Future of RF / Microwave Components
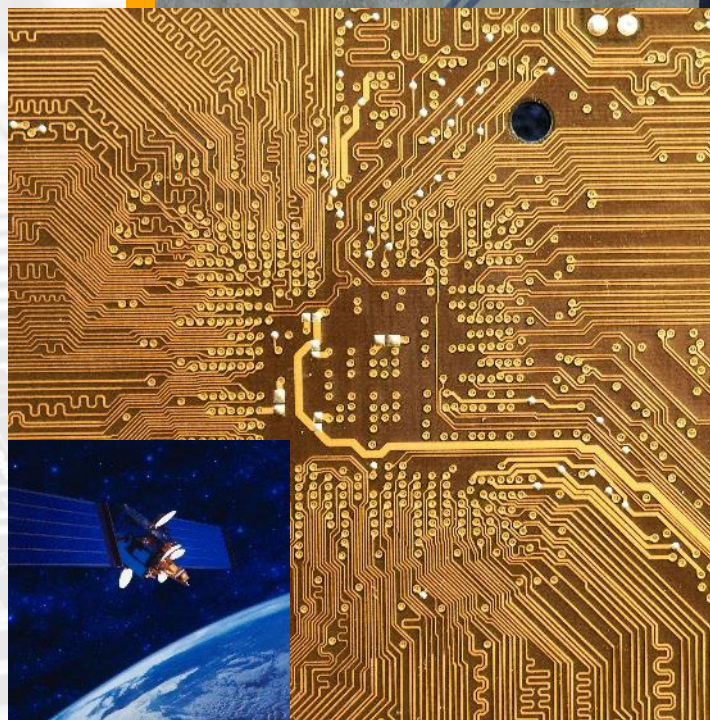
December 8th, 2023

What are RF / Microwave Components & where are they used?

Pyramid diagram from top to bottom:

- **Systems – Radars, Satellite Communications**
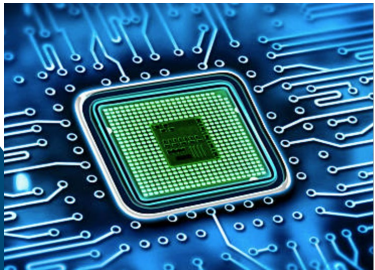- **Sub-Systems – RF Distribution Units** | **Software – Signal Analysis**
- **Multi-function Components / Integrated Microwave Assemblies – Switched Filter Banks, Successive Detector Log Video Amplifiers, Transmit / Receive Modules, Up/Down Converters**
- **Single Function Components – Limiters, Switches, Variable Attenuators, Variable Phase Shifters, Amplifiers**
- **Chips, Monolithic Microwave Integrated Circuits (MMICs)**
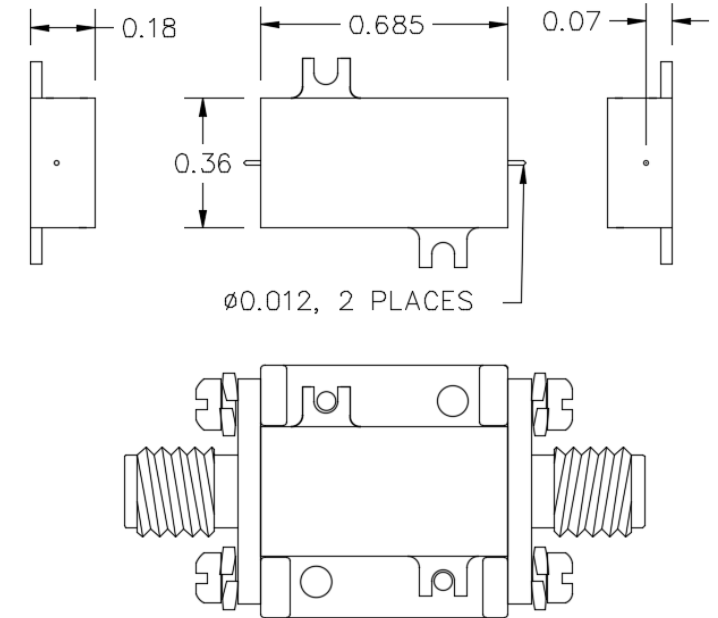- **Material Science - Chemistry, Physics**

What are Size, Weight & Power (SWaP) Constraints?

SWaP Improvements

› Platforms such as fighter jets, drones, satellites require smaller, lighter and lower power consuming components

› Connector sizes have become the limiting size factor and are getting smaller

SuperMini
Board-to-Board
Connectors
(SSBB) DC to 67 GHz
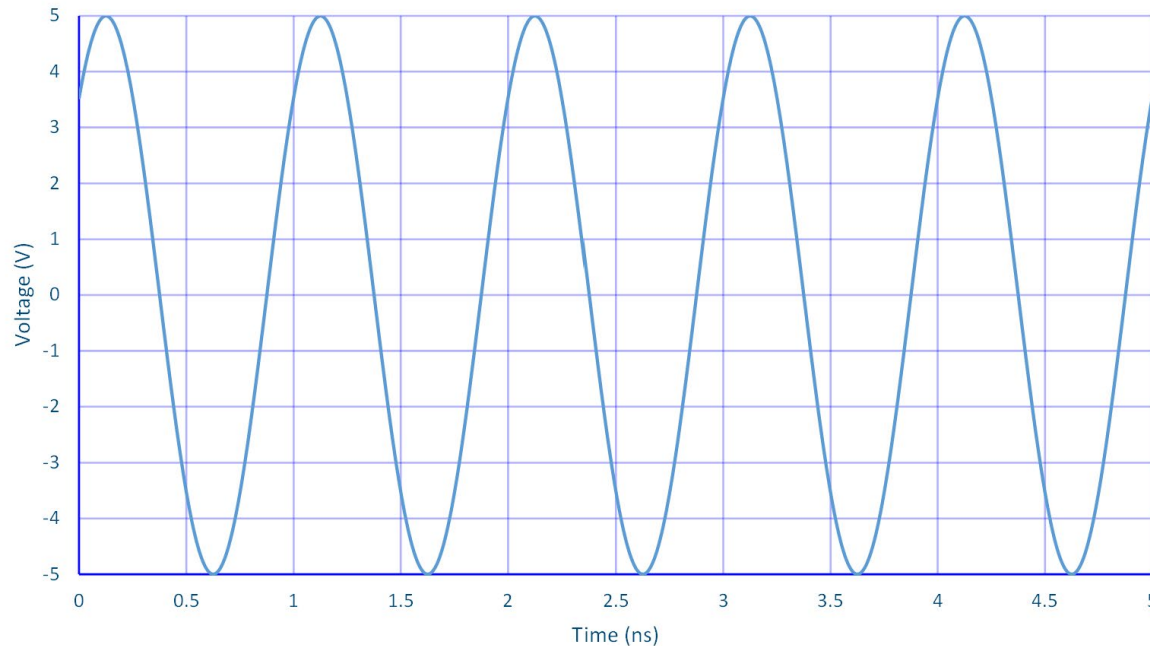
Microstrip
Grounded Coplanar Waveguide
Stripline

› Changing connectorized units to surface mount saves sub-system space and weight

› Making amplifiers more efficient and designing stages to require output power compression only as high as needed saves power

Changing requirements for future components & design tradeoffs?

Equation for an RF / Microwave Signal

$$V(t) = A * \sin[(2\pi f * t) + \varphi]$$

f = Frequency
> Higher frequencies allow more bandwidth to be transmitted more quickly

φ = Phase
> Higher resolution allows more accuracy in beam steering
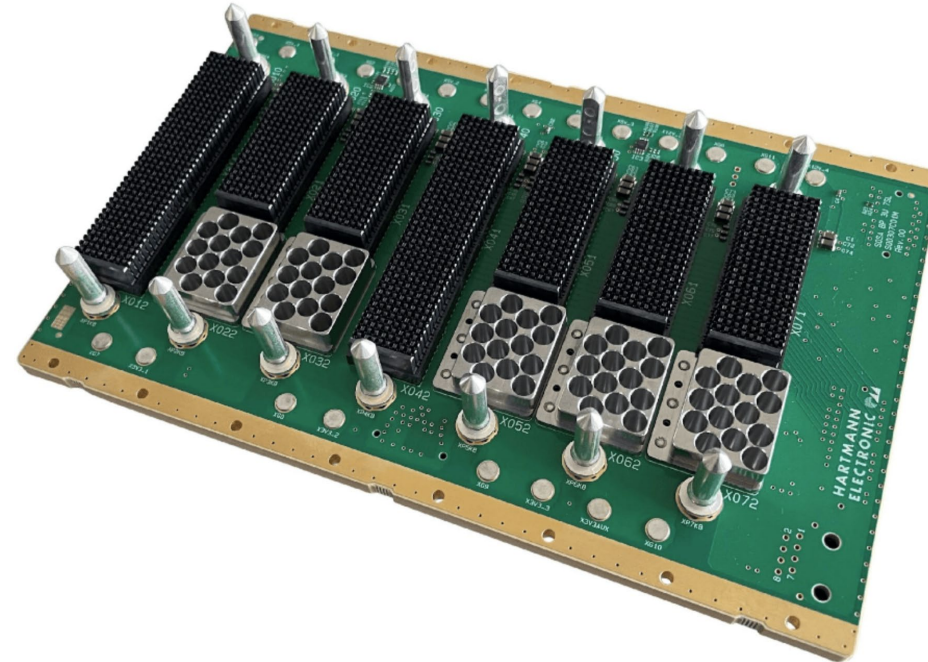
$V(t) = 5 * \sin[(2\pi*1\times10^9 * t)+\pi/4]$

A = Amplitude
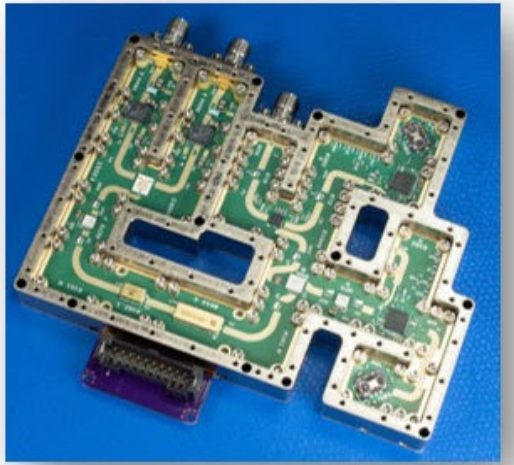> Solid-state amplifiers that can provide higher power outputs utilizing GaN

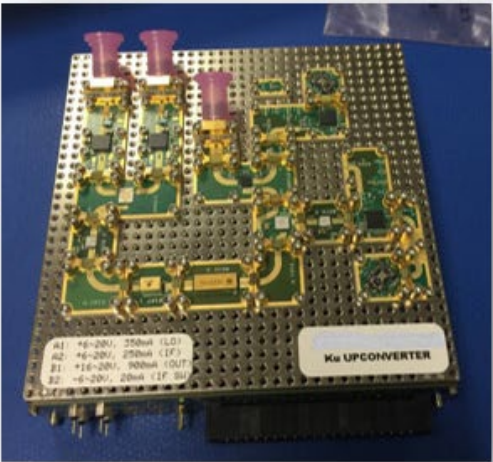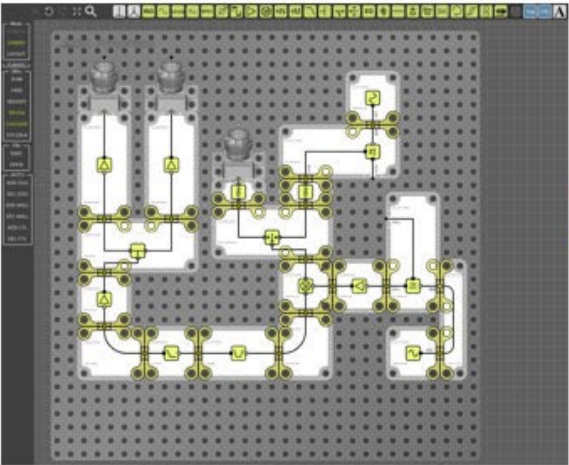# How can we standardize custom designs?
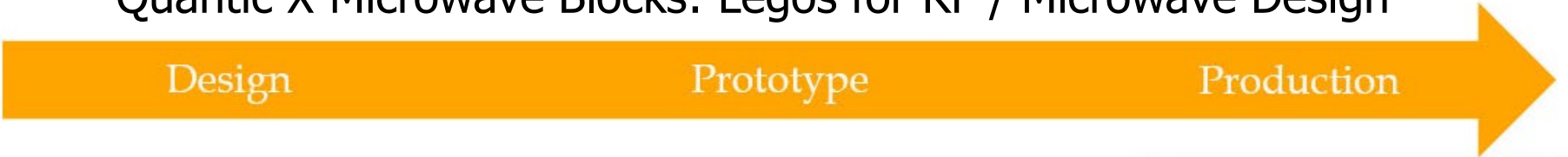
Open VPX
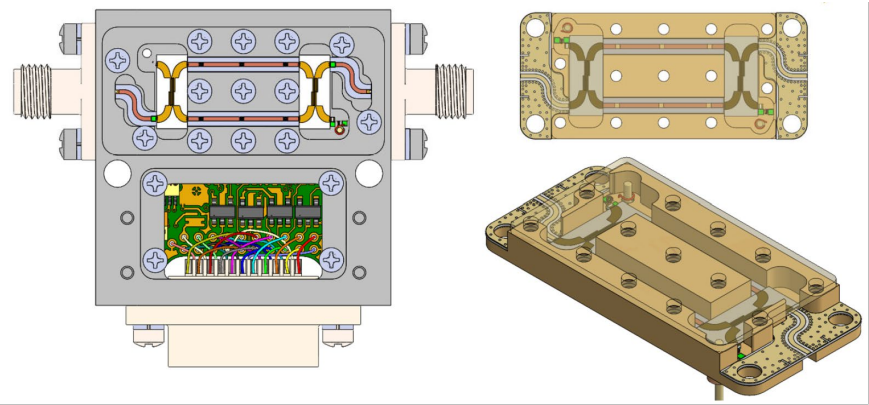
Sensor Open Systems Architecture (SOSA)

Creating interchangeable, compatible integrated microwave assemblies for multiple systems across military branches saves development costs and time to implement new technology needed to combat emerging threats

How can designs be prototyped more rapidly?

Quantic X-Microwave Blocks: Legos for RF / Microwave Design

Turning Quantic PMI discrete component designs into X-blocks

Thank You!