SWITCHES FOR A/D AND D/A CONVERTERS
AD550, AD555

GENERAL DESCRIPTION

The converter components discussed in this section were designed to form the heart of current and voltage switched D/A and A/D converters.

CURRENT STEERING CONVERTERS

The AD550 is a quad current switch that can be provided in matched sets to build 4, 8 and 12-bit converters. It consists of four logic-operated current steering switches with a reference transistor on a single monolithic chip. Further, the switch emitter areas are geometrically proportioned to achieve constant current density and thus attain virtually perfect V_{BE} matching and tracking between switches. The reference transistor is provided to compensate the external voltage reference, which powers the binary current determining resistor ladder network (e.g., AD850) for V_{BE}.

The basic operation of the current steering switch is shown in Figure 1. For a nominal full scale output current of 2.0mA (less than one LSB), a stable reference zener and precision resistor can be used to establish a reference current of 1/8mA (LSB weight) into the reference transistor Q_2. The op amp then adjusts the common base rail so that the individual bit currents will assume their correct values, as shown. These bit currents are then steered from the load or the +5V supply according to the logic level at each input. A complete 12-bit converter is shown on the page describing the AD550.

VOLTAGE SWITCHING CONVERTERS

The AD555 is a dielectrically-isolated quad voltage switch that can be provided in matched sets to build 4, 8 and 12-bit converters. Comprising four logic-operated single pole, double throw (SPDT) switches, the AD555 can switch AC signals at its reference terminals, making it ideal for multiplying and D/S and S/D converter applications.

Voltage switching involves the switching of resistor legs of an R/2R ladder network (e.g., AD855) between two continuously variable voltage references as shown in Figure 2. Depending on the logic state of the input terminals, the 2R leg of the R/2R network will be connected to the voltage appearing on either Ref A or Ref B. The R/2R network has the property that, no matter what state the digital inputs are in, the impedance seen from the R/2R output (non-inverting terminal of the output amplifier) is always R. A complete 12-bit D/A converter is shown on the page describing the AD555 switch. (See pgs. for ladder networks.)

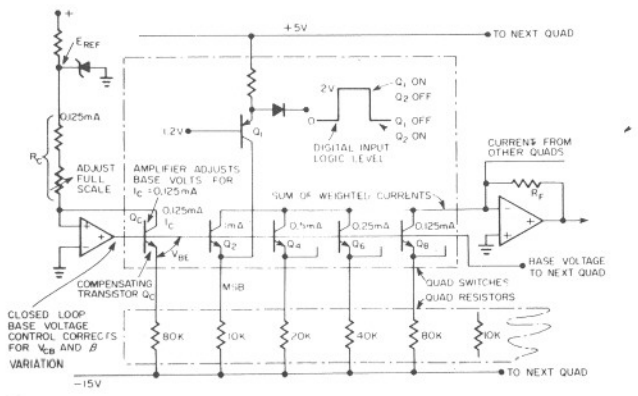


Figure 1. Precision Converter with Full Compensation; (4 Bits Shown for Clarity) Simplified Circuit.

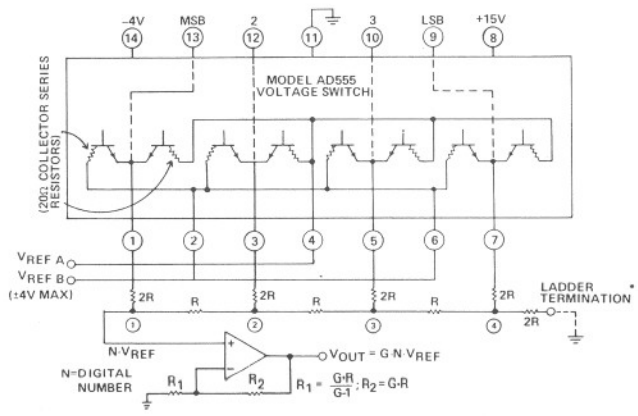


Figure 2.

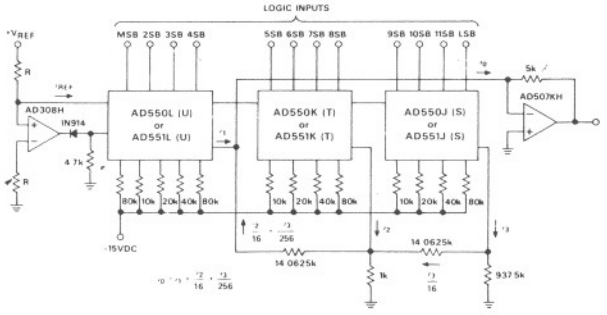
MONOLITHIC CURRENT SWITCH
AD550

GENERAL DESCRIPTION

The AD550 is a quad current switch for building 4, 8 and 12-bit accurate A/D and D/A converters. It features monolithic construction to obtain tight switch matching and tracking with temperature and high reliability for military and avionics applications.

To obtain 12-bit linearity it is important that the AD550 switch be ordered and used as matched sets. Units shipped as matched sets will be marked with a "V_{BE} group number" (–9 to +9) following the grade selection for the TO-116 package (e.g., 550K + 3D where +3 is the grade selection and D the package suffix) and following the pin 1 designator for the flat pack (e.g., ● +5XXXX, where ● is the pin 1 designator and XXXX the date code).

APPLICATION



NOTE:
The AD850 includes the binary resistors, interquad attenuators, gain resistors, a bipolar option and reference current resistors on a single substrate.

ELECTRICAL CHARACTERISTICS (Typical @ +25°C, unless otherwise noted.)

Parameter	AD550
Logic Inputs	
"0" (Switch ON)	0.8V max, 1.6mA nom. (Avg. Sum of 4)
"1" (Switch OFF)	2.0V min, 100μA max
Common Base Bias Voltage	-2.0V max (-5.0V min)
Input Coding	Complementary Binary
Output Current (Nominal)	
Bit 1	1.0mA
Bit 2	0.5mA
Bit 3	0.25mA
Bit 4	0.125mA
Bit 5	N/A
Output Voltage Limit	
Unloaded	0V (Amplifier Σ pt)
Resistor Load	-2V to +10V
Switch Speed	
Switching Time (to turn on LSB)	500nsec
Settling Time to ±½LSB	
12 Bits	1.8μsec
10 Bits	0.8μsec
Accuracy (% Full Scale, With 10V Across Resistor Network)	
Linearity J/S	1.0% max
K/T	0.1% max
L/U	0.01% max
Temperature Coefficient	2ppm/°C
Power Requirements	
+5VDC (±5%)	±12mA max
-15VDC (±3%)	-9mA max
Packages	TO-87 (F.P.) TO-116A (DIL)
Operating Temperature Range	
J, K, L	0 to +70°C
S, T, U	-55°C to +125°C

*Same as AD550.

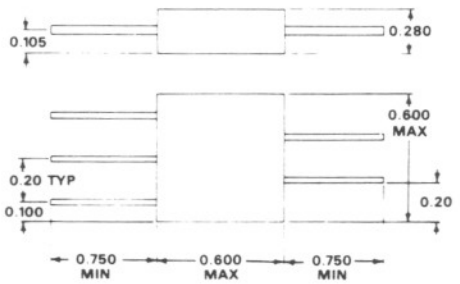
ORDERING GUIDE

AD550 X Y* Z
- X = Performance/Temperature Grade J, K, L, S, T, U
- Y = V_{BE} Characteristic (-9 to +9)
- Z = JEDEC Package Designation D = TO-116, F = TO-87

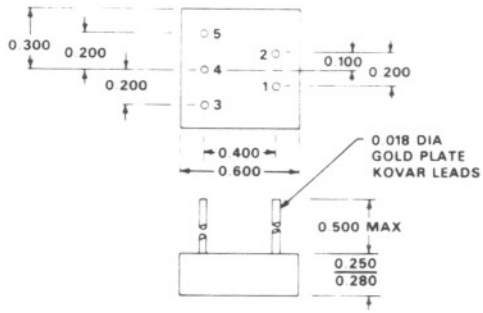
*Do not specify unless ordering a replacement part. Units ordered as 12 bit matched sets will automatically be shipped with the same V_{BE} characteristic.

PRICES: Consult the factory or your local representative for the latest pricing.

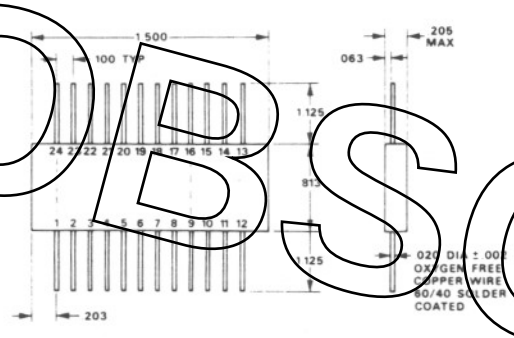
FP1



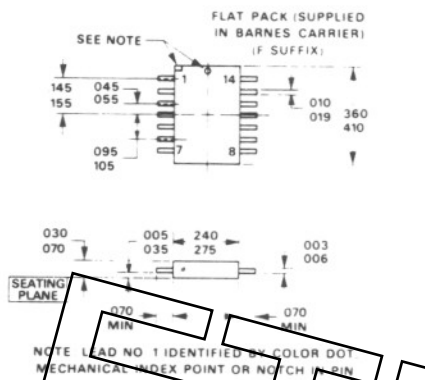
MP72



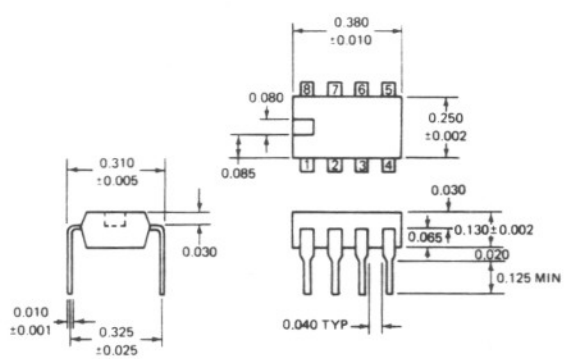
24 PIN MOLDED PACKAGE



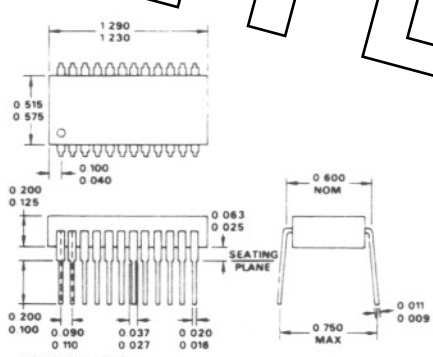
TO-87



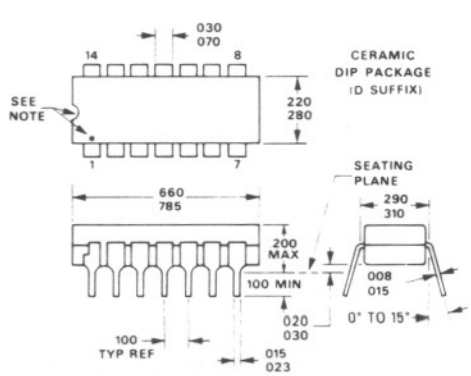
MINI-DIP



24 PIN DIL

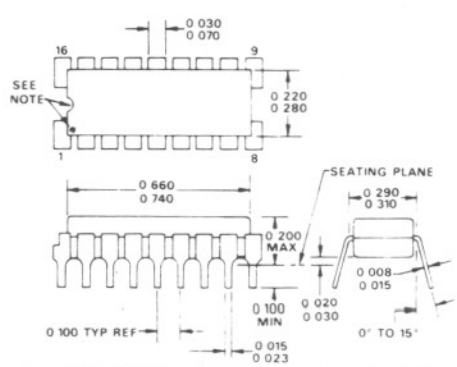


TO-116
14 PIN



NOTE LEAD NO 1 IDENTIFIED BY COLOR DOT OR NOTCH
MECHANICAL INDEX POINT OR NOTCH IN PIN

TO-116
16 PIN



NOTE LEAD NO 1 IDENTIFIED BY COLOR DOT OR NOTCH
MECHANICAL INDEX POINT OR NOTCH IN PIN