

AQxxC-01FTG Series 450W Bidirectional TVS Diode

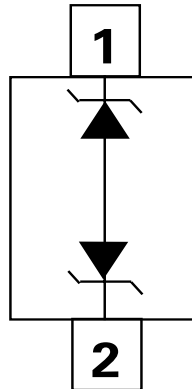


Description

The bidirectional AQxxC-01FTG Series is designed to replace multilayer varistors (MLVs) in electronic equipment for low speed and DC applications. It will protect any sensitive equipment from damage due to electrostatic discharge (ESD) and other transient events.

The AQxxC-01FTG series can safely absorb repetitive ESD strikes of ±30 kV (contact and air discharge as defined in IEC 61000-4-2) without any performance degradation. Additionally, the AQ05C can safely conduct a 30A 8/20 surge event as defined in IEC 61000-4-5 2nd Edition.

Pinout and Functional Block Diagram



Features

- ESD, IEC 61000-4-2, ±30kV contact, ±30kV air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning, 30A (8/20 as defined in IEC 61000-4-5 2nd edition) for the AQ05C
- Low clamping voltage
- PPAP capable
- Low leakage current
- Small SOD323 package fits 0805 footprints
- AEC-Q101 qualified
- Moisture Sensitivity Level(MSL -1)
- Halogen free, lead free and RoHS compliant

Applications

- Switches / Buttons
- Test Equipment / Instrumentation
- Point-of-Sale Terminals
- Medical Equipment
- Notebooks / Desktops / Servers
- Computer 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.

Absolute Maximum Ratings

| Symbol | Parameter | Value | Units |
|------------|--------------------------------------|------------|-------|
| P_{pk} | Peak Pulse Power ($t_p=8/20\mu s$) | 450 | W |
| T_{OP} | Operating Temperature | -40 to 150 | °C |
| T_{STOR} | Storage Temperature | -55 to 150 | °C |

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.

AQ05C Electrical Characteristics ($T_{OP}=25^\circ C$)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|------------------------------------|---------------|-----------------------------------|----------|------|------|----------|
| Reverse Standoff Voltage | V_{RWM} | $I_R=1\mu A$ | | | 5.0 | V |
| Breakdown Voltage | V_{BR} | $I_R=1 mA$ | 6.0 | | | V |
| Reverse Leakage Current | I_{LEAK} | $V_R=5V$ | | | 1.0 | μA |
| Clamp Voltage ¹ | V_C | $I_{PP}=1A, t_p=8/20\mu s, Fwd$ | | | 10.0 | V |
| | | $I_{PP}=10A, t_p=8/20\mu s, Fwd$ | | | 14.5 | V |
| Dynamic Resistance ² | R_{DYN} | TLP, $t_p=100ns, I/O$ to Ground | | 0.31 | | Ω |
| Peak Pulse Current | I_{PP} | $t_p=8/20\mu s$ | | | 30.0 | A |
| ESD Withstand Voltage ¹ | V_{ESD} | IEC 61000-4-2 (Contact Discharge) | ± 30 | | | kV |
| | | IEC 61000-4-2 (Air Discharge) | ± 30 | | | kV |
| Diode Capacitance ¹ | $C_{I/O-I/O}$ | Reverse Bias=0V, f=1MHz | | | 200 | pF |

AQ12C Electrical Characteristics ($T_{OP}=25^\circ C$)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|------------------------------------|---------------|-----------------------------------|----------|------|------|----------|
| Reverse Standoff Voltage | V_{RWM} | $I_R=1\mu A$ | | | 12.0 | V |
| Breakdown Voltage | V_{BR} | $I_R=1 mA$ | 13.3 | | | V |
| Reverse Leakage Current | I_{LEAK} | $V_R=12V$ | | | 1.0 | μA |
| Clamp Voltage ¹ | V_C | $I_{PP}=1A, t_p=8/20\mu s, Fwd$ | | | 18.5 | V |
| | | $I_{PP}=10A, t_p=8/20\mu s, Fwd$ | | | 23.0 | V |
| Dynamic Resistance ² | R_{DYN} | TLP, $t_p=100ns, I/O$ to Ground | | 0.41 | | Ω |
| Peak Pulse Current | I_{PP} | $t_p=8/20\mu s$ | | | 17.0 | A |
| ESD Withstand Voltage ¹ | V_{ESD} | IEC 61000-4-2 (Contact Discharge) | ± 30 | | | kV |
| | | IEC 61000-4-2 (Air Discharge) | ± 30 | | | kV |
| Diode Capacitance ¹ | $C_{I/O-I/O}$ | Reverse Bias=0V, f=1MHz | | | 100 | pF |

AQ15C Electrical Characteristics (T_{op}=25°C)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|------------------------------------|----------------------|---|------|------|------|-------|
| Reverse Standoff Voltage | V _{RWM} | I _R =1μA | | | 15.0 | V |
| Breakdown Voltage | V _{BR} | I _R =1mA | 16.7 | | | V |
| Reverse Leakage Current | I _{LEAK} | V _R =15V | | | 1.0 | μA |
| Clamp Voltage ¹ | V _C | I _{pp} =1A, t _p =8/20μs, Fwd | | | 24.0 | V |
| | | I _{pp} =10A, t _p =8/20μs, Fwd | | | 31.0 | V |
| Dynamic Resistance ² | R _{DYN} | TLP, t _p =100ns, I/O to Ground | | 0.46 | | Ω |
| Peak Pulse Current | I _{pp} | t _p =8/20μs | | | 12.0 | A |
| ESD Withstand Voltage ¹ | V _{ESD} | IEC 61000-4-2 (Contact Discharge) | ±30 | | | kV |
| | | IEC 61000-4-2 (Air Discharge) | ±30 | | | kV |
| Diode Capacitance ¹ | C _{I/O-I/O} | Reverse Bias=0V, f=1MHz | | | 75 | pF |

AQ24C Electrical Characteristics (T_{op}=25°C)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|------------------------------------|----------------------|--|------|------|------|-------|
| Reverse Standoff Voltage | V _{RWM} | I _R =1μA | | | 24.0 | V |
| Breakdown Voltage | V _{BR} | I _R =1mA | 26.7 | | | V |
| Reverse Leakage Current | I _{LEAK} | V _R =24V | | | 1.0 | μA |
| Clamp Voltage ¹ | V _C | I _{pp} =1A, t _p =8/20μs, Fwd | | | 36.0 | V |
| | | I _{pp} =5A, t _p =8/20μs, Fwd | | | 42.0 | V |
| Dynamic Resistance ² | R _{DYN} | TLP, t _p =100ns, I/O to Ground | | 0.62 | | Ω |
| Peak Pulse Current | I _{pp} | t _p =8/20μs | | | 7.0 | A |
| ESD Withstand Voltage ¹ | V _{ESD} | IEC 61000-4-2 (Contact Discharge) | ±30 | | | kV |
| | | IEC 61000-4-2 (Air Discharge) | ±30 | | | kV |
| Diode Capacitance ¹ | C _{I/O-I/O} | Reverse Bias=0V, f=1MHz | | | 50 | pF |

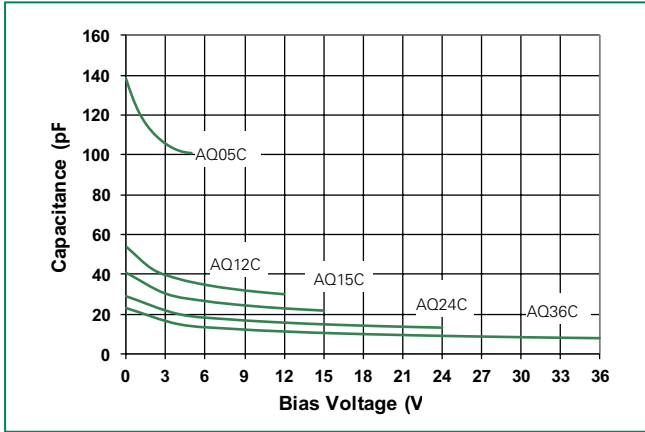
AQ36C Electrical Characteristics (T_{op}=25°C)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|------------------------------------|----------------------|--|------|------|------|-------|
| Reverse Standoff Voltage | V _{RWM} | I _R =1μA | | | 36.0 | V |
| Breakdown Voltage | V _{BR} | I _R =1mA | 40.0 | | | V |
| Reverse Leakage Current | I _{LEAK} | V _R =36V | | | 1.0 | μA |
| Clamp Voltage ¹ | V _C | I _{pp} =1A, t _p =8/20μs, Fwd | | | 52.0 | V |
| | | I _{pp} =5A, t _p =8/20μs, Fwd | | | 62.0 | V |
| Dynamic Resistance ² | R _{DYN} | TLP, t _p =100ns, I/O to Ground | | 0.68 | | Ω |
| Peak Pulse Current | I _{pp} | t _p =8/20μs | | | 5.0 | A |
| ESD Withstand Voltage ¹ | V _{ESD} | IEC 61000-4-2 (Contact Discharge) | ±30 | | | kV |
| | | IEC 61000-4-2 (Air Discharge) | ±30 | | | kV |
| Diode Capacitance ¹ | C _{I/O-I/O} | Reverse Bias=0V, f=1MHz | | | 30 | pF |

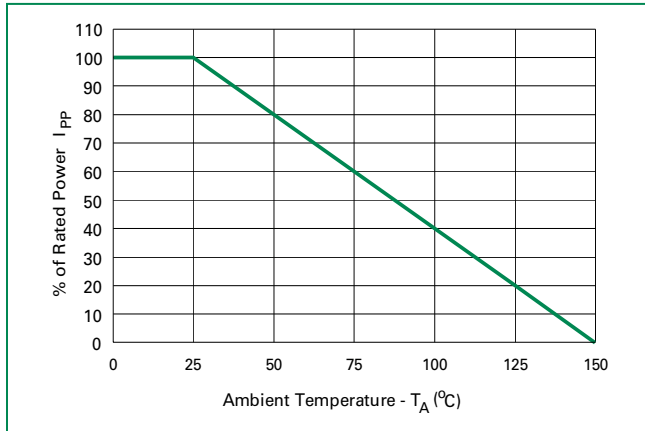
Note:

- Parameter is guaranteed by design and/or component characterization.
- Transmission Line Pulse (TLP) with 100ns width, 2ns rise time, and average window t1=70ns to t2= 90ns

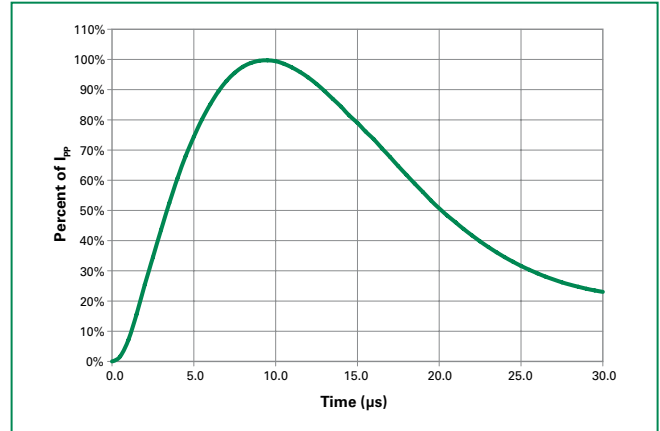
Capacitance vs. Bias



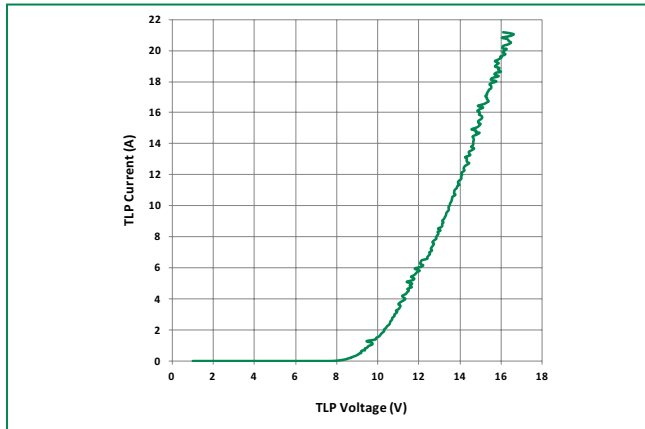
Power Derating Curve



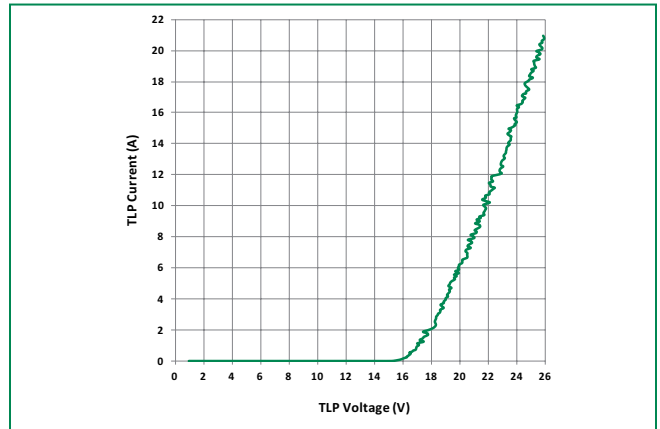
8/20µs Pulse Waveform



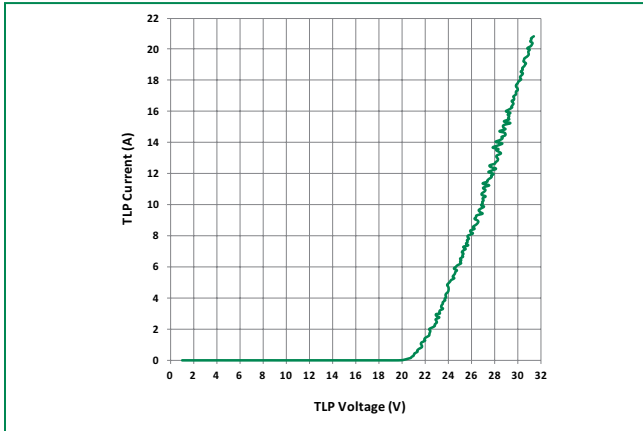
AQ05C Transmission Line Pulsing(TLP) Plot



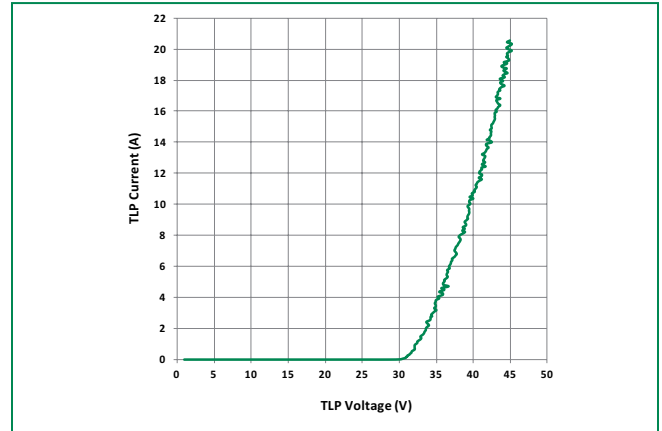
AQ12C Transmission Line Pulsing(TLP) Plot



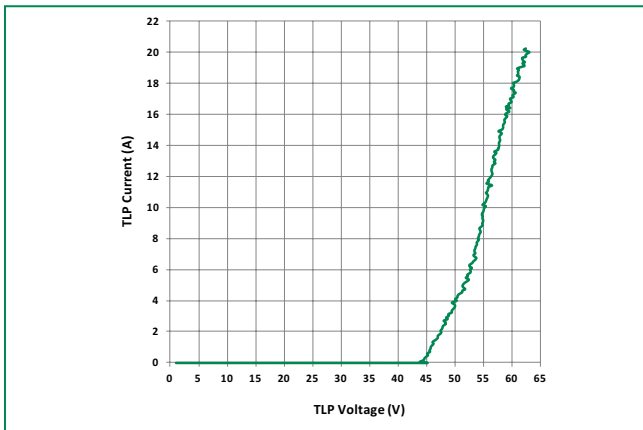
AQ15C Transmission Line Pulsing(TLP) Plot



AQ24C Transmission Line Pulsing(TLP) Plot



AQ36C Transmission Line Pulsing(TLP) Plot

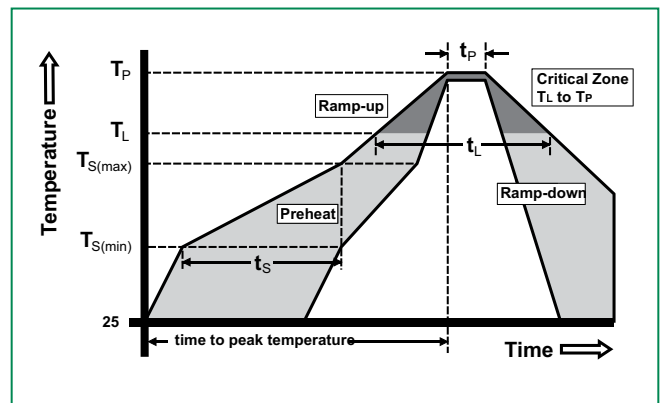


Product Characteristics

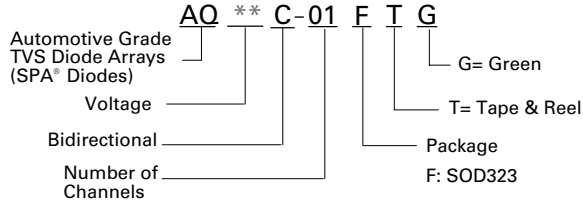
| | |
|---------------------------|--|
| Lead Plating | Matte Tin |
| Lead Material | Copper Alloy |
| Lead Coplanarity | 0.0004 inches (0.102mm) |
| Substrate material | Silicon |
| Body Material | Molded Compound |
| Flammability | UL Recognized compound meeting flammability rating V-0 |

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 ^{+0/-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 |



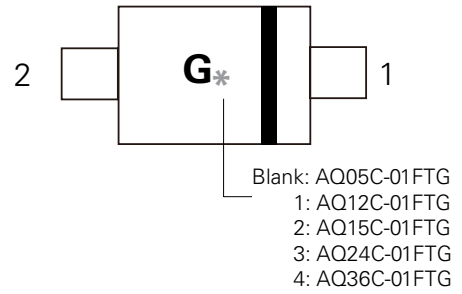
Part Numbering System



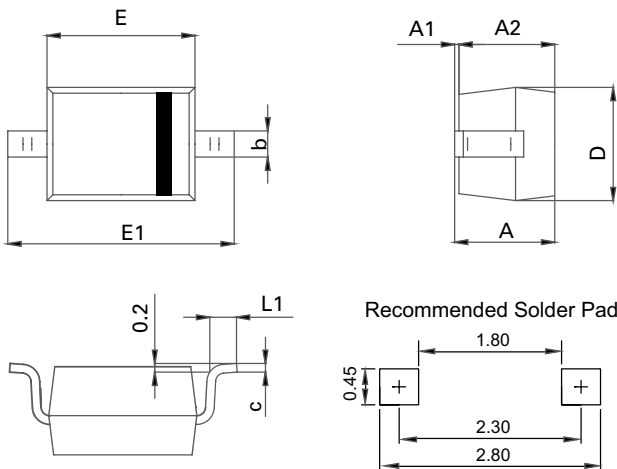
Ordering Information

| Part Number | Package | Min. Order Qty. |
|-------------|---------|-----------------|
| AQ05C-01FTG | SOD323 | 3000 |
| AQ12C-01FTG | SOD323 | 3000 |
| AQ15C-01FTG | SOD323 | 3000 |
| AQ24C-01FTG | SOD323 | 3000 |
| AQ36C-01FTG | SOD323 | 3000 |

Part Marking System



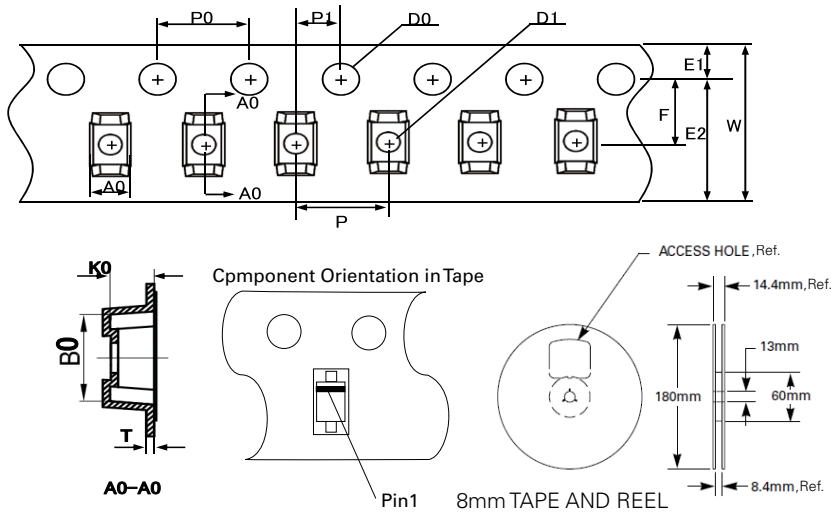
Package Dimensions -SOD323



Unit: mm

| Symbol | SOD323 | | | |
|-----------|-------------|------|--------|-------|
| | Millimeters | | Inches | |
| | Min | Max | Min | Max |
| A | - | 1.00 | - | 0.039 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| A2 | 0.80 | 0.90 | 0.031 | 0.035 |
| b | 0.25 | 0.35 | 0.010 | 0.014 |
| c | 0.08 | 0.15 | 0.003 | 0.006 |
| D | 1.20 | 1.40 | 0.047 | 0.055 |
| E | 1.60 | 1.80 | 0.063 | 0.071 |
| E1 | 2.50 | 2.70 | 0.098 | 0.106 |
| L1 | 0.25 | 0.40 | 0.010 | 0.016 |

Embossed Carrier Tape & Reel Specification – SOD323



| Symbol | Millimeters |
|--------|-------------------|
| A0 | 1.36min/1.62max |
| B0 | 2.90+/-0.10 |
| W | 8.0+0.3/-0.10 |
| D0 | 1.50+0.10 |
| D1 | ø1.00min/ø1.25max |
| E | 1.75+/-0.10 |
| E2 | - |
| F | 3.50+/-0.05 |
| P0 | 4.00+/-0.10 |
| P | 4.00+/-0.10 |
| P1 | 2.00+/-0.05 |
| K0 | 1.15min/1.45max |
| T | 0.254+/-0.13 |

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