TPS53125EVM-599

The TPS53125EVM-599 Evaluation Module presents an easy-to-use reference design for a common dual output power supply using the TPS53125 controller in cost-sensitive applications. Also included are the schematic, board layout, and bill of materials.

Contents

List of Figures

D-CAP2 is a trademark of Texas Instruments.

List of Tables

1 Description

The TPS53125EVM-599 evaluation board provides the user with a convenient way to evaluate the TPS53125 Dual Synchronous Step-Down Controller in a realistic cost-sensitive application. Providing both a low core-type 1.05-V and I/O-type, 1.8-V outputs at up to 4 A from a loosely regulated 12-V (8-V to 22-V) source, the TPS53125EVM-599 includes switches and test points to assist users in evaluating the performance of the TPS53125 controller in their applications.

1.1 Applications

- Digital television
- Set-top box
- DSL and cable modems
- Cost-sensitive digital consumer products

1.2 Features

- 8-V to 22-V input
- 1.05-V and 1.8-V outputs
- Up to 4 A per channel output
- 350-kHz pseudo-fixed frequency D-CAP2™ mode control
- Independent enable switches for power-on/power-off testing

2 TPS53125EVM-599 Electrical Performance Specifications

Table 1. TPS53125EVM-599 Electrical and Performance Specifications

Parameter		Notes and Conditions	Min	Typ	Max	Unit
Input Characteristics						
V_{IN}	Input Voltage		8	12	22	V
I_{IN}	Input Current	V_{IN} = 12 V, I_{OUT1} = 4 A, I_{OUT2} = 4 A	–	1.2	1.5	A
	No Load Input Current	V_{IN} = 12 V, I_{OUT} = 0 A	–	20	35	mA
V_{IN_UVLO}	Input UVLO	I_{OUT} = 4	4.0	4.2	4.5	V
Output Characteristics						
V_{OUT1}	Output Voltage 1	V_{IN} = 12 V, I_{OUT} = 2 A	1.03	1.05	1.07	V
	Line Regulation	V_{IN} = 8 to 22	–	–	1%	
	Load Regulation	I_{OUT} = 0 A to 4 A	–	–	1%	
V_{OUT1_rip}	Output Voltage Ripple	V_{IN} = 12 V, I_{OUT} = 4 A	–	–	30	mVpp
I_{OUT1}	Output Current 1	V_{IN} = 8 V to 22 V	0		4	A
V_{OUT2}	Output Voltage 2	V_{IN} = 12 V, I_{OUT} = 2 A	1.78	1.80	1.82	V
	Line Regulation	V_{IN} = 8 V to 22 V	–	–	1%	
	Load Regulation	I_{OUT} = 0 A to 4 A	–	–	1%	
V_{OUT2_rip}	Output Voltage Ripple	V_{IN} = 12 V, I_{OUT2} = 4 A	–	–	30	mVpp
I_{OUT2}	Output Current 2	V_{IN} = 8 V to 22 V	0		4	A
Systems Characteristics						
F_{SW}	Switching Frequency		200	350	400	kHz
ηpk	Peak Efficiency	V_{IN} =12	–	88%	–	
η	Full Load Efficiency	V_{IN} = 12, I_{OUT1} = I_{OUT2} = 4 A	–	80%	–	

3   TPS53125EVM-599 Schematic
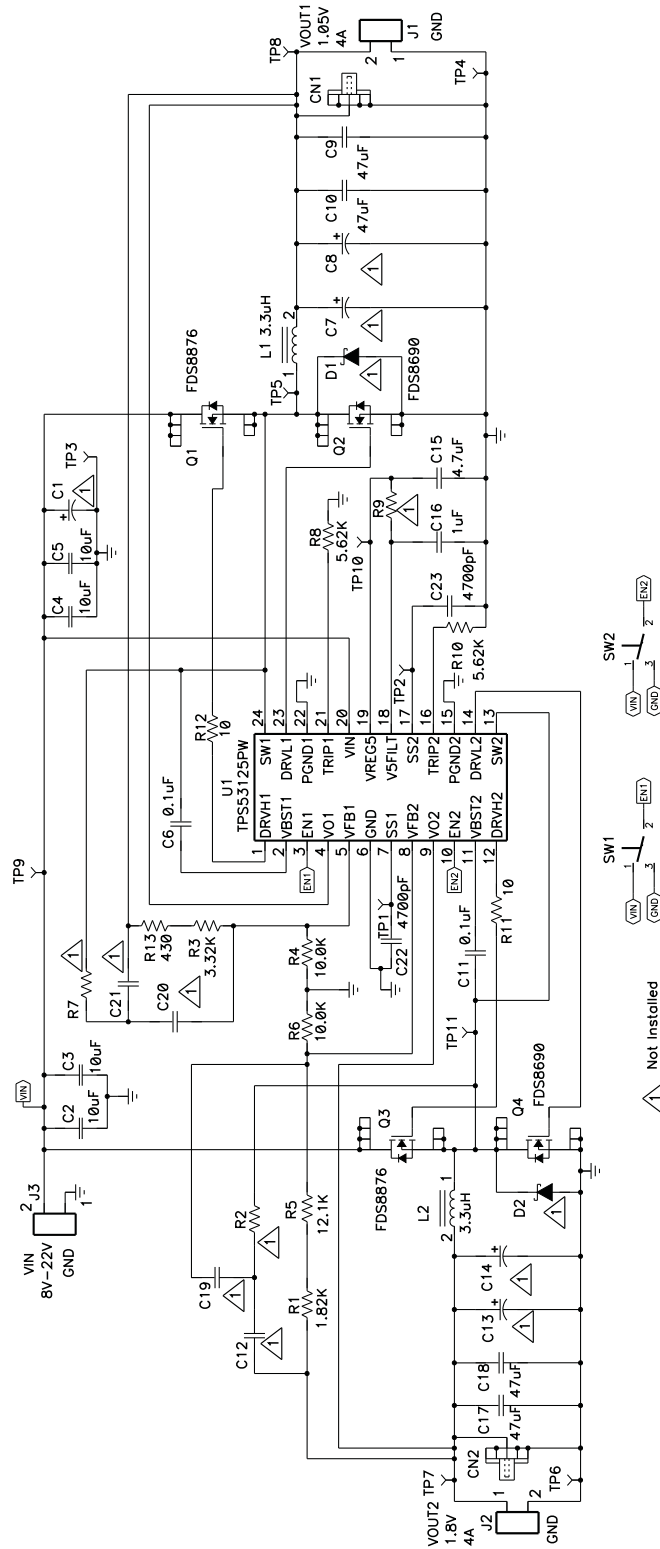
For Reference Only, See Table x: for Specific Values

Figure 1. TPS53125EVM-599 Schematic

4 Connector and Test Point Descriptions

4.1 Enable Jumpers/Switches –SW1 and SW2

The TPS53125EVM-599 board includes independent enable switches for each of the two outputs. When the switch is in the DIS position, the channel is disabled and discharged per the TPS53125's internal discharge characteristics.

To enable VOUT1, place SW1 in the EN position. To enable VOUT2, place SW2 in the EN position.

4.2 Test Point Descriptions

Table 2 lists the test points, their labels, uses, and where additional information is located.

Table 2. Test Point Description

Test Point	Label	Use	Section
TP1	TEST1	Monitor Channel 1 Soft-Start Voltage	4.2.4
TP2	TEST2	Monitor Channel 2 Soft-Start Voltage	4.2.4
TP3	GND	Ground for Input Voltage	4.2.1
TP4	GND	Ground for Channel 1 Output Voltage	4.2.2
TP5	SW1	Monitor Switching Node for Channel 1	4.2.5
TP6	GND	Ground for Channel 2 Output Voltage	4.2.3
TP7	VO2	Monitor Output Voltage for Channel 2	4.2.3
TP8	VO1	Monitor Output Voltage for Channel 1	4.2.2
TP9	VIN	Monitor Input Voltage	4.2.1
TP10	VREG5	Monitor Output of VREG5 Regulator	4.2.6
TP11	SW2	Monitor Switching Node for Channel 2	4.2.5
CN1	VOUT1	Monitor Output Voltage for Channel 1	4.2.2
CN2	VOUT2	Monitor Output Voltage for Channel 2	4.2.3

4.2.1 Input Voltage Monitoring – TPS and TP9

The TPS53125EVM-599 provides two test points for measuring the voltage applied to the module. This allows the user to measure the actual module voltage without losses from input cables and connectors. Measure all input voltage measurements between TP9 and TP3. To use TP9 and TP3, connect a voltmeter positive terminal to TP9 and negative terminal to TP3.

4.2.2 Channel 1 Output Voltage Monitoring – TP4 and TP8 or CN1

TPS53125EVM-599 provides two test points for measuring the voltage generated at the VO1 Output by the module. This allows the user to measure the actual output voltage without losses from output cables and connectors. Measure all DC Output voltage between TP8 and TP4. To use TP8 and TP4, connect a voltmeter positive terminal to TP8 and negative terminal to TP4.

TPS53125EVM-599 also provides a shielded oscilloscope jack to allow ac measurements of the output ripple. Insert an oscilloscope probe with exposed ground barrel into CN1 for all Output 1 ripple measurements.

4.2.3 Channel 2 Output Voltage Monitoring – TP6 and TP7 or CN2

TPS53125EVM-599 provides two test points for measuring the voltage generated at the VO1 Output by the module. This allows the user to measure the actual output voltage without losses from output cables and connectors. Measure all dc output voltage measurements between TP7 and TP6. To use TP7 and TP6, connect a voltmeter positive terminal to TP7 and negative terminal to TP6.

TPS53125EVM-599 also provides a shielded oscilloscope jack to allow ac measurements of the output ripple. Insert an oscilloscope probe with exposed ground barrel into CN2. for all Output 2 ripple measurements.

4.2.4   Soft-Start Voltage Monitoring – TP1, TP2, and TP3

TPS53125EVM-599 provides two test points for measuring the soft-start ramp voltages. TP1 monitors the soft-start ramp of Channel 1. TP2 monitors the soft-start ramp of Channel 2. To use TP1 or TP2, connect an oscilloscope probe between TP1 or TP2 and TP3.

4.2.5   Switching Node Monitoring – TP3, TP5, and TP11

TPS53125EVM-599 provides two test points for measuring the switching node waveform voltages. TP5 monitors the switching node of Channel 1. TP2 monitors the switching node of Channel 2. To use TP5 or TP11, connect an oscilloscope probe between TP5 or TP11 and TP3

4.2.6   5-V Regulator Output Monitoring – TP3 and TP10

TPS53125EVM-599 provides a test point for measuring the output of the internal 5-V regulator. TP10 monitors the output voltage of the internal 5-V regulator. To use TP10, connect a voltmeter positive terminal to TP10 and negative terminal to TP3.

5   Test Setup

5.1   Equipment

The following equipment is recommended for testing the TPS53125EVM-599 evaluation board.

5.1.1   Voltage Source

The input voltage source, V_{VIN}, must be a 0-V to 15-V, variable dc source capable of supplying 3 Adc minimum.

5.1.2   Meters

A1: 0-Adc to 4-Adc ammeter

V1: VIN, 0-V to 22-V voltmeter

V2: VOUT1, 0-V to 2-V voltmeter

V3: VOUT2, 0-V to 2-V voltmeter

5.1.3   Loads

LOAD1: One output load is an electronic load set for constant current mode capable of 0 Adc to 4 Adc at 1.05 Vdc.

LOAD2: The other output load is an electronic load set for constant current mode capable of 0 Adc to 4 Adc at 1.8 Vdc.

5.1.4   Oscilloscope and Probe

The oscilloscope, analog or digital, must be set for ac-coupled measurement with a 20-MHz bandwidth limiting. Use 20 mV/division vertical resolution, 1.0 µs/division horizontal resolution for the Output Ripple Voltage Test. Set cursors at +20 mV and –20 mV.

The oscilloscope probe must be a Tektronix P6138 or equivalent oscilloscope probe with exposed conductive ground barrels.

5.1.5   Recommended Wire Gauge

V_{VIN} **to J3** – The connection between the source voltage, V_{VIN} and J1 of TPS53125EVM-599 can carry as much as 2 Adc. The minimum recommended wire size is AWG #16 with the total length of wire less than 2 feet (1-foot input, 1-foot return).

J1 to LOAD1 and J2 to LOAD2 - The connection between J1 and LOAD1 and J2 and LOAD2 of TPS53125EVM-599 can carry as much as 4 Adc each. The minimum recommended wire size is AWG #14, with the total length of wire less than 2 feet (1-foot input, 1-foot return).

5.1.6   Other Test Equipment

Fan – The TPS53125EVM-599 Evaluation Module includes components that can become hot to the touch. Because this EVM is not enclosed to allow probing of circuit nodes, a small fan capable of 200-400 lfm is required to reduce component temperatures when operating.

5.2   *Equipment Setup*

Figure 2 shows the basic test setup that is recommended to evaluate the TPS53125EVM-599. Note that although the return for J3 and J1 and JP2 are the same system ground, the connections must remain separate as shown in Figure 2.

5.2.1   Test Procedure

1. When working at an ESD workstation, ensure that wrist straps, bootstraps, or mats are connected referencing the user to earth ground before power is applied to the EVM. Electrostatic smock and safety glasses are also recommended.
2. Prior to connecting the dc input source, V_{IN}, it is advisable to limit the source current from V_{IN} to 3 Adc maximum. Ensure that V_{IN} is initially set to 0 V and connected as shown in Figure 2.
3. Verify SW1 and SW2 are in the desired position.
4. Increase VIN from 0 V to 12 Vdc.
5. Vary VIN between 8 Vdc and 22 Vdc.
6. Vary LOAD1 between 0 A and 4 Adc.
7. Vary LOAD2 between 0 A and 4 Adc.
8. Adjust SW1 between EN and DIS.
9. Adjust SW2 between EN and DIS.
10. Set SW1 to DIS.
11. Set SW2 to DIS.
12. Decrease LOAD1 to 0 A.
13. Decrease LOAD2 to 0 A.
14. Decrease VIN to 0 V.
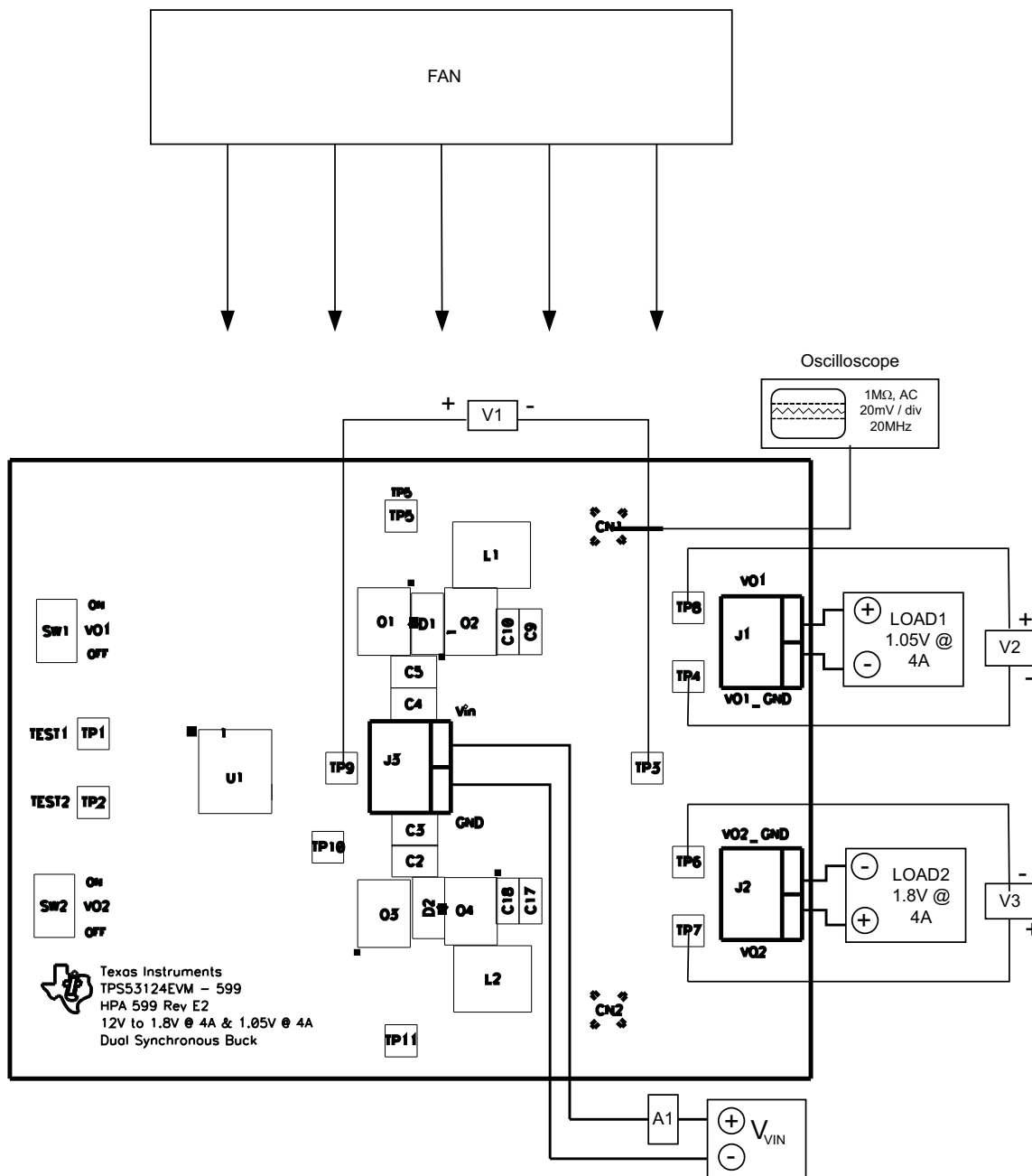
5.2.2   Test Setup Diagram

Figure 2. TPS53125EVM-599 Recommended Test Setup

5.3   *Start-Up/Shutdown Procedures*

Perform the start-up and shutdown procedures in the following manner.

1. Increase V_{IN} from 0 V to 12 Vdc.
2. Vary LOAD1 from 0 V – 4 Adc.
3. Vary LOAD2 from 0 V – 4 Adc.
4. Vary V_{IN} from 8 Vdc to 22 Vdc.
5. Decrease V_{IN} to 0 Vdc.
6. Decrease LOAD1 to 0 A.

7. Decrease LOAD2 to 0 A.

5.4 *Output Ripple Voltage Measurement Procedure*

Perform the Output Ripple Voltage Measurement procedure in the following manner.

1. Increase V_{IN} from 0 V to 12 Vdc.
2. Adjust LOAD1 to desired load between 0 Adc and 4 Adc.
3. Adjust LOAD2 to desired load between 0 Adc and 4 Adc.
4. Adjust V_{IN} to desired load between 8 Vdc and 22 Vdc.
5. Connect oscilloscope probe to CN1 or CN2 shown in Figure 2.
6. Measure Output Ripple.
7. Decrease V_{IN} to 0 Vdc.
8. Decrease LOAD1 to 0 A.
9. Decrease LOAD2 to 0 A.

5.5 *Equipment Shutdown*

Shut down the equipment in the following manner.

1. Shut down oscilloscope.
2. Shut down V_{IN}.
3. Shut down LOAD1.
4. Shut down LOAD2.
5. Shut down FAN.

6   TPS53125EVM-599 Test Data

Figure 3 through Figure 10 present typical performance curves for the TPS53125EVM-599. Because actual performance data can be affected by measurement techniques and environmental variables, these curves are presented for reference and may differ from actual field measurements.

6.1 *Efficiency*
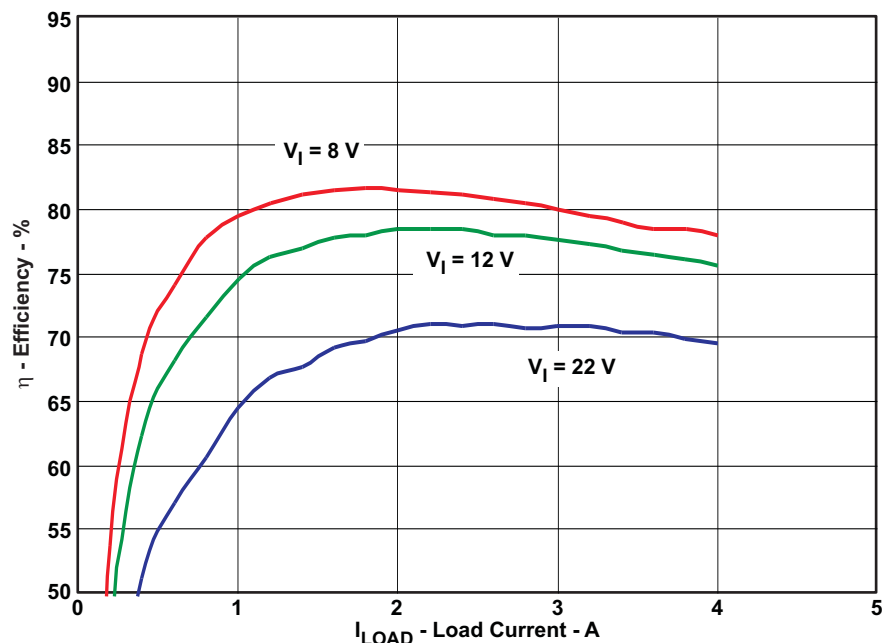
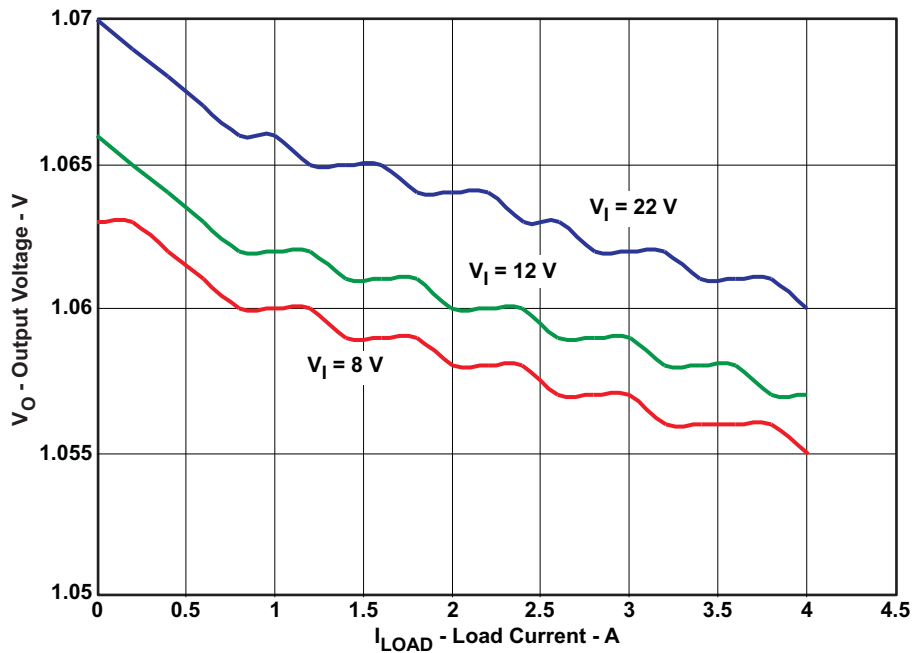V_{IN} = 8 V − 22 V, V_{OUT1} = 1.05 V, I_{OUT1} = 0 A − 4 A

Figure 3. TPS53125EVM-599 Efficiency vs Load Current
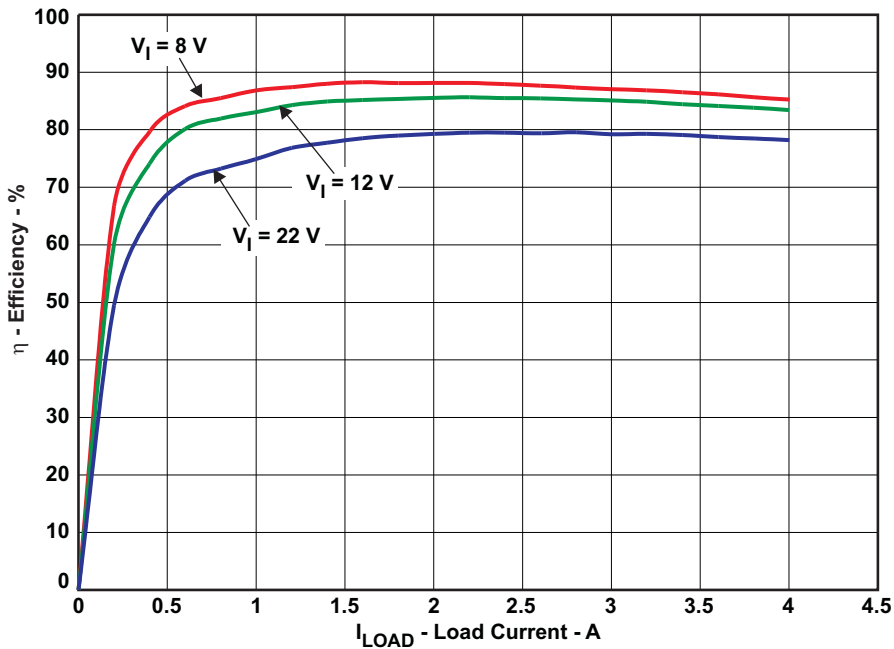
V_{IN} = 8 V – 22 V, V_{OUT2} = 1.80 V, I_{OUT2} = 0 A – 4 A

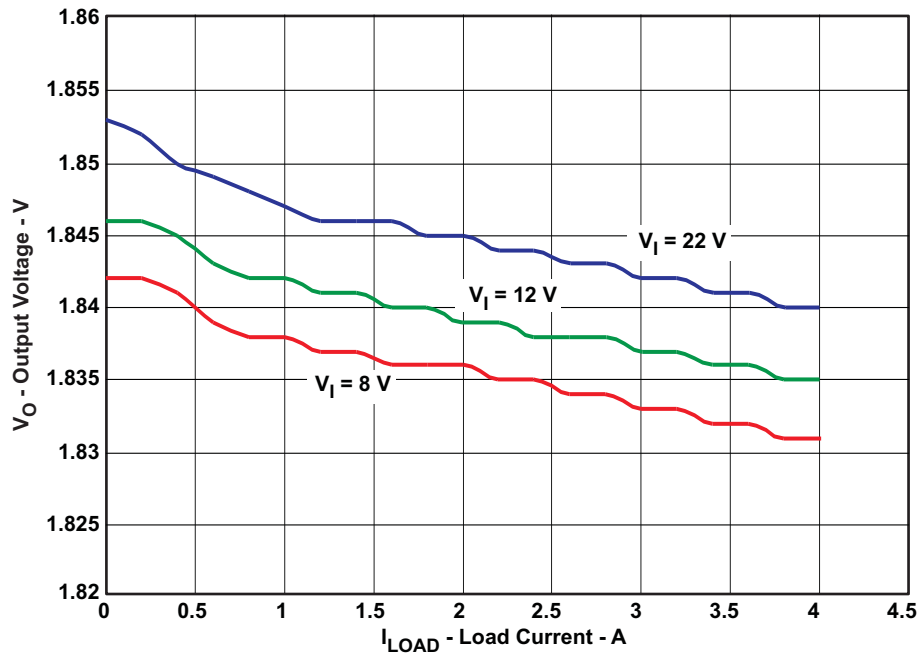**Figure 4. TPS53125EVM-599 Efficiency vs Load Current**

6.2 Line and Load Regulation

V_{IN} = 8 V – 22 V, V_{OUT1} = 1.05 V, I_{OUT} = 0 A – 4 A

Figure 5. TPS53125EVM-599 Output Voltage vs Load Current

V_{IN} = 8 V – 22 V, V_{OUT1} = 1.80 V, I_{OUT} = 0 A – 4 A

Figure 6. TPS53125EVM-599 Output Voltage vs Load Current

6.3 *Output Voltage Ripple and Switching Node Waveforms*
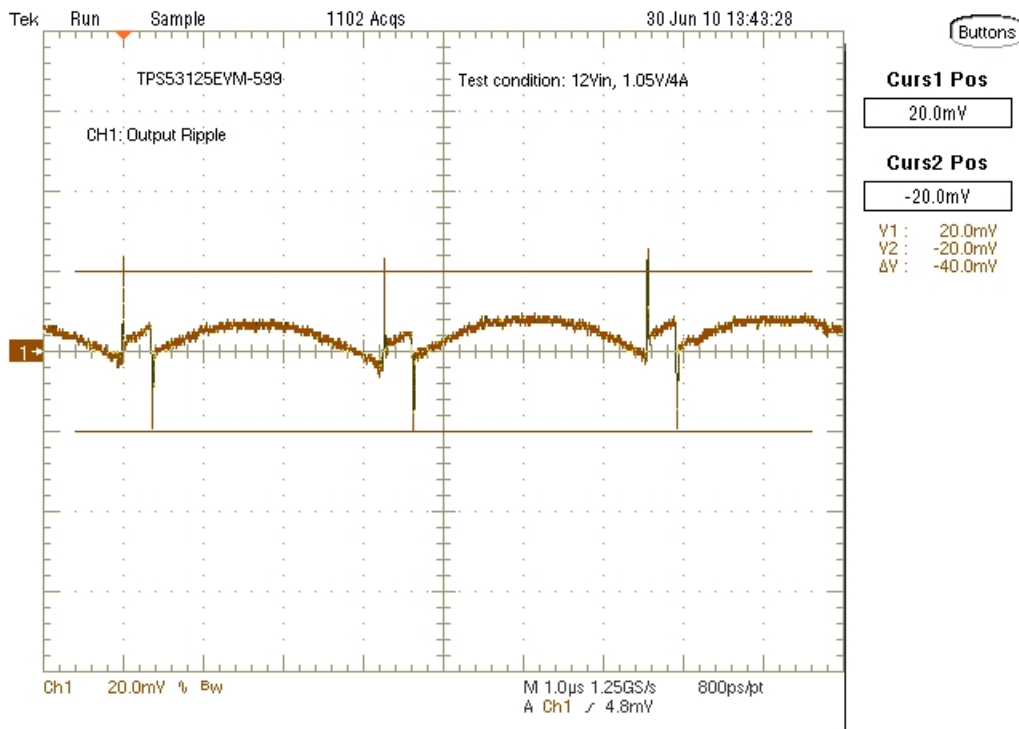
V_{IN} = 12, V_{OUT1} = 1.05, I_{OUT1} = 4 A

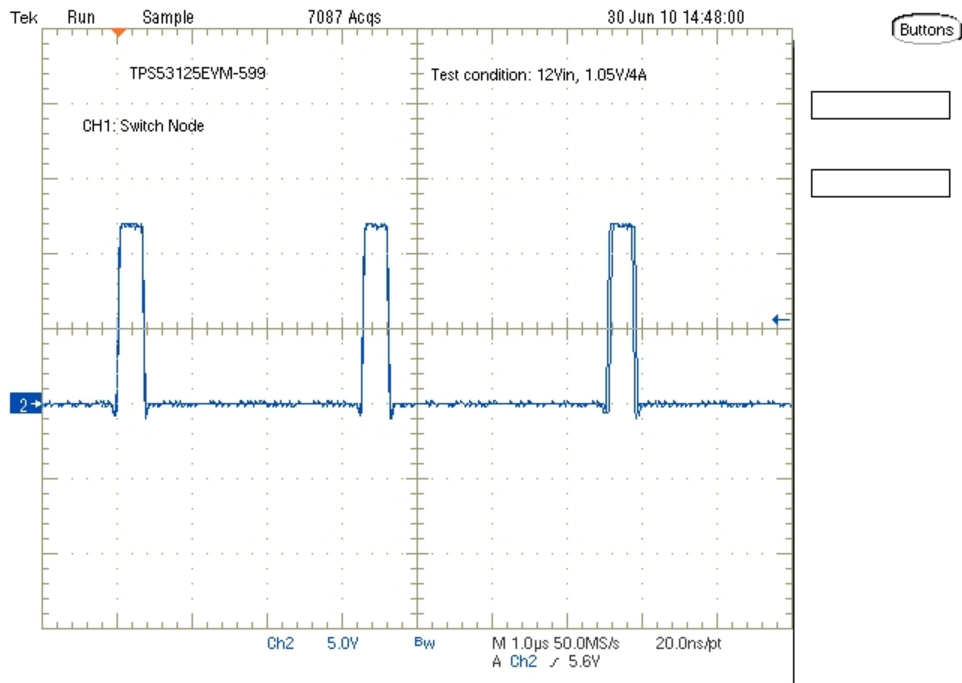**Figure 7. TPS53125EVM-599 Output Voltage Ripple and Switching Waveform**
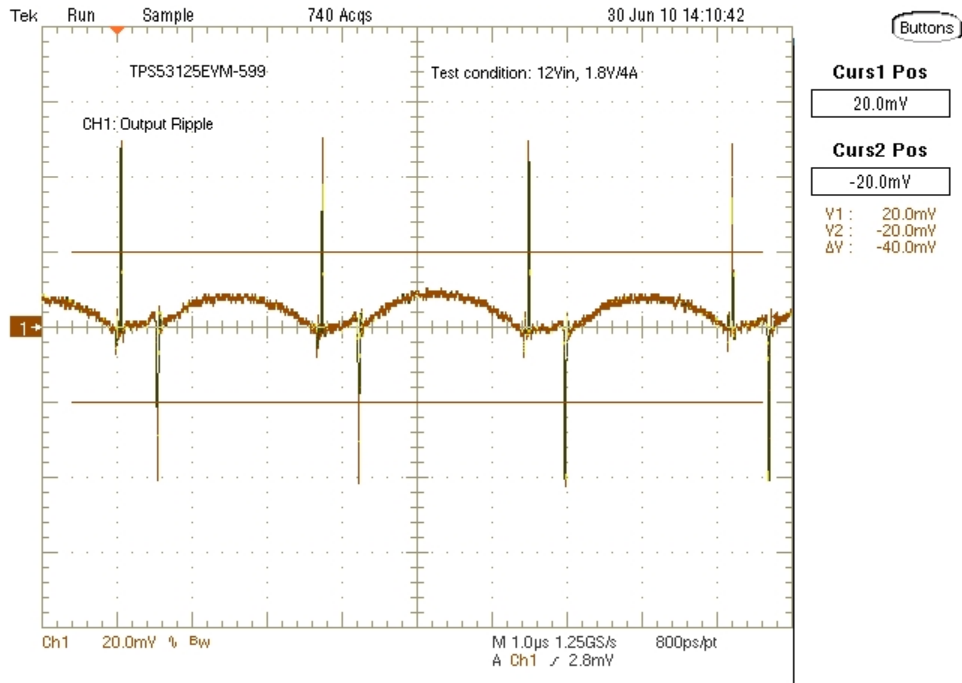
V_{IN} = 12, V_{OUT2} = 1.80, I_{OUT2} = 4 A

Figure 8. TPS53125EVM-599 Output Voltage Ripple

6.4 Switch Node

tV_{IN} = 12, V_{OUT1} = 1.05, I_{OUT1} = 4A,
Ch1: TP5 (SW1)

Figure 9. TPS53125EVM-599 Switching Waveforms
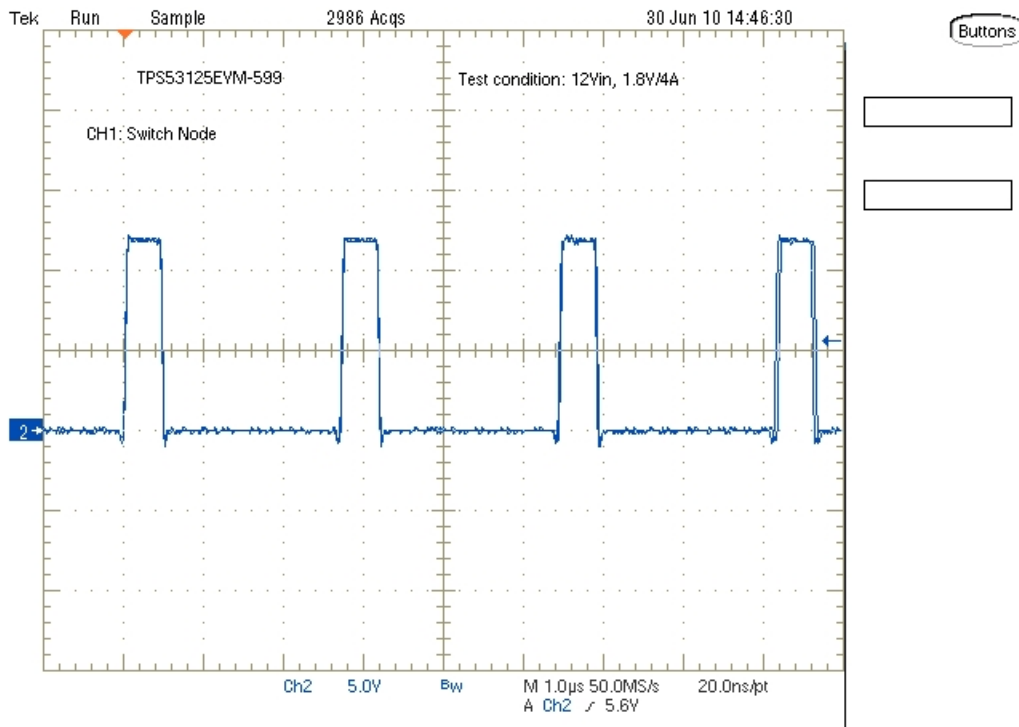
V_{IN} = 12, V_{OUT2} = 1.80, I_{OUT2} = 4A
Ch1: TP11 (SW2)

Figure 10. TPS53125EVM-599 Switching Waveforms

7 TPS53125EVM-599 Assembly Drawings and Layout

The following figures (Figure 11 through Figure 15) show the design of the TPS53125EVM-599 printed-circuit board. The EVM has been designed using a 4-layer, 2-oz copper-clad circuit board 3.5 in 2.7 to allow the user to easily view, probe, and evaluate the TPS53125 control IC in a practical application. Moving components to both sides of the PCB or using additional internal layers can offer additional size reduction for space-constrained systems.

Figure 11. TPS53125EVM-599 Component Placement, Viewed From Top

Figure 12. TPS53125EVM-599 Top Copper, Viewed From Top

Figure 13. TPS53125EVM-599 Bottom Copper, Viewed From Bottom

Figure 14. TPS53125EVM-599 Internal 1, X-Ray View From Top
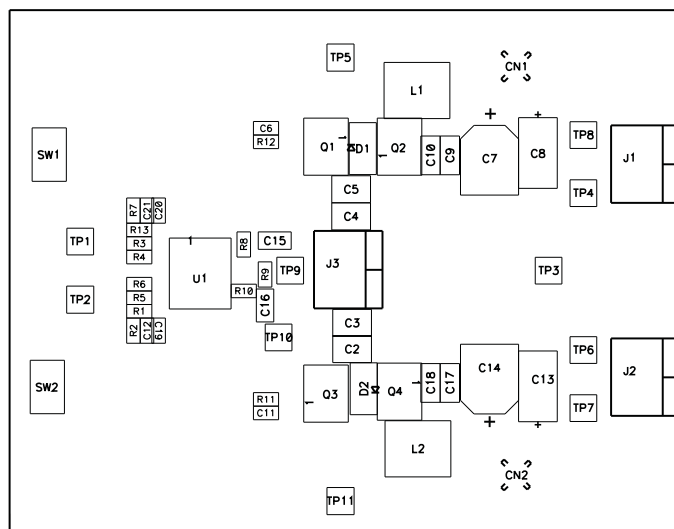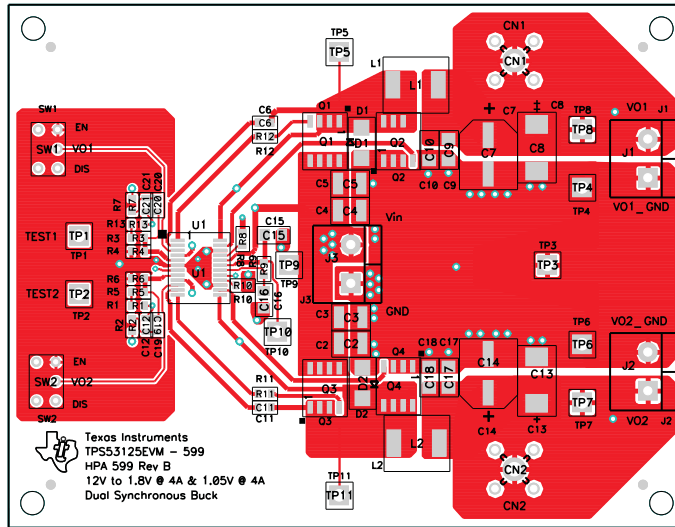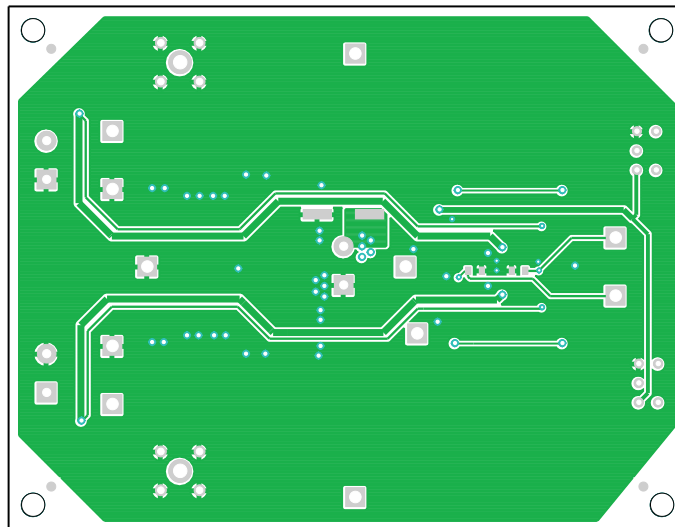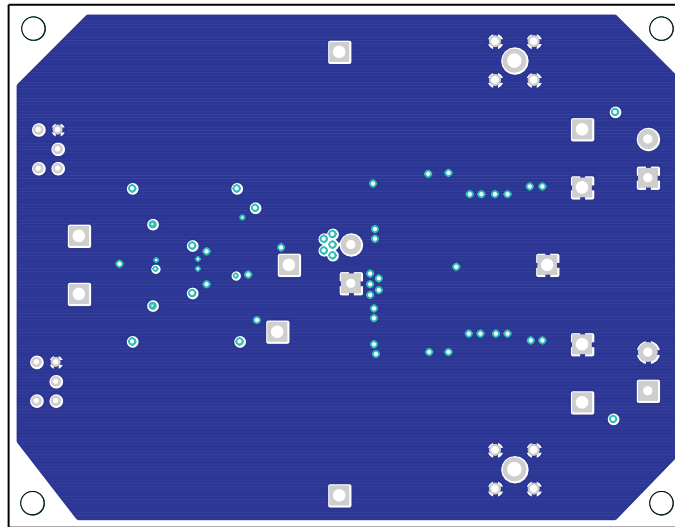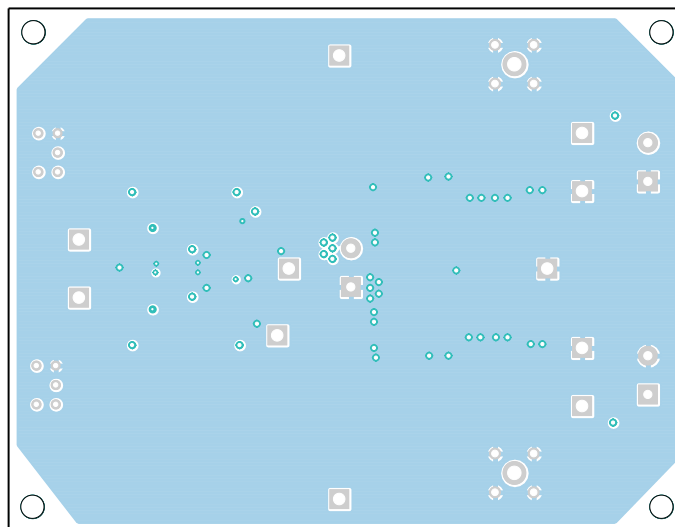

Figure 15. TPS53125EVM-599 Internal 2, X-Ray View From Top

8   TPS53125EVM-599 Bill of Materials

The Table 3 contains the bill of materials for TPS53125EVM-599. The reference designators reference the schematic in Figure 1 and assembly locations in Figure 11. The components listed with a quantity of 0 are not populated on the PCB but are provided for reference.

Table 3. TPS53125EVM-599 Bill of Materials

QTY	RefDes	Value	Description	Size	Part Number	MFR
0	C1		Capacitor, Aluminum, 25V, 20%	0.328 x 0.390 inch	Std	Std
0	C12, C19, C20, C21		Capacitor, Ceramic,	0603	Std	Std
0	C14, C7		Capacitor, OS CON, 6.3V,20%	0.260 Sq inch	Std	Std
1	C15	4.7µF	Capacitor, Ceramic, 10V, X5R, 20%	0805	Std	Std
1	C16	1µF	Capacitor, Ceramic, 16V, X5R, 20%	0805	Std	Std
4	C9, C10, C17, C18	47µF	Capacitor, Ceramic, 6.3V, X5R, 20%	1206	Std	Std
4	C2, C3, C4, C5	10µF	Capacitor, Ceramic, 25V, X5R, 20%	1210	Std	Std
2	C22, C23	4700pF	Capacitor, Ceramic, Low Inductance, 16V, X7R, 20%	0603	Std	Std
2	C6, C11	0.1µF	Capacitor, Ceramic, 50V, X7R, 10%	0603	Std	Std
0	C8, C13	330µF	Capacitor, PXE, 330-µF, 4.0-V, 15-mΩ, 20%	7343 (D)	APXE4R0ARA331MF61G	NIPPON CHEMI-CON
2	CN1, CN2	131-5031-00	Adaptor, 3.5-mm probe clip (or 131-5031-00)	0.2	131-4244-00	Tektronix
0	D1, D2		Diode, Schottky, 1-A, 30-V	SMA	Std	Std
3	J1, J2, J3	ED120/2DS	Terminal Block, 2-pin, 15-A, 5.1mm	0.40 x 0.35 inch	ED120/2DS	OST
2	L1, L2	3.3µH	Inductor, SMT, 5.6A, 29.7 mΩ	0.256 x 0.280 inch	SPM6530T-3R3M	TDK
2	Q1, Q3	FDS8876	MOSFET, N-ch, 30-V, 10.2-A, 14-mΩ	SO8	FDS8876	Fairchild
2	Q2, Q4	FDS8690	MOSFET, N-ch, 30-V, 11.4-A, 11.4-mΩ	SO8	FDS8690	Fairchild
1	R1	1.82K	Resistor, Chip, 1/16W, 1%	0603	Std	Std
2	R11, R12	10	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	R13	430	Resistor, Chip, 1/16W, 1%	0603	Std	Std
0	R2, R7, R9		Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	R3	3.32K	Resistor, Chip, 1/16W, 1%	0603	Std	Std
2	R4, R6	10.0K	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	R5	12.1K	Resistor, Chip, 1/16W, 1%	0603	Std	Std
2	R8, R10	5.62K	Resistor, Chip, 1/16W, 1%	0603	Std	Std
2	SW1, SW2	G12AP-R0	Switch, ON-ON Mini Toggle	0.28 x 0.18"	G12AP-R0	Nikkai
4	TP1, TP2, TP5, TP11	5012	Test Point, White, Thru Hole	0.125 x 0.125 inch	5012	Keystone
1	TP10	5013	Test Point, Orange, Thru Hole	0.125 x 0.125 inch	5013	Keystone
3	TP3, TP4, TP6	5011	Test Point, Black, Thru Hole	0.125 x 0.125 inch	5011	Keystone
2	TP7, TP8	5014	Test Point, Yellow, Thru Hole	0.125 x 0.125 inch	5014	Keystone
1	TP9	5010	Test Point, Red, Thru Hole	0.125 x 0.125 inch	5010	Keystone
1	U1	TPS53125PW	IC, Dual Synchronous Step-Down Controller For Low-Voltage Power Rails	TSSOP	TPS53125PW	TI

Evaluation Board/Kit Important Notice

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. Persons handling the product(s) must have electronics training and observe good engineering practice standards. As such, the goods being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore may not meet the technical requirements of these directives or other related directives.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

TI currently deals with a variety of customers for products, and therefore our arrangement with the user **is not exclusive.**

TI assumes **no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.**

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please contact the TI application engineer or visit www.ti.com/esh.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

FCC Warning

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 8 V to 22 V and the output voltage range of 0.8 V to 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.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2010, Texas Instruments Incorporated

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DLP® Products	www.dlp.com	Communications and Telecom	www.ti.com/communications
DSP	dsp.ti.com	Computers and Peripherals	www.ti.com/computers
Clocks and Timers	www.ti.com/clocks	Consumer Electronics	www.ti.com/consumer-apps
Interface	interface.ti.com	Energy	www.ti.com/energy
Logic	logic.ti.com	Industrial	www.ti.com/industrial
Power Mgmt	power.ti.com	Medical	www.ti.com/medical
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Space, Avionics & Defense	www.ti.com/space-avionics-defense
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video and Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless-apps

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2010, Texas Instruments Incorporated

Free Manuals Download Website

http://myh66.com

http://usermanuals.us

http://www.somanuals.com

http://www.4manuals.cc

http://www.manual-lib.com

http://www.404manual.com

http://www.luxmanual.com

http://aubethermostatmanual.com

Golf course search by state

http://golfingnear.com

Email search by domain

http://emailbydomain.com

Auto manuals search

http://auto.somanuals.com

TV manuals search

http://tv.somanuals.com