95238

PROTEK DEVICES
ANALOG PRODUCTS DIVISION

# PA5134LV
## 24-Bit, 192 kHz Stereo D/A Converter for PCM Audio

### FEATURES

- 95 dB dynamic range
- -85 dB THD+N
- Up to 200 kHz sampling frequency
- $I^2S$ audio data format, 16-24 bits
- Single power supply 3.0V to 5.5V

### APPLICATIONS

- DVD players
- Portable audio players
- Set top boxes
- Digital TVs

### GENERAL DESCRIPTION

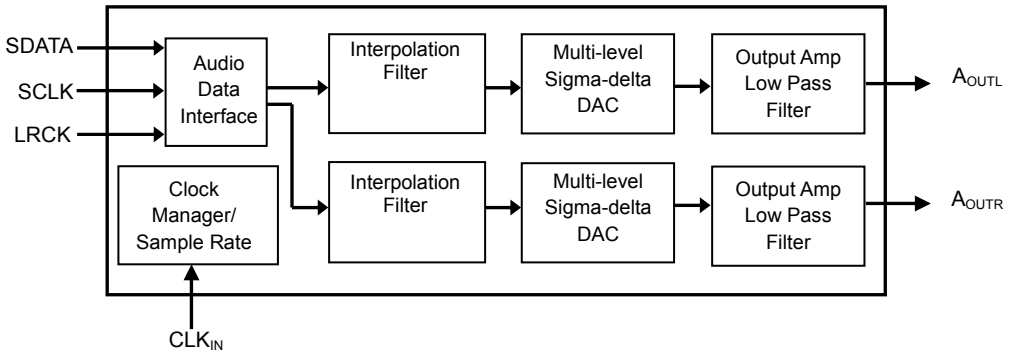
The PA5134LV is a low cost 8-pin stereo digital to analog converter.

The PA5134LV can accept I²S serial audio data format up to 24-bit word length.

The device uses advanced multi-bit Δ-∑ modulation technique to convert data into two channel analog outputs.

The multi-bit Δ-∑ modulator makes the device with very low sensitivity to clock jitter and very low out of band noise.

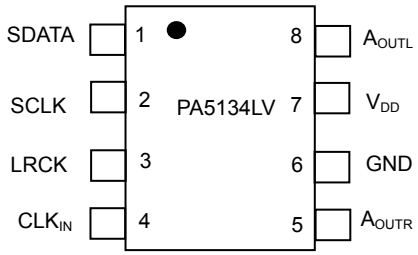
### BLOCK DIAGRAM




### PIN DESCRIPTIONS

| PIN | VALUE | DESCRIPTION |
|---|---|---|
| 1 | SDATA | Serial audio data input |
| 2 | SCLK | Bit clock input |
| 3 | LRCK | Left and right channel clock input indicating input data sampling rate (Fs) and channel selection |
| 4 | $CLK_{IN}$ | System clock input |
| 5 | $A_{OUTR}$ | Analog output of right channel |
| 6 | GND | Ground |
| 7 | VDD | Device power supply |
| 8 | $A_{OUTL}$ | Analog output of left channel |

### PIN CONFIGURATION




### ORDERING INFORMATION

| Temperature Range | Package | Part Number |
|---|---|---|
| -40 to 85 °C | SO8-IC | PA5134LV-T7 |

561 E. Elliot Road #175 Chandler, AZ 85225 Tel: (480) 539-2900. Fax: (480) 747-1715
www.protekanalog.com


NOT FOR USE IN LIFE SUPPORT SYSTEMS

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage ..... MIN-0.3V MAX +7.0V
Input Voltage ..... MIN GND-0.3V MAX $V_{DD}$+0.3V
Operating Temperature.....MIN -40°C MAX +85°C
Storage Temperature.....MIN -65°C MAX +150°C

## RECOMMENDED OPERATING CONDITIONS

Supply Voltage ..... MIN 3.0 MAX 5.5V

## ANALOG CHARACTERISTICS

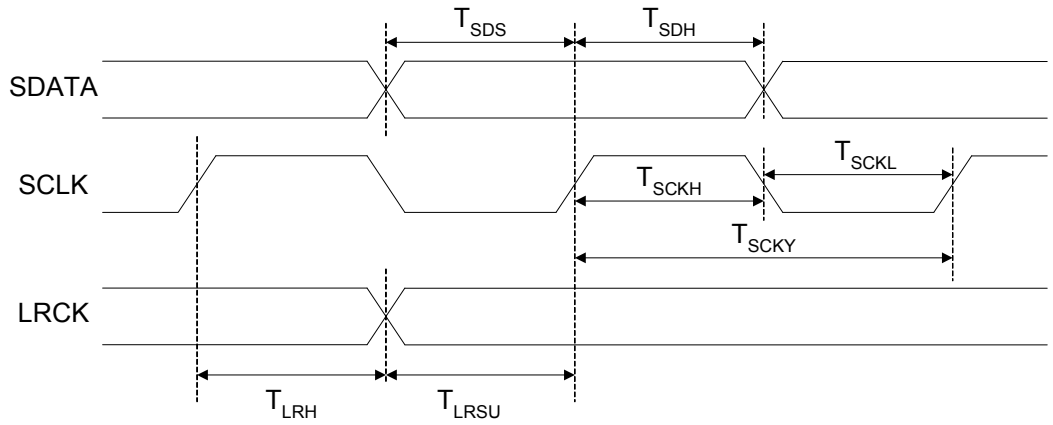
*Test conditions: VDD=5.0V, GND=0V, ambient temperature=25°C, Fs=48KHz, CLKIN/LRCK=256, input 0dB 1KHz sinewave*

| PARAMETERS | MINIMUM | TYPICAL | MAXIMUM | UNIT |
|---|---|---|---|---|
| **DAC Performance** | | | | |
| Dynamic Range *(Note 1)* | 90 | 95 | | dB |
| THD+N | | -85 | -80 | dB |
| Channel Separation (1KHz) | | 100 | | dB |
| Signal to Noise Ratio | | 95 | | dB |
| Interchannel Gain Mismatch | | 0 | | dB |
| Frequency Response (20Hz-20KHz) | -0.02 | | +0.08 | dB |
| **Filter Frequency Response Characteristics** | | | | |
| **Single Speed** | | | | |
| Passband | 0 | | 0.454 | Fs |
| Stopband | 0.547 | | | Fs |
| Passband Ripple | | ±0.05 | | dB |
| Stopband Attenuation | -53 | | | dB |
| **Double Speed** | | | | |
| Passband | 0 | | 0.417 | Fs |
| Stopband | 0.583 | | | Fs |
| Passband Ripple | | ±0.005 | | dB |
| Stopband Attenuation | -56 | | | dB |
| **Quad Speed** | | | | |
| Passband | 0 | | 0.2083 | Fs |
| Stopband | 0.792 | | | Fs |
| Passband Ripple | | ±0.006 | | dB |
| Stopband Attenuation | -50 | | | dB |
| **Analog Output Characteristics** | | | | |
| Full Scale Output Level | 3.25 | 3.5 | 3.75 | Vpp |
| Output Impedance | | 120 | | Ω |
| Minimum Load Resistance | | 2 | | KΩ |
| Maximum Capacitance | | 100 | | pF |

*Note 1. A-weighted filter is used in measurement.*

## SERIAL AUDIO PORT SWITCHING CHARACTERISTICS

| PARAMETER | SYMBOL | MIN | MAX | UNIT |
|---|---|---|---|---|
| CLKIN Frequency | | | 51.2 | MHz |
| CLKIN Duty Cycle | | 40 | 60 | % |
| LRCK Frequency | | | 200 | KHz |
| LRCK Duty Cycle | | 40 | 60 | % |
| SCLK Frequency | | | 26 | MHz |
| SCLK Pulse Width Low | $T_{SCKL}$ | 15 | | ns |
| SCLK Pulse Width High | $T_{SCKH}$ | 15 | | ns |
| SCLK Rising to LRCK Edge Delay | $T_{LRH}$ | 10 | | ns |
| SCLK Rising to LRCK Edge Setup Time | $T_{RSU}$ | 10 | | ns |
| SDATA Valid to SCLK Rising Setup Time | $T_{SDS}$ | 10 | | ns |
| SCLK Rising to SDATA Hold Time | $T_{SDH}$ | 10 | | ns |




*Serial Audio Port Timing Diagram*

## DC CHARACTERISTICS

| PARAMETER | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|
| **Normal Operation Mode** | | | | |
| VDD Current $V_{DD}$=3.3V | | 15.0 | 20.0 | mA |
| Power Dissipation $V_{DD}$=3.3V | | 50.0 | 70.0 | mW |
| **Digital Voltage Level** | | | | |
| Input High-level Voltage | 2.0 | | | V |
| Input Low-level Voltage | | | 0.8 | V |
| Output High-level Voltage | | $V_{DD}$ | | V |
| Output Low-level Voltage | | 0 | | V |

## RECOMMENDED APPLICATION CIRCUIT

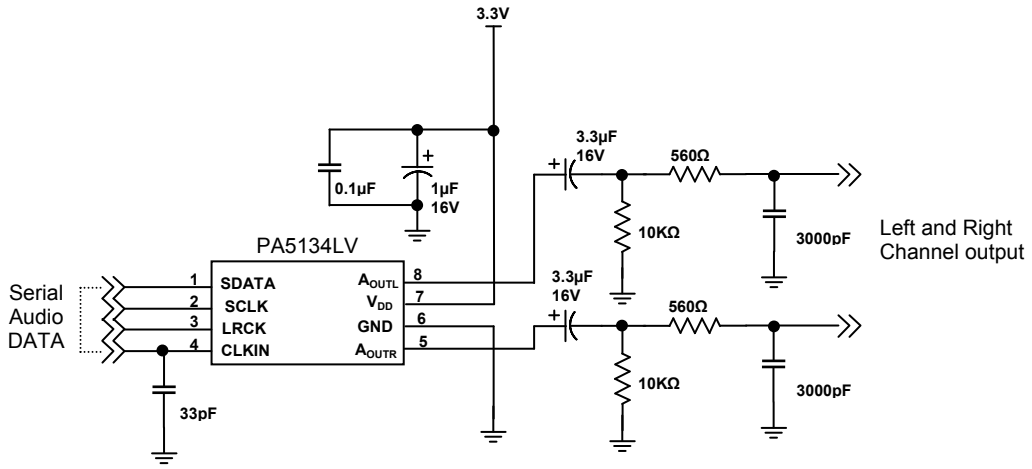



*Figure 1 Recommended Application Circuit.*

## APPLICATION DESCRIPTIONS

### Sampling Rate and Input Clocks

The serial audio input data is transmitted to the device at SDATA pin.
According to the sampling rate, the device can work in three speed modes, single speed, double speed and quad speed.
The device can detect the speed mode of the input data stream automatically when the sampling rate falls into the auto detection ranges listed in Table1.
If the sampling rate is outside the auto detection ranges, the device will not work properly.

| **Table 1 Auto Detection Ranges and CLKIN/LRCK Ratio.** | | |
|---|---|---|
| **MODE** | **Fs Auto Detection Range** | **CLKIN/LRCK Ratio** |
| Single Speed | 8kHz – 50kHz | 256, 384, 512, 768, 1024 |
| Double Speed | 84kHz – 100kHz | 128, 192, 256, 384, 512 |
| Quad Speed | 167kHz – 200kHz | 128, 192, 256 |

The device works with the input system clock CLKIN, sample data clock LRCK and bit clock SCLK.
The data clock and bit clock must be synchronously derived from the system clock with some specific rates.
The device only supports the CLKIN/LRCK ratios listed in Table1. The LRCK/SCLK ratio is normally 64.
The device detects clock ratios automatically, and it will not work properly if any ratio is incorrect.

### Audio Data Input

The PA5134LV can accept I²S serial audio input data from 16-bit to 24-bit. The device can detect the data word length automatically.
The relationship of SDATA, SCLK and LRCK for the format is illustrated through Figures 2.

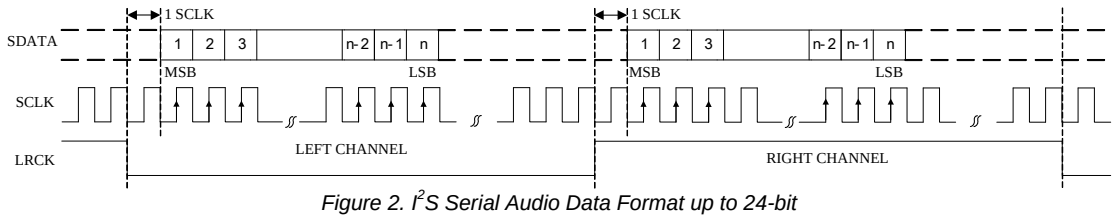


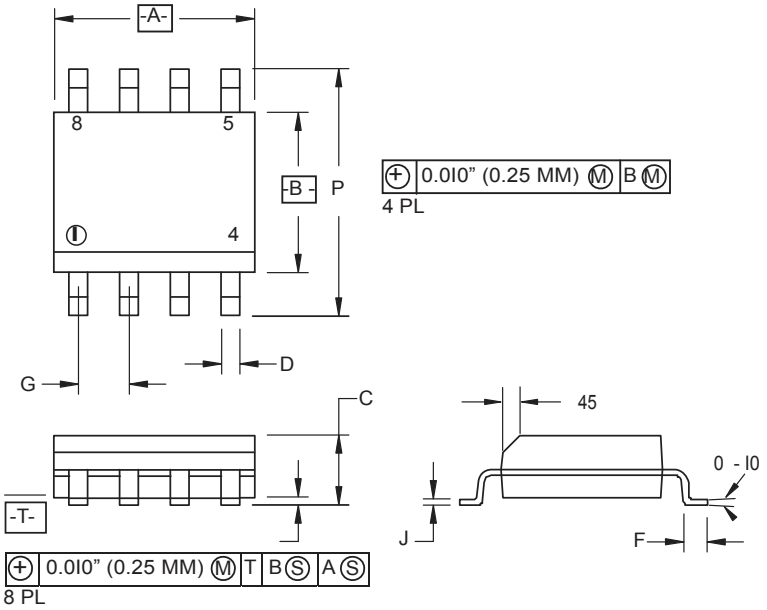

*Figure 2. I²S Serial Audio Data Format up to 24-bit*

**Power Up and Power Down**

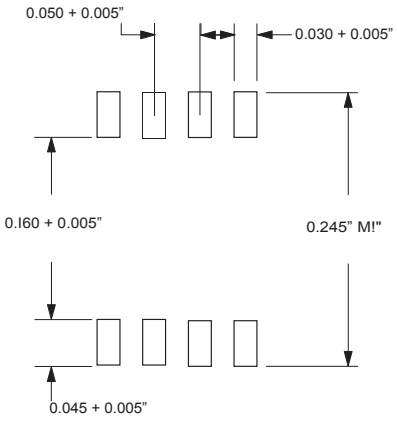
Upon applying VDD, the device will reset itself and enter power down state. During this state, the device clamps outputs to ground and power down the device operation except for clock management unit.
Once proper CLKIN and LRCK clocks are applied, the device will leave power down state, and the device outputs ramp from ground to common mode voltage softly.
Then the device enters the normal operation.

## PACKAGE DIMENSIONS AND MEASUREMENTS

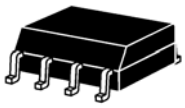
### PACKAGE OUTLINE




### MOUNTING PAD




### SO-8



### PACKAGE DIMENSIONS

| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 4.80 | 5.00 | 0.189 | 0.196 |
| B | 3.80 | 4.00 | 0.150 | 0.157 |
| C | 1.35 | 1.75 | 0.054 | 0.068 |
| D | 0.35 | 0.49 | 0.014 | 0.019 |
| F | 0.40 | 1.250 | 0.016 | 0.049 |
| G | 1.27 BSC | 1.27 BSC | 0.05 BSC | 0.05 BSC |
| J | 0.18 | 0.25 | 0.007 | 0.009 |
| K | 0.10 | 0.25 | 0.004 | 0.008 |
| P | 5.80 | 6.20 | 0.229 | 0.244 |
| R | 0.25 | 0.50 | 0.010 | 0.019 |

**NOTES**

1. - T - = Seating Plane and Datum Surface.
2. Dimensions “A” and “B” are Datum.
3. Dimensions “A” and “B” do not include mold protrusion.
4. Maximum mold protrusion is 0.015” (0.380 mm) per side.
5. Dimensioning and tolerances per ANSI Y14.5M, 1982.
6. Dimensions are exclusive of mold flash and metal burrs.

**TAPE & REEL/BULK ORDERING NOMENCLATURE**

1. Surface mount product is taped and reeled in accordance with EIA-481.
2. Suffix-T7 = 7 Inch Reel - 1,000 pieces per 12mm tape.
3. Suffix-T13 = 13 Inch Reel - 2,500 pieces per 12mm tape.
4. No Suffix = Product Shipped in Tubes of 98 pcs per Tube.

**Outline & Dimensions: Rev 1 - 11/01, 06009**

**Life Support Policy**

PROTEK ANALOG'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF PROTEK DEVICES.