User Manual

Using Allegro ASEK37800 Samples Programmer with ASEK37800 Evaluation Boards

By Kasey Hampton and Evan Shorman,
Allegro MicroSystems

Introduction

This quick guide documents the use of the ASEK37800 evaluation boards (TED-0003306, TED-0003358, TED-0003359, TED-0003360, and TED-0003361) with the Allegro ACS37800 samples programmer.

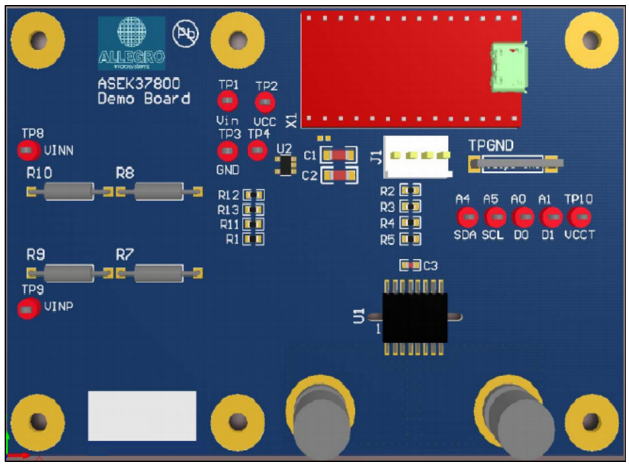

Figure 1: ASEK37800 Demo Board Layout

ASEK37800 Demo Board

The ASEK37800 PCB is shown in Figure 1 below. Table 1 is a summary of the demo board components and Table 2 is a summary of the demo board test points. Please refer to the Appendix section for the top and bottom layers of the ASEK37800 demo board (TED-0003306), as well as the demo board schematics for each of the five demo boards.

Table 1: Summary of Demo Board Components

Symbol	Description
U1	Location of Allegro ACS37800
U2	Voltage regulator
X1	Teensy 3.2
C1/C2	0.1 µF regulator capacitors
C3	0.1 µF device bypass capacitor
R1	RSENSE resistor voltage step down circuit (application specific)
R2-R5	Digital I/O pull-up resistors (used for SPI or I2C communication)
R7-R10	Isolation resistors
TPx	Test points

Table 2: Summary of Test Points

Symbol	Description
TP1	Vin (input to regulator)
TP2	VCC (device power supply)
TP3	GND (device ground)
TP4	VINP (positive input voltage)
A4	SDA (serial data line)
A5	SCL (serial clock line)
A0	DO (digital I/O 0)
A1	D1 (digital I/O 1)
TP8	L (line)
TP9	N (neutral)
TP10	VCCT (Teensy power supply)

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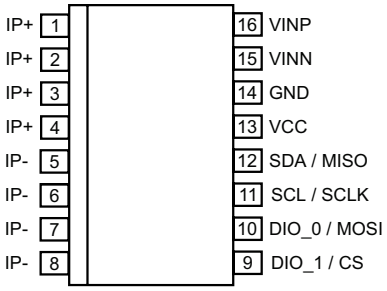

Figure 2: ACS3700 Pinout

Table 3: ACS37800 Terminal List

Number	Name	Description	
		I2C	SPI
1, 2, 3, 4	IP+	Terminals for current being sensed; fused internally	
5, 6, 7, 8	IP-	Terminals for current being sensed; fused internally	
9	DIO_1/CS	Digital I/O 1	Chip Select (CS)
10	DIO_0/MOSI	Digital I/O 0	MOSI
11	SCL/SCLK	SCL	SCLK
12	SDA/MISO	SDA	MISO
13	VCC	Device power supply terminal	
14	GND	Device ground terminal	
15	VINN	Negative input voltage (always connect to GND)	
16	VINP	Positive input voltage	

Downloading the Programmer

1. Register for software on the Allegro Software Portal: https://registration.allegromicro.com/login.
2. After registering and logging in to the software portal, the dashboard page will be shown. Choose the "Find a Part" button highlighted in Figure 3.

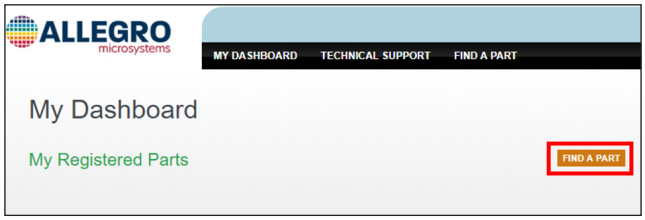

Figure 3: "Find a Part" button allowing the user to register specific devices

3. Click "Find a Part" to go to the "Available Parts & Software" page.
4. Search for "ACS37800" in the "Select by Part Number" search bar shown in Figure 4.

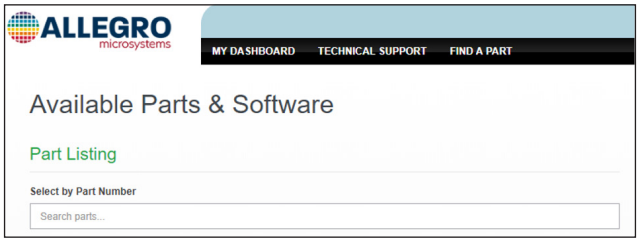

Figure 4: "Select by Part Number" on the Available Parts & Software page

5. Click "View" next to the ACS37800 search result as shown highlighted in Figure 5.

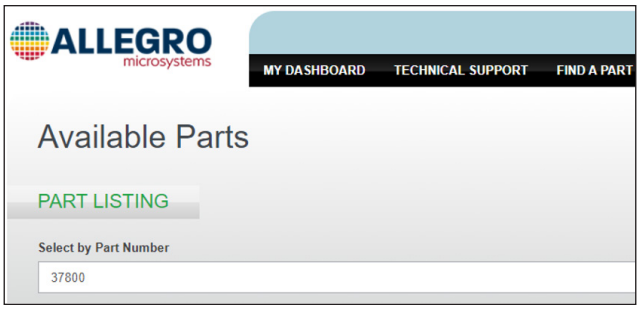

Figure 5: "View" next to "ACS37800" search result

6. Click "Download" next to the first result to open the Programming Application ZIP file.
7. Open and extract the downloaded ZIP file and save to a known location.
8. Open the extracted ZIP file and open the folder "Allegro ACS37800 Demonstration".
9. Open the Allegro ACS37800 application file (EXE file extension) to open the samples programmer.

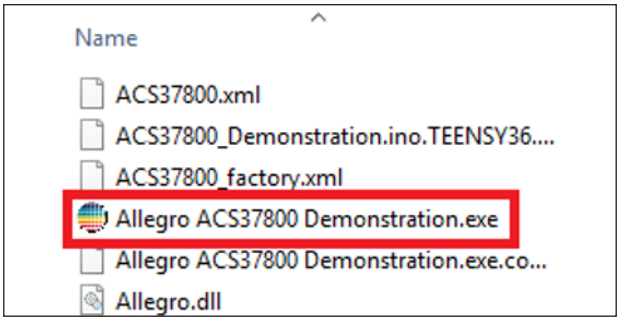

Figure 6: Allegro ACS37800 Samples Programmer

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ASEK37800 and GUI Setup and Connection

Powering-on the ACS37800

There are two ways to power the ACS37800: connect pin VCCT (TP10) to the VCC pin (TP2) on the ASEK37800 demo board or use an external power supply and connect to the device VCC (TP2) and GND (TP3).

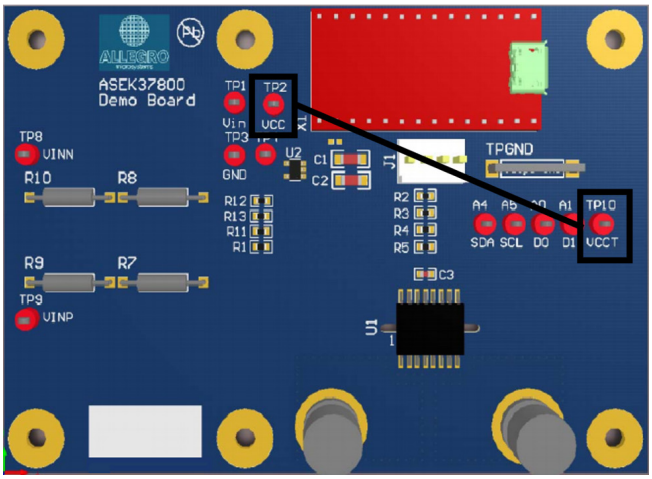

Figure 7: Connect VCCT to VCC to Power ACS37800 without an External Supply

Opening the GUI

Opening the programmer will result in a window identical to Figure 7. Once the "Allegro ACS37800 Samples Programmer" application file has been opened and executed, the user must connect a USB cable from the USB port of a personal computer to the micro-USB port of the Teensy 3.2 (refer to Figure 8 below for an image of the Teensy 3.2).

If connecting and programming the ASEK37800 demo board for the first time, the user must first update the Teensy firmware. Please follow the steps in Updating Teensy Firmware section below. If not using the ASEK37800 evaluation board for the first time, please skip to Selecting the COM Port section below.

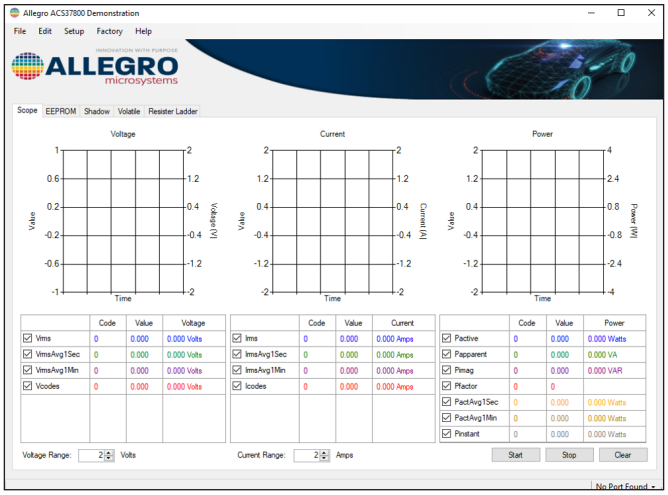

Figure 8: ACS37800 Programmer Application

Updating Teensy Firmware

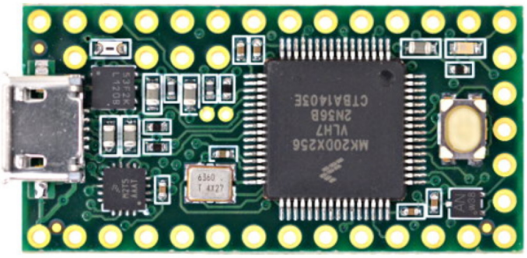

Figure 9: Teensy 3.2

1. Ensure the Teensy USB port is connected to the PC.
2. Navigate to the "Setup" menu on the file menu of the programmer. Select "Update Firmware…." (refer to Figure 9).
3. The "Download Firmware" dialogue window will open (refer to Figure 10).
   A. In this window, the user will ensure the correct board is connected.
   B. Before exiting the dialogue window, the user should press the white button on the Teensy (shown outlined in red in Figure 11).
   C. Select "Ok" in the dialogue window.

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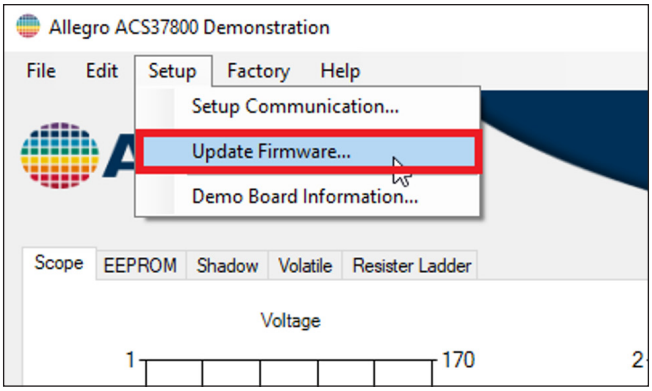

Figure 10: "Update Firmware" Option in the "Setup" Menu

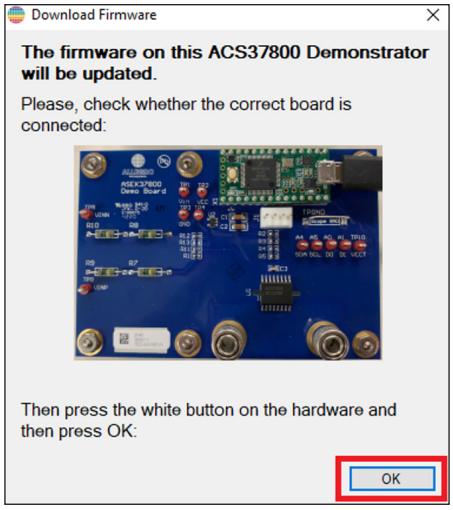

Figure 11: "Download Firmware" Dialogue Window

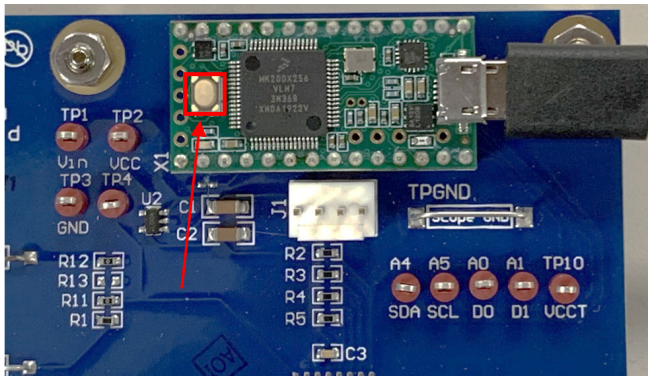

Figure 12: White Button on Teensy, Press When Updating the Firmware

Selecting the COM Port

To select a COM port, navigate to the file bar on the bottom of the GUI, as shown in Figure 12. Upon startup, the GUI will state "No Port Found". Select the drop-down arrow and select the COM port the Teensy is connected to. If the wrong COM port is selected, an Error message dialogue window will appear (refer to Figure 13).

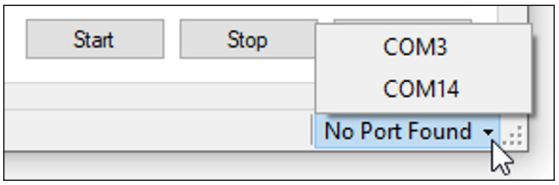

Figure 13: COM Port Setup

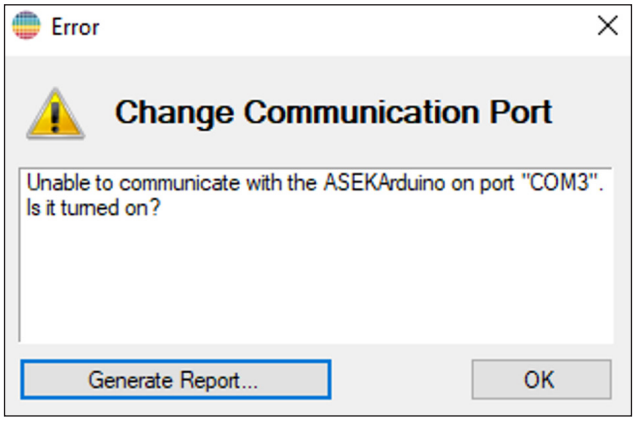

Figure 14: Wrong COM Port Selection Error Window

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Notable GUI Features

Scope Page

The first page of the ACS37800 GUI is the Scope mode page. Here, the user can plot and observe different fields. The fields are defined below. For more information about these fields, refer to the ACS37800 datasheet on the ACS37800 device page on the Allegro website.

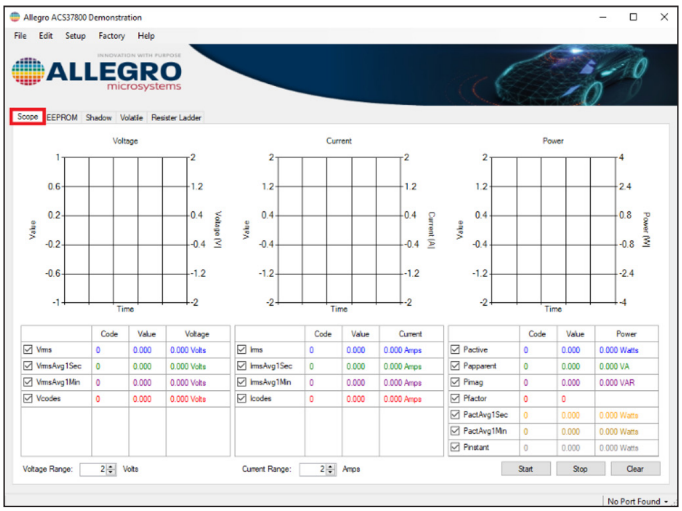

Figure 15: Default Scope Mode Page in the ACS37800 GUI

Voltage

1. Vrms: RMS voltage output
2. VrmsAvg1Sec: averaged voltage RMS value, duration set by rms_avg_1
3. VrmsAvg1Min: averaged voltage RMS value, duration set by rms_avg_2
4. Vcodes: instantaneous voltage measurement before any RMS calculations are done

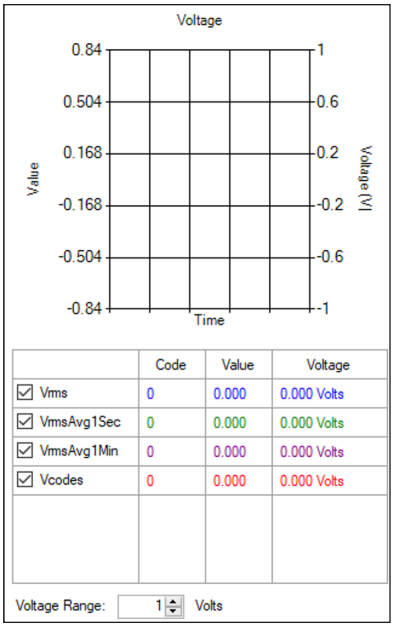

Figure 16: Default Voltage Plot

Current

1. Irms: RMS current output
2. IrmsAvg1Sec: averaged voltage RMS value, duration set by rms_avg_1
3. IrmsAvg1Min: averaged voltage RMS value, duration set by rms_avg_2
4. Icodes: instantaneous current measurement before any RMS calculations are done

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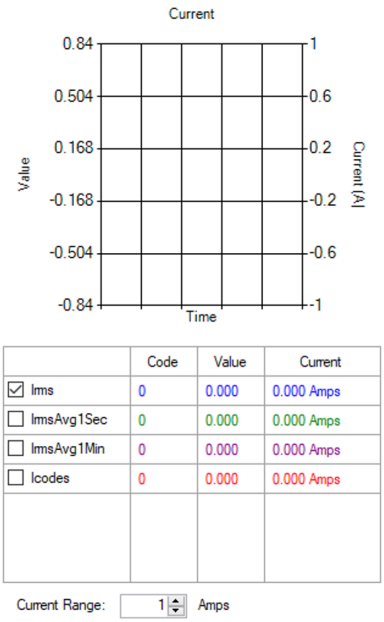

Figure 17: Default Current Plot

Power

1. Pactive: active power output
2. Papparent: apparent power output magnitude
3. Pimag: reactive power output
4. Pfactor: power factor output
5. PactAvg1Sec: active power value averaged according to rms_avg_1.
6. PactAvg1Min: active power value averaged according to rms_avg_2.
7. Pinstant: this field contains the instantaneous power measurement before any RMS calculations are done

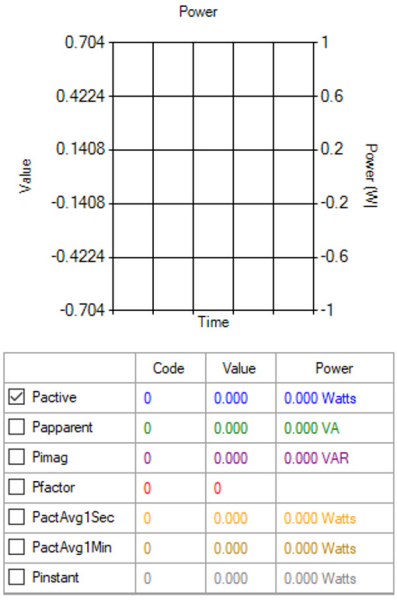

Figure 18: Default Power Plot

In the bottom right hand corner of the Scope mode window, there are three buttons: start (begin plotting), stop (end plotting), and clear (removes existing data from plots).

Refer to Figure 18 below for an example of the scope mode.

Figure 19: Example Scope Mode

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EEPROM Page

The second page of the ACS37800 GUI is the EEPROM page. Here, the user can read and write to EEPROM.

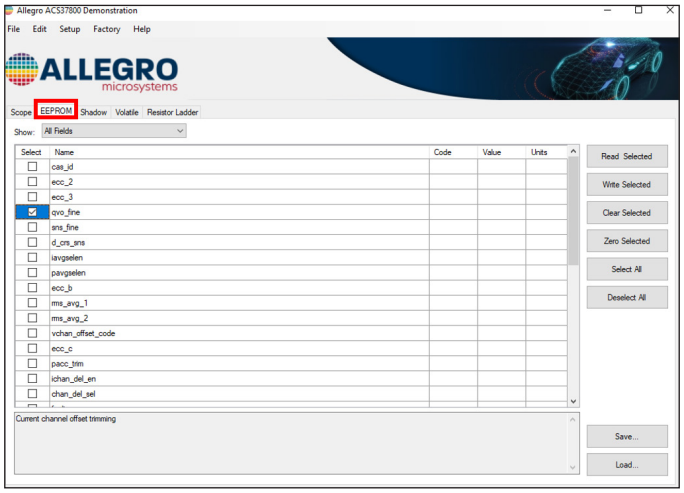

Figure 20: Default EEPROM Page

Reading and Writing to the Part

Note before reading and writing to the part, the ASEK37800 board must be powered and must be connected to the programmer GUI. Ensure the firmware of the Teensy is up to date.

It is recommended that the user save the memory to a tabular file before experimenting with programming so the user can return the device to its original factory programmed state if necessary. See the Saving and Loading Memory Files section below for more information.

To read a field, select the desired field by checking the box under “Select” to the left of the register name (refer to Figure 20) and click the “Read Selected” button highlighted in red in Figure 21.

To write to a field, select the desired field by checking the box under “Select” to the left of the name. Change the value under “Code” to the desired value and press Enter. Click

“Write Selected” button highlighted in blue in Figure 21.

To verify that field was written to the device, do the following: click “Clear Selected” causing the values in the “Code” and “Value” cells to disappear. Then click “Read Selected”. The values that were written will reappear in the “Code” and “Value” cells verifying the user correctly wrote to the part.

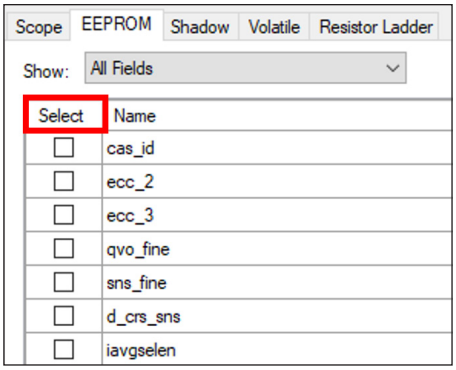

Figure 21: Select the Desired Field

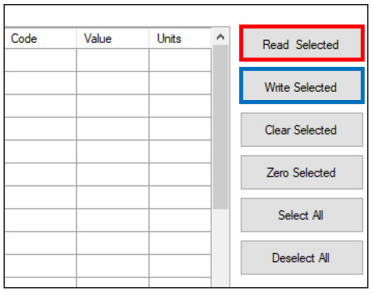

Figure 22: “Read Selected” and “Write Selected”

Below, each option on the programmer menu has been briefly defined:

1. Read Selected: reads value of the selected field
2. Write Selected: writes entered value to the part
3. Clear Selected: this option will hide and clear the value of the selected field but will not change the value
4. Zero Selected: this option will zero the selected field but will not write zero to the device unless “Write Selected” is clicked
5. Select All: selects all fields
6. Deselect All: deselects all selected fields.

Note that clicking on the name of a selected field will define the field to the user. Hovering over a field with the PC cursor will tell the user the address of that field (refer to Figure 22).

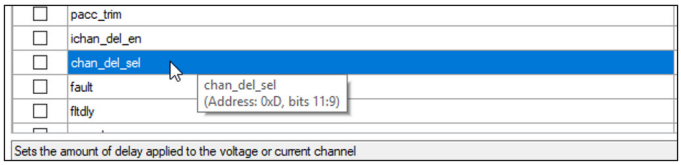

Figure 23: Field Definition by Clicking Desired Field

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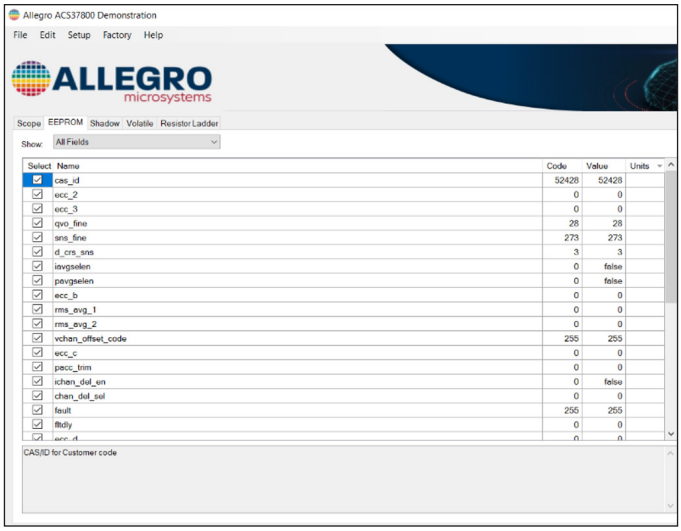

Figure 24: Example EEPROM Read

Shadow Page

The third page of the ACS37800 GUI is the Shadow page. At power up, all shadow registers are loaded from EEPROM. The Shadow page has a “Load From EEPROM” option (refer to Figure 24).

The shadow registers, or the working memory of the device, can be written to in order to change the device behavior without hav¬ing to perform an EEPROM write. Any changes made in shadow memory are temporary and do not persist through a reset event. When programing the ACS37800, shadow can be used to iterate and find the configuration that is desired, while EEPROM should be used as the final write.

Figure 25: Shadow Default Page

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Volatile Page

The fourth page of the GUI is the Volatile page. Data in the volatile fields are maintained while the device is powered on.

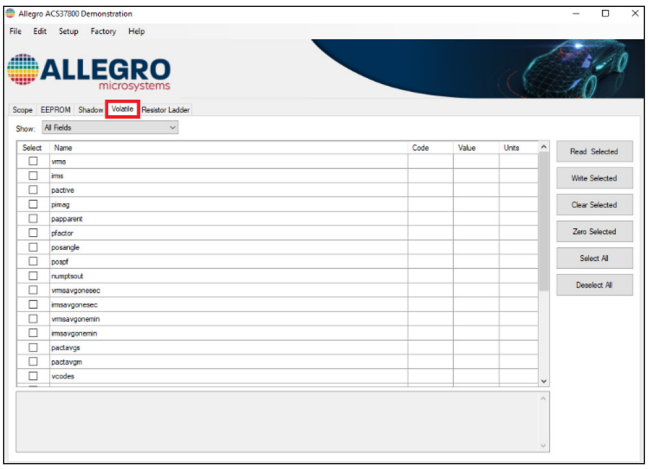

Figure 26: Default Volatile Page

Resistor Ladder Page

The final page in the ACS37800 programmer is the Resistor Ladder page. Here, the user can calculate the maximum RSENSE value based on the application specific VLINE voltage (V_line_peak [V] in the GUI) and isolation resistor values R_iso_total [MΩ], the total resistance of the isolation resistors).

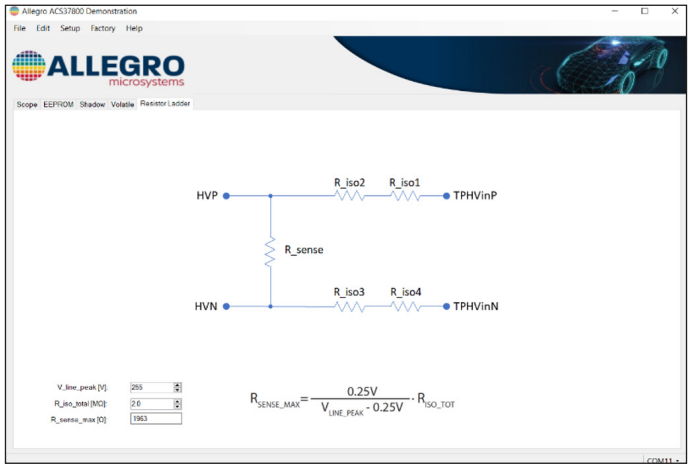

Figure 27: Resistor Ladder Page

The Resistor Ladder application circuit is based on the typical AC application circuit from the ACS37800 datasheet where R_iso_total = RISO1+ RISO2+ RISO3+ RISO4.

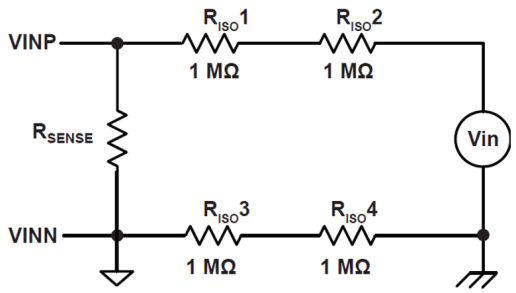

Figure 28: Typical Voltage Channel Application; Device GND is Isolated from Neutral

If the application requires device GND to be connected to Neutral, R_iso_total = RISO1+ RISO2 (RISO3 = RISO4 = 0 Ω).

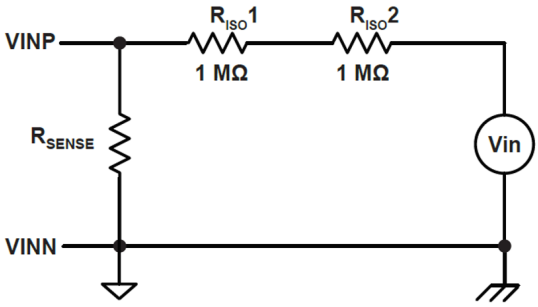

Figure 29: Typical Voltage Channel Application Circuit; Device GND is Connected to Neutral

Demo Board Information

To access the Demo Board Information, hover over "Setup" on the menu bar. Select "Demo Board Information…". This will open a dialogue window identical to the window in Figure 30.

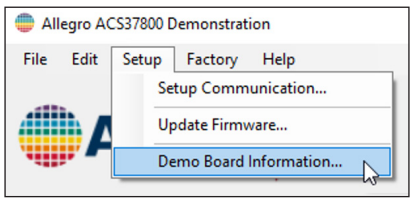

Figure 30: "Setup" → "Demo Board Information..."

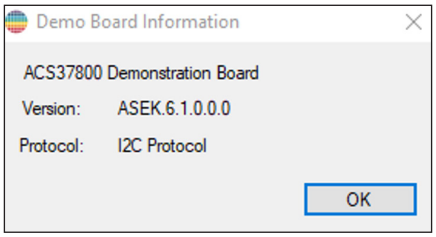

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Figure 31: Demo Board Information Dialogue Window Example

Accessing the Register Diagram

To access the register diagram, hover over “Help” on the menu bar. Select “ACS37800 Register Diagram” (refer to Figure 31). This will open a dialogue window identical to the window in Figure 32 below. Here, the user can view both the EEPROM register diagram and the Volatile register diagram. See the appendix section below for larger register diagrams.

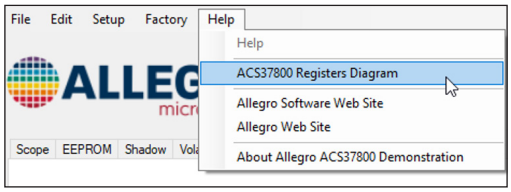

Figure 32: “Help” → “ACS37800 Registers Diagram”

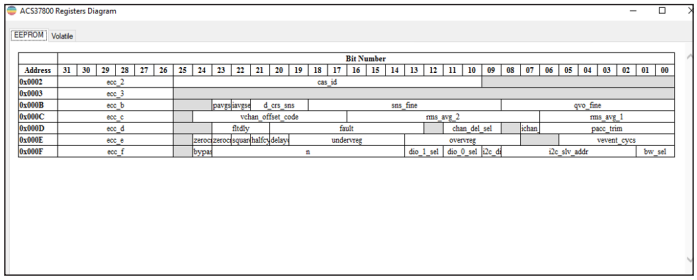

Figure 33: ACS37800 Register Diagram with EEPROM and Volatile Pages

Saving and Loading Memory Files

To save the memory as a tabular data file (.csv, excel) or text file (.txt), click “Save…” in the bottom right side of the GUI as highlighted in red in Figure 33. Clicking “Save…” will open a file explorer where the user can save the memory information as a “.csv” file or “.txt” file. Saving the memory is recommended before experimenting with programming so the user can return the device to its original factory programmed state if necessary. The user can also save the memory by clicking “File” → “Save Memory…”.

To load a previously saved file containing memory information, click “Load…” as highlighted in green in Figure 33 below. Clicking “Load…” will open a file explorer where the user can navigate to a previously saved “.csv” file or “.txt” file. The user can also load a memory file by clicking “File” → “Load Memory…”.

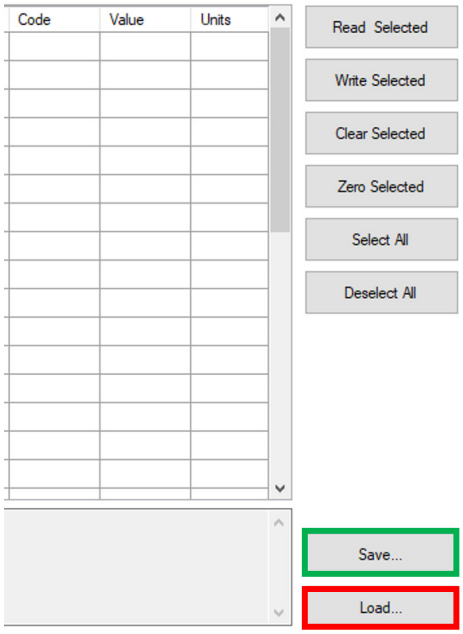

Figure 34: “Load” and “Save” the Memory to a Tabular File

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Appendix

Demo Board Schematics

ASEK37800, Demo, SOIC16, Teensy, Bare Board (TED-0003306)

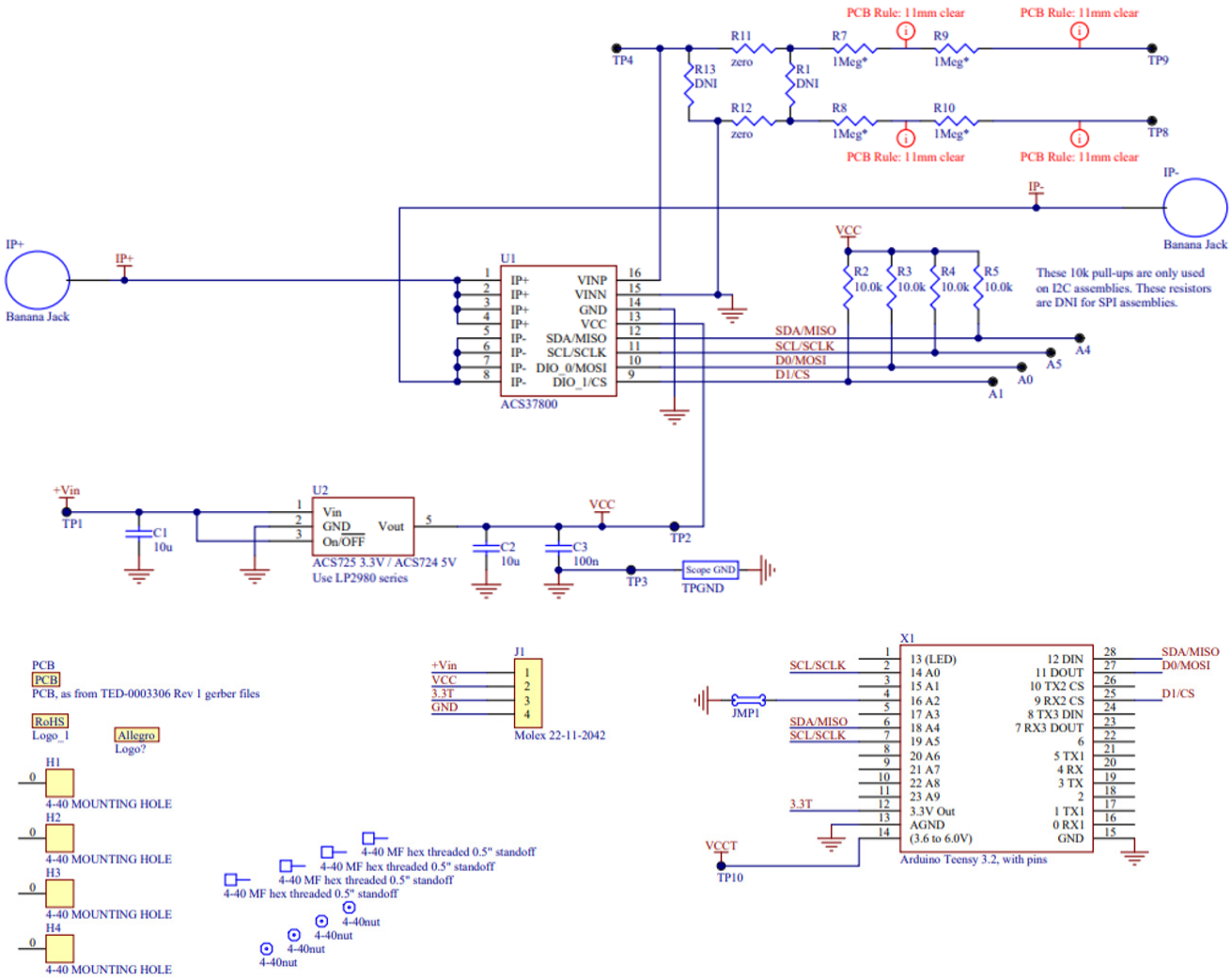

Figure 35: TED-0003306 Schematic

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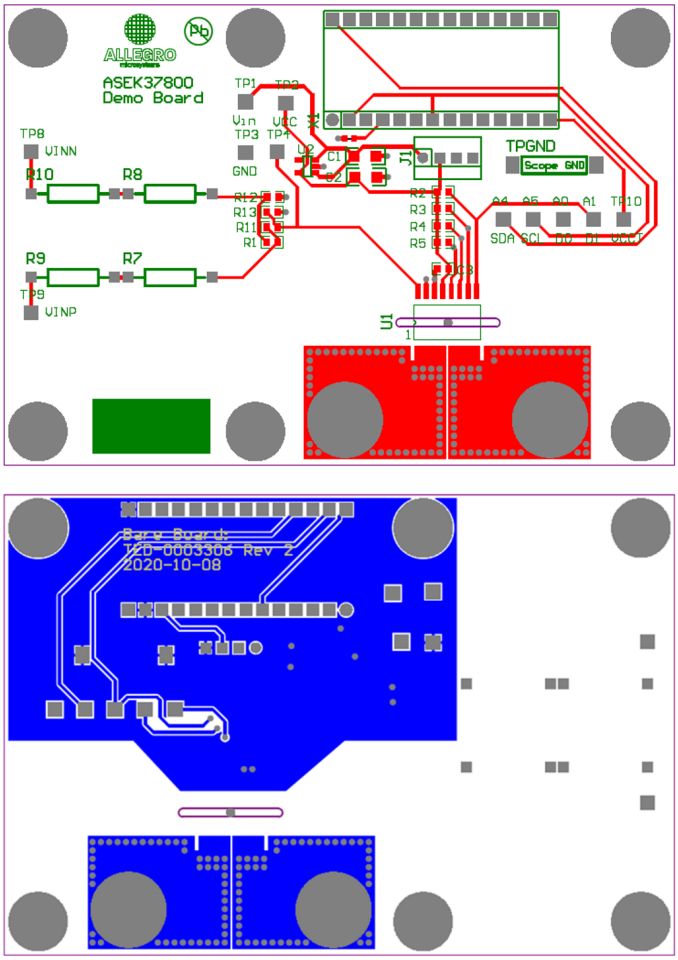

Figure 36: Top and Bottom Layers of TED-0003306

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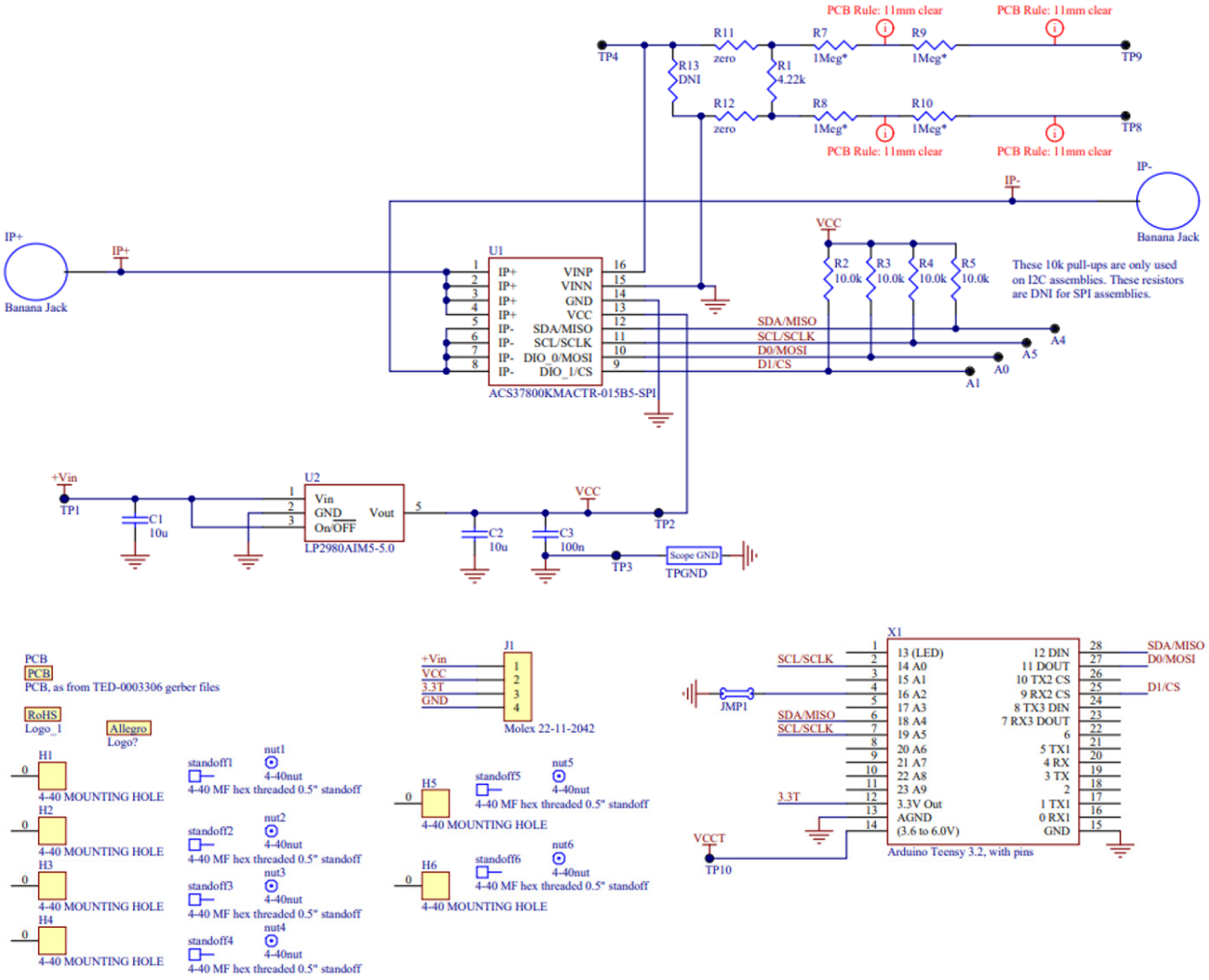

Figure 37: TED-0003358 Schematic

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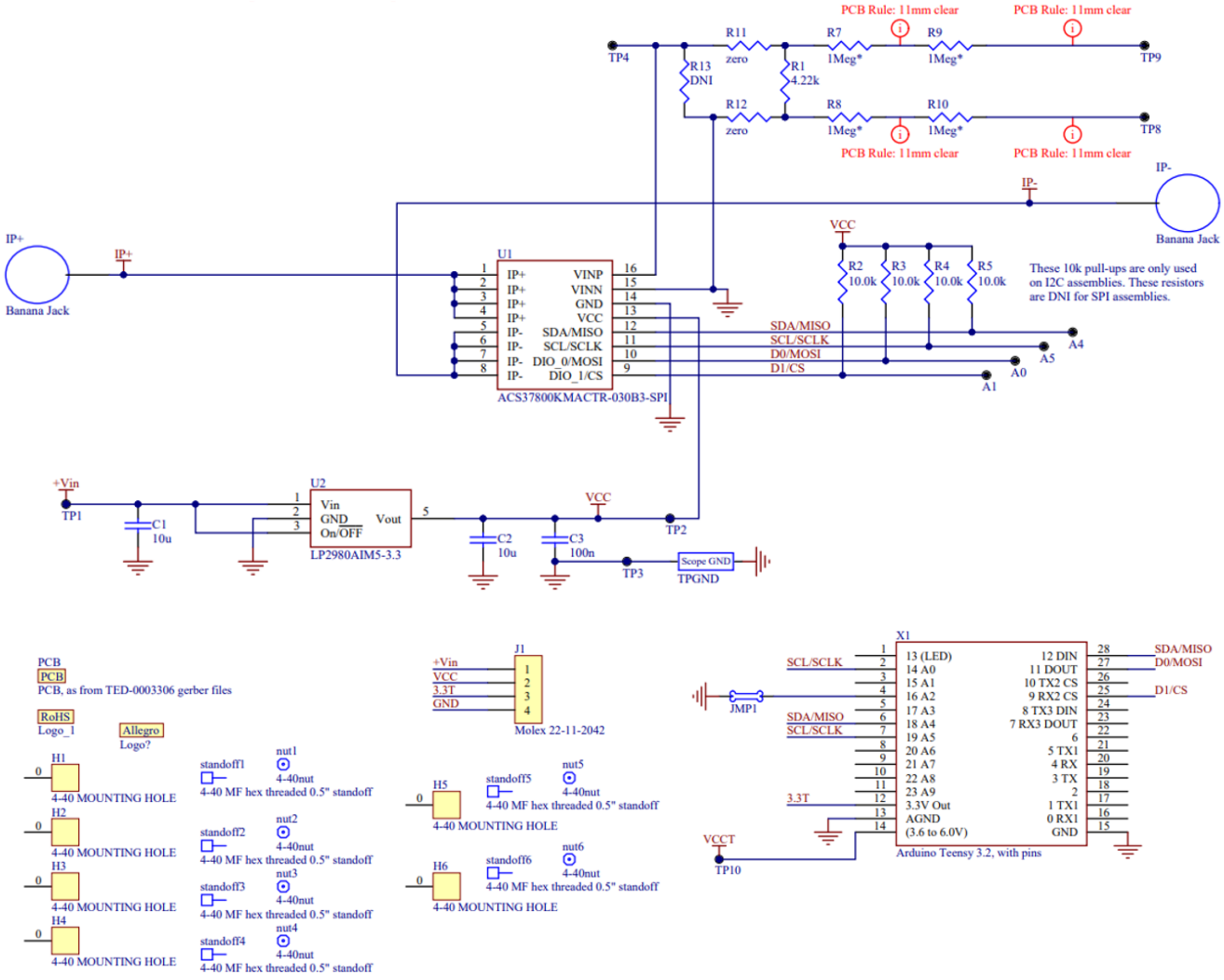

Figure 38: TED-0003359 Schematic

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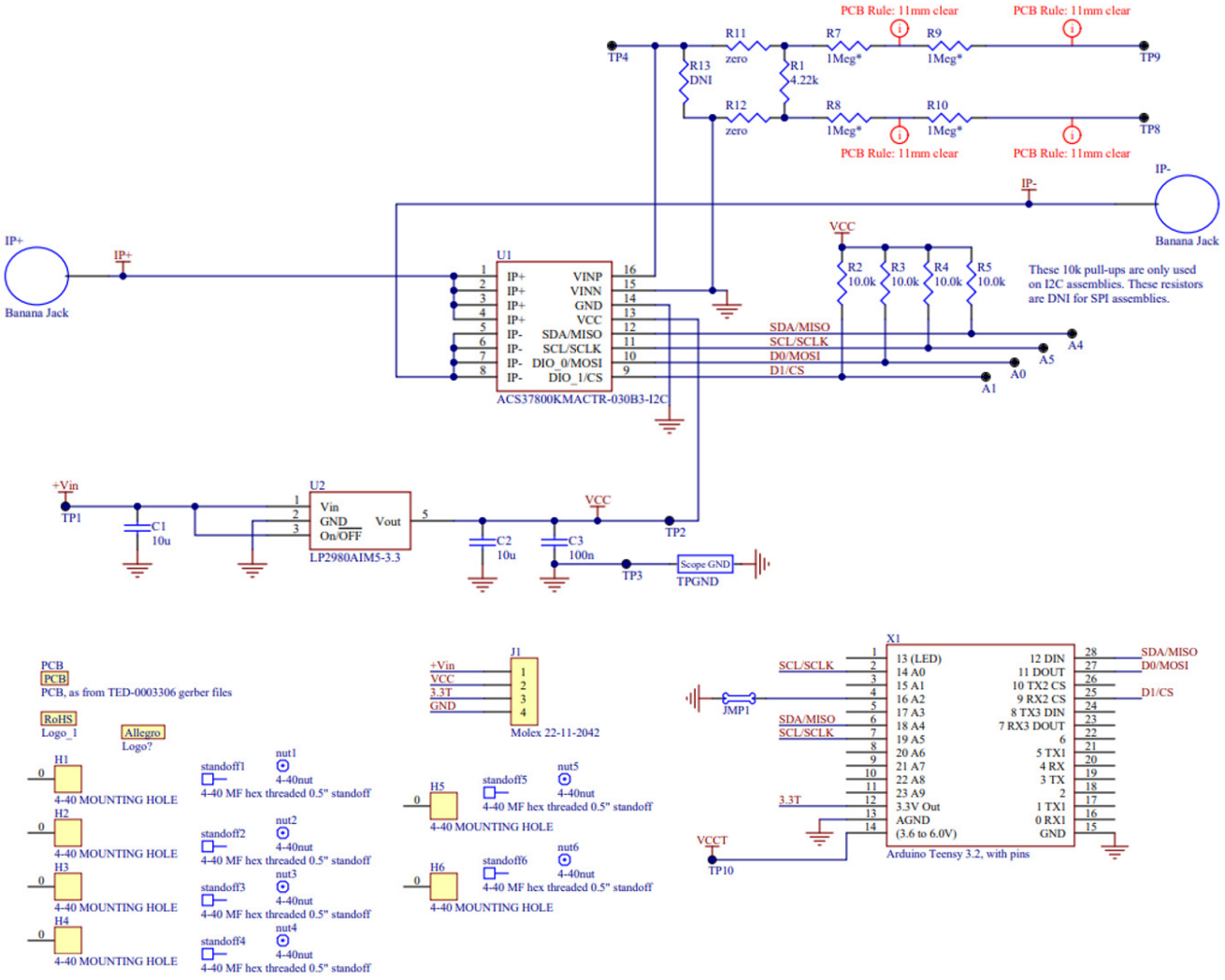

Figure 39: TED-0003360 Schematic

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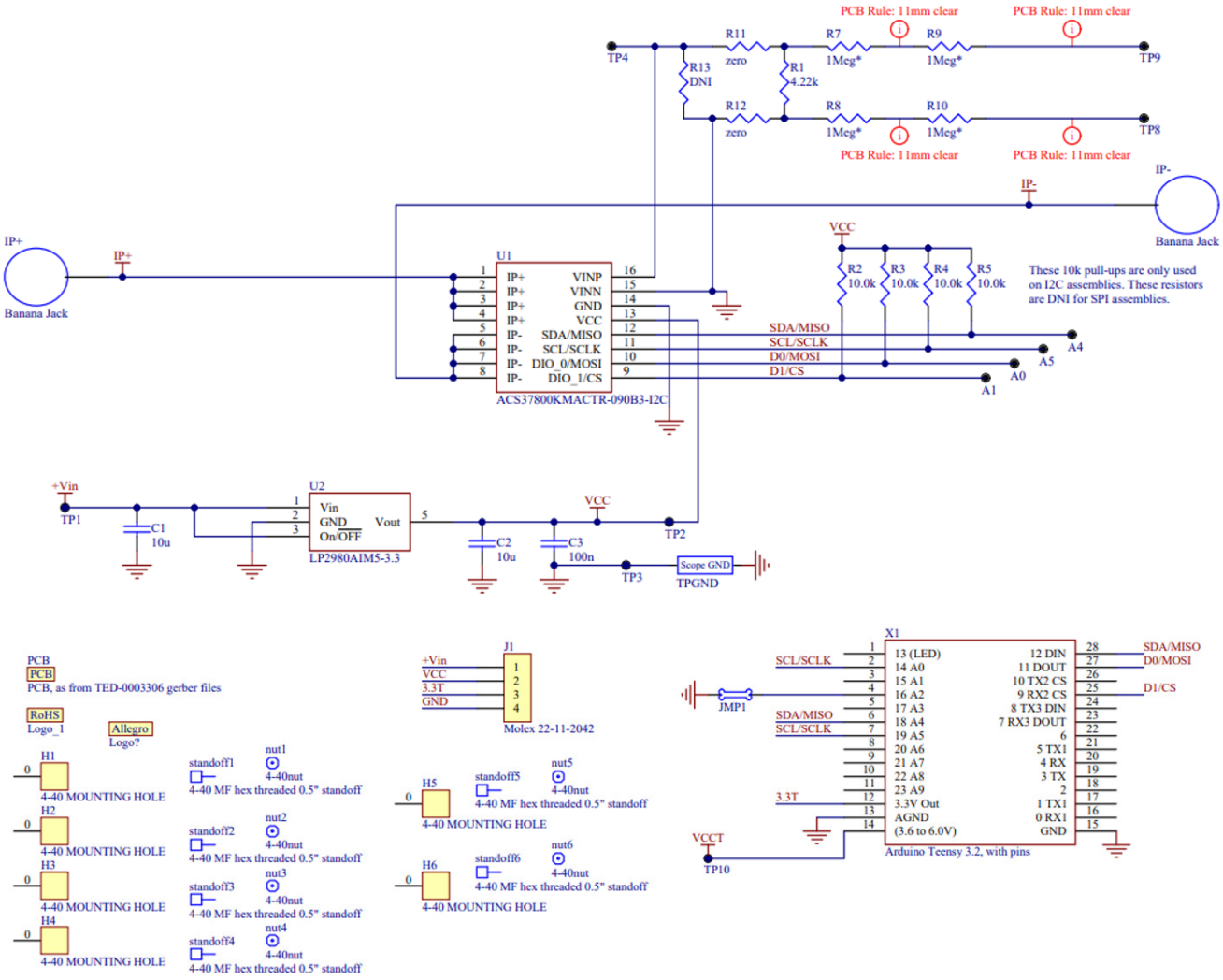

Figure 40: TED-0003361 Schematic

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EEPROM Registers Map

	Address	Bits																													
		31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
EEPROM	0x0B	ECC								pavgselen	iavgselen	crs_sns			sns_fine										qvo_fine								
	0x0C	ECC							vchan_offset_code											rms_avg_2							rms_avg_1						
	0x0D	ECC								fltdly			fault									chan_del_sel				ichan_del_en							
	0x0E	ECC							zerocrossedgesel	zerocrosschansel	squarewave_en	halfcycle_en	delaycnt_sel	undervreg					overvreg								vevent_cycs						
	0x0F	ECC							bypass_n_en	n										dio_1_sel		dio_0_sel		i2c_dis_slv_addr		i2c_slv_addr						

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Volatile Memory Map

	Address	Bits																														
		31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
VOLATILE	0x20	irms																vrms															
	0x21	pimag																pactive															
	0x22				pospf	posangle	pfactor											papparent															
	0x23																																
	0x24																																
	0x25																							numptsout									
	0x26	irmsavgonesec																vrmsavgonesec															
	0x27	irmsavgonemin																vrmsavgonemin															
	0x28																	pactavgonesec															
	0x29																	pactavgonemin															
	0x2A	icodes																vcodes															
	0x2B																																
	0x2C																	pinstant															
	0x2D																												undervoltage	overvoltage	faultlatched	faultout	vzerocrossout
	0x2E																																
	0x2F	access_code																															
	0x30																																customer_access
	0x31																																

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Revision History

Number	Date	Description
–	December 9, 2020	Initial release

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