

MAXIM

CMOS 8 Bit Multiplying D/A Converter

MX7523

General Description

The MX7523 is high performance multiplying 8 bit digital-to-analog converter (DAC). Low power CMOS technology and low cost make it suitable for a wide range of analog data acquisition and control applications.

Thin-film resistors assure 8 bit resolution with up to 10 bit linearity (L grade) over the full operating temperature range. In addition, all digital inputs are compatible with CMOS logic levels.

Maxim's MX7523 is electrically and pin compatible with the Analog Devices AD7523 and is available in a standard width 16-lead DIP as well as small outline package.

Applications

Automatic Test Equipment
Digital Calibration Systems
Battery Powered Instruments
Audio Gain Control
Digitally Controlled Filters
Programmable Power Supplies
Motion Control Systems

Features

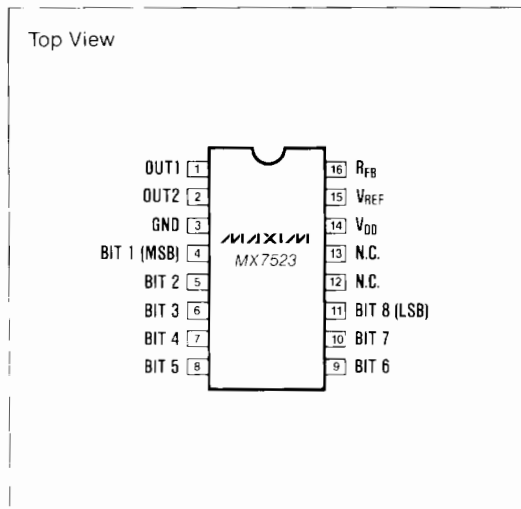
- ◆ 8, 9 and 10 Bit Linearity
- ◆ $\pm 1.5\%$ Untrimmed Gain Accuracy
- ◆ Guaranteed Monotonic
- ◆ Low Feedthrough 1/2LSB at 200kHz
- ◆ Low Power Consumption
- ◆ CMOS Compatible Logic Inputs
- ◆ Widely Second Sourced

Ordering Information

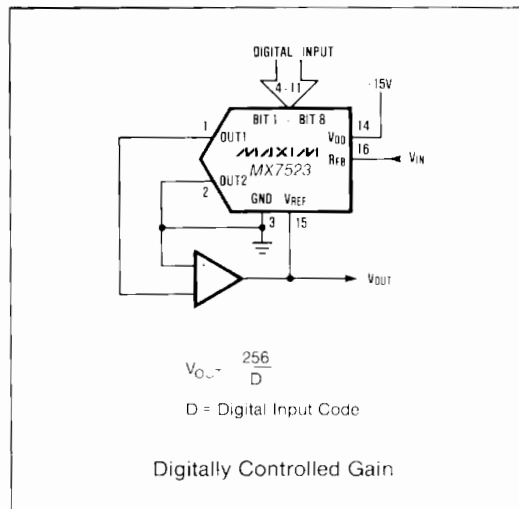
PART	TEMP RANGE	PACKAGE*	ERROR
MX7523JN	0°C to +70°C	Plastic DIP	1/2LSB
MX7523KN	0°C to +70°C	Plastic DIP	1/4LSB
MX7523LN	0°C to +70°C	Plastic DIP	1/8LSB
MX7523JCWE	0°C to +70°C	Small Outline	1/2LSB
MX7523KCWE	0°C to +70°C	Small Outline	1/4LSB
MX7523LCWE	0°C to +70°C	Small Outline	1/8LSB

* All devices — 16 lead packages

Pin Configuration



Typical Operating Circuit



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Call toll free 1-800-998-8800 for free samples or literature.

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ABSOLUTE MAXIMUM RATINGS

V_{DD} to GND	-0.3V, +17V	Storage Temperature	-65°C to +150°C
V_{REF} to GND	±25V	Lead Temperature (Soldering 10 secs)	+300°C
R_{FB} to GND	±25V	Power Dissipation to +70°C	
Digital Input Voltage to GND	-0.3V, V_{DD}	Plastic DIP	670mW
Output Voltage (OUT1, OUT2) (Note 1)	-0.3V, V_{DD}	Small Outline	450mW
Operating Temperature	0°C to +70°C		

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

($T_A = T_{MIN}$ to T_{MAX} , $V_{DD} = +15V$, $V_{REF} = +10V$, $V_{OUT1} = V_{OUT2} = GND$, unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS		MIN.	TYP.	MAX.	UNITS
DC ACCURACY							
Resolution				8			Bits
Nonlinearity (Note 2)		0.2% FSR = 1/2LSB 0.1% FSR = 1/4LSB 0.05% FSR = 1/8LSB	J K L			1.5 1.0 0.5	LSB
Monotonicity					Guaranteed		
Gain Error (Note 2, 3)		Digital Inputs = V _{INH}	T _A = +25°C T _{MIN} to T _{MAX}			1.5 1.8	% FSR
Power Supply Rejection (Note 2)	PSRR	V _{DD} = +14V to +15V	T _A = +25°C T _{MIN} to T _{MAX}			0.02 0.03	%/%V _{DD}
Output Leakage Current		OUT1, Digital Inputs = V _{INL}	T _A = +25°C T _{MIN} to T _{MAX}			50 200	nA
		OUT2, Digital Inputs = V _{INH}	T _A = 25°C T _{MIN} to T _{MAX}			50 200	
V _{REF} Input Resistance	R _{REF}	T _A = +25°C		5	10	20	kΩ
V _{REF} Resistance Tempco		(Note 4)				-500	ppm/°C
AC PERFORMANCE (Note 4)							
Output Current Settling Time to 0.2% of FSR		R _L = 100Ω, Digital Inputs = V _{INH} to V _{INL} and V _{INL} to V _{INH}	T _A = +25°C T _{MIN} to T _{MAX}			150 200	ns
Feedthrough Error		Digital Inputs = V _{INL} , V _{REF} = 20V _{P-P} , 200 KHz	T _A = +25°C T _{MIN} to T _{MAX}			1.5 1	LSB
Output Capacitance	C _{OUT}	Digital Inputs = V _{INH}	OUT1 OUT2			100 30	pF
		Digital Inputs = V _{INL}	OUT1 OUT2			30 100	
DIGITAL INPUTS							
Logic HIGH Threshold	V _{INH}			+14.5			V
Logic LOW Threshold	V _{INL}					+0.5	V
Input Leakage Current		Digital inputs = 0V or +15V				1	μA
Input Capacitance, (Note 4)						4	pF
Input Coding		Unipolar Operation (Table 1) Bipolar Operation (Table 2)		Binary Offset Binary			
POWER REQUIREMENTS							
Power Supply Range	V _{DD}	Accuracy not guaranteed over this range.		+5		+16	V
Power Supply Current	I _{DD}	Digital inputs = V _{INH} or V _{INL}				100	μA

Note 1: $V_{OUT1, 2}$ may exceed the Absolute Maximum voltage rating if the current is limited to 30mA or less.

Note 2: Using internal feedback resistor (R_{FB}). Full scale range (FSR) = $-(V_{REF} - 1LSB)$ in unipolar mode.

Note 3: Maximum gain change from +25°C to T_{MIN} or T_{MAX} is $\pm 0.3\%$ FSR.

Note 4: Guaranteed by design but not 100% tested.

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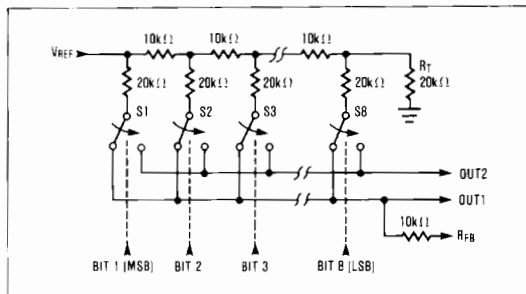


Figure 1. MX7523 Functional Diagram

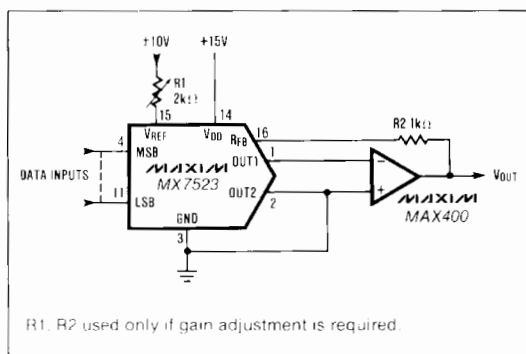


Figure 2. Unipolar Binary Operation (2-Quadrant Multiplication)

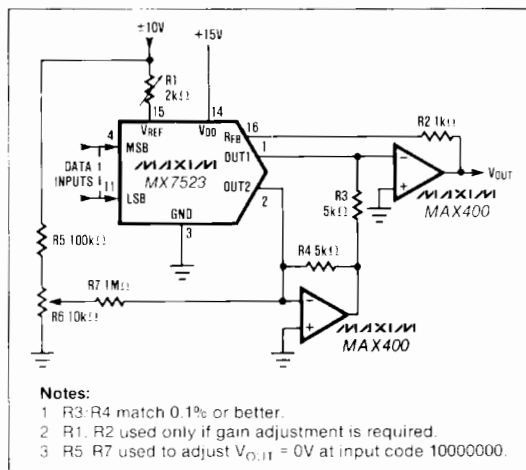


Figure 3. Bipolar (4-Quadrant) Operation

Table 1. Unipolar Binary Code Table

DIGITAL INPUT								ANALOG OUTPUT	
MSB				LSB					
1	1	1	1	1	1	1	1	$-V_{REF}$	$\left(-\frac{225}{256}\right)$
1	0	0	0	0	0	0	1	$-V_{REF}$	$\left(-\frac{129}{256}\right)$
1	0	0	0	0	0	0	0	$-V_{REF}$	$\left(-\frac{128}{256}\right) = -\frac{V_{REF}}{2}$
0	1	1	1	1	1	1	1	$-V_{REF}$	$\left(-\frac{127}{256}\right)$
0	0	0	0	0	0	0	1	$-V_{REF}$	$\left(-\frac{1}{256}\right)$
0	0	0	0	0	0	0	0	$-V_{REF}$	$\left(-\frac{0}{256}\right) = 0$

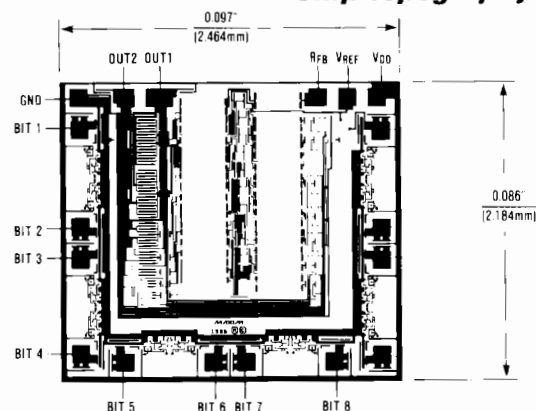
Note: 1LSB = $(2^{-8})(V_{REF}) = \left(\frac{1}{256}\right)(V_{REF})$

Table 2. Bipolar (Offset Binary) Code Table

DIGITAL INPUT								LSB	ANALOG OUTPUT
MSB									
1	1	1	1	1	1	1	1	$-V_{REF} \left(\frac{127}{128} \right)$	
1	0	0	0	0	0	0	1	$-V_{REF} \left(\frac{1}{128} \right)$	
1	0	0	0	0	0	0	0	0	
0	1	1	1	1	1	1	1	$+V_{REF} \left(\frac{1}{128} \right)$	
0	0	0	0	0	0	0	1	$+V_{REF} \left(\frac{127}{128} \right)$	
0	0	0	0	0	0	0	0	$+V_{REF} \left(\frac{128}{128} \right)$	

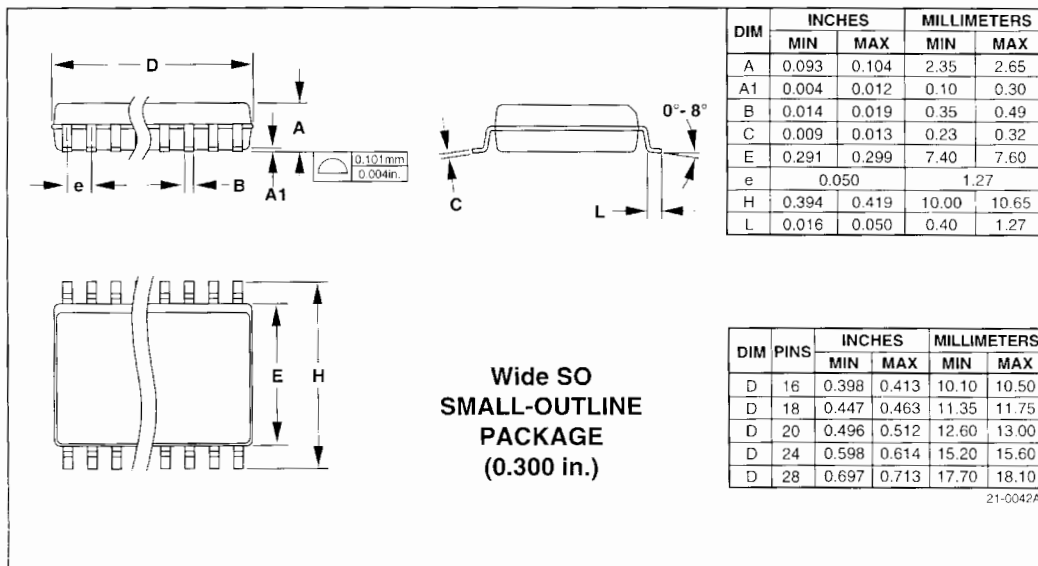
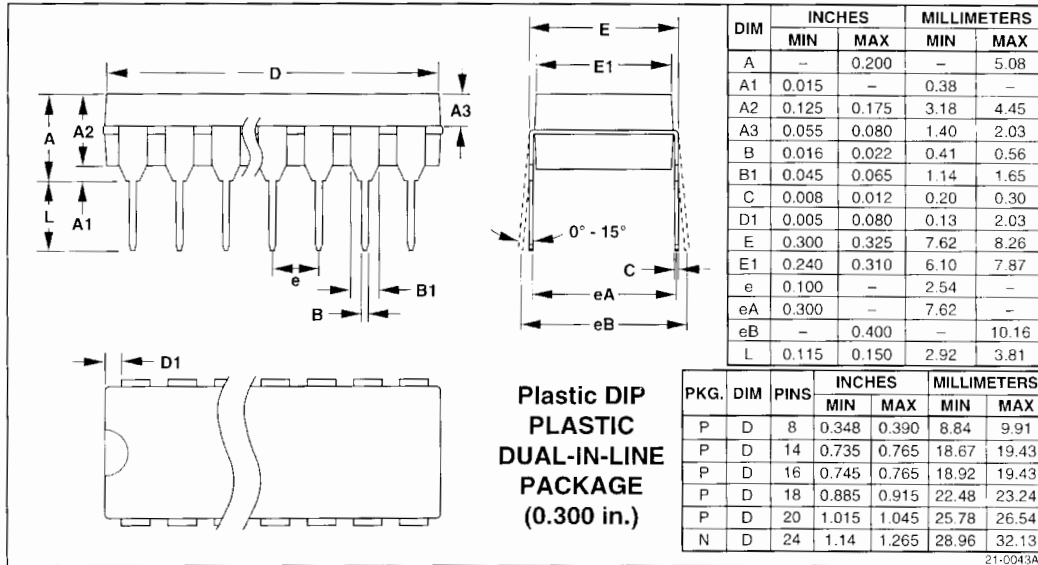
Note: 1LSB = $(2^{-7})(V_{REF}) = \left(\frac{1}{128}\right) (V_{REF})$

Chip Topography



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Package Information



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