



**THE DATASHEET OF
PLVA659A,215**





PLVA6xxA series

Low-voltage avalanche regulator diodes

Rev. 4 — 1 January 2023

Product data sheet

1. General description

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

2. Features and benefits

- 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

3. Applications

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

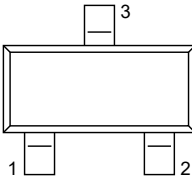
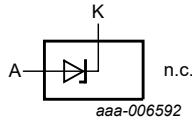
4. Quick reference data

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 | $f = 1\text{ kHz}$; $B = 1\text{ kHz}$; $I_Z = 250\text{ }\mu\text{A}$ | - | - | 1.0 | $\frac{\mu\text{V}}{\sqrt{\text{Hz}}}$ |
| ΔV_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 |
| | PLVA653A | $I_{LO} = 100\text{ }\mu\text{A}$; $I_{HI} = 1\text{ mA}$ | - | - | 0.2 | V |
| R_Z | dynamic resistance | | | | | |
| | PLVA650A | 1 kHz superimposed; I_{ZAC} is 10 % of I_{ZDC} $I_Z = 250\text{ }\mu\text{A}$ | - | - | 700 | Ω |
| | PLVA653A | | - | - | 250 | Ω |
| | PLVA656A to PLVA668A | | - | - | 100 | Ω |
| 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 |
| PLVA650A | TO-236AB | plastic surface-mounted package; 3 leads | SOT23 |
| PLVA653A | | | |
| PLVA656A | | | |
| PLVA659A | | | |
| PLVA662A | | | |
| PLVA665A | | | |
| PLVA668A | | | |

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 | $t_p = 100 \mu s$; $\delta = 10 \%$ | - | 250 | mA |
| P_{ZSM} | non-repetitive peak reverse power dissipation | $t_p = 100 \mu s$; $T_j = 150 \text{ }^\circ\text{C}$ | - | 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; I_{ZAC} is 10 % of I_{ZDC} ; $I_Z = 250\text{ }\mu\text{A}$ | - | - | 700 | Ω |
| | PLVA653A | | - | - | 250 | Ω |
| | PLVA656A to PLVA668A | | - | - | 100 | Ω |
| | | | | | | |
| 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 | - | μA |
| | PLVA653A | | - | 3.5 | - | μA |
| | PLVA656A | | - | 1.3 | - | μA |
| | PLVA659A | | - | 1.0 | - | μA |
| | PLVA662A | | - | 0.05 | - | μA |
| | PLVA665A | | - | 0.04 | - | μA |
| | PLVA668A | | - | 0.006 | - | μA |
| ΔV_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. Package outline

Table 8. Package outline

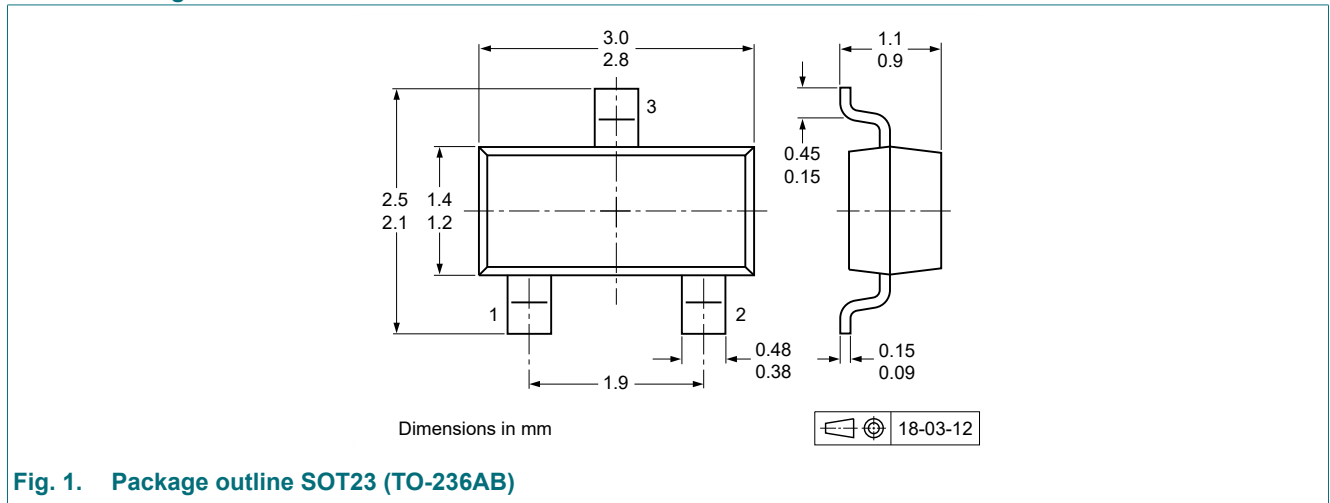


Fig. 1. Package outline SOT23 (TO-236AB)

12. Soldering

Table 9. Soldering

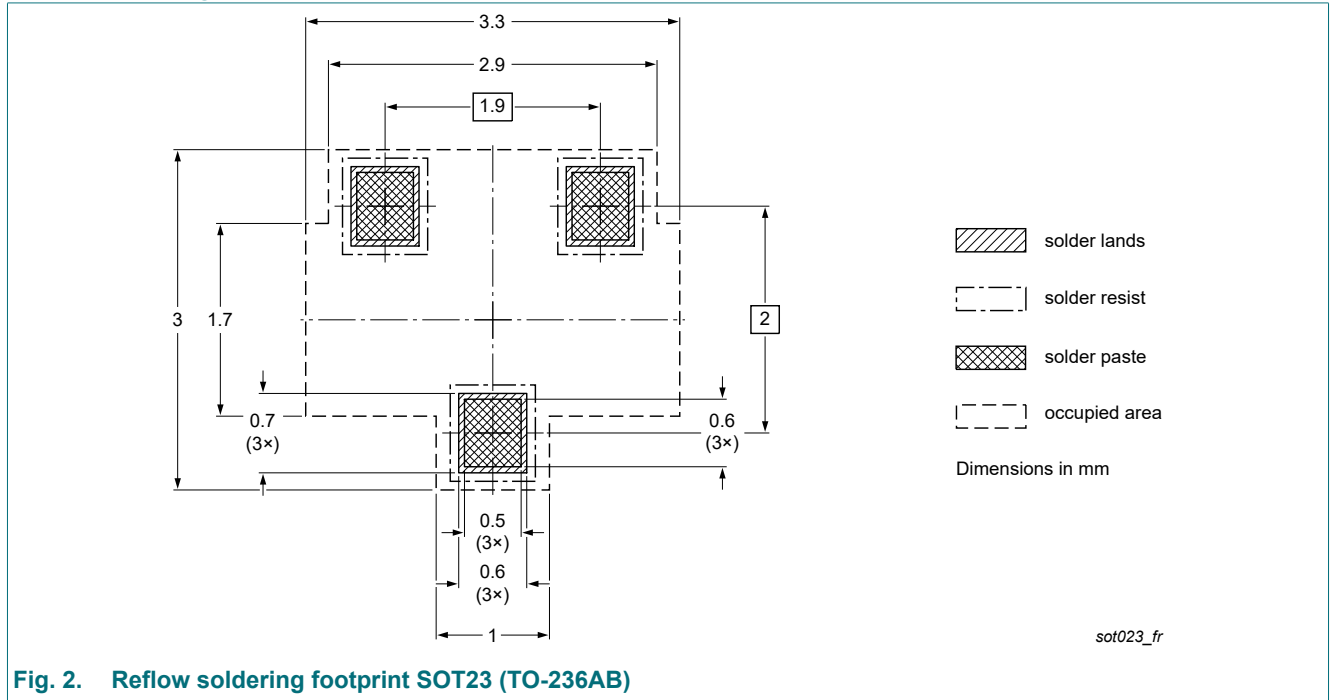


Fig. 2. Reflow soldering footprint SOT23 (TO-236AB)

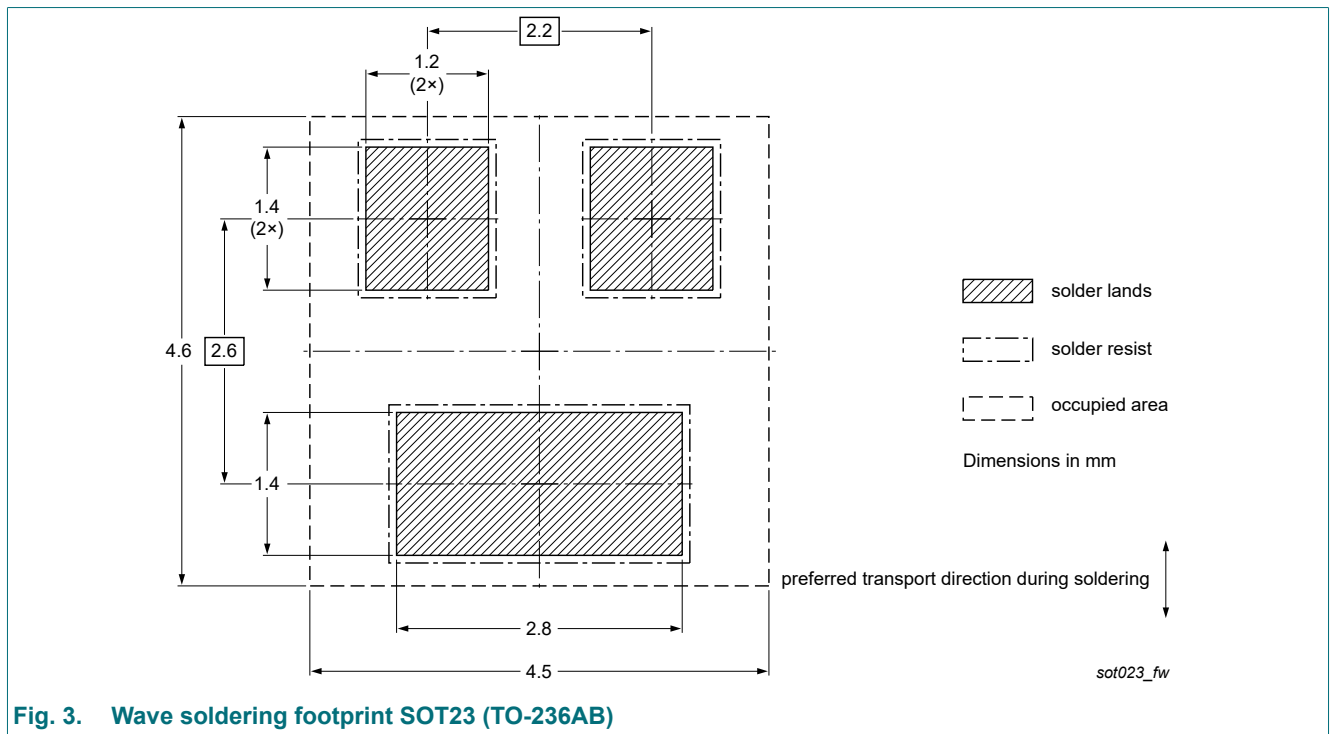


Fig. 3. Wave soldering footprint SOT23 (TO-236AB)

13. Revision history

Table 10. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---------------------|---|--------------------|---------------|---------------------|
| PLVA6XXA_SER v.4 | 20230101 | Product data sheet | - | PLVA6XXA_SER v.3 |
| Modifications: | <ul style="list-style-type: none">Product changed to non-automotive qualification. Please refer to nexperia.com for automotive (-Q) product alternative(s). | | | |
| PLVA6XXA_SER v.3 | 20220512 | Product data sheet | - | PLVA6XXA_SERIES v.2 |
| PLVA6XXA_SERIES v.2 | 20040114 | Product data sheet | - | PLVA6XXA_SERIES v.1 |
| PLVA6XXA_SERIES v.1 | 19990525 | Product data sheet | - | - |

14. 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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Contents

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

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Date of release: 1 January 2023

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