nected to the lead **38** through a bonding wire, thereby enabling external acquisition of the output signal of the oscillation circuit **61**. In the present exemplary embodiment, the frequency error of the oscillation circuit **61** is acquired for each of the temperature environments by measuring output signals of the oscillation circuit **61** externally acquired in each of the temperature environments of low temperature, room temperature, and high temperature. Namely, the frequency errors of the oscillation circuit **61** in each of the temperature environments are acquired externally to the semiconductor device **6**. The frequency error of the oscillation circuit **61** supplied from externally is stored as temperature measurement values in the low temperature register **72**, the room temperature register **73** and the high temperature register **74**. According to the semiconductor device **6** of the present exemplary embodiment, the derivation processing of the frequency errors is performed externally, eliminating the need for the measurement counter **81** and the reference counter **82** of the first exemplary embodiment described above, and thereby enabling the size of the semiconductor chip **30** to be made smaller.

Modified Example

[0159] FIG. **25** is a perspective view illustrating a configuration of a semiconductor module **7** according to a modified example of the present invention. The semiconductor module **7** is configured including a semiconductor device **2*a*** mounted on a reference board **500**, capacitors C_{GL} and C_{DL} that are mounted on the reference board **500** and are connected to the semiconductor device **2*a***, and molding resin **510** that serves as a sealing member for these members mounted on the reference board **500**. The semiconductor device **2*a*** is the semiconductor device **2** according to the second exemplary embodiment described above, with the capacitors C_{GL} and C_{DL} removed. Namely, the semiconductor module **7** has the capacitors C_{GL} and C_{DL} of the semiconductor device **2** according to the second exemplary embodiment described above removed and connected to the semiconductor device **2*a*** on the reference board **500**. According to such a configuration, although frequency correction processing cannot be executed by the semiconductor device **2*a*** on its own, it is possible to perform frequency correction as the semiconductor module **7**.

[0160] Normally an exterior mounted metering apparatus such as an electricity meter or a gas meter is liable to being affected by the external environment. The resonance frequency of quartz oscillators widely employed for time measurement circuits fluctuates according the peripheral temperature. Thus the oscillation frequency of an oscillation circuit including an oscillator changes according to peripheral temperature variations. Thus accurate time measurements can no longer be performed when the oscillation frequency of the oscillation circuit fluctuates. In particular, there is a need for measurement instruments such as electricity meters to always perform time measurements at high precision. To address this, semiconductor devices that include timing functions and are in-built into measuring instruments such as electricity meters use temperature sensing devices (temperature sensors) to measure the temperature of the oscillator and to perform correction for the fluctuation amount in the oscillation frequency. In such cases, there is a need to accurately measure the temperature of the oscillator using the temperature sensing device in order to perform appropriated frequency correction.

[0161] For example, in a configuration with a temperature sensing device in-built into an IC chip, it is difficult to accurately measure the temperature of the oscillator due to the temperature sensing device being affected by heat from the semiconductor chip. Moreover, as the temperature sensing device in-built into a semiconductor chip there is the assumption that utilization is made of one with temperature characteristics of forward direction voltage V_F in a pn junction, however it is difficult to perform temperature measurement at high precision since the change in output signal with temperature of such a temperature sensing device is small and yet has a large variation. Thus with a temperature sensing device in-built into a semiconductor chip, it is difficult to perform correction at high precision of the fluctuation amount of oscillation frequency accompanying changes in temperature.

[0162] However, in an oscillation circuit employing an oscillator such as a quartz oscillator, a capacitor for forming a resonance circuit is connected to the oscillator. Building this capacitor into the semiconductor chip enables the number of components to be reduced. However, the capacitor configuring the semiconductor needs to have a comparatively large surface area within the semiconductor chip, with an accompany increase in the chip size. Consequently, sometimes building a capacitor into the semiconductor chip actually results in an increase in cost. Moreover, a capacitor configuring a semiconductor has larger variation in capacitance values and larger capacitance value fluctuation to temperature changes compared to discrete components such a ceramic condenser, making it difficult to make high precision changes in the oscillation frequency.

[0163] Thus although building a temperature sensing device and a capacitor into a semiconductor chip enables a reduction to be made in the number of components, it becomes difficult to achieve high precision of oscillation frequency of the oscillation circuit across the range of usage temperatures, and it is difficult to perform accurate timing measurements.

[0164] The present invention provides a semiconductor device with a time measurement function capable of performing more accurate timing measurements, and a metering device including such semiconductor device.

What is claimed is:

1. A semiconductor device comprising:

an oscillator;

a semiconductor chip that includes an oscillation circuit connected to the oscillator, a timer circuit that generates a timing signal of a frequency according to a oscillation frequency of the oscillation circuit, and a frequency correction section that corrects a frequency of the timing signal based on temperature data; and

a discrete device that includes at least one of a temperature sensing device that detects a peripheral temperature, that supplies the detected temperature as temperature data to the frequency correction section, and that is provided as a separate body to the semiconductor chip, or a capacitor that is electrically connected to both the oscillator and the oscillation circuit and that is provided as a separate body to the semiconductor chip, wherein

the oscillator, the semiconductor chip and the discrete device are contained within a single package.

2. The semiconductor device of claim **1**, wherein:

the discrete device includes the temperature sensing device;