3.8V--32V Vin, 2-A Synchronous Buck Converter with EMI Reduction

FEATURES

- EMI Reduction with Switching Node Ringing-free
- 500kHz Switching Frequency with 6% Frequency Spread Spectrum (SCT2320, SCT2323, SCT2325)
- 3.8V-32V Wide Input Voltage Range
- Adjustable Output Voltage (SCT2320, SCT2321)
- 3.3V ±1% Output Voltage (SCT2323)
- 5V ±1% Output Voltage (SCT2325)
- Up to 2A Continuous Output Load Current
- Fully Integrated 140mΩ (R_{dson}) High Side MOSFET and 70mΩ (R_{dson}) Low Side MOSFET
- 1uA Shut-down Current
- 20uA Ultra Low Quiescent Current (SCT2320, SCT2323, SCT2325)
- Peak Current Mode Control with Integrated Loop Compensation
- PSM Mode in Light Load Condition (SCT2320, SCT2323, SCT2325)
- 4ms Soft Start Time
- Output Over Voltage Protection
- Thermal Shutdown Protection at 160°C
- Available in TSOT23-6LPackage

APPLICATIONS

- White Goods, Home Appliance
- Surveillance
- Audio, WiFi Speaker
- Printer, Charging Station
- DTV, STB, Monitor/LCD Display

DESCRIPTION

The EV2320-B-01A Evaluation Board is designed to demonstrate the capabilities of SCT2320 , SCT2321, SCT2323, SCT2325, what are 2A, EMI friendly synchronous buck converters with up to 32V wide input voltage range. The SCT2320, SCT2323, SCT2325 features an ultra-low quiescent operating current of 20uA. The SCT2320 , SCT2321, SCT2323, SCT2325 is available in a low-profile SOT23-6 package.
This user's guide describes the characteristics, operation and the use of the EV2320-B-01A Evaluation Module including EVM specifications, recommended test setup, test result, schematic diagram, bill of materials, and the board layout.

Board Number	IC Number
EV2320-B-01A	SCT2320, SCT2321 SCT2323, SCT2325

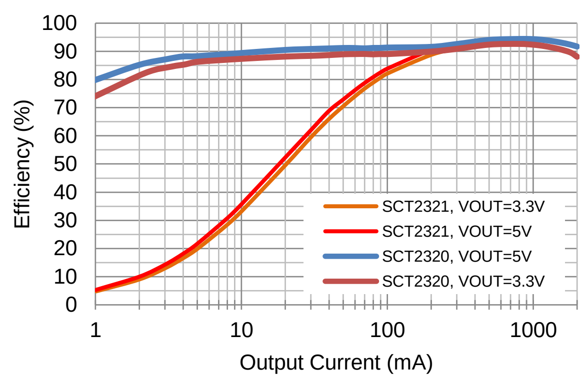
PERFORMANCE SUMMARY

Table 1. Performance — Specifications are at TA = 25°C

Parameter	Condition	Value
Input Voltage	DC up to 32V	3.8V-32V
Output Voltage	PFM	5V ± 1%
Output Current	Continuous DC current	2A
Frequency	Default	500KHz

EV2320-B-01AEvaluation Board Top View

*for SCT2323/2325, C1,R2 should be removed, R0 and R1 placed 0Ω



Efficiency, Vout=5V/3.3V, V in=12V/24

QUICK START PROCESURE

Evaluation board EV2320-B-01A is easy to set up to evaluate the performance of the SCT2320. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Place jumpers in the following positions:
   - J1: ON Connect V_{IN} supply to V_{IN} pin of IC.
   - J2: ON Connect Loading to V_{OUT} pin of IC.
   - JP3: Enable. ON Connect EN pin to V_{CC} to enable IC. OFF Disable IC
2. With power off, connect the input power supply to J1 V_{IN} connector and J1 GND connector. Turn on the power at the input. Make sure that the input voltage does not exceed 28V, and supports sufficient current limit.
3. Check the output voltage at J3. The output voltage should be 5V typical. Once the proper output voltage is established, adjust the load within the operating range and observe the output voltage regulation, output voltage ripple, efficiency and other parameters.
4. To use the enable function, apply a digital input to the EN pin of JP3.

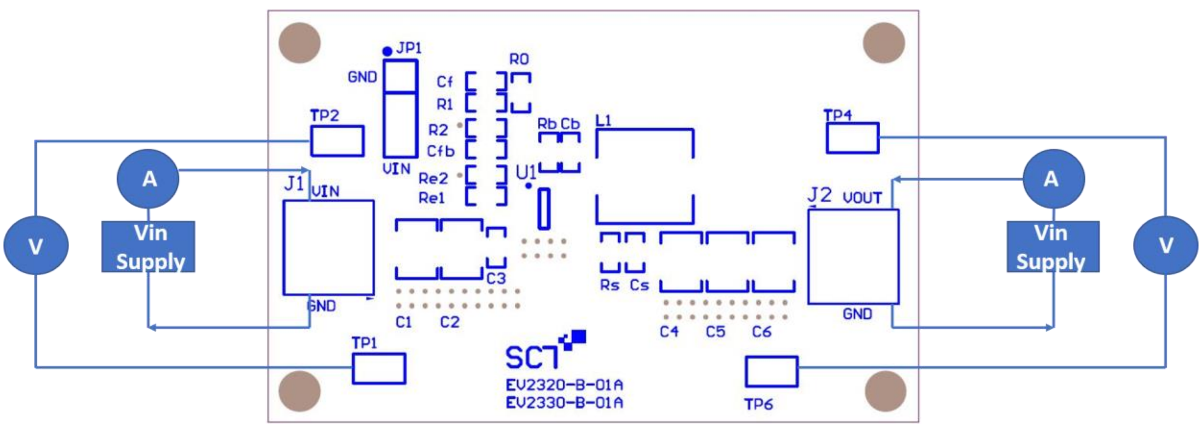


Figure 1. Proper Supply, Load and Measurement Equipment Setup

NOTE: When measuring the voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across relevant capacitor of VIN or VOUT. See Figure 2 for proper scope probe technique.

Figure 2. Measuring Voltage Ripple Across Terminals or Directly Across Ceramic Capacitor

SCHEMATIC DIAGRAM

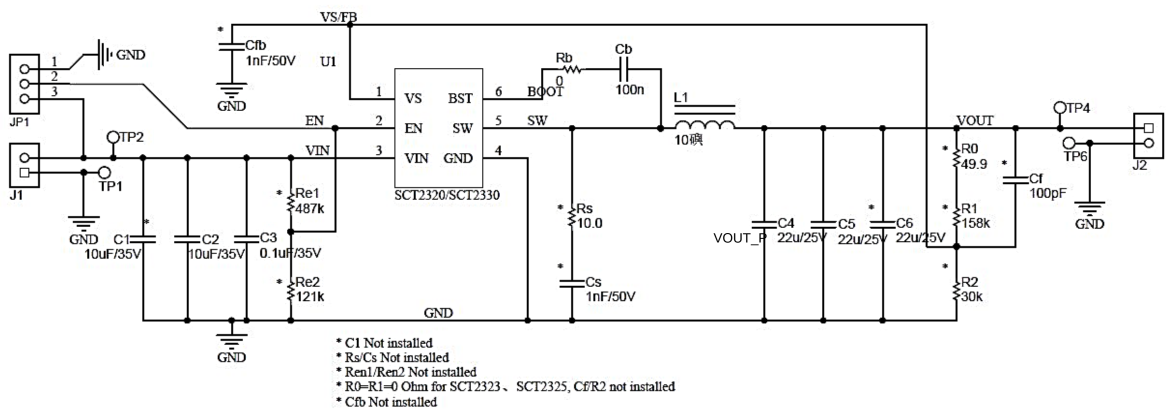


Figure 3. Evaluation Board Schematic

BILL OF MATERIALS

Table 2. Bills of Materials

Manufacture	Comment	Designator	Description	Quantity
Silicon Content Technology	SCT2320	U1	SCT2320, 3.8V-28V Vin, 2A, Low Quiescent Current Synchronous Step-down Converter SOT23-6	1
Wurth Elektronix	613 002 111 21	JP1	'Header, 100mil, 3x1, Tin plated, TH	1
Wurth Elektronix	691 214 110 002S	J1, J2	Terminal Block, 6A, 3.5mm Pitch, 2-Pos, TH	2
Murata Electronics	GRM32ER7YA106KA12L	C1	CAP, CERM, 10 uF, 35 V, +/- 10%, X7R, 1210	Not Installed
Murata Electronics	GRM32ER7YA106KA12L	C2	CAP, CERM, 10 uF, 35 V, +/- 10%, X7R, 1210	1
Wurth Elektronix	885 012 206 095	C3, Cb	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, 0603	2
Wurth Elektronix	885 012 109 010	C4, C5	CAP, CERM, 22 uF, 16V, +/-10%, X7R, 1210	2
Wurth Elektronix	885 012 109 010	C6	CAP, CERM, 22 uF, 16V, +/-10%, X7R, 1210	Not Installed
Wurth Elektronix	885012206077	Cf	CAP, CERM, 100 pF, 50 V, +/- 10%, X7R, 0603	1
	N/A (SCT2320, SCT2321)	Cf	N/A	Not Installed
Murata Electronics	GRM188R71C102KA01D	Cfb	CAP, CERM, 1000 pF, 16 V, +/- 10%, X7R, 0603	Not Installed
Murata Electronics	GRM188R71C102KA01D	Cs	CAP, CERM, 1000 pF, 16 V, +/- 10%, X7R, 0603	Not Installed
Wurth Elektronix	744314101	L1	Inductor, Shielded Drum Core, WE-Superflux200, 10 u, 3.5 A, 0.033 ohm, SMD	1
Vishay	CRCW060349R9FKEA (SCT2320, SCT2321)	R0	RES, 49.9, 1%, 0.1 W, 0603	1
	CRCW06030000Z0EA (SCT2323, SCT2325)	R0	RES, 0, 5%, 0.1 W, 0603	1
Vishay	RC0603FR-07158KL (SCT2320, SCT2321)	R1	RES, 158 k, 1%, 0.1 W, 0603	1
	CRCW06030000Z0EA (SCT2323, SCT2325)	R1	RES, 0, 5%, 0.1 W, 0603	1
Yageo	RC0603FR-0730K (SCT2320, SCT2321)	R2	RES, 30 k, 1%, 0.1 W, 0603	1
	N/A (SCT2320, SCT2321)	R2	N/A	Not Installed
Vishay	CRCW06030000Z0EA	Rb	RES, 0, 5%, 0.1 W, 0603	1
Yageo	RC0603FR-07487KL	Re1	RES, 487 k, 1%, 0.1 W, 0603	Not Installed
Yageo	RC0603FR-07121KL	Re2	RES, 121 k, 1%, 0.1 W, 0603	Not Installed
Vishay	CRCW060310R0FKEA	Rs	RES, 10.0, 1%, 0.1 W, 0603	Not Installed
Keystone	5015	TP1, TP2, TP4, TP6	Test Point, Miniature, SMT	4

PRINTED CIRCUIT BOARD LAYOUT

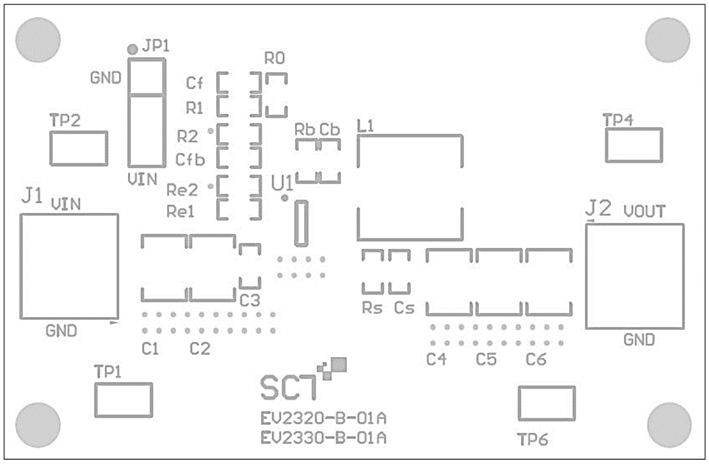


Figure 4. Top Silkscreen Layer

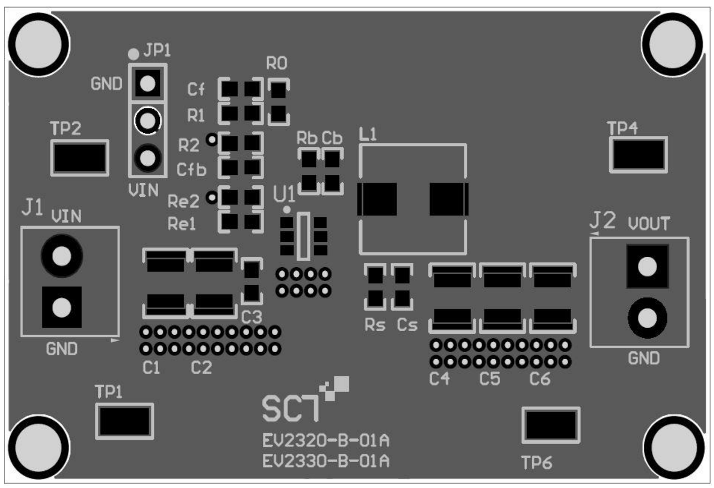


Figure 5.Top Layer

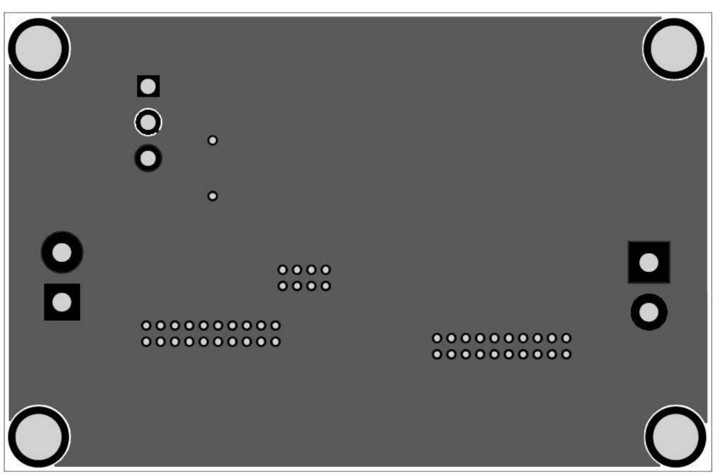


Figure 6. Bottom Layer

EVB TEST RESULTS

Vin=24V, Vout=5V, 2A loading, unless otherwise noted

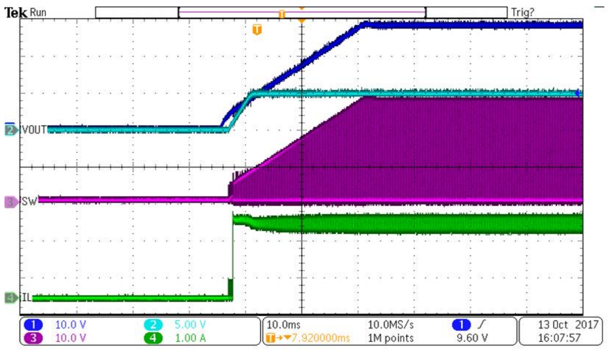


Figure 6. Power Up

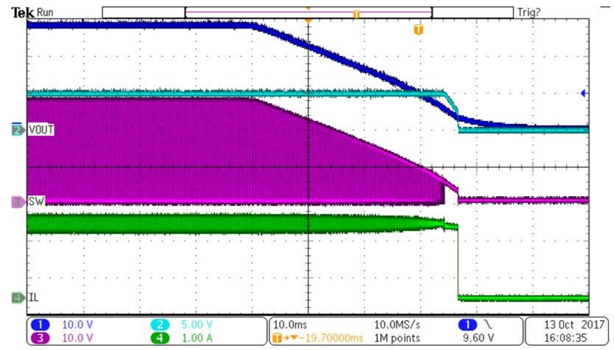


Figure 7. Power Down

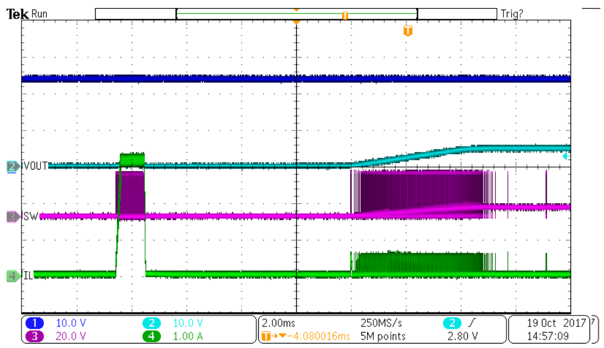


Figure 8. Output Overload and Recovery with 3.5A Load

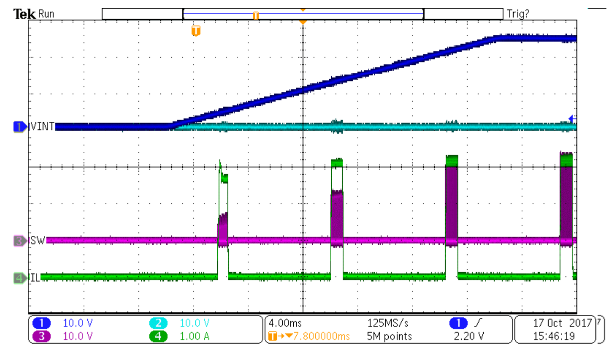


Figure 9. Startup at Output Hard-short

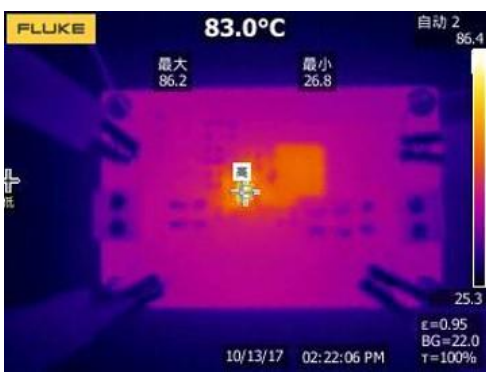


Figure 10. Infrared Thermal Image, Iout=2A

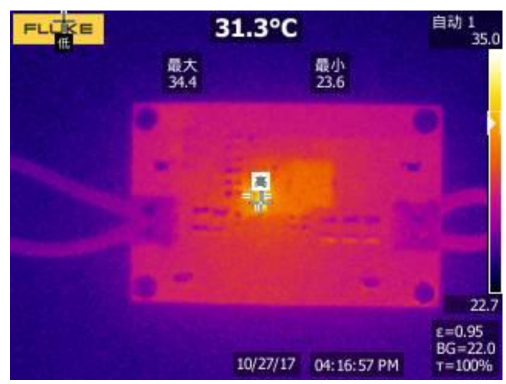


Figure 11. Infrared Thermal Image, Output Hard Short

OPTIONAL MODIFICATION

Output Voltage

The output voltage is set by an external resistor divider R1 and R2 in typical application schematic. The value of R2 can be calculated by equation 3. A minimum current of typical 20uA flowing through feedback resistor divider gives good accuracy and noise covering.

$$R_1 = \frac{(V_{OUT} - V_{REF}) \times R_2}{V_{REF}} \qquad (3)$$

where:

- V_{REF} is the feedback reference voltage, typical 0.8V

Table 5. Feedback Resistor R_1 R_2 Value for Output Voltage (Room Temperature)

V_{OUT}	R_1	R_2
3.3 V	93.1 KΩ	30 KΩ
5 V	158 KΩ	30 KΩ
12 V	420 KΩ	30 KΩ

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