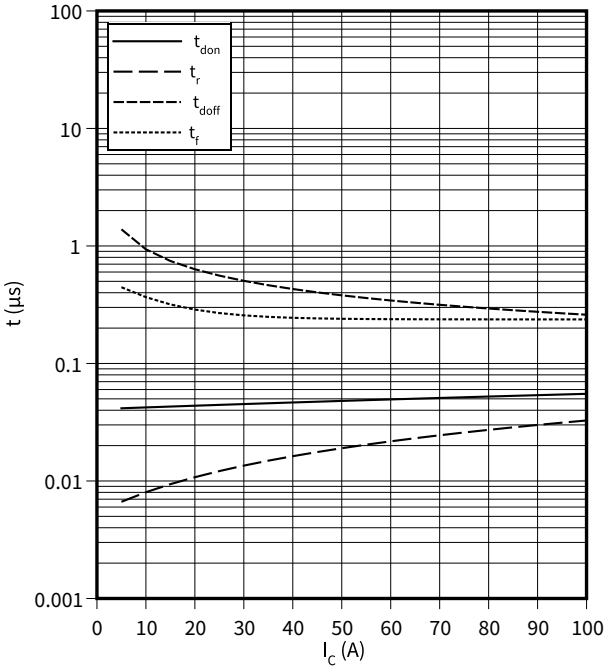
$E = f(R_G)$
$I_C = 50\ A$, $V_{CE} = 300\ V$, $V_{GE} = \pm 15\ V$



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

$t = f(I_C)$

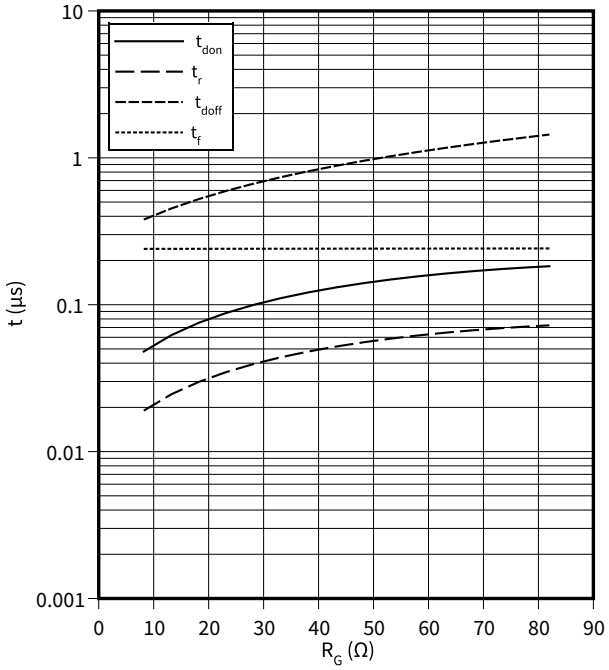
$R_{Goff} = 8.2\ \Omega$, $R_{Gon} = 8.2\ \Omega$, $V_{CE} = 300\ V$, $V_{GE} = \pm 15\ V$, $T_{vj} = 150\ °C$




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

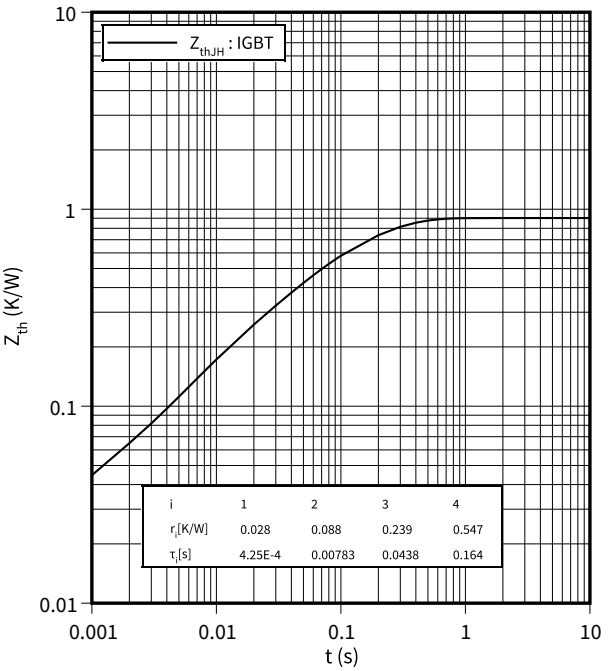
$t = f(R_G)$

$I_C = 50\ A$, $V_{CE} = 300\ V$, $V_{GE} = \pm 15\ V$, $T_{vj} = 150\ °C$




### transient thermal impedance , IGBT, Inverter

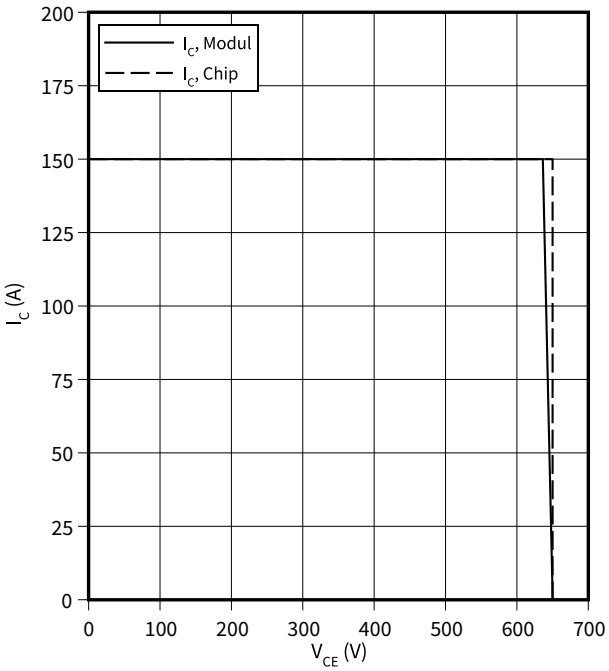
$Z_{th} = f(t)$




### reverse bias safe operating area (RBSOA), IGBT, Inverter

$I_C = f(V_{CE})$

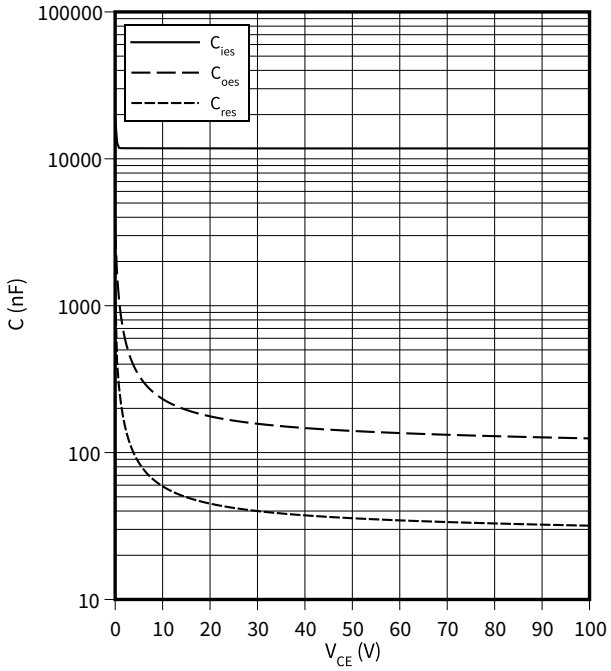
$R_{Goff} = 8.2\ \Omega$, $V_{GE} = \pm 15\ V$, $T_{vj} = 150\ °C$



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

$C = f(V_{CE})$

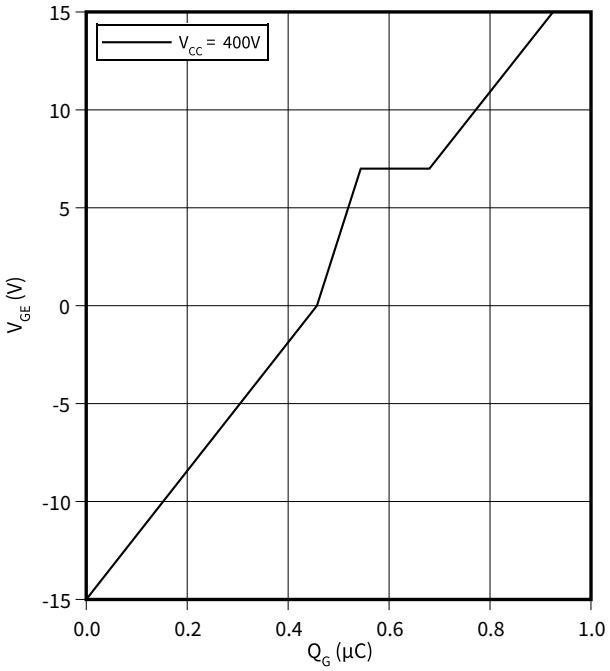
$f = 100$ kHz, $V_{GE} = 0$ V, $T_{vj} = 25$ °C




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

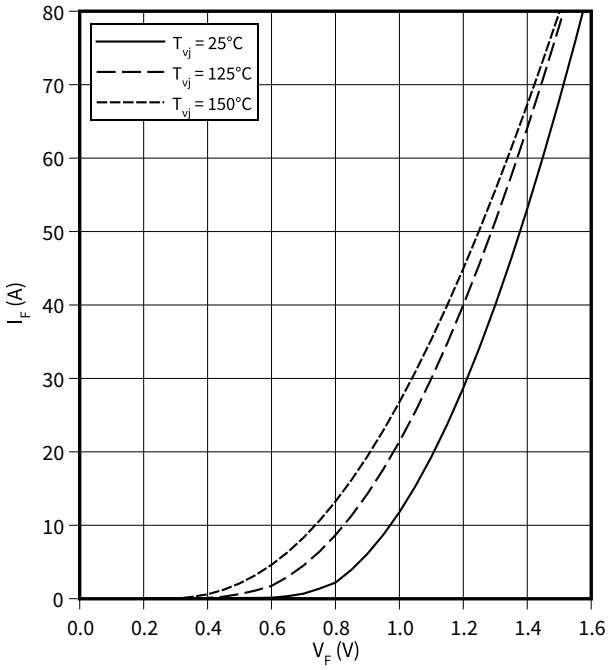
$V_{GE} = f(Q_G)$

$I_C = 50$ A, $T_{vj} = 25$ °C




**forward characteristic of (typical), Diode, 3-Level**

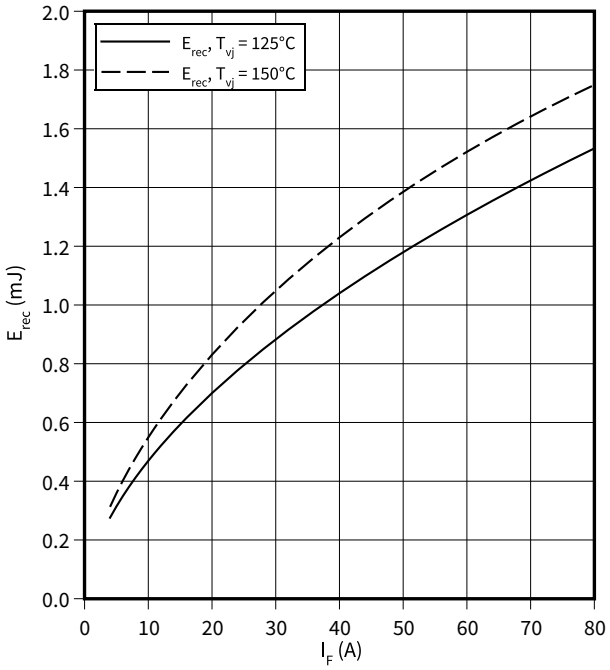
$I_F = f(V_F)$




**switching losses (typical), Diode, 3-Level**

$E_{rec} = f(I_F)$

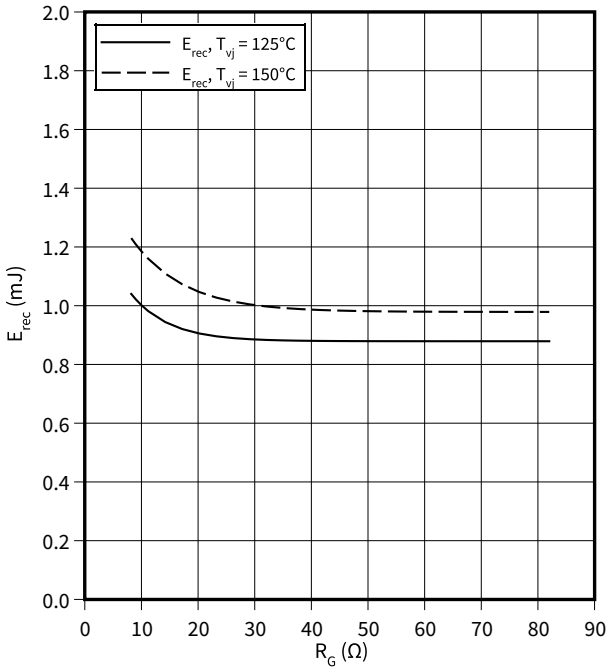
$R_{Gon} = 8.2\ \Omega$, $V_{CE} = 300$ V



### switching losses (typical), Diode, 3-Level

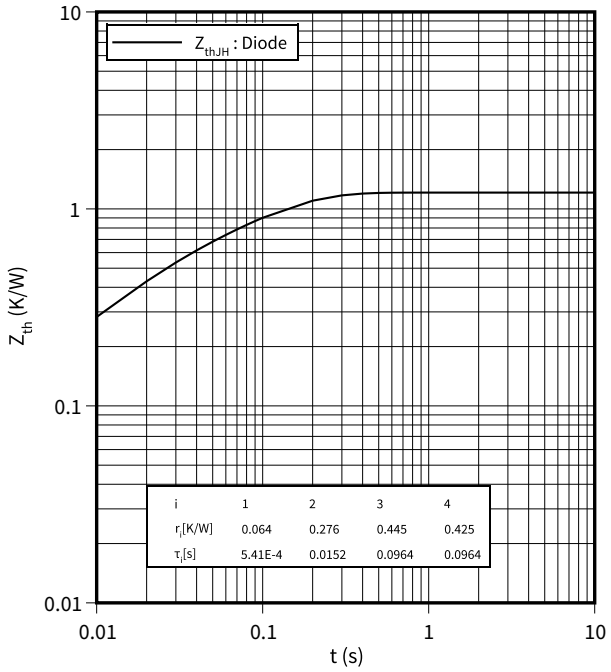
$E_{rec} = f(R_G)$

$V_{CE} = 300\ V$, $I_F = 40\ A$



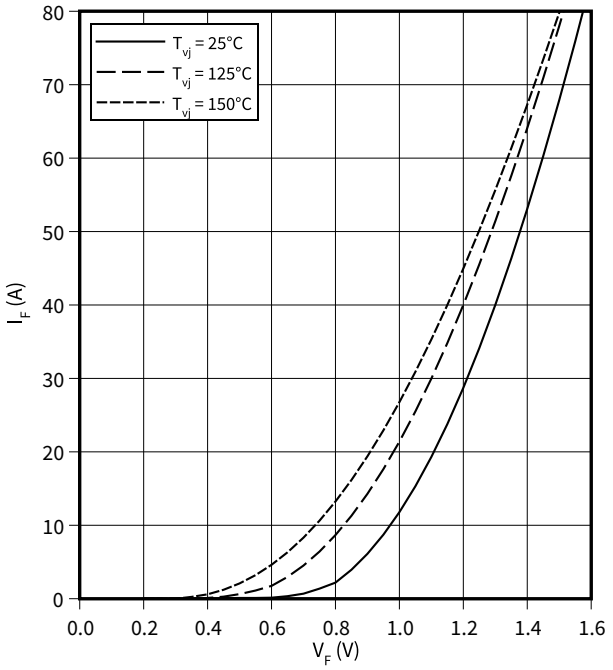

### transient thermal impedance , Diode, 3-Level

$Z_{th} = f(t)$




### forward characteristic of (typical), Diode, Inverter

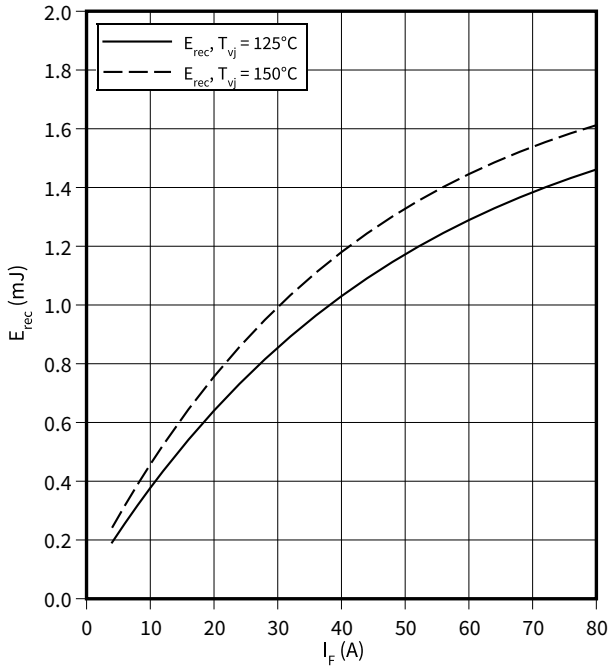
$I_F = f(V_F)$




### switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

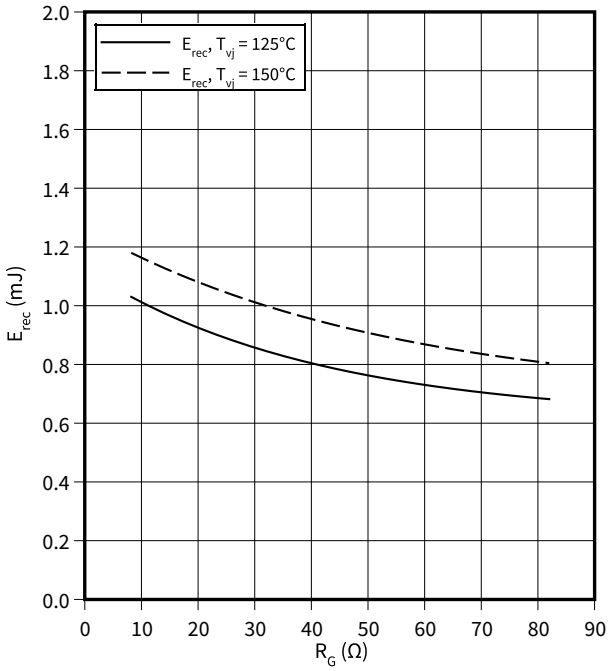
$R_{Gon} = 8.2\ \Omega$, $V_{CE} = 300\ V$



### switching losses (typical), Diode, Inverter

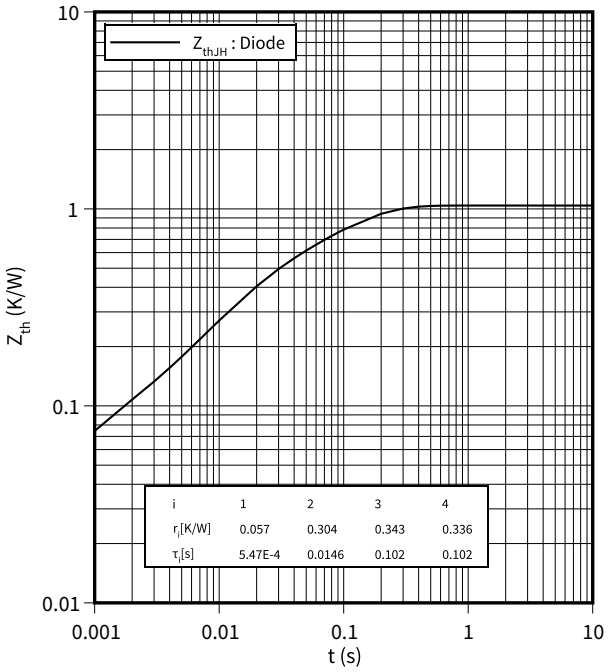
$E_{rec} = f(R_G)$

$V_{CE} = 300\ V$, $I_F = 40\ A$



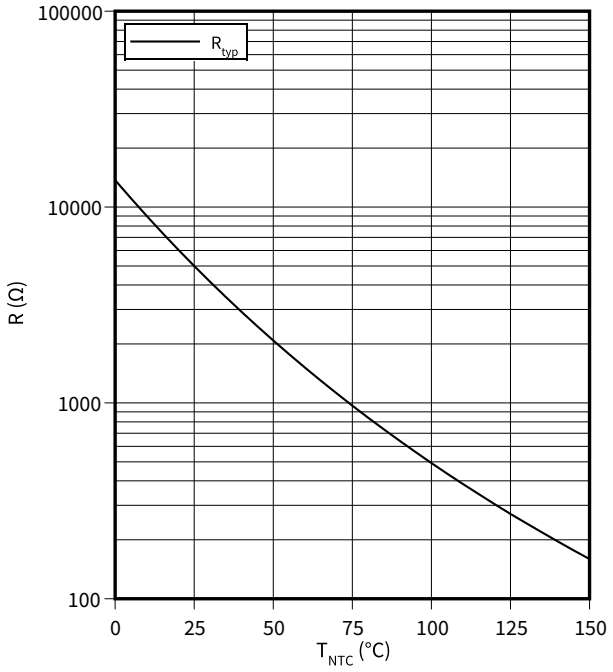

### transient thermal impedance , Diode, Inverter

$Z_{th} = f(t)$




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

$R = f(T_{NTC})$



# 8 Circuit diagram

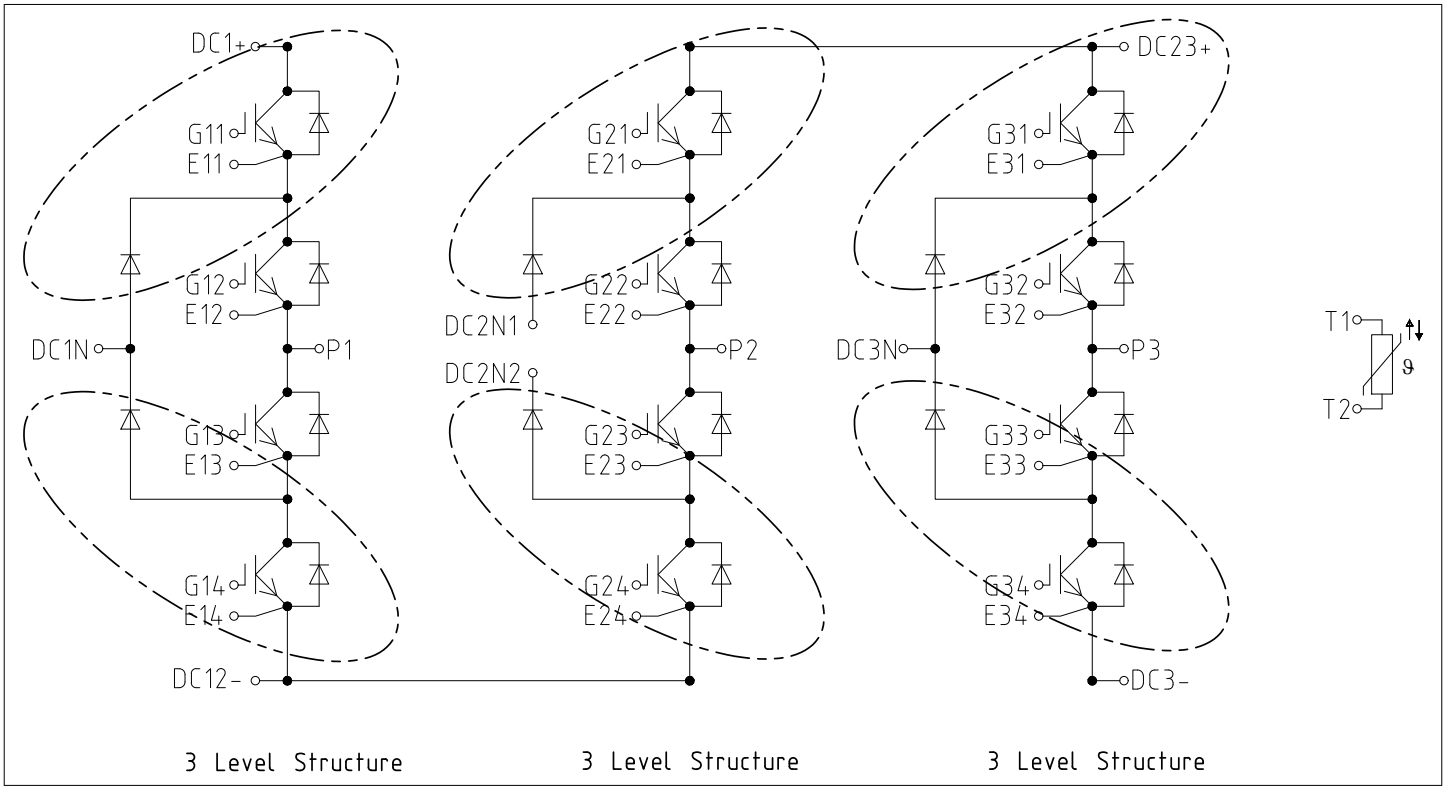



**Figure 2**

# 9 Package outlines

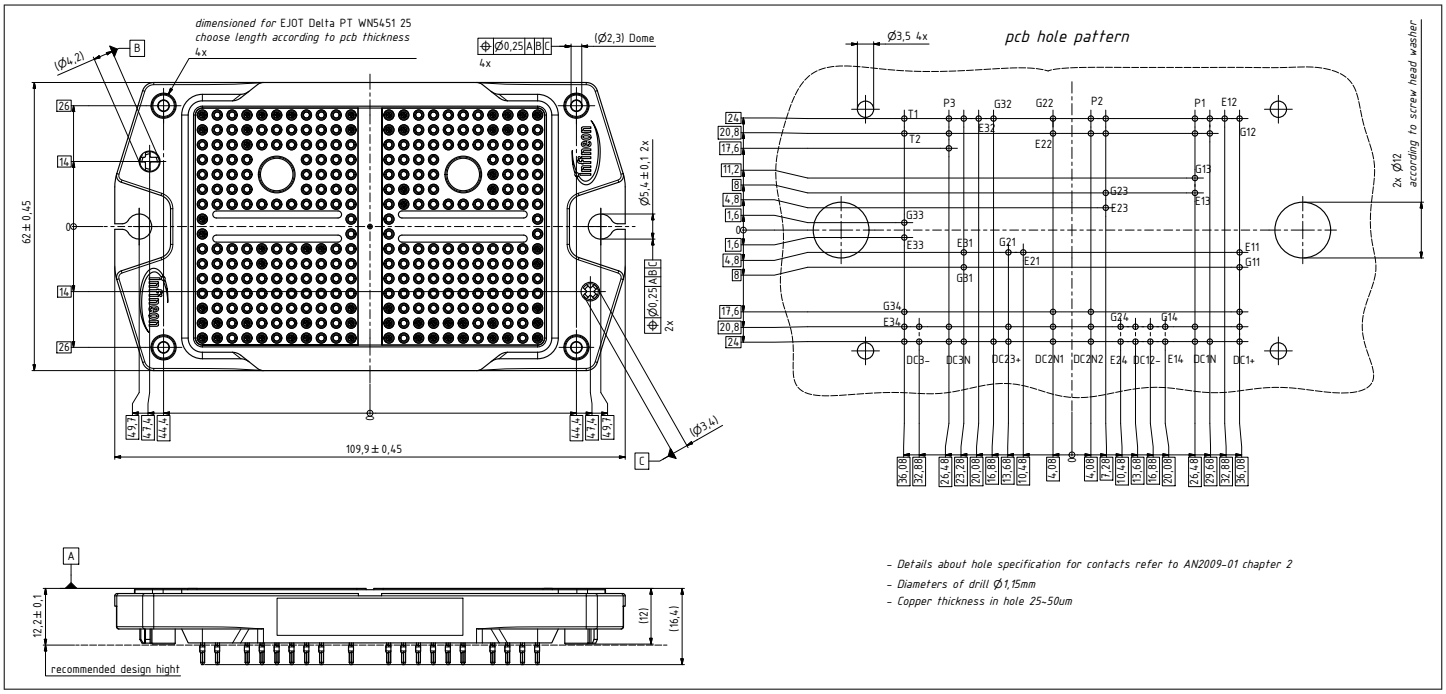



**Figure 3**

# 10 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 | 7154914284655054991530 | | 7154914284655054991530 |

**Figure 4**

# Revision history

| Document revision | Date of release | Description of changes |
|---|---|---|
| V1.0 | 2020-04-03 | |
| 1.00 | 2021-04-22 | Final |

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