Highest Quality Microcontroller Portfolio DRIVES Your Ideas to Business

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Infineon’s Microcontrollers Overview

Infineon’s Microcontrollers: Outstanding Real-time Performance for a Wide Range of Applications

Volume Production

Development/Concept

TC1 Super-scalar, 150 MHz
Industrial Drives
TC116x
High-end Automotive
TC179x
Mid-range Automotive
TC113x
Industrial and Networking

Op Code Comp.

Next Generation
16 bit

8051 Compliant
8 bit

8 bit

Mid-range Industrial
C165
44 Pin, CAN

Mid-range
C167
High-end Automotive

Low-end Industrial
C161
80 Pin, CAN

High-end Automotive
C164

Mid-range
XC164
Low-end
XC167
Mid-range
XC164CS
High-end Motor Ctrl
XC161
High-end

Low-end Automotive
C800 20 MHz, 12 Cycle
C868 28/38 Pin, Lowest Cost

Low-end
XC88x
48/64 Pin, CAN, LIN
Series with eFlash members

Mid-range
XC86x
38 Pin, LIN
# 8-bit Microcontrollers Overview

## C500, C800 & XC800 Families (8051 Compatible)

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# 16-bit Microcontrollers Overview

## C166, XC166 Family

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<td>Dedicated PWM Channels</td>
<td>Interrupt Vectors/Priorities</td>
<td>Serial I/O</td>
<td>Real Time Clock</td>
<td>CAN Interface 2.0b active</td>
<td>OCD/TAG</td>
<td>Hardware Power Down</td>
<td>Watch-dog Timer</td>
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<td>PG-TQFP-144</td>
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# 32-bit Microcontrollers Overview

<table>
<thead>
<tr>
<th>Type</th>
<th>Core</th>
<th>Max. CPU Clock [MHz]</th>
<th>Instruction Cycle Time [ns]</th>
<th>FPU</th>
<th>MMU</th>
<th>PCP</th>
<th>Dedicated DMA Module</th>
<th>Interrupt Vectors / Priorities</th>
<th>$V_c$</th>
<th>SRAM [Byte]</th>
<th>ROM/OTP/Flash/eDRAM [Byte]</th>
<th>Linear Address Space for Code &amp; Data [Byte]</th>
<th>I/O Lines</th>
<th>ADC Channels/Max. Resolution</th>
<th>Timers / Counters</th>
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<td>1.3</td>
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<td>Serial I/O</td>
<td>Real Time Clock</td>
<td>CAN</td>
<td>Ethernet MHz</td>
<td>Power Management System</td>
<td>OCDS / JTAG</td>
<td>Watch-dog Timer</td>
<td>On-Chip Bootstrap Loader</td>
<td>Temperature (°C)</td>
<td>Packaging</td>
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<td>P-LQFP-176</td>
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THE C505CA ENHANCES the C500 family of 8-bit microcontrollers by a new member which provides Full-CAN version 2.0B integrated On-Chip. The C505CA meets the current requirements for increasingly small controllers with high performance, optimized EMC behavior and fast communication between decentralized sensors, actuators and the host.

THE DEVICE PROVIDES 32 KByte of OTP or 16/32 KByte of ROM, 256 Byte of RAM, 1 KByte of XRAM, CAN Version 2.0B, an asynchronous/synchronous serial interface and highly accurate 10-bit ADC integrated on chip. With an external clock rate of 20 MHz, the C505CA has an instruction time of 300 ns. Typical applications for the C505CA are automotive body and industrial control.

Key Features

■ Fully compatible to standard 8051 microcontroller
■ Superset of the 8051 architecture with 8 datapointers
■ Up to 20 MHz operating frequency (without clock prescaler) 375 ns instruction cycle time at 16 MHz 300 ns instruction cycle time at 20 MHz (50% duty cycle)
■ 256 Byte On-Chip RAM
■ 32 KByte On-Chip OTP or 16/32 KByte ROM memory
■ 1 KByte On-Chip XRAM
■ 32 + 2 digital I/O lines
■ Three 16-bit timers/counters
■ Full duplex serial interface with programmable baudrate generator
■ Full-CAN Module Version 2.0B active with 15 Message Objects and Basic CAN Feature (C505CA only)
■ 10-bit A/D Converter with 8 multiplexed inputs with built-in self calibration
■ Twelve interrupt sources with four priority levels
■ On-Chip emulation support logic (Enhanced Hooks)
■ Enhanced Fail Safe Mechanisms with Programmable 15-bit Watchdog Timer and Oscillator Watchdog
■ Fast Power-On Reset
■ Power Saving Modes
■ Wake-up from power-down via external interrupt or incoming CAN message (C505CA only) possible
■ P/PG-MQFP-44-2 package
■ Temperature ranges:
  - Standard: 0°C to +70°C
  - Extended: -40°C to +85°C
  - -40°C to +125°C
**C505CA Microcontroller with Complete CAN Capability and OTP Memory**

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**C505CA Block Diagram**

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**C505CA Pin Configuration**

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THE C515C IS A DERIVATIVE of the C500 family of 8-bit microcontrollers with new peripherals. It combines the well known functionality of the standard 80C51 5A microcontroller with enhanced features.

THE C515C FEATURES a SPI compatible interface and a CAN module which meets version 2.0B of the Controller Area Network specification.

THE HIGH PERIPHERAL performance and the CAN feature is ideal for automotive and industrial control applications. Due to EMC/RFI enhancements and power consumption reduction this design excels especially for car radio applications.

Key Features
- Enhanced 8-bit C500-CPU – Fully Software/Toolset Compatible to Standard 80C51/80C52 Microcontrollers
- 600 ns Instruction Cycle Time at 10 MHz CPU Clock without clock prescaler
- 15 Interrupt Vectors with four Priority Levels selectable
- 64 KByte On-Chip OTP memory
- 256 Byte On-Chip Internal RAM (IRAM)
- 2 KByte On-Chip Extended RAM (XRAM)
- Supports external Address Range up to 64 KByte Program and Data Memory
- Full CAN Module Version 2.0B active with 15 Message Objects and BasicCAN Feature
- Synchronous Serial Interface (SSC) with full SPI Compatibility for Peripherals and E2PROMs
- 8 Datapointers with 16-bit for Indirect Addressing of Program and Data Memory
- Three 16-bit Timer/Counters
- 4-Channel Capture/Compare Unit for PWM Generation
- 8-Channel 10-bit A/D Converter. A/D Converter Inputs can be used as Digital Inputs
- Full Duplex Serial Interface with Asynchronous and Synchronous Modes and Programmable Baudrate Generator
- 49 Multifunctional Input/Output Pins
- Extended Power Saving Modes with Wake-Up from Software Power-Down via External Interrupt or incoming CAN message possible
- Extended Slow-Down Features
- Enhanced EMV/RFI Improvements with ALE switch off and latest design optimizations
- Enhanced Fail Safe Mechanisms with Programmable Watchdog Timer and Oscillator Watchdog
- Fast Power-On Reset
- 80-Pin P/PG-MQFP Package-Pin
- Temperature ranges:
  - Standard 0°C to +70°C
  - Extended -40°C to +85°C

Starter Kits are also available and can be ordered by referencing the following number: B515R-H7007-G1-X-7600
Multipurpose Microcontroller with On-Chip Full-CAN Module

C515C Block Diagram

C515C Pin Configuration
C868 is a member of our cost-effective 8-bit μC portfolio. It provides advanced control over your application and system costs.

For development and ramp up a SRAM version offers high flexibility at lowest system costs. An onchip monitor helps for system evaluation and debugging. A compatible ROM version provides further cost saving potential.

The C868 fulfills all requirements for low cost power bridge control, where a fast and high resolving PWM (CAPCOM6E) is needed. All time critical issues are managed by hardware with the flexible CAPCOM6E, whereas the CPU handles user commands and can be used for respective control algorithms. Thereby the embedded 5 ch/8-bit ADC helps analyzing relevant system parameters.

The C868 is well positioned for all kinds of consumer and industrial power control applications where reduction of system costs is a key challenge.

Key Features
- Standard 8051 architecture
- 300 ns instruction cycle time at 40 MHz CPU clock
- PLL (factor 1-4)
- 8 Kbytes ROM/SRAM
- 256 Byte RAM, 256 Byte XRAM
- 8 DPTR
  - For powerful table handling
- Three 16-bit timer/counters

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<tr>
<th>Type</th>
<th>Comments</th>
<th>Package</th>
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<td>PG-TSSOP-38</td>
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</table>

- Powerful PWM Unit (CAPCOM6E)
  - Perfect fitting for:
    - Induction machine,
    - DC brushless
    - Switched reluctance drives
    - Power factor correction
    - Lamp ballast
    - Battery management
  - 25 ns resolution
- Data Scrambling
- Bootstrap loader
  - from PC via UART
  - from EEPROM via SPI
- ADC
  - 5 channels/8 bit
  - 2 pure analog channels / 3 mixed with external interrupt
- Interrupt
  - 4 priority levels
  - 4-8 external interrupts
  - 9 peripheral interrupts
- UART
  - Full duplex mode
- 18 I/O pins with push/pull and sink capability (10 mA)
- Flexible power management
  - Slowdown
  - Powerdown
  - Idle mode
- Wake up from power down via ext. interrupt
- Fail save mechanism
  - Oscillator Watchdog
  - Watchdog timer
- Packages: PG-TSSOP-38, P-DSO-28
- Single voltage supply:
  - 3.3 V
  - Core gets 2.5 V from internal voltage regulator
- Temperature range:
  - SAF (-40°C to +85°C)
  - SAK (-40°C to +125°C)

Tools
- C-Compiler/Assembler
- Starterkit
- On chip debug monitor
- DAVE
Combines Control over Power and Costs

C868 Block Diagram

C868 Application Example

C868

XRAM 256 x 8
RAM 256 x 8
ROM/ RAM 8k x 8
Boot/ ROM

Programmable
Watchdog Timer
Timer 0
Timer 1
Timer 2
UART
CAPCOM6E
Interrupt Unit
8-bit A/D Converter

CPU
8 Datapounters

Port 1
5 digital I/O

Port 3
8 digital I/O

5-Channel
Analog in

Timer 12 Features

■ Three capture/compare channels, each channel can be used either as capture or as compare channel
■ Generation of a three-phase PWM supported (six outputs, individual signals for highside and lowside switches)
■ 16-bit resolution, maximum count frequency = peripheral clock
■ Dead-time control for each channel to avoid short-circuits in the power stage
■ Center-aligned and edge-aligned PWM can be generated
■ Output of the three channels can be synchronized
■ Single-shot mode supported
■ Many interrupt request sources

Timer 13 Features

■ One independent compare channel with one output
■ 16-bit resolution, maximum count frequency = peripheral clock
■ T13 can be synchronized to T12
■ Interrupt generation at period-match and compare-match
■ Single-shot mode supported

Additional Features

■ Block commutation for Brushless DC-drives implemented
■ Position detection via Hall-sensor pattern
■ Automatic rotational speed measurement for block commutation
■ Integrated error handling
■ Fast emergency stop by HW signal (CTRAP)
■ Output levels can be selected and adapted to the power stage
THE XC866 is the first product of a new and advanced 8-bit µC family (XC800 family), combining a high performance 8051 core with on-chip Flash memory and powerful peripheral set. In addition, further performance and cost-saving enhancements to the XC800 family include features such as an on-chip oscillator and embedded voltage regulator (EVR), supporting single voltage supply of 3.3 V or 5.0 V.

THE FLEXIBILITY offered by the XC866 embedded Flash products is also expanded to include a family of compatible ROM versions for further cost saving potential in high volume production. Both embedded Flash as well as ROM based products include data Flash for flexible storage and in-system-update of specific data.

ADDITIONAL KEY FEATURES of the XC866 family of products include support for LIN (Local Interconnect Network), an enhanced capture compare unit (CCU6E) for flexible PWM generation and a new 10-bit ADC with extended functionality (e.g. comparator mode).

THE XC866 with its rich peripheral set offers an optimized fit to a wide range of different applications such as industrial motor control, automotive body and consumer drive.

Key Features
- High performance XC800 core, compatible to the industry standard 8051 architecture
- 75 ns instruction cycle time @ 26.67 MHz CPU clock
- 2 data pointers
- 8/16 KByte of Flash memory
  - Built-in Error Correction to target automotive zero defect quality standard
  - Up to 4 KByte of the Flash ideal for Data Flash and EEPROM emulation
- 256 Byte RAM, 512 Byte XRAM
- UART (with LIN support capability)
- High-Speed SPI Compatible Synchronous Serial Interface (SSC)
- Brown-out detection for core logic supply
- On-chip OSC (10 MHz) and PLL for clock generation
- High performance capture compare unit for PWM signal generation (CCU6E) with special modes for motor control
- 10-bit ADC with high accuracy (8-channels)
  - Fast conversion time
  - Auto-scan, Injection and Comparator Modes to offload CPU
- Three 16-bit timers
- Interrupts
  - 14 interrupt vectors with 4 priority levels
  - Non-maskable interrupt (NMI)
- On-chip debug support (JTAG)
- Port- and core-voltage watchdog circuit with RESET generation
- Power saving modes
  - Slow-down mode
  - Idle mode
  - Power-down mode with wake-up capability via RxD (LIN) or EXINT0
  - Clock gating control to each peripheral
- Programmable 16-bit Watchdog Timer (WDT)
- 27 general purpose I/O Ports
- Flexible single voltage supply of 3.3 V or 5.0 V; core logic supply at 2.5 V (generated by embedded voltage regulator)
- Package: PG-TSSOP-38 (green)
- Temperature range
  - SAF (-40°C to 85°C)
  - SAK (-40°C to 125°C)
High Performance 8-bit Microcontroller with On-Chip Flash Memory and Powerful Peripheral Set

**Derivatives**

<table>
<thead>
<tr>
<th>Type</th>
<th>Comments</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAF-XC866-2FR</td>
<td>8 KB Flash, -40°C to +85°C</td>
<td>PG-TSSOP-38</td>
</tr>
<tr>
<td>SAK-XC866-2FR</td>
<td>8 KB Flash, -40°C to +125°C</td>
<td>PG-TSSOP-38</td>
</tr>
<tr>
<td>SAF-XC866L-2FR</td>
<td>8 KB Flash, LIN BSL Support, -40°C to +85°C</td>
<td>PG-TSSOP-38</td>
</tr>
<tr>
<td>SAK-XC866L-2FR</td>
<td>8 KB Flash, LIN BSL Support, -40°C to +125°C</td>
<td>PG-TSSOP-38</td>
</tr>
<tr>
<td>SAF-XC866-4FR</td>
<td>16 KB Flash, -40°C to +85°C</td>
<td>PG-TSSOP-38</td>
</tr>
<tr>
<td>SAK-XC866-4FR</td>
<td>16 KB Flash, -40°C to +125°C</td>
<td>PG-TSSOP-38</td>
</tr>
<tr>
<td>SAF-XC866L-4FR</td>
<td>16 KB Flash, LIN BSL Support, -40°C to +85°C</td>
<td>PG-TSSOP-38</td>
</tr>
<tr>
<td>SAK-XC866L-4FR</td>
<td>16 KB Flash, LIN BSL Support, -40°C to +125°C</td>
<td>PG-TSSOP-38</td>
</tr>
</tbody>
</table>

1) Includes 1 KB of Monitor ROM
THE XC886/888CLM enhances the XC800 family of 8-bit µCs with a new member providing advanced networking capabilities by integrating both a CAN controller (V2.0B active) and LIN support on a single chip.

THE ON-CHIP CAN module reduces the CPU load by performing most of the functions required by the networking protocol (masking, filtering and buffering of CAN frames).

ADDITIONAL KEY FEATURES include up to 32 KByte of embedded Flash memory, an intelligent PWM unit, a highly accurate 10-bit ADC with fast conversion speed, a CORDIC and a Multiplication Division Unit (MDU) for fast mathematical computations.

THE FLEXIBILITY offered by the XC886/888CLM embedded Flash products is also expanded to include a family of compatible ROM versions for further cost saving potential in high volume production.

THE XC886/888CLM offers an optimized fit to a wide range of CAN networking applications including automotive body, control for industrial and agricultural equipments, building control for lifts/escalators, intelligent sensors, distributed I/O modules and industrial automation.

**Key Features**
- High performance XC800 core, based on industry standard 8051 architecture
- 83 – 166 ns instruction cycle time @ 24 MHz CPU clock
- 24 KByte or 32 KByte of Flash memory
  - Built-in error correction (ECC)
  - Increased Flash performance through caching
  - Up to 8 KByte of the 24/32 KByte Flash ideal for data Flash and EEPROM emulation
- 256 Byte RAM, 1536 Byte XRAM
- MultiCAN with 2 nodes
  - 32 message objects shared between both nodes
  - 8 interrupt nodes
  - Automatic FIFO and gateway mode support
- 2 UART (one for LIN support)
- High speed SPI compatible synchronous serial interface (SSC)
- Capture/Compare Unit (CCU6) with two independent 16-bit timers dedicated for PWM generation for AC and DC motor control
  - 4 compare channels with 7 outputs and 6 capture inputs
  - Support for dead time generation
- 10-bit ADC with high accuracy (8 channels)
  - Fast conversion time of less than 1.5 µs
  - TUE less than ±2 LSB
  - Auto scan, injection and comparator modes to reduce CPU load
- LIN bootstrap loader (BSL) support (Flash programming through LIN possible)
- Multiplication/Division Unit (MDU) for high-speed 16- and 32-bit multiplication, division and shift operations
- CORDIC (COrdinate Rotation Digital Computer) unit for high-speed computation of trigonometric, linear or hyperbolic functions
- Brown-out detection for core logic supply
- On-chip OSC (9.6 MHz) and PLL for clock generation
- 4 general purpose 16-bit timers
- Programmable 16-bit watchdog timer (WDT)
- Interrupts
  - 14 interrupt vectors with 4 priority levels
  - Non-maskable interrupt (NMI)
- On-chip debug support (JTAG)
- Port- and core-voltage watchdog circuit with RESET generation
- Power saving modes
  - Slow-down mode
  - Idle mode
  - Power-down mode with fast wake-up capability via RxD (LIN) or EXINT0
  - Clock gating control to each peripheral
- Flexible single voltage supply of 3.3 V or 5.0 V
- 34/48 general purpose I/O ports (incl. 8 analog ports)
- Packages:
  - PG-TQFP-48 (green)
  - PG-TQFP-64 (green)
- Temperature range:
  - SAF (-40°C to 85°C)
  - SAK (-40°C to 125°C)
High Performance 8-bit Microcontroller with On-Chip Flash Memory and CAN

XC886/888CLM Block Diagram

Derivatives

<table>
<thead>
<tr>
<th>Type</th>
<th>eFlash [KByte]</th>
<th>RAM [Byte]</th>
<th>MultiCAN</th>
<th>MDU</th>
<th>LIN BSL Support</th>
<th>Package</th>
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</thead>
<tbody>
<tr>
<td>XC886C-6FF</td>
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<td>–</td>
<td>PG-TQFP-48</td>
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<tr>
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<td>1792</td>
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<td>–</td>
<td>–</td>
<td>PG-TQFP-48</td>
</tr>
<tr>
<td>XC888C-6FF</td>
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<td>PG-TQFP-64</td>
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<td>✓</td>
<td>✓</td>
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<td>PG-TQFP-48</td>
</tr>
<tr>
<td>XC888CM-6FF</td>
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<td>✓</td>
<td>✓</td>
<td>–</td>
<td>PG-TQFP-64</td>
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<tr>
<td>XC888CM-8FF</td>
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<td>PG-TQFP-64</td>
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<tr>
<td>XC888CLM-6FF</td>
<td>24</td>
<td>1792</td>
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<td>✓</td>
<td>PG-TQFP-64</td>
</tr>
<tr>
<td>XC888CLM-8FF</td>
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<td>1792</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>PG-TQFP-64</td>
</tr>
</tbody>
</table>

1) Includes 1 KB of Monitor ROM
2) Includes up to 8 KB for Data Flash
THE XC886/888LM enhances the XC800 family of 8-bit µCs with a new member providing advanced motor drive capability by combining up to 32 KByte of embedded Flash with a powerful capture compare unit (CCU6) for flexible PWM generation and the new Multiplication/Division Unit (MDU) for fast mathematical computations.

ADDITIONAL KEY FEATURES include support for LIN, a highly accurate 10-bit ADC with fast conversion speed and a CORDIC unit.

THE FLEXIBILITY offered by the XC886/888LM embedded Flash products is also expanded to include a family of compatible ROM versions for further cost saving potential in high volume production.

THE XC886/888LM family offers an optimized fit to a wide range of motor control applications including automotive body, industrial motor control and consumer drive.

Key Features

- High performance XC800 core, based on industry standard 8051 architecture
- 83 – 166 ns instruction cycle time @ 24 MHz CPU clock
- 24 KByte or 32 KByte of Flash memory
  - Built-in error correction (ECC)
  - Increased Flash performance through caching
  - Up to 8 KByte of the 24/32 KByte Flash ideal for data Flash and EEPROM emulation
- 256 Byte RAM, 1536 Byte XRAM
- 2 UART (one for LIN support)
- High speed SPI compatible synchronous serial interface (SSC)
- Capture/Compare Unit (CCU6) with two independent 16-bit timers dedicated for PWM generation for AC and DC motor control
  - 4 compare channels with 7 outputs and 6 capture inputs
  - Support for dead time generation
- 10-bit ADC with high accuracy (8 channels)
  - Fast conversion time of less than 1.5 µs
  - TUE less than ±2 LSB
  - Auto scan, injection and comparator modes to offload CPU
- LIN bootstrap loader (BSL) support (Flash programming through LIN possible)
- Multiplication/Division Unit (MDU) for high-speed 16- and 32-bit multiplication, division and shift operations
- CORDIC (COrdinate Rotation Digital Computer) unit for high-speed computation of trigonometric, linear or hyperbolic functions
- Brown-out detection for core logic supply
- On-chip OSC (9.6 MHz) and PLL for clock generation
- 4 general purpose 16-bit timers
- Programmable 16-bit watchdog timer (WDT)
- Interrupts
  - 14 interrupt vectors with 4 priority levels
  - Non-maskable interrupt (NMI)
- On-chip debug support (JTAG)
- Port- and core-voltage watchdog circuit with RESET generation
- Power saving modes
  - Slow-down mode
  - Idle mode
  - Power-down mode with fast wake-up capability via RxD (LIN) or EXINT0
  - Clock gating control to each peripheral
- Flexible single voltage supply of 3.3 V or 5.0 V
- 34/48 general purpose I/O ports (incl. 8 analog ports)
- Packages:
  - PG-TQFP-48 (green),
  - PG-TQFP-64 (green)
- Temperature range
  - SAF (-40°C to 85°C)
  - SAK (-40°C to 125°C)
High Performance 8-bit Microcontroller with On-Chip Flash Memory for Enhanced Motor Control

XC86/888LM Block Diagram

Derivatives

<table>
<thead>
<tr>
<th>Type</th>
<th>eFlash [KByte]</th>
<th>RAM [Byte]</th>
<th>MDU</th>
<th>LIN BSL Support</th>
<th>Package</th>
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<tr>
<td>XC886-6FF</td>
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<td>1792</td>
<td>–</td>
<td>–</td>
<td>PG-TQFP-48</td>
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<tr>
<td>XC886-8FF</td>
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<td>1792</td>
<td>–</td>
<td>–</td>
<td>PG-TQFP-48</td>
</tr>
<tr>
<td>XC888-6FF</td>
<td>24</td>
<td>1792</td>
<td>–</td>
<td>–</td>
<td>PG-TQFP-64</td>
</tr>
<tr>
<td>XC888-8FF</td>
<td>32</td>
<td>1792</td>
<td>–</td>
<td>–</td>
<td>PG-TQFP-64</td>
</tr>
<tr>
<td>XC886LM-6FF</td>
<td>24</td>
<td>1792</td>
<td>✓</td>
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<td>PG-TQFP-48</td>
</tr>
<tr>
<td>XC886LM-8FF</td>
<td>32</td>
<td>1792</td>
<td>✓</td>
<td>✓</td>
<td>PG-TQFP-48</td>
</tr>
<tr>
<td>XC888LM-6FF</td>
<td>24</td>
<td>1792</td>
<td>✓</td>
<td>✓</td>
<td>PG-TQFP-64</td>
</tr>
<tr>
<td>XC888LM-8FF</td>
<td>32</td>
<td>1792</td>
<td>✓</td>
<td>✓</td>
<td>PG-TQFP-64</td>
</tr>
</tbody>
</table>

1) Includes 1 KB of Monitor ROM
2) Includes up to 8 KB for Data Flash
## Starter Kits for 8-bit Microcontrollers

<table>
<thead>
<tr>
<th>Starter Kits</th>
<th>MCU Derivative</th>
<th>CPU Clock [MHz]</th>
<th>On-Board Memory</th>
<th>Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>SK-XC866 Starter Kit</td>
<td>XC866</td>
<td>26.67</td>
<td>–</td>
<td>RS232, Lin, JTAG, SBC-Board and Motorcontrol connector</td>
</tr>
<tr>
<td>SK-XC866 Easy Kit</td>
<td>XC866</td>
<td>26.67</td>
<td>–</td>
<td>RS232, LIN, JTAG</td>
</tr>
<tr>
<td>SK-XC886/888 Starter Kit</td>
<td>XC886/888</td>
<td>24</td>
<td>–</td>
<td>RS232, 2 x CAN, Lin, JTAG, SBC-Board and Motorcontrol connector</td>
</tr>
<tr>
<td>SK-XC886/888 Easy Kit</td>
<td>XC886/888</td>
<td>24</td>
<td>–</td>
<td>RS232, 2 x CAN, LIN, JTAG</td>
</tr>
<tr>
<td>SK-C868</td>
<td>C868</td>
<td>40</td>
<td>8 k EEPROM</td>
<td>RS232</td>
</tr>
<tr>
<td>SK-505</td>
<td>C505CA-4E</td>
<td>16</td>
<td>32 KByte SRAM, 128 KByte FLASH</td>
<td>1 x RS-232, 1 x CAN</td>
</tr>
<tr>
<td>SK-505-PRIME + SK-OTP-1 + 15 samples + extraction tool</td>
<td>C505CA-4E</td>
<td>16</td>
<td>32 KByte SRAM, 128 KByte FLASH</td>
<td>1 x RS-232, 1 x CAN</td>
</tr>
<tr>
<td>SK-515C</td>
<td>C515C-8E</td>
<td>10</td>
<td>32 KByte SRAM, 128 KByte FLASH</td>
<td>1 x RS-232, 1 x CAN</td>
</tr>
<tr>
<td>SK-515-PRIME + SK-OTP-1 + 15 samples + extraction tool</td>
<td>C515C-8E</td>
<td>10</td>
<td>32 KByte SRAM, 128 KByte FLASH</td>
<td>1 x RS-232, 1 x CAN</td>
</tr>
<tr>
<td>SK-OTP-2 Programmer</td>
<td>Programmer with P-MQFP-80 programming socket for C515C-8E derivative with internal OTP memory</td>
<td>1 x RS-232</td>
<td>1 x RS-232</td>
<td></td>
</tr>
</tbody>
</table>

More information about Microcontrollers tools available at: [www.infineon.com/mc-tools](http://www.infineon.com/mc-tools)
THESE MEMBERS OF THE C166 family offer all benefits of a full 16-bit controller at the average price of an 8-bit controller. The C161 product range is focused on price sensitive applications such as in consumer products. Grouped around the 25 MHz C166 core a variety of basic peripherals have been chosen for optimal product and system costs.

Device Cross-Reference
The table below describes the differences between the three C161 derivatives

<table>
<thead>
<tr>
<th>Features</th>
<th>C161K</th>
<th>C161O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal RAM Size (IRAM)</td>
<td>1 KByte</td>
<td>2 KBytes</td>
</tr>
<tr>
<td>Chip Select Signals</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Bus Modes</td>
<td>MUX/DEMUX</td>
<td>MUX/DEMUX</td>
</tr>
<tr>
<td>Power Saving Modes</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Fast External Interrupts</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>General Purpose Timer Unit 1 (GPT1)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Input/Output Functionality of GPT1</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>General Purpose Timer Unit 2 (GPT2) with Capture Input (CAPIN) Functionality</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td>Bootstrap-Loader</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Key Features
- High Performance 16-bit CPU with 4-stage pipeline
- 80 ns Instruction Cycle Time at 25 MHz CPU Clock
- 400 ns Multiplication (16 x 16 bit)
- 800 ns Division (32/16 bit)
- Clock Generation via Prescaler or via Direct Clock Input
- Enhanced Boolean Bit Manipulation Facilities
- Additional Instructions to Support HLL and Operating Systems
- Register-Based Design with Multiple Variable Register Banks
- Single-Cycle Context Switching Support
- Up to 4 MBytes Linear Address Space for Code and Data
- Up to 2 KBytes On-Chip RAM
- Programmable External Bus Characteristics for Different Address Ranges
- 8-bit or 16-bit External Data Bus
- Multiplexed or Demultiplexed External Address/Data Buses
- Programmable Chip-Select Signals
- 1024 Bytes On-Chip Special Function Register Area
- Idle and Power Down Modes
- 8-Channel Interrupt-Driven Single-Cycle Data Transfer Facilities via Peripheral Event Controller (PEC)
- 16-Priority-Level Interrupt System with 20 Sources, (14 Sources on C161K)
- Multi-Functional General Purpose Timer Units with up to five 16-bit Timers
- Two Serial Channels (Synchronous/Asynchronous and High-Speed-Synchronous)
- Programmable Watchdog Timer
- Up to 63 General Purpose I/O Lines
- On-Chip Bootstrap-Loader
- 3 V Operation at max. CPU Clock of 20 MHz (C1610-LM 3 V only)
- Supported by large Range of Development Tools including C-Compilers, Makro-Assembler Packages, Real-Time Operating Systems, Emulators, Evaluation boards, HLL-Debuggers, Simulators, Logic Analyzers Disassemblers, Programming Boards
- 80-Pin MQFP Green Package

1) For complete device designations (corresponding to PRO ELECTRON) please refer to the data sheet.
The Basic 16-bit Microcontrollers

The Basic 16-bit Microcontrollers

C161K/C161O Block Diagram

C161K/C161O Pin Configuration

PG-MQFP-80

Note:
The marked signals are not available on all C161 derivatives. Please refer to the detailed description in the data sheet.
THE C161PI IS A NEW 16-bit entry-level microcontroller particularly well suited for low cost, low power and high performance Consumer or Telecom applications.

BASED ON OUR C166 CORE, this flexible microcontroller comes with a host of useful peripherals, such as on-chip Real Time Clock, fast 10-bit ADC, as well as various clock generation schemes. It also incorporates serial interfaces, such as I²C and USART, making communications easy with other devices in target applications.

THIS COMBINATION OF CAREFULLY selected features together with flexible power management provides designers with the required flexibility and an excellent price-performance ratio-improving system performance while lowering system costs.

Key Features

- High Performance 16-bit CPU with 4-stage Pipeline
- 80 ns Instruction Cycle Time at 25 MHz CPU Clock
- 400 ns Multiplication (16 x 16 bit) 800 ns Division (32/16 bit)
- Enhanced Boolean Bit Manipulation Facilities
- Additional Instructions to Support HLL and Operating Systems
- Clock Generation via on-chip PLL, via Prescaler or via Direct Drive
- Register-Based Design with Multiple Variable Register Banks
- Single Cycle Context Switching Support
- 3 KByte On-Chip RAM
- 8 MByte Total Linear Address Space for Code and Data
- Programmable External Bus Characteristics for Different Address Ranges
- 8-bit or 16-bit External Data Bus
- Multiplexed or Demultiplexed External Address/Data Bus
- 5 Programmable Chip Select Signals
- 1024 Byte On-Chip Special Function Register Area
- Idle and Power-Down Modes with Flexible Power Management
- Programmable Watchdog and Oscillator Watchdog
- On-Chip Real Time Clock
- I²C Bus Interface (10-bit Addressing, 400 kHz) with 2 Channels (Multiplexed)
- 2 Multi-Functional General Purpose Timer Units with 5 Timers
- Two Serial Channels (Synchronous/Asynchronous and High Speed Synchronous)
- 4-Channel 10-bit A/D Converter
- 16 Priority-Level Interrupts System with 27 Sources
- 8-Channel Interrupt-Driven Single-Cycle Data Transfer Facilities via Peripheral Event Controller (PEC)
- Up to 76 General Purpose I/O Lines
- 3 V Operation (max. CPU Clock of 20 MHz)
- On-Chip Bootstrap Loader
- Supported by a Large Range of Development Tools
- 100-Pin MQFP/TQFP Green Package
- Temperature ranges:
  - Standard: 0°C to +70°C
  - Extended: -40°C to +85°C
Consumer Class 16-bit Microcontroller

C161PI
Block Diagram

C161PI
Pin Configuration
PG-TQFP-100
(Top View)
C161S

THE C161S IS A NEW MEMBER in the C161 Family, which offers the full performance of the C166 Architecture. This device is focused on price sensitive applications such as communication or low end industrial control.

THIS FLEXIBLE MICROCONTROLLER comes with a host of useful peripherals, such as Real Time Clock, a clock generation via on chip PLL and a flexible power management. It also incorporates serial interfaces like USART and SPI making communications easy with other devices in target applications.

Applications
■ Industrial Controls
■ Telephone
■ PBX
■ Linecard

Features
■ High Performance 16-bit CPU with 4-Stage Pipeline
■ 80 ns Instruction Cycle Time at 25 MHz CPU Clock
■ 400 ns Multiplication (16 × 16 bit), 800 ns Division (32/16 bit)
■ Enhanced Boolean Bit Manipulation Facilities
■ Additional Instructions to Support HLL and Operating Systems
■ Register-Based Design with Multiple Variable Register Banks
■ Single-Cycle Context Switching Support
■ 16 Mbytes Total Linear Address Space for Code and Data
■ 1024 bytes On-Chip Special Function Register Area
■ 16-Priority-Level Interrupt System with 30 Sources, Sample-Rate down to 40 ns
■ 8-Channel Interrupt-Driven Single-Cycle Data Transfer Facilities via Peripheral Event Controller (PEC)
■ Clock Generation via On-Chip PLL (factors 1:1.5/2/2.5/3/4/5), via prescaler or via direct clock input
■ On-Chip Memory Modules: 2 Kbytes On-Chip Internal RAM (IRAM)
■ Two Multi-Functional General Purpose Timer Units with 5 Timers
■ Two Serial Channels (Synchronous/Asynchronous and High-Speed-Synchronous)
■ On-Chip Real Time Clock
■ Up to 4/16 Mbytes External Address Space for Code and Data
■ Programmable External Bus Characteristics for Different Address Ranges
■ Multiplexed or demultiplexed External Address/Data Buses with 8-bit or 16-bit Data Bus Width
■ Four Programmable Chip-Select Signals
■ 4 Mbytes maximum address window size, results in a total external address space of 16 Mbytes, when all chip-select signal (address windows) are active
■ Idle and Power Down Modes with Flexible Power Management
■ Programmable Watchdog Timer and Oscillator Watchdog
■ Up to 63 General Purpose I/O Lines, partly with Selectable Input Thresholds and Hysteresis
■ Power Supply: the C161S can operate from a 5 V or a 3 V power supply
■ Supported by a Large Range of Development Tools like C-Compilers, Macro-Assembler Packages, Emulators, Evaluation Boards, HLL-Debuggers, Simulators, Logic Analyzer Disassemblers, Programming Boards
■ On-Chip Bootstrap Loader
■ 80-Pin MQFP Green Package
Low Cost Consumer Class Controller

C161S Block Diagram

Application Example
- Industrial Controls
- Industrial Networking
- Small PLC
- Telephone
- PBX
- Linecard
- Basestation
THE SAB C161U IS A LOW-COST high-performance general-purpose 16-bit microcontroller that includes USB device interface at full speed of 12 Mbits. The device combines the successful Infineon C166 16-bit static core technology and offers many On-Chip peripheral functions such as USART, 5 timers, Watchdog timer, 8 DMA channels, 8 software configurable bi-directional USB end-points, and a high number of programmable I/Os. C161U’s high performance, low cost, and rich peripheral functions provide users the maximum flexibility and performance to implement additional value-added software for product differentiation.

Key Features
- High-performance CPU with 18 MIPS processing power
- 55.5 ns per instruction
- 3 KBytes On-Chip high performance Dual-Port RAM
- 56 programmable I/Os with 8 LED drivers
- Eight DMA channels for high-performance data transfer
- Up to 2-MByte linear address space for data and code
- Four programmable chip selects
- Five 16-bit multi-mode general-purpose timers
- 16 programmable priority-level interrupts
- One 16-bit programmable watchdog timer
- USART with Autobaud Detection & IrDA support
- Low supply voltage (3.3 V)
- 5 V (TTL) tolerant I/Os
- USB features:
  - USB Specification 1.1 compliant
  - Supports 3 configurations and up to 4 interfaces
  - 8 bi-directional endpoints:
    1 at 64Bytes and
    7 at 1024 Bytes packet
  - On-Chip USB transceiver
  - Supports isochronous, bulk, and interrupt modes
- High-speed Serial Synchronous Channel
- Power management supporting Idle and Power-Down Modes
- On-Chip Debug Support (OCDS) & JTAG Boundary Scan Test Support (IEEE 1149.1) for ease of use and low-cost product development & debugging
- 100-pin TQFP Package
- -40°C to 85°C temperature range

Potential Applications
- Communication: CTI, ISDN and Modem
- USB printer & scanner
- Audio/speakers
- Still/digital camera
- High performance gaming products
- Removable storage
- Video conference and monitor
- Low cost VOIP phones
- Data acquisition High-performance USB Adapters
- Microcontroller/embedded applications where intelligent USB-PHY is required

EASY C161U Evaluation System:
Q67000 -H9413 -A101
A New Generation High-Performance
18 MIPs 16-bit USB Microcontroller

C161U Block Diagram

Development Tools
Infineon has comprehensive development tools and solutions available for designing USB peripherals. The development tools and solutions start from a low-cost OCDS-based debugger and evaluation board to cost-effective, high-function, third-party emulators. In addition, software drivers for Windows® 98 and standard sample firmware are available. Software for C161U can be written in assembly language or C/C++ language.

C161U Application Example

Availability
The C161U device is available with complete documentation and support package. A dedicated engineering support team is there to assist you. Please contact your local Infineon office for further details.

C161U: offers all benefits of a high-performance 16-bit USB microcontroller at the average price of an 8-bit USB controller. The C161U product is focused on price sensitive and high performance applications such as in consumer and communication products.
C164CI/CL/SI

C164CI/CL/SI is a member of the Infineon C166 family of 16-bit microcontrollers. It was designed to meet the requirements of real-time embedded-control applications like automotive electronics or industrial control. A 32 or 64 KByte OTP or ROM program memory and up to 4 KByte data memory are implemented on chip. It combines a wide variety of on chip features like CAN interface (version 2.0B active), a module for generation of PWM signals, a real time clock as well as flexible power management characteristics for battery powered applications.

Key Features

- High Performance 16-bit CPU with 4-stage pipeline
- 100 ns Instruction Cycle Time at 20 MHz CPU Clock (ROM/ROMless 80 ns at 25 MHz)
- 500 ns Multiplication (16 x 16 bit), 1 µs division (32/16 bit)
- Enhanced Boolean Bit Manipulation Facilities
- Additional Instructions to support HLL and Operating Systems
- Register-Based Design with Multiple Variable Register Banks
- Single-Cycle Context Switching Support
- Up to 4 MByte Linear Address Space for Code and Data
- 2 KByte On-Chip RAM (ROM/ROM-less 4 KByte RAM)
- 32/64 KByte On-Chip OTP or ROM
- Clock Generation via On-Chip PLL or via direct of prescaled Clock Input
- Programmable External Bus Characteristics for Different Address Ranges
- 8-bit or 16-bit External Data Bus
- Multiplexed or Demultiplexed External Address/Data Bus
- Four Programmable Chip-Select Signals
- 1024 Byte On-Chip Special Function Register Area
- Extended Power Saving Modes with Wake-up via External/Internal Interrupt
- 8-Channel Interrupt-Driven Single-Cycle Data Transfer Facilities via Peripheral Event Controller (PEC)
- 16-Priority-Level Interrupt System with 32 Interrupt Sources, Sample Rate down to 50 ns
- 8-Channel 10-bit A/D Converter with 9.7 µs Conversion Time
- One 8-Channel Capture/Compare Unit
- 3/6-Channel 16-bit Capture/Compare Unit Dedicated for AC/DC Motor Control Applications
- Multi-Functional General Purpose Timer Unit with three 16-bit Timers
- On-Chip CAN Interface (V2.0B active)
- Two Serial Channels (Synchronous/Asynchronous and High-Speed-Synchronous)
- On-Chip Real Time Clock
- Programmable Watchdog Timer
- Oscillator Watchdog
- On-Chip Bootstrap Loader
- Up to 59 General Purpose I/O Lines
- Supported by a Large Range of Development Tools
- 80-Pin MQFP Package

Controller Area Network (CAN): License of Robert Bosch GmbH
General Purpose High-Performance Microcontroller with OTP or ROM

C164CI/CL/SI

Block Diagram

C164CI/CL/SI

Pin Configuration
The C164CM is a new derivative of the popular C166 microcontroller family.

The well proven C166 architecture with the outstanding realtime performance is the basis for two new derivatives in the 1.2 x 1.2 cm² small P/PG-TQFP-64 package. The integration of a powerful peripheral set and high performance on-chip OTP or ROM memory makes the C164CM the instrument of choice for industrial and automotive applications like multi phase brushless DC motor control or 'smart' Sensing.

The applicability in a high temperature environment and availability as bare die allows cost optimized mechatronic solutions.

The flexible and intelligent PWM unit in combination with the high speed, high resolving Analog Digital Converter simplifies control of AC-, DC- or reluctance motors (sensorless solutions).

The on-chip communication interfaces including a Full-CAN interface handle networked solutions confidently.

Applications
■ BLDC drive control
■ Intelligent sensors
■ Sensorless Multi Phase Drive Control
■ Automotive Body and Safety Applications

Features
■ High Performance 16-bit C166 CPU with 4-Stage Pipeline
■ 80 ns cycle time at 25 MHz CPU clock
■ 400 ns multiplication (16 x 16 bit), 800 ns Division (32/16 bit)
■ Enhanced Boolean Bit Manipulation Facilities
■ Register-Based Design with multiple variable Register Banks
■ Single-Cycle Context Switching Support
■ Flexible Synchronous External Bus Interface
■ 16-Priority-Level Interrupt System with 32 sources, Sample rate down to 40 ns
■ 8 Channel Interrupt driven Peripheral Event Controller (PEC)
■ Clock generation via on Chip PLL or via direct Clock Input
■ 2 KByte on chip RAM
■ 32 KByte on chip Program OTP or ROM Memory
■ Up to 64 KByte external address space for code and data
■ Flexible System Control and Power Management
■ Real Time Clock with alarm interrupt
■ 8-Channel 10-bit A/D Converter, conversion time down to 7.8 µs
■ 12-Channel Capture/Compare Units with 2 independent time bases
■ Multifunctional General Purpose Timer Unit with 3 Timers
■ Asynchronous/Synchronous Serial Channel (USART)
■ High Speed Synchronous Serial Channels (SPI)
■ Full-CAN interface Rev. 2.0 Part B with 15 Message Objects
■ CAPCOM6 module with two independent timers dedicated to PWM generation for AC-motor control
■ Programmable Watchdog timer and Oscillator Watchdog
■ Up to 50 general purpose I/O Lines
■ Package: P/PG-TQFP-64 Plastic Thin Quad Flat Package
■ Temperature Range: -40°C to +125°C
■ Supply Voltage: 5.0 V
Drive Control in the Smallest Space

C164CM Block Diagram

C164CM
Brushless DC drive control and extensive communication capabilities for space and cost saving mechatronic solutions
C164SV

THE C164SV IS A NEW derivative of the popular C166 microcontroller family.

IT IS THE BEST CHOICE for cost sensitive solutions, where performance is the key for success.

THE WELL PROVEN C166 architecture with the out-standing realtime performance is the basis for this new derivative in the 1.2 x 1.2 cm² small TQFP-64 package. The integration of a powerful peripheral set and high performance on-chip OTP or ROM memory makes the C164SV the instrument of choice for industrial and automotive applications like multi phase brushless DC motor control or 'smart' Sensoring. The applicability in a high temperature environment and availability as bare die allows cost optimized mechatronic solutions.

THE FLEXIBLE and intelligent PWM unit in combination with the high speed, high resolving Analog Digital Converter simplifies control of AC-, DC- or reluctance motors (sensorless solutions).

THE C164SV IS PIN compatible to the C164CM, offering scalability in memory sizes.

Applications
■ BLDC drive control
■ Intelligent sensors
■ Sensorless Multi Phase Drive Control
■ Automotive Body and Safety Applications
■ White Goods

Features
■ High Performance 16-bit C166 CPU with 4-Stage Pipeline
■ 80 ns cycle time at 25 MHz CPU clock
■ 400 ns multiplication (16 x 16 bit), 800 ns Division (32/16 bit)
■ Enhanced boolean Bit Manipulation Facilities
■ Register-Based Design with multiple variable Register Banks
■ Single -Cycle Context Switching Support
■ Flexible Synchronous External Bus Interface
■ 16-Priority-Level Interrupt System with 32 sources, Sample rate down to 40 ns
■ 8 Channel Interrupt driven Peripheral Event Controller (PEC)
■ Clock generation via on Chip PLL or via direct Clock Input
■ 1 KByte on chip RAM
■ 16 KByte on chip Program ROM Memory (OTP Version available)
■ Up to 64 KByte external address space for code and data
■ Flexible System Control and Power Management
■ Real Time Clock with alarm interrupt
■ 8-Channel 10-bit (optional 12 -bit) A/D Converter, conversion time down to 7.8 µs
■ 12-Channel Capture/Compare Units with 2 independent time bases
■ Multifunctional General Purpose Timer Unit with 3 Timers
■ Asynchronous/Synchronous Serial Channel (USART)
■ High Speed Synchronous Serial Channels (SPI)
■ CAPCOM6 module with two independent timers dedicated to PWM generation for AC-motor control
■ Programmable Watchdog timer and Oscillator Watchdog
■ Up to 50 general purpose I/O Lines
■ Package: P/PG-TQFP-64 Plastic Thin Quad Flat Package
■ Temperature Range: -40°C to + 125°C
■ Supply Voltage: 5.0 V
Drive Control in the Smallest Space

C164SV Block Diagram

<table>
<thead>
<tr>
<th>Type</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAF-C164SV-2RF</td>
<td>P/PG-TQFP-64</td>
</tr>
<tr>
<td>SAK-C164SV-2RF</td>
<td>P/PG-TQFP-64</td>
</tr>
</tbody>
</table>

C164SV

Brushless DC Drive Control and Extensive Communication Capabilities for Space and Cost Saving Mechatronic Solutions
THE C165-L is a processor oriented version within the Infineon C166 microcontroller family. It meets the demands of embedded applications with high-end realtime requirements and large data throughput where pricing is a sensitive factor, for example in dataprocessing and telecom products.

THE FASTEST VERSION of the C165, the SAB C165-L25M, needs just 80 ns at 25 MHz CPU clock to process each instruction. The C165 can operate at voltages down to 3 V reducing the power consumption in battery-powered applications. Two surface mount packages are available; PG-MQFP-100 and PG-TQFP-100.

Key Features
■ High Performance 16-bit CPU with 4-stage pipeline
■ 80 ns Instruction Cycle Time at 25 MHz CPU Clock (SAB C165-L25M)
■ 3 V Operation at max. 20 MHz
■ 400 ns Multiplication (16 x 16 bit) 800 ns Division (32/16 bit) (SAB C165-L25M)
■ Enhanced Boolean Bit Manipulation Facilities
■ Additional Instructions to Support HLL and Operating Systems
■ Register-Based Design with Multiple Variable Register Banks
■ Single-Cycle Context Switching Support
■ Up to 16 MByte Linear Address Space for Code and Data
■ 2 KByte On-Chip RAM
■ Programmable External Bus Characteristics for Different Address Ranges
■ 8-bit or 16-bit External Data Bus
■ Multiplexed or Demultiplexed External Address/Data Buses
■ Five Programmable Chip-Select Signals
■ Hold-and Hold-Acknowledge Bus Arbitration Support
■ 1024 Bytes On-Chip Special Function Register Area
■ Idle and Power-Down Modes
■ 8-Channel Interrupt-Driven Single-Cycle Data Transfer Facilities via Peripheral Event Controller (PEC)

■ 16-Priority-Level Interrupt System with 28 Sources, Sample-Rate down to 40 ns (SAB C165-L25M)
■ Two Multi-Functional General Purpose Timer Units with a total of five 16-bit Timers
■ Two Serial Channels (Synchronous/Asynchronous and High-Speed-Synchronous)
■ Programmable Watchdog Timer
■ Up to 77 General Purpose I/O Lines
■ On-Chip Bootstrap-Loader
■ Supported by a large Range of Development Tools including C-Compilers, Makro-Assembler Packages, Real-Time Operating Systems, Evaluators, Emulators, Evaluation Boards, HLL-Debuggers, Simulators, Logic Analyzers, Disassemblers, Programming Boards
■ 100-Pin MQFP Green Package (EIAJ) or 100-Pin TQFP Green Package (14 x 14 x 1.4 mm, 0.5 mm pitch; suited for PCMCIA-Applications)

1) For complete device designations (corresponding to PRO ELECTRON) please refer to the data sheet.
Processor-Oriented Microcontroller with up to 25 MHz CPU Clock

C165-L
Block Diagram

C165-L
Pin Configuration
PG-MQFP Package
(PG-TQFP Package also available)
C165H

The C165H is a new low-cost member of the Infineon Communication Controller family. The device combines the successful Infineon C166 16-bit full static core with four independent HDLC controllers, IOM®-2 interface and 3-KByte of On-Chip Dual-Port RAM. The C165H addresses all embedded HDLC based features in ISDN-TA Intelligent-NT, IDSL and low cost SOHO-PBX designs offering up to 18 MiPs along with legacy peripherals such as USART, SSC/SCI and Timers.

The C165H core has a built-in DMA, that provides maximum flexibility and performance. Off-loading the CPU in such a manner allows the user to implement value-added software features for enabling product differentiation.

The C165H Provides:

- C166 Static Core with Peripherals including
  - 16-bit fully-static core design running up to 36 MHz (18 MiPs)
  - Peripheral Event Controller (PEC) for 8 user-defined independent DMA channels
  - Sixteen dynamically programmable priority-level interrupt system
  - Eight fast external interrupts
  - Up to 72 software-configurable Input/Output (I/O) ports, some with interrupt capabilities
  - 8-bit or 16-bit external data bus
  - Multiplexed or demultiplexed address/data bus
  - Up to 8-MByte linear address space for code and data
  - Five programmable chip-select lines with wait-state
  - On-chip 3-KByte Dual-Port SRAM for user applications
  - On-Chip 1-KByte special function register area
  - On-Chip PLL with output-signal
  - Five multimode General Purpose Timers (GPTs)
  - USART with AutoBaud detection & IrDA support
  - SSC/SCI serial interface
  - On-Chip programmable watchdog timer
  - Glueless interface to EPROM, Flash EPROM, and SRAM
  - Power management supporting idle and power-down modes
  - Bootstrap loader support via USART interface
  - On-Chip Debug Support (OCDS) & JTAG Boundary Scan Test Support (IEEE 1149.1) for low-cost product development & debugging

ISDN BRI Core including

- 56 Kbit/s to 144 Kbit/s user data rate
- IOM®-2/PCM interface to S/U transceiver
- TE mode support
- Four On-Chip independent full duplex HDLC channels
- Independent FIFOs for each transmit and receive channel
The C165H device is available with complete documentation and support package. A dedicated engineering support team is there to assist you. Please contact your local Infineon office for further details.
THE C167CR IS A NEW derivative of the Infineon C166 Family of full featured single-chip CMOS microcontrollers. It combines high CPU performance with high peripheral functionality and enhanced IO-capabilities.

THE C167CR FEATURES a CAN module which meets version 2.0B active of the Controller Area Network specification and was designed to fulfill the requirements of coming generations of automotive and industrial control applications.

<table>
<thead>
<tr>
<th>Device</th>
<th>ROM</th>
<th>CAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>C167CR-LM</td>
<td>–</td>
<td>✓</td>
</tr>
<tr>
<td>C167CR-4RM</td>
<td>32 Kbytes</td>
<td>✓</td>
</tr>
<tr>
<td>C167CR-16RM</td>
<td>128 Kbytes</td>
<td>✓</td>
</tr>
<tr>
<td>C167SR-LM</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

25 MHz = standard
33 MHz = optional

Key Features
- High Performance 16-bit CPU with 4-Stage Pipeline
- 80 ns Instruction Cycle Time at 25 MHz CPU Clock
- 400 ns Multiplication (16 x 16 bit), 800 ns Division (32/16 bit) at 25 MHz CPU Clock
- Enhanced Boolean Bit Manipulation Facilities
- Additional Instructions to Support HLL and Operating Systems
- Register-Based Design with Multiple Variable Register Banks
- Single-Cycle Context Switching Support
- Clock Generation via On-Chip PLL or via direct clock-input
- Up to 16 Mbytes Linear Address Space for Code and Data
- 4 Kbytes On-Chip SRAM (2 Kbytes Internal RAM, 2 Kbytes Extension RAM)
- Programmable External Bus Characteristics for Different Address Ranges
- 8-bit or 16-bit External Data Bus
- Multiplexed or Demultiplexed External Address/Data Buses
- Five Programmable Chip-Select Signals
- Hold- and Hold-Acknowledge Bus Arbitration Support
- 1024 Bytes On-Chip Special Function Register Area
- Idle and Power Down Modes
- 8-Channel Interrupt-Driven Single-Cycle Data Transfer Facilities via Peripheral Event Controller (PEC)
- 16-Priority-Level Interrupt System with 56 Sources, Sample-Rate down to 40 ns
- 16-Channel 10-bit A/D Converter with 7.76 μs at 25 MHz Conversion Time
- Two 16-Channel Capture/Compare Units
- 4-Channel PWM Unit
- Two Multi-Functional General Purpose Timer Units with five 16-bit Timers
- Two Serial Channels (Synchronous/Asynchronous and High-Speed-Synchronous, 6 Mbit/s at 25 MHz)
- On-Chip CAN Interface 2.0B active with 15 Message Objects (Full-CAN/Basic-CAN)
- Programmable Watchdog Timer
- Up to 111 General Purpose I/O Lines, partly with Selectable Input Thresholds and Hysteresis
- On-Chip Bootstrap-Loader
- Supported by a Wealth of Development Tools like C-Compilers, Macro-Assembler Packages, Realtime Operating Systems, Emulators, Evaluation Boards, HLL-Debuggers, Simulators, Logic Analyzer Disassemblers, Programming Boards
- 144-Pin MQFP Package
- Full Automotive Temperature Range -40°C to +125°C

Controller Area Network (CAN): License of Robert Bosch GmbH

1) For complete device designations (corresponding to PRO ELECTRON) please refer to the data sheet.
Highly Integrated Microcontroller with On-Chip CAN-Module

C167CR
Block Diagram

C167CR
Pin Configuration
THE C167CS IS A NEW high end derivative of the Infineon C166 Family of full featured single-chip CMOS microcontrollers. The C167CS features additionally internal units like two CAN modules (V2.0B active), ADC, CAPCOM, XRAM, IRAM, PLL, Watchdog, RTC, GPT, power management control and up to 40 MHz performance.

THIS MICROCONTROLLER fulfills the requirements of highly sophisticated automotive and industrial control applications.

Key Features
- High Performance 16-bit CPU with 4-Stage Pipeline
- 80 ns Instruction Cycle Time at 25 MHz CPU Clock (standard)
- Up to 12.5 million instructions per second
- 400 ns Multiplication (16 x 16 bit), 800 ns Division (32/16 bit)
- Enhanced Boolean Bit Manipulation Facilities
- Additional Instructions to Support HLL and Operating Systems
- Register-Based Design with Multiple Variable Register Banks
- Single-Cycle Context Switching Support
- Clock Generation via On-Chip PLL or via Direct Clock Input
- Up to 16 MBytes Linear Address Space for Code and Data
- 3 KByte On-Chip Internal RAM (IRAM)
- 8 KByte On-Chip Extension RAM (XRAM)
- Two On-Chip CAN modules operating on one or two CAN Buses (30 or 2 x 15 Message Objects) Version 2.0B active
- Programmable External Bus Characteristics for Different Address Ranges
- 8-bit or 16-bit External Data Bus
- Multiplexed or Demultiplexed External Address/Data Buses
- Five Programmable Chip-Select Signals
- Hold and Hold-Acknowledge Bus Arbitration Support
- 1024 Byte On-Chip Special Function Register Area
- Idle, Power Down Modes and Power Saving Features
- 8-Channel Interrupt-Driven Single-Cycle Data Transfer Facilities via Peripheral Event Controller (PEC)
- 16-Priority-Level Interrupt System with 56 Sources, Sample-Rate down to 40 ns
- 24-Channel 10-bit A/D Converter with < 10 µs Conversion Time (7.76 µs at 25 MHz)
- Two 16-Channel Capture/Compare Units with Bidirectional I/O Port Pins
- 4-Channel PWM Unit

Device | ROM
---|---
C167CS-4RM | 32 KB
C167CS-LM | –

25 MHz = standard
33 MHz = optional
40 MHz = optional
3.3 V at 16 MHz = optional

- Two Multi-Functional General Purpose Timer Units with five 16-bit Timers
- Two Serial Channels (Synchronous/Asynchronous and High-Speed-Synchronous)
- Programmable Watchdog Timer
- Real Time Clock
- On-Chip Bootstrap Loader
- Oscillator Watchdog
- Up to 111 General Purpose I/O Lines, partly with Selectable Input Thresholds and Hysteresis
- Identification Register Support
- Optimized EMC Behavior
- Exit/Wakeup from Sleep Mode with External Interrupt or RTC Interrupt
- Single Chip Reset (optional)
- Flexible CAN Interface Line Assignment for additional Address Pins (use Address Pins while CAN is active)
- Compatible in Pins, Timing and Code to existing Cs167CR Derivatives
- Supported by a Wealth of Development Tools like C-Compilers, Macro-Assembler Packages, Emulators, Evaluation Boards, HLL-Debuggers, Simulators, Logic Analyzer Disassemblers
- 144-Pin MQFP Package
- Full Automotive Temperature Range: -40°C to +125°C

Controller Area Network (CAN): License of Robert Bosch GmbH

1) For complete device designations (corresponding to PRO ELECTRON) please refer to the data sheet.
High Performance Microcontroller with On-Chip Memory and Two-CAN-Modules
**XC161CJ/CS**

**THE XC161CJ IS A NEW** derivative of the popular C166 microcontroller family.

**BASED ON THE ENHANCED** C166S V2 architecture it outperforms existing 16-bit solutions. The XC161CJ is an improved and new-generation representative of the Infineon family of the full featured 16-bit single-chip CMOS microcontroller. It combines the extended functionality and performance of the C166S V2 Core with powerful On-Chip peripheral subsystems and on-chip Flash memory.

**THE ARCHITECTURE** of XC161CJ has been optimized for high instruction throughput and minimum response time to external interrupts.

**INTELLIGENT PERIPHERAL** systems have been integrated to reduce the need for CPU intervention. The high flexibility of this architecture allows to serve the diverse and varying needs of different application areas such as automotive, industrial control, or data communications.

**ALL THIS COMBINED** in a P/PG-TQFP-144 package serves the requirements for highest system integration.

**Applications**
- Automotive Dashboard
- Robotic Control
- Automotive Body Control Modules
- Car Radio
- Central Gateway

**Features**
- High performance 16-bit C166S V2 CPU with 5-Stage Pipeline
- Single clock cycle instruction execution with 25 ns instruction time at 40 MHz CPU clock
- 25 ns multiplication (16 x 16 bit) time at 40 MHz CPU clock
- DSP support with Built-in advanced MAC unit
- 16 MByte total linear address space for code and data
- Flexible Synchronous External Bus Interface
- 16-Priority-Level Interrupt System on 8 group levels
- On-chip debug controller and related interface to JTAG controller
- Gated clock concept (function related) for reduced power consumption and improved EMC
- 8 KByte on Chip RAM
- 128 /256 KByte advanced Program Flash Memory (CJ/CS)
- Serial Data Link Module (SDLM), compliant with J1850 (only for CJ)
- Flexible System Control and Power Management
- Real Time Clock with alarm interrupt
- 12-Channel 10-bit A/D Converter, conversion time < 3 µs
- Two 16-channel Capture/Compare Units with 2 independent time bases each
- I²C Bus module with 10-bit addressing and 400 Kbit/s
- Serial Data Link Module (SDLM), compliant with J1850
- Two Multifunctional General Purpose Timer units
- Two Asynchronous/Synchronous Serial Channels (USART)
- Two High Speed Synchronous Serial Channels (SPI)
- TwinCAN module, two Full-CAN nodes with 32 message buffers and gateway function
- Up to 99 I/O Lines with individual bit addressability
- Package: P/PG-TQFP-144
- Plastic Thin Quad Flat Package
- Temperature Range: -40°C to +125°C
- Supply Voltage:
  - Core Supply: 2.5 V
  - Ports: 5.0 V
High End Performance

XC161CJ Block Diagram

<table>
<thead>
<tr>
<th>Type</th>
<th>Package</th>
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<tbody>
<tr>
<td>SAF-XC161CJ-16FF</td>
<td>P/PG-TQFP-144</td>
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<tr>
<td>SAK-XC161CJ-16FF</td>
<td>P/PG-TQFP-144</td>
</tr>
<tr>
<td>SAF-XC161CS-32FF</td>
<td>P/PG-TQFP-144</td>
</tr>
<tr>
<td>SAK-XC161CS-32FF</td>
<td>P/PG-TQFP-144</td>
</tr>
</tbody>
</table>

XC161CJ
The Best Solution for Automotive Body and Dashboard Application
THE XC164CM series is the new family of the enhanced 16-bit microcontroller XC166 which offers impressive DSP performance and advanced interrupt handling combined with a powerful integrated peripheral set, high performance and reliable on-chip Flash memory.

THE XC164CM series gives embedded system designers the ability to scale memory, speed and peripherals. The tiny TPFQ-64 pb-free package makes it fit to any industrial and automotive applications that require little board space and low cost.

THE FLEXIBLE and intelligent PWM unit simplifies control of AC-, DC- or reluctance motors. A high speed, high resolution ADC handles the fast and accurate translation of complex analog environment. Networked solutions can be confidently solved with powerful communication interfaces like the high speed TwinCAN module with autonomous gateway function.

THE XC164CM series is the logic successor of Infineon’s successful C164 family. The migration path from C164 to XC164CM series is supported by the same basic architecture and instruction set, so a high level of reuse can be achieved.

Applications
- Automotive body & comfort
- Automotive safety
- Industrial motor control
- Consumer drives

Key Features
- High performance 16-bit C166S V2 CPU with 5-stage pipeline
- Single clock instruction execution with 25 ns instruction time at 40 MHz CPU clock
- 25 ns multiplication (16 x 16 bit), background division (32/16 bit), and multiply-and-accumulate (MAC) instructions
- Zero-cycle jump execution
- Register-based design with multiple variable register banks
- Fast context switch with two additional local register banks
- 16 Mbytes total linear address space for code and data
- 1024 Bytes on-chip SFR area (C166 family compatible)
- 16-priority-level interrupt system with up to 75 sources, sample rate down to 50 ns
- 8-channel interrupt-driven single-cycle data transfer facilities via peripheral event controller
- Clock generation via on-chip PLL or via prescaler
- 2 Kbytes on-chip dual-port RAM
- 2 Kbytes on-chip data SRAM
- 2 Kbytes on-chip program/data SRAM
- 32 or 64 Kbytes on-chip program Flash (with Error Correction)
- 14-channel A/D converter with programmable resolution and conversion time down to 2.15 µs (on versions -CM, -GM, -SM, -TM)
- One 16-channel general purpose capture/compare unit
- Capture/compare unit for flexible PWM signal generation (3/6 capture/compare channels and 1 compare channel), (on versions -CM, -SM)
- Multi-functional general purpose timer unit with 5 timers
- Two synchronous/asynchronous serial channels (USARTs)
- Two high-speed synchronous serial channels
- On-chip TwinCAN interface (Rev. 2.0B active) with 32 MO and gateway functionality (on versions -CM, -GM, -KM)
- On-chip real time clock
- Enhanced power saving modes with flexible power management
- Programmable watchdog timer and oscillator watchdog
- Up to 47 general purpose I/O
- On-chip bootstrap loader
- Supported by a large range of development tools
- On-chip debug support via JTAG interface
- 64-pin PG-TQFP pb-free package, 0.5 mm (19.7 mil) pitch
- Temperature range: -40°C to +125°C and -40°C to + 85°C
- Supply Voltage:
  - Core Supply: 2.5 V
  - Port: 5 V

XC164CM Series
The 16-bit Flash Microcontroller Family in PG-TQFP-64 Package

Block Diagram

Product Summary

<table>
<thead>
<tr>
<th></th>
<th>XC164CM</th>
<th>XC164GM</th>
<th>XC164LM</th>
<th>XC164KM</th>
<th>XC164SM</th>
<th>XC164TM</th>
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<tr>
<td>eFlash [KB]</td>
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<td>RAM [KB]</td>
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<td>4/6</td>
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<td>CC6</td>
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<tr>
<td>TwinCAN</td>
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<td>✓</td>
<td>–</td>
<td>✓</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>A/D Converter</td>
<td>✓</td>
<td>✓</td>
<td>–</td>
<td>–</td>
<td>✓</td>
<td>✓</td>
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</table>

Application Example
THE XC164CS series are derivatives of the popular C166 microcontroller families. Based on the enhanced C166S V2 architecture it outperforms existing 16-bit solutions. Impressive DSP performance and advanced interrupt handling combined with a powerful integrated peripheral set and high performance on-chip memory make the XC164CS the instrument of choice for demanding industrial and automotive applications like synchronous DC motor control, future head lamp concepts or effective power steering solutions.

THE FLEXIBLE and intelligent PWM unit simplifies control of AC-, DC- or reluctance motors. A high speed, high resolution ADC handles the fast and accurate translation of complex analog environment. Networked solutions can be solved with powerful communication interfaces like the high speed TwinCAN module with autonomous gateway function.

THE XC164CS series gives embedded system designers the ability to scale memory, speed and peripherals. The small P/PG-TQFP-100 package makes it fit to any industrial and automotive applications that require little board space and low cost.

Applications
- Intelligent head lamp concepts
- Electrical power steering
- Airbag
- Body control modules
- Multi phase drive control

Features
- High performance 16-bit C166S V2 CPU with 5-stage pipeline
- Single clock cycle instruction execution with 25 ns instruction time at 40 MHz CPU clock
- 25 ns multiplication (16 x 16 bit) time at 40 MHz CPU clock
- DSP support with built-in advanced MAC unit
- 16 Mbytes total linear address space for code and data
- Flexible synchronous external bus interface
- 16-priority-level Interrupt system with 8 group levels each
- Gated clock concept (function related) for reduced power consumption and improved EMC
- 6 or 12 Kbytes on-chip RAM
- 64/128/256 Kbytes on-chip program Flash (with Error Correction)
- Flexible system control and power management
- Real time clock with alarm interrupt
- 14-channel 10-bit A/D converter, conversion time down to 2.15 µs (on versions -CS and -S)
- Two 16-channel capture/compare units with 2 independent time bases each
- Two multifunctional general purpose timer units
- Asynchronous/synchronous serial channels (USART)
- Two high speed synchronous serial channels (SPI)
- TwinCAN module, two full-CAN nodes with 32 message buffers and gateway function (on versions -CS and -D)
- CAPCOM6E module with two independent timers dedicated to PWM generation for AC and DC motor control
- On-chip real time clock
- Enhanced power saving modes with flexible power management
- Programmable watchdog timer and oscillator watchdog
- Up to 79 I/O lines with individual bit addressability
- On-chip bootstrap loader
- Supported by a large range of development tools
- On-chip debug support via JTAG interface
- Package: P/PG-TQFP-100 plastic thin quad flat package
- Temperature range: -40°C to +125°C and -40°C to + 85°C
- Supply Voltage:
  - Core Supply: 2.5 V
  - Ports: 5.0 V
The 16-bit Flash Microcontroller Family in P/PG-TQFP-100 Package

**Product Summary**

<table>
<thead>
<tr>
<th></th>
<th>XC164CS</th>
<th>XC164S</th>
<th>XC164D</th>
<th>XC164N</th>
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<tbody>
<tr>
<td>eFlash [KB]</td>
<td>64/128/256</td>
<td>64/128/256</td>
<td>64/128/256</td>
<td>64/128/256</td>
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<td>P/PG-TQFP-100</td>
<td>P/PG-TQFP-100</td>
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<tr>
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<td>-40 ... 85</td>
<td>-40 ... 85</td>
<td>-40 ... 85</td>
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<td>TwinCAN</td>
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</tr>
<tr>
<td>A/D Converter</td>
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<td></td>
<td></td>
</tr>
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</table>

**Application Example**
**XC167CI**

THE XC167CI is a new derivative of the popular C166 microcontroller family that is based on the enhanced C166S V2 architecture. It outperforms existing 16-bit solutions. Impressive DSP performance and advanced interrupt handling combined with an integrated powerful peripheral set and a high performance on-chip flash makes the XC167CI the instrument of choice for demanding industrial and automotive applications. Additionally to the well-known C167 peripheral set the XC167CI has a flexible on-chip PWM unit for all kinds of motor control applications as well as an I2C-module.

THE ARCHITECTURE of XC167CI has been optimized for high instruction throughput and minimum response time to external interrupts. Integrated intelligent peripheral systems reduce the need for CPU intervention. The high flexibility of this architecture perfectly supports the diverse and varying needs of different application areas such as industrial drives and control, or automotive body. All this combined in a small PG-TQFP-144 package enables very high levels of system integration.

**Applications**
- Industrial drives
- Industrial controls
- Electrical power steering
- Body control modules

**Features**
- High performance 16-bit C166S V2 CPU with 5-stage pipeline
- Single clock cycle instruction execution with 25 ns instruction time at 40 MHz CPU clock
- 25 ns multiplication (16 x 16-bit) time at 40 MHz CPU clock
- DSP support with built-in advanced MAC unit
- 16 Mbytes total linear address space for code and data
- Flexible synchronous external bus interface
- 16-priority-level interrupt system on 8 group levels
- On-chip debug controller and related interface to JTAG controller
- Gated clock concept (function related) for reduced power consumption and improved EMC
- 8/12 Kbytes on-chip RAM
- 128/256 Kbytes advanced program Flash memory
- Flexible system control and power management
- Real time clock with alarm interrupt
- 16-channel 10-bit A/D converter, conversion time < 3 µs
- Two 16-channel capture/compare units with 2 independent time bases each
- CAPCOM6E module with two independent timers dedicated to PWM generation for AC and DC motor control
- I2C bus module with 10-bit addressing and 400 kbit/s data rate
- Two multifunctional general purpose timer units
- Two asynchronous/synchronous serial channels (USART)
- Two high speed synchronous serial channels (SPI)
- TwinCAN module, two full-CAN nodes with 32 message buffers and gateway function and FIFO
- Up to 103 I/O lines with individual bit addressability
- Package: PG-TQFP-144 (pb-free)
  Plastic Green Thin Quad Flat Package
- Temperature range: -40°C to +125°C
- Supply Voltage:
  - Core Supply: 2.5 V
  - Ports: 5.0 V
High Performance 16-bit Microcontroller with Embedded Flash for Industrial Applications

**XC167CI Block Diagram**

**Product Summary**

<table>
<thead>
<tr>
<th>Type</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAF-XC167CI-16F40F</td>
<td>PG-TQFP-144</td>
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<tr>
<td>SAK-XC167CI-16F40F</td>
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<td>SAF-XC167CI-32F40F</td>
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<tr>
<td>SAK-XC167CI-32F40F</td>
<td>PG-TQFP-144</td>
</tr>
</tbody>
</table>

**XC167CI Application Example**

- Industrial Controls
- Robotic Controls
- Industrial Networking
- Electrical Power Steering
- Body Control Modules
- Distributed Control
### Starter Kits for 16-bit Microcontrollers

**DAvE**

DAvE IS your personal Infineon FAE to help you in your development with Infineon microcontrollers. As an Expert Wizard DAvE has all the information you need to automatically configure your system and kick-start your application development!

DAvE IS the CD-ROM hosted digital application engineer. He offers easy and intuitive access to the complete standard documentation for all Infineon microcontrollers, helps the developer configure the chip for his application, and automatically generates the appropriate device drivers that glue the application software to the hardware.

ALL DAvE components are available for FREE download from www.infineon.com/DAvE.

#### Starter Kits for 16-bit Microcontrollers

<table>
<thead>
<tr>
<th>Starter Kit</th>
<th>MCU Derivative</th>
<th>CPU Clock [MHz]</th>
<th>On-Board Memory</th>
<th>Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>SK-161</td>
<td>C161O</td>
<td>16 (16)</td>
<td>64 KByte SRAM, 256 KByte FLASH</td>
<td>2 x RS-232</td>
</tr>
<tr>
<td>SK-161PI</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>SK-164</td>
<td>C164CI-8E</td>
<td>20 (5)</td>
<td>64 KByte SRAM, 256 KByte FLASH</td>
<td>1 x RS-232, 1 x CAN</td>
</tr>
<tr>
<td>SK-164-PRIME + 15 samples + extraction tool</td>
<td>C164CI</td>
<td>20 (5)</td>
<td>64 KByte SRAM, 256 KByte FLASH</td>
<td>1 x RS-232, 1 x CAN</td>
</tr>
<tr>
<td>SK-167CR</td>
<td>C167CR</td>
<td>20 (5)</td>
<td>64 KByte SRAM, 256 KByte FLASH</td>
<td>2 x RS-232, 1 x CAN</td>
</tr>
<tr>
<td>SK-167CS</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Starter Kits</th>
<th>MCU Derivative</th>
<th>CPU Clock [MHz]</th>
<th>On-Board Memory</th>
<th>Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>SK-XC164CM Easy Kit</td>
<td>XC164CM</td>
<td>40</td>
<td>–</td>
<td>RS 232, JTAG, 2 x CAN, LIN</td>
</tr>
<tr>
<td>SK-XC164CS Easy Kit</td>
<td>XC164CS</td>
<td>40</td>
<td>–</td>
<td>RS 232, JTAG, 2 x CAN, LIN</td>
</tr>
<tr>
<td>SK-XC167CI Easy Kit</td>
<td>XC167CI</td>
<td>40</td>
<td>–</td>
<td>RS 232, JTAG, 2 x CAN, LIN</td>
</tr>
<tr>
<td>SK-XC161CS Easy Kit</td>
<td>XC161CS</td>
<td>40</td>
<td>–</td>
<td>RS 232, JTAG, 2 x CAN, LIN</td>
</tr>
<tr>
<td>SK-XC161</td>
<td>XC161CJ</td>
<td>40</td>
<td>2 x 512 KB SRAM (+ optional: 2 x up to 1 MB Flash)</td>
<td>2 x RS232, JTAG, 2 x CAN, 6 additional connectors</td>
</tr>
<tr>
<td>SK-XC164</td>
<td>XC164CS</td>
<td>40</td>
<td>2 x 512 KB SRAM (+ optional: 2 x up to 1 MB Flash)</td>
<td>2 x RS232, JTAG, 2 x CAN, 6 additional connectors</td>
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<tr>
<td>SK-XC164 Industrial</td>
<td>XC164S/D/N</td>
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<td>2 x 512 KB SRAM (+ optional: 2 x up to 1 MB Flash)</td>
<td>2 x RS232, JTAG, 2 x CAN, 6 additional connectors</td>
</tr>
<tr>
<td>SK-XC167</td>
<td>XC167CI</td>
<td>40</td>
<td>2 x 512 KB SRAM (+ optional: 2 x up to 1 MB Flash)</td>
<td>2 x RS232, JTAG, 2 x CAN, 6 additional connectors</td>
</tr>
</tbody>
</table>
Complete Tool Chain Support with Global Partners

Software Generation and Debug Tools:
- hitex
- TASKING
- Keil Software
- Lauterbach
- NOHau Corporation
- AbsInt
- TeQ Components
- DataIO
- MicroConsult
- BP Microsystems
- Willert Software Tools

Operating Systems:
- Wind River
- Accelerated Technology
- 3SOFT
- CMX Company
- Dr. Kaneff Engineering
- KEIL Software
- HighTec
- Vector
- TQ Components
- PHYTEC
- Hi-LO Systems
- SYndesis
- dSPACE
- Enea
- ETAS Engineering Tools

More information about Microcontrollers tools available at: www.infineon.com/mc-tools
THE HIGHLY INTEGRATED TC1100 combines a Memory Management Unit (MMU) and a Floating Point Unit (FPU) on one single chip. With its powerful MMU the TriCore is capable of using operating systems including Linux or RTAI Linux. The award-winning unified 32-bit TriCore architecture combines RISC, CISC, and DSP functionality in a single chip. TC1100 is a member of the industrial TriCore family and compared to the TC1130 has a reduced peripheral set and a lower price. This high performance device is well suited for applications such as PLCs, high end drives, industrial field bus controller and communication devices.

Applications
- High-end drives
- Robotics
- PLC
- Gateway body controller
- General purpose industrial control
- Backbone bus controller

External Bus Interface
- Programmable external bus interface for low cost system implementation (Intel-style and Motorola-style device/peripheral support)
- Glueless interface to a wide selection of external memories (ROM, EPROM, SRAM, SDRAM, Burst Flash and PC 100 SDRAM)
- 8/16/32-bit data transfer
- Support for big and little endian byte ordering at bus interface
- Flexible address generation and access timing

Integrated On-Chip Memory
- 28 KByte Data Memory (SPRAM)
- 32 KByte Code Memory (SPRAM)
- 16 KByte Instruction Cache (ICACHE)
- 4 KByte Data Cache (DCACHE)
- 64 KByte SRAM Data Memory Unit (DMU)
- 16 KByte Boot ROM

High Performance
32-bit TriCore V1.3 CPU with 4-Stage Pipeline
- 150 MHz maximum clock speed
- Floating Point Unit (FPU)
- Dual Issue super-scalar implementation
  - MAC Instruction maximum triple issue
- Circular Buffer and bit-reverse addressing modes for DSP algorithms
- Flexible multi-master interrupt system
- Very fast interrupt response time
- Hardware controlled context switch for task switch and interrupts
- Memory Management Unit (MMU)
- Data formats include: bit, 8-bit byte, 16-bit half word, 32-bit word, and 64-bit double word data formats
32-bit Consumer Class TriCore™

TC1100 Block Diagram

On-Chip Peripheral Units
- Two Asynchronous/Synchronous Serial Channels (ASC0/1/2) with baudrate generator, parity, framing and overrun error detection, and IrDA data transmission
- Two High Speed Synchronous Serial Channels (SSC0/1) with programmable data length and shift direction
- One Inter IC (IIC) Serial Module with two channels
- One high speed Micro Link Interfaces (MLI0/1) for controller communication and emulation
- One Multifunctional General Purpose Timer Units (GPTU) with three 32-bit timer/counters
- One Capture and Compare unit 6 (CCU6) for PWM signal generation
  - 3-channel, 16-bit Capture and Compare unit
  - 1-channel, 16-bit Compare unit

Technical Summary
- The TC1100 is packaged in a PG-LBGA-208 package
- Ambient temperature: -40°C to +85°C
- Dual voltage supply: 1.5 V Core, 3.3 V I/O
- 72 Digital I/Os
- 4 power down modes

Application Example

32-bit Microcontrollers
16-bit Microcontrollers
THE HIGHLY INTEGRATED TC1115 combines a Memory Management Unit (MMU) and a Floating Point Unit (FPU) on one chip. It is designed to meet the increasing performance, reliability and costs requirements of a wide range of drive and control applications. The TC1115 is well suited for applications such as PLC (Programmable Logic Control), high-end drives, robotics, industrial field bus controllers, communication devices and other general purpose industrial control applications. TC1115 is based on Infineon’s TriCore architecture and includes application specific on-chip peripherals such as 4 CAN nodes, 3 Asynchron- and 2 Synchron- serial interfaces, IIC and 2 motor drives optimized PWM units at a clock rate of up to 150 MHz. Compared to its big brother, the TC1130, the TC1115 has a reduced peripheral set at a lower price.

Applications
- High End Drives
- Robotics
- PLC
- Gateway Body Controller
- General Purpose Industrial Control
- Backbone Bus Controller

External Bus Interface
- Programmable external bus interface for low cost system implementation (Intel-style and Freescale-style device/peripheral support)
- Glueless interface to a wide selection of external memories (ROM, EPROM, SRAM, SDRAM, Burst Flash and PC 100 SDRAM)
- 8/16/32-bit data transfer
- Support for big and little endian byte ordering at bus interface
- Flexible address generation and access timing

Integrated On-Chip Memory
- 28 KByte Data Memory (SPRAM)
- 32 KByte Code Memory (SPRAM)
- 16 KByte Instruction Cache (ICACHE)
- 4 KByte Data Cache (DCACHE)
- 64 KByte SRAM Data Memory Unit (DMU)
- 16 KByte Boot ROM

High Performance 32-bit TriCore™ V1.3 CPU with 4-Stage Pipeline
- 150 MHz maximum clock speed
- Floating Point Unit (FPU)
- Dual issue super-scalar implementation
  - MAC Instruction maximum triple issue
- Circular Buffer and bit-reverse addressing modes for DSP algorithms
- Flexible multi-master interrupt system
- Very fast interrupt response time
- Hardware controlled context switch for task switch and interrupts
- Memory Management Unit (MMU)
- Data formats include: Bit, 8-bit byte, 16-bit half word, 32-bit word, and 64-bit double word data formats
32-bit Superscalar TriCore™ Architecture

TC1115 Block Diagram

On-Chip Peripheral Units
- Three Asynchronous/Synchronous Serial Channels (ASC0/1/2) with baudrate generator, parity, framing and overrun error detection, and IrDA data transmission
- Two High Speed Synchronous Serial Channels (SSC0/1) with programmable data length and shift direction
- One Inter IC (IIC) Serial Module with two channels
- Two high speed Micro Link Interfaces (MLI0/1) for controller communication and emulation
- One Multifunctional General Purpose Timer Units (GPTU) with three 32-bit timer/counters
- Two Capture and Compare unit 6 (CCU6) for PWM signal generation
  - 3-channel, 16-bit Capture and Compare unit
  - 1-channel, 16-bit Compare unit
- One MultiCAN Module with four CAN nodes and 64 message buffers for high efficiency data handling

Technical Summary
- The TC1115 is packaged in a PG-LBGA-208 package
- Ambient temperature: -40°C to +85°C
- Dual Voltage Supply: 1.5 V Core, 3.3 V I/O
- 72 Digital I/Os
- 4 power down modes

Application Example
TC1130 is a highly integrated controller combining a Memory Management Unit (MMU) and a Floating Point Unit (FPU) on one chip. Thanks to the powerful MMU, this member of the 32-bit TriCore™ family supports operating systems such as Linux (real time application interface Linux included). The award-winning unified 32-bit TriCore architecture combines RISC, CISC and DSP functionality in a single chip. An advanced set of on-chip communication peripherals makes this microcontroller ideal for highly integrated applications such as programmable logic controller (PLCs), high-end drives, industrial field bus controllers and communication devices. It ensures design flexibility by providing integrated support for increasingly popular interfaces such as Ethernet and USB (universal serial bus). It also supports 4 CAN nodes.

Applications
- High-end drives
- Robotics
- PLC
- Gateway body controller
- General purpose industrial control
- Backbone bus controller

External Bus Interface
- Programmable external bus interface for low cost system implementation (Intel-style and Motorola-style device/peripheral support)
- Glueless interface to a wide selection of external memories (ROM, EPROM, SRAM, SDRAM, Burst Flash, Supports PC100 SDRAM and PC133 SDRAM (runs in maximum 120 MHz))
- 16/32-bit data transfer
- Support for little endian byte ordering at bus interface
- Flexible address generation and access timing

Integrated On-Chip Memory
- 28 KBytes data memory (SPRAM)
- 32 KBytes code memory (SPRAM)
- 16 KBytes instruction cache (ICACHE)
- 4 KBytes data cache (DCACHE)
- 64 KBytes SRAM Data Memory Unit (DMU)
- 16 KBytes boot ROM

High Performance 32-bit TriCore™ V1.3 CPU with 4-Stage Pipeline
- 150 MHz maximum clock speed
- Floating Point Unit (FPU)
- Dual issue super-scalar implementation MAC instruction maximum triple issue
- Circular buffer and bit-reverse addressing modes for DSP algorithms
- Programmable priority of the DMA sub-block on the bus interfaces
- Full 32-bit addressing capability of each DMA channel
- Up to 27 ns interrupt response time
- Hardware controlled context switch for task switch and interrupts
- Memory Management Unit (MMU)
- Data formats include: bit, 8-bit byte, 16-bit half word, 32-bit word, and 64-bit double word data formats
- Efficient critical tasks handling by trap service (non-maskable interrupt)
### 32-Bit Superscalar TriCore™ Architecture

#### TC1130 Block Diagram

![TC1130 Block Diagram](image)

#### On-Chip Peripheral Units
- Three asynchronous/synchronous serial channels (ASC0/1/2) with baudrate generator, parity, framing and overrun error detection, and IrDA data transmission. 8 byte data buffer (FIFO with depth of 8) for each ASC.
- Two high speed synchronous serial channels (SSC0/1) with programmable data length and shift direction. 4 byte data buffer (FIFO with depth of 4) for each SSC.
- One inter IC (IIC) serial module with two channels.
- USB module with compliance to USB specification revision 1.1, with support for 1.5 Mbit/s to 12 Mbit/s devices.
- Two high speed Micro Link interfaces (MLI0/1) for controller communication and emulation.
- One multifunctional general purpose timer unit (GPTU) with three 32-bit timer/counters.
- Two capture and compare unit 6 (CCU6) for PWM signal generation – 3-channel, 16-bit capture and compare unit.
- 1-channel, 16-bit compare unit.
- One MultiCAN module with four CAN nodes and 128 message buffers for high efficiency data handling.
- Fast Ethernet controller with 10/100 Mbit/s MIL-based physical devices support.
- Individually programmable operation modes for each DMA channel.

#### Technical Summary
- The TC1130 is packaged in a PG-LBGA-208 package.
- Ambient temperature: -40°C to +85°C.
- Dual voltage supply: 1.5 V Core, 3.3 V I/O.
- 72 digital I/Os.
- Four power-management modes.

#### Application Example

![Application Example](image)
TC11IB IS INFINEON’S FIRST TriCore™ microcontroller targeting general purpose and industrial applications. An advanced set of on chip communication peripherals makes this microcontroller very useful for highly integrated applications such as PLC, slot CPU in a PC or as industrial communication device. The External Bus Unit (EBU), usually the bottleneck of 32-bit devices, is designed for new performance dimensions and fulfills the PC100 specification. This device takes credit from the strongly increasing demand for high performance interfaces like PCI and Ethernet, which are integrated on the chip. Sophisticated real time operating systems will find enough memory with the 1.5 MB embedded DRAM to enable single chip solutions.

Feature Overview
- Unified 32-bit MCU-DSP TriCore™ V1.3
  - 96 MHz CPU clock rate
  - Hardware supported context switch
  - 22 ns interrupt latency @ 96 MHz
  - 1, 8, 16, 32 & 64 data format
  - Powerful integrated DSP capabilities
  - Bit logical operations
  - Concurrent 16/32-bit instruction set
  - Superscalar RISC design with 3 pipelines
  - Load/Store architecture
  - Dual 16 x 16 MACs
  - 4 Gbyte address range
- On-chip memories
  - 1.5 MB eDRAM
  - 32 KB configurable code memory for scratch-pad and cache
  - 32 KB configurable data memory for scratch-pad and cache
  - 16 KB boot ROM
  - 16 KB PCP code memory
  - 4 KB PCP data memory
- 32-bit I/O-processor PCP (Peripheral Control Processor)
  - Data move between any memory or I/O location
  - Read-modify-write
  - Arithmetic and logical operations
  - Interrupt driven
- Bus Systems
  - 64-bit, 96 MHz on chip LMB (Local Memory Bus)
  - 32-bit, 96 MHz and 48 MHz multi-master on-chip FPI bus (Flexible Peripheral Interconnect Bus)
- PCI V2.2 Interface
  - 32-bit/33 MHz operation
  - Target/Initiator operation
  - Host functionality
  - Multi function PCI device (up to 2)
  - DMA transfer capability
  - Configurable configuration space
  - Power Management V1.1
- External Bus Unit (EBU)
  - PC100 SDRAM multibanking and power-down support
  - Master/Slave operation
  - SRAM, ROM, EPROM support
  - Burst flash
  - 7 fully programmable chip-selects
- Fast Ethernet Interface (10/100 Mbit/s)
  - IEEE802.3 standard
  - MII interface (media independent interface)
- 12 Mbaud High Speed Synchronous Serial Interface (SSC) with SCI support
- 1.5 Mbaud Asynchronous/Synchronous Serial Interface (ASC) with IrDA support
- 3 Mbaud 16 x 50 Serial Interface
- 2 General Purpose Timer Units (GPTU)
  - 6 independently operating 32-bit timers
  - 32-bit timers can be split into 8 and 16-bit sub timers
- 16 Mhz MultimediaCard™ Interface (MMC)
- Up to 96 General Purpose software configurable Inputs/Outputs (GPIO)
  - Organized into 6 ports of 16 bits each
- Enhanced boot mechanism
- Watchdog timer
- System timer
- On Chip Debug Support (OCDS)
  - JTAG
  - Level 2
  - Multicore debugging (PCP, TriCore™)
- On Chip Power Management
  - Supply voltage 1.8 V
  - I/O voltage 3.3 V
  - PCI 3.3 V signaling
  - 388 pin P-BGA package
- Ambient temperature range 0°C to +85°C
Highly Integrated 32-bit Microcontroller

TC11IB Block Diagram

Key Features

- 32-bit I/O-processor PCP
  - Intelligent DMA controller
  - Logical and arithmetic operation support

- EBU
  - PC100 SDRAM support
  - Master / Slave operation
  - 7 fully programmable chip selects

- eDRAM
  - 512 KB eDRAM on the 96 MHz 64-bit bus for system operations
  - 1 MB eDRAM on the 96 MHz 32-bit bus for data buffer
  - Universal for code and data

- PCI
  - 32-bit / 33 MHz operation
  - Host functionality
  - Multi functions
  - DMA transfer capable

- MMC™
  - 16 MHz bus interface
  - Stack of up to 30 different cards

Key Benefits

- I/O-processor for autonomous peripheral management
- 400 MB/s maximum throughput
- Highly flexible memory interface with a high choice of memory types
- High throughput on PCI and Ethernet interfaces
- Huge on chip memory space for operation systems and applications
- Excellent adoption to the PC environment
- Mobility through the memory card itself
THE TC1162 / TC1161 is optimized for highly demanding applications where embedded real-time performance and DSP capabilities combined with an extremely fast interrupt response time and highest level of fault tolerance are needed.

THE TC1162 / TC1161 is based on the award-winning unified 32-bit TriCore™ architecture combining RISC, CISC and DSP functionality in a single chip.

THE PERIPHERALS include a comprehensive and flexible timer unit for PWM generation, multi-channel ADCs and serial interfaces with MultiCAN, Micro Second bus and Micro Link Interface. Together with its 1 Mbyte of embedded Flash the TC1162/TC1161 offers the most cost effective 32-bit microcontroller solution for real-time control.

Applications

■ High performance drives / servo drives
■ Industrial motion control
■ General purpose industrial control
■ Robotics

Features

■ High performance 32-bit super-scalar TriCore™ V1.3 CPU with
  4 stage pipeline
  – Superior real-time performance
  – Strong bit handling
  – Fully integrated DSP capabilities
  – Single precision floating point unit (FPU)
  – 66 MHz at full industrial temperature range
■ Memories
  – 1 Mbyte embedded program flash with ECC
  – 16 Kbyte data flash for scalable EEPROM emulation
  – 32 Kbyte on-chip SRAM
  – 8 Kbyte instruction cache
  – 8 Kbyte code scratchpad memory
■ 8-channel DMA controller
■ Sophisticated interrupt system with 255 hardware priority
  arbitration levels serviced by CPU
■ High performing triple bus structure
  – 64-bit local memory buses to internal flash and data memory
  – 32-bit system peripheral bus
  – 32-bit remote peripheral bus
■ Flexible general purpose timer array module (GPTA) with digital
  signal filtering and timer functionality to generate 3-phase PWM
  signals for electrical motor control
  – Filter and prescaler cells for input noise filtering and prescaling
  – Phase discrimination logic units for decoding the direction
    information output by a rotation tracking system
  – Duty cycle measurement cells for pulse width measurement
  – Digital phase locked loop unit
■ Two asynchronous/synchronous serial channels with baud rate
  generator, parity, framing and overrun error detection (ASC)
■ High speed synchronous serial channels
  with programmable data length and shift direction (SSC)
■ High-speed Micro Link Interfaces for serial
  inter-processor communication (MLI)
■ MultiCAN module with two CAN nodes and
  64 free assignable message objects for high
  efficiency data handling via FIFO buffering
  and gateway data transfer (TC1162 only)
■ Micro Second bus interface (MSC) for port
  expansion to external Power ICs
■ 2-channel fast analog-to-digital converter
  unit (FADC)
■ 16-channel analog-to-digital converter unit
  (ADCo) with 8-bit, 10-bit or 12-bit resolution
■ 36 analog input lines for ADC and FADC
■ 81 digital general purpose I/O lines
■ Digital I/O ports with 3.3 V IO capabilities
■ On-chip debug support for OCDS level 1 and 2
■ Power management system
■ Clock generation unit with PLL
■ Core supply voltage 1.5 V
■ I/O voltage 3.3 V
■ Full industrial temperature range -40 to +85°C
■ PG-LQFP-176 package
Highly Integrated 32-bit TriCore™-based Microcontroller with embedded Flash Memory for Industrial Applications

Block Diagram

Product Summary

<table>
<thead>
<tr>
<th>Type</th>
<th>CPU Clock [MHz]</th>
<th>Program Flash [Mbyte]</th>
<th>MultiCAN</th>
<th>Temperature (Tₜₒ) [°C]</th>
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<td>-40/85</td>
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</table>
TC1165/TC1166

The TC1166/TC1165 is optimized for highly demanding applications where embedded real-time performance and DSP capabilities combined with an extremely fast interrupt response time and highest level of fault tolerance are needed.

The TC1166/TC1165 is based on the award-winning unified 32-bit TriCore™ architecture combining RISC, CISC and DSP functionality in a single chip.

The peripherals include a comprehensive and flexible timer unit for PWM generation, multi-channel ADCs and serial interfaces with MultiCAN (TC1166), Micro Second bus and Micro Link Interface. Together with its 1.5 MByte of embedded Flash the TC1166/TC1165 offers the most cost effective 32-bit microcontroller solution for real-time control.

Applications
- High Performance drives / servo drives
- Industrial motion control
- General purpose industrial control
- Robotics

Features
- High performance 32-bit super-scalar TriCore™ V1.3 CPU with 4 stage pipeline
  - Superior real-time performance
  - Strong bit handling
  - Fully integrated DSP capabilities
  - Single precision floating point unit (FPU)
  - 80 MHz at full industrial temperature range
- 32-bit peripheral control processor with single cycle instruction (PCP2)
- Memories
  - 1.5 MByte embedded program flash with ECC
  - 32 KByte data flash for scalable EEPROM emulation
  - 56 KByte on-chip SRAM
  - 8 KByte instruction cache
  - 16 KByte code scratchpad memory
- 8-channel DMA controller
- Sophisticated interrupt system with 2 x 255 hardware priority arbitration levels serviced by CPU and PCP2 Coprocessor
- High performing triple bus structure
  - 64-bit local memory buses to internal flash and data memory
  - 32-bit system peripheral bus
  - 32-bit remote peripheral bus
- Flexible general purpose timer array module (GPTA) with digital signal filtering and timer functionality to generate 3-phase PWM signals for electrical motor control
  - Filter and prescaler cells for input noise filtering and prescaling
  - Phase discrimination logic units for decoding the direction information output by a rotation tracking system
  - Duty cycle measurement cells for pulse width measurement
  - Digital phase locked loop unit
- Two high speed synchronous serial channels with programmable data length and shift direction (SSC)
- Two high-speed Micro Link Interfaces for serial inter-processor communication (MLI)
- MultiCAN module with two CAN nodes and 64 free assignable message objects for high efficiency data handling via FIFO buffering and gateway data transfer (TC1166 only)
- Micro Second bus interface (MSC) for port expansion to external Power IC's
- 2-channel fast analog-to-digital converter unit (FADC)
- 16-channel analog-to-digital converter unit (ADCO) with 8-bit, 10-bit or 12-bit resolution
- 36 analog input lines for ADC and FADC
- 81 digital general purpose I/O lines
- Digital I/O ports with 3.3 V IO capabilities
- On-chip debug support for OCDS level 1 and 2
- Power management system
- Clock generation unit with PLL
- Core supply voltage 1.5 V
- I/O voltage 3.3 V
- Full industrial temperature range -40 to +85°C
- PG-LQFP-176 package
Highly Integrated 32-bit TriCore™-based Microcontroller with embedded Flash Memory for Industrial Applications

**Block Diagram**

<table>
<thead>
<tr>
<th>CPU Clock [MHz]</th>
<th>Program Flash [Mbyte]</th>
<th>MultiCAN</th>
<th>Temperature ($T_{A}$) [°C]</th>
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</table>

Abbreviations:
- ICACHE: Instruction Cache
- SPRAM: Scratch-Pad RAM
- LDRAM: Local Data RAM
- OVRAM: Overlay RAM
- BROM: Boot ROM
- PFlash: Program Flash
- DFlash: Data Flash

MultiCAN not available in TC1165
THE TC1762 - member of the AUDO-NG family - is cost optimized for demanding applications where real-time performance and DSP capabilities combined with an outstanding fast interrupt response time and highest level of fault tolerance are required. AUDO-NG is based on the award-winning unified 32-bit TriCore™ architecture combining RISC, CISC and DSP functionality in a single chip. New groundbreaking peripherals like the Micro Second bus, fast analog-to-digital converter unit or the Micro Link Interface boosting the overall system performance turns the TC1762 into the most cost effective 32-bit microcontroller for high sophisticated applications of the automotive and industrial market.

Applications
- Automotive engine and transmission control
- Automotive suspension control
- Industrial robotic control

Features
- High performance 32-bit super-scalar TriCore™ V1.3 CPU with 4 stage pipeline
  - Superior real-time performance
  - Strong bit handling
  - Fully integrated DSP capabilities
  - Single precision floating point unit (FPU)
  - 40 - 80 MHz at full automotive temperature range
- Memories
  - 1 Mbytes embedded program Flash with ECC
  - 16 Kbytes data flash for scalable EEPROM emulation
  - 32 Kbytes on-chip SRAM
  - 8 Kbytes instruction cache
  - 8 Kbytes code scratchpad memory
- 8-channel DMA controller
- Sophisticated interrupt system with 2 x 255 hardware priority arbitration levels serviced by CPU
- High performing triple bus structure
  - 64-bit local memory buses to internal flash and data memory
  - 32-bit system peripheral bus for interconnections of on-chip peripherals and further functional units
- One Micro Second bus interface (MSC) for port expansion to external Power ASIC’s
- One general purpose timer array module with a digital signal filtering and timer functionality to realize autonomous and complex I/O management (GPTA4)
- Two asynchronous/synchronous serial channels with baud rate generator, parity, framing and overrun error detection (ASC)
- One high-speed synchronous serial channel with programmable data length and shift direction (SSC)
- One high-speed Micro Link Interfaces for serial inter-processor communication (MLI)
- MultiCAN module with two CAN nodes and 64 free assignable message objects for high efficiency data handling via FIFO buffering and gateway data transfer
- 2-channel fast analog-to-digital converter unit (FADC)
- One 32-channel analog-to-digital converter unit (ADC) with 8-bit, 10-bit or 12-bit resolution
- 36 analog input lines for ADC and FADC
- 81 digital general purpose I/O lines
- Digital I/O ports with 3.3 V IO capabilities
- Pin to pin compatible to TC1766
- On-chip debug support OCDS level 1 + 2 (CPU, PCP, DMA)
- TC1766 emulation device for multicore debugging, tracing and calibration via USB 1.1 interface
- Power management system
- Clock generation unit with PLL
- Supply voltage 1.5 V
- I/O voltage 3.3 V
- Full automotive temperature range -40 to +125°C
- PG-LQFP-176 package
Highly Integrated 32-bit TriCore™-based Next Generation Microcontroller for Automotive Applications

TC1762 Block Diagram

TC1762 The Most Cost Effective Solution for Engine and Transmission Control

Gasoline Engine Control
- Reduced emission levels
- Better engine behavior
- Less fuel consumption

Automated Transmission Control
- Better acceleration
- More comfort
- Less fuel consumption
Advanced 32-bit TriCore™-based Microcontroller for Automotive Embedded Control Applications

THE INFINEON AUDO™ family of 32-bit microcontrollers is optimized for highly demanding applications where real-time performance and DSP capabilities combined with an extremely fast interrupt response time are needed. Combining the best of three worlds - microcontroller, DSP and RISC load-store architectures - the TC1765 perfectly fits the demanding applications of the automotive and industrial market.

Applications
- Engine management
- Transmission control
- Starter generator
- 3-phase motor control
- Robotic control

Features
- High performance 32-bit super-scalar TriCore™ CPU with 4 Stage Pipeline
  - Superior real-time performance
  - Strong bit handling
  - Fully integrated DSP capabilities
  - 25 ns Instruction Cycle Time at 40 MHz
- 8-channel DMA Controller
- 48 KBytes of on-chip SRAM for data and time critical code
- 32-bit External Bus Interface Unit (Burst mode memory support)
- Built-in calibration support
- General Purpose Timer Array (GPTA) with a powerful set of digital signal filtering and timer functionality to realize autonomous and complex I/O management
- Multifunctional General Purpose Timer Unit (GPTU) with three 32-bit timer/counters
- 56-bit System timer (STM) designed for global system timing applications requiring both high precision and long range
- Watchdog Timer
- Two Asynchronous/Synchronous Serial Channels (ASC0, ASC1) with baudrate generator, parity, framing and overrun error detection
- Two High Speed Synchronous Serial Channels (SSCo, SSC1) with programmable data length and shift direction
- TwinCAN Module with two interconnected CAN nodes for high efficiency data handling via FIFO buffering and gateway data transfer
- Two Analog-to-Digital Converter Units (ADC0, ADC1) with 8-bit, 10-bit, or 12-bit resolution and 24 analog inputs
- 77 digital general purpose I/O lines and one 24-bit analog port
- On-chip Debug Support
- Power Management System
- Clock Generation Unit with PLL
- Two derivatives with upward compatible pin configuration:
  - TC1765N (OCDS Level 1)
  - TC1765T (with additional 16-bit OCDS Level 2 trace port)
- Full automotive temperature range
- P-LBGA-260 package

TC1765
AUDEO™
Highly Integrated 32-bit Microcontroller for Automotive Application

**TC1765 Block Diagram**

<table>
<thead>
<tr>
<th>Type</th>
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<td>Additional OCDS 2 trace port</td>
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<td>SAK-TC1765T-L40U</td>
<td>Additional OCDS 2 trace port</td>
<td>Bare Chip</td>
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**TC1765**
The Most Innovative Solution for Engine and Transmission Control

**Diesel & Gasoline Engine Control**
- Reduced emission levels
- Better engine behaviour
- Less fuel consumption

**Automated Transmission Control**
- Better acceleration
- More comfort
- Less fuel consumption
The TC1766 - member of the AUDO-NG family - is optimized for highly demanding applications where embedded real-time performance and DSP capabilities combined with an extremely fast interrupt response time and highest level of fault tolerance are needed. AUDO-NG is based on the award-winning unified 32-bit TriCore™ architecture combining RISC, CISC and DSP functionality in a single chip. New innovative peripherals like the Micro Second bus, fast analog-to-digital converter unit or the Micro Link Interface as well as the advanced triple layer structure boosting the overall system performance turns the TC1766 into the most cost effective 32-bit microcontroller for high demanding applications of the automotive and industrial market.

**Applications**
- Automotive engine and transmission control
- Automotive by-wire systems
- Industrial robotic control

**Features**
- High performance 32-bit super-scalar TriCore™ V1.3 CPU with 4 stage pipeline
  - Superior real-time performance
  - Strong bit handling
  - Fully integrated DSP capabilities
  - Single precision floating point unit (FPU)
  - 80 MHz at full automotive temperature range
- 32-bit Peripheral Control Processor with single cycle instruction (PCP2)
- Memories
  - 1.5 MByte embedded program flash with ECC
  - 32 KByte data flash for scalable EEPROM emulation
  - 76 KByte on-chip SRAM
  - 8 KByte instruction cache
  - 16 KByte Code Scratchpad Memory
- 8-channel DMA controller
- Sophisticated interrupt system with 2 x 255 hardware priority arbitration levels serviced by CPU and PCP2
- High performing triple bus structure
  - 64-bit local memory buses to internal flash and data memory
  - 32-bit system peripheral bus for interconnections of on-chip peripherals and further functional units
  - 32-bit remote peripheral bus serving the requirements of high speed peripherals
- One Micro Second bus interface (MSC) for port expansion to external Power ASIC’s
- One general purpose timer array module with a digital signal filtering and timer functionality to realize autonomous and complex I/O management (GPTA4)
- Two asynchronous/synchronous serial channels with baud rate generator, parity, framing and overrun error detection (ASC)
- Two high speed synchronous serial channels with programmable data length and shift direction (SSC)
- Two high-speed Micro Link Interfaces for serial inter-processor communication (MLI)
- MultiCAN module with two CAN nodes and 64 free assignable message objects for high efficiency data handling via FIFO buffering and gateway data transfer
- 2-channel fast analog-to-digital converter unit (FADC) with concatenated comb filters for hardware data reduction; 10-bit resolution/min. conversion time 280 ns
- One 32-channel analog-to-digital converter unit (ADC) with 8-bit, 10-bit or 12-bit resolution
- 36 analog input lines for ADC and FADC
- 81 digital general purpose I/O lines
- Digital I/O ports with 3.3 V capability
- On-chip debug support OCDS level 1 + 2 (CPU, PCP, DMA)
- Dedicated emulation device chip for multicore debugging, tracing and calibration via USB 1.1 interface
- Power management system
- Clock generation unit with PLL
- Supply Voltage 1.5 V
- I/O Voltage 3.3 V
- Full automotive temperature range -40 to +125°C
- PG-LQFP-176 package
Highly Integrated 32-bit TriCore™-based Next Generation Microcontroller for Automotive Applications

TC1766 Block Diagram

TC1766
The most cost effective Solution for Engine and Transmission Control

Diesel & Gasoline Engine Control
- Reduced emission levels
- Better engine behavior
- Less fuel consumption

Automated Transmission Control
- Better acceleration
- More comfort
- Less fuel consumption
THE TC1775 ADVANCED 32-bit TriCore™-based microcontroller - winner of the prestigious EDN Innovation Award in the year 2001 - is optimized for highly demanding applications in the automotive and industrial sectors where real-time performance and DSP capabilities combined with extremely fast interrupt response times are needed.

Applications
- Automotive engine and transmission control
- Starter Alternator
- 3-phase motor control
- Robotic control

Features
- 32-bit super-scalar TriCore™ main CPU
  - Hardware supported context switch
  - 1, 8, 16, 32 & 64-bit data format
  - Powerful integrated DSP capabilities
  - Bit logical operations
  - Concurrently 16/32-bit instruction set
- 32-bit I/O-processor PCP: (Peripheral Control Processor)
  - Data move between any memory or I/O location
  - Read-modify-write
  - Arithmetic and logical operations
- On-Chip memories
  - 32 KBytes scratch-pad code RAM
  - 1 KBytes code cache
  - 8 KBytes boot ROM
  - 40 KBytes TriCore™ data memory
  - 16 KBytes PCP code memory
  - 4 KBytes PCP data memory
- 32-bit multi-master on-chip FPI bus (Flexible Peripheral Interconnect Bus)
- More than 100 interrupt request nodes
- 2 service request arbitration units
- TwinCAN™
  - 2 x CAN nodes, Version 2.0B (active)
  - Standard frames (11 bit) or extended frames (29 bit)
  - 32 independent message objects flexibly assignable to each of the two CAN nodes
  - Configurable gateway functionality
  - Dedicated control register per channel
  - Advanced acceptance filtering
- J1850 (SDLM)
- General Purpose Timer Array (GPTA)
  - 6 x Filter and prescaler cells for input signal filtering and prescaling
  - 2 x Phase discrimination units for direction indication
  - 4 x Duty cycle measurement cells e.g. for speed analysis
  - 1 x Digital PLL: Fly-wheel treatment and accurate clock signal generation with high resolution
  - 32 x Global timer cells for input signal capture and output signal generation
  - 64 x Local timer cells for PWM signal treatment and signal capture/measurement
  - Flexible assignment of input and output signals to pins
- General Purpose Timer Unit (GPTU)
  - 3 independently operating 32-bit timers
  - 32-bit timers can be split into 8- and 16-bit sub-timers
- System Timer
- Real Time Clock
- 2 x ADC:
  - 5 V input
  - 16 channels, each
  - Selectable resolution: 8/10/12 bit
  - 5 µs conversion time at 10-bit resolution
  - Multiple conversion request mode incl. equidistant sampling
  - Optional synchronization
- 2 x High-speed Synchr. Serial Interface (SSC)
- 2 x Asynchr./Synchr. Serial Interface (ASC)
- Debug interface (OCDS level 2)
- 32-bit wide external memory interface
  - Glueless interface to wide range of memories
  - Burst mode memory support
- 40 MHz, automotive temperature range
- P-BGA-329
Highly Integrated 32-bit TriCore™-based Microcontroller for Automotive Applications

TC1775 Block Diagram

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TC1775 32-bit TriCore™-based Solution for Highly Demanding Automotive and Industrial Applications
TC1796

THE TC1796 - MEMBER of the AUDO-NG family - is optimized for highly demanding applications where embedded real-time performance and DSP capabilities combined with an extremely fast interrupt response time and highest level of fault tolerance are needed. AUDO-NG is based on the award-winning unified 32-bit TriCore™ architecture combining RISC, CISC and DSP functionality in a single chip. New innovative peripherals like the Micro Second bus, fast analog-to-digital converter unit or the Micro Link Interface as well as the advanced triple bus structure boosting the overall system performance turn the TC1796 into the most powerful 32-bit microcontroller in the automotive arena.

Applications
- Automotive engine and transmission control
- Automotive by-wire control systems
- Industrial robotic control

Features
- High performance 32-bit super-scalar TriCore™ V1.3 CPU with 4 stage pipeline
  - Superior real-time performance
  - Strong bit handling
  - Fully integrated DSP capabilities
  - Single precision floating point unit (FPU)
  - 150 MHz at full automotive temperature range
- 32-bit Peripheral Control Processor with single cycle instruction (PCP2)
- Memories
  - 2 MByte embedded program flash with ECC
  - 128 KByte data flash for scalable 16 KByte EEPROM emulation
  - 192 KByte on-chip SRAM
  - 16 KByte instruction cache
- 16-channel DMA controller
- 32-bit external bus interface unit with synchronous burst flash access capability
- Sophisticated interrupt system with 2 x 255 hardware priority arbitration levels serviced by CPU and PCP2
- High performing triple bus structure
  - 64-bit local memory buses to internal flash and data memory
  - 32-bit system peripheral bus for interconnections of on-chip peripherals and further functional units
  - 32-bit remote peripheral bus serving the requirements of high speed peripherals
- Two Micro Second bus interfaces (MSC) for port expansion to external Power ASICs
- Two general purpose timer array modules plus separate LTC array with a digital signal filtering and timer functionality to realize autonomous and complex I/O management (GPTA4)
- Two asynchronous/synchronous serial channels with baud rate generator, parity, framing and overrun error detection (ASC)
- Two high speed synchronous serial channels with programmable data length and shift direction (SSC)
- Two high-speed Micro Link Interfaces for serial inter-processor communication (MLI)
- MultiCAN module with four CAN nodes and 128 free assignable message objects for high efficiency data handling via FIFO buffering and gateway data transfer; one CAN node with TTCAN functionality
- 4-channel fast analog-to-digital converter unit (FADC) with concatenated comb filters for hardware data reduction; 10-bit resolution/min. conversion time 280 ns
- Two 16-channel analog-to-digital converter units (ADC) with 8-bit, 10-bit or 12-bit resolution
- 44 analog input lines for ADC and FADC
- 135 digital general purpose I/O lines, 4 input lines
- Digital I/O ports with 3.3 V capability
- On-chip debug support OCDS level 1 + 2 (CPU, PCP, DMA)
- Dedicated emulation device chip for multicore debugging, tracing and calibration via USB 1.1 interface (TC1796ED)
- Power management system
- Clock generation unit with PLL
- Supply Voltage 1.5 V
- I/O Voltage 3.3 V
- Full automotive temperature range -40° to +125°C
- P-BGA-416 package
Highly Integrated 32-bit TriCore™-based Next Generation Microcontroller for Automotive Applications

TC1796 Block Diagram

TC1796 The Most Innovative Solution for High-end Engine and Transmission Control

Diesel & Gasoline Engine Control
- Reduced emission levels
- Better engine behavior
- Less fuel consumption

Automated Transmission Control
- Better acceleration
- More comfort
- Less fuel consumption

Overview

8-bit Microcontrollers

16-bit Microcontrollers

32-bit Microcontrollers
## Starter Kits for 32-bit Microcontrollers

<table>
<thead>
<tr>
<th>Starter Kit</th>
<th>MCU Derivative</th>
<th>CPU Clock [MHz]</th>
<th>On-Board Memory</th>
<th>Interface</th>
<th>Price EUR excl. VAT</th>
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<td>SK-TC1130</td>
<td>TC1130 TC1115 TC1100</td>
<td>150</td>
<td>64 MByte Burst Flash, 2 x 64 MByte SDRAM</td>
<td>2 x RS232, 2 x CAN w Transceiver, OCDS Level 1/2, Ethernet, USB</td>
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<tr>
<td>SK TC116x</td>
<td>TC1161 TC1162 TC1165 TC1166</td>
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<td>2 x RS232, 2 x CAN w Transceiver, OCDS Level 1/2</td>
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<td>SK TC1766</td>
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</table>
Complete Tool Chain Support with Global Partners

More information about Microcontrollers tools available at: www.infineon.com/mc-tools
Selection Tree for Industrial and Consumer Motor Control

This selection tree is only a product recommendation for Industrial and consumer motor control application and does not include the complete microcontroller portfolio from Infineon.
This selection tree is only a product recommendation for Industrial and consumer motor control application and does not include the complete microcontroller portfolio from Infineon.
Selection Tree for Automotive Applications

This selection tree is only a product recommendation and does not include the complete microcontroller portfolio from Infineon.
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*All dimensions are in millimeter.*