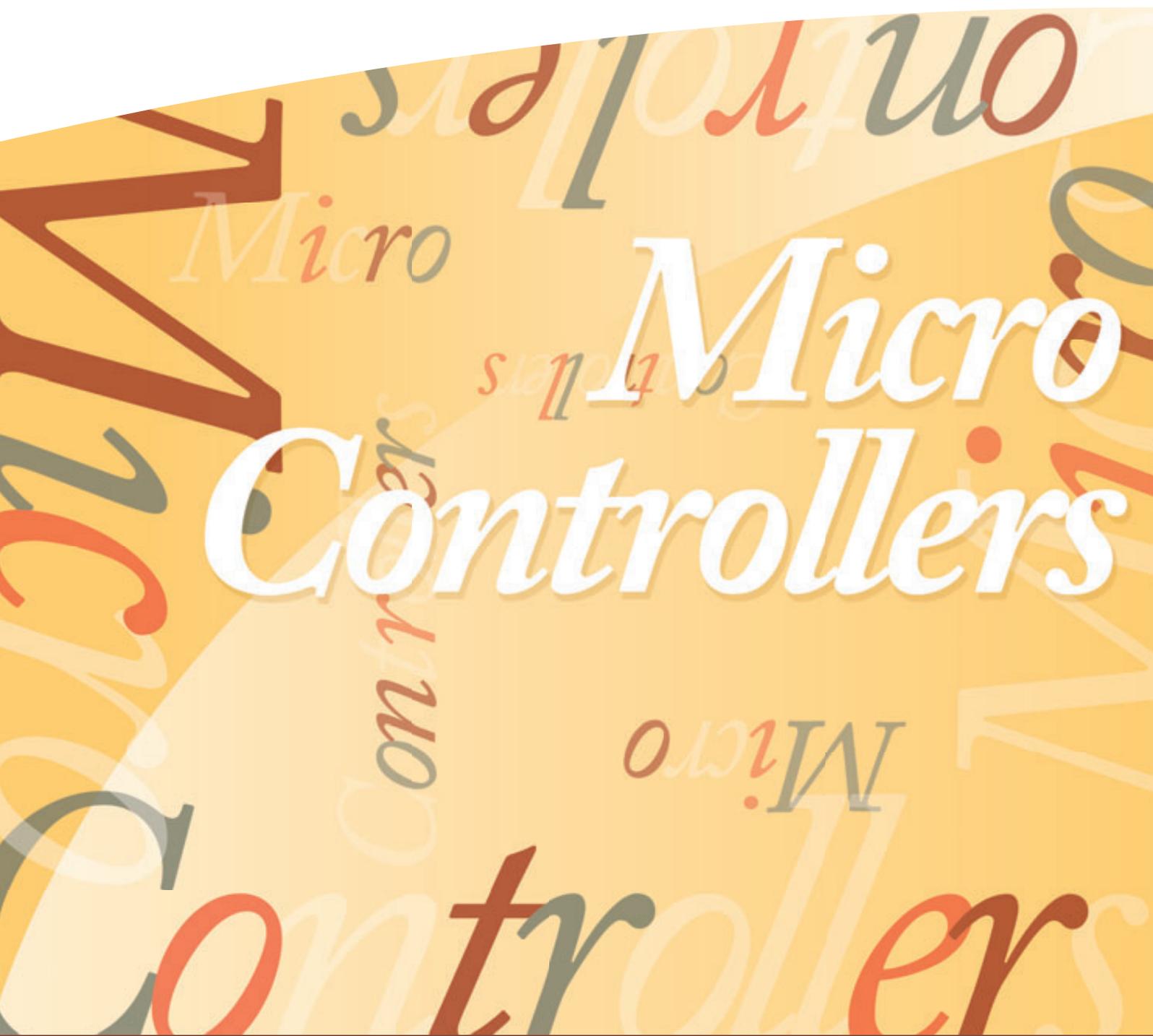


TOSHIBA

Leading Innovation >>>

Semiconductor Catalog Oct. 2013

TX00/TX03/TX04 Series
32-Bit Microcontrollers



Micro
Micro
Controllers
Controllers
Micro
Controller

SEMICONDUCTOR & STORAGE PRODUCTS

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

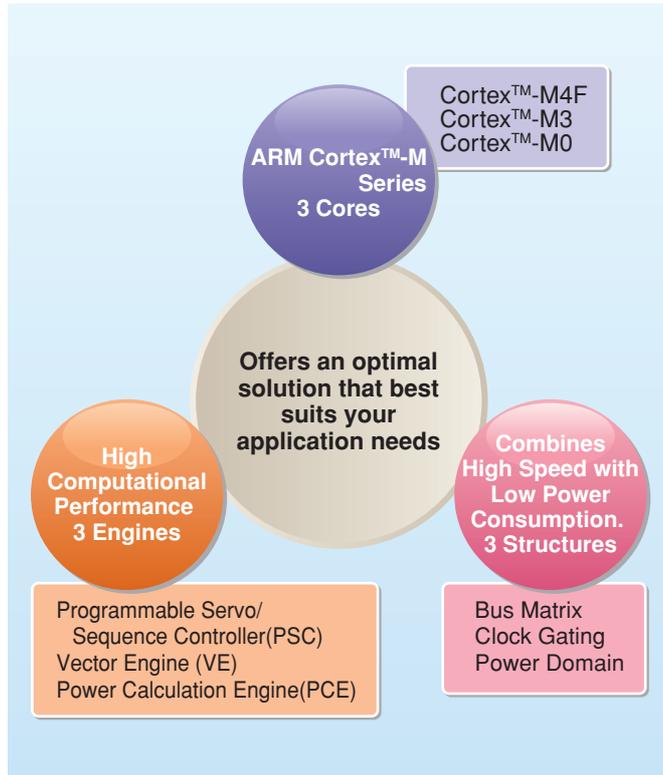
Toshiba's ARM Core-Based Microcontrollers

ARM Core-Based Microcontrollers Proven in the Global Market

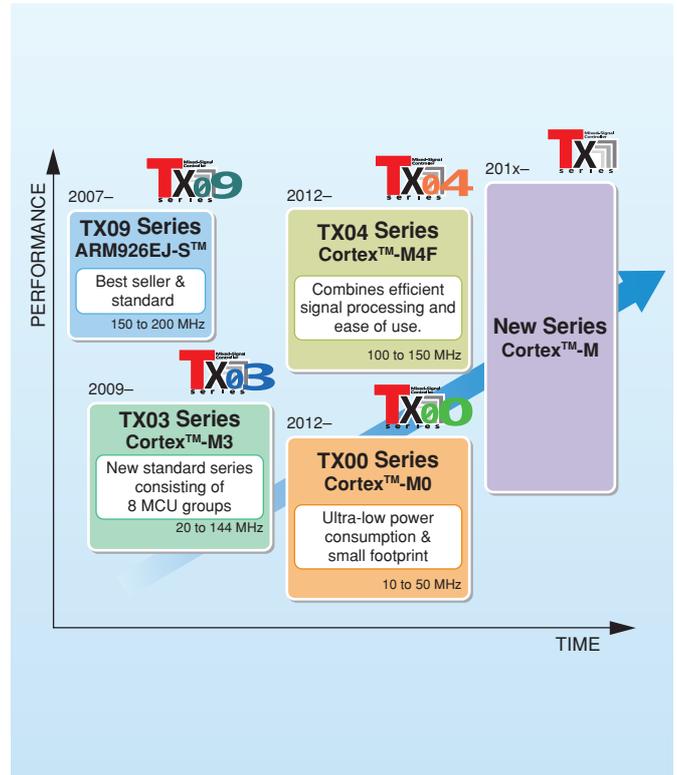
Microcontrollers with an ARM core are becoming increasingly popular not only for cell phone applications but also for general-purpose applications.

In addition to its TX03 series with ARM Cortex™-M3 core, Toshiba now offers new product lineups-the TX00 series, which incorporates an ARM Cortex™-M0 core and the TX04 series, which incorporates an ARM Cortex™-M4F core. Based on the CPU core manufactured by ARM Ltd., the product groups are mixed signal controllers that combine a broad spectrum of peripheral IPs fully utilizing analog technology unique to Toshiba.

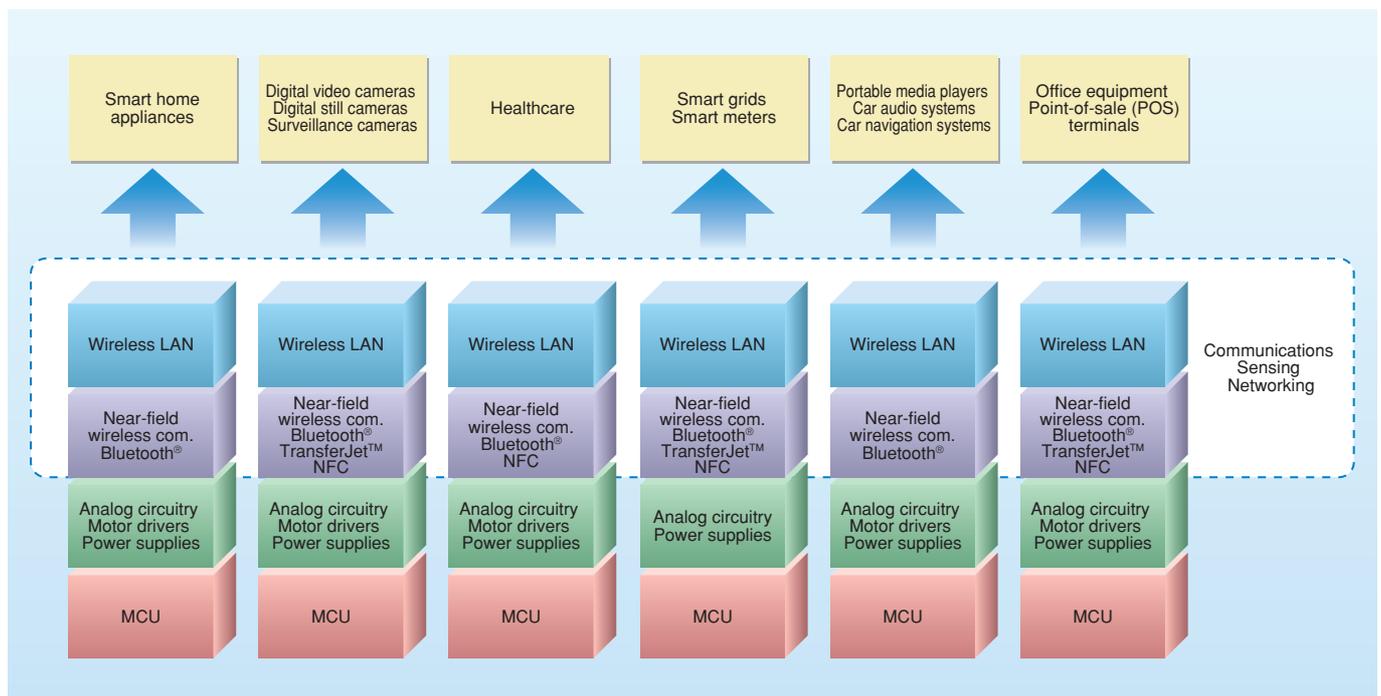
TX00, TX03 and TX04 Microcontrollers Series



Roadmap for ARM Core-Based Microcontrollers

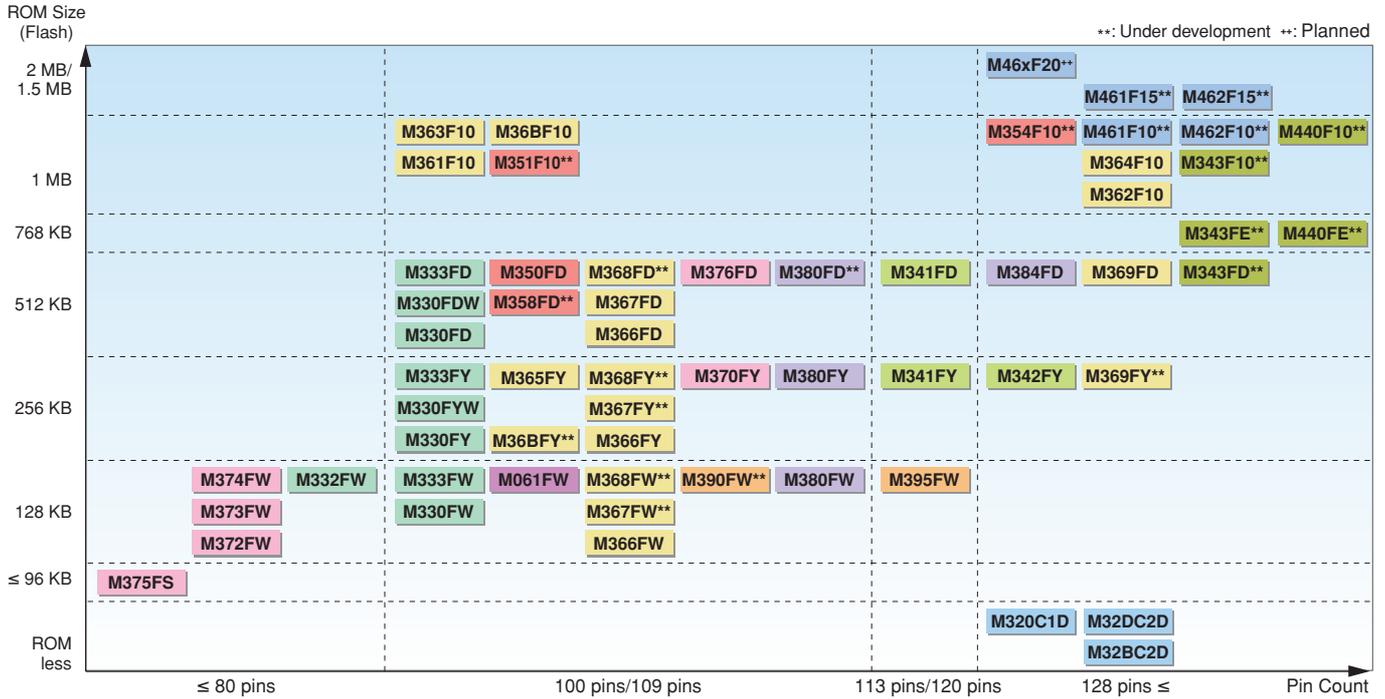


Extensive Applications Supported by Toshiba's ARM Core-Based Microcontrollers



This catalog contains the latest information available as of September 20, 2013.

Toshiba's ARM Cortex™-M0/M3/M4F Core-Based Microcontroller Lineup



Added Functions

	M440 Group	M460 Group	M060 Group	M320 Group	M330 Group	M340 Group	M350 Group	M360 Group	M370 Group	M380 Group	M390 Group
Programmable motor driver							•	•	•	•	
Vector Engine (VE)							•		•		
PSC(i)	•					•					
Power calculation engine (PCE)			•								
Op amp/Comparator									•		
CEC(ii)		•			•			•			•
Remote control preprocessor		•			•			•		•	•
I ² S (Inter-IC Sound)				•							
USB				•				•			
EtherMAC								•			
CAN				•			•	•			
ESIO	•										
High-resolution PPG						•					
Multi-purpose timer		•						•		•	
External bus interface	•	•		•		•		•			
Oscillation frequency detector (OFD)		•				•		•	•	•	•
ΔΣ AD converter			•			•					
LCD driver			•								
JTAG boundary scan	•	•				•		•			

(i)PSC: Programmable Servo/Sequence Controller

(ii)CEC: Consumer Electronic Control

There are microcontrollers that do not contain some of the peripherals shown. For details, see appropriate datasheets.

Note

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

•NANO FLASH is a trademark of Toshiba Corporation.

•ARM, ARM926EJ-S, Cortex and Thumb are trademarks or registered trademarks of ARM Limited in the EU and other countries.

•Bluetooth is a registered trademark owned by Bluetooth SIG, Inc. and any use of such marks by Toshiba is under license.

•TransferJet is a trademark of Sony Corporation.

•ZigBee is a registered trademark of ZigBee Alliance, Inc.

CONTENTS

Toshiba's ARM Core-Based Microcontrollers.....	2	TX03 Series M370 Group.....	12
TX04 Series/TX00 Series.....	4	TX03 Series M380 Group.....	14
TX03 Series.....	5	TX03 Series M390 Group.....	15
TX04 Series M440 Group.....	6	TX03 Series M320 Group(for Audio Applications).....	16
TX04 Series M460 Group.....	6	TX03 Series M350 Group(for Automotive Applications)...	16
TX00 Series M060 Group.....	7	Development Environment.....	17
TX03 Series M330 Group.....	8	Toshiba Microcomputer web page.....	23
TX03 Series M340 Group.....	9	Toshiba's ARM Core-Based Microcontroller Lineup.....	24
TX03 Series M360 Group.....	10		

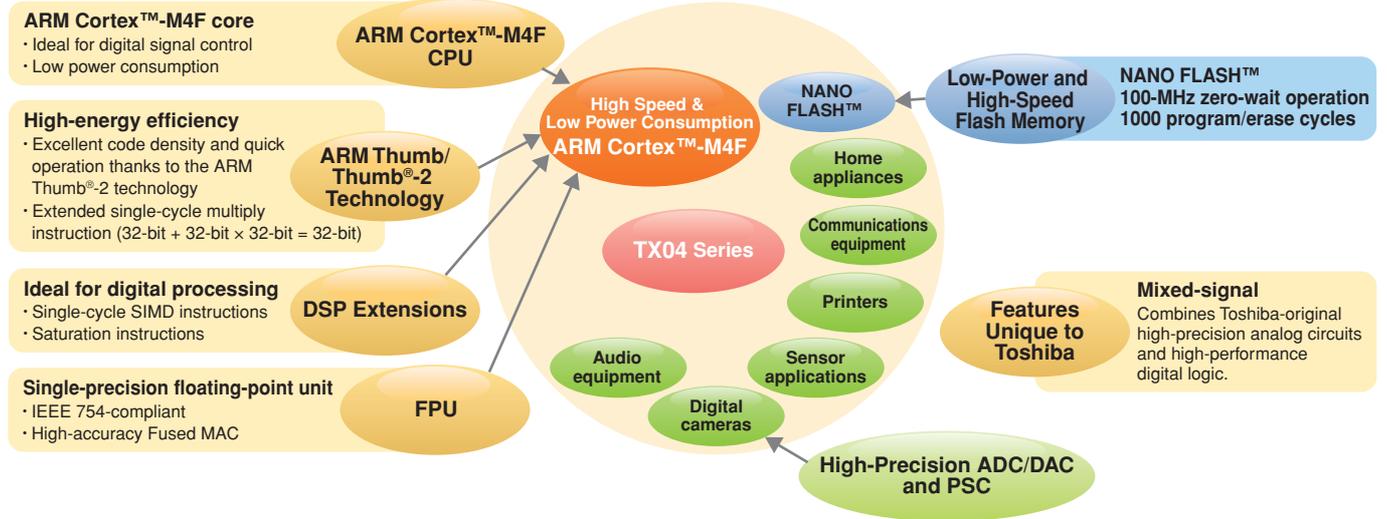
TX04 Series/TX00 Series

Microcontrollers with ARM Cortex™-M4F/M0 Core

Features of the TX04 Series

The ARM Cortex™-M4F core-based TX04 Series supports the Thumb®-2 and Thumb® instruction sets and provides DSP extensions and a floating-point unit (FPU) in order to deliver high energy efficiency. The TX04 Series includes microcontrollers that also integrate a selection of peripheral circuits such as high-speed NANO FLASH™-100 and high-performance coprocessors, making them ideal for high-speed data processing.

M440/M460 Group NEW



M440 Group

- Features

 - Programmable servo/sequence controller (PSC)

- Application examples

 - Digital single-lens reflex camera, digital video camera and other applications

M460 Group

- Features

 - Large-capacity memory

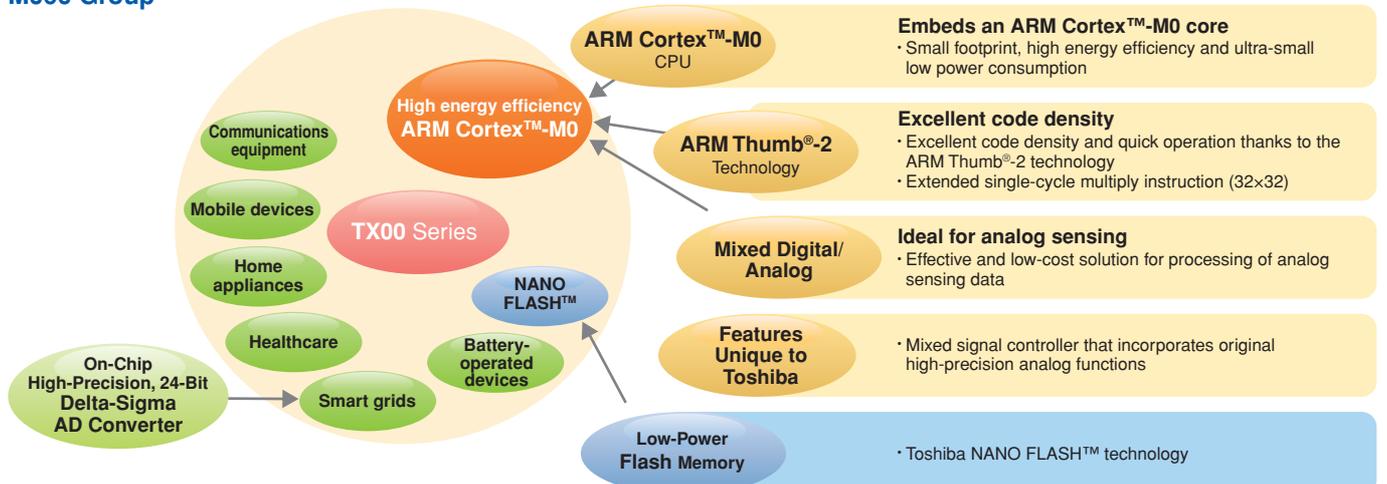
- Application examples

 - Printers, AV systems, industrial equipment and other applications

Features of the TX00 Series

The TX00 Series contains an ARM Cortex™-M0 core on-chip, and like the TX03 Series, offers the Thumb® instruction set. The Thumb®-2 technology extends the limited 16-bit instruction set of Thumb® with additional 32-bit instructions and thus provides excellent code density. This in turn leads to high energy efficiency. Additionally, the TX00 Series incorporates Toshiba-original high-precision analog functions. It is ideal for healthcare, energy measurement and portable applications.

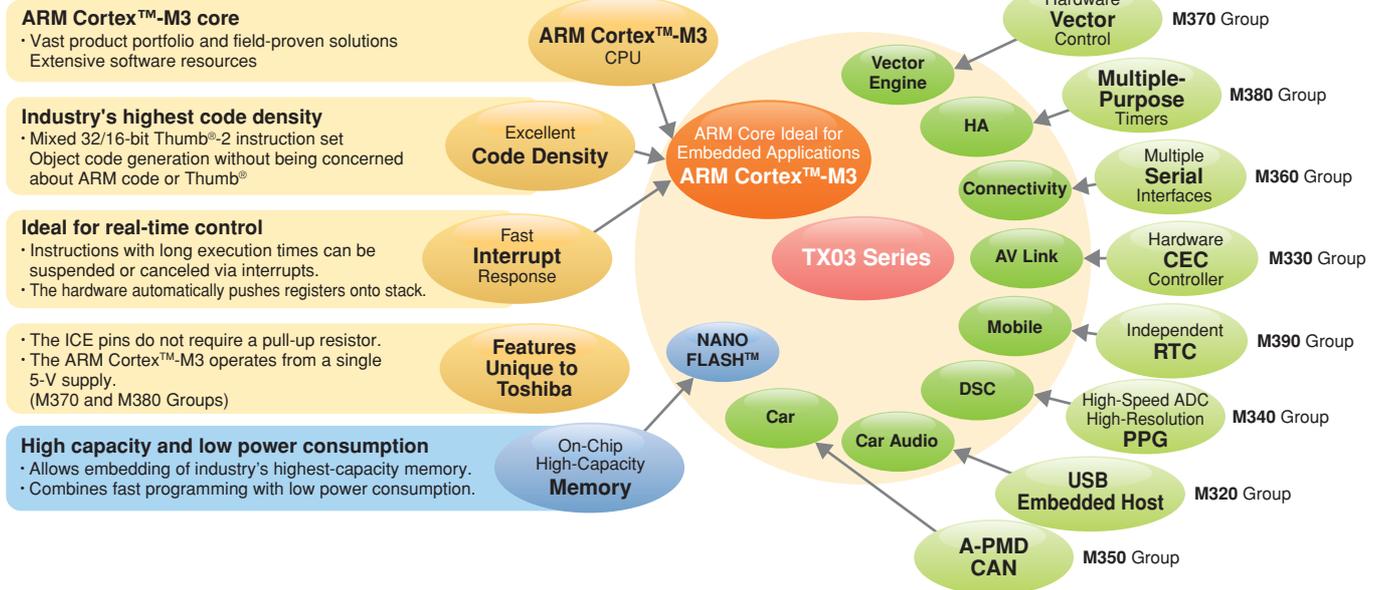
M060 Group



TX03 Series

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.



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

M320 Group (USB Embedded Host) <ul style="list-style-type: none"> Features: USB Embedded Host, System solutions that combine a MCU and an audio DSP Application examples: Car and home audio systems 	M330 Group (Power-saving modes, CEC controller) <ul style="list-style-type: none"> 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) <ul style="list-style-type: none"> 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) <ul style="list-style-type: none"> Features: Large-capacity Flash memory, Up to 7 communication interfaces (SIO, I²C, SPI, UART, CAN, USB, EtherMAC), Programmable Motor Driver (PMD) Application examples: Printers, AV systems, digital appliances, PC peripherals, industrial equipment, networking equipment, office equipment 	M390 Group (1.8-V operation) <ul style="list-style-type: none"> 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 	

Automotive Applications

M350 Group (Automotive Applications) <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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

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

M370 Group (On-chip vector engine) <ul style="list-style-type: none"> Features: Toshiba-original vector engine (VE), Single 5-V supply operation with high market demands, System solutions that combine an MCU with motor drivers Application examples: Washing machines, air conditioners, refrigerators, heat pumps, inverter-motor-controlled equipment 	M380 Group (Multi-purpose timers for IGBT control) <ul style="list-style-type: none"> 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
--	--

Note 1: There are microcontrollers that do not contain some of the peripherals shown. For details, see appropriate datasheets.

TX04 Series M440 Group

The M440 Group of microcontrollers are ideal for digital video camera and digital single-lens reflex camera applications. They incorporate analog circuits required for lens and system control. The high-performance ARM Cortex™-M4F core provides high-speed computation functionality. Additionally, Toshiba-original coprocessor PSC(Programmable Servo/Sequence Controller) helps to improve system performance and reduce the CPU workload through parallel processing.

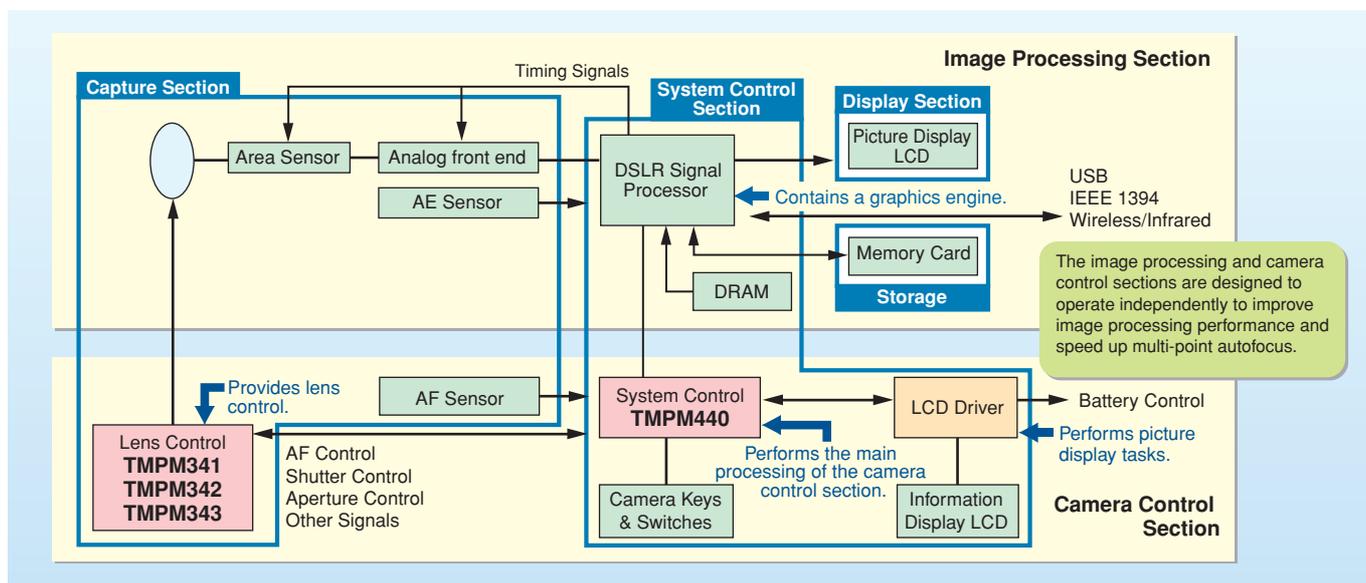
Features

- High-performance ARM Cortex™-M4F core: 100-MHz operation (max)
- Improved performance thanks to multiple computing units (MAC, FPU, PSC)
- Toshiba-original NANO FLASH™-100: 100-MHz operation with zero wait states, small block size support
- Various serial interface channels suitable for communications with multiple timers and sensors
- High-speed, high-accuracy 12-bit AD converter; 10-bit DA converter
- 228 I/O pins

Applications

- Digital video cameras
- Digital single-lens reflex cameras
- Home appliances
- Audio equipment
- Sensor applications
- Printers
- Communications equipment

System Block Diagram (Digital single-lens reflex camera)



Product Lineup

Part Number	ROM (Flash) Size	RAM Size	Package	Features
TMPM440FEXBG **	768 KB	64 KB + 16 KB	VFBGA289 (11 x 11 mm)	100 MHz No Wait Flash (NANO FLASH™-100) Programmable Servo/Sequence Controller (PSC) 12-bit AD converter, 10-bit DA converter Enhanced serial interface I/O (ESIO) Key matrix scanning (KSCAN)
TMPM440F10XBG **	1024 KB	64 KB + 16 KB	VFBGA289 (11 x 11 mm)	

** : Under development

TX04 Series M460 Group

NEW

The M460 Group of microcontrollers are best suited to applications such as printers, AV systems and industrial equipment.

Product Lineup

Part Number	ROM (Flash) Size	RAM Size	Package	Features
TMPM461F10FG **	1 MB	193 KB	LQFP144	High-performance ARM Cortex™-M4F core: 120-MHz operation (max) Large-capacity memory Multi-purpose timer (MPT)
TMPM461F15FG **	1.5 MB	193 KB		
TMPM462F10FG **/XBG **	1 MB	193 KB	LQFP176/TFBGA189	
TMPM462F15FG **/XBG **	1.5 MB	193 KB		

** : Under development

TX00 Series M060 Group

The TPM061FWFG of the M060 Group is a microcontroller with a Cortex™-M0 core specifically designed for smart metering applications. It contains a Toshiba-original 24-bit delta-sigma AD converter and a power calculation engine for high-accuracy electricity metering.

The Cortex™-M0 core provides high computational performance and low power consumption, but its cost is as low as that of conventional 8-bit and 16-bit microcontrollers. Moreover, the Cortex™-M0 core is supported by extensive software resources and an integrated development environment. This also helps to reduce non-recurring engineering (NRE) costs.

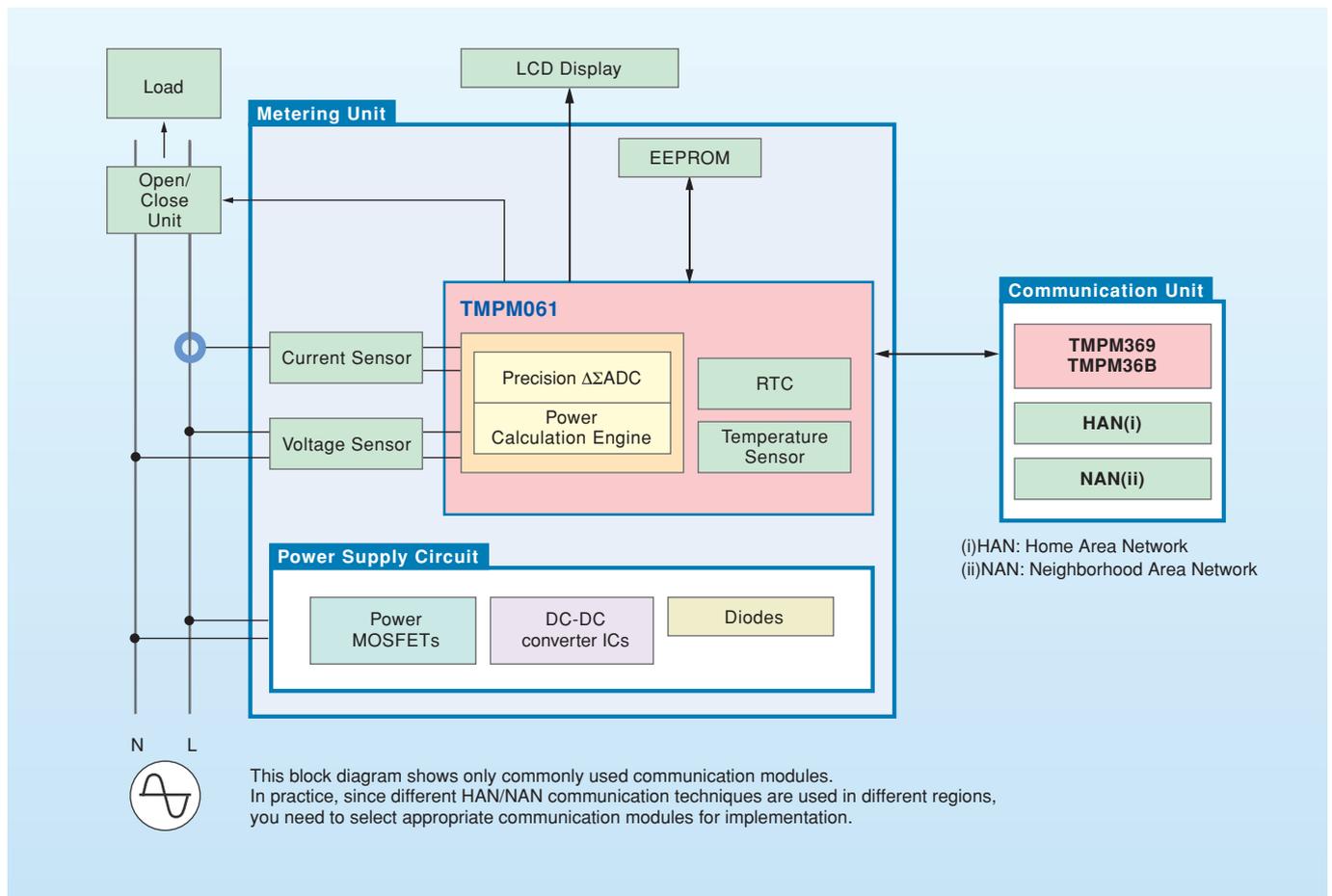
Features

- High-performance ARM Cortex™-M0 core: 16-MHz operation (max)
- Toshiba-original NANO FLASH™ memory: Fast programming
- 24-bit delta-sigma AD converter
- LCD driver
- Power calculation engine
- Real-time clock (RTC)
- Temperature sensor

Applications

- Smart meters
- HEMS equipment
- Monitoring of power inside equipment
- Measuring instruments
- Healthcare products

System Block Diagram (Smart meters)



Product Lineup

Part Number	ROM (Flash) Size	RAM Size	Package	Features
TPM061FWFG	128 KB	8 KB	LQFP100 (14 x 14 mm)	24-bit delta-sigma AD converter LCD driver Power calculation engine Real-time clock (RTC) Temperature sensor

TX03 Series 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.

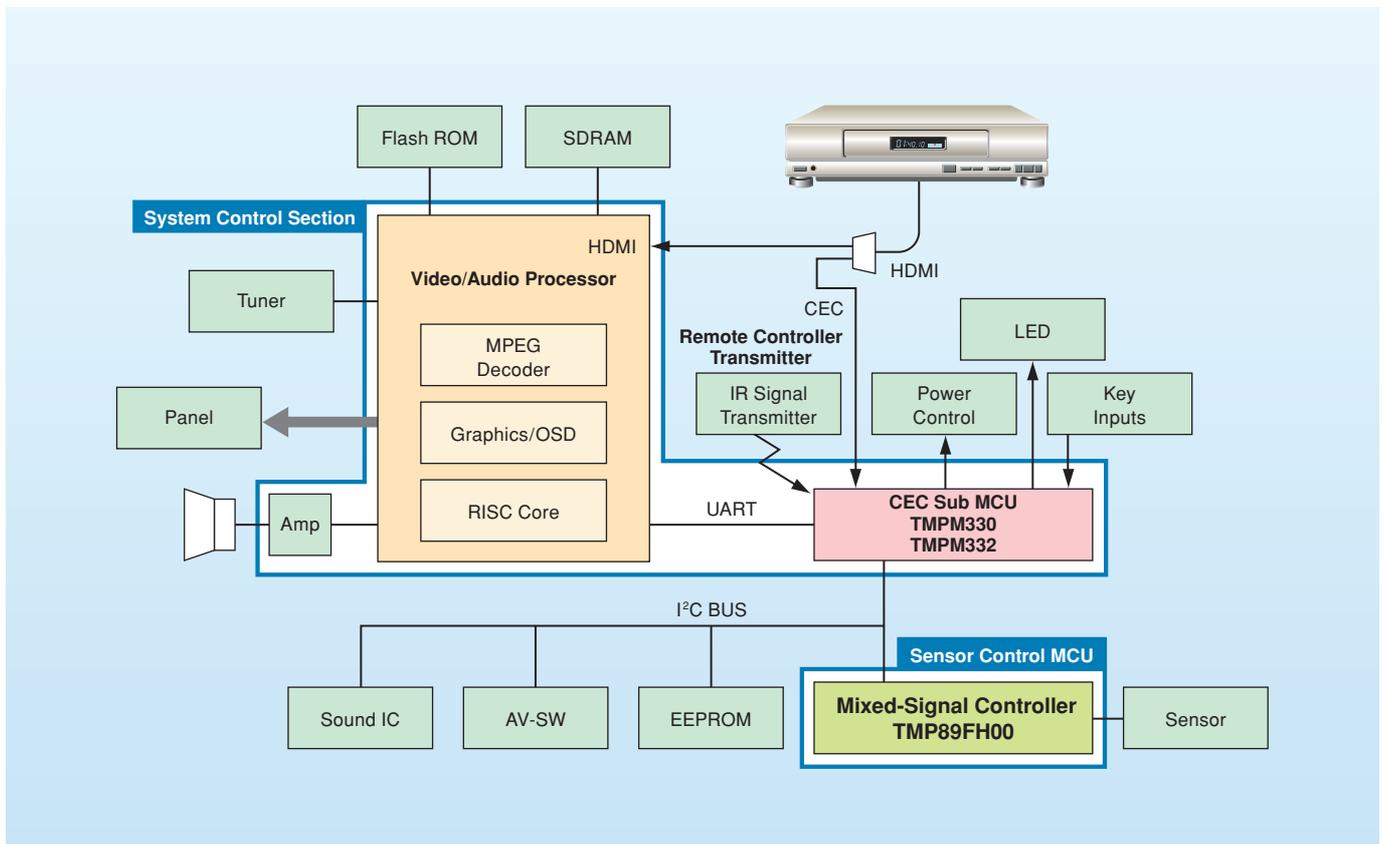
Features

- 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- μ s conversion time @40 MHz)
- Real-time clock (RTC)

Applications

- Digital TVs
- Harddisk 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 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)	Real-time clock (RTC)
TMPM333FWFG	128 KB	8 KB	LQFP100 (14 x 14 mm)	
TMPM333FYFG	256 KB	16 KB	LQFP100 (14 x 14 mm)	
TMPM333FDFG	512 KB	32 KB	LQFP100 (14 x 14 mm)	

TX03 Series M340 Group

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

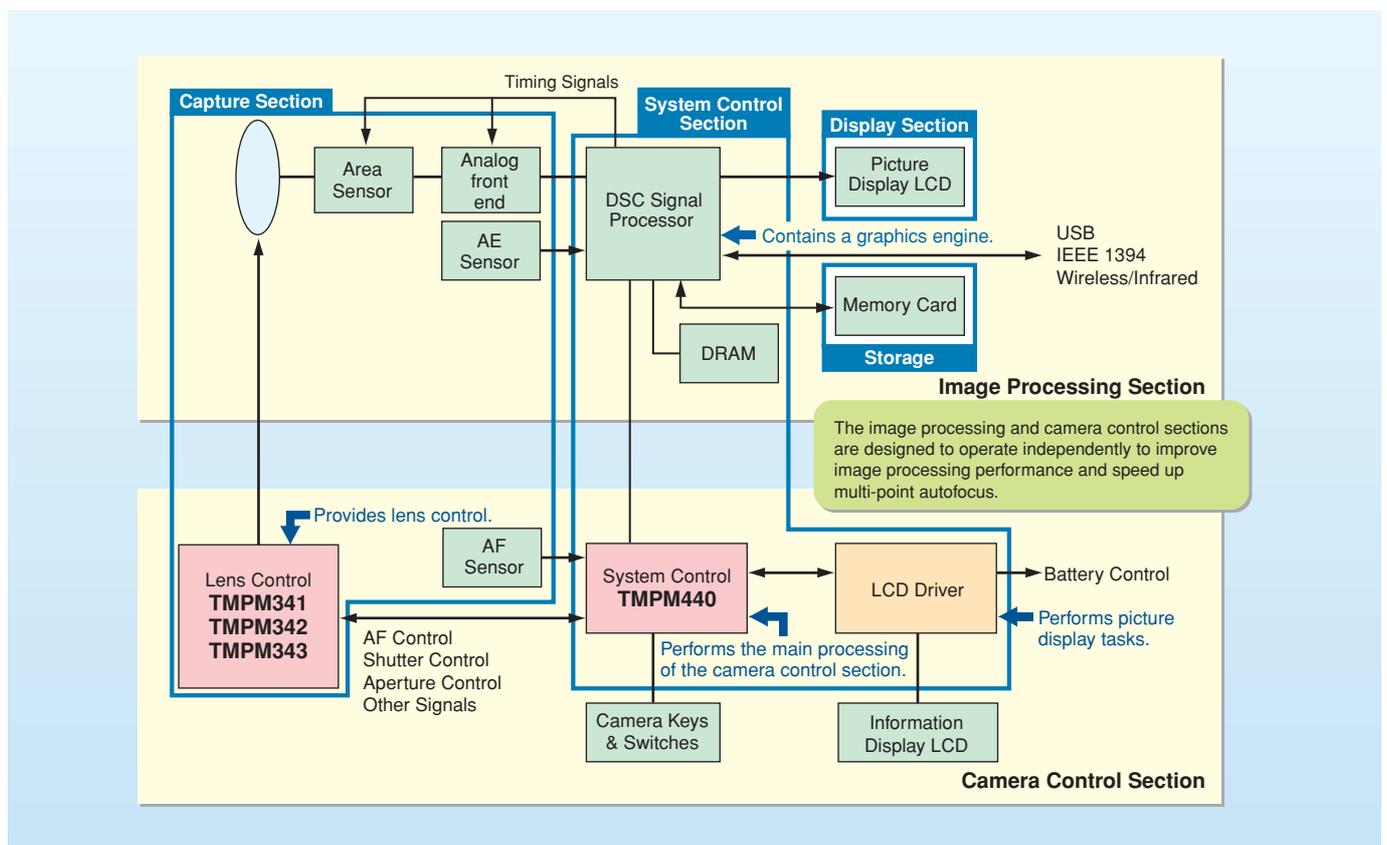
Features

- 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 $\pm 90^\circ$): 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

Applications

- 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)	54-MHz operation (max) 12-bit AD converter (1 μ s), 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)	
TMPM342FYXBG	256 KB	32 KB + 4 KB	VFPGA142 (7 x 7 mm)	40-MHz operation (max) 16-bit delta-sigma AD converter (40 μ s) 12-bit AD converter (1 μ s), 10-bit DA converter High-resolution PPG: 160 MHz (max); ideal for ultrasonic motor control 7.5-ch H-SW driver (incl. two microstep units)
TMPM343FDXBG**	512 KB	48 KB + 32 KB	VFPGA162 (7 x 7 mm)	PSC (4 units) 12-bit AD converter, 10-bit DA converter 8-ch H-SW driver (including μ step 3 units) Large-capacity ROM (compliant to OS and capable of data holding for a high-magnification lens)
TMPM343FEXBG**	768 KB	64 KB + 32 KB		
TMPM343F10XBG**	1 MB			

** : Under development

TX03 Series 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 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.

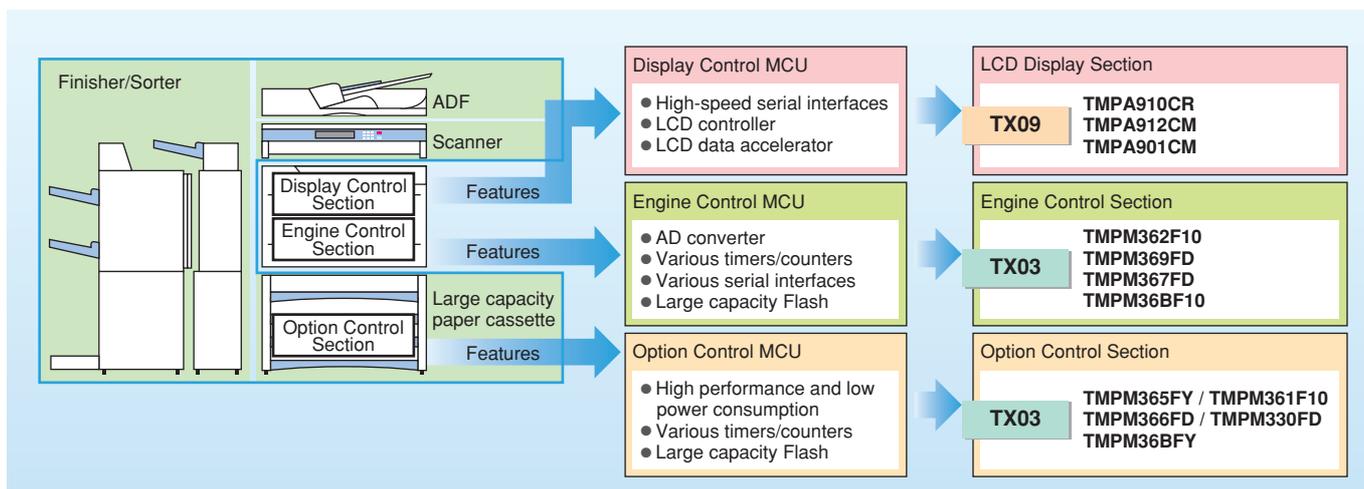
Features

- 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, USB Embedded 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

Applications

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

System Block Diagram (Printer)



Product Lineup

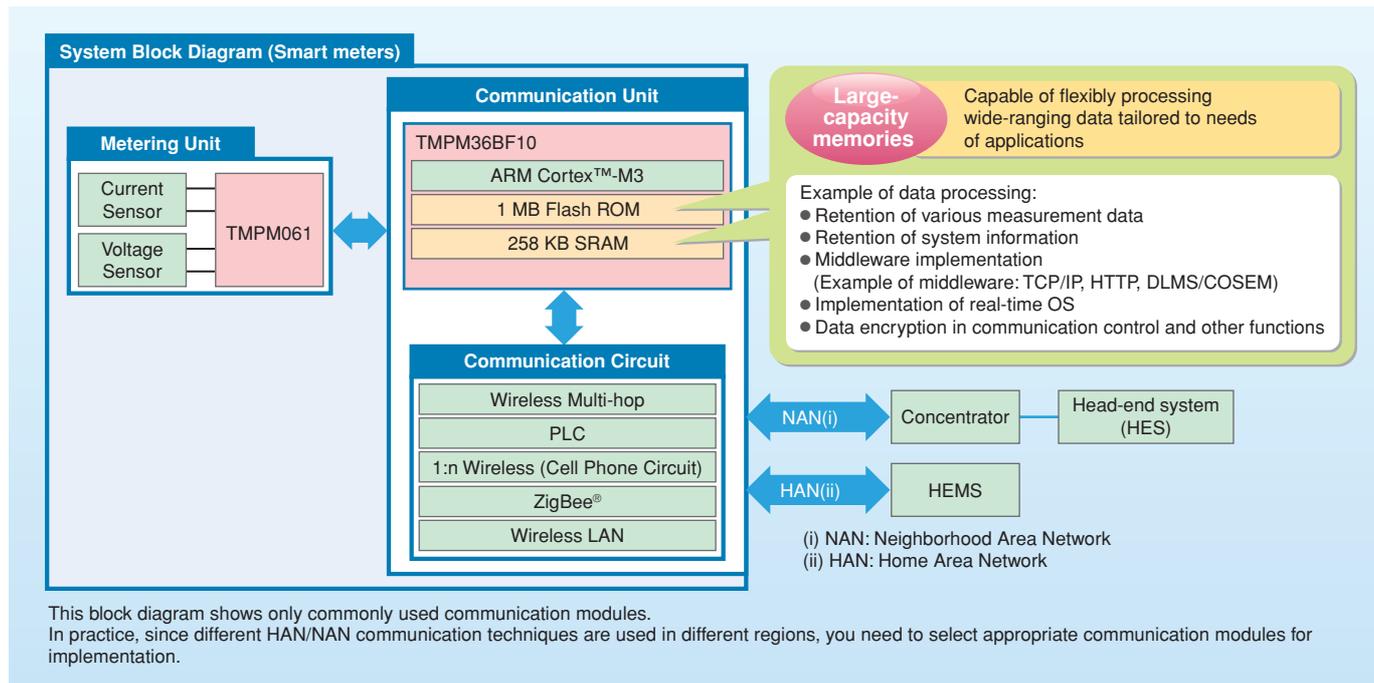
Part Number	ROM (Flash) Size	RAM Size	Package	Features
TMPM361F10FG	1 MB	64 KB	LQFP100 (14 x 14 mm)	CEC, remote control preprocessor
TMPM362F10FG	1 MB	64 KB	LQFP144 (20 x 20 mm)	CEC, remote control preprocessor, 18 serial interface channels
TMPM363F10FG	1 MB	64 KB	LQFP100 (14 x 14 mm)	CAN USB Embedded Host
TMPM364F10FG	1 MB	64 KB	LQFP144 (20 x 20 mm)	
TMPM365FYXBG	256 KB	24 KB	LFBGA105 (9 x 9 mm)	USB, 12-bit AD Converter
TMPM366FWFG/XBG	128 KB	32 KB	LQFP100 (14 x 14 mm) TFBGA109 (9 x 9 mm)	USB 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 Dual AD converter 3-Phase PWM generator(PMD)
TMPM367FYFG **/XBG **	256 KB	66 KB		
TMPM367FDFG/XBG **	512 KB	128 KB	LQFP100 (14 x 14 mm) TFBGA109 (9 x 9 mm)	USB Dual AD converter 3-Phase PWM generator(PMD), CAN
TMPM368FWFG **/XBG **	128 KB	50 KB		
TMPM368FYFG **/XBG **	256 KB	66 KB		
TMPM368FDFG/XBG **	512 KB	128 KB	LQFP144 (20 x 20 mm) TFBGA177 (11 x 11 mm)	USB, USB Embedded Host, Dual AD converter PMD, CAN, EtherMAC
TMPM369FYFG **/XBG **	256 KB	66 KB		
TMPM369FDFG/XBG	512 KB	128 KB	LQFP100 (14 x 14 mm)	12-bit AD converter Multi-purpose timers for 3-phase PWM and IGBT control
TMPM36BFYFG**	256 KB	66 KB		
TMPM36BF10FG	1 MB	258 KB		1-MB Flash ROM and 258-KB SRAM 12-bit AD converter Multi-purpose timers for 3-phase PWM and IGBT control

** : Under development

► Features of TPM36BFYFG (under development) and TPM36BF10FG

Large-capacity memories (1-MB Flash ROM, 258-KB SRAM) –Capable of processing wide-ranging data flexibly–

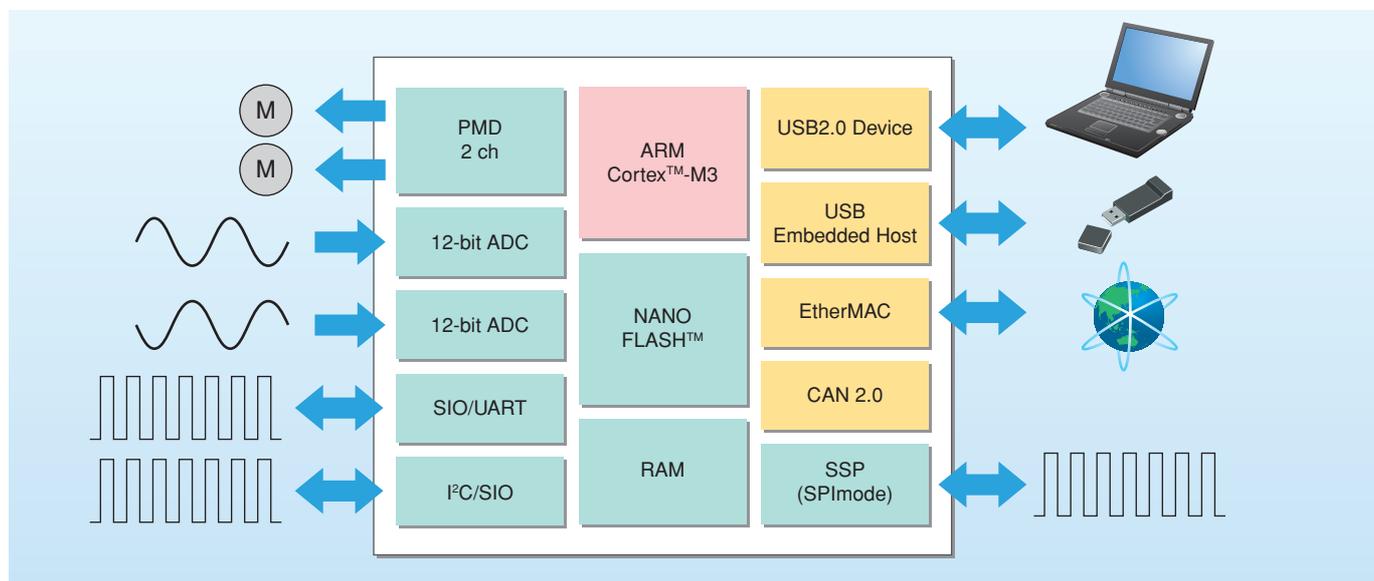
The TPM36BF10 and TPM36BFY are pin-compatible and integrate on chip large-capacity memories and abundant serial communication functions that are needed in systems that require measurement and communication control such as smart meters. The large-capacity memories not only retain measurement data of various types and system information, but also facilitate implementation of middleware and real-time OS. The large-capacity memories also permit flexible processing of wide-ranging data tailored to the needs of applications such as encryption of data in communication control. The products feature high efficiency through optimization of their internal designs while they provide a large number of large-capacity memories and IPs of high value added. These features contribute to reducing the power consumption of systems.



► Features of the TPM369FDFG/XBG and TPM369FYFG(Under Development)/XBG (Under Development)

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

The TPM369 has various external communication interfaces such as USB, USB Embedded Host, CAN, EtherMAC, SIO/UART, I²C/SIO and SSP (SPI mode). Additionally, the TPM369 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 TPM369 provides Flash ROM of up to 512 KB and SRAM of up to 128 KB to facilitate the use of the various communication interfaces.



TX03 Series 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.

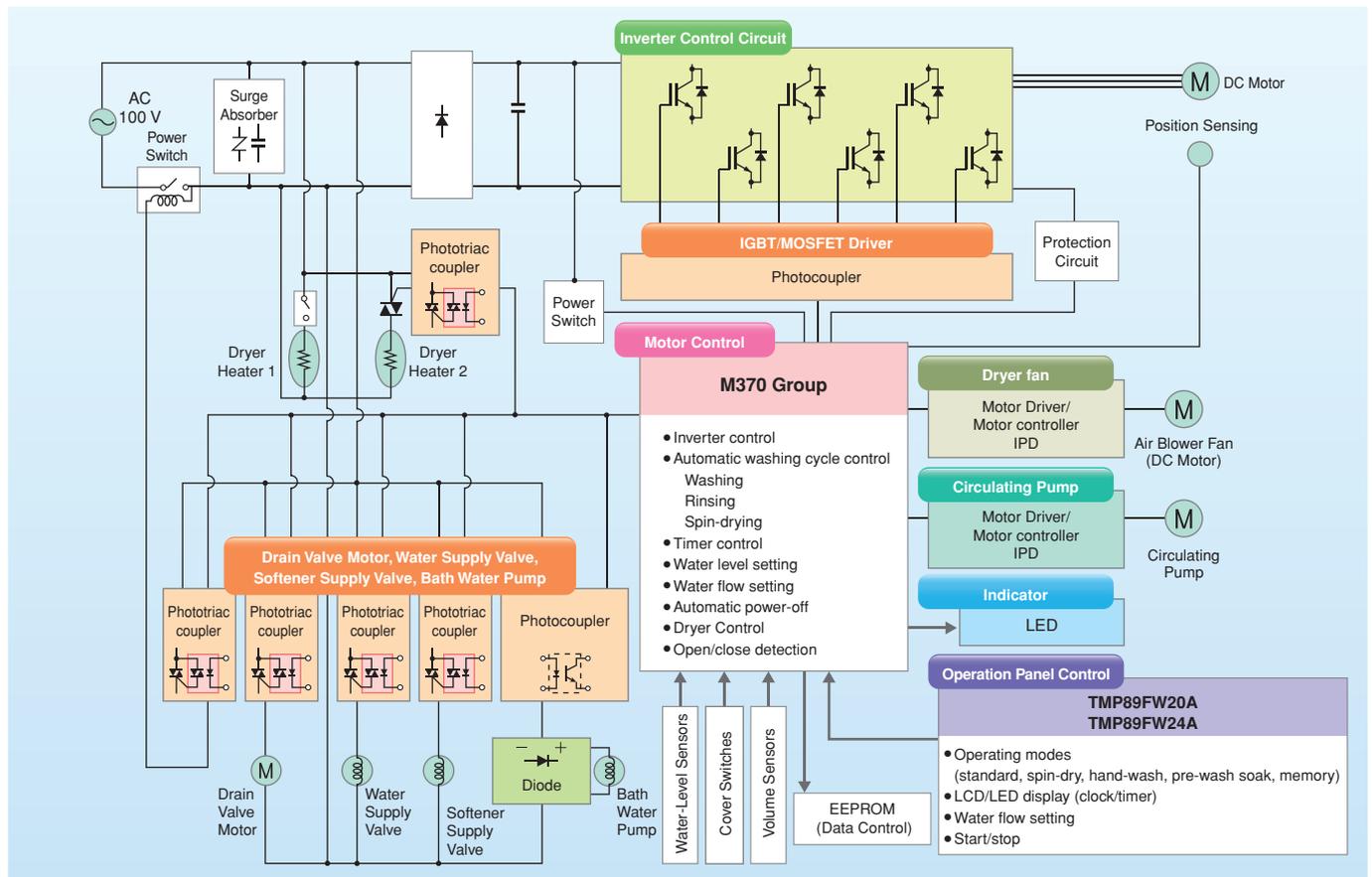
Features

- 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 (SSOP30) Note: TMPM375FSDMG

Applications

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

System Block Diagram (Washing Machine)



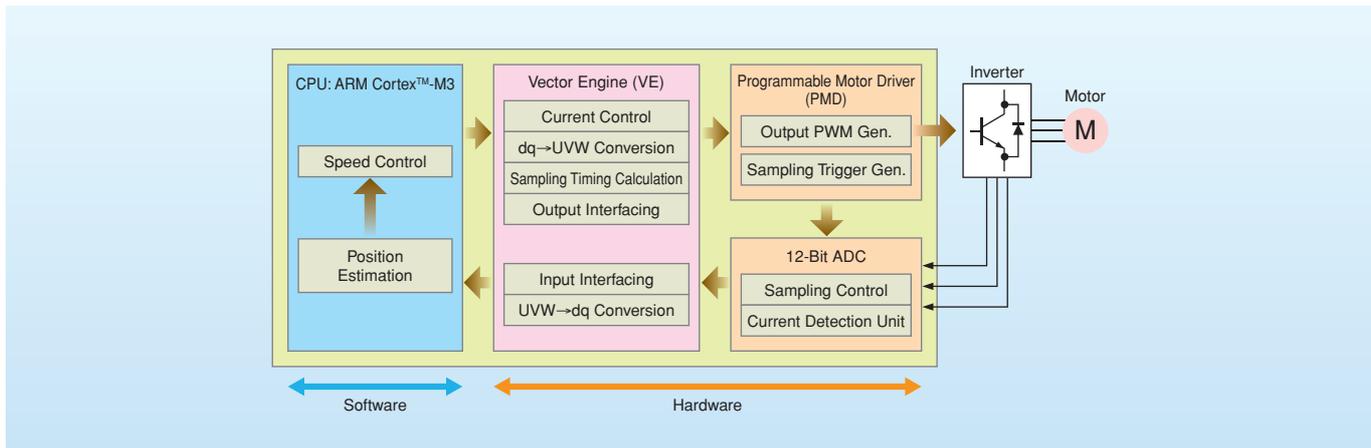
Product Lineup

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)	
TMPM375FSDMG	64 KB	4 KB	SSOP30	Capable of controlling two motors for a wide range of inverter applications.
TMPM376FDFG	512 KB	32 KB	LQFP100 (14 x 14 mm)	
TMPM376FDDFG	512 KB	32 KB	QFP100 (14 x 20 mm)	

► Features of the Vector Engine (VE)

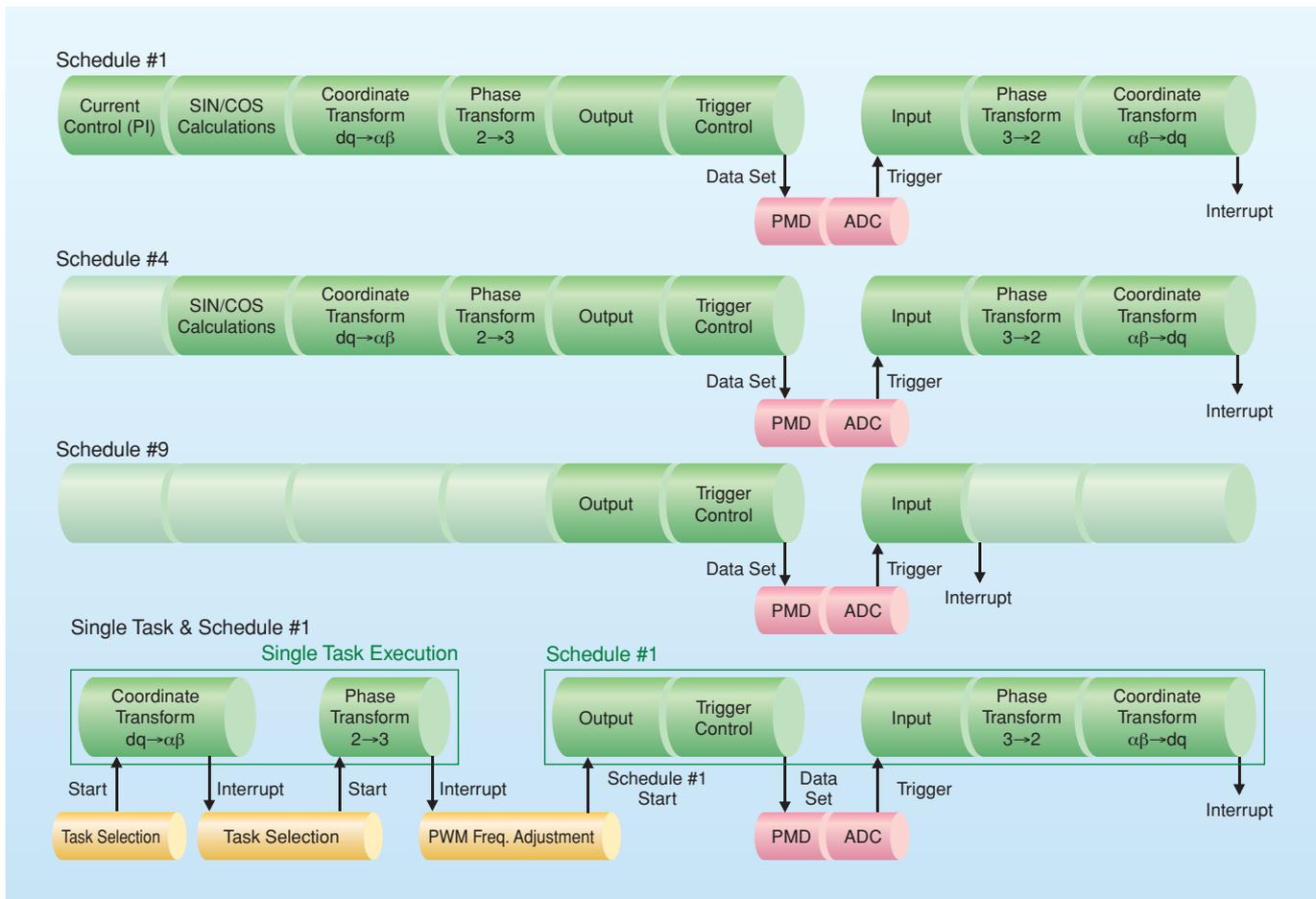
High-efficiency motor control, reducing the CPU workload

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.



TX03 Series 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.

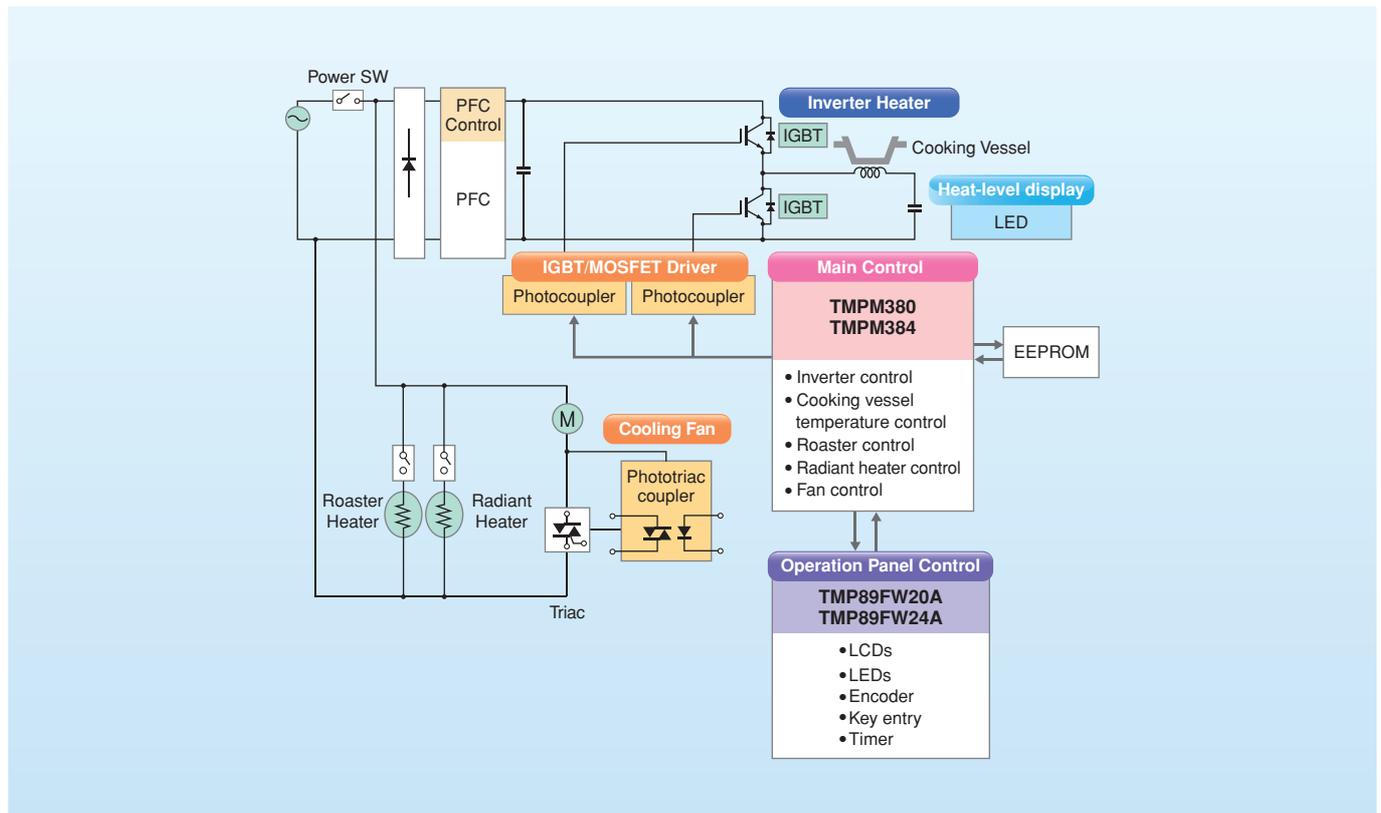
Features

- 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

Applications

- 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)	
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 two motors

TX03 Series 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.

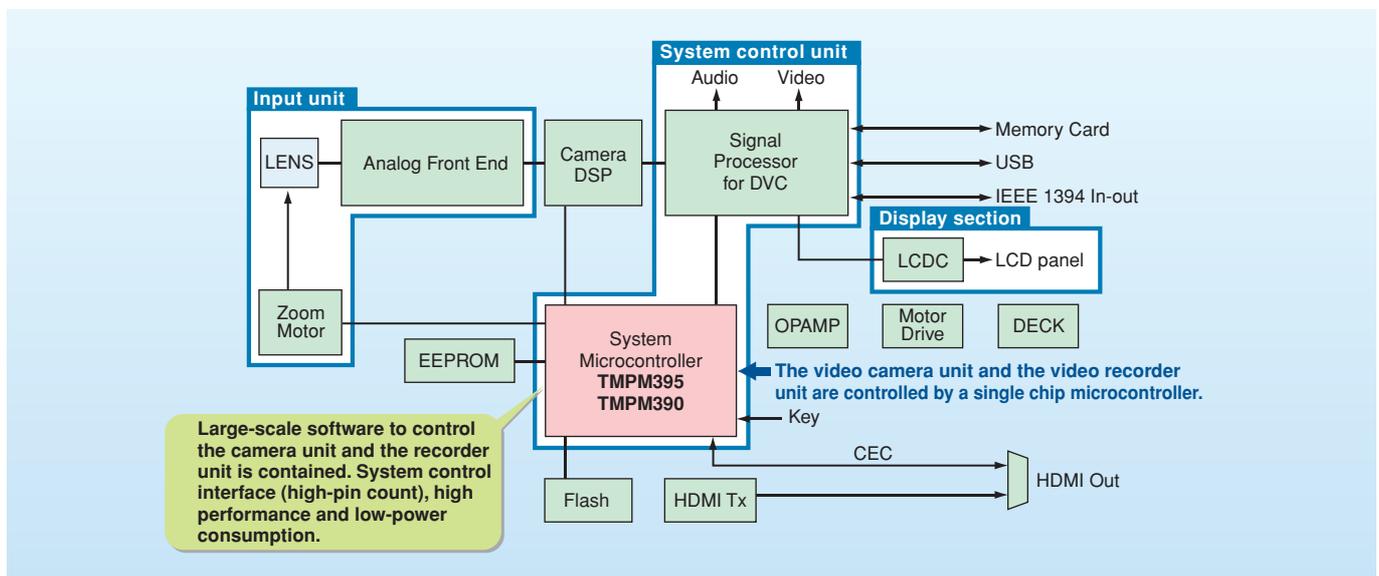
Features

- 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 μ A 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 \pm 3% @ 0 to 70°C)
- Oscillation frequency detection (OFD); compliant with the IEC 60730 standard
- Small package (6 x 6 mm TFBGA120)

Applications

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

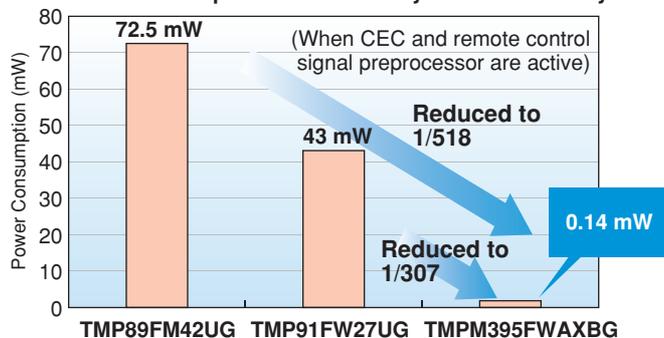
System Block Diagram (Digital Video Camera)



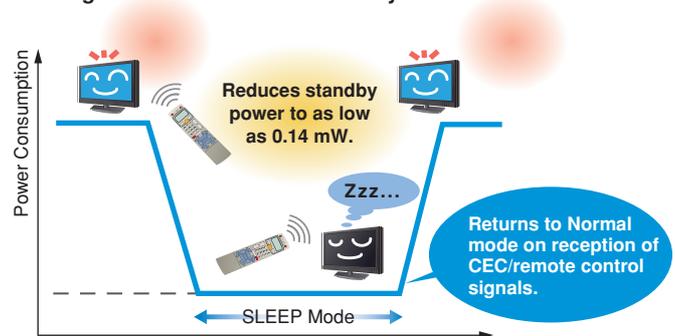
Low-Power MCUs

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 μ A 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 μ A typ.)

** : Under development

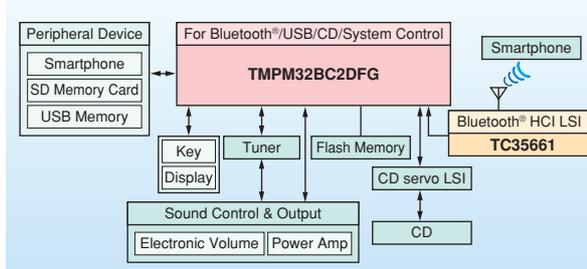
TX03 Series M320 Group (for Audio Applications)

The TPM32BC2DFG in the M320 Group is a microcontroller that can easily implement Bluetooth® audio, hands-free speech and other functions by combining a Bluetooth® HCI LSI (TC35661), in addition to control various conventional audio systems. The DSP provided in this microcontroller processes various signals of a high workload, to lessen the CPU workload.

Features(TPM32BC2DFG)

- High-performance ARM Cortex™.M3 core: 96-MHz operation (max)
- DSP incorporated, and 144 MHz operation (max)
- Asynchronous sampling rate converter
- PCM interface
- USB Embedded Host (Full-Speed)
- SD host controller
- Serial flash interface
- Power-saving mode by cutting off internal power supply

System Block Diagram (Car Audio System)



Applications

- Car audio
- Home audio

Audio Features

- Audio replay by Bluetooth® connection
- Hands-free speech (Echo canceling (EC) and noise reduction (NR) processing)
- Audio replay from USB memory or SD card (Various audio decoding modes by decompression)
- Compatible with CDDA and CD-MP3 (In combination with CD servo LSI)

Product Lineup

Part Number	ROM Size	RAM Size	Package	Features
TMPM32BC2DFG	-	2560 KB	LQFP176 (20 × 20 mm)	DSP incorporated, PCM interface, USB Embedded Host (Full-Speed)
TMPM32DC2DFG				DSP incorporated, PCM interface, USB Embedded Host (Full-Speed), CAN

TX03 Series M350 Group (for Automotive Applications)

The TPM350FDTFG and TPM351F10TFG microcontrollers of the M350 Group are pin-compatible and specifically designed for automotive applications. The TPM350FDTFG/TPM351F10TFG provides various peripheral functions, such as CAN controllers and AD converters, as well as a Toshiba-original Programmable Motor Driver (PMD). Additionally, the TPM350FDTFG/TPM351F10TFG offers functional safety features.

The TPM354F10TAFG 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 TPM354F10TAFG offers functional safety features.

Because Toshiba's functional safety technology is compliant with ISO 26262, using the TPM354F10TAFG will facilitate certification of your product.

Product Lineup

Part Number	ROM (Flash) Size	RAM Size	Package	Features
TMPM350FDTFG	512 KB	48 KB	LQFP100 (14 × 14 mm)	<ul style="list-style-type: none"> • 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 • 88-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 TPM350FDTFG suitable for motor applications in safety-related systems such as electronic power steering (EPS).
TMPM351F10TFG **	1 MB	64 KB	LQFP100 (14 × 14 mm)	<ul style="list-style-type: none"> • 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 125°C max) • The CAN controllers and the blocks that implement functional safety contain logic specifically designed for automotive applications, making the TPM351F10TFG suitable for motor applications in safety-related systems such as electronic power steering (EPS).
TMPM354F10TAFG **	1 MB	64 KB	HQFP144 (20 × 20 mm)	<ul style="list-style-type: none"> • 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 × 14 mm)	<ul style="list-style-type: none"> • 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 TPM358FDTFG suitable for control applications such as battery power monitoring.

** : Under development

Development Environment

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.

	Compiler	Debugger	In-circuit emulator	Flash programmer	Starter kit	Real-time OS	Middleware	Verification tool	Flash programming service
ARM Ltd.	●	●	●		●	●	●	●	
Atollic AB	●	●						●	
BITRAN CORPORATION		●	●						
COMPUTEX CO., LTD.		●	●	ON board					
Coocox	●	●	●						
eForce Co.,Ltd.						●	●		
Eltec s.r.o				OFF board					
Falcon Denshi K.K.				OFF board					●
Flash Support Group Inc. of Toa Electronics Inc.				ON board OFF board					●
GAIO TECHNOLOGY CO., LTD								●	
Green Hills Software/Advanced Data Controls Corp.	●	●							
GRAPE SYSTEM INC.						●	●		
HI-LO SYSTEMS RESEARCH CO., LTD				OFF board					
IAR Systems AB	●	●	●		●	●	●		
KYOEI co.,LTD.				ON board					
Kyoto Microcomputer Co., Ltd.	●	●	●						
MICROTEK Inc.									●
MINATO ELECTRONICS INC.				OFF board					●
Sohwa & Sophia Technologies Co., Ltd.		●	●	ON board					
TOSHIBA INFORMATION SYSTEMS (JAPAN) CORPORATION						●	●		
Ubiquitous Computing Technology Corporation						●	●		
VAMOS									●
Yokogawa Digital Computer Corporation		●	●	ON board					

Partner Information

For the support status and other details, please contact tool vendors directly.

Company names, logos and product names mentioned herein may be trademarks or registered trademarks of respective companies.

ARM Ltd.

<http://www.arm.com/>



Keil MDK-ARM™ is a complete software development environment for Cortex™-M, ARM7™ and ARM9™ processor-based devices. MDK-ARM, which is specifically optimized for microcontroller applications, contains the ARM C/C++ Compiler, the μVision IDE and Debugger, the Keil RTX real-time operating system and middleware libraries. ARM DS-5™ (Development Studio 5) is a software development tool suite for ARM processor-based ASICs and standard devices. ARM provides versatile, high-performance and easy-to-use development environments for software developers.

Atollic AB

<http://www.atollic.com/>



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.

Development Environment

Company names, logos and product names mentioned herein may be trademarks or registered trademarks of respective companies.

● BITRAN CORPORATION

<http://www.bitran.co.jp/ccd/english/>



JeRana is a JTAG emulator that supports the TX03 Series. Designed specifically for Cortex™-M3, JeRana is priced lower than its predecessors. Above all, JeRana is small and easy to use. To improve your productivity, JeRana provides basic debugging features and is capable of directly programming Flash ROM integrated in MCUs.

● COMPUTEX CO., LTD.

<http://www.computex.co.jp/eg/>



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.

● Coocox

<http://www.coocox.org/>



CooCox, from element14 Embest, provides a complete set of **FREE** software tools enabling rapid development and debugging of full-featured applications for ARM Cortex-M based devices. These tools include the ColDE, an Eclipse and GCC based IDE (Integrated Development Environment) with enhancements and simplification specific to Cortex M development, enabling embedded developers using TX03 series to develop applications from initial evaluation through to final production. In particular, with the integrated code component platform for uploading and downloading reusable code components, ColDE can organize, extract, and share expertise through the collective wisdom.

● eForce Co., Ltd.

<http://www.eforce.co.jp/english.htm/>



eForce offers μ C3/Compact, a μ TRON-compliant compact RTOS, μ NET3/Compact, a TCP/IP protocol stack that operates only with a CPU's internal memory, etc. eForce supports ARM Cortex™-M and other ARM core-based microcontrollers to address customer needs to reduce development time and win a valuable time-to-market edge. It offers μ C3/Compact for the TX03 Series and μ C3/Standard for the TX09 Series.

● Elnec s.r.o.

<http://www.elnec.com/>



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.

● ESP Co., Ltd.

<http://www.esp.jp/>



ESP Co., Ltd. responds to customer requirements from circuit design in the development of embedded systems to artwork, manufacture of printed circuit boards, parts procurement, packaging, inspection and software development fully utilizing its integrated technological competence and speedy actions.

ESP Co. is also engaged in assisting development work utilizing its experience in developing printed circuit boards for evaluation of Toshiba microcomputers that embed ARM cores and in editing a book titled "Vector Control Technology of Brushless DC Motors" by CQ Publishing Co., Ltd. posted in TMPM370.

● Falcon Denshi K.K.

<http://www.falcon-denshi.co.jp/en/>



Falcon Denshi is a subsidiary of Hi-Lo Systems in Japan. It offers device programmers and automated programming systems worldwide under the brand names of Hi-Lo Systems and FALCON. It also offers device programming services using its facilities in Japan, Taiwan, Hong Kong, China, Singapore, etc. Falcon Denshi supports the ARM core-based TX03 Series, TLCS-900/H1Series, TLCS-47E Series, TLCS-870/C1 Series and so on. Its product portfolio includes ALL-100AX, a single-device programmer for engineering, gang programmers that allow simultaneous programming of 4 to 8 devices for medium-scale production, and automated programming systems that support programming of 900 to 2200 devices per hour. Falcon Denshi also offers custom algorithm development services.

● Flash Support Group Inc. of Toa Electronics Inc.

<http://www.j-fsg.co.jp/en/>



Flash Support Group Inc. of Toa Electronics Inc. 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.

● GAI0 TECHNOLOGY CO., LTD

<http://www.gai0.com/>



GAIO TECHNOLOGY is an embedded development tool provider. One of our best selling products is the unit test tool CoverageMaster, the first product in the Asia-Pacific region to obtain tool certification (by TUV SUD Germany) for the ISO 26262 automotive functional safety standard. CoverageMaster is increasing its share of the market not only in the Japanese domestic region, but also being marketed overseas with a focus on the European region. Supported devices include TLCS-870/TLCS-900/TX19 and the latest ARM core-based TX03/TX04R microcontrollers.

Company names, logos and product names mentioned herein may be trademarks or registered trademarks of respective companies.

● Green Hills Software/Advanced Data Controls Corp. <http://www.ghs.com/> <http://www.adac.co.jp/eng/>



Advanced Data Controls Corporation (ADaC) has been a partner of Green Hills Software (GHS) for 20 years in sales and technical support in Japan and other Asian countries. GHS offers total solution support for compilers, debuggers and JTAG probes to help you create applications for Toshiba's ARM core-based microcontrollers. It delivers overwhelming compiler performance in terms of speed and code size. GHS MULTI Tool Chain has received the highest level of certification ISO 26262 ASIL D for tool qualification requirements from TUV Nord on September 2012. ADaC and GHS provide technical support to help you improve your application performance.

● GRAPE SYSTEMS INC. <http://www.grape.co.jp/english/index.html>



Grape Systems offers the GR-USB USB stack series for the TX03 Series, various class drivers such as a Mass Storage Class driver, the GR-FILE FAT system, the ThreadX high-speed real-time operating system, the NetX networking protocol, etc. Grape Systems also provides custom development services. Contact Grape Systems for details.

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



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.

● IAR Systems AB <http://www.iar.com/>



IAR Systems offers comprehensive solutions for the entire development cycle of Toshiba's ARM core-based microcontrollers, from conception and evaluation through prototyping and development. IAR Systems provides a comprehensive optimized environment for your product development, such as various evaluation kits and an integrated development environment that works seamlessly with various in-circuit emulators (ICEs), real-time operating systems (RTOS) and middleware. Its ARM solution is well proven in markets worldwide.

● KYOEI co.,LTD. <http://www.k-kyoei.jp/>



Kyoei designs and develops measurement control systems and Flash memory programming systems. Kyoei offers an on-board Flash programmer called I.S.P-310, which supports various Flash microcontrollers such as the Toshiba TX03 ARM core-based microcontroller series. The I.S.P-310 is small and lightweight and powered by two AA batteries. It is a standalone system and easily portable. You can use it in production lines and in the field.

● Kyoto Microcomputer Co., Ltd. <http://www.kmckk.co.jp/eng/>



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.

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



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, home information appliances and automotive applications, as a reliable provider of IC programming services.

● 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 core-based TX03 series, as well as the TX19, TLCS-900, and TLCS-870 Families. Programming services using these products are also available.

● Sohwa & Sophia Technologies Co., Ltd. <http://www.ss-technologies.co.jp/>



Sohwa & Sophia Technologies offers embedded development solutions for Toshiba microcontrollers, such as Flash writers, emulators for the TX03 Series (ARM core-based microcontrollers), etc. Sohwa & Sophia Technologies has a proven track record in the design and development of custom boards and systems using Toshiba's microcontrollers. Being an authorized distributor of the ARM products (KEIL and DS-5), Sohwa & Sophia Technologies can provide a comprehensive solution, including an integrated development environment and a compilation environment.

Development Environment

Company names, logos and product names mentioned herein may be trademarks or registered trademarks of respective companies.

TOSHIBA INFORMATION SYSTEMS (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 μ ITRON4.0-compliant real-time operating systems (RTOS). It offers standard UDEOS4/Cortex™-M3 (compliant with μ ITRON4.0) for the TX03 Series that operates with on-chip ROM/RAM and UDEOS4/ARM (compliant with μ ITRON4.0), an enhanced version, for the TX09 Series. Also included among its product offerings is the compact UDEOS4/Lite for Cortex™-M0 and Cortex™-M3.

Ubiquitous Computing Technology Corporation

<http://ts.uctec.com/uctec/index-e.php>

 **Technology**

UC Technology offers the source code of μ T-Kernel, a tuned-up version of the latest μ T-Kernel RTOS being standardized by the T-Engine Forum, as well as various sample programs. Since μ T-Kernel comes with a project file for the integrated development environment, you can start creating μ T-Kernel drivers and application software right after you have installed software without performing any complicated setup.

You can purchase a royalty-free project license for μ T-Kernel for mass production at a reasonable price.

VAMOS

<http://www.vamos-net.jp/>

 株式会社 ヴァーモ

With over 25 years of experience in EPROM programming, VaMos has been engaged in programming on-chip EPROM of Toshiba microcontrollers ever since its establishment in 1985. VaMos has been highly acclaimed by many customers for quick-turnaround, low-cost and high-quality services.

Its mottoes are "Readiness," "Quick Turnaround," and "From Small Engineering Lots to Production Lots." VaMos offers various adapters for Toshiba's OTP microcontrollers, Flash microcontrollers and ARM core-based microcontrollers. Contact VaMos if you need EPROM or Flash programming service.

Yokogawa Digital Computer Corporation

<http://www2.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 NETIMPRESS 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. Yokogawa Digital Computer is an authorized distributor of and a certified training center for the ARM KEIL and DS-5. Thus, it can offer optimal solutions that best suit your need.

Microcontroller Starter Kits

For Toshiba's ARM core-based TX00, TX03 and TX04 Series, starter kits are available from development tool partners. They will come in handy for microcontroller selection and evaluation purposes prior to development. A starter kit consists of a CPU board, an integrated development environment (IDE), and a suite of sample programs such as a header file and drivers. It allows you to start empirical evaluation quickly and facilitate development. Starter kits are also ideal for use as educational tools. For the latest information, visit Toshiba's Web site.

Toshiba Semiconductor & Storage Products Company Web site: <http://www.semicon.toshiba.co.jp/eng/>

Toshiba Microcomputer Web page: <http://www.semicon.toshiba.co.jp/eng/product/micro/>

All the photos are photographed specially for this catalog. Some products appearing in these photos may differ from actual products. Please contact the development tool partners for product specifications and details of the products.

Company names, logos and product names mentioned herein may be trademarks or registered trademarks of respective companies.

<p>IAR Starter Kit for TPM061</p> <ul style="list-style-type: none"> ● Included hardware: <ul style="list-style-type: none"> TPM061 evaluation board IAR J-Link Lite USB cable IAR Embedded Workbench for ARM KickStart edition ● Key features of the evaluation board <ul style="list-style-type: none"> • USB/UART serial converter (Mini-B) • RS232 driver(UART) • Power jack/Power LED • Tactile switch • LCD panel 	 <ul style="list-style-type: none"> • Reset button • 16-MHz crystal oscillator • LED • Potentiometer input analog signal • Button-type cell socket 	<p>IAR Starter Kit for TPM330</p> <ul style="list-style-type: none"> ● Included hardware: <ul style="list-style-type: none"> TMPM330-SK evaluation board J-Link for Toshiba Cortex-M3 USB cable IAR Embedded Workbench for ARM KickStart edition ● Key features of the evaluation board <ul style="list-style-type: none"> • USB driver and connector / UART1 • RS232 driver • Power jack/Power LED • 4 tactile switches • 2 UART connectors • Reset button 	 <ul style="list-style-type: none"> • 10-MHz crystal oscillator (with socket, changeable), 32-kHz crystal oscillator • 8 user LEDs • Potentiometer input analog signal • LCD module
<p>ARM Starter Kit for TPM330</p> <ul style="list-style-type: none"> ● Included hardware: <ul style="list-style-type: none"> TMPM330 evaluation board ULINK-ME™ USB cable MDK-ARM (Microcontroller Development Kit) download ● Key features of the evaluation board <ul style="list-style-type: none"> • Reset button • USB BUS Power/Power LED • 1 tactile switch 	 <ul style="list-style-type: none"> • 10-MHz and 32-kHz crystal oscillators • 3 user LEDs • Potentiometer for ADC input 	<p>IAR Starter Kit for TPM341</p> <ul style="list-style-type: none"> ● Included hardware: <ul style="list-style-type: none"> IAR KickStart Kit for TPM341 IAR J-Link on-board (on-board ICE) USB cable IAR Embedded Workbench for ARM KickStart edition ● Key features of the evaluation board <ul style="list-style-type: none"> • Optical rotary encoder • USB/UART serial converter • Potentiometer (slider) • Tactile switch 	 <ul style="list-style-type: none"> • Reset button • 10-MHz crystal oscillator • 1 user LED • Power LED
<p>ARM Starter Kit for TPM362/TPM364</p> <ul style="list-style-type: none"> ● Included hardware: <ul style="list-style-type: none"> TMPM362/TPM364 evaluation board ULINK-ME™ USB cables (for tools and USB Embedded Host) MDK-ARM (Microcontroller Development Kit) download ● Key features of the evaluation board <ul style="list-style-type: none"> • USB Embedded Host connector (M364) • CAN interface (M364) • Potentiometer for ADC input • 6 tactile switches 	 <ul style="list-style-type: none"> • Reset button • 10-MHz crystal oscillator • 5 LEDs • USB BUS Power 	<p>IAR Starter Kit for TPM364</p> <ul style="list-style-type: none"> ● Included hardware: <ul style="list-style-type: none"> TMPM364-SK evaluation board IAR J-Link Lite USB cable IAR Embedded Workbench for ARM KickStart edition ● Key features of the evaluation board <ul style="list-style-type: none"> • USB Embedded Host connector • USB/UART serial converter • CAN interface • Tactile switch • Power LED 	 <ul style="list-style-type: none"> • Potentiometer input analog signal • 12-MHz and 32-kHz crystal oscillators • 8 user LEDs • Reset button
<p>IAR Starter Kit for TPM365</p> <ul style="list-style-type: none"> ● Included hardware: <ul style="list-style-type: none"> TMPM365 evaluation board IAR J-Link Lite USB cable IAR Embedded Workbench for ARM KickStart edition ● Key features of the evaluation board <ul style="list-style-type: none"> • USB(Mini-B) • USB/UART serial converter (Mini-B) • RS232 driver(UART) • Tactile switch • Power LED 	 <ul style="list-style-type: none"> • Potentiometer input analog signal • 12-MHz crystal oscillator • LED x 8 • Reset/NMI button 	<p>ARM Starter Kit for TPM366</p> <ul style="list-style-type: none"> ● Included hardware: <ul style="list-style-type: none"> TMPM366-SK evaluation board IAR J-Link on-board (on-board ICE) USB cable IAR Embedded Workbench for ARM KickStart edition ● Key features of the evaluation board <ul style="list-style-type: none"> • USB connector • USB/UART serial converter • UART interface x 2 • 2 tactile switches • Power LED 	 <ul style="list-style-type: none"> • Potentiometer input analog signal • 12-MHz crystal oscillator • 8 user LEDs • SD card slot (SSP) • Reset button

Development Environment

Company names, logos and product names mentioned herein may be trademarks or registered trademarks of respective companies.

ARM Starter Kit for TMPM369



- Included hardware:
 - TMPM369 evaluation board
 - ULINK-ME™
 - USB cable
 - MDK-ARM (Microcontroller Development Kit) download
- Key features of the evaluation board
 - USB Embedded Host connector
 - Ethernet connector
 - RS232 driver (UART)×2
 - Potentiometer input analog signal
 - Power LED
 - USB connector (Mini-B)
 - CAN interface
 - LED x 4
 - Reset button

IAR Starter Kit for TMPM369



- Included hardware:
 - TMPM369-SK evaluation board
 - IAR J-Link on-board (on-board ICE)
 - USB cable
 - IAR Embedded Workbench for ARM KickStart edition
- Key features of the evaluation board
 - USB Embedded Host connector
 - Ethernet connector
 - 2 UART interfaces
 - JOY Stick
 - LCD module
 - Power LED
 - USB connector
 - CAN interface
 - 8 user LEDs
 - SD card slot (SSP)
 - Reset button
 - DC Power Jack

IAR Starter Kit for TMPM370



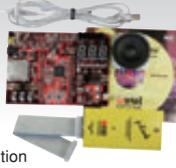
- Included hardware:
 - TMPM370-SK evaluation board
 - J-Link for Toshiba Cortex-M3
 - USB cable
 - IAR Embedded Workbench for ARM KickStart edition
- Key features of the evaluation board
 - 4 tactile switches
 - Isolated JTAG interface
 - DC Power Jack
 - 3 user LEDs
 - Reset button

IAR Starter Kit for TMPM376



- Included hardware:
 - TMPM376-SK evaluation board
 - J-Link for Toshiba Cortex-M3
 - USB cable
 - IAR Embedded Workbench for ARM KickStart edition
- Key features of the evaluation board
 - 4 tactile switches
 - Isolated JTAG interface
 - DC Power Jack
 - 3 user LEDs
 - Reset button
 - EEPROM

IAR Starter Kit for TMPM380



- Included hardware:
 - TMPM380-SK evaluation board
 - J-Link for Toshiba Cortex-M3
 - USB cable
 - IAR Embedded Workbench for ARM KickStart edition
- Key features of the evaluation board
 - 16-bit external serial Flash ROM
 - Power LED
 - 3 seven-segment LEDs
 - SD/MMC card slot
 - Reset switch
 - Slide volume (speaker loudness)
 - Speaker amp
 - USB/UART serial converter
 - 8 user LEDs
 - 10-MHz ceramic resonator,
 - 32-kHz crystal oscillator(slide)
 - 3 toggle switches
 - Potentiometer for ADC input
 - 2 low-pass filters
 - Speaker output connector

ARM Starter Kit for TMPM395



- Included hardware:
 - TMPM395 evaluation board
 - ULINK-ME™
 - USB cable
 - MDK-ARM (Microcontroller Development Kit) download
- Key features of the evaluation board
 - USB/UART serial converter
 - HDMI interface (CEC)
 - 2 LEDs
 - Reset switch
 - CR1220 lithium-ion battery
 - SD/MMC card slot (SSP)
 - Potentiometer for ADC input
 - 4 tactile switches
 - DC Power Jack

Toshiba Application Notes and Sample Programs

Application notes and sample programs are available for download from our Web site. Application notes will help you better understand Toshiba's microcontrollers. You can use sample programs as a guide for creating software. Toshiba offers header files and startup routines for each microcontroller as well as sample programs for on-chip peripherals that combine multiple drivers. You can use them to control on-chip peripherals without being concerned about registers.

Visit our Web site for information on the availability of sample programs and the supported microcontrollers.

Sample Program Examples

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

CMSIS-Compliant Drivers

Toshiba's sample programs and drivers are 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 programs and drivers are also available for download from ARM's ARM Web site.

ARM Web site <http://www.arm.com/>

Microcomputer web page

The Toshiba microcomputer web page always delivers updated information including new product information and product lineups. Please access "Toshiba MCU Park" that explains elementary technologies in an easy-to-understand format and "Parametric Search" that allows search by narrowing down products. These pages also contain a wide range of useful information.

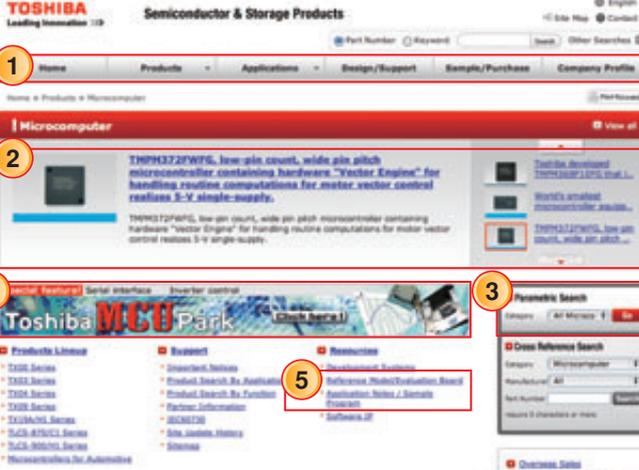


Access by reading QR code.
Toshiba Microcomputer

Toshiba Semiconductor & Storage Company
Microcomputer web page
<http://www.semicon.toshiba.co.jp/eng/product/micro/>

Toshiba microcontroller

Web Search



- 1 Home
- 2 Microcomputer
- 3 Parametric Search
- 4 Toshiba MCU Park
- 5 New product

1 Global Navigation

For example, if clicking "Products"

Hovering the mouse over will change the display on the right.

The screen will be unfolded and the product list will be displayed.

Moving category from one product to other product has become very easy.

Links to content will be displayed.

2 New product

Information of new microcomputer products can be viewed.



4 Toshiba MCU Park

A page for an easy-to-understand explanation of peripheral functions and elementary technologies of products in a theme park form. Be certain to visit the site.



[Village]

- Vector engine and vector control
- Delta-sigma AD converter
- Ultrasonic motor control technology
- High-resolution control by MCU
- USB interface
- Serial interface
- Inverter control

[e-Workshop]

- Ultrasonic actuator control by a microcontroller

3 Parametric Search

A desired product can be searched by selecting a category and specification.

- Product narrowing down and sorting by selecting ROM/RAM size, function, package, pin count and electrical characteristic
- Column display is customized
- Downloading product list data
- Displaying detailed product information and downloading of data sheet

Narrow down by checking of part number.

Sorting

Concealing column

Selecting condition for narrowing down

Canceling all check marks

Part Number	Life-cycle	group name
<input checked="" type="checkbox"/> TM9330DFG		
<input type="checkbox"/> TM9330DFG		
<input checked="" type="checkbox"/> TM9330WFG		
<input type="checkbox"/> TM9330WFG		
<input type="checkbox"/> TM9330DFG	H330	32
<input type="checkbox"/> TM9330WFG	H330	32
<input type="checkbox"/> TM9330WFG	H330	32

*Press to reset.

facebook

Official Facebook page of Toshiba Semiconductor & Storage Company "Toshiba Microcontroller"

A new face that made a debut in April 2013! A wide variety of information is delivered from technical information that arouses reader interest to event information, comic strips and other items of interest.




Access by reading the QR code.
Official Toshiba microcontroller Facebook

facebook

<http://www.facebook.com/ToshibaMicrocontroller>

5 Support of development

Application notes and sample programs can be downloaded from our website for use in understanding microcomputers and as reference information in creating programs when the customers develop products.

[TM933 Series MCU Group: Details of the application notes and sample programs](#)

Product Name	Contents	Status	Update	Download File	Reference Document
TM933H	Users guide (Japanese)				
	Users guide (English)				
	Mode - Start-up routine	Ver.	October 2013	Download	
	Driver - Sample program (C/C++)				

- Driver/sample program
- CMSIS-SVD
- Application note

Toshiba's ARM Core-Based Microcontroller Lineup

32-Bit Microcontrollers

TX04 Series

Part Number	ROM (Bytes)	SRAM (Bytes)	Maximum Operating Frequency (MHz)	DMA Controller (ch)	SSP (ch) ⁽¹⁾	UART/SIO (ch)	Full UART (ch)	I ² C (ch)	I ² C/SIO (ch)	CAN (ch)	Enhanced Serial Interface I/O (ESIO) (ch)	USB Embedded Host (Full-Speed) (ch)	USB (Full-Speed) (ch)	EtherMAC (ch)	10-Bit AD Converter (ch)	12-Bit AD Converter (ch)	10-Bit DA Converter (ch)	16-Bit Timer/Counter (ch)	32-Bit Timer (unit)	High-Res. 16-Bit Timer/PPG Gen. (ch)	2-Phase Pulse Counter (PHC) (ch)	Programmable Servo/Sequence controller (PSC) (ch)	External Interrupt Pins (Pins)	Key-On Wake-Up (KWUP) (ch)	Key Matrix Scan (KSCAN) (Column x Row)	CS/WAIT Controller (ch)	RTC (ch)	Dual Clocks	Trace Function	Oscillation Frequency Detector	Power-On Reset	Voltage Detecting Circuit	I/O Port (Pins)	Supply Voltage (V)	Operating Temperature (°C)	Package
TMPM440FEXBG**	768K	80K	100	6	6	2	1				3				20	2	20	1	4	3	1	22	40	8 x 8	2	1	Yes	Yes	Yes	Yes	228	2.7 to 3.6	-40 to 85	VF8GA289 (11 x 11 mm)		
TMPM440F10XBG**	1024K	80K	100	6	6	2	1				3				20	2	20	1	4	3	1	22	40	8 x 8	2	1	Yes	Yes	Yes	Yes	228					

See page 27 for an explanation of the footnotes.

* Contact the Toshiba sales representative for information about RoHS compliance before you purchase any components.

** Under development

TX00 Series

Flash Versions

Part Number	ROM (Bytes)	SRAM (Bytes)	Maximum Operating Frequency (MHz)	LED Driver (ch)	LCD Driver (Seg. x Com.)	SSP (ch) ⁽¹⁾	UART/SIO (ch)	Full UART (ch)	I ² C (ch)	I ² C/SIO (ch)	CAN (ch)	USB Embedded Host (Full-Speed) (ch)	USB (Full-Speed) (ch)	10-Bit AD Converter (ch)	12-Bit AD Converter (ch)	24-Bit ΔΣ AD Converter (ch)	10-Bit DA Converter (ch)	16-Bit Timer/Counter (ch)	High-Res. 16-Bit Timer/PPG Gen. (ch)	3-Phase PWM Generator (PMD) (ch)	Multi-Purpose Timer (MPT) (ch)	Incremental Encoder Input (ch)	Power Calc. Engine	Temp. Sensor	External Interrupt Pins (Pins)	RTC (ch)	Dual Clocks	Trace Function	Oscillation Frequency Detector	Power-On Reset	Voltage Detecting Circuit	I/O Port (Pins)	Supply Voltage (V)	Operating Temperature (°C)	Package
TMPM061FWFG	128K	8K	16	40 x 4		4				1				2	3			9					Yes	Yes	4	1	Yes			Yes	64	1.8 to 3.6	-40 to 85	LQFP100 (14 x 14 mm)	

See page 27 for an explanation of the footnotes.

* Contact the Toshiba sales representative for information about RoHS compliance before you purchase any components.

TX03 Series

Flash Versions

Part Number	ROM (Bytes)	SRAM (Bytes)	Maximum Operating Frequency (MHz) ⁽⁴⁾	DMA Controller (ch)	SSP (ch) ⁽¹⁾	UART/SIO (ch)	Full UART (ch)	I ² C (ch)	I ² C/SIO (ch)	CAN (ch)	USB Embedded Host (Full-Speed) (ch)	USB (Full-Speed) (ch)	EtherMAC (ch)	10-Bit AD Converter (ch)	12-Bit AD Converter (ch)	10-Bit DA Converter (ch)	16-Bit Timer/Counter (ch)	High-Res. 16-Bit Timer/PPG Gen. (ch)	CEC (ch) ⁽²⁾	Remote Control Preprocessor (ch)	Vector Engine (VE)	3-Phase PWM Generator (PMD) (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)	Oscillation Frequency Detector	I/O Port (Pins)	Supply Voltage (V)	Operating Temperature (°C)	Package
TMPM375FSDMG	64K	4K	40		2 ⁽⁵⁾				1					4		4				Yes	1	1	1	1	3		Yes	21	4.5 to 5.5	-40 to 105	SSOP30			
TMPM372FWFG	128K	6K	(a) 80 (b) 32		4									11		8				Yes	1	1			10		Yes	53		(a) -40 to 85 (b) -40 to 105	LQFP64 (14 x 14 mm)			
TMPM372FWUG		(a) 80 (b) 32		4										11		8				Yes	1	1			10		Yes	53		LQFP64 (10 x 10 mm)				

See page 27 for an explanation of the footnotes.

* Contact the Toshiba sales representative for information about RoHS compliance before you purchase any components.

Flash Versions

Part Number	ROM (Bytes)	SRAM (Bytes)	Maximum Operating Frequency (MHz) ⁽⁴⁾	DMA Controller (ch)	SSP (ch) ⁽¹⁾	UART/SIO (ch)	Full UART (ch)	I ² C (ch)	I ² C/SIO (ch)	Variable-Length Data Serial Interface (VSDIO) (ch)	CAN (ch)	USB Embedded Host (Full-Speed) (ch)	USB (Full-Speed) (ch)	EtherMAC (ch)	10-Bit AD Converter (ch)	12-Bit AD Converter (ch)	16-Bit ΔΣ AD Converter (ch)	10-Bit DA Converter (ch)	16-Bit Timer/Counter (ch)	High-Res. 16-Bit Timer/PPG Gen. (ch)	2-Phase Pulse Counter (PHC) (ch)	CEC (ch) ⁽²⁾	Remote Control Preprocessor (ch)	Vector Engine (VE)	3-Phase PWM Generator (PMD) (ch)	Programmable Servo/Sequence controller (PSC) (ch)	Motor Driver (MCD) (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)	Oscillation Frequency Detector	I/O Port (Pins)	Supply Voltage (V)	Operating Temperature (°C)	Package
TMPM373FWDUG	6K	(a) 80 (b) 32			3										7		8							Yes	1			1		8			Yes	37	4.5 to 5.5	(a) -40 to 85 (b) -40 to 105	LQFP48 (7 x 7 mm)		
TMPM374FWUG		(a) 80 (b) 32			3										6		8							Yes	1			1		7			Yes	33		LQFP44 (10 x 10 mm)			
TMPM330FWFG	8K	40			3			3							12		10													8	1			Yes	78	2.7 to 3.6	-20 to 85	LQFP100 (14 x 14 mm)	
TMPM332FWUG		40			2			2							8		10													5	1			Yes	44			LQFP64 (10 x 10 mm)	
TMPM333FWFG		40				3			3						12		10													8	1			Yes	78			LQFP100 (14 x 14 mm)	
TMPM390FWFG **		20	1	3		1	1								12		10													8	1	Yes	74	1.7 to 3.6	LQFP100 (14 x 14 mm)				
TMPM395FWAXBG		20	4	3		1	1								12		10													11	1	Yes	91		TFBGA120 (6 x 6 mm)				
TMPM380FWDFG		12K	40	2	2	5			2							18		8							1	(3) 2			3	2		16	1	Yes	84			4.0 to 5.5	QFP100 (14 x 20 mm)
TMPM380FWFG	40		2	2	5			2							18		8							1	(3) 2			3	2		16	1	Yes	84	LQFP100 (14 x 14 mm)				
TMPM366FWFG	32K	48	4	3	2	1		2				1			12		10													10	2					74	-40 to 85	LQFP100 (14 x 14 mm)	
TMPM366FWXBG		48	4	3	2	1		2				1			12		10													10	2					74		TFBGA109 (9 x 9 mm)	
TMPM367FWFG **	50K	80	32	3	4	2		3				1			8		2	8						1	(3) 1			4	1		14	4	1	Yes	60	2.7 to 3.6	LQFP100 (14 x 14 mm)		
TMPM367FWXBG **		80	32	3	4	2		3				1			8		2	8						1	(3) 1			4	1		14	4	1	Yes	60		TFBGA109 (9 x 9 mm)		
TMPM368FWFG **		80	32	3	4	2		3	1	1	1				8		2	8						1	(3) 1			4	1		14	4	1	Yes	60		LQFP100 (14 x 14 mm)		
TMPM368FWXBG **		80	32	3	4	2		3	1	1	1				8		2	8						1	(3) 1			4	1		14	4	1	Yes	60		TFBGA109 (9 x 9 mm)		
TMPM370FYDFG	10K	80			4										22		8							Yes	2			2	4	4	16			Yes	76	4.5 to 5.5	QFP100 (14 x 20 mm)		
TMPM370FYFG		80			4										22		8							Yes	2			2	4	4	16			Yes	76				
TMPM330FYFG	16K	40			3			3							12		10													8	1					78	2.7 to 3.6	-20 to 85	LQFP100 (14 x 14 mm)
TMPM330FYWFG		40			3			3							12		10													8	1					78			-40 to 85
TMPM333FYFG		40			3			3							12		10													8	1					78			-20 to 85
TMPM380FYDFG		256K	40	2	2	5			2							18		8							1	(3) 2			3	2		16	1	Yes	84	4.0 to 5.5		QFP100 (14 x 20 mm)	
TMPM380FYFG			40	2	2	5			2							18		8							1	(3) 2			3	2		16	1	Yes	84			LQFP100 (14 x 14 mm)	
TMPM365FYXBG		24K	48	2		2			2				1			12		10													10							74	(6) 2.7 to 3.5
TMPM341FYXBG	32K	54	4	1	5			2							15	2	10	2												12	2		Yes	86	(7) 1.65 to 3.6	-40 to 85	TFBGA113 (6 x 6 mm)		
TMPM342FYXBG	36K	40	4	1	3	1		1	1						12	4	2	10	8	2						1	7.5		6	2	8				63	(8) 2.7 to 3.6	(9) -40 to 85	VFPGA142 (7 x 7 mm)	
TMPM366FYFG	48K	48	4	3	2	1		2				1			12		10													10	2					74	2.7 to 3.6	-40 to 85	LQFP100 (14 x 14 mm)
TMPM366FYXBG		48	4	3	2	1		2				1			12		10													10	2					74			TFBGA109 (9 x 9 mm)
TMPM367FYFG **	66K	80	32	3	4	2		3				1			8		2	8						1	(3) 2			4	1		14	4	1	Yes	60	-40 to 85	LQFP100 (14 x 14 mm)		
TMPM367FYXBG **		80	32	3	4	2		3				1			8		2	8						1	(3) 2			4	1		14	4	1	Yes	60		TFBGA109 (9 x 9 mm)		

See page 27 for an explanation of the footnotes.

• Contact the Toshiba sales representative for information about RoHS compliance before you purchase any components.

** : Under development

Toshiba's ARM Core-Based Microcontroller Lineup

Flash Versions (Continued)

Part Number	ROM (Bytes)	SRAM (Bytes)	Maximum Operating Frequency (MHz)	DMA Controller (ch)	SSP (ch) ⁽¹⁾	UART/SIO (ch)	Full UART (ch)Ω	I ² C (ch)	I ² C/SIO (ch)	Variable-Length Data Serial Interface (VSIO) (ch)	CAN (ch)	USB Embedded Host (Full-Speed) (ch)	USB (Full-Speed) (ch)	EtherMAC (ch)	10-Bit AD Converter (ch)	12-Bit AD Converter (ch)	16-Bit ΔΣ AD Converter (ch)	10-Bit DA Converter (ch)	16-Bit Timer/Counter (ch)	High-Res. 16-Bit Timer/PPG Gen. (ch)	2-Phase Pulse Counter (PHC) (ch)	CEC (ch) ⁽²⁾	Remote Control Preprocessor (ch)	Vector Engine (VE)	3-Phase PWM Generator (PMD) (ch)	Programmable Servo/Sequence controller (PSC) (ch)	Motor Driver (MCD) (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)	Oscillation Frequency Detector	I/O Port (Pins)	Supply Voltage (V)	Operating Temperature (°C)	Package
TMPM368FYFG **	256K	66K	80	32	3	4	2	3			1	1	1		8		2	8					1		⁽³⁾ 2		4	1		14	4	1	Yes	60	2.7 to 3.6	-40 to 85	LQFP100 (14 x 14 mm)		
TMPM368FYXBG **			80	32	3	4	2	3				1	1	1		8		2	8					1		⁽³⁾ 2		4	1		14	4	1	Yes			60	TFBGA109 (9 x 9 mm)	
TMPM369FYFG **			80	32	3	4	2	3				1	1	1	1	16		2	8					1		⁽³⁾ 2		4	2		16	4	1	Yes			102	LQFP144 (20 x 20 mm)	
TMPM369FYXBG **			80	32	3	4	2	3				1	1	1	1	16		2	8					1		⁽³⁾ 2		4	2		16	4	1	Yes			102	TFBGA177 (11 x 11 mm)	
TMPM36BFYFG **			80	32	3	4	2	3								16			8					1		⁽³⁾ 1		4	1		16	4	1	Yes			74	LQFP100 (14 x 14 mm)	
TMPM330FDFG	512K	32K	40		3			3							12			10					1	2							8		1	78	2.7 to 3.6	-40 to 85	LQFP100 (14 x 14 mm)		
TMPM330FDWFG			40		3			3								12			10					1	2						8		1	78					
TMPM333FDFG			40		3			3								12			10												8		1	78					
TMPM341FDXBG	512K	32K	54	4	1	5		2							15		2	10	2												12	2	Yes	86	1.65 to 3.6	-40 to 85	TFBGA113 (6 x 6 mm)		
TMPM376FDDFG			80		4		1									22		8							Yes	2			2		16		Yes	82	4.5 to 5.5		QFP100 (14 x 20 mm)		
TMPM376FDFG			80		4		1									22		8							Yes	2			2		16		Yes	82			LQFP100 (14 x 14 mm)		
TMPM380FDFG **			40	2	2	5		2								18		8						1		⁽³⁾ 2		3	2		16	1	Yes	84	4.0 to 5.5		LQFP100 (14 x 14 mm)		
TMPM384FDFG			40	2	2	5		2								22		12						1		⁽³⁾ 2		4	2		16	1	Yes	121			LQFP144 (20 x 20 mm)		
TMPM366FDFG			48	4	3	2	1	2					1			12		10													10	2		74			LQFP100 (14 x 14 mm)		
TMPM366FDXBG			48	4	3	2	1	2					1			12		10												10	2		74		TFBGA109 (9 x 9 mm)				
TMPM367FDFG	128K	64K	80	32	3	4	2	3							8		2	8					1		⁽³⁾ 1		4	1		14	4	1	Yes	60	2.7 to 3.6	-40 to 85	LQFP100 (14 x 14 mm)		
TMPM367FDXBG **			80	32	3	4	2	3							1	8		2	8					1		⁽³⁾ 1		4	1		14	4	1	Yes			60	TFBGA109 (9 x 9 mm)	
TMPM368FDFG			80	32	3	4	2	3		1	1	1				8		2	8					1		⁽³⁾ 1		4	1		14	4	1	Yes			60	LQFP100 (14 x 14 mm)	
TMPM368FDXBG **			80	32	3	4	2	3		1	1	1				8		2	8					1		⁽³⁾ 1		4	1		14	4	1	Yes			60	TFBGA109 (9 x 9 mm)	
TMPM369FDFG			80	32	3	4	2	3		1	1	1	1			16		2	8					1		⁽³⁾ 2		4	2		16	4	1	Yes			102	LQFP144 (20 x 20 mm)	
TMPM369FDXBG			80	32	3	4	2	3		1	1	1	1			16		2	8					1		⁽³⁾ 2		4	2		16	4	1	Yes			102	TFBGA177 (11 x 11 mm)	
TMPM361F10FG			1024K	64K	64	2	1	5		1	3						8			16					1	1						10	4	1				76	2.7 to 3.6
TMPM362F10FG	64	2			1	12		5								16			16					1	2					16	4	1		120	LQFP144 (20 x 20 mm)				
TMPM363F10FG	⁽¹⁰⁾ 64	2			1	5		1	3		1	1				8			16					1	1					8	4	1		74	⁽⁶⁾ 2.7 to 3.6	LQFP100 (14 x 14 mm)			
TMPM364F10FG	⁽¹⁰⁾ 64	2			1	12		5		1	1					16			16					1	2					14	4	1		118	LQFP144 (20 x 20 mm)				
TMPM36BF10FG	258K	64			32	3	4	2	3							16			8					1		⁽³⁾ 1		4	1		16	4	1	Yes	74	2.7 to 3.6	LQFP100 (14 x 14 mm)		

See page 27 for an explanation of the footnotes.

Contact the Toshiba sales representative for information about RoHS compliance before you purchase any components.

** Under development

TX03 Series

ROM-Less Versions

Part Number	ROM (Bytes)	SRAM (Bytes)	DRAM (Bytes)	Maximum Operating Frequency (MHz)	Audio DSP (unit)	DMA Controller (ch)	Static Memory Controller (ch)	Serial Flash controller (ch)	Sampling rate converter (ch)	SSP (ch) ⁽¹⁾	UART (ch)	SIO/UART (ch)	I ² C/SIO (ch)	I ² C (ch)	PCM interface (unit)	CAN (ch)	USB Embedded Host (Full-Speed) (ch)	USB Embedded Host (High-Speed) (ch)	SD Host controller (ch)	10-Bit AD Converter (ch)	16-Bit Timer/Counter (ch)	Remote Control Preprocessor (ch)	External Interrupt Pins (Pins)	RTC (ch)	Watch dog Timer (ch)	On-Chip Debug Unit	Trace Function	I/O Port (Pins)	Supply Voltage (V)	Operating Temperature (°C)	Package
TMPM320C1DFG	320K	1024K	144		8	2				4	4			2				1	1	4	8		4		Yes	Yes	Yes	55	⁽¹¹⁾	-40 to 85	LQFP144 (20 x 20 mm)
TMPM32EC1DFG**	1664K	NA	96	1	16		1	1	2	2	4	5		2		1		1	8	8	1	10	1	Yes	Yes	Yes	83	3.0 to 3.6 1.1 to 1.3			
TMPM32FC1DFG**		NA	96	1	16		1	1	2	2	4	5		2	2	1		1	8	8	1	10	1	Yes	Yes	Yes	83				
TMPM32BC2DFG	2560K	NA	96	1	16		1	2	2	2	4	5		5		1		1	8	8	1	10	1	Yes	Yes	Yes	112	3.0 to 3.6 1.1 to 1.3	-40 to 85	LQFP176 (20 x 20 mm)	
TMPM32DC2DFG		NA	96	1	16		1	2	2	2	4	5		5	2	1		1	8	8	1	10	1	Yes	Yes	Yes	112				

* Contact the Toshiba sales representative for information about RoHS compliance before you purchase any components.

** Under development

32-Bit Microcontrollers for Automotive

TX03 Series

Flash Versions

Part Number	ROM (Bytes)	SRAM (Bytes)	Maximum Operating Frequency (MHz)	CAN (ch)	DMA Controller (ch)	ESEI (ch)	UART/SIO (ch)	12-Bit AD Converter (ch)	Timer/Compare (32 bit) (ch)	Timer/Capture (32 bit) (ch)	PWM (24bit) (ch)	Vector Engine (VE)	3-Phase PWM Generator (PMD) (ch)	Resolver Digital Converter (RDC)	External Interrupt Pins (Pins)	Watchdog Timer	On-Chip Debug Unit	Trace Function	I/O Port (Pins)	Supply Voltage (V)	Operating Temperature (°C)	Package
TMPM350FDTFG	512K	48K	88	2	32	1	2	20	3	7	6		1		⁽¹²⁾ 1	Yes	Yes	Yes	43	⁽¹⁵⁾	-40 to 105	LQFP100 (14 x 14 mm)
TMPM358FDTFG ** ⁽¹⁷⁾		80K	40	3	32	3	2	20	5	3	3				⁽¹³⁾ 1	Yes	Yes	Yes	35	4.5 to 5.5		
TMPM354F10TAFG **	1024K	64K	96	3	64	2	3	21	5	6	4	Yes	1	1	⁽¹⁴⁾ 1	Yes	Yes	Yes	54	⁽¹⁶⁾	-40 to 125	HQFP144 (20 x 20 mm)

* Contact the Toshiba sales representative for information about RoHS compliance before you purchase any components.

** Under development

Note (1): SSP: Synchronous Serial Port

(2): CEC: Consumer Electronics Control

(3): Either the Programmable Motor Driver (PMD) or the Multi-Purpose Timer (MPT) is selectable.

(4): Maximum Operating Frequency (a) and (b) correspond to Operating Temperatures (a) and (b).

(5): One channel is configurable only as UART.

(6): 3.0 to 3.45 V when USB is used.

(7): When the supply voltage is less than 2.7 V, part of the peripheral blocks (the external bus interface and the SSP) can be used.

(8): MCD analog supply voltage: 3.1 V to 3.5 V

MCD motor supply voltage: 2.5 V to 5.5 V

(9): The operating temperature of the Motor Control Driver (MCD) is between -25 and 85°C.

When the operating temperature is between -40 and -25°C, the MCD is used in stand-by state.

(10): 48 MHz when USB is used.

(11): The following three power supplies are available:

(i) For general ports, and A/D converter: 3.0 V to 3.6 V

(ii) For USB Embedded Host: 3.15 V to 3.45 V

(iii) For internal circuitry: 1.1 V to 1.3 V

(12): The seven capture inputs of the timer can be programmed as external maskable interrupts.

(13): The three capture inputs of the timer can be programmed as external maskable interrupts.

(14): The six capture inputs of the timer can be programmed as external maskable interrupts.

(15): The following two power supplies are available:

(i) For internal circuitry: 1.4 V to 1.65 V

(ii) For general ports and A/D converter: 4.5 V to 5.5 V

(16): The following two power supplies are available:

(i) For internal circuitry: 1.35 V to 1.65 V

(ii) For general ports and A/D converter: 4.5 V to 5.5 V

(17): Low-power modes are available.

* Contact the Toshiba sales representative about a product that is not listed or about a product whose information is different between the list and product introduction page.

Toshiba America**Electronic Components, Inc.**

- Irvine, Headquarters
Tel: (949)462-7700 Fax: (949)462-2200
- Buffalo Grove (Chicago)
Tel: (847)484-2400 Fax: (847)541-7287
- Duluth/Atlanta
Tel: (770)931-3363 Fax: (770)931-7602
- El Paso
Tel: (915)533-4242
- Marlborough
Tel: (508)481-0034 Fax: (508)481-8828
- Parsippany
Tel: (973)541-4715 Fax: (973)541-4716
- San Jose
Tel: (408)526-2400 Fax: (408)526-2410
- Wixom (Detroit)
Tel: (248)347-2607 Fax: (248)347-2602

Toshiba Electronics do Brasil Ltda.

- Tel: (011)2936-6681 Fax: (011)2936-6675

Toshiba India Private Ltd.

- New Delhi Office
Tel: (0124)499-6600 Fax: (0124)499-6611
- Bangalore Office
Tel: (080)251-90800 Fax: (080)490-91945

Toshiba Electronics Europe GmbH

- Düsseldorf Head Office
Tel: (0211)5296-0 Fax: (0211)5296-400
- France Branch
Tel: (1)47282181
- Italy Branch
Tel: (039)68701 Fax: (039)6870205
- Munich Office
Tel: (089)20302030 Fax: (089)203020310
- Spain Branch
Tel: (91)660-6798 Fax: (91)660-6799
- Sweden Branch
Tel: (08)704-0900 Fax: (08)80-8459
- U.K. Branch
Tel: (1932)841600

Toshiba Vietnam Consumer Products Co.,Ltd.

- Tel: (043)776-5950 Fax: (043)776-5956

Toshiba Electronics Asia (Singapore) Pte. Ltd.

- Tel: (6278)5252 Fax: (6271)5155

Toshiba Electronics Service (Thailand) Co., Ltd.

- Tel: (02)835-3491 Fax: (02)835-3490

Toshiba Electronics Trading (Malaysia)Sdn. Bhd.

- Kuala Lumpur Head Office
Tel: (03)5631-6311 Fax: (03)5631-6307
- Penang Office
Tel: (04)226-8523 Fax: (04)226-8515

Toshiba Electronics (Shanghai) Co., Ltd.

- Shanghai Head Office
Tel: (021)6139-3888 Fax: (021)6190-8288
- Beijing Branch
Tel: (010)6590-8796 Fax: (010)6590-8791
- Chengdu Branch
Tel: (028)8675-1773 Fax: (028)8675-1065
- Hangzhou Office
Tel: (0571)8717-5004 Fax: (0571)8717-5013
- Nanjing Office
Tel: (025)8689-0070 Fax: (025)8689-0125
- Qingdao Branch
Tel: (532)8579-3328 Fax: (532)8579-3329
- Shenzhen Branch
Tel: (0755)2399-6897 Fax: (0755)2399-5573
- Dalian Branch
Tel: (0411)8368-6882 Fax: (0411)8369-0822
- Xiamen Branch
Tel: (0592)226-1398 Fax: (0592)226-1399
- Dongguan Branch
Tel: (0769)8155-6858 Fax: (0769)8155-6368
- Toshiba Electronics Asia, Ltd.
Tel: 2375-6111 Fax: 2375-0969
- Toshiba Electronics Korea Corporation
Tel: (02)3484-4334 Fax: (02)3484-4302
- Toshiba Electronics Taiwan Corporation
Tel: (02)2508-9988 Fax: (02)2508-9999

RESTRICTIONS ON PRODUCT USE

- ▶ Toshiba Corporation, and its subsidiaries and affiliates (collectively "TOSHIBA"), reserve the right to make changes to the information in this document, and related hardware, software and systems (collectively "Product") without notice.
- ▶ This document and any information herein may not be reproduced without prior written permission from TOSHIBA. Even with TOSHIBA's written permission, reproduction is permissible only if reproduction is without alteration/omission.
- ▶ Though TOSHIBA works continually to improve Product's quality and reliability, Product can malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Before customers use the Product, create designs including the Product, or incorporate the Product into their own applications, customers must also refer to and comply with (a) the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the "TOSHIBA Semiconductor Reliability Handbook" and (b) the instructions for the application with which the Product will be used with or for. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this Product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. **TOSHIBA ASSUMES NO LIABILITY FOR CUSTOMERS' PRODUCT DESIGN OR APPLICATIONS.**
- ▶ **PRODUCT IS NEITHER INTENDED NOR WARRANTED FOR USE IN EQUIPMENTS OR SYSTEMS THAT REQUIRE EXTRAORDINARILY HIGH LEVELS OF QUALITY AND/OR RELIABILITY, AND/OR A MALFUNCTION OR FAILURE OF WHICH MAY CAUSE LOSS OF HUMAN LIFE, BODILY INJURY, SERIOUS PROPERTY DAMAGE AND/OR SERIOUS PUBLIC IMPACT ("UNINTENDED USE").** Except for specific applications as expressly stated in this document, Unintended Use includes, without limitation, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, devices related to electric power, and equipment used in finance-related fields. **IF YOU USE PRODUCT FOR UNINTENDED USE, TOSHIBA ASSUMES NO LIABILITY FOR PRODUCT.** For details, please contact your TOSHIBA sales representative.
- ▶ Do not disassemble, analyze, reverse-engineer, alter, modify, translate or copy Product, whether in whole or in part.
- ▶ Product shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable laws or regulations.
- ▶ The information contained herein is presented only as guidance for Product use. No responsibility is assumed by TOSHIBA for any infringement of patents or any other intellectual property rights of third parties that may result from the use of Product. No license to any intellectual property right is granted by this document, whether express or implied, by estoppel or otherwise.
- ▶ **ABSENT A WRITTEN SIGNED AGREEMENT, EXCEPT AS PROVIDED IN THE RELEVANT TERMS AND CONDITIONS OF SALE FOR PRODUCT, AND TO THE MAXIMUM EXTENT ALLOWABLE BY LAW, TOSHIBA (1) ASSUMES NO LIABILITY WHATSOEVER, INCLUDING WITHOUT LIMITATION, INDIRECT, CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OR LOSS, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF OPPORTUNITIES, BUSINESS INTERRUPTION AND LOSS OF DATA, AND (2) DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES AND CONDITIONS RELATED TO SALE, USE OF PRODUCT, OR INFORMATION, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, ACCURACY OF INFORMATION, OR NONINFRINGEMENT.**
- ▶ Do not use or otherwise make available Product or related software or technology for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). Product and related software and technology may be controlled under the applicable export laws and regulations including, without limitation, the Japanese Foreign Exchange and Foreign Trade Law and the U.S. Export Administration Regulations. Export and re-export of Product or related software or technology are strictly prohibited except in compliance with all applicable export laws and regulations.
- ▶ Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. Please use Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. **TOSHIBA ASSUMES NO LIABILITY FOR DAMAGES OR LOSSES OCCURRING AS A RESULT OF NONCOMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS.**

TOSHIBA**TOSHIBA CORPORATION**

Semiconductor & Storage Products Company

Website: <http://www.semicon.toshiba.co.jp/eng>