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Digital Nulling of Precision Op Amps

FEATURES

- Digitally-controlled offset nulling is achieved by imbalancing the first stage collector currents of a precision op amp.
- Greater than 1.5mV of offset voltage may be nulled to zero with 5μV resolution at 25°C.
- This application is especially useful in microprocessorcontrolled systems where stringent error budgets exist.
- Circuit uses the nulling terminals with a DAC-08 substituted for the conventional nulling potentiometer.

GENERAL DESCRIPTION

The input offset voltage of a precision op amp (OP-05, OP-07, OP-77) may be nulled to $<5\mu$ V using the complementary cur-

rent outputs of a DAC-08 to change the ratio of collector currents in the first stage. With V_{OS} being defined as the voltage which must be applied between the input terminals to force V_{OUT} to zero and assuming all errors to be in the first stage, V_{OS} may be expressed as:

1)
$$V_{OS} = \frac{kT}{q} \log_e \frac{I_{C1}}{I_{C2}} \cdot \frac{I_{S2}}{I_{S1}}$$

where:

k = Boltzmann's constant = 1.38 x 10⁻²³ joules/° K

T = Absolute temperature, ° K

q = Charge of an electron = 1.6 x 10⁻¹⁹ coulomb

I_S = Theoretical reverse-saturation current

I_C = Collector Current

Changing the ratio I_{C1}/I_{C2} over a $\pm 3\%$ range results in an input offset voltage nulling range of greater than 1.5mV at 25°C.

CIRCUIT

