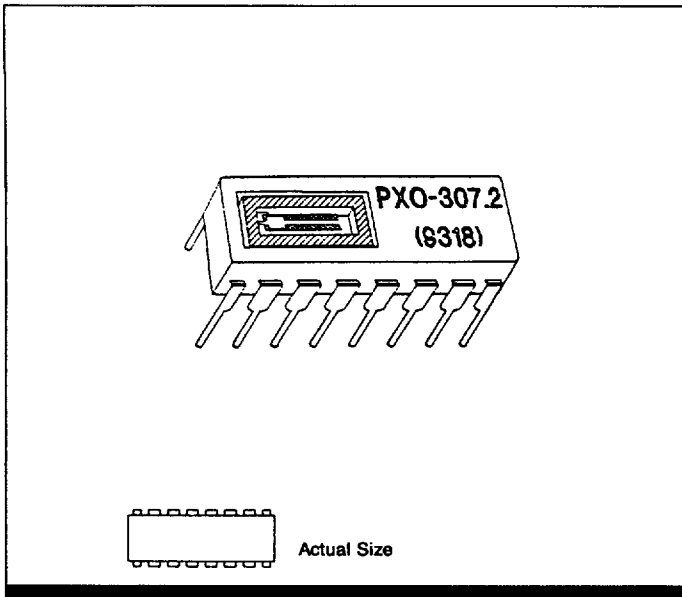




# PROGRAMMABLE CRYSTAL OSCILLATORS

*PXO Series*  
*0.002 Hz to 2 MHz*



## FEATURES

- Provides 57 different frequencies from a single quartz crystal.
- Covers broad frequency range: 0.002 Hz to 2 MHz
- Packaged in standard 16-pin DIP containing both IC and crystal.
- Laser trimmed for high accuracy.
- Low power consumption.
- Low aging.
- TTL compatible.

## DESCRIPTION

The Programmable Crystal Oscillator PXO Series can be easily programmed to generate any one of 57 different frequencies in the range 0.002 Hz to 2 MHz.

All frequencies generated are derived from a single built-in quartz crystal oscillator and exhibit the same high levels of accuracy and stability as those of the base frequency supplied by the crystal.

The PXO Series is a low-power device containing a quartz crystal and a CMOS IC, both packaged in a standard 16-pin DIP. The oscillator operates in the range 0.002 Hz to 2 MHz.

## SPECIFICATIONS

Specifications are typical unless otherwise noted and are subject to change without notice.

Calibration Tolerance*	
PXO-32768	± 10 ppm
All others	± 100 ppm
Frequency Stability**	± 0.015%, -10 to +70°C
Voltage Coefficient	10 ppm/V typical, 25 ppm/V maximum
Aging	10 ppm maximum first year

\* Tighter tolerances available.  
\*\* Does not include calibration tolerance.

## STANDARD FREQUENCIES\*

MODEL	BASE FREQUENCY	OUTPUT FREQUENCY
PXO-32768	327.68 kHz	0.00273 Hz to 327.68 kHz
PXO-600	600 kHz	0.005 Hz to 600 kHz
PXO-768	768 kHz	0.0064 Hz to 768 kHz
PXO-1000	1 MHz	0.0083 Hz to 1 MHz
PXO-2000	2 MHz	0.01667 Hz to 2 MHz

\*Other frequencies available.

## ABSOLUTE MAXIMUM RATINGS

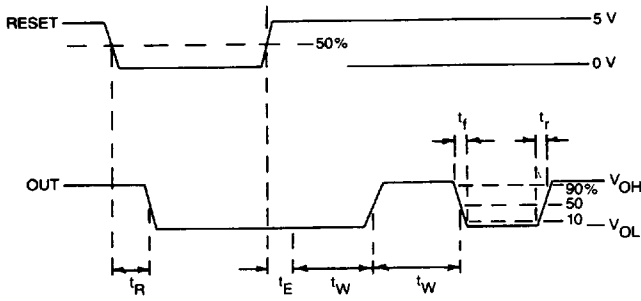
Supply voltage	-0.3 to +10V
Operating temperature	-10 to +70°C
Storage temperature	-30 to +85°C



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## TIMING DIAGRAM

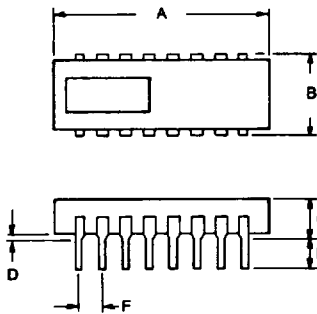


## SWITCHING CHARACTERISTICS

$T_a = 25^\circ\text{C}$   $V_{DD} = 5\text{V}$   $C_L = 15\text{pF}$

SYMBOL	PARAMETER	TYP	MAX	UNIT
$t_R$	Reset delay time		10	$\mu\text{sec}$
$t_E$	Timing error after reset released		15	$\mu\text{sec}$
$t_r$	Rise time	70		nsec
$t_f$	Fall time	30		nsec
$F_{in}$	External oscillator operating frequency		15	MHz

## PACKAGE DIMENSIONS



	INCHES	MM
A	0.808	20.50 max
B	0.311	7.90 $\pm$ 0.2
C	0.178	4.50 max
D	0.004	0.10 min
E	0.118	3.00 min
F	0.100	2.54 $\pm$ 0.2

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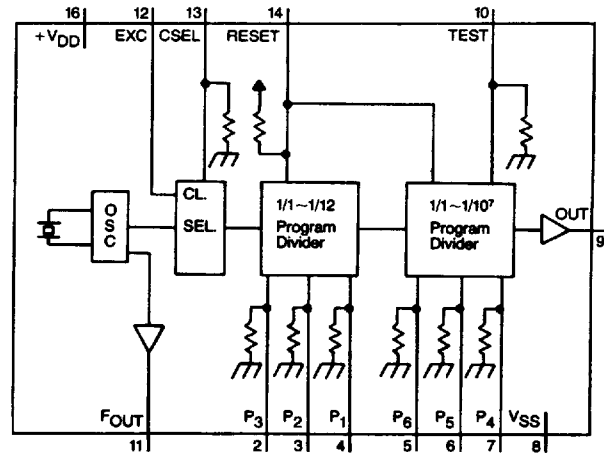
## ELECTRICAL CHARACTERISTICS

$T_a = 25^\circ\text{C}$   $V_{DD} = 5\text{V}$

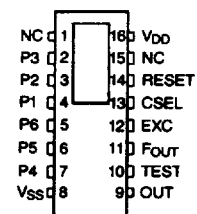
SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT
$V_{DD}$	Supply voltage	4.0	5.0	6.0	V
$I_{OH}$	Output current Hi <sup>1</sup> (Source)			-1.0	mA
$I_{OL}$	Output current Lo <sup>2</sup> (Sink)	1.6			mA
$V_{IH}$	Input voltage logic 1	$V_{DD} - 1.0$		$V_{DD}$	V
$V_{IL}$	Input voltage logic 0	0.0		1.0	V
$I_{IH}$	Input current reset Hi			0.5	$\mu\text{A}$
$I_{IL}$	Input current reset Lo	-15			$\mu\text{A}$
$I_{IH}$	Input current Prog 1-6, CSEL, EXC, TEST Hi			15	$\mu\text{A}$
$I_{IL}$	Input current Prog 1-6, CSEL, EXC, TEST Lo	-0.5			$\mu\text{A}$
$I_{DD}$	Supply current <sup>3</sup>		0.7	1.0	mA

<sup>1</sup> $V_{OH} = 4\text{V}$  <sup>2</sup> $V_{OL} = 0.4\text{V}$  <sup>3</sup>Crystal 600 kHz, OUT 60 kHz

## BLOCK DIAGRAM



## PIN CONNECTIONS



NC: Not connected

## PIN FUNCTIONS

Prog 1 through Prog 6 control divide ratio of base frequency

P1	P2	P3	DIVIDING RATIO	P4	P5	P6	DIVIDING RATIO
0	0	0	1/1	0	0	0	1 1
0	0	1	1/10	0	0	1	1 10
0	1	0	1/2	0	1	0	1 10 <sup>2</sup>
0	1	1	1/3	0	1	1	1 10 <sup>3</sup>
1	0	0	1/4	1	0	0	1 10 <sup>4</sup>
1	0	1	1/5	1	0	1	1 10 <sup>5</sup>
1	1	0	1/6	1	1	0	1 10 <sup>6</sup>
1	1	1	1/12	1	1	1	1 10 <sup>7</sup>

**OUT:** Supplies programmed output frequency with rectangular pulse shape (50% duty cycle, except as noted)

**TEST:** Setting this terminal Hi multiplies programmed output frequency by 1,000, except when programmed divide ratio is less than 1/1000

**F<sub>OUT</sub>:** Supplies base frequency of internal crystal oscillator

**EXC:** External clock input

**CSEL** Clock select. Setting this terminal Hi causes the divider to count the frequency of an external clock instead of the internal clock

**RESET:** Setting this terminal Lo resets all counters and sets output to Lo

(All inputs except EXC and RESET have internal pull-down resistor. RESET has pull-up resistor)

## OUTPUT FREQUENCIES OF MODEL PXO-32768 (0.00273 Hz - 327.68 kHz)

PROGRAM PIN SETTINGS			P4	0	0	0	0	1	1	1	1
			P5	0	0	1	1	0	0	1	1
			P6	0	1	0	1	0	1	0	1
P1	P2	P3									
0	0	0	327 680K	32 768K	3 2768K	327 68	32 768	3 2768	0 32768	0 03277	
0	0	1	32 768K	3 2768K	327 68	32 768	3 2768	0 32768	0 03277	0 00328	
0	1	0	163 840K	16 384K	1 6384K	163 84	16 384	1 6384	0 16384	0 01638	
0	1	1	109 226K	10 9226K	1 09226K	109 226	10 9226	1 09226	0 10923	0 01092	
1	0	0	81 920K	8 192K	819 2	81 92	8 192	0 81920	0 08192	0 00819	
1	0	1	65 536K	6 5536K	655 36	65 536	6 5536	0 65536	0 06554	0 00655	
1	1	0	54 613K	5 4613K	546 13	54 613	5 4613	0 54613	0 05461	0 00546	
1	1	1	27 306K	2 7306K	273 06	27 306	2 7306	0 27306	0 02731	0 00273	

\*33% duty cycle \*\*40% duty cycle

## OUTPUT FREQUENCIES OF MODEL PXO-600 (0.005 Hz - 600 kHz)

UNIT Hz

PROGRAM PIN SETTINGS			P4	0	0	0	0	1	1	1	1
			P5	0	0	1	1	0	0	1	1
			P6	0	1	0	1	0	1	0	1
P1	P2	P3									
0	0	0	600K	60K	6K	600	60	6	0 6	0 06	
0	0	1	60K	6K	600	60	6	0 6	0 06	0 006	
0	1	0	300K	30K	3K	300	30	3	0 3	0 03	
0	1	1	200K	20K	2K	200	20	2	0 2	0 02	
1	0	0	150K	15K	1 5K	150	15	1 5	0 15	0 015	
1	0	1	120K	12K	1 2K	120	12	1 2	0 12	0 012	
1	1	0	100K	10K	1K	100	10	1	0 1	0 01	
1	1	1	50K	5K	500	50	5	0 5	0 05	0 005	

\*33% duty cycle \*\*40% duty cycle

## OUTPUT FREQUENCIES OF MODEL PXO-768 (0.0064 Hz - 768 kHz)

UNIT Hz

PROGRAM PIN SETTINGS			P4	0	0	0	0	1	1	1	1
			P5	0	0	1	1	0	0	1	1
			P6	0	1	0	1	0	1	0	1
P1	P2	P3									
0	0	0	768K	76 8K	7 68K	768	76 8	7 68	0 768	0 0768	
0	0	1	76 8K	7 68K	768	76 8	7 68	0 768	0 0768	0 00768	
0	1	0	384K	38 4K	3 84K	384	38 4	3 84	0 384	0 0384	
0	1	1	256K	25 6K	2 56K	256	25 6	2 56	0 256	0 0256	
1	0	0	192K	19 2K	1 92K	192	19 2	1 92	0 192	0 0192	
1	0	1	153 6K	15 36K	1 536K	153 6	15 36	1 536	0 1536	0 01536	
1	1	0	128K	12 8K	1 28K	128	12 8	1 28	0 128	0 0128	
1	1	1	64K	6 4K	640	64	6 4	0 64	0 064	0 0064	

\*33% duty cycle \*\*40% duty cycle

## OUTPUT FREQUENCIES OF MODEL PXO-1000 (0.0083 Hz - 1 MHz)

UNIT Hz

PROGRAM PIN SETTINGS			P4	0	0	0	0	1	1	1	1
			P5	0	0	1	1	0	0	1	1
			P6	0	1	0	1	0	1	0	1
P1	P2	P3									
0	0	0	1M	100K	10K	1K	100	10	1	0 1	
0	0	1	100K	10K	1K	100	10	1	0 1	0 01	
0	1	0	500K	50K	5K	500	50	5	0 5	0 05	
0	1	1	333 3K	33 3K	3 3K	333 3	33 3	3 3	0 33	0 033	
1	0	0	250K	25K	2 5K	250	25	2 5	0 25	0 025	
1	0	1	200K	20K	2K	200	20	2	0 2	0 02	
1	1	0	166 6K	16 6K	1 6K	166 6	16 6	1 6	0 16	0 016	
1	1	1	83 3K	8 3K	833 3	83 3	8 3	0 83	0 083	0 0083	

\*33% duty cycle \*\*40% duty cycle

## OUTPUT FREQUENCIES OF MODEL PXO-2000 (0.01667 Hz - 2 MHz)

UNIT Hz

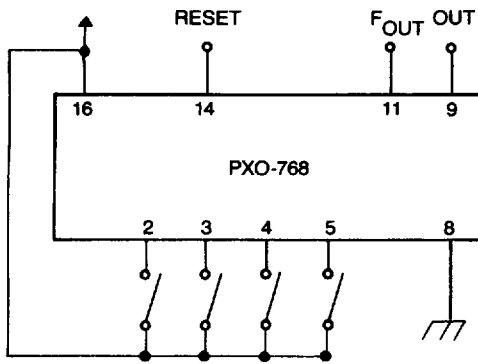
PROGRAM PIN SETTINGS			P4	0	0	0	0	1	1	1	1
			P5	0	0	1	1	0	0	1	1
			P6	0	1	0	1	0	1	0	1
P1	P2	P3									
0	0	0	2M	200K	20K	2K	200	20	2	0 2	
0	0	1	200K	20K	2K	200	20	2	0 2	0 02	
0	1	0	1M	100K	10K	1K	100	10	1 0	0 1	
0	1	1	666 6K	66 6K	6 6K	666 6	66 6	6 6	0 66	0 066	
1	0	0	500K	50K	5K	500	50	5	0 5	0 05	
1	0	1	400K	40K	4K	400	40	4	0 4	0 04	
1	1	0	333 3K	33 3K	3 3K	333 3	33 3	3 3	0 3	0 03	
1	1	1	166 6K	16 6K	1 6K	166 6	16 6	1 6	0 16	0 016	

\*33% duty cycle \*\*40% duty cycle

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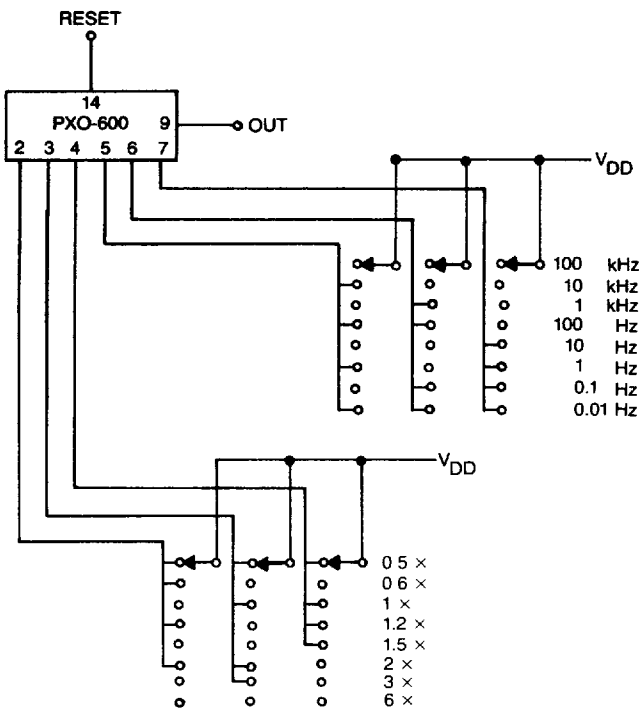
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### APPLICATION 1: BAUD RATE GENERATOR

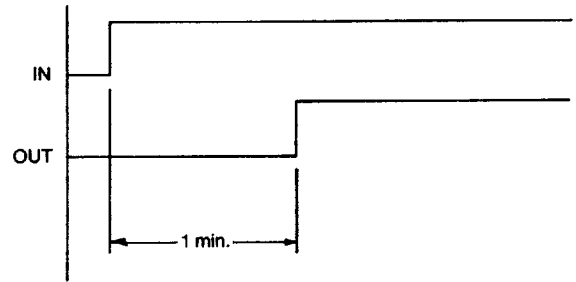
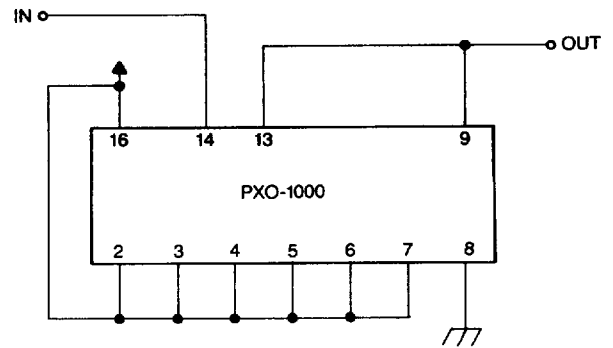


CLOCK FREQ kHz	19.2	38.4	76.8	153.6	768
BAUD RATE bps	1200	2400	4800	9600	48000
Pin 2 (P3)	0	0	1	1	0
Pin 3 (P2)	0	1	0	0	0
Pin 4 (P1)	1	0	0	1	0
Pin 5 (P6)	1	1	0	0	0

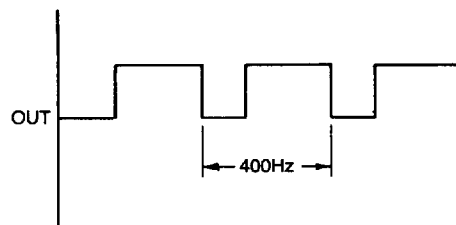
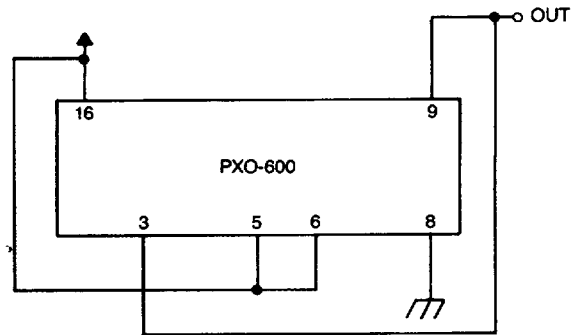
### APPLICATION 2: SQUARE WAVE GENERATOR PROVIDING 0.005 Hz to 600 kHz



### APPLICATION 3: ONE SHOT TIMER



### APPLICATION 4: EXAMPLE OF NON-STANDARD OUTPUT (DUTY CYCLE NOT 50%)



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