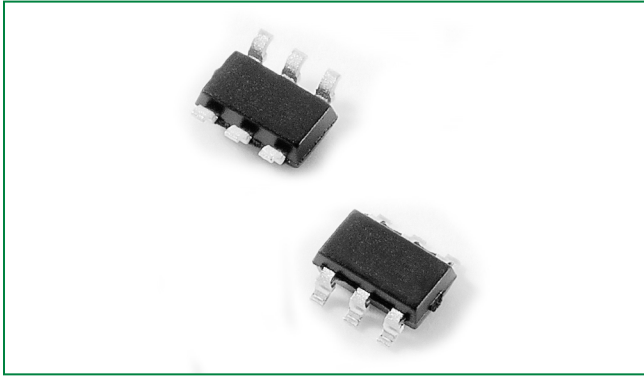
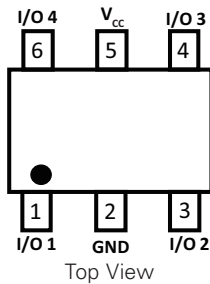


# AQRV05-4HTG

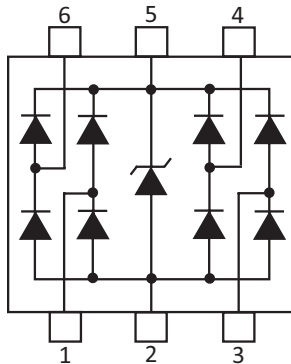
## 1pF 12A Low Capacitance ESD Protection



### Pinout



### Functional Block Diagram



### Applications

- 10/100/1000 Ethernet
- Automotive Touch Screen
- Automotive Display
- USB2.0 Power and Data Line

#### 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.

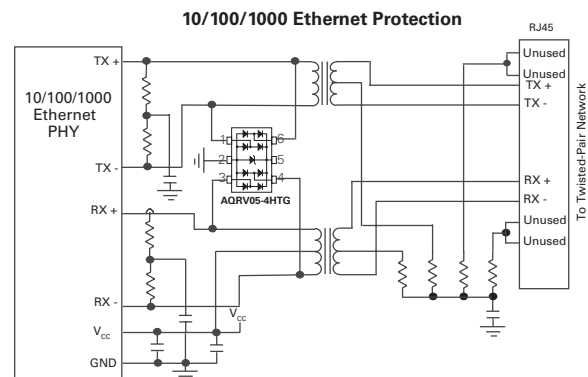
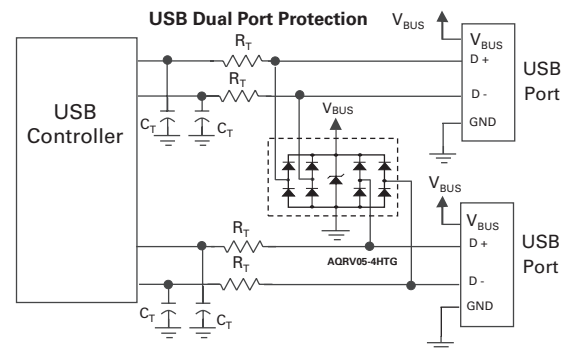
### Description

The AQRV05-4HTG integrates low capacitance rail-to-rail diodes with an additional zener diode to protect each I/O pin against ESD and high surge events. This robust device can absorb maximum 12A surge current per IEC 61000-4-5 ( $t_p=8/20\mu s$ ) without performance degradation and a minimum  $\pm 30kV$  ESD per IEC 61000-4-2. Their very low loading capacitance also makes them ideal for protecting high speed signal pins.

### Features

- ESD, IEC 61000-4-2,  $\pm 30kV$  contact/air
- ESD, ISO10605 330pF 330 $\Omega$ ,  $\pm 30kV$  contact/air
- EFT, IEC61000-4-4, 40A (5/50ns)
- Maximum surge tolerance, IEC 61000-4-5 2<sup>nd</sup> Edition, 12A (8/20 $\mu s$ )
- Low capacitance of 1pF (TYP) per I/O
- Low leakage current of 0.5 $\mu A$  (MAX) at 5V
- Small SOT23-6 (JEDEC MO-178) packaging
- Halogen free, lead free and RoHS compliant
- Moisture Sensitivity Level (MSL-1)
- AEC-Q101 qualified and PPAP capable

### Application Examples



# AQRV05-4HTG

## 1pF 12A Low Capacitance ESD Protection

### Absolute Maximum Ratings

| Symbol     | Parameter                            | Value      | Units |
|------------|--------------------------------------|------------|-------|
| $I_{PP}$   | Peak Current ( $t_p=8/20\mu s$ )     | 12         | A     |
| $P_{PK}$   | Peak Pulse Power ( $t_p=8/20\mu s$ ) | 180        | W     |
| $T_{OP}$   | Operating Temperature                | -40 to 150 | °C    |
| $T_{STOR}$ | Storage Temperature                  | -55 to 150 | °C    |

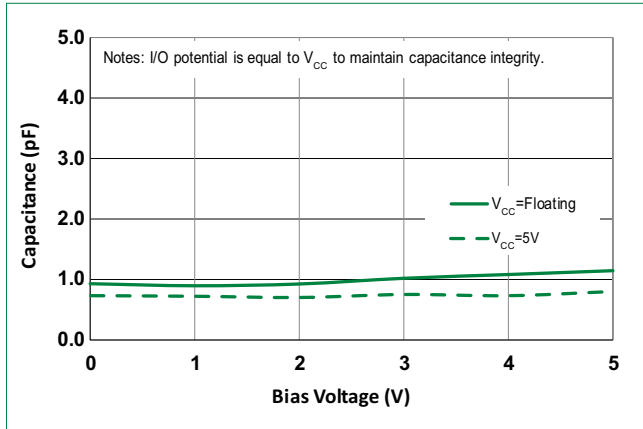
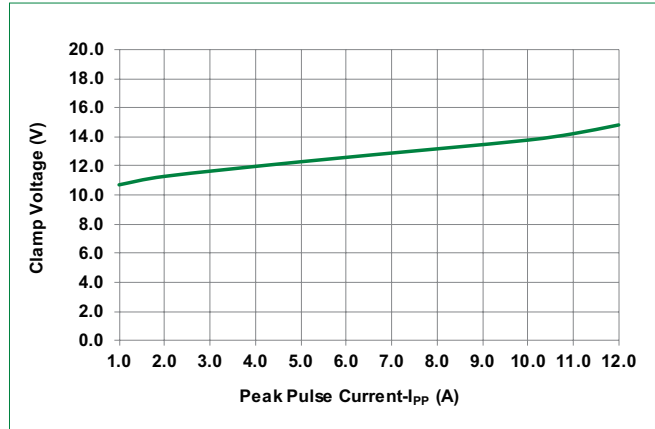
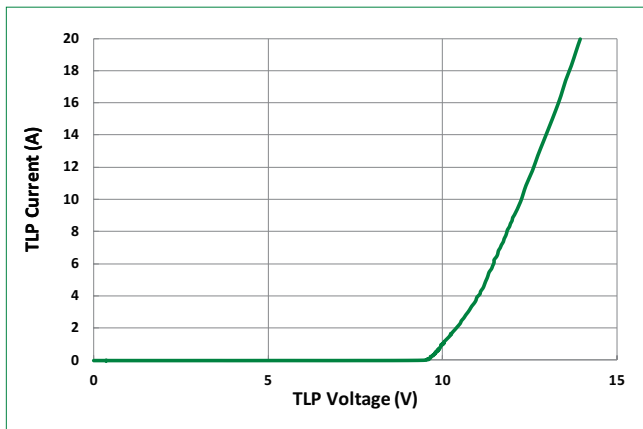
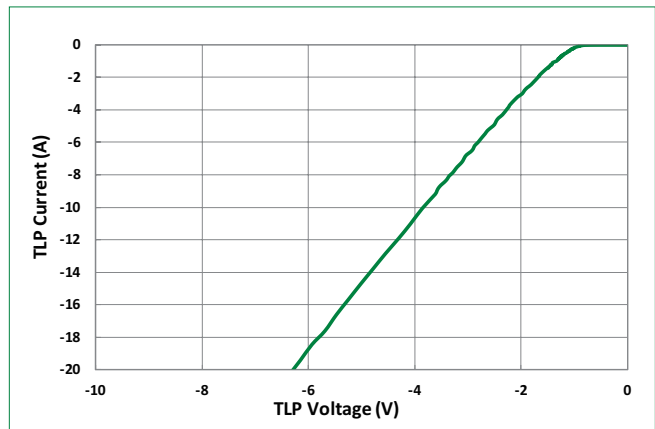
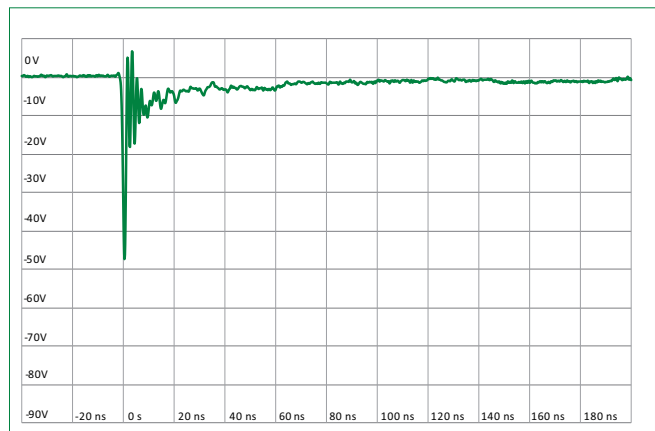
**CAUTION:** Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the component. This is a stress only rating and operation of the component at these or any other conditions above those indicated in the operational sections of this specification is not implied.

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

| Parameter                            | Symbol        | Test Conditions                             | Min      | Typ  | Max | Units    |
|--------------------------------------|---------------|---------------------------------------------|----------|------|-----|----------|
| Reverse Standoff Voltage             | $V_{RWM}$     |                                             |          |      | 6   | V        |
| Breakdown Voltage                    | $V_{BR}$      | $I_R=1mA$ , I/O to GND                      | 6        | 8.5  |     | V        |
| Reverse Leakage Current              | $I_{LEAK}$    | $V_R=5V$ , I/O to GND                       |          | 0.1  | 0.5 | $\mu A$  |
| Clamp Voltage <sup>1</sup>           | $V_C$         | $I_{PP}=5A$ , $t_p=8/20\mu s$ , I/O to GND  |          | 11.7 | 13  | V        |
|                                      |               | $I_{PP}=10A$ , $t_p=8/20\mu s$ , I/O to GND |          | 13.2 | 15  |          |
|                                      |               | $I_{PP}=12A$ , $t_p=8/20\mu s$ , I/O to GND |          | 15   |     |          |
| Dynamic Resistance <sup>2</sup>      | $R_{DYN}$     | TLP, $t_p=100ns$ , I/O to GND               |          | 0.2  |     | $\Omega$ |
| ESD Withstand Voltage <sup>1,3</sup> | $V_{ESD}$     | IEC 61000-4-2 (Contact Discharge)           | $\pm 30$ |      |     | kV       |
|                                      |               | IEC 61000-4-2 (Air Discharge)               | $\pm 30$ |      |     | kV       |
|                                      |               | ISO10605 (Contact Discharge)                | $\pm 30$ |      |     | kV       |
|                                      |               | ISO10605 (Air Discharge)                    | $\pm 30$ |      |     | kV       |
| Diode Capacitance <sup>1</sup>       | $C_{IO-GND}$  | Reverse Bias=0V, $f=1MHz$ , I/O to GND      |          | 1    | 3   | pF       |
|                                      | $C_{I/O-I/O}$ | Reverse Bias=0V, $f=1MHz$ , I/O to I/O      |          | 0.5  |     |          |

**Note:**

- Parameter is guaranteed by design and/or component characterization.
- Transmission Line Pulse (TLP) with 100ns width, 0.2ns rise time, and average window  $t_1=70ns$  to  $t_2=90ns$ .
- Device stressed with ten non-repetitive ESD pulses.

**AQRV05-4HTG****1pF 12A Low Capacitance ESD Protection****Capacitance vs Reverse Bias****Clamping Voltage vs  $I_{PP}$** **Positive Transmission Line Pulsing (TLP) Plot****Negative Transmission Line Pulsing (TLP) Plot****IEC 61000-4-2 +8 kV Contact ESD Clamping Voltage****IEC 61000-4-2 -8 kV Contact ESD Clamping Voltage**

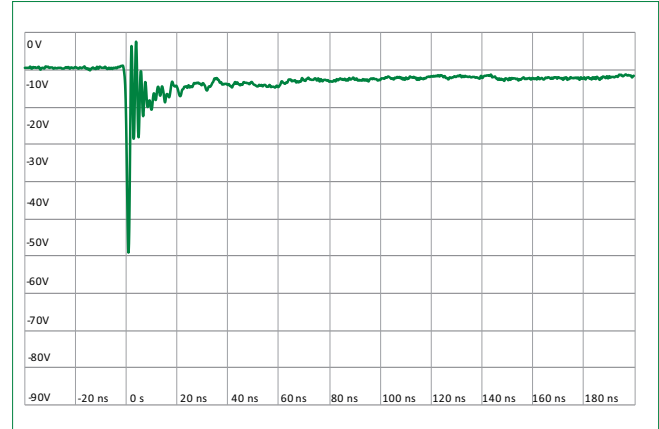
# AQ RV05-4HTG

## 1pF 12A Low Capacitance ESD Protection

ISO10605 Contact Discharge Plot at +8 kV

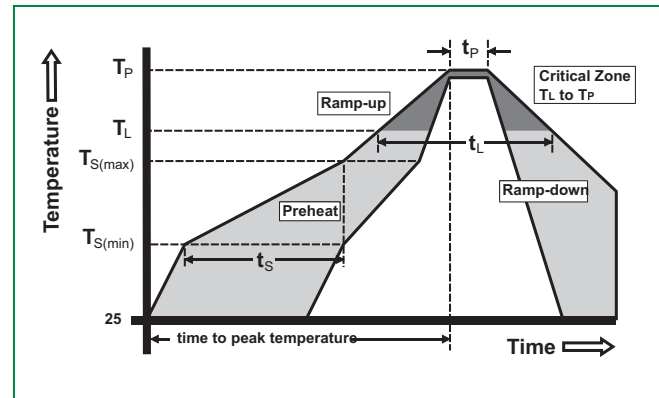


ISO10605 Contact Discharge Plot at -8 kV



### Soldering Parameters

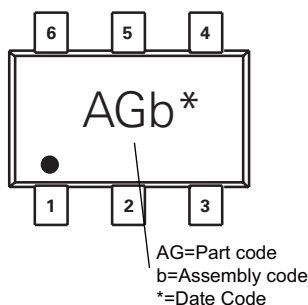
|                                                                        |                                    |                         |
|------------------------------------------------------------------------|------------------------------------|-------------------------|
| <b>Reflow Condition</b>                                                |                                    | 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                   |



### Ordering Information

| Part Number  | Package | Min. Order Qty. |
|--------------|---------|-----------------|
| AQ RV05-4HTG | SOT23-6 | 3000            |

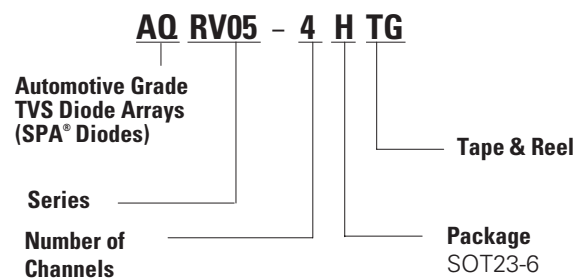
### Part Marking System



### Product Characteristics

|                           |                                                          |
|---------------------------|----------------------------------------------------------|
| <b>Lead Plating</b>       | Matte Tin                                                |
| <b>Lead material</b>      | Copper Alloy                                             |
| <b>Lead Coplanarity</b>   | 0.0004 inches (0.102mm)                                  |
| <b>Substrate Material</b> | Silicon                                                  |
| <b>Body Material</b>      | Molded Compound                                          |
| <b>Flammability</b>       | UL Recognized compound meeting flammability rating 94V-0 |

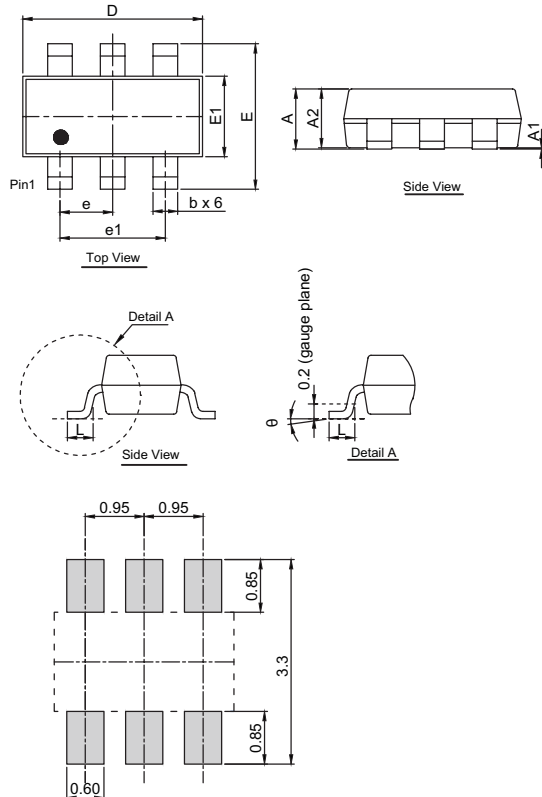
### Part Numbering System



# AQRV05-4HTG

## 1pF 12A Low Capacitance ESD Protection

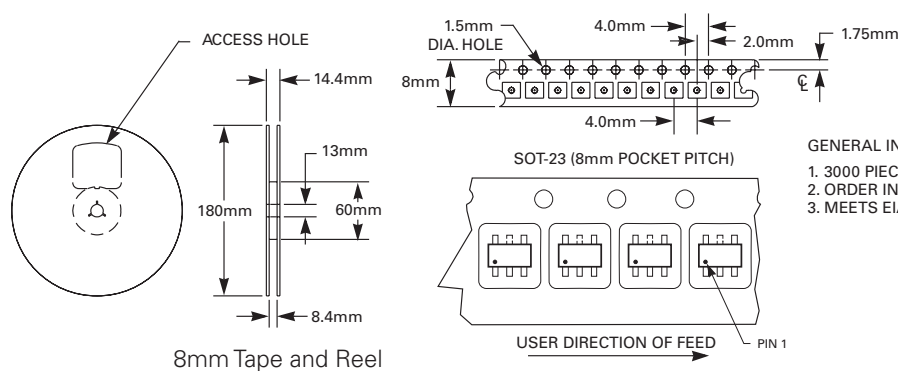
### Package Dimensions - SOT23-6



Recommended soldering pad layout (unit :mm)

| Symbol   | Millimeters |      | Inches    |       |
|----------|-------------|------|-----------|-------|
|          | Min         | Max  | Min       | Max   |
| A        | -           | 1.45 | -         | 0.057 |
| A1       | 0           | 0.15 | 0         | 0.006 |
| A2       | 0.90        | 1.30 | 0.035     | 0.051 |
| b        | 0.25        | 0.50 | 0.010     | 0.020 |
| D        | 2.70        | 3.05 | 0.106     | 0.120 |
| E        | 2.60        | 3.00 | 0.102     | 0.118 |
| E1       | 1.45        | 1.75 | 0.057     | 0.069 |
| e        | 0.95 BSC    |      | 0.037 BSC |       |
| e1       | 1.90 BSC    |      | 0.075 BSC |       |
| L        | 0.30        | 0.55 | 0.012     | 0.022 |
| $\theta$ | 0°          | 8°   | 0°        | 8°    |

### Embossed Carrier Tape & Reel Specification — SOT23-6



#### GENERAL INFORMATION

1. 3000 PIECES PER REEL.
2. ORDER IN MULTIPLES OF FULL REELS ONLY.
3. MEETS EIA-481 REVISION "A" SPECIFICATIONS.

**Product Disclaimer:** Littelfuse products are not designed for, and shall not be used for, any purpose (including, without limitation, automotive, military, aerospace, medical, life-saving, life-sustaining or nuclear facility applications, devices intended for surgical implant into the body, or any other application in which the failure or lack of desired operation of the product may result in personal injury, death, or property damage) other than those expressly set forth in applicable Littelfuse product documentation. Warranties granted by Littelfuse shall be deemed void for products used for any purpose not expressly set forth in applicable Littelfuse documentation. Littelfuse shall not be liable for any claims or damages arising out of products used in applications not expressly intended by Littelfuse as set forth in applicable Littelfuse documentation. The sale and use of Littelfuse products is subject to Littelfuse Terms and Conditions of Sale, unless otherwise agreed by Littelfuse. "Littelfuse" includes Littelfuse, Inc., and all of its affiliate entities. <http://www.littelfuse.com/disclaimer-electronics>.