This is the Revision B verion of the IRDistance4 Module. The status of this project is finished.

IRDistance4 Module (Revision B)

Table of Contents

This document is also available in PDF format.

1. Introduction

The IRDistance4 Module is used to connect up to 5 Sharp® GP2D12 IROD (InfraRed Optical Distance) measuring sensors. The GP2D12 module provides an analog voltage that is proportional to the distance (although not linearly.)

2. Programming

The IRDistance4 Module can enable zero, one or more of the AIROD's. For the ones that are enabled, it continuously reads the distance values. To conserve power, only one AIROD is powered up at a time.

The IRDistance4 Module supports Module Interrupt Protocol for those lines that are being used as inputs. The interrupt pending bit is set whenever the the formula:

$$L\&(\sim I) \mid H\&I \mid R\&(\sim P)\&I \mid F\&P\&(\sim I)$$

is non−zero, where:

- I is the current input bits XOR'ed with the complement mask (C)
- P is the previous value of I
- L is the low mask
- H is the high mask
- R is the raising mask
- F is the falling mask

and

- ~ is bit−wise complement
- | is bit−wise OR
- & is bit−wise AND

Once the interrupt pending bit is set, it must be explicitly cleared by the user.

In addition to the common shared commands and the shared interrupt commands, the AnalogIn4 Module supports following commands:

| Command	Send/ Receive	Byte Value								Discussion
		7	6	5	4	3	2	1	0	
Read Distance	Send	0	0	0	0	0	0	0	*b*	Read IROD *b* and respond with 8−bit value *dddddddd*
	Send	*d*	*d*	*d*	*d*	*d*	*d*	*d*	*d*	
Read Binary Values	Send	0	0	0	0	0	0	1	0	Return the binary values *ab* (after XOR'ing with complement mask)
	Receive	0	0	0	0	0	0	*a*	*b*	
Read Raw Binary	Send	0	0	0	0	0	0	1	1	Return the raw binary values *ab* (no XOR with complement mask)
	Receive	0	0	0	0	0	0	*a*	*b*	
Reset	Send	0	0	0	0	0	1	0	0	Reset everything to zero
Read Enable Bit	Send	0	0	0	0	0	1	0	1	Read and return the enable bit *e*
	Receive	0	0	0	0	0	0	0	*e*	
Set Enable Bit	Send	0	0	0	0	0	1	1	*e*	Set enable bit to *e*
Read Complement Mask	Send	0	0	0	0	1	0	0	0	Return and return the complement mask *cccc*
	Receive	0	0	0	0	0	0	*c*	*c*	
Read High Mask	Send	0	0	0	0	1	0	0	1	Return and return the high mask *hh*
	Receive	0	0	0	0	0	0	*h*	*h*	
Read Low Mask	Send	0	0	0	0	1	0	1	0	Return and return the low mask *ll*
	Receive	0	0	0	0	0	0	*l*	*l*	
Read Raising Mask	Send	0	0	0	0	1	0	1	1	Return and return the raising mask *rr*
	Receive	0	0	0	0	0	0	*r*	*r*	
Read Falling Mask	Send	0	0	0	0	1	1	0	0	Return and return the falling mask *ff*
	Receive	0	0	0	0	0	0	*f*	*f*	
Read High Threshold	Send	0	0	0	1	0	0	0	*b*	Read and return high threshold for pin *b* of *hhhhhhhh*
	Receive	*h*	*h*	*h*	*h*	*h*	*h*	*h*	*h*	
Read Low Threshold	Send	0	0	0	1	0	0	1	*b*	Read and return low threshold for pin *bb* of *llllllll*
	Receive	*l*	*l*	*l*	*l*	*l*	*l*	*l*	*l*	
Set High Threshold	Send	0	0	0	1	0	1	0	*b*	Set high threshold for pin *b* to *hhhhhhhh*
	Send	*h*	*h*	*h*	*h*	*h*	*h*	*h*	*h*	
Set Low Threshold	Send	0	0	0	1	0	1	1	*b*	Set low threshold for pin *b* to *llllllll*
	Send	*l*	*l*	*l*	*l*	*l*	*l*	*l*	*l*	
Set Complement Mask	Send	0	0	1	0	0	0	*c*	*c*	Set complement mask to *cc*
Set High Mask	Send	0	0	1	0	0	1	*h*	*h*	Set high mask to *hh*
Set Low Mask	Send	0	0	1	0	1	0	*l*	*l*	Set low mask to *ll*
Set Raising Mask	Send	0	0	1	0	1	1	*r*	*r*	Set raising mask to *rr*
Set Falling Mask	Send	0	0	1	1	0	0	*f*	*f*	Set falling mask to *ff*
Read Interrupt Bits	Send	1	1	1	0	1	1	1	1	Return the interrupt pending bit *p* and the interrupt enable bit *e*.
	Receive	0	0	0	0	0	0	*e*	*p*	
Set Interrupt Commands	Send	1	1	1	1	0	*c*	*c*	*c*	Set Interrupt Command *ccc*.
Shared Commands	Send	1	1	1	1	1	*c*	*c*	*c*	Execute common shared command *ccc*

3. Hardware

The hardware consists of a circuit schematic and a printed circuit board.

3.1 Circuit Schematic

The schematic for the IRDistance4 Module is shown below:
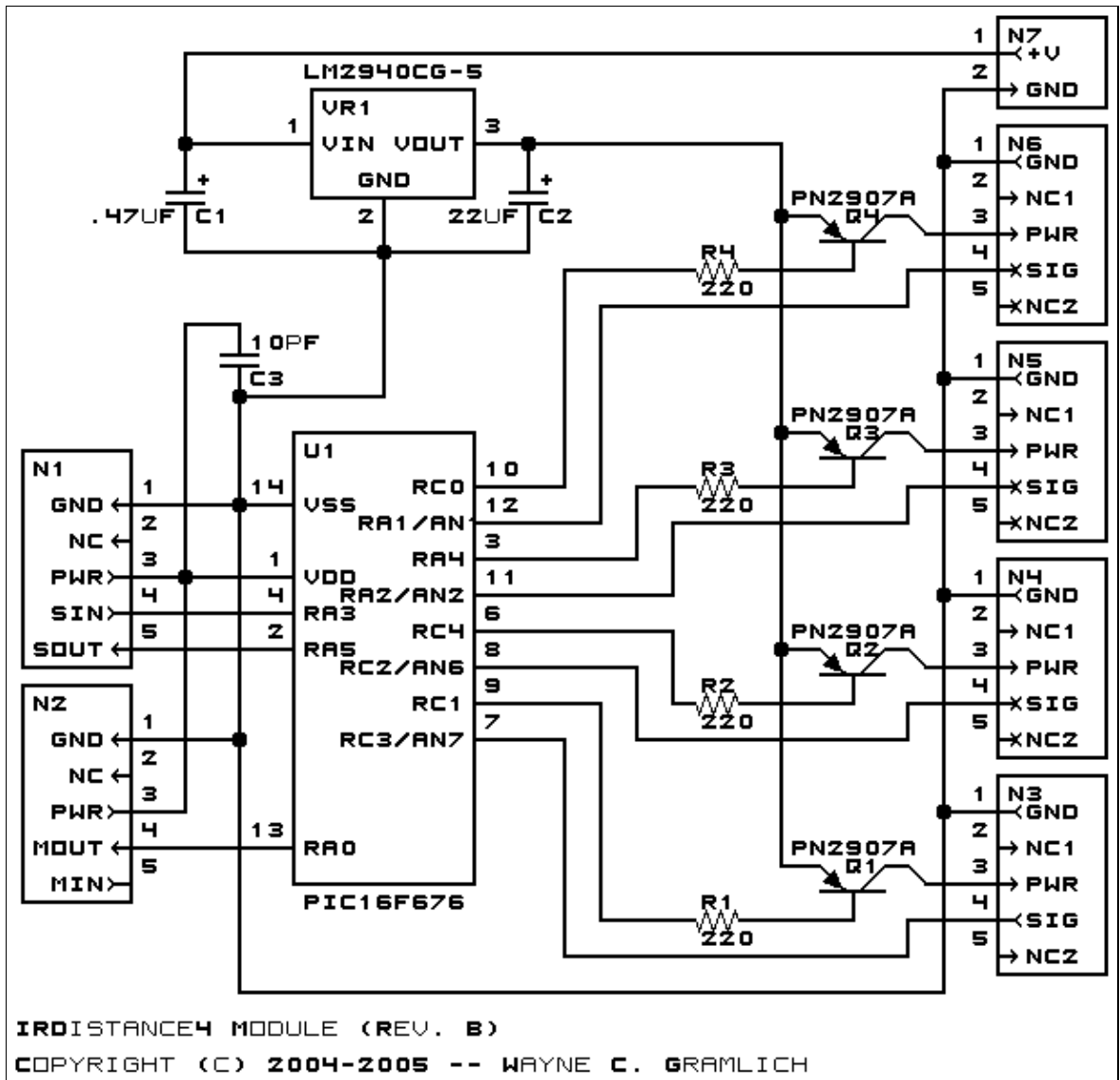
The parts list kept in a separate file –– irdistance4.ptl.

3.2 Printed Circuit Board

The printed circuit board files are listed below:

irdistance4_back.png
        The solder side layer.

irdistance4_front.png
>   The component side layer.

irdistance4_artwork.png
>   The artwork layer.

irdistance4.gbl
>   The RS−272X "Gerber" back (solder side) layer.

irdistance4.gtl
>   The RS−272X "Gerber" top (component side) layer.

irdistance4.gal
>   The RS−272X "Gerber" artwork layer.

irdistance4.drl
>   The "Excellon" NC drill file.

irdistance4.tol
>   The "Excellon" tool rack file.

4. Software

The software for the IRDistance4 is listed below:

irdistance4.ucl
>   The μCL file for IRDistance4.

irdistance4.asm
>   The assembly file for IRDistance4.

irdistance4.hex
>   The Intel® Hex file.

irdistance4.lst
>   The listing file for IRDistance4.

5. Issues

Any fabrication issues will be listed here.

A. Appendix A: Parts List

```
# Parts list for IRDistance4 RoboBrix (Rev. B)
#
C1: Capacitor470nF – .47 uF Tantalum Capacitor [Jameco: 33531]
C2: Capacitor22uF – 22 uF Tantalum Capacitor [Jameco: 94094]
C3: Capacitor10pF – 10 pF Ceramic Capacitor [Jameco: 15333]
N1: Header1x5.Slave – 1x5 Male Header [5/40 Jameco: 160881]
N2: Header1x5.Debug – 1x5 Male Header [5/40 Jameco: 160881]
N3-6: Header1x5.IRDistance4 – 1x5 Male Header [5/40 Jameco: 160881]
N7: TerminalStrip2.Power – 2 Junction Terminal Strip [Jameco: 189675]
Q1-4: PN2907.CBE – PNP Silicon Transistor [Jameco: 28644]
R1-4: Resistor220 – 220 Ohm 1/4 Watt Resistor [Jameco: 30470]
U1: PIC16F676.IRDistance4 – Microchip PIC16C676 [Digikey: PIC16F676-I/P-ND]
VR1: LM2940CG-5 – 5 Volt Low Dropout Voltage Regulator [Jameco: 107182]
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B. Appendix B: Artwork Layer
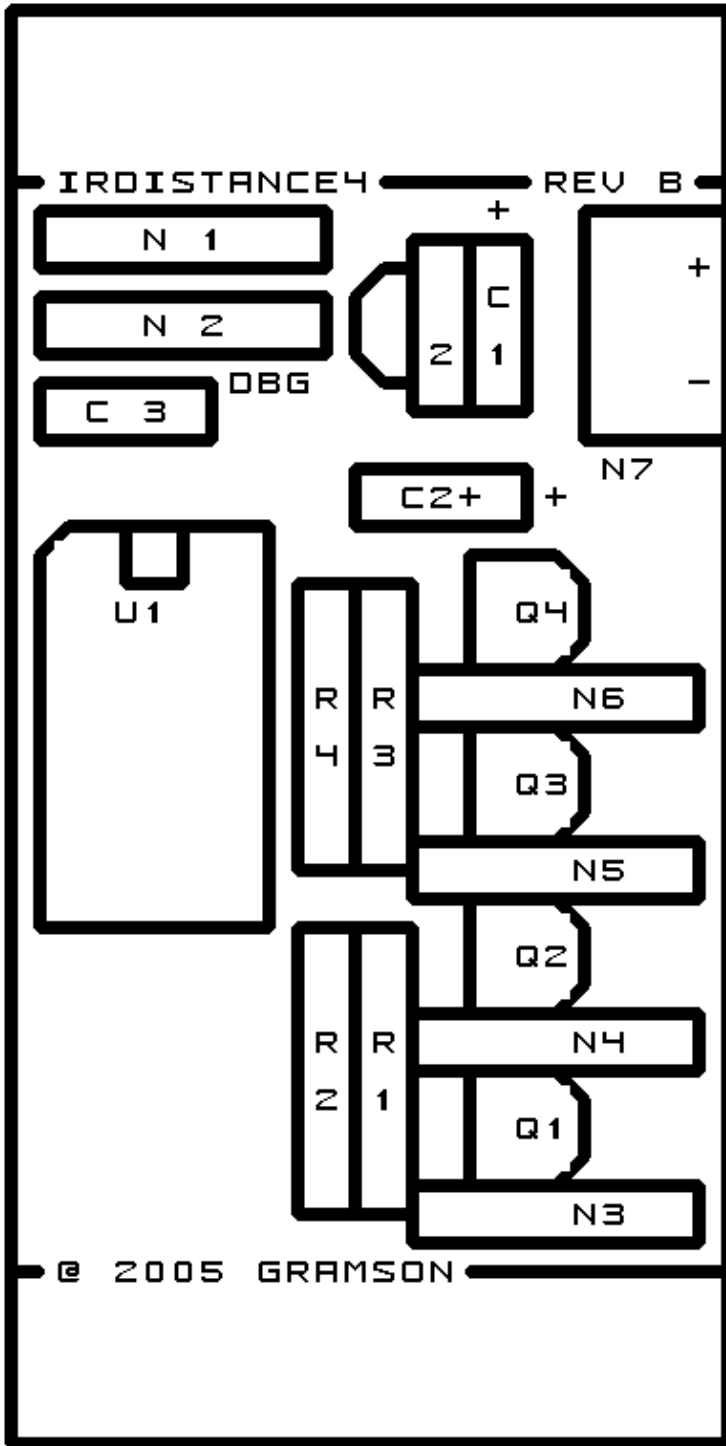
C. Appendix C: Back (Solder Side) Layer
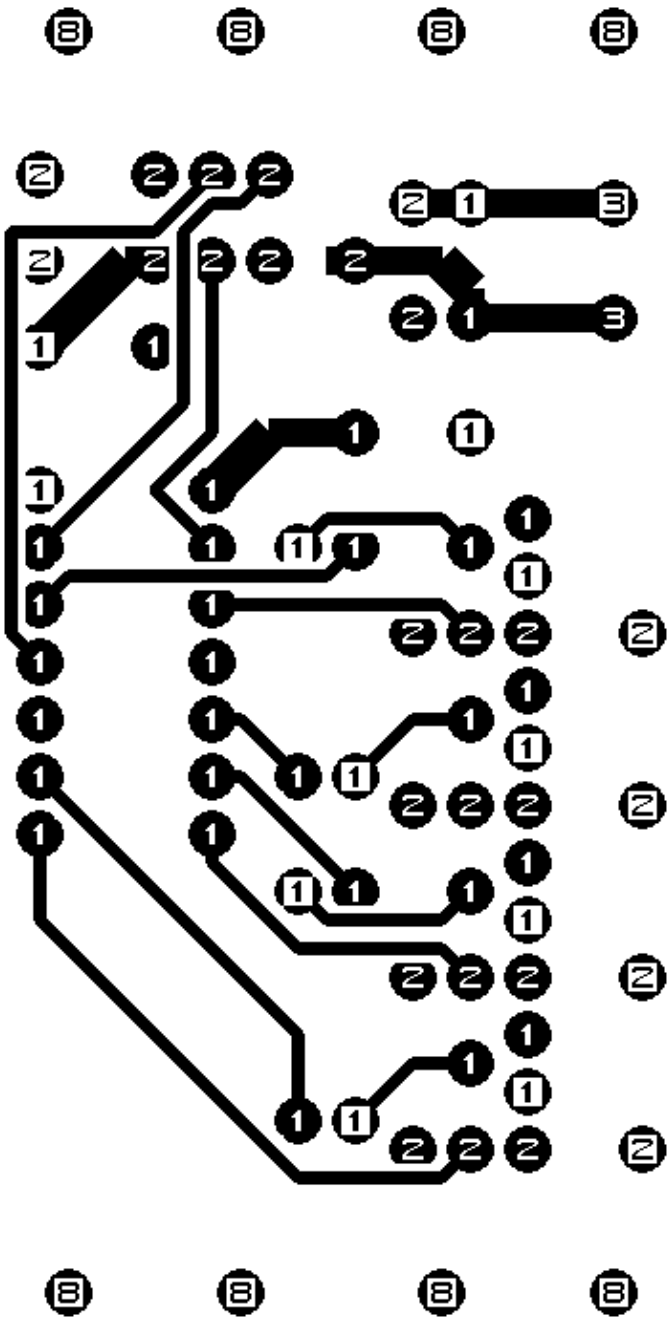
D. Appendix D: Front (Component Side) Layer