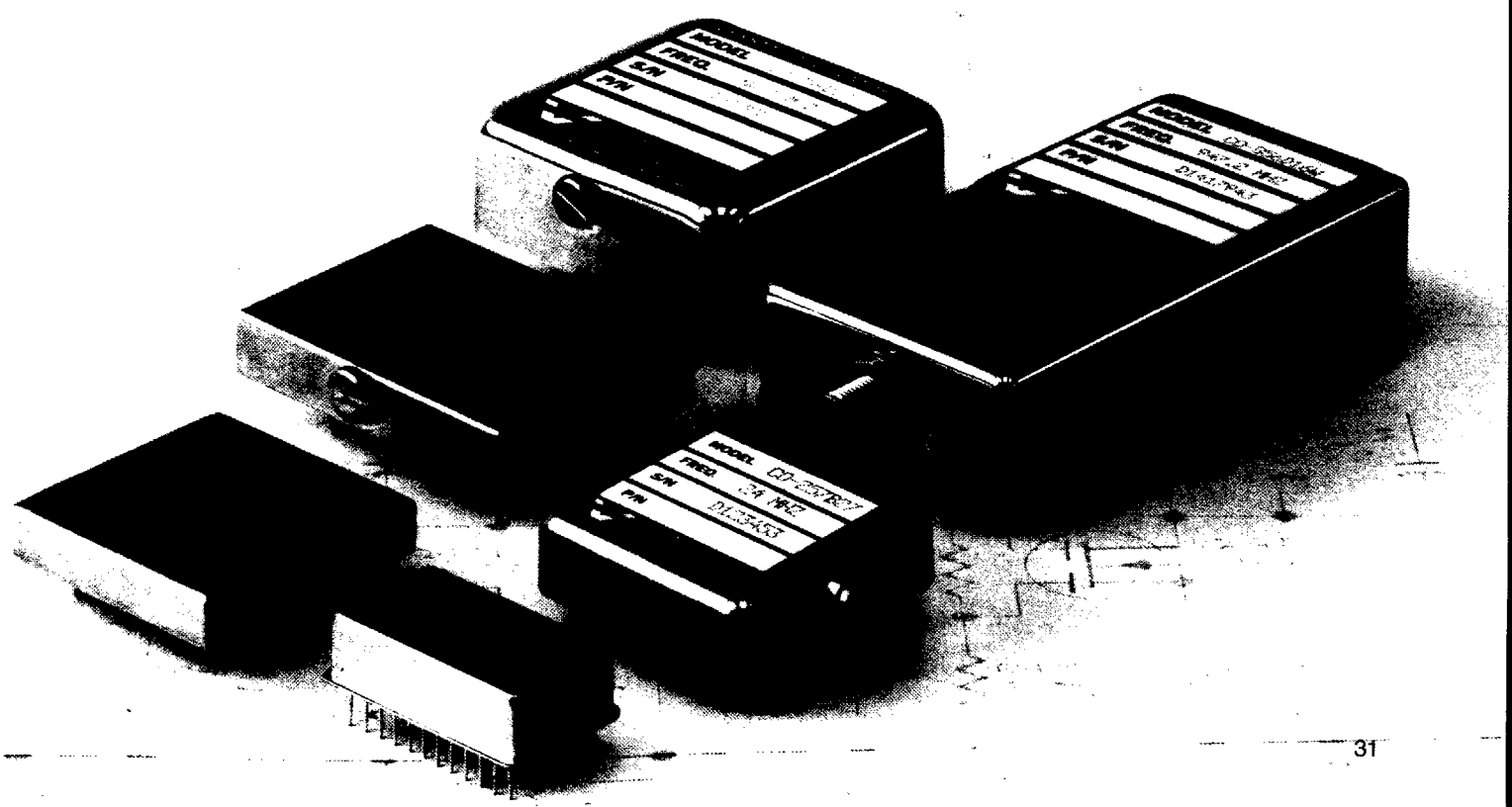
T-50-23

Basic TCXOs

Temperature Compensated Crystal Oscillators

FEATURES:

- Frequency from 50 Hz to 1,000 MHz
- High stability without use of oven
- Low current drain
- On-frequency instantly; virtually no warm-up time
- Low aging rate
- Small, rugged packages
- Low phase noise option



TCXOs (50 Hz to 140 MHz)

Series CO-252 and CO-254 offer the highest stability alternatives and broadest range of options within Vectron's line of TCXOs. The TCXOs on the adjacent page are more limited in input/output alternatives and other options, but are smaller in size. There is a higher price associated with our low profile Series CO-253, CO-258 and CO-259.

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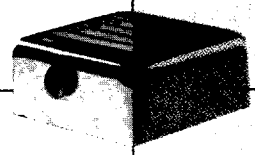

	50 Hz to 20 MHz CO-252 SERIES	20.1 to 140 MHz CO-254 SERIES
FREQUENCY	Sine: 1 MHz to 20 MHz TTL: 50 Hz to 20 MHz CMOS: 50 Hz to 15 MHz HCMOS: 40 kHz to 20 MHz	Sine: 20.01 MHz to 140 MHz TTL: 20.01 MHz to 100 MHz HCMOS: 20.01 MHz to 50 MHz ECL: 20.01 MHz to 140 MHz
STABILITY Temperature (Temp. Range **A**) +15°C to +35°C:	**CO-252A17:** $\pm 1 \times 10^{-7}$ **CO-252A58:** $\pm 5 \times 10^{-8}$	**CO-254A57:** $\pm 5 \times 10^{-7}$ **CO-254A17:** $\pm 1 \times 10^{-7}$
(Temp. Range **B**) 0°C to +50°C:	**CO-252B57:** $\pm 5 \times 10^{-7}$ **CO-252B27:** $\pm 2 \times 10^{-7}$ **CO-252B17:** $\pm 1 \times 10^{-7}$	**CO-254B16:** $\pm 1 \times 10^{-6}$ **CO-254B57:** $\pm 5 \times 10^{-7}$ **CO-254B27:** $\pm 2 \times 10^{-7}$
(Temp. Range **C**) 0°C to +70°C:	**CO-252C16:** $\pm 1 \times 10^{-6}$ **CO-252C57:** $\pm 5 \times 10^{-7}$ **CO-252C37:** $\pm 3 \times 10^{-7}$	**CO-254C36:** $\pm 3 \times 10^{-6}$ **CO-254C16:** $\pm 1 \times 10^{-6}$ **CO-254C37:** $\pm 3 \times 10^{-7}$
(Temp. Range **D**) −20°C to +70°C:	**CO-252D16:** $\pm 1 \times 10^{-6}$ **CO-252D57:** $\pm 5 \times 10^{-7}$	**CO-254D56:** $\pm 5 \times 10^{-6}$ **CO-254D16:** $\pm 1 \times 10^{-6}$ **CO-254D57:** $\pm 5 \times 10^{-7}$
(Temp. Range **E**) −40°C to +75°C:	**CO-252E56:** $\pm 5 \times 10^{-6}$ **CO-252E26:** $\pm 2 \times 10^{-6}$ **CO-252E16:** $\pm 1 \times 10^{-6}$	**CO-254E56:** $\pm 5 \times 10^{-6}$ **CO-254E26:** $\pm 2 \times 10^{-6}$ **CO-254E16:** $\pm 1 \times 10^{-6}$
(Temp. Range **F**) −55°C to +85°C:	**CO-252F56:** $\pm 5 \times 10^{-6}$ **CO-252F26:** $\pm 2 \times 10^{-6}$ **CO-252F16:** $\pm 1 \times 10^{-6}$	**CO-254F56:** $\pm 5 \times 10^{-6}$ **CO-254F26:** $\pm 2 \times 10^{-6}$ **CO-254F16:** $\pm 1 \times 10^{-6}$
(Temp. Range **G**) −55°C to +105°C:	**CO-252G56:** $\pm 5 \times 10^{-6}$	**CO-254G56:** $\pm 5 \times 10^{-6}$
(Temp. Range **H**) −55°C to +125°C:	**CO-252H15:** $\pm 1 \times 10^{-5}$	**CO-254H15:** $\pm 1 \times 10^{-5}$
Aging Rate	≤5 MHz: 5×10^{-7}/year (3×10^{-9}/day ave) >5 MHz: 1×10^{-6}/year (5×10^{-9}/day ave)	
Short Term (Allan Variance)	1×10^{-9}/second under constant conditions	
Frequency vs Supply	2×10^{-8} per percent change in supply with 10 to 28 Vdc input; 1×10^{-7} per percent change in supply for 5 to 9 Vdc input	

OUTPUT/SUPPLY

	Output level	*Supply ±5%	Output level	*Supply ±5%
Standard	>1 Vrms/1kΩ (1-20 MHz)	+15 Vdc, 4-15 mA	> 0.5 Vrms/50Ω	+15 Vdc, <20 mA
Option "**R**"	>1 Vrms/50Ω (+13 dBm), 1-20 MHz	+15 Vdc, 30 mA	>1 Vrms/50Ω (+13 dBm)	+15 Vdc, 35 mA
Option "J**"	TTL	+15 Vdc, <10 mA & +5 Vdc, 10-50 mA	TTL (to 100 MHz)	+15 Vdc, <10 mA & +5 Vdc, <30 mA
Option "K**"	TTL	+5 Vdc, 15-60 mA	TTL (to 70 MHz)	+5 Vdc, <35 mA
Option "M**"			ECL	+15 Vdc, <15 mA & −5.2 Vdc, 30-60 mA
Option "E**"			ECL (to 70 MHz)	−5.2 Vdc, <60 mA
Other Options	HCMOS (40 kHz-20 MHz) CMOS (50 Hz-15 MHz)	+5 Vdc, 10-20 mA 5 to 15 Vdc, 3-15 mA	HCMOS (to 50 MHz)	+5 Vdc, 10-30 mA

*Any supply in 10-24 Vdc range optional in lieu of +15 Vdc; current drain depends upon frequency
**Options J and M are more economical than Options K and E respectively

Harmonics and Sub-harmonics (sine output)	20 dB below output. If internal multiplication is used (generally above 70 MHz but sometimes at lower frequencies) subharmonics are also down 20 dB. Harmonic and subharmonic attenuation can be improved on special order.
Phase Noise	See page 34 for standard and low noise Option L2 specifications
FREQUENCY ADJUSTMENT Mechanical	Range sufficient to compensate for 5 to 10 years of crystal aging; settable to $<1 \times 10^{-7}$
Electronic Tuning Option Option "V"	VCXO operation permits remote frequency adjustment or locking onto an external frequency source. Add "**V**" to Model Number. Nominal range with 0 to +5 volt control input is 3×10^{-6} total (Wider deviations available). (For very wide deviation and/or linear voltage control, see TC/VCXOs in the VCXO section on pages 63-66.)
SIZE/CONFIGURATION Standard (See drawings on page 38)	2" x 2" x ¾" (51 x 51 x 19mm); pins on base for pc board mounting. Most models available with reduced height, to ½". For smaller models, with height as low as 0.3" (8 mm), see our TCXOs on next page.
Options	Option "**SW**": 2" x 2¼" x ¾" (51 x 57 x 19 mm) SMA output connector on side, pins for pc board mounting on base. Option "**W**": 2" x 2" x ¾" (51 x 51 x 19 mm) SMA output connector, solder header and mounting studs on base. Option "**U**": 2" x 2" x ¾" (51 x 51 x 19 mm) SMC output connector, solder header and mounting studs on base.
ENVIRONMENTAL	See Pages 72-73 for environmental specifications and screen test option.
HOW TO ORDER	See page 34

TCXOs (to 140 MHz)

Model CO-257 uses surface mount construction on a printed circuit board housed in a solder sealed metal can. Model CO-253 employs surface mount construction on a ceramic substrate with laser trimmed deposited resistors; the product is housed in a resistance welded case. Both models include discrete thermistors and resistors in the temperature compensation network. The circuits are similar in the two models; the denser packaging technique of Model CO-253 results in its 60% volume reduction.

The rf circuit is hybridized and packaged in a resistance welded case which is optionally available screened to Class B per chart on page 72. The hybrid. packaged crystal and compensation components are mounted on a printed circuit board which is housed in a solder sealed metal can. Models CO-258 and CO-259 use an identical rf hybrid circuit. The CO-259's larger size permits (1) additional circuitry allowing operation from a single 5V source and (2) internal mechanical frequency adjustment with a voltage tuning option (Model CO-258 uses tuning from an external potentiometer only).

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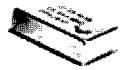

	CO-257 SERIES *Least expensive Type among Vectron's size reduced Series*	CO-253 SERIES *24 pin double-DIP resistance welded package*	CO-258 SERIES *Lowest profile 0.32" (8.2 mm) height*	CO-259 SERIES *0.4" (10.2 mm) height with mechanical tuning*
FREQUENCY	HCMOS/TTL: 315 kHz to 50 MHz Sine: 5 MHz to 140 MHz	HCMOS/TTL: 315 kHz to 50 MHz Sine: 5 MHz to 140 MHz	TTL output: 20 kHz to 70 MHz HCMOS output: 40 kHz to 50 MHz CMOS output: 400 Hz to 15 MHz ECL output: 5 MHz to 70 MHz	

STABILITY Temperature	
(Temp. Range **A**) +15°C to +35°C:	**CO-25☐A37:** $\pm 3 \times 10^{-7}$ **CO-25☐A17:** $\pm 1 \times 10^{-7}$
(Temp. Range **B**) 0°C to +50°C:	**CO-25☐B57:** $\pm 5 \times 10^{-7}$ **CO-25☐B27:** $\pm 2 \times 10^{-7}$
(Temp. Range **C**) 0°C to +70°C:	**CO-25☐C57:** $\pm 5 \times 10^{-7}$ **CO-25☐C37:** $\pm 3 \times 10^{-7}$
(Temp. Range **D**) −20°C to +70°C:	**CO-25☐D36:** $\pm 3 \times 10^{-6}$ **CO-25☐D16:** $\pm 1 \times 10^{-6}$ ***CO-25☐D57:** $\pm 5 \times 10^{-7}$
(Temp. Range **E**) −40°C to +75°C:	**CO-25☐E56:** $\pm 5 \times 10^{-6}$ **CO-25☐E26:** $\pm 2 \times 10^{-6}$ **CO-25☐E16:** $\pm 1 \times 10^{-6}$
(Temp. Range **F**) −55°C to +85°C:	**CO-25☐F56:** $\pm 5 \times 10^{-6}$ **CO-25☐F26:** $\pm 2 \times 10^{-6}$ ***CO-25☐F16:** $\pm 1 \times 10^{-6}$
(Temp. Range **G**) −55°C to +105°C:	**CO-25☐G56:** $\pm 5 \times 10^{-6}$ ***CO-25☐G36:** $\pm 3 \times 10^{-6}$
(Temp. Range **H**) −55°C to +125°C:	**CO-25☐H15:** $\pm 1 \times 10^{-5}$ ▲ 7 for CO-257 Series 3 for CO-253 Series 8 for CO-258 Series 9 for CO-259 Series *Asterisked models not available above 12 MHz
Aging Rate	1×10^{-6} per year
Short Term	1×10^{-9} per second under constant conditions (Allan Variance)
Frequency vs Supply	2×10^{-8} per percent change in supply for ≥ 10 Vdc 1×10^{-7} per percent change in supply for < 10 Vdc

OUTPUT/SUPPLY	CO-257 SERIES	CO-253 SERIES	CO-258 SERIES	CO-259 SERIES
Standard	Output: **HCMOS/TTL; *Supply ±5%: 5 Vdc, 5-20 mA	Output: **HCMOS/TTL; *Supply ±5%: 15 Vdc, <15 mA & 5 Vdc, 2-15 mA	Output: TTL; *Supply ±5%: 15 Vdc, 5-15 mA & 5 Vdc, 10-40 mA	
Optional	Option "K" ***TTL: 5 Vdc, 15-50 mA Sine +7 dBm/50Ω, +13 dBm/50Ω: 12-15 Vdc, 15-30 mA	Option "N" **HCMOS/TTL: 5 Vdc, 10-25 mA **HCMOS/TTL: 12-24 Vdc, 10-15 mA, 5 Vdc, 2-15 mA Sine +7 dBm/50Ω, +13 dBm/50Ω: 12-15 Vdc, 15-30 mA	Option "K" TTL: 5 Vdc, 15-60 mA (CO-259 only) HCMOS: 10-15 Vdc, 5-15 mA & 5 Vdc, 3-10 mA HCMOS: 5 Vdc, 10-25 mA (CO-259 only) CMOS: 10-15 Vdc, 10-25 mA ECL: 10-15 Vdc, 5-15 mA & −5.2 Vdc, 40 mA	

*Actual current drain depends upon frequency. Voltage range (e.g. 12-24 Vdc) means any specified voltage in that range.
**Drives 3 TTL loads, 10 LSTTL loads or HCMOS (output is from HCMOS gate)
***Drives 10 TTL loads; this option is more costly than standard product.

	CO-257 SERIES	CO-253 SERIES	CO-258 SERIES	CO-259 SERIES
FREQUENCY ADJUSTMENT	Multiturn adjustment with range sufficient to compensate for 10 years aging; settable to 1×10^{-7}. "V" Option: Range > 3×10^{-6} for 0 to 5V control voltage	Tuning via external potentiometer with range sufficient to compensate for 10 years aging.	Tuning via external potentiometer with range sufficient to compensate for 10 years aging.	Multiturn adjustment with range sufficient to compensate for 10 years aging; settable to 1×10^{-7}. "V" Option: Range > 3×10^{-6} for 0 to 5V control voltage; increasing voltage decreases frequency.
SIZE/CONFIGURATION (See drawings on page 34)	1.5" x 1.5" x 0.5" (38 x 38 x 12.7 mm) pins for pc board mounting	0.8" x 1.4" x 0.39" (21 x 36 x 9.9 mm) 24 pin DIP	1.5" x 1.5" x 0.32" (38 x 38 x 8.2 mm) Pins for printed circuit board mounting	1.5" x 2.0" x 0.4" (38 x 51 x 10.2 mm)
ENVIRONMENTAL	See Pages 72-73 for environmental specifications and screen test options (except for the CO-258/259 internal hybrids, these are discrete oscillators)			
HOW TO ORDER	See page 34			

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TCXOs (to 140 MHz)

PHASE NOISE (including Low Noise Option "L2")

Option "L2" offers ultra low phase noise characteristics, as follows:

Offset	Standard 3-20 MHz	Standard 20.1-70 MHz	Option L2 3-70 MHz
100 Hz	−115 dBc/Hz	−110 dBc/Hz	−115 dBc/Hz
1 kHz	−135 dBc/Hz	−130 dBc/Hz	−140 dBc/Hz
10 kHz	−140 dBc/Hz	−135 dBc/Hz	−155 dBc/Hz
50 kHz	−145 dBc/Hz	−140 dBc/Hz	−160 dBc/Hz

These apply to sine output to 70 MHz; degradation is 6 dB per octave above 70 MHz

L2 option is available as follows:

Frequency	rf connector (preferred)	pcb mount	Size
3-20 MHz	CO-252W, CO-252SW	CO-252	2" x 2" x 3/4" 2" x 2-1/4" x 3/4"
20-280 MHz	CO-255	CO-255P (to 100 MHz)	2" x 3" x 3/4"

Standard output level of all L2 models is 0.5 Vrms/50Ω (+7 dBm); current drain is <30 mA for CO-252L2 and <50 mA for CO-255L2

ORDERING METHOD

For example, a 50 MHz TCXO with stability of ± 1 x 10^{-6} over −20°C to + 70°C and standard +7 dBm/50Ω sinewave output via SMA connector is

CO-254 D 16 — □ □ W □ at 50 MHz = CO-254D16W at 50 MHz

- CO-254 — Series
- D — Temp. Range
- 16 — Stability over Temp.
- W — *Mechanical option (W, U, SW, P)
- at 50 MHz — Frequency
- □ — *Low phase noise (L2)
- □ — *VCXO option (V)
- □ — *Input/output option (J, K, E, M, R)

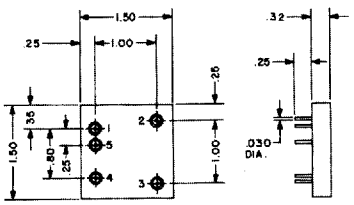
NOTE: If none of our standard models with coded options meet your specific needs, please detail the differences from our closest standard model (e.g., CO-252D57 except 12 Vdc supply and CMOS output).

*Leave blank if option is not desired.

OUTLINE/INSTALLATION DRAWINGS

For CO-252 and CO-254 outline/installation drawings, see page 38.

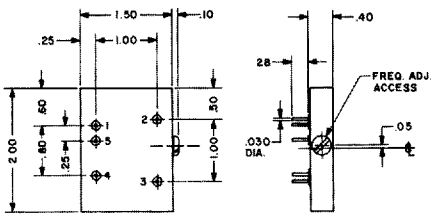
CO-258 SERIES



Pin	With Separate TTL Supply	With Single Supply
1	Output	Output
2	Supply (+)	Supply (+)
3	0 volt/case	*0 volt/case
4	**tuning	**tuning
5	+5V	*rf return

*Internally connected
**For external tuning, connect as follows:

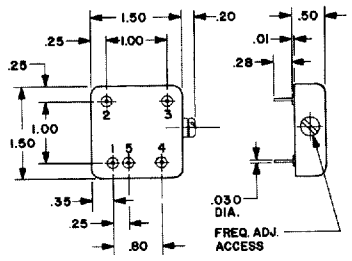
CO-259 SERIES



Pin	WITH SEPARATE TTL SUPPLY: No "V" Option	WITH SEPARATE TTL SUPPLY: "V" Option	WITH SINGLE SUPPLY: No "V" Option	WITH SINGLE SUPPLY: "V" Option
1	Output	Output	Output	Output
2	Supply (+)	Supply (+)	Supply (+)	Supply (+)
3	*0 volt/case	0 volt/case	*0 volt/case	*0 volt/case
4	+5V	VCXO in	*0 volt/case	VCXO in
5	*rf return	+5V	*rf return	*rf return

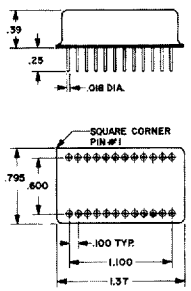
*internally connected

CO-257 SERIES



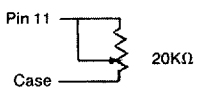
Pin	Function
1	RF Output
2	Supply (+)
3	Case
4	Case
5	RF Return, Case

CO-253 SERIES



Pin	Function
1	RF Return, Case
3	RF Output
*11	External Tune
12-17	Case
**18	+5V
23	Case
**24	Supply (+)
Other	No Connection

*For external tuning, connect as follows:
**For Option N, pin 18 is no connection and 5V is applied to pin 24. For sine output pin 18 is N/C.



Markings do not appear on oscillators; they are for reference only. Case dimension tolerances are ± .02"

TCXOs (140-1000 MHz)

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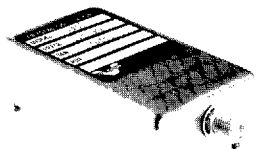

	CO-255 SERIES	CO-256 SERIES	CO-856 SERIES
FREQUENCY	140.1-420 MHz	420.1-630 MHz	630.1-1000 MHz
STABILITY Temperature (Temp. Range **A**) +15°C to +35°C:	**CO-255A57:** $\pm 5 \times 10^{-7}$ **CO-255A17:** $\pm 1 \times 10^{-7}$	**CO-256A57:** $\pm 5 \times 10^{-7}$ **CO-256A17:** $\pm 1 \times 10^{-7}$	**CO-856A57:** $\pm 5 \times 10^{-7}$ **CO-856A17:** $\pm 1 \times 10^{-7}$
(Temp. Range **B**) 0°C to +50°C:	**CO-255B16:** $\pm 1 \times 10^{-6}$ **CO-255B57:** $\pm 5 \times 10^{-7}$ **CO-255B27:** $\pm 2 \times 10^{-7}$	**CO-256B16:** $\pm 1 \times 10^{-6}$ **CO-256B57:** $\pm 5 \times 10^{-7}$ **CO-256B27:** $\pm 2 \times 10^{-7}$	**CO-856B16:** $\pm 1 \times 10^{-6}$ **CO-856B57:** $\pm 5 \times 10^{-7}$
(Temp. Range **C**) 0°C to +70°C:	**CO-255C36:** $\pm 3 \times 10^{-6}$ **CO-255C16:** $\pm 1 \times 10^{-6}$ **CO-255C37:** $\pm 3 \times 10^{-7}$	**CO-256C36:** $\pm 3 \times 10^{-6}$ **CO-256C16:** $\pm 1 \times 10^{-6}$ **CO-256C37:** $\pm 3 \times 10^{-7}$	**CO-856C36:** $\pm 3 \times 10^{-6}$ **CO-856C16:** $\pm 1 \times 10^{-6}$
(Temp. Range **D**) −20°C to +70°C:	**CO-255D56:** $\pm 5 \times 10^{-6}$ **CO-255D16:** $\pm 1 \times 10^{-6}$ **CO-255D57:** $\pm 5 \times 10^{-7}$	**CO-256D56:** $\pm 5 \times 10^{-6}$ **CO-256D16:** $\pm 1 \times 10^{-6}$ **CO-256D57:** $\pm 5 \times 10^{-7}$	**CO-856D56:** $\pm 5 \times 10^{-6}$ **CO-856D16:** $\pm 1 \times 10^{-6}$
(Temp. Range **E**) −40°C to +75°C:	**CO-255E56:** $\pm 5 \times 10^{-6}$ **CO-255E26:** $\pm 2 \times 10^{-6}$ **CO-255E16:** $\pm 1 \times 10^{-6}$	**CO-256E56:** $\pm 5 \times 10^{-6}$ **CO-256E26:** $\pm 2 \times 10^{-6}$ **CO-256E16:** $\pm 1 \times 10^{-6}$	**CO-856E56:** $\pm 5 \times 10^{-6}$ **CO-856E26:** $\pm 2 \times 10^{-6}$
(Temp. Range **F**) −55°C to +85°C:	**CO-255F56:** $\pm 5 \times 10^{-6}$ **CO-255F26:** $\pm 2 \times 10^{-6}$ **CO-255F16:** $\pm 1 \times 10^{-6}$	**CO-256F56:** $\pm 5 \times 10^{-6}$ **CO-256F26:** $\pm 2 \times 10^{-6}$ **CO-256F16:** $\pm 1 \times 10^{-6}$	**CO-856F56:** $\pm 5 \times 10^{-6}$
(Temp. Range **G**) −55°C to +105°C:	**CO-255G56:** $\pm 5 \times 10^{-6}$	**CO-256G56:** $\pm 5 \times 10^{-6}$	
(Temp. Range **H**) −55°C to +125°C:	**CO-255H15:** $\pm 1 \times 10^{-5}$	**CO-256H15:** $\pm 1 \times 10^{-5}$	
Aging Rate	1×10^{-6}/year		
Short Term (Allan Variance)	1×10^{-9}/second under constant conditions		
Frequency vs Supply	2×10^{-8} per percent change in supply		
OUTPUT/SUPPLY (±5%)	Output Level / ***Supply Standard: 0.5 Vrms/50Ω (+7 dBm) / +15 Vdc *Option "**R**": 1.0 Vrms/50Ω (+13 dBm) / +15 Vdc **Option "**M**": 100K ECL / +15 Vdc and −5.2 Vdc (−4.5 Vdc optional) *Not available in CO-856 **Only available in CO-255 ***Any supply in 12-24 Vdc range optional		
Current	Sine: <50 mA ECL: <30 mA for oscillator; also <60 mA at −5.2V	<60 mA	<85 mA
Harmonics and Sub-harmonics (sine output)	Harmonics and subharmonics are −20 dBc. Improved harmonic and subharmonic attenuation optional.		
Phase Noise	See page 34 for standard and low noise Option L2 specifications.		
FREQUENCY ADJUSTMENT Mechanical	Range sufficient to compensate for 5 to 10 years of crystal aging; settable to $<1 \times 10^{-7}$		
Electronic Tuning Option "V"	VCXO operation permits remote frequency adjustment or locking onto an external frequency source. Add "**V**" to Model Number Nominal range with 0 to +5 volt control input is 3×10^{-6} total. (Wider deviations available). V option not available in CO-856. For very wide deviation and/or linear voltage control, see TC/VCXOs in the VCXO section on pages 63-66.		
SIZE/ CONFIGURATION (See drawings on page 36)	2" x 3" x ¾" (51 x 76 x 19 mm) SMA output connector on 2" x ¾" side, pins for supply and studs on base. Option "**U**": Replace SMA connector with SMC. Option "**P**": Pins for printed circuit board mount and studs on base	2" x 4" x ¾" (51 x 102 x 19 mm) SMA output connector on 2" x ¾" side, pins for supply and studs on base. Option "**U**": Replace SMA connector with SMC	1.75" x 3.75" x 0.75" (45 x 95 x 19 mm) SMA output connector on 1.75" x 0.75" side; pins for supply and hold-down on base Option "**U**": Replace SMA with SMC
ENVIRONMENTAL	See pages 72-73 for environmental specifications and screen test option.		
HOW TO ORDER	See page 34		

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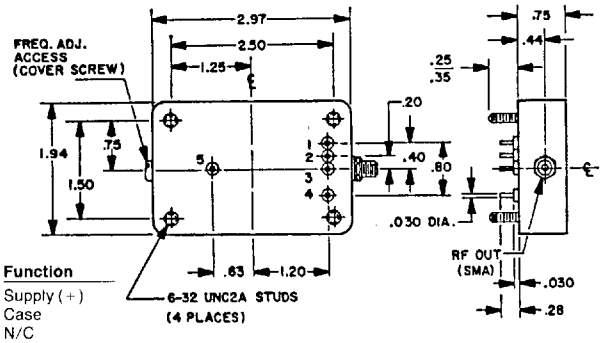
TCXOs
(140-1000 MHz)

OUTLINE/INSTALLATION DRAWINGS

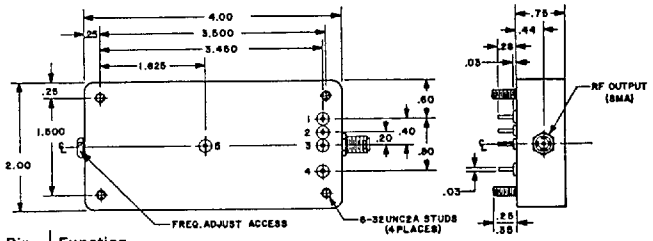
CO-255 SERIES



Pin	Function
1	Supply (+)
2	Case
3	N/C
4	0 volts, case
*5	Case

*For models with electronic tuning, control voltage is applied from pin 5 to pin 4.

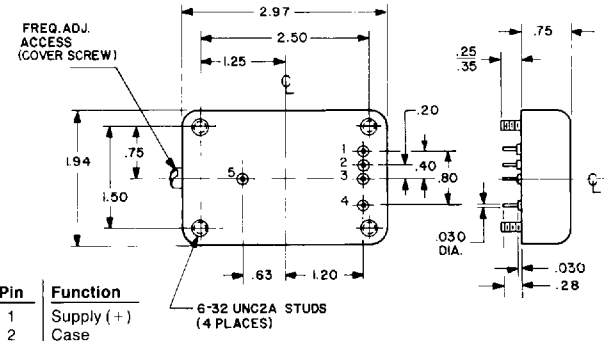
CO-256 SERIES



Pin	Function
1	Supply (−)
2	Case
3	N/C
4	0 volts, case
*5	Case

*For models with electronic tuning, control voltage is applied from pin 5 to pin 4.

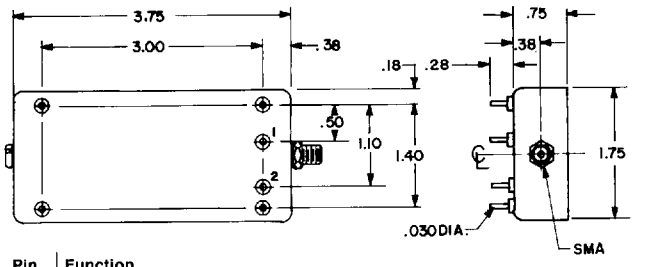
CO-255P (pcb mount) SERIES



Pin	Function
1	Supply (+)
2	Case
3	RF output
4	0 volts, rf return, case
*5	Case

*For models with electronic tuning, control voltage is applied from pin 5 to pin 4.

CO-856 SERIES

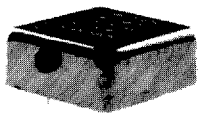


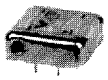
Pin	Function
1	0 volts, case
2	Supply (+)

Markings do not appear on oscillators; they are for reference only. Case dimension tolerances are ±.02″

Low Cost Moderate Stability TCXOs

B-45-03
T-50-23

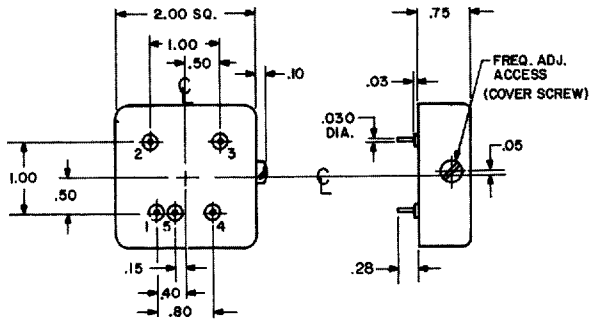




	TTL, CMOS, Sine *widest range of options*	TTL *Lowest price*	TTL *Smallest size; DIP pin configuration*	CMOS
FREQUENCY	50 Hz to 20 MHz	12 kHz-20 MHz	32 kHz-20 MHz	300 Hz-15 MHz
STABILITY Temperature (Temp. Range **A**) +15°C to +35°C:	**CO-251A57:** $\pm 5 \times 10^{-7}$ **CO-251A27:** $\pm 2 \times 10^{-7}$	**CO-231A57:** $\pm 5 \times 10^{-7}$	**CO-532A57:** $\pm 5 \times 10^{-7}$	**CO-236A57:** $\pm 5 \times 10^{-7}$
(Temp. Range **B**) 0°C to +50°C:	**CO-251B16:** $\pm 1 \times 10^{-6}$	**CO-231B16:** $\pm 1 \times 10^{-6}$	**CO-532B16:** $\pm 1 \times 10^{-6}$	**CO-236B16:** $\pm 1 \times 10^{-6}$
(Temp. Range **C**) 0°C to +70°C:	**CO-251C36:** $\pm 3 \times 10^{-6}$	**CO-231C36:** $\pm 3 \times 10^{-6}$	**CO-532C36:** $\pm 3 \times 10^{-6}$	**CO-236C36:** $\pm 3 \times 10^{-6}$
(Temp. Range **D**) −20°C to +70°C:	**CO-251D56:** $\pm 5 \times 10^{-6}$	**CO-231D56:** $\pm 5 \times 10^{-6}$	**CO-532D56:** $\pm 5 \times 10^{-6}$	**CO-236D56:** $\pm 5 \times 10^{-6}$
(Temp. Range **E**) −40°C to +75°C:	**CO-251E15:** $\pm 1 \times 10^{-5}$	**CO-231E15:** $\pm 1 \times 10^{-5}$	**CO-532E15:** $\pm 1 \times 10^{-5}$	**CO-236E15:** $\pm 1 \times 10^{-5}$
(Temp. Range **F**) −55°C to +85°C:	**CO-251F25:** $\pm 2 \times 10^{-5}$	**CO-231F25:** $\pm 2 \times 10^{-5}$	**CO-532F25:** $\pm 2 \times 10^{-5}$	**CO-236F25:** $\pm 2 \times 10^{-5}$
Aging Rate	≤5 MHz: 5×10^{-7}/year >5 MHz: 1×10^{-6}/year	1×10^{-6} per year		
Short Term (Allan Variance)	1×10^{-9} per second under constant conditions			
Frequency vs Supply	1×10^{-7} per percent change in supply voltage			
OUTPUT/SUPPLY	**Output Level** / **Supply (±5%)** Standard: TTL +5 Vdc Option "**R**": +13 dBm/50Ω +15 Vdc Other Options: Lower level sine +10 to +24 Vdc CMOS +5 to +15 Vdc sine not available below 1 MHz; for <1 MHz see model CO-281T-4Y	Output: TTL compatible (drives 10 TTL loads) Supply: +5 Vdc ±5%		Output: CMOS compatible Supply: +12 Vdc ±5% (9-15 Vdc optional)
Current	Sine <15 mA (as low as 4 mA available) CMOS <15 mA (as low as 3 mA available) TTL *<30 mA (as low as 6 mA available) *For TTL below 3 MHz, current may increase due to TTL dividers	4-20 MHz: <30 mA <4 MHz: 40-80 mA	8-20 MHz: <30 mA <8 MHz: 40-80 mA	3-10 mA depending upon frequency
FREQUENCY ADJUSTMENT Mechanical	settable to 1×10^{-7}	settable to 1×10^{-6}		
Electronic Tuning Option	**Option "V"**: Nominal range with 0 to +5V control input is 3×10^{-6} total (wider deviation available)	Not available in these models—see VCXO section for voltage controlled clock oscillators		
SIZE/CONFIGURATION (See drawings on page 38)	2" x 2" x ¾" (51 x 51 x 19 mm) sealed metal case rf connector optional; see configurations on next page	1½" x 1½" x ½" (38 x 38 x 13 mm) pcb mount housed in metal can with epoxy base	1" x 1" x .38" (26 x 26 x 10 mm) DIP compatible pin configuration metal can with metalized base	1½" x 1½" x ½" (38 x 38 x 13 mm) pcb mount housed in metal can with epoxy base
ENVIRONMENTAL	See Pages 72-73 for environmental specifications and screen test option.			

CO-251, CO-252, CO-254 SERIES

pcb mount (standard)

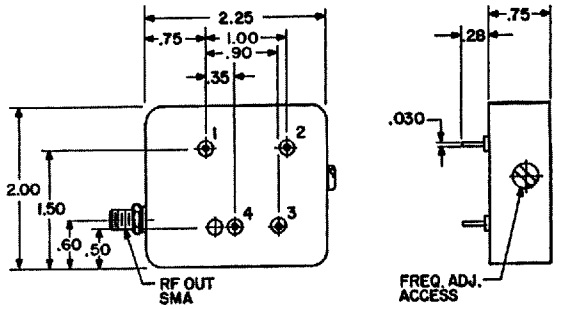


Pin	WITH SINGLE SUPPLY		WITH SEPARATE TTL SUPPLY	
	No "V" Option	"V" Option	No "V" Option	"V" Option
1	Output	Output	Output	Output
2	Supply (+)	Supply (+)	Supply (+)	Supply (+)
3	*0 volt/case	*0 volt/case	*0 volt/case	0 volt/case
4	*0 volt/case	VCXO in	+5 Vdc	VCXO in
5	*rf return	*rf return	*rf return	+5 Vdc

*internally connected (except pin 5 is not internally connected with sine output in CO-251 and CO-252 series).

rf Connector options

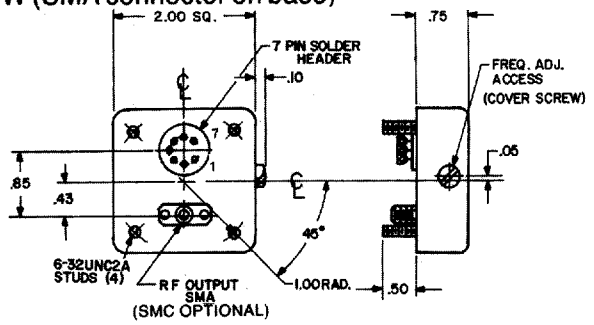
Option SW (SMA connector on side)



Pin	Function
1	Supply (+)
2	0 volts, case
*3	Case
4	Case

*In units with electronic tuning ("V" option), control voltage is applied from pin 3 to pin 2.

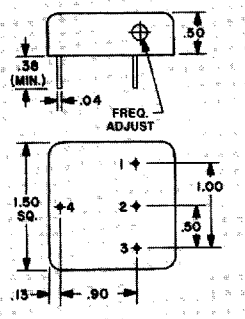
Option W (SMA connector on base)



Pin	Function
1	Supply (+)
2	N/C
3	0 volts, case
4	N/C
5	Case
6	N/C
*7	N/C

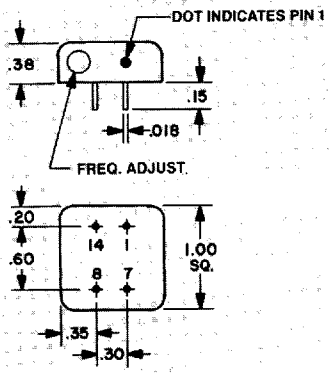
*In units with electronic tuning ("V" option), control voltage is applied from pin 7 to pin 3.

CO-231 SERIES
CO-236 SERIES



Pin	Function
1	0 volts, case
2	Case
3	Supply (+)
4	Output

CO-532 SERIES



Pin	Function
1	Case
7	0 volts, common
8	Output
14	+5 Vdc

Markings do not appear on oscillators; they are for reference only. Case dimension tolerances are ±.02"