



# PMEG40T20EP

40 V, 2 A low VF Trench MEGA Schottky barrier rectifier

29 September 2017

Product data sheet

## 1. General description

Trench Maximum Efficiency General Application (MEGA) Schottky barrier rectifier encapsulated in a CFP5 (SOD128) small and flat lead Surface-Mounted Device (SMD) plastic package.

## 2. Features and benefits

- Average forward current:  $I_{F(AV)} \leq 2$  A
- Reverse voltage:  $V_R \leq 40$  V
- Low forward voltage
- Low leakage current due to Trench MEGA Schottky technology
- High power capability due to clip-bonding technology
- Small and flat lead SMD plastic package
- Capable for reflow and wave soldering
- 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 | -   | -   | 2    | A       |
| $V_R$       | reverse voltage         | $T_j = 25$ °C  | -   | -   | 40   | V       |
| $V_F$       | forward voltage         | $I_F = 2$ A; $T_j = 25$ °C; pulsed                               | [1] | 445 | 515  | mV      |
| $I_R$       | reverse current         | $V_R = 10$ V; $T_j = 25$ °C; pulsed                              | [1] | 3   | 11.5 | $\mu$ A |
|             |                         | $V_R = 40$ V; $T_j = 25$ °C; pulsed                              | [1] | 6   | 22   | $\mu$ A |

[1] Very short pulse, in order to maintain a stable junction temperature.

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline   | Graphic symbol  |
|-----|--------|-------------|--|---|
| 1   | K      | cathode     | <br>CFP5 (SOD128) | <br>sym001 |
| 2   | A      | anode       |  |   |

## 6. Ordering information

Table 3. Ordering information

| Type number | Package |  |         |
|-------------|---------|--|---------|
|             | Name    | Description  | Version |
| PMEG40T20EP | CFP5    | plastic, surface mounted package; 2 terminals; 4 mm pitch; 3.8 mm x 2.6 mm x 1 mm body | SOD128  |

## 7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PMEG40T20EP | DV           |

## 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                     | $T_j = 25\text{ °C}$  |     | -   | 40   | V    |
| $I_F$       | forward current                     | $T_{sp} \leq 160\text{ °C}; \delta = 1$                                       |     | -   | 2.8  | A    |
| $I_{F(AV)}$ | average forward current             | $\delta = 0.5$ ; $f = 20\text{ kHz}; T_{sp} \leq 165\text{ °C}$ ; square wave |     | -   | 2    | A    |
| $I_{FSM}$   | non-repetitive peak forward current | $t_p = 8\text{ ms}; T_{j(\text{init})} = 25\text{ °C}$ ; square wave          |     | -   | 20   | A    |
| $P_{tot}$   | total power dissipation             | $T_{amb} \leq 25\text{ °C}$   | [1] | -   | 0.75 | W    |
|             |                                     |   | [2] | -   | 1.2  | 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 Printed-Circuit Board (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>.

## 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] | -   | -   | 200 | K/W  |
|                |  |             | [1] [3] | -   | -   | 120 | K/W  |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |             | [4]     | -   | -   | 12  | 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 cm<sup>2</sup>.

[4] Soldering point of cathode tab.

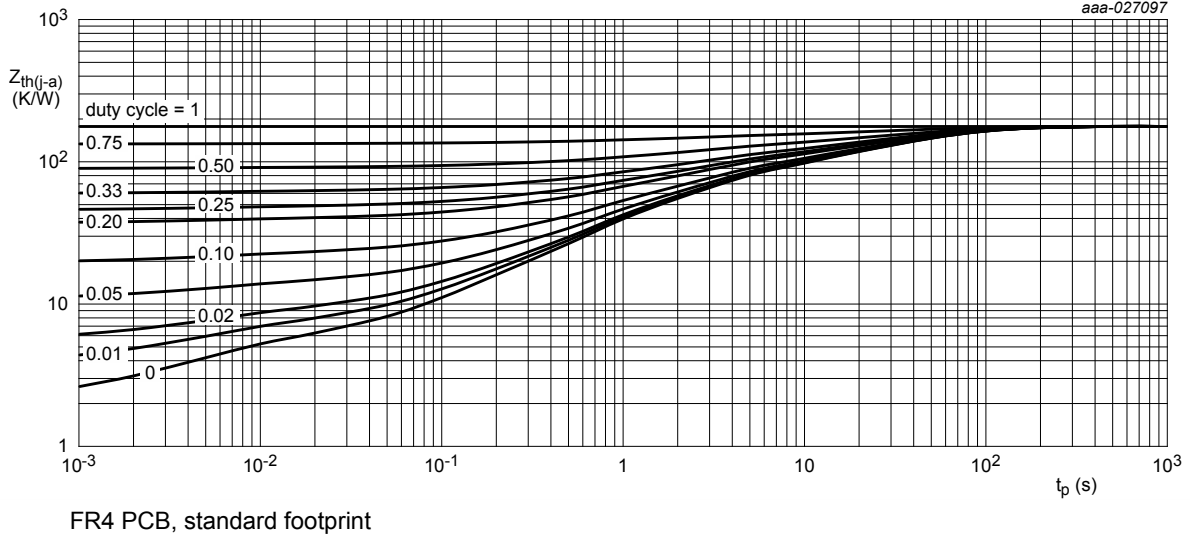


Fig. 1. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

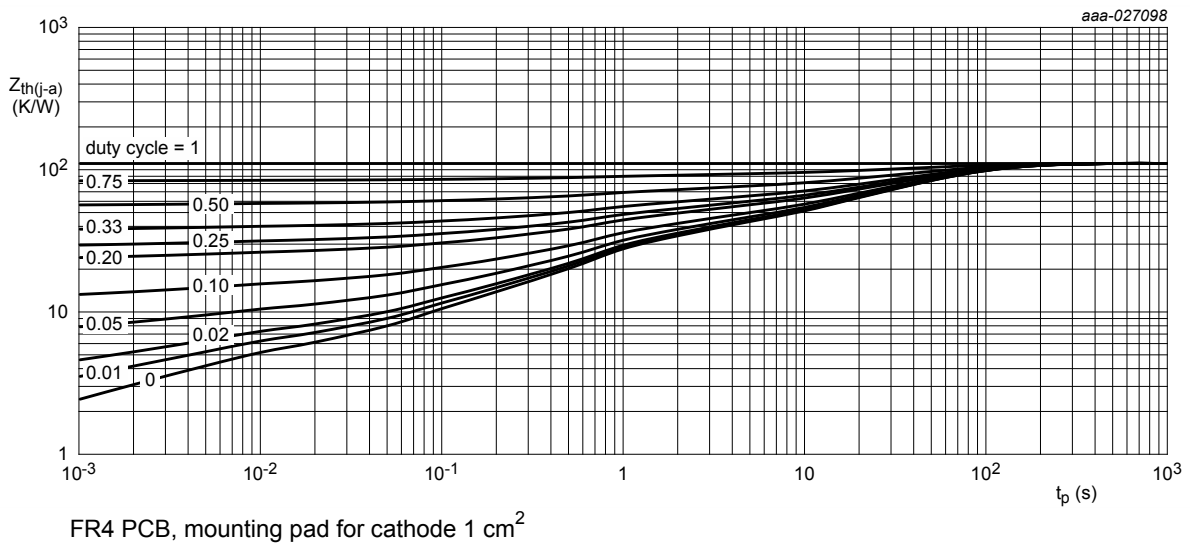


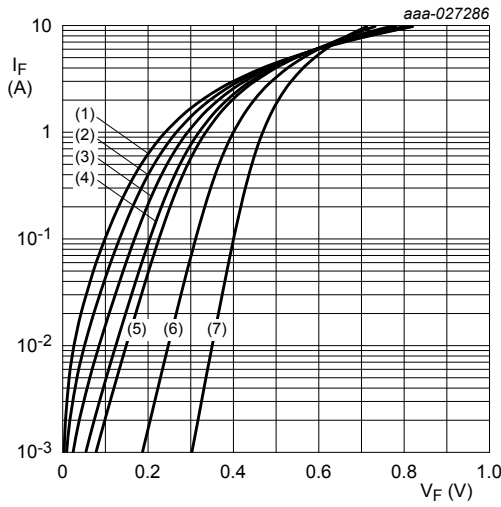
Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

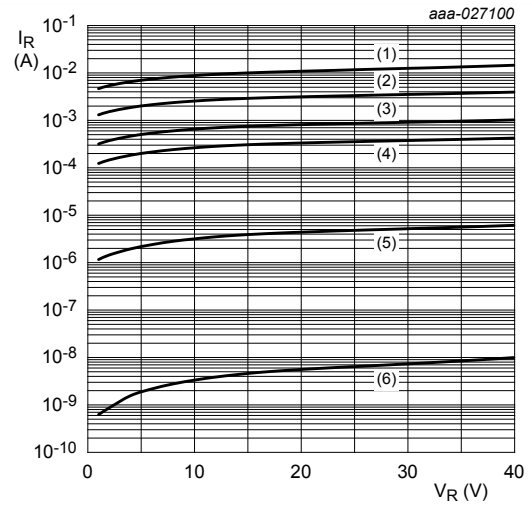
| Symbol      | Parameter                           | Conditions   |     | Min | Typ  | Max  | Unit          |
|-------------|-------------------------------------|--|-----|-----|------|------|---------------|
| $V_{(BR)R}$ | reverse breakdown voltage           | $I_R = 1 \text{ mA}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; pulsed  | [1] | 40  | -    | -    | V             |
| $V_F$       | forward voltage                     | $I_F = 0.1 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; pulsed   | [1] | -   | 310  | 360  | mV            |
|             |                                     | $I_F = 0.5 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; pulsed   | [1] | -   | 365  | 420  | mV            |
|             |                                     | $I_F = 1 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; pulsed   | [1] | -   | 400  | 460  | mV            |
|             |                                     | $I_F = 2 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; pulsed   | [1] | -   | 445  | 515  | mV            |
|             |                                     | $I_F = 2 \text{ A}$ ; $T_j = -40 \text{ }^\circ\text{C}$ ; pulsed  | [1] | -   | 505  | -    | mV            |
|             |                                     | $I_F = 2 \text{ A}$ ; $T_j = 125 \text{ }^\circ\text{C}$ ; pulsed  | [1] | -   | 365  | -    | mV            |
| $I_R$       | reverse current                     | $V_R = 10 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; pulsed  | [1] | -   | 3    | 11.5 | $\mu\text{A}$ |
|             |                                     | $V_R = 30 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; pulsed  | [1] | -   | 5    | -    | $\mu\text{A}$ |
|             |                                     | $V_R = 40 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; pulsed  | [1] | -   | 6    | 22   | $\mu\text{A}$ |
|             |                                     | $V_R = 40 \text{ V}$ ; $T_j = 125 \text{ }^\circ\text{C}$ ; pulsed   | [1] | -   | 4    | -    | mA            |
| $C_d$       | diode capacitance                   | $V_R = 1 \text{ V}$ ; $f = 1 \text{ MHz}$ ; $T_j = 25 \text{ }^\circ\text{C}$  |     | -   | 355  | -    | pF            |
|             |                                     | $V_R = 10 \text{ V}$ ; $f = 1 \text{ MHz}$ ; $T_j = 25 \text{ }^\circ\text{C}$   |     | -   | 150  | -    | pF            |
| $t_{rr}$    | reverse recovery time step recovery | $I_F = 0.5 \text{ A}$ ; $I_R = 0.5 \text{ A}$ ; $I_{R(\text{meas})} = 0.1 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ |     | -   | 11.5 | -    | ns            |
|             | reverse recovery time ramp recovery | $dI_F/dt = 200 \text{ A}/\mu\text{s}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; $I_F = 6 \text{ A}$ ; $V_R = 26 \text{ V}$   |     | -   | 10.5 | -    | ns            |
| $V_{FRM}$   | peak forward recovery voltage       | $I_F = 0.5 \text{ A}$ ; $dI_F/dt = 20 \text{ A}/\mu\text{s}$ ; $T_j = 25 \text{ }^\circ\text{C}$                         |     | -   | 430  | -    | mV            |

[1] Very short pulse, in order to maintain a stable junction temperature.



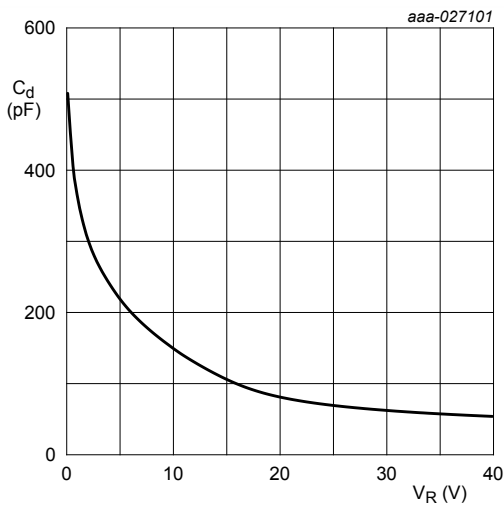
- pulsed condition
- (1)  $T_j = 175\text{ }^\circ\text{C}$
  - (2)  $T_j = 150\text{ }^\circ\text{C}$
  - (3)  $T_j = 125\text{ }^\circ\text{C}$
  - (4)  $T_j = 100\text{ }^\circ\text{C}$
  - (5)  $T_j = 85\text{ }^\circ\text{C}$
  - (6)  $T_j = 25\text{ }^\circ\text{C}$
  - (7)  $T_j = -40\text{ }^\circ\text{C}$

Fig. 3. Forward current as a function of forward voltage; typical values



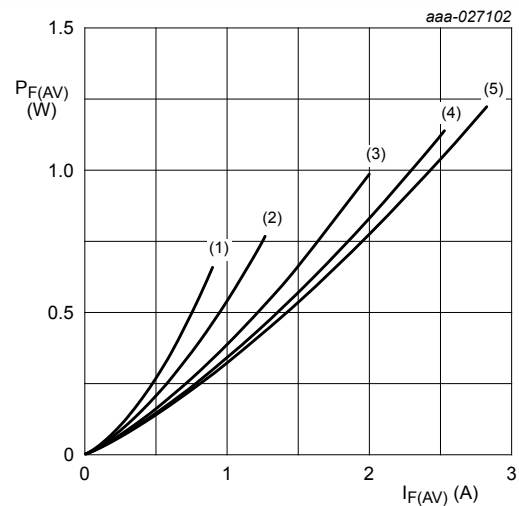
- pulsed condition
- (1)  $T_j = 150\text{ }^\circ\text{C}$
  - (2)  $T_j = 125\text{ }^\circ\text{C}$
  - (3)  $T_j = 100\text{ }^\circ\text{C}$
  - (4)  $T_j = 85\text{ }^\circ\text{C}$
  - (5)  $T_j = 25\text{ }^\circ\text{C}$
  - (6)  $T_j = -40\text{ }^\circ\text{C}$

Fig. 4. Reverse current as a function of reverse voltage; typical values



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

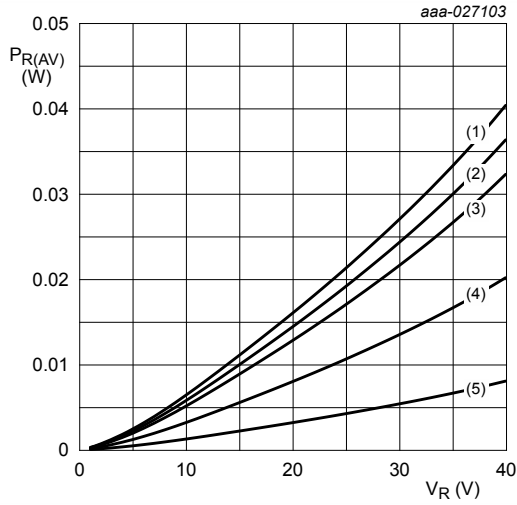
Fig. 5. Diode capacitance as a function of reverse voltage; typical values



- $T_j = 100\text{ }^\circ\text{C}$
- (1)  $\delta = 0.1$
  - (2)  $\delta = 0.2$
  - (3)  $\delta = 0.5$
  - (4)  $\delta = 0.8$
  - (5)  $\delta = 1$ ; DC

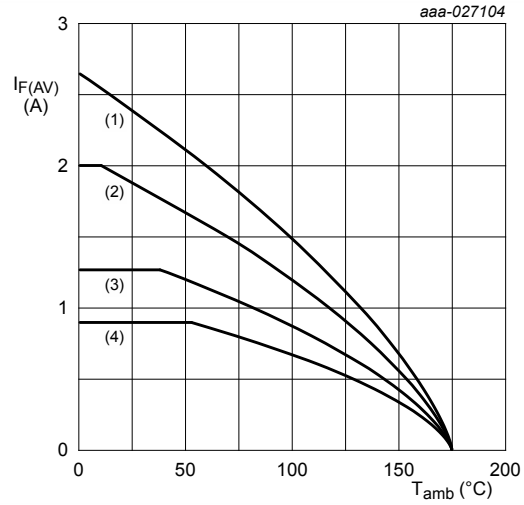
Fig. 6. Average forward power dissipation as a function of average forward current; typical values

40 V, 2 A low VF Trench MEGA Schottky barrier rectifier



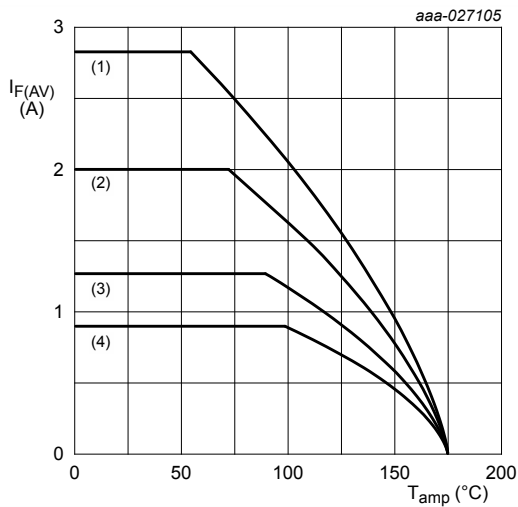
$T_j = 100\text{ °C}$   
 (1)  $\delta = 1$ ; DC  
 (2)  $\delta = 0.9$   
 (3)  $\delta = 0.8$   
 (4)  $\delta = 0.5$   
 (5)  $\delta = 0.2$

**Fig. 7. Average reverse power dissipation as a function of reverse voltage; typical values**



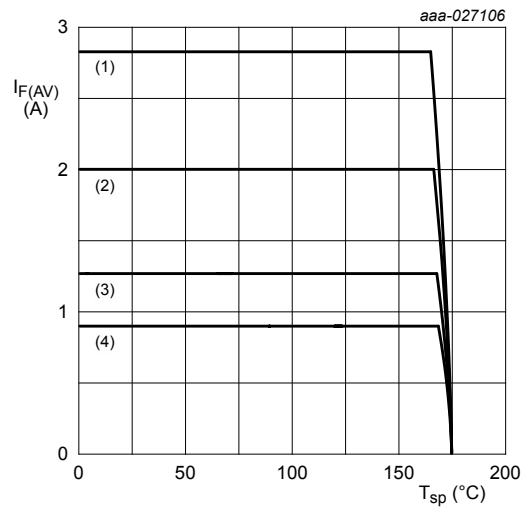
FR4 PCB, standard footprint  
 $T_j = 175\text{ °C}$   
 (1)  $\delta = 1$ ; DC  
 (2)  $\delta = 0.5$ ;  $f = 20\text{ kHz}$   
 (3)  $\delta = 0.2$ ;  $f = 20\text{ kHz}$   
 (4)  $\delta = 0.1$ ;  $f = 20\text{ kHz}$

**Fig. 8. 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. 9. 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. 10. Average forward current as a function of solder point temperature; typical values**

### 11. Test information

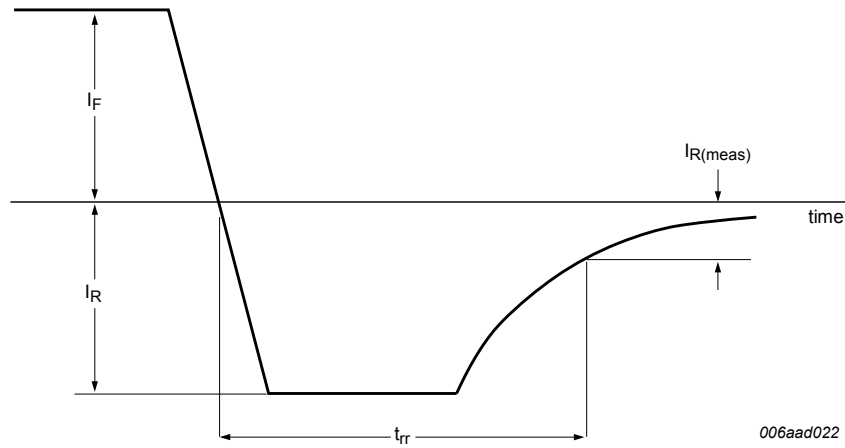


Fig. 11. Reverse recovery definition; step recovery

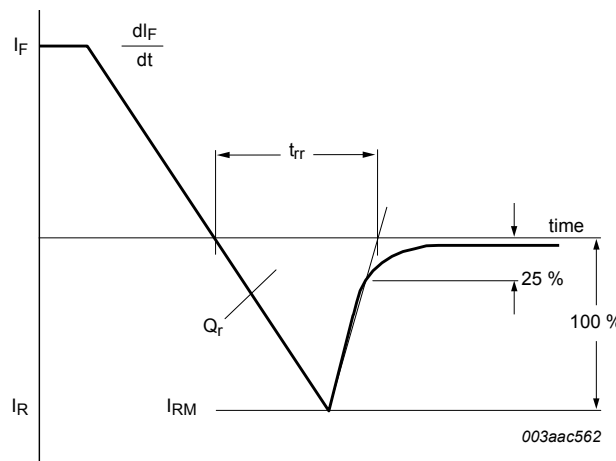


Fig. 12. Reverse recovery definition; ramp recovery

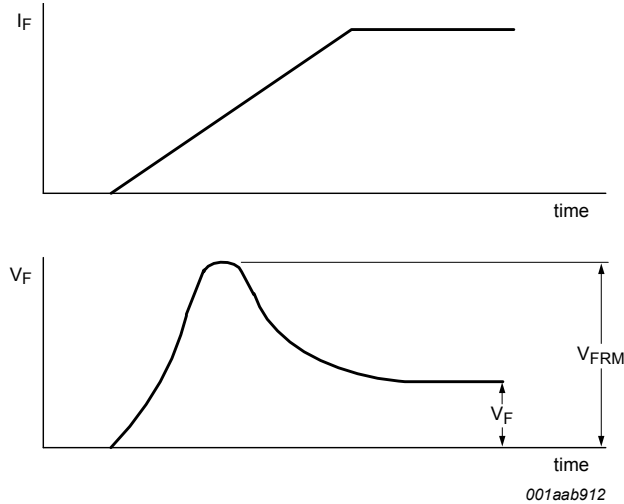


Fig. 13. Forward recovery definition



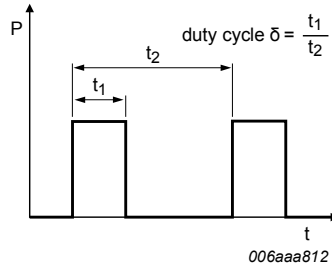


Fig. 14. Duty cycle definition

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,

$$I_{RMS} = I_{F(AV)} \text{ at DC, and } I_{RMS} = I_M \times \sqrt{\delta}$$

with  $I_{RMS}$  defined as RMS current.

**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**

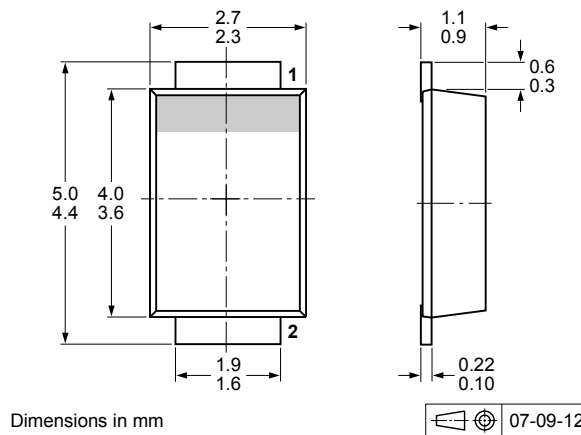


Fig. 15. Package outline CFP5 (SOD128)

### 13. Soldering

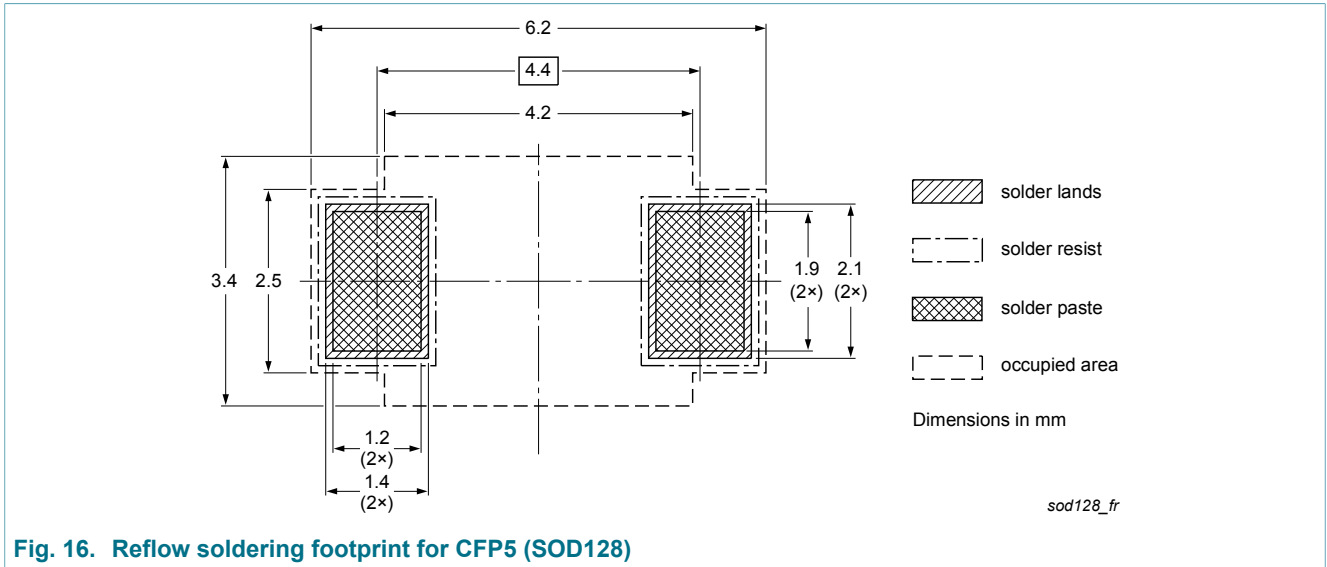
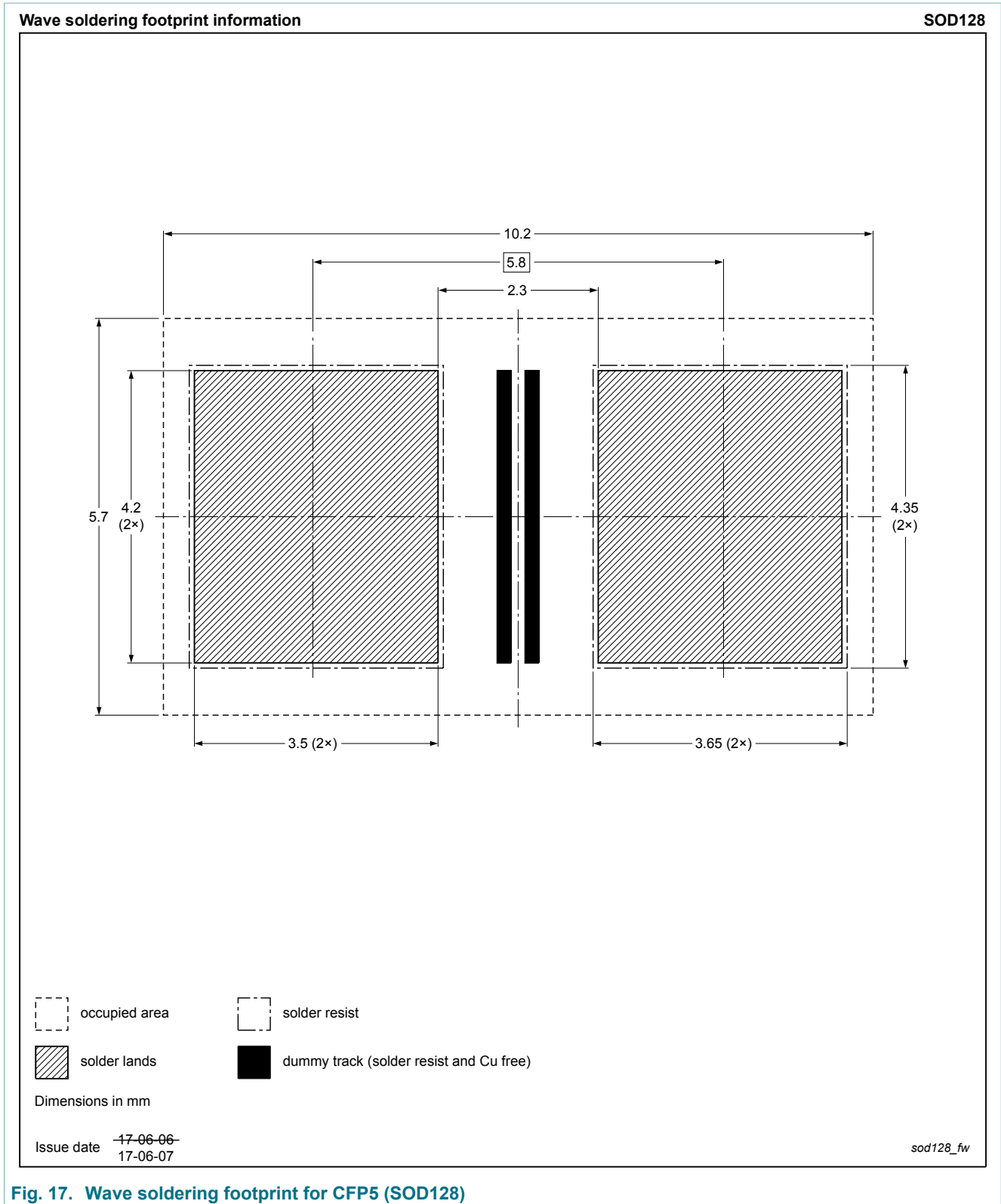


Fig. 16. Reflow soldering footprint for CFP5 (SOD128)



**Fig. 17. Wave soldering footprint for CFP5 (SOD128)**

## 14. Revision history

Table 8. Revision history

| Data sheet ID   | Release date | Data sheet status  | Change notice | Supersedes |
|-----------------|--------------|--------------------|---------------|------------|
| PMEG40T20EP v.1 | 20170929     | Product data sheet | -             | -          |

## 15. Legal information

### 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.                                     |

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Date of release: 29 September 2017

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