Due to the rise in consciousness concerning automobile safety in recent years, almost all vehicles in Japan are now equipped with a system for controlling a 4-item set of occupant protection devices, consisting of Air Bags and seat belt pre-tensioners for both the driver seat and passenger seat ("4 channel system" below). And such systems are now expanding into the Chinese and other Asian markets. Fujitsu Ten is engaged in developing not only an advanced Air Bag ECU, but also a low-cost high-quality 4-channel Air Bag ECU to meet needs of the expanding market in the future. In order to win over the competition in such markets, we have set up collaborations with automobile manufacturers to enhance our development capabilities and design efficiency, and have started activities to develop "an Air Bag ECU with a world wide competitive edge". This paper presents the first results of such activities; the low-cost standard Air Bag ECU that was put into mass production in 2000.
Introduction

Overview of Air Bag system

Development objectives
4.1 Development of integrated ASIC

1) Basic configuration of Air Bag ECU

- The basic configuration of the Air Bag ECU is as follows. The ECU is designed to control the deployment of the airbag in case of a collision. It receives input signals from various sensors and processes them to determine whether the deployment is necessary. The ECU then controls the airbag inflator to inflate the bag at the appropriate time.

- The ECU integrates various functions into a single chip, reducing the number of components and lowering the cost of the airbag system.

- The newly-developed technology allows for a more compact and efficient design, which is expected to improve the overall performance of the airbag system.

2) Incorporation of functions in integrated ASIC

- The ECU integrates various functions into a single chip, including:
  - Acceleration sensors
  - Compass sensors
  - Gyro sensors
  - Microcontroller

- This integration reduces the number of components, leading to a cost-effective solution.

3) Cost cutting effect through reduction in number of components

- The integration of functions in a single chip allows for a reduction in the number of components, which in turn reduces the cost of the airbag system.

- The newly-developed technology contributes to the development of a low-cost, high-performance airbag system that can be installed in various vehicles at a reasonable price.

**Newly-developed technology**

- The newly-developed technology allows for a more compact and efficient design, which is expected to improve the overall performance of the airbag system.

- The integration of various functions into a single chip reduces the number of components, leading to a cost-effective solution.

- This integration is expected to have a significant impact on the airbag industry, allowing for a more widespread adoption of airbag systems in vehicles.
4) Circuits built into the integrated ASIC

The circuit is built into the integrated ASIC and the block diagram of the circuit is shown below.

The circuit consists of several blocks, including a power supply block, an input buffer block, an amplifier block, and a filter block. The power supply block provides stable supply voltage to the other blocks. The input buffer block buffers the input signal and prevents signal distortion. The amplifier block amplifies the input signal to a desired level. The filter block filters out unwanted noise and signals to improve signal quality.

The circuit is designed to meet the specifications for high-speed, low-noise, and wide-bandwidth operation. It is suitable for use in various applications such as audio equipment, communication systems, and signal processing systems.
4.2 Development of standard case

4.2.1 Configuration of Air Bag ECU

a) Configuration of firing control circuit extension

b) Communication interface circuits for satellite sensors

The development of low-cost standard air bag ECU is of great importance in the automotive industry, as it allows vehicle manufacturers to offer more advanced safety features at a lower cost. This paper presents the development of a low-cost standard air bag ECU, focusing on its configuration and communication interface circuits for satellite sensors. The configuration of the firing control circuit extension is also discussed, highlighting the benefits of such an extension for improved safety performance. The communication interface circuits for satellite sensors are designed to facilitate better integration with other vehicle systems, enhancing overall vehicle safety and performance. These advancements in air bag ECU technology are crucial for the future of automotive safety systems.
4.2.2 Problems with conventional construction

In the conventional construction, there are several problems that need to be addressed:

- **Weight**: The conventional ECU cases are heavy, which can increase the overall weight of the vehicle.
- **Size**: The size of the conventional cases is larger than necessary, leading to inefficient space utilization.
- **Cost**: The production cost of the conventional cases is higher due to complex assembly processes.

These issues arise from the lack of standardization and the use of different materials and processes.

4.2.3 Development of standard ECU case

To address these problems, a new standard ECU case has been developed. This new case is designed to be lightweight, compact, and cost-effective. It utilizes advanced materials and manufacturing techniques to achieve these objectives. The new case also follows the guidelines for environmentally friendly materials and processes.

The development process involves extensive research and testing to ensure the new case meets all the necessary requirements. The result is a more efficient and sustainable ECU case that can be easily integrated into various vehicle models.

The new case has already been tested in several prototypes and has shown promising results. It is expected to be widely adopted in the future.
4.2.4 Employment of taptight screws

4.2.5 Effects of development of standard case
4.3 Improvements in manufacture inspection processes

4.3.1 Problems in conventional inspection processes

4.3.2 New manufacture inspection method
4.3.3 Effects of inspection process improvement

1) Improved trouble detection ability

- Improved trouble detection ability leads to faster and more accurate problem identification.

- This improvement reduces the time required to identify and address issues, thereby increasing efficiency.

2) Shortening of inspection duration’s

- Shortening of inspection duration improves the overall process flow and reduces production time.

- This leads to increased productivity and cost savings.
3) Increased efficiency of trouble analysis

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Conclusion