

Microprocessor-Compatible 12-BIT DIGITAL-TO-ANALOG CONVERTER

FEATURES

- SINGLE INTEGRATED CIRCUIT CHIP
- MICROCOMPUTER INTERFACE: DOUBLE-BUFFERED LATCH
- VOLTAGE OUTPUT: ±10V, ±5V, +10V
- MONOTONICITY GUARANTEED OVER TEMPERATURE
- ±1/2LSB MAXIMUM NONLINEARITY OVER TEMPERATURE
- GUARANTEED SPECIFICATIONS AT ±12V AND ±15V SUPPLIES
- TTL/5V CMOS-COMPATIBLE LOGIC INPUTS

DESCRIPTION

The DAC811 is a complete, single-chip integratedcircuit, microprocessor-compatible, 12-bit digital-toanalog converter. The chip combines a precision voltage reference, microcomputer interface logic, and double-buffered latch, in a 12-bit D/A converter with a voltage output amplifier. Fast current switches and a laser-trimmed thin-film resistor network provide a highly accurate and fast D/A converter.

Microcomputer interfacing is facilitated by a doublebuffered latch. The input latch is divided into three 4-bit nibbles to permit interfacing to 4-, 8-, 12-, or 16-bit buses and to handle right-or left-justified data. The 12-bit data in the input latches is transferred to the D/A latch to hold the output value. Input gating logic is designed so that loading the last nibble or byte of data can be accomplished simultaneously with the transfer of data (previously stored in adjacent latches) from adjacent input latches to the D/A latch. This feature avoids spurious analog output values while using an interface technique that saves computer instructions.

The DAC811 is laser trimmed at the wafer level and is specified to $\pm 1/4$ LSB maximum linearity error (B, K, and S grades) at 25°C and $\pm 1/2$ LSB maximum over the temperature range. All grades are guaranteed monotonic over the specification temperature range.

The DAC811 is available in six performance grades and three package types. DAC811J and K are specified over the temperature ranges of 0°C to +70°C; DAC811A and B are specified over -25°C to +85°C; DAC811R and S are specified over -55°C to +125°C. DAC811J and K are packaged in a reliable 28-pin plastic DIP or plastic SOIC package, while DAC811A, B, R and S are available in a 28-pin 0.6" wide dualinline hermetically sealed ceramic side-brazed package (H package).



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勝特力材料 886-3-5753170 胜特力电子(上海) 86-21-54151736 胜特力电子(深圳) 86-755-83298787 Http://www.100y.com.tw

SPECIFICATIONS At $T_A = +25^{\circ}C. \pm V_{CC} = 12V$ or 15V, unless otherw	vise note	ed.					1	房 胜年 胜年	村 寺力日 寺力日 Http	电子(L 电子(L ://w	イイ・ 上海) 采圳) WW.	86-2 86-7 100y.	1-54151736 55-83298787 com. tw
WWW. OV.COM.TW	DA	C811AH, J	P, JU	DAC8	11BH, I	KP, KU	D	AC8111	RH	D	AC8115	SH	W.C.M.
PARAMETER	MIN	ТҮР	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
DIGITAL INPUT Resolution Codes ⁽¹⁾ Digital Inputs Over Temperature Range ⁽²⁾	N	USB, BOB	12	.100	*	*	TN.	*	*	NN NN	*	*	Bits
V_{IH} V_{IL} $I_{IH}, V_{I} = +2.7V$ $I_{IL}, V_{I} = +0.4V$	+2 0		+15 +0.8 +10 ±20	*	00X	* * * *	*	N N	* * *	* *	NN	* * *	VDC VDC μA μA
Digital Interface Timing Over Temperature Range t_{WP} , \overline{WR} Pulse Width $t_{AW}1$, $\overline{N_X}$ and \overline{LDAC} Valid to End of \overline{WR} t_{DW} , Data Valid to End of \overline{WR} t_{DH} , Data Valid Hold Time	50 50 80 0	N N	V	* * *	1.10 N.1	7.C	* * * +10	1.Т М.Т		* * * *	W		ns ns ns
ACCURACY Linearity Error Differential Linearity Error Gain Error ⁽³⁾ Offset Error ^(3, 4) Monotonicity Power Supply Sensitivity: +V _{CC} -V _{CC} V _{DD}		±1/4 ±1/2 ±0.1 ±0.05 Guaranteed ±0.001 ±0.002 ±0.0005	$\begin{array}{c} \pm 1/2 \\ \pm 3/4 \\ \pm 0.2 \\ \pm 0.15 \\ d \\ \pm 0.003 \\ \pm 0.006 \\ \pm 0.0015 \end{array}$	A A A	±1/8 ±1/4 * * * *	±1/4 ±1/2 * * *	¥.C 0¥.C 00¥. 100	±1/4 ±1/2 * * * *	±1/2 ±3/4 * * *	LM M	±1/8 ±1/4 * * * *	±1/4 ±1/2 * * *	LSB LSB % % of FSR ⁽⁵⁾ % of FSR/%V _{CC} % of FSR/%V _{CC} % of FSR/%V _{DL}
DRIFT (Over Specification Temperature Range) Gain Unipolar Offset Bipolar Zero Linearity Error Over Temperature Range Monotonicity Over Temperature Range	007. 1003 1003	±10 ±5 ±5 ±1/2 Guaranteed	±30 ±10 ±10 ±3/4		±10 ±5 ±5 ±1/4 *	±20 ±7 ±7 ±1/2	1.10 N.1 NN	±15 ±5 ±5 ±1/2 *	±30 ±10 ±10 ±3/4	<u>и.т</u> М. ^т	±15 ±5 ±5 ±1/4 *	±30 ±7 ±7 ±1/2	ppm/°C ppm of FSR/°C ppm of FSR/°C LSB
SETTLING TIME ⁽⁶⁾ (to within ±0.01% of FSR of For Full Scale Range Change, 20V Range 10V Range For 1LSB Change at Major Carry ⁽⁷⁾ Slew Rate ⁽⁶⁾	Final Va	alue; 2kΩ l 3 3 1 12	oad) 4 4	*	* * *	* *	*	* * *	*	.00 .00 .*	* * *	*	μs μs μs V/μs
ANALOG OUTPUT Voltage Range $(\pm V_{CC} = 15V)^{(8)}$: Unipolar Bipolar Output Current Output Impedance (at DC) Short Circuit to Common Duration	±5	0 to +10 ±5, ±10 0.2 Indefinite	x.CON	* 01.1	* * *		*	* * *	41.10 1.10 1.10	*	* * *		V V mA Ω
REFERENCE VOLTAGE Voltage Source Current Available for External Loads Temperature Coefficient Short Circuit to Common Duration	+6.2 +2	+6.3 ±10 Indefinite	+6.4 ±30	*	* ±10 *	* ±20	*	* ±10 *	* ±30	*	* ±10 *	* ±20	V mA ppm/°C
POWER SUPPLY REQUIREMENTS Voltage: $+V_{CC}$ $-V_{CC}$ V_{DD} Current (no load): $+V_{CC}$ $-V_{CC}$ V_{DD} Potential at DCOM with Respect to ACOM ⁽⁹⁾ Power Dissipation	+11.4 -11.4 +4.5	+15 -15 +5 +16 -23 +8 ±0.5 625	+16.5 -16.5 +5.5 +25 -35 +15 800	* *	******	*****	* * *	* * * * *	******	* * *	* * * * * *	*****	VDC VDC VDC mA mA MA V W mW
TEMPERATURE RANGE Specification: J, K A, B R, S	0 -25 -65		+70 +85 +150	* *	00%	* *	* *	L.M.	* *	* * *		* *	°C ℃ ℃
Storage: J, K A, B, R, S	-60 -65		+100 +150	*	100	*	-55 * *		+125 * *	* * *		* *	0° 0° 0°

* Specification same as DAC811AH.

NOTES: (1) USB = unipolar straight binary; BOB = bipolar offset binary. (2) TTL, LSTTL and 54/74 HC compatible. (3) Adjustable to zero with external trim potentiometer. (4) Error at input code 000₁₆ for both unipolar and bipolar ranges. (5) FSR means full scale range and is 20V for the ±10V range. (6) Maximum represents the 3σ limit. Not 100% tested for this parameter. (7) At the major carry, 7FF₁₆ to 800₁₆ and 800₁₆ to 7FF₁₆. (8) Minimum supply voltage required for ±10V output swing is ±13.5V. Output swing for ±11.4V supplies is at least -8V to +8V. (9) The maximum voltage at which ACOM and DCOM may be separated without affecting accuracy specifications.



PIN DESCRIPTIONS

PIN	NAME	FUNCTION				
_1<	+V _{DD}	Logic supply, +5V.				
2	WR	Write, command signal to load latches. Logic low loads latches.				
3	LDAC	Load D/A converter, enables \overline{WR} to load the D/A latch. Logic low enables.				
4	N _A	Nibble A, enables \overline{WR} to load input latch A (the most significant nibble). Logic low enables.				
5	N _B	Nibble B, enables $\overline{\text{WR}}$ to load input latch B. Logic low enables.				
6	N _C	Nibble C, enables \overline{WR} to load input latch C (the least significant nibble). Logic low enables.				
7	D ₁₁	Data bit 12, MSB, positive true.				
8	D ₁₀	Data bit 11.				
9	D ₉	Data bit 10.				
10	D ₈	Data bit 9.				
11	D ₇	Data bit 8.				
12	D ₆	Data bit 7.				
13	D ₅	Data bit 6.				
14	D4	Data bit 5.				
15	DCOM	Digital common, V _{DD} supply return.				
16	D ₀	Data bit 1, LSB.				
17	D ₁	Data bit 2.				
18	D ₂	Data bit 3.				
19	D ₃	Data bit 4.				
20	+V _{CC}	Analog supply input, +15V or +12V.				
21	-V _{CC}	Analog supply input, -15V or -12V.				
22	Gain Adj	To externally adjust gain.				
23	ACOM	Analog common, $\pm V_{CC}$ supply return.				
24	V _{OUT}	D/A converter voltage output.				
25	10V Range	Connect to pin 24 for 10V range.				
26	SJ	Summing junction of output amplifier.				
27	BPO	Bipolar offset. Connect to pin 26 for bipolar operation.				
28	Ref Out	6.3V reference output.				

ABSOLUTE MAXIMUM RATINGS

+V _{CC}	0 to +18V
-V _{CC} to ACOM	0 to -18V
V _{DD} to DCOM	0 to +7V
V _{DD} to ACOM	
ACOM to DCOM	
Digital Inputs (Pins 2-14, 16-19) to DCOM	0.4V to +18V
External Voltage Applied to 10V Range Resiste	or ±12V
Ref Out	Indefinite Short to ACOM
External Voltage Applied to DAC Output	5\/ to +5\/
U 11	
Power Dissipation	
Power Dissipation Lead Temperature (soldering, 10s)	
Power Dissipation Lead Temperature (soldering, 10s) Max Junction Temperature	1000mW +300°C +165°C
Power Dissipation Lead Temperature (soldering, 10s) Max Junction Temperature Thermal Resistance, θ_{LA} : Plastic DIP and SOI0	1000mW +300°C +165°C C100°C/W
Power Dissipation Lead Temperature (soldering, 10s) Max Junction Temperature Thermal Resistance, θ_{J-A} : Plastic DIP and SOIC Ceramic DIP	1000mW +300°C +165°C C 100°C/W 65°C/W

NOTE: Stresses above those listed above may cause permanent damage to the device. Exposure to absolute maximum conditions for extended periods may affect device reliability.

ELECTROSTATIC DISCHARGE SENSITIVITY 10

This integrated circuit can be damaged by ESD. Burr-Brown recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

PACKAGE/ORDERING INFORMATION

PACKAGE/	ORDERING I	NFORMATION	.COM Y.COM.TV				
PRODUCT	MINIMUM RELATIVE ACCURACY (LSB)	DIFFERENTIAL LINEARITY (LSB)	PACKAGE	PACKAGE DRAWING NUMBER	SPECIFICATION TEMPERATURE RANGE	ORDERING NUMBER ⁽¹⁾	TRANSPORT MEDIA
DAC811AH	±1/2 LSB	3/4	CerDIP-28	149	-25°C to +85°C	DAC811AH	Rails
DAC811JP	±1/2 LSB	3/4	DIP-28	215	0°C to +70°C	DAC811JP	Rails
DAC811JU	±1/2 LSB	3/4	SOIC-28	217	0°C to +70°C	DAC811JU	Rails
"	"	"	W.1" - C	ON	"WW.	DAC811JU/1K	Tape and Reel
DAC811KP	±1/4 LSB	1/2	DIP-28	215	0°C to +70°C	DAC811KP	Rails
DAC811KU	±1/4 LSB	1/2	SOIC-28	217	0°C to +70°C	DAC811KU	Rails

NOTE: (1) Models with a slash (/) are available only in Tape and Reel in the quantities indicated (e.g., /1K indicates 1000 devices per reel). Ordering 1000 pieces of "DAC811JU/1K" will get a single 1000-piece Tape and Reel.

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TIMING DIAGRAMS

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DISCUSSION OF SPECIFICATIONS

INPUT CODES

The DAC811 accepts positive-true binary input codes. DAC811 may be connected by the user for any one of the following codes: USB (unipolar straight binary), BOB (bipolar offset binary) or, using an external inverter on the MSB line, BTC (binary two's complement). See Table I.

	USB 🕥	BOB	DTO(1)
MSB LSB	Unipolar	Bipolar	Binary
	Straight	Offset	Two's
	Binary	Binary	Complement
111111111111	+ Full Scale	+ Full Scale	-1LSB
100000000000	+ 1/2 Full Scale	Zero	- Full Scale
01111111111	+ 1/2 Full Scale – 1LSB	–1LSB	+ Full Scale
000000	Zero	– Full Scale	Zero

TABLE I. Digital Input Codes.

LINEARITY ERROR

Linearity error as used in D/A converter specifications by Burr-Brown is the deviation of the analog output from a straight line drawn between the end points (inputs all 1s and all 0s). The DAC811 linearity error is specified at $\pm 1/4$ LSB (max) at +25°C for B and K grades, and $\pm 1/2$ LSB (max) for A, J, and R grades.

DIFFERENTIAL LINEARITY ERROR

Differential linearity error (DLE) is the deviation from a 1LSB output change from one adjacent state to the next. A DLE specification of 1/2LSB means that the output step size can range from 1/2LSB to 3/2LSB when the input changes from one state to the next. Monotonicity requires that DLE be less than 1LSB over the temperature range of interest.

MONOTONICITY

A D/A converter is monotonic if the output either increases or remains the same for increasing digital inputs. All grades of DAC811 are monotonic over their specification temperature range.



DRIFT

Gain drift is a measure of the change in the full scale range (FSR) output over the specification temperature range. Drift is expressed in parts per million per degree centigrade (ppm/°C). Gain drift is established by testing the full scale range value (e.g., +FS minus –FS) at high temperature, +25°C, and low temperature, calculating the error with respect to the +25°C value, and dividing by the temperature change.

Unipolar offset drift is a measure of the change in output with all 0s on the input over the specification temperature range. Offset is measured at high temperature, $+25^{\circ}$ C, and low temperature. The offset drift is the maximum change in offset referred to the $+25^{\circ}$ C value, divided by the temperature change. It is expressed in parts per million of full scale range per degree centigrade (ppm of FSR/°C).

Bipolar zero drift is measured at a digital input of 800_{16} , the code that gives zero volts output for bipolar operation.

SETTLING TIME

Settling time is the total time (including slew time) for the output to settle within an error band around its final value after a change in input. Three settling times are specified to $\pm 0.01\%$ of full scale range (FSR): two for maximum full scale range changes of 20V and 10V, and one for a 1LSB change. The 1LSB change is measured at the major carry (7FF₁₆ to 800₁₆ and 800₁₆ to 7FF₁₆), the input transition at which worst-case settling time occurs.

REFERENCE SUPPLY

DAC811 contains an on-chip 6.3V reference. This voltage (pin 28) has a tolerance of ± 0.1 V. The reference output may be used to drive external loads, sourcing at least 2mA. This current should be constant for best performance of the D/A converter.

POWER SUPPLY SENSITIVITY

Power supply sensitivity is a measure of the effect of a power supply change on the D/A converter output. It is defined as a percent of FSR output change per percent of change in either the positive, negative, or logic supply voltages about the nominal voltages. Figure 1 shows typical power supply rejection versus power supply ripple frequency.





FIGURE 1. Power Supply Rejection vs Power Supply Ripple Frequency.

OPERATION

DAC811 is a complete single IC chip 12-bit D/A converter. The chip contains a 12-bit D/A converter, voltage reference, output amplifier, and microcomputer-compatible input logic as shown in Figure 2.

INTERFACE LOGIC

Input latches A, B, and C hold data temporarily while a complete 12-bit word is assembled before loading into the D/A register. This double-buffered organization prevents the generation of spurious analog output values. Each register is independently addressable.

These input latches are controlled by $\overline{N_A}$, $\overline{N_B}$, $\overline{N_C}$, and \overline{WR} . NA, NB, and NC are internally NORed with WR so that the input latches transmit data when both $\overline{N_A}$ (or N_B , N_C) and $\overline{\text{WR}}$ are at logic 0. When either $\overline{N_A}$, $(\overline{N_B}, \overline{N_C})$ or $\overline{\text{WR}}$ go to logic 1, the input data is latched into the input registers and held until both $\overline{N_A}$ (or $\overline{N_B}$, $\overline{N_C}$) and \overline{WR} go to logic 0.

The D/A latch is controlled by $\overline{\text{LDAC}}$ and $\overline{\text{WR}}$. $\overline{\text{LDAC}}$ and WR are internally NORed so that the latches transmit data to the D/A switches when both $\overline{\text{LDAC}}$ and $\overline{\text{WR}}$ are at logic 0. When either $\overline{\text{LDAC}}$ or $\overline{\text{WR}}$ are at logic 1, the data is latched in the D/A latch and held until LDAC and WR go to logic 0.

All latches are level-triggered. Data present when the control signals are logic 0 will enter the latch. When any one of the control signals returns to logic 1, the data is latched. Table II is a truth table for all latches.

WR	NA	NB	N _C	LDAC	OPERATION
60	Х	X	Х	X	No operation
0	0	1	1	1	Enables input latch 4MSBs
0	1	0	1	1 <	Enables input latch 4 middle bits
0	1	1	0	1	Enables input latch 4LSBs
0	1	1	1	0	Loads D/A latch from input latches
0	0	0	0	0	Makes all latches transparent

TABLE II. DAC813 Interface Logic Truth Table.

GAIN AND OFFSET ADJUSTMENTS

Figures 3 and 4 illustrate the relationship of offset and gain adjustments to unipolar and bipolar D/A converter output.

OFFSET ADJUSTMENT

For unipolar (USB) configurations, apply the digital input code that should produce zero voltage output, and adjust the offset potentiometer for zero output. For bipolar (BOB, BTC) configurations, apply the digital input code that should produce the maximum negative output voltage and adjust the offset potentiometer for minus full scale voltage. Example: If the full scale range is connected for 20V, the maximum negative output voltage is -10V. See Table III for corresponding codes.



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FIGURE 3. Relationship of Offset and Gain Adjustments for a Unipolar D/A Converter.



FIGURE 4. Relationship of Offset and Gain Adjustments for a Bipolar D/A Converter.

	ANALOG OUTPUT					
DIGITAL INPUT	0 to +10V	±5V	±10V			
$\begin{array}{c c} MSB & LSB \\ \downarrow & \downarrow \end{array}$			WWW			
111111111111 1000000000000	+9.9976V +5V	+4.9976V 0V	+9.9951V 0V			
01111111111 0000000000000 LSB	+4.9976V 0V 2.4mV	-0.0024V -5V 2.44mV	-0.0049V -10V 4.88mV			

TABLE III. Digital Input/Analog Output.

GAIN ADJUSTMENT

For either unipolar or bipolar configurations, apply the digital input that should give the maximum positive voltage output. Adjust the gain potentiometer for this positive full scale voltage. See Table III for positive full scale voltages.



±12V OPERATION

The DAC811 is fully specified for operation on $\pm 12V$ power supplies. However, in order for the output to swing to $\pm 10V$, the power supplies must be $\pm 13.5V$ or greater. When operating with $\pm 12VB$ supplies, the output swing should be restricted to $\pm 8V$ in order to meet specifications.

LOGIC INPUT COMPATIBILITY

The DAC811 digital inputs are TTL, LSTTL, and 54/74HC CMOS-compatible over the operating range of V_{DD}. The input switching threshold remains at the TLL threshold over the supply range.

The logic input current over temperature is low enough to permit driving the DAC811 directly from the outputs of 4000B and 54/74C CMOS devices.

Resistors of 47Ω should be placed in series with D0 through D11, \overline{WR} , $\overline{N_A}$, $\overline{N_B}$, $\overline{N_C}$ and \overline{LDAC} if edges are <10ns or if the logic input is driven below ground by undershoot.

INSTALLATION

POWER SUPPLY CONNECTIONS

For optimum performance and noise rejection, power supply decoupling capacitors should be added as shown in Figure 5.

These capacitors (1 μ F tantalum recommended) should be located close to the DAC811.



FIGURE 5. Power Supply, Gain, and Offset Potentiometer Connections.

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The Analog Common is the high quality return for the D/A converter and should be connected directly to the analog reference point of the system. The load driven by the output amplifier should be returned to the Analog Common.

EXTERNAL OFFSET AND GAIN ADJUSTMENT

Offset and Gain may be trimmed by installing external Offset and Gain potentiometers. Connect these potentiometers as shown in Figure 5. TCR of the potentiometers should be 100ppm/°C or less. The 1M Ω and 3.9M Ω resistors (20% carbon or better) should be located close to the DAC811 to prevent noise pickup. If it is not convenient to use these high value resistors, an equivalent "T" network, as shown in Figure 6, may be substituted in each case. The Gain Adjust (pin 22) is a high impedance point and a 0.001µF to 0.01µF ceramic capacitor should be connected from this pin to Analog Common to reduce noise pickup in all applications, including those not employing external gain adjustment. Excessive capacitance on the Gain Adjust or Offset Adjust pin may affect slew rate and settling time.

FIGURE 6. Equivalent Resistances.

OUTPUT RANGE CONNECTIONS

Internal scaling resistors provided in the DAC811 may be connected to produce bipolar output voltage ranges of $\pm 10V$ and $\pm 5V$ or a unipolar output voltage range of 0 to $\pm 10V$. The 20V range ($\pm 10V$ bipolar range) is internally connected. Refer to Figure 7. Connections for the output ranges are listed in Table IV.



FIGURE 7. Output Amplifier Voltage Range Scaling Circuit.

OUTPUT RANGE	DIGITAL INPUT CODES	CONNECT PIN 25 TO	CONNECT PIN 27 TO
0 to +10V	USB	24	23
±5	BOB or BTC	24	26
±10V	BOB or BTC	NC	26

TABLE IV.	Output	Range	Connections.

APPLICATIONS

MICROCOMPUTER BUS INTERFACING

The DAC811 interface logic allows easy interface to microcomputer bus structures. The control signal \overline{WR} is derived from external device select logic and the I/O Write or Memory Write (depending upon the system design) signals from the microcomputer.

The latch enable lines $\overline{N_A}$, $\overline{N_B}$, $\overline{N_C}$ and \overline{LDAC} determine which of the latches are enabled. It is permissible to enable two or more latches simultaneously, as shown in some of the following examples.

The double-buffered latch permits data to be loaded into the input latches of several DAC811s and later strobed into the D/A latch of all D/As, simultaneously updating all analog outputs. All the interface schemes shown below use a base address decoder. If blocks of memory are used, the base address decoder can be simplified or eliminated altogether. For instance, if half the memory space is unused, address line A15 of the microcomputer can be used as the chip select control.

4-BIT INTERFACE

An interface to a 4-bit microcomputer is shown in Figure 8. Each DAC811 occupies four address locations. A 74LS139 provides the two-to-four decoder and selects it with the base address. Memory Write (WR) of the microcomputer is connected directly to the WR pin of the DAC811. An 8205 decoder is an alternative to the 74LS139.

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8-BIT INTERFACE

The control logic of DAC811 permits interfacing to rightjustified data formats, as illustrated in Figure 9. When a 12-bit D/A converter is loaded from an 8-bit bus, two bytes of data are required. Figures 10 and 11 show an addressing scheme for right-justified and left-justified data respectively. The base address is decoded from the high-order address bits. A_0 and A_1 address the appropriate latches. Note that adjacent addresses are used. For the right-justified case, X10₁₆ loads the 8LSBs, and X01₁₆ loads the 4MSBs and simultaneously transfers input latch data to the D/A latch. Addresses X00₁₆ and X11₁₆ are not used.

Left-justified data is handled in a similar manner, shown in Figure 11. The DAC811 still occupies two adjacent locations in the microcomputer's memory map.











FIGURE 10. Right-Justified Data Bus Interface.



FIGURE 11. Left-Justified Data Bus Interface.

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INTERFACING MULTIPLE DAC811s IN 8-BIT SYSTEMS

Many applications, such as automatic test systems, require that the outputs of several D/A converters be updated simultaneously. The interface shown in Figure 12 uses a 74LS138 decoder to decode a set of eight adjacent addresses, to load the input latches of four DAC811s. The example shows a right-justified data format.

A ninth address using A_3 causes all DAC811s to be updated simultaneously. If a particular DAC811 is always loaded last—for instance, D/A #4—A₃ is not needed, thus saving eight address spaces for other uses. Incorporate A_3 into the base address decoder, remove the inverter, connect the common LDAC line to $\overline{N_C}$ of D/A #4, and connect D1 of the 74LS138 to +5V.

12- AND 16-BIT MICROCOMPUTER INTERFACE

For this application, the input latch enable lines, $\overline{N_A}$, $\overline{N_B}$ and $\overline{N_C}$, are tied low, causing the latches to be transparent. The D/A latch, and therefore DAC811, is selected by the address decoder and strobed by \overline{WR} .



FIGURE 12. Interfacing Multiple DAC811s to an 8-Bit Bus.

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