



# 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><i>sym001</i> |
| 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                     | $T_j = 25\text{ }^{\circ}\text{C}$                                                             |     | -   | 40   | V                  |
| $I_F$       | forward current                     | $T_{sp} \leq 160\text{ }^{\circ}\text{C}$ ; $\delta = 1$                                       |     | -   | 2.8  | A                  |
| $I_{F(AV)}$ | average forward current             | $\delta = 0.5$ ; $f = 20\text{ kHz}$ ; $T_{sp} \leq 165\text{ }^{\circ}\text{C}$ ; square wave |     | -   | 2    | A                  |
| $I_{FSM}$   | non-repetitive peak forward current | $t_p = 8\text{ ms}$ ; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; square wave          |     | -   | 20   | A                  |
| $P_{tot}$   | total power dissipation             | $T_{amb} \leq 25\text{ }^{\circ}\text{C}$                                                      | [1] | -   | 0.75 | W                  |
|             |                                     |                                                                                                | [2] | -   | 1.2  | W                  |
| $T_j$       | junction temperature                |                                                                                                |     | -   | 175  | $^{\circ}\text{C}$ |
| $T_{amb}$   | ambient temperature                 |                                                                                                |     | -55 | 175  | $^{\circ}\text{C}$ |
| $T_{stg}$   | storage temperature                 |                                                                                                |     | -65 | 175  | $^{\circ}\text{C}$ |

[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  $1\text{ cm}^2$ .

## 9. Thermal characteristics

**Table 6. Thermal characteristics**

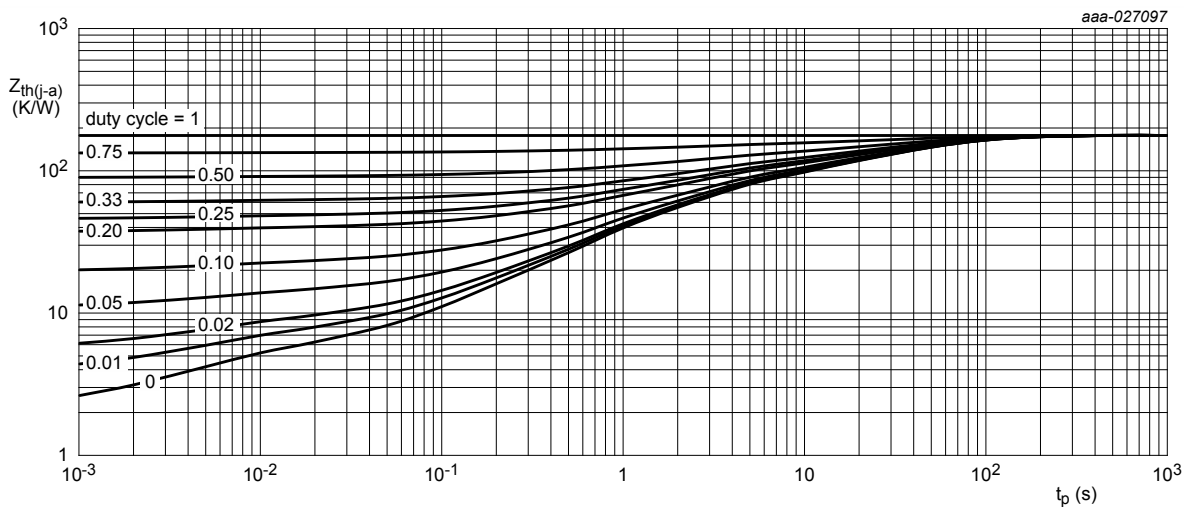
| Symbol         | Parameter                                        | Conditions  |         | Min | Typ | Max | Unit |
|----------------|--------------------------------------------------|-------------|---------|-----|-----|-----|------|
| $R_{th(j-a)}$  | thermal resistance from junction to ambient      | 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.

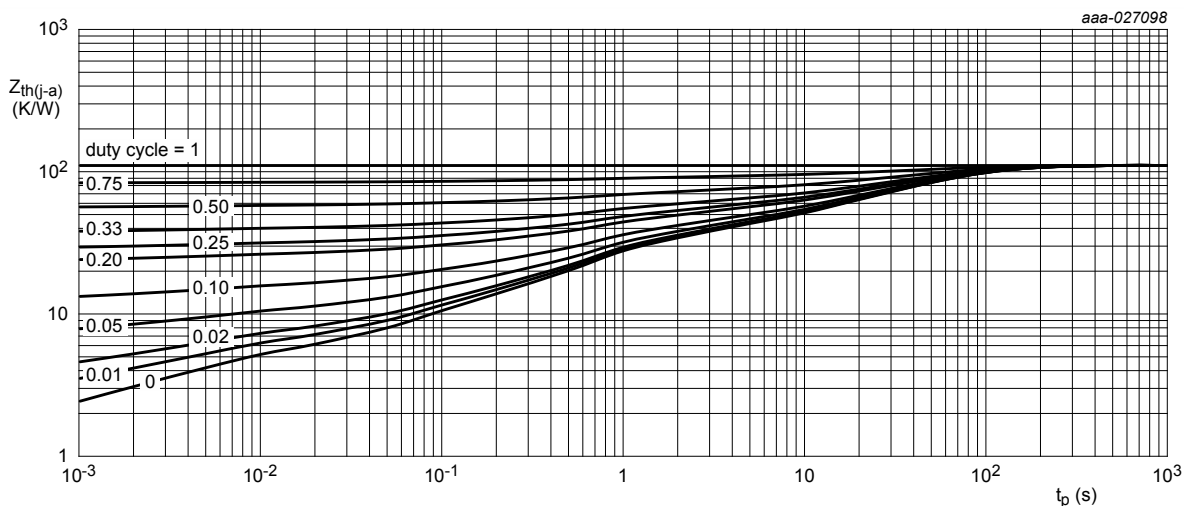
[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode  $1\text{ cm}^2$ .

[4] Soldering point of cathode tab.



FR4 PCB, standard footprint

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



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

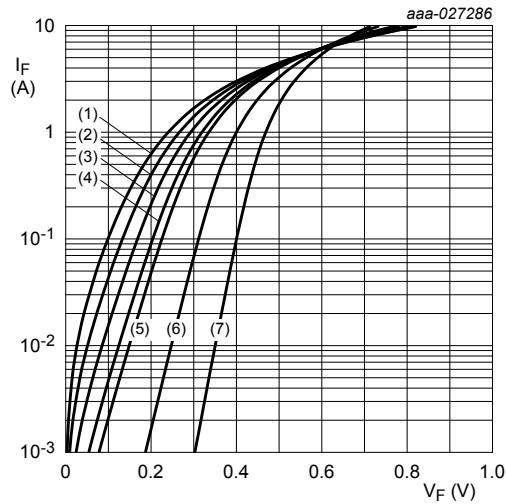
Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 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            |

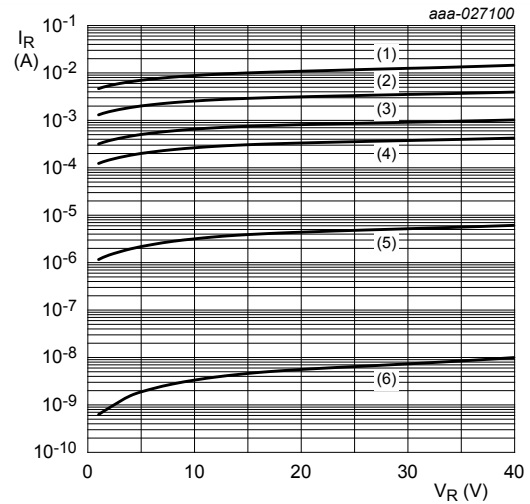
[1] Very short pulse, in order to maintain a stable junction temperature.



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)  $T_j = -40\text{ }^{\circ}\text{C}$

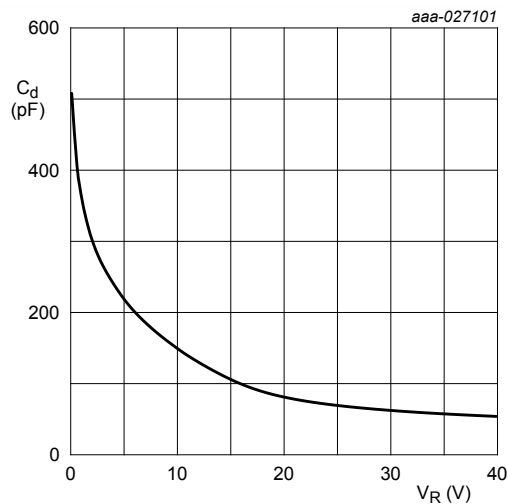
**Fig. 3. Forward current as a function of forward voltage; typical values**



pulsed condition

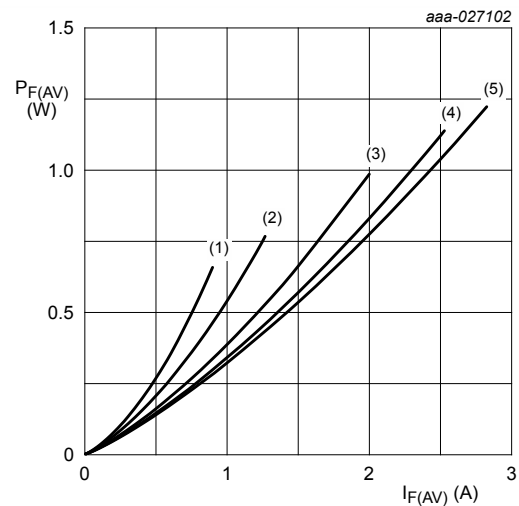
- (1)  $T_j = 150\text{ }^{\circ}\text{C}$
- (2)  $T_j = 125\text{ }^{\circ}\text{C}$
- (3)  $T_j = 100\text{ }^{\circ}\text{C}$
- (4)  $T_j = 85\text{ }^{\circ}\text{C}$
- (5)  $T_j = 25\text{ }^{\circ}\text{C}$
- (6)  $T_j = -40\text{ }^{\circ}\text{C}$

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



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

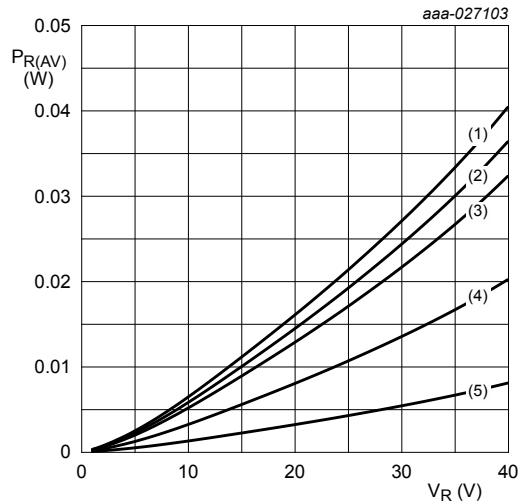
**Fig. 5. Diode capacitance as a function of reverse voltage; typical values**



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

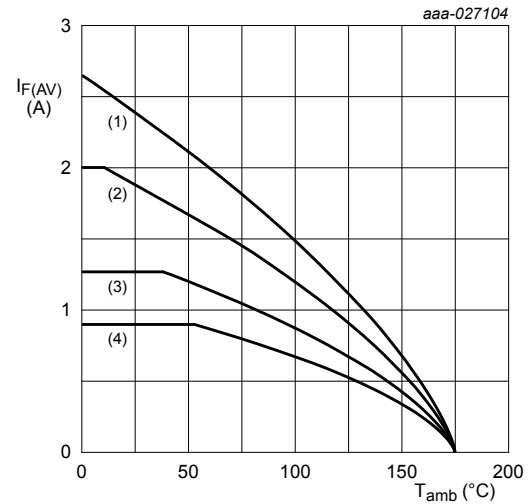
- (1)  $\delta = 0.1$
- (2)  $\delta = 0.2$
- (3)  $\delta = 0.5$
- (4)  $\delta = 0.8$
- (5)  $\delta = 1$ ; DC

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



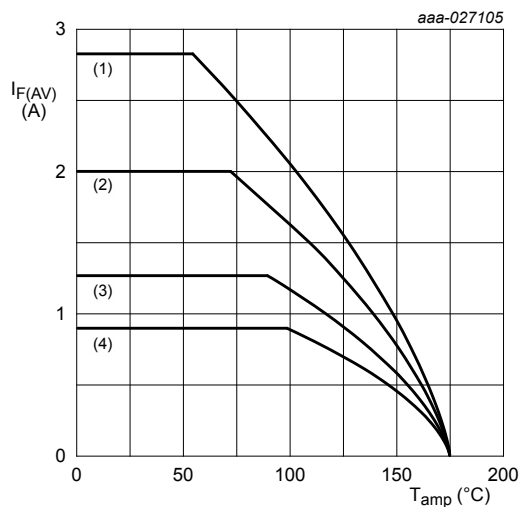
$T_j = 100\text{ °C}$   
 (1)  $\delta = 1$ ; DC  
 (2)  $\delta = 0.9$   
 (3)  $\delta = 0.8$   
 (4)  $\delta = 0.5$   
 (5)  $\delta = 0.2$

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



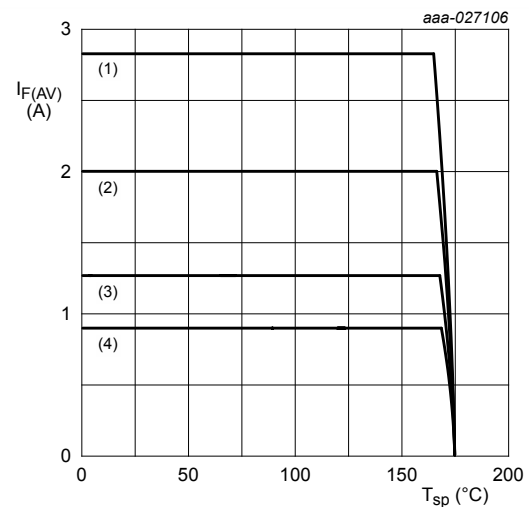
FR4 PCB, standard footprint  
 $T_j = 175\text{ °C}$   
 (1)  $\delta = 1$ ; DC  
 (2)  $\delta = 0.5$ ;  $f = 20\text{ kHz}$   
 (3)  $\delta = 0.2$ ;  $f = 20\text{ kHz}$   
 (4)  $\delta = 0.1$ ;  $f = 20\text{ kHz}$

**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

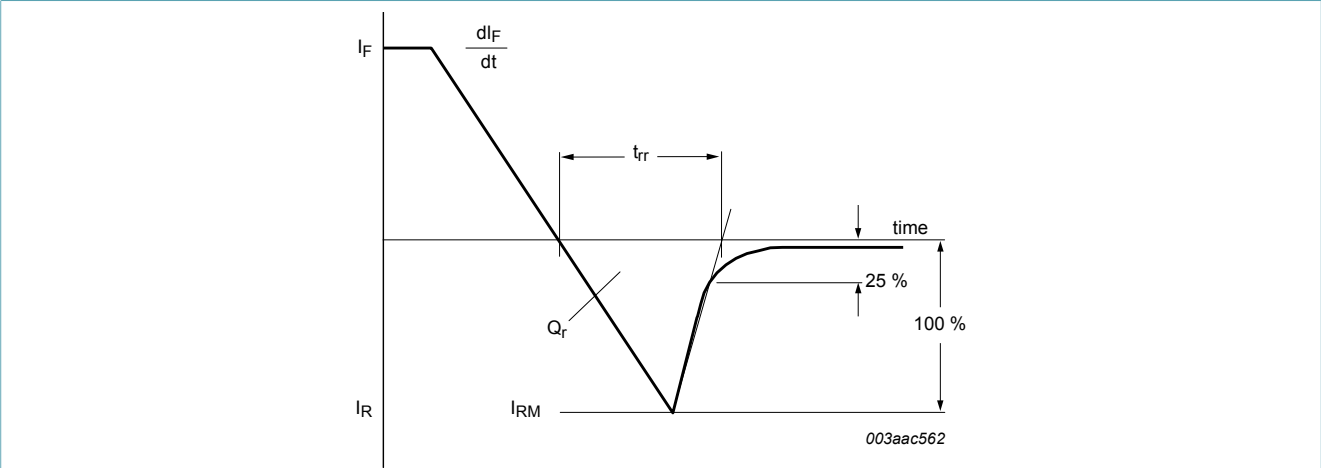


Fig. 12. Reverse recovery definition; ramp recovery

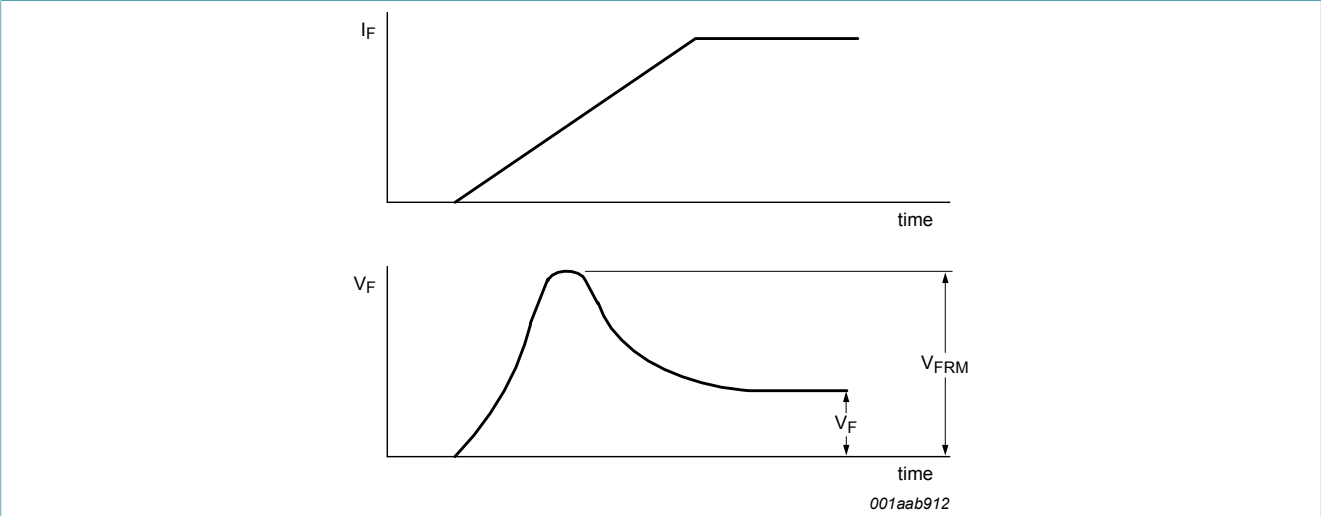


Fig. 13. Forward recovery definition

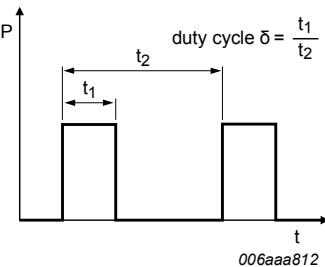


Fig. 14. Duty cycle definition

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,

$I_{RMS} = I_{F(AV)}$  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

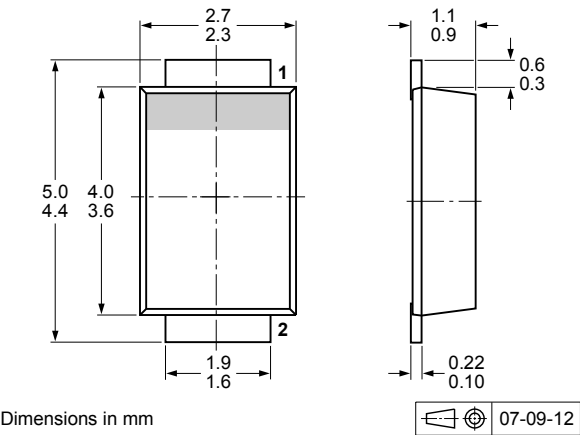


Fig. 15. Package outline CFP5 (SOD128)

13. Soldering

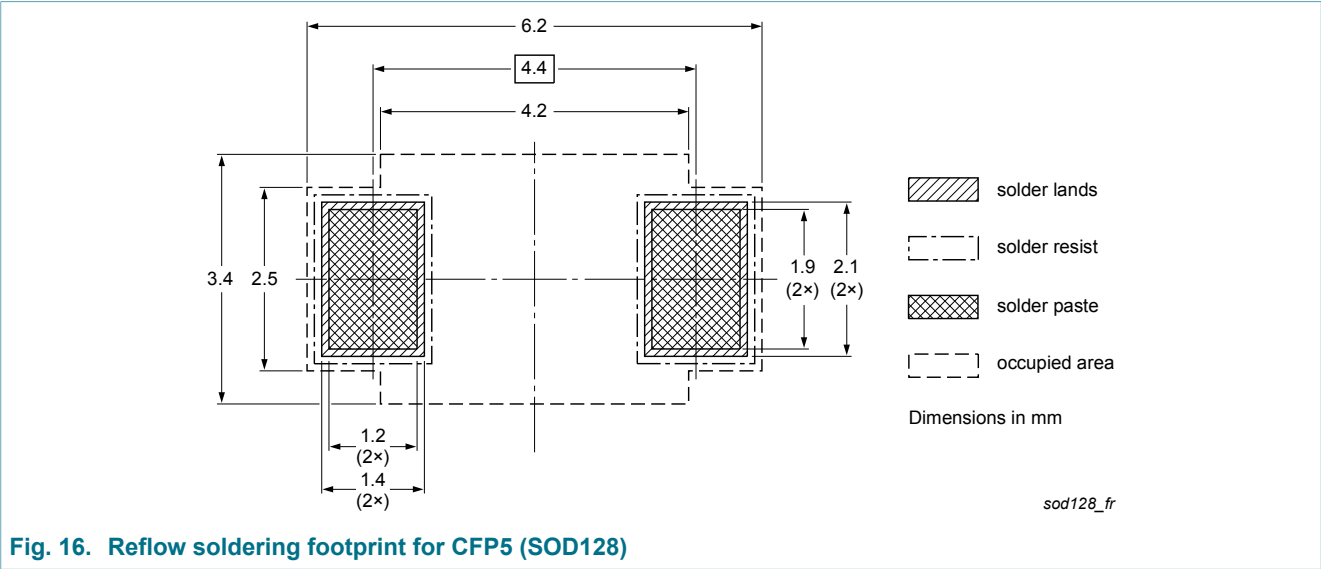


Fig. 16. Reflow soldering footprint for CFP5 (SOD128)

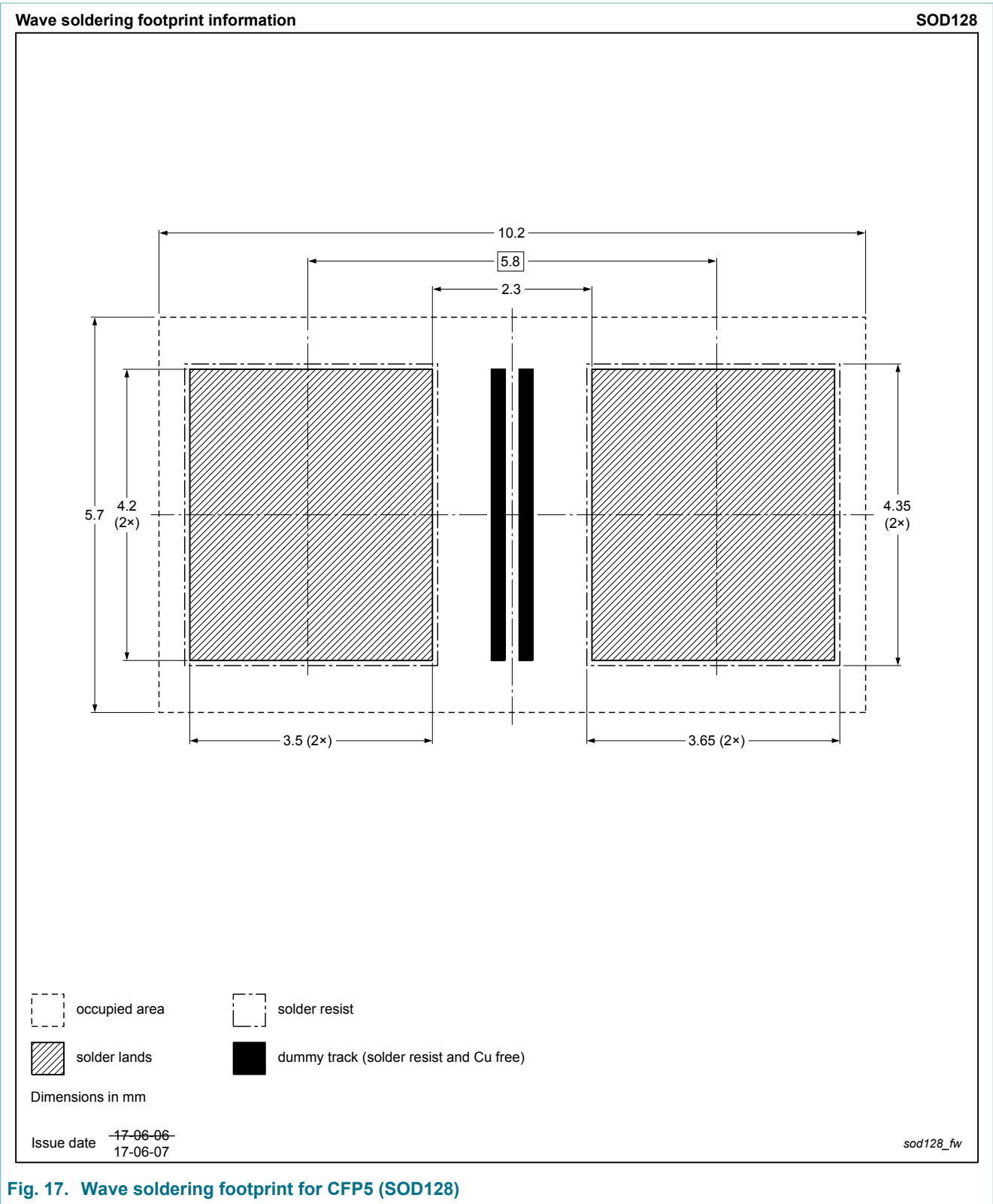


Fig. 17. Wave soldering footprint for CFP5 (SOD128)

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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