

Interfacing the LTC1290 to the COP820C MCU

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Introduction

This application note describes the hardware and software required for communication between the LTC1290 12-bit data acquisition system and the National Semiconductor COP800 microcontroller family which uses the MICROWIRE/PLUS serial interface. The simple four wire interface is capable of completing a 12-bit conversion and shifting the data in 37 μ s. Configuration of the LTC1290 and the COP820C will be discussed as it applies to this interface. Schematics, code, and timing diagrams will be shown. Finally, a summary of the key points of this interface will be given including data throughput rates.

Interface Details

The LTC1290 has two clock lines: ACLK and SCLK. ACLK controls the A/D conversion rate while SCLK controls the data shift rate. Data is transferred in a full duplex format over D_{IN} and D_{OUT}.

The National Semiconductor MICROWIRE/PLUS is a synchronous, full duplex, serial port built into the COP800 family that allows easy interface to the LTC1290. MICROWIRE/PLUS provides clock, data in and data out lines that are compatible with the LTC1290. One additional line (G1) is required to control the \overline{CS} pin on the LTC1290. The schematic of Figure 1 shows how the two devices are connected.

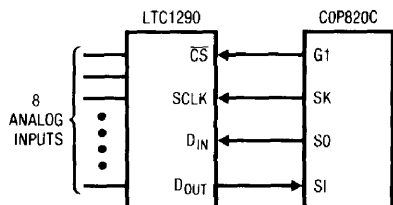
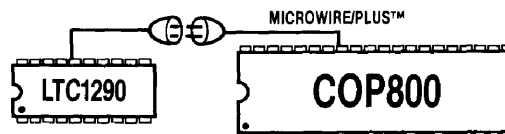


Figure 1. Schematic



Hardware Description

The actual interface was done using the COP820C, a member of the COP800 family. All code shown here should work with any of the COP800 family.

The code for this interface was developed on a COP820 evaluation board operated in the emulation mode.

The timing diagram of Figure 2 was obtained with an HP1631A logic analyzer using a 4MHz ACLK. The COP820C clock was 10MHz. To obtain a 37 μ s transfer time it is necessary to run the COP820C at 20MHz which requires a high speed version of the part.

The analog section of the schematic in Figure 1 is omitted for clarity. For a complete discussion of the analog considerations involved in using the LTC1290 please see the data sheet.

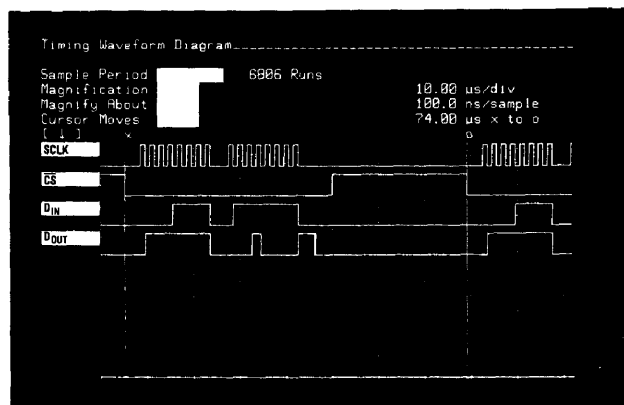


Figure 2. Timing Diagram

Software Description

The software configures and controls the MICROWIRE/PLUS serial interface of the COP820C. Additionally, the software manipulates G1 (\overline{CS} of the LTC1290) and generates a delay during which time the LTC1290 performs a conversion.

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The code first loads the LTC1290 D_{IN} word into memory location \$F0. This D_{IN} word configures the LTC1290 for CH0 with respect to CH1, MSB first, unipolar and 16 bits as shown in Figure 3. Next port G is configured for MICROWIRE™ master mode and G1 is configured as an output. The control register is initialized so that SO and SK are outputs. The port G data register address is loaded into the B register. At this point the COP820C is initialized and the data transfer process is ready to begin.

The D_{IN} word for the LTC1290 is then loaded into the ACC from location \$F0. G1 (\overline{CS}) is cleared and D_{IN} is transferred into the MICROWIRE shift register. The BUSY bit of the PSW register is set which starts the transfer of the first eight bits. A delay consisting of 15 NOPs waits for the data shift to finish at which time the D_{OUT} word from the LTC1290 is loaded into the ACC. The busy bit is set again which causes the transfer to continue. Then, the D_{OUT} word in the ACC is stored in location \$F3. The busy bit is cleared which halts the transfer. G1 (\overline{CS}) is set and the contents of the MICROWIRE shift register are swapped with those of the ACC. The contents of the ACC are then stored in \$F4. The data at this point is left justified as shown in Figure 4.

52 ACLK cycles must be allowed between transfers for the A/D to perform its next conversion. The instructions, after G1 is set, take enough time so that no additional delay is required by this program.

0	0	0	0	1	1	1	1
S/D	O/S	S1	S2	UNI	MSBF	WL1	WL0

Figure 3. D_{IN} Word for LTC1290

MSB								F3
MSB	11	10	9	8	7	6	5	4
LSB								F4
LSB	3	2	1	0	0	0	0	0

D_{OUT} from LTC1290 stored in COP820C RAM

Figure 4. Memory Map

LABEL	MNEMONIC	COMMENTS
LOOP	LD (F0)—0F	LOAD 0F INTO F0 (D_{IN})
	LD (D5)—32	CONFIGURE PORT G
	LD (EE)—8	CONFIGURE CONTROL REG.
	LD (B)—D4	PORT G DATA REG. INTO B
	LD (A)—(F0)	LOAD D_{IN} INTO ACC
	RBIT 1	G1 RESET (\overline{CS} GOES LOW)
	X (A)—→(E9)	LOAD D_{IN} INTO SHIFT REG.
	LD (B)—EF	LOAD PSW REG ADDR IN B
	SBIT 2	TRANSFER BEGINS
	NOP	15 NOPs FOR TIMING
	X (A)—→(E9)	LOAD D_{OUT} INTO ACC
	SBIT 2	TRANSFER CONTINUES
	NOP	15 NOPs FOR TIMING
	X (A)—→(F3)	LOAD D_{OUT} IN ADDR F3
	LD (B)—D4	PUT PORT G ADDR IN B
	SBIT 1	G1 SET (\overline{CS} GOES HIGH)
	X (A)—→(E9)	LOAD D_{OUT} INTO ACC
	X (A)—→(F4)	LOAD D_{OUT} IN ADDR F4

Figure 5. COP820C Code

Power Shutdown

The LTC1290 can be shutdown by inputting the appropriate D_{IN} word (0D). A dummy conversion prior to a request for power shutdown is required because the data from the previous conversion will be shifted out as a 10-bit word during the power shutdown request. Upon power up the LTC1290 is ready for conversion and the D_{OUT} word will be valid on the second request for conversion.

Summary

A four wire interface between the LTC1290 and the COP820C with a combined data conversion and transfer time of 37 μ s was demonstrated. The interface used the MICROWIRE/PLUS serial port of the COP820C. The 16 data bits of the LTC1290 are shifted MSB first in two 8-bit transfers. The data is stored left justified in the COP820C's internal RAM.

Reference

Hoover, Guy and Rempfer, William, "Interfacing the LTC1090 to the COP820C MCU," Application Note 26D, Linear Technology Corp.

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