Trasmissione FM su canale ottico

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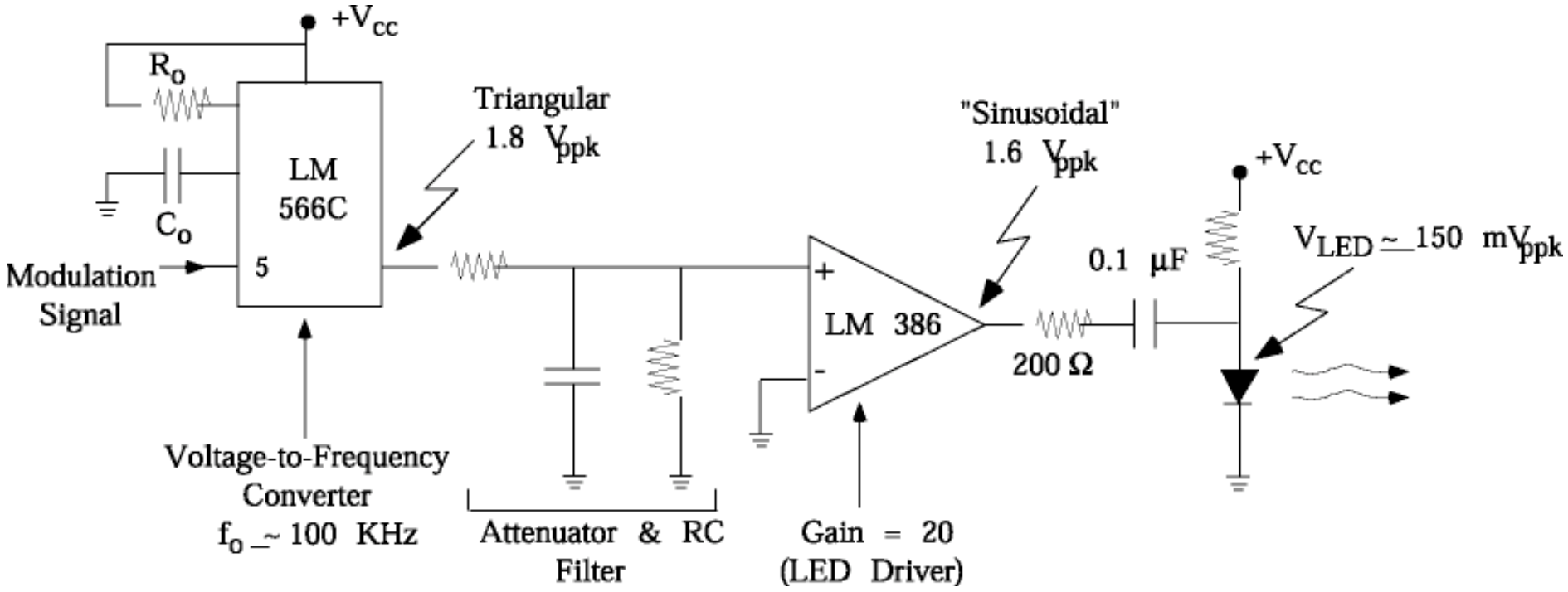
Corso di Metodi di Trattamento dei Segnali

A. A. 2016-2017

Trasmettitore con modulazione FM



National Semiconductor

February 1995

LM566C Voltage Controlled Oscillator

General Description

The LM566CN is a general purpose voltage controlled oscillator which may be used to generate square and triangular waves, the frequency of which is a very linear function of a control voltage. The frequency is also a function of an external resistor and capacitor.

The LM566CN is specified for operation over the 0°C to +70°C temperature range.

Features

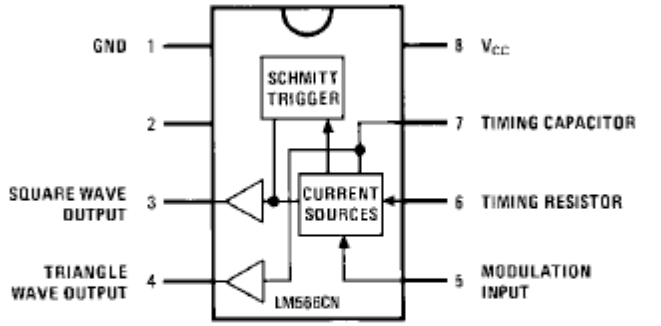
- Wide supply voltage range: 10V to 24V
- Very linear modulation characteristics
- High temperature stability
- Excellent supply voltage rejection
- 10 to 1 frequency range with fixed capacitor
- Frequency programmable by means of current, voltage, resistor or capacitor

Applications

- FM modulation
- Signal generation
- Function generation
- Frequency shift keying
- Tone generation

Connection Diagram

Dual-In-Line Package

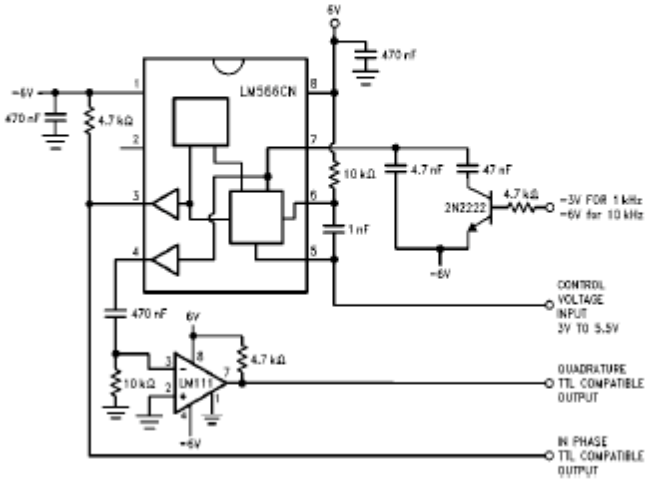


TL/H/7854–2

Order Number LM566CN
See NS Package Number N08E

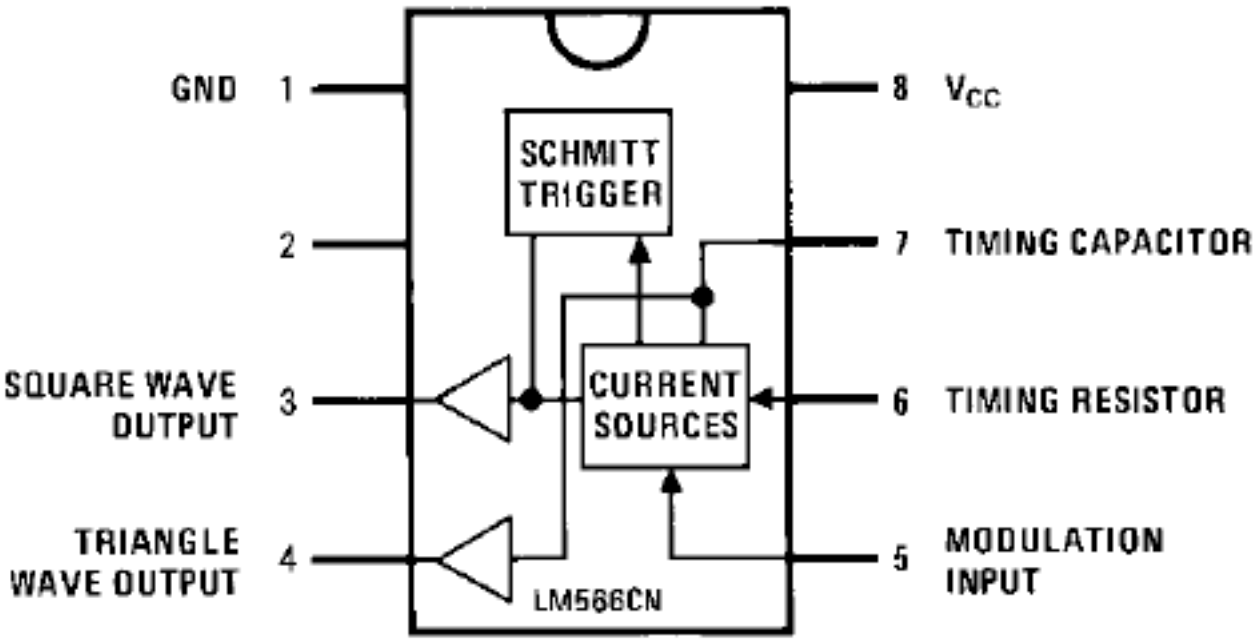
Typical Application

1 kHz and 10 kHz TTL Compatible Voltage Controlled Oscillator

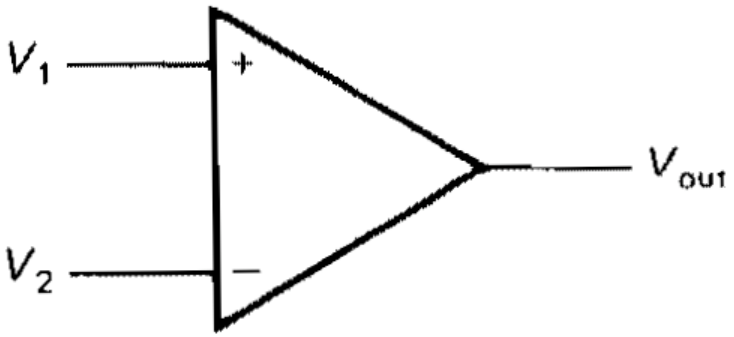


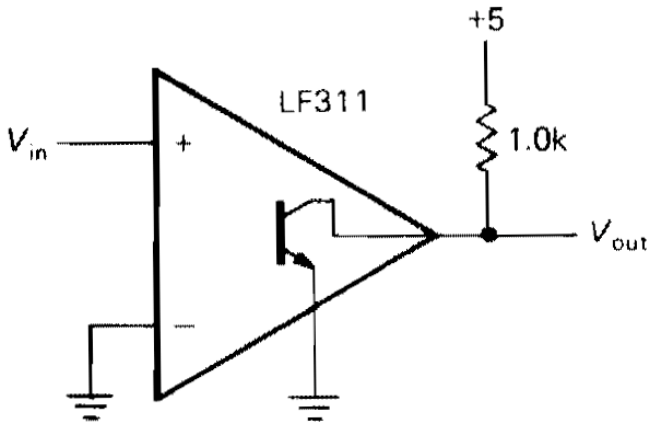
TL/H/7854–3

Dual-In-Line Package



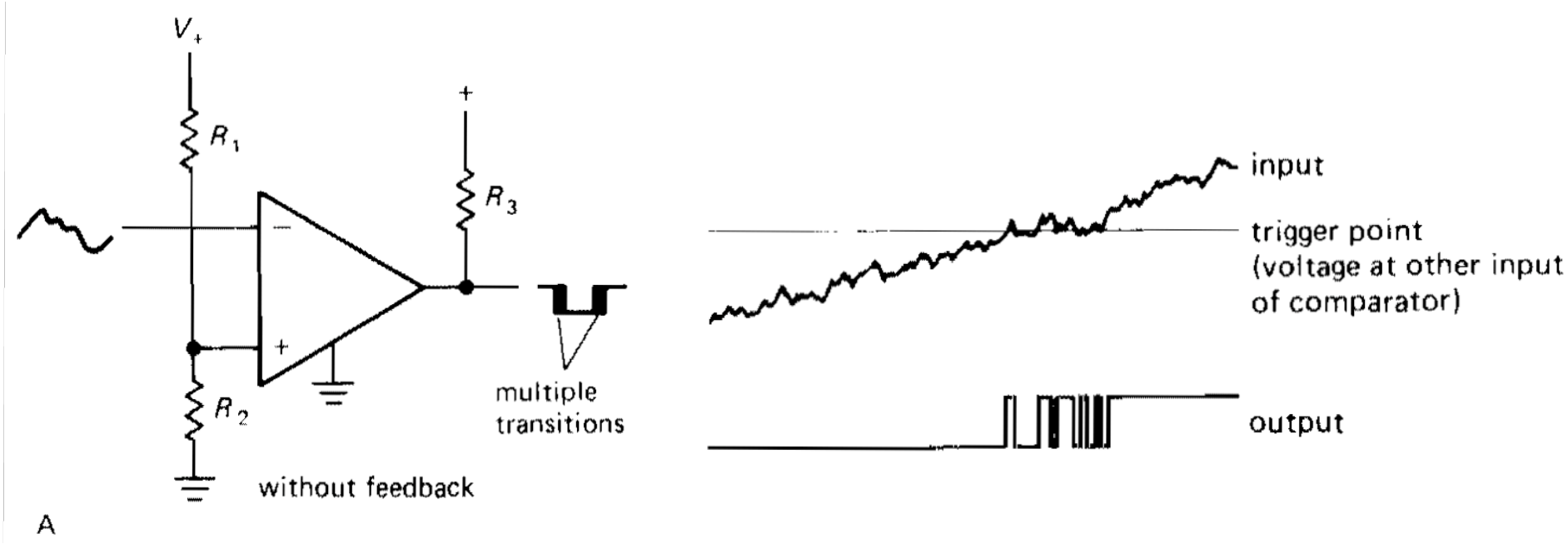
Il trigger di Schmitt: 1. comparatori





L'esempio più semplice di comparatore: un amplificatore differenziale ad alto guadagno (Vout corrisponde alla tensione di saturazione = ±Vcc)

Il trigger di Schmitt: 2. comparatori



Comparatore con una rete di input che definisce il valore della tensione di soglia: in questo caso il rumore in prossimità della soglia rende instabile il passaggio dallo stato basso allo stato alto.

Il trigger di Schmitt: 3. feedback

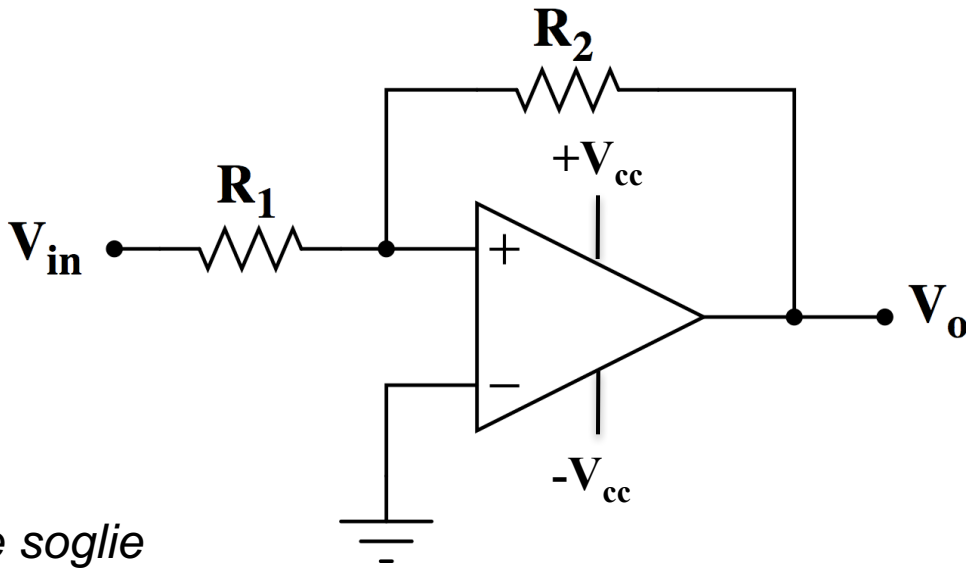
Il guadagno dell'amplificatore con feedback è dato genericamente da

$$G' = \frac{G}{1 - \alpha G} \rightarrow -\frac{1}{\alpha}$$

e quindi se G è molto alto, si trova – **sia nel caso di feedback negativo che di feedback positivo** – che il segnale all'ingresso dell'amplificatore diventa trascurabile

$$S_{in} + \alpha S_{out} \approx S_{in} + \alpha\left(-\frac{1}{\alpha}\right)S_{in} = 0$$

Il trigger di Schmitt: 4. comparatori con feedback positivo



Definizione delle soglie

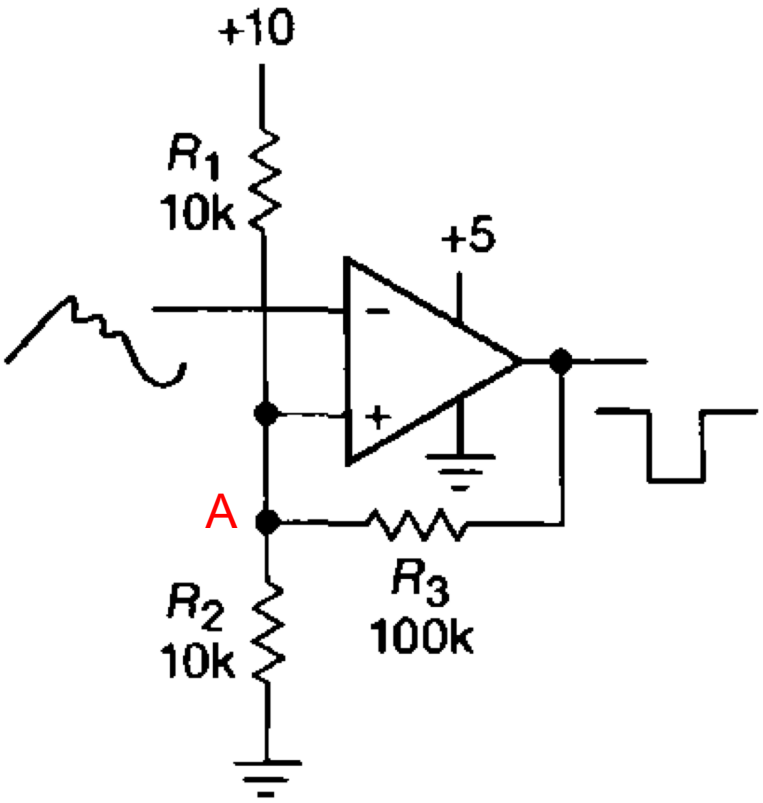
SE Vo = Vcc (stato alto)

$$\frac{V_{in}}{R_1} + \frac{V_{cc}}{R_2} = 0 \quad \Rightarrow \quad V_{in} = -\frac{R_1}{R_2} V_{cc}$$

SE Vo = -Vcc (stato basso)

$$\frac{V_{in}}{R_1} - \frac{V_{cc}}{R_2} = 0 \quad \Rightarrow \quad V_{in} = \frac{R_1}{R_2} V_{cc}$$

Il trigger di Schmitt: 5. comparatori con feedback positivo

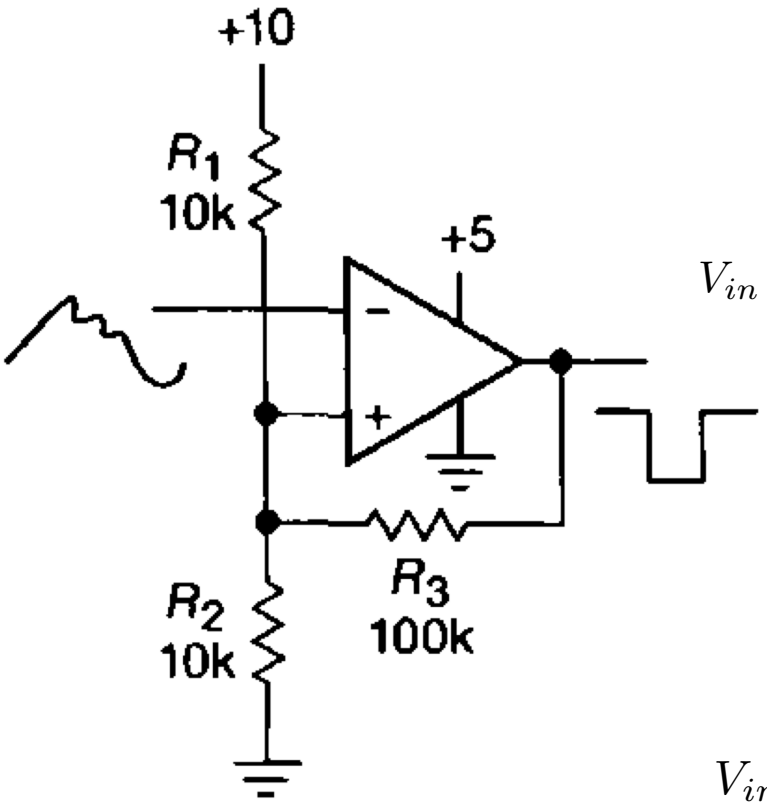


Soglie non simmetriche rispetto V = 0

Se l'output dell'Op-Amp è basso (0 V)
allora la tensione in A è ≈ 4.76 V

Se l'output dell'Op-Amp è alto (5 V)
allora la tensione in A è ≈ 5 V

Il trigger di Schmitt: 5. comparatori con feedback positivo



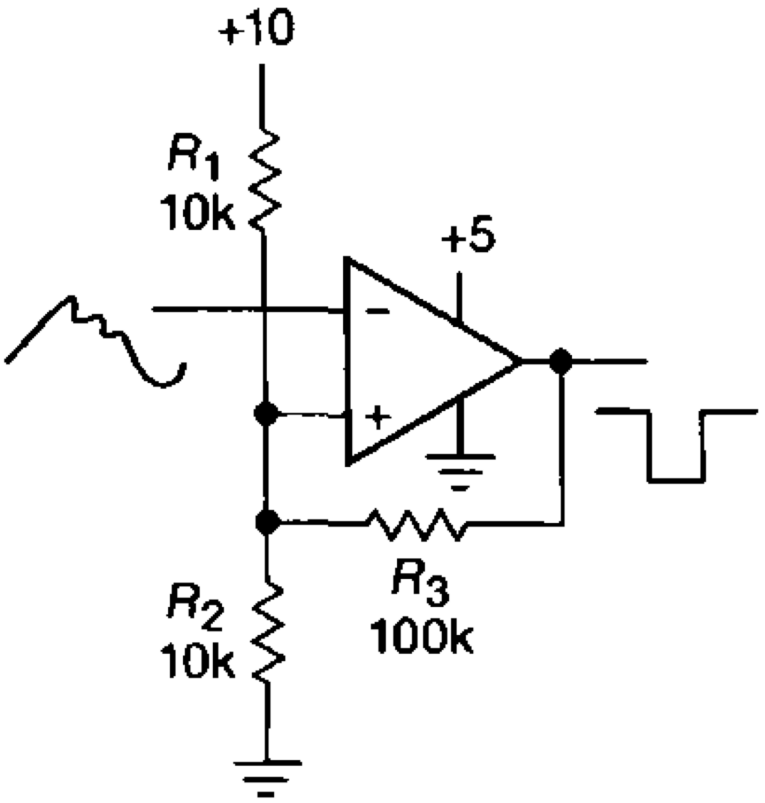
SE Vo = 5V $\quad \frac{V_{in} - 10\text{V}}{R_1} + \frac{V_{in} - 5\text{V}}{R_3} + \frac{V_{in}}{R_2} = 0$

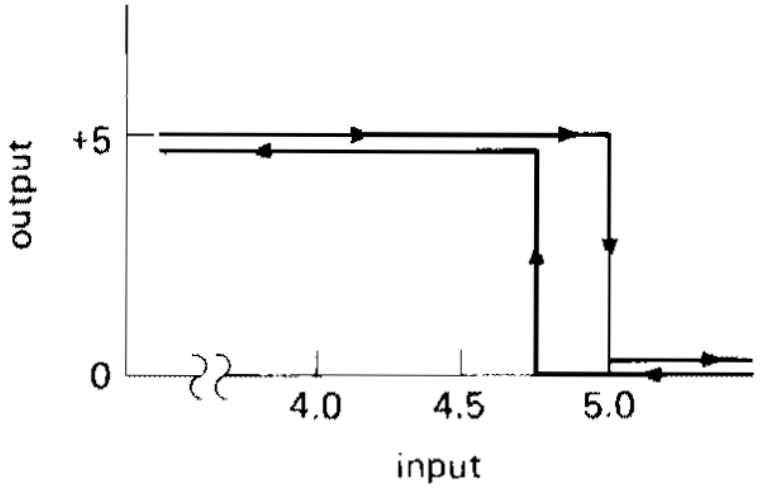
$$V_{in}\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right) = \left(\frac{10\text{V}}{R_1} + \frac{5\text{V}}{R_3}\right) \Rightarrow V_{in} = 5V$$

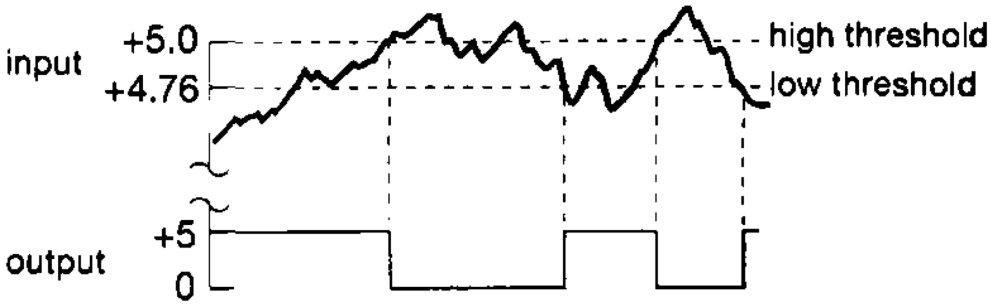
SE Vo = 0V $\quad \frac{V_{in} - 10\text{V}}{R_1} + \frac{V_{in}}{R_3} + \frac{V_{in}}{R_2} = 0$

$$V_{in}\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right) = \left(\frac{10\text{V}}{R_1}\right) \Rightarrow V_{in} = 4.762V$$

Il trigger di Schmitt: 5. comparatori con feedback positivo





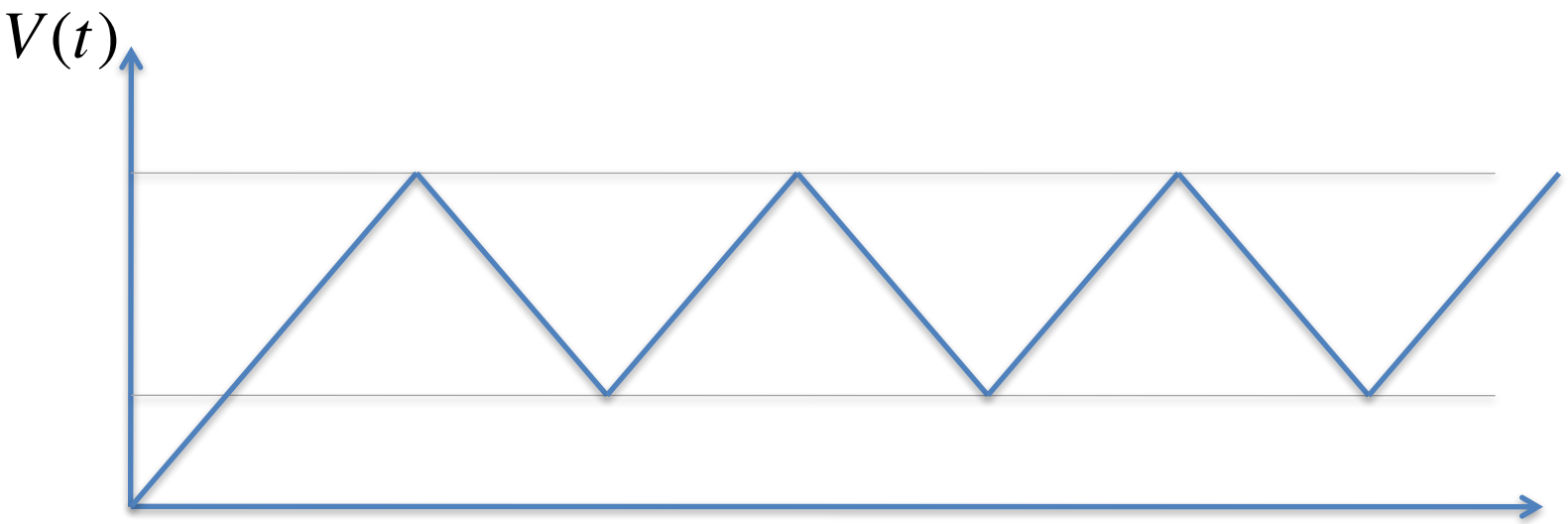


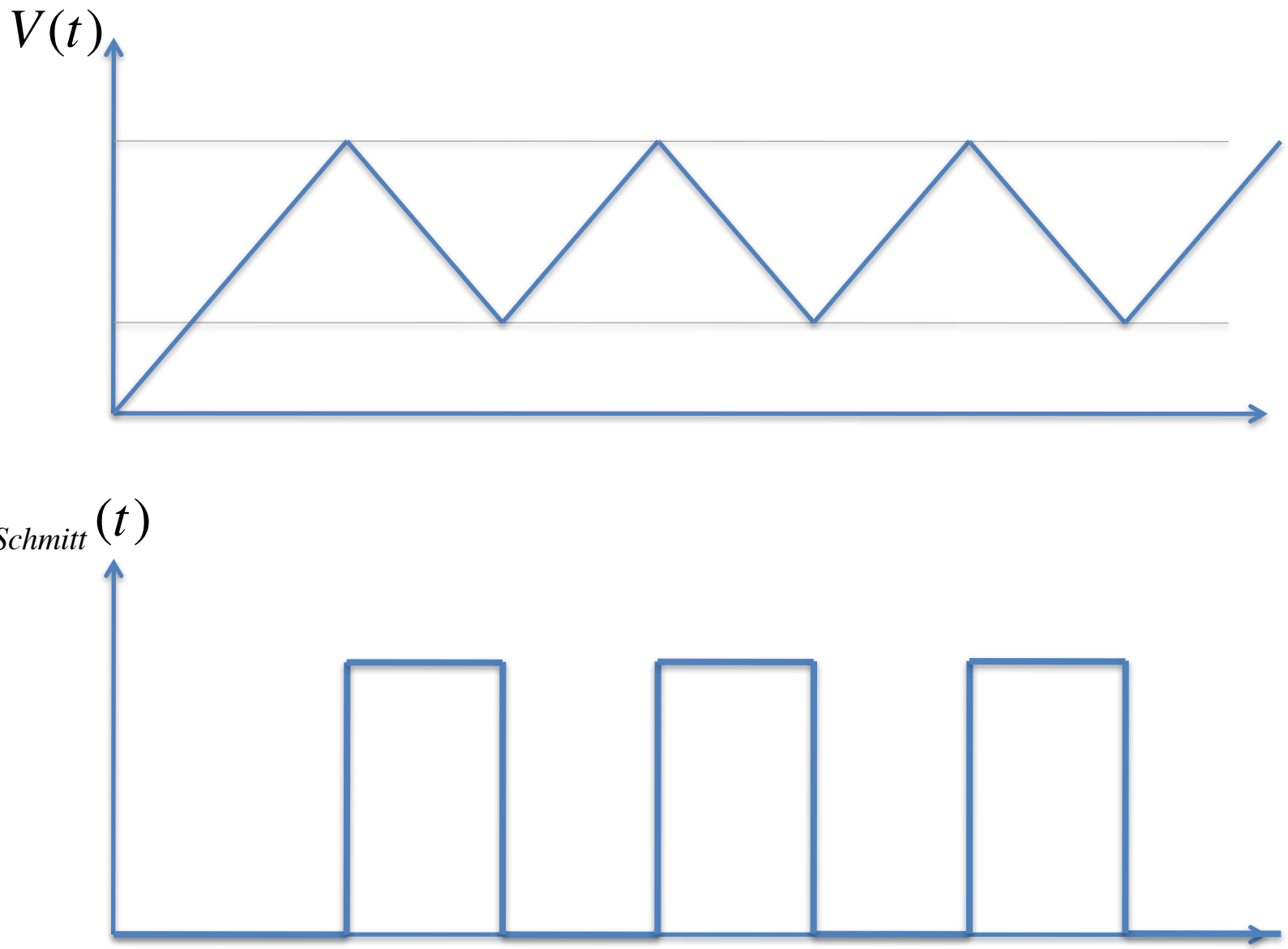
Sorgenti di corrente e condensatori

$$\frac{dQ}{dt} = \frac{1}{C}\frac{dV}{dt} = I_0 \quad \Rightarrow \quad \frac{dV}{dt} = I_0 C \quad \Rightarrow \quad V(t) = V_0 + I_0 C \cdot t$$

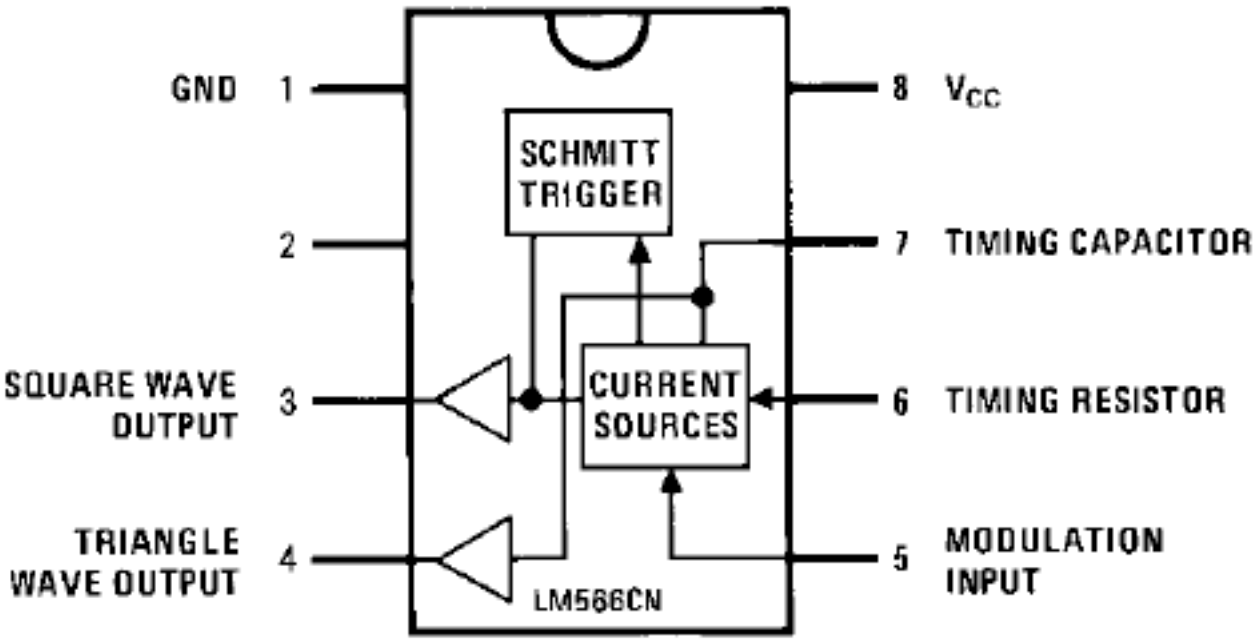
Qui supponiamo che l'uscita del trigger di Schmitt faccia cambiare la polarità della corrente quando vengono attraversate le soglie

Se I0 dipende da Vin allora la frequenza dell'onda triangolare è funzione di Vin
Questo si può fare con un transistor

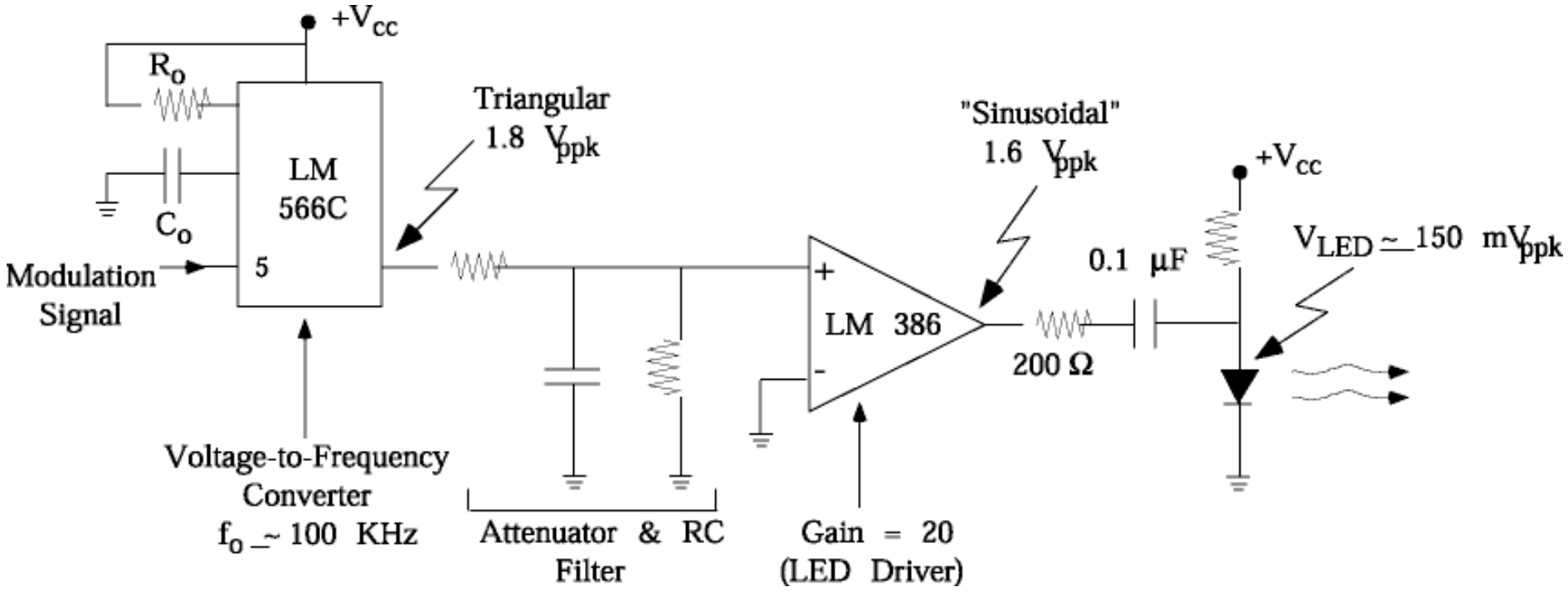



$V(t)$
$V_{Schmitt}(t)$

Dual-In-Line Package



Trasmettitore con modulazione FM



National Semiconductor

August 2000

LM386
Low Voltage Audio Power Amplifier

General Description

The LM386 is a power amplifier designed for use in low voltage consumer applications. The gain is internally set to 20 to keep external part count low, but the addition of an external resistor and capacitor between pins 1 and 8 will increase the gain to any value from 20 to 200.

The inputs are ground referenced while the output automatically biases to one-half the supply voltage. The quiescent power drain is only 24 milliwatts when operating from a 6 volt supply, making the LM386 ideal for battery operation.

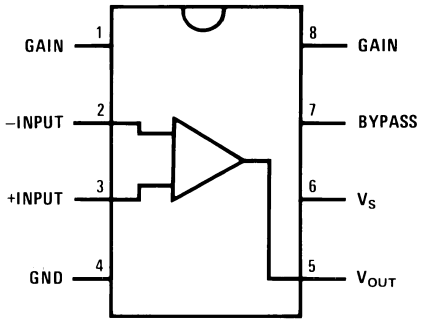
Features

- Battery operation
- Minimum external parts
- Wide supply voltage range: 4V–12V or 5V–18V
- Low quiescent current drain: 4mA
- Voltage gains from 20 to 200
- Ground referenced input
- Self-centering output quiescent voltage
- Low distortion: 0.2% (A_V = 20, V_S = 6V, R_L = 8Ω, P_O = 125mW, f = 1kHz)
- Available in 8 pin MSOP package

Applications

- AM-FM radio amplifiers
- Portable tape player amplifiers
- Intercoms
- TV sound systems
- Line drivers
- Ultrasonic drivers
- Small servo drivers
- Power converters

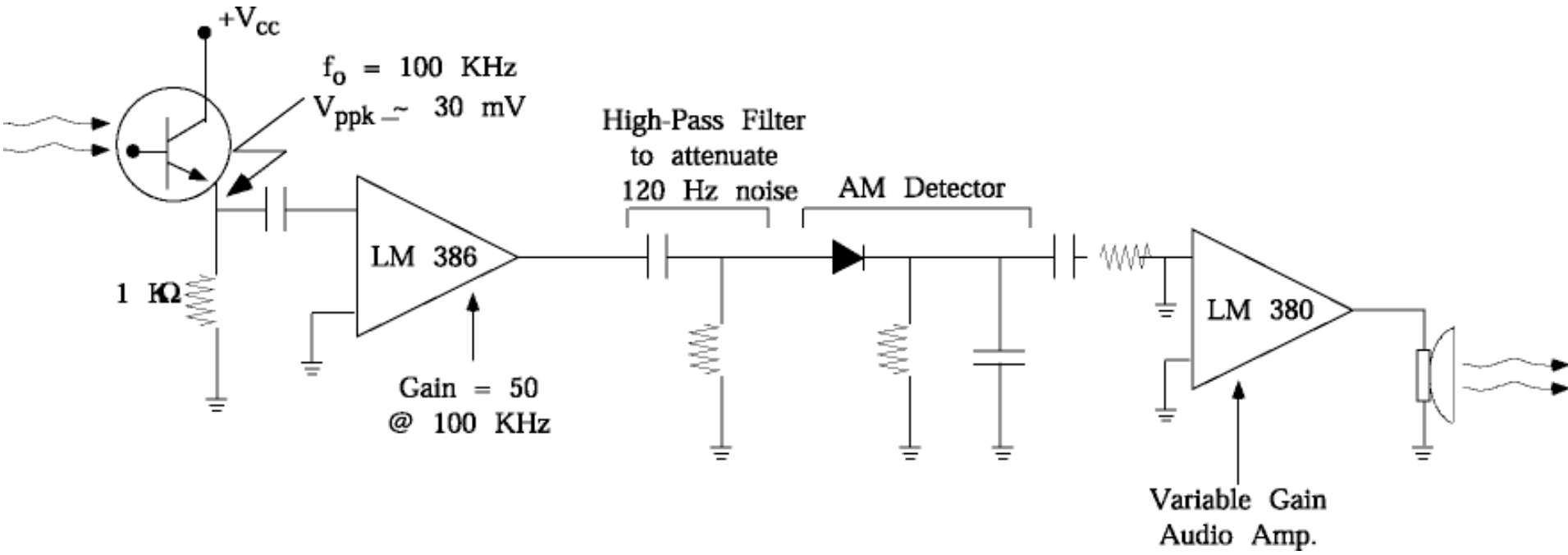
Small Outline,
Molded Mini Small Outline,
and Dual-In-Line Packages



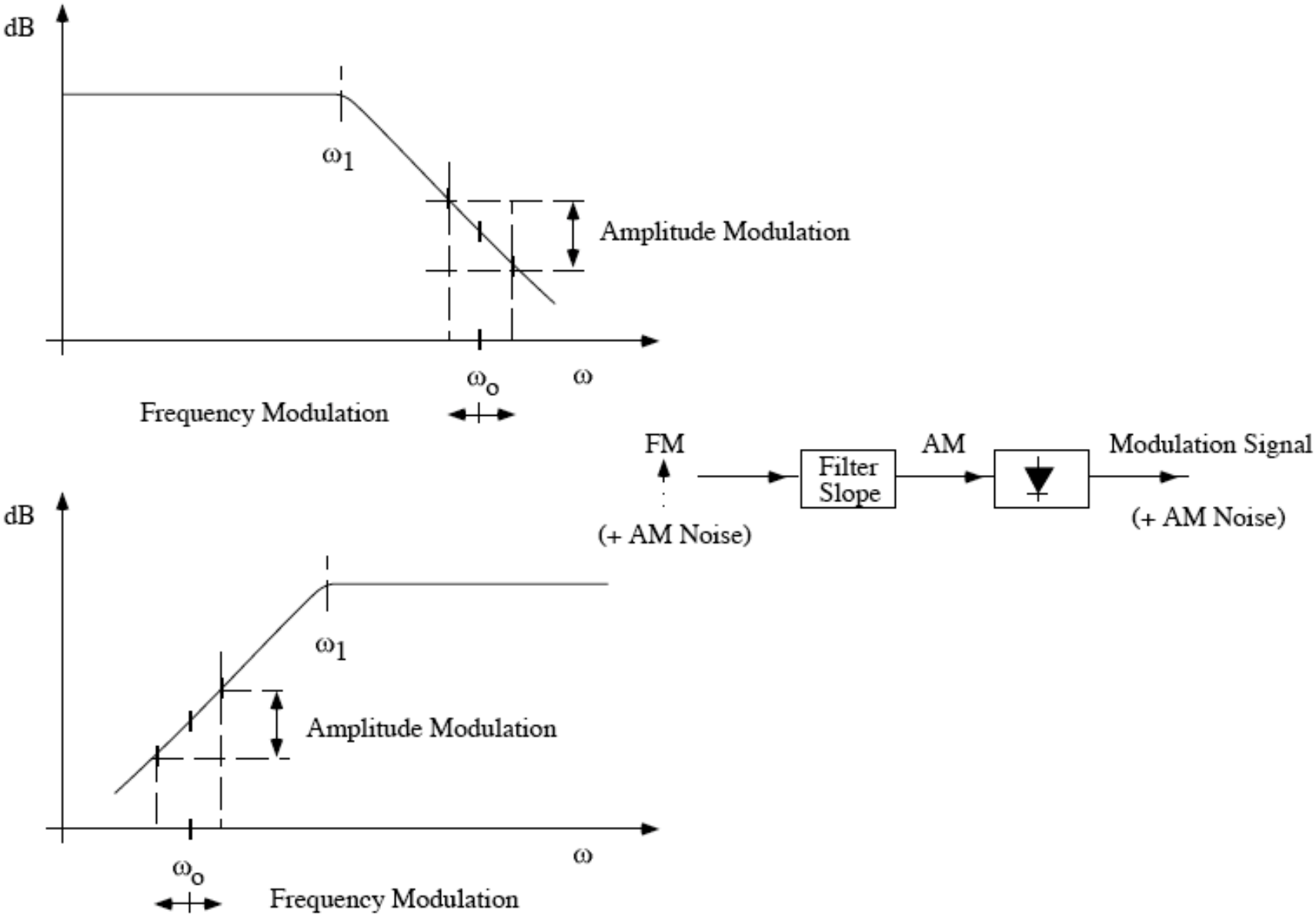
DS006976-2

Top View
Order Number LM386M-1, LM386MM-1, LM386N-1, LM386N-3 or LM386N-4
See NS Package Number M08A, MUA08A or N08E

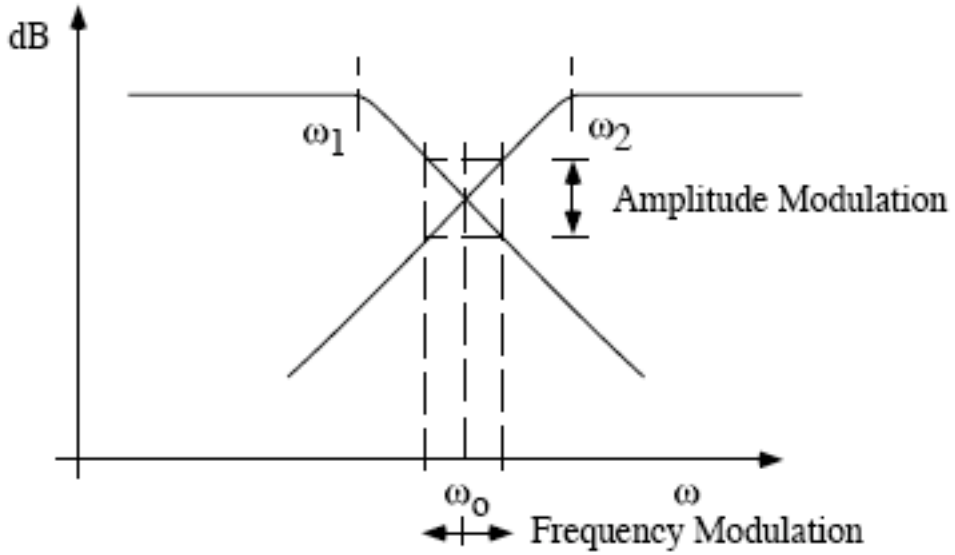
Ricevitore con demodulazione FM

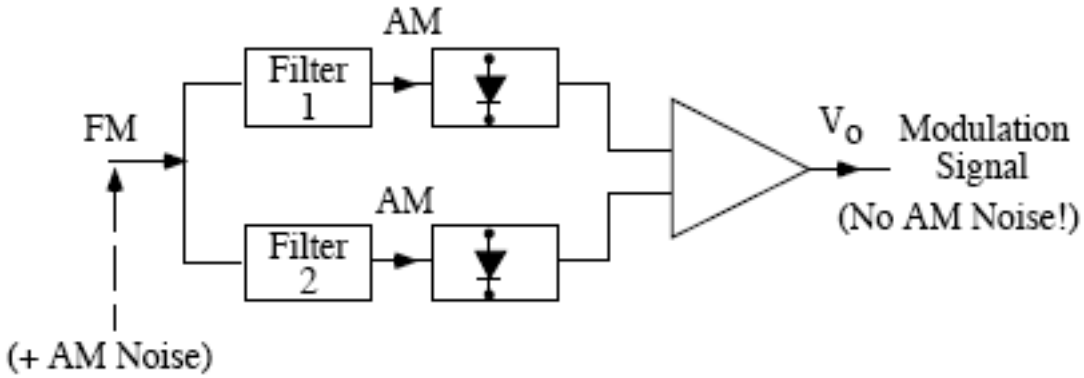


Demodulazione per mezzo di uno slope detector



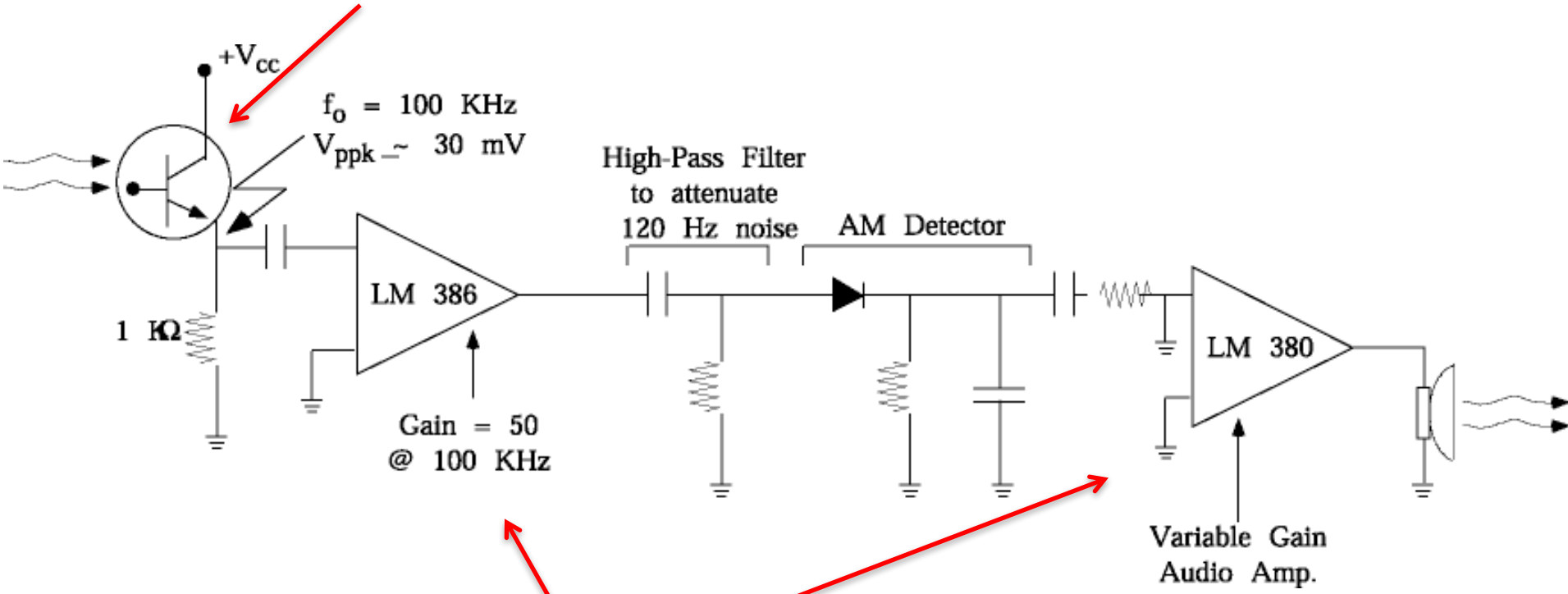
Matched slope detector
(migliore linearità, rimozione del rumore AM)





Ricevitore con demodulazione FM

il fototransistor fa
anche da slope detector



Questi amplificatori non sono essenziali nello schema di demodulazione, servono solo a dare potenza al segnale

National Semiconductor

August 2000

LM380
2.5W Audio Power Amplifier

General Description

The LM380 is a power audio amplifier for consumer applications. In order to hold system cost to a minimum, gain is internally fixed at 34 dB. A unique input stage allows ground referenced input signals. The output automatically self-centers to one-half the supply voltage.

The output is short circuit proof with internal thermal limiting. The package outline is standard dual-in-line. The LM380N uses a copper lead frame. The center three pins on either side comprise a heat sink. This makes the device easy to use in standard PC layouts.

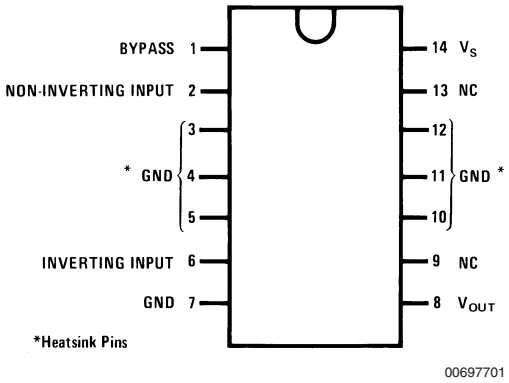
Uses include simple phonograph amplifiers, intercoms, line drivers, teaching machine outputs, alarms, ultrasonic drivers, TV sound systems, AM-FM radio, small servo drivers, power converters, etc.

A selected part for more power on higher supply voltages is available as the LM384. For more information see AN-69.

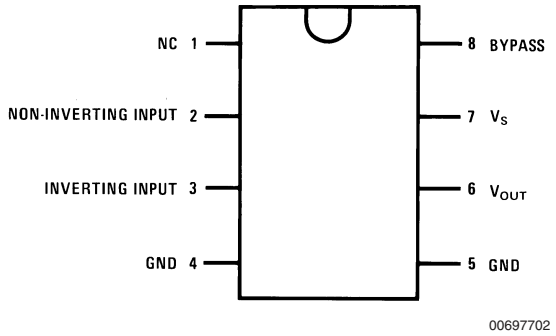
Features

- Wide supply voltage range: 10V-22V
- Low quiescent power drain: 0.13W (V_S= 18V)
- Voltage gain fixed at 50
- High peak current capability: 1.3A
- Input referenced to GND
- High input impedance: 150kΩ
- Low distortion
- Quiescent output voltage is at one-half of the supply voltage
- Standard dual-in-line package

Connection Diagrams (Dual-In-Line Packages, Top View)



Order Number LM380N
See NS Package Number N14A



Order Number LM380N-8
See NS Package Number N08E