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DEFENSE ELECTRONICS

- HOME
- COMPANIES
- ABOUT US
- NEWS
- INVESTOR RELATIONS
- CORPORATE GOVERNANCE
- EMPLOYMENT
- CONTACT US
- SITEMAP

Defense Electronics > [Microwave Products](#) > [Voltage Controlled Oscillators \(VCO\) Selection Guide](#)

[View Printable Version](#)

Octave Voltage Controlled Oscillators (VCO)

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Applications Note for [Microwave Oscillators](#)

Wideband VCOs

General Microwave's catalog line of broadband VCOs covers the 2-18 GHz frequency range in octave (2-4, 2.6-5.2 and 4-8 GHz) and half-octave (8-12 and 12-18) GHz bands. The major features of the VCOs are fast settling time, low phase noise and excellent frequency stability.

A simplified block diagram is shown in Fig. 1. For optimum performance, the active element used is a silicon bipolar transistor. (This is in lieu of GaAs FETs which typically exhibit 10-20 dB poorer phase noise performance. Although GaAs FETs have extremely low noise in amplifier applications, they suffer from high 1/f noise, which is upconverted in the nonlinear oscillator to phase noise near the carrier.) To vary the frequency of the oscillator, a high-Q silicon hyperabrupt varactor is utilized. The capacitance-voltage characteristic is specified to provide as nearly linear frequency vs. voltage tuning curve as possible. In practice, good linearity can only be realized over a small portion of the tuning range because of parasitic reactances present in the physical circuit and the bipolar transistor. Typical ratios of maximum to minimum frequency vs. voltage sensitivity for an octave band are 2:1 and are specified at 3:1. GaAs varactors, although having higher Q's than silicon varactors, suffer from long-term charging effects as well as relatively poor thermal conductivity. Silicon varactors are therefore mandatory in high-speed applications requiring settling times of the order of several hundred nanoseconds and low post-tuning drift.

To minimize pulling effects on the oscillator frequency due to variations in the external load, attenuator pads followed by buffer amplifiers are incorporated at the oscillator output. Voltage regulators are also included to minimize the effect of variations in the power supply voltage on both oscillator frequency and power level. Finally, filtering is provided to reduce the harmonic content of the output signal.

Of particular note is General Microwave's 8-12 GHz VCO, which utilizes a high performance transistor operating in the fundamental, rather than the doubling push-push mode. This mode of operation eliminates all $(2n + 1) f_0/2$ frequencies in the output spectrum. The second harmonic signal is specified at -40 dBc maximum but is typically less than -50 dBc.

Because fundamental mode oscillation is not currently achievable with available silicon devices in the 12-18 GHz band, the doubling push-push approach, shown schematically in Fig. 2, is used. Thus, for example, for a 12 GHz output frequency, each oscillator is designed to operate at 6 GHz. If the structure were perfectly symmetrical, all odd harmonics of 6 GHz would be suppressed, and only even harmonics would be present in the output spectrum. By suitable filtering, an essentially pure 12 GHz output signal could be obtained. In practice, imperfect symmetry results in $f_0/2$ and $3f_0/2$ signals, which are filtered to the extent possible. (For the case of a 12 GHz output signal, the undesired $3f_0/2$ signal at 18 GHz cannot be filtered since it is within the 12-18 GHz frequency range of the VCO.)

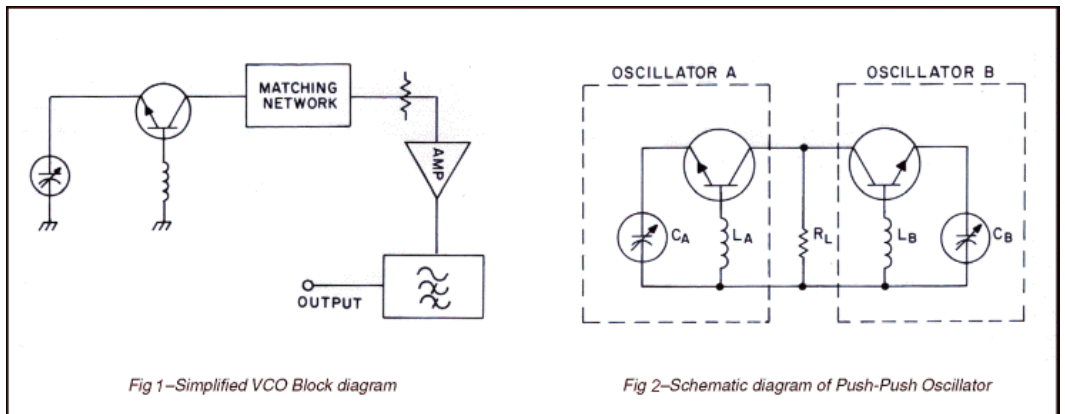


Fig 1 - Simplified VCO Block diagram

Fig 2 - Schematic diagram of Push-Push Oscillator

SERIES V60 BROADBAND VCO SPECIFICATIONS

PARAMETER	MODEL				
	V6020	V6026	V6040	V6080	V6120A
FREQUENCY RANGE (GHz)	2-4	2.6-5.2	4-8	8-12	12-18
FREQUENCY SETTling ⁽¹⁾ , max (MHz) within 50 nsec, Typical	±8				±10
within 200nsec, Typical	±3		±4		±5

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within 1µsec	±1.5	±3	±4
MODULATION			
Bandwith, min (MHz)	100		
Sensitivity ratio, max	3:1		
RF POWER			
Output, min (dBm)	+10		
Variation, Incl. temp. and freq. max (dB)	±2.5	±3.0	
PHASE NOISE, max (dBc/Hz) @ 100 kHz offset	-95	-90	-80
HARMONICS, max (dBc)	-15	-40	-20
f/2, 3f/2, max (dBc)	N/A		-20
SPURIOUS, max (dBc)	-60		
TEMPERATURE STABILITY, typ (PPM/°C)	100		
PULLING VSWR 2:1 max (MHz)	1		
PUSHING, max (kHz/V)	250		
CONNECTORS			
Power Supply	Solder terminal		
Tuning voltage	SMA female		
RF output	SMA female		
POWER SUPPLY REQUIREMENT			
Voltage (Vdc)	+15 ±0.5		
Current, max (mA)	150	300	
Tuning voltage (Vdc)	0 to +20	0 to +15	
INPUT CAPACITANCE, nominal	25 pF, 10 k ohms		
ENVIRONMENTAL⁽²⁾			
Operating temperature (°C)	-54 to +85		
Storage temperature (°C)	-54 to +125		
MECHANICAL DIMENSIONS			
Inches	1.79 x 1.10 x 0.45		2.19 x 1.10 x 0.45
Millimeters	45,5 x 27,9 x 11,4		55,6 x 27,9 x 11,4

1. Δf relative to f after 1 sec.
2. Hermetically sealed.

AVAILABLE OPTIONS**Option No. Description**

- 49 High Reliability Screening (see table 1)

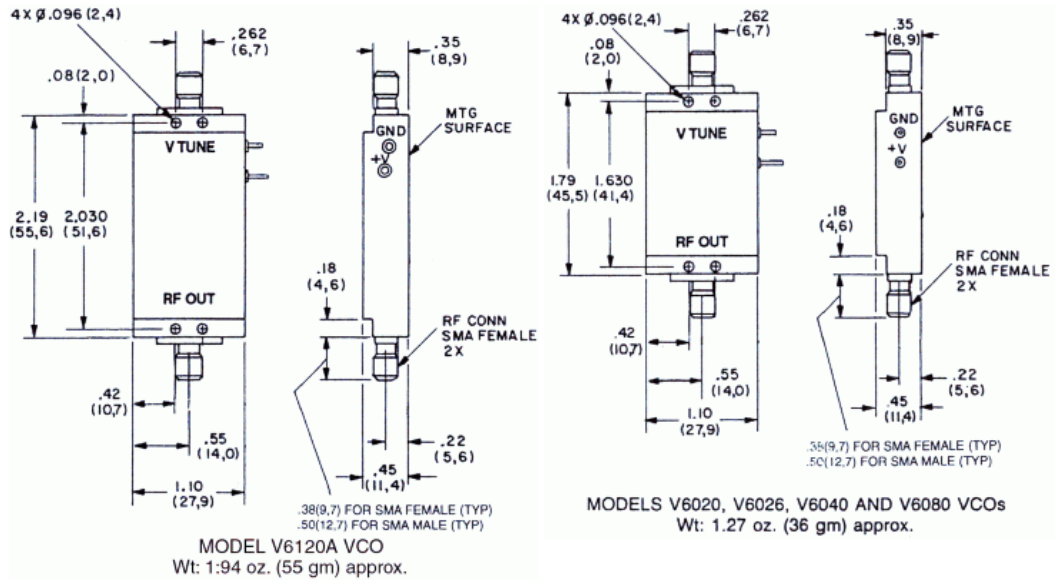
Table 1. Option 49A High Rel Screening

General Microwave's hermetically-sealed products utilize rugged construction techniques and hermetic sealing to meet stringent military requirements for shock, vibration, temperature, altitude, humidity, and salt atmosphere. All hermetically-sealed parts may be ordered, if desired, with 100% screening in accord with the following MIL-STD 883:

TEST	METHOD	CONDITION
Internal Visual	2017	—
Temperature Cycle	1010	B
Mechanical Shock	2002	B
Burn-In	1015	—
Leak	1014	A1 & A2

DIMENSIONS AND WEIGHT

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Dimensional Tolerances, unless otherwise indicated: .XX ±.02; .XXX ±.005

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