

8. Power Management and Sleep Modes

The high performance and industry leading code efficiency makes the AVR microcontrollers an ideal choice for low power applications.

Sleep modes enable the application to shut down unused modules in the MCU, thereby saving power. The AVR provides various sleep modes allowing the user to tailor the power consumption to the application's requirements.

Figure 7-1 on page 22 presents the different clock systems in the ATTiny25/45/85, and their distribution. The figure is helpful in selecting an appropriate sleep mode. Table 8-1 on page 33 shows the different sleep modes, their wake-up sources and BOD Disable ability.

Table 8-1. Active Clock Domains and Wake-up Sources in the Different Sleep Modes

Sleep Mode	Active Clock Domains					Oscillators	Wake-up Sources						
	clk _{CPU}	clk _{FLASH}	clk _{IO}	clk _{ADC}	clk _{PCK}	Main Clock Source Enabled	INT0 and Pin Change	SPM/EEPROM Ready	USI Start Condition	ADC	Other I/O	Watchdog Interrupt	Software BOD Disable
Idle			X	X	X	X	X	X	X	X	X	X	
ADC Noise Reduction				X		X	X ⁽¹⁾	X	X	X		X	
Power-down							X ⁽¹⁾		X			X	X ⁽²⁾

- Note:
1. For INT0, only level interrupt.
 2. The software BOD Disable is available in ATTiny45.

To enter any of the three sleep modes, the SE bit in MCUCR must be written to logic one and a SLEEP instruction must be executed. The SM1:0 bits in the MCUCR Register select which sleep mode (Idle, ADC Noise Reduction or Power-down) will be activated by the SLEEP instruction. See Table 8-2 for a summary.

If an enabled interrupt occurs while the MCU is in a sleep mode, the MCU wakes up. The MCU is then halted for four cycles in addition to the start-up time, executes the interrupt routine, and resumes execution from the instruction following SLEEP. The contents of the Register File and SRAM are unaltered when the device wakes up from sleep. If a reset occurs during sleep mode, the MCU wakes up and executes from the Reset Vector.

8.1 BOD Disable

When the Brown-out Detector (BOD) is enabled by BODLEVEL fuses, Table 23-4 on page 151, the BOD is actively monitoring the power supply voltage during a sleep period. To save power, in ATTiny45 it is possible to disable the BOD by software for some of the sleep modes, see Table 8-1 on page 33. The sleep mode power consumption will then be at the same level as when BOD is globally disabled by fuses. If BOD is disabled in software, the BOD function is turned off immediately after entering the sleep mode. Upon wake-up from sleep, BOD is automatically enabled again. This ensures safe operation in case the V_{CC} level has dropped during the sleep period.