UMW AQxx-02HTG

1.Description

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

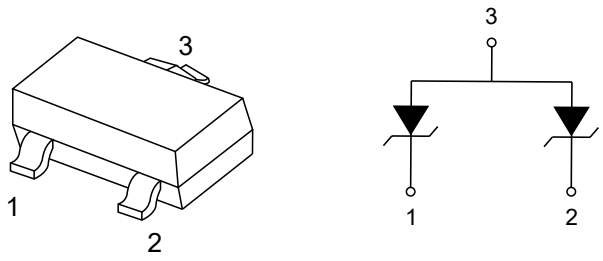
2.Applications

- Industrial Equipment
- Test and Medical
- Equipment
- Point-of-Sale Terminals
- Motor Controls
- Legacy Ports
- Security and Alarm Systems

3.Features

- ESD, ±30kV contact, ±30kV air
  EFT, IEC 61000-4-4, 50A (5/50ns)
- Lightning, 33A (8/20μs as defined in IEC 61000-4-5 2nd edition) for the AQ05
- Working voltages: 5V,12V, 15V, 24V and 36V ESD, ISO 10605, 330pF 330Ω, ±30kV contact, ±30kV air
- Low clamping voltage
- Low leakage current
- Moisture Sensitivity Level (MSL -1)
- Halogen free, lead free and RoHS compliant PPAP capable

4.Pinning information



SOT-23

5.Absolute Maximum Ratings

Parameter	Symbol	Value	Units
Peak Current (t_p=8/20μs)	P_{PK}	500	W
Junction Temperature	T_{OP}	-40 to 150	°C
Storage Temperature	T_{STOR}	-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.

6.1AQ05 Electrical Characteristics (T_{OP}=25ºC)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Reverse stand-off voltage	V_{RWM}	I_R=1μA			5	V
Breakdown Voltage	V_{BR}	I_R=1mA	6	7		V
Reverse Leakage Current	I_{LEAK}	V_R=5V			1	μA
Clamp Voltage [1]	V_C	I_{PP}=1A, t_p=8/20μs, Pin 1 or Pin 2 to Pin 3		8	9.8	V
		I_{PP}=10A, t_p=8/20μs, Pin 1 or Pin 2 to Pin 3		10.5	13	V
Dynamic Resistance [2]	R_{DYN}	TLP, t_p=100ns, Pin 1 or Pin 2 to Pin 3		0.19		Ω
Peak Pulse Current	I_{PP}	t_p=8/20μs			33	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]	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz		290	350	pF
	$C_{I/O-I/O}$	Reverse Bias=0V, f=1MHz		145	180	pF

6.2AQ12 Electrical Characteristics (T_{OP}=25ºC)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Reverse stand-off voltage	V_{RWM}	I_R=1μA			12	V
Breakdown Voltage	V_{BR}	I_R=1mA	13.3	14.2		V
Reverse Leakage Current	I_{LEAK}	V_R=12V			1	μA
Clamp Voltage [1]	V_C	I_{PP}=1A, t_p=8/20μs, Pin 1 or Pin 2 to Pin 3		16	18.5	V
		I_{PP}=10A, t_p=8/20μs, Pin 1 or Pin 2 to Pin 3		20	22.5	V
Dynamic Resistance [2]	R_{DYN}	TLP, t_p=100ns, Pin 1 or Pin 2 to Pin 3		0.25		Ω
Peak Pulse Current	I_{PP}	t_p=8/20μs			20	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]	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz		110	135	pF
	$C_{I/O-I/O}$	Reverse Bias=0V, f=1MHz		55	85	pF

6.3AQ15 Electrical Characteristics (T_{OP}=25ºC)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Reverse stand-off voltage	V_{RWM}	I_R=1μA			15	V
Breakdown Voltage	V_{BR}	I_R=1mA	16.7	18.5		V
Reverse Leakage Current	I_{LEAK}	V_R=15V			1	μA
Clamp Voltage [1]	V_C	I_{PP}=1A, t_p=8/20μs, Pin 1 or Pin 2 to Pin 3		20.5	24	V
		I_{PP}=10A, t_p=8/20μs, Pin 1 or Pin 2 to Pin 3		26.6	30	V
Dynamic Resistance [2]	R_{DYN}	TLP, t_p=100ns, Pin 1 or Pin 2 to Pin 3		0.3		Ω
Peak Pulse Current	I_{PP}	t_p=8/20μs			15	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]	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz		85	100	pF
	$C_{I/O-I/O}$	Reverse Bias=0V, f=1MHz		45	75	pF

6.4AQ24 Electrical Characteristics (T_{OP}=25ºC)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Reverse stand-off voltage	V_{RWM}	I_R=1μA			24	V
Breakdown Voltage	V_{BR}	I_R=1mA	26.7	28		V
Reverse Leakage Current	I_{LEAK}	V_R=24V			1	μA
Clamp Voltage [1]	V_C	I_{PP}=1A, t_p=8/20μs, Pin 1 or Pin 2 to Pin 3		30	36	V
		I_{PP}=5A, t_p=8/20μs, Pin 1 or Pin 2 to Pin 3		36	42	V
Dynamic Resistance [2]	R_{DYN}	TLP, t_p=100ns, Pin 1 or Pin 2 to Pin 3		0.5		Ω
Peak Pulse Current	I_{PP}	t_p=8/20μs			9	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]	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz		60	65	pF
	$C_{I/O-I/O}$	Reverse Bias=0V, f=1MHz		30	50	pF

6.5AQ36 Electrical Characteristics (T_{OP}=25ºC)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Reverse stand-off voltage	V_{RWM}	I_R=1μA			36	V
Breakdown Voltage	V_{BR}	I_R=1mA	40	41.8		V
Reverse Leakage Current	I_{LEAK}	V_R=36V			1	μA
Clamp Voltage [1]	V_C	I_{PP}=1A, t_p=8/20μs, Pin 1 or Pin 2 to Pin 3		45	52	V
		I_{PP}=5A, t_p=8/20μs, Pin 1 or Pin 2 to Pin 3		58.5	62	V
Dynamic Resistance [2]	R_{DYN}	TLP, t_p=100ns, Pin 1 or Pin 2 to Pin 3		0.65		Ω
Peak Pulse Current	I_{PP}	t_p=8/20μs			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]	$C_{I/O-GND}$	Reverse Bias=0V, f=1MHz		45	50	pF
	$C_{I/O-I/O}$	Reverse Bias=0V, f=1MHz		25	40	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

7.1Typical characteristic

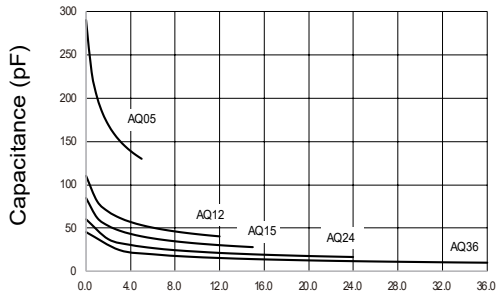


Figure 1: Capacitance vs. Reverse Bias (Pin1 or Pin2 to Pin3)

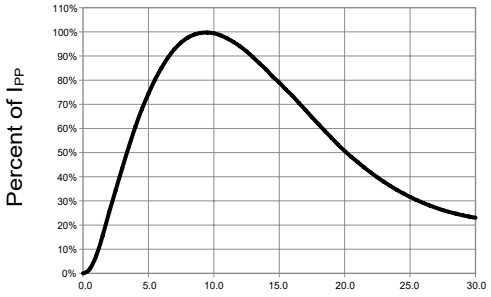


Figure 2: 8/20μs Pulse Waveform

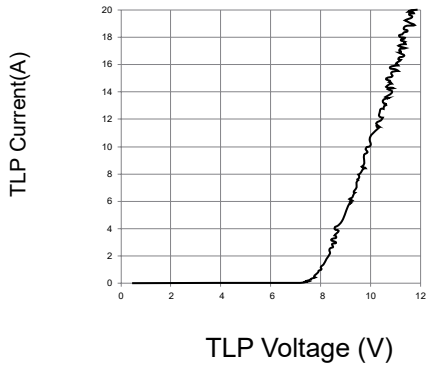


Figure 3: AQ05 Transmission Line Pulsing(TLP) Plot

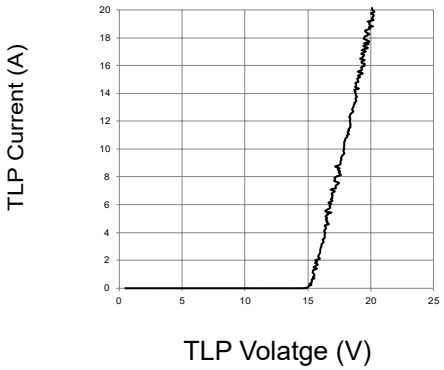


Figure 4: AQ12 Transmission Line Pulsing(TLP) Plot

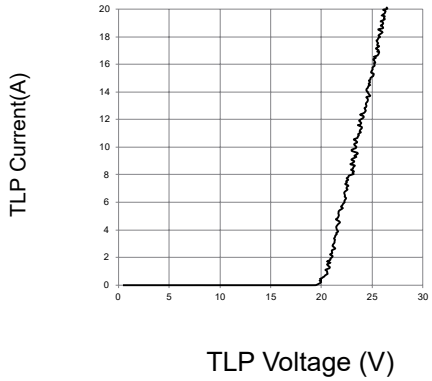


Figure 5: AQ15 Transmission Line Pulsing(TLP) Plot

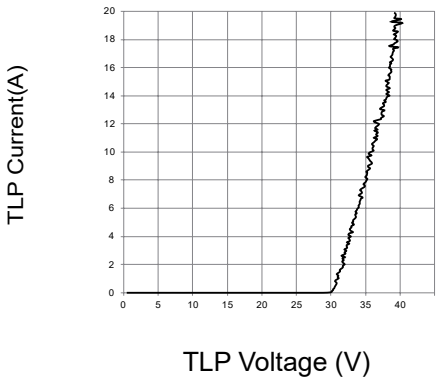


Figure 6: AQ24 Transmission Line Pulsing(TLP) Plot

7.2Typical characteristic

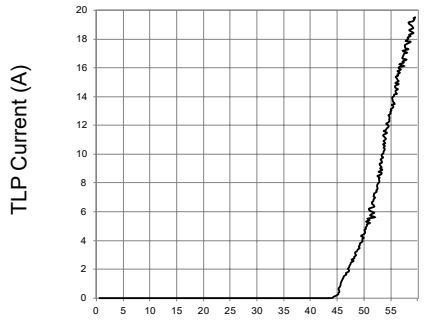


Figure 7: AQ36 Transmission Line Pulsing(TLP) Plot

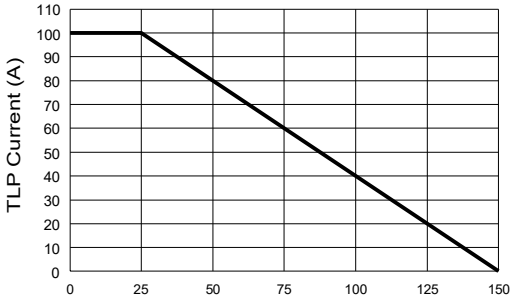


Figure 8: Power Derating Curve

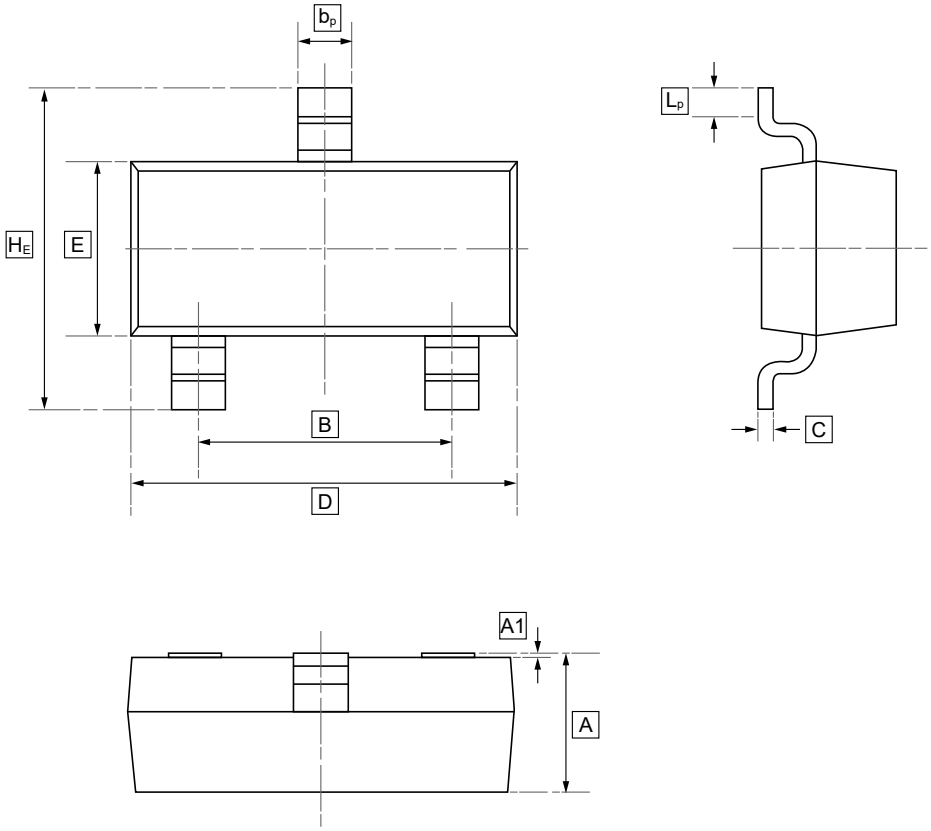
8.Soldering parameters

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 (Liquid us Temp (T_L) to peak)		3°C/sec. Max
$T_{s(max)}$ to T_L - Ramp-up Rate		3°C/sec. Max
Reflow	-Temperature(T_L) (Liquidus)	217°C
	-Temperature(T_L)	60-150 secs.
Peak Temp (T_p)		+260 $^{+0/-5}$ °C
Time within 5°C of actual Peak Temp (T_p)		20-40 seconds
Ramp-down Rate		6°C/sec. Max
Time 25°C to Peak Temp (T_p)		8 min. Max
Do not exceed		260°C

9.Product Characteristics

Lead Plating	Matte Tin
Lead Material	Copper Alloy
Lead Coplanarity	0.004 inches(0.102mm)
Substrate Material	Silicon
Body Material	Molded Compound
Flammability	UL Recognized compound meeting flammability rating V-0

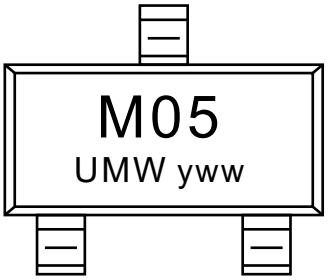
10.SOT-23 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A	B	b_p	C	D	E	H_E	A1	L_p
Min	0.95	1.78	0.35	0.08	2.70	1.20	2.20	0.013	0.20
Max	1.40	2.04	0.50	0.19	3.10	1.65	3.00	0.100	0.50

11.Ordering information



yww: Batch Code

Order Code	Package	Base QTY	Delivery Mode
UMW AQ05-02HTG	SOT-23	3000	Tape and reel
UMW AQ12-02HTG	SOT-23	3000	Tape and reel
UMW AQ15-02HTG	SOT-23	3000	Tape and reel
UMW AQ24-02HTG	SOT-23	3000	Tape and reel
UWM AQ36-02HTG	SOT-23	3000	Tape and reel



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