Product Brief
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Revision 1.0

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.

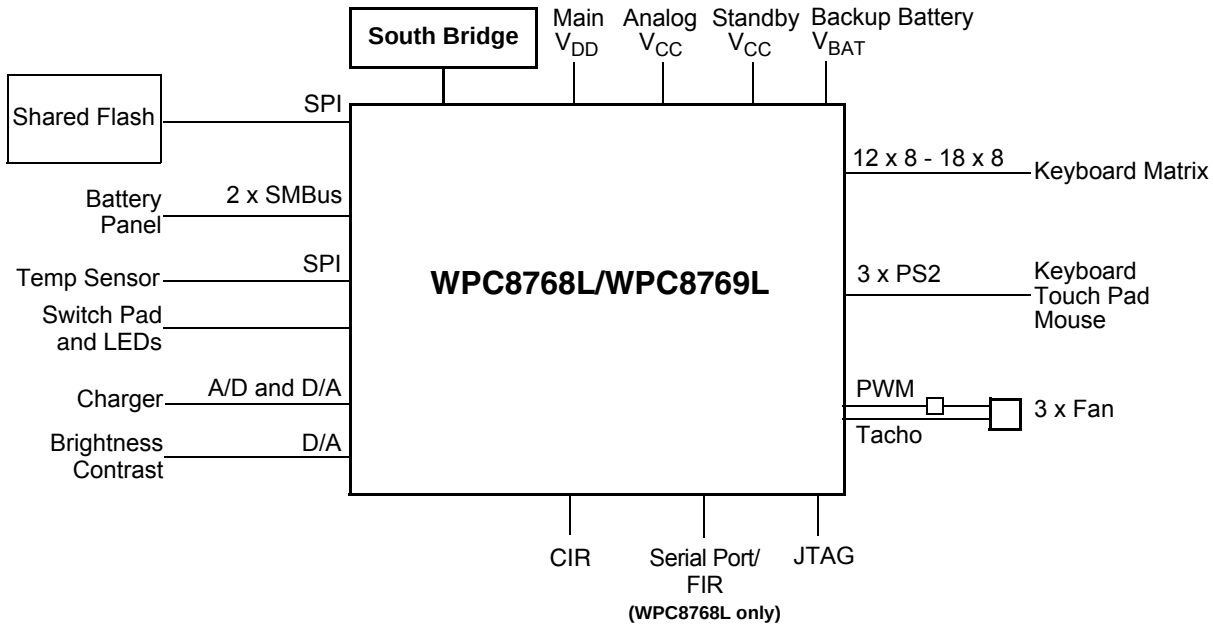
The WPC8768L/WPC8769L interface with the host via an LPC interface. They also include a host-controlled Serial Port, CIR Port and Fast Infrared (FIR, IrDA 1.1 compliant) Port **(WPC8768L only)**.

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 programing 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 programing 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 μs 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 μs conversion time
  - External voltage reference
- Digital-to-Analog Converter (DAC)
  - Four channels, 8-bit resolution
  - 1 μs 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 programing 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)

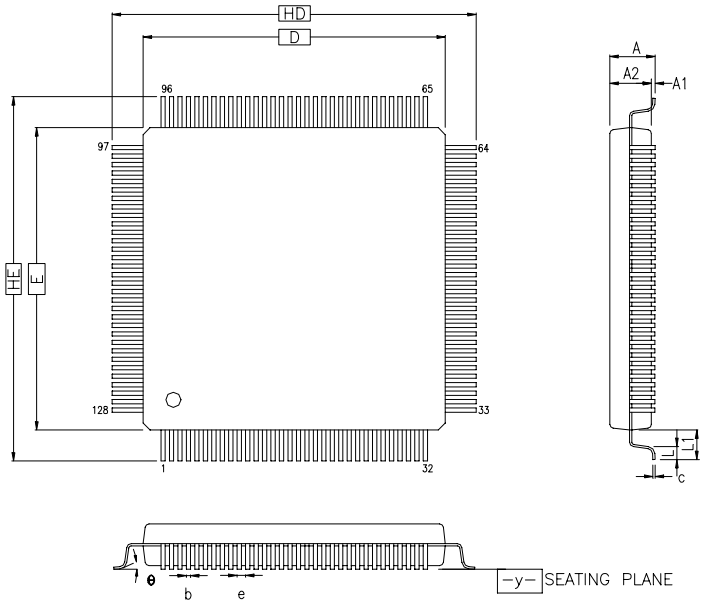
Features (Continued)

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 ($\overline{TRIS}$)
- 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
A_1	0.05	—	0.15	0.002	—	0.006
A_2	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

Important Notice

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