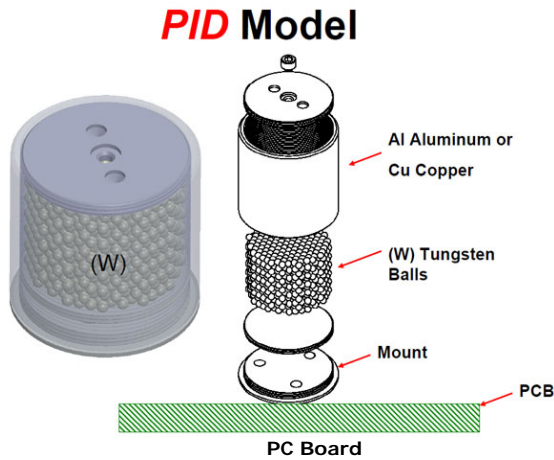


## PID Design Rules

- PID Weight 10% of PCBA
- PID Center of Board
- Top or Bottom Board
- Tungsten balls inside PID



## PCB Mounting Options:

- SMT Surface Mount
- Thru-Hole Mount
- Screw Mount
- Adhesive Mount

Available From:

# TopLine®

USA

1-800-776-9888

info@TopLine.tv

Web Site

[www.TopLine.tv/Vibration\\_Damping.html](http://www.TopLine.tv/Vibration_Damping.html)

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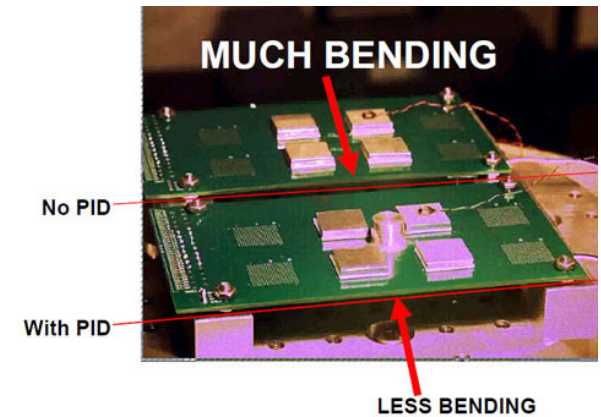
## Vibration Attenuation

# PID DAMPER

Particle Impact Damper

Invented by NASA

## Protect PCB Assembly



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## What is PID ?

Vibration causes damage to Printed Circuit Boards (PCB) assemblies. Vibration can be attenuated by using a Particle Impact Damper (**PID**). The damping effect increases reliability in the PCB. The **PID** mounts near the geometric center (anti-node) of the PCB. This maximizes energy transfer to the **PID** to dampen vibration.

The **PID** is housed in a hermetically sealed container that is filled to 90% with tungsten (W) balls. The counterbalance impact of tungsten balls in the **PID** dampens fundamental frequency *fo* mode vibrations in the PCB assembly. The weight of the **PID** is approximately 10% the mass of the PCB assembly.

Tungsten (W) is environmentally friendly. Tungsten's properties include high density and tensile strength. The **PID** can fully function at extremely low and very high temperatures without derating.

Vibration at the fundamental frequency *fo* causes bending, fatigue and cracks in the PCB assembly. Excessive vibration from external excitations lead to catastrophic failure. NASA invented **PID** technology to reduce vibration and increase reliability in circuit board assemblies.

**PID** are commercially available COTS components. Mounting methods include: standard surface mount soldering, snap-in throughhole, screw mounting and epoxy mounting with permanent adhesives. Engineering development kits are currently under development.



### Property of Tungsten

Tungsten (W) is an environmentally friendly substance of high density and tensile strength that can fully function at extremely low and very high temperatures.

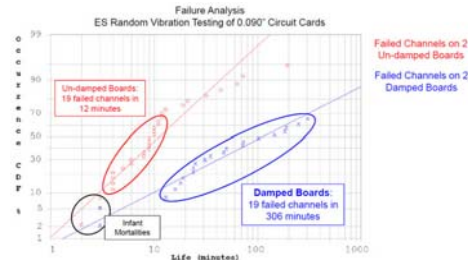
- Atomic Number 74
- Density 19.3g/cc
- Linear CTE 4.3 ppm/°C
- Poisson's Ratio 0.284
- Melting Point 3400°C

## YouTube Video

2-Minute Video shows how PID



<https://www.youtube.com/watch?v=P4SQuBaKXWw&feature=youtu.be>



### Weibull Failure Analysis

A destructive life test was performed on NASA's Marshall Space Flight Center printed circuit card assemblies 4" x 7" (10 x 18cm) 0.090-inch (2.3mm) thick. Four 21mm x 21mm daisy-chained 400-I/O CCGA column grid array components were mounted on each card. One card was left undamped. A PID damper was epoxy mounted at the center of the second card. The cards were mounted side by side onto a vibration table and subjected to excessive vibrations. 19 channels on the undamped boards (without PID) failed within 12 minutes. By comparison, 19 channels on the damped boards (with PID) survived 5 hours (306 minutes) before ultimately failing.

## PCB Board Assembly and PID Weight & Size Chart

PCB Assembly Weight	PID ØDia mm	PID Height mm	Tungsten (W) Payload in PID
0.23 kg (0.5 lbs)	19mm	19mm	0.023 kg (0.050 lbs)
	25mm	15mm	
0.5 kg (1.1 lbs)	25mm	23mm	0.05 kg (0.11 lbs)
	32mm 38mm	17mm 15mm	
1.0 kg (2.2 lbs)	25mm	35mm	0.10 kg (0.22 lbs)
	32mm	25mm	
	38mm	20mm	
1.5 kg (3.3 lbs)	32mm	33mm	0.15 kg (0.33 lbs)
	38mm	25mm	
2.0 kg (4.4 lbs)	32mm	40mm	0.20 kg (0.44 lbs)
	38mm	30mm	
3.0 kg (6.6 lbs)	38mm	40mm	0.30 Kg (0.66 lbs)
4.0 kg (8.8 lbs)	45mm	40mm	0.40 kg (0.88 lbs)
5.0 kg (11 lbs)	50mm	32mm	0.50 kg (1.1 lbs)
6.0 kg (13 lbs)	50mm	38mm	0.60 kg (1.3 lbs)

