



ES1J

600 V, 1 A hyperfast recovery rectifier in SMA

20 January 2025

Product data sheet

1. General description

Hyperfast recovery rectifier, encapsulated in an SMA package.

2. Features and benefits

- Reverse voltage: $V_R \leq 600$ V
- Forward current: $I_F \leq 1$ A
- Hyperfast recovery time: $t_{rr} \leq 35$ ns
- Pt doped life time control
- Ideal for automated placement
- Glass passivated chip junction
- High forward surge capability

3. Applications

- Rectification
- Reverse polarity protection
- Fast switching
- Freewheeling applications

4. Quick reference data

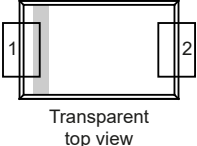
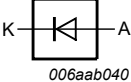
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$I_{F(AV)}$	average forward current	$\delta = 0.5$; $f = 20$ kHz; square wave; $T_{sp} \leq 136$ °C		-	-	1	A
V_{RRM}	repetitive peak reverse voltage	$T_j = 25$ °C		-	-	600	V
V_R	reverse voltage			-	-	600	V
V_F	forward voltage	$I_F = 1$ A; pulsed; $T_j = 25$ °C	[1]	-	-	1.7	V
		$I_F = 1$ A; pulsed; $T_j = 125$ °C	[1]	-	1.04	-	V
I_R	reverse current	$V_R = 600$ V; pulsed; $T_j = 25$ °C	[1]	-	-	5	µA
		$V_R = 600$ V; pulsed; $T_j = 125$ °C	[1]	-	-	150	µA

[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	 SMA (SOD1001-1)	 006aab040
2	A	anode		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
ES1J	SMA	plastic, surface mounted package; 2 terminals; 4.30 mm x 2.65 mm x 2.10 mm body	SOD1001-1

7. Marking

Table 4. Marking codes

Type number	Marking code
ES1J	BU5

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{RRM}	repetitive peak reverse voltage	$T_j = 25\text{ }^{\circ}\text{C}$		-	600	V
V_R	reverse voltage			-	600	V
V_{RMS}	RMS voltage			-	420	V
I_F	forward current	$\delta = 1; T_{sp} \leq 132\text{ }^{\circ}\text{C}$		-	1.4	A
$I_{F(AV)}$	average forward current	$\delta = 0.5; f = 20\text{ kHz}; \text{square wave}; T_{sp} \leq 136\text{ }^{\circ}\text{C}$		-	1	A
I_{FSM}	non-repetitive peak forward current	$t_p = 8.3\text{ ms}; \text{single half sine wave (applied at rated load condition)}; T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$		-	30	A
P_{tot}	total power dissipation	$T_{amb} \leq 25\text{ }^{\circ}\text{C}$	[1]	-	0.63	W
			[2]	-	0.93	W
T_j	junction temperature			-55	150	$^{\circ}\text{C}$
T_{stg}	storage temperature			-55	150	$^{\circ}\text{C}$

[1] Device mounted on an FR4 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 cm².

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]	-	-	200	K/W
			[2]	-	-	135	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		[3]	-	-	30	K/W

- [1] Device mounted on an FR4 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 cm².
[3] Soldering point of cathode tab.

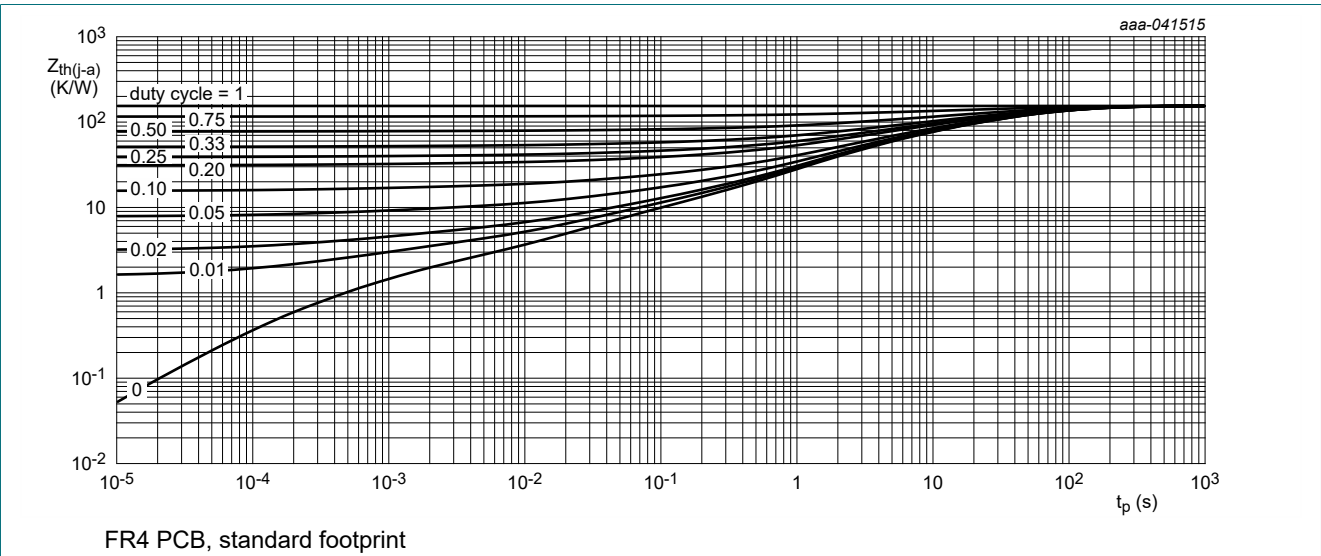


Fig. 1. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

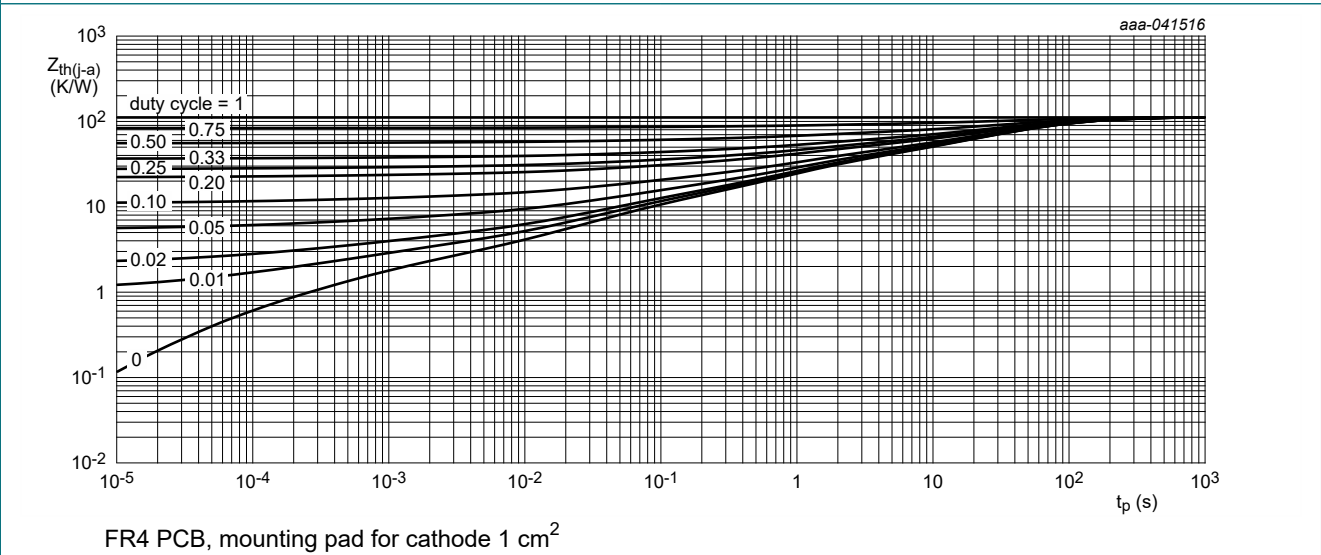


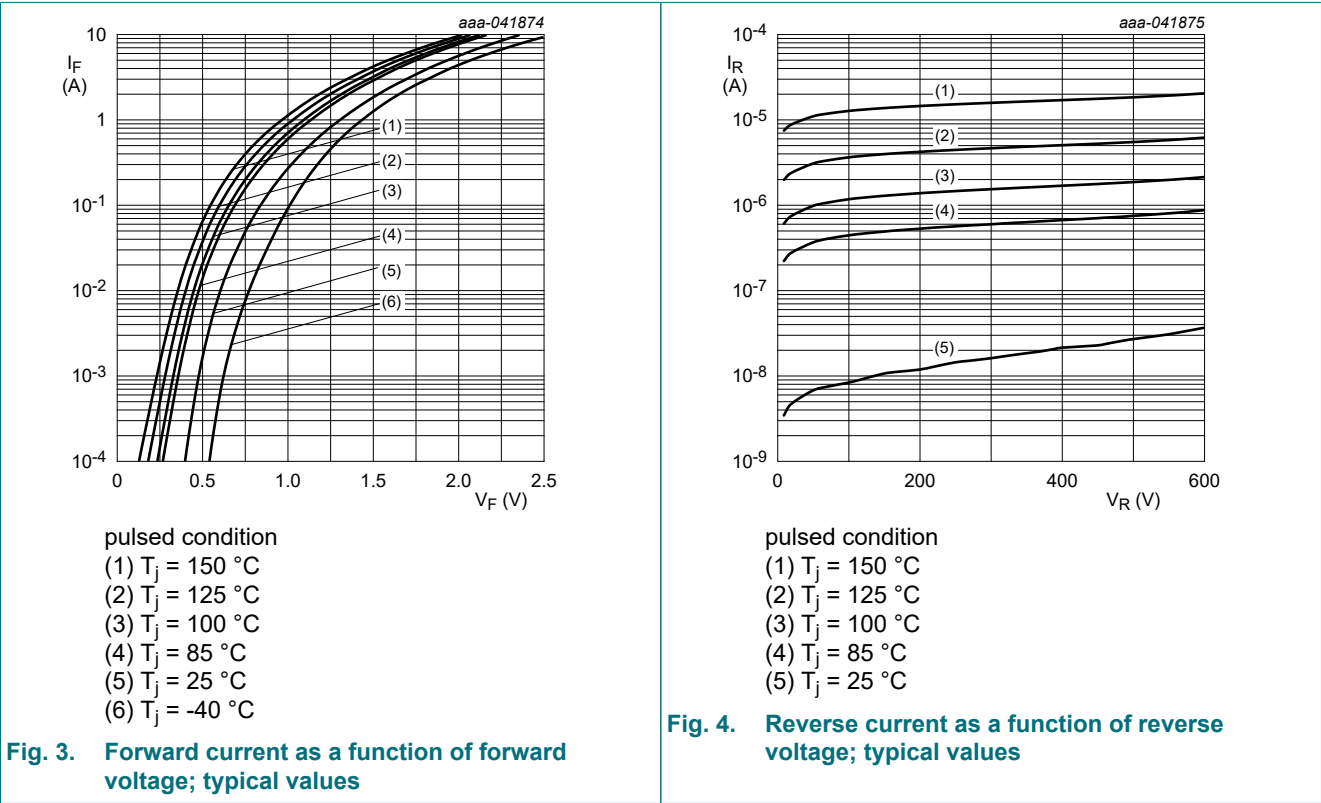
Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

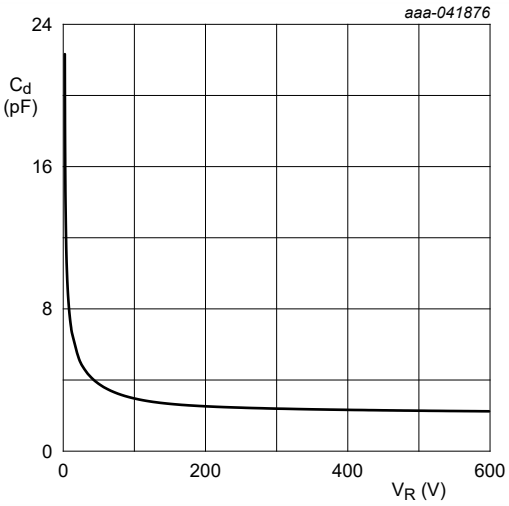
10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{(BR)R}$	reverse breakdown voltage	$I_R = 100\text{ }\mu\text{A}$; pulsed; $T_j = 25\text{ }^\circ\text{C}$	[1]	600	-	-	V
V_F	forward voltage	$I_F = 1\text{ A}$; pulsed; $T_j = 25\text{ }^\circ\text{C}$	[1]	-	-	1.7	V
		$I_F = 1\text{ A}$; pulsed; $T_j = 125\text{ }^\circ\text{C}$	[1]	-	1.04	-	V
I_R	reverse current	$V_R = 600\text{ V}$; pulsed; $T_j = 25\text{ }^\circ\text{C}$	[1]	-	-	5	μA
		$V_R = 600\text{ V}$; pulsed; $T_j = 125\text{ }^\circ\text{C}$	[1]	-	-	150	μA
C_d	diode capacitance	$V_R = 4\text{ V}$; $f = 1\text{ MHz}$; $T_j = 25\text{ }^\circ\text{C}$		-	10	-	pF
t_{rr}	reverse recovery time ; step recovery	$I_F = 0.5\text{ A}$; $I_R = 1\text{ A}$; $I_{R(meas)} = 0.25\text{ A}$; $T_j = 25\text{ }^\circ\text{C}$		-	23	35	ns

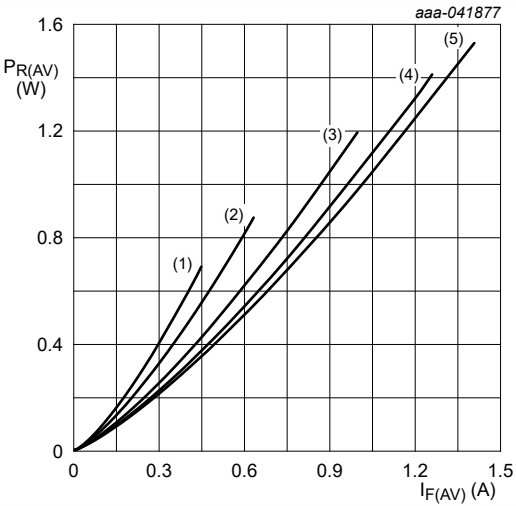
[1] Very short pulse, in order to maintain a stable junction temperature.





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

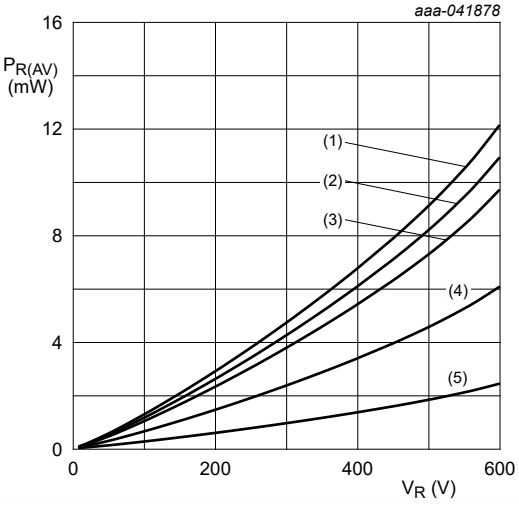
Fig. 5. Diode capacitance as a function of reverse voltage; typical values



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

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

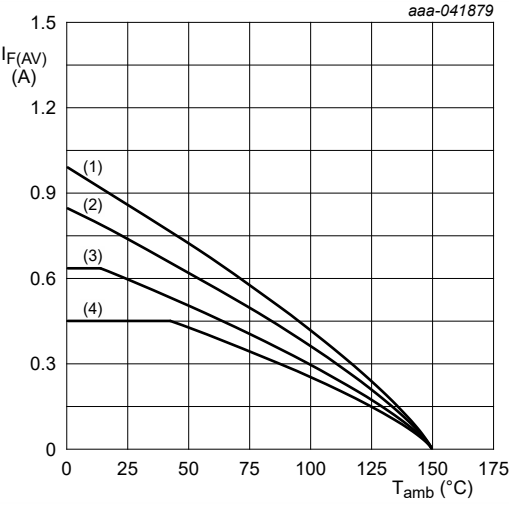
Fig. 6. Average forward power dissipation as a function of average forward current; typical values



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

- (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

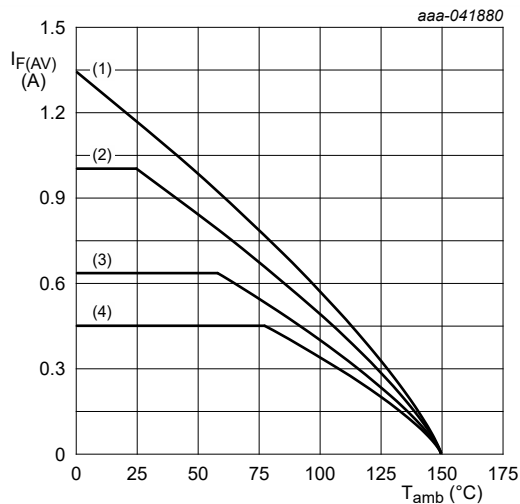


FR4 PCB, standard footprint

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

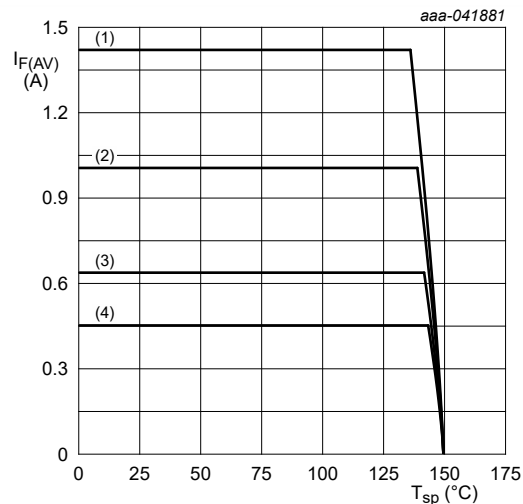
- (1) $\delta = 1$; DC
- (2) $\delta = 0.5$; $f = 20 \text{ kHz}$
- (3) $\delta = 0.2$; $f = 20 \text{ kHz}$
- (4) $\delta = 0.1$; $f = 20 \text{ kHz}$

Fig. 8. Average forward current as a function of ambient temperature; typical values



FR4 PCB, mounting pad for cathode 1 cm²
 $T_j = 150$ °C
(1) $\delta = 1$; DC
(2) $\delta = 0.5$; $f = 20$ kHz
(3) $\delta = 0.2$; $f = 20$ kHz
(4) $\delta = 0.1$; $f = 20$ kHz

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



$T_j = 150$ °C
(1) $\delta = 1$; DC
(2) $\delta = 0.5$; $f = 20$ kHz
(3) $\delta = 0.2$; $f = 20$ kHz
(4) $\delta = 0.1$; $f = 20$ kHz

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

11. Test information

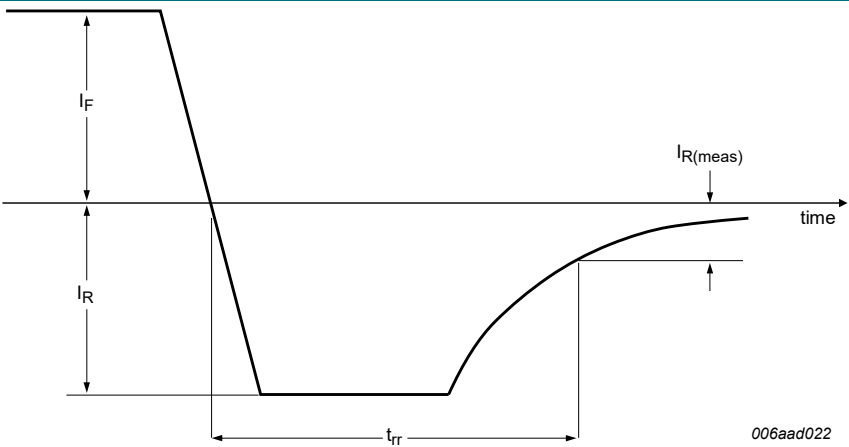


Fig. 11. Reverse recovery definition

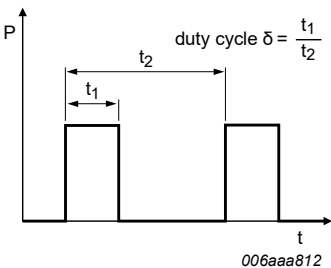


Fig. 12. Duty cycle definition

The current ratings for the typical waveforms are calculated according to the equations:

$$I_{F(AV)} = I_M \times \delta \text{ with } I_M \text{ defined as peak current,}$$

$$I_{RMS} = I_{F(AV)} \text{ at DC}$$

$$I_{RMS} = I_M \times \sqrt{\delta} \text{ with } I_{RMS} \text{ defined as RMS current.}$$

12. Package outline

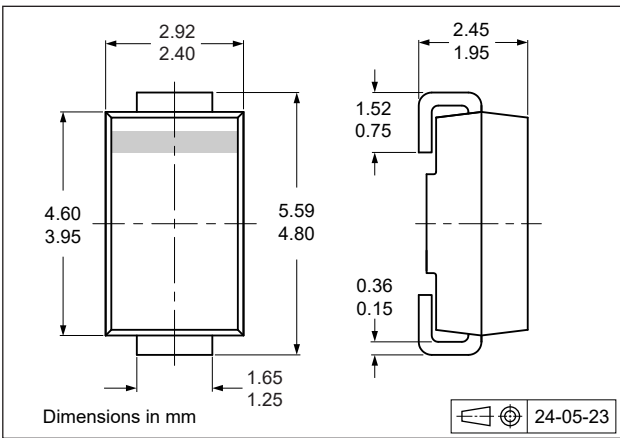


Fig. 13. Package outline SMA (SOD1001-1)

13. Soldering

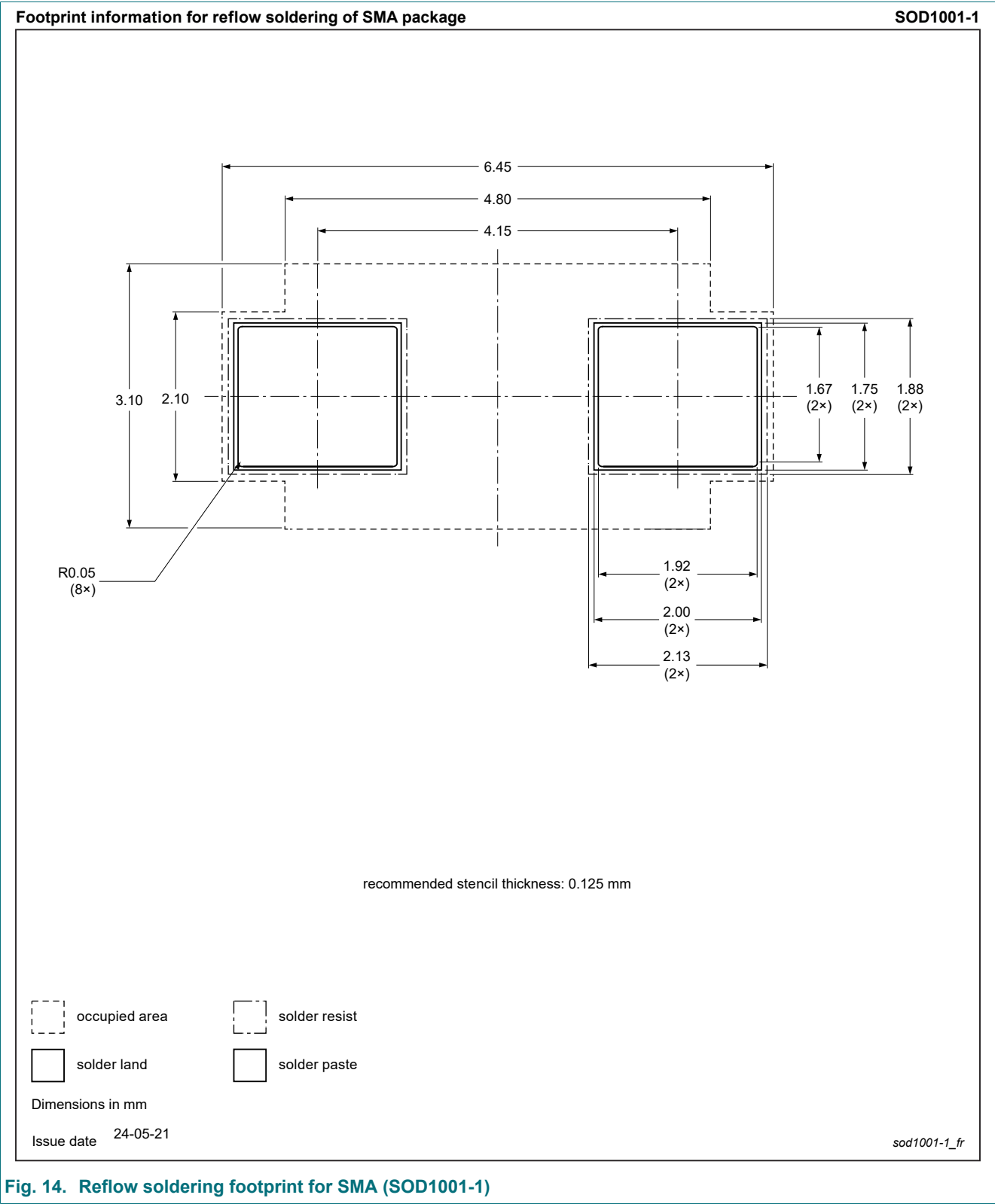


Fig. 14. Reflow soldering footprint for SMA (SOD1001-1)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
ES1J v.1	20250120	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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- [2] The term 'short data sheet' is explained in section "Definitions".
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