

Product BriefMPC555PB/D
Rev. 3, 2/2003

MPC555 Product Brief

This document provides an overview of the MPC555 microcontroller, including a block diagram showing the major modular components and sections that list the major features. The MPC555 member of the Freescale MPC500 RISC Microcontroller family.

Table 1. MPC555 Features

| Device | Flash | Code Compression |
|--------|------------|--------------------------------|
| MPC555 | 448 Kbytes | Code compression not supported |

1 Introduction

The MPC555 device offers the following features:

- PowerPC™ core with floating-point unit
- 26 Kbytes fast RAM and 6 Kbytes TPU microcode RAM
- 448 Kbytes Flash EEPROM with 5-V programming
- 5-V I/O system
- Serial system: queued serial multi-channel module (QSMCM), dual CAN 2.0B controller modules (TouCAN™)
- 50-channel timer system: dual time processor units (TPU3), modular I/O system (MIOS1)
- 32 analog inputs: dual queued analog-to-digital converters (QADC64)
- Submicron HCMOS (CDR1) technology
- 272-pin plastic ball grid array (PBGA) packaging
- 40-MHz operation, -40 °C to 125 °C with dual supply (3.3 V, 5 V) (-55 °C to 125 °C for the suffix A device)
- 32-bit architecture (PowerPC ISA architecture compliant)
- Core performance measured at 52.7-Kbyte Dhrystones (v2.1) @ 40 MHz
- Fully static, low power operation
- Integrated double-precision floating-point unit
- Precise exception model

Block Diagram

- Extensive system development support
 - On-chip watchpoints and breakpoints
 - Program flow tracking
 - BDM on-chip emulation development interface

1.1 Block Diagram

Figure 1 is a block diagram of the MPC555.

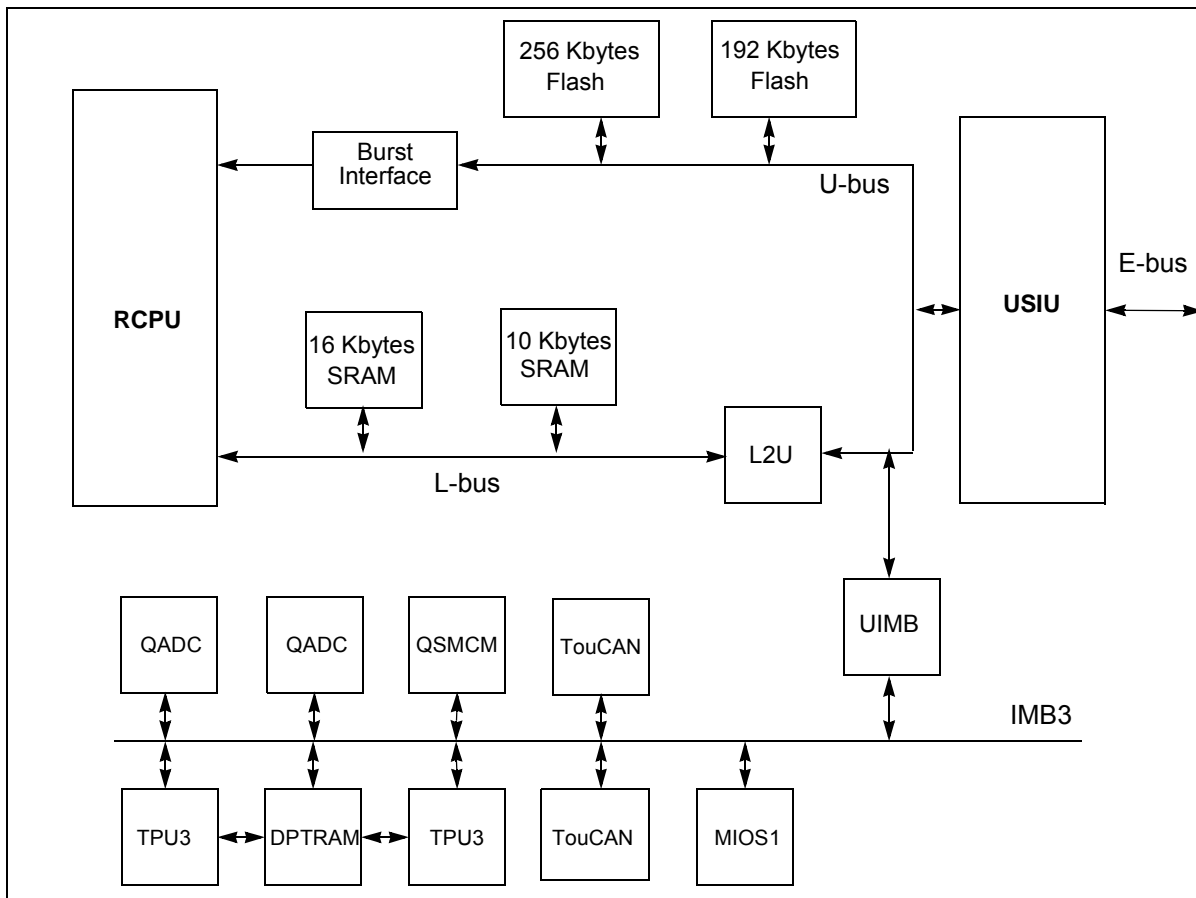


Figure 1. MPC555 Block Diagram

1.2 Key Features

The MPC555 key features are explained in the following sections.

1.2.1 Four-Bank Memory Controller

- Works with SRAM, EPROM, Flash EEPROM, and other peripherals
- Byte write enables
- 32-bit address decodes with bit masks

1.2.2 U-Bus System Interface Unit (USIU)

- Clock synthesizer
- Power management
- Reset controller
- MPC555 decremter and time base
- Real-time clock register
- Periodic interrupt timer
- Hardware bus monitor and software watchdog timer
- Interrupt controller that supports up to eight external and eight internal interrupts
- IEEE 1149.1 JTAG test access port
- External bus interface
 - 24 address pins, 32 data pins
 - Supports multiple master designs
 - Four-beat transfer bursts, two-clock minimum bus transactions
 - Supports 5V inputs, provides 3.3-V outputs

1.2.3 Flexible Memory Protection Unit

- Four instruction regions and four data regions
- 4-Kbyte to 16-Mbyte region size support
- Default attributes available in one global entry
- Attribute support for speculative accesses

1.2.4 448-Kbyte Flash EEPROM Memory

- One 256-Kbyte and one 192-Kbyte module
- Page read mode
- Block (32-Kbyte) erasable
- External 4.75-V to 5.25-V program and erase power supply

1.2.5 26-Kbytes of Static RAM

- One 16-Kbyte and one 10-Kbyte module
- Fast (one-clock) access
- Keep-alive power
- Soft defect detection (SDD)

1.2.6 General-Purpose I/O Support

- Address (24) and data (32) pins can be used for general-purpose I/O in single-chip mode
- Nine general-purpose I/O pins in MIOS1 unit
- Many peripheral pins can be used for general-purpose I/O when not used for primary function
- 5-V tolerant inputs/outputs

1.2.7 Two Time Processor Units (TPU3)

- Each TPU3 module provides these features:
 - A dedicated micro-engine operates independently of the RCP
 - 16 independent programmable channels and pins
 - Each channel has an event register consisting of a 16-bit capture register, a 16-bit compare register and a 16-bit comparator
 - Nine pre-programmed timer functions are available
 - Any channel can perform any time function
 - Each timer function can be assigned to more than one channel
 - Two timer count registers with programmable prescalers
 - Each channel can be synchronized to one or both counters
 - Selectable channel priority levels
 - 5-V tolerant inputs/outputs
- 6-Kbyte dual port TPU RAM (DPTRAM) is shared by the two TPU3 modules for TPU microcode

1.2.8 18-Channel Modular I/O System (MIOS1)

- Ten double action submodules (DASM)
- Eight dedicated PWM sub-modules (PWMSM)
- Two 16-bit modulus counter submodules (MCSM)
- Two parallel port I/O submodules (PIOSM)
- 5-V tolerant inputs/outputs

1.2.9 Two Queued Analog-to-Digital Converter Modules (QADC64)

Each QADC provides:

- Up to 16 analog input channels, using internal multiplexing
- Up to 41 total input channels, using internal and external multiplexing
- 10-bit A/D converter with internal sample/hold
- Typical conversion time of 10 μ s (100,000 samples per second)
- Two conversion command queues of variable length
- Automated queue modes initiated by:
 - External edge trigger/level gate
 - Software command
- 64 result registers
- Output data that is right- or left-justified, signed or unsigned
- 5-V reference and range

1.2.10 Two CAN 2.0B Controller Modules (TouCAN)

Each TouCAN provides these features:

- Full implementation of CAN protocol specification, version 2.0A and 2.0B
- Each module has 16 receive/transmit message buffers of 0 to 8 bytes data length
- Global mask register for message buffers 0 to 13
- Independent mask registers for message buffers 14 and 15
- Programmable transmit-first scheme: lowest ID or lowest buffer number
- 16-bit free-running timer for message time-stamping
- Low power sleep mode with programmable wake-up on bus activity
- Programmable I/O modes
- Maskable interrupts
- Independent of the transmission medium (external transceiver is assumed)
- Open network architecture
- Multimaster concept
- High immunity to EMI
- Short latency time for high-priority messages
- Low power sleep mode with programmable wakeup on bus activity

1.2.11 Queued Serial Multi-Channel Module (QSMCM)

- Queued serial peripheral interface (QSPI)
 - Provides full-duplex communication port for peripheral expansion or interprocessor communication
 - Up to 32 preprogrammed transfers, reducing overhead
 - 160-byte queue buffer
 - Programmable transfer length: from 8 to 16 bits, inclusive
 - Synchronous interface with baud rate of up to system clock divided by 4
 - Four programmable peripheral-select pins support up to 16 devices
 - Wrap-around mode allows continuous sampling for efficient interfacing to serial peripherals (e.g., – serial A/D converters, I/O latches, etc.)
- Two serial communications interfaces (SCI). Each SCI offers these features:
 - UART mode provides NRZ format and half-or full-duplex interface
 - 16 register receive buffer and 16 register transmit buffer (SCI1 only)
 - Advanced error detection and optional parity generation and detection
 - Word length programmable as 8 or 9 bits
 - Separate transmitter and receiver enable bits and double buffering of data
 - Wakeup functions allow the CPU to run uninterrupted until either a true idle line is detected or a new address byte is received
 - External source clock for baud generation
 - Multiplexing of transmit data pins with discrete outputs and receive data pins with discrete inputs, allowing realization of a low-speed serial protocol

2 MPC555 Address Map

The internal memory map is shown in Figure 2.

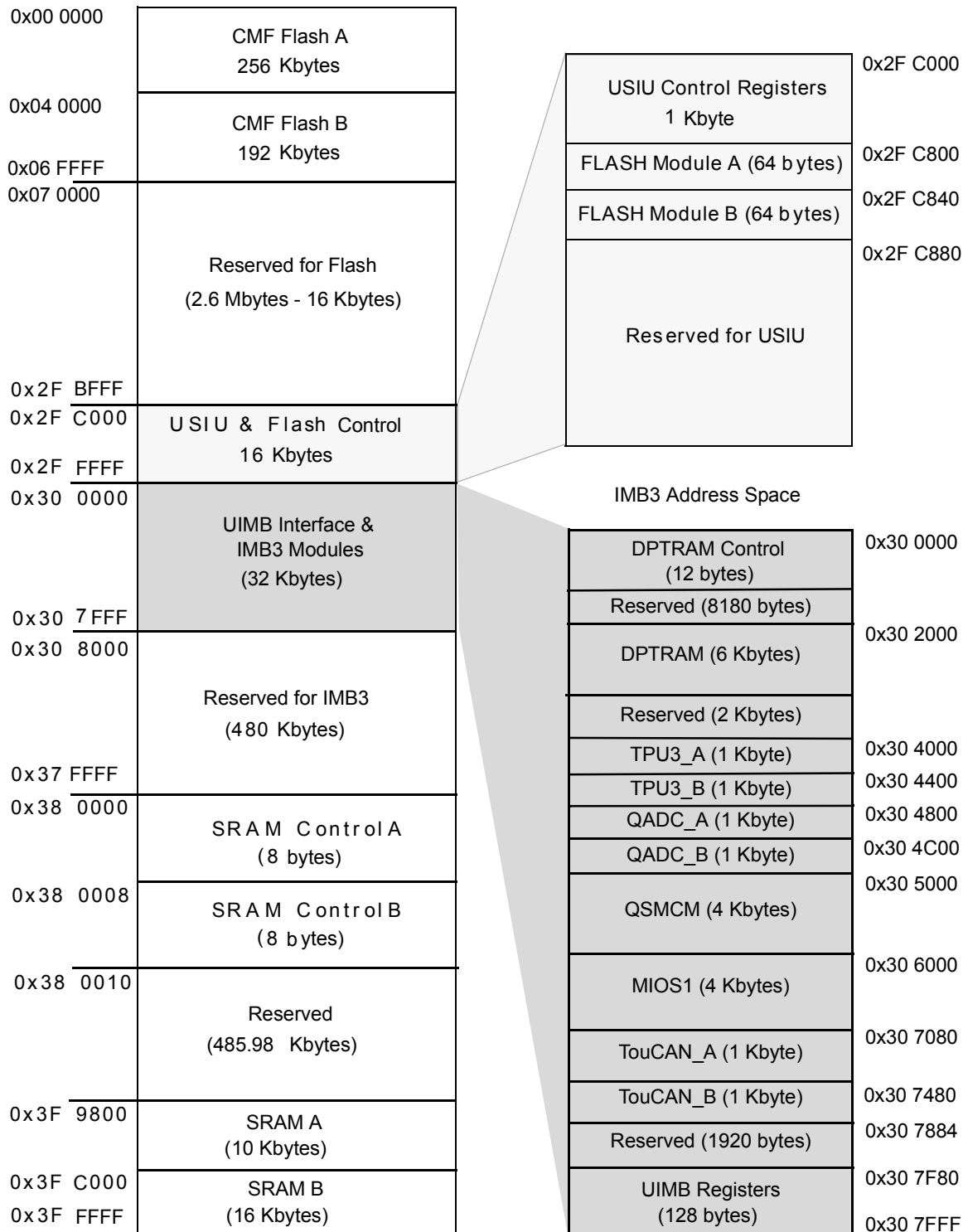


Figure 2. MPC555 Internal Memory Map

3 MPC555 Pinout Diagram

Figure 3 shows the pinout for the MPC555.

MPC555 Ball Map

| | | | | | | | | | | | | | | | | | | | | |
|----|------|-------|-------|-------|-------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|------|
| 20 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 19 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 18 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 17 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 16 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 15 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 14 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 13 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 12 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 11 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 10 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 9 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 8 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 7 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 6 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 5 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 4 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 3 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 2 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |
| 1 | VDDH | MDA13 | MDA12 | MDA11 | MDA10 | MDA9 | MDA8 | MDA7 | MDA6 | MDA5 | MDA4 | MDA3 | MDA2 | MDA1 | MDA0 | MDA31 | MDA30 | MDA29 | MDA28 | VDDH |

Note: The pinout is a top down view of the package.

| | | | |
|-----|-----|-----|-----|
| VSS | VSS | VSS | VSS |
| VSS | VSS | VSS | VSS |
| VSS | VSS | VSS | VSS |
| VSS | VSS | VSS | VSS |

Figure 3. MPC555 Pinout Diagram

4 Supporting Documentation List

This list contains references to currently available and planned documentation.

- *MPC555 User's Manual* (MPC555UM/AD)
- *RCPURM Reference Manual* (RCPURM/AD)
- *Board Strategies for Ensuring Optimum Frequency Synthesizer Performance* (AN1282/D)
- *Using the MIOS on the MPC555 Evaluation Board* (AN1778/D)
- *Exception Table Relocation and Multi-Processor Address Mapping in the Embedded MPC5XX Family* (AN1821/D)
- *Non-Volatile Memory Technology Overview* (AN1837/D)
- *Designing Expansion Boards for the Freescale EVB555/ETAS ES200* (AN2001/D)
- *MPC555 Interrupts* (AN2109/D)
- *EMC Guidelines for MPC500-Based Automotive Powertrain Systems* (AN2127/D)
- Nexus Standard Specification (non-Freescale document)
- Nexus Web Site: <http://www.nexus5001.org/>
- IEEE 1149.1 Specification (non-Freescale document)

5 Revision History

Table 2. Revision History

| Revision Number | Substantive Changes | Date of Release |
|-----------------|--|------------------|
| 2 | Existing Document. | September 2001 |
| 2.1 | Added temperature range for suffix A device. | 11 December 2002 |
| 3 | Updated template and formats. | 11 February 2003 |

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