SCT82A30 Evaluation Board User's Guide

FEATURES

- Synchronous DCDC Buck Controller
  - 5.5V-100V Wide Input Range
  - 0.8V-60V Adjustable Output Voltage
  - 0.8V±1% Reference Voltage
  - 40ns Minimum t_{ON} for low duty ratio
  - 140ns Minimum t_{OFF} for high duty ratio
- 100 KHz to 1.2 MHz Switching Frequency
  - Clock Synchronization In/Out capability
  - Selectable Diode Emulation or FPWM
- 7.5-V Gate Drivers
  - 2.3-A Source and 3.5-A Sink Current
  - Low-side Soft Start for prebiased Start-up
- Fast Line and Load Transient Response
  - Voltage-mode control with line feedforward
  - High Gain Bandwidth Error Amplifier
- Protection Features for Robustness
  - Adjustable Soft Start time
  - Hiccup-mode Overcurrent Protection
  - Input UVLO with hysteresis
  - VCC and Gate-drive UVLO Protection
  - Precision Enable Input Threshold
  - Open-drain Power Good Indicator for Sequencing and Control
  - Over Temperature Shutdown Protection
- External VCC Input for Bypassing Internal LDO
- Available in QFN-20L 3.5mmx4.5mm Package

APPLICATIONS

- High Current Distributed Power Systems
- Telecom, Datacom
- Non-isolated PoE and IP Camera
- Industrial Motor Control
- High Power Automotive DCDC

DESCRIPTION

The EV82A30-B-01A Evaluation Board is designed to demonstrate the capabilities of SCT82A30 5.5V-100V Wide Input Voltage Range Synchronous Buck Controller. This evaluation module is a synchronous buck DC/DC regulator that employs synchronous rectification to achieve high conversion efficiency in a small footprint. The input voltage range is 15v-85v (To protect the MOSFET).

The SCT82A30 is 100-V synchronous buck controller with wide input voltage (wide VIN) range, wide duty cycle range, voltage-mode PWM control loop, integrated high-side and low-side MOSFET gate drivers, cycle-by-cycle overcurrent protection, precision enable, and power supply tracking features. The EVM's free-running switching frequency is 400 kHz and is synchronizable to a higher or lower frequency if required. Moreover, a synchronization output signal (SYNCOUT) 180° phase-shifted relative to the internal clock is available for master-slave configurations. VCC voltage rail UVLO protects the converter at low input voltage conditions, and the EN/UVLO pin supports adjustable input UVLO for application specific power-up and power-down requirements.

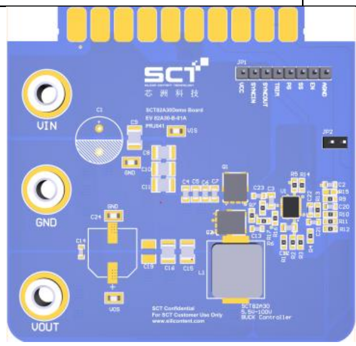
The device is available in QFN-20L 3.5mmx4.5mm Package

This user's guide describes the characteristics, operation and the use of the EV82A30-B-01A Evaluation Module including EVM specifications, recommended test setup, test result, schematic diagram, bill of materials, and the board layout.

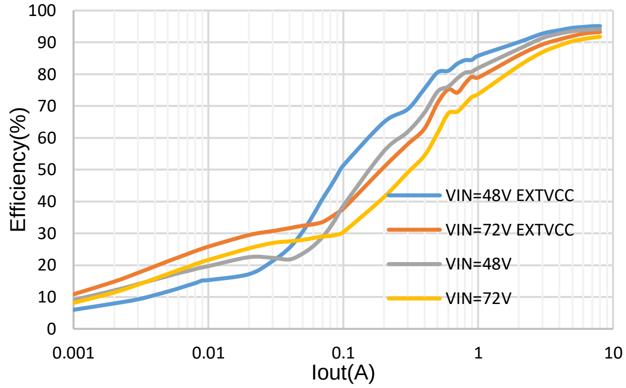
Board Number	IC Number
EV82A30-B-01A	SCT82A30

PERFORMANCE SUMMARY

Parameter	Condition	Value
Input Voltage	DC up to 85V	15V-85V
Output Voltage	Iout=0A~8A	12V ± 1%
Output Current	Continuous DC current	8A



EV82A30-B-04A Evaluation Board Top View



SCT82A30 Efficiency, Freq.=400KHz

QUICK START PROCESURE

Evaluation board EV82A30-B-01A is easy to set up to evaluate the performance of SCT82A30 synchronous step-down DCDC converter. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Place jumpers in the following positions:
   - VIN,GND : Connect the power supply to the input of converter.
   - VOUT,GND : Connect the load to the output of converter.
   - VIS: Input voltage test point.
   - VOS: Output voltage test point.
   - JP1:VCC,SYNCIN,SYNCOUT,TRIM,PG,SS,EN,AGND Pin connector.
   - JP2: Connect Extvcc and Vout.
2. With power off, connect the input power supply to V_{IN} connector and GND connector. Make sure that the input voltage does not exceed 85V, and supports sufficient current limit. Turn on the power at the input.
3. Check the output voltage at VOS,GND. The output voltage should be 12V 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 JP1.
5. Trim input for output voltage adjust.
6. Users can place C1 if input wire is long and C24 for better load transient performance.

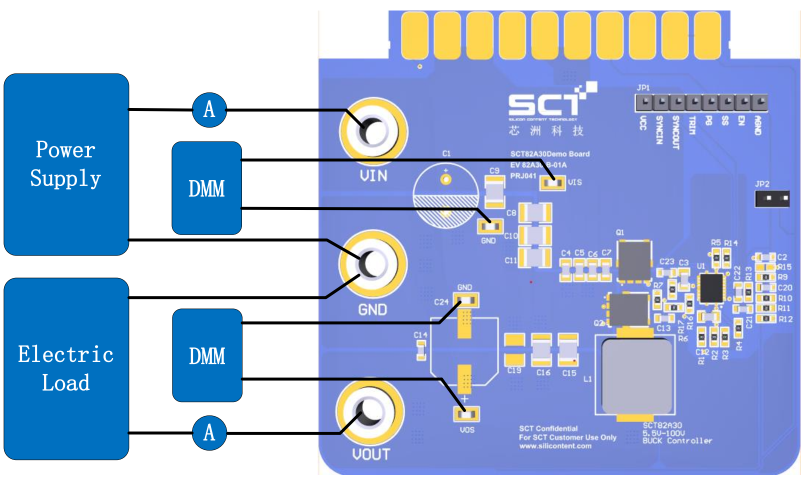


Figure 1. Power Supply, Load and Measurement Equipment Setup

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

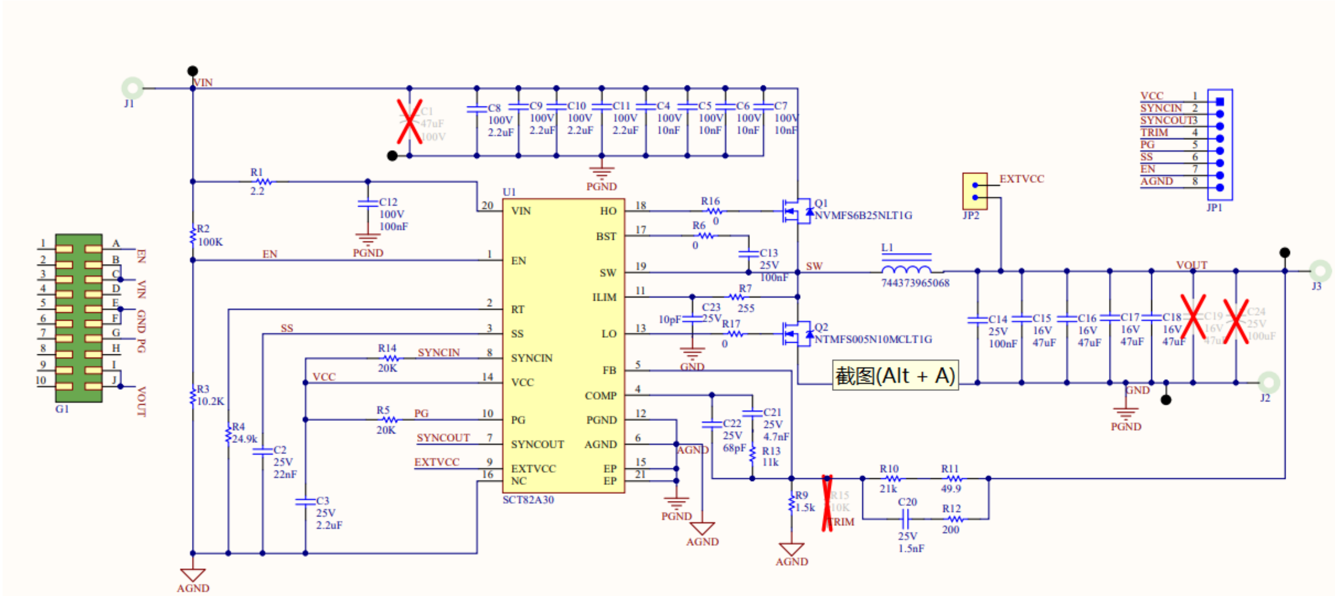


Figure 3. SCT82A30 EVM Schematic

BILL OF MATERIALS

Table 2. SCT82A30 EVM Bills of Materials

Manufacture	Part Number	Designator	Description	Quantity
Wurth Electronix	870 055 975 004	C1	CAP,CERM,47uF,100V,+-20%	0
Wurth Electronix	885 012 205 052	C2	CAP,CERM,22nF,25V,+-10%,X7R,0603	1
Wurth Electronix	885 012 207 079	C3	CAP,CERM,2.2uF,25V,+-10%,X7R,0805	1
Wurth Electronix	885 012 207 122	C4, C5, C6, C7	CAP,CERM,10nF,100V,+-10%,X7R,0805	4
Wurth Electronix	885 012 209 071	C8, C9, C10, C11	CAP,CERM,2.2uF,100V,+-10%,X7R,1210	4
Wurth Electronix	885 012 207 128	C12	CAP,CERM,100nF,100V,+-10%,X7R,0805	1
Wurth Electronix	885 012 206 071	C13, C14	CAP,CERM,100nF,25V,+-10%,X7R,0603	2
Wurth Electronix	885 012 109 011	C15, C16, C17, C18	CAP,CERM,47uF,15.5V,+-10%,X7R,1210	4
Wurth Electronix	885 012 109 011	C19	CAP,CERM,47uF,15.5V,+-10%,X7R,1210	0
Wurth Electronix	885 012 206 059	C20	CAP,CERM,1.5nF,25V, +/- 10%, X7R, 0603	1
Wurth Electronix	885 012 206 063	C21	CAP,CERM,4.7nF,25V, +/- 10%, X7R, 0603	1
Wurth Electronix	885 012 206 063	C22	CAP,CERM,68pF,25V, +/- 5%, NP0, 0603	1
Wurth Electronix	885 012 206 054	C23	CAP,CERM,10pF,25V,+-10%,X7R,0603	1
Wurth Electronix	875 075 561 005	C24	CAP, AL, 100uF, 25V, +/- 10%, SMT	0
Keystone	5015	INGND, OUTGND, VIS, VOS	Test Point	4
Keystone	575-8	VIN,VOUT,GND	Banana Jack	3
Nextron	Z-211-0811-0021-001	JP1	Nextron Header*8 2.54mm	1
Nextron	Z-211-0211-0021-001	JP2	Nextron Header*2 2.54mm	1
Wurth Electronic	744373965068	L1(1)	Inductor, Shielded Drum Core, Powdered Iron, 6.8 uH, 15.8 A, 0.0092 ohm, SMD	1
Onsemi	NVMFS6B25NLT1G	Q1	MOSFET, N-Channel, 100V, 24mΩ, SON 5 × 6	1
Onsemi	NTMFS005N10MCLT1G	Q2	MOSFET, N-Channel, 100V, 5.1mΩ, SON 5 × 6	1
YAGEO(国巨)	AC0603FR-072R2L	R1	Resistor, 2.2Ω, 1%, 0.1W, 0603	1
YAGEO(国巨)	AC0603FR-07100KL	R2	Resistor, 100k, 1%, 0.1W, 0603	1
YAGEO(国巨)	AC0603FR-0710K2L	R3	Resistor, 10.2k, 1%, 0.1W, 0603	1
YAGEO(国巨)	AC0603FR-0724K9KL	R4	Resistor, 24.9k, 1%, 0.1W, 0603	1
YAGEO(国巨)	AC0603FR-0720KL	R5, R14	Resistor, 20k, 1%, 0.1W, 0603	2
YAGEO(国巨)	AC0603JR-070RL	R6, R16, R17	Resistor, 0, 1%, 0.1W, 0603	3
YAGEO(国巨)	AC0603FR-07255RL	R7	Resistor, 255, 1%, 0.1W, 0603	1
YAGEO(国巨)	RC0603FR-0710KL	R8	Resistor, 10k, 1%, 0.1W, 0603	0
YAGEO(国巨)	RC0603FR-071K5L	R9	Resistor, 1.5k, 1% 0.1W, 0603	1
YAGEO(国巨)	RC0603FR-0721KL	R10	Resistor, 21k, 1% 0.1W, 0603	1
YAGEO(国巨)	AC0603FR-0749R9L	R11	Resistor, 49.9, 1%, 0.1W, 0603	1
YAGEO(国巨)	RC0603FR-07200RL	R12	Resistor, 200, 1%, 0.1W, 0603	1
YAGEO(国巨)	RC0603FR-0711KL	R13	Resistor, 11k, 1%, 0.1W, 0603	1
silicontent	SCT82A30	U1	6-100V，5.5V-100V Wide Input Voltage Range Synchronous Buck Controller	1

(1) Other WE-LHMI series products can be selected to adapt to different output voltages and different frequency.

PRINTED CIRCUIT BOARD LAYOUT

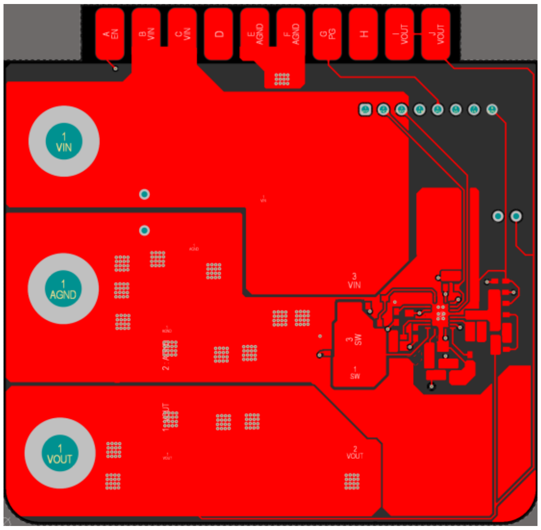


Figure 4. Top Layer

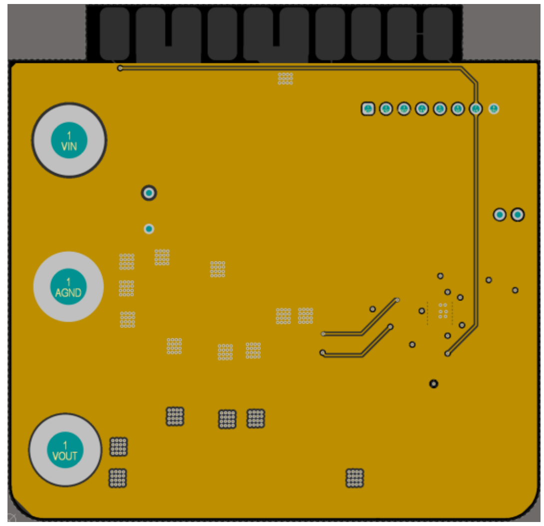


Figure 5. Internal 1 Layer

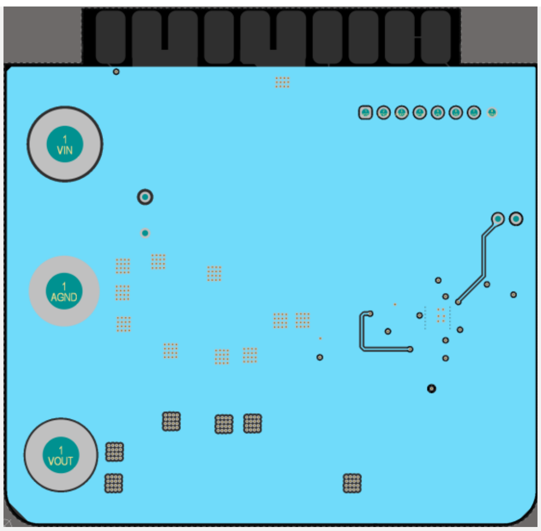


Figure 6. Internal 2 Layer

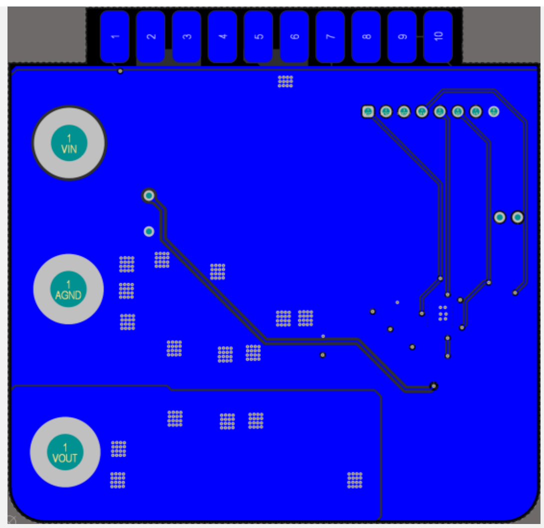


Figure 7. Bottom Layer

EVB TEST RESULTS

Vin=48V, Vout=12V, unless otherwise noted

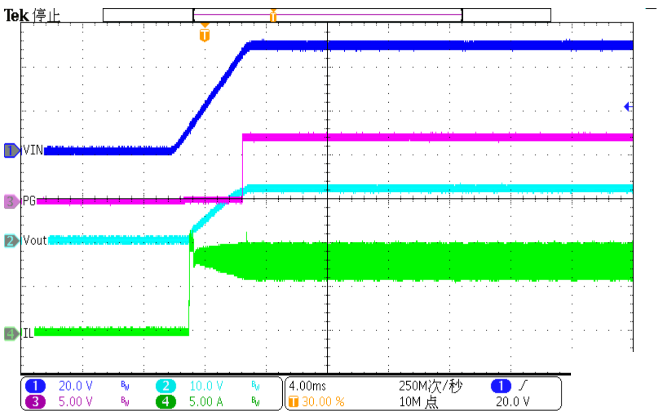


Figure 8. Power Up
(CH-1: Vin, CH-2: Vout, CH-3: PG, CH-IL)

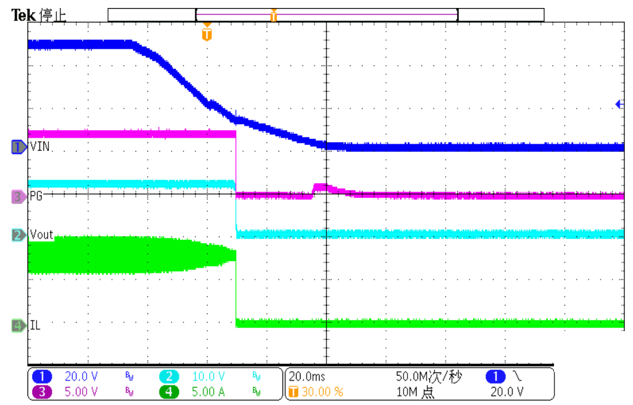


Figure 9. Power Down
(CH-1: Vin, CH-2: Vout, CH-3: PG, CH-IL)

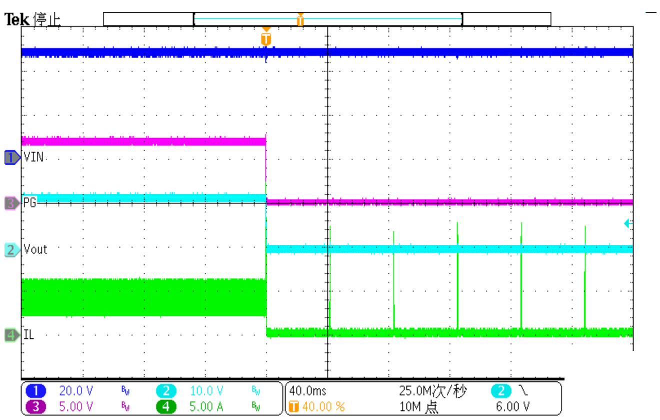


Figure 10. Startup at Output Hard-short
(CH-1: Vin, CH-2: Vout, CH-3: PG, CH-IL)

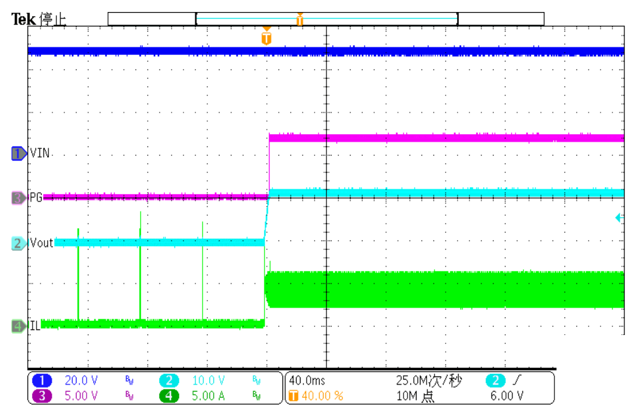


Figure 11. Output Hard-short and Recovery
(CH-1: Vin, CH-2: Vout, CH-3: PG, CH-IL)

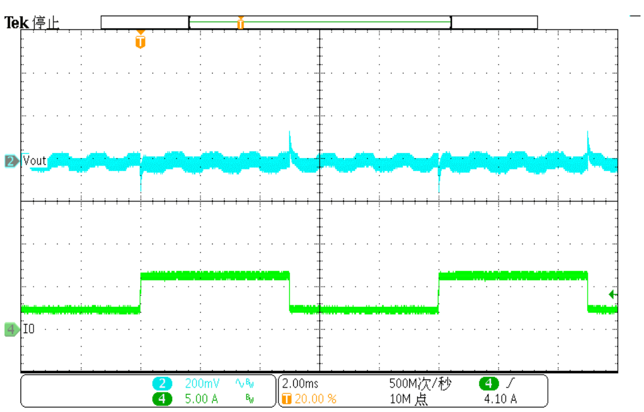


Figure 12. Load Transient
(2A-6A, SR=1600mA/us, CH-4: Iout, CH-2: Vout)

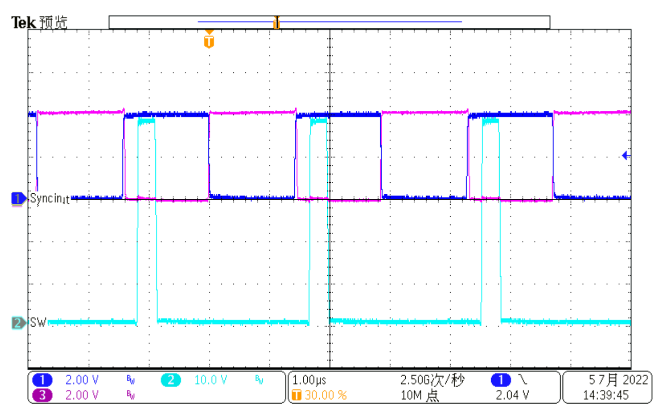


Figure 13. SYNCIN and SYNCOUT
(CH-1: SYCNIN, CH-2: SW, CH-3: SYNCOUT)

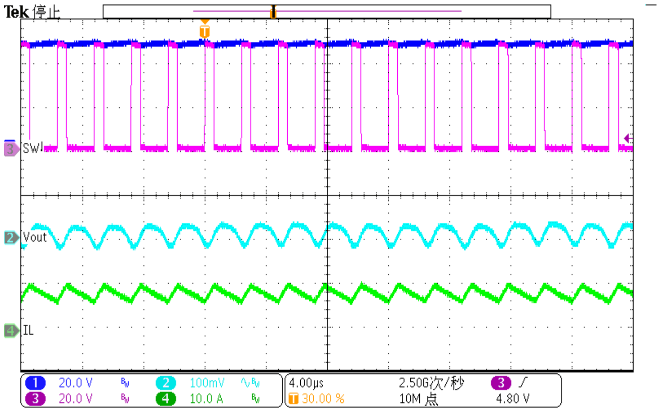


Figure 14. Output Ripple, PWM, Iout=8A
(CH-1: Vin, CH-2: Vout, CH-3: SW, CH-4: IL)

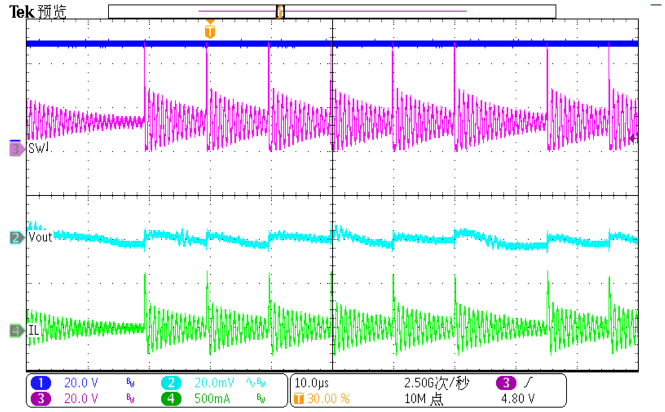


Figure 15. Output Ripple, PSM, Iout=10mA
(CH-1: Vin, CH-2: Vout, CH-3: SW, CH-4: IL)

OPTIONAL MODIFICATION

Switching Frequency

The resistor R4 connected from SCT82A30 RT/CLK pin to ground (Default 24.9KΩ) sets switching frequency of the converter. Use equation 1 to set a desired frequency.

Eq. (1)

$$R_4 = \frac{10000}{fsw\ (KHz)} \quad (1)$$

where:

- f_{SW} is the desired switching frequency

Table 3. R_4 Value for Common Switching Frequencies (Room Temperature)

fsw	R_3
200 KHz	50 KΩ
330 KHz	30.1 KΩ
400 KHz	24.9 KΩ
1000 KHz	100 KΩ

Programmable Soft-Start

The SCT82A30 features programmable soft-start time to prevent inrush current during start-up stage. The soft-start time can be programmed easily by connecting a soft-start capacitor C_6 from SS pin to ground.

The SS pin sources an internal 10µA current charging the external soft-start capacitor C_6 when the EN pin exceeds turn-on threshold. The device adopts the lower voltage between the internal voltage reference 0.8V and the SS pin voltage as the reference input voltage of the error amplifier and regulates the output. The soft-start completes when the voltage at the SS pin exceeds the internal reference voltage of 0.8V.

The soft-start capacitor value can be calculated going with following equation 2.

$$C_2 = t_{ss} * \frac{10uA}{0.8V} \quad (2)$$

.

Output Voltage

The output voltage is set by an external resistor divider R_9 and R_{10} in EVM schematic. The values of R_5 and R_6 can be calculated by equation 3.

$$R_{10} = \frac{(V_{OUT} - V_{REF}) \times R_9}{V_{REF}} \quad (3)$$

where:

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

Overcurrent Protection

The EVM implements current sense schemes , using the on-state resistance of the low-side MOSFET, limiting the inductor current during an overload or output short-circuit condition. The controller senses the inductor current during the PWM off-time when LO is high.

If an application requires a higher current, R7 can be used to achieve an expected system current. The current limit threshold can be calculated by Equation 4.

$$R_7 = \frac{I_{OUT} - \Delta I_L/2}{200uA} \cdot R_{DS(ON)Q2} \quad (4)$$

Under Voltage Lockout Threshold

The SCT82A30 are enabled when the VIN pin voltage rises about 5.5V and the EN pin voltage exceeds the enable threshold of 1.2V.

If an application requires a higher system under voltage lockout threshold, two external resistors divider (R2 and R3) in Figure 16 can be used to achieve an expected system UVLO. The UVLO rising and falling threshold can be calculated by Equation 5 and Equation 6 respectively.

$$R_2 = \frac{V_{IN(ON)} - V_{IN(OFF)}}{I_{HYS}} \quad (5)$$

$$R_3 = R_2 \cdot \frac{V_{EN}}{V_{IN(ON)} - V_{EN}} \quad (6)$$

where:

- $V_{IN(ON)}$ is the rising threshold of Vin UVLO.
- $V_{IN(OFF)}$ is the falling threshold of Vin UVLO

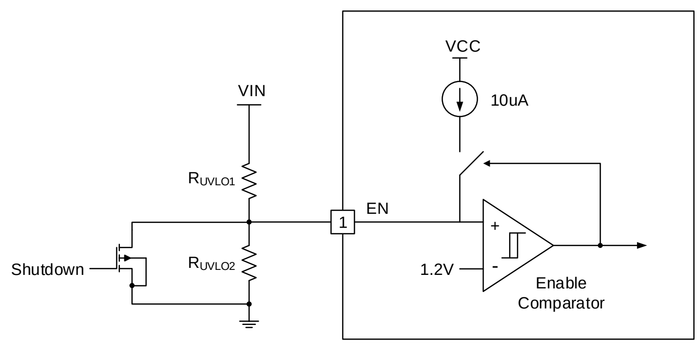


Figure 16. VIN UVLO Programmable by EN Dividers

For more information www.silicontent.com

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