

CAN DC Motor Controller

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Project Summary

This project is about a motor control unit that receives the PWM duty cycle via CAN, generates a 15 kHz PWM signal, and transmits the measured motor speed over CAN every 0.05 seconds. The speed measurement is performed using an encoder (PhaseA and PhaseB) and the duty cycle received is displayed at a seven segment display.

More information in the Application Note: [CAN Protocol for DC Motor Speed Control](#)

Implementation

The subprojects have led0 and led1 for visual confirmation of proper CAN communication, where both must be ON when working properly. In addition, both subprojects also use 4 pins of the FPGA to be connected at the CAN Transceiver: RX, TX, Vcc and GND. The CAN Transceivers are connected together using their High and Low pins. For the CAN DC Motor Controller subproject, the generated PWM Signal are showed at led2 and is connected to the Enable channel of the H-Bridge module and his In1 input to the 3v3 of the FPGA, fixing the direction of the DC Motor to only one direction. The correspondent output of the H-Bridge module is then connected to the positive and negative DC Motor terminals. The phases A and B, 3v3 and GND of the built-in DC Motor encoder are then connected to the FPGA, finishing the connections of this subproject. The following table resumes all connections.

Table 1 - System Specifications

Field	Description
FPGA Board	Tang Primer 20K
FPGA Core	Gowin GW2AR-18
CAN Transceiver	TJA1050
CAN Functionality	Bitrate of 500 Kbps (See document at Links section)
Input Interface	- CAN DC Motor Controller: 1 button for reset
DC Motor Used	GM-25 370 DC Motor with encoder(No load 6V 210 RPM)
DC Motor Power Supply Used	AC to DC 6V 2A
H-Bridge Motor Driver Used	L298n
PWM Frequency	15 kHz
PWM Duty Cycle	8-bit resolution (0-255)
Speed Measurement	Encoder pulses from PhaseA and PhaseB
Clock Frequency	27 MHz FPGA clock
Power Supply	5V via USB-A
Programming Interface	JTAG or USB Programmer
Speed Transmission Rate	20 times per second (via CAN)
PWM Duty Cycle Transmission Rate	2 times per second (via CAN)
Data Display	Seven Segment Display for motor speed and duty cycle visualization
Sampling Frequency	10 Hz (for motor speed measurement)

Field	Description
Reset Functionality	One reset button for each subproject

Table 2 - System Connections

Component	Connection/Terminal	FPGA Pin or Power Supply
L298N (Motor Driver)	Vcc and GND	6V 2A Power Supply
	Logic Level	5V from FPGA
	In1	3.3V from FPGA
	In2	GND from FPGA
	Motor + (Out 1)	Motor connection (Motor +)
	Motor - (Out 2)	Motor connection (Motor -)
	Enable 1	FPGA Pin F4
Motor Encoder	Phase A	FPGA Pin F7
	Phase B	FPGA Pin F6
CAN Transceiver TJA1050	VCC	3.3V from FPGA
	GND	GND from FPGA
	TX	FPGA Pin D7
	RX	FPGA Pin D6

Block Diagrams



Figure 1 - Project developed at ChipInventor platform

dc motor.png

Figure 2 - CAN DC Motor Controller subproject developed at ChipInventor

Visual Resources

fpga dc motor.png

Figure 1 - CAN DC Motor Controller input keys placement