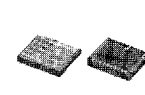


TTL Clock Oscillators

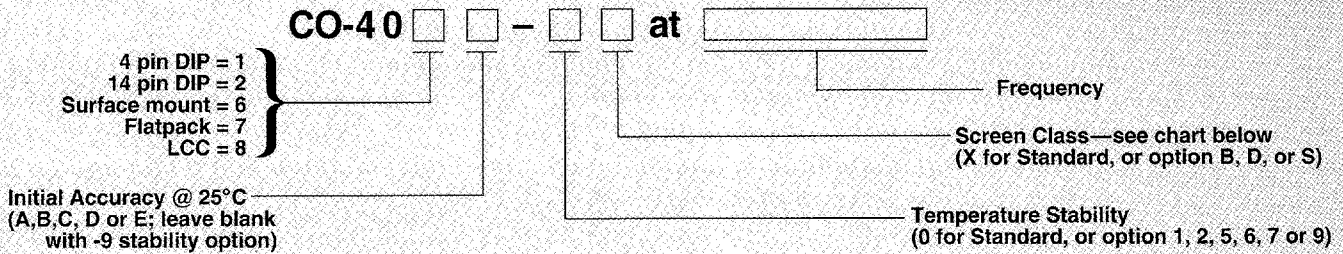


Series	DIP AND SURFACE MOUNT HYBRIDS CO-401: 4 PIN DIP CO-402: 14 PIN DIP CO-406: SURFACE MOUNT CO-407: FLATPACK	LCC CO-408	PCB MOUNT CO-231/CO-231H to 100 MHz Packaged Crystal for best temperature stability Mechanical tuning available Best aging available	14 PIN DIP CO-238 Packaged Crystal for best temperature stability Mechanical tuning available Best aging available																																																
Features	Low profile resistance/seam welded ruggedized designs	Smallest size Lowest profile	Broadest range of frequencies and options	Best stability options in DIP package																																																
ELECTRICAL																																																				
Frequency	16 kHz-100 MHz	1 MHz-60 MHz	CO-231: 1 Hz-75 MHz CO-231H: 75.01-100 MHz	16 kHz- 70 MHz																																																
Accuracy (maximum error at 25°C)	CO-401A: ± 50 ppm CO-401C: ± 25 ppm CO-401D: ± 15 ppm CO-401B: ± 10 ppm *CO-401E: ± 1 ppm □ for 4 pin DIP □ for 14 pin DIP □ for surface mount □ for flatpack *Stability via external capacitor: 16 kHz-60 MHz only. (See page 16 for pin connections.)	CO-408A: ± 50 ppm CO-408C: ± 25 ppm	CO-231: ± 10 ppm *CO-231T: ± 1 ppm CO-231H: ± 10 ppm *CO-231HT: ± 1 ppm	CO-238A: ± 50 ppm CO-238C: ± 25 ppm CO-238D: ± 15 ppm CO-238B: ± 10 ppm *CO-238T: ± 1 ppm *(16 kHz-30 MHz only)																																																
Temperature Stability	STANDARD: 0°C to +70°C: ± 25 ppm Option 1: -55°C to +85°C: ± 50 ppm Option 2: -55°C to +125°C: ± 50 ppm Option 3: 0°C to +50°C: ± 3 ppm (N/A in CO-400 Series) Option 4: 0°C to +50°C: ± 1 ppm (only for CO-231, 12 kHz-20 MHz) Option 5: 0°C to +50°C: ± 5 ppm Option 6: 0°C to +50°C: ± 10 ppm Option 7: -55°C to +125°C: ± 100 ppm *Option 9: -55°C to +200°C: ± 300 ppm (only for CO-401/2/6/7 series in 4-20 MHz range) *Specified stability includes initial accuracy: do not specify A, B, C, D or E accuracy			Improved accuracy/stability available on some models to, for example, fo ± 7 ppm over 0°C to +50°C and fo ± 10 ppm over 0°C to +70°C. Improvement also available over wider temperature ranges. Please contact factory.																																																
Aging Rate (typically after initial 30 days)	3 ppm first year 2 ppm/year thereafter		Standard: 5 ppm first year, 3 ppm/year thereafter Option "Y": 1-2 ppm first year, 1 ppm/year thereafter																																																	
Supply	5 Vdc ± 5% <4 MHz: <90 mA 4-20 MHz: <30 mA >20 MHz: <65 mA	5 Vdc ± 5% <12.5 MHz: <70 mA ≥12.5 MHz: <50 mA	5 Vdc ± 5% <4 MHz: <90 mA 4-20 MHz: <30 mA >20 MHz: <65 mA																																																	
Output Drive "0" Level "1" Level Rise/Fall Time (0.5-2.4V) Symmetry @ 1.5V	<table border="1"> <tr><th><4 MHz</th><th>4-20 MHz</th><th>>20 MHz</th></tr> <tr><td>10 TTL</td><td>10 TTL</td><td>10 STTL</td></tr> <tr><td><0.4V</td><td><0.4V</td><td><0.4V</td></tr> <tr><td>>2.4V</td><td>>2.4V</td><td>>2.4V</td></tr> <tr><td><15ns</td><td><15ns</td><td>2-5ns</td></tr> <tr><td>55/45</td><td>60/40</td><td>60/40</td></tr> </table>	<4 MHz	4-20 MHz	>20 MHz	10 TTL	10 TTL	10 STTL	<0.4V	<0.4V	<0.4V	>2.4V	>2.4V	>2.4V	<15ns	<15ns	2-5ns	55/45	60/40	60/40	<table border="1"> <tr><th><12.5 MHz</th><th>≥12.5 MHz</th></tr> <tr><td>10 TTL</td><td>10 STTL</td></tr> <tr><td><0.4V</td><td><0.4V</td></tr> <tr><td>>2.4V</td><td>>2.4V</td></tr> <tr><td><15ns</td><td>2-5ns</td></tr> <tr><td>55/45</td><td>60/40</td></tr> </table>	<12.5 MHz	≥12.5 MHz	10 TTL	10 STTL	<0.4V	<0.4V	>2.4V	>2.4V	<15ns	2-5ns	55/45	60/40	<table border="1"> <tr><th><4 MHz</th><th>4-20 MHz</th><th>>20 MHz</th></tr> <tr><td>10 TTL</td><td>10 TTL</td><td>10 STTL</td></tr> <tr><td><0.4V</td><td><0.4V</td><td><0.4V</td></tr> <tr><td>>2.4V</td><td>>2.4V</td><td>>2.4V</td></tr> <tr><td><15ns</td><td><15ns</td><td>2-5ns</td></tr> <tr><td>55/45</td><td>65/35</td><td>65/35</td></tr> </table>	<4 MHz	4-20 MHz	>20 MHz	10 TTL	10 TTL	10 STTL	<0.4V	<0.4V	<0.4V	>2.4V	>2.4V	>2.4V	<15ns	<15ns	2-5ns	55/45	65/35	65/35	
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MECHANICAL																																																				
Size (see drawings on page 16)	†CO-401: 0.5" x 0.8" x 0.2" (12.7 x 20.3 x 5.1 mm) CO-402: 0.5" x 0.8" x 0.2" (12.7 x 20.3 x 5.1 mm) CO-406: 0.5" x 0.8" x 0.25" (12.7 x 20.3 x 6.4 mm) ††CO-407: 0.6" x 0.8" x 0.17" (15.3 x 20.3 x 4.2 mm) ††0.12" (3.1mm) height available <20 MHz	0.480" x 0.480" x 0.085" (12.2 x 12.2 x 2.2 mm)	1.5" x 1.5" x 0.5" (38 x 38 x 12.7 mm)	0.5" x 0.8" x 0.35" (12.7 x 20.3 x 8.9 mm)																																																
Case	Resistance or seamwelded metal case †CO-401 Series available with insulated standoffs; height increases to 0.23" (5.8 mm)	Sealed ceramic leadless chip carrier	Metal can, epoxy or metal base "C" option: solder sealed metal case, height 0.68" (17.3 mm)	Epoxy Case																																																
ENVIRONMENTAL																																																				
Vibration	20 g to 2 kHz sine per MIL-STD-202, Method 204, Condition D. 20 grms to 2 kHz random per MIL-STD-202, Method 214, Condition I-F.		Standard: 5g to 500 Hz Optional: 20 g to 2 kHz sine per MIL-STD-202, Method 204, Condition D. 20 grms to 2 kHz random per MIL-STD-202, Method 214, Condition I-F.																																																	
Shock	100 g 6 ms per MIL-STD-202, Method 213, Conditions C and I.		Standard: 30 g, 11 ms per MIL-STD-202 Method 213, Condition J. Optional: 100 g, 6 ms per MIL-STD-202, Method 213, Conditions C and I.																																																	
Humidity	100%, rh per MIL-STD-202, Method 103, Condition B.		Standard: 95 % rh, no condensation "C" option: 100% rh per MIL-STD-202, Method 103, Conditions B.																																																	
Seal	Hermetic per MIL-STD-883, Method 1014, Condition A2.		Standard: N/A "C" option: Available Per MIL-STD-202 Method 112, Condition D, when requested																																																	
OTHER OPTIONS	Other mechanical configurations and stability specifications tailored to customer's specific needs.																																																			
HOW TO ORDER	Voltage frequency control (VCXO) in CO-231 and CO-400 Series; see page 72.																																																			

Available as QPL to MIL-O-55310/16B&S

Vectron is a QPL source for
DIP TTL Clock Oscillators
per M55310/16.

CO-400 SERIES



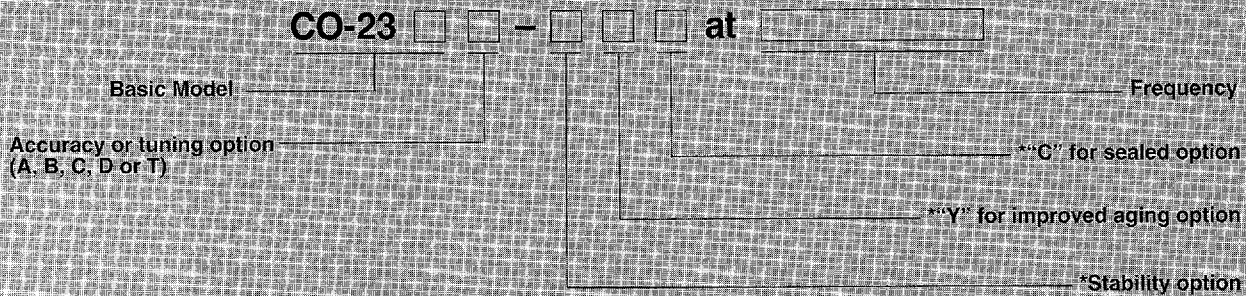
For Example
CO-401A-OX at 50 MHz is a 4 pin DIP with "A" initial accuracy of ±50 ppm, "Standard" stability of ±25 ppm over 0°C to +70°C, and is 100% screen tested to level "X"

CO-407E-2B at 100 kHz is a flatpack with "E" accuracy remotely settable to ±1 ppm, "-2" temperature stability of ±50 ppm over -55°C to +125°C, and is 100% screen tested to level "B"

SCREEN TESTING OF ABOVE MODELS

SCREEN TEST	MIL-STD-883 METHOD	Standard	Options		
		CLASS X	CLASS D	CLASS B	CLASS S
Stabilization Bake (150°C)	—	X	X	X	Class S screen test requirements include 24 hour additional bake-out, 80 hour additional burn-in, thermal shock, PIND test and radiographic inspection in addition to Class B Screening. Has major cost impact.
Seal Test (Gross and Fine)	1014, Cond A2	X	X	X	
Temperature Cycling (Thermal Shock)	1010, Cond B		X	X	
Burn-in, operating 160 hours @125°C	—		X	X	
Acceleration (5000g in Y ₁ axis)	2001, Cond A			X	

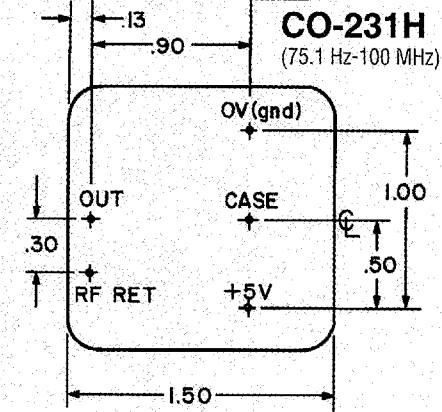
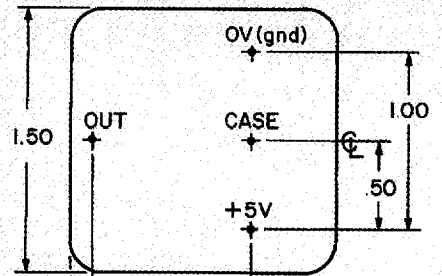
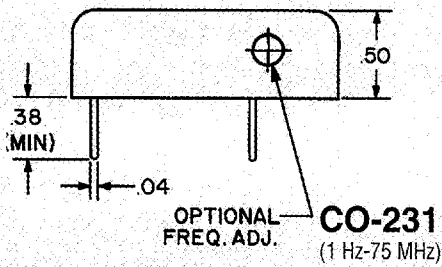
CO-231, CO-238 SERIES



*Leave blank if -0 stability option or not applicable to your requirement.

For Example:
CO-238 at 6.144 MHz with ±.001% accuracy at 25°C and ±.005% over -55/+85°C = CO-238B-1 at 6.144 MHz
CO-231 at 60 Hz with ±.0001% accuracy (via tuning adjust) and ±.0025% over 0/70°C = CO-231T at 60 Hz

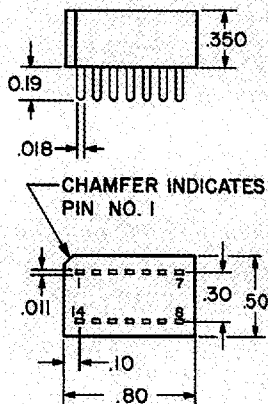
CO-231/CO-231H



CO-231C/CO-231HC

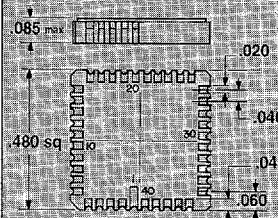
Same as above except height is 0.68" and pin diameter is 0.03".

CO-238



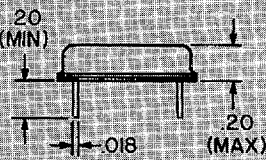
Function	Pin
+5V	14
OV, gnd	7
Output	4 (16 kHz-30 MHz) 8 (Above 30 MHz)
Other	N/C

CO-408

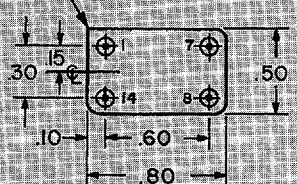


Function	Pad
+5Vdc	4
+5Vdc	10
Ground	31
Ground	37
Output	39
N/C	Other

CO-401

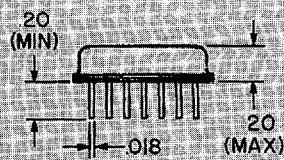


SQUARE CORNER PIN NO. 1

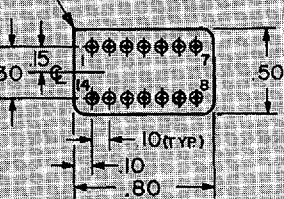


Available with insulated standoffs; increases height to 0.23" maximum

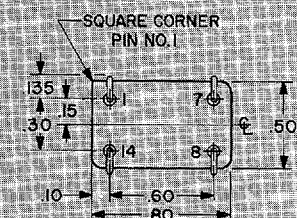
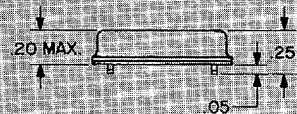
CO-402



SQUARE CORNER PIN NO. 1

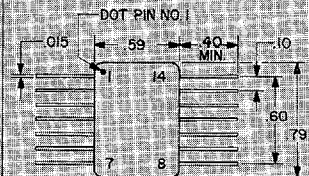


CO-406



Function	Pin
N/C	1
OV, case, gnd	7
Output	8
+5V	14
N/C	Other

CO-407



*For external tuning, "E" accuracy connect variable capacitor with nominal range of 5 to 30 pf from pin 1 to pin 7.

Markings do not appear on oscillators; they are for reference only. Dimensions are in inches. Case dimension tolerances are $\pm .02$ "



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We maintain a broad inventory of clock oscillators at numerous frequencies.