TVS Diode Arrays (SPA® Diodes)
Lightning Surge Protection- AQ4023 Series

AQ4023 Series 1.3pF, 12A Discrete TVS Diode

Description
The AQ4023 Series integrates low capacitance steering diodes with one or two avalanche breakdown diodes for unidirectional or bidirectional protection, respectively, to protect against ESD and lightning induced surge events. These components can safely absorb up to 12A per IEC 61000-4-5 2nd edition ($t_p=8/20\mu s$) without performance degradation and a minimum ±30kV ESD per IEC 61000-4-2 International Standard. The low loading capacitance and high surge capability make it ideal for protecting telecommunication ports such as xDSL and other high voltage, high speed legacy interfaces.

Features
- ESD, IEC 61000-4-2, ±30kV contact, ±30kV air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning, IEC 61000-4-5 2nd edition, 12A ($t_p=8/20\mu s$)
- Low capacitance of 1.3pF (@ $V_R=0V$)
- Low leakage current
- Unidirectional and bidirectional configuration
- Small SOD323 package fits 0805 footprints
- AEC-Q101 qualified
- Moisture Sensitivity Level(MSL -1)
- Halogen free, lead free and RoHS compliant

Applications
- xDSL Interfaces
- RS-232
- RS-485
- Power Ports
- Security Equipment
- Instrumentation
- Medical Equipment
- Computers and Peripherals
- CAN Bus protection
- Automotive applications

Life Support Note:
Not Intended for Use in Life Support or Life Saving Applications
The products shown herein are not designed for use in life sustaining or life saving applications unless otherwise expressly indicated.

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Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>I_{PP}</td>
<td>Peak Current ((t_p=8/20\mu s))</td>
<td>12</td>
<td>A</td>
</tr>
<tr>
<td>P_{PK}</td>
<td>Peak Pulse Power ((t_p=8/20\mu s))</td>
<td>450</td>
<td>W</td>
</tr>
<tr>
<td>T_{OP}</td>
<td>Operating Temperature</td>
<td>-40 to 150</td>
<td>°C</td>
</tr>
<tr>
<td>T_{STOR}</td>
<td>Storage Temperature</td>
<td>-55 to 150</td>
<td>°C</td>
</tr>
</tbody>
</table>

Notes:
CAUTION: Stresses above those listed in “Absolute Maximum Ratings” may cause permanent damage to the component. This is a stress only rating and operation of the component at these or any other conditions above those indicated in the operational sections of this specification is not implied.

Electrical Characteristics \((T_{OP}=25^\circ C)\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse Standoff Voltage</td>
<td>(V_{BVM})</td>
<td>(I_p \leq 1\mu A) with Pin 1 to Pin 2</td>
<td>15</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breakdown Voltage</td>
<td>(V_{BD})</td>
<td>(I=1mA) with Pin 1 to Pin 2</td>
<td>16</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leakage Current</td>
<td>(I_{LEAK})</td>
<td>(V=15V) with Pin 1 to Pin 2</td>
<td>0.1</td>
<td>μA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clamp Voltage(^1)</td>
<td>(V_C)</td>
<td>(I_p=1A, t_p=8/20\mu s, Fwd)</td>
<td>23</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&amp;</td>
<td>(I_p=2A, t_p=8/20\mu s, Fwd)</td>
<td>24</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&amp;</td>
<td>(I_p=10A, t_p=8/20\mu s, Fwd)</td>
<td>35</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&amp;</td>
<td>(I_p=12A, t_p=8/20\mu s, Fwd)</td>
<td>375</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic Resistance(^2)</td>
<td>(R_{DYN})</td>
<td>TLP (t_p=100\text{~ns}, \text{Pin 1 to Pin 2})</td>
<td>0.55</td>
<td>Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESD Withstand Voltage(^1)</td>
<td>(V_{ESD})</td>
<td>IEC 61000-4-2 (Contact Discharge)</td>
<td>±30</td>
<td>kV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&amp;</td>
<td>IEC 61000-4-2 (Air Discharge)</td>
<td>±30</td>
<td>kV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diode Capacitance(^1)</td>
<td>(C_D)</td>
<td>Reverse Bias=0V, (f=1\text{MHz}), Pin 1 to Pin 2</td>
<td>1.3</td>
<td>2</td>
<td>pF</td>
<td></td>
</tr>
</tbody>
</table>

Note:
1Parameter is guaranteed by design and/or component characterization.
2Transmission Line Pulse (TLP) test setting: S/D TDR(50Ω), \(t_p=100\text{~ns},\) \(t_r=0.3\text{~ns}\) TLP and VTLP averaging window: start \(t_1=70\text{~ns}\) to end \(t_2=80\text{~ns}\)

8/20μs Pulse Waveform

Capacitance vs. Reverse Bias (Pin 1 to Pin 2)
Soldering Parameters

- **Reflow Condition**
  - Pb – Free assembly

- **Pre Heat**
  - Temperature Min ($T_{s(min)}$) 150°C
  - Temperature Max ($T_{s(max)}$) 200°C
  - Time (min to max) ($t_{s}$) 60 – 180 secs

- **Average ramp up rate (Liquidus) Temp ($T_{L}$) to peak** 3°C/second max

- **$T_{s(max)}$ to $T_{L}$ - Ramp-up Rate** 3°C/second max

- **Reflow**
  - Temperature ($T_{L}$) (Liquidus) 217°C
  - Temperature ($t_{L}$) 60 – 150 seconds

- **Peak Temperature ($T_{P}$)** 260°C ± 5°C

- **Time within 5°C of actual peak Temperature ($t_{p}$)** 20 – 40 seconds

- **Ramp-down Rate** 6°C/second max

- **Time 25°C to peak Temperature ($T_{P}$)** 8 minutes Max.

- **Do not exceed** 260°C

Product Characteristics

- **Lead Plating** Matte tin
- **Lead Material** Copper Alloy
- **Lead Coplanarity** 0.0004 inches (0.102mm)
- **Substrate material** Silicon
- **Body Material** Molded Compound
- **Flammability** UL Recognized compound meeting flammability rating V-0

Notes:
1. All dimensions are in millimeters
2. Dimensions include solder plating.
3. Dimensions are exclusive of mold flash & metal burr.
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Part Marking System

Part Numbering System

Lightning Surge Protection- SP4023 Series

Ordering Information

Part Number | Package | Marking | Min. Order Qty.
AQ4023-01FTG | SOD323 | 15 | 3000
AQ4023-01FTG-C | SOD323 | 15C | 3000

Package Dimensions - SOD323

Recommended Solder Pad

Unit: mm

Embossed Carrier Tape & Reel Specification — SOD323

Component Orientation in Tape

8mm TAPE AND REEL

Symbol | Millimeters
A, A0 | 1.46+/−0.10
B0 | 2.90+/−0.10
W | 8.0+0.3/-0.10
D0 | 1.50+0.10
D1 | 0.45min/1.15max
E1 | 1.75+/−0.10
E2 | -
F | 3.50+/−0.10
P0 | 4.00+/−0.10
P | 4.00+/−0.10
P1 | 2.00+/−0.05
K0 | 1.25+/−0.10
T | 0.254+/−0.02

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