Precision Sine Wave Reference

FEATURES

- Very High Accuracy: +7.071 Vrms ±0.5%
- Extremely Low Drift: 20 ppm/°C (-55°C to +125°C)
- Excellent Stability: 10 ppm/1000 Hrs. Typical
- Low Distortion: 0.1% Thd @ f = 3300 Hz
- Hermetic 14-pin Ceramic DIP
- Military Processing Option

APPLICATIONS

- Transducer Excitation
- High Resolution Servo Systems
- High Precision Test and Measurement Instruments
- AC Voltage Standard
- L_{VDT} Or R_{VDT} Reference
- Multiplying D/A Reference

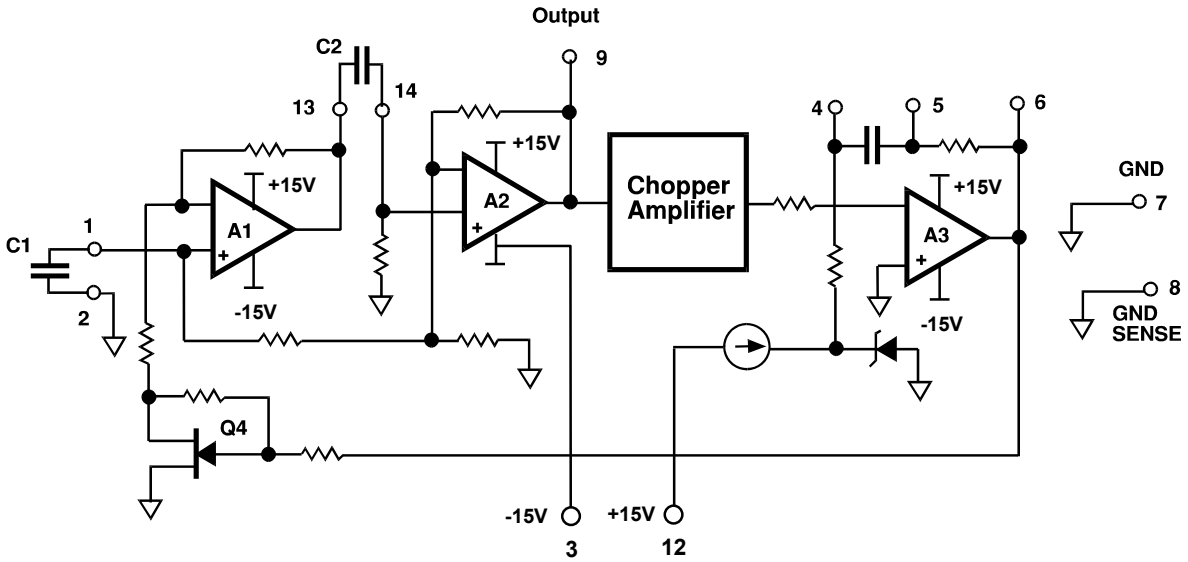
DESCRIPTION

SWR200 is a Precision Sine Wave Reference providing an ultra stable sine wave output of +7.071 V at ±0.5% initial accuracy and temperature coefficient as low as 20 ppm/°C over the full military temperature range. The extreme accuracy is made possible by a chopper-based AGC circuit. The temperature characteristic of the chopper circuit compensates the typical nonlinearity of the internal DC zener reference, resulting in a nearly linear amplitude-temperature characteristic. Frequency of the SWR200 is programmable with two external capacitors.

The SWR200 is available in a 14-pin bottom braze package. They are hermetically sealed and “M” versions are screened for high reliability and quality.

SWR200 is well suited for any application requiring a stable sine wave source. The SWR200 can be used as a reference source in precision sensing systems based on L_{VDT} or R_{VDT} position sensors. A programmable AC reference can be constructed using the SWR200 as a reference for a high accuracy multiplying Digital to Analog Converter.

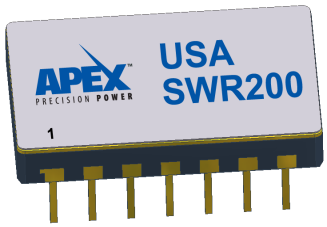
Figure 1. BLOCK DIAGRAM



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SELECTION GUIDE

Type	Output (Typ.)	Temperature Operating Range	Package
SWR200C	+7.071V	-25°C to +85°C	DIP
SWR200M	+7.071V	-55°C to +125°C	DIP



Hermetic 14-pin Ceramic DIP
Package Style HC

1. CHARACTERISTICS AND SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

V_{PS} =±15V, T = +25°C, R_L = 10KΩ UNLESS OTHERWISE NOTED.

Model	SWR200C			SWR200M			
Parameter	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Units**
ABSOLUTE MAXIMUM RATINGS							
Power Supply	±13.5	±15	±22	*	*	*	V
Operating Temperature	-25		+85	-55		+125	ºC
Storage Temperature	-65		+85	*		*	ºC
Short Circuit Protection		Continuous			*		Vrms
OUTPUT VOLTAGE		7.071			*		V
OUTPUT VOLTAGE ERRORS							
Initial Error			±0.5			*	%
Warmup Drift		100			*		µV
DC Offset			3			*	mV
DC Offset Over Temp.		3	18		*	*	µV/ ºC
T_{MIN} - T_{MAX}			20.0			30.0	ppm/ ºC
Long-Term Stability		10			*		ppm/ ºC
OUTPUT CURRENT							
Range	±10			*			mA
REGULATION							
Line		10			*		ppm/V
Load		3			*		ppm/mA
POWER SUPPLY CURRENTS							
+PS		10.5	13		*	*	mA
-PS		9.5	13		*	*	mA
DISTORTION			0.5			*	%
FREQUENCY							
Range (f) $f = \frac{10^{-5}}{\sqrt{C_1 C_2}}$	.98	1	1.02	*	*	*	Hz
	400		10K	*		*	Hz
$\frac{\Delta f}{f}$ vs. temperature			15			*	ppm/ºC

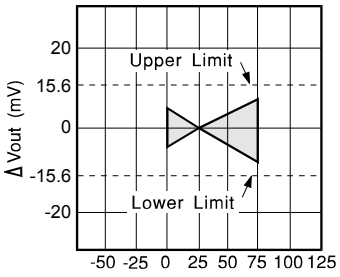
NOTES:

* Same as C Models.

1. Using the box method, the specified value is the maximum deviation from the output voltage at +25°C over the specified operating temperature range.
2. The specified values are unloaded.
3. Pin 8 is internally connected to Pin 7 and can be used as Ref. GND.
4. The frequency range can be extended to any desired lower value by using 2 external AGC capacitors (see AN-3).
5. The increase in distrotion at lower frequencies can be eliminated by using external AGC capacitors (see AN-3).

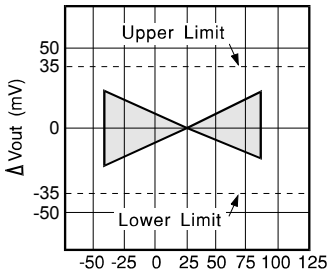
2. TYPICAL PERFORMANCE GRAPHS

V_{OUT} vs. TEMPERATURE



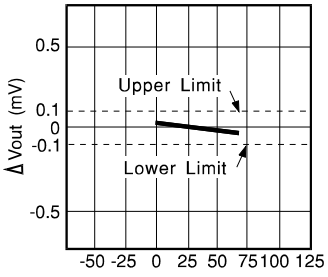
Temperature °C
SWR200C

V_{OUT} vs. TEMPERATURE



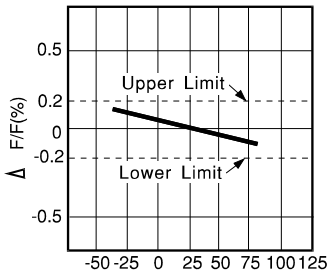
Temperature °C
SWR200M

% Δ FREQ. vs. TEMP.



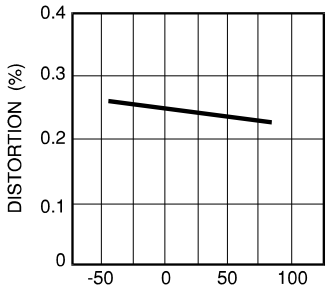
Temperature °C
SWR200C

% Δ FREQ. vs. TEMP.



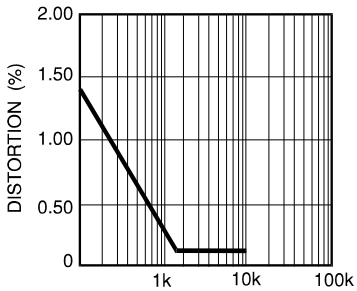
Temperature °C
SWR200M

DISTORTION VS. TEMP



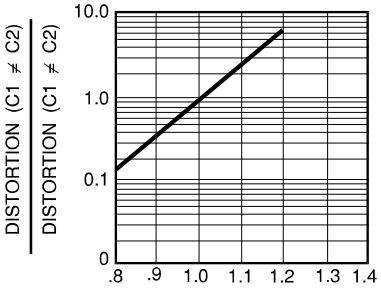
Temperature °C

DISTORTION vs. FREQUENCY



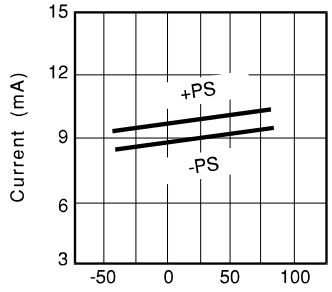
Frequency (Hz)

NORMALIZED DISTORTION vs. C2/C1



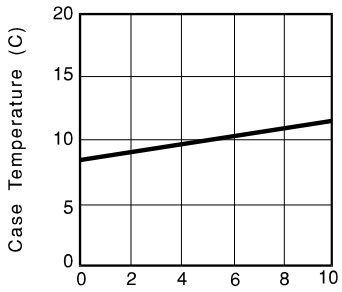
C2/C1

POWER SUPPLY CURRENT vs. TEMP.



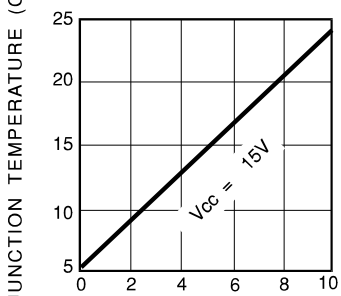
Temperature °C

CASE TEMP. RISE ABOVE AMBIENT vs. OUTPUT CURRENT



Output Current (mA)

JUNCTION TEMP. RISE ABOVE CASE TEMP. vs OUTPUT CURRENT



Output Current (mA)

3. THEORY OF OPERATION

The following refers to the schematic in Figure 1. A1 and A2 are connected as a phase-shift oscillator circuit with the frequency set by the external capacitors C1 and C2. Q4 is included in the feedback loop of A1 as a gain control element.

The oscillator output is fed to the chopper amplifier which develops an absolute value representation of the oscillator output. The chopper output is compared to a precision DC reference in integrator amplifier A3. This DC error signal is used ot control the gain setting FET Q4.

As in all precision zener based DC references, the drift of the zener becomes nonlinear at temperature extremes. The chopper amplifier drift characteristic is complementary to this nonlinearity and compensates for the reference drift.

4. APPLICATION INFORMATION

Figure 1 shows the connections for the SWR200 including the two frequency setting capacitors. The frequency is:

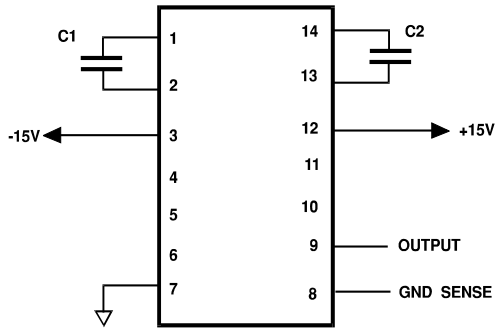
$$f = \frac{10^{-5}}{\sqrt{C_1 C_2}}$$

The frequency stability is directly related to the stability of the capacitors, therefore stable capacitors like NPO ceramic, or polycarbonate or polystyrene film should be used.

Two separate ground pins are provided for accurate ground sensing. This minimizes errors due to drops in the ground pin which can become a significant source of error in sockets.

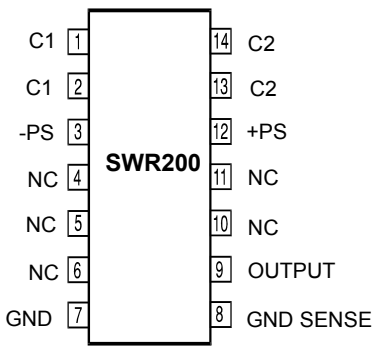
The offset of the SWR200 is fully specified for initial offset and drift and is low enough that it can normally be neglected. In applications which are especially sensitive to offset the output can be AC coupled. Proper capacitor sizing and high impedance sensing will minimize errors due to capacitive coupling.

EXTERNAL CONNECTIONS



PIN CONFIGURATION

TOP VIEW



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