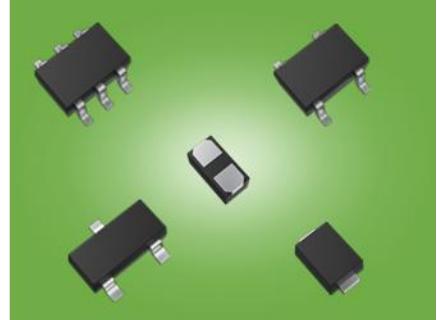


Introduction of Toshiba Small Signal Schottky Barrier Diode

Toshiba offers a wide range of Schottky Barrier Diodes (SBD) mounted in small packages, including low-voltage types and low leakage current types.

Toshiba, a leading company in Diodes

Since Toshiba started mass production of diodes in 1956, it has been one of the major diode vendors who have continued to market products as a pioneer in the industry since the early days of semiconductors. We will continue to provide a wide range of highly reliable diode products based on our experience in delivering products to many customers.

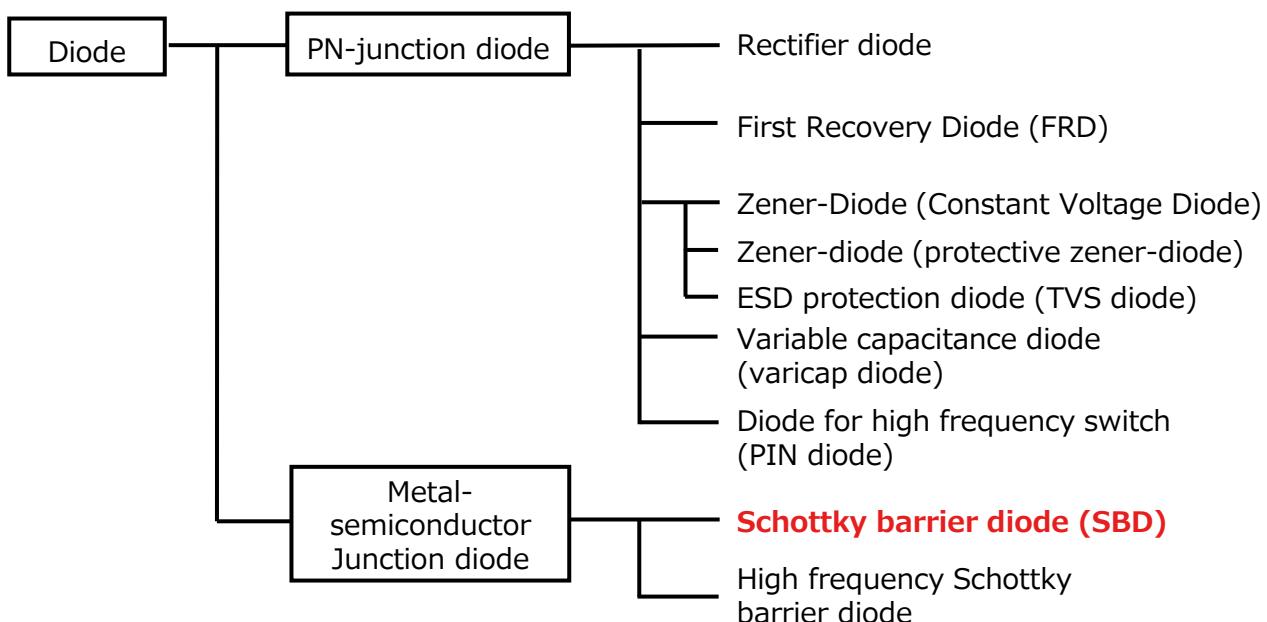


High-quality, stable production system at plants in Japan and Thailand

Our diode products are mainly surface mount type small packages. We will provide high-quality, stable production at our plants in Japan and Thailand.

Schottky barrier diode overview

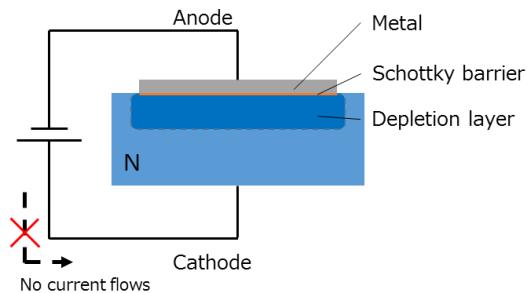
A diode is a two-terminal semiconductor device with one PN junction or an alternative junction. They are broadly classified as shown in the figure below. A Schottky barrier diode is utilizing a Schottky barrier created by junction between a metal and semiconductor. Compared to PN-junction diode, this diode has a lower forward-voltage (V_F) and faster switching performance. Therefore, power supply circuits can be made more efficient and more compact, and they are widely used in IoT, communication equipment, power supplies, industrial applications, etc.



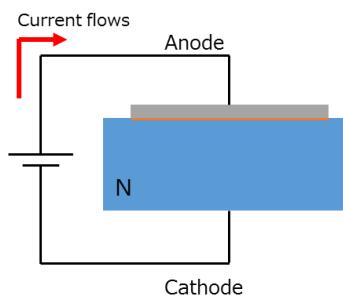
Basic Structure and Operation of Schottky Barrier Diode (SBD)

A schottky barrier diode has the same properties as PN junction diodes in that current flows (forward direction) and no current flows (reverse direction) according to the direction of the applied voltage. Therefore it is also used as rectifying devices. The electrode terminals are called the anode(A) and cathode(K), and current flows when the anode electrode has a positive voltage.

Apply voltage in reverse direction

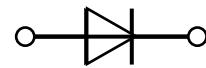


Apply voltage in forward direction

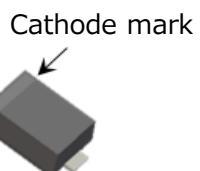


Anode (A)

Cathode (K)



Diode symbol mark



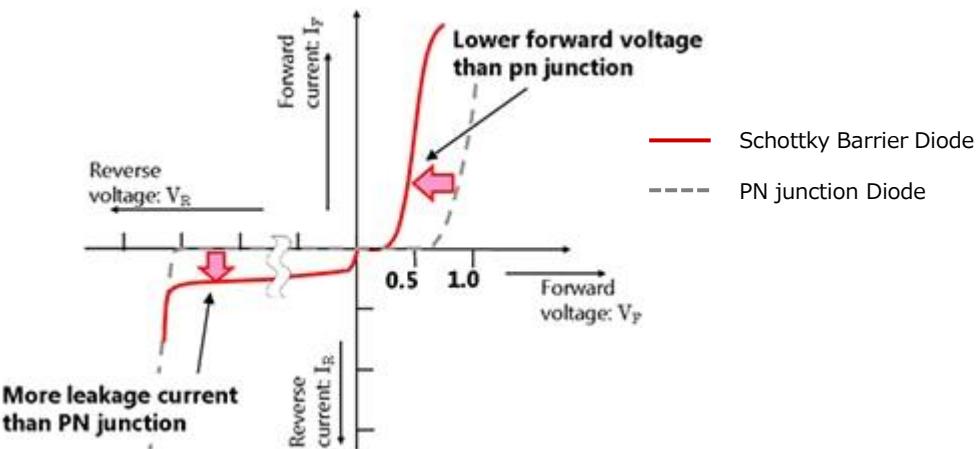
Cathode mark

Structural drawing of SBD (example)

Diode Package (Example)

A depletion layer is created in a part of semiconductor by the junction (Schottky junction) of a metal and a semiconductor, enabling rectifying operations to be performed in the same way as a PN junction diode. A energy barrier called a Schottky barrier is formed at the junction, and current can be flow through by applying a voltage. However, it has the advantage of low forward voltage (V_F) and high speed switching characteristic because it allows current to flow with less energy than a PN junction diode. By utilizing such characteristics, it contribute to higher efficiency and miniaturization of power supply circuits, etc.

Since the reverse current (I_R) increases than PN junction diode, it is sensitive to heat (thermal runaway). Therefore, attention must be paid to thermal design and operating conditions.



Schottky Barrier Diode Current vs. Voltage Characteristics (Example)

The characteristic of V_F vs. I_R depend on the metallic material. We offer a lineup of low VF and low IR products in a various packages and ratings. We would appreciate you to select the suitable product from the selection table for the Schottky barrier diodes next section.

Schottky Barrier Diode Selection Table (1)

Io > 0.5A

Io < 0.5A(1)

Io < 0.5A(2)

Click

| VR | Io | Part Number | Feature | VF typ (V) | IR max (μA) | Int. Circuit | Pin | Package (Toshiba) | Package dimension (mm) | Buy Online |
|-----|------|---------------------------|-------------------------------|------------|-------------|--------------|-----|-------------------|------------------------|---|
| 60V | 2.0A | CUHS20F60 | High Voltage / High current | 0.52 | 70 | Single | 2 | US2H | 2.5×1.4×0.6 |  |
| | | CUHS20S60 | High voltage/ Low VF | 0.46 | 650 | | 2 | US2H | 2.5×1.4×0.6 |  |
| | 1.5A | CUHS15F60 | High Voltage / High current | 0.66 | 50 | | 2 | US2H | 2.5×1.4×0.6 |  |
| | | CUHS15S60 | High voltage/ Low VF | 0.60 | 450 | | 2 | US2H | 2.5×1.4×0.6 |  |
| | 1.0A | CUHS10F60 | High voltage/ Low VF | 0.56 | 40 | | 2 | US2H | 2.5×1.4×0.6 |  |
| | | CUHS20F40 | High current/ Low IR | 0.47 | 60 | | 2 | US2H | 2.5×1.4×0.6 |  |
| | 40V | CUHS20S40 | High current/ Low VF | 0.40 | 300 | | 2 | US2H | 2.5×1.4×0.6 |  |
| | | CCS15F40 | High current/ Low IR | 0.59 | 25 | | 2 | CST2C | 1.6 x 0.8 x 0.48 |  |
| | | CCS15S40 | High current/ Low VF | 0.47 | 200 | | 2 | CST2C | 1.6 x 0.8 x 0.48 |  |
| | | CUS15S40 | High current/ Low VF | 0.47 | 200 | | 2 | USC | 2.5×1.25×0.9 |  |
| | | CUHS15F40 | High current/ Low IR | 0.57 | 50 | | 2 | US2H | 2.5×1.4×0.6 |  |
| | 30V | CUHS15S40 | High current/ Low VF | 0.45 | 200 | | 2 | US2H | 2.5×1.4×0.6 |  |
| | | CLS10F40 | High current/ Low IR | 0.52 | 25 | Single | 2 | CL2E | 1.0 x 0.6 x 0.28 |  |
| | | CBS10F40 | High current/ Low IR | 0.63 | 20 | | 2 | CST2B | 1.2 x 0.8 x 0.38 |  |
| | | CBS10S40 | High current/ Low VF | 0.48 | 150 | | 2 | CST2B | 1.2 x 0.8 x 0.38 |  |
| | | CUS10F40 | High current/ Low IR | 0.60 | 20 | | 2 | USC | 2.5×1.25×0.9 |  |
| | 0.5A | CUS10S40 | High current/ Low VF | 0.45 | 150 | | 2 | USC | 2.5×1.25×0.9 |  |
| | | CTS05F40 | High speed switching / Low IR | 0.74 | 15 | | 2 | CST2 | 1.0 x 0.6 x 0.38 |  |
| | | CTS05S40 | High speed switching | 0.56 | 50 | | 2 | CST2 | 1.0 x 0.6 x 0.38 |  |
| | | CUS05F40 | High speed switching / Low IR | 0.74 | 15 | | 2 | USC | 2.5×1.25×0.9 |  |
| | | CUS05S40 | High speed switching | 0.56 | 50 | | 2 | USC | 2.5×1.25×0.9 |  |
| | 2.0A | CUHS20F30 | High current/ Low IR | 0.40 | 60 | Single | 2 | US2H | 2.5×1.4×0.6 |  |
| | | CUHS20S30 | High current/ Low VF | 0.34 | 500 | | 2 | US2H | 2.5×1.4×0.6 |  |
| | | CCS15S30 | High current/ Low VF | 0.39 | 500 | | 2 | CST2C | 1.6 x 0.8 x 0.48 |  |
| | | CUS15S30 | High current/ Low VF | 0.39 | 500 | | 2 | USC | 2.5×1.25×0.9 |  |
| | | CUHS15F30 | High current/ Low IR | 0.46 | 50 | | 2 | US2H | 2.5×1.4×0.6 |  |
| | 1.5A | CUHS15S30 | High current/ Low VF | 0.37 | 500 | | 2 | US2H | 2.5×1.4×0.6 |  |
| | | CBS10S30 | High current/ Low VF | 0.39 | 500 | | 2 | CST2B | 1.2 x 0.8 x 0.38 |  |
| | | CUS10F30 | High current/ Low VF | 0.43 | 50 | | 2 | USC | 2.5×1.25×0.9 |  |
| | | CUS10S30 | High current/ Low VF | 0.37 | 500 | | 2 | USC | 2.5×1.25×0.9 |  |
| | | CTS05S30 | High speed switching | 0.41 | 300 | Single | 2 | CST2 | 1.0 x 0.6 x 0.38 |  |
| | 0.5A | CBS05F30 | High speed switching | 0.38 | 50 | | 2 | CST2B | 1.2 x 0.8 x 0.38 |  |
| | | CUS05F30 | High speed switching | 0.38 | 50 | | 2 | USC | 2.5×1.25×0.9 |  |
| | | CUS05S30 | High speed switching | 0.41 | 300 | | 2 | USC | 2.5×1.25×0.9 |  |

Schottky Barrier Diode Selection Table (2)

Io > 0.5A

Io < 0.5A(1)

Io < 0.5A(2)

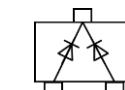
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| VR | Io | Part Number | Feature | VF typ (V) | IR max (μA) | Int. Circuit | Pin | Package (Toshiba) | Package dimension (mm) | Buy Online |
|-----|-------|----------------------------|-------------------------------|------------|-------------|--------------|-----|-------------------|------------------------|---|
| 40V | 0.1A | 1SS417CT | High speed switching / Low IR | 0.56 | 5 | Single | 2 | CST2 | 1.0 x 0.6 x 0.38 |  |
| | | 1SS417 | High speed switching / Low IR | 0.56 | 5 | | 2 | SOD-923 | 1.0 x 0.6 x 0.4 |  |
| | | CES388 | High speed switching | 0.54 | 5 | | 2 | ESC | 1.6 x 0.8 x 0.6 |  |
| | | CUS357 | High speed switching | 0.54 | 5 | | 2 | USC | 2.5 x 1.25 x 0.9 |  |
| | | 1SS423 | High speed switching | 0.56 | 5 | | 3 | SSM | 1.6 x 1.6 x 0.7 |  |
| 30V | 0.2A | CTS521 | High speed switching / Low VF | 0.45 | 30 | Single | 2 | CST2 | 1.0 x 0.6 x 0.38 |  |
| | | CES521 | High speed switching / Low VF | 0.45 | 30 | | 2 | ESC | 1.6 x 0.8 x 0.6 |  |
| | | CUS521 | High speed switching / Low VF | 0.45 | 30 | | 2 | USC | 2.5 x 1.25 x 0.9 |  |
| | | CTS520 | High speed switching | 0.52 | 5 | | 2 | CST2 | 1.0 x 0.6 x 0.38 |  |
| | | CES520 | Low leak current | 0.52 | 5 | | 2 | ESC | 1.6 x 0.8 x 0.6 |  |
| | | CUS520 | Low leak current | 0.52 | 5 | | 2 | USC | 2.5 x 1.25 x 0.9 |  |
| | 0.1A | 1SS416CT | High speed switching / Low VF | 0.38 | 50 | Single | 2 | CST2 | 1.0 x 0.6 x 0.38 |  |
| | | 1SS416 | High speed switching / Low VF | 0.38 | 50 | | 2 | SOD-923 | 1.0 x 0.6 x 0.4 |  |
| | | 1SS422 | Low forward voltage | 0.38 | 50 | | 3 | SSM | 1.6 x 1.6 x 0.7 |  |
| | | DSF01S30SL | Low forward voltage | 0.41 | 50 | | 2 | SL2 | 0.62 x 0.32 x 0.3 |  |
| | | DSR01S30SL | Low leak current | 0.51 | 0.7 | | 2 | SL2 | 0.62 x 0.32 x 0.3 |  |
| 20V | 0.3A | 1SS404 | High current/ Low VF | 0.38 | 50 | Single | 2 | USC | 2.5 x 1.25 x 0.9 |  |
| | 0.2A | 1SS424 | High current/ Low VF | 0.42 | 50 | Single | 2 | ESC | 1.6 x 0.8 x 0.6 |  |
| | 0.05A | 1SS413CT | High speed switching / Low IR | 0.5 | 0.5 | Single | 2 | CST2 | 1.0 x 0.6 x 0.38 |  |
| | | 1SS413 | High speed switching / Low IR | 0.5 | 0.5 | | 2 | SOD-923 | 1.0 x 0.6 x 0.4 |  |
| | | 1SS405 | High speed switching / Low IR | 0.5 | 0.5 | | 2 | ESC | 1.6 x 0.8 x 0.6 |  |
| | | 1SS406 | High speed switching / Low IR | 0.5 | 0.5 | | 2 | USC | 2.5 x 1.25 x 0.9 |  |
| | | 1SS389 | Low forward voltage | 0.35 | 20 | Single | 2 | ESC | 1.6 x 0.8 x 0.6 |  |
| 10V | 0.1A | 1SS367 | Low forward voltage | 0.35 | 20 | K Com. | 2 | USC | 2.5 x 1.25 x 0.9 |  |
| | | 1SS385FV | Low forward voltage | 0.35 | 20 | | 3 | VESM | 1.2 x 1.2 x 0.5 |  |
| | | 1SS385 | Low forward voltage | 0.35 | 20 | | 3 | SSM | 1.6 x 1.6 x 0.7 |  |

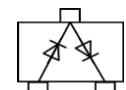
Pin assignment:



Single



Series



Cathode common
(K com.)

Schottky Barrier Diode Selection Table (3)

Io > 0.5A

Io < 0.5A(1)

Io < 0.5A(2)

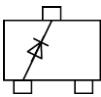
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| VR | Io | Part Number | Feature | VF typ (V) | IR max (μA) | Int. Circuit | Pin | Package (Toshiba) | Package dimension (mm) | Buy Online |
|-----|-------|--------------------------|-------------------------------|------------|-------------|--------------|-----|-------------------|------------------------|---|
| 40V | 0.1A | ISS322 | High speed switching | 0.54 | 5 | Single | 3 | USM | 2.0×2.1×0.9 |  |
| | | ISS393 | High speed switching | 0.54 | 5 | K com. | 3 | USM | 2.0×2.1×0.9 |  |
| | | ISS294 | High speed switching | 0.54 | 5 | Single | 3 | S-Mini | 2.9×2.5×1.1 |  |
| | | ISS392 | High speed switching | 0.54 | 5 | K com. | 3 | S-Mini | 2.9×2.5×1.1 |  |
| | | HN2S02JE | High speed switching | 0.54 | 5 | Separate | 5 | ESV | 1.6×1.6×0.55 |  |
| | | HN2S02FU | High speed switching | 0.54 | 5 | | 6 | US6 | 2.0×2.1×0.9 |  |
| 30V | 0.2A | TBAT54 | Low IR / Low VF | 0.45 | 2 | Single | 3 | SOT23 | 2.9×2.4×0.9 |  |
| | | TBAT54C | Low IR / Low VF | 0.45 | 2 | K com. | 3 | SOT23 | 2.9×2.4×0.9 |  |
| | | TBAT54S | Low IR / Low VF | 0.45 | 2 | Series | 3 | SOT23 | 2.9×2.4×0.9 |  |
| | | TBAT54A | Low IR / Low VF | 0.45 | 2 | A com. | 3 | SOT23 | 2.9×2.4×0.9 |  |
| 20V | 0.3A | ISS401 | High current/ Low VF | 0.38 | 50 | Single | 3 | USM | 2.0×2.1×0.9 |  |
| | 0.2A | HN2S04FU | High current/ Low VF | 0.36 | 50 | Separate | 6 | US6 | 2.0×2.1×0.9 |  |
| | 0.05A | HN2S03FU | High speed switching / Low IR | 0.5 | 0.5 | | 6 | US6 | 2.0×2.1×0.9 |  |
| 10V | 0.1A | ISS395 | Low forward voltage | 0.35 | 20 | Single | 3 | USM | 2.0×2.1×0.9 |  |
| | | ISS378 | Low forward voltage | 0.35 | 20 | K com. | 3 | USM | 2.0×2.1×0.9 |  |
| | | ISS372 | Low forward voltage | 0.35 | 20 | Series | 3 | USM | 2.0×2.1×0.9 |  |
| | | ISS394 | Low forward voltage | 0.35 | 20 | Single | 3 | S-Mini | 2.9×2.5×1.1 |  |
| | | ISS377 | Low forward voltage | 0.35 | 20 | K com. | 3 | S-Mini | 2.9×2.5×1.1 |  |
| | | ISS374 | Low forward voltage | 0.35 | 20 | Series | 3 | S-Mini | 2.9×2.5×1.1 |  |
| | | HN2S01FU | Low forward voltage | 0.35 | 20 | Separate | 6 | US6 | 2.0×2.1×0.9 |  |
| | | HN2S01F | Low forward voltage | 0.35 | 20 | | 6 | SM6 | 2.9×2.8×1.1 |  |
| | 0.05A | ISS321 | Low leak current | 0.63 | 0.5 | K com. | 3 | S-Mini | 2.9×2.5×1.1 |  |

Pin assignment:



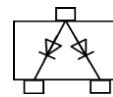
Single



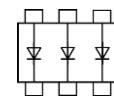
Cathode common
(K com.)



Series



Anode common
(A com.)



Separate

LINK

● Parametric search

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● Application Notes

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● Frequently Asked Question (FAQ) of Diodes

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● Cross-reference search

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