

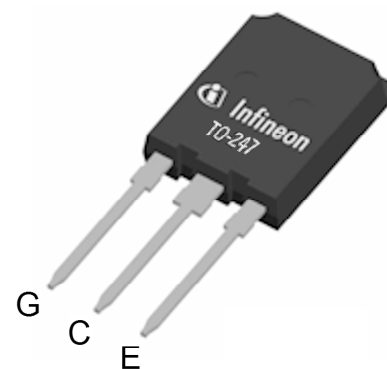
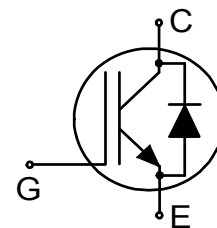
TRENCHSTOP™ 2 low $V_{ce(sat)}$ second generation IGBT

Low $V_{ce(sat)}$ IGBT in TRENCHSTOP™ 2 technology copacked with soft, fast recovery full current rated anti-parallel Emitter Controlled Diode

Features:

TRENCHSTOP™ 2 technology offers:

- Very low $V_{CE(sat)}$, 1.75V at nominal current
- 10µsec short circuit withstand time at $T_{vj}=175^{\circ}C$
- Easy paralleling capability due to positive temperature coefficient in $V_{CE(sat)}$
- Low EMI
- Very soft, fast recovery full current anti-parallel diode
- Maximum junction temperature $175^{\circ}C$
- Pb-free lead plating; RoHS compliant
- Complete product spectrum and PSpice Models:
<http://www.infineon.com/igbt>



Applications:

- GPD (General Purpose Drives)
- Servo Drives
- Commercial Vehicles
- Agricultural Vehicles
- Three-level Solar String Inverter
- Welding

Product Validation:

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



Key Performance and Package Parameters

| Type | V_{CE} | I_C | $V_{CEsat}, T_{vj}=25^{\circ}C$ | T_{vjmax} | Marking | Package |
|--------------|----------|-------|---------------------------------|----------------|---------|---------------|
| IKQ75N120CT2 | 1200V | 75A | 1.75V | $175^{\circ}C$ | K75MCT2 | PG-TO247-3-46 |

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TRENCHSTOP™ 2 low $V_{ce(sat)}$ second generation IGBT

Maximum Ratings

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

| Parameter | Symbol | Value | Unit |
|---|-------------|----------------|--------------------|
| Collector-emitter voltage, $T_{vj} \geq 25^{\circ}\text{C}$ | V_{CE} | 1200 | V |
| DC collector current, limited by T_{vjmax} $T_c = 25^{\circ}\text{C}$ value limited by bondwire $T_c = 137^{\circ}\text{C}$ | I_C | 150.0 75.0 | A |
| Pulsed collector current, t_p limited by T_{vjmax} | I_{Cpuls} | 300.0 | A |
| Turn off safe operating area $V_{CE} \leq 1200\text{V}$, $T_{vj} \leq 175^{\circ}\text{C}$, $t_p = 1\mu\text{s}$ | - | 300.0 | A |
| Diode forward current, limited by T_{vjmax} $T_c = 25^{\circ}\text{C}$ value limited by bondwire $T_c = 100^{\circ}\text{C}$ | I_F | 150.0 75.0 | A |
| Diode pulsed current, t_p limited by T_{vjmax} | I_{Fpuls} | 300.0 | A |
| Gate-emitter voltage | V_{GE} | ± 20 | V |
| Short circuit withstand time $V_{GE} = 15.0\text{V}$, $V_{CC} \leq 600\text{V}$ Allowed number of short circuits < 1000 Time between short circuits: $\geq 1.0\text{s}$ $T_{vj} = 175^{\circ}\text{C}$ | t_{SC} | 10 | μs |
| Power dissipation $T_c = 25^{\circ}\text{C}$ Power dissipation $T_c = 137^{\circ}\text{C}$ | P_{tot} | 938.0 237.0 | W |
| Operating junction temperature | T_{vj} | -40...+175 | $^{\circ}\text{C}$ |
| Storage temperature | T_{stg} | -55...+150 | $^{\circ}\text{C}$ |
| Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s | | 260 | $^{\circ}\text{C}$ |

Thermal Resistance

| Parameter | Symbol | Conditions | Value | | | Unit |
|--|---------------|------------|-------|------|------|------|
| | | | min. | typ. | max. | |
| R_{th} Characteristics | | | | | | |
| IGBT thermal resistance, ¹⁾ junction - case | $R_{th(j-c)}$ | | - | - | 0.16 | K/W |
| Diode thermal resistance, ¹⁾ junction - case | $R_{th(j-c)}$ | | - | - | 0.28 | K/W |
| Thermal resistance junction - ambient | $R_{th(j-a)}$ | | - | - | 40 | K/W |

¹⁾ Thermal resistance of thermal grease $R_{th(c-s)}$ (case to heat sink) of more than 0.1K/W not included.

TRENCHSTOP™ 2 low $V_{ce(sat)}$ second generation IGBTElectrical Characteristic, at $T_{vj} = 25^{\circ}\text{C}$, unless otherwise specified

| Parameter | Symbol | Conditions | Value | | | Unit |
|--------------------------------------|---------------|--|--------|--------------|-----------|---------------|
| | | | min. | typ. | max. | |
| Static Characteristic | | | | | | |
| Collector-emitter breakdown voltage | $V_{(BR)CES}$ | $V_{GE} = 0\text{V}, I_C = 0.50\text{mA}$ | 1200 | - | - | V |
| Collector-emitter saturation voltage | V_{CEsat} | $V_{GE} = 15.0\text{V}, I_C = 75.0\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$ | - - | 1.75 2.30 | 2.15 - | V |
| Diode forward voltage | V_F | $V_{GE} = 0\text{V}, I_F = 75.0\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$ | - - | 1.90 1.85 | 2.30 - | V |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $I_C = 2.60\text{mA}, V_{CE} = V_{GE}$ | 5.1 | 5.8 | 6.5 | V |
| Zero gate voltage collector current | I_{CES} | $V_{CE} = 1200\text{V}, V_{GE} = 0\text{V}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$ | - - | - 5000 | 450 - | μA |
| Gate-emitter leakage current | I_{GES} | $V_{CE} = 0\text{V}, V_{GE} = 20\text{V}$ | - | - | 100 | nA |
| Transconductance | g_{fs} | $V_{CE} = 20\text{V}, I_C = 75.0\text{A}$ | - | 27.0 | - | S |

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

| Parameter | Symbol | Conditions | Value | | | Unit |
|--|-----------|--|-------|-------|------|------|
| | | | min. | typ. | max. | |
| Dynamic Characteristic | | | | | | |
| Input capacitance | C_{ies} | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$ | - | 4856 | - | pF |
| Output capacitance | C_{oes} | | - | 505 | - | |
| Reverse transfer capacitance | C_{res} | | - | 290 | - | |
| Gate charge | Q_G | $V_{CC} = 960\text{V}, I_C = 75.0\text{A},$ $V_{GE} = 15\text{V}$ | - | 370.0 | - | nC |
| Internal emitter inductance measured 5mm (0.197 in.) from case | L_E | | - | 13.0 | - | nH |

Switching Characteristic, Inductive Load

| Parameter | Symbol | Conditions | Value | | | Unit |
|-----------|--------|------------|-------|------|------|------|
| | | | min. | typ. | max. | |

IGBT Characteristic, at $T_{vj} = 25^{\circ}\text{C}$

| | | | | | | |
|------------------------|--------------|---|---|-------|---|----|
| Turn-on delay time | $t_{d(on)}$ | $T_{vj} = 25^{\circ}\text{C},$ $V_{CC} = 600\text{V}, I_C = 75.0\text{A},$ $V_{GE} = 0.0/15.0\text{V},$ $R_{G(on)} = 6.0\Omega, R_{G(off)} = 6.0\Omega,$ $L_{\sigma} = 90\text{nH}, C_{\sigma} = 67\text{pF}$ L_{σ}, C_{σ} from Fig. E Energy losses include "tail" and diode reverse recovery. | - | 37 | - | ns |
| Rise time | t_r | | - | 49 | - | ns |
| Turn-off delay time | $t_{d(off)}$ | | - | 326 | - | ns |
| Fall time | t_f | | - | 46 | - | ns |
| Turn-on energy | E_{on} | | - | 6.70 | - | mJ |
| Turn-off energy | E_{off} | | - | 4.10 | - | mJ |
| Total switching energy | E_{ts} | | - | 10.80 | - | mJ |

TRENCHSTOP™ 2 low $V_{ce(sat)}$ second generation IGBTDiode Characteristic, at $T_{vj} = 25^{\circ}\text{C}$

| | | | | | | |
|--|--------------|--|---|------|---|------------------------|
| Diode reverse recovery time | t_{rr} | $T_{vj} = 25^{\circ}\text{C},$ $V_R = 600\text{V},$ $I_F = 75.0\text{A},$ $di_F/dt = 800\text{A}/\mu\text{s}$ | - | 320 | - | ns |
| Diode reverse recovery charge | Q_{rr} | | - | 5.10 | - | μC |
| Diode peak reverse recovery current | I_{rrm} | | - | 29.0 | - | A |
| Diode peak rate of fall of reverse recovery current during t_b | di_{rr}/dt | | - | -300 | - | $\text{A}/\mu\text{s}$ |

Switching Characteristic, Inductive Load

| Parameter | Symbol | Conditions | Value | | | Unit |
|-----------|--------|------------|-------|------|------|------|
| | | | min. | typ. | max. | |

IGBT Characteristic, at $T_{vj} = 175^{\circ}\text{C}$

| | | | | | | |
|------------------------|--------------|--|---|-------|---|----|
| Turn-on delay time | $t_{d(on)}$ | $T_{vj} = 175^{\circ}\text{C},$ $V_{CC} = 600\text{V}, I_C = 75.0\text{A},$ $V_{GE} = 0.0/15.0\text{V},$ $R_{G(on)} = 6.0\Omega, R_{G(off)} = 6.0\Omega,$ $L\sigma = 90\text{nH}, C\sigma = 67\text{pF}$ $L\sigma, C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery. | - | 35 | - | ns |
| Rise time | t_r | | - | 50 | - | ns |
| Turn-off delay time | $t_{d(off)}$ | | - | 460 | - | ns |
| Fall time | t_f | | - | 103 | - | ns |
| Turn-on energy | E_{on} | | - | 10.30 | - | mJ |
| Turn-off energy | E_{off} | | - | 9.10 | - | mJ |
| Total switching energy | E_{ts} | | - | 19.40 | - | mJ |

Diode Characteristic, at $T_{vj} = 175^{\circ}\text{C}$

| | | | | | | |
|--|--------------|---|---|-------|---|------------------------|
| Diode reverse recovery time | t_{rr} | $T_{vj} = 175^{\circ}\text{C},$ $V_R = 600\text{V},$ $I_F = 75.0\text{A},$ $di_F/dt = 800\text{A}/\mu\text{s}$ | - | 600 | - | ns |
| Diode reverse recovery charge | Q_{rr} | | - | 13.30 | - | μC |
| Diode peak reverse recovery current | I_{rrm} | | - | 42.0 | - | A |
| Diode peak rate of fall of reverse recovery current during t_b | di_{rr}/dt | | - | -125 | - | $\text{A}/\mu\text{s}$ |

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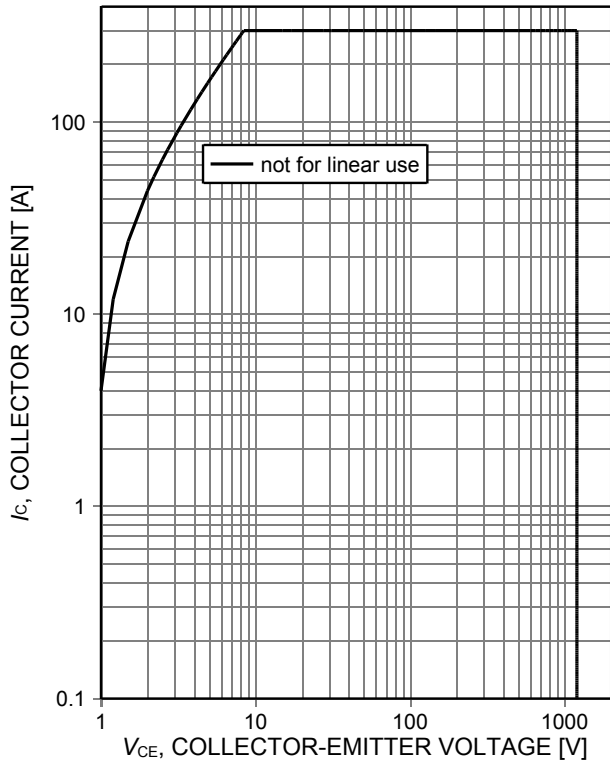


Figure 1. **Forward bias safe operating area**
($D=0$, $T_C=25^\circ\text{C}$, $T_{vj}\leq 175^\circ\text{C}$; $V_{GE}=15\text{V}$)

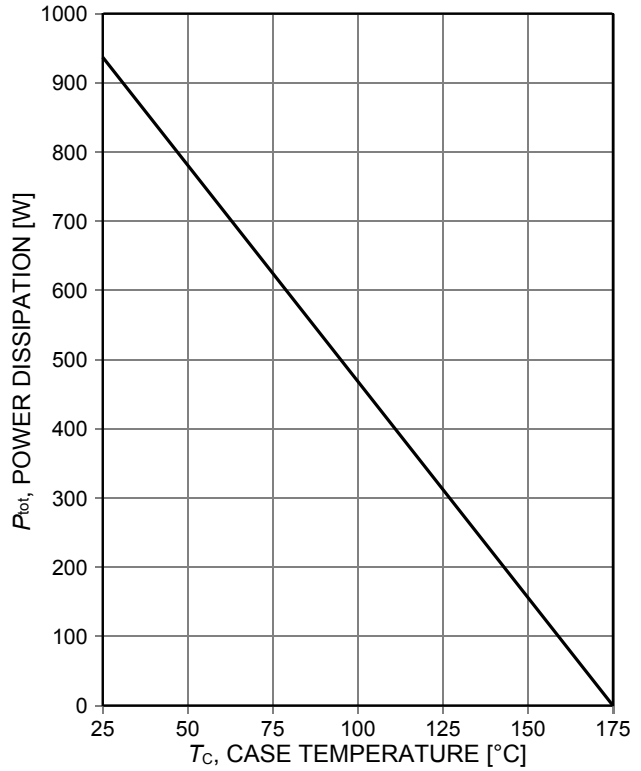


Figure 2. **Power dissipation as a function of case temperature**
($T_{vj}\leq 175^\circ\text{C}$)

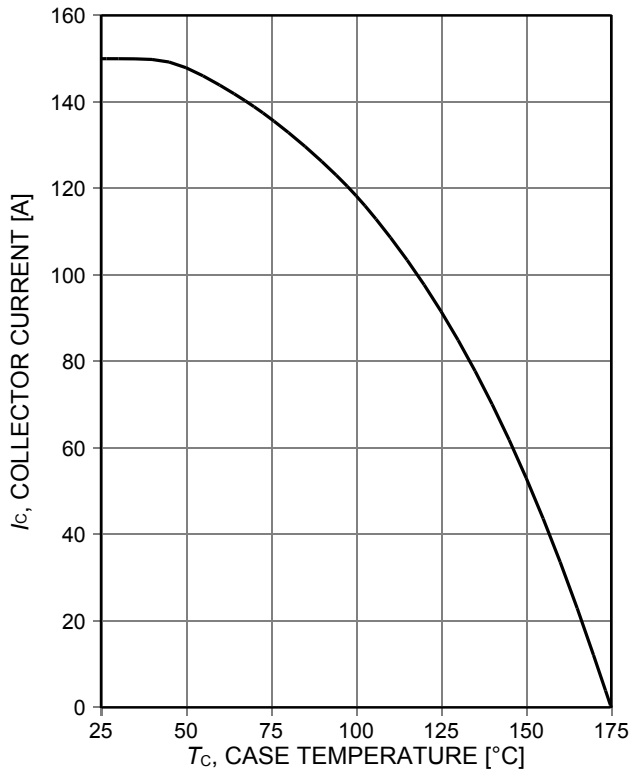


Figure 3. **Collector current as a function of case temperature**
($V_{GE}\geq 15\text{V}$, $T_{vj}\leq 175^\circ\text{C}$)

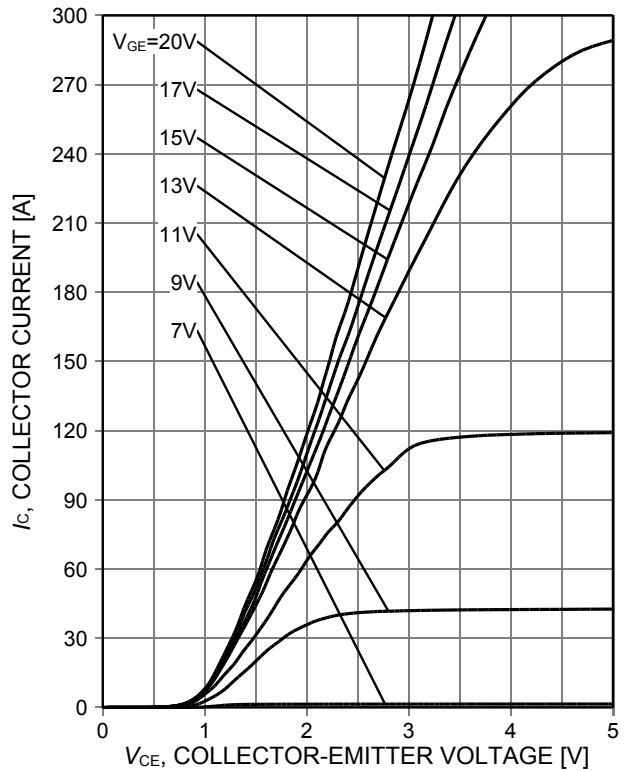


Figure 4. **Typical output characteristic**
($T_{vj}=25^\circ\text{C}$)

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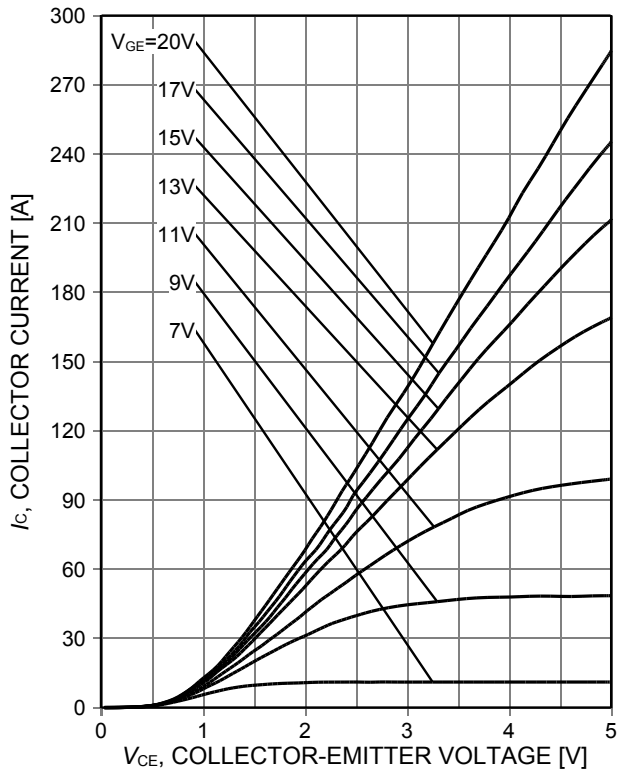


Figure 5. Typical output characteristic ($T_{vj}=175^{\circ}\text{C}$)

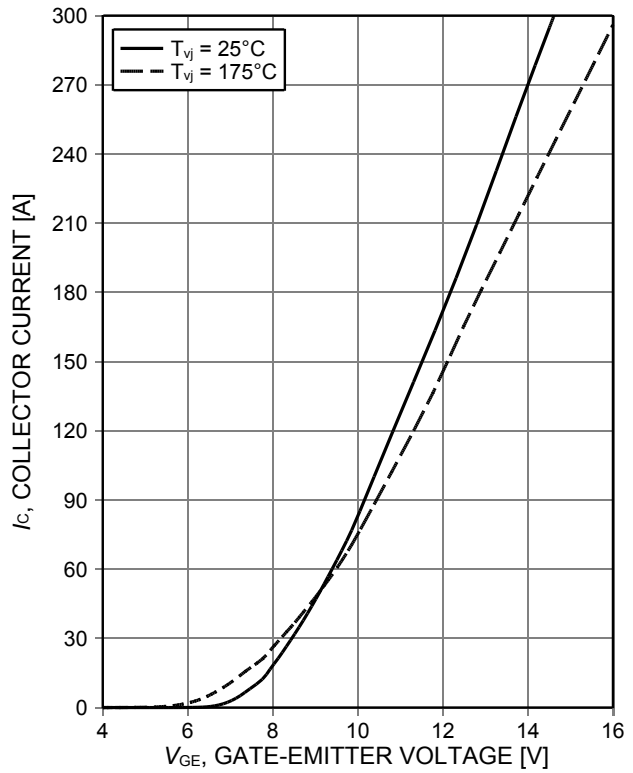


Figure 6. Typical transfer characteristic ($V_{CE}=20\text{V}$)

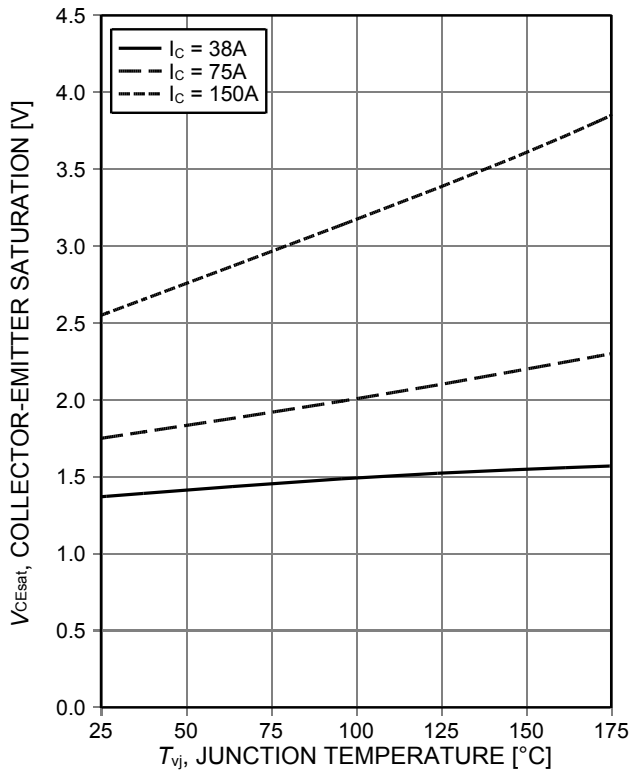


Figure 7. Typical collector-emitter saturation voltage as a function of junction temperature ($V_{GE}=15\text{V}$)

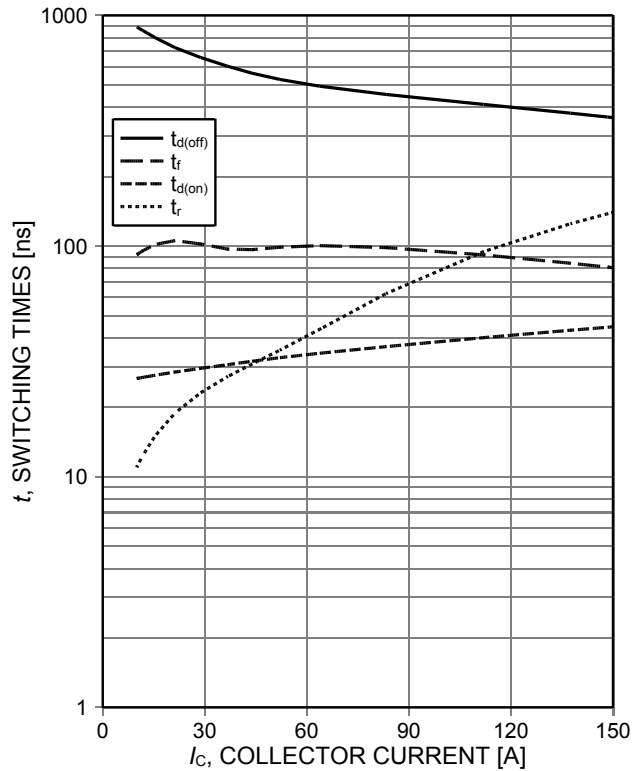


Figure 8. Typical switching times as a function of collector current (inductive load, $T_{vj}=175^{\circ}\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $r_G=6\Omega$, Dynamic test circuit in Figure E)

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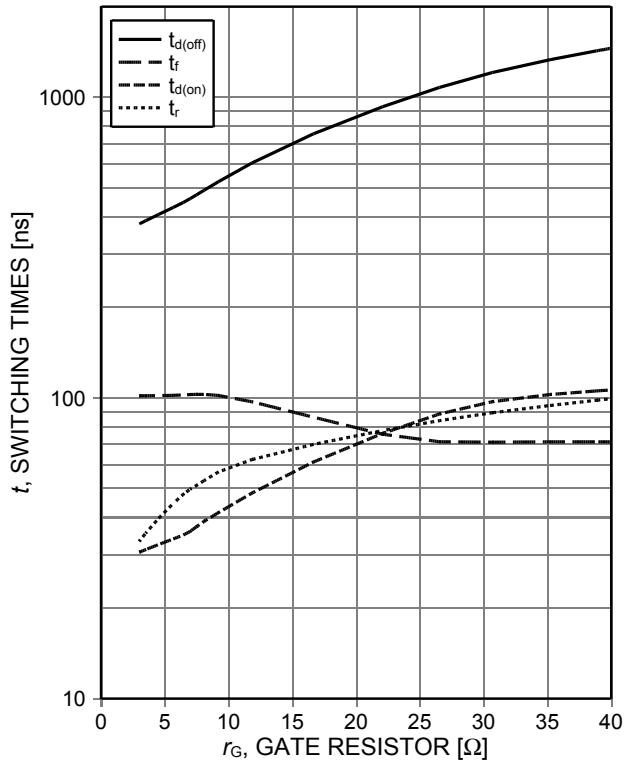


Figure 9. **Typical switching times as a function of gate resistor**
(inductive load, $T_{vj}=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=75\text{A}$, Dynamic test circuit in Figure E)

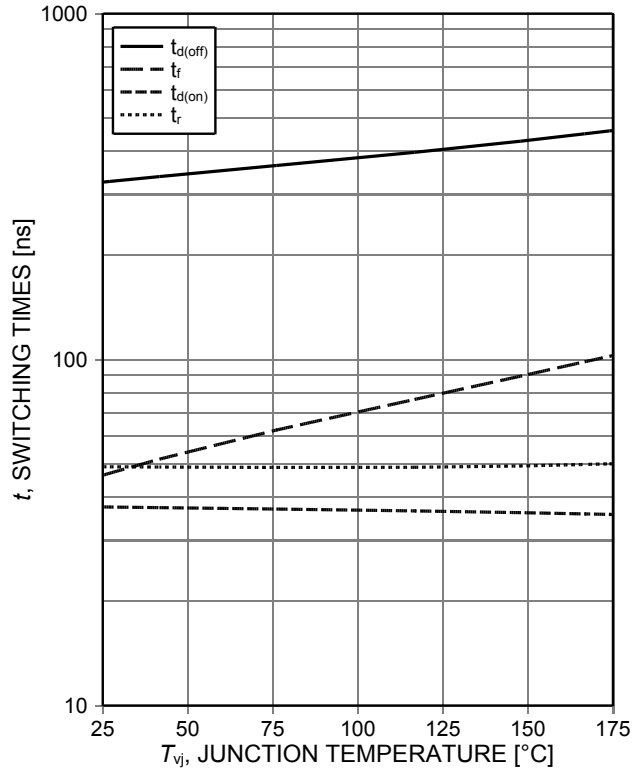


Figure 10. **Typical switching times as a function of junction temperature**
(inductive load, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=75\text{A}$, $r_G=6\Omega$, Dynamic test circuit in Figure E)

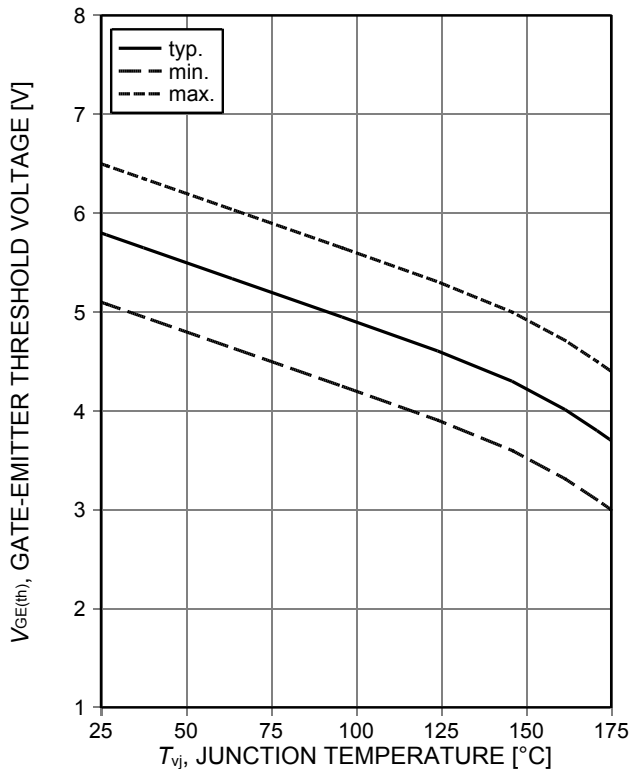


Figure 11. **Gate-emitter threshold voltage as a function of junction temperature**
($I_C=2.6\text{mA}$)

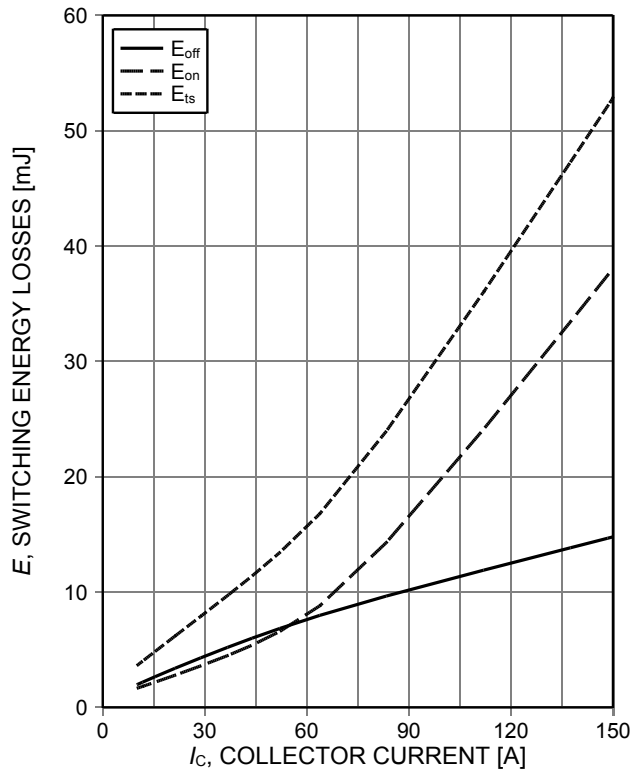


Figure 12. **Typical switching energy losses as a function of collector current**
(inductive load, $T_{vj}=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $r_G=6\Omega$, Dynamic test circuit in Figure E)

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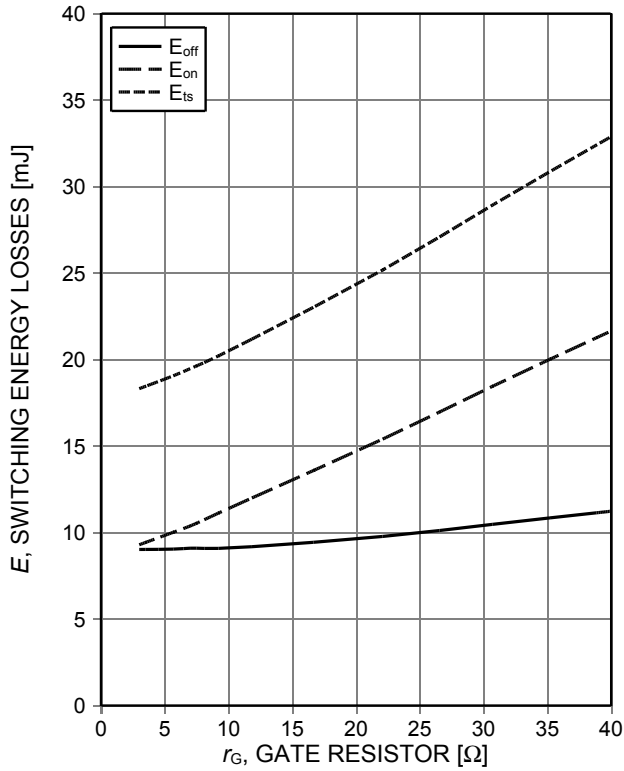


Figure 13. **Typical switching energy losses as a function of gate resistor**
 (inductive load, $T_{vj}=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=75\text{A}$, Dynamic test circuit in Figure E)

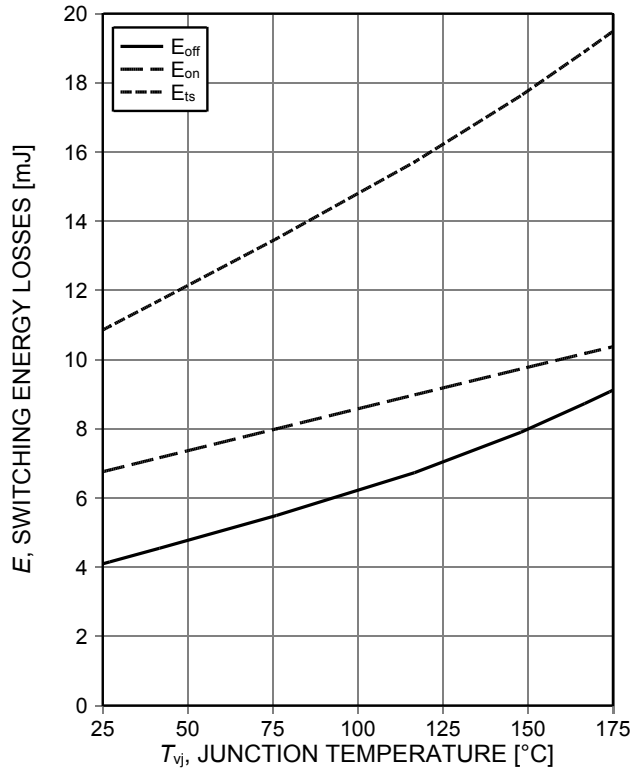


Figure 14. **Typical switching energy losses as a function of junction temperature**
 (inductive load, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=75\text{A}$, $r_G=6\Omega$, Dynamic test circuit in Figure E)

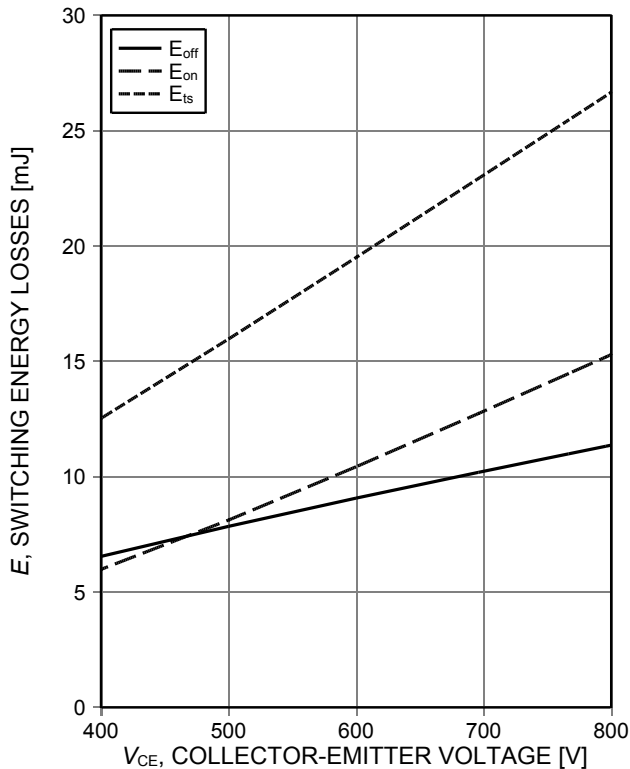


Figure 15. **Typical switching energy losses as a function of collector emitter voltage**
 (inductive load, $T_{vj}=175^\circ\text{C}$, $V_{GE}=0/15\text{V}$, $I_C=75\text{A}$, $r_G=6\Omega$, Dynamic test circuit in Figure E)

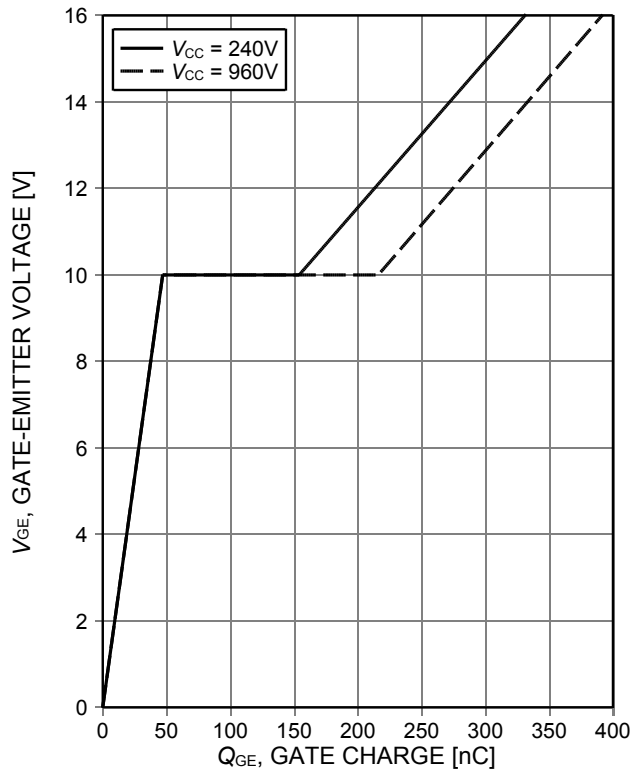


Figure 16. **Typical gate charge**
 ($I_C=75\text{A}$)

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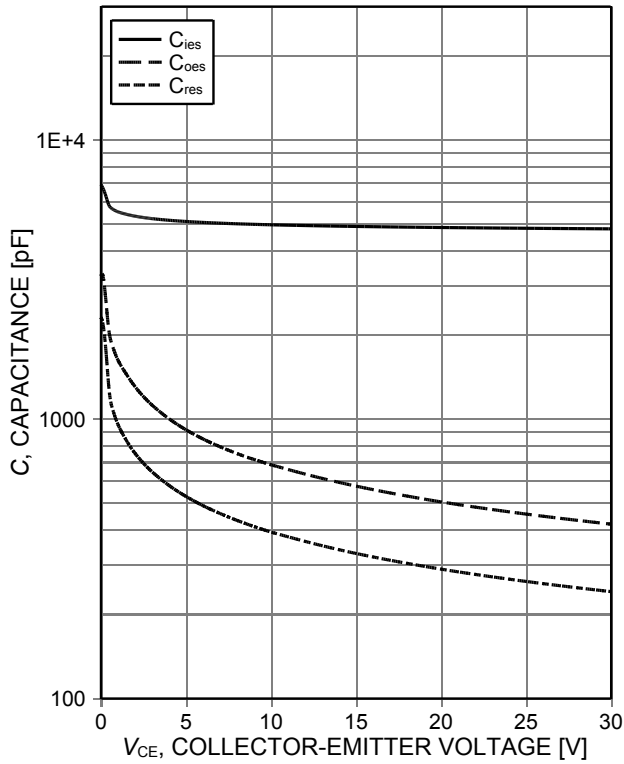


Figure 17. Typical capacitance as a function of collector-emitter voltage ($V_{GE}=0V$, $f=1MHz$)

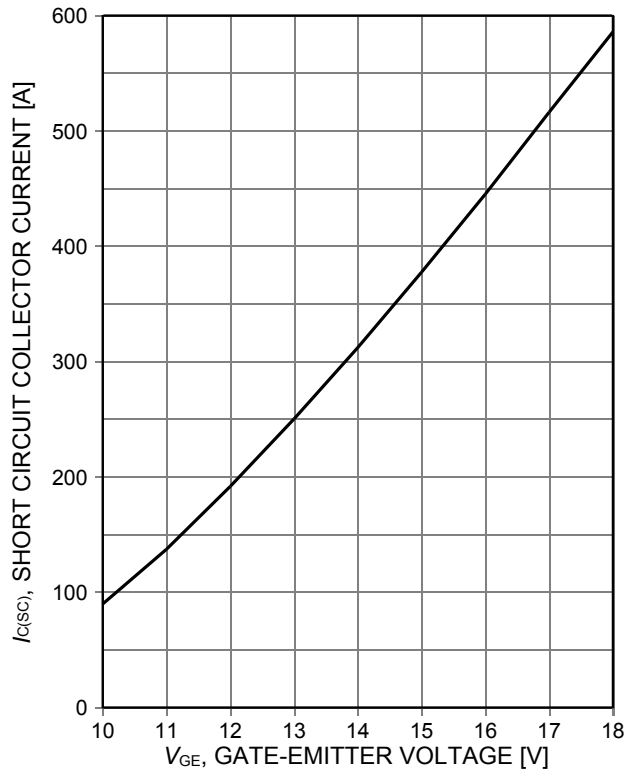


Figure 18. Typical short circuit collector current as a function of gate-emitter voltage ($V_{CE}\leq 600V$, $T_{vj}\leq 175^\circ C$)

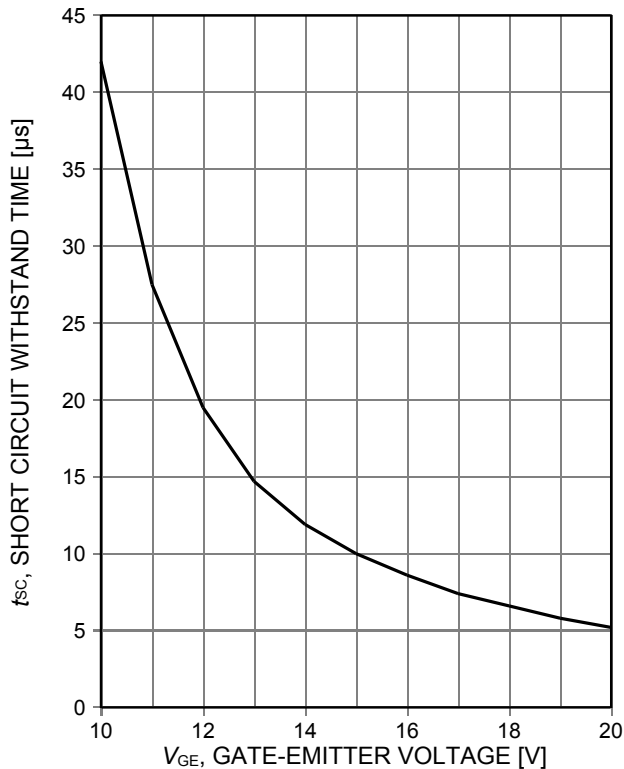


Figure 19. Short circuit withstand time as a function of gate-emitter voltage ($V_{CE}\leq 600V$, start at $T_{vj}\leq 175^\circ C$)

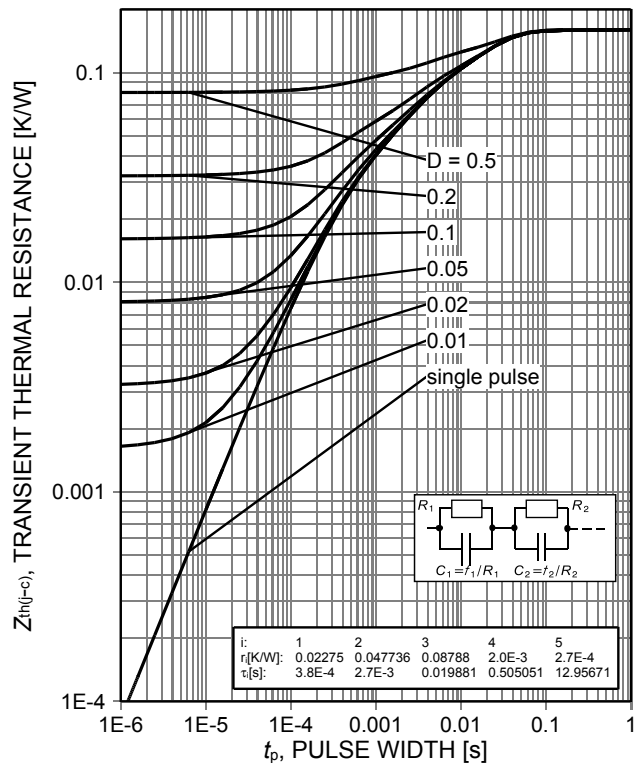


Figure 20. IGBT transient thermal resistance ($D=t_p/T$)

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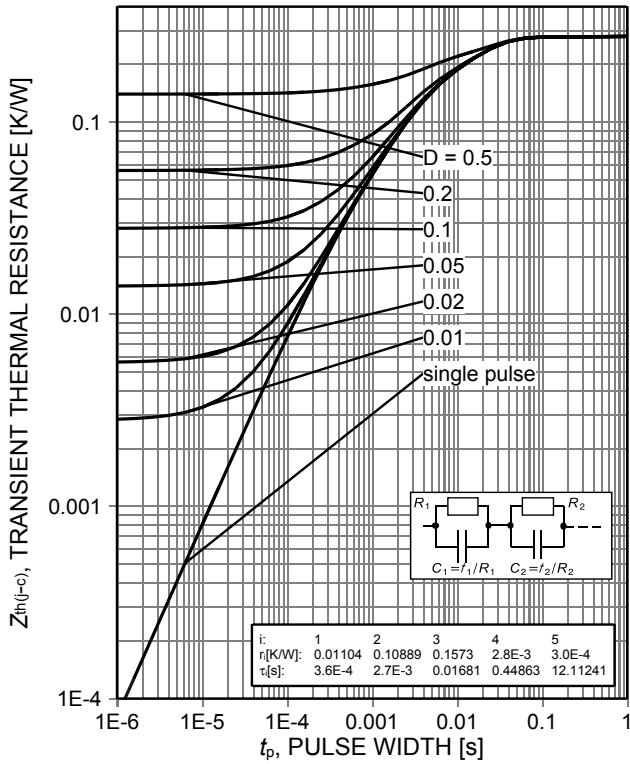


Figure 21. Diode transient thermal impedance as a function of pulse width ($D=t_p/T$)

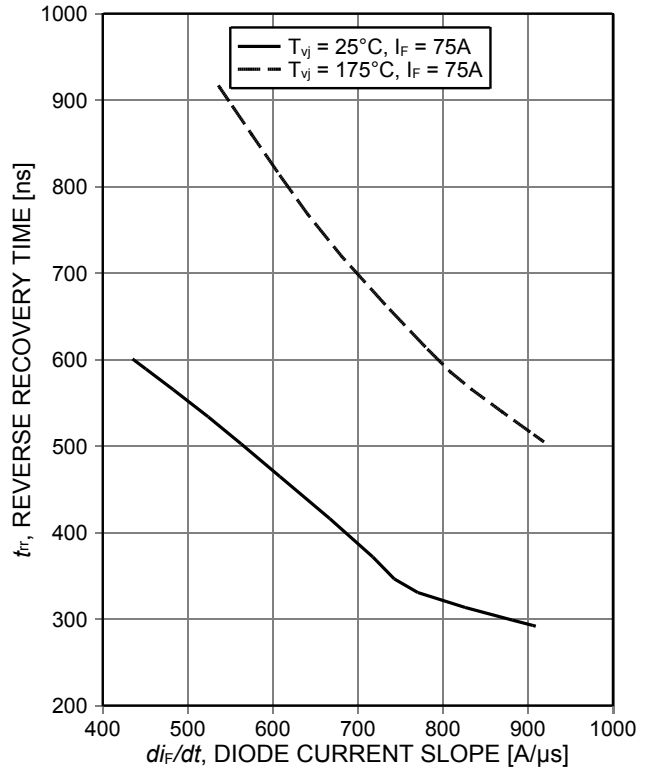


Figure 22. Typical reverse recovery time as a function of diode current slope ($V_R=600V$)

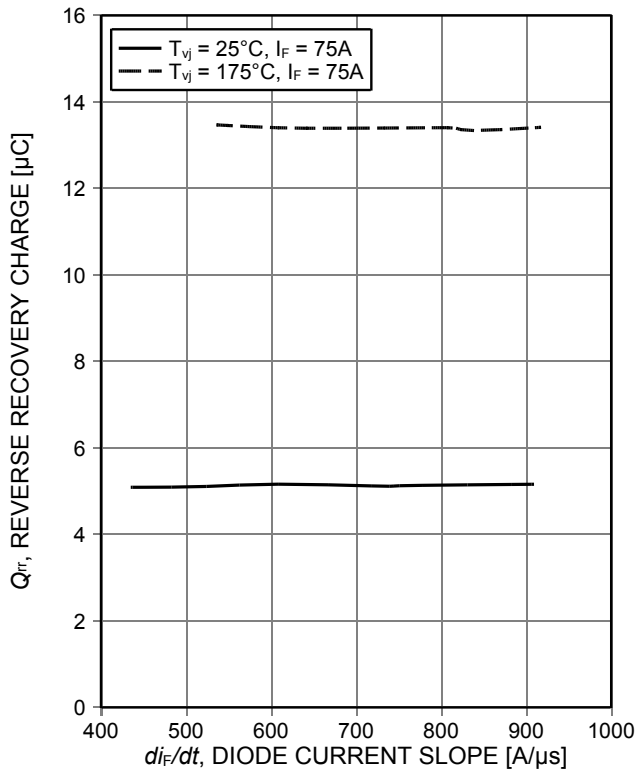


Figure 23. Typical reverse recovery charge as a function of diode current slope ($V_R=600V$)

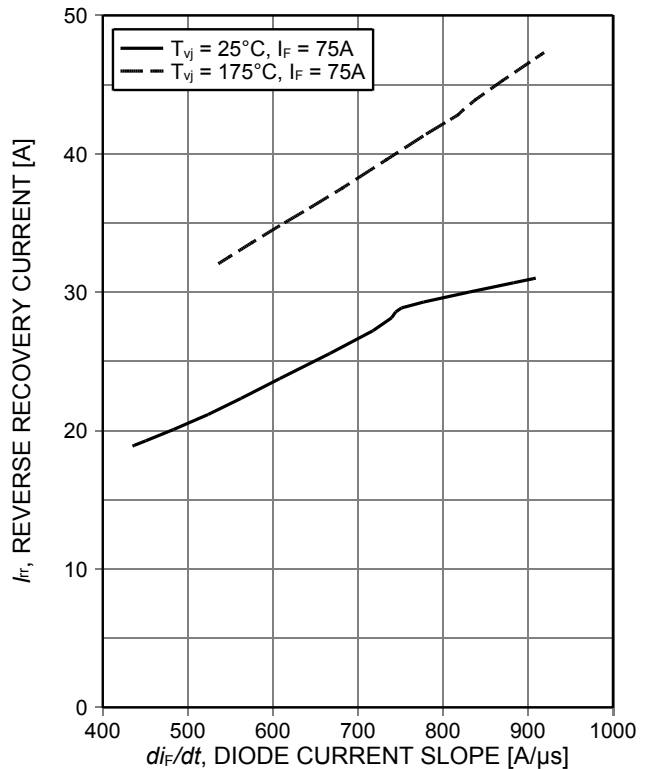


Figure 24. Typical reverse recovery current as a function of diode current slope ($V_R=600V$)

TRENCHSTOP™ 2 low $V_{ce(sat)}$ second generation IGBT

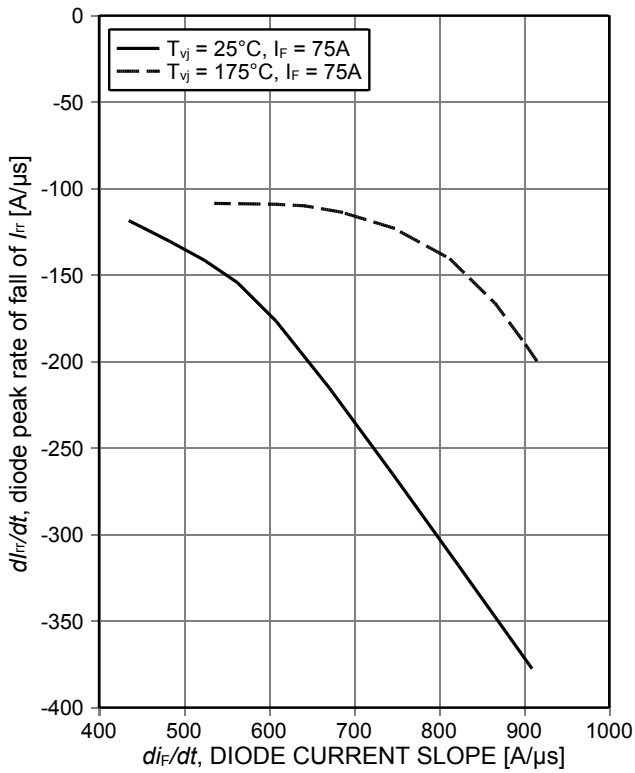


Figure 25. Typical diode peak rate of fall of reverse recovery current as a function of diode current slope ($V_R=600V$)

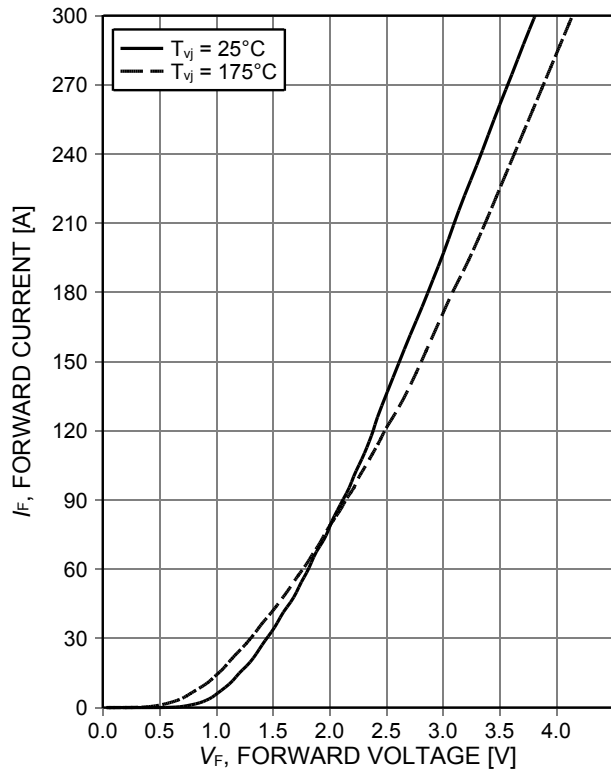


Figure 26. Typical diode forward current as a function of forward voltage

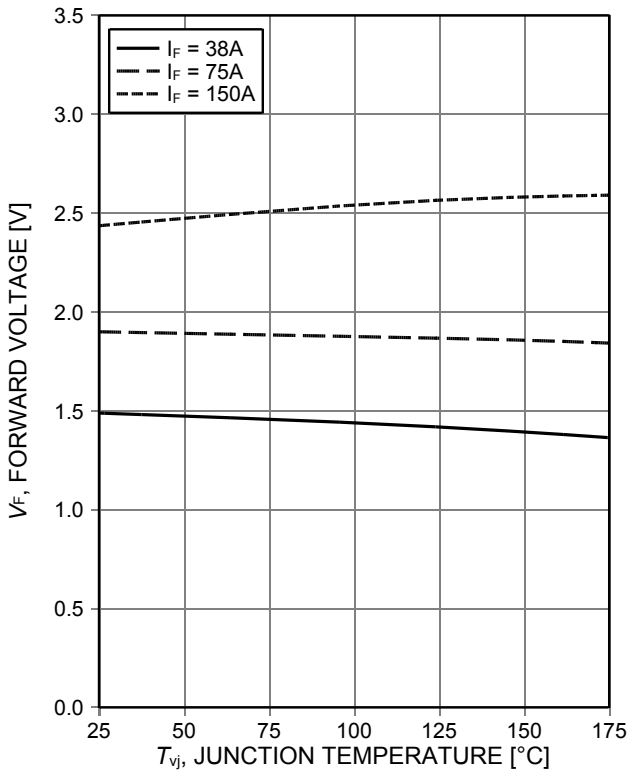
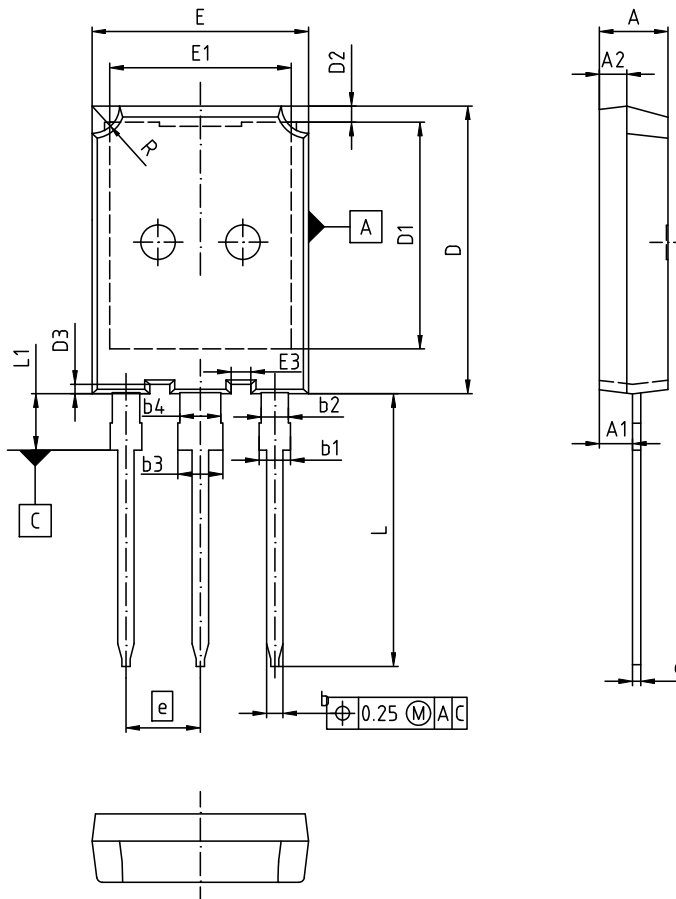


Figure 27. Typical diode forward voltage as a function of junction temperature

TRENCHSTOP™ 2 low $V_{ce(sat)}$ second generation IGBT

Package Drawing PG-TO247-3-46



| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.90 | 5.10 | 0.193 | 0.201 |
| A1 | 2.31 | 2.51 | 0.091 | 0.099 |
| A2 | 1.90 | 2.10 | 0.075 | 0.083 |
| b | 1.16 | 1.26 | 0.046 | 0.050 |
| b1 | 1.96 | 2.25 | 0.077 | 0.089 |
| b2 | 1.96 | 2.06 | 0.077 | 0.081 |
| c | 0.59 | 0.66 | 0.023 | 0.026 |
| D | 20.90 | 21.10 | 0.823 | 0.831 |
| D1 | 16.25 | 16.85 | 0.640 | 0.663 |
| D2 | 1.05 | 1.35 | 0.041 | 0.053 |
| D3 | 0.58 | 0.78 | 0.023 | 0.031 |
| E | 15.70 | 15.90 | 0.618 | 0.626 |
| E1 | 13.10 | 13.50 | 0.516 | 0.531 |
| E3 | 1.35 | 1.55 | 0.053 | 0.061 |
| e | 5.44 (BSC) | | 0.214 (BSC) | |
| N | 3 | | 3 | |
| L | 19.80 | 20.10 | 0.780 | 0.791 |
| L1 | - | 4.30 | - | 0.169 |
| R | 1.90 | 2.10 | 0.075 | 0.083 |

DOCUMENT NO.
Z8B00174295

SCALE

EUROPEAN PROJECTION

ISSUE DATE
13-08-2014

REVISION
01

Testing Conditions

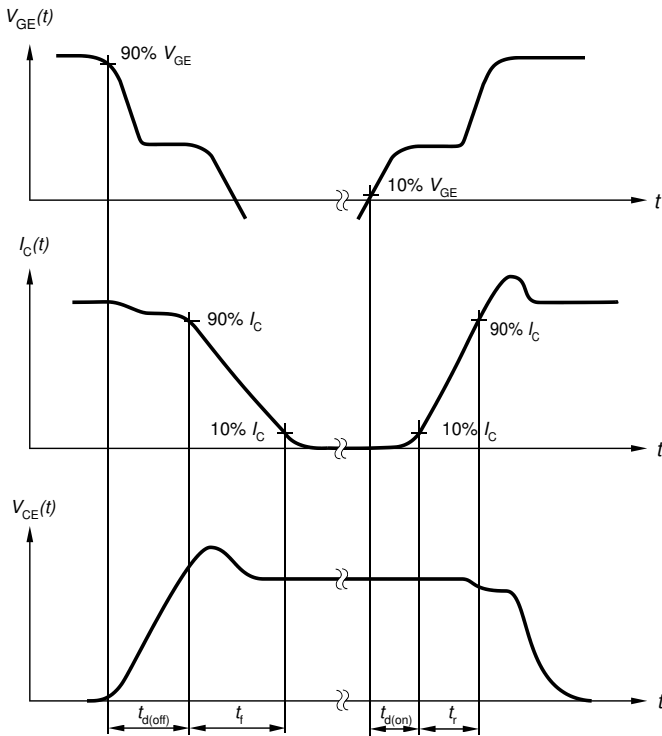


Figure A. Definition of switching times

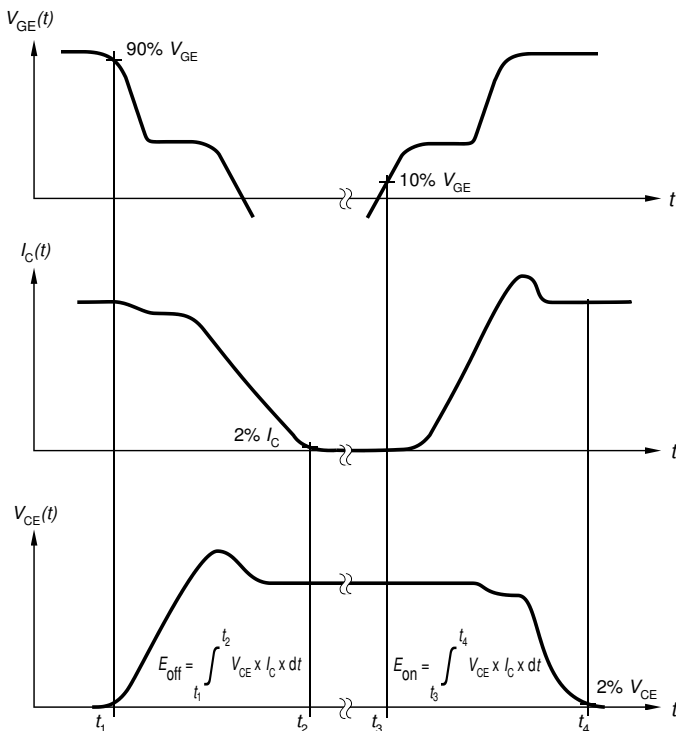


Figure B. Definition of switching losses

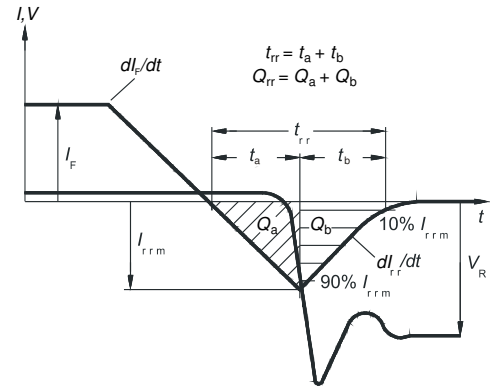


Figure C. Definition of diode switching characteristics

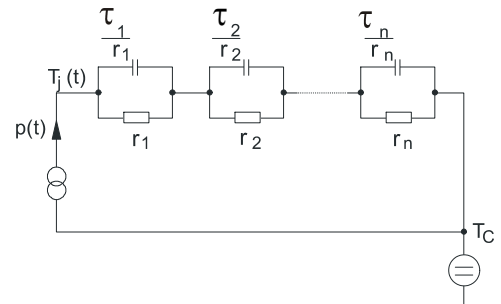


Figure D. Thermal equivalent circuit

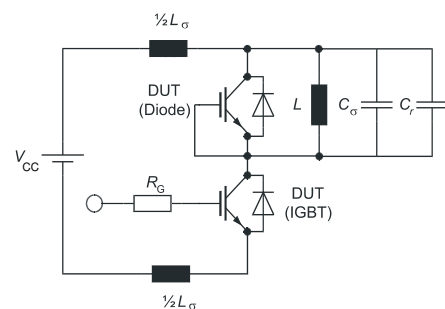


Figure E. Dynamic test circuit
Parasitic inductance L_{σ} ,
parasitic capacitor C_{σ} ,
relief capacitor C_r ,
(only for ZVT switching)

Revision History

IKQ75N120CT2

Revision: 2019-04-15, Rev. 2.3

Previous Revision

| Revision | Date | Subjects (major changes since last revision) |
|----------|------------|--|
| 2.1 | 2017-04-26 | Final data sheet |
| 2.2 | 2017-05-02 | Update figure 7 |
| 2.3 | 2019-04-15 | Update condition for V_{geth} page 4 and Fig. 11 |

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