

PMEG4010ETR

High-temperature 40 V, 1 A Schottky barrier rectifier

26 September 2012

Product data sheet

1. Product profile

1.1 General description

Planar Maximum Efficiency General Application (MEGA) Schottky barrier rectifier with an integrated guard ring for stress protection, encapsulated in a SOD123W small and flat lead Surface-Mounted Device (SMD) plastic package.

1.2 Features and benefits

- Average forward current: $I_{F(AV)} \leq 1$ A
- Reverse voltage: $V_R \leq 40$ V
- Low forward voltage
- High power capability due to clip-bonding technology
- Small and flat lead SMD plastic package
- AEC-Q101 qualified
- High temperature $T_j \leq 175$ °C

1.3 Applications

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

1.4 Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|-------------|-------------------------|--|-----|-----|-----|-----|---------|
| I_F | forward current | $T_{sp} = 165$ °C | | - | - | 1.4 | A |
| $I_{F(AV)}$ | average forward current | $\delta = 0.5$; $f = 20$ kHz; $T_{amb} \leq 140$ °C; square wave | [1] | - | - | 1 | A |
| | | $\delta = 0.5$; $f = 20$ kHz; $T_{sp} \leq 170$ °C; square wave | | - | - | 1 | A |
| V_R | reverse voltage | $T_j = 25$ °C | | - | - | 40 | V |
| V_F | forward voltage | $I_F = 1$ A; $T_j = 25$ °C | | - | 430 | 490 | mV |
| I_R | reverse current | $T_j = 25$ °C; $V_R = 40$ V; $t_p \leq 300$ μ s; $\delta \leq 0.02$; pulsed | | - | 10 | 50 | μ A |





| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------|-----------------------|---|-----|-----|-----|------|
| t_{rr} | reverse recovery time | $I_R = 0.5 \text{ A}$; $I_F = 0.5 \text{ A}$; $I_{R(\text{meas})} = 0.1 \text{ A}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 4.4 | - | ns |

[1] Device mounted on a ceramic Printed-Circuit Board (PCB), Al_2O_3 , standard footprint.

2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-------------|--|---|
| 1 | K | cathode[1] |  <p>SOD123W</p> |  <p>sym001</p> |
| 2 | A | anode | | |

[1] The marking bar indicates the cathode.

3. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|---------|--|---------|
| | Name | Description | Version |
| PMEG4010ETR | SOD123W | plastic surface mounted package; 2 leads | SOD123W |

4. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PMEG4010ETR | EJ |

5. 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 | $T_{sp} = 165 \text{ }^\circ\text{C}$ | - | 1.4 | A | |
| $I_{F(AV)}$ | average forward current | $\delta = 0.5$; $f = 20 \text{ kHz}$; $T_{amb} \leq 140 \text{ }^\circ\text{C}$; square wave | [1] | - | 1 | A |
| | | $\delta = 0.5$; $f = 20 \text{ kHz}$; $T_{sp} \leq 170 \text{ }^\circ\text{C}$; square wave | - | - | 1 | A |
| I_{FSM} | non-repetitive peak forward current | $t_p = 8 \text{ ms}$; $T_{j(\text{init})} = 25 \text{ }^\circ\text{C}$; square wave | - | 50 | A | |

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|------------------|-------------------------|--------------------------|-----|-----|------|------|
| P _{tot} | total power dissipation | T _{amb} ≤ 25 °C | [2] | - | 680 | mW |
| | | | [3] | - | 1150 | mW |
| | | | [1] | - | 2140 | mW |
| T _j | junction temperature | | | - | 175 | °C |
| T _{amb} | ambient temperature | | | -55 | 175 | °C |
| T _{stg} | storage temperature | | | -65 | 175 | °C |

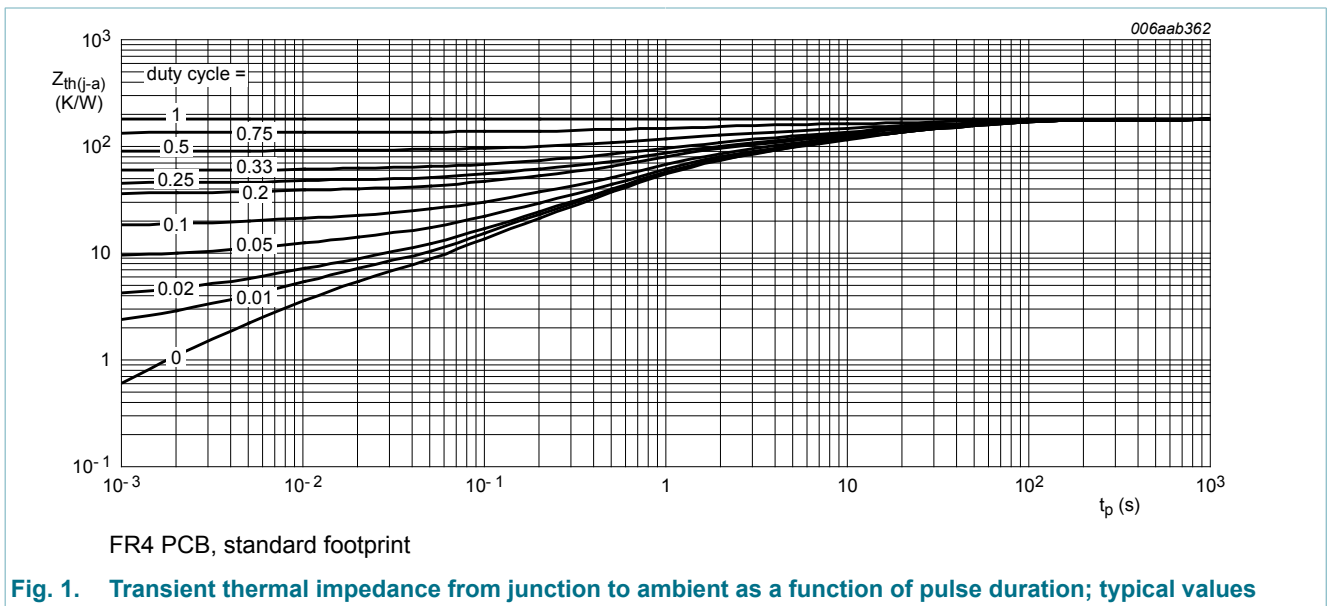
- [1] Device mounted on a ceramic Printed-Circuit Board (PCB), Al₂O₃, standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1 cm².

6. 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] | - | - | 220 | K/W |
| | | | [1][3] | - | - | 130 | K/W |
| | | | [1][4] | - | - | 70 | K/W |
| R _{th(j-sp)} | thermal resistance from junction to solder point | | [5] | - | - | 18 | 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 cm².
- [4] Device mounted on a ceramic PCB, Al₂O₃, standard footprint.
- [5] Soldering point of cathode tab.



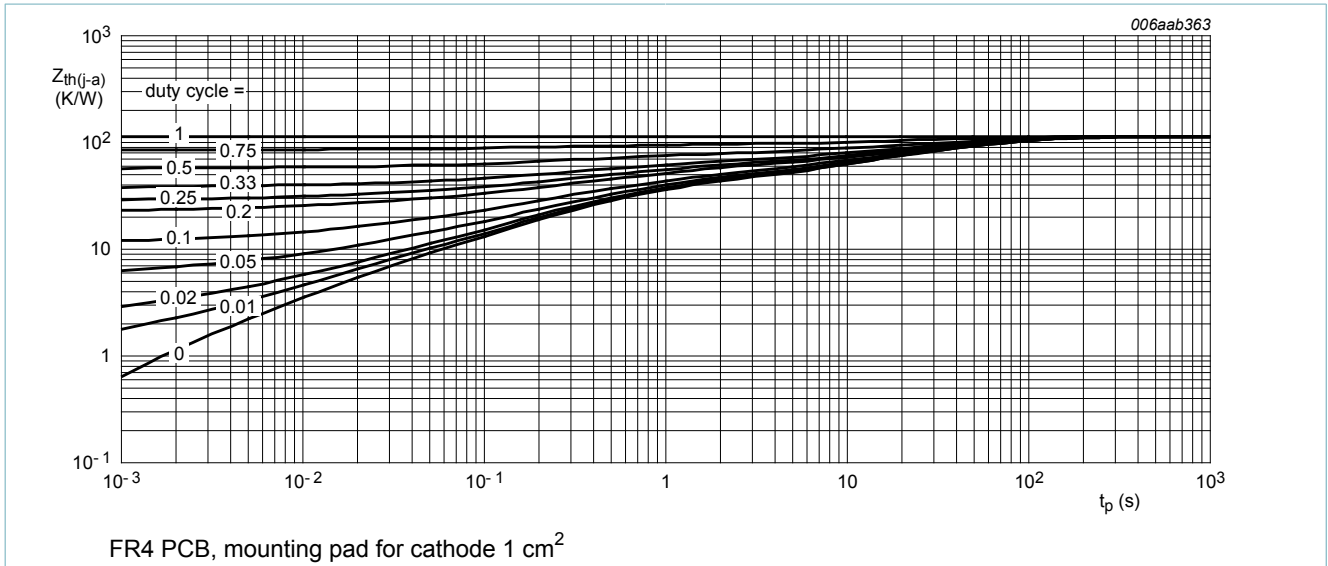


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

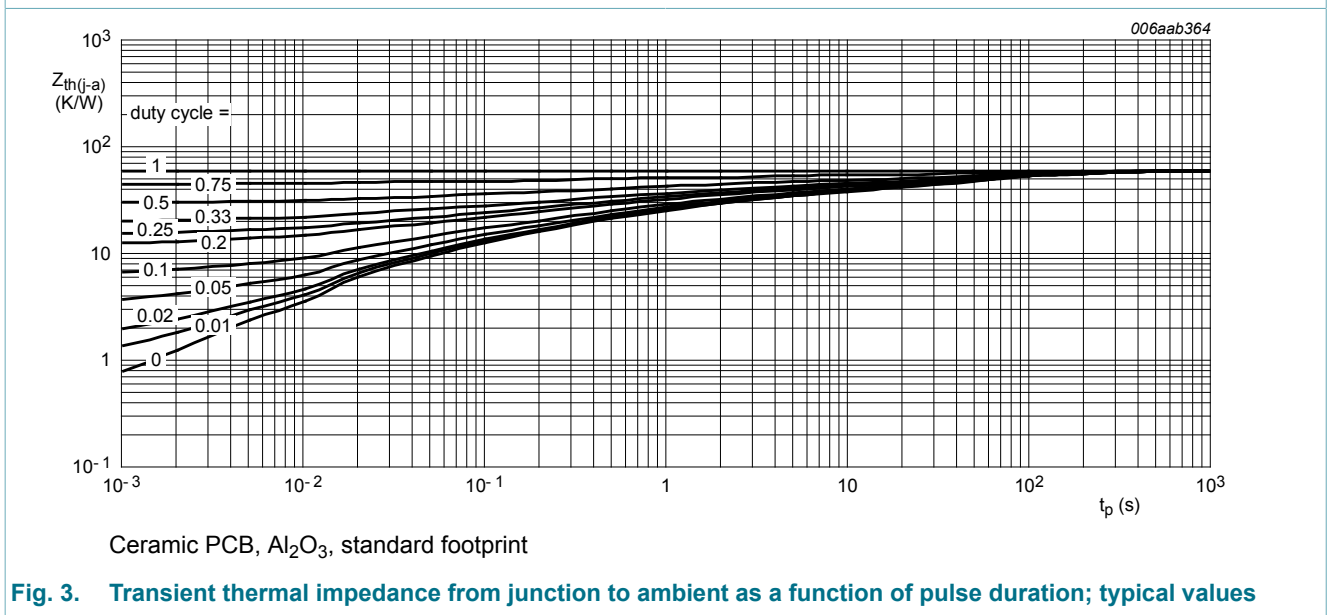


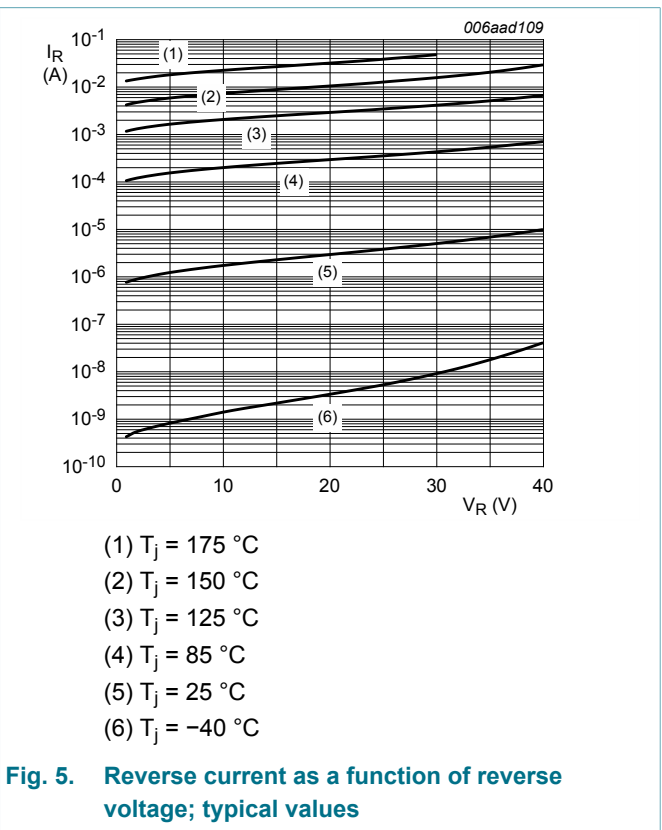
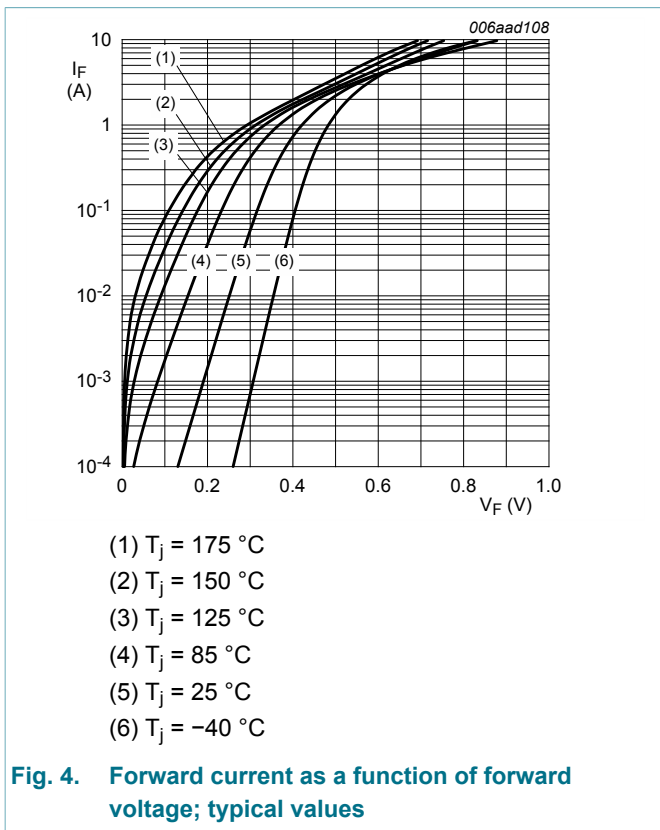
Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

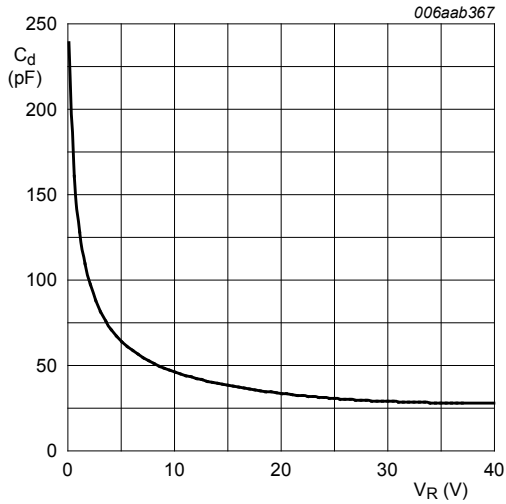
7. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|-----------------|--|-----|-----|-----|------|
| V _F | forward voltage | I _F = 0.1 A; T _j = 25 °C | - | 310 | 360 | mV |
| | | I _F = 1 A; T _j = 25 °C | - | 430 | 490 | mV |
| | | I _F = 1 A; T _j = -40 °C | - | 480 | 570 | mV |
| | | I _F = 1 A; T _j = 125 °C | - | 330 | 410 | mV |
| | | I _F = 1 A; T _j = 150 °C | - | 310 | 390 | mV |
| | | I _F = 1 A; T _j = 175 °C | - | 290 | 370 | mV |

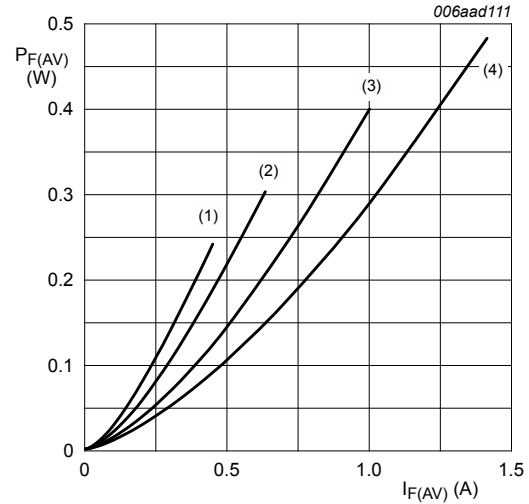
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------|-------------------------------|--|-----|------|-----|---------------|
| I_R | reverse current | $V_R = 10\text{ V}; T_j = 25\text{ }^\circ\text{C}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$; pulsed | - | 1.7 | 13 | μA |
| | | $V_R = 40\text{ V}; T_j = 25\text{ }^\circ\text{C}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$; pulsed | - | 10 | 50 | μA |
| | | $V_R = 40\text{ V}; T_j = -40\text{ }^\circ\text{C}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$; pulsed | - | 0.05 | 1 | μA |
| | | $V_R = 40\text{ V}; T_j = 125\text{ }^\circ\text{C}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.02$; pulsed | - | 6.5 | 30 | mA |
| C_d | diode capacitance | $V_R = 1\text{ V}; f = 1\text{ MHz}; T_j = 25\text{ }^\circ\text{C}$ | - | 130 | - | pF |
| | | $V_R = 10\text{ V}; f = 1\text{ MHz}; T_j = 25\text{ }^\circ\text{C}$ | - | 50 | - | pF |
| t_{rr} | reverse recovery time | $I_F = 0.5\text{ A}; I_R = 0.5\text{ A}; I_{R(\text{meas})} = 0.1\text{ A}; T_j = 25\text{ }^\circ\text{C}$ | - | 4.4 | - | ns |
| V_{FRM} | peak forward recovery voltage | $I_F = 1\text{ A}; dI_F/dt = 40\text{ A}/\mu\text{s}; T_j = 25\text{ }^\circ\text{C}$ | - | 484 | - | mV |





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

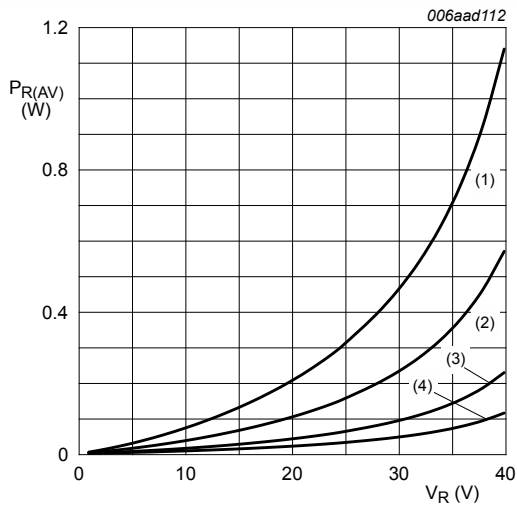
Fig. 6. Diode capacitance as a function of reverse voltage; typical values



$T_j = 175 \text{ }^\circ\text{C}$

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

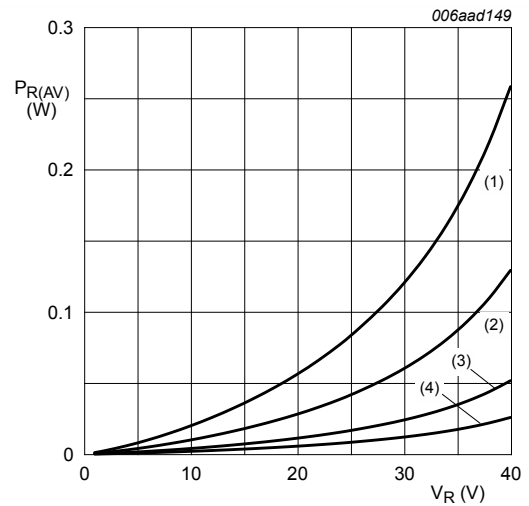
Fig. 7. Average forward power dissipation as a function of average forward current; typical values



$T_j = 150 \text{ }^\circ\text{C}$

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

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

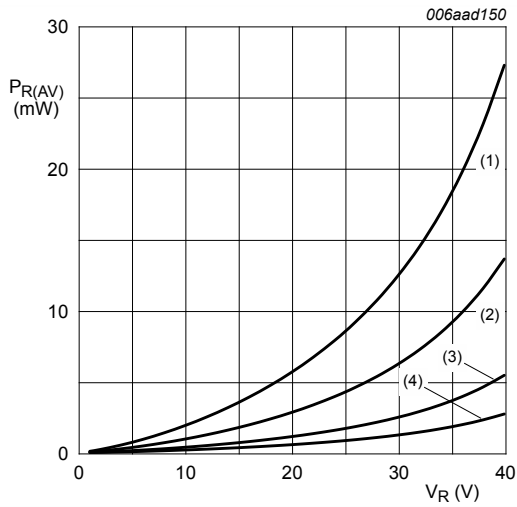


$T_j = 125 \text{ }^\circ\text{C}$

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

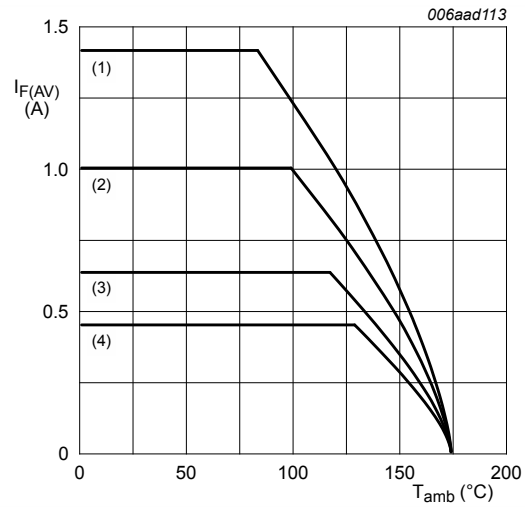
Fig. 9. Average reverse power dissipation as a function of reverse voltage; typical values

High-temperature 40 V, 1 A Schottky barrier rectifier



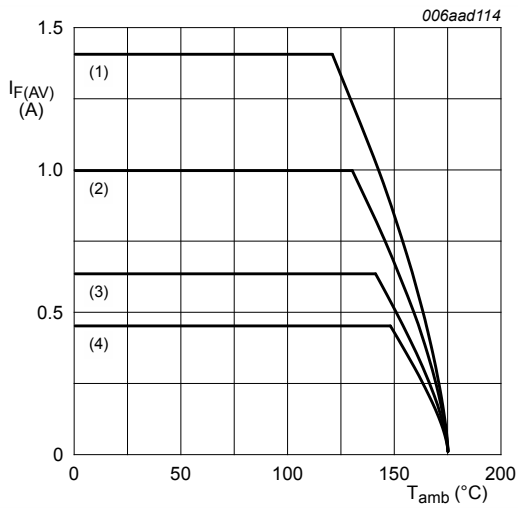
$T_j = 85\text{ °C}$
 (1) $\delta = 1$
 (2) $\delta = 0.5$
 (3) $\delta = 0.2$
 (4) $\delta = 0.1$

Fig. 10. Average reverse power dissipation as a function of reverse voltage; typical values



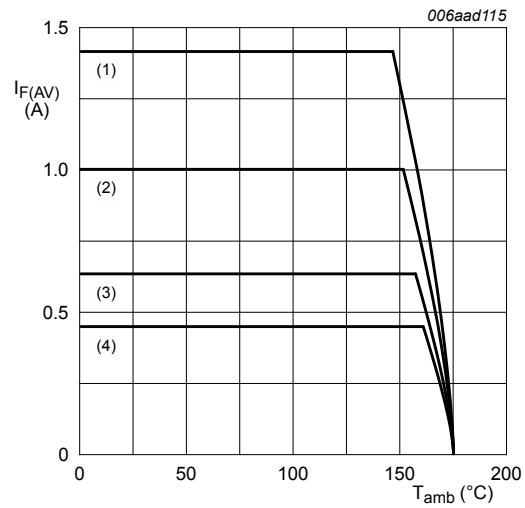
FR4 PCB, standard footprint
 $T_j = 175\text{ °C}$
 (1) $\delta = 1$ (DC)
 (2) $\delta = 0.5$; $f = 20\text{ kHz}$
 (3) $\delta = 0.2$; $f = 20\text{ kHz}$
 (4) $\delta = 0.1$; $f = 20\text{ kHz}$

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



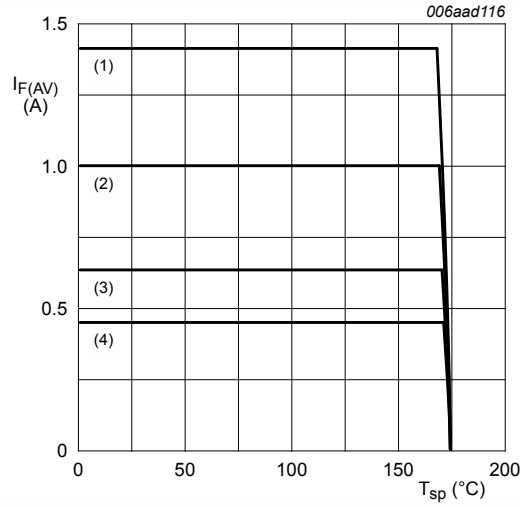
FR4 PCB, mounting pad for cathode 1 cm^2
 $T_j = 175\text{ °C}$
 (1) $\delta = 1$ (DC)
 (2) $\delta = 0.5$; $f = 20\text{ kHz}$
 (3) $\delta = 0.2$; $f = 20\text{ kHz}$
 (4) $\delta = 0.1$; $f = 20\text{ kHz}$

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



Ceramic PCB, Al_2O_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. 13. Average forward current as a function of ambient temperature; typical values



$T_j = 175\text{ }^\circ\text{C}$

(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. 14. Average forward current as a function of solder point temperature; typical values

8. Test information

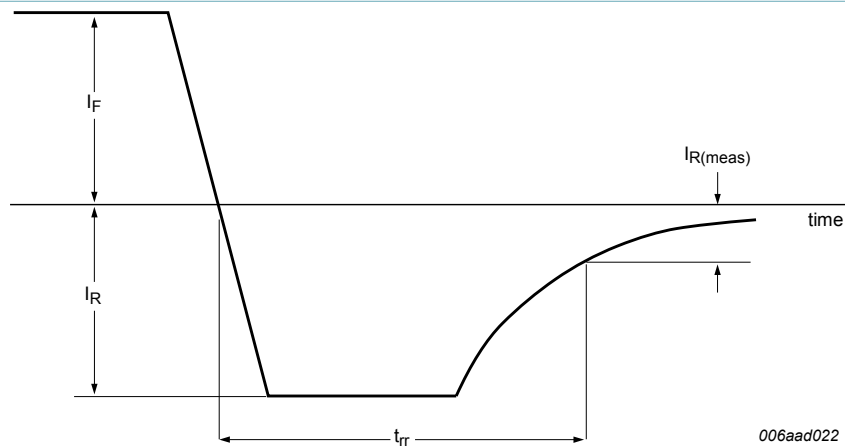


Fig. 15. Reverse recovery definition

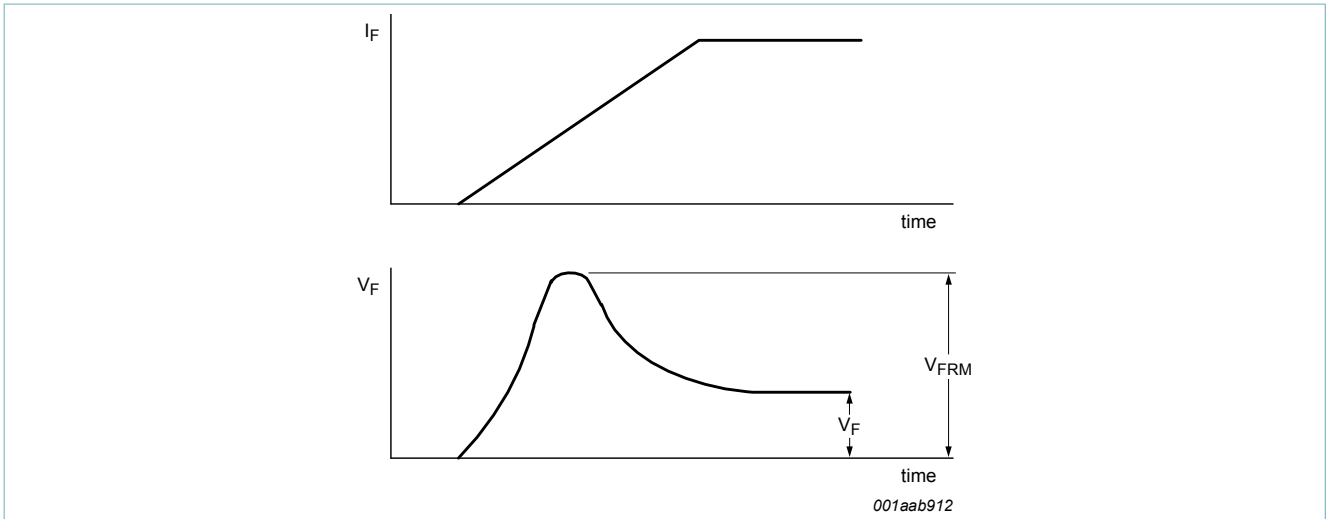


Fig. 16. Forward recovery definition

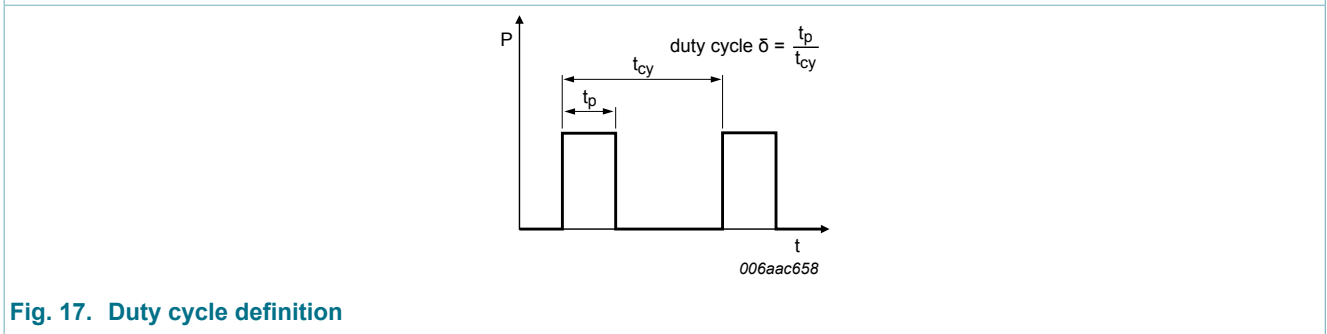


Fig. 17. Duty cycle definition

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.

8.1 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.

9. Package outline

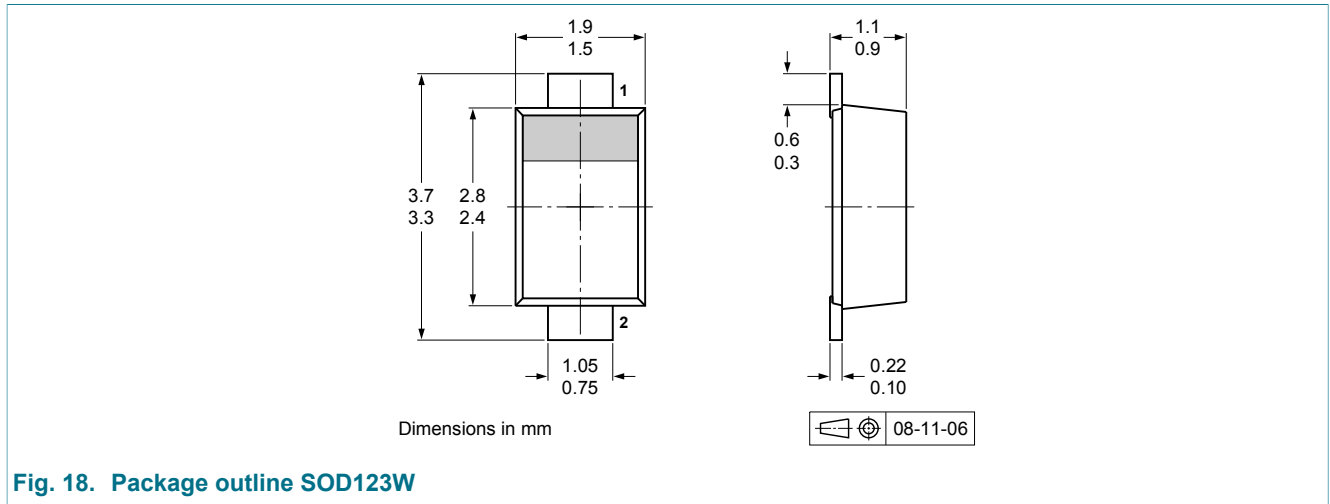


Fig. 18. Package outline SOD123W

10. Soldering

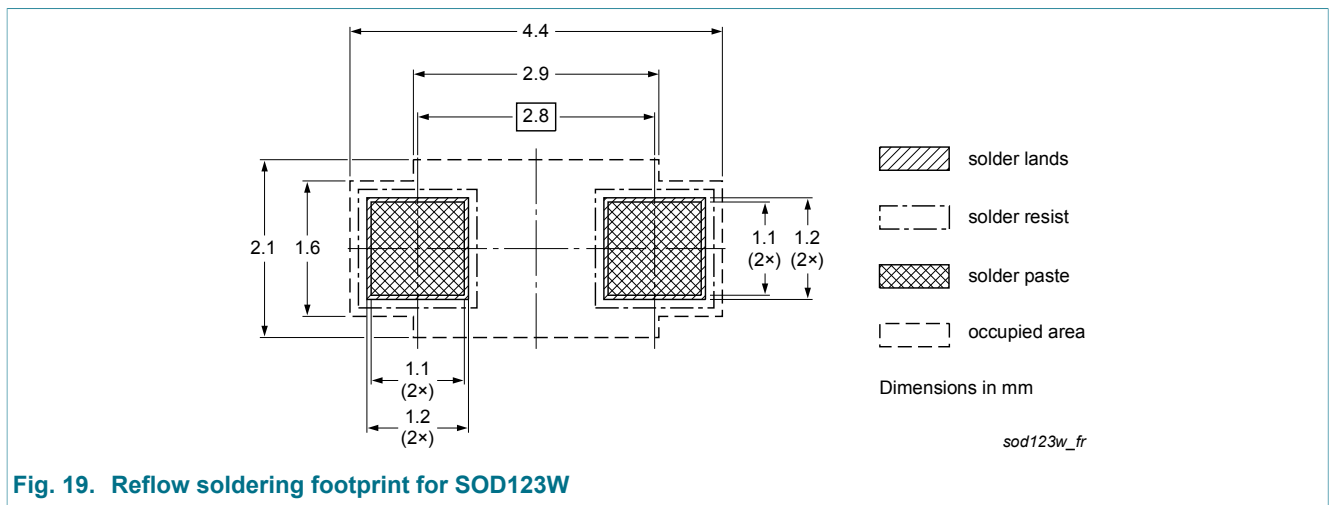


Fig. 19. Reflow soldering footprint for SOD123W

11. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|-----------------|--------------|--------------------|---------------|------------|
| PMEG4010ETR v.1 | 20120926 | Product data sheet | - | - |

12. Legal information

12.1 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. |

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