AQxxC Series 450W Discrete Bidirectional TVS Diode

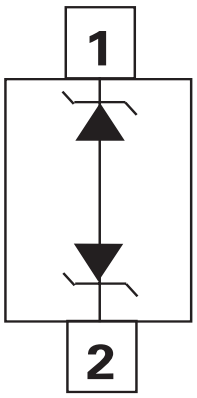
AUTOMOTIVE GRADE HF RoHS GREEN

Description

The bidirectional AQxxC series is designed to replace multilayer varistors (MLVs) in electronic equipment for low speed and DC applications. It will protect any sensitive equipment from damage due to electrostatic discharge (ESD) and other transient events.

The AQxxC series can safely absorb repetitive ESD strikes at ±30kV (contact discharge, IEC 61000-4-2) without performance degradation and safely dissipate 30A (AQ05C) of 8/20µs induced surge current (IEC 61000-4-5) with very low clamping voltages.

Pinout and Functional Block Diagram



Features

- ESD, IEC 61000-4-2, ±30kV contact, ±30kV air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning, IEC 61000-4-5 2nd edition, 30A (t_P=8/20µs, AQ05C)
- Low clamping voltage
- Low leakage current
- Small SOD323 package fits 0805 footprints
- AEC-Q101 qualified
- Moisture Sensitivity Level(MSL -1)
- Halogen free, lead free and RoHS compliant

Applications

- Switches / Buttons
- Test Equipment / Instrumentation
- Point-of-Sale Terminals
- Medical Equipment
- Notebooks / Desktops / Servers
- Computer Peripherals
- CAN Bus protection
- Automotive applications

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.

©2017 Littelfuse, Inc.
Specifications are subject to change without notice.
Revision: 09/21/17

Absolute Maximum Ratings

Symbol	Parameter	Value	Units
P_{pk}	Peak Pulse Power (t_p=8/20µs)	450	W
T_{OP}	Operating Temperature	-40 to 150	°C
T_{STOR}	Storage Temperature	-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.

AQ05C Electrical Characteristics (T_{OP}=25°C)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V_{RWM}	I_R≤1µA			5.0	V
Reverse Voltage Drop	V_R	I_R=1mA	6.0			V
Leakage Current	I_{LEAK}	V_R=5V			1.0	µA
Clamp Voltage[1]	V_C	I_{PP}=1A, t_p=8/20µs, Fwd			10.0	V
		I_{PP}=10A, t_p=8/20µs, Fwd			14.5	V
Dynamic Resistance[2]	R_{DYN}	TLP, tp=100ns, I/O to Ground		0.31		Ω
Peak Pulse Current	I_{pp}	t_p=8/20µs			30.0	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_D	Reverse Bias=0V, f=1MHz			200	pF

AQ12C Electrical Characteristics (T_{OP}=25°C)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V_{RWM}	I_R≤1µA			12.0	V
Reverse Voltage Drop	V_R	I_R=1mA	13.3			V
Leakage Current	I_{LEAK}	V_R=12V			1.0	µA
Clamp Voltage[1]	V_C	I_{PP}=1A, t_p=8/20µs, Fwd			18.5	V
		I_{PP}=10A, t_p=8/20µs, Fwd			23.0	V
Dynamic Resistance[2]	R_{DYN}	TLP, tp=100ns, I/O to Ground		0.41		Ω
Peak Pulse Current	I_{pp}	t_p=8/20µs			17.0	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_{D-GND}	Reverse Bias=0V, f=1MHz			100	pF

©2017 Littelfuse, Inc.
Specifications are subject to change without notice.
Revision: 09/21/17

AQ15C Electrical Characteristics (T_{OP}=25°C)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V_{RWM}	I_R≤1µA			15.0	V
Reverse Voltage Drop	V_R	I_R=1mA	16.7			V
Leakage Current	I_{LEAK}	V_R=15V			1.0	µA
Clamp Voltage[1]	V_C	I_{PP}=1A, t_p=8/20µs, Fwd			24.0	V
		I_{PP}=10A, t_p=8/20µs, Fwd			31.0	V
Dynamic Resistance[2]	R_{DYN}	TLP, tp=100ns, I/O to Ground		0.46		Ω
Peak Pulse Current	I_{pp}	t_p=8/20µs			12.0	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			75	pF

AQ24C Electrical Characteristics (T_{OP}=25°C)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V_{RWM}	I_R≤1µA			24.0	V
Reverse Voltage Drop	V_R	I_R=1mA	26.7			V
Leakage Current	I_{LEAK}	V_R=24V			1.0	µA
Clamp Voltage[1]	V_C	I_{PP}=1A, t_p=8/20µs, Fwd			36.0	V
		I_{PP}=5A, t_p=8/20µs, Fwd			42.0	V
Dynamic Resistance[2]	R_{DYN}	TLP, tp=100ns, I/O to Ground		0.62		Ω
Peak Pulse Current	I_{pp}	t_p=8/20µs			7.0	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			50	pF

AQ36C Electrical Characteristics (T_{OP}=25°C)

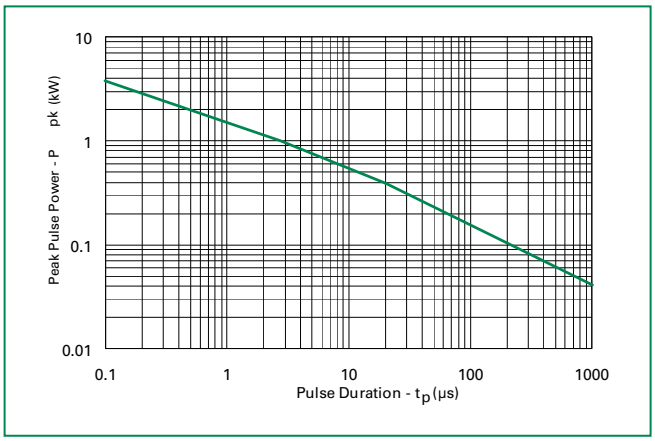
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V_{RWM}	I_R≤1µA			36.0	V
Reverse Voltage Drop	V_R	I_R=1mA	40.0			V
Leakage Current	I_{LEAK}	V_R=36V			1.0	µA
Clamp Voltage[1]	V_C	I_{PP}=1A, t_p=8/20µs, Fwd			52.0	V
		I_{PP}=5A, t_p=8/20µs, Fwd			62.0	V
Dynamic Resistance[2]	R_{DYN}	TLP, tp=100ns, I/O to Ground		0.68		Ω
Peak Pulse Current	I_{pp}	t_p=8/20µs			5.0	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			30	pF

Note:

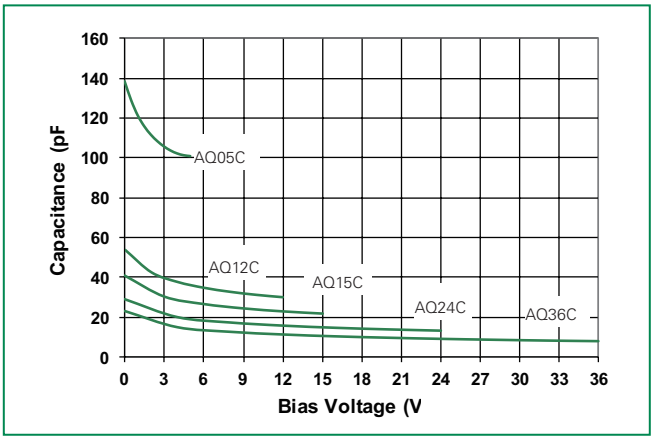
1. Parameter is guaranteed by design and/or component characterization.
2. Transmission Line Pulse (TLP) with 100ns width, 2ns rise time, and average window t1=70ns to t2= 90ns

©2017 Littelfuse, Inc.
Specifications are subject to change without notice.
Revision: 09/21/17

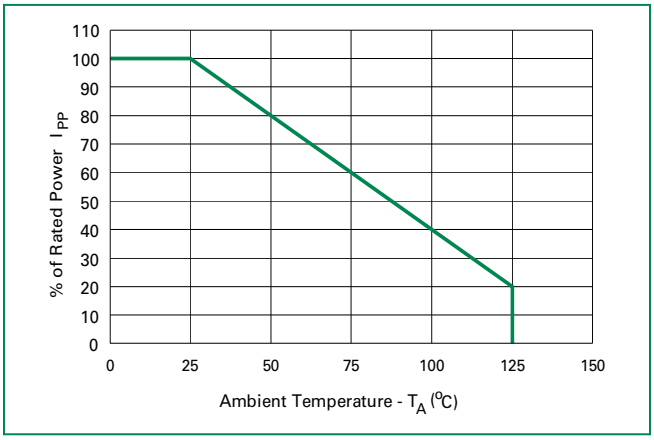
Non-Repetitive Peak Pulse Power vs. Pulse Time



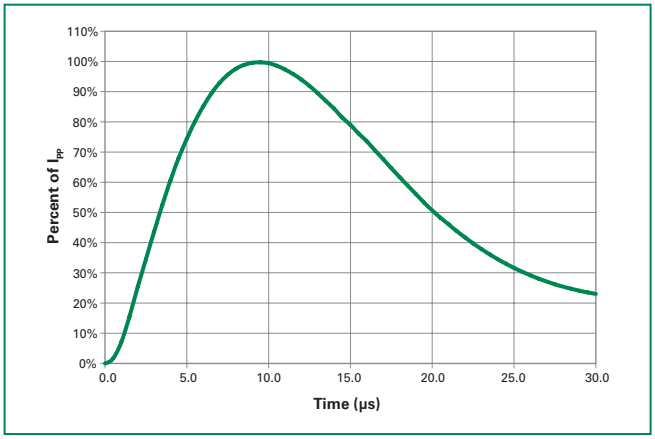
Capacitance vs. Bias



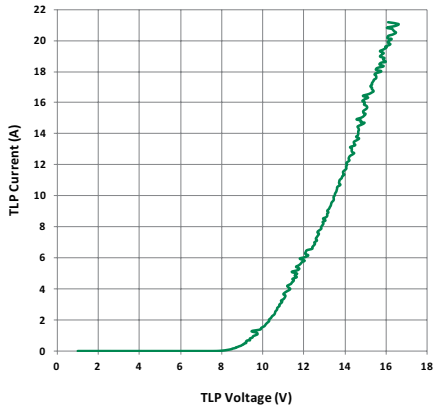
Power Derating Curve



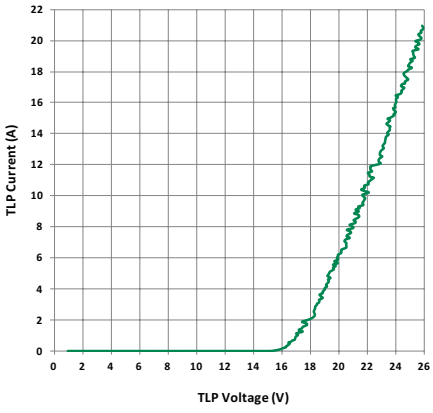
8/20µs Pulse Waveform



AQ05C Transmission Line Pulsing(TLP) Plot



AQ12C Transmission Line Pulsing(TLP) Plot

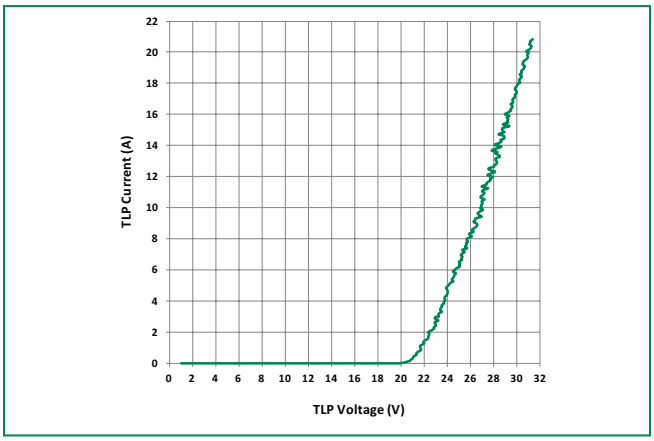


©2017 Littelfuse, Inc.
Specifications are subject to change without notice.
Revision: 09/21/17

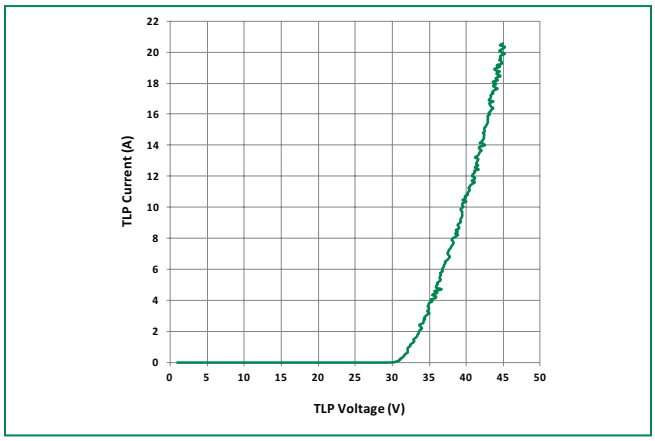
TVS Diode Arrays (SPA® Diodes)

General Purpose ESD Protection - AQxxC Series

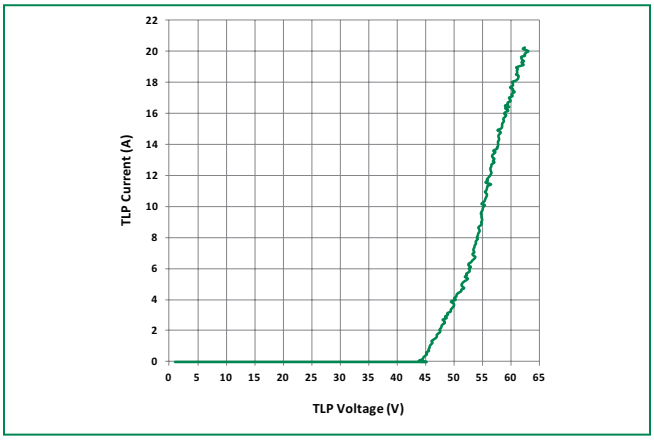
AQ15C Transmission Line Pulsing(TLP) Plot



AQ24C Transmission Line Pulsing(TLP) Plot



AQ36C Transmission Line Pulsing(TLP) Plot



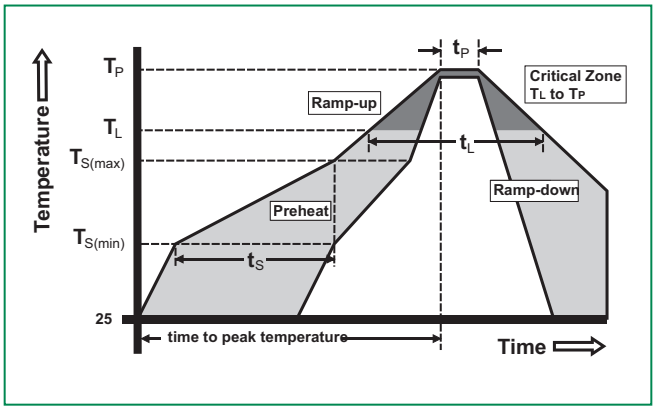
Product Characteristics

Lead Plating	Matte Tin
Lead Material	Copper Alloy
Lead Coplanarity	0.0004 inches (0.102mm)
Substrate material	Silicon
Body Material	Molded Epoxy
Flammability	UL Recognized epoxy meeting flammability rating V-0.

Notes :
1. All dimensions are in millimeters
2. Dimensions include solder plating.
3. Dimensions are exclusive of mold flash & metal burr.
4. Blo is facing up for mold and facing down for trim/form, i.e. reverse trim/form.
5. Package surface matte finish VDI 11-13.

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

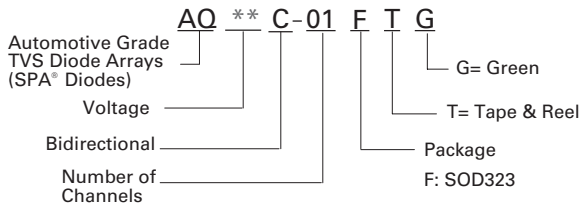


©2017 Littelfuse, Inc.
Specifications are subject to change without notice.
Revision: 09/21/17

TVS Diode Arrays (SPA® Diodes)

General Purpose ESD Protection - AQxxC Series

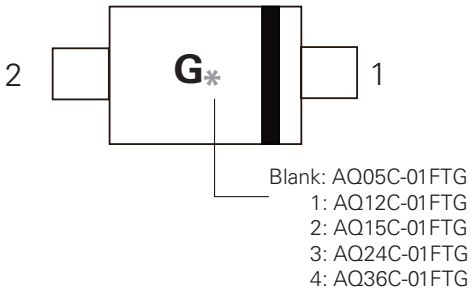
Part Numbering System



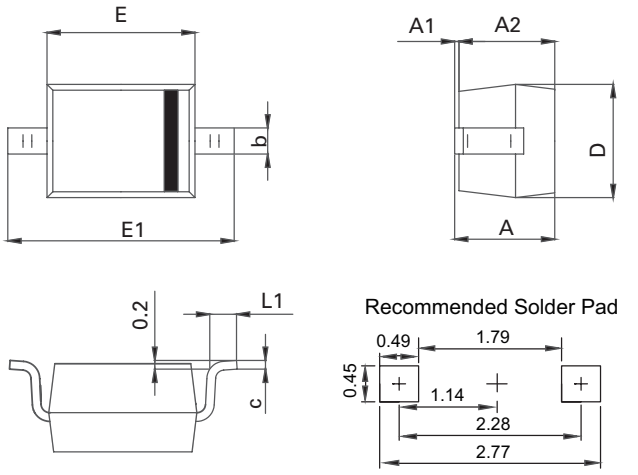
Ordering Information

Part Number	Package	Marking	Min. Order Qty.
AQ05C-01FTG	SOD323	G	3000
AQ12C-01FTG	SOD323	G1	3000
AQ15C-01FTG	SOD323	G2	3000
AQ24C-01FTG	SOD323	G3	3000
AQ36C-01FTG	SOD323	G4	3000

Part Marking System



Package Dimensions -SOD323

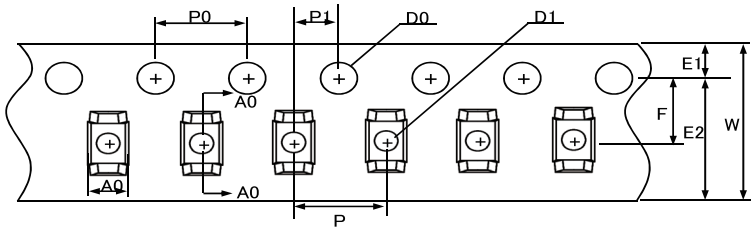


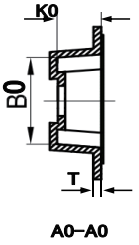
Unit: mm

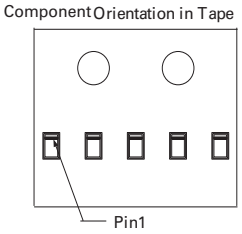
Symbol	SOD323			
	Millimeters		Inches	
	Min	Max	Min	Max
A	0.80	1.14	0.031	0.045
A1	0.00	0.10	0.000	0.004
A2	0.80	1.04	0.031	0.014
b	0.25	0.35	0.010	0.014
c	0.08	0.15	0.003	0.006
D	1.15	1.45	0.045	0.057
E	1.60	1.90	0.063	0.075
E1	2.44	2.70	0.096	0.106
L1	0.25	0.45	0.010	0.018

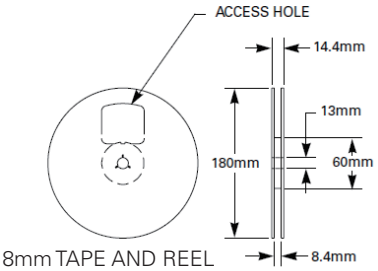
©2017 Littelfuse, Inc.
Specifications are subject to change without notice.
Revision: 09/21/17

Embossed Carrier Tape & Reel Specification — SOD323









Symbol	Millimeters
A0	1.36min/1.62max
B0	2.90+/-0.10
W	8.0+0.3/-0.10
D0	1.50+0.10
D1	ø1.00min/ø1.25max
E	1.75+/-0.10
E2	-
F	3.50+/-0.05
P0	4.00+/-0.10
P	4.00+/-0.10
P1	2.00+/-0.05
K0	1.15min/1.45max
T	0.254+/-0.13

Disclaimer Notice - Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at http://www.littelfuse.com/disclaimer-electronics.

©2017 Littelfuse, Inc.
Specifications are subject to change without notice.