



# THE DATASHEET OF PMEG4010ESBYL





# PMEG4010ESB

40 V, 1 A low VF MEGA Schottky barrier rectifier

27 November 2015

Product data sheet

## 1. General description

Planar Maximum Efficiency General Application (MEGA) Schottky barrier rectifier with an integrated guard ring for stress protection in a leadless ultra small DSN1006-2 (SOD993) Surface-Mounted Device (SMD) package.

## 2. Features and benefits

- Average forward current:  $I_{F(AV)} \leq 1$  A
- Reverse voltage:  $V_R \leq 40$  V
- Low forward voltage, typical:  $V_F = 510$  mV
- Low reverse current, typical:  $I_R = 13$   $\mu$ A
- Package height typ. 270  $\mu$ m

## 3. Applications

- Low voltage rectification
- High efficiency DC-to-DC conversion
- Switch mode power supply
- Low power consumption applications
- Ultra high-speed switching
- LED backlight for mobile application

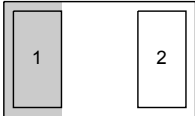

## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{F(AV)}$	average forward current	$\delta = 0.5$ ; $f = 20$ kHz; $T_{sp} \leq 140$ °C; square wave	-	-	1	A
$V_R$	reverse voltage	$T_j = 25$ °C	-	-	40	V
$V_F$	forward voltage	$I_F = 1$ A; $t_p \leq 300$ $\mu$ s; $\delta \leq 0.02$ ; $T_j = 25$ °C	-	510	610	mV
$I_R$	reverse current	$V_R = 20$ V; $t_p \leq 3$ ms; $\delta \leq 0.3$ ; $T_j = 25$ °C	-	2.1	6	$\mu$ A
		$V_R = 40$ V; $t_p \leq 3$ ms; $\delta \leq 0.3$ ; $T_j = 25$ °C	-	13	40	$\mu$ A

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K	cathode <sup>[1]</sup>	 <p>Transparent top view <b>DSN1006-2 (SOD993)</b></p>	 <i>sym001</i>
2	A	anode		

[1] The marking bar indicates the cathode.

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMEG4010ESB	DSN1006-2	DSN1006-2, leadless ultra small package; 2 terminals; body 1.0 x 0.6 x 0.27 mm	SOD993

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PMEG4010ESB	4E

## 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	$T_{sp} \leq 135\text{ °C}; \delta = 1$		-	1.4	A
$I_{F(AV)}$	average forward current	$\delta = 0.5$ ; $f = 20\text{ kHz}; T_{amb} \leq 105\text{ °C};$ square wave	[1]	-	1	A
		$\delta = 0.5$ ; $f = 20\text{ kHz}; T_{sp} \leq 140\text{ °C};$ square wave		-	1	A
$I_{FRM}$	repetitive peak forward current	$t_p \leq 1\text{ ms}; \delta \leq 0.25$		-	4	A
$I_{FSM}$	non-repetitive peak forward current	$t_p = 8\text{ ms}; T_{j(init)} = 25\text{ °C};$ square wave		-	10	A
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$	[2]	-	0.525	W
			[3]	-	1	W
			[1]	-	1.78	W
$T_j$	junction temperature			-	150	°C
$T_{amb}$	ambient temperature			-55	150	°C
$T_{stg}$	storage temperature			-65	150	°C

[1] Device mounted on a ceramic Printed-Circuit Board (PCB),  $Al_2O_3$ , 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 anode and cathode  $1\text{ cm}^2$  each.

## 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]	-	-	240	K/W
			[1][3]	-	-	125	K/W
			[1][4]	-	-	70	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		[5]	-	-	15	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 anode and cathode  $1\text{ cm}^2$  each.

[4] Device mounted on a ceramic PCB,  $Al_2O_3$ , standard footprint.

[5] Soldering point of anode tab.

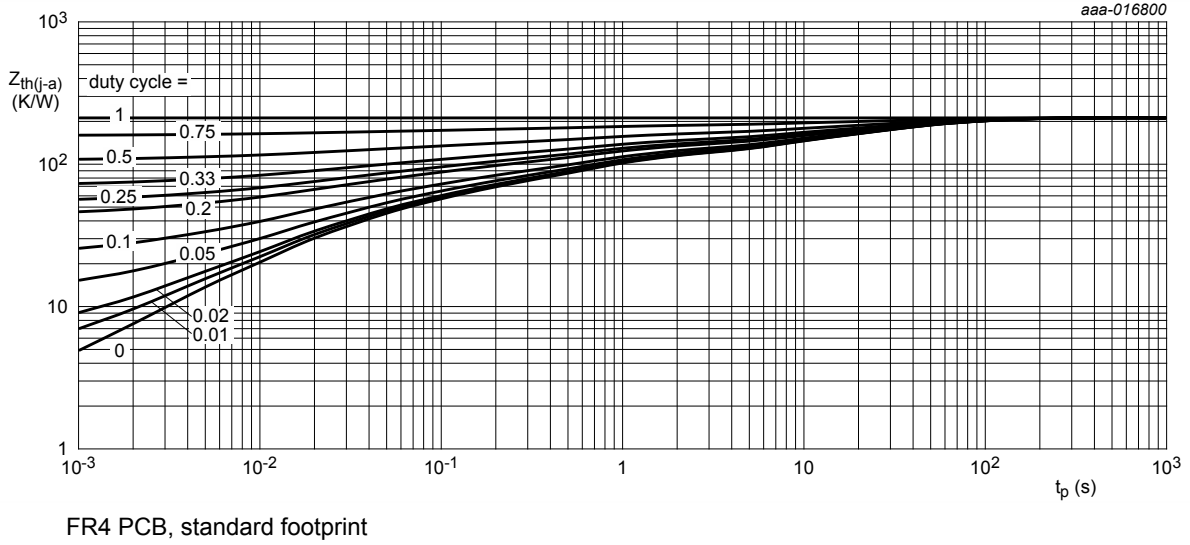


Fig. 1. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

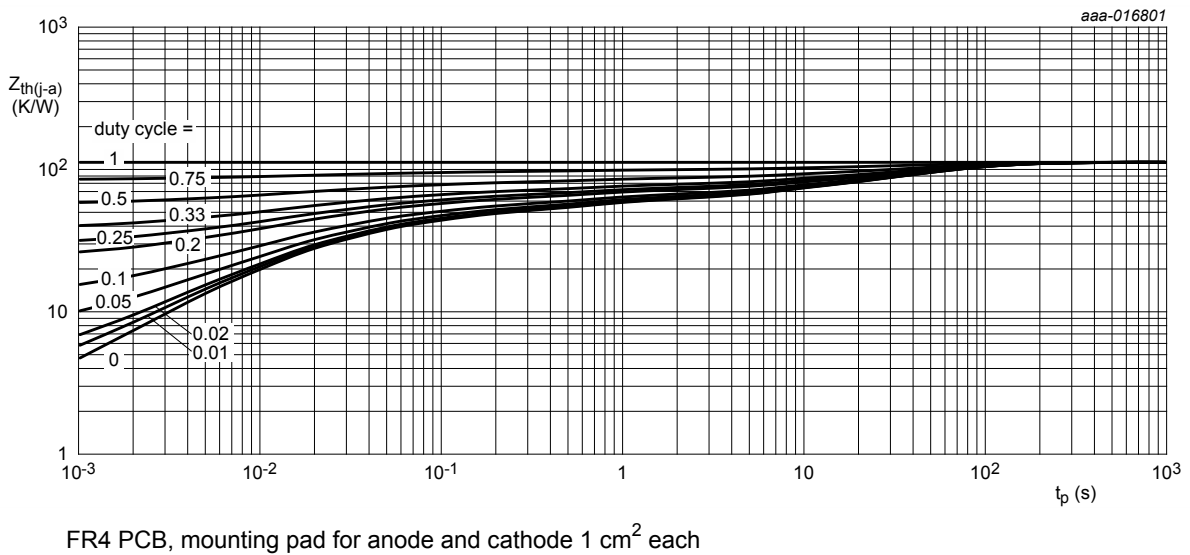


Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

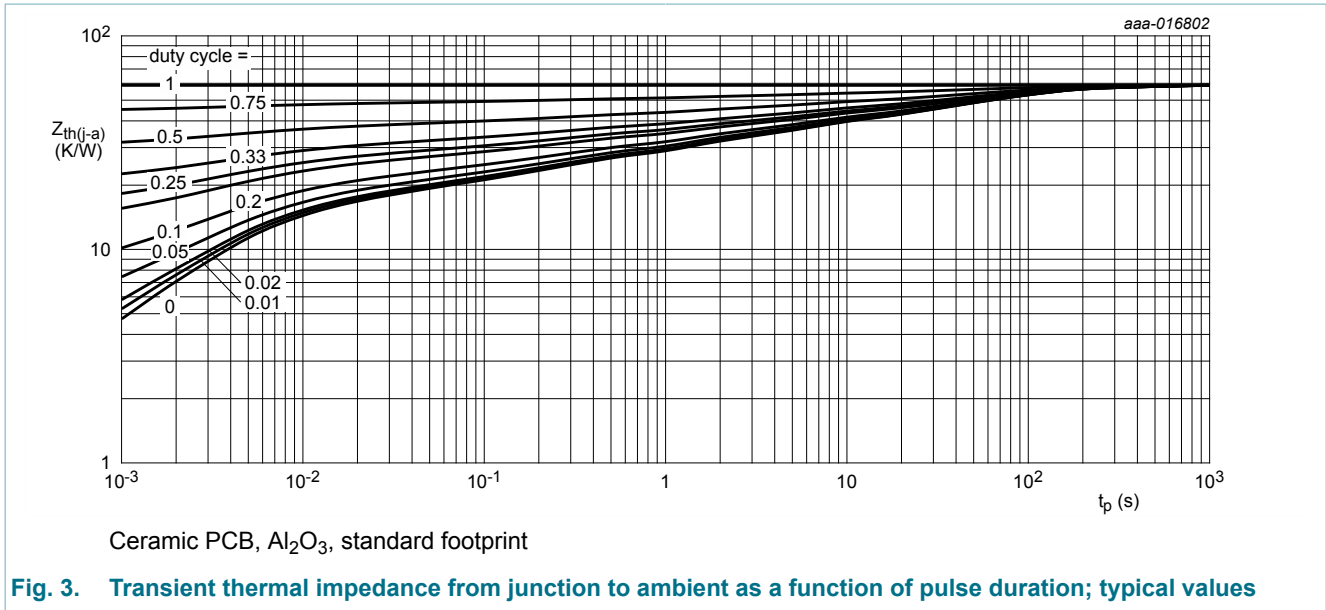


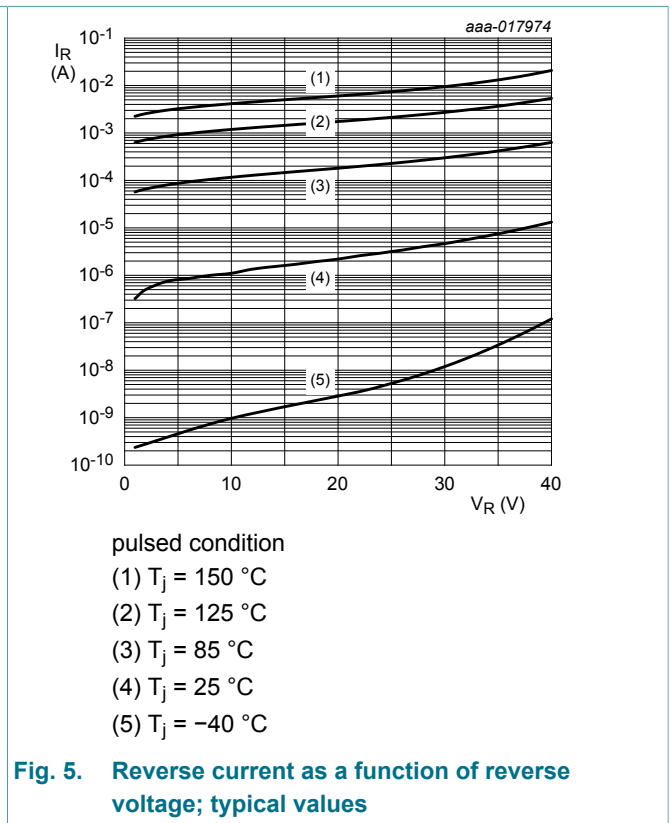
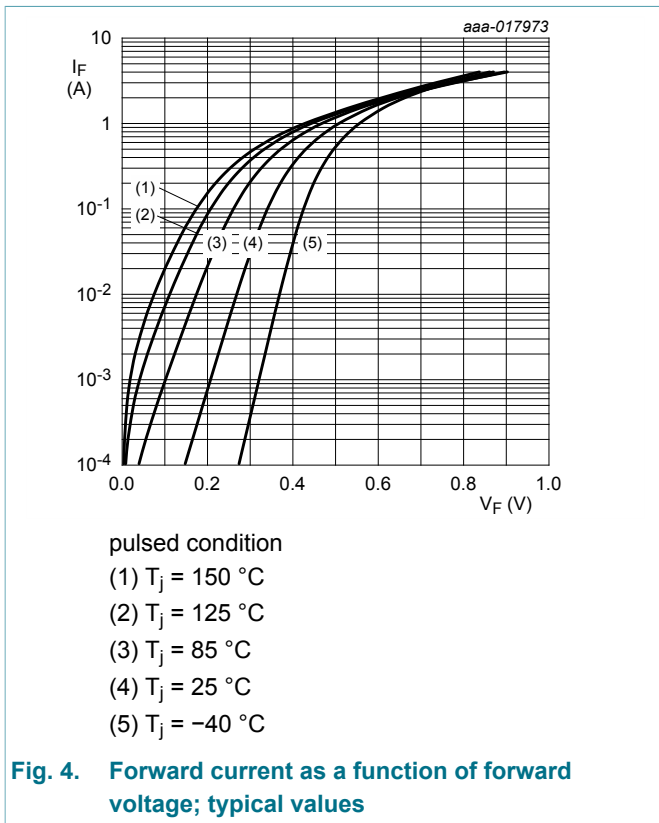
Fig. 3. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

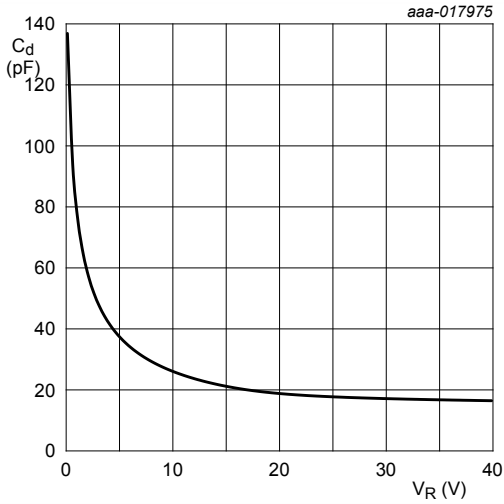
## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)R}$	reverse breakdown voltage	$I_R = 1 \text{ mA}; t_p = 300 \text{ } \mu\text{s}; \delta = 0.02 ; T_j = 25 \text{ } ^\circ\text{C}$	40	-	-	V
$V_F$	forward voltage	$I_F = 1 \text{ mA}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02 ; T_j = 25 \text{ } ^\circ\text{C}$	-	205	-	mV
		$I_F = 10 \text{ mA}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02 ; T_j = 25 \text{ } ^\circ\text{C}$	-	270	-	mV
		$I_F = 100 \text{ mA}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02 ; T_j = 25 \text{ } ^\circ\text{C}$	-	340	385	mV
		$I_F = 200 \text{ mA}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02 ; T_j = 25 \text{ } ^\circ\text{C}$	-	370	-	mV
		$I_F = 500 \text{ mA}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02 ; T_j = 25 \text{ } ^\circ\text{C}$	-	430	495	mV
		$I_F = 700 \text{ mA}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02 ; T_j = 25 \text{ } ^\circ\text{C}$	-	465	-	mV
		$I_F = 1 \text{ A}; t_p \leq 300 \text{ } \mu\text{s}; \delta \leq 0.02 ; T_j = 25 \text{ } ^\circ\text{C}$	-	510	610	mV
$I_R$	reverse current	$V_R = 5 \text{ V}; t_p \leq 3 \text{ ms}; \delta \leq 0.3 ; T_j = 25 \text{ } ^\circ\text{C}$	-	0.8	-	$\mu\text{A}$
		$V_R = 10 \text{ V}; t_p \leq 3 \text{ ms}; \delta \leq 0.3 ; T_j = 25 \text{ } ^\circ\text{C}$	-	1	4	$\mu\text{A}$
		$V_R = 20 \text{ V}; t_p \leq 3 \text{ ms}; \delta \leq 0.3 ; T_j = 25 \text{ } ^\circ\text{C}$	-	2.1	6	$\mu\text{A}$

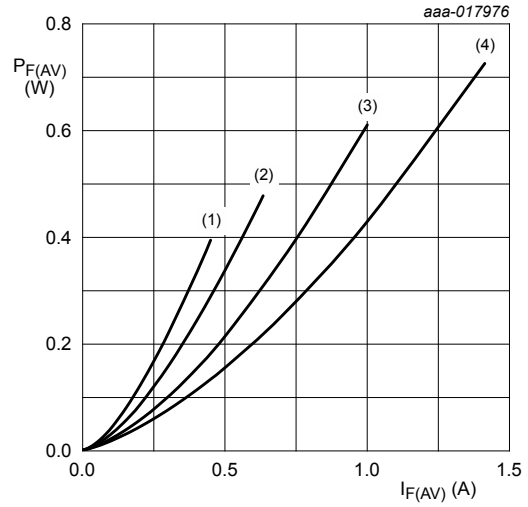
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		$V_R = 40\text{ V}; t_p \leq 3\text{ ms}; \delta \leq 0.3$ ; $T_j = 25\text{ }^\circ\text{C}$	-	13	40	$\mu\text{A}$
$C_d$	diode capacitance	$V_R = 1\text{ V}; f = 1\text{ MHz}; T_j = 25\text{ }^\circ\text{C}$	-	75	-	$\text{pF}$
		$V_R = 10\text{ V}; f = 1\text{ MHz}; T_j = 25\text{ }^\circ\text{C}$	-	22	-	$\text{pF}$
$t_{rr}$	reverse recovery time	$I_F = 0.5\text{ A}; I_R = 0.5\text{ A}; I_{R(\text{meas})} = 0.1\text{ A};$ $T_j = 25\text{ }^\circ\text{C}$	-	2.9	-	$\text{ns}$





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

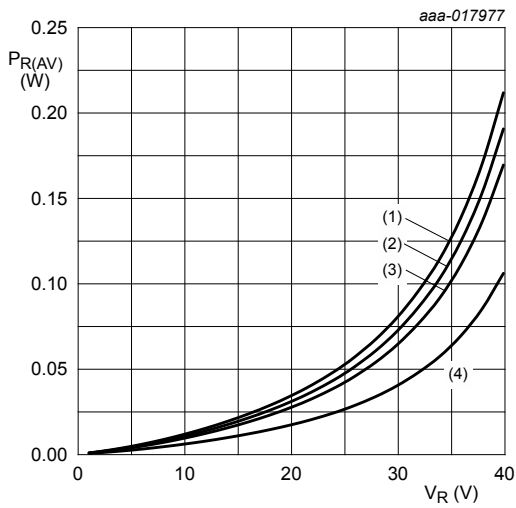
**Fig. 6. Diode capacitance as a function of reverse voltage; typical values**



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

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

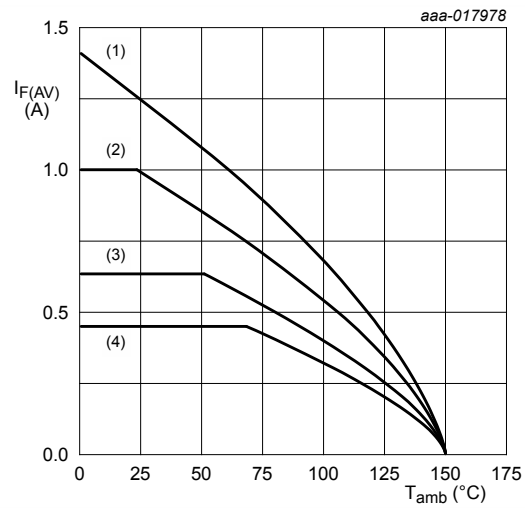
**Fig. 7. Average forward power dissipation as a function of average forward current; typical values**



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

- (1)  $\delta = 1$
- (2)  $\delta = 0.9$
- (3)  $\delta = 0.8$
- (4)  $\delta = 0.5$

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

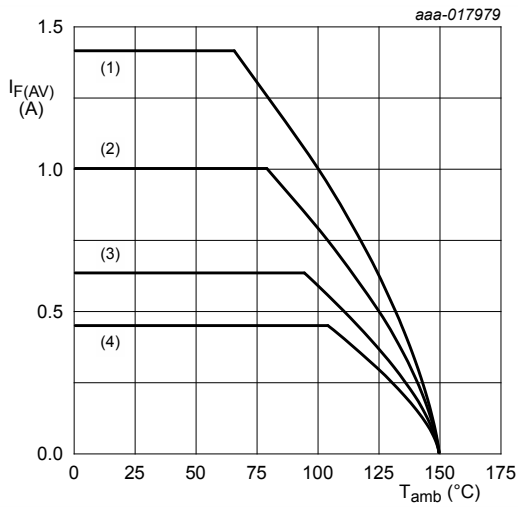


FR4 PCB, standard footprint

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

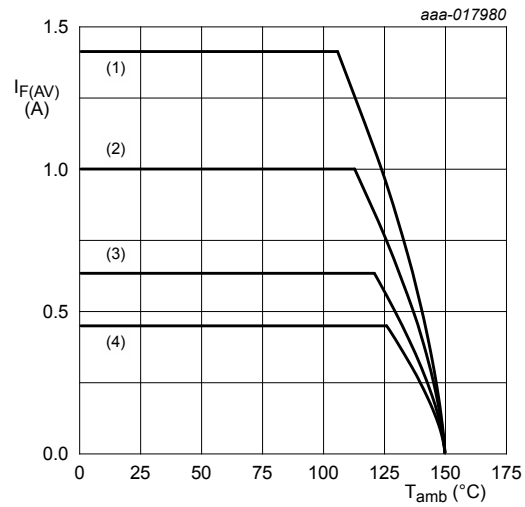
- (1)  $\delta = 1$ ; DC
- (2)  $\delta = 0.5$ ;  $f = 20 \text{ kHz}$
- (3)  $\delta = 0.2$ ;  $f = 20 \text{ kHz}$
- (4)  $\delta = 0.1$ ;  $f = 20 \text{ kHz}$

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



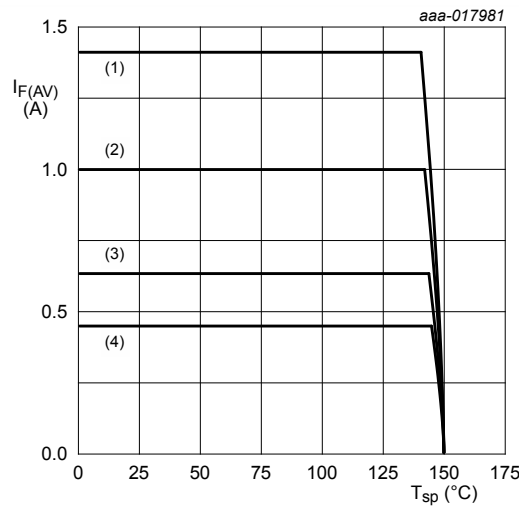
FR4 PCB, mounting pad for anode and cathode 1 cm<sup>2</sup> each  
 T<sub>j</sub> = 150 °C  
 (1) δ = 1; DC  
 (2) δ = 0.5; f = 20 kHz  
 (3) δ = 0.2; f = 20 kHz  
 (4) δ = 0.1; f = 20 kHz

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



Ceramic PCB, Al<sub>2</sub>O<sub>3</sub>, standard footprint  
 T<sub>j</sub> = 150 °C  
 (1) δ = 1 (DC)  
 (2) δ = 0.5; f = 20 kHz  
 (3) δ = 0.2; f = 20 kHz  
 (4) δ = 0.1; f = 20 kHz

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



T<sub>j</sub> = 150 °C  
 (1) δ = 1 (DC)  
 (2) δ = 0.5; f = 20 kHz  
 (3) δ = 0.2; f = 20 kHz  
 (4) δ = 0.1; f = 20 kHz

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

### 11. Test information

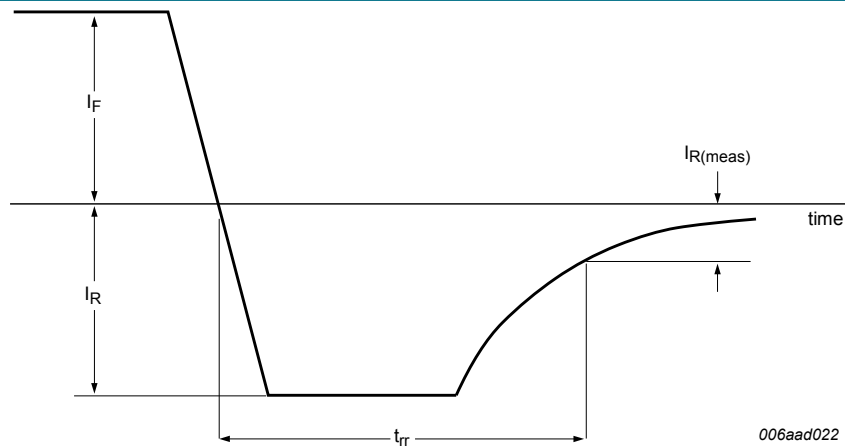


Fig. 13. Reverse recovery definition; step recovery

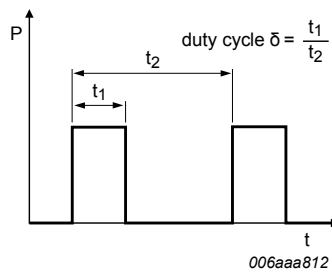


Fig. 14. Duty cycle definition

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.

### 12. Package outline

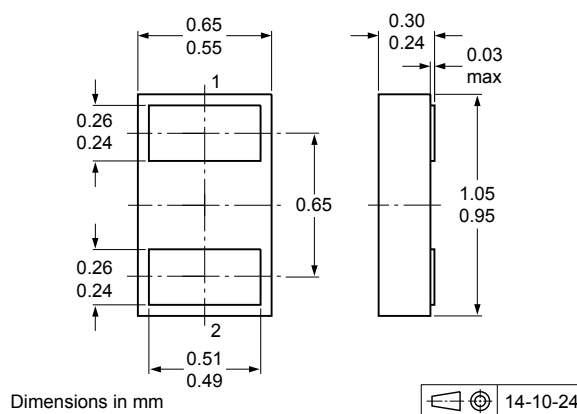


Fig. 15. Package outline DSN1006-2 (SOD993)

### 13. Soldering

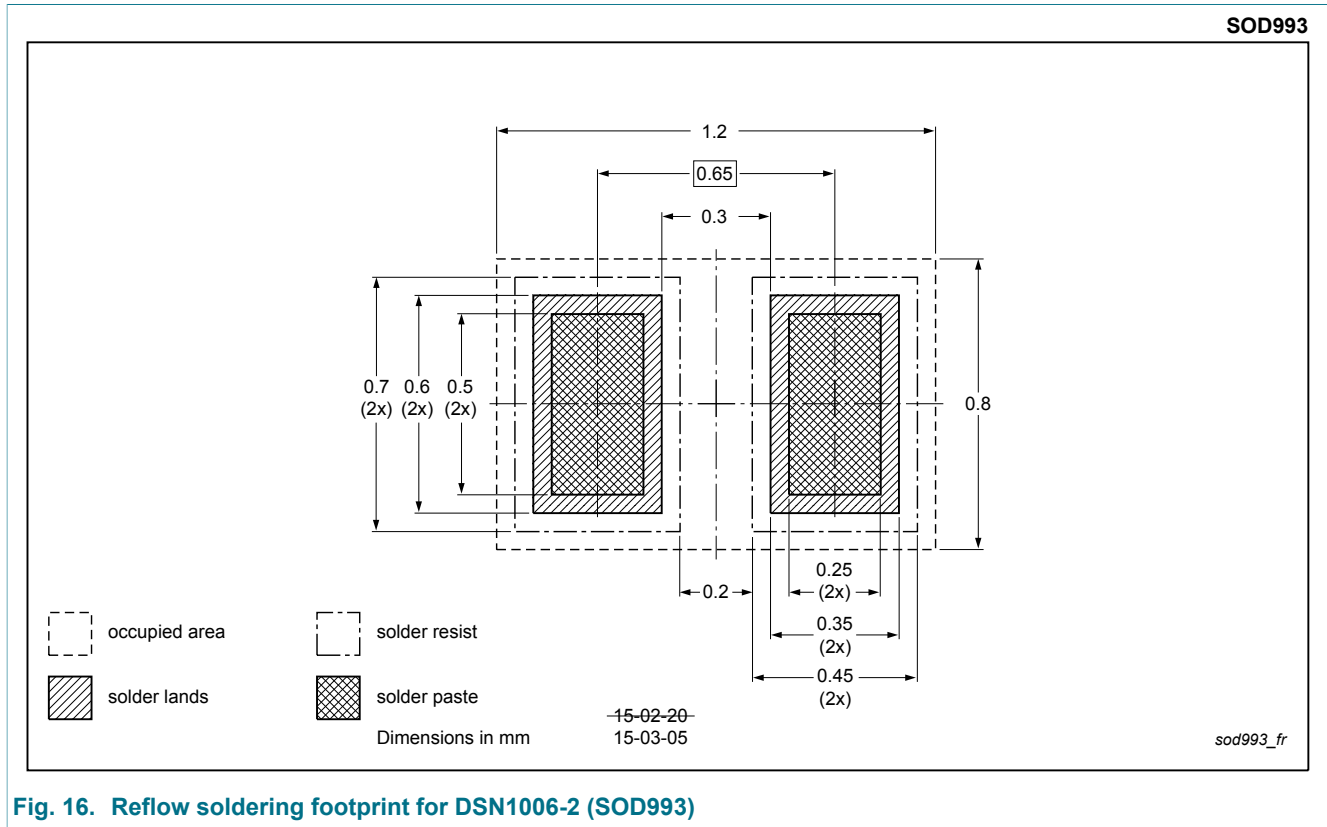


Fig. 16. Reflow soldering footprint for DSN1006-2 (SOD993)

### 14. Mounting

SOD993 is an ultra small Discretes Silicon No-leads (DSN) package allowing maximized utilization of the package area for active silicon. Due to the special product design, Nexperia investigated the board assembly process parameters. In order to have an optimum soldering quality, Nexperia advises following the assembly recommendations explained in [AN11689](#).

## 15. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMEG4010ESB v.3	20151127	Product data sheet	-	PMEG4010ESB v.2
Modifications:	<ul style="list-style-type: none"><li>Added section "Mounting"</li></ul>			
PMEG4010ESB v.2	20150624	Product data sheet	-	PMEG4010ESB v.1
PMEG4010ESB v.1	20150512	Preliminary data sheet	-	-

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### 16.1 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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Date of release: 27 November 2015

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