32-Bit Microcontrollers
Microcontrollers Transform Society.

**Arm® Core-Based 32-Bit Microcontrollers**

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

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

### Features of the TXZ Family

- **Outstanding basic performance**
  - Wide range of operating voltage: 1.62 to 5.5 V
  - Operating frequency of up to 200 MHz
  - Operating current of 100 µA/MHz
  - High-precision on-chip oscillator: 10 MHz±1%

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

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

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

- **Wide range of product lineup**
  - Packaging: 32 to 176 pins
  - Code memory: 32 KB to 2 MB
  - Data memory: 8 KB to 64 KB
  - RAM: 8 KB to 256 KB
This circuit generates three-phase complementary PWM signals for motor commutation and a start trigger signal for an AD converter. The VE is a hardware unit that handles calculations for vector control. It can operate in cooperation with ADC and PMD without software intervention. (* The current values and phases setting are programmed via software.)

The signals from an incremental encoder or Hall sensor can be input directly. This is a successive-approximation AD converter, which can be programmed to initiate successive-approximation analog-to-digital conversions on multiple channels with a single start signal.

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

### Product Lineup

<table>
<thead>
<tr>
<th>ROM Size (Flash)</th>
<th>TX03 Series/M370 Group</th>
<th>TX04 Series/M470 Group</th>
<th>TXZ4 Series/M4K Group(1)(2), M4L Group(1)</th>
<th>**: Under development</th>
</tr>
</thead>
<tbody>
<tr>
<td>512 KB</td>
<td>TMPM4KLFDDFG**</td>
<td>TMPM4KMFDDFG**</td>
<td>TMPM4KPFDDFG**</td>
<td>TMPM4KQFDDFG**</td>
</tr>
<tr>
<td>384 KB</td>
<td>TMPM4KLFYUG</td>
<td>TMPM4KLFYADUG</td>
<td>TMPM4KLFYDFG**</td>
<td>TMPM4KLYDFG**</td>
</tr>
<tr>
<td>256 KB</td>
<td>TMPM4K1FWAUG</td>
<td>TMPM4KLMFWAUG</td>
<td>TMPM4K1LFWAUG</td>
<td>TMPM4K1LFWAUG</td>
</tr>
<tr>
<td>128 KB</td>
<td>TMPM4KFWAUG</td>
<td>TMPM4KFWAUG</td>
<td>TMPM4K1FWAUG</td>
<td>TMPM4K1FWAUG</td>
</tr>
<tr>
<td>96 KB</td>
<td>TMPM4KFWAUG</td>
<td>TMPM4KFWAUG</td>
<td>TMPM4K1FWAUG</td>
<td>TMPM4K1FWAUG</td>
</tr>
<tr>
<td>64 KB</td>
<td>TMPM4K1FWAUG</td>
<td>TMPM4K1FWAUG</td>
<td>TMPM4K1FWAUG</td>
<td>TMPM4K1FWAUG</td>
</tr>
<tr>
<td>30 pins</td>
<td>32 pins</td>
<td>44 pins</td>
<td>48 pins</td>
<td>64 pins</td>
</tr>
</tbody>
</table>

### Evaluation Kit

**ESP Starter Kit for TMPM37A**
- Included hardware: TMPM37A evaluation board
- Brushless DC motors

**ESP Starter Kit for TMPM475**
- Included hardware: TMPM475 evaluation board
- Brushless DC motors
This circuit generates three-phase complementary PWM signals for motor commutation and a start trigger signal for an AD converter.

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

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

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

The arrows denote communication paths between IP cores.

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

- **Debugging and tuning during motor operation**
  - Makes it easy to debug and tune the MCU control software while a motor is running

- **No dedicated software**
  - Eliminates the need for memory-resident software for monitoring and therefore a workload for the design of a control program

### Microcontrollers that support RAMScope and EVRICA

<table>
<thead>
<tr>
<th></th>
<th>M4K0</th>
<th>M4K1</th>
<th>M4K2</th>
<th>M4K4</th>
<th>M4K6</th>
<th>M4K8</th>
<th>M4K10</th>
<th>M4K12</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAMScope</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>EVRICA</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Note: This table includes microcontrollers being planned and developed and is therefore subject to change without notice.

Note: RAMScope is a product from DTS INSIGHT Corporation.
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 high-speed ADC interface operations, it helps to reduce the software workload significantly.

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.
System Block Diagram (Air Conditioners)

System Block Diagram (Washing Machine)
### General-Purpose Microcontrollers for Home Appliance Applications

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

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

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

#### System Block Diagram (Induction Cooktops)

![System Block Diagram (Induction Cooktops)](image)

- **Inverter Heater**
- **IGBT/MOSFET Driver**
- **Photocoupler**
- **Radiant Heater**
- **Roaster Heater**
- **Cooling Fan**
- **Main Control M3H Group**

- **Operation Panel Control**
  - LCDs
  - LEDs
  - Key entry
  - Timer

#### System Block Diagram (Refrigerators)

![System Block Diagram (Refrigerators)](image)

- **Main Control M3H Group**
- **Power Supply Section**
  - Heater
  - Defrosting Heater
  - Indoor Lamps
- **Compressor Control**
  - Driver
  - M
  - Display Section
    - Operation/Panel Control
    - LCD Backlight: LEDs
    - Key Input
  - LED Outputs
- **C/R/F Interior Fan Motor Driver**
- **Motor Damper Motor Driver**
- **Driver**
- **Driver**
- **Door SW Input**
- **Sensor Input**
- **EEPROM**
- **Reset IC**

#### Included Hardware:
- TMPM3HQ evaluation board
- USB cable

#### Starter Kit for TMPM3HQ

- **Chip One Stop, Inc. Online Shop**
- **TX03 Series/M380 Group**
- **TXZ3 Series/M3H Group (1)(2)**

- **Included hardware:**
  - TMPM3H6 evaluation board
  - USB cable

#### Chip One Stop, Inc. Online Shop

- **Starter Kit for TMPM3H6**
- **Extensive lineup of standard microcontrollers featuring low power consumption and high functionality.**

- **General-Purpose Microcontrollers for Home Appliance Applications**

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

**Product Lineup**

<table>
<thead>
<tr>
<th>ROM Size (Flash)</th>
<th>TX03 Series/M380 Group</th>
<th>TXZ3 Series/M3H Group (1)(2)</th>
<th>**: Under development</th>
</tr>
</thead>
<tbody>
<tr>
<td>512 KB</td>
<td>TMPM3HDFUGG</td>
<td>TMPM3HDFUGG</td>
<td>TMPM3HDFUGG</td>
</tr>
<tr>
<td></td>
<td>TMPM3HDFUGG</td>
<td>TMPM3HDFUGG</td>
<td>TMPM3HDFUGG</td>
</tr>
<tr>
<td>384 KB</td>
<td></td>
<td>TMPM3HDFUGG</td>
<td></td>
</tr>
<tr>
<td>256 KB</td>
<td></td>
<td>TMPM3HDFUGG</td>
<td></td>
</tr>
<tr>
<td>128 KB</td>
<td></td>
<td>TMPM3HDFUGG</td>
<td></td>
</tr>
<tr>
<td>96 KB</td>
<td></td>
<td>TMPM3HDFUGG</td>
<td></td>
</tr>
<tr>
<td>64 KB</td>
<td></td>
<td>TMPM3HDFUGG</td>
<td></td>
</tr>
<tr>
<td>48 KB</td>
<td></td>
<td>TMPM3HDFUGG</td>
<td></td>
</tr>
<tr>
<td>32 KB</td>
<td></td>
<td>TMPM3HDFUGG</td>
<td></td>
</tr>
<tr>
<td>32 pins</td>
<td>44 pins</td>
<td>48 pins</td>
<td>52 pins</td>
</tr>
<tr>
<td>64 pins</td>
<td>80 pins</td>
<td>100 pins</td>
<td>128 pins</td>
</tr>
<tr>
<td>144 pins</td>
<td>Pin Count</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Evaluation Kit**

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

- Included hardware:
  TMPM3HQ evaluation board
  USB cable

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

- Included hardware:
  TMPM3H6 evaluation board
  USB cable
**Features**
- High efficiency operation
- Integrated dedicated HDMI 1.3a (CEC) circuit (TMPM330/TMPM332)
- Remote control preprocessor essential for digital applications (TMPM330/TMPM332)

**Applications**
- Televisions
- Printers
- Base stations

**System Block Diagram (Digital TV)**

**Product Lineup**

<table>
<thead>
<tr>
<th>ROM Size (Flash)</th>
<th>TX00 Series/M030 Group</th>
<th>TX03 Series/M330 Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>512 KB</td>
<td>TMPM333FDFG</td>
<td>TMPM330FDGF</td>
</tr>
<tr>
<td>256 KB</td>
<td>TMPM332FWUG</td>
<td>TMPM330FDFG</td>
</tr>
<tr>
<td>128 KB</td>
<td>TMPM037FWUG</td>
<td>TMPM330FDXBG</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pin Count</th>
<th>TX00 Series/M030 Group</th>
<th>TX03 Series/M330 Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>64 pins</td>
<td>TMPM333FDGF</td>
<td>TMPM330FDXBG</td>
</tr>
<tr>
<td>100 pins</td>
<td>TMPM332FWUG</td>
<td>TMPM330FDFG</td>
</tr>
</tbody>
</table>

**Evaluation Kit**
- Included hardware:
  - TMPM036 evaluation board
  - USB cable
Features

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

Applications

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

System Block Diagram (Sensor Hub)

Key points

In addition to USB (Full-Speed), the microcontrollers shown below incorporate various serial interfaces such as SPI*1 and I2C*2 (supporting Fast-Mode Plus*3). These microcontrollers can be used as a sensor hub that controls multiple sensors.

*1: SPI: Serial Peripheral Interface
*2: I2C: Inter-Integrated Circuit
*3: Fast-mode Plus

Product Lineup

<table>
<thead>
<tr>
<th>ROM Size (Flash)</th>
<th>TX00 Series/M060 Group</th>
<th>TX03 Series/M360 Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>512 KB</td>
<td>TMPM368FDG</td>
<td>TMPM369FDXBG</td>
</tr>
<tr>
<td>256 KB</td>
<td>TMPM367FDG</td>
<td>TMPM366FDXBG</td>
</tr>
<tr>
<td>128 KB</td>
<td>TMPM067FWQG</td>
<td>TMPM068FWXBG</td>
</tr>
<tr>
<td></td>
<td>TMPM066FWUG</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pin Count</th>
<th>TX00 Series/M060 Group</th>
<th>TX03 Series/M360 Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>48 pins</td>
<td>48 pins</td>
<td></td>
</tr>
<tr>
<td>57 pins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>64 pins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 pins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>105 pins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>109 pins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>144 pins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>177 pins</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Evaluation Kit

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

- Included hardware:
  TMPM036 evaluation board
  USB cable
**Features**
- Supports various communication interfaces
- Embedded high-capacity flash memory
- Integrated dedicated HDMI 1.3a (CEC) circuit
- External bus interface that can be connected to SoCs and external extended memory
- CEC interface and remote control signal preprocessor that remain active even in Low power consumption mode

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

**System Block Diagram (AV Amplifier)**

**System Block Diagram (Printer)**
### Product Lineup

<table>
<thead>
<tr>
<th>ROM Size (Flash)</th>
<th>TX03 Series/M360 Group</th>
<th>TX04 Series/M460 Group</th>
<th>TXZ4 Series/M4G Group (1)</th>
<th>**: Under development</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 MB</td>
<td></td>
<td></td>
<td><strong>TMPM4G8F15FG</strong></td>
<td><strong>TMPM4G9F15FG</strong></td>
</tr>
<tr>
<td>1 MB</td>
<td><strong>TMPM4G6BF10FG</strong></td>
<td><strong>TMPM4G7F10FG</strong></td>
<td><strong>TMPM4G8F15XBG</strong></td>
<td><strong>TMPM4G9F15XBG</strong></td>
</tr>
<tr>
<td>768 KB</td>
<td><strong>TMPM4G6FEFG</strong></td>
<td><strong>TMPM4G6FEFG</strong></td>
<td><strong>TMPM4G8F10FG</strong></td>
<td><strong>TMPM4G9F10FG</strong></td>
</tr>
<tr>
<td>512 KB</td>
<td><strong>TMPM4G8FDFG</strong></td>
<td><strong>TMPM4G7FDFG</strong></td>
<td><strong>TMPM4G8FDXBG</strong></td>
<td><strong>TMPM4G9FDXBG</strong></td>
</tr>
<tr>
<td>256 KB</td>
<td><strong>TMPM36BFYFG</strong></td>
<td><strong>TMPM365FYXBG</strong></td>
<td><strong>TMPM369FDFG</strong></td>
<td><strong>TMPM369FDXBG</strong></td>
</tr>
</tbody>
</table>

| Pin Count       | 100 pins               | 105/109 pins           | 128 pins                  | 144 pins               | 145 pins               | 176 pins               | 177 pins               |

### Key Points

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

### Evaluation Kit

**Chip One Stop, Inc. Online Shop**

*Starter Kit for TMPM46B*

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

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

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

**Applications**
- Surveillance cameras
- Camera lens
- Digital video cameras

**System Block Diagram (Camera Lens)**

```
  +-------------------+       +-------------------+       +-------------------+
  |  Amp              |       |  ADC               |       |  TMPM343           |
  +-------------------+       +-------------------+       +-------------------+
  |  ADC              |       |  Arm               |       |  TMPM342           |
  +-------------------+       +-------------------+       +-------------------+
  |  PSC(*)           |       |  H-SW              |       |  BODY              |
  +-------------------+       +-------------------+       +-------------------+
  |  Gyro Sensor      |       |  Autofocus Control |       |  Stepping Motor    |
  +-------------------+       +-------------------+       +-------------------+
  |  Hall Sensor      |       |  Iris Control      |       |  Stepping Motor    |
  +-------------------+       +-------------------+       +-------------------+
  |  PSC(*)           |       |  Camera Shake      |       |  Voice Coil Motor  |
  +-------------------+       +-------------------+       +-------------------+
  |  TMPM343F10XBG    |       |  Compensation      |       |  BODY              |
  +-------------------+       +-------------------+       +-------------------+
  |  TMPM342FEXBG     |       |  M                 |       |  BODY              |
  +-------------------+       +-------------------+       +-------------------+

* The TMPM343 contains four PSC units. The TMPM342 contains one PSC unit.
```

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

**Product Lineup**

<table>
<thead>
<tr>
<th>ROM Size (Flash)</th>
<th>TX03 Series/M340 Group</th>
<th>TX04 Series/M440 Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1024 KB</td>
<td>TMPM343F10XBG</td>
<td>TMPM440F10XBG</td>
</tr>
<tr>
<td>768 KB</td>
<td>TMPM343FDXBG</td>
<td>TMPM440FEXBG</td>
</tr>
<tr>
<td>512 KB</td>
<td>TMPM343F10XBG</td>
<td></td>
</tr>
<tr>
<td>256 KB</td>
<td>TMPM342FEXBG</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>142 pins</th>
<th>162 pins</th>
<th>289 pins</th>
<th>Pin Count</th>
</tr>
</thead>
</table>

**Evaluation Kit**

IAR Systems Starter Kit for TMPM440

- Included hardware:
  - TMPM440 evaluation board
  - IAR i-Jet Lite
  - USB cable
  - IAR Embedded Workbench for ARM KickStart edition
Microcontrollers for HEMS and Electricity Meter Applications

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

**Features**
- Power calculation engine (TMPM061)
- Temperature sensor (TMPM311)

**Applications**
- Smart meters
- Healthcare

**System Block Diagram (Smart meters: Metering Unit)**

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

**Product Lineup**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>ROM (Flash)</th>
<th>RAM Size</th>
<th>Package</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX00 Series/M060 Group</td>
<td>128 KB</td>
<td></td>
<td>LQFP100 (14 x 14 mm)</td>
<td>The microcontrollers shown below combine a 24-bit sigma-delta AD converter and Toshiba's unique power calculation engine (PCE) to achieve accurate power measurement. These microcontrollers are suitable for smart meter and other HEMS applications as well as office equipment applications requiring power measurement.</td>
</tr>
<tr>
<td>TX03 Series/M310 Group</td>
<td>ROM less</td>
<td></td>
<td>TMPM311CHDUG</td>
<td></td>
</tr>
<tr>
<td>TX04 Series/M440 Group</td>
<td></td>
<td></td>
<td>TMPM342FYXBG</td>
<td></td>
</tr>
<tr>
<td>TX03 Series/M340 Group</td>
<td></td>
<td></td>
<td>TMPM343FDXBG</td>
<td></td>
</tr>
</tbody>
</table>

**Microcontrollers for Automotive Control Applications**

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

**Product Lineup**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>ROM (Flash)</th>
<th>RAM Size</th>
<th>Package</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMPM351F10TFG</td>
<td>1 MB</td>
<td>64 KB</td>
<td>LQFP100 (14 x 14 mm)</td>
<td>Arm Cortex-M3 plus Toshiba-original Advanced Programmable Motor Driver (A-PMD) 2-channel CAN controller and 2 units of AD Converter Functional safety: Optimized tightly coupled fault supervisors 144-MHz operation (max), and high temperature operation (Ta: up to 105°C max) The CAN controllers and the blocks that implement functional safety contain logic specifically designed for automotive applications, making the TMPM351F10TFG suitable for motor applications in safety-related systems such as electronic power steering (EPS).</td>
</tr>
<tr>
<td>TMPM354F10TAFG</td>
<td>1 MB</td>
<td>64 KB</td>
<td>HQFP144 (20 x 20 mm)</td>
<td>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.</td>
</tr>
<tr>
<td>TMPM358FDTFG</td>
<td>512 KB</td>
<td>80 KB</td>
<td>LQFP100 (14 x 14 mm)</td>
<td>A sleep mode is provided in Arm Cortex-M3 allowing RAM backup (16 KB) 3-channel CAN controller and 2 units of AD Converter, 80-KB RAM including a backup RAM for 16 KB Functional safety: Optimized tightly coupled fault supervisors 40-MHz operation (max), and high temperature operation (Ta: up to 105°C max) The CAN controllers and the blocks that implement functional safety contain logic specifically designed for automotive applications, making the TMPM358FDTFG suitable for control applications such as battery power monitoring.</td>
</tr>
</tbody>
</table>
### Features
- Incorporates 300-MHz or 600-MHz Arm® Cortex®-A9
- Voice command and voice synthesis middleware for RTOS and Linux®
- Extensive interfaces

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

### System Block Diagram

#### TZ2100 Application Processors
- Arm® Cortex®-A9
- 300/600MHz
- FPU
- SRAM
- 1MB/32KB Backup
- Display
- 2D GFX
- YUV-to-RGB Conversion
- LCD Controller
- Memory Interface
- High-Speed Interface
- Peripheral Device Interfaces
- Power Management
- Accelerator

#### TZ2100XBG
- Part Number
- Arm® Cortex®-A9
- 1 MByte SRAM
- 32 Kbyte (Back-up)
- 300 MHz

#### TZ2102XBG
- Part Number
- Arm® Cortex®-A9
- 1 MByte SRAM
- 32 Kbyte (Back-up)
- 600 MHz

### Attractive Middleware for RTOS and Linux

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

### Product Lineup

<table>
<thead>
<tr>
<th>Part Number</th>
<th>CPU Core</th>
<th>Operating Frequency</th>
<th>SRAM</th>
<th>Differentiating Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>TZ2100XBG</td>
<td>Arm® Cortex®-A9</td>
<td>300 MHz</td>
<td>1 MByte SRAM</td>
<td>+ Incorporates an LCD panel interface, a camera interface, encryption functions and various networking functions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+ Provides ToSpeak™, speech synthesis middleware suitable for voice guidance applications</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+ Incorporates a general-purpose parallel interface to which various peripheral ICs can be connected</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+ Achieves rich and smooth rendering with a 2D graphics accelerator</td>
</tr>
</tbody>
</table>

### TZ2100 Speech HMI Solution Development Starter Kit

Toshiba provides a startup development environment that allows its voice trigger middleware to be used on the TZ2100 to realize voice commands in the local environment. Because the starter kit does not require many external components, it helps reduce the bill-of-materials (BOM) costs, simplify board layout, and reduce the application size.
Toshiba collaborates with Arm ecosystem partners to provide various tools and development environments, as well as technical information, services and sales support. Tools support designers from conception to completion, ranging from microcontroller selection to mass production.

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

### Consultation on the selection of a development environment
Toshiba provides information on various development environments, tools and partners necessary for system development and mass production of your MCU.

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

---

**Support for Arm Ecosystem**

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

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

<table>
<thead>
<tr>
<th>Technical support for MCUs</th>
<th>Consultation on the selection of a development environment</th>
<th>Ecosystem partnership</th>
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<tr>
<td>Support for technical studies (hardware and software)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Features & Applications**

- Speech HMI Solutions
  - TZ2100 Series
  - Support for Arm Ecosystem

**TZ2100 Speech HMI Solution Development Starter Kit**

- Speech HMI Solutions
- TZ2100 Series
- Support for Arm Ecosystem

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**Technical support**

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

**Development tools**

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

---

**Robust collaboration**
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.

<table>
<thead>
<tr>
<th>Ecosystem partners for development environments</th>
</tr>
</thead>
</table>

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

Website of Toshiba Electronic Devices & Storage Corporation:

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver source code</td>
<td>Setup program containing sequences for operating various IP cores. Synonymous with peripheral driver and MCU hardware abstraction layer (MCU HAL).</td>
</tr>
<tr>
<td>Sample drivers</td>
<td>Sample embedded programs for operating the HAL and IP cores. Sample drivers can run on starter kits and other boards for each microcontroller.</td>
</tr>
<tr>
<td>Sample projects</td>
<td>Genuine MDK-Arm software development environment and IAR Systems’ EWARM project. You can verify operation with a development environment and a starter kit.</td>
</tr>
</tbody>
</table>

### Genuine MDK-Arm development environment

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

### IAR Systems’ EWARM development environment

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

Application notes and sample programs are available for download at:


Semiconductor & Storage Products Home > Products > Microcomputer > Design / Support > Application Notes / Sample Programs
Evaluation Kits

In order to evaluate whether to use Toshiba’s microcontroller, it is advisable to use an entry-level evaluation kit (such as a starter kit) to start software development. Starter kits are available from development environment and evaluation kit vendors. Various evaluation kits are available, ranging from the kits that are bundled with an IDE and an emulator to those that are compliant with an on-board emulator standard called CMSIS-DAP.

Moreover, feature-rich solution packages incorporating peripheral functions are also available. For detailed information, contact a partner listed in the “Boards/Evaluation Kits” column of the “Evaluation Environment Ecosystems” table on the previous page. For evaluation kits supported by each microcontroller, see the pages that describe individual microcontrollers. The following photographs were taken for inclusion in this brochure and may differ from actual products.

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

**IAR Systems Starter Kit for TMPM440**

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

- Key features
  - USB/UART serial converter
  - 2 potentiometer input analog signals
  - Reset switch
  - Power LED
  - 2-phase encoder
  - 8 push switches
  - 8 user LEDs
  - DC power jack

**ESP Starter Kit for TMPM475**

- Included hardware: TMPM475 evaluation board
- Brushless DC motors

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

**ESP Starter Kit for TMPM37A**

- Included hardware: TMPM37A evaluation board
- Brushless DC motors

- Key features
  - Selectable from 3-shunt resistor circuitry
    (external amp only) and 1-shunt resistor circuitry
    (that allows either an internal or an external amp to be selected)
  - 12-bit DAC x 4
  - Analog (slide volume resistor input)
  - 1 reset switch
  - 1 tactile switch
  - LED (for DAC monitoring)
  - 20-pin JTAG half-pitch socket
    (only for SWD connection)
Moreover, feature-rich solution packages incorporating peripheral functions are also available. For detailed information, contact a partner.

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

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

### Evaluation Kits

#### Chip One Stop, Inc. Online Shop Starter Kit for TMPM3HQ
- Included hardware:
  - TMPM3HQ evaluation board
  - USB cable

- Key features:
  - mbed
  - Arduino-compatible connector
  - USB-UART
  - AD converter
  - Thermistor
  - 6-axis sensor
  - Reset switch
  - Selectable power supply (DC jack input, USB-to-UART input or DAP USB input)

#### Chip One Stop, Inc. Online Shop Starter Kit for TMPM36
- Included hardware:
  - TMPM36 evaluation board
  - USB cable

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

#### Chip One Stop, Inc. Online Shop Starter Kit for TMPM066
- Included hardware:
  - TMPM066 evaluation board
  - USB cable

- Key features:
  - mbed
  - Arduino-compatible connector
  - USB-UART
  - Selectable power supply (DC jack input, USB-to-UART input or DAP USB input)

#### Chip One Stop, Inc. Online Shop Starter Kit for TMPM46B
- Included hardware:
  - TMPM46B evaluation board
  - USB cable

- Key features:
  - mbed
  - Remote control receiver
  - USB-UART
  - Selectable power supply (DC jack input, USB-to-UART input or DAP USB input)
The Toshiba Microcomputer web page provides the latest information on our products.

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

- Datasheets
- Evaluation Kits
- Partner Information
- Videoclips
- Reference Boards
- Application Notes
- Purchase/Sample
- Facebook

Website of Toshiba Electronic Devices & Storage Corporation:

● Microcomputer web page ●

● Online Distributor ●

Chip One stop, Inc
Digi-Key Corporation
Mouser Electronics
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