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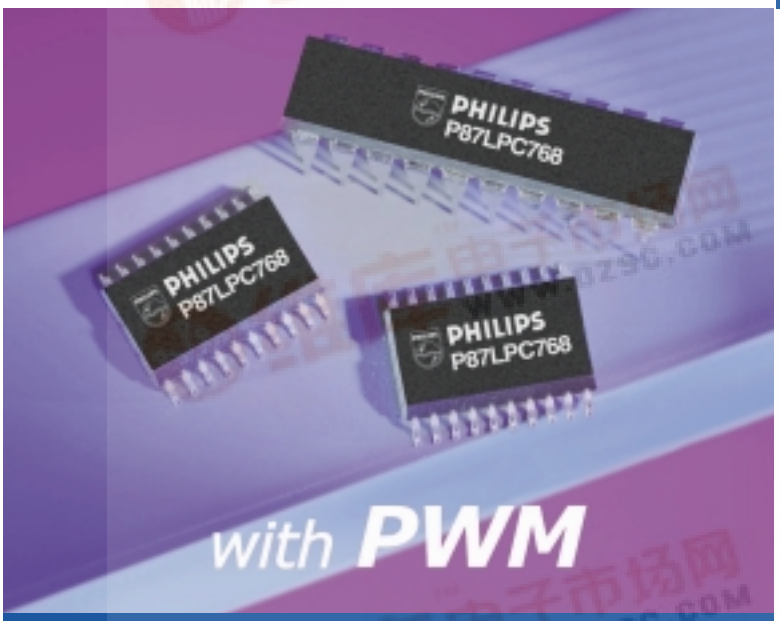
51LPC

Low Power, Low System Cost 80C51 MCU with ADC and PWM

P87LPC768



The P87LPC768 is available in 20-pin SOIC and PDIP packages

Key Features

- 4-channel Pulse Width Modulator (PWM) generator
  - — Configurable resolution 1 – 10 bits
- 4-channel, 8-bit Analog-to-Digital Converter
  - — 9.3 microseconds conversion time at 20 MHz
  - — 100% accelerated C51 CPU core runs at 6 clocks per instruction
- 20 MHz maximum operating frequency 4.5 – 6.0V and 10 MHz maximum operating frequency 2.7 – 6.0V
- Configurable brownout reset detector
- On-chip serial communications interfaces
  - — UART
  - — I^2C
- Five I/O pin modes, individually selectable for each pin
  - — Quasi bi-directional
  - — Push-pull output
  - — Open drain output
  - — Input
  - — Schmitt trigger input
- Up to 18 pins usable for general purpose I/O

As a member of the 51LPC microcontroller family, the 87LPC768 offers an 8-bit ADC with four multiplexed channels and an 8-bit Pulse Width Modulator (PWM.) Further, the device provides 4K of OTP code memory and 128 bytes of data SRAM, making it suitable for high-level programming. The code memory is In-System Programmable (ISP) through a serial interface. Other embedded features that reduce the need for external components are brownout detection, power-on reset and an on-chip RC oscillator that is very stable over temperature and voltage.

The MCU core is fully compatible with the industry-standard C51 core, but features a 2X speed mode, where the CPU clock is divided by 6 instead of 12. At 20 MHz, the 51LPC family devices provide a throughput identical to a conventional C51 running at 40 MHz, thus minimizing EMI and power consumption. The 87LPC768 is manufactured in Philips Semiconductor's low-power CMOS technology and is well suited for use in battery powered applications. At 32kHz, the device consumes only 16µA and the operating voltage ranges from 2.7 – 6.0V (3.0 – 6.0V for analog peripherals). A fixed-frequency oscillator running at 6 MHz can be used to clock the device in applications that do not require the high accuracy of a crystal. Regardless of the clock source used, the user can reduce operating frequency down to as much 1/512 of the source frequency, allowing the user to optimize performance and power consumption on-the-fly. Use of the on-chip power-on reset and oscillator makes up to 18 I/O pins available to the user, leaving only two non-I/O pins for connection to power and ground.

Because the P87LPC768 combines an embedded ADC and PWM, it is especially useful in applications that include dynamic positioning, speed and temperature control. The PWM provides very high flexibility since the output resolution can be configured to any number of bits up to 10.

The device comes with extensive serial communication capabilities. On-chip UART provides serial communications for RS-232 and RS-485. The I^2C interface provides interface to other I^2C units such as serial EEPROMs, other MCUs and a variety of peripheral devices. These communications interfaced in combination with the analog capabilities makes the 87LPC768 ideal for a variety of sensor applications.

Ordering Information

Part Number	Temperature (C)	Package Description	Operating Frequency
P87LPC768BN	0 to +70	Plastic Dual In-Line [PDIP20]	All devices operate at
P87LPC768BD	0 to +70	Plastic Small Outline [SOIC20]	20MHz @ 4.5 to 6.0V
P87LPC768FN	–40 to +85	Plastic Dual In-Line [PDIP20]	10MHz @ 2.7 to 6.0V
P87LPC768FD	–40 to +85	Plastic Small Outline [SOIC20]	

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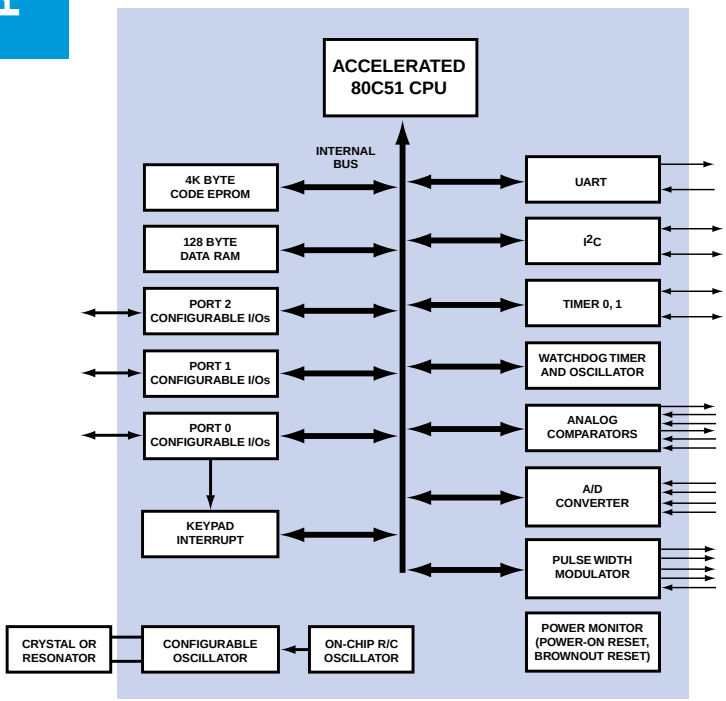
LPC768 Block Diagram



Features

- An accelerated 80C51 CPU provides instruction cycle times of 300–600 ns for all instructions except multiply and divide when executing at 20 MHz. Execution at up to 20 MHz when V_{DD} = 4.5 V to 6.0 V, 10 MHz when V_{DD} = 2.7 V to 6.0 V.
- Four-channel Pulse Width Modulator.
- Four-channel multiplexed 8-bit A/D converter. Conversion time of 9.3 microseconds at f_{osc} = 20 MHz.
- 2.7 V to 6.0 V operating range for digital functions.
- 4 K bytes OTP memory.
- 128 byte RAM data memory.
- 32-byte customer code EPROM allows serialization of devices, storage of setup parameters, etc.
- Two 16-bit counter/timers. Each timer may be configured to toggle a port output upon timer overflow.
- Two analog comparators.
- Full duplex UART.
- I^2C communication port.
- Eight keypad interrupt inputs, plus two additional external interrupt inputs.
- Four interrupt priority levels.
- Watchdog timer with separate on-chip oscillator, requiring no external components. The watchdog timeout time is selectable from 8 values.
- Active low reset. On-chip power-on reset allows operation with no external reset components.
- Low voltage reset. One of two preset low voltage levels may be selected to allow a graceful system shutdown when power fails. May optionally be configured as an interrupt.
- Oscillator Fail Detect. The watchdog timer has a separate fully on-chip oscillator, allowing it to perform an oscillator fail detect function.
- Configurable on-chip oscillator with frequency range and RC oscillator options (selected by user programmed EPROM bits). The RC oscillator option allows operation with no external oscillator components.
- Programmable port output configuration options: quasi-bidirectional, open drain, push-pull, input-only.
- Selectable Schmitt trigger port inputs.
- LED drive capability (20 mA) on all port pins.
- Controlled slew rate port outputs to reduce EMI. Outputs have approximately 10 ns minimum ramp times.
- 15 I/O pins minimum. Up to 18 I/O pins using on-chip oscillator and reset options.
- Only power and ground connections are required to operate the 87LPC768 when fully on-chip oscillator and reset options are selected.
- Serial EPROM programming allows simple in-circuit production coding. Two EPROM security bits prevent reading of sensitive application programs.
- Idle and Power Down reduced power modes. Improved wakeup from Power Down mode (a low interrupt input starts execution). Typical Power Down current is 1 microamp.
- 20-pin DIP and SO packages.

For more information, contact your Philips Semiconductors distributor or www.PhilipsMCU.com

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