Evaluating the Influence of Total Ionizing Dose Radiation Effect on IMU : M-G370PDT0

1. Summary

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Purpose

Radiation TID (Total Ionizing Dose) testing was conducted on the M-G370PDT0, an inertial measurement unit (IMU) for industrial applications, to evaluate its radiation resistance and influence on sensor characteristics.

Conclusion

The M-G370PDT0 showed no loss of functionality or abnormal current consumption up to 20k [rad(Si)].

<Note>

- This product is not designed for space applications. This report provides reference data to understand radiation resistance performance and does not guarantee performance in space applications.
- Although the test targets were IMUs from the same production lot, the internal components were not lot-controlled. Please take into account that internal components may vary from lot to lot.
- The TID test results in this report are expressed in rad units (1 rad = 0.01 Gy).
- All TID test results in this report are converted to the radiation absorbed dose of silicon.

2. Method / Results

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TID Test Method

The main purpose is to determine the limit of radiation resistance.

- Irradiation Facility : Takasaki Institute for Advanced Quantum Science
- Radiation : Gamma rays from a ^{60}Co Source
- Ambient temperature : Room Temperature
- Irradiation direction : Direction parallel to the Z axis
- Absorbed dose rate : 4.9k～48.4k [rad(Si)/h] target
- Irradiation time : Approximately 62 minutes (All conditions)
- Total Dose : 5k～50k [rad(Si)] target

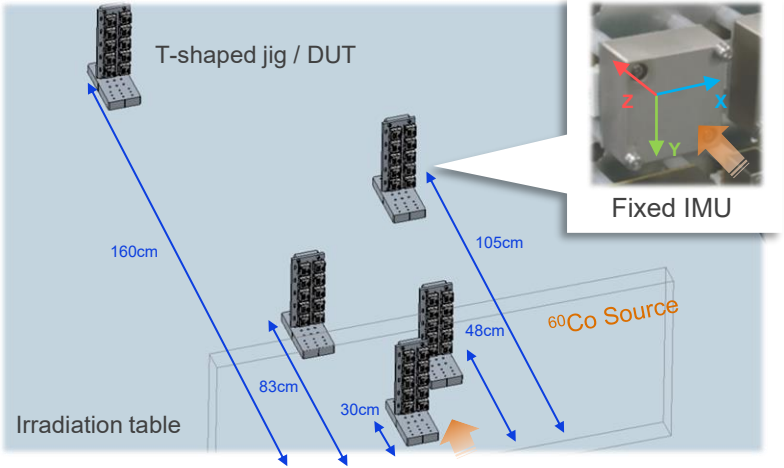


Image of TID test using gamma rays

TID Test Results (Operation, Non-volatile memory, Reset function, etc.)

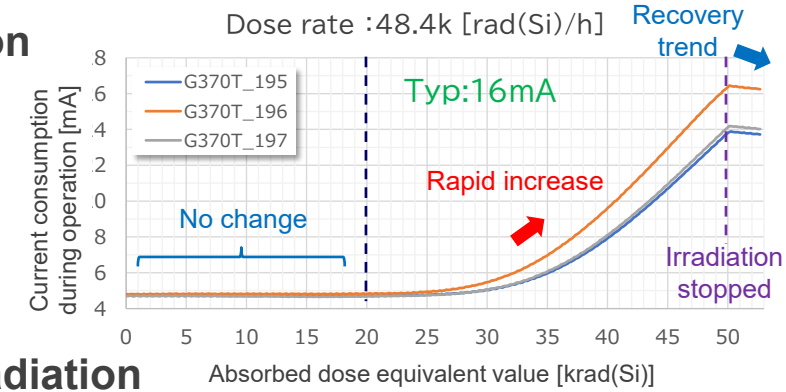
No significant loss of function was observed up to 20k [rad(Si)] under both powered and unpowered conditions.

Functional evaluation	TID [rad(Si)] (Dose rate [rad(Si)/h])	5k (4.9k)	10k (9.7k)	20k (19.4k)	30k (29.2k)	50k (48.4k)
M-G370PDT0	Powered (3p each)	Passed	Passed	Passed	Failed	Failed
	Unpowered (1p each)	Passed	Passed	Passed	Passed	Failed

3. Detailed Results

Current consumption during gamma-ray irradiation

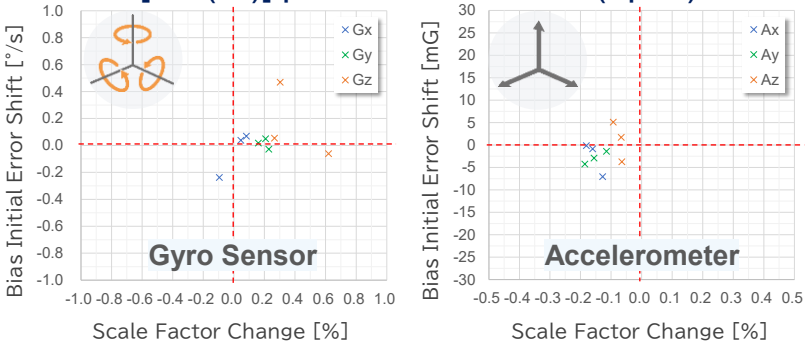
- ✓ Up to an absorbed dose of 20k [rad(Si)], there was almost no change in the 3 pcs.
- ✓ Once the absorbed dose exceeded 20k [rad(Si)], the 3 pcs increased sharply, and a recovery trend was observed after irradiation was stopped.



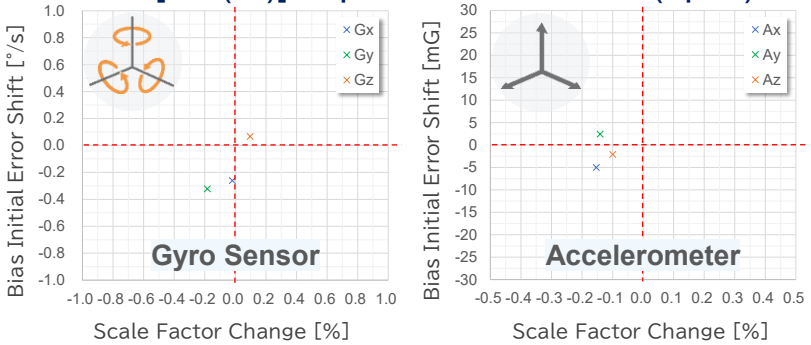
Sensor characteristic change before and after Irradiation

- ✓ The relative characteristic change within 24 hours after irradiation were at the same level as those observed in our standard reliability tests.

20k[rad(Si)] powered condition (3pcs)



20k [rad(Si)] unpowered condition (1pcs)



4. M-G370PDT0

View Product Info

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The M-G370PDT0 is a compact 6-DoF inertial measurement unit (IMU) with three-axis gyroscope and accelerometer sensors, offering high stability and accuracy through advanced compensation technology. It supports versatile SPI and UART interfaces, reducing integration barriers and enabling efficient implementation of inertial motion analysis and control with minimal design effort.

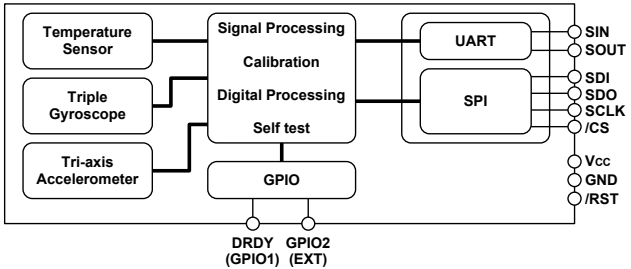
Features

- Small Size, Lightweight: 24 x 24 x 10mm, 10 grams
- Low-Noise, High-Stability
  - Gyro Bias Instability : 0.8 ˚/h
  - Angular Random Walk : 0.03 ˚/√ h
- Initial Bias Error : 360 ˚/h (1σ) / 2 mG (1σ)
- 6 Degrees Of Freedom
  - Triple Gyroscopes : ±200 ˚/s
  - Tri-Axis Accelerometer : ±8 G/±16 G
- 16/32-bit Data Resolution
- Digital Serial Interface : SPI / UART
- Calibrated Stability (Bias, Scale Factor, Axial Alignment)
- Data Output Rate : 2k Sps (Max.)
- External Trigger Input / External Counter Reset Input
- Delta Angle / Delta Velocity Output
- Operating Temperature Range : -40 ℃ to +85 ℃
- Single Voltage Supply : 3.3 V
- Low Power Consumption : 16 mA (Typ.)

Application

- Antenna Platform Stabilization
- Camera Gimbals
- Navigation Systems
- Vibration Control and Stabilization
- Pointing and Tracking Systems
- Autonomous Vehicle

Block Diagram

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