

# 1cm RF Ion Thruster BIT-1

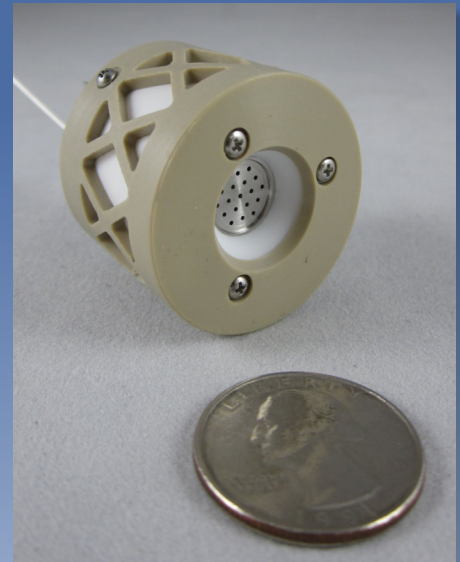
## *World's Smallest Ion Thruster*

Busek's BIT-1 RF ion thruster is an ultra-compact, high-performance ion propulsion device designed with nano-satellite users in mind. Weighing just 53 grams and having a size close to a U.S. quarter, the BIT-1 thruster can produce 100  $\mu\text{N}$  thrust and 2150 second  $I_{sp}$  with just 10W of power. When higher power is available, the thruster's performance can easily exceed 180  $\mu\text{N}$  thrust and 3200 second  $I_{sp}$ .

As with other Busek RF ion thrusters, BIT-1 employs inductively-coupled plasma (ICP) discharge to generate its ion source. The utilization of RF discharge eliminates the need for internal hot cathode and thus increases overall lifetime while enabling extreme miniaturization. Thruster life is dominated by grid erosion, which by simulation exceeds 20,000 hours. BIT-1 by default is paired with Busek's subminiature hollow cathode BHC-50E for ion beam neutralization.

In addition to its small size and low power, BIT-1 is designed to be compatible with the solid-storable propellant iodine. Such unique properties make the BIT-1 system extremely favorable for nano-satellites such as CubeSats, where volume and mass are highly constrained. Miniaturized, microcontroller-based Power Processing Unit (PPU) for BIT-1 also exists in the CubeSat form factor. The PPU contains an innovative RF generator/amplifier board with integrated load power sensor and automatic frequency matching. Based on a modified Class E RF amplifier topology, the RF board has a proven 80% DC-to-RF power conversion efficiency for BIT-1 operation.

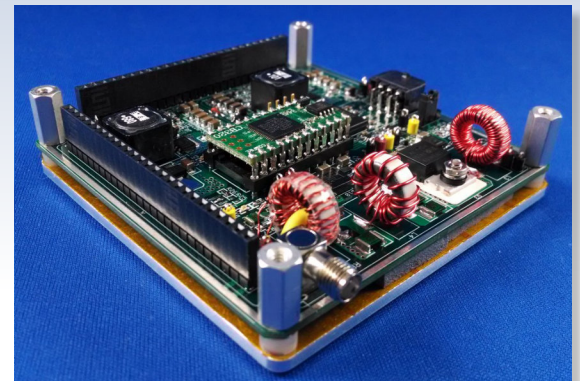
*Very precise thrust output is possible with this technology, as well as multiple modes of operation, ranging from higher to lower specific impulse.*



**BIT-1 RF Ion Thruster**



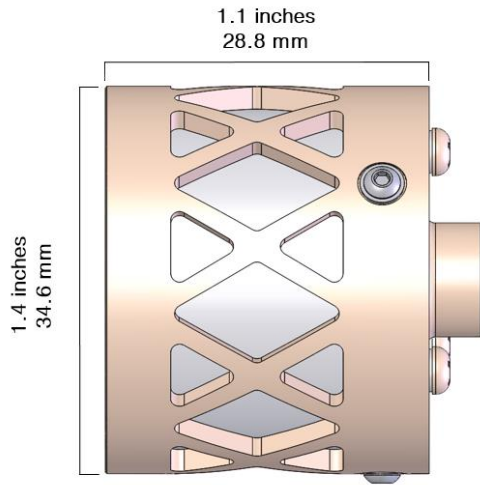
**BIT-1 Operating with Xenon at 13W**



**High-Efficiency RF  
Generator/Amplifier Board in  
the CubeSat Form Factor**

# BIT-1 Technical Specifications

## Envelope Drawing



## Nominal Specification

Total Thruster Power*	10 W
Ion Beam Current	1.5 mA
Propellant Mass Flow	4.9 $\mu\text{g}/\text{sec}$ Xe
Thrust	100 $\mu\text{N}$
Specific Impulse	2150 sec
Propellant Utilization	41%
Energy Efficiency**	27%
Grid Input Voltage	2 kV
Thruster Mass***	53 g

\* Does not include PPU efficiency or neutralizer consumption

\*\* Defined as  $P_{\text{grid}} / (P_{\text{grids}} + P_{\text{RF}})$

\*\*\* A complete BIT-1 propulsion system will need to include neutralizer, PPU, feedsystem, and propellant tank

## Performance Characteristics (Xe)

