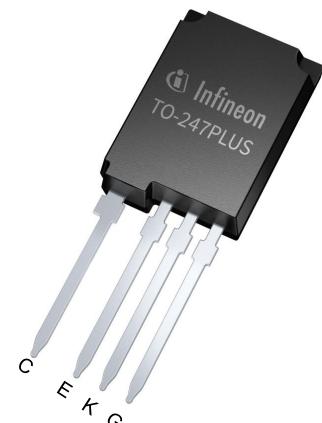


High speed and low saturation voltage 650 V TRENCHSTOP™ IGBT7 technology copacked with soft, fast recovery Emitter Controlled 7 diode

Features

- $V_{CE} = 650 \text{ V}$
- $I_C = 150 \text{ A}$
- Low switching losses
- Very low collector-emitter saturation voltage V_{CESat}
- Very soft, fast recovery antiparallel diode
- Smooth switching behavior
- Humidity robustness
- Optimized for hard switching, two- and three-level topologies
- Complete product spectrum and PSpice Models: <http://www.infineon.com/igbt/>



Potential applications

- Industrial UPS
- EV-Charging
- String inverter
- Welding

Product validation

- Qualified for industrial applications according to the relevant tests of JEDEC47/20/22



Lead-free



Green

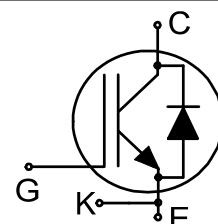


Halogen-free



RoHS

Description



| Type | Package | Marking |
|--------------|-----------------------|----------|
| IKY150N65EH7 | PG-T0247-4-PLUS-NN5.1 | K150EEH7 |

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1 Package

1 Package

Table 1 Characteristic values

| Parameter | Symbol | Note or test condition | Values | | | Unit |
|---|---------------|--|--------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Internal emitter inductance measured 5 mm (0.197 in.) from case | L_E | | | 13 | | nH |
| Storage temperature | T_{stg} | | -55 | | 150 | °C |
| Soldering temperature | T_{sold} | wave soldering 1.6 mm (0.063 in.) from case for 10 s | | | 260 | °C |
| Thermal resistance, junction-ambient | $R_{th(j-a)}$ | | | | 40 | K/W |
| IGBT thermal resistance, junction-case | $R_{th(j-c)}$ | | | 0.19 | 0.24 | K/W |
| Diode thermal resistance, junction-case | $R_{th(j-c)}$ | | | 0.26 | 0.33 | K/W |

2 IGBT

Table 2 Maximum rated values

| Parameter | Symbol | Note or test condition | | Values | | Unit |
|--|--------------|--|---------------------------|--------|--|------|
| Collector-emitter voltage | V_{CE} | $T_{vj} \geq 25^\circ\text{C}$ | | 650 | | V |
| DC collector current, limited by T_{vjmax} | I_C | limited by bondwire | $T_c = 25^\circ\text{C}$ | 160 | | A |
| | | | $T_c = 100^\circ\text{C}$ | 160 | | A |
| Pulsed collector current, t_p limited by T_{vjmax} | I_{Cpulse} | | | 600 | | A |
| Turn-off safe operating area | | $V_{CE} \leq 650\text{ V}$, $t_p \leq 1\text{ }\mu\text{s}$, $T_{vj} \leq 175^\circ\text{C}$ | | 600 | | A |
| Gate-emitter voltage | V_{GE} | | | ±20 | | V |
| Transient gate-emitter voltage | V_{GE} | $t_p \leq 10\text{ }\mu\text{s}$, $D < 0.01$ | | ±30 | | V |
| Power dissipation | P_{tot} | | $T_c = 25^\circ\text{C}$ | 621 | | W |
| | | | $T_c = 100^\circ\text{C}$ | 307 | | |

Table 3 Characteristic values

| Parameter | Symbol | Note or test condition | Values | | | Unit |
|--------------------------------------|-------------|---|------------------------------|------|------|------|
| | | | Min. | Typ. | Max. | |
| Collector-emitter saturation voltage | V_{CESat} | $I_C = 150\text{ A}$, $V_{GE} = 15\text{ V}$ | $T_{vj} = 25^\circ\text{C}$ | | 1.4 | V |
| | | | $T_{vj} = 175^\circ\text{C}$ | | 1.6 | |

(table continues...)

Table 3 (continued) Characteristic values

| Parameter | Symbol | Note or test condition | Values | | | Unit |
|-------------------------------------|-------------------|--|---|-------------|-------------|---------------|
| | | | Min. | Typ. | Max. | |
| Gate-emitter threshold voltage | $V_{GE\text{th}}$ | $I_C = 1.32 \text{ mA}, V_{CE} = V_{GE}$ | 2.9 | 3.85 | 4.8 | V |
| Zero gate-voltage collector current | I_{CES} | $V_{CE} = 650 \text{ V}, V_{GE} = 0 \text{ V}$ | $T_{vj} = 25^\circ\text{C}$ | | 50 | μA |
| | | | $T_{vj} = 175^\circ\text{C}$ | 8600 | | |
| Gate-emitter leakage current | I_{GES} | $V_{CE} = 0 \text{ V}, V_{GE} = 20 \text{ V}$ | | | 100 | nA |
| Transconductance | g_{fs} | $I_C = 150 \text{ A}, V_{CE} = 20 \text{ V}$ | | 179 | | S |
| Input capacitance | C_{ies} | $V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$ | | 7908 | | pF |
| Output capacitance | C_{oes} | $V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$ | | 240.1 | | pF |
| Reverse transfer capacitance | C_{res} | $V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$ | | 33.3 | | pF |
| Gate charge | Q_G | $V_{CC} = 520 \text{ V}, I_C = 150 \text{ A}, V_{GE} = 15 \text{ V}$ | | 300 | | nC |
| Turn-on delay time | $t_{d(on)}$ | $V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 10 \Omega, R_{G(off)} = 10 \Omega$ | $T_{vj} = 25^\circ\text{C}, I_C = 150 \text{ A}$ | | 44 | ns |
| | | | $T_{vj} = 175^\circ\text{C}, I_C = 150 \text{ A}$ | | 41 | |
| Rise time (inductive load) | t_r | $V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 10 \Omega, R_{G(off)} = 10 \Omega$ | $T_{vj} = 25^\circ\text{C}, I_C = 150 \text{ A}$ | | 22 | ns |
| | | | $T_{vj} = 175^\circ\text{C}, I_C = 150 \text{ A}$ | | 31 | |
| Turn-off delay time | $t_{d(off)}$ | $V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 10 \Omega, R_{G(off)} = 10 \Omega$ | $T_{vj} = 25^\circ\text{C}, I_C = 150 \text{ A}$ | | 343 | ns |
| | | | $T_{vj} = 175^\circ\text{C}, I_C = 150 \text{ A}$ | | 383 | |
| Fall time (inductive load) | t_f | $V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 10 \Omega, R_{G(off)} = 10 \Omega$ | $T_{vj} = 25^\circ\text{C}, I_C = 150 \text{ A}$ | | 24 | ns |
| | | | $T_{vj} = 175^\circ\text{C}, I_C = 150 \text{ A}$ | | 28 | |
| Turn-on energy | E_{on} | $V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 10 \Omega, R_{G(off)} = 10 \Omega$ | $T_{vj} = 25^\circ\text{C}, I_C = 150 \text{ A}$ | | 2.3 | mJ |
| | | | $T_{vj} = 175^\circ\text{C}, I_C = 150 \text{ A}$ | | 3.6 | |
| Turn-off energy | E_{off} | $V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 10 \Omega, R_{G(off)} = 10 \Omega$ | $T_{vj} = 25^\circ\text{C}, I_C = 150 \text{ A}$ | | 2.9 | mJ |
| | | | $T_{vj} = 175^\circ\text{C}, I_C = 150 \text{ A}$ | | 3.9 | |

(table continues...)

Table 3 (continued) Characteristic values

| Parameter | Symbol | Note or test condition | Values | | | Unit |
|--------------------------------|---------------|---|--|-------------|-------------|--------------------|
| | | | Min. | Typ. | Max. | |
| Total switching energy | E_{ts} | $V_{CC} = 400 \text{ V}$, $V_{GE} = 0/15 \text{ V}$, $R_{G(on)} = 10 \Omega$, $R_{G(off)} = 10 \Omega$ | $T_{vj} = 25 \text{ }^\circ\text{C}$, $I_c = 150 \text{ A}$ | | 5.2 | mJ |
| | | | $T_{vj} = 175 \text{ }^\circ\text{C}$, $I_c = 150 \text{ A}$ | | 7.5 | |
| Operating junction temperature | T_{vj} | | -40 | | 175 | ${}^\circ\text{C}$ |

3 Diode

Table 4 Maximum rated values

| Parameter | Symbol | Note or test condition | Values | | | Unit |
|--|---------------|-------------------------------|------------------------------------|-------------|-------------|-------------|
| | | | Min. | Typ. | Max. | |
| Diode forward current, limited by T_{vjmax} | I_F | limited by bondwire | $T_c = 25 \text{ }^\circ\text{C}$ | | 160 | A |
| | | | $T_c = 100 \text{ }^\circ\text{C}$ | | 153 | |
| Diode pulsed current, t_p limited by T_{vjmax} | I_{Fpulse} | | | | 600 | A |
| Power dissipation | P_{tot} | | $T_c = 25 \text{ }^\circ\text{C}$ | | 454 | W |
| | | | $T_c = 100 \text{ }^\circ\text{C}$ | | 226 | |

Table 5 Characteristic values

| Parameter | Symbol | Note or test condition | Values | | | Unit |
|-------------------------------------|---------------|---|--|-------------|-------------|---------------|
| | | | Min. | Typ. | Max. | |
| Diode forward voltage | V_F | $I_F = 150 \text{ A}$ | $T_{vj} = 25 \text{ }^\circ\text{C}$ | | 1.65 | V |
| | | | $T_{vj} = 175 \text{ }^\circ\text{C}$ | | 1.55 | |
| Diode reverse recovery time | t_{rr} | $V_R = 400 \text{ V}$, $R_{G(on)} = 10 \Omega$ | $T_{vj} = 25 \text{ }^\circ\text{C}$, $I_F = 150 \text{ A}$ | | 65 | ns |
| | | | $T_{vj} = 175 \text{ }^\circ\text{C}$, $I_F = 150 \text{ A}$ | | 127 | |
| Diode reverse recovery charge | Q_{rr} | $V_R = 400 \text{ V}$, $R_{G(on)} = 10 \Omega$ | $T_{vj} = 25 \text{ }^\circ\text{C}$, $I_F = 150 \text{ A}$ | | 3.7 | μC |
| | | | $T_{vj} = 175 \text{ }^\circ\text{C}$, $I_F = 150 \text{ A}$ | | 10.4 | |
| Diode peak reverse recovery current | I_{rrm} | $V_R = 400 \text{ V}$, $R_{G(on)} = 10 \Omega$ | $T_{vj} = 25 \text{ }^\circ\text{C}$, $I_F = 150 \text{ A}$ | | 100 | A |
| | | | $T_{vj} = 175 \text{ }^\circ\text{C}$, $I_F = 150 \text{ A}$ | | 146 | |

(table continues...)

Table 5 (continued) Characteristic values

| Parameter | Symbol | Note or test condition | Values | | | Unit |
|---|---------------|---|---|-------------|-------------|------------------------|
| | | | Min. | Typ. | Max. | |
| Diode peak rate of fall of reverse recovery current | di_{rr}/dt | $V_R = 400 \text{ V}$, $R_{G(on)} = 10 \Omega$ | $T_{vj} = 25^\circ\text{C}$, $I_F = 150 \text{ A}$ | | -2790 | $\text{A}/\mu\text{s}$ |
| | | | $T_{vj} = 175^\circ\text{C}$, $I_F = 150 \text{ A}$ | | -2080 | |
| Reverse recovery energy | E_{rec} | $V_R = 400 \text{ V}$, $R_{G(on)} = 10 \Omega$ | $T_{vj} = 25^\circ\text{C}$, $I_F = 150 \text{ A}$ | | 0.89 | mJ |
| | | | $T_{vj} = 175^\circ\text{C}$, $I_F = 150 \text{ A}$ | | 2.84 | |
| Operating junction temperature | T_{vj} | | | -40 | 175 | $^\circ\text{C}$ |

Note: For optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.

Electrical Characteristic at $T_{vj} = 25^\circ\text{C}$, unless otherwise specified.

Dynamic test circuit, parasitic inductance $L_\sigma = 8 \text{ nH}$, parasitic capacitor $C_\sigma = 30 \text{ pF}$ from Fig. E. Energy losses include "tail" and diode reverse recovery.

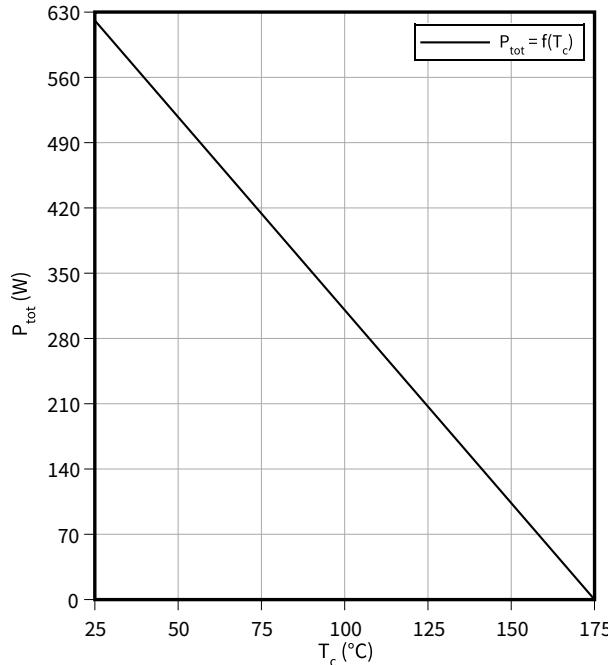
4 Characteristics diagrams

4 Characteristics diagrams

Power dissipation as a function of case temperature

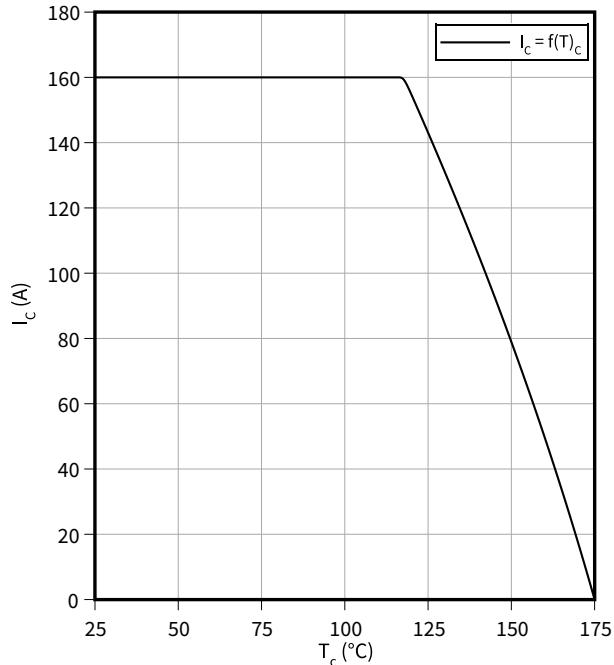
$$P_{\text{tot}} = f(T_c)$$

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

**Collector current as a function of case temperature**

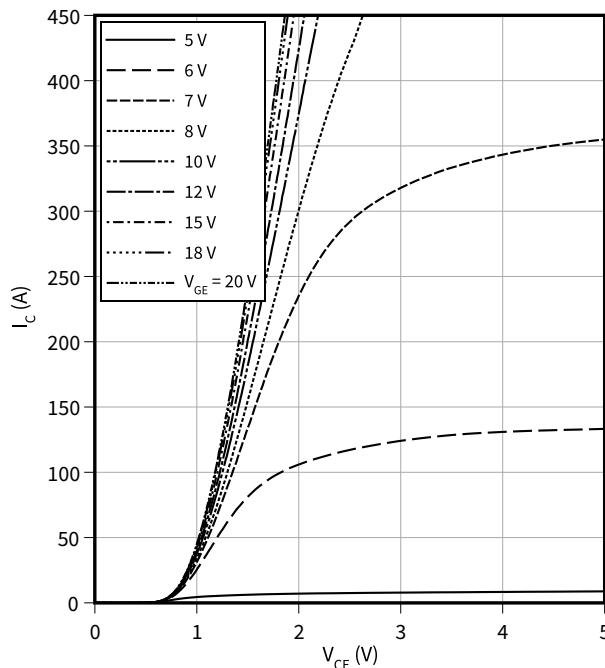
$$I_C = f(T_c)$$

$$V_{GE} \geq 15 \text{ V}, T_{vj} \leq 175 \text{ } ^\circ\text{C}$$

**Typical output characteristic**

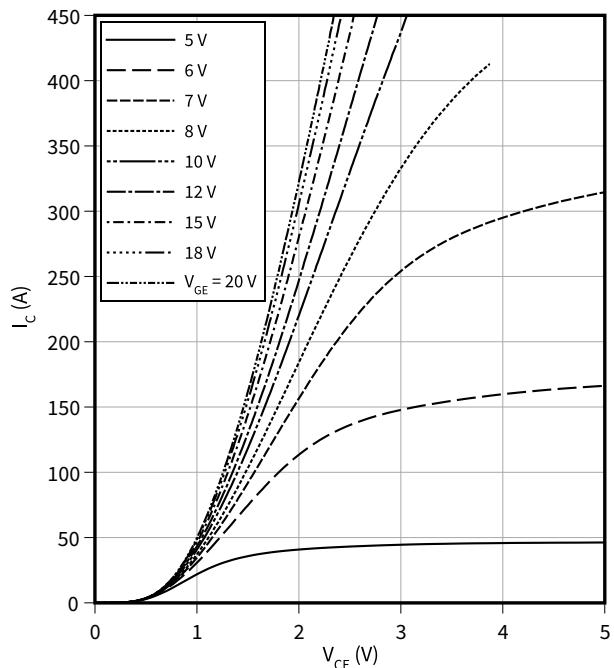
$$I_C = f(V_{CE})$$

$$T_{vj} = 25 \text{ } ^\circ\text{C}$$

**Typical output characteristic**

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

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

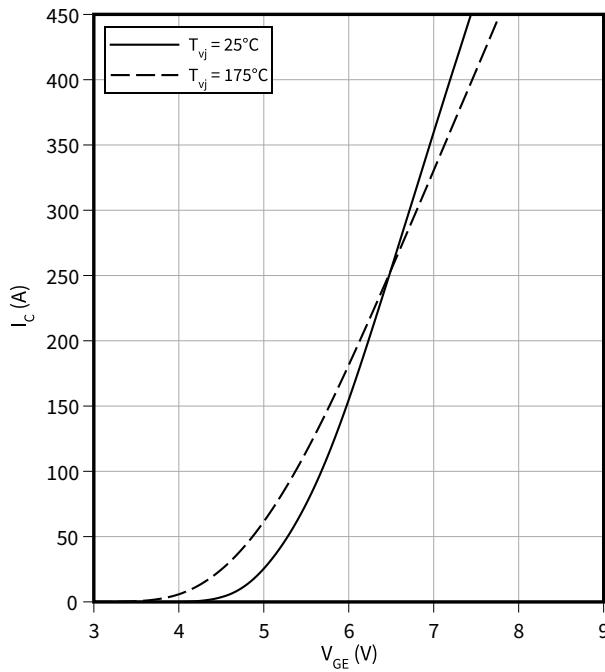


4 Characteristics diagrams

Typical transfer characteristic

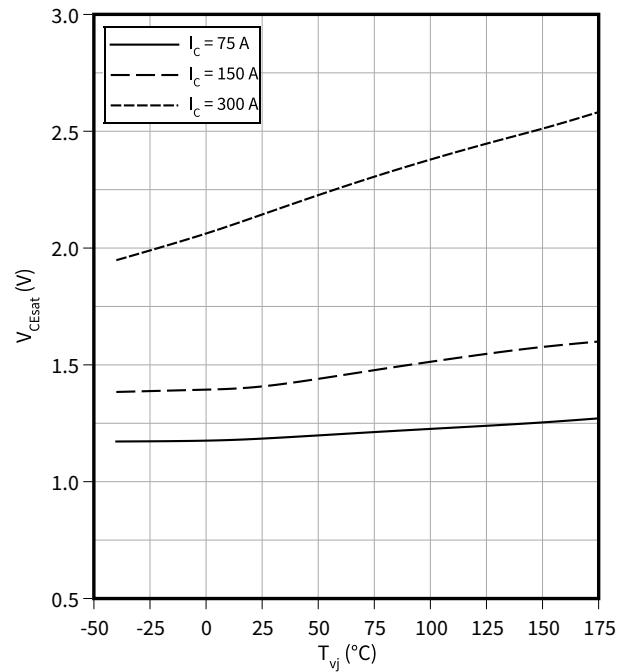
$$I_C = f(V_{GE})$$

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

**Typical collector-emitter saturation voltage as a function of junction temperature**

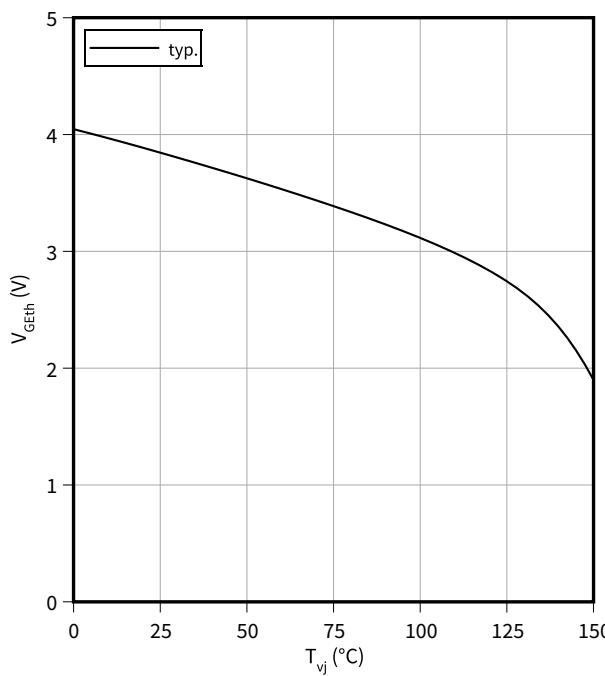
$$V_{CEsat} = f(T_{vj})$$

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

**Gate-emitter threshold voltage as a function of junction temperature**

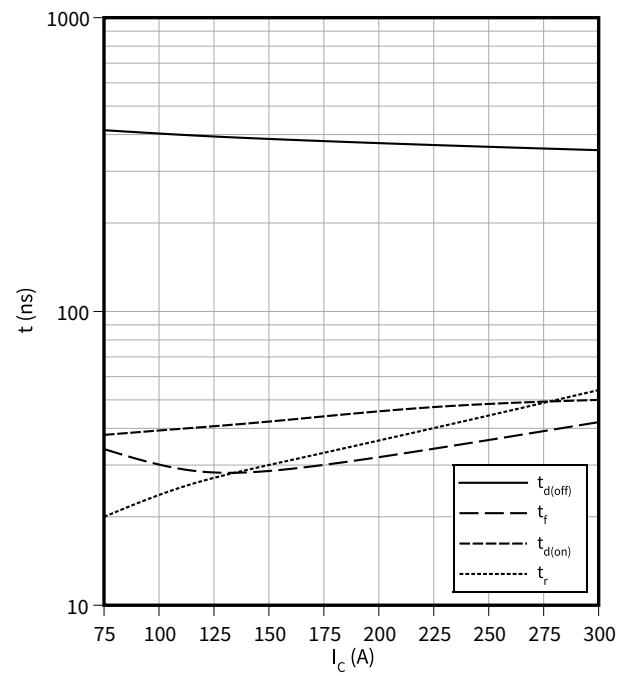
$$V_{GEth} = f(T_{vj})$$

$$I_C = 1.32 \text{ mA}$$

**Typical switching times as a function of collector current**

$$t = f(I_C)$$

$$V_{CC} = 400 \text{ V}, T_{vj} = 175 \text{ °C}, V_{GE} = 0/15 \text{ V}, R_G = 10 \Omega$$

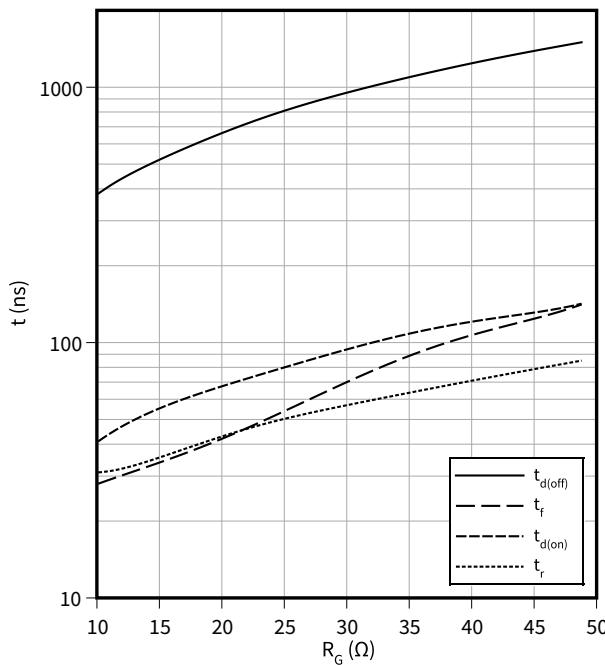


4 Characteristics diagrams

Typical switching times as a function of gate resistor

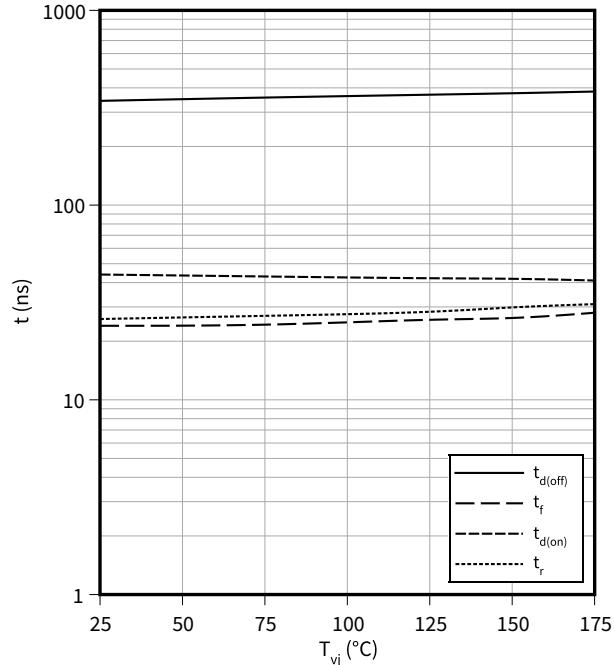
$$t = f(R_G)$$

$I_C = 150 \text{ A}$, $V_{CC} = 400 \text{ V}$, $T_{vj} = 175^\circ\text{C}$, $V_{GE} = 0/15 \text{ V}$

**Typical switching times as a function of junction temperature**

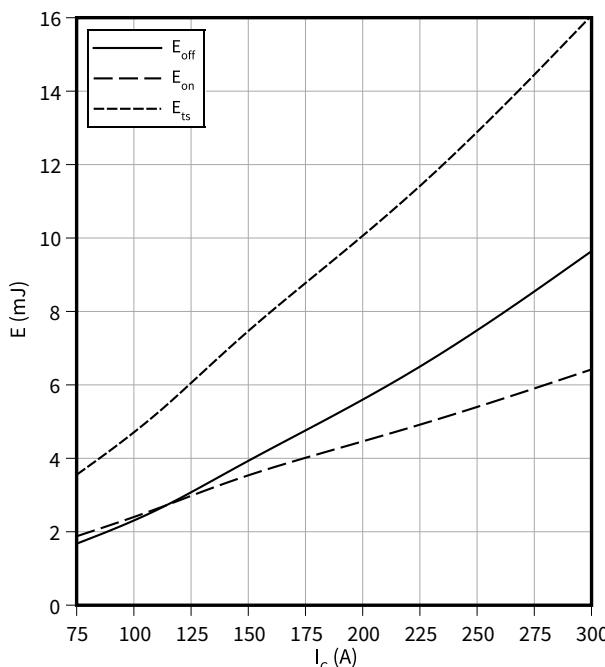
$$t = f(T_{vj})$$

$I_C = 150 \text{ A}$, $V_{CC} = 400 \text{ V}$, $V_{GE} = 0/15 \text{ V}$, $R_G = 10 \Omega$

**Typical switching energy losses as a function of collector current**

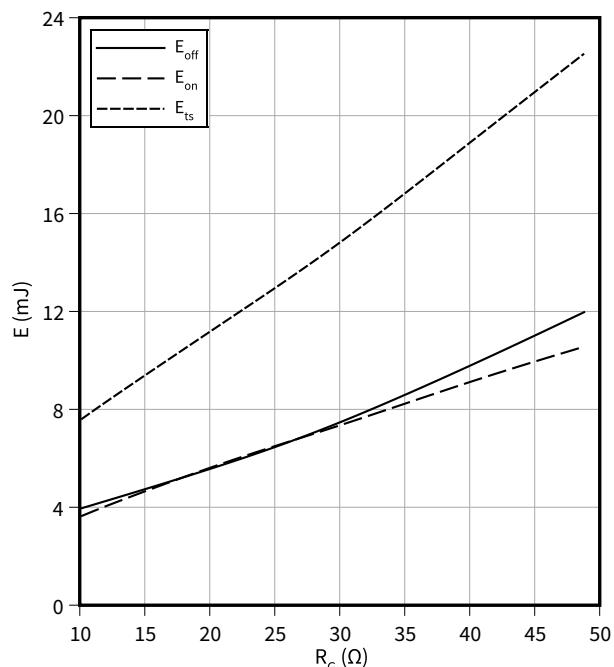
$$E = f(I_C)$$

$V_{CC} = 400 \text{ V}$, $T_{vj} = 175^\circ\text{C}$, $V_{GE} = 0/15 \text{ V}$, $R_G = 10 \Omega$

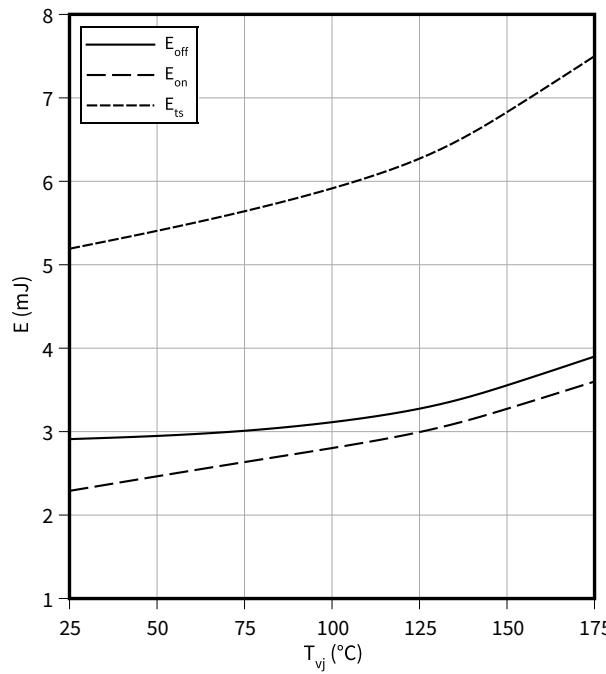
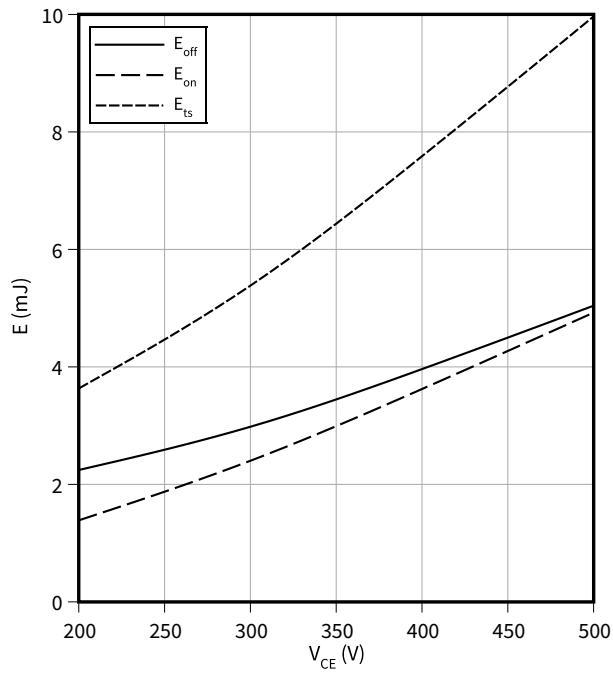
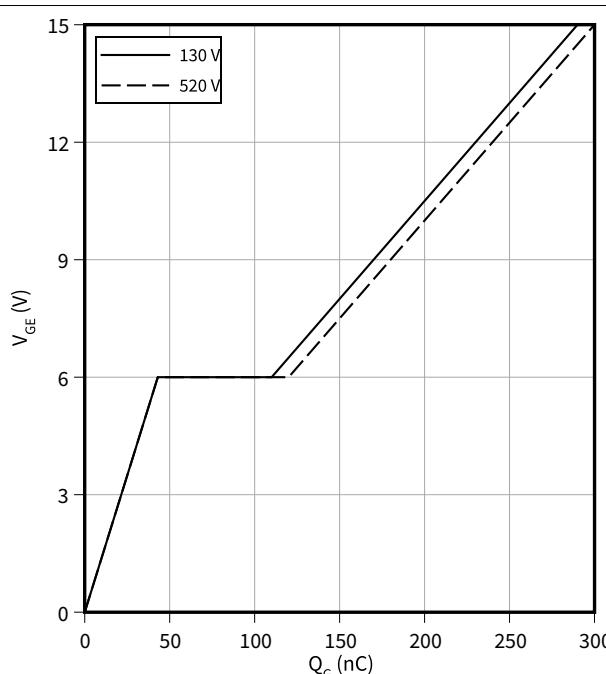
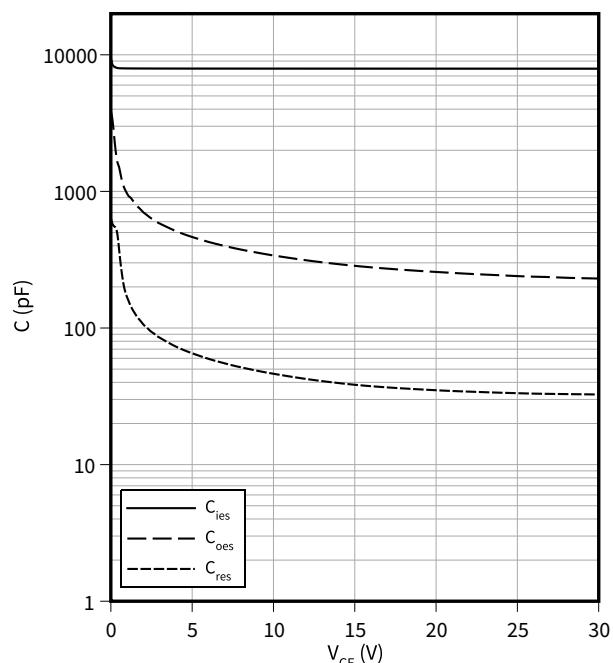
**Typical switching energy losses as a function of gate resistor**

$$E = f(R_G)$$

$I_C = 150 \text{ A}$, $V_{CC} = 400 \text{ V}$, $T_{vj} = 175^\circ\text{C}$, $V_{GE} = 0/15 \text{ V}$



4 Characteristics diagrams

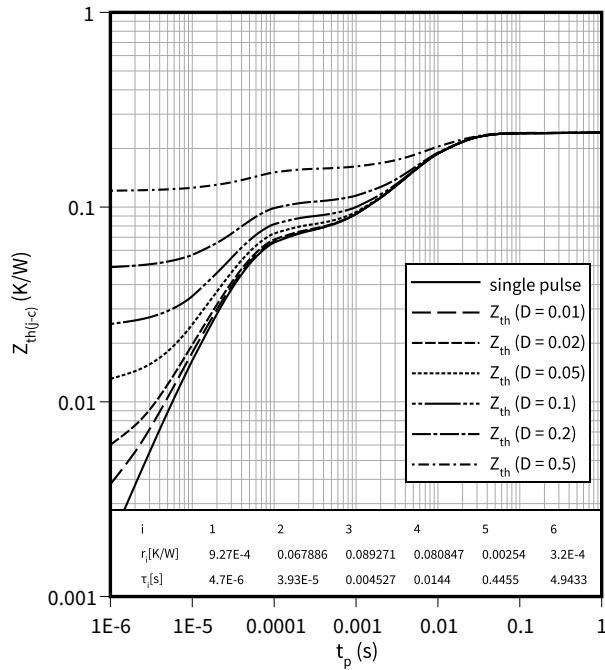
Typical switching energy losses as a function of junction temperature
 $E = f(T_{vj})$
 $I_C = 150 \text{ A}, V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_G = 10 \Omega$
**Typical switching energy losses as a function of collector-emitter voltage**
 $E = f(V_{CE})$
 $I_C = 150 \text{ A}, T_{vj} = 175 \text{ °C}, V_{GE} = 0/15 \text{ V}, R_G = 10 \Omega$
**Typical gate charge**
 $V_{GE} = f(Q_G)$
 $I_C = 150 \text{ A}$
**Typical capacitance as a function of collector-emitter voltage**
 $C = f(V_{CE})$
 $f = 100 \text{ kHz}, V_{GE} = 0 \text{ V}$


4 Characteristics diagrams

IGBT transient thermal impedance as a function of pulse width

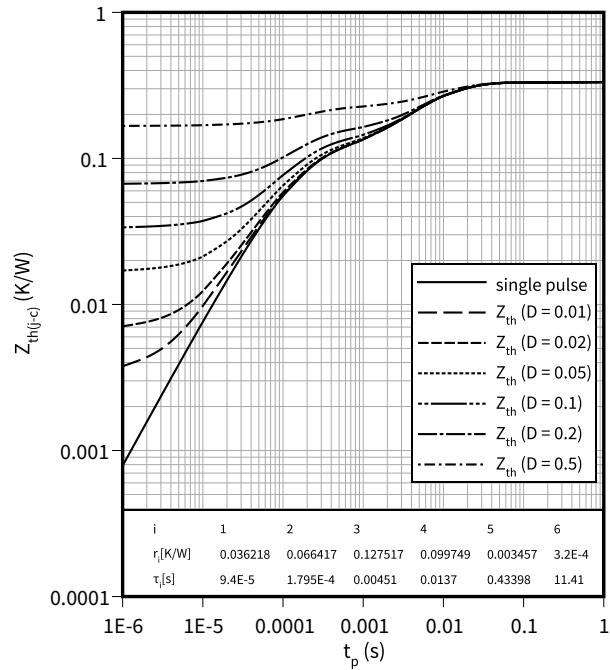
$$Z_{th(j-c)} = f(t_p)$$

$$D = t_p/T$$

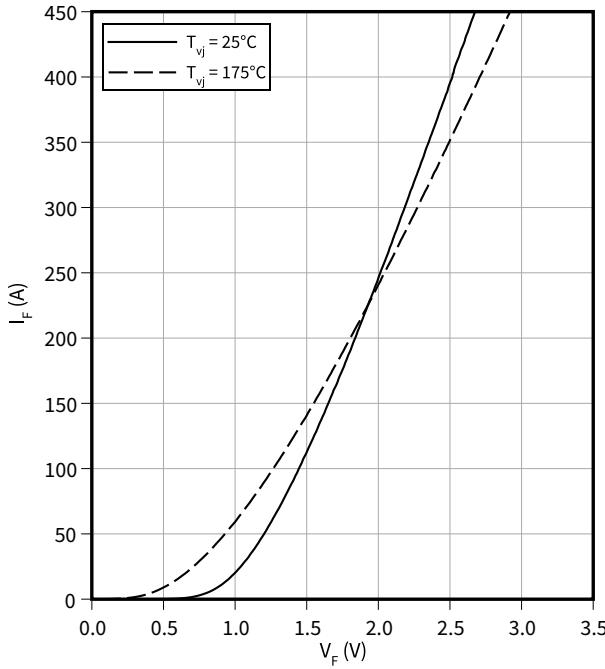
**Diode transient thermal impedance as a function of pulse width**

$$Z_{th(j-c)} = f(t_p)$$

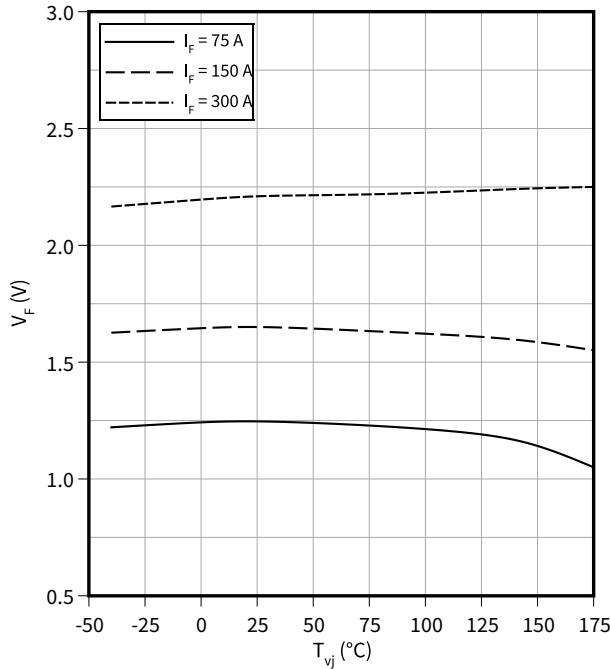
$$D = t_p/T$$

**Typical diode forward current as a function of forward voltage**

$$I_F = f(V_F)$$

**Typical diode forward voltage as a function of junction temperature**

$$V_F = f(T_{vj})$$

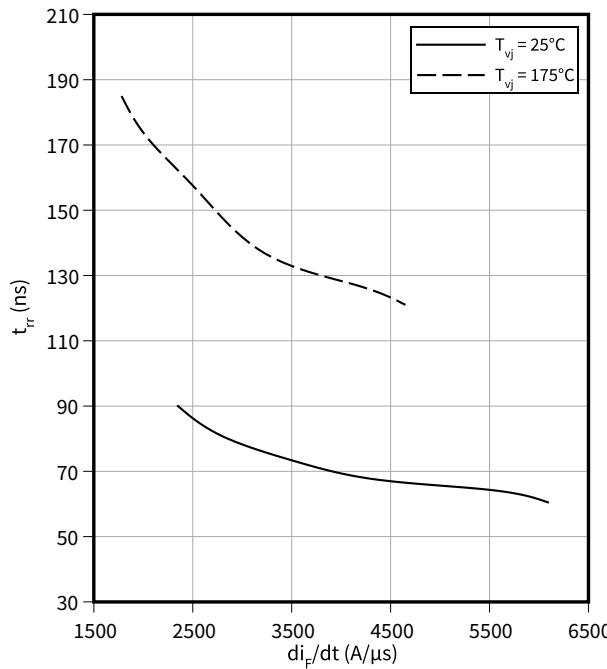


4 Characteristics diagrams

Typical reverse recovery time as a function of diode current slope

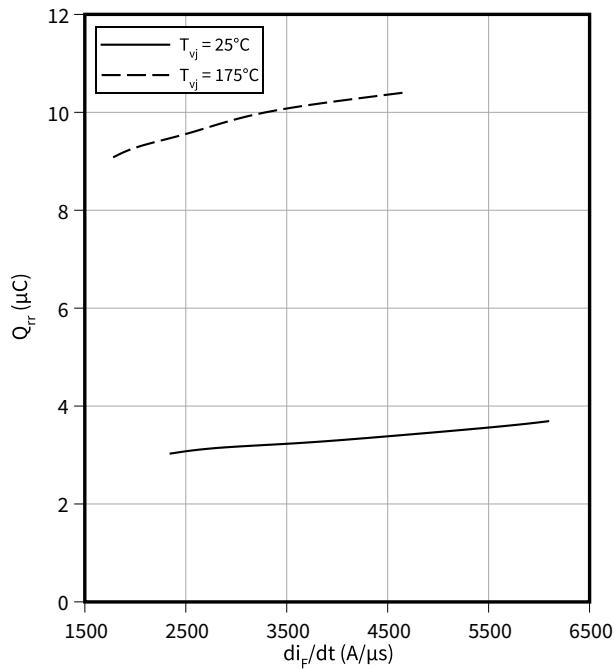
$$t_{rr} = f(di_F/dt)$$

$V_R = 400 \text{ V}$, $I_F = 150 \text{ A}$

**Typical reverse recovery charge as a function of diode current slope**

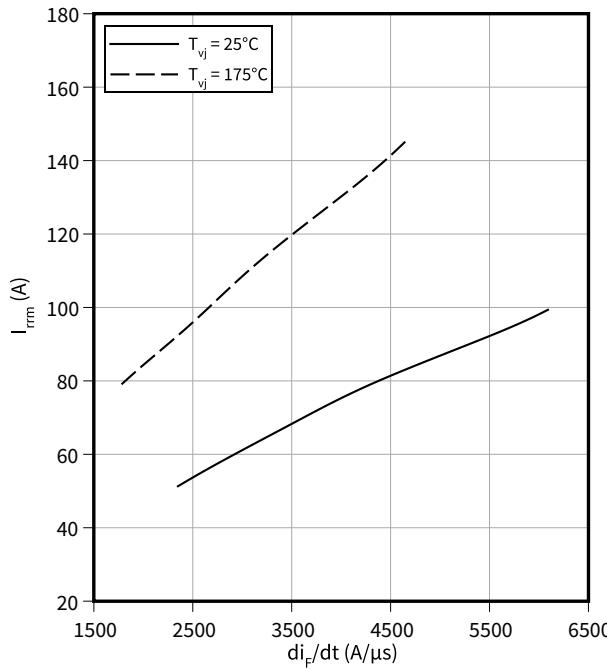
$$Q_{rr} = f(di_F/dt)$$

$V_R = 400 \text{ V}$, $I_F = 150 \text{ A}$

**Typical reverse recovery current as a function of diode current slope**

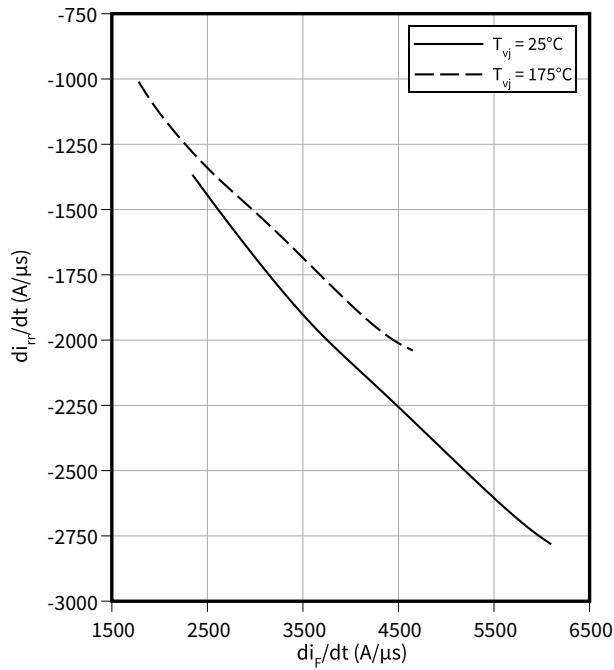
$$I_{rrm} = f(di_F/dt)$$

$V_R = 400 \text{ V}$, $I_F = 150 \text{ A}$

**Typical diode peak rate of fall of reverse recovery current as a function of diode current slope**

$$di_{rr}/dt = f(di_F/dt)$$

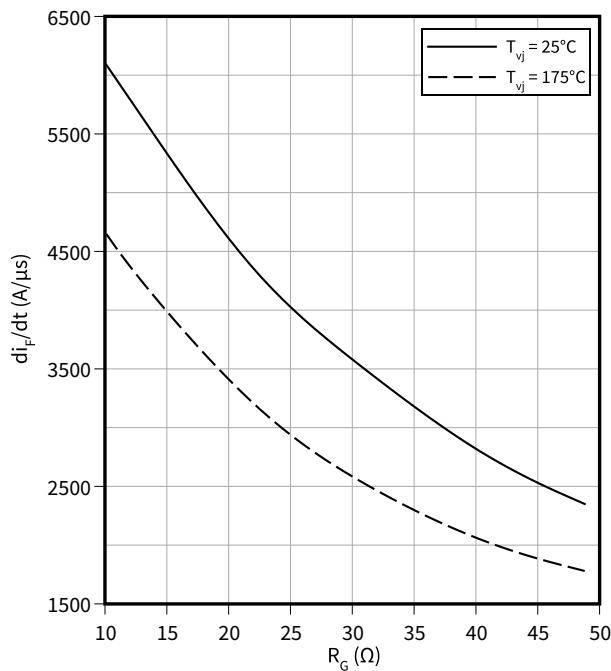
$V_R = 400 \text{ V}$, $I_F = 150 \text{ A}$



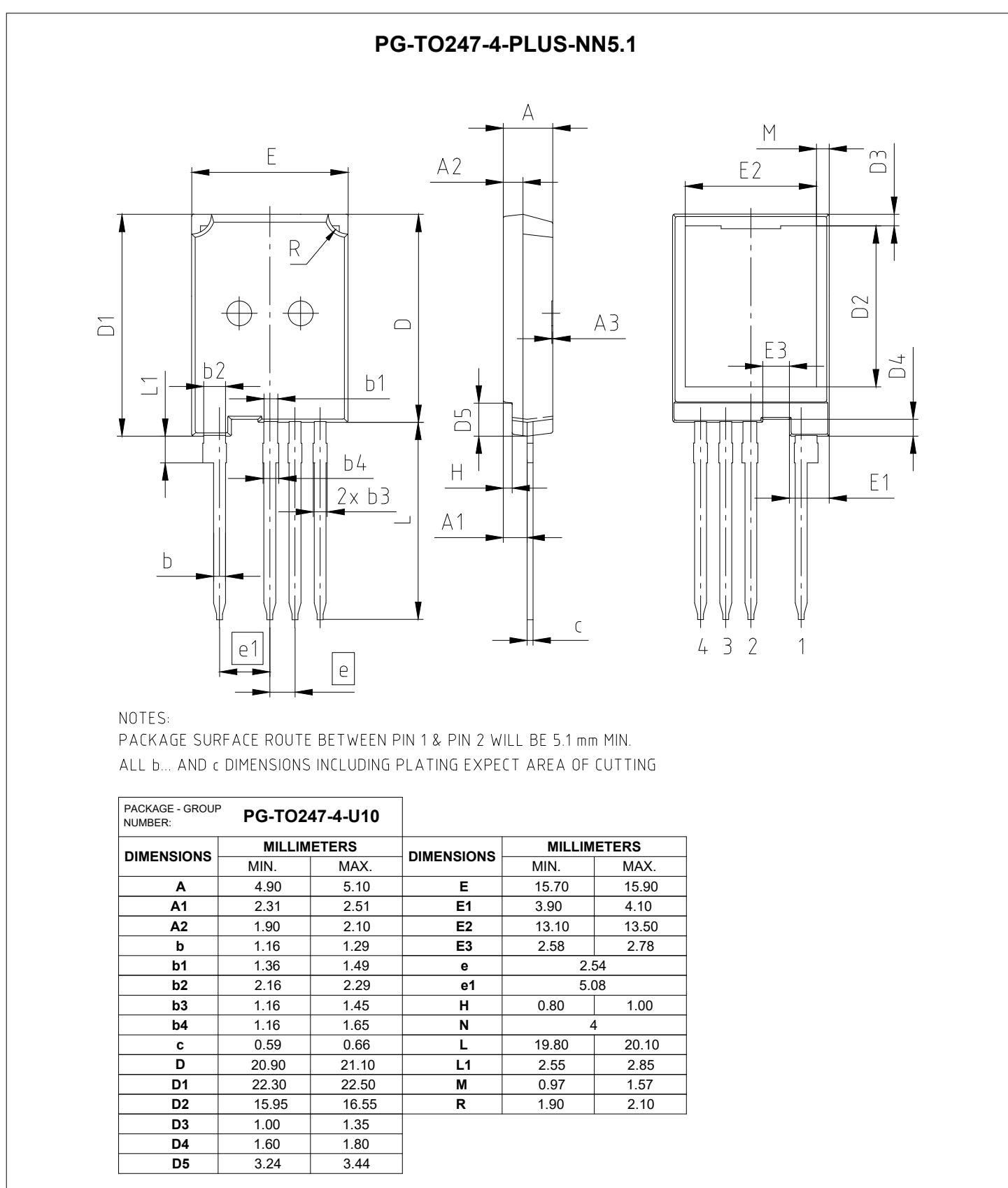
4 Characteristics diagrams

Typical diode current slope as a function of gate resistor

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

 $V_R = 400 \text{ V}, I_F = 150 \text{ A}$ 

5 Package outlines

**Figure 1**

6 Testing conditions

6 Testing conditions

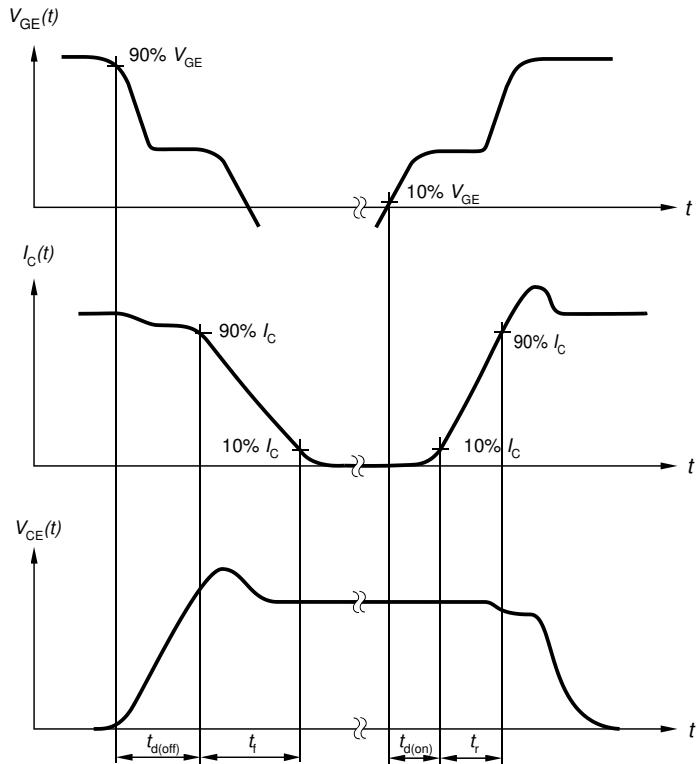


Figure A. Definition of switching times

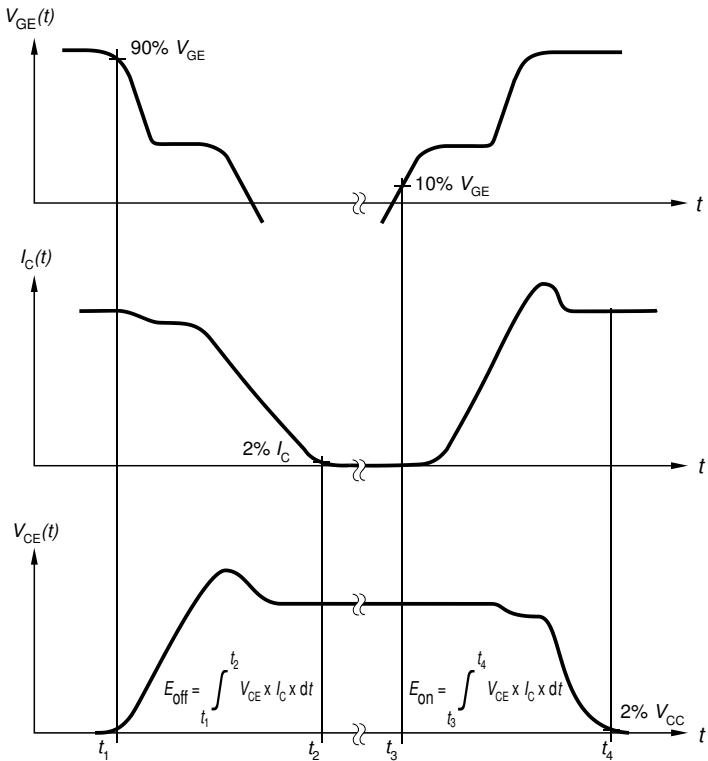


Figure B. Definition of switching losses

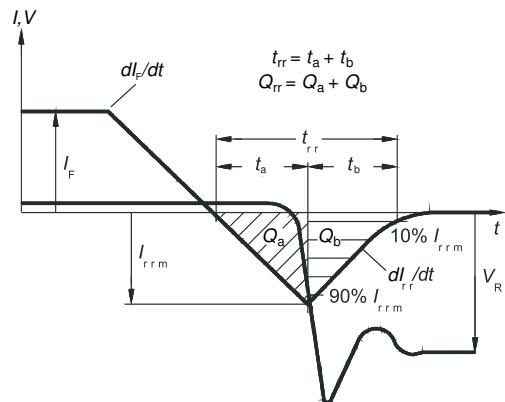


Figure C. Definition of diode switching characteristics

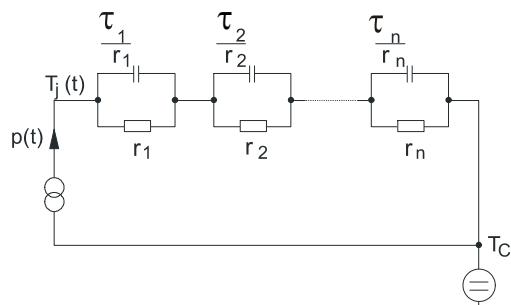


Figure D. Thermal equivalent circuit

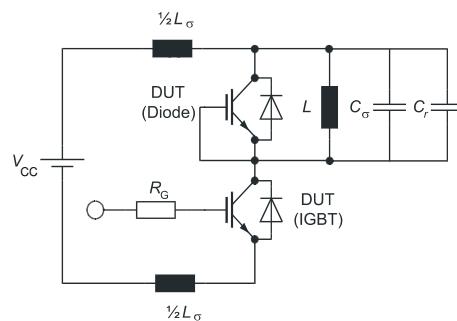


Figure E. Dynamic test circuit
 Parasitic inductance L_σ ,
 parasitic capacitor C_σ ,
 relief capacitor C_r ,
 (only for ZVT switching)

Figure 2

Revision history**Revision history**

| Document revision | Date of release | Description of changes |
|--------------------------|------------------------|-------------------------------|
| 1.00 | 2023-04-27 | Final datasheet |

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