



# PLVA6xxA series

## Low-voltage avalanche regulator diodes

Rev. 3 — 12 May 2022

Product data sheet

### 1. General description

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High performance voltage regulator diodes in a small SOT23 (TO-236AB), Surface-Mounted Device (SMD) plastic package.

### 2. Features and benefits

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- Very low dynamic impedance at low currents: approximately 5 % of conventional series
- Hard breakdown knee
- Low noise: approximately 10 % of conventional series
- Total power dissipation: max. 250 mW
- Small tolerances of  $V_Z$
- Working voltage range: nominal 5.00 to 6.80 V
- Non-repetitive peak reverse power dissipation: maximal 30 W at 150 °C
- AEC-Q101 qualified

### 3. Applications

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- Low current, low power, low noise applications
- CMOS RAM back-up circuits
- Voltage stabilizers
- Voltage limiters
- Smoke detector relays

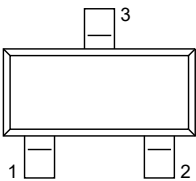
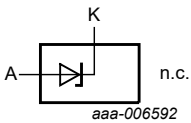
## 4. Quick reference data

**Table 1. Quick reference data**
 $T_{amb} = 25\text{ °C}$  unless otherwise specified.

| Symbol               | Parameter             | Conditions  | Min | Typ | Max      | Unit                                   |
|----------------------|-----------------------|---|-----|-----|----------|--|
| $V_n$                | noise voltage density | $f = 1\text{ kHz}$ ; $B = 1\text{ kHz}$ ;<br>$I_Z = 250\text{ }\mu\text{A}$             | -   | -   | 1.0      | $\frac{\mu\text{V}}{\sqrt{\text{Hz}}}$ |
| $\Delta V_Z$         | line regulation       |   |     |     |          |  |
|                      | PLVA659A to PLVA668A  | $I_{LO} = 10\text{ }\mu\text{A}$ ; $I_{HI} = 1\text{ mA}$                               | -   | -   | 0.1      | V                                      |
|                      | PLVA656A              | $I_{LO} = 50\text{ }\mu\text{A}$ ; $I_{HI} = 1\text{ mA}$                               | -   | -   | 0.1      | V                                      |
|                      | PLVA650A              | $I_{LO} = 100\text{ }\mu\text{A}$ ; $I_{HI} = 1\text{ mA}$                              | -   | -   | 0.4      | V                                      |
| $R_Z$                | dynamic resistance    |   |     |     |          |  |
|                      | PLVA650A              | 1 kHz superimposed;<br>$I_{ZAC}$ is 10 % of $I_{ZDC}$<br>$I_Z = 250\text{ }\mu\text{A}$ | -   | -   | 700      | $\Omega$                               |
|                      | PLVA653A              |   | -   | -   | 250      | $\Omega$                               |
| PLVA656A to PLVA668A | -                     |   | -   | 100 | $\Omega$ |  |
| $I_R$                | reverse current       |   |     |     |          |  |
|                      | PLVA650A              | $V_R = 50\text{ \% }V_Z$ nominal  | -   | 34  | -        | nA                                     |
|                      | PLVA653A              |   | -   | 22  | -        | nA                                     |
|                      | PLVA656A              |   | -   | 1.1 | -        | nA                                     |
|                      | PLVA659A              |   | -   | 0.9 | -        | nA                                     |
|                      | PLVA662A              |   | -   | 0.9 | -        | nA                                     |
|                      | PLVA665A              |   | -   | 0.9 | -        | nA                                     |
| PLVA668A             | -                     |   | 0.8 | -   | nA       |  |

## 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description   | Simplified outline   | Graphic symbol  |
|-----|--------|---------------|--|---|
| 1   | A      | anode         |  |  |
| 2   | n.c.   | not connected |  |   |
| 3   | K      | cathode       |  |   |

## 6. Ordering information

Table 3. Ordering information

| Type number              | Package  |  |                       |
|--------------------------|----------|--|-----------------------|
|                          | Name     | Description                              | Version               |
| <a href="#">PLVA650A</a> | TO-236AB | plastic surface-mounted package; 3 leads | <a href="#">SOT23</a> |
| <a href="#">PLVA653A</a> |          |  |                       |
| <a href="#">PLVA656A</a> |          |  |                       |
| <a href="#">PLVA659A</a> |          |  |                       |
| <a href="#">PLVA662A</a> |          |  |                       |
| <a href="#">PLVA665A</a> |          |  |                       |
| <a href="#">PLVA668A</a> |          |  |                       |

## 7. Marking

Table 4. Marking codes

| Type number |     | Marking code |
|-------------|-----|--------------|
| PLVA650A    | [1] | %9A          |
| PLVA653A    | [1] | %9B          |
| PLVA656A    | [1] | %9C          |
| PLVA659A    | [1] | %9D          |
| PLVA662A    | [1] | %9E          |
| PLVA665A    | [1] | %9F          |
| PLVA668A    | [1] | %9G          |

[1] % = placeholder for manufacturing site code

## 8. Limiting values

Table 5. Limiting values

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

| Symbol    | Parameter                                     | Conditions  | Min   | Max | Unit             |
|-----------|---|---|-------|-----|------------------|
| $I_F$     | continuous forward current                    |   | -     | 250 | mA               |
| $I_{ZRM}$ | repetitive peak working current               | $t_p = 100 \mu\text{s}; \delta = 10 \%$                   | -     | 250 | mA               |
| $P_{ZSM}$ | non-repetitive peak reverse power dissipation | $t_p = 100 \mu\text{s}; T_j = 150 \text{ }^\circ\text{C}$ | -     | 30  | W                |
| $P_{tot}$ | total power dissipation                       | $T_{amb} = 25 \text{ }^\circ\text{C}$                     | [1] - | 250 | mW               |
| $T_j$     | junction temperature                          |   | -     | 150 | $^\circ\text{C}$ |
| $T_{stg}$ | storage temperature                           |   | -65   | 150 | $^\circ\text{C}$ |

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

## 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] | -   | 500 | K/W  |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |             | -   | -   | 330 | K/W  |

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

## 10. Characteristics

Table 7. Characteristics

$T_j = 25\text{ °C}$  unless otherwise specified.

| Symbol | Parameter               | Conditions  | Min  | Typ  | Max  | Unit     |
|--------|-------------------------|---|------|------|------|----------|
| $V_F$  | forward voltage         | $I_F = 10\text{ mA}$  | -    | -    | 0.9  | V        |
| $V_Z$  | working voltage         |   |      |      |      |          |
|        | PLVA650A                | $I_Z = 250\text{ }\mu\text{A}$  | 4.80 | 5.00 | 5.20 | V        |
|        | PLVA653A                |   | 5.10 | 5.30 | 5.50 | V        |
|        | PLVA656A                |   | 5.40 | 5.60 | 5.80 | V        |
|        | PLVA659A                |   | 5.70 | 5.90 | 6.10 | V        |
|        | PLVA662A                |   | 6.00 | 6.20 | 6.40 | V        |
|        | PLVA665A                |   | 6.30 | 6.50 | 6.70 | V        |
|        | PLVA668A                |   | 6.60 | 6.80 | 7.00 | V        |
| $V_Z$  | working voltage         |   |      |      |      |          |
|        | PLVA650A                | $I_Z = 10\text{ }\mu\text{A}$   | -    | 4.30 | -    | V        |
|        | PLVA653A                |   | -    | 5.20 | -    | V        |
|        | PLVA656A                |   | -    | 5.51 | -    | V        |
|        | PLVA659A                |   | -    | 5.85 | -    | V        |
|        | PLVA662A                |   | -    | 6.19 | -    | V        |
|        | PLVA665A                |   | -    | 6.49 | -    | V        |
|        | PLVA668A                |   | -    | 6.80 | -    | V        |
| $R_Z$  | dynamic resistance      |   |      |      |      |          |
|        | PLVA650A                | 1 kHz superimposed;<br>$I_{ZAC}$ is 10 % of $I_{ZDC}$ ;<br>$I_Z = 250\text{ }\mu\text{A}$ | -    | -    | 700  | $\Omega$ |
|        | PLVA653A                |   | -    | -    | 250  | $\Omega$ |
|        | PLVA656A to<br>PLVA668A |   | -    | -    | 100  | $\Omega$ |
|        |                         |   |      |      |      |          |
| $S_Z$  | temperature coefficient |   |      |      |      |          |
|        | PLVA650A                | $I_Z = 250\text{ }\mu\text{A}$  | -    | 0.20 | -    | mv/K     |
|        | PLVA653A                |   | -    | 1.60 | -    | mv/K     |
|        | PLVA656A                |   | -    | 1.90 | -    | mv/K     |
|        | PLVA659A                |   | -    | 2.40 | -    | mv/K     |
|        | PLVA662A                |   | -    | 2.65 | -    | mv/K     |
|        | PLVA665A                |   | -    | 2.90 | -    | mv/K     |
|        | PLVA668A                |   | -    | 3.40 | -    | mv/K     |
|        |                         |   |      |      |      |          |

| Symbol       | Parameter             | Conditions  | Min | Typ   | Max   | Unit                                   |
|--------------|-----------------------|---|-----|-------|-------|--|
| $I_R$        | reverse current       |   |     |       |       |  |
|              | PLVA650A              | $V_R = 80 \% V_Z$ nominal                                     | -   | -     | 20000 | nA                                     |
|              | PLVA653A              |   | -   | -     | 5000  | nA                                     |
|              | PLVA656A              |   | -   | -     | 1000  | nA                                     |
|              | PLVA659A              |   | -   | -     | 500   | nA                                     |
|              | PLVA662A              |   | -   | -     | 100   | nA                                     |
|              | PLVA665A              |   | -   | -     | 50    | nA                                     |
|              | PLVA668A              |   | -   | -     | 10    | nA                                     |
| $I_R$        | reverse current       |   |     |       |       |  |
|              | PLVA650A              | $V_R = 50 \% V_Z$ nominal                                     | -   | 34    | -     | nA                                     |
|              | PLVA653A              |   | -   | 22    | -     | nA                                     |
|              | PLVA656A              |   | -   | 1.1   | -     | nA                                     |
|              | PLVA659A              |   | -   | 0.9   | -     | nA                                     |
|              | PLVA662A              |   | -   | 0.9   | -     | nA                                     |
|              | PLVA665A              |   | -   | 0.9   | -     | nA                                     |
|              | PLVA668A              |   | -   | 0.8   | -     | nA                                     |
| $I_R$        | reverse current       |   |     |       |       |  |
|              | PLVA650A              | $V_R = 90 \% V_Z$ nominal                                     | -   | 21    | -     | $\mu$ A                                |
|              | PLVA653A              |   | -   | 3.5   | -     | $\mu$ A                                |
|              | PLVA656A              |   | -   | 1.3   | -     | $\mu$ A                                |
|              | PLVA659A              |   | -   | 1.0   | -     | $\mu$ A                                |
|              | PLVA662A              |   | -   | 0.05  | -     | $\mu$ A                                |
|              | PLVA665A              |   | -   | 0.04  | -     | $\mu$ A                                |
|              | PLVA668A              |   | -   | 0.006 | -     | $\mu$ A                                |
| $\Delta V_Z$ | line regulation       |   |     |       |       |  |
|              | PLVA650A to PLVA668A  | $I_{LO} = 10 \mu\text{A}; I_{HI} = 1 \text{ mA}$              | -   | -     | 0.1   | V                                      |
|              | PLVA656A              | $I_{LO} = 50 \mu\text{A}; I_{HI} = 1 \text{ mA}$              | -   | -     | 0.1   | V                                      |
|              | PLVA650A              | $I_{LO} = 100 \mu\text{A}; I_{HI} = 1 \text{ mA}$             | -   | -     | 0.4   | V                                      |
|              | PLVA653A              | $I_{LO} = 100 \mu\text{A}; I_{HI} = 1 \text{ mA}$             | -   | -     | 0.2   | V                                      |
| $V_n$        | noise voltage density | $f = 1 \text{ kHz}; B = 1 \text{ kHz}; I_Z = 250 \mu\text{A}$ | -   | -     | 1.0   | $\frac{\mu\text{V}}{\sqrt{\text{Hz}}}$ |

## 11. Test information

### 11.1. Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101 - Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

## 12. Package outline

Table 8. Package outline

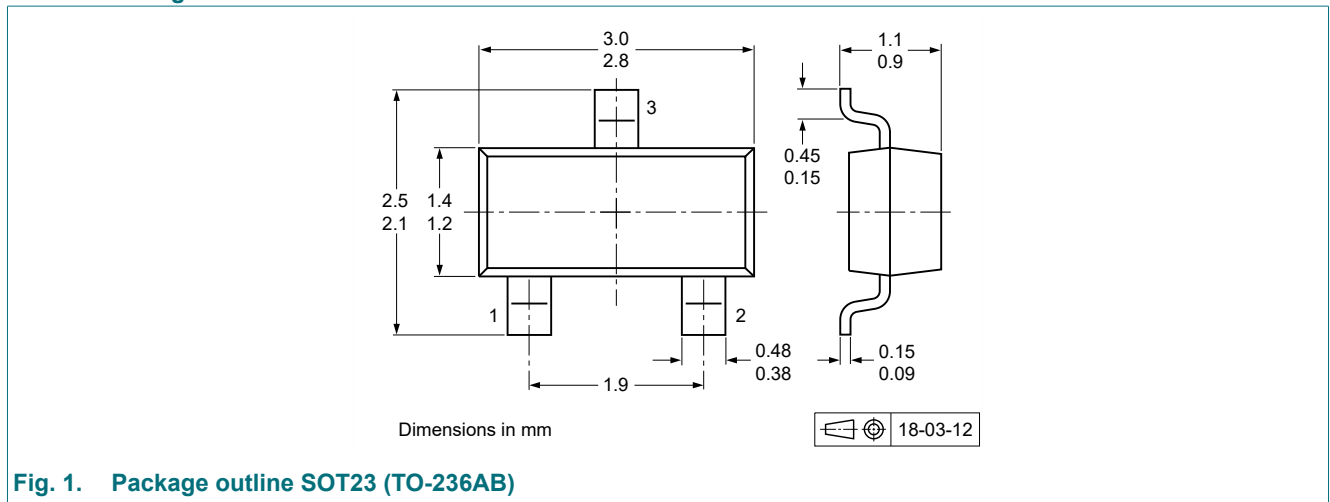


Fig. 1. Package outline SOT23 (TO-236AB)

### 13. Soldering

Table 9. Soldering

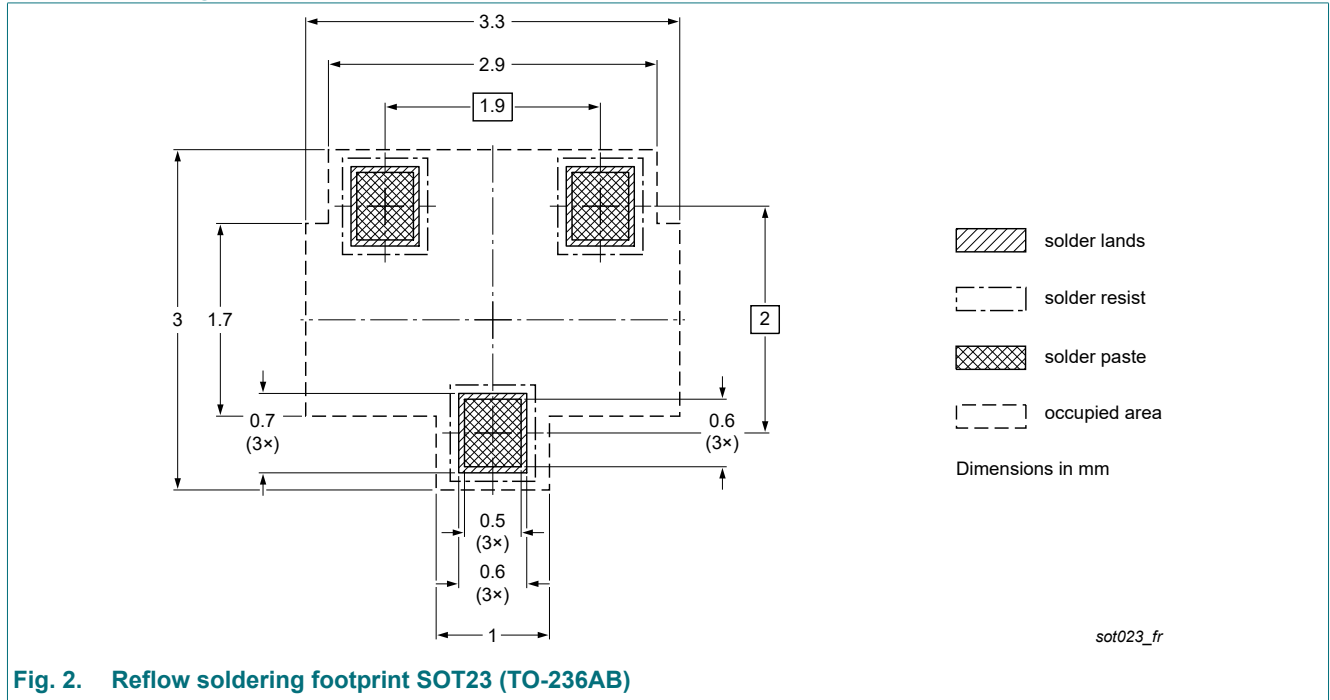


Fig. 2. Reflow soldering footprint SOT23 (TO-236AB)

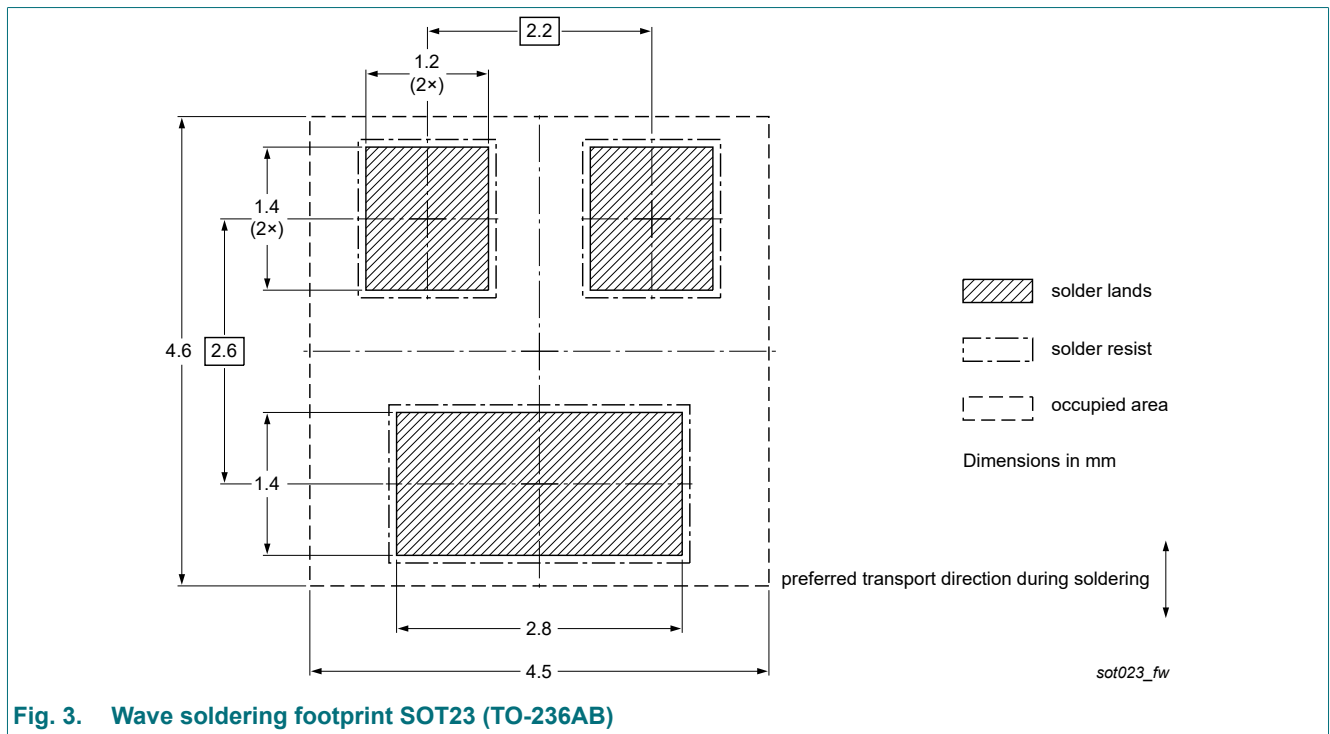


Fig. 3. Wave soldering footprint SOT23 (TO-236AB)

## 14. Revision history

**Table 10. Revision history**

| Document ID         | Release date   | Data sheet status  | Change notice | Supersedes          |
|---------------------|--|--------------------|---------------|---------------------|
| PLVA6XXA_SER v.3    | 20220512   | Product data sheet | -             | PLVA6XXA_SERIES v.2 |
| Modifications:      | <ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>Legal texts have been adapted to the new company name where appropriate.</li></ul> |                    |               |                     |
| PLVA6XXA_SERIES v.2 | 20040114   | Product data sheet | -             | PLVA6XXA_SERIES v.1 |
| PLVA6XXA_SERIES v.1 | 19990525   | 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.                                     |

- [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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Date of release: 12 May 2022

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