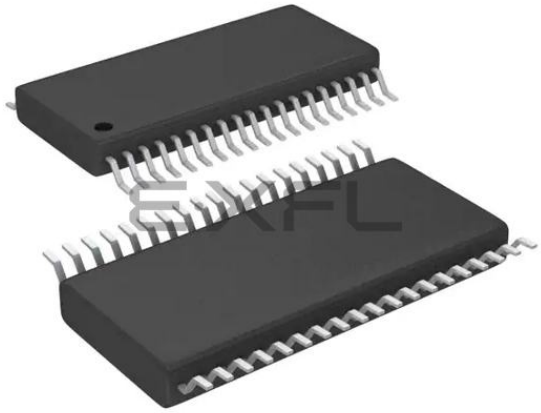

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Applications of "Embedded - Microcontrollers"

Details	
Product Status	Obsolete
Core Processor	XC800
Core Size	8-Bit
Speed	86MHz
Connectivity	LINbus, SSI, UART/USART
Peripherals	Brown-out Detect/Reset, POR, PWM, WDT
Number of I/O	19
Program Memory Size	8KB (8K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	768 x 8
Voltage - Supply (Vcc/Vdd)	4.5V ~ 5.5V
Data Converters	A/D 8x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 125°C (TA)
Mounting Type	Surface Mount
Package / Case	38-TFSOP (0.173", 4.40mm Width)
Supplier Device Package	PG-TSSOP-38
Purchase URL	https://www.e-xfl.com/product-detail/infineon-technologies/sak-xc866l-2fri-be

Edition 2007-10

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XC866 Data Sheet
Revision History: 2007-10 V1.2

Previous Version: V 0.1, 2005-01
V1.0, 2006-02
V1.1, 2006-12

Page	Subjects (major changes since last revision)
3	Device summary table is updated for Flash 4-Kb and ROM variants.
13	Footnote is added to MBC pin; description of V_{DDP} pin is updated.
25	Section on bit protection scheme and access type of register bit field PASSWD.PASS are updated.
26	Access type of PAGE bits of all module page registers are corrected to rwh.
29	Access type of Px_DIR register bits are corrected to rwh
38	New bullet point on Flash delivery state is added to the feature list.
88	Digital power supply voltage are differentiated for 5V and 3.3V variants.
89	New parameters on XTAL1 hysteresis and Voltage on GPIO pins during V_{DDP} power-off condition are added.
104	Figure on Power-on reset timing is updated.

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mcdocu.comments@infineon.com

Table 3 Pin Definitions and Functions (cont'd)

Symbol	Pin Number	Type	Reset State	Function
P2		I		**Port 2** Port 2 is an 8-bit general purpose input-only port. It can be used as alternate functions for the digital inputs of the JTAG and CCU6. It is also used as the analog inputs for the ADC.
P2.0	15		Hi-Z	CCPOS0_0 CCU6 Hall Input 0 EXINT1 External Interrupt Input 1 T12HR_2 CCU6 Timer 12 Hardware Run Input TCK_1 JTAG Clock Input CC61_3 Input of Capture/Compare channel 1 AN0 Analog Input 0
P2.1	16		Hi-Z	CCPOS1_0 CCU6 Hall Input 1 EXINT2 External Interrupt Input 2 T13HR_2 CCU6 Timer 13 Hardware Run Input TDI_1 JTAG Serial Data Input CC62_3 Input of Capture/Compare channel 2 AN1 Analog Input 1
P2.2	17		Hi-Z	CCPOS2_0 CCU6 Hall Input 2 CTRAP_1 CCU6 Trap Input CC60_3 Input of Capture/Compare channel 0 AN2 Analog Input 2
P2.3	20		Hi-Z	AN3 Analog Input 3
P2.4	21		Hi-Z	AN4 Analog Input 4
P2.5	22		Hi-Z	AN5 Analog Input 5
P2.6	23		Hi-Z	AN6 Analog Input 6
P2.7	26		Hi-Z	AN7 Analog Input 7

Table 3 Pin Definitions and Functions (cont'd)

Symbol	Pin Number	Type	Reset State	Function
V_{DDP}	18	–	–	**I/O Port Supply (3.3 V/5.0 V)** Also used by EVR and analog modules.
V_{SSP}	19	–	–	**I/O Port Ground**
V_{DDC}	8	–	–	**Core Supply Monitor (2.5 V)**
V_{SSC}	7	–	–	**Core Supply Ground**
V_{AREF}	25	–	–	**ADC Reference Voltage**
V_{AGND}	24	–	–	**ADC Reference Ground**
XTAL1	6	I	Hi-Z	**External Oscillator Input** **(NC if not needed)**
XTAL2	5	O	Hi-Z	**External Oscillator Output** **(NC if not needed)**
TMS	11	I	PD	**Test Mode Select**
$\overline{\text{RESET}}$	38	I	PU	**Reset Input**
MBC[1)]	1	I	PU	**Monitor & BootStrap Loader Control**

1) An external pull-up device in the range of 4.7 kΩ to 100 kΩ is required to enter user mode. Alternatively MBC can be tied to high if alternate functions (for debugging) of the pin are not utilized.

Figure 7 illustrates the memory address spaces of the XC866-4RR device.

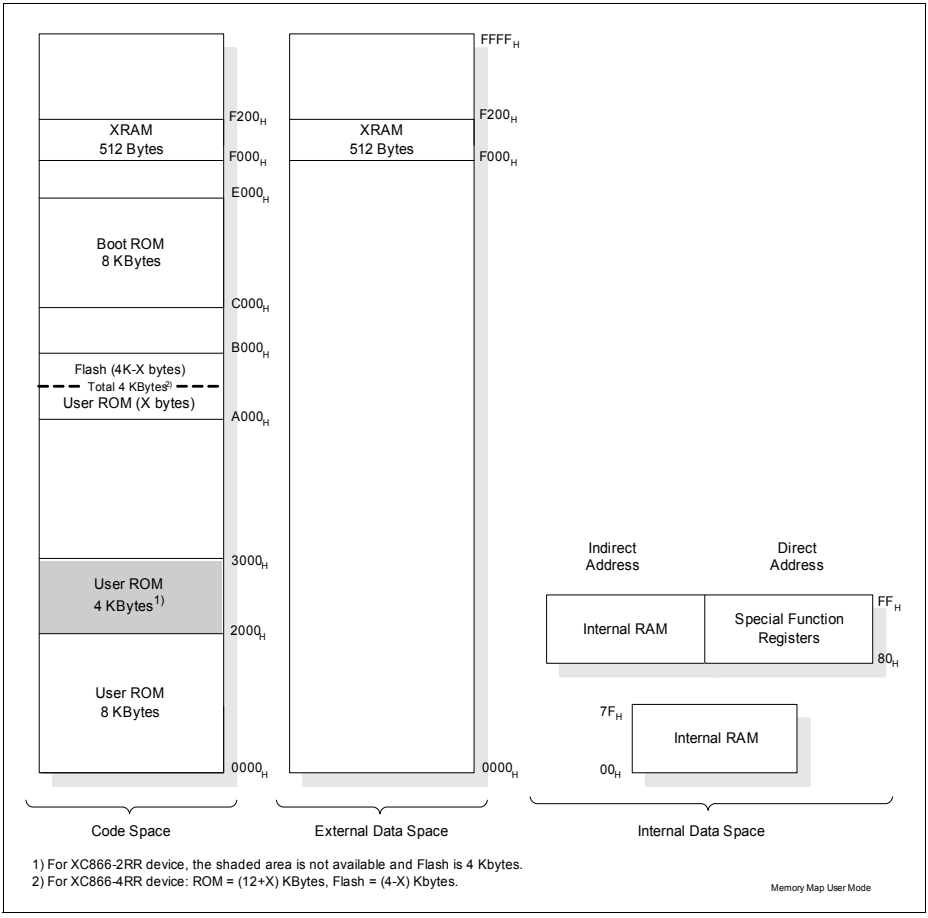

Figure 7 Memory Map of XC866 ROM Devices

Field	Bits	Type	Description
OP	[7:6]	w	**Operation** 0X Manual page mode. The value of STNR is ignored and PAGE is directly written. 10 New page programming with automatic page saving. The value written to the bit positions of PAGE is stored. In parallel, the previous contents of PAGE are saved in the storage bit field STx indicated by STNR. 11 Automatic restore page action. The value written to the bit positions PAGE is ignored and instead, PAGE is overwritten by the contents of the storage bit field STx indicated by STNR.
0	3	r	**Reserved** Returns 0 if read; should be written with 0.

Table 11 ADC Register Overview (cont'd)

Addr	Register Name	Bit	7	6	5	4	3	2	1	0
CA_H	**ADC_RESR0L** **Reset: 00_H** Result Register 0 Low	Bit Field	RESULT[1:0]		0	VF	DRC	CHNR		
		Type	rh		r	rh	rh	rh		
CB_H	**ADC_RESR0H** **Reset: 00_H** Result Register 0 High	Bit Field	RESULT[9:2]							
		Type	rh							
CC_H	**ADC_RESR1L** **Reset: 00_H** Result Register 1 Low	Bit Field	RESULT[1:0]		0	VF	DRC	CHNR		
		Type	rh		r	rh	rh	rh		
CD_H	**ADC_RESR1H** **Reset: 00_H** Result Register 1 High	Bit Field	RESULT[9:2]							
		Type	rh							
CE_H	**ADC_RESR2L** **Reset: 00_H** Result Register 2 Low	Bit Field	RESULT[1:0]		0	VF	DRC	CHNR		
		Type	rh		r	rh	rh	rh		
CF_H	**ADC_RESR2H** **Reset: 00_H** Result Register 2 High	Bit Field	RESULT[9:2]							
		Type	rh							
$D2_H$	**ADC_RESR3L** **Reset: 00_H** Result Register 3 Low	Bit Field	RESULT[1:0]		0	VF	DRC	CHNR		
		Type	rh		r	rh	rh	rh		
$D3_H$	**ADC_RESR3H** **Reset: 00_H** Result Register 3 High	Bit Field	RESULT[9:2]							
		Type	rh							
RMAP = 0, Page 3										
CA_H	**ADC_RESRA0L** **Reset: 00_H** Result Register 0, View A Low	Bit Field	RESULT[2:0]			VF	DRC	CHNR		
		Type	rh			rh	rh	rh		
CB_H	**ADC_RESRA0H** **Reset: 00_H** Result Register 0, View A High	Bit Field	RESULT[10:3]							
		Type	rh							
CC_H	**ADC_RESRA1L** **Reset: 00_H** Result Register 1, View A Low	Bit Field	RESULT[2:0]			VF	DRC	CHNR		
		Type	rh			rh	rh	rh		
CD_H	**ADC_RESRA1H** **Reset: 00_H** Result Register 1, View A High	Bit Field	RESULT[10:3]							
		Type	rh							
CE_H	**ADC_RESRA2L** **Reset: 00_H** Result Register 2, View A Low	Bit Field	RESULT[2:0]			VF	DRC	CHNR		
		Type	rh			rh	rh	rh		
CF_H	**ADC_RESRA2H** **Reset: 00_H** Result Register 2, View A High	Bit Field	RESULT[10:3]							
		Type	rh							
$D2_H$	**ADC_RESRA3L** **Reset: 00_H** Result Register 3, View A Low	Bit Field	RESULT[2:0]			VF	DRC	CHNR		
		Type	rh			rh	rh	rh		
$D3_H$	**ADC_RESRA3H** **Reset: 00_H** Result Register 3, View A High	Bit Field	RESULT[10:3]							
		Type	rh							
RMAP = 0, Page 4										
CA_H	**ADC_RCR0** **Reset: 00_H** Result Control Register 0	Bit Field	VFCTR	WFR	0	IEN	0			DRCTR
		Type	rw	rw	r	rw	r			rw
CB_H	**ADC_RCR1** **Reset: 00_H** Result Control Register 1	Bit Field	VFCTR	WFR	0	IEN	0			DRCTR
		Type	rw	rw	r	rw	r			rw
CC_H	**ADC_RCR2** **Reset: 00_H** Result Control Register 2	Bit Field	VFCTR	WFR	0	IEN	0			DRCTR
		Type	rw	rw	r	rw	r			rw
CD_H	**ADC_RCR3** **Reset: 00_H** Result Control Register 3	Bit Field	VFCTR	WFR	0	IEN	0			DRCTR
		Type	rw	rw	r	rw	r			rw
CE_H	**ADC_VFCR** **Reset: 00_H** Valid Flag Clear Register	Bit Field	0				VFC3	VFC2	VFC1	VFC0
		Type	r				w	w	w	w
RMAP = 0, Page 5										

Table 13 CCU6 Register Overview (cont'd)

Addr	Register Name	Bit	7	6	5	4	3	2	1	0
FB_H	**CCU6_CC60SRH Reset: 00_H** Capture/Compare Shadow Register for Channel CC60 High	Bit Field	CC60SH							
		Type	rwh							
FC_H	**CCU6_CC61SRL Reset: 00_H** Capture/Compare Shadow Register for Channel CC61 Low	Bit Field	CC61SL							
		Type	rwh							
FD_H	**CCU6_CC61SRH Reset: 00_H** Capture/Compare Shadow Register for Channel CC61 High	Bit Field	CC61SH							
		Type	rwh							
FE_H	**CCU6_CC62SRL Reset: 00_H** Capture/Compare Shadow Register for Channel CC62 Low	Bit Field	CC62SL							
		Type	rwh							
FF_H	**CCU6_CC62SRH Reset: 00_H** Capture/Compare Shadow Register for Channel CC62 High	Bit Field	CC62SH							
		Type	rwh							
RMAP = 0, Page 1										
$9A_H$	**CCU6_CC63RL Reset: 00_H** Capture/Compare Register for Channel CC63 Low	Bit Field	CC63VL							
		Type	rh							
$9B_H$	**CCU6_CC63RH Reset: 00_H** Capture/Compare Register for Channel CC63 High	Bit Field	CC63VH							
		Type	rh							
$9C_H$	**CCU6_T12PRL Reset: 00_H** Timer T12 Period Register Low	Bit Field	T12PVL							
		Type	rwh							
$9D_H$	**CCU6_T12PRH Reset: 00_H** Timer T12 Period Register High	Bit Field	T12PVH							
		Type	rwh							
$9E_H$	**CCU6_T13PRL Reset: 00_H** Timer T13 Period Register Low	Bit Field	T13PVL							
		Type	rwh							
$9F_H$	**CCU6_T13PRH Reset: 00_H** Timer T13 Period Register High	Bit Field	T13PVH							
		Type	rwh							
$A4_H$	**CCU6_T12DTCL Reset: 00_H** Dead-Time Control Register for Timer T12 Low	Bit Field	DTM							
		Type	rw							
$A5_H$	**CCU6_T12DTCH Reset: 00_H** Dead-Time Control Register for Timer T12 High	Bit Field	0	DTR2	DTR1	DTR0	0	DTE2	DTE1	DTE0
		Type	r	rh	rh	rh	r	rw	rw	rw
$A6_H$	**CCU6_TCTR0L Reset: 00_H** Timer Control Register 0 Low	Bit Field	CTM	CDIR	STE12	T12R	T12 PRE	T12CLK		
		Type	rw	rh	rh	rh	rw	rw		
$A7_H$	**CCU6_TCTR0H Reset: 00_H** Timer Control Register 0 High	Bit Field	0		STE13	T13R	T13 PRE	T13CLK		
		Type	r		rh	rh	rw	rw		
FA_H	**CCU6_CC60RL Reset: 00_H** Capture/Compare Register for Channel CC60 Low	Bit Field	CC60VL							
		Type	rh							
FB_H	**CCU6_CC60RH Reset: 00_H** Capture/Compare Register for Channel CC60 High	Bit Field	CC60VH							
		Type	rh							
FC_H	**CCU6_CC61RL Reset: 00_H** Capture/Compare Register for Channel CC61 Low	Bit Field	CC61VL							
		Type	rh							

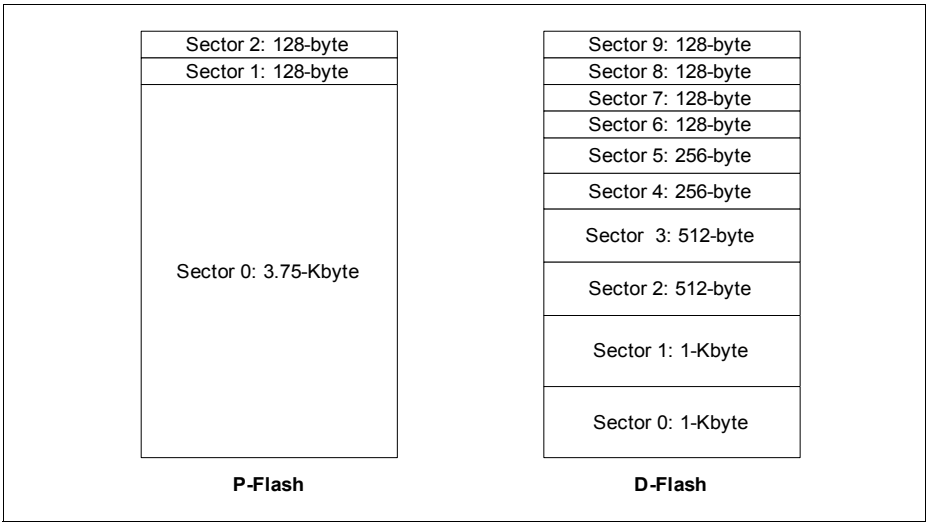

Figure 11 Flash Bank Sectorization

The internal structure of each Flash bank represents a sector architecture for flexible erase capability. The minimum erase width is always a complete sector, and sectors can be erased separately or in parallel. Contrary to standard EPROMs, erased Flash memory cells contain 0s.

The D-Flash bank is divided into more physical sectors for extended erasing and reprogramming capability; even numbers for each sector size are provided to allow greater flexibility and the ability to adapt to a wide range of application requirements.

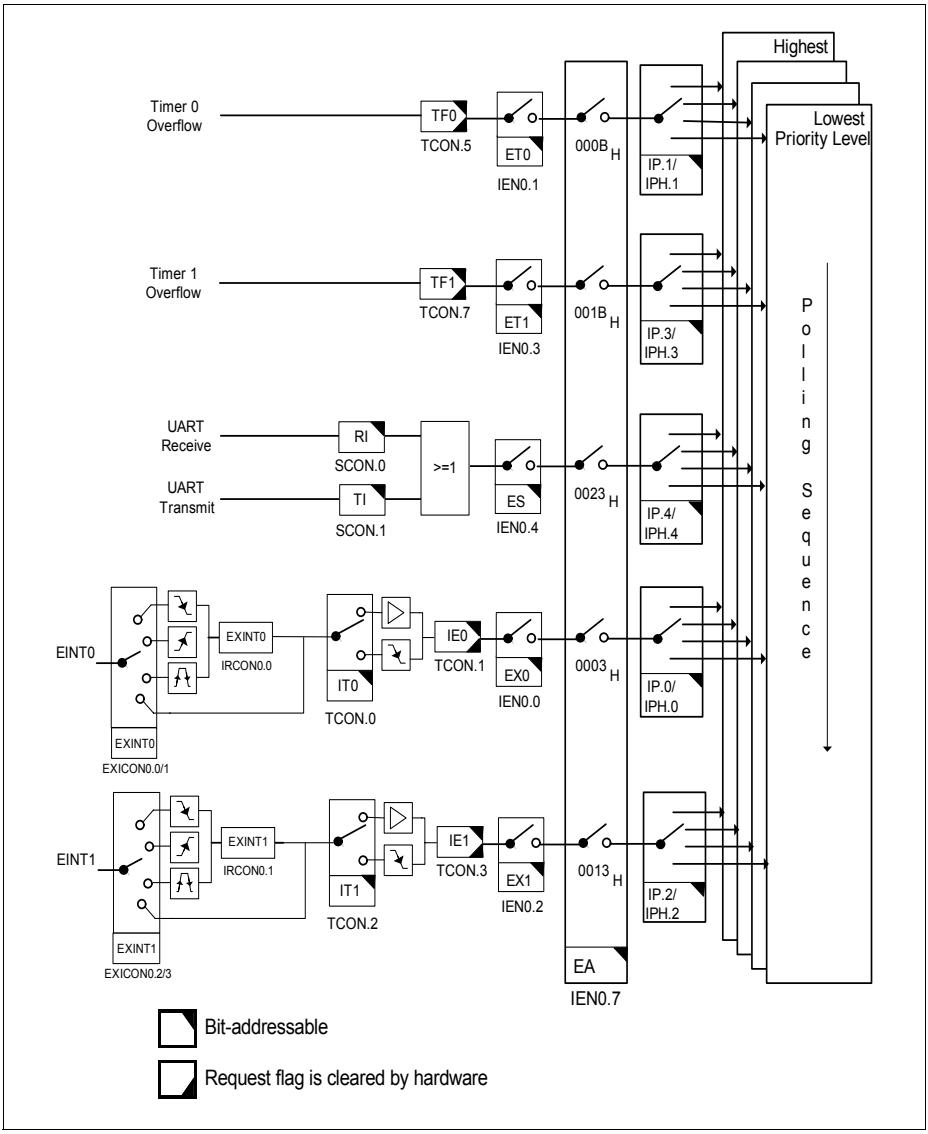

Figure 14 Interrupt Request Sources (Part 1)

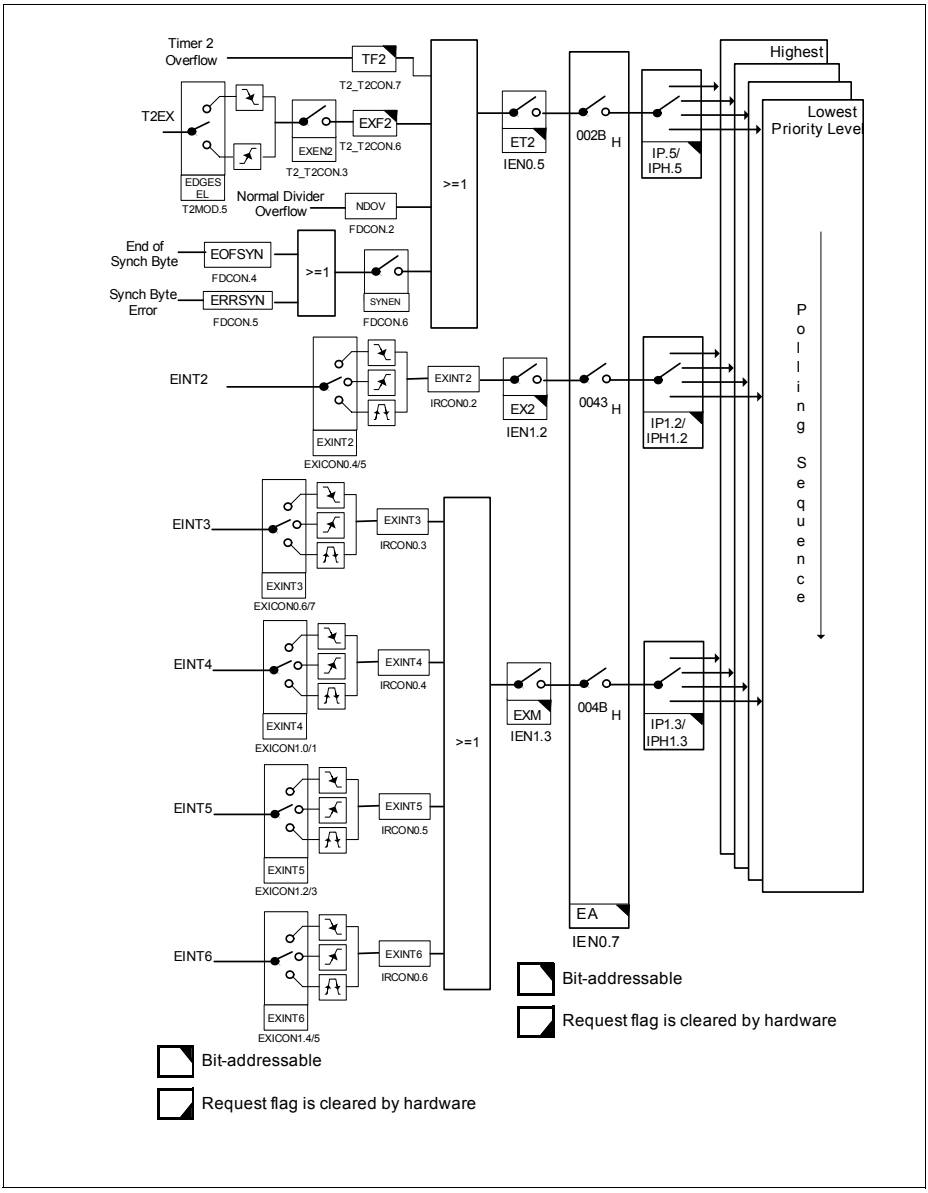

Figure 15 Interrupt Request Sources (Part 2)

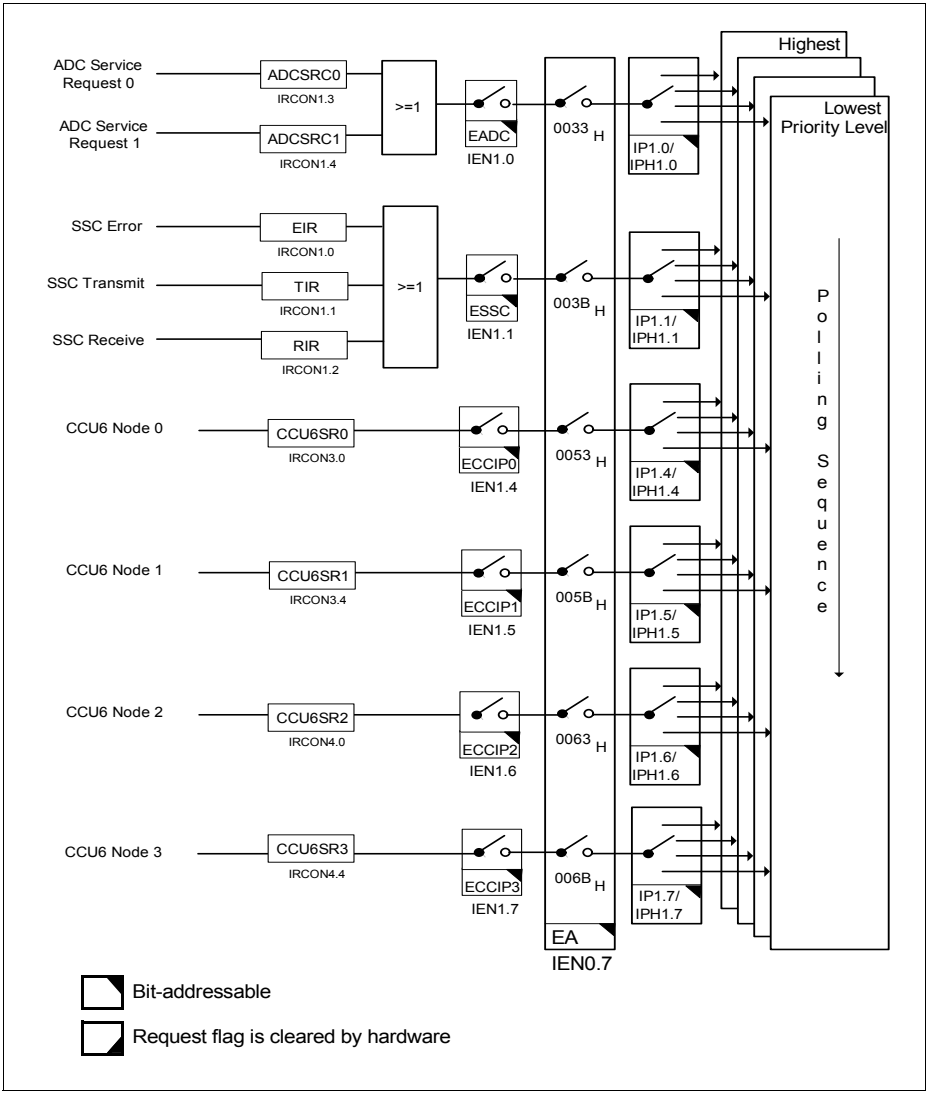

Figure 16 Interrupt Request Sources (Part 3)

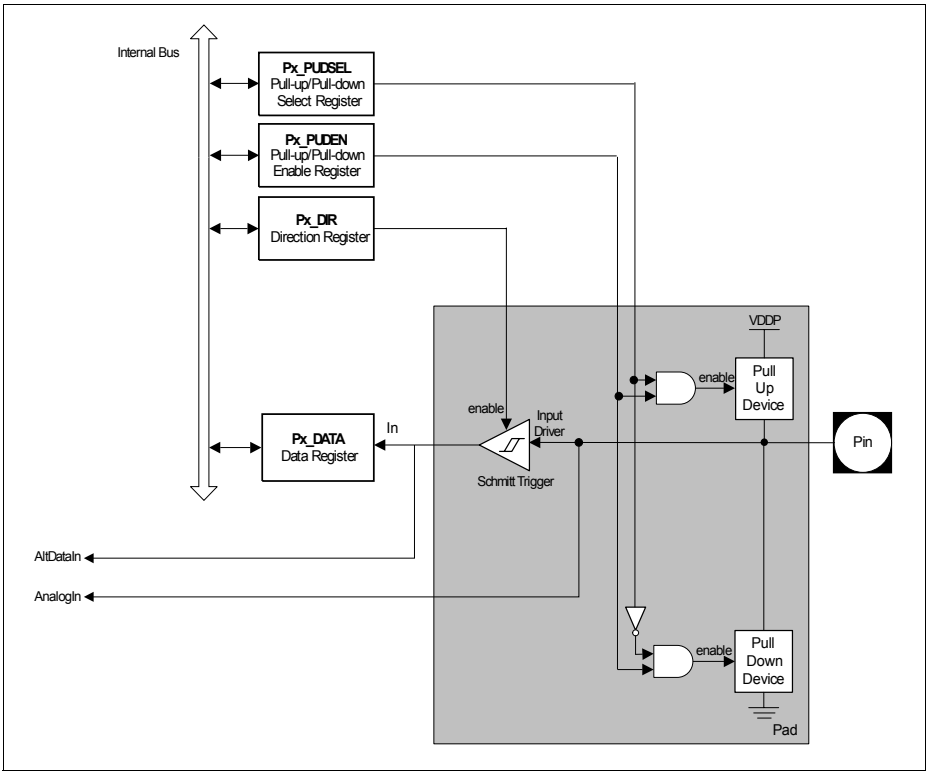

Figure 19 General Structure of Input Port

3.7.1 Module Reset Behavior

Table 19 shows how the functions of the XC866 are affected by the various reset types. A "■" means that this function is reset to its default state.

Table 19 Effect of Reset on Device Functions

Module/ Function	Wake-Up Reset	Watchdog Reset	Hardware Reset	Power-On Reset	Brownout Reset
CPU Core	■	■	■	■	■
Peripherals	■	■	■	■	■
On-Chip Static RAM	Not affected, reliable	Not affected, reliable	Not affected, reliable	Affected, un-reliable	Affected, un-reliable
Oscillator, PLL	■	Not affected	■	■	■
Port Pins	■	■	■	■	■
EVR	The voltage regulator is switched on	Not affected	■	■	■
FLASH	■	■	■	■	■
NMI	Disabled	Disabled	■	■	■

3.7.2 Booting Scheme

When the XC866 is reset, it must identify the type of configuration with which to start the different modes once the reset sequence is complete. Thus, boot configuration information that is required for activation of special modes and conditions needs to be applied by the external world through input pins. After power-on reset or hardware reset, the pins MBC, TMS and P0.0 collectively select the different boot options. Table 20 shows the available boot options in the XC866.

Table 20 XC866 Boot Selection

MBC	TMS	P0.0	Type of Mode	PC Start Value
1	0	x	User Mode; on-chip OSC/PLL non-bypassed	0000_H
0	0	x	BSL Mode; on-chip OSC/PLL non-bypassed	0000_H
0	1	0	OCDS Mode[1]; on-chip OSC/PLL non-bypassed	0000_H
1	1	0	Standalone User (JTAG) Mode[2]; on-chip OSC/PLL non-bypassed (normal)	0000_H

1) The OCDS mode is not accessible if Flash is protected.
2) Normal user mode with standard JTAG (TCK,TDI,TDO) pins for hot-attach purpose.

115.2 kHz, using different module clock frequencies. The fractional divider is enabled (fractional divider mode) and the corresponding parameter settings are shown.

Table 27 Deviation Error for UART with Fractional Divider enabled

f_{PCLK}	Prescaling Factor (2^{BRPRE})	Reload Value (BR_VALUE + 1)	STEP	Deviation Error
26.67 MHz	1	10 (A_H)	177 ($B1_H$)	+0.03 %
13.33 MHz	1	7 (7_H)	248 ($F8_H$)	+0.11 %
6.67 MHz	1	3 (3_H)	212 ($D4_H$)	-0.16 %

3.14 High-Speed Synchronous Serial Interface

The High-Speed Synchronous Serial Interface (SSC) supports full-duplex and half-duplex synchronous communication. The serial clock signal can be generated by the SSC internally (master mode), using its own 16-bit baud-rate generator, or can be received from an external master (slave mode). Data width, shift direction, clock polarity and phase are programmable. This allows communication with SPI-compatible devices or devices using other synchronous serial interfaces.

Features:

- Master and slave mode operation
  - Full-duplex or half-duplex operation
- Transmit and receive buffered
- Flexible data format
  - Programmable number of data bits: 2 to 8 bits
  - Programmable shift direction: LSB or MSB shift first
  - Programmable clock polarity: idle low or high state for the shift clock
  - Programmable clock/data phase: data shift with leading or trailing edge of the shift clock
- Variable baud rate
- Compatible with Serial Peripheral Interface (SPI)
- Interrupt generation
  - On a transmitter empty condition
  - On a receiver full condition
  - On an error condition (receive, phase, baud rate, transmit error)

Table 34 Input/Output Characteristics (Operating Conditions apply)

Parameter	Symbol		Limit Values		Unit	Test Conditions Remarks
			min.	max.		
V_{DDP} = 3.3V Range						
Output low voltage	V_{OL}	CC	–	1.0	V	I_{OL} = 8 mA
			–	0.4	V	I_{OL} = 2.5 mA
Output high voltage	V_{OH}	CC	V_{DDP} - 1.0	–	V	I_{OH} = -8 mA
			V_{DDP} - 0.4	–	V	I_{OH} = -2.5 mA
Input low voltage on port pins (all except P0.0 & P0.1)	V_{ILP}	SR	–	0.3 × V_{DDP}	V	CMOS Mode
Input low voltage on P0.0 & P0.1	V_{ILP0}	SR	-0.2	0.3 × V_{DDP}	V	CMOS Mode
Input low voltage on $\overline{\text{RESET}}$ pin	V_{ILR}	SR	–	0.3 × V_{DDP}	V	CMOS Mode
Input low voltage on TMS pin	V_{ILT}	SR	–	0.3 × V_{DDP}	V	CMOS Mode
Input high voltage on port pins (all except P0.0 & P0.1)	V_{IHP}	SR	0.7 × V_{DDP}	–	V	CMOS Mode
Input high voltage on P0.0 & P0.1	V_{IHP0}	SR	0.7 × V_{DDP}	V_{DDP}	V	CMOS Mode
Input high voltage on $\overline{\text{RESET}}$ pin	V_{IHR}	SR	0.7 × V_{DDP}	–	V	CMOS Mode
Input high voltage on TMS pin	V_{IHT}	SR	0.75 × V_{DDP}	–	V	CMOS Mode
Input Hysteresis[1] on Port pins	HYS	CC	0.03 × V_{DDP}	–	V	CMOS Mode
Input Hysteresis[1] on XTAL1	$HYSX$	CC	0.07 × V_{DDC}	–	V	
Input low voltage at XTAL1	V_{ILX}	SR	V_{SS} - 0.5	0.3 × V_{DDC}	V	
Input high voltage at XTAL1	V_{IHX}	SR	0.7 × V_{DDC}	V_{DDC} + 0.5	V	

4.2.4 Power Supply Current

Table 37 Power Supply Current Parameters (Operating Conditions apply; V_{DDP} = 5V range)

Parameter	Symbol	Limit Values		Unit	Test Condition Remarks
		typ.[1]	max.[2]		
V_{DDP} = 5V Range					
Active Mode	I_{DDP}	22.6	24.5	mA	[3]
Idle Mode	I_{DDP}	17.2	19.7	mA	XC866-4FR, XC866-2FR [4]
		12.5	14	mA	XC866-1FR, ROM device[4]
Active Mode with slow-down enabled	I_{DDP}	7.2	8.2	mA	XC866-4FR, XC866-2FR [5]
		5.6	7.5	mA	XC866-1FR, ROM device[5]
Idle Mode with slow-down enabled	I_{DDP}	7.1	8	mA	XC866-4FR, XC866-2FR [6]
		5.1	7.2	mA	XC866-1FR, ROM device[6]

1) The typical I_{DDP} values are periodically measured at T_A = + 25 °C and V_{DDP} = 5.0 V.

2) The maximum I_{DDP} values are measured under worst case conditions (T_A = + 125 °C and V_{DDP} = 5.5 V).

3) I_{DDP} (active mode) is measured with: CPU clock and input clock to all peripherals running at 26.7 MHz(set by on-chip oscillator of 10 MHz and NDIV in PLL_CON to 0010_B), $\overline{RESET}$ = V_{DDP}, no load on ports.

4) I_{DDP} (idle mode) is measured with: CPU clock disabled, watchdog timer disabled, input clock to all peripherals enabled and running at 26.7 MHz, $\overline{RESET}$ = V_{DDP} , no load on ports.

5) I_{DDP} (active mode with slow-down mode) is measured with: CPU clock and input clock to all peripherals running at 833 KHz by setting CLKREL in CMCON to 0101_B, $\overline{RESET}$ = V_{DDP}, no load on ports.

6) I_{DDP} (idle mode with slow-down mode) is measured with: CPU clock disabled, watchdog timer disabled, input clock to all peripherals enabled and running at 833 KHz by setting CLKREL in CMCON to 0101_B, $\overline{RESET}$ = V_{DDP}, no load on ports.

4.3 AC Parameters

4.3.1 Testing Waveforms

The testing waveforms for rise/fall time, output delay and output high impedance are shown in **Figure 38**, **Figure 39** and **Figure 40**.

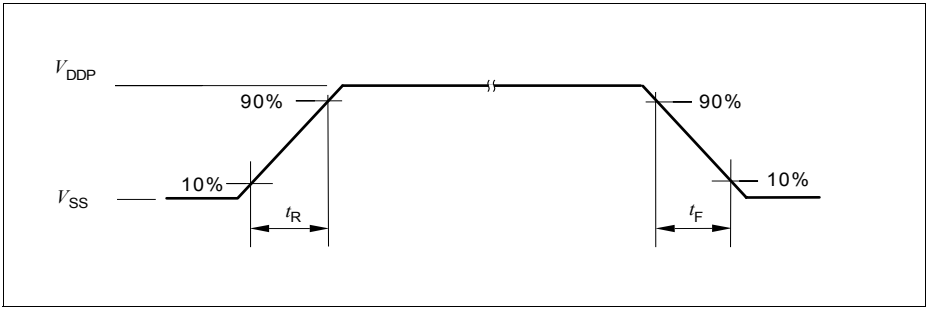

Figure 38 Rise/Fall Time Parameters

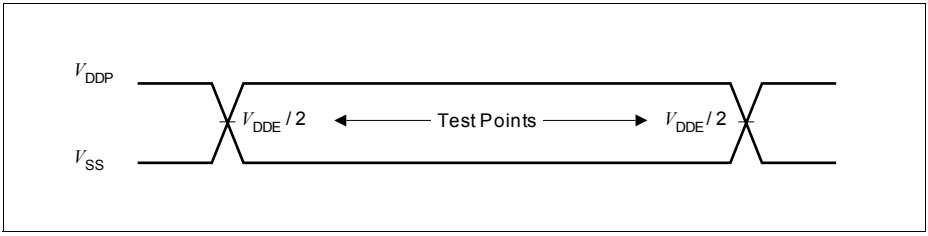

Figure 39 Testing Waveform, Output Delay

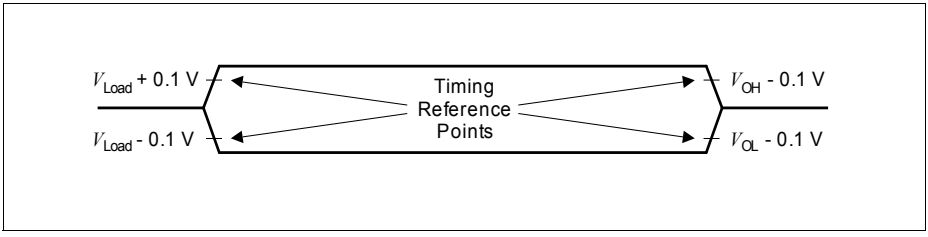

Figure 40 Testing Waveform, Output High Impedance

4.3.2 Output Rise/Fall Times

Table 41 Output Rise/Fall Times Parameters (Operating Conditions apply)

Parameter	Symbol	Limit Values		Unit	Test Conditions
		min.	max.		
V_{DDP} = 5V Range					
Rise/fall times [1] [2]	t_R, t_F	–	10	ns	20 pF. [3]
V_{DDP} = 3.3V Range					
Rise/fall times [1] [2]	t_R, t_F	–	10	ns	20 pF. [4]

[1] Rise/Fall time measurements are taken with 10% - 90% of the pad supply.

[2] Not all parameters are 100% tested, but are verified by design/characterization and test correlation.

[3] Additional rise/fall time valid for C_L = 20pF - 100pF @ 0.125 ns/pF.

[4] Additional rise/fall time valid for C_L = 20pF - 100pF @ 0.225 ns/pF.

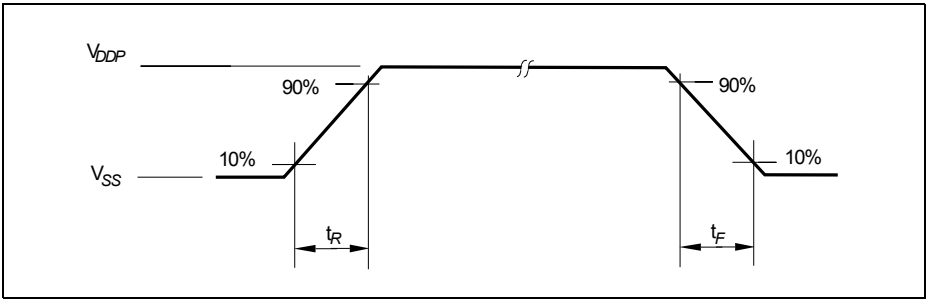

Figure 41 Rise/Fall Times Parameters