# LNBTVS

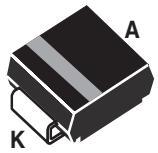
## Transil™ for low noise block protection

## Features

- Peak pulse power:
  - up to 3 kW (10/1000 µs)
  - up to 22.5 kW (8/20 µs)
- Breakdown voltage range: from 23.1 V to 30 V
- Low clamping factor
- Unidirectional with low $V_F$ ($V_F$ = 1.2 V at 3 A)
- Low leakage current: 0.2 µA at 25 °C
- Operating $T_{j\ max}$: 150 °C
- Still IEC 61000-4-5 compliant at $T_j$ = 85 °C with standard footprint
- High power capability at $T_{jmax}$:
  - 1250 W (10/1000 µs)
- JEDEC registered package outline
- Compatible with LNBH supply and control ICs

### Complies with the following standards

- IEC 61000-4-2 level 4:
  - 15 kV (air discharge)
  - 8 kV (contact discharge)
- IEC 61000-4-5
- MIL STD 883G, method 3015-7: class 3B:
  - 25 kV HBM (human body model)
- UL 497B file number: QVGQ2.E136224
- Resin meets UL 94, V0
- MIL-STD-750, method 2026 solderability
- EIA STD RS-481 and IEC 60286-3 packing
- IPC 7531 footprint




**SMC**
**(JEDEC DO-214AB)**


**SMB**
**(JEDEC DO-214AA)**

## Description

The LNBTVS series has been designed to protect LNB voltage regulators in satellite set top boxes against electrostatic discharges according to IEC 61000-4-2, and MIL STD 883, method 3015, and electrical over stress according to IEC 61000-4-4 and 5. These devices can protect against surges up to 6 kV over the whole consumer temperature range (up to 85 °C).

Planar technology makes these devices suitable for high-end set top boxes to provide reliability and stability over time.

LNBTVS are packaged in either SMB or SMC (footprints in accordance with IPC 7531 standard).

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# 1 Characteristics

**Table 1. Absolute maximum ratings ($T_{amb}$ = 25 °C)**

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $P_{PP}$ | Peak pulse power dissipation(1) (8/20 µs) | $T_{j\ initial} = T_{amb}$ | up to 22.5 | kW |
| $T_{stg}$ | Storage temperature range | | -65 to + 150 | °C |
| $T_j$ | Operating junction temperature range | | -55 to + 150 | °C |
| $T_L$ | Maximum lead temperature for soldering during 10 s. | | 260 | °C |

1. For a surge greater than the maximum values, the diode will fail in short-circuit.

**Table 2. Thermal parameter**

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $R_{th(j-l)}$ | Junction to leads | SMC | 15 | °C/W |
| | | SMB | 20 | °C/W |

**Figure 1. Electrical characteristics - definitions**

| Symbol | Parameter |
|---|---|
| $V_{RM}$ | Stand-off voltage |
| $V_{BR}$ | Breakdown voltage |
| $V_{CL}$ | Clamping voltage |
| $I_{RM}$ | Leakage current @ $V_{RM}$ |
| $I_{PP}$ | Peak pulse current |
| $\alpha T$ | Voltage temperature coefficient |
| $V_F$ | Forward voltage drop |

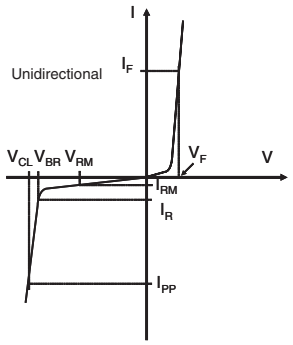


**Figure 2. Pulse definition for electrical characteristics**

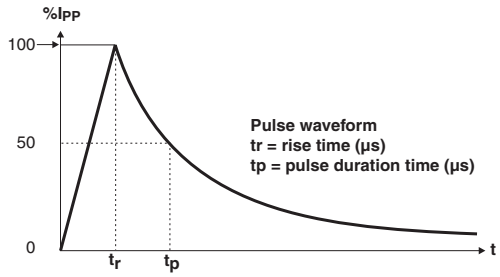




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**Table 3. Electrical characteristics, parameter values ($T_{amb}$ = 25 °C)**

| Order code | $I_{RM}$ max@$V_{RM}$ | | | $V_{BR}$ @$I_R$ | | | | $V_{CL}$ @$I_{PP}$ 10/1000 µs | | $V_{CL}$ @$I_{PP}$ 8/20 µs | | αT (1) | C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 25 °C | 85 °C | | min. | typ. | max. | | max. | | max. | | max. | typ. |
| | µA | | V | V | | | mA | V | A(2) | V | A(2) | 10-4/ °C | nF |
| LNBTVS3-220U | 0.2 | 1.0 | 20 | 22 | 23.1 | 24.2 | 1 | 33.2 | 45 | 35 | 250 | 9.3 | 3 |
| LNBTVS4-220S | 0.2 | 1.0 | 20 | 22 | 23.1 | 24.2 | 1 | 33.2 | 55 | 35 | 334 | 9.3 | 3.5 |
| LNBTVS4-221S | 0.2 | 1.0 | 20 | 22 | 23.1 | 24.2 | 1 | 33.2 | 60 | 32 | 334 | 9.3 | 5.5 |
| LNBTVS4-222S | 0.2 | 1.0 | 20 | 22 | 23.1 | 24.2 | 1 | 33.2 | 90 | 30 | 334 | 9.3 | 6 |
| LNBTVS4-304S | 0.2 | 1.0 | 28 | 30 | 31.5 | 33 | 1 | 45 | 56 | 45 | 334 | 9.8 | 4 |
| LNBTVS6-220S | 0.2 | 1.0 | 20 | 22 | 23.1 | 24.2 | 1 | 33.2 | 90 | 35 | 500 | 9.3 | 6 |
| LNBTVS6-221S | 0.2 | 1.0 | 20 | 22 | 23.1 | 24.2 | 1 | 33.2 | 90 | 32 | 500 | 9.3 | 6 |
| LNBTVS6-304S | 0.2 | 1.0 | 28 | 30 | 31.5 | 33 | 1 | 45 | 67 | 45 | 500 | 9.8 | 5 |

1. To calculate $V_{BR}$ versus junction temperature, use the following formula: $V_{BR}$ @ $T_J$ = $V_{BR}$ @ 25°C x (1 + αT x ($T_J$ – 25)).
2. Surge capability given for both directions.

**Figure 3. Peak pulse current versus initial junction temperature with regular footprints (typical values)**

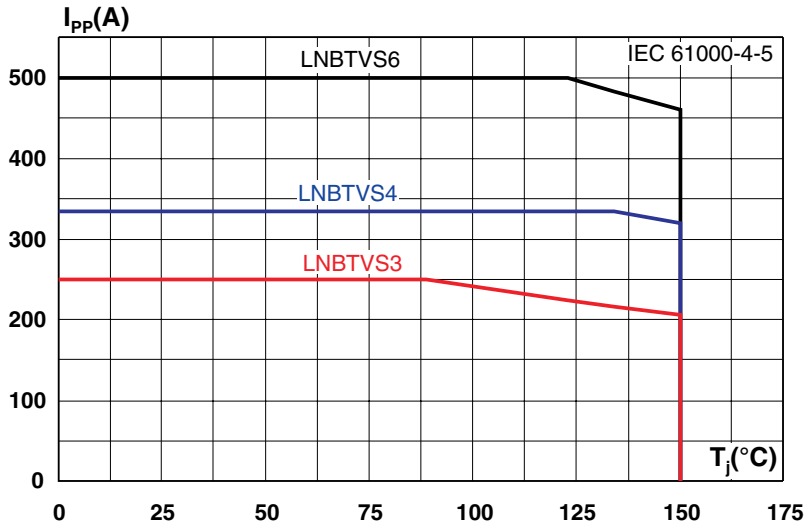




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**Figure 4. Surge test examples at +4 kV - IEC 61000-4-5, R = 12 Ω**

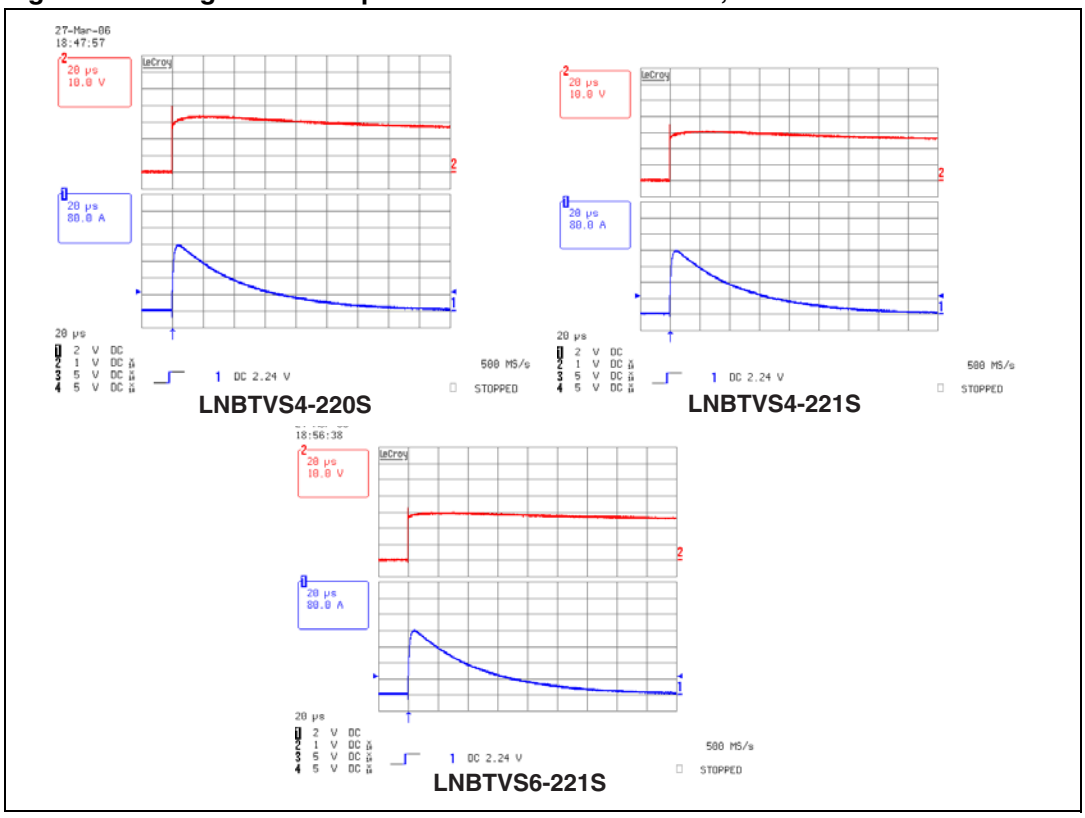
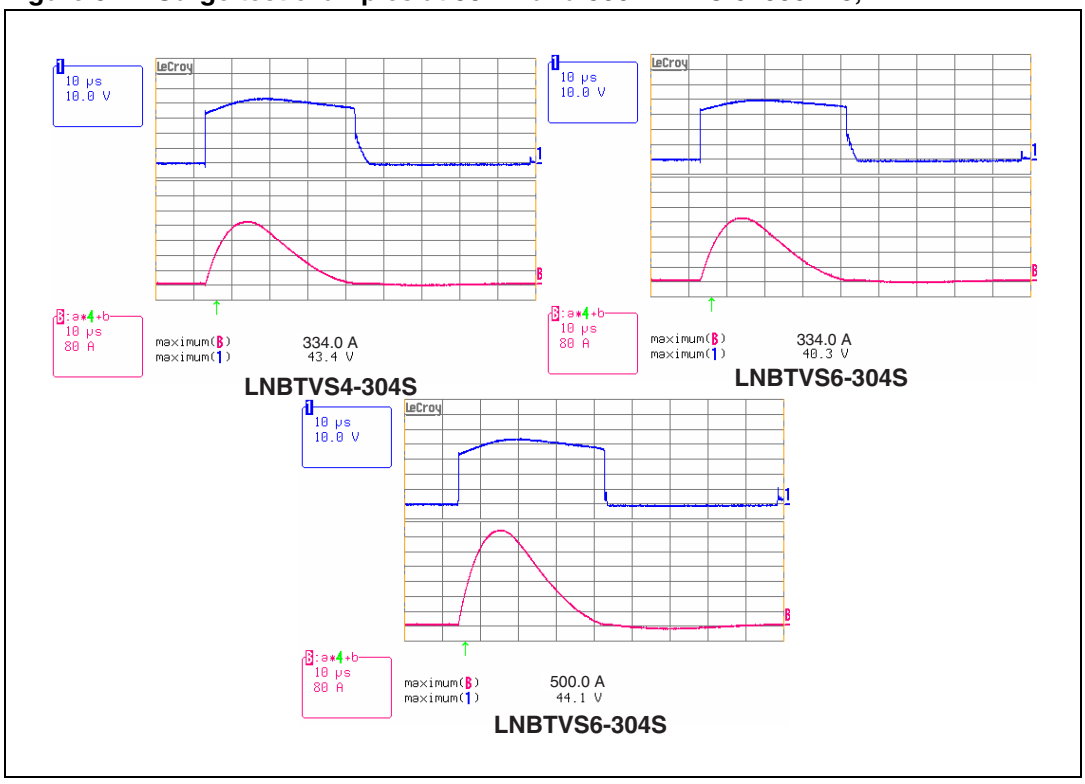



**Figure 5. Surge test examples at 334 A and 500 A - IEC 61000-4-5, R = 2 Ω**



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# 2 Application information

**Figure 6. Application schematic with LNBH23 and LNBTVSxx**

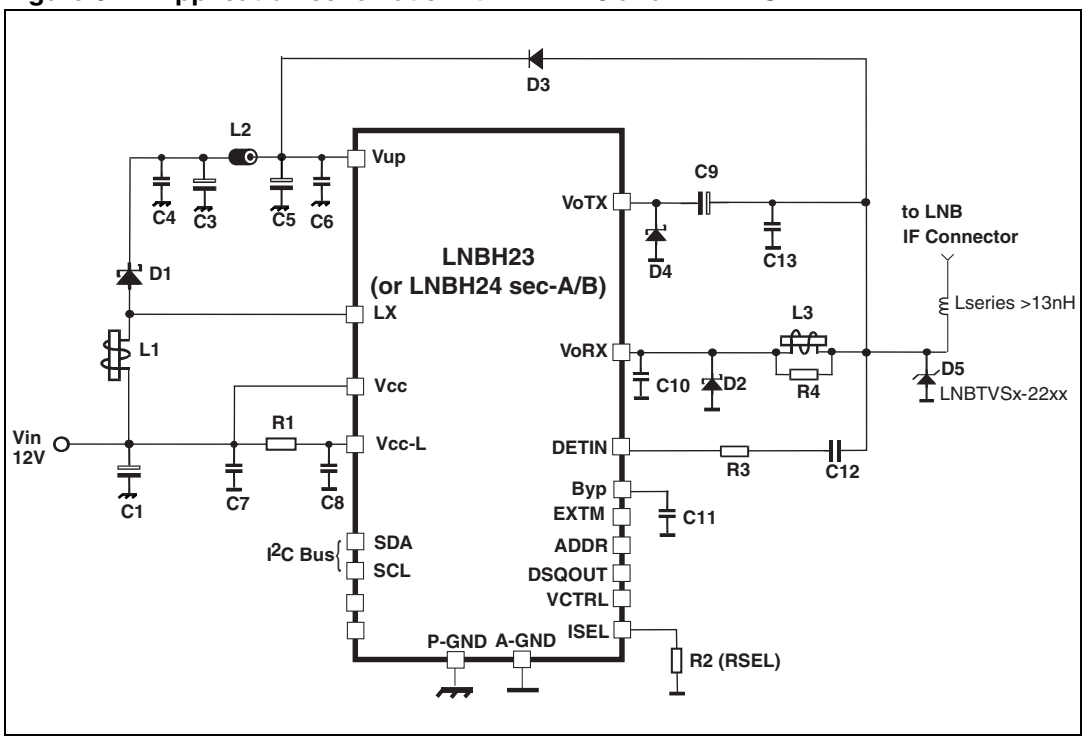


**Figure 7. Application schematic with LNBH23L and LNBTVSxx**

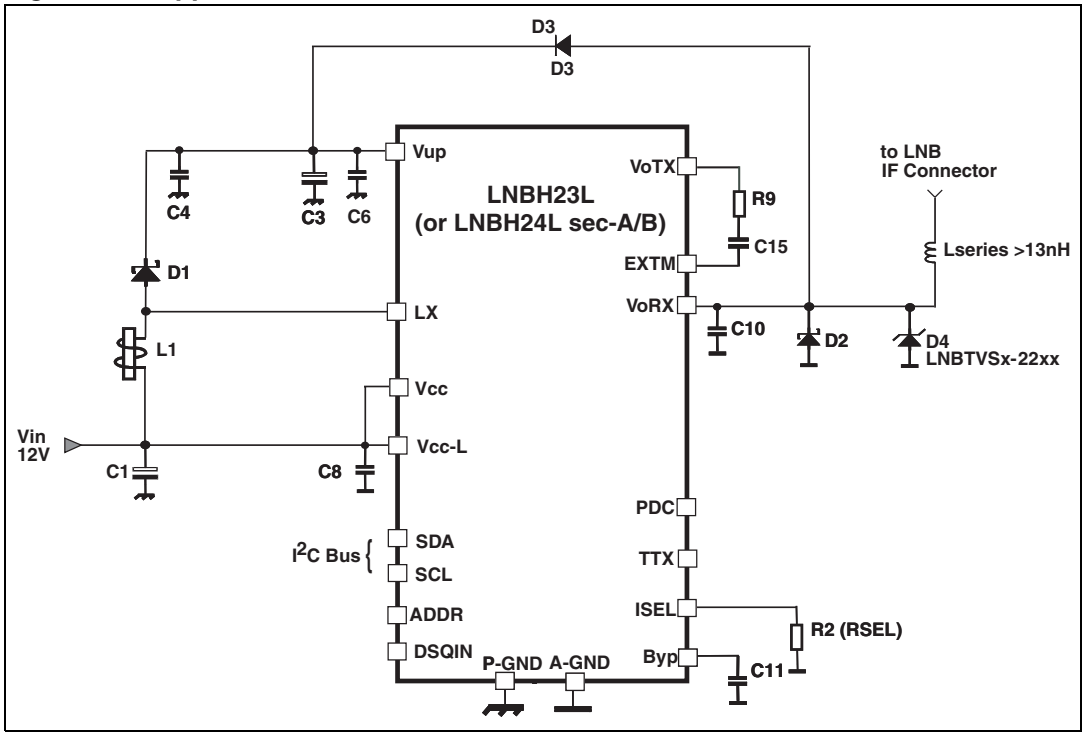




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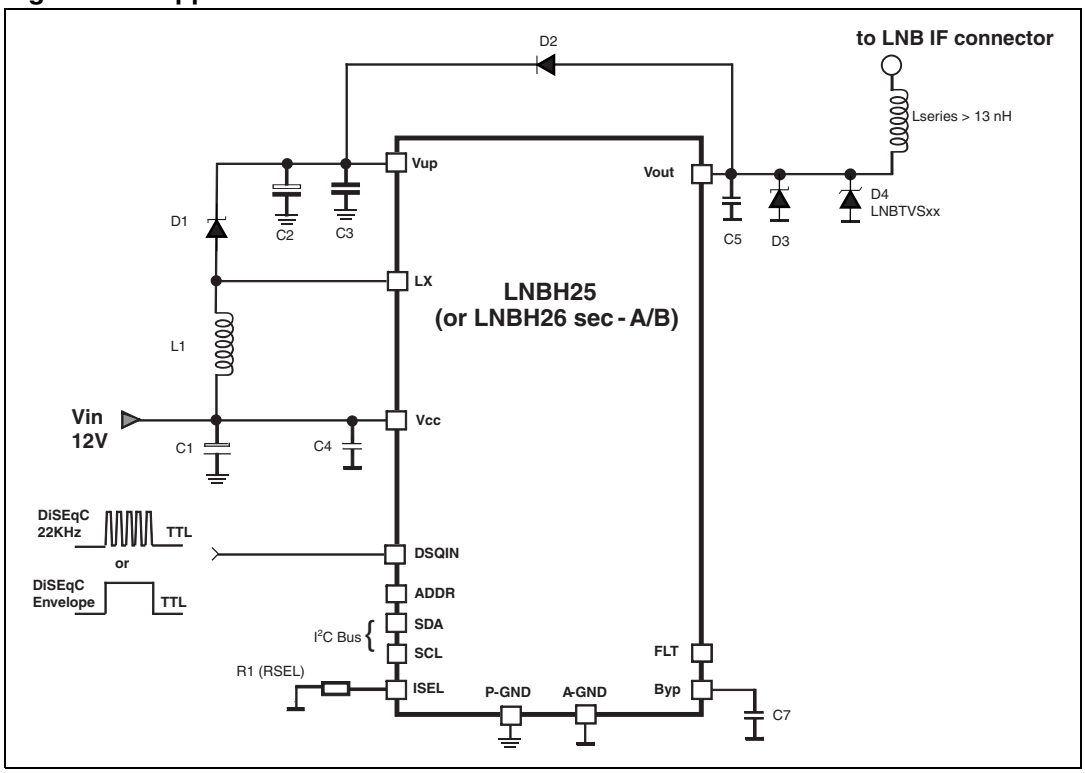
**Figure 8. Application schematic with LNBH25/26 and LNBTVSxx**




LNBHxx output is usually connected to the antenna cable of digital satellite receivers. Atmospheric phenomenon can cause high voltage discharges on the antenna cable causing damages to the attached devices.

In applications where it is required to be protected against lightning surges, transient voltage suppressor (TVS) devices like LNBTVSx-22xx can be used to protect LNBHxx and the other devices electrically connected to the antenna cable.

The LNBTVSx-22xx diodes are dedicated lightning and electrical overstress surge protection for LNBHxx voltage regulators. These protection diodes were designed to comply with the stringent IEC 61000-4-5 standard with surges up to 500 A with a whole range of products.

TVS diodes have intrinsic capacitance that attenuates the RF signal. For this reason, the LNBTVSx-22xx cannot be directly connected to the IF (RX/TX) cable connector that carries the RF signals coming from the LNB. To suppress the effect of the intrinsic capacitance, an inductance must be placed in series with the TVS diode (see *Figure 9*). The goal of the Lseries and LNBTVC inductance is to be transparent at 22 kHz and to reject frequencies higher than 900 MHz.

The value of the series inductance is usually > 13 nH, with a current capability higher than the Ipp (peak pulse current) expected during the surge.



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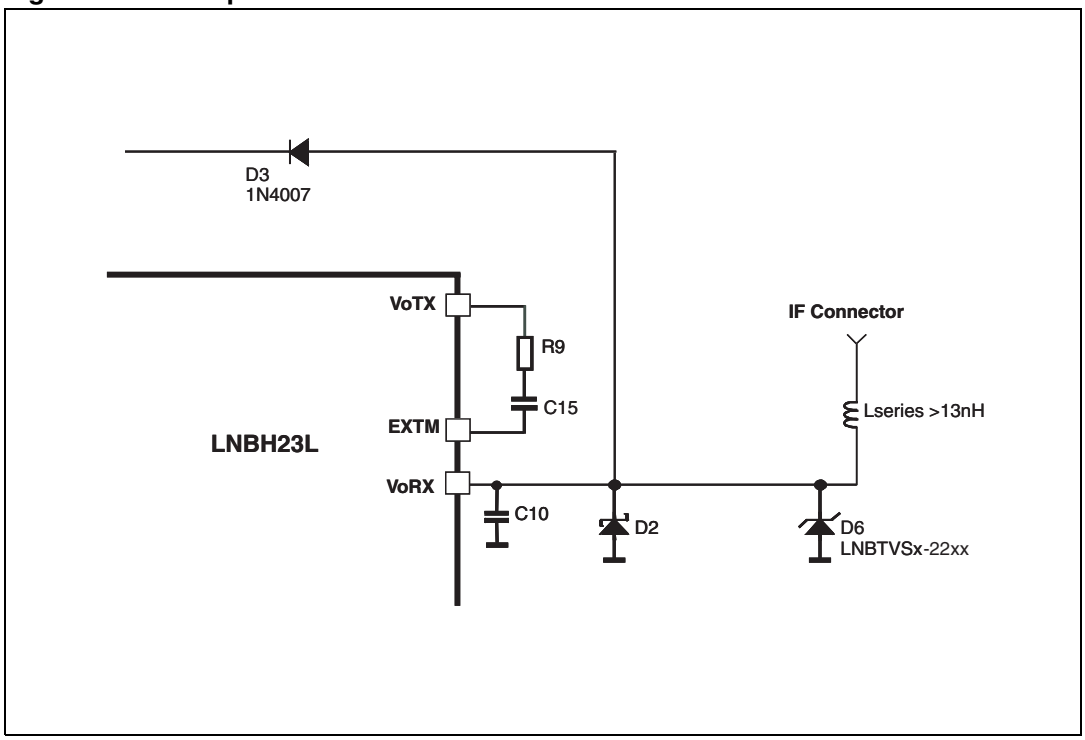
**Figure 9. Example of LNBTVS diode connection**



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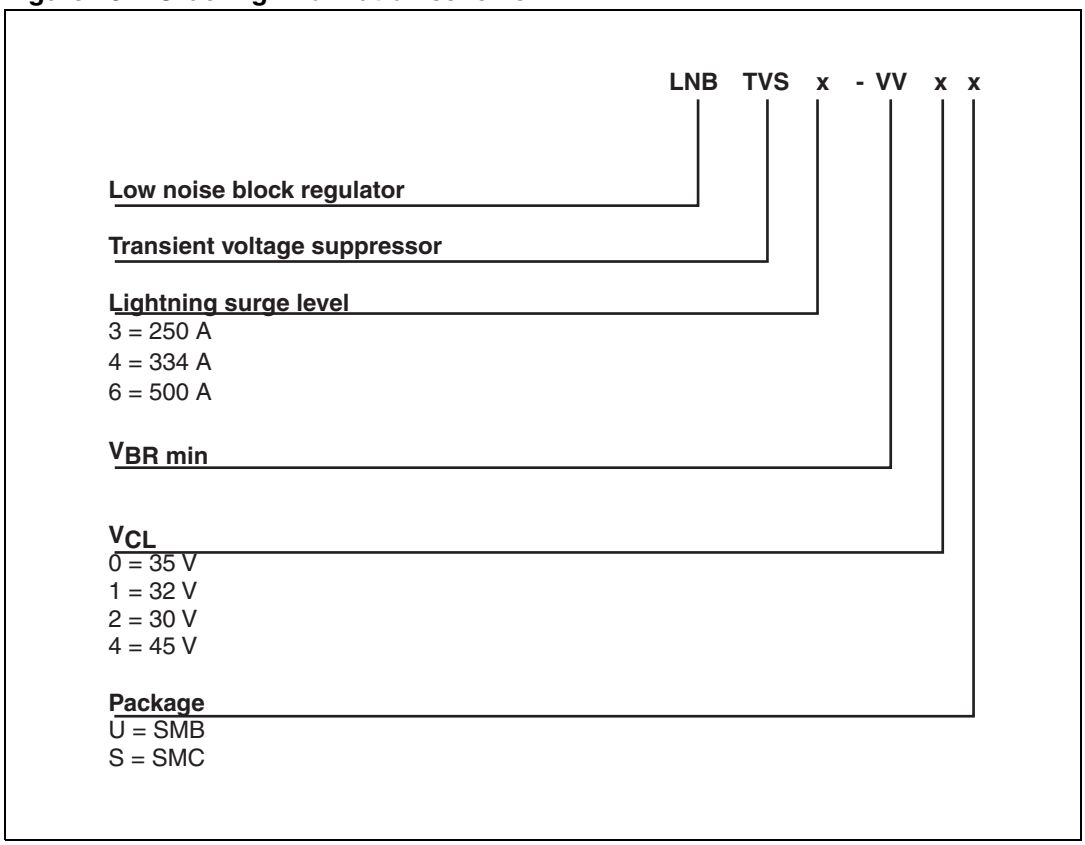
# 3 Ordering information scheme

**Figure 10. Ordering information scheme**



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# 4 Package information

- Case: JEDEC DO-214AB or JEDEC DO-214AA molded plastic over planar junction
- Terminals: solder plated, solderable as per MIL-STD-750, Method 2026
- Polarity: for unidirectional types the band indicates cathode
- Flammability: epoxy is rated UL 94, V0
- RoHS package

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

**Figure 11. SMC dimension definitions**

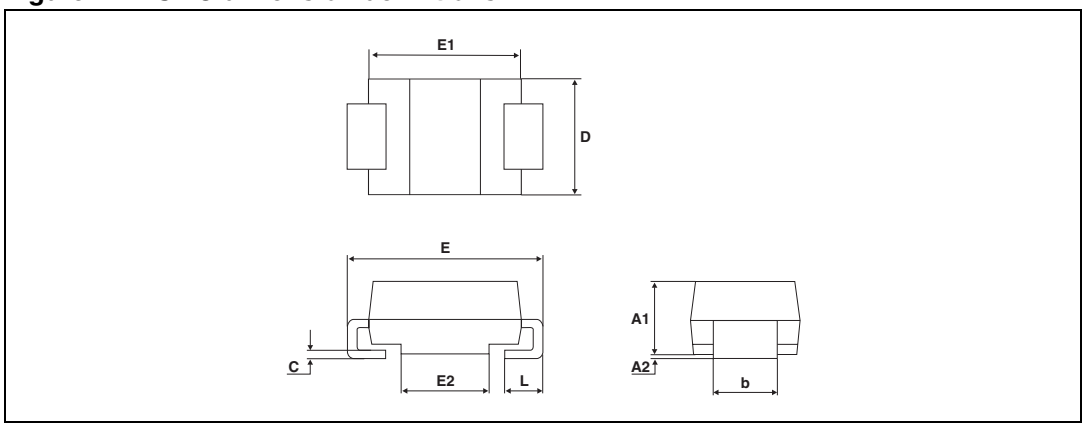


**Table 4. SMC dimension values**

| Ref. | Dimensions | | | |
|---|---|---|---|---|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A1 | 1.90 | 2.45 | 0.075 | 0.096 |
| A2 | 0.05 | 0.20 | 0.002 | 0.008 |
| b | 2.90 | 3.20 | 0.114 | 0.126 |
| c | 0.15 | 0.40 | 0.006 | 0.016 |
| D | 5.55 | 6.25 | 0.218 | 0.246 |
| E | 7.75 | 8.15 | 0.305 | 0.321 |
| E1 | 6.60 | 7.15 | 0.260 | 0.281 |
| E2 | 4.40 | 4.70 | 0.173 | 0.185 |
| L | 0.75 | 1.50 | 0.030 | 0.059 |



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**Figure 12. SMB dimension definitions**

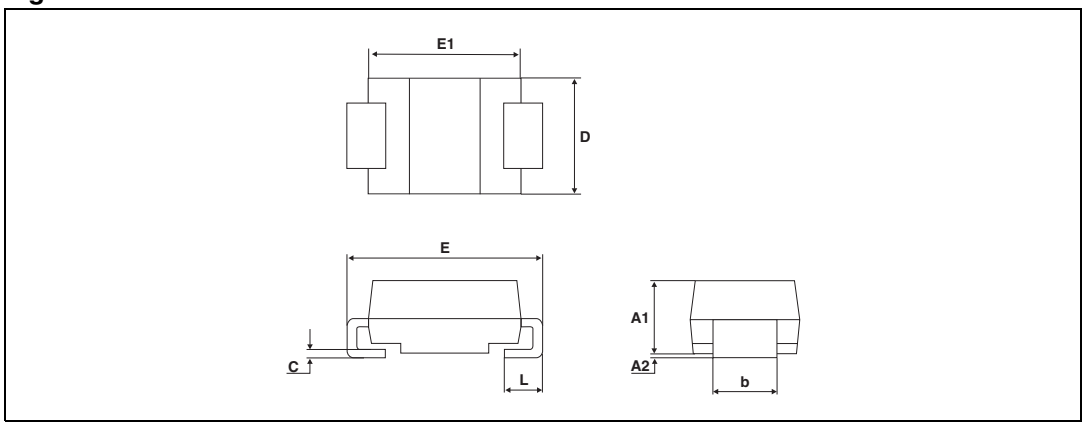


**Table 5. SMB dimension values**

| Ref. | Dimensions | | | |
|---|---|---|---|---|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A1 | 1.90 | 2.45 | 0.075 | 0.096 |
| A2 | 0.05 | 0.20 | 0.002 | 0.008 |
| b | 1.95 | 2.20 | 0.077 | 0.087 |
| c | 0.15 | 0.40 | 0.006 | 0.016 |
| D | 3.30 | 3.95 | 0.130 | 0.156 |
| E | 5.10 | 5.60 | 0.201 | 0.220 |
| E1 | 4.05 | 4.60 | 0.159 | 0.181 |
| L | 0.75 | 1.50 | 0.030 | 0.059 |

**Figure 13. SMC footprint dimensions in mm (inches)**

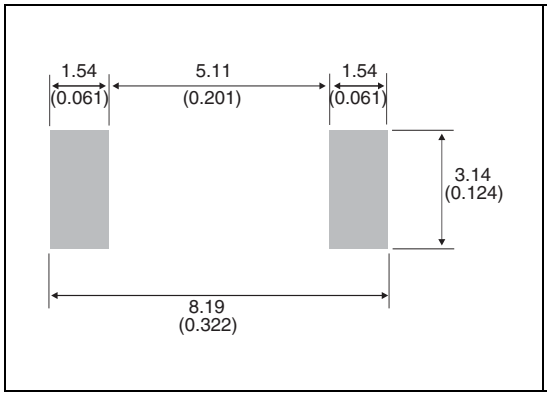


**Figure 14. SMB footprint dimensions in mm (inches)**

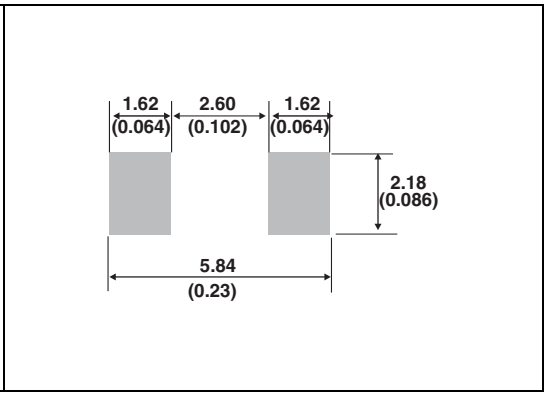




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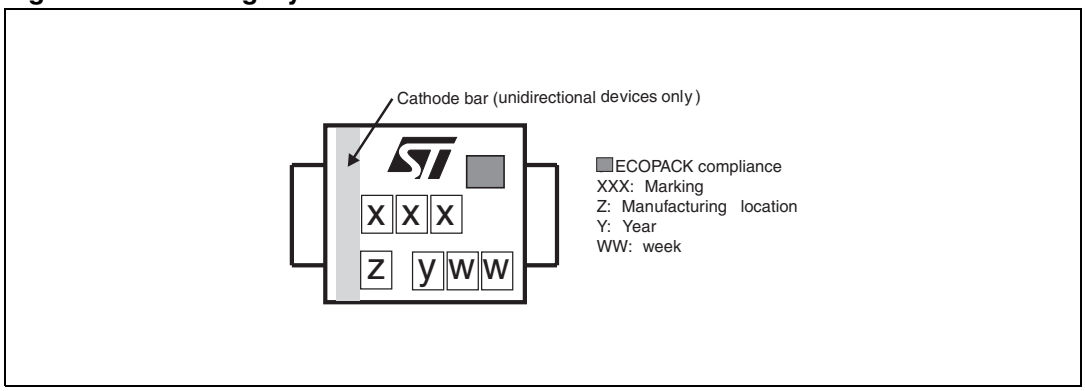
**Figure 15. Marking layout**




*Note: Marking layout can vary according to assembly location.*



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# 5 Ordering information

Table 6. Ordering information

| Order code | Marking | Package | Weight (g) | Base qty | Delivery mode |
|---|---|---|---|---|---|
| LNBTVS3-220U | LC | SMB | 0.107 | 2500 | Tape and reel |
| LNBTVS4-220S | LAA | SMC | 0.245 | 2500 | Tape and reel |
| LNBTVS4-221S | LAB | SMC | 0.245 | 2500 | Tape and reel |
| LNBTVS4-222S | LAC | SMC | 0.245 | 2500 | Tape and reel |
| LNBTVS6-220S | LBA | SMC | 0.245 | 2500 | Tape and reel |
| LNBTVS6-221S | LBB | SMC | 0.245 | 2500 | Tape and reel |
| LNBTVS4-304S | LAD | SMC | 0.245 | 2500 | Tape and reel |
| LNBTVS6-304S | LBC | SMC | 0.245 | 2500 | Tape and reel |

# 6 Revision history

Table 7. Document revision history

| Date | Revision | Changes |
|---|---|---|
| 30-Aug-2010 | 1 | First release. This document merges and updates the content of datasheets LNBTVSx-22xx Revision 3, 20-Jan-2007, and LNBTVSx-304 Revision 1, 01-Apr-2008. |
| 22-Oct-2010 | 2 | Updated *Figure 14.* |
| 05-Sep-2011 | 3 | Added *Figure 8*. |



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