# 英飞凌谐振开关系列

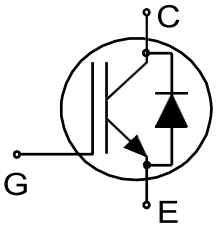
反向导通 IGBT，具有单片体二极管

# IHW20N65R5

## 数据手册

## 工业功率控制

# 反向导通 IGBT，具有单片体二极管




**特性：**

- 功能强大的单片反向导电二极管，正向电压低
- TRENCHSTOP™技术提供：
  - 参数分布紧密
  - 高健稳性、温度稳定性
  - 极低的 $V_{CEsat}$ 和低 $E_{off}$
  - 由于 $V_{CEsat}$ 具有正温度系数，因此易于并联
- 低电磁干扰
- 符合 JESD-022 目标应用要求
- 无铅引脚镀层；符合 RoHS 标准
- 完整的产品品类和 PSpice 模型：

http://www.infineon.cn/igbt/




**应用：**

- 电磁炉烹饪
- 变频微波炉
- 谐振转换器

Green

Halogen-Free

RoHS

**关键性能和封装参数**

| Type | $V_{CE}$ | $I_C$ | $V_{CEsat}$, $T_{vj}$=25°C | $T_{vjmax}$ | Marking | Package |
|---|---|---|---|---|---|---|
| IHW20N65R5 | 650V | 20A | 1.35V | 175°C | H20ER5 | PG-TO247-3 |

*本数据手册的原文使用英文撰写。为方便起见，英飞凌提供了译文；由于翻译过程中可能使用了自动化工具，英飞凌不保证译文的准确性。为确认准确性，请务必访问 infineon.com 参考最新的英文版本（控制文档）。*

**目录**

描述 ..... 2
目录 ..... 3
最大额定值 ..... 4
热阻抗 ..... 4
电气特性 ..... 5
电气特性图 ..... 7
封装图 ..... 13
测试条件 ..... 14
修订记录 ..... 15
免责声明 ..... 15

## 最大额定值

**注意：为了获得最佳的使用寿命和可靠性，英飞凌建议运行条件不超过本数据手册中所述最大额定值的 80%。**

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Collector-emitter voltage, $T_{vj} \geq 25°C$ | $V_{CE}$ | 650 | V |
| DC collector current, limited by $T_{vjmax}$<br>$T_C = 25°C$<br>$T_C = 100°C$ | $I_C$ | <br>40.0<br>20.0 | A |
| Pulsed collector current, $t_p$ limited by $T_{vjmax}$ | $I_{Cpuls}$ | 60.0 | A |
| Turn off safe operating area<br>$V_{CE} \leq 650V$, $T_{vj} \leq 175°C$, $t_p = 1\mu s$ | - | 60.0 | A |
| Diode forward current, limited by $T_{vjmax}$<br>$T_C = 25°C$<br>$T_C = 100°C$ | $I_F$ | <br>19.0<br>10.0 | A |
| Diode pulsed current, $t_p$ limited by $T_{vjmax}$ | $I_{Fpuls}$ | 60.0 | A |
| Gate-emitter voltage | $V_{GE}$ | ±20 | V |
| Power dissipation $T_C = 25°C$ Power dissipation $T_C = 100°C$ | $P_{tot}$ | 150.0<br>75.0 | W |
| Operating junction temperature | $T_{vj}$ | -40...+175 | °C |
| Storage temperature | $T_{stg}$ | -55...+150 | °C |
| Soldering temperature,<br>wave soldering 1.6mm (0.063in.) from case for 10s | | <br>260 | °C |
| Mounting torque, M3 screw Maximum of mounting processes: 3 | $M$ | 0.6 | Nm |

## 热阻抗特性

| Parameter<br>特性 | Symbol | Conditions | Max. Value | Unit |
|---|---|---|---|---|
| IGBT thermal resistance, junction - case | $R_{th(j-c)}$ | | 1.00 | K/W |
| Diode thermal resistance, junction - case | $R_{th(j-c)}$ | | 4.68 | K/W |
| Thermal resistance junction - ambient | $R_{th(j-a)}$ | | 40 | K/W |

**电气特性，测于 $T_{vj}$ = 25°C的条件下，除非另有规定**

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **静态特性** | | | | | | |
| Collector-emitter breakdown voltage | $V_{(BR)CES}$ | $V_{GE}$ = 0V, $I_C$ = 0.20mA | 650 | - | - | V |
| Collector-emitter saturation voltage | $V_{CEsat}$ | $V_{GE}$ = 15.0V, $I_C$ = 20.0A<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 175°C | <br>-<br>- | <br>1.35<br>1.60 | <br>1.70<br>- | V |
| Diode forward voltage | $V_F$ | $V_{GE}$ = 0V, $I_F$ = 20.0A<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 175°C | <br>-<br>- | <br>1.70<br>2.00 | <br>2.10<br>- | V |
| Gate-emitter threshold voltage | $V_{GE(th)}$ | $I_C$ = 0.20mA, $V_{CE}$ = $V_{GE}$ | 3.2 | 4.0 | 4.8 | V |
| Zero gate voltage collector current | $I_{CES}$ | $V_{CE}$ = 650V, $V_{GE}$ = 0V<br>$T_{vj}$ = 25°C<br>$T_{vj}$ = 175°C | <br>-<br>- | <br>-<br>600 | <br>40<br>- | µA |
| Gate-emitter leakage current | $I_{GES}$ | $V_{CE}$ = 0V, $V_{GE}$ = 20V | - | - | 100 | nA |
| Transconductance | $g_{fs}$ | $V_{CE}$ = 20V, $I_C$ = 20.0A | - | 60.0 | - | S |
| Integrated gate resistor | $r_G$ | | | none | | Ω |

**电气特性，测于 $T_{vj}$ = 25°C的条件下，除非另有规定**

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **动态特性** | | | | | | |
| Input capacitance | $C_{ies}$ | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | - | 2450 | - | pF |
| Output capacitance | $C_{oes}$ | | - | 23 | - | |
| Reverse transfer capacitance | $C_{res}$ | | - | 10 | - | |
| Gate charge | $Q_G$ | $V_{CC}$ = 480V, $I_C$ = 20.0A,<br>$V_{GE}$ = 15V | - | 97.0 | - | nC |
| Internal emitter inductance measured 5mm (0.197 in.) from case | $L_E$ | | - | 13.0 | - | nH |

**开关特性、感性负载**

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **IGBT特性，测于$T_{vj}$ = 25°C**的条件下 | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $T_{vj}$ = 25°C,<br>$V_{CC}$ = 400V, $I_C$ = 20.0A,<br>$V_{GE}$ = 0.0/15.0V,<br>$R_{G(on)}$ = 23.0Ω, $R_{G(off)}$ = 23.0Ω,<br>Lσ = 35nH, Cσ = 32pF<br>Lσ, Cσ from Fig. E<br>Energy losses include “tail” and diode reverse recovery. | - | 23 | - | ns |
| Rise time | $t_r$ | | - | 16 | - | ns |
| Turn-off delay time | $t_{d(off)}$ | | - | 250 | - | ns |
| Fall time | $t_f$ | | - | 7 | - | ns |
| Turn-on energy | $E_{on}$ | | - | 0.54 | - | mJ |
| Turn-off energy | $E_{off}$ | | - | 0.16 | - | mJ |
| Total switching energy | $E_{ts}$ | | - | 0.70 | - | mJ |

**二极管特性，测于 $T_{vj}$ = 25°C的条件下**

| | | | | | | |
|---|---|---|---|---|---|---|
| Diode reverse recovery time | $t_{rr}$ | $T_{vj}$ = 25°C, | - | 82 | - | ns |
| Diode reverse recovery charge | $Q_{rr}$ | $V_R$ = 400V, | - | 1.55 | - | µC |
| Diode peak reverse recovery current | $I_{rrm}$ | $I_F$ = 20.0A, | - | 29.0 | - | A |
| Diode peak rate of fall of reverse recovery current during $t_b$ | $di_{rr}/dt$ | $di_F/dt$ = 1100A/µs | - | -2080 | - | A/µs |

**开关特性、感性负载**

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min. | typ. | max. | |
| **IGBT特性, 测于 $T_{vj}$ = 175°C的条件下** | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $T_{vj}$ = 175°C, | - | 22 | - | ns |
| Rise time | $t_r$ | $V_{CC}$ = 400V, $I_C$ = 20.0A, | - | 16 | - | ns |
| Turn-off delay time | $t_{d(off)}$ | $V_{GE}$ = 0.0/15.0V, | - | 290 | - | ns |
| Fall time | $t_f$ | $R_{G(on)}$ = 23.0Ω, $R_{G(off)}$ = 23.0Ω, | - | 20 | - | ns |
| Turn-on energy | $E_{on}$ | $L\sigma$ = 35nH, $C\sigma$ = 32pF | - | 0.62 | - | mJ |
| Turn-off energy | $E_{off}$ | $L\sigma$, $C\sigma$ from Fig. E | - | 0.29 | - | mJ |
| Total switching energy | $E_{ts}$ | Energy losses include “tail” and diode reverse recovery. | - | 0.91 | - | mJ |

**二极管特性，测于 $T_{vj}$ = 175°C的条件下**

| | | | | | | |
|---|---|---|---|---|---|---|
| Diode reverse recovery time | $t_{rr}$ | $T_{vj}$ = 175°C, $V_R$ | - | 101 | - | ns |
| Diode reverse recovery charge | $Q_{rr}$ | = 400V, $I_F$ = | - | 2.69 | - | µC |
| Diode peak reverse recovery current | $I_{rrm}$ | 20.0A, | - | 43.0 | - | A |
| Diode peak rate of fall of reverse recovery current during $t_b$ | $di_{rr}/dt$ | $di_F/dt$ = 1100A/µs | - | -1690 | - | A/µs |

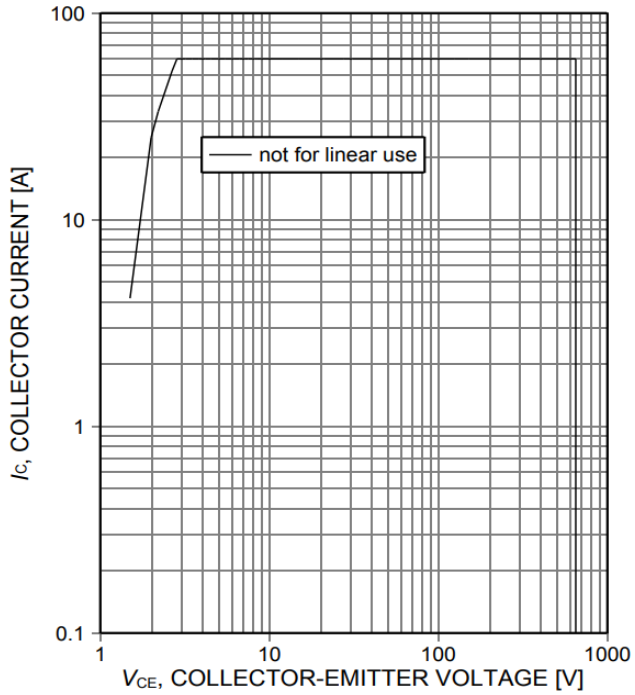



Figure 1. **Safe operating area**
($D$=0, $T_C$=25°C, $T_{vj}$≤175°C, $V_{GE}$=15V, $t_p$=1µs)

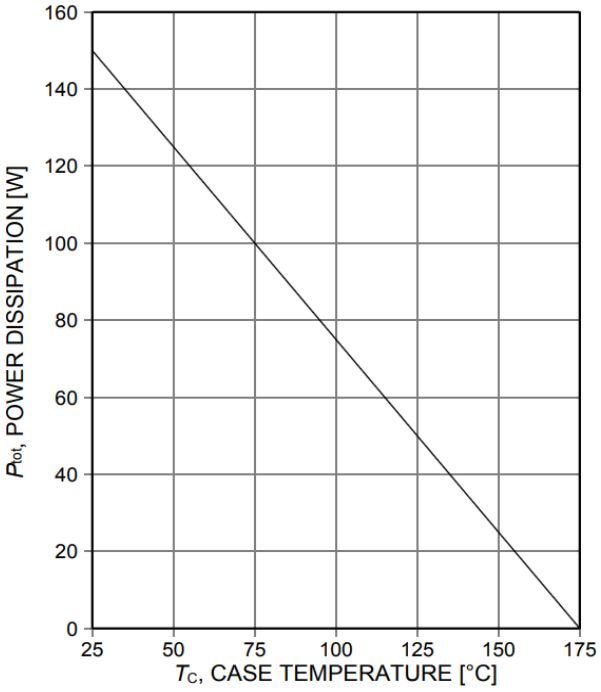



Figure 2. **Power dissipation as a function of case temperature**
($T_{vj}$≤175°C)

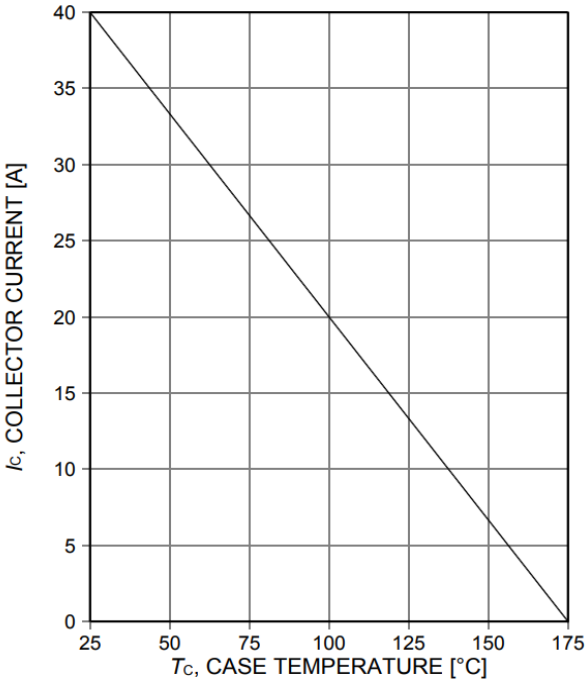



Figure 3. **Collector current as a function of case temperature**
($V_{GE}$≥15V, $T_{vj}$≤175°C)

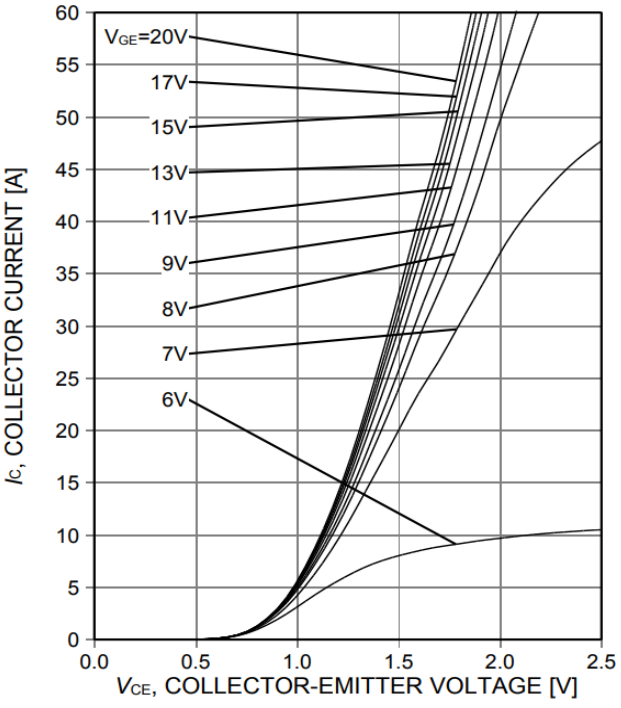



Figure 4. **Typical output characteristic**
($T_{vj}$=25°C)

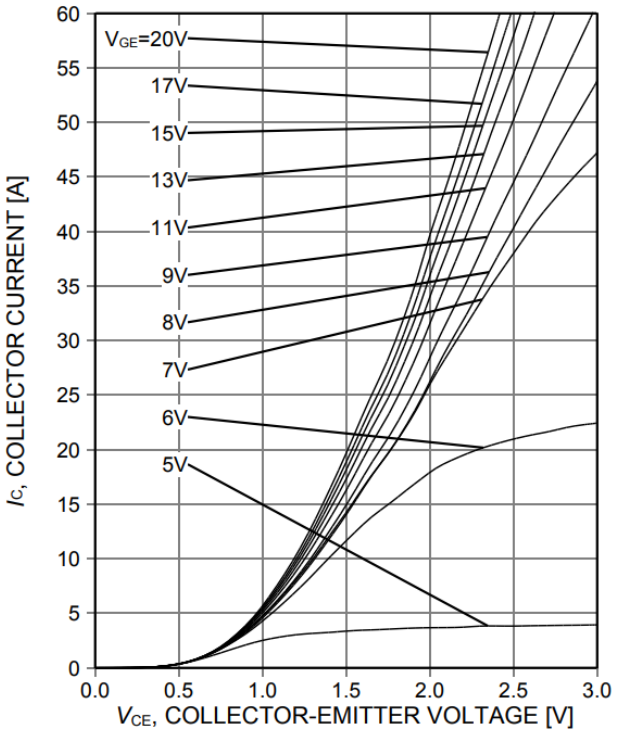



Figure 5. **Typical output characteristic**
($T_{vj}$=175°C)

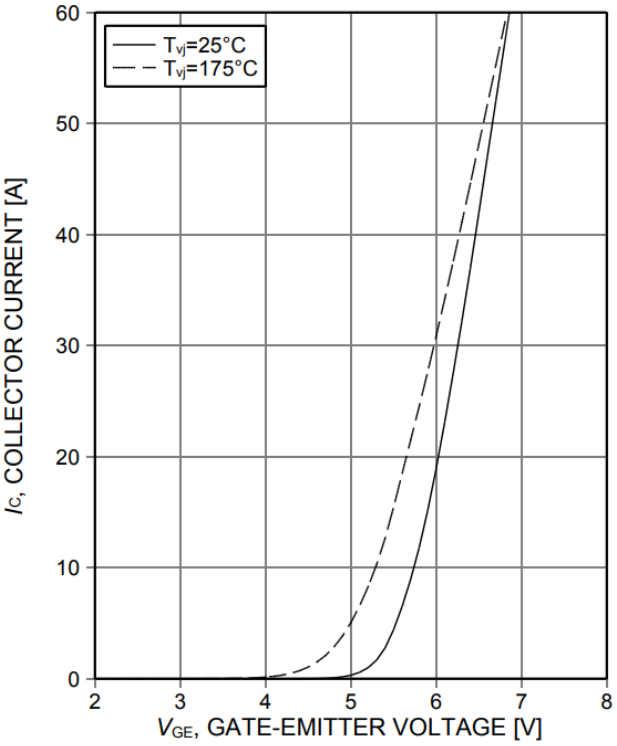



Figure 6. **Typical transfer characteristic**
($V_{CE}$=20V)

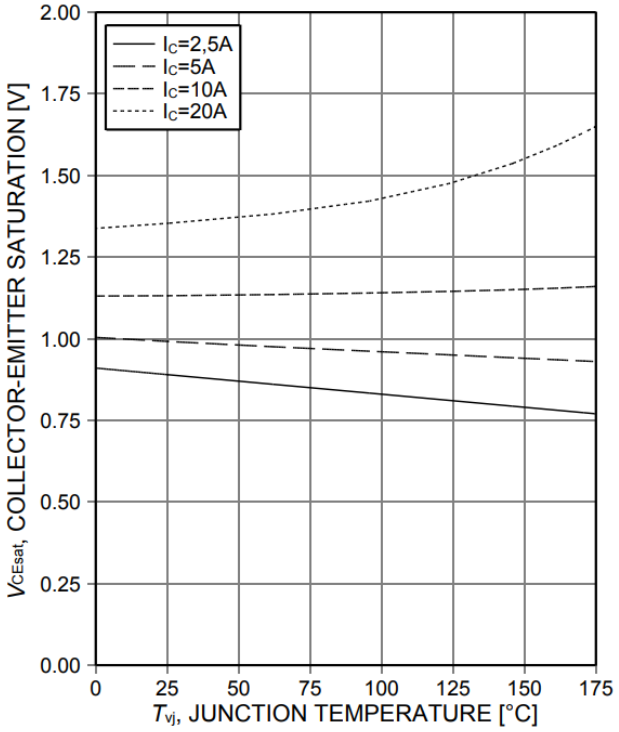



Figure 7. **Typical collector-emitter saturation voltage as a function of junction temperature**
($V_{GE}$=15V)

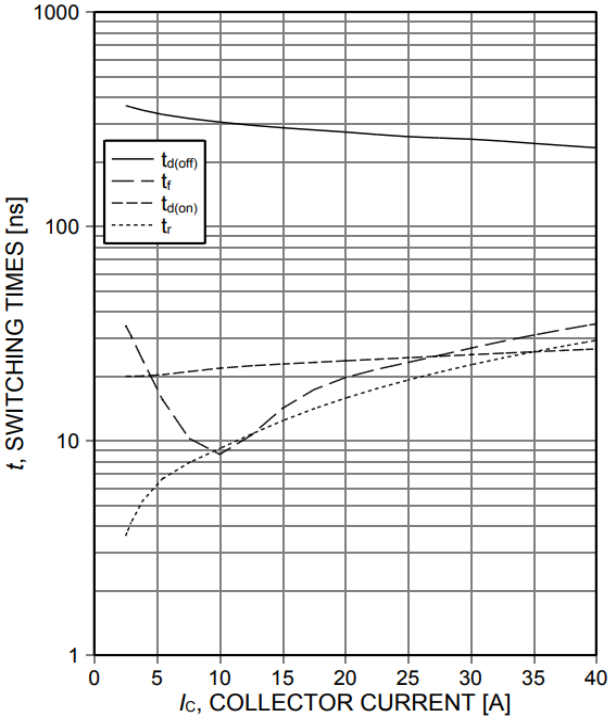



Figure 8. **Typical switching times as a function of collector current**
(inductive load, Tvj=175°C, VCE=400V, VGE=0/15V, RGon=23Ω, RGoff=23Ω, dynamic test circuit in Figure E)

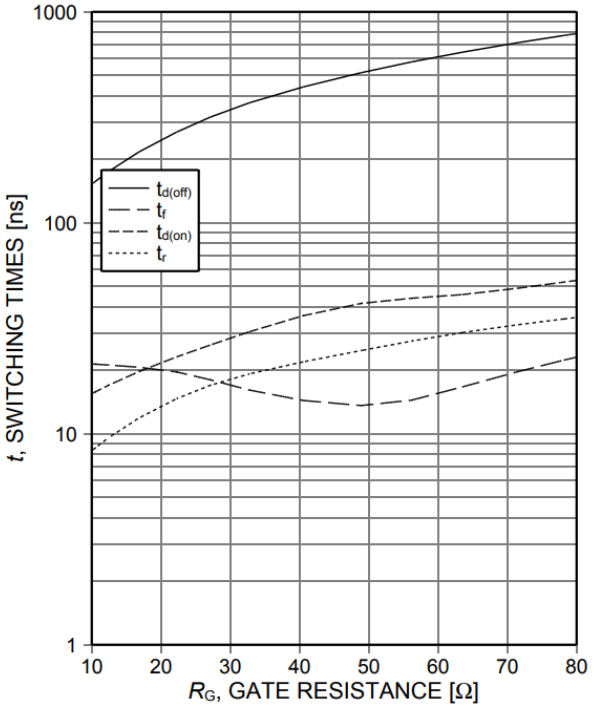



Figure 9. **Typical switching times as a function of gate resistance**
(inductive load, $T_{vj}$=175°C, $V_{CE}$=400V, $V_{GE}$=0/15V, $I_C$=20A, dynamic test circuit in Figure E)

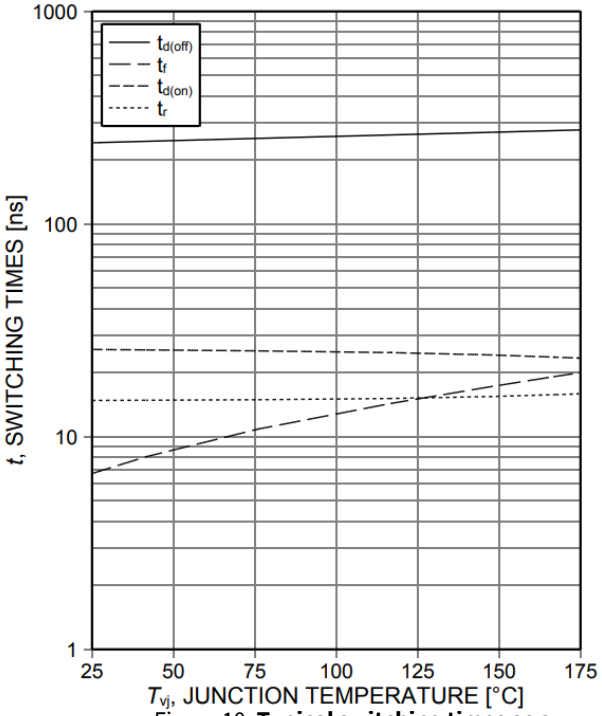



Figure 10. **Typical switching times as a function of junction temperature**
(inductive load, $V_{CE}$=400V, $V_{GE}$=0/15V, $I_C$=20A, $R_{Gon}$=23Ω, $R_{Goff}$=23Ω, dynamic test circuit in Figure E)

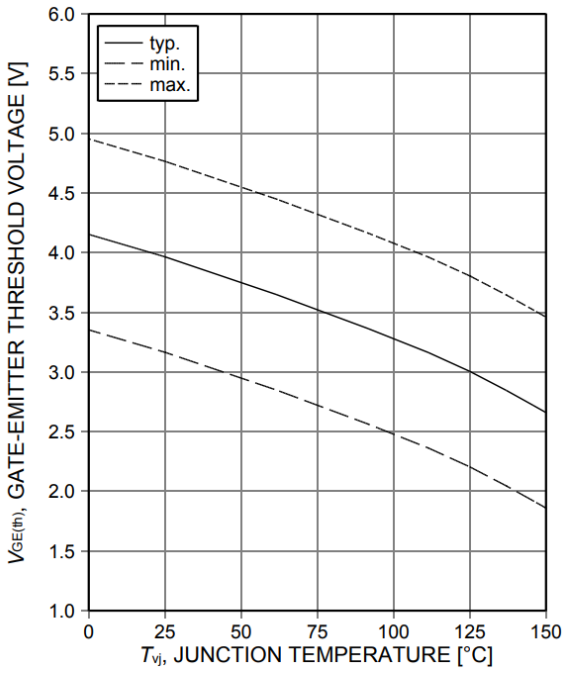



Figure 11. **Gate-emitter threshold voltage as a function of junction temperature**
($I_C$=0.2mA)

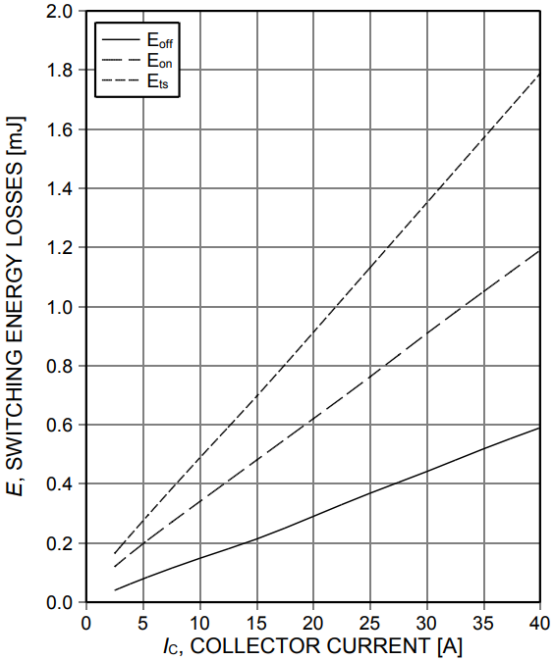



Figure 12. **Typical switching energy losses as a function of collector current** (inductive load, $T_{vj}$=175°C, $V_{CE}$=400V, $V_{GE}$=0/15V, $R_{Gon}$=23Ω, $R_{Goff}$=23Ω, dynamic test circuit in Figure E)

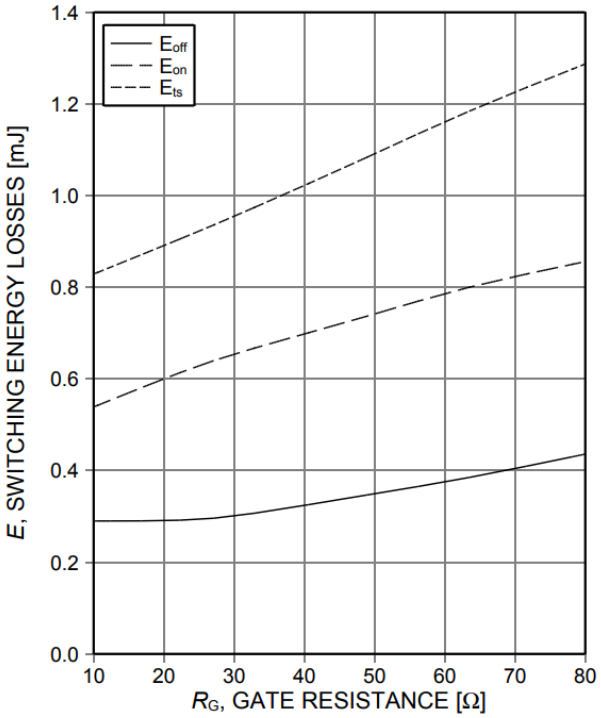



Figure 13. **Typical switching energy losses as a function of gate resistance** (inductive load, $T_{vj}$=175°C, $V_{CE}$=400V, $V_{GE}$=0/15V, $I_C$=20A, dynamic test circuit in Figure E)

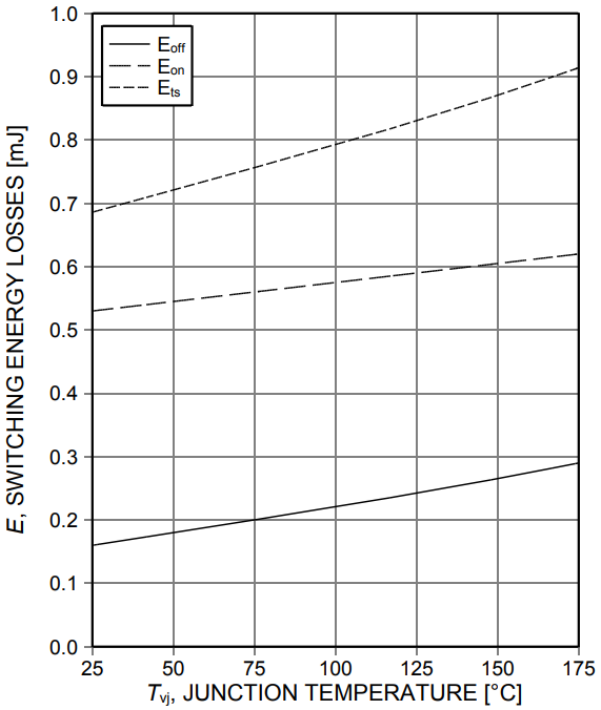



Figure 14. **Typical switching energy losses as a function of junction temperature** (inductive load, $V_{CE}$=400V, $V_{GE}$=0/15V, $I_C$=20A, $R_{Gon}$=23Ω, $R_{Goff}$=23Ω, dynamic test circuit in Figure E)

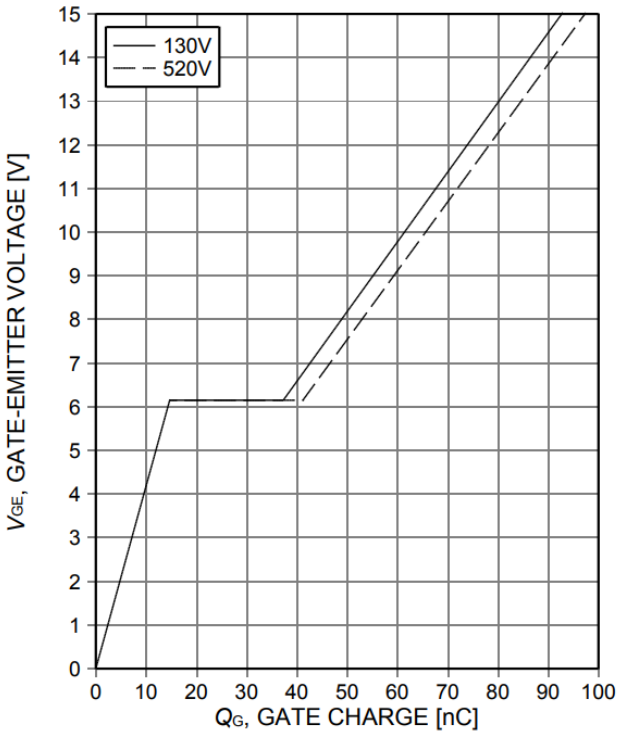



Figure 15. **Typical gate charge** ($I_C$=20A)

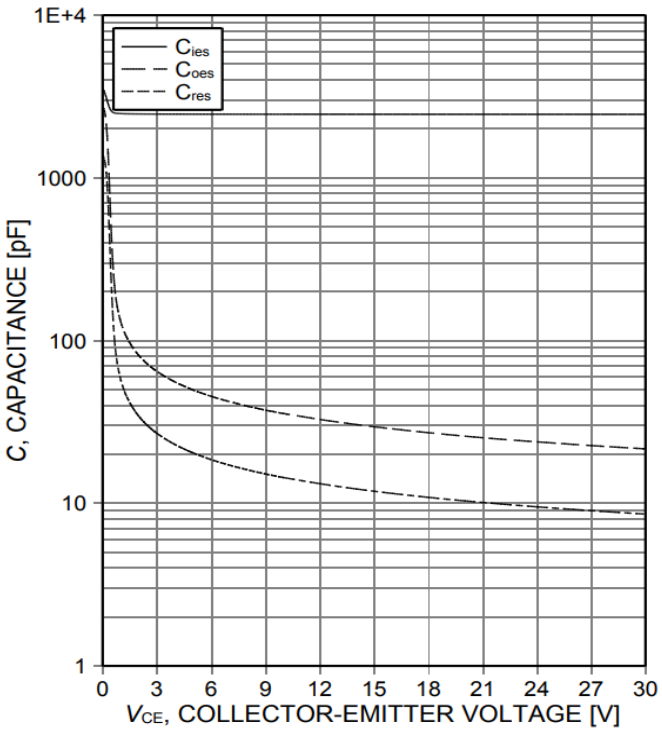



Figure 16. **Typical capacitance as a function of collector-emitter voltage** ($V_{GE}$=0V, f=1MHz)

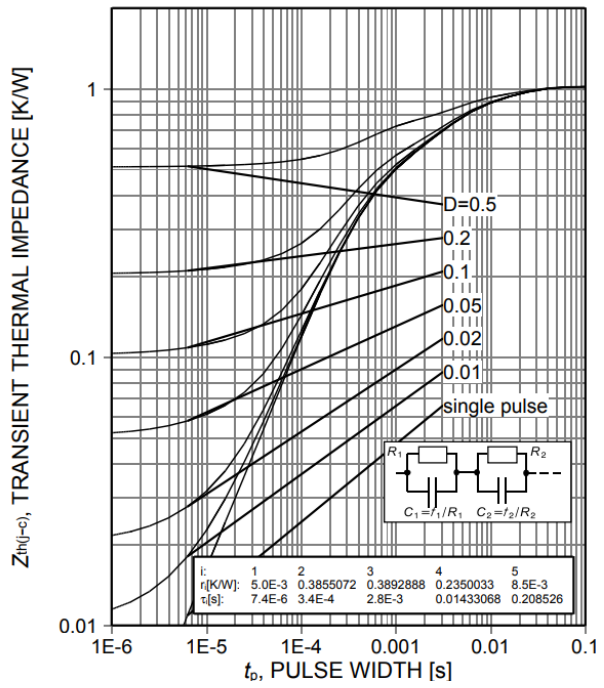



Figure 17. **IGBT transient thermal impedance as a function of pulse width**
($D$=$t_p$/T)

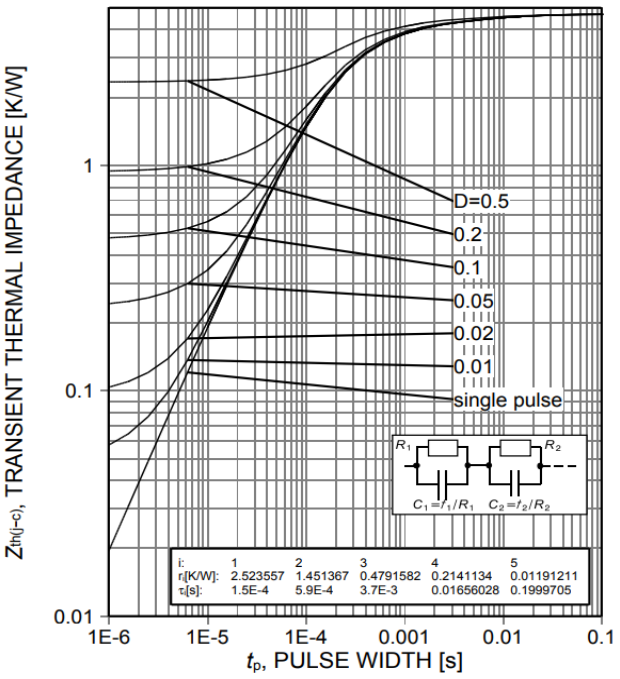



Figure 18. **Diode transient thermal impedance as a function of pulse width**
($D$=$t_p$/T)

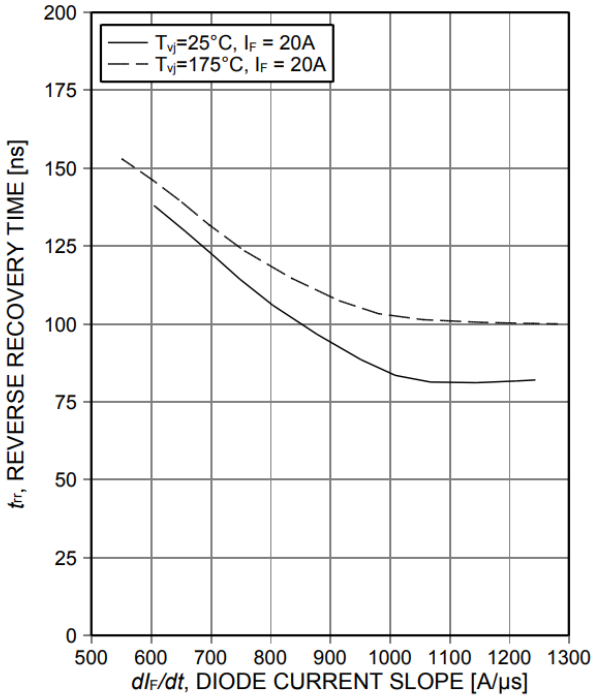



Figure 19. **Typical reverse recovery time as a function of diode current slope**
($V_R$=400V)

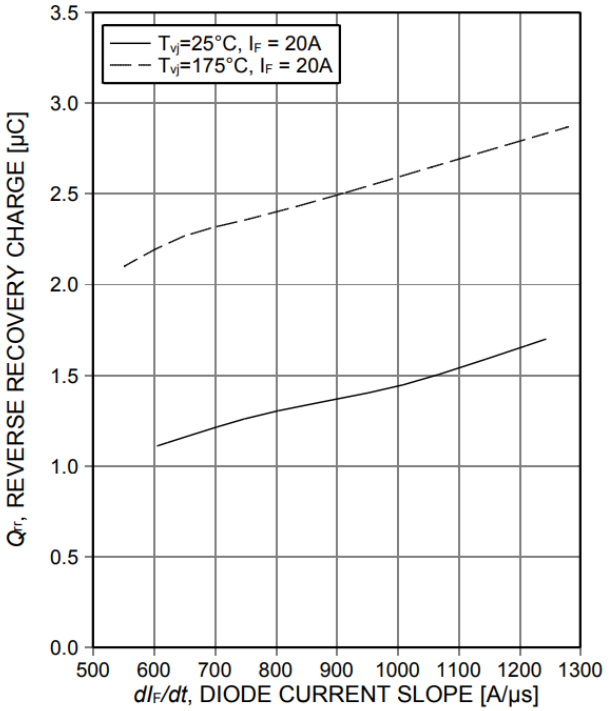



Figure 20. **Typical reverse recovery charge as a function of diode current slope**
($V_R$=400V)

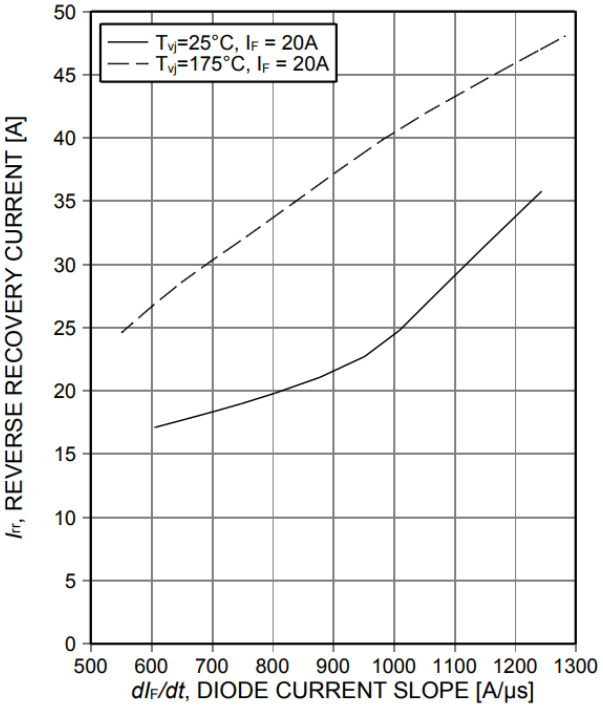



Figure 21. **Typical reverse recovery current as a function of diode current slope** ($V_R$=400V)

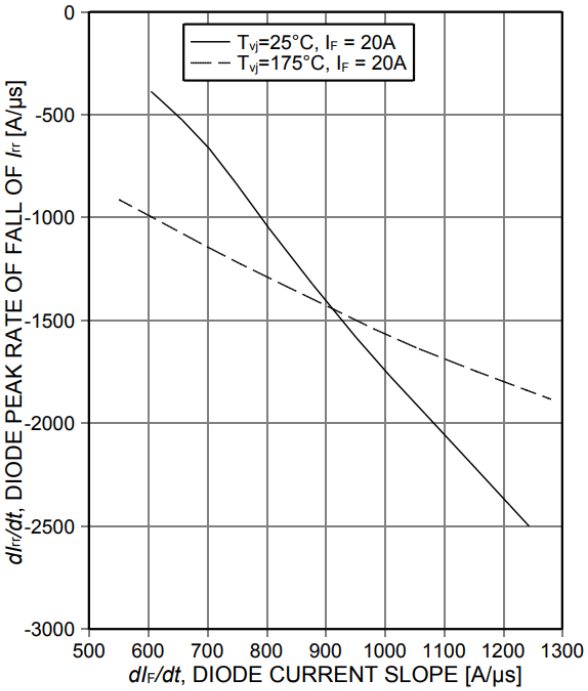



Figure 22. **Typical diode peak rate of fall of reverse recovery current as a function of diode current slope** ($V_R$=400V)

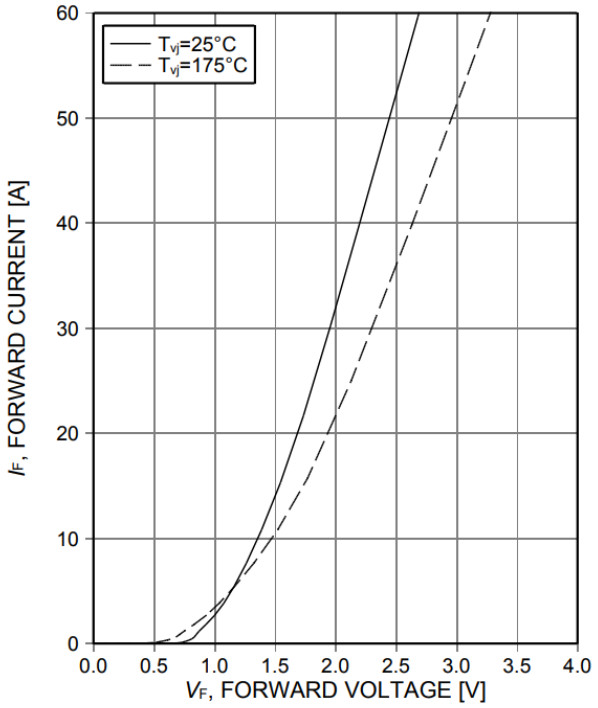



Figure 23. **Typical diode forward current as a function of forward voltage**

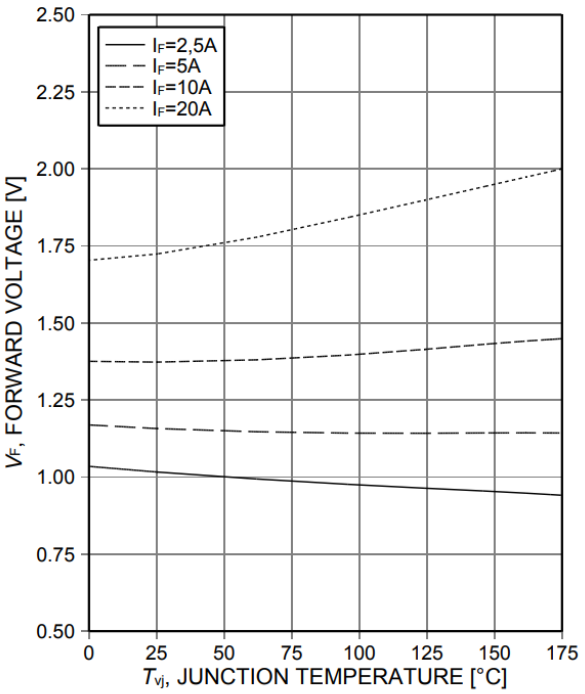
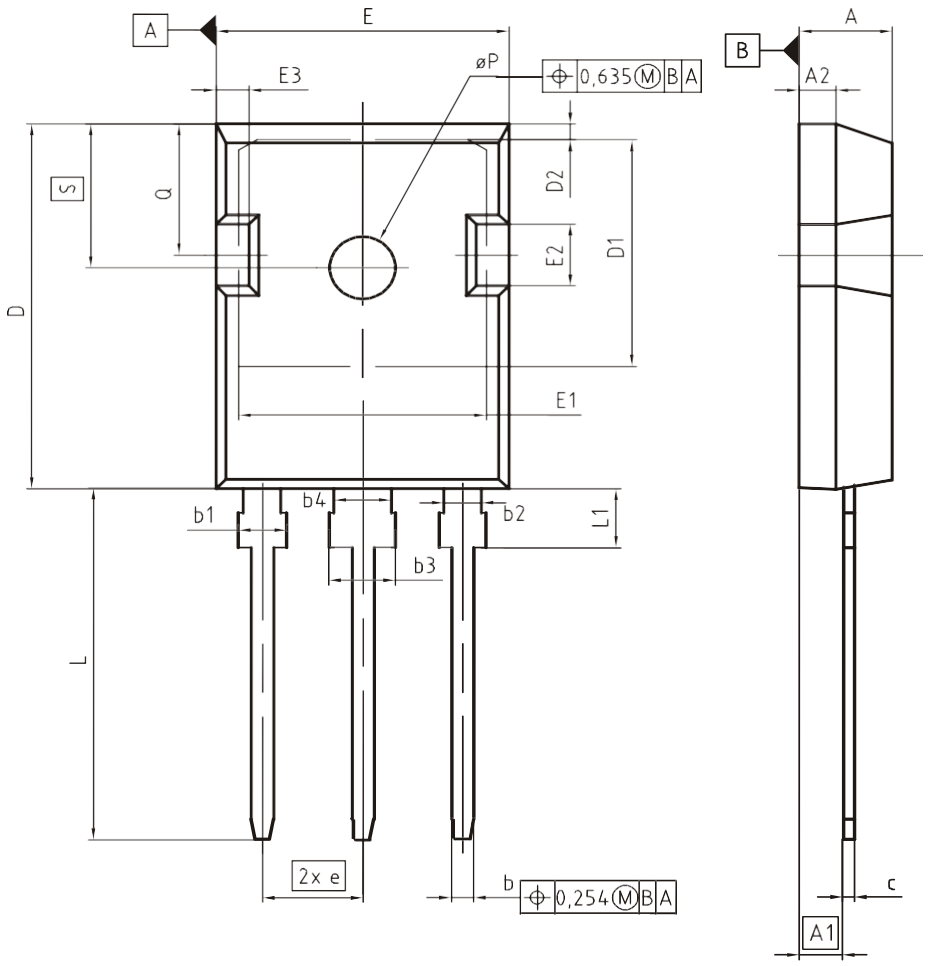



Figure 24. **Typical diode forward voltage as a function of junction temperature**

## 封装图 PG-TO247-3




| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 4.83 | 5.21 | 0.190 | 0.205 |
| A1 | 2.27 | 2.54 | 0.089 | 0.100 |
| A2 | 1.85 | 2.16 | 0.073 | 0.085 |
| b | 1.07 | 1.33 | 0.042 | 0.052 |
| b1 | 1.90 | 2.41 | 0.075 | 0.095 |
| b2 | 1.90 | 2.16 | 0.075 | 0.085 |
| b3 | 2.87 | 3.38 | 0.113 | 0.133 |
| b4 | 2.87 | 3.13 | 0.113 | 0.123 |
| c | 0.55 | 0.68 | 0.022 | 0.027 |
| D | 20.80 | 21.10 | 0.819 | 0.831 |
| D1 | 16.25 | 17.65 | 0.640 | 0.695 |
| D2 | 0.95 | 1.35 | 0.037 | 0.053 |
| E | 15.70 | 16.13 | 0.618 | 0.635 |
| E1 | 13.10 | 14.15 | 0.516 | 0.557 |
| E2 | 3.68 | 5.10 | 0.145 | 0.201 |
| E3 | 1.00 | 2.60 | 0.039 | 0.102 |
| e | 5.44 (BSC) | | 0.214 (BSC) | |
| N | 3 | | 3 | |
| L | 19.80 | 20.32 | 0.780 | 0.800 |
| L1 | 4.10 | 4.47 | 0.161 | 0.176 |
| øP | 3.50 | 3.70 | 0.138 | 0.146 |
| Q | 5.49 | 6.00 | 0.216 | 0.236 |
| S | 6.04 | 6.30 | 0.238 | 0.248 |

DOCUMENT NO.
Z8B00003327

SCALE
0 5 5 7.5mm

EUROPEAN PROJECTION

ISSUE DATE
09-07-2010

REVISION
05

**测试条件**

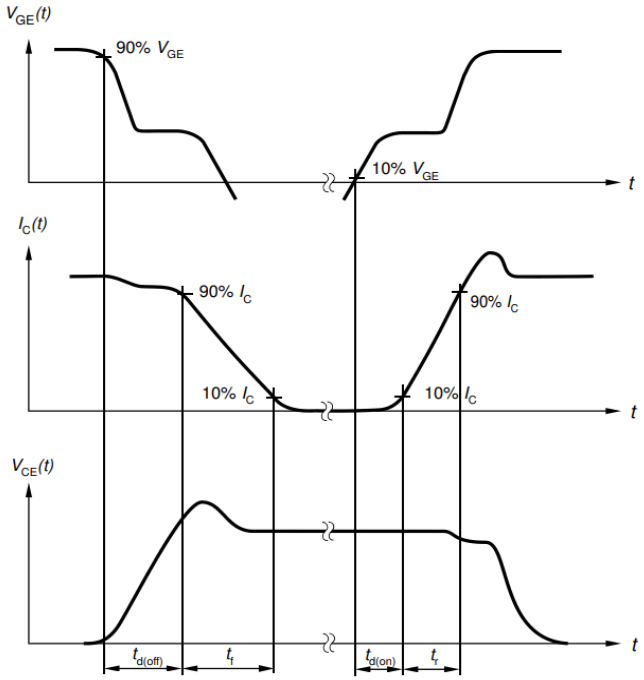



Figure A. **Definition of switching times**

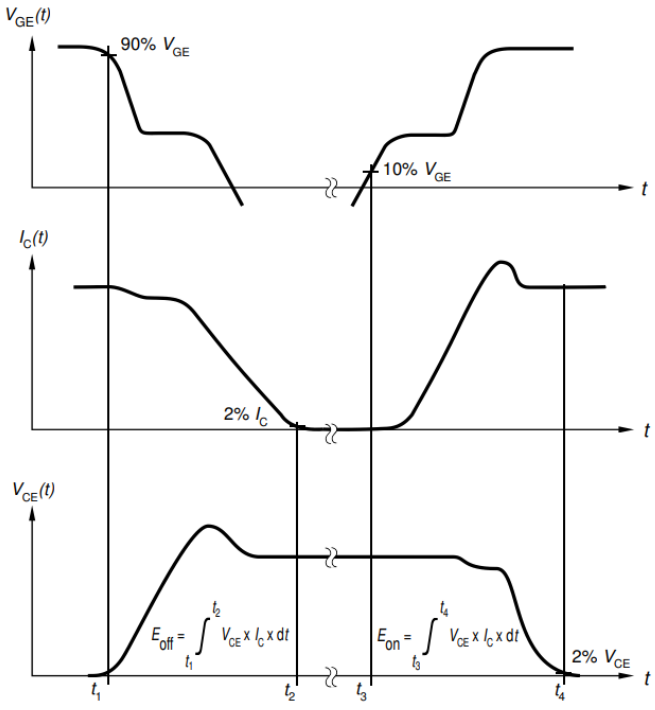



Figure B. **Definition of switching losses**

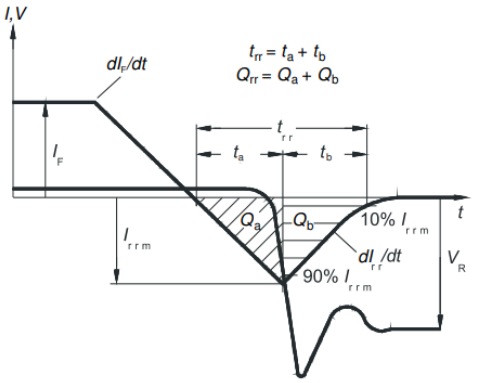



Figure C. **Definition of diode switching characteristics**

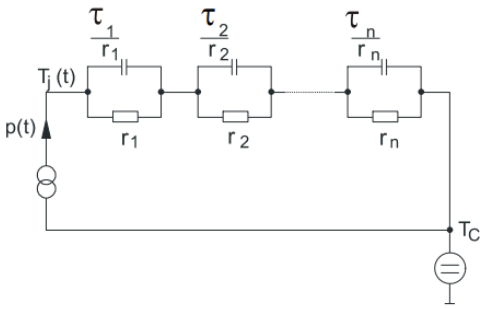



Figure D. **Thermal equivalent circuit**

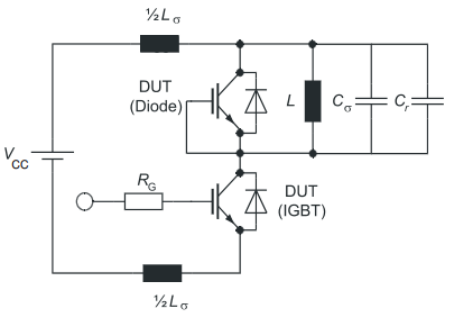



Figure E. **Dynamic test circuit**
Parasitic inductance $L_\sigma$,
parasitic capacitor $C_\sigma$,
relief capacitor $C_r$,
(only for ZVT switching)

## 修订记录

IHW20N65R5

**Revision: 2015-12-22, Rev. 2.3**

历史修订版本

| Revision | Date | Subjects (major changes since last revision) |
|---|---|---|
| 1.1 | 2014-06-13 | Preliminary data sheet |
| 1.2 | 2014-06-16 | - |
| 2.1 | 2014-09-12 | Final data sheet |
| 2.2 | 2014-11-27 | Update of diode forward current values |
| 2.3 | 2015-12-22 | Minor change Conditions Static Characteristic |

**Published by**
**Infineon Technologies AG**
**81726 München, Germany**
**© Infineon Technologies AG 2015.**
**All Rights Reserved.**

**Important Notice**
The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie"). With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office (www.infineon.com).

Please note that this product is not qualified according to the AEC Q100 or AEC Q101 documents of the Automotive Electronics Council.

**Warnings**
Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.

## 免责声明

请注意，本文件的原文使用英文撰写，为方便客户浏览英飞凌提供了中文译文。该中文译文仅供参考，并不可作为任何论点之依据。
由于翻译过程中可能使用了自动化程序，以及语言翻译和转换过程中的差异，最后的中文译文与最新的英文版本原文含义可能存在不尽相同之处。
因此，我们同时提供该中文译文版本的最新英文原文供您阅读，请参见 http://www.infineon.com
英文原文和中文译文版本之间若存有任何歧异，以最新的英文版本为准，并且仅认可英文版本为正式文件。
**您如果使用本文件，即表示您同意并理解上述说明。英飞凌不对因翻译过程中可能存在的任何不完整或不准确信息而产生的任何直接或间接损失或损害负责。英飞凌不承担中文译文版本的完整性和准确性责任。如果您不同意上述说明，请不要使用本文件。**

**Trademarks**
All referenced product or service names and trademarks are the property of their respective owners.

版本 **2026-09-22**

**Infineon Technologies AG** 出版，
德国 **Neubiberg 85579**

版权 © **2026 Infineon Technologies AG**
及其关联公司。
保留所有权利。

**Do you have a question about this document?**

**Email:**

erratum@infineon.com

**重要通知**

**Infineon Technologies AG** 及其关联公司（以下简称 "英飞凌"）销售或提供和交付的产品（可能也包括样品，且可能由硬件或软件或两者组成）（以下简称 "产品"），应遵守客户与英飞凌签订的框架供应合同或其他书面协议的条款和条件，如无上述合同或其他书面协议，则应遵守适用的英飞凌销售条件。只有在英飞凌明确书面同意的情况下，客户的一般条款和条件或对适用的英飞凌销售条件的偏离才对英飞凌具有约束力。

为避免疑义，英飞凌不承担不侵犯第三方权利的所有保证和默示保证，例如对特定用途/目的的适用性或适销性的保证。

英飞凌对与样品、应用或客户对任何产品的具体使用有关的任何信息或本文档中给出的任何示例或典型值概不负责。

本文件中包含的数据仅供具有技术资格和技能的客户代表使用。客户有责任评估产品对预期应用和客户特定用途的适用性，并在预期应用和客户特定用途中验证本文件中包含的所有相关技术数据。客户有责任正确设计、编程和测试预期应用的功能性和安全性，并遵守与其使用相关的法律要求。

除非英飞凌另行明确批准，否则产品不得用于任何因产品故障或使用产品的任何后果可合理预期会导致人身伤害的应用。但是，上述规定并不妨碍客户在英飞凌明确设计和销售的使用领域中使用任何产品，但是客户对应用负有全部责任。

英飞凌明确保留根据适用法律，如《德国版权法》（UrhG）第 44b 条，将其内容用于商业资料和数据探勘（TDM）的权利。

如果产品包含安全功能：
由于任何计算设备都不可能绝对安全，尽管产品采取了安全措施，但英飞凌不保证产品不会被入侵、数据不会被盗或遗失，或不会发生其他漏洞（以下简称"安全漏洞"），英飞凌对任何安全漏洞不承担任何责任。

如果本文档包含或引用软件：
根据美国、德国和世界其他国家的知识产权法律和条约，该软件归英飞凌所有。英飞凌保留所有权利。因此，您只能按照软件附带的软件授权协议的规定使用本软件。

如果没有适用的软件授权协议，英飞凌特此授予您个人的、非排他性的、不可转让的软件知识产权授权（无权转授权）：(a) 对于以源代码形式提供的软件，仅在贵组织内部修改和复制该软件用于英飞凌硬件产品；及 (b) 对于以二进制代码(binary code)形式对外向终端用户分发该软件，仅得用于英飞凌硬件产品。禁止对本软件进行任何其他使用、复制、修改、翻译或编译。有关产品、技术、交货条款和条件以及价格的详细信息，请联系离您最近的英飞凌办公室或访问 **https://www.infineon.com**。