Operation Modes

[0051] (A) Normal Operation Mode:

[0052] When the PC is fully powered and running under the full system OS, the various functions of special purpose circuit **40** are bypassed and switches **60** are closed, as discussed above. In the normal mode, the computer system uses the South Bridge AC97 Controller **50** to directly control the AC97 Codec **42** through the AC_link (in the Normal mode AC_link_1 and AC_link_2 are the same since switches **60** are closed. The special purpose circuit does not intercept or modify the AC_link signals.

[0053] (B) Compressed Audio Performance Mode:

[0054] When switch **54** has been closed, the system runs under the control of mini-OS, and special purpose circuit **40** is empowered and runs in the compressed audio performance mode. The South Bridge AC97 Controller **50** is isolated from the AC97 Codec **42** in this mode since switches **60** are open.

[0055] In the compressed audio performance mode, the host (CPU **26**) sets the internal registers of register block **66** to control the data flow to the AC97 Codec **42**, and to perform the various power management functions.

A Power Saving Control Method in Compressed Audio Performance Mode

[0056] A flexible control method of the special purpose circuit **40** is provided to minimize the system control cycles and power consumption in the performance mode. The system memory (RAM **30**) is used to pass most of the control commands to the special purpose circuit **40**, instead of CPU **26**, which minimizes the time that CPU **26** needs to access high speed external bus other than a standby level. This considerably reduces the power load on the portable computer battery in this mode.

[0057] CPU **26** also sets the system control memory registers in register block **66**. State machine **64** bases operation on those register settings to obtain control words and PCM data automatically through the LPC interface **62**. The control words in the system memory (RAM **30**) are fetched into the internal registers, and the state machine **64** decodes the control words to determine if PCM or audio data is ready. If the audio data is ready, the state machine **64** continues to fetch the audio data and send it to the AC97 Codec **42**. The control words in the system memory (RAM **30**) can also be used to indicate the sampling frequency of the PCM data. So, the state machine **64** can set AC97 Codec **42** to the appropriate frequency before the PCM data is sent.

[0058] Those skilled in the art will recognize that a headphone or headset system may comprise further functionality than described hereinabove, e.g., a volume control, or the audio control buttons may be integrated thereto.

[0059] It should also be recognized that a special purpose circuit consistent with the invention may be integrated into a full-time compressed (and/or non-compressed) audio playing system capable of playing music regardless of the operation of the rest of the system. In this configuration, the special purpose circuit and mini-OS are provided, as well as a software driver for handling interrupts from the function buttons under Windows®. In this configuration, when the rest of the system is either fully on (**S0**) or in "sleep" (suspend to RAM or **S3**) mode, the system may be configured to begin execution of a custom or standard audio player, e.g., Music Match or Windows® Media Player, running under Windows®, which may be adapted to play the compressed audio files stored in the play list. In this scenario, the function buttons may be adapted for use in a passthrough-type mode using the accompanying software driver to control various features of the audio player software, e.g., Music Match, instead of controlling the special purpose circuit. When the primary operating system such as Windows® is either fully off (**S5**) or in "hibernate" (suspend to HDD or **S4**) mode, operation of the special purpose circuit may proceed to play compressed audio files from the play list as described hereinabove, wherein the function buttons control the special purpose circuit.

[0060] It is noted that the power states described above (i.e., fully on, sleep/suspend to RAM, fully off, hibernate/suspend to HDD) are often referred to using the Advanced Configuration and Power Interface ("ACPI") standard conventions, as follows: The typical operating system (e.g., Windows®) supports six system power states, referred to as **S0** (fully on and operational) through **S5** (power off). Each state is characterized by the following: power consumption, i.e. how much power the computer uses; software resumption, i.e., from what point the operating system restarts; hardware latency, i.e., how long it takes to return the computer to the working state; and system context, i.e. how much system context is retained, or whether the operating system must reboot to return to the working state. State **S0** is the working state. States **S1**, **S2**, **S3**, and **S4** are sleeping states, in which the computer appears off because of reduced power consumption but retains enough context to return to the working state without restarting the operating system. State **S5** is the shutdown or off state. A system is waking when it is in transition from the shutdown state (**S5**) or any sleeping state (**S1**-**S4**) to the working state (**S0**), and it is going to sleep when it is in transition from the working state to any sleep state or the shutdown state. the system cannot enter one sleep state directly from another; it must always enter the working state before entering any sleep state. For example, a system cannot transition from state **S2** to **S4**, nor from state **S4** to **S2**. It must first return to **S0**, from which it can enter the next sleep state. Because a system in an intermediate sleep state has already lost some operating context, it must return to the working state to restore that context before it can make an additional state transition.

[0061] Referring now to **FIG. 2**, in conjunction with **FIG. 3**, an exemplary sequence **200** for the power up of the mini-OS and initiation of the player function, in one embodiment of the present invention, is illustrated. As stated above, at some time prior to the initiation of the audio player function of a PC equipped with the present invention, the user downloads (not shown in **FIG. 2**) the audio files of interest to the HDD **36** or burns a CD-ROM that is placed in the CD-ROM drive **38** for use with the audio player feature of the present invention. As shown, at step **201**, the sequence **200** begins when the user presses either an audio player power switch **54** or the computer's main power switch (not shown in **FIG. 3**), to turn the system on. A determination is then made, at step **202**, whether the computer is to boot in normal operation mode or compressed audio performance mode. This determination is typically made in the BIOS, based on whether the computer's power switch or an audio player power switch **54** was used to turn