

# PMEG4010ETR

High-temperature 40 V, 1 A Schottky barrier rectifier

28 November 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; $t_p \leq 300$ $\mu$ s; $\delta \leq 0.02$ ; pulsed		-	10	50	$\mu$ 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),  $\text{Al}_2\text{O}_3$ , 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 <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	[2]	-	680	mW
			[3]	-	1150	mW
			[1]	-	2140	mW
T <sub>j</sub>	junction temperature			-	175	°C
T <sub>amb</sub>	ambient temperature			-55	175	°C
T <sub>stg</sub>	storage temperature			-65	175	°C

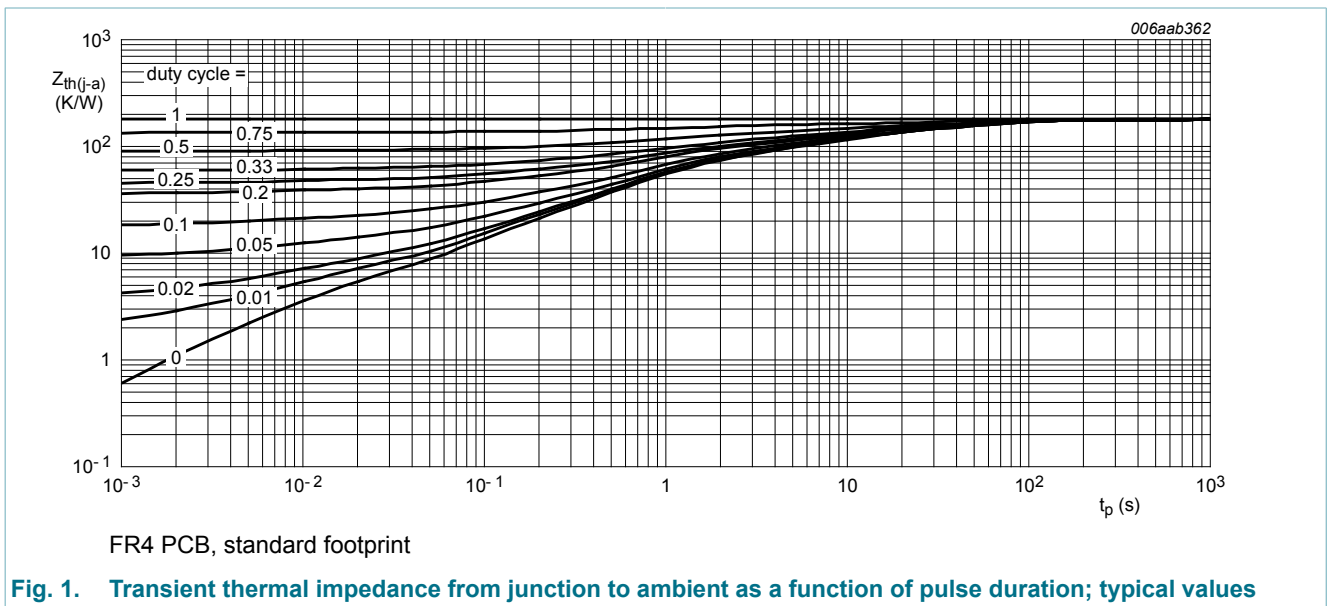
- [1] Device mounted on a ceramic Printed-Circuit Board (PCB), Al<sub>2</sub>O<sub>3</sub>, standard footprint.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1 cm<sup>2</sup>.

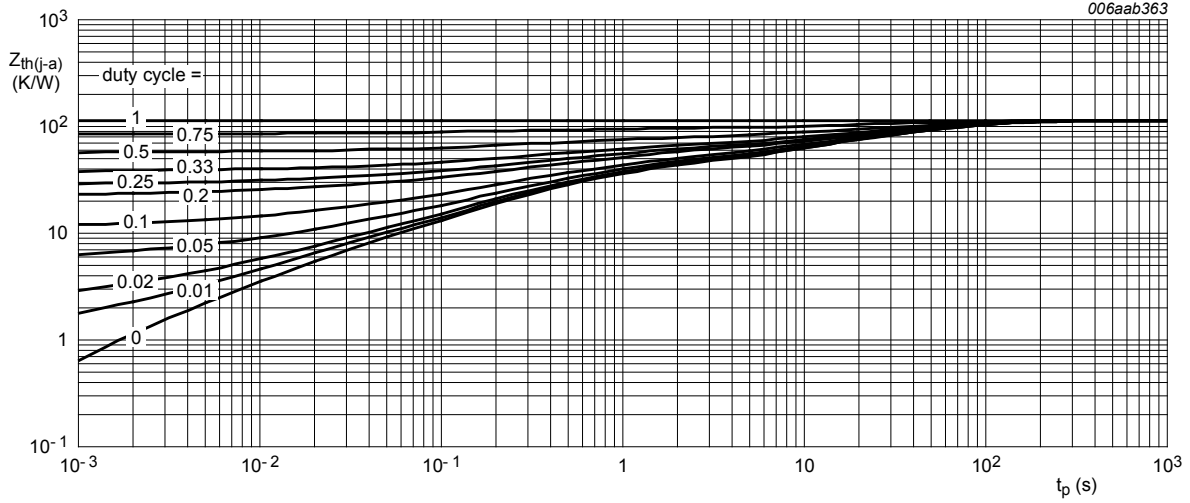
## 6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
R <sub>th(j-a)</sub>	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 <sub>th(j-sp)</sub>	thermal resistance from junction to solder point		[5]	-	-	18	K/W

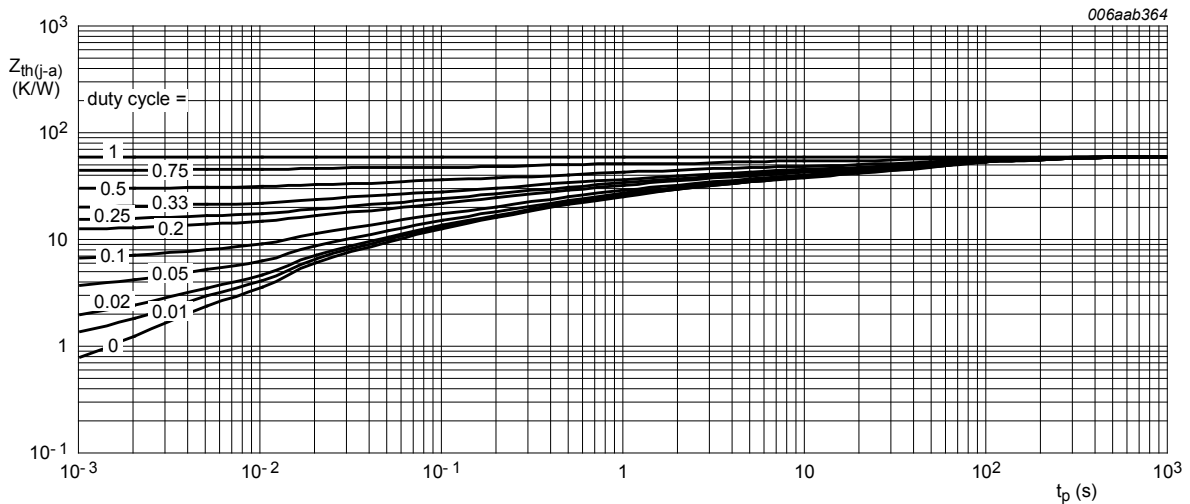
- [1] For Schottky barrier diodes thermal runaway has to be considered, as in some applications the reverse power losses P<sub>R</sub> are a significant part of the total power losses.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1 cm<sup>2</sup>.
- [4] Device mounted on a ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, 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

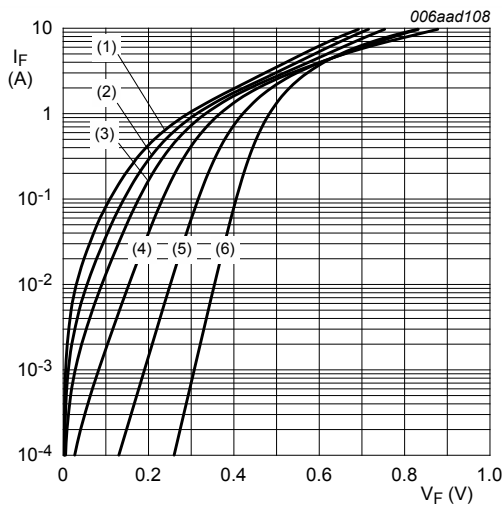
## 7. Characteristics

Table 7. Characteristics

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

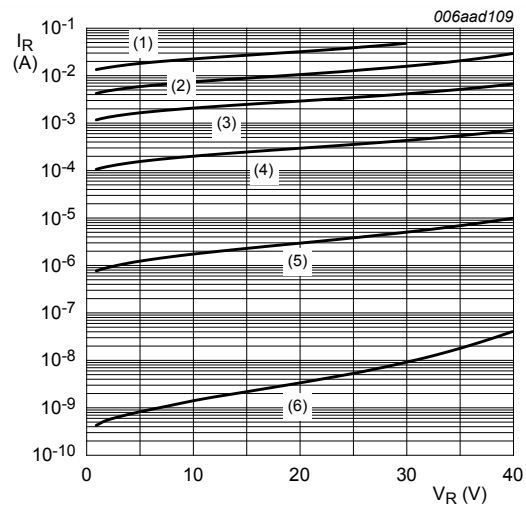
High-temperature 40 V, 1 A Schottky barrier rectifier

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_R$	reverse current	$V_R = 10 \text{ V}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02;$ $T_j = 25 \text{ }^\circ\text{C};$ pulsed	-	3	13	$\mu\text{A}$
		$V_R = 40 \text{ V}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02;$ $T_j = 25 \text{ }^\circ\text{C};$ pulsed	-	10	50	$\mu\text{A}$
		$V_R = 40 \text{ V}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02;$ $T_j = -40 \text{ }^\circ\text{C};$ pulsed	-	0.05	1	$\mu\text{A}$
		$V_R = 40 \text{ V}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02;$ $T_j = 125 \text{ }^\circ\text{C};$ pulsed	-	6.5	30	$\text{mA}$
$C_d$	diode capacitance	$V_R = 1 \text{ V}; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C}$	-	130	-	$\text{pF}$
		$V_R = 10 \text{ V}; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C}$	-	50	-	$\text{pF}$
$t_{rr}$	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	-	$\text{ns}$
$V_{FRM}$	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	-	$\text{mV}$



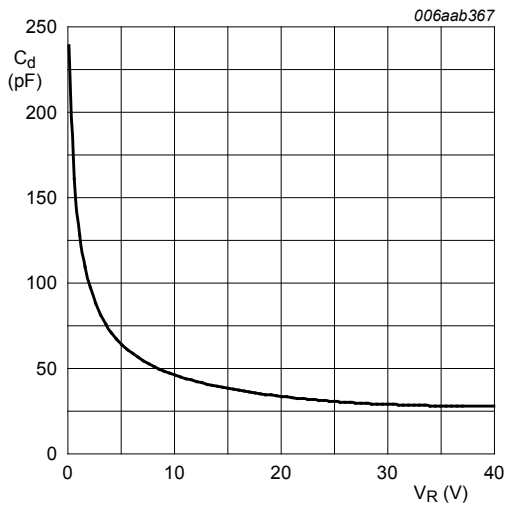
- (1)  $T_j = 175 \text{ }^\circ\text{C}$
- (2)  $T_j = 150 \text{ }^\circ\text{C}$
- (3)  $T_j = 125 \text{ }^\circ\text{C}$
- (4)  $T_j = 85 \text{ }^\circ\text{C}$
- (5)  $T_j = 25 \text{ }^\circ\text{C}$
- (6)  $T_j = -40 \text{ }^\circ\text{C}$

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



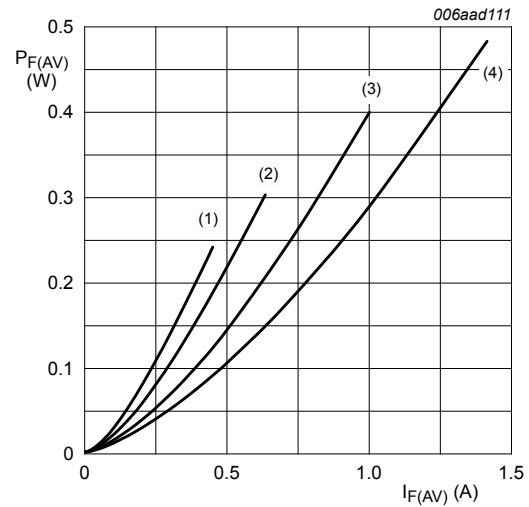
- (1)  $T_j = 175 \text{ }^\circ\text{C}$
- (2)  $T_j = 150 \text{ }^\circ\text{C}$
- (3)  $T_j = 125 \text{ }^\circ\text{C}$
- (4)  $T_j = 85 \text{ }^\circ\text{C}$
- (5)  $T_j = 25 \text{ }^\circ\text{C}$
- (6)  $T_j = -40 \text{ }^\circ\text{C}$

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



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

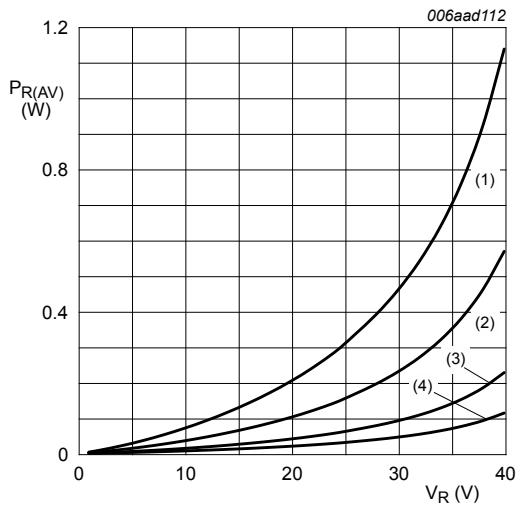
**Fig. 6. Diode capacitance as a function of reverse voltage; typical values**



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

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

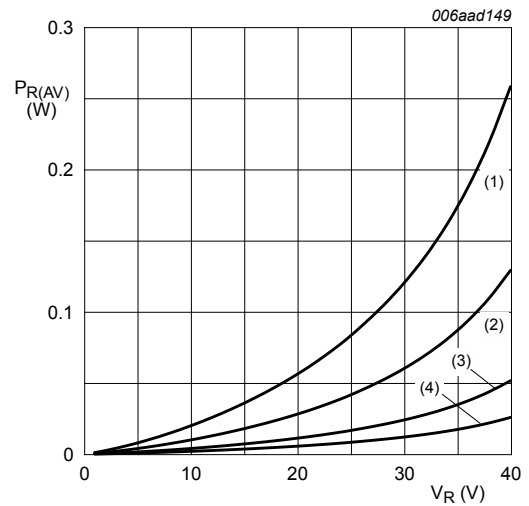
**Fig. 7. Average forward power dissipation as a function of average forward current; typical values**



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

- (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**

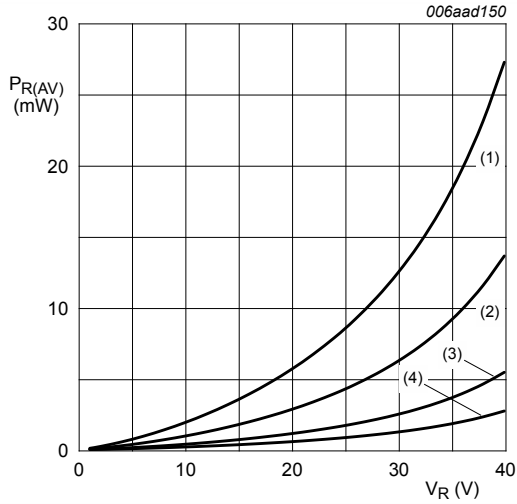


$T_j = 125 \text{ }^\circ\text{C}$

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

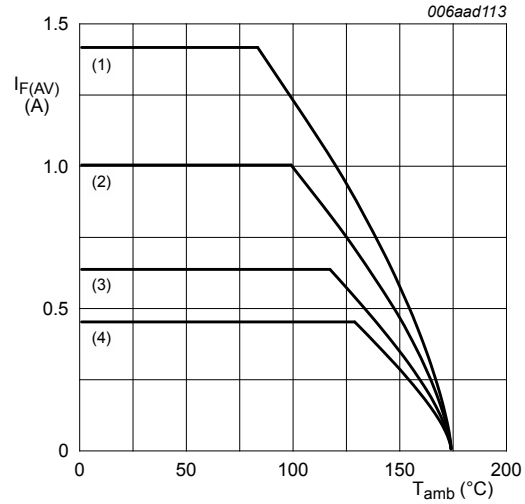
**Fig. 9. Average reverse power dissipation as a function of reverse voltage; typical values**

High-temperature 40 V, 1 A Schottky barrier rectifier



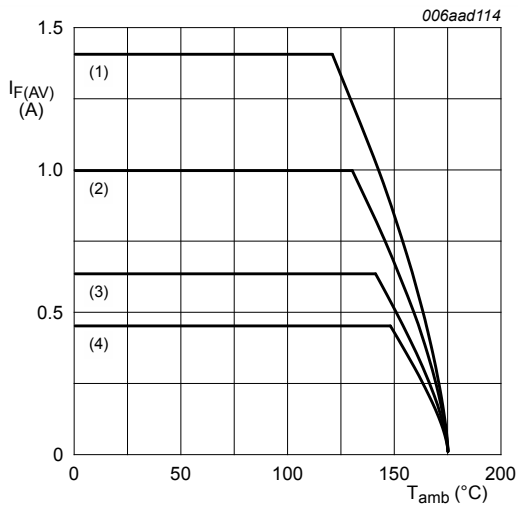
$T_j = 85\text{ °C}$   
 (1)  $\delta = 1$   
 (2)  $\delta = 0.5$   
 (3)  $\delta = 0.2$   
 (4)  $\delta = 0.1$

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



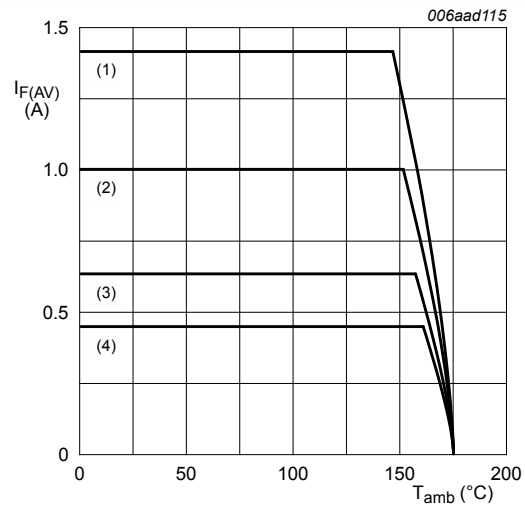
FR4 PCB, standard footprint  
 $T_j = 175\text{ °C}$   
 (1)  $\delta = 1$  (DC)  
 (2)  $\delta = 0.5$ ;  $f = 20\text{ kHz}$   
 (3)  $\delta = 0.2$ ;  $f = 20\text{ kHz}$   
 (4)  $\delta = 0.1$ ;  $f = 20\text{ kHz}$

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



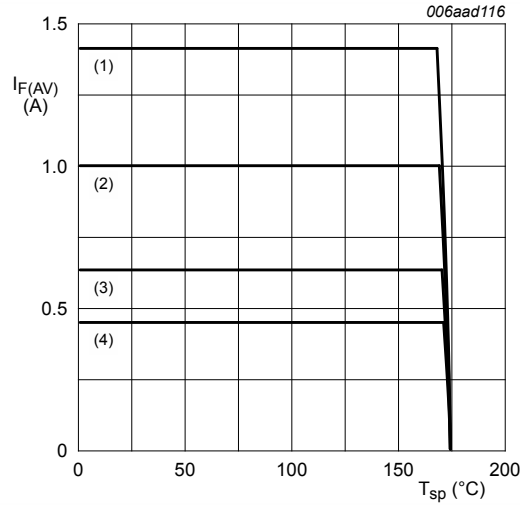
FR4 PCB, mounting pad for cathode  $1\text{ cm}^2$   
 $T_j = 175\text{ °C}$   
 (1)  $\delta = 1$  (DC)  
 (2)  $\delta = 0.5$ ;  $f = 20\text{ kHz}$   
 (3)  $\delta = 0.2$ ;  $f = 20\text{ kHz}$   
 (4)  $\delta = 0.1$ ;  $f = 20\text{ kHz}$

**Fig. 12. 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. 13. 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. 14. Average forward current as a function of solder point temperature; typical values

## 8. Test information

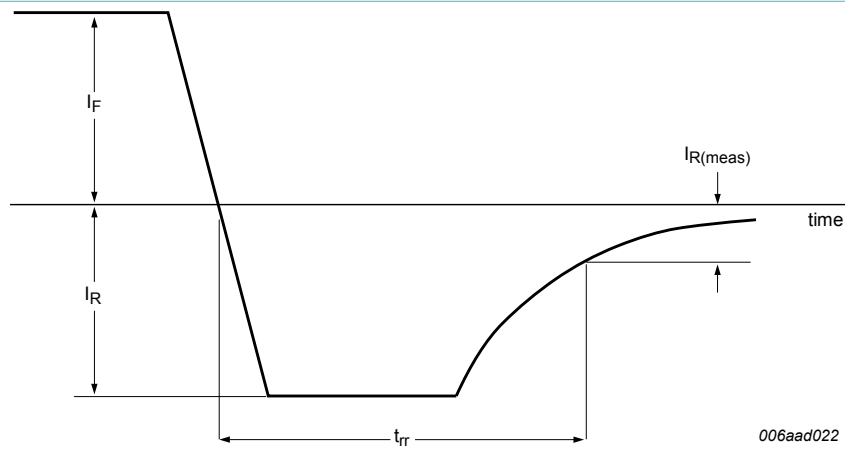


Fig. 15. Reverse recovery definition



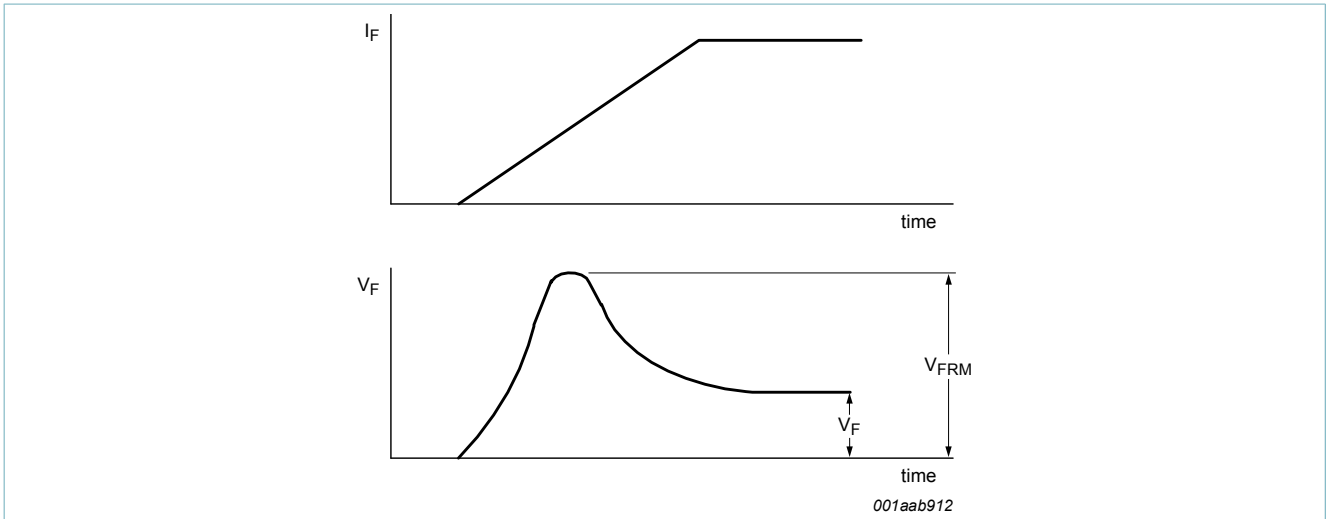


Fig. 16. Forward recovery definition

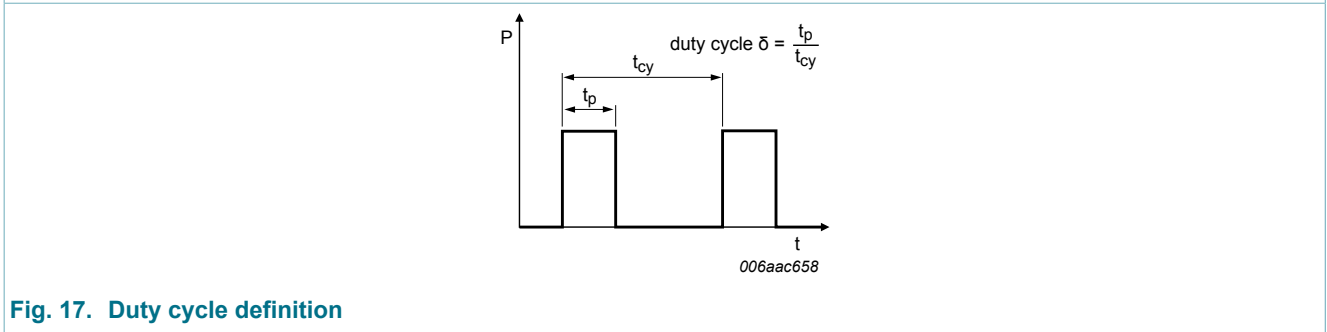


Fig. 17. Duty cycle definition

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

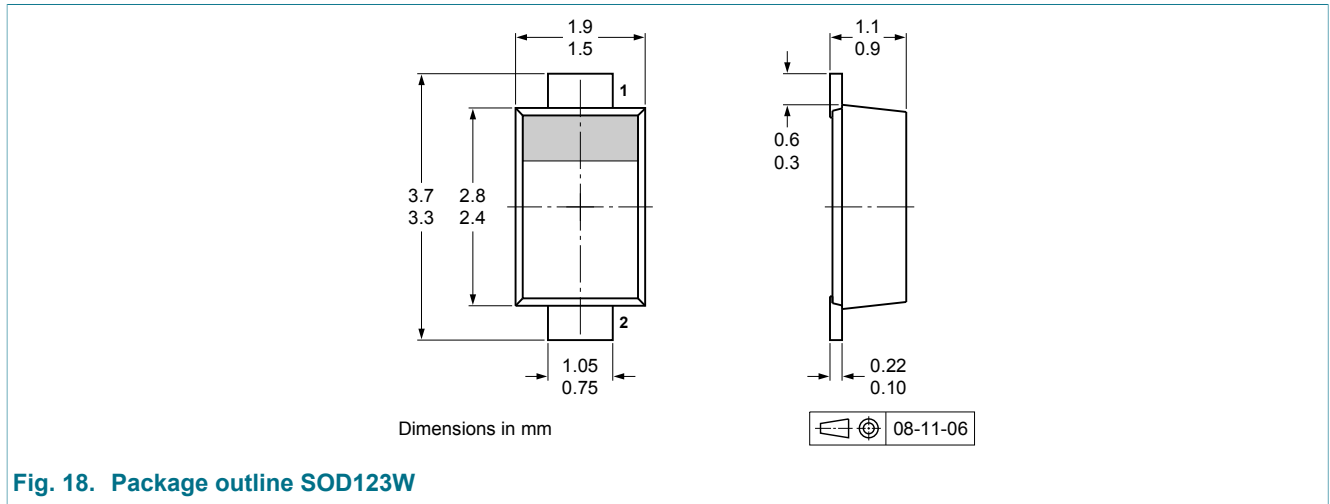


Fig. 18. Package outline SOD123W

## 10. Soldering

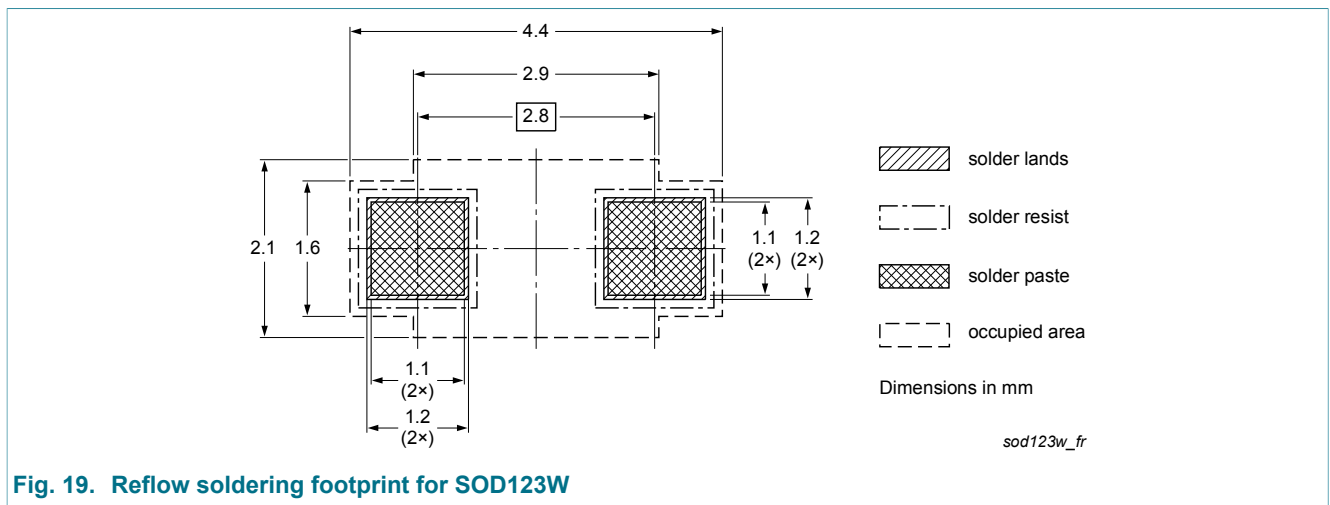


Fig. 19. Reflow soldering footprint for SOD123W

## 11. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMEG4010ETR v.2	20121128	Product data sheet	-	PMEG4010ETR v.1
Modifications:	<ul style="list-style-type: none"> <li>Table 7. Characteristics: <math>I_R</math> value corrected</li> </ul>			
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.

- [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".
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