

FEATURES

- ❑ High-Speed (15ns), Low Power 16-bit Cascadable ALU
- ❑ Implements Add, Subtract, Accumulate, Two's Complement, Pass, and Logic Operations
- ❑ All Registers Have a Bypass Path for Complete Flexibility
- ❑ 68-pin PLCC, J-Lead

DESCRIPTION

The **L4C381** is a flexible, high speed, cascadable 16-bit Arithmetic and Logic Unit. It combines four 381-type 4-bit ALUs, a look-ahead carry generator, and miscellaneous interface logic — all in a single 68-pin package. While containing new features to support high speed pipelined architectures and single 16-bit bus configurations, the L4C381 retains full performance and functional compatibility with the bipolar '381 designs.

The L4C381 can be cascaded to perform 32-bit or greater operations. See "Cascading the L4C381" toward

the end of this data sheet for more information.

ARCHITECTURE

The L4C381 operates on two 16-bit operands (A and B) and produces a 16-bit result (F). Three select lines control the ALU and provide 3 arithmetic, 3 logical, and 2 initialization functions. Full ALU status is provided to support cascading to longer word lengths. Registers are provided on both the ALU inputs and the output, but these may be bypassed under user control. An internal feedback path allows the registered ALU output to be routed to one of the ALU inputs, accommodating chain operations and accumulation. Furthermore, the A or B input can be forced to Zero allowing unary functions on either operand.

ALU OPERATIONS

The S₂-S₀ lines specify the operation to be performed. The ALU functions and their select codes are shown in Table 1.

The two functions, B minus A and A minus B, can be achieved by setting the carry input of the least significant slice and selecting codes 001 and 010 respectively.

L4C381 BLOCK DIAGRAM

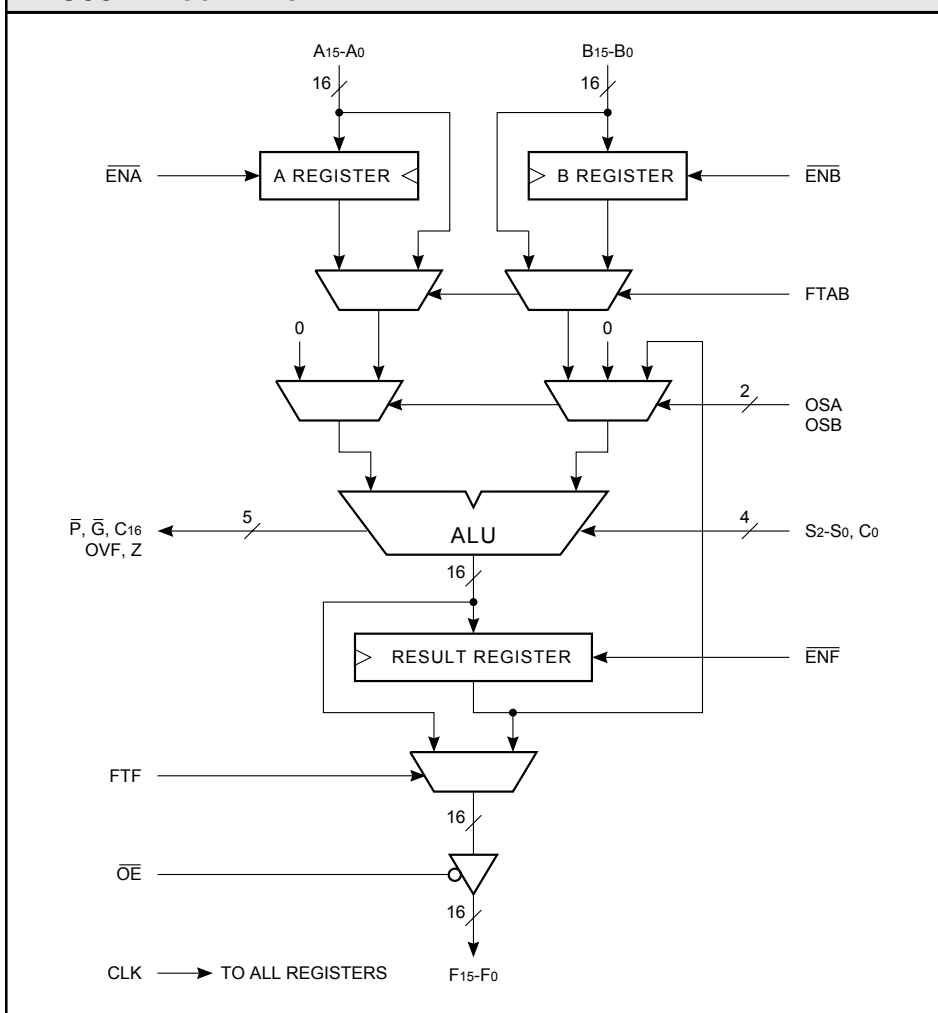


TABLE 1. ALU FUNCTIONS

S ₂ -S ₀	FUNCTION
000	CLEAR (F = 00 ... 00)
001	NOT(A) + B
010	A + NOT(B)
011	A + B
100	A XOR B
101	A OR B
110	A AND B
111	PRESET (F = 11 ... 11)

MAXIMUM RATINGS <i>Above which useful life may be impaired (Notes 1, 2, 3, 8)</i>	
Storage temperature	–65°C to +150°C
Operating ambient temperature	–55°C to +125°C
V _{CC} supply voltage with respect to ground	–0.5 V to +7.0 V
Input signal with respect to ground	–3.0 V to +7.0 V
Signal applied to high impedance output	–3.0 V to +7.0 V
Output current into low outputs	25 mA
Latchup current	> 400 mA

OPERATING CONDITIONS <i>To meet specified electrical and switching characteristics</i>		
Mode	Temperature Range (Ambient)	Supply Voltage
Active Operation, Commercial	0°C to +70°C	4.75 V ≤ V _{CC} ≤ 5.25 V
Active Operation, Military	–55°C to +125°C	4.50 V ≤ V _{CC} ≤ 5.50 V

ELECTRICAL CHARACTERISTICS <i>Over Operating Conditions (Note 4)</i>						
Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V _{OH}	Output High Voltage	V _{CC} = Min., I _{OH} = –2.0 mA	2.4			V
V _{OL}	Output Low Voltage	V _{CC} = Min., I _{OL} = 8.0 mA			0.5	V
V _{IH}	Input High Voltage		2.0		V _{CC}	V
V _{IL}	Input Low Voltage	(Note 3)	0.0		0.8	V
I _{Ix}	Input Current	Ground ≤ V _{IN} ≤ V _{CC} (Note 12)			±20	μA
I _{OZ}	Output Leakage Current	Ground ≤ V _{OUT} ≤ V _{CC} (Note 12)			±20	μA
I _{CC1}	V _{CC} Current, Dynamic	(Notes 5, 6)		15	30	mA
I _{CC2}	V _{CC} Current, Quiescent	(Note 7)			1.5	mA

NOTES

1. Maximum Ratings indicate stress specifications only. Functional operation of these products at values beyond those indicated in the Operating Conditions table is not implied. Exposure to maximum rating conditions for extended periods may affect reliability.

2. The products described by this specification include internal circuitry designed to protect the chip from damaging substrate injection currents and accumulations of static charge. Nevertheless, conventional precautions should be observed during storage, handling, and use of these circuits in order to avoid exposure to excessive electrical stress values.

3. This device provides hard clamping of transient undershoot and overshoot. Input levels below ground or above VCC will be clamped beginning at -0.6 V and VCC + 0.6 V. The device can withstand indefinite operation with inputs in the range of -0.5 V to +7.0 V. Device operation will not be adversely affected, however, input current levels will be well in excess of 100 mA.

4. Actual test conditions may vary from those designated but operation is guaranteed as specified.

5. Supply current for a given application can be accurately approximated by:

$$\frac{NCV^2F}{4}$$

where

4

- N = total number of device outputs
- C = capacitive load per output
- V = supply voltage
- F = clock frequency

6. Tested with all outputs changing every cycle and no load, at a 5 MHz clock rate.

7. Tested with all inputs within 0.1 V of VCC or Ground, no load.

8. These parameters are guaranteed but not 100% tested.

9. AC specifications are tested with input transition times less than 3 ns, output reference levels of 1.5 V (except tDIS test), and input levels of nominally 0 to 3.0 V. Output loading may be a resistive divider which provides for specified IOH and IOL at an output voltage of VOH min and VOL max respectively. Alternatively, a diode bridge with upper and lower current sources of IOH and IOL respectively, and a balancing voltage of 1.5 V may be used. Parasitic capacitance is 30 pF minimum, and may be distributed.

This device has high-speed outputs capable of large instantaneous current pulses and fast turn-on/turn-off times. As a result, care must be exercised in the testing of this device. The following measures are recommended:

- a. A 0.1 μF ceramic capacitor should be installed between VCC and Ground leads as close to the Device Under Test (DUT) as possible. Similar capacitors should be installed between device VCC and the tester common, and device ground and tester common.
- b. Ground and VCC supply planes must be brought directly to the DUT socket or contactor fingers.
- c. Input voltages should be adjusted to compensate for inductive ground and VCC noise to maintain required DUT input levels relative to the DUT ground pin.

10. Each parameter is shown as a minimum or maximum value. Input requirements are specified from the point of view of the external system driving the chip. Setup time, for example, is specified as a minimum since the external system must supply at least that much time to meet the worst-case requirements of all parts. Responses from the internal circuitry are specified from the point of view of the device. Output delay, for example, is specified as a maximum since worst-case operation of any device always provides data within that time.

11. For the tENA test, the transition is measured to the 1.5 V crossing point with datasheet loads. For the tDIS test, the transition is measured to the ±200mV level from the measured steady-state output voltage with ±10mA loads. The balancing voltage, VTH, is set at 3.5 V for Z-to-0 and 0-to-Z tests, and set at 0 V for Z-to-1 and 1-to-Z tests.

12. These parameters are only tested at the high temperature extreme, which is the worst case for leakage current.

FIGURE A. OUTPUT LOADING CIRCUIT

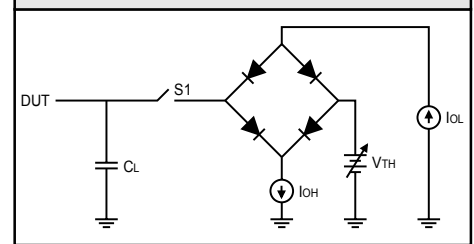


FIGURE B. THRESHOLD LEVELS

