

EVVOSEMI[®]

THINK CHANGE DO



ESD



TVS



MOS



LDO



Diode



Sensor



DC-DC

Product Specification

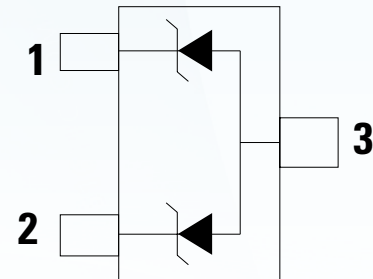
▶ Domestic	Part Number	AQxx-02HTG
▶ Overseas	Part Number	AQxx-02HTG
▶ Equivalent	Part Number	AQxx-02HTG

EV is the abbreviation of name EVVO

AQxx-02HTG

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.

**Features**

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

Applications

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

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.

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	μA
Clamp Voltage ¹	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 ²	R_{DYN}	TLP, $t_p=100ns$, Pin 1 or Pin 2 to Pin 3		0.19		Ω
Peak Pulse Current	I_{PP}	$t_p=8/20\mu s$			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 ³	$C_{I/O-GND}$	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	μA
Clamp Voltage ¹	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 ²	R_{DYN}	TLP, $t_p=100ns$, Pin 1 or Pin 2 to Pin 3		0.25		Ω
Peak Pulse Current	I_{PP}	$t_p=8/20\mu s$			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 ³	$C_{I/O-GND}$	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	μA
Clamp Voltage ¹	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 ²	R_{DYN}	TLP, $t_p=100ns$, Pin 1 or Pin 2 to Pin 3		0.30		Ω
Peak Pulse Current	I_{PP}	$t_p=8/20\mu s$			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

AQ24 Electrical Characteristics($T_{OP}=25^{\circ}C$)

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	μA
Clamp Voltage ¹	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 ²	R_{DYN}	TLP, $t_p=100ns$, Pin 1 or Pin 2 to Pin 3		0.50		Ω
Peak Pulse Current	I_{PP}	$t_p=8/20\mu s$			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

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

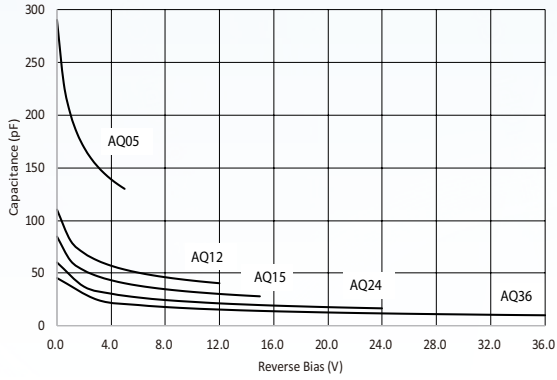
Reverse Standoff Voltage	V_{RWM}	$I_R=1\mu A$			36.0	V
Breakdown Voltage	V_{BR}	$I_R=1mA$	40.0	41.8		V
Reverse Leakage Current	I_{LEAK}	$V_R=36V$			1.0	μA
Clamp Voltage ¹	V_C	$I_{PP}=1A, t_p=8/20\mu s$, Pin 1 or Pin 2 to Pin 3		45.0	52.0	V
		$I_{PP}=5A, t_p=8/20\mu s$, Pin 1 or Pin 2 to Pin 3		58.5	62.0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

Note:

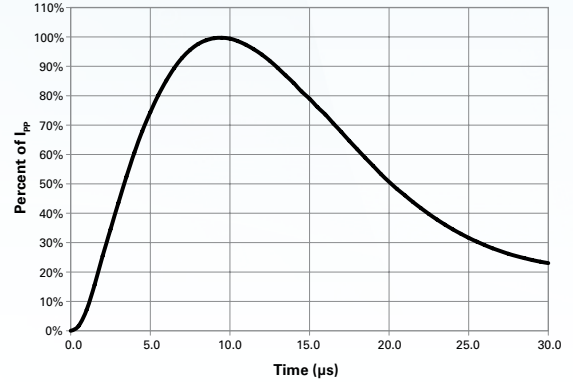
¹ Parameter is guaranteed by design and/or component characterization.

² Transmission Line Pulse (TLP) with 100ns width, 2ns rise time, and average window $t_1=70ns$ to $t_2=90ns$

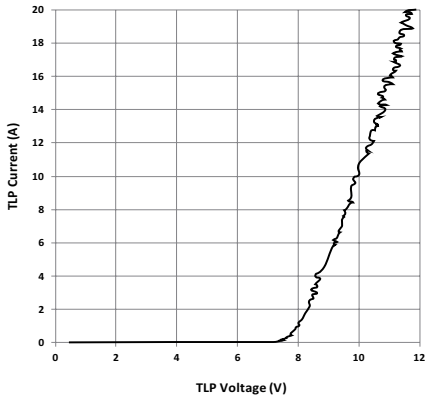
Capacitance vs. Reverse Bias (Pin1 or Pin2 to Pin3)



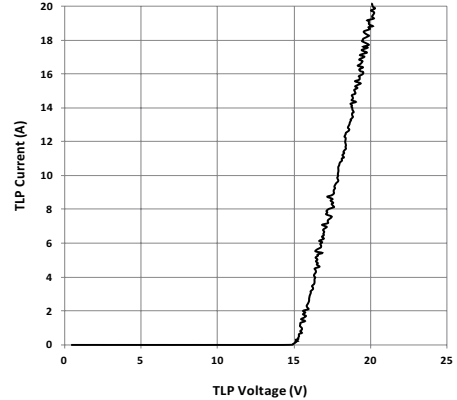
8/20μs Pulse Waveform



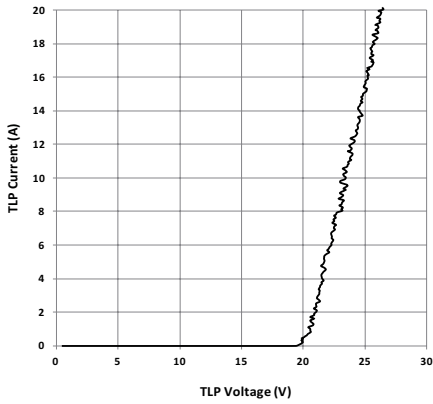
AQ05 Transmission Line Pulsing(TLP) Plot



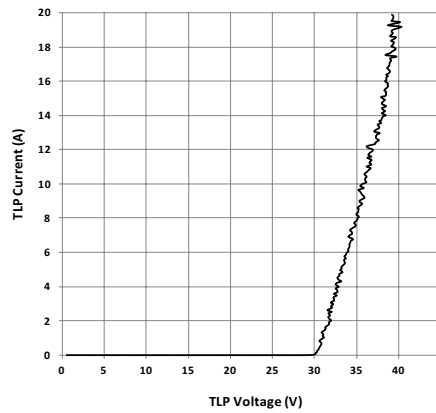
AQ12 Transmission Line Pulsing(TLP) Plot



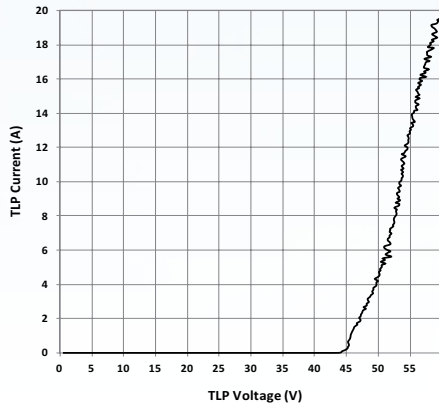
AQ15 Transmission Line Pulsing(TLP) Plot



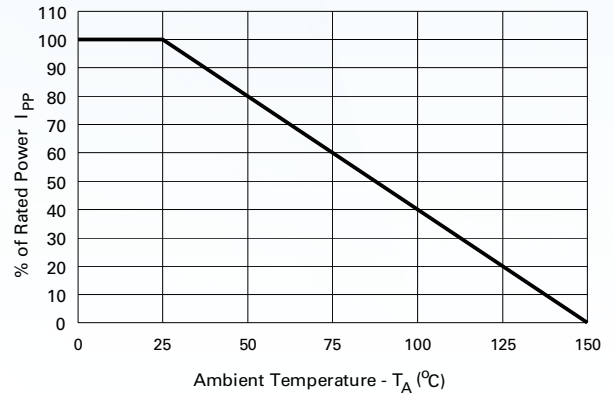
AQ24 Transmission Line Pulsing(TLP) Plot



AQ36 Transmission Line Pulsing(TLP) Plot



Power Derating Curve



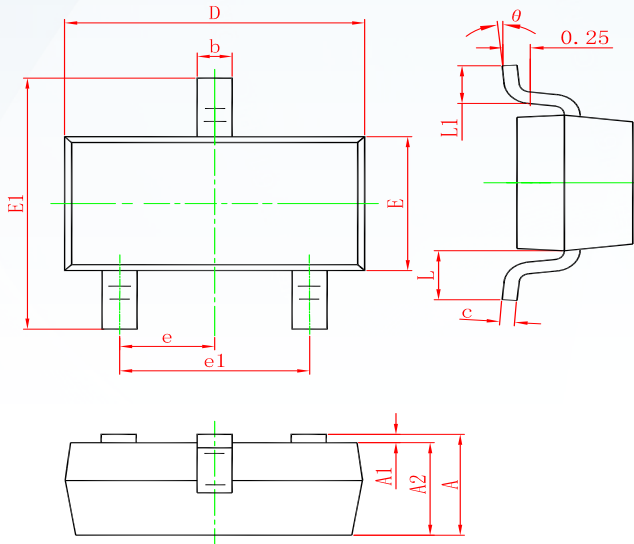
Soldering Parameters

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 (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

Product Characteristics

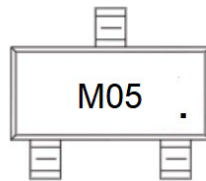
Lead Plating	Matte Tin
Lead Material	Copper Alloy
Lead Coplanarity	0.004 inches(0.102mm)
Substrate Material	Silicon
Body Material	Molded Compound
Flammability	UL Recognized compound meeting flammability rating V-0

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
theta	0°	8°	0°	8°

Marking



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