

# AQHVxx-01LTG-C Series

## 300W Discrete Bidirectional TVS Diode



### Web Resources



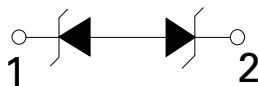
Download ECAD models, order samples, and find technical resources at [www.littelfuse.com](http://www.littelfuse.com)

### Pinout



This component is bidirectional

### Functional Block Diagram



### 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.

### Features & Benefits

- 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 $\mu\text{s}$  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

### 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.

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### 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

**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 <sup>1</sup>	$V_C$	$I_{PP}=1A, t_p=8/20\mu s, I/O$ 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 <sup>2</sup>	$R_{DYN}$	TLP, $t_p=100ns, I/O$ to I/O	-	0.34	-	$\Omega$
Peak Pulse Current <sup>1</sup>	$I_{PP}$	$t_p=8/20\mu s$	-	-	10	A
ESD Withstand Voltage <sup>1</sup>	$V_{ESD}$	IEC 61000-4-2 (Contact Discharge)	$\pm 30$	-	-	kV
		IEC 61000-4-2 (Air Discharge)	$\pm 30$	-	-	kV
Diode Capacitance <sup>1</sup>	$C_{I/O-I/O}$	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 <sup>1</sup>	$V_C$	$I_{PP}=1A, t_p=8/20\mu s, I/O$ 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 <sup>2</sup>	$R_{DYN}$	TLP, $t_p=100ns, I/O$ to I/O	-	0.36	-	$\Omega$
Peak Pulse Current <sup>1</sup>	$I_{PP}$	$t_p=8/20\mu s$	-	-	7	A
ESD Withstand Voltage <sup>1</sup>	$V_{ESD}$	IEC 61000-4-2 (Contact Discharge)	$\pm 30$	-	-	kV
		IEC 61000-4-2 (Air Discharge)	$\pm 30$	-	-	kV
Diode Capacitance <sup>1</sup>	$C_{I/O-I/O}$	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 <sup>1</sup>	$V_C$	$I_{PP}=1A, t_p=8/20\mu s, I/O$ 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 <sup>2</sup>	$R_{DYN}$	TLP, $t_p=100ns, I/O$ to I/O	-	0.52	-	$\Omega$
Peak Pulse Current <sup>1</sup>	$I_{PP}$	$t_p=8/20\mu s$	-	-	5.0	A
ESD Withstand Voltage <sup>1</sup>	$V_{ESD}$	IEC 61000-4-2 (Contact Discharge)	$\pm 25$	-	-	kV
		IEC 61000-4-2 (Air Discharge)	$\pm 30$	-	-	kV
Diode Capacitance <sup>1</sup>	$C_{I/O-I/O}$	Reverse Bias=0V, $f=1MHz$	-	15	17	pF

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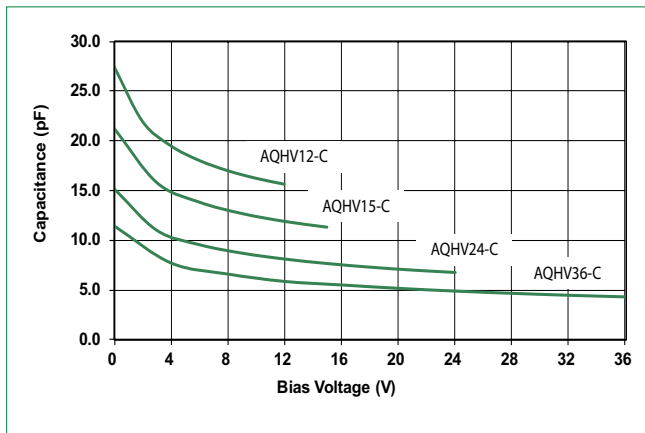
### AQHV36-C Electrical Characteristics ( $T_{OP}=25^{\circ}\text{C}$ )

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	$V_{RWM}$	$I_R=1\mu\text{A}$			36.0	V
Breakdown Voltage	$V_{BR}$	$I_R=1\text{mA}$	40	43.5		V
Reverse Leakage Current	$I_{LEAK}$	$V_R=36\text{V}$		5	50	nA
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP}=1\text{A}$ , $t_p=8/20\mu\text{s}$ , I/O to I/O		52.5	58	V
		$I_{PP}=3\text{A}$ , $t_p=8/20\mu\text{s}$ , I/O to I/O		67	72	V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p=100\text{ns}$ , I/O to I/O		1.27		$\Omega$
Peak Pulse Current <sup>1</sup>	$I_{PP}$	$t_p=8/20\mu\text{s}$			3.0	A
ESD Withstand Voltage <sup>1</sup>	$V_{ESD}$	IEC 61000-4-2 (Contact Discharge)	$\pm 15$			kV
		IEC 61000-4-2 (Air Discharge)	$\pm 20$			kV
Diode Capacitance <sup>1</sup>	$C_{I/O-I/O}$	Reverse Bias=0V, $f=1\text{MHz}$		11.5	13	pF

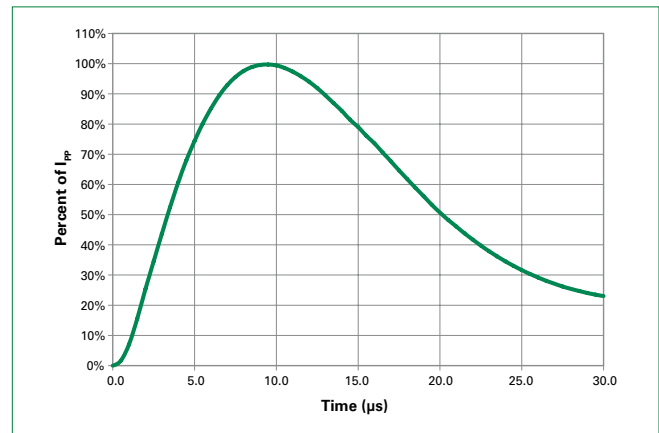
**Notes:**

- Parameter is guaranteed by design and/or component characterization.
- Transmission Line Pulse (TLP) with 100ns width, 2ns rise time, and average window  $t_1=70\text{ns}$  to  $t_2=90\text{ns}$

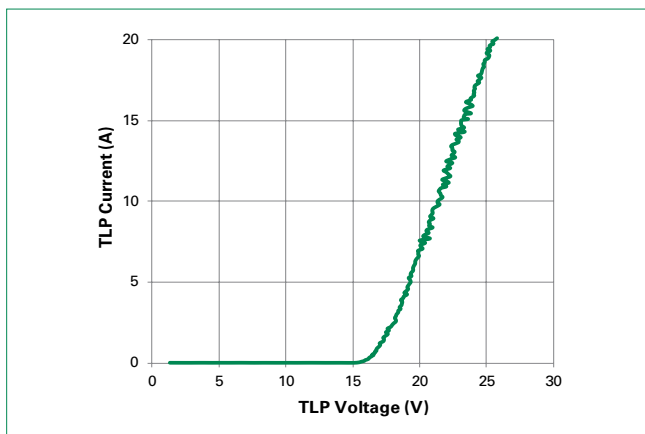
#### Capacitance vs. Reverse Bias



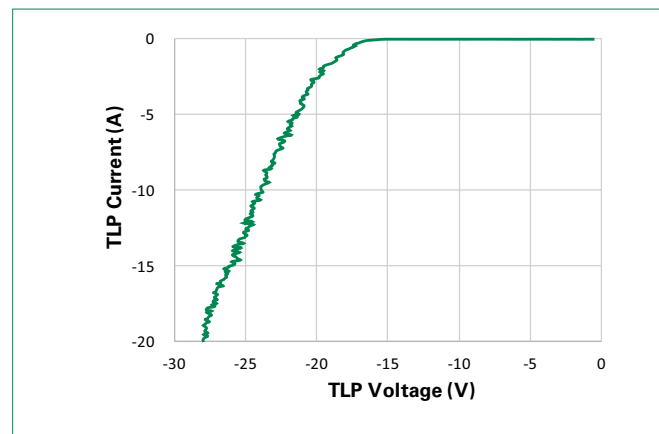
#### 8/20 $\mu\text{s}$ Pulse Waveform



#### AQHV12-C Positive Transmission Line Pulsing(TLP) Plot

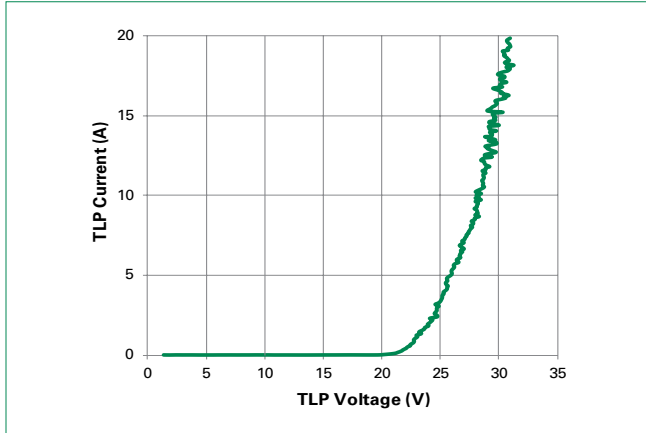
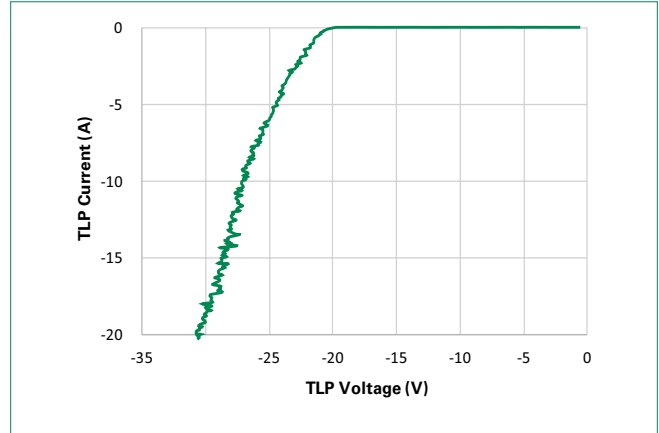
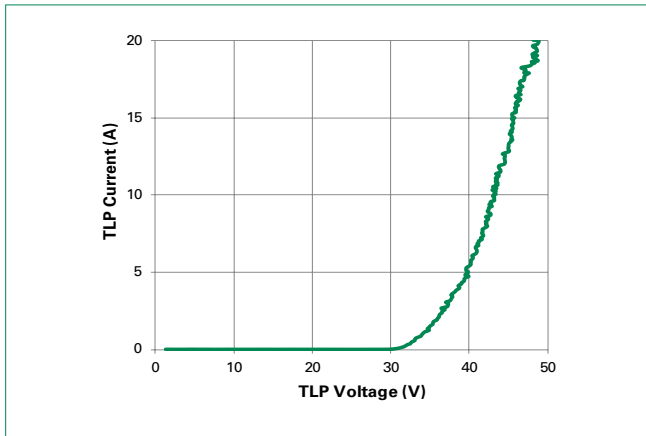
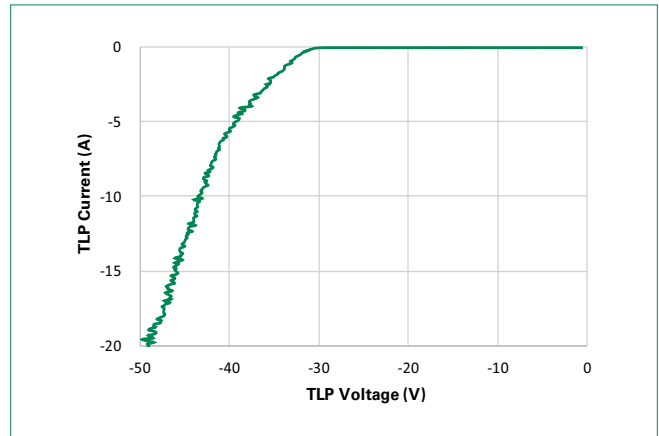
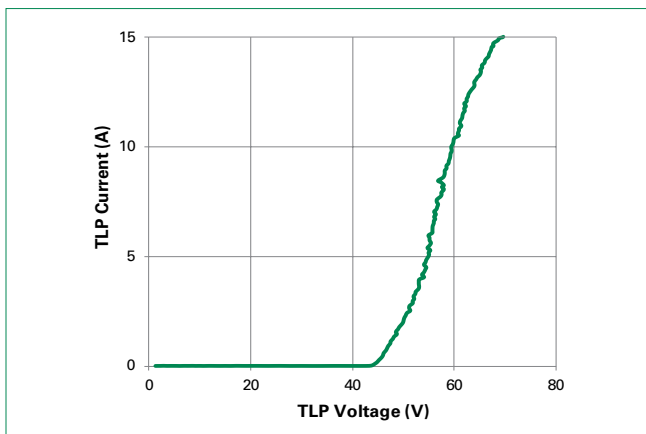
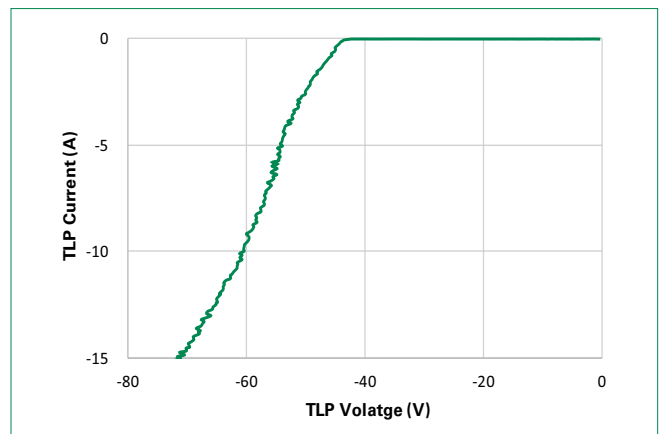


#### AQHV12-C Negative Transmission Line Pulsing(TLP) Plot



# AQHVxx-01LTG-C Series

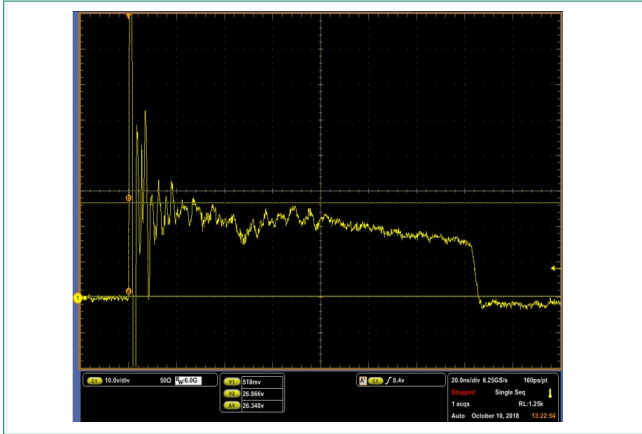
## 300W Discrete Bidirectional TVS Diode

**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**


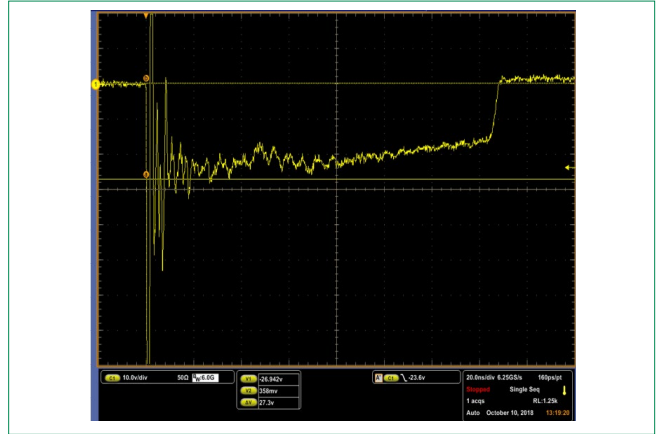
# AQHVxx-01LTG-C Series

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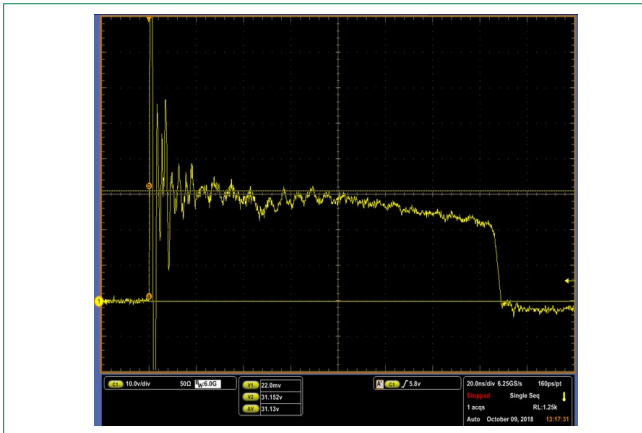
**AQHV12-C +8kV Contact ESD Clamping Voltage**



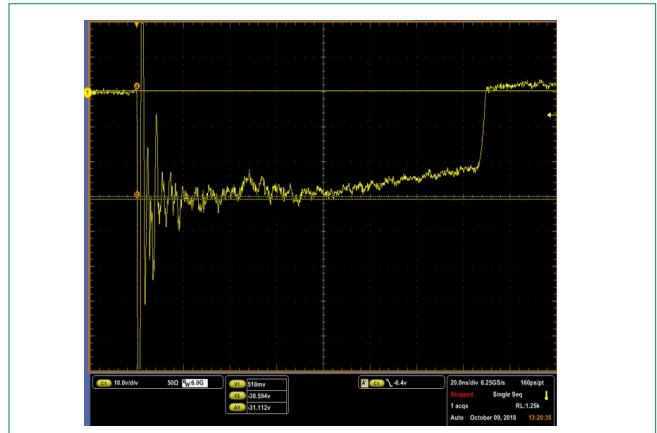
**AQHV12-C -8kV Contact ESD Clamping Voltage**



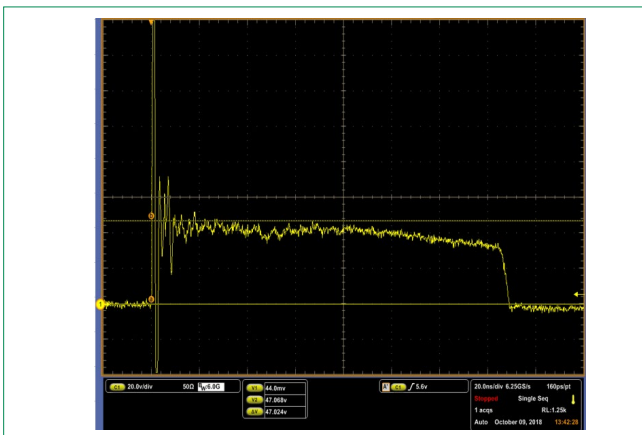
**AQHV15-C +8kV Contact ESD Clamping Voltage**



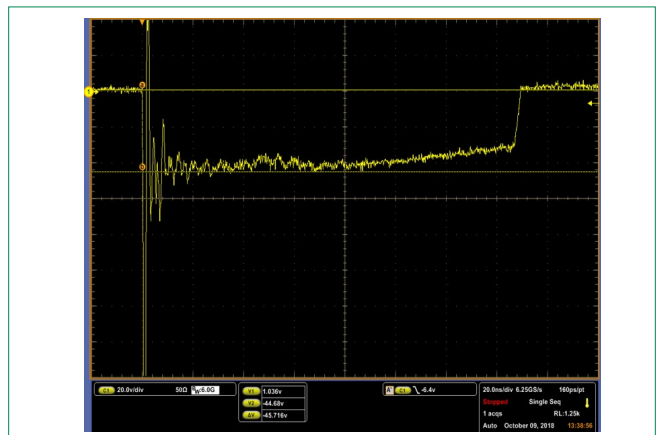
**AQHV15-C -8kV Contact ESD Clamping Voltage**



**AQHV24-C +8kV Contact ESD Clamping Voltage**



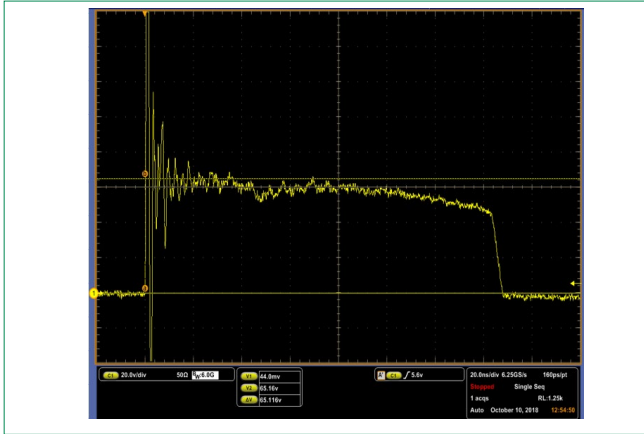
**AQHV24-C -8kV Contact ESD Clamping Voltage**



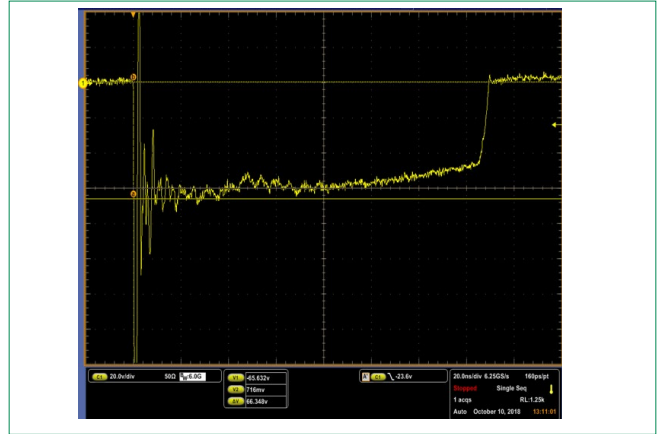
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**AQHV36-C +8kV Contact ESD Clamping Voltage**

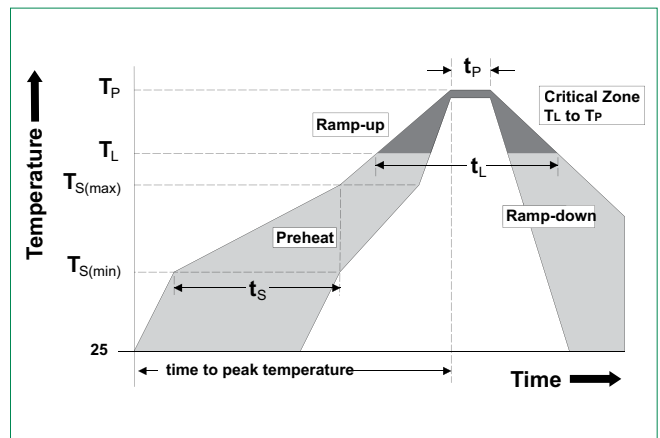


**AQHV36-C -8kV Contact ESD Clamping Voltage**

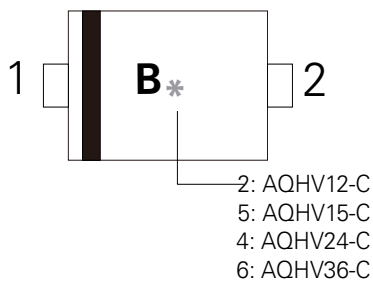


### Soldering Parameters

<b>Reflow Condition</b>		Pb – Free assembly
<b>Pre Heat</b>	- Temperature Min ( $T_{s(min)}$ )	150°C
	- Temperature Max ( $T_{s(max)}$ )	200°C
	- Time (min to max) ( $t_s$ )	60 – 120 secs
<b>Average ramp up rate (Liquidus) Temp (<math>T_L</math>) to peak</b>		3°C/second max
<b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>		3°C/second max
<b>Reflow</b>	- Temperature ( $T_L$ ) (Liquidus)	217°C
	- Temperature ( $t_L$ )	60 – 150 seconds
<b>Peak Temperature (<math>T_p</math>)</b>		260 <sup>+0/-5</sup> °C
<b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>		30 seconds
<b>Ramp-down Rate</b>		6°C/second max
<b>Time 25°C to peak Temperature (<math>T_p</math>)</b>		8 minutes Max.
<b>Do not exceed</b>		260°C



### Part Marking System



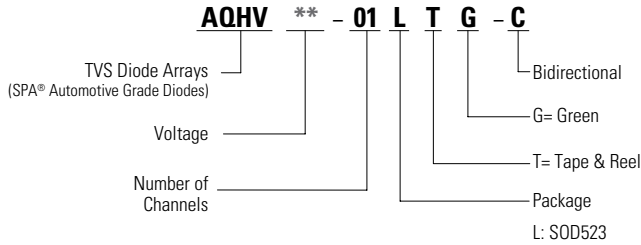
### Product Characteristics

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

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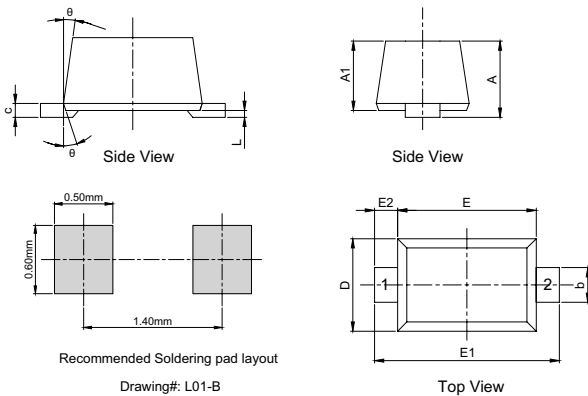
### Part Numbering System



### Ordering Information

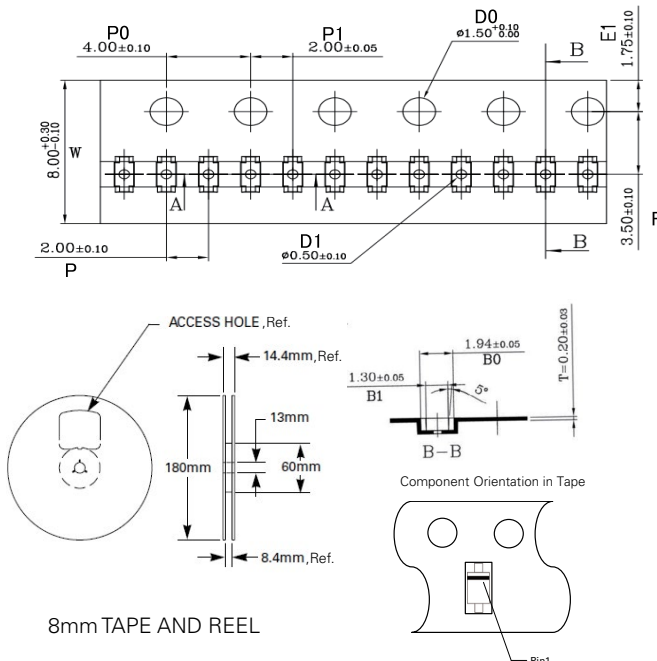
Part Number	Package	Min. Order Qty.
AQHV12-01LTG-C	SOD523	5000
AQHV15-01LTG-C		
AQHV24-01LTG-C		
AQHV36-01LTG-C		

### 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
$\theta$	7° REF		7° REF	

### Embossed Carrier Tape & Reel Specification – SOD-523



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

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