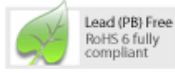


HBAT-5402

Clipping/clamping diode

Description



Lifecycle status: **Active**



Features

Lower frequency, general purpose, Schottky Diode. Used primarily for clipping and clamping clamp applications, the low series resistance, low capacitance and fast switching time makes this an ideal choice. $R_s=2.4$ Ohms. $C_t=3.0$ pF. $V_{br}=30V$. $V_f=800mV$ @ $I_F=100mA$

HBAT-5400, 5402, 540B, 540C

High Performance Schottky Diode for Transient Suppression

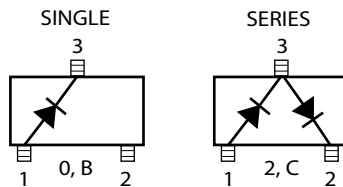


Data Sheet

Description

The HBAT-540x series of Schottky diodes, commonly referred to as clipping/clamping diodes, are optimal for circuit and waveshape preservation applications with high speed switching. Low series resistance, R_s , makes them ideal for protecting sensitive circuit elements against high current transients carried on data lines. With picosecond switching, the HBAT-540x can respond to noise spikes with rise times as fast as 1 ns. Low capacitance minimizes waveshape loss that causes signal degradation.

Package Lead Code Identification (Top View)



Features

- Ultra-low Series Resistance for Higher Current Handling
- Low Capacitance
- Low Series Resistance
- Lead-free Option Available

Applications

RF and computer designs that require circuit protection, high-speed switching, and voltage clamping.

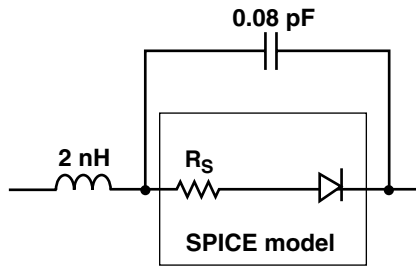
Absolute Maximum Ratings, $T_A = 25^\circ\text{C}$

| Symbol | Parameter | Unit | Absolute Maximum ^[1] | |
|---------------|--------------------------------------------|---------------------------|---------------------------------|-----------------|
| | | | HBAT-5400/-5402 | HBAT-540B/-540C |
| I_F | DC Forward Current | mA | 220 | 430 |
| I_{F-peak} | Peak Surge Current (1 μs pulse) | A | 1.0 | 1.0 |
| P_T | Total Power Dissipation | mW | 250 | 825 |
| P_{INV} | Peak Inverse Voltage | V | 30 | 30 |
| T_J | Junction Temperature | $^\circ\text{C}$ | 150 | 150 |
| T_{STG} | Storage Temperature | $^\circ\text{C}$ | -65 to 150 | -65 to 150 |
| θ_{JC} | Thermal Resistance, junction to lead | $^\circ\text{C}/\text{W}$ | 500 | 150 |

Note:

1. Operation in excess of any one of these conditions may result in permanent damage to the device.

Linear and Non-linear SPICE Model^[2]



Note:

2. To effectively model the packaged HBAT-540x product, please refer to Application Note AN1124.

SPICE Parameters

| Parameter | Unit | Value |
|-----------|----------|--------|
| BV | V | 40 |
| CJO | pF | 3.0 |
| EG | eV | 0.55 |
| IBV | A | 10E-4 |
| IS | A | 1.0E-7 |
| N | | 1.0 |
| RS | Ω | 2.4 |
| PB | V | 0.6 |
| PT | | 2 |
| M | | 0.5 |

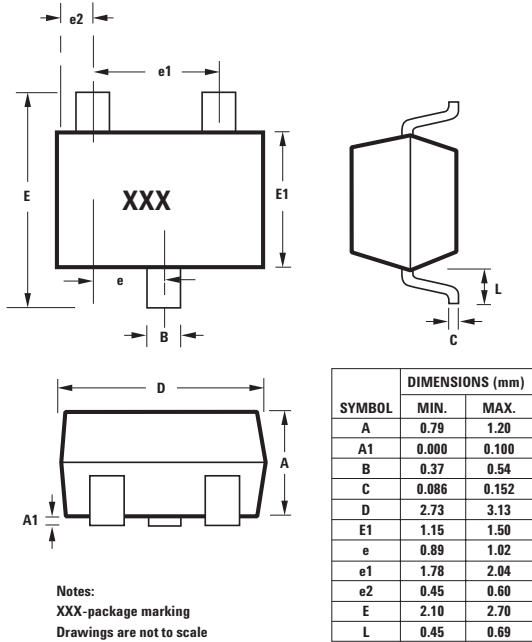
HBAT-540x DC Electrical Specifications, $T_A = +25^\circ\text{C}$ ^[1]

| Part Number HBAT-Code ^[2] | Package Marking Code | Lead Configuration | Package | V_F (mV) | Maximum Forward Voltage | Minimum Breakdown Voltage | Typical Capacitance | Typical Series Resistance | Maximum Eff. Carrier Lifetime |
|-----------------------------------------|----------------------|--------------------|---------|---------------------------|-------------------------|---------------------------|---------------------|---------------------------|-------------------------------|
| | | | | | V_{BR} (V) | C_T (pF) | R_S (Ω) | t (ps) | |
| -5400 | V0 | 0 | Single | SOT-23 | 800 ^[3] | 30 ^[4] | 3.0 ^[5] | 2.4 | 100 ^[6] |
| -540B | | B | | SOT-323 (3-lead SC-70) | | | | | |
| -5402 | V2 | 2 | Series | SOT-23 | 800 ^[3] | 30 ^[4] | 3.0 ^[5] | 2.4 | 100 ^[6] |
| -540C | | C | | SOT-323 (3-lead SC-70) | | | | | |

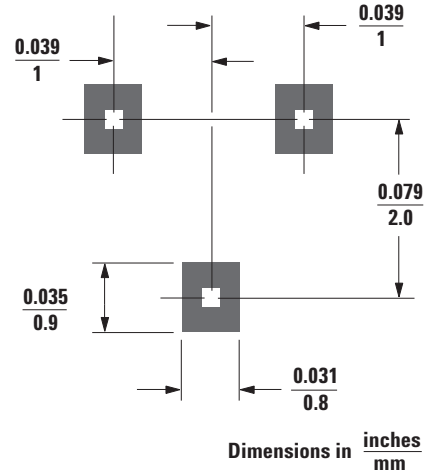
Notes:

1. $T_A = +25^\circ\text{C}$, where T_A is defined to be the temperature at the package pins where contact is made to the circuit board.
2. Package marking code is laser marked.
3. $I_F = 100$ mA; 100% tested
4. $I_R = 100$ μA ; 100% tested
5. $V_F = 0$; $f = 1$ MHz
6. Measured with Karkauer method at 20 mA guaranteed by design.

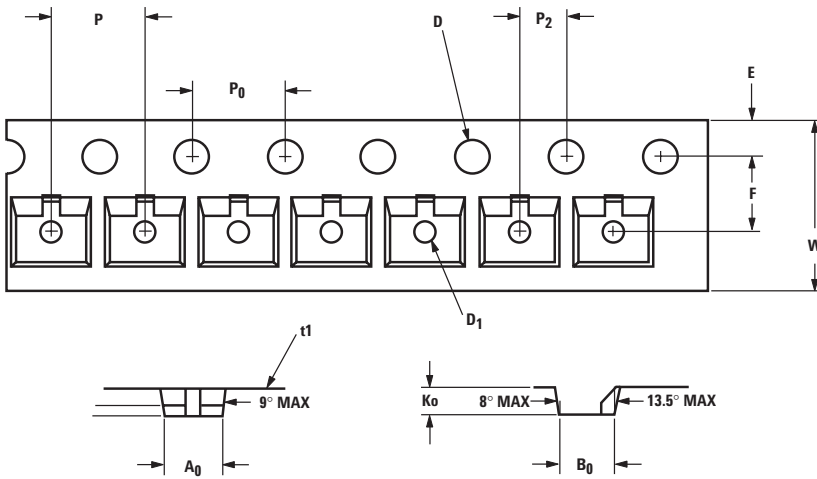
Package Dimensions Outline SOT-23



Recommended PCB Pad Layout for Avago's SOT-23 Products



Tape Dimensions and Product Orientation For Outline SOT-23



| DESCRIPTION | | SYMBOL | SIZE (mm) | SIZE (INCHES) |
|-----------------------------|------------------------------------------|----------------|--------------------|-----------------------|
| CAVITY | LENGTH | A ₀ | 3.15 ± 0.10 | 0.124 ± 0.004 |
| | WIDTH | B ₀ | 2.77 ± 0.10 | 0.109 ± 0.004 |
| | DEPTH | K ₀ | 1.22 ± 0.10 | 0.048 ± 0.004 |
| | PITCH | P | 4.00 ± 0.10 | 0.157 ± 0.004 |
| | BOTTOM HOLE DIAMETER | D ₁ | 1.00 + 0.05 | 0.039 ± 0.002 |
| PERFORATION | DIAMETER | D | 1.50 + 0.10 | 0.059 + 0.004 |
| | PITCH | P ₀ | 4.00 ± 0.10 | 0.157 ± 0.004 |
| | POSITION | E | 1.75 ± 0.10 | 0.069 ± 0.004 |
| CARRIER TAPE | WIDTH | W | 8.00 + 0.30 - 0.10 | 0.315 + 0.012 - 0.004 |
| | THICKNESS | t ₁ | 0.229 ± 0.013 | 0.009 ± 0.0005 |
| DISTANCE BETWEEN CENTERLINE | CAVITY TO PERFORATION (WIDTH DIRECTION) | F | 3.50 ± 0.05 | 0.138 ± 0.002 |
| | CAVITY TO PERFORATION (LENGTH DIRECTION) | P ₂ | 2.00 ± 0.05 | 0.079 ± 0.002 |

The key factors in these equations are: R_s , the series resistance of the diode where heat is generated under high current conditions; θ_{chip} , the chip thermal resistance of the Schottky die; and $\theta_{package}$, or the package thermal resistance.

R_s for the HBA540x family of diodes is typically 2.4Ω , other than the HSMS-270x family, this is the lowest of any Schottky diode available. Chip thermal resistance is typically $40^\circ\text{C}/\text{W}$; the thermal resistance of the iron-alloy-leadframe, SOT-23 package is typically $460^\circ\text{C}/\text{W}$; and the thermal resistance of the copper-leadframe, SOT-323 package is typically $110^\circ\text{C}/\text{W}$. The impact of package thermal resistance on the current handling capability of these diodes can be seen in Figures 3 and 4. Here the computed values of junction temperature vs. forward current are shown for three values of ambient temperature. The SOT-323 products, with their copper leadframes, can safely handle almost twice the current of the larger SOT-23 diodes. Note that the term "ambient temperature" refers to the temperature of the diode's leads, not the air around the circuit board. It can be seen that the HBA540B and HBA540C products in the SOT-323 package will safely withstand a steady-state forward current of 330 mA when the diode's terminals are maintained at 75°C .

For pulsed currents and transient current spikes of less than one microsecond in duration, the junction does not have time to reach thermal steady state. Moreover, the diode junction may be taken to temperatures higher than 150°C for short time periods without impacting device MTTF. Because of these factors, higher currents can be safely handled. The HBA540x family has the second highest current handling capability of any Avago diode, next to the HSMS-270x series.

Part Number Ordering Information

| Part Number | No. of Devices | Container |
|--------------|----------------|----------------|
| HBA5400-BLKG | 100 | Antistatic Bag |
| HBA5400-TR1G | 3,000 | 7" Reel |
| HBA5400-TR2G | 10,000 | 13" Reel |
| HBA5402-BLKG | 100 | Antistatic Bag |
| HBA5402-TR1G | 3,000 | 7" Reel |
| HBA5402-TR2G | 10,000 | 13" Reel |
| HBA540B-BLKG | 100 | Antistatic Bag |
| HBA540B-TR1G | 3,000 | 7" Reel |
| HBA540B-TR2G | 10,000 | 13" Reel |
| HBA540C-BLKG | 100 | Antistatic Bag |
| HBA540C-TR1G | 3,000 | 7" Reel |
| HBA540C-TR2G | 10,000 | 13" Reel |