

VCO with sensitivity adjustment function

BA7042

The BA7042 is a monolithic IC comprising a VCO (voltage controlled oscillator) with sensitivity adjusting capabilities. The oscillation frequency can be set with an external constant, and is controlled according to the control voltage. The BA7042 can be used to produce high-modulation-factor FM signals by superimposing its control voltage with AC signals, and to configure a PLL circuit just by attaching a frequency divider and a phase comparator.

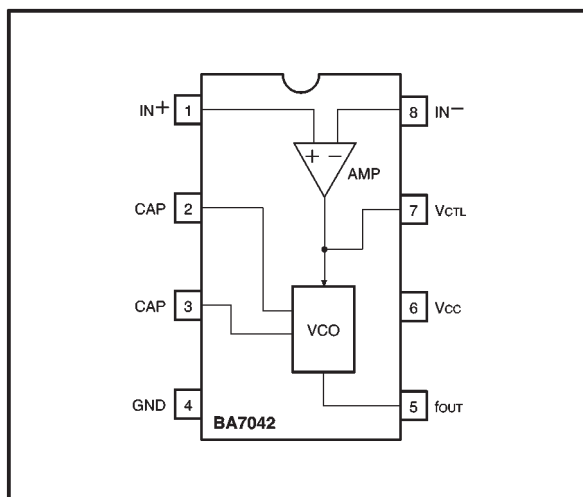
●Applications

FM intercom
FM wireless microphone
FSK modem

●Features

- 1) The number of external components is minimized.
- 2) Internal control amplifier for the VCO.
- 3) Oscillation frequency can be set with an external constant.
- 4) Maximum oscillation frequency of 18MHz.
- 5) DIP 8-pin package.

●Block diagram



● Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	V _{CC}	7.0	V
Power dissipation	P _d	800 *	mW
Operating temperature	T _{opr}	-20~+70	°C
Storage temperature	T _{stg}	-55~+125	°C

* Reduced by 8.0 mW for each increase in Ta of 1°C over 25°C.

● Recommended operating conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Power supply voltage	V _{CC}	4.5	5.0	5.5	V	—

● Electrical characteristics (unless otherwise noted, Ta = 25°C, V_{CC}=5.0V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement Circuit
Quiescent current	I _Q	6.0	12.2	19.0	mA	—	Fig.1
VCO control voltage	V _{CTL}	2.0	2.5	3.0	V	Pin 7 voltage	Fig.1
Frequency control sensitivity	G _f	-4.85	-5.20	-5.55	MHz / V	f ₀ = 14.3 MHz, amplifier gain = 0 dB	Fig.1
Frequency power supply variation	Δf _v	—	—	-600	kHz / V	f ₀ = 14.3MHz	Fig.1
Maximum oscillation frequency	f _{Max.}	18	—	—	MHz	V _{OUT} ≥ 1.0V _{P-P} , R _L = 5k Ω	Fig.1
Oscillation output	V _{OUT}	1.0	1.6	2.0	V _{P-P}	f ₀ = 100kHz, R _L = 5k Ω	Fig.1
VCO output duty ratio	D _U	48	50	52	%	f ₀ = 100kHz, C _T = 4700pF	Fig.1

● Measurement circuit

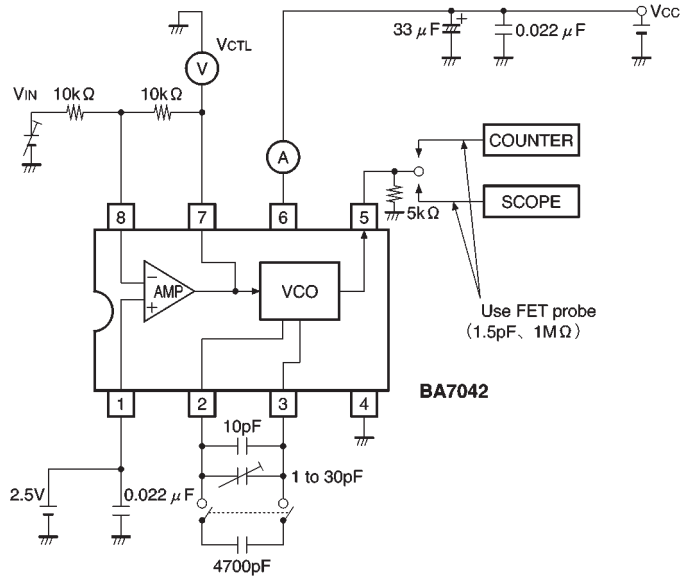


Fig. 1

● Application example

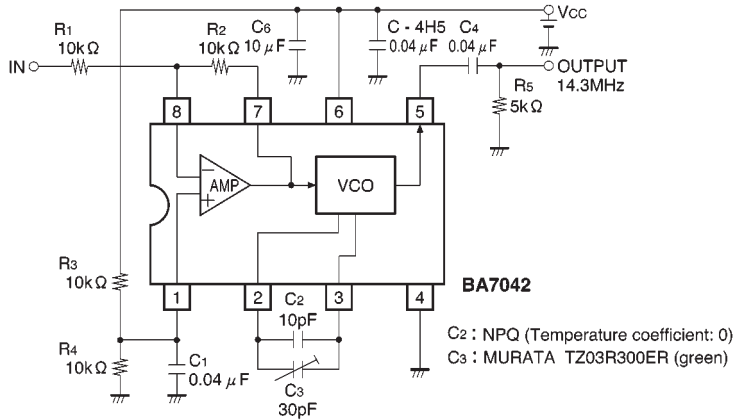


Fig. 2

● Circuit operation

(1) Circuit configuration

The control voltage, input through pin 1, is amplified by the control amplifier, then output to pin 7 and input to the VCO control circuit. The oscillation frequency of the VCO is determined by the attached capacitor and controlled according to the control voltage. Highly modulated FM signals can be produced by superimposing the control voltage with AC signals.

(2) Block description

1) Control amplifier (pin 1, pin 7, pin 8)

The differential amplifier's positive input is pin 1, its negative input pin 8, and its output pin 7. Set the input bias voltage so that the pin 7 voltage is $V_{CC}/2$. The amplification degree is determined by the external constant.

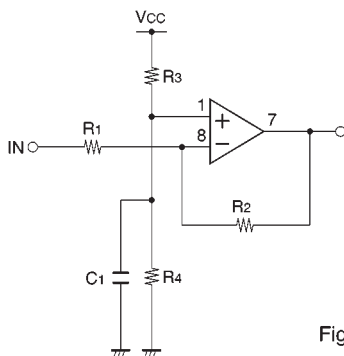


Fig. 3

2) VCO (pin 2, pin 3, pin 5)

The oscillator's center frequency is set with an external capacitor. Use the following equation to calculate oscillation frequency :

$$f \approx \frac{1}{C \text{ (pF)}} \times (1.3 \times V_7 + 0.15) \times 10^2 \text{ [MHz]}$$

where $C = C_2 + C_3$, $V_7 =$ pin 7 voltage

The oscillation frequency set by the capacitor is the center frequency in the VCO's frequency variation range. The VCO can be given a roughly linear oscillation frequency by changing its control voltage.

$$\text{Amplification degree (Gv)} = 20 \log \frac{R_2}{R_1} \text{ (dB)}$$

Input impedance (Z_{IN}) = R_1

Bias (R_3) = R_4

C_1 : For decoupling and bypass capacitor

Bias (R_3) = R_4

● Operation notes

(1) Temperature drift of the oscillator circuit can be reduced by configuring with a capacitor having a temperature coefficient. Temperature drift with a capacitor having a temperature coefficient of zero is $-30\text{kHz} / ^\circ\text{C}$ when $C = 25\text{pF}$, $f_0 = 14.3\text{MHz}$, $V_{CTL} = 2.5\text{V}$.

(2) The control amplifier's frequency characteristics depend on NF. When used as a reversing amplifier, cutoff frequency is roughly 100kHz with a gain of 20dB. When configuring PLL circuits, remember that loop stability is affected by the amplifier's frequency characteristics.

●Electrical characteristic curves

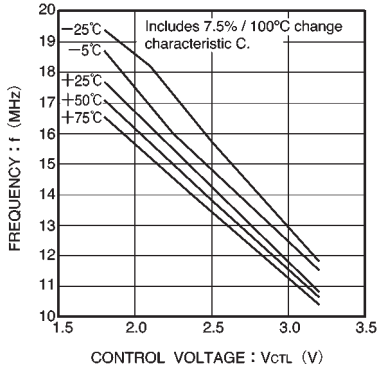


Fig. 4 Frequency vs. control voltage temperature

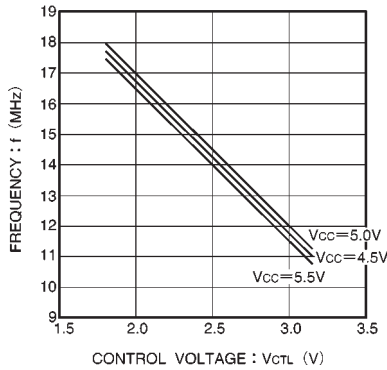


Fig. 5 Frequency vs. control voltage temperature

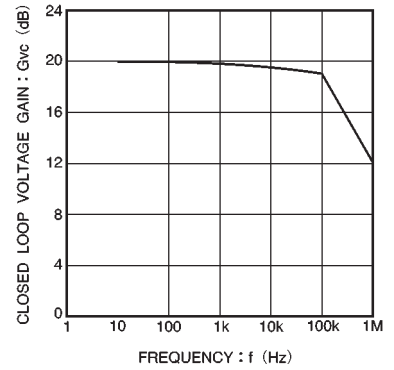


Fig. 6 Closed loop voltage gain vs. frequency (reversing amplifier)

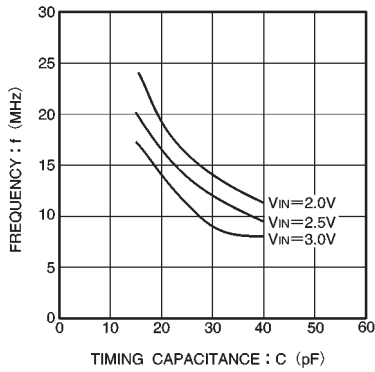
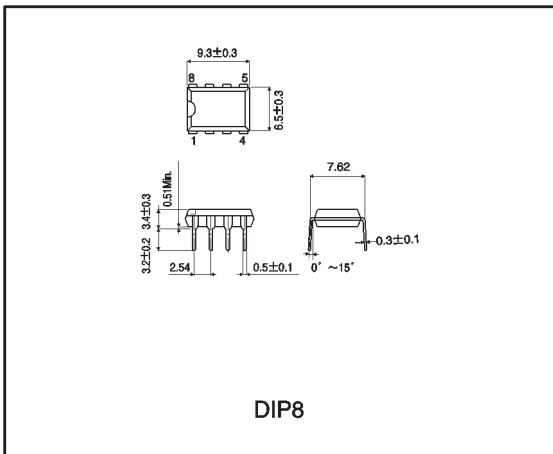


Fig. 7 Frequency vs. timing capacitor capacitance

●External dimensions (Units: mm)



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