The LA2110 has the capability to effectively remove external noise (pulse noise) caused by engine, etc. and is used in conjunction with a PLL FM multiplex stereo demodulator (such as LA3375) with pilot signal canceller.

Features
- Pilot signal compensation function.
- By using in conjunction with PLL FM multiplex stereo demodulator with pilot signal canceller, adverse effect caused by pilot signal can be compensated.
- Low distortion factor: THD = 0.02%, 300mV.
- Good space facator due to single end package.
- Variable input type noise AGC system. This system widens the noise detector's dynamic range, so that pulse noise can be satisfactorily detected even in a weak electric field, and pulse noise is removed without adversely affecting distortion factor.

Maximum Ratings at Ta = 25°C

Maximum Supply Voltage \( V_{CC\text{max}} \) 16 V
Allowable Power Dissipation \( P_{d\text{max}} \) \( Ta \leq 50^\circ C \) 450 mW
Operating Temperature \( T_{op} \) -20 to +75 °C
Storage Temperature \( T_{stg} \) -40 to +125 °C

Recommended Operating Conditions at Ta = 25°C

Recommended Supply Voltage \( V_{CC} \) 12 V
Operating Voltage Range \( V_{CC\text{op}} \) 8 to 15 V

Operating Conditions at \( Ta = 25^\circ C, V_{CC} = 12V \), See specified Test Circuit.

<table>
<thead>
<tr>
<th>Quiescent Current (input pin)</th>
<th>Voltage Gain (output pin)</th>
<th>( I_{cc} )</th>
<th>( VG )</th>
<th>( V_7 = 300mV, f = 1kHz )</th>
<th>Output</th>
<th>( -0.2 )</th>
<th>0.8</th>
<th>1.8</th>
<th>dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Signal Dynamic Range</td>
<td>( V_D )</td>
<td>( V_{7,f = 1kHz} )</td>
<td>Output, THD = 1%</td>
<td>1.3 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Impedance</td>
<td>( Z_{in} )</td>
<td>( V_7 = 300mV, f = 1kHz )</td>
<td>36k</td>
<td>51k</td>
<td>67k</td>
<td>Ω</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Harmonic Distortion</td>
<td>( THD )</td>
<td>( V_7 = 300mV, f = 1kHz )</td>
<td>Output</td>
<td>0.01</td>
<td>0.03</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-pass Amp Gain</td>
<td>( VG_L )</td>
<td>( V_5 = 300mV, f = 1kHz )</td>
<td>( V_4 )</td>
<td>1.0</td>
<td>1.1</td>
<td>1.2 times</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Package Dimensions (unit: mm)
3020A

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D247KI/4115KI,TS/NO.855-1/6
Continued from preceding page.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-pass Amp Gain</td>
<td>$V_{GH}$</td>
<td>mV$g=100mV$</td>
<td>$V_{10}$</td>
</tr>
<tr>
<td>Inverting Amp Distortion Factor</td>
<td>$THD_I$</td>
<td>%</td>
<td>0.1</td>
</tr>
<tr>
<td>Inverting Amp Dynamic Range</td>
<td>$VD_I$</td>
<td>mV$15,f=19kHz$</td>
<td>Output,THD=1%</td>
</tr>
<tr>
<td>Inverting Amp Gain</td>
<td>$VG_I$</td>
<td>mV$15,f=19kHz$</td>
<td>Output</td>
</tr>
<tr>
<td>Output Noise Voltage</td>
<td>$V_{NO}$</td>
<td>mV</td>
<td>30 60</td>
</tr>
<tr>
<td>Gate Time</td>
<td>$t_{gate}$</td>
<td>μs</td>
<td>13 21 30</td>
</tr>
<tr>
<td>Noise Sensitivity</td>
<td>$SN$</td>
<td>mV$7,1μs,f=1kHz$</td>
<td>Output</td>
</tr>
</tbody>
</table>

[Test Circuit]

![Test Circuit Diagram]

(Unit: resistance $\Omega$, capacitance $F$)

![Power Consumption vs Ambient Temperature Graph]

$P_{d,max} - T_a$ vs Ambient temperature, $T_a - ^\circ C$
Equivalent Circuit Block Diagram

[Diagram of LA2110 block diagram with labels for Buffer circuit, Low-pass amp, Gate circuit, Composite signal, Low-pass filter, High-pass amp, Noise detector, Mono-stable Multivib., Inverting amp, Bypass circuit, Noise detection sensitivity adjustment circuit, Noise AGC adjustment circuit, Pulse width adjustment circuit, Memory circuit, and a note about Triangular wave for pilot signal cancellation.]

Graphs showing:
- Total harmonic distortion, THD - % vs. Input signal level - mVrms
- Total harmonic distortion, THD - % vs. Frequency, f - Hz
- Noise sensitivity, SN - VCC vs. Supply voltage, VCC - V
- Gate time, Tgate - μs vs. Supply voltage, VCC - V

VCC = 12V
Input 300 mVrms

Pulse width 1μs
Pulse wave peak value 100mVp

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In order to simplify the operation theory, the composite signal component is given only as a low frequency signal and a pilot signal, and the pilot cancel signal has the same phase, same amplitude as the pilot signal in the composite signal.

Since the output voltage is the differential voltage of the plus and minus input of the subtraction circuit, it is equal to the voltage between the memory capacitor terminals. When the gate is closed, the composite signal is applied to the plus input terminal of the subtraction circuit, and the pilot cancel signal is applied to the minus input terminal. Thus the pilot signal is cancelled from the output and only the low frequency signal appears. In the same way, the voltage between the memory capacitor terminals is the differential voltage of the composite signal and the pilot cancel signal, so only the low frequency signal appears.

When pulse noise is generated and the gate opens, the plus input and minus input signal waveforms of the subtraction circuit become equal. This is because the input impedance of the subtraction circuit is extremely high, so the memory capacitor is considered AC-shorted. Thus, when pulse noise is generated in the composite signal, the same pulse noise appears in minus as well as plus input of the subtraction circuit. As a result, pulse noise does not appear in the output. The voltage in the output has a DC level difference of plus and minus input, and that is the voltage held by the memory capacitor. This voltage is that between the memory capacitor terminals just before the gate opens, so it is the low frequency signal voltage just before the gate opens. Because the subtraction circuit input impedance is high, no charge/discharge current flows in the memory capacitor while the gate is open, so the memory capacitor can hold the voltage between its terminals.

The voltage waveforms are illustrated below.

Note: The pilot cancel signal is given as sinusoidal in this explanation, but in the actual application circuit, pilot cancel is performed by a triangular wave.
Note: When using the sample application circuit:
1. Separation adjustment is performed with 10kΩ variable resistance in low-pass filter.
2. Change noise detection sensitivity control Rs to an adequate value for strong or medium electric field.
3. Adjust noise AGC with CV, Ry for effective noise suppression in a medium or weak electric field.
4. Adjust pilot cancel degree with variable resistance of 50kΩ connected to LA2110 pin 15.
5. By changing the 1µF capacitor between LA3375 pin 11 and 12, pilot cancel follow-up response time can be changed. But if the value is decreased, distortion factor, etc. will be adversely affected.
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