

Final datasheet

High speed and low saturation voltage 750 V TRENCHSTOP™ IGBT7 technology co-packed with soft and fast recovery Emitter Controlled 7 diode

Features

- $V_{CE} = 750\text{ V}$
- $I_C = 50\text{ A}$
- 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
- Energy storage systems (ESS)

Product validation

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

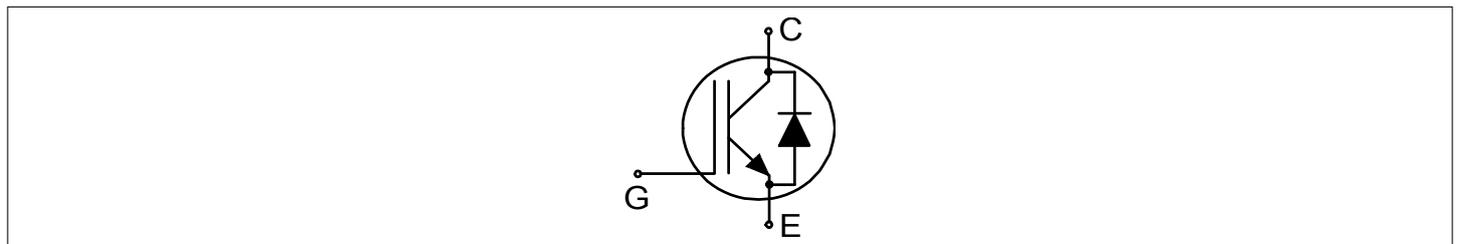
Description

Package pin definition:

- Pin G – Gate
- Pin C & backside – Collector
- Pin E – Emitter



- Lead-free
- Green
- Halogen-free
- RoHS



| Type | Package | Marking |
|--------------|----------------|---------|
| IKWH50N75EH7 | PG-TO247-3-U04 | K50GEH7 |

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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 |
| Mounting torque | M | M3 screw, Maximum of mounting processes: 3 | | | 0.6 | Nm |
| Thermal resistance, junction-ambient | $R_{th(j-a)}$ | | | | 40 | K/W |
| IGBT thermal resistance, junction-case | $R_{th(j-c)}$ | | | 0.46 | 0.6 | K/W |
| Diode thermal resistance, junction-case | $R_{th(j-c)}$ | | | 0.61 | 0.8 | K/W |

2 IGBT

Table 2 Maximum rated values

| Parameter | Symbol | Note or test condition | Values | Unit | |
|--|--------------|---|------------------------|------|---|
| Collector-emitter voltage | V_{CE} | $T_{vj} \geq 25 \text{ °C}$ | 750 | V | |
| DC collector current, limited by T_{vjmax} | I_C | limited by bondwire | $T_c = 25 \text{ °C}$ | 80 | A |
| | | | $T_c = 100 \text{ °C}$ | 67 | |
| Pulsed collector current, t_p limited by T_{vjmax} | I_{Cpulse} | | 200 | A | |
| Turn-off safe operating area | | $V_{CE} \leq 750 \text{ V}$, $t_p \leq 1 \text{ }\mu\text{s}$, $T_{vj} \leq 175 \text{ °C}$ | 200 | 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} | | $T_c = 25 \text{ °C}$ | 250 | W |
| | | | $T_c = 100 \text{ °C}$ | 125 | |

Table 3 Characteristic values

| Parameter | Symbol | Note or test condition | | Values | | | Unit |
|--------------------------------------|--------------|--|--|--------|------|------|---------------|
| | | | | Min. | Typ. | Max. | |
| Collector-emitter saturation voltage | V_{CEsat} | $I_C = 50 \text{ A}, V_{GE} = 15 \text{ V}$ | $T_{vj} = 25 \text{ }^\circ\text{C}$ | | 1.45 | 1.75 | V |
| | | | $T_{vj} = 175 \text{ }^\circ\text{C}$ | | 1.75 | | |
| Gate-emitter threshold voltage | V_{GEth} | $I_C = 0.44 \text{ mA}, V_{CE} = V_{GE}$ | | 3.2 | 4 | 4.8 | V |
| Zero gate-voltage collector current | I_{CES} | $V_{CE} = 750 \text{ V}, V_{GE} = 0 \text{ V}$ | $T_{vj} = 25 \text{ }^\circ\text{C}$ | | | 15 | μA |
| | | | $T_{vj} = 175 \text{ }^\circ\text{C}$ | | 1500 | | |
| Gate-emitter leakage current | I_{GES} | $V_{CE} = 0 \text{ V}, V_{GE} = 20 \text{ V}$ | | | | 100 | nA |
| Transconductance | g_{fs} | $I_C = 50 \text{ A}, V_{CE} = 20 \text{ V}$ | | | 65 | | S |
| Input capacitance | C_{ies} | $V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$ | | | 2560 | | pF |
| Output capacitance | C_{oes} | $V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$ | | | 79 | | pF |
| Reverse transfer capacitance | C_{res} | $V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$ | | | 9.6 | | pF |
| Gate charge | Q_G | $V_{CC} = 600 \text{ V}, I_C = 50 \text{ A}, V_{GE} = 15 \text{ V}$ | | | 105 | | nC |
| Turn-on delay time | $t_{d(on)}$ | $V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V},$ $R_{G(on)} = 10 \text{ } \Omega,$ $R_{G(off)} = 10 \text{ } \Omega$ | $T_{vj} = 25 \text{ }^\circ\text{C},$ $I_C = 50 \text{ A}$ | | 18 | | ns |
| | | | $T_{vj} = 175 \text{ }^\circ\text{C},$ $I_C = 50 \text{ A}$ | | 18 | | |
| Rise time (inductive load) | t_r | $V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V},$ $R_{G(on)} = 10 \text{ } \Omega,$ $R_{G(off)} = 10 \text{ } \Omega$ | $T_{vj} = 25 \text{ }^\circ\text{C},$ $I_C = 50 \text{ A}$ | | 18 | | ns |
| | | | $T_{vj} = 175 \text{ }^\circ\text{C},$ $I_C = 50 \text{ A}$ | | 19 | | |
| Turn-off delay time | $t_{d(off)}$ | $V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V},$ $R_{G(on)} = 10 \text{ } \Omega,$ $R_{G(off)} = 10 \text{ } \Omega$ | $T_{vj} = 25 \text{ }^\circ\text{C},$ $I_C = 50 \text{ A}$ | | 141 | | ns |
| | | | $T_{vj} = 175 \text{ }^\circ\text{C},$ $I_C = 50 \text{ A}$ | | 175 | | |
| Fall time (inductive load) | t_f | $V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V},$ $R_{G(on)} = 10 \text{ } \Omega,$ $R_{G(off)} = 10 \text{ } \Omega$ | $T_{vj} = 25 \text{ }^\circ\text{C},$ $I_C = 50 \text{ A}$ | | 30 | | ns |
| | | | $T_{vj} = 175 \text{ }^\circ\text{C},$ $I_C = 50 \text{ A}$ | | 72 | | |
| Turn-on energy | E_{on} | $V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V},$ $R_{G(on)} = 10 \text{ } \Omega,$ $R_{G(off)} = 10 \text{ } \Omega$ | $T_{vj} = 25 \text{ }^\circ\text{C},$ $I_C = 50 \text{ A}$ | | 1.1 | | mJ |
| | | | $T_{vj} = 175 \text{ }^\circ\text{C},$ $I_C = 50 \text{ A}$ | | 1.5 | | |

(table continues...)

Table 3 (continued) Characteristic values

| Parameter | Symbol | Note or test condition | Values | | | Unit | |
|--------------------------------|-----------|--|--|------|------|------|----|
| | | | Min. | Typ. | Max. | | |
| Turn-off energy | E_{off} | $V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V},$ $R_{G(on)} = 10\ \Omega,$ $R_{G(off)} = 10\ \Omega$ | $T_{vj} = 25\text{ °C},$ $I_C = 50\text{ A}$ | | 0.6 | | mJ |
| | | | $T_{vj} = 175\text{ °C},$ $I_C = 50\text{ A}$ | | 1.2 | | |
| Total switching energy | E_{ts} | $V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V},$ $R_{G(on)} = 10\ \Omega,$ $R_{G(off)} = 10\ \Omega$ | $T_{vj} = 25\text{ °C},$ $I_C = 50\text{ A}$ | | 1.7 | | mJ |
| | | | $T_{vj} = 175\text{ °C},$ $I_C = 50\text{ A}$ | | 2.7 | | |
| Operating junction temperature | T_{vj} | | -40 | | 175 | °C | |

3 Diode

Table 4 Maximum rated values

| Parameter | Symbol | Note or test condition | Values | Unit | |
|--|--------------|------------------------|-----------------------|------|---|
| Diode forward current, limited by T_{vjmax} | I_F | limited by bondwire | $T_c = 25\text{ °C}$ | 80 | A |
| | | | $T_c = 100\text{ °C}$ | 57 | |
| Diode pulsed current, t_p limited by T_{vjmax} | I_{Fpulse} | | 200 | A | |
| Power dissipation | P_{tot} | | $T_c = 25\text{ °C}$ | 188 | W |
| | | | $T_c = 100\text{ °C}$ | 94 | |

Table 5 Characteristic values

| Parameter | Symbol | Note or test condition | Values | | | Unit | |
|-------------------------------|----------|--|--|------|------|------|---------------|
| | | | Min. | Typ. | Max. | | |
| Diode forward voltage | V_F | $I_F = 50\text{ A}$ | $T_{vj} = 25\text{ °C}$ | | 1.65 | 2 | V |
| | | | $T_{vj} = 175\text{ °C}$ | | 1.6 | | |
| Diode reverse recovery time | t_{rr} | $V_R = 400\text{ V}, R_{G(on)} = 10\ \Omega$ | $T_{vj} = 25\text{ °C},$ $I_F = 50\text{ A}$ | | 88 | | ns |
| | | | $T_{vj} = 175\text{ °C},$ $I_F = 50\text{ A}$ | | 151 | | |
| Diode reverse recovery charge | Q_{rr} | $V_R = 400\text{ V}, R_{G(on)} = 10\ \Omega$ | $T_{vj} = 25\text{ °C},$ $I_F = 50\text{ A}$ | | 1.5 | | μC |
| | | | $T_{vj} = 175\text{ °C},$ $I_F = 50\text{ A}$ | | 3.4 | | |

(table continues...)

Table 5 (continued) Characteristic values

| Parameter | Symbol | Note or test condition | Values | | | Unit |
|---|--------------|--|--|------|------|--------------------|
| | | | Min. | Typ. | Max. | |
| Diode peak reverse recovery current | I_{rrm} | $V_R = 400\text{ V}, R_{G(on)} = 10\ \Omega$ | $T_{vj} = 25\text{ °C},$ $I_F = 50\text{ A}$ | | 28.8 | A |
| | | | $T_{vj} = 175\text{ °C},$ $I_F = 50\text{ A}$ | | 42.8 | |
| Diode peak rate of fall of reverse recovery current | di_{rr}/dt | $V_R = 400\text{ V}, R_{G(on)} = 10\ \Omega$ | $T_{vj} = 25\text{ °C},$ $I_F = 50\text{ A}$ | | -470 | A/ μs |
| | | | $T_{vj} = 175\text{ °C},$ $I_F = 50\text{ A}$ | | -380 | |
| Reverse recovery energy | E_{rec} | $V_R = 400\text{ V}, R_{G(on)} = 10\ \Omega$ | $T_{vj} = 25\text{ °C},$ $I_F = 50\text{ A}$ | | 0.35 | mJ |
| | | | $T_{vj} = 175\text{ °C},$ $I_F = 50\text{ A}$ | | 0.91 | |
| 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.

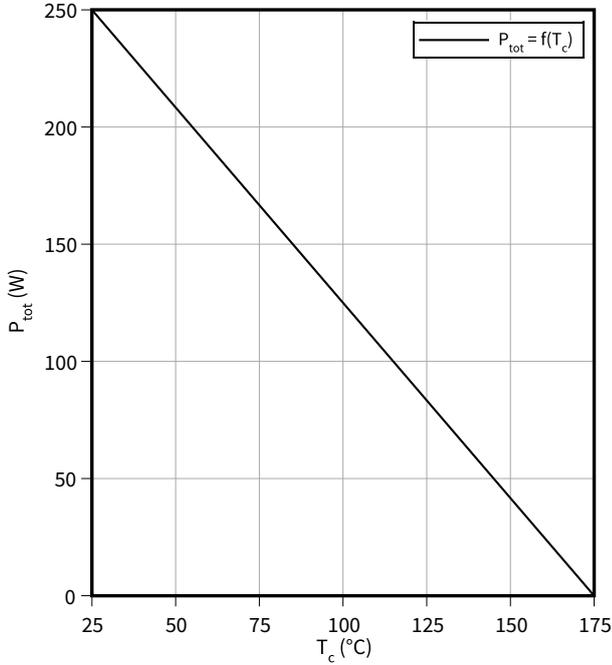
Electrical Characteristic at $T_{vj} = 25\text{ °C}$, unless otherwise specified.

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

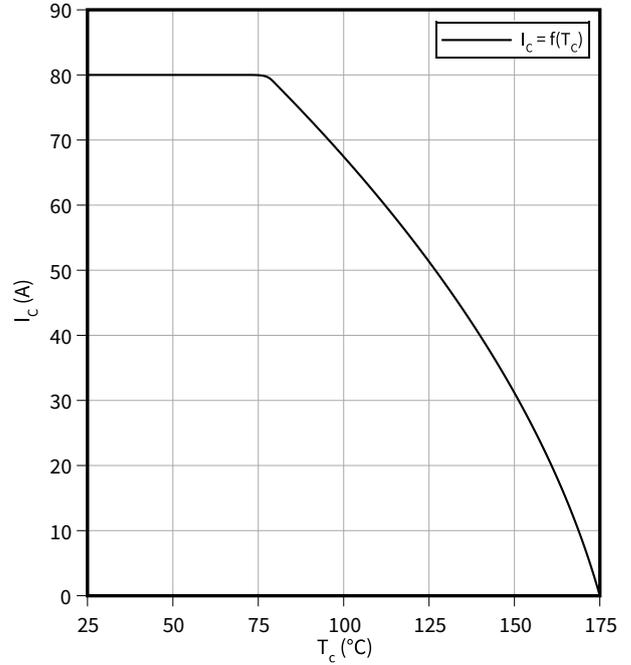
Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$
 $T_{vj} \leq 175\text{ °C}$



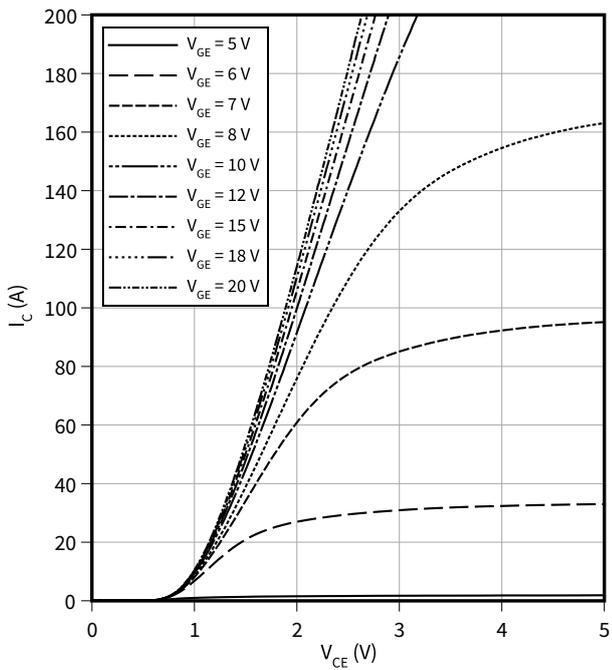
Collector current as a function of case temperature

$I_C = f(T_c)$
 $T_{vj} \leq 175\text{ °C}, V_{GE} \geq 15\text{ V}$



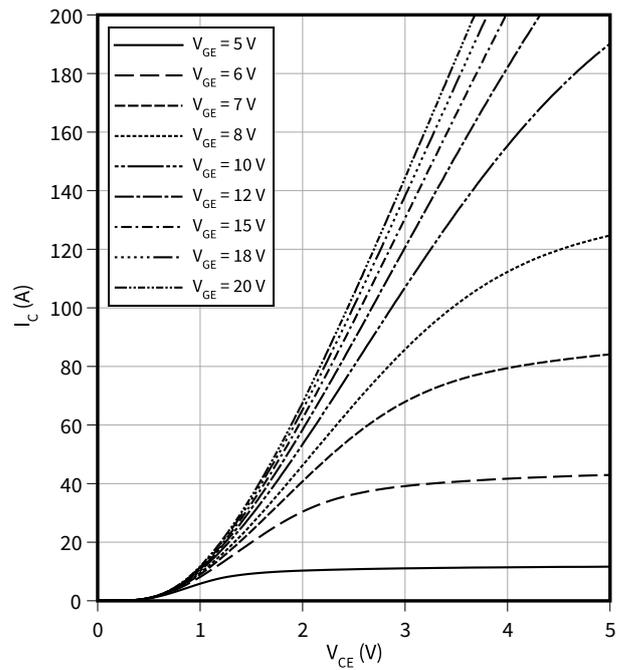
Typical output characteristic

$I_C = f(V_{CE})$
 $T_{vj} = 25\text{ °C}$



Typical output characteristic

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

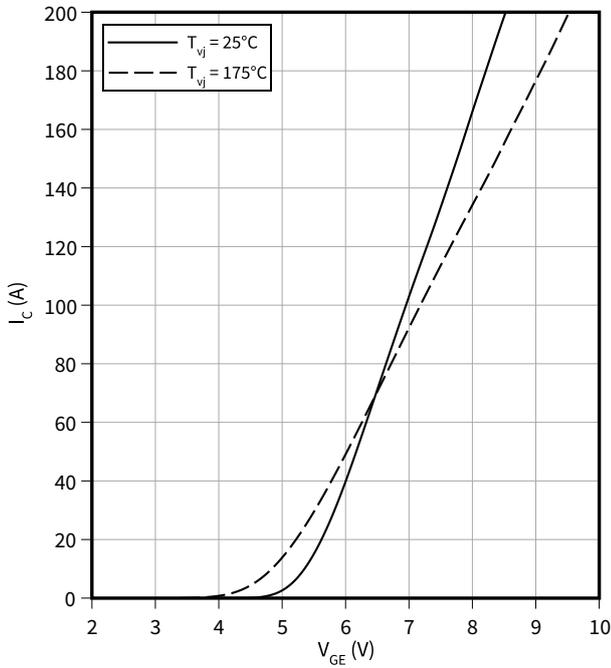


4 Characteristics diagrams

Typical transfer characteristic

$I_C = f(V_{GE})$

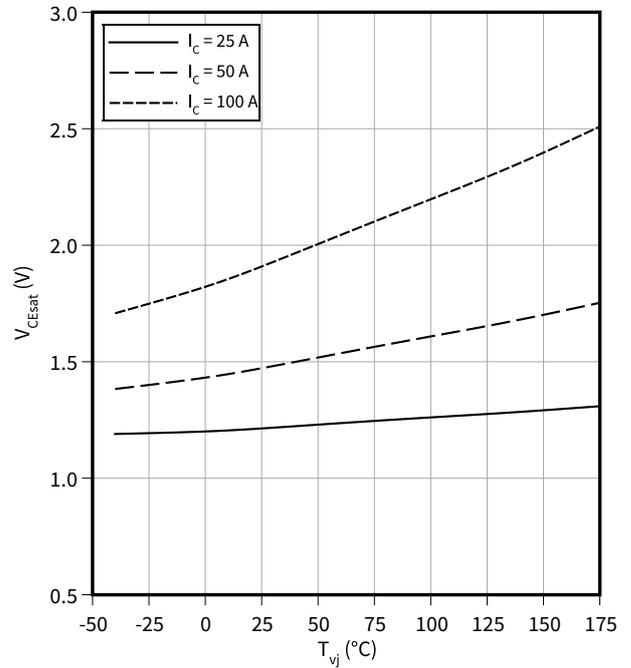
$V_{CE} = 20\text{ V}$



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

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

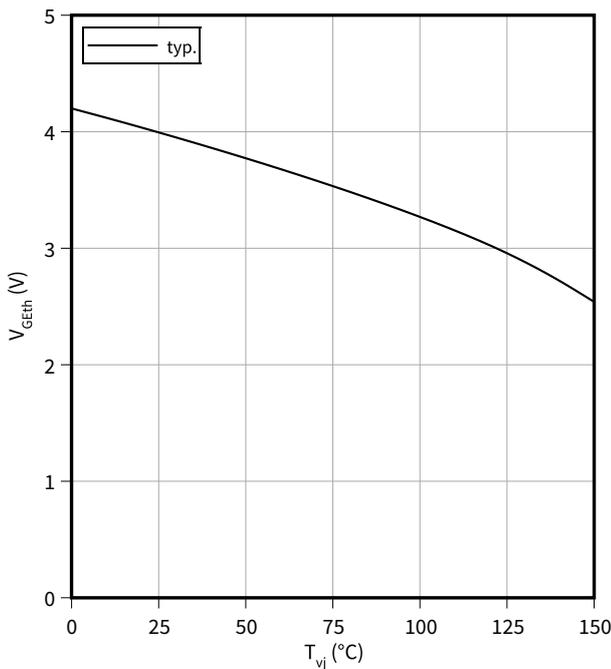
$V_{GE} = 15\text{ V}$



Gate-emitter threshold voltage as a function of junction temperature

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

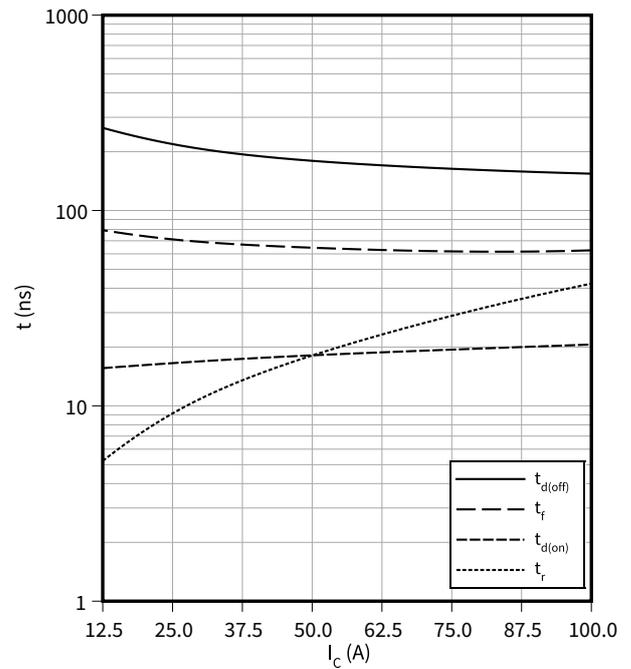
$I_C = 0.44\text{ mA}$



Typical switching times as a function of collector current

$t = f(I_C)$

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

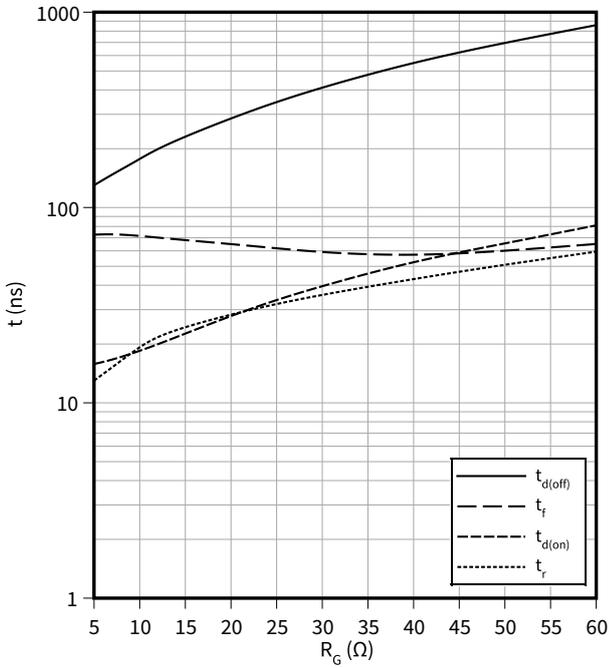


4 Characteristics diagrams

Typical switching times as a function of gate resistor

$t = f(R_G)$

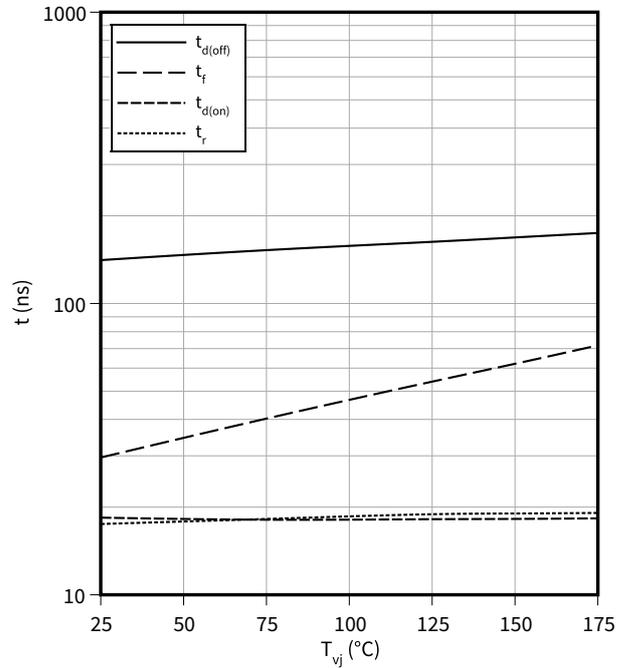
$I_C = 50\text{ A}, V_{CC} = 400\text{ V}, T_{vj} = 175\text{ °C}, V_{GE} = 0/15\text{ V}$



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

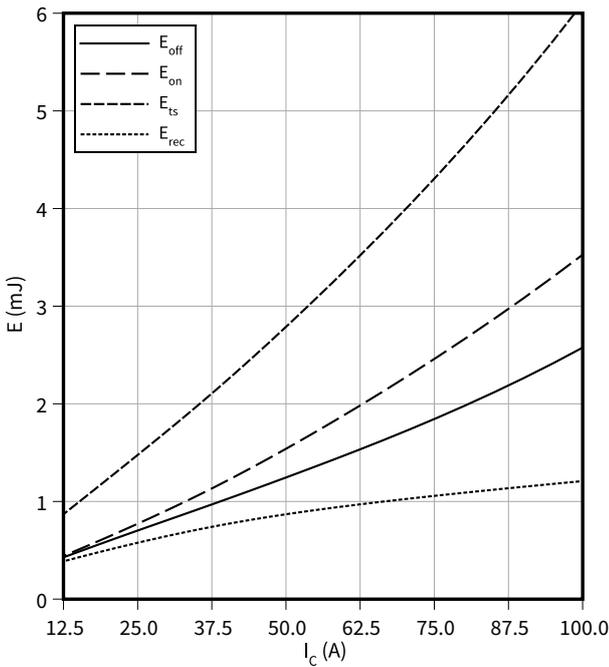
$I_C = 50\text{ A}, V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V}, R_G = 10\text{ Ω}$



Typical switching energy losses as a function of collector current

$E = f(I_C)$

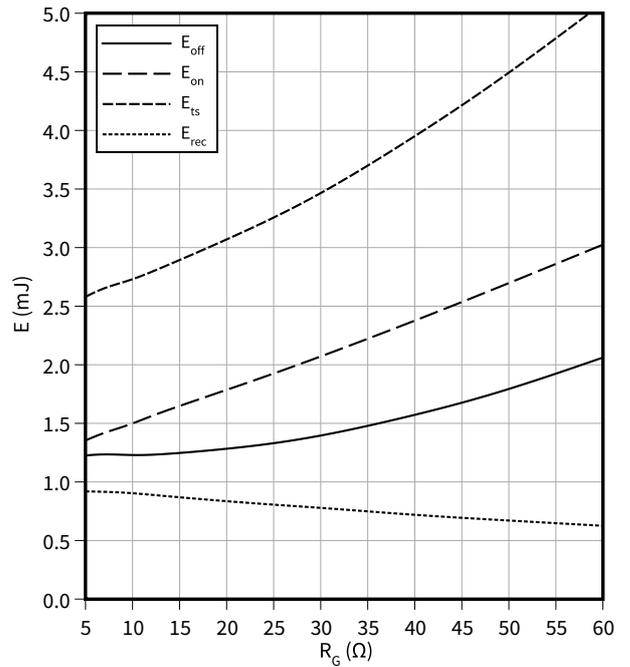
$V_{CC} = 400\text{ V}, T_{vj} = 175\text{ °C}, V_{GE} = 0/15\text{ V}, R_G = 10\text{ Ω}$



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

$I_C = 50\text{ A}, V_{CC} = 400\text{ V}, T_{vj} = 175\text{ °C}, V_{GE} = 0/15\text{ V}$

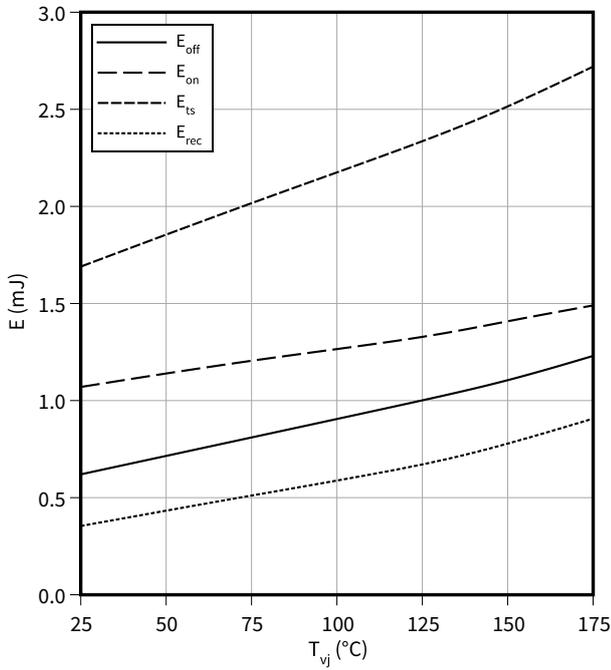


4 Characteristics diagrams

Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

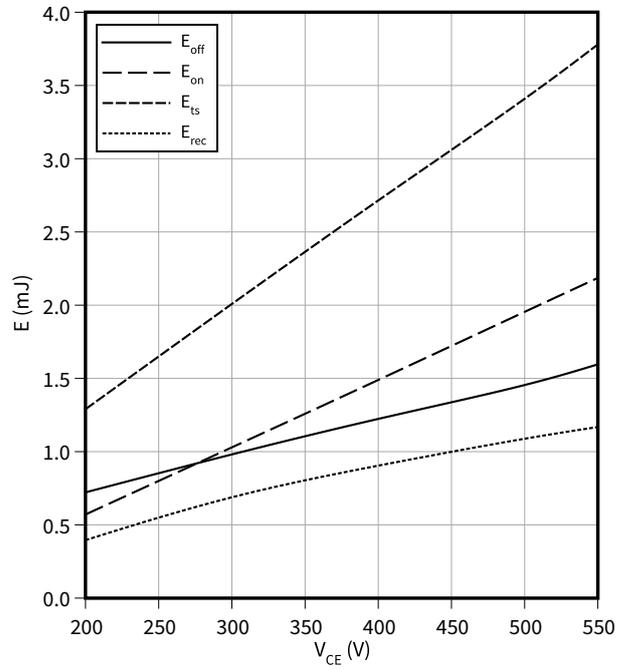
$I_C = 50 \text{ A}, V_{CC} = 400 \text{ V}, V_{GE} = 0/15 \text{ V}, R_G = 10 \text{ } \Omega$



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

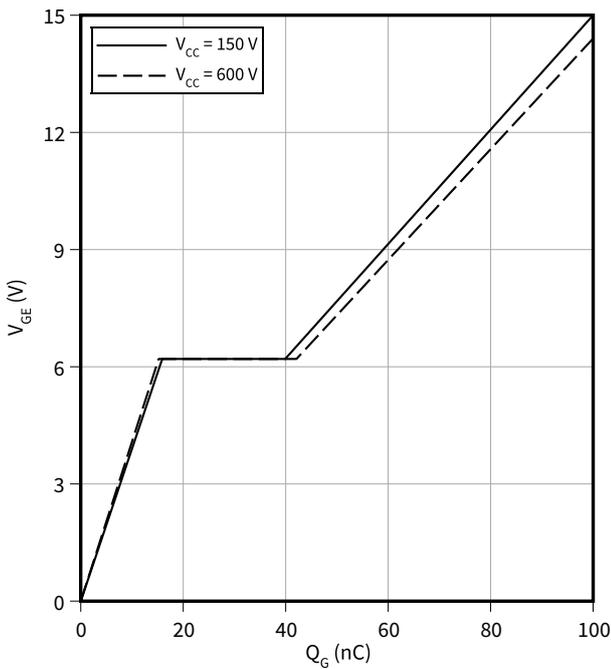
$I_C = 50 \text{ A}, T_{vj} = 175 \text{ } ^\circ\text{C}, V_{GE} = 0/15 \text{ V}, R_G = 10 \text{ } \Omega$



Typical gate charge

$V_{GE} = f(Q_G)$

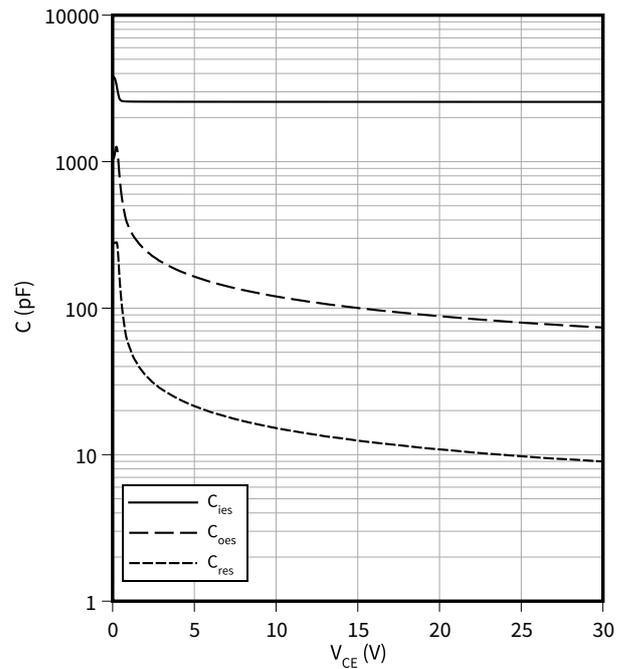
$I_C = 50 \text{ A}$



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

$f = 100 \text{ kHz}, V_{GE} = 0 \text{ V}$

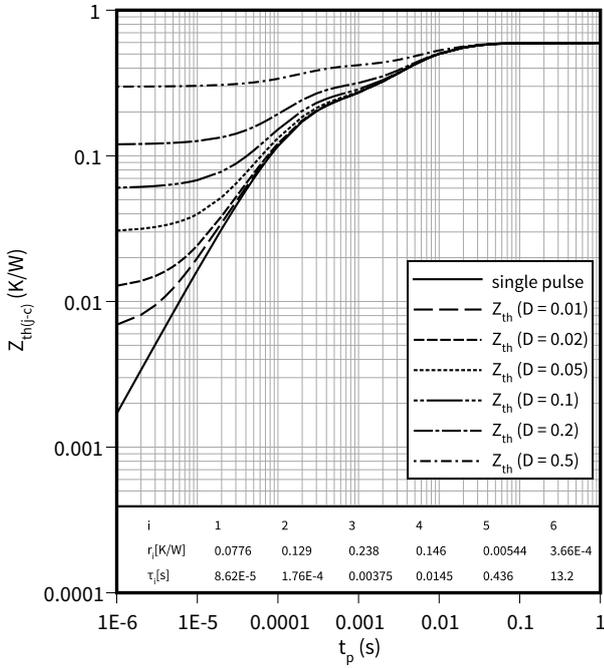


4 Characteristics diagrams

IGBT transient thermal impedance as a function of pulse width

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

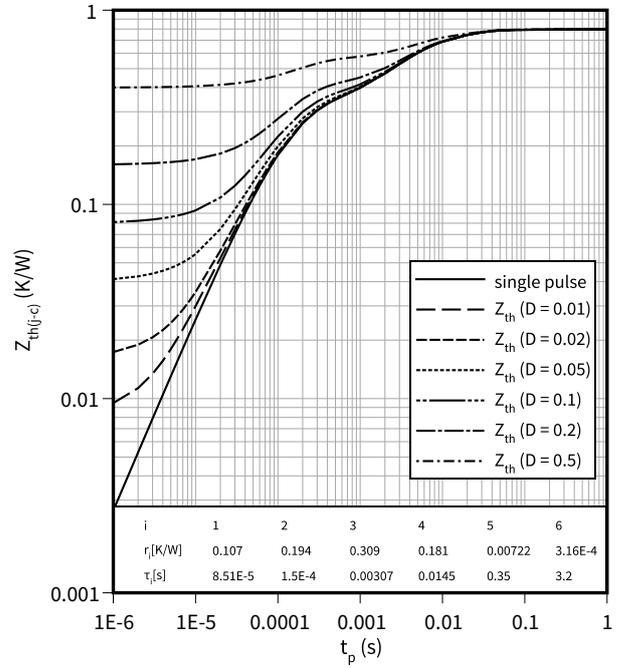
$D = t_p/T$



Diode transient thermal impedance as a function of pulse width

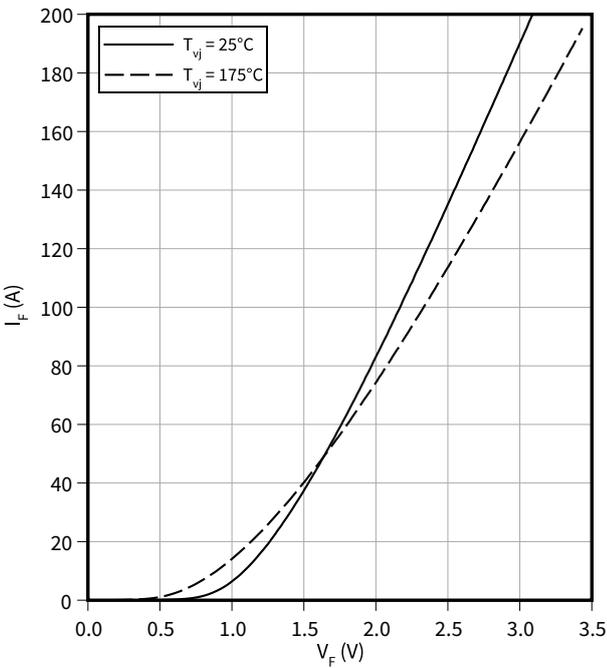
$Z_{th(j-c)} = f(t_p)$

$D = t_p/T$



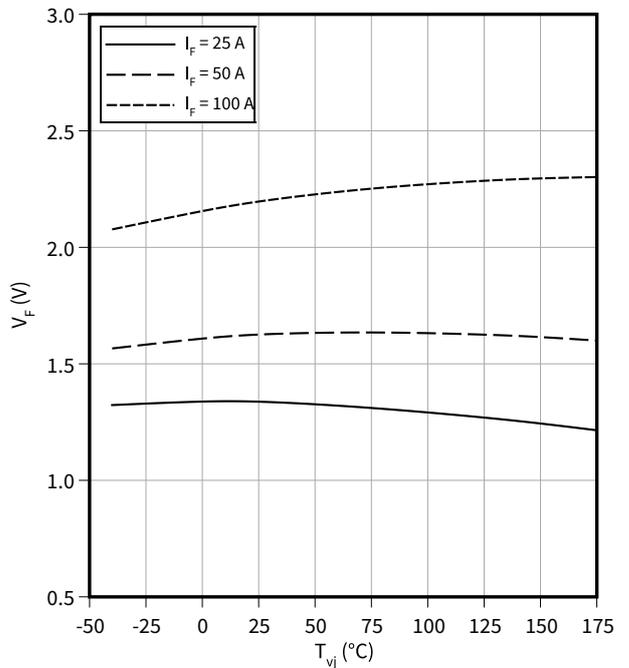
Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



Typical diode forward voltage as a function of junction temperature

$V_F = f(T_{vj})$

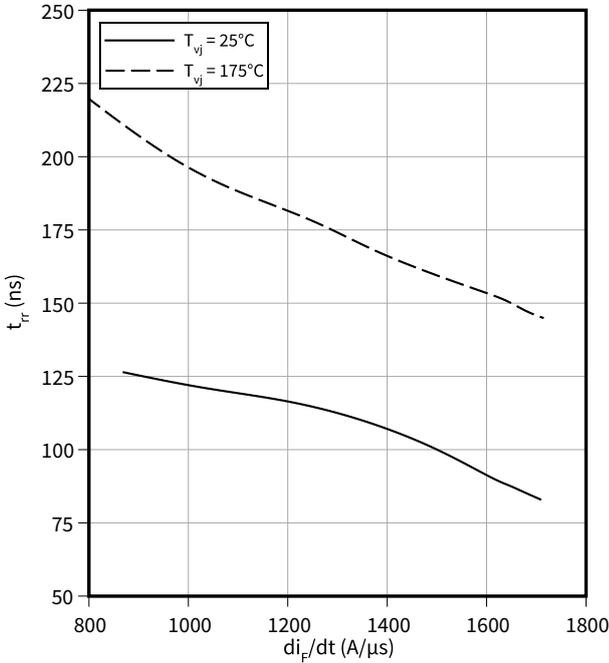


4 Characteristics diagrams

Typical reverse recovery time as a function of diode current slope

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

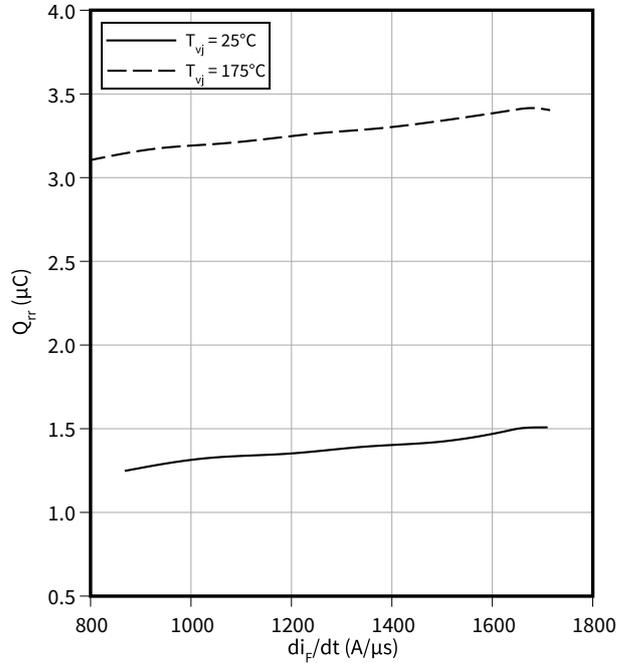
$V_R = 400\text{ V}, I_F = 50\text{ A}$



Typical reverse recovery charge as a function of diode current slope

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

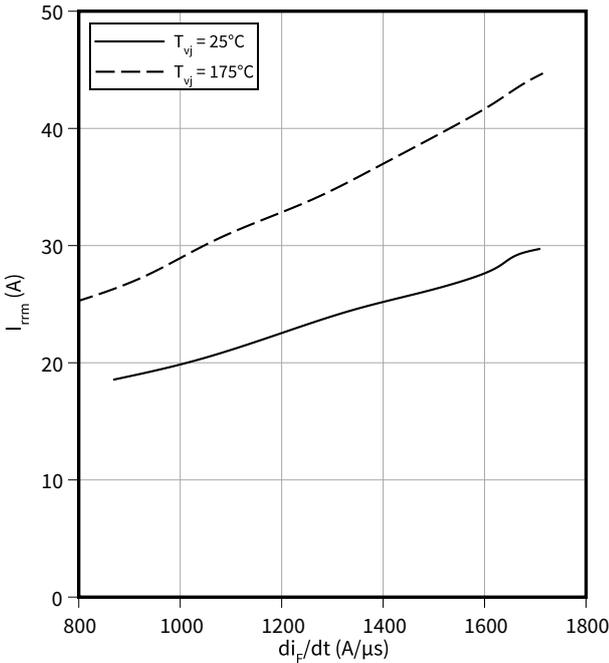
$V_R = 400\text{ V}, I_F = 50\text{ A}$



Typical reverse recovery current as a function of diode current slope

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

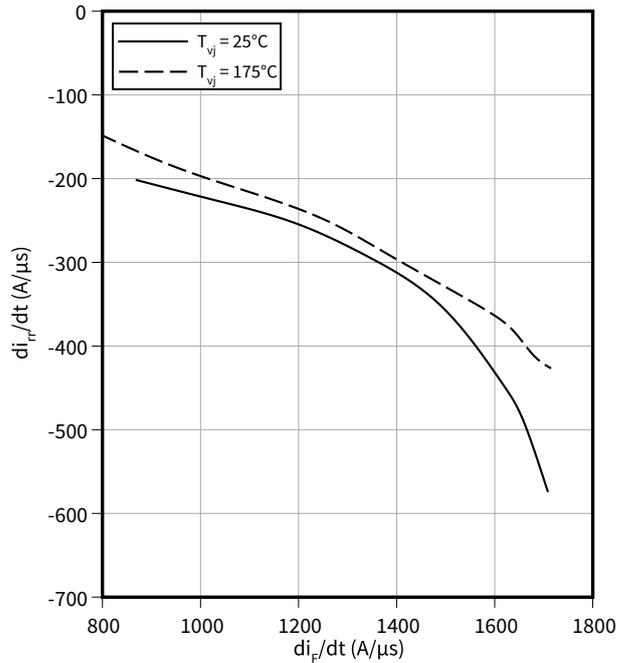
$V_R = 400\text{ V}, I_F = 50\text{ A}$



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

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

$V_R = 400\text{ V}, I_F = 50\text{ A}$

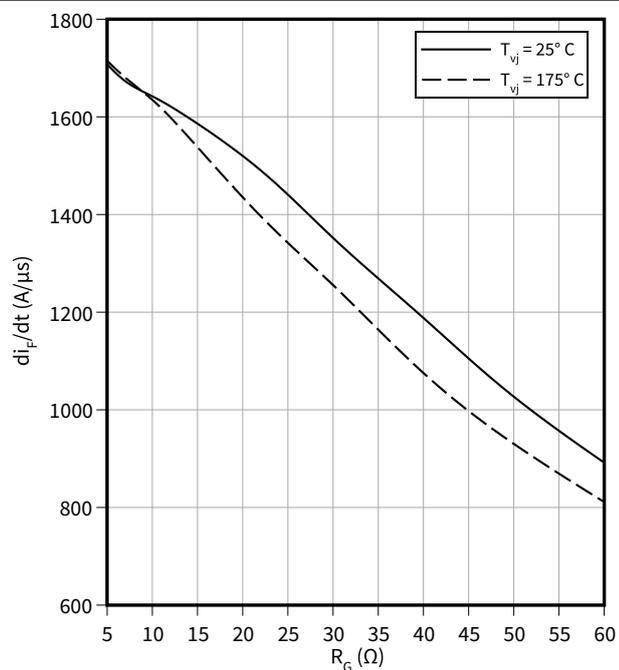


4 Characteristics diagrams

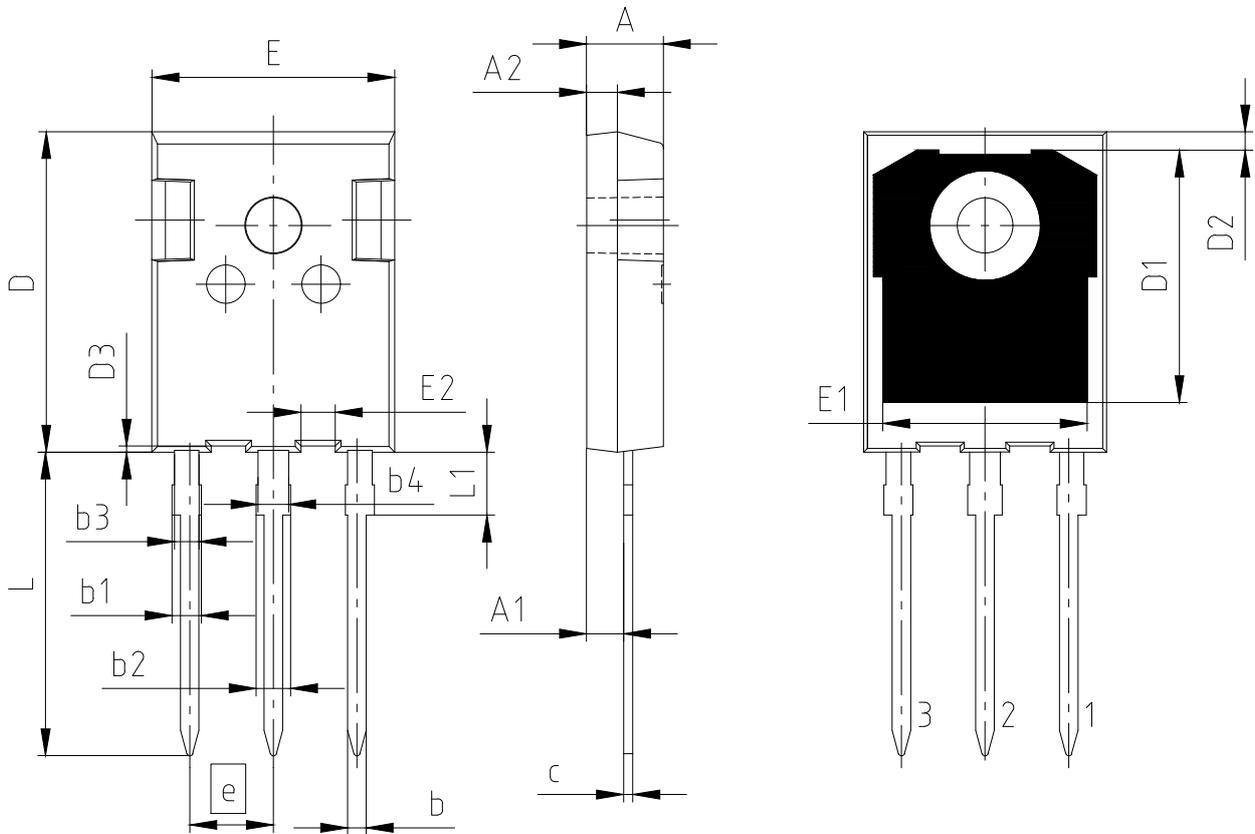
Typical diode current slope as a function of gate resistor

$di_F/dt = f(R_G)$

$V_R = 400\text{ V}, I_F = 50\text{ A}$



5 Package outlines



| PACKAGE - GROUP NUMBER: PG-TO247-3-U04 | | |
|---|-------------|-------|
| DIMENSIONS | MILLIMETERS | |
| | MIN. | MAX. |
| A | 4.90 | 5.10 |
| A1 | 2.31 | 2.51 |
| A2 | 1.90 | 2.10 |
| b | 1.16 | 1.26 |
| b1 | | 1.90 |
| b2 | | 2.30 |
| b3 | 1.55 | 1.65 |
| b4 | 1.96 | 2.06 |
| c | 0.59 | 0.66 |
| D | 20.90 | 21.10 |
| D1 | 16.25 | 16.85 |
| D2 | 1.05 | 1.35 |
| D3 | 0.55 | 0.65 |
| E | 15.70 | 15.90 |
| E1 | 13.10 | 13.50 |
| E2 | 2.14 | 2.34 |
| e | 5.44 | |
| N | 3 | |
| L | 19.80 | 20.10 |
| L1 | 3.95 | 4.30 |

Figure 1

6 Testing conditions

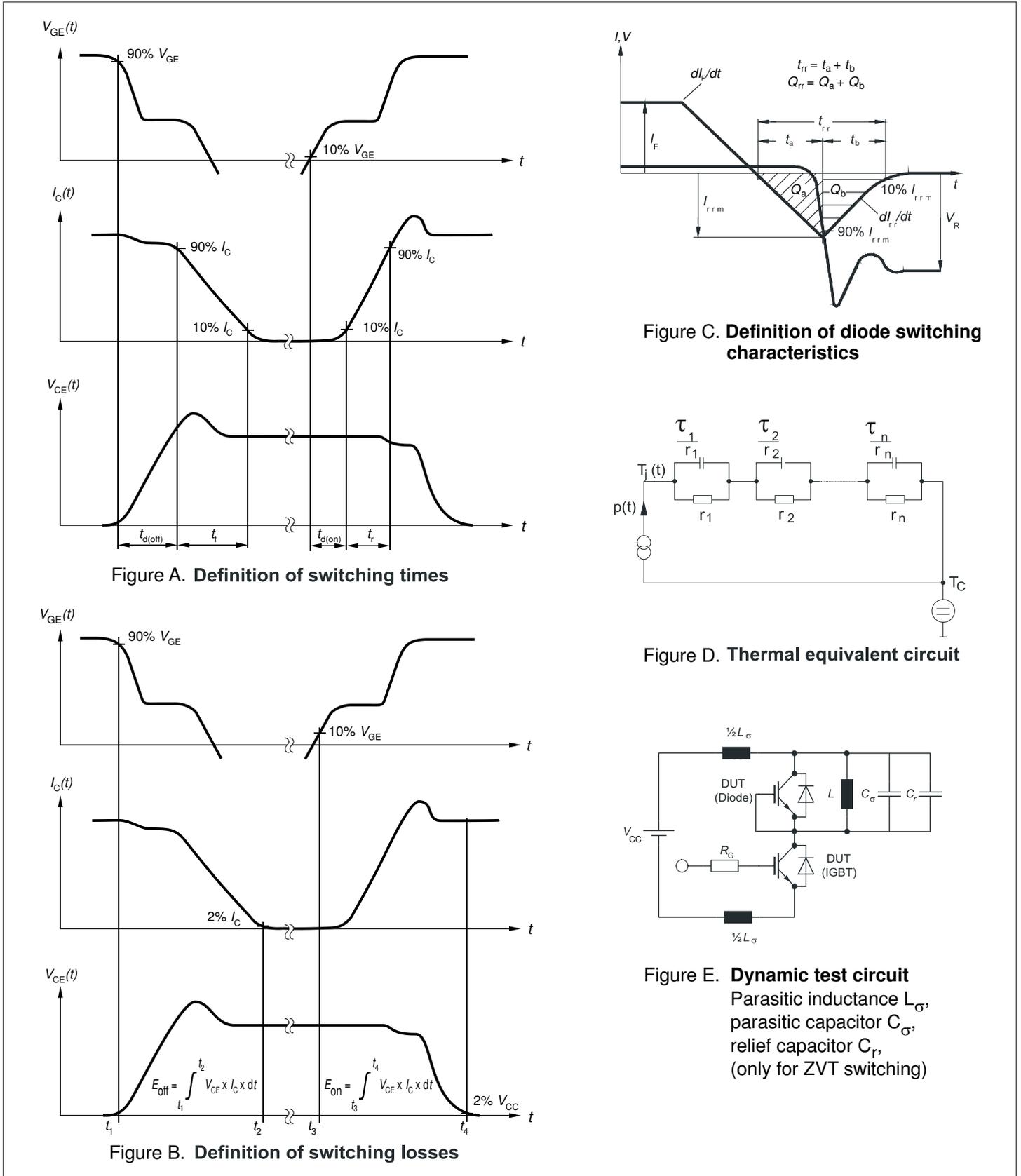


Figure 2

Revision history

| Document revision | Date of release | Description of changes |
|--------------------------|------------------------|-------------------------------|
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