

High Performance Digital-to-Analog Converter

DAC1132

PRELIMINARY TECHNICAL DATA

FEATURES 12 Bit Resolution Input Register Included Small Module Package Programmable Output Ranges 0 to +70°C Monotonicity Low 8ppm/°C Gain TC 2µs Settling Time



ONTPUT CHARACTERISTICS

The 12 binary-weighted current sources which form the basis of the digital-to-analog conversion process are directly controlled by the digital data stored in the input register. The combined output of these sources is applied to the internal op amp summing junction to produce a voltage output signal. By connecting jumpers between the proper module pins, various values of op amp feedback resistance and thus, output voltage ranges can be selected.

In order to produce bipolar outputs, the current input to the internal op amp is offset by ½ Full Scale. This offset current is generated by the precision internal reference source and is ap plied to the op amp summing junction by means of a jumper connected between appropriate module terminals.

GENERAL DESCRIPTION

The DAC1132 is a 12 bit, high performance digital to analog converter packaged in a very compace 2" \times 2" \times 0/4" module. It comes complete with an input storage register and a fast settling output amplifier which can be jumper programmed to produce either of five output voltage ranges. Performance specifications include 2µs settling time to 0.01%, 8ppm/°C gain temperature coefficient, ±½LSB linearity error, and monotonicity from 0 to +70°C.

The DAC1132 combines the AD562 integrated circuit D/A with a TTL input register, an output amplifier, and a precision reference source to form a complete converter package. The laser trimmed AD562 which consists of precision current switches, and a very stable thin film resistor network provides the DAC1132 with excellent performance over temperature and makes possible its small module size.

DIGITAL INPUT CHARACTERISTICS

The TTL/DTL compatible storage register contained within the DAC1132 accepts either Binary or Offset Binary coded inputs. Digital data appearing at the converter's 12 input terminals will be strobed into the register whenever a positive going transition is applied to the STROBE input (pin 6). With the STROBE input held at either logic "0" or logic "1", the input data may be changed without affecting either the contents of the register or the output of the converter. The transfer characteristics of the DAC1132 are such that a full scale digital input (1111111111) results in a positive full scale voltage output.

Note: this data sheet includes "Preliminary Technical Data" describing a new product. Though highly unlikely, it may be necessary to alter the specifications to reflect life data collected during the initial months of the product's use.

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SPECIFICATIONS (typical @ +25°C and rated supply voltages, unless otherwise specified)

DIGITAL INPUTS Logic Levels 0V < Logic "0" < 0.8V +2V < Logic "1" < +5V Data Input Load Strobe Pulse Width 20 standard TTL Load/bit Strobe Pulse Width 20 standard TTL Loads Strobe Pulse Width 20 standard TTL Loads Data Strup Time 20 standard TTL Loads Data Strup Time 20 standard TTL Loads Strobe Pulse Width 20 standard TTL Loads Data Strup Time 20 standard TTL Loads Strobe Pulse Width 20 standard TTL Loads Strobe Pulse Width 20 standard TTL Loads Strobe Pulse Width 20 standard TTL Loads DUTPUT RANGES 0 to -5V @ 10mA 0 to -10V @ 10mA 15V 2 @ 0 co +70° C Storage 5-5° C to +100° C Storage 5-5° C	RESOLUTION	12 Bits	OUTLINE DIMENSIONS AND
Logic Levels $0^{V} \le Logic "1" \le 0.8V$ $+2V \le Logic "1" \le 4-5V$ Data Input Load 1 Standard TTL Load/bit Strobe Input Load 2 Standard TTL Loads Strobe Pulse With 20ns (Min) Data Hold Time 5ns (Min) NPUT CODES Unipolar Diffset Binary DUTPUT RANGES 0 to +5V @ 10mA $\pm 2.5V @ 10mA$ $\pm 2.5V @ 10mA$ $\pm 10V @ 10m$	DIGITAL INPUTS		PIN DESIGNATIONS
Data Hold Load Strobe Pulse Width Data Hold Time Data Hold	Logic Levels	0V ≤ Logic "0" ≤ 0.8V +2V ≤ Logic "1" ≤ +5V	Dimensions shown in inches and (mm).
Strobe Input Load 2 Standard TTL Loads Strobe Pulse Width 20ns (Min) Data Strup Time 5 ns (Min) Durput RANGES 0 to +5V @ 10mA 0 to +10V @ 10mA ±5V @ 10mA ±10V @ 00mA ±10V @ 00mA	Data Input Load	1 Standard TTL Load/bit	2.01 MAX
Strobe Pulse Width 20ns (Min) Data Hold Time 20ns (Min) Data Hold Time 5ns (Min) INPUT CODES Binary Bipolar Offset Binary DUTPUT RANGES 0 to +5V @ 10mA ±2.5V @ 10mA ±2.5V @ 10mA ±2.5V @ 10mA ±2.5V @ 10mA ±2.5V @ 10mA ±2.5V @ 10mA DUTPUT MAPED NdE 0.0212 ETMLE Control (Control (Cont	Strobe Input Load	2 Standard TTL Loads	
Data Setup Time 20ns (Min) Data Hold Time 5ns (Min) Data Hold Time 5ns (Min) Dut Hold Time 5ns (Min) Dipolar Offset Binary Bipolar Offset Binary DUTPUT RANGES 0 to +5V @ 10mA t2.5V @ 10mA t10V @ 10mA DUTPUT PERDON DUTPUT PERDON SET LING TIME 0.02Ω SET LING TIME 0.02Ω SET LING TIME 0.02Ω DUTPUT PERDON Gain 0.02Ω Differential Nonlinearity 2.8ppm ² C (t10ppm ² C Max) Differential Nonlinearity 2.8ppm ² C (t12ppm ² C Max) TEMPERATURE REQUIREMENTS +15V ±3% @ 32mA (37mA Max) +5V ±3% @ 12mA (37mA Max) TEMPERATURE REQUIREMENTS +15V ±3% @ 12mA (37mA Max) TEMPERATURE REQUIREMENTS +15V ±3% @ 12mA (37mA Max) T5V ±3% @ 12mA (37mA Ma	Strobe Pulse Width	20ns (Min)	(10.4)
Data Hold Time 5ns (Min) INPUT CODES Binary Bipolar Offset Binary DUTPUT RANGES 0 to +5V @ 10mA t2.5V @ 10mA t2.5V @ 10mA t2.5V @ 10mA t2.5V @ 10mA t2.5V @ 10mA t10V @ 10V Max) t10V @	· Data Setup Time	20ns (Min)	0.2 MIN (5.1)
NPUT CODES Unipolar Binary Bipolar Offset Binary DUTPUT RANGES 0 to +5V @ 10mA $\pm 2.5V @ 10mA$ $\pm 5V @ 10mA$ $\pm 10V @ 10mA$ DUTPUT MPEDANCE 0020 SET_LING TIME 0.0220 SET_LING TIME 2.0122 Unipolar Offset $\pm 1.5B$ Unipolar Offset $\pm 1.5B$ Unipolar Offset ± 1.6 unces (45 grams) All pins are gold plated half-hard brass, 10VT (C MAR) 2.0 ym (2.4 x y y (2.4 x y y (2.4 x y y y y y y y y y y y y y y y y y y	Data Hold Time	5ns (Min)	
Unipolar Binary DUTPUT RANGES Of to +5V @ 10mA 0 to +10V @ 10mA $\pm 2.5V @ 10mA$ $\pm 10V @ 10mA$ $\pm 1.5S$ TEMERNTLIKE COEFFICIENT Gain Bipolar Offset $\pm 1.4VV (C (\pm 0)\mu V/ (C Max))$ $\pm 2.8pm/^{2} (\pm 12ppm/^{2} C Max)$ TEMPERATURE RANGE Operating Offset $\pm 15V \pm 3\% @ 32mA (37mA Max)$ $\pm 1.5V \pm 3\% @ 12mA (30mA Max)$ $\pm 1.5V \pm 1.5V$	INPUT CODES		-28 K •
Bipolar Offset Binary DUTPUT RANGES 0 to +3V @ 10mA 0 to +10V @ 10mA 12,5V @ 10mA ±2,5V @ 10mA ±2,5V @ 10mA ±10V @ 10mA 100V @ 10mA DUTPUT MPEDANCE 0.02Ω EET_LING TIME 0.02Ω ETTLING TIME 0.02Ω Instant TV ERFOR ±1.50 Gain 10V C (±)0µ/ (C Max) Differential Nonlinearity ±2.8 ppm/C (±12 ppm/C Max) Differential Nonlinearity ±2.8 ppm/C (±12 ppm/C Max) FEMPERATURE RAUGE 0 to +70°C Operating 0 to +70°C Storage -55° C to 100°C POWER SUPPLY SENSITIVITY ³ 4mV/V (mV/V Max) Gain 4mV/V (mV/V Max) Offset (uipolar) 4mV/V (mV/V Max) ADJUSTMENTS (User Provided) 2μ/V/V (5μ/V/ Max) Gain ±1158 (Min) Offset ±10LS8 (Min) Gain ±1158 (Min) Offset ±10LS8 (Min) BipOL ±10LS8 (Min) BipOL ±10LS8 (Min) BipOL ±10LS8 (Min) BipOL ±10LS8 (Min)	Unipolar	Binary	
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OD TFOT NANGES O to +10V @ 10mA 0 to +10V @ 10mA ±2.5V @ 10mA ±2.5V @ 10mA ±2.5V @ 10mA ±10V @ 10mA	OUTPUT PANCES	$0 \pm 5V \otimes 10mA$	◆ 22 7 ◆ 2.01 MAX (51.1)
b 0 0 0 10 V 0 0 10 mA ±2.5 V 0 10 mA ±5V 0 10 mA ±10V 0 10 mA ±110V 0 10 mA ±1110V 0 10 mA ±1110V 0 10 mA ±1110V 0 0 10 mA ±1110V 0 0 10 mA ±1110V 0 0 0 mA ±1110V 0 0 0 mA ±1110V 0 0 0 mA ±2.0 pm/ 0 C (±12 ppm/ 0 C Max) ±1110V 10 0 C Storage -55° C to +100° C Storage -15V ±3% @ 27mA (30 mA Max)	OUTFUT RANGES	$0 to + 10 V \otimes 10 m \Lambda$	• 21 8 •
12.3 V ⊕ 10mA ±10V ⊕ 10mA ±10V ⊕ 10mA ±10V ⊕ 10mA ±10V ⊕ 10mA 5ET LLIGG TIME 0.020 SET LLIGG TIME 1.mAAR[TY ER]OIS TEMPERATURE COEFFICIENT Gain Unipolar Offset 1.1 u/V © (±) oµµ/' (C Max) 2.0 ppm/°C (±) 2ppm/°C (Max) 2.0 ppm/°C (±) 2ppm/°C (Max) 1.1 u/V © (±) oµµ/' (C Max) 2.0 ppm/°C (±) 2ppm/°C (Max) Differential Nonlinearity dt 2.0 spm/°C (±) 2ppm/°C (Max) TEMPERATURE RANGE Operating 0 to +70°C Storage -55° C to +100°C POWER REQUIREMENTS +15V ±3% ⊕ 27mA (30mA Max) +5V ±3% ⊕ 140mA (150mA Max) +5V ±3% ⊕ 170 V/V Max) Gain 4mV/V (7mV/V Max) Gain 4mV/V (7mV/V Max) Gain ±8155 B (Min) Offset		+2 5V @ 10m A	
±5 V @ 10mA DUTTUT/MPEDANCE 0.02Ω SET LLING TIME 2.0µs (3.0µc Max) to 0.01% ¹ LINKAARTY ERLOR ±3LS6 TEMBERATURE COEFFICTENT 8.0ppm² C (10ppm² C Arather Strenge) Gain ±1 kV C (2.6) 6µt /² C Max) Differential Nonlinearity ±2.8ppm² C (±3.0ppm² C Max) TEMPERATURE RANGE 0 to +70° C Operating 0 to +70° C Storage -55° C to +100° C POWER REQUIREMENTS +15V ±3% @ 27mA (30mA Max) -15V ±3% @ 27mA (30mA Max) Birs in strailed only in shaded hole scattors. Module weight: 1.6 ounces (45 grams) All pins are gold plated half-hard brass. 10/025mm/ C (±3.0ppm² C (±3.0ppm² C Max)) TEMPERATURE RANGE Operating 0 to +70° C Storage -55° C to +100° C POWER SUPPLY SENSITIVITY ³ Birs in strail Gain 4mV/V (7mV/V Max) Birs in strail Offset (inpolar) 4mV/V (7mV/V Max) Birs in strail ADJUSTMENTS (User Provided) £R15K (Min) 5W Y 5W Y Gain ±R15K (Min) 5W Y 5W Y Offset			15 14
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DUTUT/MPEDANCE 0.0212 DUTUT/MPEDANCE 0.0212 SET LING TIME 0.0212 SET LING TIME 0.0019 0.0019 ¹ TEMERATURE COEFFICIENT Gain 1.1.2.56 Unipolar Offset Bipolar Offset 1.1.60, opprof C (10pprof C (4ax)) ±1.8.0pprof C (±3.0pprof C (4ax)) ±2.6prom C (±3.2pprof C Max) Differential Nonlinearity 2.6prom C (±3.0pprof C Max) TEMPERATURE RANGE Operating 0 to +70°C Storage -55°C to +100°C POWER REQUIREMENTS +15V ±3% @ 32mA (37mA Max) -15V ±3% @ 27mA (30mA Max) +5V ±3% @ 140mA (150mA Max) 0ffset (unipolar) 4mV/V (7mV/V Max) Offset (unipolar) 4mV/V (7mV/V Max) Offset (unipolar) 4mV/V (7mV/V Max) Offset (1-9) \$159 ADJUSTMENTS (User Provided) Gain ±8LSB (Min) Offset (1-9) PRICE (1-9) Storage 5159 NOTE: Terminal pins installed only in shaded hole locations. Module weight: 1.6 ounces (45 grams) All pins are gold plated half-hard brass. Module weight: 1.6 ounces (45 grams) All pins are gold plated half-hard brass. Module weight: 1.6 ounces (45 grams) MIL C-45204), 0.019'' 10.001'' (0.483) #0.025mm) dia TEMPERATURE RANGE Operating 0 to +70°C Storage -55°C to +100°C POWER SUPPLY SENSITIVITY ³ Gain 4mV/V (7mV/V Max) Offset (bipolar) 4mV/V (7mV/V Max) Offset ±10LSB (Min) Offset ±10LSB (Mi	$\left(\bigcap \right) \cap$	±10V @ 10mA	
SETTING TIME 20 µs (3 0µe Max) to 0.01% ⁴ TEMPERATURE COEVFICIENT 38.0 ppm ² C (10ppm ² C 4ax) Gain 48.0 ppm ² C (10ppm ² C 4ax) Temperature COEVFICIENT 48.0 ppm ² C (10ppm ² C 4ax) Temperature CoevFicient 1.6 ounces (45 grans) All pins are gold plated half-hard brass, MIL-G-45204), 0.01" $\pm 0.001"$ (0.483 2.0025mm ³ C (43.2ppm ² C 4ax) Differential Nonlinearity 2.8 ppm ² C (± 12 ppm ² C 4ax) TEMPERATURE RANGE Operating 0 to $\pm 70^{\circ}$ C Storage $\pm 55^{\circ}$ C to $\pm 100^{\circ}$ C Storage $\pm 50^{\circ}$ C to $\pm 100^{\circ}$ C Storage $\pm 100^{\circ}$ C to $\pm 10^{\circ}$ C Storage $\pm 100^{\circ}$ C to $\pm 10^{\circ}$ C to	OUTFUT IMPEDANCE	0.02\$2	NOTE:
LINEARTY ERGOR ± ±LSR TEMPERATURE COEFFICIENT Gain 18.0ppx/°C (±10ppm°C Max) f Rearing Unipolar Offset ±14uV°C (±3/2ppm/°C Max) t1 4uV°C (±3/2ppm/°C Max) Differential Nonlinearity ±2.8ppm/°C (±3/2ppm/°C Max) TEMPERATURE RANGE Operating 0 to +70°C Storage -55°C to +10°°C POWER REQUIREMENTS +15V ±3% @ 32mA (37mA Max) +5V ±3% @ 140mA (150mA Max) TSV ±3% @ 140mA (150mA Max) +5V ±3% @ 140mA (150mA Max) 0 ffset (unipolar) 4mV/V (7mV/V Max) Reference 2 μ V/V (5 μ V/V Max) Metades and the store and the sto	SETTLING TIME	2.0μs (3.0μs Max) to 0.01% ¹	Terminal pins installed only in shaded hole
TEMPERATURE COEFFICTENT Gain 48.0ppn/°C (110ppn °C / tax) H Realing Unipolar Offset 11 uV °C ($\pm 36\mu$ /°C ($\pm 30\mu$ /°C / C Max) $\pm 11 uV$ °C ($\pm 30\mu$ /°C ($\pm 30\mu$ /°C / C Max) $\pm 2.8ppm °C (\pm 3.0ppn) °C (Max)$ Differential Nonlinearity $\pm 2.8ppm °C (\pm 3.0ppn) °C Max$) TEMPERATURE RANGE Operating 0 to +70 °C Storage -55 °C to +100 °C $\pm 15V \pm 3\% @ 2TmA (30mA Max)$ $\pm 5V \pm 3\% @ 2TmA (30mA Max)$ $\pm 5V \pm 3\% @ 2TmA (30mA Max)$ $\pm 5V \pm 3\% @ 140mA (150mA Max)$ $\pm 5V \pm 3\% @ 140mA (150mA Max)$ $\pm 5V \pm 3\% @ 140mA (150mA Max)$ = 4WV/V (7mV/V Max) = 780000 + 100000 + 10000 + 10000 + 1000000 + 1000000 + 100000 + 100000 + 100000 + 1000000 + 1000000 + 1000000 + 1000000 + 1000000 + 1000000 + 10000000 + 100000000	LINEARITY ERFOR	±½LSB	locations.
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$\begin{array}{c} \text{Gain} \\ \text{Unipolar Offset} \\ \text{Bipolar Offset} \\ \text{Bipolar Offset} \\ \text{Bipolar Offset}^2 \\ \text{Differential Nonlinearity} \\ \text{Z2.8ppm/}^{\circ}C (\pm 3.2ppm/C C Max) \\ \text{Differential Nonlinearity} \\ \text{Z2.8ppm/}^{\circ}C (\pm 3.2ppm/C Max) \\ \text{Differential Nonlinearity} \\ \text{Z2.8ppm/}^{\circ}C (\pm 1.2ppm/^{\circ}C Max) \\ \text{TEMPERATURE RANGE} \\ \text{Operating} \\ \text{Oto +70^{\circ}C} \\ \text{Storage} \\ \text{-55^{\circ}C to +100^{\circ}C} \\ \text{Storage} \\ \text{-55^{\circ}C to +100^{\circ}C} \\ \text{Storage} \\ \text{-55^{\circ}C to +100^{\circ}C} \\ \text{Storage} \\ \text{-15V } \pm 3\% @ 32mA (37mA Max) \\ \text{How } \\ \text{Str 3\% @ 140mA (150mA Max)} \\ \text{How } \\ \text{Str 3\% @ 140mA (150mA Max)} \\ Bir 3 to 3 t$	Gain	t8 0ppp/°C (\$10ppm/°C Mar)	All pins are gold plated half-hard brass,
Unipolar Offset Bipolar Offset Bipolar Offset Bipolar Offset Differential Nonlinearity Reference Voltage t5ppm/°C (±3.0ppm/°C Max) t2.8ppm/°C (±3.0ppm/°C Max) of Full Scale t5ppm/°C (±12ppm/°C Max) TEMPERATURE RANGE Operating Storage t5°°C to +100°C Storage t5°°C to +100°C to to +15° to to t		of Reading	milL-G-45204), 0.019 ±0.001 (0.483
$\begin{array}{c} \text{Chipplar Offset}^{\text{C}} & = 12.6^{\circ}\text{POM}^{\circ}\text{C}(4)^{\circ}\text{Diff}^{\circ}\text{C}^{\text{C}}\\ \text{Bipolar Offset}^{2} & \pm 2.6^{\circ}\text{pm}^{\circ}\text{C}(\pm 3.0^{\circ}\text{pm}^{\circ}\text{C}^{\circ}\text{Max})\\ \text{Differential Nonlinearity} & \pm 2.8^{\circ}\text{pm}^{\circ}\text{C}(\pm 3.0^{\circ}\text{pm}^{\circ}\text{C}^{\circ}\text{Max})\\ \text{TEMPERATURE RANGE} & \text{of Full Scale} & \\ \text{Operating} & 0 \text{ to } +70^{\circ}\text{C}\\ \text{Storage} & -55^{\circ}\text{C} \text{ to } +100^{\circ}\text{C}\\ \text{POWER REQUIREMENTS} & +15V \pm 3\% @ 32\text{mA}(37\text{mA Max}) & \\ & +5V \pm 3\% @ 27\text{mA}(30\text{mA Max}) & \\ & +5V \pm 3\% @ 140\text{mA}(150\text{mA Max}) & \\ \text{Offset} (\text{unipolar}) & 4\text{mV/V}(7\text{mV/V Max}) & \\ \text{Offset} (\text{unipolar}) & 4\text{mV/V}(7\text{mV/V Max}) & \\ \text{Offset} (\text{bipolar}) & 4\text{mV/V}(7\text{mV/V Max}) & \\ \text{Reference} & 2\mu \text{V/V}(5\mu \text{V/V} \text{Max}) & \\ \text{Offset} & \pm 10\text{LSB}(\text{Min}) & \\ \text{Offset} & \pm 10\text{LSB}(\text{Min}) & \\ \text{Offset} & \pm 10\text{LSB}(\text{Min}) & \\ \text{Offset} & (1-2) & \\ \text{Storage} & \\ \text{Storage} & \\ \text{Multiplate} & \\ \text{Storage} & \\ \text{Constraint} & \\ \text{Storage} & \\ \\ \text{Storage} & \\ \text{Storage} & \\ \text{Storage} & \\ \\ \text{Storage} & \\ \text{Storage} & \\ \\ \\ \\ \text{Storage} & \\ \\ \\ \\ \text{Storage} & \\ \\ \\ \\ \\ \text{Storage} & \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	Unipolar Offset	$+13 \mu V$ °C (+16 μV /°C Max)	For plug-in mounting card order Board
Differential Nonlinearity Differential Nonlinearity E2.05Ppm/°C (±3.0ppm/°C Max) TEMPERATURE RANGE Operating Storage 0 to +70°C Storage 0 to +70°C Storage 0 to +70°C Storage -55°C to +100°C POWER REQUIREMENTS +15V ±3% @ 32mA (37mA Max) -15V ±3% @ 27mA (30mA Max) +5V ±3% @ 140mA (150mA Max) BIT 8 14 BIT 8 15 BIT 8 14 BIT 8 14	Pipelar Offset ²	+2 subm C (+3 2 num C Max)	No. AC1506 @ \$30.
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Differential Nonlineerity	+2.8ppm/C(+2.0ppm/C Max)	
Reference Voltage $\pm 5ppm/^{\circ}C (\pm 12ppm/^{\circ}C Max)$ TEMPERATURE RANGE Operating 0 to $\pm 70^{\circ}C$ Storage $\pm 55^{\circ}C$ to $\pm 100^{\circ}C$ POWER REQUIREMENTS $\pm 15V \pm 3\%$ @ 32mA (37mA Max) $\pm 15V \pm 3\%$ @ 27mA (30mA Max) $\pm 5V \pm 3\%$ @ 140mA (150mA Max) BIT 5 II BIT 5 III BIT 5 III	Differential Nonlinearity	of Full Scale	
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TEMPERATORE KANGEOperating 0 to $+70^{\circ}C$ Storage $-55^{\circ}C$ to $+100^{\circ}C$ POWER REQUIREMENTS $+15V \pm 3\% @ 32mA (37mA Max)$ $-15V \pm 3\% @ 27mA (30mA Max)$ $BIT 8 14$ $+5V \pm 3\% @ 140mA (150mA Max)$ $BIT 8 17$ $+5V \pm 3\% @ 140mA (150mA Max)$ $BIT 8 17$ $+5V \pm 3\% @ 140mA (150mA Max)$ $BIT 8 17$ $BIT 8 14$ $BIT 8 17$ $POWER SUPPLY SENSITIVITY3BIT 8 14Gain4mV/V (7mV/V Max)Offset (unipolar)4mV/V (7mV/V Max)ADJUSTMENTS (User Provided)4mV/V (5\mu V/V Max)Gain\pm 8LSB (Min)Offset\pm 10LSB (Min)FRICE (1-9)159	TEMPEDATURE DANCE	=5ppin/ C (=12ppin/ C max)	
Operating $= -55^{\circ}C$ to $\pm 100^{\circ}C$ Storage $= -55^{\circ}C$ to $\pm 100^{\circ}C$ POWER REQUIREMENTS $\pm 15V \pm 3\%$ @ $32mA$ ($37mA$ Max) $= 15V \pm 3\%$ @ $27mA$ ($30mA$ Max) $= -15V \pm 3\%$ @ $27mA$ ($30mA$ Max) $= 15V \pm 3\%$ @ $140mA$ ($150mA$ Max) $= 15V \pm 3\%$ @ $140mA$ ($150mA$ Max) $= 15V \pm 3\%$ @ $140mA$ ($150mA$ Max) $= 15V \pm 3\%$ @ $140mA$ ($150mA$ Max) $= 15V \pm 3\%$ @ $140mA$ ($150mA$ Max) $= 15V \pm 3\%$ @ $140mA$ ($150mA$ Max) $= 15V \pm 3\%$ @ $140mA$ ($150mA$ Max) $= 15V \pm 3\%$ @ $140mA$ ($150mA$ Max) $= 15V \pm 3\%$ $= 000000000000000000000000000000000000$	Operating	$0 to +70^{\circ}C$	
Storage55 G tot 1100 CPOWER REQUIREMENTS $+15V \pm 3\%$ @ 32mA (37mA Max) $-15V \pm 3\%$ @ 27mA (30mA Max) $-15V \pm 3\%$ @ 27mA (30mA Max) $BIT5 11$ $+5V \pm 3\%$ @ 140mA (150mA Max) $BIT5 11$ $+5V \pm 3\%$ @ 140mA (150mA Max) $BIT 3 10$ $+5V \pm 3\%$ @ 140mA (150mA Max) $BIT 3 10$ <td>Storage</td> <td>-55°C to $\pm 100^{\circ}$C</td> <td></td>	Storage	-55° C to $\pm 100^{\circ}$ C	
POWER REQUIREMENTS $\pm 15 \sqrt{25\%} \oplus 52 \text{ IIA} (57 \text{ IIA} \text{ Max}) \oplus 17 5 \text{ II} \\ \pm 15 \sqrt{25\%} \oplus 27 \text{ mA} (30 \text{ mA} \text{ Max}) \oplus 17 5 \text{ II} \\ \pm 5 \sqrt{23\%} \oplus 140 \text{ mA} (150 \text{ mA} \text{ Max}) \oplus 17 5 \text{ II} \\ \oplus 15 \sqrt{23\%} \oplus 140 \text{ mA} (150 \text{ mA} \text{ Max}) \oplus 17 5 \text{ II} \\ \oplus 15 \sqrt{23\%} \oplus 140 \text{ mA} (150 \text{ mA} \text{ Max}) \oplus 17 5 \text{ II} \\ \oplus 15 \sqrt{23\%} \oplus 140 \text{ mA} (150 \text{ mA} \text{ Max}) \oplus 17 5 \text{ II} \\ \oplus 15 \sqrt{23\%} \oplus 140 \text{ mA} (150 \text{ mA} \text{ Max}) \oplus 17 5 \text{ II} \\ \oplus 15 \sqrt{23\%} \oplus 140 \text{ mA} (150 \text{ mA} \text{ Max}) \oplus 17 5 \text{ II} \\ \oplus 15 \sqrt{2} \text{ mV} (7 \text{ mV} \text{ mV} \text{ mA} \text{ mAx}) \oplus 17 5 \text{ II} \\ \oplus 15 \sqrt{2} \text{ mV} (7 \text{ mV} \text{ mV} \text{ mA} \text{ mV} \text{ mV} (7 \text{ mV} \text{ mV} \text{ max}) \oplus 10 \text{ mV} \text{ mV} (7 \text{ mV} \text{ mV} \text{ max}) \oplus 10 \text{ mV} \text{ mV} (7 \text{ mV} \text{ mV} \text{ max}) \oplus 10 \text{ mV} (7 \text{ mV} \text{ mV} \text{ max}) \oplus 10 \text{ mV} (7 \text{ mV} \text{ mV} \text{ max}) \oplus 10 \text{ mV} (7 \text{ mV} \text{ mV} \text{ max}) \oplus 10 \text{ mV} \text{ mV} (7 \text{ mV} \text{ mV} \text{ max}) \oplus 10 \text{ mV} \text{ mV} (7 \text{ mV} \text{ mV} \text{ max}) \oplus 10 \text{ mV} \text{ mV} (7 \text{ mV} \text{ mV} \text{ max}) \oplus 10 \text{ mV} \text{ mV} (7 \text{ mV} \text{ mV} \text{ mx}) \oplus 10 \text{ mV} \text{ mV} (7 \text{ mV} \text{ mV} \text{ mx}) \oplus 10 \text{ mV} \text{ mV} (7 \text{ mV} \text{ mX}) \oplus 10 \text{ mV} \text{ mV} \text{ mV} (7 \text{ mV} \text{ mX}) \oplus 10 \text{ mV} \text{ mV} \text{ mV} (7 \text{ mV} \text{ mX}) \oplus 10 \text{ mV} \text{ mV} \text{ mV} \text{ mV} (7 \text{ mV} \text{ mX}) \oplus 10 \text{ mV} \text{ mV} \text{ mV} \text{ mV} (7 \text{ mV} \text{ mX}) \oplus 10 \text{ mV} \text{ m} \text{ mV} \text{ mV} \text{ mV} \text{ m} \text{ mV} \text{ m} \text{ mV} \text{ m} \text{ mV} \text{ m} \text{ m} \text{ m} \text{ mV} \text{ m} m$		+15V +2% @ 22mA (27mA Max	
$\frac{-15 \vee \pm 3\% \oplus 27 \text{ mA} (30 \text{ mA} \text{ max})}{+5 \vee \pm 3\% \oplus 140 \text{ mA} (150 \text{ mA} \text{ max})} \text{ Bit 5 11} \\ +5 \vee \pm 3\% \oplus 140 \text{ mA} (150 \text{ mA} \text{ max})} \text{ Bit 7 10} \\ \text{Bit 39} \\ \text{Gain} & 4 \text{mV/V} (7 \text{mV/V} \text{ Max}) \\ \text{Offset} (\text{unipolar}) & 4 \text{mV/V} (7 \text{mV/V} \text{ Max}) \\ \text{Offset} (\text{bipolar}) & 4 \text{mV/V} (7 \text{mV/V} \text{ Max}) \\ \text{Reference} & 2 \mu \text{V/V} (5 \mu \text{V/V} \text{ Max}) \\ \text{ADJUSTMENTS} (\text{User Provided}) \\ \text{Gain} & \pm 8 \text{LSB} (\text{Min}) \\ \text{Offset} & \pm 10 \text{LSB} (\text{Min}) \\ \text{Offset} & \pm 10 \text{LSB} (\text{Min}) \\ \text{Offset} & \pm 10 \text{LSB} (\text{Min}) \\ \text{Min} & \text{KEY K} \\ \text{PRICE} (1-9) & \$159 \\ \end{array}$	POWER REQUIREMENTS	$+15V \pm 5\% @ 52mA (57mA Max)$	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		$-15V \pm 3\% @ 27 mA (50 mA Max)$	BIT 5 11 0 INPUT REGISTER 0 18 LSB
POWER SUPPLY SENSITIVITYBIT 3 GI.C. DIGITAL COMMALOG CONVERTER21 BIPOLAR OFFSETGain $4mV/V (7mV/V Max)$ BIT 2 8Offset (unipolar) $4mV/V (7mV/V Max)$ MSB 7Offset (bipolar) $4mV/V (7mV/V Max)$ STROBE 6Reference $2\mu V/V (5\mu V/V Max)$ GND 5ADJUSTMENTS (User Provided) $+5V 3$ Gain $\pm 8LSB (Min)$ Offset $\pm 10LSB (Min)$ Offset $\pm 10LSB (Min)$ PRICE (1-9)\$159		+5 V ±3% @ 140mA (150mA Ma	
Gain $4mV/V (7mV/V Max)$ MSB 7CONVERTEROFFSETOffset (unipolar) $4mV/V (7mV/V Max)$ MSB 7 $5K\Omega$ $5K\Omega$ $5K\Omega$ $2 GAIN ADJ.$ Offset (bipolar) $4mV/V (7mV/V Max)$ $5ROBE 6$ $0 F SET$ $2 GAIN ADJ.$ $2 ZOV$ Reference $2 \mu V/V (5 \mu V/V Max)$ $6ND 5$ $0 F SET$ $2 GAIN ADJ.$ $2 ZOV$ ADJUSTMENTS (User Provided) $+5V 3$ $+15V 2$ $-+5V 0$ $-+5V 0$ $2 F REF. 0UT$ $2 S REF. 0UT$ Gain $\pm 8LSB (Min)$ $-15V 1$ $15V 0$ $REF 0$ $2 OF FSET$ $2 OF FSET$ PRICE (1-9)\$159 5159 $-15V 0$ <	POWER SUPPLY SENSITIVITY	(*	BIT 2 8 0 21 BIPOLAR
Offset (unipolar) $4mV/V (7mV/V Max)$ MSB 7STROBE 69950022 GAIN ADJ.Offset (bipolar) $4mV/V (7mV/V Max)$ $5K0 \pm 5K0 $	Gain	4mV/V ($7mV/V$ Max)	CONVERTER
Offset (bipolar) $4mV/V (7mV/V Max)$ $3HOBE B$	Offset (unipolar)	4mV/V ($7mV/V$ Max)	MSB 7 ΟΟ 22 GAIN ADJ.
Reference $2 \mu V/V (5 \mu V/V Max)$ ADJUSTMENTS (User Provided)+5V 3Gain±8LSB (Min)Offset±10LSB (Min)PRICE (1-9)\$159	Offset (bipolar)	4mV/V ($7mV/V$ Max)	GND 5 0- 5kΩ 5kΩ 24 10V
ADJUSTMENTS (User Provided) Gain $\pm 8LSB$ (Min) $\pm 10LSB$ (Min) $\pm 5V_3$ $\pm 10LSB$ (Min) $\rightarrow 5V_3$ $\pm 10LSB$ (Min) $\rightarrow -15V_4$ $KEY K$ $\rightarrow -15V_6$ $\rightarrow -15V_6$ 26 ANALOG CUT 27 SUM JUNCT.PRICE (1-9)\$159	Reference	$2\mu\text{V/V}$ (5 $\mu\text{V/V}$ Max)	25 REF. OUT
Gain $\pm 8LSB$ (Min) $-15V$ $+10V$ 27 SUM JUNCT.Offset $\pm 10LSB$ (Min) $-15V$ $-15V$ eF eF 27 SUM JUNCT.PRICE (1-9)\$159\$159 eF eF eF eF eF eF	ADJUSTMENTS (User Provided)	+5V 3 0-+5V 26 ANALOG CUT
Offset $\pm 10LSB$ (Min) PRICE (1-9) $\$159$	Gain	±8LSB (Min)	-15V 1 0
PRICE (1-9) $$159$ $= 5.1k\Omega = 2.2M\Omega$	Offset	±10LSB (Min)	KEY K O ADJUST
TINING TA CC WARZ	PRICE $(1-9)$	\$159	= 5.1kΩ 2.2MΩ

 1 For a 10V step. 2 These figures include the effects of Reference Voltage Temperature Drift. 3 For ±15V supplies only with +15V and -15V supplies tracking.

Specifications subject to change without notice.

Applying the DACHS

DIGITAL INPUT DATA

All digital inputs to the DAC1132 are fully DTL/TTL compatible. The 12 data inputs (pins 7–18) each represent one standard TTL load and the STROBE (pin 6) represents two TTL loads. The converter uses Binary input code to produce unipolar outputs and Offset Binary code to produce bipolar outputs.

Provided that certain timing requirements are met, data appearing at the converter's input terminals is loaded into the register by the positive-going edge of the strobe pulse. Figure 1 illustrates the required strobe timing.



OUTPUT CONNECTIONS

Figure 2, below, shows the output configuration of the DAC1132 in simplified form.



Figure 2. Output Circuit Block Diagram

External jumper connections determine whether the DAC1132 will be a unipolar or a bipolar device. Figures 3a and 3b below show the proper connections for both configurations.





The two $5k\Omega$ feedback resistors associated with the op amp of Figure 2 are used to determine the output voltage range. Serial and parallel combinations of these resistors yield three different resistance values. Table 1 shows the feedback connections used to obtain the various output voltage ranges.

Output Range		Pins Jumpered Together	
Unipolar Units	Bipolar Units	Pin 26 To:	Pin 23 To:
±2.5V	0 to +5V	24	27
±5.0V	0 to +10V	24	
$\pm 10V$		23	

Table 1. Range Programming Table

INPUT-OUTPUT RELATIONSHIPS

Table 2 and Table 3 list the analog outputs associated with various digital inputs for unipolar and bipolar units respectively.



Table 3. Bipolar Input-Output Relationships

GAIN, AND OFFSET ADJUSTMENTS

The gain and offset adjustments are made with two external potentiometers which the user supplies. With certain digital inputs applied, these potentiometers are adjusted until the desired output voltage is obtained. The voltmeter used to measure the output must be capable of clear and stable resolution of 1/10LSB in the region of zero and full scale. The adjustment procedure, described below, should be carefully followed to assure optimum converter performance.

The proper connection for the offset potentiometer was shown in Figures 3a and 3b. The gain potentiometer should be connected as shown below in Figure 4.



Figure 4. Gain Adjustment Connection

For unipolar units apply a digital input of 00000000000 and adjust the offset potentiometer until an output of $0V \pm 1/10LSB$ is obtained.

For bipolar units apply a digital input of 00000000000 and adjust the offset potentiometer until the negative full scale output shown in Table 3 is obtained within $\pm 1/10$ LSB.

Once the appropriate offset adjustment has been made, apply a digital input of 111111111111. Adjust the gain potentiometer until the positive full scale output shown in Table 2 or Table 3 is obtained within $\pm 1/10$ LSB.

POWER SUPPLY AND GROUNDING CONNECTIONS

The proper power supply and grounding connections are shown below in Figure 5.



the ±15V and +5V power inputs. Under normal droub stances, no external bypass capacitors are needed.

REFERENCE OUTPUT

The +10V reference output (pin 25) is used to set the converter's gain as shown in Figure 4 and to provide the offset for bipolar devices as shown in Figure 3. It may also be used to provide a reference voltage for other circuits in the user's system provided that the output current is limited. No more than 1.5mA should be drawn from bipolar devices and no more than 2.5mA should be drawn from unipolar devices. Excessive current drain will degrade the converter's analog output and could damage the internal reference source.

THE AC1506 MOUNTING CARD

The AC1506 mounting card is available to assist in the application of the DAC1132. This $4.5'' \ge 3.0''$ printed circuit card, shown below in Figure 6, has sockets which allow a DAC1132 to be plugged directly onto it. It includes the necessary gain, and offset adjustment potentiometers and it mates with a Cinch 250-22-30-170 (or equivalent) edge connector which is supplied with every card.





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The output voltage range is programmed by means of jumpers which the user installs as shown in Figure 7.



OUTPUT VOLTAGE RANGE	JUMPER CONNECTION	
0 to +10V	A - C	
0 to +5V	A - C, F - H	
±2.5V	D - E, A - C, F - H	
±5V	D-E, A-C	
<u>±10V</u>	A - B, D - E	

Figure 7. AC1506 Range Programming

n connectio shown below in Table p Pin Designation Pin Desig ation N A MSR Bit 1 Bit 2 P B N.C. C Bit 3 N.C D Bit 4 S Groun Ε Bit 5 Т Ref. Out. F Bit 6 U Analog Out. Η Bit 7 V Strobe W Bit 8 +5V I K Bit 9 х +15V Bit 10 Y -15V L Μ Bit 11 Z Ground

Table 4. AC1506 Pin Designations

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