TOSHIBA

32-Bit Microcontrollers

SEMICONDUCTOR & STORAGE PRODUCTS

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Microcontrollers Transform Society.

Arm® Core-Based 32-Bit Microcontrollers

The TX and TXZ families of Arm core microcontrollers realize the desires of customers and seek to provide solutions in various fields through our proprietary high-precision analog circuitry with low-power-consumption digital logic.
By thinking together with customers, Toshiba seeks to continually create a more convenient and comfortable society through microcontrollers.

Creating Microcontroller Solutions with our Customers

TX and TXZ™ Family

| Arm Cortex-M0 | Arm Cortex-M3 | Arm Cortex-M4 processor with FPU |

Contents

Note
・System block diagrams in this brochure only show the typical application examples.
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Product Lineups of the TX and TXZ Families

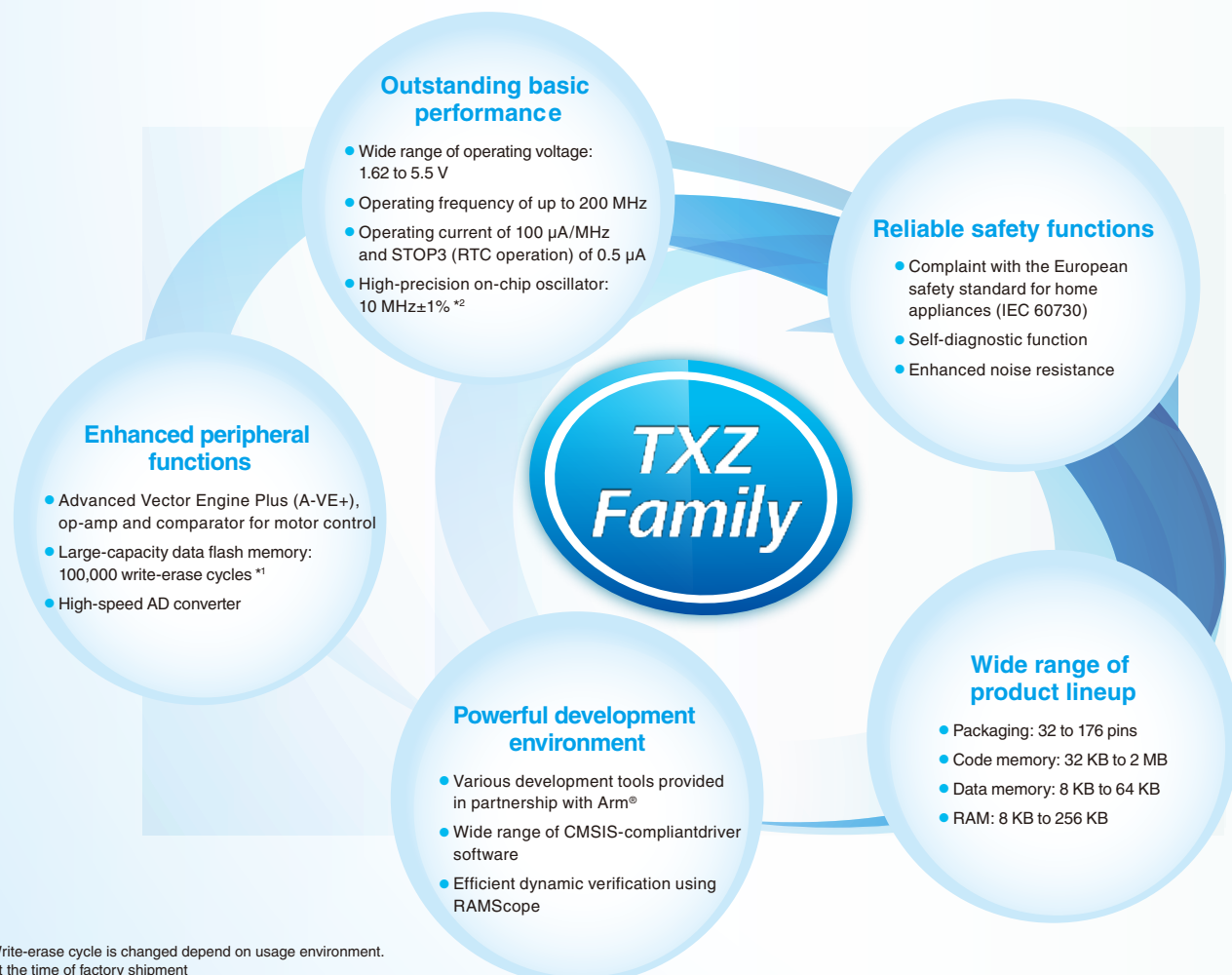The TX and TXZ families consist of microcontrollers with an Arm Cortex®-M core. These families feature high energy efficiency and are suitable for real-time control applications.
The TXZ family, a new variant of the TX family, provides an enhanced suite of IP cores and flash memories. The TXZ family also features high-precision analog circuitry, higher speed and lower power consumption.
The TX and TXZ families consist of several series named after the integrated Arm core, which are further subdivided into many groups according to their target applications.

TX Family

TX00 Series
Cortex-M0
- M030 Group
- M060 Group

TX03 Series
Cortex-M3
- M310 Group
- M330 Group
- M350 Group
- M370 Group
- M340 Group
- M360 Group
- M380 Group

TX04 Series
Cortex-M4 (with FPU)
- M440 Group
- M460 Group
- M470 Group

TXZ Family

TXZ0 Series
Cortex-M0

TXZ3 Series
Cortex-M3
Standard ● General-purpose consumer electronics (M3H Group)
- M3H Group (1)
- M3H Group (2)

TXZ4 Series
Cortex-M4 (with FPU)
Vector engine ● Motor/inverter controllers and industrial engines (M4K Group)
Connectivity ● Office equipment, digital appliances, and industrial equipment
- M4G Group (1)
- M4K Group (1)
- M4K Group (2)
- M4L Group (1)

Features of the TXZ Family

TXZ Family

Outstanding basic performance
- Wide range of operating voltage: 1.62 to 5.5 V
- Operating frequency of up to 200 MHz
- Operating current of 100 µA/MHz and STOP3 (RTC operation) of 0.5 µA
- High-precision on-chip oscillator: 10 MHz±1% [*2]

Reliable safety functions
- Complaint with the European safety standard for home appliances (IEC 60730)
- Self-diagnostic function
- Enhanced noise resistance

Enhanced peripheral functions
- Advanced Vector Engine Plus (A-VE+), op-amp and comparator for motor control
- Large-capacity data flash memory: 100,000 write-erase cycles [*1]
- High-speed AD converter

Powerful development environment
- Various development tools provided in partnership with Arm®
- Wide range of CMSIS-compliantdriver software
- Efficient dynamic verification using RAMScope

Wide range of product lineup
- Packaging: 32 to 176 pins
- Code memory: 32 KB to 2 MB
- Data memory: 8 KB to 64 KB
- RAM: 8 KB to 256 KB

(*1) Write-erase cycle is changed depend on usage environment.
(*2) At the time of factory shipment

# ● Microcontrollers for Motor Applications ●

Vector engine for high-efficiency motor control and extensive peripheral functions suitable for various applications

Features

- High-speed Arm Cortex®-M3 or Cortex®-M4 (with FPU)
- Peripheral functions suitable for motor control
  AD converter, programmable motor driver, vector engine, and encoder
- Dynamic RAM analysis
  Supports RAMScope and EVRICA.
- 5-V operation suitable for motor control

Applications

- Air conditioners
- Washing machine
- Refrigerators
- Ventilation fan
- Electric driver
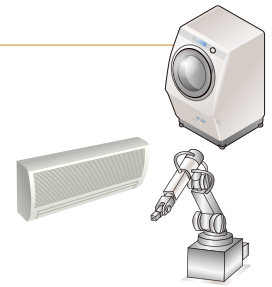
● Product Lineup

Color legend: TX03 Series/M370 Group | TX04 Series/M470 Group | TXZ4 Series/M4K Group(1)(2),M4L Group(1) | **: Under development

ROM Size (Flash)	30 pins	32 pins	44 pins	48 pins	64 pins	80 pins	100 pins	128 pins	144 pins
512 KB					TMPM4KLFDFG** TMPM4KLFDUG**	TMPM4KMFDDFG** TMPM4KMFDFG**	TMPM4KNFDDFG** TMPM4KNFDFG** TMPM470FDFG TMPM475FDFG TMPM376FDDFG TMPM376FDFG	TMPM4KPFDDFG**	TMPM4KQFDFG**
384 KB							TMPM470FZFG TMPM475FZFG		
256 KB			TMPM4K1FYAUG	TMPM4K2FYADUG	TMPM4KLFYFG** TMPM4KLFYUG** TMPM4K4FYAUG TMPM4K4FYAFG	TMPM4KMFYDFG** TMPM4KMFYFG**	TMPM4KNFYDFG** TMPM4KNFYFG** TMPM470FYFG TMPM475FYFG TMPM370FYDFG TMPM370FYFG	TMPM4KPFYDFG**	TMPM4KQFYFG**
128 KB			TMPM4K1FWAUG TMPM4L1FWUG TMPM374FWUG	TMPM4K2FWADUG TMPM4L2FWDUG TMPM373FWDUG	TMPM4KLFWFG** TMPM4KLFWUG** TMPM4K4FWAUG TMPM4K4FWAFG TMPM372FWUG	TMPM4KMFWDFG** TMPM4KMFWFG**	TMPM4KNFWDFG** TMPM4KNFWFG**	TMPM4KPFWDFG**	TMPM4KQFWFG**
96 KB			TMPM4K1FUAUG	TMPM4K2FUADUG	TMPM4K4FUAUG TMPM4K4FUAFG				
64 KB	TMPM375FSDMG	TMPM4K0FSADUG TMPM37AFSQG	TMPM4K1FSAUG	TMPM4K2FSADUG	TMPM4K4FSAUG TMPM4K4FSAFG				
									Pin Count

● Evaluation Kit

ESP Starter Kit for TMPM37A

- Included hardware:
  TMPM37A evaluation board
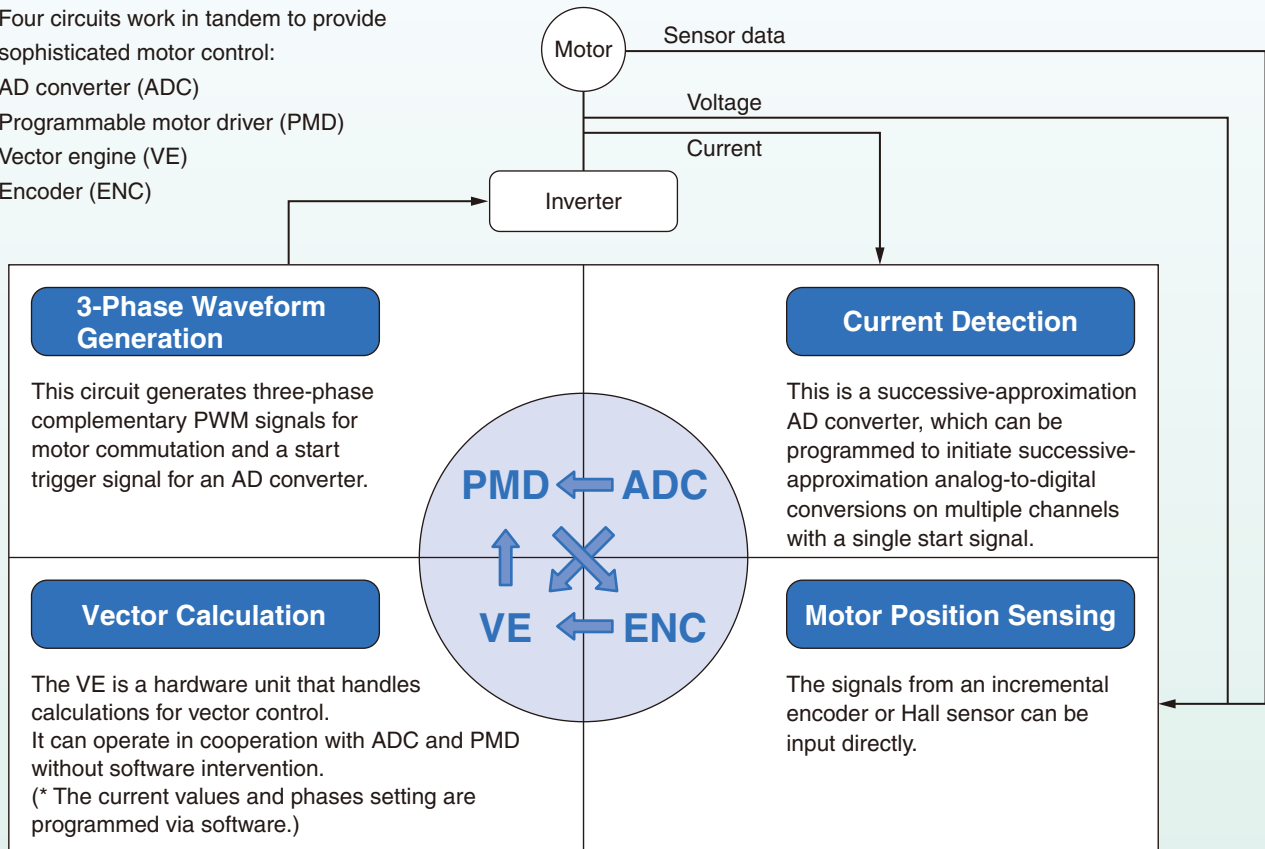 Brushless DC motors

ESP Starter Kit for TMPM475

- Included hardware:
  TMPM475 evaluation board
  Brushless DC motors

Motor Control Functions

- Four circuits work in tandem to provide sophisticated motor control:
  AD converter (ADC)
  Programmable motor driver (PMD)
  Vector engine (VE)
  Encoder (ENC)

Motor — Sensor data

Voltage

Current

Inverter

3-Phase Waveform Generation

This circuit generates three-phase complementary PWM signals for motor commutation and a start trigger signal for an AD converter.

PMD ← ADC

VE ← ENC

Current Detection

This is a successive-approximation AD converter, which can be programmed to initiate successive-approximation analog-to-digital conversions on multiple channels with a single start signal.

Vector Calculation

The VE is a hardware unit that handles calculations for vector control.
It can operate in cooperation with ADC and PMD without software intervention.
(* The current values and phases setting are programmed via software.)

Motor Position Sensing

The signals from an incremental encoder or Hall sensor can be input directly.

The arrows denote communication paths between IP cores.

Debugging

The M4K series provides an interface for a tool such as RAMScope that allows real-time debugging during motor operation.
This makes it possible to perform a dynamic analysis necessary to debug motor control programs.

Point — **Debugging and tuning during motor operation**

- Makes it easy to debug and tune the MCU control software while a motor is running

Point — **No dedicated software**

- Eliminates the need for memory-resident software for monitoring and therefore a workload for the design of a control program

MCU
RAM

PC

Microcontrollers that support RAMScope and EVRICA

	M4K0	M4K1	M4K2	M4K4	M4KL	M4KM	M4KN	M4KP	M4KQ
RAMScope	–	–	–	Y	Y	Y	Y	Y	Y
EVRICA	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: This table includes microcontrollers being planned and developed and is therefore subject to change without notice.
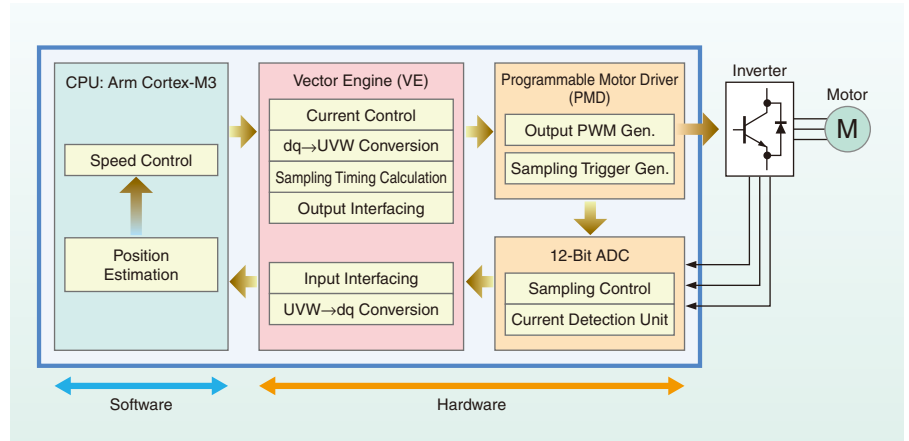Note: RAMScope is a product from DTS INSIGHT Corporation.
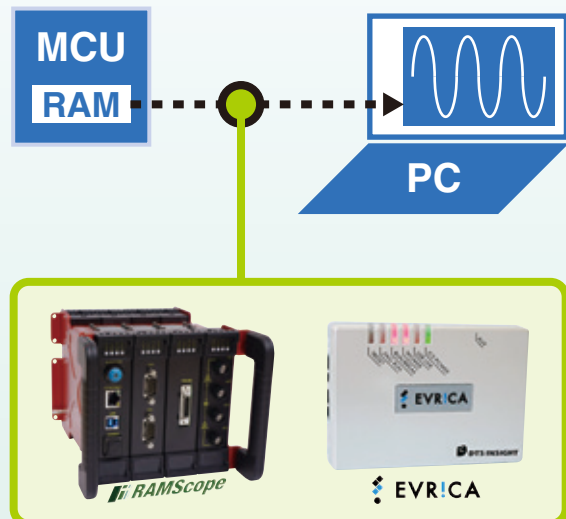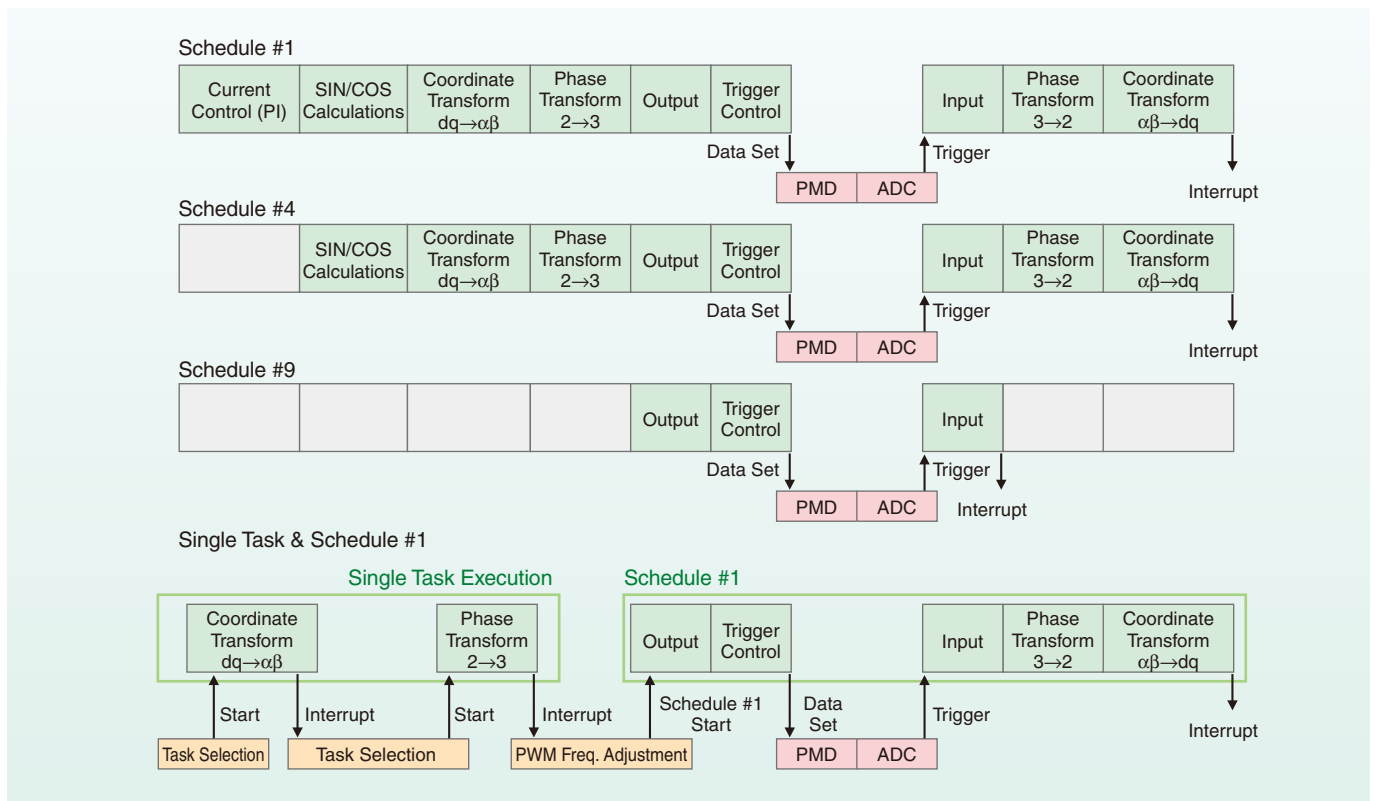
Features of the Vector Engine (VE)

High-efficiency motor control, reducing the CPU workload

The vector engine is a dedicated hardware unit designed to perform various operations for motor vector control. Since the vector engine has the capability for performing basic vector control operations (such as coordinate transformations, phase transformations and sine/cosine calculations), a PI algorithm for current control, and PMD and high-speed ADC interface operations, it helps to reduce the software workload significantly.

CPU: Arm Cortex-M3	Vector Engine (VE)	Programmable Motor Driver (PMD)	Inverter / Motor
Speed Control	Current Control / dq→UVW Conversion / Sampling Timing Calculation / Output Interfacing	Output PWM Gen. / Sampling Trigger Gen.	M
Position Estimation	Input Interfacing / UVW→dq Conversion	12-Bit ADC / Sampling Control / Current Detection Unit	

Software — Hardware

Highly flexible hardware

Since the requirements for speed control and position estimation differ greatly among individual applications and users, they can be implemented via software. The vector engine provides great flexibility in allowing you to create various schedules that define a combined sequence of VE and user's software operations to perform. The vector engine supports two operating modes: Scheduled mode that executes a series of operations consecutively and Single Task mode that executes individual tasks one by one. Schedules can select a task that causes the vector engine to start execution.

Schedule #1

| Current Control (PI) | SIN/COS Calculations | Coordinate Transform dq→αβ | Phase Transform 2→3 | Output | Trigger Control | | Input | Phase Transform 3→2 | Coordinate Transform αβ→dq |

Data Set → PMD | ADC ← Trigger → Interrupt

Schedule #4

| | SIN/COS Calculations | Coordinate Transform dq→αβ | Phase Transform 2→3 | Output | Trigger Control | | Input | Phase Transform 3→2 | Coordinate Transform αβ→dq |

Data Set → PMD | ADC ← Trigger → Interrupt

Schedule #9

| | | | | Output | Trigger Control | | Input | | |

Data Set → PMD | ADC ← Trigger → Interrupt

Single Task & Schedule #1

Single Task Execution

| Coordinate Transform dq→αβ | | Phase Transform 2→3 |

↑ Start | ↑ Interrupt | ↑ Start | ↑ Interrupt

Task Selection | Task Selection | PWM Freq. Adjustment

Schedule #1

| Output | Trigger Control | | Input | Phase Transform 3→2 | Coordinate Transform αβ→dq |

Schedule #1 Start | Data Set → PMD | ADC ← Trigger → Interrupt

System Block Diagram (Air Conditioners)
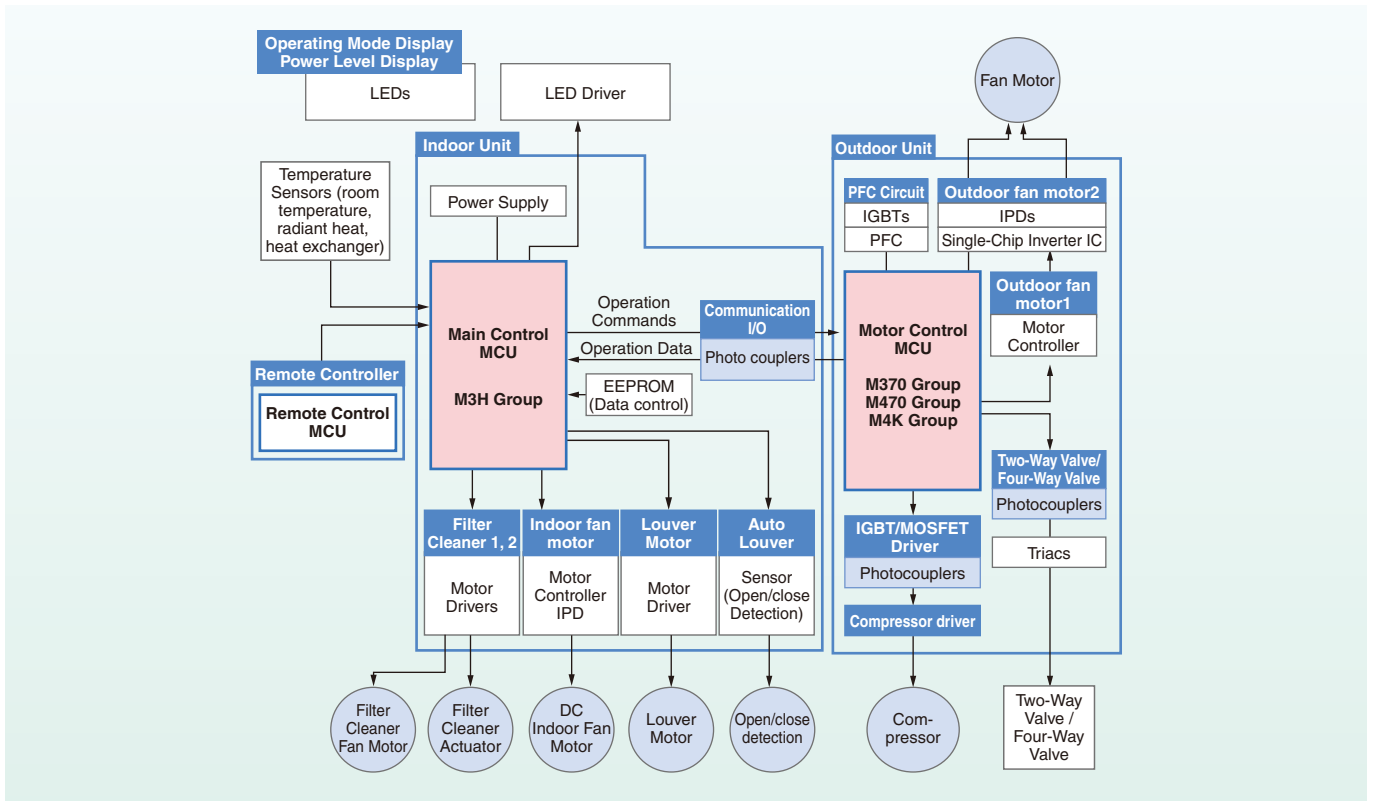
System Block Diagram (Washing Machine)
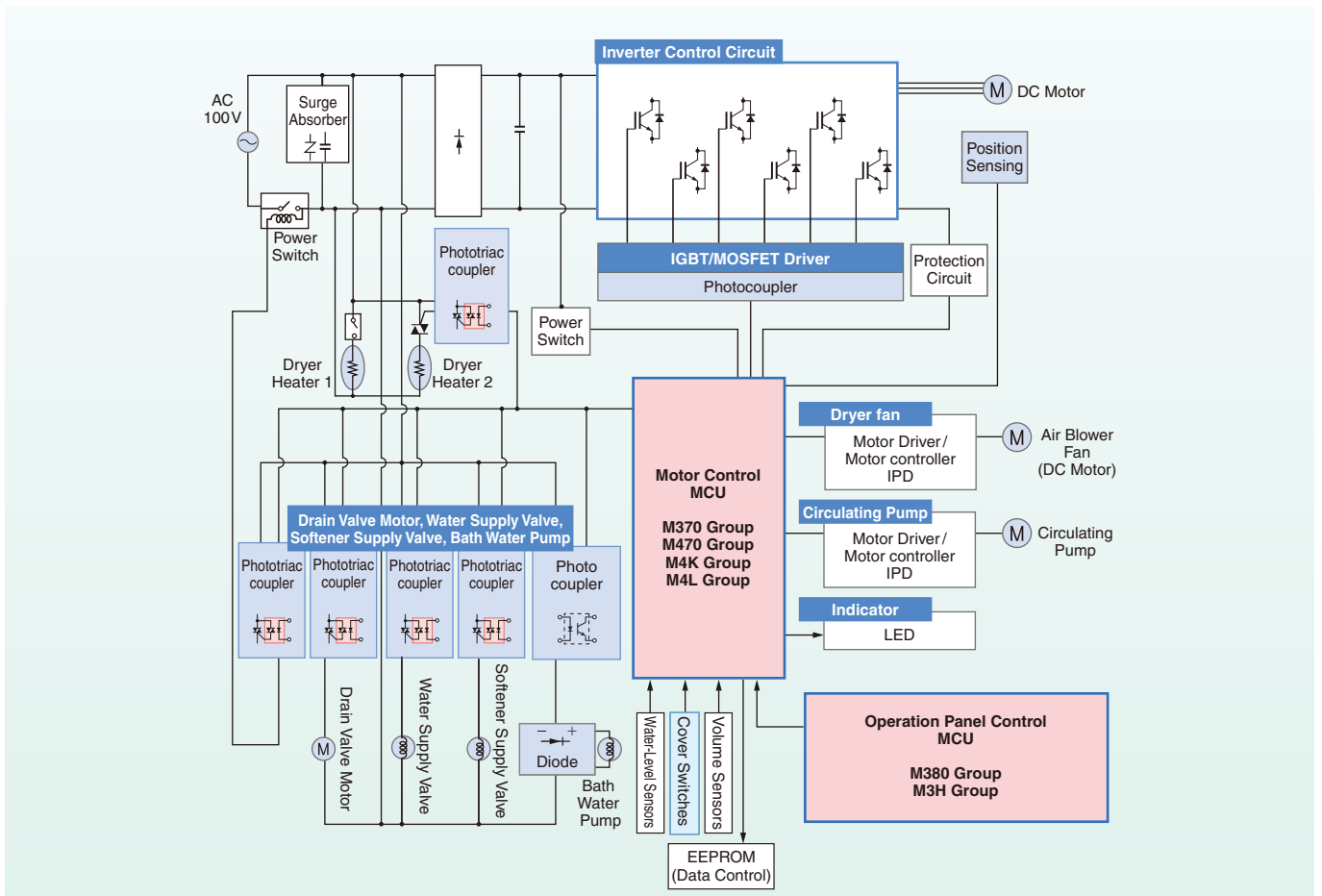
● General-Purpose Microcontrollers for Home Appliance Applications ●

Extensive memory and packaging options to support a wide range of home-appliance and industrial applications
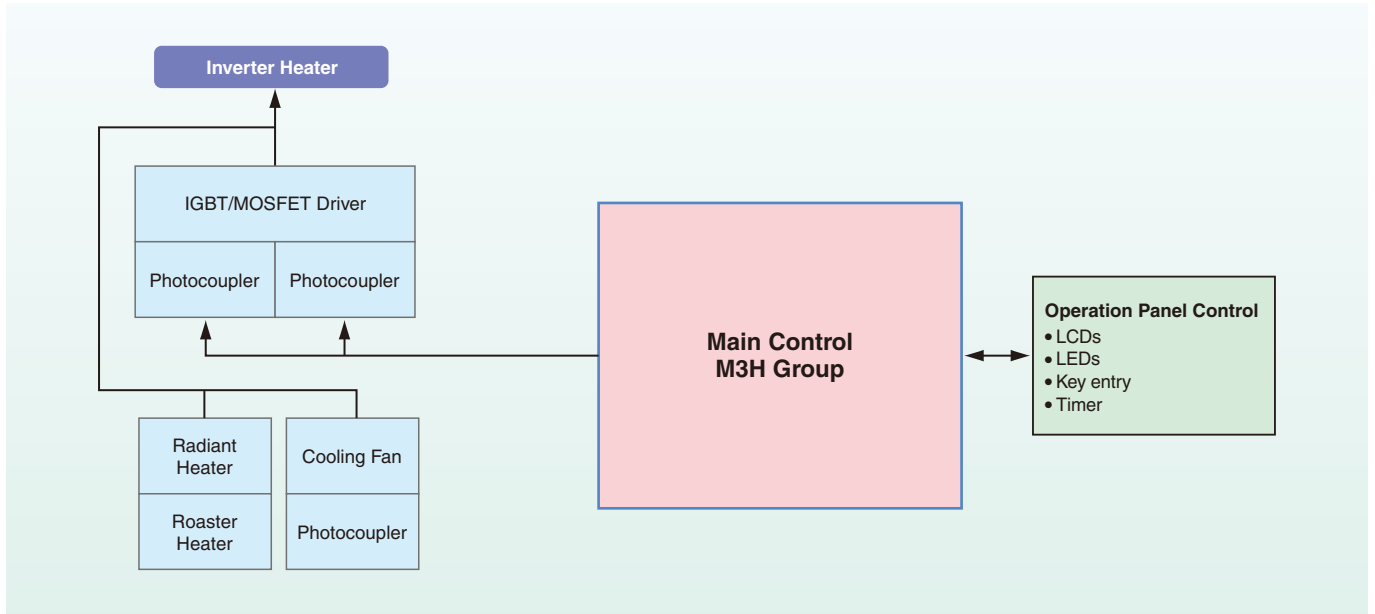
● Features

- 5-V single power supply
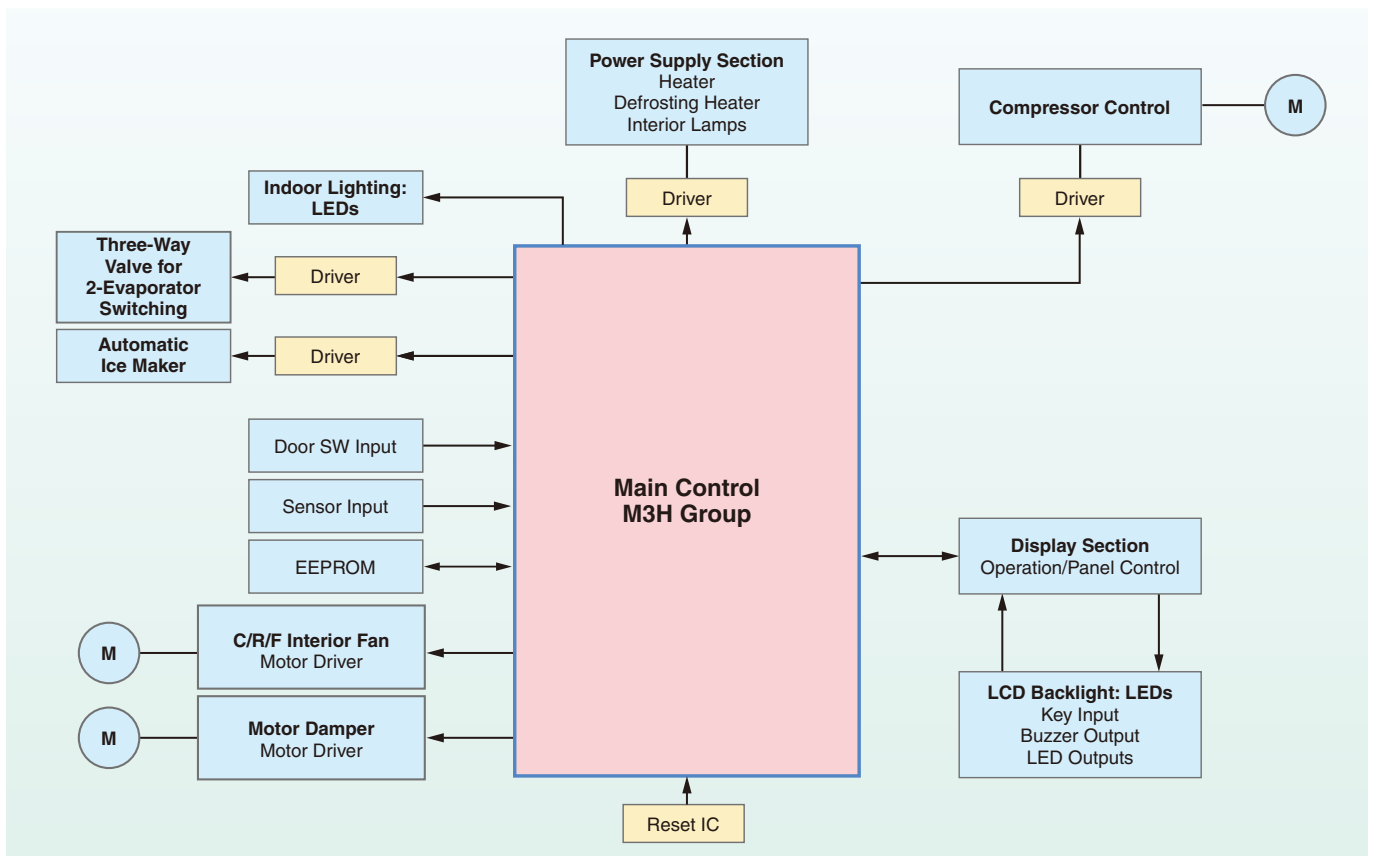- Integrated data flash memory

● Applications

- Induction cooktops
- Water heaters
- Microwave ovens
- Toilet seats with integrated bidet
- Refrigerators

● System Block Diagram (Induction Cooktops)

- Inverter Heater
- IGBT/MOSFET Driver
- Photocoupler | Photocoupler
- Radiant Heater
- Roaster Heater
- Cooling Fan
- Photocoupler
- Main Control M3H Group
- Operation Panel Control
  - LCDs
  - LEDs
  - Key entry
  - Timer

● System Block Diagram (Refrigerators)

- Power Supply Section
  - Heater
  - Defrosting Heater
  - Interior Lamps
- Compressor Control — M
- Driver
- Indoor Lighting: LEDs
- Three-Way Valve for 2-Evaporator Switching
- Driver
- Automatic Ice Maker
- Driver
- Door SW Input
- Sensor Input
- EEPROM
- Main Control M3H Group
- C/R/F Interior Fan Motor Driver — M
- Motor Damper Motor Driver — M
- Display Section Operation/Panel Control
- LCD Backlight: LEDs
  - Key Input
  - Buzzer Output
  - LED Outputs
- Reset IC

Key points

Extensive lineup of standard microcontrollers featuring low power consumption and high functionality.
The microcontrollers shown below incorporate AD converters, DA converters, UART, timers, I²C, SPI/SIO and motor controllers, making them suitable for a wide range of commercial and industrial applications.

● **Product Lineup**

ROM Size (Flash)	32 pins	44 pins	48 pins	52 pins	64 pins	80 pins	100 pins	128 pins	144 pins
512 KB					TMPM3LFDUG	TMPM3HMFDFG	TMPM3HNFDFG TMPM3HNFDDFG TMPM380FDFG	TMPM3HPFDFG	TMPM3HQFDFG TMPM384FDFG
384 KB					TMPM3LFZUG	TMPM3HMFZFG	TMPM3HNFZFG TMPM3HNFZDFG	TMPM3HPFZFG	TMPM3HQFZFG
256 KB					TMPM3LFYUG	TMPM3HMFYFG	TMPM3HNFYFG TMPM3HNFYDFG TMPM380FYFG TMPM380FYDFG	TMPM3HPFYFG	TMPM3HQFYFG
128 KB		TMPM3H1FWUG**	TMPM3H2FWDUG TMPM3H2FWQG	TMPM3H3FWUG**	TMPM3H4FWUG TMPM3H4FWFG** TMPM383FWUG TMPM383FWEFG	TMPM3H5FWFG TMPM3H5FWDFG	TMPM3H6FWFG TMPM3H6FWDFG TMPM380FWFG TMPM380FWDFG TMPM381FWFG TMPM381FWDFG		
96 KB		TMPM3H1FUUG**	TMPM3H2FUDUG TMPM3H2FUQG	TMPM3H3FUUG**	TMPM3H4FUUG TMPM3H4FUFG**	TMPM3H5FUFG TMPM3H5FUDFG	TMPM3H6FUFG TMPM3H6FUDFG		
64 KB	TMPM3H0FSDUG**	TMPM3H1FSUG**	TMPM3H2FSDUG TMPM3H2FSQG	TMPM3H3FSUG**	TMPM3H4FSUG TMPM3H4FSFG** TMPM383FSUG TMPM383FSEFG	TMPM3H5FSFG TMPM3H5FSDFG	TMPM3H6FSFG TMPM3H6FSDFG		
48 KB		TMPM3H1FPUG**							
32 KB	TMPM3H0FMDUG**								

TX03 Series/M380 Group　　TXZ3 Series/M3H Group (1)(2)　　**: Under development

Pin Count

● **Evaluation Kit**

**Chip One Stop, Inc. Online Shop
Starter Kit for TMPM3HQ**

● Included hardware:
TMPM3HQ evaluation board
USB cable

**Chip One Stop, Inc. Online Shop
Starter Kit for TMPM3H6**

● Included hardware:
TMPM3H6 evaluation board
USB cable

● Microcontrollers for Video Equipment Applications ●

Incorporating a dedicated HDMI-CEC circuit and a remote control preprocessor to reduce system power consumption
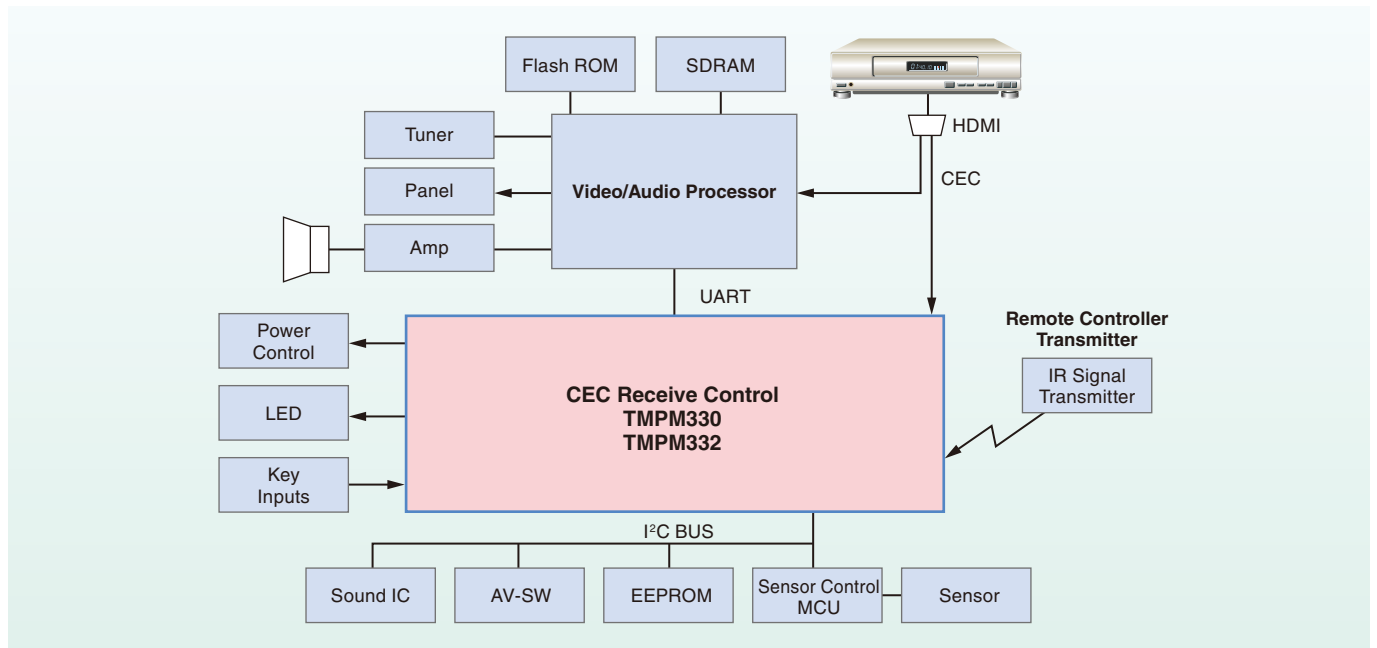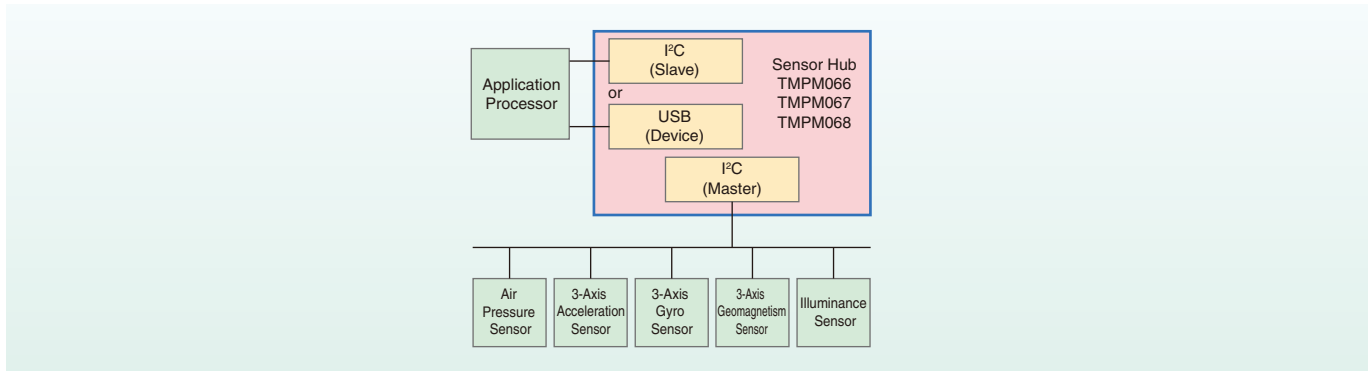
Features

- High efficiency operation
- Integrated dedicated HDMI 1.3a (CEC) circuit (TMPM330/TMPM332)
- Remote control preprocessor essential for digital applications (TMPM330/TMPM332)

Applications

- Televisions
- Printers
- Base stations

● System Block Diagram (Digital TV)

● Product Lineup

ROM Size (Flash)			TX00 Series/M030 Group	TX03 Series/M330 Group
512 KB		TMPM333FDFG	TMPM330FDFG	TMPM330FDWFG
256 KB		TMPM333FYFG	TMPM330FYWFG	TMPM330FYFG
128 KB	TMPM332FWUG	TMPM330FWFG	TMPM333FWFG	
	TMPM037FWUG	TMPM036FWFG		
Pin Count	64 pins	100 pins		

● Evaluation Kit

Chip One Stop, Inc. Online Shop Starter Kit for TMPM036

- Included hardware:
  TMPM036 evaluation board
  USB cable

Chip One Stop, Inc. Online Shop Starter Kit for TMPM037

- Included hardware:
  TMPM037 evaluation board
  USB cable

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● Microcontrollers for Sensor Control Applications ●

Incorporating a high-performance calibration function through proprietary sensor fusion

Features

- Incorporates functions that enable a multi-connection hub
  USB, USB Embedded Host, CAN and EtherMAC
- Multi-purpose timer

Applications

- Printers
- Smartphones and tablets
- VR head-mounted displays

● System Block Diagram (Sensor Hub)

Key points

In addition to USB (Full-Speed), the microcontrollers shown below incorporate various serial interfaces such as SPI[*1] and I^{2}C[*2] (supporting Fast-Mode Plus[*3]). These microcontrollers can be used as a sensor hub that controls multiple sensors.

*1: SPI: Serial Peripheral Interface
*2: I^{2}C: Inter-Integrated Circuit
*3: Fast-mode Plus

● Product Lineup

ROM Size (Flash)					TX00 Series/M060 Group		TX03 Series/M360 Group	
512 KB				TMPM368FDFG TMPM367FDFG		TMPM368FDXBG TMPM367FDXBG	TMPM369FDFG	TMPM369FDXBG
256 KB					TMPM365FYXBG			
128 KB	TMPM067FWQG	TMPM068FWXBG	TMPM066FWUG					
	48 pins	57 pins	64 pins	100 pins	105 pins	109 pins	144 pins	177 pins Pin Count

● Evaluation Kit

Chip One Stop, Inc. Online Shop Starter Kit for TMPM066

- Included hardware:
  TMPM036 evaluation board
  USB cable
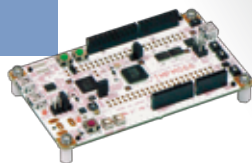
● Microcontrollers for Digital, Factory, and Office Equipment Applications ●

High-speed CPU to obtain the best performance from extensive serial interfaces and three DMAC units for efficient data transfers

Features

- Supports various communication interfaces
- Embedded high-capacity flash memory
- Integrated dedicated HDMI 1.3a (CEC) circuit
- External bus interface that can be connected to SoCs and external extended memory
- CEC interface and remote control signal preprocessor that remain active even in Low power consumption mode

Applications

- Printers
- Copiers
- Air conditioners
- Audio systems
- Wireless equipment
- Barcode readers

● System Block Diagram (AV Amplifier)
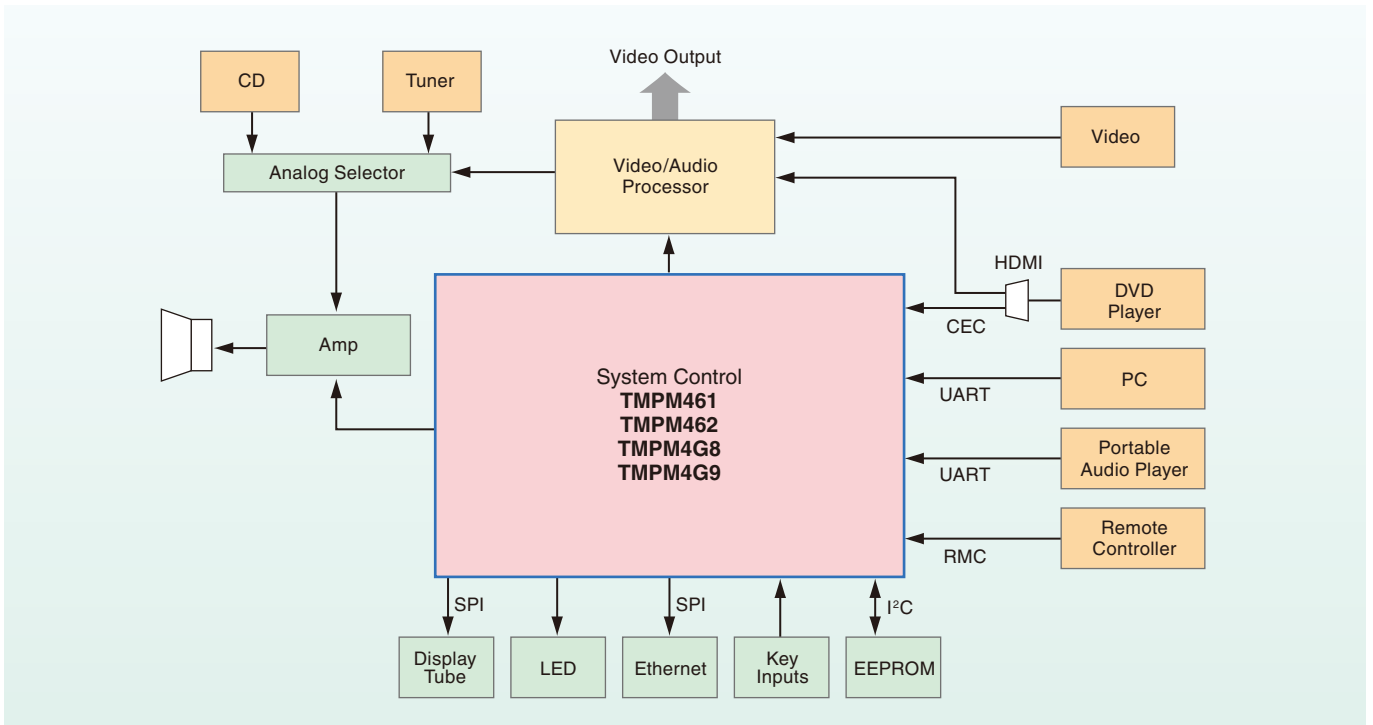
● System Block Diagram (Printer)
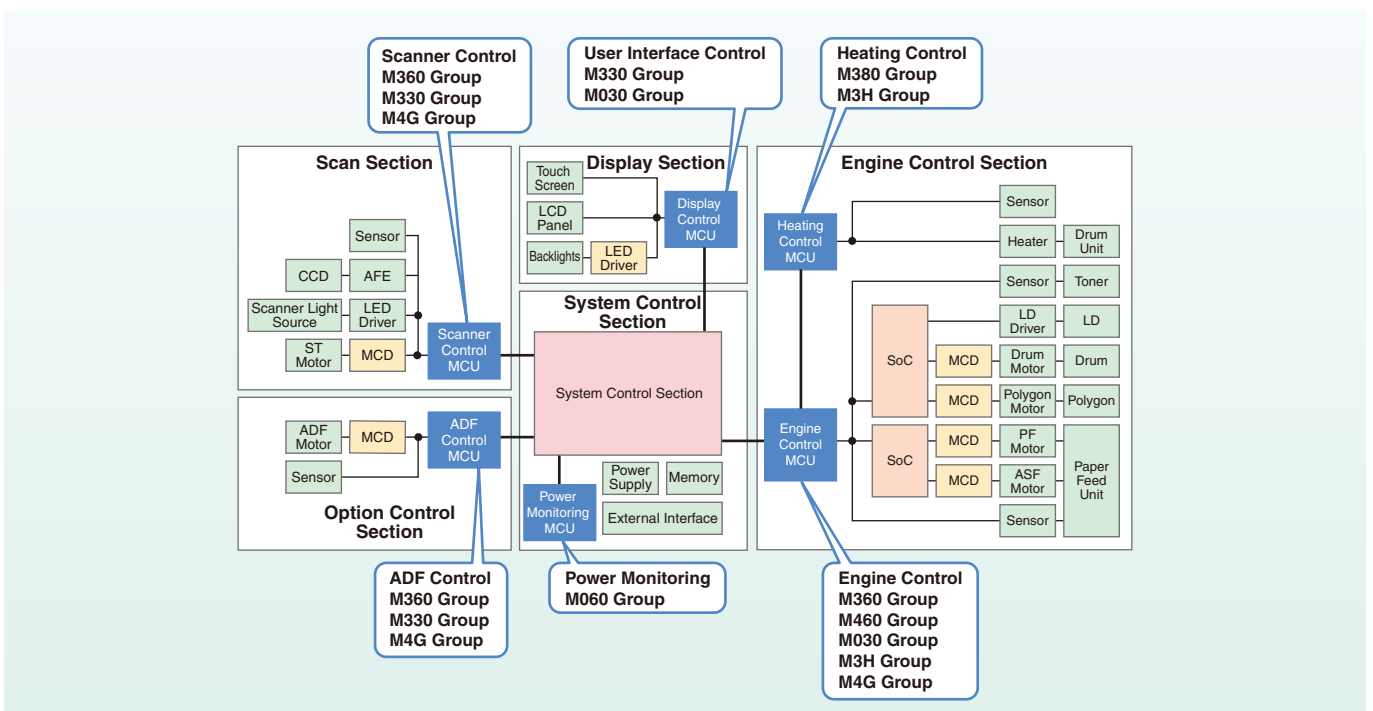
● Product Lineup

ROM Size (Flash)	TX03 Series/M360 Group			TX04 Series/M460 Group	TXZ4 Series/M4G Group (1)		
1.5 MB				TMPM4G8F15FG** / TMPM461F15FG	TMPM4G8F15XBG**	TMPM4G9F15FG / TMPM462F15FG	TMPM4G9F15XBG**
1 MB	TMPM4G6F10FG / TMPM46BF10FG / TMPM36BF10FG		TMPM4G7F10FG**	TMPM4G8F10FG / TMPM461F10FG	TMPM4G8F10XBG**	TMPM4G9F10FG / TMPM462F10FG	TMPM4G9F10XBG**
768 KB	TMPM4G6FEFG		TMPM4G7FEFG**	TMPM4G8FEFG	TMPM4G8FEXBG**	TMPM4G9FEFG	TMPM4G9FEXBG**
512 KB	TMPM4G6FDFG / TMPM368FDFG / TMPM367FDFG	TMPM368FDXBG / TMPM367FDXBG	TMPM4G7FDFG**	TMPM4G8FDFG / TMPM369FDFG	TMPM4G8FDXBG**	TMPM4G9FDFG	TMPM4G9FDXBG** / TMPM369FDXBG
256 KB	TMPM36BFYFG	TMPM365FYXBG					
	100 pins	105/109 pins	128 pins	144 pins	145 pins	176 pins	177 pins

**: Under development

Pin Count

Key points

The TMPM462 and TMPM4G9 incorporate up to 20 and 22 channels of serial interfaces, respectively.
To obtain the best performance from many serial interfaces, these microcontrollers efficiently handle various modes of communication using three DMAC units at a maximum CPU operating frequency of 120 and 160 MHz, respectively.

● Evaluation Kit

Chip One Stop, Inc. Online Shop Starter Kit for TMPM46B

● Included hardware:
  TMPM46B evaluation board
  USB cable
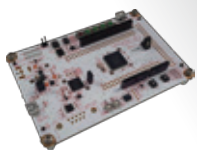
# ● Microcontrollers for Camera Control Applications ●

Small packages with a high-resolution PPG output suitable for high-precision analog-controlled equipment

Features

- Up to 4 programmable servo/sequence controller (PSC) units
  (Suitable for servo computation, motor control and communication
  sequencing for camera shake compensation)
- High-resolution PPG for ultrasound control
- Various timers and serial interfaces

Applications

- Surveillance cameras
- Camera lens
- Digital video cameras
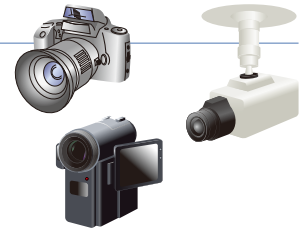
● System Block Diagram (Camera Lens)

* The **TMPM343** contains four PSC units.
The **TMPM342** contains one PSC unit.
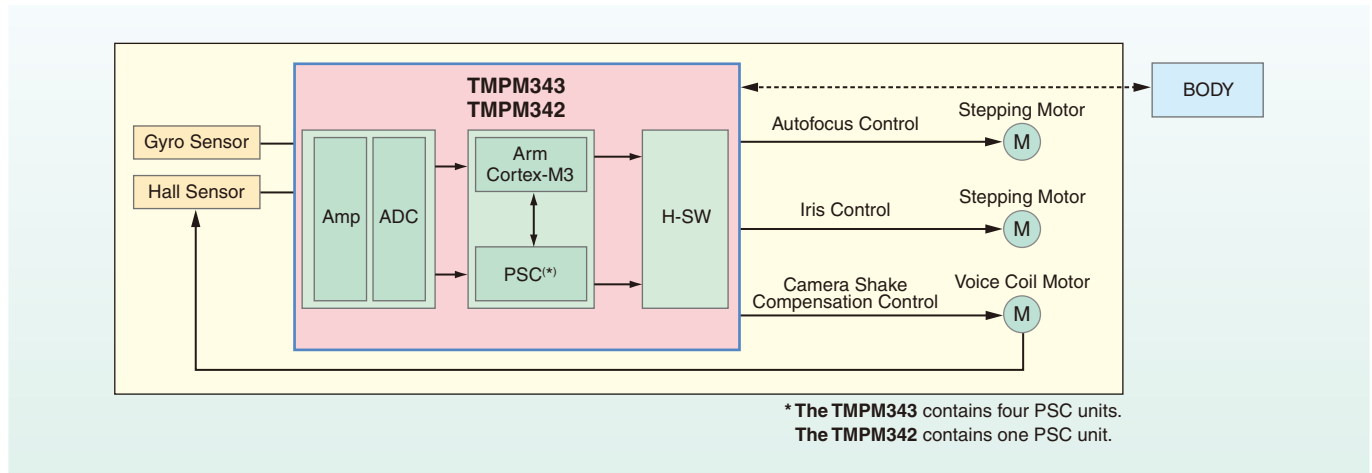
Key points

Programmable Servo/Sequence Controllers (PSCs) makes it possible to reduce the operating frequency.

● Product Lineup

ROM Size (Flash)		TX03 Series/M340 Group	TX04 Series/M440 Group
1024 KB		TMPM343F10XBG	TMPM440F10XBG
768 KB			TMPM440FEXBG
512 KB		TMPM343FDXBG	
256 KB	TMPM342FYXBG		
	142 pins	162 pins	289 pins Pin Count

● Evaluation Kit

IAR Systems Starter Kit for TMPM440

- Included hardware:
  TMPM440 evaluation board
  IAR i-Jet Lite
  USB cable
  IAR Embedded Workbench for
  ARM KickStart edition

● Microcontrollers for HEMS and Electricity Meter Applications ●

24-bit sigma-delta AD converter and Toshiba's unique power calculation engine to achieve accurate electricity measurement
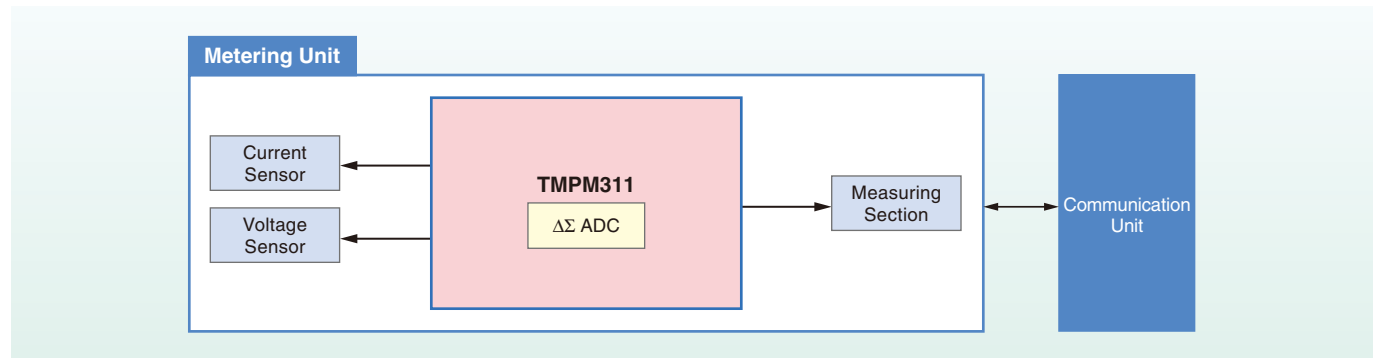
Features

● Power calculation engine (TMPM061)
● Temperature sensor (TMPM311)

Applications

● Smart meters
● Healthcare

● System Block Diagram (Smart meters: Metering Unit)

Key points

The microcontrollers shown below combine a 24-bit sigma-delta AD converter and Toshiba's unique power calculation engine (PCE) to achieve accurate power measurement.
These microcontrollers are suitable for smart meter and other HEMS applications as well as office equipment applications requiring power measurement.

● Product Lineup

ROM Size (Flash)	TX00 Series/M060 Group	TX03 Series/M310 Group
128 KB		TMPM061FWFG
ROM less	TMPM311CHDUG	
	48 pins	100 pins Pin Count

● Microcontrollers for Automotive Control Applications ●

Compliant with ISO 26262, a functional safety standard suitable for motor and battery monitoring and other control applications

● Product Lineup

Part Number	ROM (Flash) Size	RAM Size	Package	Features
TMPM351F10TFG	1 MB	64 KB	LQFP100 (14 x 14 mm)	Arm Cortex-M3 plus Toshiba-original Advanced Programmable Motor Driver (A-PMD) 2-channel CAN controller and 2 units of AD Converter Functional safety: Optimized tightly coupled fault supervisors 144-MHz operation (max), and high temperature operation (Ta: up to 105˚C max) The CAN controllers and the blocks that implement functional safety contain logic specifically designed for automotive applications, making the TMPM351F10TFG suitable for motor applications in safety-related systems such as electronic power steering (EPS).
TMPM354F10TAFG	1 MB	64 KB	HQFP144 (20 x 20 mm)	Arm Cortex-M3 plus Toshiba-original Advanced Programmable Motor Driver (A-PMD) 3-channel CAN controller and 4 units of AD Converter Vector engine Functional safety: Optimized tightly coupled fault supervisors Reduced part count and improved noise immunity due to Toshiba-original RDC 96-MHz operation (max), and high temperature operation (Ta: up to 125˚C max) Ideal for motor control applications in HEVs and EVs owing to enhanced motor controllers, angle sensor computation, in-vehicle networking, etc.
TMPM358FDTFG	512 KB	80 KB	LQFP100 (14 x 14 mm)	A sleep mode is provided in Arm Cortex-M3 allowing RAM backup (16 KB) 3-channel CAN controller and 2 units of AD Converter, 80-KB RAM including a backup RAM for 16 KB Functional safety: Optimized tightly coupled fault supervisors 40-MHz operation (max), and high temperature operation (Ta: up to 105˚C max) The CAN controllers and the blocks that implement functional safety contain logic specifically designed for automotive applications, making the TMPM358FDTFG suitable for control applications such as battery power monitoring.

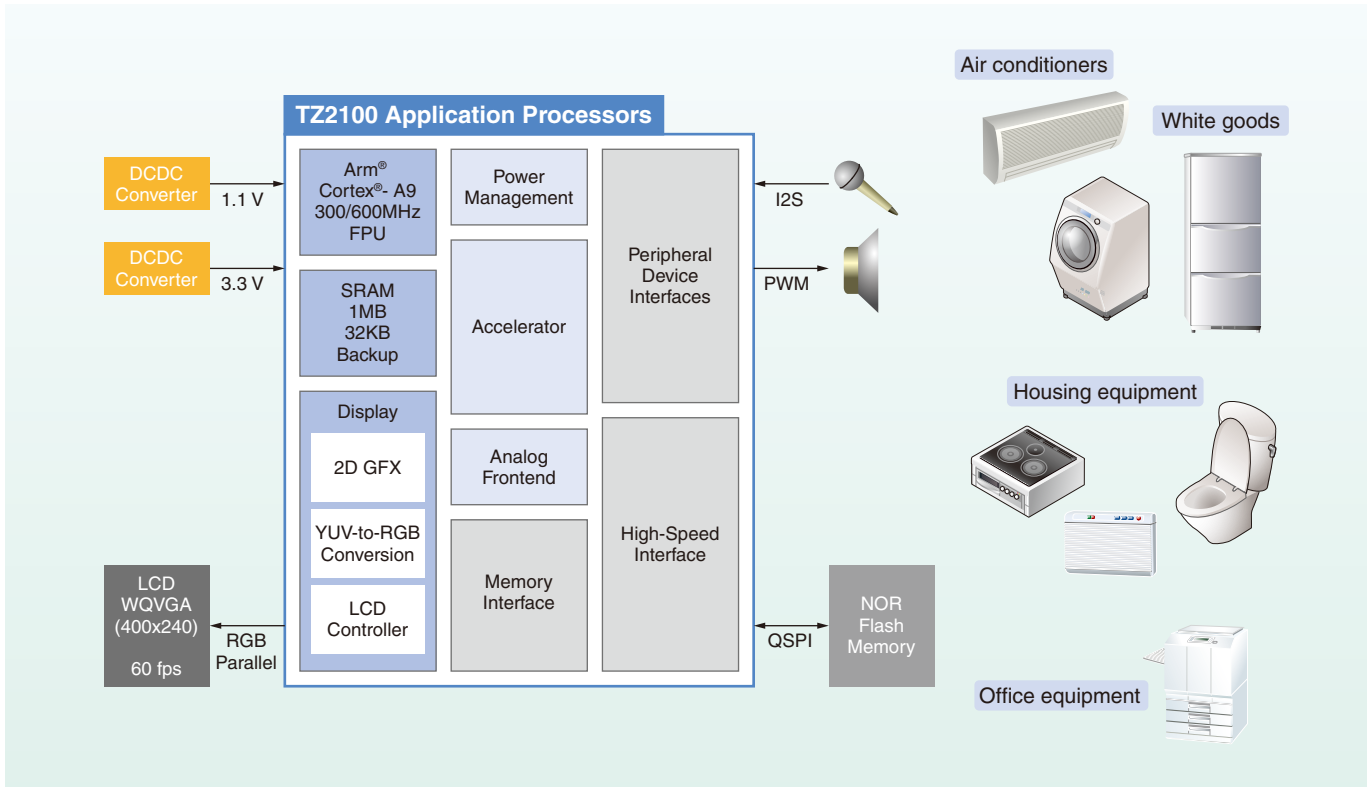# ● Speech HMI Solutions ●

TZ2100 Series

Features

- Incorporates 300-MHz or 600-MHz Arm® Cortex®-A9
- Voice command and voice synthesis middleware for RTOS and Linux®
- Extensive interfaces

Applications

- Air conditioners
- White goods
- Housing equipment
- Office equipment

● System Block Diagram

Attractive Middleware for RTOS and Linux

Toshiba offers voice command middleware for the TZ2100 series, which allows hands-free operation of equipment.
The TZ2100 series also supports the ToSpeak voice synthesis middleware from Toshiba Digital Solutions Corporation that is popular for application to car navigation systems.

● Product Lineup

Part Number	CPU Core	Operating Frequency	SRAM	Differentiating Features
TZ2100XBG	Arm® Cortex® -A9	300 MHz	1 MByte +32 Kbyte (Back-up)	· Incorporates an LCD panel interface, a camera interface, encryption functions and various networking functions · Provides ToSpeak™, speech synthesis middleware suitable for voice guidance applications · Incorporates a general-purpose parallel interface to which various peripheral ICs can be connected · Achieves rich and smooth rendering with a 2D graphics accelerator
TZ2102XBG		600 MHz		

TZ2100 Speech HMI Solution Development Starter Kit

Toshiba provides a startup development environment that allows its voice trigger middleware to be used on the TZ2100 to realize voice commands in the local environment. Because the starter kit does not require many external components, it helps reduce the bill-of-materials (BOM) costs, simplify board layout, and reduce the application size.

● Support for Arm Ecosystem ●

Arm Ecosystem-based support and maintenance, encompassing everything from the selection of an MCU to mass production

Toshiba collaborates with Arm ecosystem partners to provide various tools and development environments, as well as technical information, services and sales support. Tools support designers from conception to completion, ranging from microcontroller selection to mass production.

Technical support for MCUs
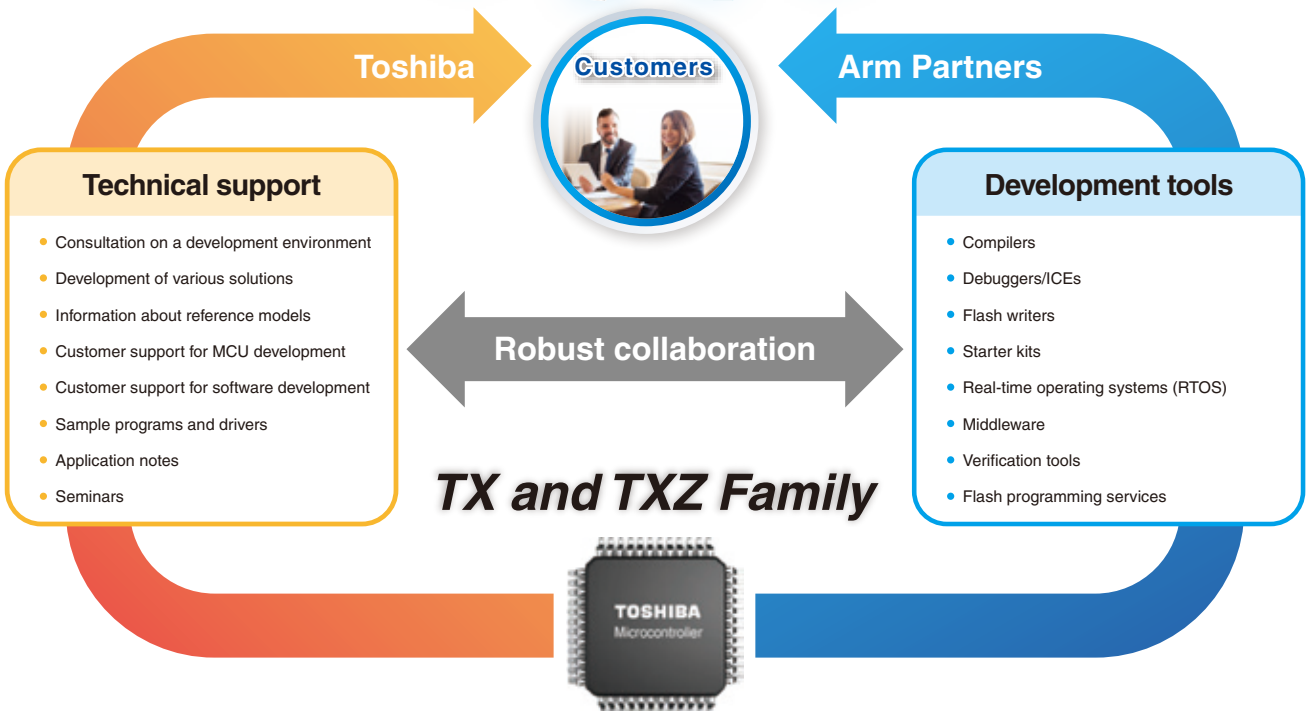
- Selection of an MCU and detailed product specifications
- Various types of benchmarking
- Support for technical studies (hardware and software)

Consultation on the selection of a development environment

Toshiba provides information on various development environments, tools and partners necessary for system development and mass production of your MCU.

Ecosystem partnership

Toshiba offers support services in cooperation with Arm Ecosystem partners according to your specific needs.

Toshiba → **Customers** ← **Arm Partners**

Technical support

- Consultation on a development environment
- Development of various solutions
- Information about reference models
- Customer support for MCU development
- Customer support for software development
- Sample programs and drivers
- Application notes
- Seminars

← Robust collaboration →

Development tools

- Compilers
- Debuggers/ICEs
- Flash writers
- Starter kits
- Real-time operating systems (RTOS)
- Middleware
- Verification tools
- Flash programming services

TX and TXZ Family

TOSHIBA
Microcontroller

● Ecosystem partners for development environments ●

You can choose among a wide range of development tool partners for Arm-based microcontroller development systems. Choose the best development tools and partners that suit your needs.

*FLASH programmer/Writer ON: ON board Writing OFF: OFF board Writing	IDE/Compiler	Debugger	Simulator	OS	Middleware	Software development/SI	Board/Evaluation kit	FLASH programmer/Writer*	FLASH programming service	Teaching Materials /Seminar	Functional Safety
Andor System Support Co., Ltd.						●		ON	●	●	
Arm Ltd.	●	●	●	●	●		●				
BITRAN CORPORATION		●						ON			
Computex Co.,Ltd.	●	●					●	ON			
Dediprog Technology Co., Ltd								ON OFF			
DTS INSIGHT CORPORATION (formerly Yokogawa Digital Computer Corporation)	●	●				●	●	ON		●	
eForce Co., Ltd.				●	●						
Elnec s.r.o								OFF			
ESP Co., Ltd				●		●	●			●	
Falcon Denshi K.K.								OFF	●		
GAIO TECHNOLOGY CO.,LTD.	●	●	●			●				●	●
GRAPE SYSTEMS INC.				●	●						
Green Hills Software/Advanced Data Controls Corp.	●	●	●	●							
HI-LO SYSTEMS RESEARCH CO.,LTD								OFF			
IAR Systems AB	●	●	●	●	●		●			●	
iFORCOM KYOEI Co.,Ltd.								ON			
Kyoto Microcomputer Co.,Ltd.	●	●									
Lauterbach Japan Ltd.		●									
MICROTEK Inc.									●		
MINATO HOLDINGS INC.								OFF	●		
P&E Microcomputer Systems, Inc.		●						ON			
SEGGER Microcontroller GmbH & Co. KG		●		●	●			ON			
Sohwa & Sophia Technologies Co.,Ltd.	●	●						ON			
SORD CORPORATION						●	●				
Techno Mathematical Co.,Ltd.					●	●	●				
TOA ELECTRONICS Inc. Flash Support Group Company.								ON OFF	●		
TOSHIBA INFORMATION SYSTEMES (JAPAN) CORPORATION				●	●	●	●				
Ubiquitous AI Corporation				●	●						
Ubiquitous Computing Technology Corporation				●							
VAMOS										●	
Xeltek Inc.								OFF			
ZLG	●	●						ON OFF			

Visit the websites of ecosystem partners for details of their products and services.

Website of Toshiba Electronic Devices & Storage Corporation:
https://toshiba.semicon-storage.com/ap-en/product/microcomputer/designsupport/partner-list.html

Semiconductor & Storage Products Home > Products > Microcomputer > Design / Support > Partner Information

● Application Notes and Sample Programs ●

Our website provides application notes and sample programs that customers can use as a reference to evaluate the functionality of our microcontrollers and develop applications.

Sample Programs

Driver source code   : Setup program containing sequences for operating various IP cores.
                       Synonymous with peripheral driver and MCU hardware abstraction layer (MCU HAL).

Sample drivers   : Sample embedded programs for operating the HAL and IP cores.
                       Sample drivers can run on starter kits and other boards for each microcontroller.

Sample projects   : Genuine MDK-Arm software development environment and IAR Systems' EWARM project.
                       You can verify operation with a development environment and a starter kit.

■ Genuine MDK-Arm development environment

■ IAR Systems' EWARM development environment
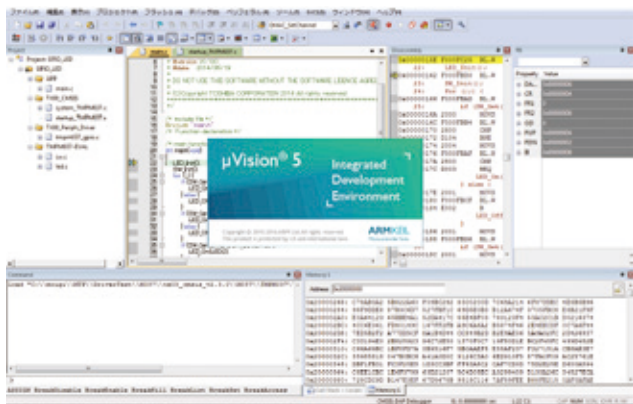
● Features

● Incorporates a genuine Arm compiler
● MDK-TOSHIBA dedicated to Toshiba's microcontrollers
  One-year license, low cost, and full versions are also available.

● Features

● Development environment from a compiler vendor
● Available under various licensing schemes,
  including a free evaluation edition
● Support for ICE, static analysis and other tools

Application notes and sample programs are available for download at:

https://toshiba.semicon-storage.com/ap-en/product/microcomputer/designsupport/applicationnote-read-me.html
Semiconductor & Storage Products Home > Products > Microcomputer > Design / Support > Application Notes / Sample Programs

● Evaluation Kits and Reference Boards ●

Evaluation Kits

In order to evaluate whether to use Toshiba's microcontroller, it is advisable to use an entry-level evaluation kit (such as a starter kit) to start software development. Starter kits are available from development environment and evaluation kit vendors.

Various evaluation kits are available, ranging from the kits that are bundled with an IDE and an emulator to those that are compliant with an on-board emulator standard called CMSIS-DAP.

Moreover, feature-rich solution packages incorporating peripheral functions are also available. For detailed information, contact a partner listed in the "Boards/Evaluation Kits" column of the "Evaluation Environment Ecosystems" table on the previous page.

For evaluation kits supported by each microcontroller, see the pages that describe individual microcontrollers.

The following photographs were taken for inclusion in this brochure and may differ from actual products.

For the contents and details of evaluation boards, please contact tool vendors.

IAR Systems Starter Kit for TMPM440

● Included hardware:
TMPM440 evaluation board
IAR i-Jet Lite
USB cable
IAR Embedded Workbench for
ARM KickStart edition
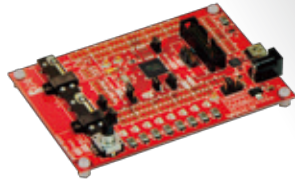
● Key features
・USB/UART serial converter
・2 potentiometer input analog signals
・Reset switch   ・8 push switches
・Power LED   ・8 user LEDs
・2-phase encoder   ・DC power jack

ESP Starter Kit for TMPM475

● Included hardware: TMPM475 evaluation board
Brushless DC motors

● Key features
・Sensorless 3-shunt and 1-shunt resistor circuits
・SIO/UART
・CAN (isolation)
・External amp   ・USB (isolation: CP2102)
・12-bit DAC x 4   ・Analog (slide volume resistor input)
・4 tactile switches   ・External op-amp
・On-board CMSIS-DAP   ・1 reset switch
・DAC (SIO) for communication ・LED
  connection   ・20-pin JTAG half-pitch socket

ESP Starter Kit for TMPM37A

● Included hardware:
TMPM37A evaluation board
Brushless DC motors
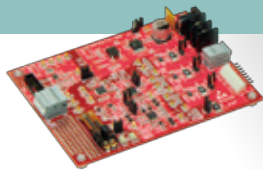
● Key features
・Selectable from 3-shunt resistor circuitry
  (external amp only) and 1-shunt resistor circuitry
  (that allows either an internal or an external amp to be selected)
・12-bit DAC x 4
・Analog (slide volume resistor input)   ・LED (for DAC monitoring)
・1 reset switch   ・20-pin JTAG half-pitch socket
・1 tactile switch   (only for SWD connection)

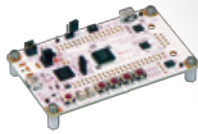## Chip One Stop, Inc. Online Shop Starter Kit for TMPM3HQ

- Included hardware:
  TMPM3HQ evaluation board
  USB cable

- Key features
  - mbed
  - Arduino-compatible connector
  - USB-UART
  - AD converter
  - Thermistor
  - 6-axis sensor
  - Reset switch
  - CMSIS-DAP debugger
  - UART
  - DA converter
  - Remote control receiver
  - Push switch
  - Pin header for boot-mode control
  - Selectable power supply (DC jack input, USB-to-UART input or DAP USB input)

Chip One Stop, Inc. Online Shop Starter Kit for TMPM3H6

- Included hardware:
  TMPM3H6 evaluation board
  USB cable

- Key features
  - mbed
  - Arduino-compatible connector
  - USB-UART
  - DA converter
  - Remote control receiver
  - Reset switch
  - CMSIS-DAP debugger
  - UART　・AD converter
  - Thermistor
  - Push switch
  - Pin header for boot-mode control
  - Selectable power supply (DC jack input, USB-to-UART input or DAP USB input)

Chip One Stop, Inc. Online Shop Starter Kit for TMPM037

- Included hardware:
  TMPM037 evaluation board
  USB cable

- Key features
  - CMSIS-DAP debugger
  - USB-UART
  - Volume
  - Push switch
  - Reset switch
  - Pin header for boot-mode control
  - Selectable power supply (DC jack input, USB-to-UART input or DAP USB input)

## Chip One Stop, Inc. Online Shop Starter Kit for TMPM036

- Included hardware: TMPM036 evaluation board
  USB cable

- Key features
  - Arduino-compatible connector
  - CMSIS-DAP debugger
  - USB-UART
  - UART
  - Volume
  - Push switch
  - Reset switch
  - Pin header for boot-mode control
  - Selectable power supply (DC jack input, USB-to-UART input or DAP USB input)

Chip One Stop, Inc. Online Shop Starter Kit for TMPM066

- Included hardware:
  TMPM066 evaluation board
  USB cable

- Key features
  - mbed
  - Arduino-compatible connector
  - CMSIS-DAP debugger
  - USB-UART
  - UART
  - Push switch
  - Reset switch
  - Pin header for boot-mode control
  - Selectable power supply (DC jack input, USB-to-UART input or DAP USB input)

Chip One Stop, Inc. Online Shop Starter Kit for TMPM46B

- Included hardware:
  TMPM46B evaluation board
  USB cable
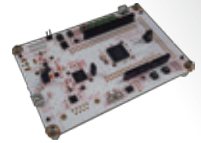
- Key features
  - mbed
  - Arduino-compatible connector
  - CMSIS-DAP debugger
  - NAND Flash
  - Remote control receiver
  - USB-UART
  - UART
  - Push switch
  - Thermistor
  - Reset switch
  - Pin header for boot-mode control
  - Selectable power supply (DC jack input, USB-to-UART input or DAP USB input)

● Microcomputer web page ●

The Toshiba Microcomputer web page provides the latest information on our products.

Convenient search functions allow you to find various types of information you need!

✓ Datasheets
✓ Evaluation Kits
✓ Partner Information
✓ Videoclips

✓ Reference Boards
✓ Application Notes
✓ Purchase/Sample
✓ Facebook

Website of Toshiba Electronic Devices & Storage Corporation:
https://toshiba.semicon-storage.com/ap-en/product/microcomputer.html

🔍 Toshiba microcontroller

● Online Distributor ●

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32-Bit Microcontrollers

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