

DAC0808

8-Bit D/A Converter

General Description

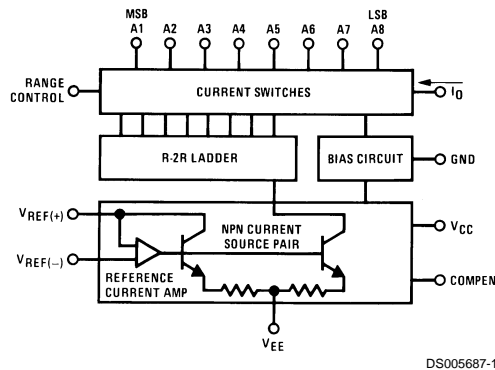
The DAC0808 is an 8-bit monolithic digital-to-analog converter (DAC) featuring a full scale output current settling time of 150 ns while dissipating only 33 mW with $\pm 5V$ supplies. No reference current (I_{REF}) trimming is required for most applications since the full scale output current is typically ± 1 LSB of $255 I_{REF}/256$. Relative accuracies of better than $\pm 0.19\%$ assure 8-bit monotonicity and linearity while zero level output current of less than $4 \mu A$ provides 8-bit zero accuracy for $I_{REF} \geq 2$ mA. The power supply currents of the DAC0808 is independent of bit codes, and exhibits essentially constant device characteristics over the entire supply voltage range.

The DAC0808 will interface directly with popular TTL, DTL or CMOS logic levels, and is a direct replacement for the MC1508/MC1408. For higher speed applications, see DAC0800 data sheet.

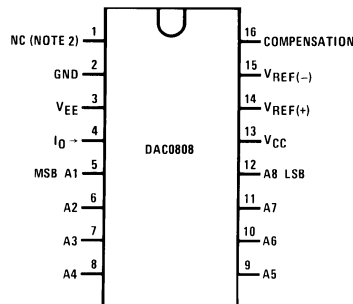
Features

- Relative accuracy: $\pm 0.19\%$ error maximum
- Full scale current match: ± 1 LSB typ
- Fast settling time: 150 ns typ
- Noninverting digital inputs are TTL and CMOS compatible
- High speed multiplying input slew rate: 8 mA/ μs
- Power supply voltage range: $\pm 4.5V$ to $\pm 18V$
- Low power consumption: 33 mW @ $\pm 5V$

Block and Connection Diagrams



Dual-In-Line Package

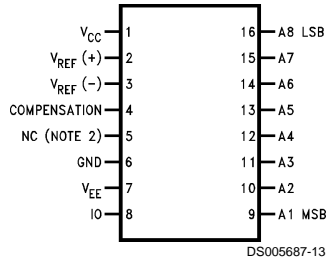


Top View

Order Number DAC0808
See NS Package M16A or N16A

Block and Connection Diagrams (Continued)

Small-Outline Package



Ordering Information

ACCURACY	OPERATING TEMPERATURE RANGE	N PACKAGE (N16A) (Note 1)		SO PACKAGE (M16A)
		8-bit	$0^{\circ}\text{C} \leq T_A \leq +75^{\circ}\text{C}$	DAC0808LCN

Note 1: Devices may be ordered by using either order number.

Absolute Maximum Ratings (Note 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Power Supply Voltage

V_{CC}	+18 V_{DC}
V_{EE}	-18 V_{DC}
Digital Input Voltage, V5–V12	-10 V_{DC} to +18 V_{DC}
Applied Output Voltage, V_O	-11 V_{DC} to +18 V_{DC}
Reference Current, I_{14}	5 mA
Reference Amplifier Inputs, V14, V15	V_{CC} , V_{EE}
Power Dissipation (Note 4)	1000 mW
ESD Susceptibility (Note 5)	TBD

Storage Temperature Range	-65°C to +150°C
Lead Temp. (Soldering, 10 seconds)	
Dual-In-Line Package (Plastic)	260°C
Dual-In-Line Package (Ceramic)	300°C
Surface Mount Package	
Vapor Phase (60 seconds)	215°C
Infrared (15 seconds)	220°C

Operating Ratings

Temperature Range	$T_{MIN} \leq T_A \leq T_{MAX}$
DAC0808	$0 \leq T_A \leq +75^\circ\text{C}$

Electrical Characteristics

($V_{CC} = 5V$, $V_{EE} = -15 V_{DC}$, $V_{REF}/R14 = 2 \text{ mA}$, and all digital inputs at high logic level unless otherwise noted.)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
E_r	Relative Accuracy (Error Relative to Full Scale I_O)	(Figure 4)				%
	DAC0808LC (LM1408-8)				± 0.19	%
	Settling Time to Within $\frac{1}{2}$ LSB (Includes t_{PLH})	$T_A = 25^\circ\text{C}$ (Note 7), (Figure 5)		150		ns
t_{PLH} , t_{PHL}	Propagation Delay Time	$T_A = 25^\circ\text{C}$, (Figure 5)		30	100	ns
TCI_O	Output Full Scale Current Drift			± 20		ppm/°C
MSB	Digital Input Logic Levels	(Figure 3)				
V_{IH}	High Level, Logic "1"		2			V_{DC}
V_{IL}	Low Level, Logic "0"				0.8	V_{DC}
MSB	Digital Input Current	(Figure 3)				
	High Level	$V_{IH} = 5V$		0	0.040	mA
	Low Level	$V_{IL} = 0.8V$		-0.003	-0.8	mA
I_{15}	Reference Input Bias Current	(Figure 3)		-1	-3	μA
	Output Current Range	(Figure 3)				
		$V_{EE} = -5V$	0	2.0	2.1	mA
		$V_{EE} = -15V$, $T_A = 25^\circ\text{C}$	0	2.0	4.2	mA
I_O	Output Current	$V_{REF} = 2.000V$, $R14 = 1000\Omega$, (Figure 3)	1.9	1.99	2.1	mA
	Output Current, All Bits Low	(Figure 3)		0	4	μA
	Output Voltage Compliance (Note 3)	$E_r \leq 0.19\%$, $T_A = 25^\circ\text{C}$			-0.55, +0.4	V_{DC}
	$V_{EE} = -5V$, $I_{REF} = 1 \text{ mA}$				-5.0, +0.4	V_{DC}
	V_{EE} Below -10V					
SRI_{REF}	Reference Current Slew Rate	(Figure 6)	4	8		mA/ μs
	Output Current Power Supply Sensitivity	$-5V \leq V_{EE} \leq -16.5V$		0.05	2.7	$\mu\text{A/V}$
I_{CC}	Power Supply Current (All Bits Low)	(Figure 3)				
				2.3	22	mA
I_{EE}				-4.3	-13	mA
V_{CC}	Power Supply Voltage Range	$T_A = 25^\circ\text{C}$, (Figure 3)	4.5	5.0	5.5	V_{DC}
	V_{EE}		-4.5	-15	-16.5	V_{DC}
	Power Dissipation					

Electrical Characteristics (Continued)

($V_{CC} = 5V$, $V_{EE} = -15V_{DC}$, $V_{REF}/R_{14} = 2\text{ mA}$, and all digital inputs at high logic level unless otherwise noted.)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
	All Bits Low	$V_{CC} = 5V$, $V_{EE} = -5V$		33	170	mW
		$V_{CC} = 5V$, $V_{EE} = -15V$		106	305	mW
	All Bits High	$V_{CC} = 15V$, $V_{EE} = -5V$		90		mW
		$V_{CC} = 15V$, $V_{EE} = -15V$		160		mW

Note 2: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. DC and AC electrical specifications do not apply when operating the device beyond its specified operating conditions.

Note 3: Range control is not required.

Note 4: The maximum power dissipation must be derated at elevated temperatures and is dictated by T_{JMAX} , θ_{JA} , and the ambient temperature, T_A . The maximum allowable power dissipation at any temperature is $P_D = (T_{JMAX} - T_A)/\theta_{JA}$ or the number given in the Absolute Maximum Ratings, whichever is lower. For this device, $T_{JMAX} = 125^\circ\text{C}$, and the typical junction-to-ambient thermal resistance of the dual-in-line J package when the board mounted is 100°C/W . For the dual-in-line N package, this number increases to 175°C/W and for the small outline M package this number is 100°C/W .

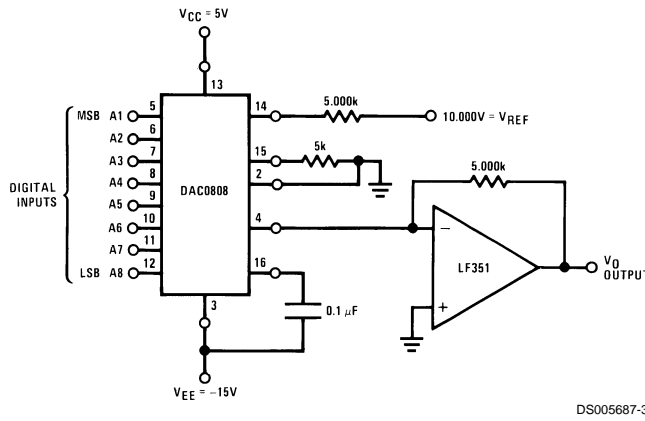
Note 5: Human body model, 100 pF discharged through a 1.5 k Ω resistor.

Note 6: All current switches are tested to guarantee at least 50% of rated current.

Note 7: All bits switched.

Note 8: Pin-out numbers for the DAL080X represent the dual-in-line package. The small outline package pinout differs from the dual-in-line package.

Typical Application



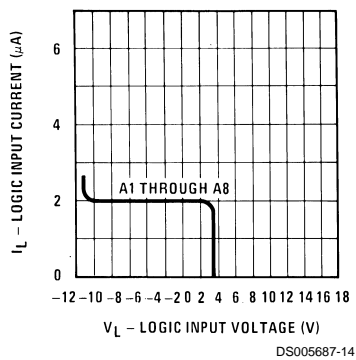
$$V_O = 10V \left(\frac{A_1}{2} + \frac{A_2}{4} + \dots + \frac{A_8}{256} \right)$$

DS005687-23

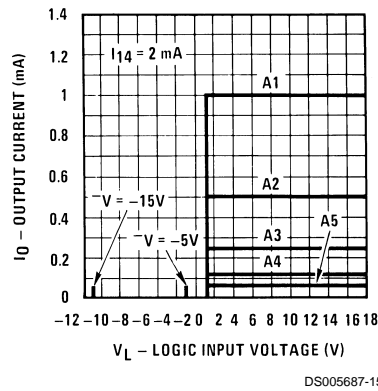
FIGURE 1. +10V Output Digital to Analog Converter (Note 8)

Typical Performance Characteristics $V_{CC} = 5V$, $V_{EE} = -15V$, $T_A = 25^\circ\text{C}$, unless otherwise noted

Logic Input Current vs Input Voltage



Bit Transfer Characteristics



Logic Threshold Voltage vs Temperature

