

Texas Instruments Space Products

Chris Hart, Space Marketing

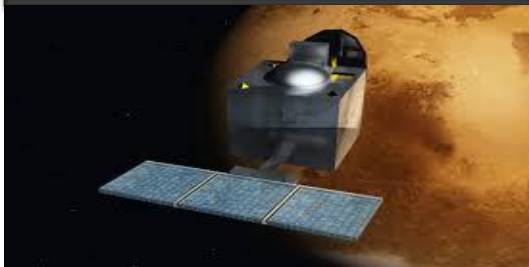
Space Products Interface Update

ESA CAN in Space Workshop (ESTEC), March 10, 2016

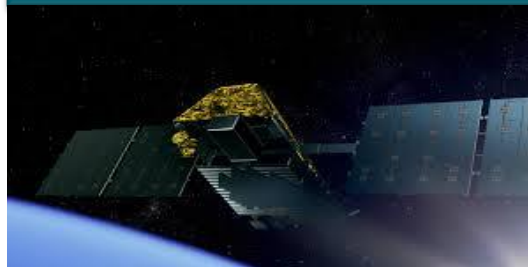
Texas Instruments' experience in space

For more than 40 years, our Space Products have helped drive many major U.S. and international based space programs, including:

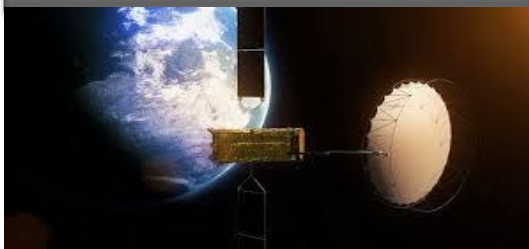
Mars Orbiter Mission



Iridium Next



Alphasat / Galileo



Exomars Rover



TI Information – Selective Disclosure

In House Radiation Testing

- **Single Event Effects Testing (SEE)**

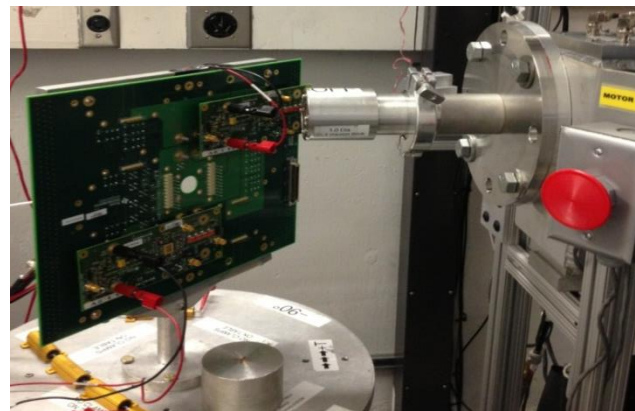
- New quad-site motherboard connected to PXI system allows testing both destructive and non-destructive events:
 - SEL, SEB, SEGR
 - SEU, SET, SEFI
- Ensure's that future space products “-SP” will have the necessary data to fly in space

- **TID Testing (HDR and LDR)**

- Leverages production test setup when testing HDR and LDR TID degradation
 - Production test setup ensures results are reliable
- Leveraging TI's Co-60 source to accelerate RHA releases for CMOS devices

- **Radiation Data and Support**

- Radiation reports can be found at www.ti.com/radiation and under the individual product under technical documents



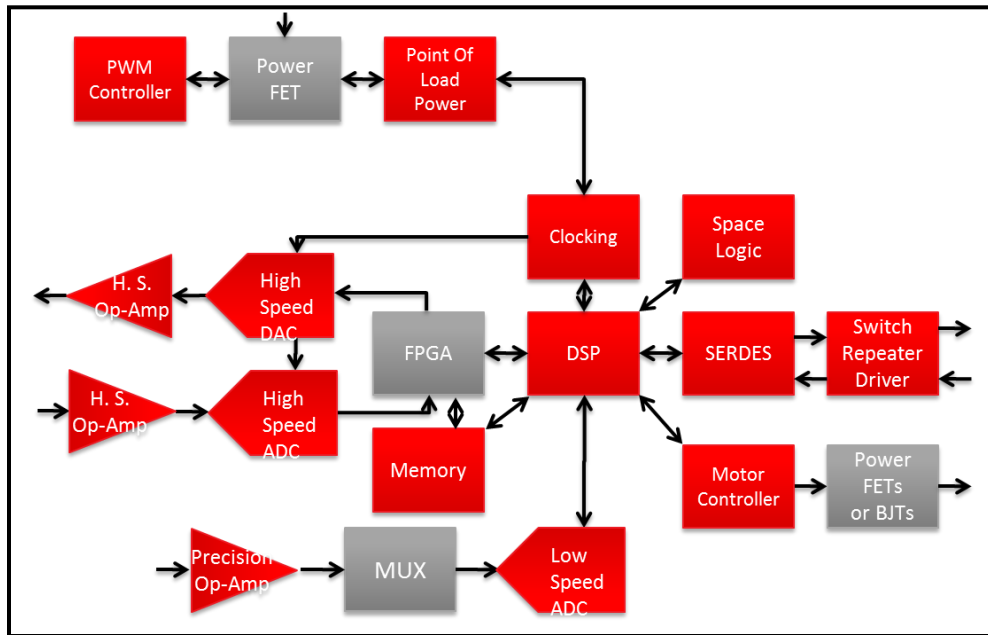
PXI System at TAMU



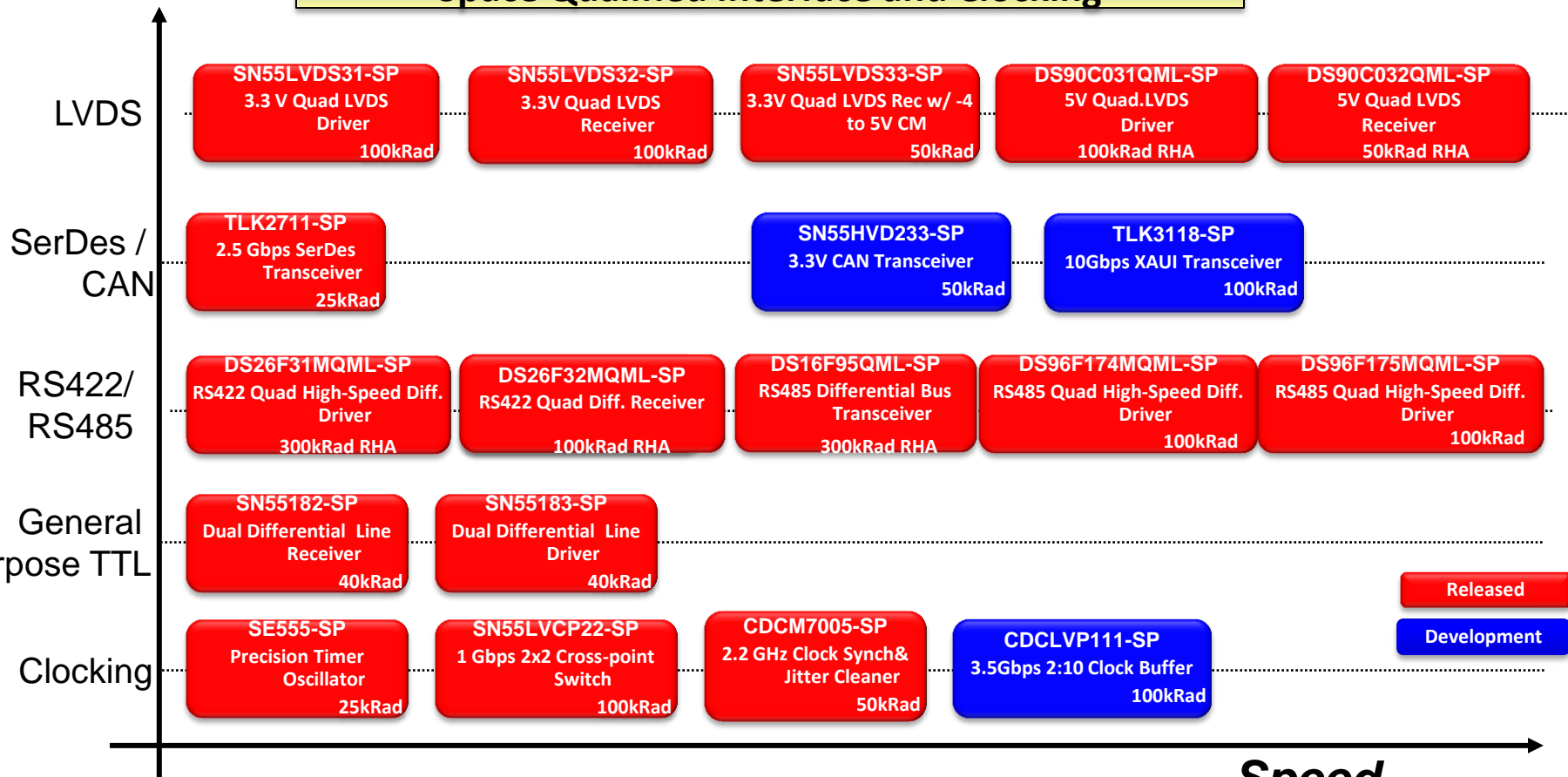
Co-60 HDR Gamma Cell

Complete Signal Chain and Power Solution

- TI's Space Products
 - Power (Point of Load (Switcher and LDO) and PWM Controllers)
 - Data Convertors (ADC and DAC)
 - Precision and High Speed
 - Memory
 - Logic
 - Interface
 - OpAmps
 - Precision and High Speed
 - Digital Signal Processors
 - Clocking



Space Qualified Interface and Clocking



TI Information – Selective Disclosure

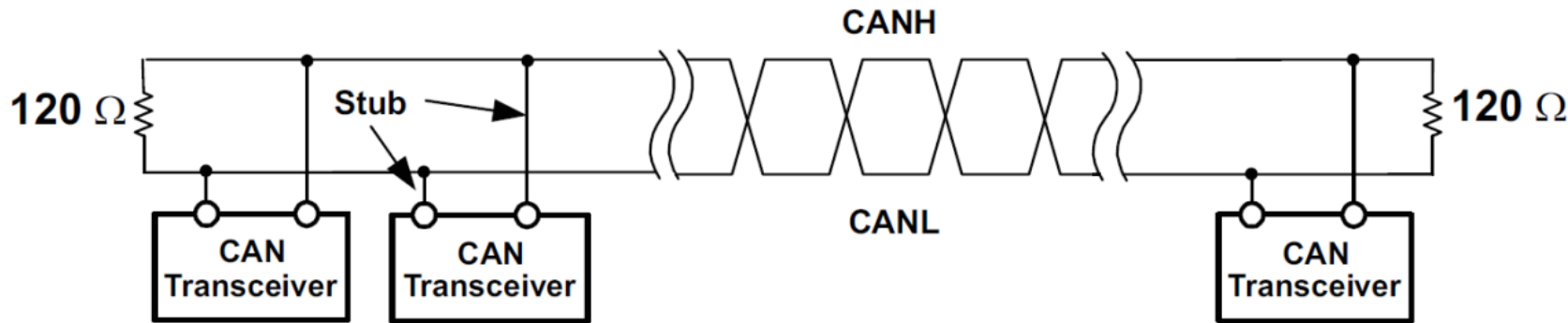
Speed



TEXAS INSTRUMENTS

Introduction to CAN

- TI introduced the industry's first 3.3V CAN transceiver targeted for automotive applications
- TI's CAN transceivers are all based on the ISO-11898 specification
 - SN55HVD233-SP is compatible with 5V CAN transceivers
 - SN55HVD233-SP is compatible with ISO-11898 with the exception of 5V I/O levels



Typical CAN Network

CAN Benefits

- Non-Destructive Bus Arbitration
 - Protocol utilizes priority schemes. Highest priority message always succeeds.
- Fault Tolerance
 - Acknowledgement of received packet
 - Protocol Error Handling
 - Protocol Error detection utilizing CRC encoding
- Noise Tolerance
 - Tolerant of ground noise
 - Good differential common mode rejection
- Well established standard for automotive communications with proven history in reliable applications
 - IP available for communication protocol

SN55HVD233-SP (ECCN: EAR99)

+3.3V CAN Transceiver

Features

- Compatible with ISO 11898-2
- 5V tolerant I/O with 3.3V Supply
- Bus pin short-circuit protection to $\pm 36V$
- ESD protection exceeds **16kV**
- Designed for signaling rates up to **1 Mbps**
- High Impedance
- Glitch free power up & power down protection
- **Lowest** standby current (600uA max)
- **Ultra fast propagation delays**
- Analog Slew Rate Control via RS pin
- -7V to 12V Common Mode Range
- 10 Pin CFP and 8 Pin CFP

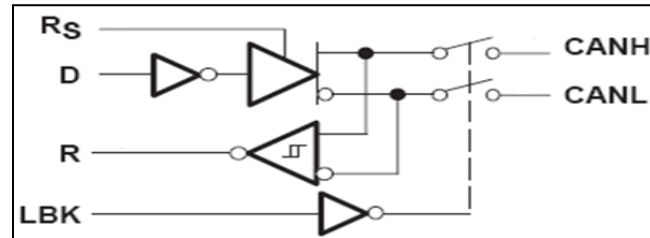
Rad Performance

- TID = 50kRad(Si) **RHA (HDR & LDR)**
- SEL Immune to LET = 60MeV @ 125C

TI Information – Selective Disclosure

Benefits

- Compatibility with existing signaling schemes
- Up to 120 nodes on bus
 - Drastic improvement in integration time at satellite integrator
- Device is unharmed by shorts to these shorts to $\pm 36V$
- Hot pluggable without data corruption
- Loopback for Diagnostic Functions Available
- Highly reliable communication link
- Very low power standby mode
- No 5V power requirement in system



Functional Block Diagram

Engineering Samples
Available Now!
QMLV RTM 2016!

SN55HVD233-SP EVM

- EVM available at product release
 - SN55HVD233/EM installed by factory
- Benefits
 - Lab verification of CAN interface compatibility with FPGA, ASIC, or uC
 - Thermal testing
 - Debugging
 - Layout and Schematic reference for designing with TI Space CAN transceiver
 - EAR99 for easy shipment to Europe

