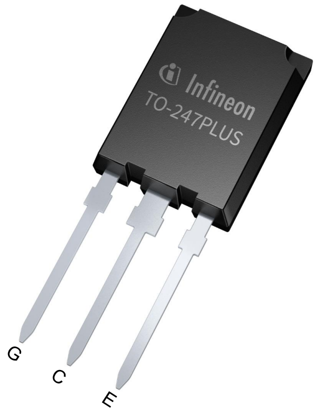
# Short circuit rugged 1200 V TRENCHSTOP™ IGBT 7 technology




## Features

- $V_{CE}$ = 1200 V
- $I_C$ = 120 A
- Low saturation voltage $V_{CEsat}$ = 2.0 V at $T_{vj}$ = 175°C
- Short circuit ruggedness 8 µs
- Wide range of dv/dt controllability
- Complete product spectrum and PSpice Models: http://www.infineon.com/igbt/

## Potential applications

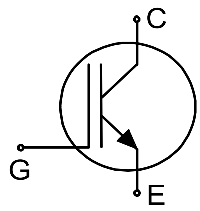
- Industrial power supplies
- Solar

## Product validation

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

Halogen-free
Lead-free
Green
RoHS

## Description




| Type | Package | Marking |
|---|---|---|
| IGQ120N120S7 | PG-TO247-3-PLUS-NN3.7 | G120MS7 |

# Table of contents

# 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 | $R_{th(j-c)}$ | | | 0.11 | 0.15 | K/W |

# 2 IGBT

**Table 2 Maximum rated values**

| Parameter | Symbol | Note or test condition | | Values | Unit |
|---|---|---|---|---|---|
| Collector-emitter voltage | $V_{CE}$ | $T_{vj} \geq 25$ °C | | 1200 | V |
| DC collector current, limited by $T_{vjmax}$ | $I_C$ | limited by bondwire | $T_c = 25$ °C | 216 | A |
| | | | $T_c = 100$ °C | 144 | |
| Pulsed collector current, $t_p$ limited by $T_{vjmax}$ | $I_{Cpulse}$ | | | 360 | A |
| Turn-off safe operating area | | $V_{CE} \leq 1200$ V, $T_{vj} \leq 175$ °C | | 360 | A |
| Gate-emitter voltage | $V_{GE}$ | | | ±20 | V |
| Transient gate-emitter voltage | $V_{GE}$ | $t_p \leq 0.5$ µs, $D < 0.001$ | | ±25 | V |
| Short-circuit withstand time | $t_{SC}$ | $V_{CC} \leq 600$ V, $V_{GE} = 15$ V, Allowed number of short circuits < 1000, Time between short circuits ≥ 1.0 s, $T_{vj} = 150$ °C | | 8 | µs |
| Power dissipation | $P_{tot}$ | $T_{vj} \leq 175$ °C | $T_c = 25$ °C | 1004 | W |
| | | | $T_c = 100$ °C | 502 | |

**Table 3 Characteristic values**

| Parameter | Symbol | Note or test condition | | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Collector-emitter saturation voltage | $V_{CEsat}$ | $I_C = 120$ A, $V_{GE} = 15$ V | $T_{vj} = 25$ °C | | 1.65 | 2 | V |
| | | | $T_{vj} = 175$ °C | | 2 | | |

**(table continues...)**

**Table 3** **(continued) Characteristic values**

| Parameter | Symbol | Note or test condition | | Values Min. | Values Typ. | Values Max. | Unit |
|---|---|---|---|---|---|---|---|
| Gate-emitter threshold voltage | $V_{GEth}$ | $I_C$ = 2.34 mA, $V_{CE}$ = $V_{GE}$ | | 5.1 | 5.7 | 6.5 | V |
| Zero gate-voltage collector current | $I_{CES}$ | $V_{CE}$ = 1200 V, $V_{GE}$ = 0 V | $T_{vj}$ = 25 °C | | | 20 | µA |
| | | | $T_{vj}$ = 175 °C | | 10400 | | |
| Gate-emitter leakage current | $I_{GES}$ | $V_{CE}$ = 0 V, $V_{GE}$ = 20 V | | | | 100 | nA |
| Transconductance | $g_{fs}$ | $I_C$ = 120 A, $V_{CE}$ = 20 V, $T_{vj}$ = 175 °C | | | 51 | | S |
| Short-circuit collector current | $I_{SC}$ | $V_{CC}$ ≤ 600 V, $V_{GE}$ = 15 V, $t_{SC}$ ≤ 8 µs, Allowed number of short circuits < 1000, Time between short circuits ≥ 1.0 s, $T_{vj}$ = 150 °C | | | 720 | | A |
| Input capacitance | $C_{ies}$ | $V_{CE}$ = 25 V, $V_{GE}$ = 0 V, $f$ = 100 kHz | | | 17.3 | | nF |
| Output capacitance | $C_{oes}$ | $V_{CE}$ = 25 V, $V_{GE}$ = 0 V, $f$ = 100 kHz | | | 325 | | pF |
| Reverse transfer capacitance | $C_{res}$ | $V_{CE}$ = 25 V, $V_{GE}$ = 0 V, $f$ = 100 kHz | | | 80 | | pF |
| Gate charge | $Q_G$ | $I_C$ = 120 A, $V_{GE}$ = 15 V, $V_{CC}$ = 960 V | | | 710 | | nC |
| Turn-on delay time | $t_{d(on)}$ | $V_{CC}$ = 600 V, $V_{GE}$ = 0/15 V, $R_{G(on)}$ = 1.3 Ω, $R_{G(off)}$ = 1.3 Ω | $T_{vj}$ = 25 °C, $I_C$ = 120 A | | 44 | | ns |
| | | | $T_{vj}$ = 175 °C, $I_C$ = 120 A | | 42 | | |
| Rise time (inductive load) | $t_r$ | $V_{CC}$ = 600 V, $V_{GE}$ = 0/15 V, $R_{G(on)}$ = 1.3 Ω, $R_{G(off)}$ = 1.3 Ω | $T_{vj}$ = 25 °C, $I_C$ = 120 A | | 34 | | ns |
| | | | $T_{vj}$ = 175 °C, $I_C$ = 120 A | | 35 | | |
| Turn-off delay time | $t_{d(off)}$ | $V_{CC}$ = 600 V, $V_{GE}$ = 0/15 V, $R_{G(on)}$ = 1.3 Ω, $R_{G(off)}$ = 1.3 Ω | $T_{vj}$ = 25 °C, $I_C$ = 120 A | | 215 | | ns |
| | | | $T_{vj}$ = 175 °C, $I_C$ = 120 A | | 256 | | |
| Fall time (inductive load) | $t_f$ | $V_{CC}$ = 600 V, $V_{GE}$ = 0/15 V, $R_{G(on)}$ = 1.3 Ω, $R_{G(off)}$ = 1.3 Ω | $T_{vj}$ = 25 °C, $I_C$ = 120 A | | 106 | | ns |
| | | | $T_{vj}$ = 175 °C, $I_C$ = 120 A | | 200 | | |
| Turn-on energy | $E_{on}$ | $V_{CC}$ = 600 V, $V_{GE}$ = 0/15 V, $R_{G(on)}$ = 1.3 Ω, $R_{G(off)}$ = 1.3 Ω | $T_{vj}$ = 25 °C, $I_C$ = 120 A | | 10.3 | | mJ |
| | | | $T_{vj}$ = 175 °C, $I_C$ = 120 A | | 12.6 | | |

**(table continues...)**

**Table 3 (continued) Characteristic values**

| Parameter | Symbol | Note or test condition | | Values | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Turn-off energy | $E_{off}$ | $V_{CC}$ = 600 V, $V_{GE}$ = 0/15 V, $R_{G(on)}$ = 1.3 Ω, $R_{G(off)}$ = 1.3 Ω | $T_{vj}$ = 25 °C, $I_C$ = 120 A | | 5.72 | | mJ |
| | | | $T_{vj}$ = 175 °C, $I_C$ = 120 A | | 9.5 | | |
| Total switching energy | $E_{ts}$ | $V_{CC}$ = 600 V, $V_{GE}$ = 0/15 V, $R_{G(on)}$ = 1.3 Ω, $R_{G(off)}$ = 1.3 Ω | $T_{vj}$ = 25 °C, $I_C$ = 120 A | | 16.1 | | mJ |
| | | | $T_{vj}$ = 175 °C, $I_C$ = 120 A | | 22.1 | | |
| Operating junction temperature | $T_{vj}$ | | | -40 | | 175 | °C |

*Note:* *Electrical Characteristic, at $T_{vj}$ = 25°C, unless otherwise specified.*

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

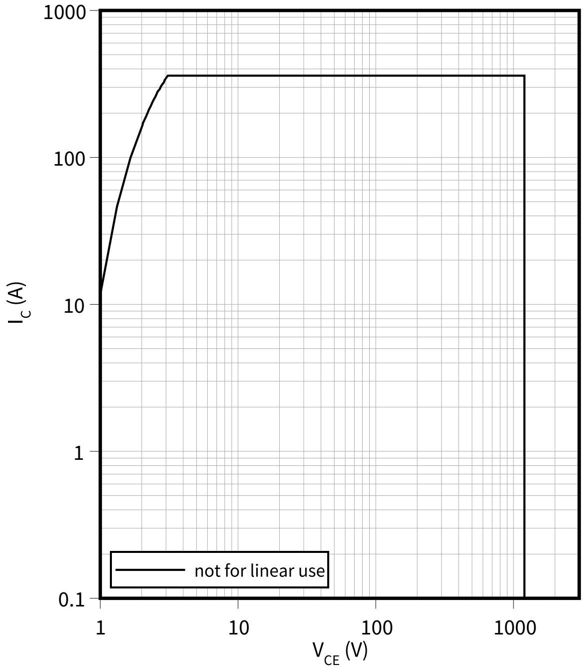
*Dynamic test circuit, parasitic inductance $L_\sigma$ = 30 nH, $C_\sigma$ = 18 pF. Energy losses include “tail” and diode (IKQ120N120CS7) reverse recovery*

# 3 Characteristics diagrams

**Reverse bias safe operating area**

$I_C = f(V_{CE})$

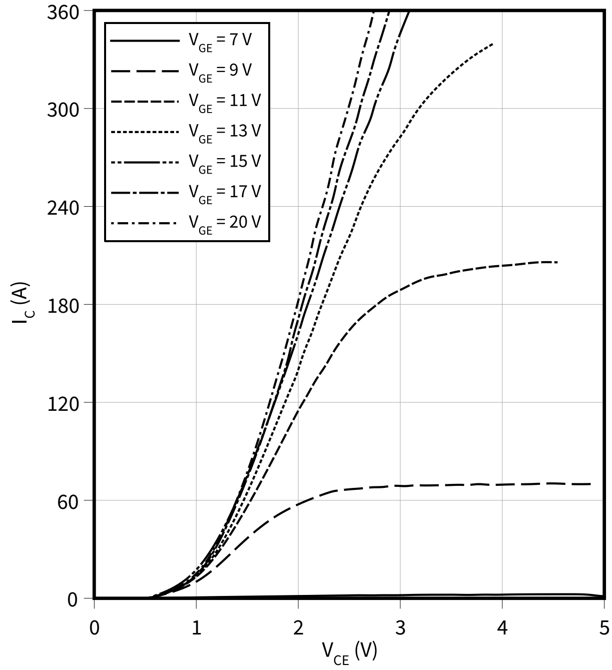
$T_{vj} \leq 175\ °C$, $V_{CE} \leq 1200\ V$




**Typical output characteristic**

$I_C = f(V_{CE})$

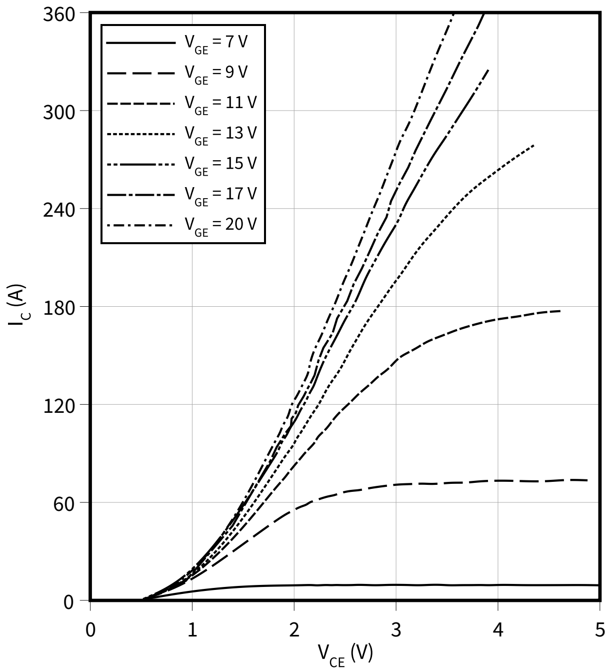
$T_{vj} = 25\ °C$




**Typical output characteristic**

$I_C = f(V_{CE})$

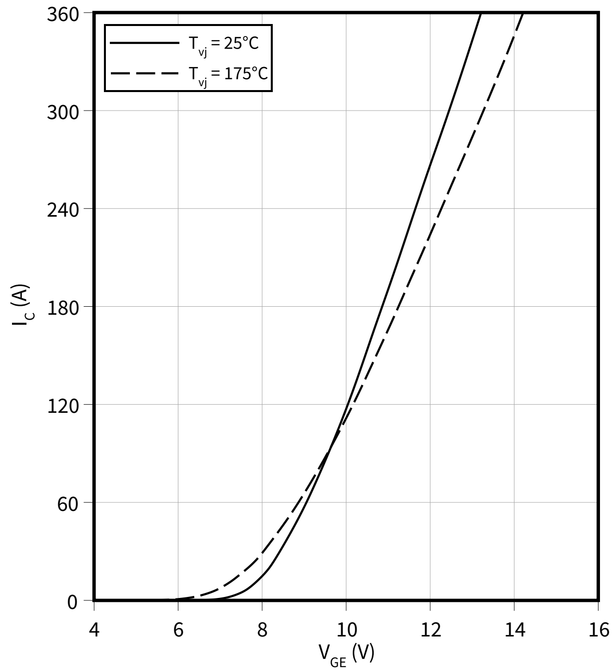
$T_{vj} = 175\ °C$




**Typical transfer characteristic**

$I_C = f(V_{GE})$

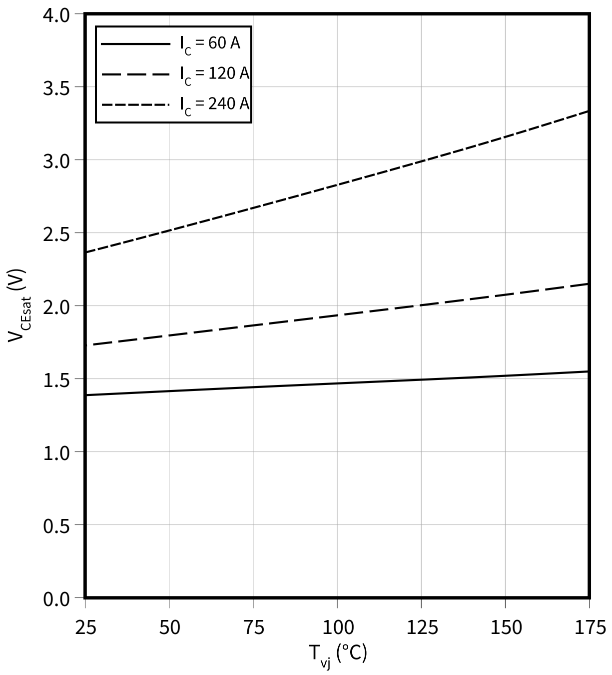
$V_{CE} = 20\ V$



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

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

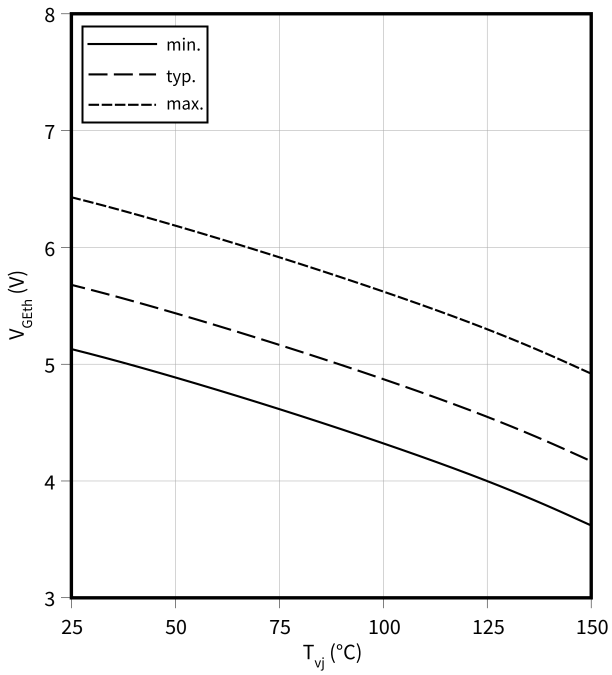
$V_{GE} = 15$ V




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

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

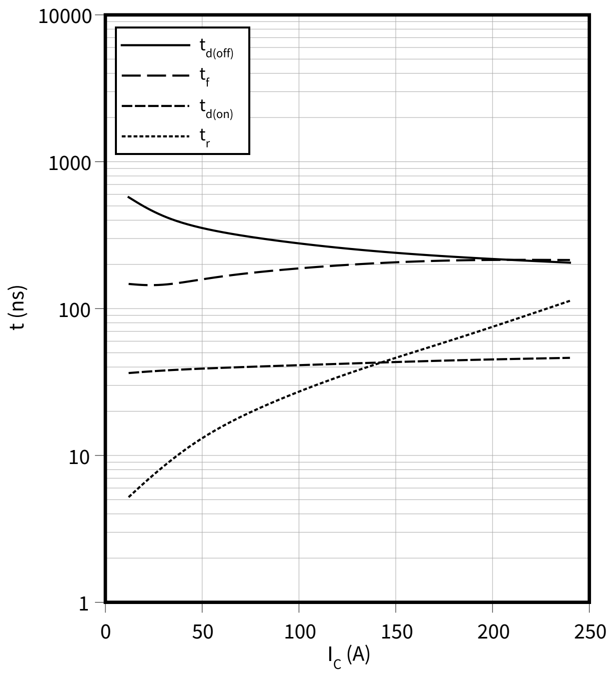
$I_C = 2.34$ mA




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

$t = f(I_C)$

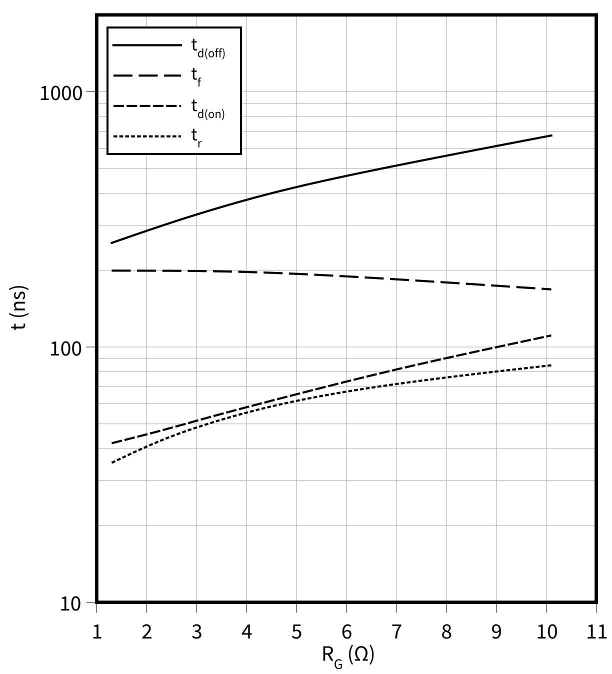
$V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 1.3$ Ω




**Typical switching times as a function of gate resistor**

$t = f(R_G)$

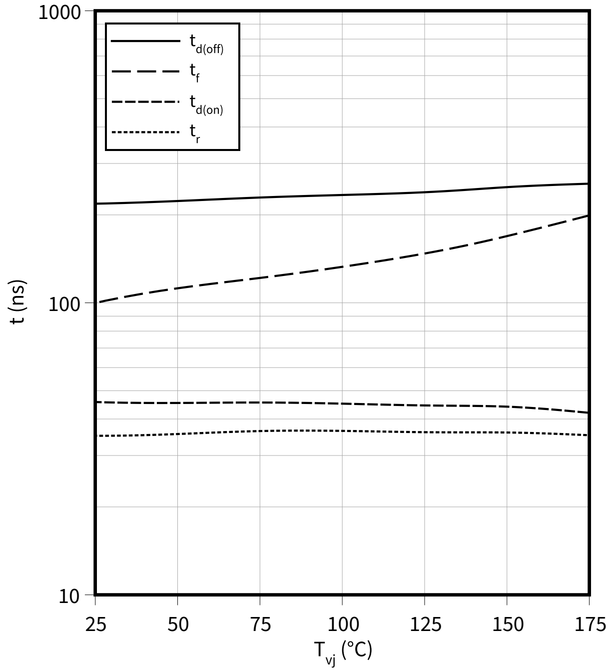
$I_C = 120$ A, $V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V



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

$t = f(T_{vj})$

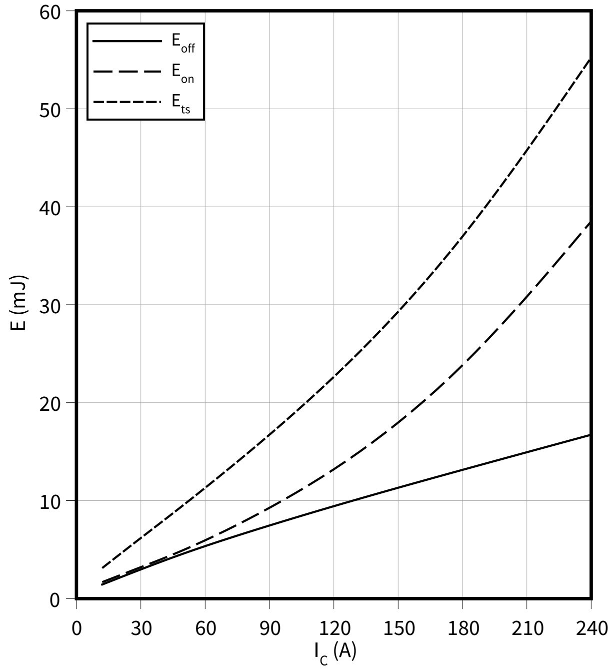
$I_C$ = 120 A, $V_{CC}$ = 600 V, $V_{GE}$ = 0/15 V, $R_G$ = 1.3 Ω




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

$E = f(I_C)$

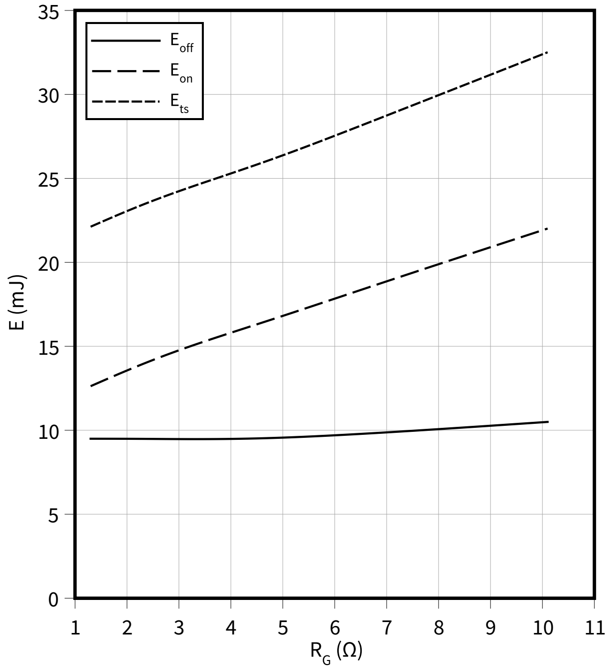
$V_{CC}$ = 600 V, $T_{vj}$ = 175 °C, $V_{GE}$ = 0/15 V, $R_G$ = 1.3 Ω




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

$E = f(R_G)$

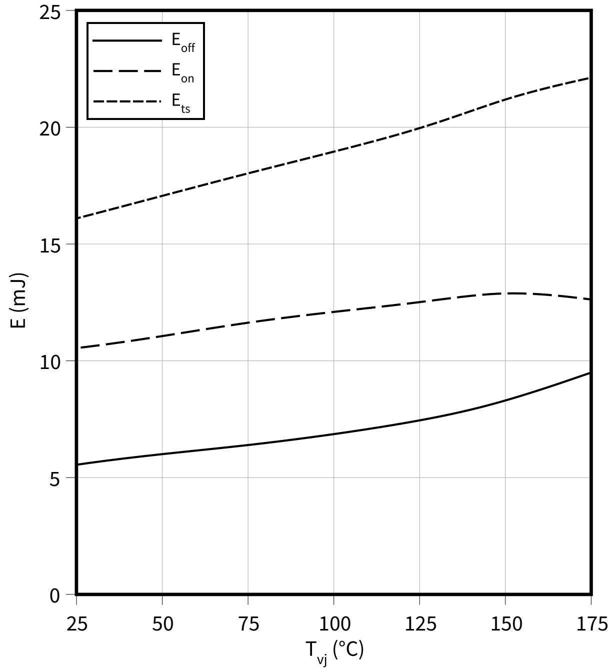
$I_C$ = 120 A, $V_{CC}$ = 600 V, $T_{vj}$ = 175 °C, $V_{GE}$ = 0/15 V




### Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

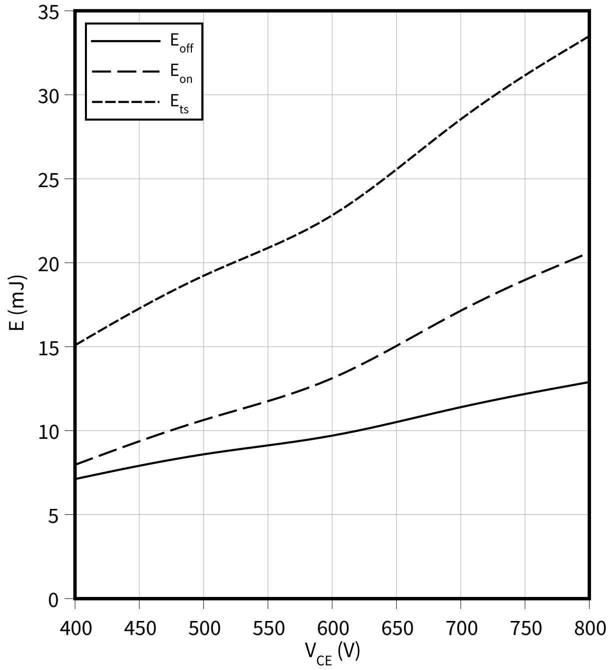
$I_C$ = 120 A, $V_{CC}$ = 600 V, $V_{GE}$ = 0/15 V, $R_G$ = 1.3 Ω



**Typical switching energy losses as a function of collector emitter voltage**

$E = f(V_{CE})$

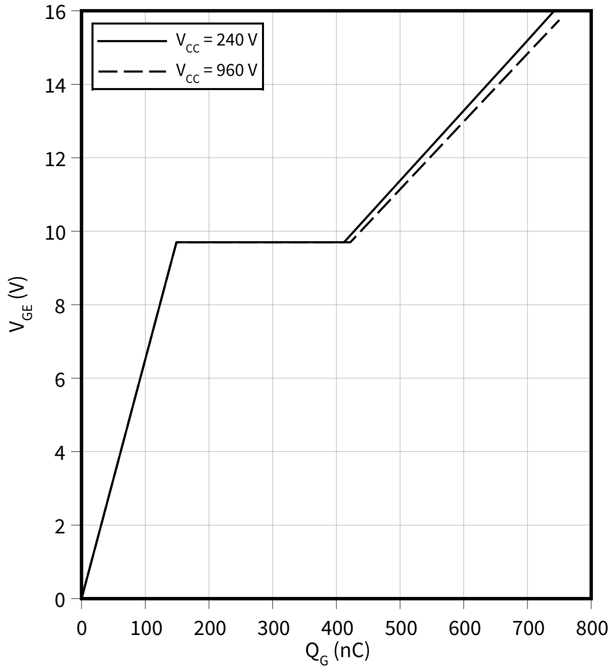
$I_C = 120$ A, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 1.3$ Ω




**Typical gate charge**

$V_{GE} = f(Q_G)$

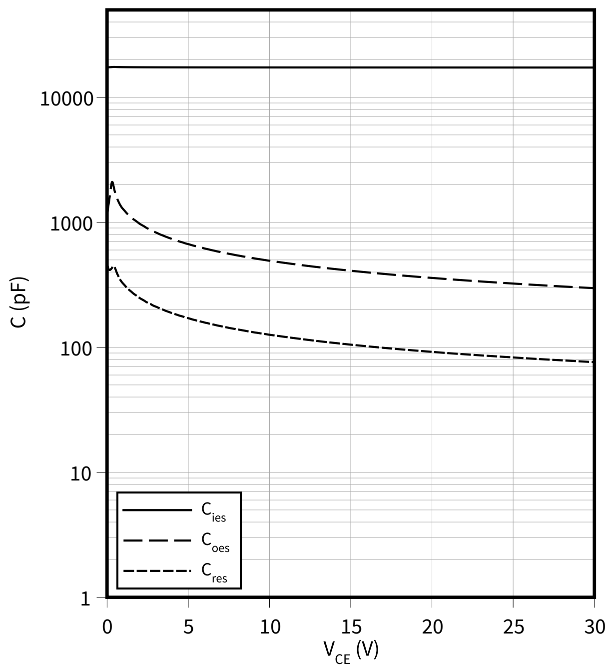
$I_C = 120$ A




**Typical capacitance as a function of collector-emitter voltage**

$C = f(V_{CE})$

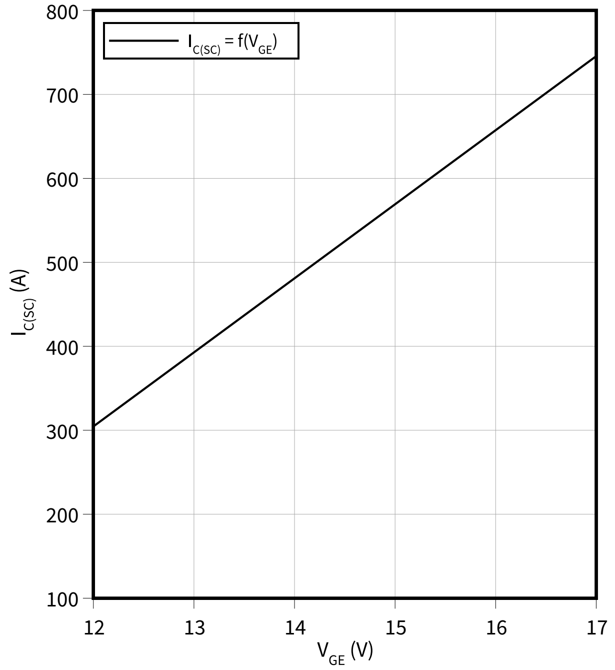
f = 100 kHz, $V_{GE} = 0$ V




**Typical short circuit collector current as a function of gate-emitter voltage**

$I_{C(SC)} = f(V_{GE})$

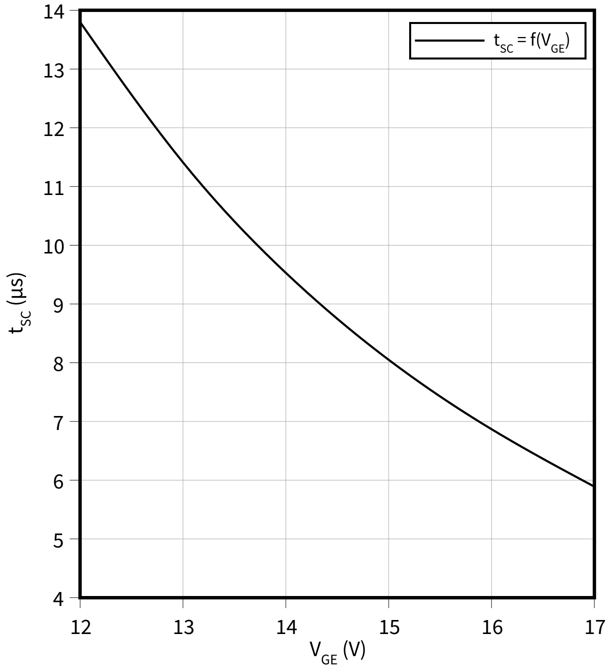
$T_{vj} = 150$ °C, $V_{CC} \leq 600$ V



**Short circuit withstand time as a function of gate-emitter voltage**

$t_{SC} = f(V_{GE})$

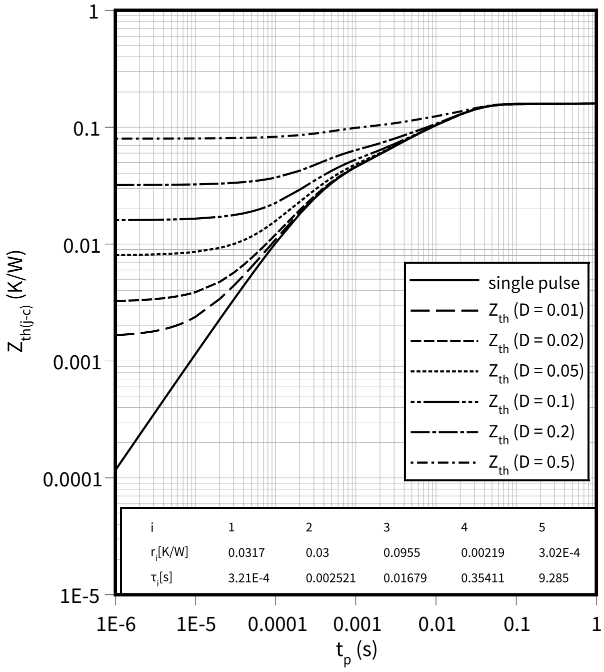
$T_{vj} \leq 150\ °C$, $V_{CC} \leq 600\ V$




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

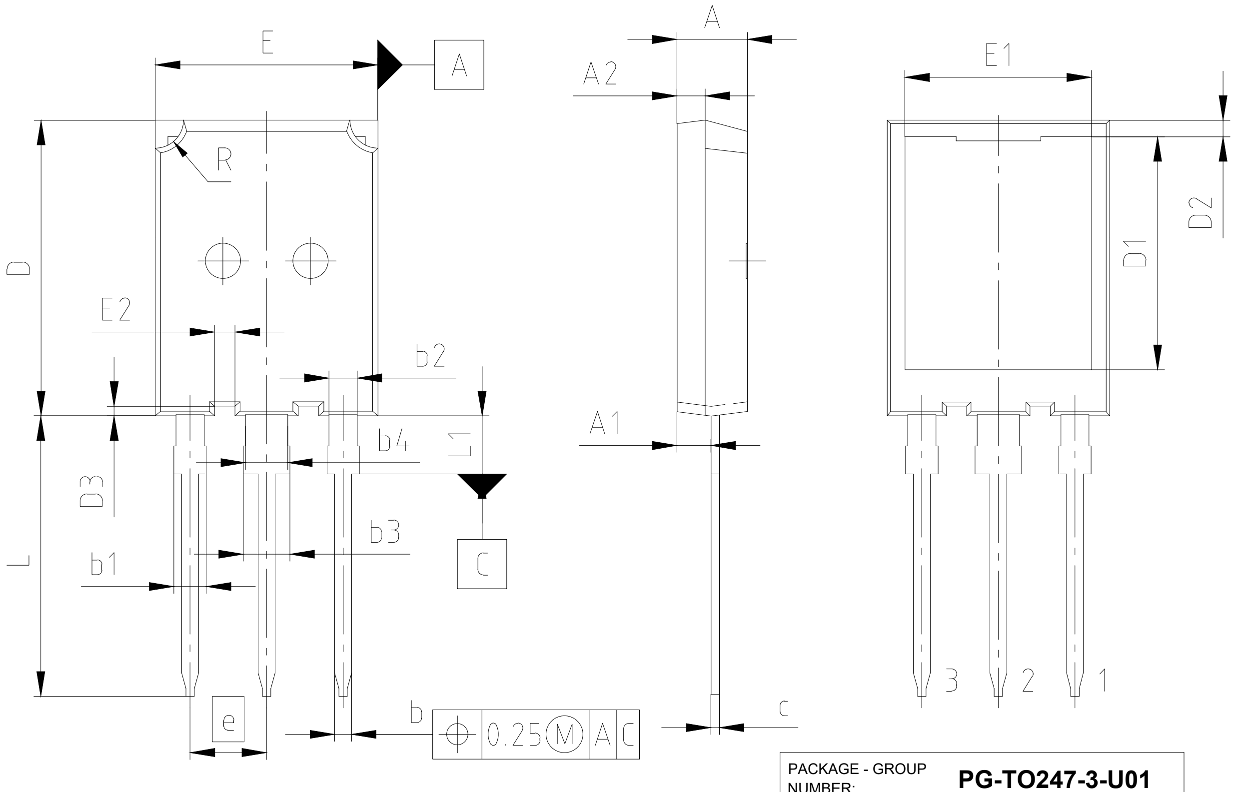
$Z_{th(j-c)} = f(t_p)$

$D = t_p/T$



# 4 Package outlines

**PG-TO247-3-PLUS-NN3.7**




| PACKAGE - GROUP NUMBER: | PG-TO247-3-U01 | |
|---|---|---|
| **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** | --- | 2.25 |
| **b2** | 1.96 | 2.06 |
| **b3** | --- | 3.25 |
| **b4** | 2.96 | 3.06 |
| **c** | 0.59 | 0.66 |
| **D** | 20.90 | 21.10 |
| **D1** | 16.25 | 16.85 |
| **D2** | 1.05 | 1.35 |
| **D3** | 0.58 | 0.78 |
| **E** | 15.70 | 15.90 |
| **E1** | 13.10 | 13.50 |
| **E2** | 1.35 | 1.55 |
| **e** | 5.44 (BSC) | |
| **N** | 3 | |
| **L** | 19.80 | 20.10 |
| **L1** | 3.90 | 4.30 |
| **R** | 1.90 | 2.10 |

NOTE:
DIMENSIONS DO NOT INCLUDE MOLDFLASH; PROTRUSION OR GATE BURRS

**Figure 1**

# 5 Testing conditions

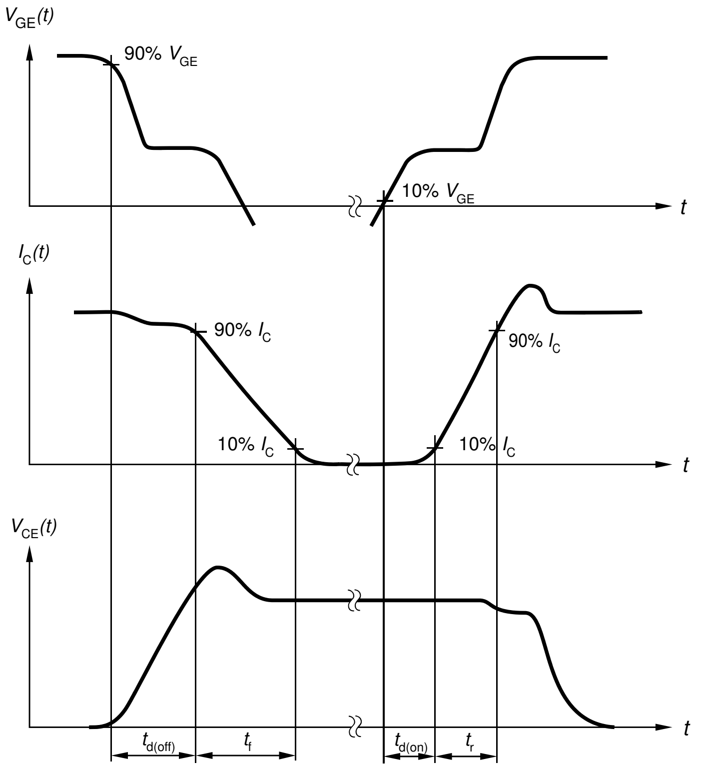



Figure A. **Definition of switching times**

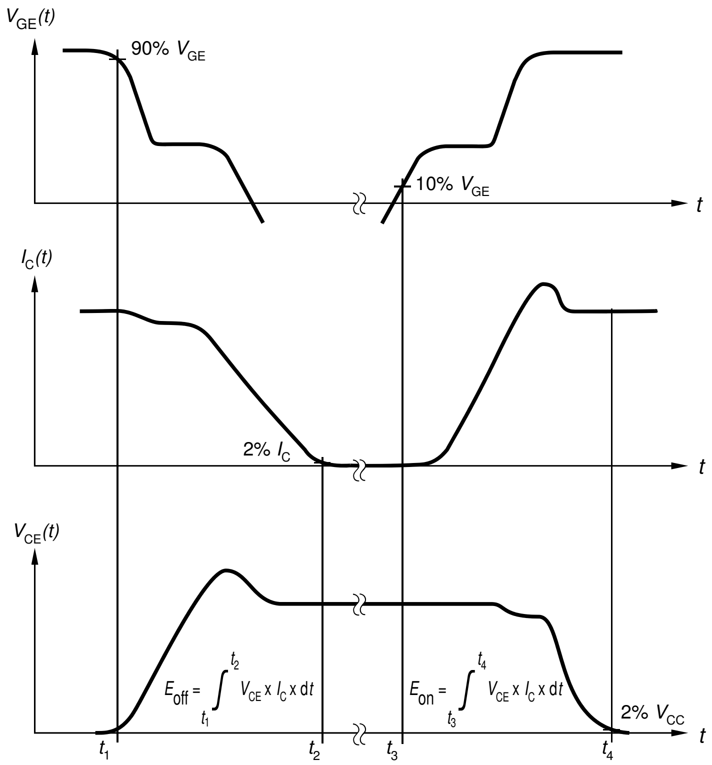



Figure B. **Definition of switching losses**

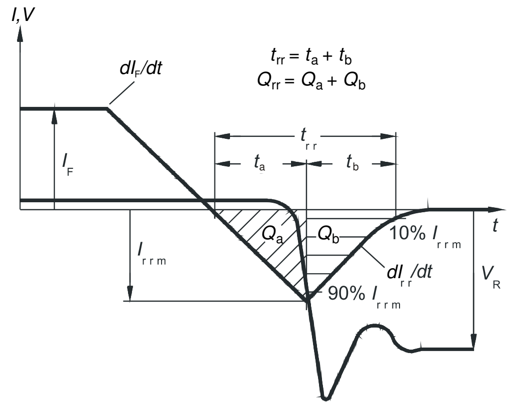



Figure C. **Definition of diode switching characteristics**

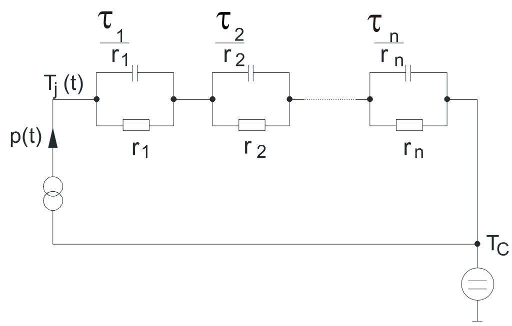



Figure D. **Thermal equivalent circuit**

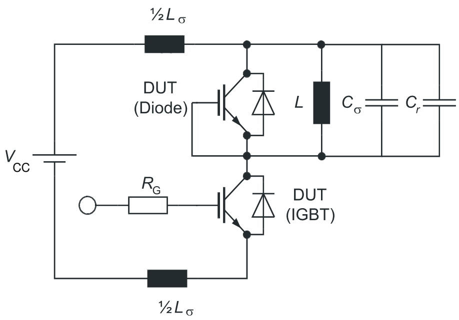



Figure E. **Dynamic test circuit**
Parasitic inductance $L_\sigma$,
parasitic capacitor $C_\sigma$,
relief capacitor $C_r$,
(only for ZVT switching)

**Figure 2**

## Revision history

| Document revision | Date of release | Description of changes |
|---|---|---|
| 0.10 | 2022-05-06 | Target datasheet |
| 1.00 | 2022-12-05 | Final datasheet |
| 1.10 | 2023-01-23 | Correction of boundary condition of diagrams $I_{C(SC)} = f(V_{GE})$ and $t_{SC} = f(V_{GE})$<br>Change of product outline drawing on page 11 |

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**Email: erratum@infineon.com**

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