Overview

The LA1805 is a characteristics-improved version of the LA1810, with the same pin assignment and package as those of the LA1810. Improvements are made on the following point:

- Separation (35dB→48dB) and its dependence on free-running frequency (Sep – fp Characteristic on page 4).
- FM main distortion (0.8%→0.45%).
- AM detection output (approximately 5dB increased).

The constants on five external parts are changed as shown on page 10.

Functions

- FM-IF : IF amp, quadrature detector, soft muting, tuning indicator.
- MPX : PLL stereo decoder, stereo indicator, forced monaural, VCO stop.
- AM : RF amp, MIX, OSC (with ALC), IF amp, detector, AGC, tuning indicator.

Features

- FM/AM/MPX functions contained on a single chip.
- Minimum number of external parts required.
- On-chip FM muting function.
- High sensitivity.
- Less carrier leak of MPX.

Specifications

Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Ratings</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum supply voltage</td>
<td>VCC max</td>
<td>Pins 3, 7, 8, 11, 20, 21</td>
<td>9</td>
<td>V</td>
</tr>
<tr>
<td>Maximum supply current</td>
<td>ICC max</td>
<td>Pins 3+20+21</td>
<td>50</td>
<td>mA</td>
</tr>
<tr>
<td>Flow-in current (Indicator drive current)</td>
<td>ILED</td>
<td>Pins 7, 8</td>
<td>20</td>
<td>mA</td>
</tr>
<tr>
<td>Flow-out current</td>
<td>I23</td>
<td>Pin 23</td>
<td>0.1</td>
<td>mA</td>
</tr>
<tr>
<td>Allowable power dissipation</td>
<td>Pd max</td>
<td>Ta≤70°C</td>
<td>500</td>
<td>mW</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Topr</td>
<td>Ta=25°C</td>
<td>−20 to +70</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>Tstg</td>
<td></td>
<td>−40 to +125</td>
<td>°C</td>
</tr>
</tbody>
</table>

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Operating Conditions at Ta=25°C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Ratings</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended operating voltage</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt;</td>
<td></td>
<td>4.5</td>
<td>V</td>
</tr>
<tr>
<td>Operating voltage range</td>
<td>V&lt;sub&gt;CC&lt;/sub&gt; OP</td>
<td></td>
<td>3.0 to 8.0</td>
<td>V</td>
</tr>
</tbody>
</table>

Note: The FM output level forms an N curve (LA1805) and an S curve (LA1806).
LA1805 : N curve (for US band)
LA1806 : S curve (for Japanese band). Your desired output level can be set by varying the output resistance.

Operating Characteristics at Ta=25°C, V<sub>CC</sub>=4.5V, See Test Circuit

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Ratings</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiescent current</td>
<td>I&lt;sub&gt;cc&lt;/sub&gt;</td>
<td>No input</td>
<td>13</td>
<td>20</td>
</tr>
<tr>
<td>–3dB sensitivity</td>
<td>–3dBL.S.</td>
<td>Referenced to V&lt;sub&gt;N&lt;/sub&gt;=100dBμ, 100%, down 3dB</td>
<td>28</td>
<td>35</td>
</tr>
<tr>
<td>Demodulation output</td>
<td>V&lt;sub&gt;O&lt;/sub&gt;</td>
<td>V&lt;sub&gt;N&lt;/sub&gt;=100dBμ, 100% mod.</td>
<td>140</td>
<td>205</td>
</tr>
<tr>
<td>Channel balance</td>
<td>C.B.</td>
<td>V&lt;sub&gt;N&lt;/sub&gt;=100dBμ, 100% mod.</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total harmonic distortion</td>
<td>THD</td>
<td>V&lt;sub&gt;N&lt;/sub&gt;=100dBμ, 100% mod.</td>
<td>0.45</td>
<td>1.2</td>
</tr>
<tr>
<td>Signal to noise ratio</td>
<td>S/N</td>
<td>V&lt;sub&gt;N&lt;/sub&gt;=100dBμ, 100% mod.</td>
<td>70</td>
<td>80</td>
</tr>
<tr>
<td>LED ON sensitivity</td>
<td>V&lt;sub&gt;LED&lt;/sub&gt;</td>
<td>I&lt;sub&gt;L&lt;/sub&gt;=1mA</td>
<td>23</td>
<td>33</td>
</tr>
</tbody>
</table>

[FM characteristics (Mono) : f<sub>c</sub>=10.7MHz, f<sub>m</sub>=1kHz]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Ratings</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separation</td>
<td>Sep</td>
<td></td>
<td>32</td>
<td>48</td>
</tr>
<tr>
<td>Stereo distortion</td>
<td>HD (Main)</td>
<td></td>
<td>0.45</td>
<td>1.2</td>
</tr>
<tr>
<td>LED ON level</td>
<td>V&lt;sub&gt;LED&lt;/sub&gt;-on</td>
<td></td>
<td>2.4</td>
<td>3.9</td>
</tr>
<tr>
<td>LED OFF level</td>
<td>V&lt;sub&gt;LED&lt;/sub&gt;-off</td>
<td></td>
<td>2.7</td>
<td></td>
</tr>
</tbody>
</table>

[FM characteristics (Stereo) : f<sub>c</sub>=10.7MHz, f<sub>m</sub>=1kHz, L+R=90%, pilot=10%, V<sub>N</sub>=100dBμ]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Ratings</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiescent current</td>
<td>I&lt;sub&gt;cc&lt;/sub&gt;</td>
<td>No input</td>
<td>9.5</td>
<td>14.5</td>
</tr>
<tr>
<td>Demodulation output</td>
<td>V&lt;sub&gt;O&lt;/sub&gt;1</td>
<td>V&lt;sub&gt;N&lt;/sub&gt;=23dBμ, 30% mod.</td>
<td>27</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>V&lt;sub&gt;O&lt;/sub&gt;2</td>
<td>V&lt;sub&gt;N&lt;/sub&gt;=80dBμ, 30% mod.</td>
<td>70</td>
<td>113</td>
</tr>
<tr>
<td>Signal to noise ratio</td>
<td>S/N1</td>
<td>V&lt;sub&gt;N&lt;/sub&gt;=23dBμ, 30% mod.</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>S/N2</td>
<td>V&lt;sub&gt;N&lt;/sub&gt;=80dBμ, 30% mod.</td>
<td>50</td>
<td>55</td>
</tr>
<tr>
<td>Total harmonic distortion</td>
<td>THD1</td>
<td>V&lt;sub&gt;N&lt;/sub&gt;=80dBμ, 30% mod.</td>
<td>0.45</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>THD2</td>
<td>V&lt;sub&gt;N&lt;/sub&gt;=100dBμ, 30% mod.</td>
<td>0.6</td>
<td>1.5</td>
</tr>
<tr>
<td>LED on sensitivity</td>
<td>V&lt;sub&gt;LED&lt;/sub&gt;</td>
<td>I&lt;sub&gt;L&lt;/sub&gt;=1mA</td>
<td>16</td>
<td>24</td>
</tr>
</tbody>
</table>

[AM characteristics : f<sub>c</sub>=10kHz, f<sub>m</sub>=1kHz]

Note: Be fully careful of dielectric breakdown.

Equivalent Circuit Block Diagram
How to use the LA1805

1. Forced monaural mode.

Figures 1 and 2 show how to cause the forced monaural mode to be entered.

(1) Connect pin 14 to VCC through a resistor of 100kΩ. (Turn ON the SW1 in Figure 1.)

(2) Connect pin 15 to GND through a resistor of 47kΩ. (Turn ON the SW2 in Figure 2.)

Either above-mentioned (1) or (2) causes the forced monaural mode to be entered. In this case, the VCO does not stop operating. If the resistance of R1 and R2 are decreased, internal bias will vary when the S1 or S2 is turned ON. This data is shown in Figure 3.
2. VCO Stop
The VCO is so designed as to stop automatically at the AM mode.
(when pin 11 and pin 21 are at the same potential)
There is no pin available for stopping the VCO at the FM mode. However, the method shown right can be used to stop the VCO at the FM mode, causing the forced monaural mode to be entered.

3. Free-running frequency measurement and adjustment
Either of the following two methods is used to measure the free-running frequency.
(1) Connect pin 13 to a frequency counter through the high input impedance amplifier.
(2) Connect the connection point of the semifixed resistor connected to pin 13 and the fixed resistor to a frequency counter through the resistor of 240kΩ or greater.

* When setting the free-running frequency, the following must be noted.
Apply a 10.7MHz 100dBµ nonmodulation carrier as IF input signal and set to 76kHz±50Hz with the tuning indicator lighted.

4. Separation setting capacitor Cs
The separation characteristic for the LA1805 alone (IF input) differs from that for the antenna input with a front end. This difference is caused by the characteristics of the front end and ceramic filter. Shown right is how the separation characteristic changes with the separation setting capacitor value when the LA1186N is used as front end. Referring to this separation characteristic, choose the optimum separation for your set model.
5. FM muting pin
The external resistor connected to pin 12 can be used to vary the muting level (Figure 9). The abnormal sound at the
time of side peak reception at the FM mode can be reduced by weak signal muting.

6. The following method can be used to change the LED ON sensitivity at the FM mode (Figure 11). The data on the
LED ON sensitivity setting resistance and LED ON sensitivity is shown in Figure 12.

7. AM-FM selection
The FM mode is entered with pin 11 open as shown in
Figure 13. When pin 11 and pin 21 are made to be at
the same potential in terms of DC, the AM mode is
entered. It should be noted that the dynamic range is
narrowed whether the potential at pin 11 is lower or
higher than that at pin 21.

8. If a noise appears in the detection output when the tuning LED goes ON at the AM mode, connect a capacitor across
pin 8 and GND to eliminate the noise.
SW Band Test Circuit

LW Band Test Circuit

Unit (capacitance : F)

T1 : YT-30117 (Mitsumi), 2158-4095-319A (Sumida)
T2 : HW-40184 (Mitsumi), 0237-1500 (Sumida)
Sample Application Circuit : LA1186N+LA1805 FM/MW

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

Note: The constants of parts 1 to 5 are changed from those of the LA1810.
Sample Printed Circuit Pattern (See Sample Application Circuit.)

Differences between LA1805 and LA1806

1. Same pin assignment
2. The internal circuit of the MPX OUT (pin 9, pin 10) is different as shown below.

   The FM S curve at pin 17 is in the opposite direction and the circuit in which AFC is provided is the same for the US band and Japanese band.

The LA1805 contains the output load resistors (Output load resistance=6.8kΩ)

For the LA1806, output load resistors R_L, R_R are connected externally. The graph of demodulation output vs. R_L (R_R) is shown below.
Coil Specifications

• MW bar antenna
  TN-10896 (Mitsumi)

• AM IFT
  HW-6215 (Mitsumi)
  HW-6194 SFU-450B
  ①-② 94T
  ②-③ 7T
  ③-④ 58T
  180pF

• SW2 OSC
  HW-40184 (Mitsumi)
  ①-② 8T
  ②-③ 12T
  Q₀ ≥ 28, L = 1.31μH

• SW2 ANT
  YT-30117 (Mitsumi)
  ①-② 4T
  ②-③ 4T
  Q₀ = 95, L = 1.4μH

• LW bar antenna
  HH-50161 (Mitsumi)

• MW OSC
  HW-6193 (Mitsumi)
  ①-③ 32T
  ③-④ 64T
  Q₀ = 140, L = 140μH

• FM quadrature
  YT-30103 (Mitsumi)
  ①-③ 10T
  Q₀ = 90, f = 10.7MHz
  82pF

• LW OSC
  MA-7014 (Mitsumi)
  ①-④ 40T
  ①-⑤ 80T
  L = 220μH, Q₀ = 130

External load resistance, Rₗ – kΩ
Demodulation output – mVrms

f = 10.7MHz
1kHz-100% mod
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