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ES1DVR

200 V, 1 A hyperfast PN-rectifier

28 March 2018

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 $I_F \leq 1$ A
- Hyperfast recovery 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

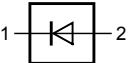
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$I_{F(AV)}$	average forward current	$\delta = 0.5$; $f = 20$ kHz; square wave; $T_{sp} \leq 145$ °C		-	-	1	A
V_{RRM}	repetitive peak reverse voltage	$T_j = 25$ °C		-	-	200	V
V_R	reverse voltage			-	-	200	V
V_F	forward voltage	$I_F = 1$ A; pulsed; $T_j = 25$ °C	[1]	-	820	875	mV
		$I_F = 1$ A; pulsed; $T_j = 125$ °C	[1]	-	675	750	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 test pulse to keep the junction temperature unchanged.

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
ES1DVR	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
ES1DVR	KK

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	$T_j = 25\text{ }^{\circ}\text{C}$		-	200	V
V_R	reverse voltage			-	200	V
V_{RMS}	RMS voltage			-	140	V
I_F	forward current	$\delta = 1; T_{sp} \leq 143\text{ }^{\circ}\text{C}$		-	1.4	A
$I_{F(AV)}$	average forward current	$\delta = 0.5; f = 20\text{ kHz; square wave; } T_{sp} \leq 145\text{ }^{\circ}\text{C}$		-	1	A
I_{FSM}	non-repetitive peak forward current	$t_p = 8.3\text{ ms; } T_{j(\text{init})} = 25\text{ }^{\circ}\text{C; single half sine wave (applied at rated load condition)}$		-	40	A
P_{tot}	total power dissipation	$T_{amb} \leq 25\text{ }^{\circ}\text{C}$	[1]	-	735	mW
			[2]	-	1.19	W
T_j	junction temperature			-	150	$^{\circ}\text{C}$
T_{amb}	ambient temperature			-55	150	$^{\circ}\text{C}$
T_{stg}	storage temperature			-65	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 cm^2 .

9. Thermal characteristics

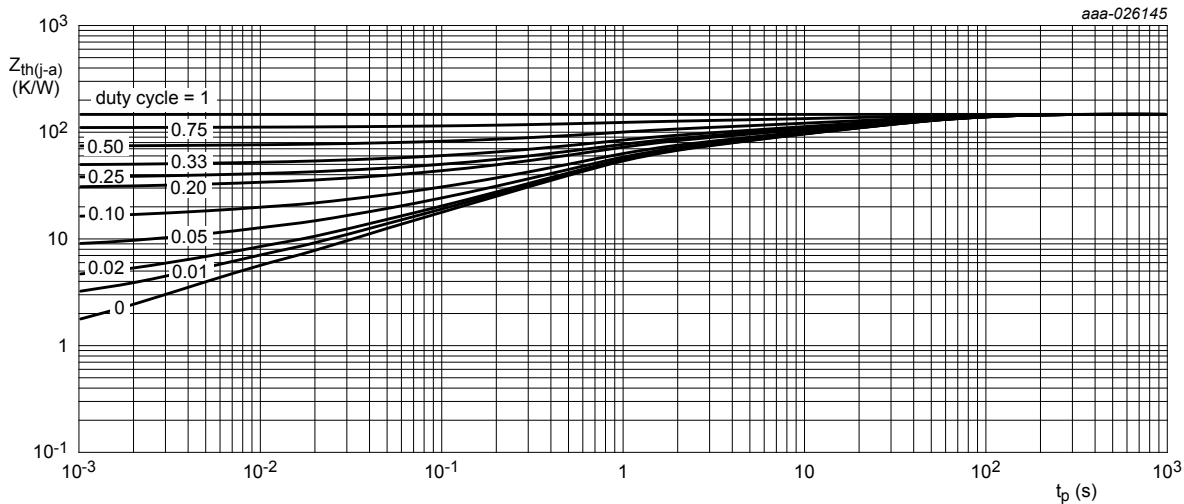
Table 6. Thermal characteristics

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

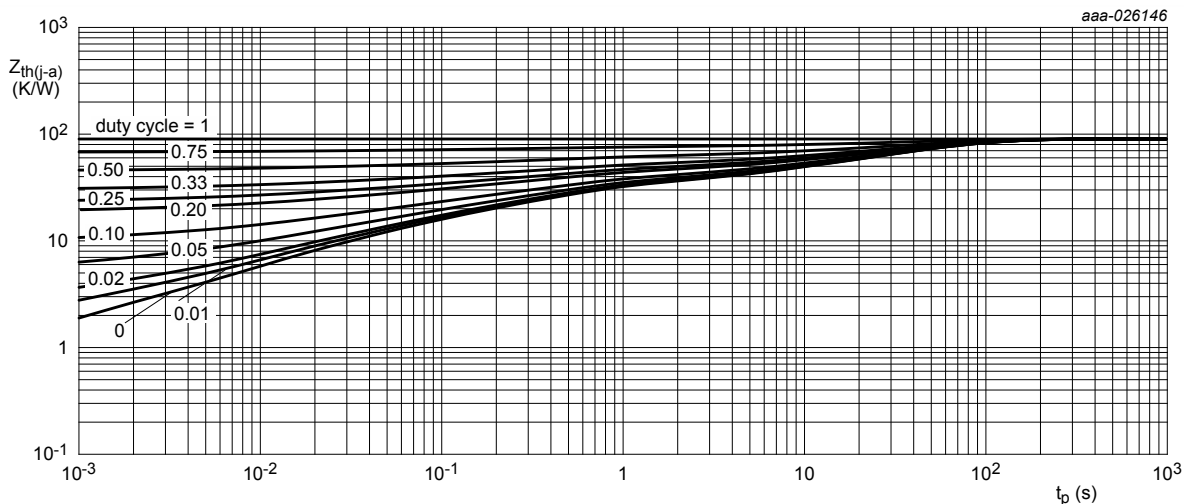
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1 cm^2 .

[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 cm²

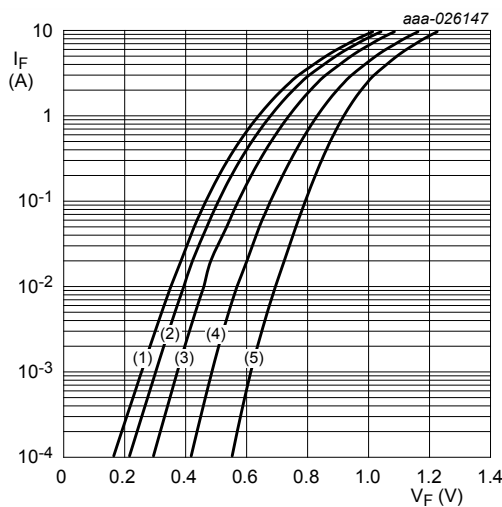
Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{(BR)R}$	reverse breakdown voltage	$I_R = 100\ \mu\text{A}$; pulsed; $T_j = 25\ ^\circ\text{C}$	[1]	200	-	-	V
V_F	forward voltage	$I_F = 1\ \text{A}$; pulsed; $T_j = 25\ ^\circ\text{C}$	[1]	-	820	875	mV
		$I_F = 1\ \text{A}$; pulsed; $T_j = 125\ ^\circ\text{C}$	[1]	-	675	750	mV
I_R	reverse current	$V_R = 200\ \text{V}$; pulsed; $T_j = 25\ ^\circ\text{C}$	[1]	-	5	200	nA
		$V_R = 200\ \text{V}$; pulsed; $T_j = 125\ ^\circ\text{C}$	[1]	-	1.5	20	μA
C_d	diode capacitance	$V_R = 4\ \text{V}$; $f = 1\ \text{MHz}$; $T_j = 25\ ^\circ\text{C}$		-	20	-	pF
t_{rr}	reverse recovery time ; step recovery	$I_F = 0.5\ \text{A}$; $I_R = 1\ \text{A}$; $I_{R(\text{meas})} = 0.25\ \text{A}$; $T_j = 25\ ^\circ\text{C}$		-	10	25	ns
	reverse recovery time ; ramp recovery	$I_F = 1\ \text{A}$; $dI_F/dt = 50\ \text{A}/\mu\text{s}$; $V_R = 30\ \text{V}$; $T_j = 25\ ^\circ\text{C}$		-	20	-	ns
V_{FRM}	peak forward recovery voltage	$I_F = 1\ \text{A}$; $dI_F/dt = 50\ \text{A}/\mu\text{s}$; $T_j = 25\ ^\circ\text{C}$		-	930	-	mV

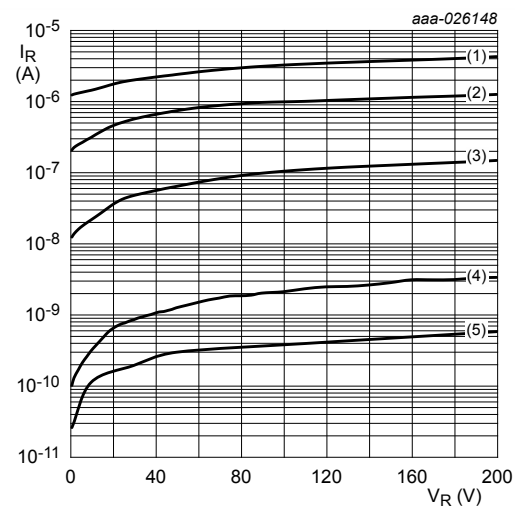
[1] Very short test pulse to keep the junction temperature unchanged.



pulsed condition

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

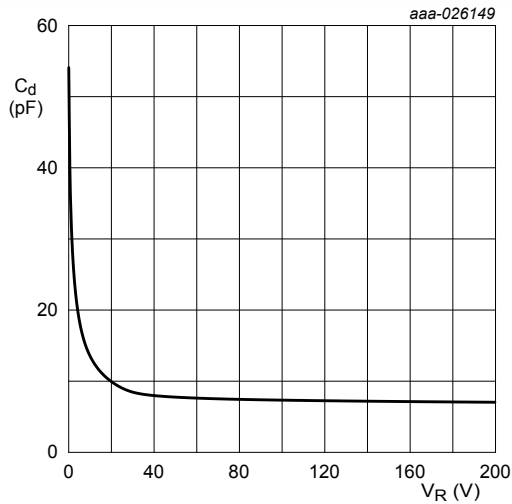
Fig. 3. Forward current as a function of forward voltage; typical values



pulsed condition

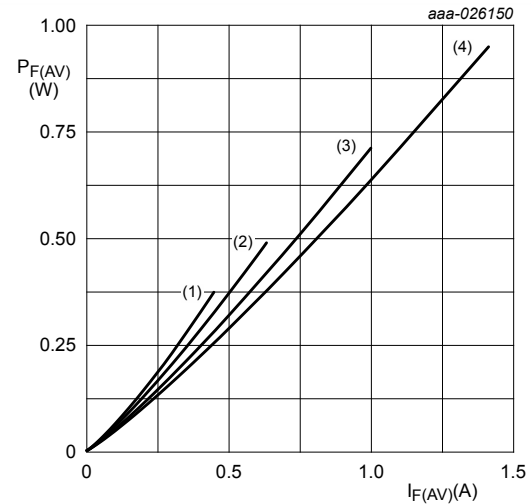
- (1) $T_j = 150\ ^\circ\text{C}$
- (2) $T_j = 125\ ^\circ\text{C}$
- (3) $T_j = 85\ ^\circ\text{C}$
- (4) $T_j = 25\ ^\circ\text{C}$
- (5) $T_j = -40\ ^\circ\text{C}$

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



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

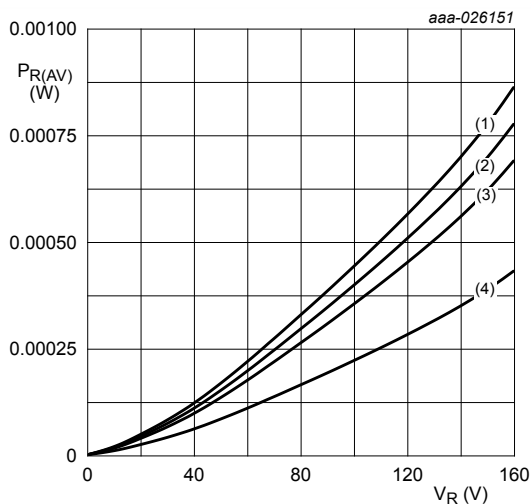
Fig. 5. Diode capacitance as a function of reverse voltage; typical values



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

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

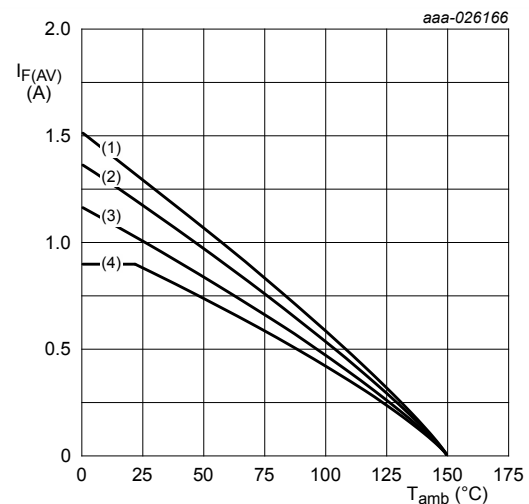
Fig. 6. Average forward power dissipation as a function of average forward current; typical values



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

- (1) $\delta = 1$
- (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

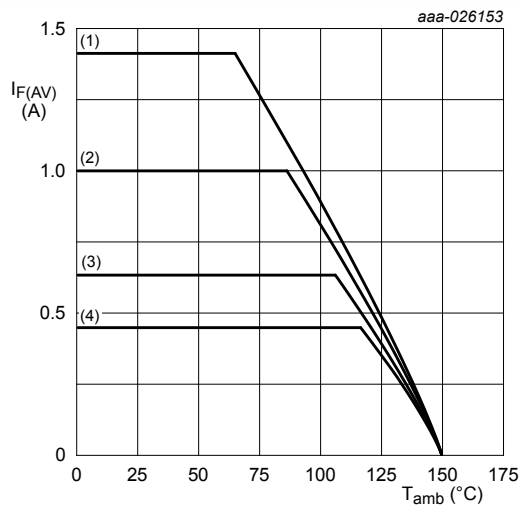


FR4 PCB, standard footprint

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

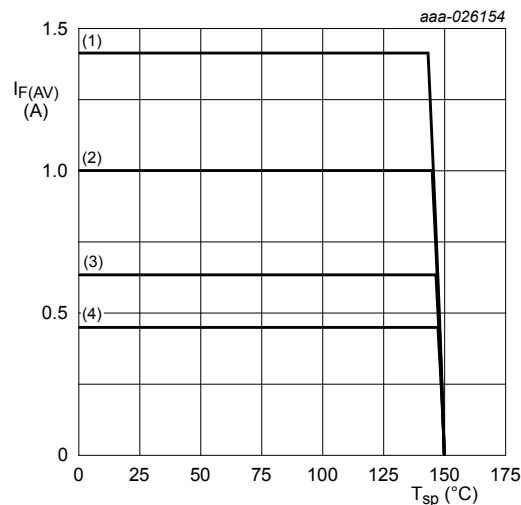
- (1) $\delta = 1$; DC
- (2) $\delta = 0.5$; $f = 20 \text{ kHz}$
- (3) $\delta = 0.2$; $f = 20 \text{ kHz}$
- (4) $\delta = 0.1$; $f = 20 \text{ kHz}$

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

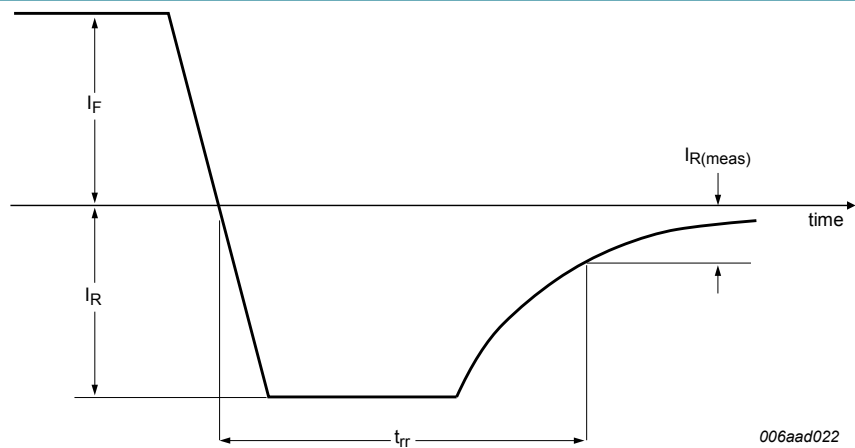


Fig. 11. Reverse recovery definition; step recovery

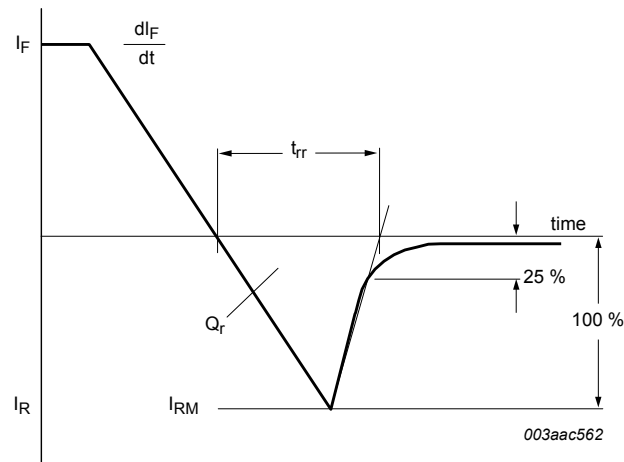


Fig. 12. Reverse recovery definition; ramp recovery

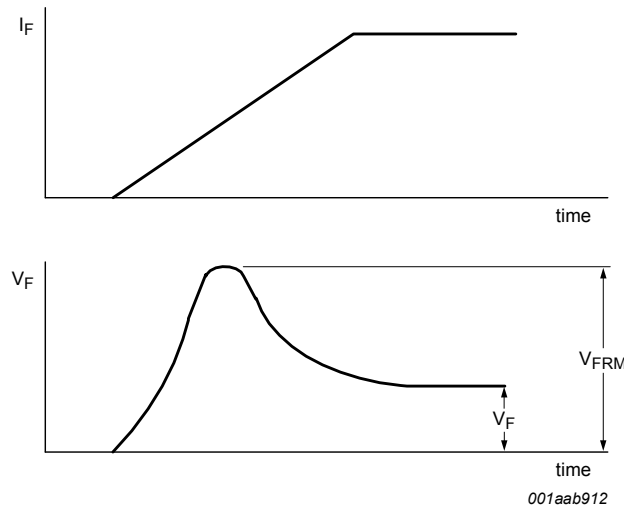


Fig. 13. Forward recovery definition

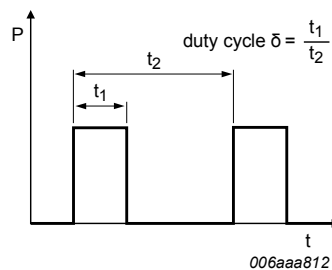
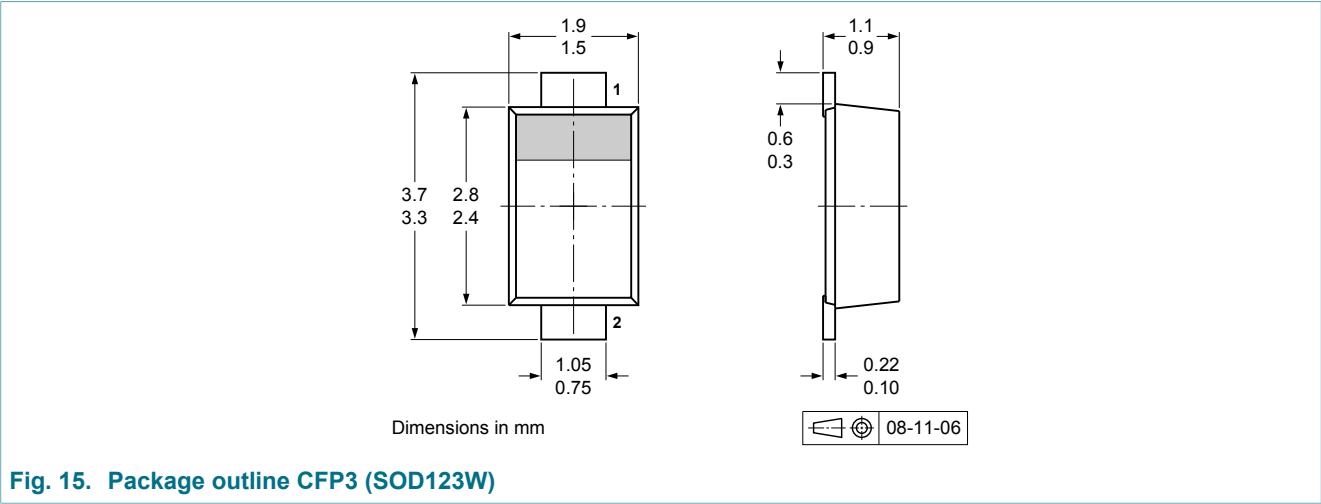


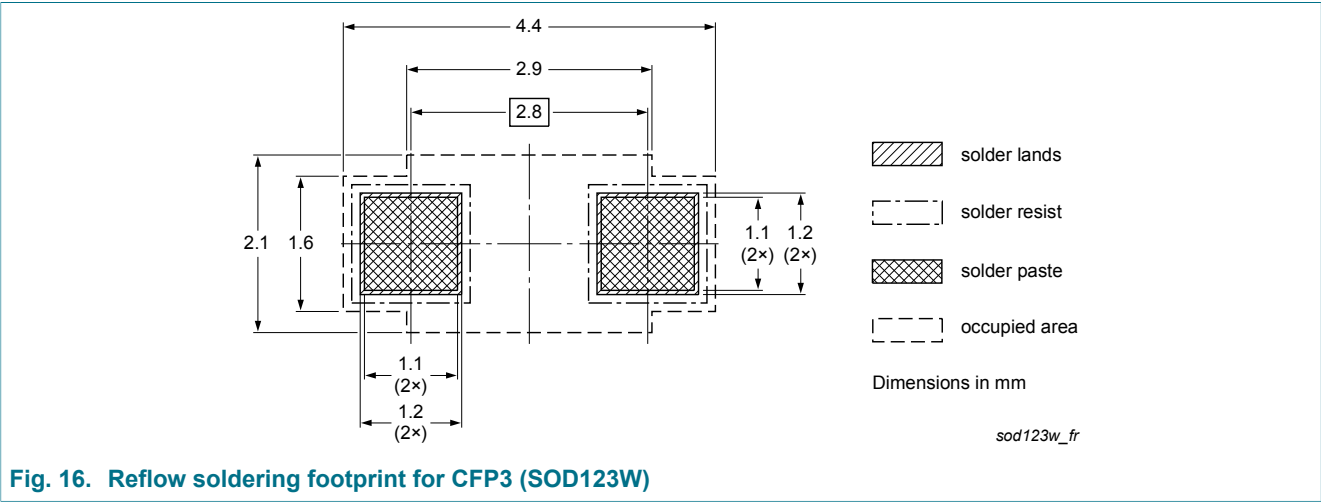
Fig. 14. Duty cycle definition

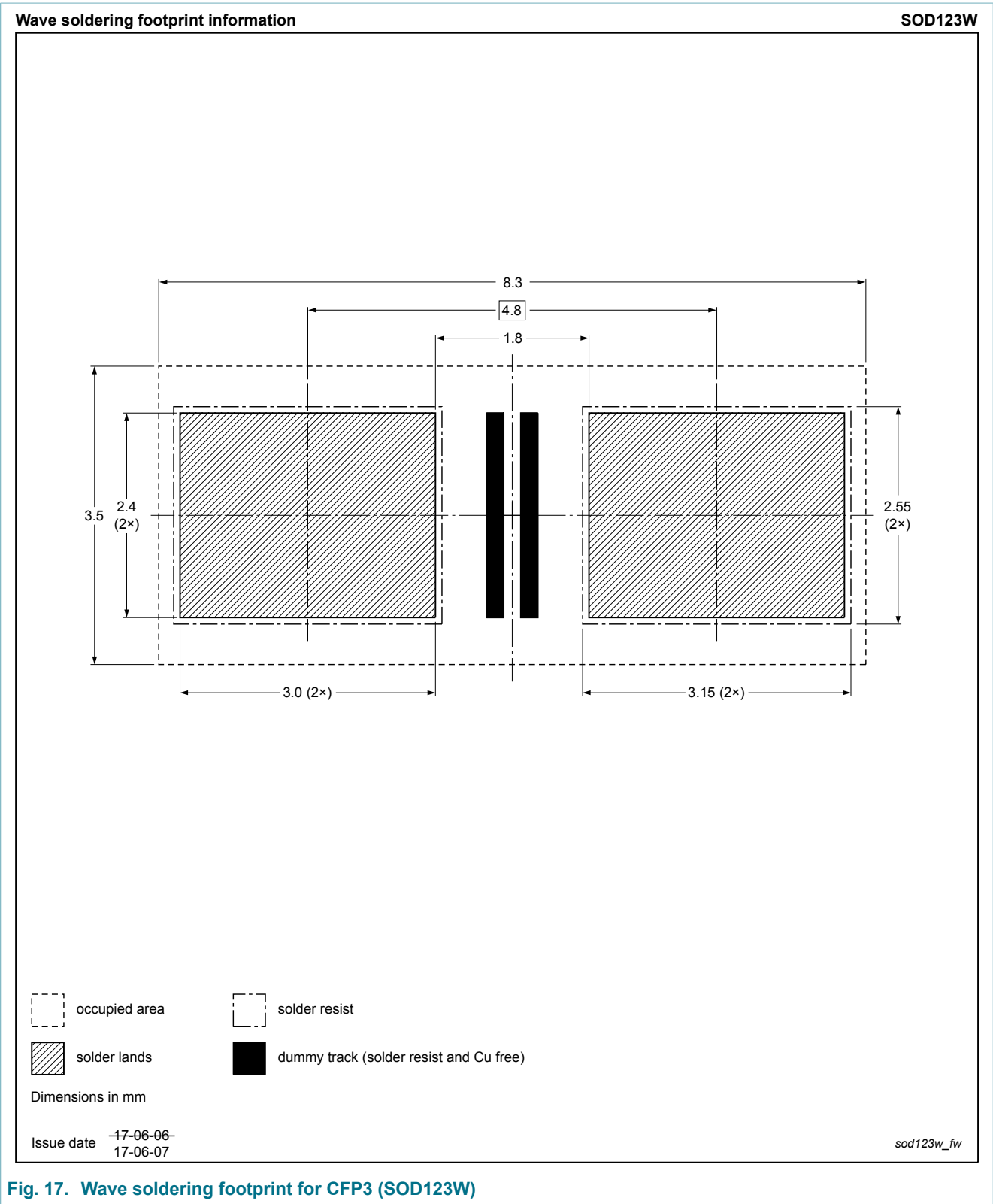
The current ratings for the typical waveforms are calculated according to the equations: $I_{F(AV)} = I_M \times \delta$ with I_M defined as peak current, $I_{RMS} = I_{F(AV)}$ at DC, and $I_{RMS} = I_M \times \sqrt{\delta}$ with I_{RMS} defined as RMS current.

12. Package outline



13. Soldering





14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
ES1DVR v.3	20180328	Product data sheet	-	ES1DVR v.2
Modifications:	• Features and benefits: Capable for reflow and wave soldering added • Soldering: Wave soldering footprint added • Section 10: V_{FRM}, $I_F = 1$ mA changed to $I_F = 1$ A			
ES1DVR v.2	20170112	Product data sheet	-	ES1DVR v.1
ES1DVR v.1	20160930	Objective 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.

- [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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