MAXIM

Low Power, 3½ Digit A/D Converter With Display Hold

MAX136

General Description

The Maxim MAX136 is a monolithic analog to digital converter with very high input impedance. It differs from the Maxim ICL7136 in that the MAX136 provides a Hold pin, which makes it possible to hold or "freeze" a reading. The MAX136 directly drives a non-multiplexed liquid crystal (LCD) display, requiring no external drive circuitry. With minor external component changes, it is pin compatible with the ICL7116 but with significantly reduced power consumption, making the MAX136 a *superior device for portable systems.*

Versatility and accuracy are inherent features of this converter. The dual-slope conversion technique automatically rejects interference signals common in industrial environments. True differential inputs allow direct measurements of bridge transducer outputs or load cells. The zero-integrator phase eliminates overrange hangover and hysteresis effects. The MAX136 offers high accuracy by lowering rollover error to less than one count and zero reading drift to less than 1μV/°C.

Applications

These devices can be used in a wide range of digital panel meter applications. Most applications, however, involve the measurement and display of analog data:

Pressure	Conductance
Voltage	Current
Resistance	Speed
Temperature	Material Thickness

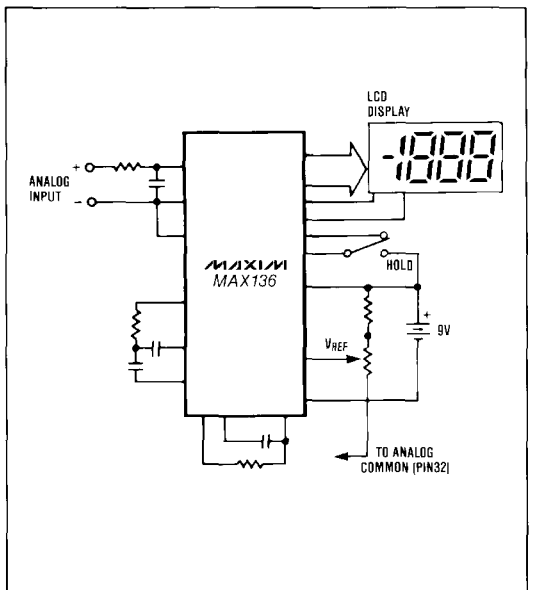
Features

- **Power dissipation guaranteed less than 1mW-9V battery life 3000 hours typical**
- **Hold pin allows indefinite display hold**
- **Guaranteed first reading recovery from overrange**
- **On board Display Drive Capability—no external circuitry required**
- **High Impedance CMOS Differential inputs**
- **Low Noise (< 15μV p-p) without hysteresis or overrange hangover**
- **Clock and Reference On-Chip**
- ***Zero Input Gives Zero Reading***
- **True Polarity Indication for Precision Null Applications**
- **Key Parameters Guaranteed over Temperature**

Ordering Information

PART	TEMP. RANGE	PACKAGE
MAX136CPL	0°C to +70°C	40 Lead Plastic DIP
MAX136CJL	0°C to +70°C	40 Lead CERDIP
MAX136CQH	0°C to +70°C	44 Lead Plastic Chip Carrier
MAX136C/D	0°C to +70°C	Dice

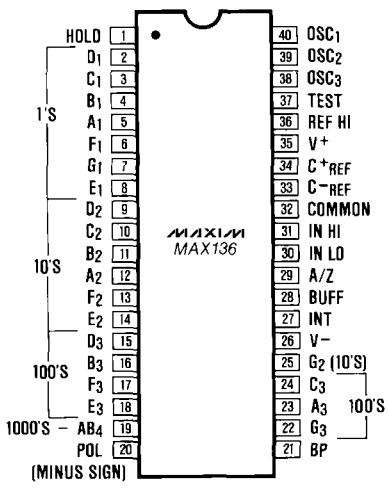
Typical Operating Circuit



(Detailed Circuit Diagram—See 3rd page)

Pin Configuration

Top View



See last page for Plastic Chip Carrier Pin Configuration

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ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V^+ to V^-) 15V
Analog Input Voltage (either input) (Note 1) ..... V^+ to V^-
Reference Input Voltage (either input) ..... V^+ to V^-
Clock Input, Hold Input ..... TEST to V^+

Power Dissipation (Note 2)
  Cerdip Package 800mW
  Plastic Package 800mW
Operating Temperature ..... 0°C to +70°C
Storage Temperature ..... -65°C to +160°C
Lead Temperature (Soldering, 60 sec.) ..... +300°C

Note 1: Input voltages may exceed the supply voltages, provided the input current is limited to ±1mA.

Note 2: Dissipation rating assumes device is mounted with all leads soldered to printed circuit board.

Stresses above 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 above 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^+ = 9V; T_A = 25°C; f_{CLOCK} = 48kHz; test circuit - Figure 1 unless noted.)

PARAMETERS	CONDITIONS	MIN	TYP	MAX	UNITS
Zero Input Reading	V_{IN} = 0.0V, Full Scale = 200.0mV T_A = 25°C (Note 3) 0° ≤ T_A ≤ 70°C (Note 6)	 -000.0 -000.0	 ±000.0 ±000.0	 +000.0 +000.0	 Digital Reading
Ratiometric Reading	V_{IN} = V_{REF}, V_{REF} = 100mV T_A = 25°C (Note 3) 0° ≤ T_A ≤ 70°C (Note 6)	 999 998	 999/1000 999/1000	 1000 1001	 Digital Reading
Rollover Error (Difference in reading for equal positive and negative reading near Full Scale)	$-V_{IN}$ = $+V_{IN}$ ≅ 200.0mV T_A = 25°C (Note 3) 0° ≤ T_A ≤ 70°C (Note 6)	-1	±0.2 ±0.2	+1	Counts
Linearity (Max. deviation from best straight line fit)	Full Scale = 200.0mV or full scale = 2.000V	-1	±0.2	+1	Counts
Common Mode Rejection Ratio (Note 7)	V_{CM} = ± 1V, V_{IN} = 0V Full Scale = 200.0mV		5		µV/V
Noise (Pk-Pk value not exceeded 95% of time)	V_{IN} = 0V Full Scale = 200.0mV		10		µV
Input Leakage Current	V_{IN} = 0, T_A = 25°C (Note 3) 0° ≤ T_A ≤ 70°C		1 20	10 200	pA
Zero Reading Drift	V_{IN} = 0, 0° ≤ T_A ≤ 70°C (Note 6)		0.2	1	µV/°C
Scale Factor Temperature Coefficient	V_{IN} = 199.0mV 0° ≤ T_A ≤ 70°C (Ext. Ref. 0ppm/°C) (Note 6)		1	5	ppm/°C
V^+ Supply Current	V_{IN} = 0 T_A = 25°C 0° ≤ T_A ≤ 70°C		80	 150 200	µA
Analog Common Voltage (with respect to Pos. supply)	250kΩ between Common & Pos. Supply	2.6	2.8	3.2	V
Temp. Coeff. of Analog Common (with respect to Pos. Supply	250kΩ between Common & Pos. Supply		75		ppm/°C
Input Resistance, Pin 1			1000		MΩ
V_{IL}, Pin 1				TEST +1.5	V
V_{IH}, Pin 1		V^+ -1.5			V
Pk-Pk Segment Drive Voltage Pk-Pk Backplane Drive Voltage	V^+ to V^- = 9V (Note 8)	4	5	6	V
Test Pin Voltage	With Respect to V^+	4	5	6	V
Overload Recovery Time (Note 5)	V_{IN} changing from ± 10V to 0V		0	1	Measurement Cycles

Note 3: Test condition is V_{IN} applied between pins IN-HI and IN-LO, i.e., 1MΩ resistor in Figures 1 and 2.
Note 4: All pins are designed to withstand electrostatic discharge (ESD) levels in excess of 2000V. (Test circuit per Mil. Std. 883C, Method 3015 .2)
Note 5: Number of measurement cycles for display to give accurate reading.
Note 6: 1MΩ resistor is removed in Figures 1 and 2.
Note 7: Refer to "Differential Input" discussion (See Maxim's ICL7136 data sheet).
Note 8: Back plane drive is in phase with segment drive for 'off' segment, 180° out of phase for 'on' segment. Frequency is 20 times conversion rate. Average DC component is less than 50mV.

Low Power, 3½ Digit A/D Converter With Display Hold

Detailed Description

The Maxim MAX136 3½ digit A/D converter is similar to the Maxim ICL7136 except for the addition of a Hold pin. For a detailed product description, and applications information (other than the operation of the Hold pin described below), refer to Maxim's ICL7136 data sheet.

Hold Input

The Hold input is a digital input with a logic threshold approximately midway between V+ and Test. The MAX136 continuously performs conversions, independent of the Hold input. When the Hold input is at V+ the display latch pulse is inhibited, and the display latches are not updated; when the Hold input is low or at the Test voltage, the display is updated at the end of each conversion. The MAX136 maintains low power dissipation *even during display hold by eliminating the pull-down resistor* between Hold and Test present on the ICL7116. The Hold input is CMOS compatible, and can also be driven by a switch connected between Test and V+ (Figure 1).

Reference Input

Unlike the ICL7136, the MAX136 does not have a Reference Low input. Apply the reference voltage between Reference High (REF HI) and Common.

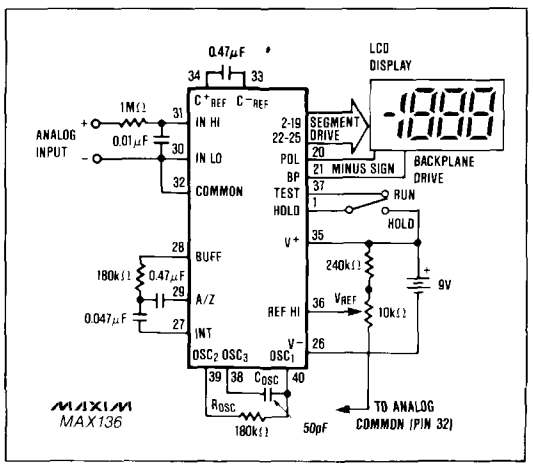


Figure 1. Maxim MAX136 Typical Operating Circuit, 200mV Full Scale.

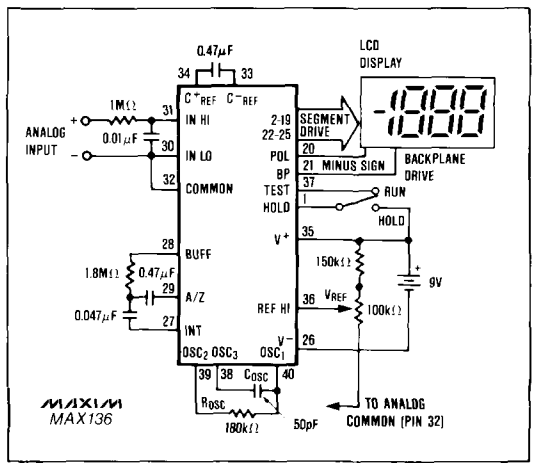
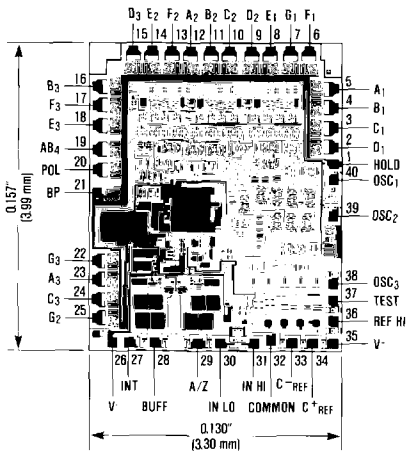
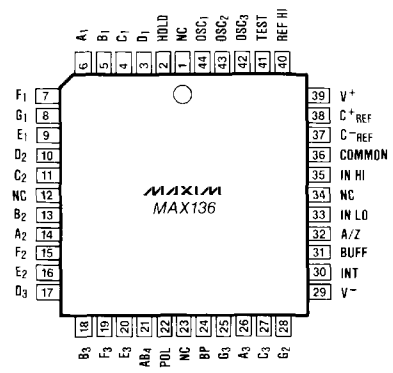


Figure 2. Maxim MAX136 Typical Operating Circuit, 2.0V Full Scale.

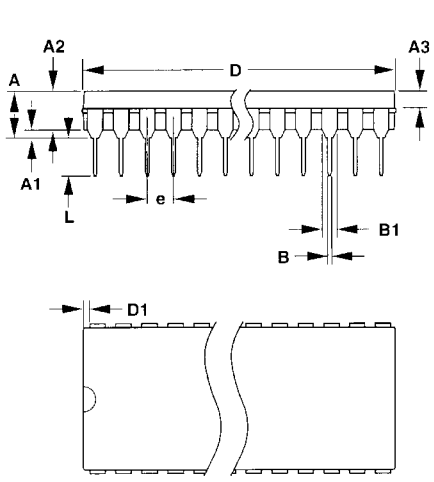
Chip Topography



Pin Configuration



44 Lead Plastic Chip Carrier (Quad Pack)



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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	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	0.020	0.41	0.51
B1	0.045	0.065	1.14	1.65
C	0.008	0.012	0.20	0.30
D1	0.050	0.090	1.27	2.29
E	0.600	0.625	15.24	15.88
E1	0.525	0.575	13.34	14.61
e	0.100	–	2.54	–
eA	0.600	–	15.24	–
eB	–	0.700	–	17.78
L	0.120	0.150	3.05	3.81

PKG.	DIM	PINS	INCHES		MILLIMETERS	
			MIN	MAX	MIN	MAX
P	D	24	1.230	1.270	31.24	32.26
P	D	28	1.430	1.470	36.32	37.34
P	D	40	2.025	2.075	51.44	52.71

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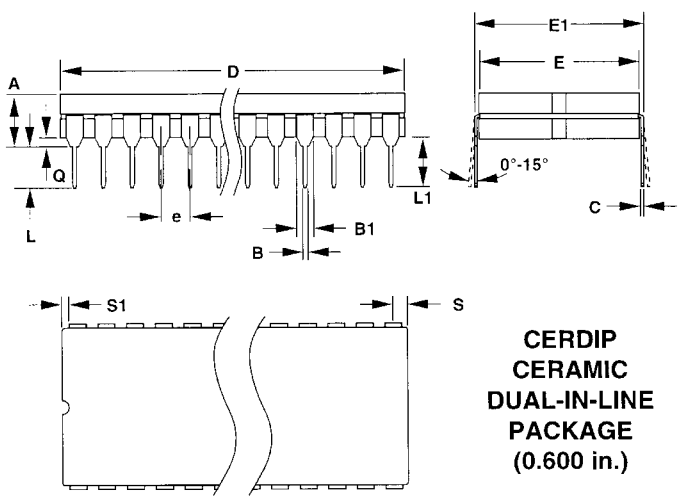

CERDIP
CERAMIC
DUAL-IN-LINE
PACKAGE
(0.600 in.)

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	–	0.232	–	5.89
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	0.500	0.620	12.70	15.75
E1	0.590	0.630	14.99	16.00
e	0.100		2.54	
L	0.120	0.200	3.05	5.08
L1	0.150	–	3.81	–
Q	0.015	0.075	0.38	1.91
S	–	0.100	–	2.54
S1	0.005	–	0.13	–

DIM	PINS	INCHES		MILLIMETERS	
		MIN	MAX	MIN	MAX
D	24	–	1.290	–	32.77
D	28	–	1.490	–	37.85
D	40	–	2.096	–	53.24

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