

AQHVxx-01LTG-C Series, 300W Discrete Bidirectional TVS Diode     



Description

This AQHVxx-01LTG-C series provides a highly effective ESD, EFT, and lightning surge protection component. It is ideally suited for power interfaces, passenger charging interfaces, LED lighting modules, and low speed I/Os.

Its rating of $\pm 30\text{kV}$ ESD exceeds the maximum ESD rating requirements as defined in the IEC 61000-4-2 international standard without suffering any performance degradation. The AQHV12-C can withstand up to 10A of surge current as defined by IEC 61000-4-5 2nd edition providing low voltage clamping levels during lightning induced events.

Pinout

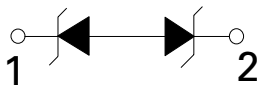


This component is bidirectional

Features

- ESD, IEC 61000-4-2, $\pm 30\text{kV}$ contact, $\pm 30\text{kV}$ air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning, 10A (8/20 μs as defined in IEC 61000-4-5 2nd edition) for AQHV12-C
- Low clamping voltage
- PPAP capable
- Low leakage current
- AEC-Q101 qualified
- Moisture Sensitivity Level(MSL -1)
- Halogen free, lead free and RoHS compliant

Functional Block Diagram



Applications

- LED Lighting Modules
- Portable Instrumentation
- General Purpose I/O
- RS232 / RS485
- CAN and LIN Bus
- Automotive application

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 ($t_p=8/20\mu s$) | 300 | 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.

AQHV12-C 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 | V |
| Breakdown Voltage | V_{BR} | $I_R=1mA$ | 13.3 | 15 | | V |
| Reverse Leakage Current | I_{LEAK} | $V_R=12V$ | | 5 | 50 | nA |
| Clamp Voltage ¹ | V_C | $I_{PP}=1A, t_p=8/20\mu s, I/O$ to I/O | | 18 | 21 | V |
| | | $I_{PP}=10A, t_p=8/20\mu s, I/O$ to I/O | | 27 | 30 | V |
| Dynamic Resistance ² | R_{DYN} | TLP, $t_p=100ns, I/O$ to I/O | | 0.34 | | Ω |
| Peak Pulse Current ¹ | I_{PP} | $t_p=8/20\mu s$ | | | 10 | 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 | | 27 | 30 | pF |

AQHV15-C Electrical Characteristics ($T_{OP}=25^\circ C$)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|------------------------------------|---------------|--|----------|------|-----|----------|
| Reverse Standoff Voltage | V_{RWM} | $I_R=1\mu A$ | | | 15 | V |
| Breakdown Voltage | V_{BR} | $I_R=1mA$ | 16.7 | 19.5 | | V |
| Reverse Leakage Current | I_{LEAK} | $V_R=15V$ | | 5 | 50 | nA |
| Clamp Voltage ¹ | V_C | $I_{PP}=1A, t_p=8/20\mu s, I/O$ to I/O | | 23.5 | 27 | V |
| | | $I_{PP}=7A, t_p=8/20\mu s, I/O$ to I/O | | 33.5 | 37 | V |
| Dynamic Resistance ² | R_{DYN} | TLP, $t_p=100ns, I/O$ to I/O | | 0.36 | | Ω |
| Peak Pulse Current ¹ | I_{PP} | $t_p=8/20\mu s$ | | | 7 | 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 | | 21 | 24 | pF |

AQHV24-C Electrical Characteristics ($T_{OP}=25^\circ C$)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|------------------------------------|---------------|--|----------|------|------|----------|
| Reverse Standoff Voltage | V_{RWM} | $I_R=1\mu A$ | | | 24.0 | V |
| Breakdown Voltage | V_{BR} | $I_R=1mA$ | 26.7 | 29.5 | | V |
| Reverse Leakage Current | I_{LEAK} | $V_R=24V$ | | 5 | 50 | nA |
| Clamp Voltage ¹ | V_C | $I_{PP}=1A, t_p=8/20\mu s, I/O$ to I/O | | 35.5 | 40 | V |
| | | $I_{PP}=5A, t_p=8/20\mu s, I/O$ to I/O | | 49.5 | 55 | V |
| Dynamic Resistance ² | R_{DYN} | TLP, $t_p=100ns, I/O$ to I/O | | 0.52 | | Ω |
| Peak Pulse Current ¹ | I_{PP} | $t_p=8/20\mu s$ | | | 5.0 | A |
| ESD Withstand Voltage ¹ | V_{ESD} | IEC 61000-4-2 (Contact Discharge) | ± 25 | | | kV |
| | | IEC 61000-4-2 (Air Discharge) | ± 30 | | | kV |
| Diode Capacitance ¹ | $C_{I/O-I/O}$ | Reverse Bias=0V, f=1MHz | | 15 | 17 | pF |

AQHV36-C Electrical Characteristics (T_{OP}=25°C)

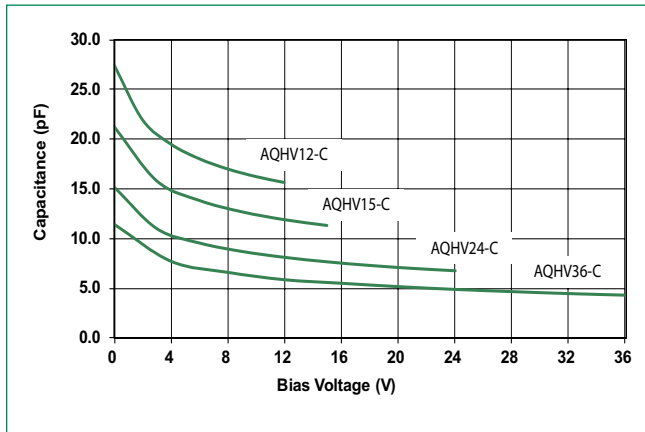
| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|------------------------------------|----------------------|---|-----|------|------|-------|
| Reverse Standoff Voltage | V _{RWM} | I _R =1μA | | | 36.0 | V |
| Breakdown Voltage | V _{BR} | I _R =1mA | 40 | 43.5 | | V |
| Reverse Leakage Current | I _{LEAK} | V _R =36V | | 5 | 50 | nA |
| Clamp Voltage ¹ | V _C | I _{pp} =1A, t _p =8/20μs, I/O to I/O | | 52.5 | 58 | V |
| | | I _{pp} =3A, t _p =8/20μs, I/O to I/O | | 67 | 72 | V |
| Dynamic Resistance ² | R _{DYN} | TLP, t _p =100ns, I/O to I/O | | 1.27 | | Ω |
| Peak Pulse Current ¹ | I _{pp} | t _p =8/20μs | | | 3.0 | A |
| ESD Withstand Voltage ¹ | V _{ESD} | IEC 61000-4-2 (Contact Discharge) | ±15 | | | kV |
| | | IEC 61000-4-2 (Air Discharge) | ±20 | | | kV |
| Diode Capacitance ¹ | C _{I/O-I/O} | Reverse Bias=0V, f=1MHz | | 11.5 | 13 | pF |

Note:

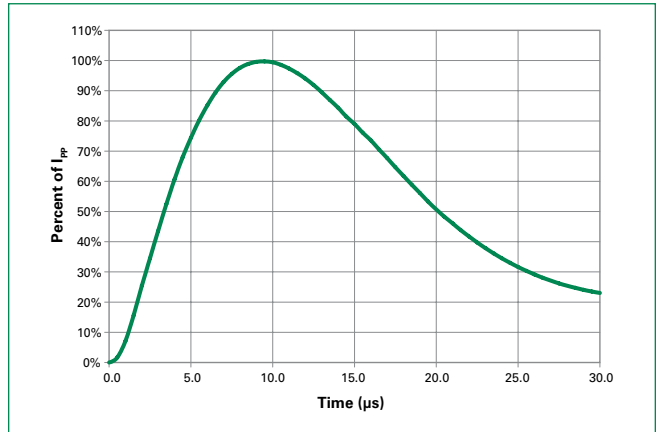
¹ Parameter is guaranteed by design and/or component characterization.

² Transmission Line Pulse (TLP) with 100ns width, 2ns rise time, and average window t1=70ns to t2= 90ns

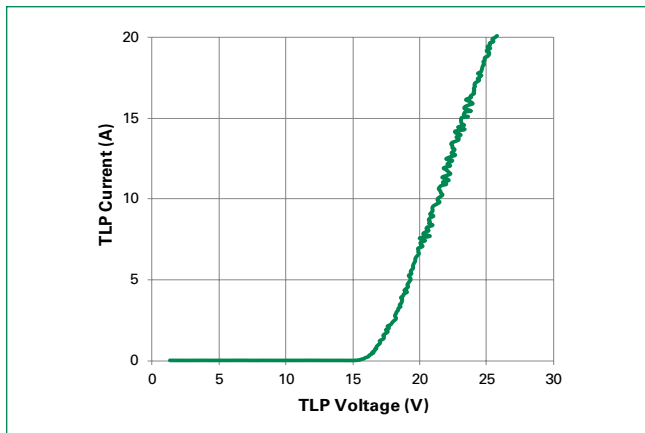
Capacitance vs. Reverse Bias



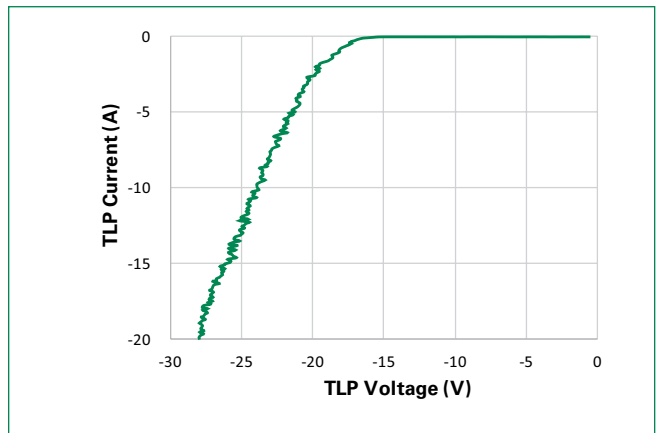
8/20μs Pulse Waveform



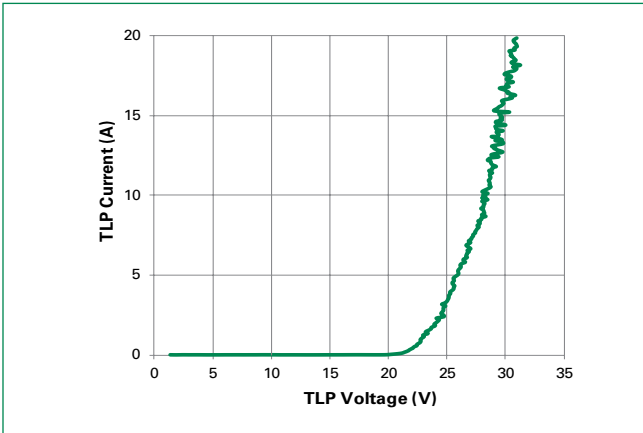
AQHV12-C Positive Transmission Line Pulsing (TLP) Plot



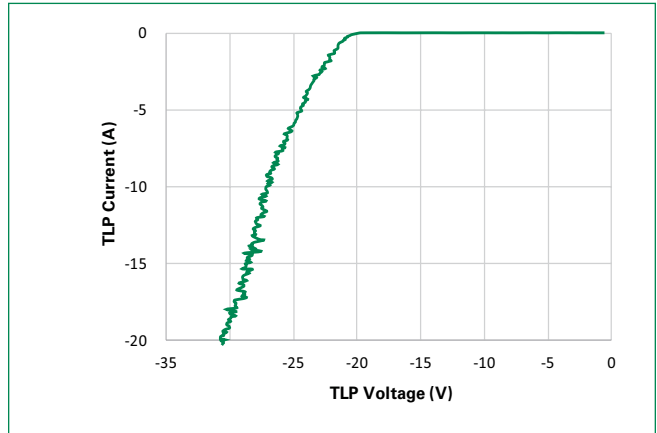
AQHV12-C Negative Transmission Line Pulsing (TLP) Plot



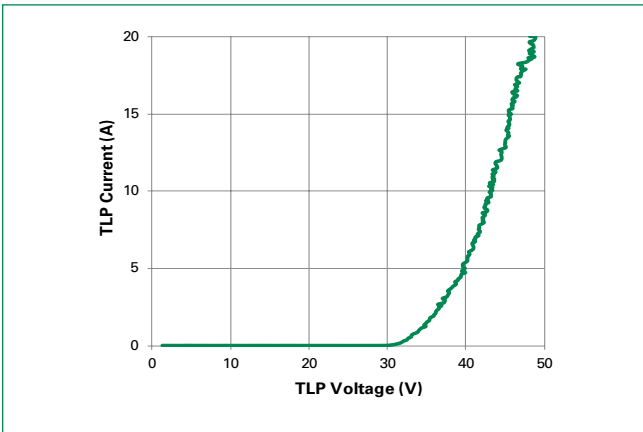
AQHV15-C Positive Transmission Line Pulsing(TLP) Plot



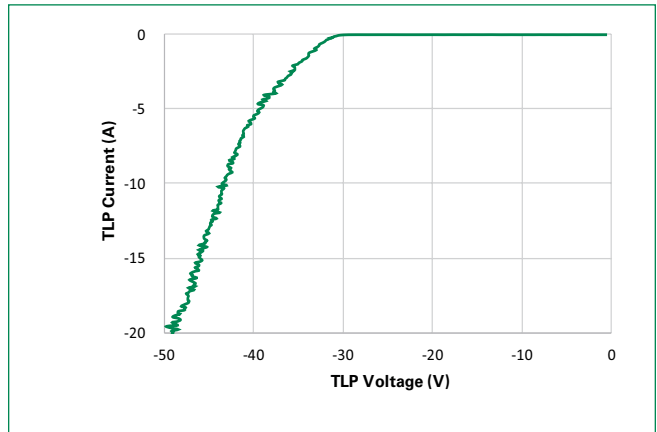
AQHV15-C Negative Transmission Line Pulsing(TLP) Plot



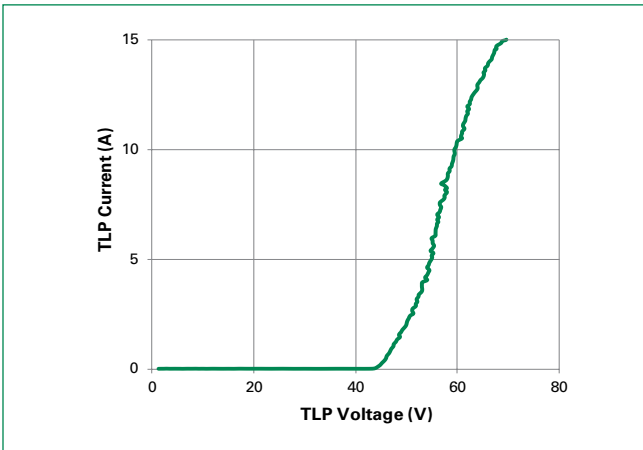
AQHV24-C Positive Transmission Line Pulsing(TLP) Plot



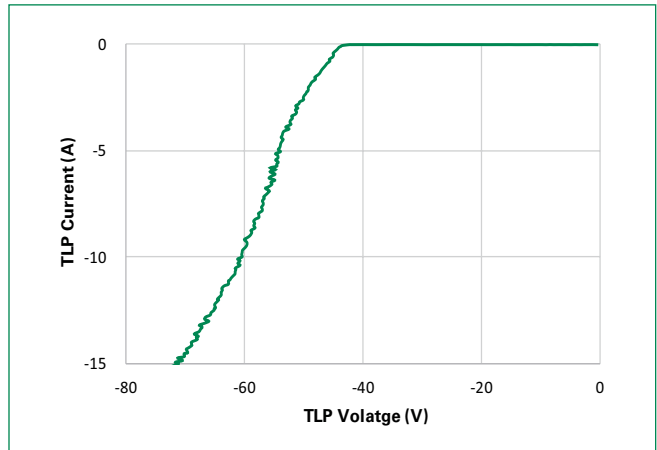
AQHV24-C Negative Transmission Line Pulsing(TLP) Plot



AQHV36-C Positive Transmission Line Pulsing(TLP) Plot



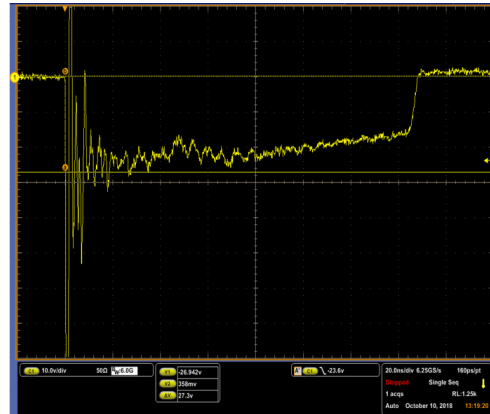
AQHV36-C Negative Transmission Line Pulsing(TLP) Plot



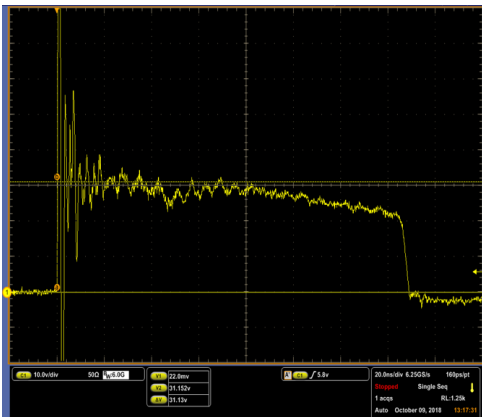
AQHV12-C +8kV Contact ESD Clamping Voltage



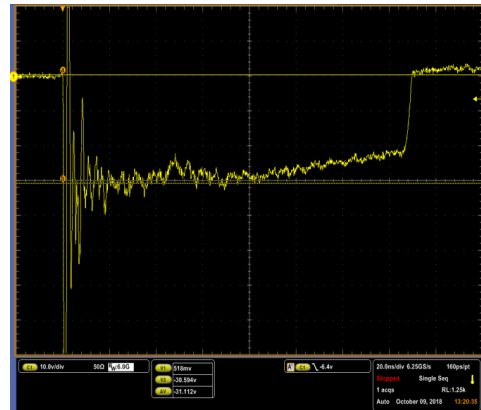
AQHV12-C -8kV Contact ESD Clamping Voltage



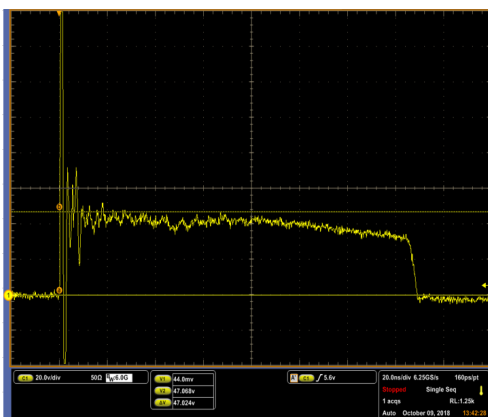
AQHV15-C +8kV Contact ESD Clamping Voltage



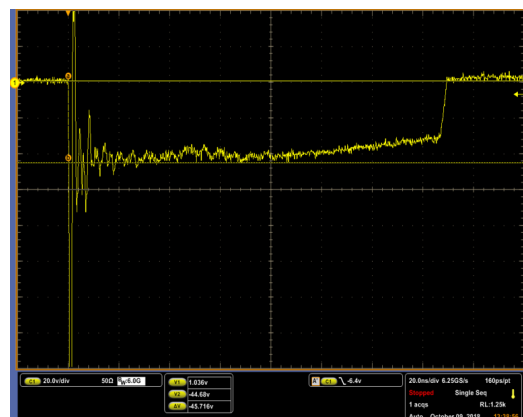
AQHV15-C -8kV Contact ESD Clamping Voltage



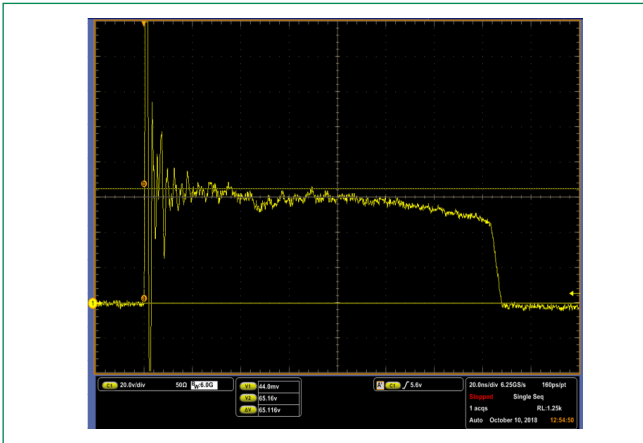
AQHV24-C +8kV Contact ESD Clamping Voltage



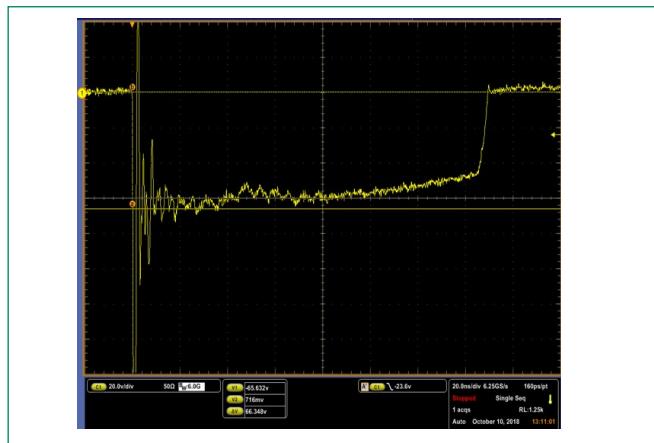
AQHV24-C -8kV Contact ESD Clamping Voltage



AQHV36-C +8kV Contact ESD Clamping Voltage

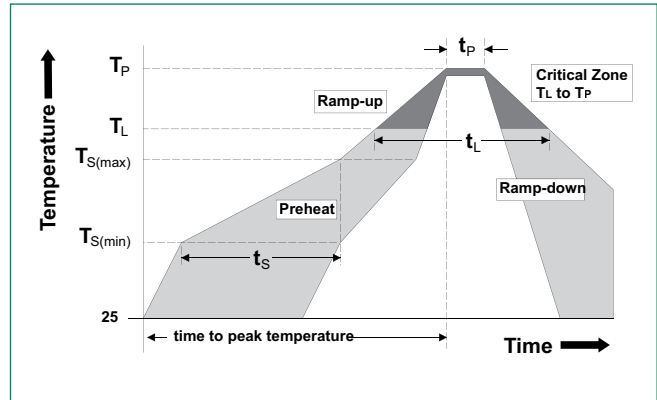


AQHV36-C -8kV Contact ESD Clamping Voltage

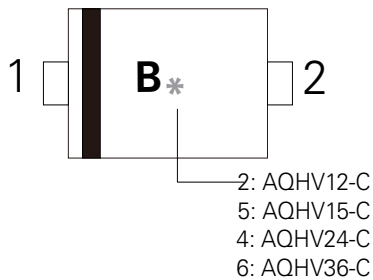


Soldering Parameters

| | | |
|--|------------------------------------|-------------------------|
| 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_p) | 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 |



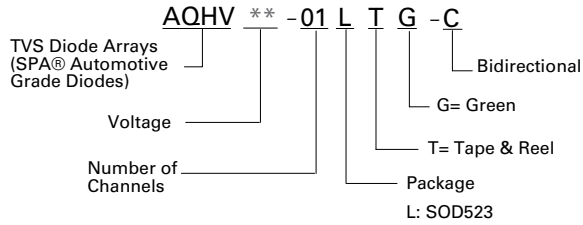
Part Marking System



Product Characteristics

| | |
|---------------------------|--|
| Lead Plating | Matte Tin |
| Lead Material | Copper Alloy |
| Substrate Material | Silicon |
| Body Material | Molded Compound |
| Flammability | UL Recognized compound meeting flammability rating V-0 |

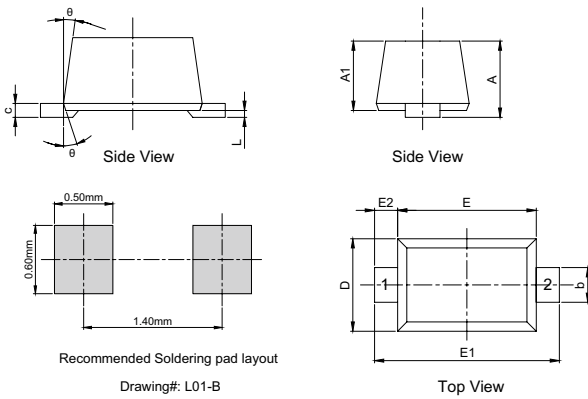
Part Numbering System



Ordering Information

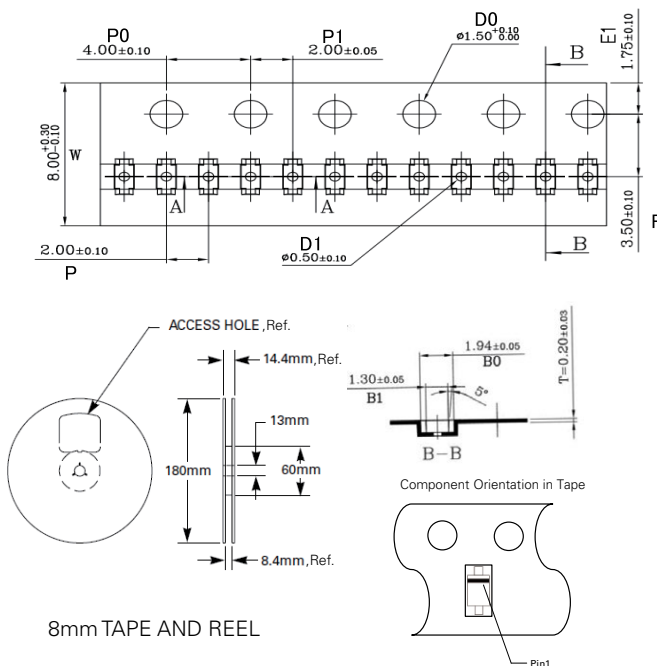
| Part Number | Package | Min. Order Qty. |
|----------------|---------|-----------------|
| AQHV12-01LTG-C | SOD523 | 5000 |
| AQHV15-01LTG-C | | |
| AQHV24-01LTG-C | | |
| AQHV36-01LTG-C | | |

Package Dimensions – SOD-523



| Symbol | Millimeters | | Inches | |
|--------|-------------|------|-----------|-------|
| | Min | Max | Min | Max |
| A | 0.51 | 0.77 | 0.020 | 0.030 |
| A1 | 0.50 | 0.70 | 0.020 | 0.028 |
| b | 0.25 | 0.35 | 0.010 | 0.014 |
| c | 0.08 | 0.15 | 0.003 | 0.006 |
| D | 0.70 | 0.90 | 0.028 | 0.035 |
| E | 1.10 | 1.30 | 0.043 | 0.051 |
| E1 | 1.50 | 1.70 | 0.059 | 0.067 |
| E2 | 0.20 REF | | 0.001 REF | |
| L | 0.01 | 0.07 | 0.000 | 0.003 |
| Θ | 7° REF | | 7° REF | |

Embossed Carrier Tape & Reel Specification – SOD-523



| Symbol | Millimeters | | Inches | |
|--------|-------------|------|--------|-------|
| | Min | Max | Min | Max |
| A0 | 0.91 | 1.01 | 0.036 | 0.040 |
| B0 | 1.89 | 1.99 | 0.074 | 0.078 |
| D0 | 1.50 | 1.60 | 0.059 | 0.063 |
| D1 | 0.40 | 0.60 | 0.016 | 0.024 |
| E1 | 1.65 | 1.85 | 0.065 | 0.073 |
| F | 3.40 | 3.60 | 0.134 | 0.142 |
| P0 | 3.90 | 4.10 | 0.154 | 0.161 |
| P | 1.90 | 2.10 | 0.075 | 0.083 |
| P1 | 1.95 | 2.05 | 0.077 | 0.081 |
| K0 | 0.68 | 0.78 | 0.027 | 0.031 |
| T | 0.17 | 0.23 | 0.007 | 0.009 |
| W | 7.90 | 8.30 | 0.311 | 0.327 |

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