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XC822/824

8-Bit Single-Chip Microcontroller

Data Sheet

V1.2 2011-10

Microcontrollers

Edition 2011-10

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XC822/824

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Data Sheet

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XC822/824 Data Sheet**Revision History: V1.2 2011-10**

Previous Versions: V1.1

Page	Subjects (major changes since last revision)
Page 3	A new variant (SAK-XC822MT-0FRA) was added in Table 2.
Page 19	Added a new chip identification number for variant (SAK-XC822MT-0FRA) in Table 5.

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1 Summary of Features

The XC822/824 has the following features:

- High-performance XC800 Core
 - compatible with standard 8051 processor
 - two clocks per machine cycle architecture (for memory access without wait state)
 - two data pointers
- On-chip memory
 - 8 Kbytes of Boot ROM, Library ROM and User routines
 - 256 bytes of RAM
 - 256 bytes of XRAM
 - 2/4 Kbytes of Flash (includes memory protection strategy)
- I/O port supply at 2.5 V - 5.5 V and core logic supply at 2.5 V (generated by embedded voltage regulator)

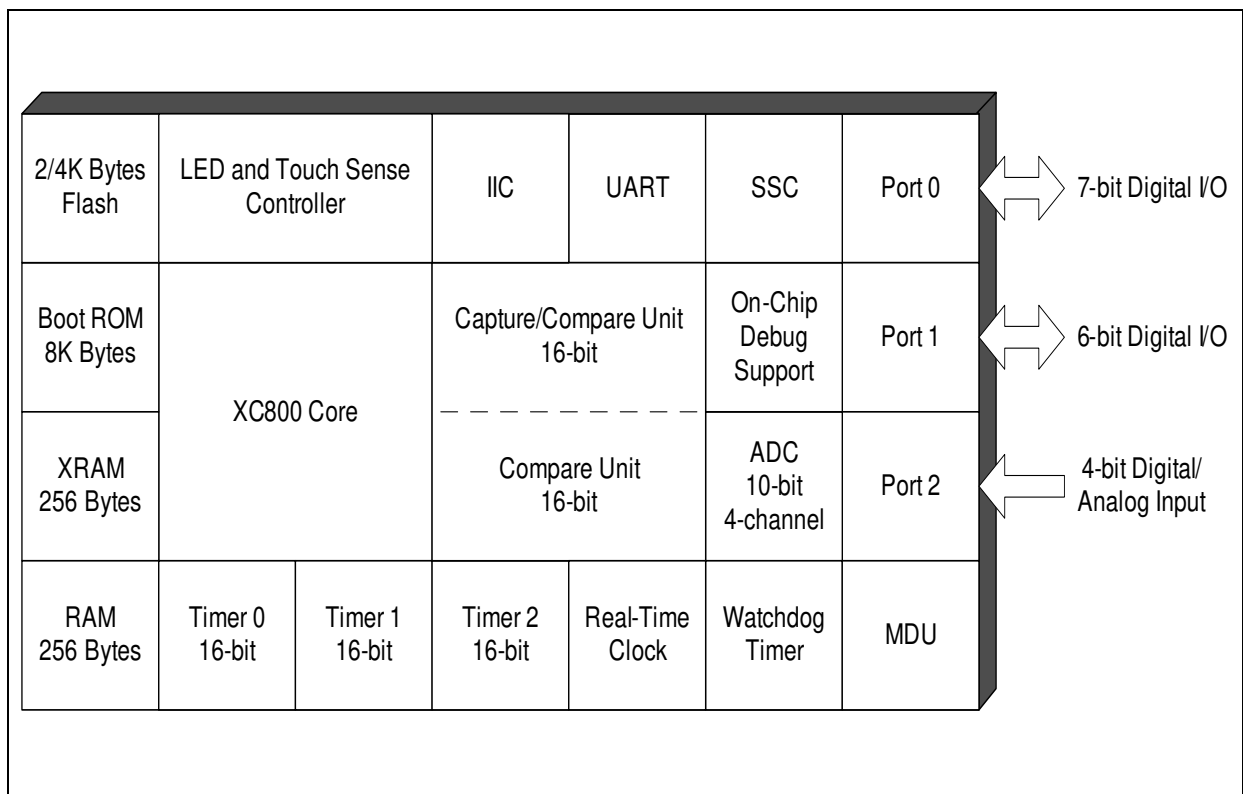


Figure 1 XC822/824 Functional Units

- Power-on reset generation
- Brownout detection for IO supply and core logic supply
- 48 MHz on-chip OSC for clock generation
 - Loss-of-Clock detection

(more features on next page)

Summary of Features

Features: (continued)

- Power saving modes
 - idle mode
 - power-down mode with wake-up capability via real-time clock interrupt
 - clock gating control to each peripheral
- Programmable 16-bit Watchdog Timer (WDT) running on independent oscillator with programmable window feature for refresh operation and warning prior to overflow
- Three ports
 - Up to 17 pins as digital I/O
 - 4 pin as digital/analog input
- 4-channel, 10-bit ADC
 - support up to 3 differential input channel
 - results filtering by data reduction or digital low-pass filter, for up to 13-bit results
- Up to 4 channels, Out of range comparator
- Three 16-bit timers
 - Timer 0 and Timer 1 (T0 and T1)
 - Timer 2 (T2)
- Periodic wake-up timer
- Multiplication/Division Unit for arithmetic operations (MDU)
- Capture and Compare unit for PWM signal generation (CCU6)
- A full-duplex or half-duplex serial interface (UART)
- Synchronous serial channel (SSC)
- Inter-IC (IIC) serial interface
- LED and Touch-sense Controller (LEDTSCU)
- On-chip debug support via single pin DAP interface (SPD)
- Packages:
 - PG-DSO-20
 - PG-TSSOP-16
- Temperature range T_A :
 - SAF (-40 to 85 °C)
 - SAX (-40 to 105 °C)
 - SAK (-40 to 125 °C)

Summary of Features
XC822/824 Variant Devices

The XC822/824 product family features devices with different configurations, program memory sizes, packages options and temperature profiles, to offer cost-effective solutions for different application requirements.

The list of XC822/824 device configurations are summarized in [Table 1](#). The type of packages available are TSSOP-16 for XC822 and DSO-20 for XC824.

Table 1 Device Configuration

Device Name	MDU Module	LEDTSCU Module
XC822/824	No	No
XC822/824M	Yes	No
XC822/824T	No	Yes
XC822/824MT	Yes	Yes

[Table 2](#) shows the device sales type available, based on above device.

Table 2 Device Profile

Sales Type	Device Type	Program Memory (Kbytes)	Temperature Profile (°C)	Package Type	Quality Profile
SAF-XC822T-0FRI	Flash	2	-40 to 85	PG-TSSOP-16	Industrial
SAF-XC822-1FRI	Flash	4	-40 to 85	PG-TSSOP-16	Industrial
SAF-XC822T-1FRI	Flash	4	-40 to 85	PG-TSSOP-16	Industrial
SAF-XC822M-1FRI	Flash	4	-40 to 85	PG-TSSOP-16	Industrial
SAF-XC822MT-1FRI	Flash	4	-40 to 85	PG-TSSOP-16	Industrial
SAF-XC824M-1FGI	Flash	4	-40 to 85	PG-DSO-20	Industrial
SAF-XC824MT-1FGI	Flash	4	-40 to 85	PG-DSO-20	Industrial
SAX-XC824M-1FGI	Flash	4	-40 to 105	PG-DSO-20	Industrial
SAK-XC824M-1FGI	Flash	4	-40 to 125	PG-DSO-20	Industrial
SAF-XC822-1FRA	Flash	4	-40 to 85	PG-TSSOP-16	Automotive
SAF-XC822MT-1FRA	Flash	4	-40 to 85	PG-TSSOP-16	Automotive
SAK-XC822MT-0FRA	Flash	2	-40 to 125	PG-TSSOP-16	Automotive
SAK-XC822-1FRA	Flash	4	-40 to 125	PG-TSSOP-16	Automotive
SAK-XC822MT-1FRA	Flash	4	-40 to 125	PG-TSSOP-16	Automotive

Summary of Features

As this document refers to all the derivatives, some description may not apply to a specific product. For simplicity, all versions are referred to by the term XC822/824 throughout this document.

Ordering Information

The ordering code for Infineon Technologies microcontrollers provides an exact reference to the required product. This ordering code identifies:

- The derivative itself, i.e. its function set, the temperature range, and the supply voltage
- The package and the type of delivery

For the available ordering codes for the XC822/824, please refer to your responsible sales representative or your local distributor.

2 General Device Information

Chapter 2 contains the block diagram, pin configurations, definitions and functions of the XC822/824.

2.1 Block Diagram

The block diagram of the XC822/824 is shown in **Figure 2**.

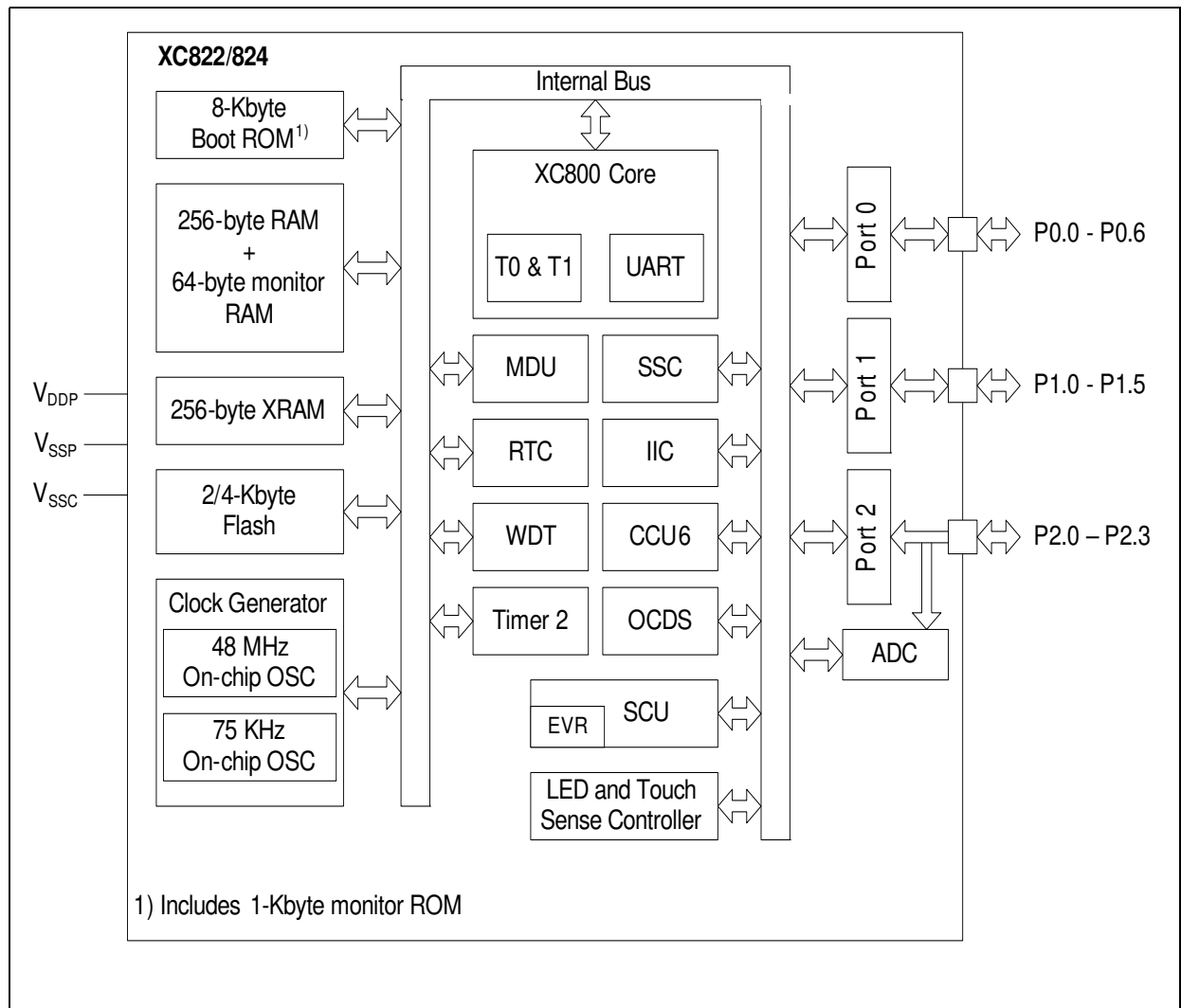


Figure 2 XC822/824 Block Diagram

2.2 Logic Symbol

The logic symbol of the XC822/824 is shown in [Figure 3](#).

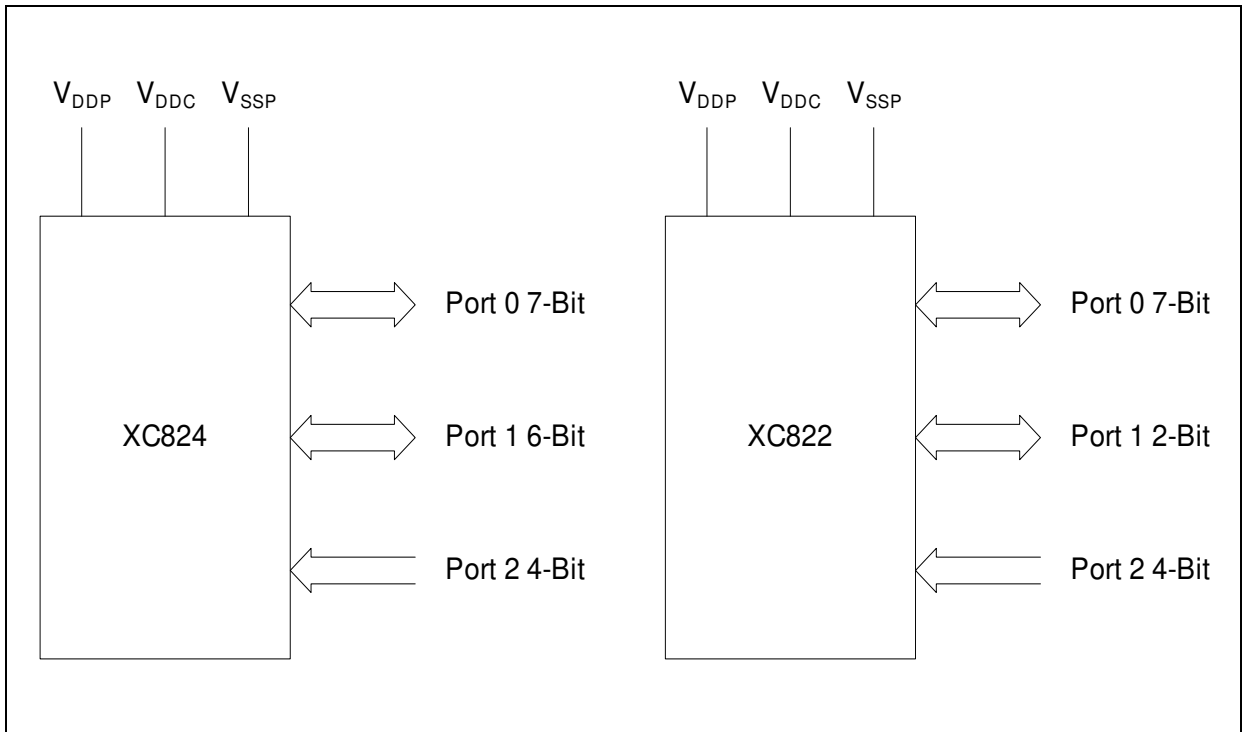


Figure 3 XC822/824 Logic Symbol

2.3 Pin Configuration

The pin configuration of the XC822 in [Figure 4](#).

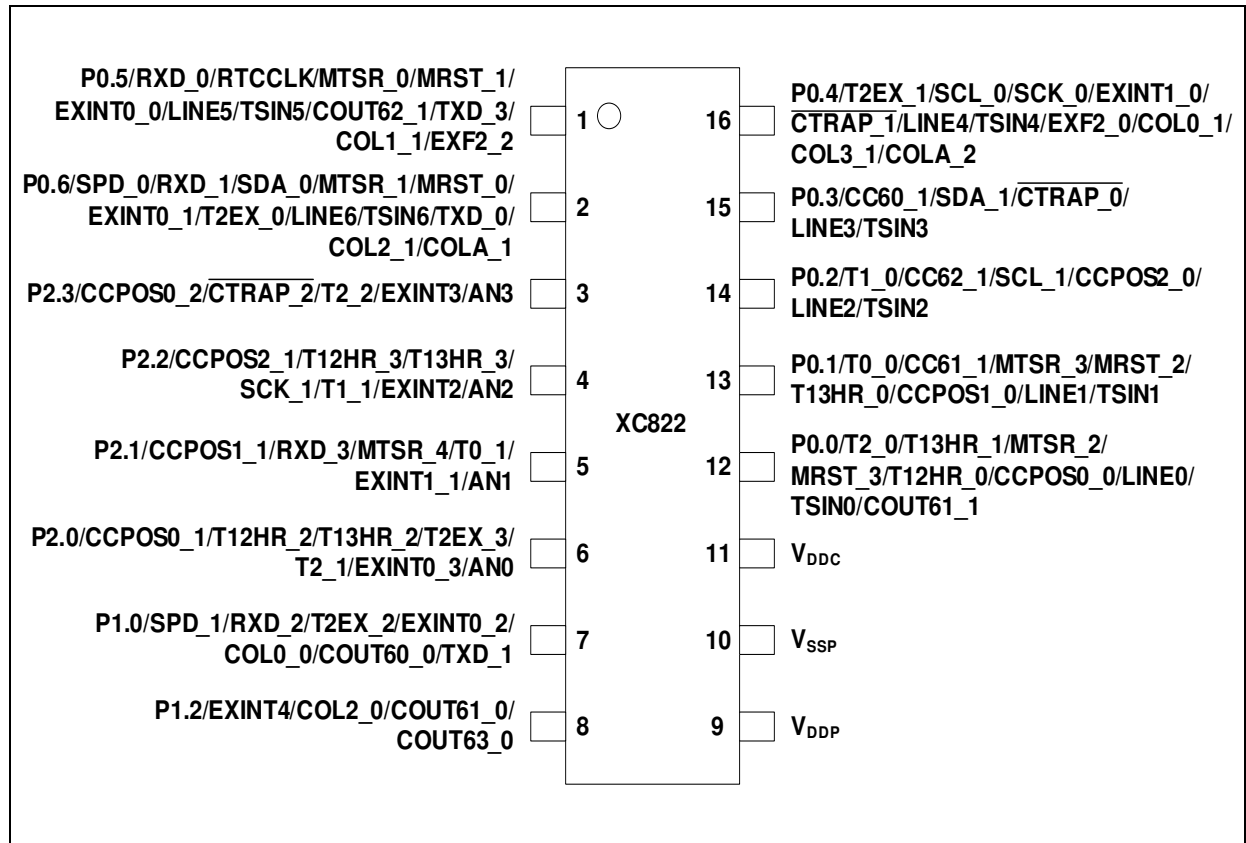


Figure 4 XC822 Pin Configuration, PG-TSSOP-16 Package (top view)

General Device Information

The pin configuration of the XC824 in [Figure 5](#).

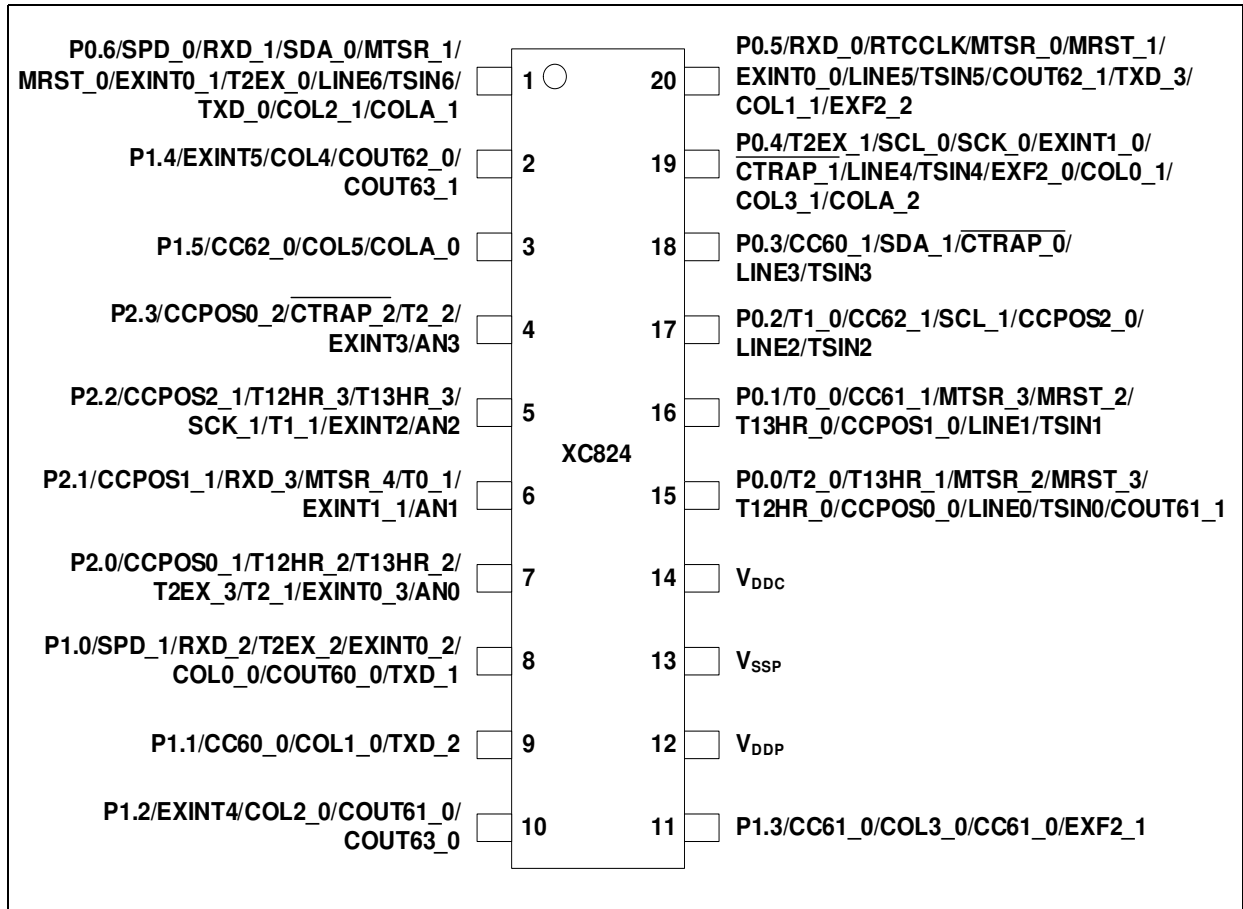


Figure 5 XC824 Pin Configuration, PG-DSO-20 Package (top view)

2.4 Pin Definitions and Functions

The functions and default states of the XC822/824 external pins are provided in [Table 3](#).

Table 3 Pin Definitions and Functions for XC822/824

Symbol	Pin Number DSO20/ TSSOP16	Type	Reset State	Function
P0		I/O		Port 0 Port 0 is a bidirectional general purpose I/O port. It can be used as alternate functions for LEDTSCU, Timer 0, 1 and 2, SSC, CCU6, IIC, SPD and UART.
P0.0	15/12		Hi-Z	T2_0 Timer 2 Input T13HR_1 CCU6 Timer 13 Hardware Run Input MTSR_2 SSC Master Transmit Output/ Slave Receive Input MRST_3 SSC Master Receive Input T12HR_0 CCU6 Timer 12 Hardware Run Input CCPOS0_0 CCU6 Hall Input 0 TSIN0 Touch-sense Input 0 LINE0 LED Line 0 COUT61_1 Output of Capture/Compare Channel 1

General Device Information
Table 3 Pin Definitions and Functions for XC822/824

Symbol	Pin Number DSO20/ TSSOP16	Type	Reset State	Function
P0.1	16/13		Hi-Z	T0_0 Timer 0 Input CC61_1 Input/Output of Capture/Compare channel 1 MTSR_3 SSC Slave Receive Input MRST_2 SSC Master Receive Input/ Slave Transmit Output T13HR_0 CCU6 Timer 13 Hardware Run Input CCPOS1_0 CCU6 Hall Input 1 TSIN1 Touch-sense Input 1 LINE1 LED Line 1
P0.2	17/14		Hi-Z	T1_0 Timer 1 Input CC62_1 Input/Output of Capture/Compare channel 2 SCL_1 IIC Clock Line CCPOS2_0 CCU6 Hall Input 2 TSIN2 Touch-sense Input 2 LINE2 LED Line 2
P0.3	18/15		Hi-Z	CC60_1 Input/Output of Capture/Compare channel 0 SDA_1 IIC Data Line CTRAP_0 CCU6 Trap Input TSIN3 Touch-sense Input 3 LINE3 LED Line 3

General Device Information
Table 3 Pin Definitions and Functions for XC822/824

Symbol	Pin Number DSO20/ TSSOP16	Type	Reset State	Function
P0.4	19/16		PD	T2EX_1 Timer 2 External Trigger Input SCK_0 SSC Clock Input/Output SCL_0 IIC Clock Line CTRAP_1 CCU6 Trap Input EXINT1_0 External Interrupt Input 1 TSIN4 Touch-sense Input 4 LINE4 LED Line 4 EXF2_0 Timer 2 Overflow Flag COL0_1 LED Column 0 COL3_1 LED Column 3 COLA_2 LED Column A
P0.5	20/1		Hi-Z	RXD_0 UART Receive Input RTCCLK RTC External Clock Input MTSR_0 SSC Master Transmit Output/ Slave Receive Input MRST_1 SSC Master Receive Input EXINT0_0 External Interrupt Input 0 TSIN5 Touch-sense Input 5 LINE5 LED Line 5 COUT62_1 Output of Capture/Compare Channel 2 TXD_3 UART Transmit Output/ 2-wire UART BSL Transmit Output COL1_1 LED Column 1 EXF2_2 Timer 2 Overflow Flag

General Device Information
Table 3 Pin Definitions and Functions for XC822/824

Symbol	Pin Number DSO20/ TSSOP16	Type	Reset State	Function
P0.6	1/2		PU	SPD_0 SPD Input/Output RXD_1 UART Receive Input/ UART BSL Receive Input SDA_0 IIC Data Line MTSR_1 SSC Slave Receive Input MRST_0 SSC Master Receive Input/ Slave Transmit Output EXINT0_1 External Interrupt Input 0 T2EX_0 Timer 2 External Trigger Input TSIN6 Touch-sense Input 6 LINE6 LED Line 6 TXD_0 UART Transmit Output/ 1-wire UART BSL Transmit Output COL2_1 LED Column 2 COLA_1 LED Column A
P1		I/O		Port 1 Port 1 is a bidirectional general purpose I/O port. It can be used as alternate functions for CCU6, LEDTSCU, SPD, UART and Timer 2.
P1.0	8/7		Hi-Z	SPD_1 SPD Input/Output RXD_2 UART Receive Input T2EX_2 Timer 2 External Trigger Input EXINT0_2 External Interrupt Input 0 COL0_0 LED Column 0 COUT60_0 Output of Capture/Compare Channel 0 TXD_1 UART Transmit Output

General Device Information
Table 3 Pin Definitions and Functions for XC822/824

Symbol	Pin Number DSO20/ TSSOP16	Type	Reset State	Function
P1.1	9/-		Hi-Z	CC60_0 Input/Output of Capture/Compare channel 0 COL1_0 LED Column 1 TXD_2 UART Transmit Output
P1.2	10/8		Hi-Z	EXINT4 External Interrupt Input 4 COL2_0 LED Column 2 COUT61_0 Output of Capture/Compare channel 1 COUT63_0 Output of Capture/Compare channel 3
P1.3	11/-		Hi-Z	CC61_0 Input/Output of Capture/Compare channel 1 COL3_0 LED Column 3 EXF2_1 Timer 2 Overflow Flag
P1.4	2/-		Hi-Z	EXINT5 External Interrupt Input 5 COL4 LED Column 4 COUT62_0 Output of Capture/Compare channel 2 COUT63_1 Output of Capture/Compare channel 3
P1.5	3/-		Hi-Z	CC62_0 Input/Output of Capture/Compare channel 2 COL5 LED Column 5 COLA_0 LED Column A
P2		I		Port 2 Port 2 is a general purpose input-only port. It can be used as inputs for A/D Converter and out of range comparator, CCU6, Timer 2, SSC and UART.

General Device Information
Table 3 Pin Definitions and Functions for XC822/824

Symbol	Pin Number DSO20/ TSSOP16	Type	Reset State	Function
P2.0	7/6		Hi-Z	CCPOS0_1 CCU6 Hall Input 0 T12HR_2 CCU6 Timer 12 Hardware Run Input T13HR_2 CCU6 Timer 13 Hardware Run Input T2EX_3 Timer 2 External Trigger Input T2_1 Timer 2 Input EXINT0_3 External Interrupt Input 0 AN0 Analog Input 0 / Out of range comparator channel 0
P2.1	6/5		Hi-Z	CCPOS1_1 CCU6 Hall Input 1 RXD_3 UART Receive Input MTSR_4 Slave Receive Input T0_1 Timer 0 Input EXINT1_1 External Interrupt Input 1 AN1 Analog Input 1 / Out of range comparator channel 1
P2.2	5/4		Hi-Z	CCPOS2_1 CCU6 Hall Input 2 T12HR_3 CCU6 Timer 12 Hardware Run Input T13HR_3 CCU6 Timer 13 Hardware Run Input SCK_1 SSC Clock Input/Output T1_1 Timer 1 Input EXINT2 External Interrupt Input 2 AN2 Analog Input 2 / Out of range comparator channel 2

Table 3 Pin Definitions and Functions for XC822/824

Symbol	Pin Number DSO20/ TSSOP16	Type	Reset State	Function
P2.3	4/3		Hi-Z	CCPOS0_2 CCU6 Hall Input 0 CTRAP_2 CCU6 Trap Input T2_2 Timer 2 Input EXINT3 External Interrupt Input 3 AN3 Analog Input 3 / Out of range comparator channel 3
V _{DDP}	12/9	–		I/O Port Supply (2.5 V - 5.5 V)
V _{DDC}	14/11	–		Core Supply Output (2.5 V)
V _{SSP} / V _{SSC}	13/10	–		I/O Port Ground/ Core Supply Ground

2.5 Memory Organization

The XC822/824 CPU operates in the following five address spaces:

- 8 Kbytes of Boot ROM, Library ROM and User routines
- 256 bytes of internal RAM
- 256 bytes of XRAM
(XRAM can be read/written as program memory or external data memory)
- A 128-byte Special Function Register area
- 2/4 Kbytes of Flash

Figure 6 illustrates the memory address spaces of the 2 Kbyte Flash devices. There are two 1-Kbyte sectors in this device. **Figure 7** illustrates the memory address spaces of the 4 Kbyte Flash devices. This device has two 1-Kbyte sectors, two 512-byte sectors, two 256-byte sectors and four 128-byte sectors. **Figure 8** shows the Flash sectorization for 2 Kbyte and 4 Kbyte Flash devices.

General Device Information

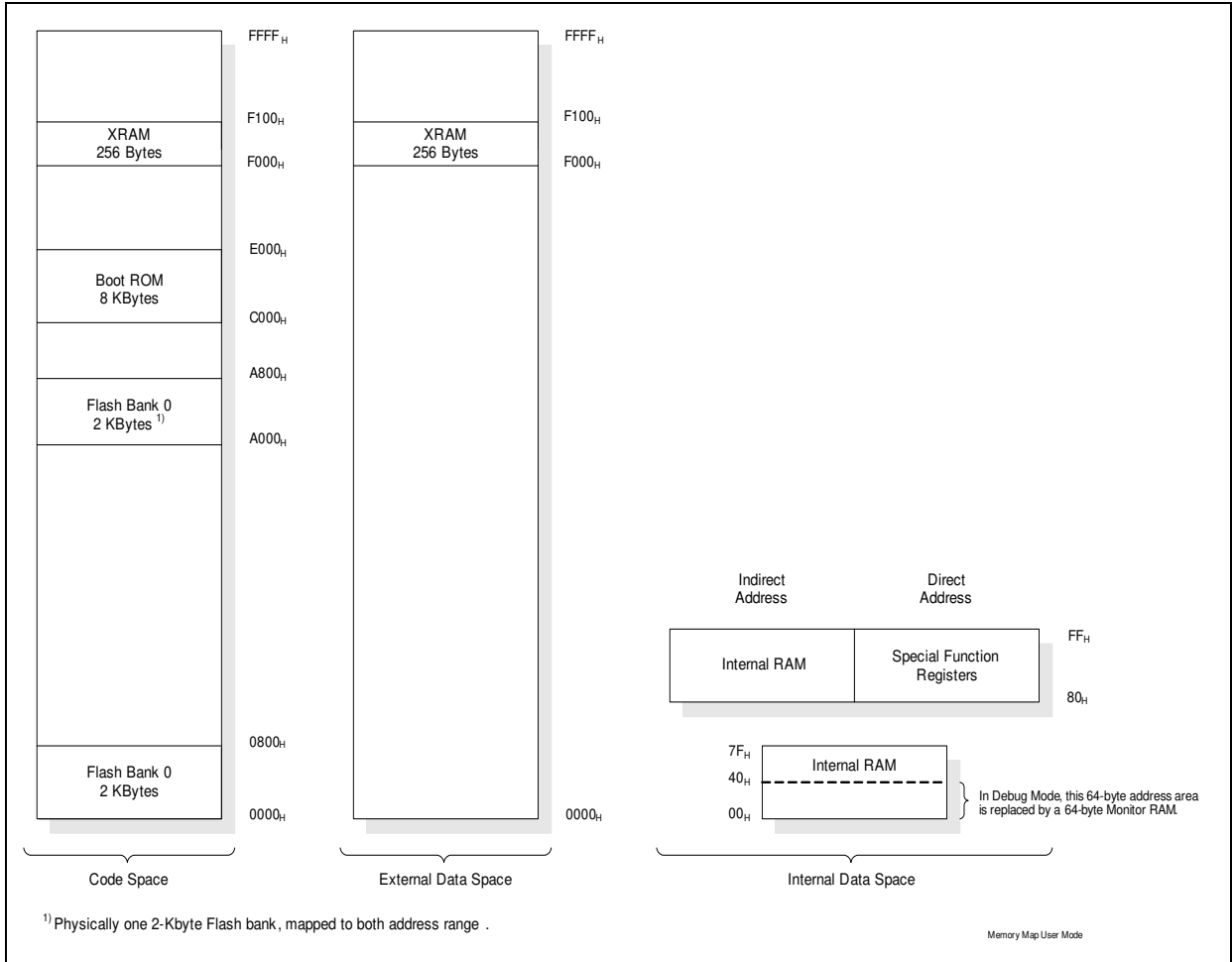


Figure 6 Memory Map of XC822/824 with 2 Kbytes of Flash memory

General Device Information

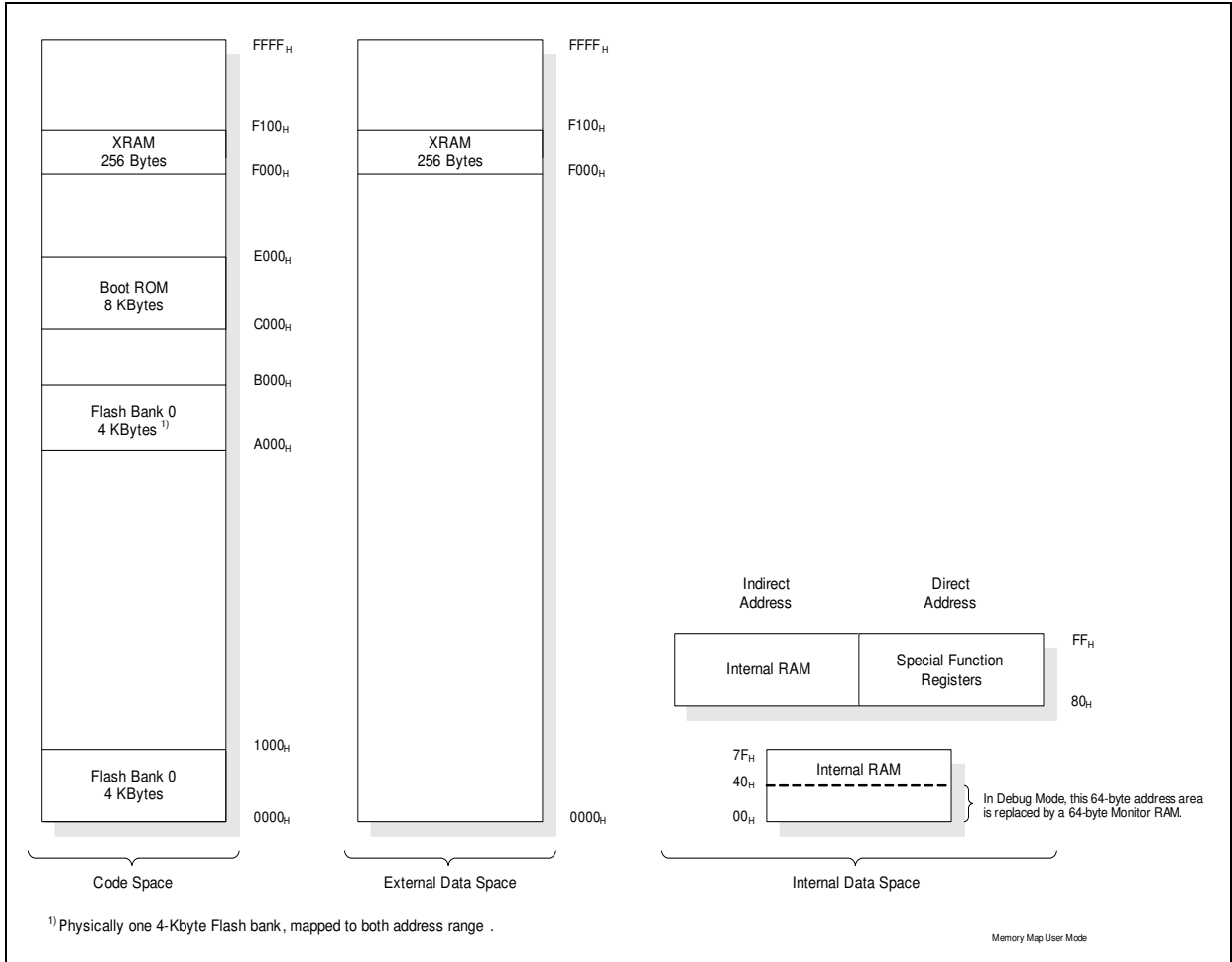


Figure 7 Memory Map of XC822/824 with 4 Kbytes of Flash memory

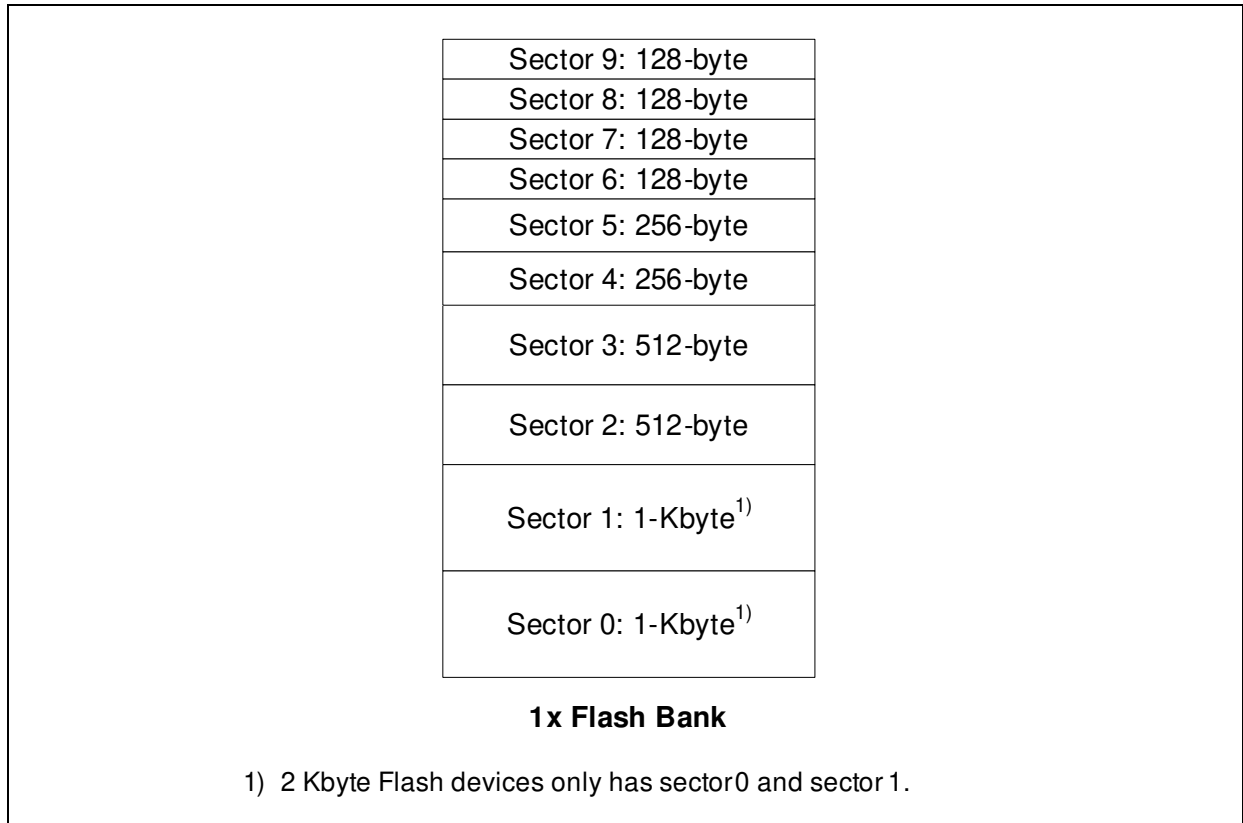


Figure 8 Flash Bank Sectorization

2.6 JTAG ID

JTAG ID register is a read-only register located inside the JTAG module, and is used to recognize the device(s) connected to the JTAG interface. Its content is shifted out when INSTRUCTION register contains the IDCODE command (opcode 04_H), and the same is also true immediately after reset.

The JTAG ID register contents for the XC822/824 Flash devices are given in [Table 4](#).

Table 4 JTAG ID Summary

Device Type	Device Name	JTAG ID
Flash	XC822/824*	101B C083 _H

Note: The asterisk () above denotes all possible device configurations.*

2.7 Chip Identification Number

The XC822/824 identity (ID) register is located at Page 1 of address B3_H. The value of ID register is 51_H. However, for easy identification of product variants, the Chip Identification Number, which is a unique number assigned to each product variant, is available. The differentiation is based on the product and variant type information.

Two methods are provided to read a device's Chip Identification number:

- In-application subroutine, GET_CHIP_INFO
- Boot-loader (BSL) mode A

Table 5 lists the Chip Identification numbers of XC822/824 device variants.

Table 5 Chip Identification Number

Product Variant	Chip Identification Number
XC822T-0FR	51080343 _H
XC822MT-0FR	51080303 _H
XC822-1FR	51080163 _H
XC822T-1FR	51080143 _H
XC822M-1FR	51080123 _H
XC822MT-1FR	51080103 _H
XC824M-1FG	51080122 _H
XC824MT-1FG	51080102 _H