Seventy Band Graphic Equalizer

Data Sheet

Description

The seven band graphic equalizer IC is a CMOS chip that divides the audio spectrum into seven bands, 63Hz, 160Hz, 400Hz, 1kHz, 2.5kHz, 6.25kHz and 16kHz. The seven frequencies are peak detected and multiplexed to the output to provide a DC representation of the amplitude of each band. No external components are needed to select the filter responses. Only an off chip resistor and capacitor are needed to select the on chip clock oscillator frequency. The filter center frequencies track this frequency.

Other than coupling and decoupling capacitors, no other external components are needed. The chip supply can be between 2.7 and 5.5 volts with 5 volts providing the best performance. The device has very low quiescent current (less than 1mA typical) for portable audio devices. The multiplexer is controlled by a reset and a strobe, permitting multiplexer readout with only two pins. The multiplexer readout rate also controls the decay time (10% decay per read), so no external pins are needed for this function.

Features

- Low Power Consumption
- Only Two External Components
- On Chip Ground Reference
- Switched - Capacitor Filters
- 3.3 or 5 volt Operation
- 20 dB of Gain Typical
- On Chip Oscillator
- Output Multiplexor
- Variable Decay Time
- 8 Pin Package

Applications

- Portable Stereos
- Car Stereos
- Hi-Fi Stereos
- Spectrum Analyzers

Absolute Maximum Ratings

- Power Supply Voltage: ±6V
- Storage Temperature: -60 to +150°C
- Operating Temperature: 0 to 70°C

Web Site “www.mix-sig.com” © 2004 Mixed Signal Integration
**Seven Band Graphic Equalizer Data Sheet**

**Electrical Characteristics**

(VDD = +5.0V, T = 25°C)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Specifications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Voltage</td>
<td>VDD</td>
<td></td>
<td>2.7</td>
<td>5.0</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>Supply Current</td>
<td>IDD</td>
<td>1 Mohm Load on Output</td>
<td>0.5</td>
<td>0.8</td>
<td>1.0</td>
<td>mA</td>
</tr>
<tr>
<td>Output Drive</td>
<td>IO</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Output Impedance</td>
<td>ZO</td>
<td></td>
<td>700</td>
<td></td>
<td></td>
<td>ohms</td>
</tr>
<tr>
<td>Output Offset</td>
<td>VOS</td>
<td></td>
<td>600</td>
<td></td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>Band Offset Difference</td>
<td></td>
<td>Same device</td>
<td>200</td>
<td></td>
<td></td>
<td>mV</td>
</tr>
</tbody>
</table>

| AC Specifications            |        |                                 |     |     |     |       |
| Gain                          | AV     | Peak input to DC output, Vin = 100 mVpp, fin = 1 kHz | 20  | 22  | 24  | dB    |
| Filter Q                      | Q      |                                 | 5.5 | 6.0 | 6.5 |       |
| Output Swing                  |        | Vin = 0.3Vpp, fin = 1 kHz       | 3.5 | 4   |     | V     |
| Clock Frequency               | FCLK   | C = 33 pF*, R = 200 kohms       | 145 | 165 | 180 | kHz   |
| Input Impedance               | ZIN    |                                 | 1   |     |     | Mohm  |

*Includes stray capacitance

**Ordering Information**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
<th>Operating Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSGEQ7P</td>
<td>8 Pin Dip</td>
<td>0-70 °C</td>
</tr>
<tr>
<td>MSGEQ7N</td>
<td>8 Pin 150 mils SOIC</td>
<td>0-70 °C</td>
</tr>
</tbody>
</table>
Seven Band Graphic Equalizer
Data Sheet

Pin Description
1. VDD   Positive Power Supply
   Typically 5 Volts
2. VSS   Negative Power Supply
   Typically 0 Volts
3. OUT   Multiplexed DC Output
4. STROBE Channel Selection Pin
5. IN    Audio Input
6. GND   Internally Generated Ground
   Reference. Typically 2.5V
7. RESET Resets Multiplexor
8. CKIN  Clock Oscillator Pin

Pin Configuration

Block Diagram

Audio In

Anti- Alias Filter

63Hz
Bandpass

160Hz
Bandpass

400Hz
Bandpass

1kHz
Bandpass

2.5kHz
Bandpass

6.25kHz
Bandpass

16kHz
Bandpass

Peak Detector

Peak Detector

Peak Detector

Peak Detector

Peak Detector

Peak Detector

Output
Multiplexor

DC Out

Reset

Strobe

Clock Oscillator

Web Site “www.mix-sig.com” © 2004 Mixed Signal Integration
Multiplexor Operation

The DC peak output for measurement is selected using the reset and strobe pins. Reset high resets the multiplexor. Reset low enables the strobe pin. After the first strobe leading edge, 63Hz output is on OUT. Each additional strobe leading edge advances the multiplexor one channel (63Hz, 160Hz, 400Hz, 1kHz, 2.5kHz, 6.25kHz, 16kHz etc.) and this will repeat indefinitely. The multiplexor read rate is also the output decay time control. Each read decays that channel approximately 10%. The strobe timing is shown below:

Strobe Timing Diagram

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>tr - Reset Pulse Width</td>
<td>100 nS min</td>
</tr>
<tr>
<td>trs - Reset to Strobe Delay</td>
<td>72 µS min</td>
</tr>
<tr>
<td>ts - Strobe Pulse Width</td>
<td>18 µS min</td>
</tr>
<tr>
<td>tss - Strobe to Strobe Delay</td>
<td>72 µS min</td>
</tr>
<tr>
<td>to - Output Settling Time</td>
<td>36 µS min</td>
</tr>
</tbody>
</table>

(with Cload = 22 pF and Rload = 1 Mohm)