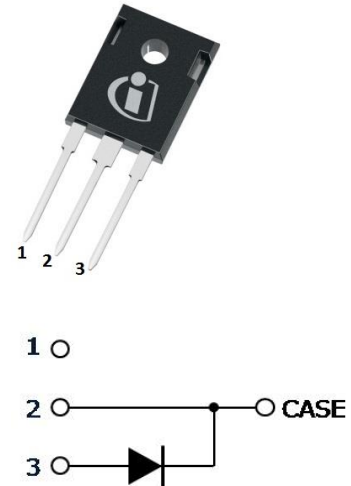


# CoolSiC™ Automotive Schottky Diode 650V G5

650V/10A Silicon Carbide Schottky Diode in TO247-3

## Features

- Revolutionary semiconductor material - Silicon Carbide
- Benchmark switching behavior
- No reverse recovery/ No forward recovery
- Temperature independent switching behavior
- High surge current capability
- Pb-free lead plating; RoHS compliant
- Junction Temperature range from -40°C to 175°C
- System efficiency improvement over Si diodes
- System cost / size savings due to reduced cooling requirements
- Enabling higher frequency / increased power density solutions
- Higher system reliability due to lower operating temperatures
- Reduced EMI



## Potential Applications

- Traction inverter
- Booster / DCDC Converter
- On board Charger / PFC



## Product Validation

“Qualified for Automotive Applications. Product Validation according to AEC-Q100/101”

## Description

The 5th Generation CoolSiC™ Automotive Schottky Diode represents Infineon leading edge technology for Silicon Carbide Schottky Barrier diodes. Thanks to a compact design and a technology based on thin wafers, this family of products shows improved efficiency over all load conditions resulting from both its thermal characteristics and low figure of merit ( $Q_C \times V_f$ ). This product family has been designed to complement Infineon's IGBT and CoolMOS™ portfolio. This ensures meeting the most stringent application requirements in the 650V voltage class.

| Product Information |               |
|---------------------|---------------|
| Ordering Code       | AIDW10S65C5   |
| Marking             | AD1065C5      |
| Package             | PG-TO247-3-41 |
| SP Number           | SP001725156   |

| Parameter                      | Value/Unit           |
|--------------------------------|----------------------|
| $V_{DC,max}$                   | 650 V                |
| $I_F; T_C < 134^\circ\text{C}$ | 10 A                 |
| $Q_C; V_R = 400\text{ V}$      | 15 nC                |
| $E_C; V_R = 400\text{ V}$      | 3.5 $\mu\text{J}$    |
| $T_{j,max}$                    | 175 $^\circ\text{C}$ |

| Pin         | Definition |
|-------------|------------|
| Pin 2, case | Cathode    |
| Pin 3       | Anode      |



Table of Contents

Table of Contents

Features..... 1

Potential Applications..... 1

Product Validation..... 1

Description..... 1

Table of Contents..... 2

1 Maximum Ratings..... 3

2 Thermal Characteristics..... 4

3 Electrical Characteristics..... 5

4 Electrical Characteristics Diagrams..... 6

5 Package Outlines..... 9

Revision History..... 10

## Maximum Ratings

### 1 Maximum Ratings

Table 1 Maximum ratings<sup>1</sup>

| Parameter                                                                                                                                       | Symbol        | Value        | Unit   |
|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------|--------|
| Repetitive peak reverse voltage                                                                                                                 | $V_{RRM}$     | 650          | V      |
| Continuous forward current for $R_{thJC,max}$<br>$T_C = 134\text{ °C}$ , $D=1$                                                                  | $I_F$         | 10           | A      |
| Surge non-repetitive forward current,<br>sine halfwave<br>$T_C = 25\text{ °C}$ , $t_p=10\text{ms}$<br>$T_C = 150\text{ °C}$ , $t_p=10\text{ms}$ | $I_{F,SM}$    | 58<br>46     | A      |
| Non-repetitive peak forward current<br>$T_C = 25\text{ °C}$ , $t_p=10\mu\text{s}$                                                               | $I_{F,max}$   | 431          | A      |
| $i^2t$ value<br>$T_C = 25\text{ °C}$ , $t_p=10\text{ms}$<br>$T_C = 150\text{ °C}$ , $t_p=10\text{ms}$                                           | $\int i^2 dt$ | 16.6<br>10.5 | $A^2s$ |
| Diode $dv/dt$ ruggedness<br>$V_R=0\ldots480\text{V}$                                                                                            | $dv/dt$       | 100          | V/ns   |
| Power dissipation<br>$T_C = 25\text{ °C}$                                                                                                       | $P_{tot}$     | 65           | W      |
| Operating temperature                                                                                                                           | $T_j$         | -40...175    | °C     |
| Storage temperature                                                                                                                             | $T_{stg}$     | -55...150    | °C     |
| ESD<br>Human body model, $R=1.5\text{ k}\Omega$ , $C=100\text{ pF}$<br>Charged device model                                                     |               | 8<br>2       | kV     |
| Soldering temperature,<br>wavesoldering only allowed at leads,<br>1.6mm (0.063 in.) from case for 10 s                                          | $T_{sld}$     | 260          | °C     |
| Mounting Torque (M3 and M4 screws)                                                                                                              |               | 70           | Ncm    |

## Thermal Characteristics

## 2 Thermal Characteristics

Table 2 Thermal Characteristics<sup>1</sup>

| Parameter                                         | Symbol     | Values |      |      | Unit | Note/Test condition |
|---------------------------------------------------|------------|--------|------|------|------|---------------------|
|                                                   |            | Min.   | Typ. | Max. |      |                     |
| Thermal resistance, junction-case <sup>2</sup>    | $R_{thJC}$ | -      | 1.8  | 2.3  | K/W  |                     |
| Thermal resistance, junction-ambient <sup>2</sup> | $R_{thJA}$ | -      | -    | 62   | K/W  |                     |

## Electrical Characteristics

### 3 Electrical Characteristics

Table 3 Static Characteristics

| Parameter                          | Symbol   | Values |      |      | Unit          | Note/Test condition                                 |
|------------------------------------|----------|--------|------|------|---------------|-----------------------------------------------------|
|                                    |          | Min.   | Typ. | Max. |               |                                                     |
| DC blocking voltage                | $V_{DC}$ | 650    | -    | -    | V             | $T_j = 25^{\circ}\text{C}$ , $I_R = 0.06\text{ mA}$ |
| Diode forward voltage <sup>3</sup> | $V_F$    | -      | 1.5  | 1.7  |               | $T_j = 25^{\circ}\text{C}$ , $I_F = 10\text{ A}$    |
|                                    |          | -      | 1.8  | 2.1  |               | $T_j = 150^{\circ}\text{C}$ , $I_F = 10\text{ A}$   |
| Reverse current                    | $I_R$    | -      | 2    | 60   | $\mu\text{A}$ | $V_R = 650\text{ V}$ , $T_j = 25^{\circ}\text{C}$   |
|                                    |          | -      | 12   | -    |               | $V_R = 650\text{ V}$ , $T_j = 150^{\circ}\text{C}$  |

Table 4 Dynamic Characteristics at  $T_j=25^{\circ}\text{C}$  unless noted otherwise

| Parameter               | Symbol | Values |      |      | Unit | Note/Test condition                                                                                               |
|-------------------------|--------|--------|------|------|------|-------------------------------------------------------------------------------------------------------------------|
|                         |        | Min.   | Typ. | Max. |      |                                                                                                                   |
| Total capacitive charge | $Q_C$  | -      | 15   | -    | nC   | $V_R = 400\text{ V}$ , $di/dt = 200\text{ A}/\mu\text{s}$ ,<br>$I_F \leq I_{F,MAX}$ , $T_j = 150^{\circ}\text{C}$ |
| Total capacitance       | C      | -      | 303  | -    | pF   | $V_R = 1\text{ V}$ , $f = 1\text{ MHz}$                                                                           |
|                         |        | -      | 40   | -    |      | $V_R = 300\text{ V}$ , $f = 1\text{ MHz}$                                                                         |
|                         |        | -      | 39   | -    |      | $V_R = 600\text{ V}$ , $f = 1\text{ MHz}$                                                                         |

#### Footnotes:

<sup>1</sup> The parameter is not subject to production test- verified by design/characterization.

<sup>2</sup>  $R_{th,JC}$  defined as per JESD-51-14.  $R_{th,JA}$  defined as per JESD-51-2.

<sup>3</sup> Only the value at  $25^{\circ}\text{C}$  is subject to production test. The value at  $150^{\circ}\text{C}$  is only verified by design/characterization.

## Electrical Characteristics Diagrams

### 4 Electrical Characteristics Diagrams

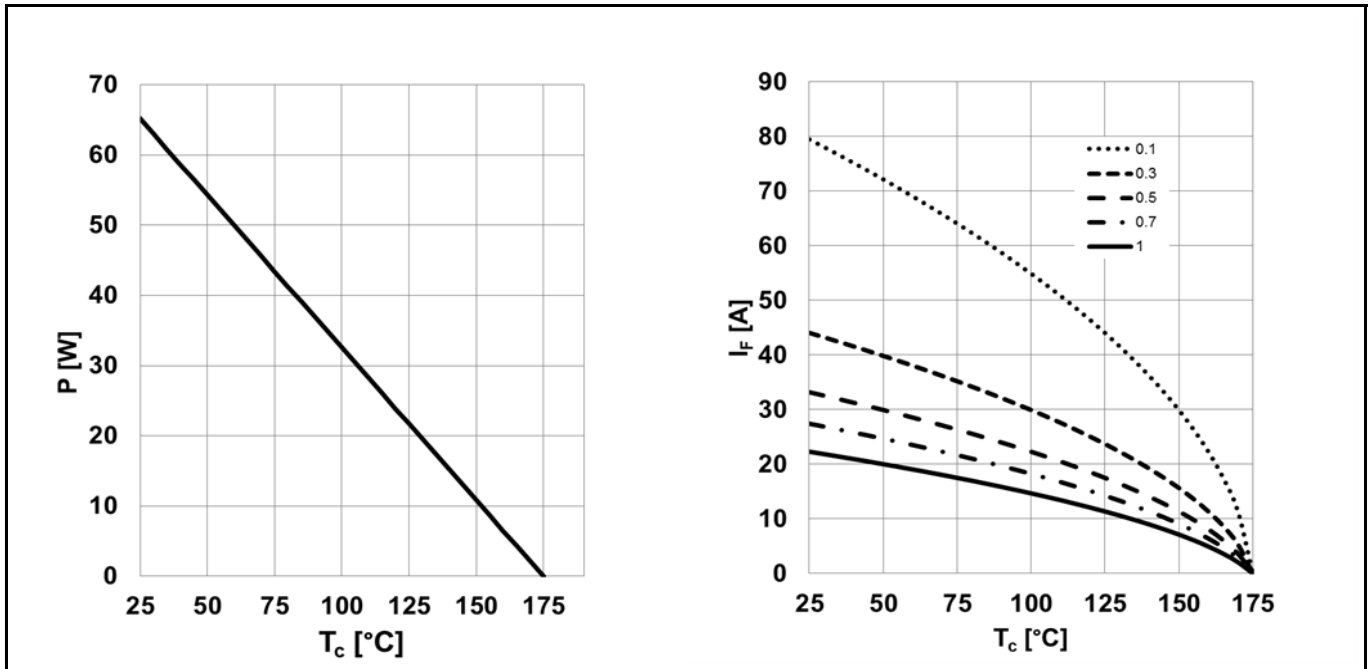


Figure 1 (LEFT) Power dissipation;  $P_{\text{tot}} = f(T_c)$ ;  $R_{\text{thJC,max}}$   
(RIGHT) Diode forward current;  $I_F = f(T_c)$ ;  $T_j \leq 175$  °C;  $R_{\text{thJC,max}}$ ; parameter:  $D$ =duty cycle

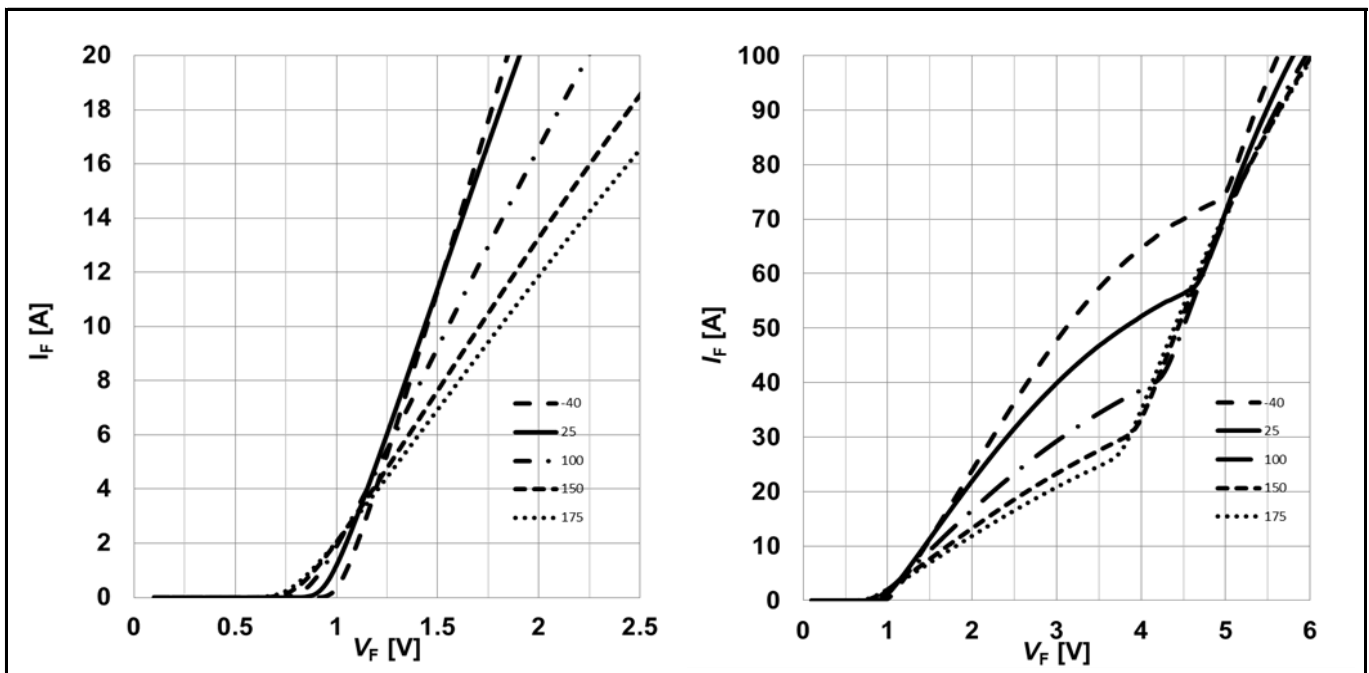


Figure 2 (LEFT) Typical forward characteristic;  $I_F = f(V_F)$ ;  $t_p = 200$  μs; parameter:  $T_j$   
(RIGHT) Typical forward characteristics in surge current;  $I_F = f(V_F)$ ;  $t_p = 200$  μs; parameter:  $T_j$

## Electrical Characteristics Diagrams

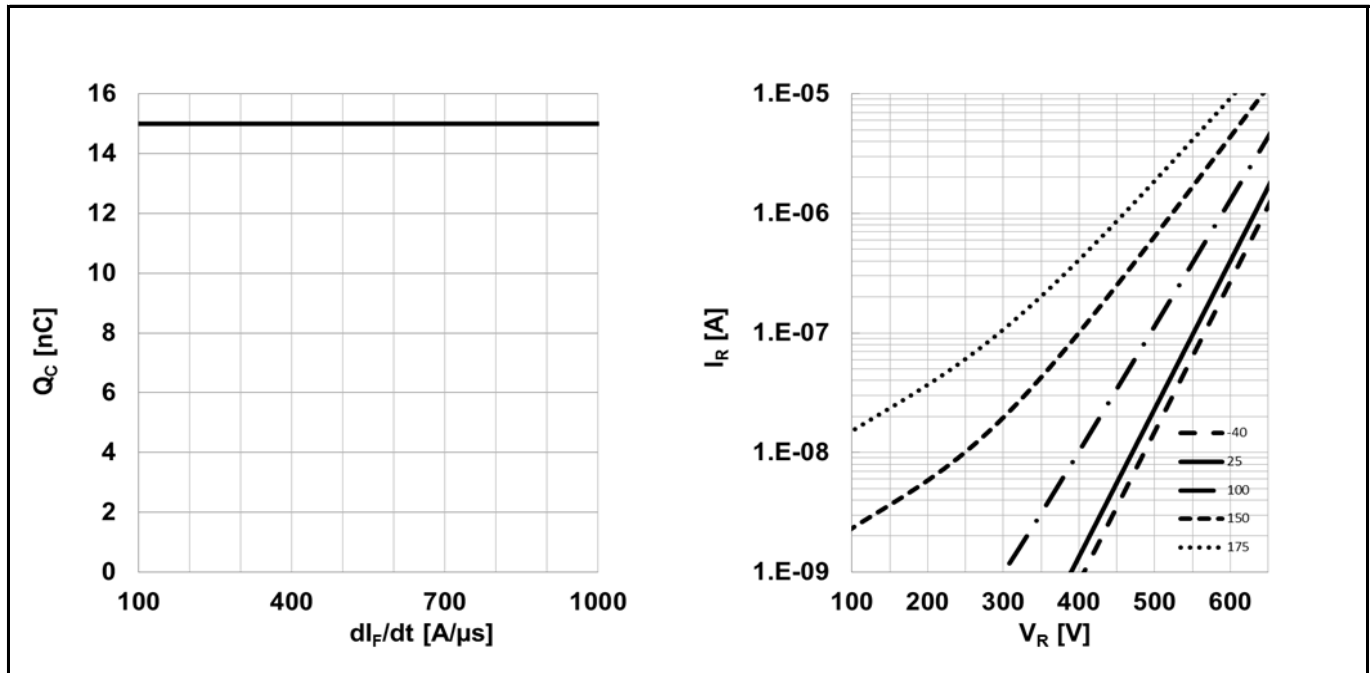


Figure 3 (LEFT) Typical capacitive charge versus current slope (only capacitive charge, guaranteed by design);  $Q_C = f(di_F/dt)$ ;  $T_j = 150^\circ\text{C}$ ;  $V_R = 400\text{V}$ ;  $I_F \leq I_{F,\text{max}}$   
(RIGHT) Typical reverse current versus reverse voltage;  $I_R = f(V_R)$ ; parameter:  $T_j$

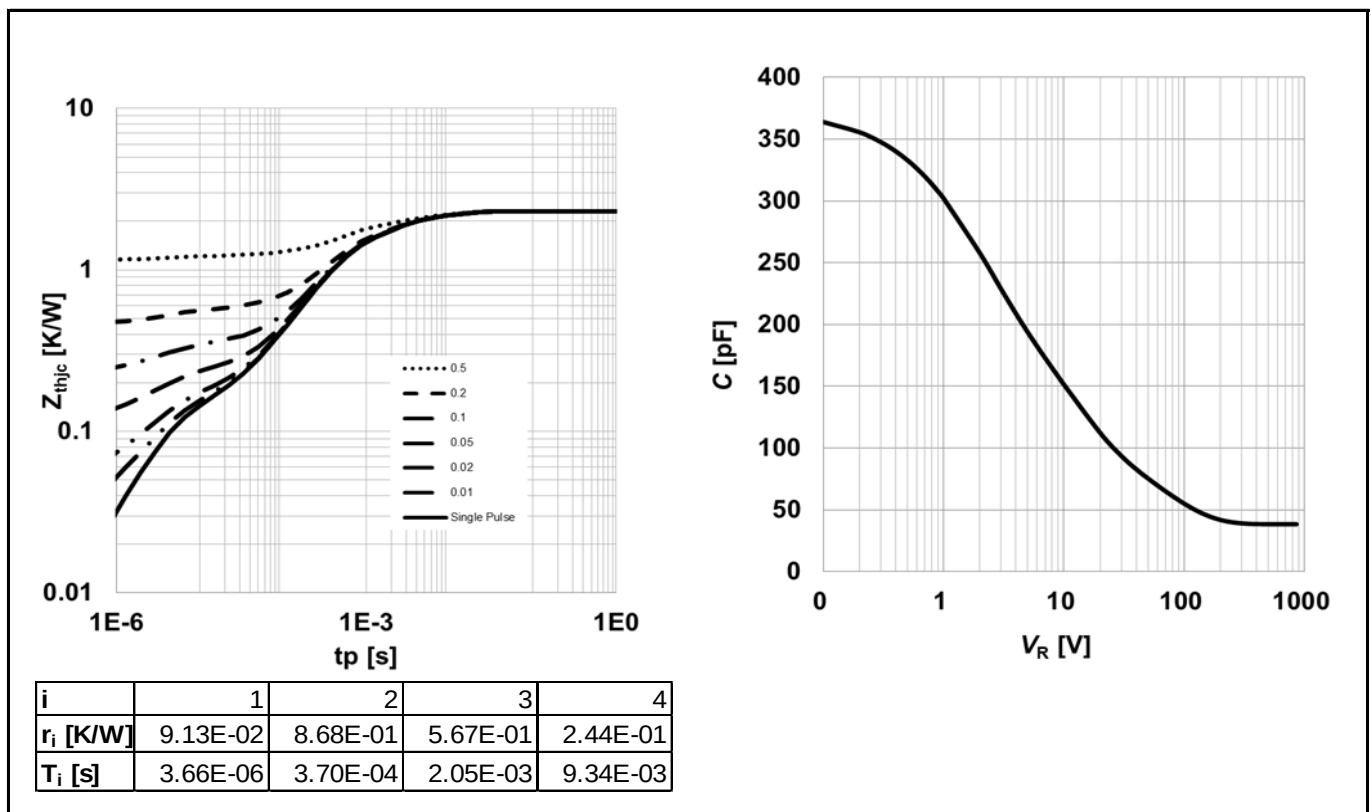


Figure 4 (LEFT) Max. Transient thermal impedance;  $Z_{thJC} = f(t_p)$ ; parameter:  $D = t_p/T$   
(RIGHT) Typ. Capacitance vs. Reverse voltage;  $C = f(V_R)$ ;  $T_j = 25^\circ\text{C}$ ;  $f = 1\text{ MHz}$

Electrical Characteristics Diagrams

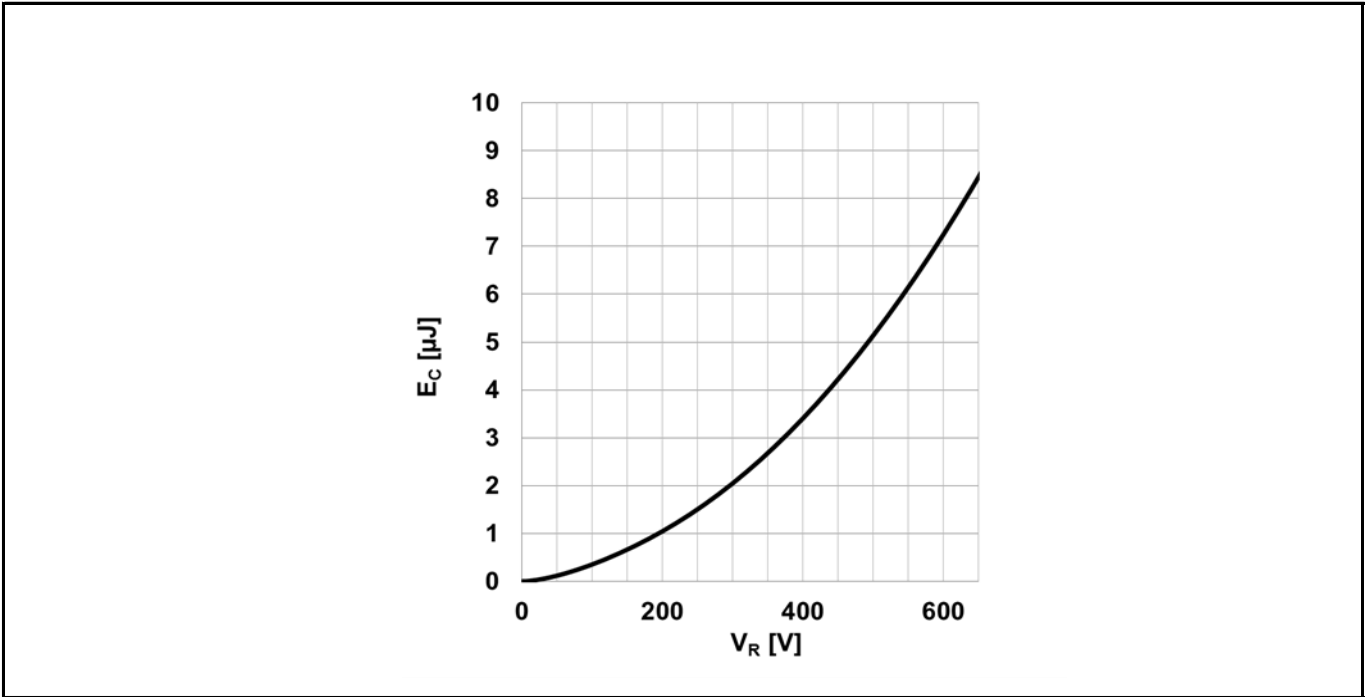


Figure 5 Typical capacitance stored energy;  $E_C = f(V_R)$

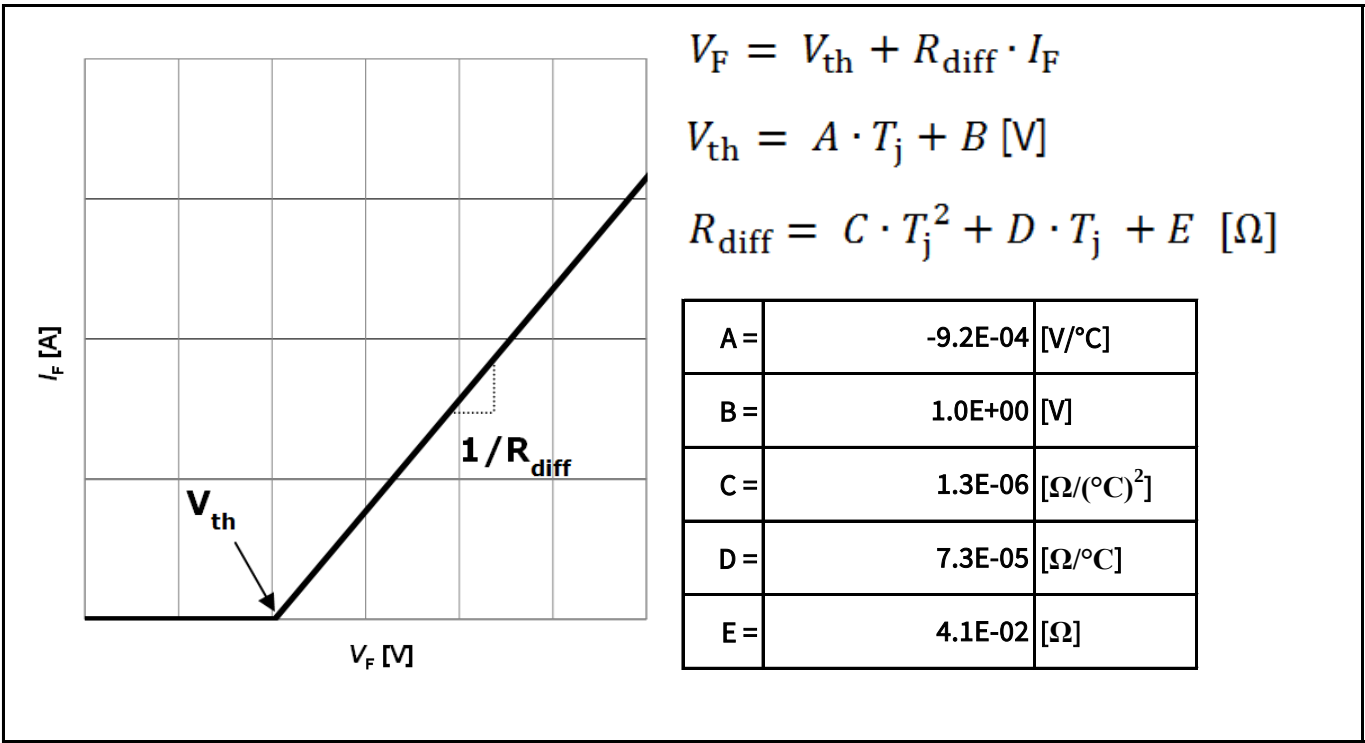


Figure 6 Simplified forward characteristics model  $V_F = f(I_F)$ ;  
 $-40^\circ\text{C} < T_j < 175^\circ\text{C}$ ;  $I_F < 20\text{ A}$



Package Outlines

5 Package Outlines

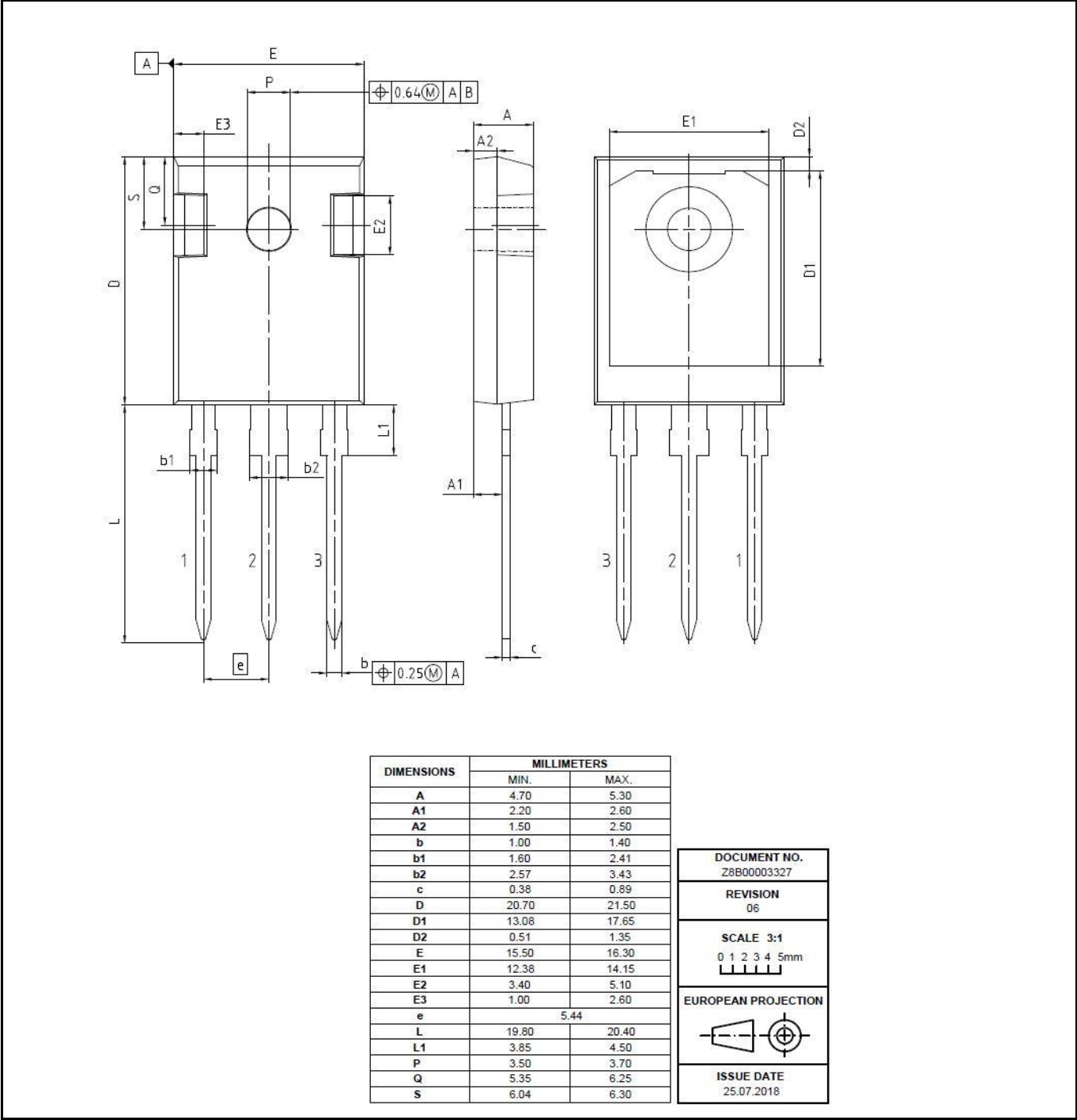


Figure 6 Package outline of PG-TO247-3-41 led (Dimensions in mm)



Revision History

Revision History

| Document Version | Date of Release | Description of changes    |
|------------------|-----------------|---------------------------|
| V3.0             | 26.11.2018      | 1st release of Data Sheet |
|                  |                 |                           |
|                  |                 |                           |
|                  |                 |                           |

#### Trademarks

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

| IMPORTANT NOTICE                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Edition 2017-07-07</b>                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Published by</b><br>Infineon Technologies AG<br>81726 München, Germany                                                   | The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics technology, delivery terms and conditions and ("Beschaffenhheitsgarantie"). For further information on the product, prices please contact your nearest Infineon Technologies office ( <a href="http://www.infineon.com">www.infineon.com</a> ).                                                                                                                                                                                                                                                                         |
| © 2017 Infineon Technologies AG.<br>All Rights Reserved.                                                                    | With respect to any examples, hints or any typical values stated herein and/or any information regarding the <b>WARNINGS</b> application of the product, Infineon Technologies hereby Due to technical requirements products may disclaims any and all warranties and liabilities of any kind, contain dangerous substances. For information including without limitation warranties of non- on the types in question please contact your infringement of intellectual property rights of any third nearest Infineon Technologies office.                                                                                                    |
| <b>Do you have a question about this document?</b><br>Email: <a href="mailto:erratum@infineon.com">erratum@infineon.com</a> | party.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Document reference</b>                                                                                                   | In addition, any information given in this document is Except as otherwise explicitly approved by subject to customer's compliance with its obligations Infineon Technologies in a written document stated in this document and any applicable legal signed by authorized representatives of Infineon requirements, norms and standards concerning Technologies, Infineon Technologies' products customer's products and any use of the product of may not be used in any applications where a Infineon Technologies in customer's applications. failure of the product or any consequences of the use thereof can reasonably be expected to |
|                                                                                                                             | The data contained in this document is exclusively result in personal injury. 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.                                                                                                                                                                                                                                                                          |