



# PMEG060V050EPD

60 V, 5 A low VF MEGA Schottky barrier rectifier

22 January 2015

Product data sheet

## 1. General description

Planar Maximum Efficiency General Application (MEGA) Schottky barrier rectifier with an integrated guard ring for stress protection, encapsulated in a CFP15 (SOT1289) power and flat lead Surface-Mounted Device (SMD) plastic package.

## 2. Features and benefits

- Average forward current:  $I_{F(AV)} \leq 5$  A
- Reverse voltage:  $V_R \leq 60$  V
- Low forward voltage
- High power capability due to clip-bonding technology and heat sink
- Small and thin SMD power plastic package, typical height 0.78 mm
- AEC-Q101 qualified

## 3. Applications

- Low voltage rectification
- High efficiency DC-to-DC conversion
- Switch mode power supply
- Freewheeling application
- Reverse polarity protection
- Low power consumption application

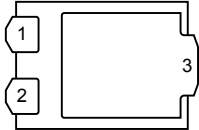
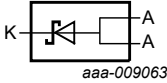
## 4. Quick reference data

Table 1. Quick reference data

| Symbol      | Parameter               | Conditions  | Min | Typ | Max | Unit    |
|-------------|-------------------------|---|-----|-----|-----|---------|
| $I_{F(AV)}$ | average forward current | $\delta = 0.5$ ; $f = 20$ kHz; $T_{sp} \leq 165$ °C; square wave                | -   | -   | 5   | A       |
| $V_R$       | reverse voltage         | $T_j = 25$ °C   | -   | -   | 60  | V       |
| $V_F$       | forward voltage         | $I_F = 5$ A; $t_p \leq 300$ $\mu$ s; $\delta \leq 0.02$ ; $T_j = 25$ °C; pulsed | -   | 480 | 560 | mV      |
| $I_R$       | reverse current         | $V_R = 10$ V; $t_p \leq 3$ ms; $\delta \leq 0.3$ ; $T_j = 25$ °C; pulsed        | -   | 10  | 30  | $\mu$ A |
|             |                         | $V_R = 60$ V; $t_p \leq 3$ ms; $\delta \leq 0.3$ ; $T_j = 25$ °C; pulsed        | -   | 100 | 400 | $\mu$ A |

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline   | Graphic symbol  |
|-----|--------|-------------|--|---|
| 1   | A      | anode       |  <p>CFP15 (SOT1289)</p> |  |
| 2   | A      | anode       |  |   |
| 3   | K      | cathode     |  |   |

## 6. Ordering information

Table 3. Ordering information

| Type number    | Package |   |         |
|----------------|---------|---|---------|
|                | Name    | Description   | Version |
| PMEG060V050EPD | CFP15   | plastic, thermal enhanced ultra thin SMD package; 3 leads;<br>body: 5.8 x 4.3 x 0.78 mm | SOT1289 |

## 7. Marking

Table 4. Marking codes

| Type number    | Marking code |
|----------------|--------------|
| PMEG060V050EPD | 060V 050E    |

## 8. Limiting values

**Table 5. Limiting values**

*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| Symbol      | Parameter                           | Conditions   |     | Min | Max  | Unit |
|-------------|-------------------------------------|--|-----|-----|------|------|
| $V_R$       | reverse voltage                     | $T_j = 25\text{ °C}$   |     | -   | 60   | V    |
| $I_F$       | forward current                     | $T_{sp} = 160\text{ °C}; \delta = 1$   |     | -   | 7    | A    |
| $I_{F(AV)}$ | average forward current             | $\delta = 0.5; f = 20\text{ kHz}; T_{sp} \leq 165\text{ °C};$<br>square wave |     | -   | 5    | A    |
| $I_{FSM}$   | non-repetitive peak forward current | $t_p = 8\text{ ms}; T_{j(\text{init})} = 25\text{ °C};$ square wave          |     | -   | 160  | A    |
| $P_{tot}$   | total power dissipation             | $T_{amb} \leq 25\text{ °C}$  | [1] | -   | 1.66 | W    |
|             |                                     |  | [2] | -   | 2.15 | W    |
|             |                                     |  | [3] | -   | 3.75 | W    |
| $T_j$       | junction temperature                |  |     | -   | 175  | °C   |
| $T_{amb}$   | ambient temperature                 |  |     | -55 | 175  | °C   |
| $T_{stg}$   | storage temperature                 |  |     | -65 | 175  | °C   |

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1 cm<sup>2</sup>.

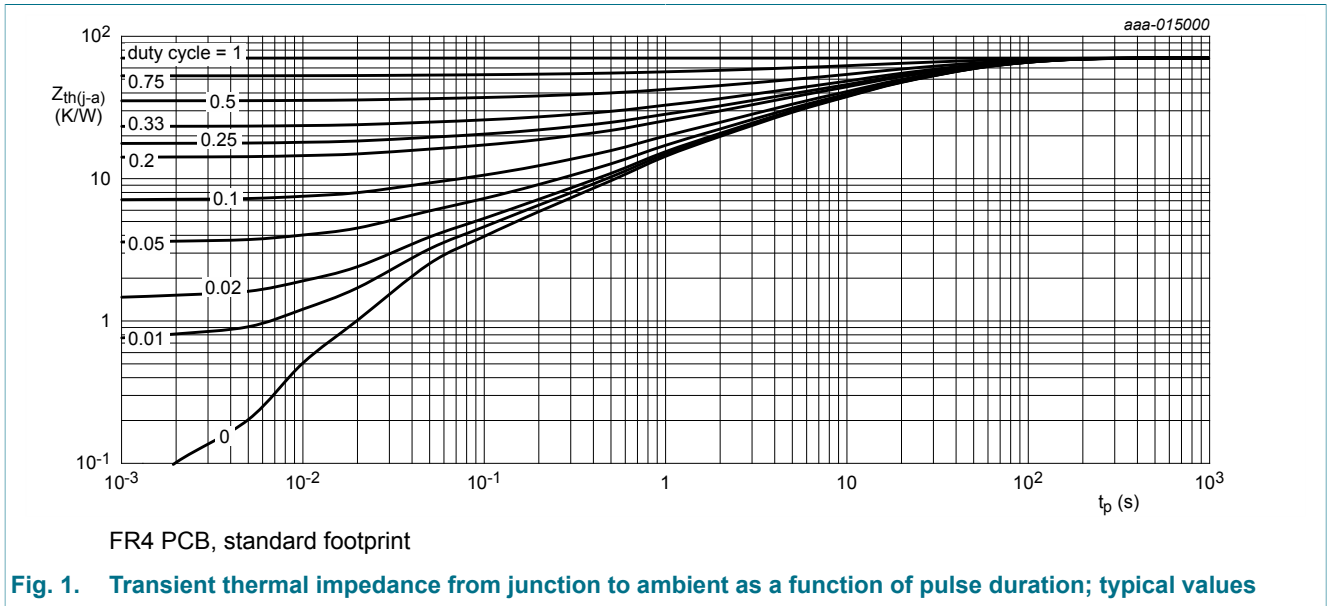
[3] Device mounted on a ceramic Printed-Circuit Board (PCB), Al<sub>2</sub>O<sub>3</sub>, standard footprint.

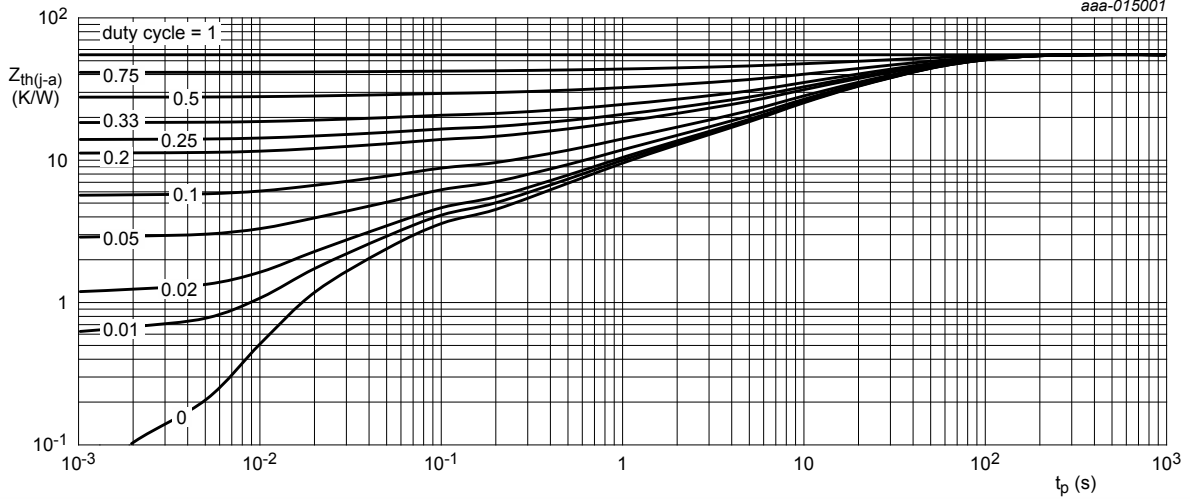
## 9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol         | Parameter  | Conditions  |        | Min | Typ | Max | Unit |
|----------------|--|-------------|--------|-----|-----|-----|------|
| $R_{th(j-a)}$  | thermal resistance from junction to ambient      | in free air | [1][2] | -   | -   | 90  | K/W  |
|                |  |             | [1][3] | -   | -   | 70  | K/W  |
|                |  |             | [1][4] | -   | -   | 40  | K/W  |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |             | [5]    | -   | -   | 3   | K/W  |

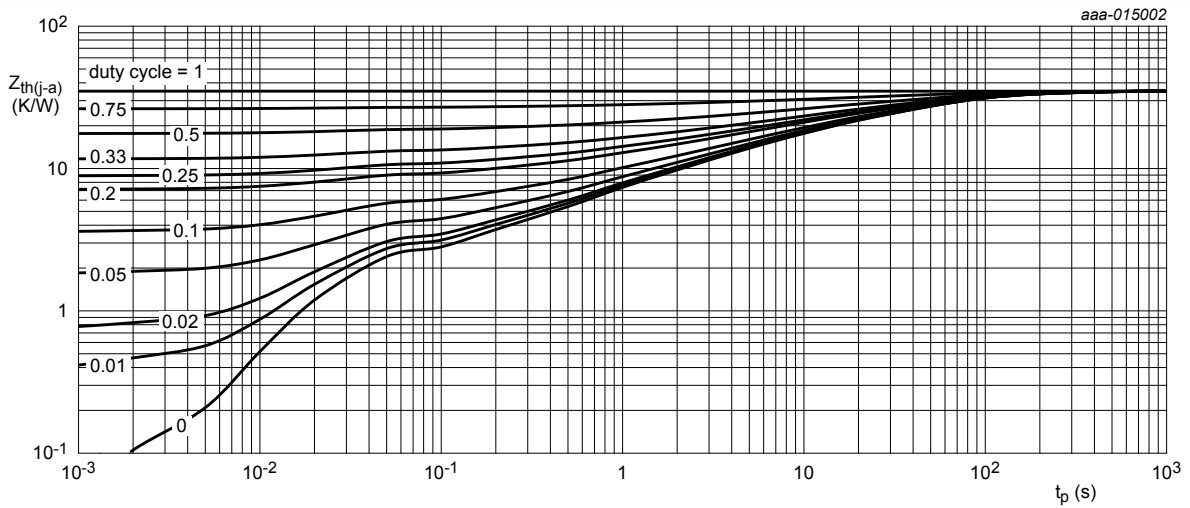
- [1] For Schottky barrier diodes thermal runaway has to be considered, as in some applications the reverse power losses  $P_R$  are a significant part of the total power losses.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode  $1\text{ cm}^2$ .
- [4] Device mounted on a ceramic PCB,  $\text{Al}_2\text{O}_3$ , standard footprint.
- [5] Soldering point of cathode tab.





FR4 PCB, mounting pad for cathode 1 cm<sup>2</sup>

Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



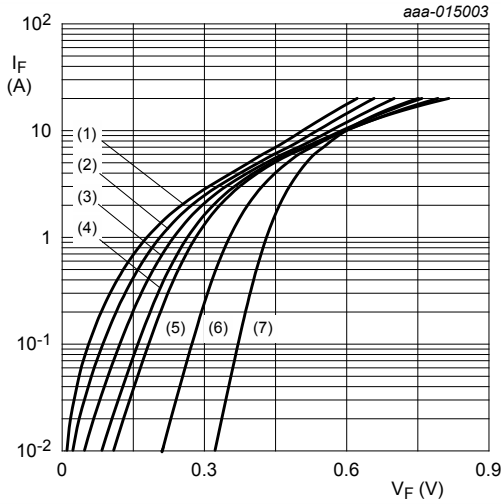
Ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint

Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

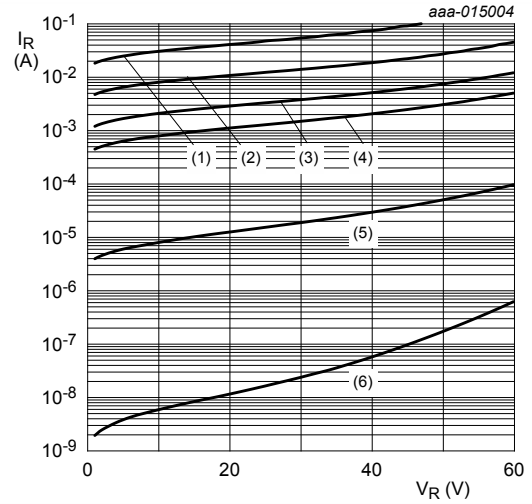
| Symbol      | Parameter                           | Conditions  | Min | Typ | Max | Unit          |
|-------------|-------------------------------------|---|-----|-----|-----|---------------|
| $V_{(BR)R}$ | reverse breakdown voltage           | $I_R = 5 \text{ mA}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; $t_p \leq 1.2 \text{ ms}$ ;<br>$\delta \leq 0.12$ ; pulsed           | 60  | -   | -   | V             |
| $V_F$       | forward voltage                     | $I_F = 1 \text{ A}$ ; $t_p \leq 300 \text{ } \mu\text{s}$ ; $\delta \leq 0.02$ ;<br>$T_j = 25 \text{ }^\circ\text{C}$ ; pulsed  | -   | 350 | 400 | mV            |
|             |                                     | $I_F = 2 \text{ A}$ ; $t_p \leq 300 \text{ } \mu\text{s}$ ; $\delta \leq 0.02$ ;<br>$T_j = 25 \text{ }^\circ\text{C}$ ; pulsed  | -   | 390 | -   | mV            |
|             |                                     | $I_F = 5 \text{ A}$ ; $t_p \leq 300 \text{ } \mu\text{s}$ ; $\delta \leq 0.02$ ;<br>$T_j = 25 \text{ }^\circ\text{C}$ ; pulsed  | -   | 480 | 560 | mV            |
|             |                                     | $I_F = 5 \text{ A}$ ; $t_p \leq 300 \text{ } \mu\text{s}$ ; $\delta \leq 0.02$ ;<br>$T_j = 125 \text{ }^\circ\text{C}$ ; pulsed | -   | 435 | -   | mV            |
| $I_R$       | reverse current                     | $V_R = 5 \text{ V}$ ; $t_p \leq 3 \text{ ms}$ ; $\delta \leq 0.3$ ; $T_j = 25 \text{ }^\circ\text{C}$ ;<br>pulsed               | -   | 6   | -   | $\mu\text{A}$ |
|             |                                     | $V_R = 10 \text{ V}$ ; $t_p \leq 3 \text{ ms}$ ; $\delta \leq 0.3$ ;<br>$T_j = 25 \text{ }^\circ\text{C}$ ; pulsed              | -   | 10  | 30  | $\mu\text{A}$ |
|             |                                     | $V_R = 30 \text{ V}$ ; $t_p \leq 3 \text{ ms}$ ; $\delta \leq 0.3$ ;<br>$T_j = 25 \text{ }^\circ\text{C}$ ; pulsed              | -   | 20  | -   | $\mu\text{A}$ |
|             |                                     | $V_R = 60 \text{ V}$ ; $t_p \leq 3 \text{ ms}$ ; $\delta \leq 0.3$ ;<br>$T_j = 25 \text{ }^\circ\text{C}$ ; pulsed              | -   | 100 | 400 | $\mu\text{A}$ |
|             |                                     | $V_R = 10 \text{ V}$ ; $t_p \leq 3 \text{ ms}$ ; $\delta \leq 0.3$ ;<br>$T_j = 125 \text{ }^\circ\text{C}$ ; pulsed             | -   | 8   | -   | mA            |
| $C_d$       | diode capacitance                   | $V_R = 1 \text{ V}$ ; $f = 1 \text{ MHz}$ ; $T_j = 25 \text{ }^\circ\text{C}$   | -   | 510 | -   | pF            |
|             |                                     | $V_R = 10 \text{ V}$ ; $f = 1 \text{ MHz}$ ; $T_j = 25 \text{ }^\circ\text{C}$  | -   | 175 | -   | pF            |
| $t_{rr}$    | reverse recovery time step recovery | $I_F = 0.5 \text{ A}$ ; $I_R = 0.5 \text{ A}$ ; $I_{R(\text{meas})} = 0.1 \text{ A}$ ;<br>$T_j = 25 \text{ }^\circ\text{C}$     | -   | 17  | -   | ns            |
| $t_{rr}$    | reverse recovery time ramp recovery | $di_F/dt = 200 \text{ A}/\mu\text{s}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; $I_F = 6 \text{ A}$ ;<br>$V_R = 26 \text{ V}$       | -   | 12  | -   | ns            |
| $V_{FRM}$   | peak forward recovery voltage       | $I_F = 0.5 \text{ A}$ ; $di_F/dt = 20 \text{ A}/\mu\text{s}$ ; $T_j = 25 \text{ }^\circ\text{C}$                                | -   | 335 | -   | mV            |



pulsed condition

- (1)  $T_j = 175\text{ }^\circ\text{C}$
- (2)  $T_j = 150\text{ }^\circ\text{C}$
- (3)  $T_j = 125\text{ }^\circ\text{C}$
- (4)  $T_j = 100\text{ }^\circ\text{C}$
- (5)  $T_j = 85\text{ }^\circ\text{C}$
- (6)  $T_j = 25\text{ }^\circ\text{C}$
- (7)  $T_j = -40\text{ }^\circ\text{C}$

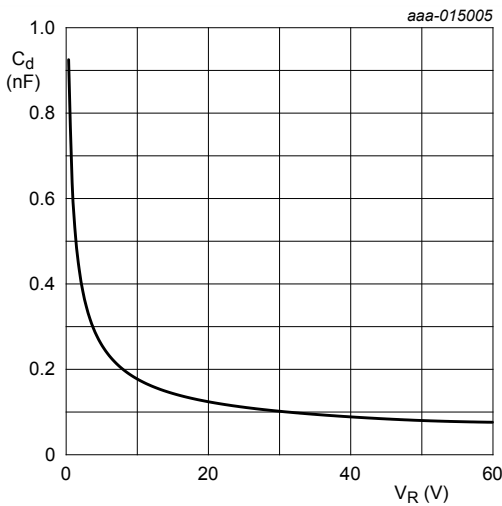
**Fig. 4. Forward current as a function of forward voltage; typical values**



pulsed condition

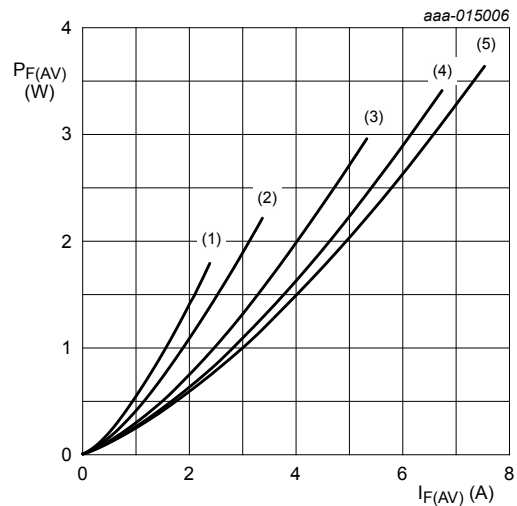
- (1)  $T_j = 150\text{ }^\circ\text{C}$
- (2)  $T_j = 125\text{ }^\circ\text{C}$
- (3)  $T_j = 100\text{ }^\circ\text{C}$
- (4)  $T_j = 85\text{ }^\circ\text{C}$
- (5)  $T_j = 25\text{ }^\circ\text{C}$
- (6)  $T_j = -40\text{ }^\circ\text{C}$

**Fig. 5. Reverse current as a function of reverse voltage; typical values**



$f = 1\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$

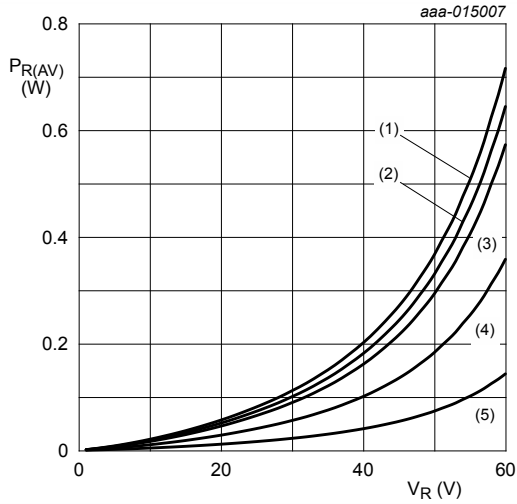
**Fig. 6. Diode capacitance as a function of reverse voltage; typical values**



$T_j = 100\text{ }^\circ\text{C}$

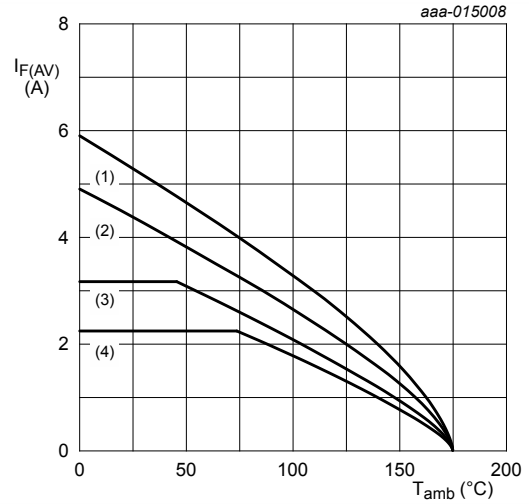
- (1)  $\delta = 0.1$
- (2)  $\delta = 0.2$
- (3)  $\delta = 0.5$
- (4)  $\delta = 0.8$
- (5)  $\delta = 1$

**Fig. 7. Average forward power dissipation as a function of average forward current; typical values**



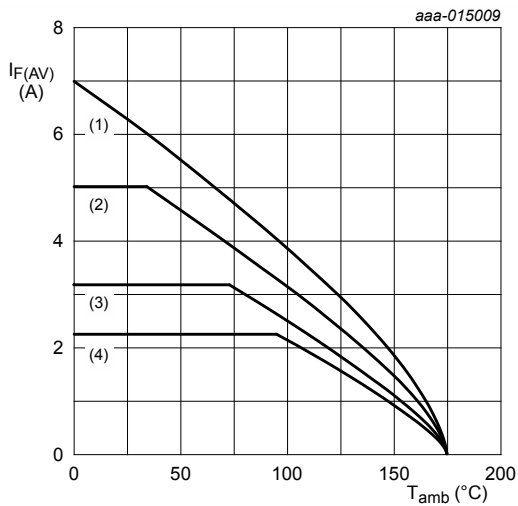
$T_j = 100\text{ °C}$   
 (1)  $\delta = 1$   
 (2)  $\delta = 0.9$   
 (3)  $\delta = 0.8$   
 (4)  $\delta = 0.5$   
 (5)  $\delta = 0.2$

**Fig. 8.** Average reverse power dissipation as a function of reverse voltage; typical values



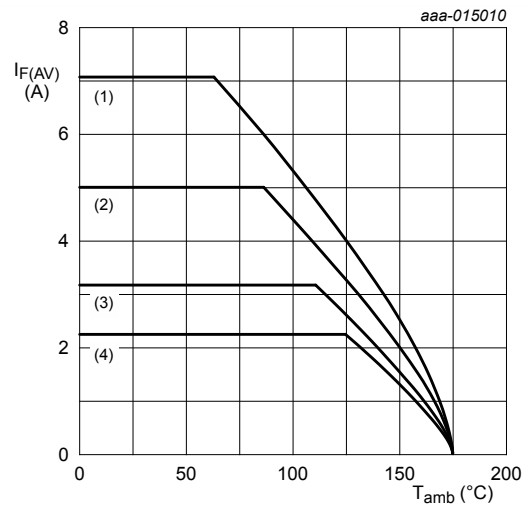
FR4 PCB, standard footprint  
 $T_j = 175\text{ °C}$   
 (1)  $\delta = 1$ ; DC  
 (2)  $\delta = 0.5$ ;  $f = 20\text{ kHz}$   
 (3)  $\delta = 0.2$ ;  $f = 20\text{ kHz}$   
 (4)  $\delta = 0.1$ ;  $f = 20\text{ kHz}$

**Fig. 9.** Average forward current as a function of ambient temperature; typical values



FR4 PCB, mounting pad for cathode  $1\text{ cm}^2$   
 $T_j = 175\text{ °C}$   
 (1)  $\delta = 1$ ; DC  
 (2)  $\delta = 0.5$ ;  $f = 20\text{ kHz}$   
 (3)  $\delta = 0.2$ ;  $f = 20\text{ kHz}$   
 (4)  $\delta = 0.1$ ;  $f = 20\text{ kHz}$

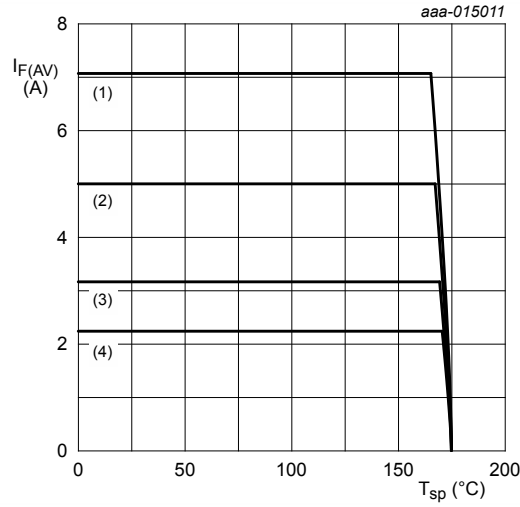
**Fig. 10.** Average forward current as a function of ambient temperature; typical values



Ceramic PCB,  $\text{Al}_2\text{O}_3$ , standard footprint  
 $T_j = 175\text{ °C}$   
 (1)  $\delta = 1$ ; DC  
 (2)  $\delta = 0.5$ ;  $f = 20\text{ kHz}$   
 (3)  $\delta = 0.2$ ;  $f = 20\text{ kHz}$   
 (4)  $\delta = 0.1$ ;  $f = 20\text{ kHz}$

**Fig. 11.** Average forward current as a function of ambient temperature; typical values





$T_j = 175\text{ °C}$

(1)  $\delta = 1$ ; DC

(2)  $\delta = 0.5$ ;  $f = 20\text{ kHz}$

(3)  $\delta = 0.2$ ;  $f = 20\text{ kHz}$

(4)  $\delta = 0.1$ ;  $f = 20\text{ kHz}$

Fig. 12. Average forward current as a function of solder point temperature; typical values

## 11. Test information

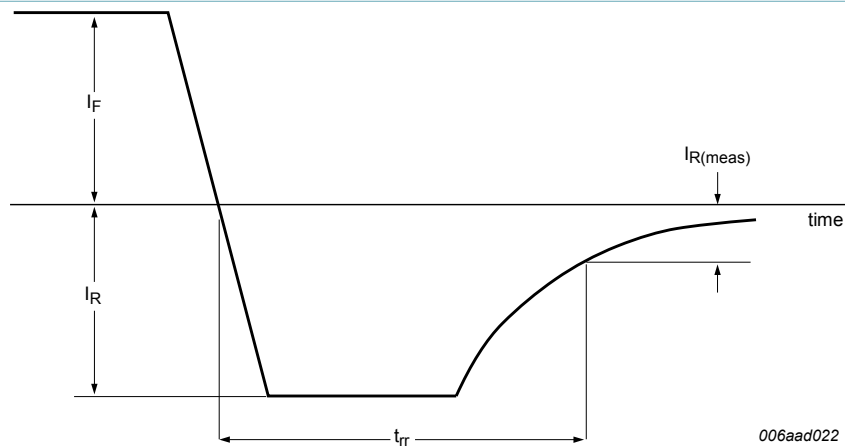


Fig. 13. Reverse recovery definition; step recovery

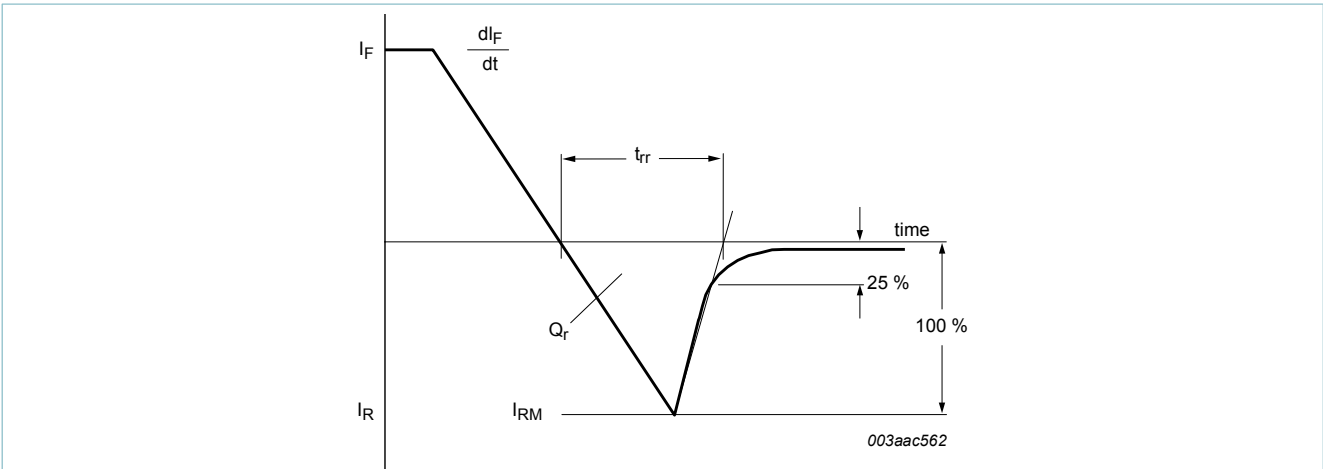


Fig. 14. Reverse recovery definition; ramp recovery

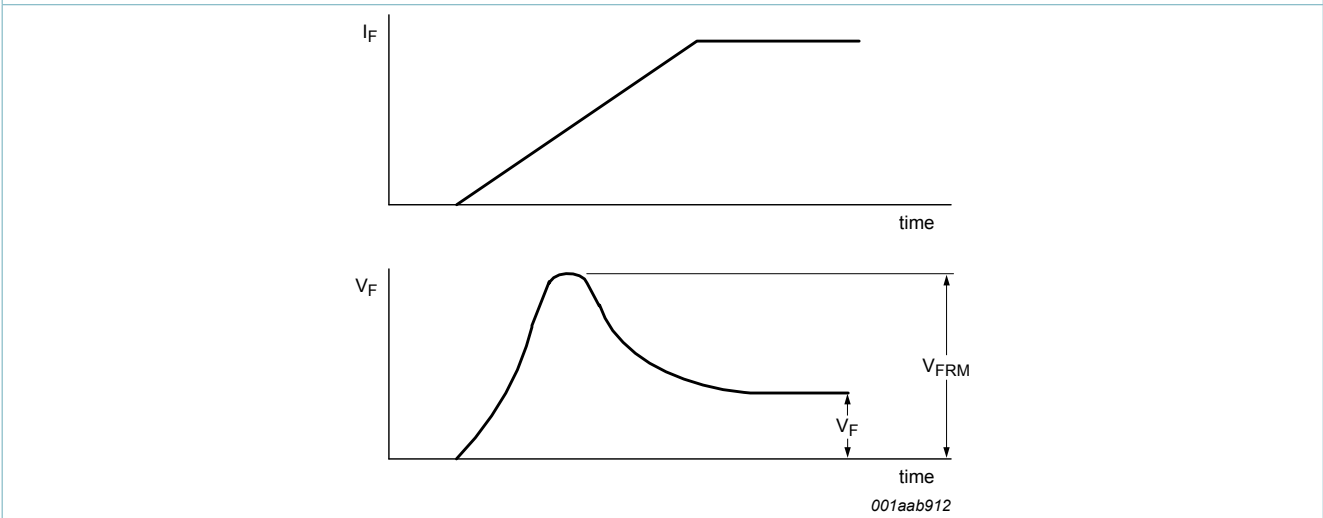


Fig. 15. Forward recovery definition

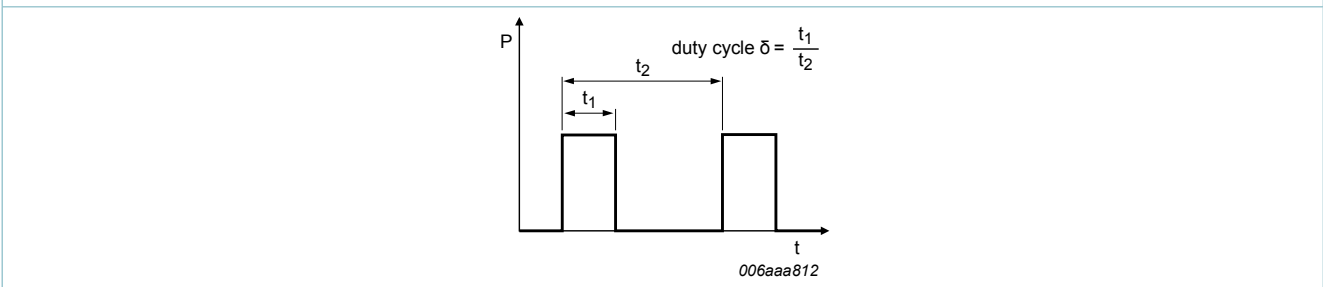


Fig. 16. Duty cycle definition

The current ratings for the typical waveforms are calculated according to the equations:  $I_{F(AV)} = I_M \times \delta$  with  $I_M$  defined as peak current,  $I_{RMS} = I_{F(AV)}$  at DC, and  $I_{RMS} = I_M \times \sqrt{\delta}$  with  $I_{RMS}$  defined as RMS current.

### 11.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - Stress test qualification for discrete semiconductors, and is suitable for use in automotive applications.

## 12. Package outline

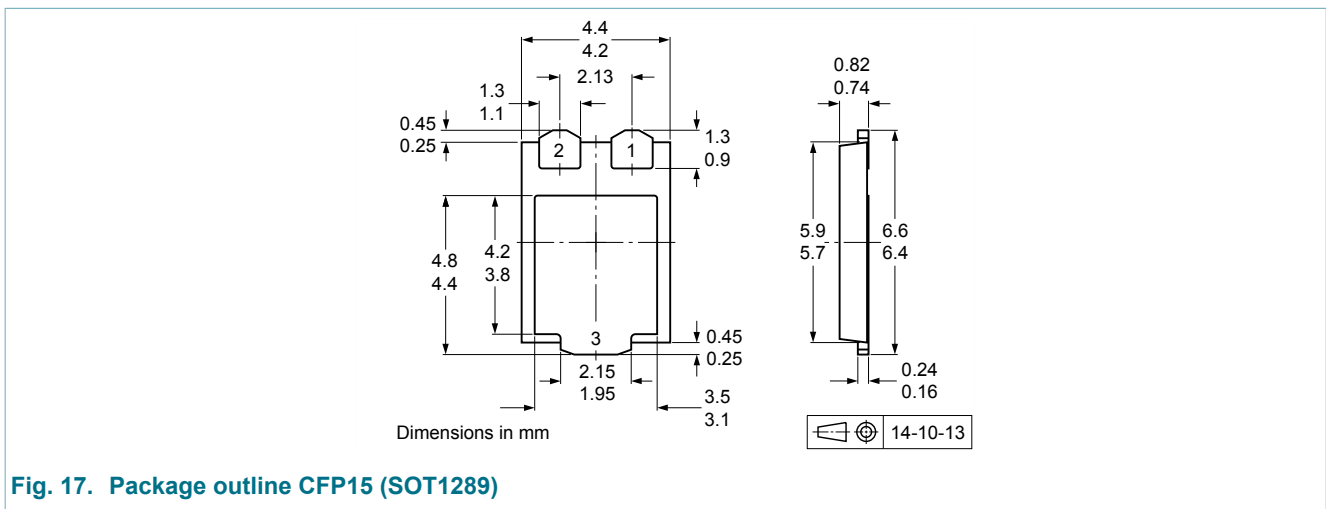


Fig. 17. Package outline CFP15 (SOT1289)

## 13. Soldering

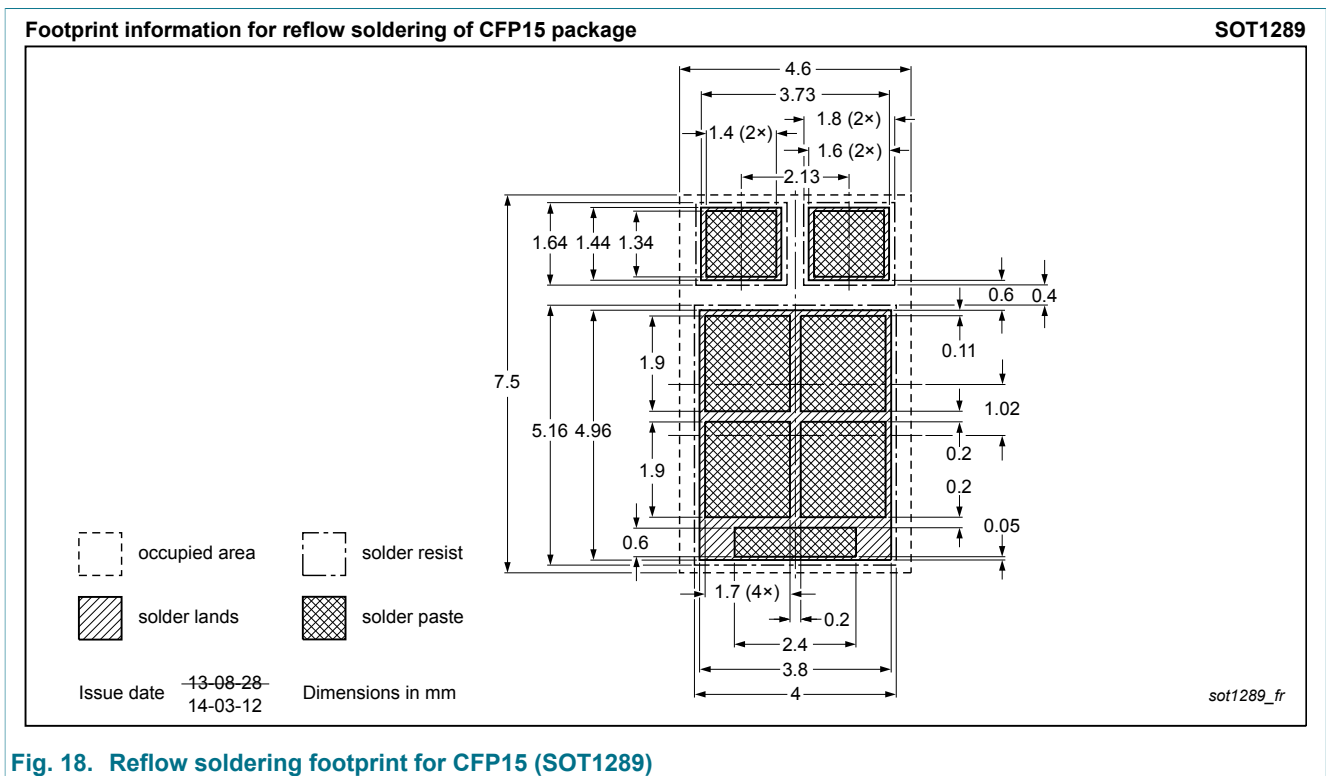


Fig. 18. Reflow soldering footprint for CFP15 (SOT1289)

## 14. Revision history

Table 8. Revision history

| Data sheet ID         | Release date | Data sheet status  | Change notice | Supersedes |
|-----------------------|--------------|--------------------|---------------|------------|
| PMEG060V050EPD<br>v.1 | 20150122     | Product data sheet | -             | -          |

## 15. Legal information

### 15.1 Data sheet status

| Document status [1][2]         | Product status [3] | Definition  |
|--------------------------------|--------------------|---|
| Objective [short] data sheet   | Development        | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification      | This document contains data from the preliminary specification.                       |
| Product [short] data sheet     | Production         | This document contains the product specification.                                     |

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

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## 16. Contents

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