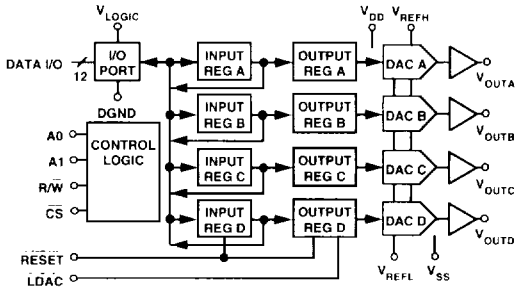
Quad, 12-Bit DACs Voltage Output with Readback

DAC8412/DAC8413

FEATURES
- +5 to ±15 Volt Operation
- Unipolar or Bipolar Operation
- True Voltage Output
- Double-Buffered Inputs
- Reset to Min or Center Scale
- Fast Bus Access Time
- Readback

APPLICATIONS
- Automatic Test Equipment
- Digitally Controlled Calibration
- Servo Controls
- Process Control Equipment

FUNCTIONAL BLOCK DIAGRAM



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GENERAL DESCRIPTION

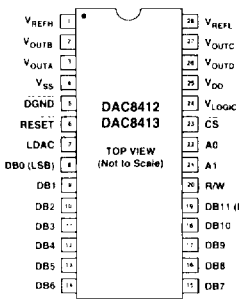
The DAC8412 and DAC8413 are quad, 12-bit voltage output DACs with readback capability. Built using a complementary BiCMOS process, these monolithic DACs offer the user very high package density.

Output voltage swing is set by the two reference inputs V_{REFH} and V_{REFL}. By setting the V_{REFL} input to 0 volts and V_{REFH} to a positive voltage, the DAC will provide a unipolar positive output range. A similar configuration with V_{REFH} at 0 volts and V_{REFL} at a negative voltage will provide a unipolar negative output range. Bipolar outputs are configured by connecting both V_{REFH} and V_{REFL} to nonzero voltages. This method of setting output voltage range has advantages over other bipolar offsetting methods because it is not dependent on internal and external resistors with different temperature coefficients.

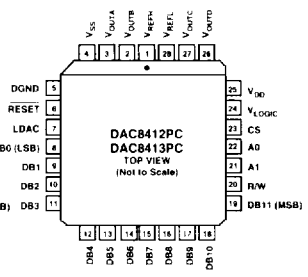
Digital controls allow the user to load or read back data from any DAC, load any DAC and transfer data to all DACs at one time.

An active low $\overline{\text{RESET}}$ loads all DAC output registers to midscale for the DAC8412 and zero scale for the DAC8413.

DIP



PLCC



The DAC8412/DAC8413 are available in 28-pin plastic DIP, cerdip, PLCC and LCC packages. They can be operated from a wide variety of supply and reference voltages with supplies ranging from single +5 volt to ±15 volts, and references from +2.5 to ±10 volts. Power dissipation is less than 330 mW with ±15 volt supplies and only 60 mW with a +5 volt supply.

For MIL-STD-883 applications, contact your local ADI sales office for the DAC8412/DAC8413/883 data sheet which specifies operation over the −55°C to +125°C temperature range. All 883 parts are also available on Standard Military Drawings 5962-91-76401MXA through -76404M3A.

ORDERING INFORMATION[1]

INL (LSB)	Military[2] Temperature −55°C to +125°C	Extended Industrial[2] Temperature −40°C to +85°C	Package	Package Option[3]
±1		DAC8412FPC	PLCC	P-28A
+1.5	DAC8412BTC/883		LCC	E-28A
±0.5		DAC8412ET	Cerdip	Q-28
±0.75	DAC8412AT/883		Cerdip	Q-28
±1		DAC8412FT	Cerdip	Q-28
±1.5	DAC8412BT/883		Cerdip	Q-28
±0.5		DAC8412EP	Plastic	N-28
±1		DAC8412FP	Plastic	N-28
±1		DAC8412GBC	Dice	
±1		DAC8413FPC	PLCC	P-28A
±1.5	DAC8413BTC/883		LCC	E-28A
±0.5		DAC8413ET	Cerdip	Q-28
±0.75	DAC8413AT/883		Cerdip	Q-28
±1		DAC8413FT	Cerdip	Q-28
±1.5	DAC8413BT/883		Cerdip	Q-28
±0.5		DAC8413EP	Plastic	N-28
±1		DAC8413FP	Plastic	N-28
±1		DAC8413GBC	Dice	

NOTES
[1]Burn-in is available on extended industrial temperature range parts in cerdip.
[2]A complete 883 data sheet is available. For availability and burn-in information, contact your local sales office.
[3]For outline information see Package Information section.

DAC8412/DAC8413–SPECIFICATIONS

ELECTRICAL CHARACTERISTICS (@ V_{DD} = +15.0 V, V_{SS} = −15.0 V, V_{LOGIC} = +5.0 V, V_{REFH} = +10.0 V, V_{REFL} = −10.0 V, −40°C ≤ T_A ≤ +85°C unless otherwise noted. See Note 1 for supply variations.)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Integral Linearity "E"	INL			0.25	±0.5	LSB
Integral Linearity "F"	INL				±1	LSB
Differential Linearity	DNL	Monotonic Over Temperature	1			LSB
Min Scale Error	V_{ZSE}	R_L = 2 kΩ			±2	LSB
Full-Scale Error	V_{FSE}	R_L = 2 kΩ			±2	LSB
Min Scale Tempco	TCV_{ZSE}	R_L = 2 kΩ		15		ppm/°C
Full-Scale Tempco	TCV_{FSE}	R_L = 2 kΩ		20		ppm/°C
MATCHING PERFORMANCE						
Linearity Matching				±1		LSB
REFERENCE						
Positive Reference Input Range		Note 2	V_{REFL} + 2.5		V_{DD} − 2.5	V
Negative Reference Input Range		Note 2	−10		V_{REFH} − 2.5	V
Reference High Input Current	I_{REFH}		−2.75	+1.5	+2.75	mA
Reference Low Input Current	I_{REFL}		0	+2	+2.75	mA
AMPLIFIER CHARACTERISTICS						
Output Current	I_{OUT}		5		+5	mA
Settling Time	t_S	to 0.01%		6		µs
Slew Rate	SR	10% to 90%		2.2		V/µs
LOGIC CHARACTERISTICS						
Logic Input High Voltage	V_{INH}	T_A = +25°C	2.4			V
Logic Input Low Voltage	V_{INL}	T_A = +25°C			0.8	V
Logic Output High Voltage	V_{OH}	I_{OH} = +0.4 mA	2.4			V
Logic Output Low Voltage	V_{OL}	I_{OL} = 1.6 mA			0.4	V
Logic Input Current	I_{IN}				1	µA
Input Capacitance	C_{IN}			8		pF
Crosstalk				>72		dB
Large Signal Bandwidth		−3 dB, V_{REFH} = 0 to +10 V p-p		160		kHz
LOGIC TIMING CHARACTERISTICS		Note 3				
WRITE						
Chip Select Write Pulse Width	t_{WCS}		80	40		ns
Write Setup	t_{WS}	t_{WCS} = 80 ns	0			ns
Write Hold	t_{WH}	t_{WCS} = 80 ns	0			ns
Address Setup	t_{AS}		0			ns
Address Hold	t_{AH}		0			ns
Load Setup	t_{LS}		70	30		ns
Load Hold	t_{LH}		30	10		ns
Write Data Setup	t_{WDS}	t_{WCS} = 80 ns	20			ns
Write Data Hold	t_{WDH}	t_{WCS} = 80 ns	0			ns
Load Pulse Width	t_{LWD}		170	130		ns
Reset Pulse Width	t_{RESET}		140	100		ns
READ						
Chip Select Read Pulse Width	t_{RCS}		130	100		ns
Read Data Hold	t_{RDH}	t_{RCS} = 130 ns	0			ns
Read Data Setup	t_{RDS}	t_{RCS} = 130 ns	0			ns
Data to Hi Z	t_{DZ}	C_L = 10 pF		150		ns
Chip Select to Data	t_{CSD}	C_L = 100 pF		120	160	ns
SUPPLY CHARACTERISTICS						
Power Supply Sensitivity	PSS	14.25 V ≤ V_{DD} ≤ 15.75 V			150	ppm/V
Positive Supply Current	I_{DD}	V_{REFH} = +2.5 V		8.5	12	mA
Negative Supply Current	I_{SS}		10	6.5		mA
Power Dissipation	P_{DISS}				330	mW

NOTES

[1]All supplies can be varied ±5%, and operation is guaranteed. Device is tested with nominal supplies.

[2]Operation is guaranteed over this reference range, but linearity is neither tested nor guaranteed.

[3]All input control signals are specified with tr = tf = 5 ns (10% to 90% of +5 V) and timed from a voltage level of 1.6 V.

Specifications subject to change without notice.