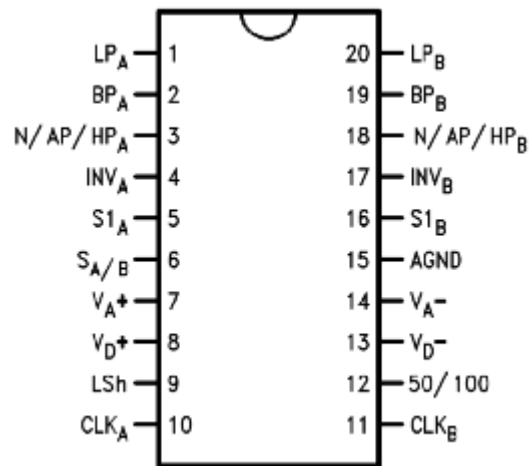


# THE LMF100 SWITCHED CAPACITOR FILTER

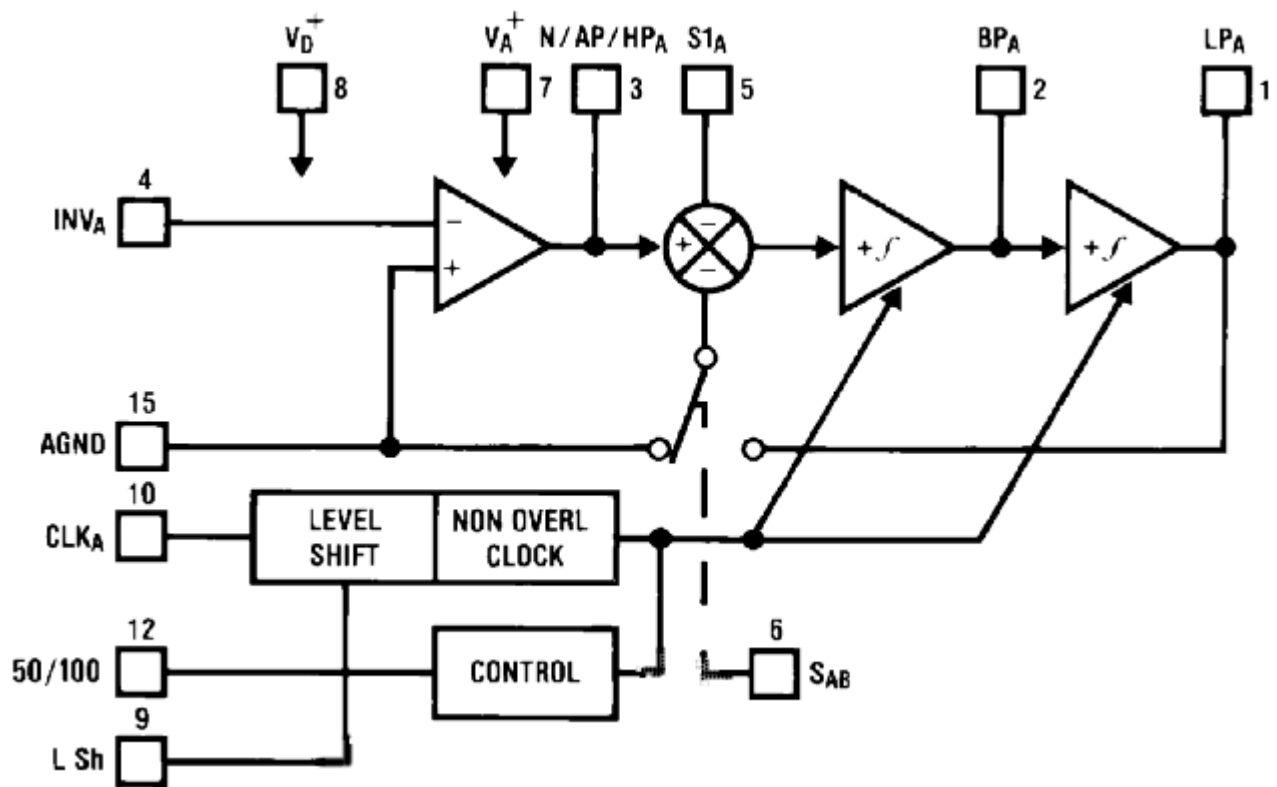
In this lab you will be using the MF100, or LMF100 integrated circuit is a versatile circuit with four switched capacitor integrators, that can be connected as two second order filters or one fourth order filter. With this chip you can choose  $\alpha$  to either be 1/50 or 1/100 of the clock frequency (this is given by the ratio  $C_1/C_2$  in the discussion above). By changing internal and external connections to the circuit you can obtain different filter types (lowpass, highpass, bandpass, notch (bandreject) or allpass).

<b>2<sup>nd</sup> Order Filters</b>	
<b>Filter Type</b>	<b>Transfer Function</b>
Low Pass	$H_{LP}(s) = \frac{H_{OLP} \omega_0^2}{s^2 + s \frac{\omega_0}{Q} + \omega_0^2}$
High Pass	$H_{HP}(s) = \frac{H_{OHP} s^2}{s^2 + s \frac{\omega_0}{Q} + \omega_0^2}$
Band Pass	$H_{BP}(s) = \frac{H_{OBP} \frac{\omega_0}{Q} s}{s^2 + s \frac{\omega_0}{Q} + \omega_0^2}$
Notch (Band Reject)	$H_N(s) = \frac{H_{ON} (\omega_0^2 + s^2)}{s^2 + s \frac{\omega_0}{Q} + \omega_0^2}$

The pinout for the LMF100 is shown below (from the data sheet):



See that the chip, for the most part, is split into two halves, left and right. A block diagram of the left half ((and a few pins from the right half) is shown below.



The pins are described as

50/100 - determines if the value of  $\omega'$  is  $\omega_{CLK}/100$ , or  $\omega_{CLK}/50$ .

- $CLK_A$  - is  $\omega_{CLK}$ .
- $INV_A$  - the inverting input to the op-amp
- $N/AP/HP_A$  - an intermediate output, and the non-inverting input to the summer. Used for Notch, All Pass or High Pass output.
- $BP_A$  - another intermediate output, the output of the first integrator. Used for Band Pass output.
- $LP_A$  - the output of the second integrator. Used for Low Pass output.
- $S1_A$  - an inverting input to the summer.
- $S_{AB}$  - determines if the switch is to the left or to the right. That is, this pin determines if the second inverting input to the summer is ground (AGND), or the low pass output.

The two integrators are switched capacitor integrators. Their transfer functions are given by,

$$\frac{\omega'}{s}$$

where  $\omega'$  is  $\omega_{CLK}/100$ , or  $\omega_{CLK}/50$ , depending on the state of the 50/100 pin. Note that the integrator is non-inverting.

Source : <https://aihteienotes.files.wordpress.com/2014/07/lic-notes.doc>