Small 2-Axis Gyro Sensors
FAR-S1DG Series

Incorporating two tuning fork-type LN crystal elements in one package, this 2-axis gyro sensor realizes ultrasmall size, high sensitivity, and low power consumption.

* LN: Lithium niobate (LiNbO₃)

Overview

Gyro sensors are used to correct hand movement when using digital cameras and video cameras. Conventionally, two detection sensors are adopted to detect hand movement in the vertical and horizontal directions; peripheral circuits for the amplifier, etc. also require two sensors.

FUJITSU has now developed a 2-axis gyro sensor capable of detecting hand movement in two directions with one package. This is one of the smallest products in the industry that incorporates two LN tuning fork-type elements, an amplifier, detection circuit, temperature correction circuit, etc. in a single chip, thereby enabling the miniaturization of digital cameras and video cameras.

This article describes the principle and features of the 2-axis gyro sensor.

Principle

The main operation principle of this product relates to Coriolis force, which occurs when an object in motion rotates (Fig.1).

When rotating a tuning fork-shaped piezoelectric element around an axis while it is vibrating, Coriolis force generates vibration in the orthogonal direction. Angular speed is detected by measuring this vibration electrically. This product incorporates two tuning fork-type elements.

Product Features

- Detection of 2-axis angular speed with an ultrasmall package
  FUJITSU incorporated two sensor elements in one package making full use of its high-density mounting technology. This enables a reduction in mounting area to less than one-half that of conventional products, which use two 1-axis gyro sensors. We also optimized the element size and assignment so that interference between the elements is minimized. Furthermore, since the elements are already orthogonal inside the package, this product does not require one to ensure that the two axes are orthogonal when mounting on the board, which is necessary for 1-axis gyro sensors.
  Fig.2 shows the directions of detection axis.

Photo 1 External View
LN crystal used as the elements
FUJITSU has provided piezoelectric vibration gyro sensors that utilize LN crystal as the piezoelectric element for car navigation. The 2-axis gyro sensors developed this time utilize the technology of LN tuning fork-shaped elements for automobile applications in order to realize miniature size; they have equivalent sensitivity to conventional hand movement detection gyro sensors in a small size.

Built-in operation amplifiers
This product has 2 channels of built-in operation amplifiers and does not require an external operation amplifier. The amplification rate of the operation amplifier is adjusted with an external resistor and condenser.

Reduced mutual interference
By shifting the operation frequencies of the elements and optimizing the assignment in the package, we minimize the mutual effects of elements.

Built-in analog switch
This product has a built-in analog switch and a start-up time of 100ms or less.

Low current consumption
By developing a special IC, we simplified the circuit configuration and reduced the power consumption.

High S/N electrode assignment and balanced detection circuit
This product adopts an original detection electrode configuration and detection circuit that deliver high S/N. Output by rotation is efficiently removed and output noise is minimized by connecting the electrodes from which similar electric charges are generated and canceling the vibration using a differential amplifier.

Applications
This product is optimal as a sensor for hand movement correction mechanisms in digital cameras and video cameras.

Specifications
Table 1 lists the features, and Fig.3 presents the external dimensions of this product.
Figure 3 External Dimensions

Unit: mm