A general Op-Amp Architecture.

\[
\begin{align*}
V_1 & \quad \begin{cases} - \frac{R_{in}}{2} & \text{Input Stage} \\
R_{in} & \end{cases} \\
V_2 & \quad \begin{cases} + \frac{R_{in}}{2} & \text{Second Stage} \\
- \frac{R_{in}}{2} & \text{Gain Amp} \\
\end{cases} \\
\end{align*}
\]

Input Stage

(*Differential Input to Single-ended Output*)

Second Stage

Gain Amp.

Power Amplifier.

* The first stage does the differential to single-ended conversion in addition to the gain \(-g_m \cdot R_o\). It also provides all the common-mode rejection for the amplifier.

* The second stage provides the remaining gain required in the amplifier. The capacitor \(C_c\) is for stability.

* Since the Op-Amp should be capable of driving very small loads, the last stage, power amplifier, does the job of providing all the power gain.
Before we derive the gain for this model, we can do a simplification using Miller’s Theorem.

\[ V_1 \]
\[ \frac{V_1}{V_2} \]
\[ \frac{V_0}{V_2-V_1} \]

where \( C_m = C_c (1+A) \) Using Miller’s Theorem.

We can write, the single pole approximation (ie. \( C_c \ll C_m \))

\[ V_0 = -A \cdot \frac{g_m (V_2-V_1)}{R_o + \frac{1}{C_m s}} \]

\[ \frac{V_0}{V_2-V_1} = \frac{A \cdot g_m / C_m}{\beta + \frac{1}{R_o C_m}} \]

D.C. gain = \( A \cdot g_m \cdot R_o \)

Dominant pole @ \( -\frac{1}{R_o C_m} = \frac{-1}{R_o C_c (1+A)} \)
Electrical Characteristics (Note 5) (Continued)

Note 3: For operation at elevated temperatures, these devices must be derated based on thermal resistance, and $T_j$ max. (listed under "Absolute Maximum Ratings"). $T_j = T_A + (\theta_A P_D)$.

<table>
<thead>
<tr>
<th>Thermal Resistance</th>
<th>Cerdip (J)</th>
<th>DIP (N)</th>
<th>HO8 (H)</th>
<th>SO-8 (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\theta_{JA}$ (Junction to Ambient)</td>
<td>100°C/W</td>
<td>100°C/W</td>
<td>170°C/W</td>
<td>195°C/W</td>
</tr>
<tr>
<td>$\theta_{JC}$ (Junction to Case)</td>
<td>N/A</td>
<td>N/A</td>
<td>25°C/W</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Note 4: For supply voltages less than ±15V, the absolute maximum input voltage is equal to the supply voltage.

Note 5: Unless otherwise specified, these specifications apply for $V_A = \pm 15V$, $-55°C \leq T_A \leq +125°C$ (LM741/LM741A). For the LM741C/LM741E, these specifications are limited to $0°C \leq T_A \leq +70°C$.

Note 6: Calculated value from: $BW$ (MHz) = $0.35/Rise\ Time(\mu s)$.

Note 7: For military specifications see RETS741X for LM741 and RETS741AX for LM741A.

Note 8: Human body model, 1.5 kΩ in series with 100 pF.

Schematic Diagram

Input Differential stage  
second gain stage  
output stage

← current mirrors

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