



# ES7154

## 24-bit I<sup>2</sup>S Audio DAC with 2 Vrms Output

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### GENERAL DESCRIPTION

The ES7154 is a low cost 14-pin stereo digital to analog converter. The ES7154 can accept I<sup>2</sup>S serial audio data format up to 24-bit word length. The device uses advanced multi-bit  $\Delta\text{-}\Sigma$  modulation technique to convert data into two channel analog outputs. The multi-bit  $\Delta\text{-}\Sigma$  modulator makes the device with very low sensitivity to clock jitter and very low out of band noise.

The device integrates a charge pump to generate negative supply from 5V supply, thus providing ground centered 2 Vrms analog output.

### FEATURES

- 102 dB SNR
- -85 dB THD+N
- Up to 100 kHz sampling frequency
- I<sup>2</sup>S audio data format, 16-24 bits
- Single power supply 4V to 5.25V
- Support non standard audio clocks like 25 MHz or 26 MHz

### APPLICATIONS

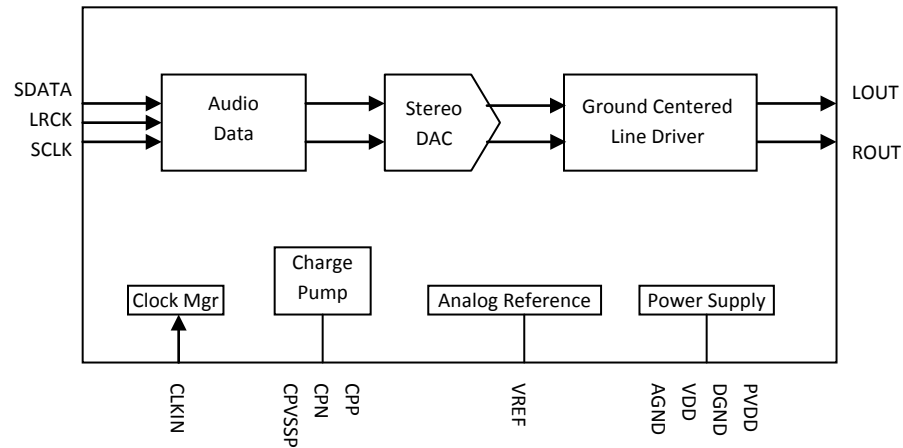
- OTT
- STB
- Digital TV
- DVD player

### ORDERING INFORMATION

ES7154 -40°C ~ +85°C  
SOIC-14

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## 1. BLOCK DIAGRAM

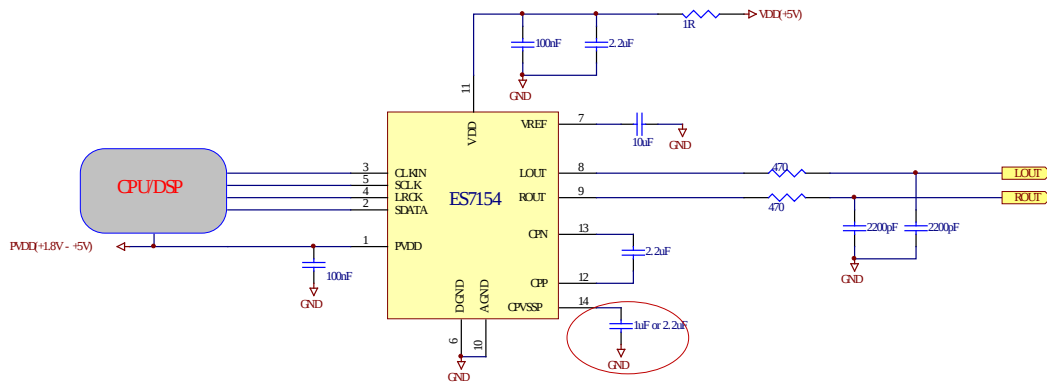


## 2. PIN OUT AND DESCRIPTION

|       |   |        |    |        |
|-------|---|--------|----|--------|
| PVDD  | 1 | ES7154 | 14 | CPVSSP |
| SDATA | 2 |        | 13 | CPN    |
| CLKIN | 3 |        | 12 | CPP    |
| LRCK  | 4 |        | 11 | VDD    |
| SCLK  | 5 |        | 10 | AGND   |
| DGND  | 6 |        | 9  | ROUT   |
| VREF  | 7 |        | 8  | LOUT   |

| PIN | NAME   | I/O    | DESCRIPTION                     |
|-----|--------|--------|---------------------------------|
| 1   | PVDD   | Supply | Digital IO supply               |
| 2   | SDATA  | I      | Audio data                      |
| 3   | CLKIN  | I      | Master clock                    |
| 4   | LRCK   | I      | Audio data left and right clock |
| 5   | SCLK   | I      | Audio data bit clock            |
| 6   | DGND   | Supply | Digital ground                  |
| 7   | VREF   |        | Decoupling capacitor            |
| 8   | LOUT   | O      | Left analog output              |
| 9   | ROUT   | O      | Right analog output             |
| 10  | AGND   | Supply | Analog ground                   |
| 11  | VDD    | Supply | Power supply                    |
| 12  | CPP    |        | Charge pump capacitor top       |
| 13  | CPN    |        | Charge pump capacitor bottom    |
| 14  | CPVSSP |        | Charge pump filtering           |

### 3. TYPICAL APPLICATION CIRCUIT



Note: for pin 14 capacitor, please use 1 uF if CLKIN frequency is higher than 15 MHz.

### 4. CLOCK MODES AND SAMPLING FREQUENCIES

According to the sampling rate, the device can work in two speed modes, single speed and double speed. Table 1 lists the typical clock modes supported by the device.

Table 1 Speed Mode and CLKIN/LRCK Ratio

| MODE         | Sampling Rate  | CLKIN/LRCK Ratio                           |
|--------------|----------------|--------------------------------------------|
| Single Speed | 8kHz – 50kHz   | 32, 64, 128, 192, 256, 384, 512, 768, 1024 |
| Double Speed | 84kHz – 100kHz | 128, 192, 256, 384, 512, 768, 1024         |

### 5. DIGITAL AUDIO INTERFACE

The ES7154 can accept I<sup>2</sup>S 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.

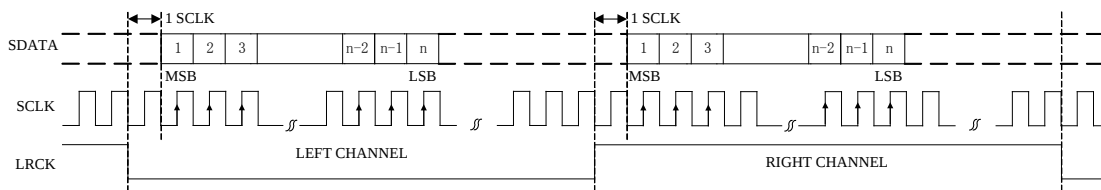


Figure 2 I<sup>2</sup>S Serial Audio Data Format Up To 24-bit

### 6. POWER UP AND 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 operation except for clock

management unit. Once proper CLKIN and LRCK clocks are applied, the device will leave power down state and enter the normal operation.

Power down can be achieved by removal of VDD, or by first stopping LRCK and then stopping CLKIN.

## 7. ELECTRICAL CHARACTERISTICS

### ***ABSOLUTE MAXIMUM RATINGS***

Continuous operation at or beyond these conditions may permanently damage the device.

| PARAMETER                   | MIN       | MAX       |
|-----------------------------|-----------|-----------|
| Supply Voltage Level        | -0.3V     | +5.5V     |
| Input Voltage Range         | DGND-0.3V | PVDD+0.3V |
| Operating Temperature Range | -40°C     | +85°C     |
| Storage Temperature         | -65°C     | +150°C    |

### ***RECOMMENDED OPERATING CONDITIONS***

| PARAMETER | MIN | TYP | MAX  | UNIT |
|-----------|-----|-----|------|------|
| VDD       | 4   | 5   | 5.25 | V    |
| PVDD      | 1.6 | 1.8 | 5.25 | V    |

### ***DAC ANALOG AND FILTER CHARACTERISTICS AND SPECIFICATIONS***

Test conditions are as the following unless otherwise specify: VDD=5V, PVDD=1.8V, AGND=0V, DGND=0V, ambient temperature=25°C, Fs=48 KHz, MCLK/LRCK=256.

| PARAMETER                                | MIN    | TYP  | MAX    | UNIT |
|------------------------------------------|--------|------|--------|------|
| DAC Performance                          |        |      |        |      |
| Signal to Noise ratio (A-weight)         | 95     | 102  | 105    | dB   |
| THD+N                                    | -88    | -85  | -80    | dB   |
| Channel Separation (1KHz)                | 80     | 85   | 90     | dB   |
| Interchannel Gain Mismatch               |        | 0.05 |        | dB   |
| Filter Frequency Response – Single Speed |        |      |        |      |
| Passband                                 | 0      |      | 0.4535 | Fs   |
| Stopband                                 | 0.5465 |      |        | Fs   |
| Passband Ripple                          |        |      | ±0.05  | dB   |
| Stopband Attenuation                     | 40     |      |        | dB   |
| Filter Frequency Response – Double Speed |        |      |        |      |
| Passband                                 | 0      |      | 0.4167 | Fs   |
| Stopband                                 | 0.5833 |      |        | Fs   |
| Passband Ripple                          |        |      | ±0.005 | dB   |
| Stopband Attenuation                     | 40     |      |        | dB   |
| Analog Output                            |        |      |        |      |
| Full Scale Output Level                  | 1.8    | 2    | 2.1    | Vrms |

**POWER CONSUMPTION CHARACTERISTICS**

| PARAMETER             | MIN | TYP | MAX | UNIT |
|-----------------------|-----|-----|-----|------|
| Normal Operation Mode |     |     |     |      |
| PVDD=1.8V, VDD=5V     |     | 35  |     | mA   |
| Power Down Mode       |     |     |     |      |
| DVDD=1.8V, VDD=5V     |     | 2   |     | mA   |

**SERIAL AUDIO PORT SWITCHING SPECIFICATIONS**

| PARAMETER                            | Symbol | MIN | MAX  | UNIT |
|--------------------------------------|--------|-----|------|------|
| MCLK frequency                       |        |     | 51.2 | MHz  |
| MCLK duty cycle                      |        | 40  | 60   | %    |
| LRCK frequency                       |        |     | 200  | KHz  |
| LRCK duty cycle                      |        | 40  | 60   | %    |
| SCLK frequency                       |        |     | 26   | MHz  |
| SCLK pulse width low                 | TSCLKL | 15  |      | ns   |
| SCLK Pulse width high                | TSCLKH | 15  |      | ns   |
| SCLK falling to LRCK edge            | TSCLR  | -10 | 10   | ns   |
| SCLK falling to SDOUT valid          | TSDO   | 0   |      | ns   |
| SDIN valid to SCLK rising setup time | TSDIS  | 10  |      | ns   |
| SCLK rising to SDIN hold time        | TSDIH  | 10  |      | ns   |

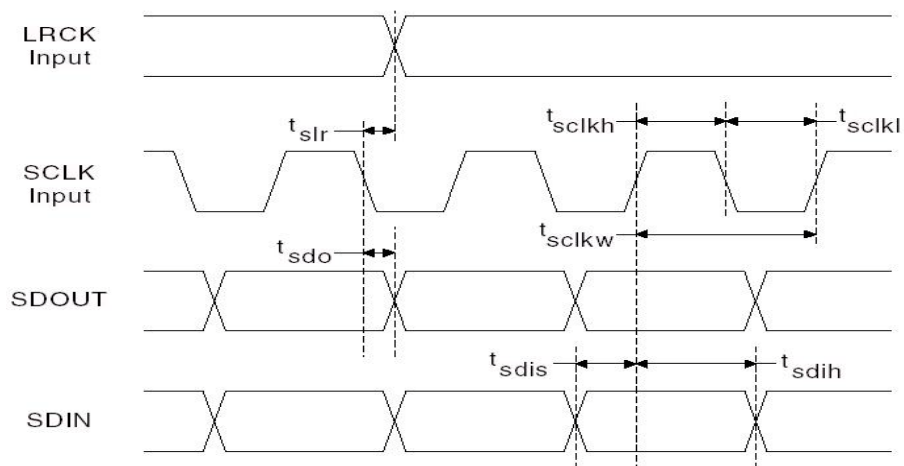
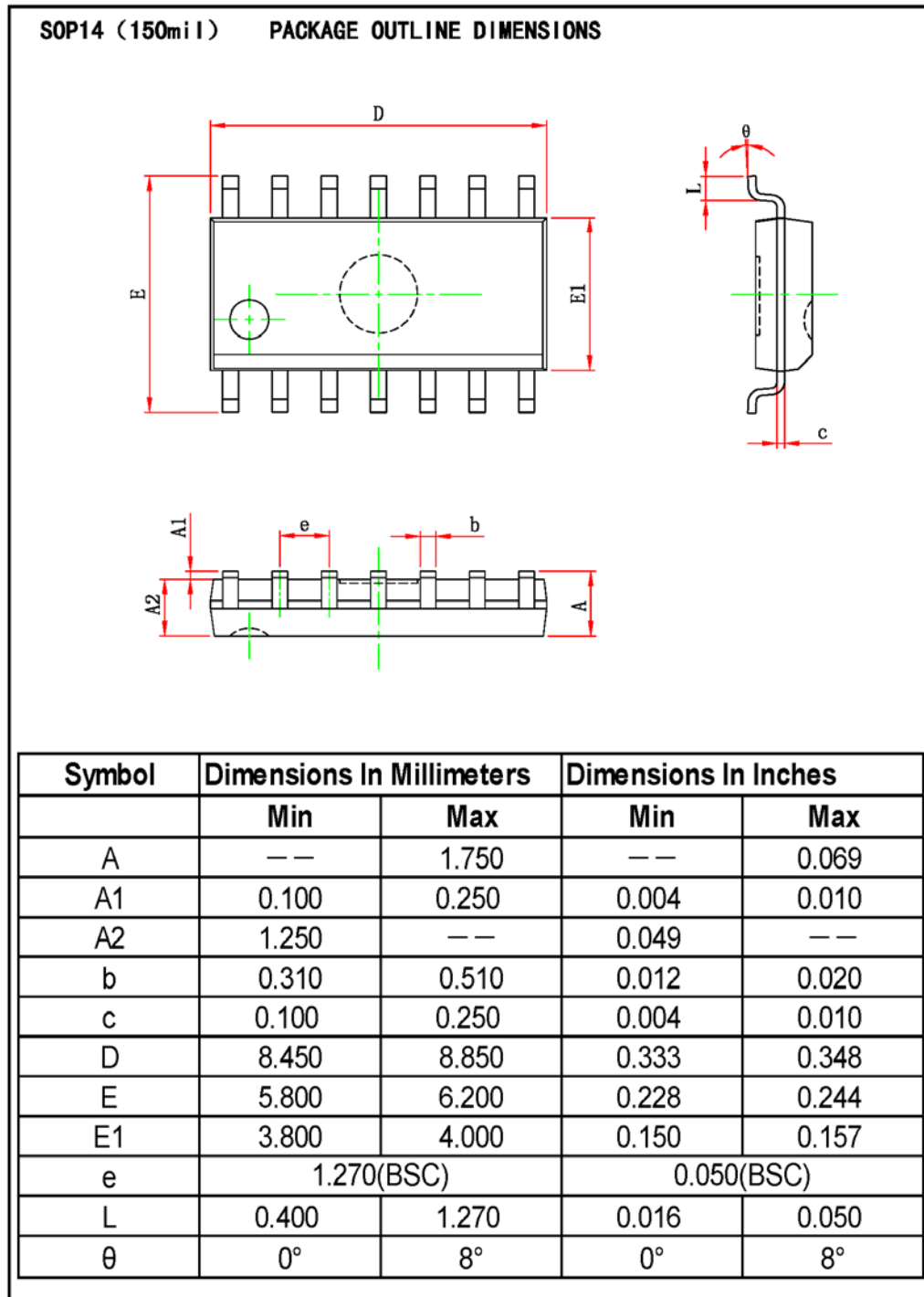


Figure 8 Serial Audio Port Timing

## 8. PACKAGE



## 9. CORPORATE INFORMATION

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