

Precision Waveform Generator

GENERAL DESCRIPTION

The XR-8038A is a precision waveform generator IC capable of producing sine, square, triangular, sawtooth, and pulse waveforms, with a minimum number of external components and adjustments. The 8038A allows the elimination of the external distortion adjusting resistor which greatly improves the temperature drift of distortion, as well as lowering external parts count. Its operating frequency can be selected over eight decades of frequency, from 0.001Hz to 200KHz, by the choice of external R-C components. The frequency of oscillation is highly stable over a wide range of temperature and supply voltage changes. Both full frequency sweeping as well as smaller frequency variations (FM) can be accomplished with an external control voltage. Each of the three basic waveform outputs, (i.e., sine, triangle and square) are simultaneously available from independent output terminals.

The XR-8038A monolithic waveform generator uses advanced processing technology and Schottky-barrier diodes to enhance its frequency performance. It can be readily interfaced with a monolithic phase-detector circuit, such as the XR-2228 to form stable phase-locked circuits.

FEATURES

Low Frequency Drift	50ppm/°C, Typical
Simultaneous Sine, Triangle, and Square Wave Outputs	
Low Sine Wave Distortion — THD $\approx$ 1%	
High FM and Triangle Linearity	
Wide Frequency Range	0.001Hz to 200KHz
Variable Duty Cycle	2% to 98%
Low Distortion Variation with Temperature	

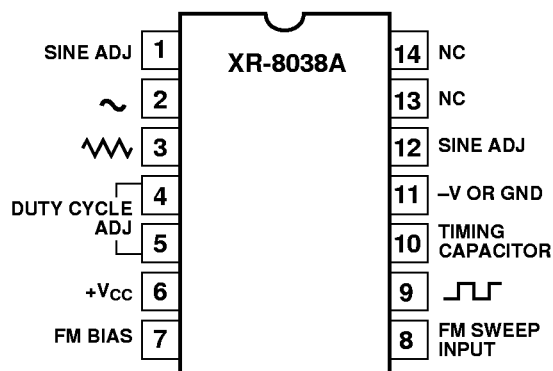
APPLICATIONS

Precision Waveform Generation
Sweep and FM Generation
Tone Generation
Instrumentation and Test Equipment Design
Precision PLL Design

ABSOLUTE MAXIMUM RATINGS

Power Supply	36V
Power Dissipation (package limitation)	
Ceramic Package	750mW
Derate Above +25°C	6.0mW/°C
Plastic Package	625mW
Derate Above +25°C	5mW/°C
Storage Temperature Range	-65°C to +150°C

PIN ASSIGNMENT



ORDERING INFORMATION

Part Number	Package	Operating Temperature
XR-8038AM	Ceramic	-55°C to +125°C
XR-8038AN	Ceramic	0°C to +70°C
XR-8038AP	Plastic	0°C to +70°C
XR-8038ACN	Ceramic	0°C to +70°C
XR-8038ACP	Plastic	0°C to +70°C

SYSTEM DESCRIPTION

The XR-8038A precision waveform generator produces highly stable and sweepable square, triangle, and sine waves across eight frequency decades. The XR-8038A is an advanced version of the XR-8038, with improved sine distortion temperature drift. The device time base employs resistors and a capacitor for frequency and duty cycle determination. The generator contains dual comparators, a flip-flop driving a switch, current sources, buffers, and a sine wave convertor. Three identical frequency outputs are simultaneously available. Supply voltage can range from 10V to 30V, or $\pm 5V$ to $\pm 15V$ with dual supplies.

Unadjusted sine wave distortion is typically less than 0.7% with the sine wave distortion adjust pin (Pin 1) open. Distortion levels may be improved by including a 100k Ω potentiometer between the supplies, with the wiper connected to Pin 1.

Small frequency deviation (FM) is accomplished by applying modulation voltage to Pins 7 and 8; large frequency deviation (sweeping) is accomplished by applying voltage to Pin 8 only. Sweep range is typically 1000:1.

The square wave output is an open collector transistor; output amplitude swing closely approaches the supply voltage. Triangle output amplitude is typically 1/3 of the supply, and sine wave output reaches 0.22 of the supply voltage.

XR-8038A

ELECTRICAL CHARACTERISTICS

Test Conditions: $V_S = \pm 5V$ to $\pm 15V$, $T_A = 25^\circ C$, $R_L = 1M\Omega$, $R_A = R_B = 10k\Omega$, $C_1 = 3300pF$, S_1 closed, unless otherwise specified.

PARAMETERS	8038AM/8038A			8038AC			UNITS	CONDITIONS
	MIN	TYP	MAX	MIN	TYP	MAX		
GENERAL CHARACTERISTICS								
Supply Voltage, V _S								
Single Supply	10		30	10		30	V	
Dual Supplies	±5		±15	±5		±15	V	
Supply Current		12	15		12	20	mA	V _S = ±10V (Note 1)
FREQUENCY CHARACTERISTICS (Measured at Pin 9)								
Range of Adjustment								
Max. Operating Frequency	200			200			KHz	R _A = R _B = 1.5kΩ, C ₁ = 680pF R _L = 10K
Lowest Practical Frequency		0.001			0.001		Hz	R _A = R _B = 1MΩ, C ₁ = 500μF (Low Leakage Capacitor)
Max. Sweep Frequency of FM Input		100			100		kHz	
FM Sweep Range		1000:1			1000:1			S ₁ Open (Notes 2 & 3)
FM Linearity 10:1 Ratio		0.1			0.2		%	S ₁ Open (Note 3)
Range of Timing Resistors	0.5		1000	0.5		1000	kΩ	Values of R _A and R _B
Temperature Stability								
XR-8038AM		50		—	—	—	ppm/°C	T _A = −55°C to +125°C
XR-8038A		50	100					
XR-8038AC					50		ppm/°C	T _A = 0°C to +70°C
Power Supply Stability		0.05			0.05		%/V	(Note 4)
OUTPUT CHARACTERISTICS								
Square-Wave								Measured at Pin 9
Amplitude (Peak-to-Peak)	0.9	0.98		0.9	0.98		x V _{SPLY}	R _L = 100kΩ
Saturation Voltage		0.2	0.4		0.2	0.5	V	I _{sink} = 2mA
Rise Time		100			100		nsec	R _L = 4.7kΩ
Fall Time		40			40		nsec	R _L = 4.7kΩ
Duty Cycle Adjustment	2		98	2		98	%	
Triangle/Sawtooth/Ramp								Measured at Pin 3.
Amplitude (Peak-to-Peak)	0.3	0.33		0.3	0.33		x V _{SPLY}	R _L = 100kΩ
Linearity		0.05			0.1		%	
Output Impedance		200			200		Ω	I _{OUT} = 5mA
Sine-Wave Amplitude (Peak-to-Peak)	0.2	0.22		0.2	0.22		x V _{SPLY}	R _L = 100kΩ
Distortion		0.7	1.5		0.8	3	%	R _L = 1MΩ (Notes 5, 6 & 7)
Unadjusted		0.5			0.5		%	R _L = 1MΩ (Notes 5, 6 & 7)
Adjusted		0.5			0.3		%	
ΔTHD/ΔT								

Note 1: Currents through R_A and R_B not included.

Note 2: $V_{SUPPLY} = 20V$.

Note 3: Apply sweep voltage at Pin 8.

$$V_{CC} - (1/3 V_{SUPPLY} - 2) \leq V_{PIN 8} \leq V_{CC}$$

V_{SUPPLY} = Total Supply Voltage across the IC

Note 4: $10V \leq V_S \leq 30V$ or $\pm 5V \leq V_S \leq 15V$.

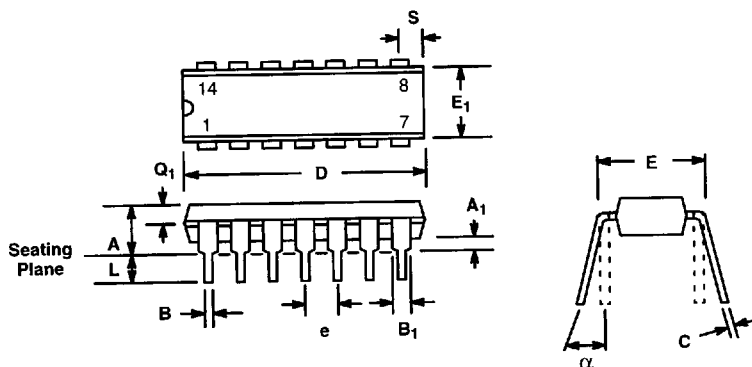
Note 5: Pin 12 open circuited (No. 82k Ω resistor as standard 8038).

Note 6: Triangle duty cycle set at 50%, use R_A and R_B .

Note 7: As R_L is decreased distortion will increase, R_L min $\approx 50k\Omega$.

Package Dimensions

14 LEAD PLASTIC DUAL-IN-LINE (300 MIL PDIP) N14

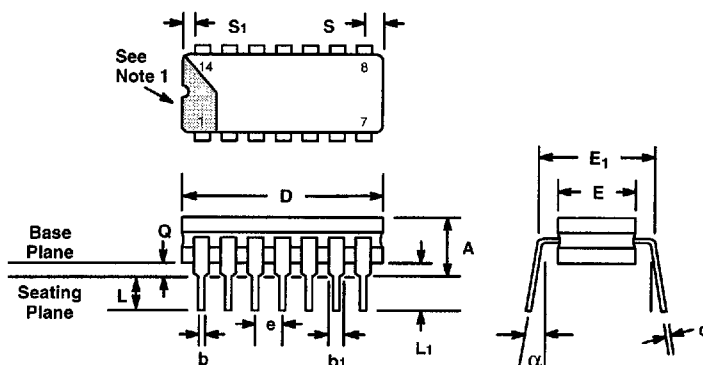


SYMBOL	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	—	0.200	—	5.08
A ₁	0.015	—	0.38	—
B	0.014	0.023	0.356	0.584
B ₁ (1)	0.038	0.005	0.965	1.65
C	0.008	0.015	0.203	0.381
D	0.745	0.785	18.92	19.94
E	0.295	0.325	7.49	8.26
E ₁	0.220	0.310	5.59	7.87
e	0.100 BSC		2.54 BSC	
L	0.115	0.150	2.92	3.81
α	0°	15°	0°	15°
Q ₁	0.055	0.070	1.40	1.78
S	0.060	0.098	0.51	2.49

Note: (1) The minimum limit for dimensions B₁ may be 0.023" (0.58 mm) for all four corner leads only.

Package Dimensions

14 LEAD CERAMIC DUAL-IN-LINE (300 MIL CDIP) D14



SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	—	0.200	—	5.08	—
b	0.014	0.023	0.356	0.584	—
b1	0.038	0.065	0.965	1.65	2
c	0.008	0.015	0.203	0.381	—
D	—	0.785	—	19.94	4
E	0.220	0.310	5.59	7.87	4
E1	0.290	0.320	7.37	8.13	7
e	0.100 BSC		2.54 BSC		5
L	0.125	0.200	3.18	5.08	—
L1	0.150	—	3.81	—	—
Q	0.015	0.060	0.381	1.52	3
S	—	0.098	—	2.49	6
S1	0.005	—	0.13	—	6
α	0°	15°	0°	15°	—

NOTES

1. Index area; a notch or a lead one identification mark is located adjacent to lead one and is within the shaded area shown.
2. The minimum limit for dimension b1 may be 0.023" (0.58 mm) for all four corner leads only.
3. Dimension Q shall be measured from the seating plane to the base plane.
4. This dimension allows for off-center lid, meniscus and glass overrun.
5. The basic lead spacing is 0.100 inch (2.54 mm) between centerlines.
6. Applies to all four corners.
7. This is measured to outside of lead, not center.