Teledyne Microelectronics Overview

- Established in 1964
  - Lewisburg, Tennessee

- From prototype to production
  - Enhance design for manufacturability
  - Miniaturize size and reduce weight
  - Improve performance and reliability
  - Comprehensive testing and screening
  - Obsolescence management

- Microelectronics Trusted Source
  - Packaging, Assembly and Test Services
  - DoD Accredited to
    - Mission Assurance Category 1
    - Trusted Category 1A
Teledyne Microelectronic Technologies

● Microelectronic Packaging & Products
  – COTS to Class K
  – More than 250,000 single die to multichip packages per year

● Technologies
  – RF & Microwave
  – Optoelectronics
  – High Speed Digital and Mixed Signal
  – Secure Communications
  – Power

● Markets
  – Defense (Class H certified)
  – Avionics
  – Space (Class K certified)
  – Secure Communications
  – Ruggedized Industrial
Major Customers & Technologies

- Boeing
- DRS
- Goodrich
- Exelis
- L3 Communications
- Maxwell
- Northrop Grumman
- Raytheon
- Semtech
- St. Jude

- Boeing
- Comtech PST
- Exelis
- L3 Communications
- Lockheed Martin
- National Instruments
- Raytheon
- Rockwell Collins
- Semtech

- Boeing
- Goodrich ISR
- Harris
- Honeywell
- L3 Communications
- Raytheon
- RIO
- Rockwell Collins

Smaller Size

Improved Performance and Reliability

Lighter Weight

Lower Power

- Airbus
- BAE Systems
- Boeing
- Borisch
- Curtiss Wright
- Diehl
- GE Aviation
- Hamilton Sundstrand
- Honeywell
- Lockheed Martin

- BAE Systems
- Boeing
- Exelis
- NSA (MPO)
- Raytheon
- SafeNet
- Sandia
- SPAWAR
- Trimble
- VIASAT

- Aerojet
- Astrium
- Boeing
- Harris
- Exelis
- JPL
- L-3 Communications
- Lockheed Martin
- Moog
- Northrop Grumman

Power

Secure Communications

Space
Pioneers in Space

Spacecraft
- ISSI
- Voyager
- Viking
- Mars Observer
- Galileo
- Susei
- Magellan
- Giotto
- MESUR
- Ulysses
- Spacelab
- Sakigake
- Cassini
- Hugyens
- Clementine
- GLAST
- Hubble Space Telescope
- James Webb Space Telescope
- Mars Global Surveyor
- Mars Science Lab

Satellite
- Tiros
- DOT
- ANIK
- INTELSAT
- Galaxy
- Palapa
- ERS
- Westar
- Brazilsat
- SBS
- GOES
- DRIRU
- OAO
- Landsat
- Solarmax
- Globalstar
- HS601/701
- Spaceway
- Satcom4000/5000

Launch & Reentry Vehicles
- Titan
- Delta
- IUS
- Centaur
- Atlas
- MK12A
- Space Shuttle
- Scout
- MX
- Minuteman
- Trident
- D5

Military Spacecraft
- DSCS
- PMALS
- Milstar
- GPS
- DMS
- PMS
- TDRSS
- PRISM
- Zodiaque
- SDI
- Crosslink
- Classified
Space Modules to Class K

- Radiation Micro-Dosimeter
- Inertial Navigation
- Power Management and Control
- Stepper Motor Control and Stabilization
- Heater Control
- Imaging, Camera Pointing and Control
- Processor and Memory
- Arcjet Thruster Control
- TWT Control
- NTSC Analog Video Modulator/Demodulator
- FDDI Optical Transmitter/Receiver
- Radar Altimeter Transmitter/Receiver
  Up/Down Converter
Radiation Micro Dosimeter

● Problem: Electronics degrade with accumulation of radiation dose
● Solution: Teledyne’s Radiation Micro-dosimeter
● Small enough to
  – place at multiple locations
  – surface and payload
● Real time data
  – alert for hazardous conditions
  – alarm for hostile action
  – anomaly diagnosis
● Accumulated data
  – improve radiation models & electrical designs
  – lead to improvements in spacecraft design
● More accurate modeling, reduces need for costly ray-tracing environmental analysis
● Dose budgets can be developed to establish more accurate estimates of spacecraft life
Additional Markets

● Defense Aircraft, Ships & Vehicles
  – Provide a radiation monitor to alarm operators of
    • hazardous environmental conditions
    • hostile action
  – Optimize future radiation models & electronic designs
  – Measure radiation during the disarming and storage of nuclear weapons

● Medical
  – Monitoring the exposure of personnel and patients to ionizing radiation.
Radiation Micro Dosimeter Features

- **Size, Weight, And Performance**
  - 1.4” x 1.0” x 0.040”
  - 20 grams
  - 10 mA from 13V to 40V input
  - 14 µrads to 40Krads

- Small footprint: can be installed next to sensitive components or areas of concern for radiation exposure

- Plug & play: connects to standard spacecraft housekeeping, power and communication busses

- Direct measurement of radiation dose vs alternative indirect measurements

- Integrates signal prior to threshold detection to improve charge collection accuracy

- 3 linear DC and 1 pseudo-log output pins
Radiation Micro Dosimeter Missions

- 2008: ISRO Chandrayaan Lunar Orbiter
- 2009: NASA Lunar Reconnaissance Orbiter
- 2009: NASA International Space Station
  - MISSE-7B test bed
- 2009: NRL & Boeing, LEO orbit
- 2010: “Deal” mission: first feedback for improving electron and proton environmental models.

NASA Radiation Belt Storm Probe (RBSP): inside an instrument called Relativistic Proton Spectrometer.
Sharing Data Information

- The Aerospace Corporation requests that Micro Dosimeter data be shared with them.
- The Aerospace Corporation plans to use the data for the purpose of improving space environment models used to predict radiation dose data.
- The goal is to process data from the multitude of Micro Dosimeters in orbit.
- Aerospace will update their models using this information, and will distribute back to the space community.

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Frequently Asked Questions

General Performance:

- **Q:** *What kind of radiation does the Dosimeter measure?*
  **A:** Electrons, Protons, Gamma Rays

- **Q:** *How much radiation does it measure?*
  **A:** 14uRads to 40kRads, broadest range in the market

- **Q:** *What is the survivability (max. radiation exposure)?*
  **A:** 40kRads

- **Q:** *Why is the operating temperature only -30 to +40°C?*
  **A:** This is standard range for space level components

- **Q:** *Are evaluation boards available?*
  **A:** They may be available in the future (6 – 8 months)
Frequently Asked Questions

Electrical:

● Q: *How much do I have to regulate the power supply?*
  A: Unregulated power between 13V and 40V is acceptable

● Q: *Do I need current limiting in my circuit?*
  A: No current limiting is necessary for power input

● Q: *What is the linearity of input vs. output?*
  A: +/- 20% is the spec. Average is 2.2%

● Q: *What if my voltage regulation exceeds +/-5%?*
  A: As long as voltage is within 13V and 40V it is okay

● Q: *What is the output voltage 0 to 5V; can it be converted to current?*
  A: We do not measure the output impedance
Frequently Asked Questions

Mechanical:

● Q: *How do I mount the device?*
  A: 6 mounting holes are provided. Mounting/location must ensure the temperature of the device will not exceed specifications

● Q: *Is thermal grease required for mounting?*
  A: Not required, power dissipation is very low

● Q: *Does torque have any affect on the device?*
  A: Torque has no effect if within the screw specification

● Q: *What affect does vibration and shock have on the device (will it survive Launch and Pyro shock – or separation)?*
  A: It will withstand shock & vibration as required in MIL-PRF-38534 Class H or Class K. (Typ. 3000 Gs.)
Frequently Asked Questions

Reliability:

- **Q:** Does temperature affect accuracy of the device?
  **A:** The device will meet all performance specifications within the operating range on the datasheet.

- **Q:** Are there any ROHS prohibited materials in the device?
  **A:** All materials in the device are compliant to MIL-PRF-38534 Class H or Class K. A quotation can be provided if a more extensive analysis is required.