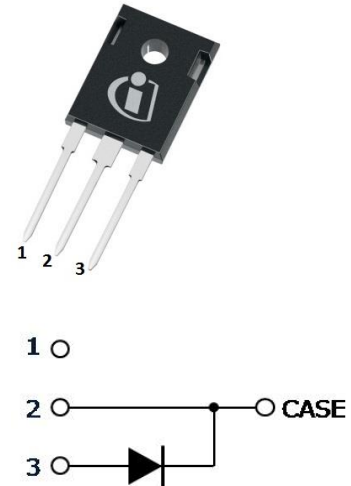


# CoolSiC™ Automotive Schottky Diode 650V G5

650V/20A 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       | AIDW20S65C5   |
| Marking             | AD2065C5      |
| Package             | PG-TO247-3-41 |
| SP Number           | SP001725214   |

| Parameter                | Value/Unit     |
|--------------------------|----------------|
| $V_{DC,max}$             | 650 V          |
| $I_F; T_C < 127^\circ C$ | 20 A           |
| $Q_C; V_R = 400 V$       | 29 nC          |
| $E_C; V_R = 400 V$       | 6.6 $\mu J$    |
| $T_{j,max}$              | 175 $^\circ C$ |

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



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## 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>$T_C = 127^\circ\text{C}$ , $D=1$                                                                      | $I_F$         | 20              | A                    |
| Surge non-repetitive forward current,<br>sine halfwave<br>$T_C = 25^\circ\text{C}$ , $t_p=10\text{ms}$<br>$T_C = 150^\circ\text{C}$ , $t_p=10\text{ms}$ | $I_{F,SM}$    | 103<br>87       | A                    |
| Non-repetitive peak forward current<br>$T_C = 25^\circ\text{C}$ , $t_p=10\mu\text{s}$                                                                   | $I_{F,max}$   | 776             | A                    |
| $i^2t$ value<br>$T_C = 25^\circ\text{C}$ , $t_p=10\text{ms}$<br>$T_C = 150^\circ\text{C}$ , $t_p=10\text{ms}$                                           | $\int i^2 dt$ | 53<br>38        | $\text{A}^2\text{s}$ |
| Diode $dv/dt$ ruggedness<br>$V_R=0\ldots 480\text{V}$                                                                                                   | $dv/dt$       | 100             | V/ns                 |
| Power dissipation<br>$T_C = 25^\circ\text{C}$                                                                                                           | $P_{tot}$     | 112             | W                    |
| Operating temperature                                                                                                                                   | $T_j$         | $-40\ldots 175$ | $^\circ\text{C}$     |
| Storage temperature                                                                                                                                     | $T_{stg}$     | $-55\ldots 150$ | $^\circ\text{C}$     |
| 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             | $^\circ\text{C}$     |
| 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>    | $R_{thJC}$ | -      | 1.0  | 1.4  | 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    | -    | -    |               | $T_j = 25^{\circ}\text{C}$ , $I_R = 0.12\text{ mA}$ |
| Diode forward voltage <sup>3</sup> | $V_F$    | -      | 1.5  | 1.7  | V             | $T_j = 25^{\circ}\text{C}$ , $I_F = 20\text{ A}$    |
|                                    |          | -      | 1.8  | 2.1  |               | $T_j = 150^{\circ}\text{C}$ , $I_F = 20\text{ A}$   |
| Reverse current                    | $I_R$    | -      | 3    | 120  | $\mu\text{A}$ | $V_R = 650\text{ V}$ , $T_j = 25^{\circ}\text{C}$   |
|                                    |          | -      | 24   | -    |               | $V_R = 650\text{ V}$ , $T_j = 150^{\circ}\text{C}$  |

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 | $Q_C$  | -      | 29   | -    | 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      | -      | 584  | -    | pF   | $V_R = 1\text{ V}$ , $f = 1\text{ MHz}$                                                                           |
|                         |        | -      | 76   | -    |      | $V_R = 300\text{ V}$ , $f = 1\text{ MHz}$                                                                         |
|                         |        | -      | 75   | -    |      | $V_R = 600\text{ V}$ , $f = 1\text{ MHz}$                                                                         |

#### 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

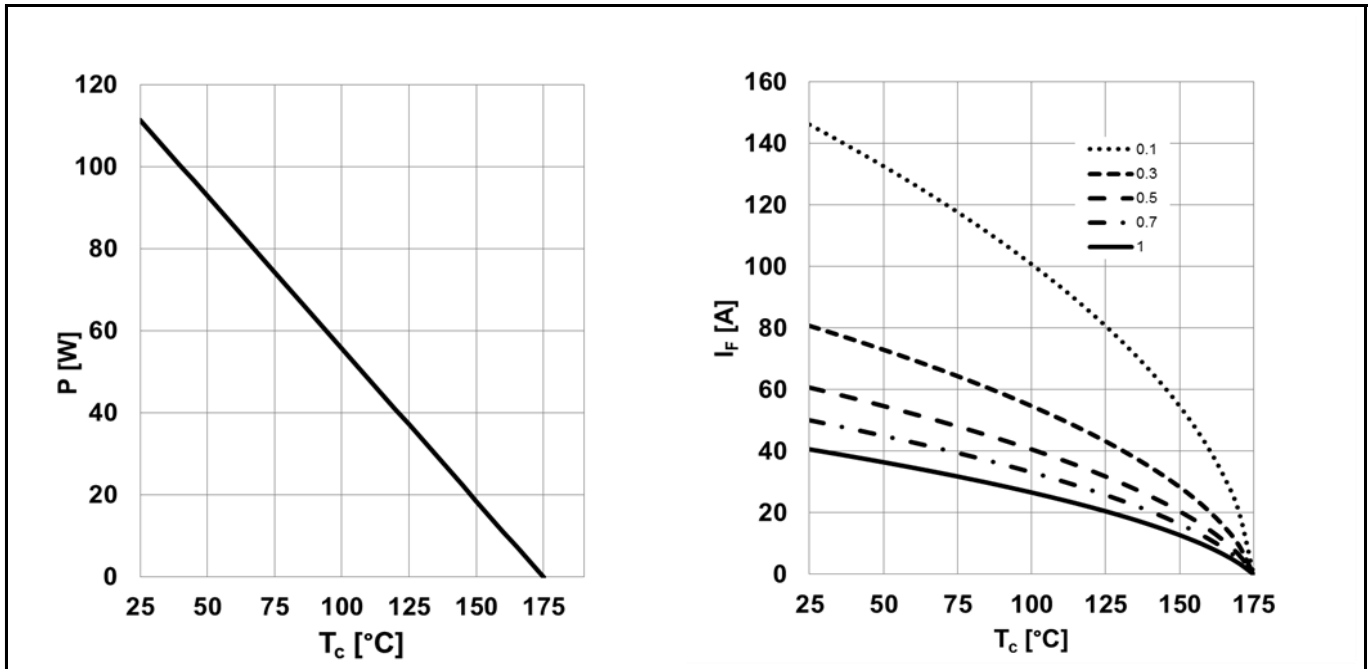


Figure 1 (LEFT) Power dissipation;  $P_{\text{tot}} = f(T_c)$ ;  $R_{\text{thJC,max}}$   
(RIGHT) Diode forward current;  $I_F = f(T_c)$ ;  $T_j \leq 175$  °C;  $R_{\text{thJC,max}}$ ; parameter:  $D$ =duty cycle

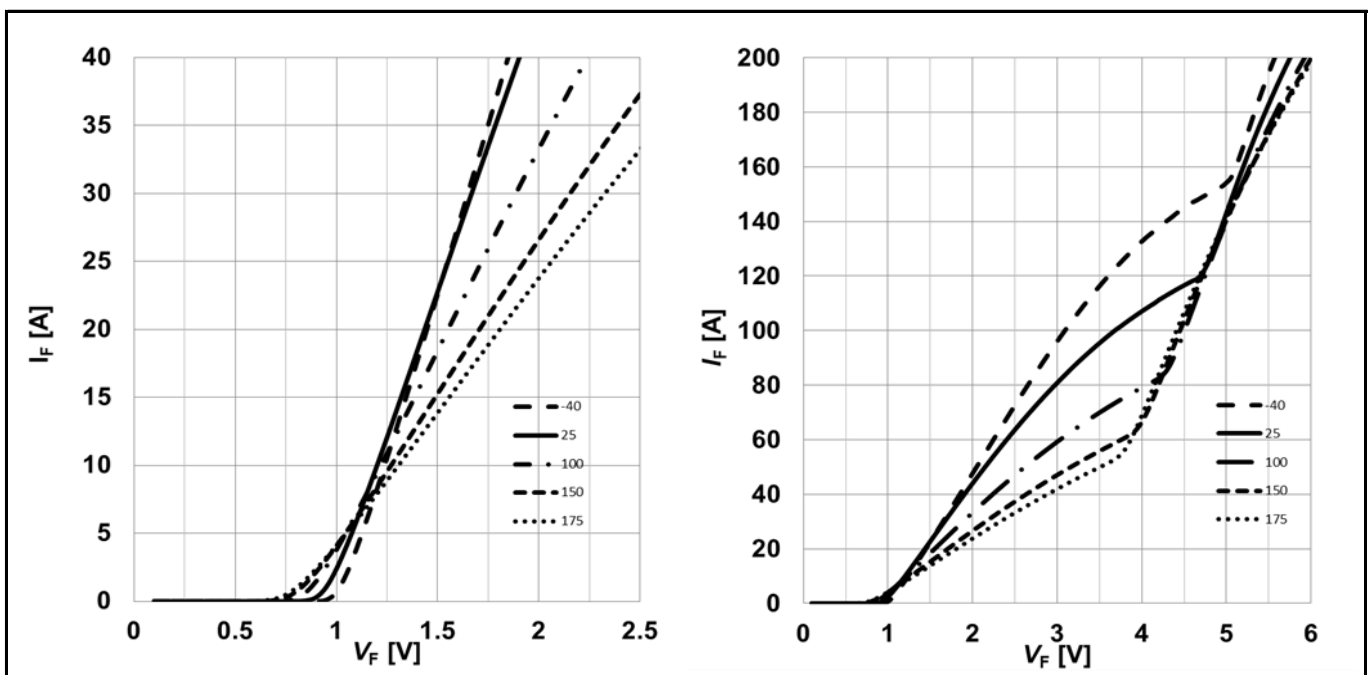


Figure 2 (LEFT) Typical forward characteristic;  $I_F = f(V_F)$ ;  $t_p = 200$   $\mu$ s; parameter:  $T_j$   
(RIGHT) Typical forward characteristics in surge current;  $I_F = f(V_F)$ ;  $t_p = 200$   $\mu$ s; parameter:  $T_j$

Electrical Characteristics Diagrams

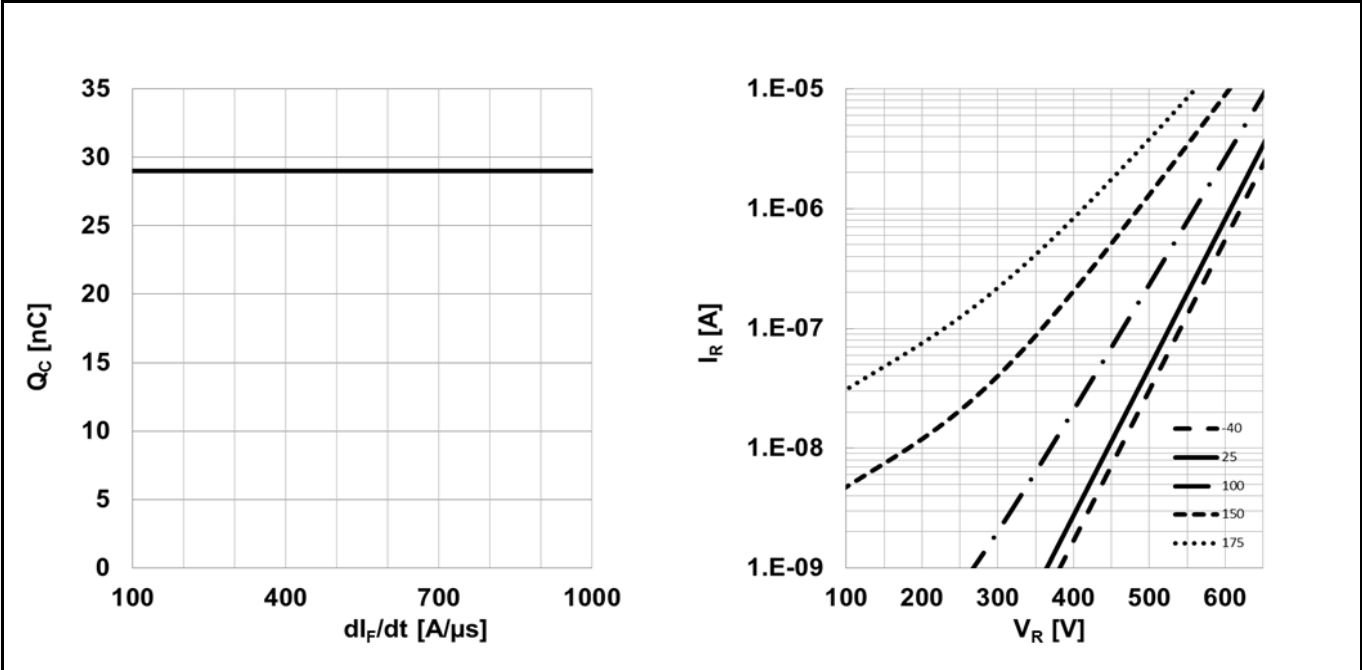


Figure 3 (LEFT) Typical capacitive charge versus current slope (only capacitive charge, guaranteed by design);  $Q_C = f(di_F/dt)$ ;  $T_j = 150^\circ\text{C}$ ;  $V_R = 400\text{V}$ ;  $I_F \leq I_{F,\text{max}}$   
(RIGHT) Typical reverse current versus reverse voltage;  $I_R = f(V_R)$ ; parameter: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

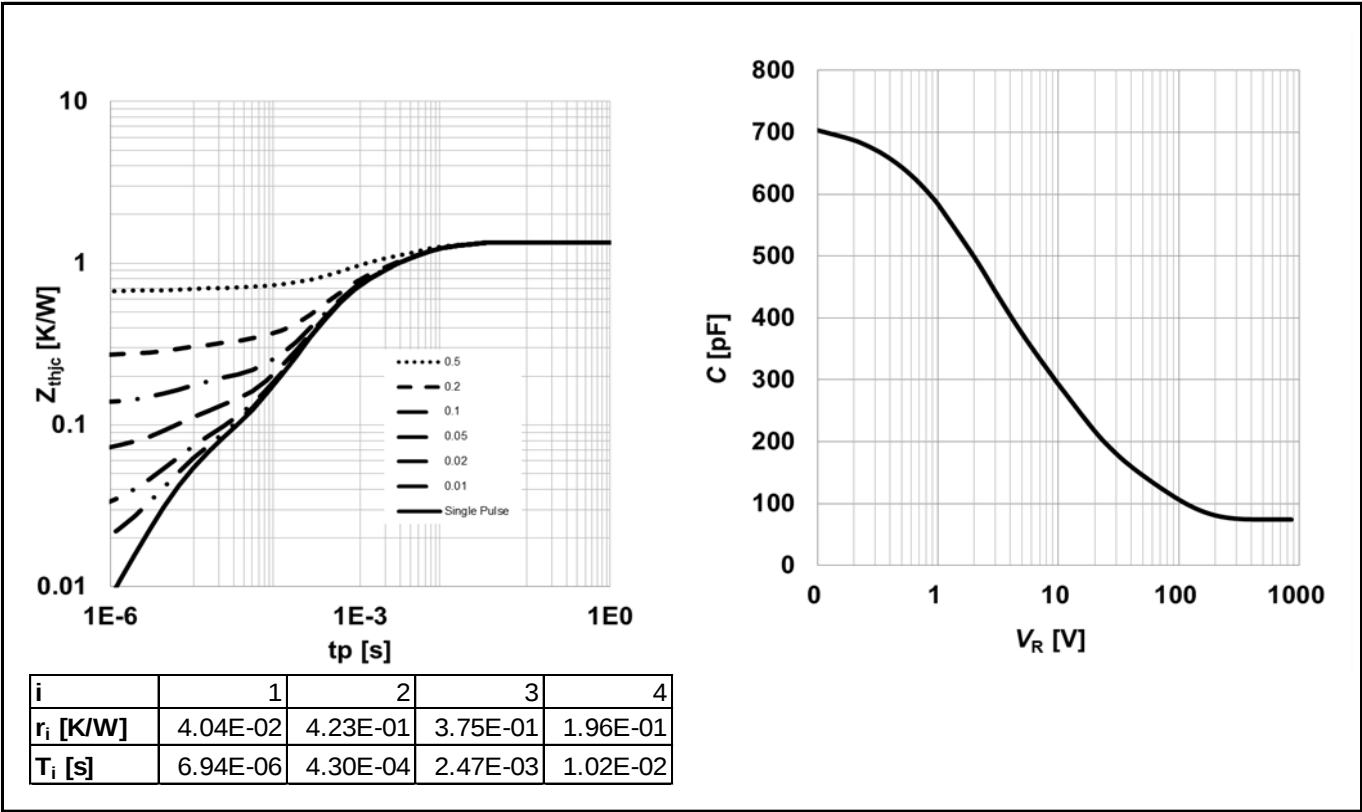


Figure 4 (LEFT) Max. Transient thermal impedance;  $Z_{thJC} = f(t_p)$ ; parameter:  $D = t_p/T$   
(RIGHT) Typ. Capacitance vs. Reverse voltage;  $C = f(V_R)$ ;  $T_j = 25^\circ\text{C}$ ;  $f = 1\text{ MHz}$

Electrical Characteristics Diagrams

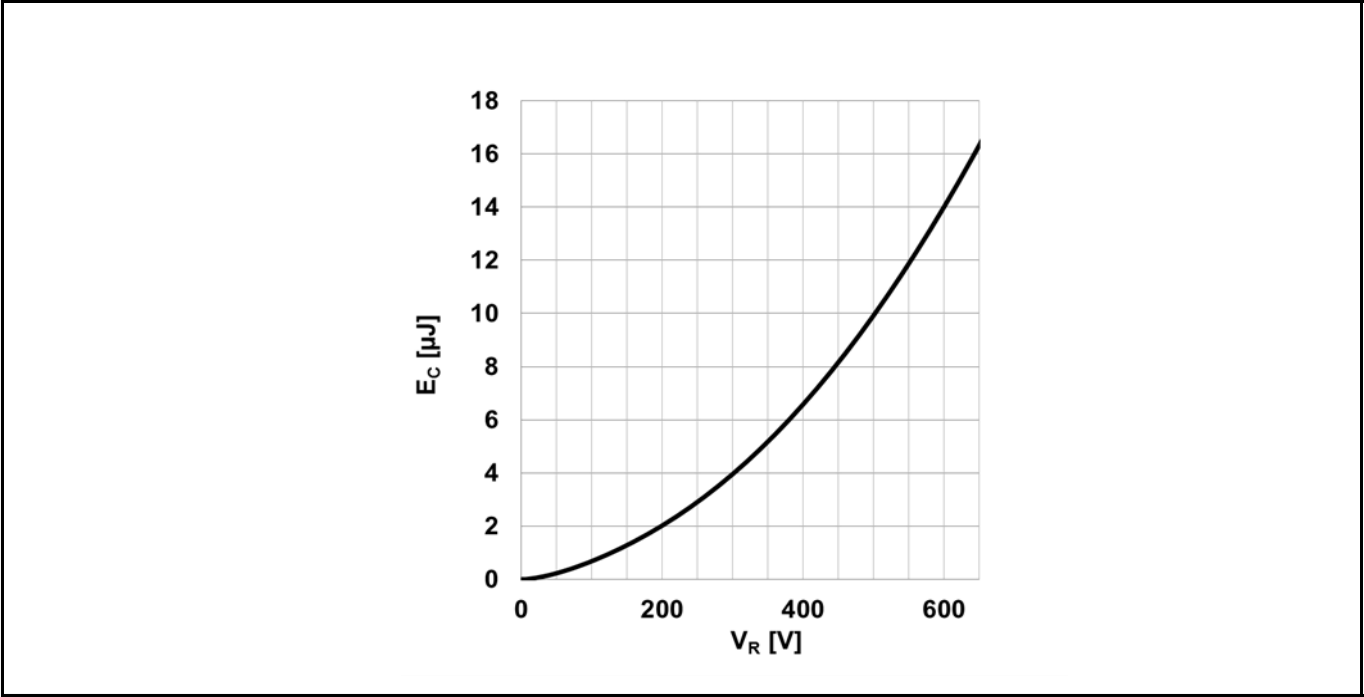


Figure 5 Typical capacitance stored energy;  $E_C = f(V_R)$

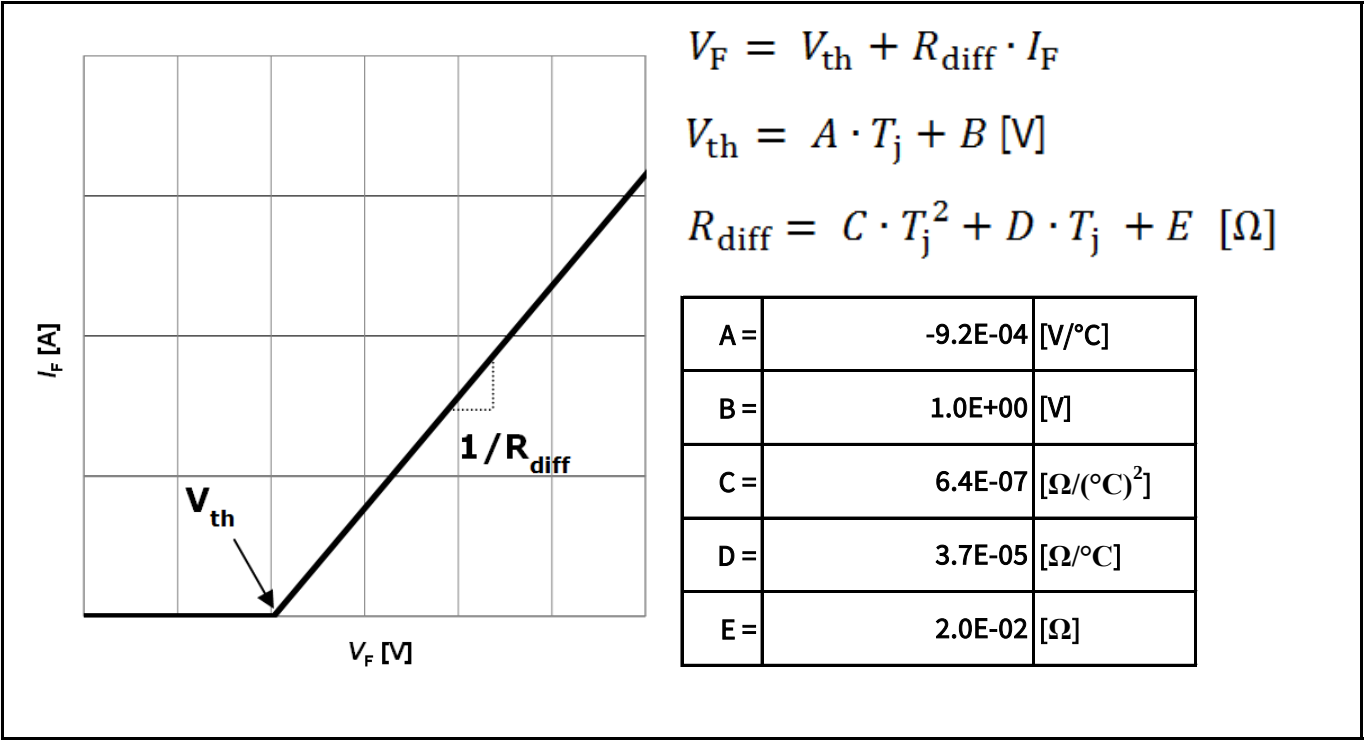


Figure 6 Simplified forward characteristics model  $V_F = f(I_F)$ ;  
 $-40^{\circ}\text{C} < T_j < 175^{\circ}\text{C}$ ;  $I_F < 40 \text{ A}$

Package Outlines

5 Package Outlines

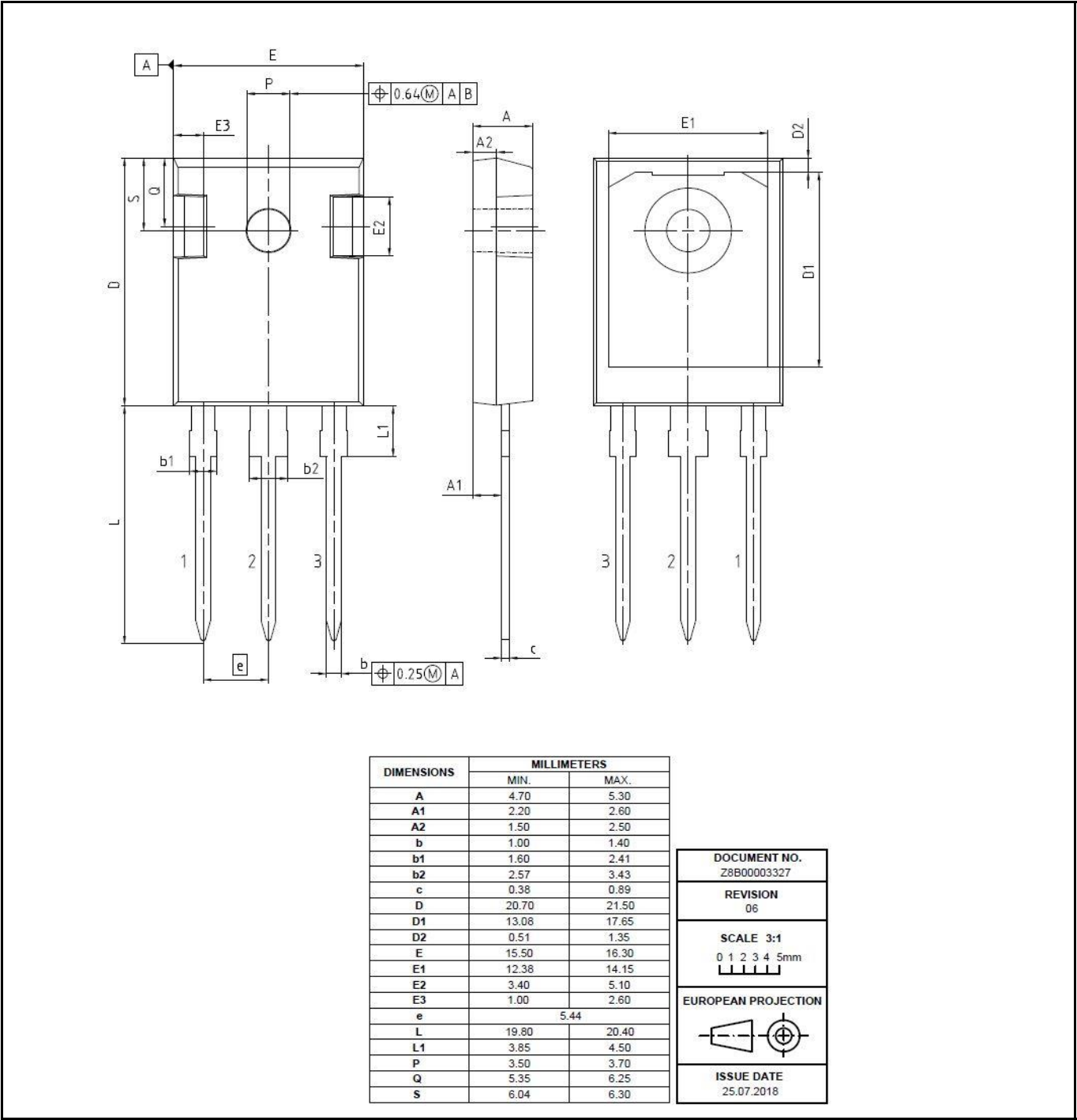


Figure 6 Package outline of PG-TO247-3-41 led (Dimensions in mm)



Revision History

Revision History

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

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