

### FEATURES

Enables evaluation of ADP5520 main functions

- Backlight control
- Ambient light sensing
- Auxiliary LED control
- Keypad decoding
- GPIOs

### GENERAL DESCRIPTION

The ADP5520 evaluation board allows the user to exercise the main features and functionality of the ADP5520 backlight driver with I/O expander IC. A daughterboard houses the actual IC and associated components for backlight driving. The daughter-board plugs into a larger motherboard that houses additional components for device configuration and stimulus. The evaluation board is powered via the USB port and is accompanied by a free register graphical user interface (GUI) that allows interaction with all internal settings of the ADP5520.

Before using the evaluation board, see the ADP5520 data sheet for information about all features available on the device and about the use of register settings in various modes. Information about how to use the evaluation board and GUI software to test some key features of the ADP5520 is given in this data sheet.

### FUNCTIONAL BLOCK DIAGRAM

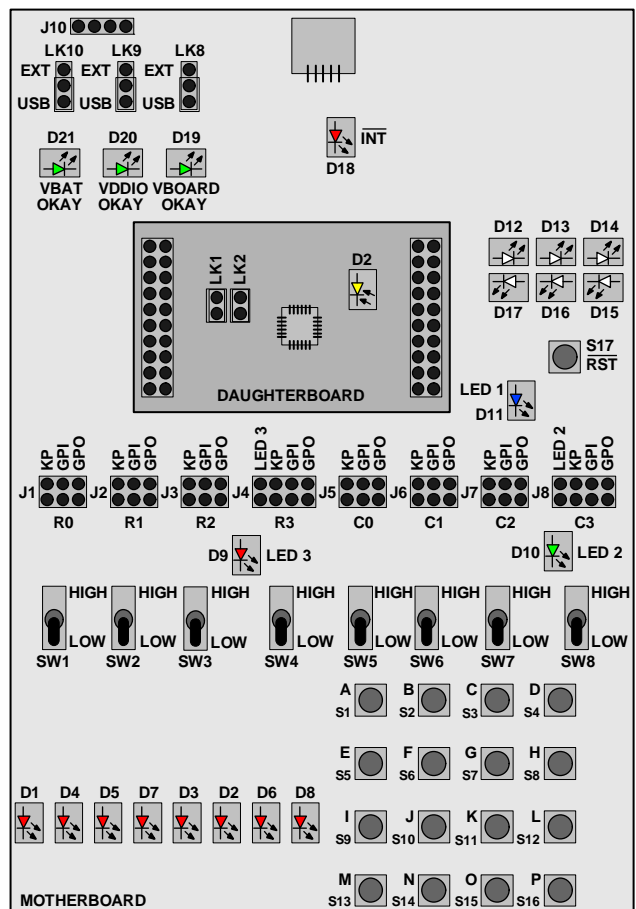


Figure 1.

#### Rev. 0

Evaluation boards are only intended for device evaluation and not for production purposes. Evaluation boards are supplied "as is" and without warranties of any kind, express, implied, or statutory including, but not limited to, any implied warranty of merchantability or fitness for a particular purpose. No license is granted by implication or otherwise under any patents or other intellectual property by application or use of evaluation boards. Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties that may result from its use. Analog Devices reserves the right to change devices or specifications at any time without notice. Trademarks and registered trademarks are the property of their respective owners. Evaluation boards are not authorized to be used in life support devices or systems.

## TABLE OF CONTENTS

Features .....	1	Auxiliary LED Blinking .....	10
General Description .....	1	GPIO Config Tab.....	11
Functional Block Diagram .....	1	GPIO Outputs.....	11
Revision History .....	2	GPIO Inputs.....	11
Evaluation Board Overview .....	3	GPIO Inputs with Interrupt.....	12
Getting Started .....	4	Keypad Status Tab .....	13
Software Installation .....	4	Keypad Matrix Decoding .....	13
Using the Evaluation Board and Software Post Install .....	4	Keypad Matrix Decoding with Interrupt .....	14
Software GUI Overview .....	4	Backlight Turn-On Due to Key Press .....	14
BackLight Config Tab .....	5	Command Save/Load Tab .....	16
Backlight Turn-On .....	5	Evaluation Board Schematics.....	17
Backlight Turn-On with Manual Dim.....	5	Daughterboard Schematic.....	17
Backlight Turn-On with Automatic Dim.....	5	Motherboard Schematic (Page 1).....	18
Backlight Turn-On with Automatic Turn-Off .....	6	Motherboard Schematic (Page 2).....	19
Backlight Turn-On with Automatic Dim and Automatic Off .....	6	Motherboard Schematic (Page 3).....	20
Backlight Turn-On/Turn-Off with Fade-In/Fade-Out.....	6	Motherboard Schematic (Page 4).....	21
Backlight Zone Adjustment (Manual).....	7	Ordering Information.....	22
Backlight Zone Adjustment (Automatic via Ambient Light Sensing).....	7	Bill of Materials (Daughterboard).....	22
Aux LEDs Config Tab .....	9	Bill of Materials (Motherboard) .....	22
Auxiliary LED Turn-On/Turn-Off.....	9	Ordering Guide .....	23
Auxiliary LED Turn-On/Turn-Off with Fade-In/Fade-Out.....	9	ESD Caution.....	23

## REVISION HISTORY

10/08—Revision 0: Initial Version

## EVALUATION BOARD OVERVIEW

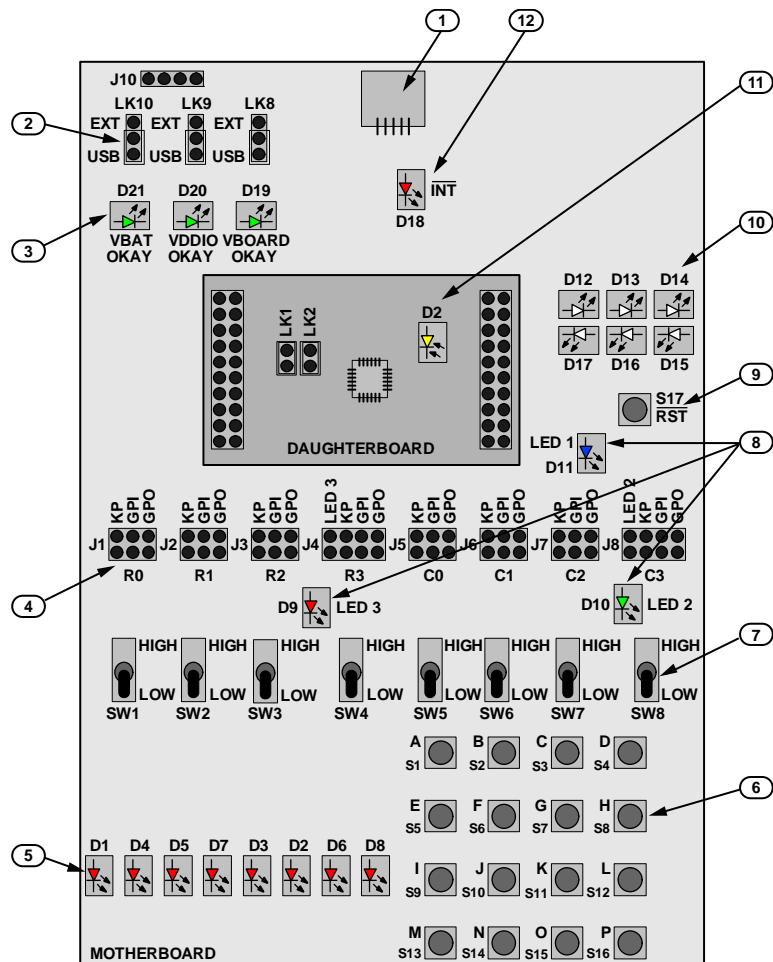


Figure 2.

Table 1. Feature Descriptions

Feature	Description
1	Mini USB connector. This allows a connection to a PC/laptop USB port.
2	Board power selection. By default, the board is powered from the USB, and the jumpers are set to USB. The USB power rail supplies three LDOs, which provide the VBAT (4.5 V), VDDIO (2.7 V), and VBOARD (3.3 V) rails. The user can also power the board from an external source via J10. The jumper settings should be moved to EXT if an external power supply is used. See the ADP5520 data sheet for the supply ranges of VBAT and VDDIO. VBOARD should be supplied with 3.3 V.
3	Supply okay indicator LEDs (green).
4	Selection Block J1 to Selection Block J8 are used to configure the function of each of the eight I/O pins (R0, R1, R2, R3, C0, C1, C2, C3) of the ADP5520. Each pin can be configured as a general-purpose input (GPI), general-purpose output (GPO), or keypad (KP) matrix row/column. Pin R3 and Pin C3 can also be configured as auxiliary LED current sinks (LED3, LED2).
5	GPO high/low indicator LEDs (red). When the LED is on, the GPO is high. When the LED is off, the GPO is low.
6	Keypad matrix. This can be used with I/O pins for keypad decoding.
7	GPI input switches. These can be used to drive I/O pins configured as general-purpose inputs.
8	D9, D10, and D11 are auxiliary LEDs. They are colored red, green, and blue for differentiation. They can be controlled by the R3, C3, and ILED pins of the ADP5520.
9	General reset for the ADP5520. This is connected to the $\overline{\text{RST}}$ pin (labeled nRST on the board).
10	Backlight white LEDs.
11	Ambient light sensor.
12	Interrupt indication LED (red). This LED lights up if an interrupt is active on the $\overline{\text{INT}}$ pin (labeled nINT on the board).

## GETTING STARTED

### SOFTWARE INSTALLATION

Before using the ADP5520 evaluation board, you must install a register interface GUI to interact with the internal setting of the device. The GUI is written in LabVIEW™, which requires a run-time engine to execute. The run-time engine and GUI installation files are included on the accompanying CD. Follow the installation sequence exactly as shown in Figure 3.

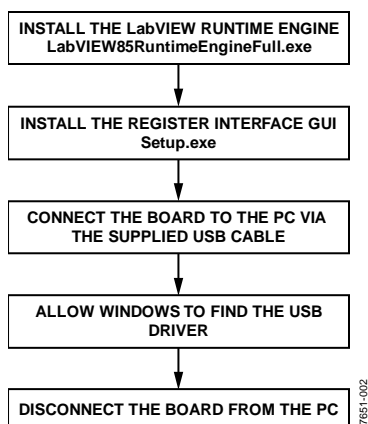


Figure 3. Installation Sequence

### USING THE EVALUATION BOARD AND SOFTWARE POST INSTALL

Once the initial software installation is complete, you can begin interacting with the evaluation board and software GUI. You should first connect the evaluation board to the PC via the supplied USB cable. You can start the software GUI via the **Start** button in Windows®, as follows:

#### Start>All Programs>Analog Devices>ADP5520 Evaluation Software

When the GUI starts up, it initiates connection to the evaluation board and displays the message **I2C Interface Okay** in the bottom left corner of the GUI. If the board is not connected or the installation process was not followed correctly, the message **Firmware not downloaded USB communication error** appears. Make sure that the install process is run correctly and that the board is connected before running the GUI program.

### SOFTWARE GUI OVERVIEW

The GUI begins to run automatically when it is opened. You can stop the program (without closing it) by clicking the **STOP** button in the bottom right corner. To restart the program, click the run arrow at the top left corner.

The register interface GUI is divided into tabs that focus on particular features of the ADP5520 (see Figure 4). Click the tabs to move among them. The GUI allows you to interact with all register settings of the ADP5520. For convenience, some register bits are grouped in drop-down boxes, which you can use to interact with device settings without referring to lookup tables or bit decoders in the data sheet.

Program and/or read buttons are available so that you can write data to or read data from each register. Data to be written is set up on the left side of each program button. Register readback data is displayed to the right of each read button. A read button is available to read back all of the ADP5520 registers sequentially.

## BACKLIGHT CONFIG TAB



Figure 4. BackLight Config Tab

### BACKLIGHT TURN-ON

You must first put the device in a known state by pressing the reset button (S17) on the evaluation board; then do the following on the **BackLight Config** tab:

1. In the **Daylight Max Current** drop-down box, select a backlight maximum current setting (for example, 30 mA); then program this setting by clicking the **Program 0x05** button.
2. Set Bit 6 and Bit 7 of Register 0x00 high and then program these settings by clicking the **Program 0x00** button.

The backlight turns on and is driven by the current chosen as the maximum setting in Step 1.

3. To modify the backlight current, write a new current setting to Register 0x05.
4. To turn off the backlight, clear Bit 6 in Register 0x00.

### BACKLIGHT TURN-ON WITH MANUAL DIM

First press the reset button (S17) on the evaluation board to put the device in a known state; then do the following on the **BackLight Config** tab:

1. In the **Daylight Max Current** drop-down box, select a backlight maximum current setting (for example, 30 mA); then program this setting by clicking the **Program 0x05** button.

2. In the **Daylight Dim Current** drop-down box, select a backlight dim current setting (for example, 5 mA); then program this setting by clicking the **Program 0x06** button.
3. Set Bit 6 and Bit 7 of Register 0x00 high and then program these settings by clicking the **Program 0x00** button.

The backlight now turns on and is driven by the current chosen as the maximum setting in Step 1.

4. Set Bit 5 of Register 0x00 high; then program this setting by clicking the **Program 0x00** button.

The backlight now dims to the current level chosen as the dim setting in Step 2.

5. To modify the backlight maximum and dim current settings, write new current settings to Register 0x05 and Register 0x06.
6. To return the backlight to its maximum setting, clear Bit 5 in Register 0x00.
7. To turn off the backlight, clear Bit 6 in Register 0x00.

### BACKLIGHT TURN-ON WITH AUTOMATIC DIM

First press the reset button (S17) on the evaluation board to put the device in a known state; then do the following on the **BackLight Config** tab:

1. In the **Daylight Max Current** drop-down box, select a backlight maximum current setting (for example, 30 mA);

then program this setting by clicking the **Program 0x05** button.

2. In the **Daylight Dim Current** drop-down box, select a backlight dim current setting (for example, 5 mA); then program this setting by clicking the **Program 0x06** button.
3. In the **Backlight DIM Timer** drop-down box, select a backlight dim time (for example, 10 sec); then program this setting by clicking the **Program 0x03** button.
4. Set Bit 6 and Bit 7 in Register 0x00 high and then program these settings by clicking the **Program 0x00** button.

The backlight now turns on and is driven by the current chosen as the maximum setting in Step 1. After the backlight turns on, the dim timer begins to count down.

When the dim timer expires, Bit 5 of Register 0x00 is automatically set and the backlight dims to the current level chosen as the dim setting in Step 2.

5. To turn off the backlight at any time during the dim timer countdown, clear Bit 6 in Register 0x00.

## BACKLIGHT TURN-ON WITH AUTOMATIC TURN-OFF

First press the reset button (S17) on the evaluation board to put the device in a known state; then do the following on the **BackLight Config** tab:

1. In the **Daylight Max Current** drop-down box, select a backlight maximum current setting (for example, 30 mA); then program this setting by clicking the **Program 0x05** button.
2. In the **Backlight OFF Timer** drop-down box, select a backlight turn-off time (for example, 10 sec); then program this setting by clicking the **Program 0x03** button.
3. Set Bit 6 and Bit 7 of Register 0x00 high and then program these settings by clicking the **Program 0x00** button.

The backlight now turns on and is driven by the current chosen as the maximum setting in Step 1. After the backlight turns on, the off timer begins to count down.

When the off timer expires, the backlight turns off, and Bit 6 in Register 0x00 is automatically cleared.

4. To turn off the backlight at any time during the off timer countdown, clear Bit 6 in Register 0x00.

## BACKLIGHT TURN-ON WITH AUTOMATIC DIM AND AUTOMATIC OFF

First press the reset button (S17) on the evaluation board to put the device in a known state; then do the following on the **BackLight Config** tab:

1. In the **Daylight Max Current** drop-down box, select a backlight maximum current setting (for example, 30 mA); then program this setting by clicking the **Program 0x05** button.

2. In the **Daylight Dim Current** drop-down box, select a backlight dim current setting (for example, 5 mA); then program this setting by clicking the **Program 0x06** button.
3. In the **Backlight DIM Timer** drop-down box, select a backlight dim time (for example, 10 sec).

In the **Backlight OFF Timer** drop-down box, select a backlight off time (for example, 10 sec).

Then program these settings by clicking the **Program 0x03** button.

4. Set Bit 6 and Bit 7 of Register 0x00 high and then program these settings by clicking the **Program 0x00** button.

The backlight now turns on and is driven by the current chosen as the maximum setting in Step 1. After the backlight turns on, the dim timer begins to count down. When the dim timer expires, Bit 5 in Register 0x00 is set automatically, and the backlight dims to the current level chosen as the dim setting in Step 2.

When the backlight is at the dim setting, the off timer begins to count down. After the off timer expires, the backlight turns off, and Bit 5 and Bit 6 in Register 0x00 are cleared automatically.

5. To turn off the backlight at any time during the dim or off timer count, clear Bit 6 in Register 0x00.

## BACKLIGHT TURN-ON/TURN-OFF WITH FADE-IN/FADE-OUT

First press the reset button (S17) on the evaluation board to put the device in a known state; then do the following on the **BackLight Config** tab:

1. In the **Daylight Max Current** drop-down box, select a backlight maximum current setting (for example, 30 mA); then program this setting by clicking the **Program 0x05** button.
2. In the **Backlight Fade IN Time** drop-down box, select a backlight fade-in time (for example, 3 sec).

In the **Backlight Fade OUT Time** drop-down box, select a backlight fade-out time (for example, 3 sec).

Then program these settings by clicking the **Program 0x04** button.

3. In the **Backlight Fade Law** drop-down box, select a backlight fading scheme (for example, square); then program this setting by clicking the **Program 0x02** button.
4. To turn on and fade in the backlight, set Bit 6 and Bit 7 in Register 0x00 high and then program these settings by clicking the **Program 0x00** button.

The backlight begins to turn on and fade into the current chosen as the maximum setting in Step 1.

- To turn off and fade out the backlight, clear Bit 6 in Register 0x00 and program this setting by clicking the **Program 0x00** button.

The backlight begins to turn off and fade out to zero current.

The fade timers can be used with the off and dim timers for fade transitions among on to dim, dim to on, and dim to off. You can try different fade laws and fade-in/fade-out times to decide which ones you want.

### BACKLIGHT ZONE ADJUSTMENT (MANUAL)

First press the reset button (S17) on the evaluation board to put the device in a known state; then do the following on the **BackLight Config** tab:

- In the **Daylight Max Current** drop-down box, select a daylight zone backlight maximum current setting (for example, 30 mA); then program this setting by clicking the **Program 0x05** button.
- In the **Office Max Current** drop-down box, select an office zone backlight maximum current setting (for example, 10 mA); then program this setting by clicking the **Program 0x07** button.
- In the **Dark Max Current** drop-down box, select a dark zone backlight maximum current setting (for example, 3 mA); then program this setting by clicking the **Program 0x09** button.
- Set Bit 6 and Bit 7 in Register 0x00 high and then program these settings by clicking the **Program 0x00** button.

The backlight begins to turn on in the daylight operating zone and is driven by the current chosen in Step 1.

- In the **Backlight Level Control** drop-down box, select the office operating zone; then program this setting by clicking the **Program 0x02** button.

The backlight changes to the office operating zone and is driven by the current chosen in Step 2.

- In the **Backlight Level Control** drop-down box, select the dark operating zone; then program this setting by clicking the **Program 0x02** button.

The backlight changes to the dark operating zone and is driven by the current chosen in Step 3.

You can also enable the fade timers for smooth transition between operating zones.

### BACKLIGHT ZONE ADJUSTMENT (AUTOMATIC VIA AMBIENT LIGHT SENSING)

The ADP5520 contains an ambient light sensor that measures the output current of an external photosensor. The ADP5520 can switch between backlight operating zones based on ambient light conditions. You can set threshold points for switching among the operating zones.

To control automatic backlight adjustment based on ambient light conditions, first press the reset button (S17) on the evaluation board to put the device in a known state; then do the following on the **BackLight Config** tab:

- In the **Daylight Max Current** drop-down box, select a daylight zone backlight maximum current setting (for example, 30 mA); then program this setting by clicking the **Program 0x05** button.
- In the **Office Max Current** drop-down box, select an office zone backlight maximum current setting (for example, 10 mA); then program this setting by clicking the **Program 0x07** button.
- In the **Dark Max Current** drop-down box, select a dark zone backlight maximum current setting (for example, 3 mA); then program this setting by clicking the **Program 0x09** button.
- In the **L2 (Office) Comparator Trip Point** drop-down box, select a threshold for switching between daylight and office operation (for example, 32  $\mu\text{A}^1$ ); then program this setting by clicking the **Program 0x0D** button.
- In the **L2 (Office) Comparator Hysteresis** drop-down box, select a hysteresis level for switching between daylight and office operation (for example, 4  $\mu\text{A}$ ); then program this setting by clicking the **Program 0x0E** button.
- In the **L3 (Dark) Comparator Trip Point** drop-down box, select a threshold for switching between office and dark operation (for example, 15  $\mu\text{A}^1$ ); then program this setting by clicking the **Program 0x0F** button.
- In the **L3 (Dark) Comparator Hysteresis** drop-down box, select a hysteresis level for switching between daylight and office operation (for example, 4  $\mu\text{A}$ ); then program this setting by clicking the **Program 0x10** button.
- Set Bit 0 and Bit 1 in Register 0x0C high and then program these settings by clicking the **Program 0x0C** button.
- Set Bit 3 in Register 0x02 high; then program this setting by clicking the **Program 0x02** button.

10. Set Bit 6 and Bit 7 in Register 0x00 high; then program these settings by clicking the **Program 0x00** button.

The backlight turns on in the daylight operating zone and is driven by the current chosen in Step 1.

If you move your finger close to the photosensor (D2) on the daughterboard, the backlight automatically switches to the office operating zone<sup>1</sup> and is driven by the current chosen in Step 2.

If you move your finger even closer to the photosensor (D2) on the daughterboard, the backlight automatically

switches to the dark operating zone<sup>1</sup> and is driven by the current chosen in Step 3.

11. To adjust the ambient light sensor response time, change response time values in the **ALS Filter time** drop-down box, and then program this setting by clicking the **Program 0x0C** button.

You can also enable the fade timers for smooth transition between operating zones.

<sup>1</sup> You should experiment with these thresholds to determine what works best in the given ambient light. A poorly lit office environment may require lower threshold points.



## AUX LEDES CONFIG TAB

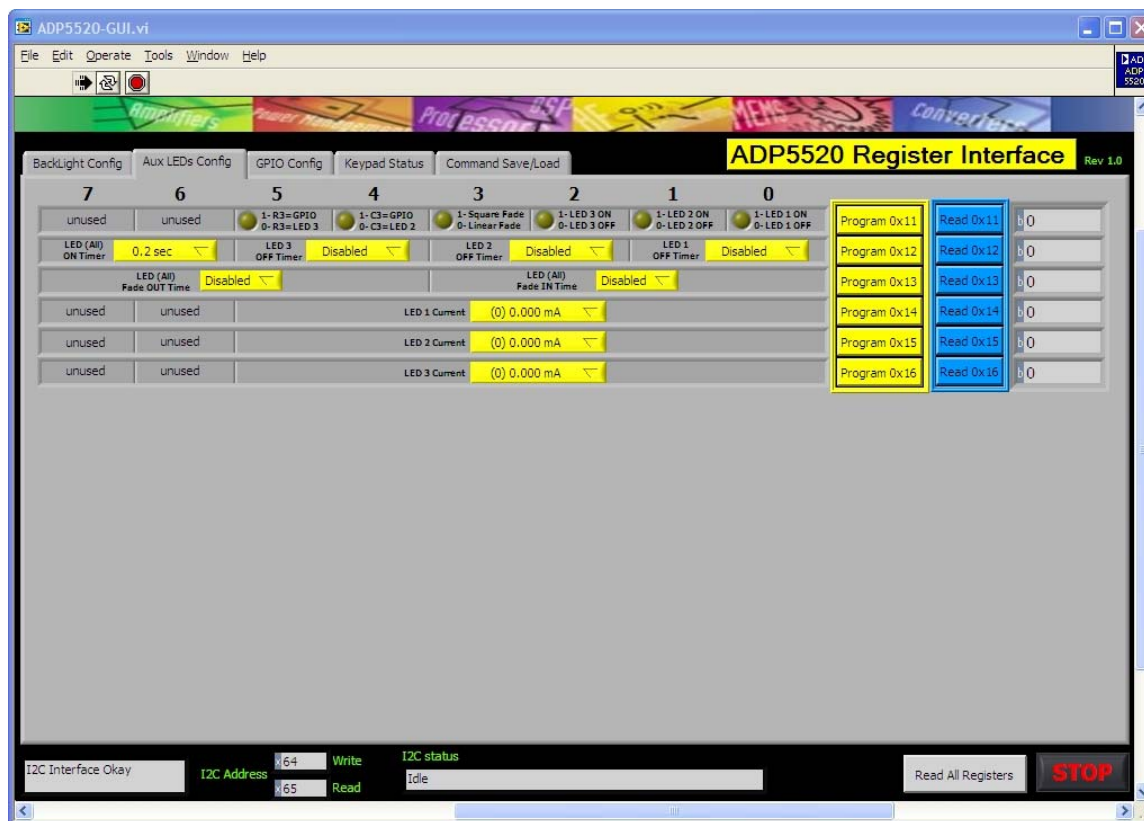


Figure 5. Aux LEDs Config Tab

### AUXILIARY LED TURN-ON/TURN-OFF

First press the reset button (S17) on the evaluation board to put the device in a known state; then complete the following steps.

1. On the motherboard, do the following:
  - a. Move the jumper on Block J8 to the LED 2 position.
  - b. Move the jumper on Block J4 to the LED 3 position.
2. On the **Aux LEDs Config** tab, do the following:
  - a. In the **LED 1 Current** drop-down box, select the LED 1 sink current setting (for example, 14 mA); then program this setting by clicking the **Program 0x14** button.
  - b. In the **LED 2 Current** drop-down box, select the LED 2 sink current setting (for example, 14 mA); then program this setting by clicking the **Program 0x15** button.
  - c. In the **LED 3 Current** drop-down box, select the LED 3 sink current setting (for example, 14 mA); then program this setting by clicking the **Program 0x16** button.
  - d. Set Bit 0, Bit 1, and Bit 2 in Register 0x11 high; then program these settings by clicking the **Program 0x11** button.
3. On the **BackLight Config** tab, set Bit 7 in Register 0x00 high; then program this setting by clicking the **Program 0x00** button.

All three auxiliary LEDs turn on.

4. To turn off an LED, clear Bit 0, Bit 1, and/or Bit 2 in Register 0x11 on the **Aux LEDs Config** tab.

You can modify the sink current in each LED by changing the settings in Register 0x14, Register 0x15, and Register 0x16.

### AUXILIARY LED TURN-ON/TURN-OFF WITH FADE-IN/FADE-OUT

First press the reset button (S17) on the evaluation board to put the device in a known state; then complete the following steps.

1. On the motherboard, do the following:
  - a. Move the jumper on Block J8 to the LED 2 position.
  - b. Move the jumper on Block J4 to the LED 3 position.
2. On the **BackLight Config** tab, set Bit 7 in Register 0x00 high; then program this setting by clicking the **Program 0x00** button.
3. On the **Aux LEDs Config** tab, do the following:
  - a. In the **LED 1 Current** drop-down box, select the LED 1 sink current setting (for example, 14 mA); then program this setting by clicking the **Program 0x14** button.
  - b. In the **LED 2 Current** drop-down box, select the LED 2 sink current setting (for example, 14 mA); then program this setting by clicking the **Program 0x15** button.

- c. In the **LED 3 Current** drop-down box, select the LED 3 sink current setting (for example, 14 mA); then program this setting by clicking the **Program 0x16** button.
- d. In the **LED (ALL) Fade OUT Time** drop-down box, select a fade-out time (for example, 1.8 sec).

In the **LED (ALL) Fade IN Time** drop-down box, select a fade-in time (for example, 1.8 sec).

- e. Then program these settings by clicking the **Program 0x13** button.

Set Bit 3 (square fade) in Register 0x11 high.

Set Bit 0, Bit 1, and Bit 2 in Register 0x11 high.

Then program these settings by clicking the **Program 0x11** button.

All three auxiliary LEDs start to turn on and fade into the current programmed levels.

- f. To turn off and fade out the LEDs, clear Bit 0, Bit 1, and Bit 2 in Register 0x11; then program these settings by clicking the **Program 0x11** button.

All three auxiliary LEDs start to turn off and fade out to zero.

You can experiment with different fade-in/fade-out times.

## AUXILIARY LED BLINKING

First press the reset button (S17) on the evaluation board to put the device in a known state; then complete the following steps.

1. On the motherboard, do the following:
  - a. Move the jumper on Block J8 to the LED 2 position.
  - b. Move the jumper on Block J4 to the LED 3 position.

2. On the **BackLight Config** tab, set Bit 7 in Register 0x00 high; then program this setting by clicking the **Program 0x00** button.
3. On the **Aux LEDs Config** tab, do the following:
  - a. In the **LED 1 Current** drop-down box, select the LED 1 sink current (for example, 14 mA); then program this setting by clicking the **Program 0x14** button.
  - b. In the **LED 2 Current** drop-down box, select the LED 2 sink current (for example, 14 mA); then program this setting by clicking the **Program 0x15** button.
  - c. In the **LED 3 Current** drop-down box, select the LED 3 sink current (for example, 14 mA); then program this setting by clicking the **Program 0x16** button.
  - d. In the **LED (All) ON Timer** drop-down box, select a blink on time (for example, 1.2 sec).

In the **LED 3 OFF Timer** drop-down box, select a blink off time for LED 3 (for example, 1.2 sec).

In the **LED 2 OFF Timer** drop-down box, select a blink off time for LED 2 (for example, 1.2 sec).

On the **LED 1 OFF Timer** drop-down box, select a blink off time for LED 1 (for example, 1.2 sec).

Then program these settings by clicking the **Program 0x12** button.

- e. Set Bit 0, Bit 1, and Bit 2 in Register 0x11 high; then program these settings by clicking the **Program 0x11** button.

All three auxiliary LEDs start to blink on and off.

You can also enable the fade timers for smooth transition between on and off.

## GPIO CONFIG TAB

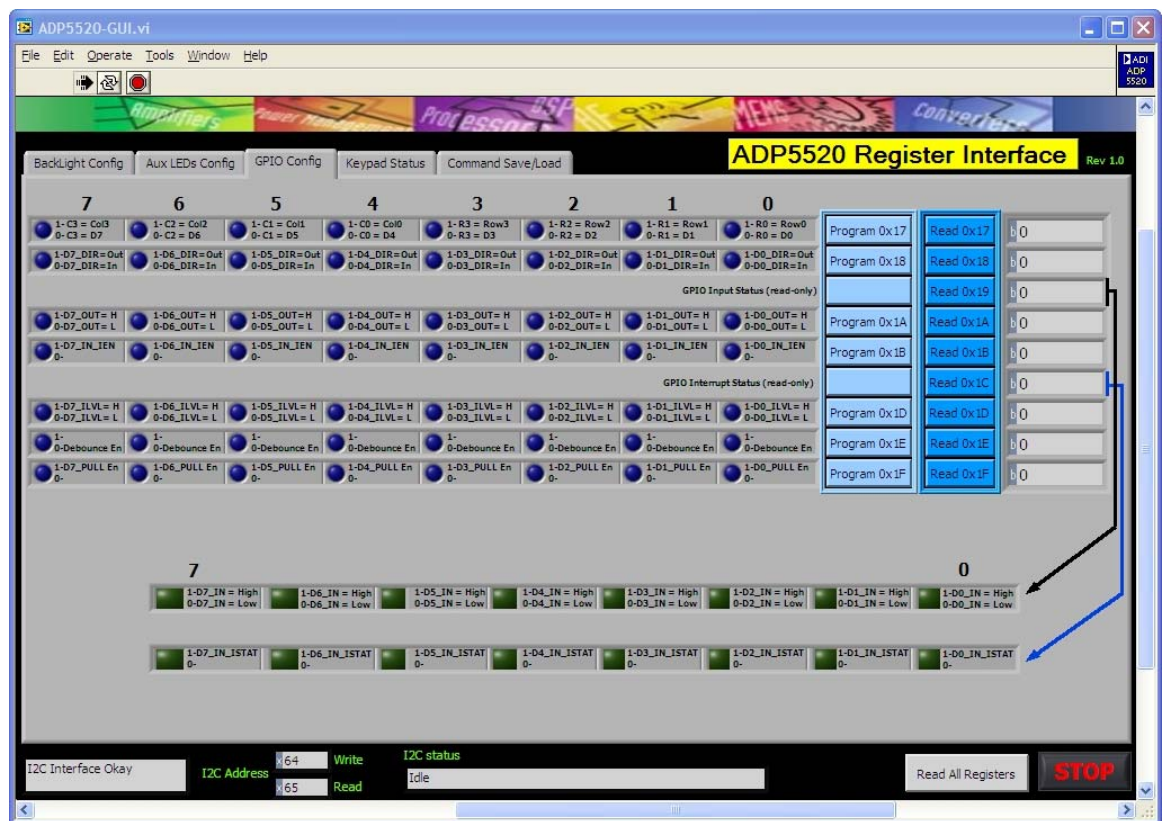


Figure 6. GPIO Config Tab

### GPIO OUTPUTS

First press the reset button (S17) on the evaluation board to put the device in a known state; then complete the following steps.

- On the motherboard, move the jumpers on Block J1 through Block J8 to the GPO position.
- On the **Aux LEDs Config** tab, set Bit 4 and Bit 5 in Register 0x11 high; then program this setting by clicking the **Program 0x11** button.

This reconfigures the R3 and C3 pins.

- On the **GPIO Config** tab, do the following:
  - Set Bit 0 through Bit 7 in Register 0x18 high; then program this setting by clicking the **Program 0x18** button.
  - This reconfigures the R0, R1, R2, R3, C0, C1, C2, and C3 pins as general-purpose outputs (GPOs).
  - Set Bit 0 through Bit 7 in Register 0x1A to any combination of 1s or 0s; then program this setting by clicking the **Program 0x1A** button.

LED D1 through LED D8 on the motherboard reflect the data programmed into Register 0x1A.

### GPIO INPUTS

First press the reset button (S17) on the evaluation board to put the device in a known state; then do the following:

- On the motherboard, do the following:
  - Move the jumpers on Block J1 through Block J8 to the GPI position.
  - Change all SW1 through SW8 switches to the low position.
- On the **Aux LEDs Config** tab, set Bit 4 and Bit 5 in Register 0x11 high; then program this setting by clicking the **Program 0x11** button.

This reconfigures the R3 and C3 pins.

- On the **GPIO Config** tab, read back Register 0x19 by clicking the **Read 0x19** button.

The readback value should be 0, indicating that all GPI pins are low.

- On the motherboard, change the SW1 through SW8 switches to any combination of high and low.
- On the **GPIO Config** tab, read back Register 0x19 by clicking the **Read 0x19** button.

The readback data reflects whatever data combination was set in Step 5.

## GPIO INPUTS WITH INTERRUPT

First press the reset button (S17) on the evaluation board to put the device in a known state; then complete the following steps.

1. On the motherboard, do the following:
  - a. Move the jumpers on Block J1 through Block J8 to the GPI position.
  - b. Change all SW1 through SW8 switches to the low position.
2. On the **Aux LEDs Config** tab, set Bit 4 and Bit 5 in Register 0x11 high; then program this setting by clicking the **Program 0x11** button.

This reconfigures the R3 and C3 pins.

3. On the **GPIO Config** tab, do the following:
  - a. Set Bit 0 in Register 0x1D high; then program this setting by clicking the **Program 0x1D** button.

This configures the GPI D0 (R0 pin) to trigger an interrupt on a low to high input event.

- b. Set Bit 0 in Register 0x1B high; then program this setting by clicking the **Program 0x1B** button.

This enables a GPI D0 (R0 pin) interrupt.

4. On the motherboard, change the SW1 switch to the high position.

LED D18 on the motherboard lights up, indicating that the  $\overline{\text{INT}}$  pin (nINT on the board) is active and that an interrupt has triggered.

5. On the **GPIO Config** tab, do the following:
  - a. Read back Register 0x19 by clicking the **Read 0x19** button.

- b. The readback value should indicate that the LSB is set to 1 and, therefore, that GPI D0 (R0 pin) is currently high.
  - c. Read back Register 0x1C by clicking the **Read 0x1C** button.
  - d. The readback value should indicate that the LSB is set to 1 and, therefore, that a GPI D0 (R0 pin) interrupt is triggered.
6. On the **BackLight Config** tab, read back Register 0x00 by clicking the **Read 0x00** button.

The readback value should indicate that Bit 2 (the master GPI interrupt bit) is set to 1 and, therefore, that a GPI interrupt is triggered.

To clear an interrupt, do the following:

1. On the motherboard, change the SW18 switch to the low position.
2. On the **GPIO Config** tab, read back Register 0x1C by clicking the **Read 0x1C** button.

After the interrupt condition is removed, reading this register clears the interrupt status bit in the register.

3. On the **BackLight Config** tab, set Bit 2 in Register 0x00 high; then program this setting by clicking the **Program 0x00** button.

This clears the master GPI interrupt bit.

All interrupt status bits are now cleared, and LED D18 on the motherboard goes out, indicating that the  $\overline{\text{INT}}$  pin (nINT on the board) is inactive.

## KEYPAD STATUS TAB



Figure 7. Keypad Status Tab

### KEYPAD MATRIX DECODING

First press the reset button (S17) on the evaluation board to put the device in a known state; then complete the following steps.

1. On the motherboard, move the jumpers on Block J1 through Block J8 to the KP position.
2. On the **Aux LEDs Config** tab, set Bit 4 and Bit 5 in Register 0x11 high; then program this setting by clicking the **Program 0x11** button.

This reconfigures the R3 and C3 pins.

3. On the **GPIO Config** tab, do the following:
  - a. Set Bit 0 through Bit 3 in Register 0x1F high; then program this setting by clicking the **Program 0x1F** button.

This enables the pull-ups on Pin R0 through Pin R3.

- b. Set Bit 0 through Bit 3 in Register 0x17 high; then program this setting by clicking the **Program 0x17** button.

This configures Pin R0 through Pin R3 as keypad matrix rows.

- c. Set Bit 4 through Bit 7 in Register 0x17 high; then program this setting by clicking the **Program 0x17** button.

This configures Pin C0 through Pin C3 as keypad matrix columns.

4. On the motherboard, press and release the S1 switch (Keypad A).
5. On the **Keypad Status** tab, do the following:
  - a. Read the key press interrupt status Register 0x20 by clicking the **Read 0x20** button.  
Bit 0 is set, indicating that Key A was pressed.
  - b. Read the key release interrupt status Register 0x22 by clicking the **Read 0x22** button.  
Bit 0 is set, indicating that Key A was released.

6. On the **BackLight Config** tab, read Register 0x00 by clicking the **Read 0x00** button.  
Bit 0 and Bit 1 (the master key press/release interrupt bits) should be set, indicating that one of the keypad matrix switches was pressed/released.

You can press/release other switches on the motherboard and read back the press/release status in Register 0x20 through Register 0x25 on the **Keypad Status** tab.

## KEYPAD MATRIX DECODING WITH INTERRUPT

First press the reset button (S17) on the evaluation board to put the device in a known state; then complete the following steps.

1. On the motherboard, move the jumpers on Block J1 through Block J8 to the KP position.
2. On the **Aux LEDs Config** tab, set Bit 4 and Bit 5 in Register 0x11 high; then program this setting by clicking the **Program 0x11** button.

This reconfigures the R3 and C3 pins.

3. On the **GPIO Config** tab, do the following:
  - a. Set Bit 0 through Bit 3 in Register 0x1F high; then program this setting by clicking the **Program 0x1F** button.

This enables the pull-ups on Pin R0 through Pin R3.

- b. Set Bit 0 through Bit 3 in Register 0x17 high; then program this setting by clicking the **Program 0x17** button.

This configures Pin R0 through Pin R3 as keypad matrix rows.

- c. Set Bit 4 through Bit 7 in Register 0x17 high; then program this setting by clicking the **Program 0x17** button.

This configures Pin C0 through Pin C3 as keypad matrix columns.

4. On the **BackLight Config** tab, set Bit 0 and Bit 1 in Register 0x01 high; then program this setting by clicking the **Program 0x01** button.

This enables key presses/releases to generate interrupts on the  $\overline{\text{INT}}$  pin (nINT on the board).

5. On the motherboard, press and release the S1 switch (Keypad A).
6. On the **Keypad Status** tab, do the following:
  - a. Read the key press interrupt status Register 0x20 by clicking the **Read 0x20** button.  
  
Bit 0 is set, indicating that Key A was pressed.
  - b. Read the key release interrupt status Register 0x22 by clicking the **Read 0x22** button.  
  
Bit 0 is set, indicating that Key A was released.

7. On the **BackLight Config** tab, read Register 0x00 by clicking the **Read 0x00** button.

Bit 0 and Bit 1 (the master key press/release interrupt bits) should be set, indicating that one of the keypad matrix switches was pressed/released.

On the motherboard, LED D18 lights up, indicating that the  $\overline{\text{INT}}$  pin (nINT on the board) is active and that an interrupt has triggered.

To clear the interrupt, do the following:

1. On the **Keypad Status** tab, clear all bits in Register 0x20 through Register 0x23 by reading the registers.
2. On the **BackLight Config** tab, clear Bit 0 and Bit 1 in Register 0x00 by writing 1 to each bit.

LED D18 on the motherboard goes out, indicating that the  $\overline{\text{INT}}$  pin (nINT on the board) is inactive.

Key press and release interrupts can be enabled independently of each other.

## BACKLIGHT TURN-ON DUE TO KEY PRESS

First press the reset button (S17) on the evaluation board to put the device in a known state; then complete the following steps.

1. On the motherboard, move the jumpers on Block J1 through Block J8 to the KP position.
2. On the **Aux LEDs Config** tab, set Bit 4 and Bit 5 in Register 0x11 high; then program this setting by clicking the **Program 0x11** button.

This reconfigures the R3 and C3 pins.

3. On the **GPIO Config** tab, do the following:
  - a. Set Bit 0 through Bit 3 in Register 0x1F high; then program this setting by clicking the **Program 0x1F** button.

This enables the pull-ups on Pin R0 through Pin R3.

- b. Set Bit 0 through Bit 3 in Register 0x17 high; then program this setting by clicking the **Program 0x17** button.

This configures Pin R0 through Pin R3 as keypad matrix rows.

- c. Set Bit 4 through Bit 7 in Register 0x17 high; then program this setting by clicking the **Program 0x17** button.

This configures Pin C0 through Pin C3 as keypad matrix columns.

4. On the **BackLight Config** tab, do the following:
  - a. Set Bit 0 of Register 0x02 high; then program this setting by clicking the **Program 0x02** button.

This allows the backlight to turn on due to a key press.
  - b. In the **Daylight Max Current** drop-down box, select a backlight maximum current setting (for example, 30 mA); then program this setting by clicking the **Program 0x05** button.
5. On the **BackLight Config** tab, set Bit 7 in Register 0x00 high; then program this setting by clicking the **Program 0x00** button.

This takes the ADP5520 out of standby mode.

6. On the motherboard, press and release the S1 switch (Keypad A).

The backlight now turns on after the switch is pressed. You can turn off the backlight by clearing Bit 6 in Register 0x00 (or optionally using the backlight off timer). To turn the backlight on again with a subsequent key press, you must first clear any bits set in Register 0x20 through Register 0x23 on the **Keypad Status** tab and then clear Bit 0 and Bit 1 in Register 0x00 on the **BackLight Config** tab.



## COMMAND SAVE/LOAD TAB

The **Command Save/Load** tab can be used to record data that you write to or read from the ADP5520. By default, this feature is disabled. To enable it, click the red **Disabled** button (it changes to a green **Enabled** button). As you write data to and read data from the ADP5520, each event is displayed in the

**Command History** box. You can save the command history list to a file by clicking the **Save Command History to File** button. You can then recall and rerun the saved commands by clicking the **Load and Run Commands from File** button.

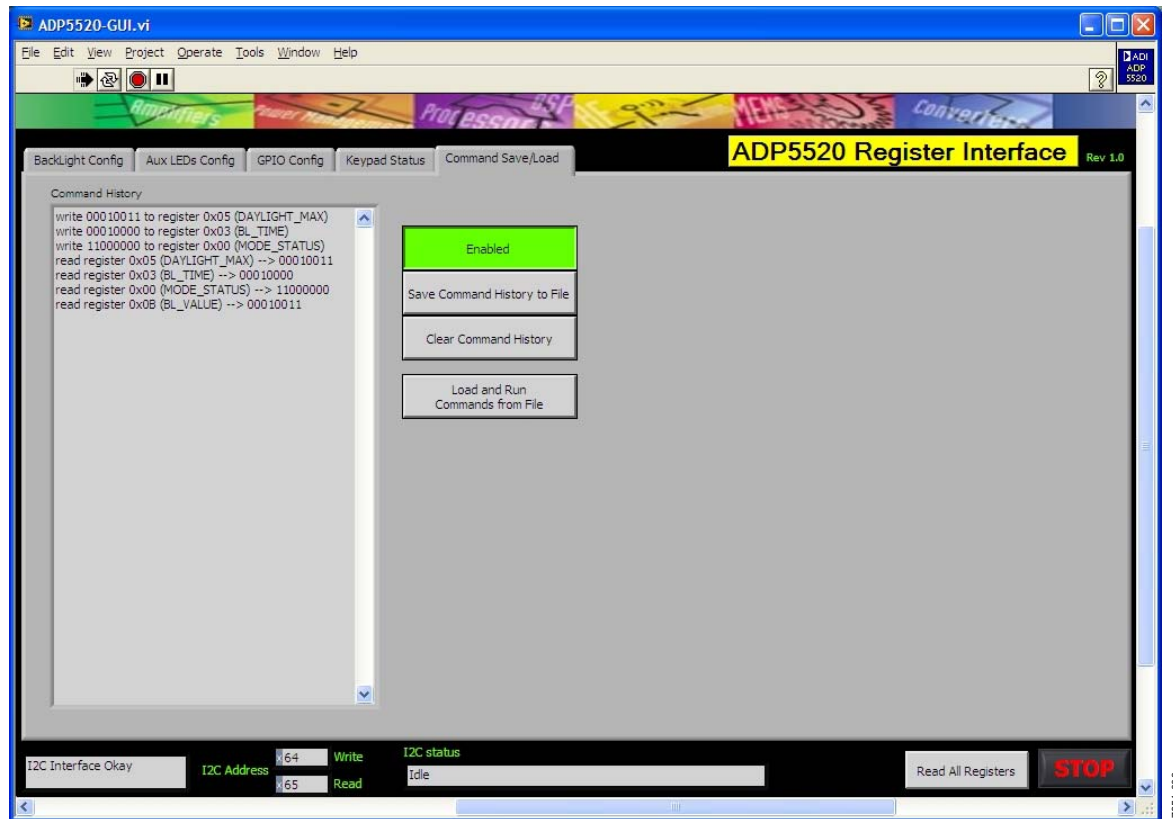


Figure 8. Command Save/Load Tab



## EVALUATION BOARD SCHEMATICS

## DAUGHTERBOARD SCHEMATIC

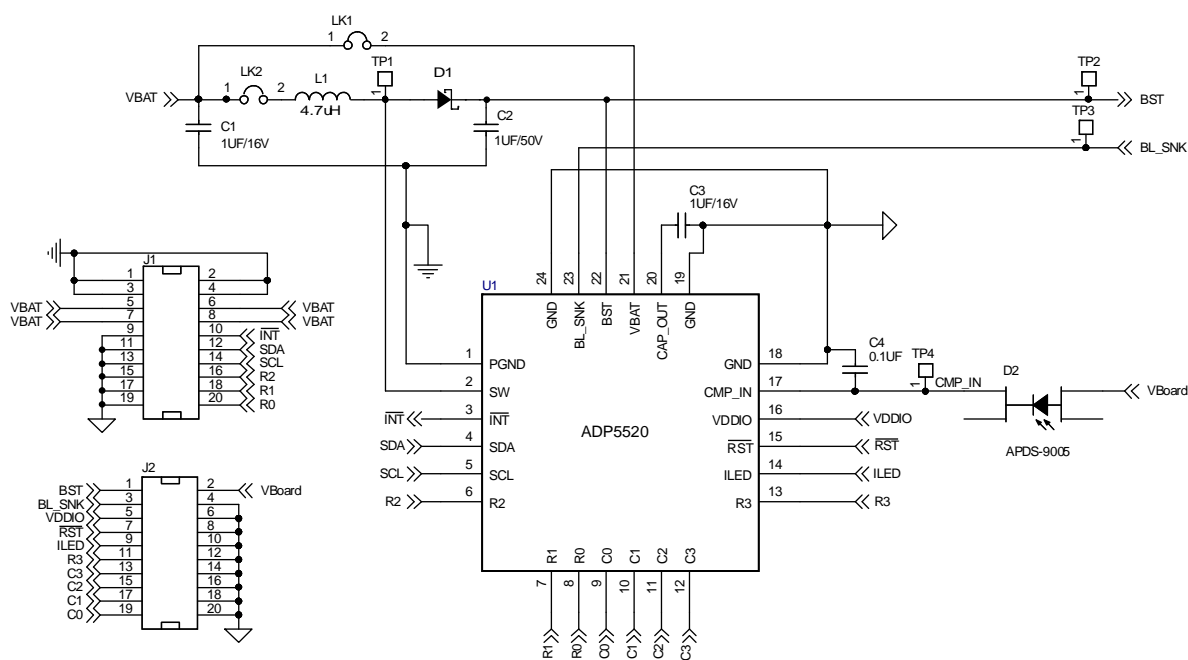


Figure 9.

07651-009

# EVAL-ADP5520

## MOTHERBOARD SCHEMATIC (PAGE 1)

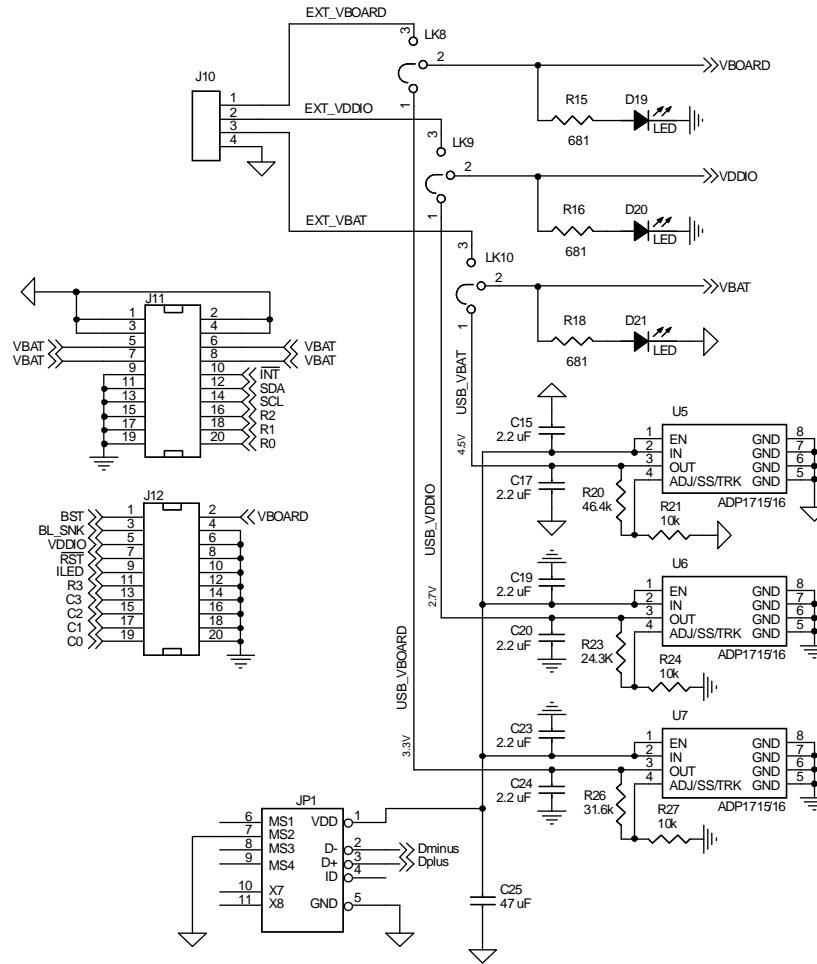


Figure 10.

07851-010

## MOTHERBOARD SCHEMATIC (PAGE 2)

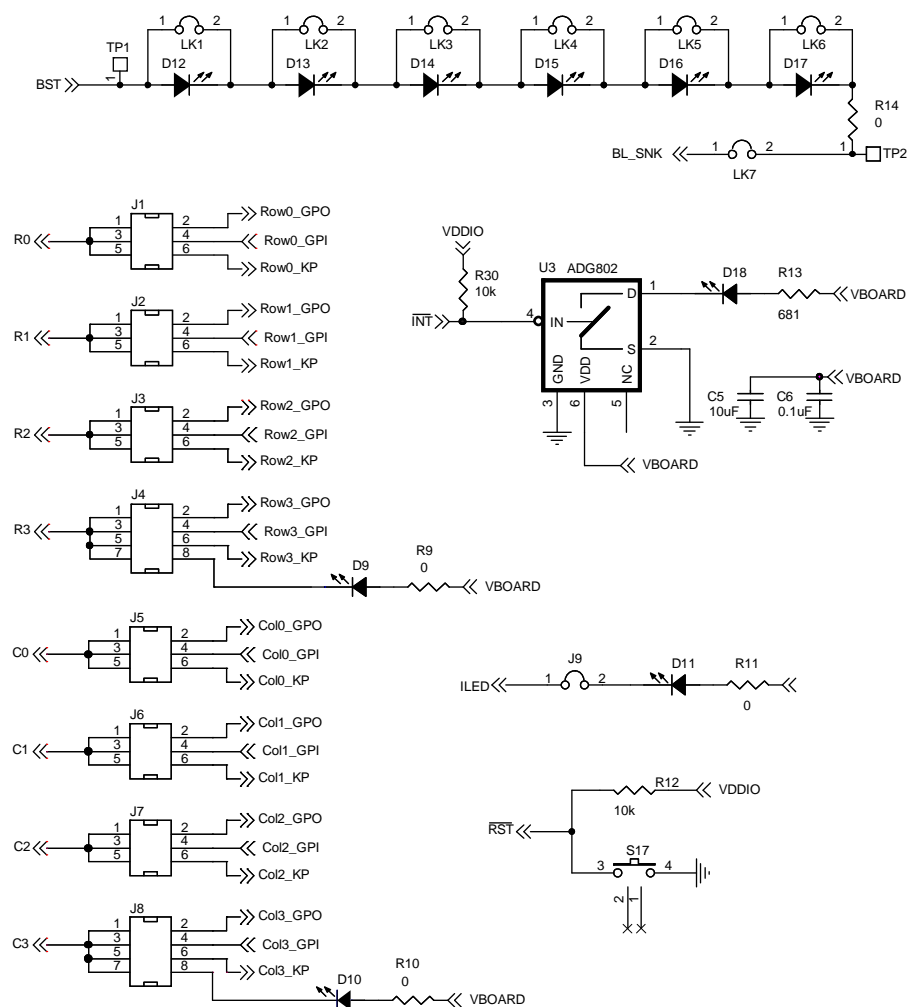


Figure 11.

076851-011

## MOTHERBOARD SCHEMATIC (PAGE 3)

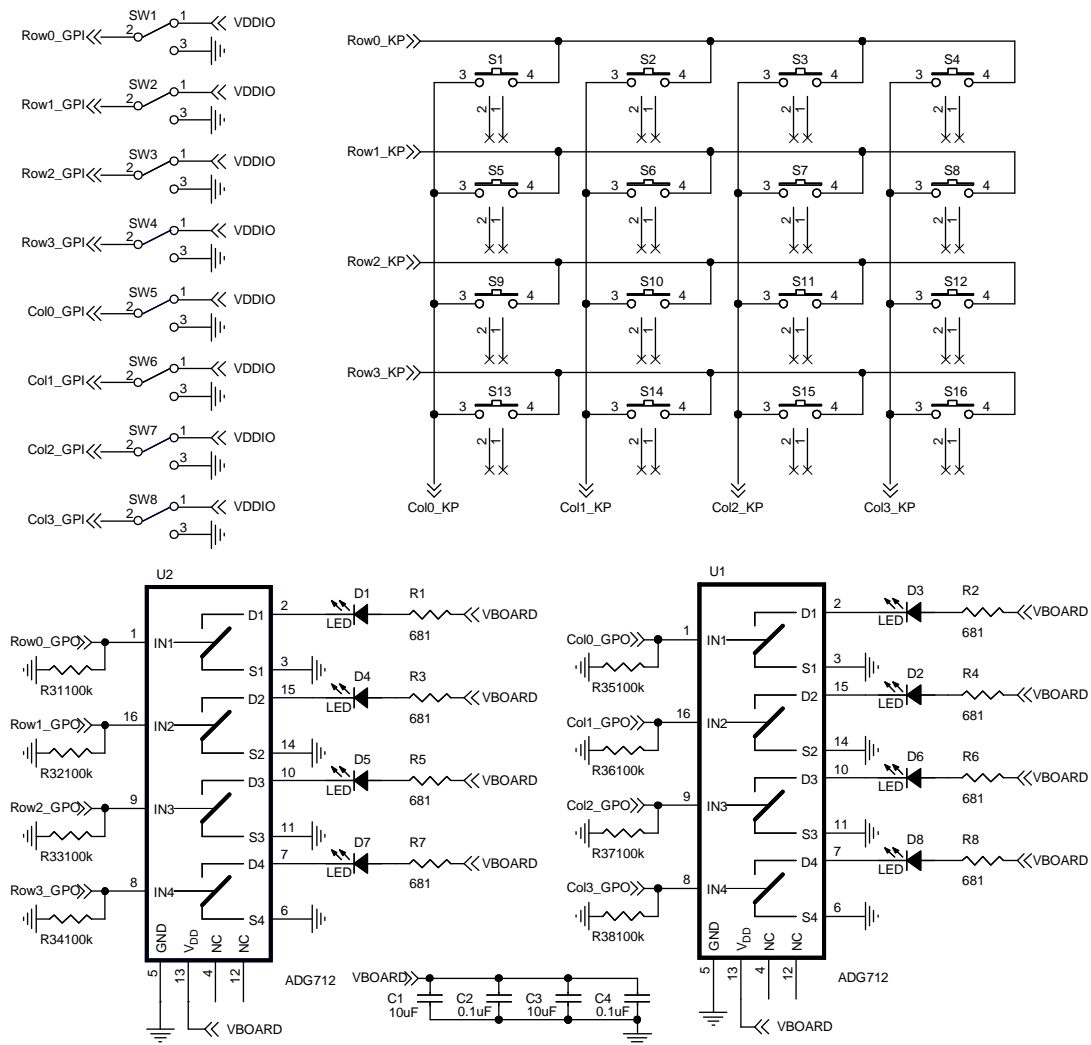


Figure 12.

07651-012

## MOTHERBOARD SCHEMATIC (PAGE 4)

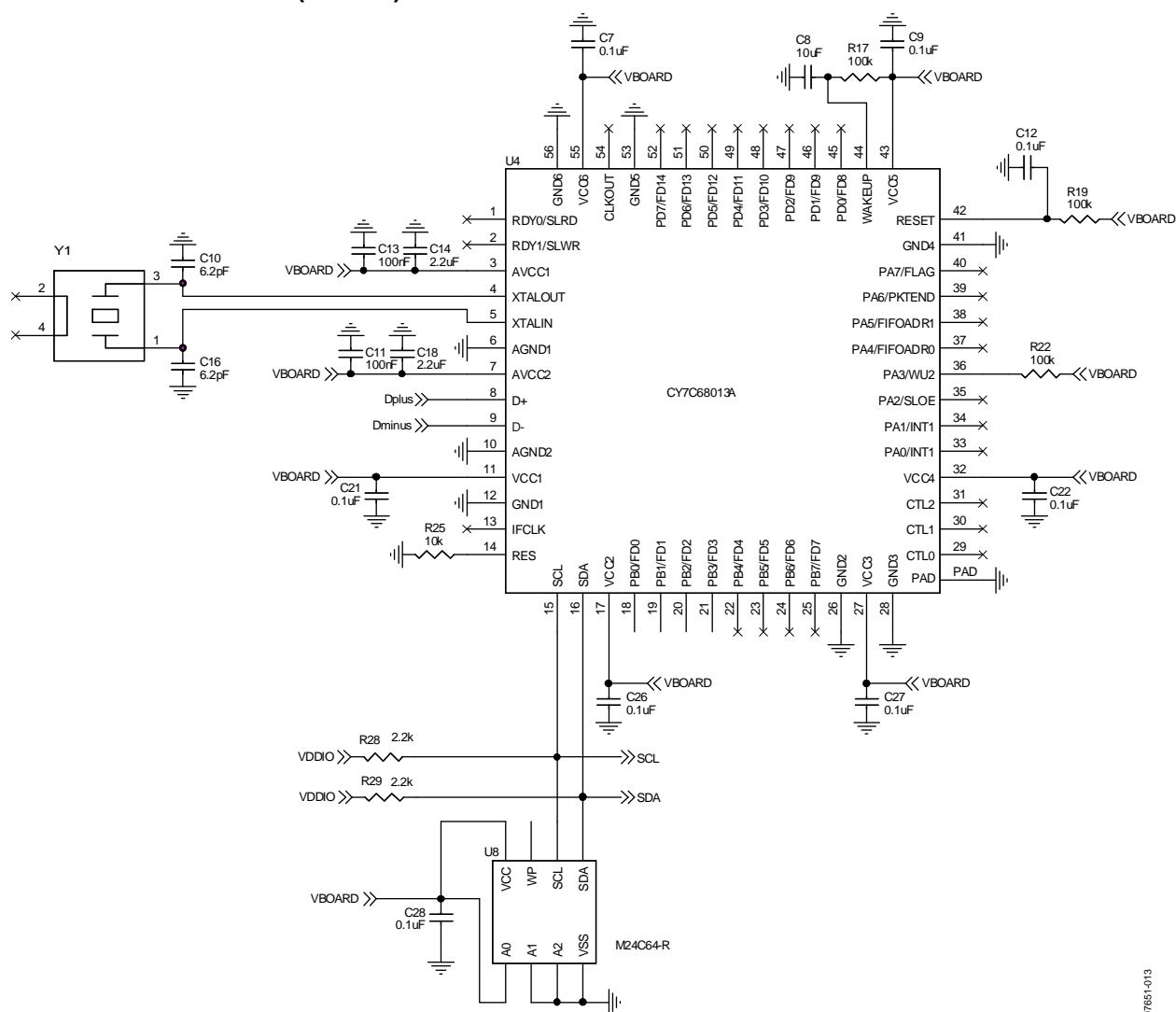


Figure 13.

07651-013

# EVAL-ADP5520

## ORDERING INFORMATION

### BILL OF MATERIALS (DAUGHTERBOARD)

Table 2.

Qty	Reference Designator	Description	Manufacturer/Vendor	Part Number
2	C1, C3	Capacitor MLCC, 1 $\mu$ F, 16 V, 0603, X5R	Murata	GRM188R61C105K
1	C2	Capacitor MLCC, 1 $\mu$ F, 50 V, 0805, X7R	Murata	GRM21BR71H105K
1	C4	Capacitor MLCC, 0.1 $\mu$ F, 25 V, 0603, X7R	Murata	GRM188R71E104KA01
1	D1	Schottky rectifier, 40 V, 1A	On Semiconductor	MBR140SFT1G
1	D2	Miniature surface-mount ambient light sensor	Avago	APDS-9005
2	J1, J2	10 $\times$ 2 connector	Samtec	SSW-110-03-G-D
2	LK1, LK2	1-way link	Sullins Electronics	PEC36SAAN
1	L1	Inductor, 4.7 $\mu$ H	Coilcraft	LPS4012-472MLB
4	TP1, TP2, TP3, TP4	Test points	Sullins Electronics	PEC36SAAN
1	U1	ADP5520	Analog Devices	ADP5520ACPZ-RL

### BILL OF MATERIALS (MOTHERBOARD)

Table 3.

Qty	Reference Designator	Description	Manufacturer/Vendor	Part Number
4	C1, C3, C5, C8	Capacitor MLCC, 10 $\mu$ F, 16 V, 0806, X5R	Murata	GRM21BR61C106K
13	C2, C4, C6, C7, C9, C11, C12, C13, C21, C22, C26, C27, C28	Capacitor MLCC, 0.10 $\mu$ F, 16 V, 0603, X5R	Murata	GRM188R61C104KA
8	C14, C15, C17, C18, C19, C20, C23, C24	Capacitor MLCC, 2.2 $\mu$ F, 16 V, 0603, X5R	Murata	GRM188R61C225K
1	C25	Capacitor MLCC, 47 $\mu$ F, 16 V, 1210, X5R	Murata	GRM32ER61C476K
2	C10, C16	Capacitor MLCC, 6.2 pF, 50 V, 0603, X5R	Murata	GRM1885C1H6R2DZ01D
6	J1, J2, J3, J5, J6, J7	Connector 3 $\times$ 2	Sullins Electronics	PEC36DAAN
2	J4, J8	Connector 4 $\times$ 2	Sullins Electronics	PEC36DAAN
8	SW1, SW2, SW3, SW4, SW5, SW6, SW7, SW8	Switch 3-way	Apem	TL39P0050
17	S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, S12, S13, S14, S15, S16, S17	Push button switch	ITT/C&K Div	KT11P3JM34LFS/ KSC321JLFS
6	D12, D13, D14, D15, D16, D17	White LED	Lite-On	LTW-170TK
10	D1, D2, D3, D4, D5, D6, D7, D8, D9, D18	Red LED	Lumex	SML-LXT0805IW-TR
4	D10, D19, D20, D21	Green LED	Lumex	SML-LXT0805GW-TR
1	D11	Blue LED	Lumex	SML-LX0805USBC-TR
2	U1, U2	ADG712	Analog Devices	ADG712BRUZ
1	U3	ADG802	Analog Devices	ADG802BRTZ-REEL7
3	U5, U6, U7	ADP1715	Analog Devices	ADP1715ARMZ-R7
1	U4	IC MCU USB PERIPH HI SPD-56QFN	Cypress Semi	CY7C68013A
1	U8	Serial EEPROM	Microchip	24LC64
2	J11, J12	10 $\times$ 2 connector	Sullins Electronics	PEC36DAAN
1	J10	4 $\times$ 1 connector	Sullins Electronics	PEC36SAAN
1	JP1	USB connector	Hirose Electric	UX60-MB-5ST
3	LK8, LK9, LK10	2-way link	Sullins Electronics	PEC36SAAN
8	LK1, LK2, LK3, LK4, LK5, LK6, LK7, J9	Jumper	Sullins Electronics	PEC36SAAN
1	Y1	Crystal 24 MHz	CTS	CTX651CT
3	R17, R19, R22	Resistor, 100 k $\Omega$ , 0402	Vishay or equivalent	CRCW0421100KFKE
4	R21, R24, R25, R27	Resistor, 10 k $\Omega$ , 0402	Vishay or equivalent	CRCW040210K0FKE

Qty	Reference Designator	Description	Manufacturer/Vendor	Part Number
1	R20	Resistor, 46.4 k $\Omega$ , 0402	Vishay or equivalent	CRCW040246K4FKE
1	R23	Resistor, 24.3 k $\Omega$ , 0402	Vishay or equivalent	CRCW040224K3FKE
1	R26	Resistor, 31.6 k $\Omega$ , 0402	Vishay or equivalent	CRCW040231K6FKE
2	R28, R29	Resistor, 2.2 k $\Omega$ , 0805	Vishay or equivalent	CRCW08052K21FKE
12	R1, R2, R3, R4, R5, R6, R7, R8, R13, R15, R16, R18	Resistor, 681 $\Omega$ 0603	Vishay or equivalent	CRCW0603681RFKE
4	R9, R10, R11, R14	Resistor, 0 $\Omega$ , 0603	Vishay or equivalent	CRCW06030000Z0E
2	R12, R30	Resistor, 10 k $\Omega$ , 0603	Vishay or equivalent	CRCW060310K0FKE
8	R31, R32, R33, R34, R35, R36, R37, R38	Resistor, 100 k $\Omega$ , 0603	Vishay or equivalent	CRCW0603100KFKE
2	TP1, TP2	Test points	Sullins Electronics	PEC36SAAN

## ORDERING GUIDE

Model	Package Description
ADP5520-EVALZ <sup>1</sup>	Evaluation Board

<sup>1</sup> Z = RoHS Compliant Part.

## ESD CAUTION



### ESD (electrostatic discharge) sensitive device.

Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

**NOTES**