



# Bay Linear

Inspire the Linear Power

## 3-1/2 Digit LCD/LED Display, A/D Converter

## ICL7106 / 7107

### Description

The ICL7106 and ICL 7107 are high performance, low power 3-1/2 digit A/D converters. Included are seven segment decoders, Display drivers, a reference and a clock. The ICL 7106 is designed to interface with a liquid crystal display (LCD) and includes a multiplexed backplane drive; the ICL 7107 will directly drive an instrument size light emitting diode (LED) display.

The ICL7106 and ICL 7107 bring together a combination of high accuracy, versatility and true economy. True differential inputs and reference are useful in all systems, but give the designer advantage when measuring load cells, strain gauges, and other Bridge type transducers.

By providing the true economy of a single power supply operation, the ICL7106 enables a high performance panel meter to be built with the addition of only 10 passive components and a display.

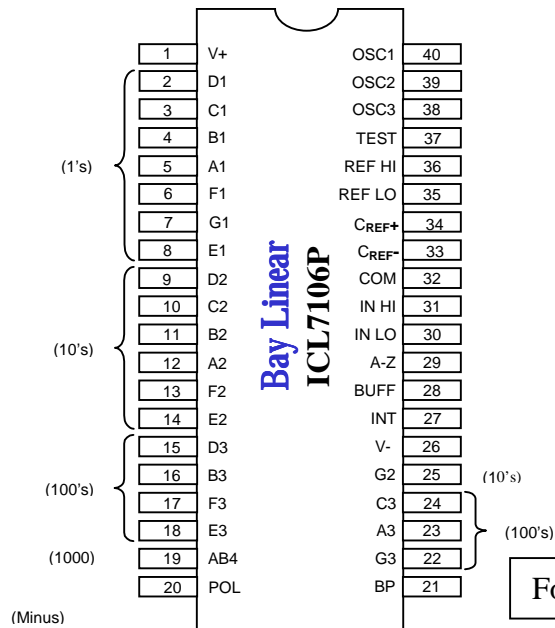
### Features

- **Guaranteed Zero Reading for OV Input on All Scales**
- **True Polarity at Zero for Precise Null Detection**
- **True Differential Input and Reference, Direct Display Drive**
- **Low Noise less than 15μVp-p**
- **On chip clock and reference**
- **Low Power Dissipation, ≤10mW (typ.)**
- **No Additional Active Circuits Required**
- **Available in Small Outline Surface Mount Package, 44MQFP**

### Applications

- **7106 for LCD**
- **7107 for LED**
- **Measuring Bridge Type Transducers**
- **Instrumentation**
- **Digital Thermometers**

### Pin Connection



### Ordering Information

Device	Package	Temp.
ICL7106P	40PDIP	0 to 70°C
ICL7107P	40PDIP	0 to 70°C

## Absolute Maximum Rating

Parameter	
Input Supply Voltage	
ICL7106, V+ to V-	15V
ICL7107, V+ to GND	6V
ICL7107, V- to GND	-9V
Analog Input Voltage (Either Input) (Note 1)	V+ to V-
Reference Input Voltage (Either Input)	V+ to V-
Clock Input	
ICL7106	TEST to V+
ICL7107	GND to V+

## Thermal Information

Parameter	
Thermal Resistance, Typical	$\theta_{JA}$ (°C/W)
PDIP	50
MQFP	75
Max. Junction Temperature	150°C
Max. Storage Temperature Range	-65°C to 150°C
Max. Lead Temperature (Soldering 10S)	300°C
MQFP – Lead Tips Only	
Operating Temperature Range	0°C to 70°C

## Electrical Characteristics

( $T_A = 25^\circ\text{C}$ ,  $f_{\text{CLOCK}} = 48\text{kHz}$  unless otherwise specified, see Note 2)

Parameter	Conditions	MIN	TYP	MAX	UNIT
<b>System Performance</b>					
Zero Input Reading	$V_{IN} = 0.0\text{V}$ , Full Scale = 200mV	-000.0	$\pm 000.0$	$\pm 000.0$	Digital Reading
Ratiometric Reading	$V_{IN} = V_{REF}$ , $V_{REF} = 100\text{mV}$		999/1000		
Rollover Error	$-V_{IN} = +V_{IN} \cong 200\text{mV}$ Difference In Reading for Equal Positive and Negative Inputs Near Full Scale	-1		+1	Counts
Linearity	Full Scale = 200mV or Full Scale = 2V Maximum Deviation from Best straight Line fit (Note 3)	-1		+1	Counts
Common Mode Rejection Ratio	$V_{CM} = 1\text{V}$ , $V_{IN} = 0\text{V}$ , Full Scale = 200mV (Note 3)		50		$\mu\text{V/V}$
End Power Supply Character V+ Supply Current	$V_{IN} = 0$ (Does Not Include LED Current for ICL7107)			1.8	mA
End Power Supply Character V- Supply Current	ICL7107 Only			1.8	mA
Common Pin Analog Common Voltage	25 k $\Omega$ Between Common and Positive Supply ( With Respect to + Supply	2.4		3.2	V
<b>Display Driver ICL7106 Only</b>					
Pk-Pk Segment Drive Voltage	$V+ = \text{to } V- = 9\text{V}$	4	5	6	V
Pk-Pk Backplane Drive Voltage					
<b>Display Driver ICL7107 Only</b>					
Segment Sinking Current (Except Pin 19 and 20)	$V+ = 5\text{V}$ , Segment Voltage = 3V	5	8		mA
Pin 19 Only		10	16		mA
Pin 20 Only		4	7		mA

Notes:

- Input voltages may exceed the supply voltages provided the input current is limited to  $\pm 100\mu\text{A}$ .
- Unless otherwise noted, specifications apply to both the ICL7106 and ICL7107 at  $T_A = +25^\circ\text{C}$ ,  $f_{\text{CLOCK}} = 48\text{kHz}$ . ICL7107 is tested in the circuit of Figure 1. ICL7107 is tested in the circuit of Figure 2.
- Not Tested, guaranteed by design



## Design Information Summary Sheet

### ❑ Oscillator Frequency Summary Sheet

$$f_{OSC} = 0.45/RC$$

$$C_{OSC} > 50\text{pF}; R_{OSC} > 50\text{k}\Omega$$

$$f_{OSC}(\text{typ}) = 48\text{kHz}$$

### ❑ Oscillator Period

$$t_{OSC} = RC/0.45$$

### ❑ Integration Clock Frequency

$$F_{CLOCK} = f_{OSC}/4$$

### ❑ Integration Period

$$t_{INT} = 1000 \times (4/f_{OSC})$$

### ❑ 60/50Hz Rejection Criterion

$$t_{INT}/t_{60\text{HZ}} \text{ or } t_{INT}/t_{50\text{HZ}} = \text{Integer}$$

### ❑ Optimum Integration Current

$$I_{INT} = 4\mu\text{A}$$

### ❑ Full Scale Analog Inout Voltage

$$V_{INFS}(\text{Typ}) = 200\text{mV or } 2\text{V}$$

### ❑ Integration Resistor

$$R_{INT} = \frac{V_{INFS}}{I_{INT}}$$

### ❑ Integration Capacitor

$$C_{INT} = \frac{(t_{INT})(I_{INT})}{V_{INT}}$$

### ❑ Integrator Output Voltage Swing

$$V_{INT} = \frac{(t_{INT})(I_{INT})}{C_{INT}}$$

### ❑ $V_{INT}$ Maximum Swing

$$(V_- + 0.5\text{V}) < V_{INT} < (V_+ - 0.5\text{V}), V_{INT}(\text{typ}) = 2\text{V}$$

### ❑ Display Count

$$\text{Count} = 1000 \times \frac{V_{IN}}{V_{REF}}$$

### ❑ Conversion Cycle

$$t_{CYC} = t_{CLOCK} \times 4000$$

$$t_{CYC} = t_{OSC} \times 16,000$$

$$\text{when } f_{OSC} = 48\text{kHz}; t_{CYC} = 333\text{ms}$$

### ❑ Common Mode Input Voltage

$$(V_- + 1\text{V}) < V_{IN} < (V_+ - 0.5\text{V})$$

### ❑ Auto-Zero Capacitor

$$0.01\mu\text{F} < C_{AZ} < 1\mu\text{F}$$

### ❑ Reference Capacitor

$$0.01\mu\text{F} < C_{REF} < 1\mu\text{F}$$

### ❑ $V_{COM}$

Biased between  $V_i$  and  $V_-$

### ❑ $V_{COM} \cong V_+ - 2.8\text{V}$

Regulation lost when  $V_+$  to  $V_- < \cong 6.8\text{V}$

If  $V_{COM}$  is externally pulled down to  $(V_+ \text{ to } V_-) / 2$ , the  $V_{COM}$  circuit will turn off.

### ❑ ICL7106 Power Supply: Single 9V

$$V_+ - V_- = 9\text{V}$$

Digital supply is generated internally

$$V_{GND} \cong V_+ - 4.5\text{V}$$

### ❑ ICL7106 Display: LCD

Direct drive type with digital logic supply amplitude.

### ❑ ICL7107 Power Supply: Dual $\pm 5.0\text{V}$

$$V_+ = +5\text{V to GND}$$

$$V_- = -5\text{V to GND}$$

Digital Logic and LED driver supply  $V_+$  to GND

### ❑ ICL7106 Display: LED

Non-Multiplexed Common Anode

Advance Information- These data sheets contain descriptions of products that are in development. The specifications are based on the engineering calculations, computer simulations and/ or initial prototype evaluation.

Preliminary Information- These data sheets contain minimum and maximum specifications that are based on the initial device characterizations. These limits are subject to change upon the completion of the full characterization over the specified temperature and supply voltage ranges.

The application circuit examples are only to explain the representative applications of the devices and are not intended to guarantee any circuit design or permit any industrial property right to other rights to execute. Bay Linear takes no responsibility for any problems related to any industrial property right resulting from the use of the contents shown in the data book. Typical parameters can and do vary in different applications. Customer's technical experts must validate all operating parameters including "Typical" for each customer application.

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## LIFE SUPPORT AND NUCLEAR POLICY

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Bay Linear products are not authorized for and should not be used within life support systems which are intended for surgical implants into the body to support or sustain life, in aircraft, space equipment, submarine, or nuclear facility applications without the specific written consent of Bay Linear President.

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