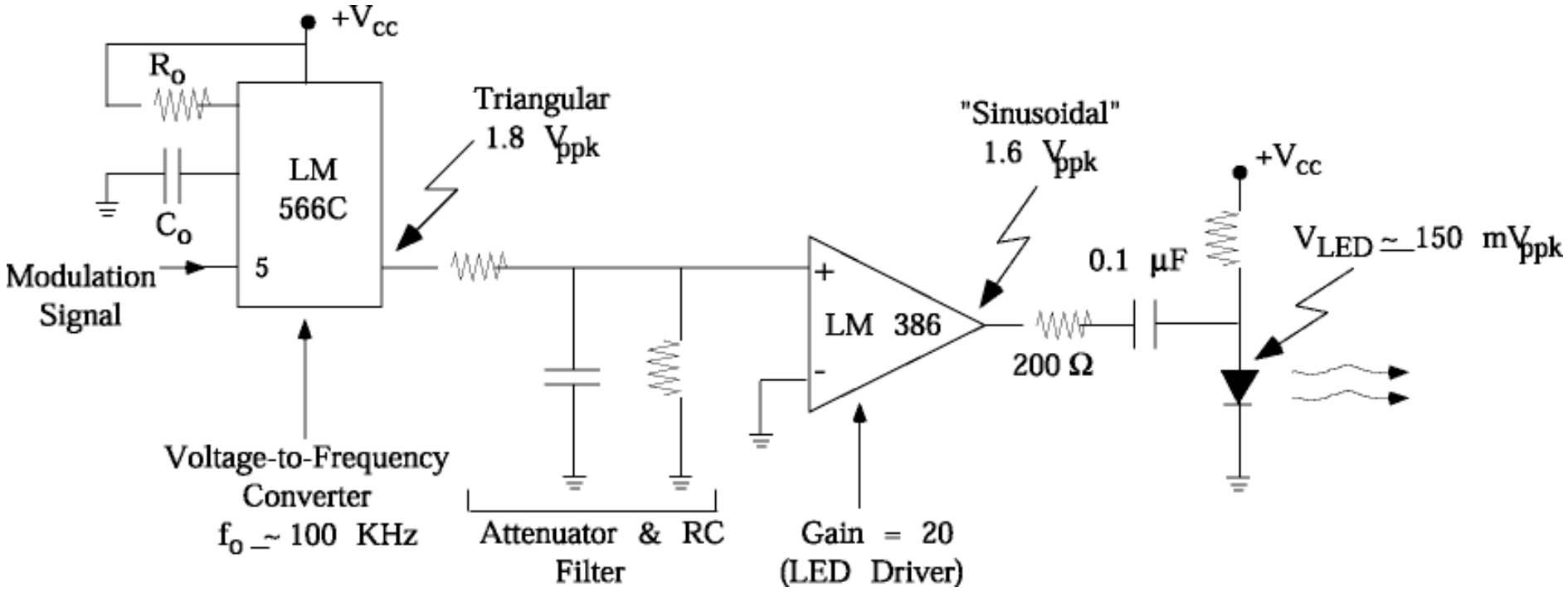
Trasmissione FM su canale ottico

Edoardo Milotti

Corso di Metodi di Trattamento dei Segnali

A. A. 2014-2015

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

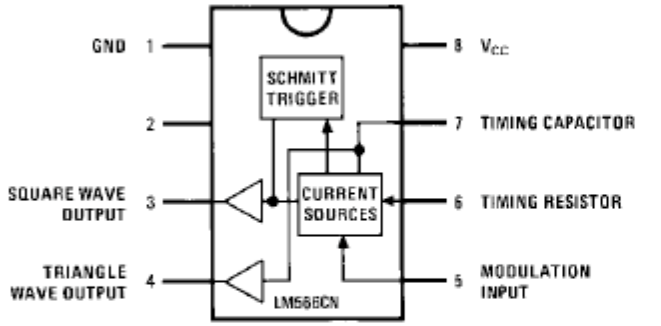
- Wide supply voltage range: 10V to 24V
- Very linear modulation characteristics
- High temperature stability
- Excellent supply voltage rejection
- 10 to 1 frequency range with fixed capacitor
- Frequency programmable by means of current, voltage, resistor or capacitor

Applications

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

Connection Diagram

Dual-In-Line Package

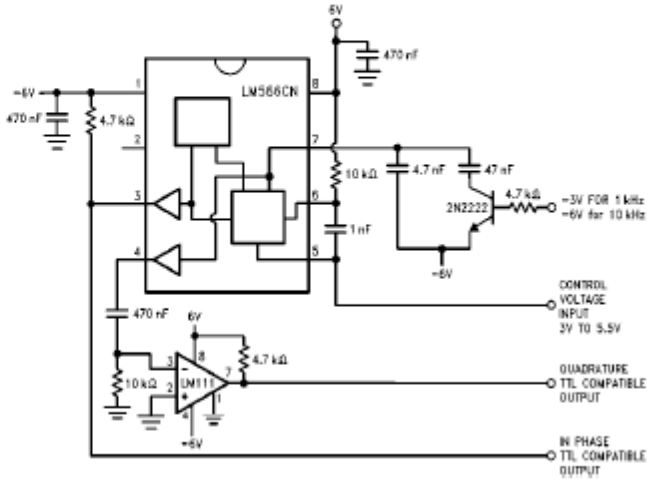


TL/H/7854–2

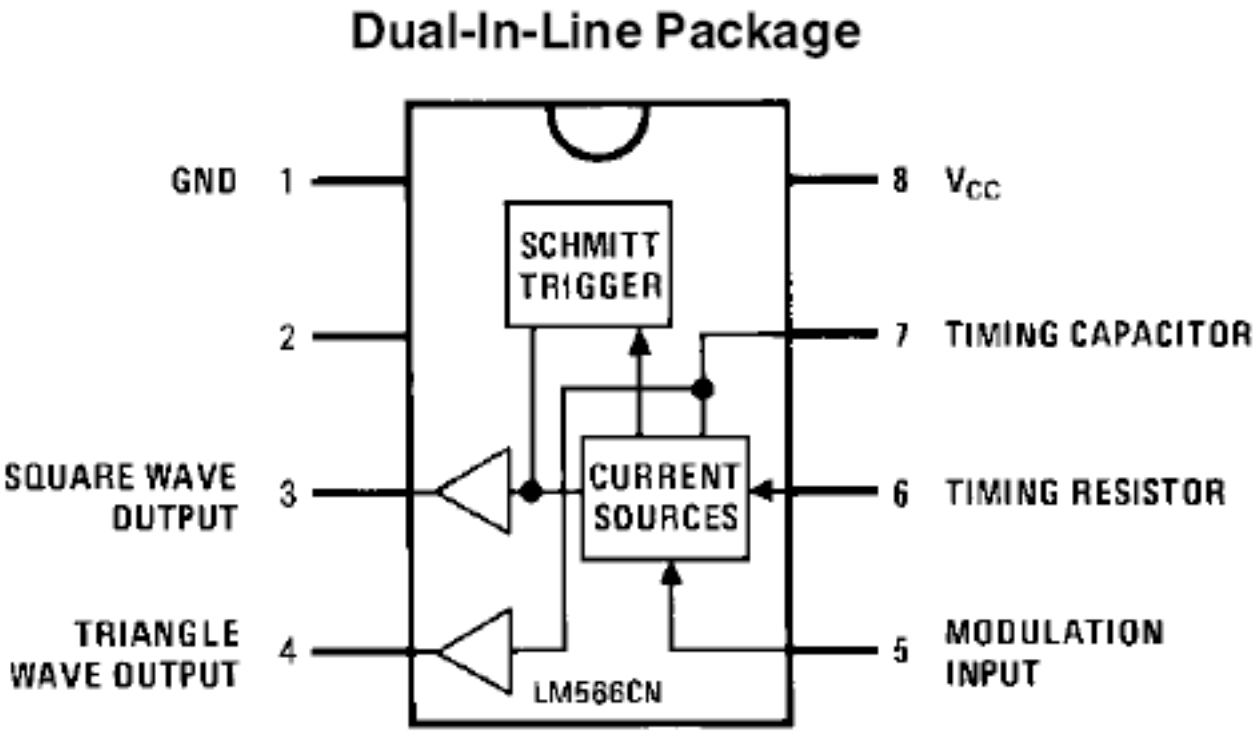
Order Number LM566CN
See NS Package Number N08E

Typical Application

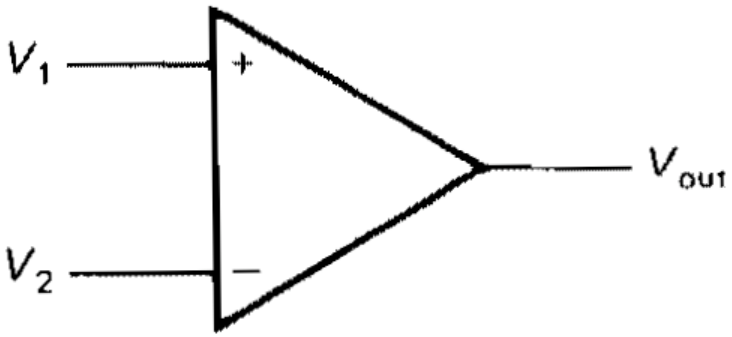
1 kHz and 10 kHz TTL Compatible Voltage Controlled Oscillator

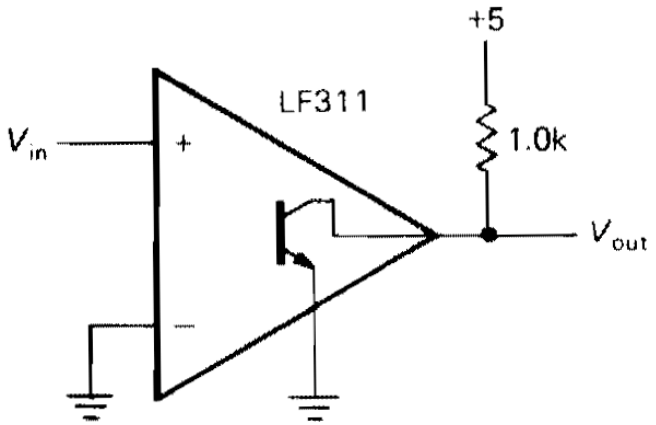


TL/H/7854–3


Dual-In-Line Package
GND
1
SCHMITT TRIGGER
2
SQUARE WAVE OUTPUT
3
CURRENT SOURCES
TRIANGLE WAVE OUTPUT
4
LM566CN
8
V_{CC}
7
TIMING CAPACITOR
6
TIMING RESISTOR
5
MODULATION INPUT

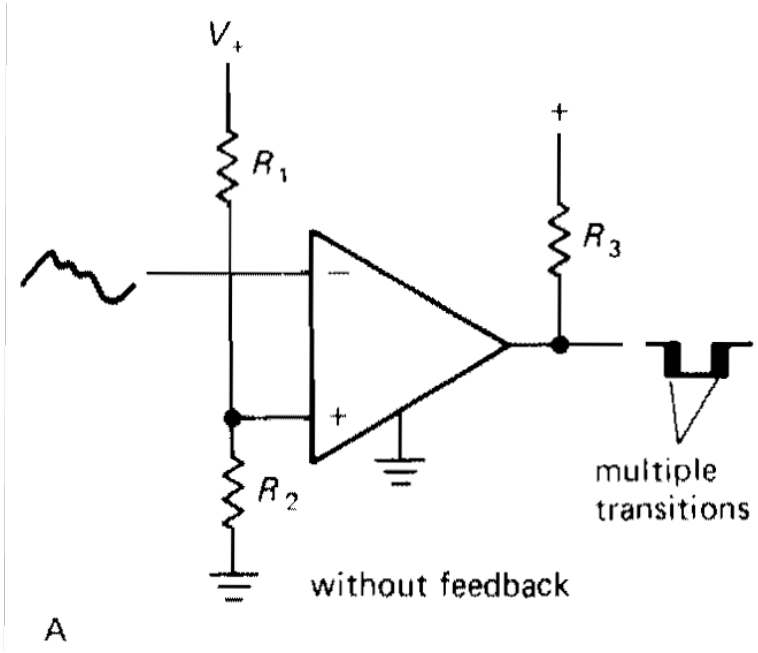
Il trigger di Schmitt: 1. comparatori

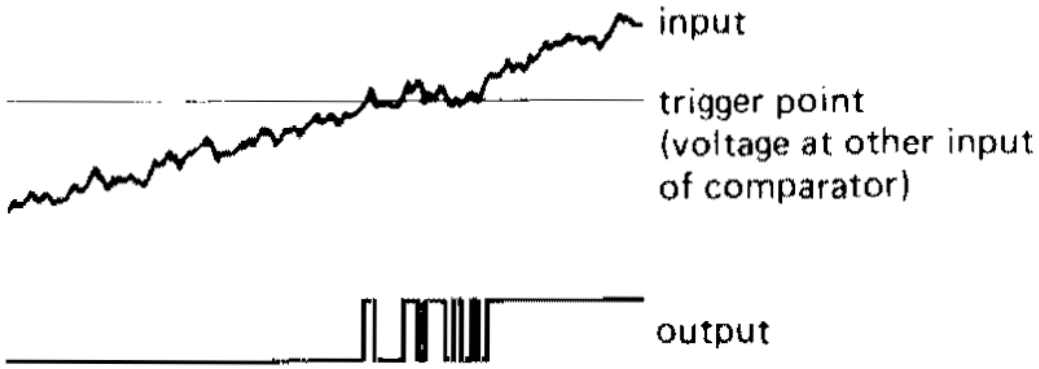




L'esempio più semplice di comparatore: un amplificatore differenziale ad alto guadagno (Vout corrisponde alla tensione di saturazione = ±Vcc)

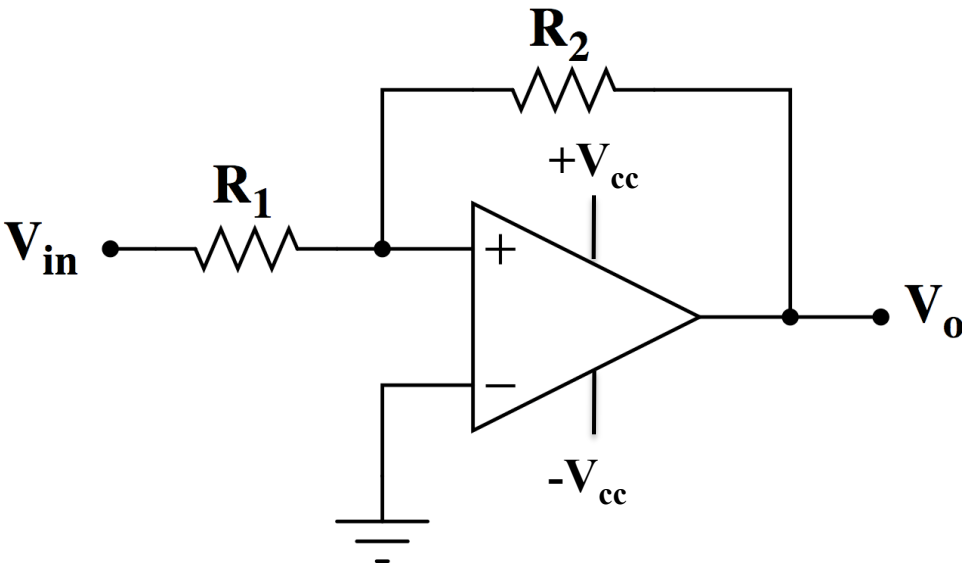
Il trigger di Schmitt: 2. comparatori





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. comparatori con feedback positivo



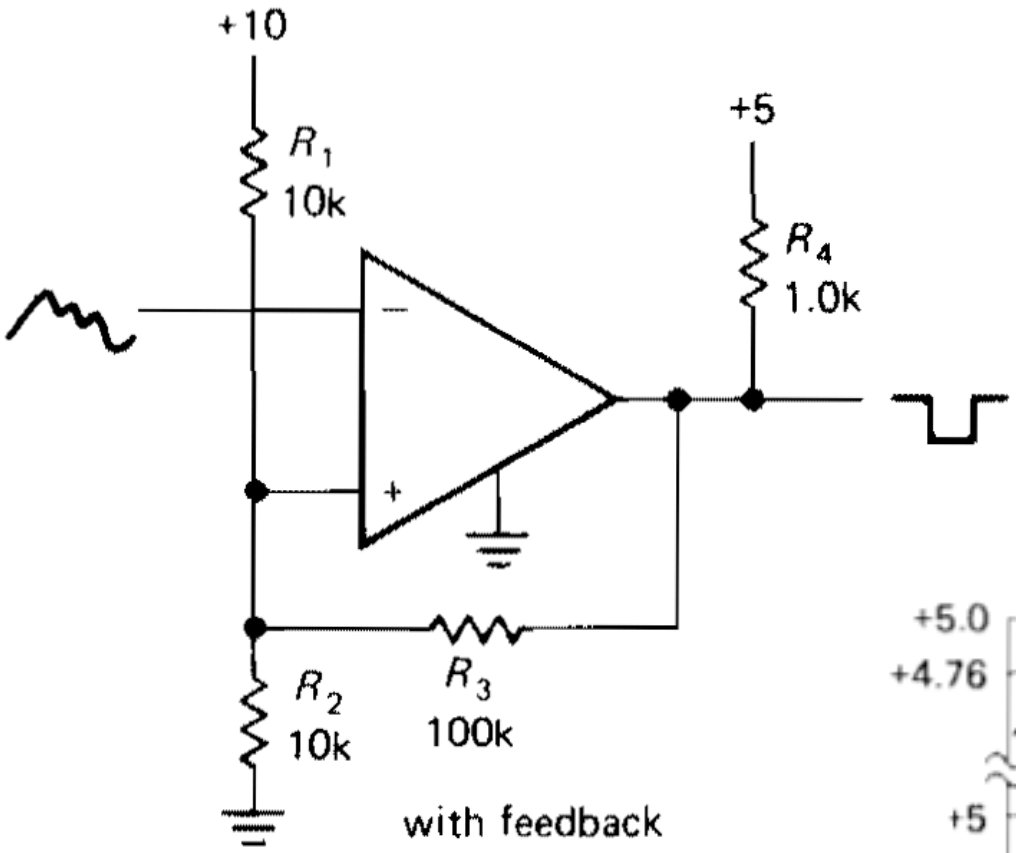
SE Vo = Vcc (stato alto) allora Vin definisce la tensione di soglia in ingresso, con le correnti che sommano a 0

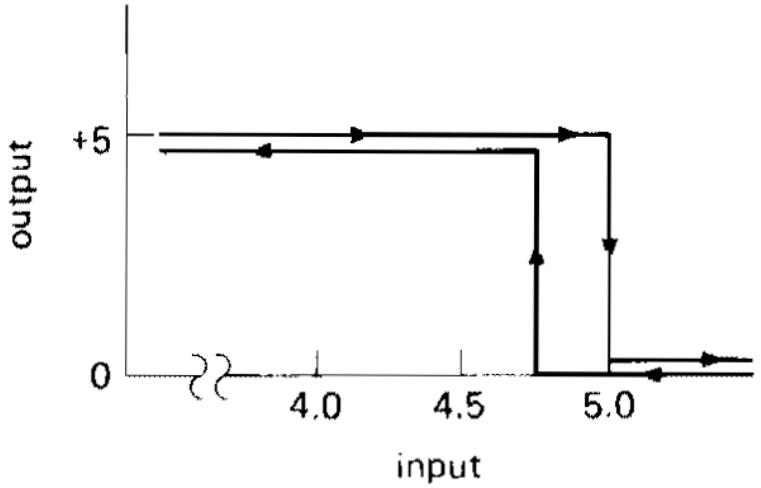
$$\frac{V_{in}}{R_1} + \frac{V_{cc}}{R_2} = 0 \quad \Rightarrow \quad V_{in} = -\frac{R_1}{R_2} V_{cc}$$

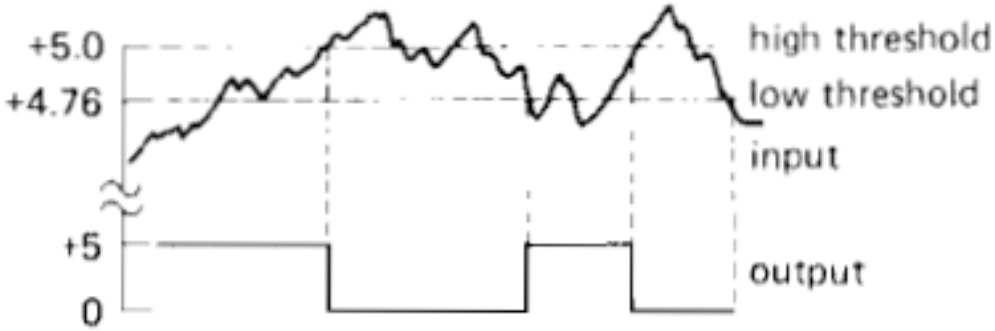
SE Vo = -Vcc (stato basso) allora Vin definisce la tensione di soglia in ingresso, con le correnti che sommano a 0

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

Il trigger di Schmitt: 4. comparatori con feedback positivo





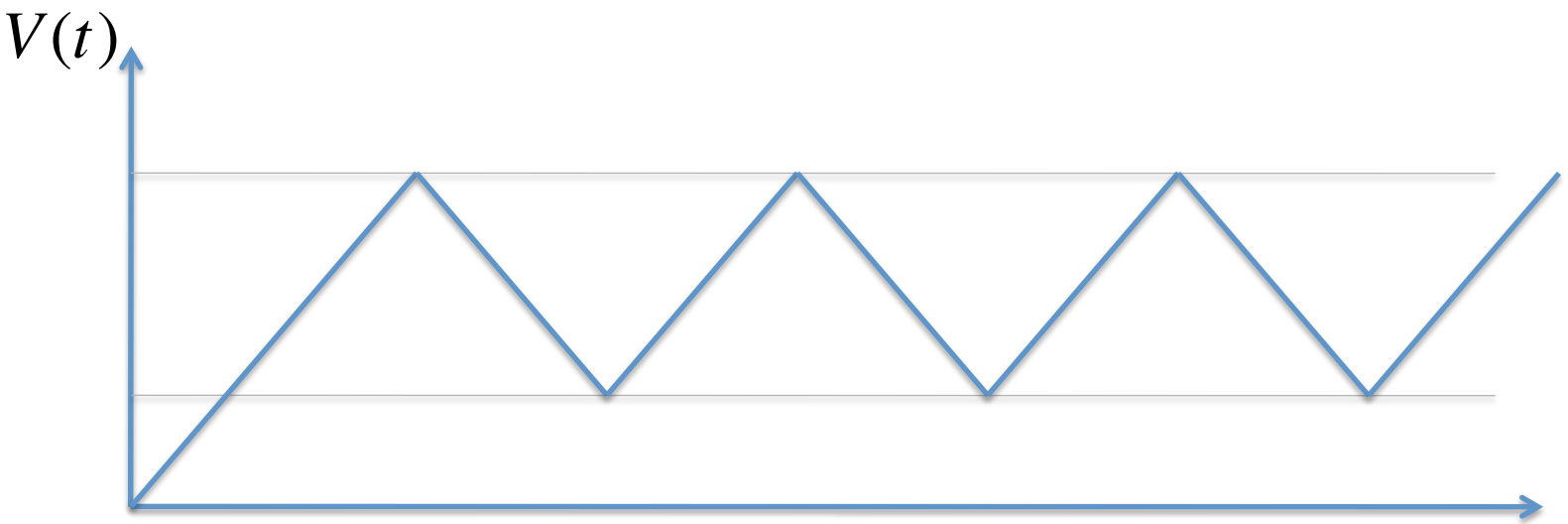


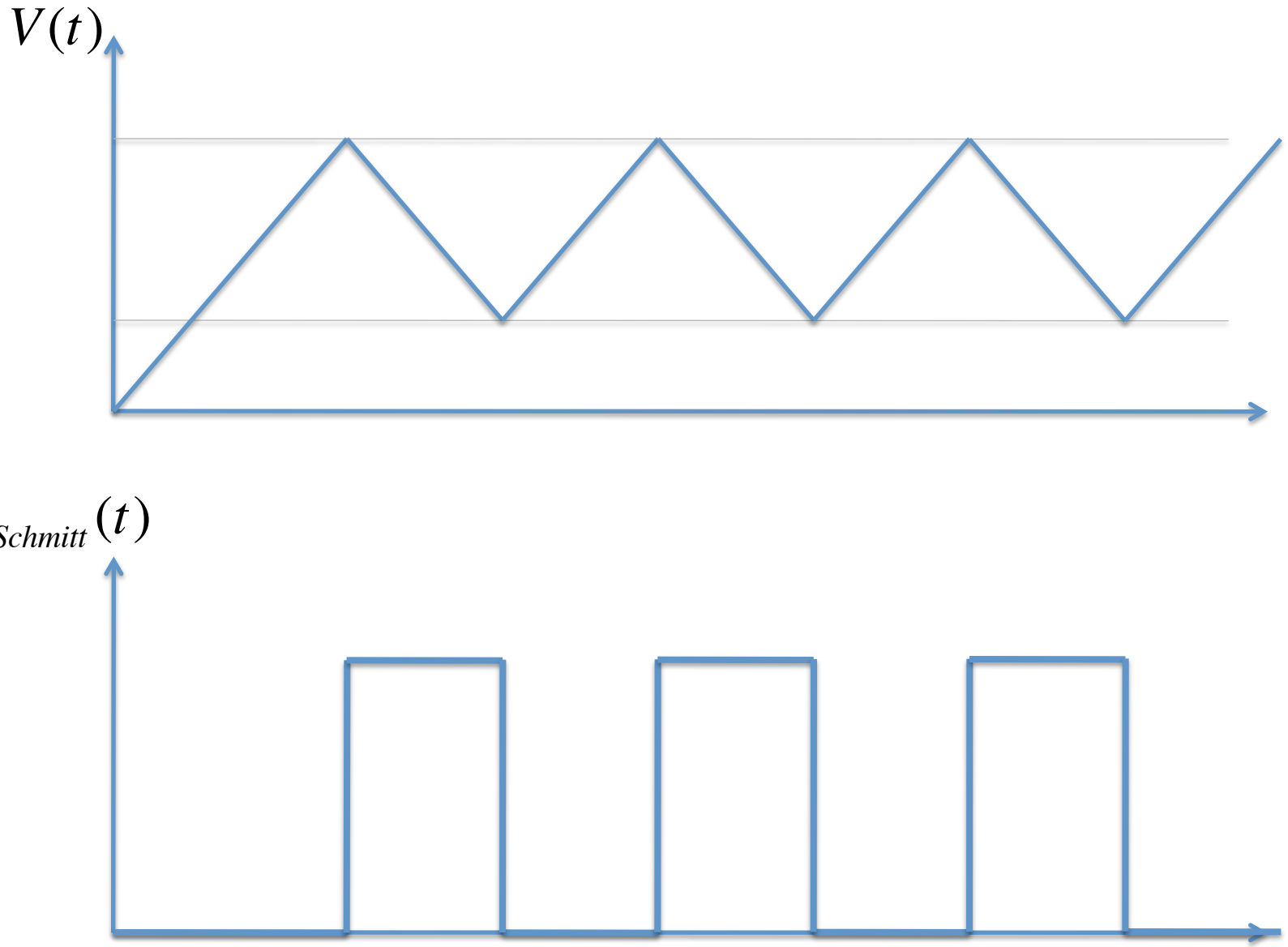
Sorgenti di corrente e condensatori

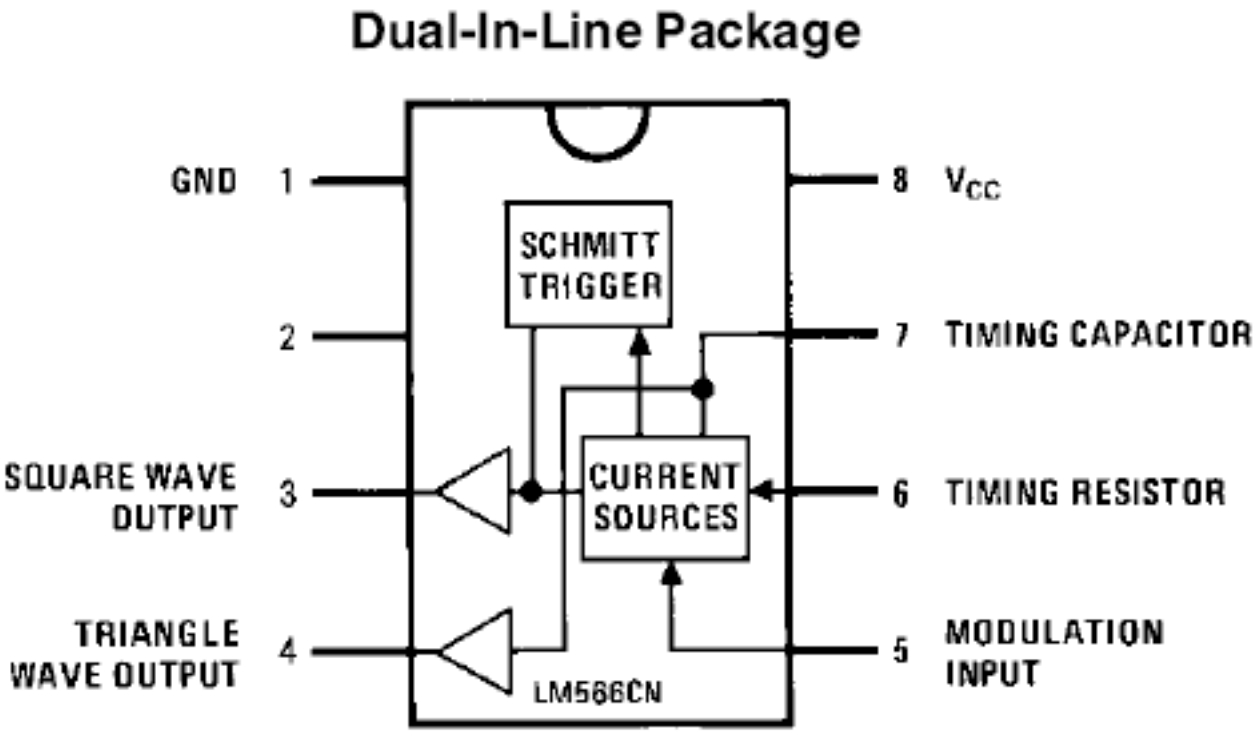
$$\frac{dQ}{dt} = \frac{1}{C}\frac{dV}{dt} = I_0 \quad \Rightarrow \quad \frac{dV}{dt} = I_0 C \quad \Rightarrow \quad V(t) = V_0 + I_0 C \cdot t$$

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

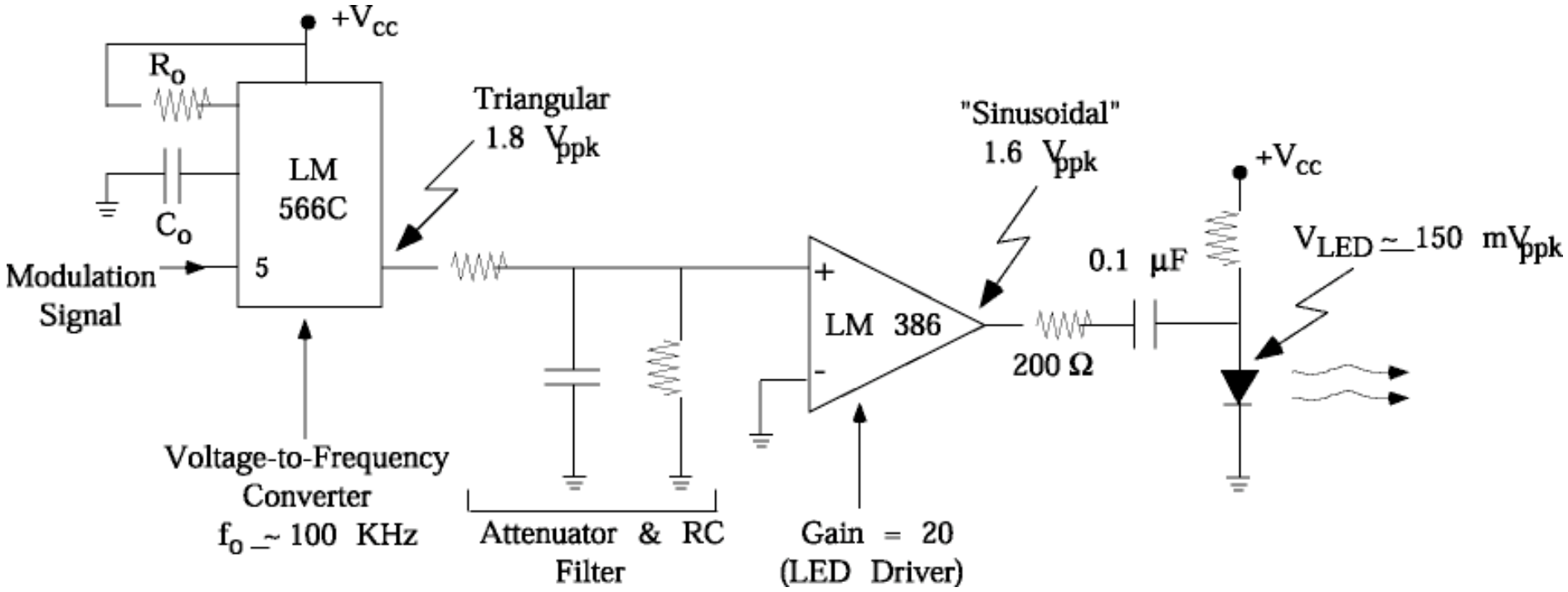
Se I0 dipende da Vin allora la frequenza dell'onda triangolare è funzione di Vin
Questo si può fare con un transistor



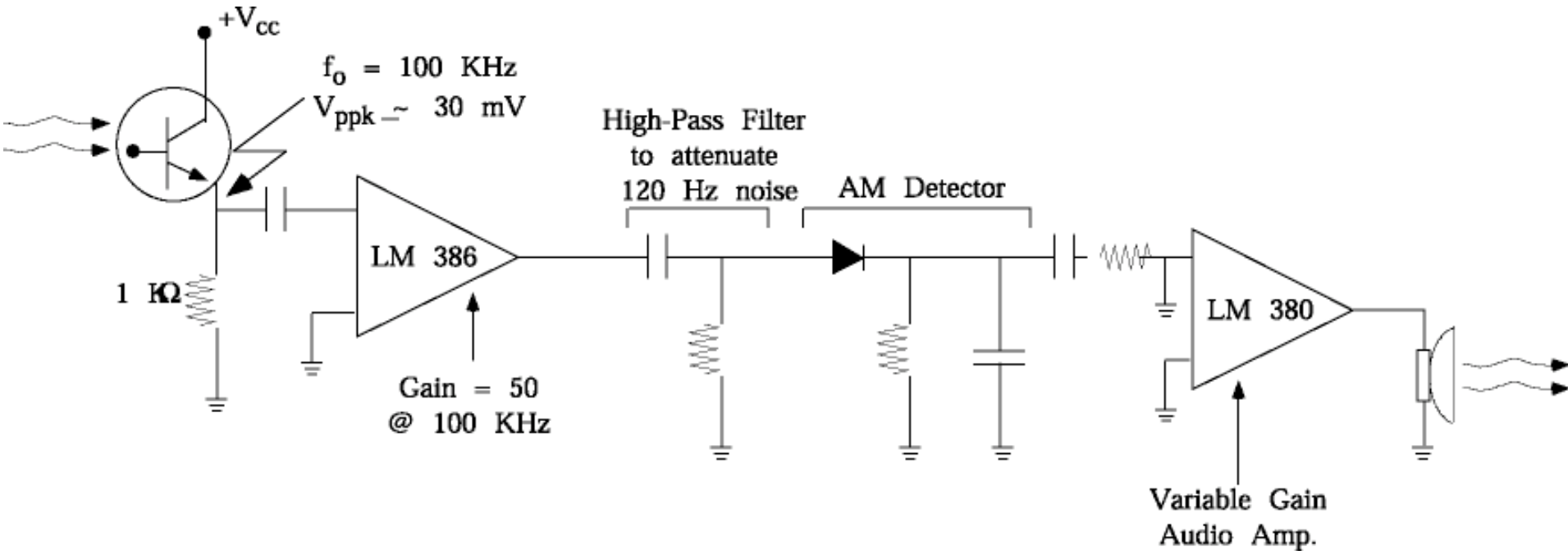

$V(t)$
$V_{Schmitt}(t)$


Dual-In-Line Package
GND
1
SCHMITT TRIGGER
2
SQUARE WAVE OUTPUT
3
CURRENT SOURCES
TRIANGLE WAVE OUTPUT
4
LM566CN
8
V_{CC}
7
TIMING CAPACITOR
6
TIMING RESISTOR
5
MODULATION INPUT

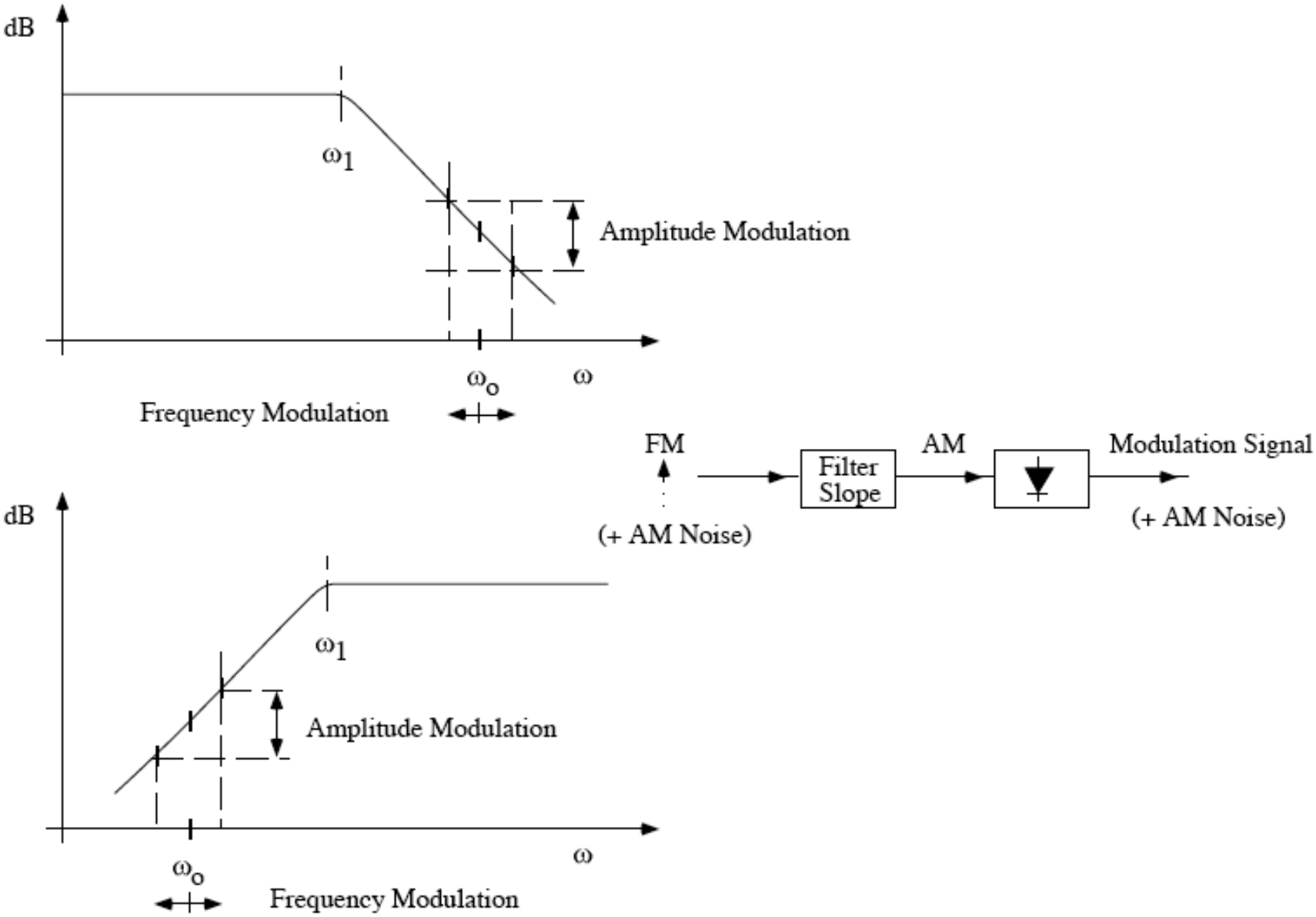
Trasmettitore con modulazione FM



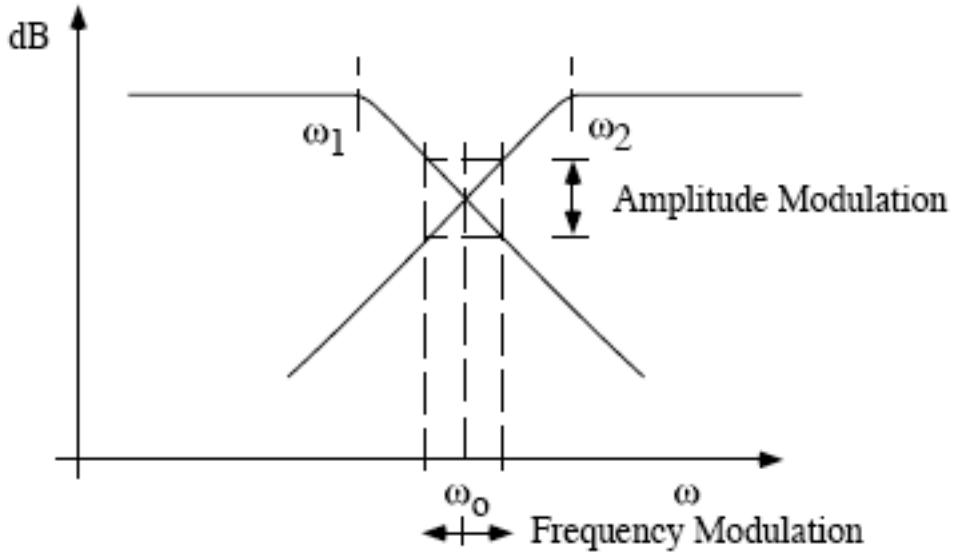
Ricevitore con demodulazione FM

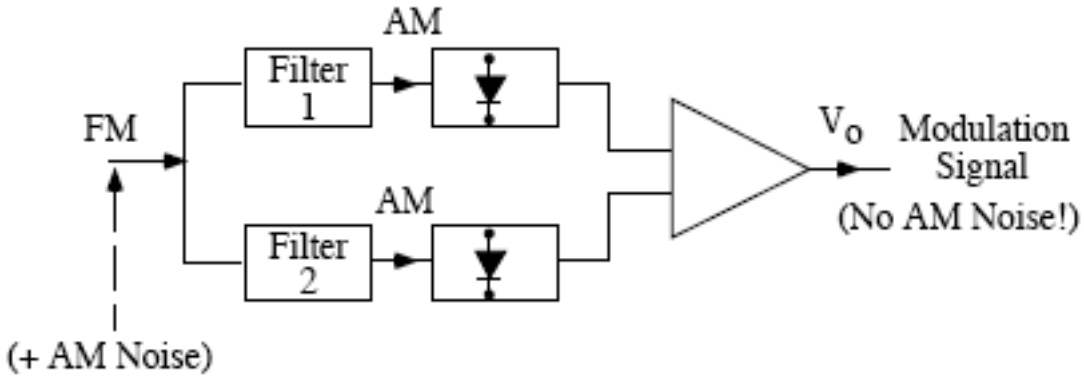


Demodulazione per mezzo di uno slope detector



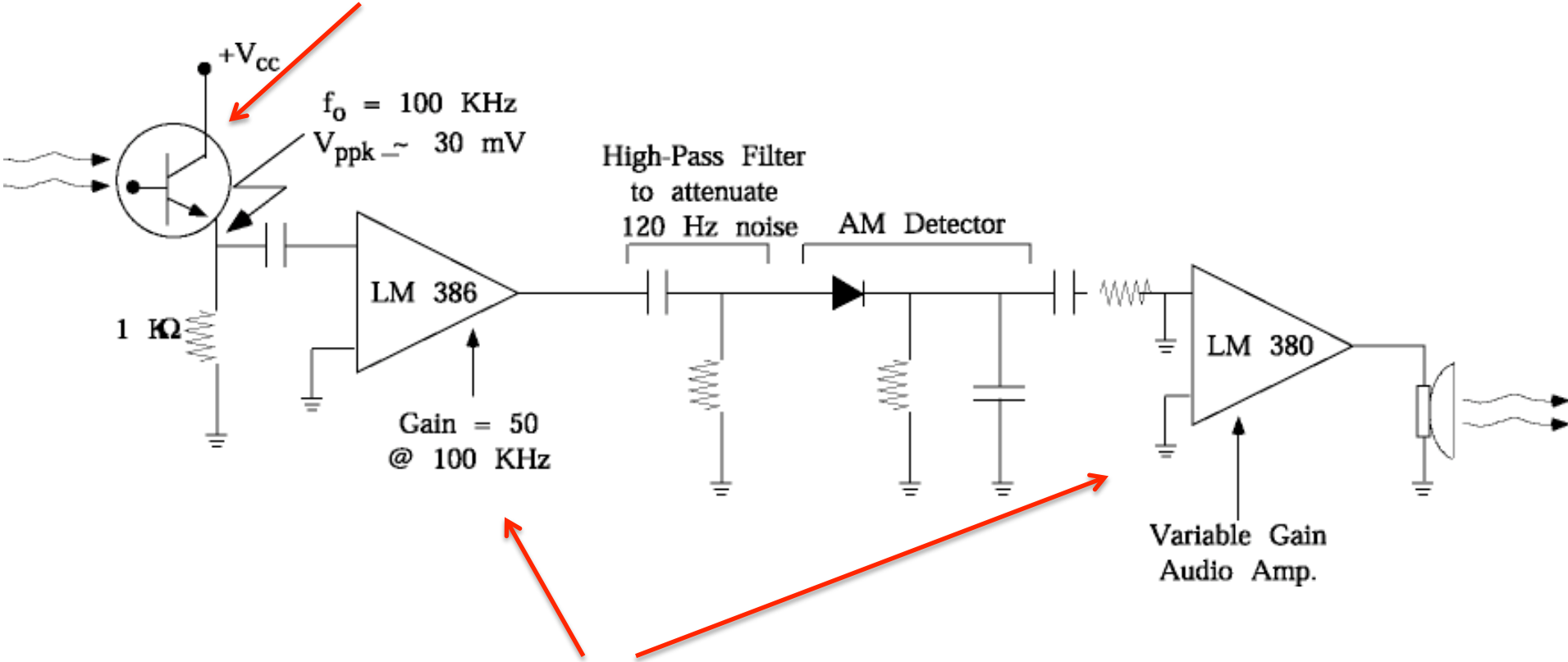
Matched slope detector
(migliore linearità, rimozione del rumore AM)





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