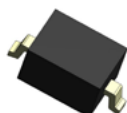


# STS321XXBXX1

## TVS Diode ESD suppressor



### Product features

- 400 Watts peak pulse power per line ( $t_p = 8/20 \mu s$ )
- Protects one bi-directional I/O line
- Low clamping voltage
- Low leakage current
- Meets moisture sensitivity level (MSL) 3
- Molding compound flammability rating: UL 94V-0
- Termination finish: Tin

### Applications

- Cellular handsets and accessories
- Microprocessor based equipment
- Portable electronics
- Notebooks, desktops, and servers
- Portable instrumentation
- Peripherals
- Pagers

### Environmental compliance and general specifications

- IEC61000-4-2 (ESD)
  - Up to  $\pm 30$  kV (air)
  - Up to  $\pm 30$  kV (contact)
- IEC61000-4-5 (Lightning) Up to 22 A (8/20  $\mu s$ )



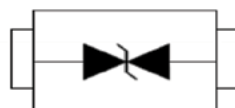
### Ordering part number

|                                | ST    | S32   | 1     | 033   | B     | 401   |
|--------------------------------|-------|-------|-------|-------|-------|-------|
| Family                         | _____ | _____ | _____ | _____ | _____ | _____ |
| Package (S32- SOD-323)         | _____ | _____ | _____ | _____ | _____ | _____ |
| Number of channels (1-1)       | _____ | _____ | _____ | _____ | _____ | _____ |
| Operating voltage (033- 3.3 V) | _____ | _____ | _____ | _____ | _____ | _____ |
| Bi/Uni directional (B- Bi)     | _____ | _____ | _____ | _____ | _____ | _____ |
| Capacitance (401- 40 pF)       | _____ | _____ | _____ | _____ | _____ | _____ |

### Pin out/functional diagram



SOD-323



Pin Configuration



Powering Business Worldwide

## Absolute maximum ratings

(+25 °C, RH=45%-75%, unless otherwise noted)

| Parameter                                             | Symbol    | Value             | Unit |
|-------------------------------------------------------|-----------|-------------------|------|
| Peak pulse power dissipation on 8/20 $\mu$ s waveform | $P_{PP}$  | 400               | W    |
| ESD per IEC 61000-4-2 (Air)                           | $V_{ESD}$ | +/-30             | kV   |
| ESD per IEC 61000-4-2 (Contact)                       |           | +/-30             |      |
| Lead soldering temperature                            | $T_L$     | +260 (10 seconds) | °C   |
| Operating junction temperature range                  | $T_J$     | -55 to +125       | °C   |
| Storage temperature range                             | $T_{STG}$ | -55 to +150       | °C   |

## Electrical characteristics

(+25 °C)

### STS321033B401

| Parameter                 | Test condition                           | Minimum | Typical | Maximum | Symbol (Units)   |
|---------------------------|------------------------------------------|---------|---------|---------|------------------|
| Reverse working voltage   | -                                        | -       | -       | 3.3     | $V_{RWM}$ (V)    |
| Reverse breakdown voltage | $I_T = 1$ mA                             | 3.6     | -       | -       | $V_{BR}$ (V)     |
| Reverse leakage current   | $V_{RWM} = 3.3$ V                        | -       | -       | 1       | $I_R$ ( $\mu$ A) |
| Clamping voltage          | $I_{PP} = 30$ A,<br>$t_p = 8/20$ $\mu$ s | -       | -       | 15      | $V_C$ (V)        |
| Junction capacitance      | $V_{RWM} = 0$ V, $f = 1$ MHz             | -       | 40      | 60      | $C_J$ (pF)       |

### STS321050B331

| Parameter                 | Test condition                           | Minimum | Typical | Maximum | Symbol (Units)   |
|---------------------------|------------------------------------------|---------|---------|---------|------------------|
| Reverse working voltage   | -                                        | -       | -       | 5       | $V_{RWM}$ (V)    |
| Reverse breakdown voltage | $I_T = 1$ mA                             | 5.5     | -       | -       | $V_{BR}$ (V)     |
| Reverse leakage current   | $V_{RWM} = 5$ V                          | -       | -       | 1       | $I_R$ ( $\mu$ A) |
| Clamping voltage          | $I_{PP} = 1$ A,<br>$t_p = 8/20$ $\mu$ s  | -       | -       | 9       | $V_C$ (V)        |
|                           | $I_{PP} = 22$ A,<br>$t_p = 8/20$ $\mu$ s | -       | -       | 18      | $V_C$ (V)        |
| Junction capacitance      | $V_{RWM} = 0$ V, $f = 1$ MHz             | -       | 33      | 75      | $C_J$ (pF)       |

### STS321120B301

| Parameter                 | Test condition                           | Minimum | Typical | Maximum | Symbol (Units)   |
|---------------------------|------------------------------------------|---------|---------|---------|------------------|
| Reverse working voltage   | -                                        | -       | -       | 12      | $V_{RWM}$ (V)    |
| Reverse breakdown voltage | $I_T = 1$ mA                             | 13.3    | -       | -       | $V_{BR}$ (V)     |
| Reverse leakage current   | $V_{RWM} = 12$ V                         | -       | -       | 1       | $I_R$ ( $\mu$ A) |
| Clamping voltage          | $I_{PP} = 1$ A,<br>$t_p = 8/20$ $\mu$ s  | -       | -       | 19      | $V_C$ (V)        |
|                           | $I_{PP} = 12$ A,<br>$t_p = 8/20$ $\mu$ s | -       | -       | 33      | $V_C$ (V)        |
| Junction capacitance      | $V_{RWM} = 0$ V, $f = 1$ MHz             | -       | 30      | 45      | $C_J$ (pF)       |

**STS321150B351**

| Parameter                 | Test condition                           | Minimum | Typical | Maximum | Symbol (Units)   |
|---------------------------|------------------------------------------|---------|---------|---------|------------------|
| Reverse working voltage   | -                                        | -       | -       | 15      | $V_{RWM}$ (V)    |
| Reverse breakdown voltage | $I_T = 1$ mA                             | 16.7    | -       | -       | $V_{BR}$ (V)     |
| Reverse leakage current   | $V_{RWM} = 15$ V                         | -       | -       | 1       | $I_R$ ( $\mu$ A) |
| Clamping voltage          | $I_{PP} = 1$ A,<br>$t_p = 8/20$ $\mu$ s  | -       | -       | 23      | $V_c$ (V)        |
|                           | $I_{PP} = 10$ A,<br>$t_p = 8/20$ $\mu$ s | -       | -       | 33      | $V_c$ (V)        |
|                           |                                          |         |         |         |                  |
| Junction capacitance      | $V_{RWM} = 0$ V, $f = 1$ MHz             | -       | 35      | 40      | $C_J$ (pF)       |

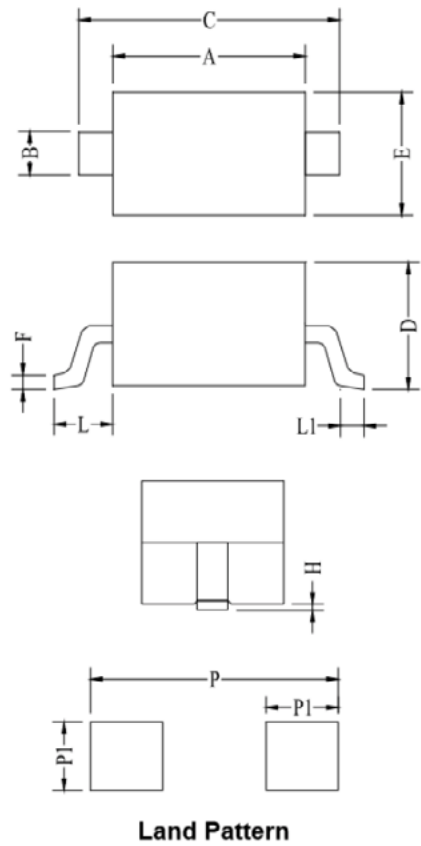
**STS321240B301**

| Parameter                 | Test condition                          | Minimum | Typical | Maximum | Symbol (Units)   |
|---------------------------|-----------------------------------------|---------|---------|---------|------------------|
| Reverse working voltage   | -                                       | -       | -       | 24      | $V_{RWM}$ (V)    |
| Reverse breakdown voltage | $I_T = 1$ mA                            | 26.7    | -       | -       | $V_{BR}$ (V)     |
| Reverse leakage current   | $V_{RWM} = 24$ V                        | -       | -       | 1       | $I_R$ ( $\mu$ A) |
| Clamping voltage          | $I_{PP} = 1$ A,<br>$t_p = 8/20$ $\mu$ s | -       | -       | 40      | $V_c$ (V)        |
|                           | $I_{PP} = 8$ A,<br>$t_p = 8/20$ $\mu$ s | -       | -       | 50      | $V_c$ (V)        |
|                           |                                         |         |         |         |                  |
| Junction capacitance      | $V_{RWM} = 0$ V, $f = 1$ MHz            | -       | 30      | 35      | $C_J$ (pF)       |

**STS321360B141**

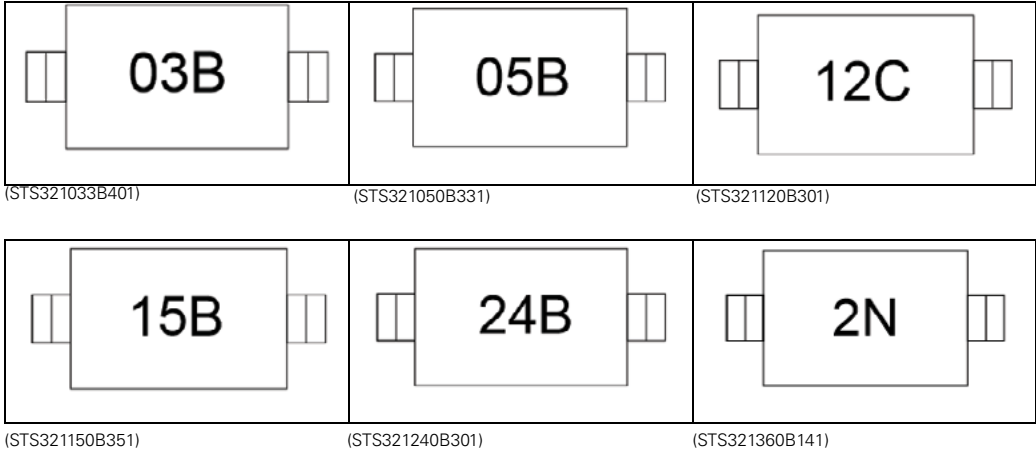
| Parameter                 | Test condition                          | Minimum | Typical | Maximum | Symbol (Units)   |
|---------------------------|-----------------------------------------|---------|---------|---------|------------------|
| Reverse working voltage   | -                                       | -       | -       | 36      | $V_{RWM}$ (V)    |
| Reverse breakdown voltage | $I_T = 1$ mA                            | 40      | 42      | 47.6    | $V_{BR}$ (V)     |
| Reverse leakage current   | $V_{RWM} = 36$ V                        | -       | -       | 0.2     | $I_R$ ( $\mu$ A) |
| Clamping voltage          | $I_{PP} = 1$ A,<br>$t_p = 8/20$ $\mu$ s | -       | 45      | 60      | $V_c$ (V)        |
|                           | $I_{PP} = 6$ A,<br>$t_p = 8/20$ $\mu$ s | -       | 60      | 70      | $V_c$ (V)        |
|                           |                                         |         |         |         |                  |
| Junction capacitance      | $V_{RWM} = 0$ V, $f = 1$ MHz            | -       | 14      | 25      | $C_J$ (pF)       |

Mechanical parameters, pad layout- mm/inches



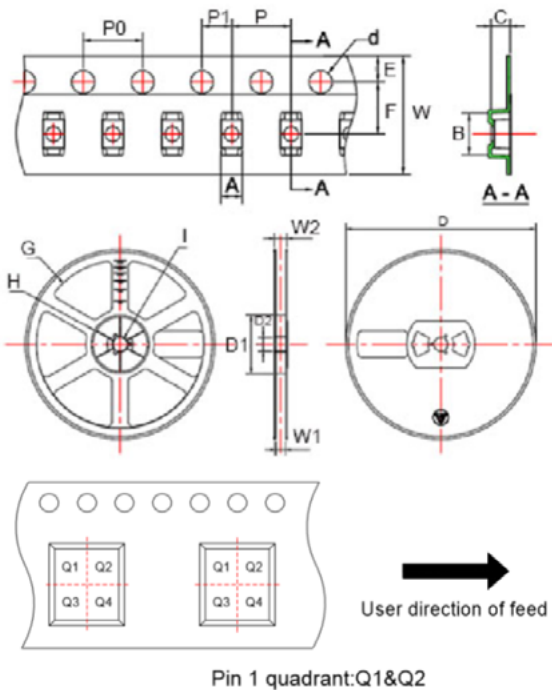
| Dimension | Millimeters |         | Inches    |         |
|-----------|-------------|---------|-----------|---------|
|           | Minimum     | Maximum | Minimum   | Maximum |
| A         | 1.60        | 1.80    | 0.063     | 0.071   |
| B         | 0.25        | 0.35    | 0.010     | 0.014   |
| C         | 2.50        | 2.75    | 0.098     | 0.108   |
| D         | 0.00        | 1.00    | 0.000     | 0.039   |
| E         | 1.20        | 1.40    | 0.047     | 0.055   |
| F         | 0.08        | 0.15    | 0.003     | 0.006   |
| L         | 0.475 REF   |         | 0.019 REF |         |
| L1        | 0.25        | 0.40    | 0.010     | 0.016   |
| H         | 0.00        | 0.10    | 0.000     | 0.004   |
| P         | 3.00        |         | 0.118     |         |
| P1        | 0.80        |         | 0.031     |         |

Part marking



Packaging information mm/inches

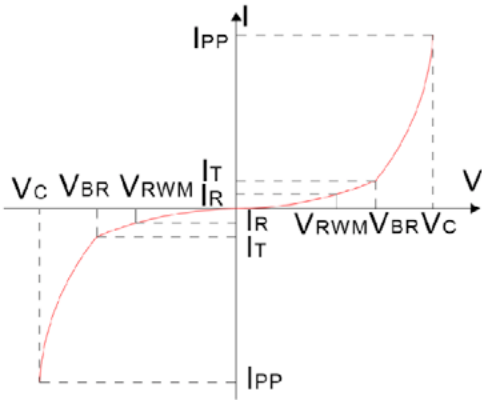
Drawing not to scale.  
Supplied in tape and reel packaging, 3,000 parts per 7" diameter reel (EIA-481 compliant)



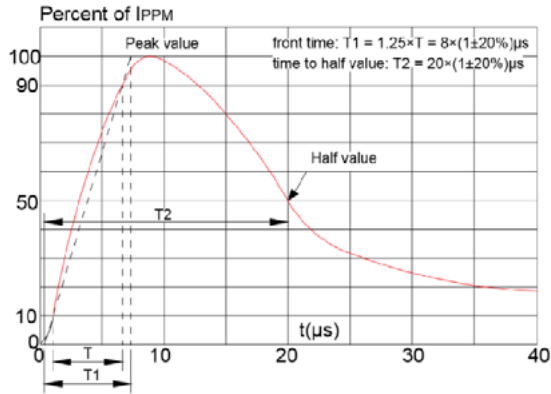
| Symbol | Millimeters   | Inches             |
|--------|---------------|--------------------|
| A      | 1.46±0.05     | 0.057±0.002        |
| B      | 2.90±0.05     | 0.114±0.002        |
| C      | 1.25±0.05     | 0.049±0.002        |
| d      | ±1.50±0.1     | ±0.059±0.004       |
| E      | 1.75±0.1      | 0.069±0.004        |
| F      | 3.50±0.1      | 0.138±0.004        |
| P0     | 4.0±0.1       | 0.157±0.004        |
| P      | 4.0±0.1       | 0.157±0.004        |
| P1     | 2.0±0.1       | 0.079±0.004        |
| W      | 8.00+0.3/-0.1 | 0.315+0.012/-0.004 |
| D      | ±178.0±2      | ±7.008±0.079       |
| D1     | 54.40±1       | 2.142±0.039        |
| D2     | 13.0±1        | 0.512±0.039        |
| G      | R78.0±1       | R3.071±0.039       |
| H      | R25.60±1      | R1.008±0.039       |
| I      | R6.50±1       | R0.256±0.039       |
| W1     | 9.50±1        | 0.374±0.039        |
| W2     | 12.30±1       | 0.484±0.039        |

Ratings and V-I characteristic curves (+25 °C unless otherwise noted)

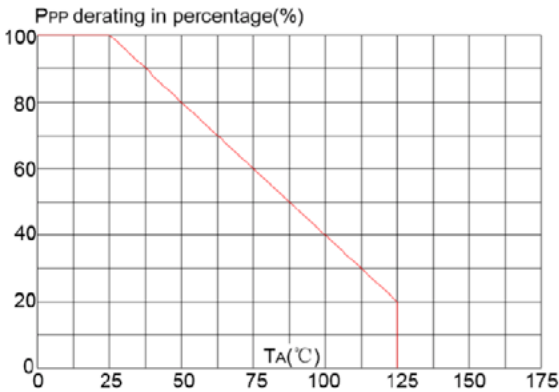
V- I curve characteristics (Bi-directional)



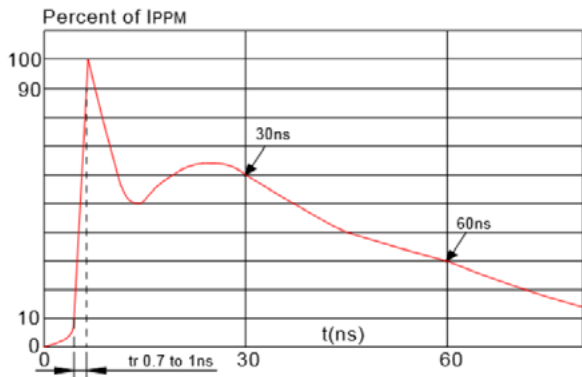
Pulse waveform (8/20  $\mu$ s)



Pulse derating curve



ESD waveform



## Solder reflow profile

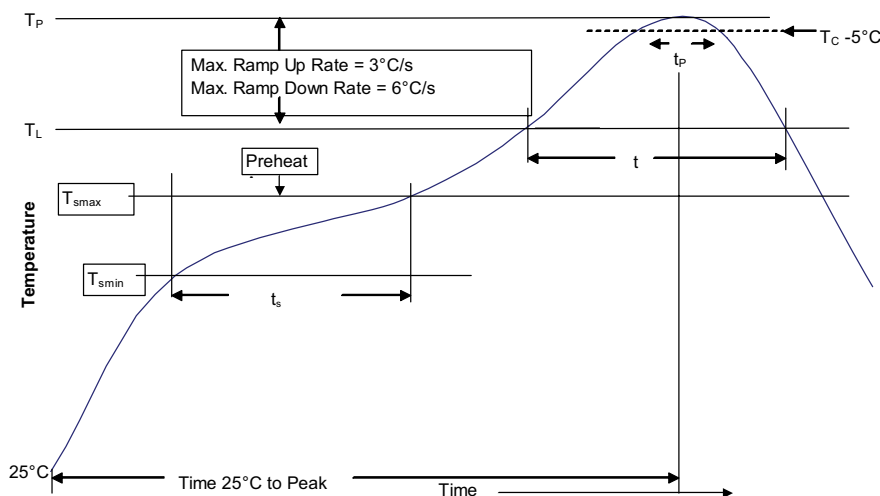


Table 1 - Standard SnPb solder ( $T_C$ )

| Package thickness | Volume mm <sup>3</sup> <350 | Volume mm <sup>3</sup> ≥350 |
|-------------------|-----------------------------|-----------------------------|
| <2.5 mm           | 235 °C                      | 220 °C                      |
| ≥2.5 mm           | 220 °C                      | 220 °C                      |

Table 2 - Lead (Pb) free solder ( $T_C$ )

| Package thickness | Volume mm <sup>3</sup> <350 | Volume mm <sup>3</sup> 350 - 2000 | Volume mm <sup>3</sup> >2000 |
|-------------------|-----------------------------|-----------------------------------|------------------------------|
| <1.6 mm           | 260 °C                      | 260 °C                            | 260 °C                       |
| 1.6 - 2.5 mm      | 260 °C                      | 250 °C                            | 245 °C                       |
| >2.5 mm           | 250 °C                      | 245 °C                            | 245 °C                       |

## Reference J-STD-020

| Profile feature                                                                   | Standard SnPb solder | Lead (Pb) free solder |
|-----------------------------------------------------------------------------------|----------------------|-----------------------|
| Preheat and soak                                                                  |                      |                       |
| • Temperature min. ( $T_{smin}$ )                                                 | 100 °C               | 150 °C                |
| • Temperature max. ( $T_{smax}$ )                                                 | 150 °C               | 200 °C                |
| • Time ( $T_{smin}$ to $T_{smax}$ ) ( $t_s$ )                                     | 60-120 seconds       | 60-120 seconds        |
| Ramp up rate $T_L$ to $T_p$                                                       | 3 °C/ second max.    | 3 °C/ second max.     |
| Liquidous temperature ( $T_L$ )                                                   | 183 °C               | 217 °C                |
| Time ( $t_L$ ) maintained above $T_L$                                             | 60-150 seconds       | 60-150 seconds        |
| Peak package body temperature ( $T_p$ )*                                          | Table 1              | Table 2               |
| Time ( $t_p$ )* within 5 °C of the specified classification temperature ( $T_C$ ) | 20 seconds*          | 30 seconds*           |
| Ramp-down rate ( $T_p$ to $T_L$ )                                                 | 6 °C/ second max.    | 6 °C/ second max.     |
| Time 25 °C to peak temperature                                                    | 6 minutes max.       | 8 minutes max.        |

\* Tolerance for peak profile temperature ( $T_p$ ) is defined as a supplier minimum and a user maximum.

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