MP7523/XRD7523

15 V CMOS
Multiplying 8-Bit
Digital-to-Analog Converter

...the analog plus company™

January 1996-2

FEATURES

- **Full Four-Quadrant Multiplying**
- **Low Feedthrough: 1/2 LSB @ 200 kHz**
- **Fast Settling: 100 ns (typ.)**
- **Low Power Dissipation**
- **Low Cost**
- **5 V/15 V Operation**
- **Buffered Version: MP7524/XRD7524**

APPLICATIONS

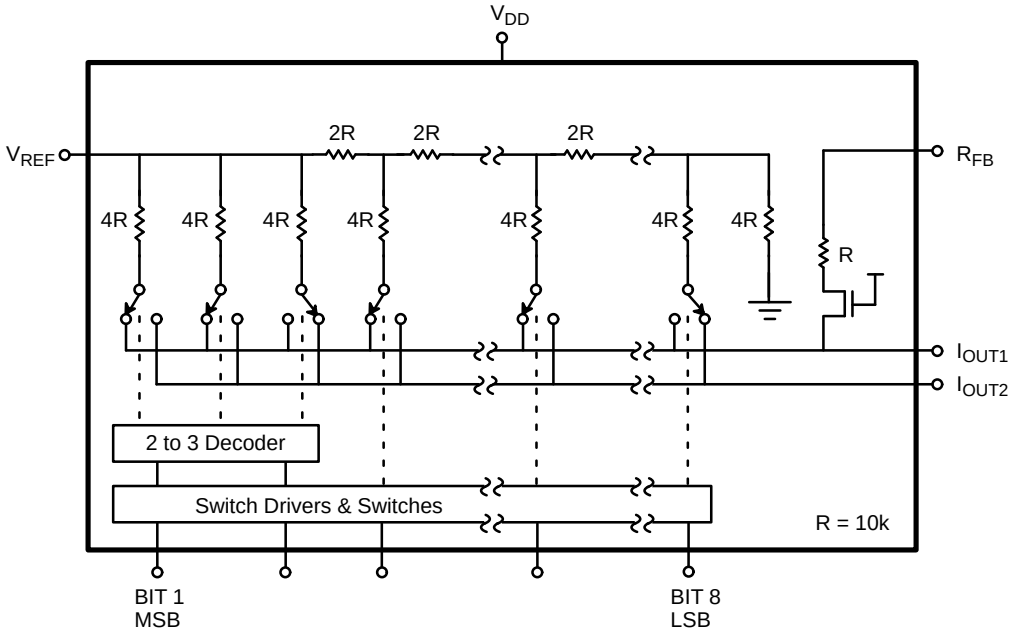
- **Battery Operated Equipment**
- **Low Power, Ratiometric A/D Converters**
- **Digitally Controlled Gain Circuits**
- **Digitally Controlled Attenuators**
- **CRT Character Generation**
- **Low Noise Audio Gain Control**

GENERAL DESCRIPTION

The MP7523/XRD7523 is a low cost multiplying Digital-to-Analog Converter. The device uses an advanced thin-film-on-CMOS technology to provide 8-bit resolution with accuracy to 10-bits and very low power dissipation.

The MP7523/XRD7523's excellent multiplying characteristics and low cost allow it to be used in a wide ranging field of applications such as: low noise audio gain control, CRT character generation, motor speed control, digitally controlled attenuators, etc.

SIMPLIFIED BLOCK DIAGRAM



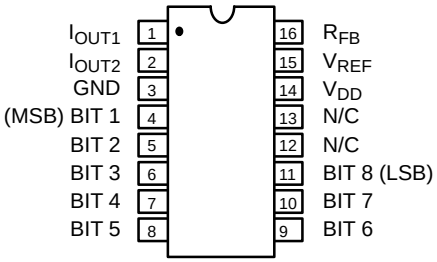
3 Segment D/A Converter with Termination to DGND
Logical "1" at Digital Input Steers Current to I_{OUT1}

EXAR Corporation, 48720 Kato Road, Fremont, CA 94538 ◆ (510) 668-7000 ◆ (510) 668-7010

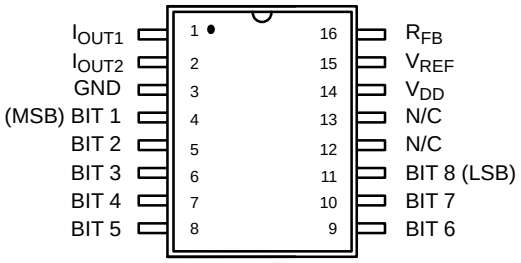
ORDERING INFORMATION

Package Type	Temperature Range	Part No.	INL (LSB)	DNL (LSB)	Gain Error (% FSR)
Plastic Dip	–40 to +85°C	MP7523JN	±1/2	±1	±1.8
Plastic Dip	–40 to +85°C	MP7523KN	±1/4	±1	±1.8
SOIC (Jedec, 0.300”)	–40 to +85°C	MP7523JS	±1/2	±1	±1.8
SOIC (Jedec, 0.300”)	–40 to +85°C	MP7523KS	±1/4	±1	±1.8
SOIC (Jedec, 0.150”)	–40 to +85°C	XRD7523AID-J	±1/2	±1	±1.8
SOIC (Jedec, 0.150”)	–40 to +85°C	XRD7523AID-K	±1/4	±1	±1.8
SOP (EIAJ)	–40 to +85°C	XRD7523AIK-J	±1/2	±1	±1.8
SOP (EIAJ)	–40 to +85°C	XRD7523AIK-K	±1/4	±1	±1.8

PIN CONFIGURATIONS



16 Pin PDIP (0.300”)



16 pin SOIC (Jedec, 0.300”)
16 pin SOIC (Jedec, 0.150”)
16 pin SOP (EIAJ, 5.5 mm)

PIN OUT DEFINITIONS

PIN NO.	NAME	DESCRIPTION
1	I_{OUT1}	Current Output 1
2	I_{OUT2}	Current Output 2
3	GND	Ground
4	BIT 1	Bit 1 (MSB)
5	BIT 2	Bit 2
6	BIT 3	Bit 3
7	BIT 4	Bit 4
8	BIT 5	Bit 5

PIN NO.	NAME	DESCRIPTION
9	BIT 6	Bit 6
10	BIT 7	Bit 7
11	BIT 8	Bit 8
12	N/C	No Connection
13	N/C	No Connection
14	V_{DD}	Positive Power Supply
15	V_{REF}	Reference Input Voltage
16	R_{FB}	Internal Feedback Resistor

ELECTRICAL CHARACTERISTICS

(V_{DD} = + 15 V, V_{REF} = +10 V unless otherwise noted)

Parameter	Symbol	25°C Min	25°C Typ	25°C Max	Tmin to Tmax Min	Tmin to Tmax Max	Units	Test Conditions/Comments
STATIC PERFORMANCE[1]								
Resolution (All Grades)	N	8			8		Bits	
Integral Non-Linearity (Relative Accuracy)	INL						LSB	Best Fit Straight Line (Max INL – Min INL) / 2
J				±1/2		±1/2		
K				±1/4		±1/4		
Monotonicity								Guaranteed over temp
Differential Non-Linearity	DNL						LSB	All grades monotonic over full temperature range.
J				±1		±1		
K				±1		±1		
Gain Error	GE			±1.5		±1.8	%	Using Internal R_{FB}
J								Digital Inputs = V_{INH}
K								
Power Supply Rejection Ratio	PSRR			±200		±300	ppm/%	$\lvert\Delta Gain/\Delta V_{DD}\rvert$ ΔV_{DD} = ± 5%
J								Digital Inputs = V_{INH}
K								
Output Leakage Current (Pin 1)	I_{OUT1}			±50nA		±200nA	nA	Digital Inputs = V_{INL}
J								
K								
Output Leakage Current (Pin 2)	I_{OUT2}			±50nA		±200nA	nA	Digital Inputs = V_{INH}
J								
K								
REFERENCE INPUT								
Input Resistance	R_{IN}	5		20	5	20	kΩ	V_{OUT1} = V_{OUT2} = 0 V
DIGITAL INPUTS								
Logical “1” Voltage	V_{IH}	14.5			14.5		V	
Logical “0” Voltage	V_{IL}			0.5		0.5	V	
Input Leakage Current	I_{LKG}			±1		±1	µA	
ANALOG OUTPUTS								
Output Capacitance[2]								
	C_{OUT1}			100		100	pF	DAC Inputs all 1’s
	C_{OUT1}			30		30	pF	DAC Inputs all 0’s
	C_{OUT2}			30		30	pF	DAC Inputs all 1’s
	C_{OUT2}			100		100	pF	DAC Inputs all 0’s

ELECTRICAL CHARACTERISTICS (CON'T)

Parameter	Symbol	25°C Min	25°C Typ	25°C Max	Tmin to Tmax Min	Tmin to Tmax Max	Units	Test Conditions/Comments
POWER SUPPLY								
Functional Voltage Range[2]	V_{DD}	5		16	5	16	V	
Supply Current	I_{DD}			1.6		1.6	mA	All digital inputs = 0 V or all = 15 V

NOTES:

1 Full Scale Range (FSR) is 10V.
2 Guaranteed but not production tested.
3 Digital input levels should not go below ground or exceed the positive supply voltage, otherwise damage may occur.
4 Specified values guarantee functionality. Refer to other parameters for accuracy.

Specifications are subject to change without notice

ABSOLUTE MAXIMUM RATINGS (T_A = +25°C unless otherwise noted)[1, 2]

V_{DD} to GND . . . . . +17 V

Digital Input Voltage to GND GND –0.5 to V_{DD} +0.5 V

I_{OUT1}, I_{OUT2} to GND . . . . . –0.5 to 6.5 V

V_{REF} to GND . . . . . ±25 V

V_{RFB} to GND . . . . . ±25 V

Storage Temperature . . . . . –65°C to +150°C

Lead Temperature (Soldering, 10 seconds) . +300°C

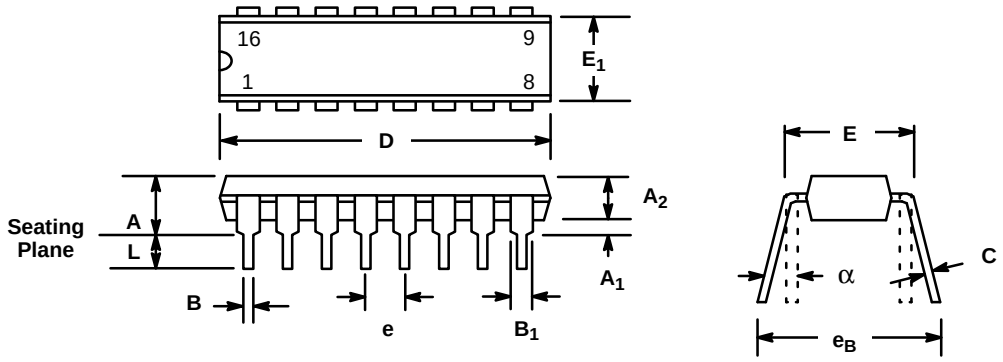
Package Power Dissipation Rating to 75°C
CDIP, PDIP, SOIC 800mW
Derates above 75°C . . . . . 11mW/°C

NOTES:
1 Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation at or above this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.
2 Any input pin which can see a value outside the absolute maximum ratings should be protected by Schottky diode clamps (HP5082-2835) from input pin to the supplies.

APPLICATION NOTES

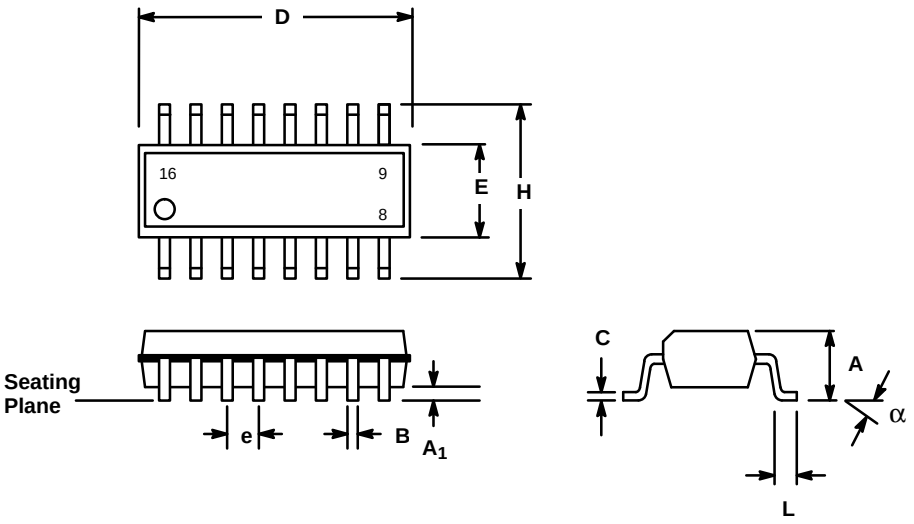
Refer to Section 8 in the 1995 Data Acquisition Products databook for Applications Information

16 LEAD PLASTIC DUAL-IN-LINE (300 MIL PDIP)



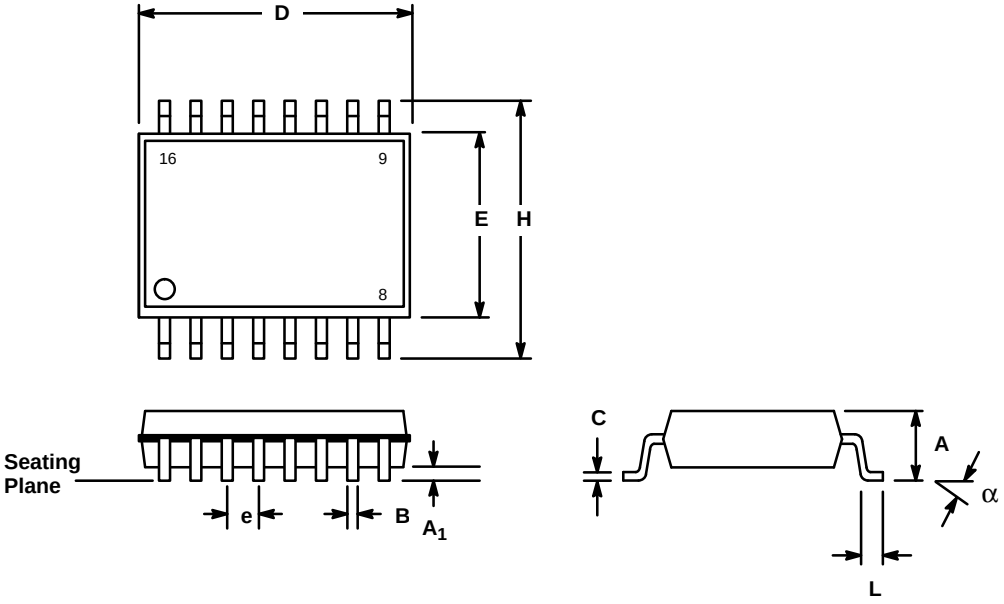
SYMBOL	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.145	0.210	3.68	5.33
A_1	0.015	0.070	0.38	1.78
A_2	0.115	0.195	2.92	4.95
B	0.014	0.024	0.36	0.56
B_1	0.030	0.070	0.76	1.78
C	0.008	0.014	0.20	0.38
D	0.745	0.840	18.92	21.34
E	0.300	0.325	7.62	8.26
E_1	0.240	0.280	6.10	7.11
e	0.100 BSC		2.54 BSC	
e_B	0.310	0.430	7.87	10.92
L	0.115	0.160	2.92	4.06
α	0°	15°	0°	15°

16 LEAD SMALL OUTLINE
(150 MIL JEDEC SOIC)



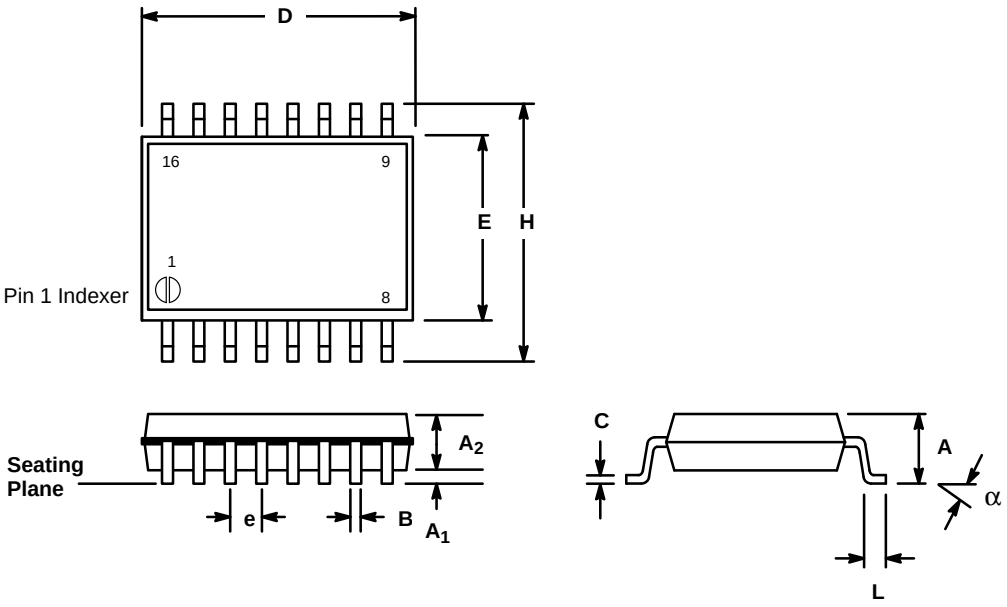
SYMBOL	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.053	0.069	1.35	1.75
A_1	0.004	0.010	0.10	0.25
B	0.013	0.020	0.33	0.51
C	0.007	0.010	0.19	0.25
D	0.386	0.394	9.80	10.00
E	0.150	0.157	3.80	4.00
e	0.050 BSC		1.27 BSC	
H	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27
α	0°	8°	0°	8°

16 LEAD SMALL OUTLINE
(300 MIL JEDEC SOIC)



SYMBOL	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.093	0.104	2.35	2.65
A_1	0.004	0.012	0.10	0.30
B	0.013	0.020	0.33	0.51
C	0.009	0.013	0.23	0.32
D	0.398	0.413	10.10	10.50
E	0.291	0.299	7.40	7.60
e	0.050 BSC		1.27 BSC	
H	0.394	0.419	10.00	10.65
L	0.016	0.050	0.40	1.27
α	0°	8°	0°	8°

16 LEAD EIAJ SMALL OUTLINE
(5.5 mm EIAJ SOP)



SYMBOL	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.80	2.40	0.071	0.095
A_1	0.02	0.20	0.001	0.008
A_2	1.80	2.20	0.079	0.087
B	0.30	0.50	0.012	0.020
C	0.13	0.20	0.005	0.008
D	9.9	10.5	0.390	0.414
E	5.30	5.70	0.209	0.224
e	1.27 BSC		0.050 BSC	
H	7.80	8.20	0.307	0.323
L	0.30	0.90	0.012	0.035
α	0°	15°	0°	15°

Notes

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NOTICE

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