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# THE MASTER HANDBOOK OF IC CIRCUITS

BY THOMAS R. POWERS



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Blue Ridge Summit, PA 17214

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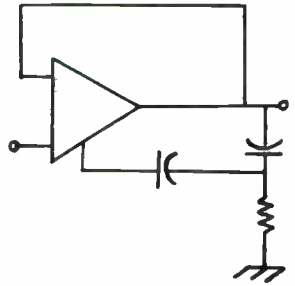
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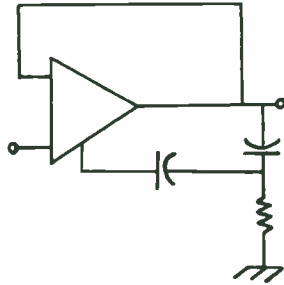
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## Introduction

No development in electronics has ever had the impact of the integrated circuit. That's a strong statement, considering such prior developments as the vacuum tube and transistor. But you'll probably be convinced of its truth as you scan through the pages of this book!

You're already familiar with such IC advantages as small size and low power requirements. What you may be unaware of is how ICs greatly simplify circuit design. Many ICs have been designed with specific purposes in mind, in contrast to many discrete components. We've gathered together over 900 applications circuits using over 200 popular ICs. The result is a smorgasbord of ideas and designs. All you have to do is connect the appropriate components to each IC and you're in business.

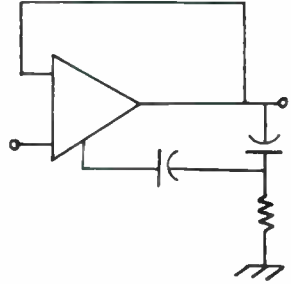
We've used a generic numbering system to refer to the ICs in this book. Various manufacturers of devices will add their company prefix (such as LM for National, SN for Texas Instruments, CA for RCA, etc.) to some of the devices in this book. Operationally, a device identified by a certain number will be identical from manufacturer to manufacturer.

Some of the circuits in this book may have a resistor and/or capacitor or two with no value indicated. The values of such parts should be determined experimentally for best circuit operation. Other circuits may have unlabeled transistors. In such circuits, the transistor can be any general purpose PNP or NPN transistor, as indicated.



With many ICs now available on the surplus market at amazingly low prices, you may have wanted to use more of them in your electronic projects and experiments but have been stymied by the lack of application information. That's the void this book hopes to fill. So go scrounging around in your junk box—odds are you'll find a couple of ICs you thought were useless, but there are some circuits using them in this book!

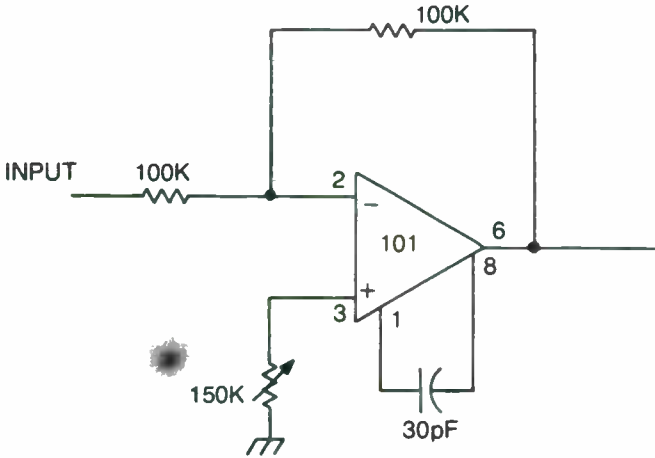
## Part I



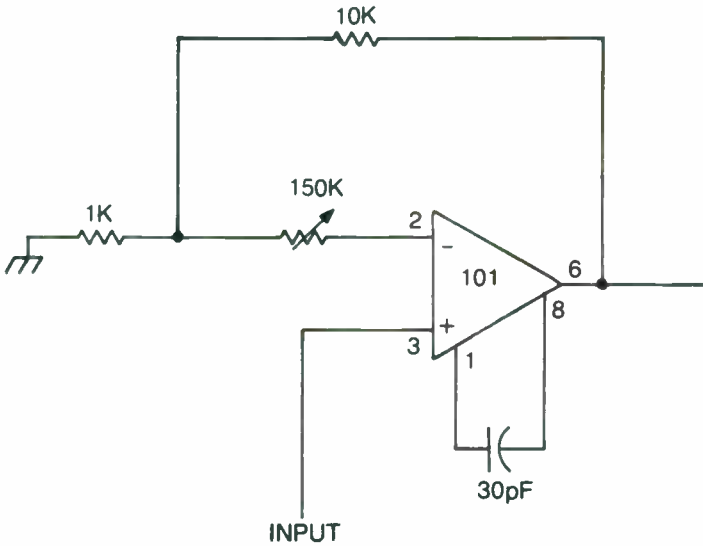
## Linear Integrated Circuits

When most of us think of linear integrated circuits, we think of op amps. Certainly, operational amplifiers are the most common linear integrated devices, but they're far from the only ones. Take a look at this section and see for yourself .

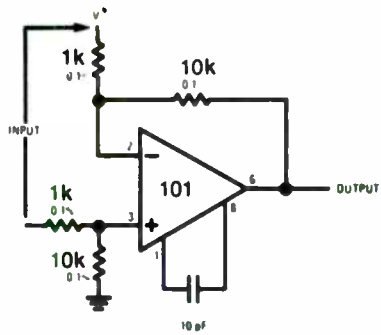
# 101—GENERAL PURPOSE OPERATIONAL AMPLIFIER



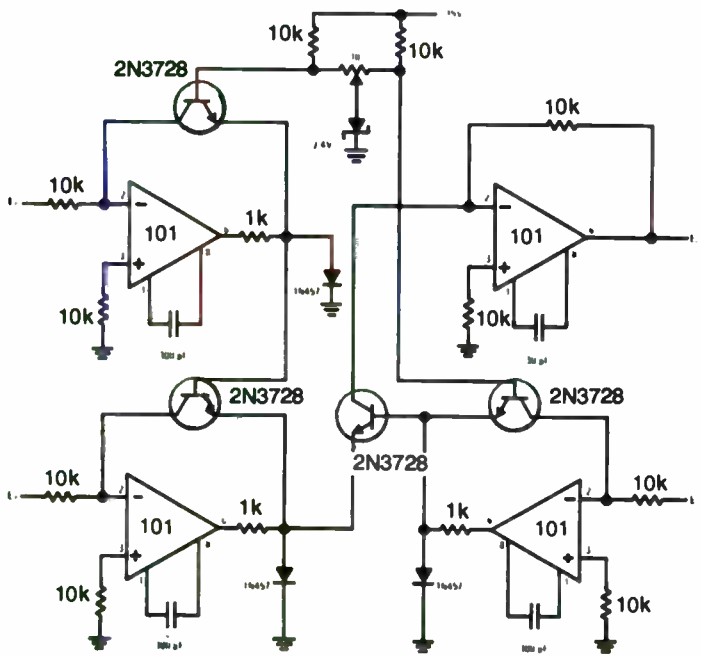
Summing amplifier with bias-current compensation



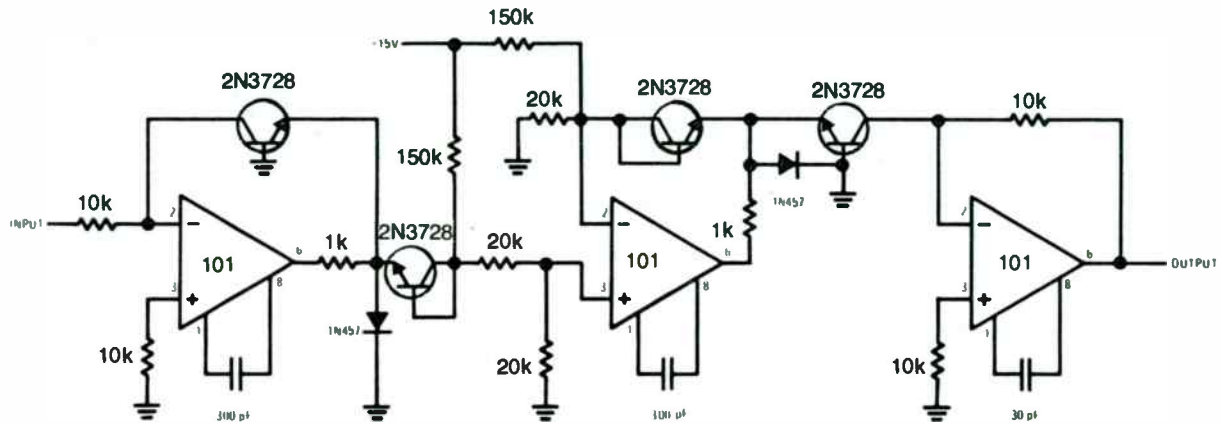
Noninverting amplifier with bias-current compensation



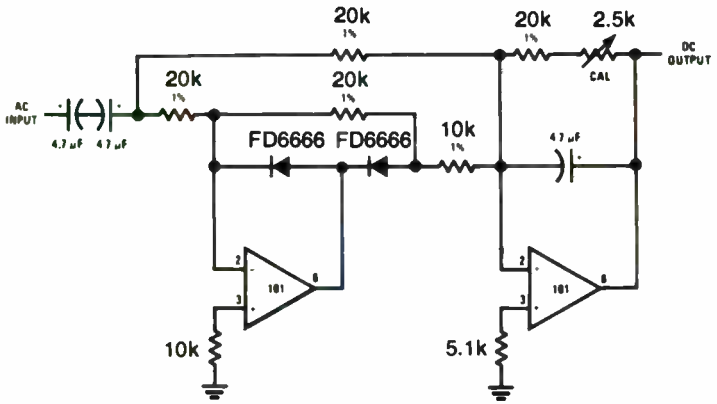
Standard differential amplifier



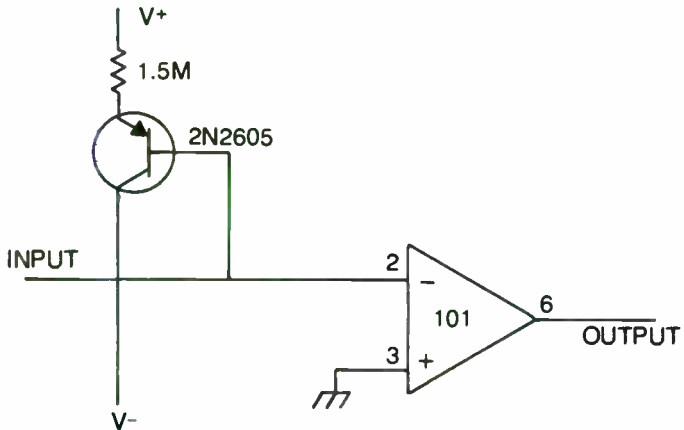
Analog multiplier/divider



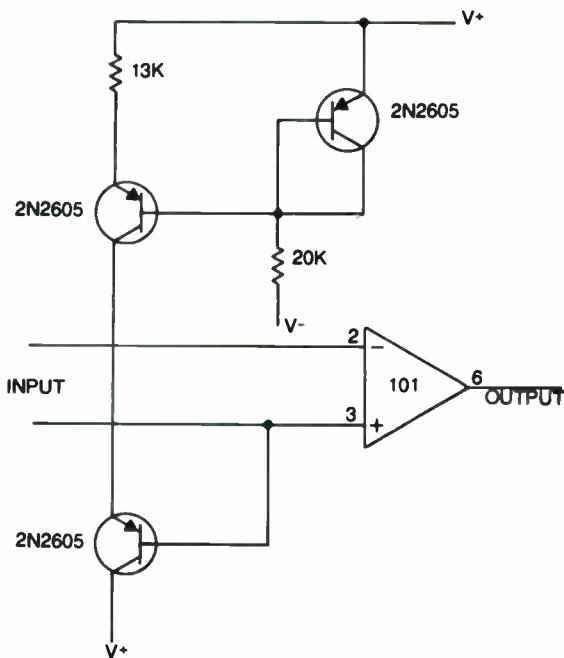
Root extractor



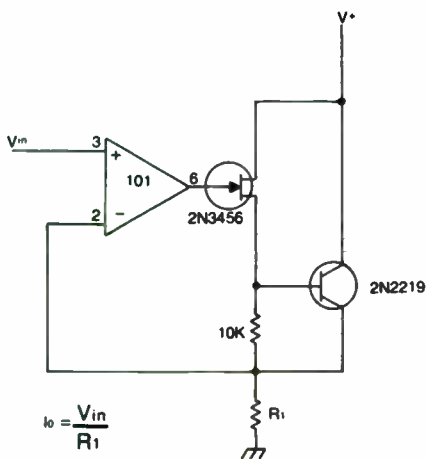
Full-wave rectifier and averaging filter



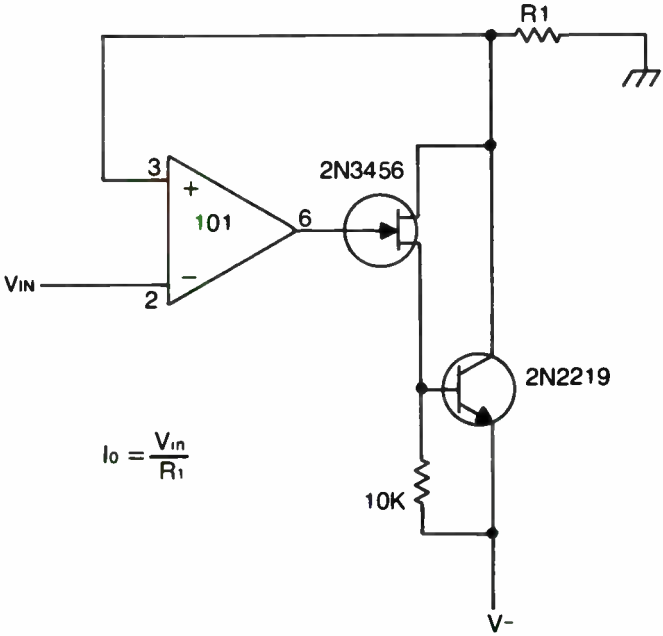
Summing amplifier with bias-current compensation and improved temperature stability



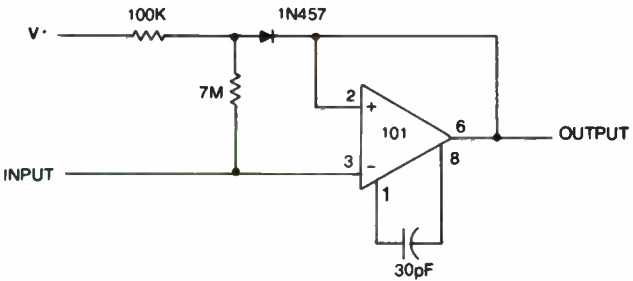
Bias-current compensated noninverting amplifier operating over large common mode range



Precision current sink

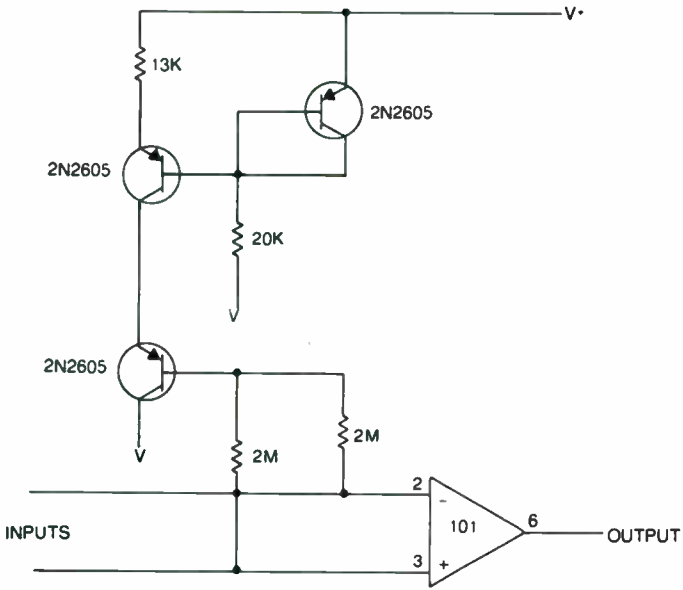


**Precision current source**

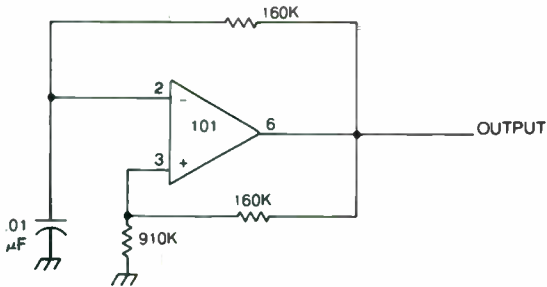


**Voltage follower with bias-current compensation**

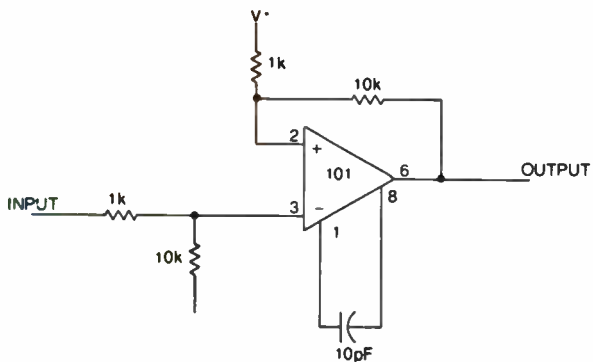




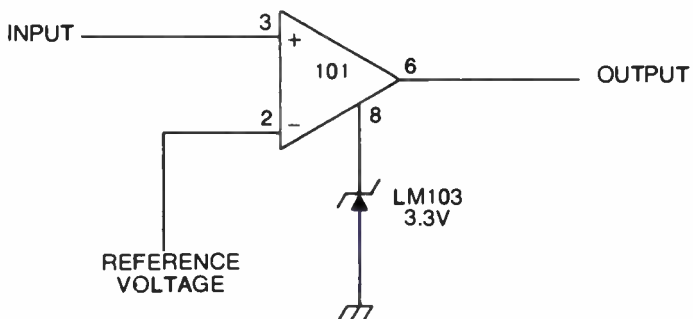
Summing amplifier with bias-current compensation for differential inputs



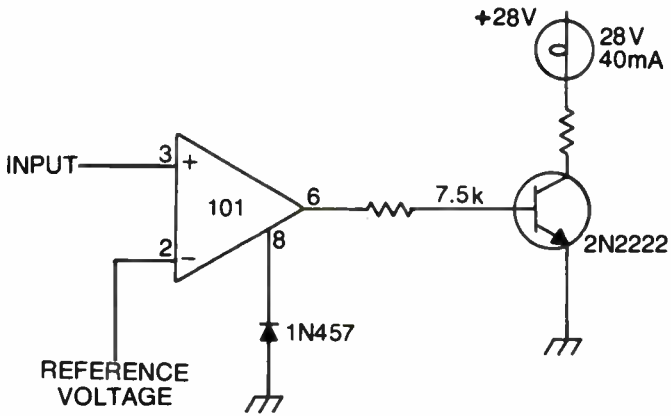
Low frequency free running multivibrator



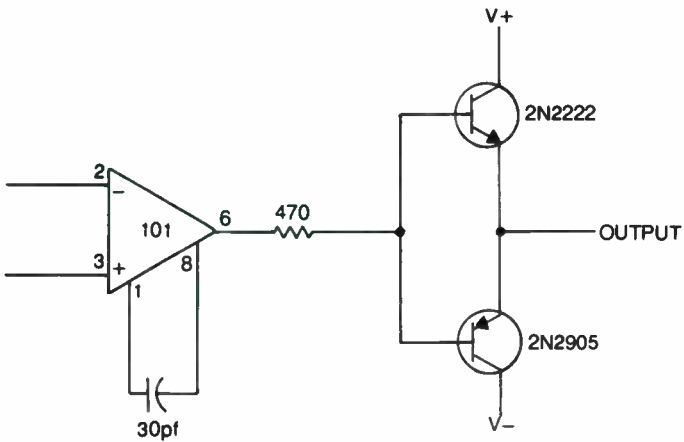
Level shifting differential amplifier



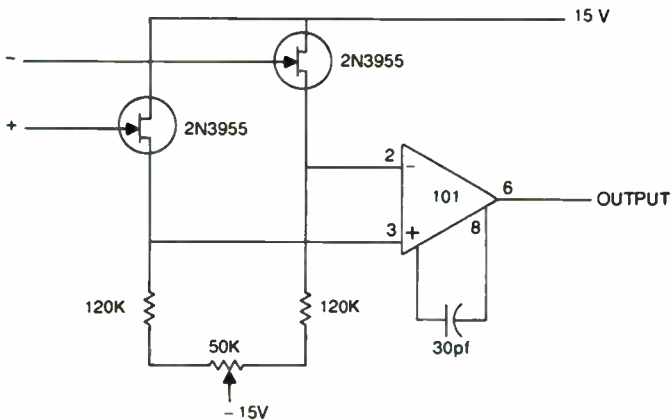
Voltage comparator for driving TTL ICs



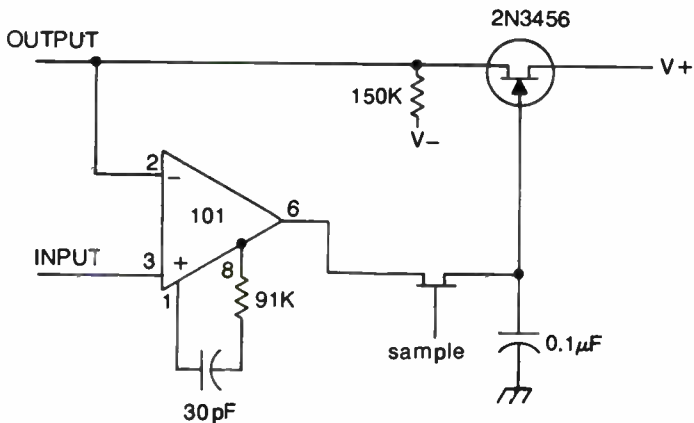
Voltage comparator and lamp driver



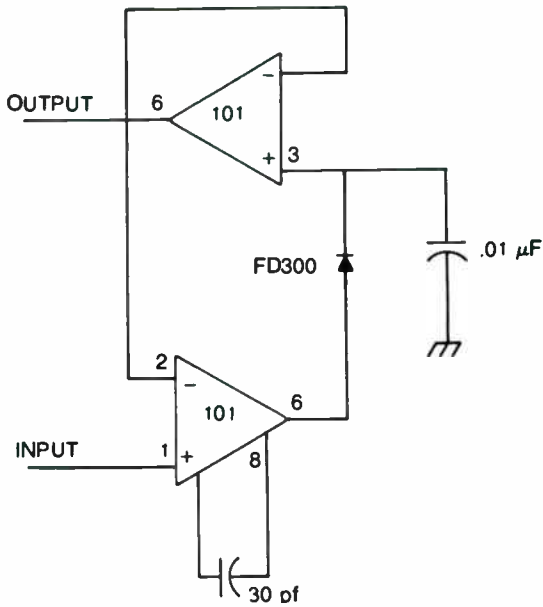
High current output buffer



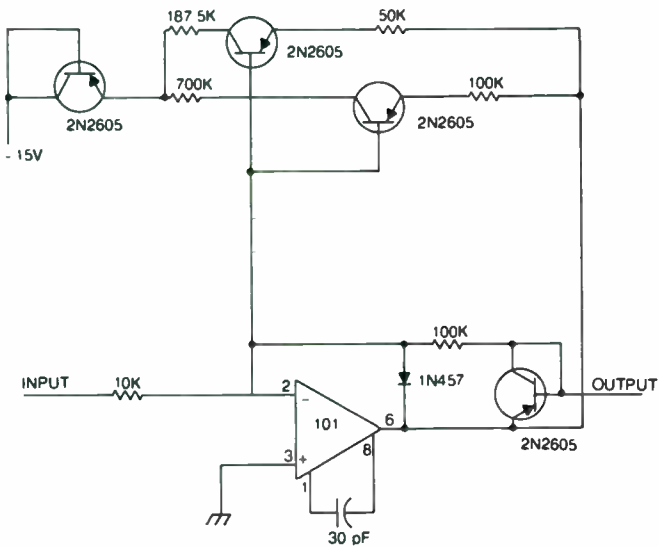
Summing amplifier with FET source followers



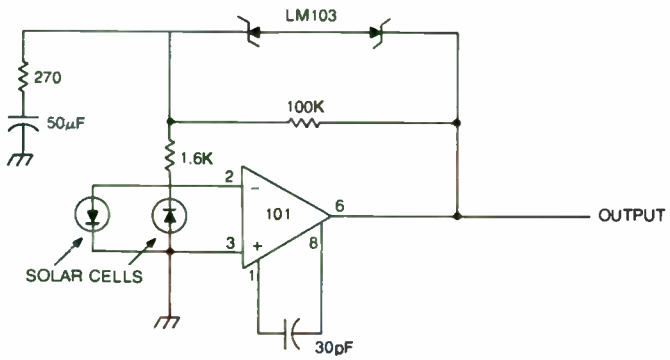
Low drift sample and hold



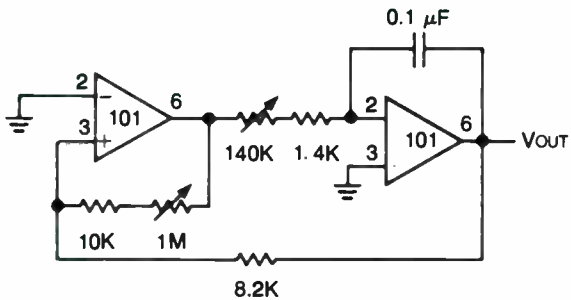
Positive peak detector with buffered output



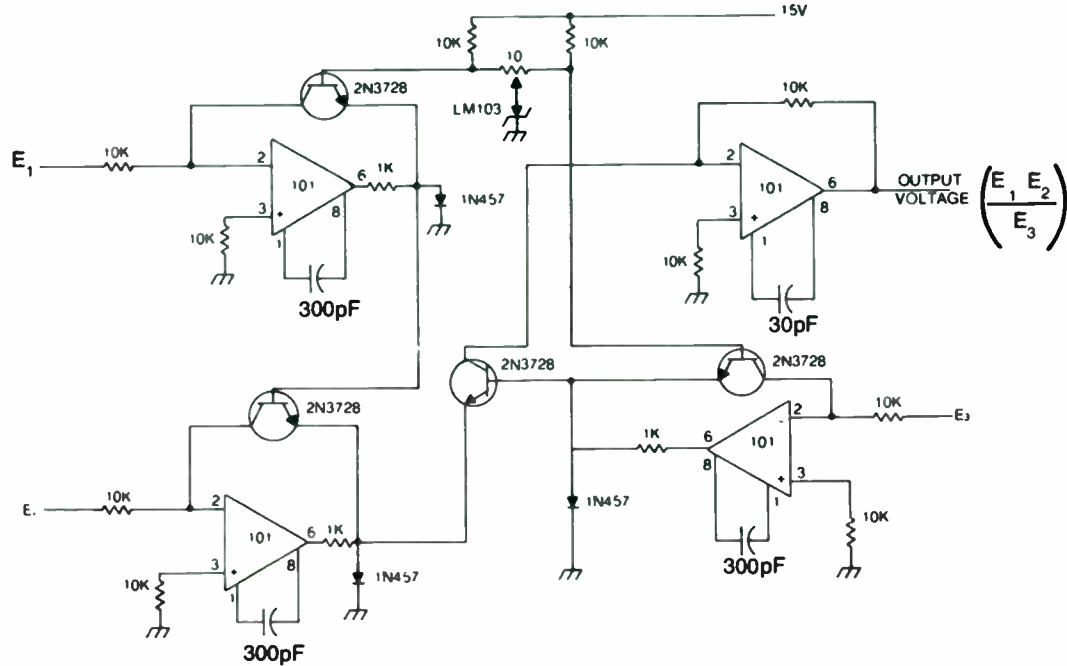
Nonlinear amplifier with temperature compensated breakpoints



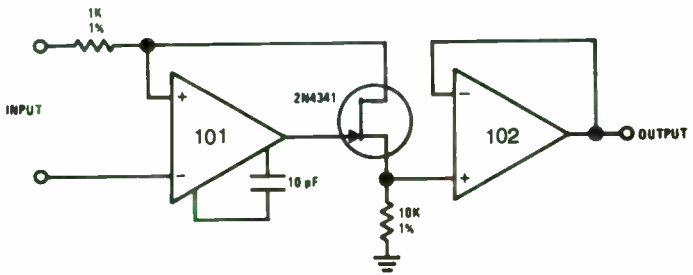
Saturating servo control preamplifier with rate feedback and solar cell sensors



Triangular-wave generator

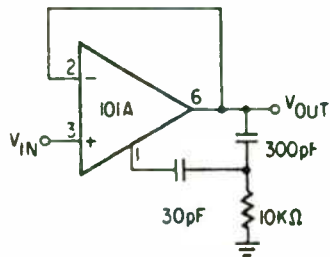


Analog multiplier/divider for input voltages from 500 mV to 50 V



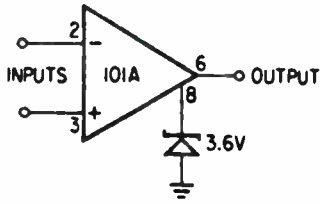
Level-shifting isolation amplifier

## 101A—LOW INPUT CURRENT GENERAL PURPOSE OPERATIONAL AMPLIFIER

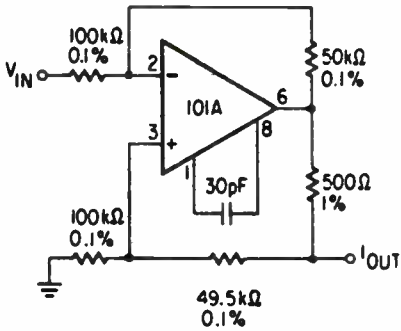


Fast voltage follower

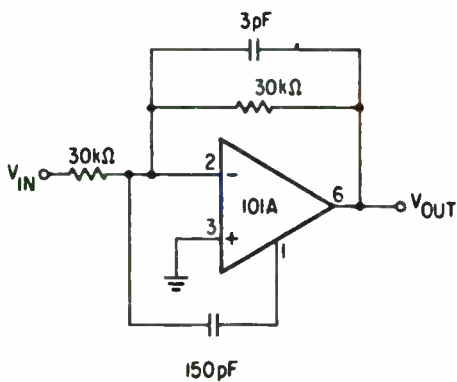




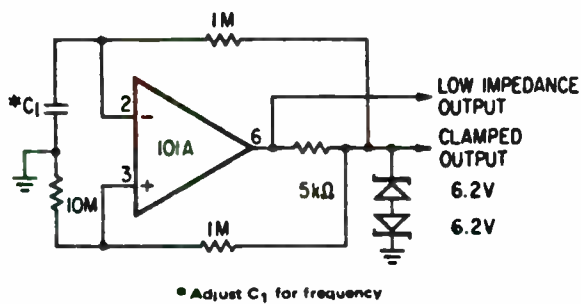
Voltage comparator for driving DTL or TTL integrated circuits



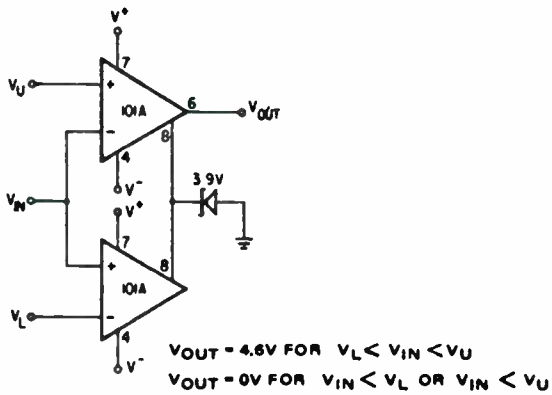
Bilateral current source



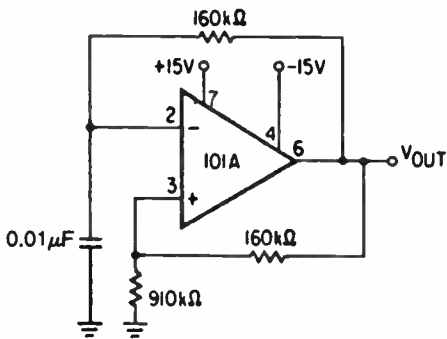
Fast summing amplifier



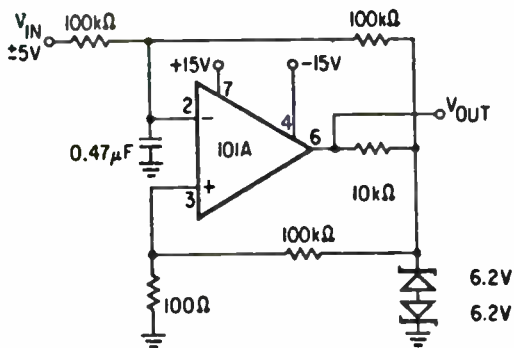
Low frequency square wave generator



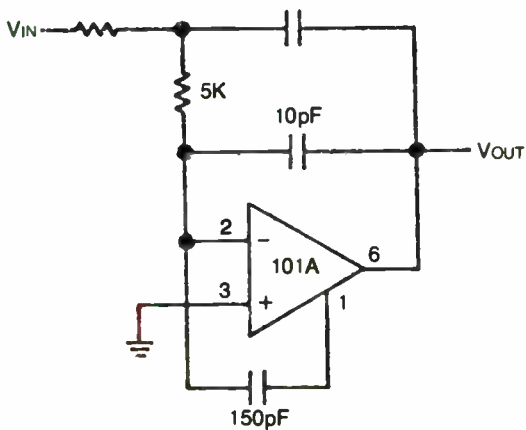
Double ended limit detector



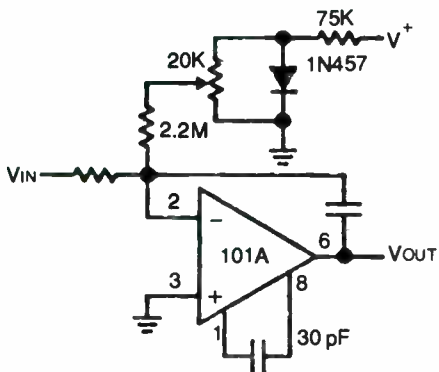
Free-running multivibrator



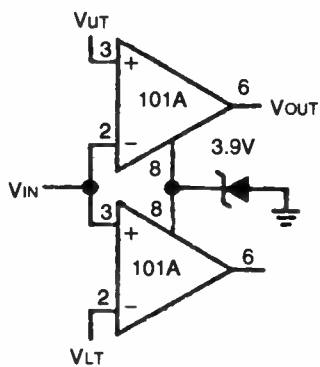
Pulse width modulator



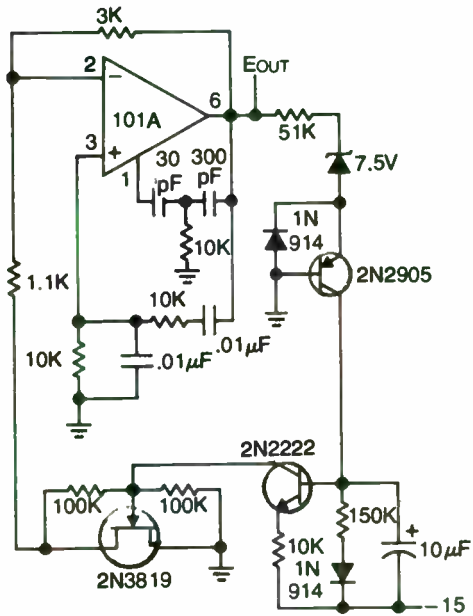
Fast integrator



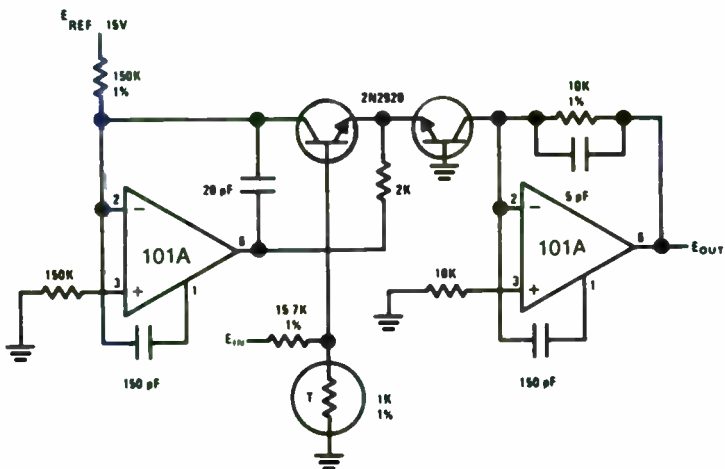
Integrator with bias current compensation



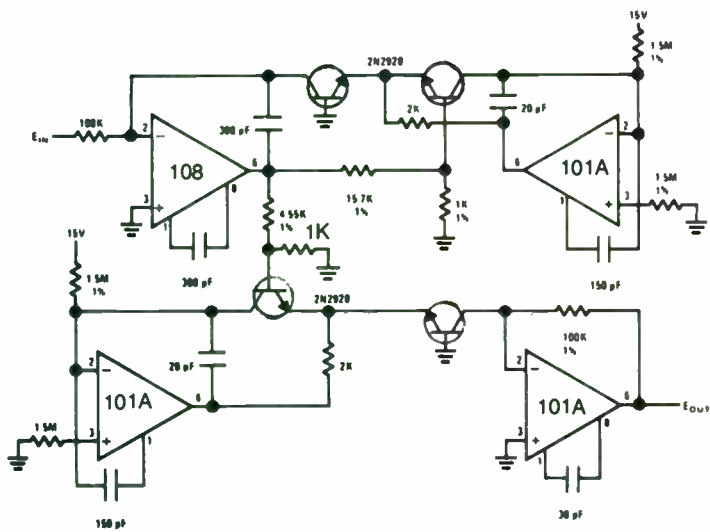
Double-ended limit detector



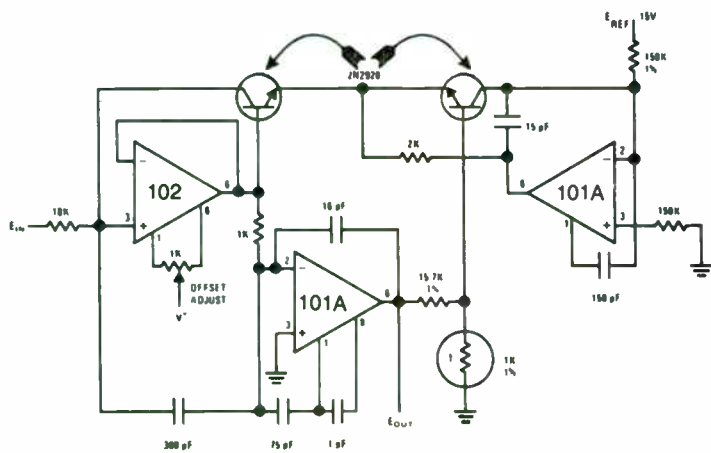
Wien bridge oscillator with FET amplitude stabilization



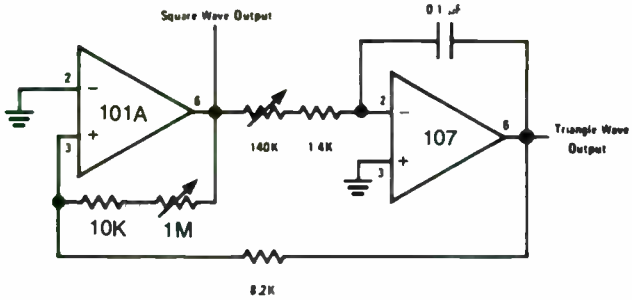
Anti-log generator



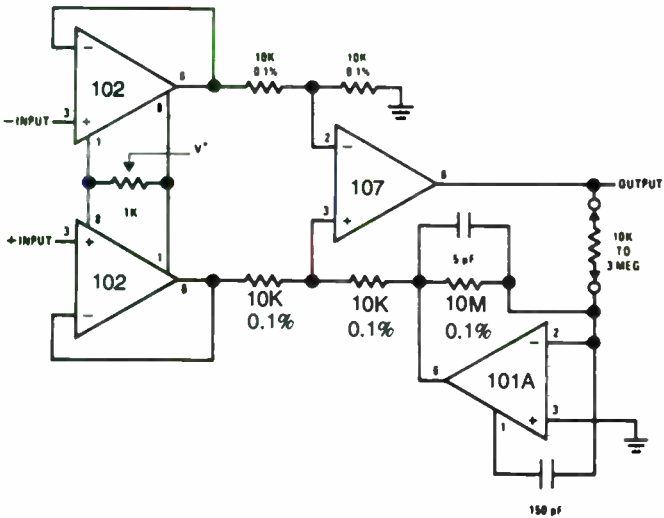
Cube generator



Fast log generator

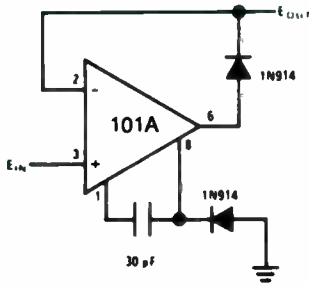


Function generator

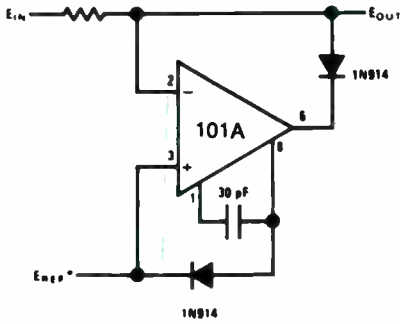


Variable gain, differential-input instrumentation amplifier

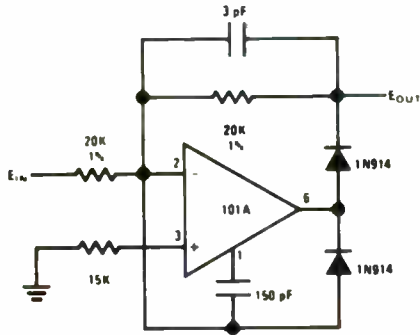




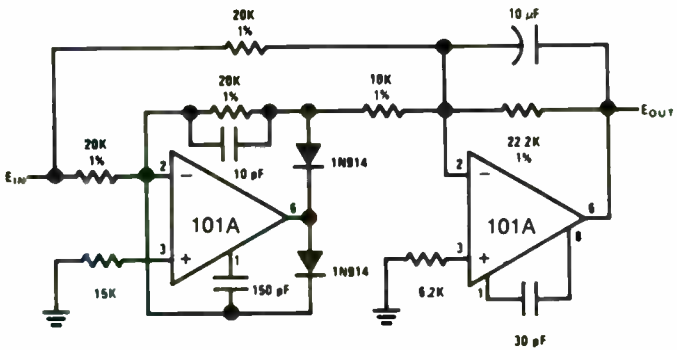
Precision diode



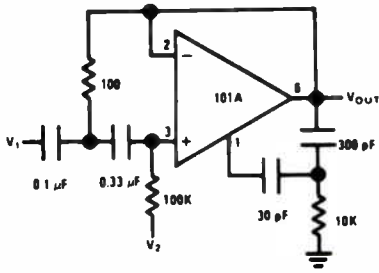
Precision clamp



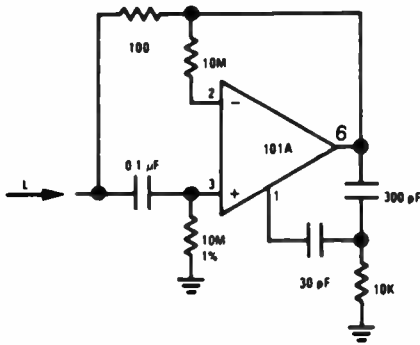
Fast half wave rectifier



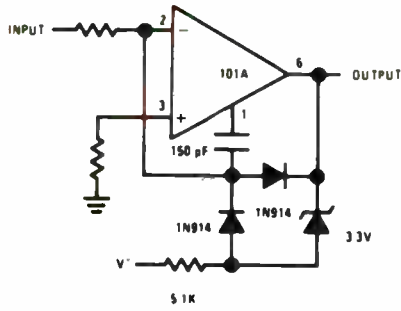
Precision ac to dc converter



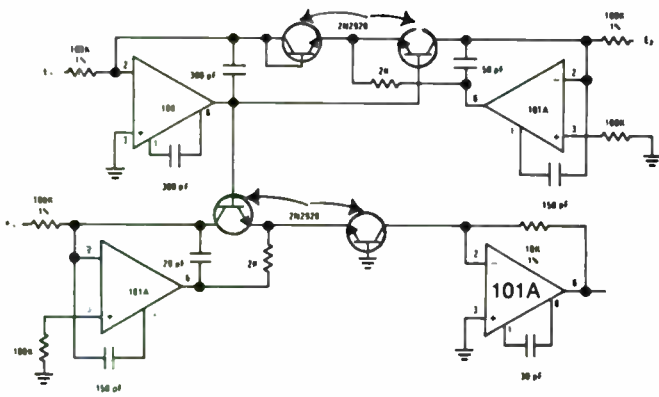
Tuned circuit



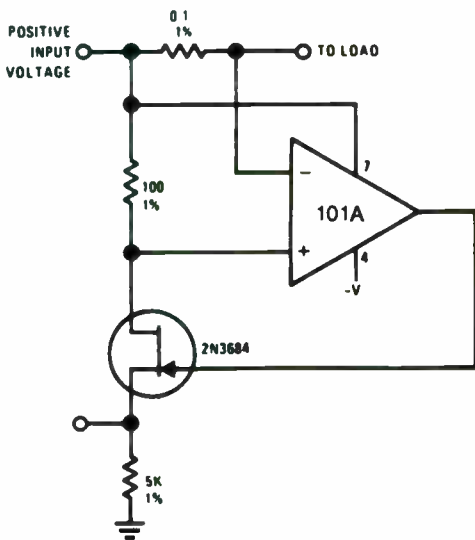
Simulated inductor



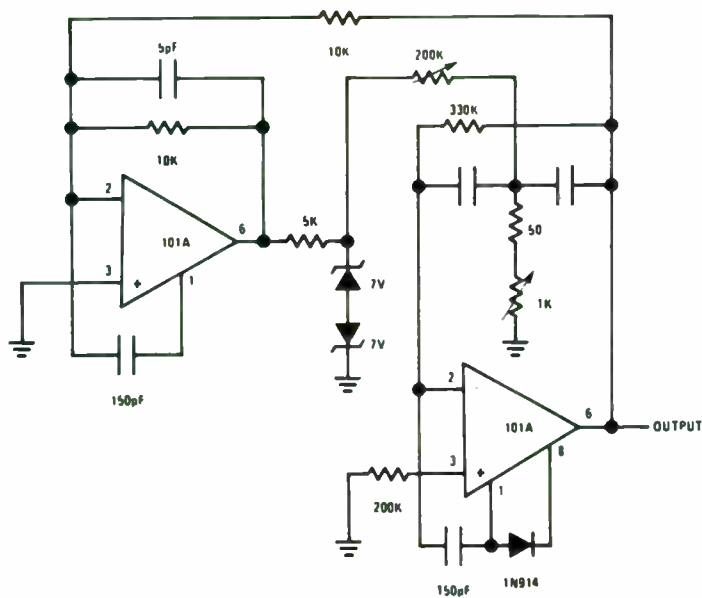
Fast zero crossing detector



Multiplier/divider

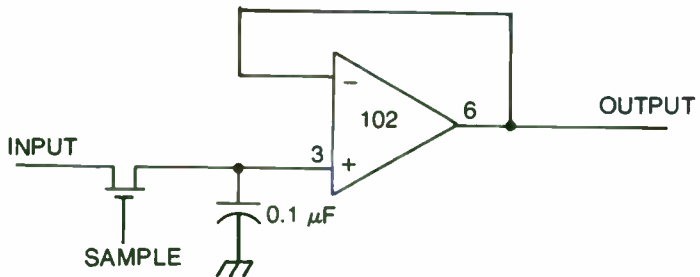


**Current Monitor**

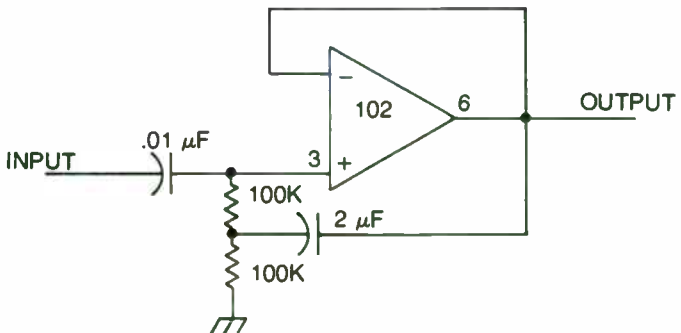


**Low distortion sine wave oscillator**

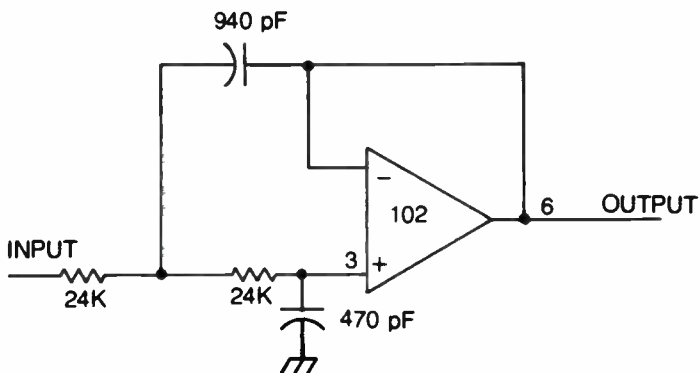
## 102—HIGH SPEED OPERATIONAL AMPLIFIER



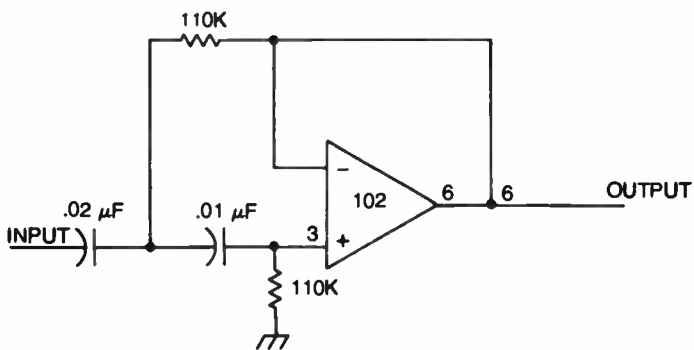
Sample and hold circuit



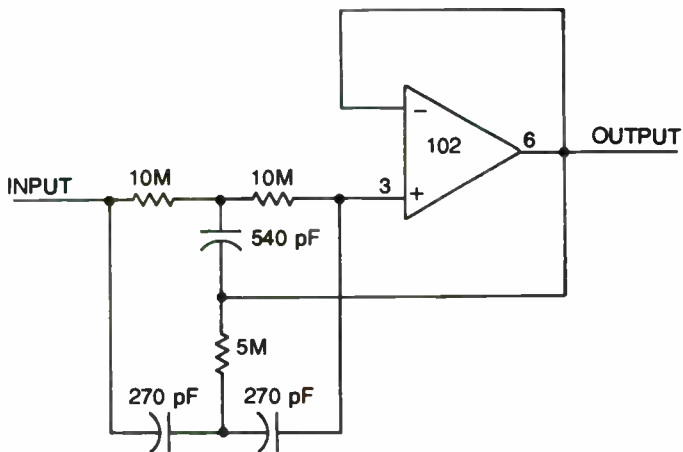
High input impedance ac amplifier



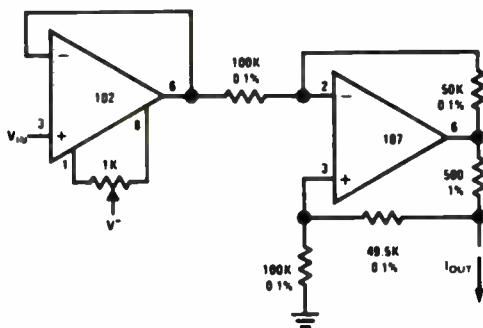
Low pass active filter



High pass active filter

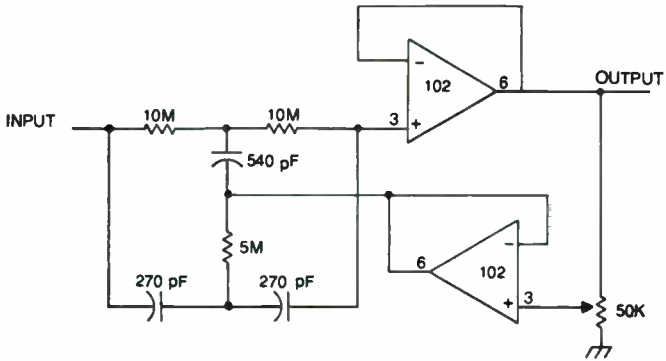


High Q notch filter

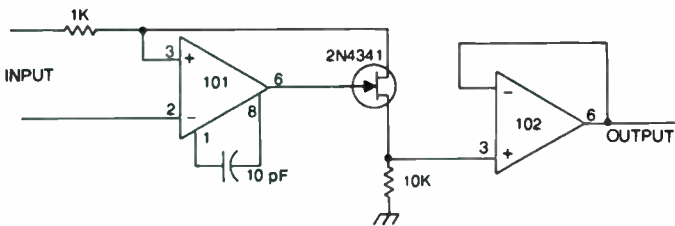


Bilateral current source

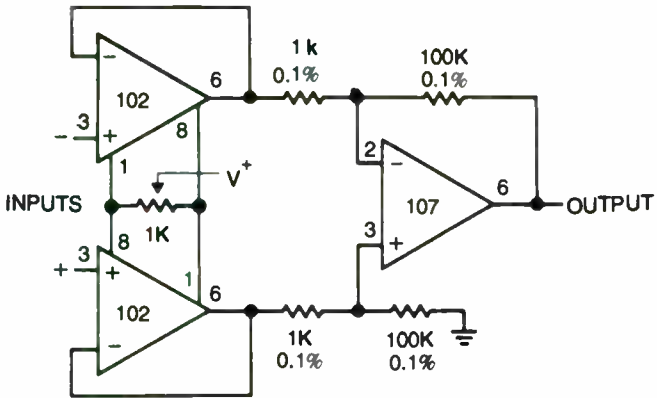




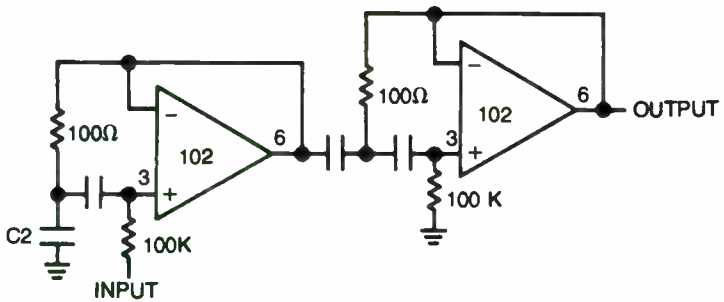
Variable Q notch filter



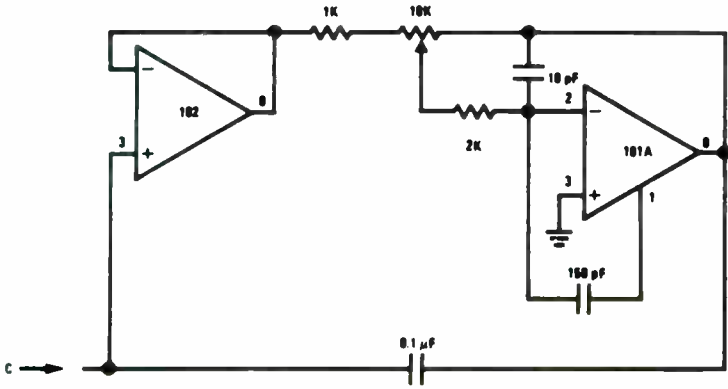
Level shifting isolation amplifier



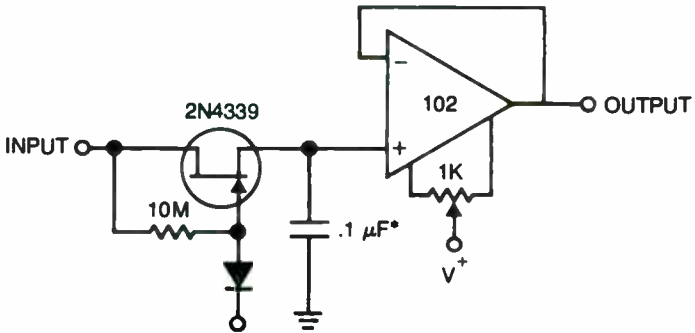
Differential-input instrumentation amplifier



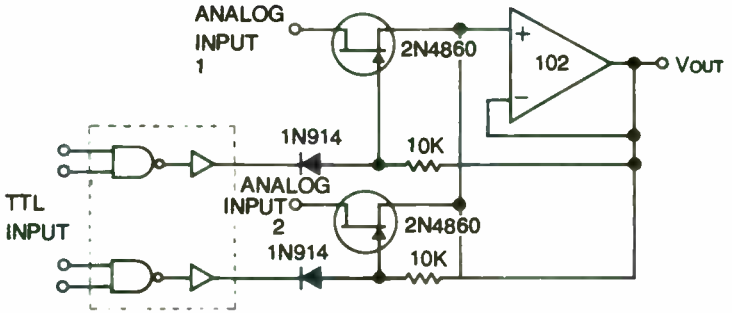
Two-stage tuned circuit



Variable capacitance multiplier

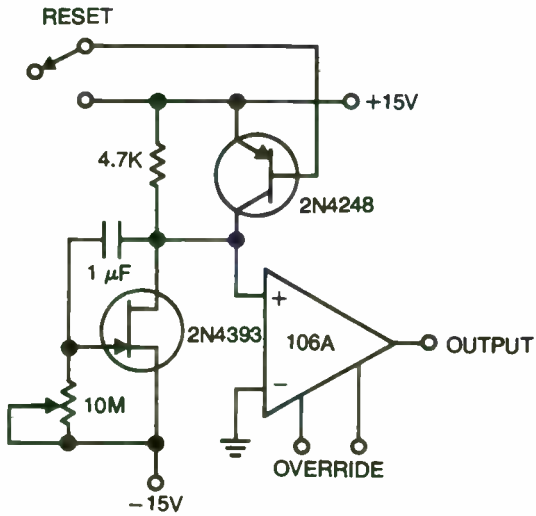


Sample and hold with offset adjustment

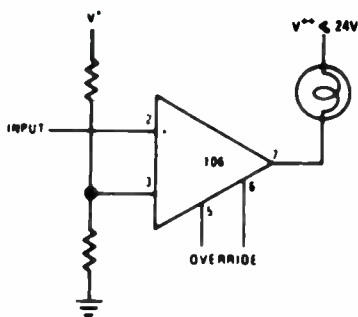


TTL controlled buffered analog switch

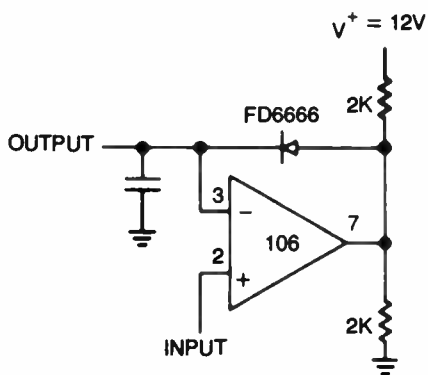
## 106—VOLTAGE COMPARATOR



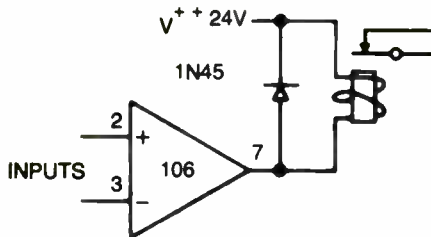
Long time comparator



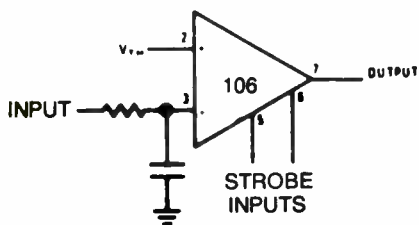
Level detector and lamp driver



Fast response peak detector

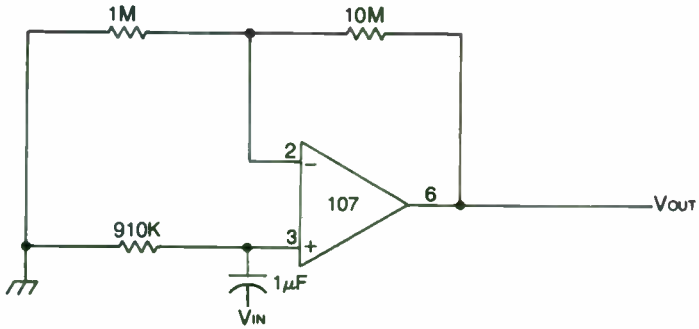


Relay driver

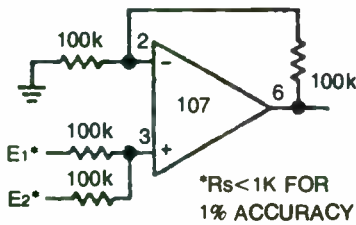


Adjustable threshold line receiver

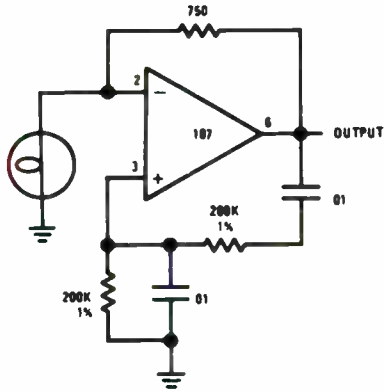
# 107—FREQUENCY COMPENSATED OPERATIONAL AMPLIFIER



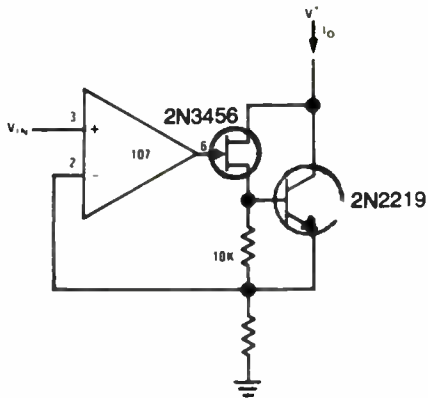
Noninverting ac amplifier



Noninverting summing amplifier

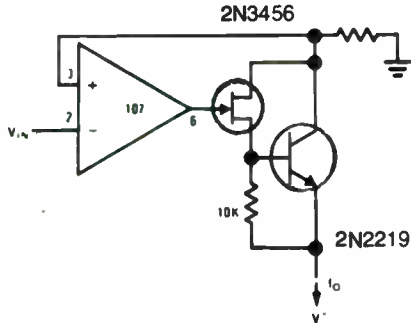


Wien bridge sine wave oscillator

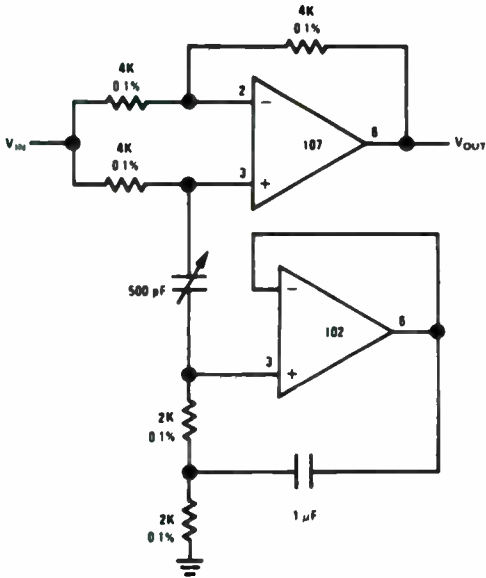


Precision current sink

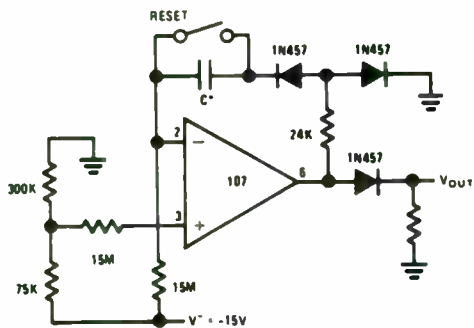




Precision current source

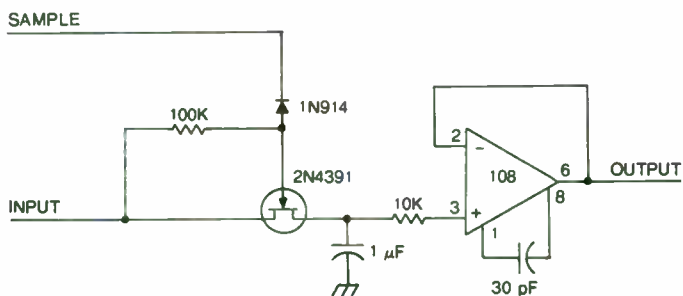


Easily tuned notch filter

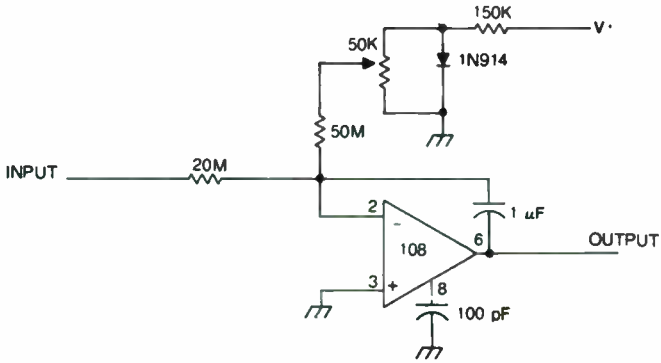


Long interval timer

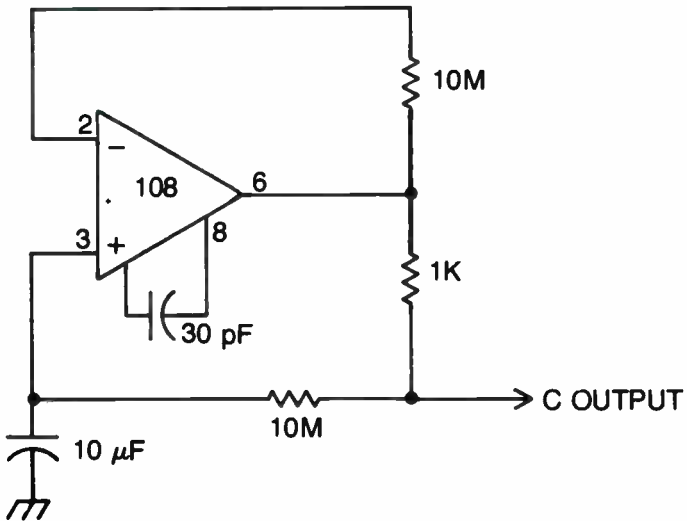
## 108—LOW INPUT CURRENT OPERATIONAL AMPLIFIER



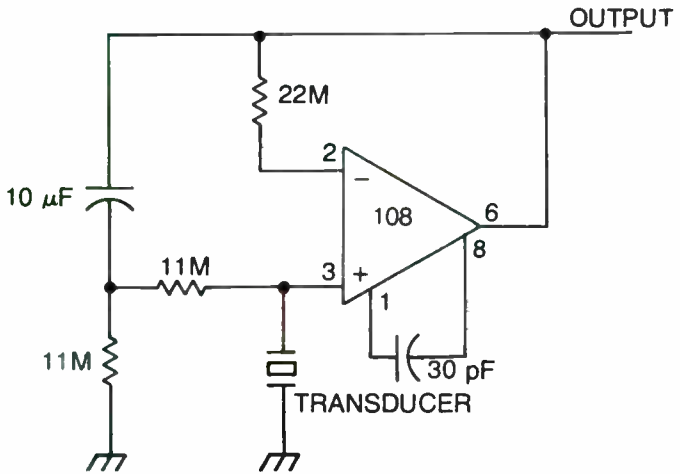
Sample and hold circuit



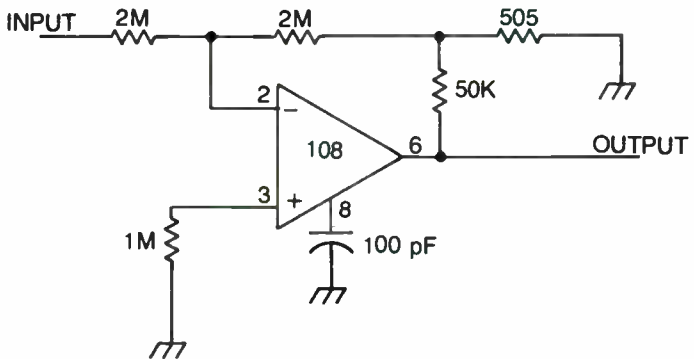
Integrator with bias current compensation



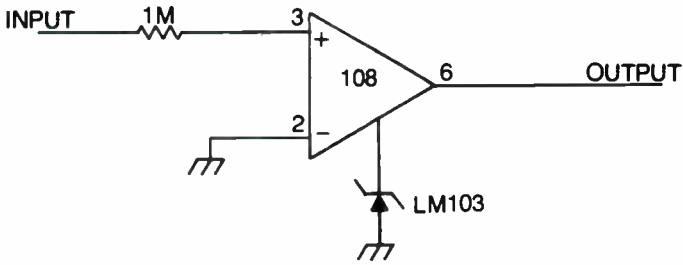
Capacitance multiplier



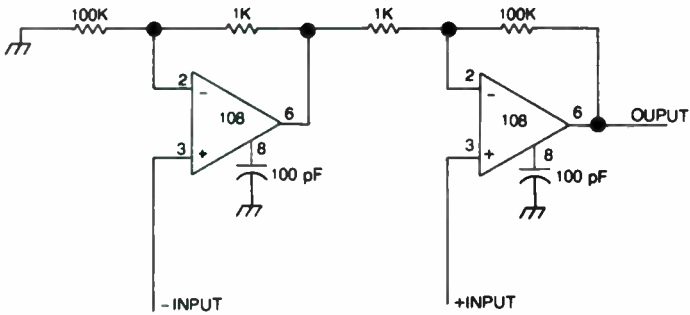
Amplifier for piezoelectric transducers



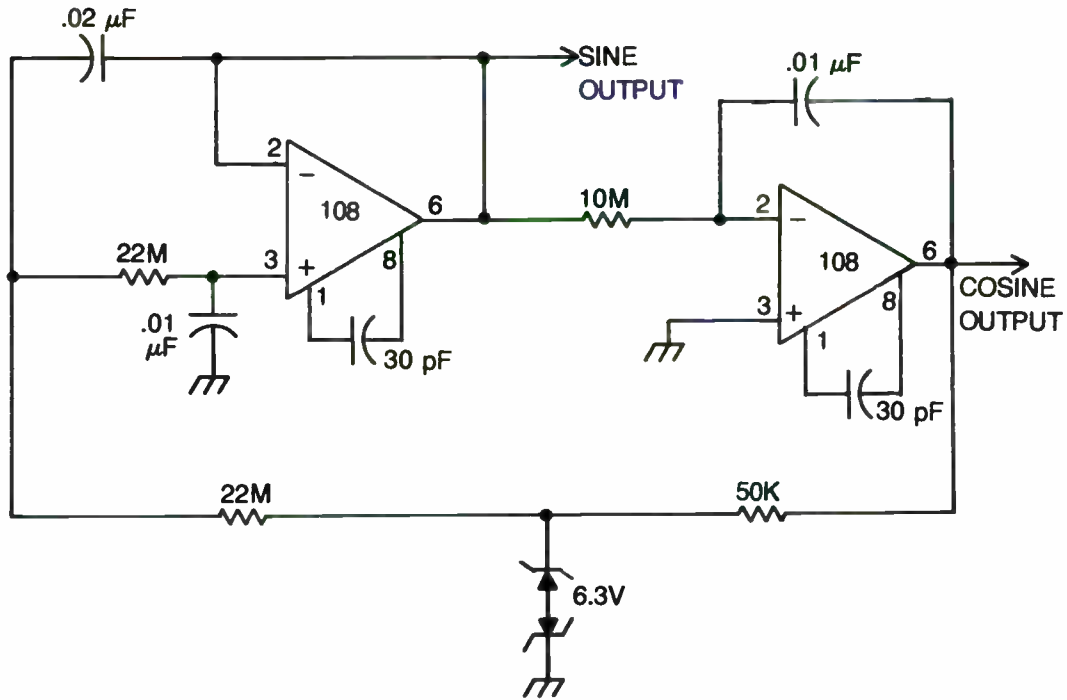
High input impedance inverting amplifier



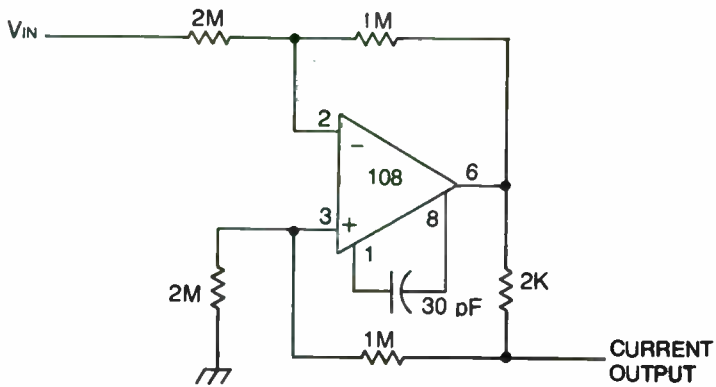
Zero crossing detector voltage comparator



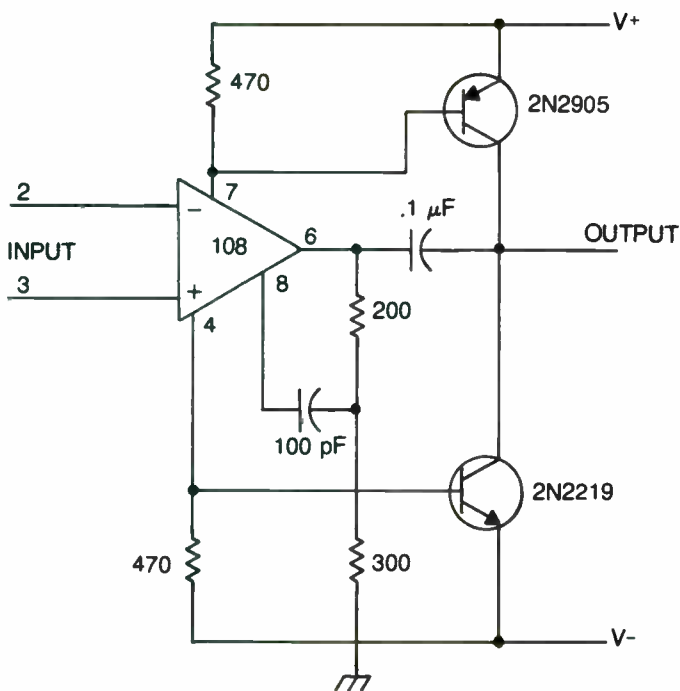
Differential input instrumentation amplifier



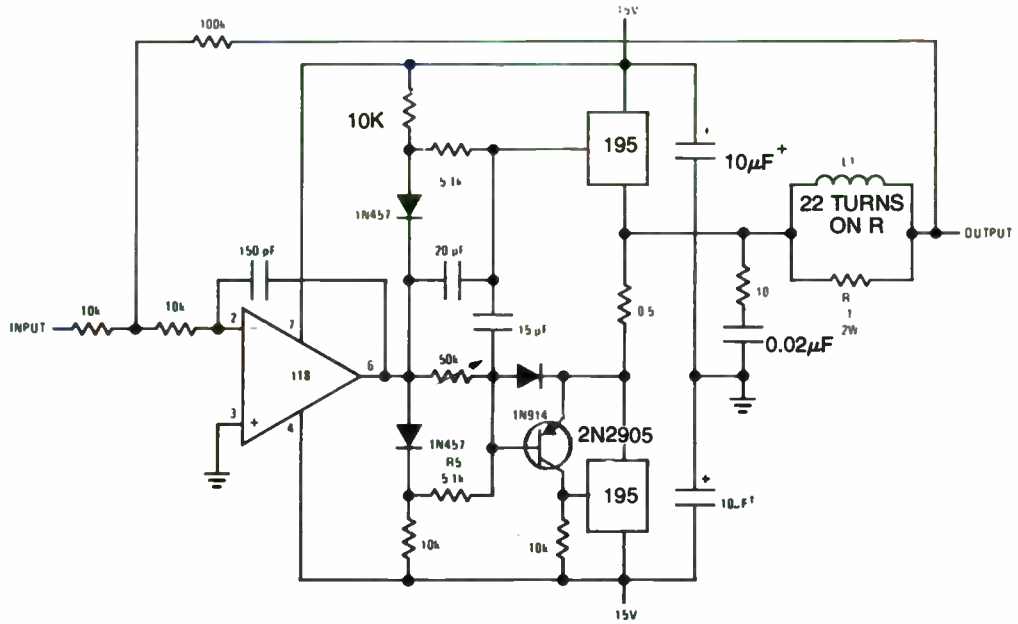
51 Sine wave oscillator



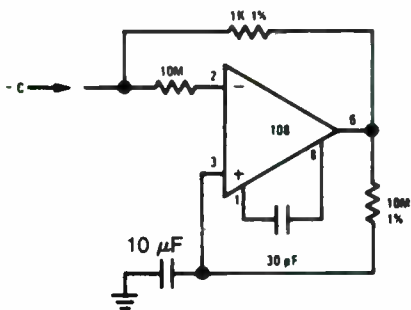
Bilateral current source



Power booster

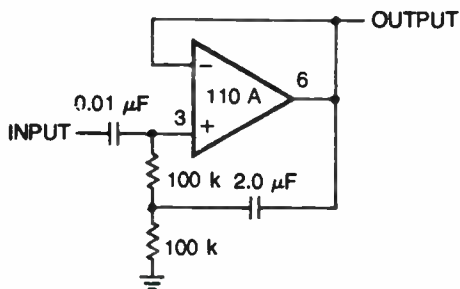




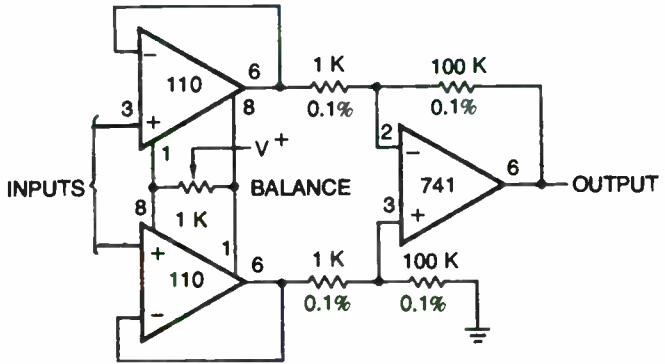


Negative capacitance multiplier

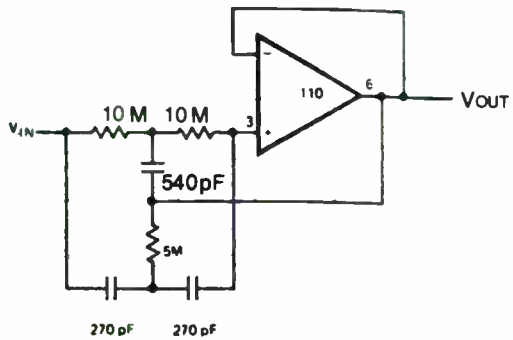
## 110—UNITY GAIN OPERATIONAL AMPLIFIER/BUFFER



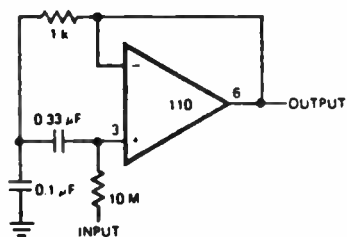
High input impedance ac amplifier



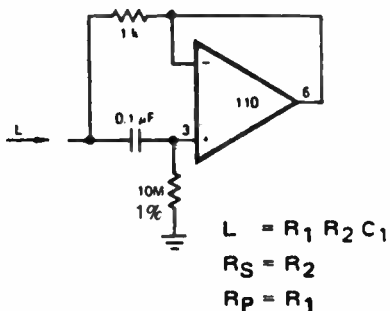
Differential input instrumentation amplifier



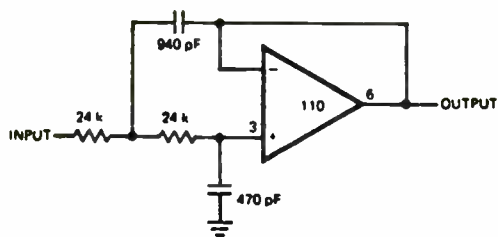
High Q notch filter



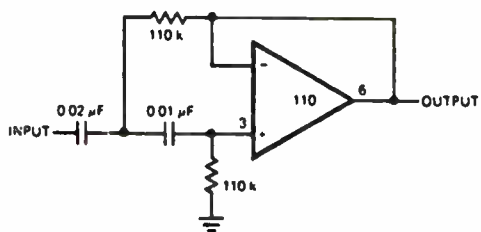
Bandpass filter



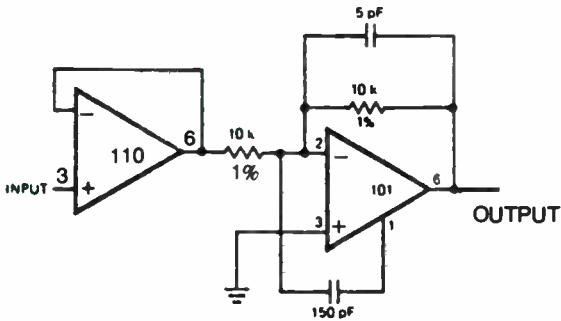
Simulated inductor



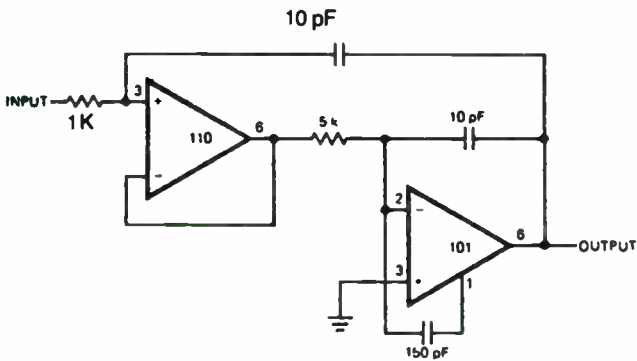
Low pass active filter  
(10 kHz CUTOFF)



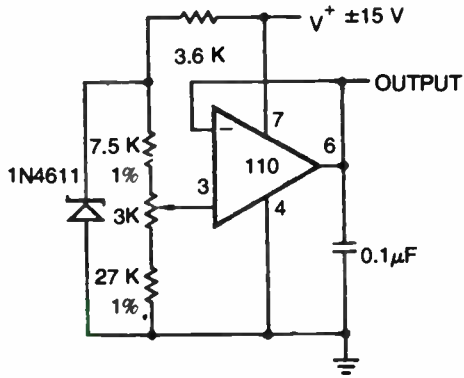
High pass active filter  
(100 Hz CUTOFF)



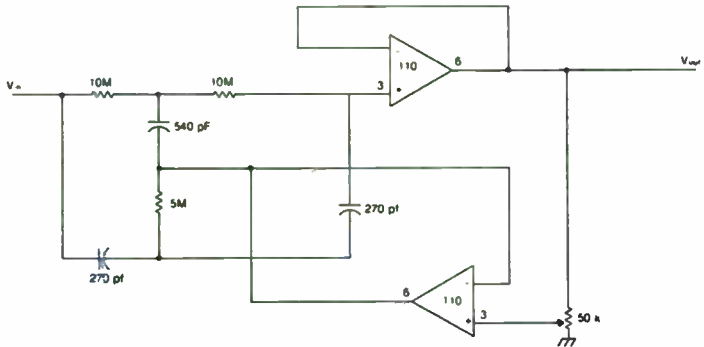
Fast inverting amplifier with high input impedance



Fast integrator with low input current

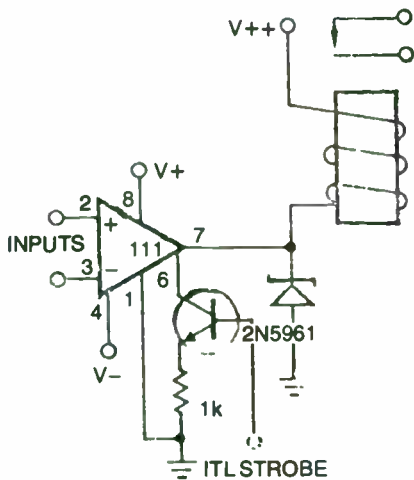


Buffered reference source

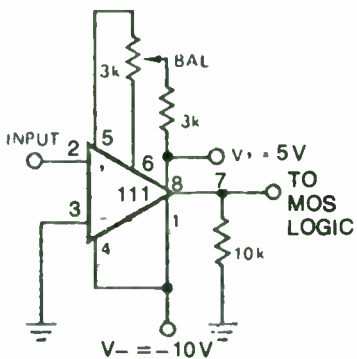


Adjustable Q notch filter

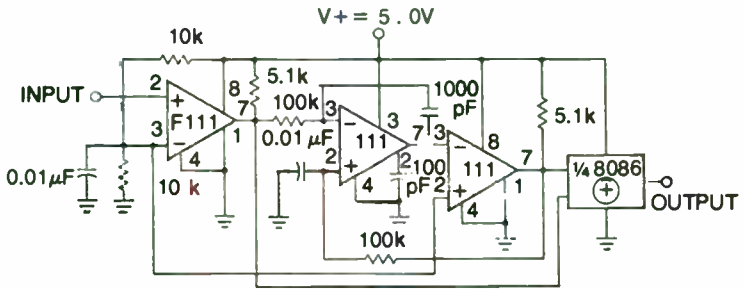
# 111—INTEGRATED VOLTAGE COMPARATOR



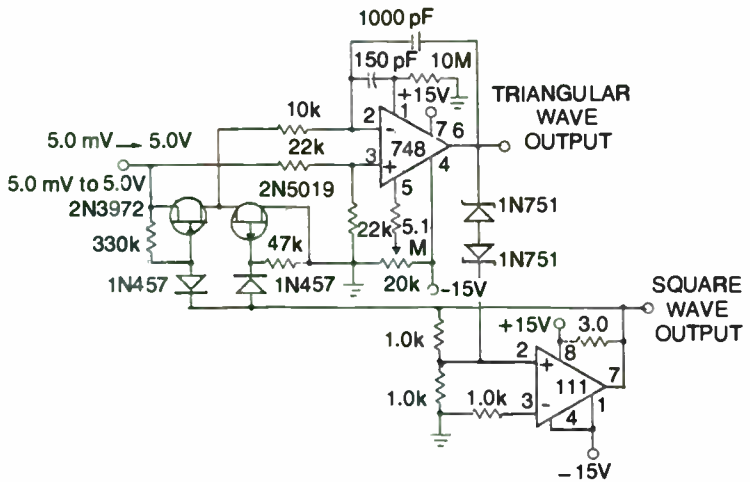
Relay driver with strobe



Zero crossing detector driving MOS logic

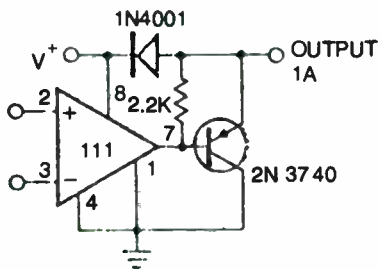


Frequency doubler

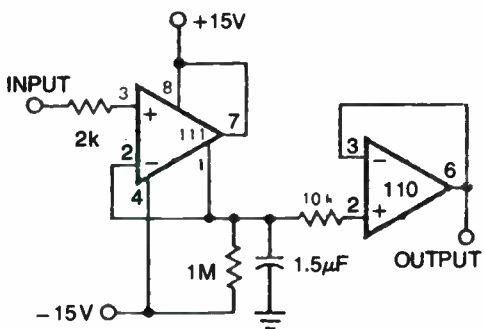


10 Hz to 10 kHz voltage controlled oscillator

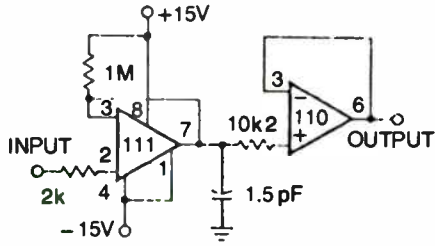




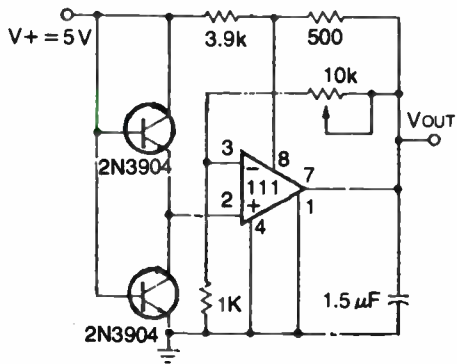
Comparator and solenoid driver



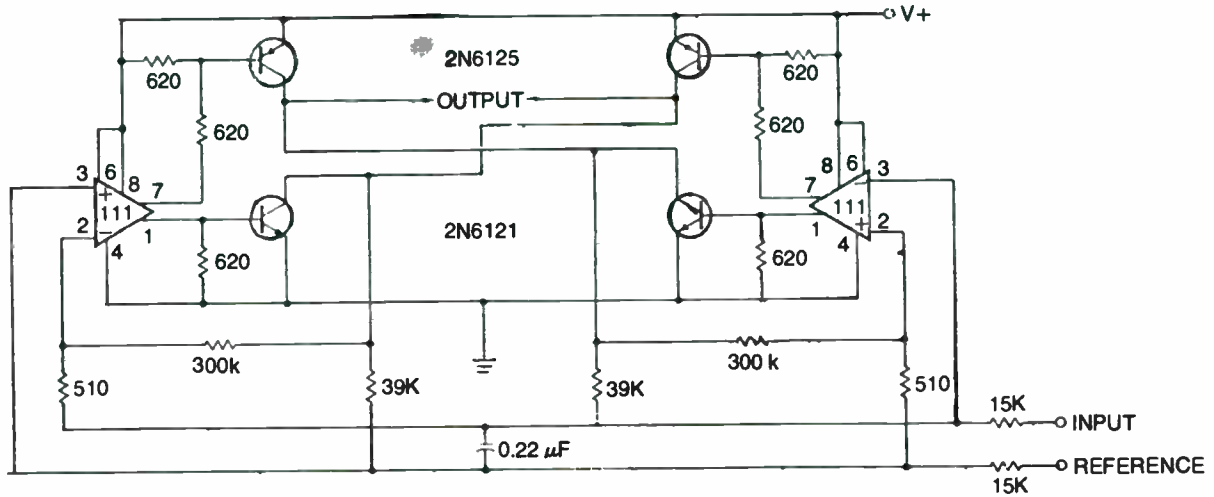
Positive peak detector



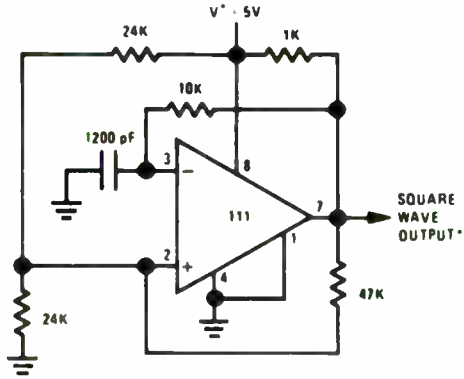
Negative peak detector



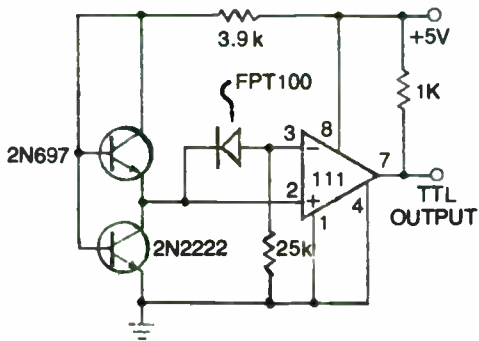
Adjustable low voltage reference supply



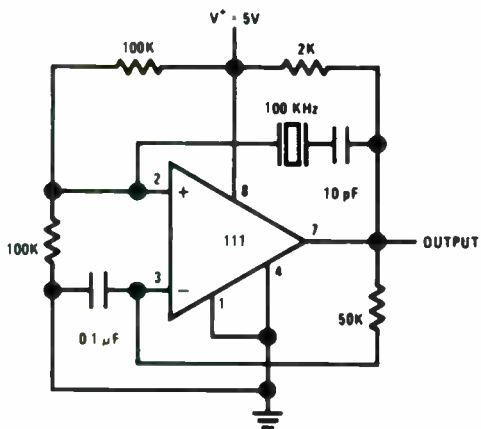
Switching power amplifier



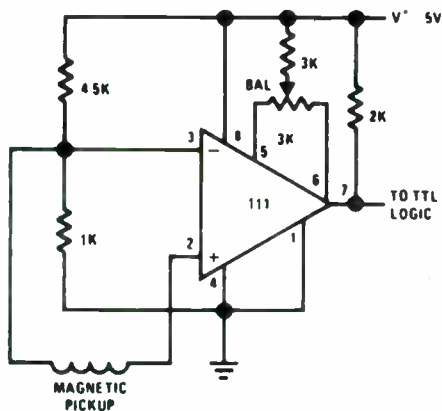
Free-running multivibrator



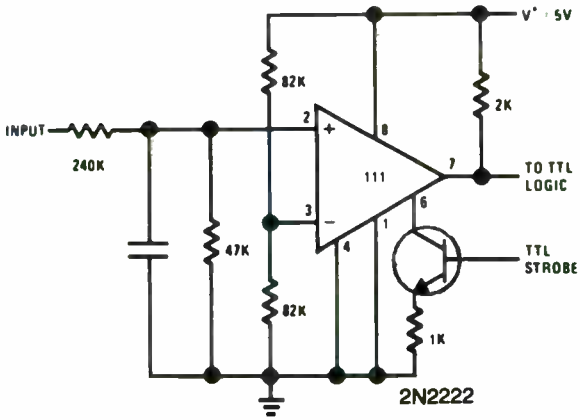
Precision photodiode comparator



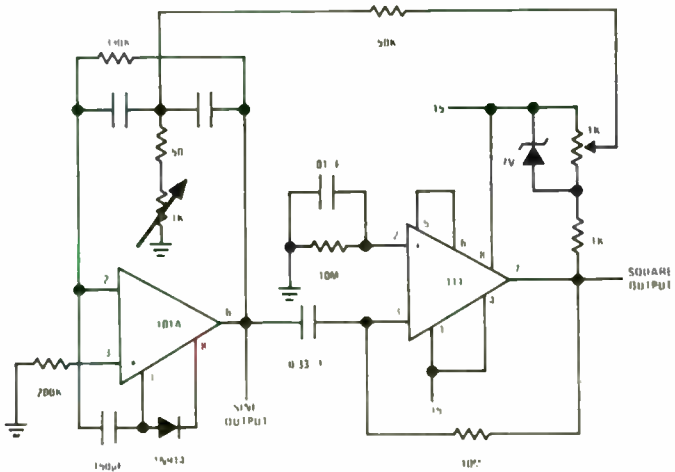
Crystal-controlled oscillator



Zero crossing detector for magnetic transducer

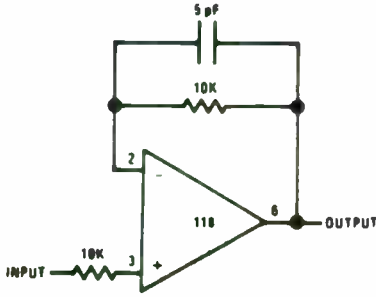


Circuit for transmitting data between high-level logic and TTL

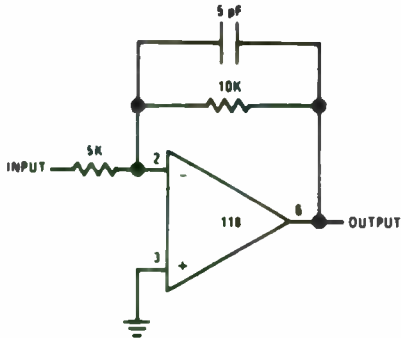


Easily tuned sine wave oscillator

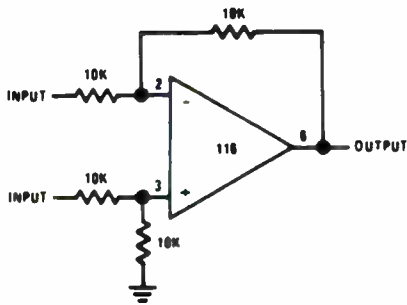
# 118—HIGH SPEED OPERATIONAL AMPLIFIER



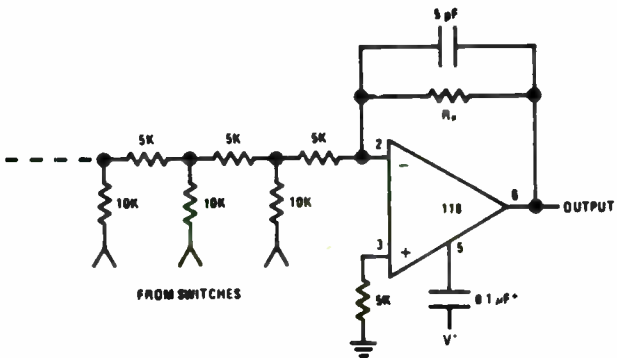
Fast voltage follower



Fast summing amplifier

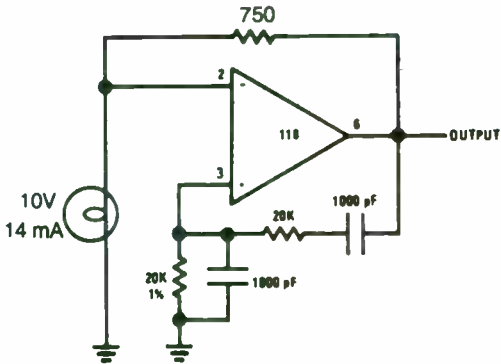


Differential amplifier



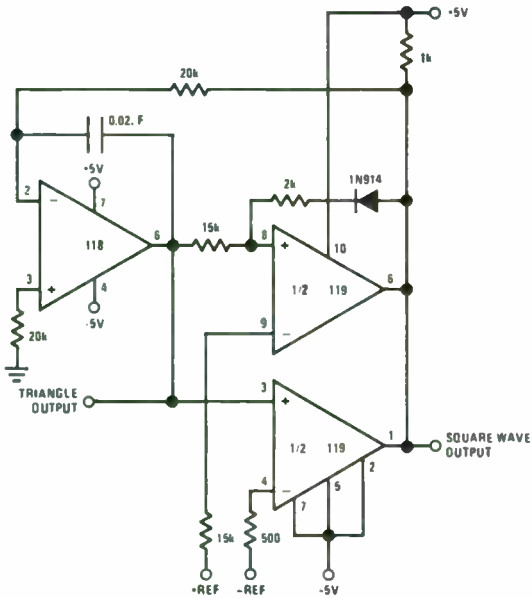
D/A converter using ladder network





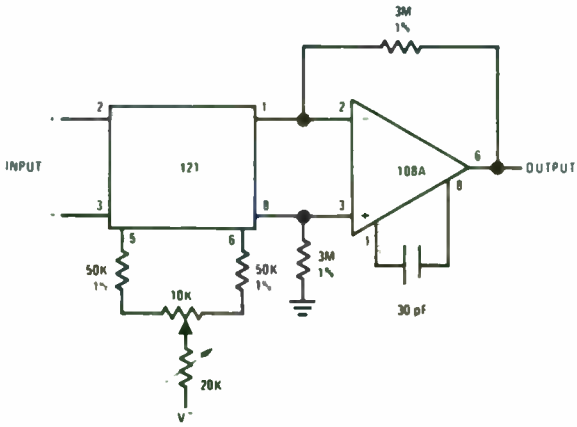
Wien bridge sine wave oscillator

**119—HIGH SPEED DUAL COMPARATOR**

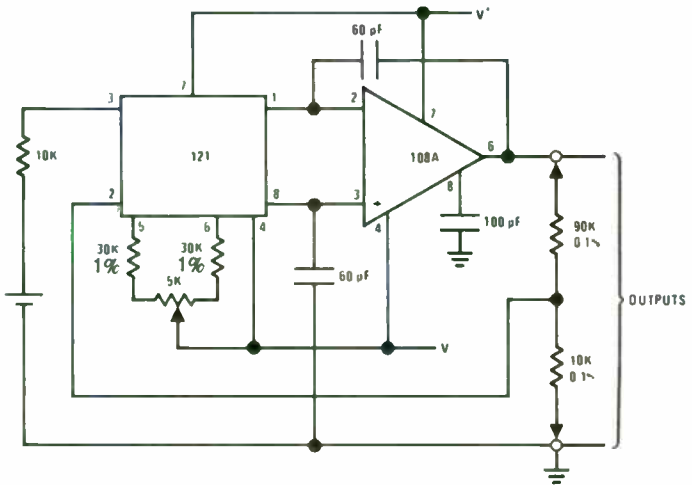


Precision triangle generator

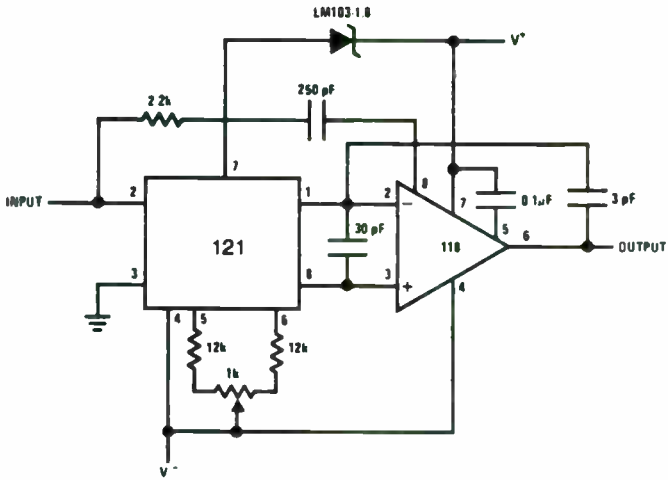
# 121—PRECISION PREAMPLIFIER



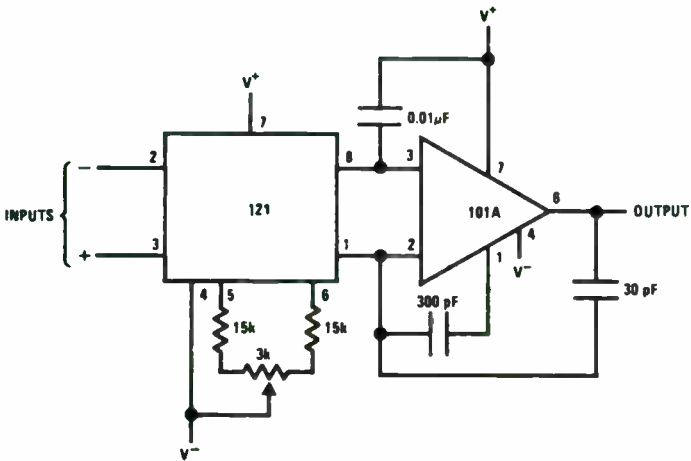
Gain of 1000 instrumentation amplifier



10V reference

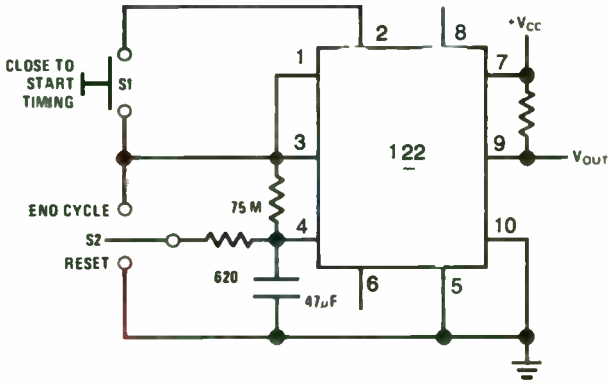


High speed inverting amplifier with low drift

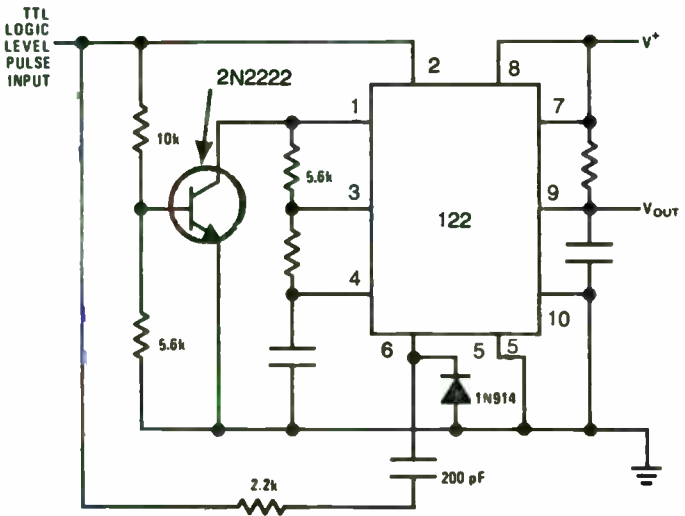


Medium speed general purpose amplifier

# 122—PRECISION TIMER

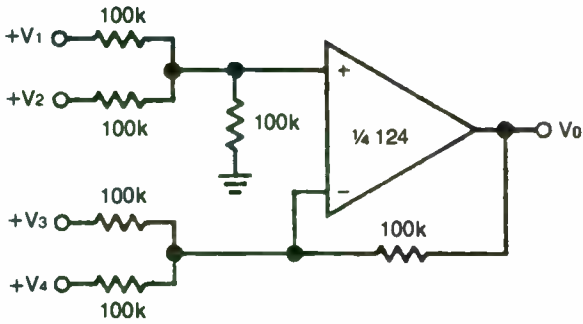


One hour timer with reset and manual cycle end

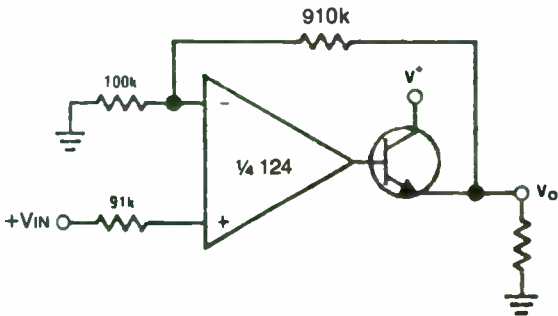


Pulse width detector

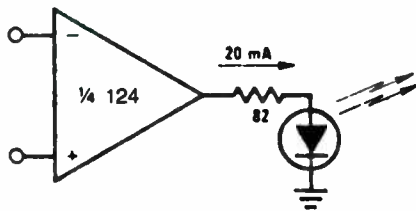
# 124—QUAD OPERATIONAL AMPLIFIER



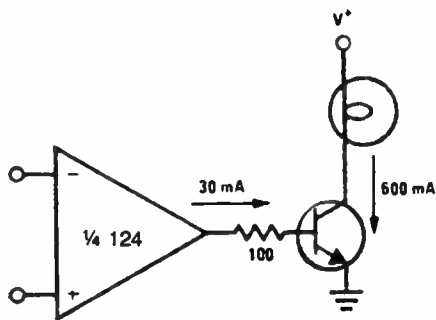
DC summing amplifier



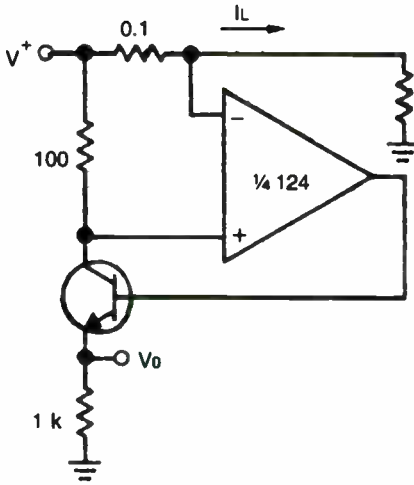
Power amplifier



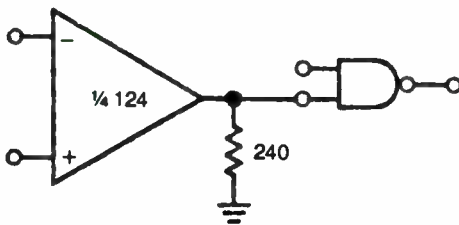
LED driver



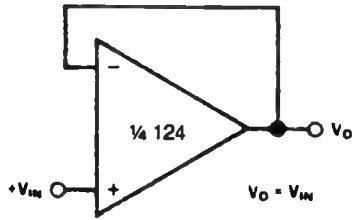
Lamp driver



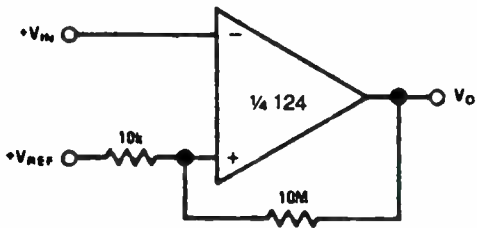
Current monitor



Driving TTL

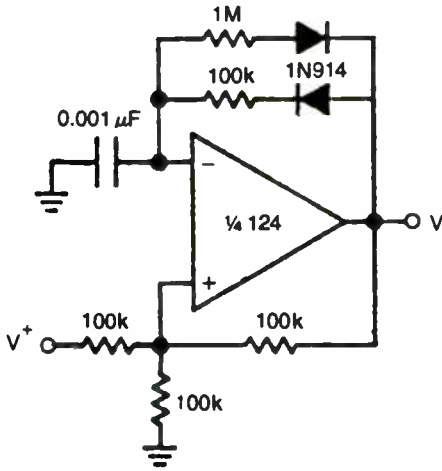


Voltage follower

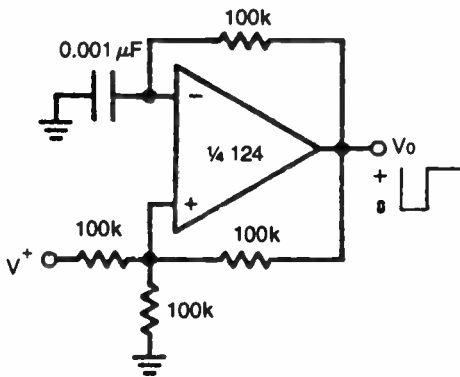


Comparator with hysteresis

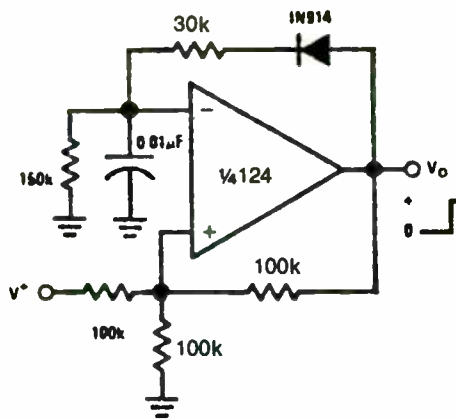




Pulse generator



Squarewave oscillator



Pulse generator

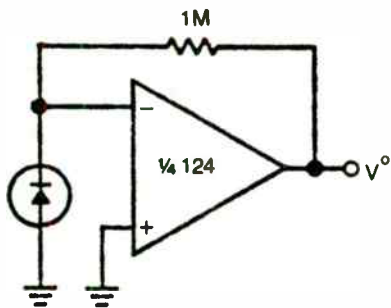
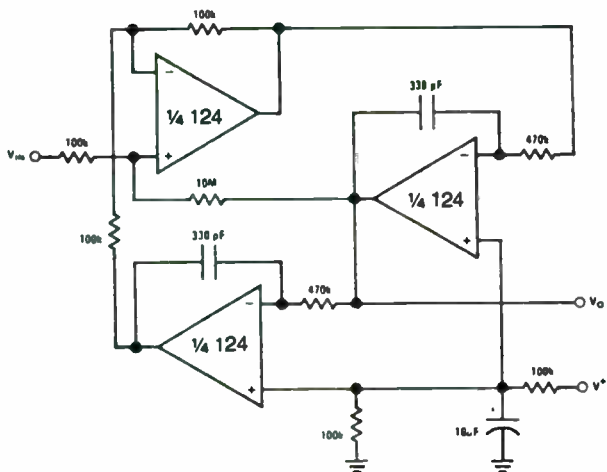
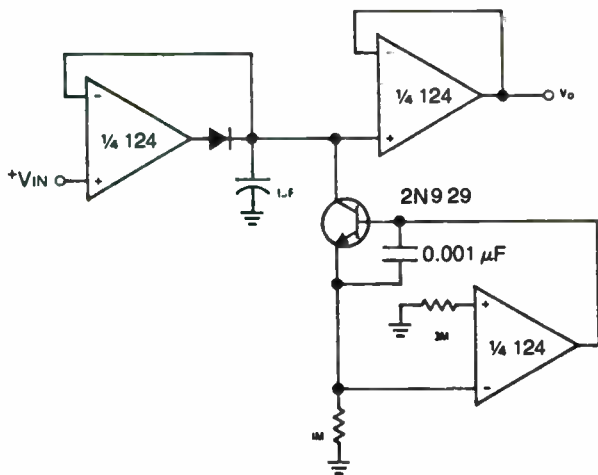


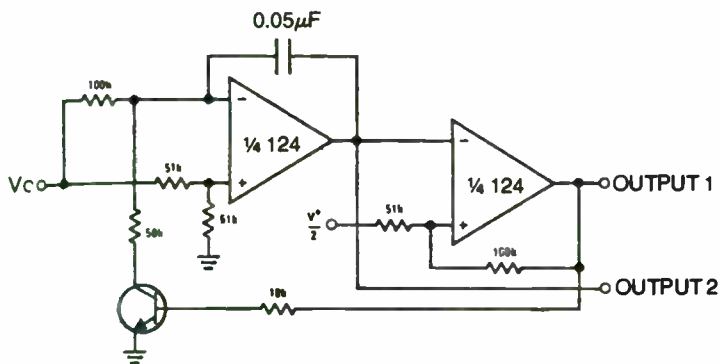
Photo voltaic-cell amplifier



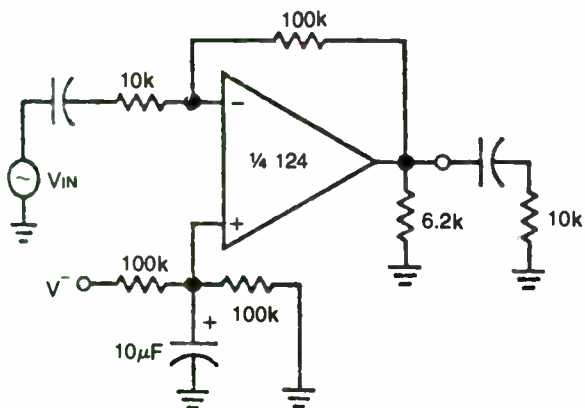
"BI-QUAD" RC active bandpass filter



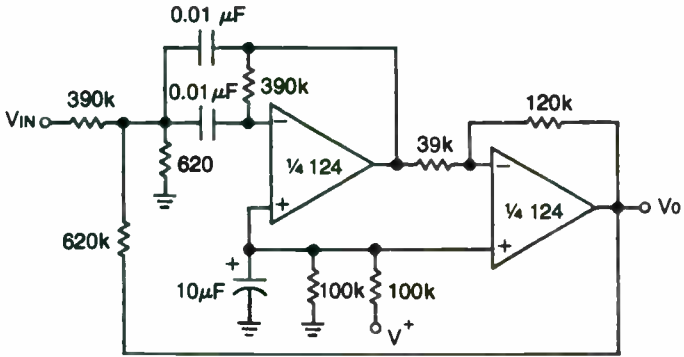
Low drift peak detector



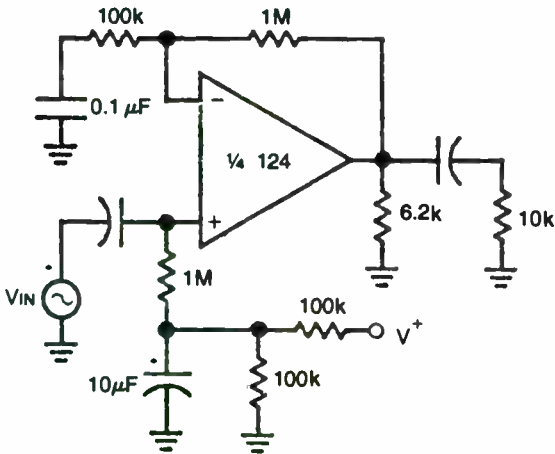
Voltage controlled oscillator circuit



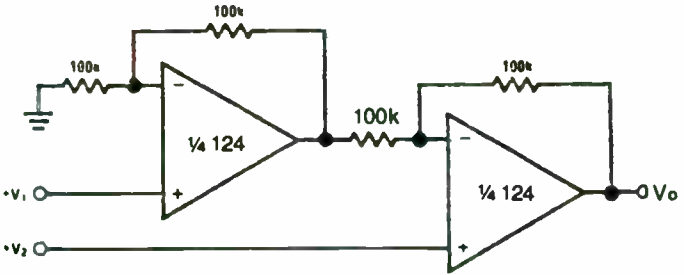
AC coupled inverting amplifier



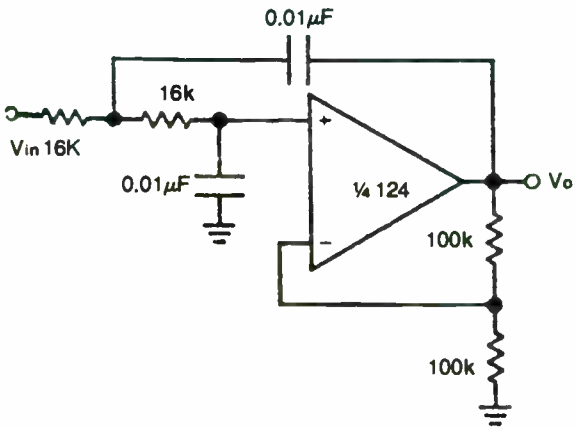
Bandpass active filter



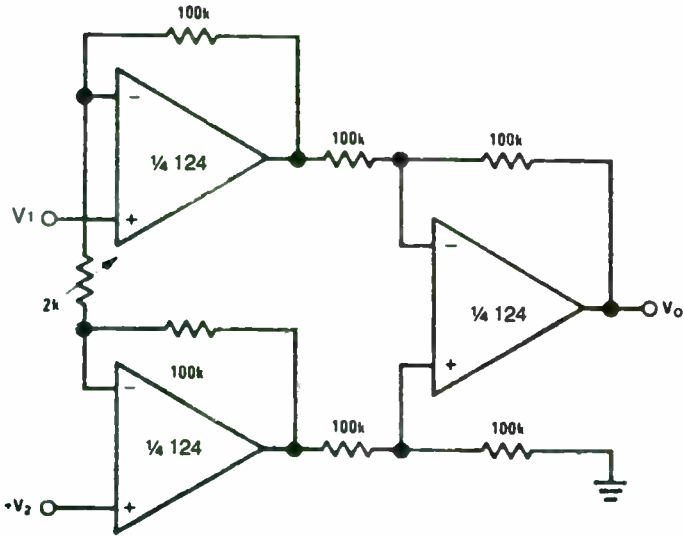
AC coupled noninverting amplifier



High input Z, dc differential amplifier

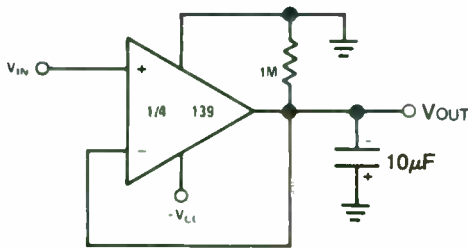


DC coupled low-pass RC active filter

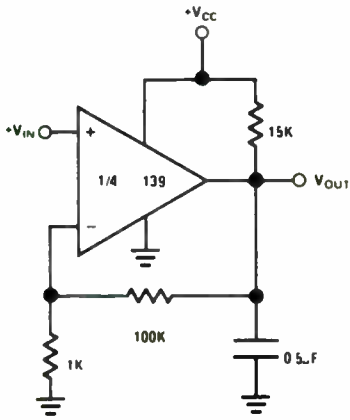


High input Z adjustable-gain dc instrumentation amplifier

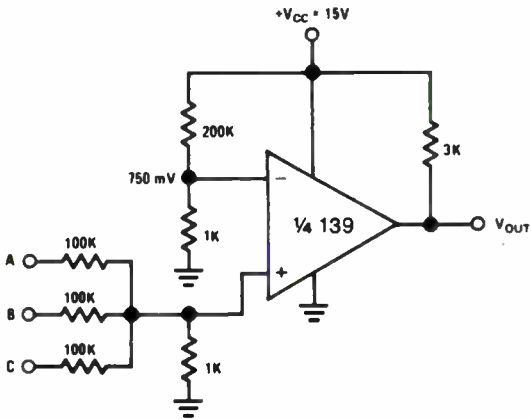
**139—LOW OFFSET VOLTAGE QUAD COMPARATOR**



Negative peak detector

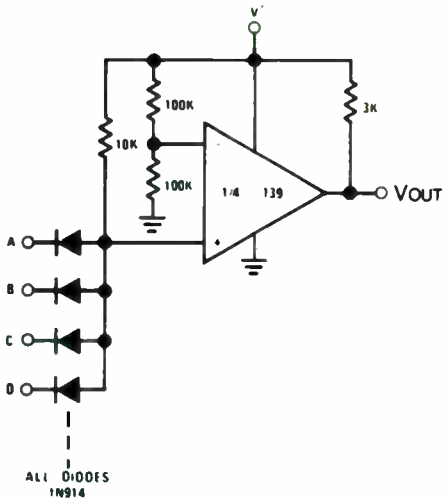


Noninverting amplifier

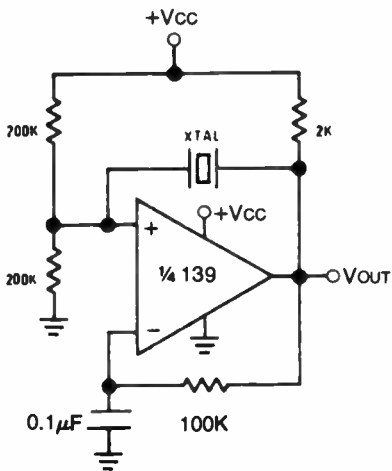


Three input OR gate

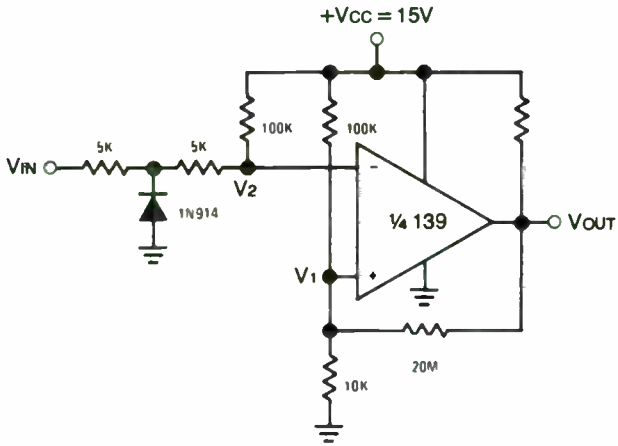




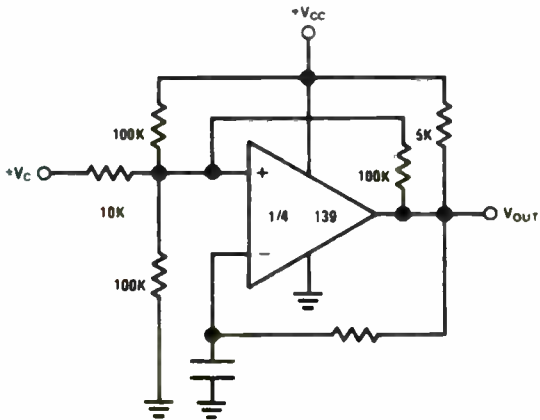
AND gate with large fan-in



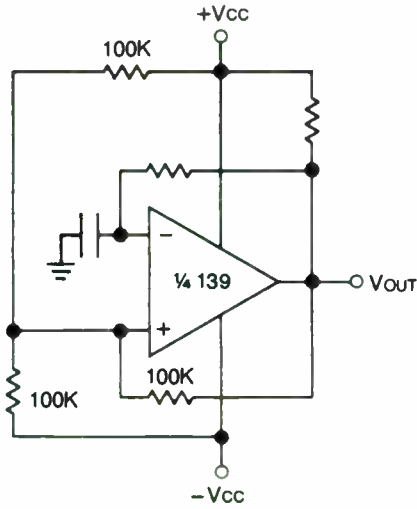
Crystal controlled oscillator



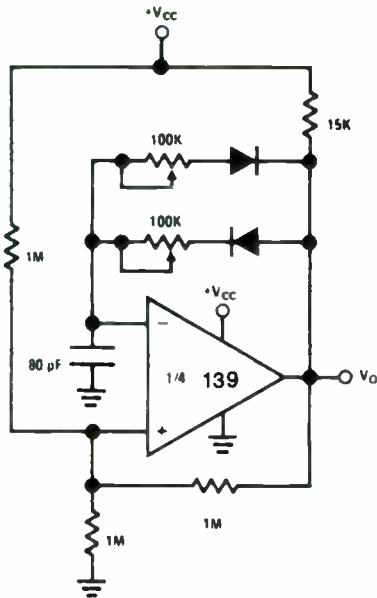
Zero crossing detector



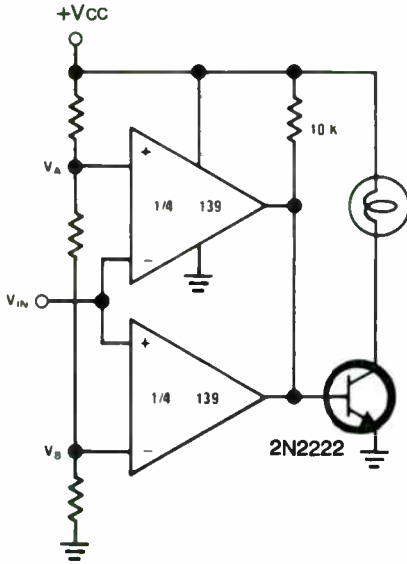
Pulse width modulator



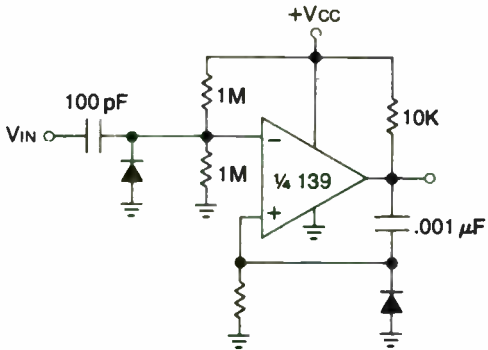
Squarewave generator using dual supplies



Pulse generator with variable duty cycle

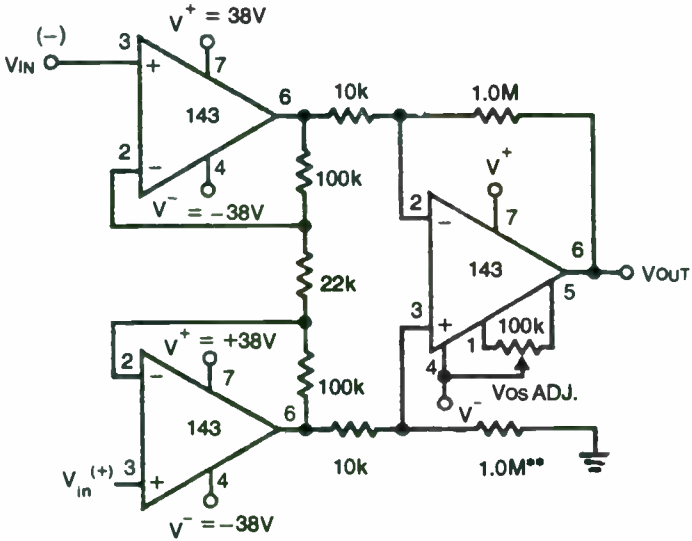


Limit comparator with lamp driver

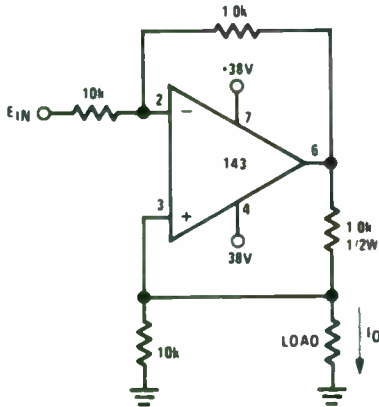


One shot multivibrator

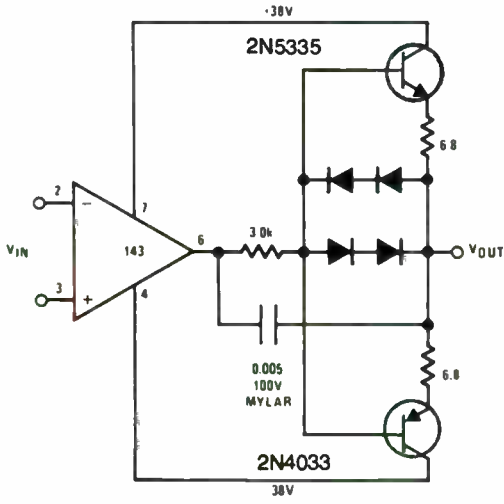
# 143—HIGH VOLTAGE OPERATIONAL AMPLIFIER



±34V common-mode instrumentation amplifier



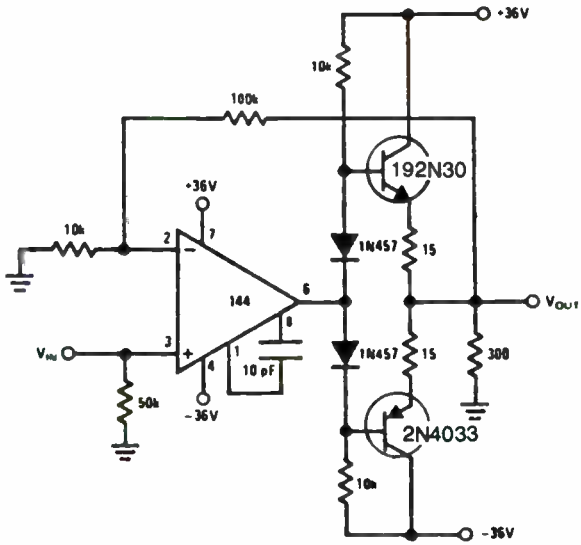
High-compliance current source



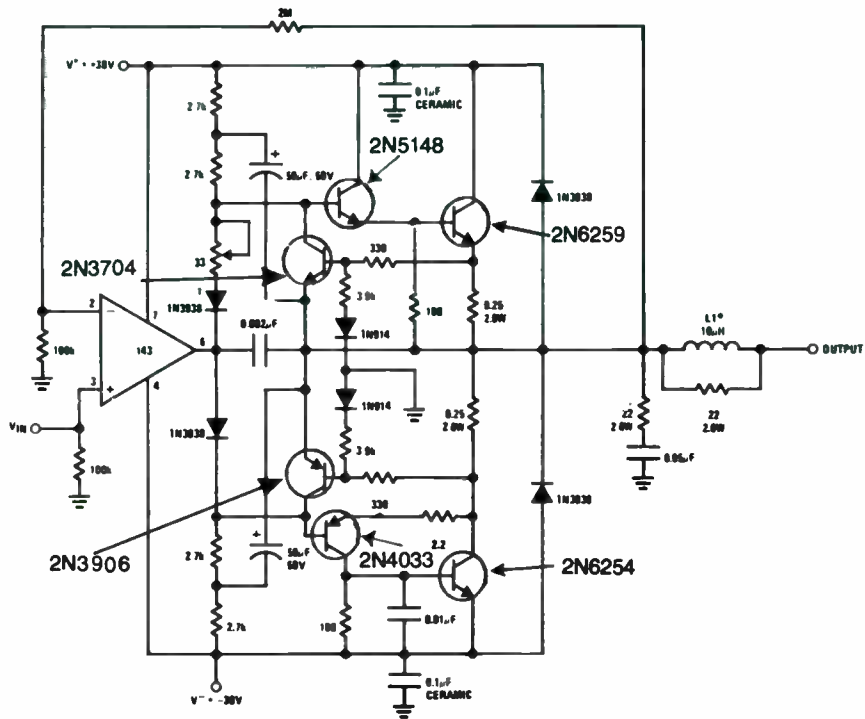
100 mA current boost circuit

All diodes are 1N914

**144—HIGH VOLTAGE, HIGH SLEW RATE OPERATIONAL AMPLIFIER**

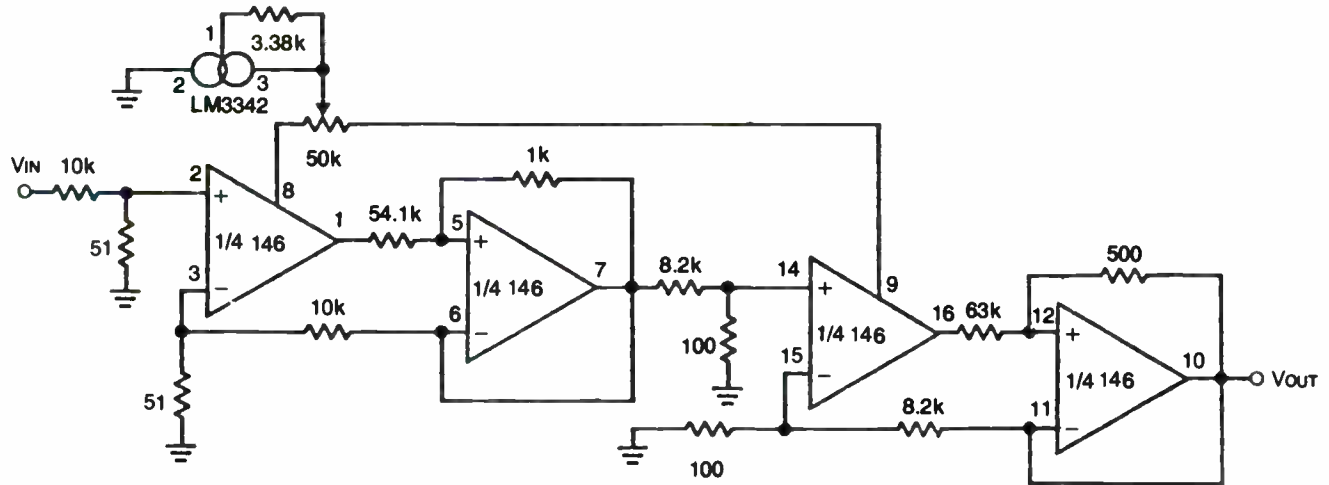


Large power bandwidth, current boosted audio line driver

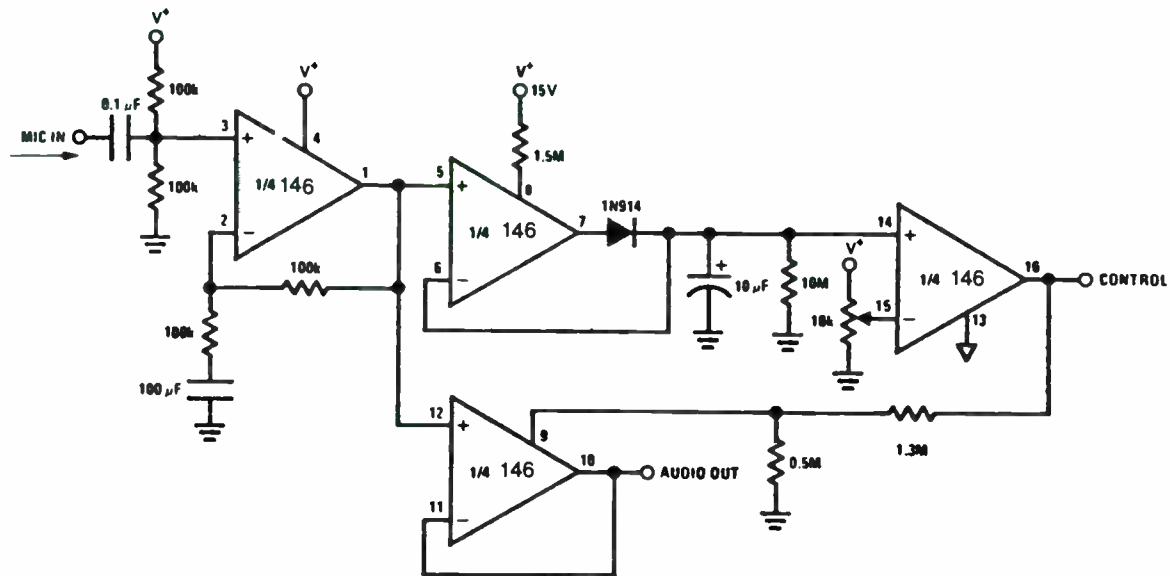


90W audio power amplifier  
 \*Turns of No. 20 wire on a  $\frac{3}{8}$ " form.

## 146—PROGRAMMABLE QUAD OPERATIONAL AMPLIFIER

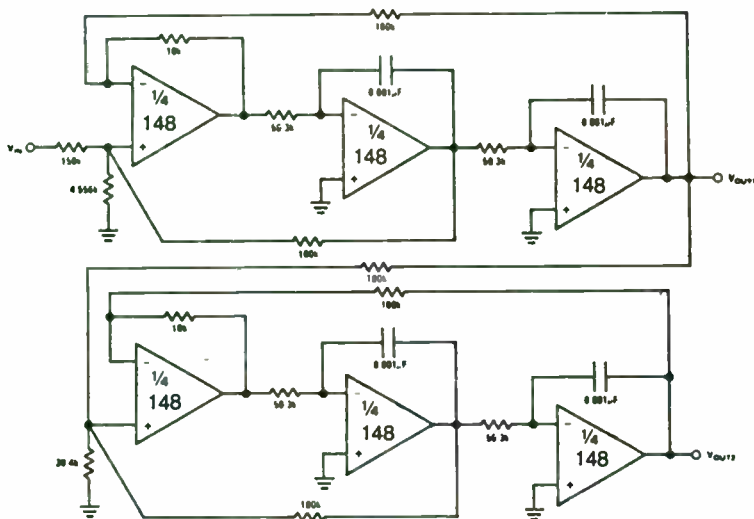




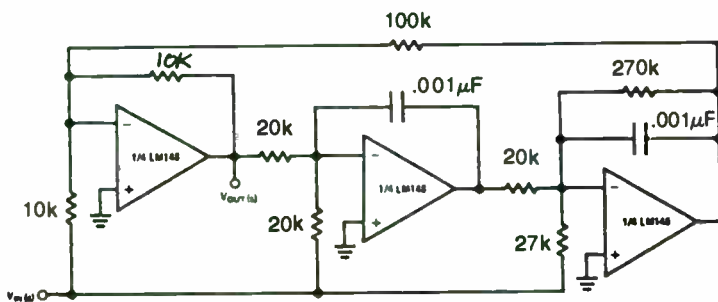


Voice activated switch and amplifier

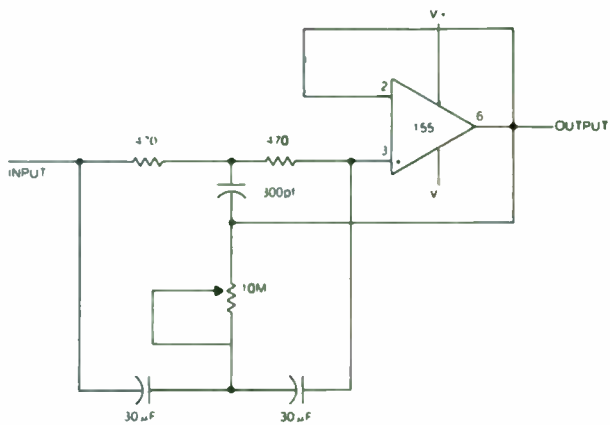
# 148 — QUAD 741 OPERATIONAL AMPLIFIER



A 1 kHz 4 pole Butterworth

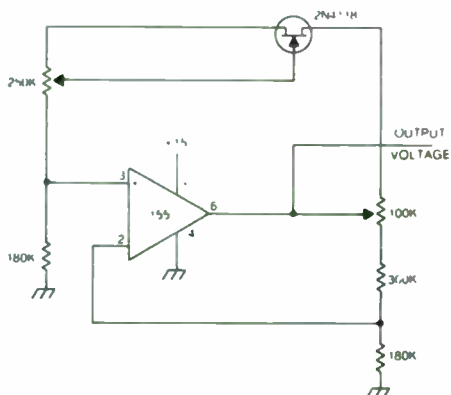


A 3 amplifier bi-quad notch filter

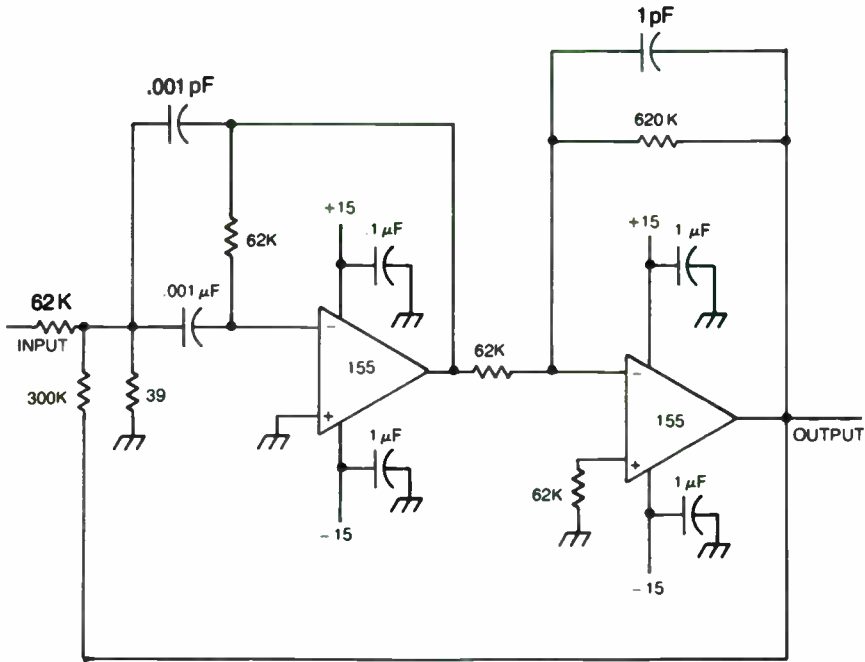


High Q notch filter

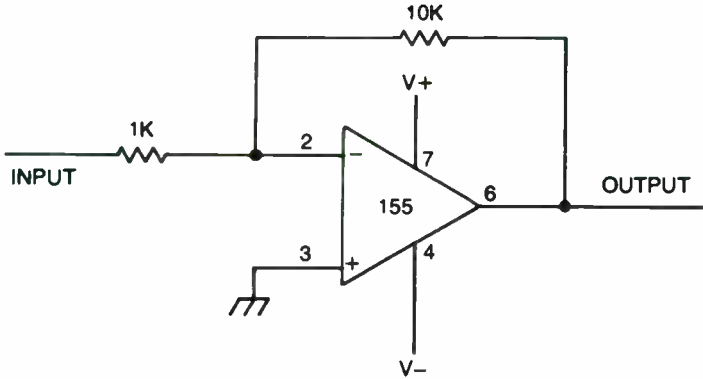
## 155—JFET INPUT OPERATIONAL AMPLIFIER



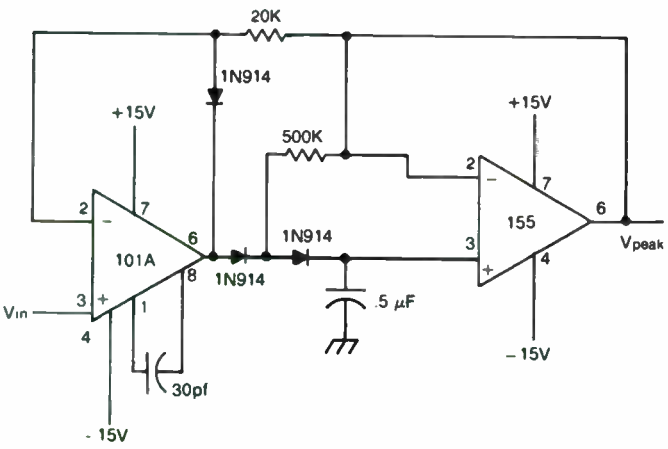
Adjustable voltage reference



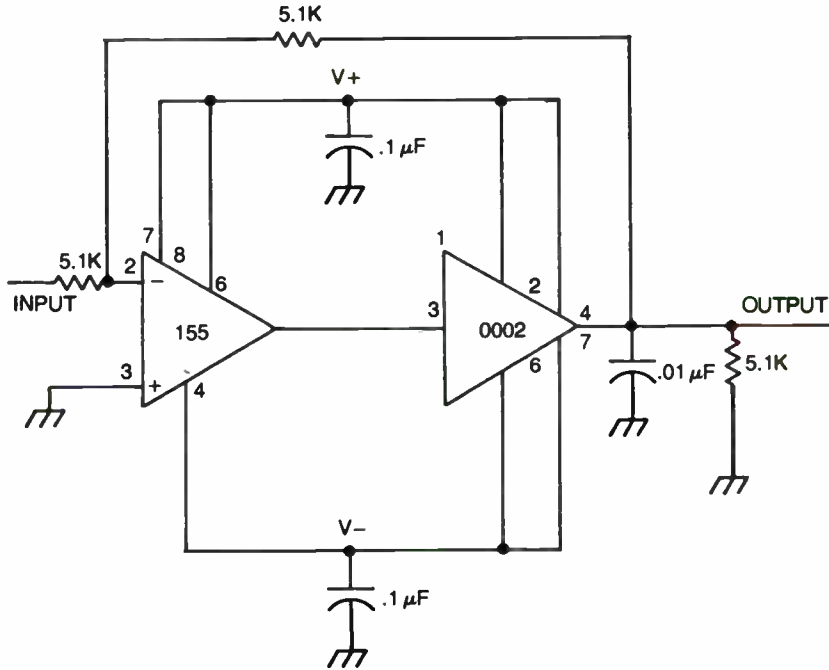
High Q bandpass filter



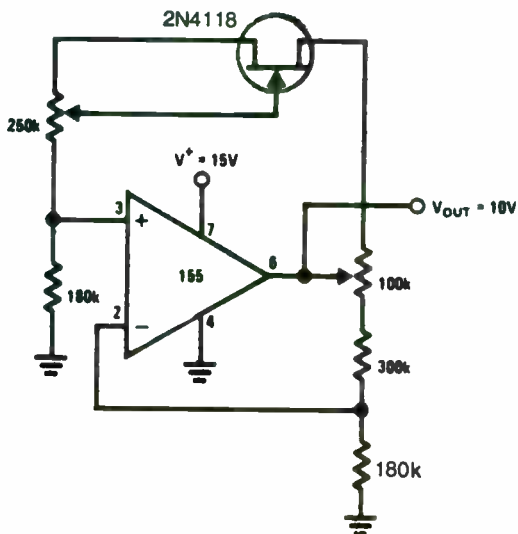
Large bandwidth amplifier



Peak voltage detector

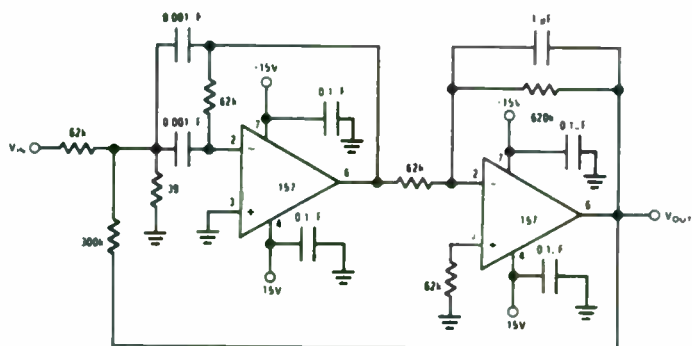


Current boosted amplifier

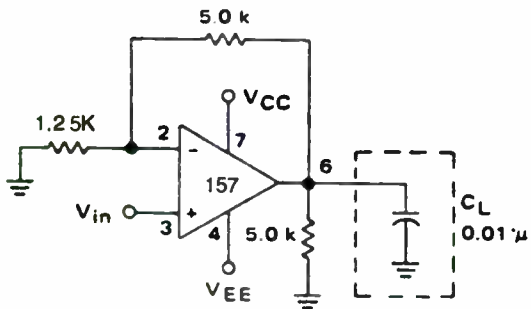


Low drift adjustable voltage reference

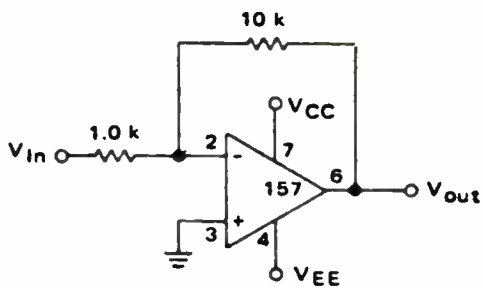
## 157 — WIDE BAND DECOMPENSATED JFET INPUT OPERATIONAL AMPLIFIER



High Q bandpass filter



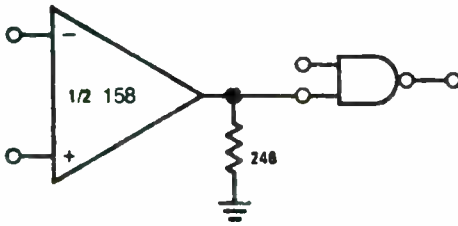
Driving capacitive loads



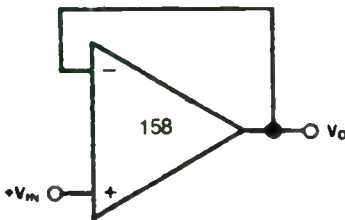
Large power bandwidth amplifier



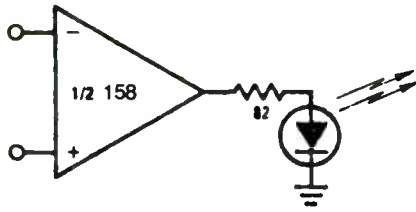
# 158—LOW POWER DUAL OPERATIONAL AMPLIFIER



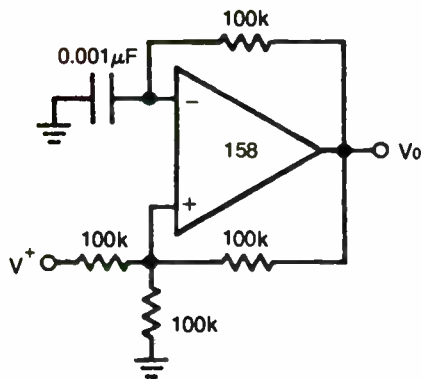
Driving TTL



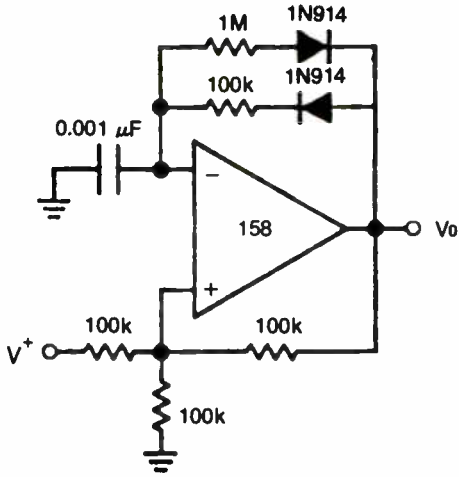
Voltage follower



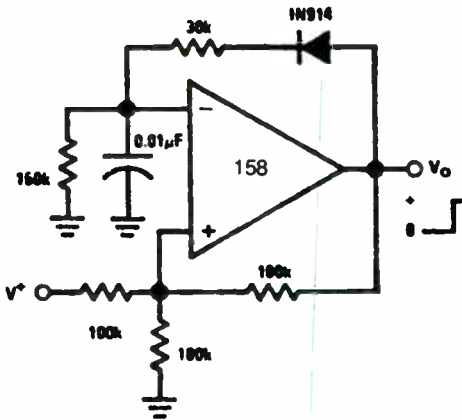
LED driver



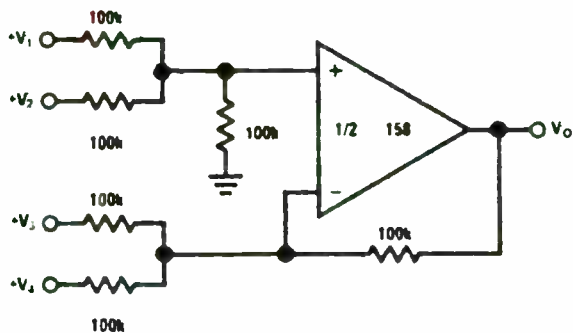
Squarewave oscillator



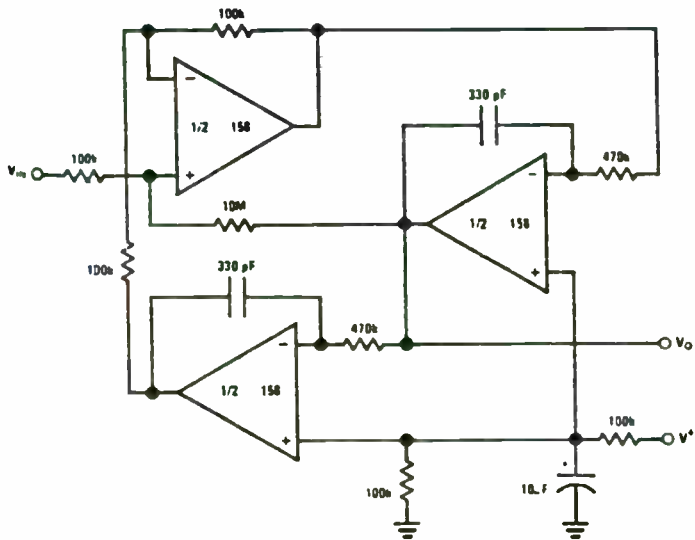
Pulse generator



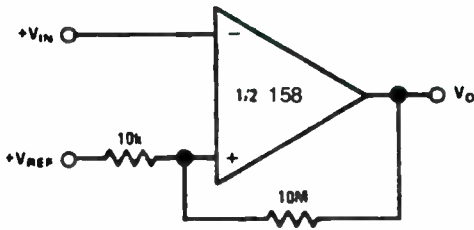
Pulse generator



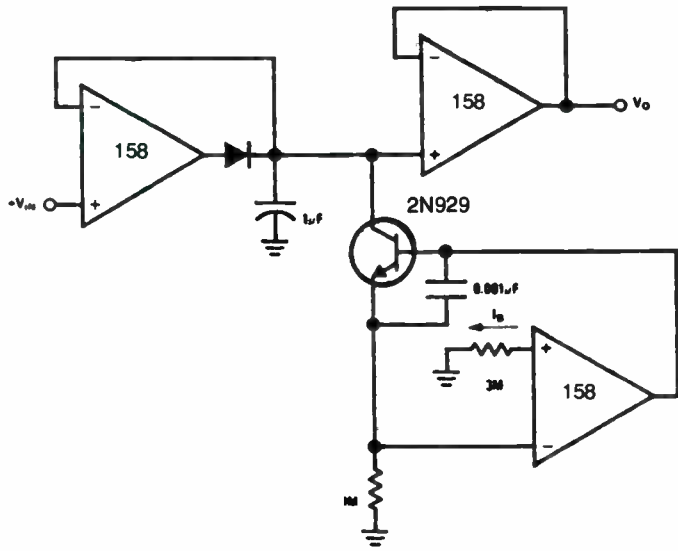
DC summing amplifier



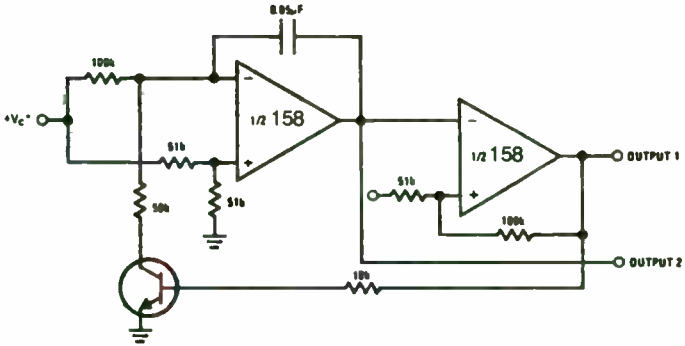
"BI-QUAD" RC active bandpass filter



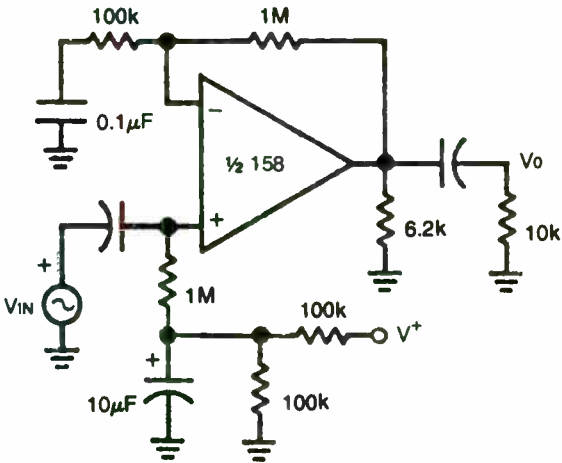
Comparator with hysteresis



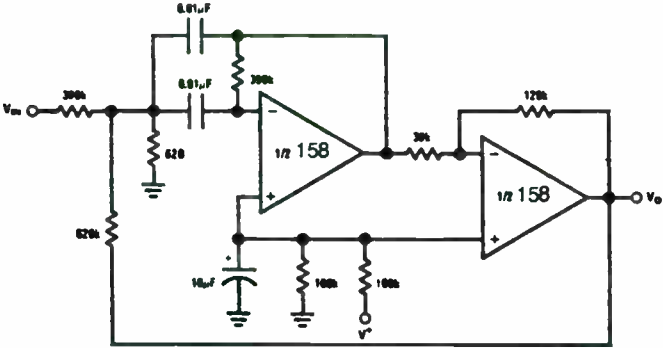
Low drift peak detector



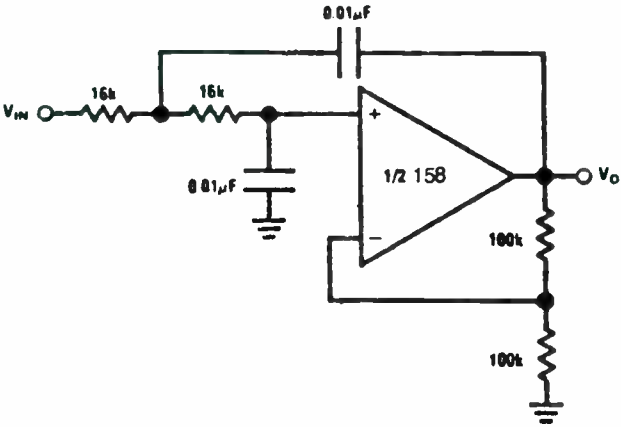
Voltage controlled oscillator (VCO)



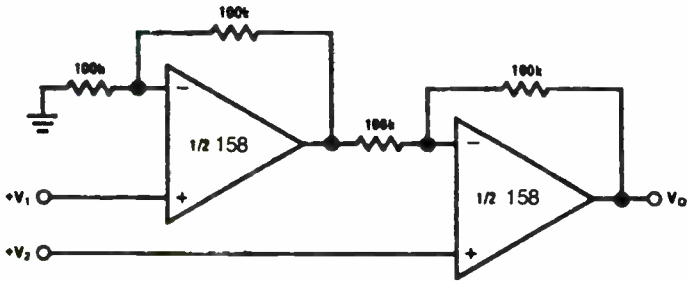
AC coupled noninverting amplifier



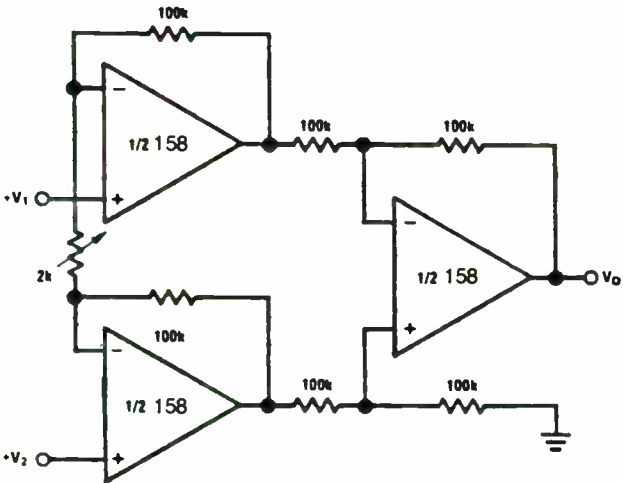
Bandpass active filter



DC coupled low-pass RC active filter

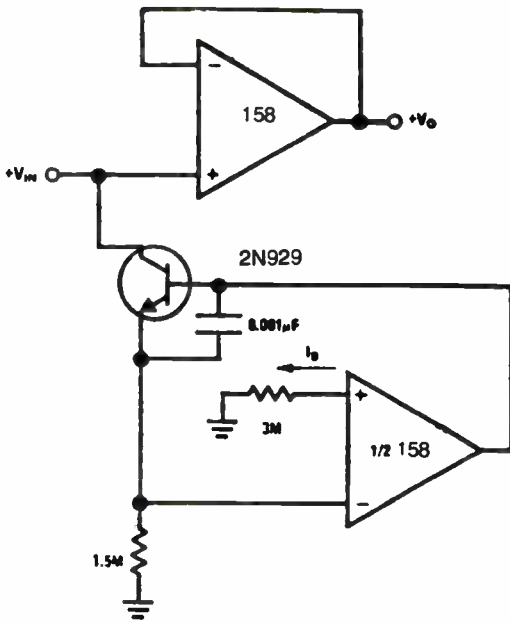


High input Z, dc differential amplifier



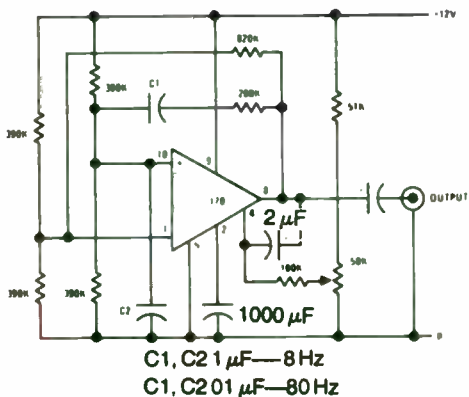
High input Z adjustable-gain dc instrumentation amplifier



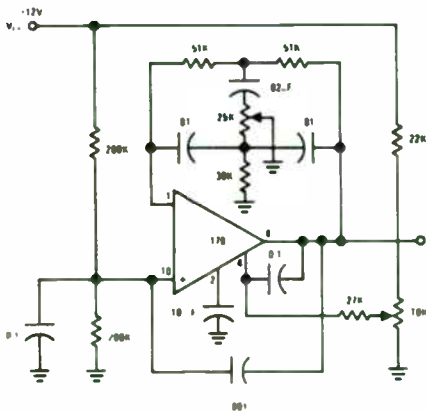


Using symmetrical amplifiers to reduce input current (general concept)

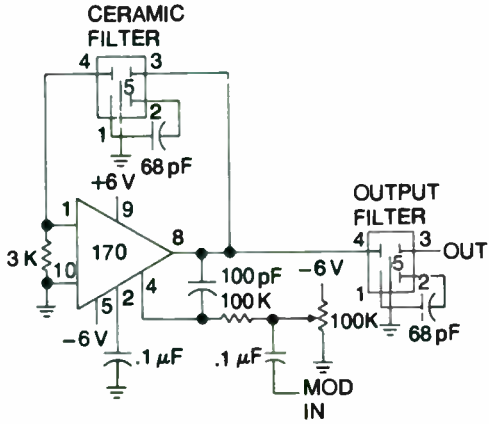
# 170—INTEGRATED AGC/SQUELCH AMPLIFIER



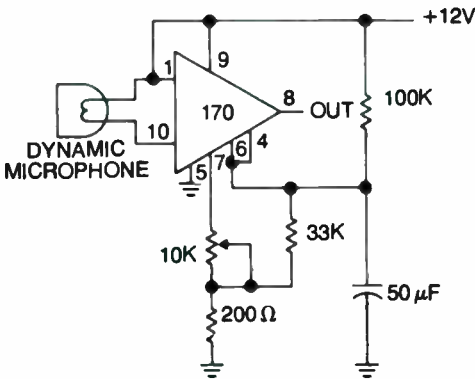
Wien-bridge oscillator



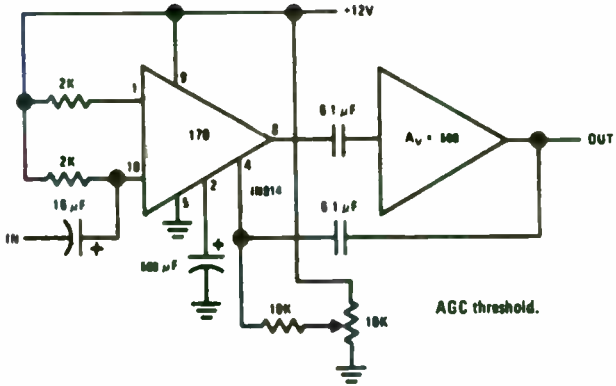
Decade tunable oscillator



455 kHz modulated constant output oscillator

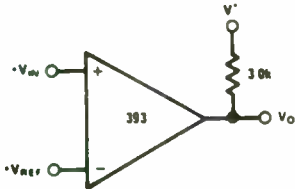


Squelched preamplifier with hysteresis

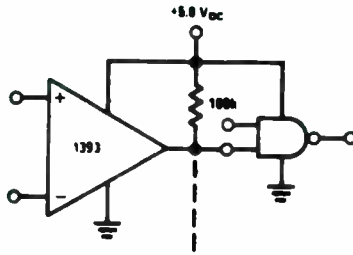


AGC using built-in detection, driven by additional system gain

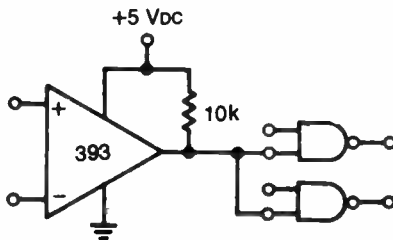
**193—LOW POWER LOW OFFSET VOLTAGE DUAL COMPARATORS**



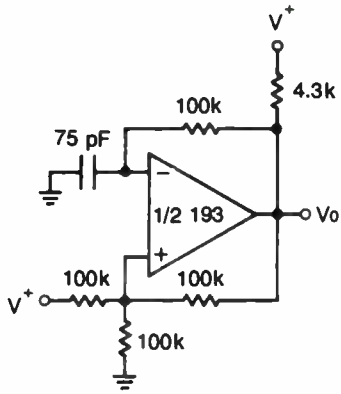
Basic comparator



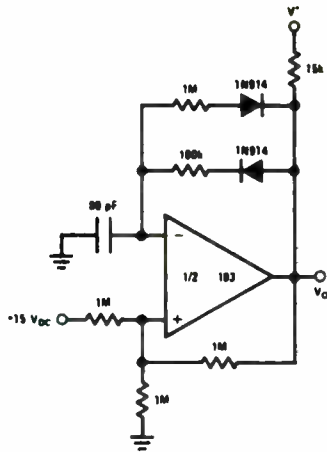
Driving CMOS



Driving TTL

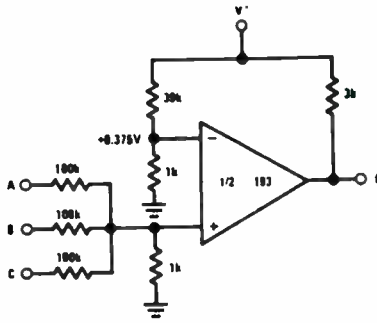


Squarewave oscillator

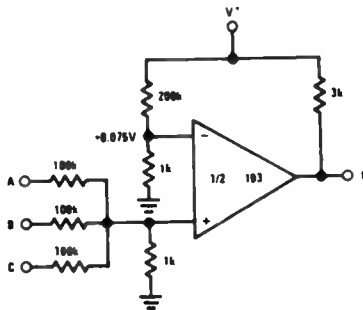


Pulse generator



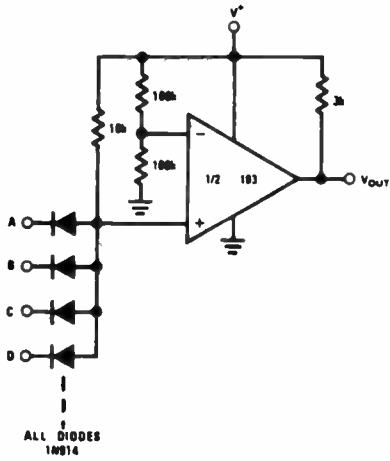


AND gate

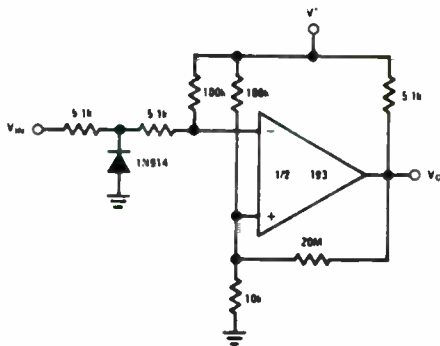


OR gate

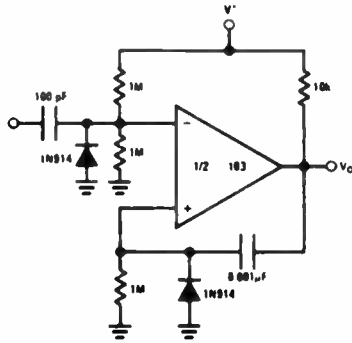




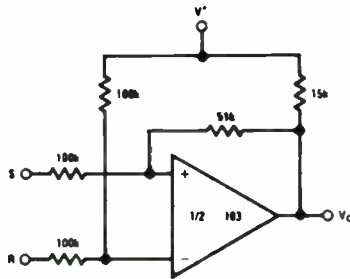
Large fan-in AND gate



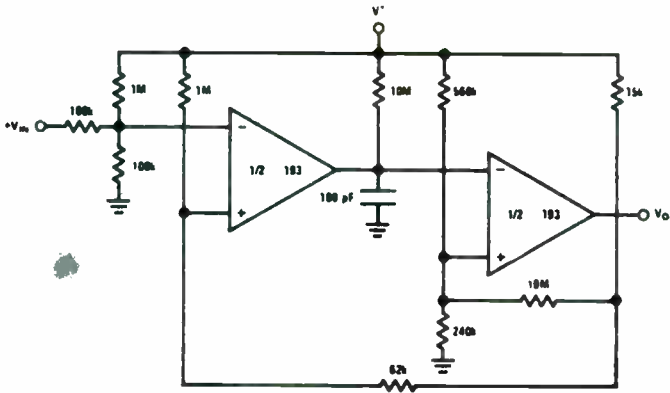
Zero crossing detector (single power supply)



One-shot multivibrator

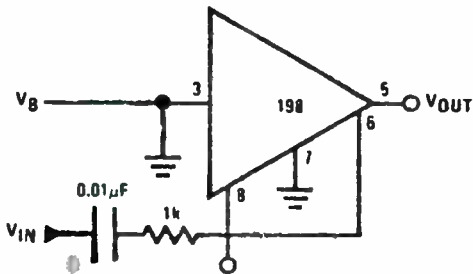


Bi-stable multivibrator

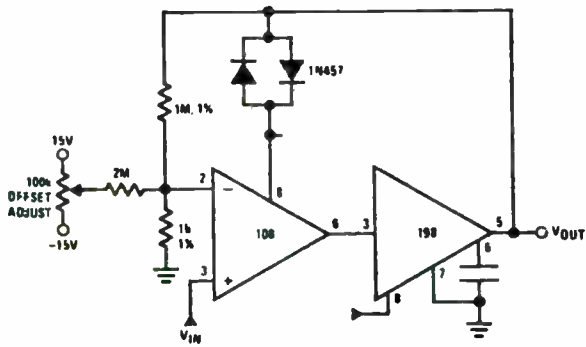


One-shot multivibrator with input lock out

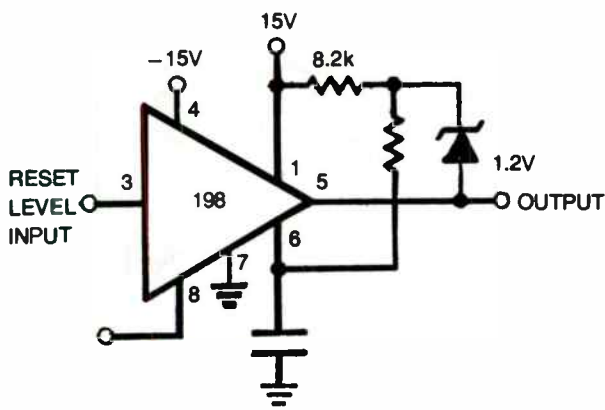
## 198—MONOLITHIC SAMPLE AND HOLD CIRCUIT



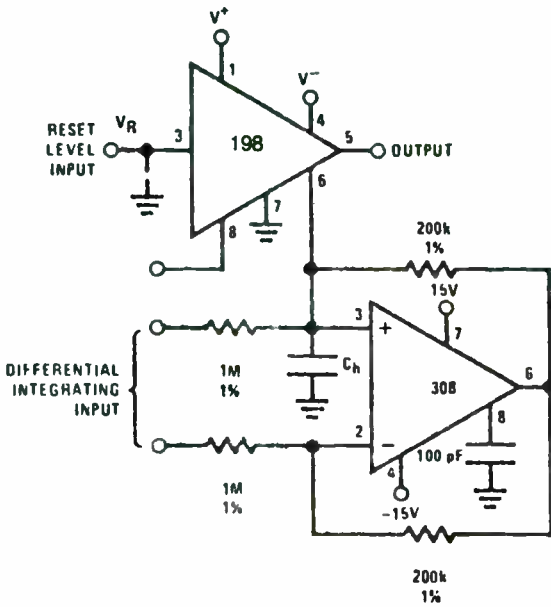
Sample and difference circuit



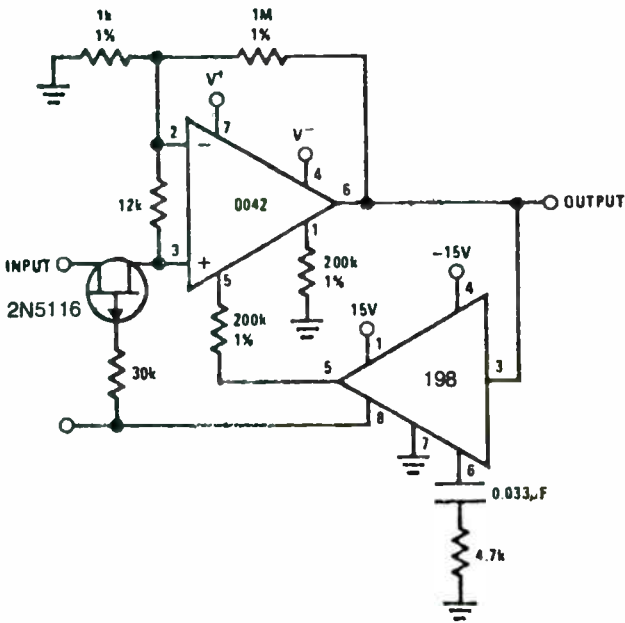
X1000 sample & hold



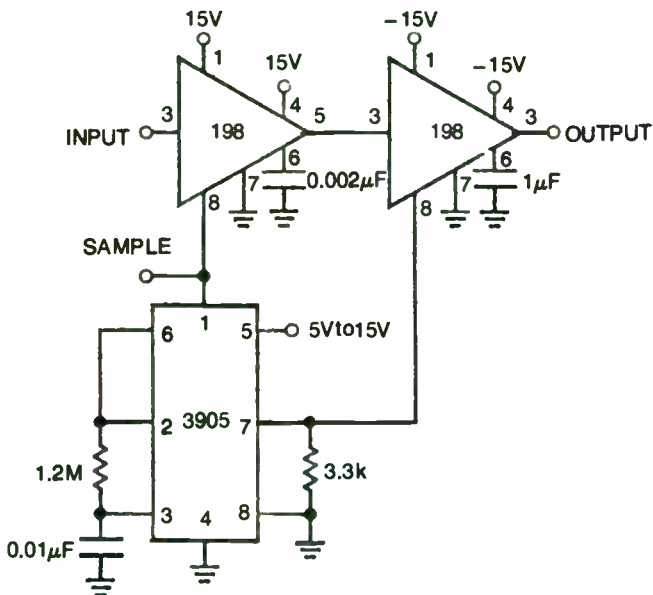
Ramp generator with variable reset level



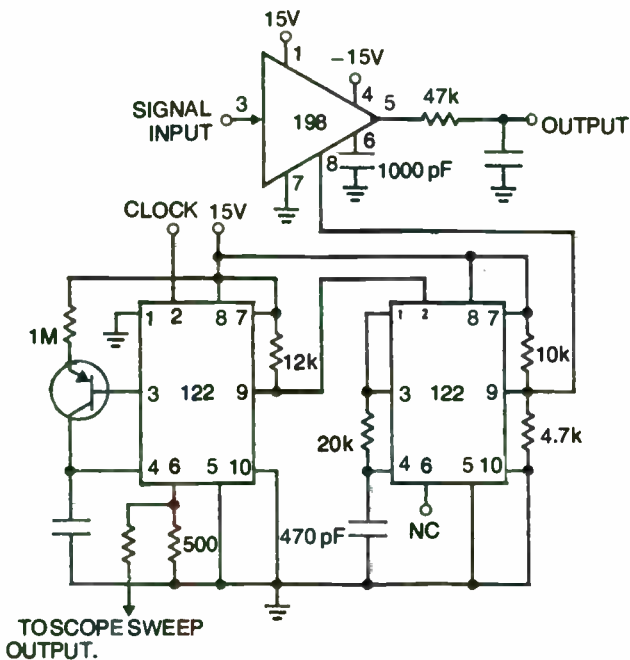
Integrator with programmable reset level



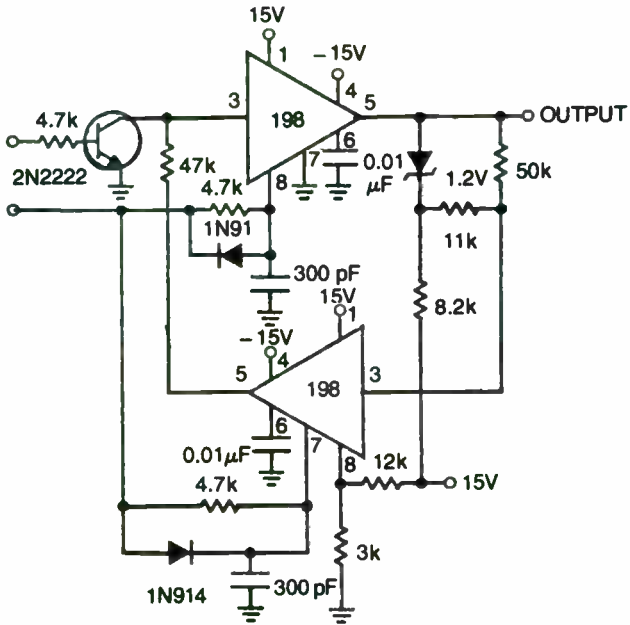
Reset stabilized amplifier (gain of 1000)



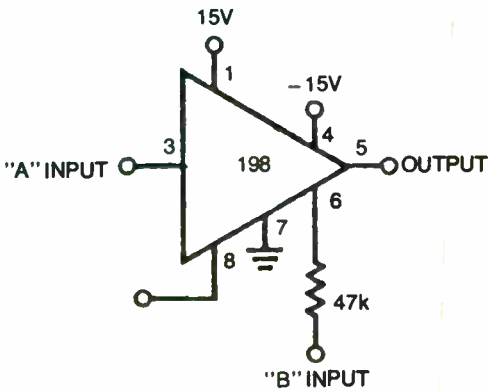
Fast acquisition, low droop sample & hold



Synchronous correlator for recovering signals below noise level

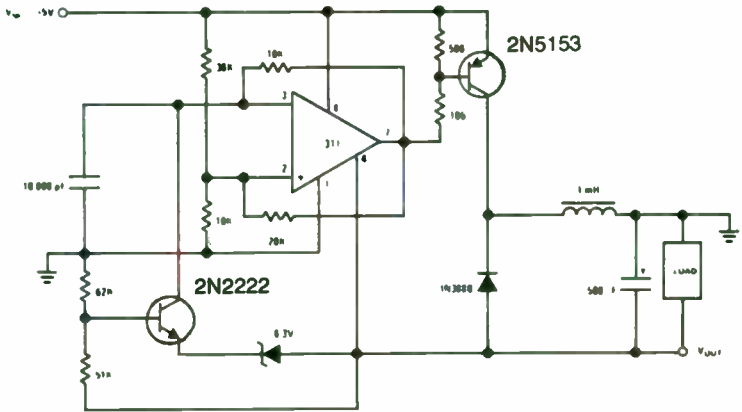


Staircase generator

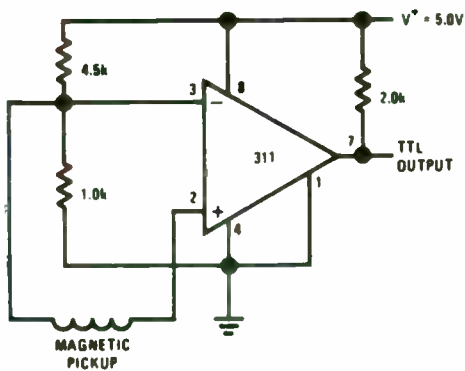


2-channel switch

## 311—VOLTAGE COMPARATOR

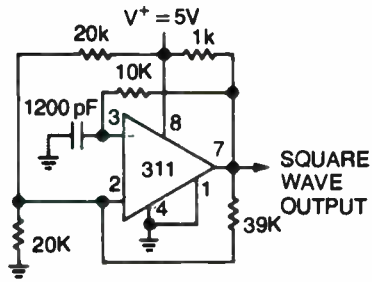


Switching regulator for voltage conversion

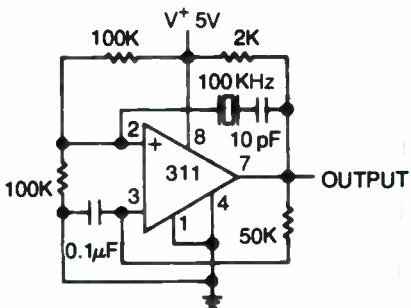


Detector for magnetic transducer



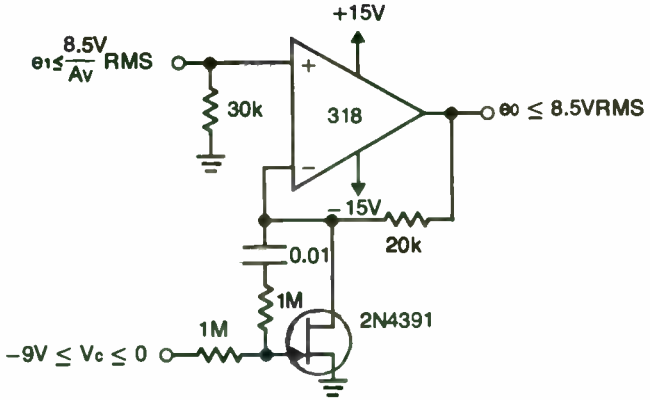


100 kHz free running multivibrator



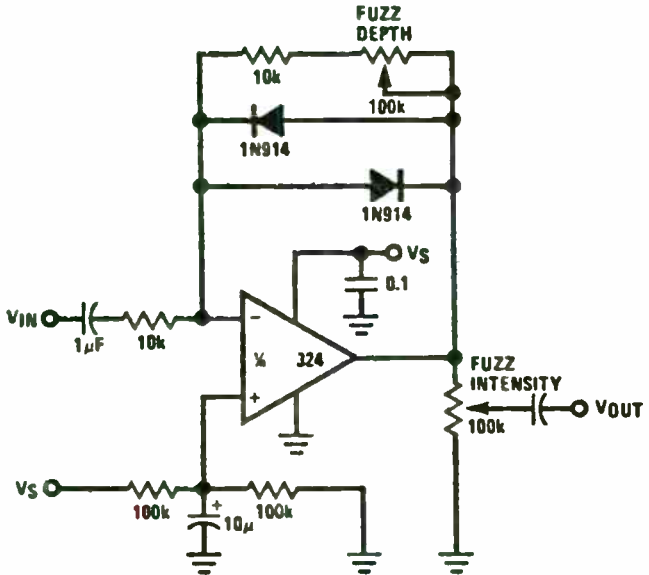
Crystal oscillator

## 318— WIDE TEMPERATURE RANGE OPERATIONAL AMPLIFIER



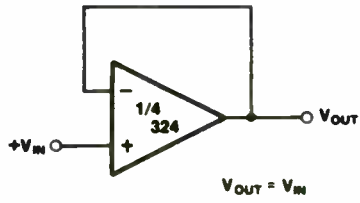
Amplifier with gain range = 1 – 1000

## 324— QUAD OPERATIONAL AMPLIFIER

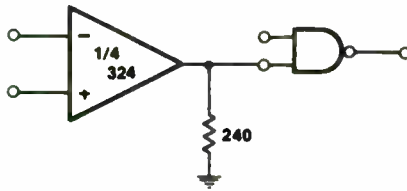


"Fuzz" circuit

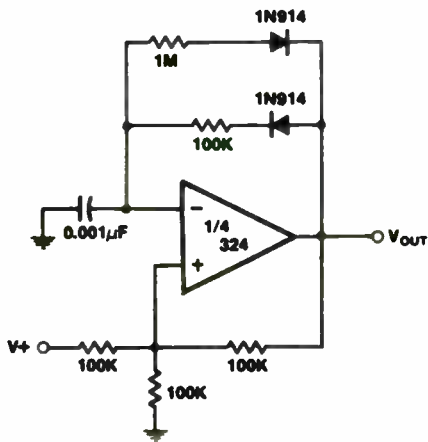




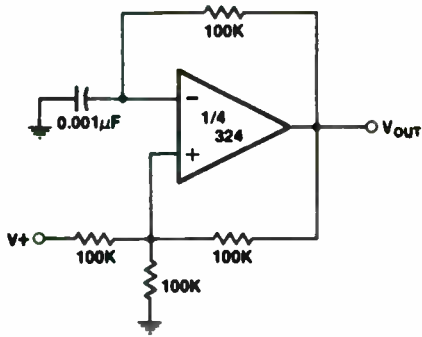
Voltage follower



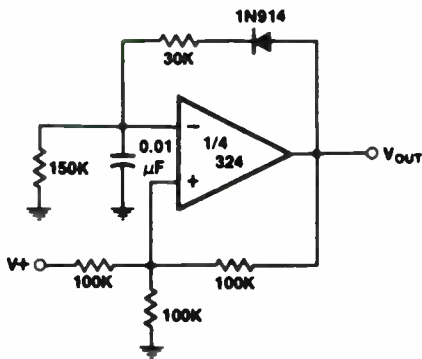
Driving TTL



Pulse generator

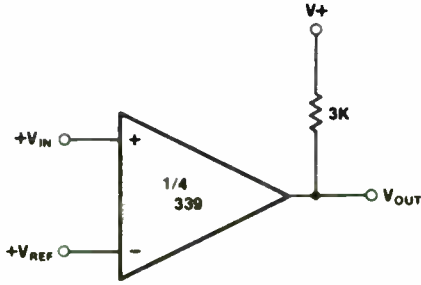


Squarewave oscillator

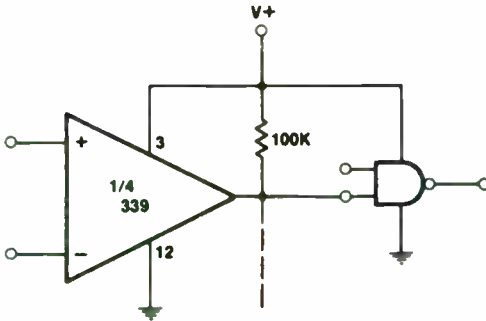


Pulse generator

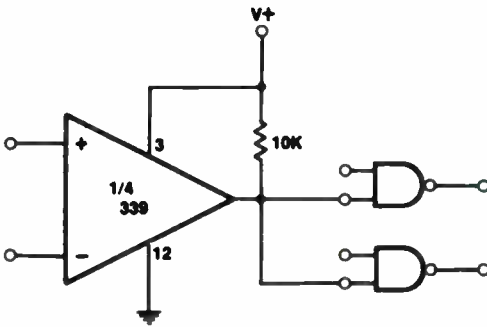
# 339—QUAD VOLTAGE COMPARATOR



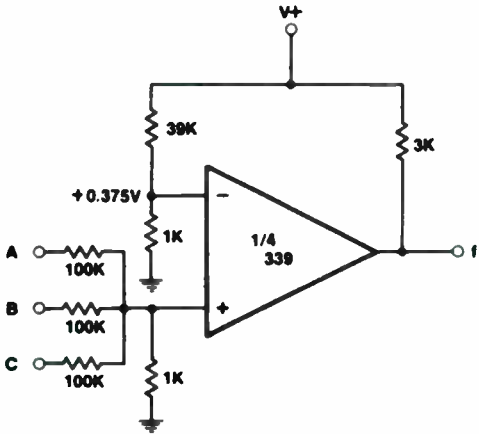
Basic comparator



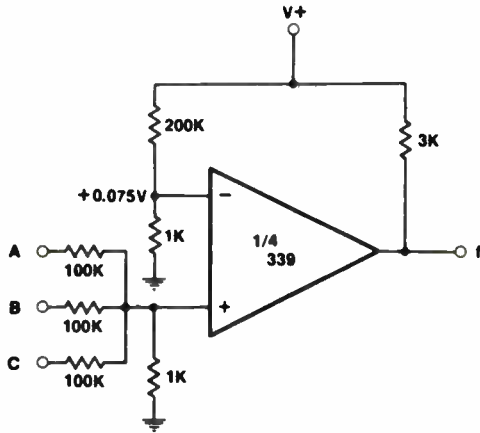
Driving CMOS



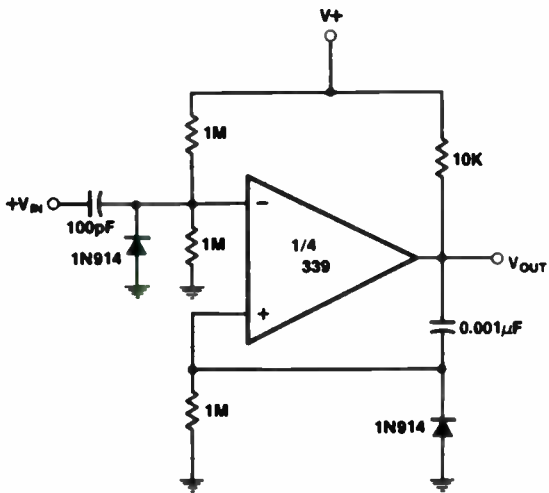
Driving TTL



AND gate

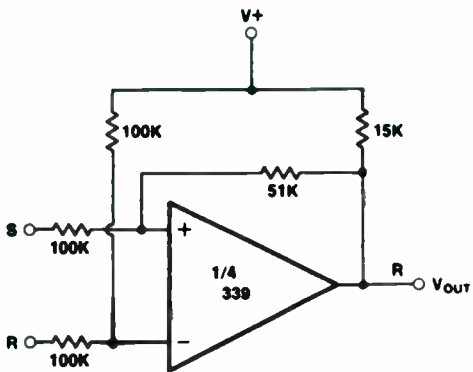


OR gate



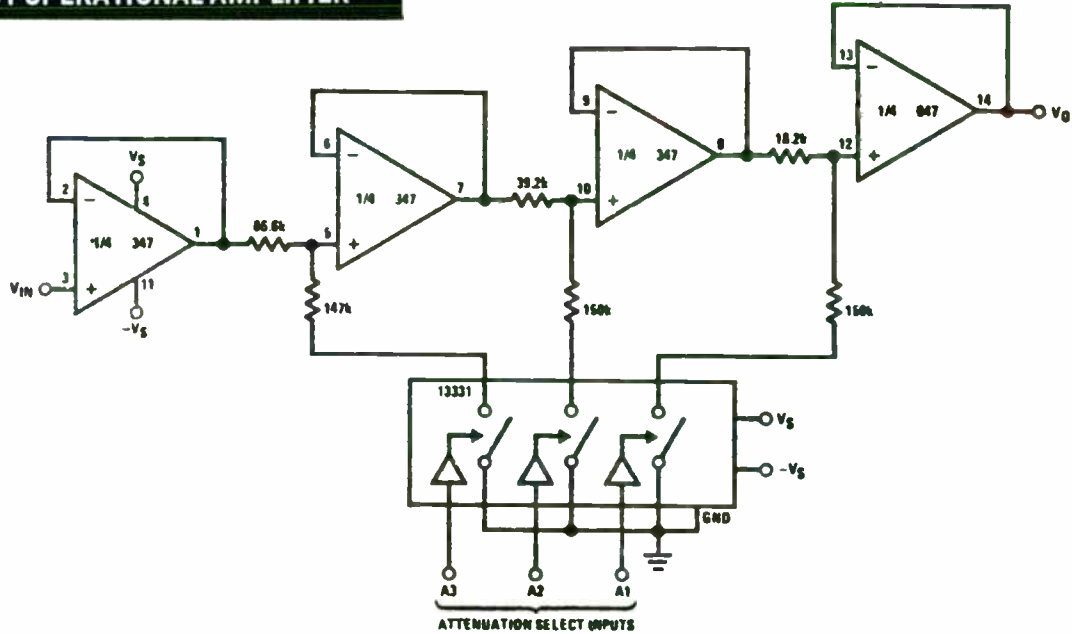
One-shot multivibrator

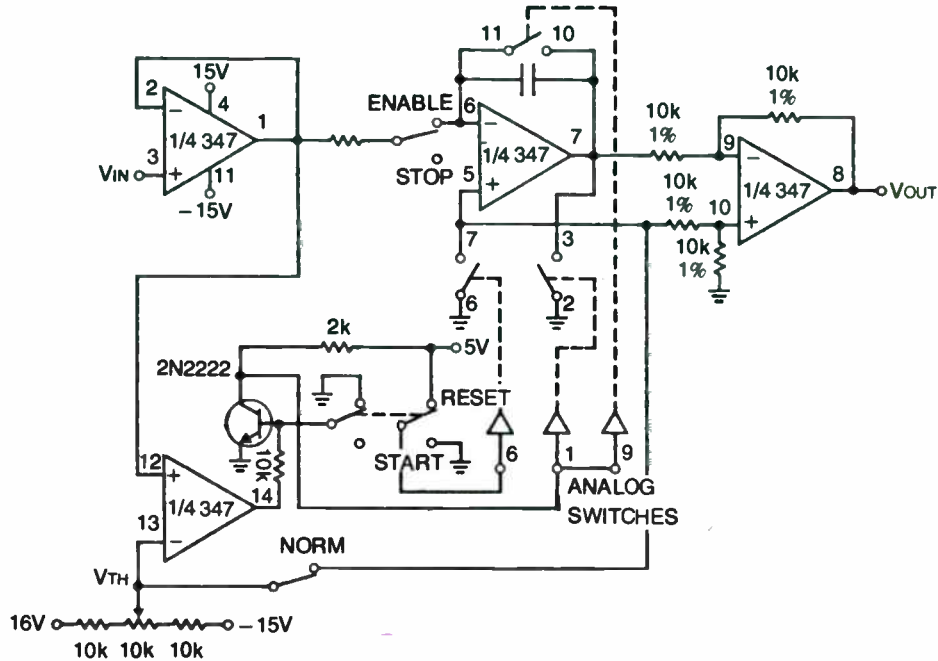




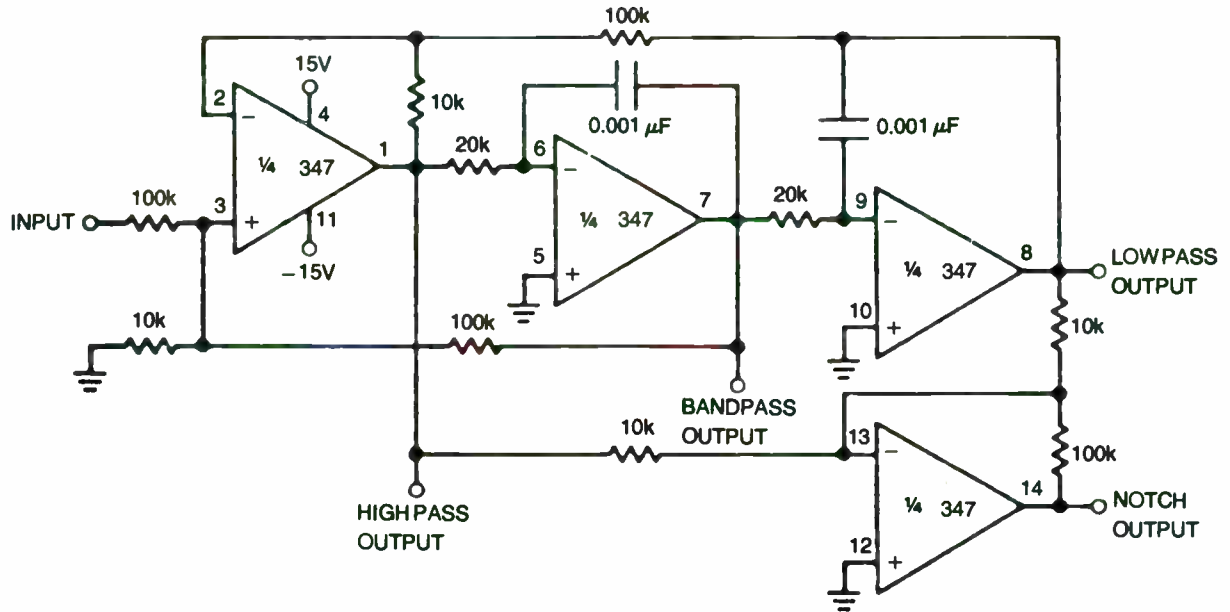
Bi-stable multivibrator

# 347 — WIDE BANDWIDTH QUAD JFET INPUT OPERATIONAL AMPLIFIER

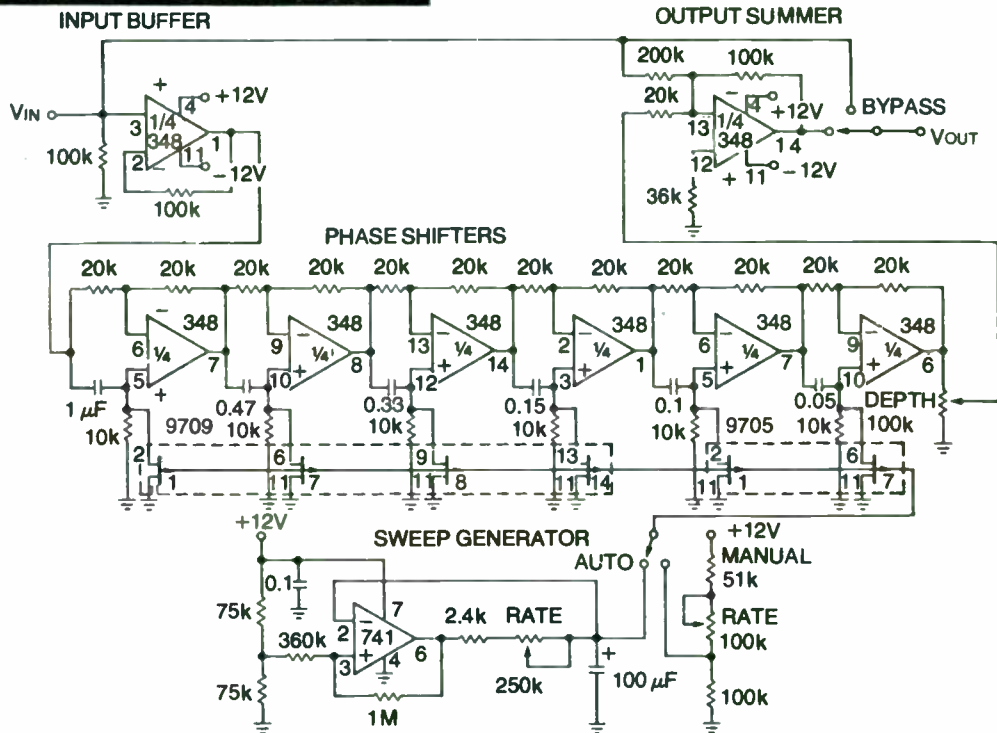




Long time integrator with reset, hold and starting threshold adjustment

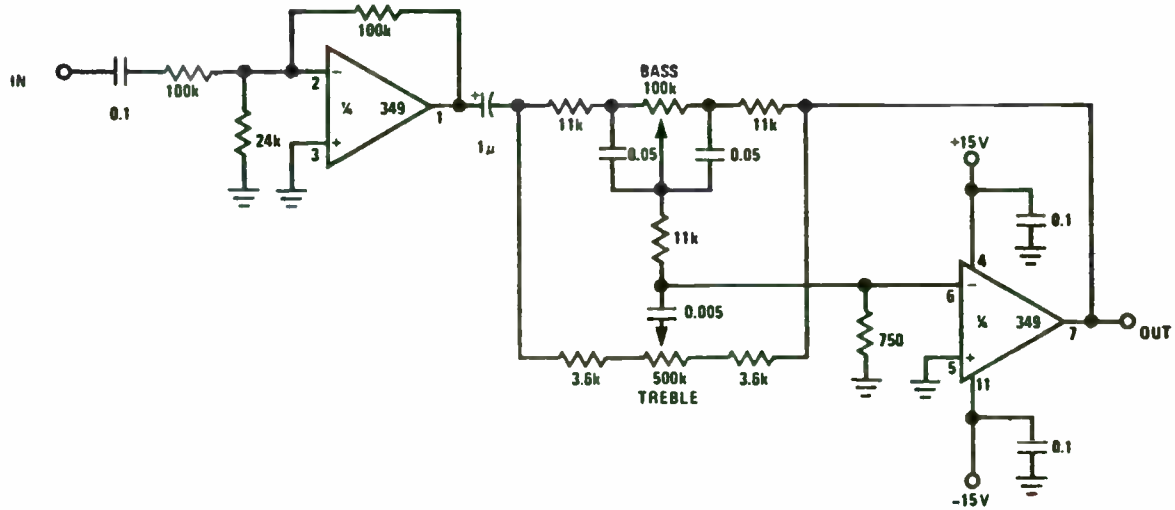


## 348—QUAD 741 OPERATIONAL AMPLIFIER

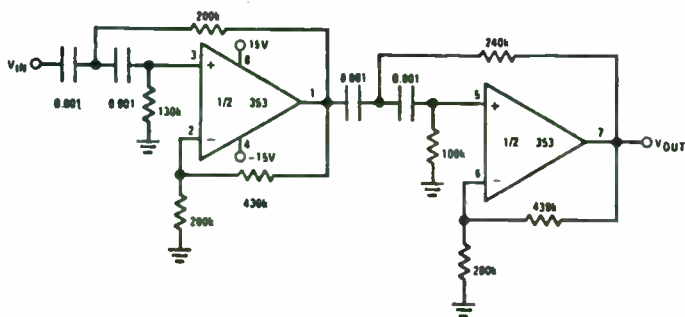


Phase Shifter

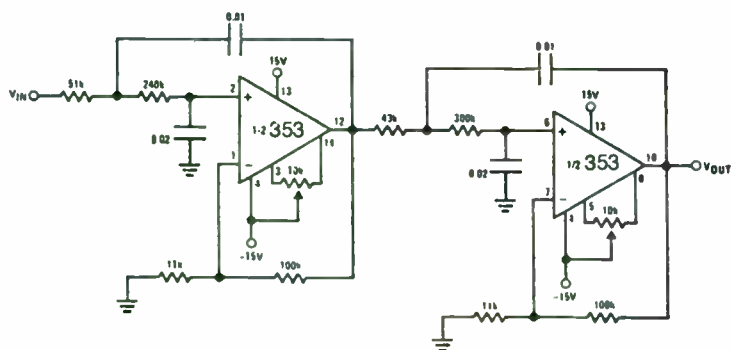
# 349— WIDE BAND DECOMPEN SATED QUAD 741 OPERATIONAL AMPLIFIER



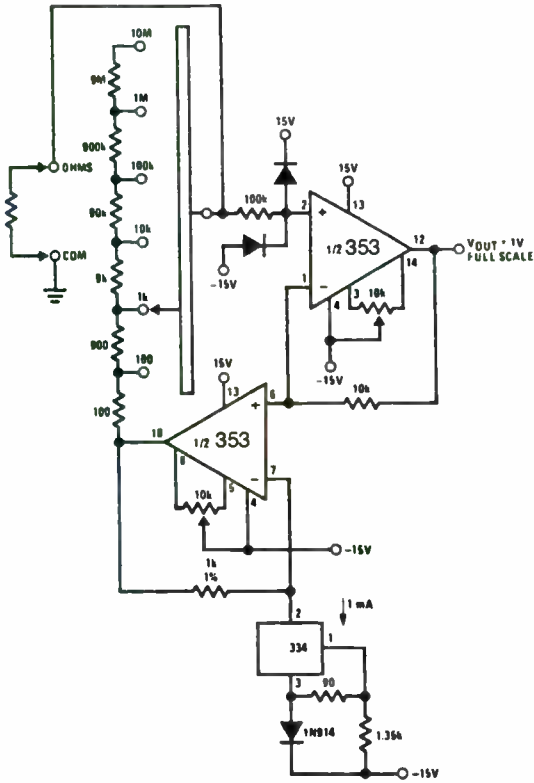
## 353— WIDE BANDWIDTH DUAL JFET INPUT OPERATIONAL AMPLIFIER



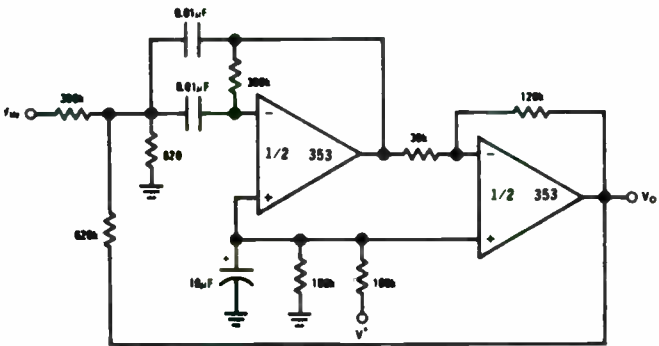
Fourth order high pass Butterworth filter



Fourth order low pass Butterworth filter

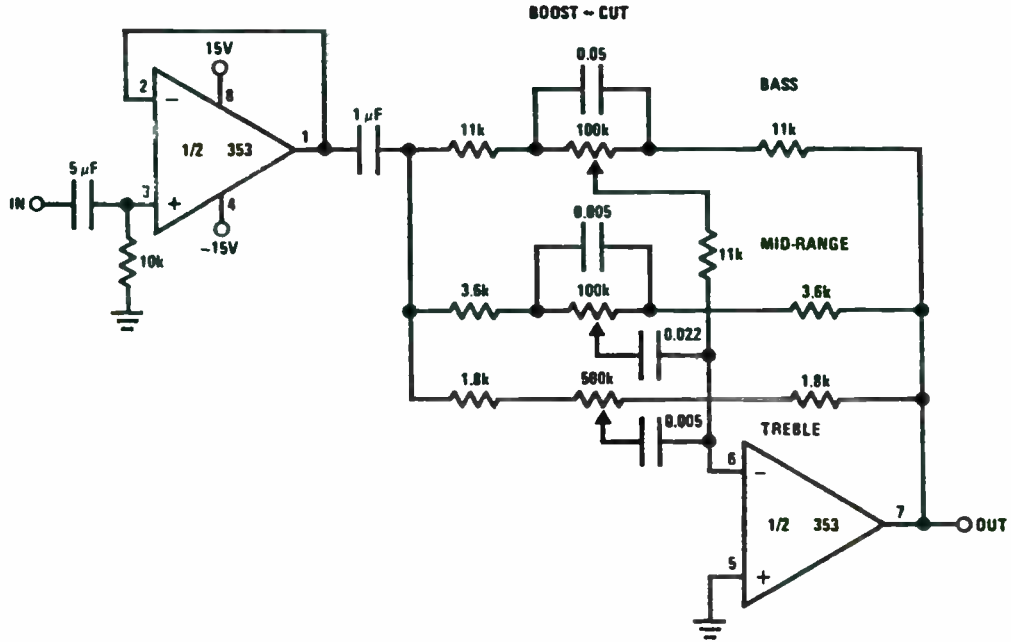


Ohms to volts converter

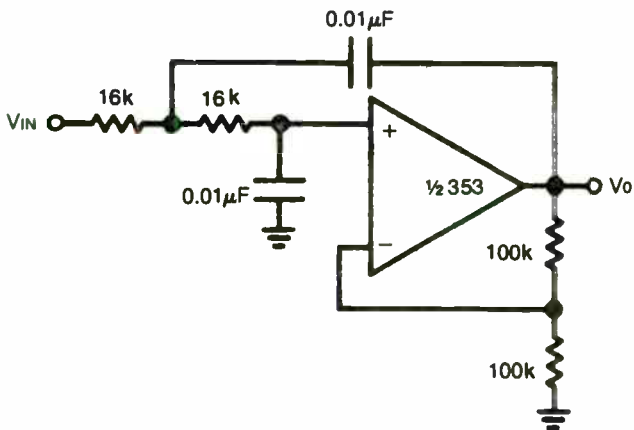


Bandpass active filter

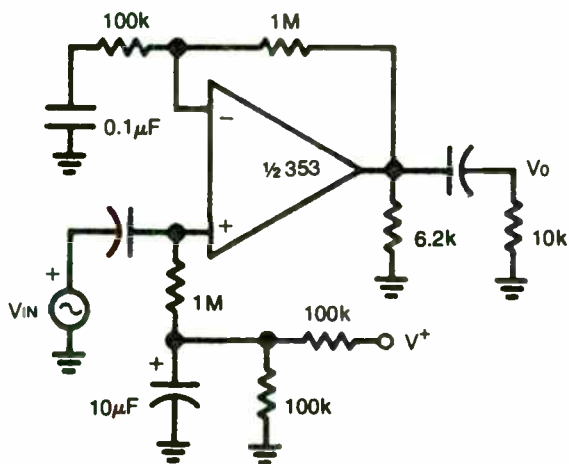




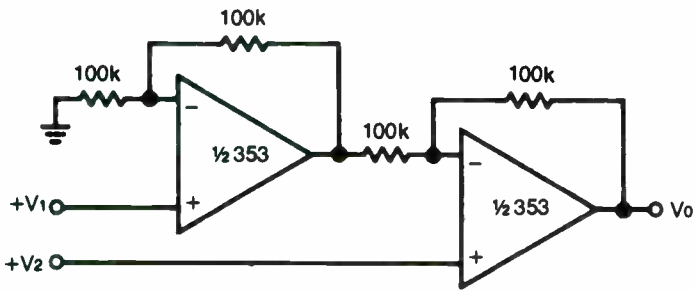
Three-band active tone control



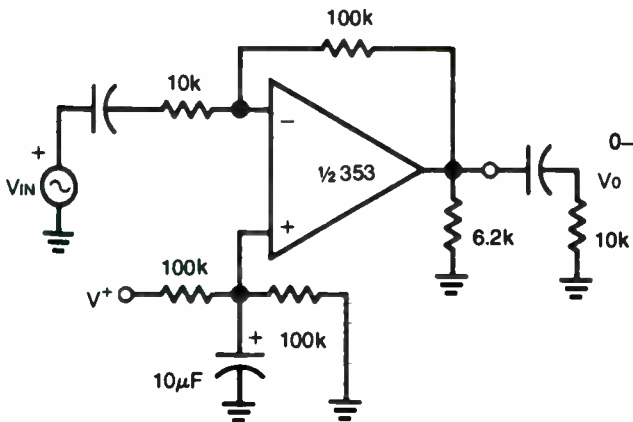
DC coupled low-pass RC active filter



AC coupled noninverting amplifier

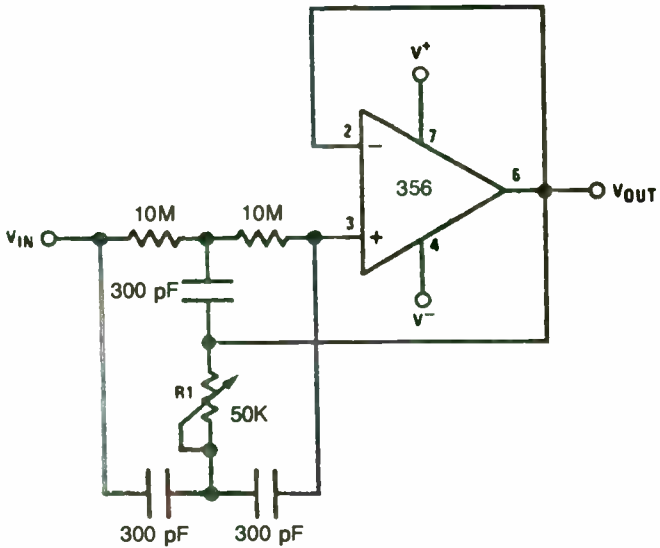


High input Z, dc differential amplifier

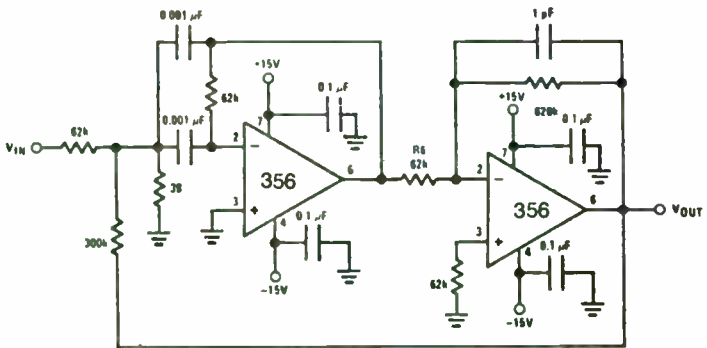


AC coupled inverting amplifier

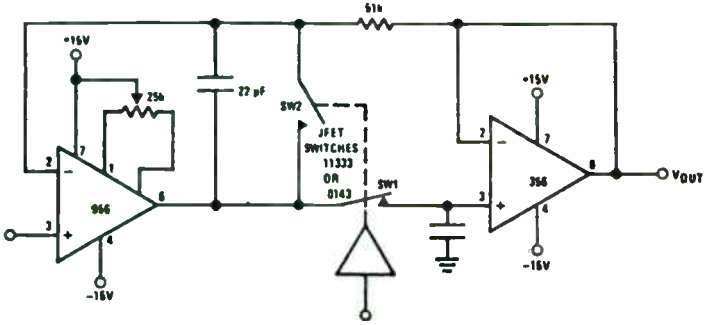
# 356—LOW OFFSET MONOLITHIC JFET INPUT OPERATIONAL AMPLIFIER



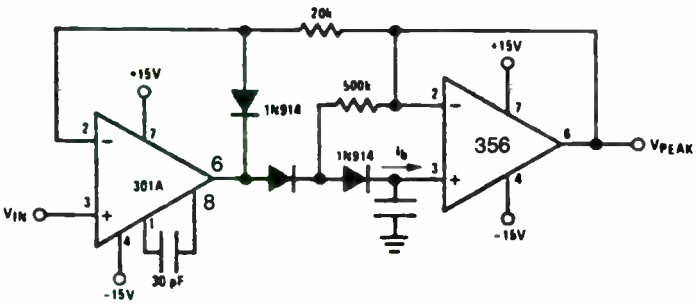
High Q notch filter



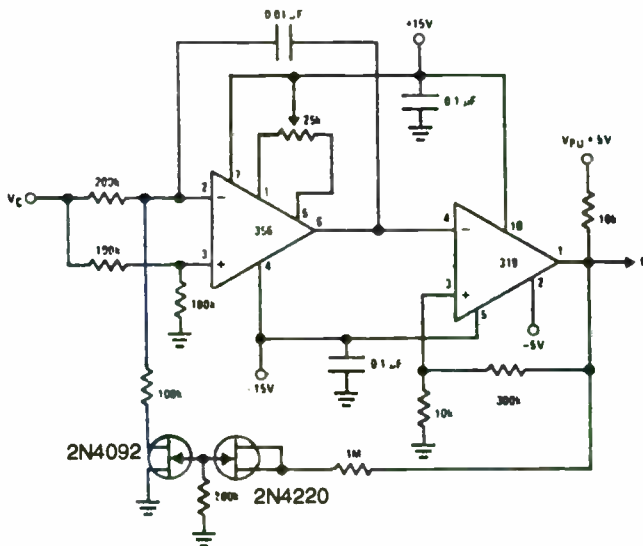
High Q bandpass filter



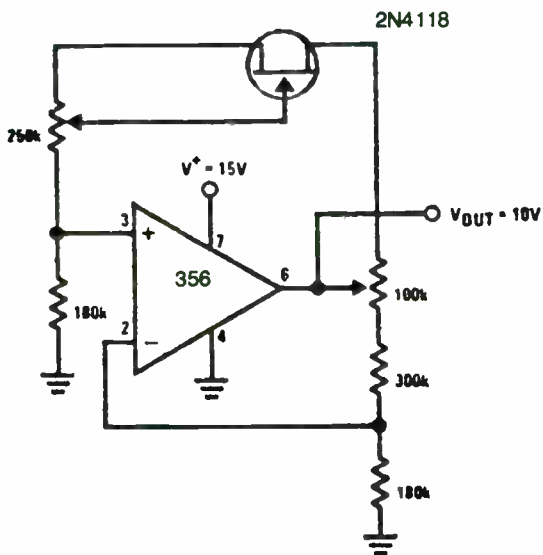
High accuracy sample and hold



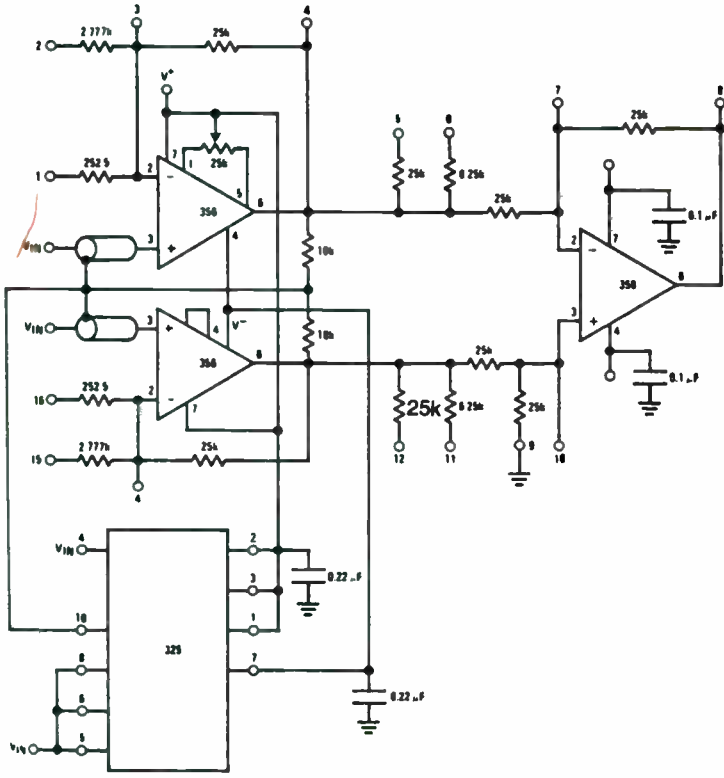
Low drift peak detector



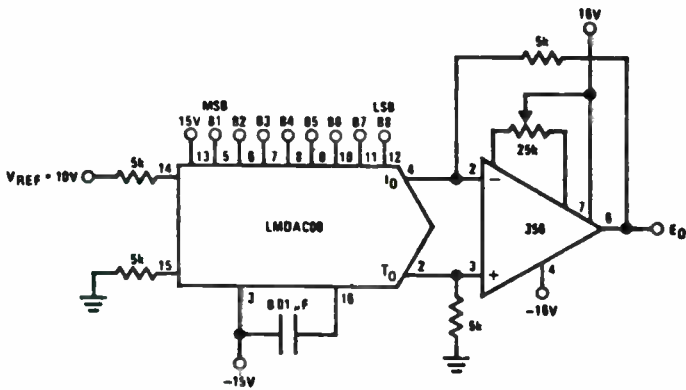
3 decades VCO



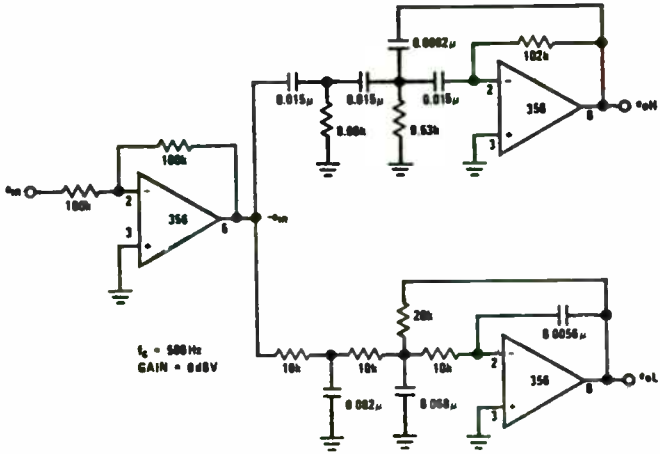
Low drift adjustable voltage reference



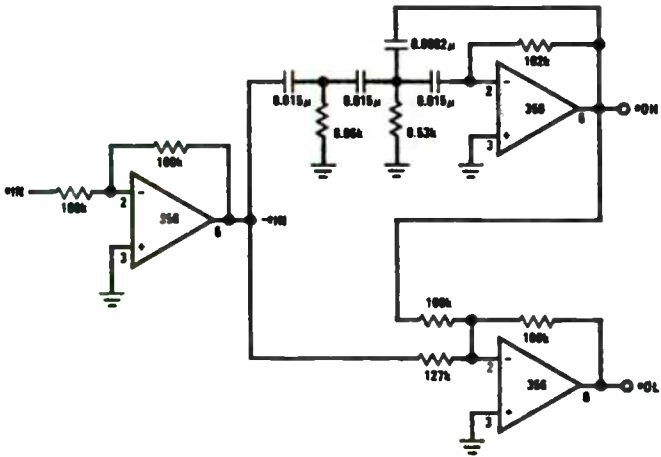
High CMRR, low drift instrumentation amplifier with floating input stage



8-bit D/A converter with symmetrical offset binary operation



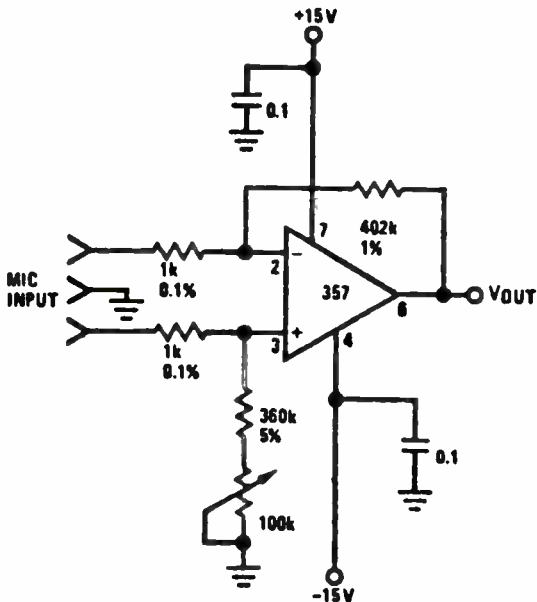
Active crossover network



Asymmetrical 3rd order Butterworth active crossover network

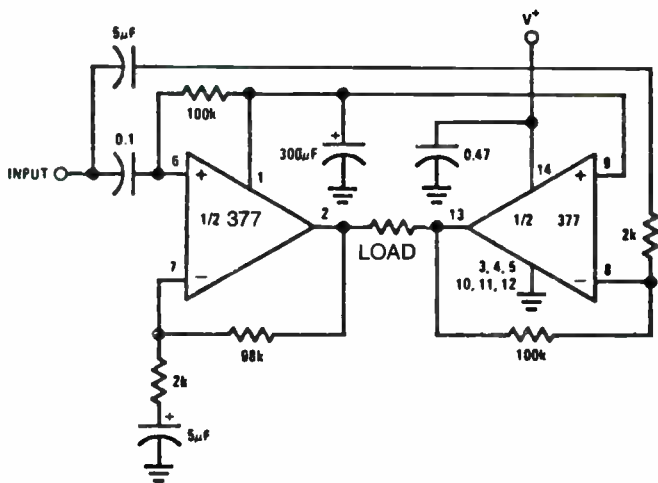


## 357—MONOLITHIC JFET INPUT OPERATIONAL AMPLIFIER

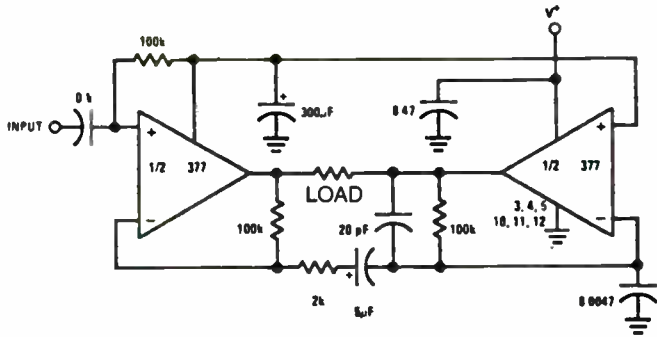


Transformerless mic preamp for balanced inputs

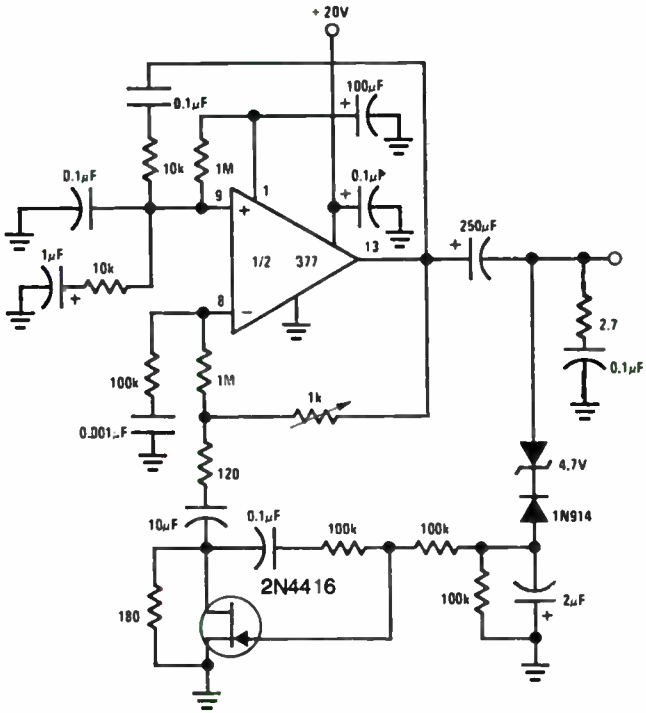
## 377—DUAL TWO WATT AUDIO AMPLIFIER



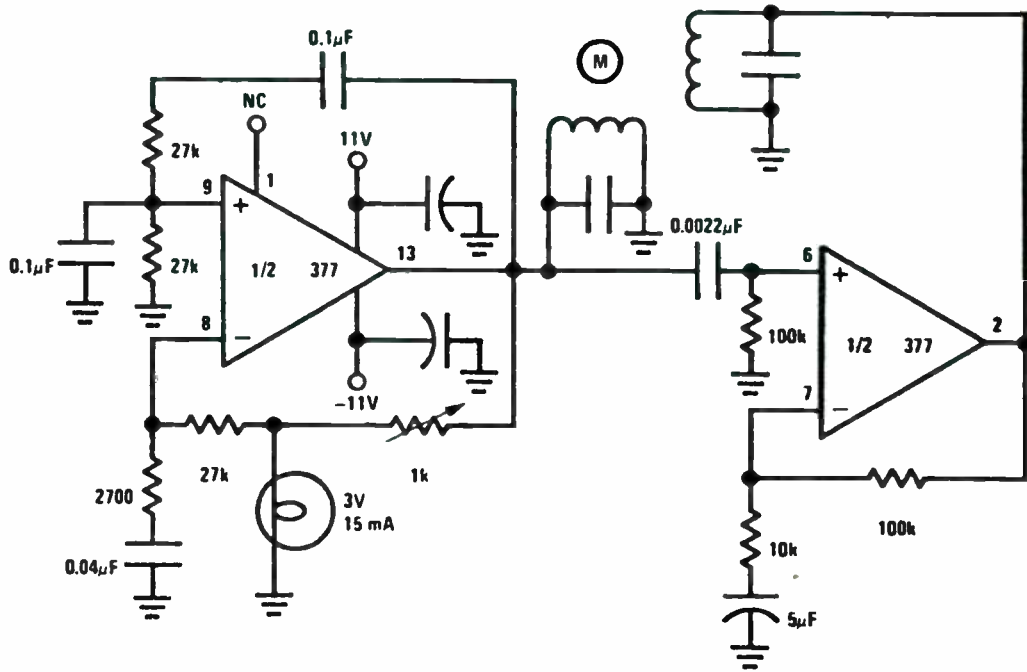
4-watt bridge amplifier



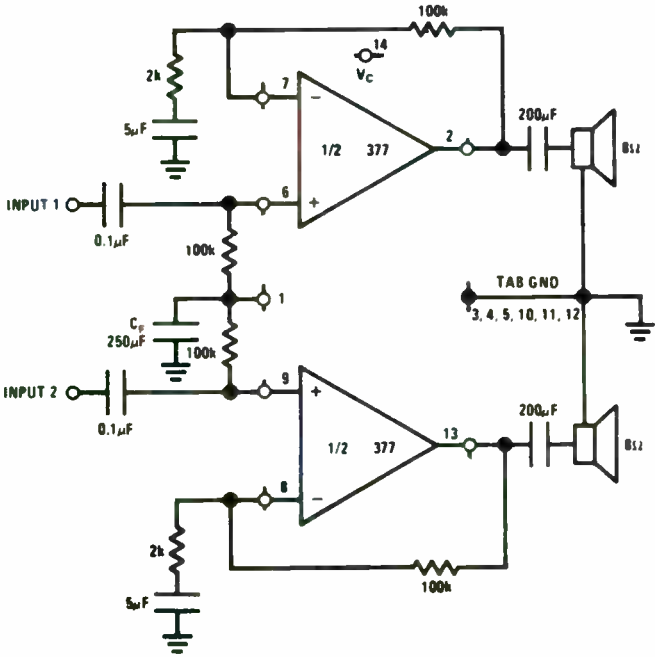
4-watt bridge amplifier with high input impedance



Wien bridge power oscillator

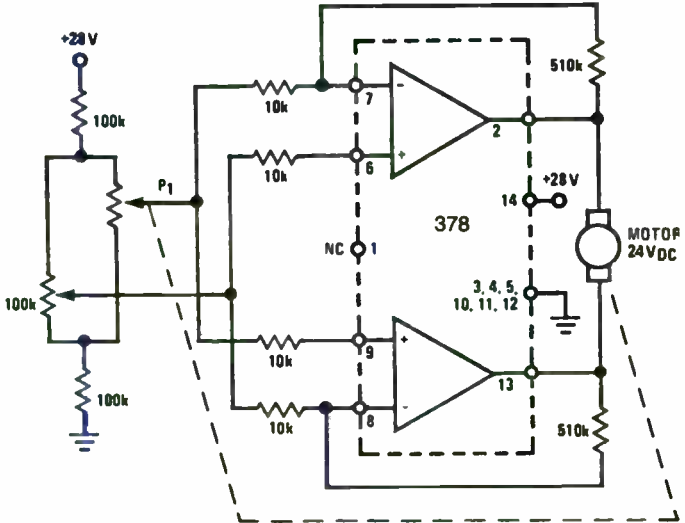


Two-phase motor drive

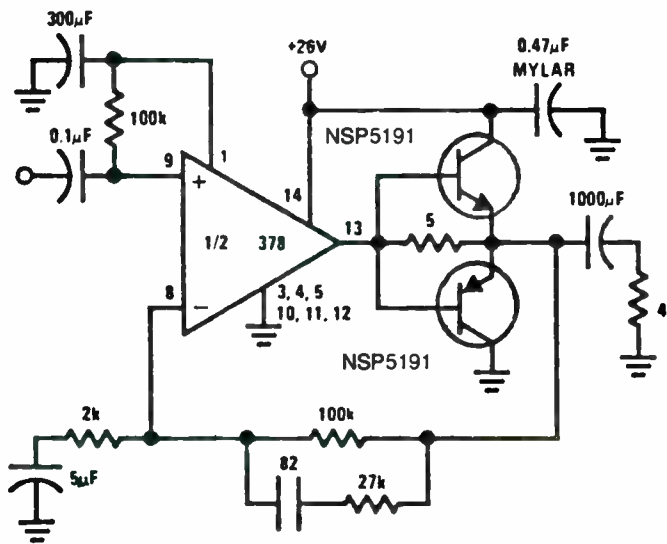


Simple stereo amplifier

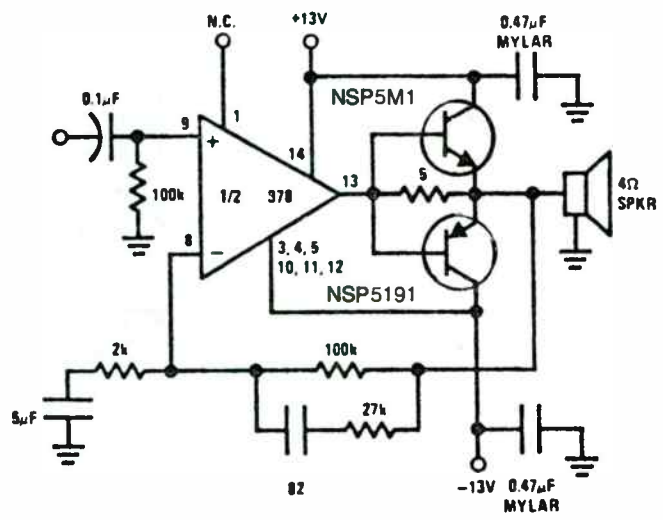
### 378—DUAL FOUR WATT AUDIO AMPLIFIER



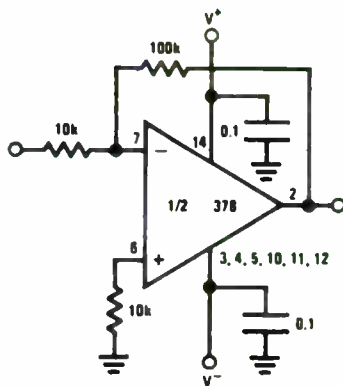
Proportional speed controller



10 Watt power amplifier

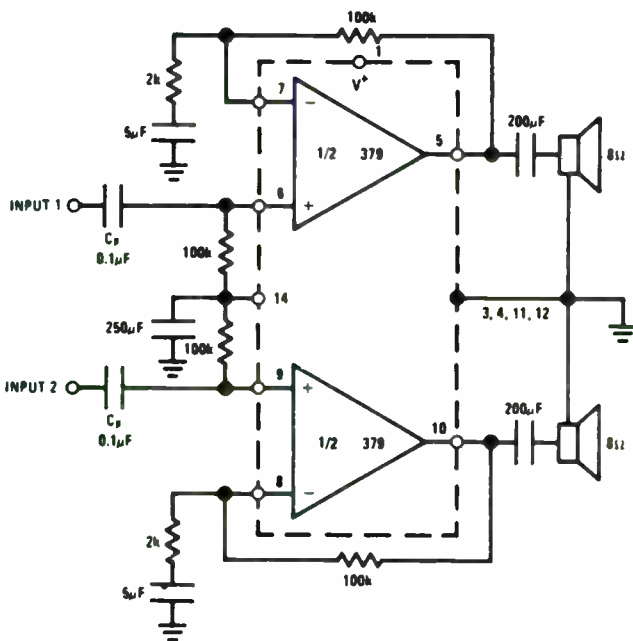


12 watt low-distortion power amplifier

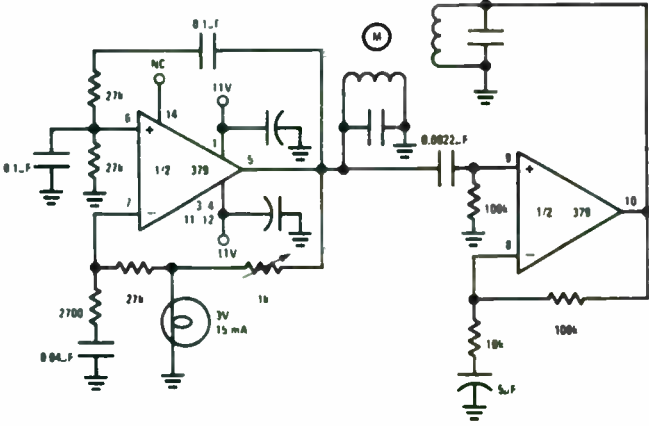


Power op amp (using split supplies)

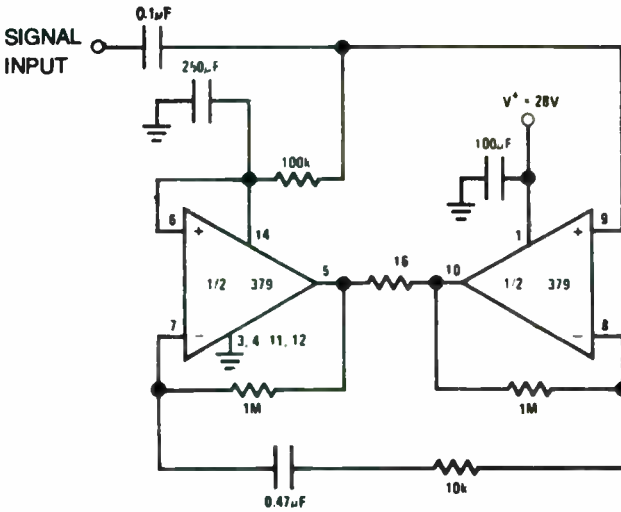
## 379—DUAL SIX WATT AUDIO AMPLIFIER



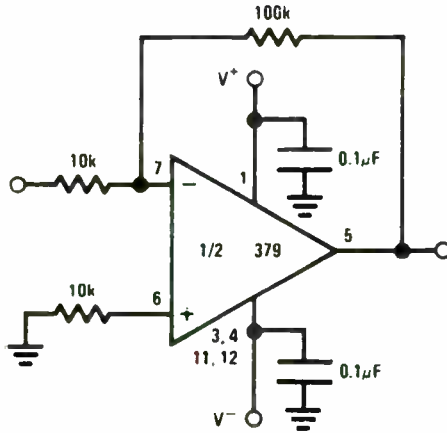
Simple stereo amplifier



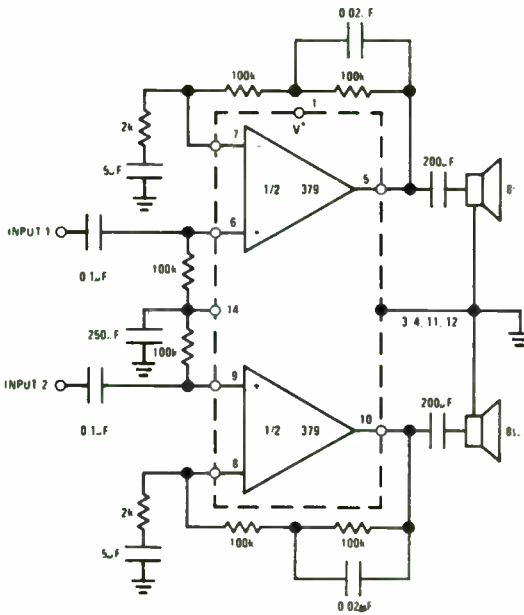
Two-phase motor drive



12W bridge amplifier



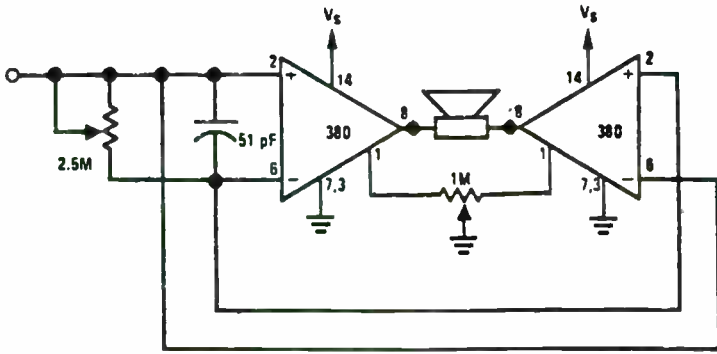
Power op amp (using split supplies)



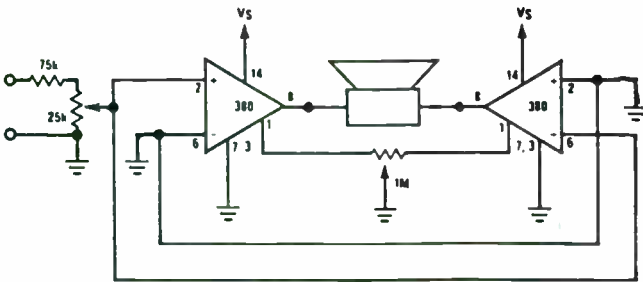
Simple stereo amplifier with bass boost



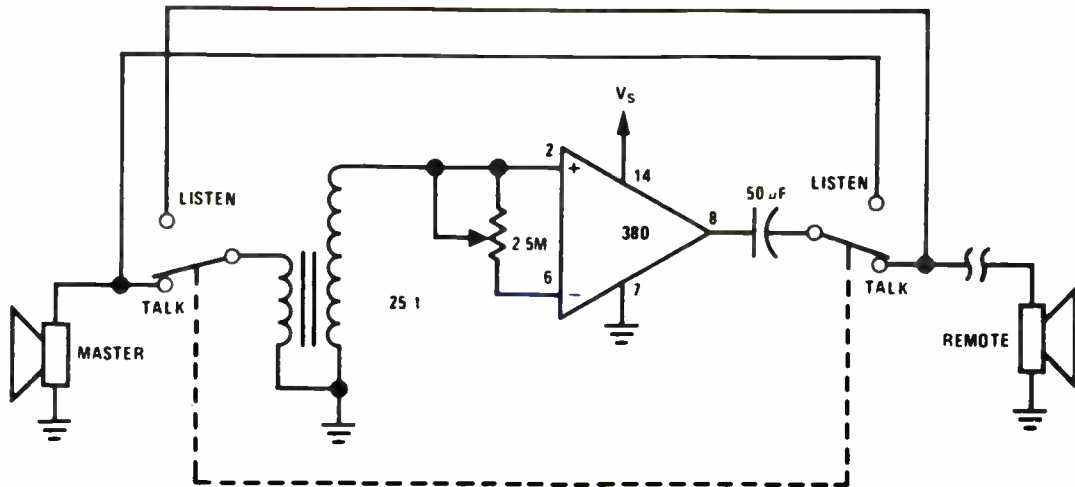
# 380—AUDIO POWER AMPLIFIER

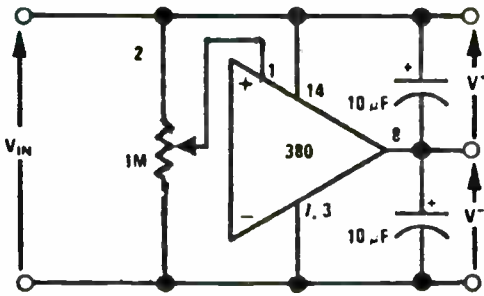


Quiescent balance control

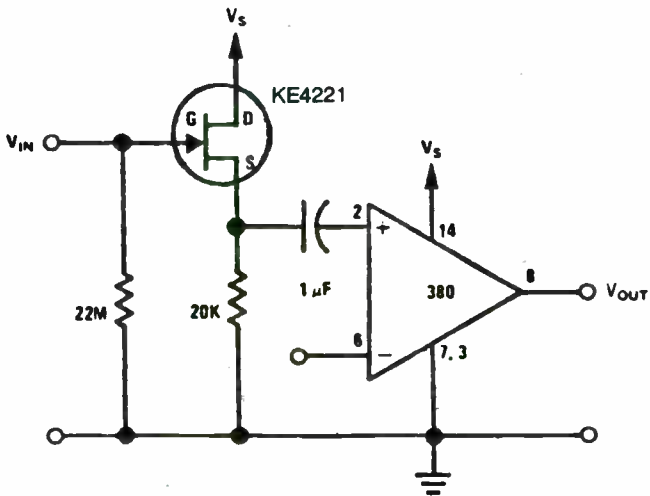


Voltage divider input

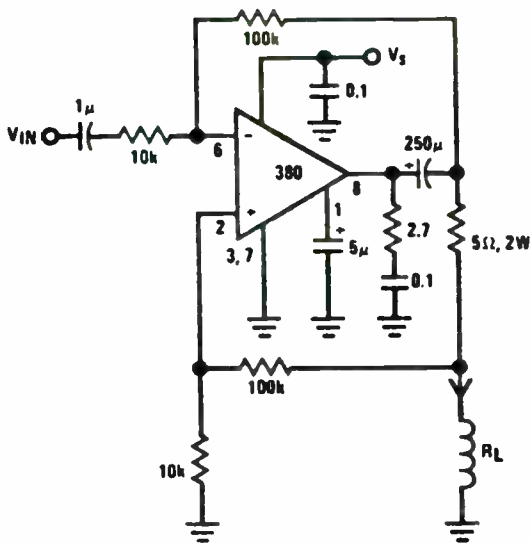




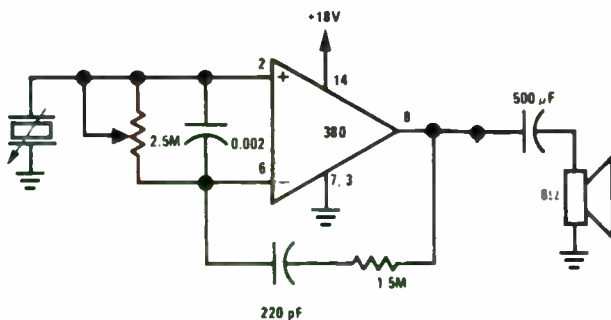
Dual supply



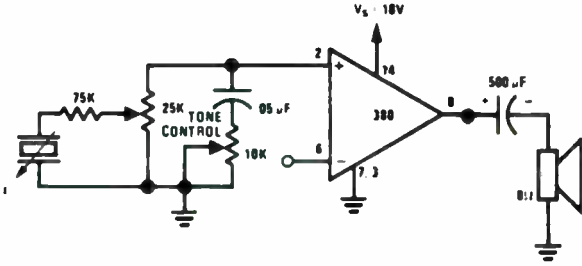
High input impedance



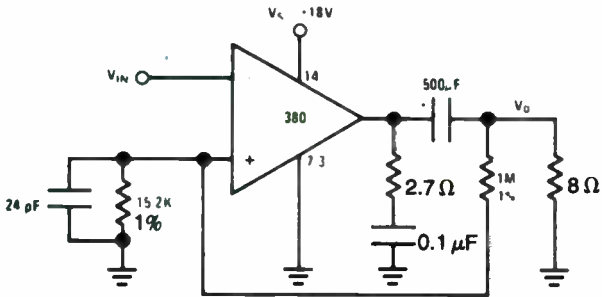
Power voltage-to-current converter



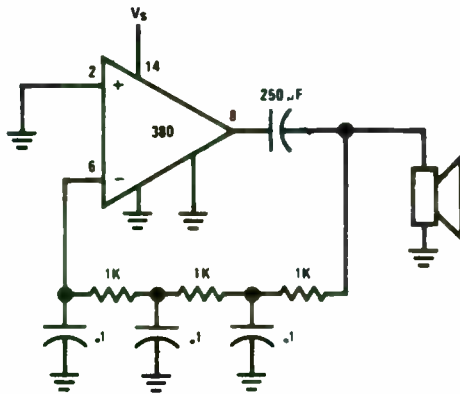
RIAA phono amplifier



Phono amp

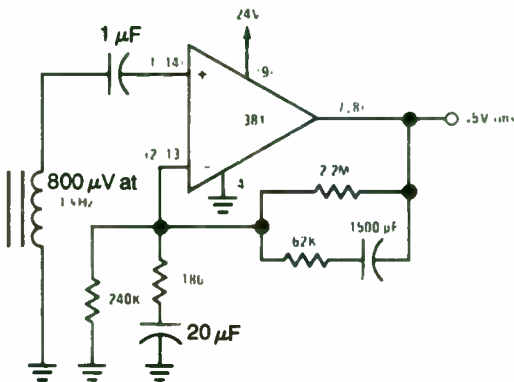


Boosted gain of 200 using positive feedback

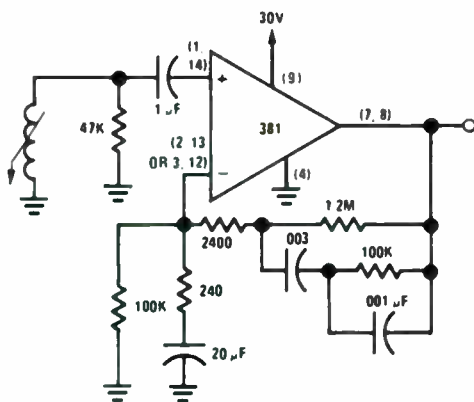


Phase shift oscillator

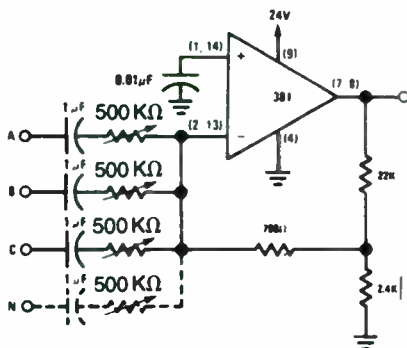
## 381 — LOW NOISE DUAL PREAMPLIFIER



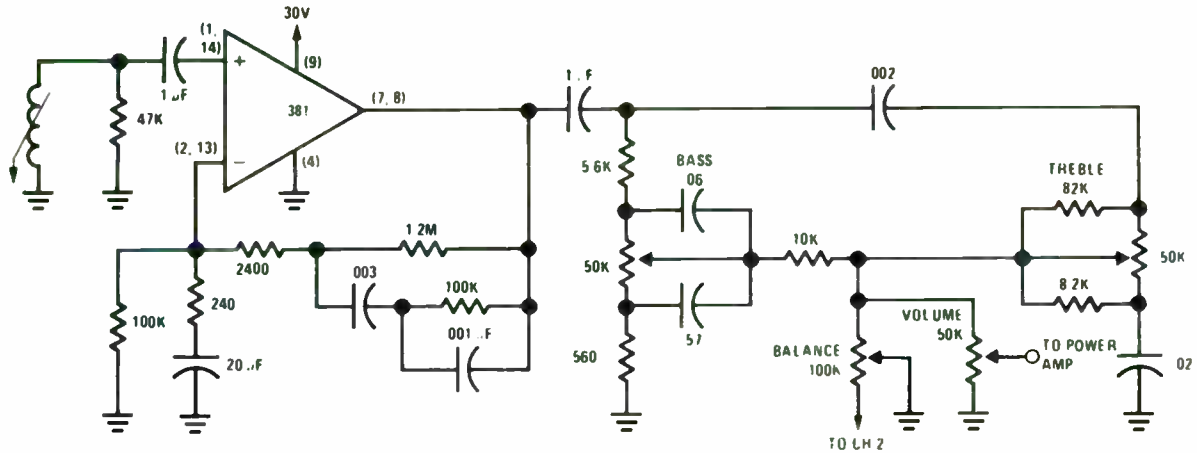
Tape playback amplifier



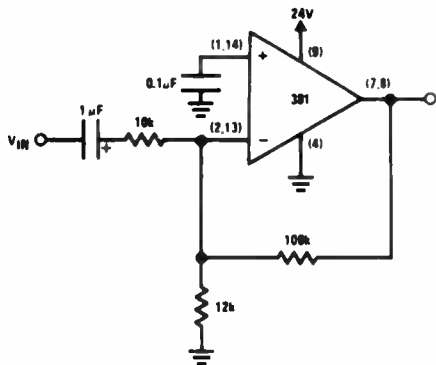
Typical magnetic phono preamp



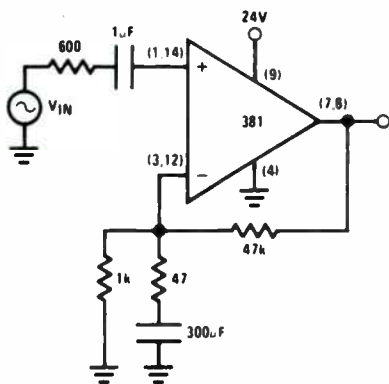
Audio mixer





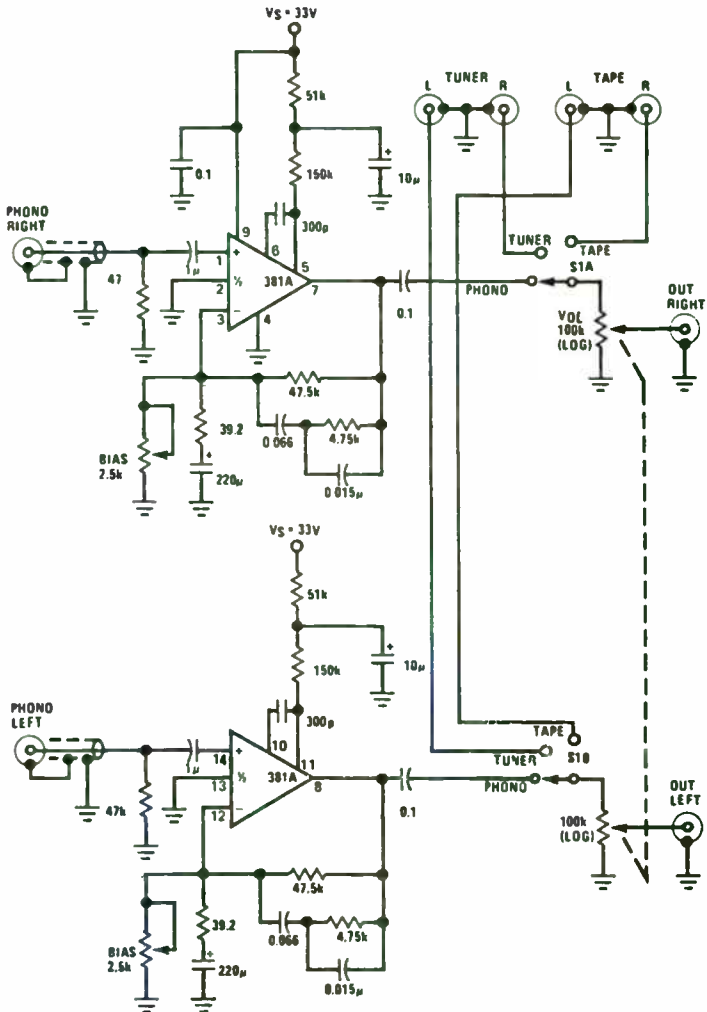


Ultra-low distortion amplifier

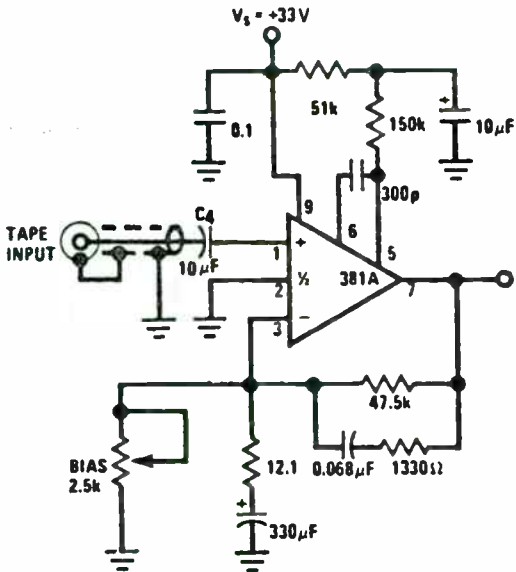


Flat gain circuit

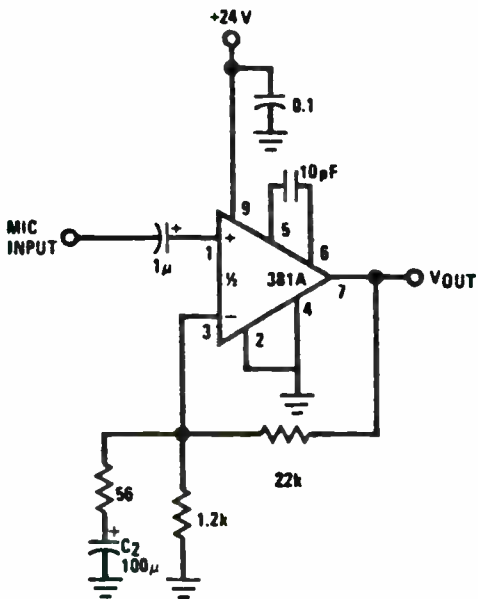
# 381A—LOW NOISE DUAL PREAMPLIFIER



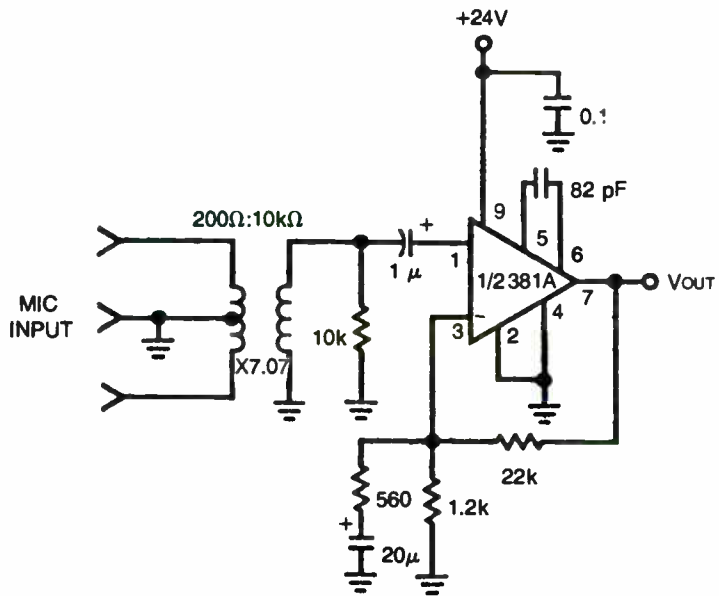
Ultra-low noise mini preamp (RIAA)



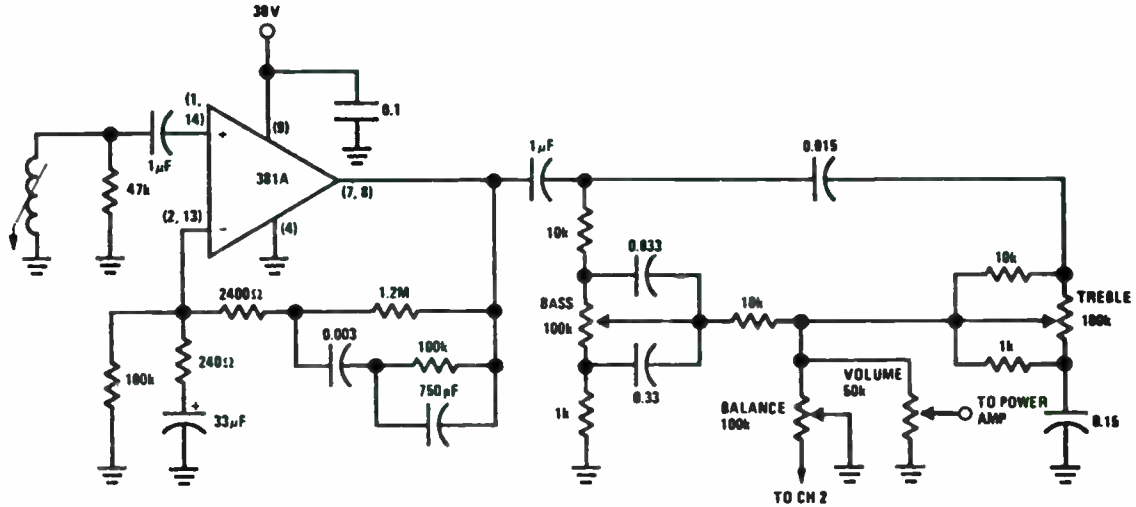
Ultra-low noise tape preamp (NAB, 1-7/8 & 3-3/4 IPS)



Unbalanced input mic preamp

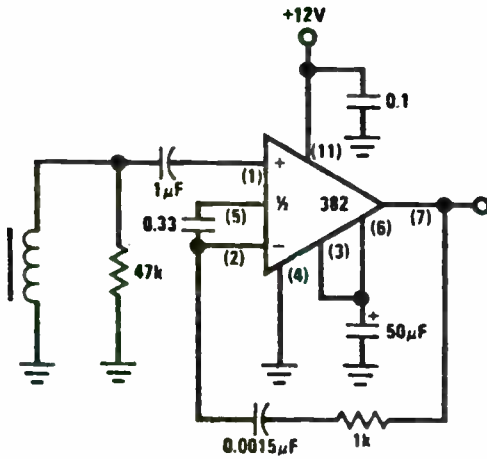


Balanced input mic preamp

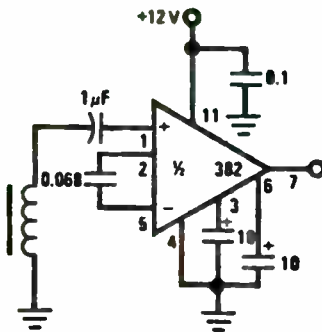


Single channel of complete phono preamp

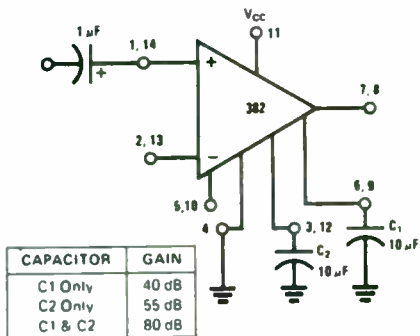
## 382—LOW NOISE DUAL PREAMPLIFIER



Phono preamp (RIIAA)

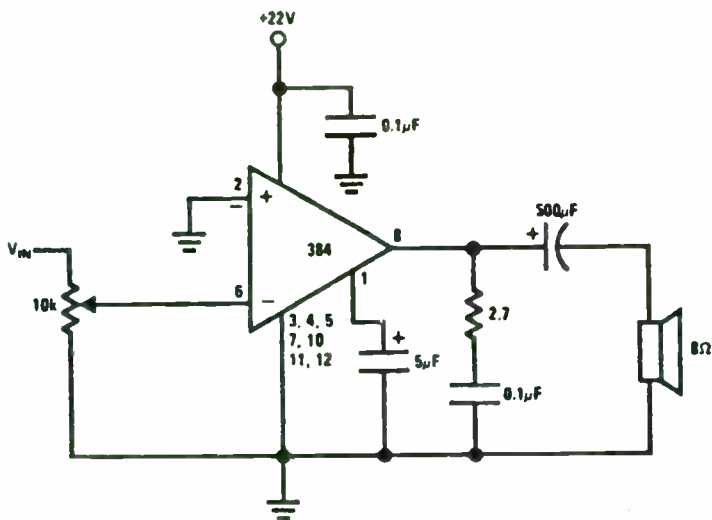


Tape preamp (NAB, 1-7/8 & 3-3/4 IPS)

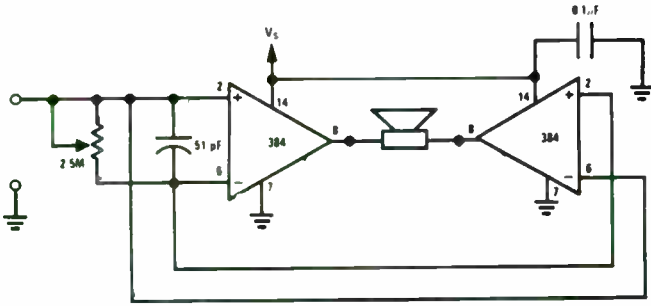


Flat response — fixed gain configuration

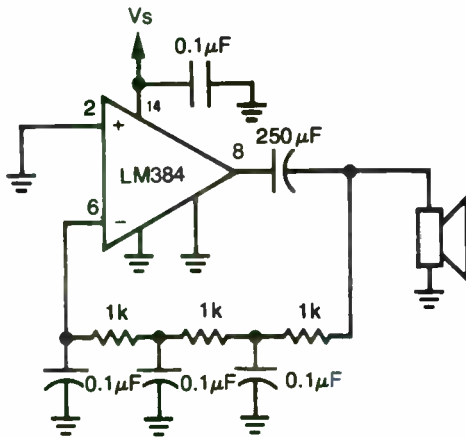
## 384—FIVE WATT AUDIO POWER AMPLIFIER



Typical 5W amplifier

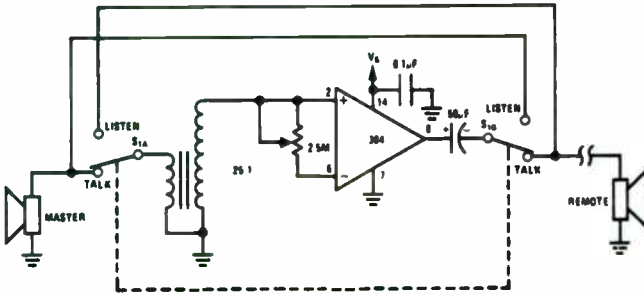


Bridge amplifier



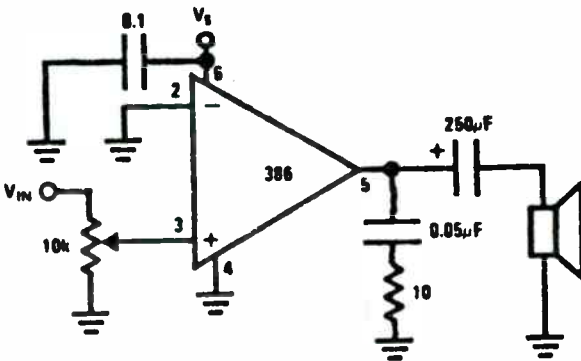
Phase shift oscillator



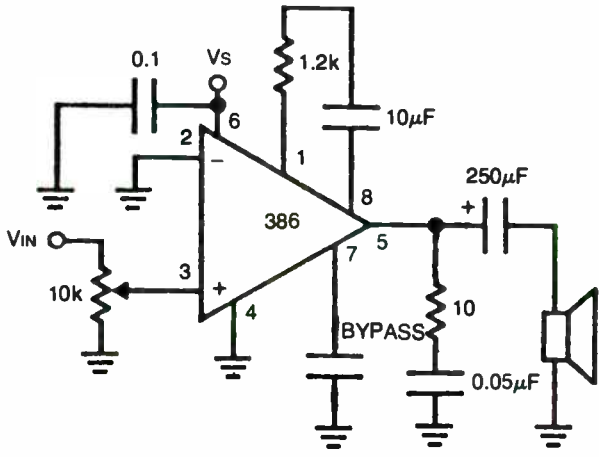


Intercom

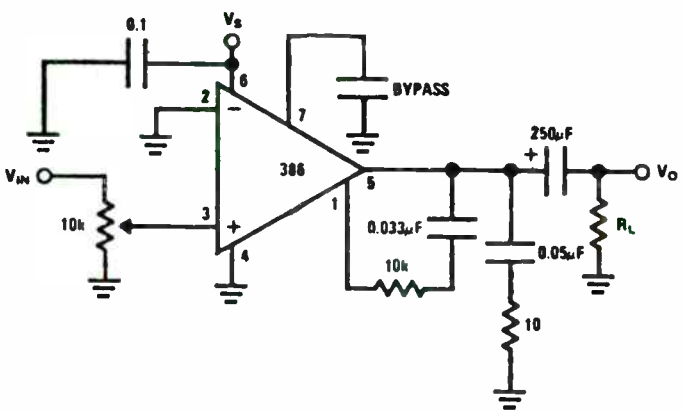
**386—LOW VOLTAGE AUDIO POWER AMPLIFIER**



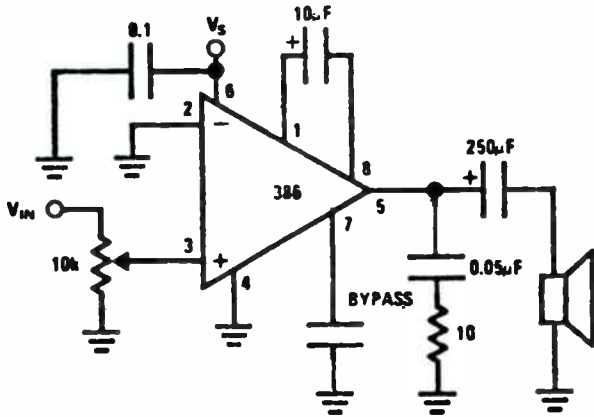
Amplifier with gain = 20 V/V (26 dB)



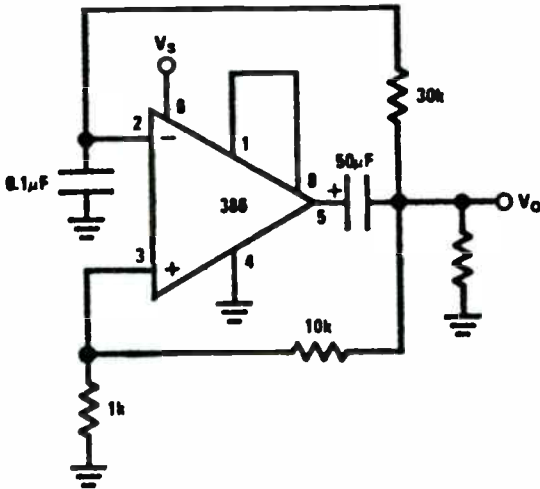
Amplifier with gain = 50 V/V (34 dB)



Amplifier with bass boost

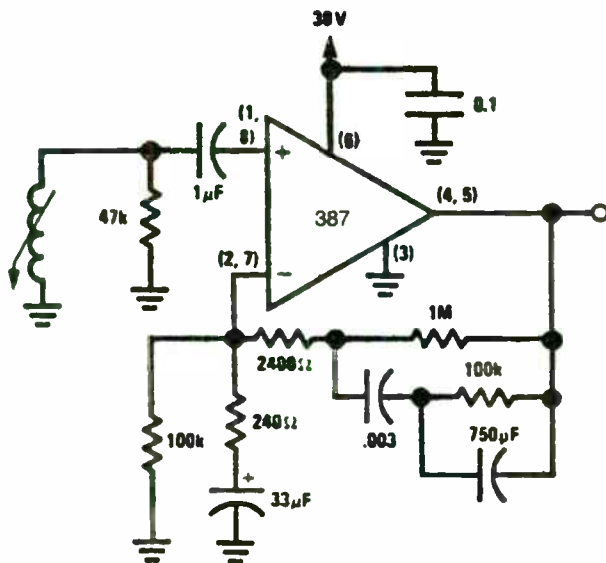


Amplifier with gain = 200 V/V (46 dB)

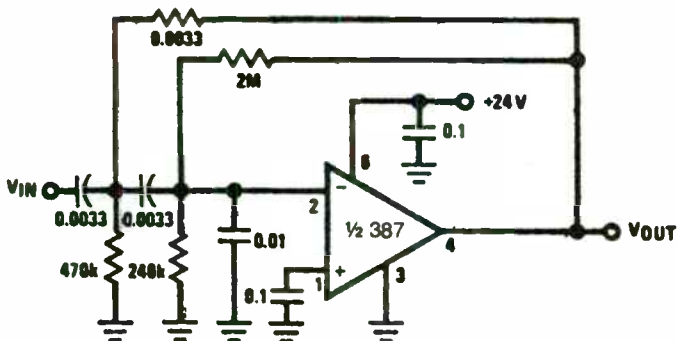


Square wave oscillator

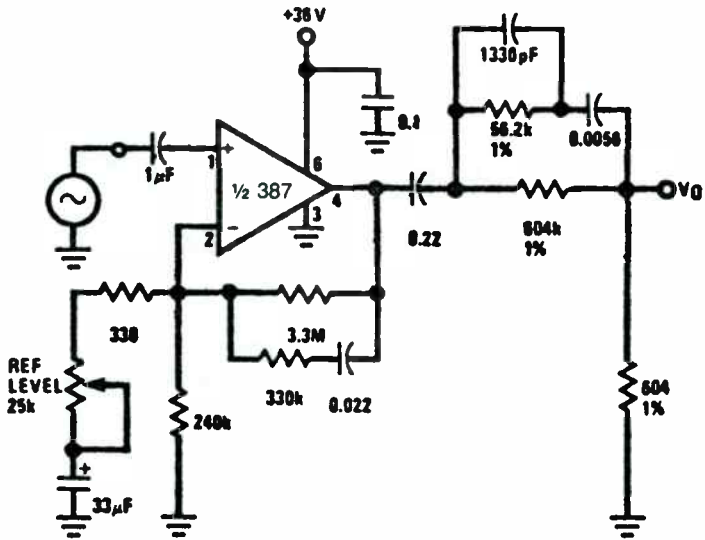
## 387—LOW NOISE DUAL PREAMPLIFIER



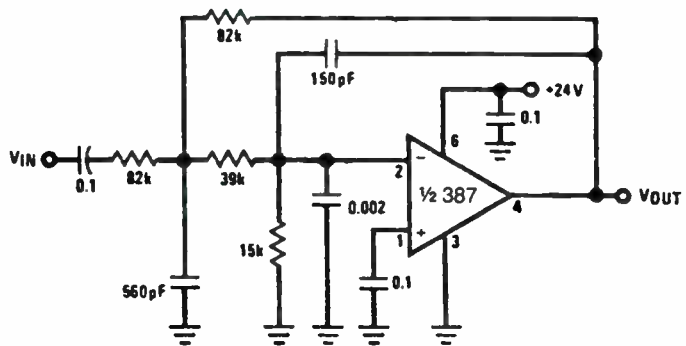
Phono preamp



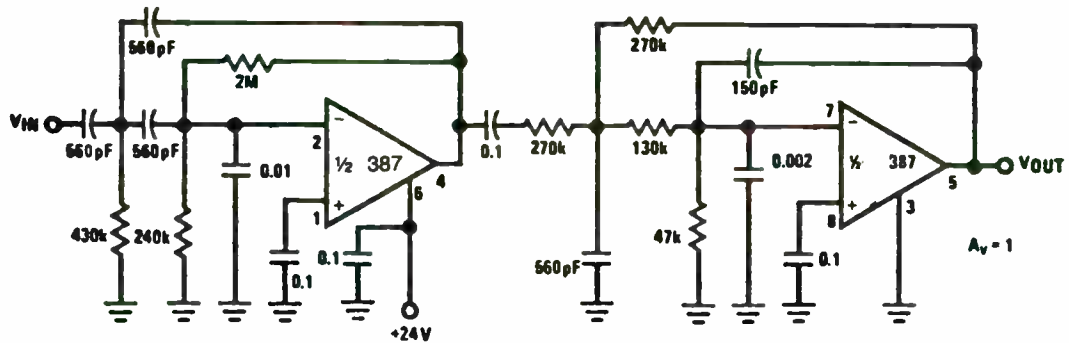
Rumble filter

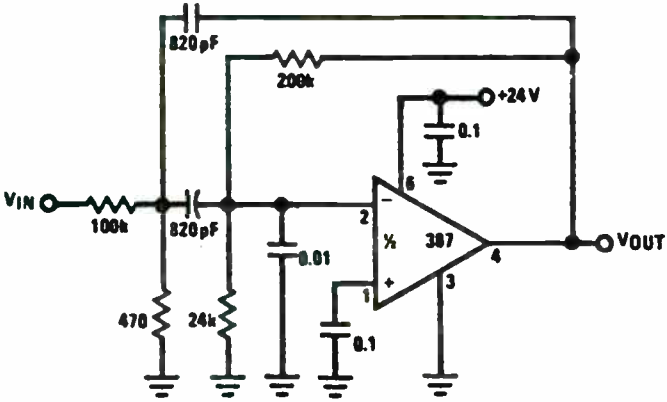


Inverse RIAA response generator

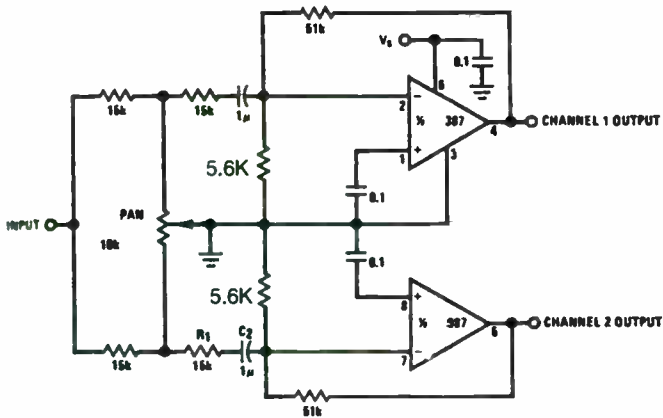


Scratch filter

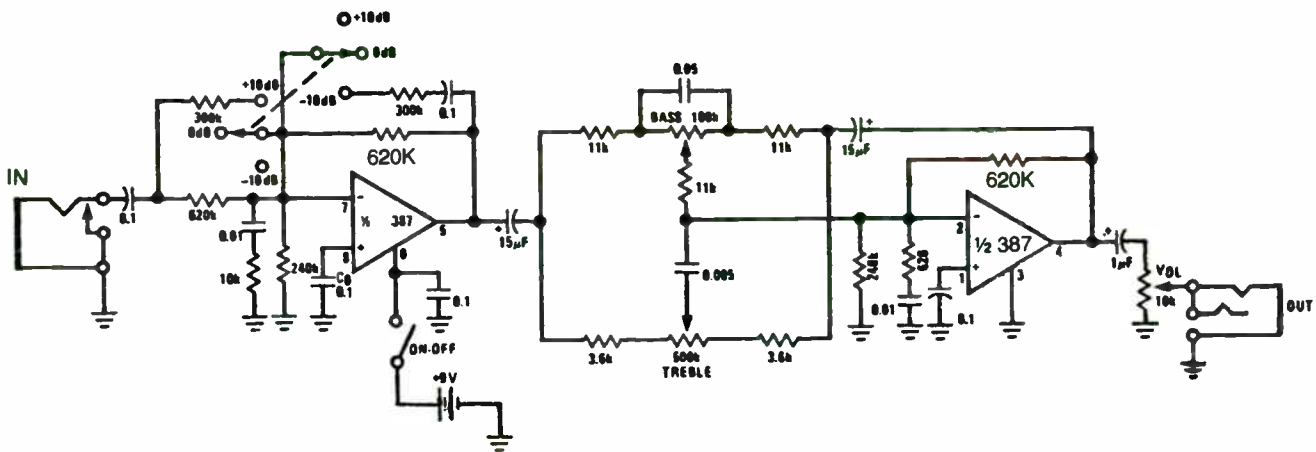




20kHz bandpass active filter

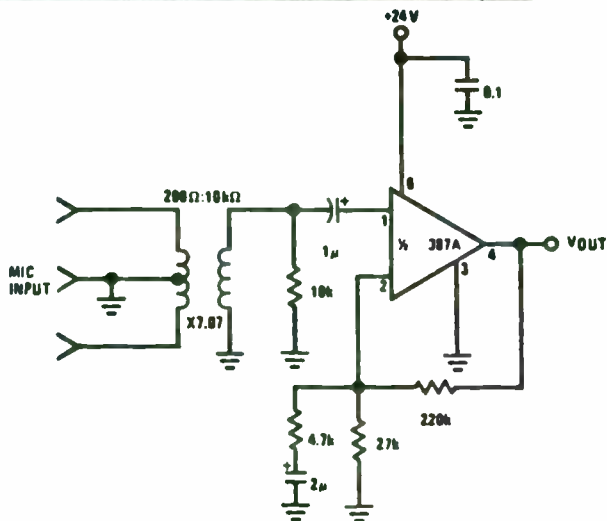


Two channel panning circuit

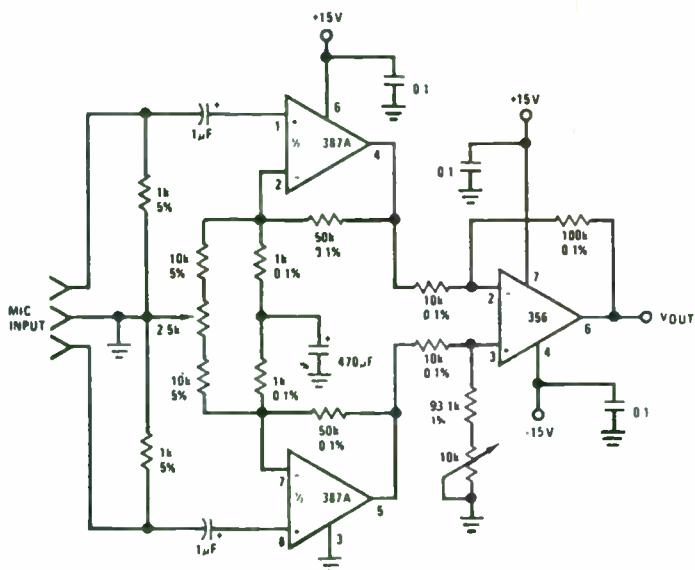




# 387A—LOW NOISE DUAL PREAMPLIFIER

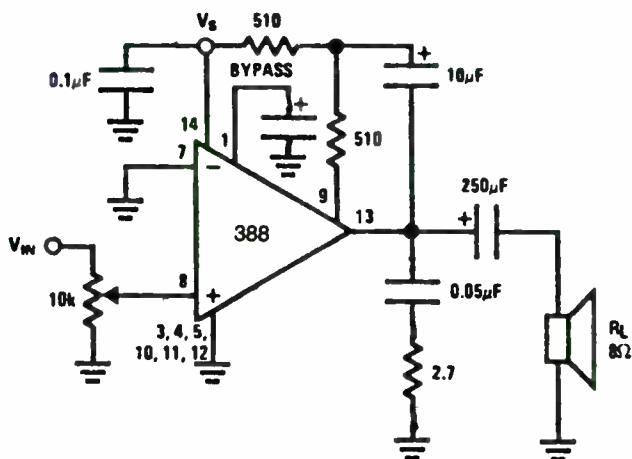


Balanced input mic preamp

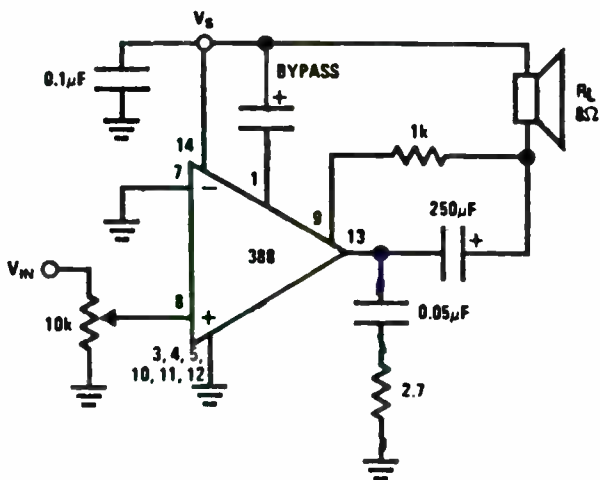


Low noise transformerless balanced mic preamp

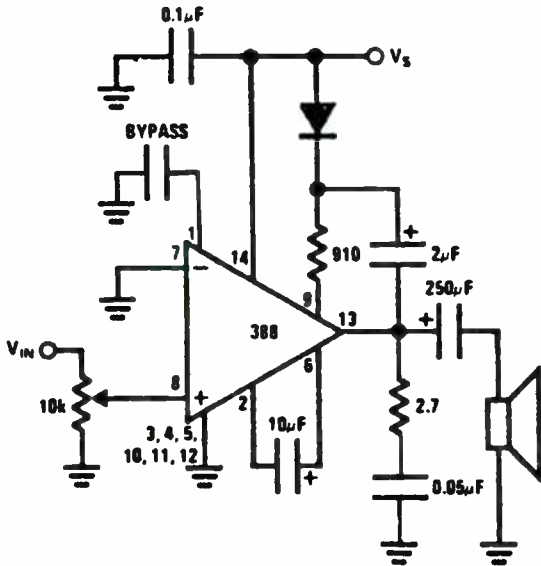
## 388—1.5 WATT AUDIO POWER AMPLIFIER



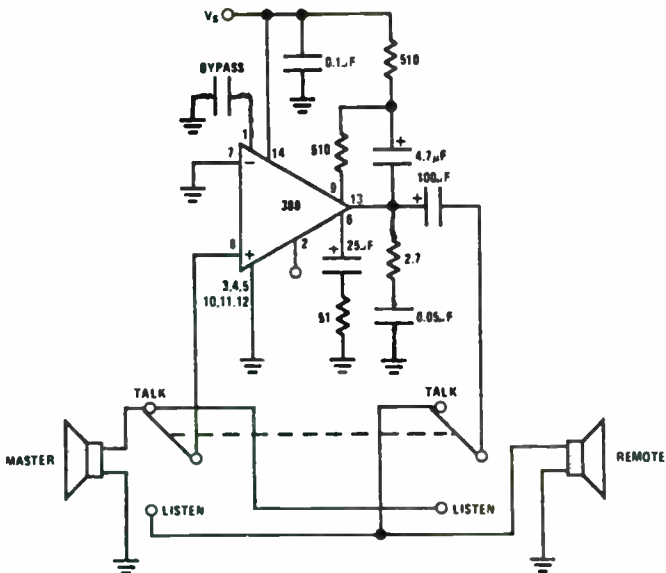
Load returned to ground amplifier with gain = 20



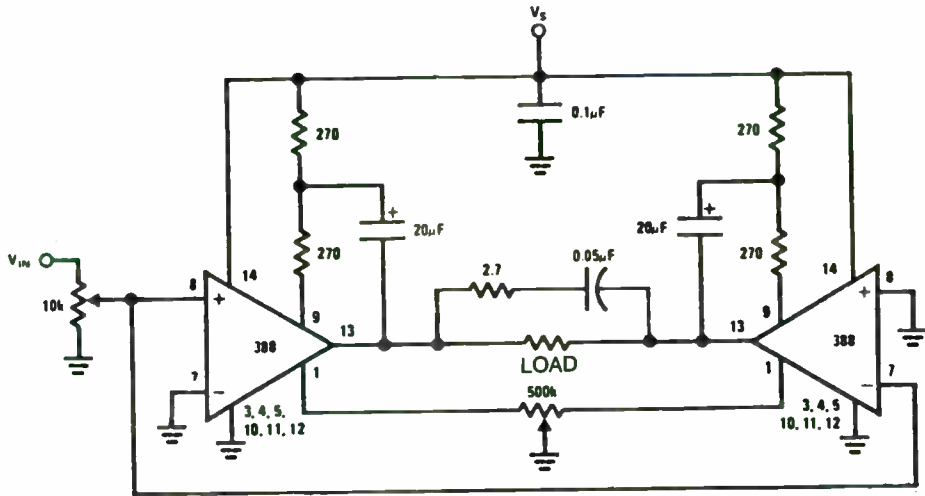
Load returned to  $V_S$  amplifier with gain = 20



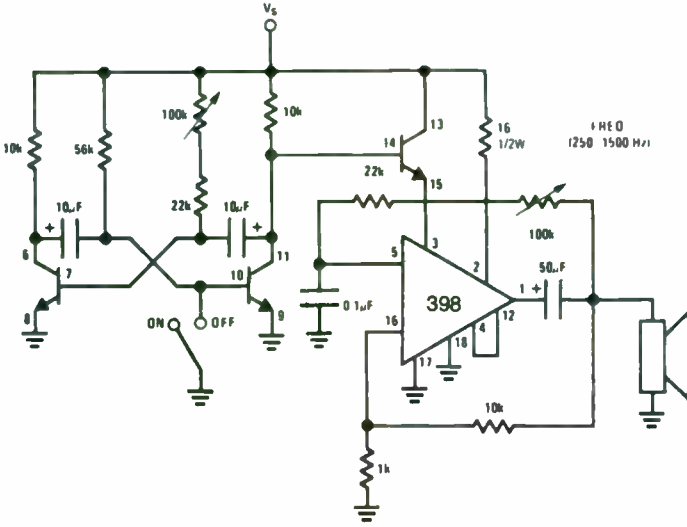
Amplifier with gain = 200



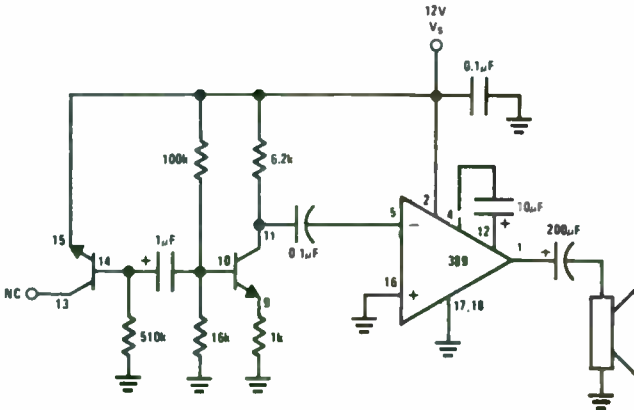
Intercom



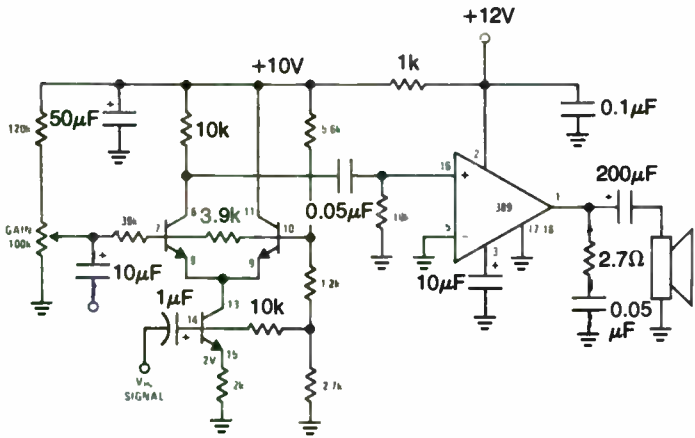
# 389—LOW VOLTAGE AUDIO POWER AMPLIFIER WITH NPN TRANSISTOR ARRAY



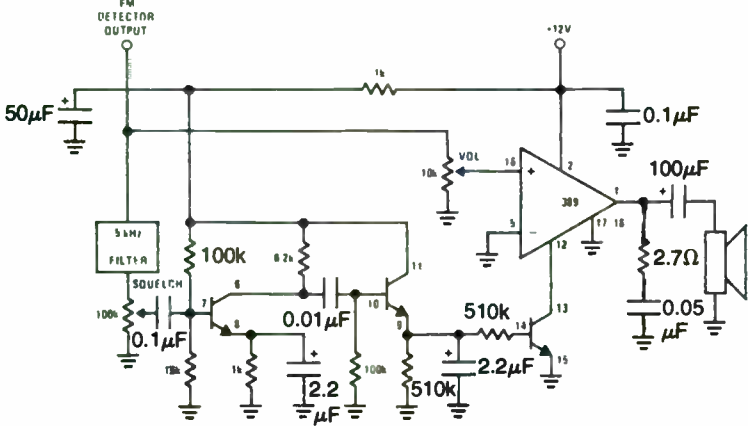
Siren



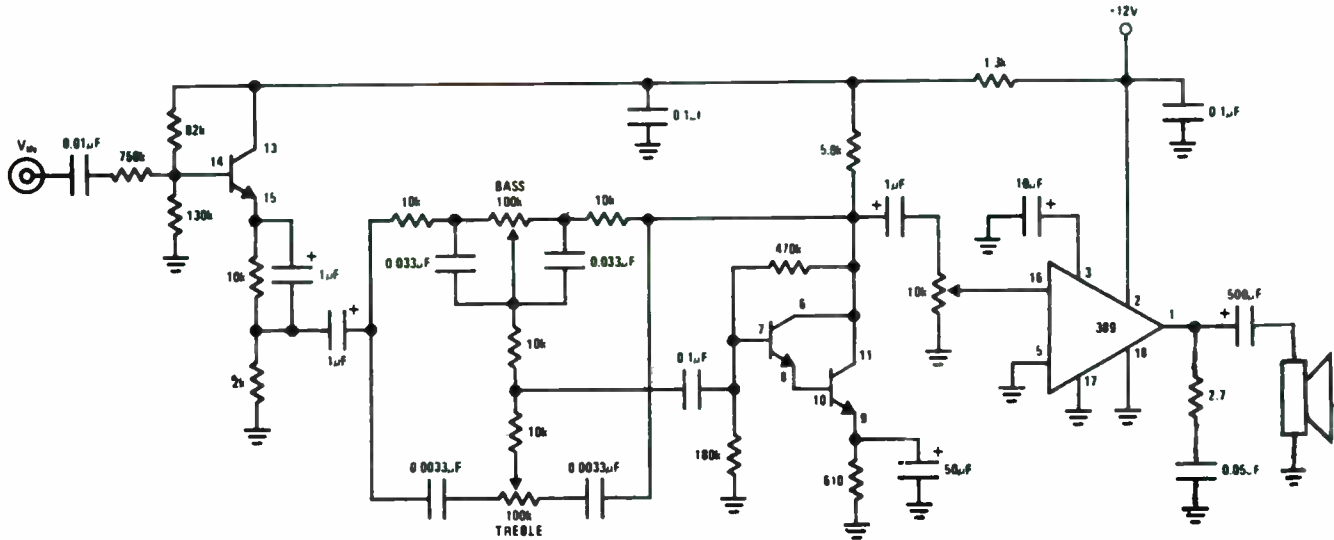
Noise generator using zener diode



Voltage-controlled amplifier or tremolo circuit

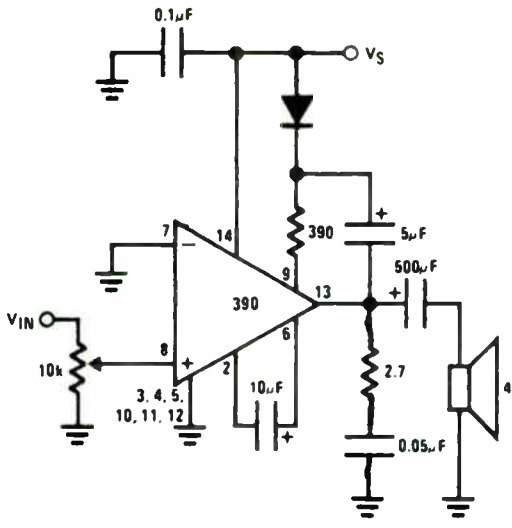


FM scanner noise squelch circuit

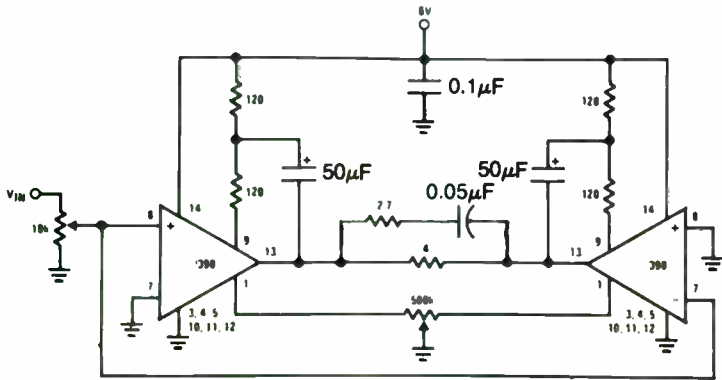


Ceramic phono amplifier with tone controls

# 390— ONE WATT LOW VOLTAGE AUDIO AMPLIFIER

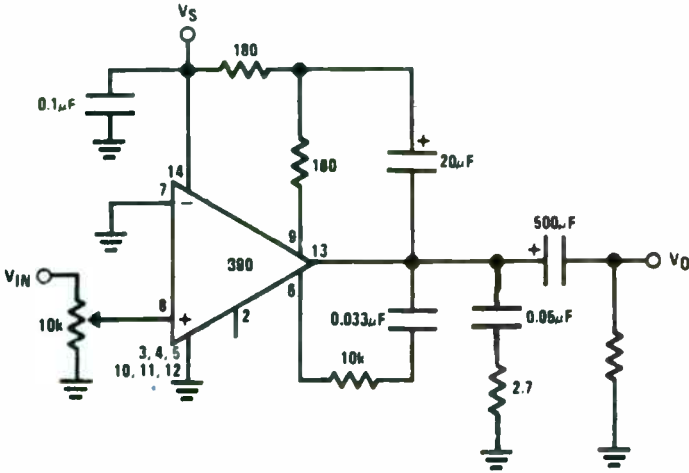


Amplifier with gain = 200 and minimum  $C_b$



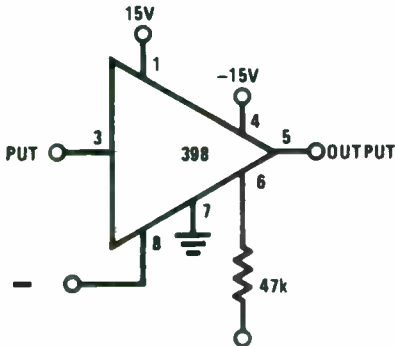
2.5W bridge amplifier



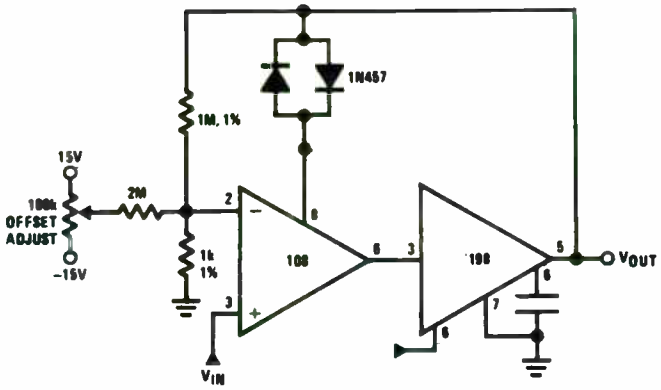


Amplifier with bass boost

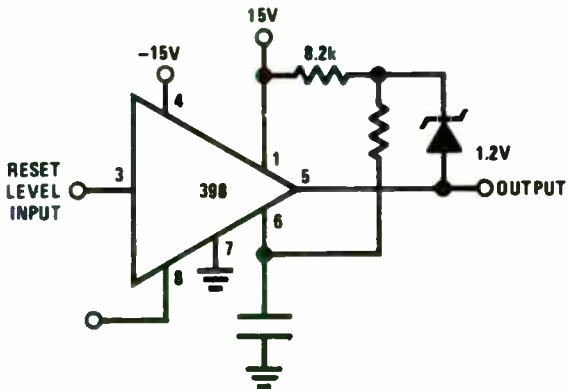
## 398 — MONOLITHIC SAMPLE AND HOLD CIRCUIT



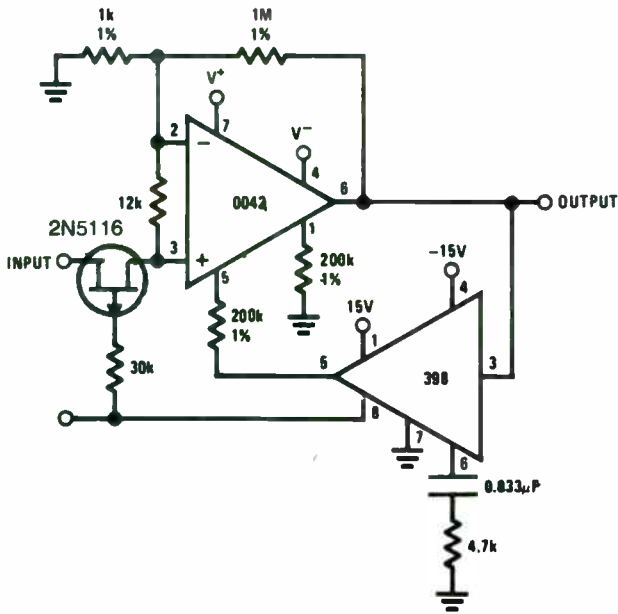
2-channel switch



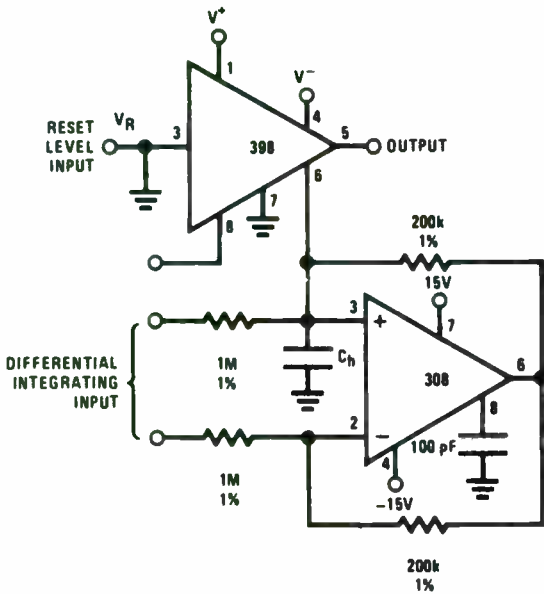
X1000 sample & hold



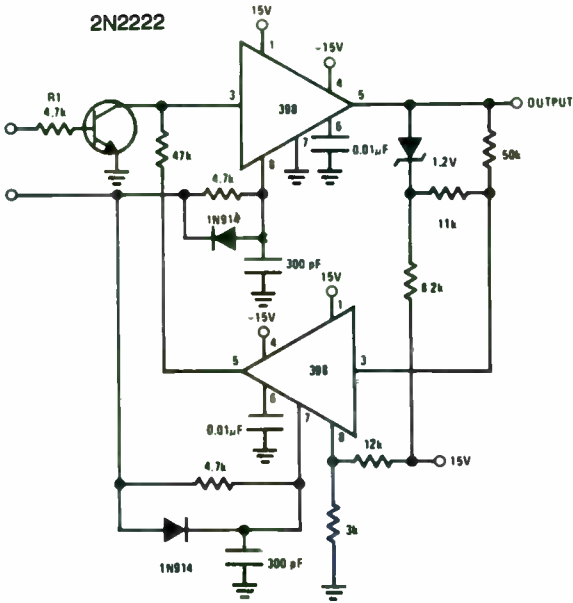
Ramp generator with variable reset level



Reset stabilized amplifier (gain of 1000)

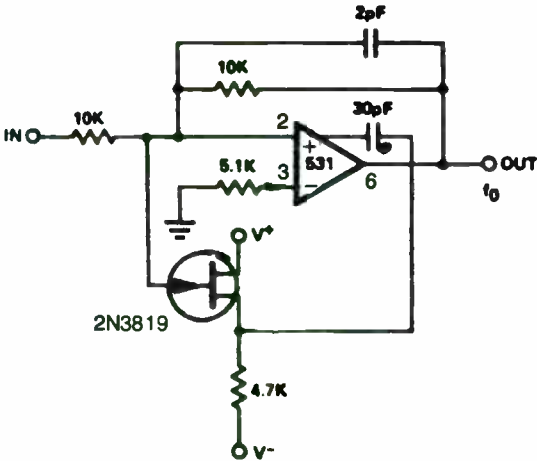


Integrator with programmable reset level

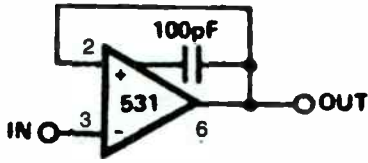


Staircase generator

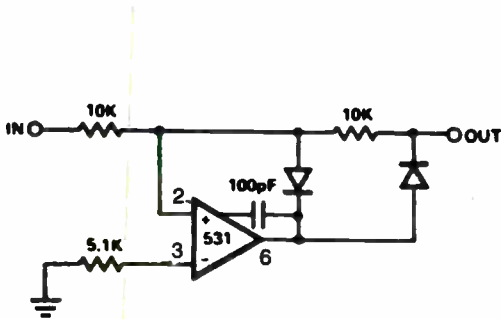
**531 — HIGH SLEW RATE OPERATIONAL AMPLIFIER**



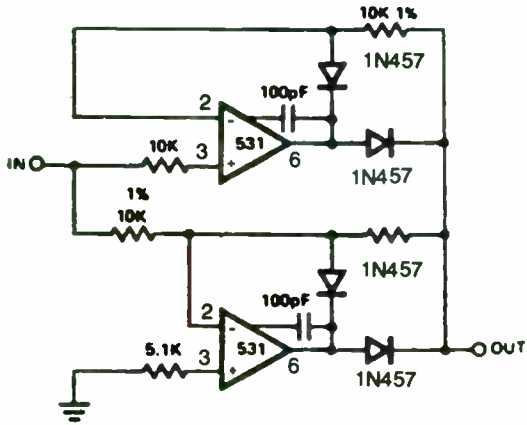
High speed inverter (10MHz bandwidth)



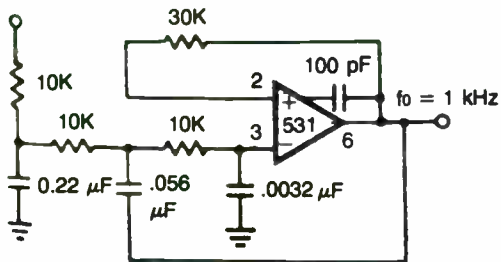
Fast settling voltage follower



Half-wave rectifier

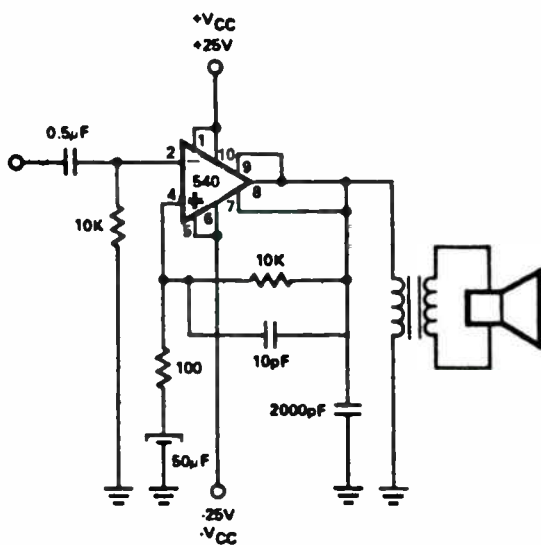


Full-wave rectifier

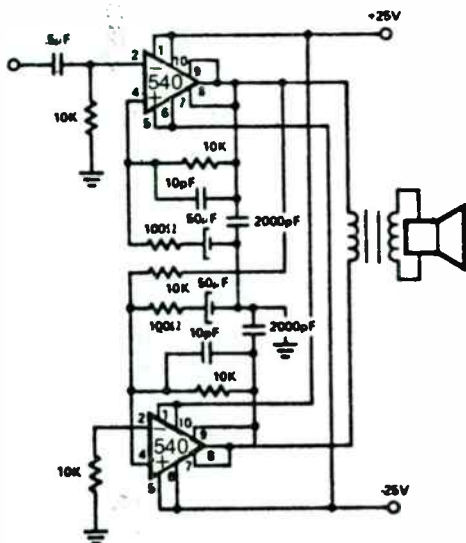


3 pole active low pass filter

## 540—INTEGRATED POWER DRIVER

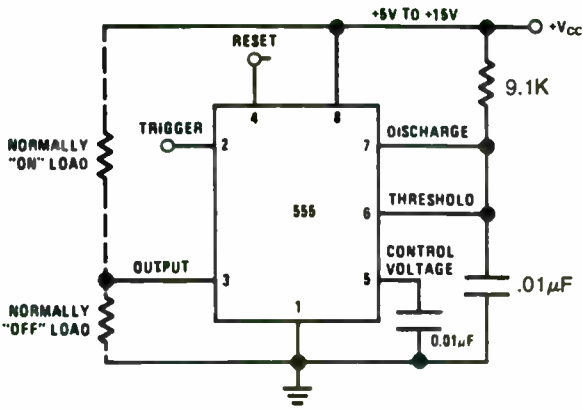


1 watt power amplifier

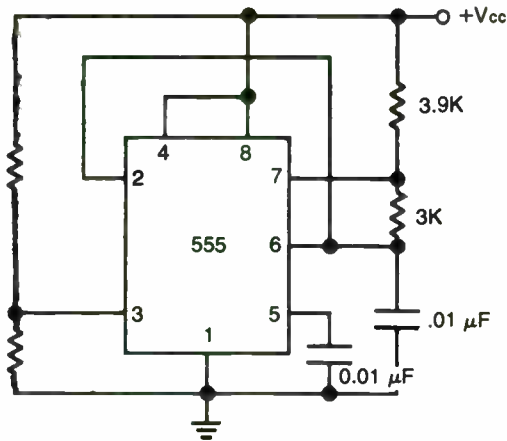


3 watt power amplifier

# 555—INTEGRATED TIMER

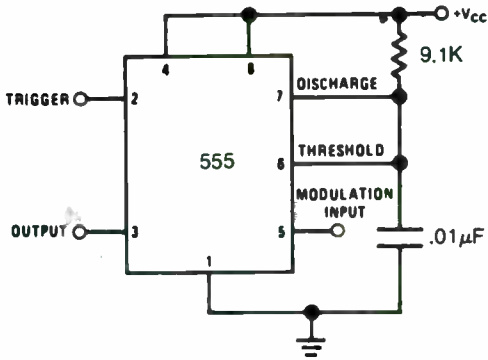


Monostable multivibrator

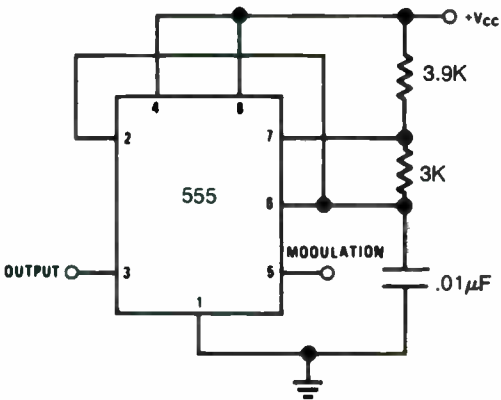


Astable multivibrator

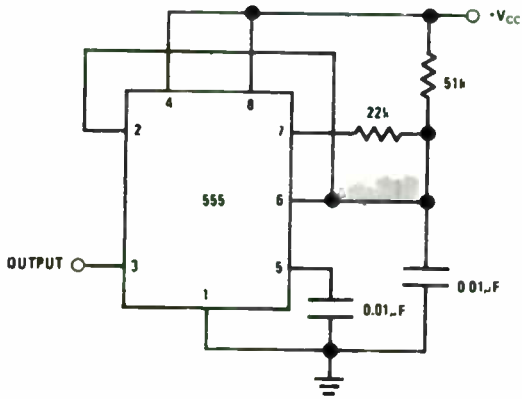




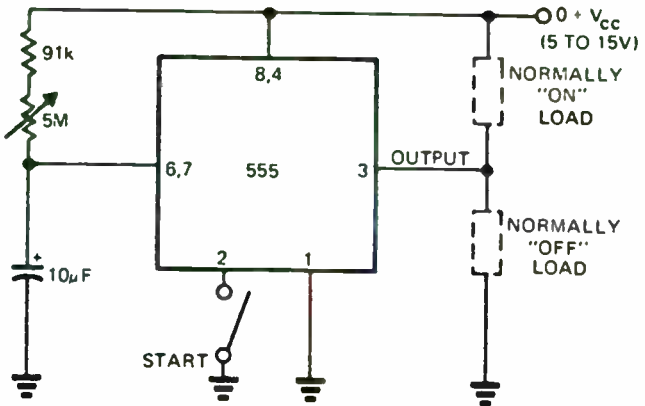
Pulse width modulator



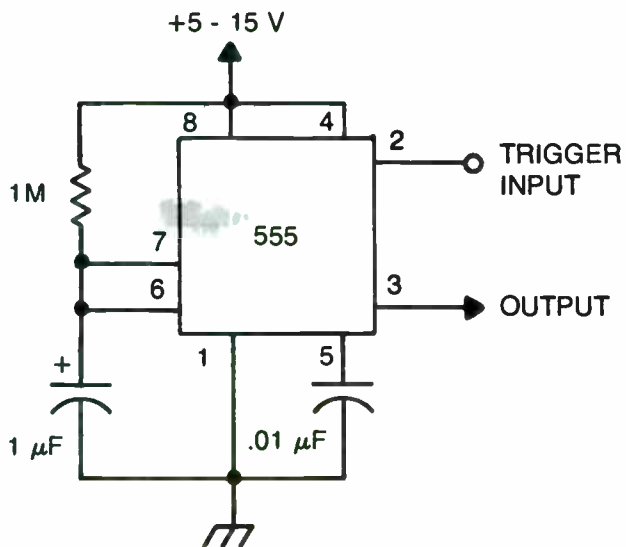
Pulse position modulator



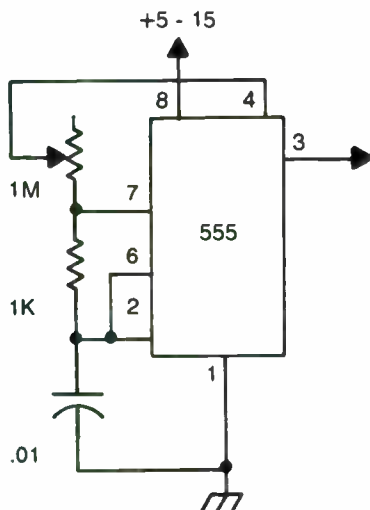
50% duty cycle oscillator



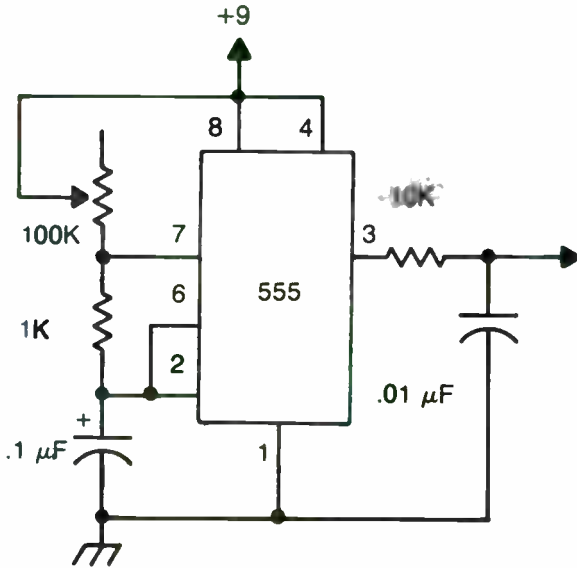
On or off control



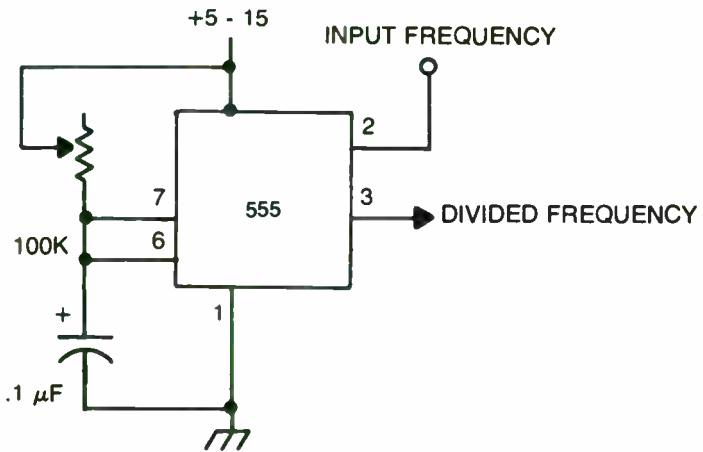
One-shot timer



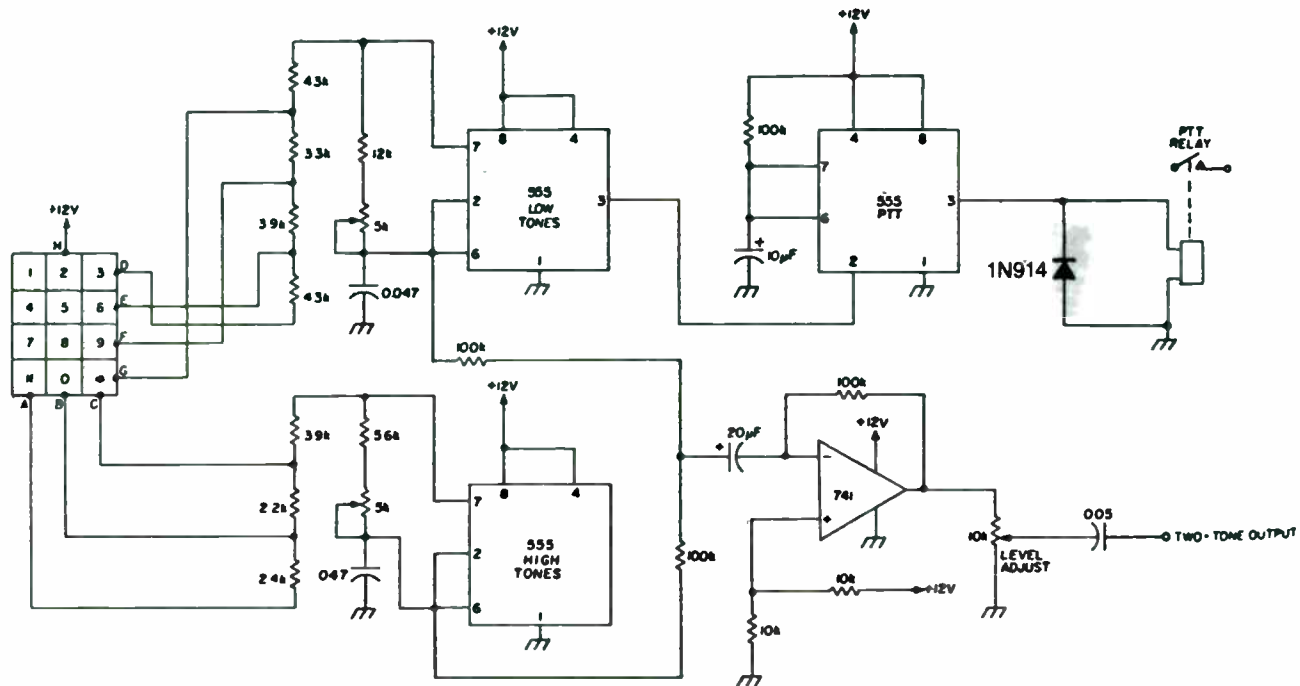
Pulse generator



Triangle wave generator

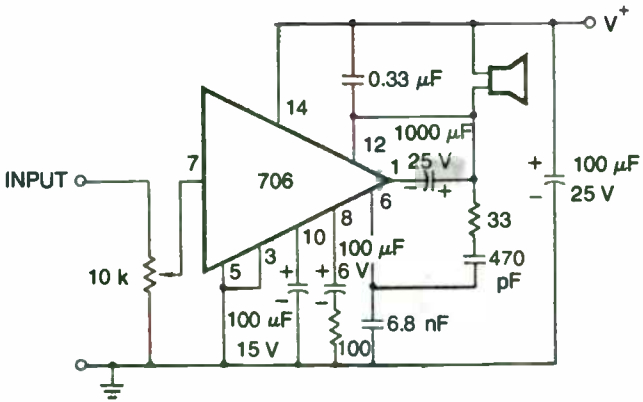


Frequency divider

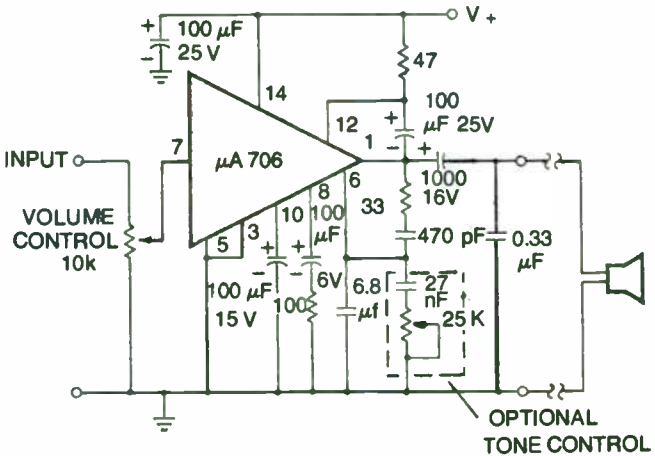


Telephone dialing tone encoder

# 706—FIVE WATT AUDIO AMPLIFIER

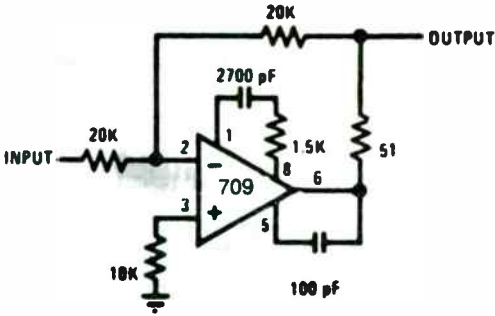


5 watt audio amplifier

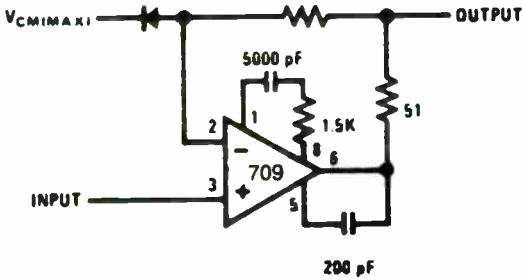


5 watt audio amplifier with load connected to ground

# 709—MONOLITHIC OPERATIONAL AMPLIFIER

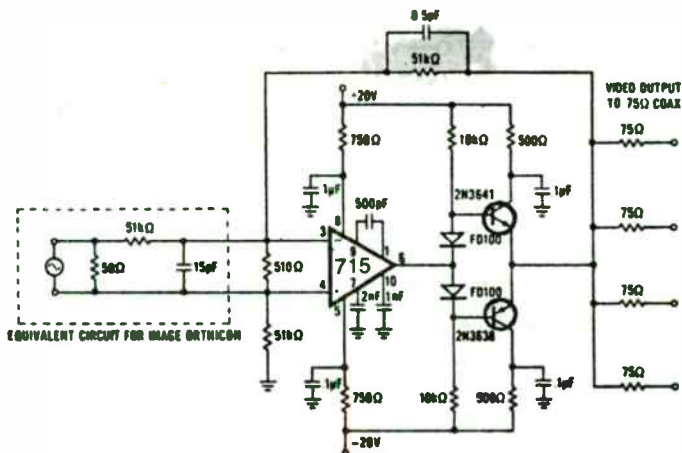


Unity gain inverting amplifier

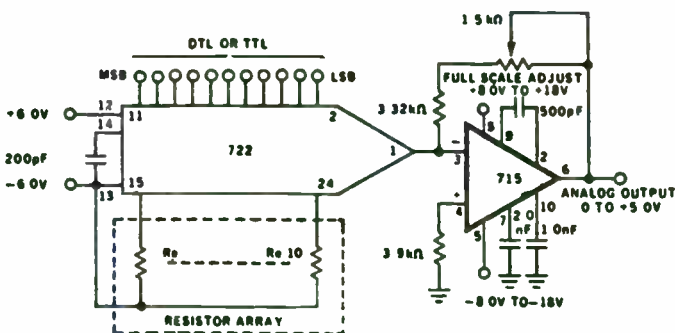


Voltage follower

## 715—HIGH SPEED OPERATIONAL AMPLIFIER

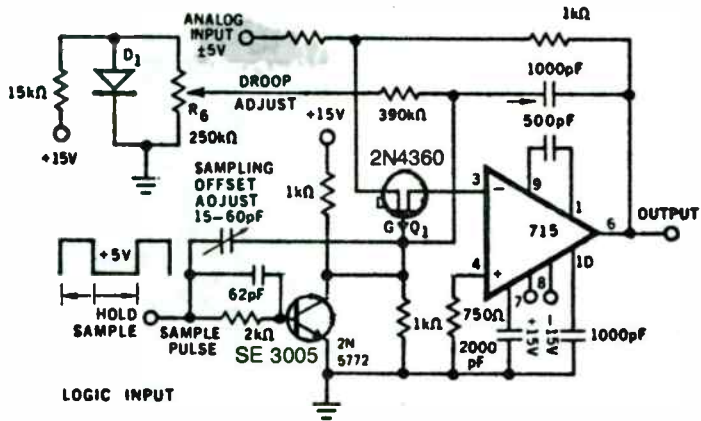


Wide band video amplifier with 75 Ω coax cable drive capability

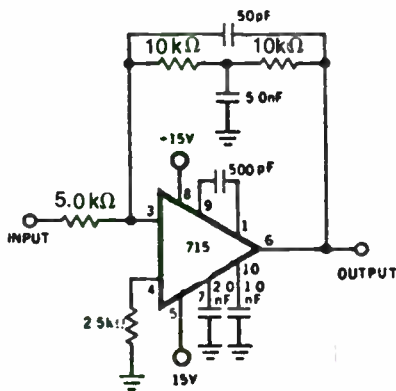


High speed 10-bit digital to analog converter



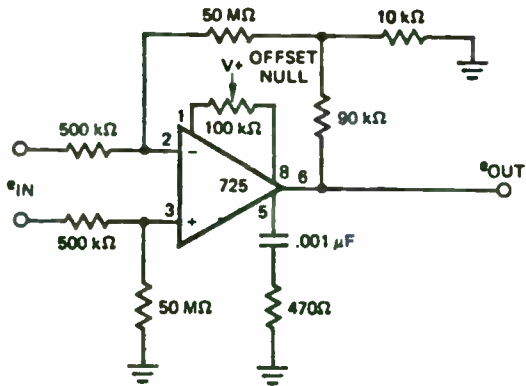


High speed sample and hold

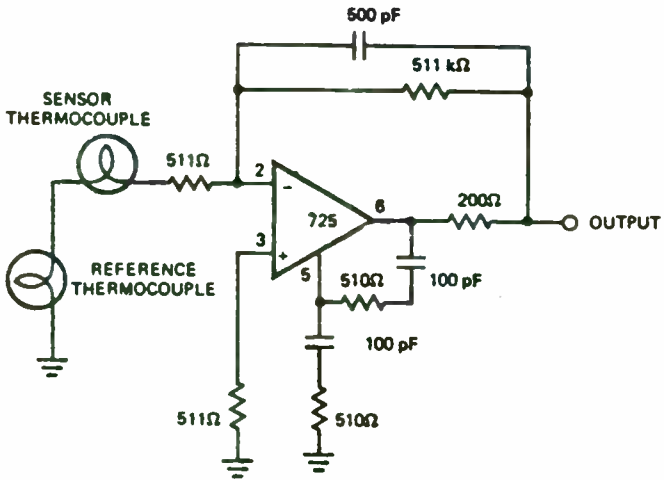


High speed integrator

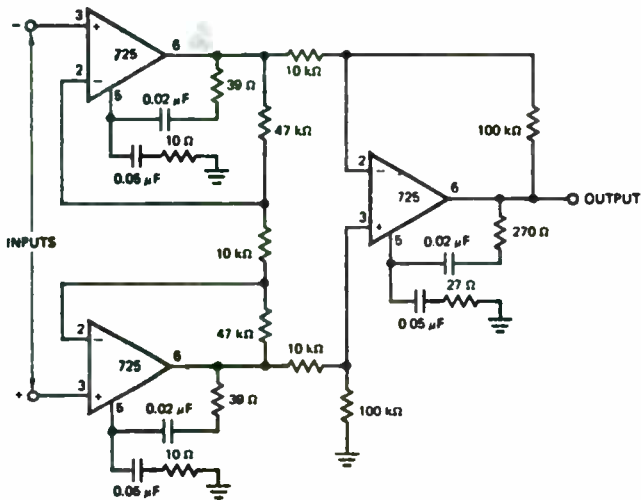
# 725—INSTRUMENTATION OPERATIONAL AMPLIFIER



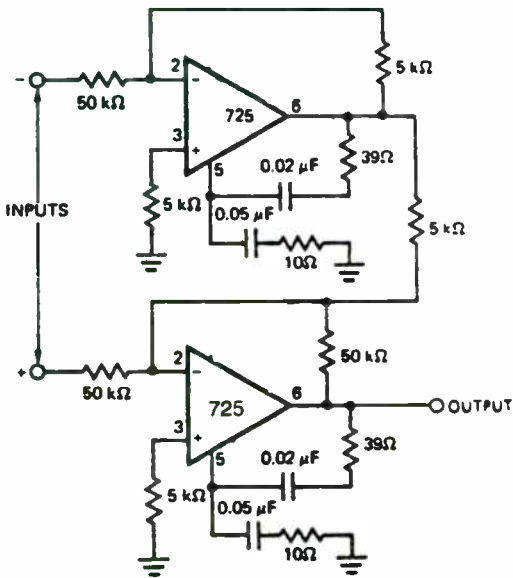
Precision amplifier



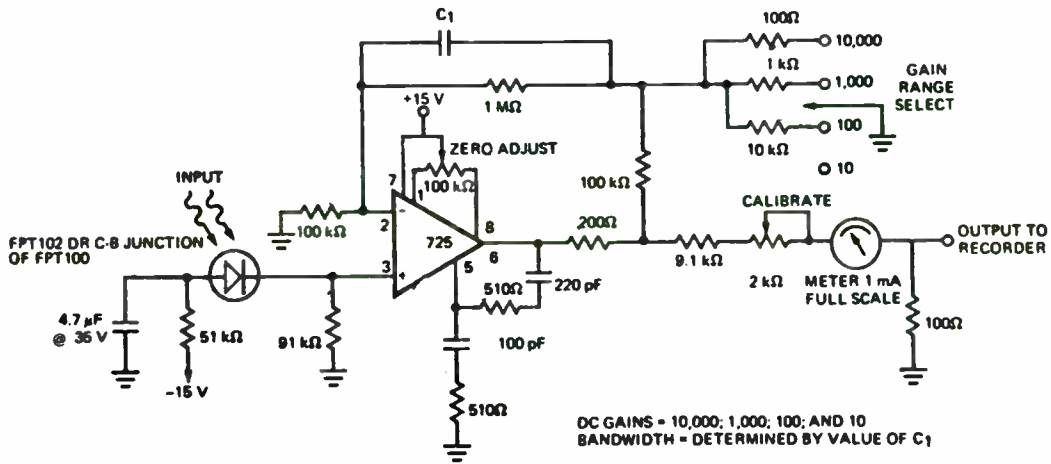
Thermocouple amplifier



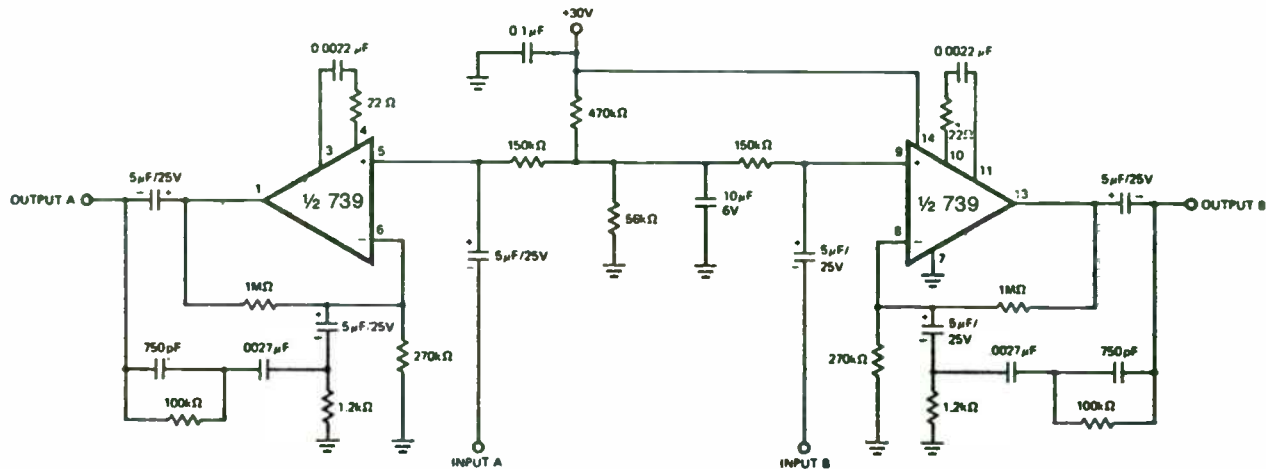
Instrumentation amplifier with high common mode rejection



+ 100 V common mode range differential amplifier

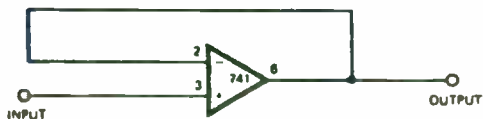


# 739—DUAL LOW NOISE AUDIO AMPLIFIER/OPERATIONAL AMPLIFIER

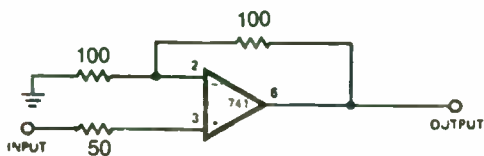


Stereo phono preamplifier — RIAA equalized

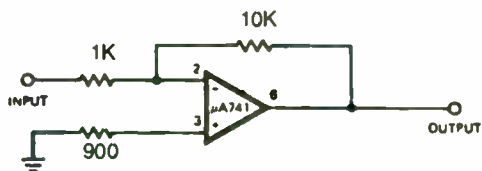
## 741 — FREQUENCY COMPENSATED OPERATIONAL AMPLIFIER



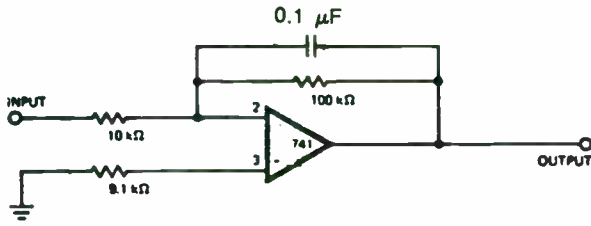
Unity-gain voltage follower



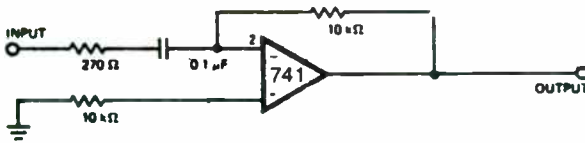
Non-inverting amplifier



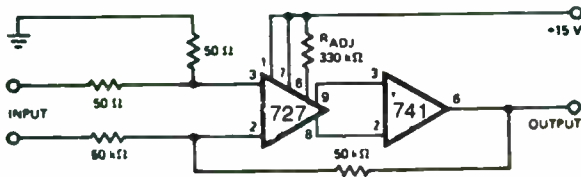
Inverting amplifier



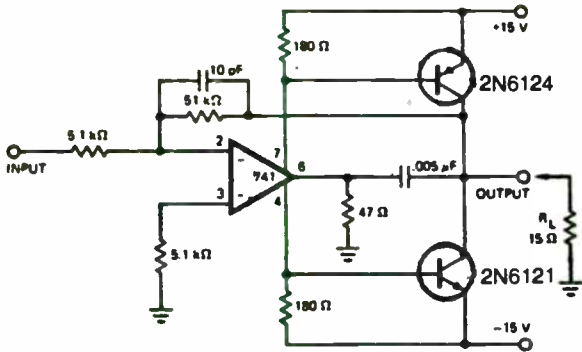
Simple integrator



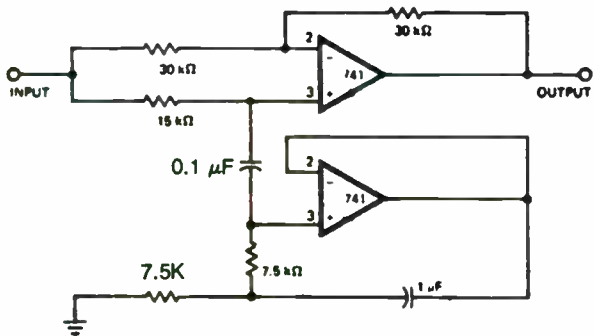
Simple differentiator



Low drift low noise amplifier

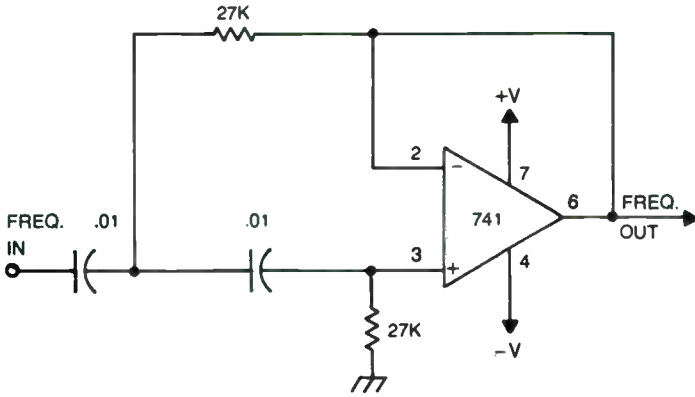


High slew rate power amplifier

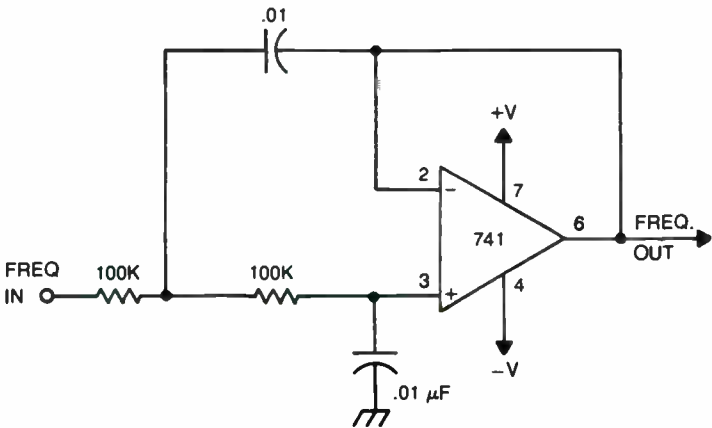


Notch filter



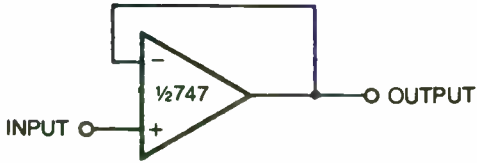


High pass active filter

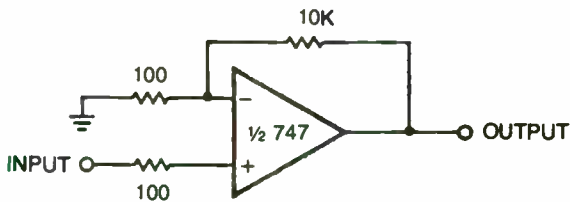


Low pass active filter

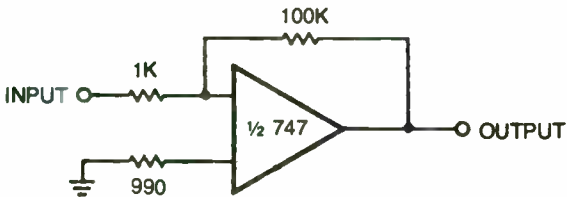
# 747—DUAL FREQUENCY COM- PENSATED OPERATIONAL AMPLIFIER



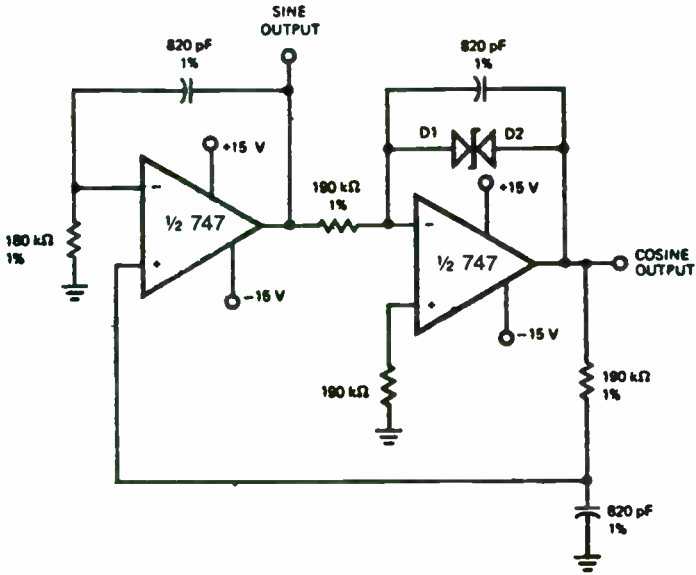
Unity-gain voltage follower



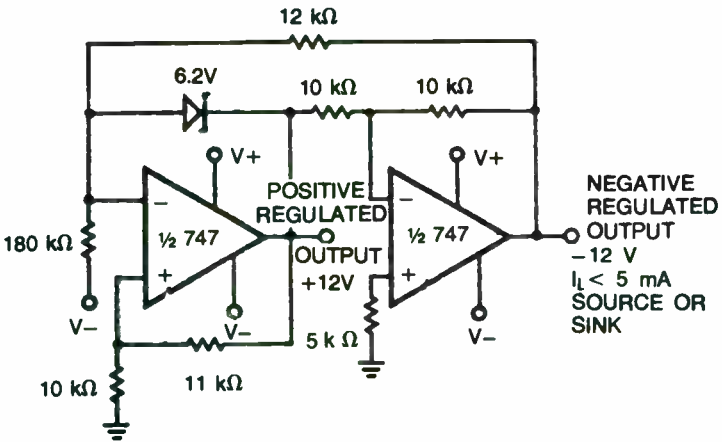
Noninverting amplifier



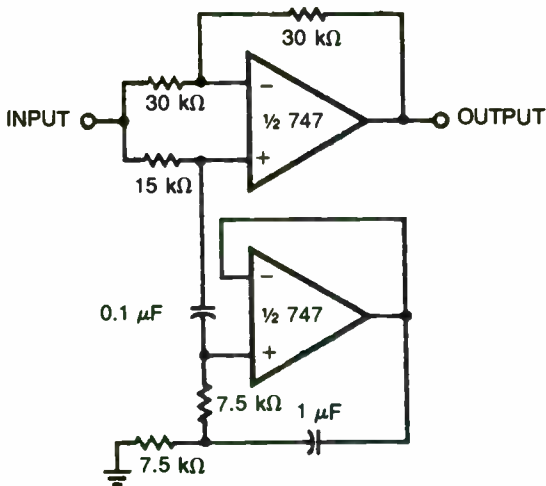
Inverting amplifier



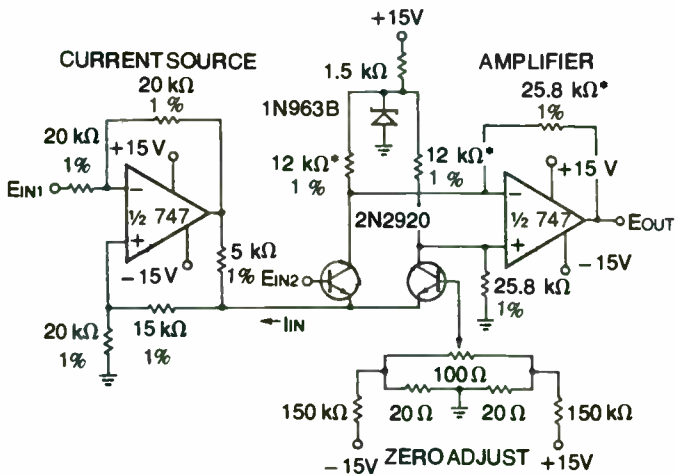
Quadrature oscillator



Tracking positive and negative voltage references

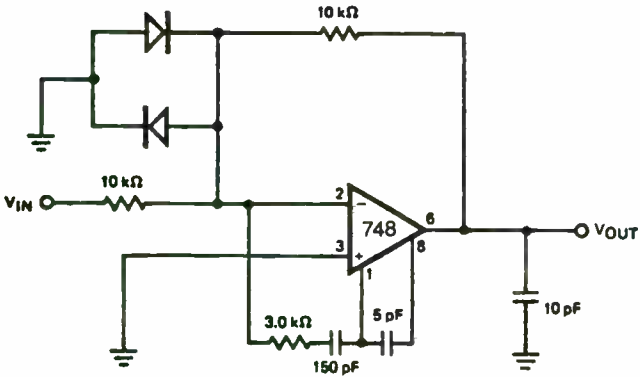


Notch filter

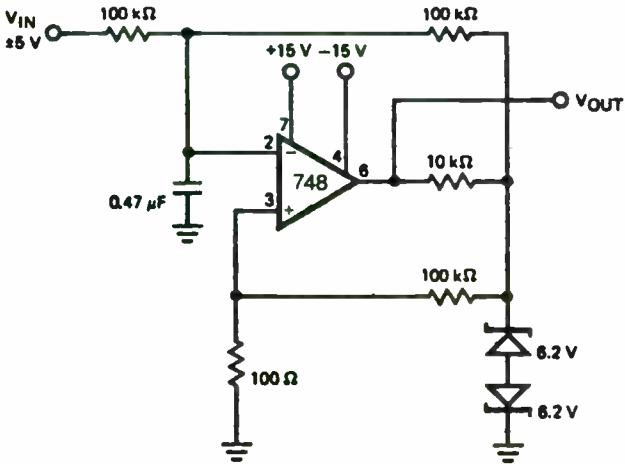


Analog multiplier

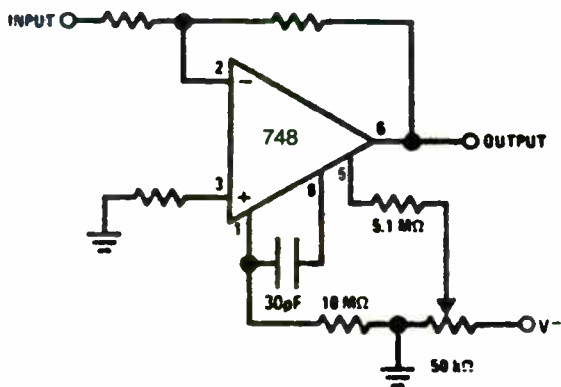
# 748—HIGH PERFORMANCE OPERATIONAL AMPLIFIER



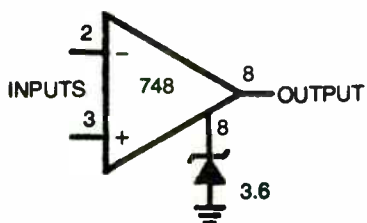
Feed forward compensation



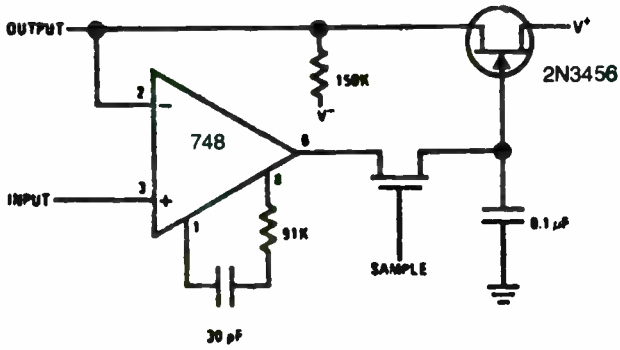
Pulse width modulator



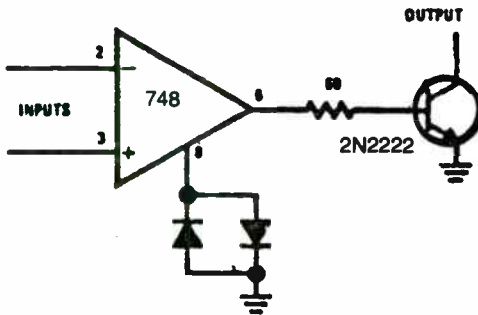
Inverting amplifier with balancing circuit



Voltage comparator for driving DTL or TTL integrated circuits

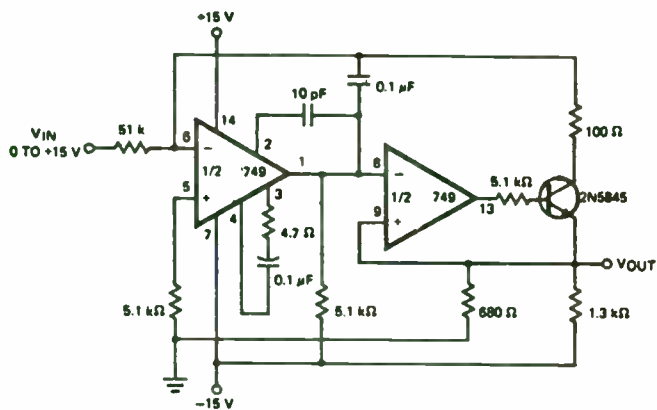


Low drift sample and hold

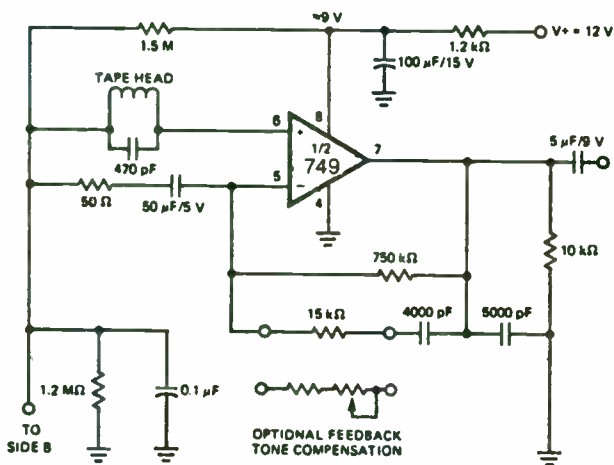


Voltage comparator for driving RTL logic or high current driver

# 749— DUAL AUDIO OPERATIONAL AMPLIFIER/PREAMPLIFIER



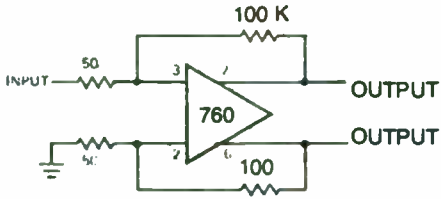
Voltage to frequency converter



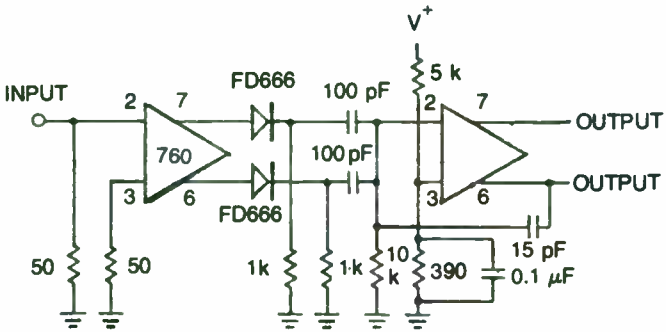
Stereo tape preamplifier



# 760—HIGH SPEED DIFFERENTIAL COMPARATOR

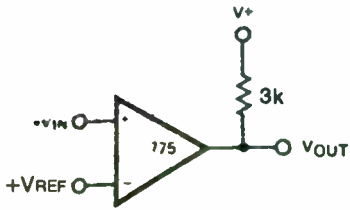


Level detector with hysteresis

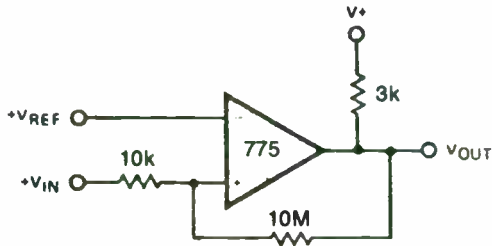


Zero crossing detector

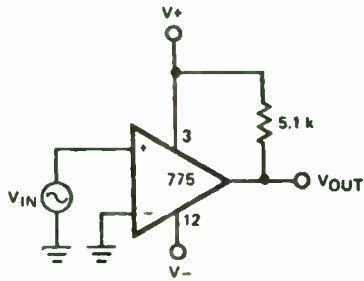
## 775—QUAD COMPARATOR



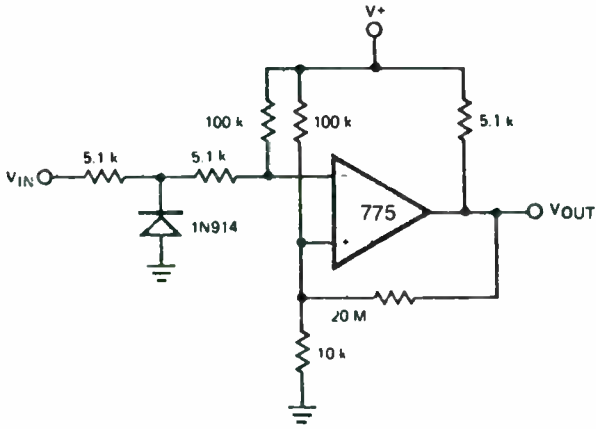
Basic comparator



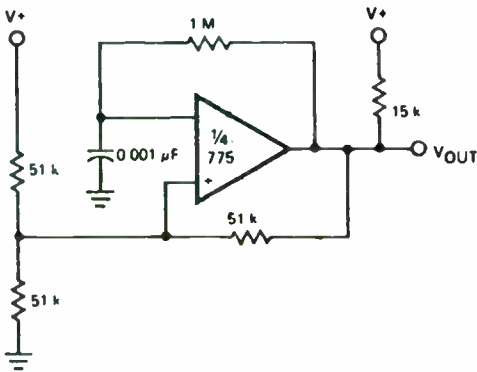
Noninverting comparator with hysteresis



Zero crossing detector (dual supply)

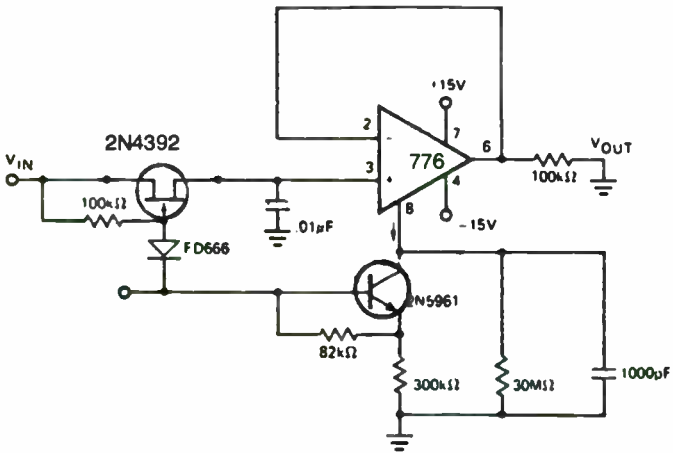


Zero crossing detector (single power supply)

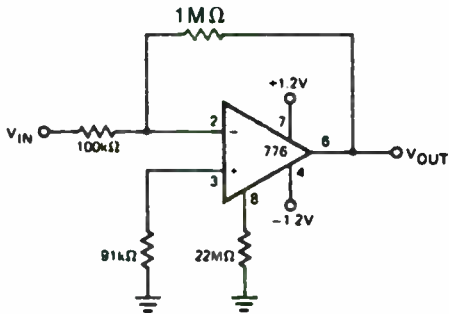


Free running square wave oscillator

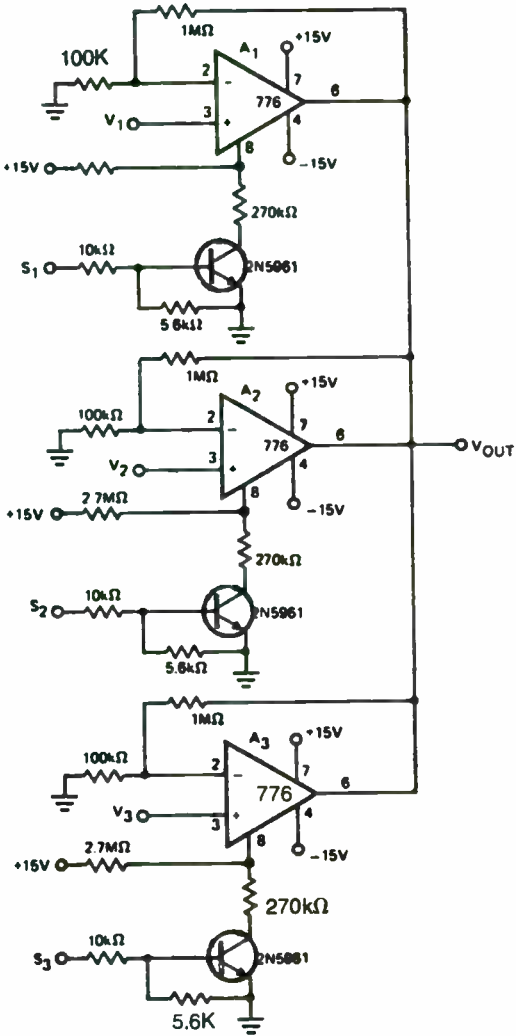
# 776—PROGRAMMABLE OPERATIONAL AMPLIFIER



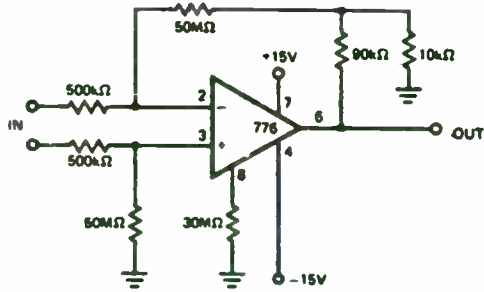
High accuracy sample and hold



Nano-watt amplifier

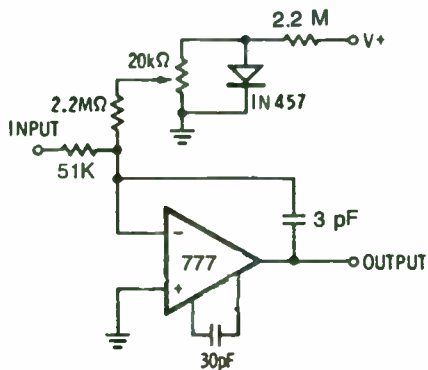


Multiplexing and signal conditioning without FETs

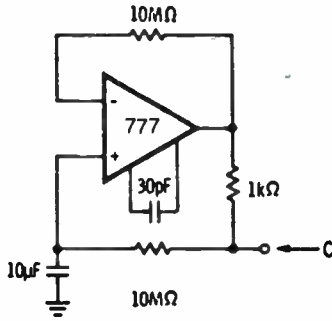


High input impedance amplifier

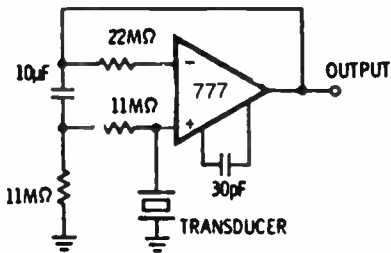
## 777—PRECISION OPERATIONAL AMPLIFIER



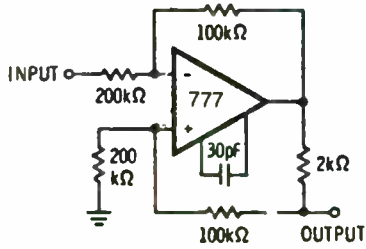
Bias compensated long time integrator



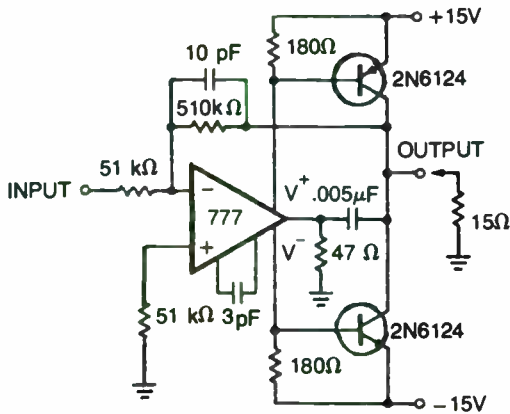
Capacitance multiplier



Amplifier for capacitance transducers

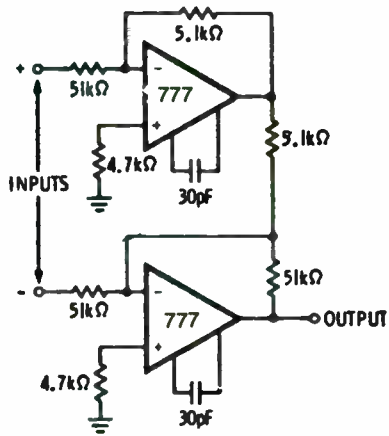


Bilateral current source

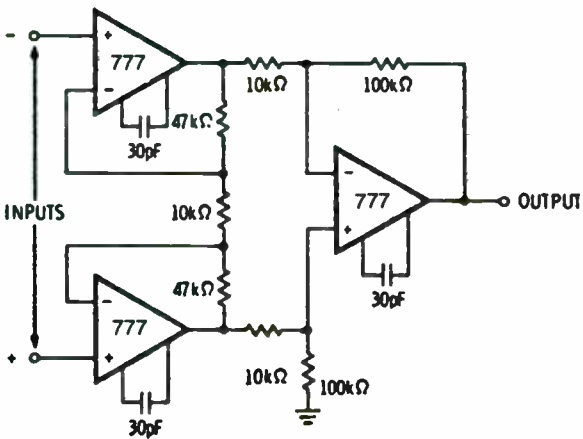


High slew rate power amplifier



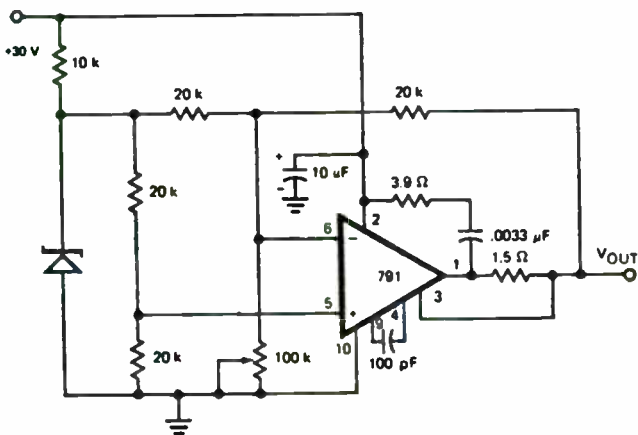


±100 V common mode range instrumentation amplifier

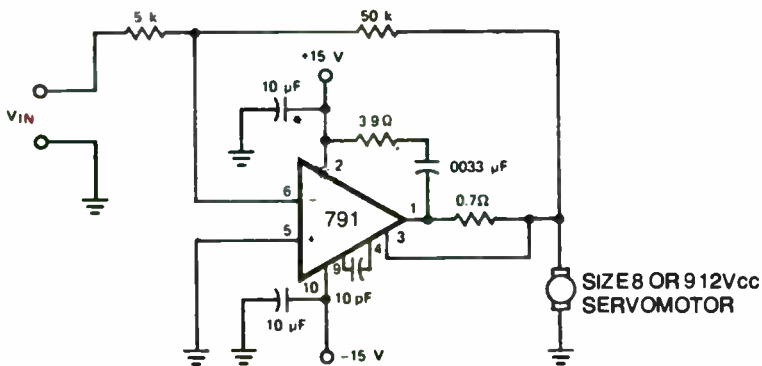


Instrumentation amplifier with high common mode rejection

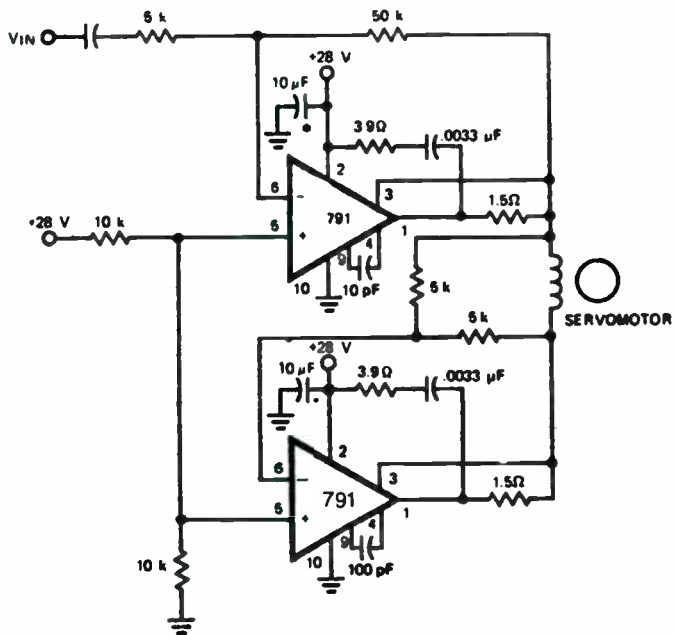
# 791—POWER OPERATIONAL AMPLIFIER



Positive voltage regulator

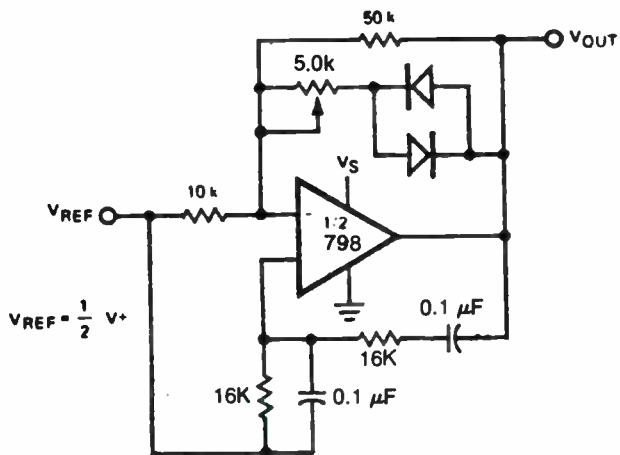


DC servo amplifier

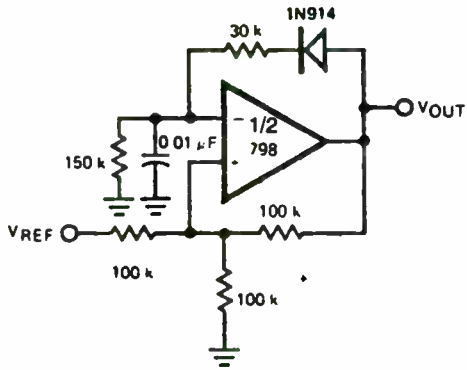


AC servo amplifier bridge type

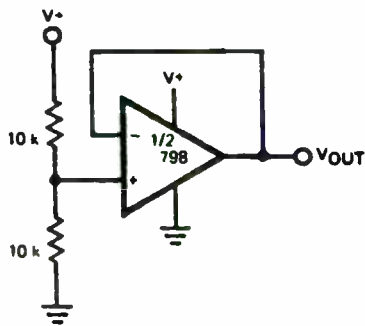
## 798—DUAL OPERATIONAL AMPLIFIER



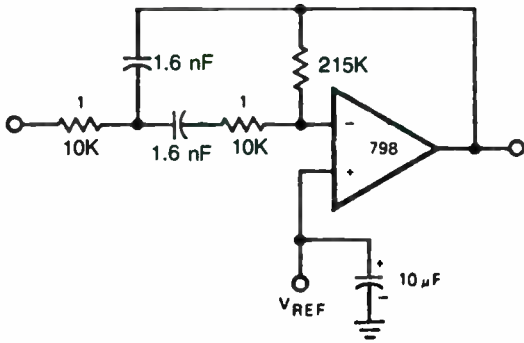
Wien bridge oscillator



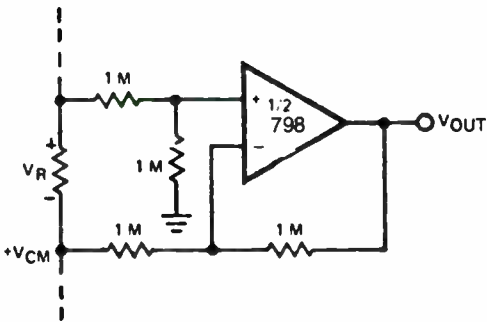
Pulse generator



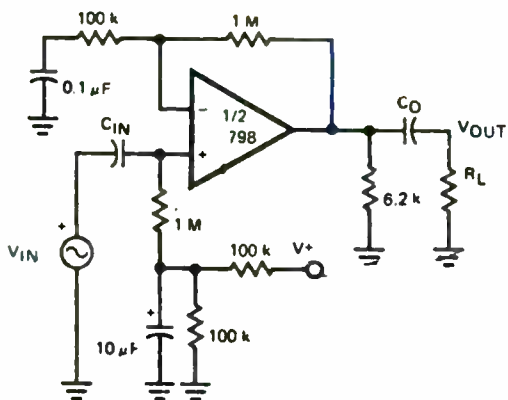
Voltage reference



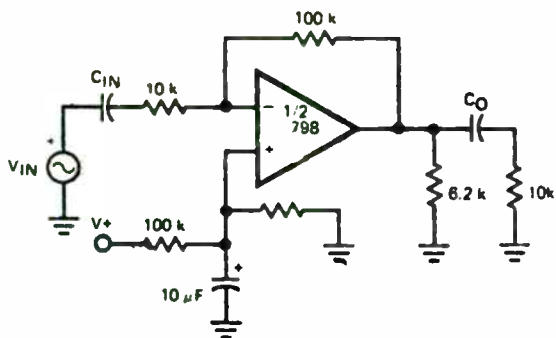
Multiple feedback bandpass filter



Ground referencing a differential input signal

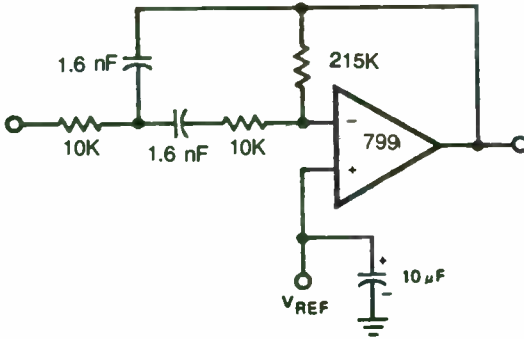


AC coupled noninverting amplifier

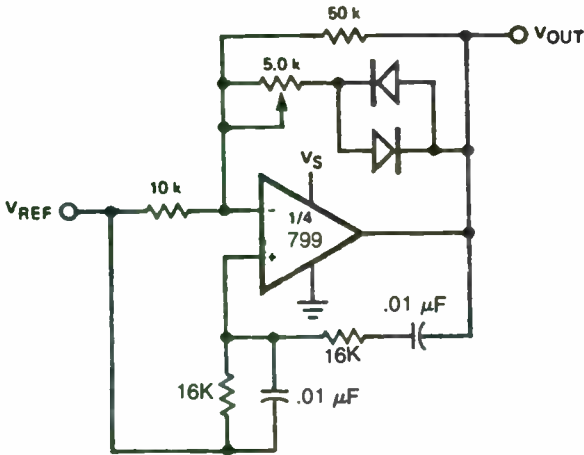


AC coupled inverting amplifier

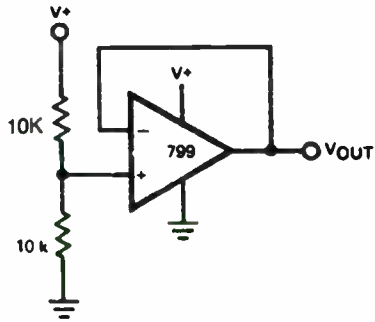
# 799—HIGH GAIN OPERATIONAL AMPLIFIER



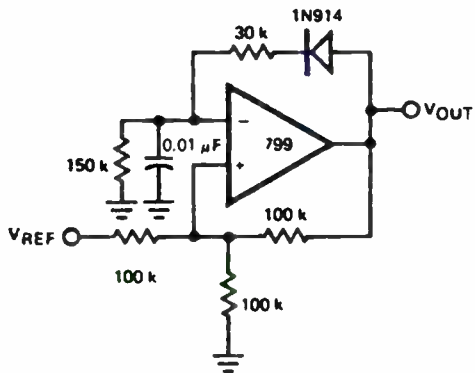
Multiple feedback bandpass filter



Wien bridge oscillator

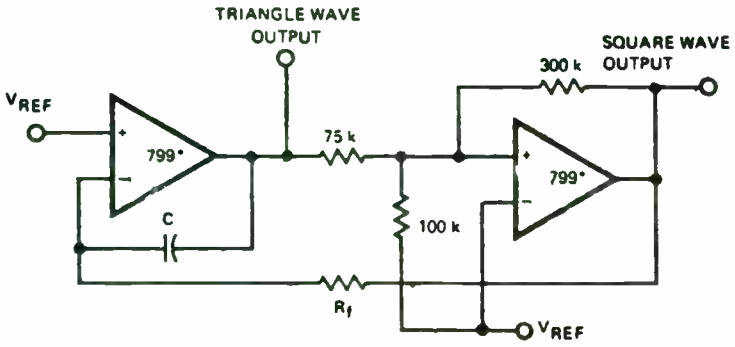


Voltage reference

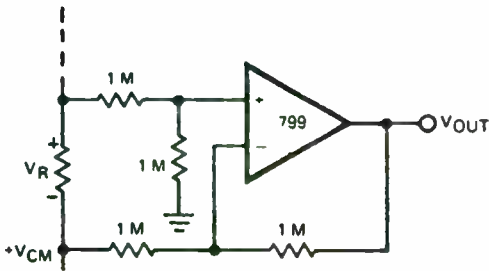


Pulse generator

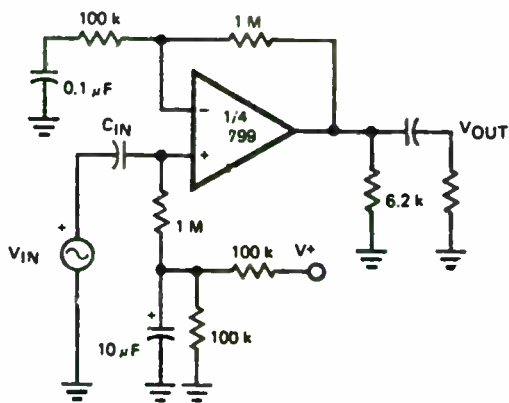




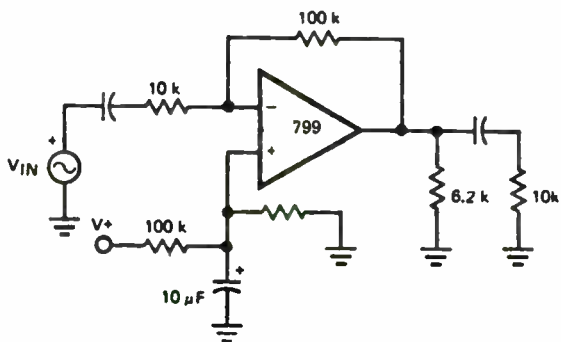
Function generator



Ground referencing a differential input signal

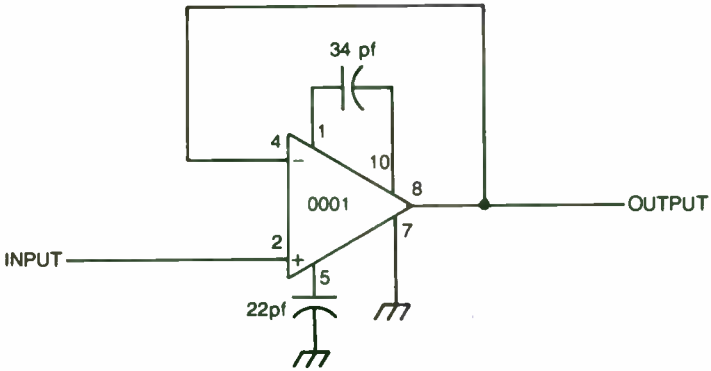


AC couple noninverting amplifier

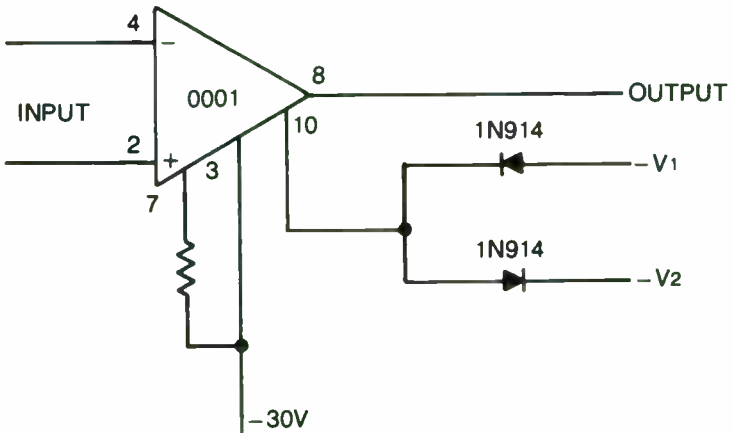


AC coupled inverting amplifier

# 0001—LOW POWER OPERATIONAL AMPLIFIER

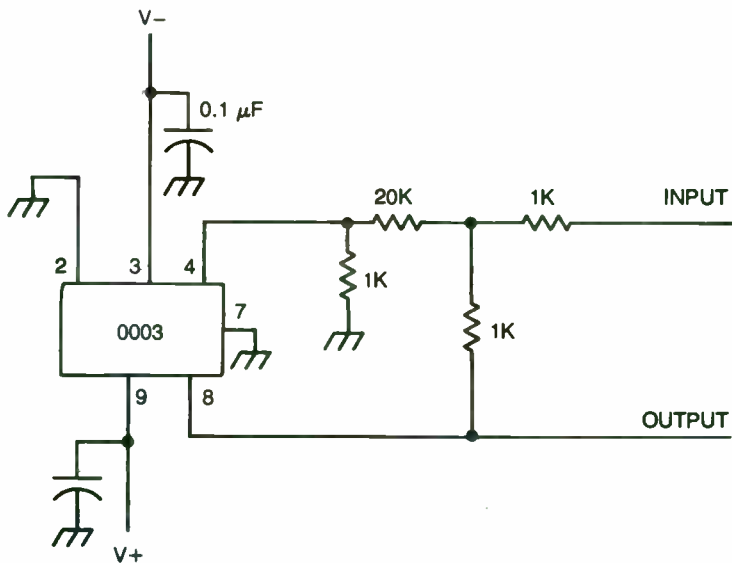


Voltage follower

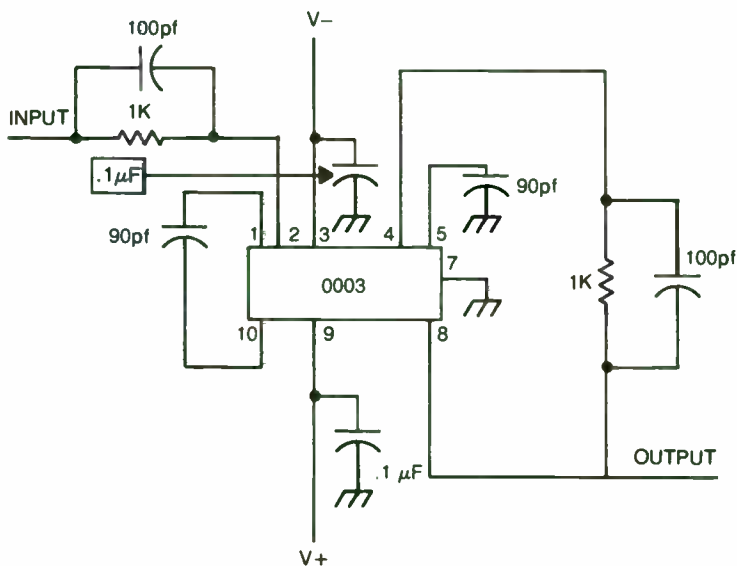


Voltage comparator and MOS driver

## 0003— WIDE BANDWIDTH OPERATIONAL AMPLIFIER

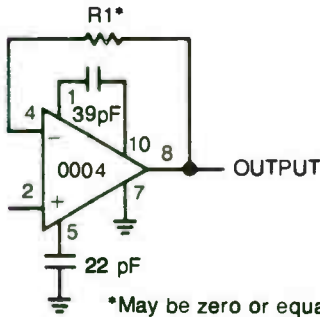


Unity gain inverting amplifier



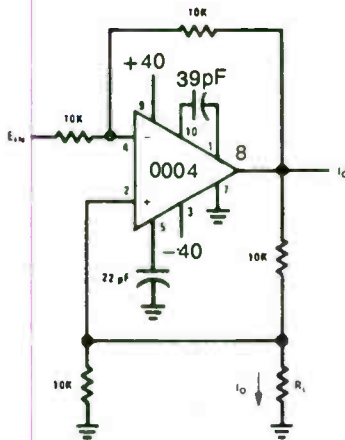
Unity gain follower

# 0004—HIGH VOLTAGE OPERATIONAL AMPLIFIER



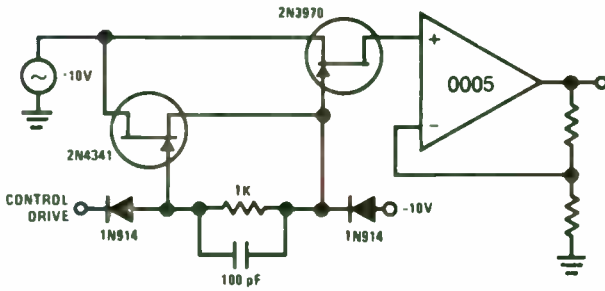
\*May be zero or equal to source resistance for minimum offset.

Voltage follower

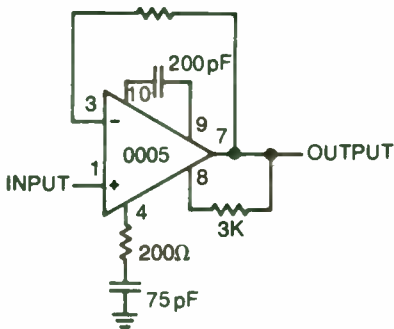


High compliance current source

## 0005—HIGH INPUT RESISTANCE OPERATIONAL AMPLIFIER

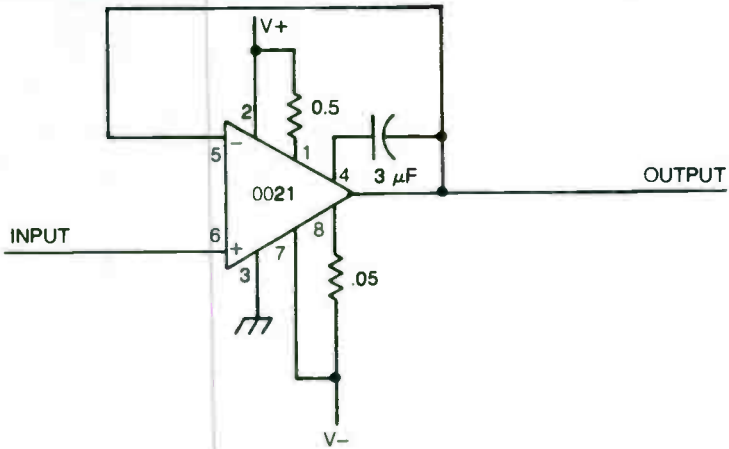


High toggle rate high frequency analog switch

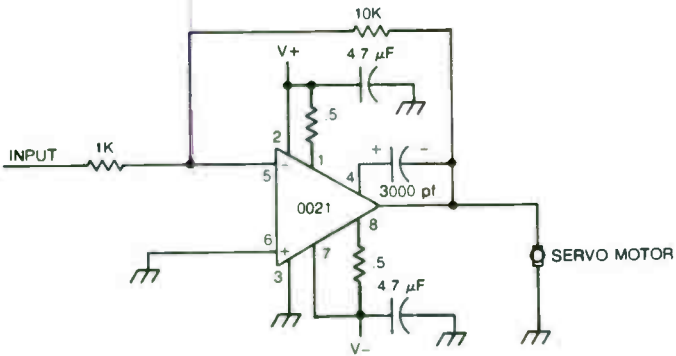


Voltage follower

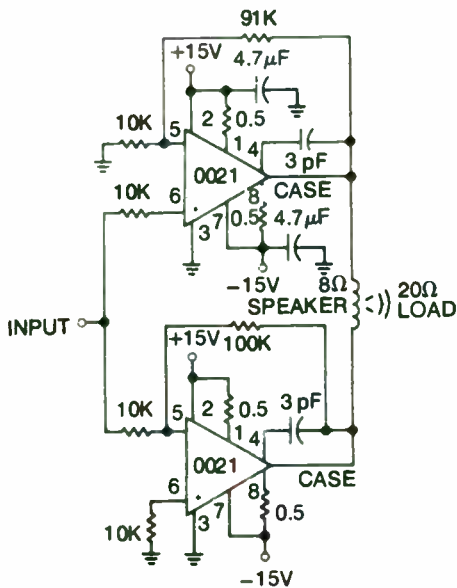
# 0021 — 1.0 AMP OPERATIONAL AMPLIFIER



Unity gain amplifier with short circuit limiting

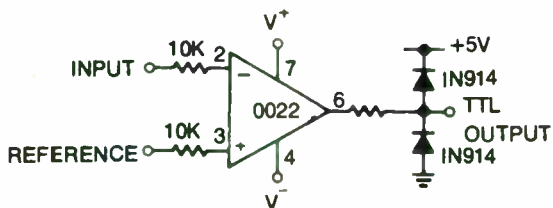


DC servo motor amplifier



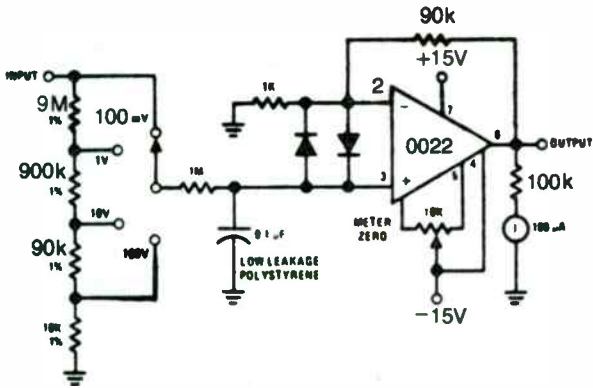
10 watt (rms) audio amplifier

## 0022—FET INPUT OPERATIONAL AMPLIFIER



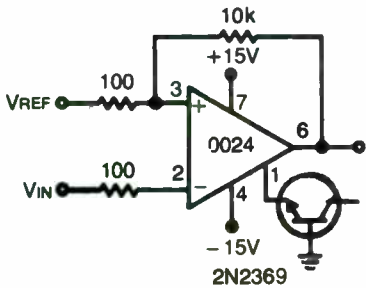
Precision voltage comparator



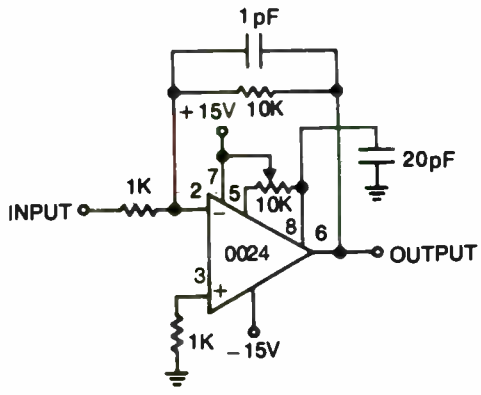


Sensitive low cost "VTVM"

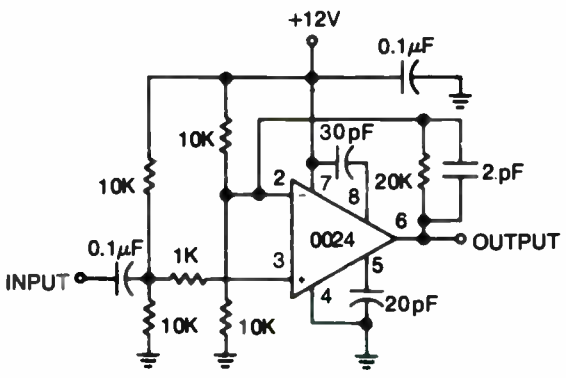
**0024—HIGH SLEW RATE OPERATIONAL AMPLIFIER**



TTL compatible comparator

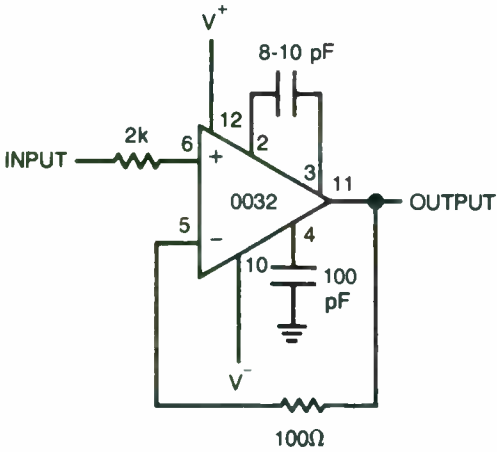


Offset null

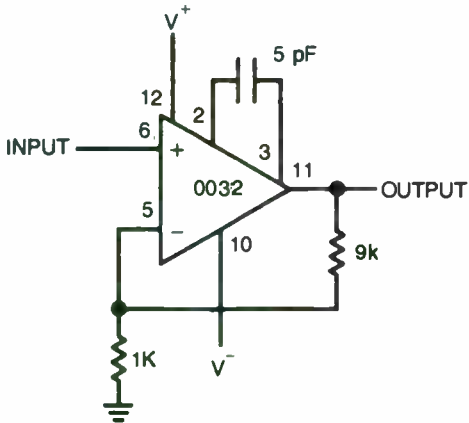


Video amplifier

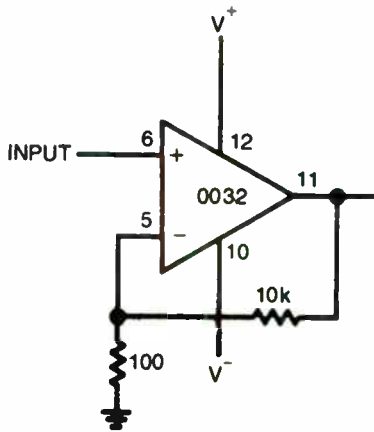
# 0032—ULTRA FAST FET OPERATIONAL AMPLIFIER



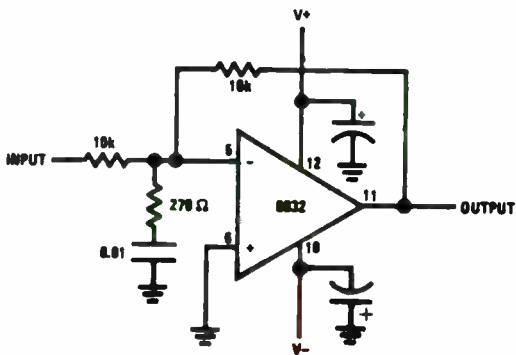
Unity gain amplifier



10X buffer amplifier

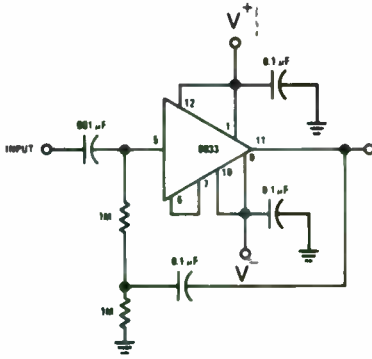


100X buffer amplifier

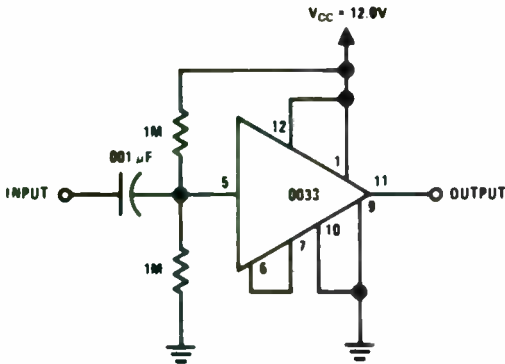


Noncompensated unity gain inverter

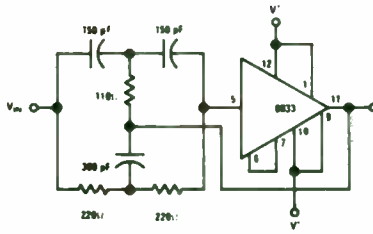
## 0033—FAST BUFFER AMPLIFIER



High input impedance ac coupled amplifier

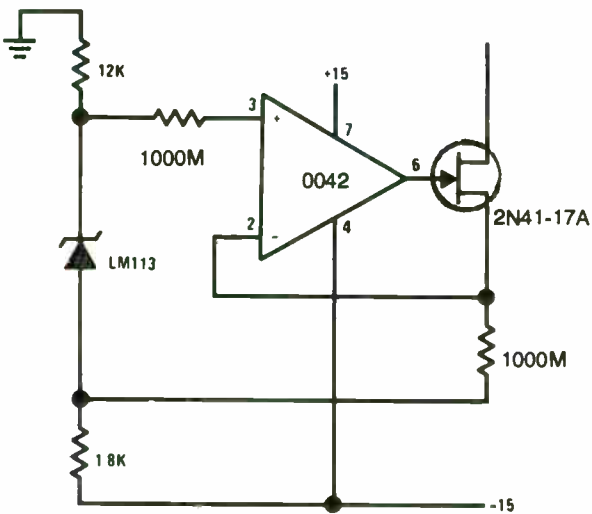


Single supply ac amplifier

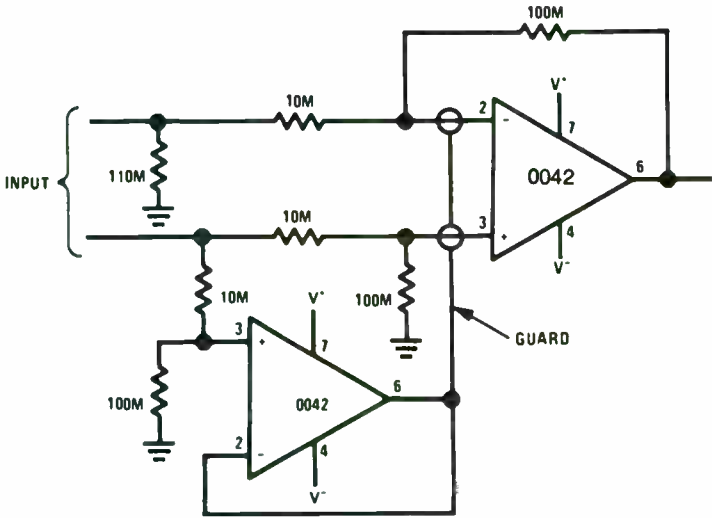


4.5 MHz notch filter

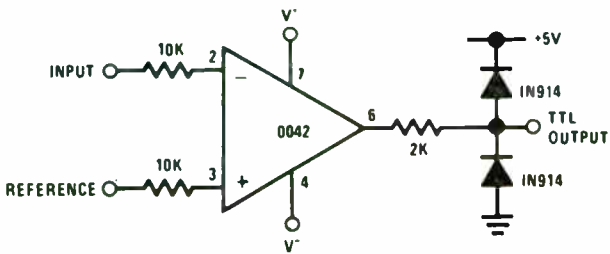
## 0042—FET INPUT OPERATIONAL AMPLIFIER



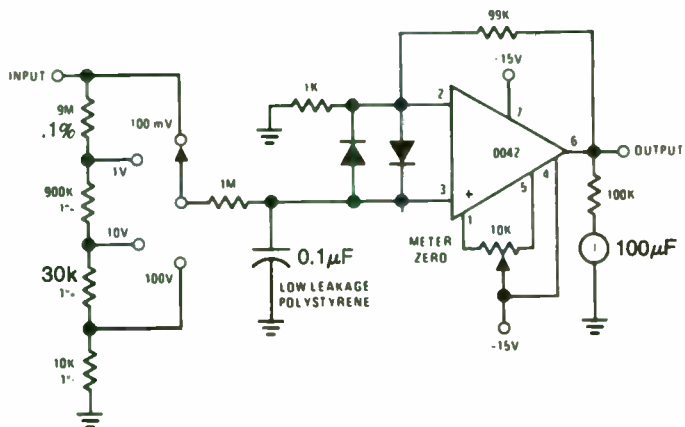
Precision current sink



Guarded full differential amplifier

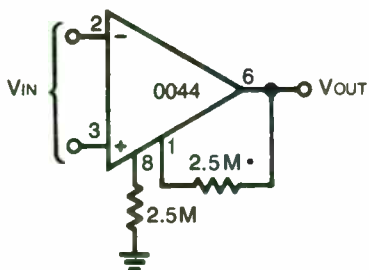


Precision voltage comparator



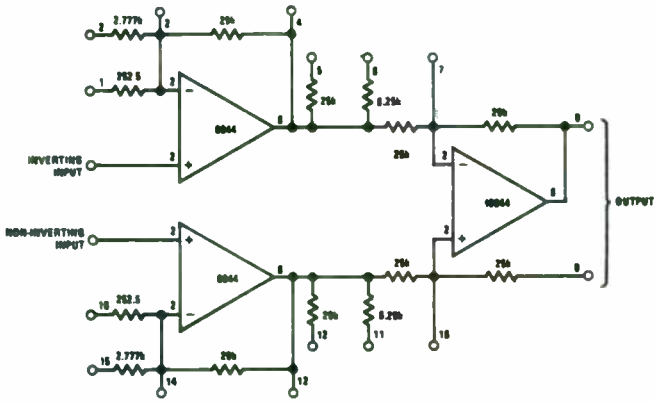
Sensitive low cost 'VTVM'

## 0044—LOW NOISE OPERATIONAL AMPLIFIER



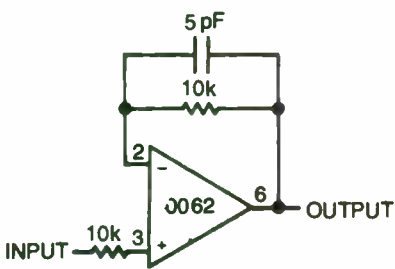
X1000 Instrumentation amp



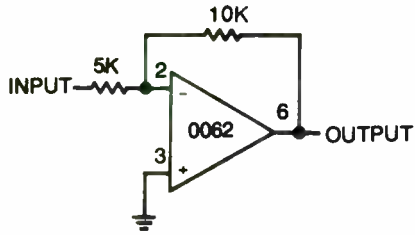


Precision instrumentation amplifier

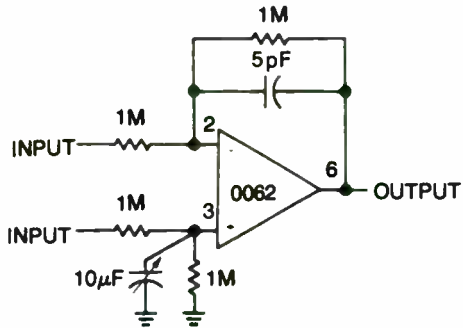
**0062—HIGH SPEED FET OPERATIONAL AMPLIFIER**



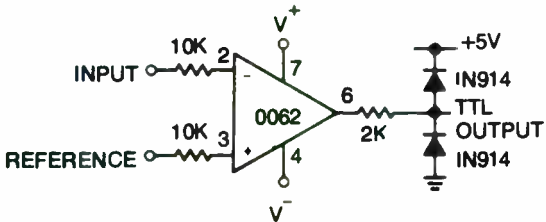
Fast voltage follower



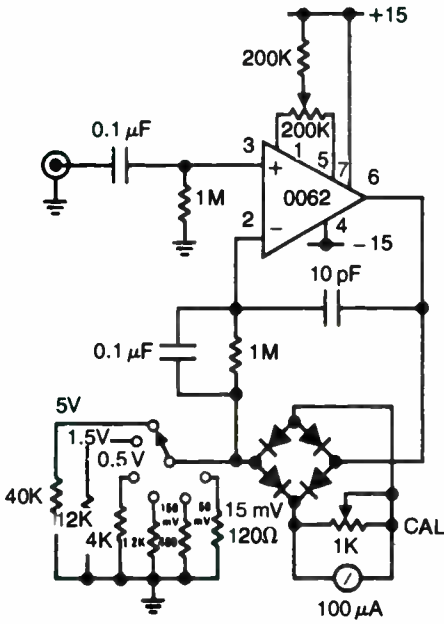
Fast summing amplifier



Differential amplifier

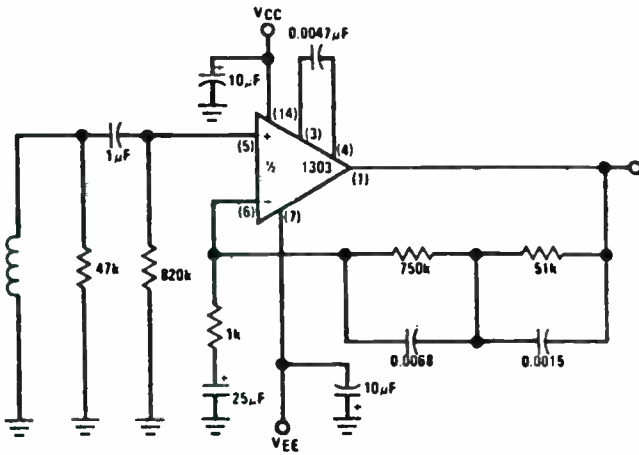


Fast precision voltage comparator

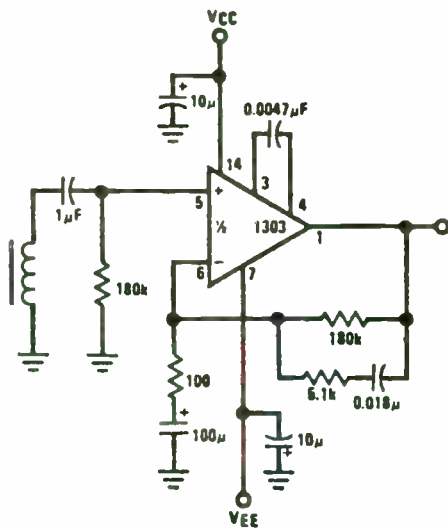


Wide range ac voltmeter

## 1303—STEREO PREAMPLIFIER

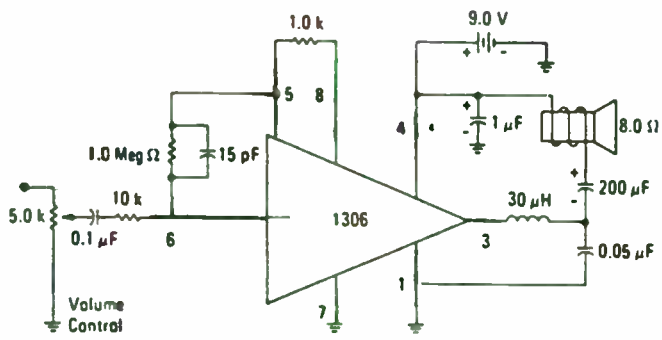


Phono preamp (RIAA)

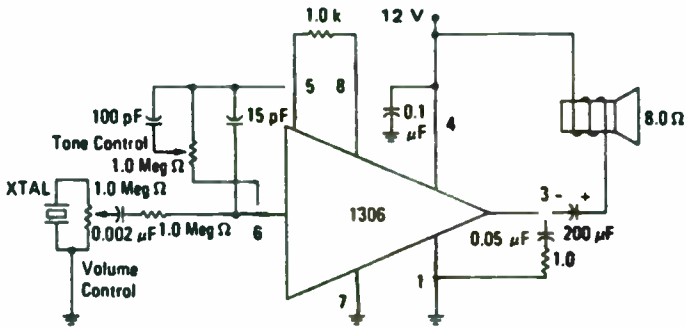


Tape preamp (NAB, 1-7/8 & 3-3/4 IPS)

**1306—HALF WATT INTEGRATED AUDIO AMPLIFIER**

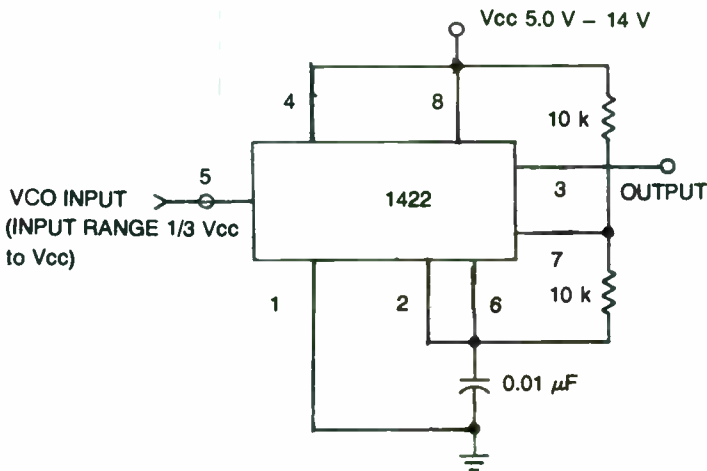


AM-FM radio, audio section

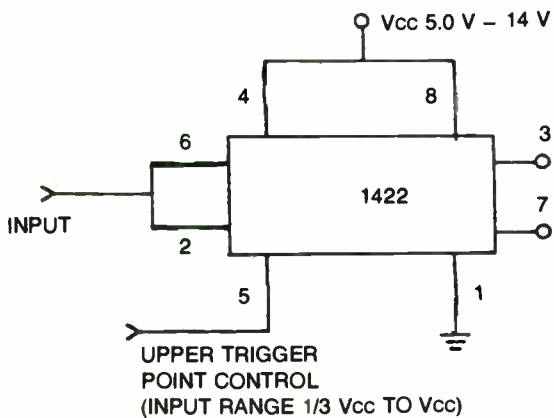


Phonograph amplifier (ceramic cartridge)

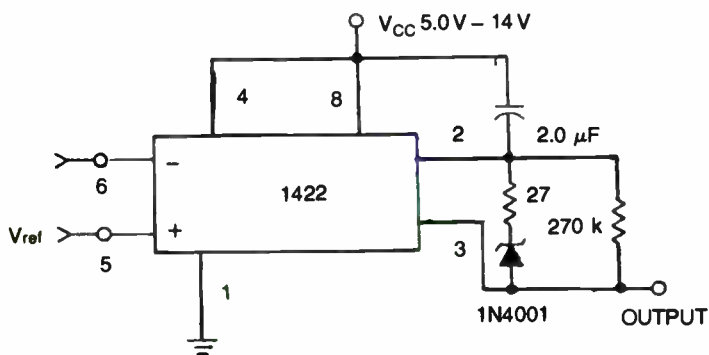
## 1422—MONOLITHIC TIMER WITH EXTERNALLY ADJUSTABLE THRESHOLD



Voltage controlled oscillator

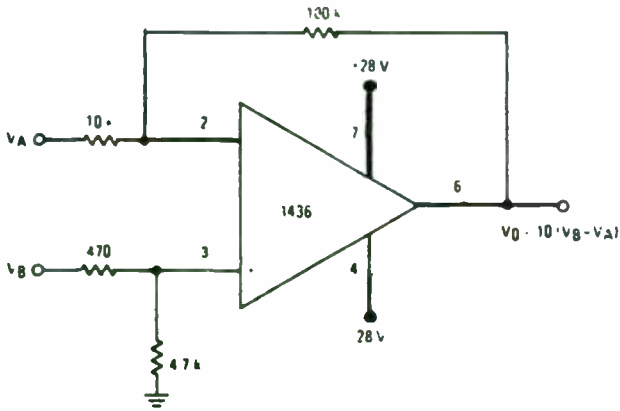


Schmitt trigger

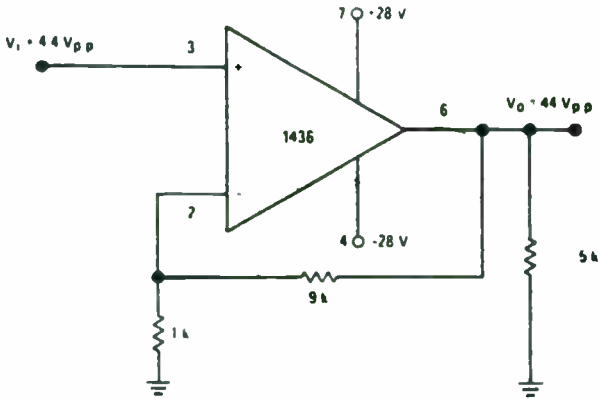


Comparator with time out

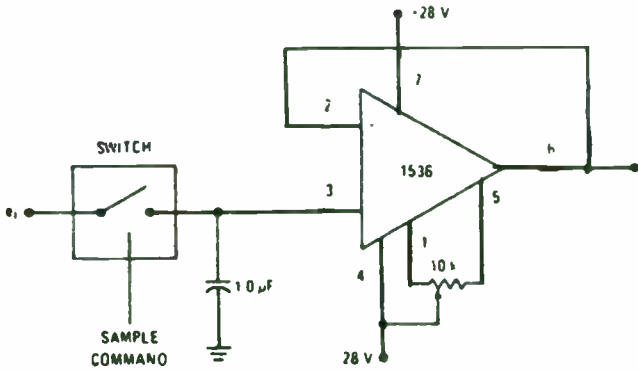
# 1436—HIGH VOLTAGE OPERATIONAL AMPLIFIER



Differential amplifier with  $\pm 20$  V common-mode input voltage range

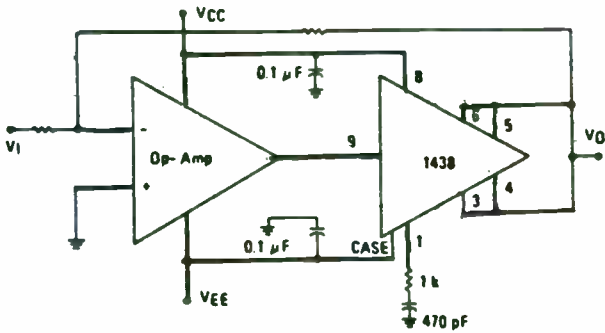


Typical noninverting X10 voltage amplifier



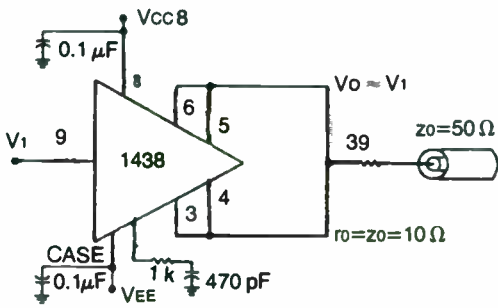
Low-drift sample and hold

## 1438—POWER BOOSTER OPERATIONAL AMPLIFIER

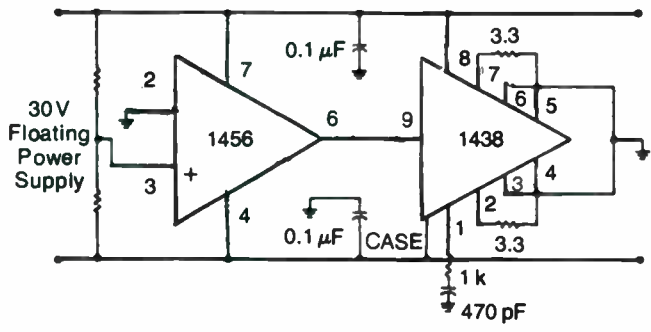


Operational amplifier boost circuit

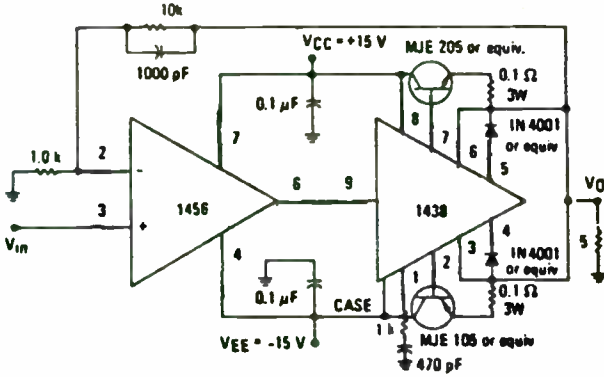




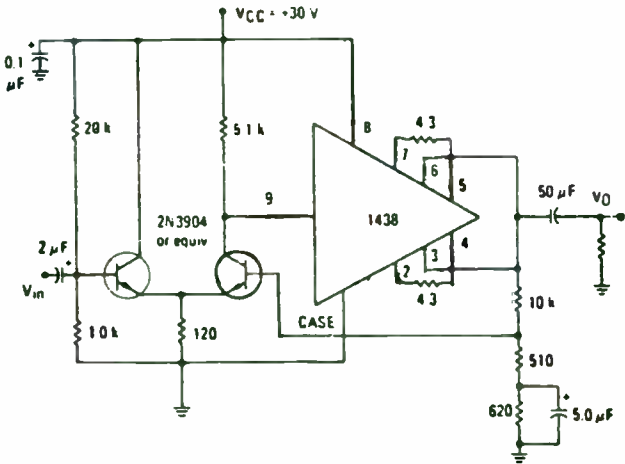
Digital or analog line driver



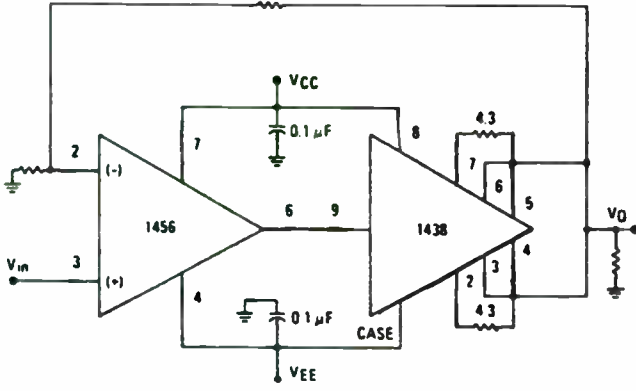
Power supply splitter



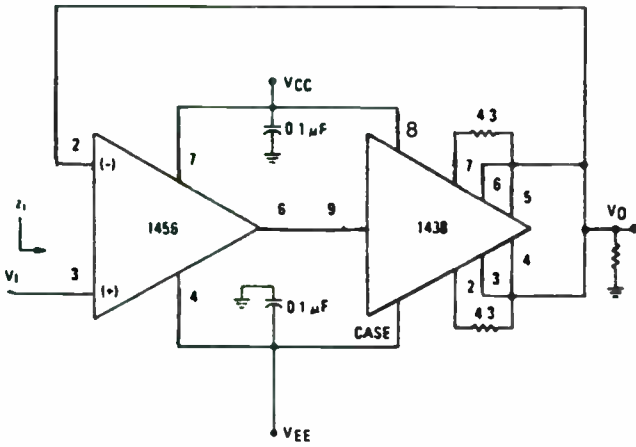
Servo/power amplifier



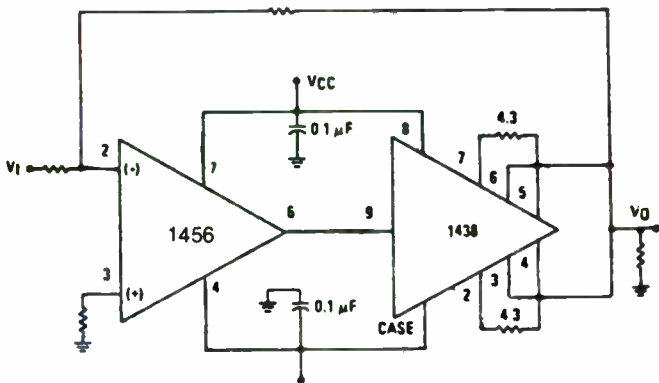
Noninverting ac power amplifier



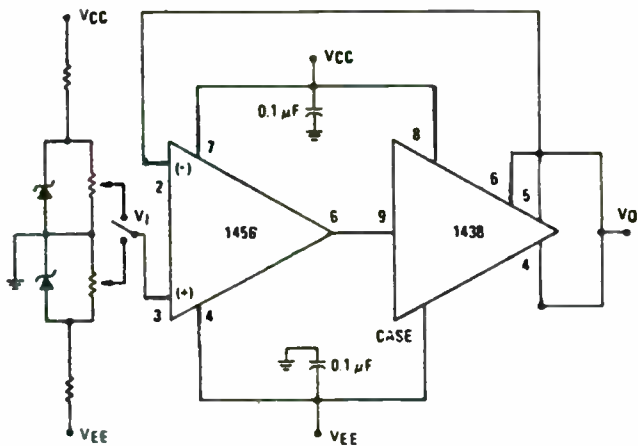
Noninverting power amplifier



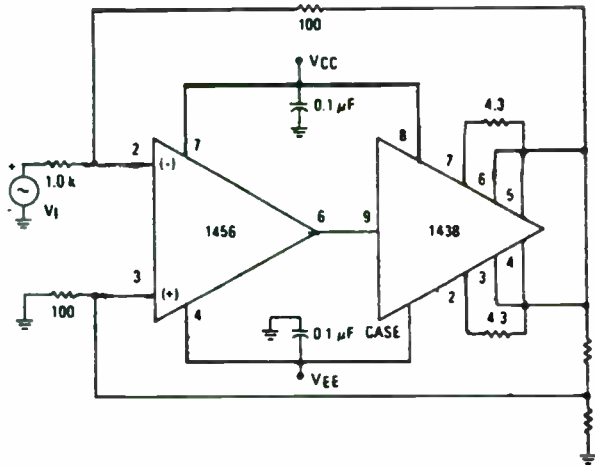
Noninverting voltage follower



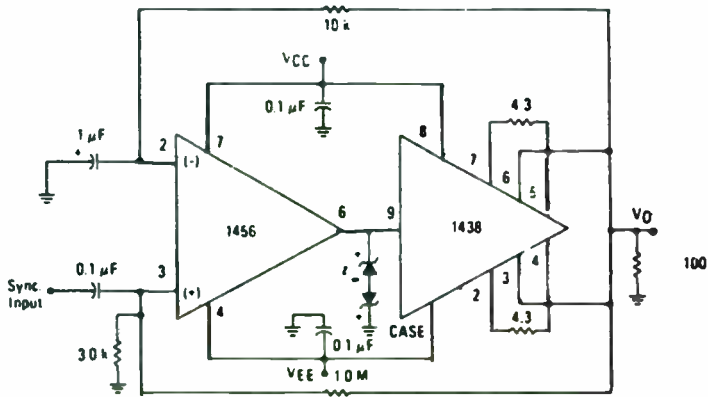
Inverting power amplifier



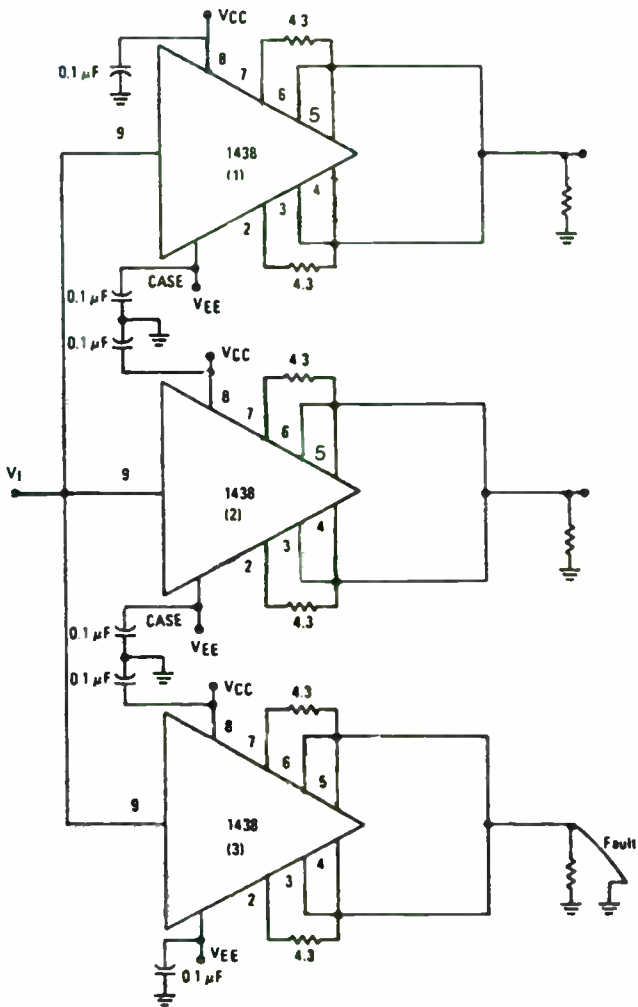
Programmable voltage source



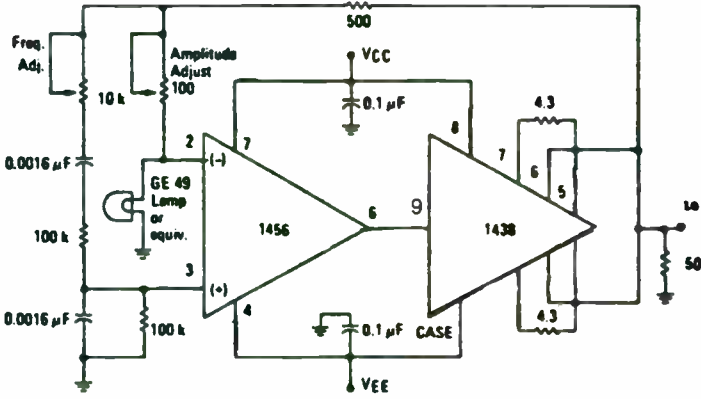
Transconductance amplifier



Astable multivibrator

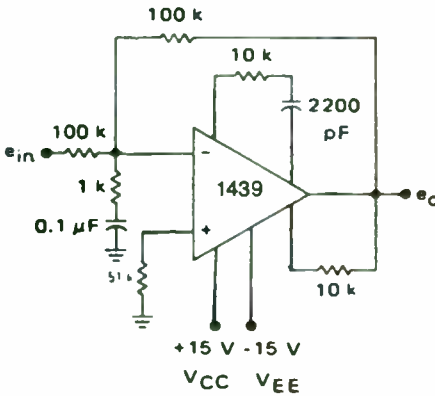


Signal distribution

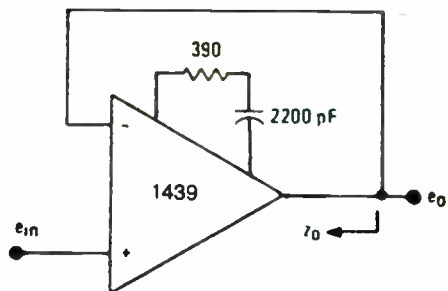


Wien bridge oscillator

## 1439—UNCOMPENSATED OPERATIONAL AMPLIFIER

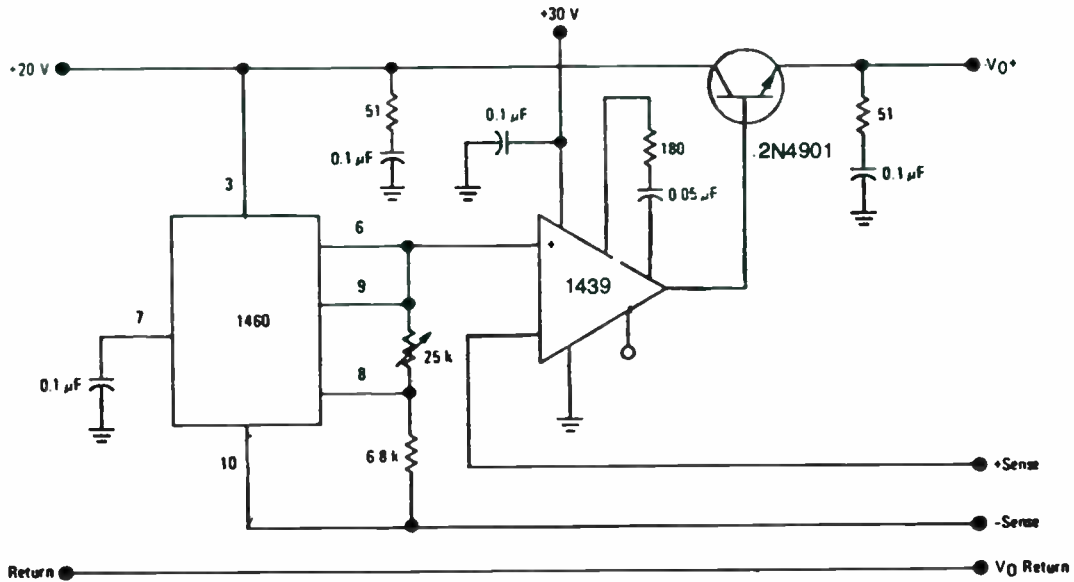


High slew rate inverter



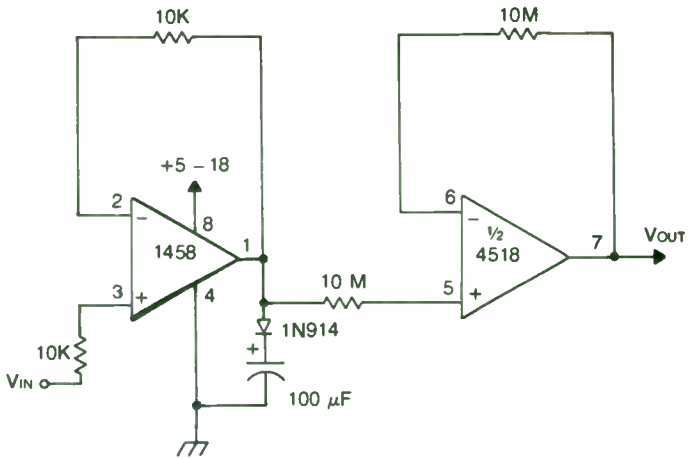
Voltage follower



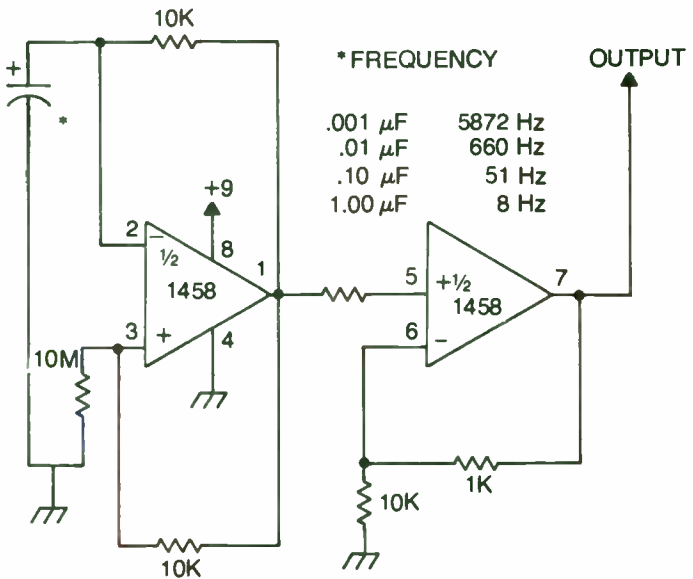


+15 volt regulator

# 1458—DUAL COMPENSATED OPERATIONAL AMPLIFIER

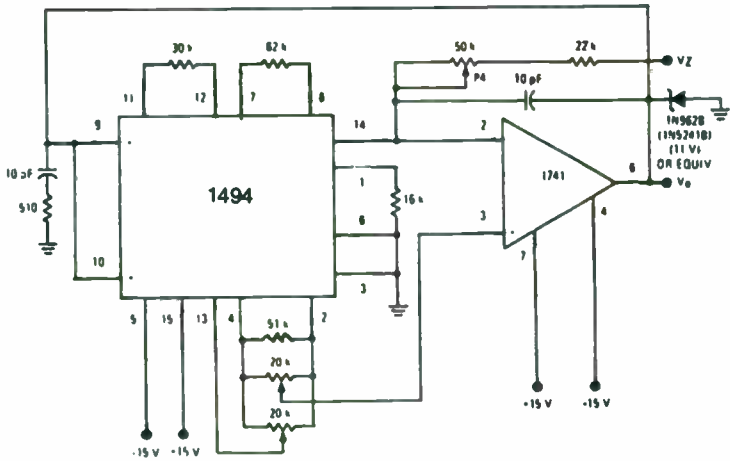


Peak detector

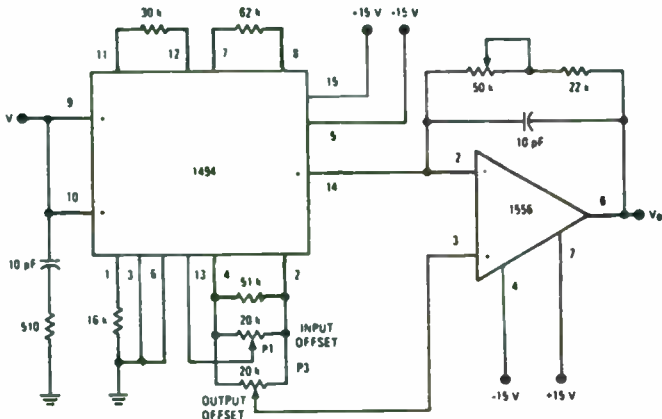


Pulse generator

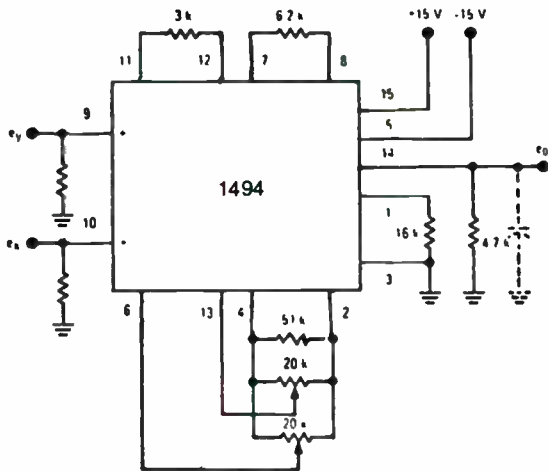
# 1494—LINEAR FOUR-QUADRANT INTEGRATED MULTIPLIER



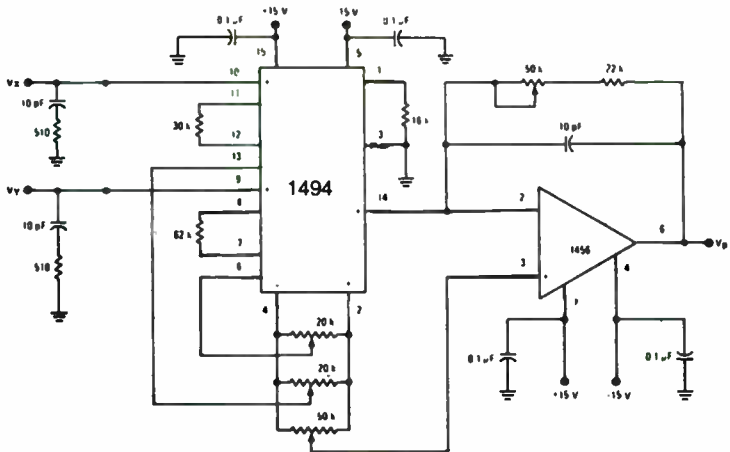
Square root circuit



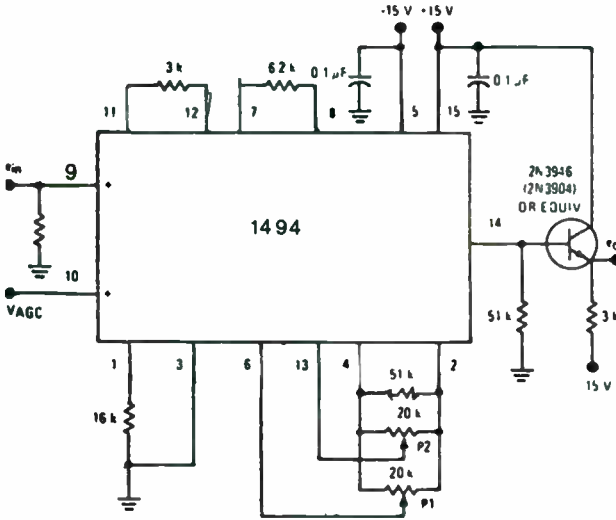
Squaring circuit



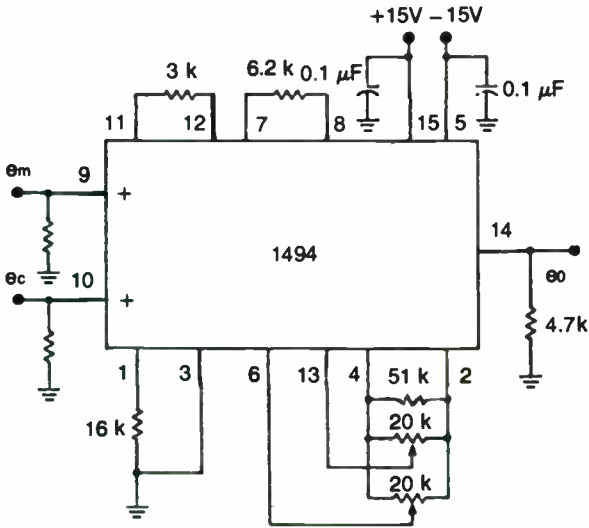
Wideband multiplier



Typical multiplier

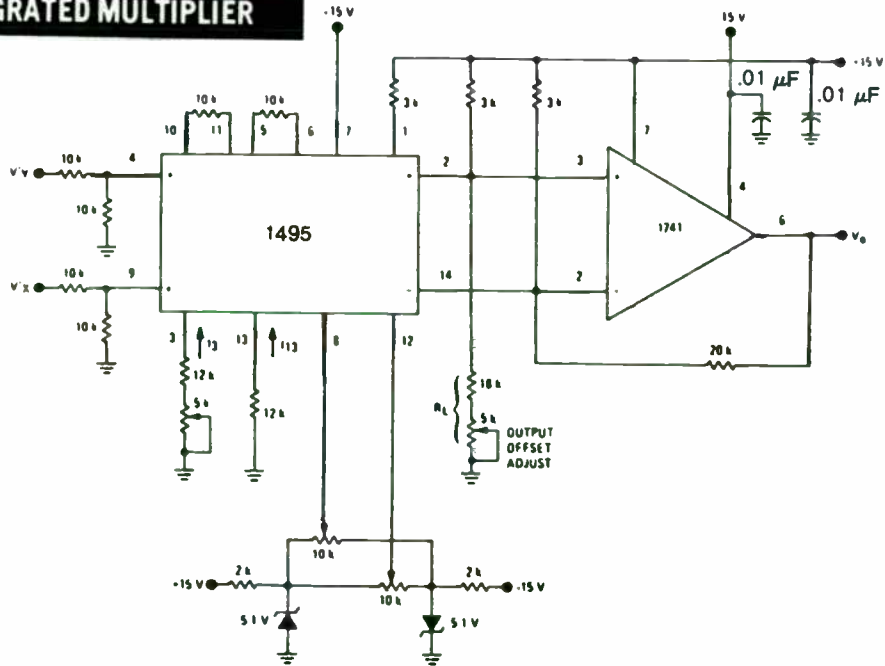


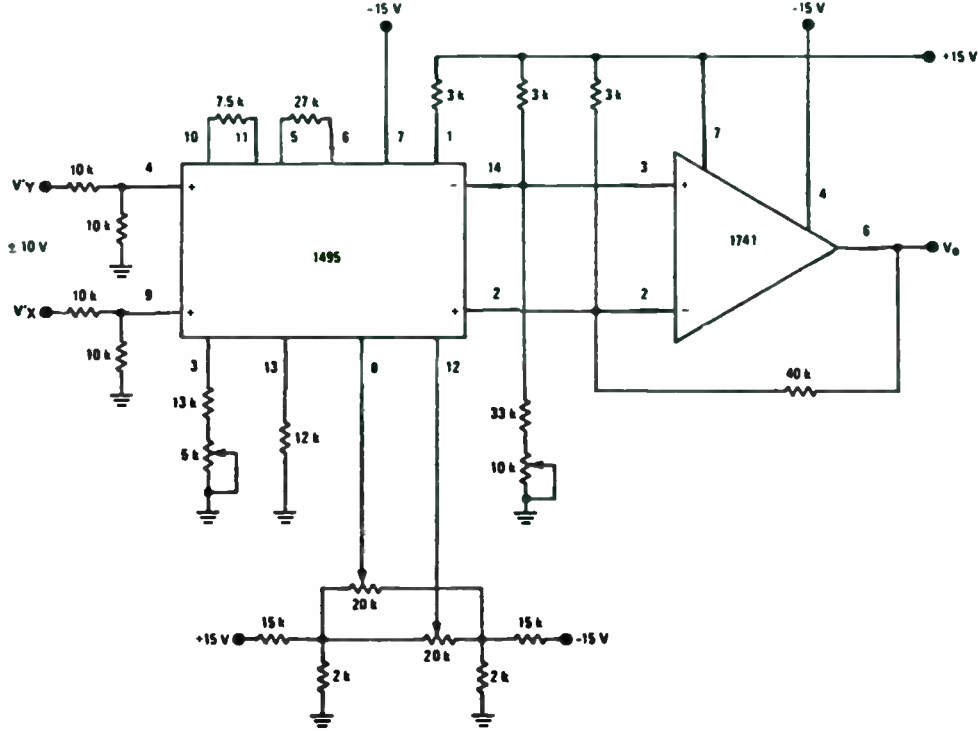
Wideband amplifier with linear AGC



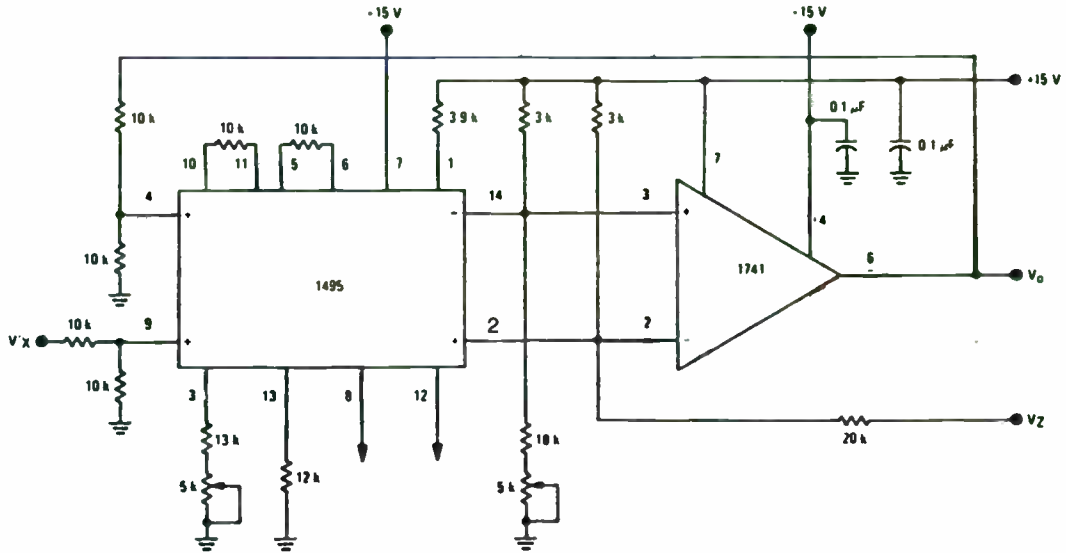
Balanced modulator

# 1495— WIDEBAND LINEAR FOUR- QUADRANT INTEGRATED MULTIPLIER

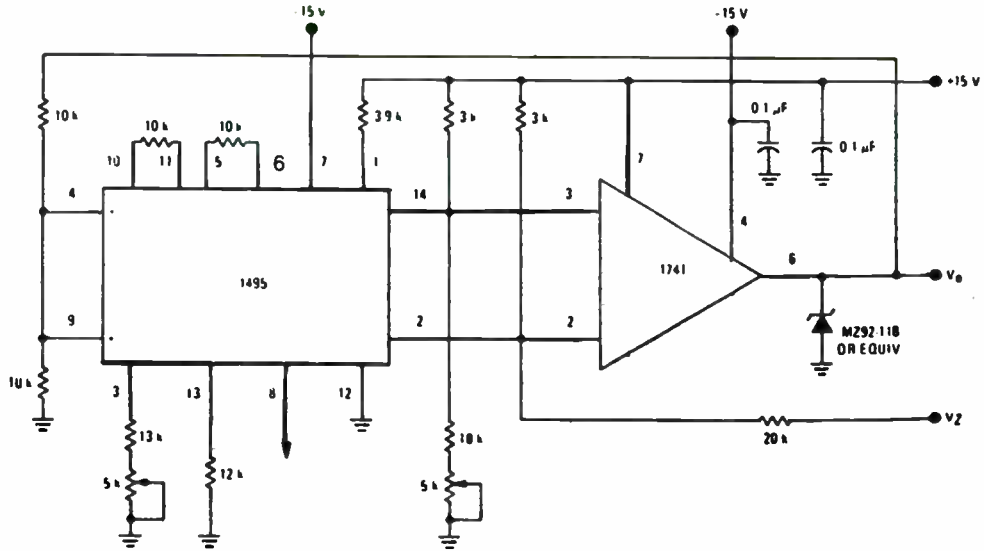




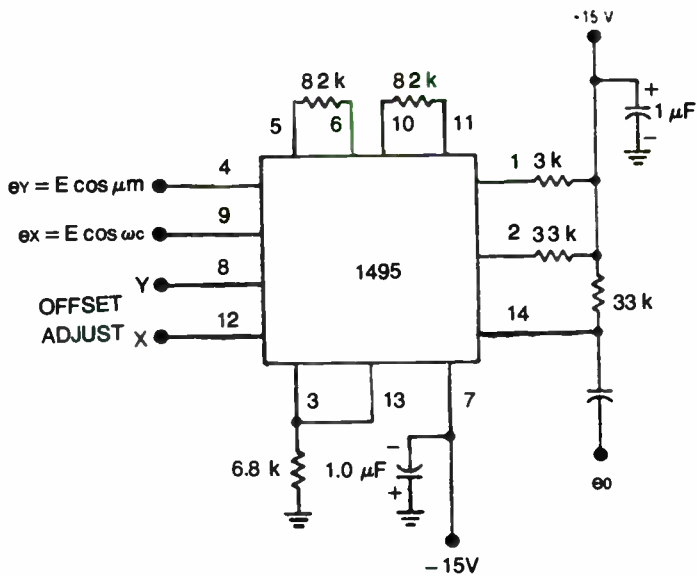
Multiplier with improved linearity



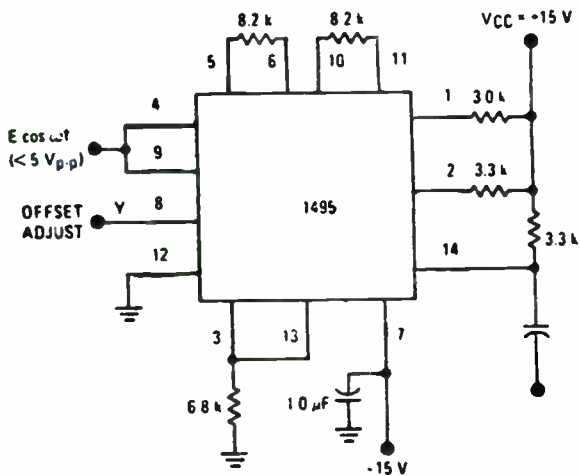




Square root circuit

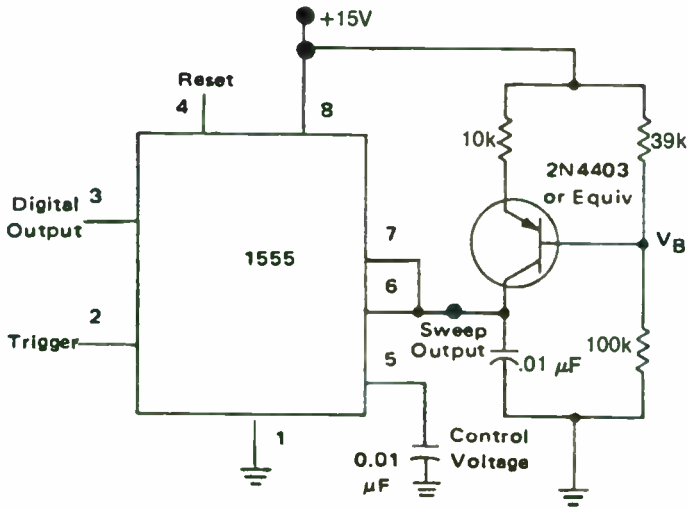


Balanced modulator

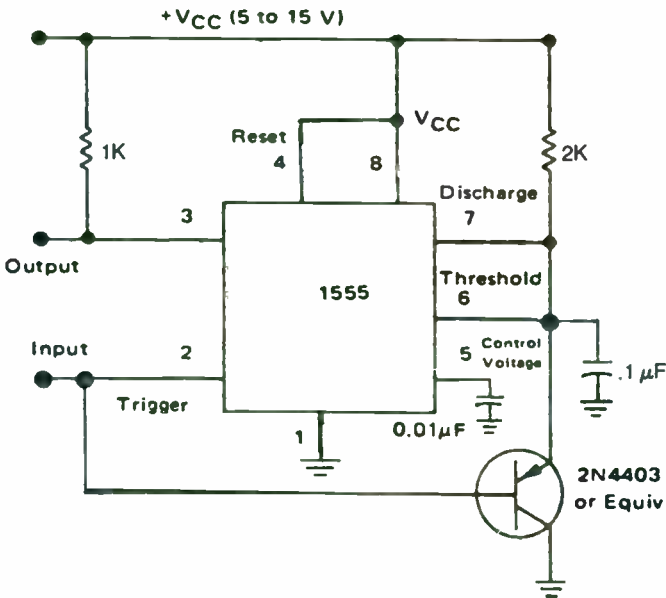


Frequency doubler

# 1555—INTEGRATED TIMER

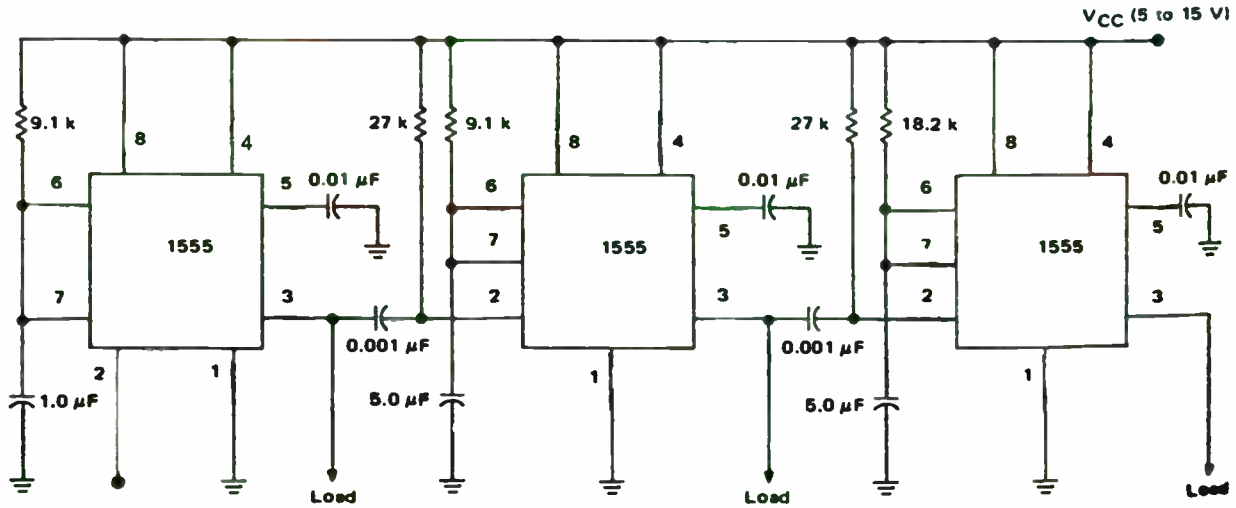


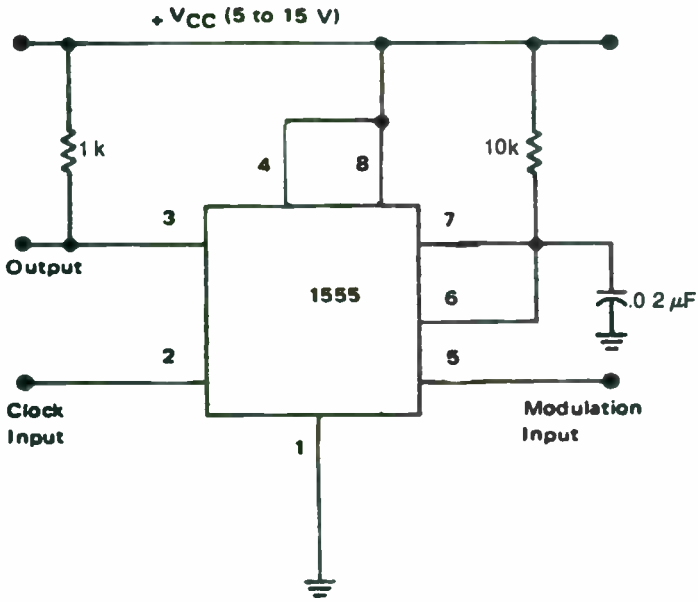
Linear voltage sweep circuit



Missing pulse detector

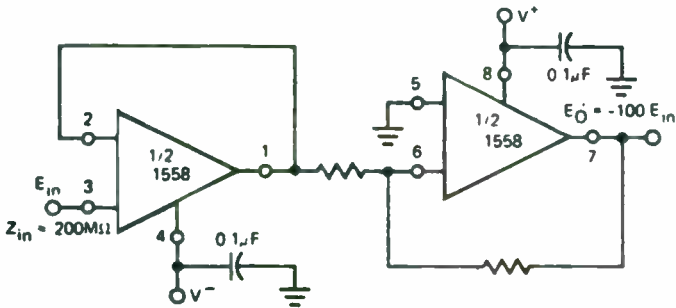
## Sequential timing circuit



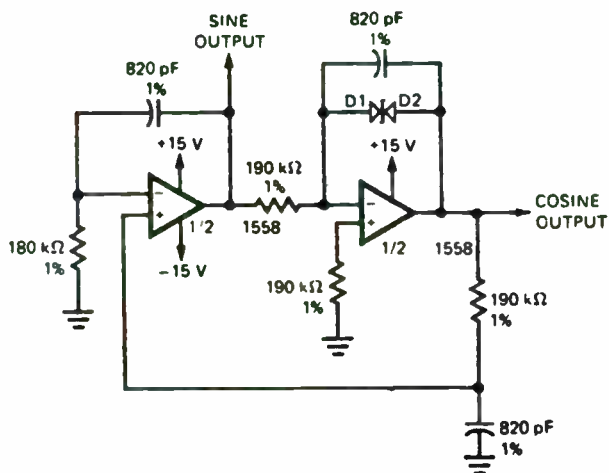


Pulse width modulator

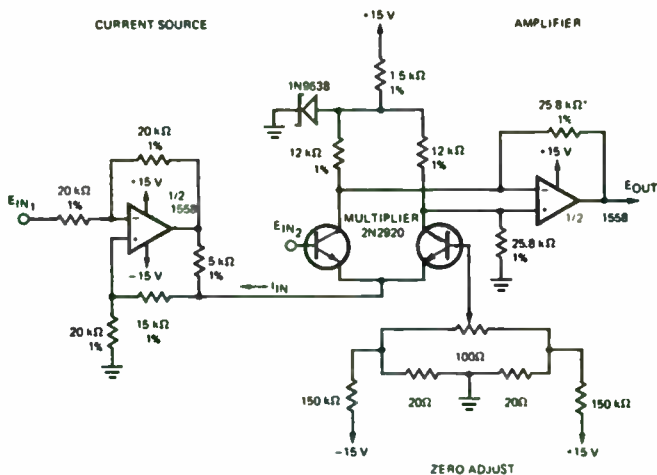
**1558—DUAL INTERNALLY COMPENSATED OPERATIONAL AMPLIFIER**



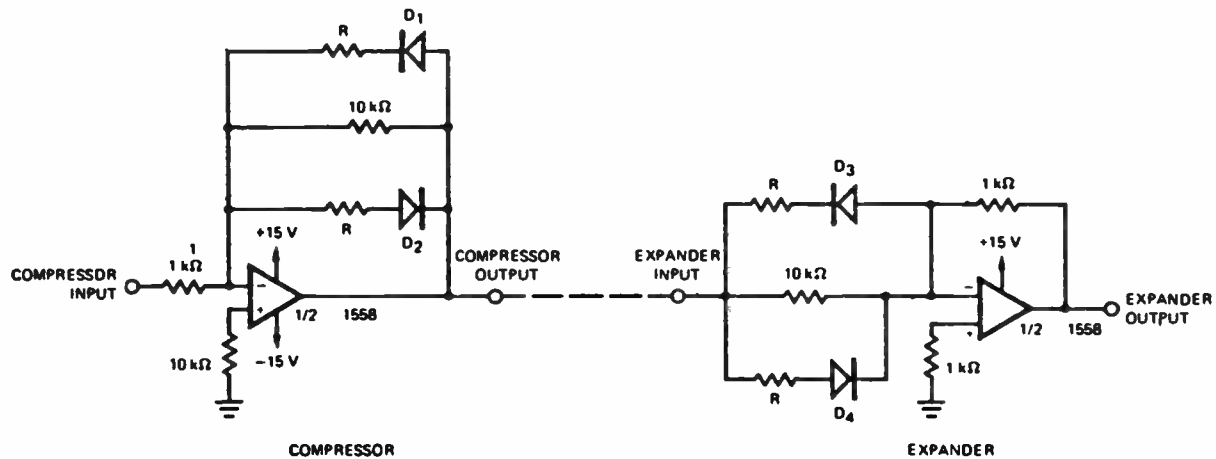
High-impedance, high-gain inverting amplifier



Quadrature oscillator

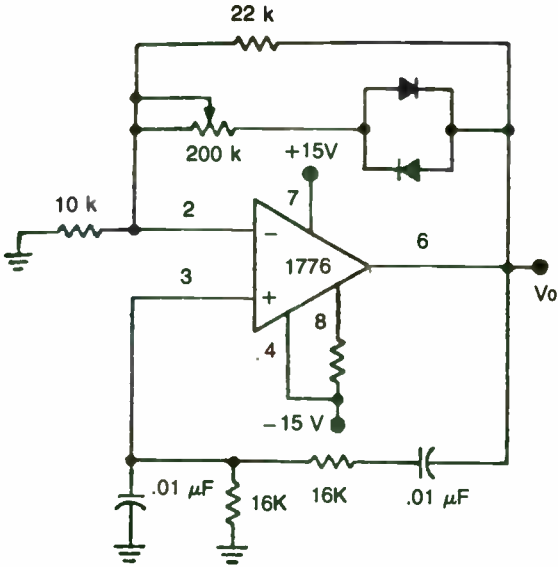


Analog multiplier

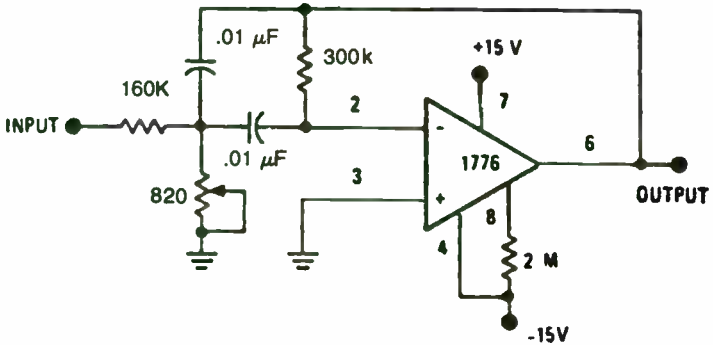


Compressor/expander amplifiers

# 1776—MICROPOWER PROGRAMMABLE OPERATIONAL AMPLIFIER

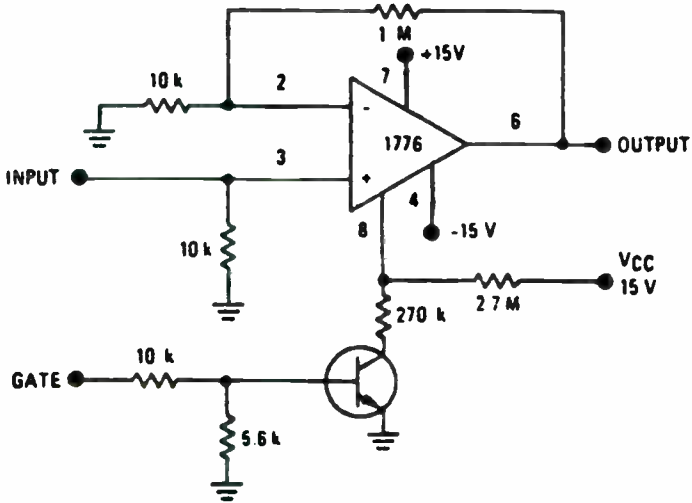


Wien bridge oscillator

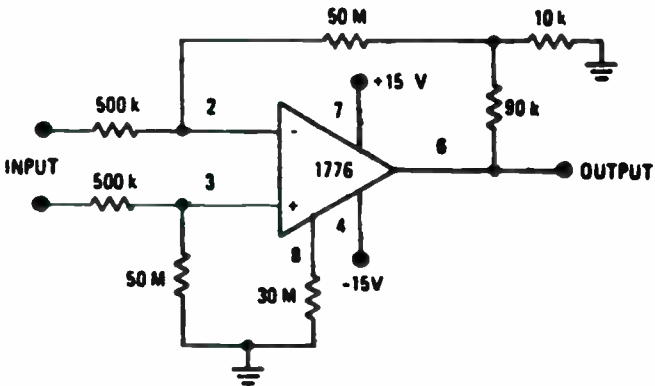


Multiple feedback bandpass filter (1.0kHz)



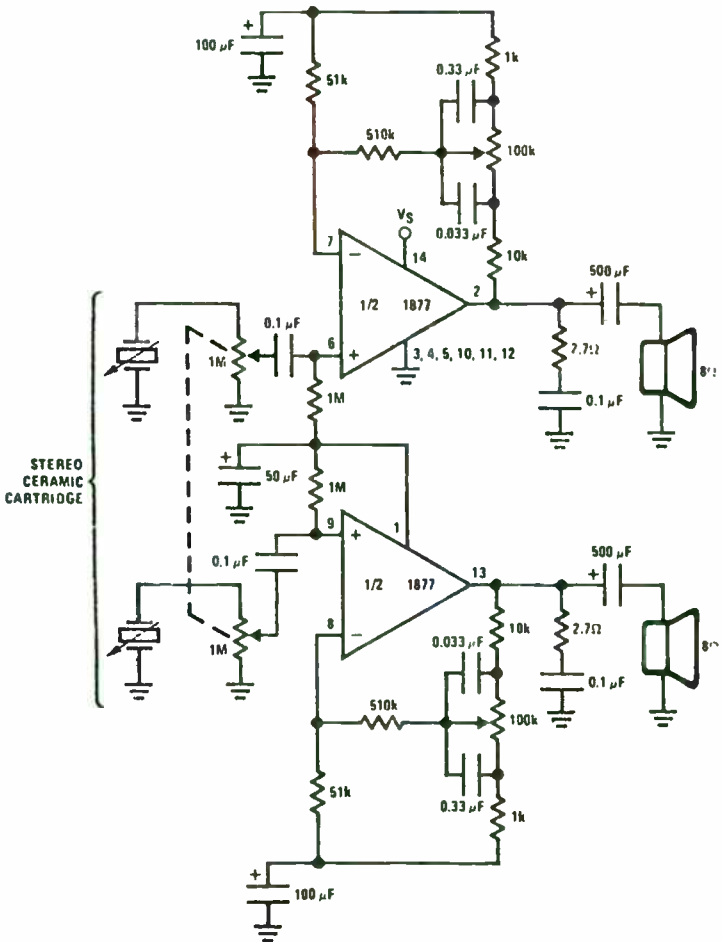


Gated amplifier

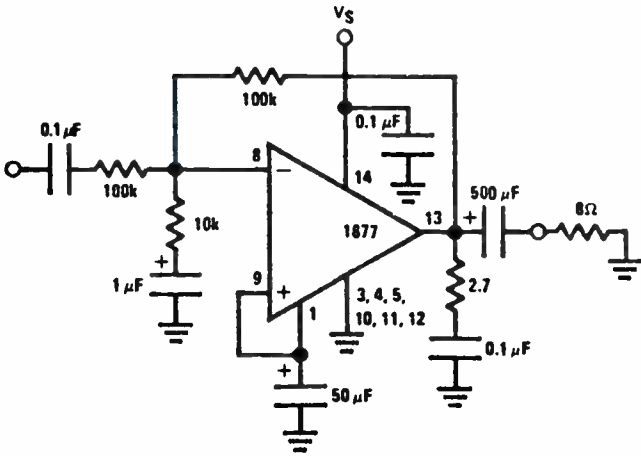


High input impedance amplifier

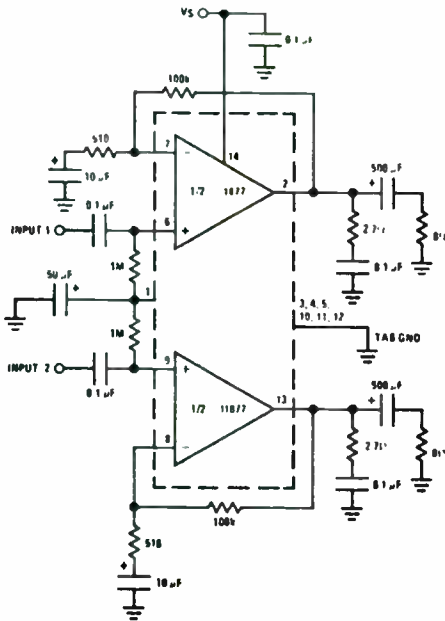
# 1877—DUAL CHANNEL POWER AUDIO AMPLIFIER



Stereo phonograph amplifier with bass tone control

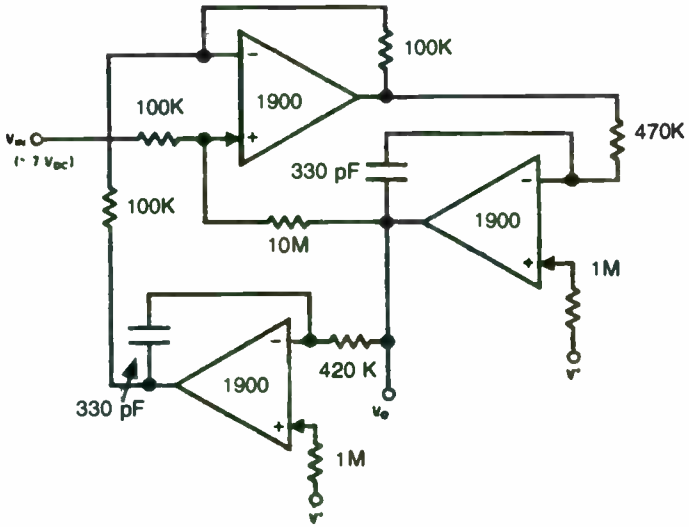


Inverting unity gain amplifier

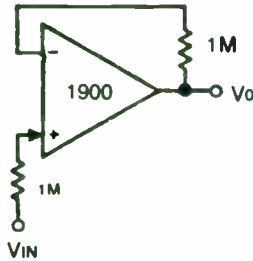


Stereo amplifier with  $A_V = 200$

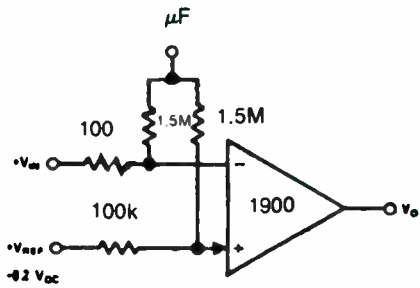
# 1900—QUAD OPERATIONAL AMPLIFIER



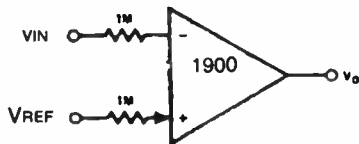
Bi-quad active filter



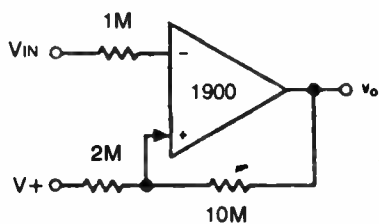
Buffer amplifier



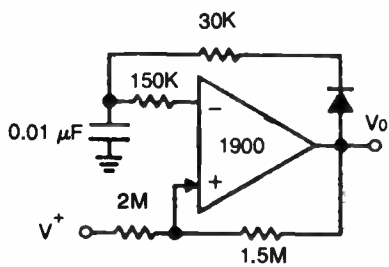
Low-voltage comparator



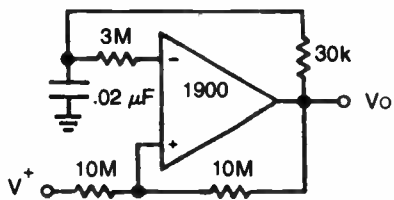
Comparator



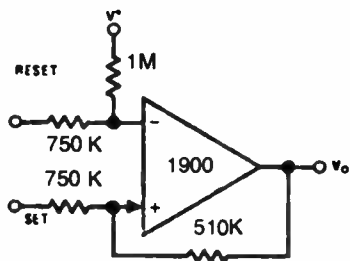
Schmitt-trigger



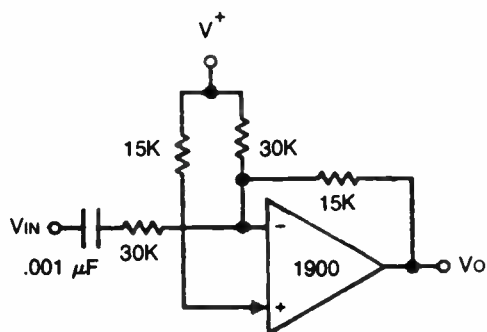
Pulse generator



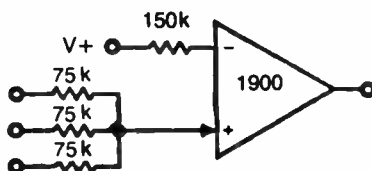
Square-wave oscillator



Bi-stable multivibrator

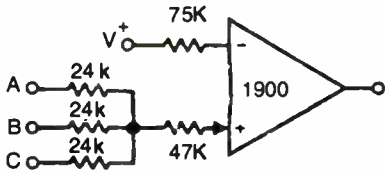


Differentiator

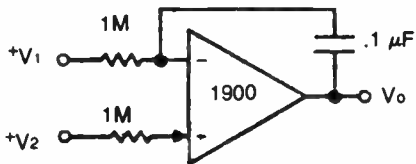


OR gate

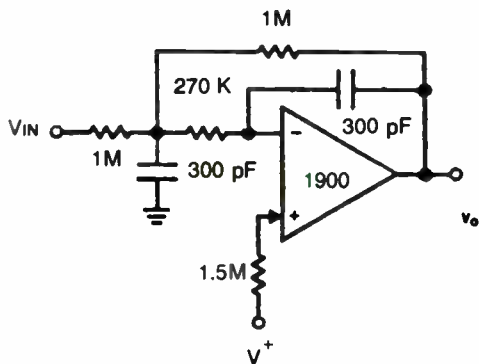




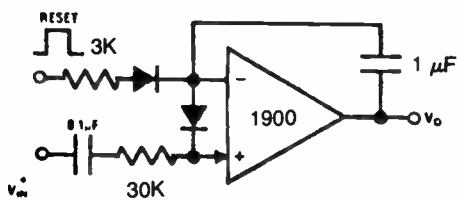
AND gate



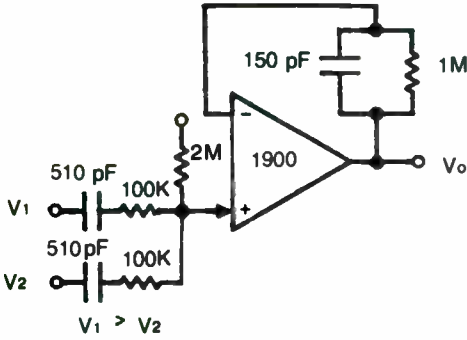
Difference integrator



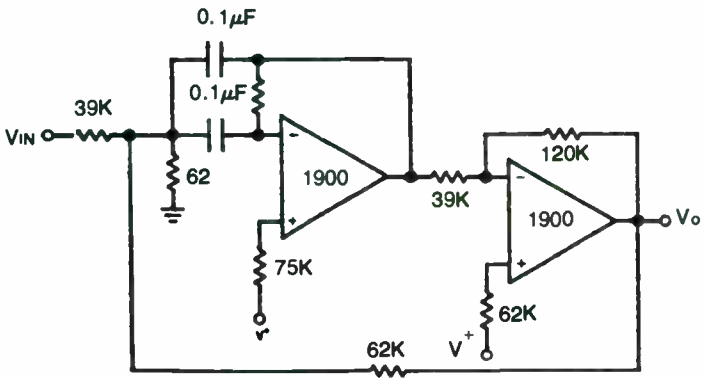
Low pass active filter



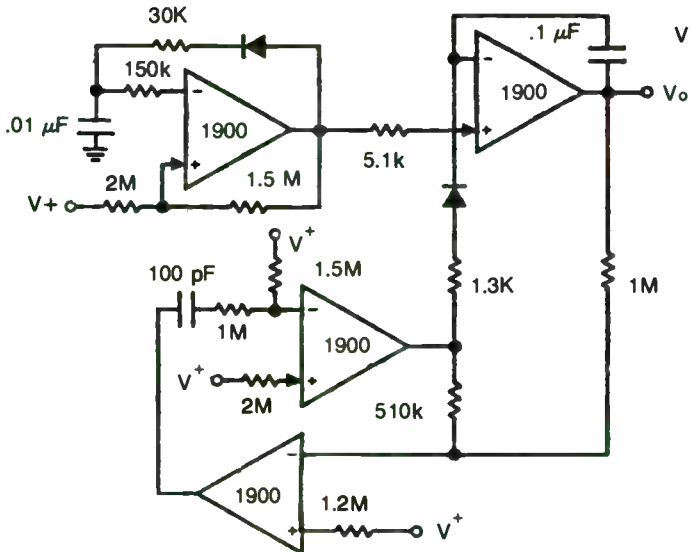
Staircase generator



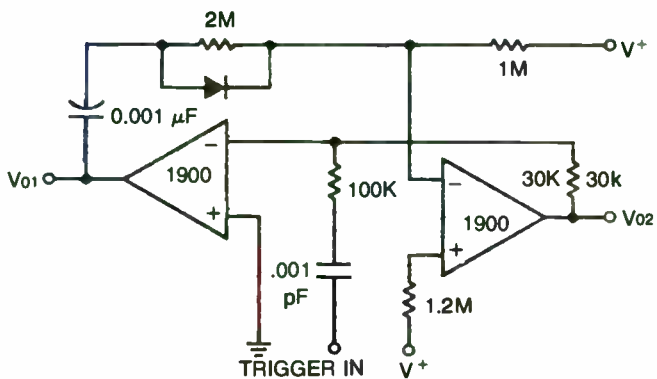
Low-frequency mixer



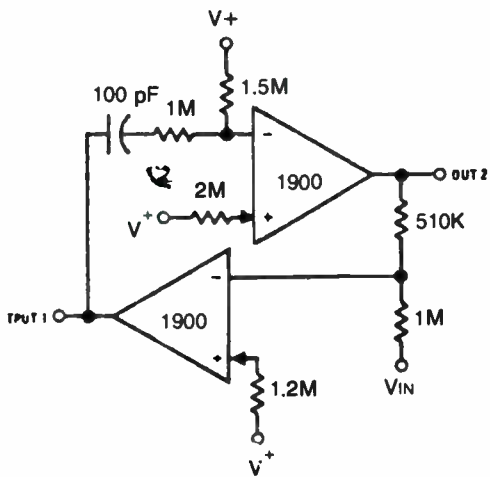
Bandpass active filter



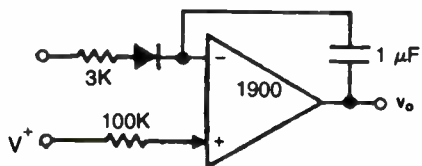
Free-running staircase generator/pulse counter



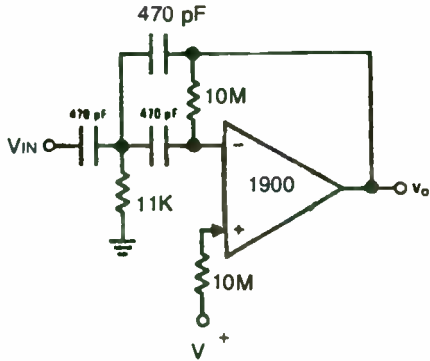
One-shot multivibrator



One-shot with dc input comparator

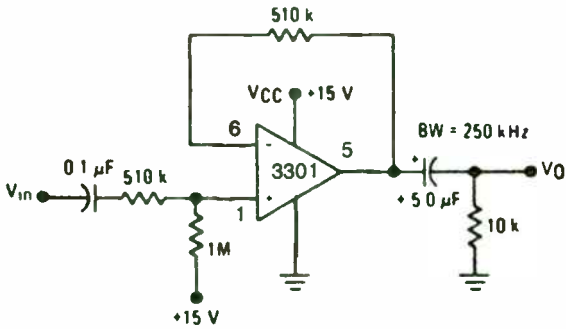


Sawtooth generator

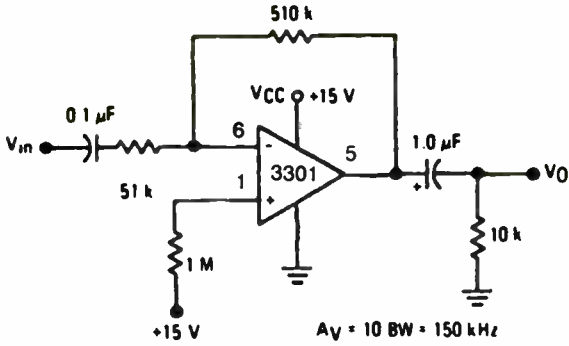


High pass active filter

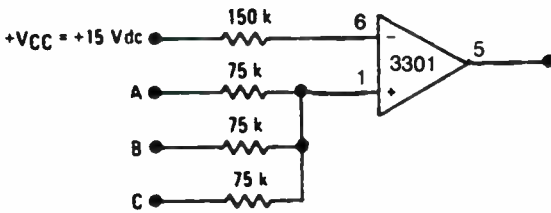
### 3301—QUAD SINGLE SUPPLY OPERATIONAL AMPLIFIER



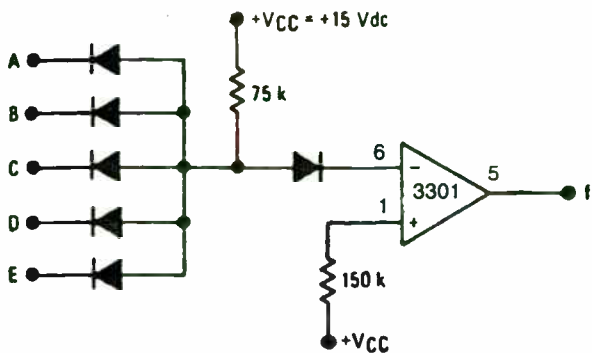
Noninverting amplifier



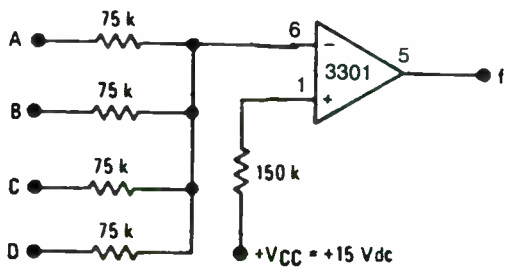
Inverting amplifier



Logic OR gate

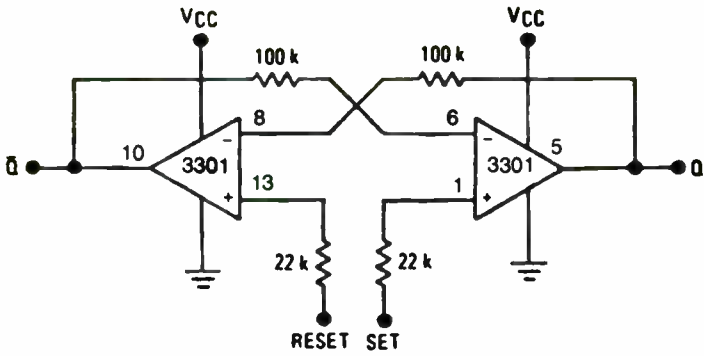


Logic NAND gate (Large Fan-In)

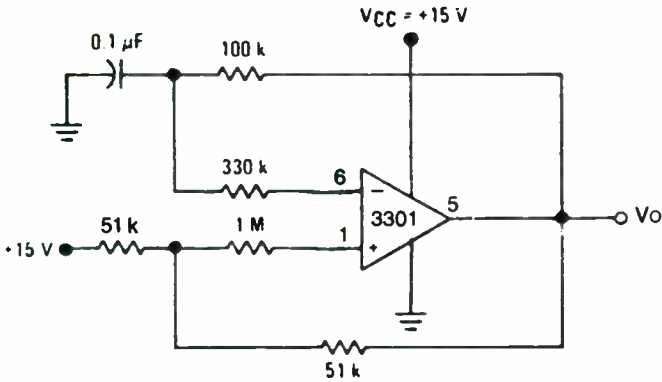


Logic NOR gate

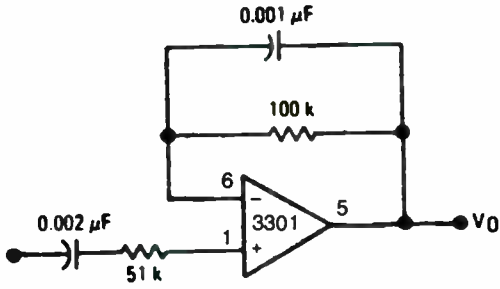




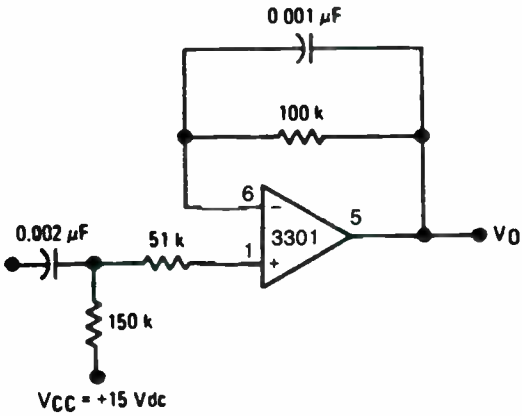
R-S flip-flop



Astable multivibrator

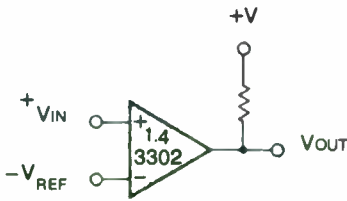


Positive-edge differentiator

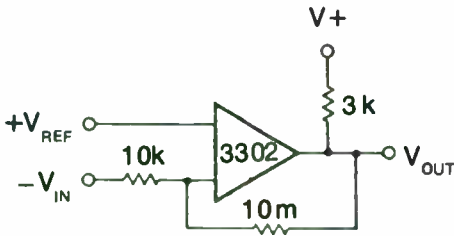


Negative-edge differentiator

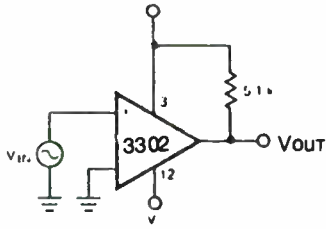
# 3302—QUAD COMPARATOR



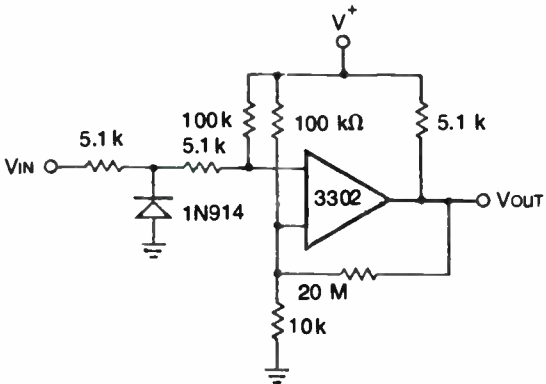
Basic comparator



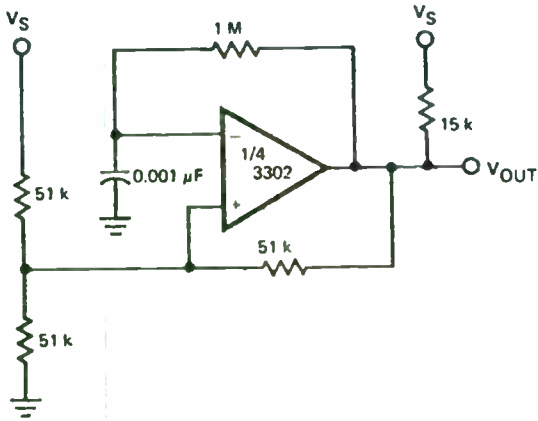
Noninverting comparator with hysteresis



Zero crossing detector

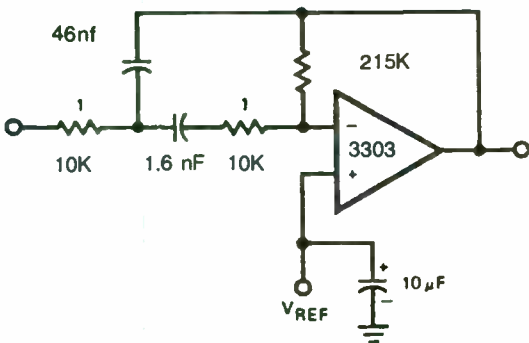


Zero crossing detector (single power supply)

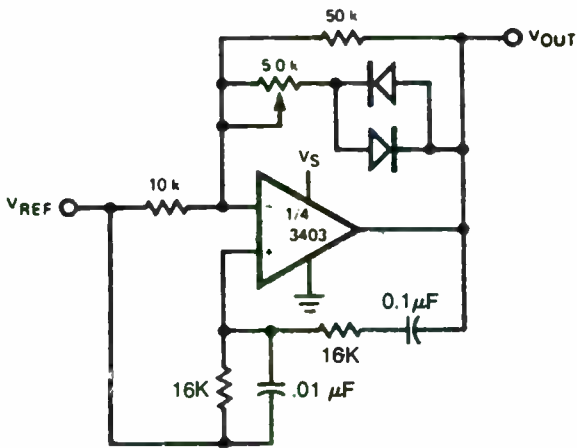


Free running square wave oscillator

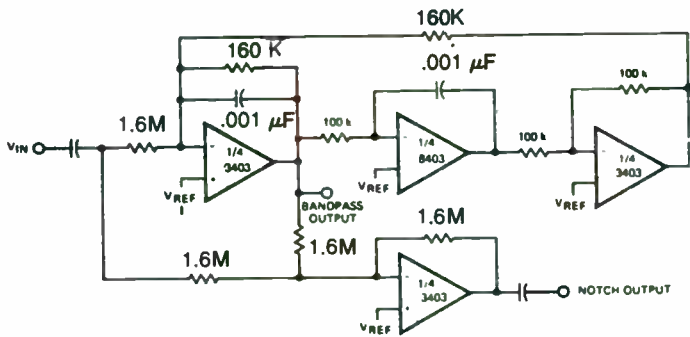
**3303—QUAD OPERATIONAL AMPLIFIER**



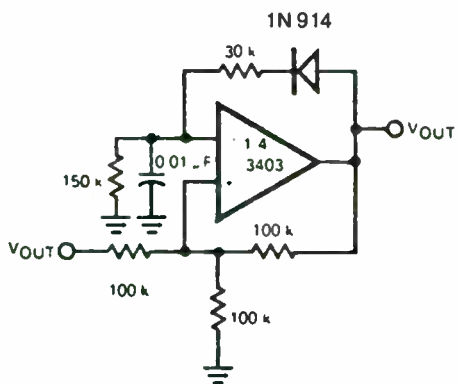
Multiple feedback bandpass filter



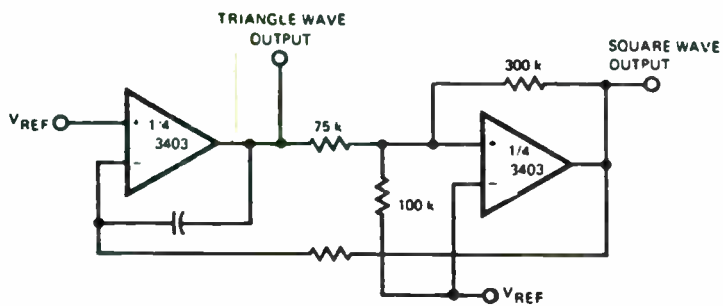
Wien bridge oscillator



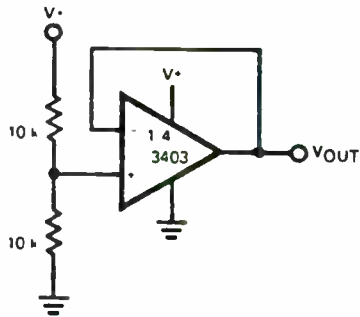
Bi-quad filter



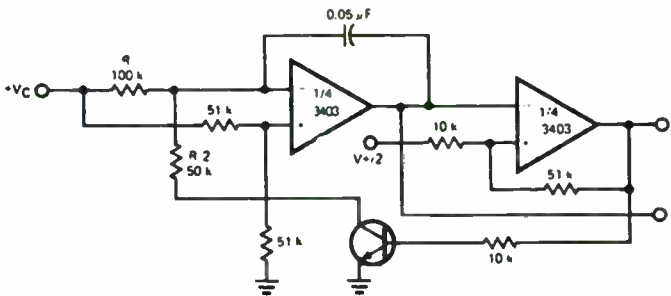
Pulse generator



Function generator

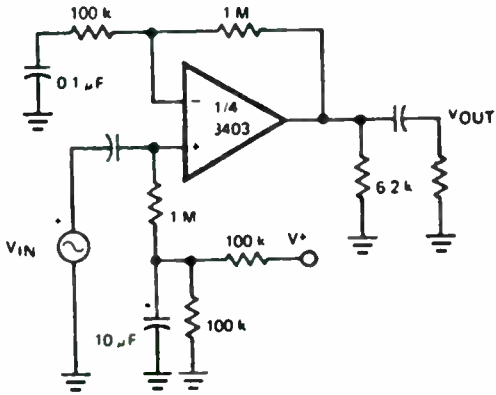


Voltage reference

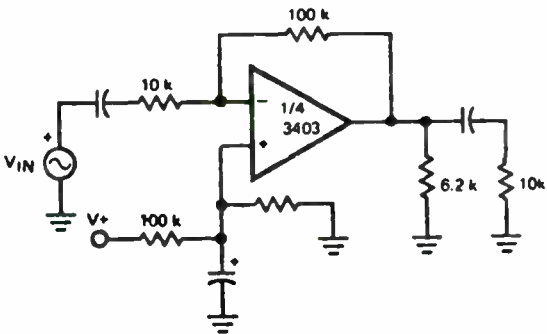


Voltage controlled oscillator



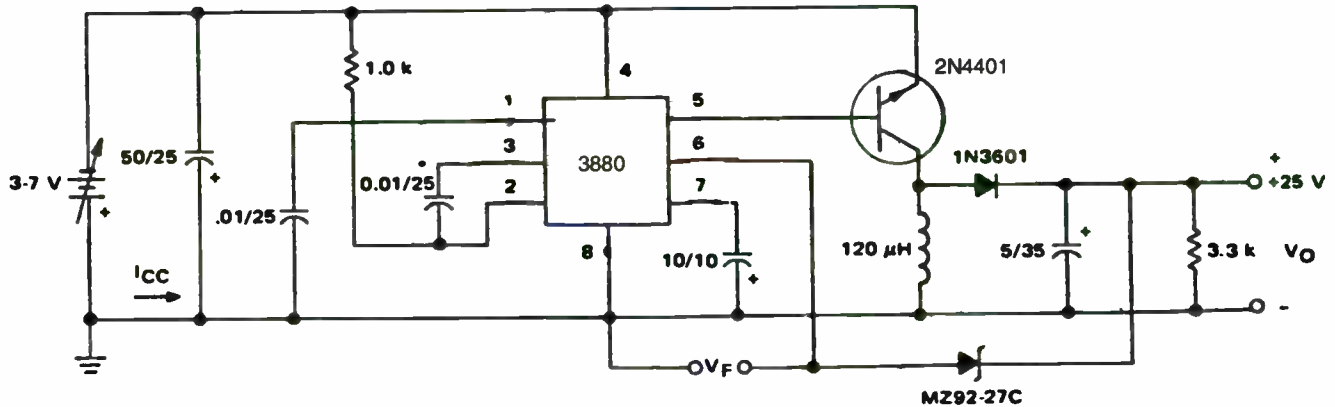


AC coupled noninverting amplifier

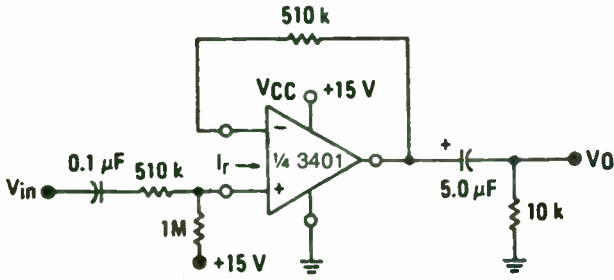


AC coupled inverting amplifier

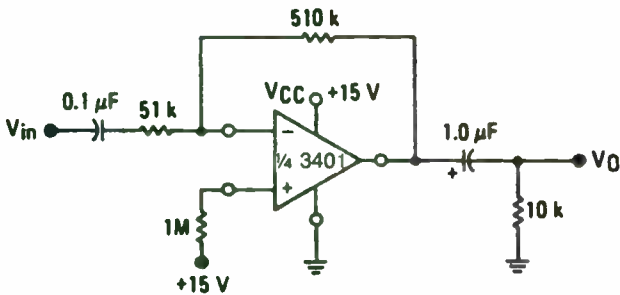
## 3380—EMITTER COUPLED INTEGRATED ASTABLE MULTIVIBRATOR



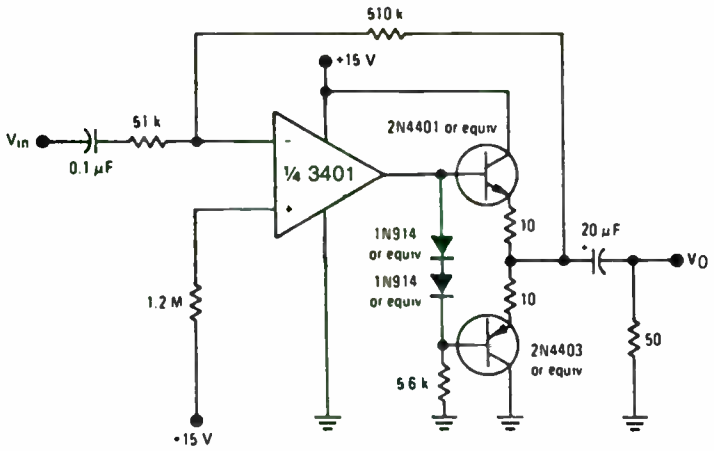
# 3401—QUAD OPERATIONAL AMPLIFIER



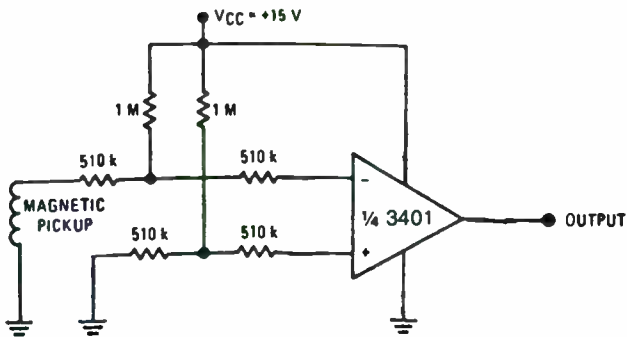
Noninverting amplifier



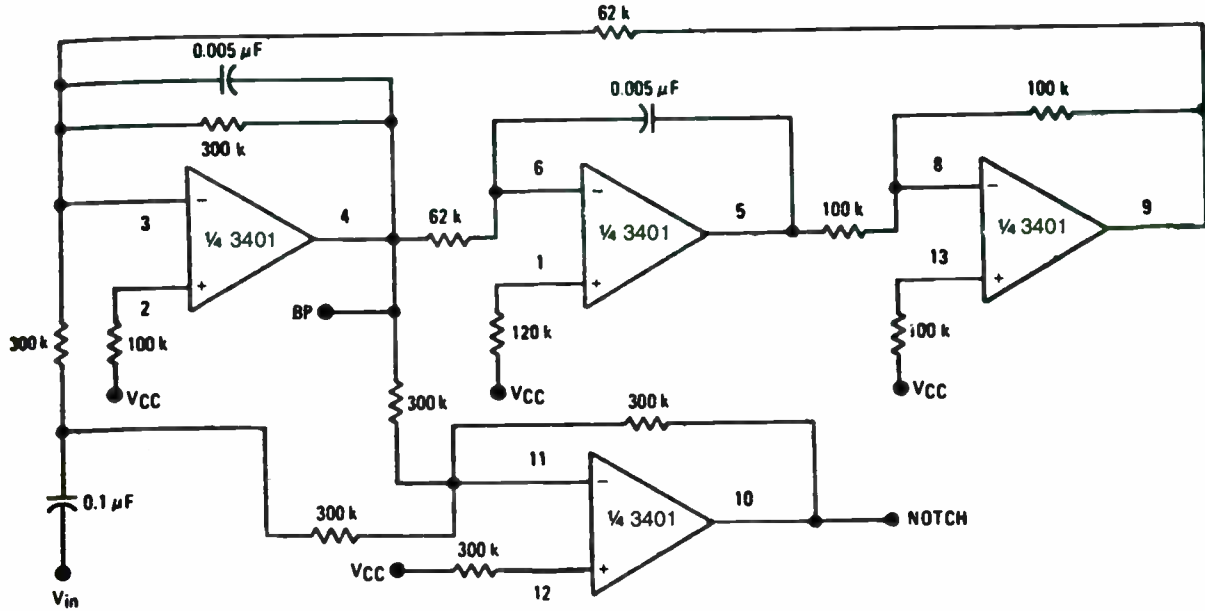
Inverting amplifier



Amplifier and driver for a 50-ohm line

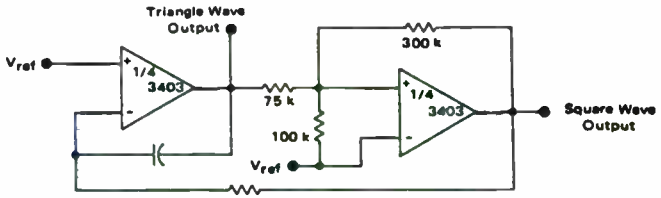


Zero crossing detector

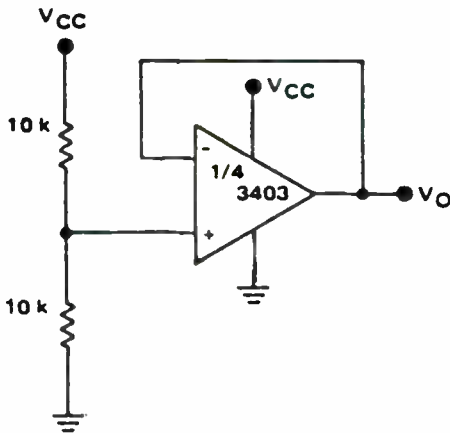


Bandpass and notch filter

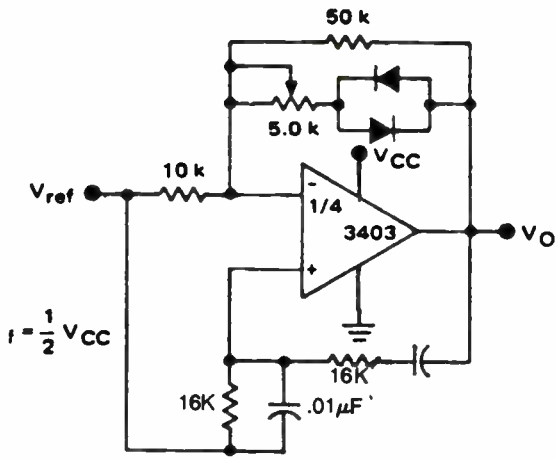
# 3403—LOW DISTORTION QUAD OPERATIONAL AMPLIFIER



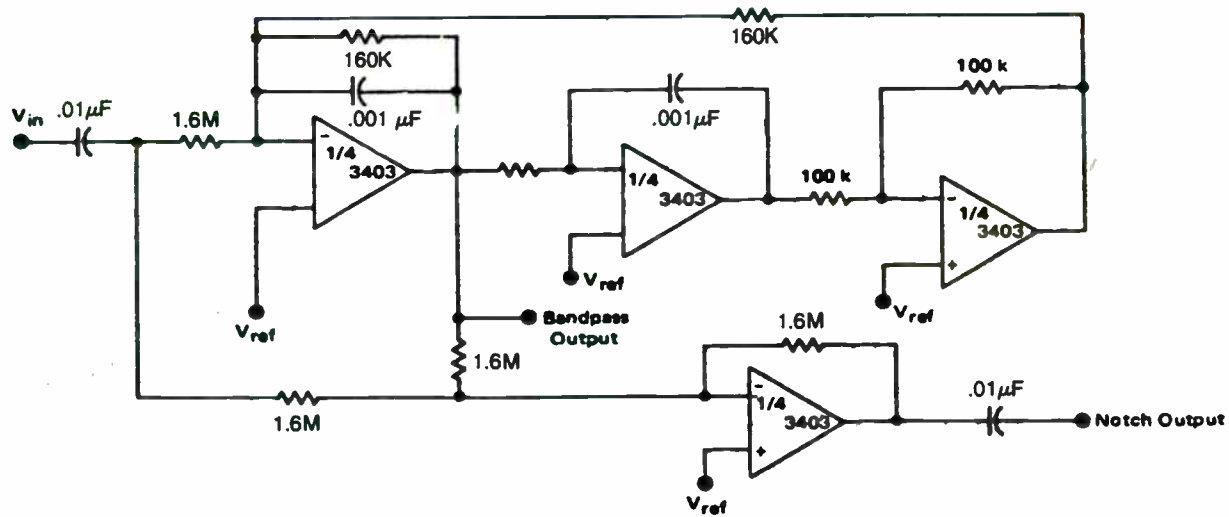
Function generator



Voltage reference

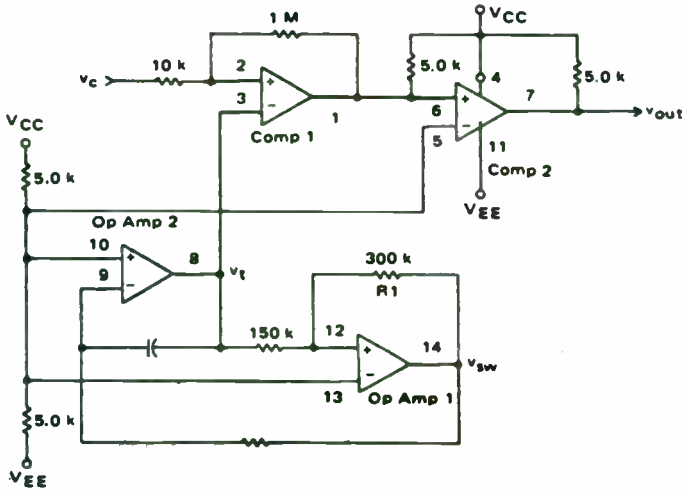


Wien bridge oscillator

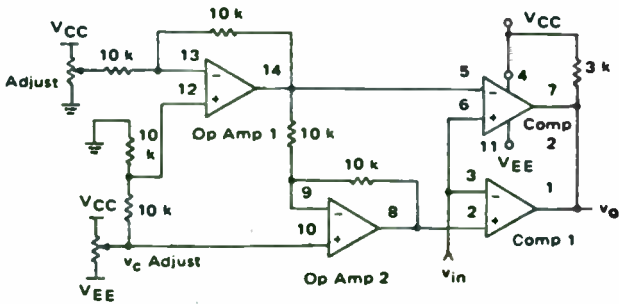




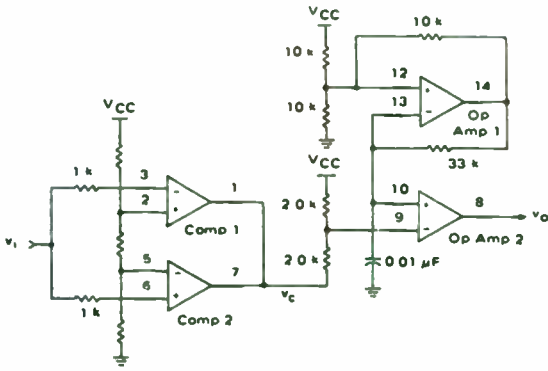
# 3405—DUAL OPERATIONAL AMPLIFIER/COMPARATOR



Pulse width modulator

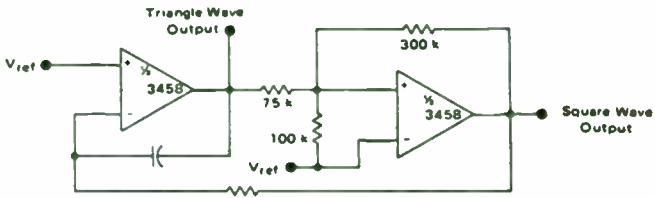


Window comparator

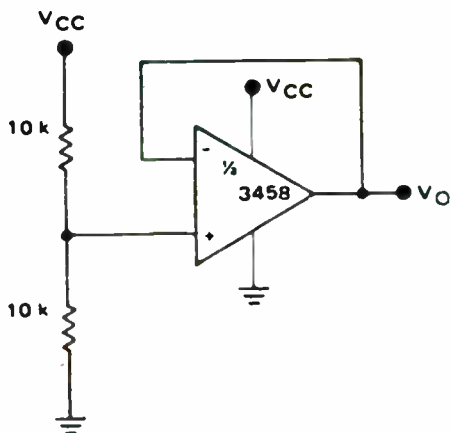


High/low limit alarm

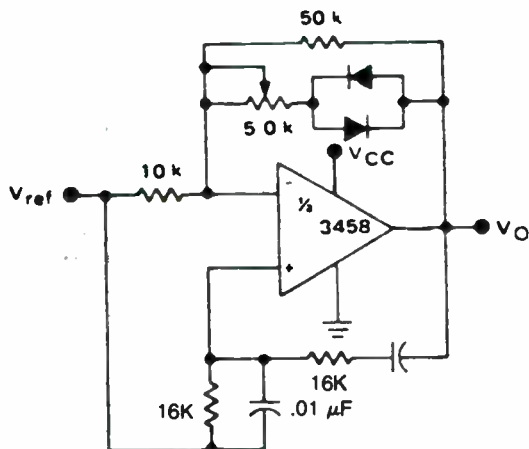
## 3458—COMPENSATED DUAL OPERATIONAL AMPLIFIER



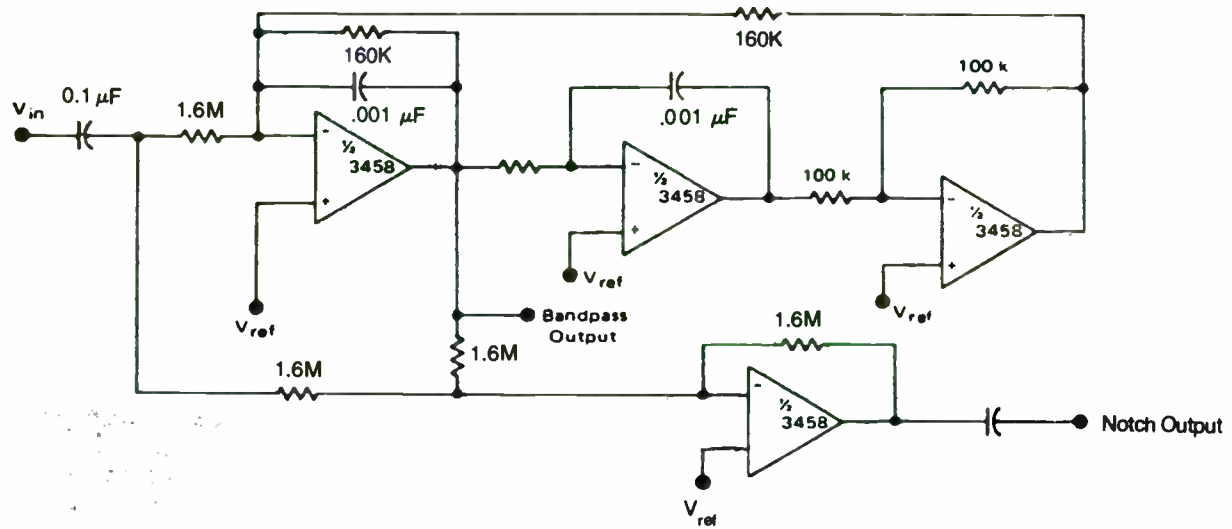
Function generator

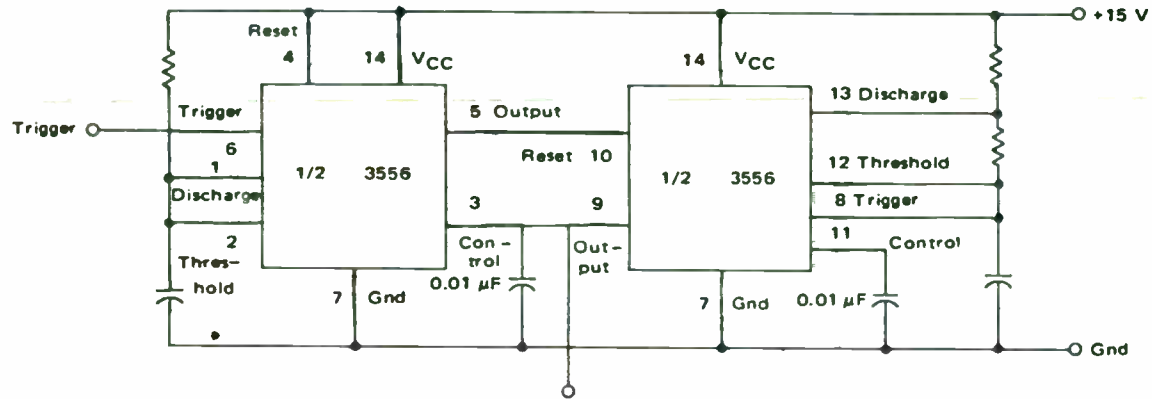


Voltage reference

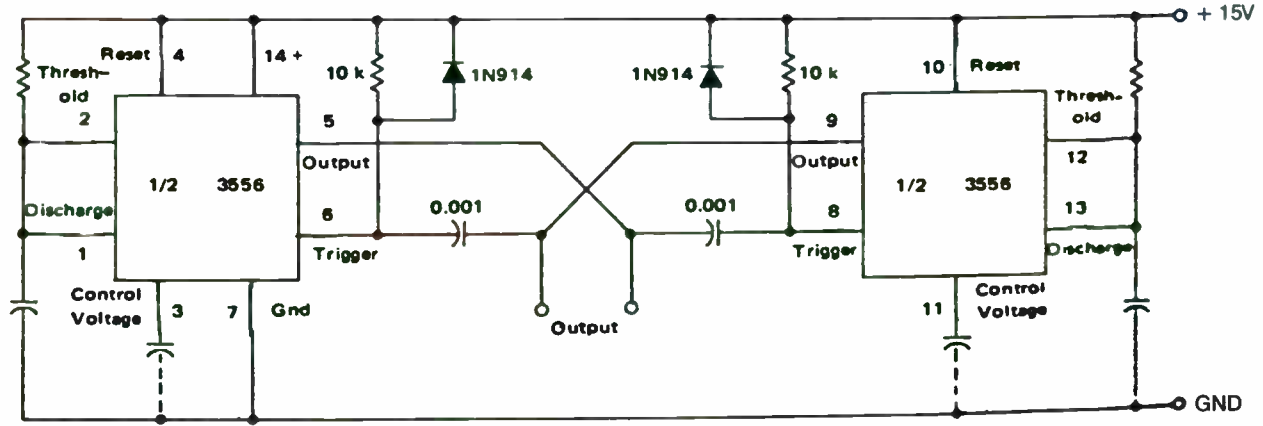


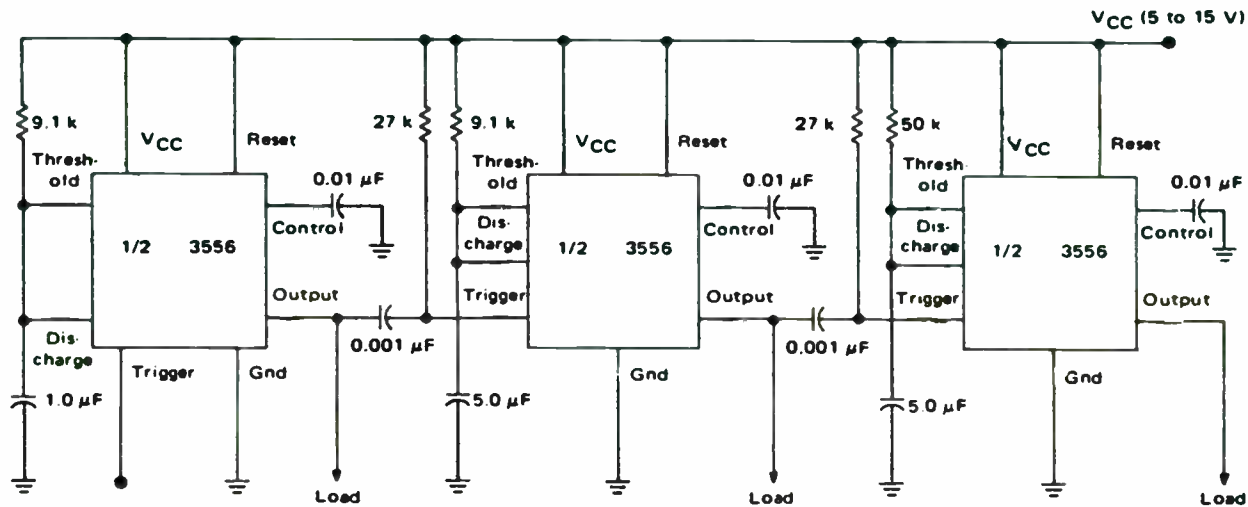
Wien bridge oscillator



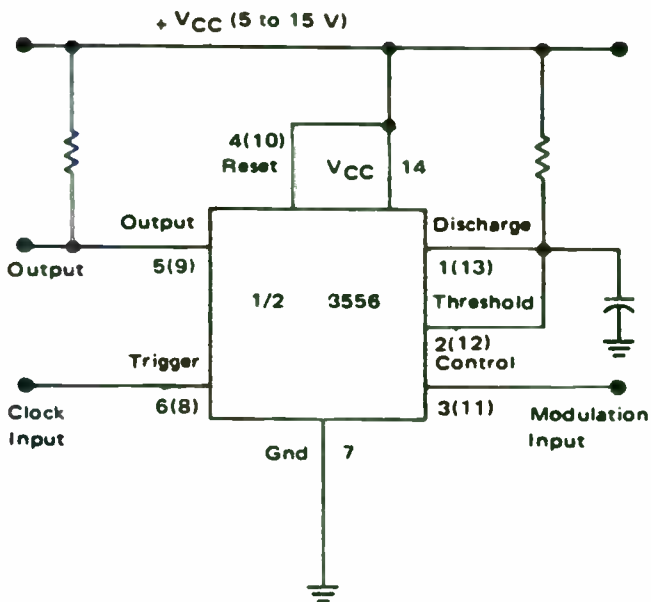
**3556—DUAL INTEGRATED TIMER**

Tone burst generator



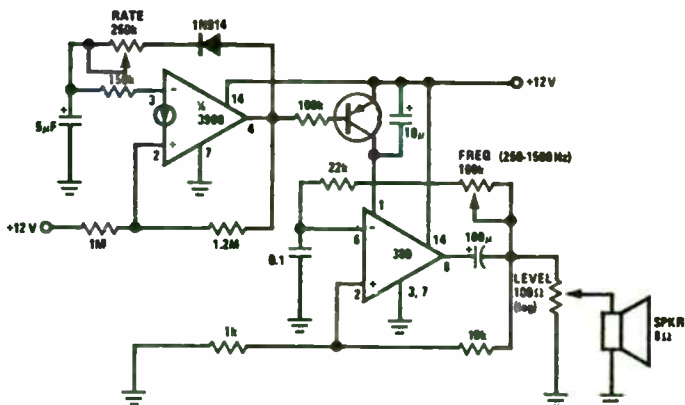


Sequential timing



Pulse width modulator

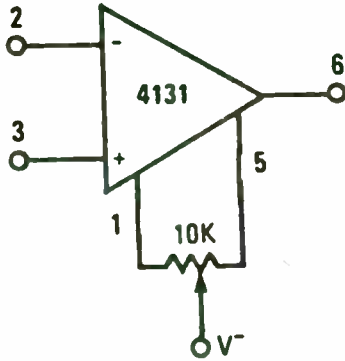
## 3900—INTEGRATED QUAD AMPLIFIER



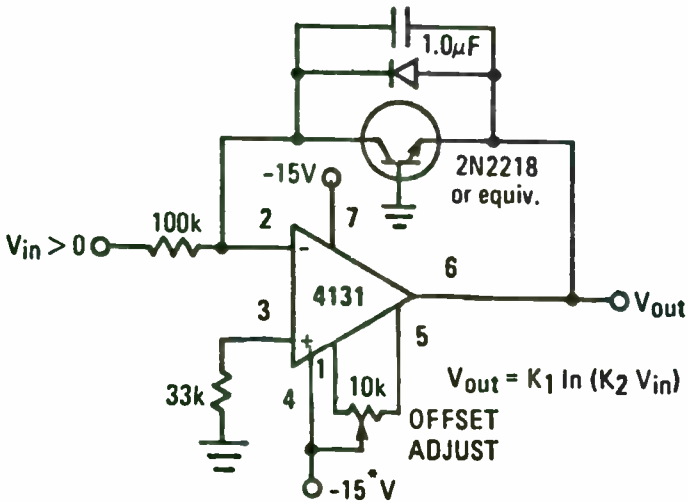
Siren with programmable frequency and rate adjustment



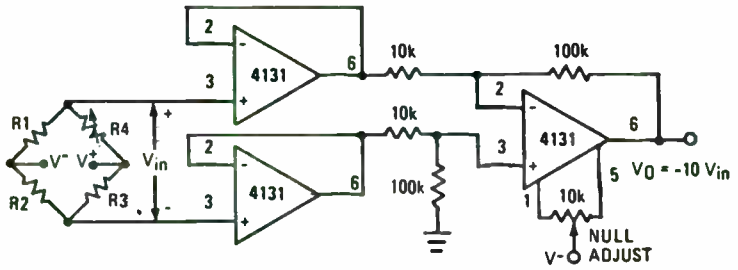
# 4131 — HIGH GAIN OPERATIONAL AMPLIFIER



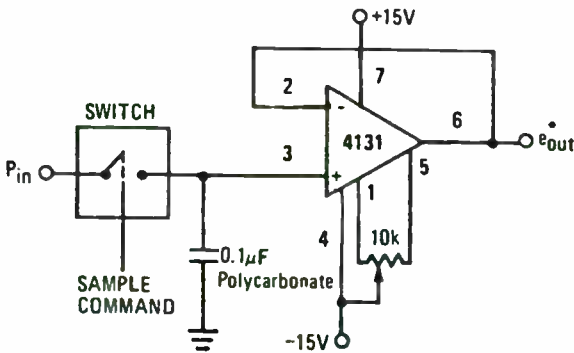
Voltage offset null circuit



Logarithmic amplifier

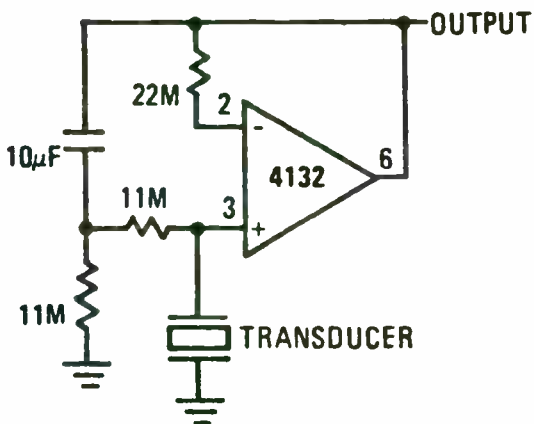


High impedance bridge amplifier

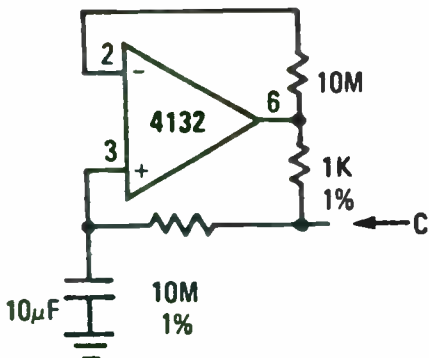


Low drift sample and hold

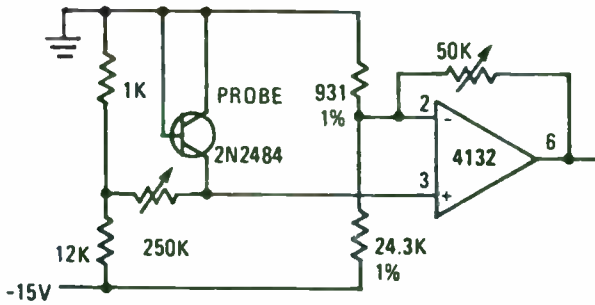
## 4132—MICROPOWER OPERATIONAL AMPLIFIER



Amplifier for Piezoelectric transducers

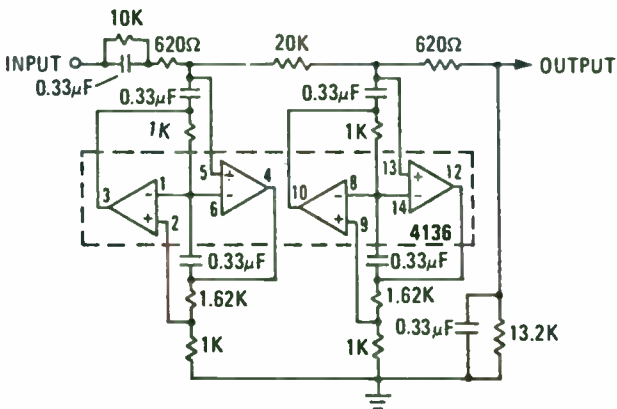


Capacitance multiplier

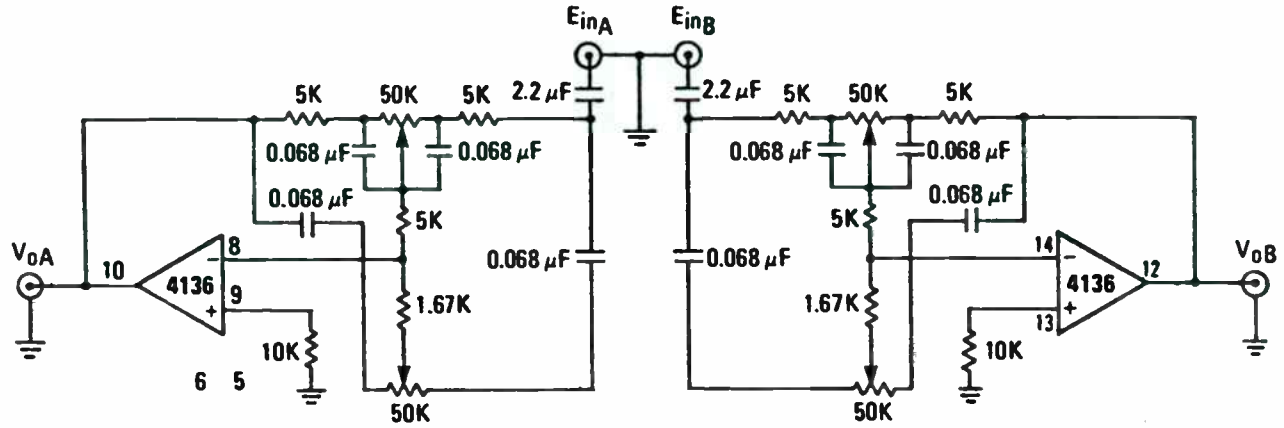


Temperature probe

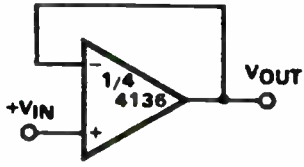
## 4136—QUAD 741 OPERATIONAL AMPLIFIER



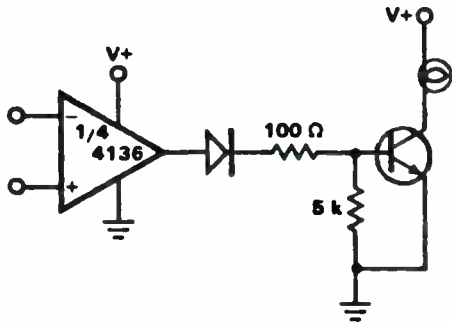
400 Hz lowpass butterworth active filter



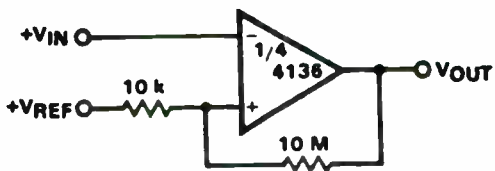
Stereo tone control



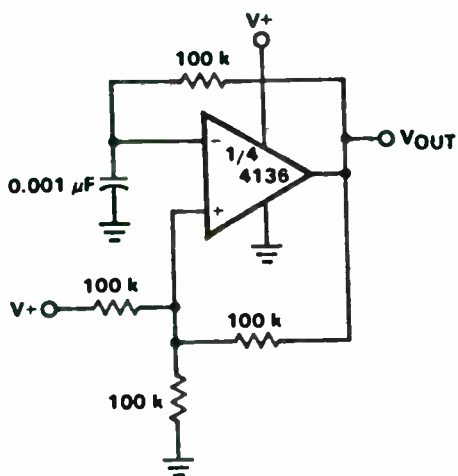
Voltage follower



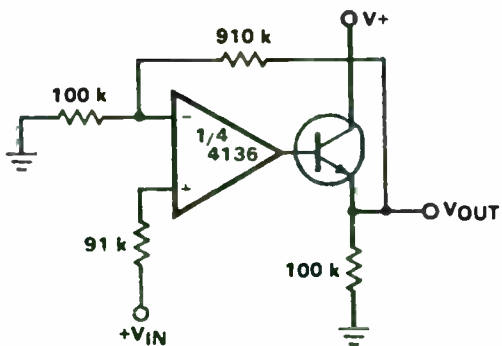
Lamp driver



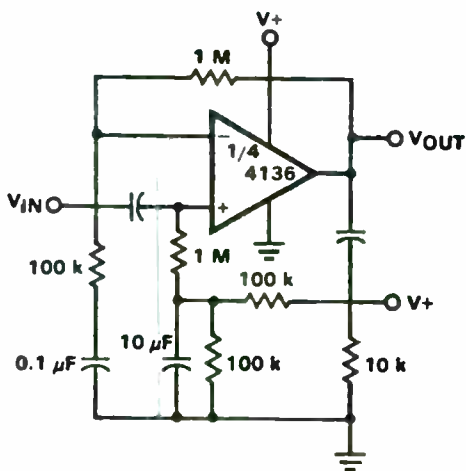
Comparator with hysteresis



Squarewave oscillator

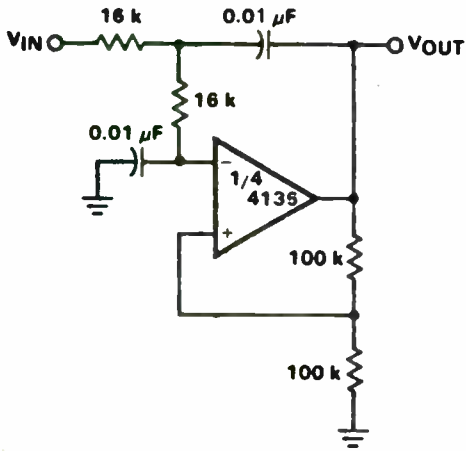


Power amplifier

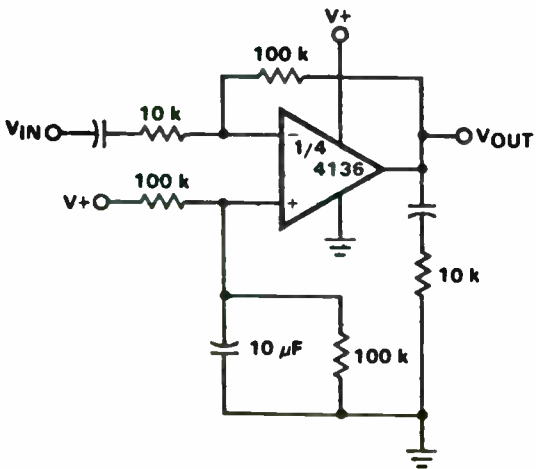


AC coupled noninverting amplifier

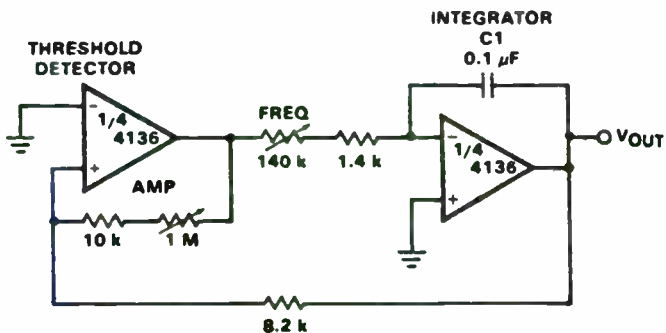




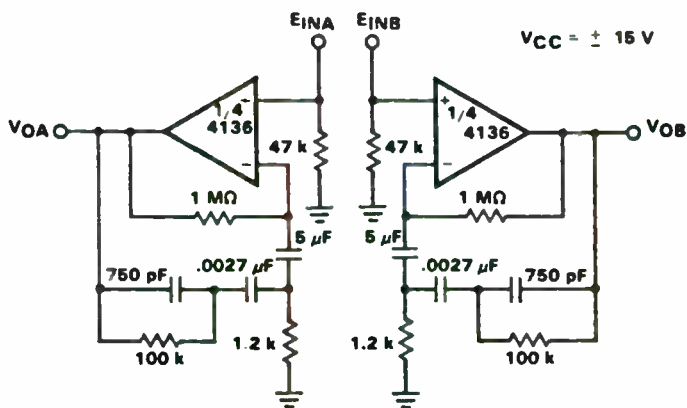
DC coupled 1 kHz low-pass active filter



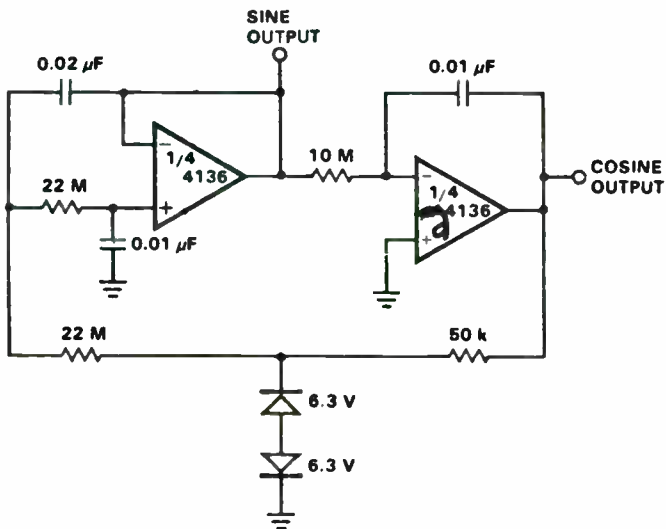
AC coupled inverting amplifier



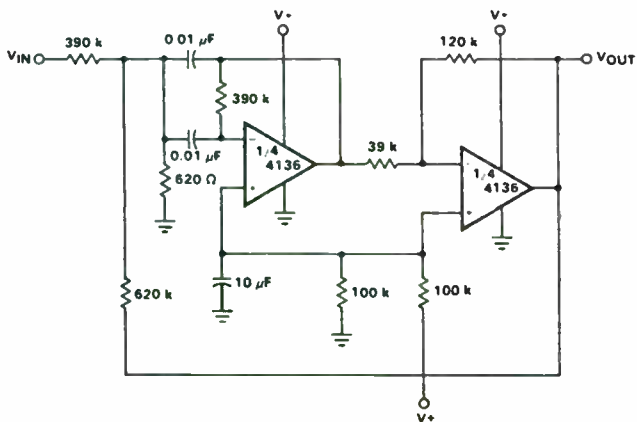
Triangular-wave generator



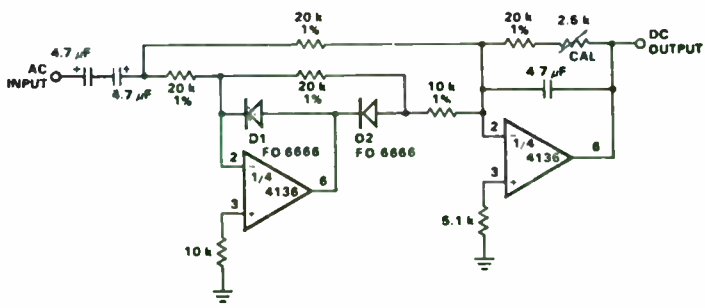
RIAA preamplifier



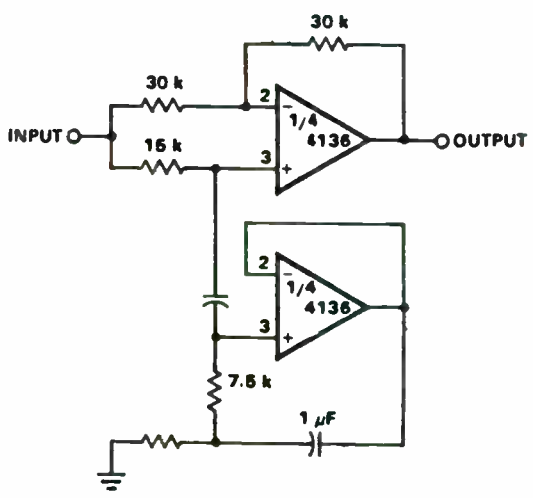
Low frequency sine wave generator with quadrature output



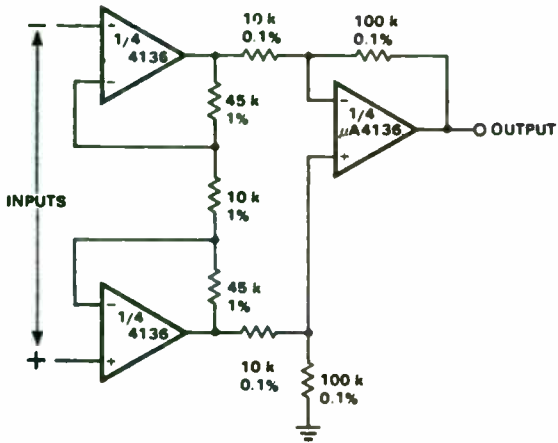
1 kHz bandpass active filter



Full-wave rectifier and averaging filter

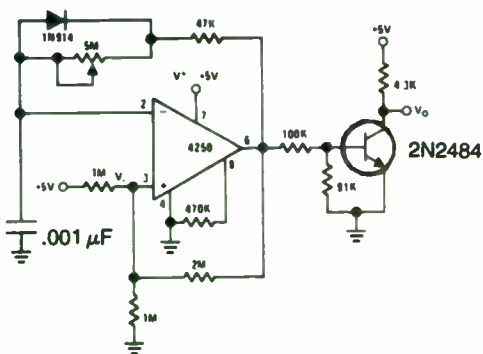


Notch filter

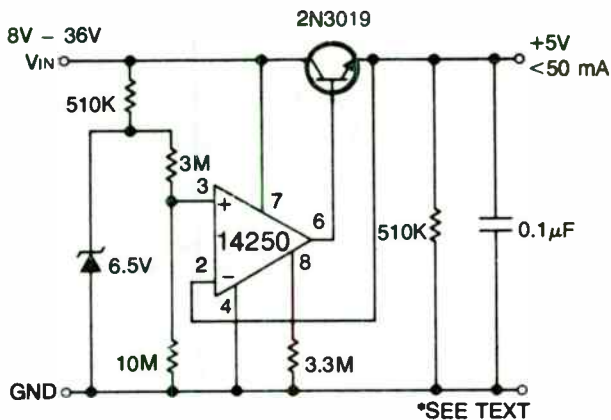


Differential input instrumentation amplifier with high common mode rejection

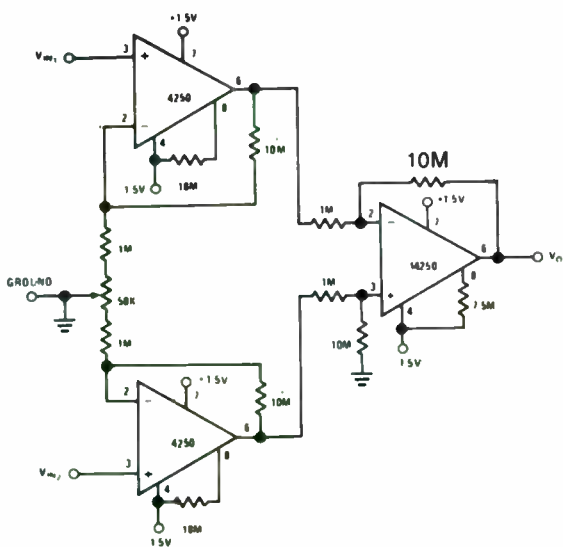
## 4250—PROGRAMMABLE OPERATIONAL AMPLIFIER



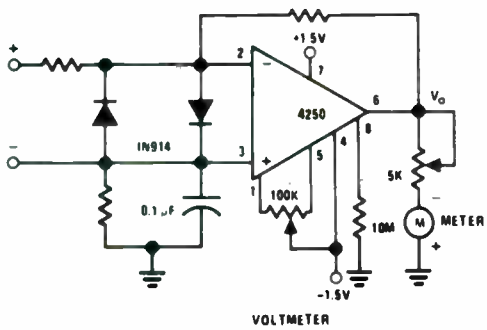
Pulse generator



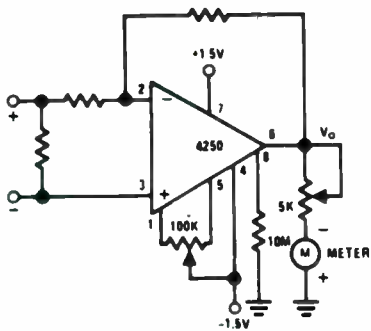
.350  $\mu$ W quiescent drain 5 volt regulator



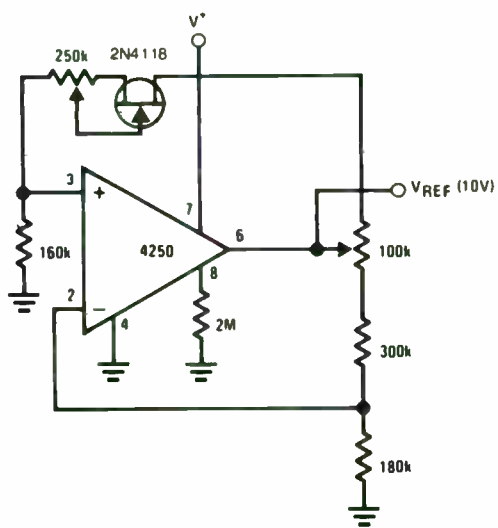
Instrumentation amplifier



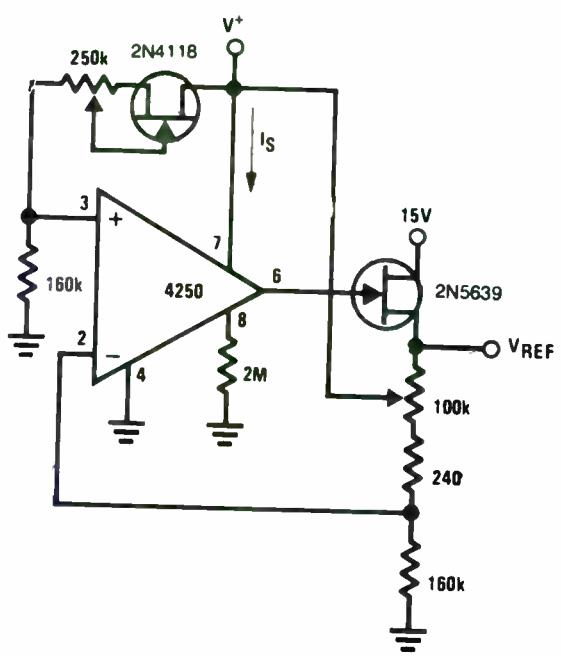
Voltmeter



Ammeter



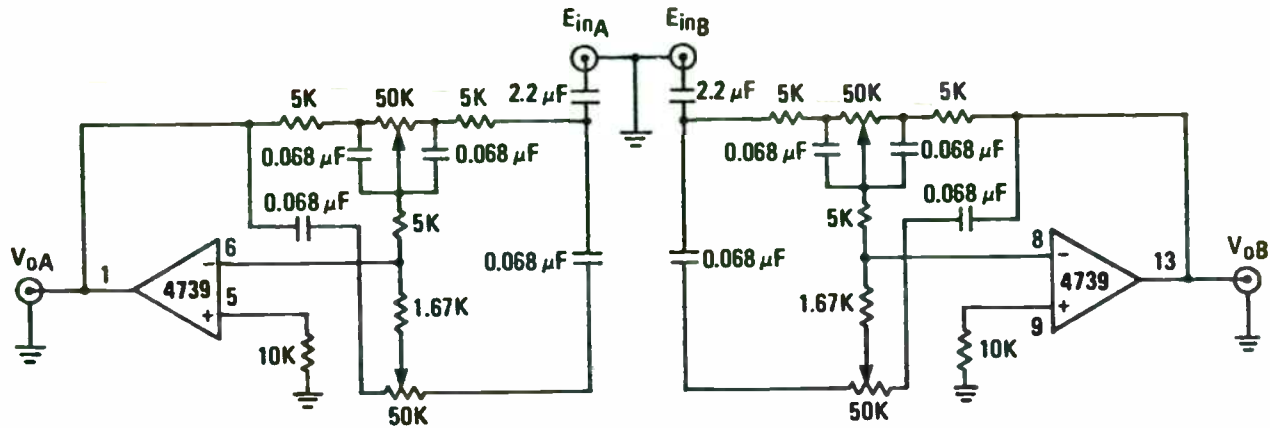
Basic voltage reference



Improved voltage reference

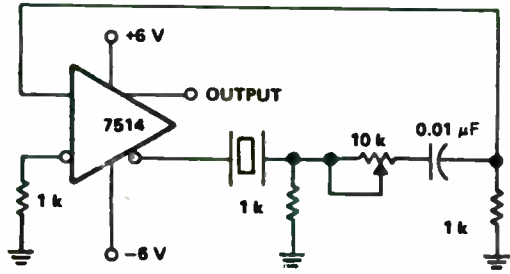


## 4739—DUAL LOW-NOISE OPERATIONAL AMPLIFIER

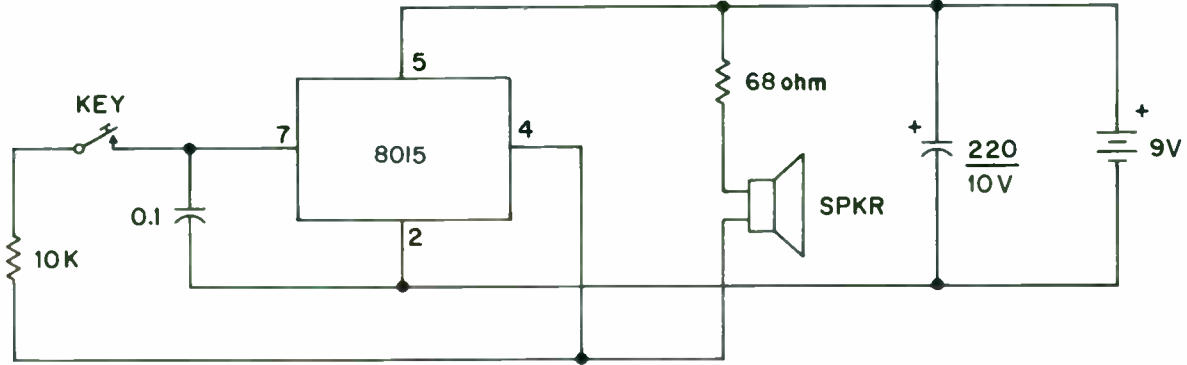


Stereo tone control

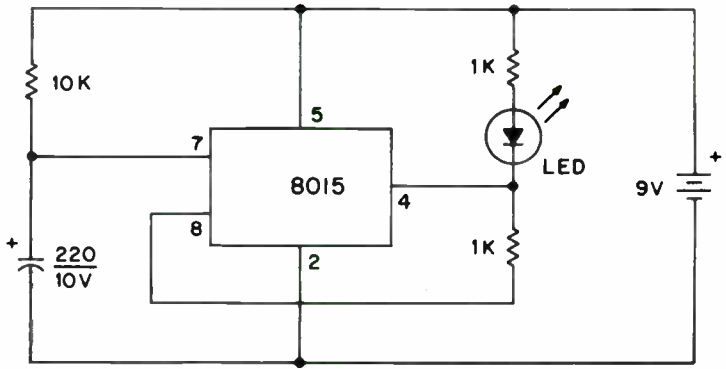
# 7514—HIGH GAIN OPERATIONAL AMPLIFIER



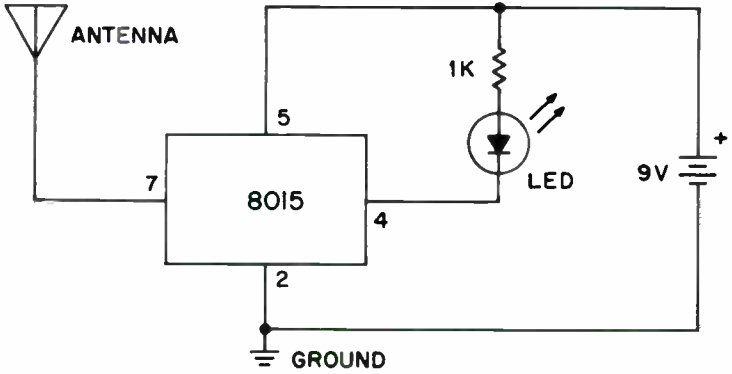
Crystal oscillator with variable feedback

**8015—INTEGRATED SCHMITT TRIGGER**

Morse code practice oscillator

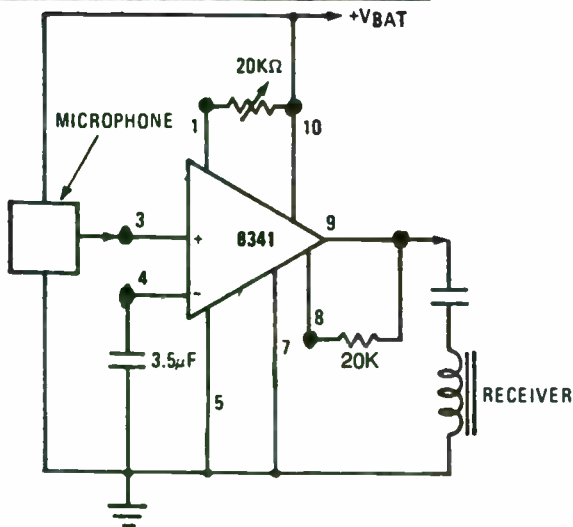


LED flasher

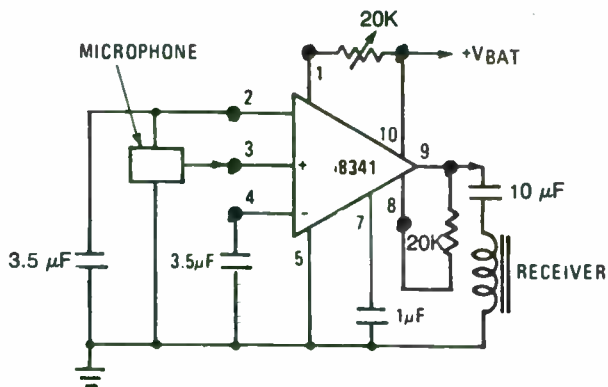


RF energy detector

# 8341 — HIGH INPUT IMPED- ANCE INTEGRATED AUDIO AMPLIFIER

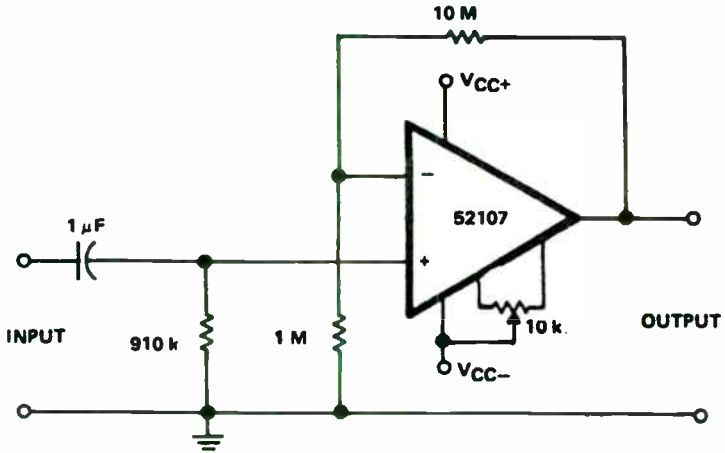


Basic amplifier



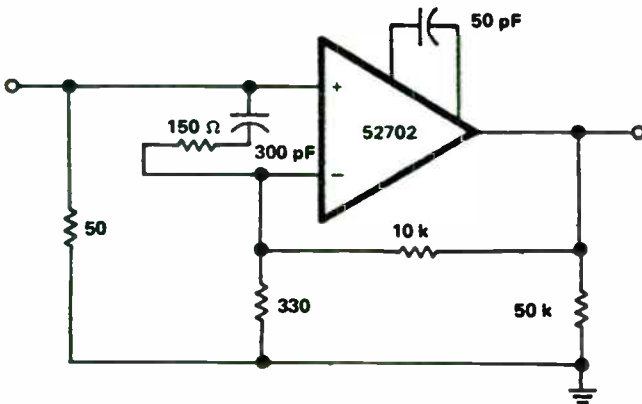
Amplifier with AGC

## 52107—LOW INPUT OFFSET OPERATIONAL AMPLIFIER

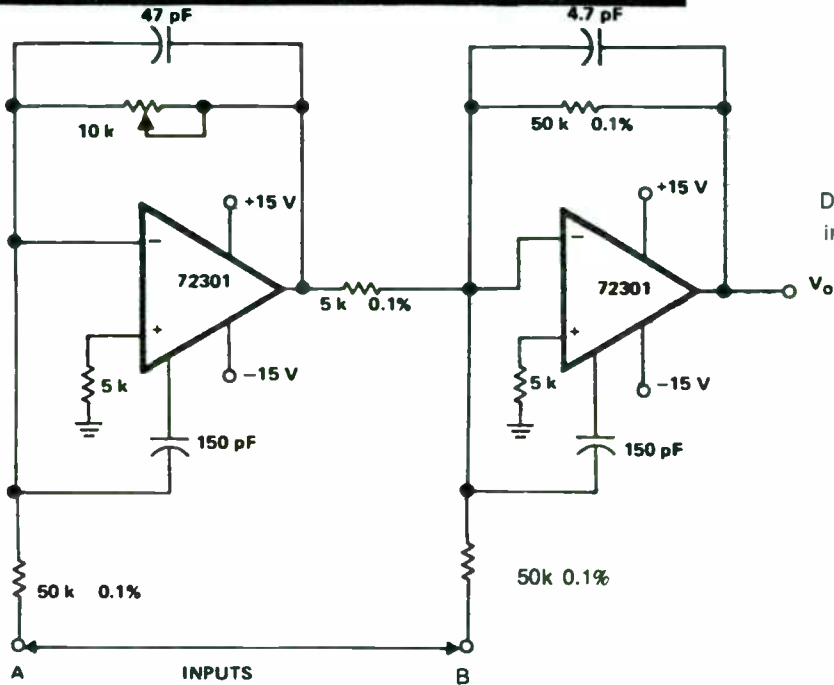


Noninverting amplifier

## 52702—INTERNALLY COMPENSATED OPERATIONAL AMPLIFIER

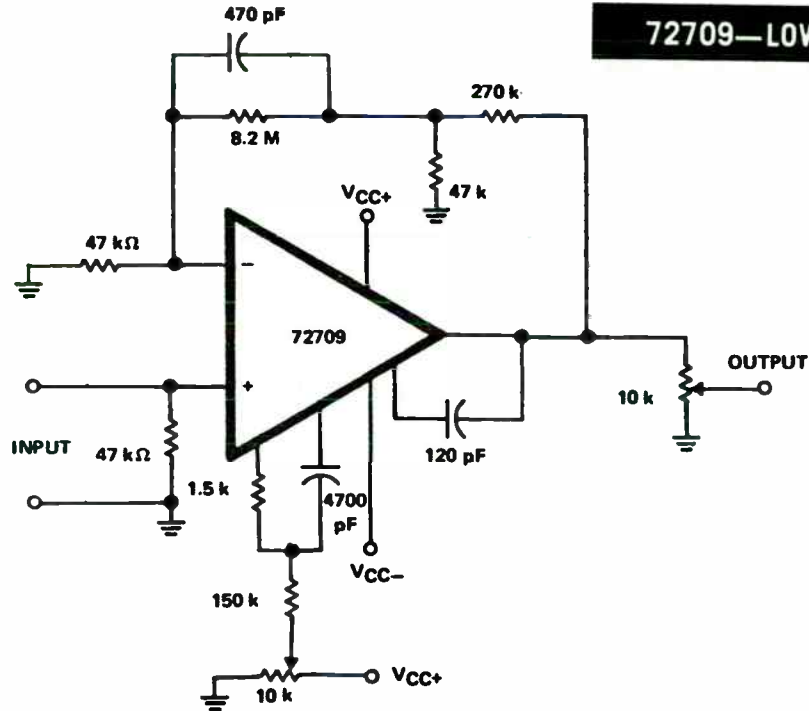


30-dB, 10-MHz amplifier

**72301—INTERNALLY COMPENSATED OPERATIONAL AMPLIFIER**

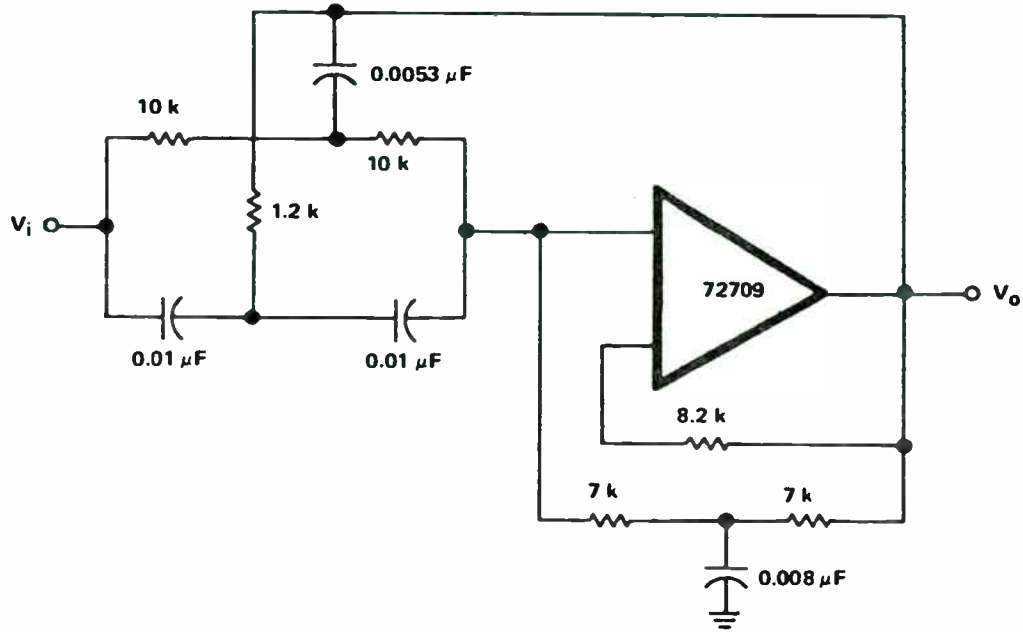
Differential-amplifier with  $\pm 100$ -V  
input-common-mode range

## 72709—LOW INPUT NOISE OPERATIONAL AMPLIFIER

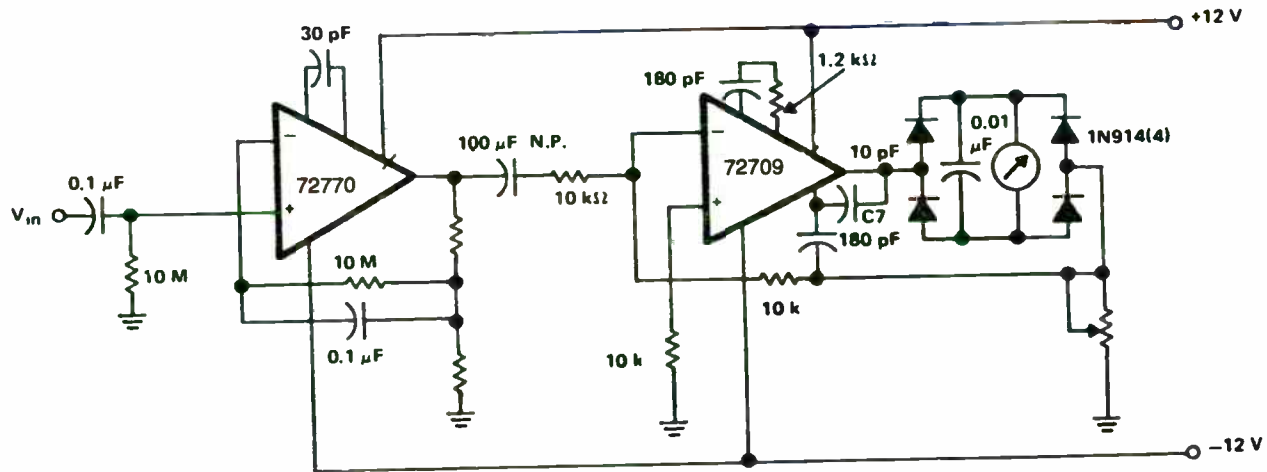


60-dB preamplifier for a magnetic tape output





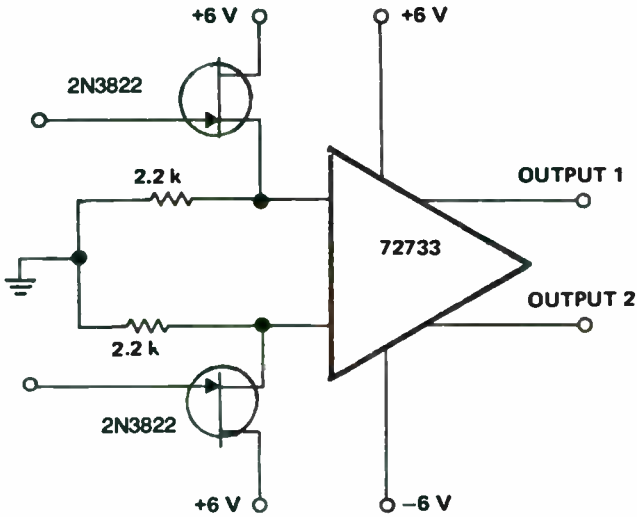
Band-reject active filter



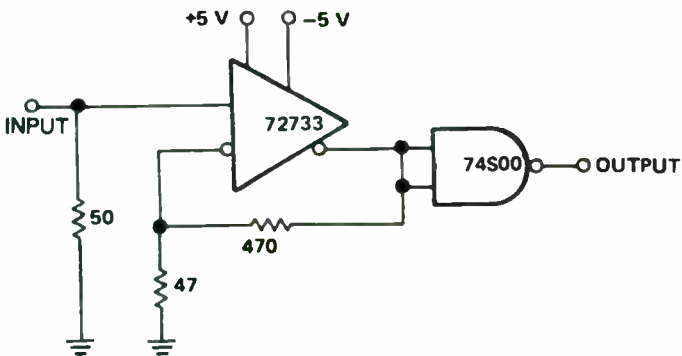
355

AC millivoltmeter

# 72733—WIDEBAND HIGH INPUT IMPEDANCE OPERATIONAL AMPLIFIER

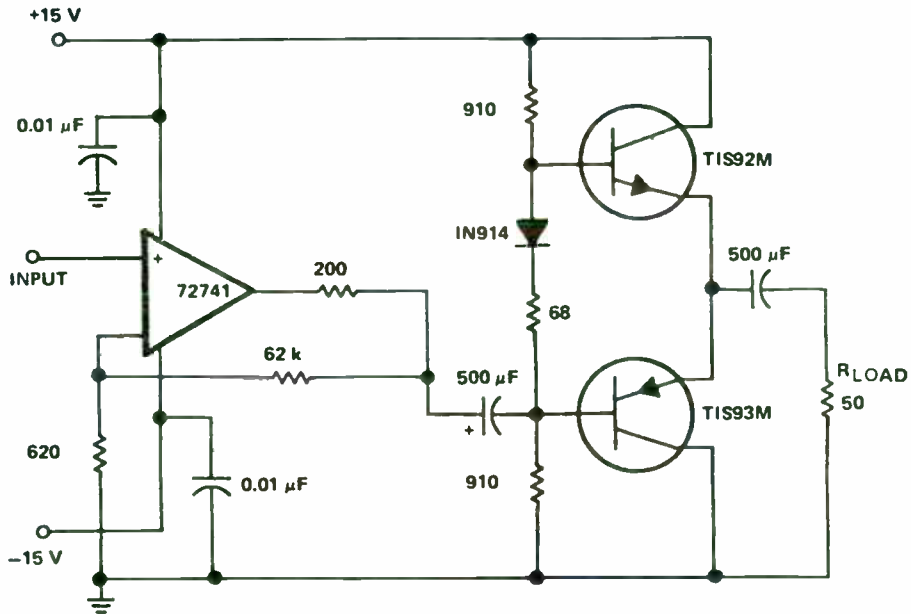


High-input-impedance wideband amplifier

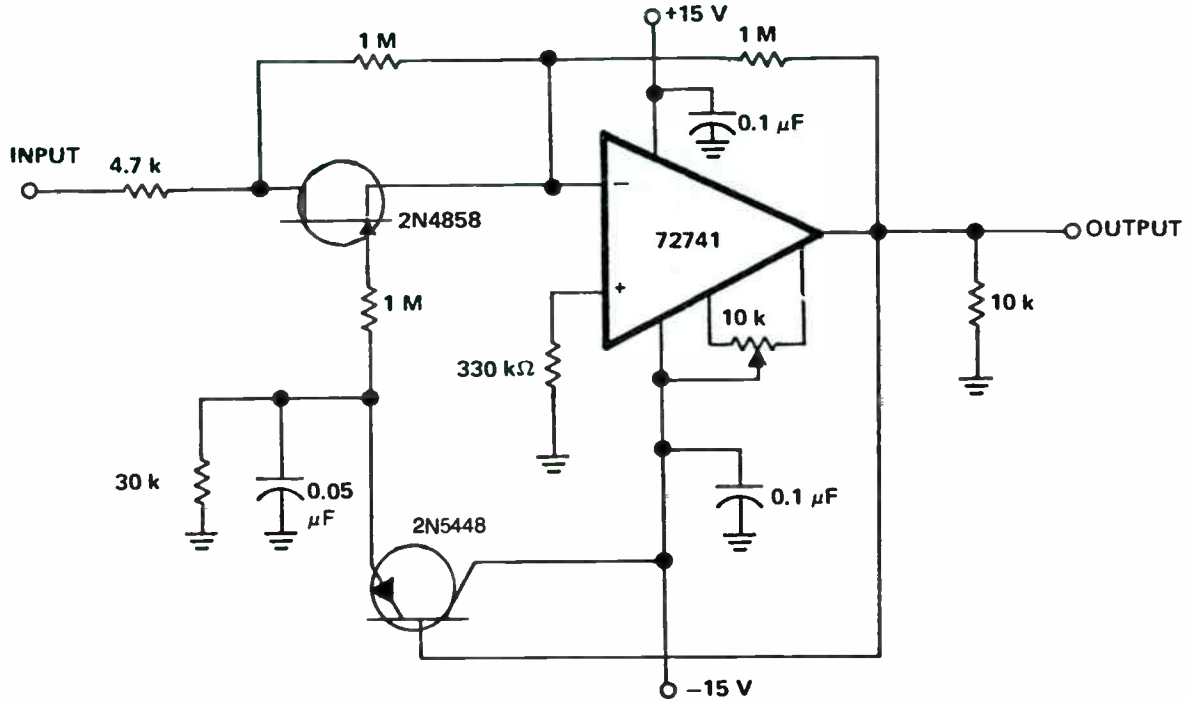


Fast Schmitt trigger using a video amplifier

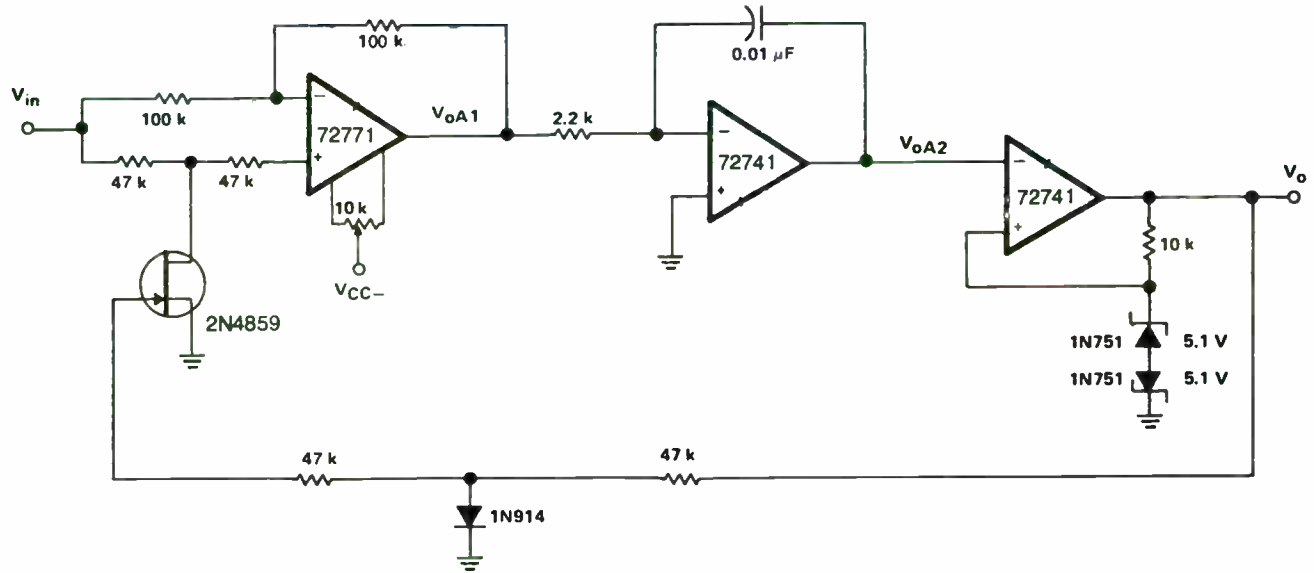
# 72741—INTERNALLY COMPENSATED OPERATIONAL AMPLIFIER



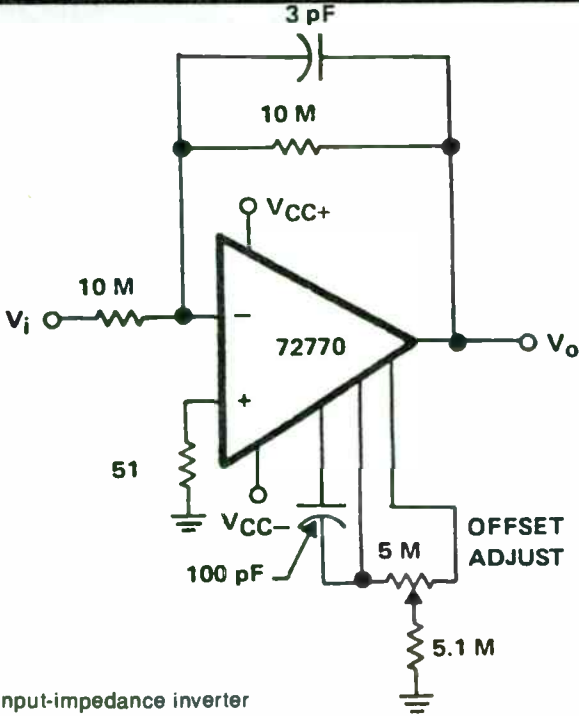
500-mW audio amplifier



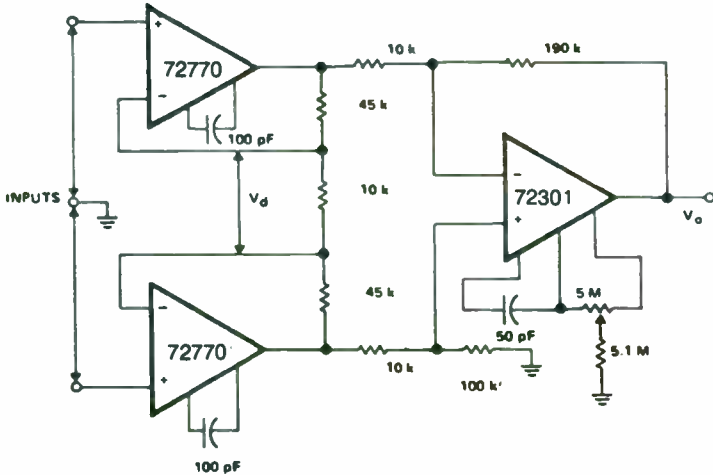
Audio amplifier with AGC



# 72770—SUPER BETA OPERATIONAL AMPLIFIER

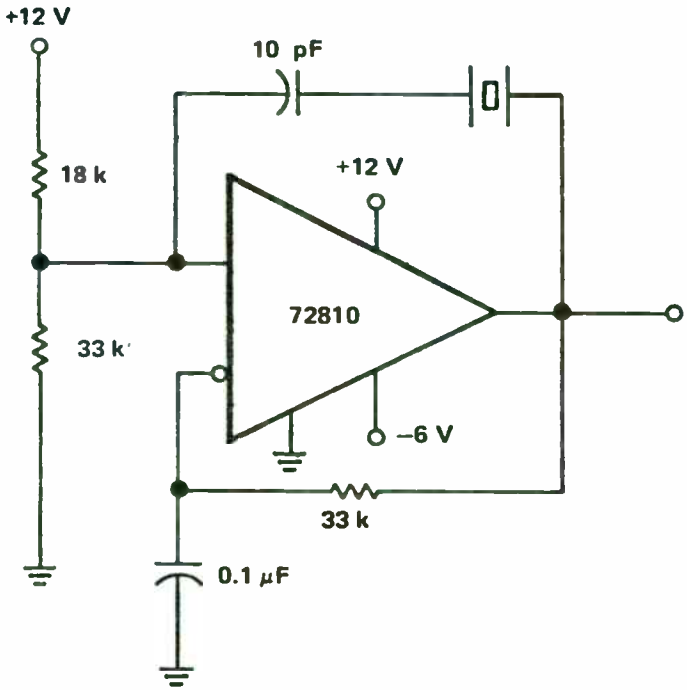


High-input-impedance inverter



High-input-impedance differential amplifier with improved common-mode rejection

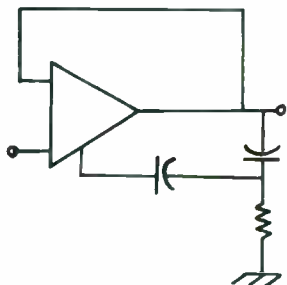
## 72810—5 MHz OPERATIONAL AMPLIFIER



Crystal-controlled logic generator



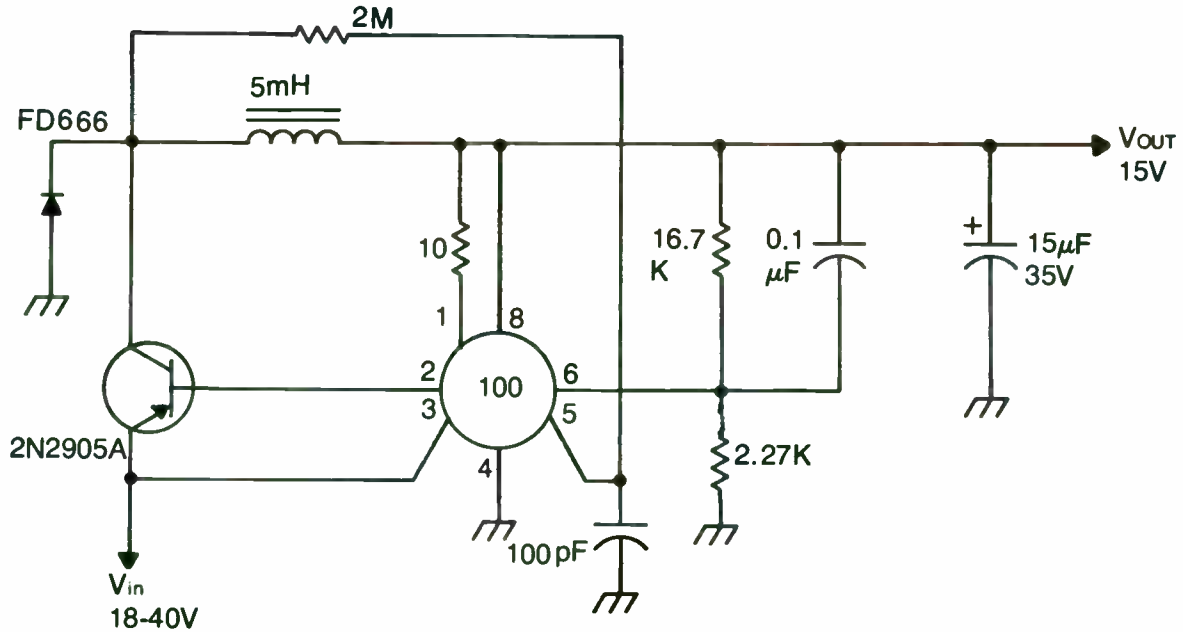
## Part II

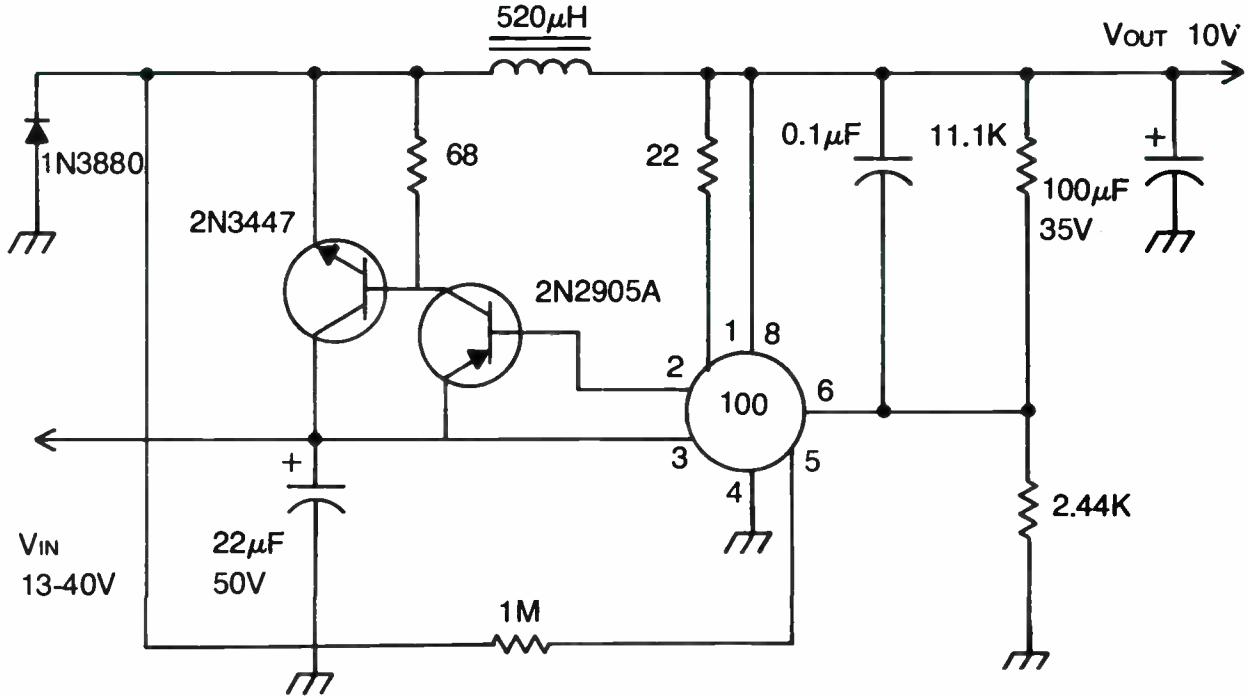


## Voltage Regulators

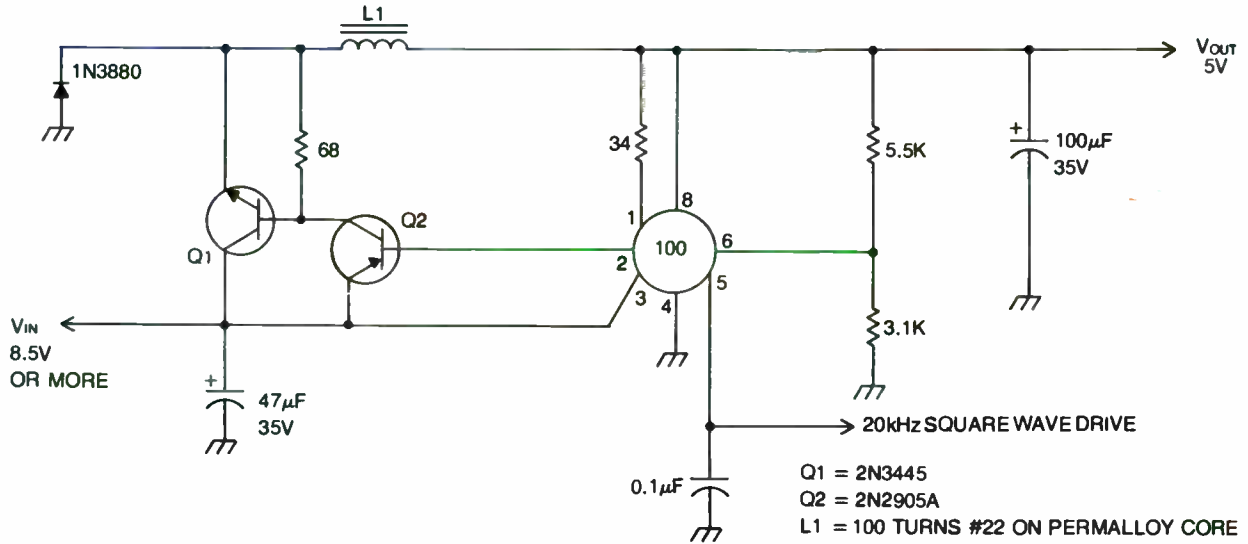
It wasn't too long ago when voltage regulator circuits involved several transistors (or tubes!), a few diodes, resistors, capacitors and a lot of space and cost. Now a single chip replaces all that.

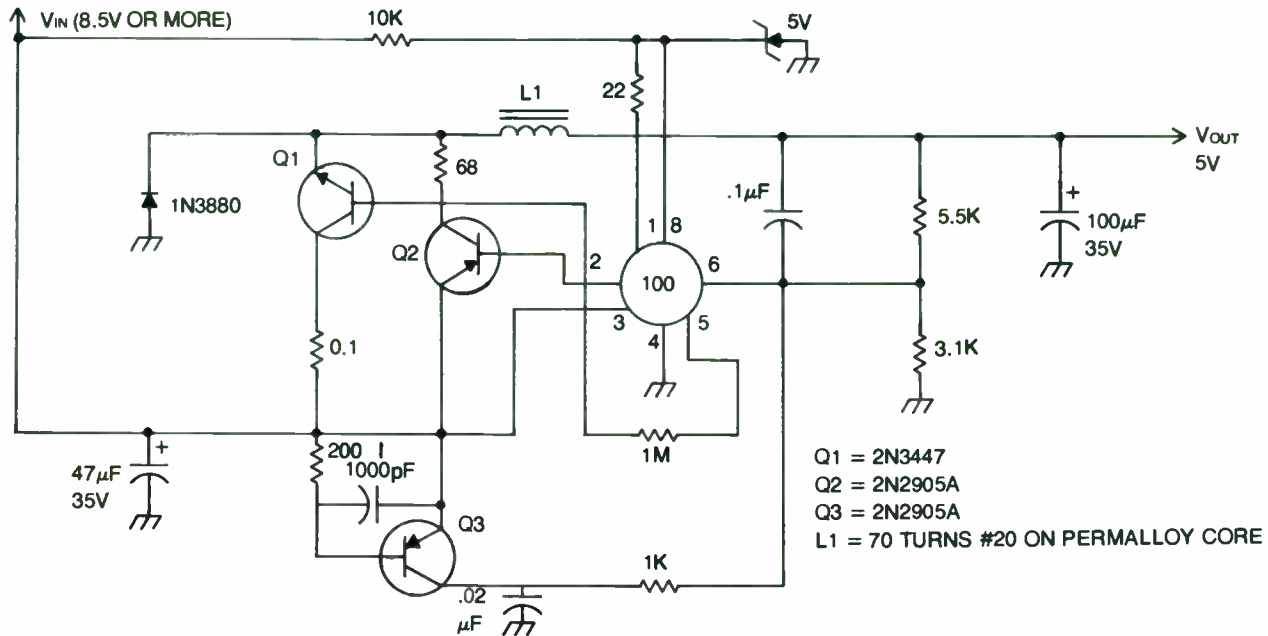
# 100—INTEGRATED VOLTAGE REGULATOR





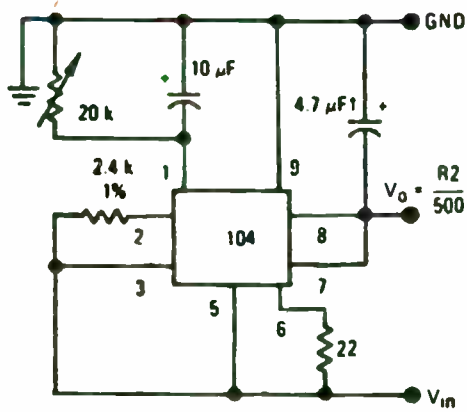
Switching regulator delivering in excess of 500 mA





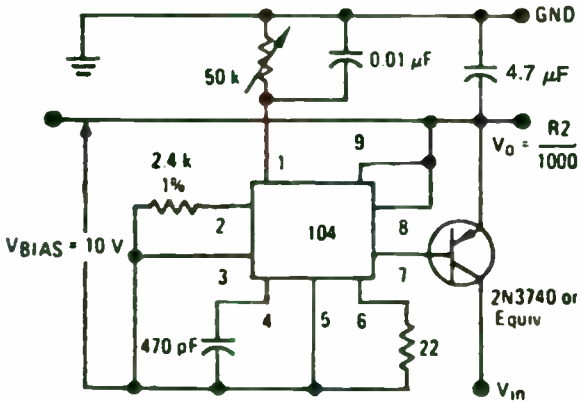
Switching regulator with overload/short-circuited output protection

# 104—NEGATIVE VOLTAGE REGULATOR



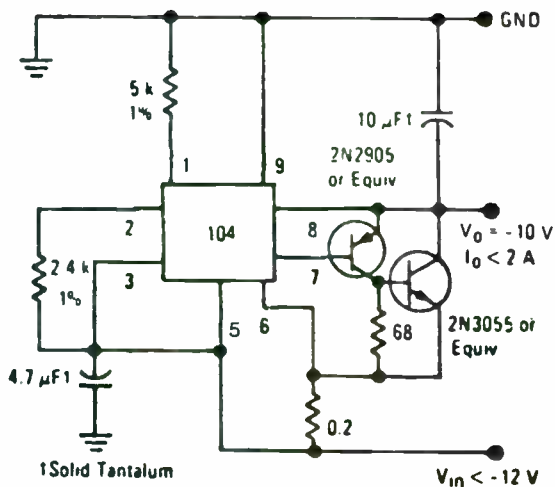
1Solid Tantalum  
 Trim R1 for exact  
 scale factor

Basic regulator circuit



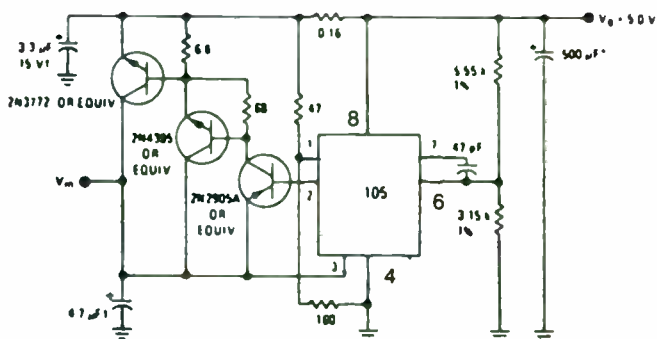
1Solid Tantalum

Separate bias supply operation

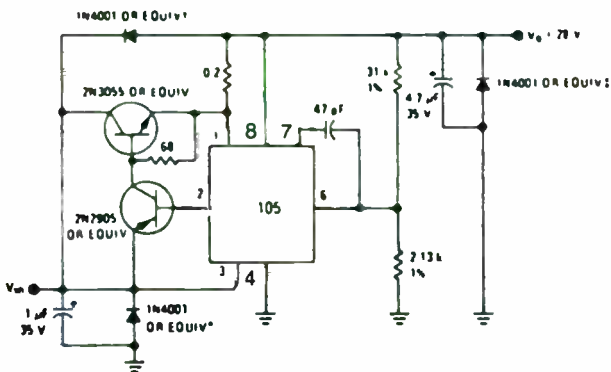


High current regulator

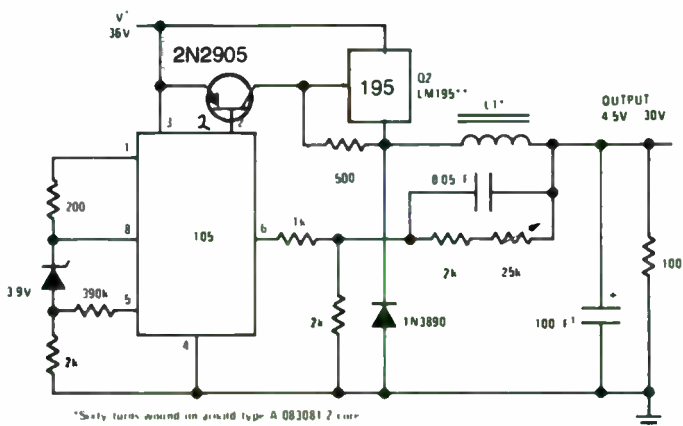
## 105—POSITIVE VOLTAGE REGULATOR



10 amp regulator with foldback current limiting



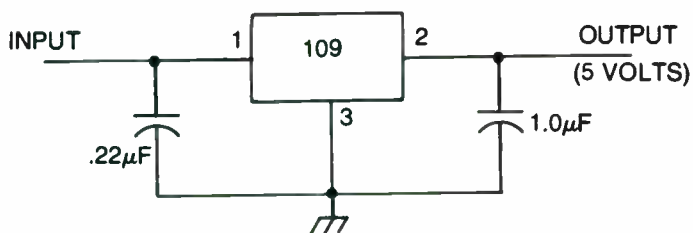
1.0 amp regulator with protective diodes



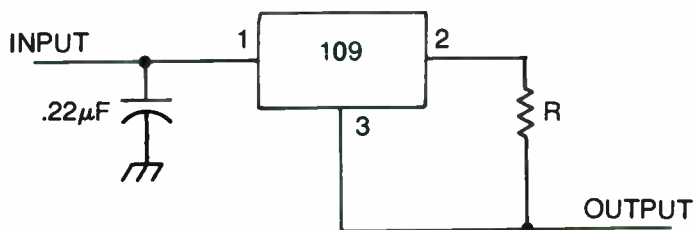
6 amp variable output switching regulator



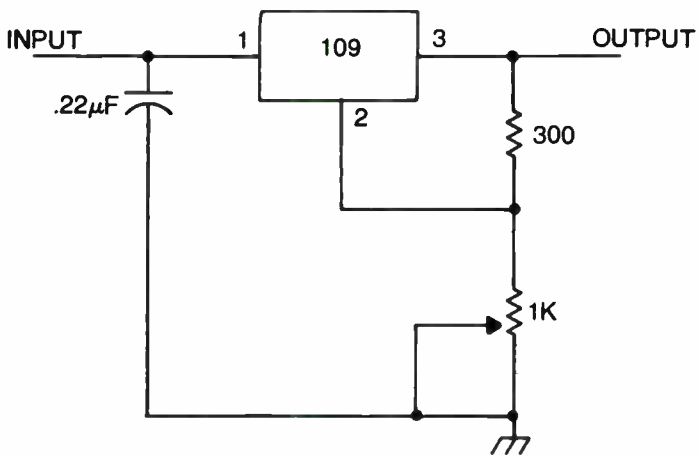
## 109—5 VOLT INTEGRATED VOLTAGE REGULATOR



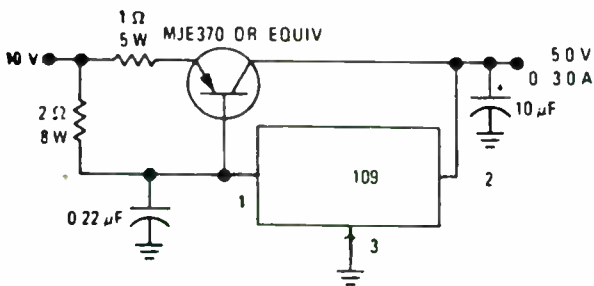
Fixed 5 volt regulator



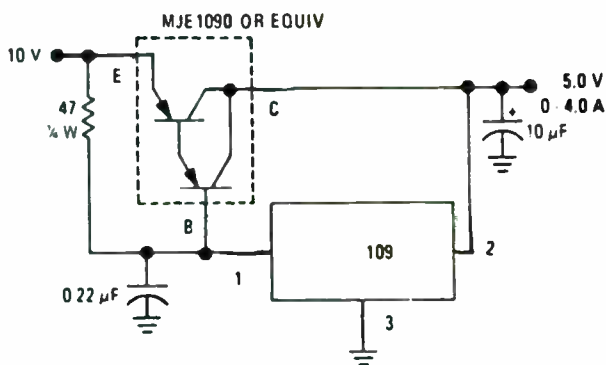
Current regulator (output current varies with value of resistor R)



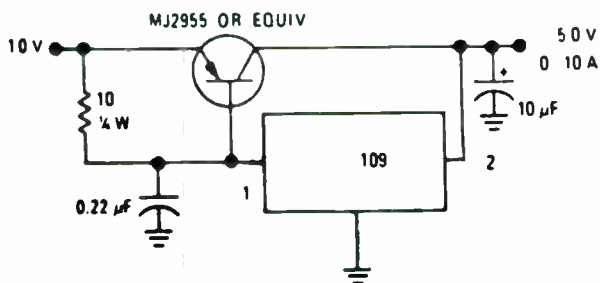
Regulator with adjustable output



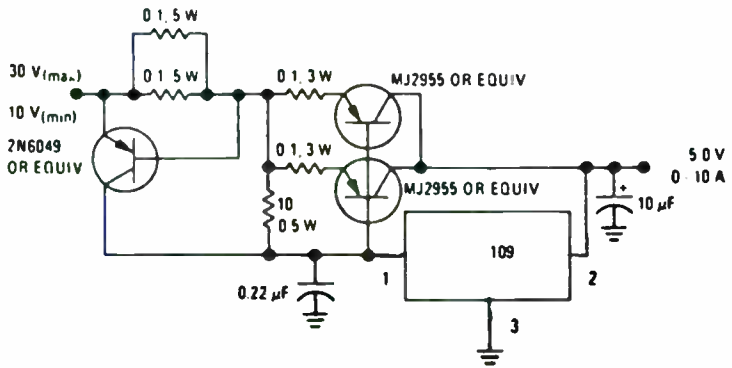
5.0-volt, 3.0-ampere regulator (with plastic boost transistor)



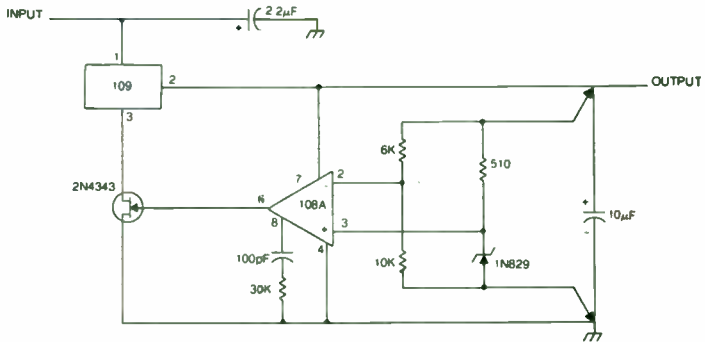
5.0 volt, 4.0-ampere transistor (with plastic Darlington boost transistor)



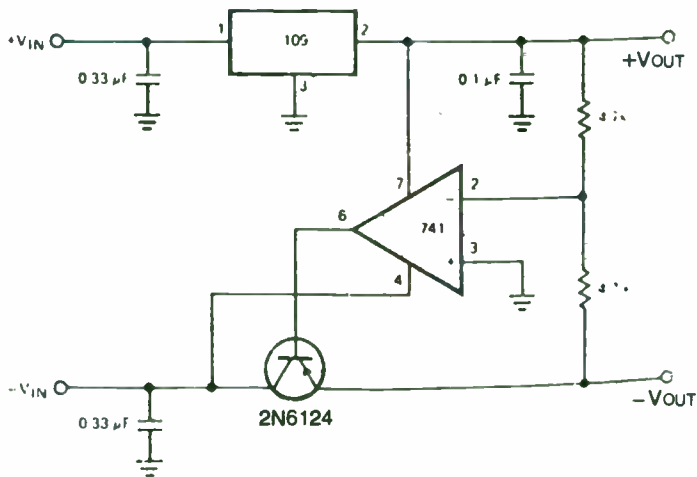
5.0-volt, 10-ampere regulator



5.0-volt, 10-ampere regulator (with short-circuit current limiting for safe-area protection of pass transistors)

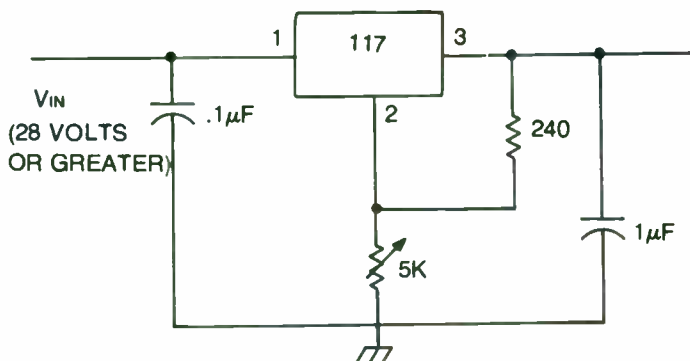


High stability (0.01%) regulator

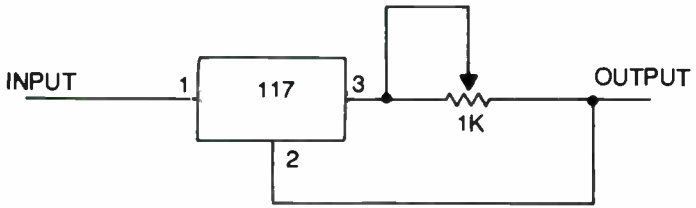


Tracking voltage regulator

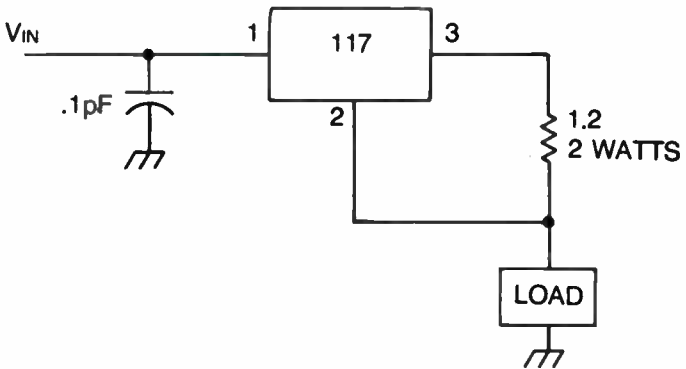
## 117—INTEGRATED ADJUSTABLE VOLTAGE REGULATOR



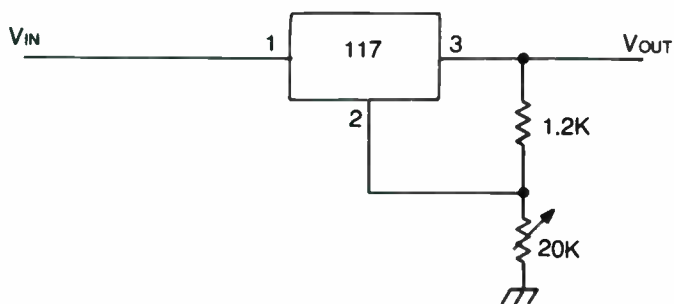
1.2-25 volt adjustable output regulator



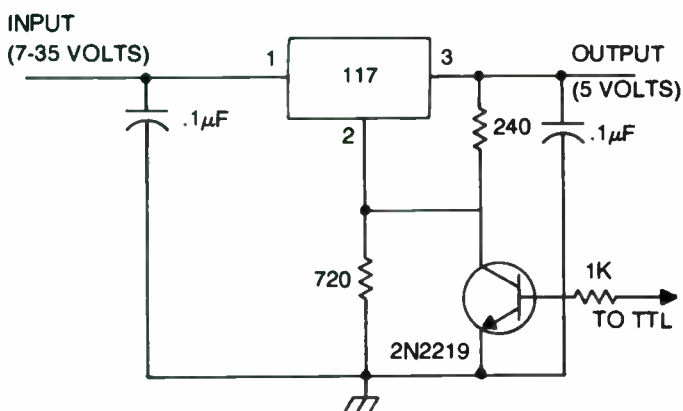
Precision current limiter



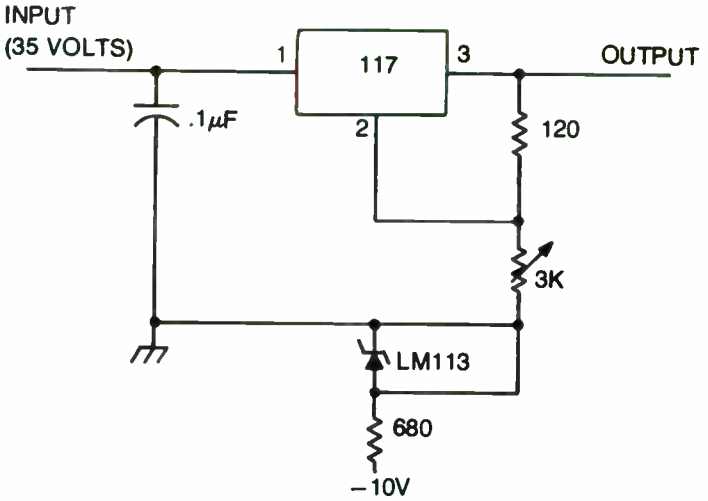
One amp current regulator



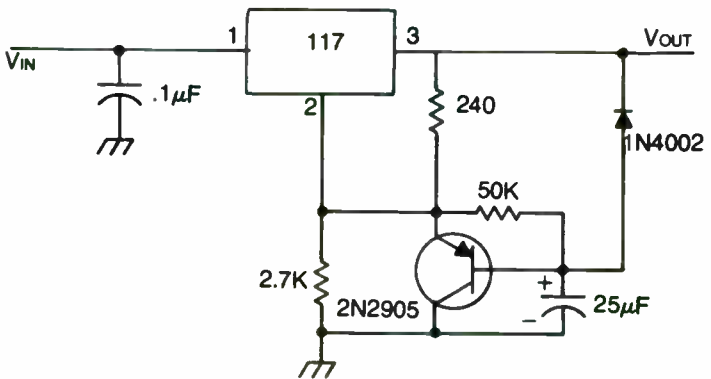
1.2-20 volt adjustable regulator with 4 mA minimum load current



Five volt logic regulator with electronic shutdown

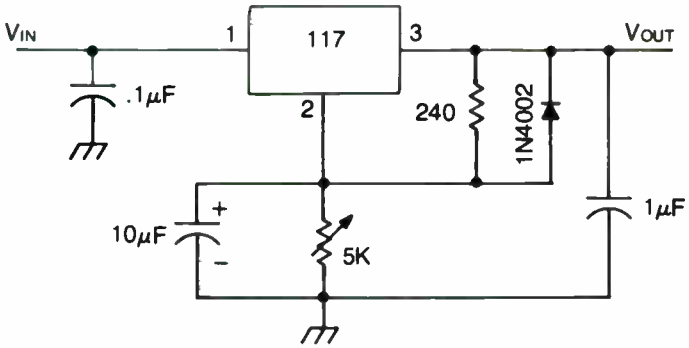


0 to 30 volt regulator

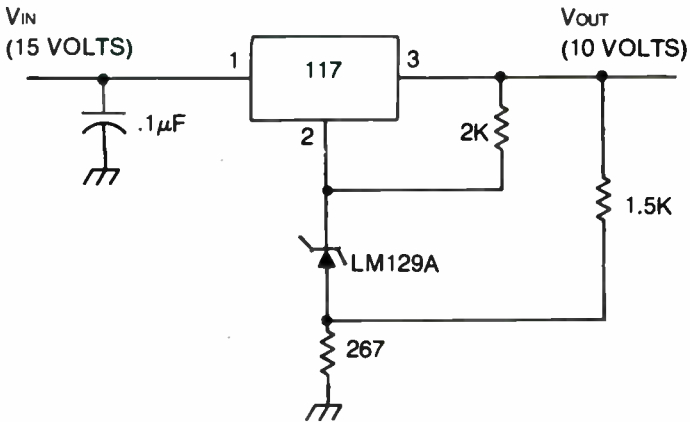


Slow turn on 15 volt regulator

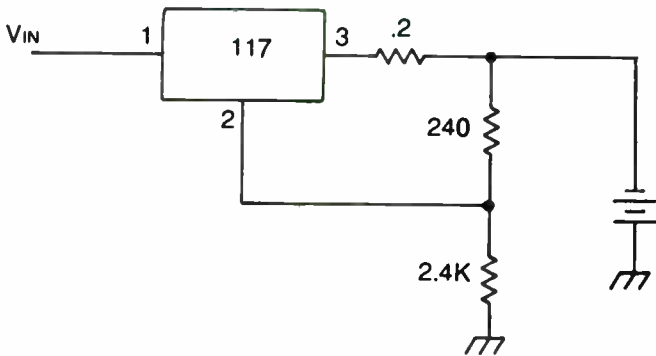




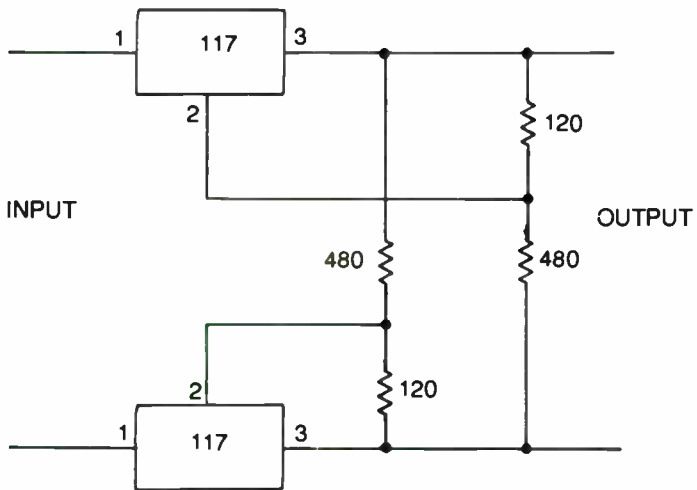
Adjustable regulator with improved ripple suppression



Highly stable 10 volt regulator

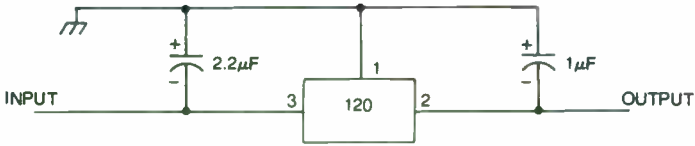


12 volt battery charger

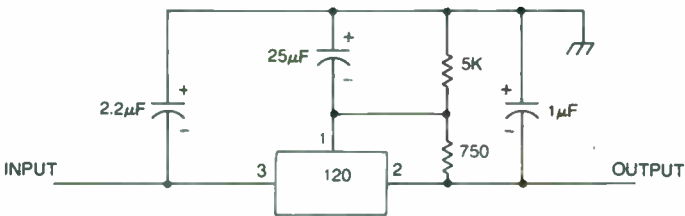


AC voltage regulator

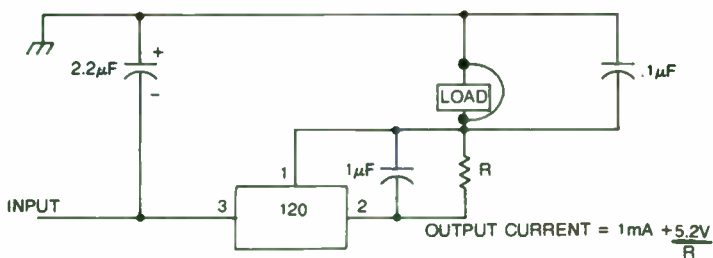
## 120—INTEGRATED NEGATIVE VOLTAGE REGULATOR



Fixed voltage regulator

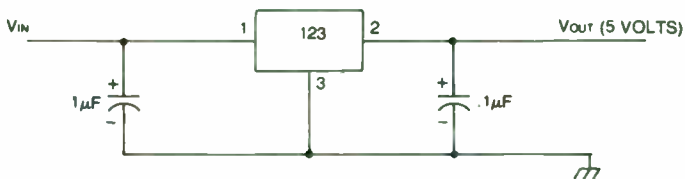


Variable output regulator

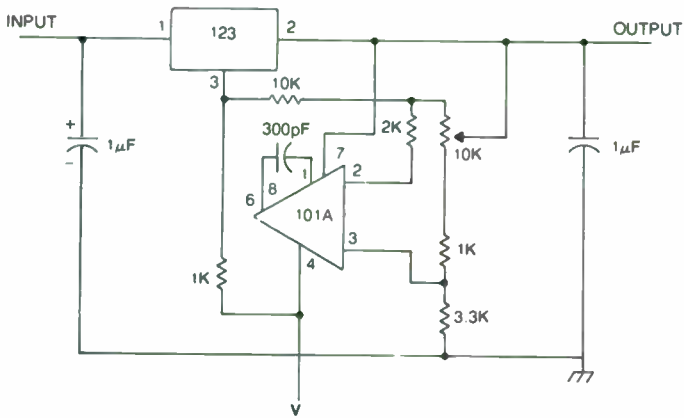


Precision current source

## 123—5 VOLT 3 AMP POSITIVE INTEGRATED REGULATOR

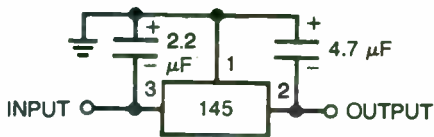


Basic 3 amp regulator

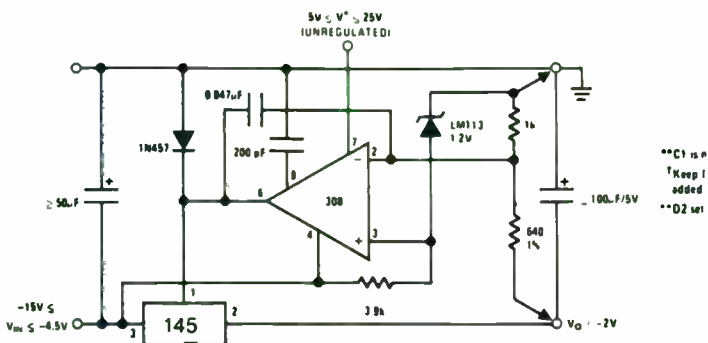


0-10 volt adjustable regulator

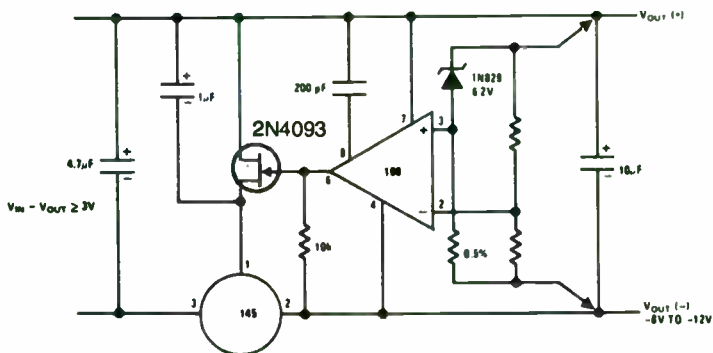
**145—NEGATIVE THREE AMP INTEGRATED REGULATOR**



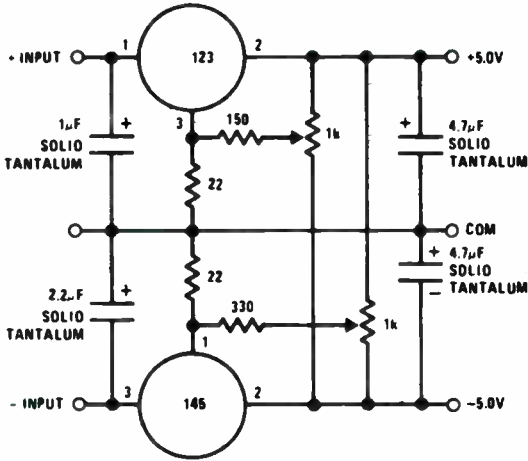
Fixed regulator



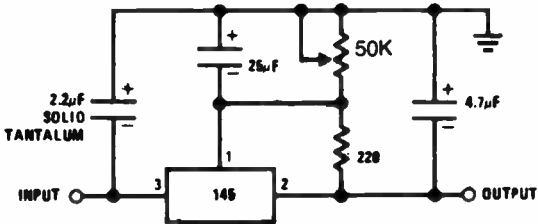
-2V ECL termination regulator



High stability regulator

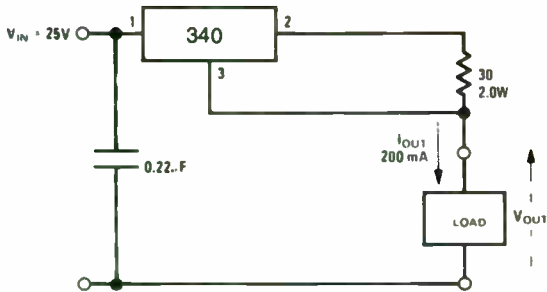


Dual 3 amp trimmed supply

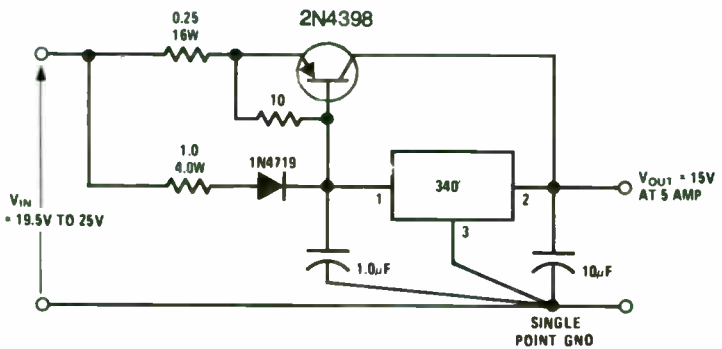


Variable output (-5.0V to -15V)

## 340—SERIES VOLTAGE REGULATOR

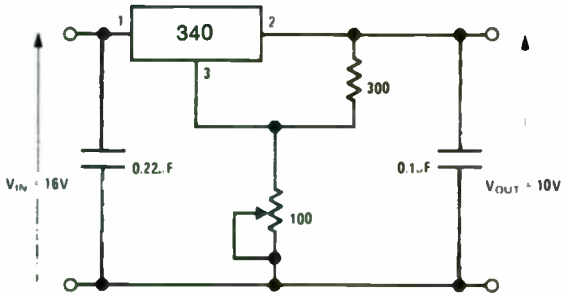


Current source

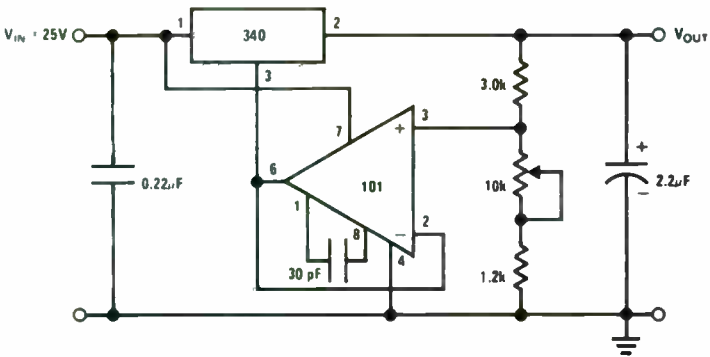


15V 5.0A regulator with short circuit current limit

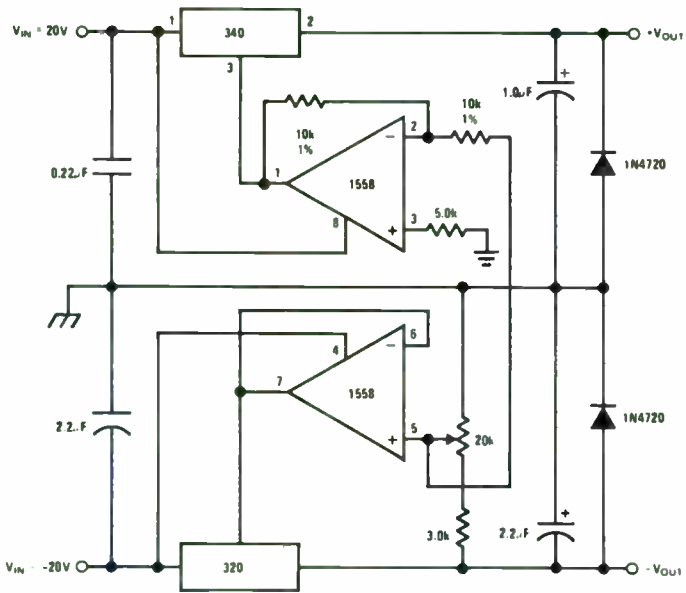




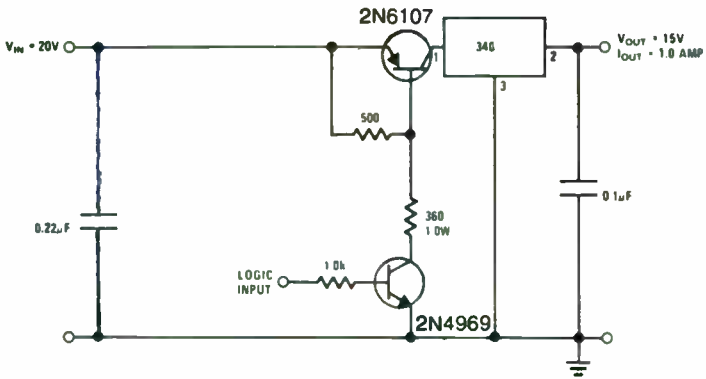
10V regulator



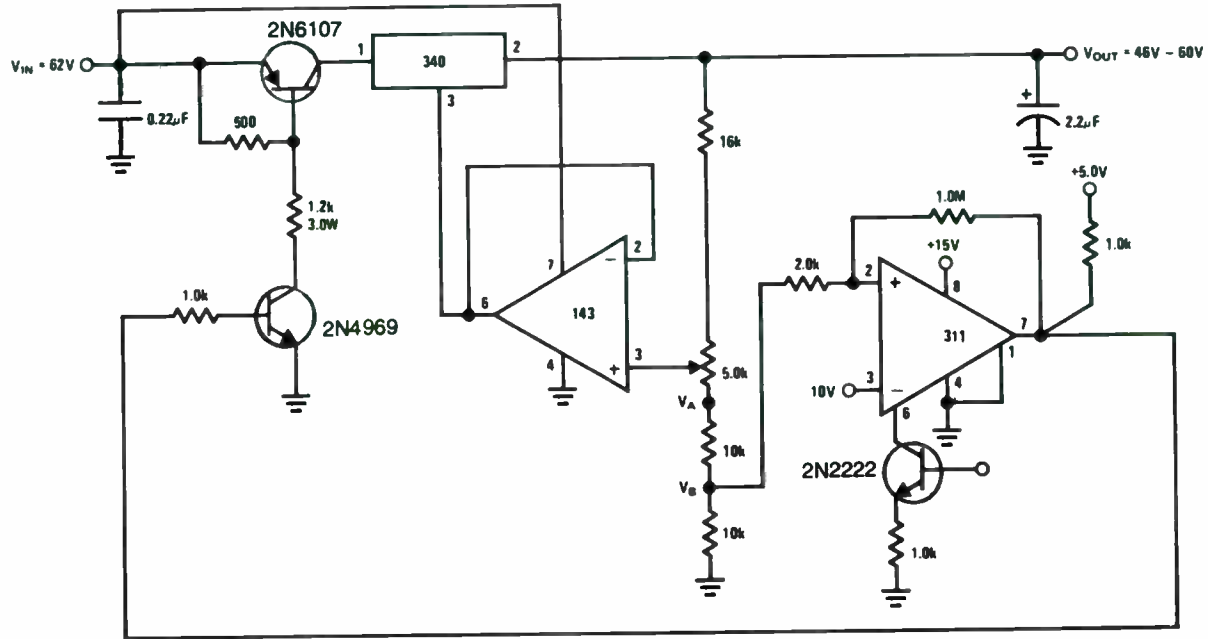
Variable output regulator



Tracking dual supply  $\pm 5.0V - \pm 18V$

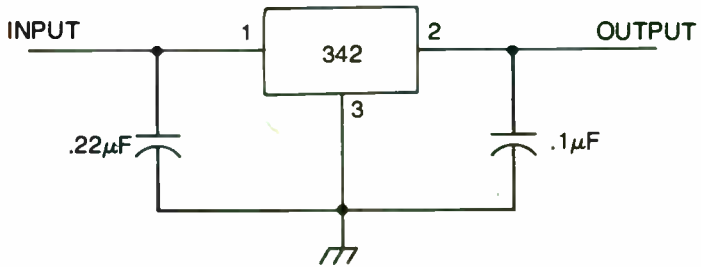


Electronic shutdown circuit

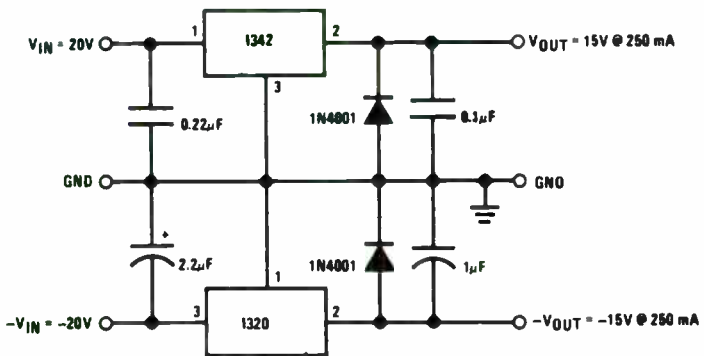


Variable high voltage regulator with shortcircuit and overvoltage protection

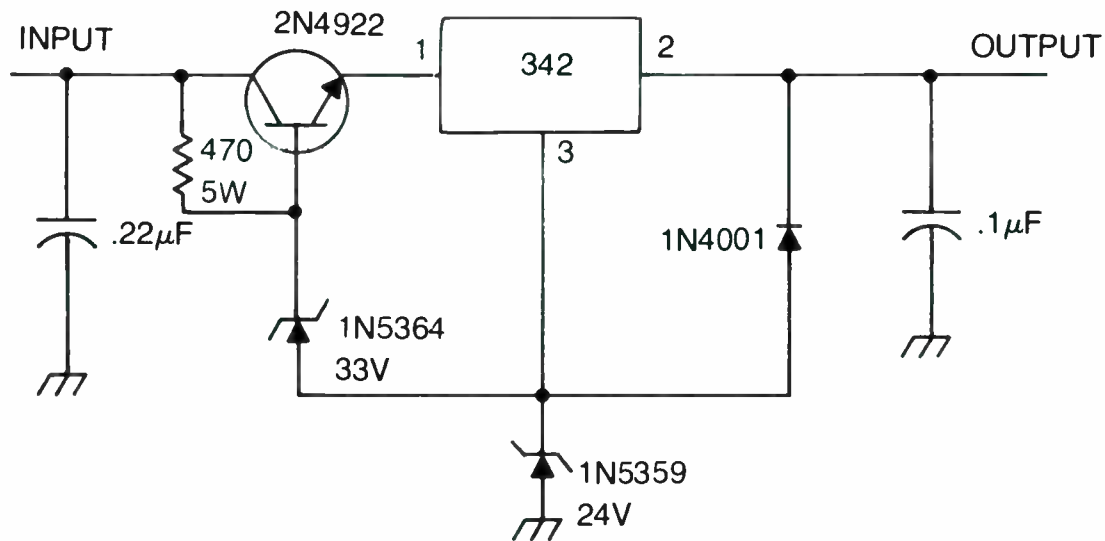
## 342—INTEGRATED VOLTAGE REGULATOR



Fixed output regulator

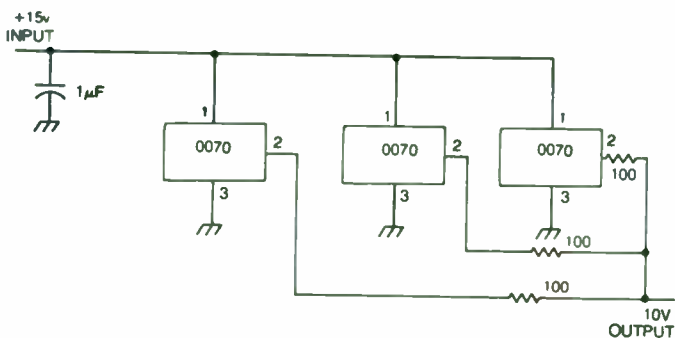


$\pm 15\text{V}$ , 250 mA dual power supply

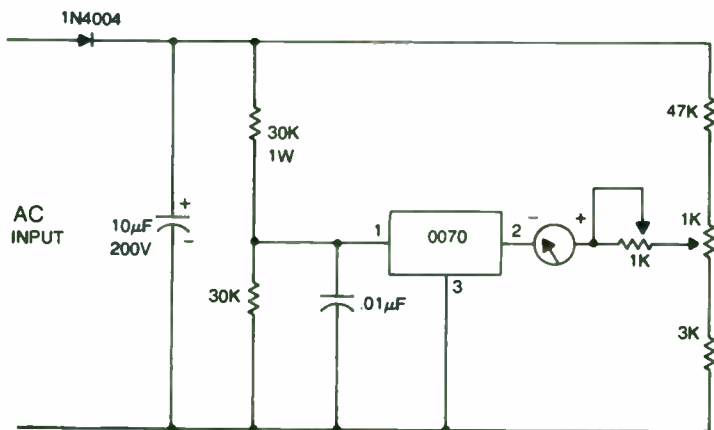


High output regulator

# 0070—PRECISION BCD BUFFERED VOLTAGE REFERENCE

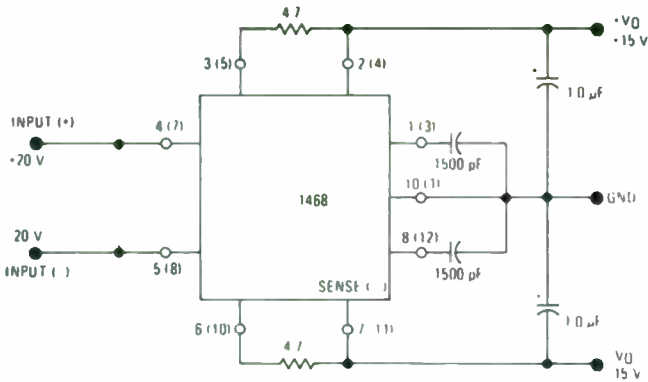


Statistical voltage standard

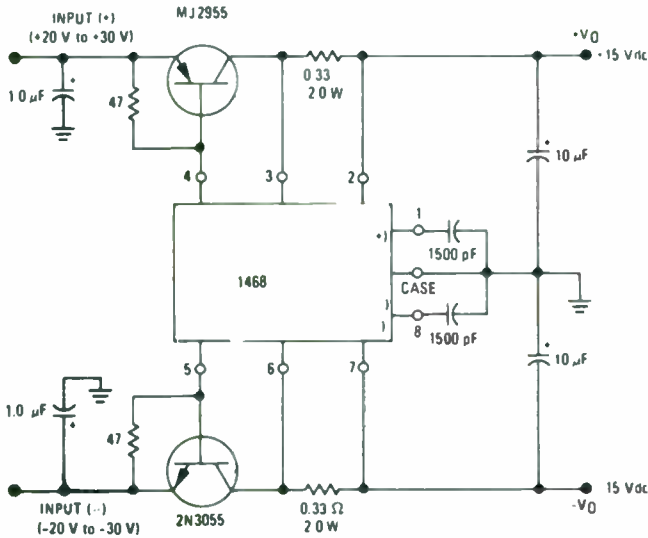


AC voltmeter

# 1468—DUAL 15 VOLT TRACKING REGULATOR

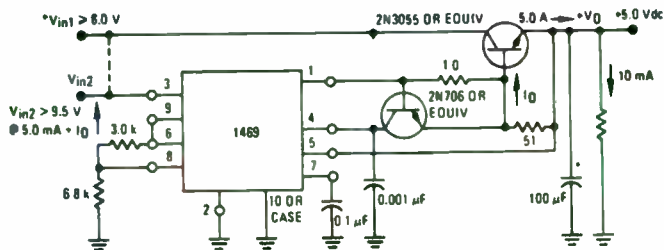


Basic 50-mA regulator

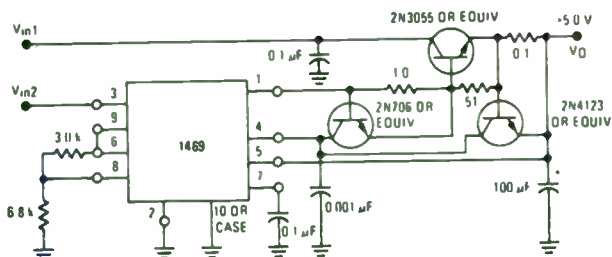


±1.5-ampere regulator

# 1469—FIVE VOLT HIGH CURRENT REGULATOR

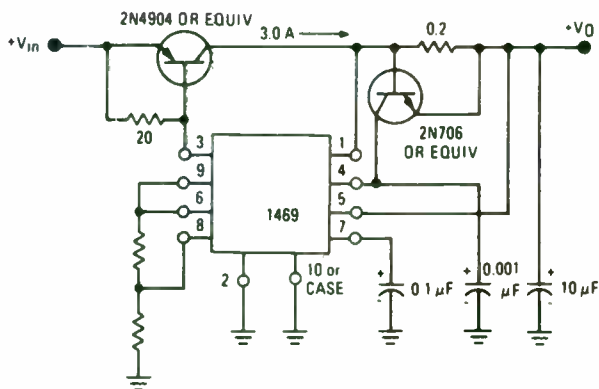


5 volt 5-ampere regulator



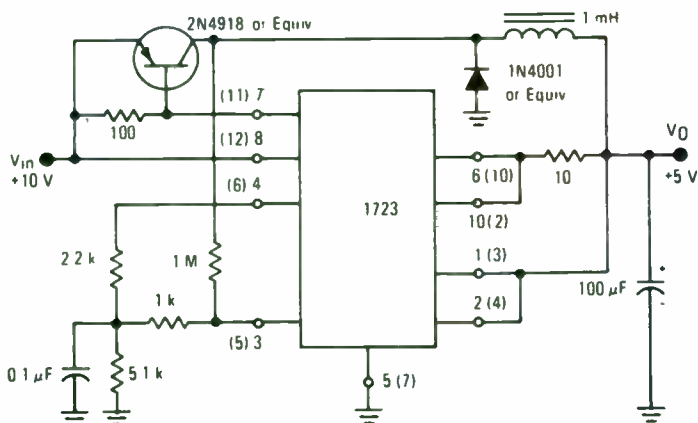
5-volt 5-ampere regulator



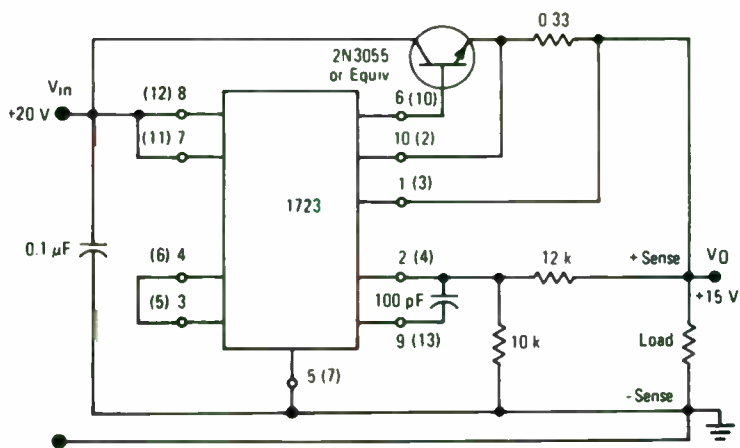


PNP current boost connection

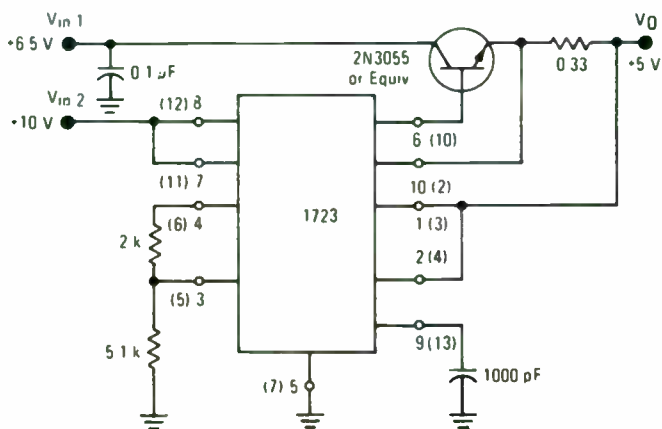
## 1723—WIDE RANGE VOLTAGE REGULATOR



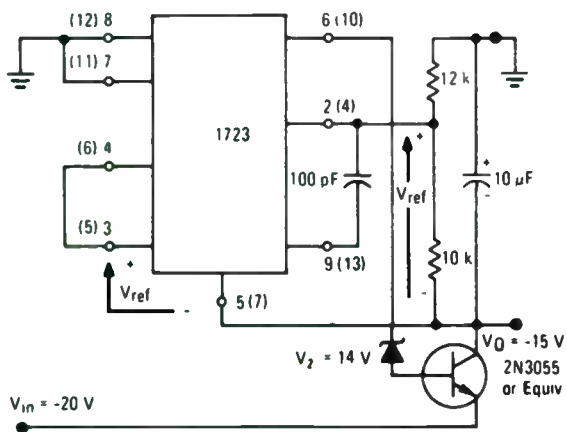
+5 V, 1-ampere switching regulator



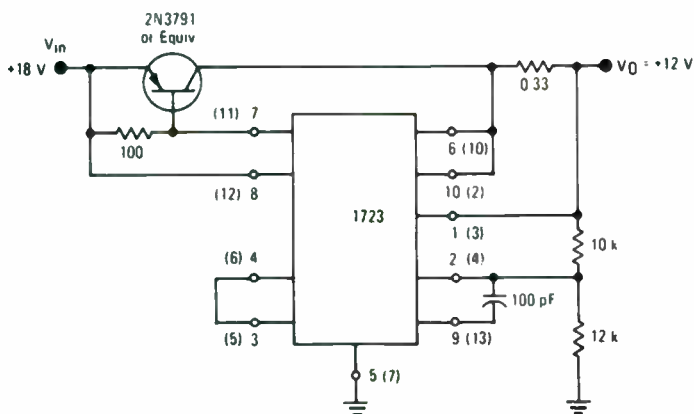
+15 V, 1-ampere regulator with remote sense



+5 V, 1-ampere high efficiency regulator

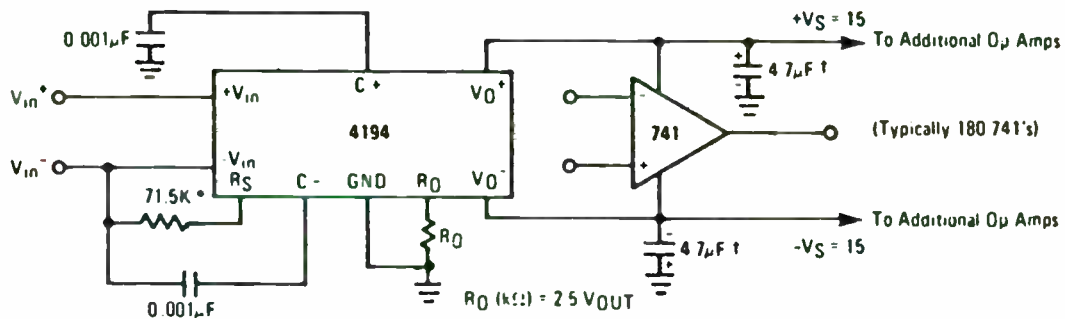


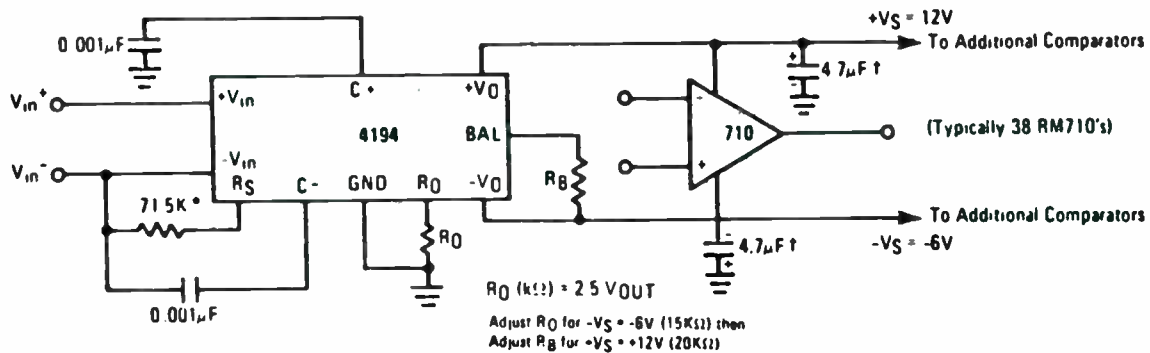
- 15 V negative regulator



+12V, 1-ampere regulator using PNP current boost

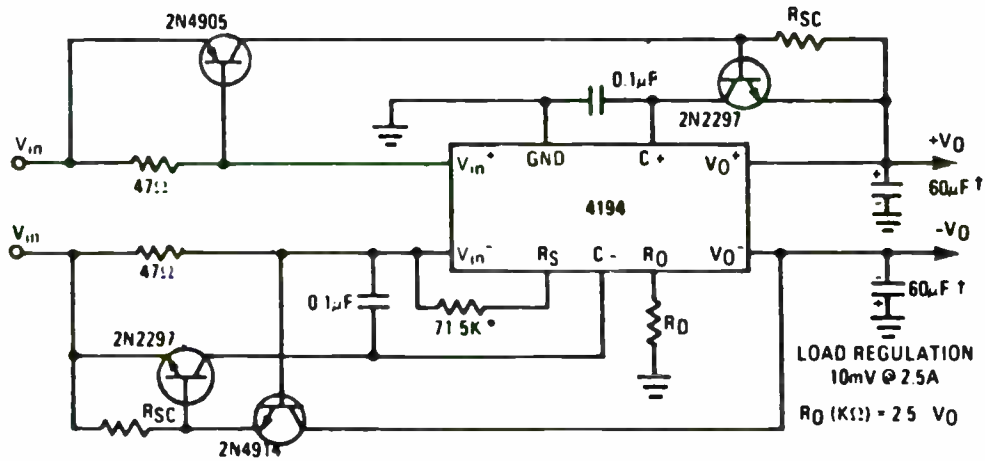
# 4194—DUAL TRACKING VOLTAGE REGULATOR



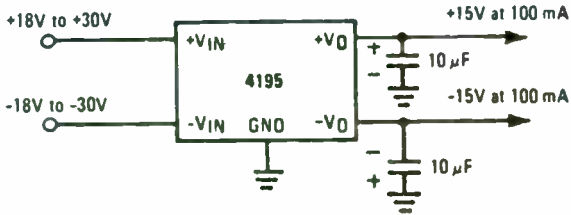


Unbalanced output voltage — comparator application

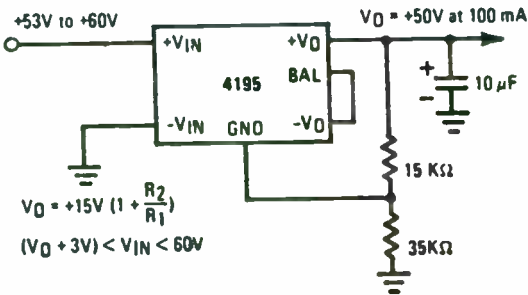
## High output current application



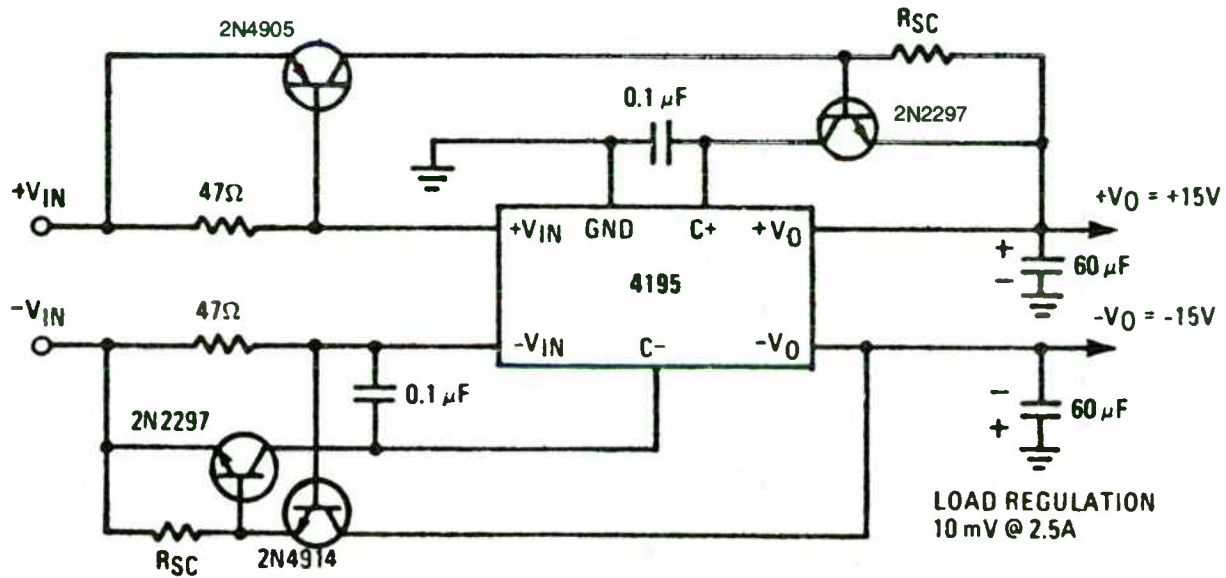
# 4195—FIXED 15 VOLT DUAL TRACKING REGULATOR



Balanced output ( $V_o = \pm 15V$ )

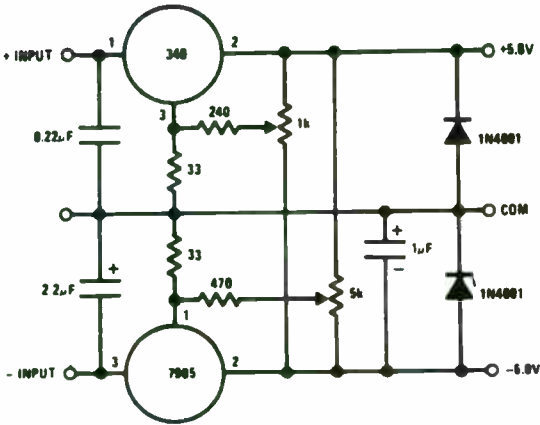


Positive single supply ( $+15V < V_o < +50V$ )

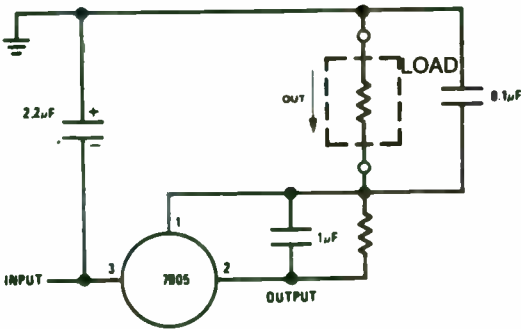




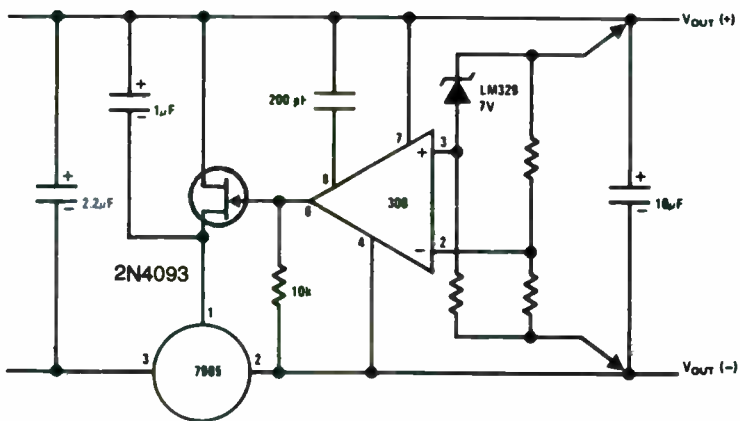
# 7905—NEGATIVE FIVE VOLT SERIES VOLTAGE REGULATOR



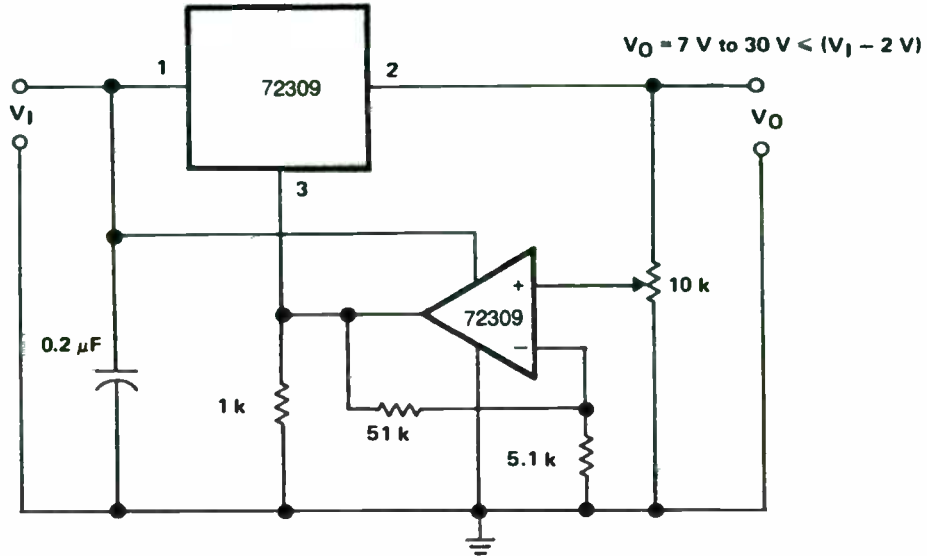
Dual trimmed supply



Current source

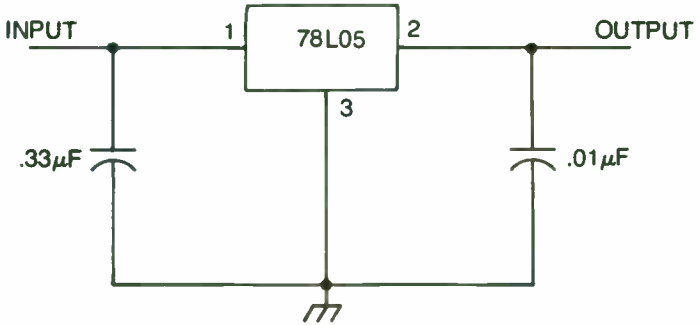


High stability 1 amp regulator

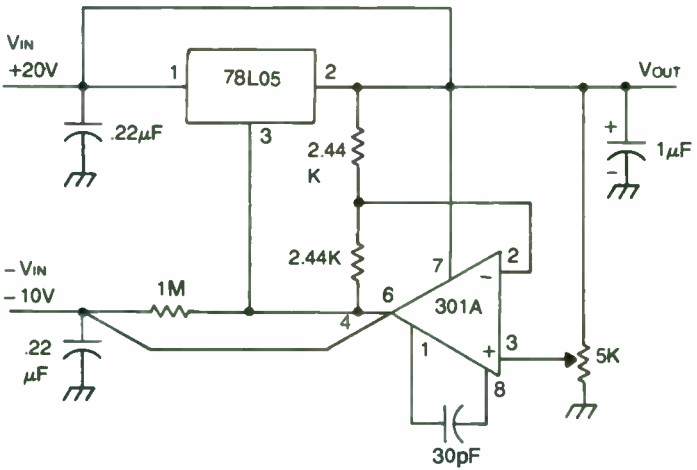
**72309—FIVE VOLT INTEGRATED VOLTAGE REGULATOR**

Highly stable adjustable-output voltage regulator

# 78L05—FIVE VOLT INTEGRATED VOLTAGE REGULATOR

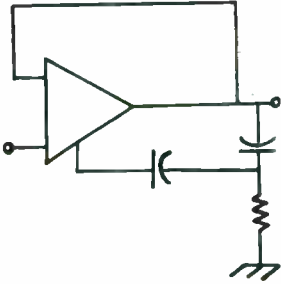


Fixed five volt output regulator



Variable output regulator

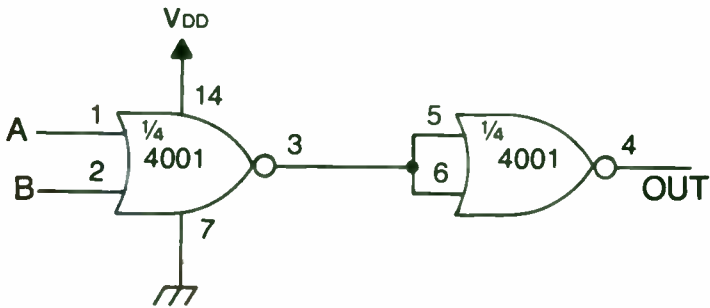
## Part III



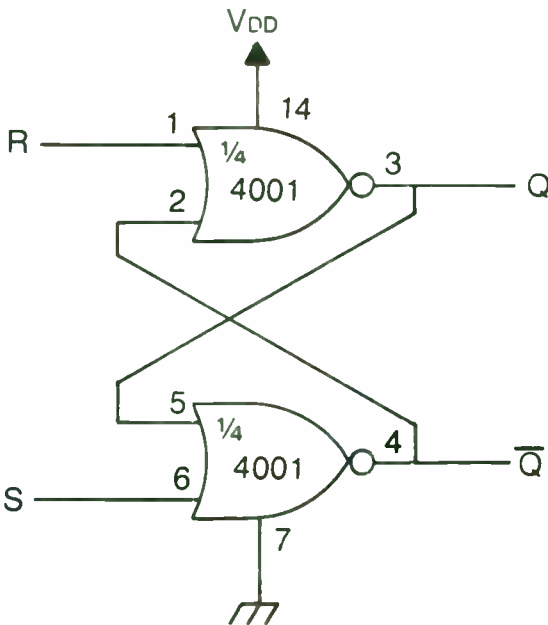
## CMOS Integrated Circuits

CMOS digital ICs are the well-known "4000" series of devices. They contain more functions per chip than comparable TTL or LS ICs. Most can be used with a power supply ranging from positive 3 to 15 volts. Their only major drawback is their susceptibility to damage from static discharge.

# 4001 — CMOS QUAD NOR GATE

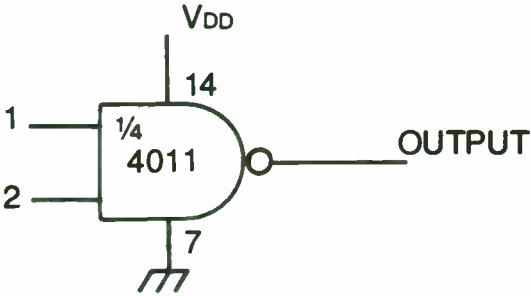


OR gate

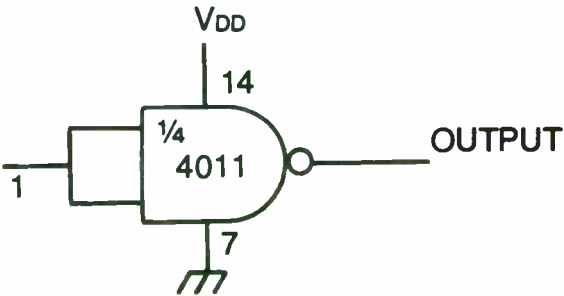


RS latch

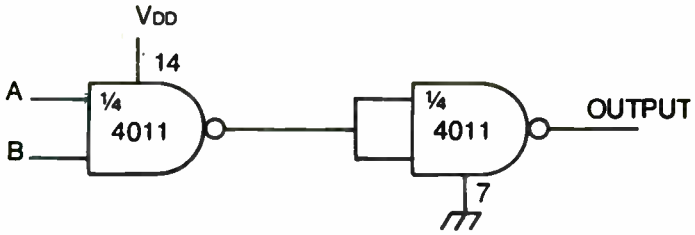
# 4011 — CMOS QUAD NAND GATE



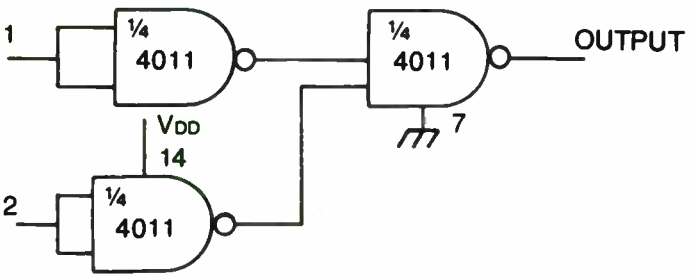
Basic NAND gate



Inverter

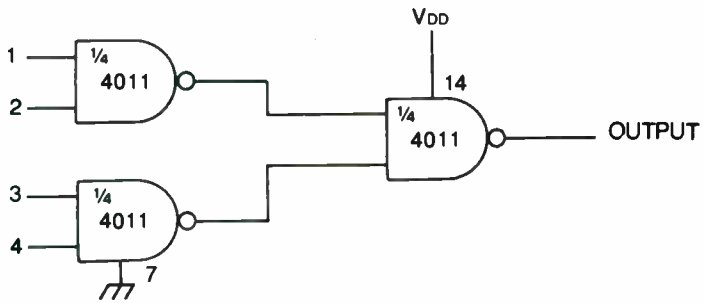


AND gate

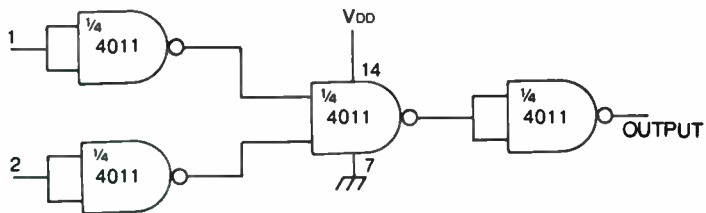


OR gate

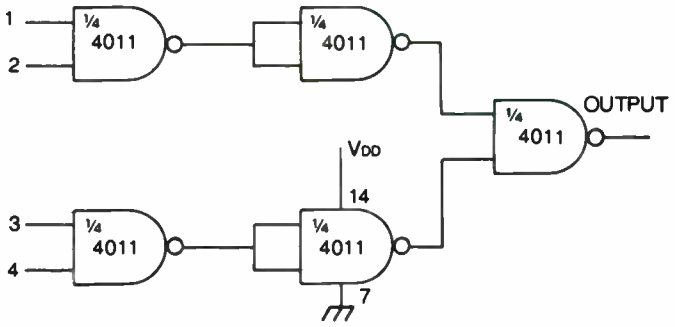




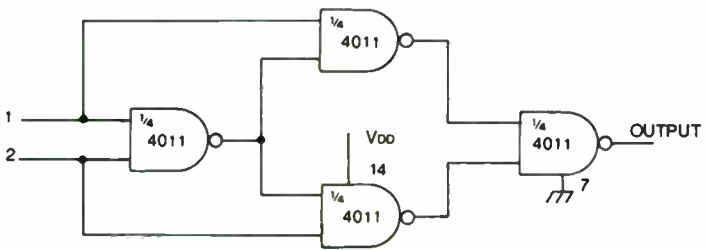
AND/OR gate



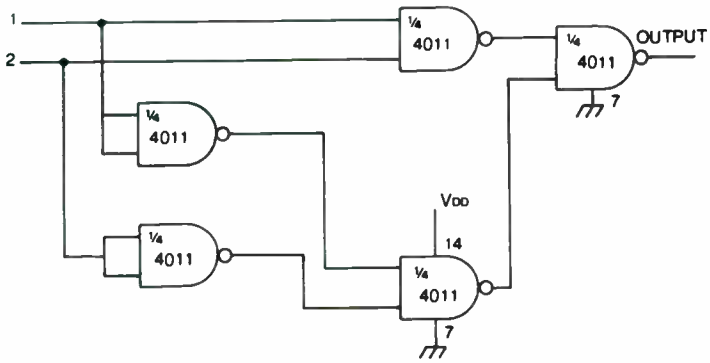
NOR gate



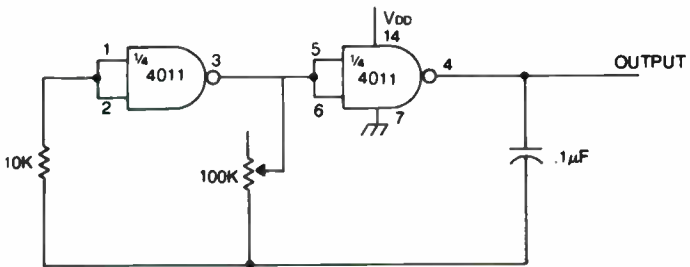
Quad input NAND gate



Exclusive OR gate

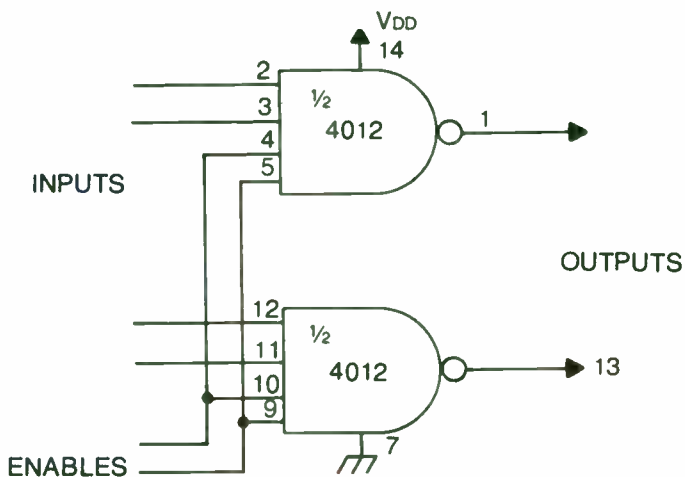


Exclusive NOR gate



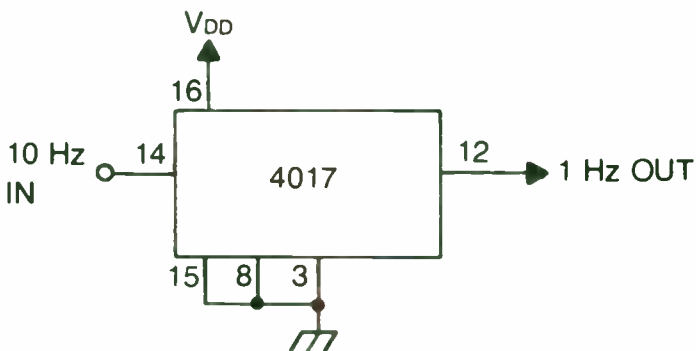
Clock pulse generator

## 4012—CMOS DUAL FOUR INPUT NAND GATE

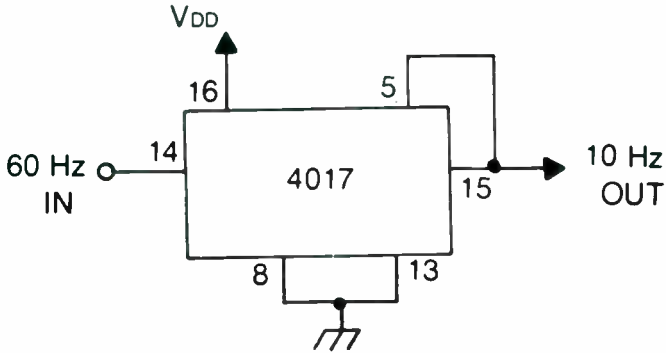


Enable input

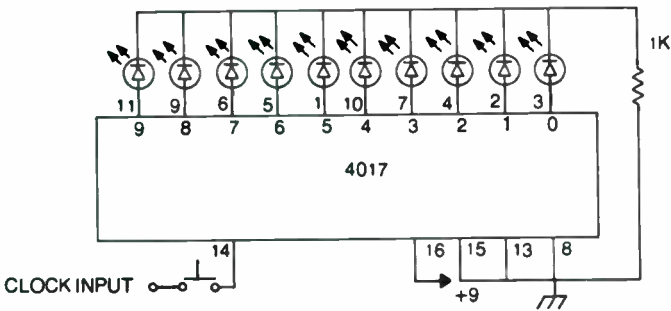
## 4017—CMOS DECADE COUNTER/DECODER



1-Hz timebase

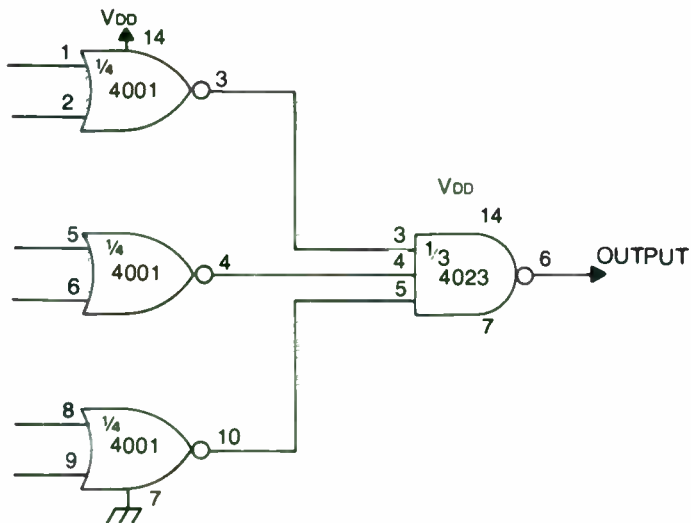


10-Hz timebase

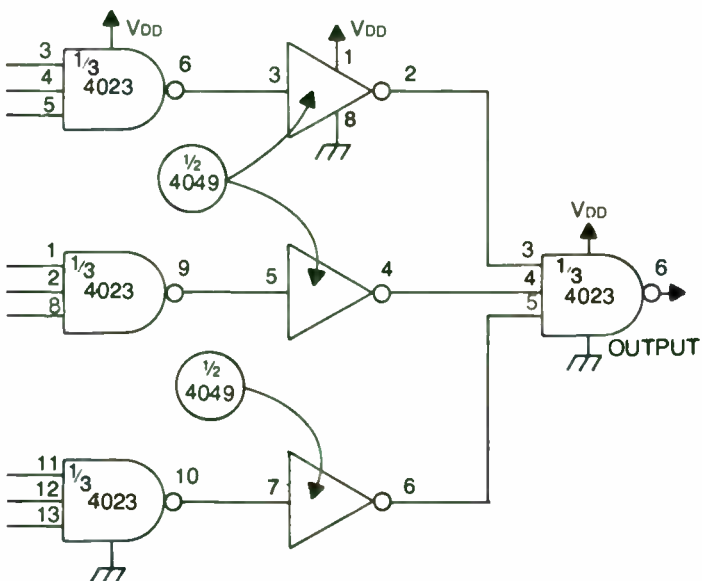


Random number generator

## 4023—CMOS TRIPLE THREE INPUT NAND GATE

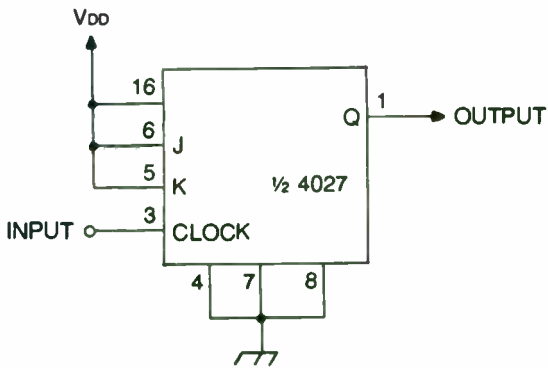


6-input OR gate

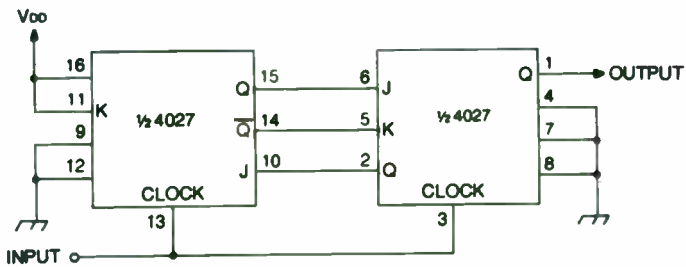


9-input NAND gate

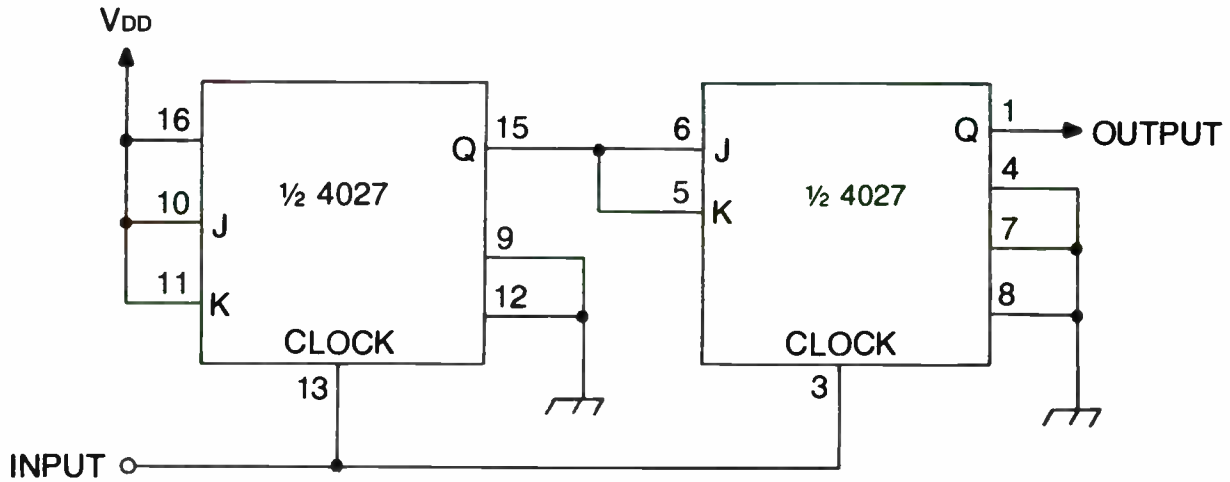
## '4027 — CMOS DUAL J-K FLIP-FLOP



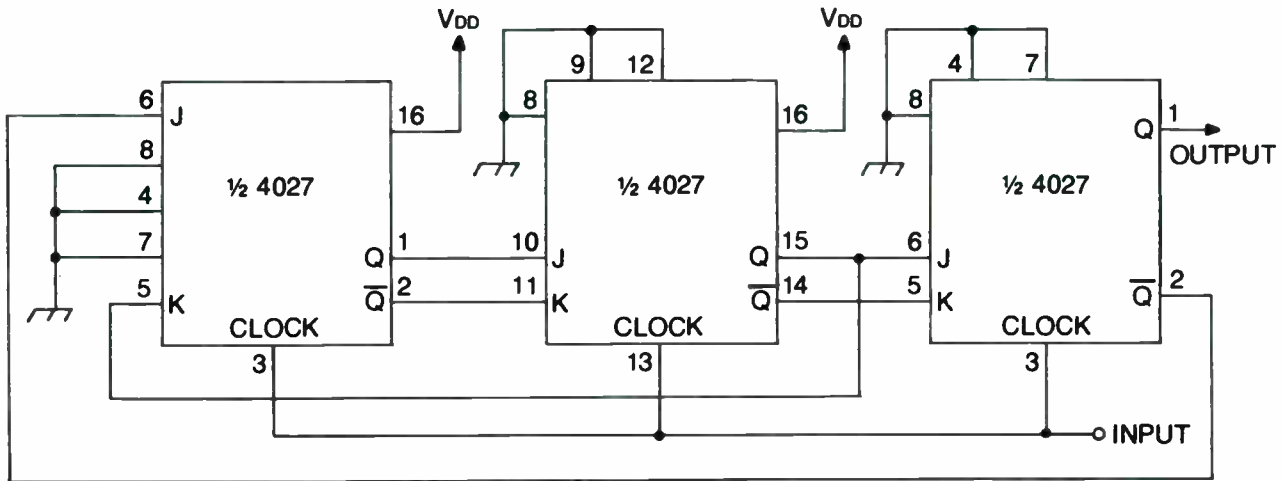
Divide-by-2 counter



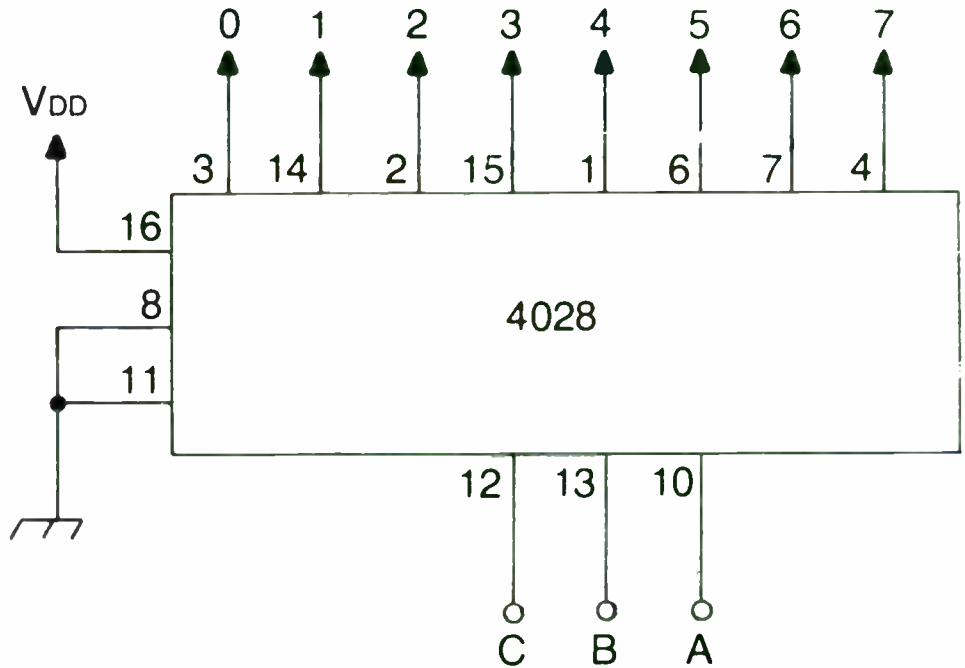
Divide-by-3 counter





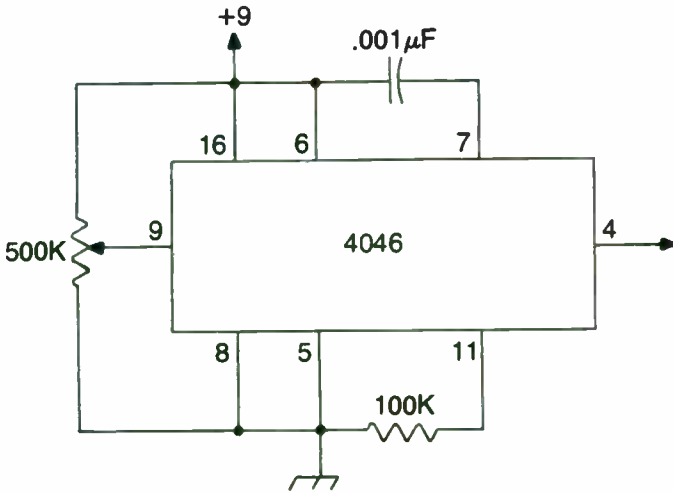


Divide-by-5 counter



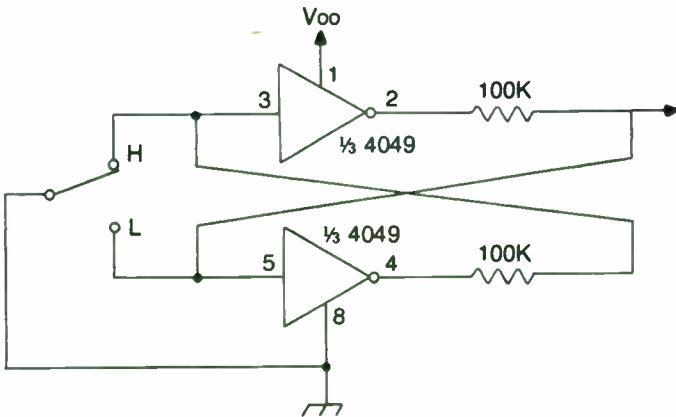
1-of-8 decoder

## 4046— CMOS PHASE LOCK LOOP INTEGRATED CIRCUIT

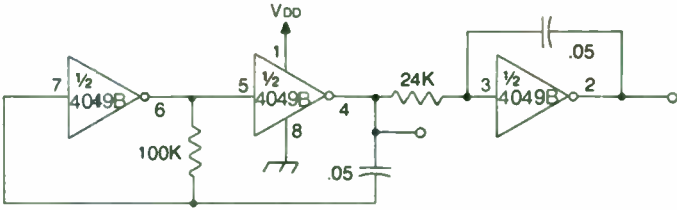


Tunable oscillator

## 4049— CMOS HEX INVERTING BUFFER

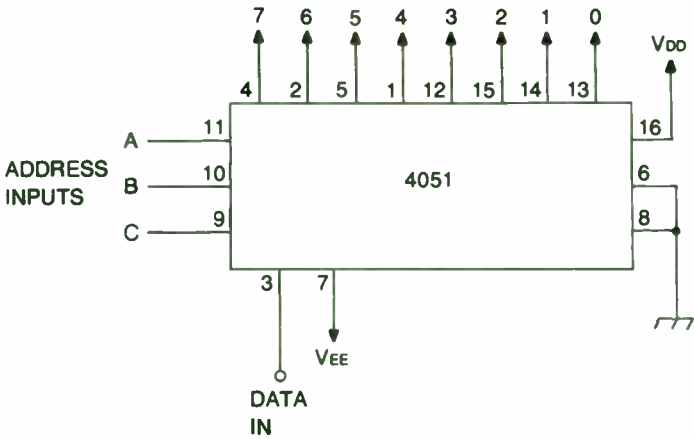


Bounceless switch

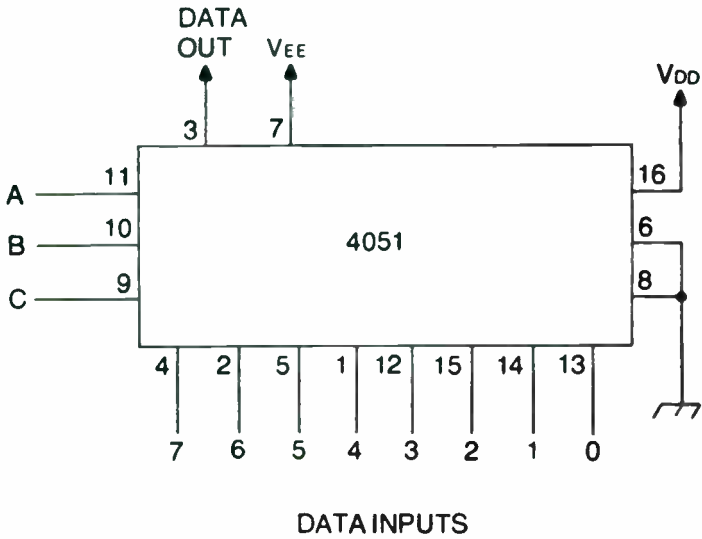


Triangle wave source

## 4051 — CMOS ANALOG MULTIPLEXER

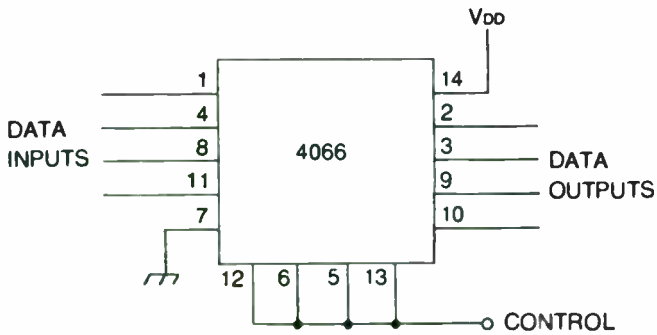


1-of-8 multiplexer

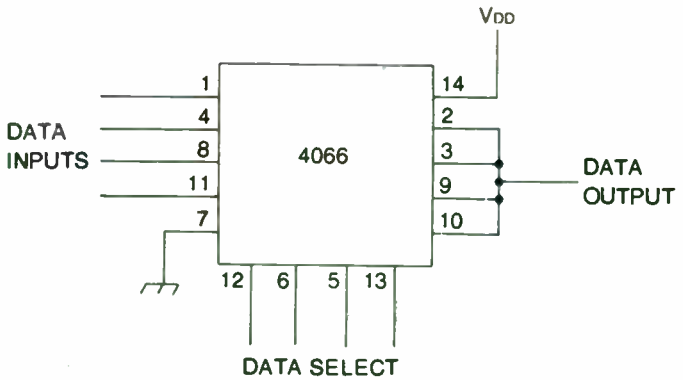


1-of-8 demultiplexer

**4066—CMOS QUAD BILATERAL SWITCH**

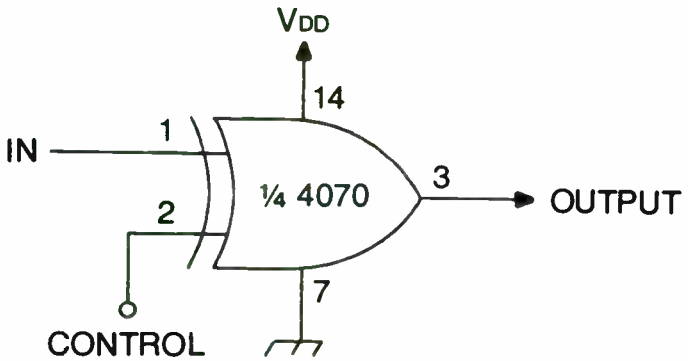


Data bus control

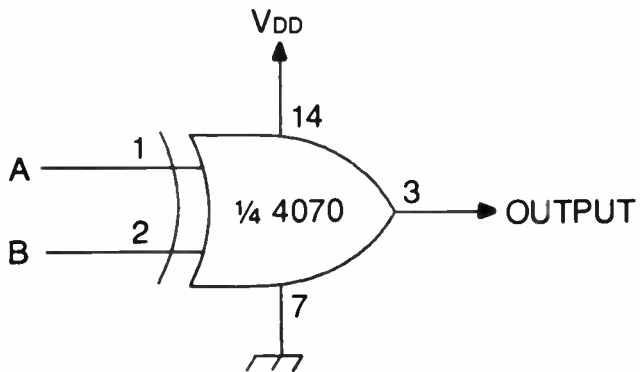


Data selector

## 4070—CMOS QUAD EXCLUSIVE OR GATE

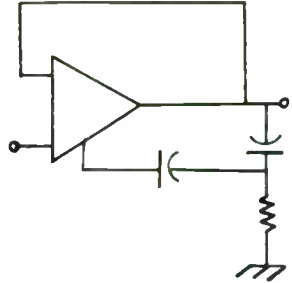


Controlled inverter



1-bit comparator

## Part IV

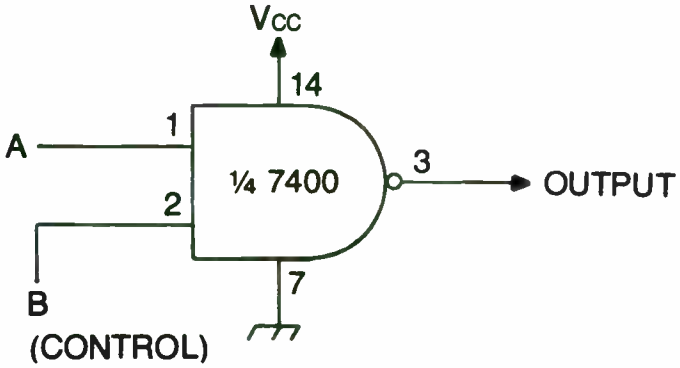


## TTL/LS Integrated Circuits

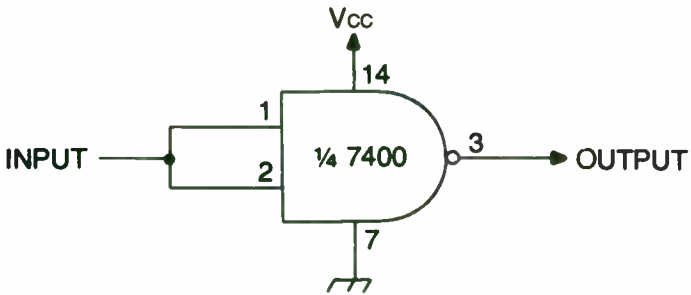
TTL/LS digital ICs are the “7000” series of ICs. They are the most commonly used logic circuits and require a five volt power source. The LS designation stands for *low power Schottky*, which uses approximately 80% less power than a standard TTL chip.



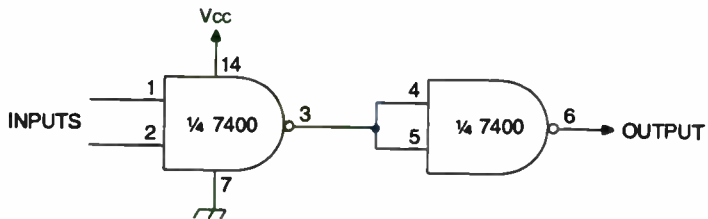
# 7400—TTL QUAD NAND GATE



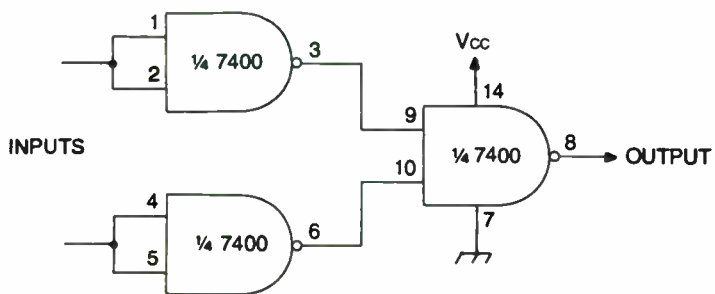
Control gate



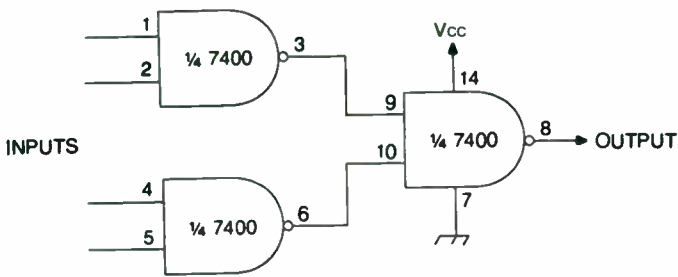
Inverter



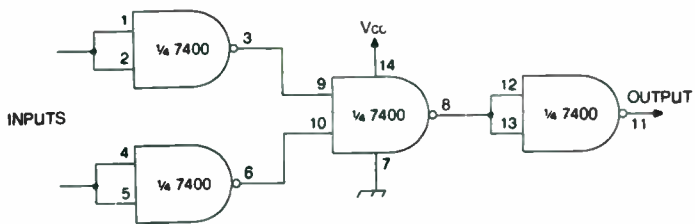
AND gate



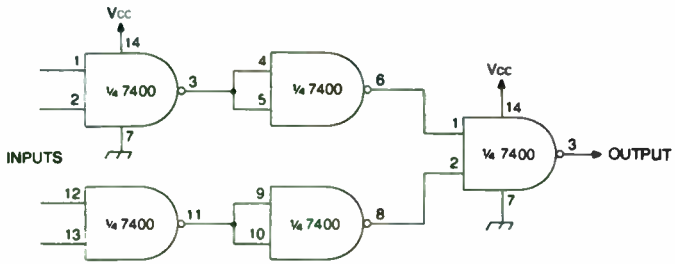
OR gate



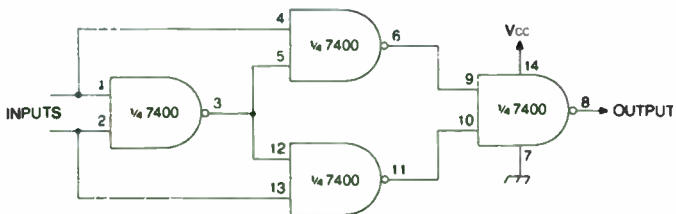
AND-OR gate



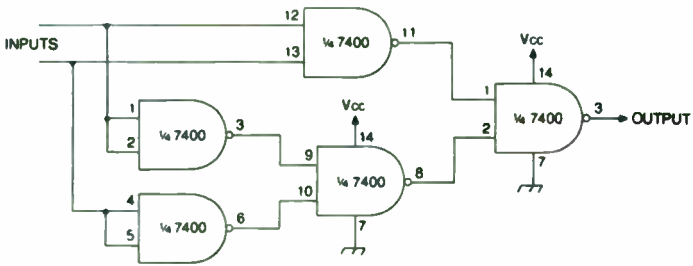
NOR gate



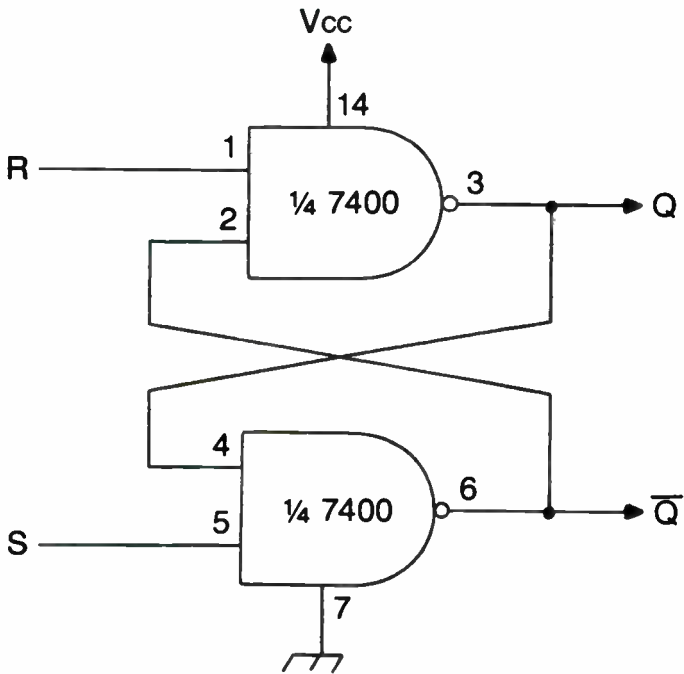
4-input NAND gate



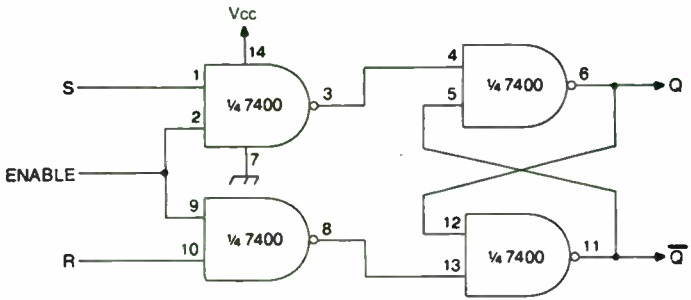
Exclusive-OR gate



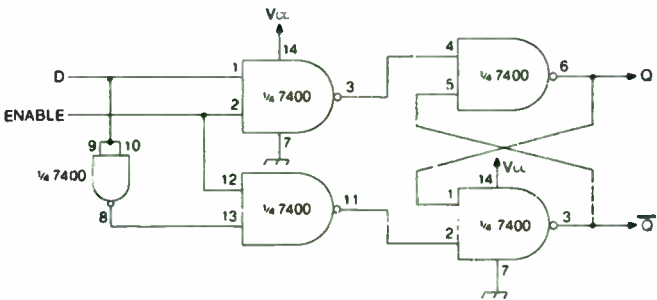
Exclusive-NOR gate



RS latch

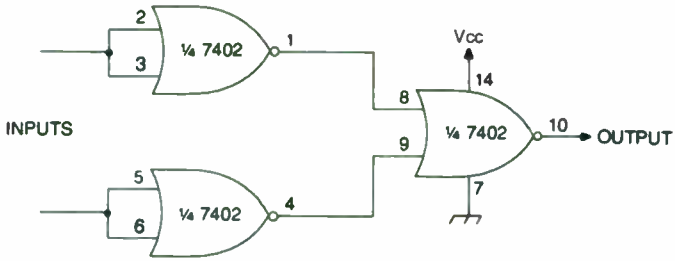


Gated RS latch

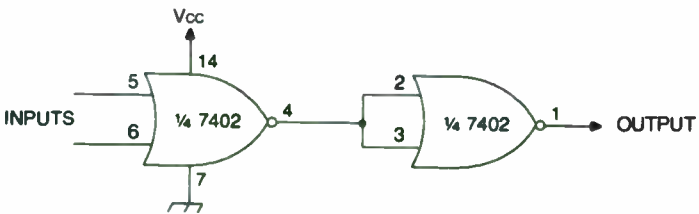


D flip-flop

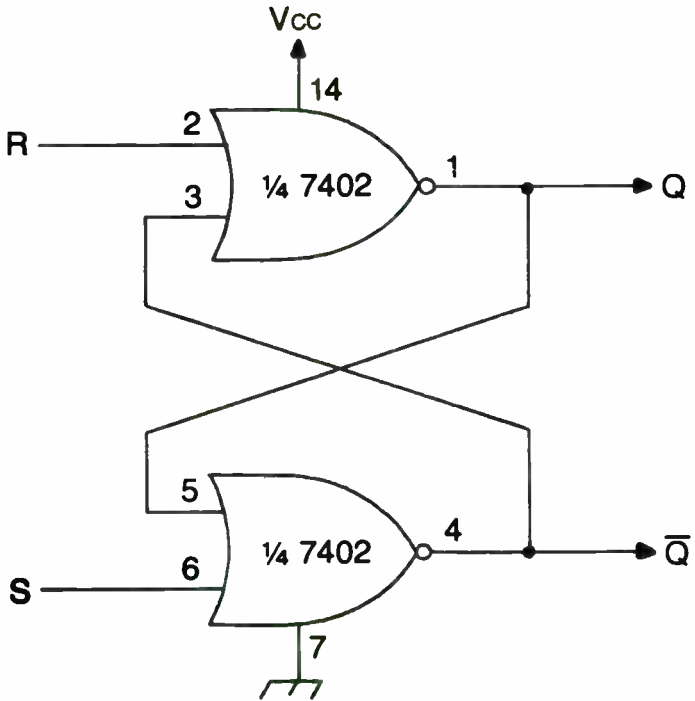
# 7402—TTL QUAD NOR GATE



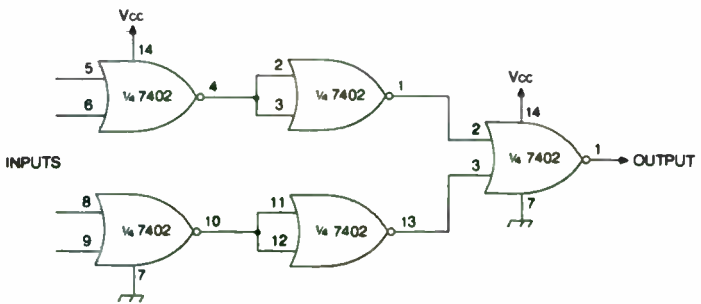
AND gate



OR gate

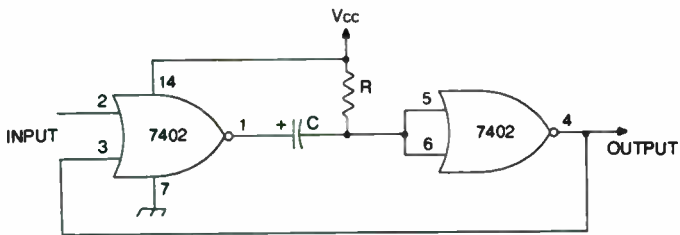


RS latch

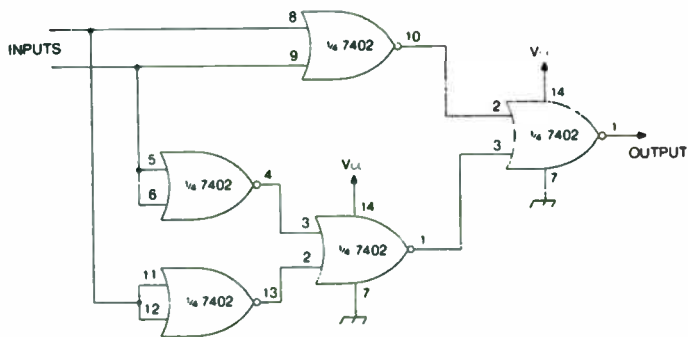


4-input NOR gate



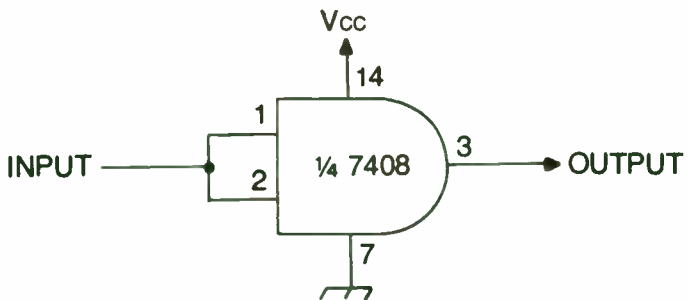


One-shot

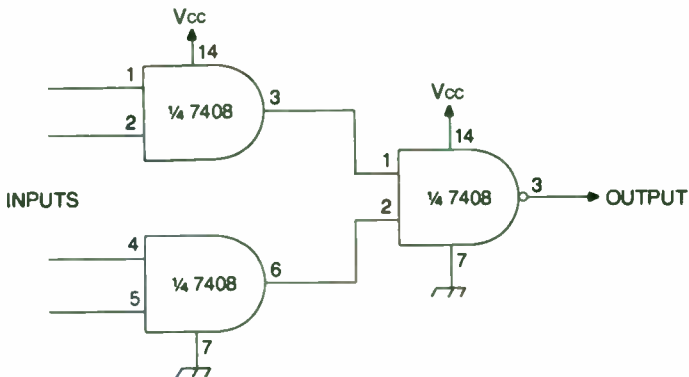


Exclusive-OR gate

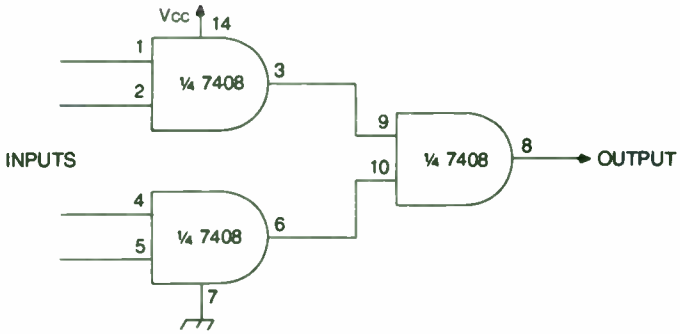
# 7408—TTL QUAD AND GATE



AND gate buffer

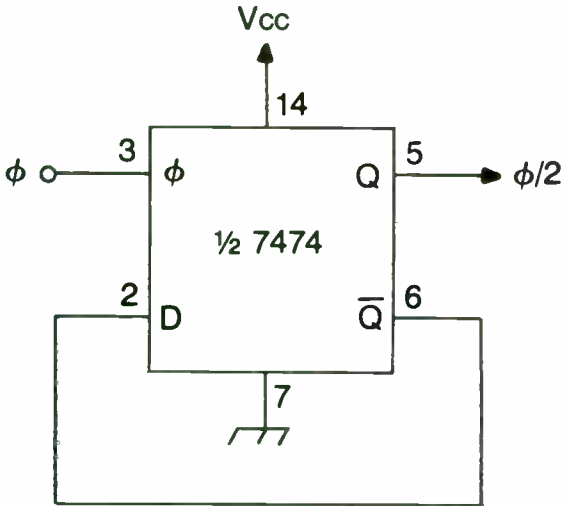


4-input NAND gate

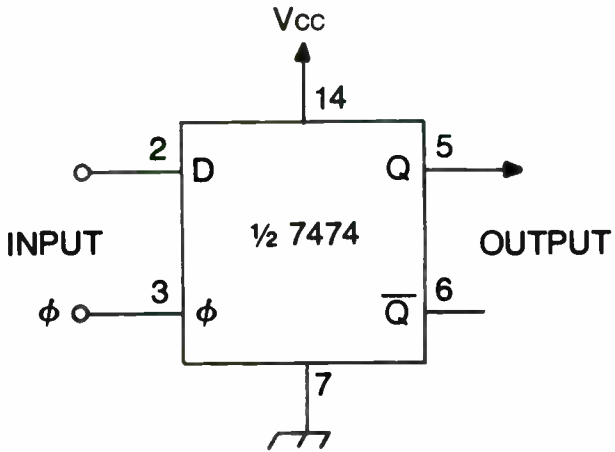


4-input AND gate

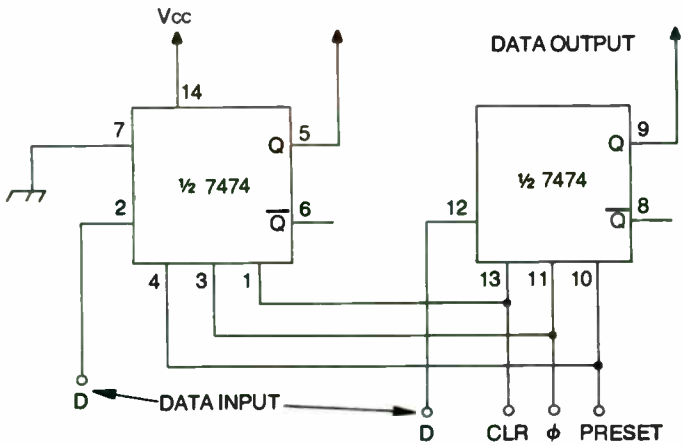
**7474—TTL DUAL D FLIP FLOP**



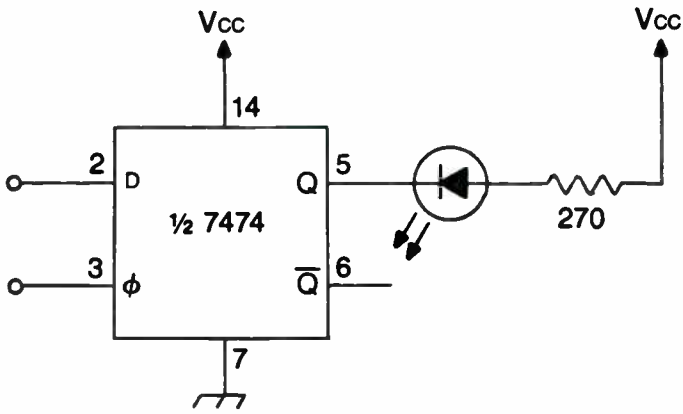
Divide-by-two counter



Wave shaper

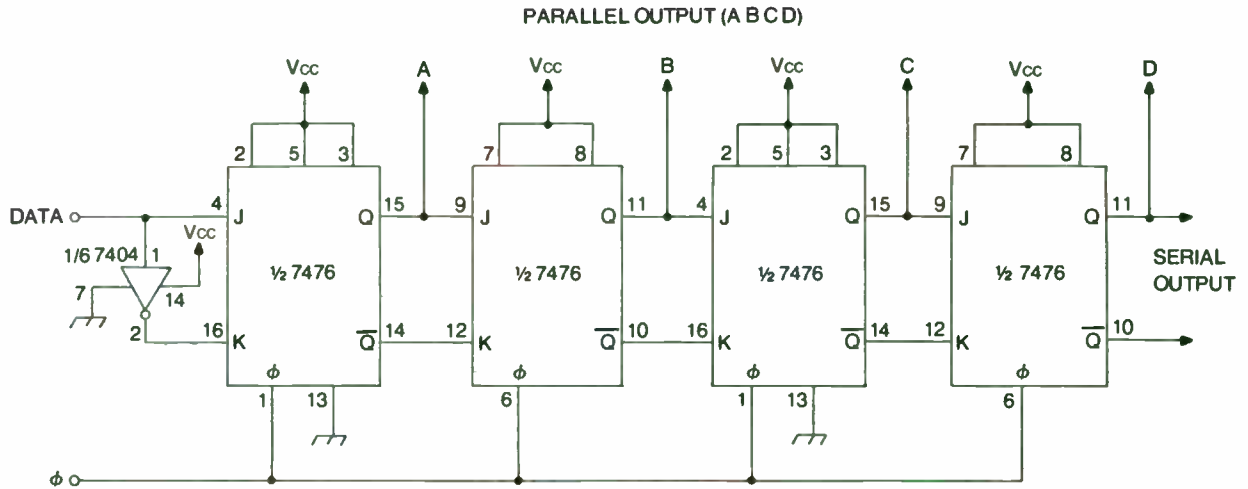


2-bit storage register

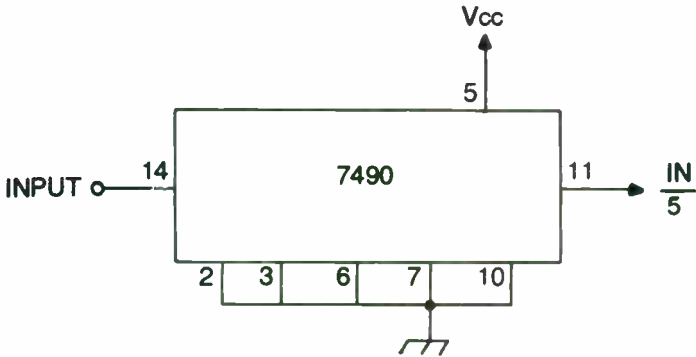


Phase detector

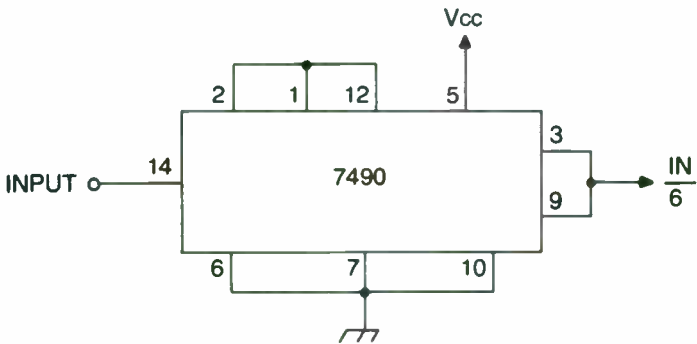
# 7476—TTL DUAL J-K FLIP FLOP



## 7490—TTL BCD DECADE COUNTER

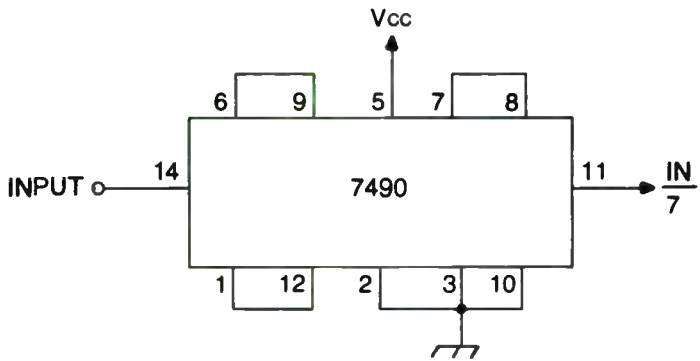


Divide-by-5 counter

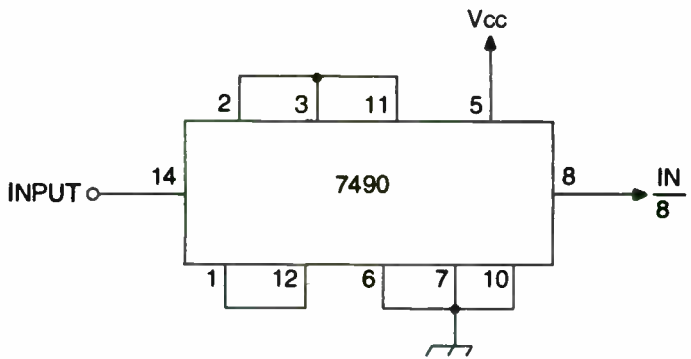


Divide-by-6 counter

440

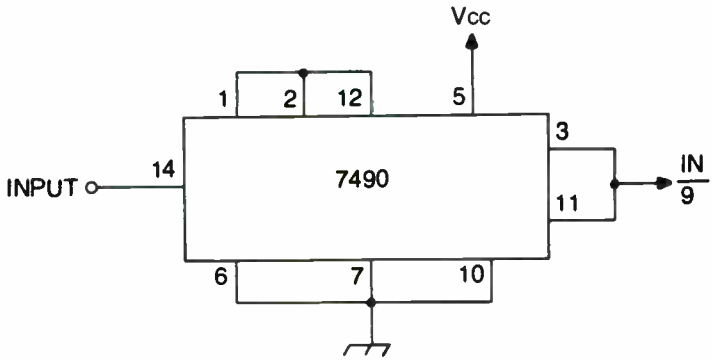


Divide-by-7 counter

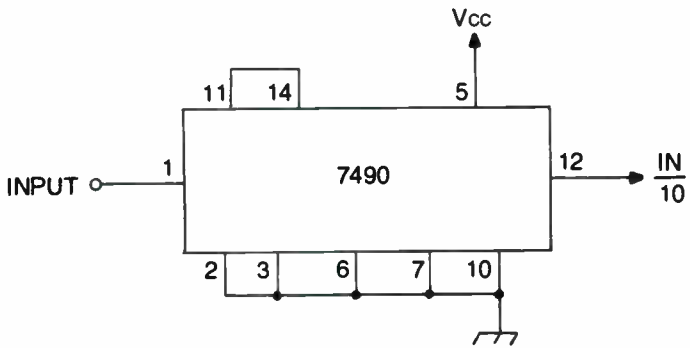


Divide-by-8 counter



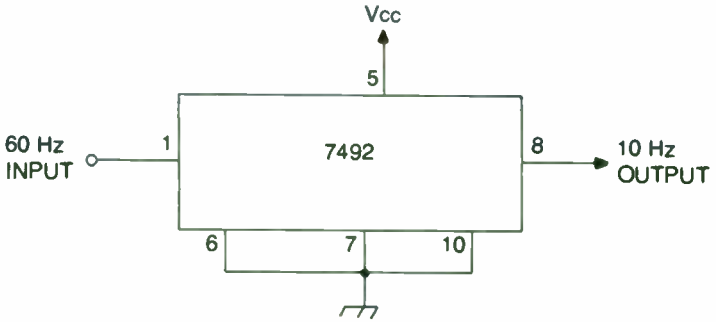


Divide-by-9 counter

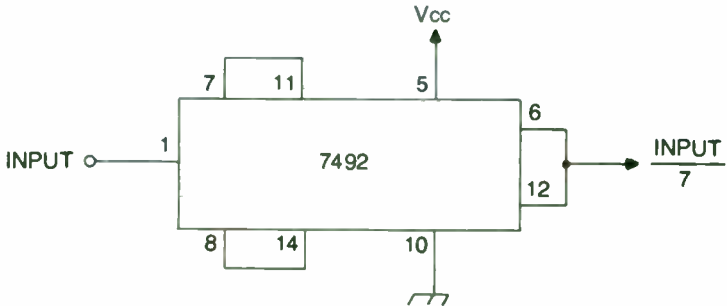


Divide-by-10 counter

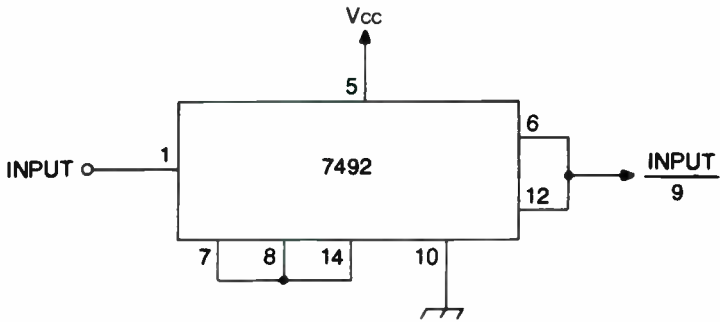
## 7492—TTL DIVIDE BY 12 BINARY COUNTER



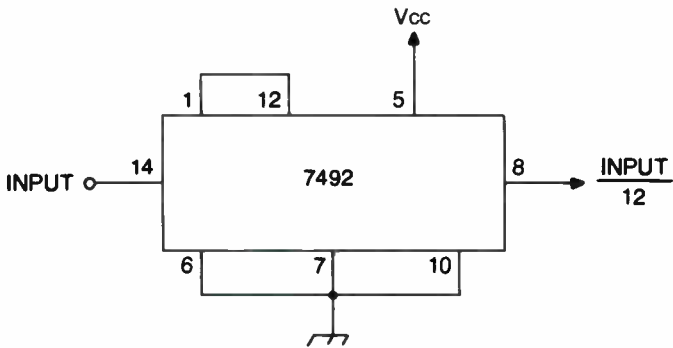
10-Hz pulse source



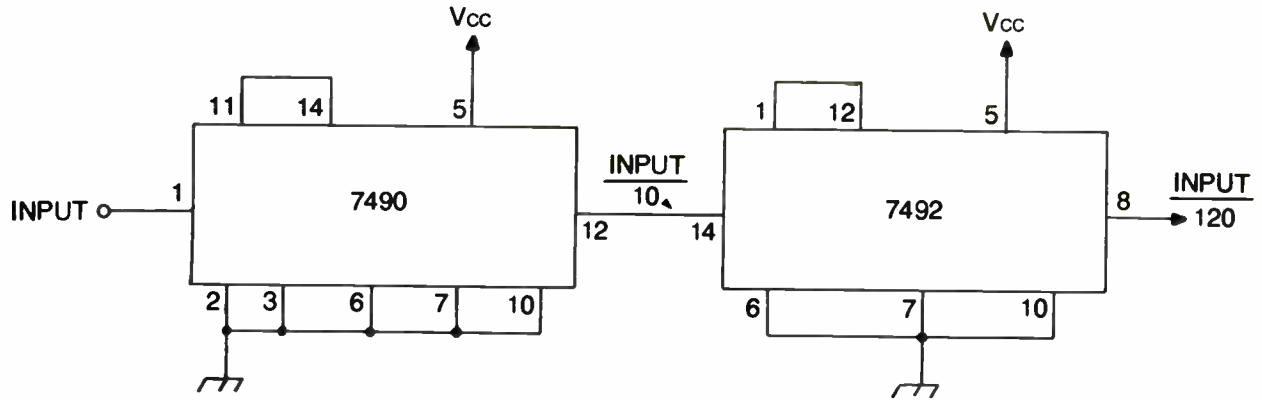
Divide-by-7 counter

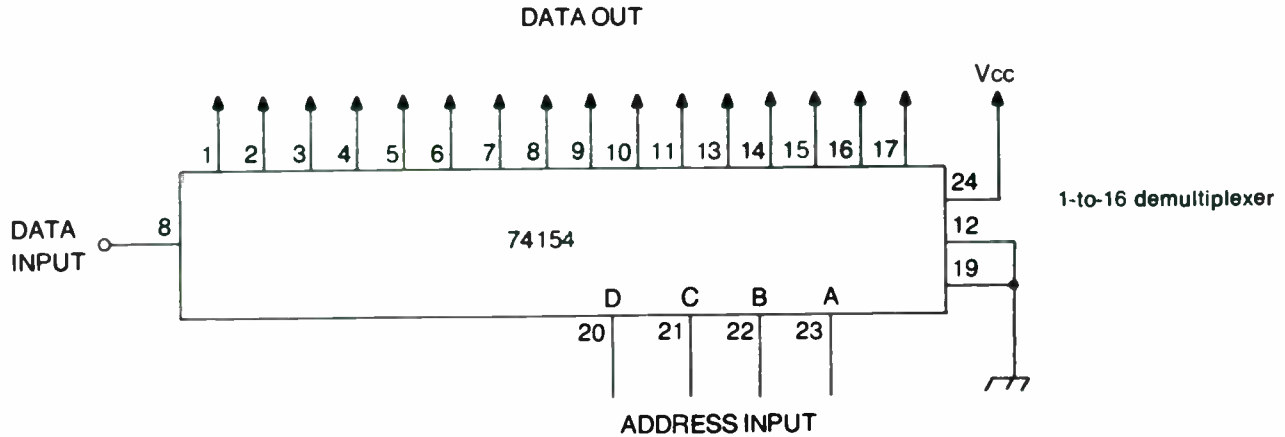


Divide-by-9 counter

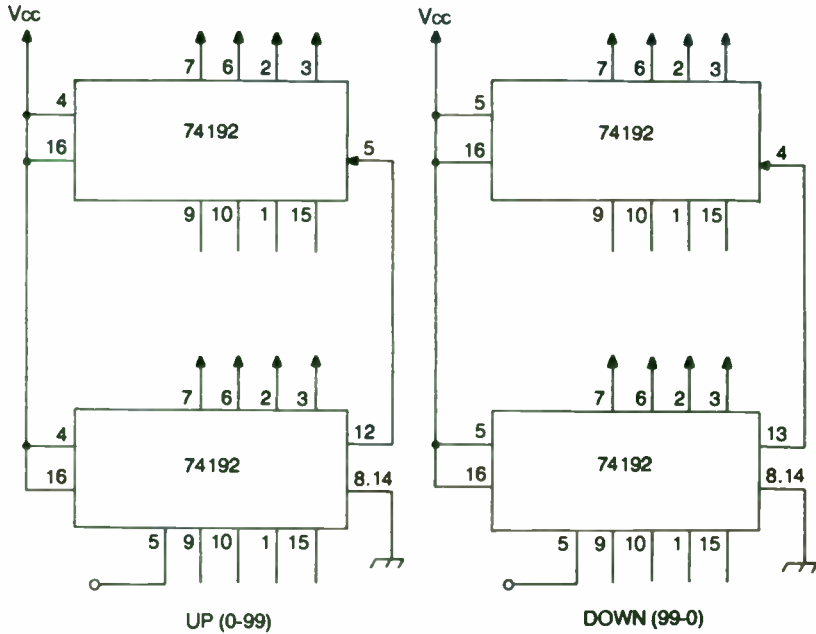


Divide-by-12 counter



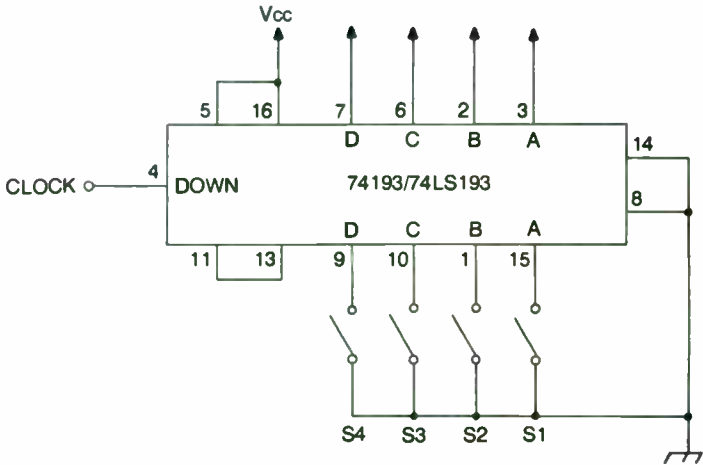
**74154—TTL FOUR TO SIXTEEN LINE DECODER**

# 74192—TTL BCD UP/DOWN COUNTER



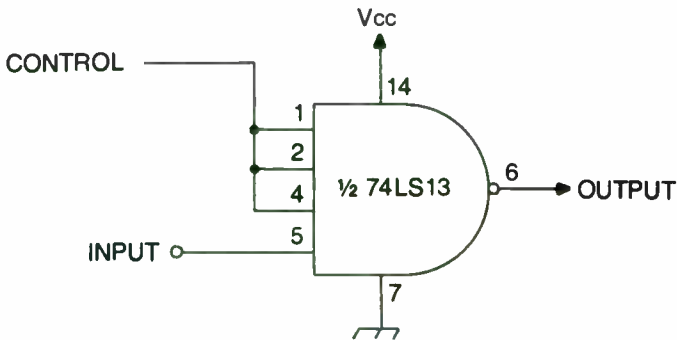
Cascaded counters

## 74193—TTL FOUR BIT UP/DOWN COUNTER

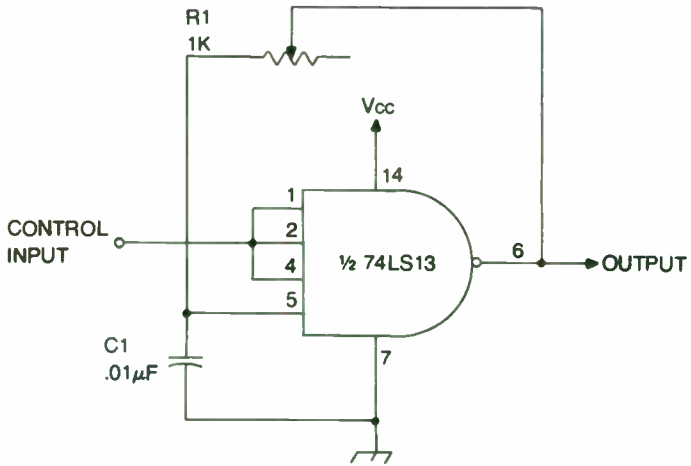


Count down from N and recycle

## 74LS13—LS DUAL NAND SCHMITT TRIGGER

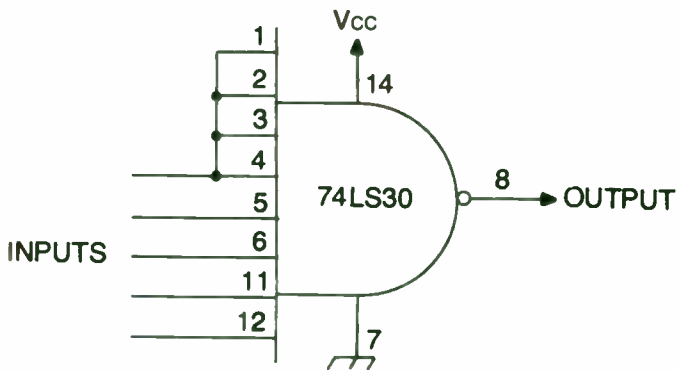


Gated threshold detector



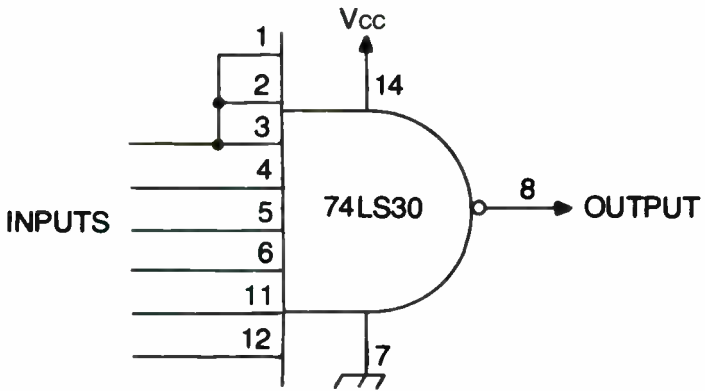
Gated oscillator

## 74LS30—LS EIGHT INPUT NAND GATE

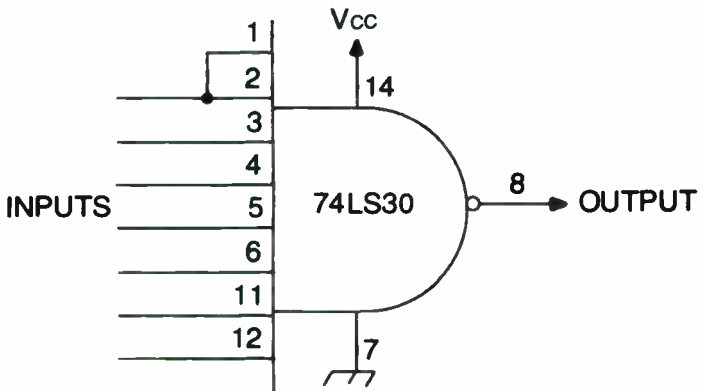


5-input NAND



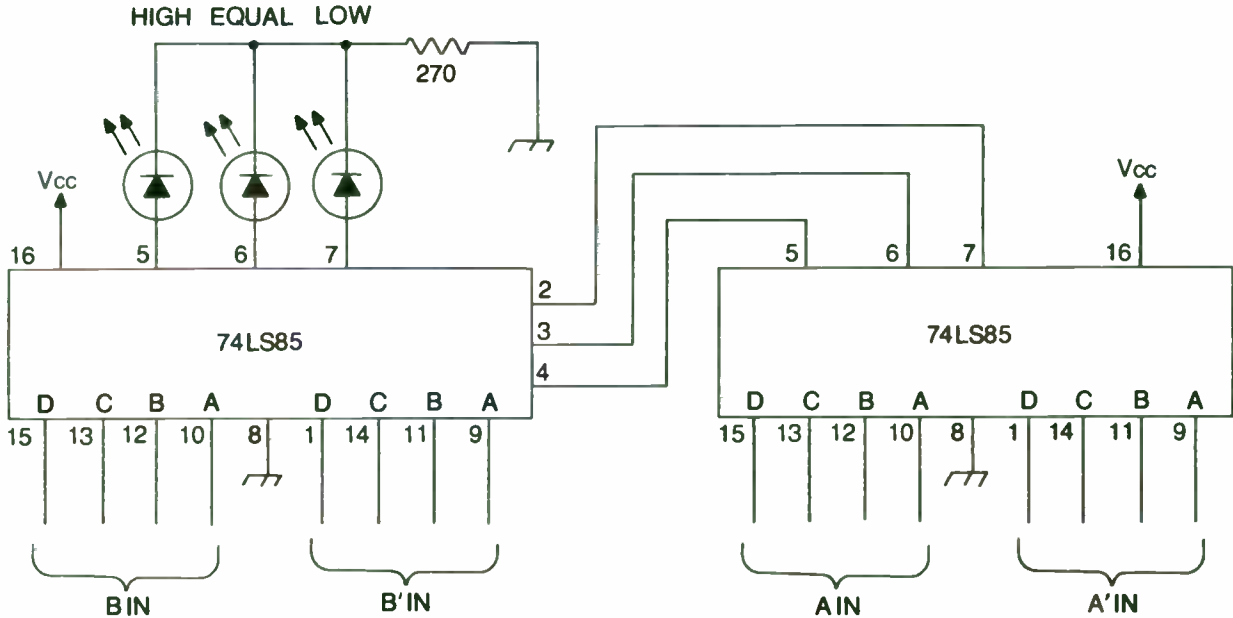


6-input NAND

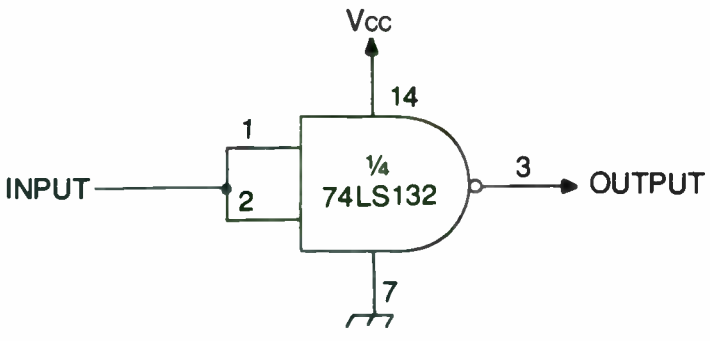


7-input NAND

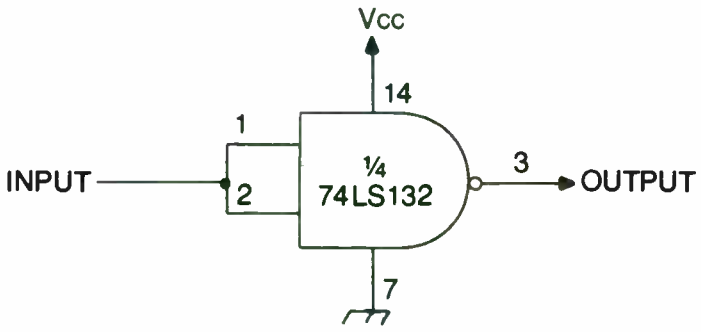
# 74LS85—LS FOUR BIT MAGNITUDE COMPARATOR



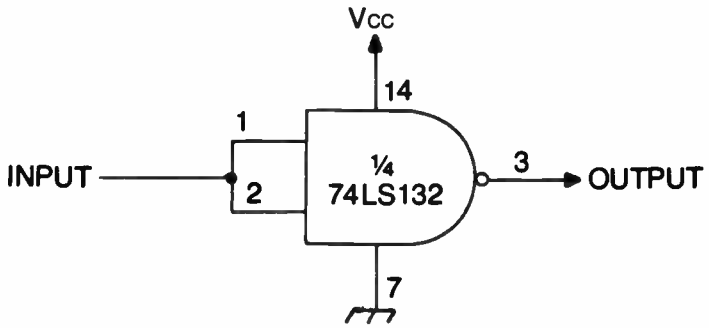
# 74LS132—LS QUAD NAND SCHMITT TRIGGER



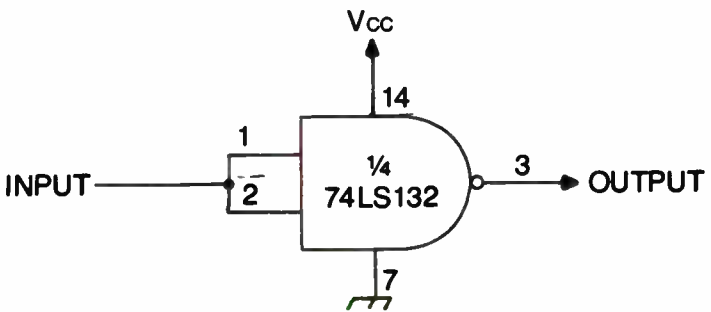
Wave shaper



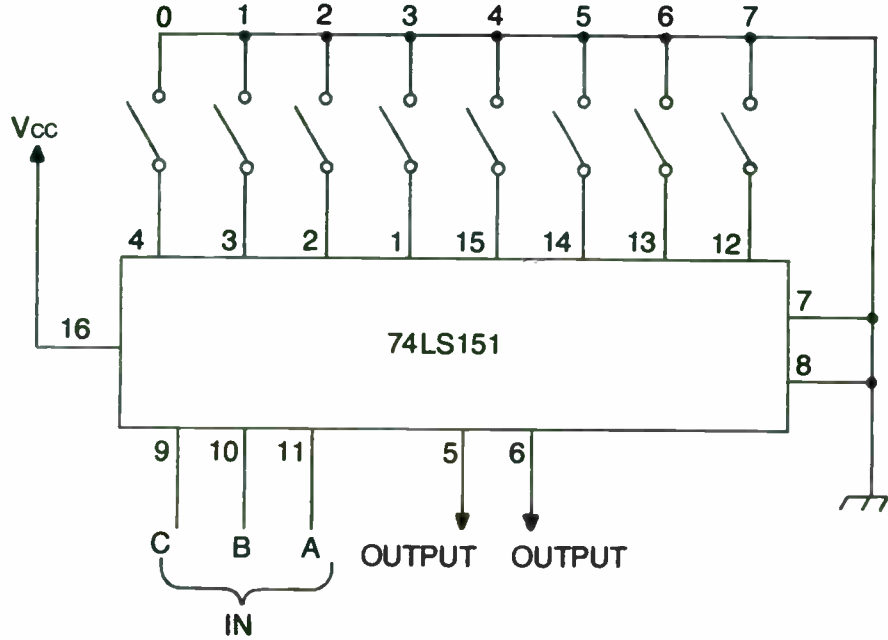
Pulse restorer



Noise eliminator

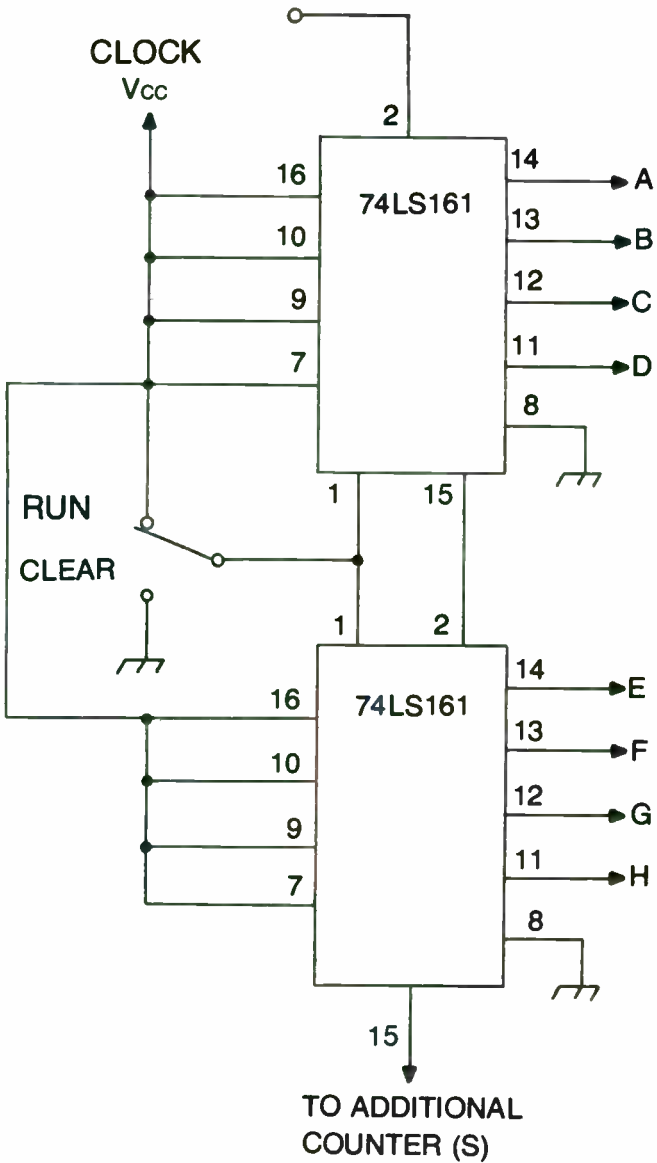


Threshold detector

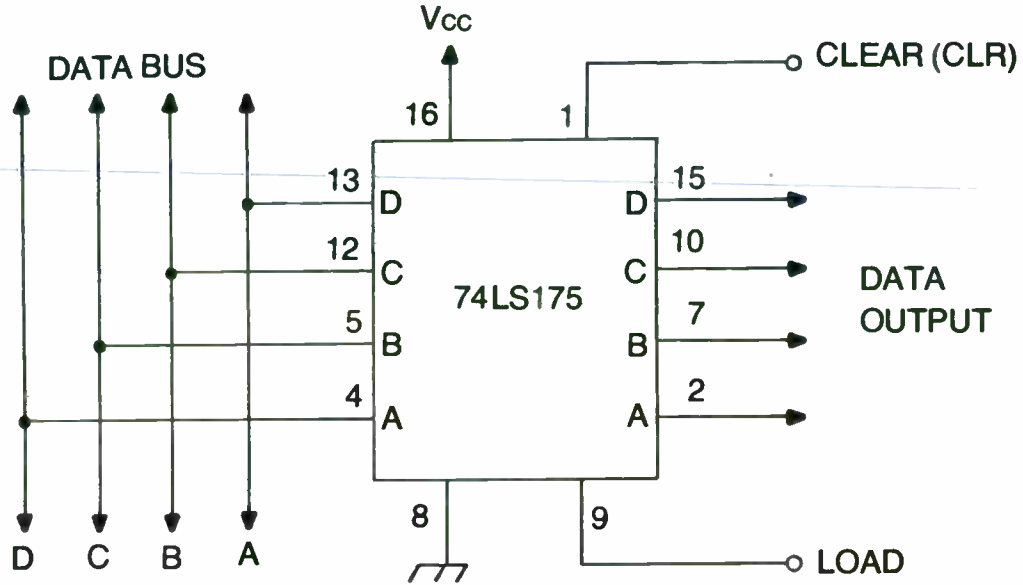
**74LS151—LS ONE OF EIGHT DATA SELECTOR**

Programmable gate

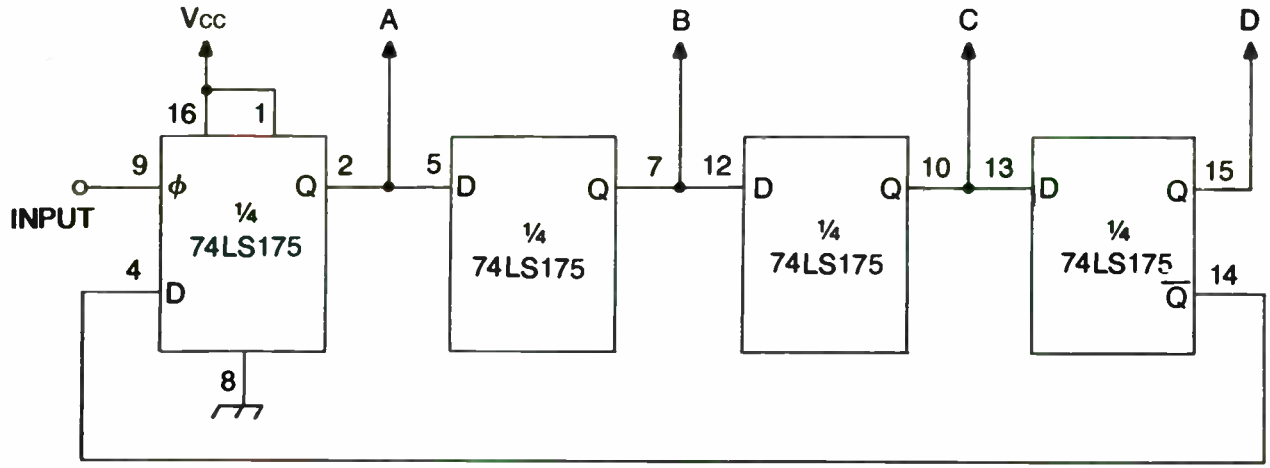
# 74LS161—LS FOUR BIT UP COUNTER



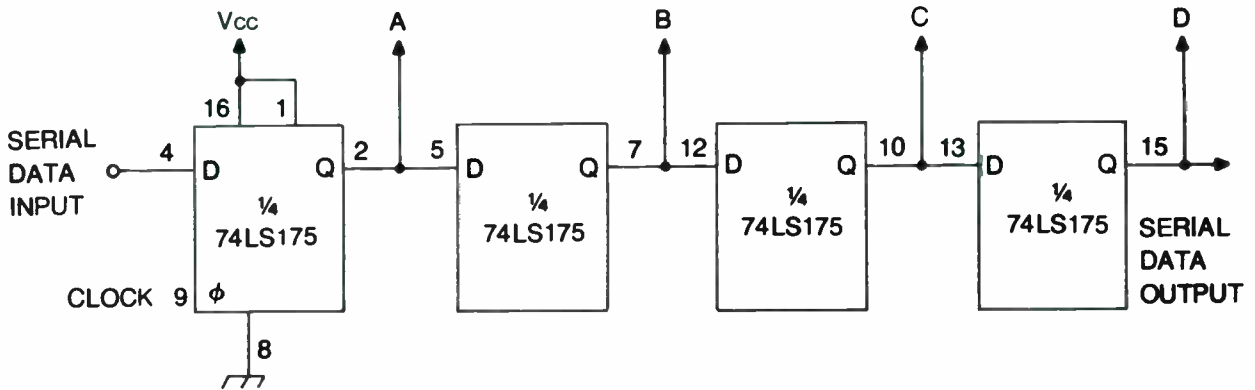
8-bit counter

**74LS175—LS QUAD D FLIP-FLOP**

4-bit data register

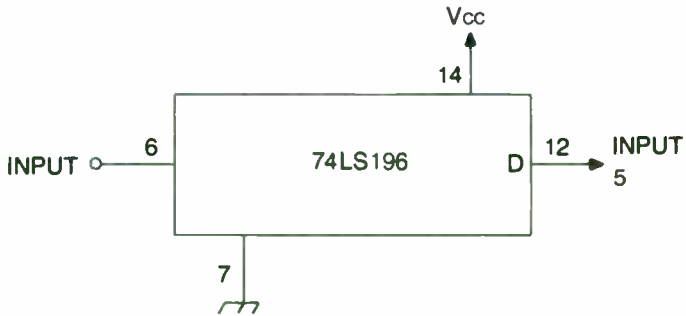




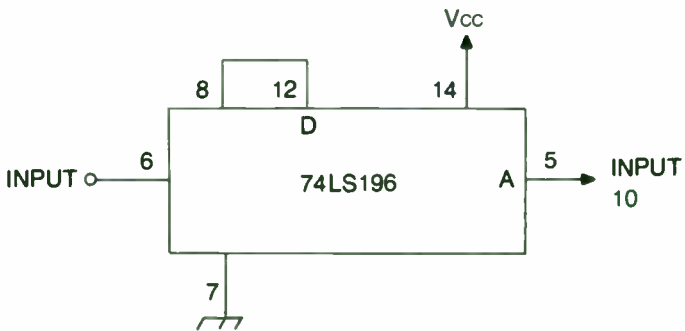


Serial in/out, parallel out shift register

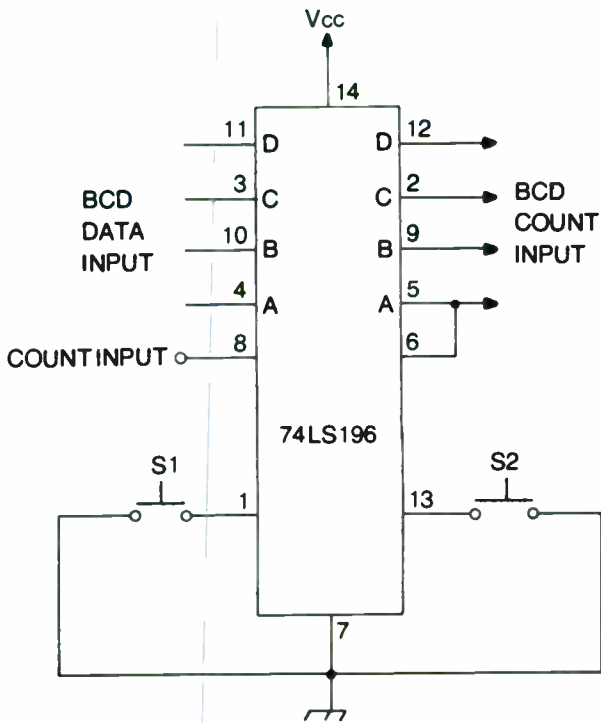
## 74LS196—LS BCD DECADE COUNTER



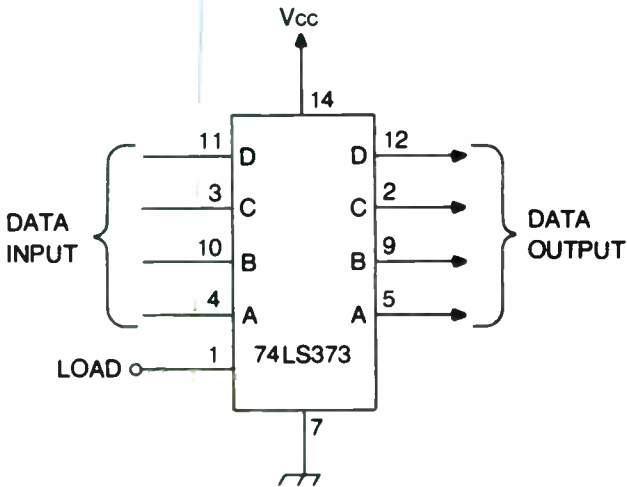
Divide-by-5 counter



Divide-by 10 counter

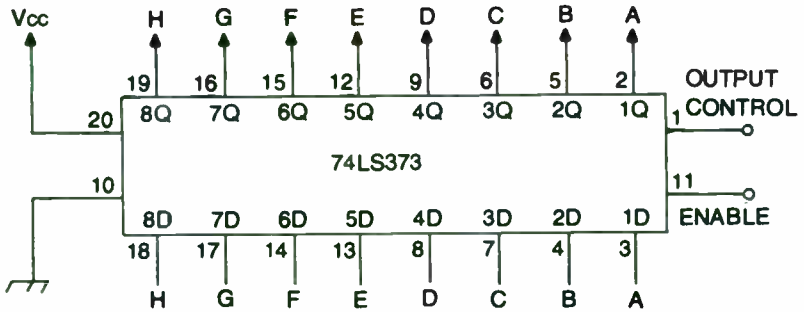


Decade counter



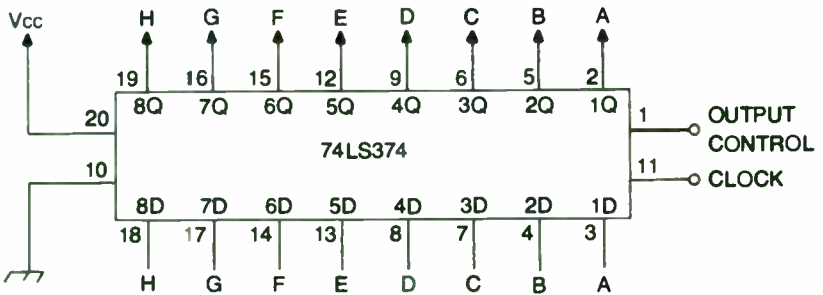
4-bit latch

## 74LS373—LS OCTAL D TYPE LATCH



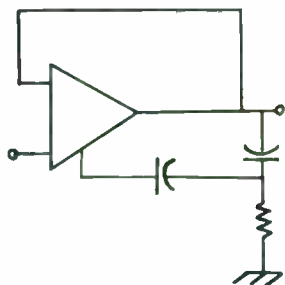
Three state eight bit storage register

## 74LS374—LS OCTAL D EDGE-TRIGGERED FLIP-FLOP



Clocked 3-state register

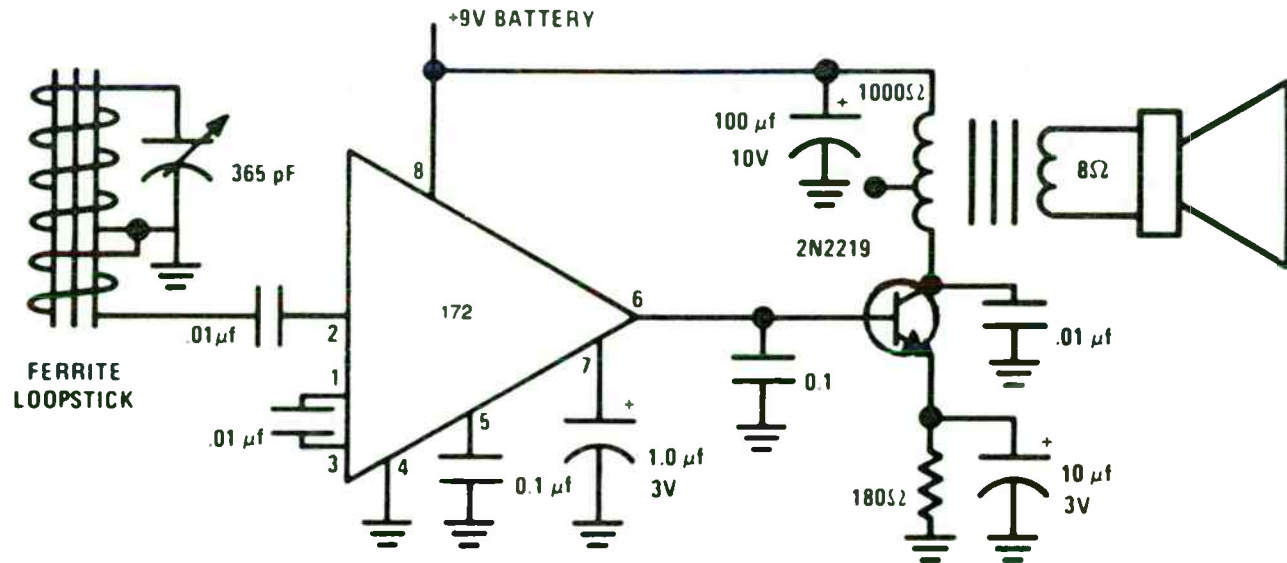
## Part V



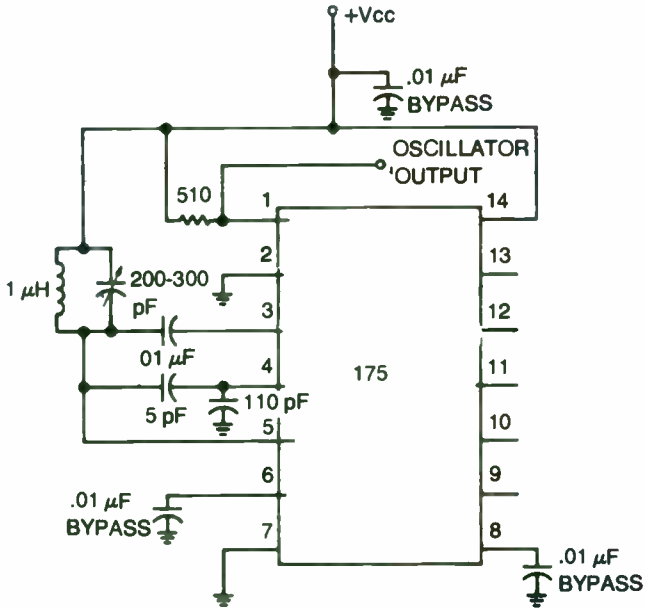
## Radio And Television Integrated Circuits

Not all chips wind up in audio amplifiers or logic circuits. Numerous ICs have been developed for use in radio and television applications. Many of these are unknown to the casual electronics experimenter. However, they are now becoming available on the surplus electronics market. This section will look at how some of these ICs can be used.

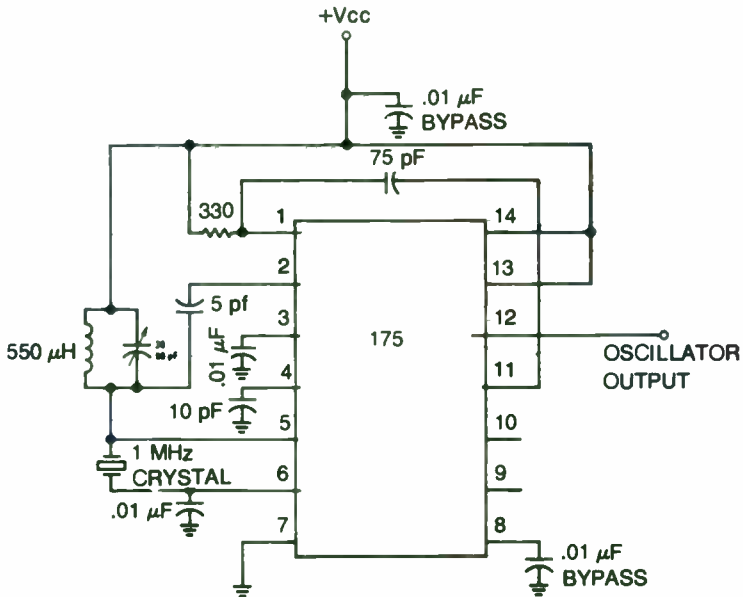
## 172—INTEGRATED AM IF STRIP



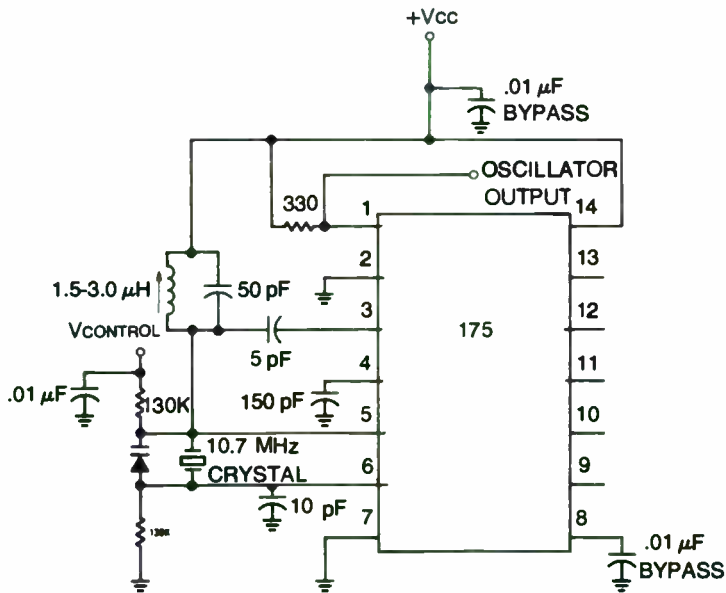
# 175—MONOLITHIC DIFFERENTIAL PAIR OSCILLATOR



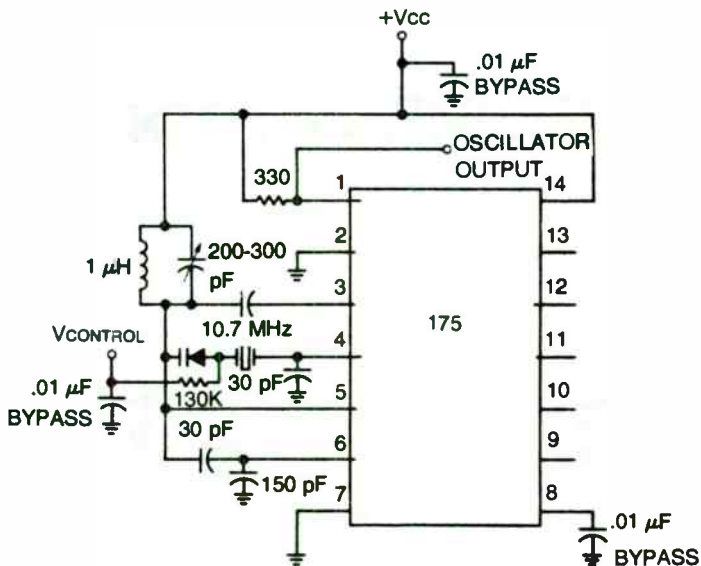
10 MHz L-C sine wave oscillator



1 MHz crystal oscillator with TTL output

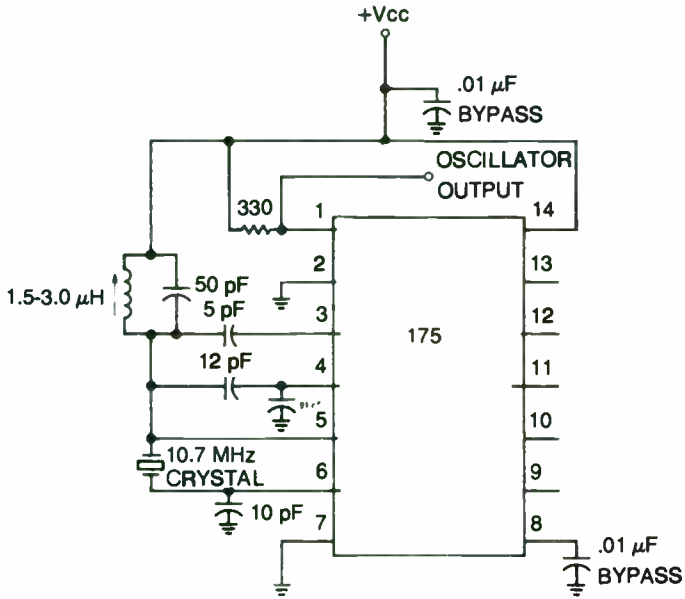


10.7 MHz voltage-controlled crystal oscillator parallel tuning



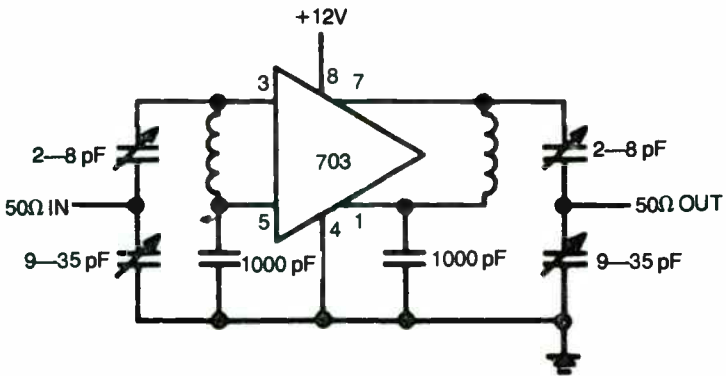
10.7 MHz voltage controlled crystal oscillator series tuning



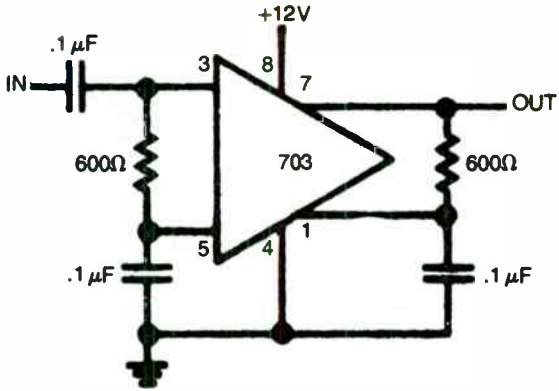


10.7 MHz parallel resonant crystal oscillator

**703—LOW POWER DRAIN RF/IF AMPLIFIER**

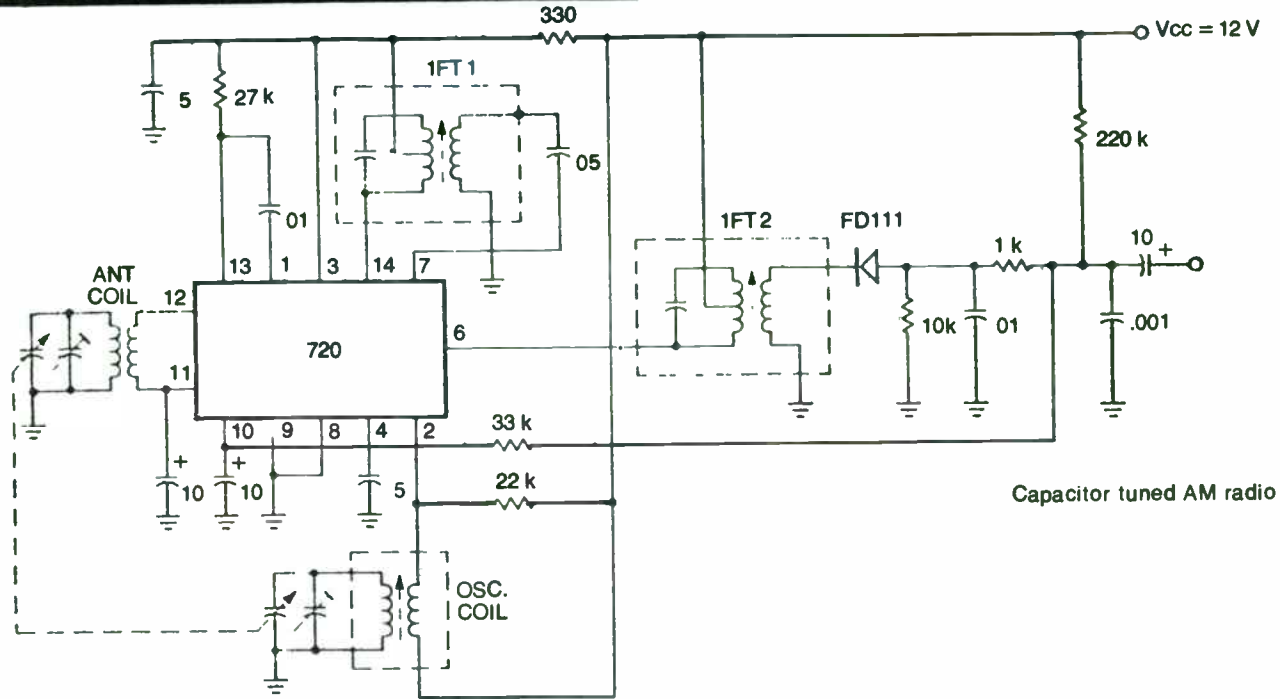


100 MHz narrow band amplifier

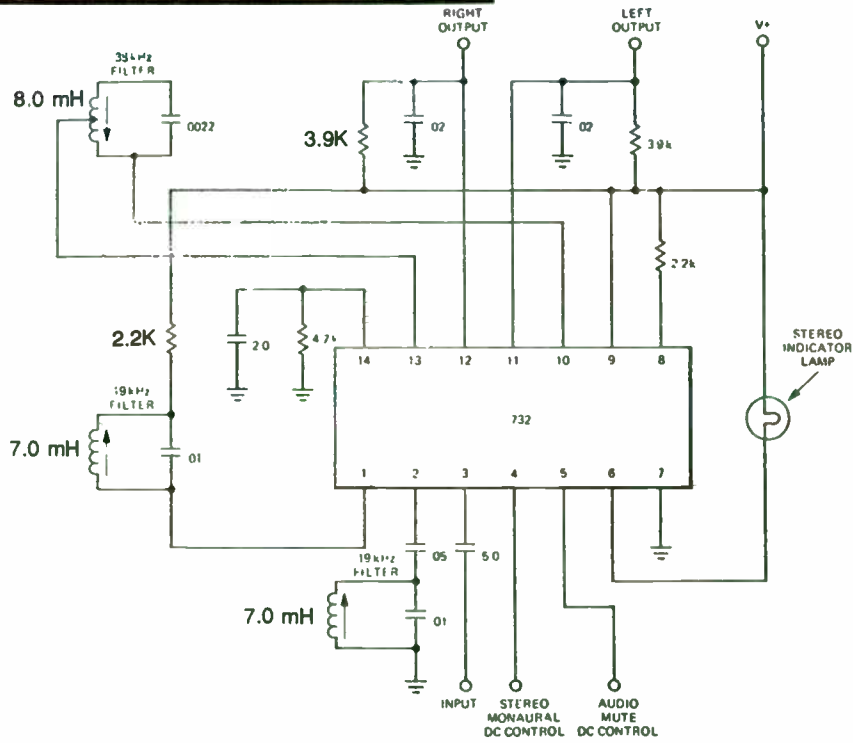


RC coupled video amplifier

# 720—AM RADIO SYSTEM INTEGRATED CIRCUIT

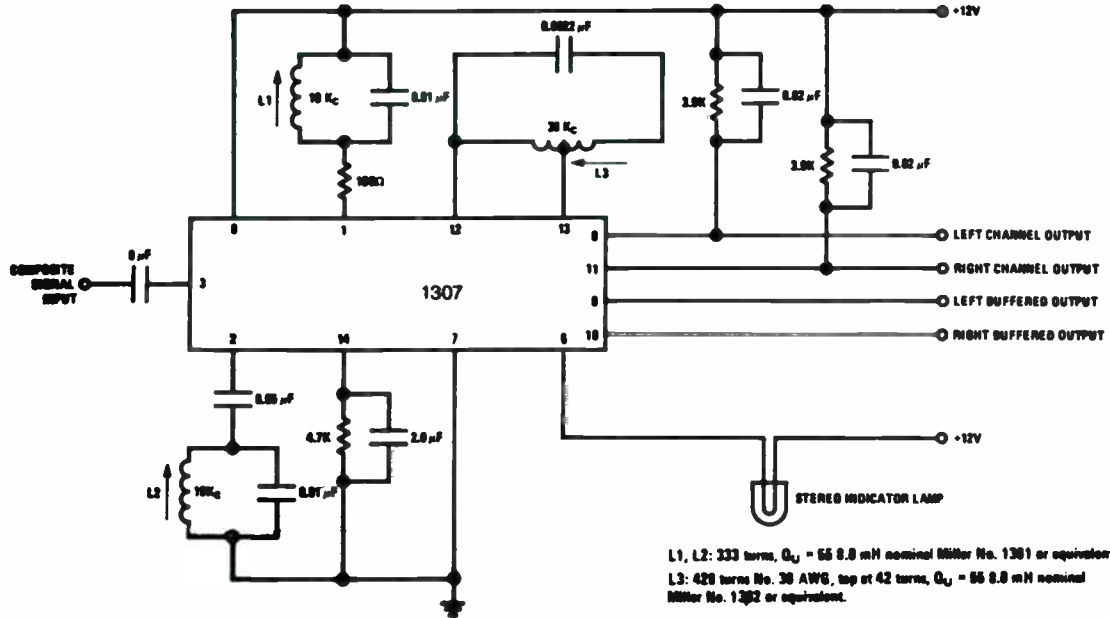


# 732—FM STEREO MULTIPLEX DECODER



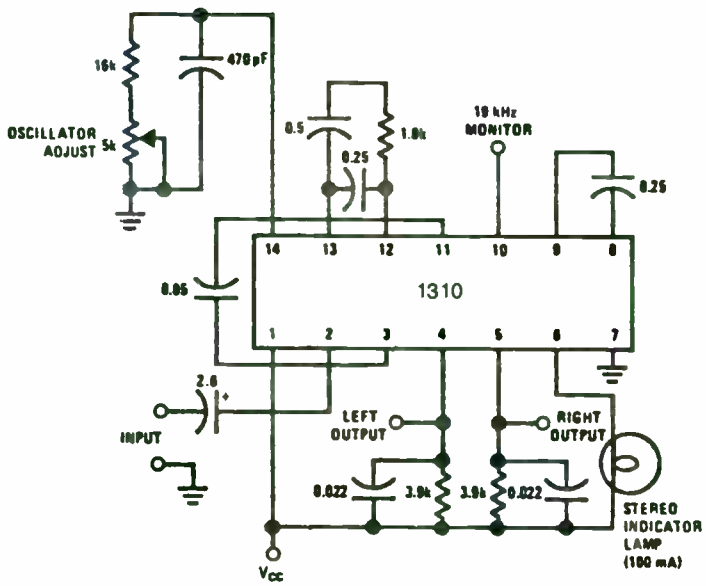
Fm stereo multiplex decoder circuit

# 1307—INTEGRATED STEREO MULTIPLEX DEMODULATOR



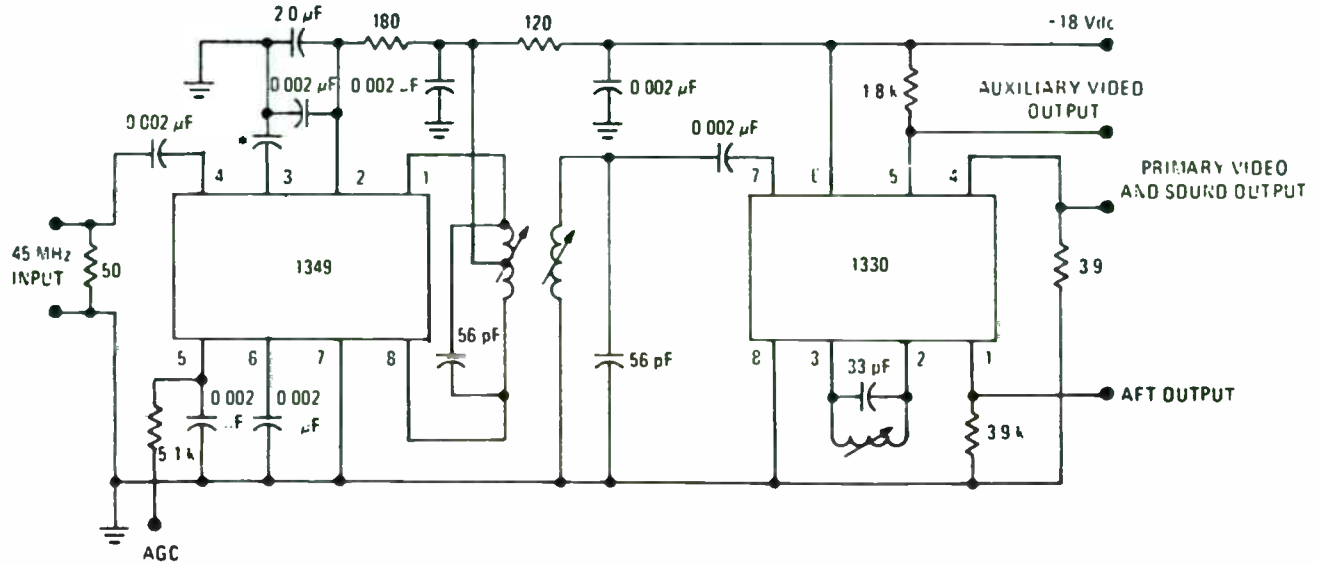
Stereo multiplex demodulator with beacon lamp

# 1310—PHASE LOCKED LOOP FM STEREO DEMODULATOR



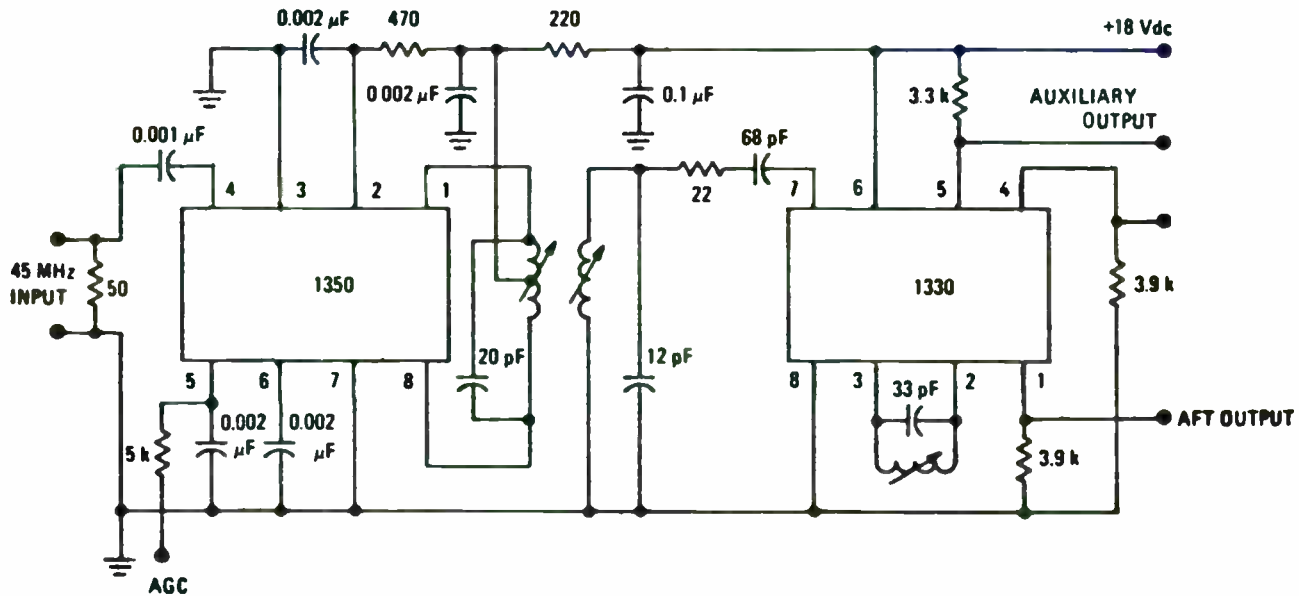
Fm stereo demodulator with indicating lamp

# 1349—INTEGRATED IF AMPLIFIER WITH AGC



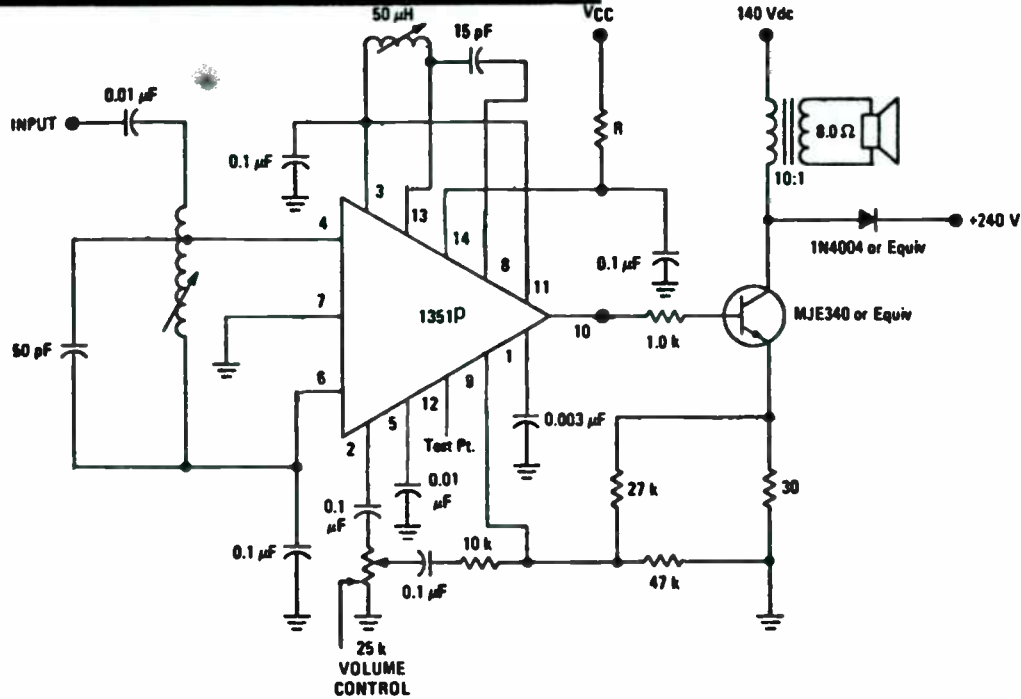
Video IF amplifier

# 1350—INTEGRATED IF AMPLIFIER



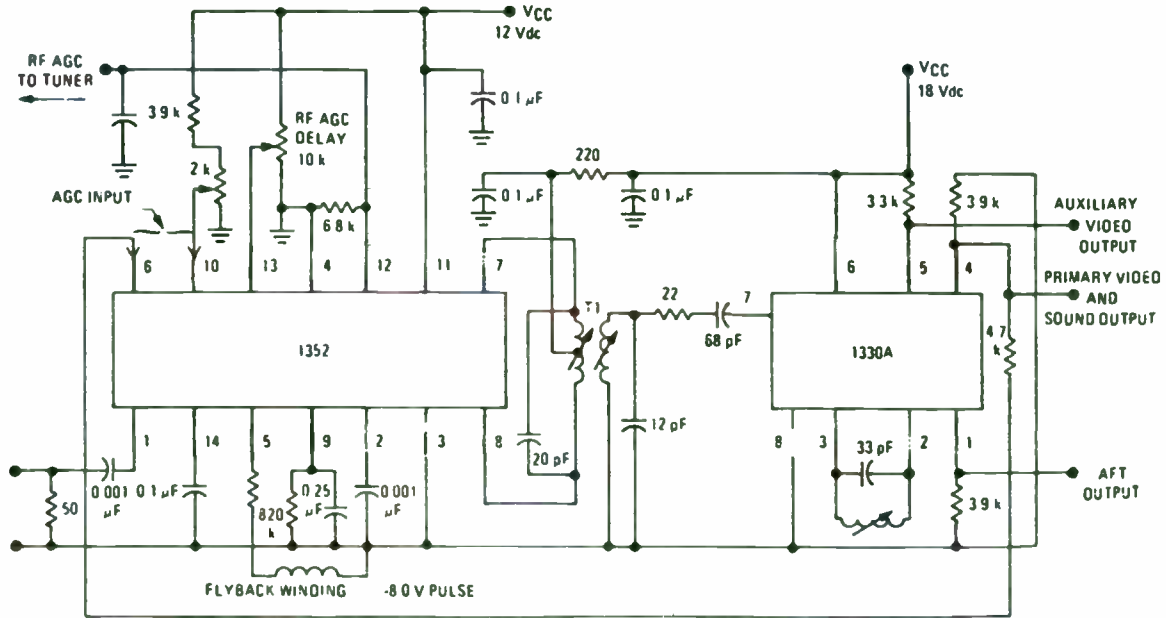


# 1351—INTEGRATED TV SOUND CIRCUIT

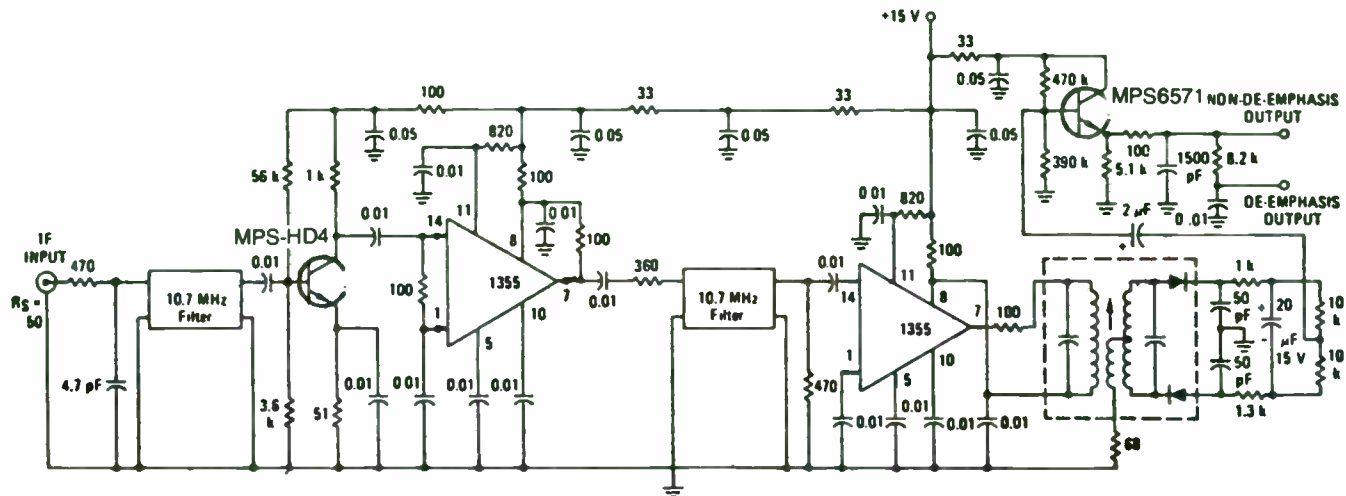


4.5 MHz typical application

# 1352—TV VIDEO AMPLIFIER WITH AGC

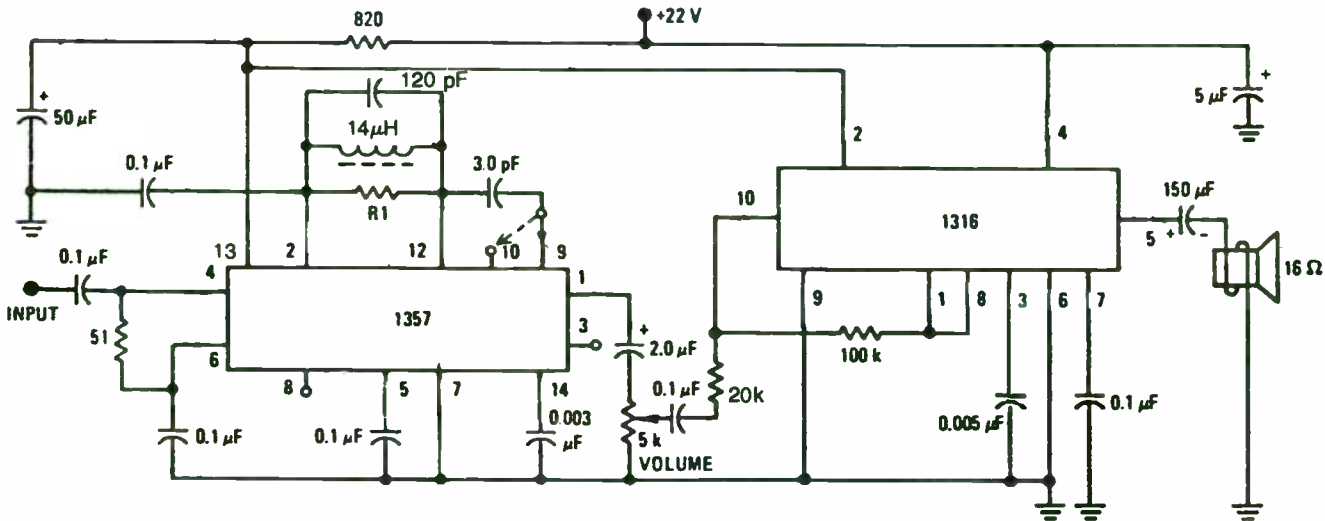


# 1355—BALANCED FOUR STAGE HIGH GAIN FM/IF AMPLIFIER

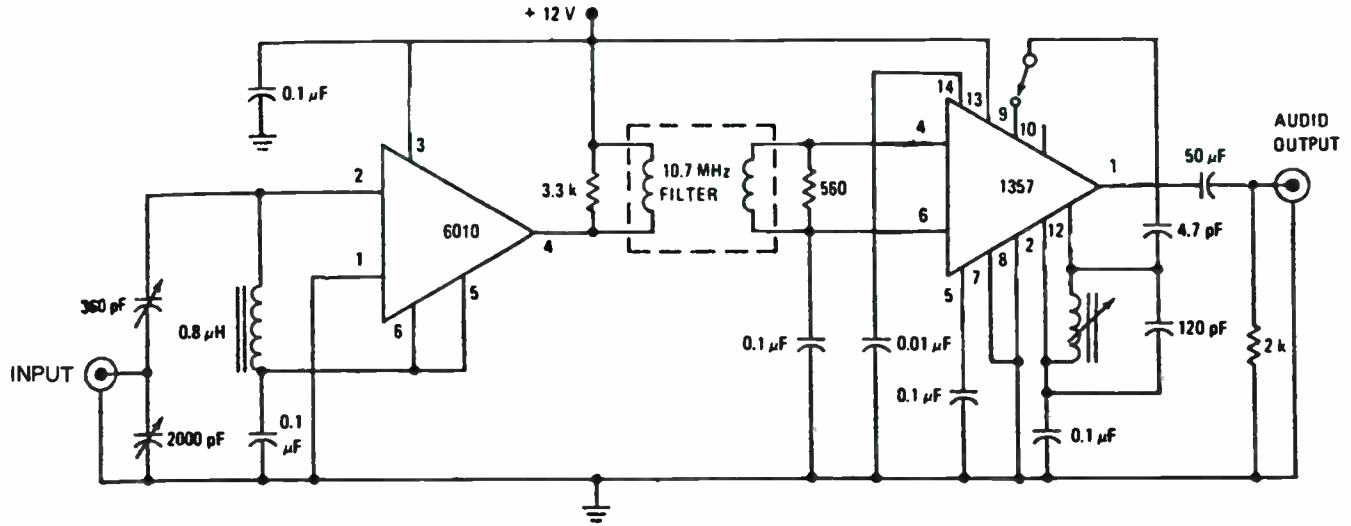


Dual 1355 FM IF application

# 1357—INTEGRATED IF AMPLIFIER AND QUADRATURE DETECTOR

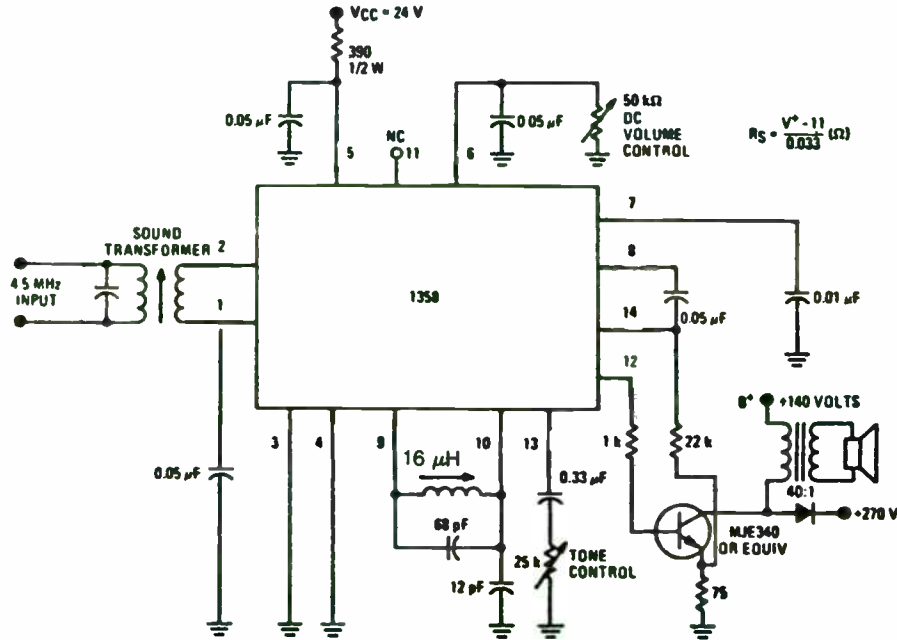


TV typical application circuit



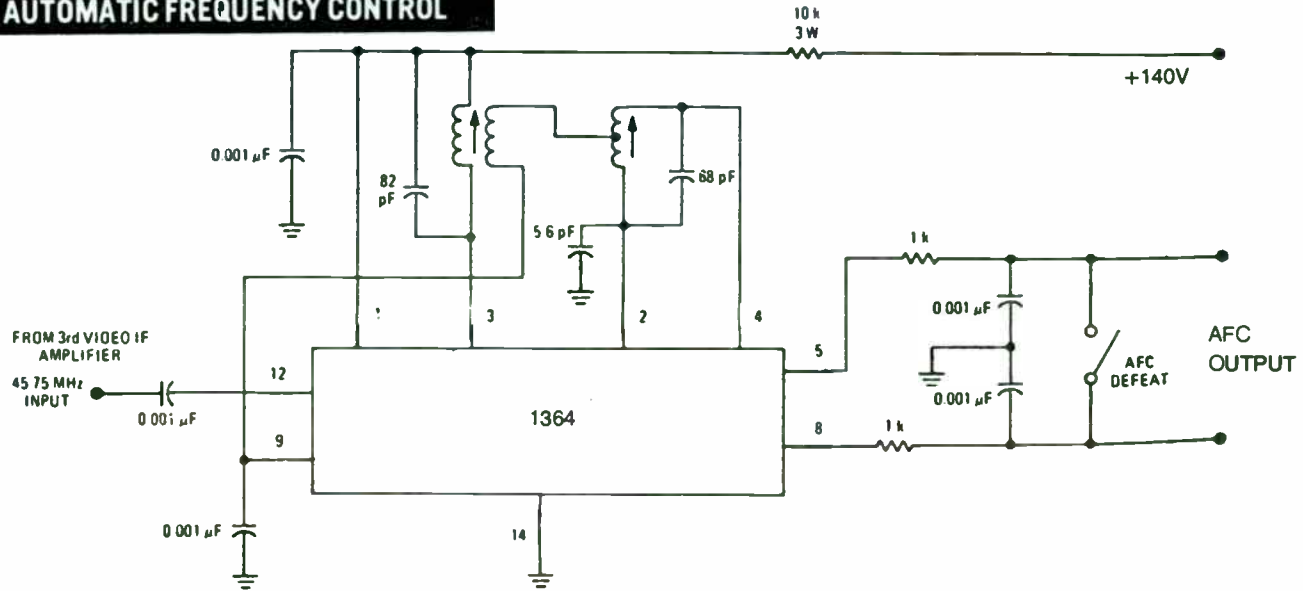
Fm radio typical application circuit

# 1358—INTEGRATED TELEVISION SOUND IF AMPLIFIER



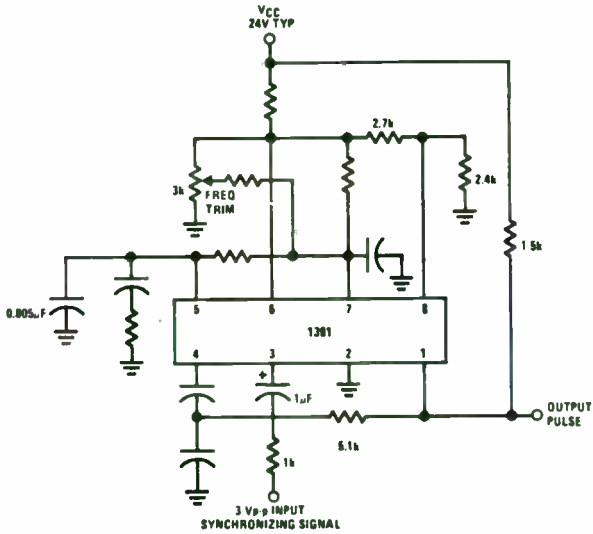
TV application circuit

# 1364—INTEGRATED TV AUTOMATIC FREQUENCY CONTROL

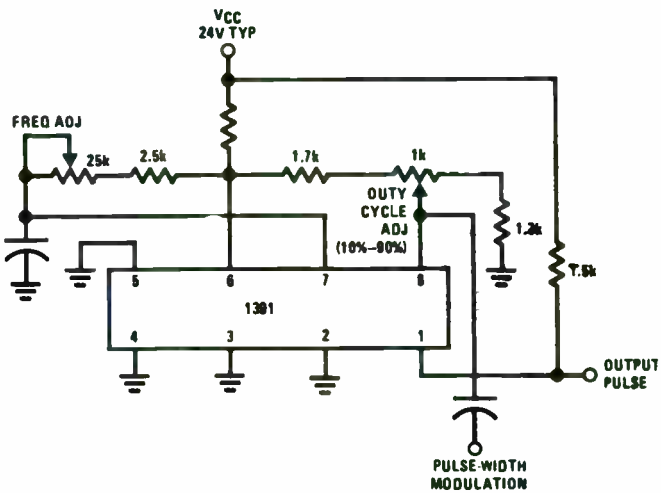


Typical AFC application

# 1391—INTEGRATED PHASE LOCK LOOP



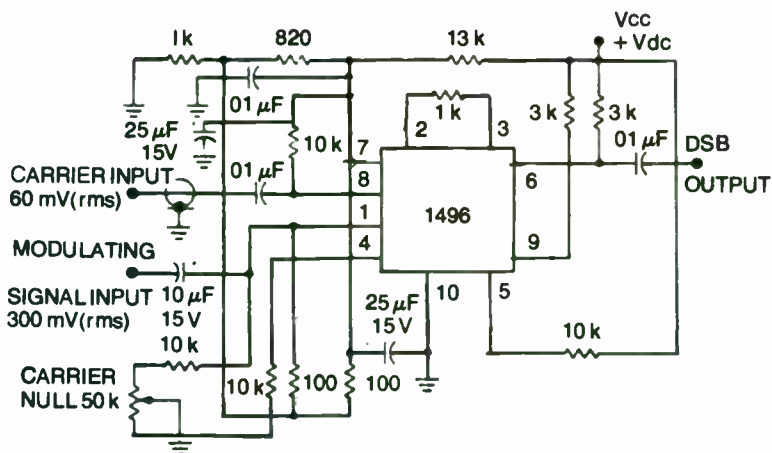
General purpose phase-lock loop



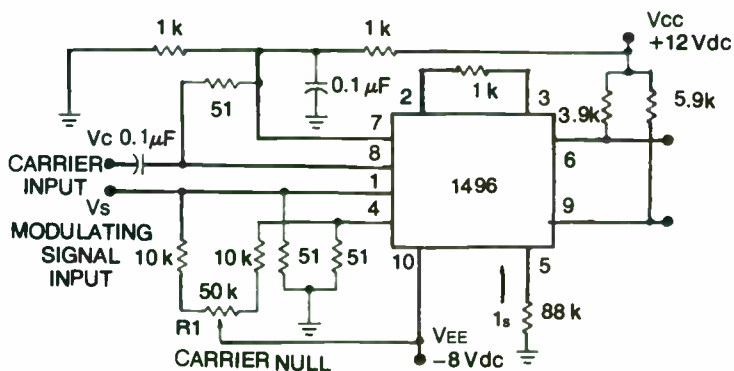
Variable duty cycle oscillator



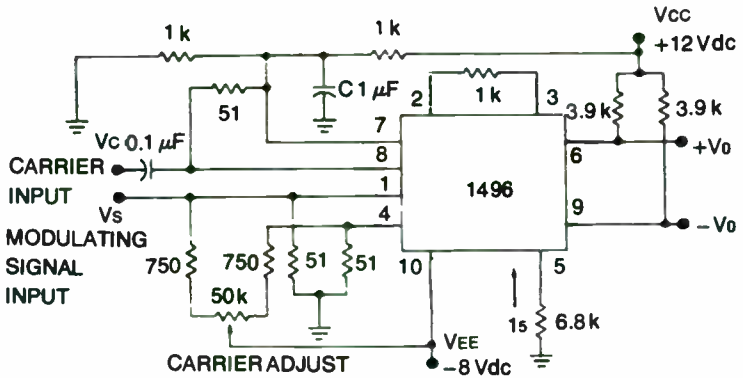
# 1496—BALANCED MODULATOR/DEMODULATOR



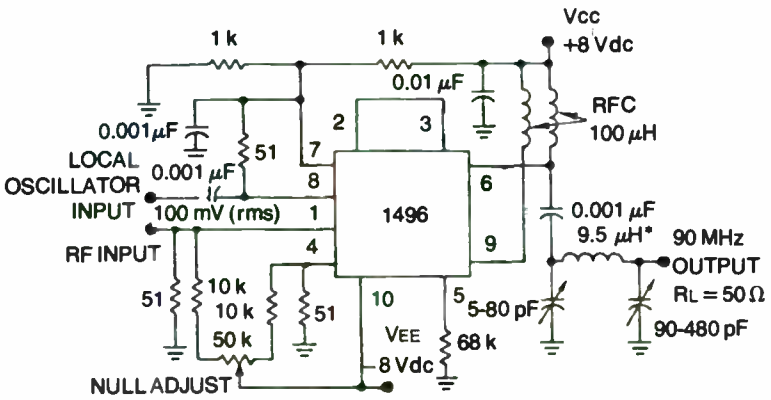
Balanced modulator (+12 Vdc single supply)



Balanced modulator-demodulator

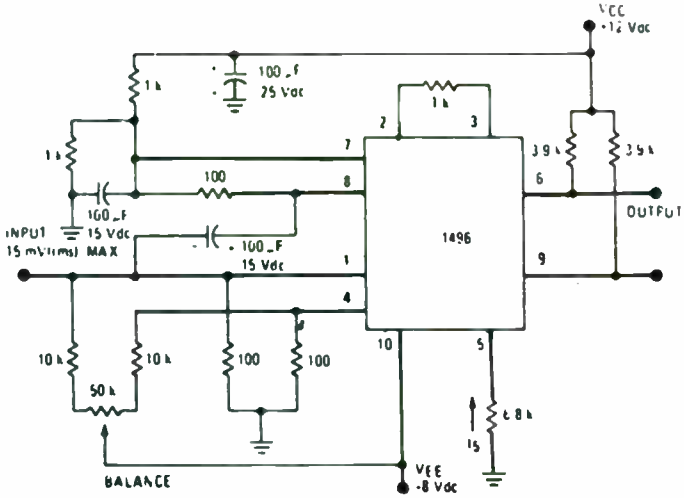


AM modulator circuit

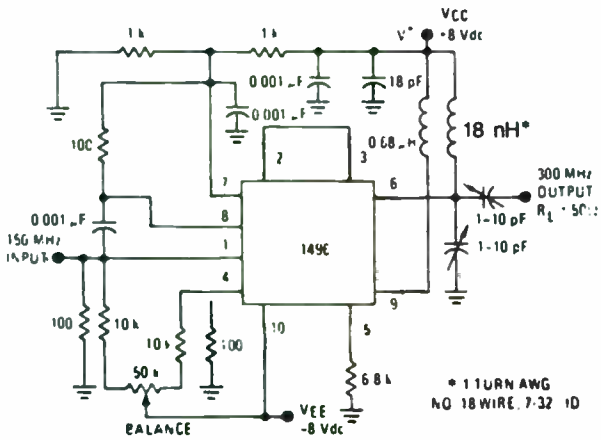


\* 44 TURNS AWG NO. 28 ENAMELLED WIRE, WOUND ON MICROMETALS TYPE 44.6 TOROID CORE

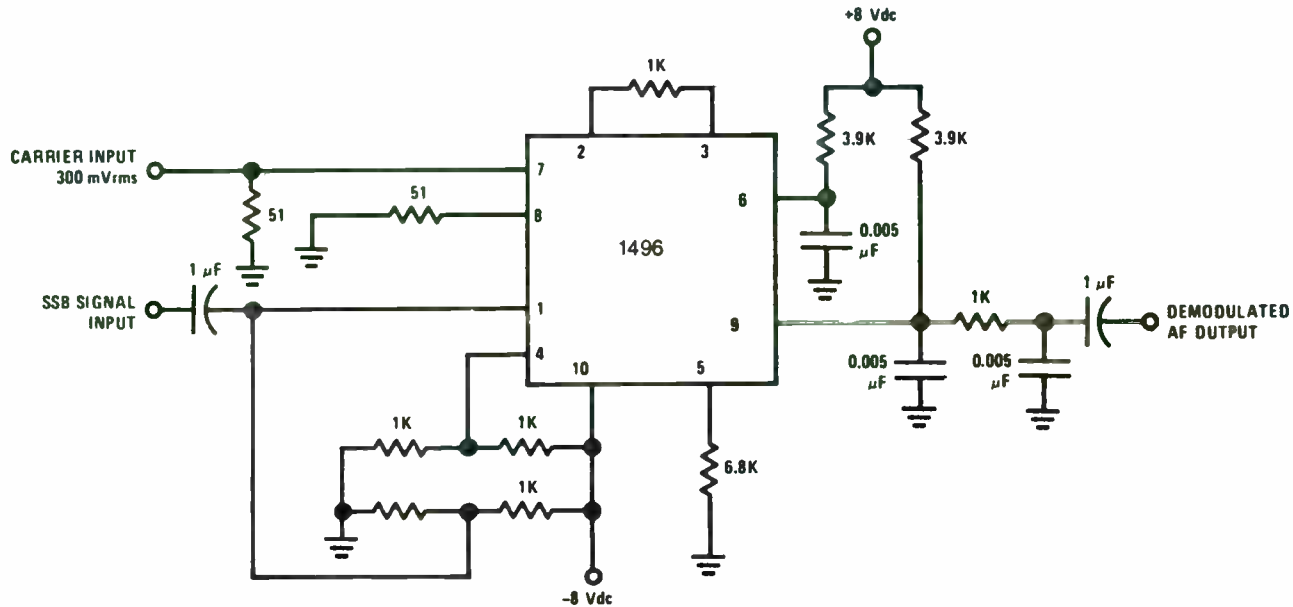
Doubly balanced mixer (broadband inputs, 9.0 MHz tuned output)

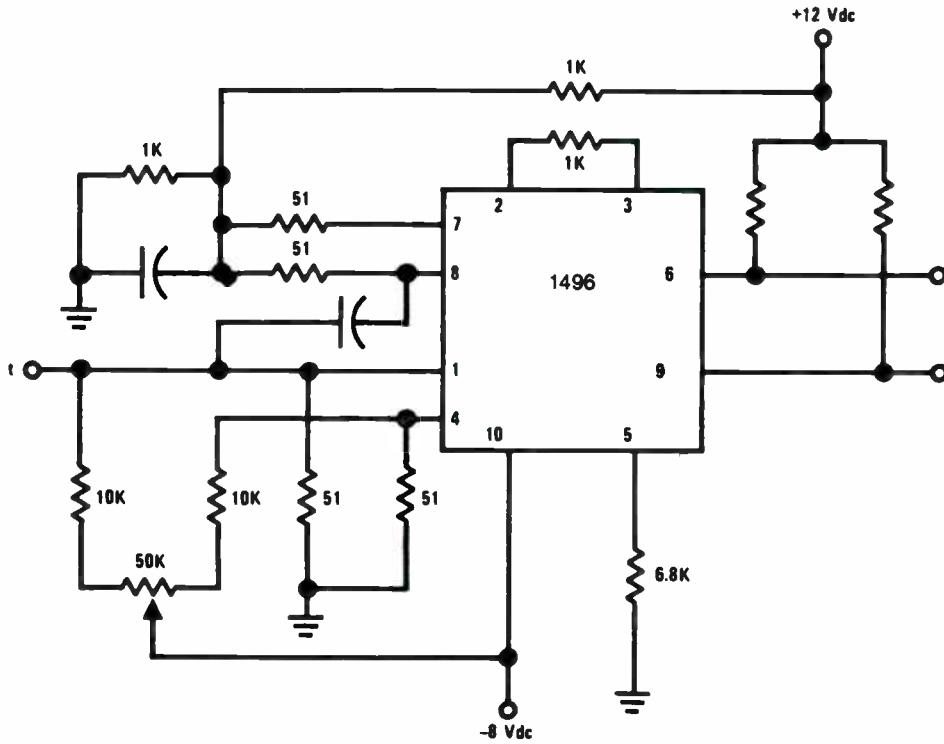


Low-frequency doubler



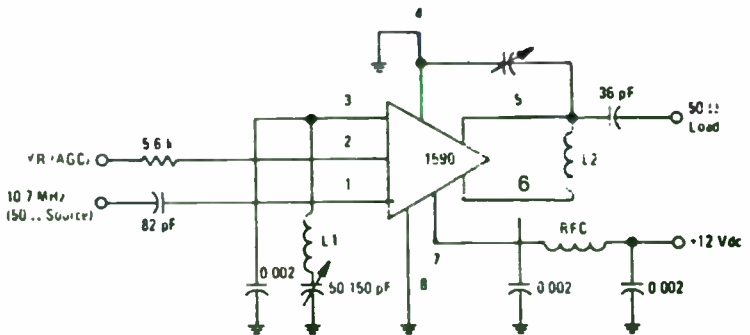
150 to 300 MHz doubler





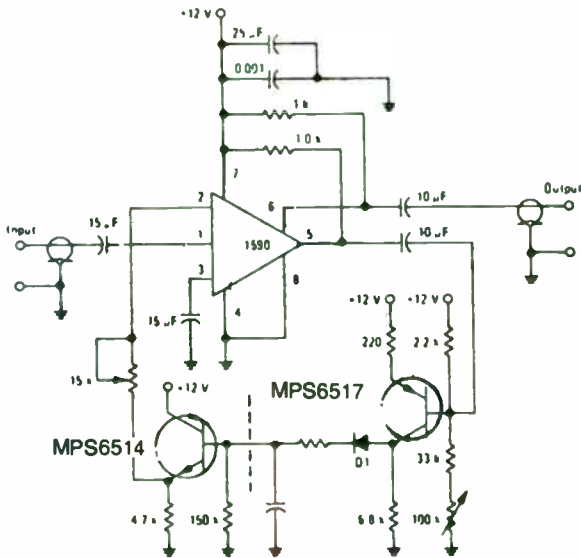
Broadband frequency doubler

# 1590— WIDEBAND INTEGRATED AMPLIFIER WITH A.G.C.

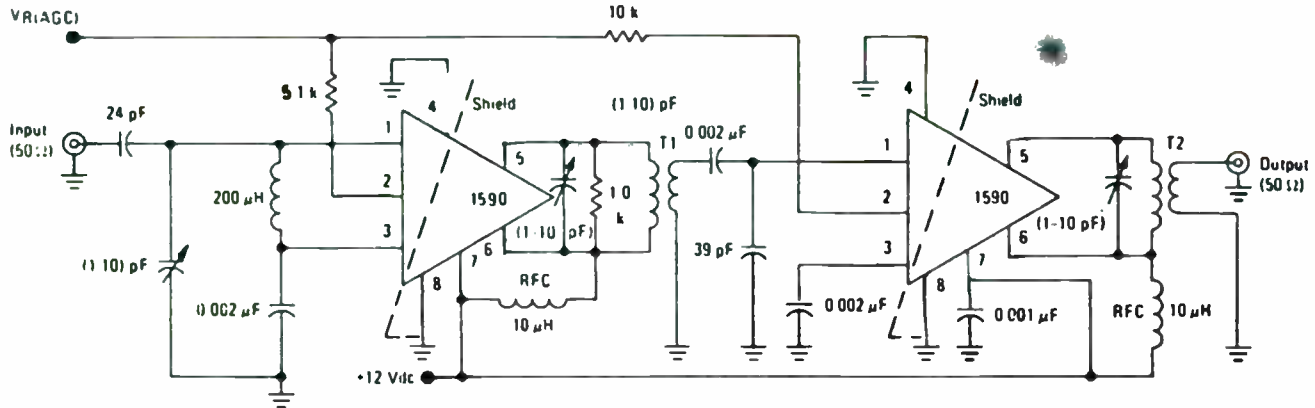


- L1 - 24 Turns No. 22 AWG Wire on a T12-44 Micro Metal Toroid Core (-124 pF)
- L2 - 20 Turns, No. 22 AWG Wire on a T12-44 Micro Metal Toroid Core (-100 pF)

10.7-MHz amplifier gain  $\approx$  55 dB, BW  $\approx$  100 kHz



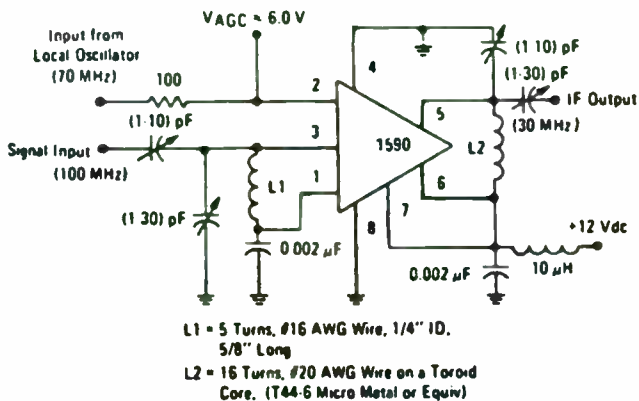
Speech compressor



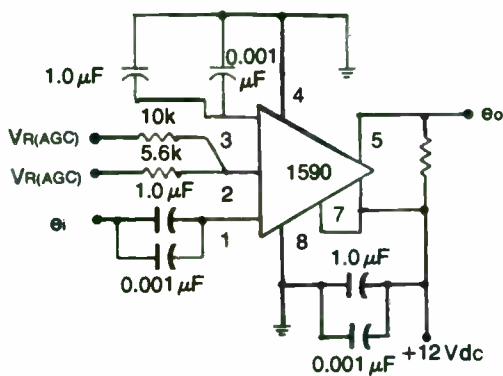
T1 Primary Winding = 15 Turns, #22 AWG Wire, 1/4" ID Air Core  
 Secondary Winding = 4 Turns, #22 AWG Wire,  
 Coefficient of Coupling = 1.0

T2 Primary Winding = 10 Turns, #22 AWG Wire, 1/4" ID Air Core  
 Secondary Winding = 2 Turns, #22 AWG Wire,  
 Coefficient of Coupling = 1.0

Two stage 60 MHz IF amplifier (Power gain  $\approx$  80 dB, BW  $\approx$  1.5 MHz)

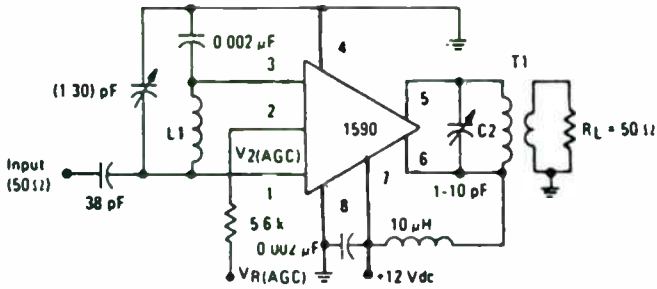


100 MHz mixer



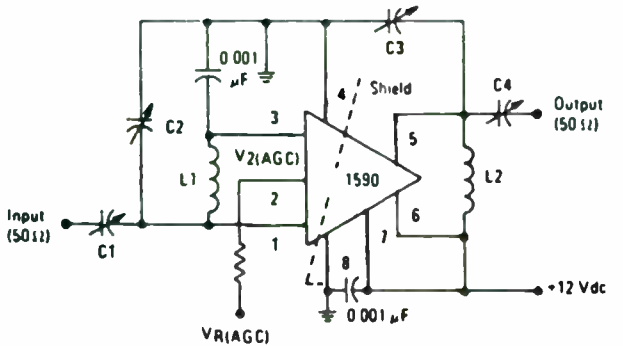
Video amplifier





- L1 = 12 Turns #22 AWG Wire on a Toroid Core.  
(T37 6 Micro Metal or Equiv)
- T1 Primary = 17 Turns #20 AWG Wire on a Toroid Core.  
(T44 6 Micro Metal or Equiv)
- Secondary = 2 Turns #20 AWG Wire

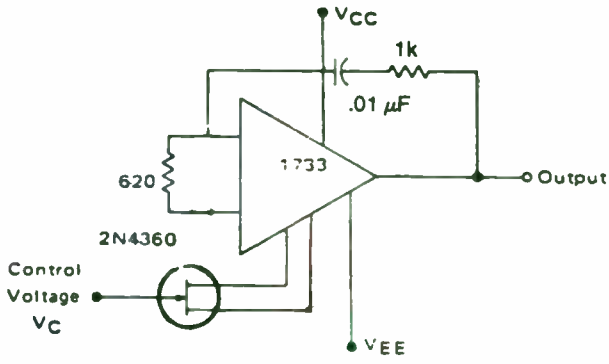
30-MHz amplifier (Power Gain = 50 dB, BW ≈ 1.0 Mhz)



- L1 = 7 Turns, #20 AWG Wire, 5/16" Dia.,  
5/8" Long
- L2 = 6 Turns, #14 AWG Wire, 9/16" Dia.,  
3/4" Long
- C1 C2 C3 = (1 30) pF  
C4 = (1 10) pF

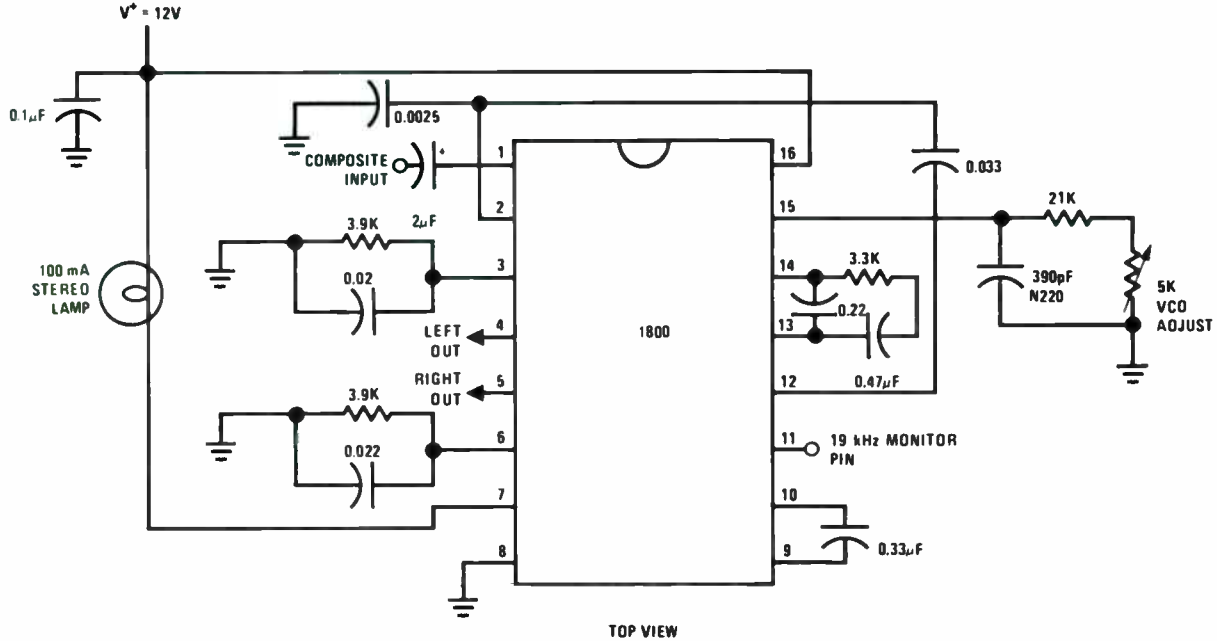
60 Mhz power gain test circuit

# 1733—DIFFERENTIAL VIDEO WIDEBAND AMPLIFIER



Voltage controlled oscillator

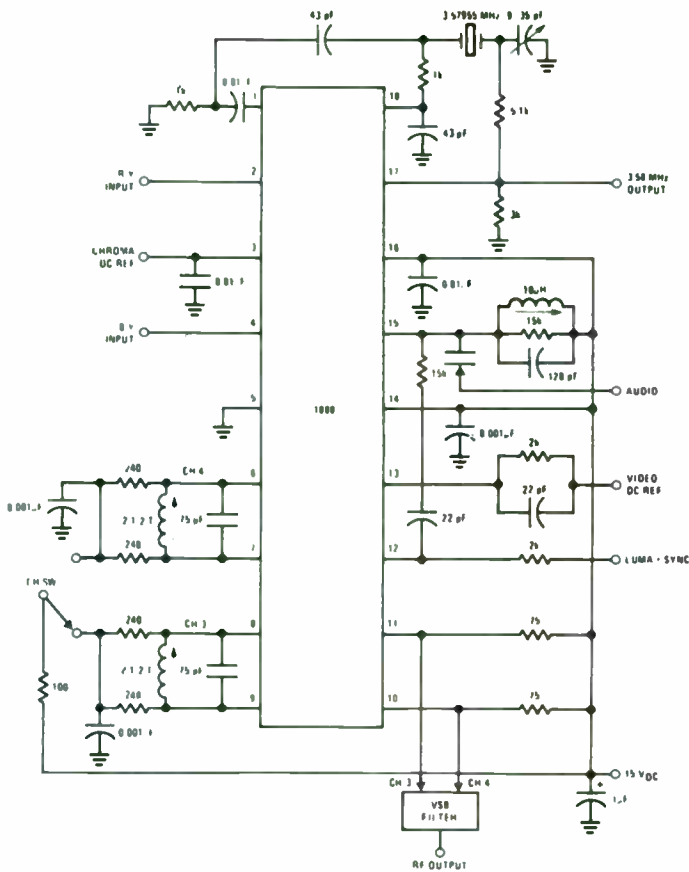
# 1800—PHASE LOCKED LOOP FM STEREO DEMODULATOR



Fm stereo demodulator with beacon

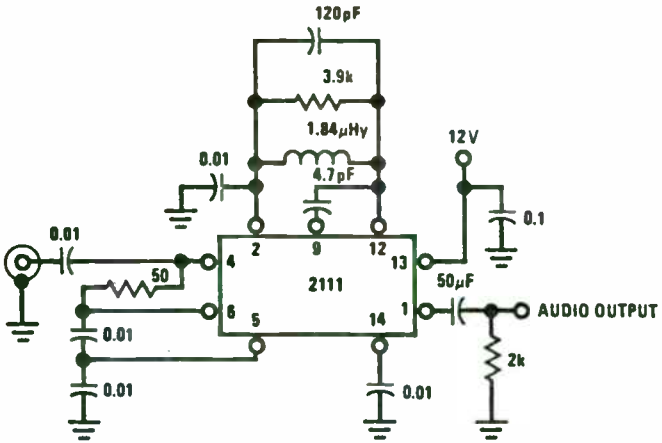


# 1889—INTEGRATED VIDEO MODULATOR

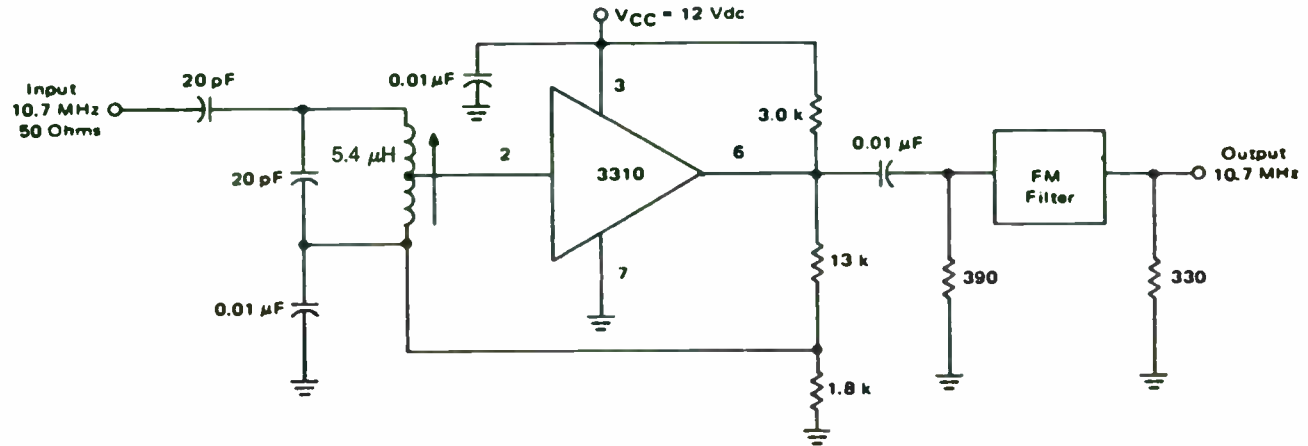


AC test circuit

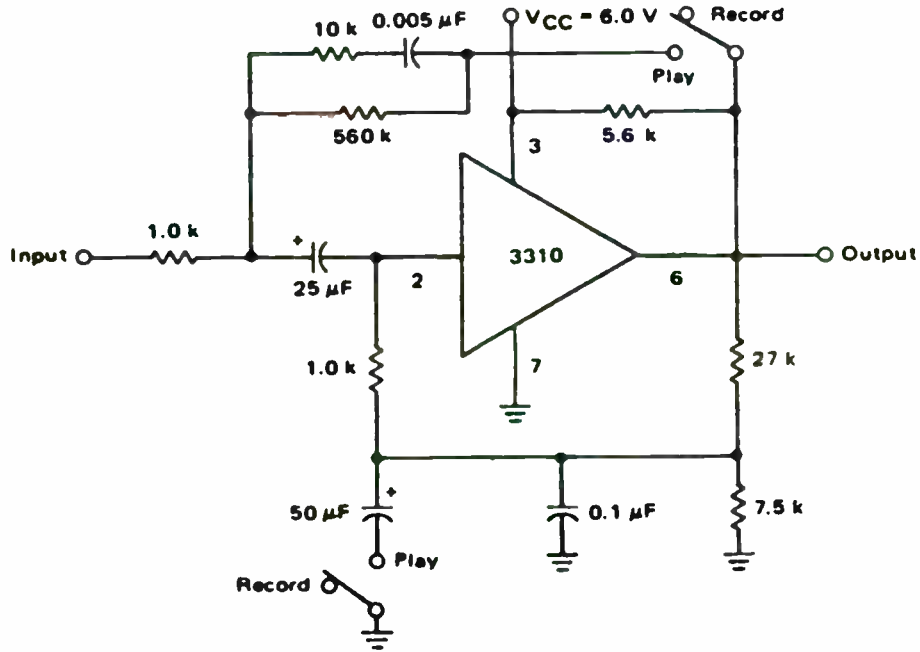
# 2111—INTEGRATED FM DETECTOR AND LIMITER



FM IF amplifier

**3310—WIDE BAND AMPLIFIER**

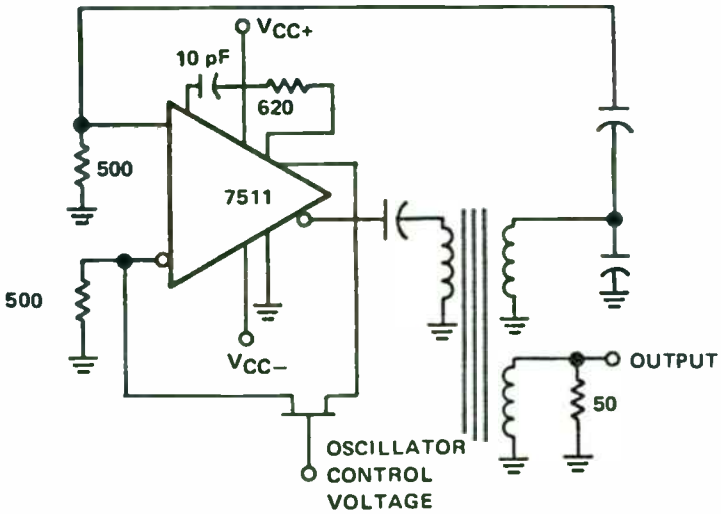
FM/IF amplifier



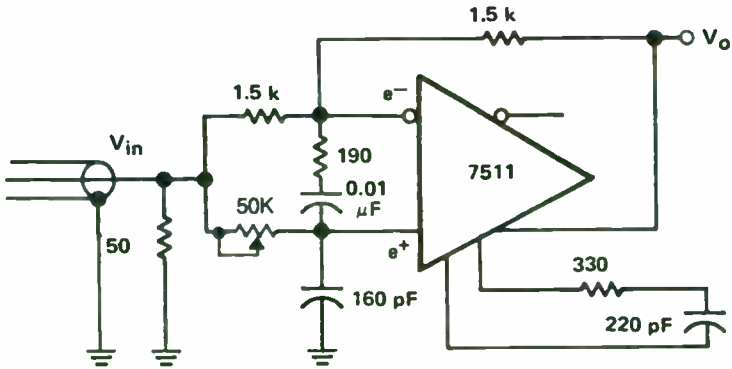
Record/Play preamplifier for cassette and portable tape recorders.



# 7511 — VIDEO OPERATIONAL AMPLIFIER

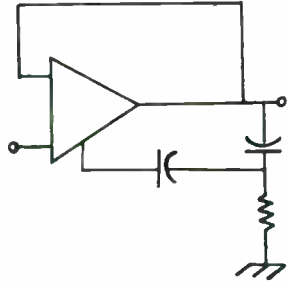


Basic transformer-feedback oscillator



Variable-phase-shift circuit

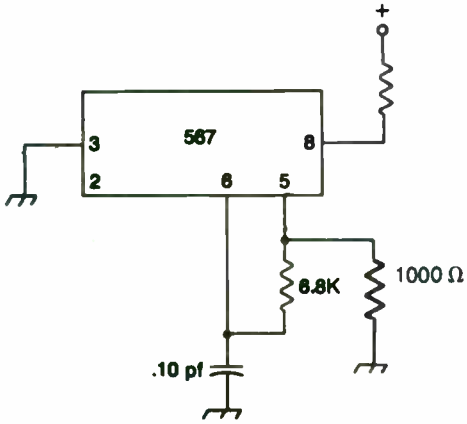
## Part VI



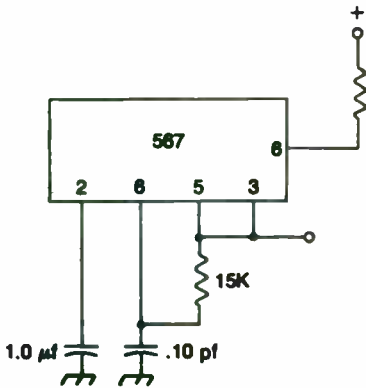
### Special Purpose Devices

Sometimes you can't help but wonder if some circuits aren't designed more to amuse the design engineers than for a serious purpose! Whatever the reason, several interesting and novel ICs are now available. They can be used to produce many interesting and unusual projects.

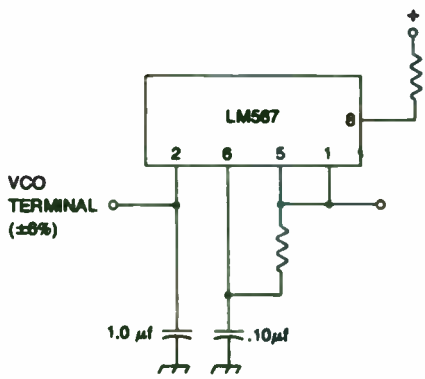
# 567—TONE DECODER



Oscillator with quadrature output

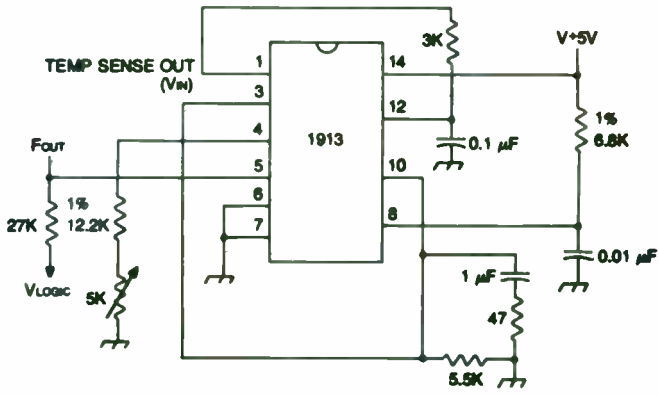


Oscillator with double frequency output



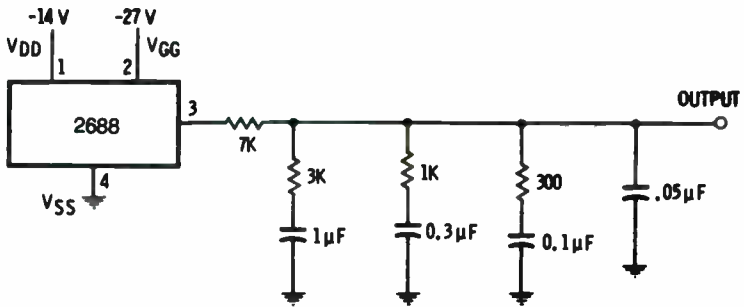
Precision oscillator drive 100 mA loads

## 1913—TEMPERATURE TO FREQUENCY CONVERTER



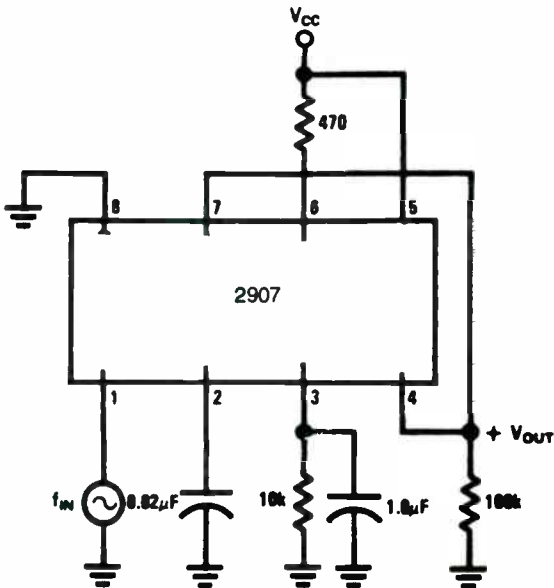
Fahrenheit scale temperature to frequency converter

## 2688—RANDOM NOISE GENERATOR

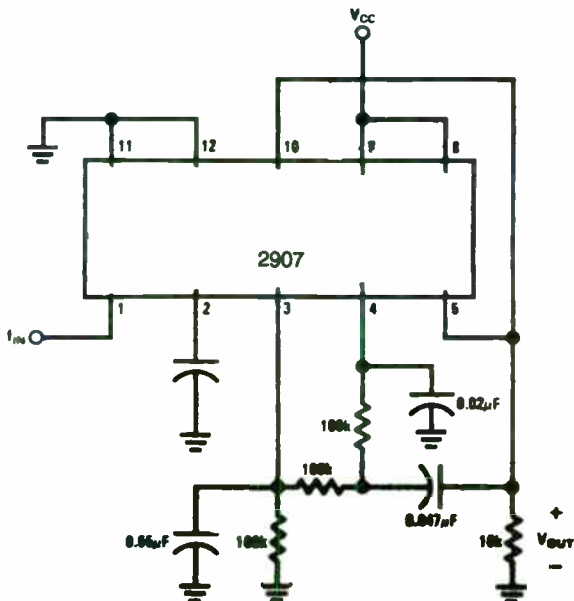


Pink noise generator

## 2907—FREQUENCY TO VOLTAGE CONVERTER

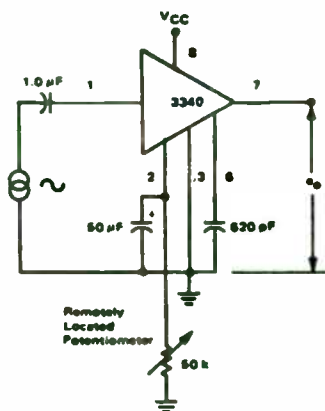


Zener regulated frequency to voltage converter



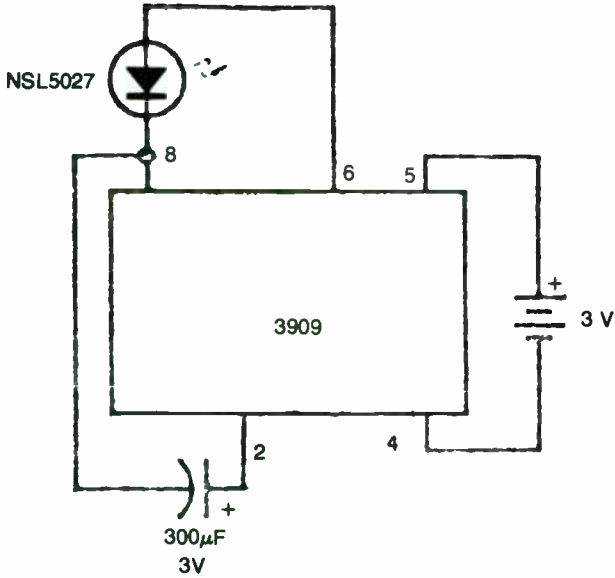
Frequency to voltage converter with 2 pole Butterworth filter to reduce ripple

### 3340—ELECTRONIC ATTENUATOR

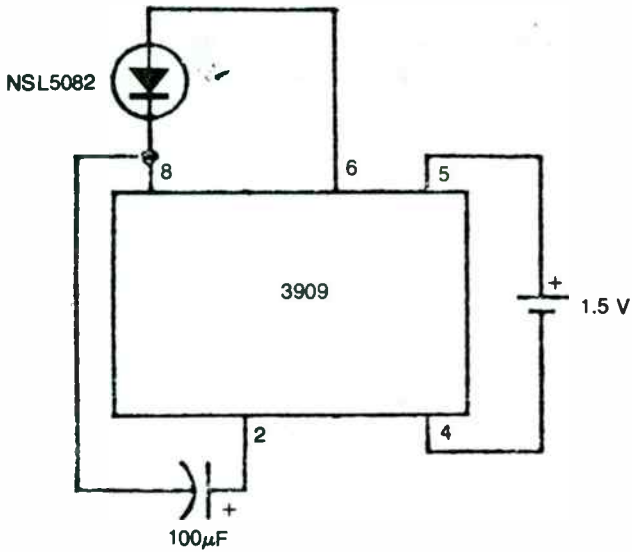


DC "remote" volume control

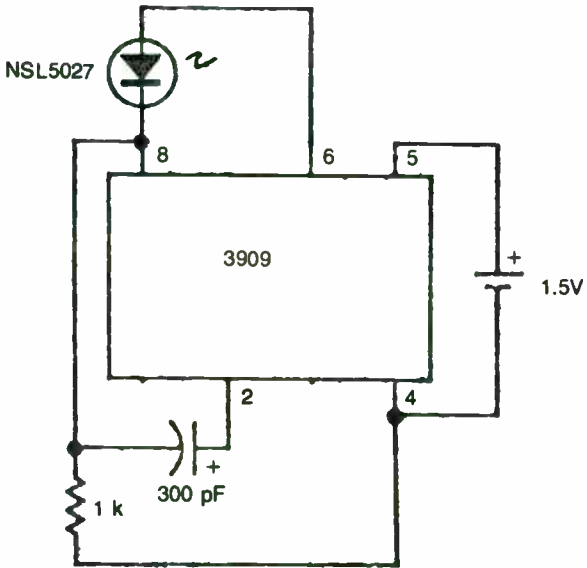
# 3909—LED FLASHER/OSCILLATOR



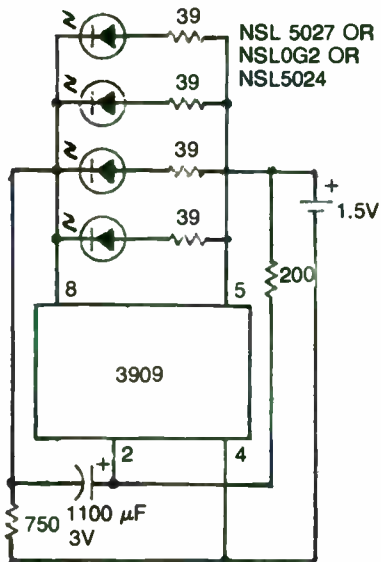
3V flasher



Minimum power at 1.5V

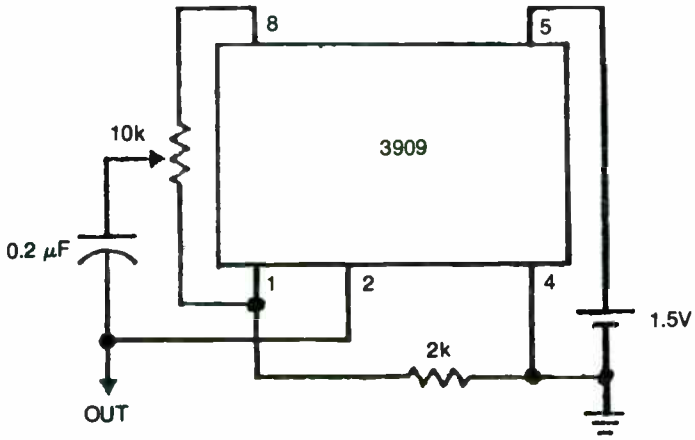


Fast blinker

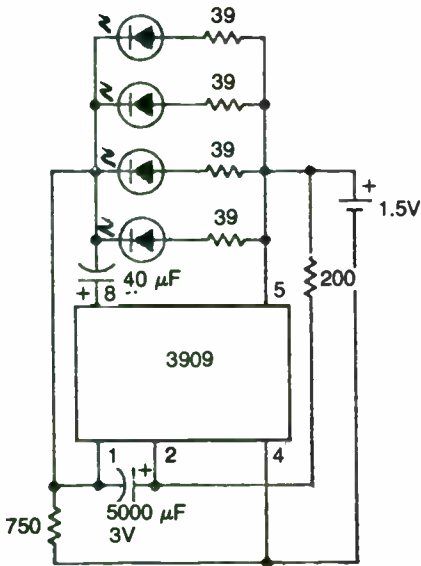


4 parallel LEDs

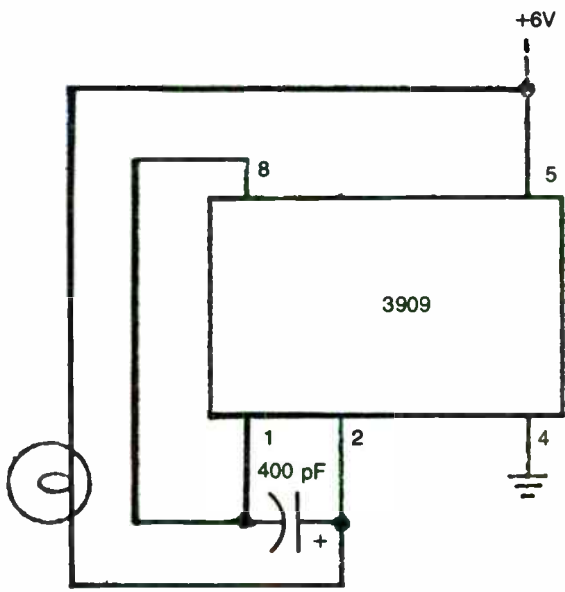




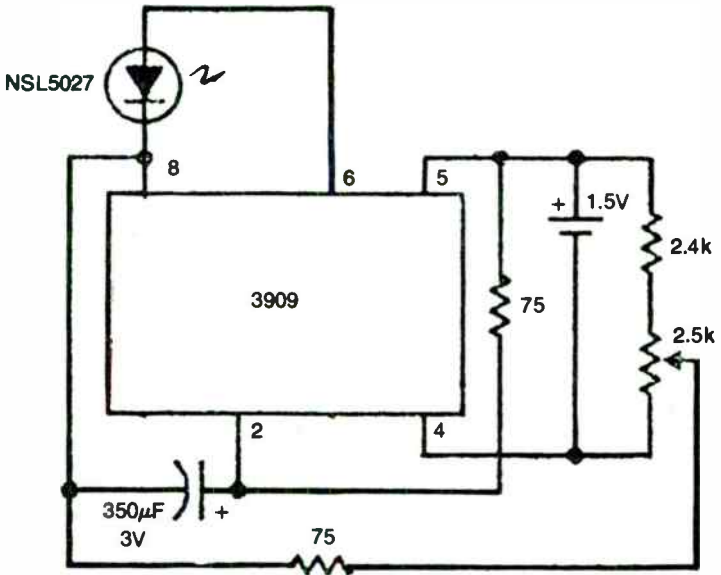
1 kHz square wave oscillator



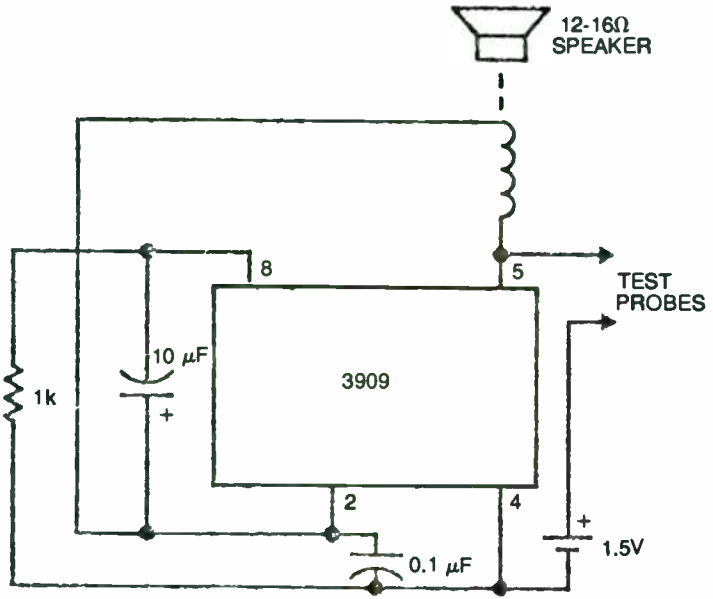
High efficiency parallel circuit



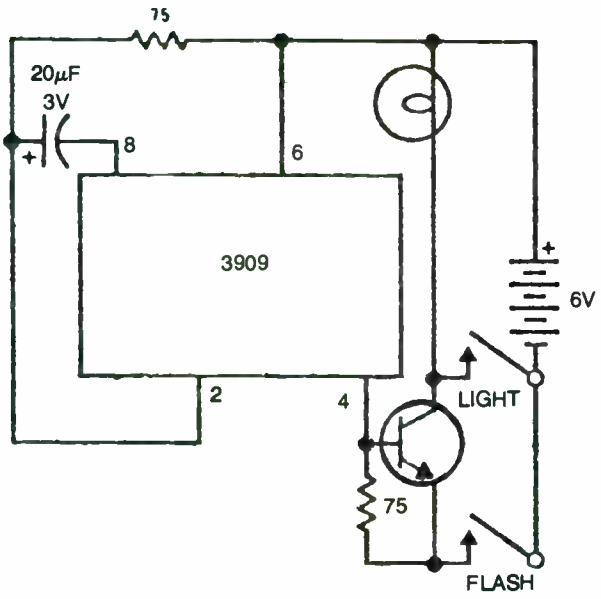
Incandescent bulb flasher



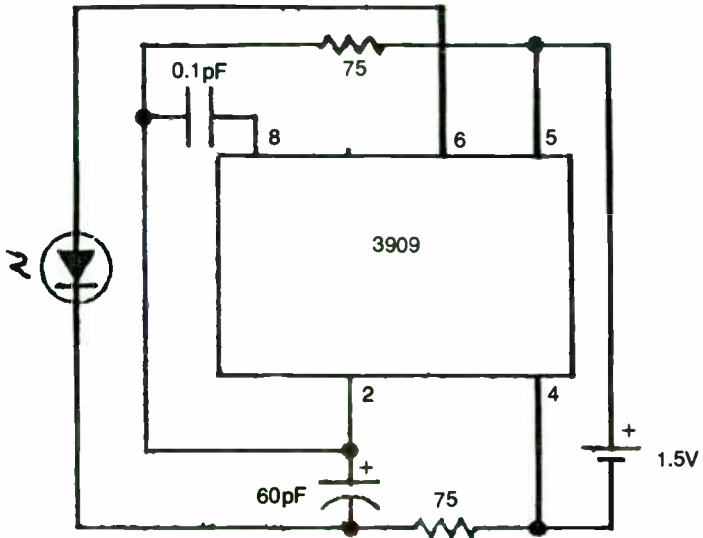
Variable flasher



"Buzz box" continuity and coil checker

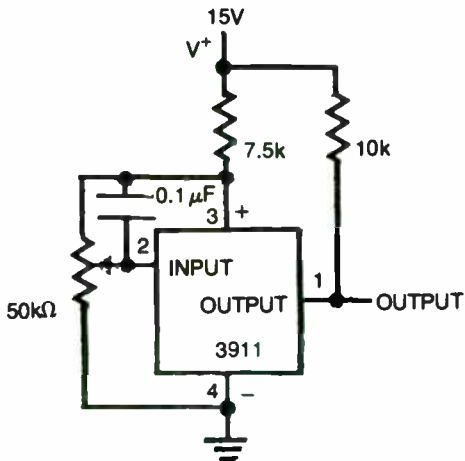


Emergency lantern/flasher

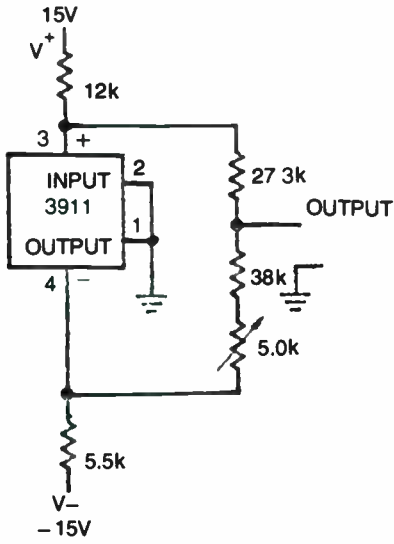


LED booster

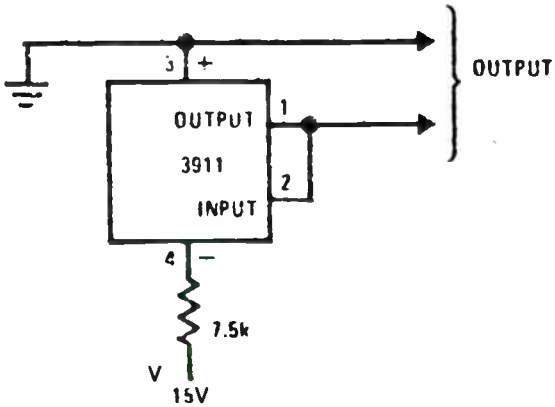
## 3911—INTEGRATED TEMPERATURE CONTROLLER



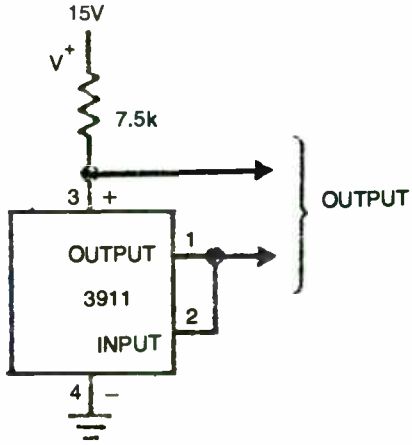
Basic temperature controller



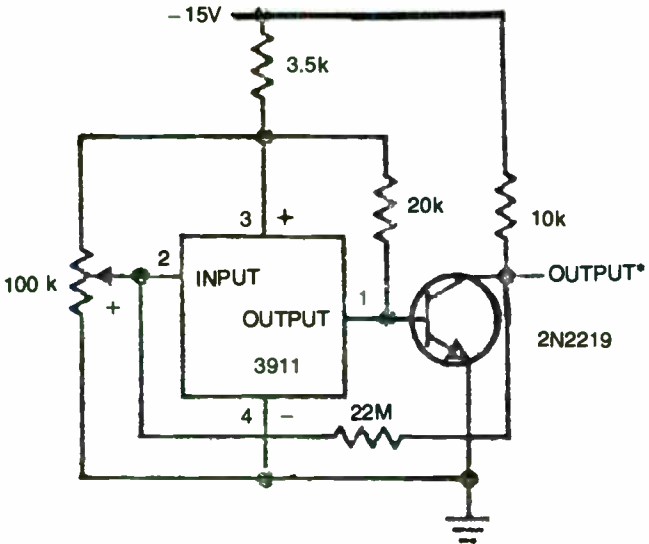
Ground referred centigrade thermometer



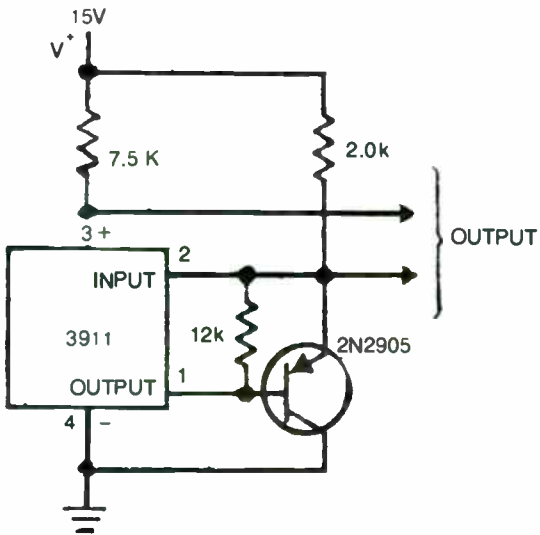
Basic thermometer for negative supply



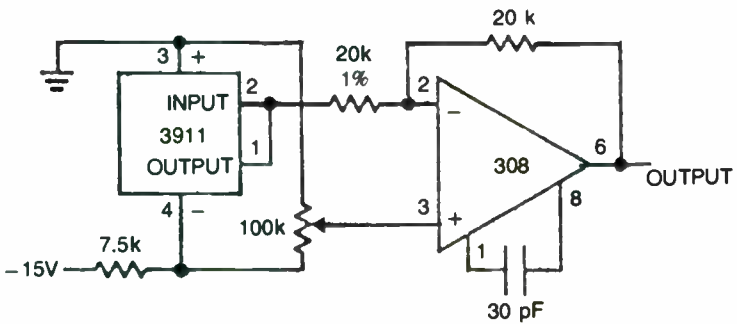
Basic thermometer for positive supply



Temperature controller with hysteresis

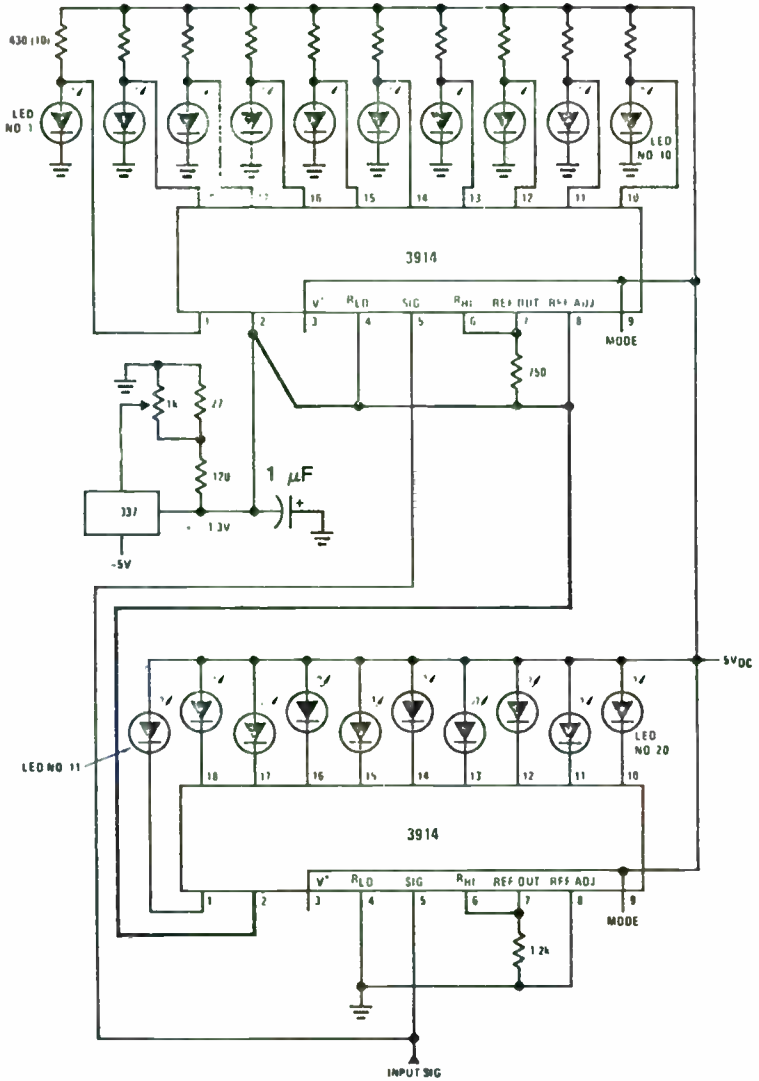


Increasing gain and output drive



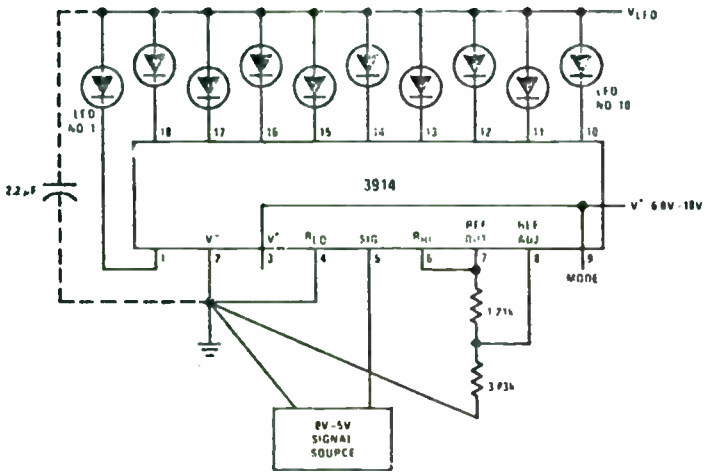
Ground referred centigrade thermometer

# 3914—DOT/BAR DISPLAY DRIVER

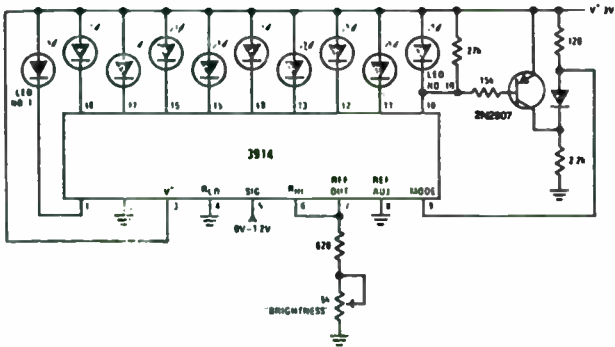


Zero-center meter, 20-segment

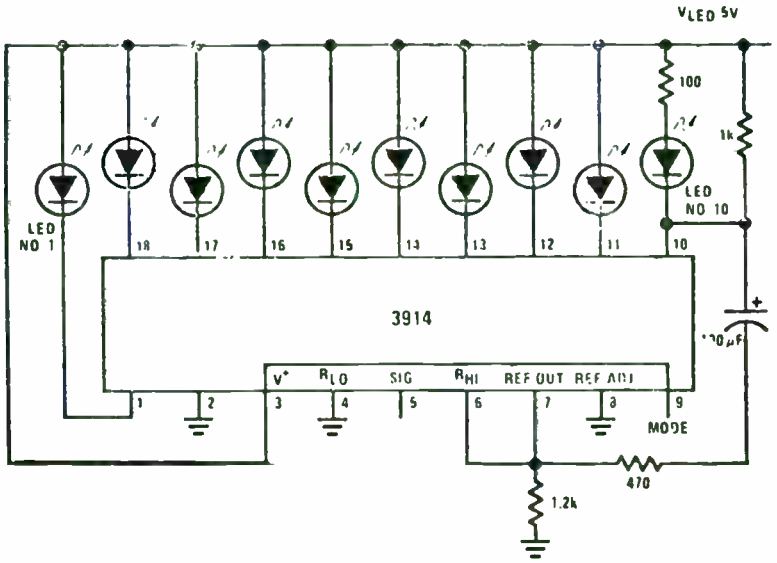




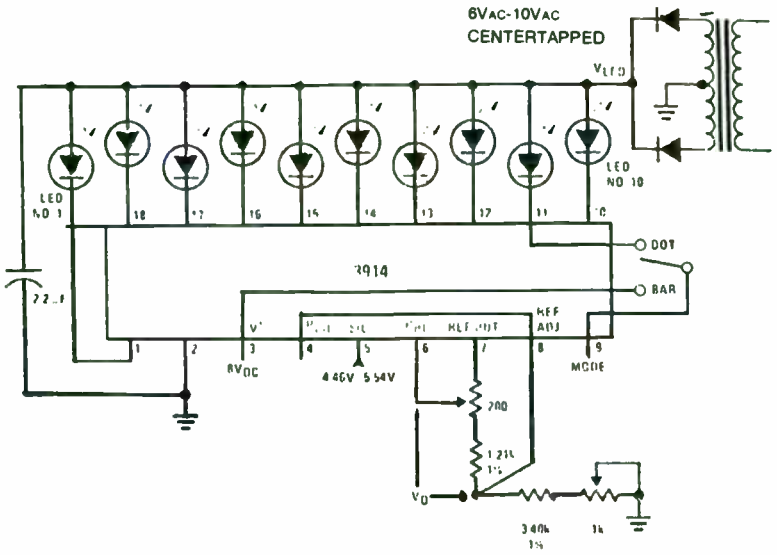
0V to 5V bar graph meter



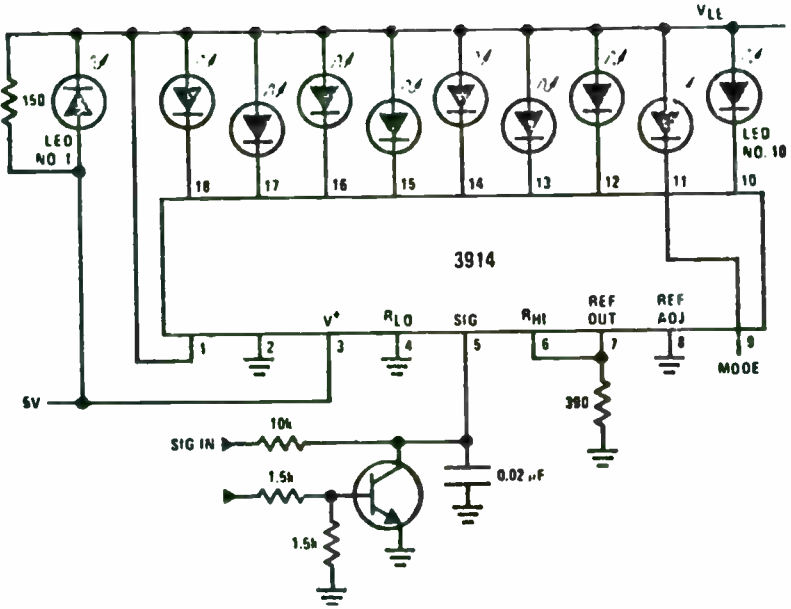
Indicator and alarm, full-scale changes display from dot to bar



Bar display with alarm flasher

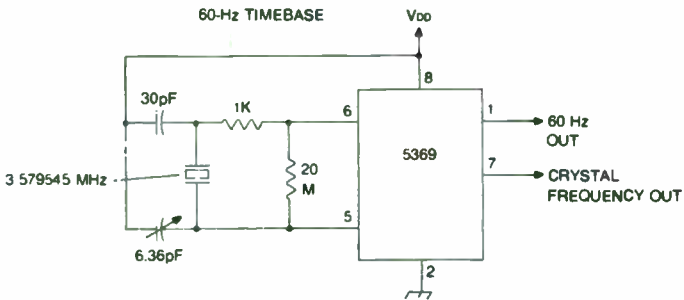


Expanded scale meter, dot or bar



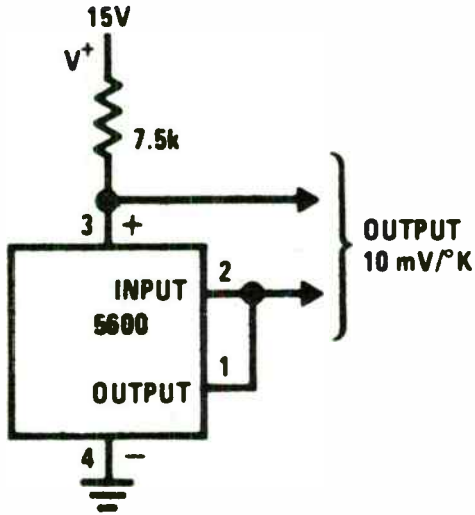
"Exclamation point" display

## 5369—INTEGRATED 60 HZ TIMEBASE GENERATOR

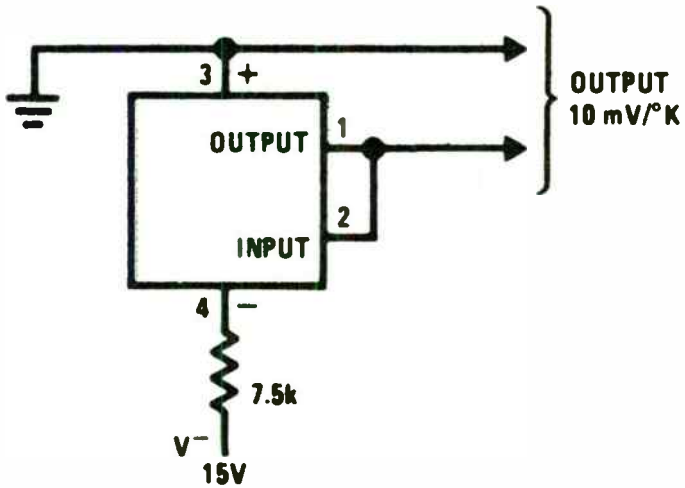


60-Hz timebase

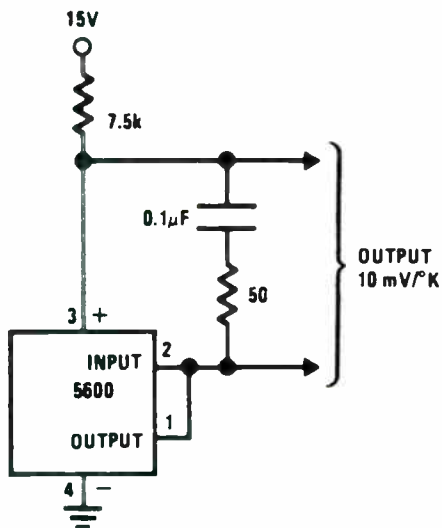
# 5600—MONOLITHIC TEMPERATURE TRANSDUCERS



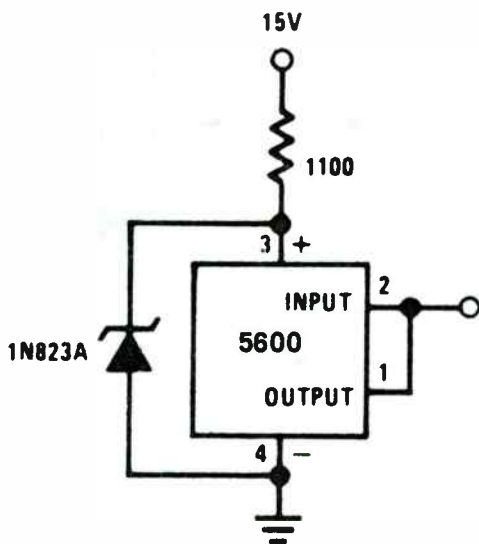
Basic thermometer for positive supply



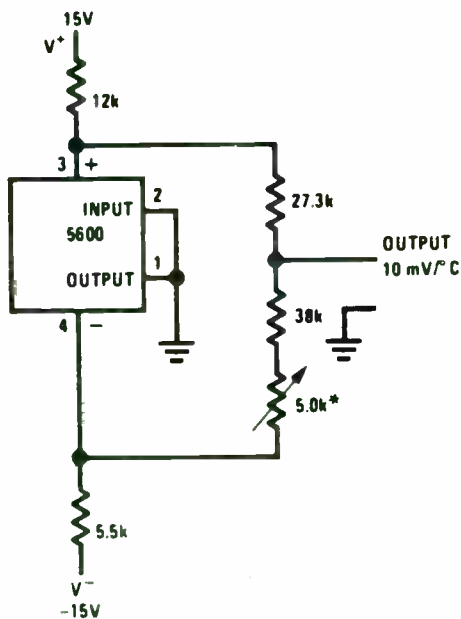
Basic thermometer for negative supply



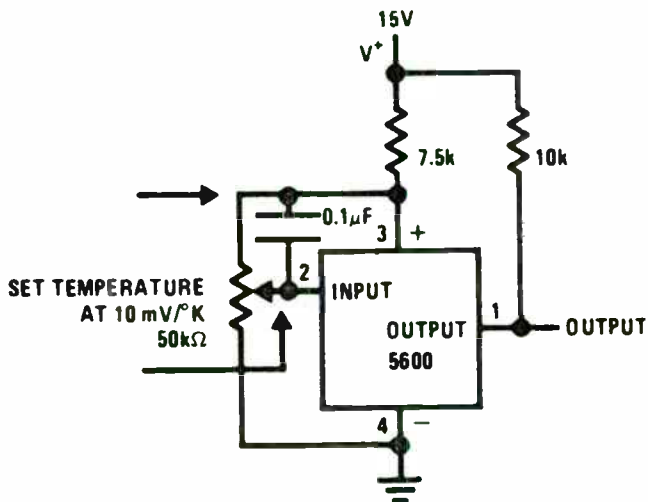
External frequency compensation for greater stability



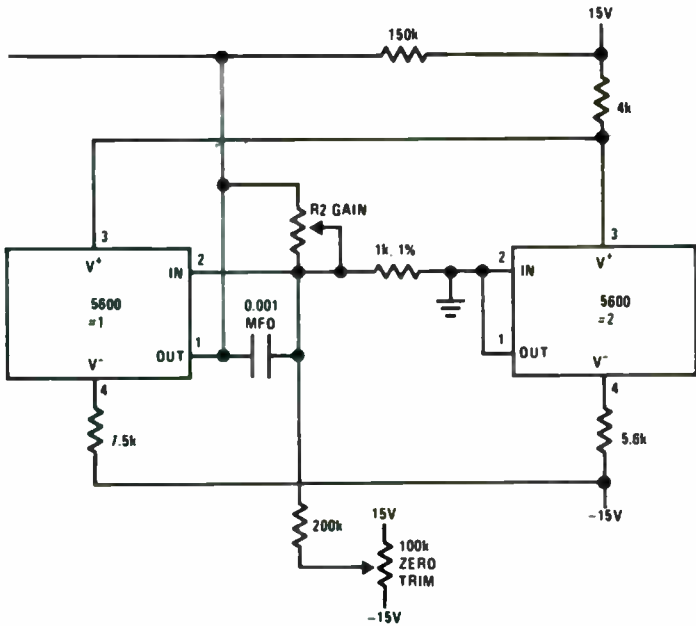
Operating with external zener for lower power dissipation and better reference stability



Ground referred centigrade thermometer

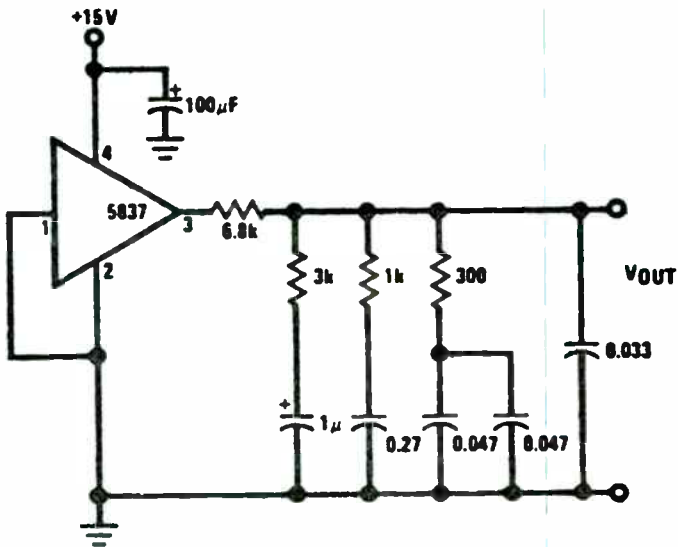


Basic temperature controller



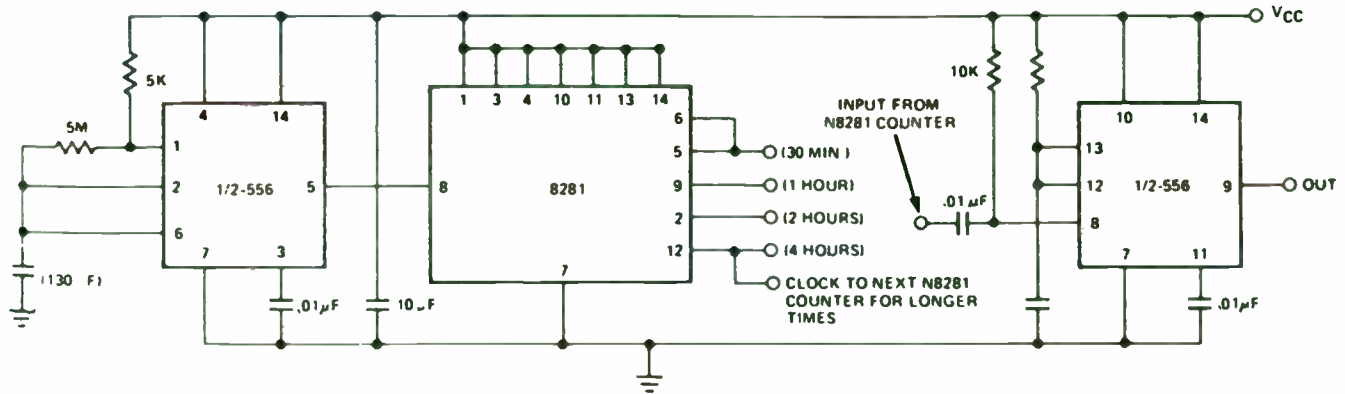
Differential thermometer

## 5837—DIGITAL NOISE SOURCE INTEGRATED CIRCUIT



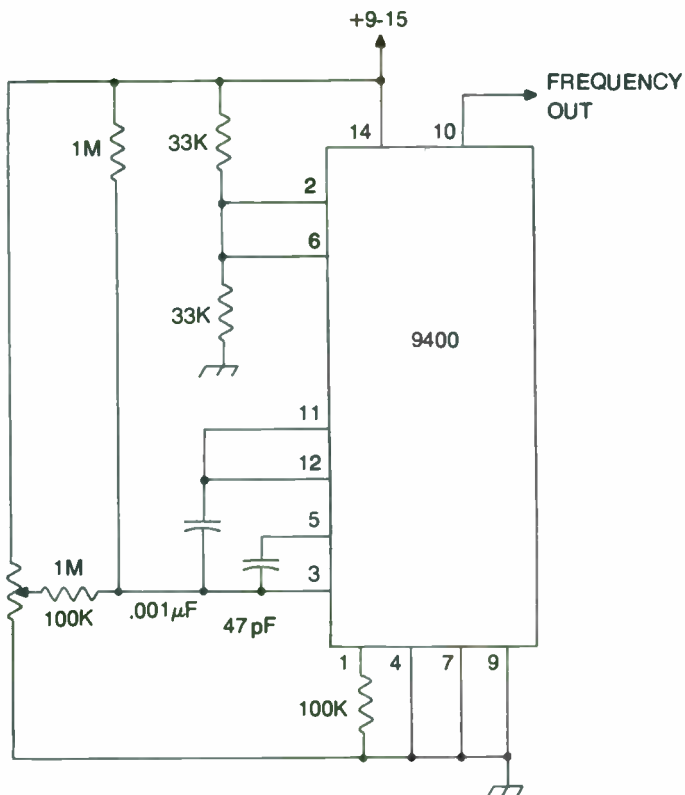
Pink noise generator

## 8281 — INTEGRATED DIVIDER NETWORK



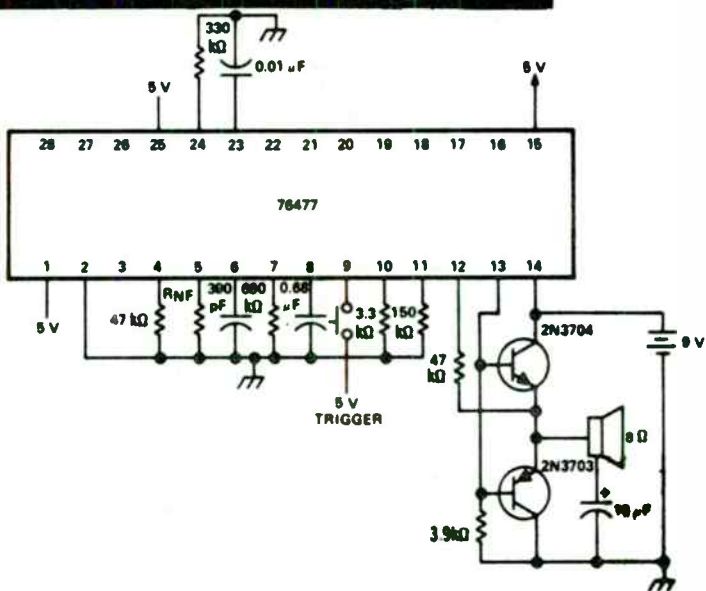


# 9400— VOLTAGE TO FREQUENCY /FREQUENCY TO VOLTAGE CONVERTER

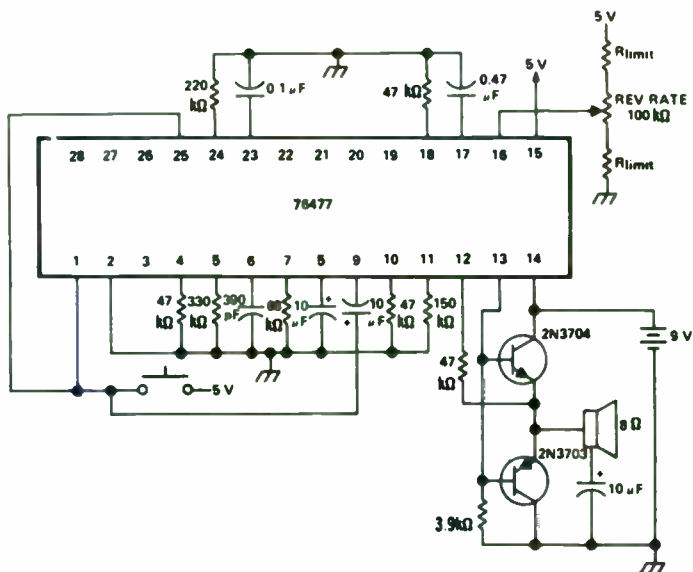


Basic voltage to frequency converter

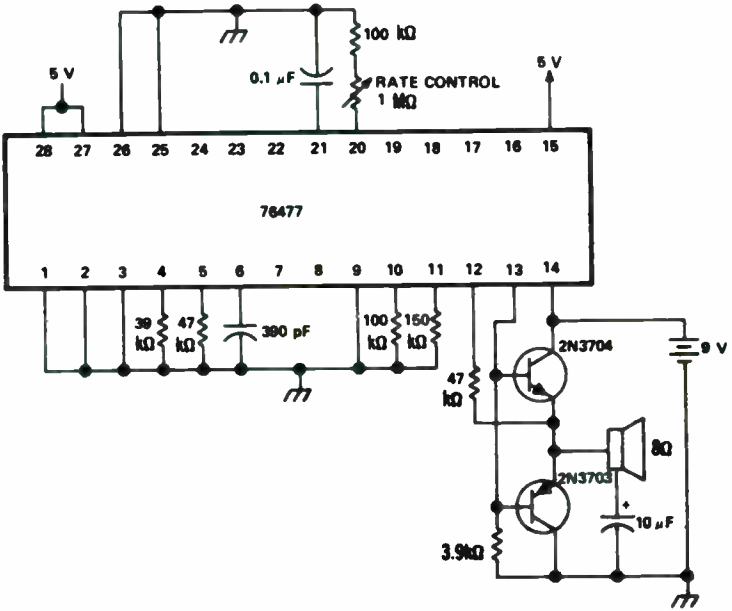
# 76477—COMPLEX SOUND GENERATOR



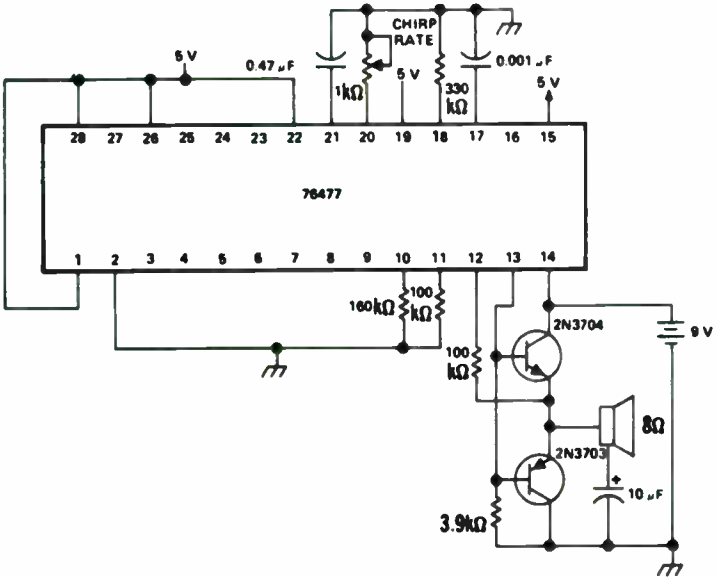
Gunshot/explosion



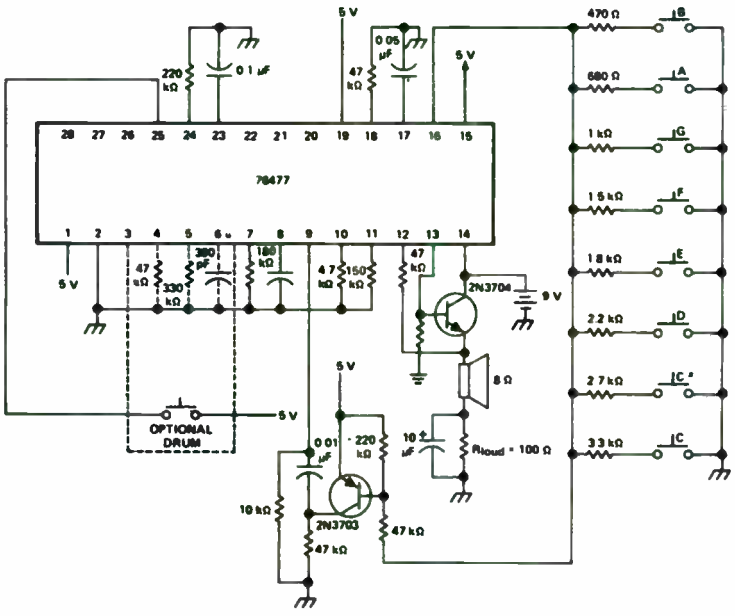
Race car motor/crash



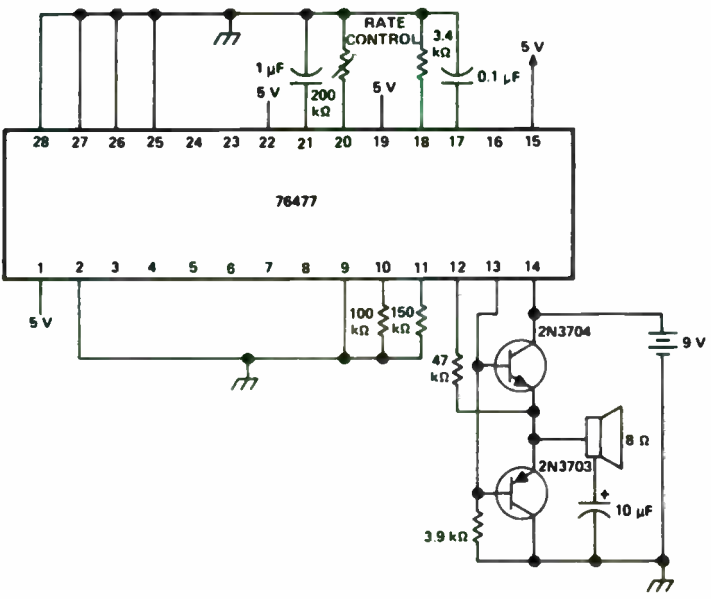
Steam train/prop plane



Bird chirp

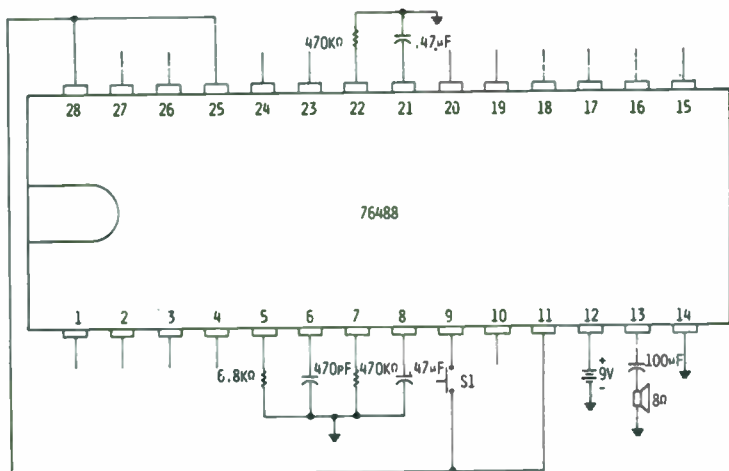


Musical organ

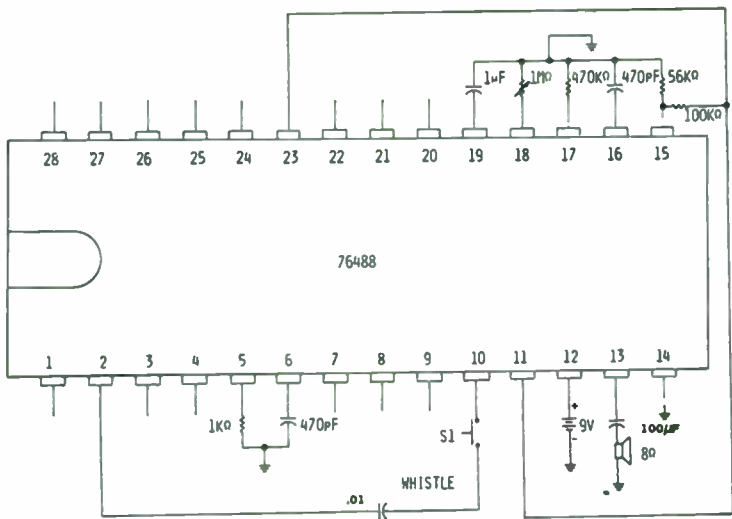


Siren/space war/phasor gun

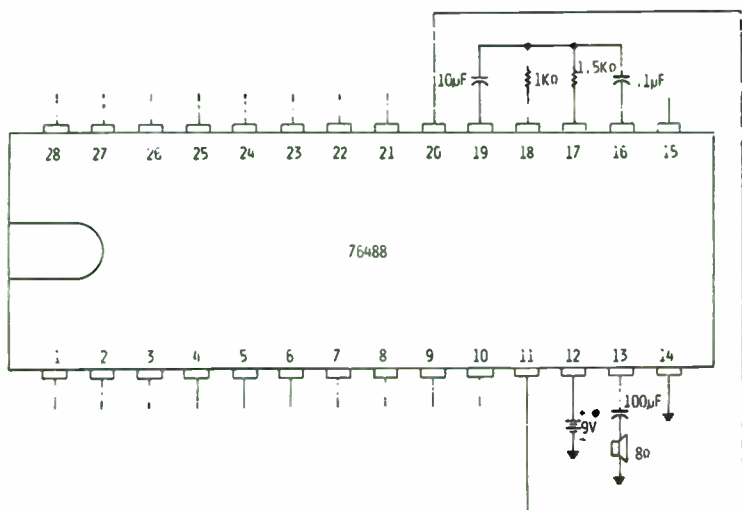
# 76488—SOUND GENERATOR WITH AUDIO AMPLIFIER



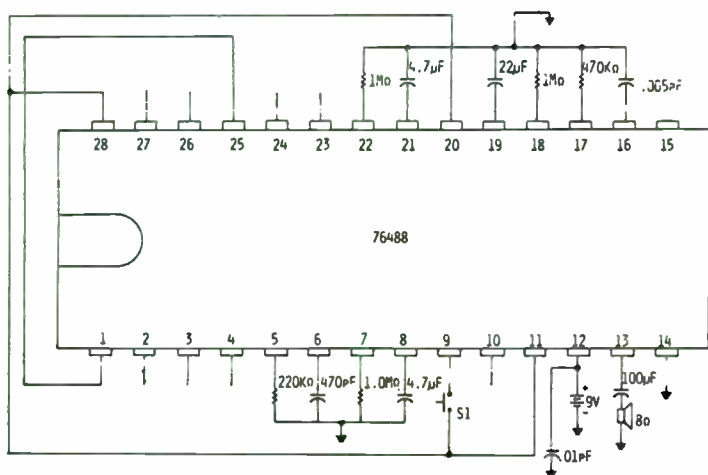
## Gunshot



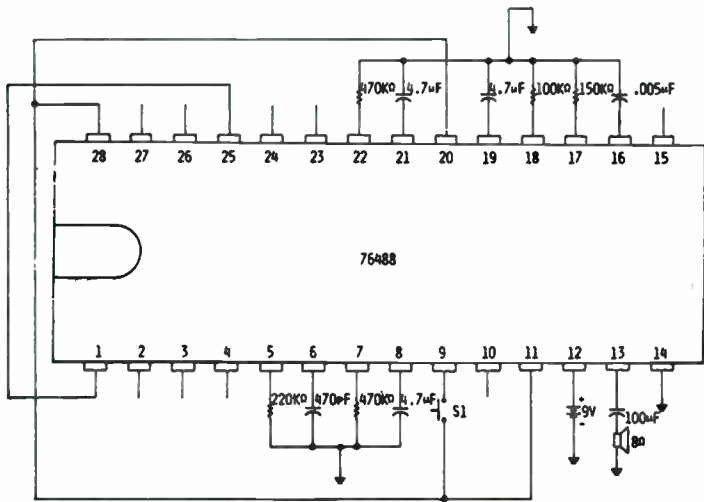
## Toy steam engine and whistle



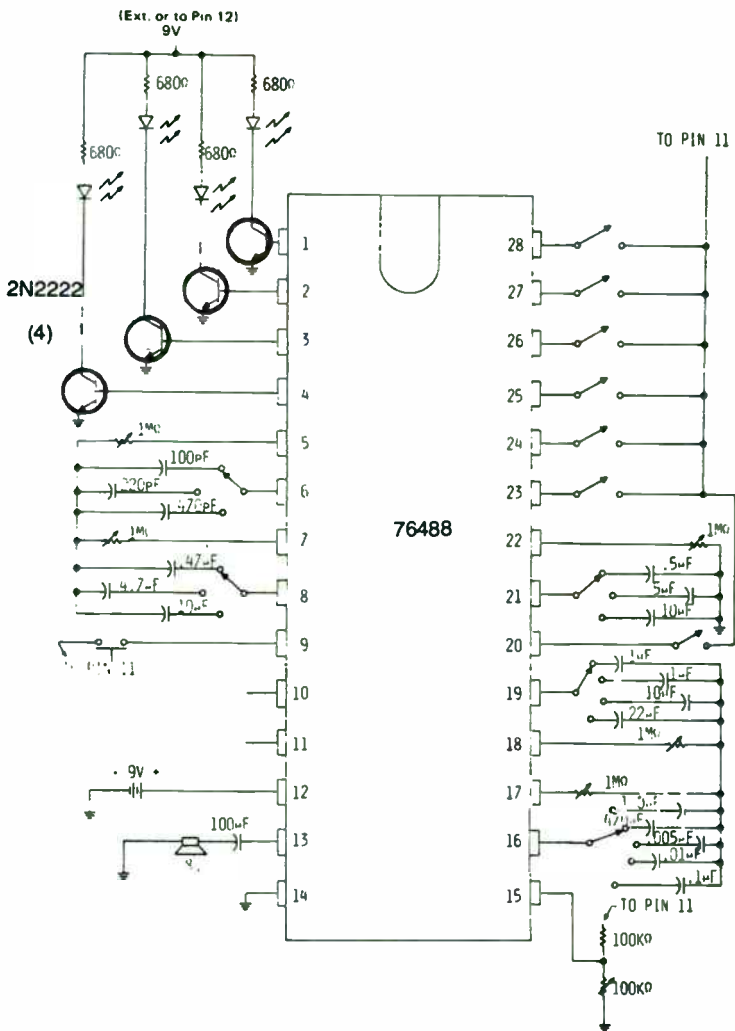
Phasor



Bomb drop and explosion

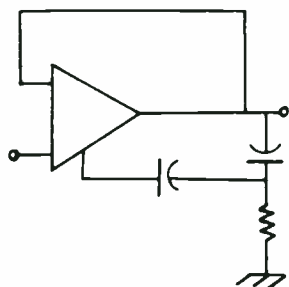


Phasor and explosion



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