# Toshiba Semiconductor and Storage - TMP86PM29BUG(C,JZ) Datasheet

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## What is "Embedded - Microcontrollers"?

"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

## Applications of "Embedded - Microcontrollers"

| Details | |
|---|---|
| Product Status | Obsolete |
| Core Processor | - |
| Core Size | 8-Bit |
| Speed | 16MHz |
| Connectivity | SIO, UART/USART |
| Peripherals | LCD, PWM, WDT |
| Number of I/O | 39 |
| Program Memory Size | 32KB (32K x 8) |
| Program Memory Type | OTP |
| EEPROM Size | - |
| RAM Size | 1.5K x 8 |
| Voltage - Supply (Vcc/Vdd) | 1.8V ~ 5.5V |
| Data Converters | A/D 8x10b |
| Oscillator Type | External |
| Operating Temperature | -40°C ~ 85°C (TA) |
| Mounting Type | Surface Mount |
| Package / Case | 64-LQFP |
| Supplier Device Package | 64-LQFP (10x10) |
| Purchase URL | https://www.e-xfl.com/product-detail/toshiba-semiconductor-and-storage/tmp86pm29bug-c-jz |

## 13.3 Function

### 13.3.1 Software Start Mode

After setting ADCCR1<AMD> to “01” (software start mode), set ADCCR1<ADRS> to “1”. AD conversion of the voltage at the analog input pin specified by ADCCR1<SAIN> is thereby started.

After completion of the AD conversion, the conversion result is stored in AD converted value registers (ADCDR1, ADCDR2) and at the same time ADCDR2<EOCF> is set to 1, the AD conversion finished interrupt (INTADC) is generated.

ADRS is automatically cleared after AD conversion has started. Do not set ADCCR1<ADRS> newly again (Restart) during AD conversion. Before setting ADRS newly again, check ADCDR2<EOCF> to see that the conversion is completed or wait until the interrupt signal (INTADC) is generated (e.g., interrupt handling routine).

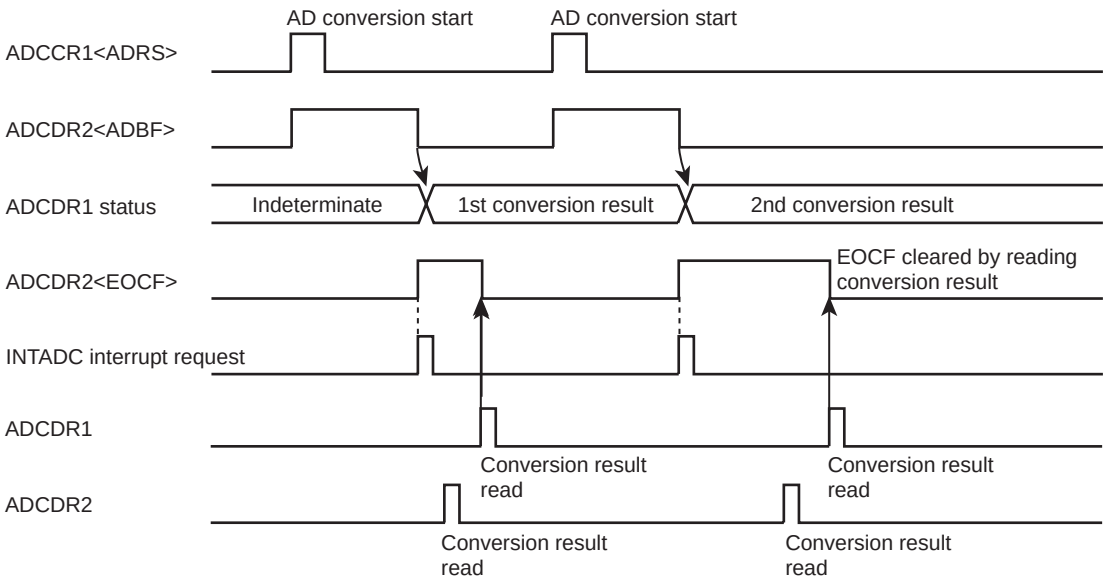



Figure 13-2 Software Start Mode

### 13.3.2 Repeat Mode

AD conversion of the voltage at the analog input pin specified by ADCCR1<SAIN> is performed repeatedly. In this mode, AD conversion is started by setting ADCCR1<ADRS> to “1” after setting ADCCR1<AMD> to “11” (Repeat mode).

After completion of the AD conversion, the conversion result is stored in AD converted value registers (ADCDR1, ADCDR2) and at the same time ADCDR2<EOCF> is set to 1, the AD conversion finished interrupt (INTADC) is generated.

In repeat mode, each time one AD conversion is completed, the next AD conversion is started. To stop AD conversion, set ADCCR1<AMD> to “00” (Disable mode) by writing 0s. The AD convert operation is stopped immediately. The converted value at this time is not stored in the AD converted value register.

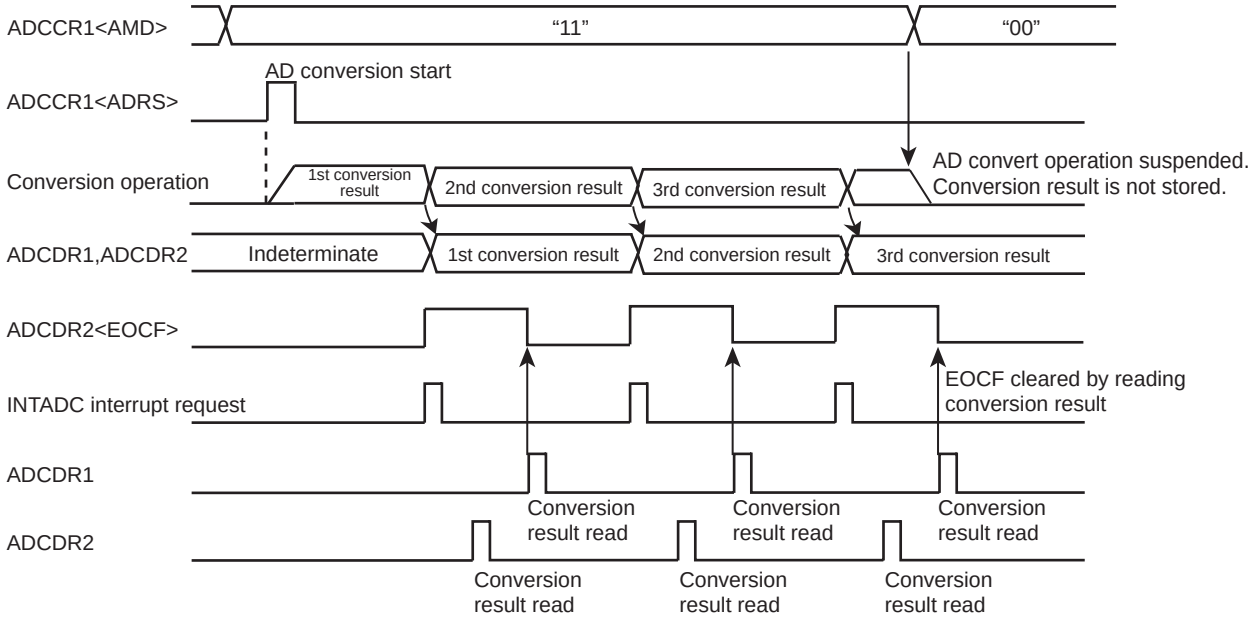



Figure 13-3 Repeat Mode

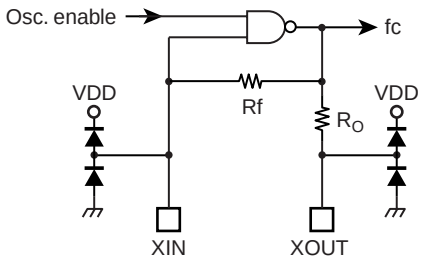
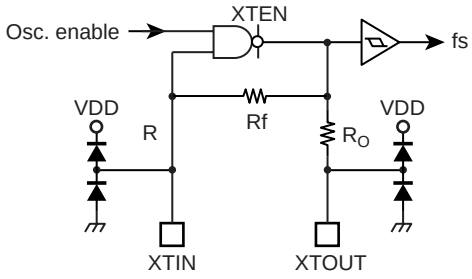
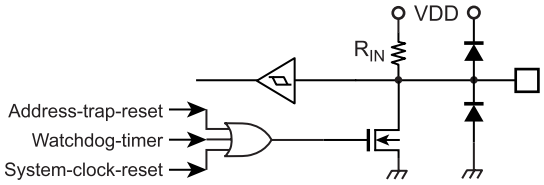
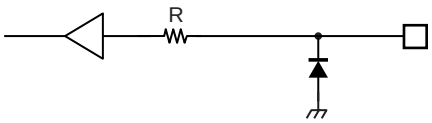
### 13.3.3 Register Setting

1. Set up the AD converter control register 1 (ADCCR1) as follows:
   - Choose the channel to AD convert using AD input channel select (SAIN).
   - Specify analog input enable for analog input control (AINDS).
   - Specify AMD for the AD converter control operation mode (software or repeat mode).
2. Set up the AD converter control register 2 (ADCCR2) as follows:
   - Set the AD conversion time using AD conversion time (ACK). For details on how to set the conversion time, refer to Figure 13-1 and AD converter control register 2.
   - Choose IREFON for DA converter control.
3. After setting up (1) and (2) above, set AD conversion start (ADRS) of AD converter control register 1 (ADCCR1) to "1". If software start mode has been selected, AD conversion starts immediately.
4. After an elapse of the specified AD conversion time, the AD converted value is stored in AD converted value register 1 (ADCDR1) and the AD conversion finished flag (EOCF) of AD converted value register 2 (ADCDR2) is set to "1", upon which time AD conversion interrupt INTADC is generated.
5. EOCF is cleared to "0" by a read of the conversion result. However, if reconverted before a register read, although EOCF is cleared the previous conversion result is retained until the next conversion is completed.

# 17. Input/Ouput Circuitry

## 17.1 Control Pins

The input/output circuitries of the TMP86PM29BUG control pins are shown below.

| Control Pin | I/O | Input/Output Circuitry | Remarks |
|---|---|---|---|
| XIN<br>XOUT | Input<br>Output |  | Resonator connecting pins<br>(High-frequency)<br>$R_f$ = 1.2 MΩ (typ.)<br>$R_O$ = 1 kΩ (typ.) |
| XTIN<br>XTOUT | Input<br>Output |  | Resonator connecting pins<br>(Low-frequency)<br>$R_f$ = 6 MΩ (typ.)<br>$R_O$ = 220 kΩ (typ.) |
| $\overline{\text{RESET}}$ | I/O |  | Sink open drain output<br>Hysteresis input<br>Pull-up resistor<br>$R_{IN}$ = 220 kΩ (typ.) |
| TEST | Input |  | Without pull-down resistor<br>R = 100 Ω (typ.)<br>Fix the TEST pin at low-level in MCU mode |

Note: The TEST pin of the TMP86PM29 does not have a pull-down resistor and protect diode(D1). Fix the TEST pin at low-level in MCU mode.

# 18.6 Timer Counter 1 input (ECIN) Characteristics

($V_{SS}$ = 0 V, Topr = –40 to 85°C)

| Parameter | Symbol | Condition | | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| TC1 input (ECIN input) | $t_{TC1}$ | Frequency measurement mode $V_{DD}$ = 4.5 to 5.5 V | Single edge count | – | – | 16 | MHz |
| | | | Both edge count | – | – | | |
| | | Frequency measurement mode $V_{DD}$ = 2.7 to 4.5 V | Single edge count | – | – | 8 | |
| | | | Both edge count | – | – | | |
| | | Frequency measurement mode $V_{DD}$ = 1.8 to 2.7 V | Single edge count | – | – | 4.2 | |
| | | | Both edge count | – | – | | |