

**AQxx-01FTG Series 450W Unidirectional TVS Diode**

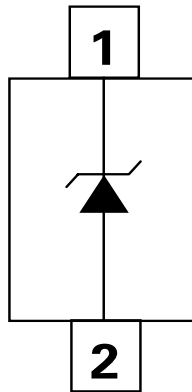


**Description**

The unidirectional AQxx-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 AQxx-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 AQ05 can safely conduct a 30A 8/20 surge event as defined in IEC 61000-4-5 2nd Edition.

**Pinout and Functional Block Diagram**



**Features**

- 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 AQ05
- 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.

### 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

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.

### 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			V
Reverse Leakage Current	$I_{LEAK}$	$V_R=5V$			1.0	$\mu A$
Clamp Voltage <sup>1</sup>	$V_C$	$I_{PP}=1A, t_p=8/20\mu s, Fwd$			9.8	V
		$I_{PP}=10A, t_p=8/20\mu s, Fwd$			13.0	V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p=100ns, I/O$ to Ground		0.22		$\Omega$
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>	$C_{IO-GND}$	Reverse Bias=0V, f=1MHz			350	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			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
		$I_{PP}=10A, t_p=8/20\mu s, Fwd$			22.5	V
Dynamic Resistance <sup>2</sup>	$R_{DYN}$	TLP, $t_p=100ns, I/O$ to Ground		0.29		$\Omega$
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>	$C_{IO-GND}$	Reverse Bias=0V, f=1MHz			150	pF

### AQ15 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			30.0	V
Dynamic Resistance <sup>2</sup>	R <sub>DYN</sub>	TLP, t <sub>p</sub> =100ns, I/O to Ground		0.34		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-GND</sub>	Reverse Bias=0V, f=1MHz			100	pF

### AQ24 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			34.0	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		0.49		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-GND</sub>	Reverse Bias=0V, f=1MHz			65	pF

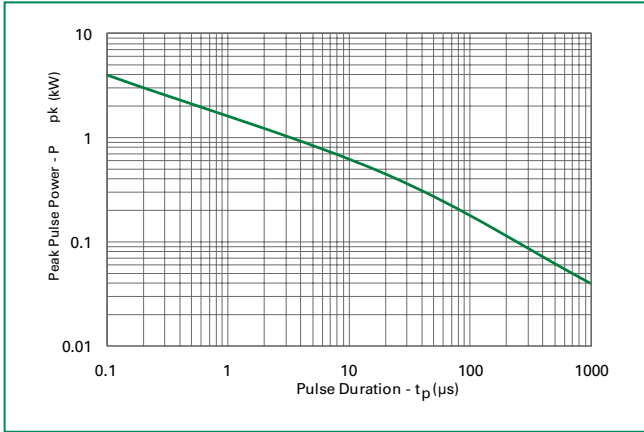
### AQ36 Electrical Characteristics (T<sub>op</sub>=25°C)

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			50.0	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		0.61		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-GND</sub>	Reverse Bias=0V, f=1MHz			50	pF

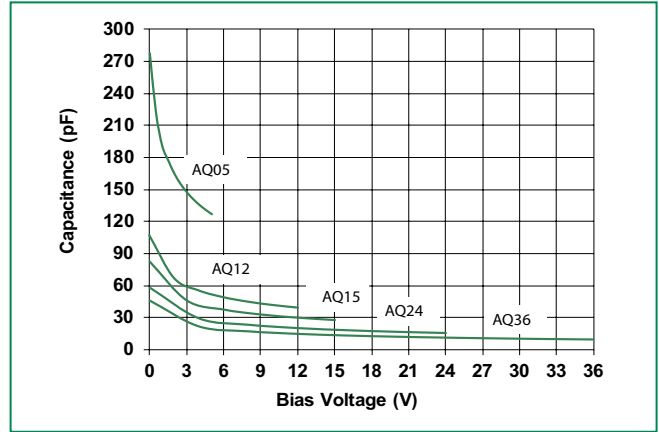
Note:

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

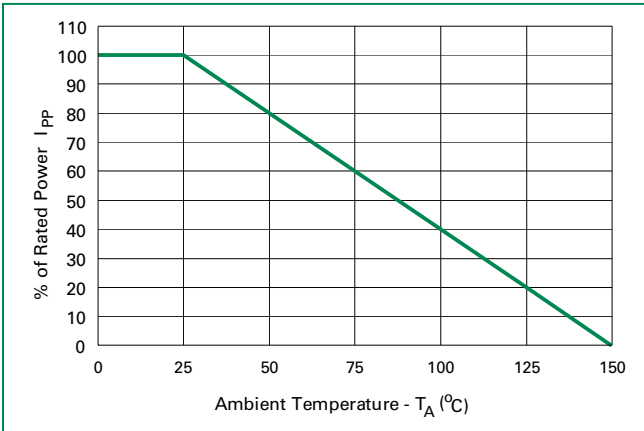
**Non-Repetitive Peak Pulse Power vs. Pulse Time**



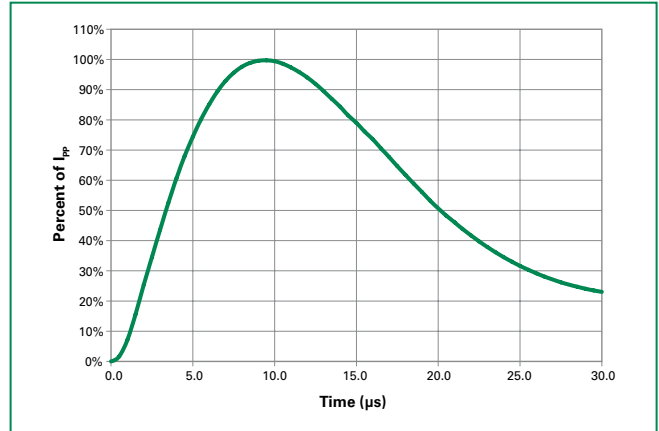
**Capacitance vs. Bias**



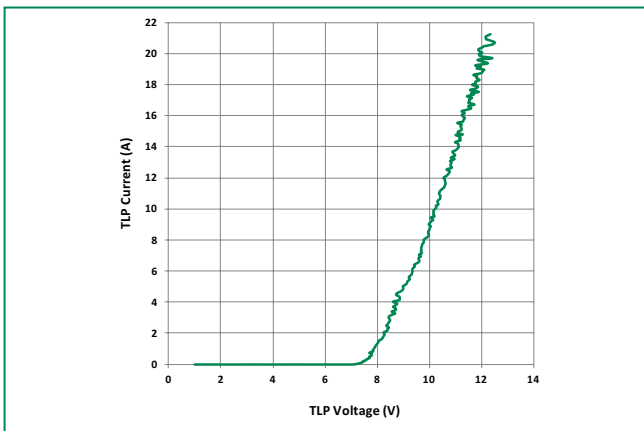
**Power Derating Curve**



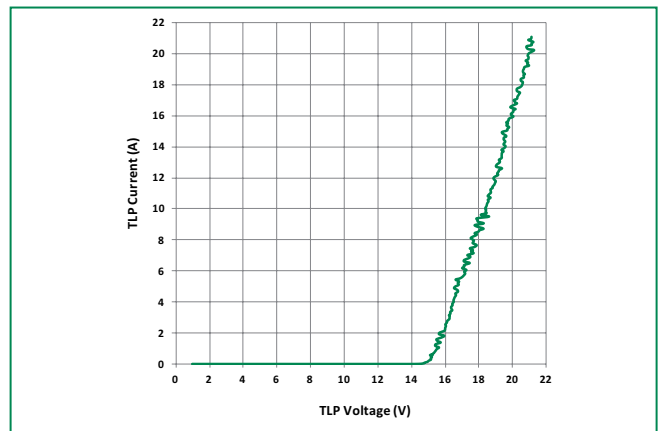
**8/20μs Pulse Waveform**



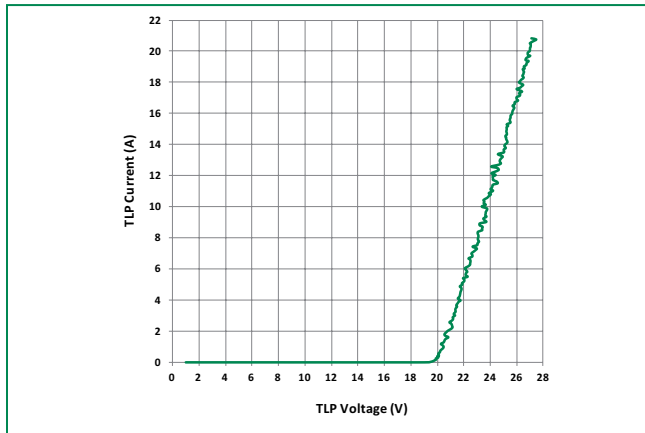
**AQ05 Transmission Line Pulsing(TLP) Plot**



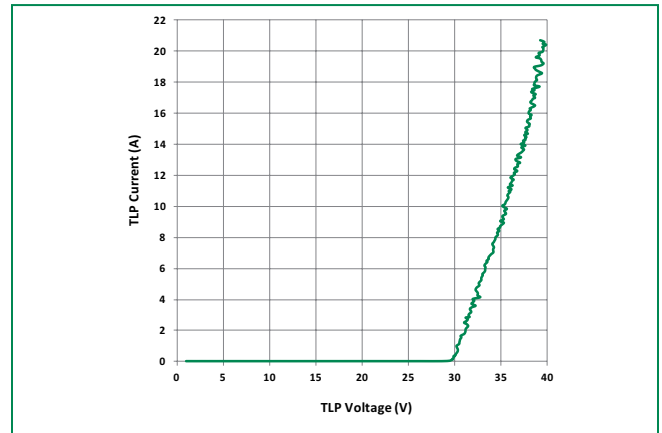
**AQ12 Transmission Line Pulsing(TLP) Plot**



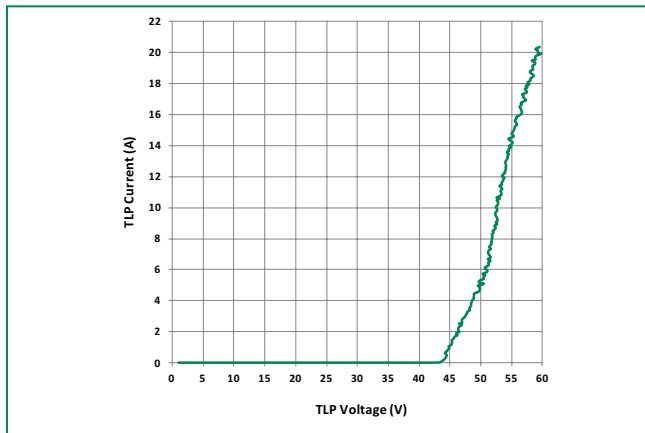
### AQ15 Transmission Line Pulsing(TLP) Plot



### AQ24 Transmission Line Pulsing(TLP) Plot



### AQ36 Transmission Line Pulsing(TLP) Plot

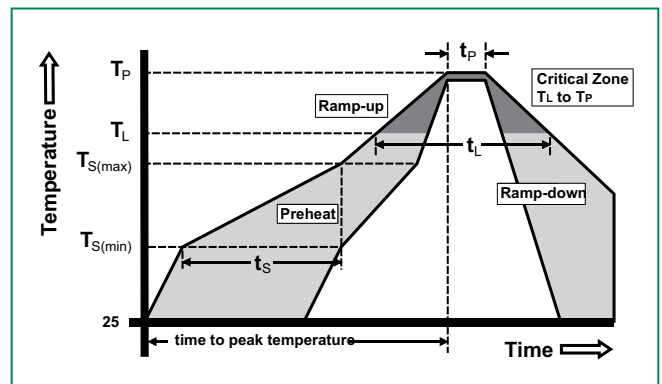


### Product Characteristics

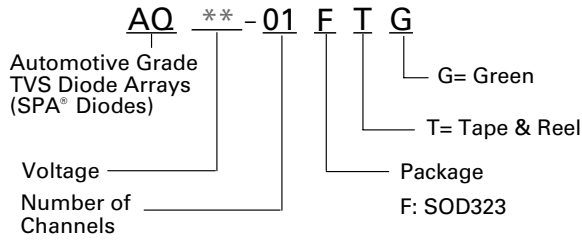
<b>Lead Plating</b>	Matte Tin
<b>Lead Material</b>	Alloy 42
<b>Lead Coplanarity</b>	0.0004 inches (0.102mm)
<b>Substrate material</b>	Silicon
<b>Body Material</b>	Molded Compound
<b>Flammability</b>	UL Recognized compound meeting flammability rating V-0

### Soldering Parameters

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 <sup>+0/-5</sup> °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



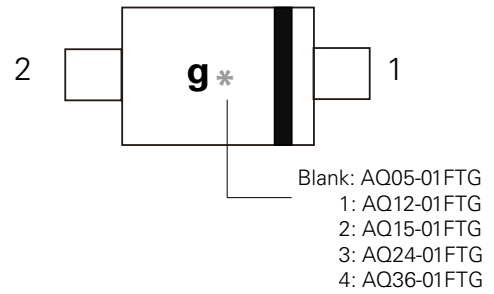
**Part Numbering System**



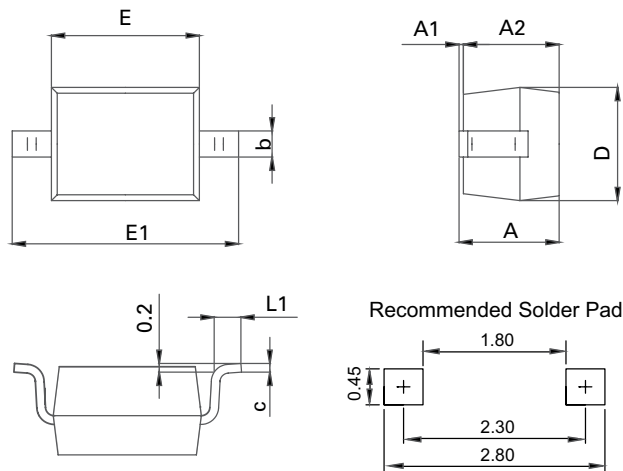
**Ordering Information**

Part Number	Package	Min. Order Qty.
AQ05-01FTG	SOD323	3000
AQ12-01FTG	SOD323	3000
AQ15-01FTG	SOD323	3000
AQ24-01FTG	SOD323	3000
AQ36-01FTG	SOD323	3000

**Part Marking System**



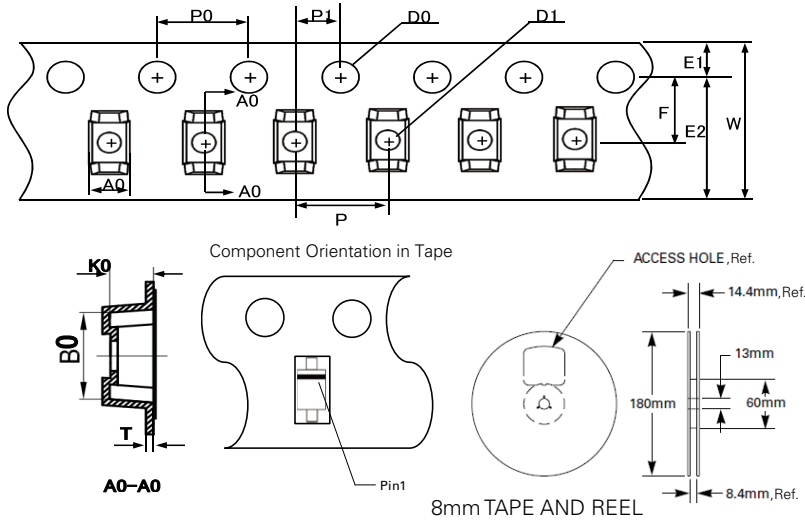
**Package Dimensions -SOD323**



Unit: mm

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

**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

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