T-51-09-08

MP7529B

CMOS
Dual Buffered Multiplying 8-Bit
Digital-to-Analog Converter

Micro Power Systems

FEATURES

- Very Low Total Harmonic Distortion
- Low Glitch Energy
- Fast Settling Time
- Four Quadrant Multiplication
- On-Chip Latches for Both DACs
- 4.5 V to 5.5 V Operation
- Low Power Consumption
- TTL/5V CMOS Compatible
- Latch-Up Resistant

BENEFITS

- Quiet Operation in Audio Applications
- Easy Interface to Microprocessors
- PDIP, PLCC & SOIC Packages Available

GENERAL DESCRIPTION

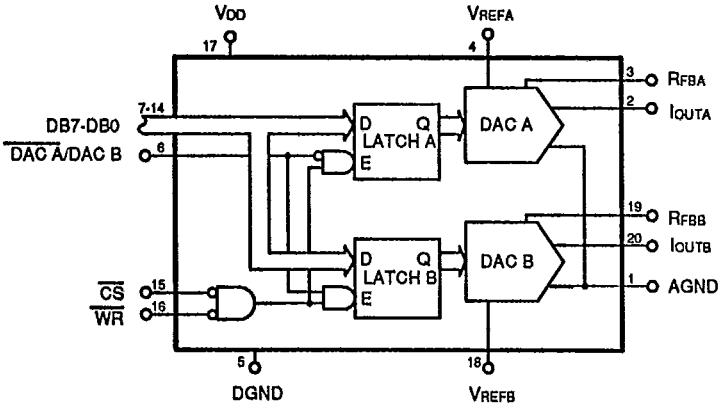
The MP7529B is a monolithic dual 8-bit D/A converter featuring excellent DAC to DAC matching, tracking and specifically optimized for applications requiring low total harmonic distortion. The MP7529B is manufactured using advanced thin film resistors on a double metal CMOS process. The MP7529B incorporates a unique bit decoding technique yielding lower glitch energy, higher speed and excellent accuracy over temperature and time.

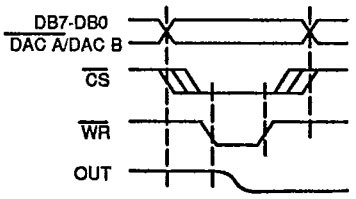
Data is transferred to either of the two D/A Converter latches via a common 8-bit TTL/5 V CMOS compatible input port. The control input $\overline{\text{DAC A}}$/DAC B determines which D/A is to be loaded.

The device operates from a 4.5 V to 5.5 V power supply, and is TTL-compatible over this range. Power dissipation is only 10 mW. Both DACs offer excellent four quadrant multiplication characteristics, and include separate reference inputs and feedback resistors. MPS' improved latch-up resistant design eliminates the need for external protective Schottky diodes in most applications.

Specified for operation over the commercial / industrial (–40 to +85°C) temperature range, the MP7529B is available in Plastic dual-in-line (PDIP), Plastic leaded chip carrier (PLCC) and Small Outline (SOIC) packages.

SIMPLIFIED BLOCK AND TIMING DIAGRAM





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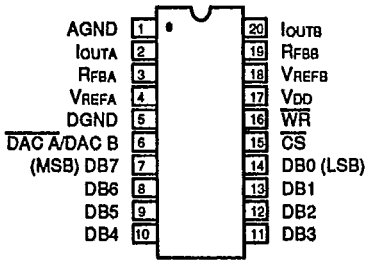
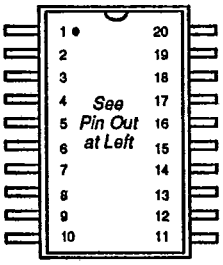
ORDERING INFORMATION

Package Type	Temperature Range	Part No.	Relative Accuracy	Differential Non-Linearity	Gain Error
Plastic Dip	–40 to +85°C	MP7529BJN	±1 LSB	±1 LSB	±5 LSB
Plastic Dip	–40 to +85°C	MP7529BKN	±1/2 LSB	±1 LSB	±3 LSB
Plastic Dip	–40 to +85°C	MP7529BLN	±1/4 LSB	±1 LSB	±1 LSB
SOIC	–40 to +85°C	MP7529BJS	±1 LSB	±1 LSB	±5 LSB
SOIC	–40 to +85°C	MP7529BKS	±1/2 LSB	±1 LSB	±3 LSB
PLCC	–40 to +85°C	MP7529BJP	±1 LSB	±1 LSB	±5 LSB
PLCC	–40 to +85°C	MP7529BKP	±1/2 LSB	±1 LSB	±3 LSB

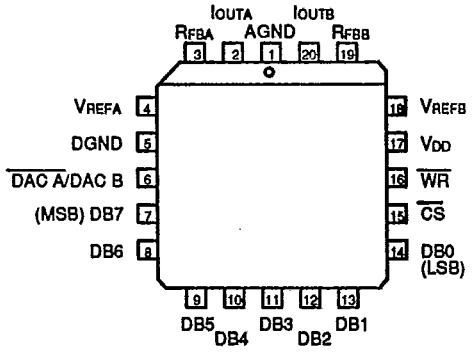
PIN CONFIGURATIONS



20 Pin PDIP (0.300")



20 Pin SOIC (Jedec, 0.300")



20 Pin PLCC (0.350")

PIN OUT DEFINITIONS

PIN NO.	NAME	DESCRIPTION
1	AGND	Analog Ground
2	IOUTA	Current Output of DAC A
3	RFBA	Internal Feedback Resistor of DAC A
4	VREFA	Reference Input Voltage of DAC A
5	DGND	Digital Ground
6	$\overline{\text{DACA/DACB}}$	DAC selection control
7	DB7	Data Input Bit 7 (MSB)
8	DB6	Data Bit 6
9	DB5	Data Bit 5
10	DB4	Data Bit 4

PIN NO.	NAME	DESCRIPTION
11	DB3	Data Bit 3
12	DB2	Data Bit 2
13	DB1	Data Bit 1
14	DB0	Data Bit 0 (LSB)
15	$\overline{\text{CS}}$	Chip Select (Active Low)
16	$\overline{\text{WR}}$	Write Enable (Active Low)
17	VDD	Power Supply
18	VREFB	Reference Input Voltage of DAC B
19	RFBB	Internal Feedback Resistor of DAC B
20	IOUTB	Current Output of DAC B

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ELECTRICAL CHARACTERISTICS

(V_{DD} = 4.5 V to 5.5 V, Nominal V_{DD} = 5 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	End Point Linearity Spec.
J				±1		±1		
K				±1/2		±1/2		
L				±1/4		±1/4		
Differential Non-Linearity	DNL						LSB	All grades monotonic over full temperature range.
J				±1		±1		
K				±1		±1		
L				±1		±1		
Gain Error	GE						LSB	Using Internal R_{FB}
J				±4		±5		
K				±2		±3		
L				±1		±1		
Gain Temperature Coefficient (2)	TC_{GE}			±15		±15	ppm/°C	ΔGain/ΔTemperature
Power Supply Rejection Ratio	PSRR			100		200	ppm/%	$\lvert\Delta Gain/\Delta V_{DD}\rvert$, ΔV_{DD} = ± 5% V_{DD} = 4.75 V, ±5%, & 5.25 V ±5%
Output Leakage Current	I_{LKG}			±50		±200	nA	
DYNAMIC PERFORMANCE (2)								
Harmonic Distortion	THD		–95				dB	V_{IN} = 6V_{RMS} @ 1 KHz
Digital Crosstalk	Q		30				nVs	
AC Feedthrough	F_T						dB	
V_{REFA} to I_{OUTA}	F_{TA}		–70			–65	dB	
V_{REFB} to I_{OUTB}	F_{TB}		–70			–65	dB	
Channel-to-Channel Isolation	CCI						dB	
V_{REFA} to I_{OUTB}	C_{CIBA}		–77				dB	
V_{REFB} to I_{OUTA}	C_{CIAB}		–77				dB	
Glitch Energy	Egl		10				nVs	All zeros to all ones Input Change.
Current Settling Time	ts		200			250	ns	To 1/2 LSB, R_L=100Ω, C_{EXT}=13pF
Propagation Delay	t_{PD}		100			150	ns	From 50% of digital input to 90% of final analog output current R_L=100Ω, C_{EXT}=13pF
REFERENCE INPUT								
Input Resistance	R_{IN}	8		15	8	15	KΩ	
Input Resistance Matching				±1		±1	%	

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ELECTRICAL CHARACTERISTICS (CONT'D)

Parameter	Symbol	25°C Min	25°C Typ	25°C Max	Tmin to Tmax Min	Tmin to Tmax Max	Units	Test Conditions/Comments
DIGITAL INPUTS (3)								
Logical "1" Voltage	V_{IH}	2.4			2.4		V	
Logical "0" Voltage	V_{IL}			0.8		0.8	V	
Input Leakage Current	I_{LKG}			±1		±10	µA	
Input Capacitance (2)								
Data	C_{IN}			10		10	pF	
Control	C_{IN}			15		15	pF	
ANALOG OUTPUTS (2)								
Output Capacitance								
	$C_{OUTA/B}$			120		120	pF	DAC inputs all 1's
	$C_{OUTA/B}$			50		50	pF	DAC inputs all 0's
POWER SUPPLY								
Supply Current	I_{DD}			1		1	mA	All digital inputs = 0 V or 5 V
				2		2	mA	All digital inputs = V_{IL} or V_{IH}
TIMING SPECIFICATIONS (4)								
Chip Select to Write Set-Up Time	t_{CS}	60			80		ns	
Chip Select to Write Hold Time	t_{CH}	15			20		ns	
DAC Select to Write Set-Up Time	t_{AS}	60			80		ns	
DAC Select to Write Hold Time	t_{AH}	15			20		ns	
Data Valid to Write Set-Up Time	t_{DS}	60			80		ns	
Data Valid to Write Hold Time	t_{DH}	0			0		ns	
Write Pulse Width (5)	t_{WR}	60			80		ns	

NOTES:

(1) Full Scale Range (FSR) is 10V for unipolar mode and ±10V for bipolar.
(2) Guaranteed but not production tested.
(3) Digital input levels should not go below GND or exceed the positive supply voltage, otherwise damage may occur.
(4) See timing diagram.
(5) t_{WR} = 40ns minimum if t_{DH} > 15ns (@T = 25°C)

Specifications are subject to change without notice

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

V_{DD} to AGND ..... 0 to +7 V
V_{DD} to DGND ..... 0 to +7 V
AGND to DGND ..... V_{DD} +0.5 V
DGND to AGND ..... V_{DD} +0.5 V
Digital Input Voltage to DGND ... GND –0.5 to V_{DD} +0.5 V
I_{OUTA}, I_{OUTB} to AGND ..... GND –0.5 to V_{DD} +0.5 V
V_{REFA}, V_{REFB} to AGND ..... ±25 V
V_{RFBA}, V_{RFBB} to AGND ..... ±25 V
Storage Temperature .....–65°C to +150°C
Lead Temperature (Soldering, 10 seconds) ..... +300°C
Package Power Dissipation Rating to 75°C
PDIP, SOIC, PLCC 450mW
Derates above 75°C ..... 6mW/°C

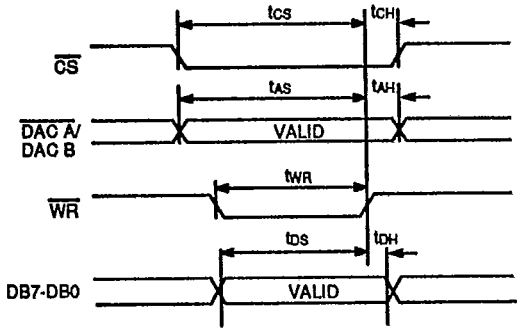
NOTES:

(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 100mA for less than 100µs.

DIGITAL INTERFACE

The digital inputs are designed to be both TTL and 5 V CMOS compatible. All logic inputs are static protected MOS gates with typical input currents of less than 10nA.

The control input $\overline{\text{DAC A}}$/DAC B selects which DAC can accept data from the input port. Inputs $\overline{CS}$ and $\overline{WR}$ control the operating mode of the selected DAC (*Table 1.*). When $\overline{CS}$ and $\overline{WR}$ are both low the selected DAC is in the write mode. The input data latches of the selected DAC are transparent and its analog output responds to activity on DB0-DB7 (Write mode). The selected DAC latch retains the data which was present on DB0-DB7 just prior to $\overline{CS}$ or $\overline{WR}$ assuming a high state. Both analog outputs remain at the values corresponding to the data in their respective latches (Hold mode).



NOTE:
1. Timing measured from (V_{IH} + V_{IL}) /2

Figure 1. Write Cycle Timing Diagram

DAC A/ DAC B	$\overline{CS}$	$\overline{WR}$	DAC A	DAC B
L	L	L	WRITE	HOLD
H	L	L	HOLD	WRITE
X	H	X	HOLD	HOLD
X	X	H	HOLD	HOLD

L = Low State H = High State X = Don't Care

Table 1. DAC's Mode Selection

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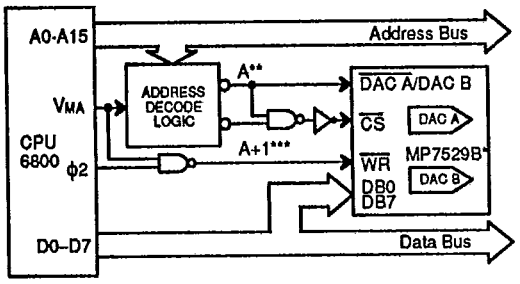
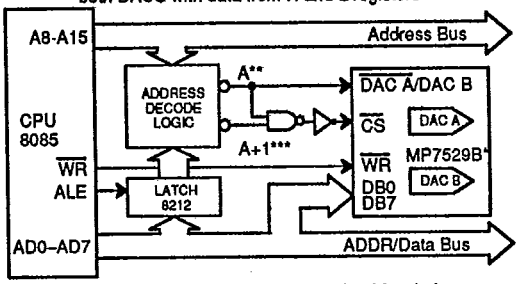
MICROPROCESSOR INTERFACE



*Analog circuitry has been omitted for clarity
**A = Decoded 7529B DAC A Address
***A + 1 = Decoded 752B9 DAC B Address

Figure 2. MP7529B Dual DAC to 6800 CPU Interface

NOTE:
8085 instruction shld (store H & L direct) can update both DACS with data from H and L registers



*Analog circuitry has been omitted for clarity
**A = Decoded 7529B DAC A Address
***A + 1 = Decoded 7529B DAC B Address

Figure 3. MP7529B Dual DAC to 8085 CPU Interface

APPLICATION NOTES

Refer to Applications Section for Additional Information