/VI/IXI/VI

660ns µP-Compatible,
8-Bit ADC with Track/Hold

MX7821

General Description

The MX7821 high-speed, microprocessor-compatible (µP), 8-bit analog-to-digital converter (ADC) is a plug-in upgrade for the industry-standard 7820. The MX7821 uses a half-flash technique, resulting in a 660ns conversion time vs. 1.36µs for the 7820. A VSS pin, not supplied by the 7820, supports dual power supplies and bipolar analog inputs.

The MX7821 has track-and-hold function capable of digitizing a 100kHz signal, and is tested for both its static and dynamic capability. The converter-µP interface appears as a memory location or input/output port that requires no external interface logic. The data outputs use latched, three-state buffered circuitry for direct connection to a µP data bus or system input port. The MX7821 has an overflow output for cascading devices to attain higher resolution. The ADC's input/reference arrangement enables ratiometric operation. For a detailed description of MX7821 operation, refer to the MX7820 data sheet.

Applications

Digital-Signal Processing

High-Speed Data Acquisition

Telecommunications

High-Speed Servo Loops

Audio Systems

Features

♦ **660ns Conversion Time**
♦ **20-Pin Narrow DIP Package**
♦ **No External Clock**
♦ **Pin-Compatible Upgrade for Industry-Standard 7820**
♦ **100kHz Input Signal Bandwidth**
♦ **Bipolar/Unipolar Inputs**
♦ **Single +5V or Dual ±5V Supplies**
♦ **Ratiometric Reference Inputs**
♦ **Static and Dynamic Tested**
♦ **Internal Track/Hold**

Ordering Information

| PART	TEMP. RANGE	PIN-PACKAGE
MX7821KN	0°C to +70°C	20 Plastic DIP
MX7821KR	0°C to +70°C	20 Wide SO
MX7821KP	0°C to +70°C	20 PLCC
MX7821K/D	0°C to +70°C	Dice*
MX7821BQ	-40°C to +85°C	20 CERDIP
MX7821KEWP	-40°C to +85°C	20 Wide SO
MX7821TE	-55°C to +125°C	20 LCC**
MX7821TQ	-55°C to +125°C	20 CERDIP**

* Contact factory for dice specifications.
** Contact factory for availability and processing to MIL-STD-883.

Functional Diagram

Pin Configurations

TOP VIEW

DIP/SO
PLCC and LCC on last page
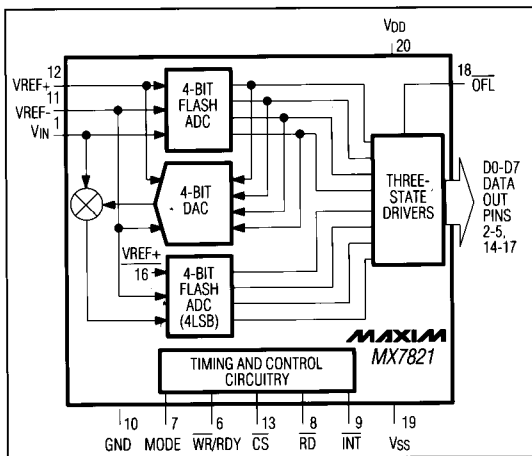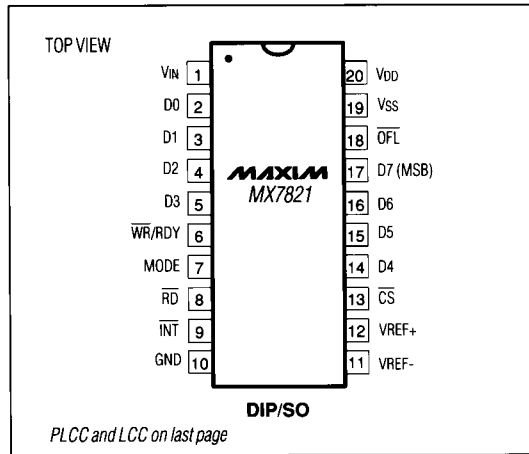
Call toll free 1-800-998-8800 for free samples or literature.

660ns μP-Compatible, 8-Bit ADC with Track/Hold

ABSOLUTE MAXIMUM RATINGS

V_{DD} to GND . . . . -0.3V to +7V
V_{SS} to GND . . . . +0.3V to -7V
Digital Output Voltage to GND
(Pins 2-5, 9, 14-16, 18) . . . . -0.3V to V_{DD} +0.3V
VREF+ to AGND . . . . V_{SS} -0.3V to V_{DD} +0.3V
VREF- to AGND . . . . V_{SS} -0.3V to V_{DD} +0.3V
V_{IN} to GND . . . . V_{SS} -0.3V to V_{DD} +0.3V
Continuous Power Dissipation (any package)
to +75°C 1000mW
derate above +75°C by . . . . 10mW/°C

Operating Temperature Ranges:
MX7821K _ . . . . 0°C to +70°C
MX7821B _ . . . . -40°C to +85°C
MX7821T _ . . . . -55°C to +125°C
Storage Temperature Range . . . . -65°C to +150°C
Lead Temperature (soldering , 10 sec) . . . . +300°C

Stresses beyond 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 beyond 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

(V_{DD} = +5V ±5%; GND = 0V; Unipolar Input Range: V_{SS} = 0V, VREF+ = 5V, VREF- = 0V; Bipolar Input Range: V_{SS} = -5V ±5%, VREF+ = 2.5V, VREF- = -2.5V; specifications apply for RD mode, Pin 7 = 0V; T_A = T_{MIN} to T_{MAX}, unless otherwise noted.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
UNIPOLAR INPUT RANGE							
Resolution	N			8			Bits
Total Unadjusted Error (Note 2)	TUE					±1	LSB
No Missing Codes Resolution				8			Bits
BIPOLAR INPUT RANGE							
Resolution	N			8			Bits
Zero-Code Error						±1	LSB
Full-Scale Error						±1	LSB
Signal-to-Noise Ratio	SNR	V_{IN} = 99.85kHz full-scale sine wave with $f_{SAMPLING}$ = 500kHz		45			dB
Total Harmonic Distortion	THD	V_{IN} = 99.85kHz full-scale sine wave with $f_{SAMPLING}$ = 500kHz				-50	dB
Peak Harmonic or Spurious Noise		V_{IN} = 99.85kHz full-scale sine wave with $f_{SAMPLING}$ = 500kHz				-50	dB
Intermodulation Distortion	IMD	f_a(84.72kHz) and f_b(94.97kHz) full-scale sine waves with $f_{SAMPLING}$ = 500kHz	2nd-order terms			-50	dB
			3rd-order terms			-50	
Slew Rate, Tracking					2.36	1.6	V/μs
REFERENCE INPUT							
Input Resistance		Resistance between VREF+ and VREF-		1		4	kΩ
VREF+ Input Range				VREF-		V_{DD}	V
VREF- Input Range				V_{SS}		VREF+	V
ANALOG INPUT							
Input Voltage Range				VREF-		VREF+	V
Input Leakage Current		-5V ≤ V_{IN} ≤ 5V				±3	μA
Input Capacitance	C_{IN}				32		pF

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ELECTRICAL CHARACTERISTICS (continued)

(V_DD = +5V ±5%; GND = 0V; Unipolar Input Range: V_SS = 0V, VREF+ = 5V, VREF- = 0V; Bipolar Input Range: V_SS = -5V ±5%, VREF+ = 2.5V, VREF- = -2.5V; specifications apply for RD mode, Pin 7 = 0V; T_A =T_MIN to T_MAX, unless otherwise noted.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
LOGIC INPUTS							
Input High Voltage	V_INH	$\overline{CS}$, $\overline{WR}$, $\overline{RD}$		2.4			V
		MODE		3.5			
Input Low Voltage	V_INL	$\overline{CS}$, $\overline{WR}$, $\overline{RD}$				0.8	V
		MODE				1.5	
Input High Current	I_INH	$\overline{CS}$, $\overline{RD}$				1	μA
		$\overline{WR}$				3	
		MODE			50	200	
Input Low Current	I_INL					-1	μA
Input Capacitance (Note 3)	C_IN				5	8	pF
LOGIC OUTPUTS							
Output Low Voltage	V_OL	D7–D0, $\overline{INT}$, $\overline{OFL}$; I_SINK = 1.6mA				0.4	V
		RDY; I_SINK = 2.6mA				0.4	
Output High Voltage	V_OH	D7–D0, $\overline{INT}$, $\overline{OFL}$; I_SOURCE = -360μA		4.0			V
Floating State Leakage Current	I_LKG	D7–D0, RDY				±3	μA
Floating State Output Capacitance (Note 3)	C_OUT	D7–D0, RDY			5	8	pF
POWER REQUIREMENTS							
Supply Current	I_DD	$\overline{CS}$ = $\overline{RD}$ = 0V	MX7821K			15	mA
			MAX7821B/T			20	
	I_SS					100	μA
Power Dissipation	P_D				50		mW
Power-Supply Sensitivity	PSR	V_DD = 4.75V to 5.25V, VREF+ = 4.75V MAX for unipolar mode			±1/16	±1/4	LSB

Note 1: Performance over power-supply tolerance guaranteed by power-supply rejection test.
Note 2: Total Unadjusted Error includes relative accuracy, zero-code error, and full-scale error.
Note 3: Guaranteed by design.

TIMING CHARACTERISTICS

(V_DD = +5V, V_SS = 0V or -5V, Unipolar or Bipolar Input Range, T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
$\overline{CS}$ to $\overline{RD}$/$\overline{WR}$ Setup Time	t_CSS			0			ns
$\overline{CS}$ to $\overline{RD}$/$\overline{WR}$ Hold Time	t_CSH			0			ns
$\overline{CS}$ to RDY Delay (Note 4)	t_RDY	T_A = +25°C				70	ns
		T_A = T_MIN to T_MAX	MX7821B/K			85	
			MX7821T			100	
Conversion Time (RD Mode)	t_CRD	T_A = +25°C				700	ns
		T_A = T_MIN to T_MAX	MX7821B/K			875	
			MX7821T			975	

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TIMING CHARACTERISTICS (continued)

(V$_{DD}$ = +5V, V$_{SS}$ = 0V or -5V, Unipolar or Bipolar Input Range, T$_A$ = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Data-Access Time (RD Mode) (Note 5)	t$_{ACC0}$	T$_A$ = +25°C, C$_L$ = 20pF				t$_{CRD}$+25	ns
		T$_A$ = T$_{MIN}$ to T$_{MAX}$, C$_L$ = 20pF	MX7821B/K			t$_{CRD}$+30	
			MX7821T			t$_{CRD}$+35	
		T$_A$ = +25°C, C$_L$ = 100pF				t$_{CRD}$+50	
		T$_A$ = T$_{MIN}$ to T$_{MAX}$, C$_L$ = 100pF	MX7821B/K			t$_{CRD}$+65	
			MX7821T			t$_{CRD}$+75	
$\overline{RD}$ to $\overline{INT}$ Delay (RD Mode)	t$_{INTH}$	T$_A$ = +25°C, C$_L$ = 50pF			50	80	ns
		T$_A$ = T$_{MIN}$ to T$_{MAX}$, C$_L$ = 50pF	MX7821B/K			85	
			MX7821T			90	
Data-Hold Time (Note 6)	t$_{DH}$	T$_A$ = +25°C				60	ns
		T$_A$ = T$_{MIN}$ to T$_{MAX}$	MX7821B/K			70	
			MX7821T			80	
Delay Time Between Conversions	t$_p$	T$_A$ = +25°C		350			ns
		T$_A$ = T$_{MIN}$ to T$_{MAX}$	MX7821B/K	425			
			MX7821T	500			
Write Pulse Width	t$_{WR}$	T$_A$ = +25°C		0.250		10	μs
		T$_A$ = T$_{MIN}$ to T$_{MAX}$	MX7821B/K	0.325		10	
			MX7821T	0.400		10	
Delay Time Between $\overline{WR}$ and $\overline{RD}$ Pulses	t$_{RD}$	T$_A$ = +25°C		250			ns
		T$_A$ = T$_{MIN}$ to T$_{MAX}$	MX7821B/K	350			
			MX7821T	450			
$\overline{RD}$ Pulse Width (WR-RD Mode) Determined by t$_{ACC1}$	t$_{READ1}$	T$_A$ = +25°C (Figure 3)		160			ns
		T$_A$ = T$_{MIN}$ to T$_{MAX}$ (Figure 3)	MX7821B/K	205			
			MX7821T	240			
Data-Access Time (WR-RD Mode) (Note 5)	t$_{ACC1}$	T$_A$ = +25°C, C$_L$ = 20pF (Figure 3) (Note 3)				160	ns
		T$_A$ = T$_{MIN}$ to T$_{MAX}$, C$_L$ = 20pF (Figure 3) (Note 3)	MX7821B/K			205	
			MX7821T			240	
		T$_A$ = +25°C, C$_L$ = 100pF (Figure 3)				185	
		T$_A$ = T$_{MIN}$ to T$_{MAX}$, C$_L$ = 100pF (Figure 3)	MX7821B/K			235	
			MX7821T			275	
$\overline{RD}$ to $\overline{INT}$ Delay	t$_{RI}$	T$_A$ = +25°C				150	ns
		T$_A$ = T$_{MIN}$ to T$_{MAX}$	MX7821B/K			185	
			MX7821T			220	
$\overline{WR}$ to $\overline{INT}$ Delay	t$_{INTL}$	T$_A$ = =25°C, C$_L$ = 50pF			380	500	ns
		T$_A$ = T$_{MIN}$ to T$_{MAX}$, C$_L$ = 50pF	MX7821B/K			610	
			MX7821T			700	

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TIMING CHARACTERISTICS (continued)

(V$_{DD}$ = +5V, V$_{SS}$ = 0V or -5V, Unipolar or Bipolar Input Range, T$_A$ = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP	MAX	UNITS
$\overline{RD}$ Pulse Width (WR-RD Mode) Determined by t$_{ACC2}$	t$_{READ2}$	T$_A$ = +25°C (Figure 4)					65	ns
		T$_A$ = T$_{MIN}$ to T$_{MAX}$ (Figure 4)	MX7821B/K				75	
			MX7821T				85	
Data-Access Time (WR-RD Mode) (Note 5)	t$_{ACC2}$	T$_A$ = +25°C, C$_L$ = 20pF (Figure 4) (Note 3)					65	ns
		T$_A$ = T$_{MIN}$ to T$_{MAX}$, C$_L$ = 20pF (Note 3)	MX7821B/K				75	
			MX7821T				85	
		T$_A$ = +25°C, C$_L$ = 100pF (Figure 4)					90	
		T$_A$ = T$_{MIN}$ to T$_{MAX}$, C$_L$ = 100pF (Figure 4)	MX7821B/K				110	
			MX7821T				130	
$\overline{WR}$ to $\overline{INT}$ Delay (Stand-Alone Operation)	t$_{IHWR}$	T$_A$ = +25°C, C$_L$ = 50pF					80	ns
		T$_A$ = T$_{MIN}$ to T$_{MAX}$, C$_L$ = 50pF	MX7821B/K				100	
			MX7821T				120	
Data-Access Time After $\overline{INT}$ (Stand-Alone Operation) (Note 5)	t$_{ID}$	T$_A$ = +25°C, C$_L$ = 20pF (Note 3)					30	ns
		T$_A$ = T$_{MIN}$ to T$_{MAX}$, C$_L$ = 20pF (Note 3)	MX7821B/K				35	
			MX7821T				40	
		T$_A$ = +25°C, C$_L$ = 100pF					45	
		T$_A$ = T$_{MIN}$ to T$_{MAX}$, C$_L$ = 100pF	MX7821B/K				60	
			MX7821T				70	

Note 3: Guaranteed by design.
Note 4: C$_L$ = 50pF and R$_L$ = 5kΩ pull-up resistor.
Note 5: See Figure 1 for load circuit. Parameter defined as the time required for the output to cross +0.8V or +2.4V.
Note 6: See Figure 2 for load circuit. Parameter defined as the time required for data lines to change 0.5V.
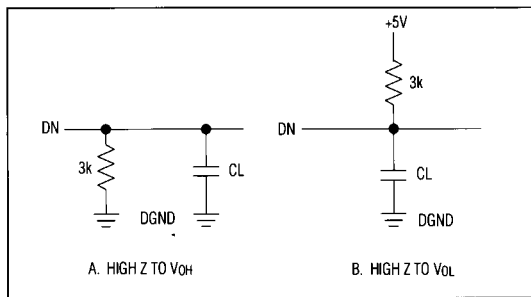

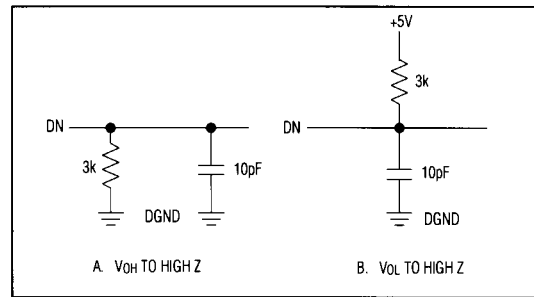*Figure 1. Load Circuits for Data-Access Time Test*

Figure 2. Load Circuits for Data-Hold Time Test
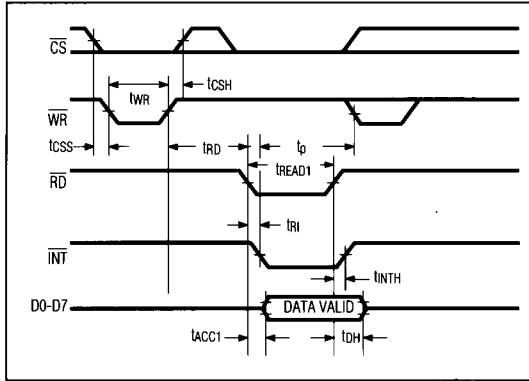
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8-Bit ADC with Track/Hold
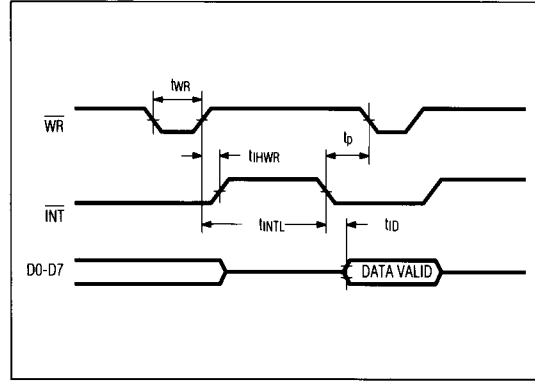
Figure 3. WR-RD Mode Timing ($t_{RD} < t_{INTL}$)

Figure 4. WR-RD Mode Timing ($t_{RD} > t_{INTL}$)

Figure 5. RD Mode
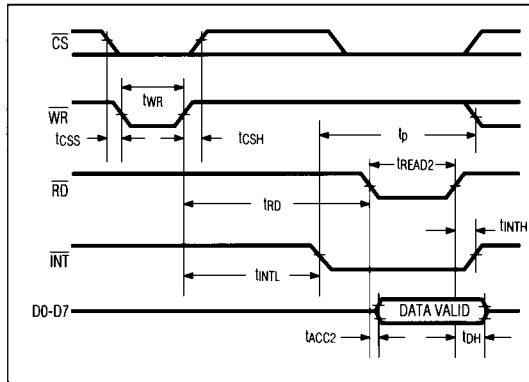

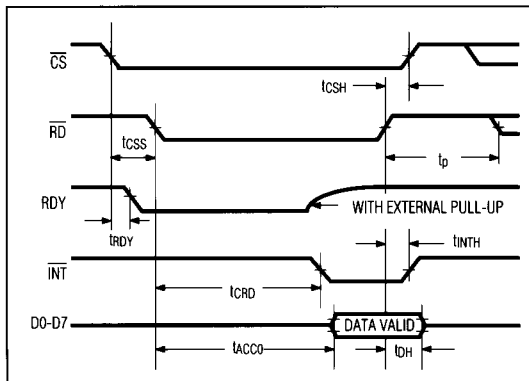Figure 6. WR-RD Mode Stand-Alone Operation ($\overline{CS} = \overline{RD} = 0$)
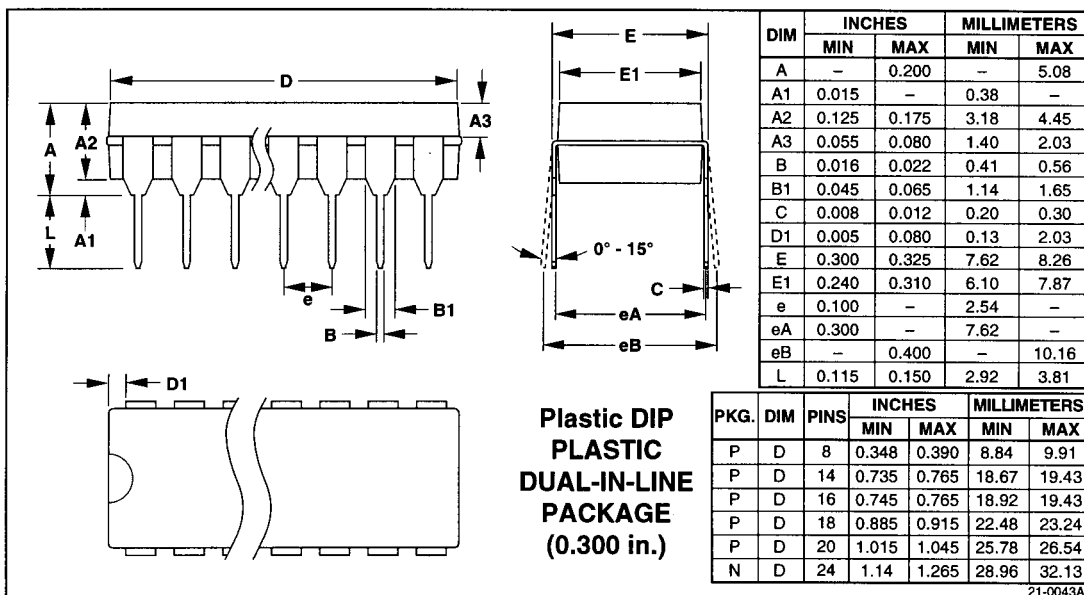
Pin Configurations (continued)

PLCC/LCC
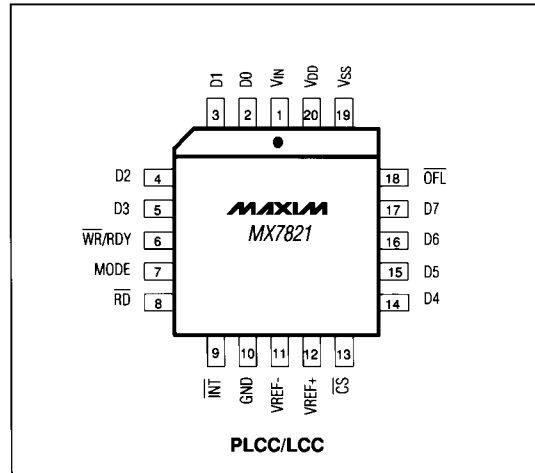
For application information, refer to the MX7820 data sheet.

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Package Information

MX7821

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	–	0.200	–	5.08
A1	0.015	–	0.38	–
A2	0.125	0.175	3.18	4.45
A3	0.055	0.080	1.40	2.03
B	0.016	0.022	0.41	0.56
B1	0.045	0.065	1.14	1.65
C	0.008	0.012	0.20	0.30
D1	0.005	0.080	0.13	2.03
E	0.300	0.325	7.62	8.26
E1	0.240	0.310	6.10	7.87
e	0.100	–	2.54	–
eA	0.300	–	7.62	–
eB	–	0.400	–	10.16
L	0.115	0.150	2.92	3.81

Plastic DIP PLASTIC DUAL-IN-LINE PACKAGE (0.300 in.)

PKG.	DIM	PINS	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
P	D	8	0.348	0.390	8.84	9.91
P	D	14	0.735	0.765	18.67	19.43
P	D	16	0.745	0.765	18.92	19.43
P	D	18	0.885	0.915	22.48	23.24
P	D	20	1.015	1.045	25.78	26.54
N	D	24	1.14	1.265	28.96	32.13

21-0043A

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.093	0.104	2.35	2.65
A1	0.004	0.012	0.10	0.30
B	0.014	0.019	0.35	0.49
C	0.009	0.013	0.23	0.32
E	0.291	0.299	7.40	7.60
e	0.050		1.27	
H	0.394	0.419	10.00	10.65
L	0.016	0.050	0.40	1.27

Wide SO SMALL-OUTLINE PACKAGE (0.300 in.)

DIM	PINS	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
D	16	0.398	0.413	10.10	10.50
D	18	0.447	0.463	11.35	11.75
D	20	0.496	0.512	12.60	13.00
D	24	0.598	0.614	15.20	15.60
D	28	0.697	0.713	17.70	18.10

21-0042A

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660ns µP-Compatible, 8-Bit ADC with Track/Hold

Package Information (continued)

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	–	0.200	–	5.08
B	0.014	0.023	0.36	0.58
B1	0.038	0.065	0.97	1.65
C	0.008	0.015	0.20	0.38
E	0.220	0.310	5.59	7.87
E1	0.290	0.320	7.37	8.13
e	0.100		2.54	
L	0.125	0.200	3.18	5.08
L1	0.150	–	3.81	–
Q	0.015	0.070	0.38	1.78
S	–	0.098	–	2.49
S1	0.005	–	0.13	–

DIM	PINS	INCHES		MILLIMETERS	
		MIN	MAX	MIN	MAX
D	8	–	0.405	–	10.29
D	14	–	0.785	–	19.94
D	16	–	0.840	–	21.34
D	18	–	0.960	–	24.38
D	20	–	1.060	–	26.92
D	24	–	1.280	–	32.51

**CERDIP
CERAMIC DUAL-IN-LINE
PACKAGE
(0.300 in.)**

21-0045A