



MBR140ESF

High temperature 40 V, 1 A low VF Schottky barrier rectifier

2 August 2024

Product data sheet

1. General description

Planar Schottky barrier rectifier with an integrated guard ring for stress protection, encapsulated in a SOD123FL small and flat lead Surface-Mounted Device (SMD) plastic package.

2. Features and benefits

- Average forward current: $I_{F(AV)} \leq 1 \text{ A}$
- Reverse voltage: $V_R \leq 40 \text{ V}$
- Low forward voltage
- High power capability due to clip-bonding technology
- Small and flat lead SMD plastic package
- High temperature $T_j \leq 175 \text{ }^\circ\text{C}$

3. Applications

- Low voltage rectification
- High efficiency DC-to-DC conversion
- Switch mode power supply
- Reverse polarity protection

4. Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------|-------------------------|---|-----|-----|-----|---------------|
| $I_{F(AV)}$ | average forward current | $\delta = 0.5$; $f = 20 \text{ kHz}$; square wave; $T_{sp} \leq 170 \text{ }^\circ\text{C}$ | - | - | 1 | A |
| V_R | reverse voltage | $T_j = 25 \text{ }^\circ\text{C}$ | - | - | 40 | V |
| V_F | forward voltage | $I_F = 1 \text{ A}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 430 | 490 | mV |
| I_R | reverse current | $V_R = 40 \text{ V}$; $t_p \leq 300 \mu\text{s}$; $\delta \leq 0.02$; $T_j = 25 \text{ }^\circ\text{C}$; pulsed | - | 10 | 50 | μA |

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-------------|--|---|
| 1 | K | cathode[1] | | |
| 2 | A | anode |  SOD123FL |  |

[1] The marking bar indicates the cathode.

6. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|----------|--|----------|
| | Name | Description | Version |
| MBR140ESF | SOD123FL | plastic, surface mounted package; 2 terminals; 3 mm x 1.9 mm x 1 mm body | SOD123FL |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| MBR140ESF | P9 |

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 | $T_j = 25^\circ\text{C}$ | | - | 40 | V |
| I_F | forward current | $T_{sp} = 165^\circ\text{C}$ | | - | 1.4 | A |
| $I_{F(AV)}$ | average forward current | $\delta = 0.5$; $f = 20\text{ kHz}$; square wave; $T_{sp} \leq 170^\circ\text{C}$ | | - | 1 | A |
| I_{FSM} | non-repetitive peak forward current | $t_p = 8.3\text{ ms}$; half sine wave; $T_{j(\text{init})} = 25^\circ\text{C}$ | | - | 40 | A |
| P_{tot} | total power dissipation | $T_{amb} \leq 25^\circ\text{C}$ | [1] | - | 680 | mW |
| | | | [2] | - | 1.15 | W |
| T_j | junction temperature | | | - | 175 | °C |
| T_{amb} | ambient temperature | | | -55 | 175 | °C |
| T_{stg} | storage temperature | | | -65 | 175 | °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

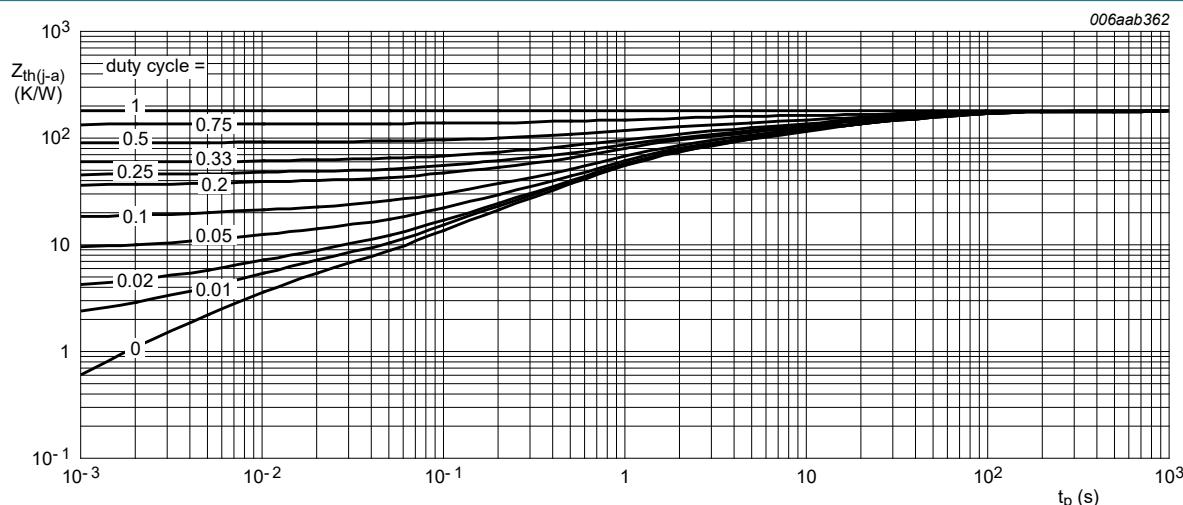
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|----------------|--|-------------|---------|-----|-----|-----|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] [2] | - | - | 220 | K/W |
| | | | [1] [3] | - | - | 130 | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | [4] | - | - | 18 | 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.

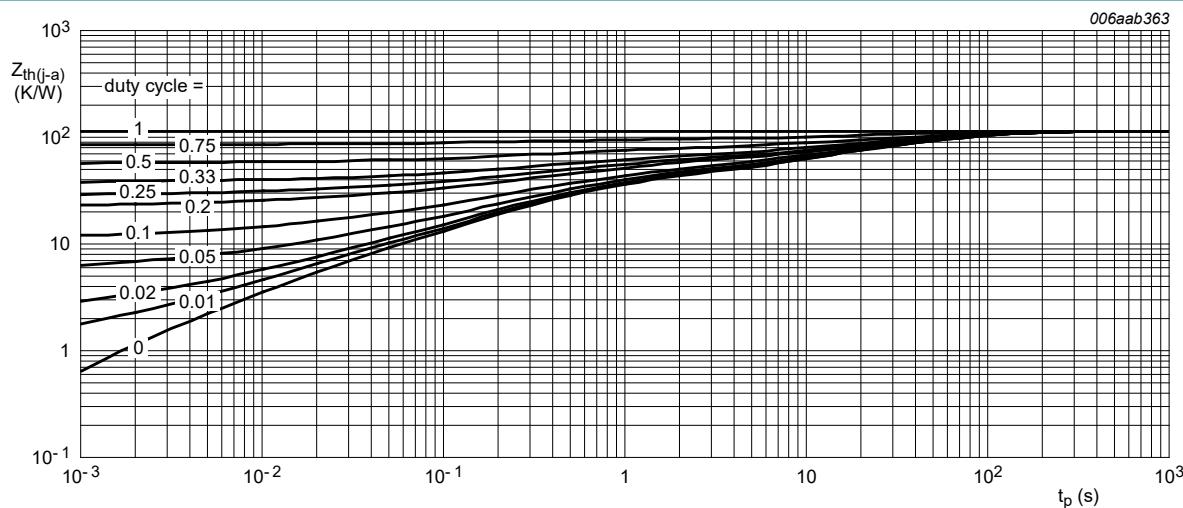
[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1 cm².

[4] 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_F | forward voltage | $I_F = 0.1 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ | - | 310 | 360 | mV |
| | | $I_F = 1 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ | - | 430 | 490 | mV |
| | | $I_F = 1 \text{ A}; T_j = -40 \text{ }^\circ\text{C}$ | - | 480 | 570 | mV |
| | | $I_F = 1 \text{ A}; T_j = 125 \text{ }^\circ\text{C}$ | - | 330 | 410 | mV |
| | | $I_F = 1 \text{ A}; T_j = 150 \text{ }^\circ\text{C}$ | - | 310 | 390 | mV |
| | | $I_F = 1 \text{ A}; T_j = 175 \text{ }^\circ\text{C}$ | - | 290 | 370 | mV |
| I_R | reverse current | $V_R = 10 \text{ V}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_j = 25 \text{ }^\circ\text{C}; \text{ pulsed}$ | - | 3 | 13 | μA |
| | | $V_R = 40 \text{ V}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_j = 25 \text{ }^\circ\text{C}; \text{ pulsed}$ | - | 10 | 50 | μA |
| | | $V_R = 40 \text{ V}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_j = -40 \text{ }^\circ\text{C}; \text{ pulsed}$ | - | 0.05 | 1 | μA |
| | | $V_R = 40 \text{ V}; t_p \leq 300 \mu\text{s}; \delta \leq 0.02; T_j = 125 \text{ }^\circ\text{C}; \text{ pulsed}$ | - | 6.5 | 30 | mA |
| C_d | diode capacitance | $V_R = 1 \text{ V}; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C}$ | - | 114 | - | pF |
| | | $V_R = 4 \text{ V}; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C}$ | - | 63 | - | pF |
| | | $V_R = 10 \text{ V}; f = 1 \text{ MHz}; T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ | - | 41 | - | 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 | - | 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 | - | mV |

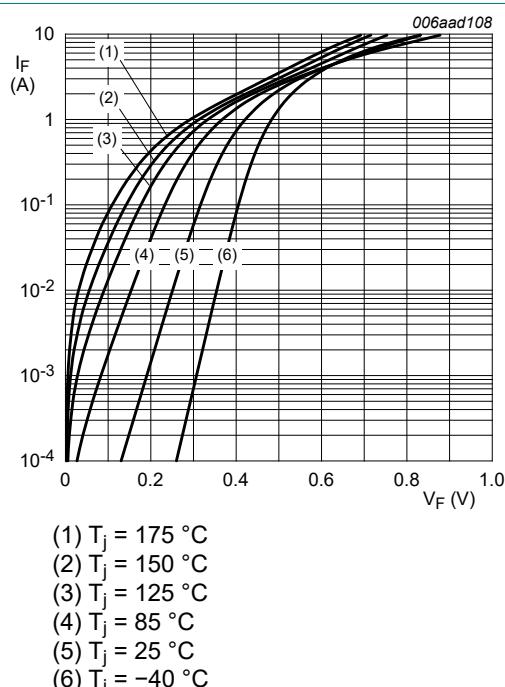


Fig. 3. Forward current as a function of forward voltage; typical values

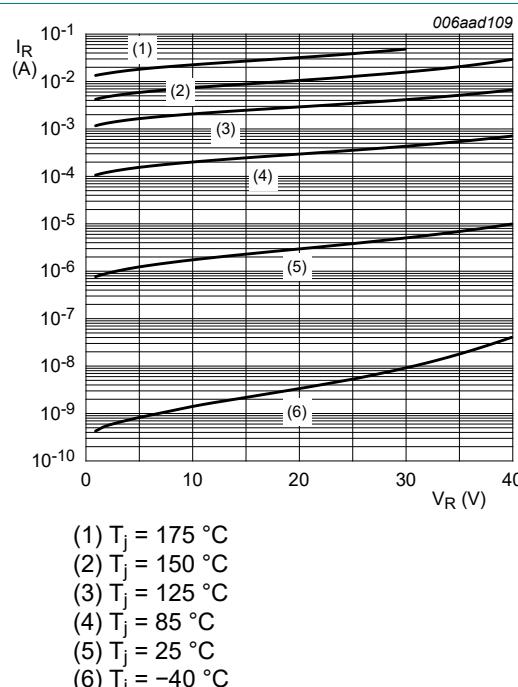
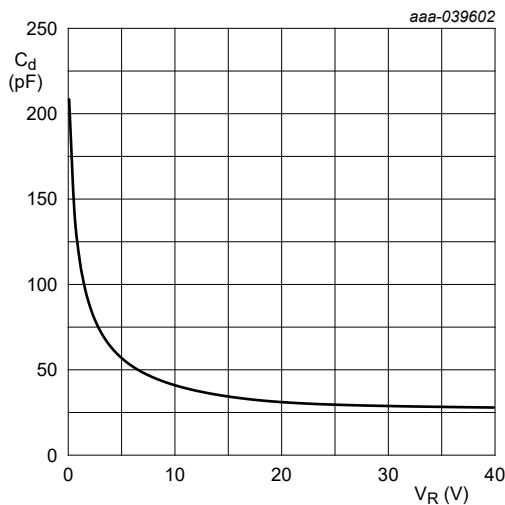


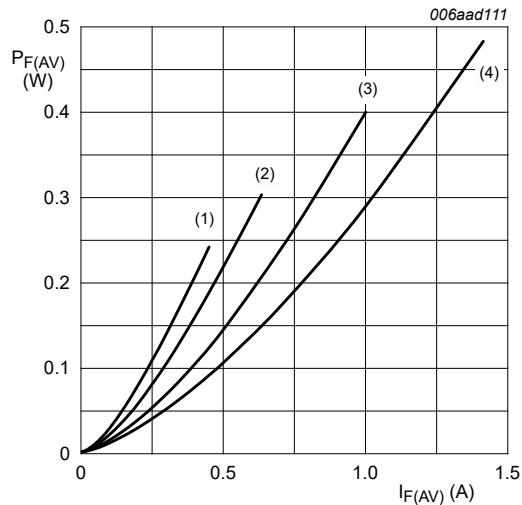
Fig. 4. Reverse current as a function of reverse voltage; typical values

High temperature 40 V, 1 A low VF Schottky barrier rectifier



$f = 1$ MHz; $T_{amb} = 25$ °C

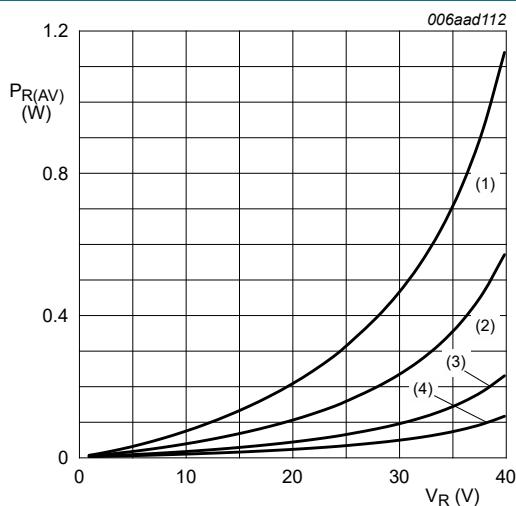
Fig. 5. Diode capacitance as a function of reverse voltage; typical values



$T_j = 175$ °C

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

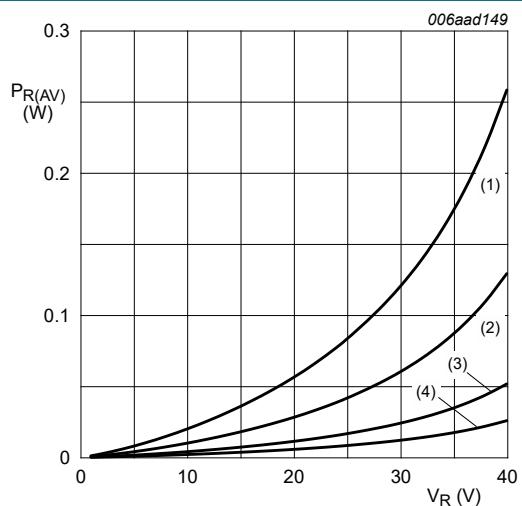
Fig. 6. Average forward power dissipation as a function of average forward current; typical values



$T_j = 150$ °C

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

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



$T_j = 125$ °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

High temperature 40 V, 1 A low VF Schottky barrier rectifier

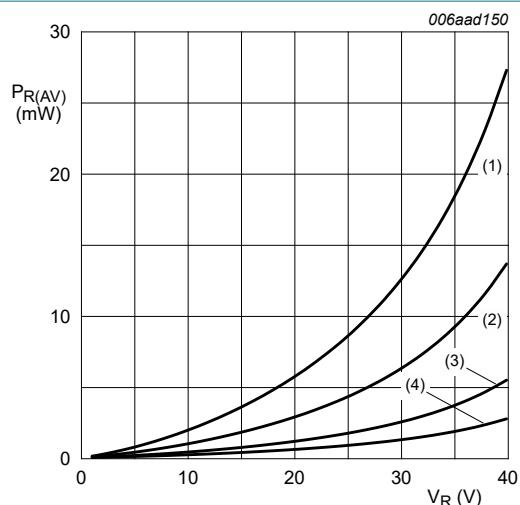


Fig. 9. Average reverse power dissipation as a function of reverse voltage; typical values

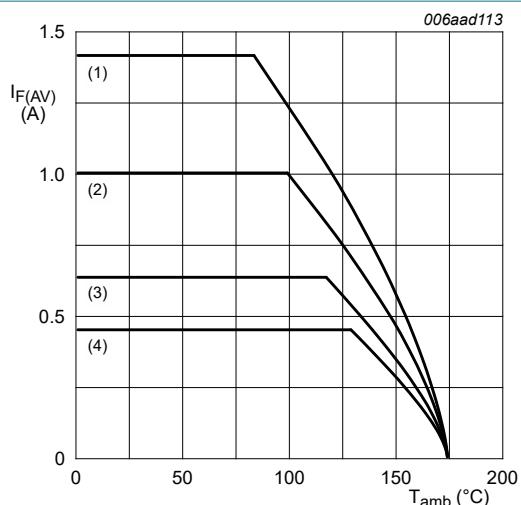


Fig. 10. Average forward current as a function of ambient temperature; typical values

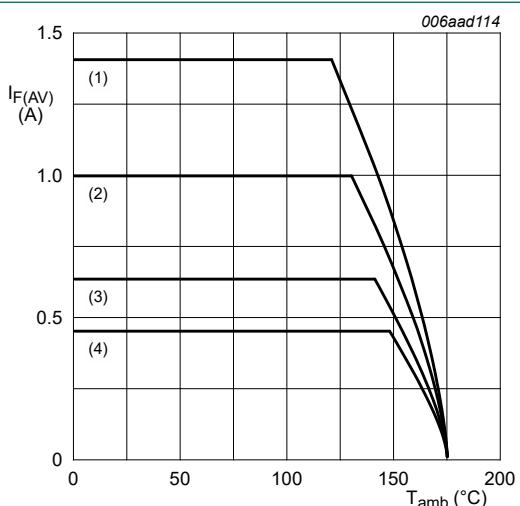


Fig. 11. Average forward current as a function of ambient temperature; typical values

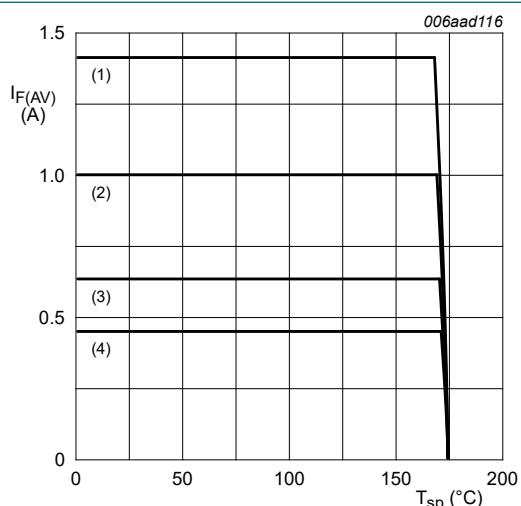


Fig. 12. Average forward current as a function of solder point temperature; typical values

11. Test information

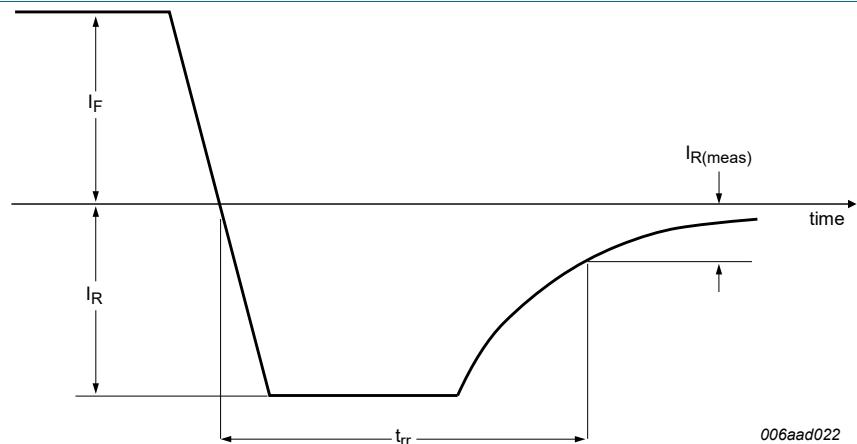


Fig. 13. Reverse recovery definition

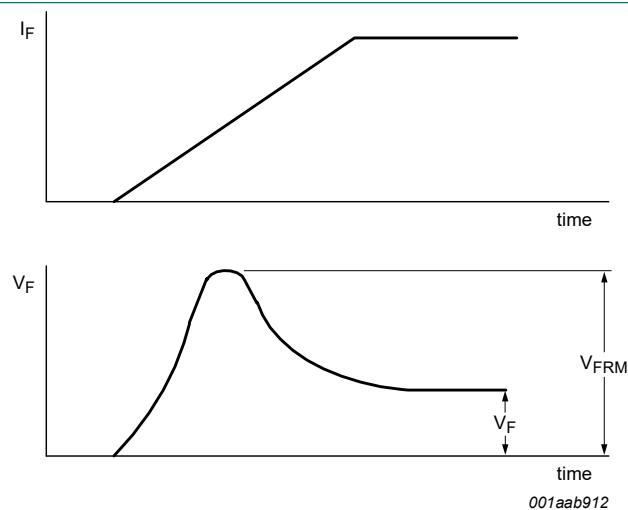


Fig. 14. Forward recovery definition

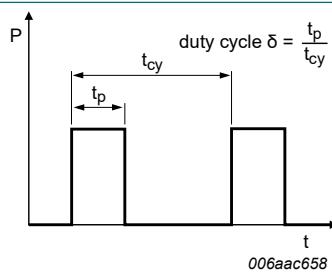


Fig. 15. Duty cycle definition

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

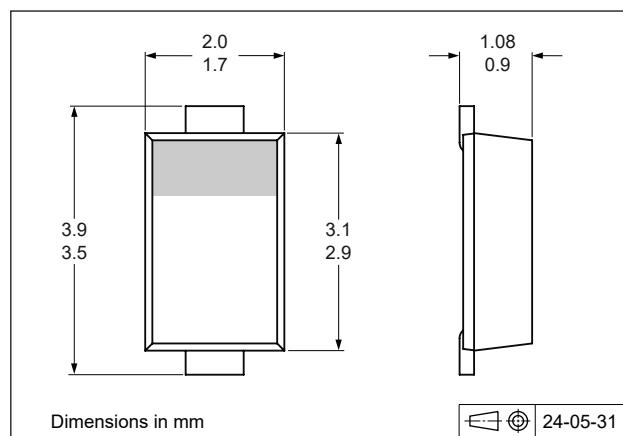
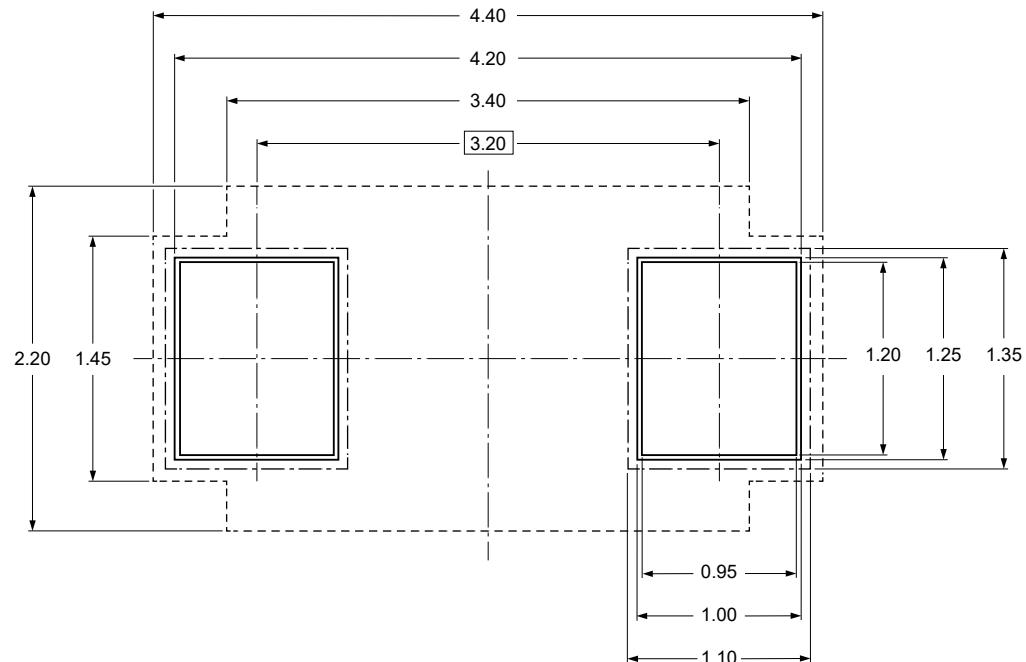


Fig. 16. Package outline SOD123FL

13. Soldering

Footprint information for reflow soldering of SOD123FL package

SOD123FL



recommended stencil thickness: 0.1 mm

occupied area

solder resist

solder land

solder paste

Dimensions in mm

Issue date 24-05-17

sod123fl_fr

Fig. 17. Reflow soldering footprint for SOD123FL

14. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| MBR140ESF v.1 | 20240802 | 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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