

FEATURES

- 10-Bit Resolution
- Non-Linearity: 1/2 LSB to 2 LSB
- Nonlinearity Tempco: 0.2 ppm of FSR/°C, Max.
- Low Power Dissipation: 20 mW
- Current Settling Time: 500 ns
- Feedthrough Error: 1 mV p-p @ 10 kHz, Max.
- TTL/CMOS Compatible
- Latch-Up Free
- Improved Replacement for AD7533

BENEFITS

- Accurate Converter at Low Cost
- Can be used in Reverse Mode (Voltage Out)
- Flexible Design

APPLICATIONS

- Digital/Analog Multiplication
- Character Generation
- Programmable Power Supplies
- Gain Controlled Circuits

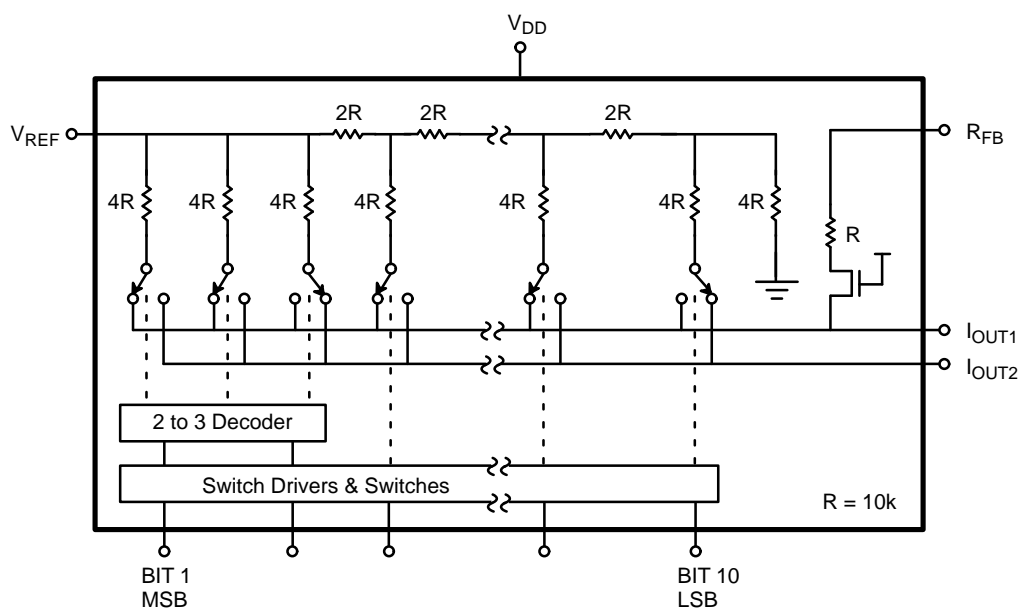
GENERAL DESCRIPTION

The MP7533 is a low cost, 10-bit multiplying Digital-to-Analog Converter. This device uses EXAR's patented advanced thin film resistor and CMOS technologies, providing up to 10-bit accuracies with TTL/CMOS compatibility.

Pin and functional equivalent to the industry standard MP7520, the MP7533 is recommended as a lower cost alternative for old MP7520 sockets or new 10-bit DAC designs.

The MP7533 applications include: digital-to-analog multiplication, CRT character generation, programmable power supplies, digitally controlled gain circuits, etc.

SIMPLIFIED BLOCK DIAGRAM



3 Segment D/A Converter with Termination to DGND
Logical "1" at Digital Input Steers Current to IOUT1

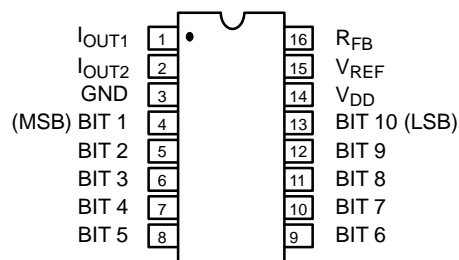
ORDERING INFORMATION

Package Type	Temperature Range	Part No.	INL (LSB)	DNL (LSB)	Gain Error (% FSR)
Plastic Dip	-40 to +85°C	MP7533JN	±2	±1	1.5
Plastic Dip	-40 to +85°C	MP7533KN	±1	±1	1.5
Plastic Dip	-40 to +85°C	MP7533LN	±1/2	±1	1.5
SOIC	-40 to +85°C	MP7533JS	±2	±1	1.5
SOIC	-40 to +85°C	MP7533KS	±1	±1	1.5
SOIC	-40 to +85°C	MP7533LS	±1/2	±1	1.5
Ceramic Dip	-40 to +85°C	MP7533AD	±2	±1	1.5
Ceramic Dip	-40 to +85°C	MP7533BD	±1	±1	1.5
Ceramic Dip	-40 to +85°C	MP7533CD	±1/2	±1	1.5
Ceramic Dip	-55 to +125°C	MP7533SD*	±2	±1	1.5
Ceramic Dip	-55 to +125°C	MP7533TD*	±1	±1	1.5
Ceramic Dip	-55 to +125°C	MP7533UD*	±1/2	±1	1.5

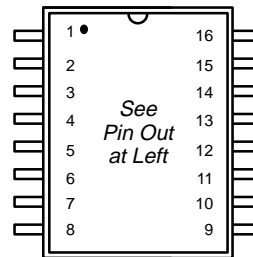
*Contact factory for non-compliant military processing

PIN CONFIGURATIONS

See Packaging Section for Package Dimensions



16 Pin CDIP, PDIP (0.300")
D16, N16



16 Pin SOIC (Jedec, 0.300")
S16

PIN OUT DEFINITIONS

PIN NO.	NAME	DESCRIPTION	PIN NO.	NAME	DESCRIPTION
1	I _{OUT1}	Current Output 1	9	BIT 6	Data Input Bit 6
2	I _{OUT2}	Current Output 2	10	BIT 7	Data Input Bit 7
3	GND	Ground	11	BIT 8	Data Input Bit 8
4	BIT 1	Data Input Bit 1 (MSB)	12	BIT 9	Data Input Bit 9
5	BIT 2	Data Input Bit 2	13	BIT 10	Data Input Bit 10 (LSB)
6	BIT 3	Data Input Bit 3	14	V _{DD}	Positive Power Supply
7	BIT 4	Data Input Bit 4	15	V _{REF}	Reference Input Voltage
8	BIT 5	Data Input Bit 5	16	R _{FB}	Internal Feedback Resistor

ELECTRICAL CHARACTERISTICS

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

Parameter	Symbol	Min	25°C Typ	Max	Tmin to Tmax Min	Max	Units	Test Conditions/Comments
STATIC PERFORMANCE ¹								
Resolution (All Grades)	N	10			10		Bits	FSR = Full Scale Range Best Fit Straight Line Spec. (Max INL – Min INL) / 2
Integral Non-Linearity (Relative Accuracy)	INL						LSB	
A, S, J				±2		±2		
B, T, K				±1		±1		
C, U, L				±1/2		±1/2		
Differential Non-Linearity	DNL						LSB	
A, S, J				±1		±1		
B, T, K				±1		±1		
C, U, L				±1		±1		
Gain Error	GE	±0.4		±1.5		±1.5	% FSR		Using Internal R_{FB}
Gain Temperature Coefficient ²	TC _{GE}					±2	ppm/°C	ΔGain/ΔTemperature
Power Supply Rejection Ratio	PSRR	±30		±50		±50	ppm/%	|ΔGain/ΔV _{DD}| ΔV _{DD} = ± 5%
Output Leakage Current	I _{OUT}			±50		±200	nA	
REFERENCE INPUT								
Input Resistance	R _{IN}	5	10	20	5	20	kΩ	
DIGITAL INPUTS ³								
Logical “1” Voltage	V _{IH}	3.0	2.4		3.0		V	
Logical “0” Voltage	V _{IL}			0.8		0.8	V	
Input Leakage Current	I _{LKG}			±1		±1	μA	
ANALOG OUTPUTS								
Output Capacitance ²								DAC Inputs all 1’s DAC Inputs all 0’s DAC Inputs all 1’s DAC Inputs all 0’s
	C _{OUT1}			52			pF	
	C _{OUT1}			26			pF	
	C _{OUT2}			13			pF	
	C _{OUT2}			45			pF	
POWER SUPPLY ⁴								
Functional Voltage Range ²	V _{DD}	4.5		15	4.5	15	V	All digital inputs = 0 or all = 5 V
Supply Current	I _{DD}			2		2	mA	
Total Dissipation			20				mW	

NOTES:

- 1 Full Scale Range (FSR) is 10V for unipolar mode.
- 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 (TA = +25°C unless otherwise noted)^{1, 2}

V _{DD} to GND	.....+17 V	Storage Temperature	..... –65°C to +150°C
Digital Input Voltage to GND	.... GND –0.5 to V _{DD} +0.5 V	Lead Temperature (Soldering, 10 seconds)	..... +300°C
I _{OUT1} , I _{OUT2} to GND	..... –0.5 to V _{DD} +0.5 V	Package Power Dissipation Rating to 75°C	
V _{REF} to GND	.....±25 V	CDIP, PDIP, SOIC, PLCC	..... 700mW
V _{RFB} to GND	.....±25 V	Derates above 75°C	..... 10mW/°C

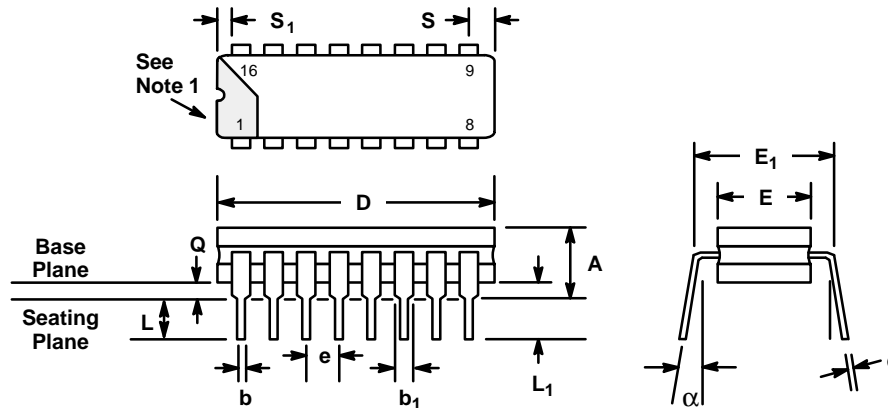
NOTES:

- 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. *All inputs have protection diodes* which will protect the device from short transients outside the supplies of less than 20mA for less than 100μs.

APPLICATION NOTES

Refer to Section 8 for Applications Information

**16 LEAD CERAMIC DUAL-IN-LINE
(300 MIL CDIP)
D16**

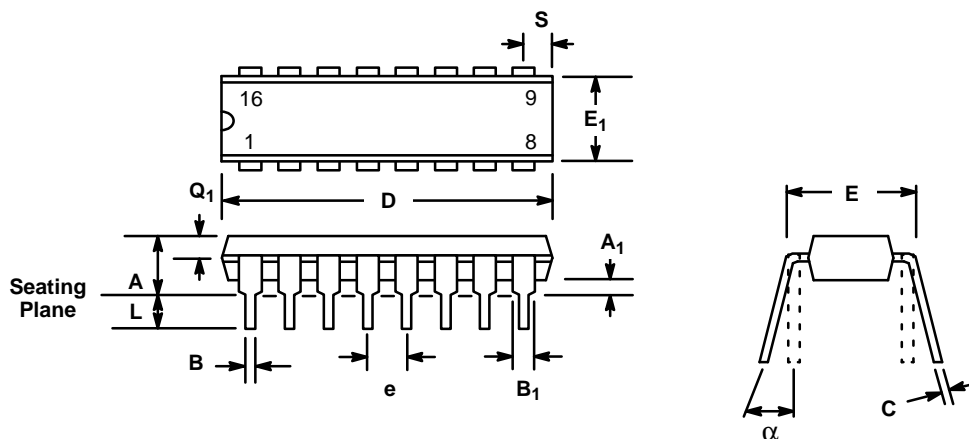


SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	—	0.200	—	5.08	—
b	0.014	0.023	0.356	0.584	—
b ₁	0.038	0.065	0.965	1.65	2
c	0.008	0.015	0.203	0.381	—
D	—	0.840	—	21.34	4
E	0.220	0.310	5.59	7.87	4
E ₁	0.290	0.320	7.37	8.13	7
e	0.100 BSC		2.54 BSC		5
L	0.125	0.200	3.18	5.08	—
L ₁	0.150	—	3.81	—	—
Q	0.015	0.060	0.381	1.52	3
S	—	0.080	—	2.03	6
S ₁	0.005	—	0.13	—	6
α	0°	15°	0°	15°	—

NOTES

1. Index area; a notch or a lead one identification mark is located adjacent to lead one and is within the shaded area shown.
2. The minimum limit for dimension b₁ may be 0.023 (0.58 mm) for all four corner leads only.
3. Dimension Q shall be measured from the seating plane to the base plane.
4. This dimension allows for off-center lid, meniscus and glass overrun.
5. The basic lead spacing is 0.100 inch (2.54 mm) between centerlines.
6. Applies to all four corners.
7. This is measured to outside of lead, not center.

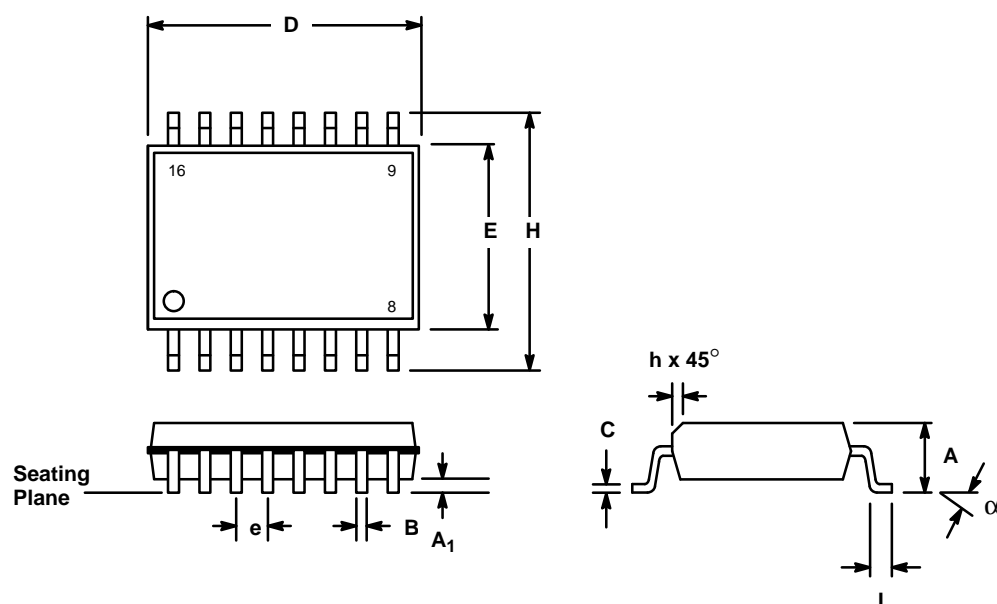
16 LEAD PLASTIC DUAL-IN-LINE
(300 MIL PDIP)
N16



SYMBOL	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	—	0.200	—	5.08
A ₁	0.015	—	0.38	—
B	0.014	0.023	0.356	0.584
B ₁ (1)	0.038	0.065	0.965	1.65
C	0.008	0.015	0.203	0.381
D	0.745	0.785	18.92	19.94
E	0.295	0.325	7.49	8.26
E ₁	0.220	0.310	5.59	7.87
e	0.100 BSC		2.54 BSC	
L	0.115	0.150	2.92	3.81
α	0°	15°	0°	15°
Q ₁	0.055	0.070	1.40	1.78
S	0.020	0.080	0.51	2.03

Note: (1) The minimum limit for dimensions B1 may be 0.023" (0.58 mm) for all four corner leads only.

**16 LEAD SMALL OUTLINE
(300 MIL JEDEC SOIC)
S16**



SYMBOL	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.097	0.104	2.46	2.64
A ₁	0.0050	0.0115	0.127	0.292
B	0.014	0.019	0.356	0.482
C	0.0091	0.0125	0.231	0.318
D	0.402	0.412	10.21	10.46
E	0.292	0.299	7.42	7.59
e	0.050 BSC		1.27 BSC	
H	0.400	0.410	10.16	10.41
h	0.010	0.016	0.254	0.406
L	0.016	0.035	0.406	0.889
α	0°	8°	0°	8°

NOTICE

EXAR Corporation reserves the right to make changes to the products contained in this publication in order to improve design, performance or reliability. EXAR Corporation assumes no responsibility for the use of any circuits described herein, conveys no license under any patent or other right, and makes no representation that the circuits are free of patent infringement. Charts and schedules contains here in are only for illustration purposes and may vary depending upon a user's specific application. While the information in this publication has been carefully checked; no responsibility, however, is assumed for inaccuracies.

EXAR Corporation does not recommend the use of any of its products in life support applications where the failure or malfunction of the product can reasonably be expected to cause failure of the life support system or to significantly affect its safety or effectiveness. Products are not authorized for use in such applications unless EXAR Corporation receives, in writing, assurances to its satisfaction that: (a) the risk of injury or damage has been minimized; (b) the user assumes all such risks; (c) potential liability of EXAR Corporation is adequately protected under the circumstances.

Copyright EXAR Corporation

Datasheet April 1995

Reproduction, in part or whole, without the prior written consent of EXAR Corporation is prohibited.