



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

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 Free
- 15 V Operation: MP7529A

BENEFITS

- Quiet Operation in Audio Applications
- Easy Interface to Microprocessors

GENERAL DESCRIPTION

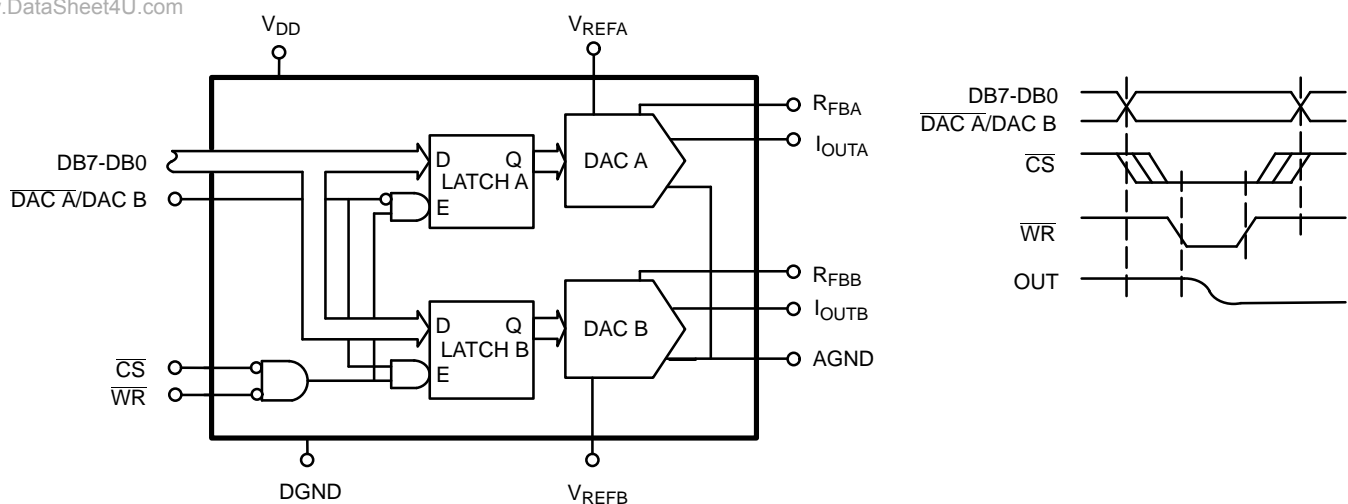
The MP7529B is a dual 8-bit Digital-to-Analog Converter featuring excellent DAC to DAC matching, tracking and specifically optimized for applications requiring low total harmonic distortion. The MP7529B is manufactured using advanced thin film resistors on a double metal CMOS process. The MP7529B incorporates 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. An improved latch-up resistant design eliminates the need for external protective Schottky diodes in most applications.

SIMPLIFIED BLOCK AND TIMING DIAGRAM

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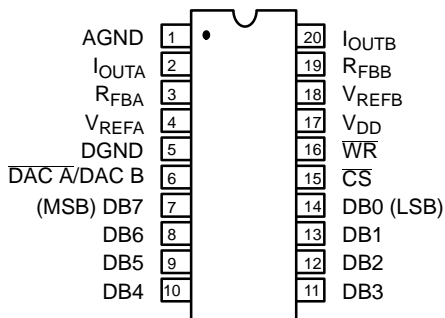


ORDERING INFORMATION

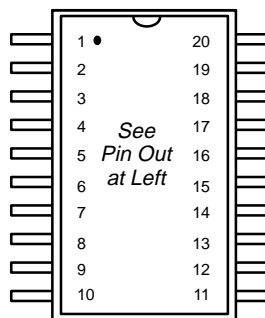
Package Type	Temperature Range	Part No.	INL (LSB)	DNL (LSB)	Gain Error (LSB)
Plastic Dip	-40 to +85°C	MP7529BJN	±1	±1	±5
Plastic Dip	-40 to +85°C	MP7529BKN	±1/2	±1	±3
SOIC	-40 to +85°C	MP7529BJS	±1	±1	±5
SOIC	-40 to +85°C	MP7529BKS	±1/2	±1	±3
PLCC	-40 to +85°C	MP7529BJP	±1	±1	±5
PLCC	-40 to +85°C	MP7529BKP	±1/2	±1	±3

PIN CONFIGURATIONS

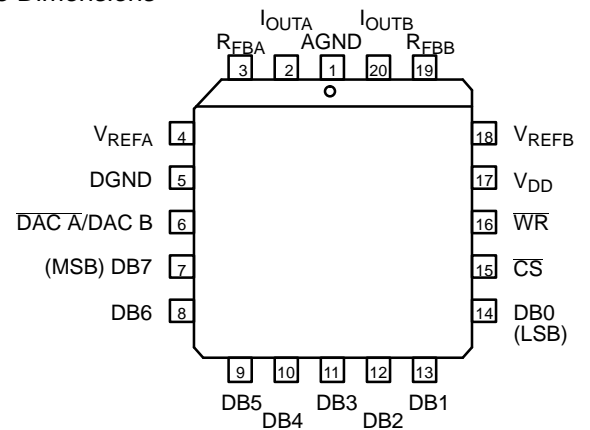
See Packaging Section for Package Dimensions



**20 Pin PDIP (0.300")
N20**



**20 Pin SOIC (Jedec, 0.300")
S20**



**20 Pin PLCC
P20**

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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	DAC A/DAC B	DAC selection control
7	DB7	Data Input Bit 7 (MSB)
8	DB6	Data Input Bit 6
9	DB5	Data Input Bit 5
10	DB4	Data Input Bit 4

PIN NO.	NAME	DESCRIPTION
11	DB3	Data Input Bit 3
12	DB2	Data Input Bit 2
13	DB1	Data Input Bit 1
14	DB0	Data Input Bit 0 (LSB)
15	CS	Chip Select (Active Low)
16	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

ELECTRICAL CHARACTERISTICS

($V_{DD} = 4.5\text{ V to }5.5\text{ V}$, Nominal $V_{DD} = 5\text{ V}$, $V_{REF} = 10\text{ V}$ unless otherwise noted)

Parameter	Symbol	25°C			Tmin to Tmax		Units	Test Conditions/Comments
		Min	Typ	Max	Min	Max		
STATIC PERFORMANCE¹								
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	
Differential Non-Linearity	DNL						LSB	All grades monotonic over full temperature range.
J				±1			±1	
K				±1			±1	
Gain Error	GE						LSB	Using Internal R_{FB}
J				±4			±5	
K				±2			±3	
Gain Temperature Coefficient ²	TC_{GE}			±15			ppm/°C	$\Delta\text{Gain}/\Delta\text{Temperature}$
Power Supply Rejection Ratio	PSRR			±100			ppm/%	$ \Delta\text{Gain}/\Delta V_{DD} $, $\Delta V_{DD} = \pm 5\%$ $V_{DD} = 4.75\text{ V}, \pm 5\%$, & $5.25\text{ V} \pm 5\%$
Output Leakage Current	I_{LKG}			±50			nA	
DYNAMIC PERFORMANCE²								
Harmonic Distortion	THD		-95				dB	$V_{IN} = 6V_{RMS} @ 1\text{ KHz}$
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	t_S		200			250	ns	To 1/2 LSB, $R_L=100\Omega$, $C_{EXT}=13\text{pF}$
Propagation Delay	t_{PD}		100			150	ns	From 50% of digital input to 90% of final analog output current $R_L=100\Omega$, $C_{EXT}=13\text{pF}$
REFERENCE INPUT								
Input Resistance	R_{IN}	8		15	8	15	k Ω	
Input Resistance Matching				±1		±1	%	
DIGITAL INPUTS³								
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	

ELECTRICAL CHARACTERISTICS (CONT'D)

Parameter	Symbol	25°C			Tmin to Tmax		Units	Test Conditions/Comments
		Min	Typ	Max	Min	Max		
ANALOG OUTPUTS²								
Output Capacitance	C _{OUTA/B}			120		120	pF	DAC inputs all 1's DAC inputs all 0's
	C _{OUTA/B}			50		50	pF	
POWER SUPPLY								
Supply Current	I _{DD}			1		1	mA	All digital inputs = 0 V or 5 V All digital inputs = V _{IL} or V _{IH}
				2		2	mA	
TIMING SPECIFICATIONS⁴								
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.
- 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 (TA = +25°C unless otherwise noted)^{1, 2, 3}

V _{DD} to GND	0 to +7 V	V _{RFBA} , V _{RFBB} to GND	±25 V
AGND to DGND (Functionality Guaranteed ±0.5 V)	±1 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 _{OUTA} , I _{OUTB} to GND	GND -0.5 to V _{DD} +0.5 V	Package Power Dissipation Rating to 75°C	
V _{REFA} , V _{REFB} to GND	±25 V	PDIP, SOIC, PLCC	900mW
		Derates above 75°C	12mW/°C

NOTES:

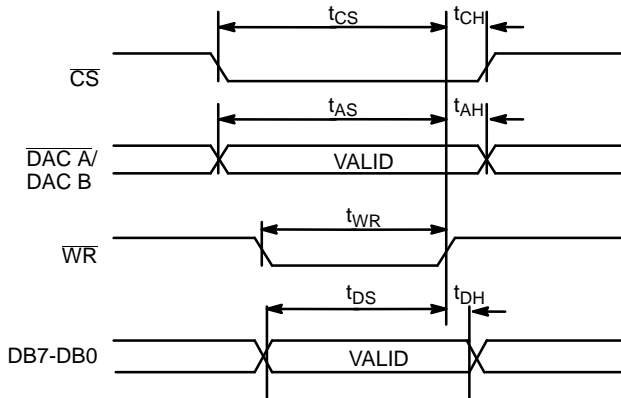
- 1 Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation at or above this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.
- 2 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.
- 3 GND refers to AGND and DGND.

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 $\overline{\text{CS}}$ and $\overline{\text{WR}}$ control the operating mode of the selected DAC (Table 1.). When $\overline{\text{CS}}$ and $\overline{\text{WR}}$

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 $\overline{\text{CS}}$ or $\overline{\text{WR}}$ 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 $(V_{IH} + V_{IL}) / 2$

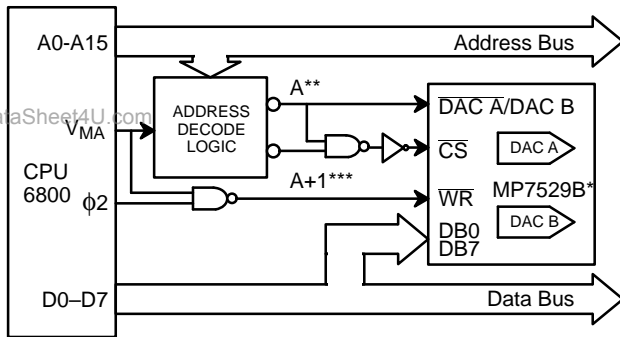
Figure 1. Write Cycle Timing Diagram

DAC A/ DAC B	$\overline{\text{CS}}$	$\overline{\text{WR}}$	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

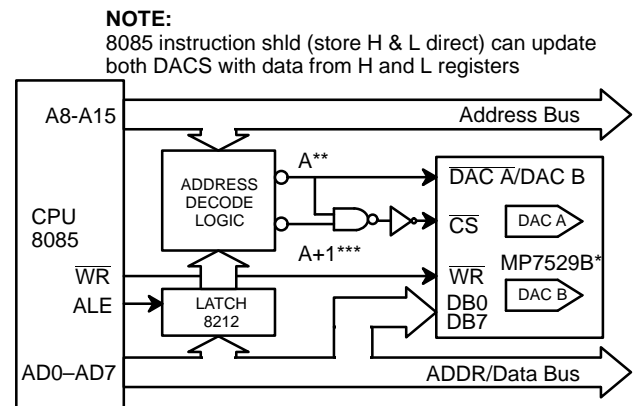
Table 1. DAC's Mode Selection

MICROPROCESSOR INTERFACE



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

Figure 2. MP7529B Dual DAC to 6800 CPU Interface



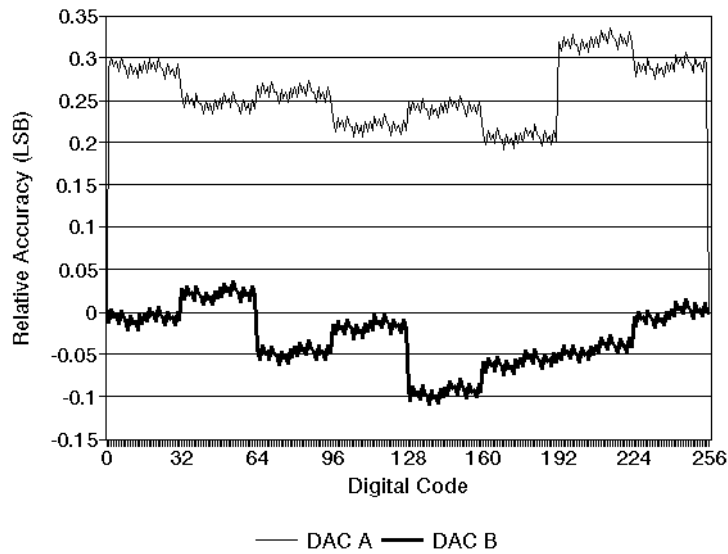
NOTE:

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

PERFORMANCE CHARACTERISTICS

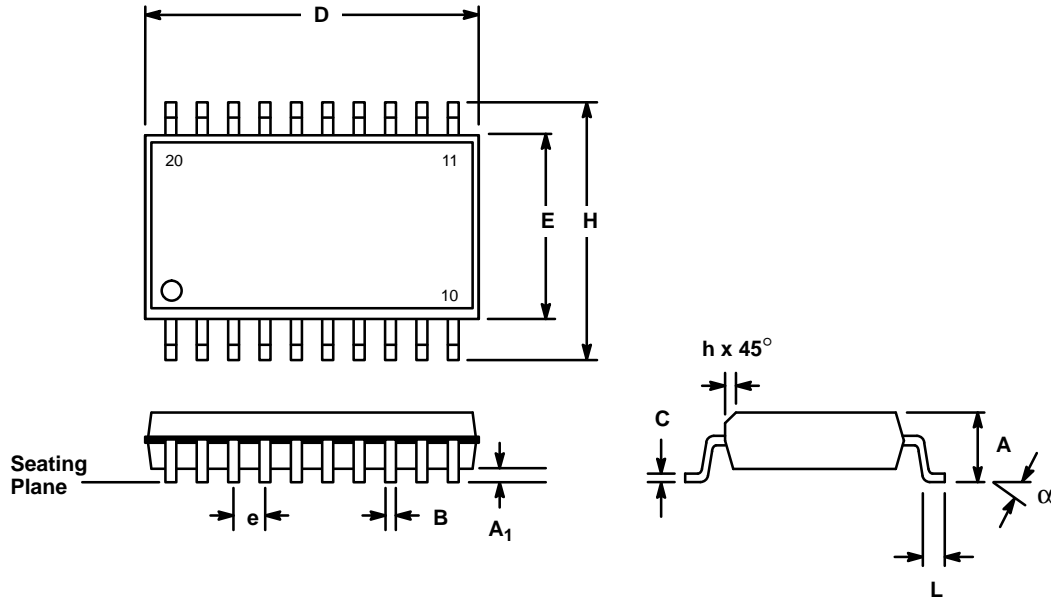


Graph 1. Relative Accuracy vs. Digital Code

APPLICATION NOTES

Refer to Section 8 for Applications Information

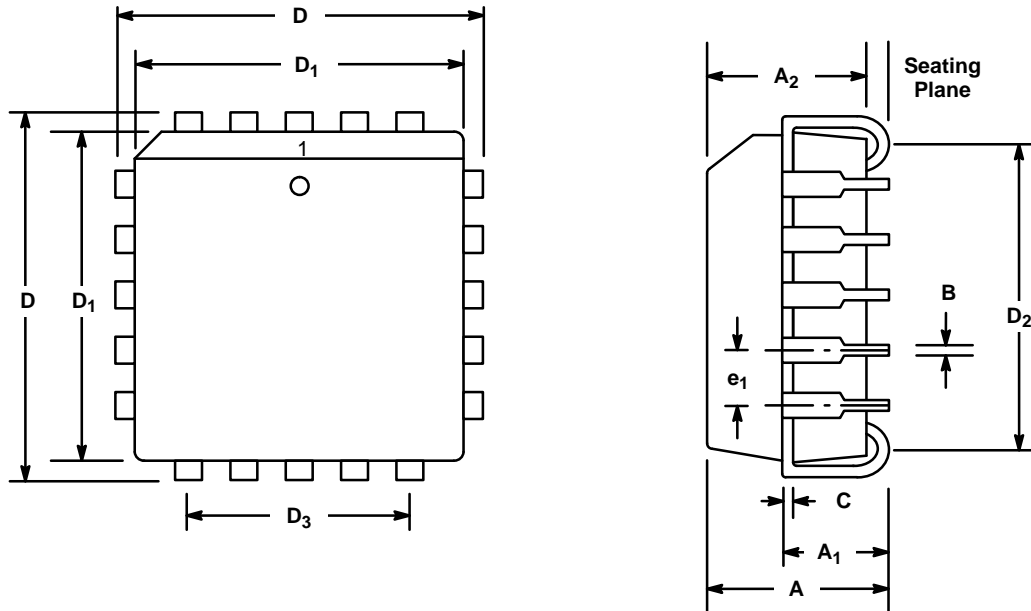
**20 LEAD SMALL OUTLINE
(300 MIL JEDEC SOIC)
S20**



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SYMBOL	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.097	0.104	2.464	2.642
A ₁	0.0050	0.0115	0.127	0.292
B	0.014	0.019	0.356	0.483
C	0.0091	0.0125	0.231	0.318
D	0.500	0.510	12.70	12.95
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°

20 LEAD PLASTIC LEADED CHIP CARRIER (PLCC) P20

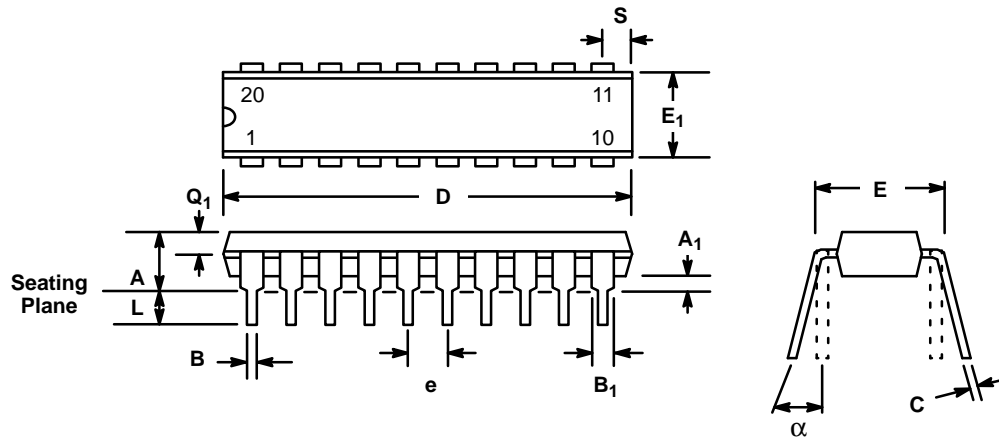


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SYMBOL	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.165	0.180	4.19	4.57
A ₁	0.100	0.110	2.54	2.79
A ₂	0.148	0.156	3.76	3.96
B	0.013	0.021	0.330	0.533
C	0.008	0.012	0.203	0.305
D	0.385	0.395	9.78	10.03
D ₁ (1)	0.350	0.354	8.89	8.99
D ₂	0.290	0.330	7.37	8.38
D ₃	0.200 Ref		5.08 Ref.	
e ₁	0.050 BSC		1.27 BSC	

Note: (1) Dimension D₁ does not include mold protrusion.
 Allowed mold protrusion is 0.254 mm/0.010 in.

**20 LEAD PLASTIC DUAL-IN-LINE
(300 MIL PDIP)
N20**



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	0.945	1.060	24.0	26.92
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	0.040	0.080	1.02	2.03

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

Notes

Notes

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