

WPC8768L, WPC8769L Mobile Embedded Controller with SPI™ Flash Interface and MCE-Compliant CIR Port

General Description

The Winbond WPC8768L and WPC8769L are highly integrated embedded controllers (EC) with an embedded RISC core and integrated advanced functions. They are targeted for a wide range of portable applications.

The WPC8768L/WPC8769L incorporate the CompactRISC® CR16CPlus core (a high-performance 16-bit RISC processor), on-chip ROM and RAM memories, system support functions and a Flash Interface Unit (FIU) that interfaces directly with external SPI flash memory devices.

System support functions include: watchdog, PWM, timers, interrupt control, General-Purpose I/O (GPIO) with internal keyboard matrix scanning, PS/2® interface, SMBus® interface, UART, SPI™, high-accuracy analog-to-digital (ADC) and digital-to-analog (DAC) converters for battery charging, system control, system health monitoring and analog controls, and a SensorPath™ interface.

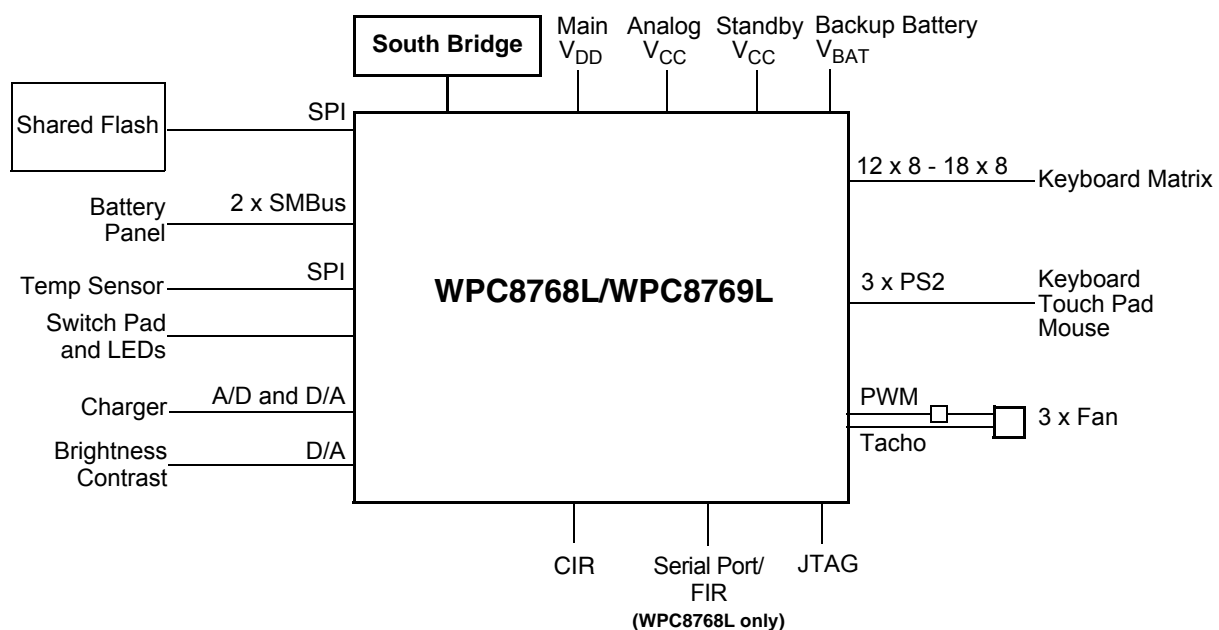
The WPC8768L/WPC8769L interface with the host via an LPC interface. They also include a host-controlled Serial Port, CIR Port and Fast Infrared (FIR, IrDA 1.1 compliant) Port (**WPC8768L only**).

The WPC8768L/WPC8769L are PC01 and ACPI compliant, and offer a single-chip solution for the most commonly used notebook PC I/O peripherals.

Outstanding Features

- Shared BIOS flash memory
- Support for SPI flash memories
- Flash page programming support
- MCE-compliant Consumer Infrared (CIR) Port
- Fast Infrared Port (FIR, IrDA 1.1 compliant) (**WPC8768L only**)
- High-accuracy, high-speed ADC
- Up to 88 GPIO ports (including keyboard scanning) with a variety of wake-up events
- 16-bit RISC core, with up to 4 Mbytes of external address space, running at up to 25 MHz
- 128-pin LQFP package

System Block Diagram



Device-Specific Information

The following table shows the main differences between the WPC8768L and WPC8769L devices.

Feature	WPC8768L	WPC8769L
FIR Port	✓	✗

Features

Embedded Controller Features

- Processing Unit
 - CompactRISC CR16CPlus 16-bit embedded RISC processor core (the “core”)
 - Up to 4 Mbytes of external address space
- Internal Memory
 - 1 Kbyte of ROM
 - 4 Kbytes of on-chip RAM
 - All memory types can hold both code and data
- Flash Interface Unit (FIU)
 - Up to 4 Mbytes of code and data
 - Hardware-protected boot zone block protection
 - SPI External Memory
 - Up to 32 Mbits
 - Fast Read mode
 - Page programming support
 - Configurable clock rate
 - Field upgradeable
- Shared Memory Controller (SHM)
 - Supports BIOS (flash) memory sharing with PC host
 - Supports host-controlled code download and update
 - Memory access protection

LPC System Interface

- Based on Intel's *LPC Interface Specification Revision 1.1*, August 2002
- Four optional 8-bit DMA channels
- I/O, Memory and 8-bit Firmware Memory read and write cycles, Firmware Memory writes may insert wait cycles
- Bootable Memory Support
- Base Address (BADDR1-0) straps to determine the base address of the index-data register pair
 - Alternate base address configurable by the core
- $\overline{\text{LPCPD}}$ and $\overline{\text{CLKRUN}}$ support

Embedded Controller System Features

- Host Interface
 - Comprises host interface channels, typically used for KBC and ACPI Private or Shared EC channels
 - 8042 KBC-standard interface (legacy 60h, 64h)
 - Two PM interface ports (legacy 62h, 66h; 68h, 6Ch)
 - ACPI EC with either Shared or Private interface through the PM interface
 - Two Mailbox areas for host-core communication, up to 4 Kbytes each; maximum 4 Kbytes total
 - Generates IRQ, SMI and SCI
 - Provides IRQ1 and IRQ12 support
 - Provides Fast Gate A20 and Fast Host reset via firmware
- Interrupt Control Unit (ICU)
 - 31 maskable vectored interrupts (of which eight are external)
 - General-purpose external interrupt inputs through MIWU
 - Enable and pending indication for each interrupt
 - Non-maskable interrupt input
- Multi-Input Wake-Up (MIWU)
 - Up to 40 wake-up or interrupt inputs
 - Generates wake-up event to PMC (Power Management Controller)
 - Generates interrupts to ICU
 - User-selectable trigger conditions
- Internal Keyboard Matrix Scanning
 - Up to 18 open-collector outputs (at least 12)
 - Eight Schmitt inputs with internal pull-ups
- General-Purpose I/O (GPIO) Ports
 - 64 port pins
 - I/O pins individually configured as input or output
 - Configurable internal pull-up / pull-down resistors
 - Outputs individually configured as push-pull or open-drain
 - Two echo inputs with wake-enabled interrupts
 - Additional 12 GPIOs with wake-enabled interrupts
 - Four GPIOs capable of 12 mA sink current
 - Seven GPIOs are accessible to the host
 - Optional low-cost external GPIO expansion through the SensorPath interface
- PS/2 Interface
 - Three external ports: can be used for keyboard, mouse and an additional pointing device
 - Byte-level handling via hardware accelerator

Features (Continued)

- Two SMBus (SMB) Interface Modules; each module:
 - Is Intel SMBus, Philips I²C[®] and ACCESS.bus compatible
 - Is SMBus master and slave
 - Supports up to two simultaneous slave addresses
 - Supports polling- and interrupt-controlled operations
 - Generates a wake-up signal on detection of a Start condition while in Idle mode
 - Supports an optional internal pull-up on SDA and SCL pins
 - Core Universal Asynchronous Receiver-Transmitter (CR_UART) Module
 - A full-duplex UART channel
 - Programmable baud rate
 - Data transfer via interrupt or polling
 - Two 16-bit Multi-Function Timer (MFT16) Modules; each module has:
 - Two 16-bit timers with a 5-bit prescaler
 - Pulse Width Modulation (PWM), Capture and Timer/Counter modes
 - Capture inputs with programmable edge detection
 - An interrupt on compare match
 - Two Pulse Width Modulation (PWM) Modules
 - Group A_PWM: two outputs
 - Group B_PWM: one output
 - Serial Peripheral Interface (SPI) Module
 - Bus master
 - 8-bit interface
 - Up to 10 MHz data clock rate
 - Clock can be selected to be high or low in Idle mode
 - Clock polarity can be selected for normal (sample on rising edge) or alternate (sample on falling edge)
 - Timer and Watchdog (TWD)
 - 16-bit periodic interrupt timer with 30 μ s resolution and 5-bit prescaler for system tick and periodic wake-up tasks
 - 8-bit watchdog timer with enable/disable
 - “Watchdog occurred” flag
 - Two watchdog reset options: warm or cold
 - SensorPath™ Bus Interface
 - Single Wire bus master
 - Supports up to seven slave devices
 - x1, x4 SensorPath clock rate support
 - Analog-to-Digital Converter (ADC)
 - Six channels, with 8-bit resolution
 - 125 μ s conversion time
 - External voltage reference
 - Digital-to-Analog Converter (DAC)
 - Four channels, 8-bit resolution
 - 1 μ s conversion time for 50 pF load
 - Full output range from AGND to AVCC
 - Development Support
 - Interface to debugger via Nexus 5001 interface
 - Physical connection using JTAG
 - On-board Debug mode with eight hardware breakpoints
 - Embedded memory programming via JTAG with content read protection
 - Core Access to Host Modules
 - Enabled via lock mechanism
- ### Host Function Features
- Mobile System Wake-Up Control (MSWC)
 - Software-controlled off events
 - Event routing to IRQ, $\overline{\text{SMI}}$ or $\overline{\text{PWUREQ}}$
 - Host- or Core-Controlled CEIR (Consumer Electronic IR) Receiver
 - Supports RC-5, RC-6 and NEC protocols
 - Wake-up on a pre-configured message
 - Infrared Port
 - Supports IR learning and emitting
 - Software compatible with the 16550A and the 16450
 - Shadow register support for write-only bit monitoring
 - HP-SIR
 - ASK-IR option of SHARP-IR
 - DASK-IR option of SHARP-IR
 - Consumer Remote Control supports RC-5, RC-6, NEC, RCA and RECS 80
 - Fast Infrared (FIR) Port (**WPC8768L only**)
 - Software compatible with the 16550A and the 16450
 - Shadow register support for write-only bit monitoring
 - FIR IrDA 1.1 compliant
 - HP-SIR
 - ASK-IR option of SHARP-IR
 - DASK-IR option of SHARP-IR
 - Consumer Remote Control supports RC-5, RC-6, NEC, RCA and RECS 80
 - DMA support: one or two channels
 - Serial Port (SP)
 - In the WPC8768L, SP can be used only when FIR is not needed
 - Software compatible with the 16550A and the 16450
 - Shadow register support for write-only bit monitoring
 - UART data rates up to 1.5 Mbaud
 - Supports *Microsoft[®] Advanced Power Management (APM) Specifications Revision 1.2*, February 1996
 - Generates the System Management Interrupt (SMI)
 - PC01 Rev 1.0 and ACPI 3.0 Compliant
 - PnP configuration register structure
 - Flexible resource allocation for all logical devices
 - Relocatable base address
 - 15 IRQ routing options
 - Four optional 8-bit DMA channels (where applicable)

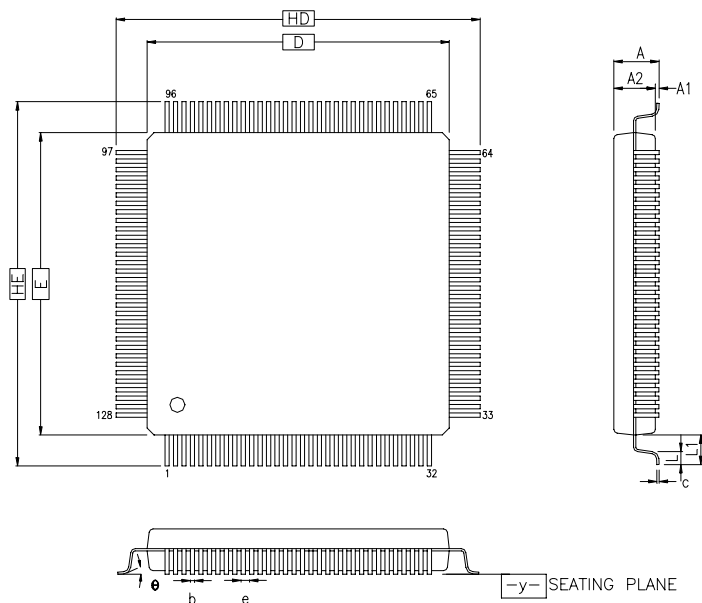
Features (Continued)

Clocking, Supply and Package Information

- Strap Input-Controlled Operating Modes:
 - Shared BIOS memory mode
 - TRI-STATE[®] mode
 - Development mode
- Clocks
 - Single 32.768 KHz crystal oscillator
 - On-chip high-frequency clock generators
 - Either 32.768 KHz or CR16CPlus clock out
- Testability
 - XOR-tree structure includes all device pins (except supply, A/D, D/A, and crystal oscillator pins), selected at power-up by strap inputs
 - TRI-STATE device pins, selected at power-up by strap input (TRIS)
- Power Supply
 - 3.3V supply operation
 - 5V tolerance and back-drive protection on all pins (except crystal oscillator, A/D, D/A, LPC bus, and SPI flash pins)
 - Separate supply for host I/F (V_{DD}) and EC functions (V_{CC})
 - Backup battery input for wake-up configuration
 - Reduced power consumption capability
 - Software- or hardware-switched power modes:
 - Active mode
 - Active mode executing WAIT
 - Idle
 - Deep Idle
 - Suspend
 - Power Off, for oscillator only, from the backup battery
 - Automatic wake-up on system events
- Package Options
 - 128-pin LQFP package

Physical Dimensions

Control dimensions are in millimeters



SYMBOL	MILLIMETER			INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	—	—	1.60	—	—	0.063
A1	0.05	—	0.15	0.002	—	0.006
A2	1.35	1.40	1.45	0.053	0.055	0.057
HD	16.00 BSC.			0.630 BSC.		
D	14.00 BSC.			0.551 BSC.		
HE	16.00 BSC.			0.630 BSC.		
E	14.00 BSC.			0.551 BSC.		
b	0.13	0.16	0.23	0.005	0.006	0.009
e	0.40 BSC.			0.016 BSC.		
θ	0°	3.5°	7°	0°	3.5°	7°
c	0.09	—	0.20	0.004	—	0.008
L	0.45	0.60	0.75	0.018	0.024	0.030
L ₁	1.00 REF			0.039 REF		
y	—	—	0.1	—	—	0.004

128-Pin Low-Profile Plastic Quad Flatpack (LQFP) Order Numbers WPC8768LDG / WPC8769LDG

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