

RoHS Compliant & Pb Free Product
MC1-AN004

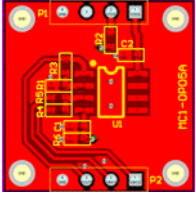
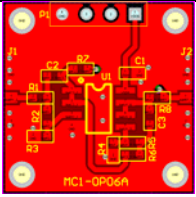
- Documents: Microwave Cell Application Note: Op-Amp Applications

Unlimited Possibilities!

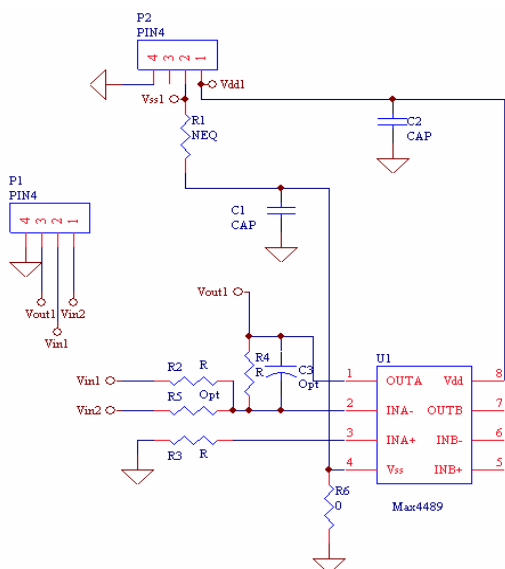
There are total 6 PCB cells offered for op-amp applications. MC1-OP01A, -OP02A, -OP03A are the same as MC1-OP04A, -OP05A and -OP06A except for different op-amp device packages. -OP01A to -OP03A supports MSOP-8 package and -OP04A to -OP06A supports SOIC-8 package. There are many basic applications designed for these three op-amp cells. The purpose of op-amp PCB cell is not intended for op-amp verification and is more designed for op-amp applications.

Table 1: Inventory Summary for Op-Amp PCB Cells

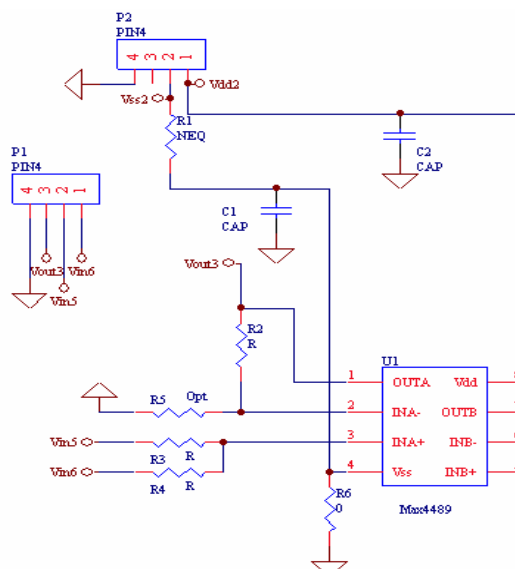
Cell Name	Supported Package	Cell Size	PCB Layout	Supported Device Vendor	Minimum Supported Device Part #	Typical Applications
MC1-OP01A	MSOP-8	1x1		Maxim Etc. Other vendors	Max4489 www.maxim.com	-Inverting Amp. -Summing Amp. -Difference Amp. -Differentiator -Low Pass Filter -Integrator
MC1-OP02A	MSOP-8	1x1		Maxim Etc. Other vendors	Max4489 www.maxim.com	-Non-Inverting Amp. -Unity Gain Buffer -Non-Inverting Summing Amp.
MC1-OP03A	MSOP-8	1x1		Maxim Etc. Other vendors	Max4489 www.maxim.com	- 1, 2, 3 and 4th order Butterworth and Bessel Active Filters
MC1-OP04A	SOIC-8	1x1		Maxim Etc. Other vendors	Max4489 www.maxim.com	-Inverting Amp. -Summing Amp. -Difference Amp. -Differentiator -Low Pass Filter -Integrator

MC1-OP05A	SOIC-8	1x1		Maxim Etc. Other vendors	Max4489 www.maxim.com	-Non-Inverting Amp. -Unity Gain Buffer -Non-Inverting Summing Amp.
MC1-OP06A	SOIC-8	1x1		Maxim Etc. Other vendors	Max4489 www.maxim.com	- 1, 2, 3 and 4th order Butterworth and Bessel Active Filters

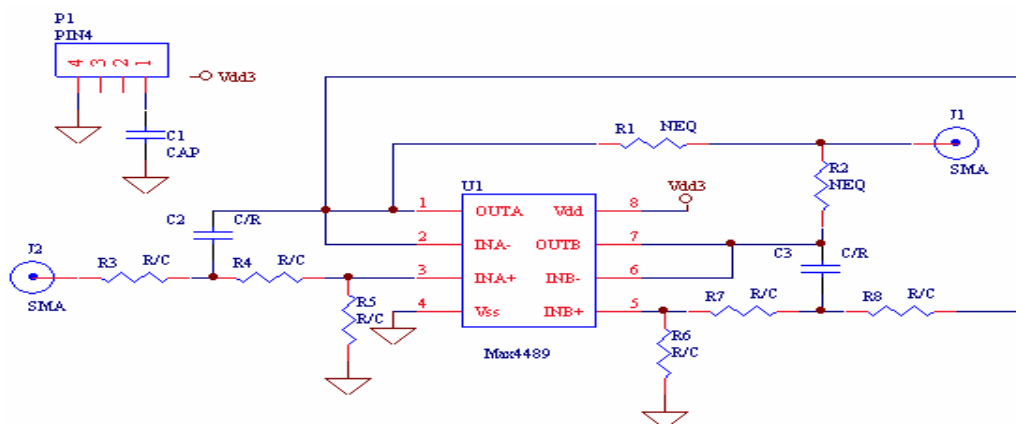
Offered schematics:



MC1-OP01A/MC1-OP04A

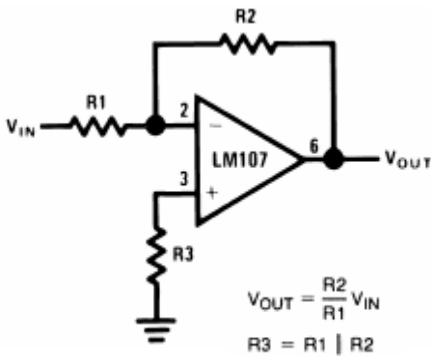


MC1-OP02A/MC1-OP05A

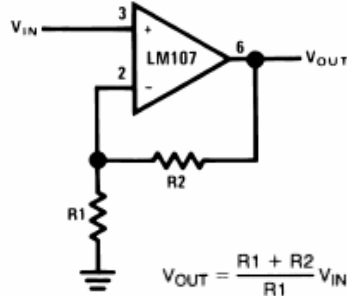


MC1-OP03A/MC1-OP06A

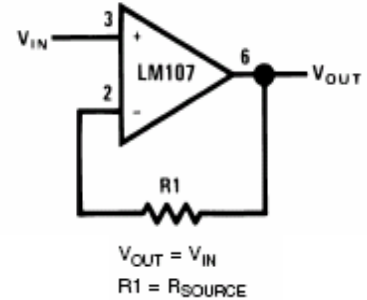
Typical Op-Amp Applications:



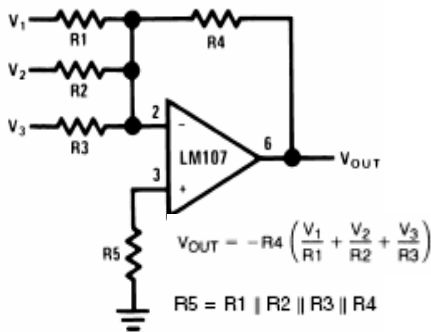
Inverting Amplifier



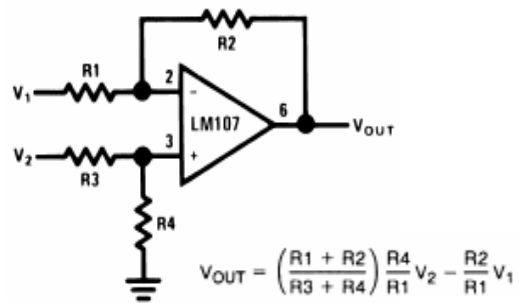
Non-Inverting Amplifier



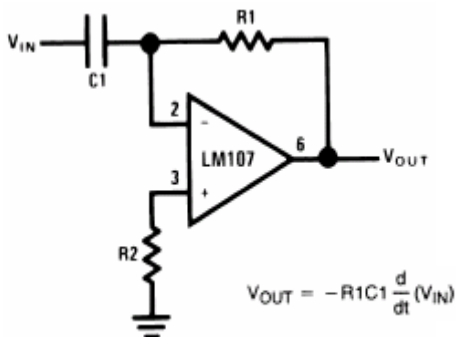
Unity Gain Amplifier



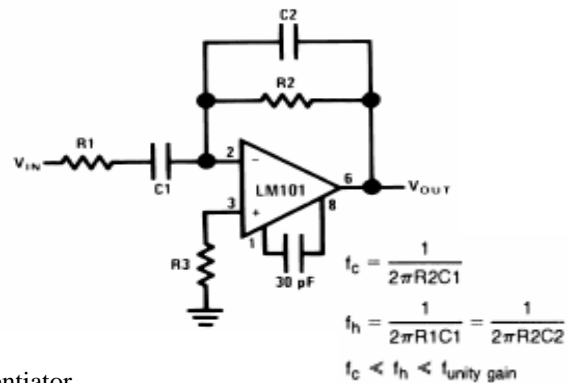
Summing Amplifier

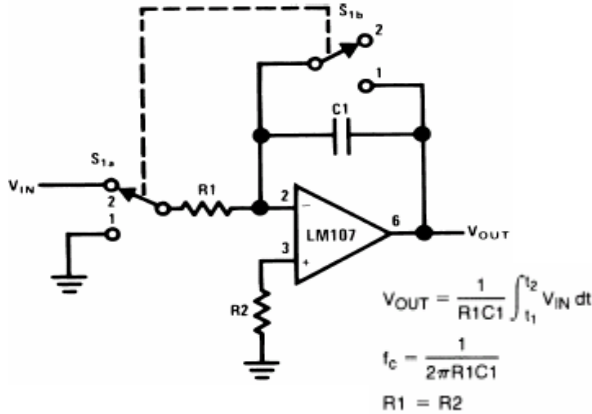


Difference Amplifier

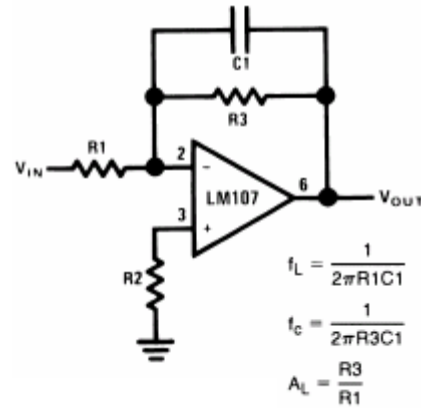


Differentiator



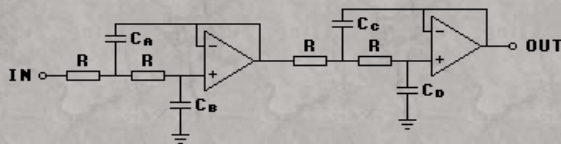


Integrator



Low Pass Filter

Active Filter: Butterworth (4th order, 24 dB/octave, Lowpass)



$R=4.7k-10\text{ kOhm}$

$C_a=1.0824/(2*\pi*F_c*R)$

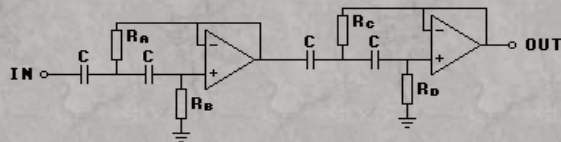
$C_b=0.9239/(2*\pi*F_c*R)$

$C_c=2.6130/(2*\pi*F_c*R)$

$C_d=0.3827/(2*\pi*F_c*R)$

Units: $R[\text{Ohm}]$, $C_x[\text{F}]$, $F_c[\text{Hz}]$

Active Filter: Butterworth (4th order, 24 dB/octave, Highpass)



$C=4.7n-10nF$

$R_a=0.9239/(2*\pi*F_c*C)$

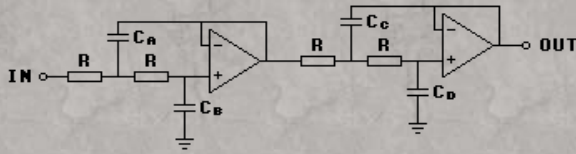
$R_b=1.0824/(2*\pi*F_c*C)$

$R_c=0.3827/(2*\pi*F_c*C)$

$R_d=2.6130/(2*\pi*F_c*C)$

Units: $R_x[\text{Ohm}]$, $C[\text{F}]$, $F_c[\text{Hz}]$

Active Filter: Bessel (4th order, 24 dB/octave, Lowpass)



$$R=4.7k-10\text{ kOhm}$$

$$C_a=0.7298/(2*\pi*F_c*R)$$

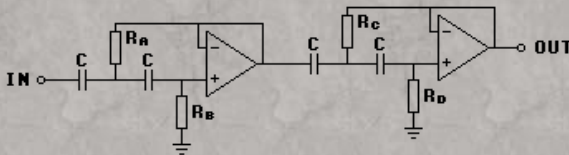
$$C_b=0.6699/(2*\pi*F_c*R)$$

$$C_c=1.0046/(2*\pi*F_c*R)$$

$$C_d=0.3872/(2*\pi*F_c*R)$$

Units: R [Ohm], C_x [F], F_c [Hz]

Active Filter: Bessel (4th order, 24 dB/octave, Highpass)



$$C=4.7n-10nF$$

$$R_a=1.3701/(2*\pi*F_c*C)$$

$$R_b=1.4929/(2*\pi*F_c*C)$$

$$R_c=0.9952/(2*\pi*F_c*C)$$

$$R_d=2.5830/(2*\pi*F_c*C)$$

Units: R_x [Ohm], C [F], F_c [Hz]

References:

- 1) D.Johnson and J.Hilburn, Rapid Practical Designs of Active Filters, John Wiley & Sons
- 2) H.Berlin, Design of Active Filters with Experiments, Howard W.Sams &Co., 1979
- 3) W.G.Jung, Op Amp Applications, Analog Devices

www.microwavecells.com