TPS62230EVM-370 User's Guide

This user's guide describes the characteristics, operation, and use of the TPS62230EVM-370 evaluation module (EVM). This EVM demonstrates three individual configurations of the Texas Instruments TPS62230 3-MHz, synchronous step-down converter capable of supplying up to 500 mA of output current. This user's guide includes setup instructions, a schematic diagram, a bill of materials, and printed-circuit board layout drawings for the evaluation module.

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1 Introduction

The Texas Instruments TPS62230EVM-370 evaluation module helps designers evaluate the operation and performance of the TPS62230 family of devices. These devices are high-efficiency, ultra-small size, buck converters that switch at 3 MHz.

The EVM contains three independent dc/dc converters. Table 1 lists the default output voltages of the converters.

Table 1. Device and Output Voltage Configurations

Converter	Integrated Circuit	Output Voltage
U11	TPS62230DRY	2.5 V
U21	TPS62231DRY	1.8 V
U31	TPS62232DRY	1.2 V

See the data sheet (SLVS941) for the various fixed output voltage options available in the TPS62230 device family.

2 Setup

This section describes the jumpers and connectors on the EVM and how to properly connect, set up, and use the TPS62230EVM-370.

2.1 Input/Output Connector Descriptions

2.1.1 J11 , J21, and J31 – VIN

This is the positive input connection to the corresponding converter. Twist the leads to the input supply, and keep as short as possible to minimize EMI transmission.

2.1.2 J13 , J23, and J33 – GND

This is the return connection for the input power supply for the corresponding converter.

2.1.3 J12, J22, and J32 – Input Sense

This connection provides monitoring for input voltage using independent traces to the input capacitor.

2.1.4 J14, J24, and J34 – VOUT

This is the positive connection from the output of the corresponding buck power supply.

2.1.5 J16 , J26, and J36 – GND

This is the negative connection from the output of the corresponding buck power supply.

2.1.6 J15, J25, and J35 – Output Sense

This connection provides monitoring for output voltage using independent traces to the output capacitor.

2.1.7 JP11, JP21, JP31 – ENABLE

This jumper enables or disables the converter through the IC EN pin. Connect the shorting jumper from the center (EN) pin to either the ON or OFF position. Never leave EN floating.

2.1.8 JP12, JP22, and JP32 – Mode

This jumper is used to select the operating mode of the converter. The converter operates in a fixed-frequency, low-noise, PWM mode when a jumper is used to short the MODE pin to the ON pin. Shorting the MODE pin and OFF pin together allows the controller to use the power-saving (PFM) mode for high efficiency at low output currents.

2.2 Converter Configurations

All converters are designed to use an input voltage between 2.05 V and 6 V. But the input voltage must be higher than the output voltage in order to maintain voltage regulation, and U11 requires 2.5-V minimum input. Connect the input voltage power supply and output according to Table 2.

Table 2. Input and Output Connections

Converter No.	Output Voltage	Signal	Connection
U11	2.5 Vdc Fixed	Positive Input Voltage	J11
		Input Voltage Return	J13
		Positive Output Voltage	J14
		Output Voltage Return	J16
U21	1.8 Vdc Fixed	Positive Input Voltage	J21
		Input Voltage Return	J23
		Positive Output Voltage	J24
		Output Voltage Return	J26
U31	1.2 Vdc Fixed	Positive Input Voltage	J31
		Input Voltage Return	J33
		Positive Output Voltage	J34
		Output Voltage Return	J36

2.3 Operation

The ENABLE jumper and the MODE jumper must be configured for proper operation of the converter.

For ENABLE, the converter enable uses a shorting block to set the JPX1 header to the desired configurations. Each converter has its own header: JP11 for U11, JP21 for U21, and JP31 for U31. The converters are shut down when the EN pin is pulled low; this is the ENABLE-to-OFF connection. The converters are in operate mode when the EN pin is pulled high; this is the ENABLE-to-ON connection. Do not leave the EN pin floating.

The MODE header, JPX2, controls the device power-save mode option. This mode changes the operation at light loads; it has no impact at mid-to-high loads . The device can operate in the low-noise, fixed-frequency PWM mode or high-efficiency, power-saving PFM mode at low power. Each converter has its own mode header: JP12 for U11, JP22 for U21, and JP32 for U31. The converters are in PWM mode when the MODE pin is pulled high; this is the MODE-to-ON connection. The converters operate in PFM mode when the MODE pin is pulled low; this is the MODE-to-OFF connection. Do not leave the MODE pin floating.

2.4 Test Results

See the Typical Characteristics section of the TPS62230 data sheet. This EVM uses the same inductors and similar capacitors as those used for characterization in the data sheet. Performance is consistent with that shown in the data sheet.

3 Board Layout

This section provides the TPS62230EVM-370 board layout and illustrations.

Board layout is critical for all high-frequency, switch-mode power supplies. Figure 1, Figure 2, and Figure 3 show the board layout for the TPS62230EVM-370 printed-circuit board. The nodes with high-switching frequencies and currents are kept as short as possible to minimize trace inductance. High-impedance inputs to the TPS62230, such as the Vout pin, have traces that are shielded by ground traces and planes. Careful attention has been given to the routing of high-frequency current loops, and a single-point grounding scheme is used. See the data sheet for specific layout guidelines. Input and output capacitors must be kept as close as possible to the device. A large bulk input capacitor (C13, C23, and C33) is provided to compensate for impedance in long input leads.

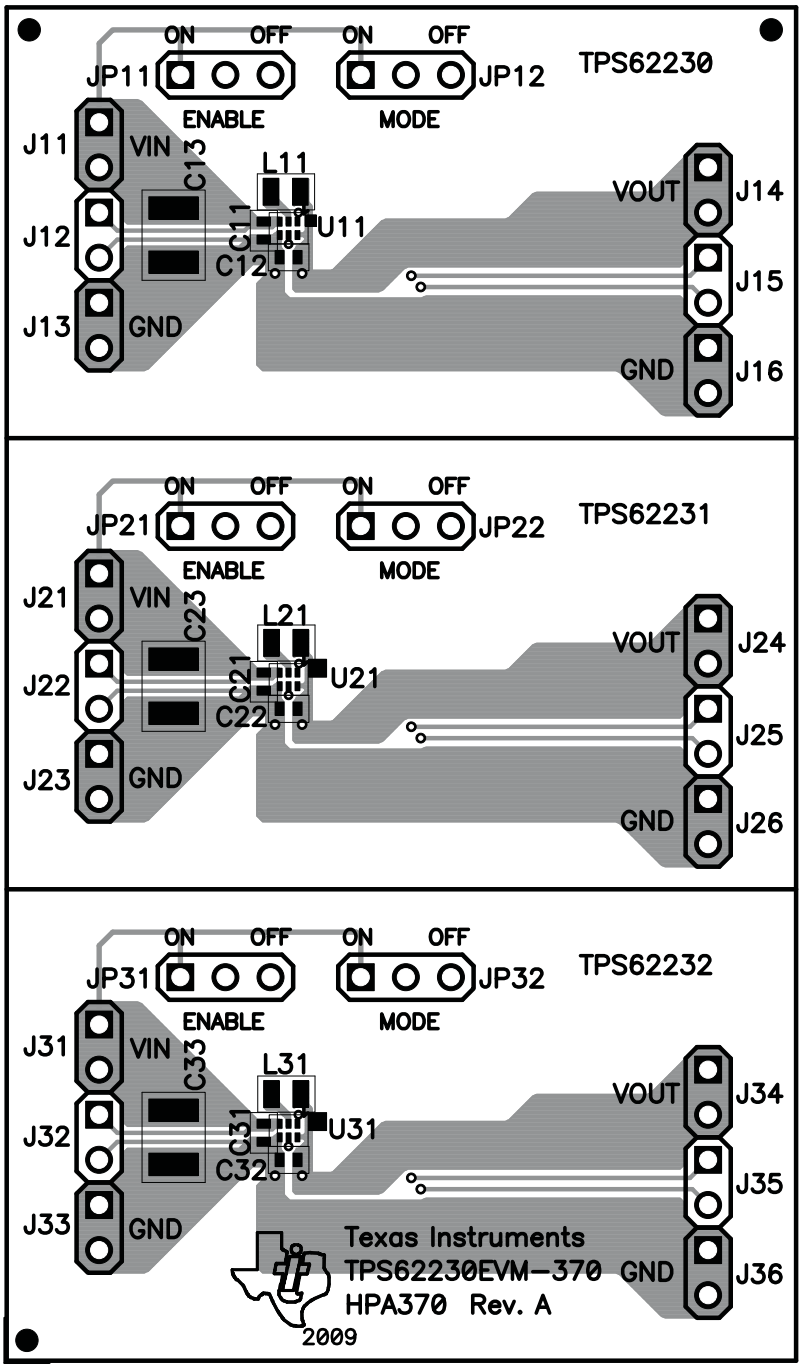


Figure 1. Assembly Layer

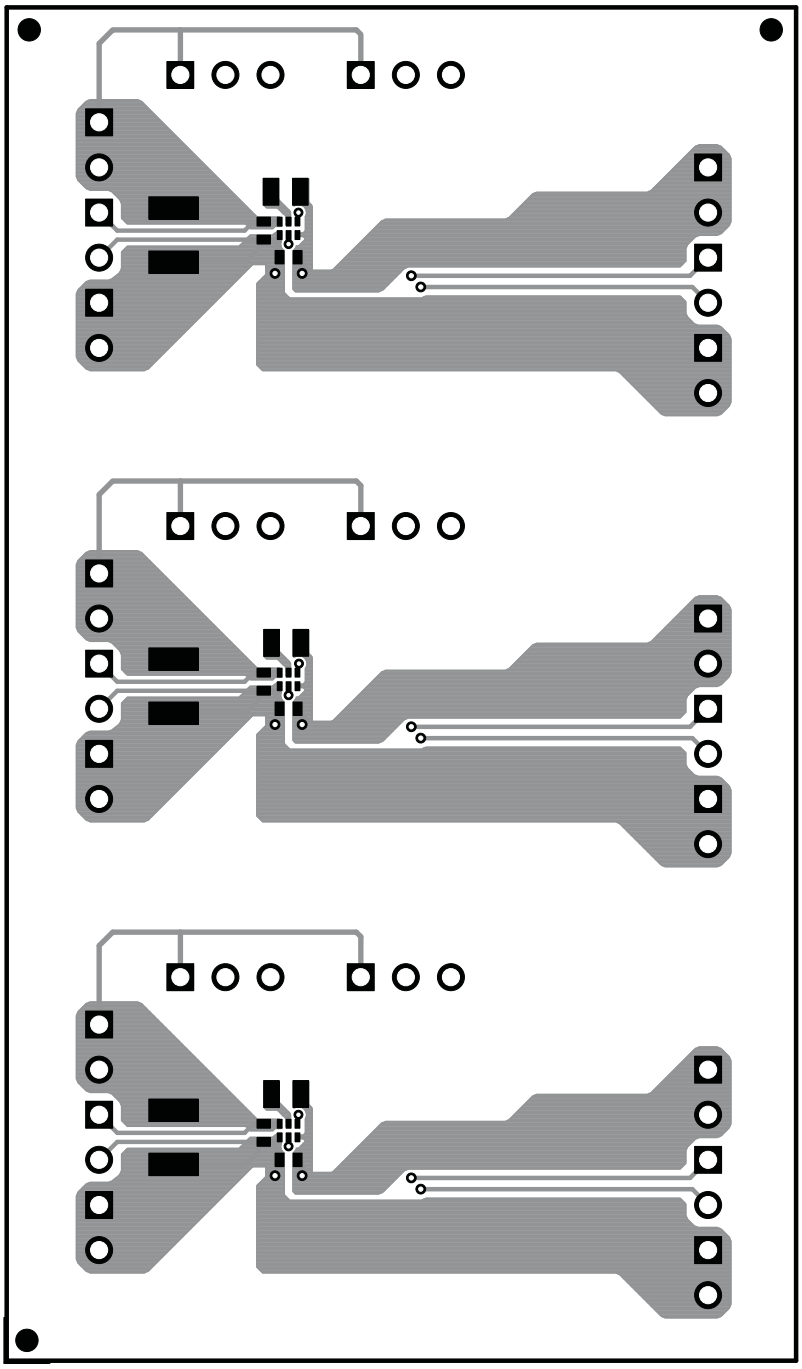


Figure 2. Top Layer Routing

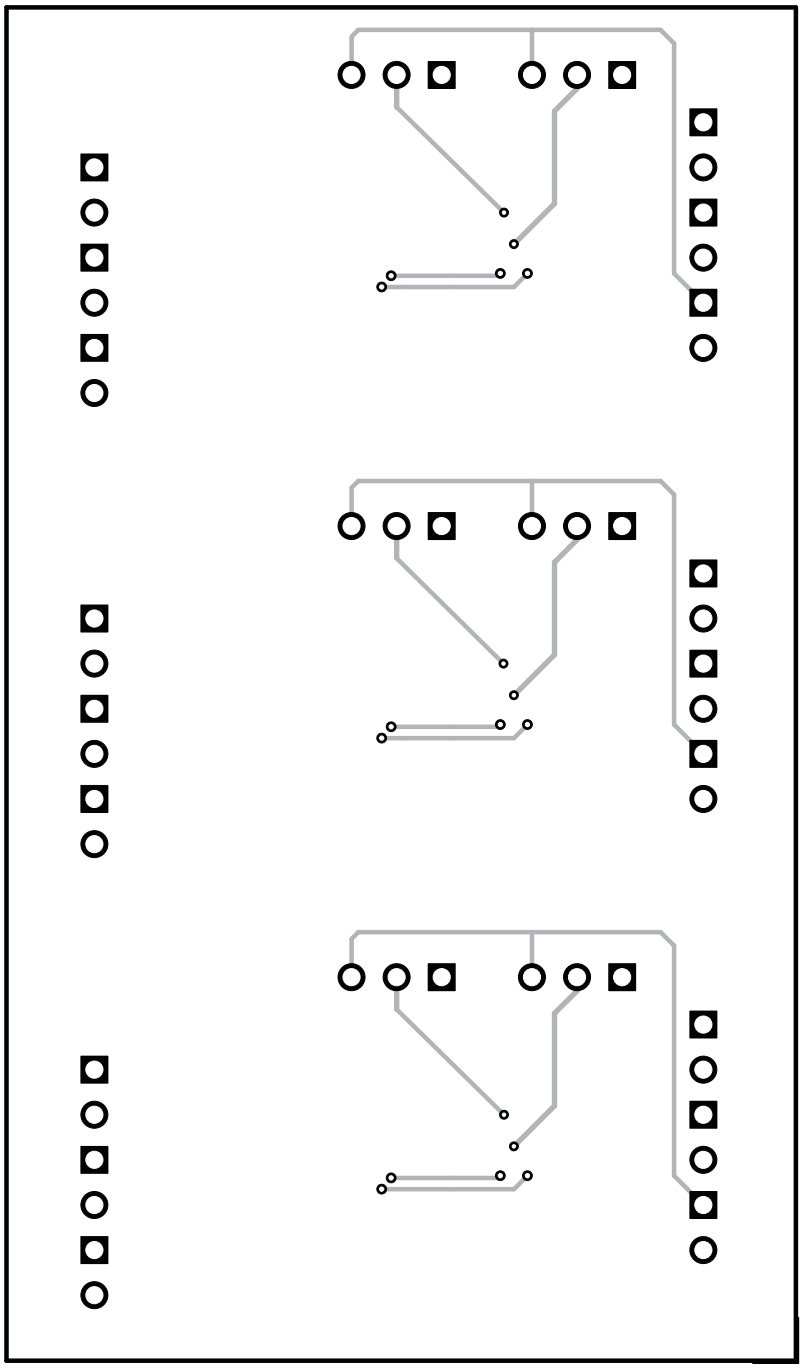


Figure 3. Bottom Layer Routing

4 Schematic and Bill of Materials

This section provides the TPS62230EVM-370 schematic and bill of materials.

4.1 Schematic

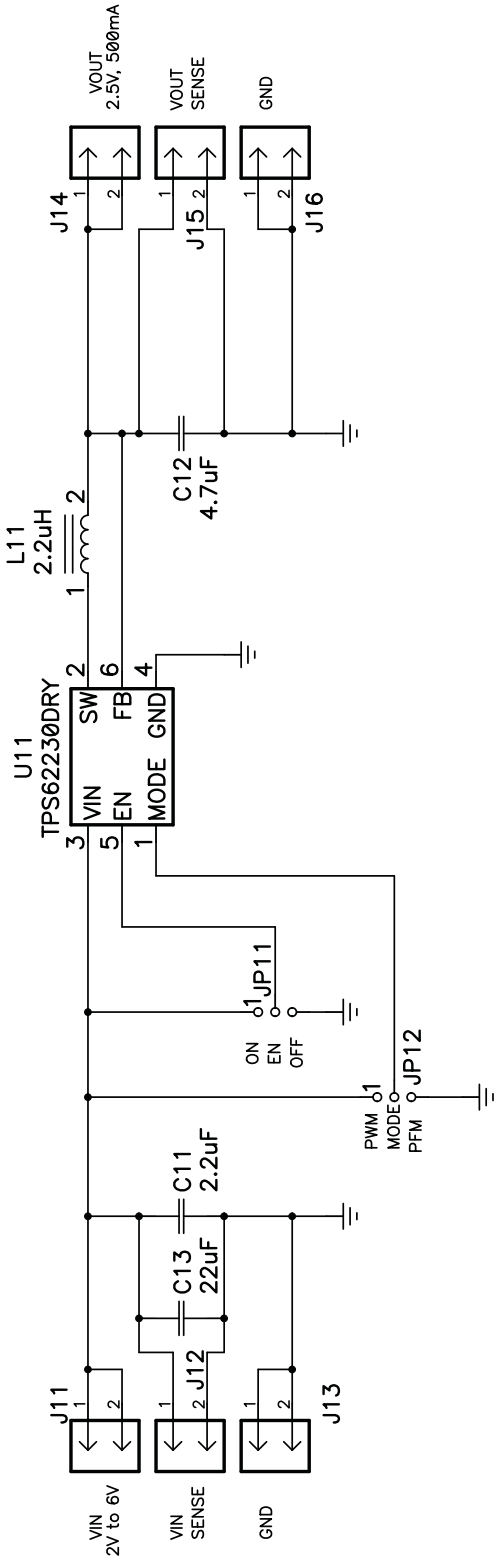


Figure 4. TPS62230EVM-370 Schematic, U11 Section

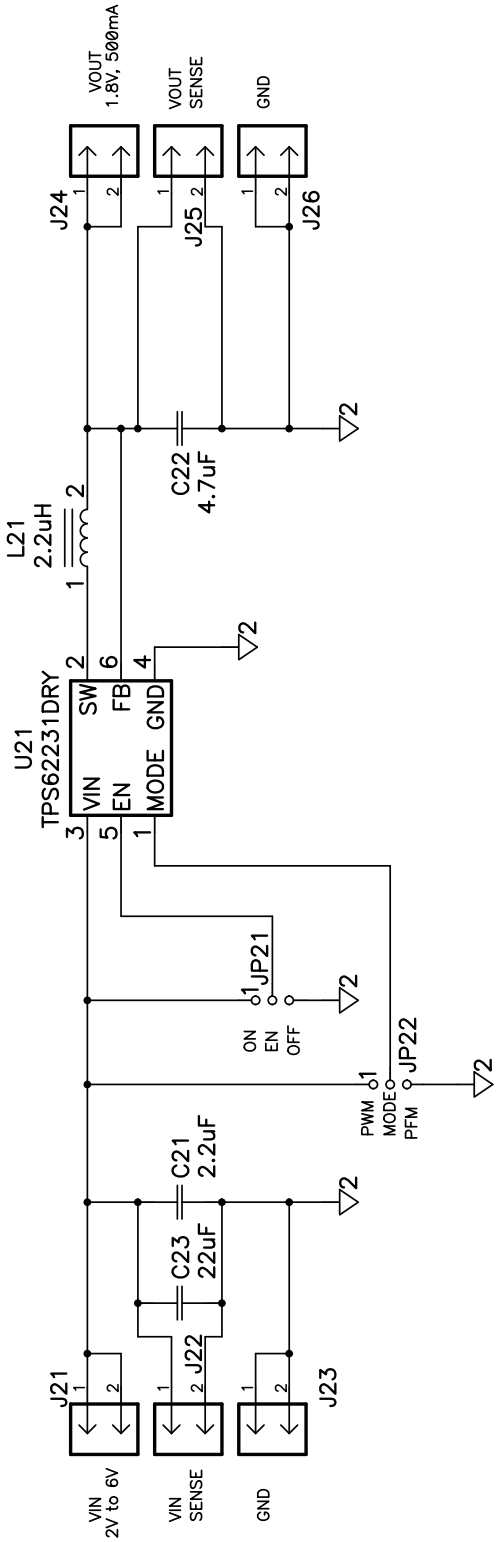


Figure 5. TPS62230EVM-370 Schematic, U21 Section

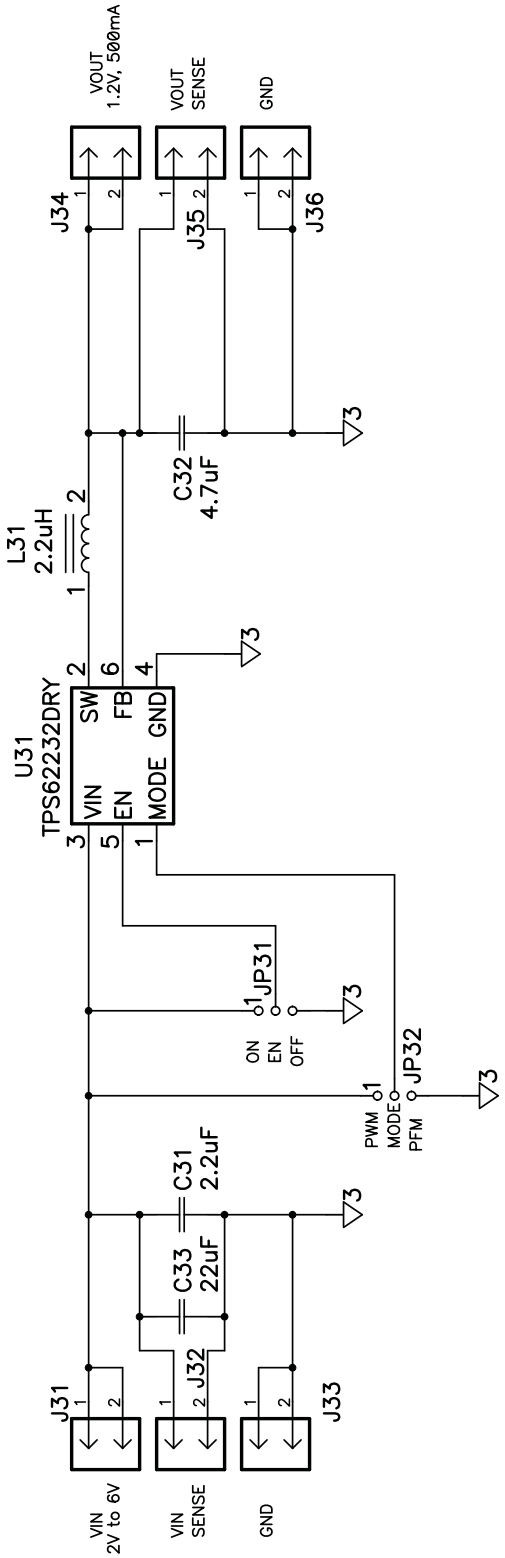


Figure 6. TPS62230EVM-370 Schematic, U31 Section

4.2 Bill of Materials

Table 3. TPS62230EVM-370 Bill of Materials

COUNT	RefDes	Value	Description	Size	Part Number	MFR
3	C11,C21,C31	2.2µF	Capacitor, Ceramic, 6.3V, X5R, 20%	0402	CL05A225MQ5NNNC	Samsung
3	C12,C22,C32	4.7µF	Capacitor, Ceramic, 6.3V, X5R, 20%	0402	CL05A475MQ5NRNC	Samsung
3	C13, C23, C33	22µF	Capacitor, Ceramic, 10V, X5R, 20%	1210	Std	Vishay
18	J11, J12, J13, J14, J15, J16, J21, J22, J23, J24, J25, J26, J31, J32, J33, J34, J35, J36	PEC02SAAN	Header, Male 2-pin, 100mil spacing	0.100 inch x 2	PEC02SAAN	Sullins
6	JP11, JP12, JP21, JP22, JP31, JP32	PEC03SAAN	Header, 3 pin, 100mil spacing	0.100 x 3	PEC03AAN	Sullins
3	L11,L21,L31	2.2µH	Inductor, SMT, 0.7A, 230-milliohm	0805	MIPSZ20120D2R2	FDK
1	U11	TPS62230DRY	IC, 3MHz Ultra Small Step Down Converter, 2.5 V	QFN	TPS62230DRY	TI
1	U21	TPS62231DRY	IC, 3MHz Ultra Small Step Down Converter, 1.8 V	QFN	TPS62231DRY	TI
1	U31	TPS62232DRY	IC, 3MHz Ultra Small Step Down Converter, 1.2 V	QFN	TPS62232DRY	TI
6	--		Shunt, 100-mil, Black	0.100	929950-00	3M
1			PCB	1.75x3.0x0.062"	HPA370	Any

5 Related Documentation From Texas Instruments

TPS62230, TPS62231, TPS62232, 3 MHz Ultra Small Step Down Converter in 1x1.5 SON Package data sheet (SLVS941)

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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 2.05 V to 6 V and the output voltage range of 1.2 V to 2.5 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 25°C. The EVM is designed to operate properly with certain components above 25°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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