MONOLITHIC FUNCTION GENERATOR XR-2206

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ABSTRACT

This paper described here is based on high quality the industry standard integrated circuit XR2206. This XR2206 Function Generator is capable of producing high quality sine and triangle waveforms of high-stability and accuracy in the range about .01Hz to more than 1MHz [1]. Frequency adjustment range is accomplished using 4-DIP switch. It is IC having 16 Pins.

Keywords: FSK, PDIP, CDIP, SOIC.

I INTRODUCTION

The XR-2206 is a monolithic function generator integrated circuit capable of producing high quality square, triangle, sine, pulse and ramp waveforms of accuracy and high-stability. The output waveforms can be both frequency and amplitude modulated by an external voltage. Frequency of operation can be externally selected over a range of 0.01Hz to more than 1MHz.The circuit is ideally suited for communications, instrumentation, and function generator applications requiring sinusoidal tone, frequency modulation, amplitude modulation or frequency shift keying generation. XR-2206 has a typical drift specification of 20ppm/° C. The oscillator frequency can be linearly swept over a range of 2000:1 frequency with an external control voltage, while maintaininglow distortion.

II FEATURES OF XR-2206

2.1 Low-Sine Wave Distortion (THD 0.5%), insensitive to signal sweep
2.2 Linear Amplitude Modulation
2.3 Wide Supply Range (10V to 26V)
2.4 Excellent Temperature Stability (20 ppm/^{0}C, typical)
2.5 Low-Supply Sensitivity (.01%V, typical)
2.6 TTL Compatible Frequency shift keying Controls
2.7 Adjustable Duty Cycle (1% to 99%)

III ABSOLUTE MAXIMUM RATINGS

3.1 Power Supply (26V)
3.2 Power Dissipation (750mW)

3.3 Derate Above 25°C (5mW/°C)

3.4 Total Timing Current (6mA)

3.5 Storage temperature range (-65°C to +150°C)

3.6 Operating temperature range (0^0C to $+75^0$C)

IV FUNCTIONAL BLOCK DIAGRAM OF XR-2206

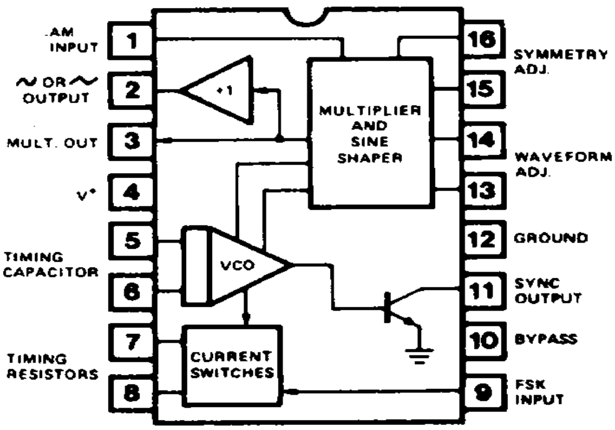


Fig1. Block diagram

As shown in fig.1, The monolithic circuit is comprise of four blocks:

4.1 A VCO (Voltage Controlled Oscillator)

4.2 Analog multiplier and sine shaper

4.3 A unit gain buffer amplifier

4.4 A set of current switches

V PIN DIAGRAM

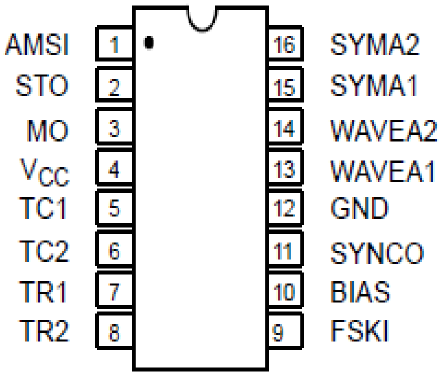


Fig.2 16 pin PDIP, CDIP

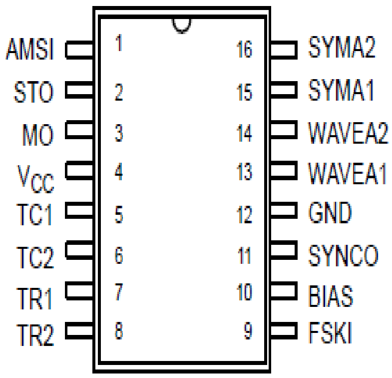


Fig.3 16 pin SOIC

5.1 PIN Description

PIN	SYMBOL	TYPE	DESCRIPTION
1	AMSI	1	AM Signal Input
2	STO	0	Triangle or Sine Wave Output
3	MO	0	Multiplier Output
4	VCC	-	+ve Power Supply
5	TC1	1	Timing Capacitor Input
6	TC2	1	Timing Capacitor Input
7	TR1	0	Timing Resistor 1 Output
8	TR2	0	Timing Resistor 2 Output
9	FSKI	1	FSK Input
10	BIAS	0	Internal Voltage Reference
11	SYNCO	0	Sync Output
12	GND	-	Ground Pin
13	WAVEA1	1	Waveform Adjust Input 1
14	WAVEA2	1	Waveform Adjust Input 2
15	SYMA1	1	Wave Symetry Adjust 1
16	SYMA2	1	Wave Symetry Adjust 2

VI DC ELECTRICAL CHARACTERISTICS

Test Conditions: Test Circuit of Figure 4. VCC = 12V, TA = 25°C, C =.01F, R1 = 100kohm, R2 = 10kohm, R3 = 25ohm unless otherwise specified. S1 closed for sine wave andopen for triangle.

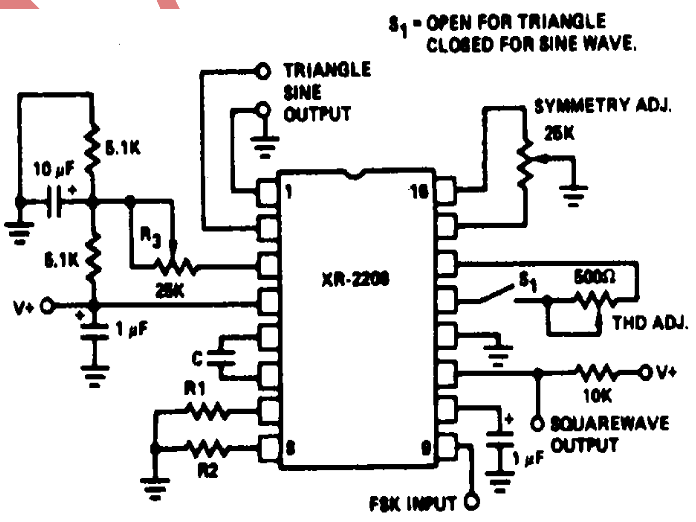


Fig 4. Basic Test Circuit of XR-2206

6.1 Characteristic Table

CHARACTERISTICS	MINIMUM	TYP.	MAXIMUM	UNIT	CONDITIONS
Single Supply Voltage Supply Current Split-Supply Voltage	10 ±5	 14 	26 20 ±13	V mA V	R1 ≥ 10kΩ
Oscillator section Max. Operating Freq. Lowest Practical Freq. Frequency Accuracy Temperature Stability Frequency Supply Sensitivity Sweep Range	 0.5	 1 0.01 ±2 ±20 0.01 2000:1		 MHz Hz % of f_0 Ppm/^{0}C %/V f_{H}= f_L	 C = 1000pF, R1 = 1k C = 50_F, R1 = 2M_ f0= 1/R1C 0□C _ TA_ 70□C R1 = R2 = 20k_ VLOW = 10V, VHIGH = 20V, R1 = R2 = 20k_ fH@ R1 = 1k_ fL@ R1 = 2M_
Square-Wave Output Amplitude Rise Time Fall Time Saturation Voltage Leakage Current		 12 250 50 0.2 0.1	 0.6 100	 Vpp nsec nsec V μA	 Measured at Pin 11. CL = 10pF CL = 10pF IL = 2mA IL = 2mA
Amplitude Modulation Input Impedance Modulation Range Carrier Suppression Linearity	 50	 100 100 50 2		 kΩ % dB %	 For 95% Modulation
Reference Bypass Voltage	2.9	3.1	3.5	V	Measured at Pin 10.

6.2 Description of Circuit Control

6.2.1 Operation of Frequency

The oscillation frequency F_0, is determined by the external timing capacitor C which is across Pin 5 and 6, and by the timing resistor R, connected to either Pin 7 or 8. The frequency is given as:

$$F_0 = 1/(RC) \text{ Hz}$$

and can be adjusted by varying either R or C. Temperature stability is optimum for 4KΩ< R < 200KΩ. Recommended values of C are in the range of 1000pF to 100μF.

6.2.2 Frequency Sweep and Modulation

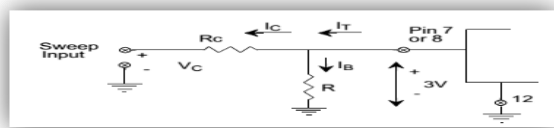


Fig 5. Circuit for Frequency Sweep

Oscillation Frequency is proportional to the total timing current I, drawn from Pin 7 or 8:

$$F = (320I\ (mA) \div C\ (\mu F))\ Hz$$

The timing terminals are low-impedance points, and are internally biased at +3V, with respect to Pin 12. Frequency varies linearly with I, of range from 1μA to 3mA. By applying a control voltage, VC, to the activated timing pin we can be controlled the frequency. The oscillation frequency is related to VC as:

$$F = 1/RC(1+R/RC(1-Vc/3))\ Hz$$

From voltage-to-frequency conversion gain K, is given as:

$$K = df/dV_c = -\ .32/R_cC\ Hz/V$$

6.2.3 Output Amplitude

Maximum output amplitude is inversely proportional to the external resistor R_3, connected to Pin 3. For the output of sine wave, amplitude is approximately 60mV peak per KΩ of R3; for triangle, the peak amplitude is approx. 160mV peak per KΩ of R_3. Thus, for example, R_3= 50kΩ would produce approximately 13V sinusoidal output amplitude.

VII MAIN APPLICATION OF XR-2206

7.1 Sine & Triangle Wave Generation

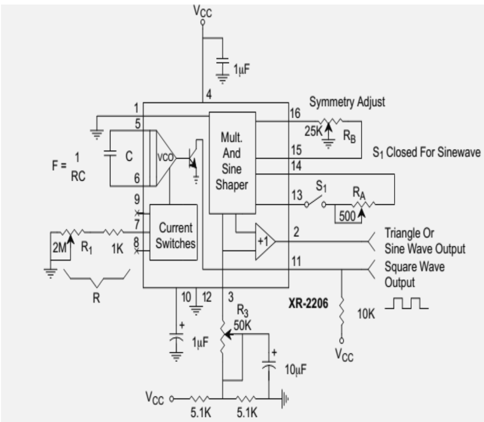
The harmonic sinusoidal output can be reduced to -0.5% by additional adjustments as shown in Figure 6.The potentiometer, Ra, adjusts the sine-shaping resistor, and Rb provides the fine adjustment for the waveform symmetry. The adjustment procedure is as follows:

1. Set Rb at midpoint and adjust Ra for minimum distortion.

2. With Ra set as above, adjust Rb to further reduce distortion.

7.2 Frequency Shift Keying Generation

The circuit connection for sinusoidal FSK signal operation is shown in figure 7. Space and mark frequencies can be independently adjusted by the choice of timing resistors R1and R2; the output is phase-continuous during transitions. The keying signal is applied to Pin 9. The circuit can be converted to split-supply operation by replacing ground with V.



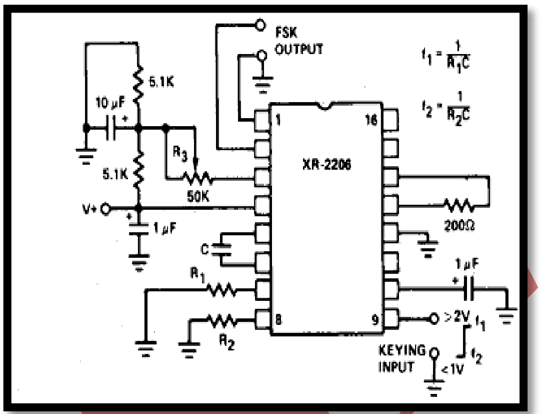


Fig 6. Circuit for sine and triangle wave generation **Fig-7. Circuit of FSK Genrator**

7.3 Pulse and Ramp Generation

The circuit for pulse and ramp waveform generation is shown in Figure 8. In this mode of operation, the FSK keying terminal is shorted to the square-wave output and the circuit automatically frequency-shift keys itself between two separate frequencies during the +ve going and –ve going output waveforms. The duty cycle and pulse width can be adjusted from 1% to 99% by the choice of R1and R2. The values of R1and R2 should be in the range of 1KΩto 2MΩ.

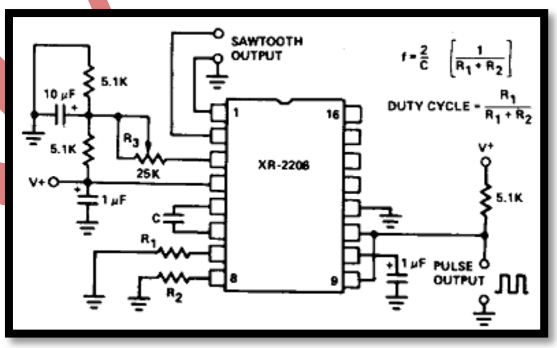


Fig 8. Circuit of Pulse and Ramp generation

7.4 Other Applications of XR-2206

7.4.1 AM/FM Generation

7.4.2 V/F Conversion

7.4.3 PWM controller [2]

7.4.4 Microcontroller Based System for the Measurement of Dielectric Constant in Liquids [3].

7.4.5 Development of Multi-frequency Electrical Impedance Spectroscopy (EIS) System for Detection of Breast Cancer [4].

7.4.6 Class D Full-Range Audio Power Amplifier [5].

7.4.7 Pyroelectric Infrared Sensor for Intruder Detection [6].

VIII CONCLUSION AND FUTURE SCOPE

In this paper many features and applications of IC XR-2206 Monolithic Function Generator is discussed. In future this IC can be used in many fields like medical Instruments and measurement Instrument. It has several scope in Instrumental science.

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