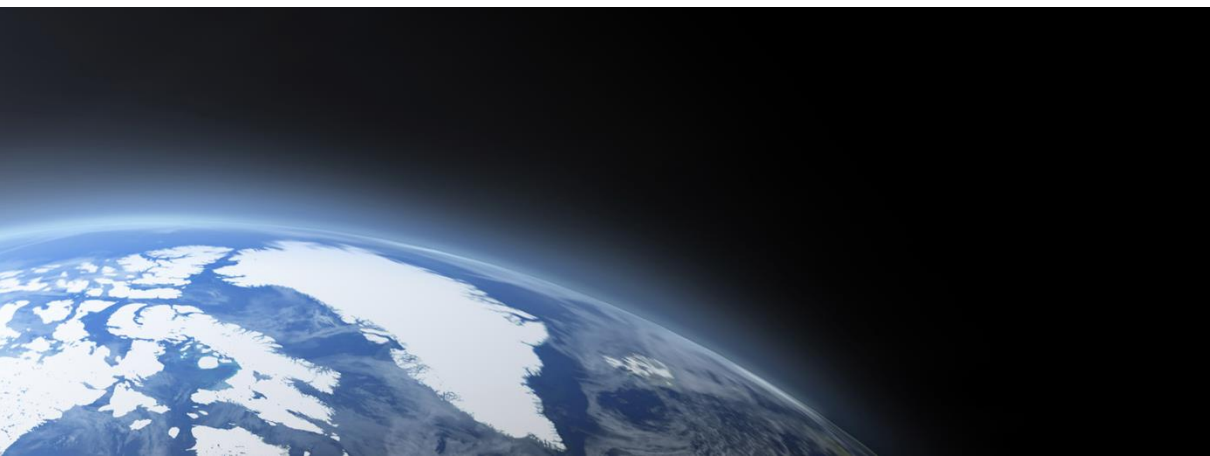




Microsemi – Your Partner for Space System Solutions

Microsemi Space Forum India – July/August 2013

Patrick Franks
Director of Engineering, Power Management Group



Agenda

- Technical Overview
- Space Heritage
- Systems View of Product Definition and Development
- Recent Products
- Processes, Capabilities, and Products in the Development “Pipe”
- Summary

About Microsemi Corporation (Nasdaq: MSCC)

- Global provider of semiconductor solutions for applications focused on delivering power, reliability, security and performance
- High-value, high barrier-entry markets
 - Communications
 - Defense & Security
 - Aerospace
 - Industrial
- FY 2012 Revenue: \$1 billion
 - 3,000 employees globally



Corporate headquarters in Aliso Viejo, CA

About Microsemi

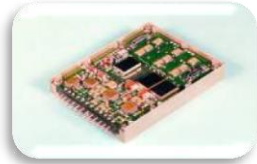
- Microsemi is focused on key markets where we look to apply our system knowledge to help define integrated roadmaps to leverage our breath in applications
- Microsemi has a very broad portfolio of technologies to serve our partners product needs
- Microsemi excels where solving problems is difficult, there is a need multi-disciplinary engineering, or where reliability and security are critical
- Microsemi applies its breath of capabilities to develop broad-based solutions to specific circuit and system problems (leverage.)

Technical Overview: Design

- Deep and Broad Engineering Team

- Systems

- Space/Aerospace/Industrial power generation, conversion, and switching
- Security: mmWave, integrated systems, secure components
- Avionics systems and subsystems

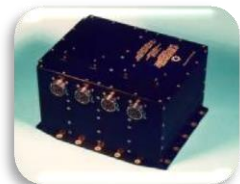


- Circuits

- RF: transceivers, AFEs, power modules, ULP radios, PAs, LNA, mixers
- Timing: sync, synth, distribution, frac-N, Ultra low jitter, any in any out
- Communication: SLICs, SLACs, voice processing, PoE
- High Density: FPGAs, SoCs, ASICs
- Power: switchers, drivers, conversion, regulation, protection
- SSD: high speed, security, and reliability

- Module/Hybrid

- High density/integration
- POL, linear, digital
- SS relays
- Build to print



Technical Overview: Design

- Process Engineering
 - Device: SiC, GaN, IGBTs, RH, high temperature
 - ICs: CMOS, HV Bipolar, HV CMOS, NVM, Anti-fuse, MIMICs
 - Misc: TVS, sensors
 - Packages: Stacked die, multi-die package, hermetic, non-hermetic, high temp
 - Modeling: Process, device, reliability, thermal, photonic

Technical Overview: Design

- Security
 - Information assurance: IP, circuits, firmware, and software
 - Anti-tamper: systems, IP, circuits, firmware, and software
 - Black hat, white hat, red hat, etc.
 - SoCs: special security features, extensive IP, NV memory
- Integration
 - High gate count: FPGAs, ASICs
 - Mixed signal: ASICs, FPGAs, SoCs
 - Multi-die packaging: horizontal, vertical, interposer, TSVs
- Harsh Environment
 - Radiation hard: process development, RH by design, circuit library, HV and power processes, TID, SEE, ELDRS
 - High temperature: devices, drivers, POLs, FPGAs
 - Up to 250 degrees, low and high temp cycle

Technical overview: Design

- World's best tools and procedures

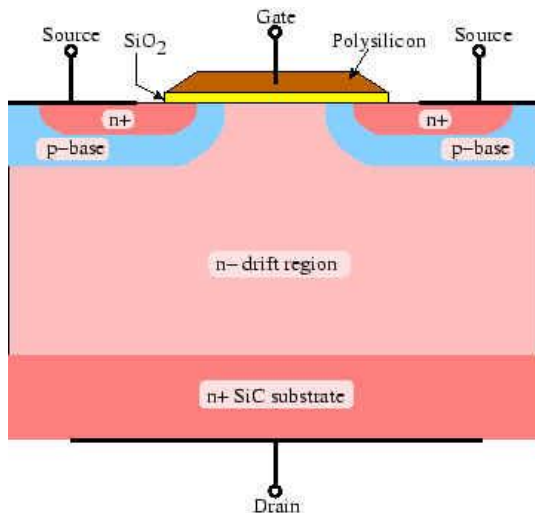
- System simulation
- Circuit simulation
- Process simulation
- Thermal simulation
- Radiation modeling
- Software ecosystems
- Mechanical stress
- Parasitic extraction
- Environment modeling/simulation

Continued Investment in
R&D

Technical Overview: Process

■ Device

- High performance
- Harsh environment
- Power



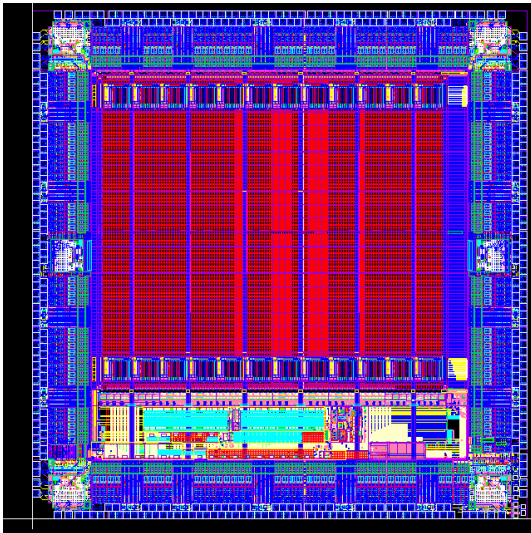
Device Technologies:

- Wide Band Gap (Compound Semiconductor)
 - SiC
 - GaN/SiC, GaN/Si
 - NG 0.25um (Low noise Epi and power Epi)
- SiGe
 - 0.18u
 - 0.35u
 - 0.35u on 1K Substrate
- GaAs
 - HBT3 (2u, High Linearity for WAN PA applications)
 - Enhancement Mode pHEMT (LNA's)
 - Depletion Mode pHEMT (Switches)
 - pHEMT Low Noise
 - pHEMT Power
 - HFET 0.25u
 - VPIN High Power
- InGaP
 - HBT Low Phase Noise
- SOI
 - 0.32u, 0.28u, 2.5v FET's
- IPD

Technical Overview: Process

■ IC

- High density
- High voltage
- Radiation hard
- Power switching
- Pico-power
- RF



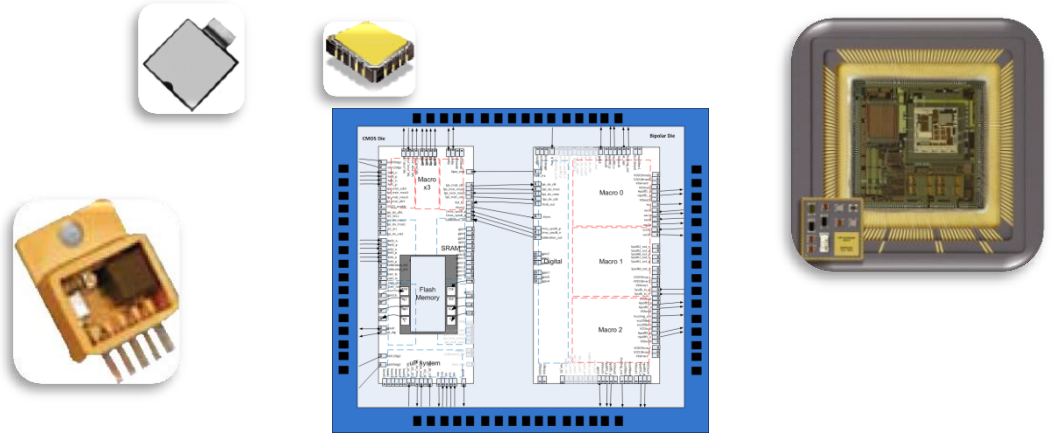
Process Technologies:

- Pure CMOS
 - 0.5u, 0.35u, 0.35u with color filter, 0.18u, 0.13u, 0.065u
- CMOS with NVM
 - 0.15u, 0.11u, 0.065u
- CMOS with Anti-Fuse
 - 2.0u, 0.35u, 0.15u
- BCD CMOS
 - 0.5u 30V
 - 0.35u 20V, 30V, 40V (Full Float)
 - 0.35u 80V (Trench Isolated)
 - 0.35u SmartFET
 - 0.35u 20-60V, natural Vt and 5,12Vgs
 - 0.18u, 40v, 80v (Full Float)
 - 100V and 200V N and P MOSFETs for military and RT applications.
- Bipolar
 - 9 to 11 mask with voltage from 12V to 60V, single or double metals.
 - BiCMOS: 4mm and 1.4mm double metals with 19 mask Non-RT
 - Schottky: up to 200V with Pt, W, TiW barrier metal.
 - Rectifier: Planar or Mesa, switching or non-switching, up to 1600V
 - SCR: up to 1200V SCR and RGT
 - Zener and TVS: 5V to 250V
 - 5 Ohm-cm Bipolar with Buried Layer, Deep Collector, 24 KA SLM RT
 - 12v, 20V, 40V Bipolar with Buried Layer, Deep Collector, SLM or DLM – Rad Hard

Technical Overview: Process

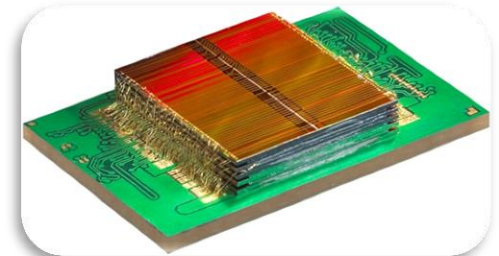
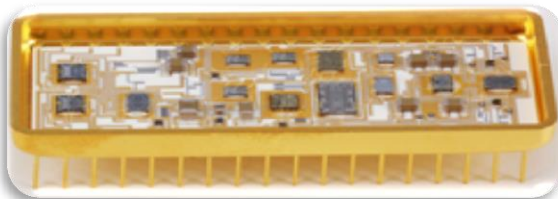
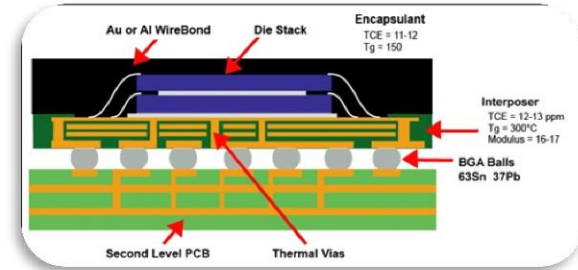
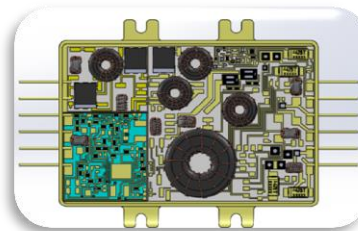
■ Module/Hybrid

- High density/integration
- POL, linear, digital
- SS relays
- Build to print



■ Packaging

- Hermetic & Non-hermetic
- Multi-die, stacked
- Power



Technical Overview: Test & Reliability

■ Test

- Full device characterization and modeling
- Production device and IC testing
 - Power
 - RF
 - High performance timing (Jitter, wander, etc.)
 - Digital/mixed signal
 - Processor, memory, fabric, scan, ATPG
- Radiation Hard
 - SEE
 - ELDRS
 - TID
 - Process characterization

■ Reliability

- Thermal cycling
- Mil and Space level testing (more on this later)
- Circuit DPPM levels below 5
- QML
- ELDRS lab

Space Heritage: Part of our DNA

- Microsemi has a greater than a 55 year history in space
 - Very broad product and capability base
 - Experience with systems, circuits and customers

- Microsemi is dedicated to space
 - Enlarging product portfolio - non obsolescence policy
 - Space segment is key for Microsemi growth
 - We continue to invest in space segment (R&D)
 - Leveraging size and diversity of company to expand and enhance product capabilities
 - Building advanced technologies to serve space requirements
 - Packaging, device technologies, system design

- 2013 overview
 - Continued strong market growth
 - Continuing to increase content
 - Systems approach to product development
 - Product Leadership in FPGAs, power converters and control, ASICs, rad-hard components and RF technology

Space Heritage: Where do we fly?

Launchers / Missiles

Delta IV
Sea Launch
VLS
MinuteMan III
THAAD
Pegasus
Arianne Y
H-2A
D5 ENTB
Patriot
Atlas II, V

Commercial

Globalstar
Anik F2
Intelsat IX
GE-1,2, . . . 18
Echostar
Telstar
Radarsat I, II
CRSS / IKONOS
OrbView
IndoStar
QuickBird
Hispasat
Astra
WorldStar
Orion 2
KompSa
Orbcom
PanAmSat

Military

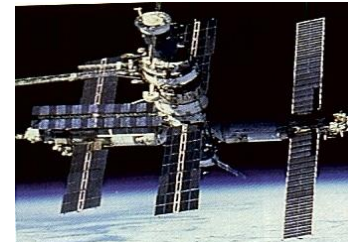
MightySat
P81 (Classified)
P59 (Classified)
HESSI
Clementine
SBIRS
AEHF
Myter Joint
GeoLite
WarFighter 1
TSX-5
MTI
STEP
STSS
Midcourse Space Exp
NPP / NPOESS
GPS
MUOS

International

EnviSat
Cluster II
METOP
Rosetta
Champollion
Stentor
Yamal 100
SAC
Sicral
ACeS
L-Star
SOHO
SILEX
Integral
Int'l Space Station
MDS
N-Star
MTSat
ETS VII
JEM
ADEOS II
OICETS
DRTS

Civilian / Scientific

Deep Space I
Mars Pathfinder, Surveyor
Mars MER1 and 2, MRO
Mars: MSL
Contours
Seawinds
SIRTF
Messenger
Lunar Prospector
GALEX
GIFTS
TIROS
Landsat VII
EOS-AM1, Chem1, PM1
Cassini
TDRS
Space Shuttle
Hubble Space Telescope
Windsat
GOES
AXAF
TRMM
XTE
ACE
SMEX
MIDEX
GLAS
NEAR
Timed
FUSE
Genesis



Space Heritage: Committed to QPL-19500

- Microsemi remains committed to the QPL-19500 system for discrete
 - 100% committed to the QML system
 - Still have the largest number of QPLs in the industry
 - We are adding parts on a continuing basis
 - RH MOSFETs
 - Small signal transistors
 - Also expanding our commitment to MIL-PRF-38534

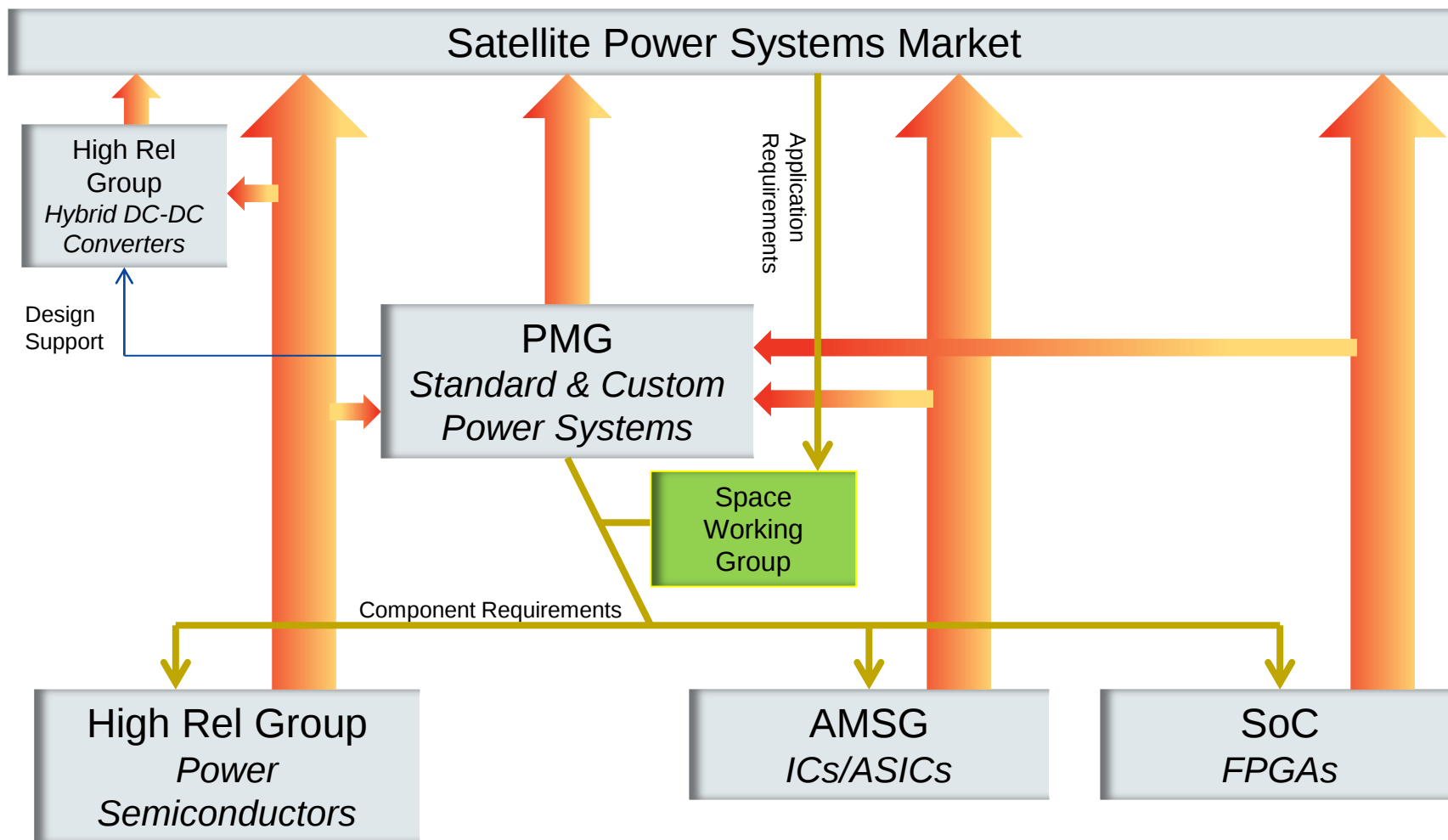


System View Device Development

- We look at the total system when building our product roadmaps to build devices that work together better in the final system
 - Smaller, lighter, less expensive, faster, more reliable
- System engineers always look at a satellite as a system
- Interfaces and partitioning are done at this level of engineering
- Without coordination of component development
 - Difficult and limited choices in partitions
 - Performance, power, weight, and cost are sacrificed
 - Interoperability assurance diminished



Microsemi Space Product Flow



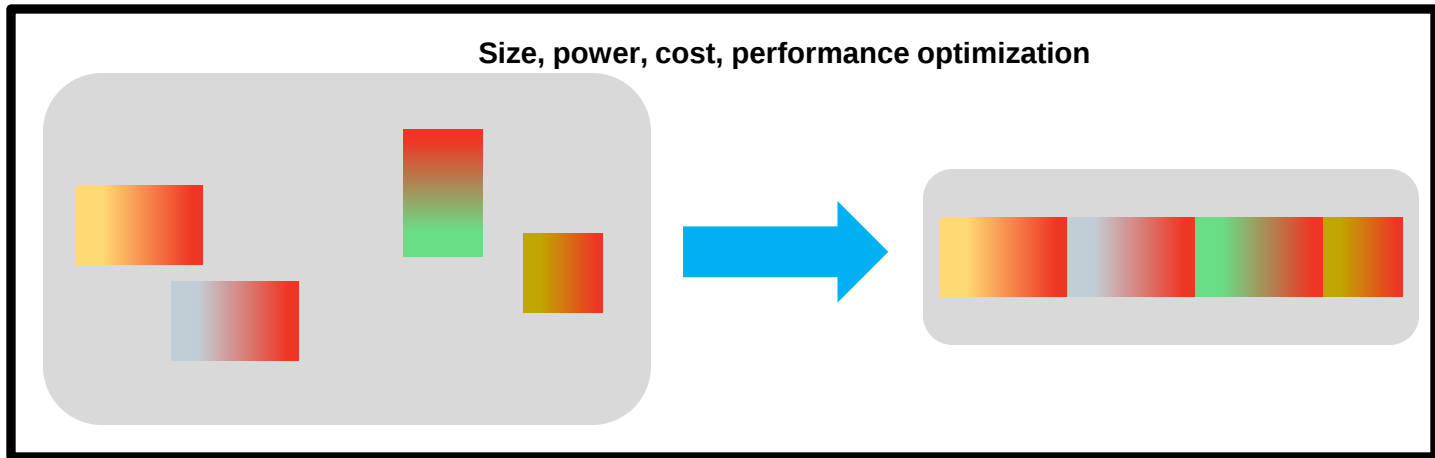
System View Device Development

- If device designers look at the system design to define products
 - Digital interface formats aligned
 - Digital and analog physical interfaces aligned
 - Power generation optimized for load and rails
 - No more level converters, signal dividers, extra clock channels
 - Product introductions aligned
 - Reliability architected into the component systems



System View Device Development

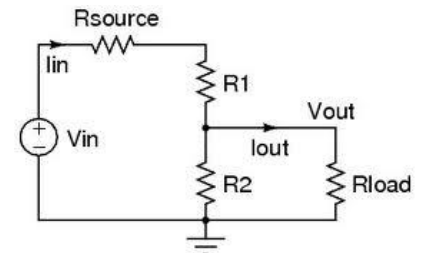
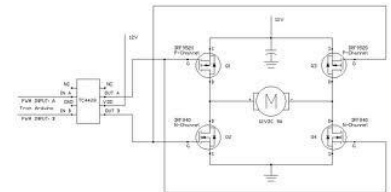
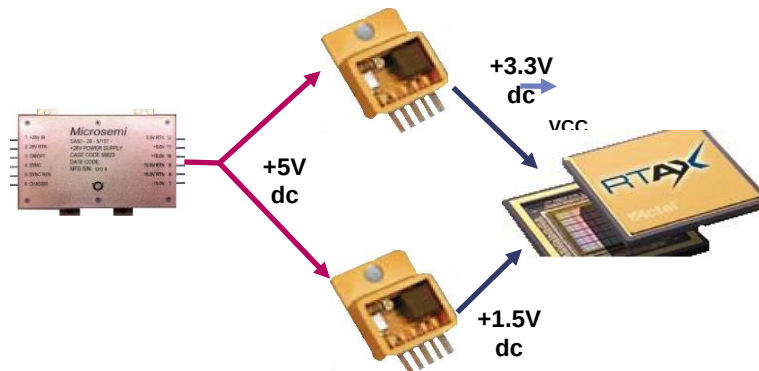
- To take advantage of this advanced view of product definition
 - Companies can align products in their portfolio
 - Companies can partner
 - General standards



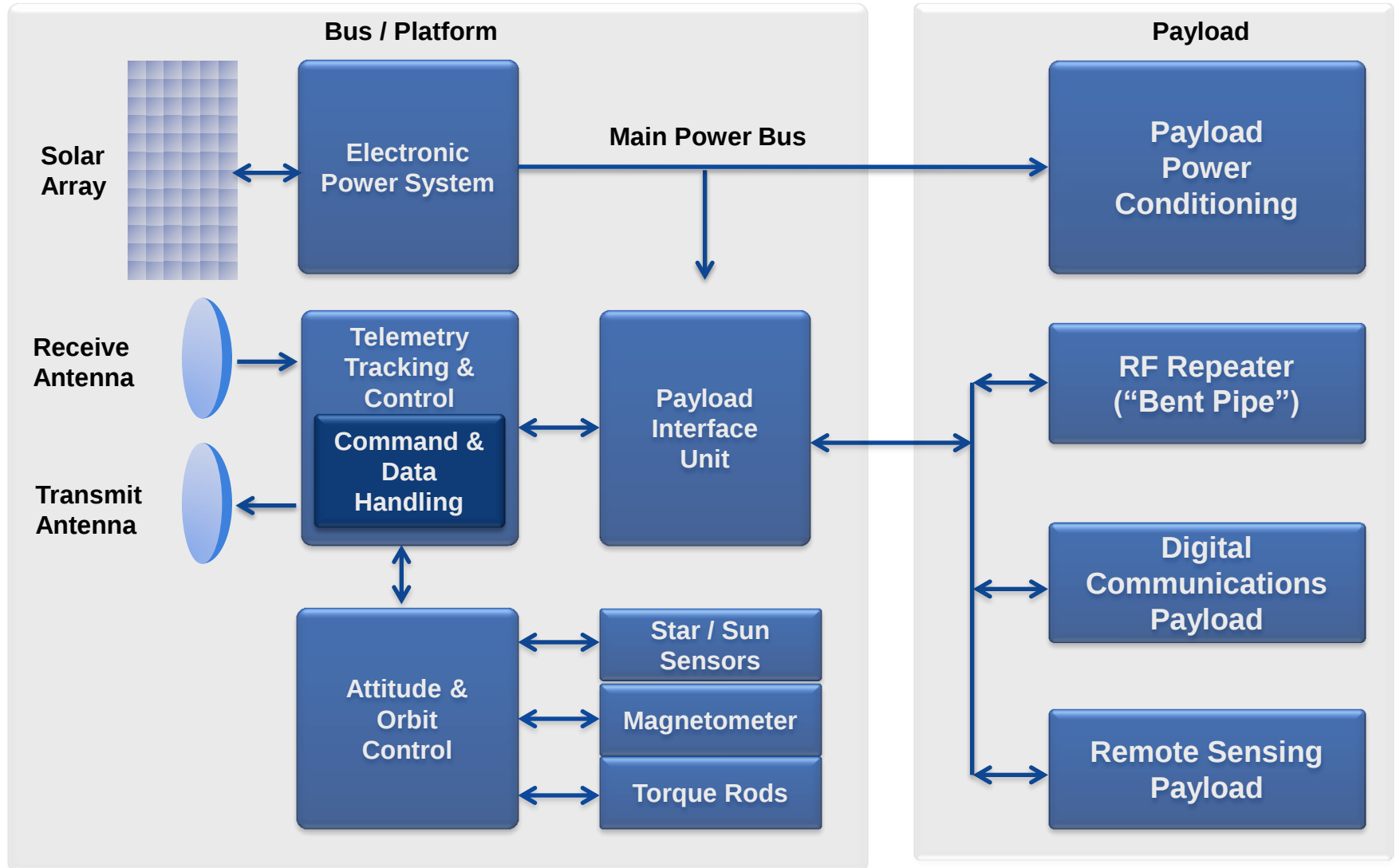
System View Device Development

■ Examples

- High-speed digital interfaces, standard, and custom
- Analog converters (A/D, D/A) dynamic range alignment
- Integrated voltage and current references
- POL devices and FPGA or ASIC current and voltage load matching
- Consistent cross device radiation performance (weakest link)
- High temperature switching device drivers optimized to switching device characteristics
- Serial communication width appropriate for the device technologies involved
- FPGAs control and monitoring clock and power generation
- Optimized device power down



Satellite Block Diagram



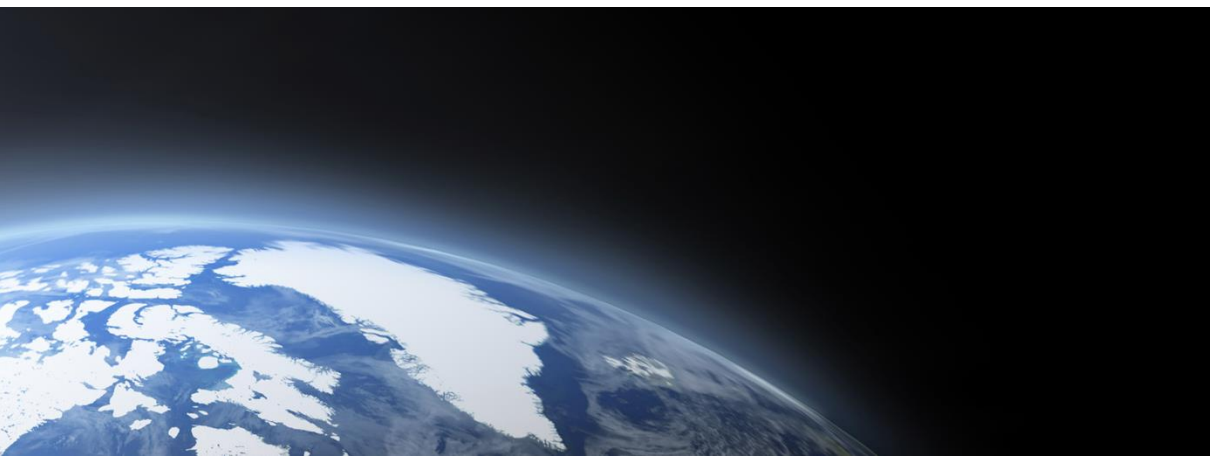
System View: Roadmap Alignment Examples

- Next-generation RT FPGAs
 - High-speed communications common with our space system managers
 - POL matched to load requirements, programmable and monitoring
- Space system companion devices
 - Analog and/or digital processing
 - “Custom ASIC”
 - High speed interfaces
 - Digital bus alignment
- High power switching devices
 - Custom drivers for optimized performance and protection
 - Device switching constraints eliminated from user
- Needs of system designers built into roadmaps from the start



Summary

- Microsemi is dedicated, focused, and investing in space products and capabilities
- Microsemi has been in the space business as a partner with our customers for more than 55 years and expects to be for a long time
- Microsemi has the system, circuit, and production experience in space to be a long term supplier of state-of-the-art products for long life cycles
- Microsemi uses a system view of applications, our breadth of technology and design experience to build the best in class products for space



Thank You