

# AQxxC-01FTG Series

## 450W Bidirectional TVS Diode

 AUTOMOTIVE GRADE **HF**  RoHS  Pb  GREEN



### Additional Information



Resources

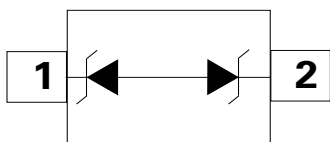


Accessories



Samples

### Pinout and Functional Block Diagram



### Description

The bidirectional AQxxC-01FTG 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-01FTG 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. Additionally, the AQ05C can safely conduct a 30A 8/20 surge event as defined in IEC 61000-4-5 2nd Edition.

### Features & Benefits

- ESD, IEC 61000-4-2,  $\pm 30$ kV contact,  $\pm 30$ kV air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning, 30A (8/20 as defined in IEC 61000-4-5 2nd edition) for the AQ05C
- Low clamping voltage
- PPAP capable
- 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.

# AQxxC-01FTG Series

## 450W Bidirectional TVS Diode

### Absolute Maximum Ratings

Symbol	Parameter	Value	Units
$P_{pk}$	Peak Pulse Power ( $t_p=8/20\mu s$ )	450	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.

### AQ05C 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			V
Reverse Leakage Current	$I_{LEAK}$	$V_R=5V$			1.0	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP}=1A, t_p=8/20\mu s, Fwd$			10.0	V
		$I_{PP}=10A, t_p=8/20\mu s, Fwd$			14.5	V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p=100ns, I/O$ to Ground		0.31		$\Omega$
Peak Pulse Current	$I_{PP}$	$t_p=8/20\mu s$			30.0	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>	$C_{I/O-I/O}$	Reverse Bias=0V, f=1MHz			200	pF

### AQ12C 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			V
Reverse Leakage Current	$I_{LEAK}$	$V_R=12V$			1.0	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP}=1A, t_p=8/20\mu s, Fwd$			18.5	V
		$I_{PP}=10A, t_p=8/20\mu s, Fwd$			23.0	V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p=100ns, I/O$ to Ground		0.41		$\Omega$
Peak Pulse Current	$I_{PP}$	$t_p=8/20\mu s$			17.0	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>	$C_{I/O-I/O}$	Reverse Bias=0V, f=1MHz			100	pF

# AQxxC-01FTG Series

## 450W Bidirectional TVS Diode

### AQ15C Electrical Characteristics (T<sub>op</sub>=25°C)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V <sub>RWM</sub>	I <sub>R</sub> =1μA			15.0	V
Breakdown Voltage	V <sub>BR</sub>	I <sub>R</sub> =1mA	16.7			V
Reverse Leakage Current	I <sub>LEAK</sub>	V <sub>R</sub> =15V			1.0	μA
Clamp Voltage <sup>1</sup>	V <sub>C</sub>	I <sub>pp</sub> =1A, t <sub>p</sub> =8/20μs, Fwd			24.0	V
		I <sub>pp</sub> =10A, t <sub>p</sub> =8/20μs, Fwd			31.0	V
Dynamic Resistance <sup>2</sup>	R <sub>DYN</sub>	TLP, t <sub>p</sub> =100ns, I/O to Ground		0.46		Ω
Peak Pulse Current	I <sub>pp</sub>	t <sub>p</sub> =8/20μs			12.0	A
ESD Withstand Voltage <sup>1</sup>	V <sub>ESD</sub>	IEC 61000-4-2 (Contact Discharge)	±30			kV
		IEC 61000-4-2 (Air Discharge)	±30			kV
Diode Capacitance <sup>1</sup>	C <sub>I/O-I/O</sub>	Reverse Bias=0V, f=1MHz			75	pF

### AQ24C Electrical Characteristics (T<sub>op</sub>=25°C)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V <sub>RWM</sub>	I <sub>R</sub> =1μA			24.0	V
Breakdown Voltage	V <sub>BR</sub>	I <sub>R</sub> =1mA	26.7			V
Reverse Leakage Current	I <sub>LEAK</sub>	V <sub>R</sub> =24V			1.0	μA
Clamp Voltage <sup>1</sup>	V <sub>C</sub>	I <sub>pp</sub> =1A, t <sub>p</sub> =8/20μs, Fwd			36.0	V
		I <sub>pp</sub> =5A, t <sub>p</sub> =8/20μs, Fwd			42.0	V
Dynamic Resistance <sup>2</sup>	R <sub>DYN</sub>	TLP, t <sub>p</sub> =100ns, I/O to Ground		0.62		Ω
Peak Pulse Current	I <sub>pp</sub>	t <sub>p</sub> =8/20μs			7.0	A
ESD Withstand Voltage <sup>1</sup>	V <sub>ESD</sub>	IEC 61000-4-2 (Contact Discharge)	±30			kV
		IEC 61000-4-2 (Air Discharge)	±30			kV
Diode Capacitance <sup>1</sup>	C <sub>I/O-I/O</sub>	Reverse Bias=0V, f=1MHz			50	pF

### AQ36C Electrical Characteristics (T<sub>op</sub>=25°C)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V <sub>RWM</sub>	I <sub>R</sub> =1μA			36.0	V
Breakdown Voltage	V <sub>BR</sub>	I <sub>R</sub> =1mA	40.0			V
Reverse Leakage Current	I <sub>LEAK</sub>	V <sub>R</sub> =36V			1.0	μA
Clamp Voltage <sup>1</sup>	V <sub>C</sub>	I <sub>pp</sub> =1A, t <sub>p</sub> =8/20μs, Fwd			52.0	V
		I <sub>pp</sub> =5A, t <sub>p</sub> =8/20μs, Fwd			62.0	V
Dynamic Resistance <sup>2</sup>	R <sub>DYN</sub>	TLP, t <sub>p</sub> =100ns, I/O to Ground		0.68		Ω
Peak Pulse Current	I <sub>pp</sub>	t <sub>p</sub> =8/20μs			5.0	A
ESD Withstand Voltage <sup>1</sup>	V <sub>ESD</sub>	IEC 61000-4-2 (Contact Discharge)	±30			kV
		IEC 61000-4-2 (Air Discharge)	±30			kV
Diode Capacitance <sup>1</sup>	C <sub>I/O-I/O</sub>	Reverse Bias=0V, f=1MHz			30	pF

**Note:**

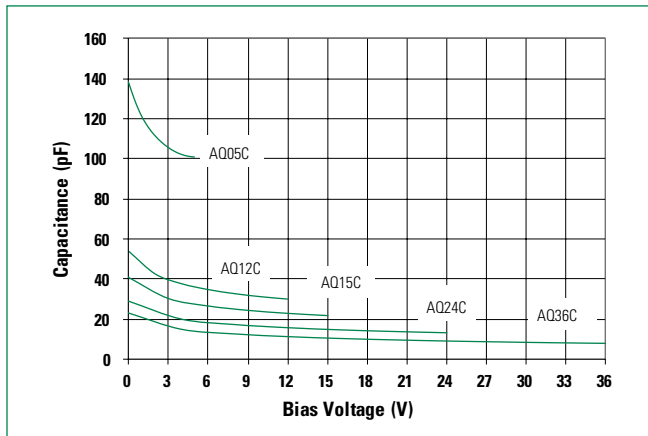
1. Parameter is guaranteed by design and/or component characterization.

2. Transmission Line Pulse (TLP) with 100ns width, 2ns rise time, and average window t1=70ns to t2= 90ns

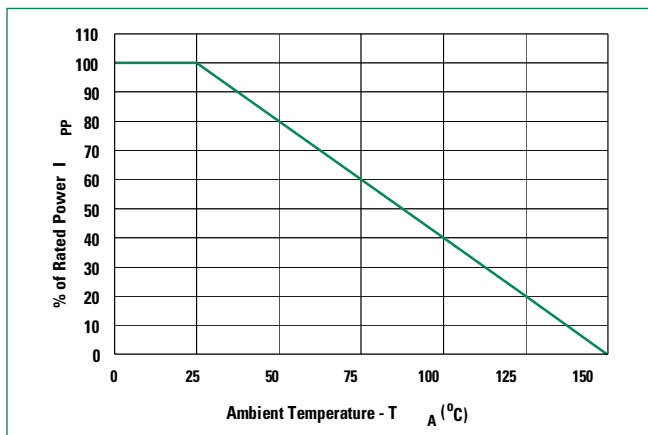
# AQxxC-01FTG Series

## 450W Bidirectional TVS Diode

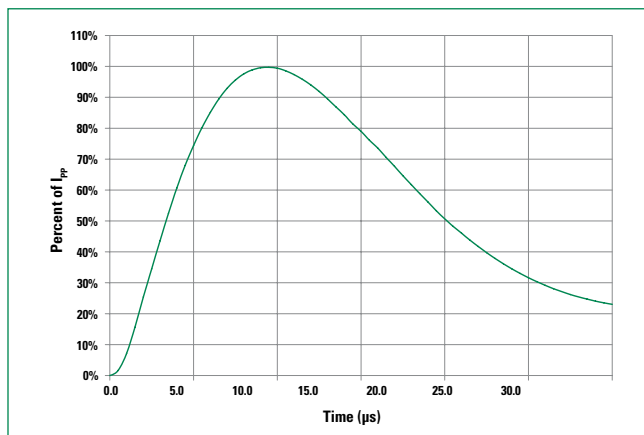
Capacitance vs. Bias



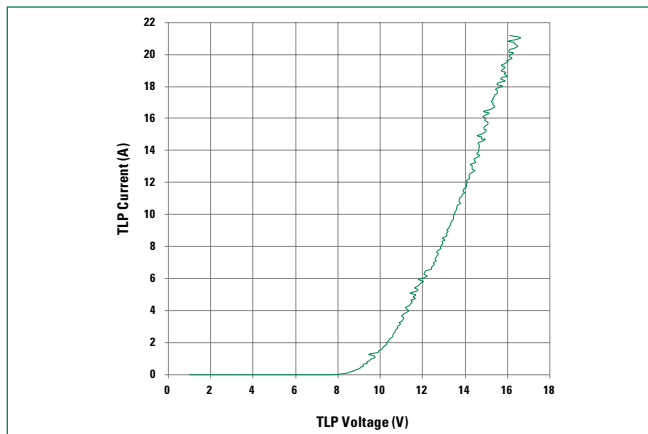
Power Derating Curve



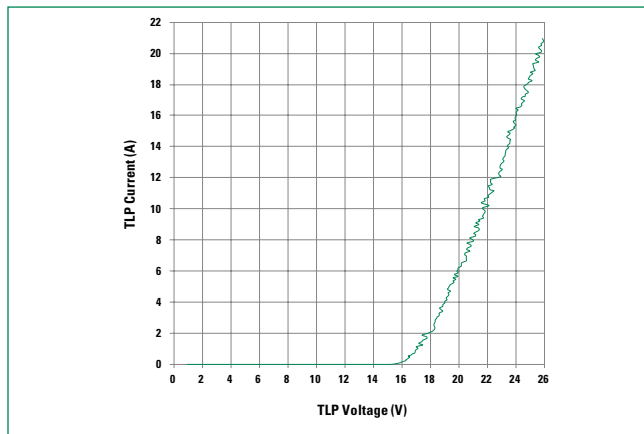
8/20µs Pulse Waveform



AQ05C Transmission Line Pulsing(TLP) Plot



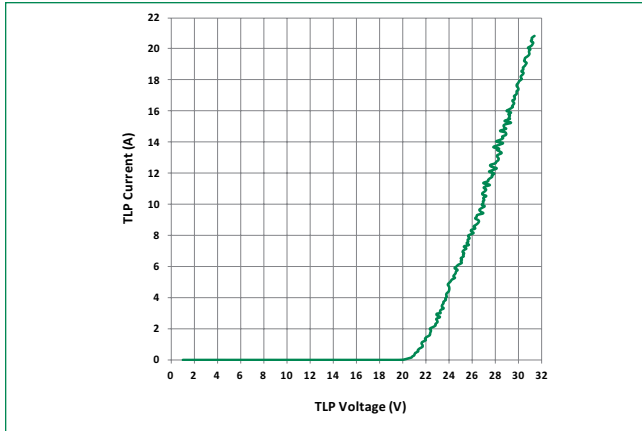
AQ12C Transmission Line Pulsing(TLP) Plot



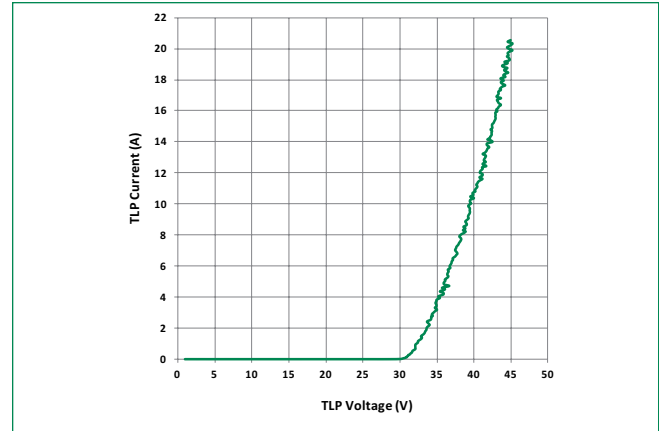
# AQxxC-01FTG Series

## 450W Bidirectional TVS Diode

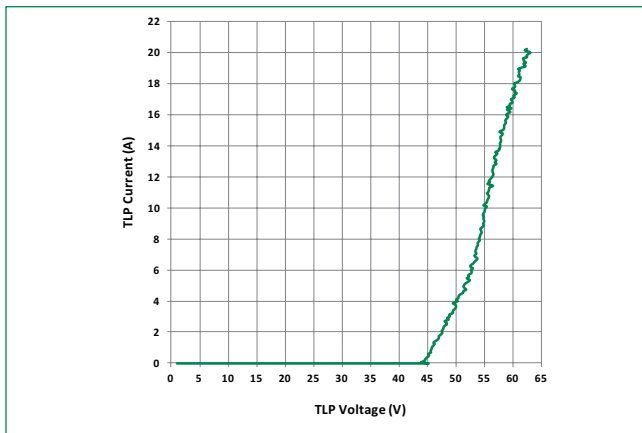
AQ15C Transmission Line Pulsing (TLP) Plot



AQ24C Transmission Line Pulsing (TLP) Plot



AQ36C Transmission Line Pulsing (TLP) Plot

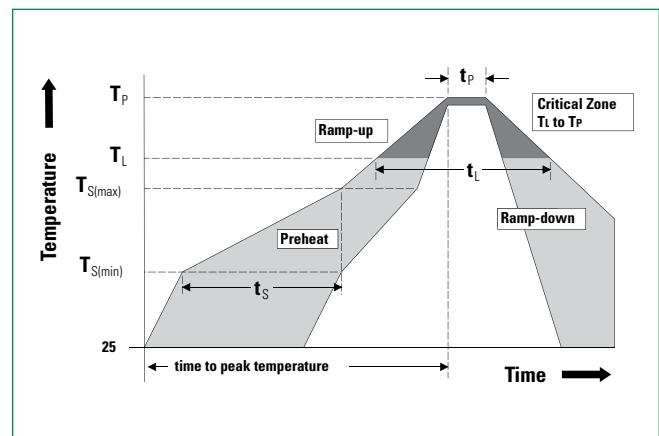


### Product Characteristics

<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 V-0

### Soldering Parameters

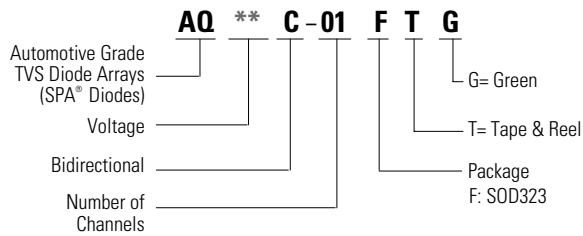
<b>Reflow Condition</b>	Pb – Free assembly	
<b>Pre Heat</b>	- Temperature Min ( $T_{s(min)}$ )	150°C
	- Temperature Max ( $T_{s(max)}$ )	200°C
	- Time (min to max) ( $t_s$ )	60 – 120 secs
<b>Average ramp up rate (Liquidus) Temp (<math>T_L</math>) to peak</b>	3°C/second max	
<b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>	3°C/second max	
<b>Reflow</b>	- Temperature ( $T_L$ ) (Liquidus)	217°C
	- Temperature ( $t_t$ )	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	



# AQxxC-01FTG Series

## 450W Bidirectional TVS Diode

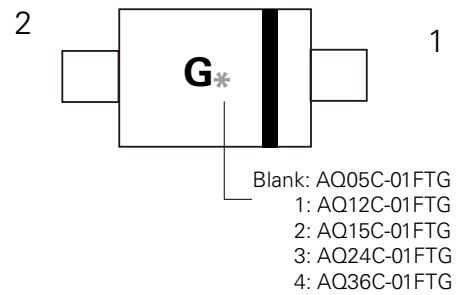
### Part Numbering System



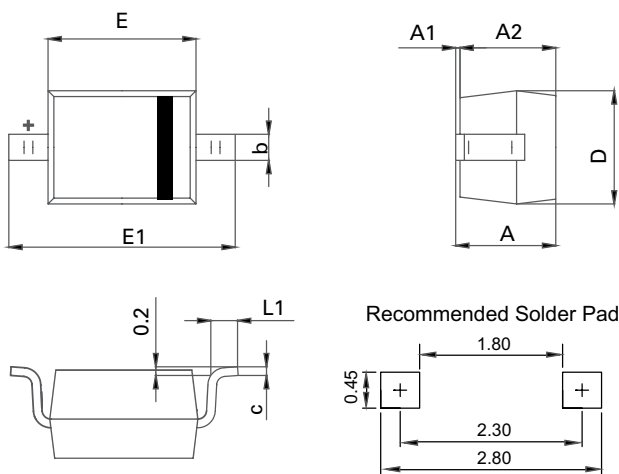
### Ordering Information

Part Number	Package	Min. Order Qty.
AQ05C-01FTG	SOD323	3000
AQ12C-01FTG	SOD323	3000
AQ15C-01FTG	SOD323	3000
AQ24C-01FTG	SOD323	3000
AQ36C-01FTG	SOD323	3000

### Part Marking System



### Package Dimensions -SOD323

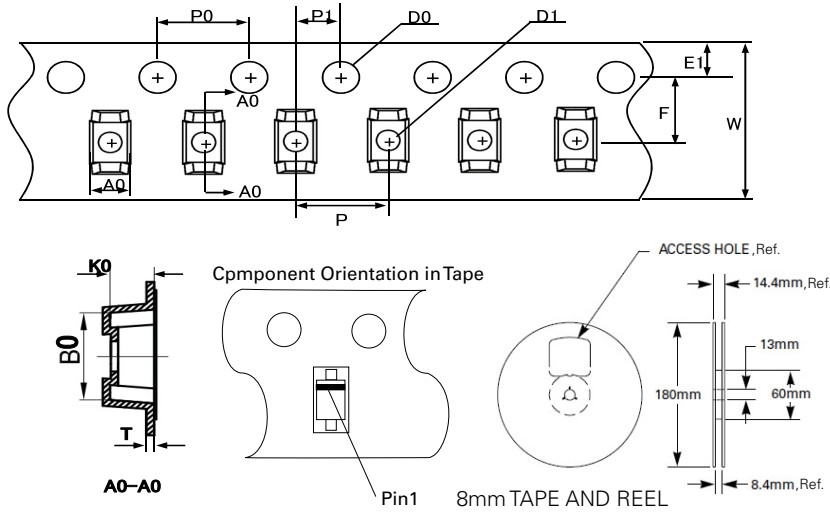


Symbol	SOD323			
	Millimeters		Inches	
	Min	Max	Min	Max
<b>A</b>	-	1.00	-	0.039
<b>A1</b>	0.00	0.10	0.000	0.004
<b>A2</b>	0.80	0.90	0.031	0.035
<b>b</b>	0.25	0.35	0.010	0.014
<b>c</b>	0.08	0.15	0.003	0.006
<b>D</b>	1.20	1.40	0.047	0.055
<b>E</b>	1.60	1.80	0.063	0.071
<b>E1</b>	2.50	2.70	0.098	0.106
<b>L1</b>	0.25	0.40	0.010	0.016

# AQxxC-01FTG Series

## 450W Bidirectional TVS Diode

### 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
E1	1.75+/-0.10
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>.