

## A Highly Integrated USB Audio Single Chip

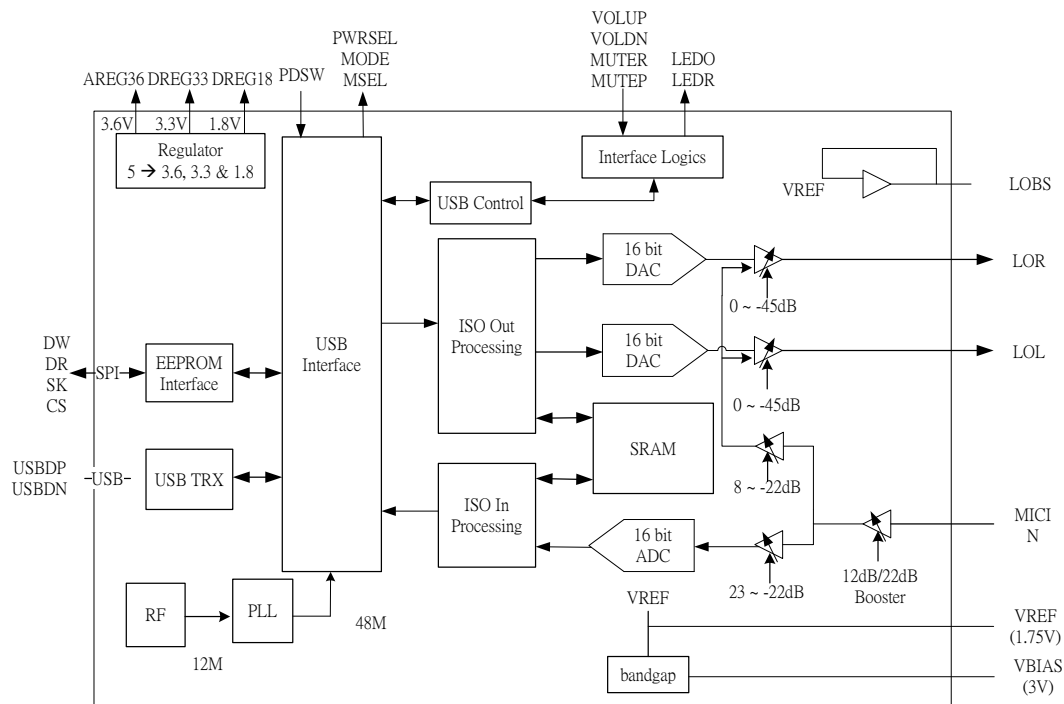
### DESCRIPTION

The HS-100B is a highly-integrated, crystal-free USB audio single chip solution optimized typically for USB headset, headphone, and dongle (wireless adapter enabled) applications. All necessary analog and digital modules were embedded in the HS-100B, including stereo DAC and earphone driver; mono ADC; microphone pre-amp booster; PLL; regulator; and USB transceiver. Many features of the HS-100B are programmable with jumper pins or external EEPROM. Customers can customize unique USB VID / PID / Product String / Manufacture String and max / min / initial volume settings via an external EEPROM. In addition, the HS-100B supports HID compliant volume control pins such as Playback Mute, Volume Up/Down and a Record Mute pin which interacts with the playback operation LED and record mute LED control pins. The HS-100B also comes with an anti-pop noise circuits design and internal oscillator which can operate without an external crystal oscillator.

### FEATURES

- Compliant with USB 2.0 Full-Speed operation
- Compliant with USB Audio Device class specification v1.0
- Supports USB Suspend/Resume Mode and remote wakeup with volume control pins
- On-chip oscillator that provides reference sources for PLL and embedded USB transceiver
- Jumper pin for Headset Mode (Playback + Recording) and Speaker/Headphone Mode (Playback Only)
- Jumper pin for Mixer Unit enable/disable under Headset Mode
- Jumper pin for Power Mode setting
- USB audio function topology that has 2 Input Terminals, 2 Output Terminals, 1 Mixer Unit, 1 Selector Unit, and 3 Feature Units. (Headset Mode)
- USB audio function topology that has 1 Input Terminal, 1 Output Terminal, and 1 Feature Unit. (Speaker Mode)
- Anti-pop noise design for device plugged and vice-versa.

### BLOCK DIAGRAM



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**Revision notes**

| Revision | Date        | Description   |
|----------|-------------|---------------|
| 1.0      | 27 Sep 2013 | First release |

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## 1 Description and Overview

The HS-100B is a highly-integrated, crystal-free USB audio single chip solution optimized typically for USB headset, headphone, and dongle (wireless-adapter enabled) applications. All necessary analog and digital modules are embedded in the HS-100B, including stereo DAC and earphone driver; mono ADC; microphone pre-amp booster; PLL; regulator; and USB transceiver. Many features of the HS-100B are programmable with jumper pins or external EEPROM. Customers can customize unique USB VID / PID / Product String / Manufacture String and max / min / initial volume settings via an external EEPROM. In addition, the HS-100B supports HID compliant volume control pins such as Playback Mute, Volume Up/Down and a Record Mute pin which interacts with the playback operation LED and record mute LED control pins. The HS-100B also comes with an anti-pop noise circuits design and internal oscillator which can operate without an external crystal oscillator. With turn-key reference design, customers can easily and quickly deliver the quality USB headset peripherals to the market.

## 2 Ordering Information

| Product | Package Marking | Package Type                       | Transport Media | Storage Temperature |
|---------|-----------------|------------------------------------|-----------------|---------------------|
| HS-100B | HS-100B         | LQFP-48 (7 x 7mm)<br>Green Package | Tray            | -45 to 120°C        |

## 3 Features

- Compliant with USB 2.0 Full-Speed operation
- Compliant with USB Audio Device class specification v1.0
- Supports USB Suspend/Resume Mode and remote wakeup with volume control pins
- On-chip oscillator that provides reference sources for PLL and embedded USB transceiver
- Jumper pin for Headset Mode (Playback + Recording) or Speaker/Headphone Mode (Playback Only)
- Jumper pin for Mixer Unit enable/disable under Headset Mode
- Jumper pin for Power Mode setting
- USB audio function topology that has 2 Input Terminals, 2 Output Terminals, 1 Mixer Unit, 1 Selector Unit, and 3 Feature Units. (Headset Mode)
- USB audio function topology that has 1 Input Terminal, 1 Output Terminal, and 1 Feature Unit. (Speaker Mode)
- Anti-pop noise design for device plugged and vice-versa, while A-A path is off.
- Supports one control endpoint, one Isochronous out endpoint, one Isochronous in endpoint, and one Interrupt in endpoint
- Alternate zero bandwidth setting for releasing playback bandwidth on USB bus when this device is inactive
- Includes Volume up, volume down, and playback mute support USB HID for PC host system SW volume synchronization
- Record Mute pin with a LED Indicator for record mute status
- External EEPROM interface using SPI (Serial Peripheral Interface) for vendor Specific USB VID, PID, Product String, Manufacture String, Serial Number and initial/min/max volume settings
- Isochronous transfer uses Adaptive Mode with internal PLL for synchronization
- 48K/44.1KHz sampling rate for both playback and recording
- Soft Mute function
- Embedded 16bit audio DAC with earphone phone buffer

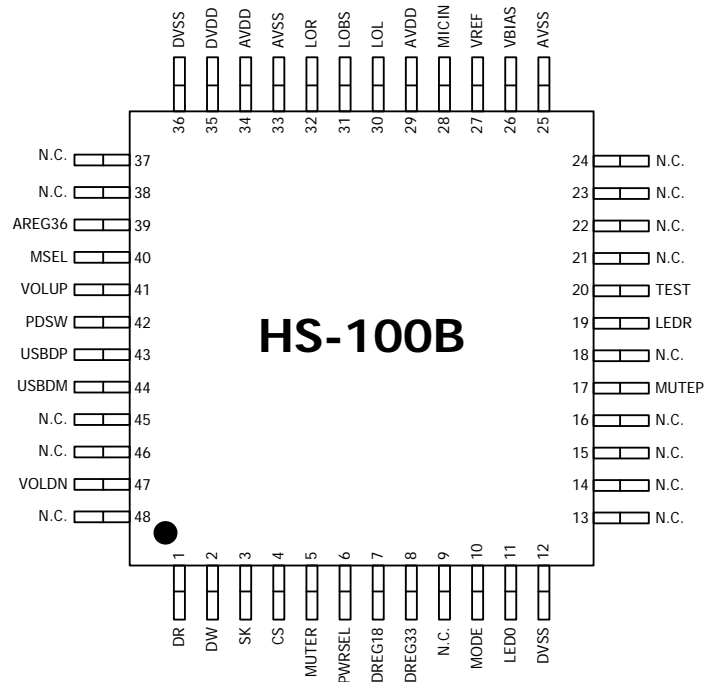
- Embedded 16bit ADC input with Microphone Boost
- Embedded power on reset block
- Embedded 5V to 3.6V / 3.3V / 1.8 V regulators for single external 5V power
- Industrial standard 48-pin LQFP Package

## 4 Pin Descriptions

### 4.1 Pin Assignment

| Pin # | Signal Name | Pin # | Signal Name | Pin # | Signal Name | Pin # | Signal Name |
|-------|-------------|-------|-------------|-------|-------------|-------|-------------|
| 1     | DR          | 13    | N.C.        | 25    | AVSS        | 37    | N.C.        |
| 2     | DW          | 14    | N.C.        | 26    | VBIAS       | 38    | N.C.        |
| 3     | SK          | 15    | N.C.        | 27    | VREF        | 39    | AVDD36      |
| 4     | CS          | 16    | N.C.        | 28    | MICIN       | 40    | MSEL        |
| 5     | MUTER       | 17    | MUTEP       | 29    | AVDD        | 41    | VOLUP       |
| 6     | PWRSEL      | 18    | N.C.        | 30    | LOL         | 42    | PDSW        |
| 7     | VDD         | 19    | LEDR        | 31    | LOBS        | 43    | USBDP       |
| 8     | DVDD33      | 20    | TEST        | 32    | LOR         | 44    | USBDM       |
| 9     | N.C.        | 21    | N.C.        | 33    | AVSS        | 45    | N.C.        |
| 10    | MODE        | 22    | N.C.        | 34    | AVDD        | 46    | N.C.        |
| 11    | LEDO        | 23    | N.C.        | 35    | DVDD        | 47    | VOLDN       |
| 12    | DVSS        | 24    | N.C.        | 36    | DVSS        | 48    | N.C.        |

### 4.2 Pin-out Diagram



### 4.3 Pin-out Diagram

| Pin # | Symbol | Type              | Description   |
|-------|--------|-------------------|---|
| 1     | DR     | DIO, 8mA, PD, 5VT | USB Controller Data Read From EEPROM Interface. EEPROM Data Output.   |
| 2     | DW     | DO, 4mA, SR       | USB Controller Data Writes to EEPROM Interface. EEPROM Data Input.  |
| 3     | SK     | DO, 4mA, SR       | EEPROM Interface Clock (100KHz)   |
| 4     | CS     | DO, 4mA, SR       | EEPROM Interface Chip Select  |
| 5     | MUTER  | DI, ST, PU        | Mute Recording (Edge Trigger with de-Bouncing)  |
| 6     | PWRSEL | DI, ST            | H: Pull Up to 3.3V; L: Pull Down to Ground Speaker Mode H : Self-Power with 100mA ; L : Bus Power with 500mA Headset Mode H : Bus Power with 100mA ; L : Bus Power with 500mA |
| 7     | DREG18 | P                 | 1.8V Regulator Output for Digital Circuit   |
| 8     | DREG33 | P                 | 3.3V Regulator Output for Digital Circuit (driving current 40mA)  |
| 10    | MODE   | DI, ST            | H: Pull Up to 3.3V; L: Pull Down to Ground<br>L : Headset Mode: Playback & Recording<br>H : Speaker Mode: Playback Only   |
| 11    | LEDO   | DO, SR, 4mA       | LED for Operation; Output H for Power On; Toggling for Data Transmit  |
| 12    | DVSS   | P                 | Digital Ground  |
| 17    | MUTEP  | DI, ST, PU        | Mute Playback (Edge Trigger with de-Bouncing)   |
| 19    | LEDR   | DO, SR, 4mA       | LED for Mute Recording Indicator; Output H when Recording is Muted  |
| 20    | TEST   | DI, ST, PD        | Test Mode Select Pin; Pull Low for Normal Operation   |
| 25    | AVSS   | P                 | Analog Ground   |
| 26    | VBIAS  | AO                | Microphone Bias Voltage Supply (3V)   |
| 27    | VREF   | AO                | Connecting to External Decoupling Capacitor for Embedded Band gap Circuit; 1.75V Output   |
| 28    | MICIN  | AI                | Microphone Input, input impedance is 10k Ohm  |
| 29    | AVDD   | P                 | 5V Analog Power for Analog Regulator Circuit  |
| 30    | LOL    | AO                | Line Out Left Channel (Headphone Out Left)  |
| 31    | LOBS   | AO                | DC 1.75V Output for Line Out Bias (Headphone Out Bias) as a cap-less ground   |
| 32    | LOR    | AO                | Line Out Right Channel (Headphone Out Right)  |
| 33    | AVSS   | P                 | Analog Ground   |
| 34    | AVDD   | P                 | 5V Analog Power for Analog Regulator Circuit  |
| 35    | DVDD   | P                 | 5V Digital Power for Digital Regulator Circuit  |
| 36    | DVSS   | P                 | Digital Ground  |
| 39    | AREG36 | P                 | 3.6V Regulator Output for Analog Circuit  |

|   |       |             |   |
|---|-------|-------------|---|
| 40  | MSEL  | DI, ST      | Mixer Enable/Disable pin<br>H: Pull Up to 3.3V, L: Pull Down to Ground<br>L: Without Mixer<br>H: With Mixer (With Default Mute) USB Descriptors are changed accordingly |
| 41  | VOLUP | DI, ST, PU  | Volume Up (Edge Trigger with de-Bouncing)   |
| 42  | PDSW  | DO, 4mA, OD | Power Down Switch Control (for PMOS Polarity)<br>0: Normal Mode, 1: Power Down Mode   |
| 43  | USBDP | AIO         | USB Data D+   |
| 44  | USBDM | AIO         | USB Data D-   |
| 47  | VOLDN | DI, ST, PU  | Volume Down (Edge Trigger with de-Bouncing)   |
| 13-15,<br>18,<br>21-24,3<br>7, 38,<br>45, 46, | NC    | --          | No functions  |

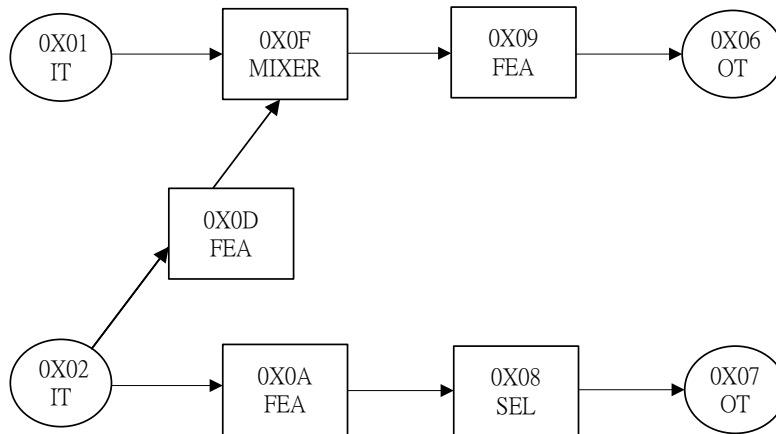
Note: DI - Digital Input Pin, DO - Digital Output Pin, DIO - Digital bi-Directional Pin, AI/AO/AIO - Analog Pin, SR Slew Rate Control, ST - Schmitt Trigger, PD/PU - Pull Down or Pull Up, 5VT - 5-Volt Tolerant (3.3V Pin), OD - Open Drain

## 5 USB Topology

The HS-100B supports headset and speaker topology that can be selected by MODE pin. The topology setting as following: MODE=0, Headset Topology

MODE=1, Speaker Topology

### 5.1 Headset Topology



#### 5.1.1 Device Descriptor

| Offset | Field              | Size | Value (Hex) | Description  |
|--------|--------------------|------|-------------|--|
| 0      | bLength            | 1    | 12          | Total 18 Bytes   |
| 1      | bDescriptorType    | 1    | 01          | Device descriptor  |
| 2      | bcdUSB             | 2    | 0110        | USB 1.1 compliant  |
| 4      | bDeviceClass       | 1    | 00          | Device class specified by interface                                      |
| 5      | bDeviceSubClass    | 1    | 00          | Device subclass specified by interface                                   |
| 6      | bDeviceProtocol    | 1    | 00          | Device protocol specified by interface                                   |
| 7      | bMaxPacketSize0    | 1    | 8           | Endpoint zero Size = 8 bytes   |
| 8      | idVendor           | 2    | 0d8c        | Vendor ID  |
| 10     | idProduct          | 2    | 0014        | Product ID   |
| 12     | bcdDevice          | 2    | 0100        | Device compliant to the Audio Device Class specification version 1.00    |
| 14     | iManufacturer      | 1    | 01          | Index of string descriptor that characterizes manufacturer               |
| 15     | iProduct           | 1    | 02          | Index of string descriptor that characterizes product                    |
| 16     | iSerialNumber      | 1    | 00          | Index of string descriptor that characterizes the device's serial number |
| 17     | bNumConfigurations | 1    | 01          | Configurations number = 1  |

#### 5.1.2 Configuration Descriptor

| Offset | Field               | Size | Value (Hex) | Description  |
|--------|---------------------|------|-------------|--|
| 0      | bLength             | 1    | 09          | Total 9 Bytes  |
| 1      | bDescriptorType     | 1    | 02          | Configuration Descriptor   |
| 2      | wTotalLength        | 2    | XXXX        | Total length of data returned for this configuration:<br>Programmable by MSEL and MODE pin   |
| 4      | bNumInterfaces      | 1    | 04          | Number of interfaces supported by this configuration:<br>0: control interface 1: ISO-OUT interface<br>2: ISO-IN interface 3: INT-IN(HID) interface |
| 5      | bConfigurationValue | 1    | 01          | Configuration value  |



|   |                |   |    |  |
|---|----------------|---|----|--|
| 6 | iConfiguration | 1 | 00 | Index of string descriptor that characterizes this configuration |
| 7 | bmAttributes   | 1 | 80 | Bus Power and support Remote Wakeup                              |
| 8 | bMaxPower      | 2 | 32 | Maximum power consumption of the USB Device: 100mA               |

## 5.2 Speaker Topology



### 5.2.1 Device Descriptor

| Offset | Field              | Size | Value (Hex) | Description   |
|--------|--------------------|------|-------------|---|
| 0      | bLength            | 1    | 12          | Descriptor length   |
| 1      | bDescriptorType    | 1    | 01          | Device descriptor   |
| 2      | bcdUSB             | 2    | 0110        | USB 1.1 compliant   |
| 4      | bDeviceClass       | 1    | 00          | Device class specified by interface                             |
| 5      | bDeviceSubClass    | 1    | 00          | Device subclass specified by interface                          |
| 6      | bDeviceProtocol    | 1    | 00          | Device protocol specified by interface                          |
| 7      | bMaxPacketSize0    | 1    | 08          | Endpoint zero packet size                                       |
| 8      | idVendor           | 2    | 0d8c        | Vendor ID   |
| 10     | idProduct          | 2    | 0014        | Product ID  |
| 12     | bcdDevice          | 2    | 0100        | Device release number   |
| 14     | iManufacturer      | 1    | 01          | Index of string descriptor that characterizes the manufacturer  |
| 15     | iProduct           | 1    | 02          | Index of string descriptor that characterizes the product       |
| 16     | iSerialNumber      | 1    | 00          | Index of string descriptor that characterizes the serial number |
| 17     | bNumConfigurations | 1    | 01          | Number of configuration   |

### 5.2.2 Configuration Descriptor

| Offset | Field               | Size | Value (Hex) | Description   |
|--------|---------------------|------|-------------|---|
| 0      | bLength             | 1    | 09          | Descriptor length   |
| 1      | bDescriptorType     | 1    | 02          | Configuration descriptor  |
| 2      | wTotalLength        | 2    | XXXX        | Total length of data returned for this configuration:<br>Programmable by MSEL and MODE pin              |
| 4      | bNumInterfaces      | 1    | 03          | Number of interfaces supported by this Configuration:<br>00: Control<br>01: ISO-Out<br>02: INT-IN (HID) |
| 5      | bConfigurationValue | 1    | 01          | Configuration value   |
| 6      | iConfiguration      | 1    | 00          | Index of string descriptor that characterizes this configuration  |
| 7      | bmAttributes        | 1    | 80          | Attributes (PWRSEL=0:Bus Powered, 1:SELF Powered)   |
| 8      | bMaxPower           | 1    | 32          | Maximum power consumption from bus = 100mA  |

## 6 Function Description

### 6.1 Content Format for EEPROM(93C46)

The HS-100B integrates USB transceiver, internal oscillator and regulator so that only several passive components are necessary for the USB interface connection. Default USB descriptors are embedded in the HS-100B; therefore there is no additional design effort needed for a generic USB operation. For customized product, customer can attach a SPI interface 93C46 EEPROM to override the embedded VID, PID, initial/max/min volume settings and provide addition serial number for each set. The HS-100B automatically detects 93C46 existence and performs the overwrite function during power up.

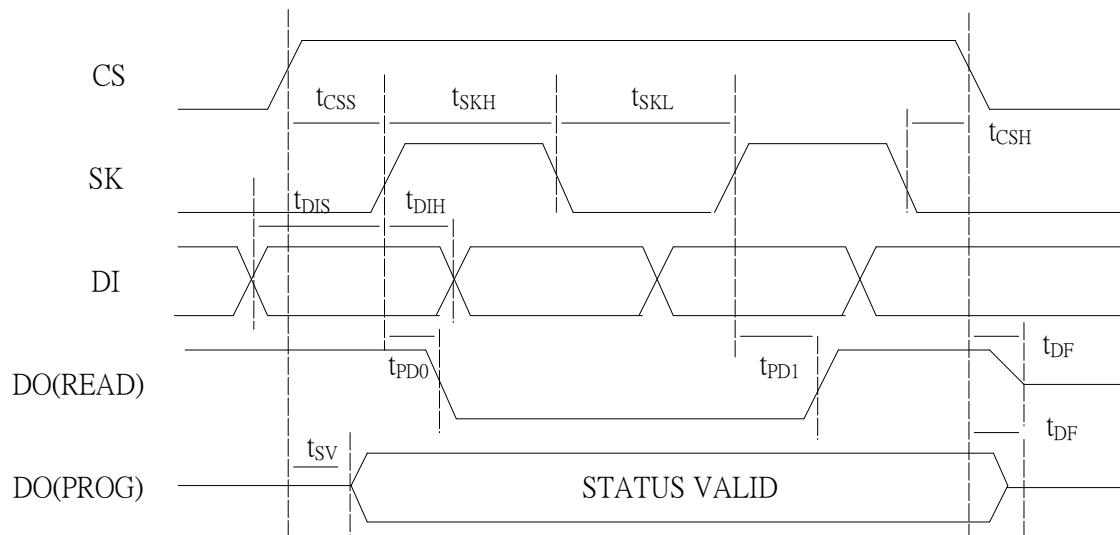
#### 6.1.1 Addressing

Each addresses has 2-byte data, prefix `0x` means hex number; given below with their respective descriptions:

| Addr<br>(Hex)     | Description   |   |
|-------------------|---|---|
| 0x00              | bit[15:4] Magic Word<br>0x670X where X = bit 4, 3, 2, 1<br>bit[3] The value within address 0x2A,0x2B,0x32 is valid 1: valid(default) 0: invalid<br>bit[2] Reserved, should be 1<br>bit[1] Serial number enable control 1: enable, 0: disable(default)<br>bit[0] Reserved, should be 1   |   |
| 0x01              | VID 2-byte  |   |
| 0x02              | PID 2-byte  |   |
| 0x03              | Serial number 1 <sup>st</sup> byte<br>(bit15-bit8, first character)   | Serial number length<br>(bit7-bit0)                               |
| 0x04<br>~<br>0x09 | Serial number 12-byte   |   |
| 0x0A              | Product string 1 <sup>st</sup> byte<br>(bit15-bit8, first character)  | Product string length<br>(bit7-bit0) [0x3E->30,0x40->31Char]      |
| 0x0B<br>~<br>0x19 | Product string 30-byte (default: USB Audio Device)  |   |
| 0x1A              | Manufacturer string<br>1 <sup>st</sup> byte<br>(bit15-bit8, first character)  | Manufacturer string length<br>(bit7-bit0) [0x3E->30,0x40->31Char] |
| 0x1B<br>~<br>0x29 | Manufacturer string 30-byte (default: C-Media Electronics Inc.)   |   |
| 0x2A              | bit[15:9] DAC initial volume (7-bit, default=-10dB)<br>bit[8:3] ADC initial volume (6-bit, default=8dB)<br>bit[2] DAC EEPROM MAX/MIN volume valid<br>bit[1] ADC EEPROM MAX/MIN volume valid<br>bit[0] AA EEPROM MAX/MIN volume valid  |   |
| 0x2B              | bit[15:11] AA initial volume (5-bit, default=-7dB)<br>bit[10] Reserved, should be 0<br>bit[9] boost mode 0: 22dB 1:12dB(default)<br>bit[8] Reserved, should be 0<br>bit[7] Total Power Control 1:enable, 0:disable(default)<br>bit[6] Reserved, should be 0<br>bit[5] MIC High Pass Filter 1:enable(default), 0:disable<br>bit[4] MIC PLL Adjust 1:enable, 0:disable(default)<br>bit[3] MIC BOOST 1:enable (default), 0:disable<br>bit[2] DAC Output Terminal property set to SPK or HP |   |

|       |   |
|-------|---|
|       | 1: Headset, 0: Speaker(default)<br>bit[1] HID, 1: enable (default), 0: disable<br>bit[0] Remote wakeup, 1:enable, 0:disable(default)                |
| 0x2C  | bit[15:0] DAC Minimum Volume (0xD300, DAC-Min.=-37dB, default=-37dB)  |
| 0x2D  | bit[15:0] DAC Maximum Volume (0x0000, DAC-Max.=0dB, default=0dB)  |
| 0x2E  | bit[15:0] ADC Minimum Volume(0xEA00, ADC-Min.=-22dB, default=-12dB)   |
| 0x2F  | bit[15:0] ADC Maximum Volume(0x1700, ADC-Max.=+23dB, default=+23dB)   |
| 0x30  | bit[15:0] AA Minimum Volume (0xE900, AA-Min.=-23dB, default=-23dB)  |
| 0x31  | bit[15:0] AA Maximum Volume (0x0800,AA-Max.+8dB, default=+8dB)  |
| 0x32  | EE_OPTION2 Register<br>bit[3] Reserved, should be 0<br>bit[2] Reserved, should be 0<br>bit[1] Reserved, should be 1<br>bit[0] Reserved, should be 0 |
| ~ END |   |

### 6.1.2 EEPROM SPI Interface Timing Information



| Symbol    | Parameter           | Test Condition* | Min | Typ | Max | Units |
|-----------|---------------------|-----------------|-----|-----|-----|-------|
| $f_{SK}$  | SK Clock Frequency  | 2.7V<=Vcc<=5.5V | 0   |     | 1   | MHz   |
| $t_{SKH}$ | SK High Time        | 2.7V<=Vcc<=5.5V | 250 |     |     | ns    |
| $t_{SKL}$ | SK Low Time         | 2.7V<=Vcc<=5.5V | 250 |     |     | ns    |
| $t_{CS}$  | Minimum CS Low Time | 2.7V<=Vcc<=5.5V | 250 |     |     | ns    |
| $t_{CSS}$ | CS Setup Time       | 2.7V<=Vcc<=5.5V | 50  |     |     | ns    |
| $t_{DIS}$ | DI Setup Time       | 2.7V<=Vcc<=5.5V | 100 |     |     | ns    |
| $t_{CSH}$ | CS Hold Time        | 2.7V<=Vcc<=5.5V | 0   |     |     | ns    |

|           |                            |                              |     |   |     |    |
|-----------|----------------------------|------------------------------|-----|---|-----|----|
| $t_{DIH}$ | DI Hold Time               | $2.7V \leq V_{CC} \leq 5.5V$ | 100 |   |     | ns |
| $t_{PD1}$ | Output Delay to "1"        | $2.7V \leq V_{CC} \leq 5.5V$ |     |   | 250 | ns |
| $t_{PD0}$ | Output Delay to "0"        | $2.7V \leq V_{CC} \leq 5.5V$ |     |   | 250 | ns |
| $t_{SV}$  | CS to Status Valid         | $2.7V \leq V_{CC} \leq 5.5V$ |     |   | 250 | ns |
| $t_{DF}$  | CS to DO in High Impedance | $2.7V \leq V_{CC} \leq 5.5V$ |     |   | 100 | ns |
| $t_{WP}$  | Write Cycle Time           | $4.5V \leq V_{CC} \leq 5.5V$ | 0.1 | 3 | 10  | ms |

\* based on ATMEL 93C46 EEPROM data

## 6.2 Jumper Pins and Mode Setting

Several jumper pins can set the configuration of the HS-100B. These jumper pin settings affect both USB descriptors and USB audio topology. If MODE pin is switched up to 3.3V (speaker mode), a playback only function is activated and there is no recording function declared to the host. At this setting, MSEL pin is ignored and only one input terminal, one output terminal and one feature unit is initialized in USB audio topology.

If MODE pin is switched down (headset mode), a full duplex playback and recording function is reported to the host. MSEL pin setting activates one mixer unit and one feature unit. The following USB audio topology is an example of headset mode. PWRSEL pin affects the power configuration of the HS-100B, together with MODE pin totally 4 combinations are programmable.

| Combinations |      | MODE  |   |
|--------------|------|---|---|
|              |      | 3.3V  | GND   |
| PWRSEL       | 3.3V | Speaker Mode:<br>Playback Only<br>(Self Power with 100mA) | Headset Mode:<br>Playback + Recording<br>(Bus Power with 100mA) |
|              | GND  | Speaker Mode:<br>Playback Only<br>(Bus Power with 500mA)  | Headset Mode:<br>Playback + Recording<br>(Bus Power with 500mA) |

## 6.3 HID Feature and Descriptions

USB protocols can be used to configure devices at startup or when they are plugged in during run time. These devices are divided into various device classes. Each device class defines the common behavior and protocols for devices that serve similar functions. The HID (Human Interface Device) class is one of the device classes. The HID class consists primarily of devices that are used by humans to control the operation of computer systems. HID feature is provided by the HS-100B to enable user settings to volume up, volume down, and playback mute button pin is reported to the host to synchronize host side settings. In addition, all the HS-100B internal registers can be accessed through HID function call.

### 6.3.1 HID Interface Descriptor

| Offset | Field              | Size | Value (Hex) | Description  |
|--------|--------------------|------|-------------|--|
| 0      | bLength            | 1    | 09          | Size of this descriptor: 9 byte                                |
| 1      | bDescriptorType    | 1    | 04          | Interface descriptor type                                      |
| 2      | bInterfaceNumber   | 1    | 03          | Number of Interface: 3   |
| 3      | bAlternateSetting  | 1    | 00          | Alternate 0  |
| 4      | bNumEndpoints      | 1    | 01          | Number of endpoints used by this Interface: 1                  |
| 5      | bInterfaceClass    | 1    | 03          | HID Interface Class  |
| 6      | bInterfaceSubClass | 1    | 00          | No Subclass  |
| 7      | bInterfaceProtocol | 1    | 00          | Must be set to 0   |
| 8      | iInterface         | 1    | 00          | Index of a string descriptor that characterizes this interface |

### 6.3.2 HID Descriptor

| Offset | Field             | Size | Value (Hex) | Description  |
|--------|-------------------|------|-------------|--|
| 0      | bLength           | 1    | 09          | Total 9 Bytes  |
| 1      | bDescriptorType   | 1    | 21          | HID Descriptor Type  |
| 2      | bcdHID            | 2    | 0100        | HID class version 1.00   |
| 4      | bCountryCode      | 1    | 00          |  |
| 5      | bNumDescriptors   | 1    | 01          |  |
| 6      | bDescriptorType   | 1    | 22          | Report Descriptor  |
| 7      | wDescriptorLength | 2    | 003C        | Numeric expression that is the total size of the optional descriptor: 60 Bytes |

### 6.3.3 Interrupt in Endpoint Descriptor

| Offset | Field            | Size | Value (Hex) | Description                        |
|--------|------------------|------|-------------|------------------------------------|
| 0      | bLength          | 1    | 07          | Total 7 Bytes                      |
| 1      | bDescriptorType  | 1    | 05          | Endpoint Descriptor Type           |
| 2      | bEndpointAddress | 1    | 87          | In Endpoint<br>Endpoint number = 3 |
| 3      | bmAttributes     | 1    | 03          | Interrupt endpoint type            |
| 4      | wMaxPacketSize   | 2    | 0004        | Maximum packet size: 4 bytes       |
| 6      | bInterval        | 1    | 2           | Two(2) ms                          |

## 7 Electrical Characteristics

### 7.1 Absolute Maximum Rating

| Symbol    | Parameter                                  | Value         | Unit |
|-----------|--|---------------|------|
| Dvmin     | Min Digital Supply Voltage                 | - 0.3         | V    |
| Dvmax     | Max Digital Supply Voltage                 | + 6           | V    |
| Avmin     | Min Analog Supply Voltage                  | - 0.3         | V    |
| Avmax     | Max Analog Supply Voltage                  | + 6           | V    |
| Dvinout   | Voltage on any Digital Input or Output Pin | -0.3 to +5.5  | V    |
| Avinout   | Voltage on any Analog Input or Output Pin  | -0.3 to +3.96 | V    |
| TBstgB    | Storage Temperature Range                  | -40 to +125   | POPC |
| ESD (HBM) | ESD Human Body Mode                        | +4000         | V    |
| ESD (MM)  | ESD Machine Mode                           | +200          | V    |
| Latch Up  | JEDEC Standard No.78, Mar 1997             | 200           | mA   |

### 7.2 Operation Conditions

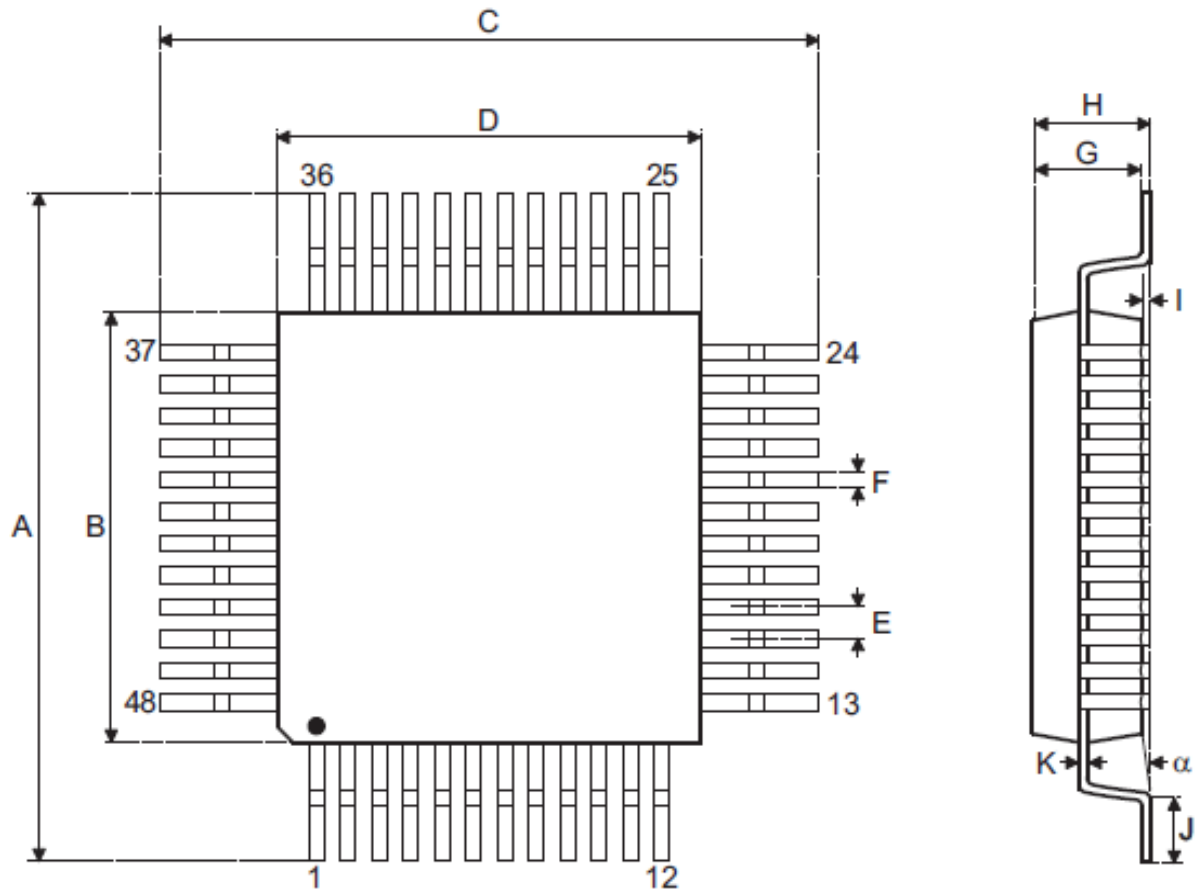
| Operation conditions           |     |       |     |      |
|--------------------------------|-----|-------|-----|------|
|                                | Min | Typ   | Max | Unit |
| Analog Supply Voltage          | 4.5 | 5.0   | 5.5 | V    |
| Digital Supply Voltage         | 4.5 | 5.0   | 5.5 | V    |
| Total Power Consumption        | -   | 37.25 |     | mA   |
| Suspend Mode Power Consumption | -   | 1.58  |     | mA   |
| Operating ambient temperature  | -15 | -     | 70  | PoPC |

### 7.3 Electrical Parameters

|                               | Min   | Typ            | Max  | Unit  |
|-------------------------------|-------|----------------|------|-------|
| <b>DAC (10K Ohm Loading)</b>  |       |                |      |       |
| Resolution                    | -     | 16             | -    | bits  |
| THD + N (-3dBr)@1KHz          | -     | -72            | -    | dB    |
| SNR                           | -     | 93             | -    | dB    |
| Silent SNR                    | -     | 98             | -    | dB    |
| Dynamic range                 | -     | 92             | -    | dB    |
| Frequency response 48KHz      | 20    | -              | 20K  | hz    |
| Frequency Response 44.1KHz    | 20    | -              | 20K  | hz    |
| Output Voltage (rms)          | -     | 0.995          | -    | vrms  |
| <b>DAC (32 Ohm Loading)</b>   |       |                |      |       |
| Resolution                    | -     | 16             | -    | bits  |
| THD + N (-3dBr)@1KHz          | -     | -70            | -    | dB    |
| SNR                           | -     | 93             | -    | dB    |
| Silent SNR                    | -     | 98             | -    | dB    |
| Dynamic Range                 | -     | 92             | -    | dB    |
| Frequency Response 48KHz      | 20    | -              | 20K  | hz    |
| Frequency Response 44.1KHz    | 20    | -              | 20K  | hz    |
| Output Voltage (rms)          | -     | 0.442          | -    | vrms  |
| <b>ADC</b>                    |       |                |      |       |
| Resolution                    | -     | 16             | -    | bit   |
| THD + N (-3dBr)@1KHz          | -     | -84            | -    | dB    |
| SNR                           | -     | 90             | -    | dB    |
| Dynamic Range                 | -     | 88.5           | -    | dB    |
| Frequency Response 48KHz      | 100   | -              | 20K  | hz    |
| Frequency Response 44.1KHz    | 100   | -              | 20K  | hz    |
| Input Range                   | 0     | -              | 2.88 | vpp   |
| <b>Amplification</b>          |       |                |      |       |
| Volume Control Initial Value  |       | -10            |      | dB    |
| Volume Control Level          | -37   | -              | 0    | dB    |
| Volume Control Step           | -     | 38             | -    | steps |
| <b>Microphone Input</b>       |       |                |      |       |
| Boost Gain                    | -     | 12/22 (EEPROM) | -    | dB    |
| Gain Adjustment Initial Value |       | 8              |      |       |
| Gain Adjustment Range         | -12   | -              | 23   | dB    |
| Gain Adjustment Steps         | -     | 36             | -    | steps |
| Mixer Gain Initial Value      |       | -7             |      |       |
| Mixer Gain Adjustment         | -23.0 | -              | 8.0  | dB    |
| Mixer Gain Adjustment Steps   | -     | 32             | -    | steps |



## 8 Package Dimensions



| Symbol   | Dimensions in mm |        |         |
|----------|------------------|--------|---------|
|          | Minimum          | Normal | Maximum |
| A        | 8.90             | —      | 9.10    |
| B        | 6.90             | —      | 7.10    |
| C        | 8.90             | —      | 9.10    |
| D        | 6.90             | —      | 7.10    |
| E        | —                | 0.50   | —       |
| F        | —                | 0.20   | —       |
| G        | 1.35             | —      | 1.45    |
| H        | —                | —      | 1.60    |
| I        | —                | 0.10   | —       |
| J        | 0.45             | —      | 0.75    |
| K        | 0.10             | —      | 0.20    |
| $\alpha$ | 0°               | —      | 7°      |

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## Reference

- Universal Serial Bus Specification, Version 2.0
- Universal Serial Bus Device Class Definition for Audio Devices, Version 1.0.
- Universal Serial Bus Device Class Definition for Human Interface Devices, Version 1.11

— End of Datasheet —

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