



a  MICROCHIP company

## **A COTS approach with Radiation Tolerant FPGAs and MSICs**

### **Workshop on High End Digital Processing Technologies and EEE Components for Future Space Missions**

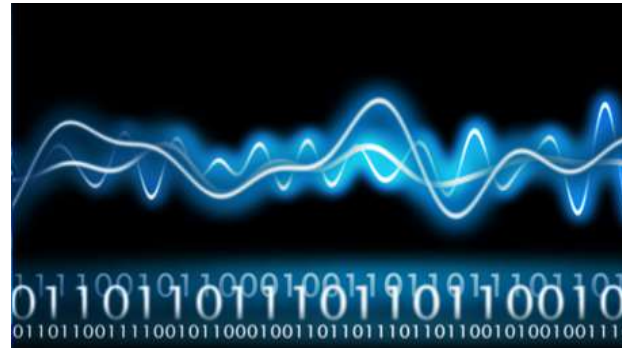
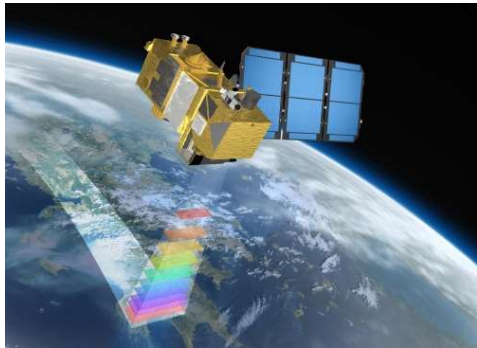
Ken O'Neill  
Director of Marketing, Space and Aviation

# Spacecraft Development – What's Next?

- What's driving new spacecraft development
  - Science
    - Climate research
    - Resource monitoring
    - Planetary and lunar research
  - Commercial
    - Global broadband access
    - Imaging – improved resolution, more frequent revisit
  - General
    - Cheaper cost to acquire and deploy
    - Faster entry into service



# Challenges



- Our ability to generate data in satellite sensor systems is growing faster than our ability to transmit data to Earth
  - Sensor resolution is increasing dramatically
  - Downlink bandwidth remains constrained
- Need to do more on-board processing
  - Extract INFORMATION from the torrent of DATA
- Can COTS EEE components solve the signal processing bottleneck?

# COTS in Space – A Supplier’s Perspective

- COTS in space is not a new concept
  - COTS components offer performance, power, and feature advantages, cheaper than QML or RH
  - Successful use of COTS in many programs, including 1990’s communications constellations
- Diversification of screening and qualification requirements
  - Many programs require the highest levels of component screening and qualification
    - Human spaceflight
    - ESA, NASA class 1 missions (highest cost, highest visibility, highest scientific value)
    - National security missions
    - Commercial systems that generate large revenues for the satellite operator
  - Many programs seeking to reduce BOM cost and achieve reliable operation by redundancy
    - Reduces the requirements for component screening and qualification
- It is Microsemi’s intention to support these diverse customer requirements
  - QML class Q and class V qualification and screening
  - Sub-QML parts which are radiation hardened by design, at a fraction of the cost of QML parts

# Cost and COTS

- Satellite operators are seeking lower acquisition cost and faster service entry
- Commercial Off The Shelf (COTS) components to reduce cost and lead-time
- The cost of COTS – lower component cost, higher cost of ownership

	General Industry COTS	QML Rad Tolerant
Unit Cost	✓ Low	✗ High
Leadtime	✓ Short	✗ Long
Space-flight Heritage	✗ No	✓ Yes
Supplier Tech Support	✗ No	✓ Yes
Radiation Data and Support	✗ No	✓ Yes
Reliability Data and Support	✗ No	✓ Yes
Lot Traceability, Homogeneity	✗ No	✓ Yes

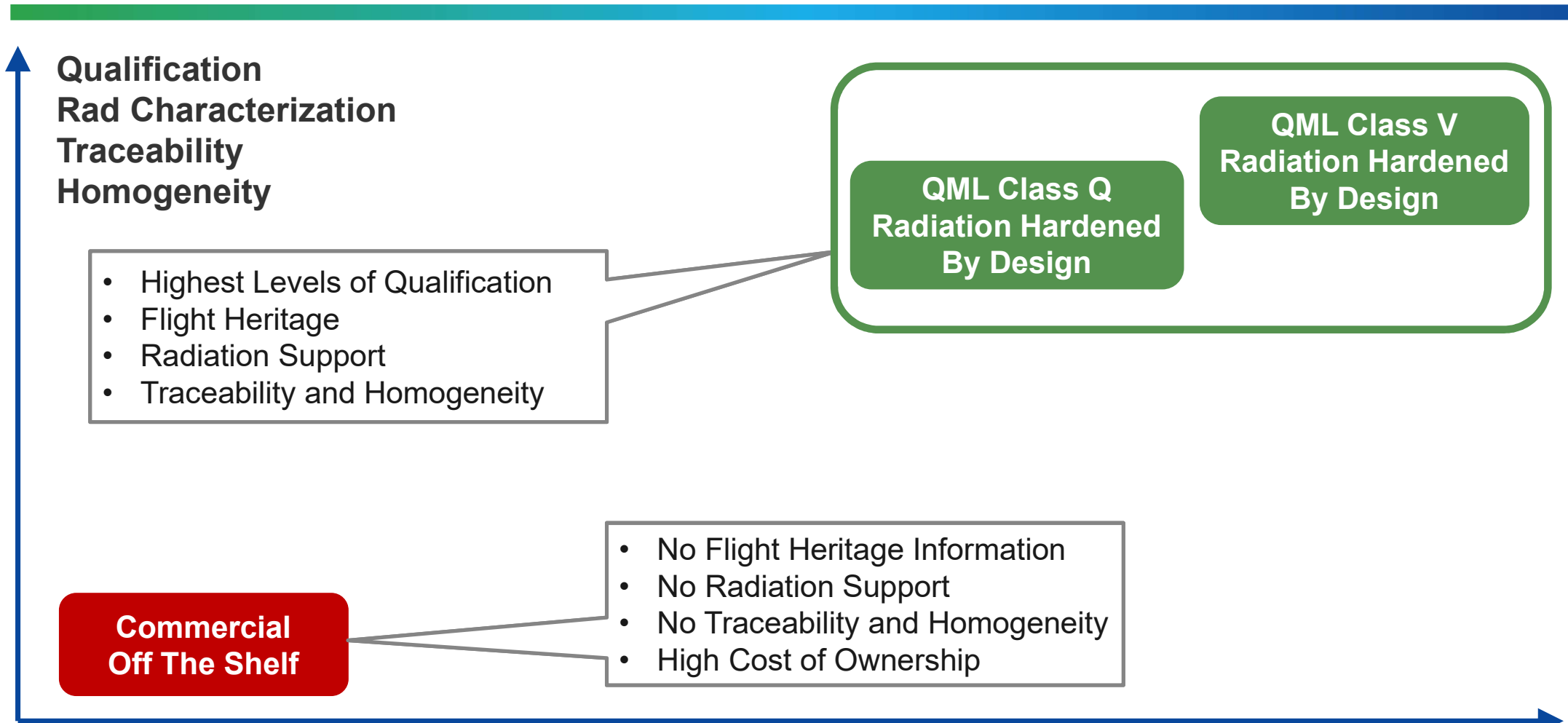
# Cost and COTS

- Satellite operators are seeking lower acquisition cost and faster service entry
- Commercial Off The Shelf (COTS) components to reduce cost and lead-time
- The cost of COTS – lower component cost, higher cost of ownership

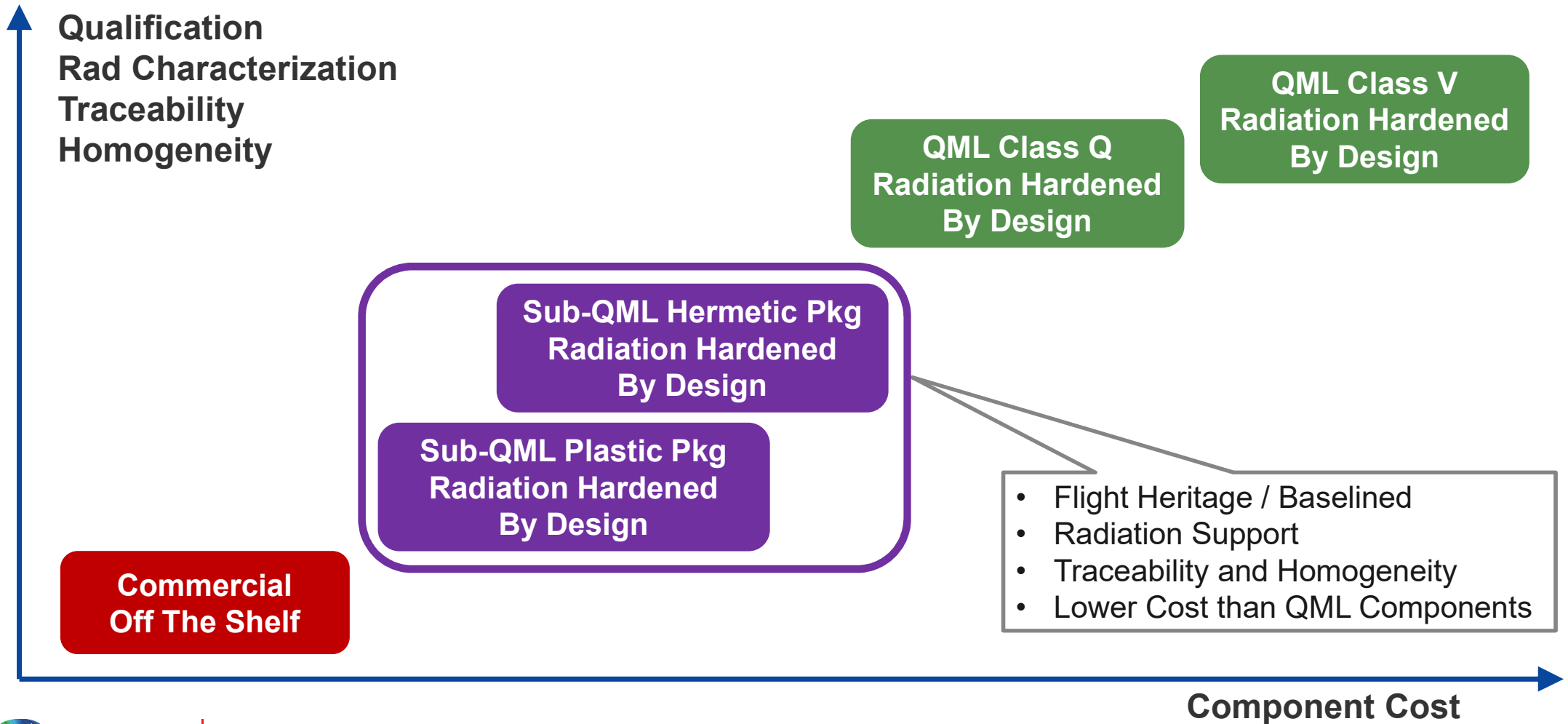
	General Industry COTS	QML Rad Tolerant
Unit Cost	✓ Low	✗ High
Leadtime	✓ Short	✗ Long
Space-flight Heritage	✗ No	✓ Yes
Supplier Tech Support	✗ No	✓ Yes
Radiation Data and Support	✗ No	✓ Yes
Reliability Data and Support	✗ No	✓ Yes
Lot Traceability, Homogeneity	✗ No	✓ Yes

Addressing these shortcomings results in hidden cost for organizations using COTS in space systems

# Significant Gap between QML and COTS



# Sub-QML: Bridging the Gap Between QML and COTS



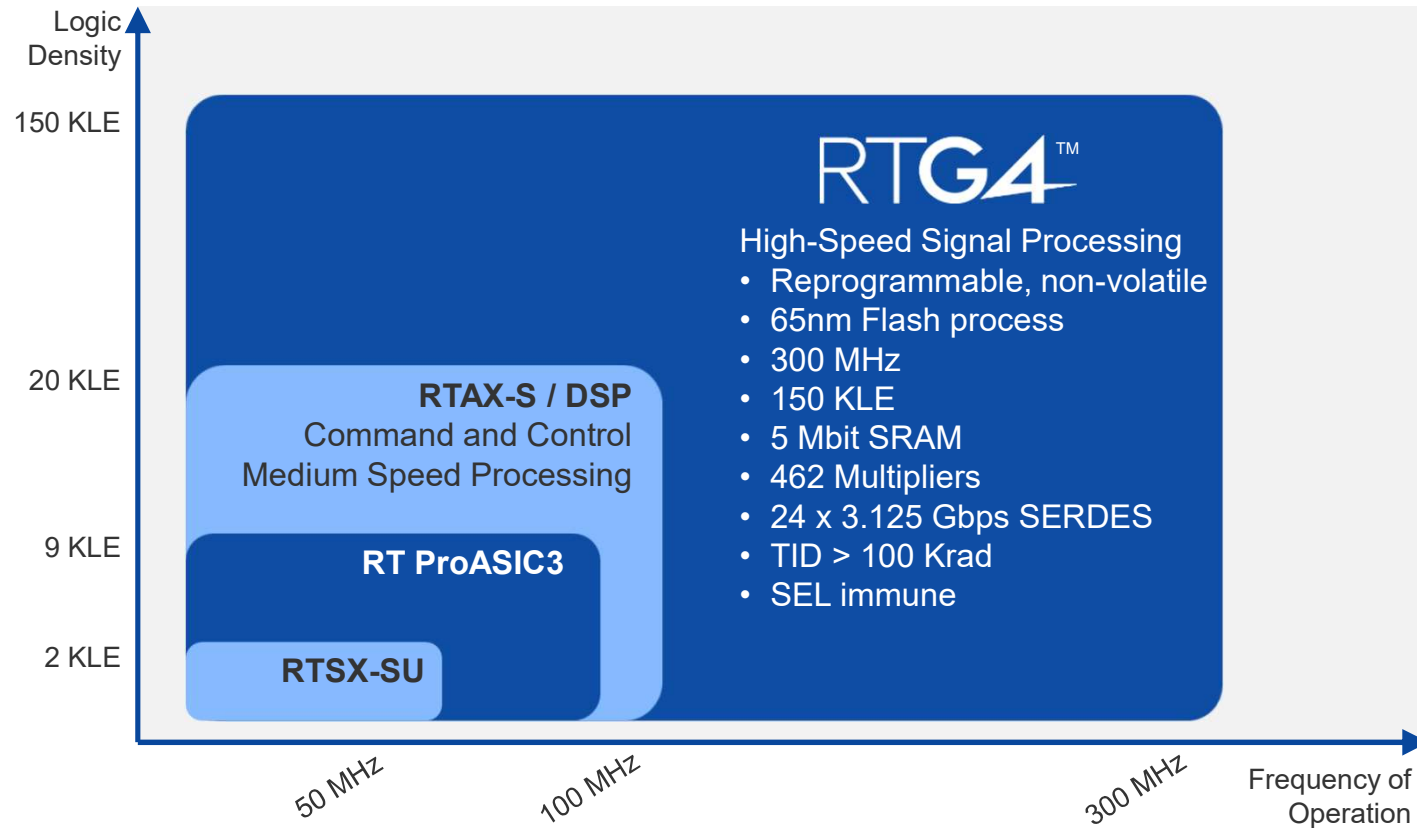


# Sub-QML Components

- Reducing or eliminating QML testing and documents removes a lot of cost
- Elimination of solder columns removes cost and reduces lead times
- Plastic packaging reduces cost still further

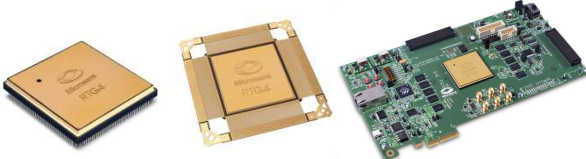




	General Industry COTS	QML Rad Tolerant	Sub-QML RT Hermetic	Sub-QML RT Plastic
Unit Cost	✓ Lowest	✗ High	✓ Lower	✓ Lower
Leadtime	✓ Shortest	✗ Long	✓ Shorter	✓ Shorter
Space-flight Heritage	✗ No	✓ Yes	✓ Yes	✓ Yes
Supplier Tech Support	✗ No	✓ Yes	✓ Yes	✓ Yes
Radiation Data and Support	✗ No	✓ Yes	✓ Yes	✓ Yes
Reliability Data and Support	✗ No	✓ Yes	✓ Yes	✓ Yes
Lot Traceability, Homogeneity	✗ No	✓ Yes	✓ Yes	✓ Yes

# RTG4 High-Speed RT FPGAs



**RTG4 mitigates the risks of ASICs and SRAM FPGAs, and has  
20x improvement in signal processing throughput  
Available with QML and Sub-QML screening**

# Delivering A Comprehensive Space Portfolio

<p>Radiation-Tolerant FPGAs</p>	<p>High Performance, High Density, Low Power              TID up to 300 Krad, SEL Immune              RTG4 FPGAs up to 300 MHz and 150K LE              RTProASIC3, RTAX and RTSX-SU QML Qualified</p>	
<p>Rad-Hard Mixed Signal Integrated Circuits</p>	<p>Telemetry and Motor Control Space System Managers              High Side Drivers              Regulators and PWMs              Extensive Custom IC Capability</p>	
<p>Space Qualified Oscillators</p>	<p>Ovenized Quartz Oscillators              Hybrid Voltage Controlled and Temperature Compensated Crystal Oscillators              Cesium Clocks</p>	
<p>Rad-Hard Power Solutions</p>	<p>Rad-hard JANS Diodes, Bi-Polar Small Signal Transistors, and MOSFETs              Rad-hard Isolated DC-DC Converter Modules              Custom Power Supplies 2 W to &gt; 5 KW              Point of Load Hybrid Solutions              Electromechanical Relays</p>	
<p>Space Screening capability on RF Products</p>	<p>Surface Acoustic Wave (SAW ) Filters              Packaged and Chip Si Diodes              Si Bipolar Transistors              GaAs pHEMT MMICs</p>	

# Food for Thought

---

- General COTS components reduce unit cost and lead time issues, but create cost of ownership issues
- Would sub-QML radiation hardened by design components solve system engineering and product ownership issues for low-cost constellations?
  - Wouldn't have to design around radiation limitations of soft COTS components
  - Wouldn't have to buy and upscreen a large quantity in order to assure homogeneity
  - Would get the technical support you need even though you're not buying huge volumes

# Summary

---

- COTS components are appealing as they offer performance, power and feature benefits, and significantly cheaper unit costs
- Cost of ownership can be a significant burden
- Microsemi and Microchip support programs which do not need QML components
  - Top-down approach:  
FPGAs and Mixed Signal ICs with radiation hardening offered with Sub-QML screening
  - Bottom-up approach:  
Commercial MCUs and MPUs with additional testing, traceability and documentation

# Your Partner for Space Technology



- Leadership in space
- Leveraging our product breadth
- Innovative new products
- Focused on growth applications



# Thank You



## Microsemi Headquarters

One Enterprise, Aliso Viejo, CA 92656 USA

Within the USA: +1 (800) 713-4113

Outside the USA: +1 (949) 380-6100

Sales: +1 (949) 380-6136

Fax: +1 (949) 215-4996

email: [sales.support@microsemi.com](mailto:sales.support@microsemi.com)

[www.microsemi.com](http://www.microsemi.com)

Microsemi, a wholly owned subsidiary of Microchip Technology Inc. (Nasdaq: MCHP), offers a comprehensive portfolio of semiconductor and system solutions for aerospace & defense, communications, data center and industrial markets. Products include high-performance and radiation-hardened analog mixed-signal integrated circuits, FPGAs, SoCs and ASICs; power management products; timing and synchronization devices and precise time solutions, setting the world's standard for time; voice processing devices; RF solutions; discrete components; enterprise storage and communication solutions, security technologies and scalable anti-tamper products; Ethernet solutions; Power-over-Ethernet ICs and midspans; as well as custom design capabilities and services. Learn more at [www.microsemi.com](http://www.microsemi.com).

Microsemi makes no warranty, representation, or guarantee regarding the information contained herein or the suitability of its products and services for any particular purpose, nor does Microsemi assume any liability whatsoever arising out of the application or use of any product or circuit. The products sold hereunder and any other products sold by Microsemi have been subject to limited testing and should not be used in conjunction with mission-critical equipment or applications. Any performance specifications are believed to be reliable but are not verified, and Buyer must conduct and complete all performance and other testing of the products, alone and together with, or installed in, any end-products. Buyer shall not rely on any data and performance specifications or parameters provided by Microsemi. It is the Buyer's responsibility to independently determine suitability of any products and to test and verify the same. The information provided by Microsemi hereunder is provided "as is, where is" and with all faults, and the entire risk associated with such information is entirely with the Buyer. Microsemi does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other IP rights, whether with regard to such information itself or anything described by such information. Information provided in this document is proprietary to Microsemi, and Microsemi reserves the right to make any changes to the information in this document or to any products and services at any time without notice.

©2018 Microsemi, a wholly owned subsidiary of Microchip Technology Inc. All rights reserved. Microsemi and the Microsemi logo are registered trademarks of Microsemi Corporation. All other trademarks and service marks are the property of their respective owners.