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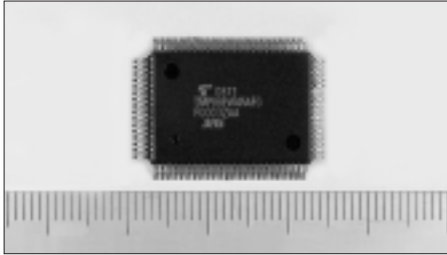
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Reduces burden of software processing and meets European IEC60730 safety standard

High-performance PMD flash microcontroller for motor control equipment: TMP88FW45AFG



Toshiba has developed a high-performance PMD flash microcontroller for motor control equipment, TMP88FW45AFG, that makes it possible for manufacturers to meet International Electrotechnical Commission (IEC) standard IEC60730 without having to modify set boards.

Compliance with the standard has been mandatory for all home appliances sold in Europe since October 2007. The standard was enacted for the purpose of performing periodic self-diagnoses on all finished products in use for early detection of malfunctions and failures thereby protecting consumers from any potential risks.

The standard classifies applicable equipment into three categories:

- Class A: Equipment not requiring a fail-safe function (such as lighting fixtures)
- Class B: Equipment requiring a fail-safe function (such as washing machines)
- Class C: Equipment requiring an advanced fail-safe function (such as combustion equipment)

The following indicates examples of recommended self-diagnostic tests for microcontrollers in Class B finished products, such as washing machines, in which this new PMD flash microcontroller is to be used.

- * Diagnosis of stack failures of microcontrollers and program counters
- * Diagnosis of interrupt cycle abnormalities
- * Diagnosis of abnormalities in microcontroller clock frequency
- * Diagnosis of memory abnormalities (ROM/RAM)
- * Diagnosis of abnormalities in external interface (communications)

In response to these recommendations, set manufacturers are required to add new countermeasure software, in addition to conventional equipment control software. As a result, they frequently encounter difficulties in dealing with the growing size of software accompanying the need to provide periodic self-diagnoses.

In order to effectively respond to this situation, Toshiba has developed the new TMP88FW45AFG microcontroller by adding hardware in the form of a clock frequency detection function, which cannot be supported by software alone, in order to respond to the wishes of the customers seeking to comply with IEC60730 without having to modify the set board.

In comparison with the conventional watchdog timer (WDT) detection method, in which a clock operates independently from the core clock of the microcontroller in order to monitor the clock frequency, this new microcontroller offers the advantages of: (1) eliminating the need for complex software, such as for clearing within the window period of the WDT; and (2) enabling detection even at frequencies for which normal operation of software is not guaranteed by the microcontroller (e.g., low frequencies and high frequencies).

Following the release of this new product, which was developed by adding hardware to a product widely used in washing machines in Europe, as the first in a lineup of microcontrollers enabling set manufacturers to reduce the increasing volume of software processing, Toshiba plans to gradually expand the lineup centered on the TLCS-870/C1 core product group and work towards improving ease of use.

Features

- ① Built-in memory for storage and control of complex control programs
- ② Oscillation frequency detection circuit for automatic detection of operating clock abnormalities
- ③ PMD circuit providing support for conventional complex motor control
- ④ Wide range of I/O pins

Main Specifications

Product name	TMP88FW45AFG
Microcontroller core	TLCS-870/X
ROM/RAM size	Flash-ROM 120 Kbytes/RAM 4 Kbytes
Oscillation frequency detection circuit	1 channel
PMD circuit (motor control circuit)	2 channels
PWM (high-speed PWM circuit)	2 channels
Other peripheral circuits	16-bit timer/counter: 2 channels 8-bit timer/counter: 4 channels UART: 2 channels SIO: 1 channel 10-bit A/D converter: 16 channels Watchdog timer: 1 channel
I/O ports	71 pins
Package	QFP80 (QFP80-P-1420-0.80M)
Operating voltage (VDD)	4.5 to 5.5 V
Operating temperature (Topr)	-40°C to +85°C
Sample shipment date	September 2008
Volume production	November 2008

* PMD: Programmable Motor Driver

* PWM: Pulse Width Modulation

NEW PRODUCTS

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8-bit microcontroller TLCS-870/X series with 1 Mbyte of address space and a 20 MHz operating core
44-pin flash ROM microcontroller with a built-in inverter motor control circuit (PMD): TMP88F846UG



There is growing demand for high-speed, high-precision control in set development, including motors, in response to moves toward high-performance for energy savings, etc. in home appliances. On the other hand, there is also a growing desire to reduce the increasingly large burden being placed on software.

Toshiba has developed and released the new TMP88F846UG flash ROM microcontroller to provide a solution to these contradictory needs.

This new product integrates into a single package hardware for which there is a particularly large demand, including a three-phase PWM output, rotor position detection function, dedicated motor control timer and capture function, overload protective circuit and automatic commutation/position detection.

A sine wave generation circuit has been added without increasing the load on the software, resulting in an 8-bit microcontroller capable of easily supporting AC inverters.

A sine wave drive system that further improves upon conventional square wave drive systems makes this product ideal for applications in washing machines and ventilation fans installed with brushless DC motors equipped with a sensor, as well as AC inverter products such as air-conditioners, refrigerators and washing machines equipped with three-phase induction motors.

The use of hardware for peripheral functions realizes high-priority interrupt as well as the ability to accommodate programs for which processing was difficult in the past, thereby leading to a greater program processing margin and improved efficiency.

Moreover, the three-phase PWM output uses a sine wave table deploying a 100 ns resolution, 12-bit width output on RAM, enabling high-speed arithmetic processing and sine wave generation.

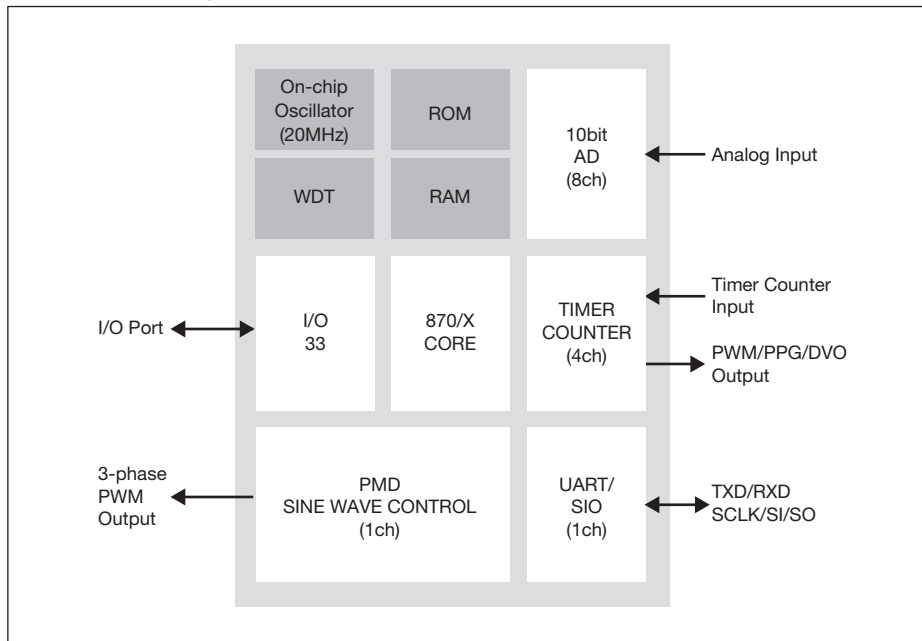
In addition, the use of flash ROM facilitates evaluation by on-board programming, making it possible to shorten development time as well as facilitate inventory management to fulfill short-time delivery.

The TMP88F846UG uses 8 kbytes of flash ROM for small-scale applications and operates only with a 20 MHz on-chip oscillator.

Features

- ① Operating voltage: 4.5 to 5.5 V
- ② ROM size: 8 kbytes, RAM size: 512 bytes
- ③ Minimum instruction execution time: 200 ns: 20 MHz/4.5 to 5.5 V
- ④ Programmable motor driver (PMD): 1 channel
 - * Sine wave drive circuit (built-in sine wave data table RAM)
 - * Rotor position detection function
 - * Motor control timer/capture function
 - * Overload protective function
 - * Automatic commutation, automatic position detection start function
- ⑤ UART/SIO: 1 channel
- ⑥ 8-bit timer: 2 channels
- ⑦ 16-bit timer: 2 channels
- ⑧ 10-bit A/D converter: 8 channels (motor PWM trigger starting)
- ⑨ 20 MHz on-chip oscillator
- ⑩ Power on reset, low-voltage detection circuit
- ⑪ Package: QFP44 10 x 10 mm

System Block Diagram





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