



ES2DR

200 V, 2 A hyperfast PN-rectifier

22 November 2017

Product data sheet

1. General description

High power density, hyperfast PN-rectifier with high-efficiency planar technology, encapsulated in a small and flat lead SOD123W Surface-Mounted Device (SMD) plastic package.

2. Features and benefits

- Reverse voltage $V_R \leq 200$ V
- Forward current $I_F \leq 2$ A
- Switching time $t_{rr} \leq 25$ ns
- Pt doped life time control
- Low inductance
- Small and flat lead SMD plastic package
- Package height typ. 1 mm
- High power capability due to clip-bond technology
- Planar die design
- Capable for reflow and wave soldering

3. Applications

- General-purpose rectification
- Reverse polarity protection
- Hyperfast switching
- Freewheeling applications

4. Quick reference data

Table 1. Quick reference data

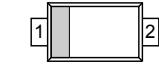
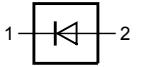
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$I_{F(AV)}$	average forward current	$\delta = 0.5$; $f = 20$ kHz; square wave; $T_{sp} \leq 128$ °C		-	-	2	A
V_{RRM}	repetitive peak reverse voltage	$T_j = 25$ °C		-	-	200	V
V_R	reverse voltage			-	-	200	V
V_F	forward voltage	$I_F = 2$ A; pulsed; $T_j = 25$ °C	[1]	-	915	980	mV
		$I_F = 2$ A; pulsed; $T_j = 125$ °C	[1]	-	780	870	mV
I_R	reverse current	$V_R = 200$ V; pulsed; $T_j = 25$ °C	[1]	-	5	200	nA
		$V_R = 200$ V; pulsed; $T_j = 125$ °C	[1]	-	1.5	20	µA

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

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5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K	cathode	 CFP3 (SOD123W)	 006aab040
2	A	anode		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
ES2DR	CFP3	plastic, surface mounted package; 2 terminals; 2.6 mm x 1.7 mm x 1 mm body	SOD123W

7. Marking

Table 4. Marking codes

Type number	Marking code
ES2DR	KN

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	$T_j = 25^\circ\text{C}$		-	200	V
V_R	reverse voltage			-	200	V
V_{RMS}	RMS voltage			-	140	V
I_F	forward current	$\delta = 1$; $T_{sp} \leq 121^\circ\text{C}$		-	2.8	A
$I_{F(AV)}$	average forward current	$\delta = 0.5$; $f = 20 \text{ kHz}$; square wave; $T_{sp} \leq 128^\circ\text{C}$		-	2	A
I_{FSM}	non-repetitive peak forward current	$t_p = 8.3 \text{ ms}$; $T_{j(\text{init})} = 25^\circ\text{C}$; single half sine wave (applied at rated load condition)		-	32	A
P_{tot}	total power dissipation	$T_{\text{amb}} \leq 25^\circ\text{C}$	[1]	-	735	mW
			[2]	-	1.19	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 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 cm^2 .

9. Thermal characteristics

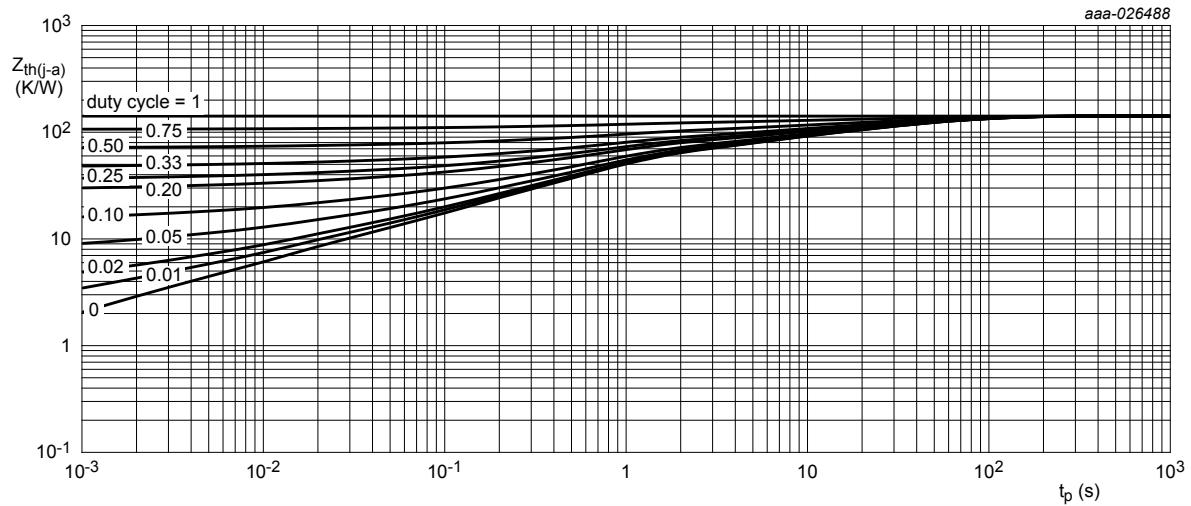
Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{\text{th(j-a)}}$	thermal resistance from junction to ambient	in free air	[1]	-	-	170	K/W
			[2]	-	-	105	K/W
$R_{\text{th(j-sp)}}$	thermal resistance from junction to solder point		[3]	-	-	15	K/W

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

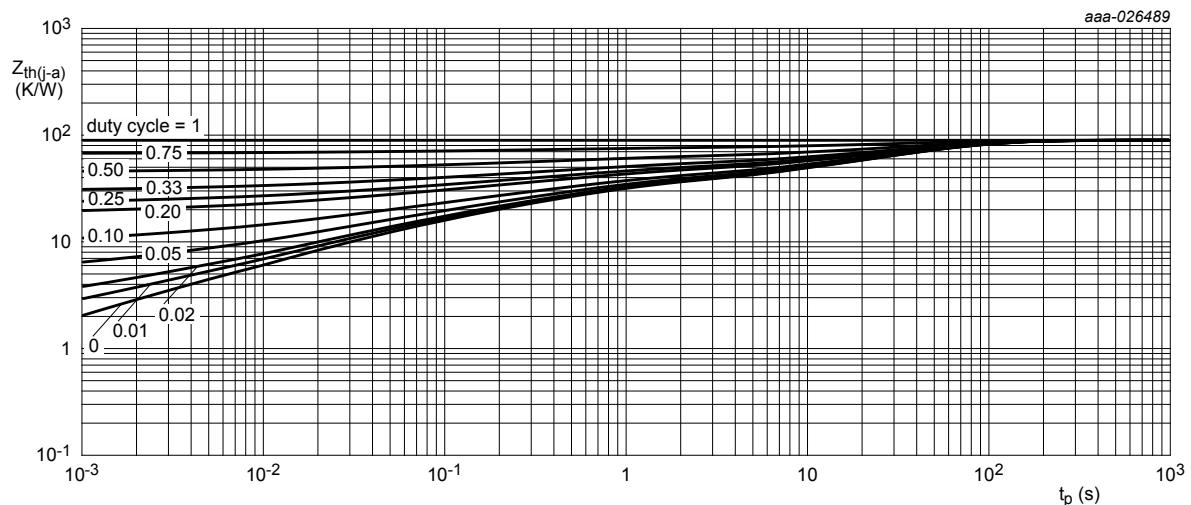
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1 cm^2 .

[3] 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^2

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	$I_R = 100 \mu A$; pulsed; $T_j = 25^\circ C$	[1]	200	-	-	V
V_F	forward voltage	$I_F = 2 A$; pulsed; $T_j = 25^\circ C$	[1]	-	915	980	mV
		$I_F = 2 A$; pulsed; $T_j = 125^\circ C$	[1]	-	780	870	mV
I_R	reverse current	$V_R = 200 V$; pulsed; $T_j = 25^\circ C$	[1]	-	5	200	nA
		$V_R = 200 V$; pulsed; $T_j = 125^\circ C$	[1]	-	1.5	20	μA
C_d	diode capacitance	$V_R = 4 V$; $f = 1 MHz$; $T_j = 25^\circ C$		-	17	-	pF
t_{rr}	reverse recovery time : step recovery	$I_F = 0.5 A$; $I_R = 1 A$; $I_{R(meas)} = 0.25 A$; $T_j = 25^\circ C$		-	10	25	ns
	reverse recovery time ; ramp recovery	$I_F = 1 A$; $dI_F/dt = 50 A/\mu s$; $V_R = 30 V$; $T_j = 25^\circ C$		-	20	-	ns
V_{FRM}	peak forward recovery voltage	$I_F = 1 A$; $dI_F/dt = 50 A/\mu s$; $T_j = 25^\circ C$		-	930	-	V

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

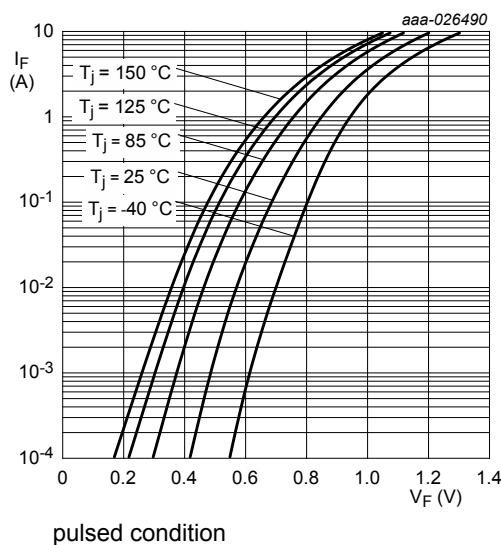


Fig. 3. Forward current as a function of forward voltage; typical values

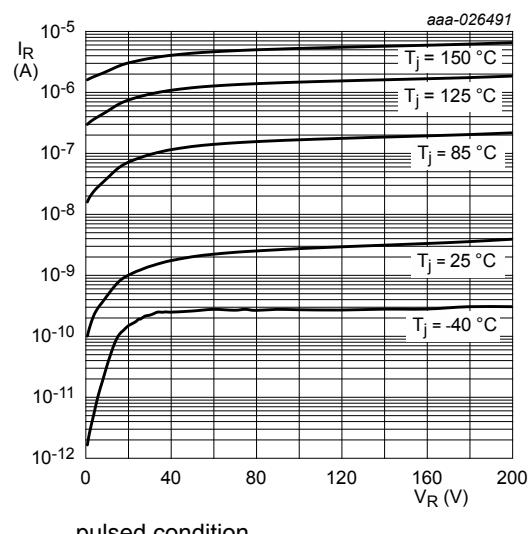
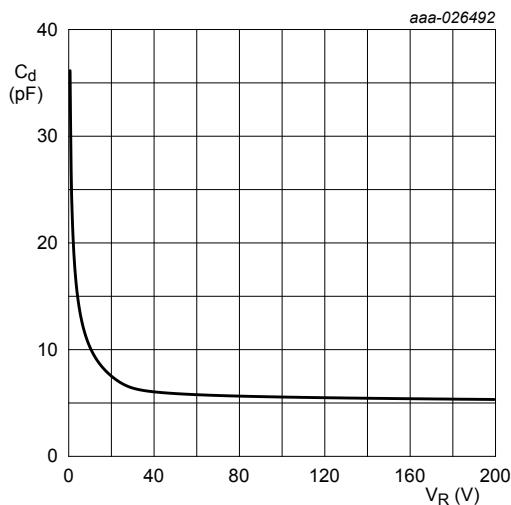


Fig. 4. Reverse current as a function of reverse voltage; typical values



$f = 1$ MHz; $T_{amb} = 25$ °C

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

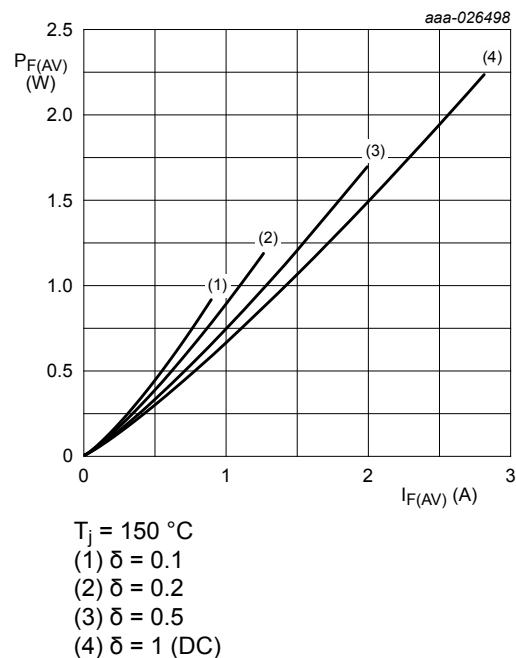
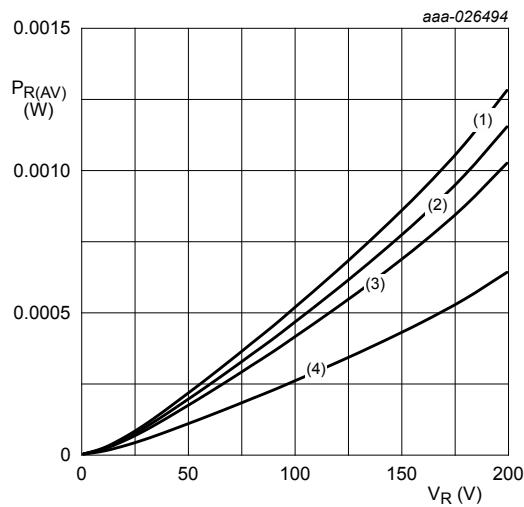
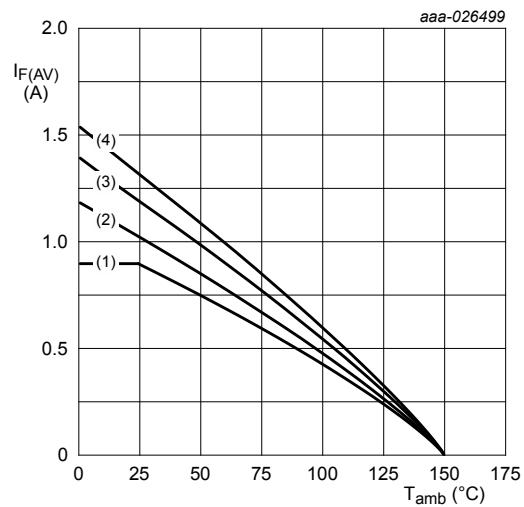


Fig. 6. Average forward power dissipation as a function of average forward current; typical values



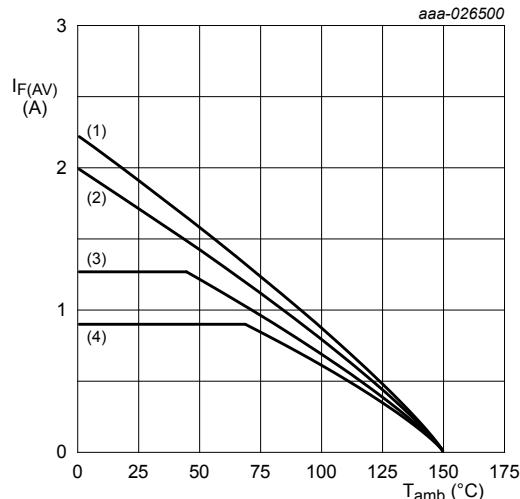
$T_j = 150$ °C
(1) $\delta = 1$; DC
(2) $\delta = 0.9$
(3) $\delta = 0.8$
(4) $\delta = 0.5$

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



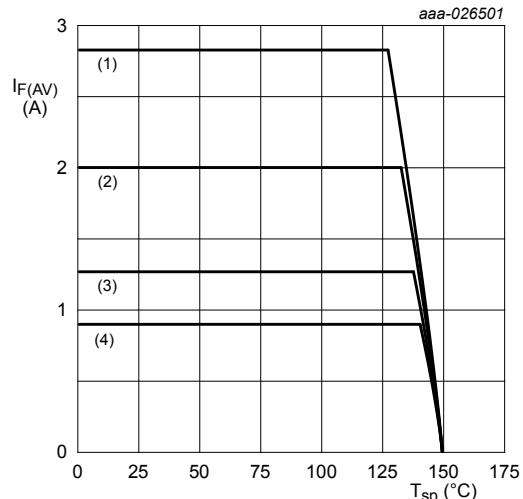
FR4 PCB, standard footprint
 $T_j = 150$ °C
(1) $\delta = 1$; DC
(2) $\delta = 0.5$; $f = 20$ kHz
(3) $\delta = 0.2$; $f = 20$ kHz
(4) $\delta = 0.1$; $f = 20$ kHz

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



FR4 PCB, mounting pad for cathode 1 cm²
 $T_j = 150 \text{ }^\circ\text{C}$
 (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



$T_j = 150 \text{ }^\circ\text{C}$
 (1) $\delta = 1$
 (2) $\delta = 0.5$
 (3) $\delta = 0.2$
 (4) $\delta = 0.1$

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

11. Test information

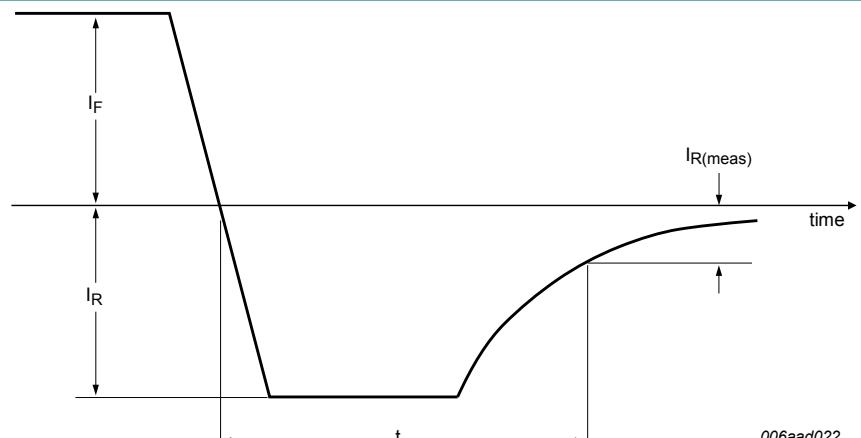


Fig. 11. Reverse recovery definition; step recovery

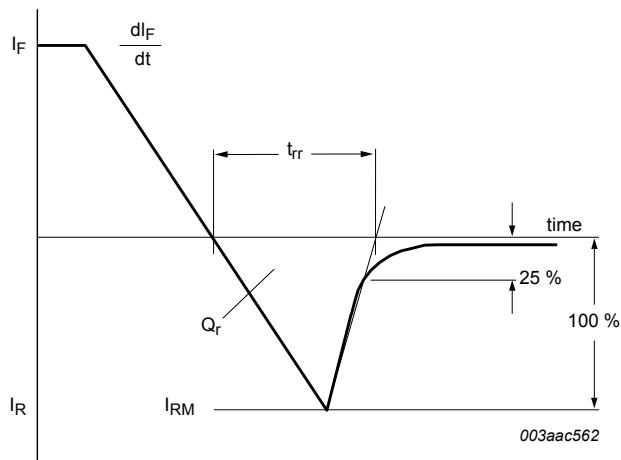


Fig. 12. Reverse recovery definition; ramp recovery

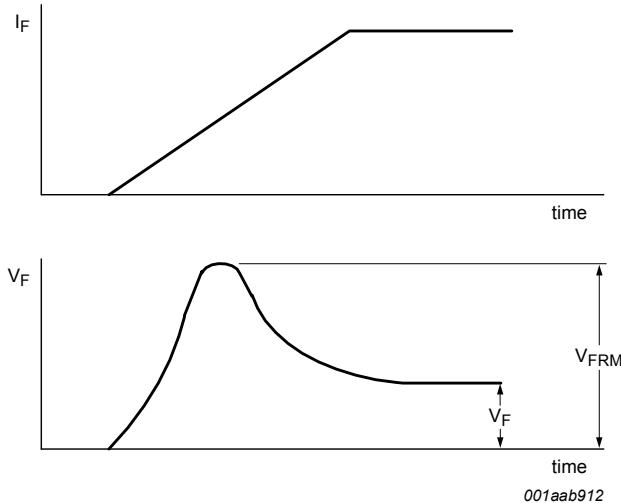


Fig. 13. Forward recovery definition

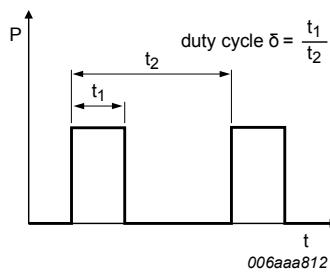


Fig. 14. Duty cycle definition

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.

12. Package outline

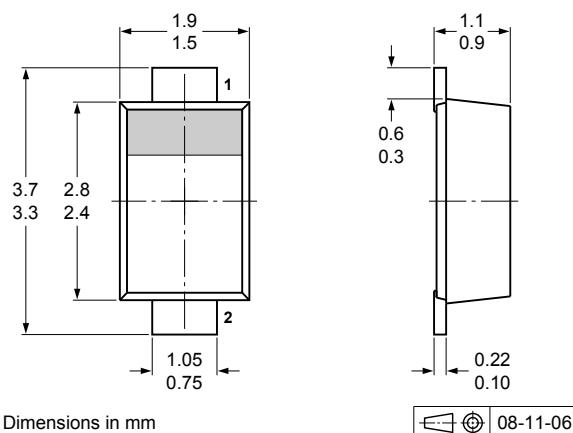


Fig. 15. Package outline CFP3 (SOD123W)

13. Soldering

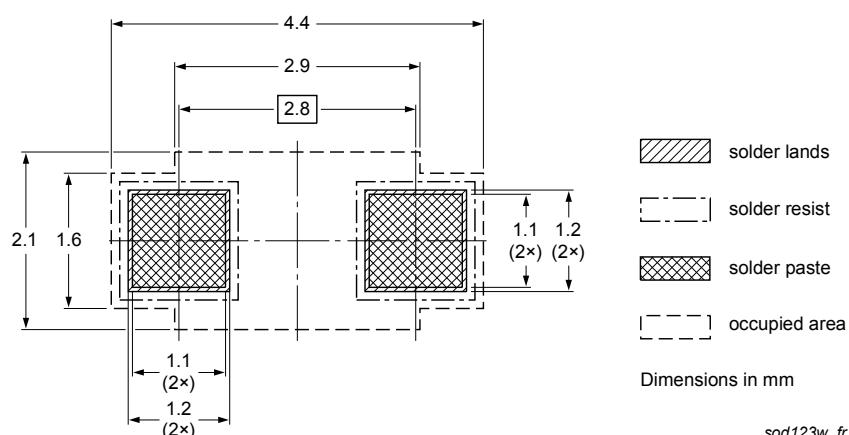


Fig. 16. Reflow soldering footprint for CFP3 (SOD123W)

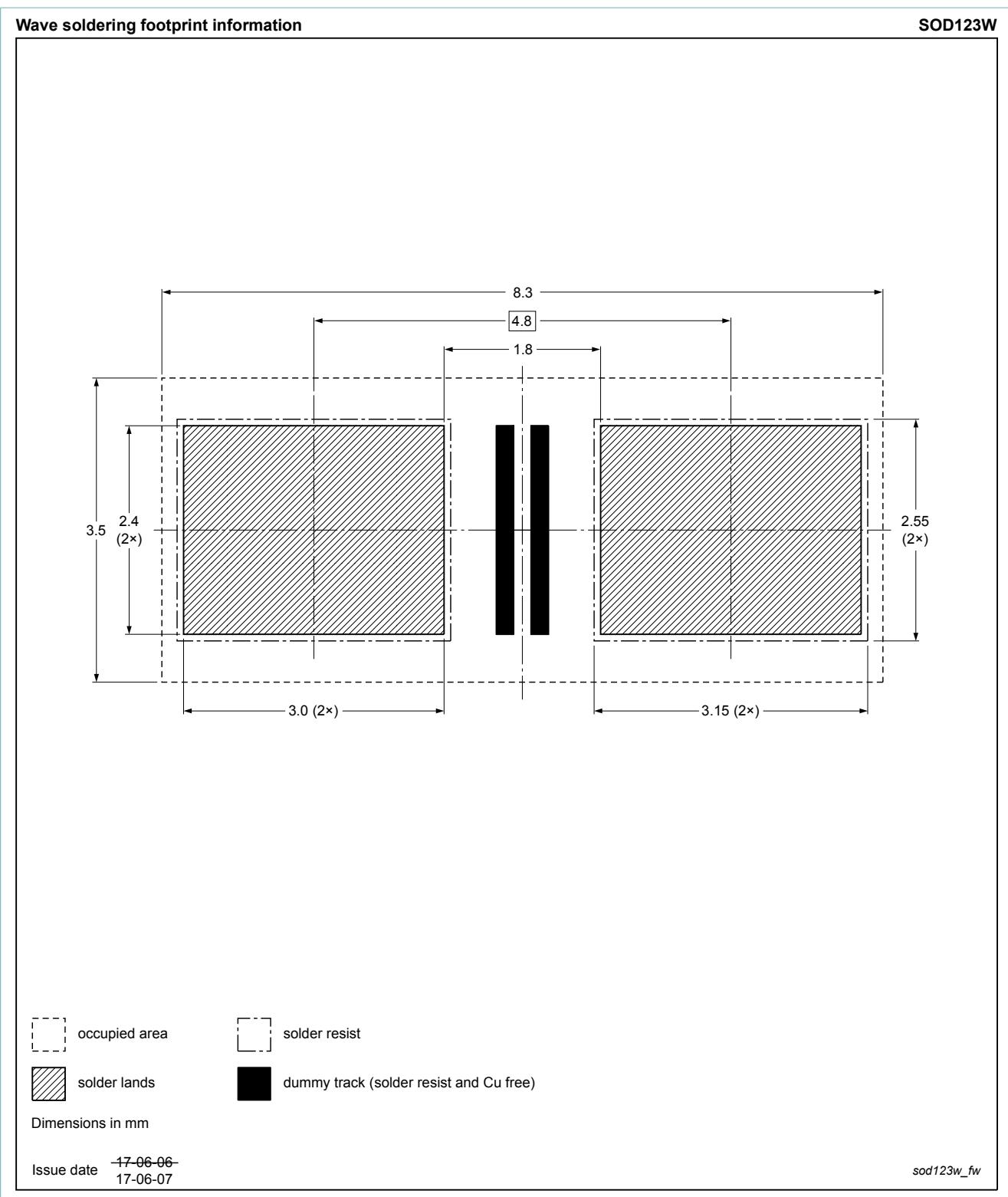


Fig. 17. Wave soldering footprint for CFP3 (SOD123W)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
ES2DR v.2	20171122	Product data sheet	-	ES2DR v.1
Modifications:	<ul style="list-style-type: none">Features and benefits: Capable for reflow and wave soldering addedSoldering: Wave soldering footprint added			
ES2DR v.1	2017329	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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16. Contents

1. General description.....	1
2. Features and benefits.....	1
3. Applications.....	1
4. Quick reference data.....	1
5. Pinning information.....	2
6. Ordering information.....	2
7. Marking.....	2
8. Limiting values.....	3
9. Thermal characteristics.....	3
10. Characteristics.....	5
11. Test information.....	7
12. Package outline.....	9
13. Soldering.....	9
14. Revision history.....	11
15. Legal information.....	12

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