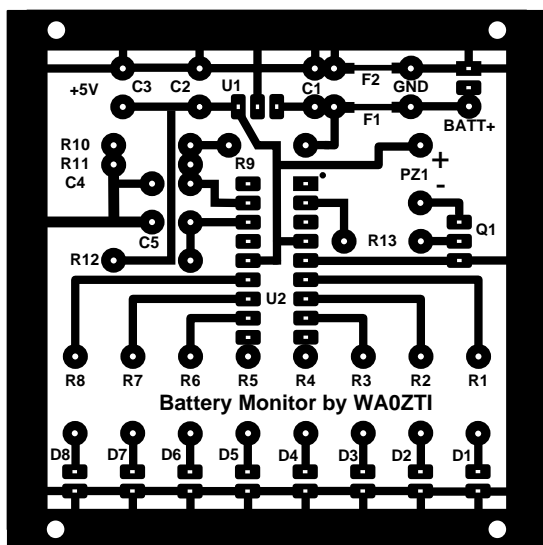
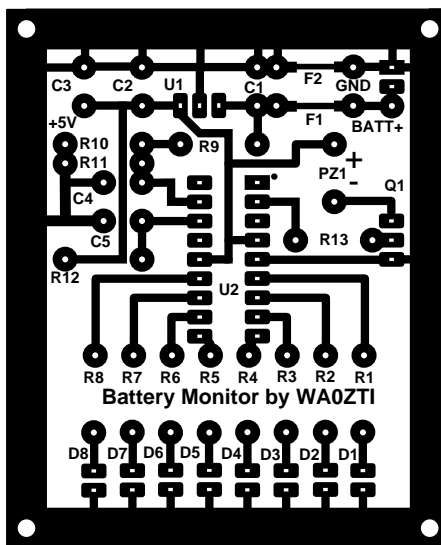


Original Article in January 1999 CQ Magazine page 36.

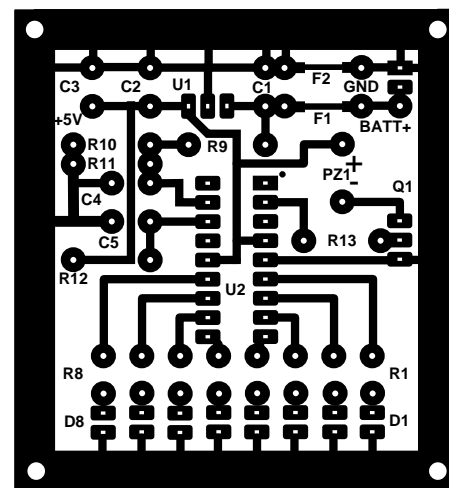
Date:	Revision/Addition/ Note	By:
Sep.3, 2017	Initial Drawing. Redrawn in latest version of Visio. Thanks to Tom Kanode KA4HFP for his original Visio files.	GSC
Sep.3, 2017	Original PIC 16C71. This is a one time programmable part (OTP). Not recommended for new designs by Microchip. Not programmable with PIC Kit 2 or 3 programmer. Going to try a PIC 16F628 as a replacement at a later time.	GSC
Sep.3, 2017	Do not substitute a 78L05 for the LP2950ACZ-5. Will kill a charged battery if left connected.	GSC
Sep.3, 2017	Software, Release1.hex. Labeled PIC's as BATTMON.R1	GSC
Sep.7, 2017	Programming a 16F628A with Release1.hex did not work.	GSC
Sep.7, 2017	The new Audible alarm did not work connected to 12V. Worked connected to +5V. Changed schematic and artwork to reflect this change.	GSC
Sep.9, 2017	Programmed a 16F716 that Microchip wants used as a replacement for the 16C71 with a PIC Start plus and a PIC Kit 3 programmer. Release1.hex did not work.	GSC
<p><b>Materials List</b></p> <p>C1,C2,C4 0.1uF C3 1uF C5 330 pF 5% C0G D1-D8 LED F1-F2 1 amp Pico fuse(Optional) R1-R8 100-300 ohm 1/8-1/4 watt 5% R9-R12 30.1k 1/4 watt 1%(3 matched to 0.1%, See Notes) R13 10k 1/4 watt 5% S1 SPST Switch (If desired, Off Board) PZ1 Piezo Electric Buzzer CEP-2242 (Digi-Key) U1 PIC16C71-04 MPU(Digi-Key) U2 LP2950ACZ-5 Regulator (Digi-Key) Q1 2N2222 Switching Transistor</p>		
<p>At turn on the device goes through a self test, lighting the LEDS one at a time, then sounding the audible alarm once. The LED Bar graph then gives an indication of the battery voltage. 10.6V for the first LED, 12.5V for last one ( ~0.26V per segment). After 30-45 seconds the LEDS turn off and the device goes into low current/sleep mode, checking the voltage every few seconds. If the voltage falls below 10.6V the audible alarm sounds with an on and off duty cycle of 40%.The bar graph will not give a display again until rebooted.</p>		
Drawn By:	Gerald Crenshaw WD4BIS	Date: Sep. 3, 2017
Designed By:	Gerald Crenshaw WD4BIS	Date: Sep. 3, 2017
Checked By:	Janet Crenshaw WB9ZPH	Date: Sep. 3, 2017
From the bench of:		Page 1
Amateur Radio Station WD4BIS		of 4
Title: Battery Monitor by WA0ZTI		Scale:



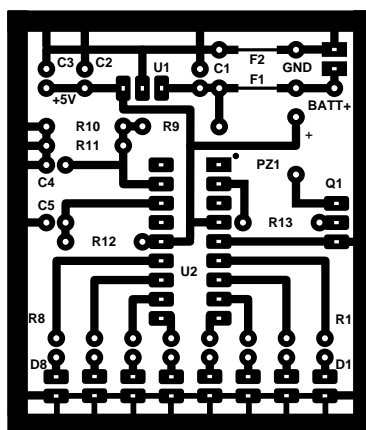
2.8"x2.8"  
For T1 ¾ LEDs



2.3"x2.8"  
For T1 or Rectangular LEDs

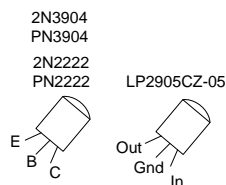


2.3"x2.5"  
For T1 or Rectangular LEDs

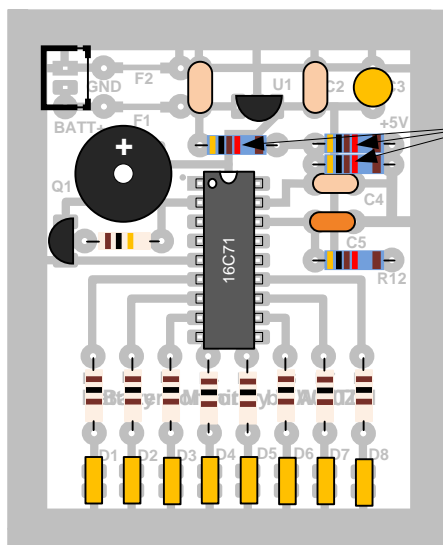
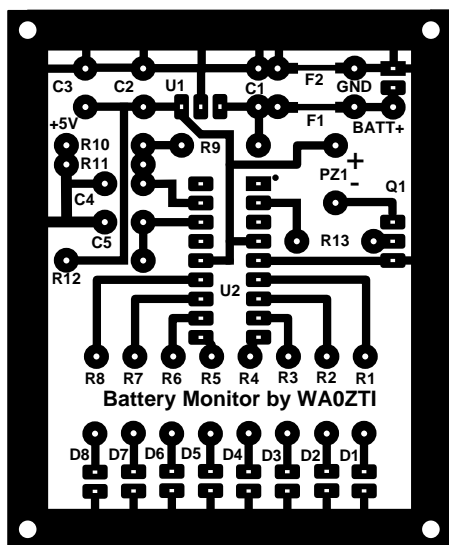


2.2"x1.9"  
For T1 or Rectangular LEDs

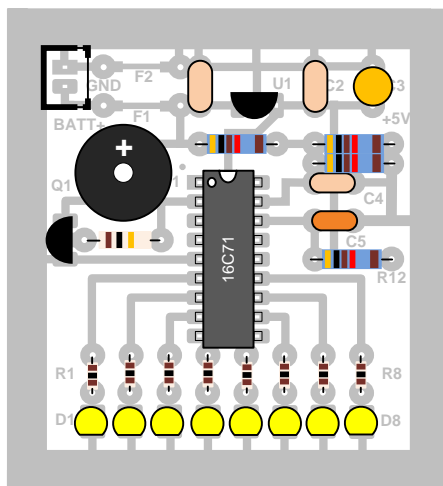
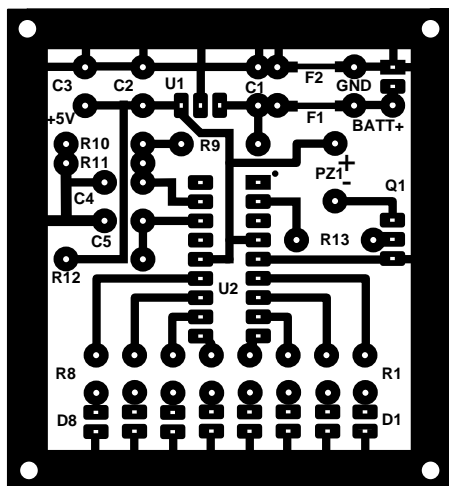
Date:	Revision/Addition/ Note	By:
Sep.3, 2017	Initial Drawing.	GSC
Sep.4, 2017	2.8"x2.8" battery monitor PWB. Art previously proved out.	
Sep.5, 2017	Added 2.3"x2.8" PWB	GSC
Sep.6, 2017	Added 2.3"x2.5" PWB	GSC
Sep.6, 2017	Added option on DC input. Will accept a .2" center terminal block or a .1" JST connector.	GSC
Sep.6, 2017	Added polarity mark on Piezo Buzzer.	GSC
Sep.6, 2017	Added printed on fuse, with option of replacing with a Pico Fuse if printed fuse blows on the PWB.	GSC



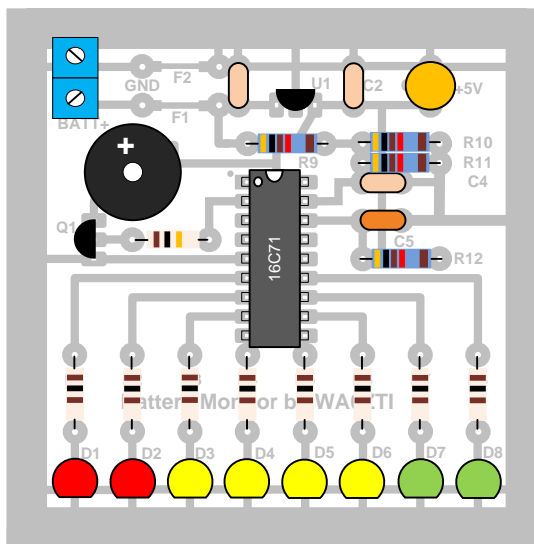
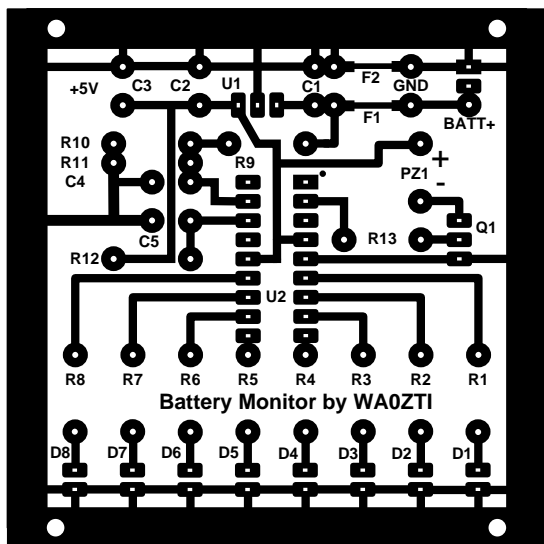
Drawn By: Gerald Crenshaw WD4BIS	Date: Sep. 3, 2017	From the bench of: Amateur Radio Station WD4BIS	Page of 2 4
Designed By: Gerald Crenshaw WD4BIS	Date: Sep. 3, 2017	Title: PWB's for Voltage Monitor	Scale:
Checked By: Janet Crenshaw WB9ZPH	Date: Sep. 3, 2017		



2.3"x2.8"  
For T1 or Rectangular  
LEDS



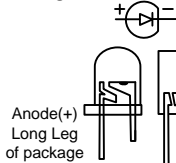
2.3"x2.5"  
For T1 or Rectangular  
LEDS



2.8"x2.8"  
For T1 ¾ LEDS

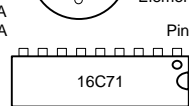
Date:	Revision/Addition/ Note	By:
Sep.3, 2017	Initial Drawing.	GSC
Sep.5, 2017	Added 2.3"x2.5" board and component placement.	GSC
Sep.6, 2017	Options shown top to bottom: 1)JST Power Connector, Rectangular LED, all one color. 2)JST Power Connector, T1 LED all one color, 1/8W resistor for R1-R8 3)Terminal Power Connector, T1 ¾ LED Multi color	GSC
Drawn By:	Gerald Crenshaw WD4BIS	Date: Sep. 3, 2017
Designed By:	Gerald Crenshaw WD4BIS	Date: Sep. 3, 2017
Checked By:	Janet Crenshaw WB9ZPH	Date: Sep. 3, 2017

#### Package Outlines

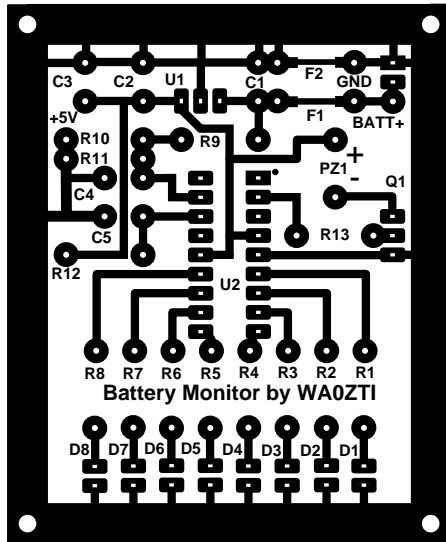
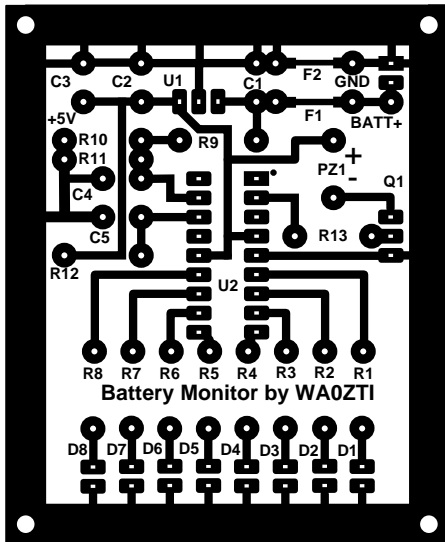
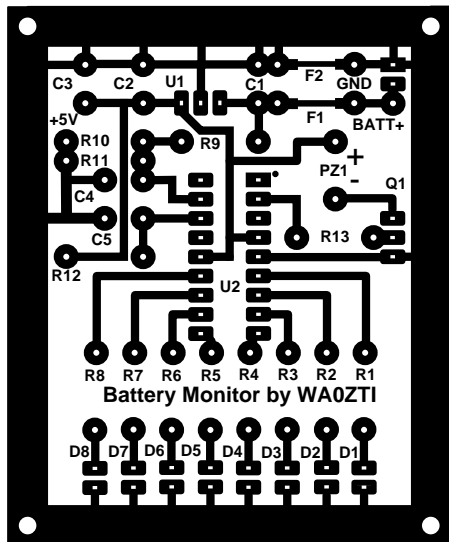
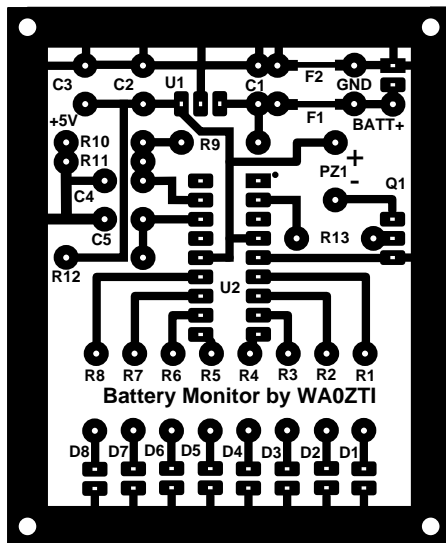
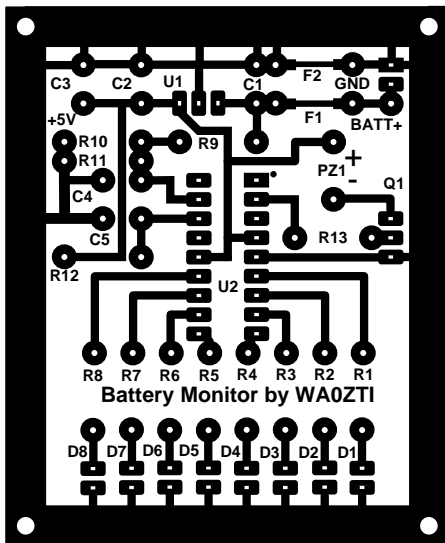
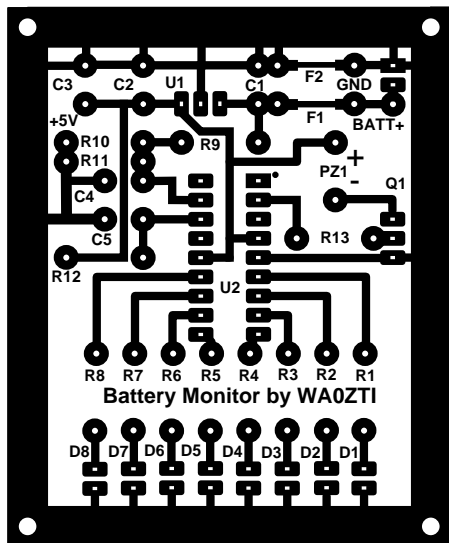
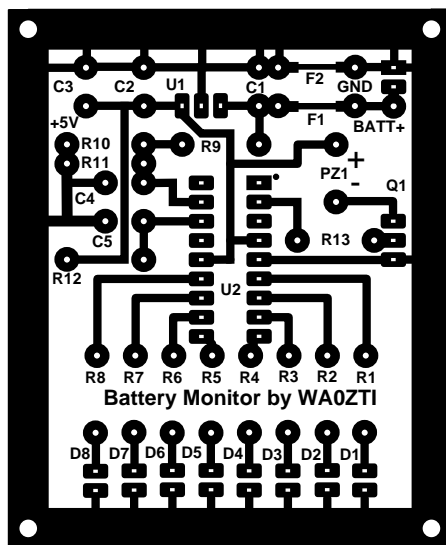
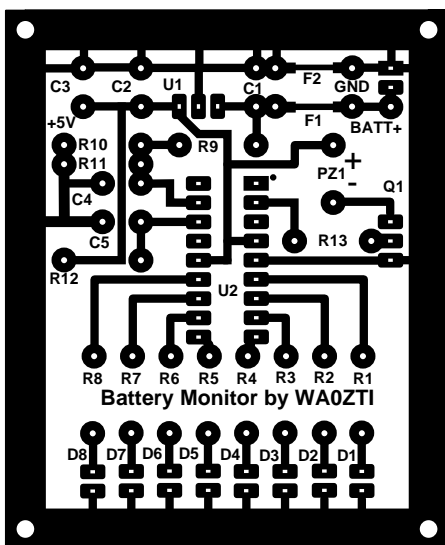
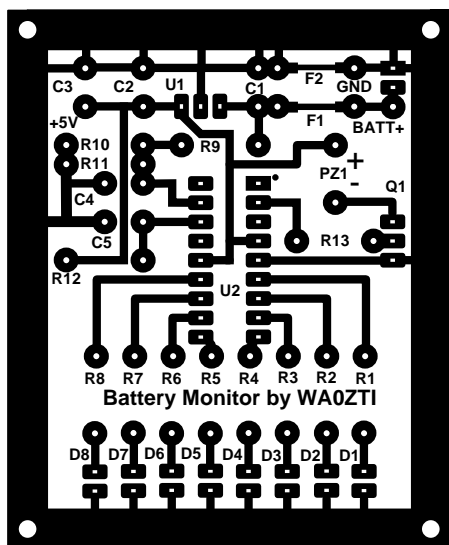


LP2950ACZ-5.0

2N2222A  
PN2222A



From the bench of:	Page 3
Amateur Radio Station WD4BIS	of 4
Title: Battery Monitor Component Placement	Scale:



<b>Date:</b> Sep.6, 2017 Sep.6, 2017	<b>Revision/Addition/ Note</b> Initial Drawing. 2.3"x 2.8" Group and Dupe. This will be one of the easiest to manufacture as a Club/workshop project as it has limited crowding.	<b>By:</b> GSC GSC	Print to HP Laserjet P3005, Single sheet feed Shiny side up, Staples basic photo stock paper. Properties, Finishing, Mirror Image. Heat press, 400 degrees for 240 seconds. 4 min Print to HP Laserjet P3005, Single sheet feed Blue side up TTF PCB Fab in a box transfer paper. Properties, Finishing, Mirror Image. Paper/quality Pro res 1200 dpi Heat press, 300 degrees for 60 seconds gave best results. 325 degrees for 1 minute started smearing.	
Drawn By: Gerald Crenshaw WD4BIS	Date: Sep. 6, 2017	From the bench of: Amateur Radio Station WD4BIS		Page of 4 4
Designed By: Gerald Crenshaw WD4BIS	Date: Sep. 6, 2017	Title: Group and Dupe, Battery Monitor		Scale:
Checked By: Janet Crenshaw WB9ZPH	Date: Sep. 6, 2017			