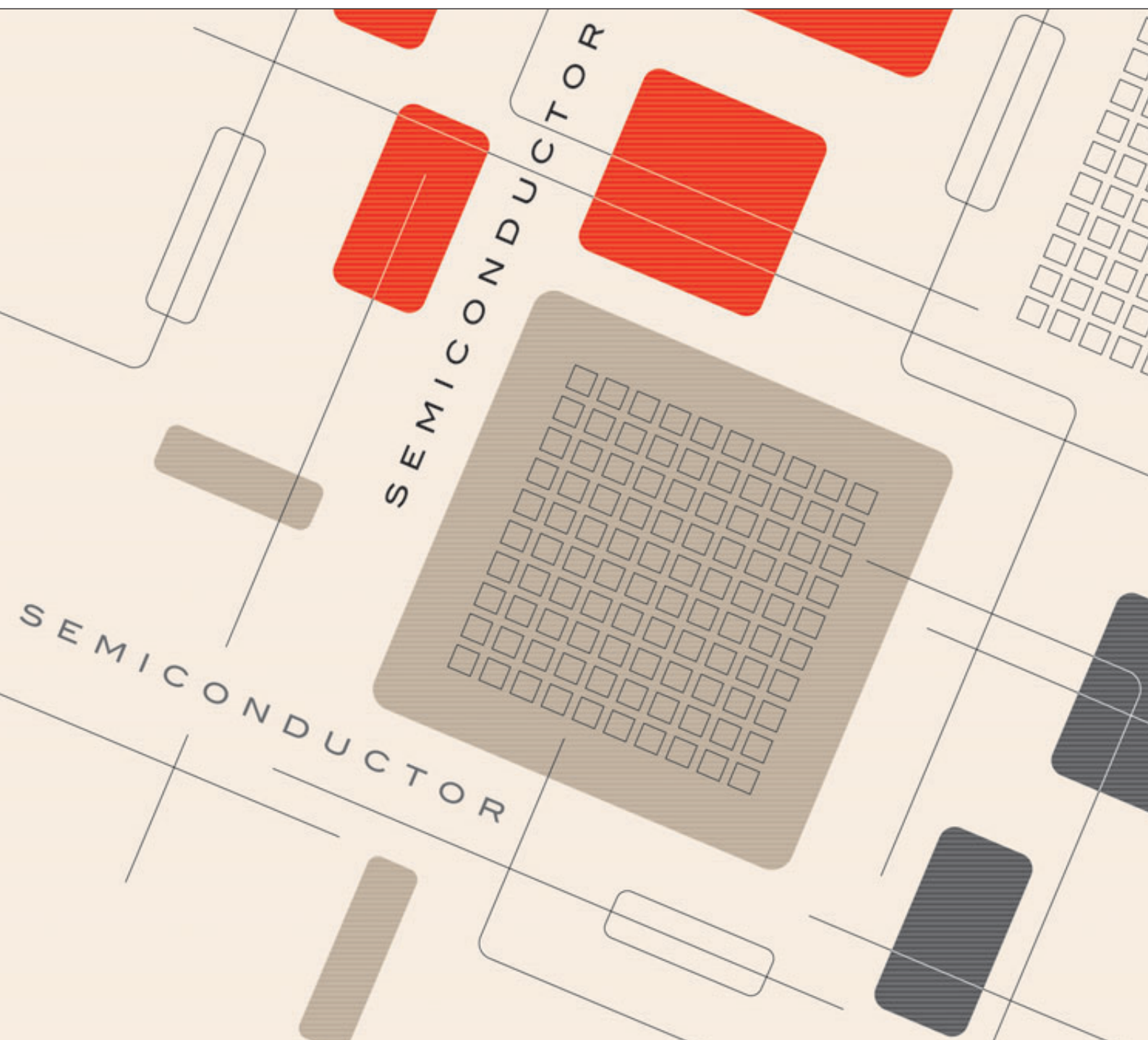# TOSHIBA
Leading Innovation >>>

PRODUCT GUIDE

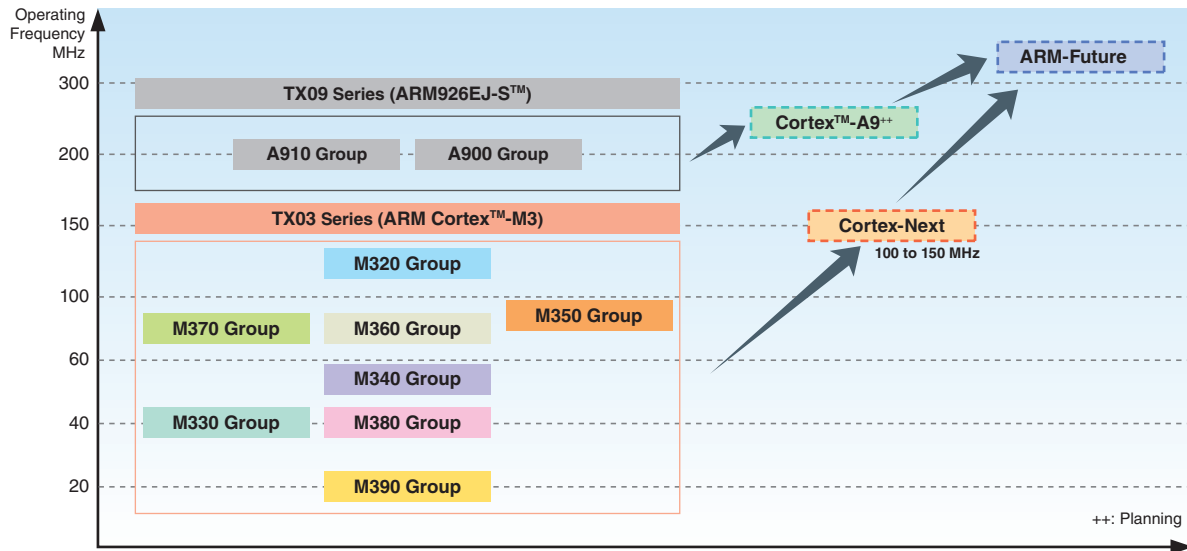# 32-Bit Microcontrollers

TX03 Series

Toshiba's ARM Core-Based Microcontrollers

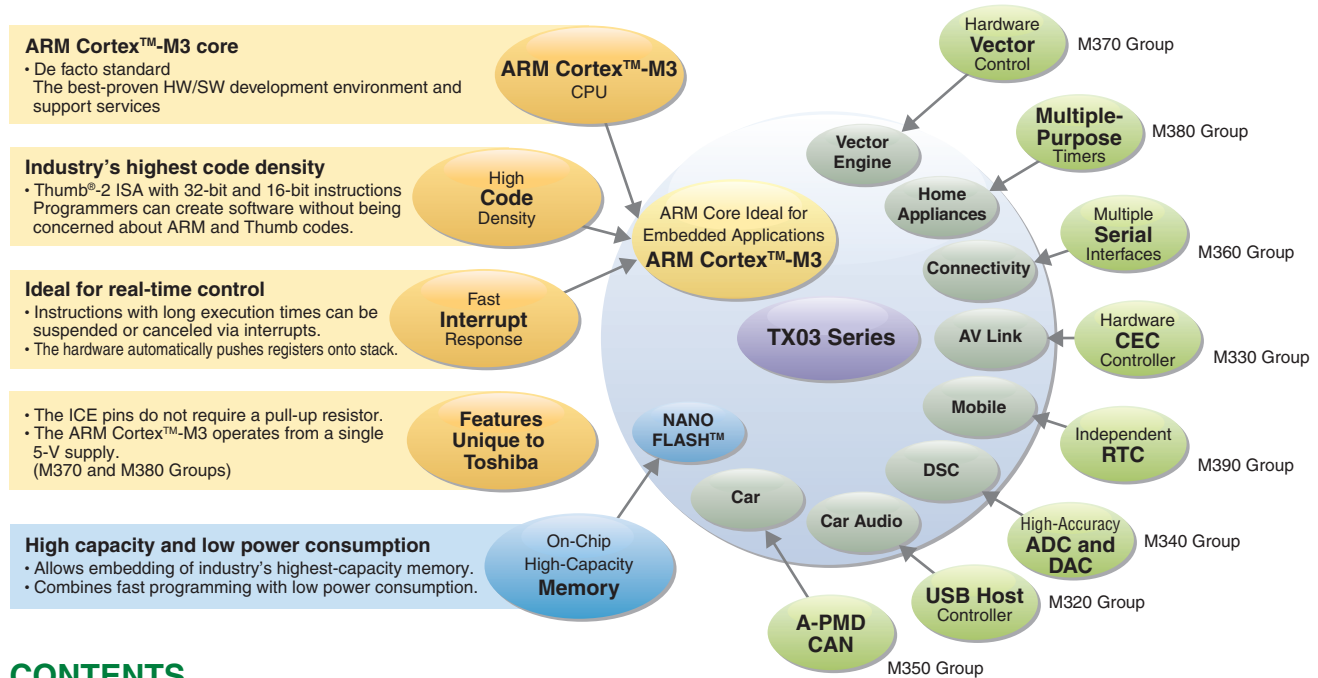## ARM Core-Based Microcontrollers Proven in the Global Market

Microcontrollers with an ARM core are becoming increasingly popular not only for cell phone applications but also for general-purpose applications. Toshiba is the first Japanese vendor to release general-purpose microcontrollers with an ARM Cortex™-M3 core. Our product lineup includes microcontrollers with a broad spectrum of peripherals.

Roadmap for ARM Core-Based Microcontrollers

Features of the TX03 Series

The TX03 microcontroller series embeds an ARM Cortex™-M3 core, which provides high code density and fast interrupt response times required for real-time applications. The TX03 Series also incorporates a Toshiba-proprietary NANO FLASH™ memory featuring high capacity and low power consumption.

CONTENTS

Note: System block diagrams in this brochure only show the typical application examples.

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■ Product Groups with a 3-V Supply (Note 1)

M320 Group — USB-Host
- Features
  USB host controller
  System solutions that combine a MCU and an audio DSP
- Application examples
  Car and home audio systems

M330 Group — Power-saving modes / CEC controller
- Features
  Dedicated controller compliant with HDMI 1.3a (CEC)
  Remote control signal preprocessor essential for digital consumer electronics
- Application examples
  Digital TVs, projectors, Blu-ray recorders, AV systems, printers, home appliances, factory equipment, office equipment

M340 Group — High-resolution PPG
- Features
  High-accuracy analog control interface
  Small package (6 x 6 mm TFBGA113)
  High-resolution PPG ideal for motor control
- Application examples
  DVCs, DSLR cameras, camera lens controllers

M360 Group — Multiple serial interfaces
- Features
  Large-capacity Flash memory
  Up to 7 communications interfaces (SIO, I²C, SPI, UART, CAN, USB, EtherMAC)
  Programmable Motor Driver (PMD)
  Multi-purpose timer capable of IGBT control
  Small package (9 x 9 mm TFBGA109)
- Application examples
  Printers, AV systems, digital appliances, PC peripherals, industrial equipment, networking equipment, office equipment

M390 Group — 1.8-V operation
- Features
  Power-saving modes for 1.8-V operation
  High-speed on-chip oscillator
  Small package (6 x 6 mm TFBGA120)
- Application examples
  Power supply monitors, battery-operated devices, remote-controlled equipment, game consoles, AV systems

■ Product Groups with a 5-V Supply (Note 1)

M370 Group — On-chip vector engine
- Features
  Toshiba-original vector engine (VE)
  Single 5-V supply operation with high market demands
  System solutions that combine an MCU with motor drivers
  Small package (7 x 7 mm LQFP48)
- Application examples
  Washing machines, air conditioners, refrigerators, heat pumps, inverter-motor-controlled equipment

M380 Group — Multi-purpose timers for IGBT control
- Features
  Multi-purpose timers for motor and IGBT control
  Single 5-V supply operation with high market demands
  System solutions that combine an MCU with various peripheral ICs
- Application examples
  Air conditioners, refrigerators, electric oven-grills, rice cookers, induction cooktops

■ Automotive Applications

M350 Group — Automotive Applications

M350
- Features
  Programmable Motor Driver (PMD), CAN controllers, timers, 12-bit AD converter, crossbar switches, functional safety capabilities and 5-V I/Os
- Application examples
  Electric power steering (EPS) systems and other automotive applications

M354
- Features
  Advanced PMD (A-PMD), VE, CAN controllers, timers, 12-bit AD converters, resolver-to-digital converter, crossbar switches, functional safety capabilities and 5-V I/O
- Application examples
  HEV, EV and other automotive applications

■ TX03 Series Common Functions

- Cortex™-M3 core
- High-speed writing by NANO-Flash™ technology
- On-chip debug function
- ETM (embedded trace macro cell)
  Except some microcontrollers in the M370 Group
- Watchdog timer

■ Added Functions (Note 1)

	M320 Group	M330 Group	M340 Group	M350 Group	M360 Group	M370 Group	M380 Group	M390 Group
High-speed operating clock (80 MHz or higher)	●			●	●			
Large-capacity Flash ROM (1 MB or more)				●	●			
On-chip DRAM	●							
USB device/host	●				●			
CAN				●	●			
EtherMAC					●			
Motor control			● (Note 4)	●	●	●	●	
Vector Engine				●		●		
Low-voltage operation (1.8 V or higher)								●
Single 5-V power supply						●	●	
High-accuracy analog IP (Note 2)			●	●	●	●	●	
Functions for audiovisual and home appliances (Note 3)	●	●			●			●
Compact package (Note 5)			●		●	●		●
External bus interface	●		●		●			
JTAG boundary scan			●		●			

Note 1: There are microcontrollers that do not contain some of the peripherals shown. For details, see appropriate datasheets.
Note 2: Contains either analog circuitry for motor control or a 12-bit AD converter.
Note 3: Contains a Consumer Electronics Control (CEC) unit, a remote control signal preprocessor or an I²S interface.
Note 4: Ultrasonic motor controller
Note 5: 9 x 9 mm or smaller packages

M330 Group

The M330 Group of microcontrollers are ideal for audiovisual applications. They incorporate a remote control signal receiving function and a Consumer Electronics Control (CEC) interface that remain active even in 32-kHz SLEEP mode. This helps to reduce standby power consumption of audiovisual systems.
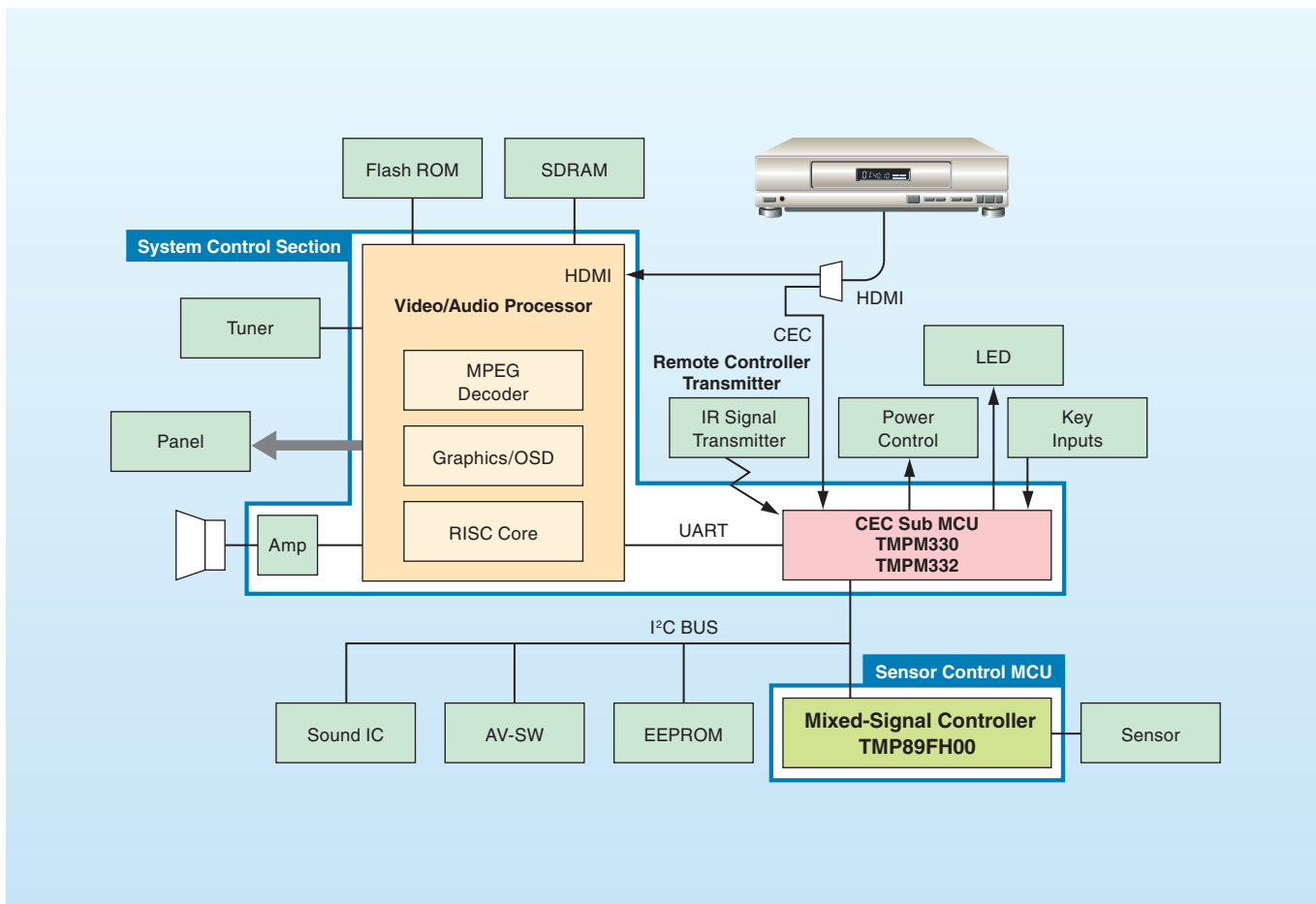
■ Features

- High-performance ARM Cortex™-M3 core: 40-MHz operation (max)
- Toshiba-original low-power consumption NANO FLASH™ memory: Fast programming
- Various serial interfaces
- CEC interface and remote control signal preprocessor that remain active even in SLEEP mode
- High-speed, high-accuracy 10-bit AD converter (1.15-μs conversion time @40 MHz)
- Real-time clock (RTC)

■ Application

- Digital TVs
- Hard disk recorders
- Projectors
- Blu-ray players
- Set-top boxes
- AV systems
- Home appliances
- Factory equipment
- Office equipment

■ System Block Diagram (Digital TV)

■ Product Lineup

Part Number	ROM (Flash) Size	RAM Size	Package	Features
TMPM330FWFG	128 KB	8 KB	LQFP100 (14 x 14 mm)	CEC interface Remote control signal preprocessor Real-time clock (RTC) * The TMPM330FDWFG and TMPM330FYWFG support an extended temperature range.
TMPM330FYFG	256 KB	16 KB	LQFP100 (14 x 14 mm)	
TMPM330FYWFG	256 KB	16 KB	LQFP100 (14 x 14 mm)	
TMPM330FDFG	512 KB	32 KB	LQFP100 (14 x 14 mm)	
TMPM330FDWFG	512 KB	32 KB	LQFP100 (14 x 14 mm)	
TMPM332FWUG	128 KB	8 KB	LQFP64 (10 x 10 mm)	
TMPM333FWFG	128 KB	8 KB	LQFP100 (14 x 14 mm)	Real-time clock (RTC)
TMPM333FYFG	256 KB	16 KB	LQFP100 (14 x 14 mm)	
TMPM333FDFG	512 KB	32 KB	LQFP100 (14 x 14 mm)	

M340 Group

The M340 Group of microcontrollers are ideal for digital video camera, digital still camera and camera lens control applications. They incorporate analog circuits required for optical image stabilization, autofocus and auto-exposure control. The high-performance ARM Cortex™-M3 core provides high-speed computation functionality. Additionally, a high-resolution programmable phase generator (PPG) enables smooth and quiet motor operation.
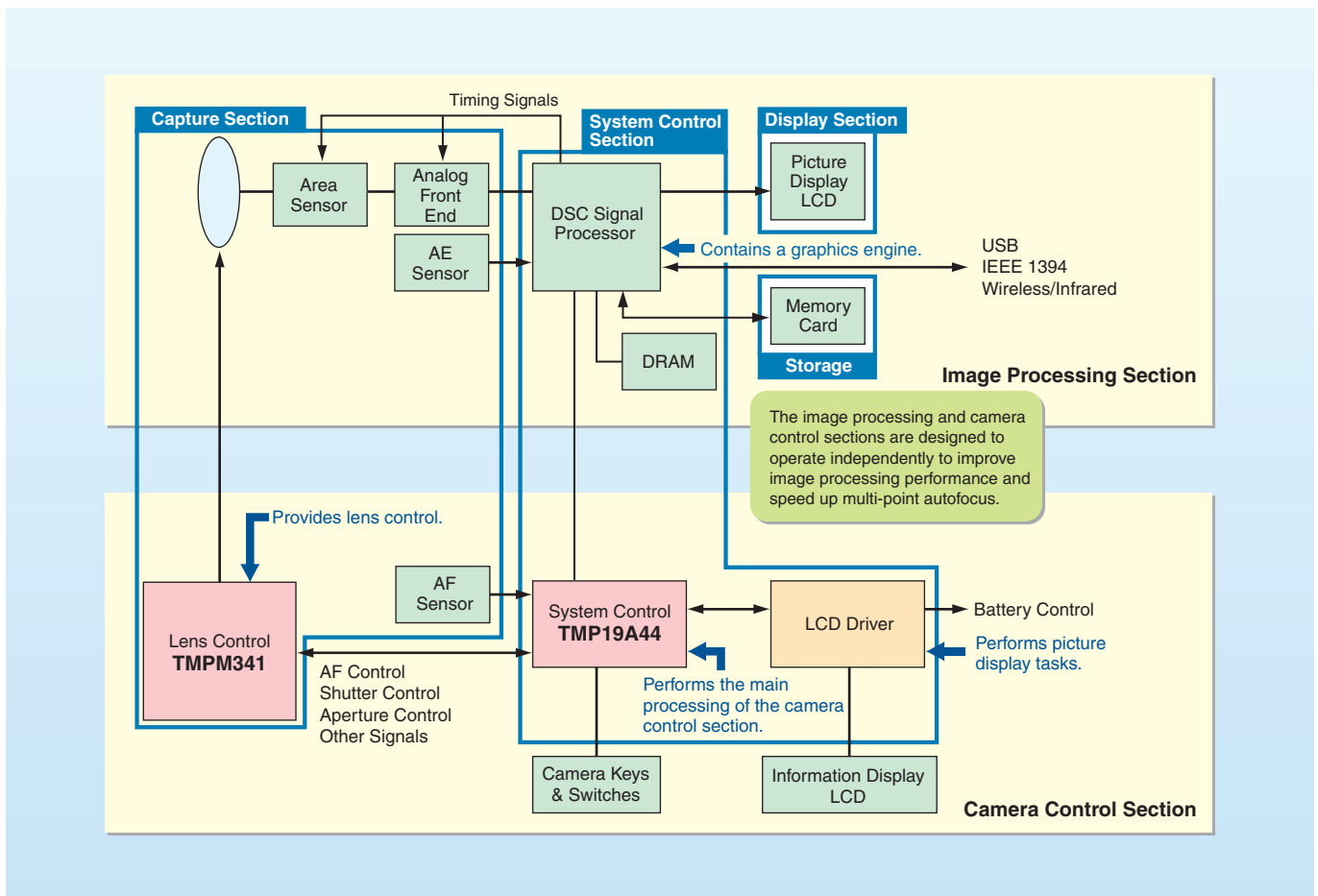
■ Features

- High-performance ARM Cortex™-M3 core: 54-MHz operation (max)
- Toshiba-original NANO FLASH™ memory: Fast programming
- High-resolution PPG (programmable phase difference of up to ± 90˚): 160 MHz (max)
- High-speed, high-accuracy 12-bit AD converter; 10-bit DA converter
- Oscillation frequency detection (OFD)
- Various timers and serial interfaces
- 2-phase pulse counter
- Small package (6 x 6 mm TFBGA113)

■ Application

- Digital video cameras
- Digital still cameras
- Camera lens

■ System Block Diagram (Digital Still Camera)

■ Product Lineup

Part Number	ROM (Flash) Size	RAM Size	Package	Features
TMPM341FYXBG **	256 KB	32 KB	TFBGA113 (6 x 6 mm)	12-bit AD converter (1 μs), 10-bit DA converter High-resolution PPG: 160 MHz (max); ideal for ultrasonic motor control
TMPM341FDXBG	512 KB	32 KB	TFBGA113 (6 x 6 mm)	

**: Under development

M360 Group

The base versions of the M360 Group include microcontrollers that offer large-capacity Flash ROM and up to 18 serial interface channels. The advanced versions also provide USB, CAN and EtherMAC interfaces, which are becoming de facto standards in embedded systems, as well as motor control capabilities. The M360 Group are ideal for a wide range of applications such as multifunction printers, audiovisual systems, industrial equipment and digital appliances.
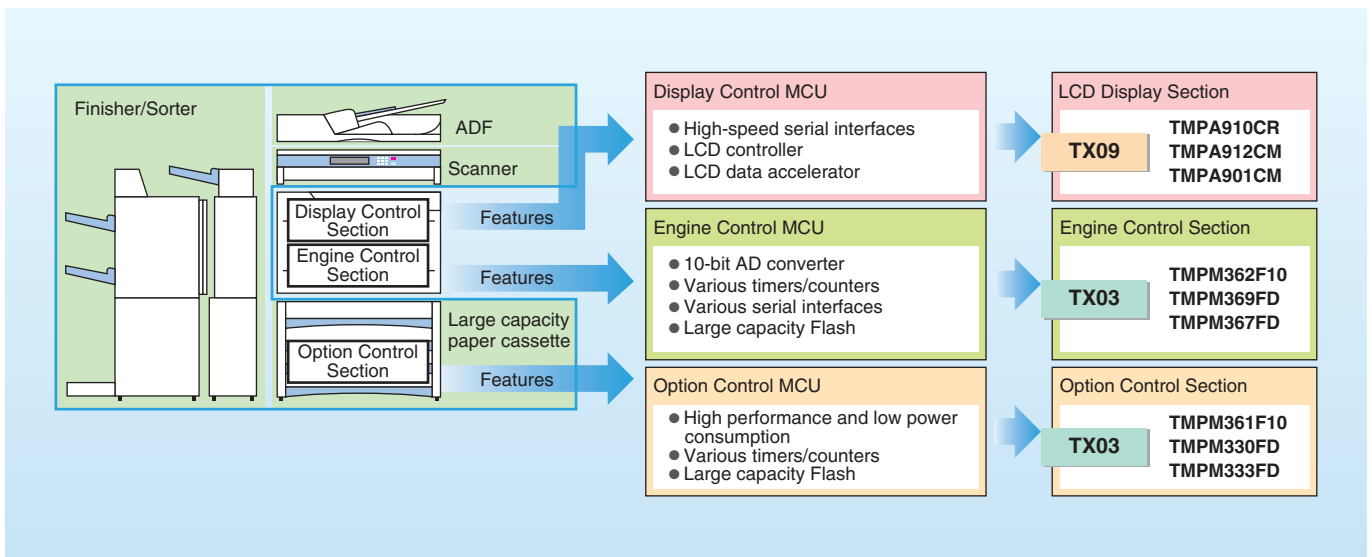
■ Features

- High-performance ARM Cortex™-M3 core: 80-MHz operation (max)
- Large-capacity embedded Flash ROM fabricated using Toshiba-original NANO FLASH™ technology
- Various serial interfaces (up to 18 channels)
- USB device, USB host, CAN and EtherMAC controllers suitable for multi-connection systems
- External bus interface that can be connected to SoCs and external extended memory
- Multi-purpose timers capable of controlling various motors and IGBTs
- CEC interface and remote control signal preprocessor that remain active even in SLEEP mode
- Oscillation frequency detection (OFD)
- Small package (9 x 9 mm TFBGA109)
  Note: TFBGA package of the TMPM366 and TMPM367 only

■ Application

- Printers
- AV systems
- Digital appliances
- PC peripherals
- Industrial equipment
- Networking equipment
- Office equipment

## ■ System Block Diagram (Printer)

■ Product Lineup

Part Number	ROM (Flash) Size	RAM Size	Package	Features
TMPM361F10FG	1 MB	64 KB	LQFP100 (14 x 14 mm)	CEC interface; remote control signal preprocessor
TMPM362F10FG	1 MB	64 KB	LQFP144 (20 x 20 mm)	CEC interface; remote control signal preprocessor Up to 18 serial interface channels
TMPM363F10FG	1 MB	64 KB	LQFP100 (14 x 14 mm)	CAN and USB 2.0 host controllers
TMPM364F10FG	1 MB	64 KB	LQFP144 (20 x 20 mm)	CAN and USB 2.0 host controllers
TMPM366FWFG/XBG **	128 KB	32 KB	LQFP100 (14 x 14 mm) TFBGA109 (9 x 9 mm)	USB 2.0 device controller DMA controller Full UART
TMPM366FYFG/XBG	256 KB	48 KB		
TMPM366FDFG/XBG	512 KB	64 KB		
TMPM367FWFG/XBG **	128 KB	50 KB	LQFP100 (14 x 14 mm) TFBGA109 (9 x 9 mm)	USB 2.0 device controller Dual AD converter PMD
TMPM367FYFG/XBG **	256 KB	66 KB		
TMPM367FDFG/XBG **	512 KB	128 KB		
TMPM369FYFG/XBG **	256 KB	66 KB	LQFP144 (20 x 20 mm) TFBGA177 (11 x 11 mm)	USB 2.0 device and host controller Dual AD converter PMD CAN EtherMAC
TMPM369FDFG/XBG **	512 KB	128 KB		

**: Under development

■ Controls various interfaces independently – Contributing to reduction of the CPU workload

The TMPM369 has various external communication interfaces such as USB device, USB host, CAN, EtherMAC, SIO/UART, I²C/SIO and SSP (SPI mode). Additionally, the TMPM369 contains 2 units of AD converter and a programmable motor driver (PMD). All of them are designed to operate independently, significantly reducing the software workload. The TMPM369 provides Flash ROM of up to 512 KB and SRAM of up to 128 KB to facilitate the use of the various communication interfaces.
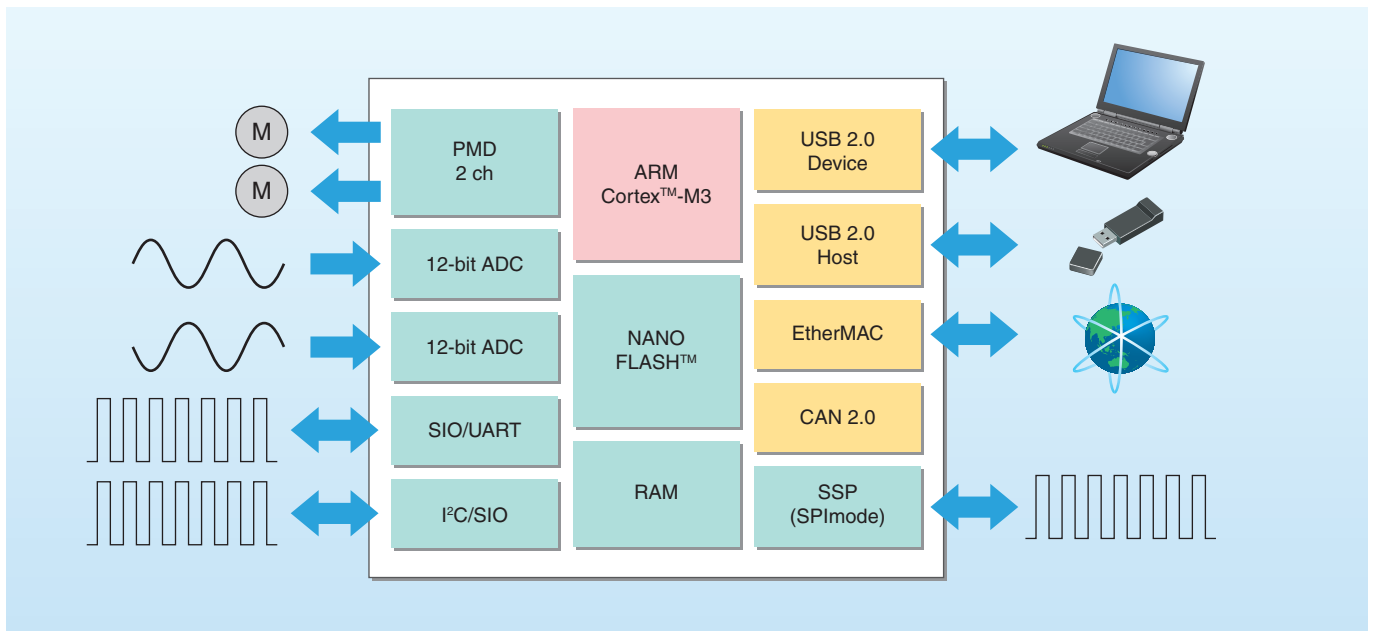
■ High-speed AD conversion – Using 2 units of AD converter

The TMPM369 contains 2 units of ADC. Their combined use provides high-speed AD conversion. While a single ADC offers a minimum conversion time of 1.0 μs at 80 MHz, applying an analog signal to 2 units of ADC and using them in a time-interleaved manner significantly reduces the conversion time required*.

*0.5 μs minimum (design target)

A sample application using Barcode Read Control
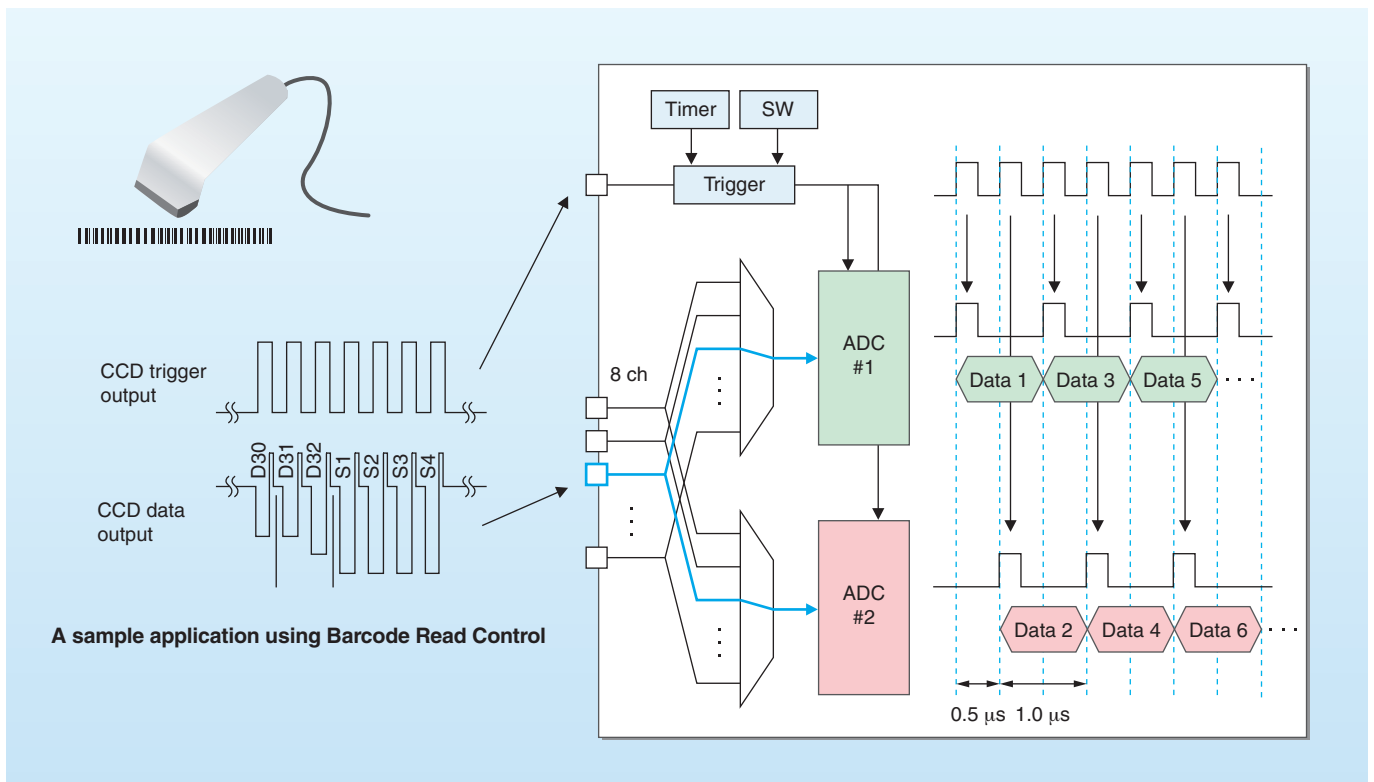
M370 Group

The M370 Group of microcontrollers contain a Vector Engine (VE) that implements the common computation functionality for motor vector control. Additionally, the VE is closely coupled with a three-phase PWM timer and a 12-bit AD converter for motor current sensing. The M370 Group are designed to improve motor control efficiency while reducing software workload. The M370 Group operate with a single 5-V supply and provide analog comparators and amplifiers to help cut system costs.
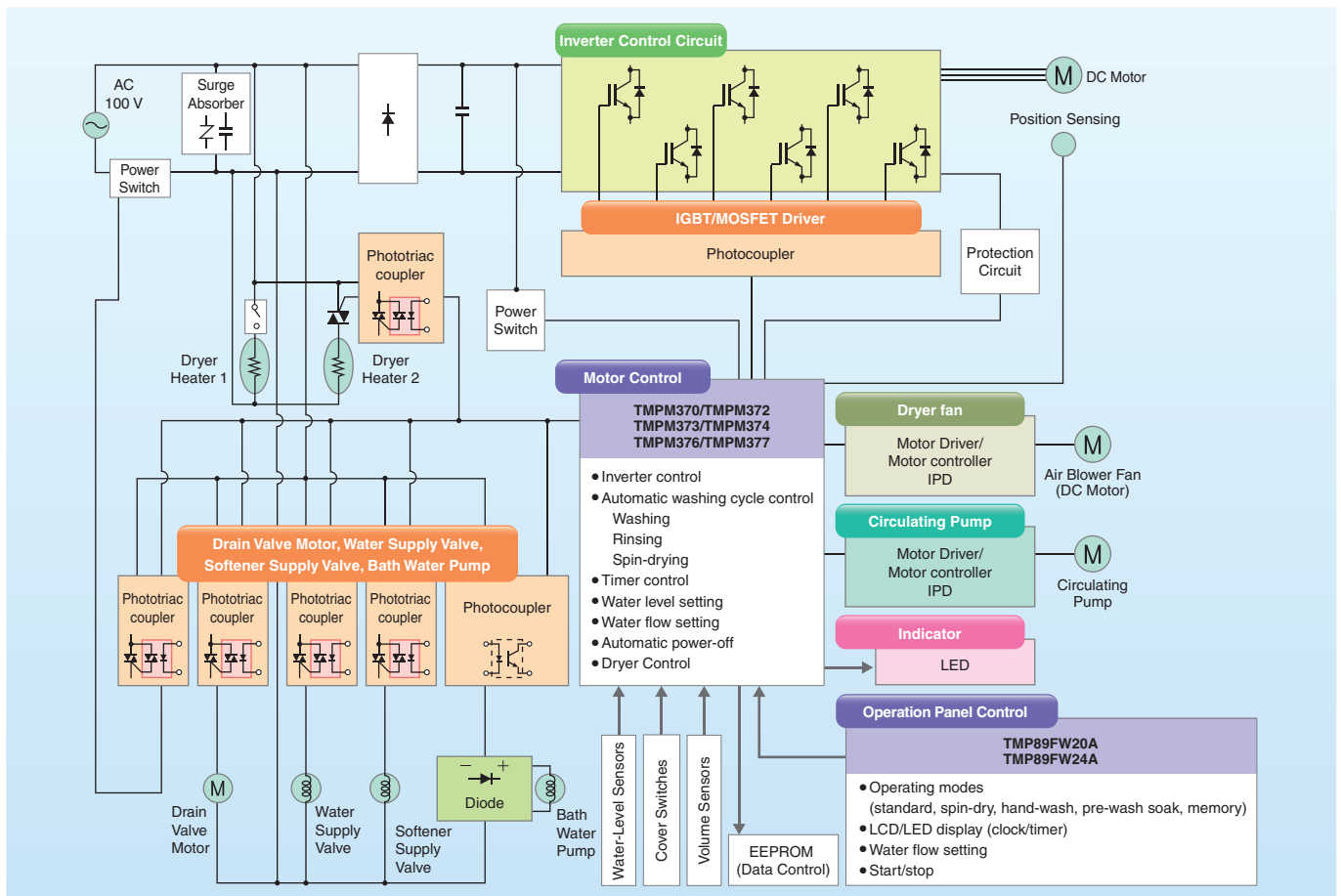
■ Features

- High-performance ARM Cortex™-M3 core: 80-MHz operation (max)
- Toshiba-original NANO FLASH™ memory: Fast programming
- Toshiba-original Vector Engine (VE) that implements part of motor vector control as hardware
- Various analog circuits* (comparators, op amps)   * TMPM370 only
- 12-bit AD converter
- Oscillation frequency detection (OFD); compliant with the IEC 60730 standard
- Single 5-V power supply
- Small package (7 x 7 mm LQFP48)   Note: TMPM373FWDUG only

■ Application

- Washing machines
- Air conditioners
- Refrigerators
- Heat pumps
- Pumps, compressors, air blowers
- Other rotating devices

■ System Block Diagram (Washing Machine)

■ Product Lineup

Part Number	ROM (Flash) Size	RAM Size	Package	Features
TMPM370FYFG	256 KB	10 KB	LQFP100 (14 x 14 mm)	Capable of controlling two motors for a wide range of inverter applications. Contributing to the system cost reduction by incorporating various analog circuits
TMPM370FYDFG	256 KB	10 KB	QFP100 (14 x 20 mm)	
TMPM372FWUG **	128 KB	6 KB	LQFP64 (10 x 10 mm)	Low-pin-count MCUs for single motor control Ideal for compressor control for refrigerators, etc.
TMPM373FWDUG **	128 KB	6 KB	LQFP48 (7 x 7 mm)	
TMPM374FWUG	128 KB	6 KB	LQFP44 (10 x 10 mm)	
TMPM376FDFG **	512 KB	32 KB	LQFP100 (14 x 14 mm)	Capable of controlling two motors for a wide range of inverter applications.
TMPM376FDDFG **	512 KB	32 KB	QFP100 (14 x 20 mm)	
TMPM377FYFG **	256 KB	16 KB	LQFP80 (12 x 12 mm)	
TMPM377FYDFG **	256 KB	16 KB	LQFP80 (14 x 14 mm)	

**: Under development

☐ 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.
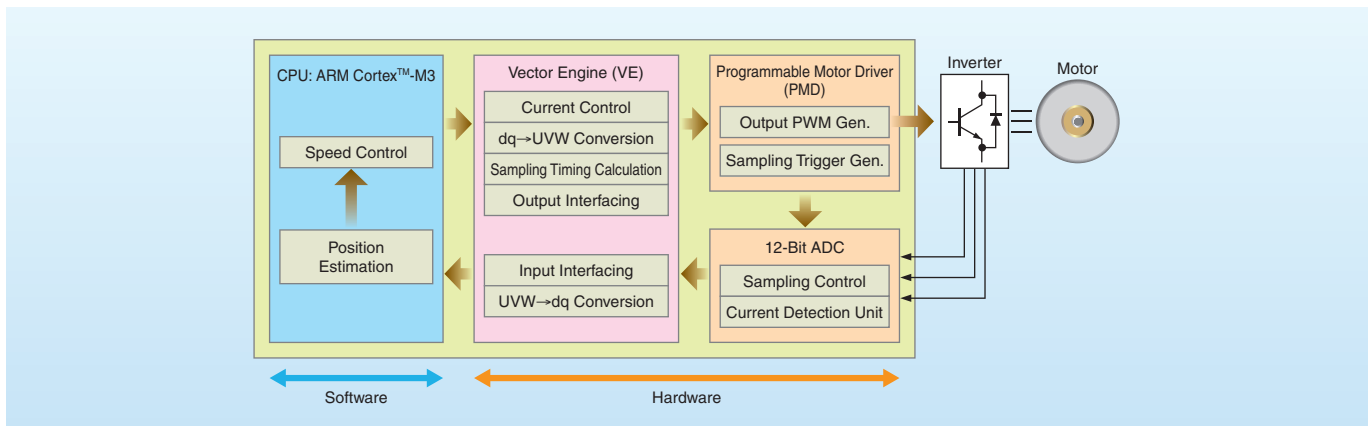
■ Highly flexible hardware

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.
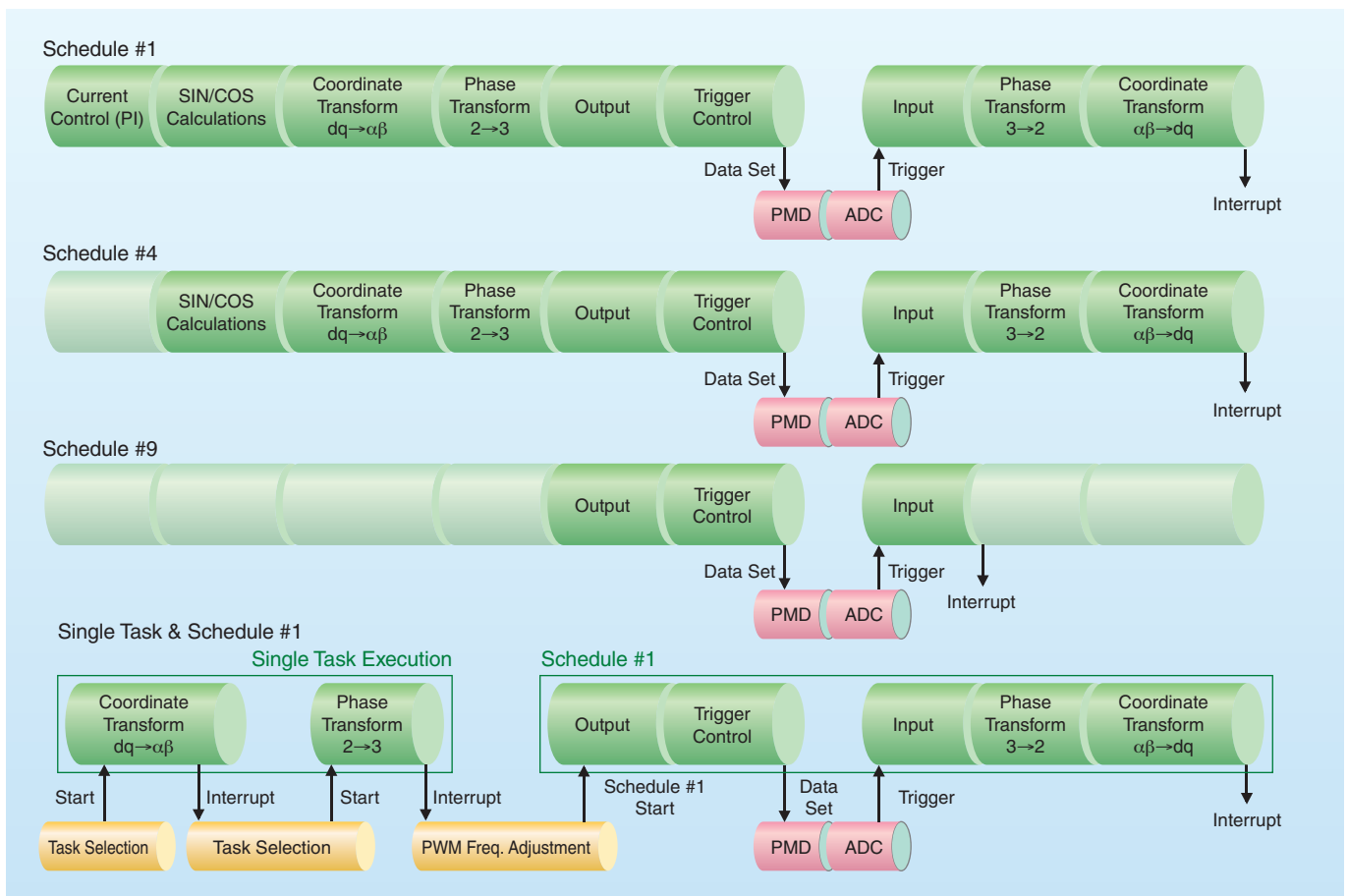
M380 Group

The M380 Group consists of high-performance microcontrollers that provide multi-purpose timers capable of controlling power devices used in home appliances, thereby enabling motor and induction heating (IH) control. Since they operate with a single 5-V supply, new designs can be created without replacing 5-V peripheral ICs. Additionally, a wide variety of on-chip timers and serial interfaces makes the M380 suitable for a broad range of applications, including housing and industrial equipment. The oscillation frequency detection (OFD) circuit allows the M380 to detect abnormal oscillation at the hardware level.
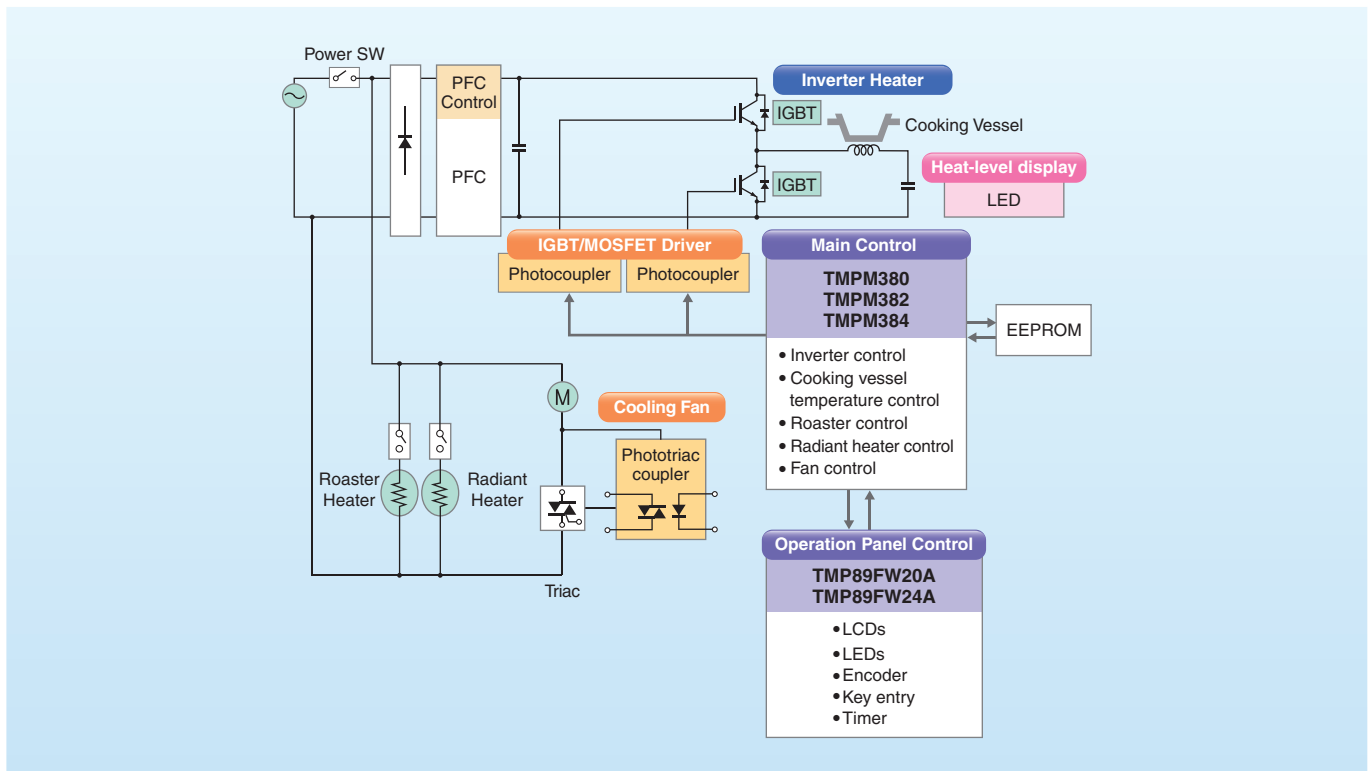
■ Features

- High-performance ARM Cortex™-M3 core: 40-MHz operation (max)
- Toshiba-original NANO FLASH™ memory: Fast programming
- Multi-purpose timers (IGBT and motor control modes)
- Various serial interfaces
- AD converter with data monitoring function
- Oscillation frequency detection (OFD); compliant with the IEC 60730 standard
- High-speed oscillator; power-on reset; voltage detection circuit
- Single 5-V power supply

■ Application

- Air conditioners
- Refrigerators
- Dishwashers
- Induction cooktops
- Microwave ovens
- Water heaters
- Rice cookers
- Bidet toilets

■ System Block Diagram (Induction Cooktops)

■ Product Lineup

Part Number	ROM (Flash) Size	RAM Size	Package	Features
TMPM380FWFG	128 KB	12 KB	LQFP100 (14 x 14 mm)	Capable of controlling three-channel half bridges or two-channel motors with multi-purpose timers. The emergency protection circuit can disable the PWM output immediately.
TMPM380FWDFG	128 KB	12 KB	QFP100 (14 x 20 mm)	
TMPM380FYFG	256 KB	16 KB	LQFP100 (14 x 14 mm)	
TMPM380FYDFG	256 KB	16 KB	QFP100 (14 x 20 mm)	
TMPM380FDFG **	512 KB	32 KB	LQFP100 (14 x 14 mm)	
TMPM382FSFG **	64 KB	8 KB	QFP64 (14 x 14 mm)	Low-pin-count MCUs with multi-purpose timers designed to control a single-channel half bridge or motor
TMPM382FWFG **	128 KB	12 KB	QFP64 (14 x 14 mm)	
TMPM384FDFG **	512 KB	32 KB	LQFP144 (20 x 20 mm)	High-pin-count MCU with multi-purpose timers designed to control up to four-channel half bridges or a single-channel motor

**: Under development

M390 Group

The 1.8-V low-power mode of the M390 Group makes it ideal for battery-operated applications. The on-chip high-speed, high-accuracy oscillator helps reduce product costs. The M390 Group are available in standard and small packages.

■ Features

- High-performance ARM Cortex™-M3 core: 20-MHz operation (max)
- Toshiba-original NANO FLASH™ memory: Fast programming
- 1.8-V low-power (RTC) mode (1.3 μA typ.)
- Various serial interfaces
- CEC interface and remote control signal preprocessor that remain active even in low-power mode
- On-chip high-speed oscillator (9.91 MHz ± 3% @ 0 to 70°C)
- Oscillation frequency detection (OFD); compliant with the IEC 60730 standard
- Small package (6 x 6 mm TFBGA120)   Note: TMPM395FWAXBG only

■ Application

- Health care equipment
- Game consoles
- AV systems
- Power monitoring devices
- Battery-operated devices
- Remote-controlled equipment

■ System Block Diagram (Digital Video Camera)
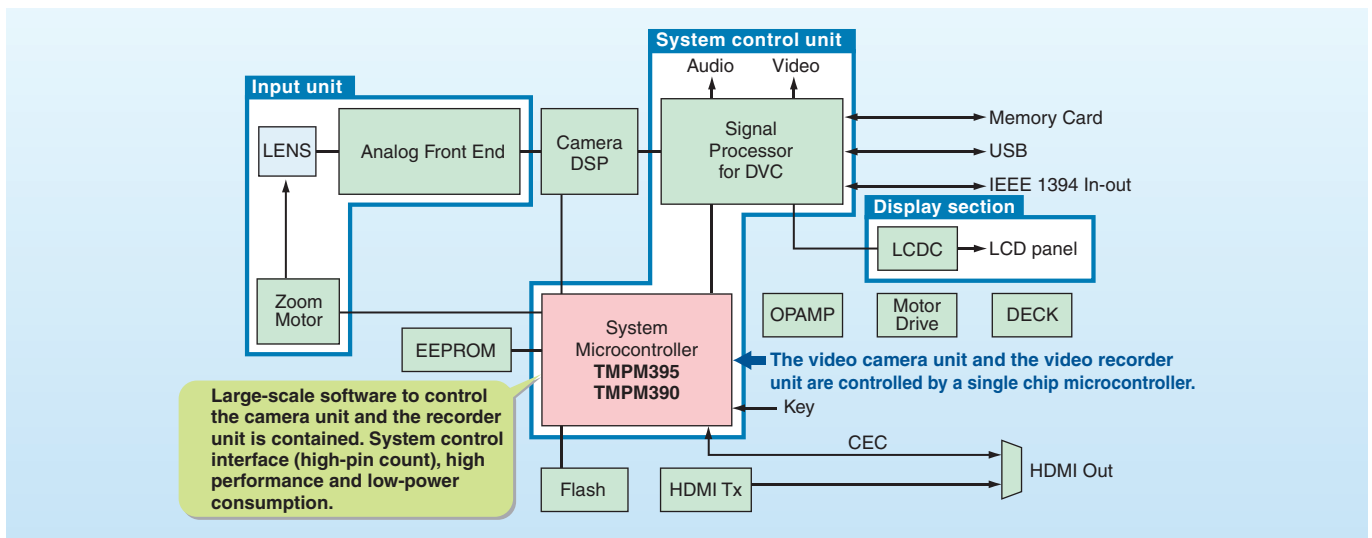
■ Low-Power MCUs

Audiovisual systems must be able to receive Consumer Electronics Control (CEC) commands and remote control signals even when they are off. While the predecessor microcontrollers, the TLCS-900/L1 and TLCS-870/C Series, need to keep these functions in normal operating mode even when off, the M390 Group of microcontrollers can do them in low-power mode at 32.768 kHz, significantly reducing standby power consumption.

MCU Power Consumption When an AV System is in Standby Mode
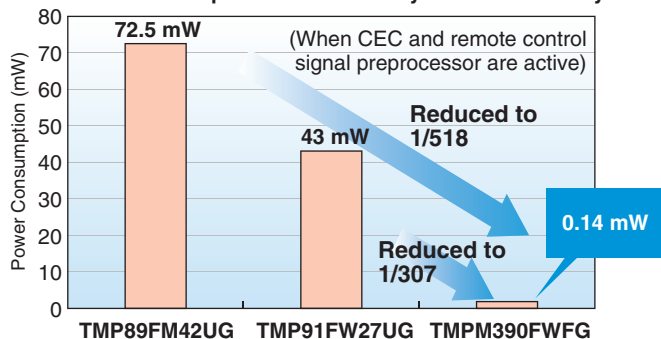
Significant Reduction of Standby Power
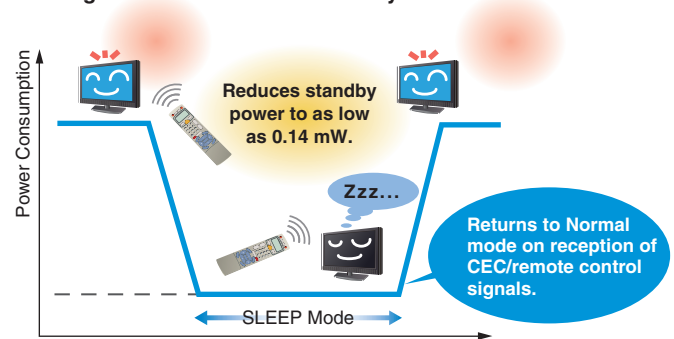
■ Product Lineup

Part Number	ROM (Flash) Size	RAM Size	Package	Features
TMPM390FWFG **	128 KB	8 KB	LQFP100 (14 x 14 mm)	1.8-V low-power (RTC) mode (1.3 μA typ.)
TMPM395FWAXBG	128 KB	8 KB	TFBGA120 (6 x 6 mm)	Housed in a small package. 1.8-V low-power (RTC) mode (1.3 μA typ.)

**: Under development

M350 Group (for Automotive Applications)

The TMPM350FDTFG microcontroller of the M350 Group is specifically designed for automotive applications. The TMPM350FDTFG provides various peripheral functions, such as CAN controllers and AD converters, as well as a Toshiba-original Programmable Motor Driver (PMD).

The TMPM354F10TFG is designed for automotive motor control applications. It contains a Vector Engine (VE) that enables efficient motor control, a Toshiba-original motor controller that supports one-shot pulse control, CAN controllers, and a resolver-to-digital converter (RDC). Additionally, the TMPM354F10TFG offers functional safety features. Because Toshiba's functional safety technology is compliant with ISO 26262, using the TMPM354F10TFG will facilitate certification of your product.

■ Features (TMPM350FDTFG)

● High-performance ARM Cortex™-M3 core: 88-MHz operation (max)
● Motor control circuits
　・Programmable Motor Driver (PMD)
　・12-bit AD converters: 10 ch x 2 units
　・Resolver excitation circuit
● CAN controller: 2 channels (V2.0 B)
● High temperature operation (Ta: 105˚C max)
● Functional safety: Optimized tightly coupled fault supervisors (ISO 26262-compliant)
　Fault supervisors with different algorithms monitor the detailed operation of each block integrated in an MCU. This architecture provides a low-cost, single-CPU solution for functional safety.

■ Features (TMPM354F10TFG)

● High-performance ARM Cortex™-M3 core: 80-MHz operation (max)
● Advanced motor control circuits
　・Advanced Programmable Motor Driver (A-PMD)
　・Vector Engine (VE): The increased hardware computation for motor vector control reduces the CPU workload approx. 50% (compared to the predecessor).
　・One-shot pulse control: Almost the same CPU workload at high rpms as for mid-rpms
　・Resolver-to-digital converter (RDC): Increases design flexibility, reduces system costs and improves noise immunity.
● High-temperature operation (Ta: 125˚C max)
● Functional safety: Optimized tightly coupled fault supervisors (ISO 26262-compliant)
　Fault supervisors with different algorithms monitor the detailed operation of each block integrated in an MCU. This architecture provides a low-cost, single-CPU solution for functional safety.

■ Application

● Electric power steering (EPS) and other automotive control applications

■ Application

● HEV, EV and other automotive control applications

■ Product Lineup

Part Number	ROM (Flash) Size	RAM Size	Package	Features
TMPM350FDTFG **	512 KB	48 KB	LQFP100 (14 x 14 mm)	・ARM Cortex™-M3 plus Toshiba-original Programmable Motor Driver (PMD) ・2-channel CAN controller and 2 units of AD Converter ・Functional safety: Optimized tightly coupled fault supervisors The CAN controllers and the blocks that implement functional safety contain logic specifically designed for automotive applications, making the TMPM350FDTFG suitable for motor applications in safety-related systems such as electronic power steering (EPS).
TMPM354F10TFG **	1 MB	64 KB	LQFP144 (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 ・Toshiba-original Vector Engine ・Reduced part count and improved noise immunity due to the built-in RDC Ideal for motor control applications in HEVs and EVs owing to enhanced motor controllers, angle sensor computation, in-vehicle networking, etc.

**: Under development

M320 Group (for Audio Applications)

The TMPM320C1DFG of the M320 Group incorporates a USB host controller and an SD host controller. Additionally, it has a 1-MB DRAM to process a large amount of data.

The TMPM320C1DFG can be used in tandem with a system MCU and a CD processor to play back music content from USB memory, etc.
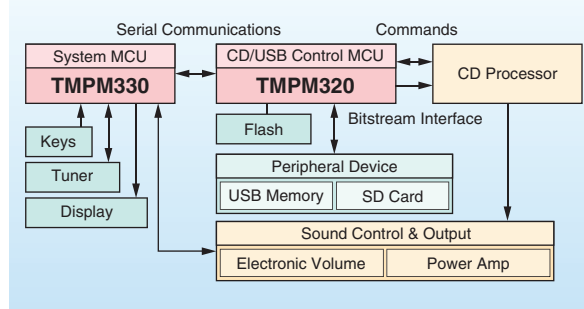
■ Features

- High-performance ARM Cortex™-M3 core: 144-MHz operation (max)
- USB 2.0 host controller (HS/FS)
- SD host controller
- 320-KB SRAM and 1-MB DRAM

■ Application

Car audio systems
Home audio systems

■ System Block Diagram (Car Audio System)

Serial Communications   Commands

System MCU / **TMPM330** ↔ CD/USB Control MCU / **TMPM320** → CD Processor

Keys
Tuner
Display

Flash   Bitstream Interface

Peripheral Device
USB Memory   SD Card

Sound Control & Output
Electronic Volume   Power Amp

■ USB/SD Audio Features

- Music content playback from an USB memory
- Music content playback from an SD card (SDHC and SDXC* supported)
- Quick USB/SD analysis
- PlayList playback*
- Alphabetical sorting
- Supports MP3, WMA, AAC and WAV.

* Enhancements will be added.

■ Product Lineup

Part Number	ROM Size	RAM Size	DRAM Size	Package	Features
TMPM320C1DFG	–	320 KB	1 MB	LQFP144 (20 x 20 mm)	USB host controller (HS/FS) SD host controller DRAM 1 MB

▶ TOSHIBA Semiconductor & Storage Products Company

Website

Right here and now! | Toshiba Semiconductor | **Web Search**

http://www.semicon.toshiba.co.jp/eng/

▶ **Microcomputer web page**

You can find microcontrollers that will best suit your applications.

Find microcontrollers based on applications.

Find microcontrollers based on the core performance.

Find microcontrollers based on functions.

Find development systems.

Information on new products

Development Environment

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

● Third-Party

Legend:
- **S** : Starter kit
- **C** : Compiler
- **D** : Debugger
- **I** : In-circuit emulator
- **R** : Real-time OS
- **M** : Middleware
- **F** : Flash programmer

Worldwide

Vendor	Tools	Vendor	Tools
ARM Ltd. (Keil)	S C D I R M	MINATO ELECTRONICS INC.	F
Atollic AB	C D	Sophia Systems Co., Ltd.	D I F
Elnec s.r.o.	F	Yokogawa Digital Computer Corporation	D I F
IAR Systems	S C D I R F		

Vendor	Tools
ZLG (GUANGZHOU ZHIYUAN ELECTRONICS CO., LTD)	C D I F
HI-LO SYSTEMS ELECTRONICS CO., LTD	F

Vendor	Tools	Vendor	Tools	Vendor	Tools
BITRAN CORPORATION	D I	Falcon Denshi K.K.	F	Kyoto Microcomputer Co., Ltd.	C D I
COMPUTEX CO., LTD.	S D I F	Flash Support Group, Inc.	F	MiSPO Co., Ltd.	R
eForce Co., Ltd.	R	GRAPE SYSTEMS INC.	R M	TOSHIBA INFORMATION SYSTEMES (JAPAN) CORPORATION	R

● Development Systems

Compiler
- ARM Ltd. (Keil)
- IAR Systems

GNU
- Atollic AB
- Kyoto Microcomputer Co., Ltd.
- ZLG (GUANGZHOU ZHIYUAN ELECTRONICS CO., LTD)

Debugger/Emulator
- ARM Ltd. (Keil)
- BITRAN CORPORATION
- COMPUTEX CO., LTD.
- IAR Systems
- Kyoto Microcomputer Co., Ltd.
- Segger
- Sophia Systems Co., Ltd.
- ZLG (GUANGZHOU ZHIYUAN ELECTRONICS CO., LTD)

Partner Vendor	Compiler	Debugger	Emulator
ARM Ltd. (Keil)	MDK-ARM	μVision®	ULINK2®, ULINK® Pro
Atollic AB	TrueStudio		J-LINK (Note 1)
BITRAN CORPORATION	–	Code Stage	JeRana
COMPUTEX CO., LTD.	–	CSIDE®	J-STICK, PALMiCE3, PALMiCE2H
IAR Systems	EWARM (IAR Embedded Workbench for ARM)		J-LINK, J-TRACE
Kyoto Microcomputer Co., Ltd.	exeGCC		ICE PARTNER-Jet
Sophia Systems Co., Ltd.	–	WATCHPOINT	EjSCATT
Yokogawa Digital Computer Corporation	–	microVIEW	Advice Pro, Advice LUNA
ZLG (GUANGZHOU ZHIYUAN ELECTRONICS CO., LTD)	TKStudio		Tkscope emulators

● Real-Time OS

Partner Vendor	Tool
ARM Ltd. (Keil)	RTX Kernel
eForce Co., Ltd.	μC3, μNET3
GRAPE SYSTEMS INC.	ThreadX
IAR Systems	embOS (Note 1), μC/OSII (Note 2)
MiSPO Co., Ltd.	NORTi
TOSHIBA INFORMATION SYSTEMES (JAPAN) CORPORATION	UDEOS4

● Programming Tools

Partner Vendor	On-Board Programming	Off-Board Programming
COMPUTEX CO., LTD.	FP-10	–
Elnec s.r.o.	–	BeeProg2 series
Falcon Denshi K.K.	–	ALL-100AX
Flash Support Group, Inc.	AF9101, AF9103	AF9709C, AF9723B + AF9845B/C
HI-LO SYSTEMS RESEARCH CO., LTD	–	ALL-100A
IAR Systems	Flasher ARM	–
MINATO ELECTRONICS INC.	–	Model1895, Model1895/2, Model1896, Model1940
Yokogawa Digital Computer Corporation	MegaNET IMPRESS	–
ZLG (GUANGZHOU ZHIYUAN ELECTRONICS CO., LTD)	TKScope + K-Flash	SmartPRO programmers

For development tools and vendors that are not described herein, contact your local Toshiba sales representative.
Note 1: SEGGER Microcontroller's product
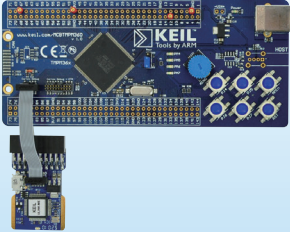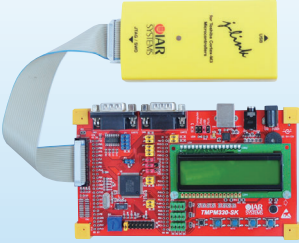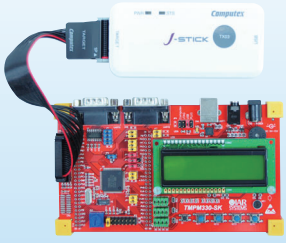Note 2: Micrium's product
* The system and product names listed on this page may be trademarks or registered trademarks of their respective companies.

■ Third-Party Microcontroller Starter and Training Kits

For the ARM core-based TX03 Series, evaluation and training kits are available from third parties. They will come handy for evaluation purposes prior to development.
All the kits come with an evaluation version of the Toshiba integrated development environment* and sample software*, so you can perform all the software development steps from prototyping to evaluation. (*Packaged or downloadable)

KEIL An ARM® Company

ARM Ltd. (Keil)
www.arm.com

<Supported MCUs>
TMPM330 TMPM364 TMPM395
TMPM362 TMPM390

IAR SYSTEMS

IAR Systems
www.iar.com

<Supported MCUs>
TMPM330 TMPM364 TMPM370
TMPM341 TMPM366 TMPM380

Computex

COMPUTEX CO., LTD.
www.computex.co.jp/eg

<Supported MCU>
TMPM330

■ Toshiba Sample Device Drivers

CMSIS COMPLIANT ARM® Cortex™ Microcontroller Software Interface Standard ARM Cortex-M3

You can download standard device drivers for the on-chip peripherals; thus you can focus on the development of application software.

For the supported microcontrollers, visit the Toshiba microcomputer website at:
http://www.semicon.toshiba.co.jp/eng/product/micro/index.html

● CMSIS

Toshiba's microcontrollers with an ARM Cortex™-M3 core is compliant with the Cortex Microcontroller Software Interface Standard (CMSIS) defined by ARM Ltd.
The CMSIS is a software interface standard, which enables consistent and simple software interfaces to the processor for interface peripherals, real-time operating systems, and middleware, simplifying software re-use, and reducing the learning time for new microcontroller developers. Toshiba's sample software and drivers are CMSIS-compliant. ARM Ltd. also offers various CMSIS DSP libraries of sample software as shown at right, which can be downloaded from the onARM website.

onARM website: http://www.onarm.com/

Sample Software Examples

・Vector operations
・Matrix operations
・Complex number operations
・Filter functions
・Control functions
・PID controllers
・Fourier transforms

● Header files, peripheral drivers and sample programs

Toshiba offers a suite of drivers for controlling on-chip peripherals without being concerned about registers.
Toshiba also offers sample programs for on-chip peripherals that combine multiple drivers.

Sample Program Examples

・Reading ADC data from an analog input pin	・I²C master/slave configuration
・Switching between NORMAL and STOP modes	・SSP initialization and self-loopback test
・Generating a sawtooth waveform from the DA pin	・Generating timer interrupts at an interval of 500 ms
・UART initialization and receive/transmit operation using the DMAC	・Generating square-wave forms with variable duty cycles using the PPG
・Reading and writing an SRAM connected to the external bus	・Watchdog timer initialization
・Executing a program out of the on-chip RAM to erase and program the on-chip Flash memory	

● Application Notes

Application notes are provided in the form of sample software in order to help you better understand Toshiba's microcontrollers before you begin product development. You can also use them as a guide when creating software.

Third-Party Development Support Tools

S : Starter kit		**M** : Middleware	
C : Compiler		**V** : Verification tool	
D : Debugger		**F** : Flash programmer	
I : In-circuit emulator		**P** : Flash programming service	
R : Real-time OS		**Di** : Distributor	

For details, please contact the third-party companies directly. (Listed in alphabetical order)

S C D I R M

● ARM Ltd. (Keil) http://www.arm.com/

KEIL™ An ARM® Company

The RealView Microcontroller Development Kit (MDK) is an integrated software development environment for ARM-based microcontrollers. The RealView MDK consists of the ARM RealView Compilation Tools and the Keil μVision IDE, a debugger and simulation environment. It is an easy-to-use yet powerful tool optimized for ARM-based devices.

C D

● Atollic AB http://www.atollic.com/

atollic

The Atollic TrueSTUDIO® is an embedded system tool that will meet your needs for the next 10 years. Built on the ECLIPSE IDE framework, TrueSTUDIO® can be seamlessly integrated with existing embedded systems, improving development productivity and user-friendliness. TrueSTUDIO® provides C/C++, build/debug and simulation tools for the Toshiba TX processors and enables algorithm testing even before a hardware interface is available. Additionally, it supports features that facilitate team collaboration such as migration paths from UML models to software solutions, a version management system and a bug/task database system.

S D I F

● COMPUTEX CO., LTD. http://www.computex.co.jp/eg/

Computex®

Computex manufactures development support systems that assist in debugging embedded software. A seamless development environment is available for the TX03 Series that encompasses everything from evaluation and development to the production phase. The PALMiCE3 JTAG emulators support various target interfaces such as JTAG and ETM. The on-chip flash programmer, FP-10, provides a standalone mode that does not require a host PC and operates at 3 to 5 V. ROMiCEmini supports the TX19A and TLCS-900/H1 Series.

R

● eForce Co., Ltd. http://www.eforce.co.jp/english.html

eForce

eForce is a pure-play embedded software firm dedicated to the development and sales of middleware such as the μITRON-compliant μC3 real-time operating system (RTOS), the compact μNet3 TCP/IP stack and USB. Since its establishment, eForce has focused on ARM microcontrollers, offering the compact μC3/Compact RTOS for the TX03 Series and μC3/Standard for the TX09 Series.

F

● Elnec s.r.o. http://www.elnec.com/

ELNEC

Elnec develops and manufactures universal programmers for engineering and volume production. The company offers high-quality and well-designed products at affordable prices. Most Elnec device programmers include a 3-year warranty. Updates of programmer's software are released according to the customers' needs (in many cases daily) and download of the new software version is available free of charge. For more information, please visit Elnec's website. Elnec supports an extensive range of Toshiba programmable devices and support grows with each version of a new programmer's software.

For details, please contact the third-party companies directly. (Listed in alphabetical order)

F
P
● Flash Support Group, Inc. http://www.j-fsg.co.jp/en/

Flash Support Group

Flash Support Group offers various semiconductor device tools mainly for Flash microcontrollers. The company's product portfolio includes auto programming systems, a wide variety of programmers (covering low-cost on-board programming to development and mass-production programming) and peripheral tools. The programmers support an extensive range of devices including Toshiba's TX19, TLCS-900 and TLCS-870 Families. Speedy and flexible programming services are also available.

V
● GAIO TECHNOLOGY CO., LTD http://www.gaio.com/

Solution House GAIO TECHNOLOGY

Gaio Technology develops and offers tools for improving the quality of embedded software, such as CoverageMaster winAMS, a unit testing tool for embedded software, No. 1 System Simulator that uses a high-speed MPU simulator, and CasePlayer2, a program chart and specification document generation tool. These tools support the latest ARM-based TX03 Series in addition to TX19, TLCS-900 and TLCS-870.

F
● HI-LO SYSTEMS RESEARCH CO., LTD http://www.hilosystems.com.tw/

HI-LO SYSTEMS

The ALL-100A programmer from Hi-Lo Systems has 68 sets of Precise Universal Pin Driver to provide high-speed, low-noise, accurate and reliable programming signals for various IC products including high-speed, low-power devices recently released to the market.
ALL-100A can be set up for either single-site programming for engineering or multi-site programming for production. If required, up to 8 sets of ALL-100A can be set up for multi-set operation so up to 64 sites can be programmed simultaneously to maximize production.
Supporting software for the ARM core-based TX03 Series, TLCS-900/H1 Series, TLCS-870/C1 Series, etc. is available now. Device support on the website for check/retrieve is updated weekly.

S
C
D
I
R
F
● IAR Systems http://www.iar.com/

IAR SYSTEMS

IAR Systems offers an inexpensive evaluation kit for the ARM Cortex™-M3-based TX03 and ARM9-based TX09 Series. The IAR evaluation kit consists of a target board, an integrated development environment (evaluation version), a JTAG in-circuit emulator and ready-to-run sample application programs. You can readily use it for the entire development cycle from device evaluation to application-level prototyping and evaluation. You can save significant time and costs otherwise needed at the onset of development.

C
D
I
● Kyoto Microcomputer Co., Ltd. http://www.kmckk.co.jp/eng/

KMC

As a company specializing in debugger software and in-circuit emulators, Kyoto Microcomputer has been engaged in the improvement of embedded development environments. Its JTAG ICE, "PARTNER-Jet", offers a powerful and efficient debug environment incorporating advanced features ahead of other companies, such as support for multi-core processors and operating systems with an MMU (Linux, Windows CE, T-Engine, etc.) that are recently adopted in high-end embedded environments. PARTNER-Jet supports the TX49 and TX99 Families.

P
● MICROTEK Inc. http://www.microtek.co.jp/english/

MICROTEK

Microtek embarked on contract IC programming in 2000. Since then, the company has been building a successful track record in a wide range of fields, including communications, information home appliances and automotive applications, as a reliable provider of IC programming services.

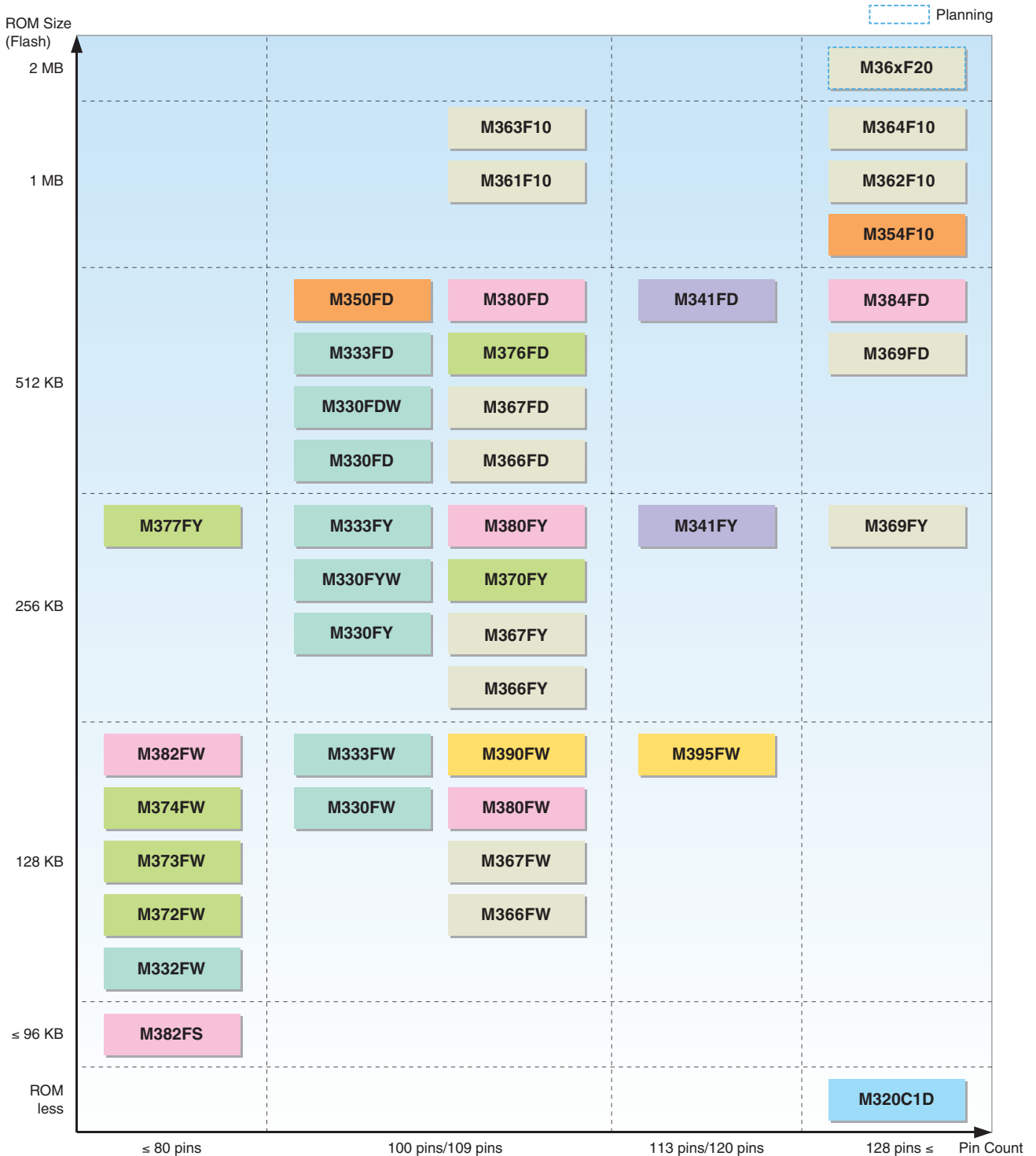| S : Starter kit | M : Middleware |
C : Compiler	V : Verification tool
D : Debugger	F : Flash programmer
I : In-circuit emulator	P : Flash programming service
R : Real-time OS	Di : Distributor

For details, please contact the third-party companies directly. (Listed in alphabetical order)

F
P

● MINATO ELECTRONICS INC.　　　　　　　　　http://www.minato.co.jp/en/

Minato Electronics developed the first "device programmer" in Japan when PROM first came on the market. Since then, the company has been occupying the leading position in the programmer field. Its product line includes not only programmers but also auto programming equipment and exchange adapters for a wide variety of packages to meet various programming needs of customers. Minato's programmers support the ARM-based TX03 series, as well as the TX19, TLCS-900, and TLCS-870 Families. Programming services using these products are also available.

D
I
F
Di

● Sophia Systems Co., Ltd.　　　　　　　　　http://www.sophia-systems.com/

Sophia Systems offers development environments for Toshiba's microcontrollers, such as a starter kit for the TX19A that readily allows software evaluation, a flash programmer for the TX19A and emulators that support microcontrollers with TX19, MeP, Cell Broadband Engine and ARM Cortex cores (M3/A9/R4). Sophia Systems also provides a wide range of solutions using Toshiba's microcontrollers, including turnkey services for custom boards and systems.

R

● TOSHIBA INFORMATION SYSTEMES (JAPAN) CORPORATION　　　http://www.tjsys.co.jp/english/

東芝情報システム株式会社　Toshiba Information Systems develops, sells and offers support services for μITRON-compliant real-time operating systems (RTOS). It offers compact UDEOS4/Cortex-M3 (compliant with μITRON 4.0) for the TX03 Series that operates only with on-chip ROM/RAM and UDEOS4/ARM (compliant with μITRON 4.0), an enhanced version, for the TX09 Series.

D
I
F

● Yokogawa Digital Computer Corporation　　　　　　　http://www.yokogawa-digital.com/en/

YOKOGAWA ◆
Yokogawa Digital Computer Corporation

Yokogawa Digital Computer specializes in embedded solutions and offers an extensive range of products related to the design and development of microcomputer and peripheral systems. Included among its products are the "advice" series of in-circuit emulators, the NET IMPRESS series of flash microcontroller programmers, Windows Embedded CE starter kits and development process improvement tools. Yokogawa provides the ideal development environment by leveraging its experience and expertise.

C
D
I
F

● ZLG (GUANGZHOU ZHIYUAN ELECTRONICS CO., LTD)　　　http://www.embedtools.com/

广州致远电子有限公司　Guangzhou Zhiyuan Electronics founded in May 2001 is engaged in design, production, and sales. It is a member of Field-bus DeviceNet ODVA China. The company has departments dedicated to development in specific fields, including the Industrial Communication Network Department, the Building Automation Department, the Measuring Instrument Technology Department, the Embedded System Application Department, the Power Supply Department, the OEM/ODM Product Department, the Computer Software Development Center, and the Industrial Design Center. The Measuring Technology Department focuses on the design and development of measuring and testing instruments and related development tools. It currently offers over ten types of products, including digital oscilloscopes, logic analyzers, protocol analyzers, digital multimeters, signal generators, universal emulators, and data collection cards. The products are widely applied in electronics design, manufacturing, industrial control, network communication, and scientific research. In accordance with its business philosophy, Guangzhou Zhiyuan Electronics emphasizes a faithful, customer-oriented approach. Proud of its tradition of high quality and excellent service, the company is ready to serve every customer in a spirit of wholehearted cooperation.

Toshiba has been expanding its portfolio of microcontrollers that combine an ARM Cortex™-M3 core, which features high performance, high code density and low power consumption, with a Toshiba-original NANO FLASH™ memory, which features high-speed programming and low power consumption. With Toshiba's wide range of low-cost ARM Cortex™-M3 core-based microcontroller offerings covering 8-bit to 32-bit, you can find the optimum solutions for your applications.

Our product portfolio includes microcontrollers specifically designed for digital TV, digital audio and motor applications, kitchen and home appliances, as well as industrial, office and automotive applications.

ROM Size (Flash)	≤ 80 pins	100 pins/109 pins	113 pins/120 pins	128 pins ≤
2 MB				M36xF20 (Planning)
1 MB		M363F10 / M361F10		M364F10 / M362F10 / M354F10
512 KB		M350FD / M333FD / M330FDW / M330FD	M380FD / M376FD / M367FD / M366FD	M341FD	M384FD / M369FD
256 KB	M377FY	M333FY / M330FYW / M330FY	M380FY / M370FY / M367FY / M366FY	M341FY	M369FY
128 KB	M382FW / M374FW / M373FW / M372FW / M332FW	M333FW / M330FW	M390FW / M380FW / M367FW / M366FW	M395FW	
≤ 96 KB	M382FS			
ROM less				M320C1D

Pin Count →

TX03 Family: TX03 Series

■ Flash Versions

Part Number	ROM (Bytes)	SRAM (Bytes)	Maximum Operating Frequency (MHz)	DMA Controller (Ch)	SSP (Ch)	UART/SIO (Ch)	Full UART (Ch)	I²C (Ch)	I²C/SIO (Ch)	CAN (Ch)	USB Host (Full Speed) (Ch)	USB Dvice (Full Speed) (Ch)	Ether MAC (Ch)	10-Bit AD Converter (Ch)	12-Bit AD Converter (Ch)	10-Bit DA Converter (Ch)	16-Bit Timer/Counter (Ch)	CEC (Ch)	Remote Control Preprocessor (Ch)	Motor Controller (Ch)	Multi-Purpose Timer (MPT) (Ch)	Incremental Encoder Input (Ch)	Op Amp (Ch)	Comparator (Ch)	External Interrupt Pins (Pins)	CS/WAIT Controller (Ch)	RTC (Ch)	Dual Clocks	Trace Function	Oscillation Frequency Detector	Power-On Reset	Voltage Detecting Circuit	I/O Port (Pins)	Power Supply Voltage (V)	Operating Temperature (°C)	Package
TMPM382FSFG **	64K	8K	40	2	1	3			1						10		8	1		(Note 1) 1	1				8		1	Yes	Yes	Yes	Yes	Yes	48	4.0 to 5.5	-40 to 85	QFP64 (14×14 mm)
TMPM372FWUG **	128K	6K	(1) 80 (2) 32			4									11		8				1	1			10				Yes	Yes	Yes	Yes	53	4.5 to 5.5	(1) -40 to 85 (2) -40 to 105	LQFP64 (10×10 mm)
TMPM373FWDUG **	128K	6K	(1) 80 (2) 32			3									7		8				1	1			8					Yes	Yes	Yes	37	4.5 to 5.5	(1) -40 to 85 (2) -40 to 105	LQFP48 (7×7 mm)
TMPM374FWUG	128K	6K	(1) 80 (2) 32			3									6		8				1	1			7					Yes	Yes	Yes	33	4.5 to 5.5	(1) -40 to 85 (2) -40 to 105	LQFP44 (10×10 mm)
TMPM330FWFG	128K	8K	40			3			3					12			10	1	2						8		1	Yes	Yes				78	2.7 to 3.6	-20 to 85	LQFP100 (14×14 mm)
TMPM332FWUG	128K	8K	40			2			2					8			10	1	1						5		1	Yes	Yes				44	2.7 to 3.6	-20 to 85	LQFP64 (10×10 mm)
TMPM333FWFG	128K	8K	40			3			3					12			10								8		1	Yes	Yes				78	2.7 to 3.6	-20 to 85	LQFP100 (14×14 mm)
TMPM390FWFG **	128K	8K	20		1	3		1	1					12			10	1	2						8		1	Yes	Yes	Yes	Yes	Yes	74	1.7 to 3.6	-40 to 85	LQFP100 (14×14 mm)
TMPM395FWAXBG	128K	8K	20		4	3		1	1					12			10	1	2						11		1	Yes	Yes	Yes	Yes	Yes	91	1.7 to 3.6	-40 to 85	TFBGA120 (6×6 mm)
TMPM380FWDFG	128K	12K	40	2	2	5			2						18		8	1		(Note 1) 2	3	2			16		1	Yes	Yes	Yes	Yes	Yes	84	4.0 to 5.5	-40 to 85	QFP100 (14×20 mm)
TMPM380FWFG	128K	12K	40	2	2	5			2						18		8	1		(Note 1) 2	3	2			16		1	Yes	Yes	Yes	Yes	Yes	84	4.0 to 5.5	-40 to 85	LQFP100 (14×14 mm)
TMPM382FWFG **	128K	12K	40	2	1	3			1						10		8	1		(Note 1) 1	1				8		1	Yes	Yes	Yes	Yes	Yes	48	4.0 to 5.5	-40 to 85	QFP64 (14×14 mm)
TMPM366FWFG **	128K	32K	48	4	3	2	1		2	1				12			10								10	2			Yes				74	(Note 2) 2.7 to 3.6	-40 to 85	LQFP100 (14×14 mm)
TMPM366FWXBG **	128K	32K	48	4	3	2	1		2	1				12			10								10	2			Yes				74	(Note 2) 2.7 to 3.6	-40 to 85	TFBGA109 (9×9 mm)
TMPM367FWFG **	128K	50K	80	31	3	4	2		3	1				8		2	8	1		(Note 1) 1	4	1			14	4	1	Yes	Yes	Yes	Yes	Yes	60	(Note 2) 2.7 to 3.6	-40 to 85	LQFP100 (14×14 mm)
TMPM367FWXBG **	128K	50K	80	31	3	4	2		3	1				8		2	8	1		(Note 1) 1	4	1			14	4	1	Yes	Yes	Yes	Yes	Yes	60	(Note 2) 2.7 to 3.6	-40 to 85	TFBGA109 (9×9 mm)

Note 1) The motor controller channel is multiplexed with the multi-purpose timer (MPT).
Note 2) 3.0 to 3.6 V when USB is used.
Note 3) 48 MHz when USB is used.
• All products on this page incorporate a watchdog timer, a clock gear and an on-chip debug unit.
• Contact the Toshiba sales representative for information about RoHS compliance before you purchase any components.
• For detailed product specifications, see appropriate datasheets.

**: Under development

Toshiba 32-bit RISC microcontroller (TX03 series) selection table:

Part Number	ROM (Bytes)	SRAM (Bytes)	Maximum Operating Frequency (MHz)	DMA Controller (Ch)	SSP (Ch)	UART/SIO (Ch)	Full UART (Ch)	I²C (Ch)	I²C/SIO (Ch)	CAN (Ch)	USB Host (Full Speed) (Ch)	USB Dvice (Full Speed) (Ch)	Ether MAC (Ch)	10-Bit AD Converter (Ch)	12-Bit AD Converter (Ch)	10-Bit DA Converter (Ch)	16-Bit Timer/Counter (Ch)	CEC (Ch)	Remote Control Preprocessor (Ch)	Motor Controller (Ch)	Multi-Purpose Timer (MPT) (Ch)	Incremental Encoder Input (Ch)	Op Amp (Ch)	Comparator (Ch)	External Interrupt Pins (Pins)	CS/WAIT Controller (Ch)	RTC (Ch)	Dual Clocks	Trace Function	Oscillation Frequency Detector	Power-On Reset	Voltage Detecting Circuit	I/O Port (Pins)	Power Supply Voltage (V)	Operating Temperature (°C)	Package
TMPM370FYDFG	256K	10K	80			4									22		8			2		2	4	4	16				Yes	Yes	Yes	Yes	76	4.5 to 5.5	-40 to 85	QFP100 (14×20 mm)
TMPM370FYFG	256K	10K	80			4									22		8			2		2	4	4	16				Yes	Yes	Yes	Yes	76	4.5 to 5.5	-40 to 85	LQFP100 (14×14 mm)
TMPM330FYFG	256K	16K	40			3			3					12			10	1	2						8		1	Yes	Yes				78	2.7 to 3.6	-20 to 85	LQFP100 (14×14 mm)
TMPM330FYWFG	256K	16K	40			3			3					12			10	1	2						8		1	Yes	Yes				78	2.7 to 3.6	-40 to 85	LQFP100 (14×14 mm)
TMPM333FYFG	256K	16K	40			3			3					12			10								8		1	Yes	Yes				78	2.7 to 3.6	-20 to 85	LQFP100 (14×14 mm)
TMPM377FYDFG **	256K	16K	80			3			1						11		8			2		2			5				Yes	Yes	Yes	Yes	63	4.5 to 5.5	-40 to 85	LQFP80 (14×14 mm)
TMPM377FYFG **	256K	16K	80			3			1						11		8			2		2			5				Yes	Yes	Yes	Yes	63	4.5 to 5.5	-40 to 85	LQFP80 (12×12 mm)
TMPM380FYDFG	256K	16K	40	2	2	5			2						18		8	1		2 (Note 1)	3	2			16		1	Yes	Yes	Yes	Yes	Yes	84	4.0 to 5.5	-40 to 85	QFP100 (14×20 mm)
TMPM380FYFG	256K	16K	40	2	2	5			2						18		8	1		2 (Note 1)	3	2			16		1	Yes	Yes	Yes	Yes	Yes	84	4.0 to 5.5	-40 to 85	LQFP100 (14×14 mm)
TMPM341FYXBG **	256K	32K	54	4	1	5			2					15		2	12								12	2			Yes	Yes			86	(Note 4) 1.65 to 3.6	-40 to 85	TFBGA113 (6×6 mm)
TMPM366FYFG	256K	48K	48	4	3	2	1		2	1				12			10								10	2			Yes				74	2.7 to 3.6	-40 to 85	LQFP100 (14×14 mm)
TMPM366FYXBG	256K	48K	48	4	3	2	1		2	1				12			10								10	2			Yes				74	2.7 to 3.6	-40 to 85	TFBGA109 (9×9 mm)
TMPM367FYFG **	256K	66K	80	31	3	4	2		3	1				8		2	8	1		1 (Note 1)	4	1			14	4	1		Yes	Yes	Yes	Yes	60	(Note 2) 2.7 to 3.6	-40 to 85	LQFP100 (14×14 mm)
TMPM367FYXBG **	256K	66K	80	31	3	4	2		3	1				8		2	8	1		1 (Note 1)	4	1			14	4	1		Yes	Yes	Yes	Yes	60	(Note 2) 2.7 to 3.6	-40 to 85	TFBGA109 (9×9 mm)
TMPM369FYFG **	256K	66K	80	31	3	4	2		3	1	1	1	1	16		2	8	1		2 (Note 1)	4	2			16	4	1		Yes	Yes	Yes	Yes	102	(Note 2) 2.7 to 3.6	-40 to 85	LQFP144 (20×20 mm)
TMPM369FYXBG **	256K	66K	80	31	3	4	2		3	1	1	1	1	16		2	8	1		2 (Note 1)	4	2			16	4	1		Yes	Yes	Yes	Yes	102	(Note 2) 2.7 to 3.6	-40 to 85	TFBGA177 (11×11 mm)
TMPM330FDFG	512K	32K	40			3			3					12			10	1	2						8		1	Yes	Yes				78	2.7 to 3.6	-20 to 85	LQFP100 (14×14 mm)
TMPM330FDWFG	512K	32K	40			3			3					12			10	1	2						8		1	Yes	Yes				78	2.7 to 3.6	-40 to 85	LQFP100 (14×14 mm)
TMPM333FDFG	512K	32K	40			3			3					12			10								8		1	Yes	Yes				78	2.7 to 3.6	-20 to 85	LQFP100 (14×14 mm)
TMPM341FDXBG	512K	32K	54	4	1	5			2					15		2	12								12	2			Yes	Yes			86	(Note 4) 1.65 to 3.6	-40 to 85	TFBGA113 (6×6 mm)
TMPM376FDDFG **	512K	64K	80			4			1						22		8			2		2			16				Yes	Yes	Yes	Yes	82	4.5 to 5.5	-40 to 85	QFP100 (14×20 mm)
TMPM376FDFG **	512K	64K	80			4			1						22		8			2		2			16				Yes	Yes	Yes	Yes	82	4.5 to 5.5	-40 to 85	LQFP100 (14×14 mm)
TMPM366FDFG	512K	64K	48	4	3	2	1		2	1				12			10								10	2			Yes				74	2.7 to 3.6	-40 to 85	LQFP100 (14×14 mm)
TMPM366FDXBG	512K	64K	48	4	3	2	1		2	1				12			10								10	2			Yes				74	2.7 to 3.6	-40 to 85	TFBGA109 (9×9 mm)
TMPM367FDFG **	512K	128K	80	31	3	4	2		3	1				8		2	8	1		1 (Note 1)	4	1			14	4	1		Yes	Yes	Yes	Yes	60	(Note 2) 2.7 to 3.6	-40 to 85	LQFP100 (14×14 mm)
TMPM367FDXBG **	512K	128K	80	31	3	4	2		3	1				8		2	8	1		1 (Note 1)	4	1			14	4	1		Yes	Yes	Yes	Yes	60	(Note 2) 2.7 to 3.6	-40 to 85	TFBGA109 (9×9 mm)
TMPM369FDFG **	512K	128K	80	31	3	4	2		3	1	1	1	1	16		2	8	1		2 (Note 1)	4	2			16	4	1		Yes	Yes	Yes	Yes	102	(Note 2) 2.7 to 3.6	-40 to 85	LQFP144 (20×20 mm)
TMPM369FDXBG **	512K	128K	80	31	3	4	2		3	1	1	1	1	16		2	8	1		2 (Note 1)	4	2			16	4	1		Yes	Yes	Yes	Yes	102	(Note 2) 2.7 to 3.6	-40 to 85	TFBGA177 (11×11 mm)

Note 1) The motor controller channel is multiplexed with the multi-purpose timer (MPT).
Note 2) 3.0 to 3.6 V when USB is used.
Note 3) 48 MHz when USB is used.
Note 4) Part of the peripheral blocks (external bus interface and SSP) can continue to operate even when the supply voltage drops below 2.7 V.
• All products on this page incorporate a watchdog timer, a clock gear and an on-chip debug unit.
• Contact the Toshiba sales representative for information about RoHS compliance before you purchase any components.
• For detailed product specifications, see appropriate datasheets.

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TX03 Family: TX03 Series

Flash Versions (Continued)

Part Number	ROM (Bytes)	SRAM (Bytes)	Maximum Operating Frequency (MHz)	DMA Controller (Ch)	SSP (Ch)	UART/SIO (Ch)	Full UART (Ch)	I²C (Ch)	I²C/SIO (Ch)	CAN (Ch)	USB Host (Full Speed) (Ch)	USB Dvice (Full Speed) (Ch)	Ether MAC (Ch)	10-Bit AD Converter (Ch)	12-Bit AD Converter (Ch)	10-Bit DA Converter (Ch)	16-Bit Timer/Counter (Ch)	CEC (Ch)	Remote Control Preprocessor (Ch)	Motor Controller (Ch)	Multi-Purpose Timer (MPT) (Ch)	Incremental Encoder Input (Ch)	Op Amp (Ch)	Comparator (Ch)	External Interrupt Pins (Pins)	CS/WAIT Controller (Ch)	RTC (Ch)	Dual Clocks	Trace Function	Oscillation Frequency Detector	Power-On Reset	Voltage Detecting Circuit	I/O Port (Pins)	Power Supply Voltage (V)	Operating Temperature (°C)	Package
TMPM380FDFG **	512K	32K	40	2	2	5			2						18		8		1	(Note 1) 2	3	2			16		1	Yes	Yes	Yes	Yes	Yes	84	4.0 to 5.5	-40 to 85	LQFP100 (14×14 mm)
TMPM384FDFG **	512K	32K	40	2	2	5			2						22		8		1	(Note 1) 2	4	2			16		1	Yes	Yes	Yes	Yes	Yes	84	4.0 to 5.5	-40 to 85	LQFP144 (20×20 mm)
TMPM361F10FG	1024K	64K	64	2	1	5	1		3					8			16	1	1						10	4	1	Yes	Yes				76	2.7 to 3.6	-20 to 85	LQFP100 (14×14 mm)
TMPM362F10FG	1024K	64K	64	2	1	12			5					16			16	1	2						16	4	1	Yes	Yes				120	2.7 to 3.6	-20 to 85	LQFP144 (20×20 mm)
TMPM363F10FG	1024K	64K	(Note 3) 64	2	1	5	1		3		1	1		8			16	1	1						8	4	1	Yes	Yes				74	(Note 2) 2.7 to 3.6	-40 to 85	LQFP100 (14×14 mm)
TMPM364F10FG	1024K	64K	(Note 3) 64	2	1	12			5		1	1		16			16	1	2						14	4	1	Yes	Yes				118	2.7 to 3.6	-40 to 85	LQFP144 (20×20 mm)

Note 1) The motor controller channel is multiplexed with the multi-purpose timer (MPT).
Note 2) 3.0 to 3.6 V when USB is used.
Note 3) 48 MHz when USB is used.
• All products on this page incorporate a watchdog timer, a clock gear and an on-chip debug unit.
• Contact the Toshiba sales representative for information about RoHS compliance before you purchase any components.
• For detailed product specifications, see appropriate datasheets.

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TX03 Family: TX03 Series (for Audio Applications)

ROM Less Versions

Part Number	ROM (Bytes)	SRAM (Bytes)	DRAM (Bytes)	Maximum Operating Frequency (MHz)	DMA Controller (Ch)	USB Host (High Speed) (Ch)	SD Host Controller (Ch)	SSP (SPI/MicroWire) (Ch)	UART (Ch)	I²C (Ch)	10-Bit AD Converter (Ch)	16-Bit Timer/Counter (Ch)	External Interrupt Pins (Pins)	Watchdog Timer	Static Memory Controller (Ch)	On-Chip Debug Unit	Trace Function	I/O Port (Pins)	Power Supply Voltage (V)	Operating Temperature (°C)	Package
TMPM320C1DFG	NA	320K	1024K	144	8	1	1	4	4	2	4	8	4	Yes	2	Yes	Yes	55	(Note 1)	-40 to 85	LQFP144 (20×20 mm)

Note 1) The following three power supplies are available:
    (1) For general port, AD converter: 3.0 V to 3.6 V
    (2) For USB: 3.15 V to 3.45 V
    (3) For internal circuitry: 1.1 V to 1.3 V
• Contact the Toshiba sales representative for information about RoHS compliance before you purchase any components.
• For detailed product specifications, see appropriate datasheets.

TX03 Family: TX03 Series (for Automotive Applications)

Flash Versions

Part Number	ROM (Bytes)	SRAM (Bytes)	Maximum Operating Frequency (MHz)	CAN (Ch)	DMA Controller (Ch)	SEI (Ch)	UART/SIO (Ch)	12-Bit AD Converter (Ch)	Timer/Compare (32 bit) (Ch)	Timer/Capture (32 bit) (Ch)	PWM (24 bit)	Motor Controller (Ch)	Resolver Digital Converter (RDC)	External Interrupt Pins (Pins)	Watchdog Timer	On-Chip Debug Unit	Trace Function	I/O Port (Pins)	Power Supply Voltage (V)	Operating Temperature (°C)	Package
TMPM350FDTFG **	512K	48K	88	2	32	1	2	20	7	1	6	1		(Note 1) 1	Yes	Yes	Yes	43	4.5 to 5.5	-40 to 105	LQFP100 (14×14 mm)
TMPM354F10TFG **	1024K	64K	80	3	64	2	3	21	5	2	4	1	1	(Note 1) 1	Yes	Yes	Yes	56	4.5 to 5.5	-40 to 125	LQFP144 (20×20 mm)

Note 1) The seven capture inputs of the timer can be programmed as external maskable interrupts.
• Contact the Toshiba sales representative for information about RoHS compliance before you purchase any components.
• For detailed product specifications, see appropriate datasheets.

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