

# ***TPS211xAEVM***

## ***Power Multiplexer Evaluation Module***

# *User's Guide*

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## **EVM WARNINGS AND RESTRICTIONS**

It is important to operate this EVM within the input voltage range of 2.8 V and 5.5 V, and the output voltage range of 2.8 V and 5.5 V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 60°C. The EVM is designed to operate properly with certain components above 60°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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# Read This First

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### ***About This Manual***

This user's guide describes the TPS211xA evaluation module (EVM). This guide contains the EVM schematic, bill of materials, assembly drawing, and top and bottom layer printed circuit board layouts.

### ***How to Use This Manual***

This document contains the following chapters:

- Chapter 1 – Introduction
- Chapter 2 – EVM Setup
- Chapter 3 – Schematic and Bill of Materials
- Chapter 4 – Board Layout

The information in a caution or a warning is provided for your protection. Please read each caution and warning carefully.

### ***Related Documentation From Texas Instruments***

<b>Data Sheet:</b>	<b>Literature Number:</b>
<i>TPS2110/1A: Autoswitching Power Mux</i>	SBVS043
<i>TPS2112/3A: Autoswitching Power Mux</i>	SBVS045
<i>TPS2114/5A: Autoswitching Power Mux</i>	SBVS044

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## ***Electrostatic Sensitive Devices***



**This EVM contains components that can potentially be damaged by electrostatic discharge. Always transport and store the EVM in its supplied ESD bag when not in use. Handle using an antistatic wristband. Operate on an antistatic work surface. For more information on proper handling, refer to SSYA008.**

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# Introduction

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The TPS211xA EVM is an evaluation module for the Texas Instruments TPS211xA family of two-input, one-output power multiplexers. These multiplexers enable seamless transition between two power supplies, each operating at 2.8 V–5.5 V and delivering up to 1 A. EVM configurations are available for the TPS2110A through TPS2115A. Refer to Table 3–1, the schematic, and the bill of materials in this user’s guide to distinguish between these configurations.

The EVM has test points for convenient access to all critical node voltages, potentiometers for adjusting the current limit and the auto-switching voltage sense thresholds, headers for selecting the manual/auto-switching operating modes, and headers for selecting the output hold-up capacitance.



# EVM Setup

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This chapter describes the proper setup of the TPS211xAEVM for use in device evaluations.

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## 2.1 Setting Up the EVM

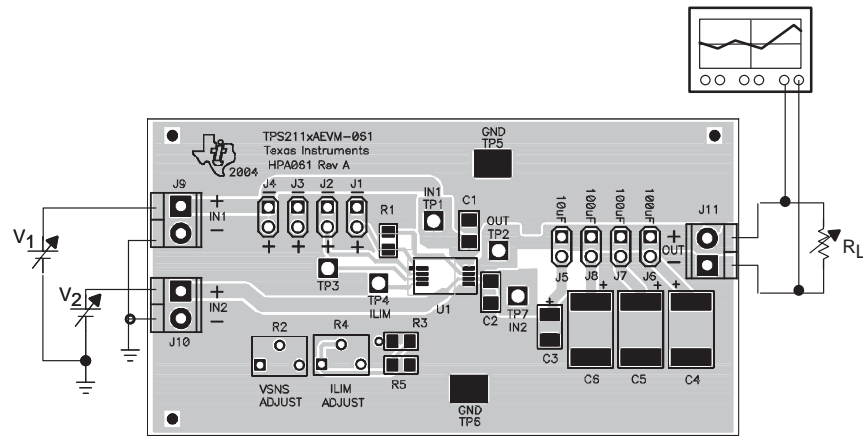
The user is encouraged to read the applicable TPS211xA data sheet before using the EVM.

The following test equipment is recommended:

- Storage oscilloscope
- Current probe
- Two adjustable power supplies, 0 V – 6 V @ 2–A
- Volt–Ohm meter
- A passive or active load

Figure 2–1 shows the EVM test configuration.

Figure 2–1. Basic EVM Setup



## 2.2 Current-Limit Adjustment

Potentiometer R4 controls the resistance  $R_{ILIM}$  that sets the TPS211xA current limit threshold. Adjusting R4 clockwise increases the current limit threshold by decreasing  $R_{ILIM}$ . The current limit threshold is  $250/R_{ILIM}$  for the TPS2110A, TPS2112A, and TPS2114A and  $500/R_{ILIM}$  for the TPS2111A, TPS2113A, and TPS2115A.

To measure the resistance  $R_{ILIM}$ , connect an ohmmeter between test points TP4 and GND. The measurement should be made with the IN1 and IN2 supplies off. To ensure accurate in-circuit resistance measurements, the ohmmeter must apply no more than 0.5 V across the resistor.

## 2.3 Manual Switching Mode (TPS2110/1/4/5A Only)

Potentiometer R2 and header J4 do not affect the operation of the manual switching mode.

Some products like digital cameras and hand-held devices that receive power from an internal battery or from a docking station can take advantage of the manual-switching feature. The TPS2110/1/4/5A digital control input, D1, can directly sense the presence of the docking station and connect the load to the appropriate power source.

### 2.3.1 Configuring the TPS2110/1A for Manual Switching

To place the device into manual switching mode, short header J1. The logic level on the D1 pin now determines which input is selected. On the EVM, header J2 controls the D1 pin. If J2 is left open, then D1 is internally pulled high and IN1 is selected. If J2 is shorted, then D1 is pulled low and IN2 is selected.

### 2.3.2 Configuring the TPS2114/5A for Manual Switching

To place the device into manual switching mode, short header J2. The logic level on the D1 pin determines which input is selected. On the EVM, header J3 controls the D1 pin. If J3 is left open, then D1 is internally pulled high and IN1 is selected. If J3 is shorted, then D1 is pulled low and IN2 is selected.

## 2.4 Automatic Switching Modes

All EVMs support Mode 1 automatic switching. Mode 2 automatic switching is supported by the TPS2110A–TPS2113A EVMs only.

### 2.4.1 Mode 1 Automatic Switching

OUT connects to the higher of IN1 and IN2 in Mode 1 automatic switching. Refer to Table 2–1 to configure the EVM for Mode 1 automatic switching.

Table 2–1. EVM Shorting Jumper Placement for Mode 1 Automatic Switching

EVM	Device	Header			
		J1	J2	J3	J4
HPA061–001	TPS2110A		X		
HPA061–002	TPS2111A		X		
HPA061–003	TPS2112A		X		
HPA061–004	TPS2113A		X		
HPA061–005	TPS2114A			X	
HPA061–006	TPS2115A			X	

A manufacturer can provide a secondary battery pack option to extend the product run time with Mode 1 automatic switching. The TPS211xA cycles between the primary and secondary batteries until both batteries are drained.

### 2.4.2 Mode 2 Automatic Switching (TPS2110/1/2/3A Only)

In Mode 2 automatic switching, OUT connects to IN1 if the voltage at IN1 is sufficiently high; otherwise, OUT connects to the higher of IN1 and IN2. The threshold at which IN1 is selected corresponds to approximately 0.8 V at test point TP3. The corresponding value of the IN1 voltage depends upon the setting of potentiometer R2. Adjusting R2 clockwise increases the IN1 selection threshold voltage.

Refer to Table 2–2 to configure the EVM for Mode 2 automatic switching.

Table 2–2. EVM Shorting Jumper Placement for Mode 2 Automatic Switching

EVM	Device	Header			
		J1	J2	J3	J4
HPA061–001	TPS2110A		X		X
HPA061–002	TPS2111A		X		X
HPA061–003	TPS2112A		X		X
HPA061–004	TPS2113A		X		X

A manufacturer can provide a secondary battery pack option to extend the product run time with Mode 2 automatic switching. The TPS2110A–TPS2113A drains the primary battery at IN1 and automatically switches to the secondary battery at IN2.

## 2.5 Output Voltage Holdup

Headers J5–J8 select the output holdup capacitance.

The output voltage drops out for 60  $\mu$ s (max) whenever the TPS211xA switches between the IN1 and IN2 supplies. Some capacitance at the TPS211xA output is necessary to prevent the output voltage from dropping too much during the supply switchover. Excessive voltage drop can cause a system to reset or lose data.

## 2.6 Switch Status (TPS2112/3/4/5A Only)

The switch status output can be monitored at the positive terminal of header J1. A switch status output equal to logic 1 corresponds to an IN2 switch that is on.

# Schematic and Bill of Materials

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This chapter provides the TPS211xAEVM schematic and bill of materials.

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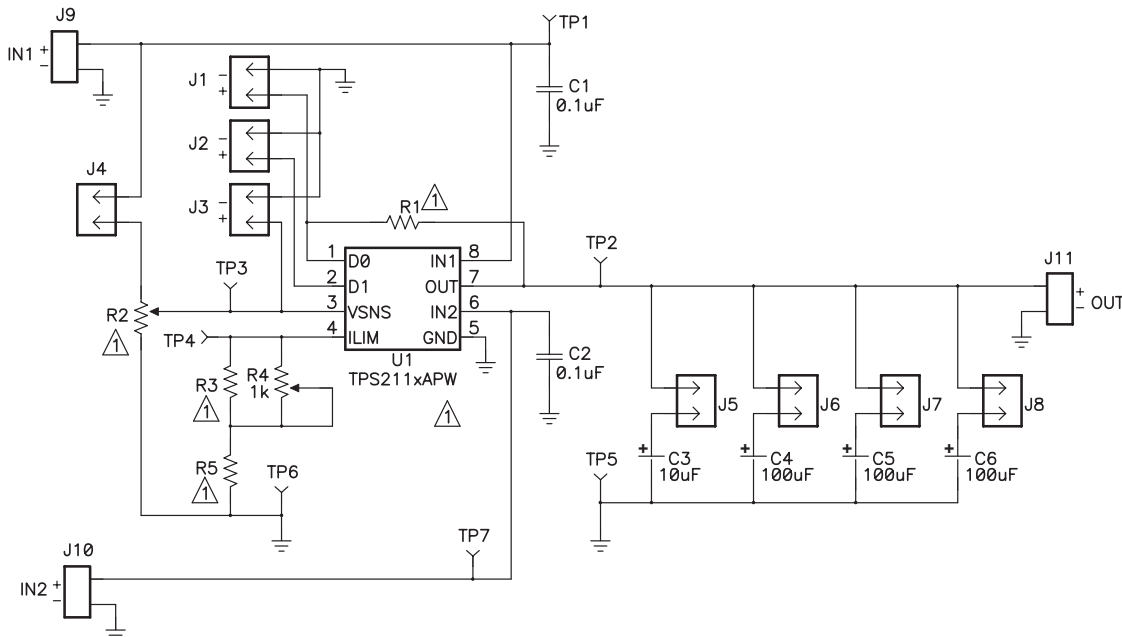
### 3.1 EVM Configurations

Table 3–1. Available EVM Configurations

EVM Designator	Device	Current-Limit Adjustment Range	Switch Status Output	Switching Modes	
				Automatic	Manual
HPA061–001	TPS2110A	0.31 A–0.75 A	No	Yes	Yes
HPA061–002	TPS2111A	0.63 A–1.25 A	No	Yes	Yes
HPA061–003	TPS2112A	0.31 A–0.75 A	Yes	Yes	No
HPA061–004	TPS2113A	0.63 A–1.25 A	Yes	Yes	No
HPA061–005	TPS2114A	0.31 A–0.75 A	Yes	Yes	Yes
HPA061–006	TPS2115A	0.63 A–1.25 A	Yes	Yes	Yes

### 3.2 Schematic

Figure 3–1. TPS211xAEVM Schematic



U1	R1	R2	R3	R5	Current-Limit
TPS2110A	—	10KΩ	887	332	0.31 A–0.75 A
TPS2111A	—	10KΩ	681	392	0.63 A–1.25 A
TPS2112A	10KΩ	10KΩ	887	332	0.31 A–0.75 A
TPS2113A	10KΩ	10KΩ	681	392	0.63 A–1.25 A
TPS2114A	10KΩ	—	887	332	0.31 A–0.75 A
TPS2115A	10KΩ	—	681	392	0.63 A–1.25 A



### 3.3 Bill of Materials

Table 3–2. HPA601 Bill of Materials

Ref Des	Quantity						Description	MFG	MFG Part #	Size
	–001	–002	–003	–004	–005	–006				
U1	1	0	0	0	0	0	IC, Power mux	Texas Instruments	TPS2110APW	PW–8
	0	1	0	0	0	0	IC, Power mux	Texas Instruments	TPS2111APW	PW–8
	0	0	1	0	0	0	IC, Power mux	Texas Instruments	TPS2112APW	PW–8
	0	0	0	1	0	0	IC, Power mux	Texas Instruments	TPS2113APW	PW–8
	0	0	0	0	1	0	IC, Power mux	Texas Instruments	TPS2114APW	PW–8
	0	0	0	0	0	1	IC, Power mux	Texas Instruments	TPS2115APW	PW–8
R3	1	0	1	0	1	0	Resistor, 887 $\Omega$ , 1%, 0.1 W	Panasonic	ERJ–6ENF8870	805
	0	1	0	1	0	1	Resistor, 681 $\Omega$ , 1%, 0.1 W	Panasonic	ERJ–6ENF6810	805
R5	0	1	0	1	0	1	Resistor, 392 $\Omega$ , 1%, 0.1 W	Panasonic	ERJ–6ENF3920	805
	1	0	1	0	1	0	Resistor, 332 $\Omega$ , 1%, 0.1 W	Panasonic	ERJ–6ENF3320	805
R1	0	0	1	1	1	1	Resistor, 10 K $\Omega$ , 1%, 0.1 W	Panasonic	ERJ–6ENF1002	805
R4	1	1	1	1	1	1	Resistor, Pot, 1 K $\Omega$ , 10%, 0.25 W, 12-turn	Bourns	3266W–1–102	N/A
R2	1	1	1	1	0	0	Resistor, Pot, 10 K $\Omega$ , 10%, 0.25 W, 12-turn	Bourns	3266W–1–103	N/A
C1, C2	2	2	2	2	2	2	Capacitor, 0.1 $\mu$ F, 10%, 50 V, X7R	Philips	12062R104K9B20D	1206
C3	1	1	1	1	1	1	Capacitor, tantalum, 10 $\mu$ F, 20%, 10 V	Vishay	293D106X0010B2T	B
C4–C6	3	3	3	3	3	3	Capacitor, tantalum, 100 $\mu$ F, 20%, 10 V	Vishay	293D107X0010D2T	D
J1–J8	8	8	8	8	8	8	Header, 2 pin, 0.1" center	Molex	22–03–2021	N/A
TP1–TP4, TP7	5	5	5	5	5	5	Test-point, white	Keystone	5012	N/A
TP5, TP6	2	2	2	2	2	2	Test-point, surface mount, square	Keystone	5016	N/A
J9–J11	3	3	3	3	3	3	Terminal block, 125 VAC, 6A, 2 x 3,5mm	On-Shore Tech.	ED555/2DS	N/A

Table 3-2. HPA601 Bill of Materials (continued)

Ref Des	Quantity						Description	MFG	MFG Part #	Size
	-001	-002	-003	-004	-005	-006				
REF	1	1	1	1	1	1	PCB, SLVP227A	American PCB		N/A
REF	4	4	4	4	4	4	Bumper, rubber, PSA, black	SPC Technology	SPC2568	N/A
REF	5	5	5	5	5	5	Shorting jumper, 10 $\mu$ -inch gold	3M	929955-06	N/A

# Board Layout

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This chapter describes the TPS211xAEVM board layout and presents some component placement considerations.

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## 4.1 Layout Considerations

The IN1, IN2, and OUT pins of the TPS211xA can carry up to 1 A, so traces to these pins should be of suitable length and width to minimize the voltage drop to the load. Locate the 0.1  $\mu\text{F}$  bypass capacitors close to the IN1, IN2, and GND pins of the TPS211xA.

Figure 4–1. Component Placement

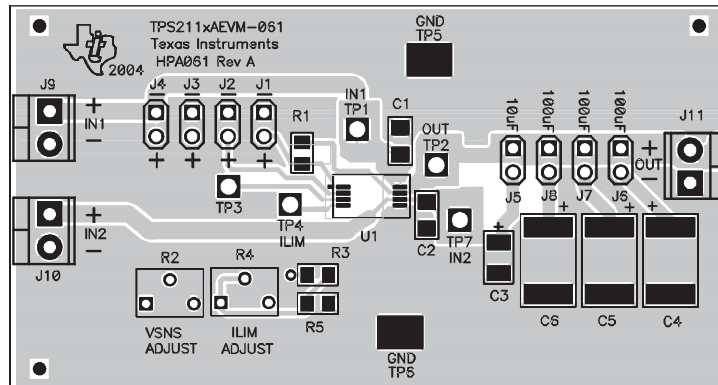


Figure 4–2. Top-Side Layout

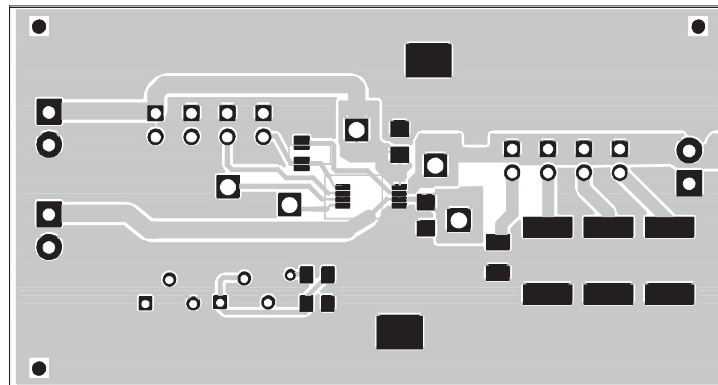


Figure 4–3. Bottom-Side Layout

