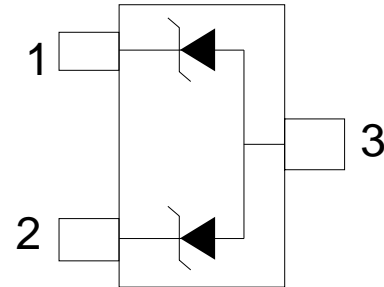


## Description

The AQxx-02HTG Series TVS Diode Array is designed to protect sensitive equipment from damage due to electrostatic discharge (ESD), electrical fast transients (EFT), and lightning induced surges.

This AQxx series can safely absorb repetitive ESD strikes of  $\pm 30$  kV (contact and air discharge as defined in IEC 61000-4-2) without any performance degradation.



## Features

- ESD, IEC 61000-4-2,  $\pm 30$ kV contact,  $\pm 30$ kV air
- EFT, IEC 61000-4-4, 50A (5/50ns)
- Lightning, 33A (8/20 $\mu$ s as defined in IEC 61000-4-5 2<sup>nd</sup> edition) for the AQ05
- Working voltages: 5V, 12V, 15V, 24V and 36V  
ESD, ISO 10605, 330pF 330 $\Omega$ ,  $\pm 30$ kV contact,  $\pm 30$ kV air
- Low clamping voltage
- Low leakage current
- Moisture Sensitivity Level (MSL -1)

## Applications

- Industrial Equipment
- Test and Medical Equipment
- Point-of-Sale Terminals
- Motor Controls
- Legacy Ports (RS-232, RS-485)
- Security and Alarm Systems

**Absolute Maximum Ratings**

Symbol	Parameter	Value	Units
$P_{PK}$	Peak Pulse Power ( $t_p=8/20\mu s$ )	500	W
$T_{OP}$	Operating Temperature	-40 to 150	°C
$T_{STOR}$	Storage Temperature	-55 to 150	°C

**AQ05 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	$V_{BR}$	$I_R=1mA$	6.0	7.0		V
Reverse Leakage Current	$I_{LEAK}$	$V_R=5V$			1.0	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP}=1A, t_p=8/20\mu s$ , Pin 1 or Pin 2 to Pin 3		8.0	9.8	V
		$I_{PP}=10A, t_p=8/20\mu s$ , Pin 1 or Pin 2 to Pin 3		10.5	13.0	V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p=100ns$ , Pin 1 or Pin 2 to Pin 3		0.19		$\Omega$
Peak Pulse Current	$I_{PP}$	$t_p=8/20\mu s$			33	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>3</sup>	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz		290	350	pF
	$C_{I/O-I/O}$	Reverse Bias=0V, f=1MHz		145	180	pF

**AQ12 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	$V_{BR}$	$I_R=1mA$	13.3	14.2		V
Reverse Leakage Current	$I_{LEAK}$	$V_R=12V$			1.0	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP}=1A, t_p=8/20\mu s$ , Pin 1 or Pin 2 to Pin 3		16.0	18.5	V
		$I_{PP}=10A, t_p=8/20\mu s$ , Pin 1 or Pin 2 to Pin 3		20.0	22.5	V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p=100ns$ , Pin 1 or Pin 2 to Pin 3		0.25		$\Omega$
Peak Pulse Current	$I_{PP}$	$t_p=8/20\mu s$			20	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>3</sup>	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz		110	135	pF
	$C_{I/O-I/O}$	Reverse Bias=0V, f=1MHz		55	85	pF

**AQ15 Electrical Characteristics** ( $T_{OP}=25^{\circ}C$ )

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	$V_{RWM}$	$I_R=1\mu A$			15.0	V
Breakdown Voltage	$V_{BR}$	$I_R=1mA$	16.7	18.5		V
Reverse Leakage Current	$I_{LEAK}$	$V_R=15V$			1.0	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP}=1A, t_p=8/20\mu s$ , Pin 1 or Pin 2 to Pin 3		20.5	24.0	V
		$I_{PP}=10A, t_p=8/20\mu s$ , Pin 1 or Pin 2 to Pin 3		26.6	30.0	V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p=100ns$ , Pin 1 or Pin 2 to Pin 3		0.30		$\Omega$
Peak Pulse Current	$I_{PP}$	$t_p=8/20\mu s$			15	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>	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz		85	100	pF
	$C_{I/O-I/O}$	Reverse Bias=0V, f=1MHz		45	75	pF

**AQ24 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	28		V
Reverse Leakage Current	$I_{LEAK}$	$V_R=24V$			1.0	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP}=1A, t_p=8/20\mu s$ , Pin 1 or Pin 2 to Pin 3		30.0	36.0	V
		$I_{PP}=5A, t_p=8/20\mu s$ , Pin 1 or Pin 2 to Pin 3		36.0	42.0	V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p=100ns$ , Pin 1 or Pin 2 to Pin 3		0.50		$\Omega$
Peak Pulse Current	$I_{PP}$	$t_p=8/20\mu s$			9	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>	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz		60	65	pF
	$C_{I/O-I/O}$	Reverse Bias=0V, f=1MHz		30	50	pF

**AQ36 Electrical Characteristics** ( $T_{OP}=25^{\circ}C$ )

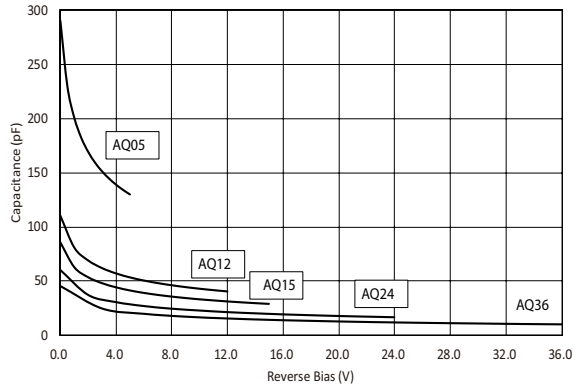
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	$V_{RWM}$	$I_R=1\mu A$			36.0	V
Breakdown Voltage	$V_{BR}$	$I_R=1mA$	40.0	41.8		V
Reverse Leakage Current	$I_{LEAK}$	$V_R=36V$			1.0	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP}=1A, t_p=8/20\mu s$ , Pin 1 or Pin 2 to Pin 3		45.0	52.0	V
		$I_{PP}=5A, t_p=8/20\mu s$ , Pin 1 or Pin 2 to Pin 3		58.5	62.0	V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p=100ns$ , Pin 1 or Pin 2 to Pin 3		0.65		$\Omega$
Peak Pulse Current	$I_{PP}$	$t_p=8/20\mu s$			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>	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz		45	50	pF
	$C_{I/O-I/O}$	Reverse Bias=0V, f=1MHz		25	40	pF

Note:

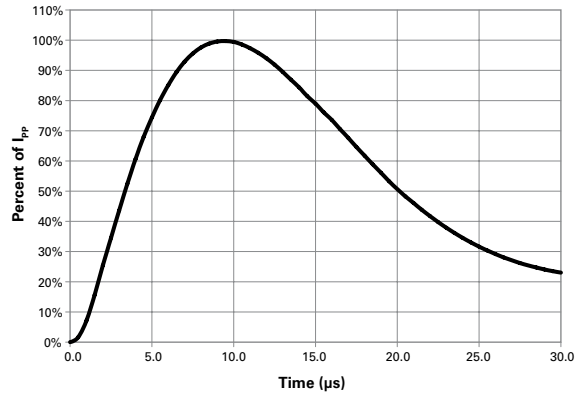
<sup>1</sup> Parameter is guaranteed by design and/or component characterization.

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

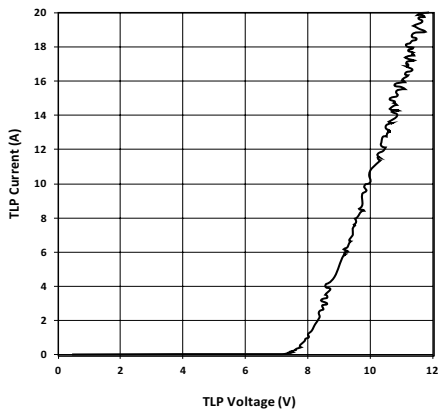
Capacitance vs. Reverse Bias (Pin1 or Pin2 to Pin3)



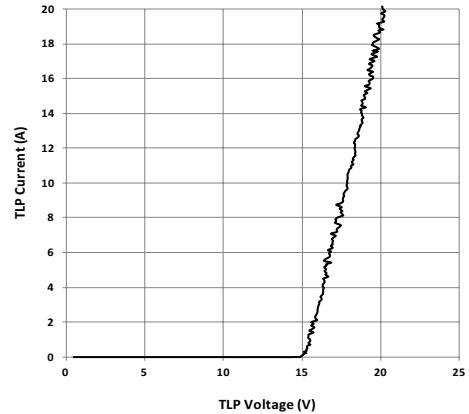
8/20μs Pulse Waveform



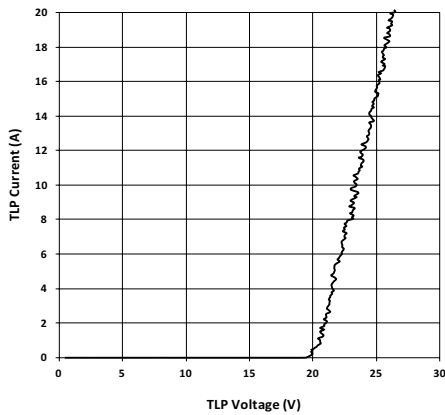
AQ05 Transmission Line Pulsing(TLP) Plot



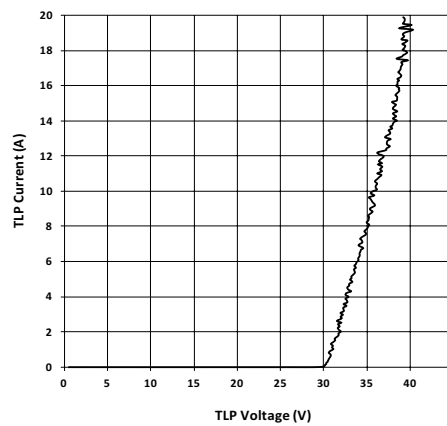
AQ12 Transmission Line Pulsing(TLP) Plot



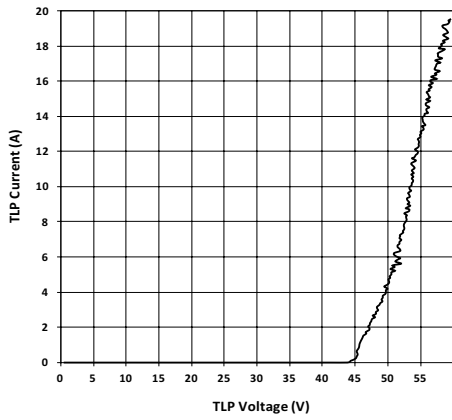
AQ15 Transmission Line Pulsing(TLP) Plot



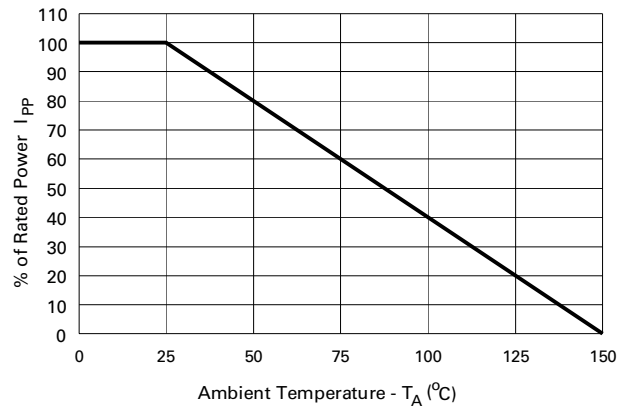
AQ24 Transmission Line Pulsing(TLP) Plot



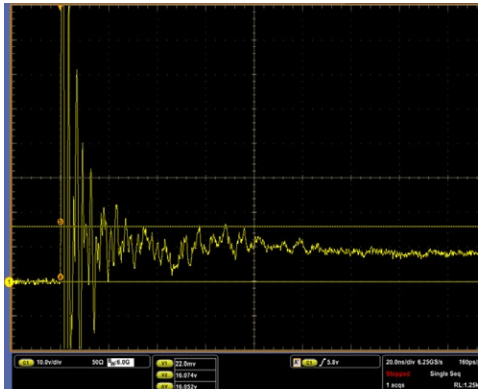
AQ36 Transmission Line Pulsing(TLP) Plot



Power Derating Curve



ISO10605 (C:330pF, R:330Ω) contact discharge plot at +8KV



ISO10605 (C:330pF, R:330Ω) contact discharge plot at -8KV



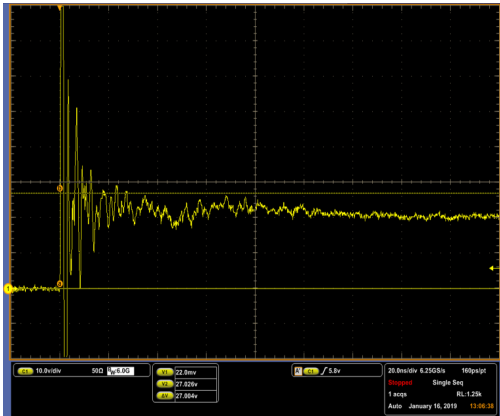
ISO10605 (C:330pF, R:330Ω) contact discharge plot at +8KV



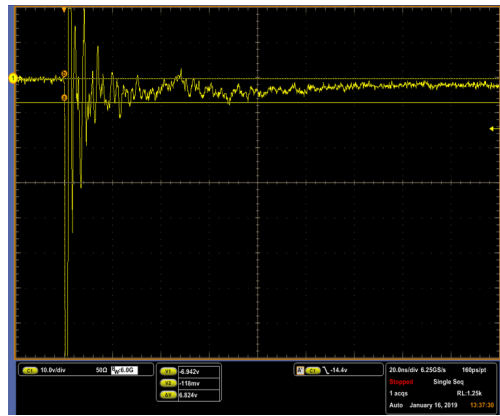
ISO10605 (C:330pF, R:330Ω) contact discharge plot at -8KV



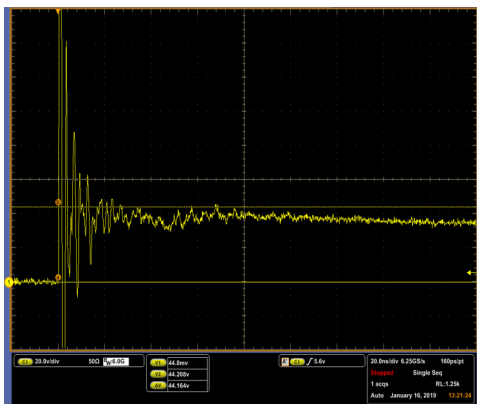
ISO10605 (C:330pF, R:330Ω) contact discharge plot at +8KV



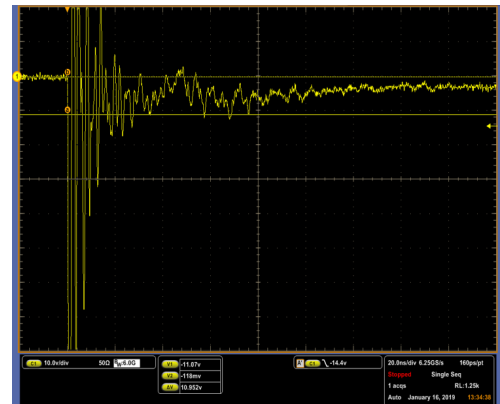
ISO10605 (C:330pF, R:330Ω) contact discharge plot at -8KV



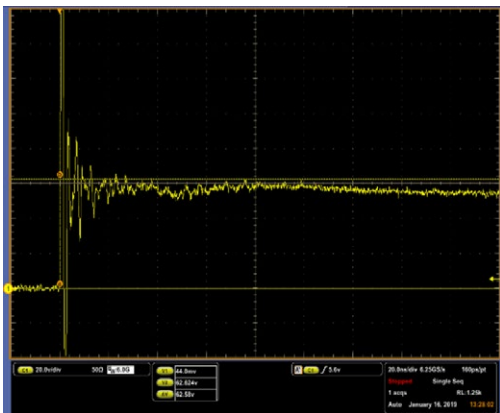
ISO10605 (C:330pF, R:330Ω) contact discharge plot at +8KV



ISO10605 (C:330pF, R:330Ω) contact discharge plot at -8KV



ISO10605 (C:330pF, R:330Ω) contact discharge plot at +8KV

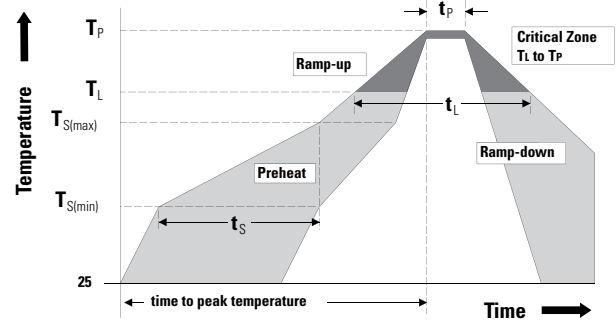


ISO10605 (C:330pF, R:330Ω) contact discharge plot at -8KV

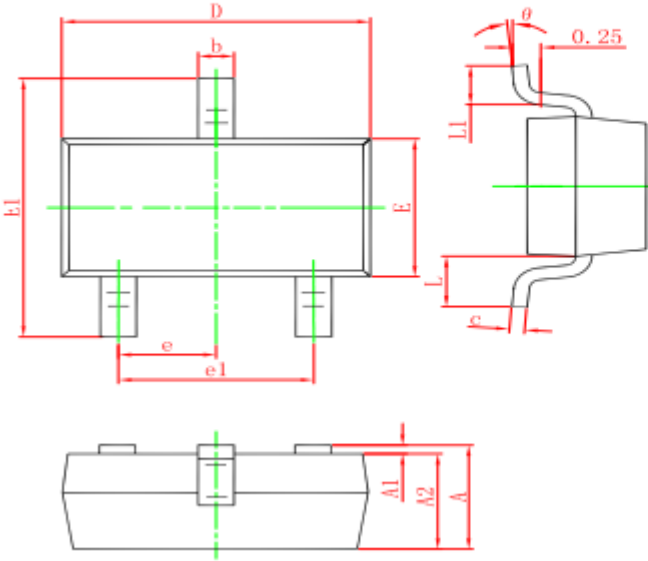


### Soldering Parameters

<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) ( $t_p$ )	60 – 180 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>		20 – 40 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

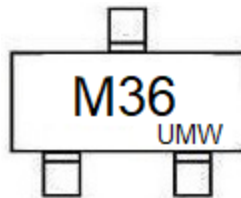


**SOT-23 PACKAGE OUTLINE DIMENSIONS**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 TYP.		0.037 TYP.	
e1	1.800	2.000	0.071	0.079
L	0.550 REF.		0.022 REF.	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°

**Marking**



**Ordering information**

Order code	Package	Baseqty	Deliverymode
UMW AQ36-02HTG	SOT-23	3000	Tape and reel