

Insulated Gate Bi-Polar Transistor

Type T0160NB45A

Absolute Maximum Ratings

| | VOLTAGE RATINGS | MAXIMUM LIMITS | UNITS |
|-----------------------|--|----------------|-------|
| V_{CES} | Collector – emitter voltage | 4500 | V |
| $V_{DC \text{ link}}$ | Permanent DC voltage for 100 FIT failure rate. | 2800 | V |
| V_{GES} | Peak gate – emitter voltage | ± 20 | V |

| | RATINGS | MAXIMUM LIMITS | UNITS |
|----------------|--|----------------|--------------------|
| $I_{C(DC)}$ | DC collector current, IGBT | 160 | A |
| I_{CRM} | Repetitive peak collector current, $t_p=1\text{ms}$, IGBT | 320 | A |
| $I_{F(DC)}$ | Continuous DC forward current, Diode | 160 | A |
| I_{FRM} | Repetitive peak forward current, $t_p=1\text{ms}$, Diode | 320 | A |
| I_{FSM} | Peak non-repetitive surge $t_p=10\text{ms}$, $V_{RM}=60\%V_{RRM}$, Diode (Note 4) | 690 | A |
| I_{FSM2} | Peak non-repetitive surge $t_p=10\text{ms}$, $V_{RM}\leq 10\text{V}$, Diode (Note 4) | 760 | A |
| P_{MAX} | Maximum power dissipation, IGBT (Note 2) | 1.47 | kW |
| $(di/dt)_{cr}$ | Critical diode di/dt (note 3) | 300 | A/ μs |
| T_j | Operating temperature range. | -40 to +125 | $^{\circ}\text{C}$ |
| T_{stg} | Storage temperature range. | -40 to +125 | $^{\circ}\text{C}$ |

Notes: -

- 1) Unless otherwise indicated $T_j = 125^{\circ}\text{C}$.
- 2) $T_{\text{sink}} = 25^{\circ}\text{C}$, double side cooled.
- 3) Maximum commutation loop inductance 200nH.
- 4) Half-sinewave, 125°C T_j initial.

Characteristics

IGBT Characteristics

| | PARAMETER | MIN | TYP | MAX | TEST CONDITIONS | UNITS |
|---------------|--|-----|------|---------|---|------------|
| $V_{CE(sat)}$ | Collector – emitter saturation voltage | - | 2.70 | 3.15 | $I_C = 160A, V_{GE} = 15V, T_j = 25^\circ C$ | V |
| | | - | 3.40 | 3.80 | $I_C = 160A, V_{GE} = 15V$ | V |
| V_{T0} | Threshold voltage | - | - | 1.71 | Current range: 53.3 – 160A | V |
| r_T | Slope resistance | - | - | 13.1 | | m Ω |
| $V_{GE(TH)}$ | Gate threshold voltage | - | 5.2 | - | $V_{CE} = V_{GE}, I_C = 18mA$ | V |
| I_{CES} | Collector – emitter cut-off current | - | 5 | 15 | $V_{CE} = V_{CES}, V_{GE} = 0V$ | mA |
| I_{GES} | Gate leakage current | - | - | ± 4 | $V_{GE} = \pm 20V$ | μA |
| C_{ies} | Input capacitance | - | 30 | - | $V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$ | nF |
| $t_{d(on)}$ | Turn-on delay time | - | 2.4 | - | $I_C = 160A, V_{CE} = 2800V, di/dt = 300A/\mu s$ $V_{GE} = \pm 15V, L_s = 200nH$ $R_{g(ON)} = 33\Omega, R_{g(OFF)} = 38\Omega, C_{GE} = 22nF$ Integral diode used as freewheel diode (Note 3 & 4) | μs |
| $t_r(V)$ | Rise time | - | 3.2 | - | | μs |
| $Q_{g(on)}$ | Turn-on gate charge | - | 1.2 | - | | μC |
| E_{on} | Turn-on energy | - | 1.1 | - | | J |
| $t_{d(off)}$ | Turn-off delay time | - | 2.3 | - | | μs |
| $t_f(I)$ | Fall time | - | 2.5 | - | | μs |
| $Q_{g(off)}$ | Turn-off gate charge | - | 1.5 | - | | μC |
| E_{off} | Turn-off energy | - | 0.7 | - | | J |
| I_{sc} | Short circuit current | - | 550 | - | | A |
| | | - | | | $V_{GE} = +15V, V_{CC} = 2800V, V_{CEmax} \leq V_{CES}, t_p \leq 10\mu s$ | |

Diode Characteristics

| | PARAMETER | MIN | TYP | MAX | TEST CONDITIONS | UNITS |
|----------|----------------------------------|-----|------|------|---|------------|
| V_F | Forward voltage | - | 3.65 | 3.95 | $I_F = 160A, T_j = 25^\circ C$ | V |
| | | - | 3.90 | 4.20 | $I_F = 160A$ | V |
| V_{T0} | Threshold voltage | - | - | 2.28 | Current range 53.3 - 160A | V |
| r_T | Slope resistance | - | - | 12 | | m Ω |
| I_{rm} | Peak reverse recovery current | - | 165 | - | $I_F = 160A, V_{GE} = -15V, di/dt = 300A/\mu s$ | A |
| Q_{rr} | Recovered charge | - | 270 | - | | μC |
| t_{rr} | Reverse recovery time, 50% chord | - | 1.8 | - | | μs |
| E_r | Reverse recovery energy | - | 0.38 | - | | J |

Thermal Characteristics

| | PARAMETER | MIN | TYP | MAX | TEST CONDITIONS | UNITS |
|------------|--|-----|-----|-----|-----------------------|-------|
| R_{thJK} | Thermal resistance junction to sink, IGBT | - | - | 72 | Double side cooled | K/kW |
| | | - | - | 118 | Collector side cooled | K/kW |
| | | - | - | 186 | Emitter side cooled | K/kW |
| R_{thJK} | Thermal resistance junction to sink, Diode | - | - | 172 | Double side cooled | K/kW |
| | | - | - | 268 | Cathode side cooled | K/kW |
| | | - | - | 478 | Anode side cooled | K/kW |
| F | Mounting force | 8 | - | 12 | Note 2 | kN |
| W_t | Weight | - | 0.5 | - | | kg |

Notes:-

- 1) Unless otherwise indicated $T_j = 125^\circ C$.
- 2) Consult application note 2008AN01 for detailed mounting requirements
- 3) C_{GE} is additional gate – emitter capacitance added to output of gate drive
- 4) Figures 6 to 9 are obtained using integral diode as freewheeling diode

Curves

Figure 1 – Typical collector-emitter saturation voltage characteristics

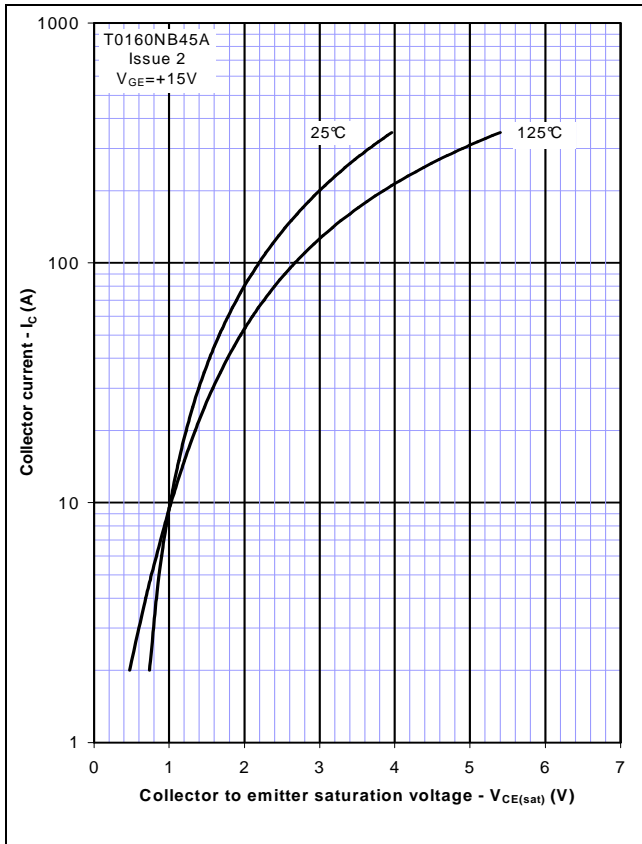


Figure 2 – Typical output characteristic

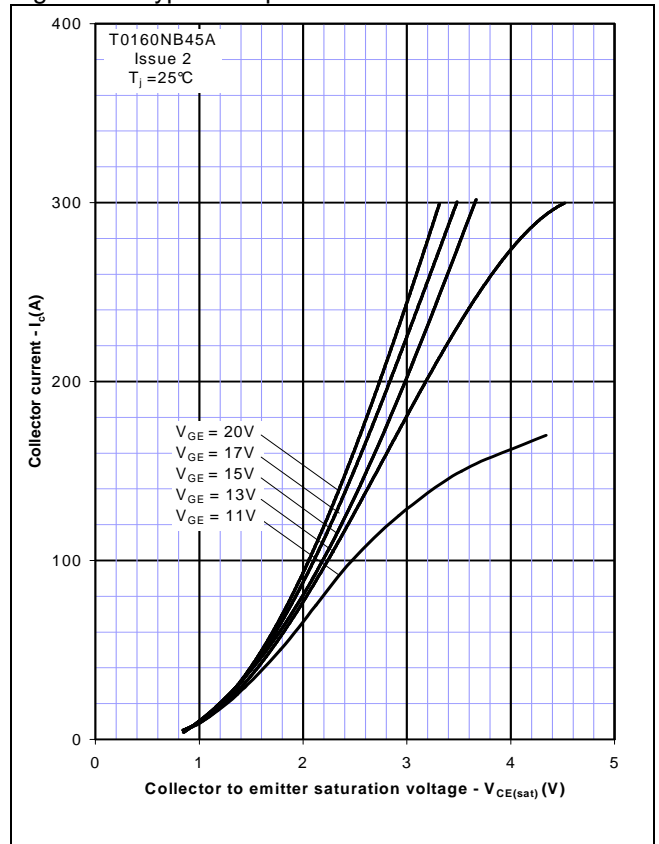


Figure 3 – Typical output characteristic

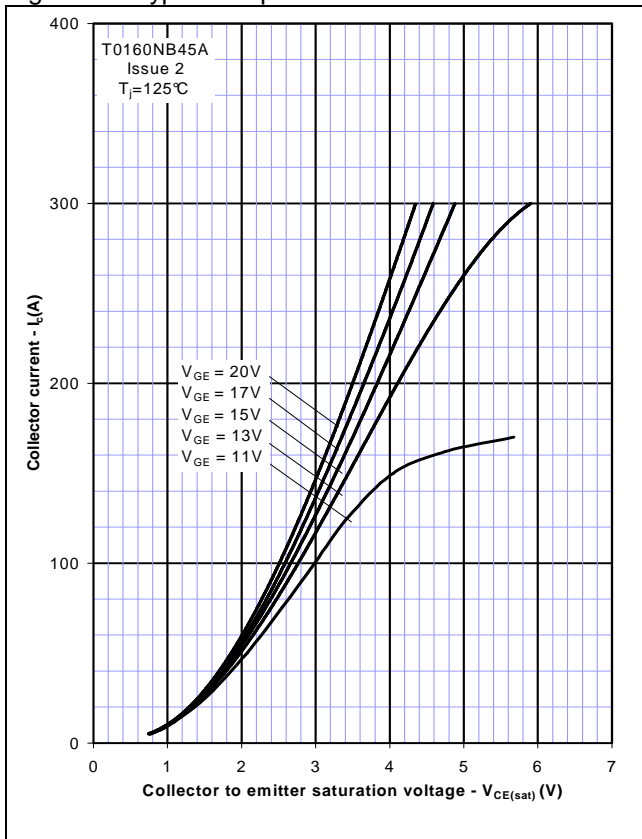


Figure 4 – Typical turn-on delay time vs gate resistance

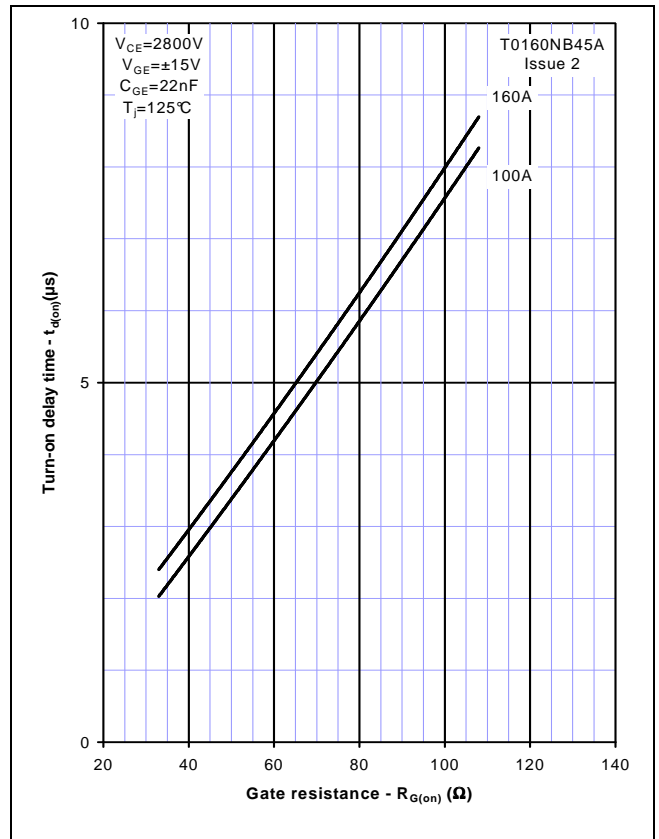


Figure 5 – Typical turn-off delay time vs. gate resistance

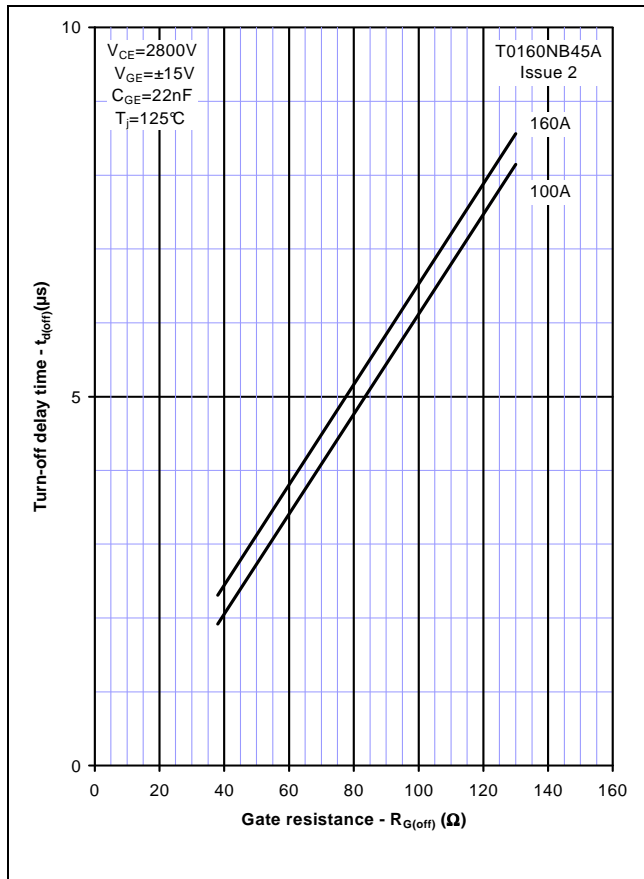


Figure 6 – Typical turn-on energy vs. collector current

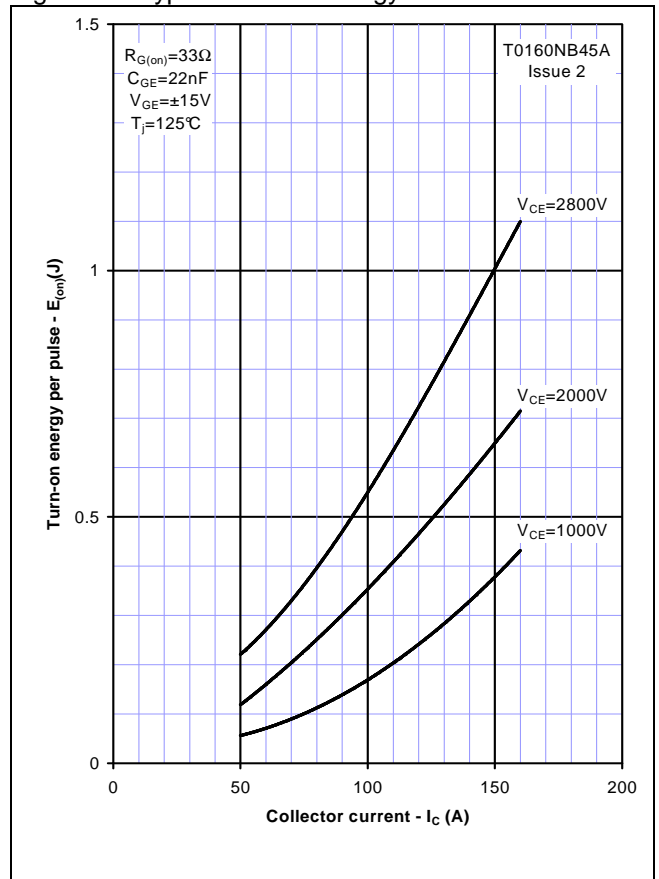


Figure 7 – Typical turn-on energy vs. di/dt

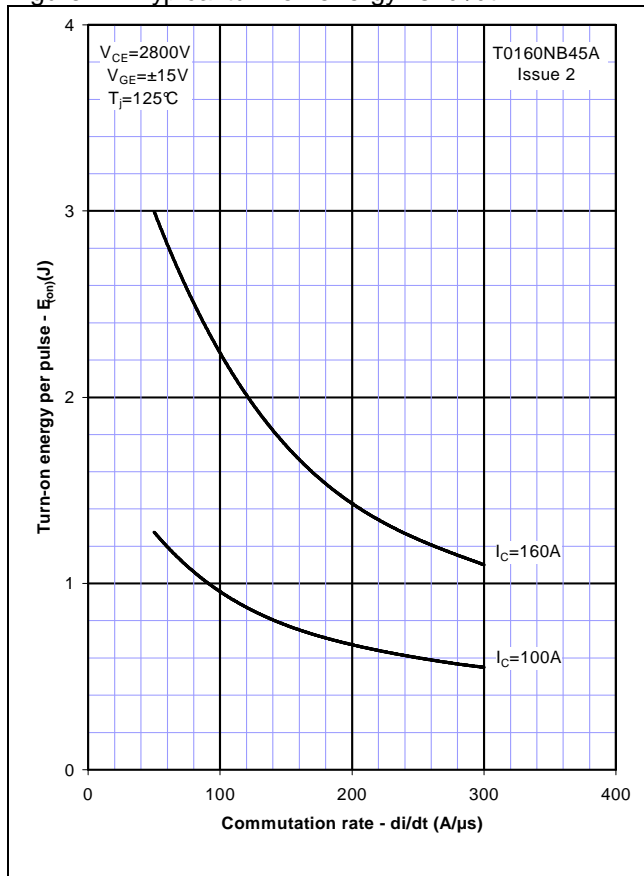


Figure 8 – Typical turn-off energy vs. collector current

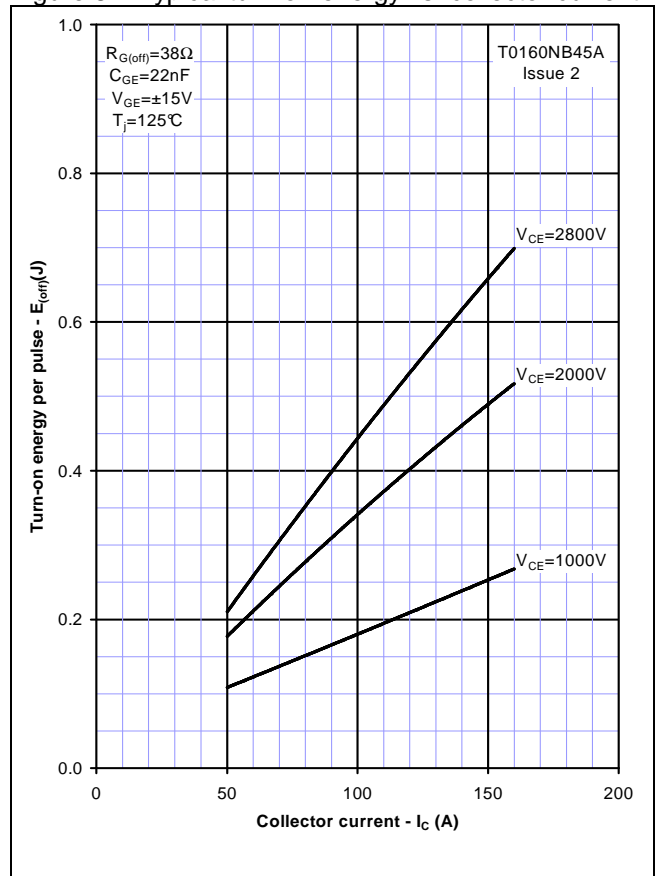


Figure 9 – Turn-off energy vs voltage

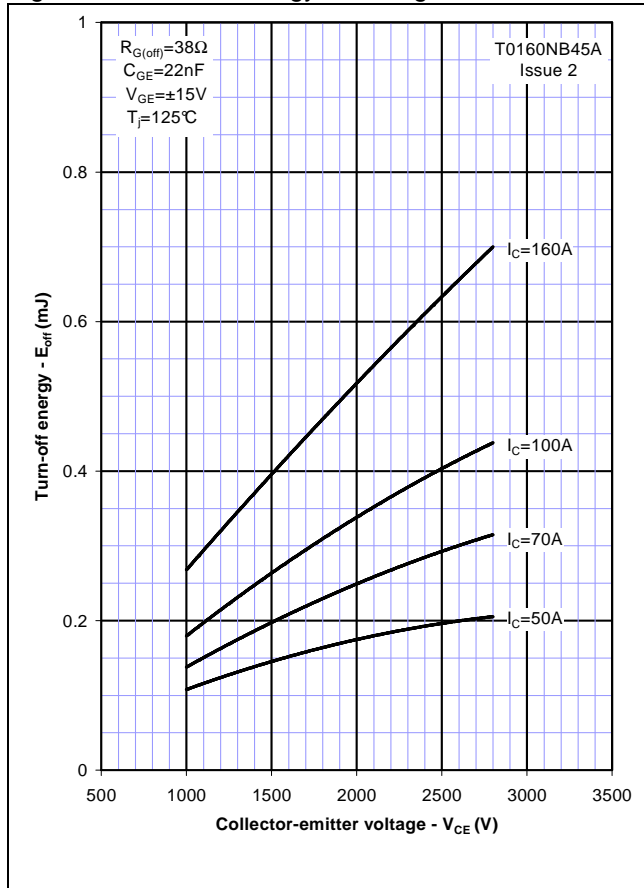


Figure 10 – Safe operating area

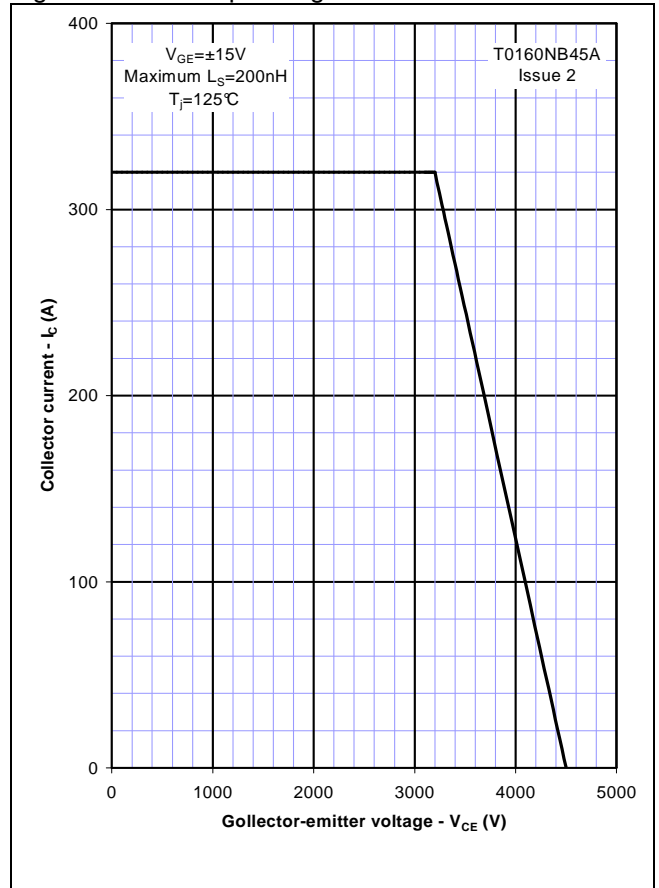


Figure 11 – Typical diode forward characteristics

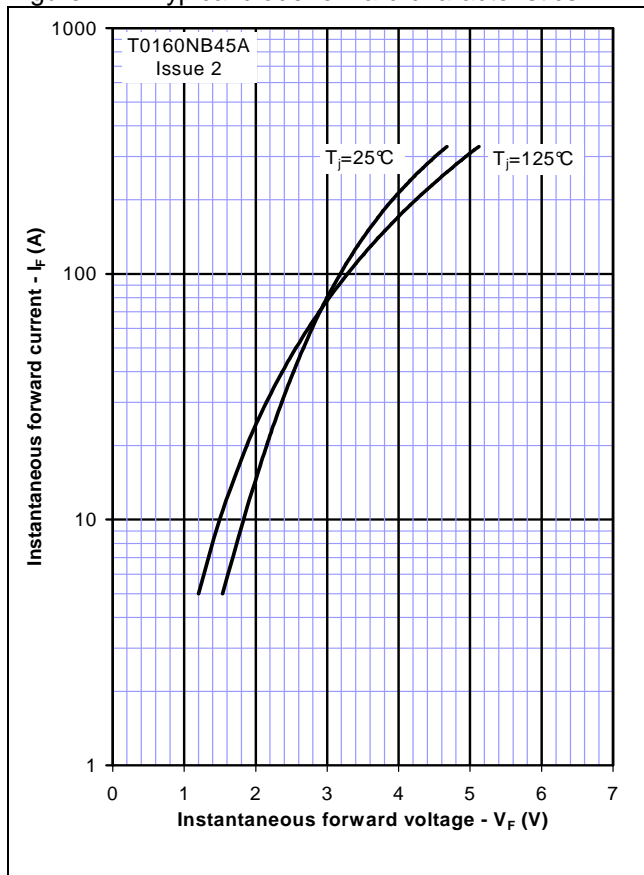


Figure 12 – Typical recovered charge

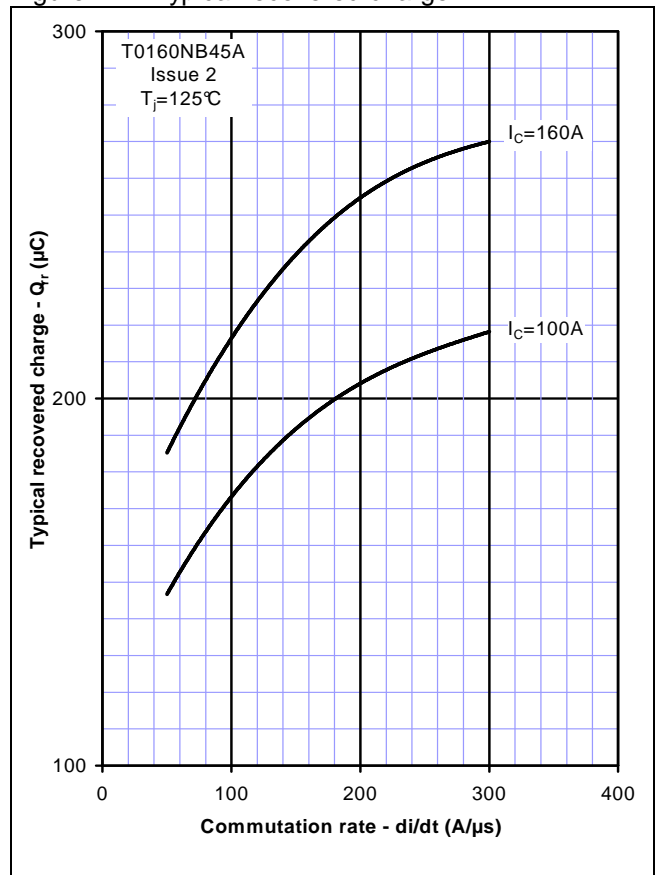


Figure 13 – Typical reverse recovery current

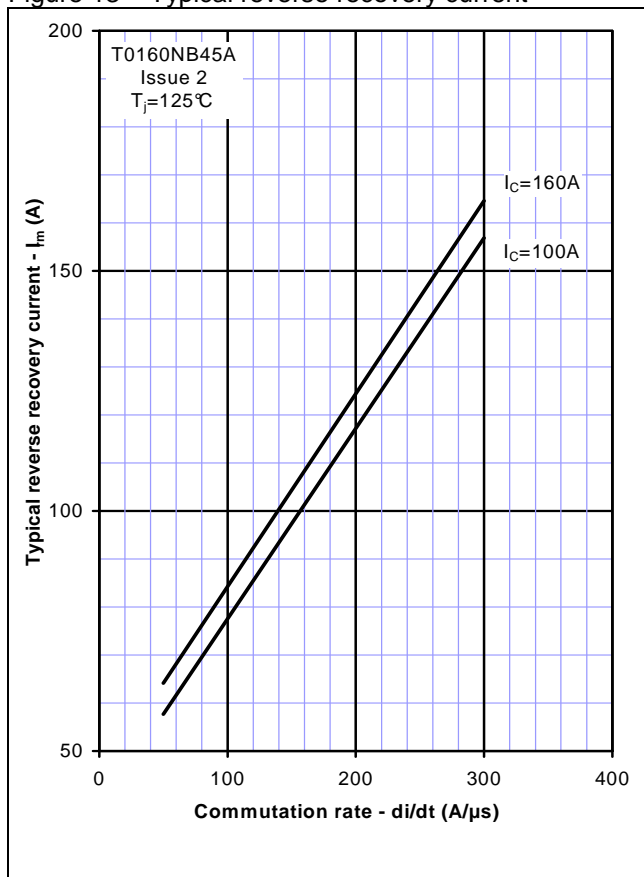


Figure 14 – Typical reverse recovery time

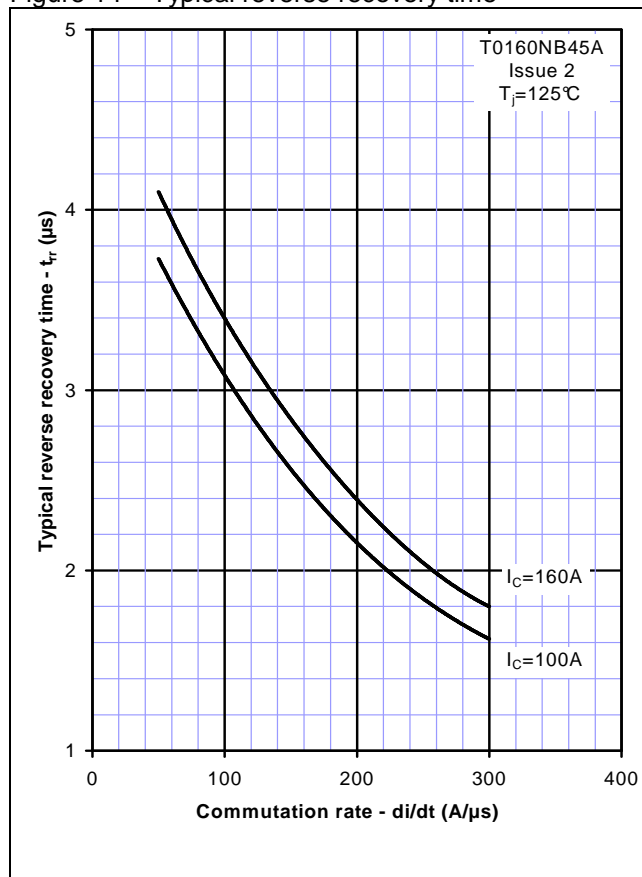


Figure 15 – Transient thermal impedance (IGBT)

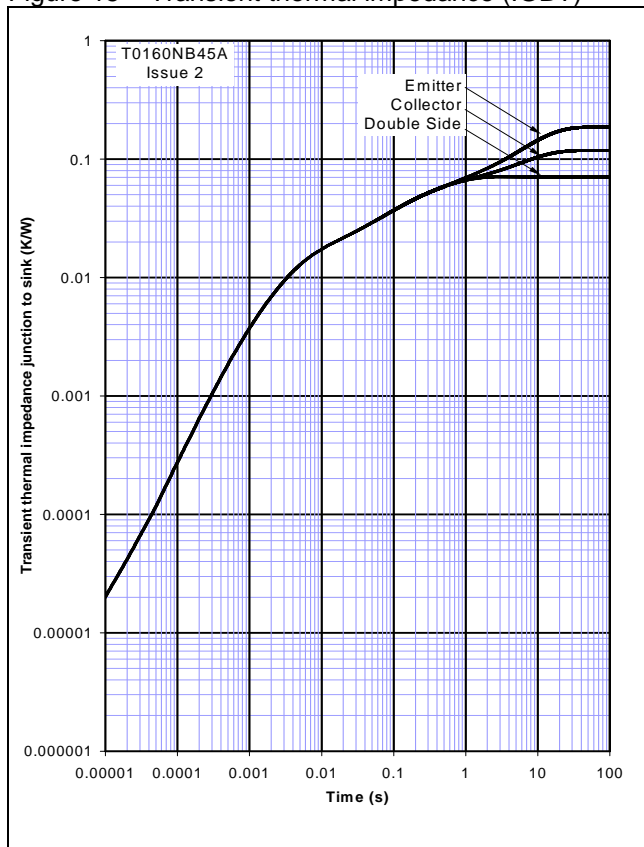
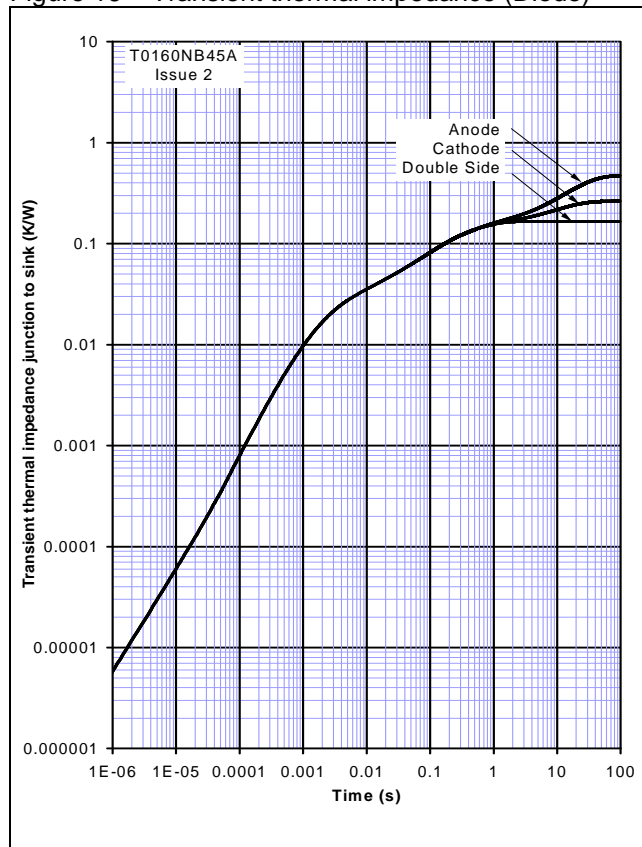
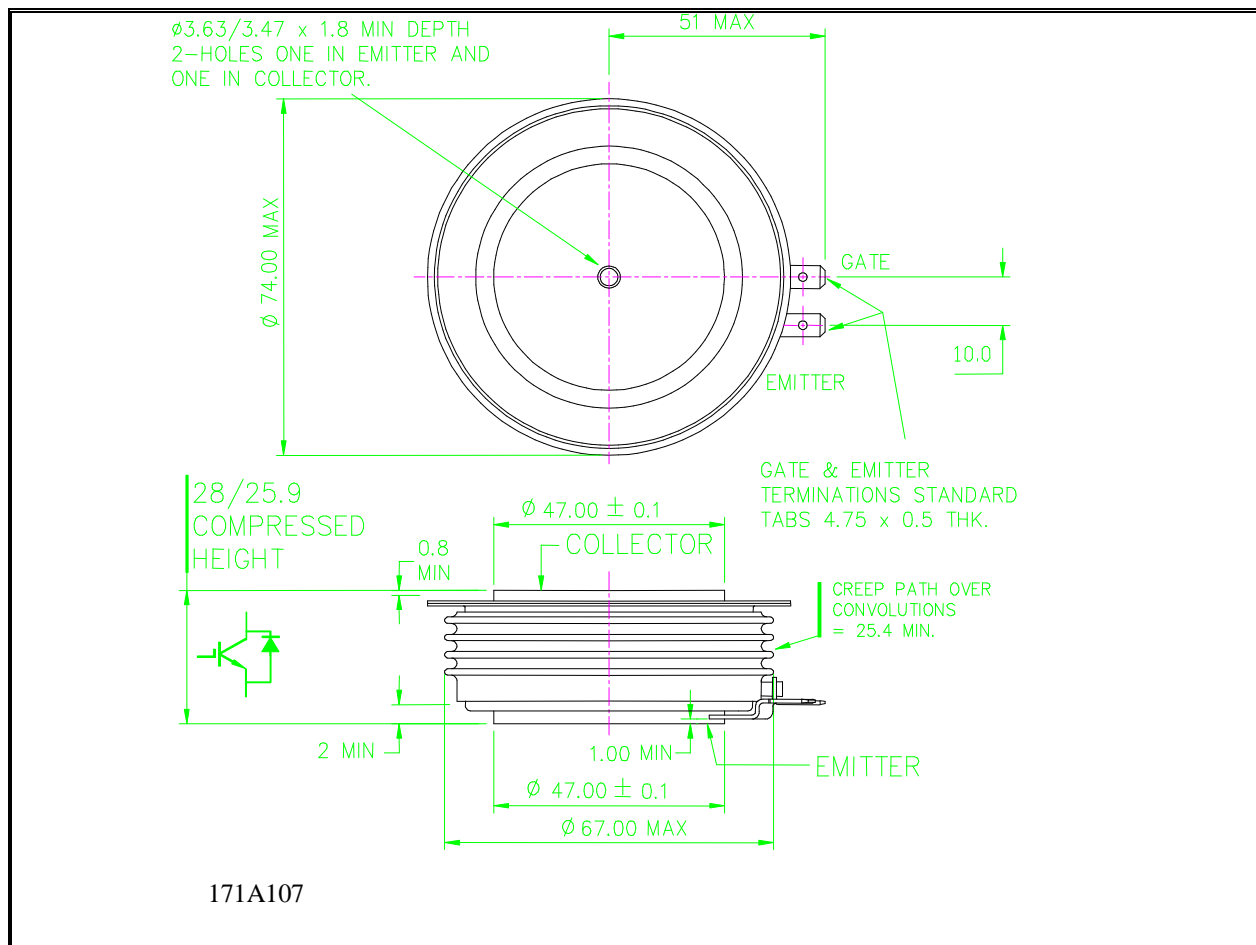


Figure 16 – Transient thermal impedance (Diode)



Outline Drawing & Ordering Information



ORDERING INFORMATION

(Please quote 10 digit code as below)

| T0160 | NB | 45 | A |
|-----------------|--------------------|--------------------------------------|-------------------|
| Fixed type Code | Fixed Outline Code | Voltage Grade $V_{CES}/100$ 45 | Fixed format code |

Typical order code: T0160NB45A ($V_{CES} = 4500V$)

IXYS Semiconductor GmbH
Edisonstraße 15
D-68623 Lampertheim
Tel: +49 6206 503-0
Fax: +49 6206 503-627
E-mail: marcom@ixys.de



IXYS UK Westcode Ltd
Langley Park Way, Langley Park,
Chippenham, Wiltshire, SN15 1GE.
Tel: +44 (0)1249 444524
Fax: +44 (0)1249 659448
E-mail: sales@ixysuk.com

IXYS Corporation
1590 Buckeye Drive
Milpitas CA 95035-7418
Tel: +1 (408) 457 9000
Fax: +1 (408) 496 0670
E-mail: sales@ixys.net

www.ixysuk.com

www.ixys.net

IXYS Long Beach
IXYS Long Beach, Inc
2500 Mira Mar Ave, Long Beach
CA 90815
Tel: +1 (562) 296 6584
Fax: +1 (562) 296 6585
E-mail: service@ixyslongbeach.com

The information contained herein is confidential and is protected by Copyright. The information may not be used or disclosed except with the written permission of and in the manner permitted by the proprietors IXYS UK Westcode Ltd.

© IXYS UK Westcode Ltd.

In the interest of product improvement, IXYS UK Westcode Ltd reserves the right to change specifications at any time without prior notice.

Devices with a suffix code (2-letter, 3-letter or letter/digit/letter combination) added to their generic code are not necessarily subject to the conditions and limits contained in this report.