UG175: TS331x EVB User's Guide

The TS331x is a low power boost converter with an industry leading low quiescent current of 150 nA, enabling ultra long battery life in systems running from a variety of battery sources. The TS331x steps up input voltages from 0.9 V to 5.0 V to eight selectable output voltages ranging from 1.8 V to 5.0 V. The TS331x includes two output options, one being an always-on storage output while the additional output is an output load switch that is designed to burst-on loads in a low duty cycle manner.

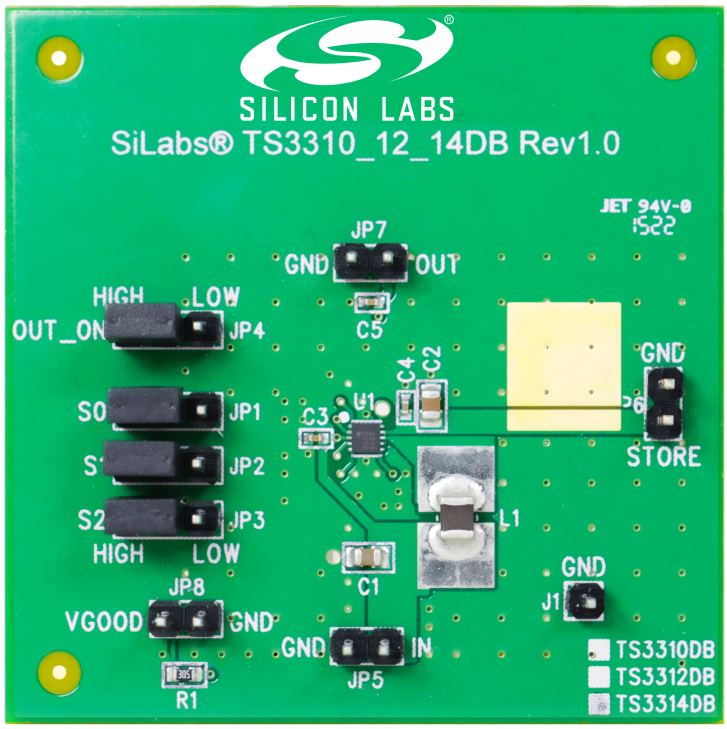
The TS331x output voltage can be set via jumpers S0, S1, and S2. Both the STORE and OUT output can be monitored along with the power good output VGOOD. Jumper OUT_ON is available to disable or enable the OUT output.

KEY FEATURES

- Input Voltage Range: 0.9 V–5.0 V
- Jumper selectable VOUT:
  - 1.8 V, 2.1 V, 2.5 V, 2.85 V, 3 V, 3.3 V, 4.1 V, 5 V (TS3310/12)
  - 4 V, 4.2 V, 4.35 V, 4.5 V, 4.6 V, 4.7 V, 4.8 V, 4.9 V (TS3314)
- OUT Enable/Disable Jumper
- 10 µH Inductor, 900 mA I_{SAT}
  - Taiyo Yuden: CBC3225T100KR

ORDERING INFORMATION

- TS3310DB
- TS3312DB (1.9 V UVLO)
- TS3314DB (4.xV outputs)



1. Description

The maximum available output current for the TS331x is a function of the inductor value and the average input current. The average input current will vary according to the load. When the output current is at its maximum, the averaged input current is also at a maximum. The maximum averaged input current is defined by the following equation.

$$I_{IN(AVG,MAX)} = \frac{I_{pk}}{2} = \frac{1\mu s \times V_{IN}}{L}$$

Equation 1. Maximum Average Input Current Calculation

The expected maximum STORE output current is defined by the following equation.

$$I_{STORE(MAX)} = \frac{V_{IN}}{V_{OUT}} \times I_{IN(AVG,MAX)} \times \text{Efficiency}$$

Equation 2. Expected Maximum STORE Output Current Calculation

The table below lists some example inductor values and the corresponding expected maximum output load current available for the TS331x, assuming an 85% efficiency, an input voltage of 2 V, and an output voltage of 3 V (4.35 V for TS3314).

Table 1.1. Expected Maximum Output Current

L	TS3310 and TS3312	TS3314
	$I_{STORE(MAX)}$	$I_{STORE(MAX)}$
10 µH	56.67 mA	38.63 mA
22 µH	25.75 mA	17.56 mA
33 µH	17.17 mA	11.71 mA
100 µH	5.67 mA	3.86 mA

The TS3310 and TS3312 demo board is configured for 3 V output by default. The TS3314 demo board is configured for a 4.35 V output by default. The TS331x demo board provides test points to monitor the output voltage STORE and OUT. The power good pin, VGOOD, is pulled to the STORE output by a 3.3 MΩ pull-up resistor R1 and can be monitored via test point PG. To enable or disable the OUT output voltage, a jumper for the OUT_ON pin is available. The STORE and OUT output voltage can be set via jumpers S2, S1, and S0.

2. Quick Start Procedure

Table 2.1. STORE Output Voltage Options

S2	S2	S0	TS3310 STORE	TS3312 STORE	TS3314 STORE
0	0	0	1.8 V	—	4 V
0	0	1	2.5 V	2.5 V	4.2 V
0	1	0	3.3 V	3.3 V	4.35 V
0	1	1	5 V	5 V	4.5 V
1	0	0	2.1 V	2.1 V	4.6 V
1	0	1	2.85 V	2.85 V	4.7 V
1	1	0	3 V	3 V	4.8 V
1	1	1	4.1 V	4.1 V	4.9 V

To evaluate the TS331x, perform the following steps:

1. Connect the battery or power supply's positive terminal to the test point labeled IN. Connect the negative terminal of the battery or power supply to the test point labeled GND.
2. To monitor the STORE output voltage, connect the positive terminal of the voltmeter to the test point labeled STORE. Connect the negative terminal of the voltmeter to the test point labeled GND. The output voltage should be approximately 3 V (TS3314: 4.35 V).
3. To monitor the STORE output voltage ripple, connect an Oscilloscope probe to the test point labeled STORE.
4. To monitor the OUT output voltage, connect the positive terminal of the second voltmeter to the test point labeled OUT. Connect the negative terminal of the voltmeter to the test point labeled GND. The output voltage should be approximately 3 V (TS3314: 4.35 V). To disable the OUT output voltage, set jumper OUT_ON to LOW.
5. To monitor the open-drain VGOOD output, connect an Oscilloscope Probe to the test point labeled PG. The VGOOD output signal assumes a high impedance once the STORE output voltage is greater than 90% of the target output voltage, which is 2.7 V for the 3 V default configuration for the TS3310 and TS3312. 90% of the target output voltage for the TS3314 is 3.915 V for the default 4.35 V configuration.

To evaluate the TS331x with a different output voltage setting, reconfigure the provided jumpers S0–S2. Please refer to the above table for the available output voltages and their corresponding S0–S2 jumper configuration.

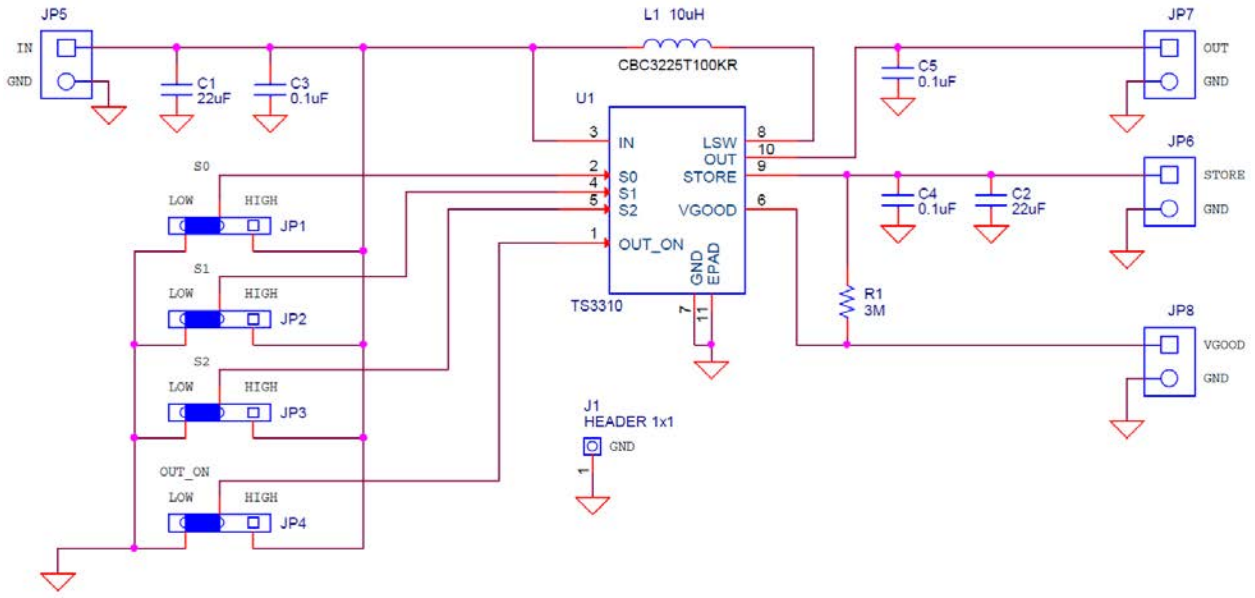
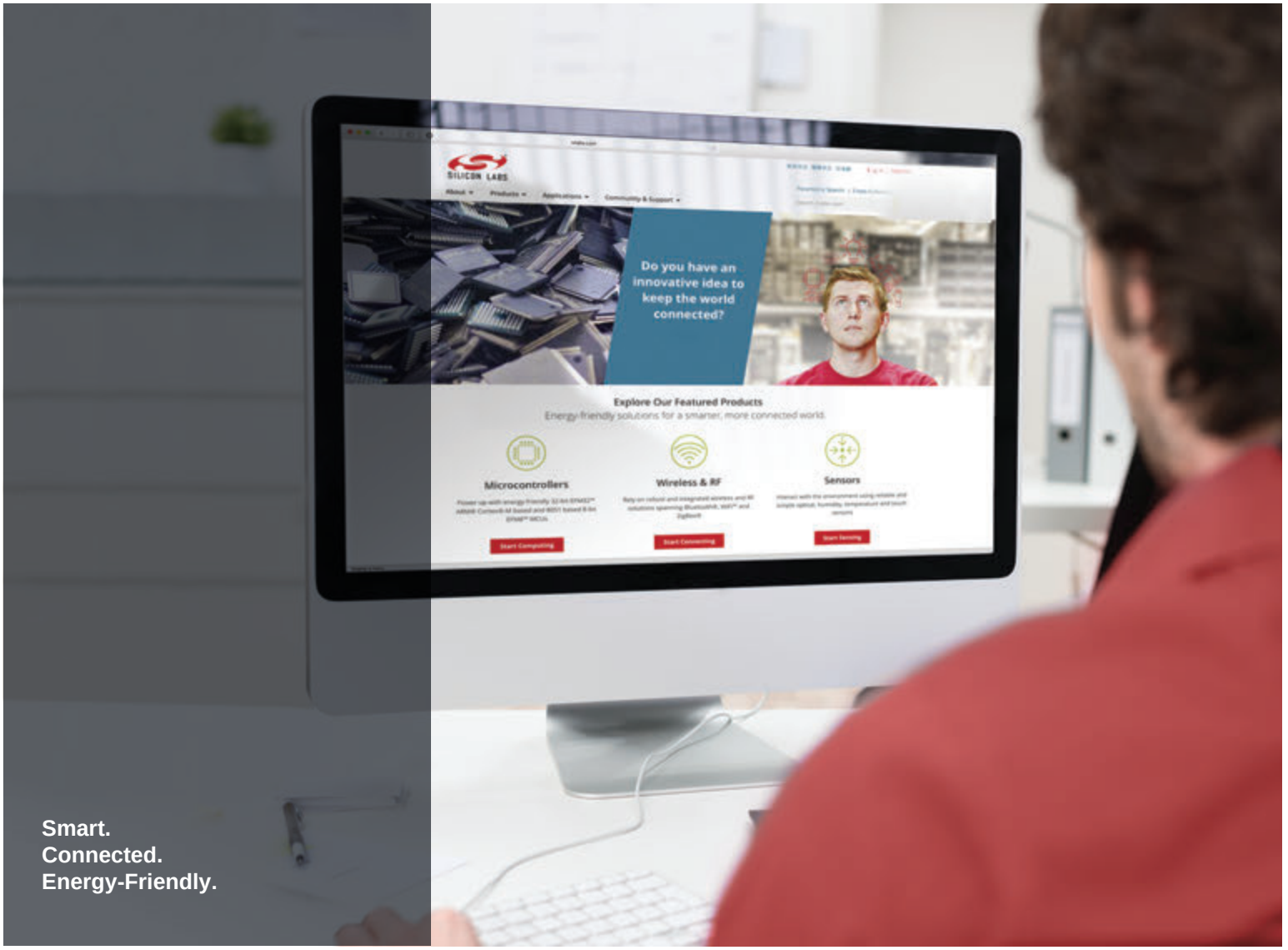


Figure 2.1. TS331x-EVB Schematic

Table 2.2. TS331x-EVB Component List

Quantity	Reference	Value	Rating	Voltage	Tolerance	Type	Footprint	OPN
2	C1, C2	22 µF		6.3 V	±20%	X5R	C0805	C0805X5R6R3-226M
3	C3, C4, C5	0.1 µF		16 V	±10%	X7R	C0402	C0402X7R160-104K
1	J1					Header	HDR1X1	TSW-101-07-L-S
4	JP1, JP2, JP3, JP4					Header	CONN-1X3	TSW-103-07-L-S
4	JP5, JP6, JP7, JP8					Header	CONN1X2	TSW-102-07-L-S
4	JS1, JS2, JS3, JS4					Shunt	N/A	SNT-100-BK-T
1	L1	10 µH	900 mA		±10%	UnShielded	IND-CB3225	CBC3225T100KR
1	PCB					BARE PCB	N/A	TS3310_12_14DB Rev 1.0
1	R1	3 MΩ	1/16 W		±5%	Thickfilm	R0603	CR0603-16W-305J
1	U1	TS3310 TS3312 TS3314		5 V		Power	DFN10N2.0P0.4E0.9X1.4	TS3310ITD1022 TS3312ITD1022 TS3314ITD1022



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