NeoLoch

NLT-28P-12LED-5S Tester Datasheet

Overview

The LED budget IC Tester comes with firmware to test 6116, 6264, 5101 and 9114 RAM ICs quickly and provide rapid feedback as to the state of the IC under test.

The inclusion of an ICSP (In-Circuit Serial Programming) port allows the user to develop and program the tester with custom code.

This document details the operation of the default configuration of the budget IC tester as well as details on the device's operation for custom code design.

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1.0 Device Connection

1.1 CN1 – ICSP

ICSP connector, this port is designed to attach to a PICKit 2, PICkit 3 or compatible programmer.

1.2 CN2 – Power Connecter

Positive voltage supply greater than 6V, this connector feeds the on board +5V regulator. Input voltage shouldn't exceed 12V.

1.3 CN3 – +5V Power Connector

This connector can either supply 5V power to the tester or be used to power another device provided that CN2 is regulating a higher input voltage. Please note that the on board regulator is limited to 100 ma and the tester uses up to approximately 40ma to power the IC under test as well as the LEDs. So external power draw should be limited to no more than 40 to 50 ma.

Higher current draws will most likely require the addition of a heatsink for the 5V regulator.

You will need to supply an appropriate power source for the budget tester tester to operate.

1.4 ZIF 1 – Zero Insertion Force Socket

The ZIF socket provides an easy way to insert and remove ICs under test. Pin 1 of the ZIF socket is the pin closest to pin 1 of the MCU and apposite of the lever of the ZIF socket.

Please not that the ZIF socket is 28 pins while a 5101 RAM IC is only 22 pins. Pin 1 of the IC under test should be lined up and inserted so that it lines up with pin 1 of the ZIF socket.

2.0 Budget Tester Operation

The budget tester tester was designed to be quickly and easily operated. RAM ICs can be inserted into the device while it is powered. When not testing, the ZIF socket is not powered and all pins are either at ground potential or in a high-impedance state.

2.1 Operating The Tester (V4.0 Firmware)

When first powered on, the tester will configure itself. When ready, the four LEDs on the right side of the tester will light up to indicate which firmware version the MCU is programmed with. And, the left most red LED will begin blinking to indicate the tester is ready for use.

2.2 Testing 5101 RAM ICs.

Step 1: To test 5101 RAM ICs, first power the unit and then press the up arrow key. The last green LED on the display will light up and the first green LED will begin blinking. This indicates the tester is configured for 5101 RAM ICs and is ready.

Step 2: Insert the 5101 RAM IC with pin one closest to the ZIF lever. Lower the lever to lock the IC in place.

Step 3: Press the center button (“Enter / Test”) and the test will begin. If the RAM IC passes then all the green LEDs will light up, if the tester fails then some or all of the red LEDs will light up. Each LED has the following meaning:

LED Pair 1: address range 00 through 2A hex have passed or failed testing.
LED Pair 2: address range 2B through 55 hex have passed or failed testing.
LED Pair 3: address range 56 through 80 hex have passed or failed testing.
LED Pair 4: address range 81 through AB hex have passed or failed testing.
LED Pair 5: address range AC through D6 hex have passed or failed testing.
LED Pair 6: address range D7 through FF hex have passed or failed testing.

2.2.1 5101 PASS 1

The value '1111' is written to each address in the RAM IC (00h – FFh) and read back, if all memory addresses pass this test then the PASS 1 green LED will light up, if the test fails then the red LED will light up.

2.2.2 5101 PASS 2

The Value '0000' is written to each address in the RAM IC (00h – FFh) and read back, if all memory addresses pass this test then the PASS 1 green LED will light up, if the test fails then the red LED will light up.

2.2.3 5101 PASS 3

Two counters are used during this pass, the first keeps track of the memory address being tested and the second is a counter used to write and then read back values between 0h and Fh. This is a more rigorous test than PASS 1 and PASS 2.

2.2.4 5101 PASS 4

This pass looks to test data retention of a longer period of time and writes a value between 0h and Fh in an incremental manor to each memory location, data is not read back directly after a write. The entire address range is written to first and then the process is repeated to read data back, if even one address fails to contain the correct data then the pass will fail and the red LED will light up.

2.3.0 Testing 6264 RAM ICs.

Step 1: To test 6264 RAM ICs, first power the unit and then press the right arrow key. The 4th green LED on the display will light up and the first green LED will begin blinking. This indicates the tester is configured for 6264 RAM ICs and is ready.

Step 2: Insert the 6264 RAM IC with pin one closest to the ZIF lever. Lower the lever to lock the IC in place.

Step 3: Press the center button ("Enter / Test") and the test will begin. Testing 6264 RAM ICs takes a few seconds to complete. If the RAM IC passes then all the green LEDs will light up, if the tester fails then some or all of the red LEDs will light up. Each LED has the following meaning:

LED Pair 1: address range 0000 through 05FF hex have passed or failed testing.
LED Pair 2: address range 0600 through 0AFF hex have passed or failed testing.
LED Pair 3: address range 0B00 through 0FFF hex have passed or failed testing.
LED Pair 4: address range 1000 through 14FF hex have passed or failed testing.
LED Pair 5: address range 1500 through 19FF hex have passed or failed testing.
LED Pair 6: address range 1A00 through 1FFF hex have passed or failed testing.

Note: With the release of firmware version 3, a new feature was added to indicate testing progress for 6264 RAM ICs. The 6th LED pair will toggle between red and green to indicate that the RAM IC is being tested.

2.3.1 6264 PASS 1

The value '1111' is written to each address in the RAM IC (00h – FFh) and read back, if all memory addresses pass this test then the PASS 1 green LED will light up, if the test fails then the red LED will light up.

2.3.2 6264 PASS 2

The Value '0000' is written to each address in the RAM IC (00h – FFh) and read back, if all memory addresses pass this test then the PASS 1 green LED will light up, if the test fails then the red LED will light up.

2.3.3 6264 PASS 3

Two counters are used during this pass, the first keeps track of the memory address being tested and the second is a counter used to write and then read back values between 00h and FFh. This is a more rigorous test than PASS 1 and PASS 2.

2.4.0 Testing 21C14/9114 RAM ICs.

Step 1: To test 9114* RAM ICs, first power the unit and then press the down arrow key. The 4th and 5th green LEDs on the display will light up and the first green LED will begin blinking. This indicates the tester is configured for 9114 RAM ICs and is ready.

Step 2: Insert the 9114 RAM IC with pin one closest to the ZIF lever. Lower the lever to lock the IC in place.

Step 3: Press the center button ("Enter / Test") and the test will begin. Testing 9114 RAM ICs takes very little time and the results will display almost instantly. If the RAM IC passes then all the green LEDs will light up, if the tester fails then some or all of the red LEDs will light up. Each LED has the following meaning:

LED Pair 1: address range 000 through 0AA hex have passed or failed testing.
LED Pair 2: address range 0AB through 154 hex have passed or failed testing.
LED Pair 3: address range 155 through 1FE hex have passed or failed testing.
LED Pair 4: address range 1FF through 2A8 hex have passed or failed testing.
LED Pair 5: address range 2A9 through 352 hex have passed or failed testing.
LED Pair 6: address range 353 through 3FF hex have passed or failed testing.

Note: With the release of firmware version 3, a new feature was added to indicate testing progress for 9114 RAM ICs. The 6th LED pair will toggle between red and green to indicate that the RAM IC is being tested.

2.4.1 21C14/9114 PASS 1

The value '1111' is written to each address in the RAM IC (00h – FFh) and read back, if all memory addresses pass this test then the PASS 1 green LED will light up, if the test fails then the red LED will light up.

2.4.2 21C14/9114 PASS 2

The Value '0000' is written to each address in the RAM IC (00h – FFh) and read back, if all memory addresses pass this test then the PASS 1 green LED will light up, if the test fails then the red LED will light up.

2.4.3 21C14/9114 PASS 3

Two counters are used during this pass, the first keeps track of the memory address being tested and the second is a counter used to write and then read back values between 00h and FFh. This is a more rigorous test than PASS 1 and PASS 2.

* Due to the higher current requirements of the 2114 RAM IC, the 2114 can't be tested using this tester. However, it is possible to test 21C14 RAM ICs, though at this point in time 21C14 support has not been fully tested.

2.5.0 Testing 6116 RAM ICs.

Step 1: To test 6116 RAM ICs, first power the unit and then press the left arrow key. The 4th,5th, and 6th green LEDs on the display will light up and the first green LED will begin blinking. This indicates the tester is configured for 6116 RAM ICs and is ready.

Step 2: Insert the 6116 RAM IC with pin one closest to the ZIF lever. Lower the lever to lock the IC in place.

Step 3: Press the center button ("Enter / Test") and the test will begin. Testing 6116 RAM ICs takes a few seconds to complete. If the RAM IC passes then all the green LEDs will light up, if the tester fails then some or all of the red LEDs will light up. Each LED has the following meaning:

LED Pair 1: address range 000 through 0FF hex have passed or failed testing.
LED Pair 2: address range 100 through 1FF hex have passed or failed testing.
LED Pair 3: address range 200 through 2FF hex have passed or failed testing.
LED Pair 4: address range 300 through 3FF hex have passed or failed testing.
LED Pair 5: address range 400 through 4FF hex have passed or failed testing.
LED Pair 6: address range 500 through 7FF hex have passed or failed testing.

Note: With the release of firmware version 3, a new feature was added to indicate testing progress for most RAM ICs. The 6th LED pair will toggle between red and green to indicate that the RAM IC is being tested.

2.5.1 6116 PASS 1

The value '11111111' is written to each address in the RAM IC (00h – FFh) and read back, if all memory addresses pass this test then the PASS 1 green LED will light up, if the test fails then the red LED will light up.

2.5.2 6116 PASS 2

The Value '00000000' is written to each address in the RAM IC (00h – FFh) and read back, if all memory addresses pass this test then the PASS 1 green LED will light up, if the test fails then the red LED will light up.

2.5.3 6116 PASS 3

Two counters are used during this pass, the first keeps track of the memory address being tested and the second is a counter used to write and then read back values between 00h and FFh. This is a more rigorous test than PASS 1 and PASS 2.

2.6 Identifying Firmware Version

The current firmware version is displayed in hexadecimal on the rightmost LEDs when the unit is powered up. For example: Firmware version will have the rightmost red LED illuminated with all others (except the blinking ready LED) off. This indicates firmware version 1.

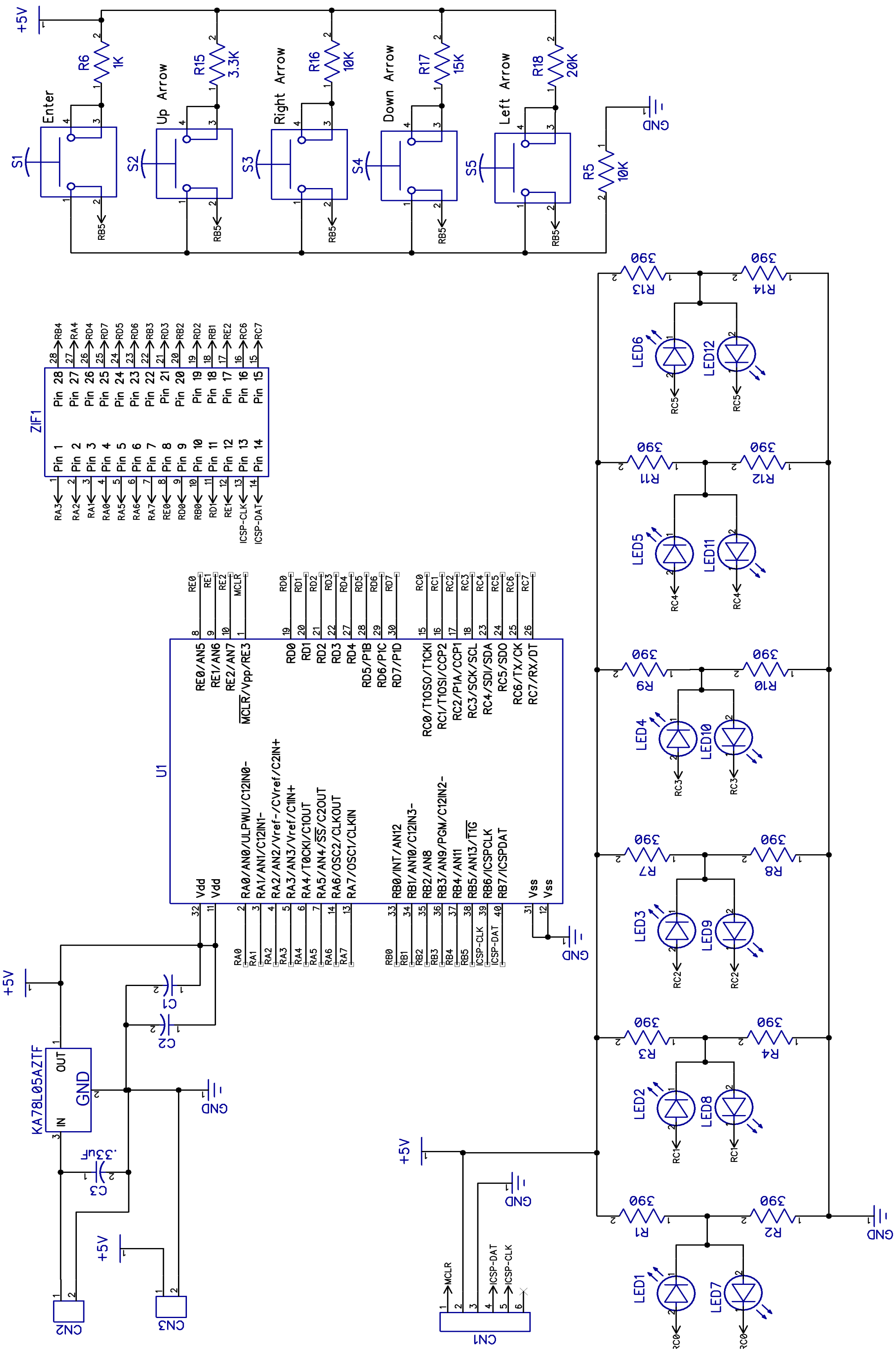
Firmware version 1 is indicated by the 6th red LED lighting up.

Firmware version 2 is indicated by the 5h red LED lighting up. This version corrected some bugs and added support for the 2114 / 9114 RAM ICs.

Firmware version 3 is indicated by the 5th and 6th LEDs lighting up. This version corrected a minor testing bug that didn't effect results. And, also added visual feedback during the testing process for 2114 / 9114 & 6264 RAM ICs.

Firmware version 4 is indicated by the 4th LED lighting up. This version corrected an issue that prevented some 2114 RAM ICs from testing correctly. And, added support for 6116 RAM ICs .

3.0 Schematic



4.0 Ports Configuration

MCU Pin Number	Description	Assigned to
1	MCLR	ICSP
2	RA0	ZIF Pin 4
3	RA1	ZIF Pin 3
4	RA2	ZIF Pin 2
5	RA3	ZIF Pin 1
6	RA4	ZIF Pin 27
7	RA5	ZIF Pin 5
8	RE0	ZIF Pin 8
9	RE1	ZIF Pin 12*
10	RE2	ZIF Pin 17*
11	VDD	GND
12	VSS	+5V
13	RA7	ZIF Pin 7
14	RA6	ZIF Pin 6
15	RC0	LED 1 Anode & 5 Cathode
16	RC1	LED 1 Cathode & 5 Anode
17	RC3	LED 2 Anode & 6 Cathode
18	RC4	LED 2 Cathode & 6 Anode
19	RD0	ZIF Pin 9
20	RD1	ZIF Pin 11
21	RD2	ZIF Pin 19
22	RD3	ZIF Pin 21
23	RC4	LED 3 Anode & 7 Cathode
24	RC5	LED 3 Cathode & 7 Anode
25	RC6	LED 4 Anode & 8 Cathode
26	RC7	LED 4 Cathode & 8 Anode
27	RD4	ZIF Pin 26
28	RD5	ZIF Pin 24
29	RD6	ZIF Pin 23
30	RD7	ZIF Pin 6
31	VSS	GND
32	VDD	+5V
33	RB0	ZIF Pin 10
34	RB1	ZIF Pin 18
35	RB2	ZIF Pin 20
36	RB3	ZIF Pin 22
37	RB4	ZIF Pin 28
38	RB5	PCB Switch
39	RB6	ICSP
40	RB7	ICSP

* RE1 and RE2 are connected to pins 12 and 17 on the ZIF socket but are not used by the 5101 RAM testing code, these two connections are for use by the user.

5.0 Parts List

1 – PC Board
1 – 40 Pin DIP Socket
1 – 28 Pin ZIF Socket
1 – 6 Pin Right Angle Header
1 – 78L05 +5V Regulator
1 – 0.33 uF Capacitor
6 – Green 2mm x 5mm LED
6 – Red 2mm x 5mm LED
12 – 390 Ohm ¼ Watt Resistors
2 – 0.1 uF Capacitors
1 – 1K Ohm Resistor
2 – 10K Ohm Resistor
1 – 3,3K Ohm Resistor
1 – 15K Ohm Resistor
1 – 20K Ohm Resistor
5 – PCB Mount Switch
1 – PIC16F884 Microcontroller (Programmed)

6.0 Code Examples

The following pages consist of code examples for controlling the LEDs and reading the switch array.

6.1 LED Control Code

```
;----------------------------------------------------------------------------
; LED CONFIGURATION ROUTINES
;----------------------------------------------------------------------------
LEDS_OFF
        CALL    LED1_OFF
        CALL    LED2_OFF
        CALL    LED3_OFF
        CALL    LED4_OFF
        CALL    LED5_OFF
        CALL    LED6_OFF
        RETURN

LED1_OFF
        BANKSEL TRISC
        BSF     TRISC,0         ;Change PORTC, bit 0 to high-impedance state.
        RETURN

LED1_GREEN
        BANKSEL PORTC
        BCF     PORTC,0         ;Clear bit 0 of PORTC (turn green LED on.)
        BANKSEL TRISC
        BCF     TRISC,0         ;Change PORTC bit 0 to output.
        BCF     SYS_FLAG,7 ;keep track of what color LED is lite.
        RETURN

LED1_RED
        BANKSEL PORTC
        BSF     PORTC,0         ;Set bit 0 of PORTC (turn red LED on.)
        BANKSEL TRISC
        BCF     TRISC,0         ;Change PORTC bit 0 to output.
        BSF     SYS_FLAG,7 ;keep track of what color LED is lite.
        RETURN
;----------------------------------------------------------------------------
LED2_OFF
        BANKSEL TRISC
        BSF     TRISC,1
        RETURN
```

```
LED2_GREEN
        BANKSEL PORTC
        BCF     PORTC,1
        BANKSEL TRISC
        BCF     TRISC,1
        RETURN

LED2_RED
        BANKSEL PORTC
        BSF     PORTC,1
        BANKSEL TRISC
        BCF     TRISC,1
        RETURN
;-----------------------------------------------------------------------------
LED3_OFF
        BANKSEL TRISC
        BSF     TRISC,2
        RETURN

LED3_GREEN
        BANKSEL PORTC
        BCF     PORTC,2
        BANKSEL TRISC
        BCF     TRISC,2
        RETURN

LED3_RED
        BANKSEL PORTC
        BSF     PORTC,2
        BANKSEL TRISC
        BCF     TRISC,2
        RETURN
;-----------------------------------------------------------------------------
LED4_OFF
        BANKSEL TRISC
        BSF     TRISC,3
        RETURN

LED4_GREEN
        BANKSEL PORTC
        BCF     PORTC,3
        BANKSEL TRISC
        BCF     TRISC,3
        RETURN

LED4_RED
```

```
        BANKSEL PORTC
        BSF     PORTC,3
        BANKSEL TRISC
        BCF     TRISC,3
        RETURN
;-----------------------------------------------------------------------------
LED5_OFF
        BANKSEL TRISC
        BSF     TRISC,4
        RETURN

LED5_GREEN
        BANKSEL PORTC
        BCF     PORTC,4
        BANKSEL TRISC
        BCF     TRISC,4
        RETURN

LED5_RED
        BANKSEL PORTC
        BSF     PORTC,4
        BANKSEL TRISC
        BCF     TRISC,4
        RETURN
;-----------------------------------------------------------------------------
LED6_OFF
        BANKSEL TRISC
        BSF     TRISC,5
        RETURN

LED6_GREEN
        BANKSEL PORTC
        BCF     PORTC,5
        BANKSEL TRISC
        BCF     TRISC,5
        RETURN

LED6_RED
        BANKSEL PORTC
        BSF     PORTC,5
        BANKSEL TRISC
        BCF     TRISC,5
        RETURN
```

6.2 Reading The Switch Array.

The switch array consists of 5 switches and 6 resistors. When each switch is pressed it creates a different voltage on the analog input. By reading this voltage and converting it to a digital value, it becomes possible to know which switch has been pressed.

Since resistance values of resistors can vary not only from the manufacturing process, but also environmental conditions, such as temperature, it's important to normalize the voltage reading as much as possible so that switch presses can be reliably detected. This is accomplished by dropping most of the digital conversion and only using the 5 most significant bits from the conversion.

The switch ADC code left justifies the conversion data and then only using ADRESH, thereby dropping the 2 least significant bits. However, we still need to drop some more bits to get a stable and reliable number to work with. This is accomplished by filtering out the least significant bits of ADRESH with an AND statement. Now we are just left with the four most significant bits of the ADC value. This filtered ADC value is then compared to what the reading should be for each switch voltage.

Switch	ADC Value After Filtering
None	00h
Up	C0h
Right	70h or 80h
Down	60h
Left	50h
Enter	E0h

To do an ADC scan of the switch array, PORTB, bit 0 must be configured as an analog input. Then KEY_PRESS_SCAN is called, the rest of the required code is self contained in the following routines.

6.3 Switch Array Example Code.

```
;------------------------------------------------------------------------------
; SWTICH SCAN
;------------------------------------------------------------------------------
KEY_PRESS_SCAN
        CALL      ADC_GET_DATA      ;Configure and read ADC input
        MOVLW     0XF0
        BANKSEL ADRESH
        ANDWF     ADRESH,W          ;Filter out lower nibble.
        MOVWF     RAM_TEMP          ;Store result in RAM_TEMP

        MOVLW     0X00
        SUBWF     RAM_TEMP,W
        BTFSC     STATUS,Z          ;RAM_TEMP = 00?
        GOTO      KEY_RELEASED      ;Yes, key press released.

        MOVLW     0XE0
        SUBWF     RAM_TEMP,W
        BTFSC     STATUS,Z          ;RAM_TEMP = E0?
        GOTO      KEYPRESS_ENTER    ;Yes, enter key has been pressed.

        MOVLW     0XC0
        SUBWF     RAM_TEMP,W
        BTFSC     STATUS,Z          ;RAM_TEMP = C0?
        GOTO      KEYPRESS_UP       ;Yes, up key pressed.
;-----------------------------------------------------------
        MOVLW     0X70
        SUBWF     RAM_TEMP,W
        BTFSC     STATUS,Z          ;RAM_TEMP = 70?
        GOTO      KEYPRESS_RIGHT    ;Yes, right key pressed.

        MOVLW     0X80
        SUBWF     RAM_TEMP,W
        BTFSC     STATUS,Z          ;RAM_TEMP = 80?
        GOTO      KEYPRESS_RIGHT    ;Yes, right key pressed
;-----------------------------------------------------------
        MOVLW     0X60
        SUBWF     RAM_TEMP,W
        BTFSC     STATUS,Z          ;RAM_TEMP = 60?
        GOTO      KEYPRESS_DOWN     ;Yes, down key pressed.

        MOVLW     0X50
        SUBWF     RAM_TEMP,W
        BTFSC     STATUS,Z          ;RAM_TEMP = 50?
        GOTO      KEYPRESS_LEFT     ;Yes, left key pressed.
```



```
KEYPRESS_ENTER
        BTFSC   KEY_PRESSED         ;Have we already acted on key press?
        RETURN                      ;Yes, ignore key press.
        BSF     KEY_PRESSED         ; No, set key press flag and run code.
        MOVLW   0X00
        SUBWF   RAM_TEST_TO_DO,W    ;Testing 5101 RAM IC?
        BTFSC   STATUS,Z
        GOTO    RAM_TEST_5101       ;Yes

        MOVLW   0X01
        SUBWF   RAM_TEST_TO_DO,W    ;Testing 6264 RAM IC?
        BTFSC   STATUS,Z
        GOTO    RAM_TEST_6264       ;Yes
        RETURN                      ;No, so do nothing.

KEYPRESS_UP
        BTFSC   KEY_PRESSED         ;Already acted on key press?
        RETURN                      ;Yes, so do nothing.
        BSF     KEY_PRESSED         ;Set key press flag.
        MOVLW   0X00
        MOVWF   RAM_TEST_TO_DO      ;Configure tester for 5101 RAM ICs.
        CALL    LEDS_OFF
        CALL    LED1_GREEN
        CALL    LED6_GREEN
        RETURN

KEYPRESS_RIGHT
        BTFSC   KEY_PRESSED
        RETURN
        BSF     KEY_PRESSED         ;Configure tester for 6264 RAM ICs.
        MOVLW   0X01
        MOVWF   RAM_TEST_TO_DO
        CALL    LEDS_OFF
        CALL    LED1_GREEN
        CALL    LED4_GREEN
        RETURN

KEYPRESS_DOWN
        BTFSC   KEY_PRESSED
        RETURN
        BSF     KEY_PRESSED
        ; Add keypress action code here.
        RETURN
```

```
KEYPRESS_LEFT
        BTFSC       KEY_PRESSED
        RETURN
        BSF         KEY_PRESSED
        ; Add keypress action code here.
        RETURN

KEY_RELEASED
        BCF         KEY_PRESSED          ;Clear key pressed flag.
        RETURN

;-----------------------------------------------------------------------------
; ADC CODE
;-----------------------------------------------------------------------------
ADC_GET_DATA
        BANKSEL ADCON1             ;CONFIGURE ADC MODULE
        MOVLW   B'00000000'        ;Left justified, VREF- = VSS, VREF+= VDD
        MOVWF   ADCON1

        BANKSEL ADCON0
        MOVLW   B'00110101'        ;Converions clock = Fosc/2, AN12, ADC Enabled.
        MOVWF   ADCON0

        NOP                        ;GIVE ADC VOLTAGE TIME TO SETTLE.
        NOP
        NOP
        NOP
        BSF         ADCON0,GO      ;START CONVERSION
        BTFSC       ADCON0,GO      ;DONE CONVERTING?
        GOTO        $-1            ;NO
        RETURN
```

Appendix A: Revision History

Revision A (12/2012)
Initial release of this document

Revision B (3/2013)
Added support for 2114/9114 RAM ICs and added relevant documentation.

Updated firmware to support testing 9114 RAM ICs and firmware version to 2.

Revision C (4/2013)

- Fixed a bug that prevented 2114 and 6264 RAM ICs from being fully tested, this issue does not prevent previous firmware versions from properly detecting good and bad RAM ICs.
- Added a new feature that provides visual feedback on RAM tests that take time to complete. This mainly effects the 2114/9114 and 6264 tests and toggles LED pair 6 during the test to indicate the tester is "working".
- Added text describing this new feature to 2114/9114 and 6264 sections.

Revision D (4/2013)
Corrected a bug the prevented some 2114 RAM ICs from being tested propertly

Added support for 6116 RAM ICs.

Revision E (4/2013)
Corrected typographical errors and updated datasheet to clarify 2114 and 9114 RAM compatibility.

