**T01: Digital Level**

TEST PLAN

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Version 1.0

11/21/15

# Version History

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| --- | --- | --- | --- |
| Version # | Implemented By | Revision Date | Reason |
| 1.0 | Calhoun Zabel | 11/21/15 | Initial Draft |
|  |  |  |  |

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# 1.0 INTRODUCTION

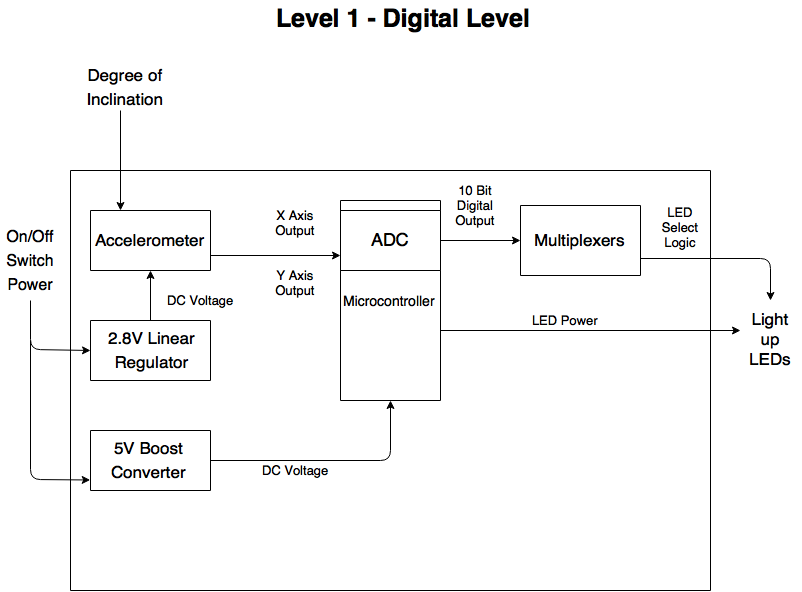
## 1.1 PURPOSE OF THIS DOCUMENT

This Test Plan document outlines and documents the necessary information regarding proper testing and debugging of the Digital Level. The intended audience includes project managers and assembly and test personnel.

# 2.0 REFERENCE DOCUMENTATION

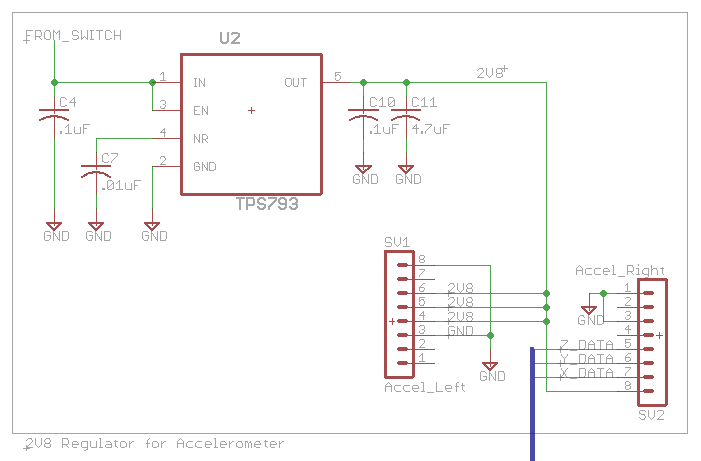
## 2.1 DESIGN DOCUMENTATION

### 2.1.1 DIGITAL LEVEL BLOCK DIAGRAM

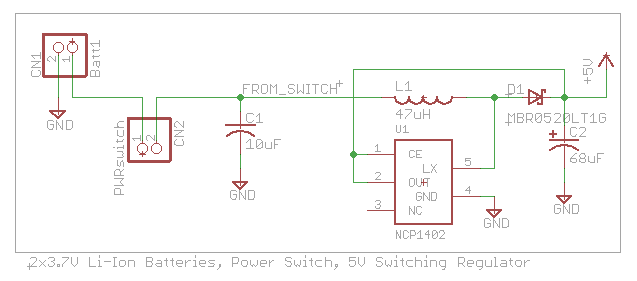


### 2.1.2 MAINBOARD SCHEMATICS

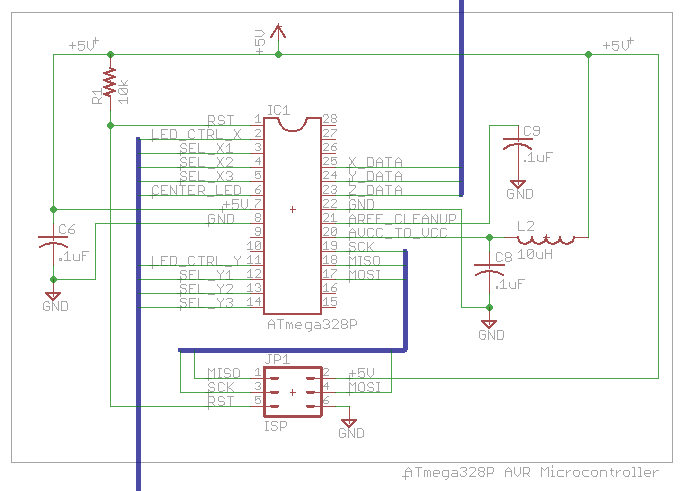
#### 2.1.2.1 2.8V LINEAR REGULATOR SCHEMATIC



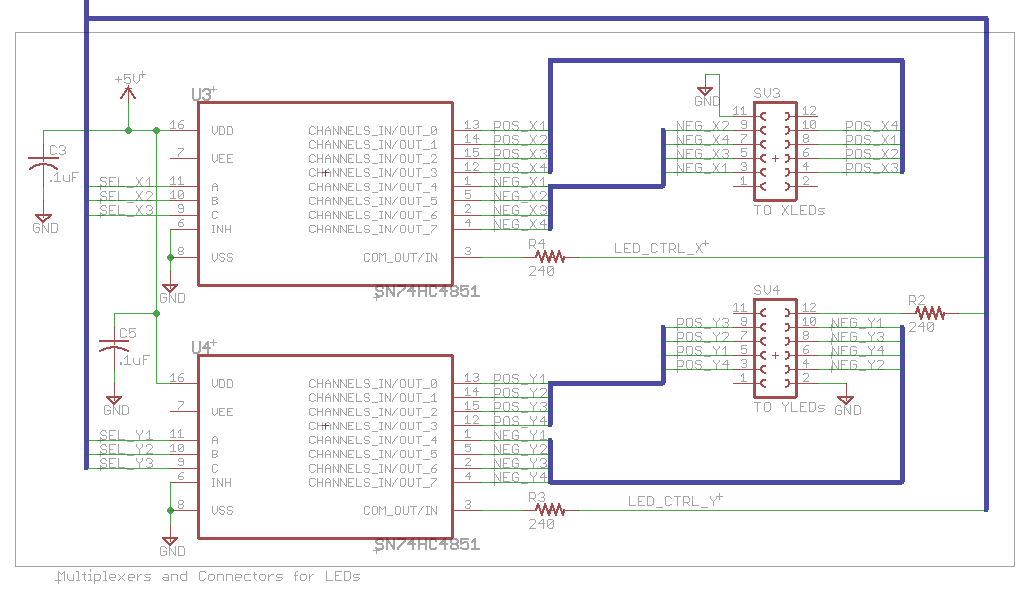
#### 2.1.2.2 5V BOOST REGULATOR SCHEMATIC



#### 2.1.2.3 MICROCONTROLLER SCHEMATIC

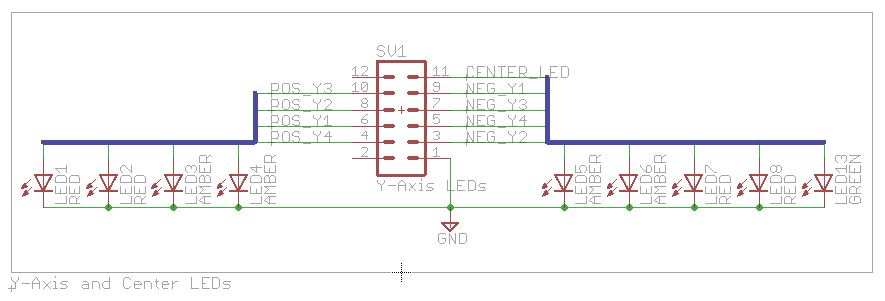


#### 2.1.2.4 MULTIPLEXING SCHEMATIC

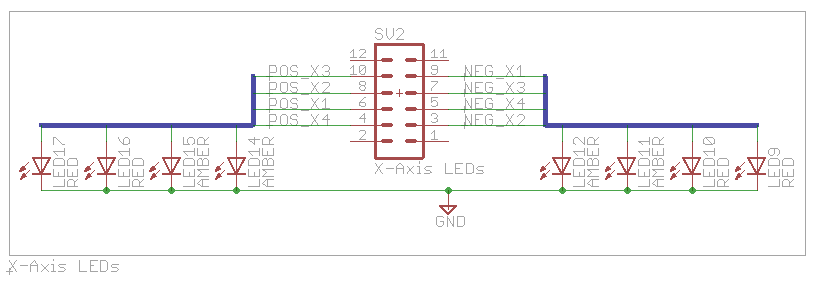


### 2.1.3 LED BOARD SCHEMATICS

#### 2.1.3.1 Y-AXIS AND CENTER LEDS



#### 2.1.3.2 X-AXIS LEDS



# 3.0 DIGITAL LEVEL OVERVIEW

## 3.1 STANDARD OPERATION

To use the digital level, the power switch must be toggled to the “ON” position, then the device must be placed on the surface that is to be measured. The LEDs will be illuminated to display whether or not that surface is level, and if it is not, the direction in which it is not level.

## 3.2 TERMINOLOGY DEFINITIONS

* PCB: Printed Circuit Board
* ISP: In-System Programming
* MORE?

## 3.3 COMPUTATIONAL METHODS

### 3.3.1 ANALOG TO DIGITAL CONVERSION

BLALALA

# 4.0 PRE-TEST INFORMATION

## 4.1 TEST EQUIPMENT

* Craftsman Digital Multimeter
* Kikusui PFX2000 Battery Test System
* Standard Level
* Level surface

## 4.2 TEST SETUP AND CALIBRATION

The tests involving the individual blocks involve the multimeter and the Kikusui system, while the tests involving the whole system involve the standard level, and the level surface. The Kikusui system is regularly calibrated by Tektronix every **HOW OFTEN??**

# 5.0 TESTS

## 5.1 BASIC FUNCTIONALITY

### 5.1.1 BATTERY TESTING

Batteries will be connected to a Kikusui PFX2021 unit for charge/discharge information and to calculate the capacity. **INCLUDE CHARGE PROFILE INFORMATION HERE**

### 5.1.2 POWER SWITCH

Connect power switch to surface mounted JST connector on PCB and test continuity with digital multimeter. Toggle switch to “OFF” position and check resistance using the multimeter on the board. Resistance should overflow the meter (infinite resistance). Toggle switch to “ON” and test again – resistance should now be almost zero.

### 5.1.3 SUPPLY VOLTAGES

Populate PCB with components for either the 5V or 2.8V regulator, components can be found in the schematics. Connect power switch and toggle to “OFF” position. Connect battery to board. Connect leads of the multimeter to ground and any pad connected to the output of the regulator under test. Toggle power switch “ON” and ensure the correct voltage is measured at the required positions.

Repeat this procedure for the other regulator.

### 5.1.4 ACCELEROMETER OUTPUT

With the voltage regulators operational, connect the accelerometer breakout board to the main PCB. Place assembly on a level surface. Connect multimeter leads to ground and either the X or Y outputs on the accelerometer. Toggle system power “ON” and ensure the accelerometer outputs the 0-g voltage (.75V), and that it changes when the inclination of the board is changed.

### 5.1.5 MICROCONTROLLER ANALOG TO DIGITAL CONVERSION

Populate the PCB with components for the microcontroller, components can be found in the schematics. Connect ISP header from AVR Dragon to PCB in order to program microcontroller. Toggle board power to “ON.” Open Atmel Studio and load the firmware for the Digital Level. Build and begin debugging. Watch the adc\_value variable to ensure it is correctly translating the analog voltage from the accelerometer.

## 5.2 SYSTEM FUNCTIONALITY

### 5.2.1 CORRECTLY DISPLAYS LEVEL

### 5.2.2 INCLINATION CHANGE

### 5.2.3 CORRECT AXIS

### 5.2.4 CORRECT DIRECTION

## 5.3 EXTREME/UNSUPPORTED USE CASES

### 5.3.1 UPSIDE DOWN

### 5.3.2 SHAKING/VIBRATION/SHOCKS