MicroConverter®
The Precision Analog Microcontroller Series from ADI

Eamon Neary April 2004
MicroConverter® Definition

- High Performance Analog I/O
- Non-Volatile Flash EEPROM Memory
- Industry Standard Microcontroller

**Precision Analog Microcontroller**

or

**MicroConverter®**
MicroConverter® – Roadmap – Processor Core Progression

Time

Core Speed / Processing Power

ADuC8xx 12-Cycle Core

ADuC8xx 1-Cycle Core

ADuC7xxx ARM7 Core
# MicroConverter® 8052 MCU Family Overview

This table provides an overview of the MicroConverter® 8052 MCU family, categorizing them into Standard, Large Memory, and Fast Core groups, based on their performance and memory size. The table distinguishes between 12-bit and 16-bit/24-bit ADCs, with specific models marked as recommended for new designs.

### 12-bit
- up to 400KSPS

<table>
<thead>
<tr>
<th>Standard</th>
<th>ADuC812</th>
<th>ADuC814</th>
<th>ADuC824</th>
<th>ADuC816</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADuC831</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADuC832</td>
<td></td>
<td></td>
<td>ADuC834</td>
<td>ADuC836</td>
</tr>
<tr>
<td>ADuC841</td>
<td></td>
<td></td>
<td>ADuC845</td>
<td></td>
</tr>
<tr>
<td>ADuC842</td>
<td></td>
<td></td>
<td>ADuC847</td>
<td></td>
</tr>
<tr>
<td>ADuC843</td>
<td></td>
<td></td>
<td>ADuC848</td>
<td></td>
</tr>
</tbody>
</table>

### 16-bit/24-bit
- 5Hz - 1KHz

<table>
<thead>
<tr>
<th>Standard</th>
<th>ADuC812</th>
<th>ADuC814</th>
<th>ADuC824</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ADuC831</td>
<td></td>
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<td></td>
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<tr>
<td>ADuC832</td>
<td></td>
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<td>ADuC834</td>
<td>ADuC836</td>
</tr>
<tr>
<td>ADuC841</td>
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<td></td>
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<td>ADuC842</td>
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<tr>
<td>ADuC843</td>
<td></td>
<td></td>
<td>ADuC848</td>
<td></td>
</tr>
</tbody>
</table>

* = recommended for new designs

The table indicates the pin compatibility across different models, with **pin compatible** noted for the ADuC812, ADuC814, ADuC824, ADuC816, ADuC834, ADuC836, ADuC845, and ADuC847 models.

**Note:** The table is a visual representation of the MicroConverter® 8052 MCU family's features and specifications.
ADuC814 – an Unbeatable Deal

(Before we launch into the new 1-cycle core parts, let me remind you of a part we intro’d a year ago and represents one of the best deals in the industry....)

ADuC814

♦ LOW COST – just think about it ..... 
  ♦ An 8051 MCU + Flash (8k) + 6-CH 12-bit ADC + 2x12-bit DACs + Temp sensor + Ref .... For $4.50 @ 1k, under $3 in volume

♦ Small package: 28-pin TSSOP

♦ Robust Internal POR (Power On Reset)

♦ Time Interval Counter

♦ 32KHz Oscillator & PLL with Programmable Core Clock
Reduced Pin-Count / Low Cost
8052 MicroConverter® – ADuC814

- 12bit ADC
- Temperature Monitor
- Voltage Reference
- RAM
- Flash Code & Data Memory
- 8052 MCU
- 1MIPS
- Watchdog Timer
- Supply Monitor
- SPI / I2C
- Timers / Counters
- UART
- Download Debug
- Single-Pin Emulation
- V_{REF}

ADuC814
ADuC84x (Single-cycle 8052 core) Roadmap

- **ADuC841/842**
  - 1-Cycle core (20/16 MIPS)
  - Memory Options: 62k, 32k, 8k in 8x8mm CSP56 PQFP, 62k only ('812/31/32 upgrade)

- **ADuC843**
  - ('842 with ADC only)
  - Memory Options: 62k, 32k & 8k in 8x8mm CSP56

- **ADuC845 / 7 /8**
  - (Multi-Chnl) 12.7MIPs
  - Memory Options: 62k, 32k, 8k in 8x8mm CSP56 And 52-pin QFP.
8052 MicroConverter® with 12-Bit Analog I/O

ADuC842, 841
ADuC841/ADuC842/ADuC843 Features

**ADuC841 is Pin-compatible with the ADuC812 & ‘831; the ADuC842 is pin compatible with the ADuC832**

- Optimized 8052 Core
  - ADuC841-3 & ADuC842-3: 8.38MIPS (2.7V-3.6V)
  - ADuC842-5: 16.7MIPS (5V)
  - ADuC841-5: 20 MIPS (5V)

- Faster ADC (400KSPS)
- Better Voltage Reference (20ppm)

- Upgraded I²C Port
  - Faster (400KHz)
  - Quad Addressing
  - SPI & I2C Available on Separate Pins

- ADuC843 is simply a “Stripped-Down” ADuC842 (no DACs)

- NOTE: Use ADuC842 for new designs. Use ADuC841 for drop-in compatibility with existing ADuC812/ADuC831 designs.
ADuC842 Performance

Normal Mode (uC active)
# ADuC841, ADuC842, ADuC843, memory options.

(1-cycle 8051 MCU, SAR ADC, DACs)

<table>
<thead>
<tr>
<th>Model</th>
<th>MIP</th>
<th>kB</th>
<th>Vdd</th>
<th>Pkg</th>
<th>Price 1k</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADuC841BCP62-5</td>
<td>20</td>
<td>62</td>
<td>5</td>
<td>CSP</td>
<td>$9.64</td>
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<tr>
<td>ADuC841BCP62-3</td>
<td>8</td>
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<td>3</td>
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<tr>
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<td>20</td>
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<td>$6.56</td>
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<tr>
<td>ADuC841BCP8-3</td>
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<td>8</td>
<td>3</td>
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<td>$6.56</td>
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<td>ADuC841BS62-5</td>
<td>20</td>
<td>62</td>
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<td>PQFP</td>
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<tr>
<td>ADuC841BS62-3</td>
<td>8</td>
<td>62</td>
<td>3</td>
<td>PQFP</td>
<td>$9.64</td>
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<th>Model</th>
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</tr>
</thead>
<tbody>
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<td>62</td>
<td>3/5</td>
<td>QFP</td>
<td>$6.90</td>
</tr>
</tbody>
</table>

ADuC843 = ADuC842 without DACs
ADuC814 Application Example: Portable Blood Pressure Monitor
ADuC831/832 Application Example: Cable Modem Head End ("CMTS")
ADuC842 Application Example: Cellular Base Station RF Power Amp
Dual 10-Channel 24-bit MicroConverter®

...with 1-cycle flash 8052

- 21-bit effective resolution @ 50 Hz
- 15ppm max INL
- 24-bit monotonic
- Low offset ±0.6ppm
- Offset drift: ±0.002ppm/°C
High Channel-Count $\Sigma \Delta$ ADC, 8052 MicroConverter®
**ADuC845/ADuC847**

**Additional Features**

- Increased ADC Channel Count (10 single-ended or 5 differential, or any combination)
- Both Primary & Auxiliary ADC are 24-bit
- Option for Increased ADC Throughput (up to >1KHz) at the Cost of Reduced Accuracy
- Input Buffer can be Disabled or Enabled under Software
- Chop Mode can be Disabled or Enabled under Software
- Two Analog Input Pins can be used as a Second Differential Reference Pair
- Completely Separate & Independent SPI & I2C Functions
- I2C Dual Addressing
- ADuC847 is simply a “Stripped-Down” ADuC845 (no DAC, no PWM, no Aux ADC)
- ADuC848 16-bit version of ‘847
**ADuC845, ADuC847, ADuC848**

1-Cycle 8052 MCU, $\Delta \Sigma$ ADCs (DAC & PWM)

<table>
<thead>
<tr>
<th>Model</th>
<th>MIP</th>
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<th>Vdd</th>
<th>Pkg</th>
<th>Price 1k</th>
</tr>
</thead>
<tbody>
<tr>
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<table>
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<th>Pkg</th>
<th>Price 1k</th>
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</thead>
<tbody>
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<tr>
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<td>ADuC847BS8-3/5</td>
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<td>$6.95</td>
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<tr>
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<td>6/12</td>
<td>8</td>
<td>3/5</td>
<td>CSP</td>
<td>$6.95</td>
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<td>$5.90</td>
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<tr>
<td>ADuC848BCP8-3/5</td>
<td>6/12</td>
<td>8</td>
<td>3/5</td>
<td>CSP</td>
<td>$5.90</td>
</tr>
</tbody>
</table>

ADuC845 = Multi-channel Input ADCs
ADuC847 = An ADuC845 without the aux. ADC & DAC
ADuC848 = 16-bit version of ADuC847
MicroConverter® Tools Update for the ADuC8xx series
ADC Performance – Normal Mode

Drift = 10nV/°C
INL = 2ppm typ, 15ppm max
MicroConverter® Applications

- Direct Interface to precision sensors
- DAC and PWM outputs for direct voltage / 4-20mA sensor output
- Multiple serial ports for sensor network interface
- Optimized 8052 core allows sensor linearization

- Industrial & Instrumentation
  - Smart Sensors
  - Data Loggers
  - Handheld Instruments
  - Weighscale Systems

- Portable Medical Instruments
  - Precision Analysis
  - Glucose Monitors
  - Blood Pressure Monitors
Weigh Scale Solution using the ADuC845

- 1-cycle 12.6MHz 8052
- 62k Flash Memory
- Dual ADC design – allows temperature compensation of bridge
- Reference Detect
- Resolution – 350nV rms or 1 count p-p in 10,000 on +/-10mV
ADuC834 Application Example: Precision Sensor Data-Logger

Universalsensor 834

ADuC834

up to 32MB Flash

Sensor Interfaces

Software...
- calibrate
- convert
- display
- alarm
- store
- recall
- etc

RS-232 Driver/Receiver
Intelligent multichannel sensor I/O port

Up to 11 Channels
7 Diff I/Ps and 4 S/E Inputs
KEY:
- 3 Critical Diff I/Ps - 20mV

ADuC845

Smart Xmitter Module
Sensor Network

Mux | Conditioning | 24-Bit ADC | LOGIC INTERFACE | Micro

Ext Vref | External EEPROM
RTD Interfacing Using a MicroConverter®
Thermocouple Interfacing Using a MicroConverter®

ADuC834
AIN1 VDD
AIN2 SPI
AIN5 I2C
REFIN UART
etc.
XTAL1 GPIO
REFIN+
XTAL2 GPIO
REFIN-
GND

AD592

AD780

+5V
QuickStart™ & QuickStart™ Plus Kits

QuickStart™
- Eval Board
- Download/Debug Cable
- International Power Supply
- Software & Documentation

$75

featuring
Serial-Port Debug (Assembly Only)

QuickStart™ Plus
- Eval Board
- Single-Pin Emulator
- Serial Cable
- International Power Supply
- Software & Documentation

$299

featuring
Non-Intrusive Emulation (C-Source/Assembly)
<table>
<thead>
<tr>
<th>Part #</th>
<th>ADC</th>
<th>DAC</th>
<th>MCU</th>
<th>Flash/EE Code</th>
<th>Flash/EE Data</th>
<th>RAM</th>
<th>PKGs</th>
<th>Special Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADuC812</td>
<td>8-chan 12-bit</td>
<td>Dual 12-bit</td>
<td>12-clock 8052</td>
<td>8K-byte</td>
<td>640-byte</td>
<td>256-byte</td>
<td>52-PQFP 56-CSP</td>
<td>5µs ADC</td>
</tr>
<tr>
<td>ADuC814</td>
<td>6-chan 12-bit</td>
<td>Dual 12-bit</td>
<td>12-clock 8052</td>
<td>8K-byte</td>
<td>640-byte</td>
<td>256-byte</td>
<td>28-TSSOP</td>
<td>Small, Low-Cost</td>
</tr>
<tr>
<td>ADuC816</td>
<td>Dual 16-bit</td>
<td>Single 12-bit</td>
<td>12-clock 8052</td>
<td>8K-byte</td>
<td>640-byte</td>
<td>256-byte</td>
<td>52-PQFP 56-CSP</td>
<td>Buffered PGA Input</td>
</tr>
<tr>
<td>ADuC824</td>
<td>24-bit + 16-bit</td>
<td>Single 12-bit</td>
<td>12-clock 8052</td>
<td>8K-byte</td>
<td>640-byte</td>
<td>256-byte</td>
<td>52-PQFP 56-CSP</td>
<td>Pin-Compatible Upgrade to ADuC816</td>
</tr>
<tr>
<td>ADuC831</td>
<td>8-chan 12-bit</td>
<td>Dual 12-bit +Dual PWM</td>
<td>12-clock 8052</td>
<td>62K-byte</td>
<td>4-byte</td>
<td>256-byte</td>
<td>52-PQFP 56-CSP</td>
<td>“Big-Memory” Upgrade to ADuC812</td>
</tr>
<tr>
<td>ADuC832</td>
<td>8-chan 12-bit</td>
<td>Dual 12-bit +Dual PWM</td>
<td>12-clock 8052</td>
<td>62K-byte</td>
<td>4-byte</td>
<td>256-byte</td>
<td>52-PQFP 56-CSP</td>
<td>Same As ADuC831, But With PLL Clock</td>
</tr>
<tr>
<td>ADuC834</td>
<td>24-bit + 16-bit</td>
<td>Single 12-bit</td>
<td>12-clock 8052</td>
<td>62K-byte</td>
<td>4-byte</td>
<td>256-byte</td>
<td>52-PQFP 56-CSP</td>
<td>“Big-Memory” Upgrade to ADuC824</td>
</tr>
<tr>
<td>ADuC836</td>
<td>Dual 16-bit</td>
<td>Single 12-bit +Dual PWM</td>
<td>12-clock 8052</td>
<td>62K-byte</td>
<td>4-byte</td>
<td>256-byte</td>
<td>52-PQFP 56-CSP</td>
<td>“Big-Memory” Upgrade to ADuC816</td>
</tr>
<tr>
<td>ADuC841</td>
<td>8-chan 12-bit</td>
<td>Dual 12-bit +Dual PWM</td>
<td>1-clock 8052</td>
<td>8K,32K,62K-byte</td>
<td>4-byte</td>
<td>256-byte</td>
<td>52-PQFP 56-CSP</td>
<td>“Fast-Core” Upgrade to ADuC831</td>
</tr>
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<td>ADuC842</td>
<td>8-chan 12-bit</td>
<td>Dual 12-bit +Dual PWM</td>
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<td>8K,32K,62K-byte</td>
<td>4-byte</td>
<td>256-byte</td>
<td>52-PQFP 56-CSP</td>
<td>“Fast-Core” Upgrade to ADuC832</td>
</tr>
<tr>
<td>ADuC843</td>
<td>8-chan 12-bit</td>
<td>Dual PWM</td>
<td>1-clock 8052</td>
<td>8K,32K,62K-byte</td>
<td>4-byte</td>
<td>256-byte</td>
<td>52-PQFP 56-CSP</td>
<td>stripped-down ADuC842</td>
</tr>
<tr>
<td>ADuC845*</td>
<td>10-chan 24-bit</td>
<td>Single 12-bit +Dual PWM</td>
<td>1-clock 8052</td>
<td>8K,32K,62K-byte</td>
<td>4-byte</td>
<td>256-byte</td>
<td>52-PQFP 56-CSP</td>
<td>“Fast-Core” δΣ with Multi-Channel Input</td>
</tr>
<tr>
<td>ADuC847*</td>
<td>10-chan 24-bit</td>
<td>PWM Only</td>
<td>1-clock 8052</td>
<td>8K,32K,62K-byte</td>
<td>4-byte</td>
<td>256-byte</td>
<td>52-PQFP 56-CSP</td>
<td>stripped-down ADuC845</td>
</tr>
<tr>
<td>ADuC848*</td>
<td>10-chan 16-bit</td>
<td>PWM Only</td>
<td>1-clock 8052</td>
<td>8K,32K,62K-byte</td>
<td>4-byte</td>
<td>256-byte</td>
<td>52-PQFP 56-CSP</td>
<td>16-bit version of ADuC847</td>
</tr>
</tbody>
</table>
Introducing the ADuC7000 Series

ARM7TDMI MCU Core!
- 16-/32-bit RISC architecture
- 45MHz operation (Flash & SRAM)
- Embedded JTAG for Debug

NEW
- Uncommitted Comparators
- Three Phase PWMs
- More Flexible ADC I/Ps
- Low Drift Vref
- Programmable Logic Array (PLA)
- Size, Performance, Integration and Cost
ADuC7026
Key Features

Analog Input

Analog Output

Core and Memory

Additional Peripherals

ARM7 TDMI MCU
2kB X 32 SRAM
31kB X 16 FLASH/EEROM
JTAG
OSG & PLL
POR

PLA
SERIAL I/O UART, SPI, 2xI²C
GPIO
4 GEN. PURPOSE TIMERS
PSM
Three Phase PWM
12bit/1MSPS ADC

- 12bit, 1MSPS SAR ADC
- 0-to-\(V_{\text{REF}}\)
- Input Modes
  - Single-Ended
  - Pseudo-Differential
  - Fully Differential
- Trigger Modes
  - External CONVST Pin
  - Timer Overflow
  - Software Trigger
  - PLA Trigger
  - Continuous
- Key Specs @1MSPS
  - INL = 1.5LSB, DNL = 1LSB
  - Offset/Gain = ±5LSB
  - SNR = 71dB
Uncommitted Voltage Comparator

- 10mV Hysteresis
- 5μs Response
ADuC7026
Key Features

Analog Input

Analog Output

Core and Memory

Additional Peripherals

ARM7
TDMI
MCU

2kB X 32 SRAM

31kB X 16
FLASH/EPPROM

JTAG

PLA

SERIAL I/O
UART, SPI, 2xI²C

GPIO

4 GEN. PURPOSE
TIMERS

OSC & PLL

POR

PSM

Three Phase
PWM
DAC

12bit String DAC

Output Modes
- 0-to-\(V_{DD}\)
- 0-to-\(V_{REF}\)
- 0-to-\(DAC_{REF}\)

Settling Time
- Buffered: 10\(\mu\)s
- Unbuffered: 15\(\mu\)s

Key Specs
- \(\text{INL} = 1.5\text{LSB}, \text{DNL} = \pm 1\text{LSB}\)
- Offset Error
  - Buffered: \(\pm 5\text{mV max}\)
  - Unbuffered: \(\pm 2\text{mV max}\)
- \(\text{Gain Error} = \pm 0.5\%\)
ADuC7026
Key Features

Analog Input

- ADC0
- ADC5
- ADC9
- ADC10
- ADC11
- AINCOM
- CMP0
- CMP1
- CMPOUT
- VREF

- MUX
- 1MSPS 12-BIT ADC
- TEMP SENSOR
- BANDGAP REF

Analog Output

- 12-BIT DAC
  - DAC0
- 12-BIT DAC
  - DAC1
- 12-BIT DAC
  - DAC2
- 12-BIT DAC
  - DAC3

Core and Memory

- ARM7 TDMI MCU
- 2kB X 32 SRAM
- 31kB X 16 FLASH/EPPROM
- JTAG
- OSC & PLL
- POR

Additional Peripherals

- PLA
- SERIAL I/O UART, SPI, 2xI²C
- GPIO
- 4 GEN. PURPOSE TIMERS
- PSM
- Three Phase PWM
Programmable Logic Array (PLA)

- GPIO Pins
- Register Bits
- PLA Feedback
- Clocks

Configured by Run-Time Software

Programmable Logic Array

- GPIO Pins
- Register Bits
- Interrupts
- ADC Convert Start

Additional Peripherals

- PLA
- SERIAL IO
- GPIO
- 4 GEN. PURPOSE TIMERS
- PSM
- Three Phase PWM
PLA Example

MMR Bit: S/W Enable

GPIO Pin: H/W Enable

CMP0 Pin: Trigger

Trip-Voltage

DAC

NOR

PLA Element 6

AND

PLA Element 7

PLA Output: ADC CONVST

Launch ADC Conversion if Trigger Exceeds Trip Point AND System is Enabled

Additional Peripherals

PLA

GPIO

Additional Peripherals

SERIAL I/O

UART, SPI, 2-wire

4 GEN. PURPOSE TIMERS

PSM

Three Phase PWM
Serial Comms

- UART
  - 16450 Compatible UART, with standard divisor latch and fractional divider

- SPI
  - Single Serial Peripheral Interface

- I²C
  - Two Master/Slave devices: [ ADuC7020/1/2 ]
  - Single Master/Slave: [ ADuC7024/5/6/7 ]
Four General Purpose Timers

- **Timer0**
  - Timer0 is a general purpose 16-bit count-down timer.

- **Timer1**
  - Timer1 is a 32-bit general purpose, count-down or count-up, timer.

- **Timer2**
  - Timer2 is a 32-bit wake-up, count-down or count-up, timer.

- **Timer3**
  - 16 Bit Count-down timer with two modes of operation
    - Normal mode: Operates identically to Timer0
    - Watchdog mode: Can cause an interrupt or a reset to occur
ADuC7026
Key Features

**Analog Input**
- ADC0
- ADC5
- ADC9
- ADC10
- ADC11
- AINCOM
- CMP0
- CMP1
- CMPOUT
- VREF

**Analog Output**
- 12-BIT DAC
  - DAC0
- 12-BIT DAC
  - DAC1
- 12-BIT DAC
  - DAC2
- 12-BIT DAC
  - DAC3

**Core and Memory**
- ARM7 TDMI MCU
- 2kB X 32 SRAM
- 31kB X 16 FLASH/EPPROM
- JTAG
- OSC & PLL
- POR

**Additional Peripherals**
- PLA
- SERIAL I/O UART, SPI, 2xI2C
- GPIO
- 4 GEN. PURPOSE TIMERS
- PSM
- Three Phase PWM
ARM7TDMI

◆ ARM7
  ◆ 32-bit Reduced Instruction Set Computer (RISC) architecture.
  ◆ Uses a single 32-bit bus for instructions and data.
  ◆ Integrates JTAG test port, used for debug access.
  ◆ Operates at 45MHz, single cycle, 32-bit instructions.

◆ ARM7 + TDMI = ARM7TDMI
  ◆ T – Thumb (16-bit) instruction set support
  ◆ D – Debug features integrated on-chip
  ◆ M – Multiply and Multiply-Accumulate operations
  ◆ I – In-Circuit Emulation hardware built-in
Simplified Programmers Model

ADuC7020 Series

- 62Kbytes Flash Program and Data Memory
- ARM7TDMI MCU
- 8Kbytes Internal RAM
- MMRs Memory Mapped Registers
- Multi-Channel ADC
- DACs
- Comparator
- PLA
- Timers
- Serial Comms UART, SPI and I²C
- Digital I/O

External 16-bit Memory Interface (ADuC7026 Only)
Memory Organisation

- ARM7 Core sees memory as a linear array of $2^{32}$ bytes.
- Into this linear space is mapped
  - MMRs – Memory Mapped Registers used to access peripherals
  - Flash/EE – 64kBytes (62 kB available to user and 2kB boot-code)
  - SRAM – 8kBytes
Oscillator and PLL

- The ADuC7020 series may be clocked, via a programmable clock divider, by the internal PLL or by an external clock source.

- **Internal PLL**
  - Modes of Operation:
    - *External* 32.768kHz crystal to generate 45.088MHz
    - *On-Chip* 32.768kHz crystal to generate 45.088MHz ±5%

- **External Clock**
  - Specified operational clock range is 50kHz to 20MHz
ADuC702x Key Features

◆ ARM7TDMI MCU Core:
  ◆ 16-/32-bit RISC architecture
  ◆ 45MHz operation (Flash & SRAM)
  ◆ Embedded JTAG for Debug

◆ Memory Organisation
  ◆ 8K Bytes SRAM in 2K X 32 words
  ◆ 62K Bytes Flash/EE in 31K X 16 words
  ◆ Retention – 20yrs, Endurance – 10K cycles
  ◆ In-System Programming (ISP) via UART or JTAG Ports
  ◆ External Memory interface (7026)

◆ Analog I/O
  ◆ Multi-Channel 12-bit, 1MHz ADC
  ◆ Multiple 12-bit V-Output DACs
  ◆ 20ppm/°C Vref, ±3°C Temp Sensor
  ◆ Uncommitted Comparator

◆ And Much More ……
  ◆ 2 X GP Timers
  ◆ WDT and Wake-Up Timer
  ◆ Programmable PLA
  ◆ UART, SPI and I\(^2\)C Serial I/O
  ◆ Up to 36 Pin GPIO Port
  ◆ Power Supply Monitor
  ◆ Three Phase PWM

◆ Other
  ◆ Specified for 3V operation (5V compatible I/O)
  ◆ Temperature Range –40°C to +85°C/125°C
  ◆ Packages: 6x6mm 40LFCSP; 9x9mm 64 LFCSP, 64 & 80-pin LQFP (BGA TBD)
  ◆ 2mA/MHz current consumption
  ◆ Low Cost Development System Support
  ◆ Full Third-Party Support
## ADuC7000 Series Product selector – ARM7 + 12-Bit Analog I/O
*(Pin-Compatible within Colour)*

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Flash</th>
<th>SRAM</th>
<th>ADC</th>
<th>DAC</th>
<th>GPIO</th>
<th>PWM</th>
<th>Ext Mem</th>
<th>Temp</th>
<th>Pkg</th>
<th>Price</th>
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<td>62k</td>
<td>8k</td>
<td>12-Bit 5-Chnl</td>
<td>4x12-Bit</td>
<td>14</td>
<td>-40 +105</td>
<td>40-CSP 6x6mm</td>
<td>9.60</td>
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<td>8k</td>
<td>12 Bit 8-Chnl</td>
<td>2x12-Bit</td>
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<td>-40 +85</td>
<td>40 CSP 6x6mm</td>
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<td>2x12-Bit</td>
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<td>3-Phase 16-bit</td>
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<td>2x12-Bit</td>
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<td>3-Phase 16-bit</td>
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<td>3-Phase 16-bit</td>
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<td>-40 +125</td>
<td>80-Lead LQFP</td>
<td>6.90</td>
<td>Feb-05</td>
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</tbody>
</table>
ADuC7000 Series Development System

Hardware
- Evaluation Board
- Keil “ULINK” JTAG Emulator
- Power Supply
- Serial Download Cable

Software
- Keil µVision3 IDE (16K limited)
  - Compiler/Simulator/Debugger
- Serial Downloader
- PLA Tool

< $250
Keil µVision3

- IDE Includes
  - Project Management
  - Source Code Editing
  - Compiler/Assembler/Linker
  - Simulator
  - In-System Debugger (using ULINK Emulator)

- Open-Source GNU Tools Fully Integrated
- Fully Compatible with ARM RealView Tools
- Free 16K-byte Code Size Limited Version Packaged with QuickStart™ Kits

$1700
On-Chip Tools Resources

Serial Downloader

JTAG Emulator

ADuC70xx

UART

RxD

TxD

TMS

TDO

TDI

TCK

TRST

MCU core

Download Embedded Firmware

JTAG interface

EmbeddedICE (In-Circuit Emulator)
ADuC7000 Series Key Milestones

- **Feb 2004** - Beta Sampling, Lead Customers
- **29th March 2004** - Product Announcement at E-USA
- **April 2004** - General Sampling of Development kits
- **May 2004** - General Sampling of parts
- **August 2004** - Final Silicon
- **Nov 2004** - Product Release
APPENDIX
The ADuC7020 Series
**ADuC7020 Precision Analog Microcontroller**

- **ARM7 TDMI MCU**: 45MIPS
- **Flash Code & Data Memory**: 62KBytes
- **RAM**: 8KBytes
- **Watchdog Timer**
- **Supply Monitor**
- **Serial Download**
- **JTAG Emulation**
- **12bit DAC**
- **SPI / I2C**
- **Timers / Counters**
- **UART**
- **Bandgap Reference**
- **Voltage Reference (VREF)**
- **12bit ADC**: 1MSPS
- **Temperature Monitor**
- **Comparator**
- **PLA**
- **DAC**
ADuC7021
Precision Analog Microcontroller

- ARM7 TDMI MCU
  - 45MIPS
  - On Chip Oscillator
  - PLL
  - RAM 8KBytes
  - Flash Code & Data Memory 62KBytes

- Supply Monitor
- Watchdog Timer
- SPI / I2C
- Timers / Counters
- UART
- JTAG Emulation
- Serial Download
- UART

- 12bit DAC
- JTAG Emulation
- Supply Monitor
- Watchdog Timer
- SPI / I2C
- Timers / Counters
- UART

- PLA
- DAC
- COMPARATOR
- Temperature Monitor
- MUX 12bit ADC 1MSPS
- VREF
- Bandgap Reference

54
ADuC7022
Precision Analog Microcontroller
ADuC7024
Precision Analog Microcontroller

- ARM7 TDMI MCU
  - 45MIPS
  - Flash Code & Data Memory: 62KBytes
  - RAM: 8KBytes
  - 12bit DAC
  - 16 Bit 3-Phase PWM
  - SPI / I2C
  - Timers / Counters
  - UART
  - PLL
  - Watchdog Timer
  - Supply Monitor
  - JTAG Emulation
  - Serial Download

- Bandgap Reference
- Temperature Monitor
- COMPARATOR
- DAC
- PLA
- MUX
- 12bit ADC: 1MSPS
- VREF

GPIO
ADuC7025
Precision Analog Microcontroller

- ARM7 TDMI MCU: 45MIPS
- On Chip Oscillator
- PLL
- RAM: 8KBytes
- Flash Code & Data Memory: 62KBytes
- 12bit ADC: 1MSPS
- 16 Bit 3-Phase PWM
- SPI / I2C
- UART
- Supply Monitor
- Watchdog Timer
- Timers / Counters
- Serial Download
- JTAG Emulation
- ADuC7025
- Temperature Monitor
- DAC
- COMPARATOR
- PLA
- VREF
- MUX
- Bandgap Reference
- GPIO
ADuC7026
Precision Analog Microcontroller

- ARM7 TDMI MCU
  - 45MIPS
- On Chip Oscillator
- PLL
- RAM 8KBytes
- Flash Code & Data Memory 62KBytes
- 12bit DAC
- 12bit DAC
- 12bit DAC
- 12bit DAC
- 16 Bit 3-Phase PWM
- SPI / I2C
- Timers / Counters
- UART
- Supply Monitor
- Watchdog Timer
- JTAG Emulation
- Serial Download
- Serial
- 12bit DAC
- MUX
- 12bit ADC 1MSPS
- Bandgap Reference
- Temperature Monitor
- VREF
- COMPARATOR
- DAC
- PLA
- PLL
- TIMERS / COUNTERS
- UART
ADuC7027
Precision Analog Microcontroller

- 12bit ADC 1MSPS
- Bandgap Reference
- PLL
- RAM 8KBytes
- FLASH Code & Data Memory 62KBytes
- Temperature Monitor
- UART
- Serial Download
- 16 Bit 3-Phase PWM
- SPI / I2C
- Supply Monitor
- Timers / Counters
- Watchdog Timer
- On Chip Oscillator
- JTAG Emulation
- 45MIPS
- ARM7 TDMI MCU
- COMPARATOR
- DAC
- MUX
- PLA
- Temperature Monitor
- GPIO/External Memory Interface
ADuC702x (ARM7) Market Development Status

- **Some** Target Market Segments for ADuC702x Series
  - Sensor interface for Industrial automation equipment
  - Optical Transceivers
  - Motor Control (user I/O & main MCU)
  - Automotive Control Systems
  - Communications infrastructure / other instrumentation

- What Customers think of the planned ADuC702x Family
  - Positives:
    - Small Footprint (given the functionality / performance)
    - A nice core (plenty of processing headroom)
    - The ideal combination of Analog I/O
    - PLA
    - JTAG & Keil uVision-based development software
  - Suggested Extensions
    - Options with CAN
    - Larger memory
    - Alternate AFE’s
    - Low Power options
Market Segment - Industrial Sensors – eg. Proximity Sensor

Pictures from Siemens Catalog

ADuC702x
2.5G TRx Reference Design Block diagram

Ref: SFP Reference Design
Nobhiro Matzusoe
Motor Control
Variable Speed AC Induction Motors

Flash Based RISC MCU
3-Phase PWM
Multi/Sim Channel 12-Bit ADC
User I/O
Comms

Power Stage
Motor Currents Feedback
Encoder Feedback
Encoder

User Inputs
System Diagnostics

ADuC70xx
Developing Cores for Key Markets

**MicroConverter® (the Precision Analog Flash MCU)**

- ARM7+12-Bit fast ADC’s & DAC’s
- 8052+12-Bit ADC’s & DAC’s
- 8052+Σ-Δ 24-Bit ADC’s
- 8052+Multi-Chnl 24-Bit Σ-Δ ADC

Key Target Market Segments

- Optical Comms
- Comms Infrastruct
- Automotive
- Industrial control
- Precision instrument
- Smart Sensor
AD Instruments

**ADI Precision Analog Microcontrollers**

<table>
<thead>
<tr>
<th>Converters</th>
<th>Microconverters</th>
<th>Parameter</th>
<th>ADI Advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog CE</td>
<td>ARM7 Flash MCU, 12-Bit I/O; small pkg, 6x6mm (4)</td>
<td>Integration</td>
<td>Precision converters with programmable microcontrollers and flash memory</td>
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<tr>
<td>References</td>
<td>8052 Flash MCU, Σ-Δ A/D’sx2 (4)</td>
<td>Board Space Savings</td>
<td>Multiple single-ended or differential channels on one chip; 6x6mm CSP</td>
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<tr>
<td>Temperature</td>
<td>8052 Flash MCU, 12-Bit I/O; PWM, Ext memory (2)</td>
<td>High Performance</td>
<td>High accuracy converters, Low noise, 45MIP ARM7, 20MIP 8052</td>
</tr>
<tr>
<td>Audio/Video</td>
<td>8052 Flash 20MIP MCU, 12-Bit I/O (7)</td>
<td>ADI Bottom Line</td>
<td>Industry-leading portfolio, Competitively priced, Best size/functionality</td>
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<tr>
<td>Potentiometers</td>
<td>ARM7 Flash MCU; 12-Bit I/O; Hi-chnl Σ-Δ A/D’s (3)</td>
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<tr>
<td>Switches and Muxes</td>
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<td>Interface</td>
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<td>Power Management</td>
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<td>RF/IF</td>
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<td>Specialty Linear</td>
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Number of products offered by Analog Devices, 3Q 2003
MicroConverter® Support Contacts

**Marketing**
- Donal Killackey (Worldwide) - 353 61 495122

**Applications**
- Brian O’Mara (ROW) - 353 61 495343
- Eamon Neary (ROW) - 353 61 494024
- Aude Richard (ROW) - 353 61 494169
- Brian Moss (ROW) - 353 61 495761
ADuC845/847
Performance – Chop Mode Enabled
ADuC845/847
Performance – Chop Mode Disabled

The graph shows the peak-to-peak resolution in bits as a function of the output word rate in Hz for different voltage ranges. The graph includes lines for various voltage offsets: ±2.56V, ±1.28V, ±640mV, ±320mV, ±160mV, ±80mV, ±40mV, and ±20mV.