SCT236x Evaluation Board User's Guide

FEATURES

- Wide 4V-28V Input Voltage Range
- 0.6V-14V Output Voltage Range (SCT2360)
- 0.6V-6V Output Voltage Range(SCT2361)
- 6A Continuous Output Current
- Integrated 36mΩ/18mΩ Rdson of HS/LS Power MOSFETs
- Selectable 400KHz, 800KHz, 1.2MHz Switching Frequencies (SCT2360)
- Fixed 400KHz Switching Frequencies (SCT2361)
- A 3.3V, 150mA LDO Integrated (SCT2361)
- Selectable PWM, PFM and USM Operation Modes
- Available in a QFN 12-leads 3mmx3mm Package

APPLICATIONS

- Auto
- DTV, Monitor/LCD Display
- Printer, Charging Station
- Industry PC

DESCRIPTION

The EV236x-B-02A Evaluation Board is designed to demonstrate the capabilities of SCT2360 and SCT2361, high efficiency fully integrated synchronous step-down DCDC converter supporting up to 6A continuous output current from an input source from 4V to 28V. The device fully integrates high-side and low-side power MOSFETs with 36mΩ/18mΩ on-resistance to minimize the conduction loss. SCT2360 offers Selectable 400KHz, 800KHz, 1.2MHz Switching Frequencies. SCT2361 integrates a 3.3V, 150mA LDO. The Supply of integrated 3.3V output LDO has path management between Vin and DC-DC converter output to achieve the lower power loss and better thermal performance.

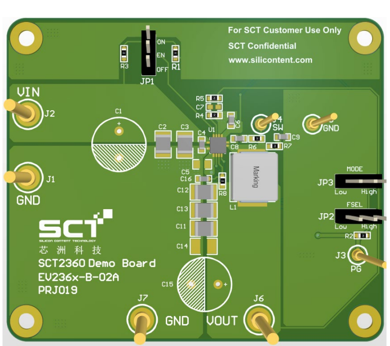
This user's guide describes the characteristics, operation and the use of the EV236x-B-02A Evaluation Module including EVM specifications, recommended test setup, test result, schematic diagram, bill of materials, and the board layout.

Board Number	IC Number
EV236x-B-02A	SCT2360 SCT2361

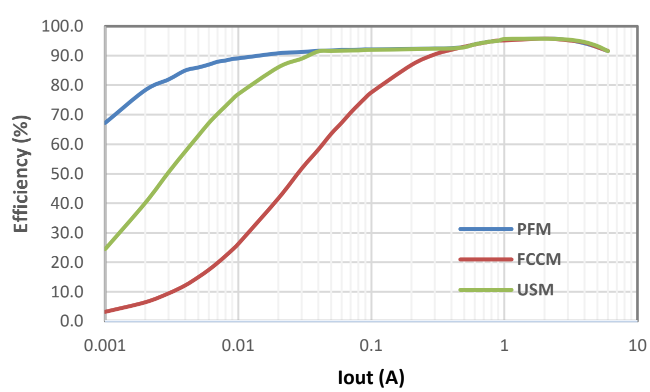
PERFORMANCE SUMMARY

Table 1. Test Condition — Specifications are at T_A = 25°C

Parameter	Condition	Value
Input Voltage	DC up to 28V	4V-28V
Output Voltage	Iout=0A~6A	5V ± 1%
Output Current	Continuous DC current	6A



EV2360-B-02A Evaluation Board Top View



SCT236X Buck Efficiency, VIN=12V, V=5V, 400kHz

QUICK START PROCESURE

Evaluation board EV236x-B-02A is easy to set up to evaluate the performance of SCT2360 and SCT2361 synchronous step-down DCDC converter. Refer to Figure 1 and Figure 2 for proper measurement equipment setup and follow the procedure below:

1. Place jumpers in the following positions:
   - J1, J2: Input terminal. Connect the power supply to the input of converter.
   - J6, J7: Output terminal. Connect the load to the output of converter.
   - J3: Power Good test point for SCT2360; LDO output for SCT2361.
   - JP1: Enable Jumper. Install ON shunt to connect EN pin to V_{in} through a 100KΩ resistor to enable IC. Install OFF shunt to disable IC.
   - JP2: Frequency select jumper for SCT2360. Install shunt to connect FSEL with VCC to set frequency at 1.2MHz, float jumper to set frequency at 800KHz, install shunt to connect FSEL with GND to set frequency at 400KHz.

     LDO enable jumper for SCT2361. Install shunt to connect LDO_EN with VCC or float jumper to enable LDO, install shunt to connect LDO_EN with GND to Disable LDO.
   - JP3: Mode select jumper. Install shunt to connect MODE with VCC to set mode as FCCM, float jumper to set mode as USM, install shunt to connect MODE with GND to set mode as PFM.
2. With power off, connect the input power supply to J1 and J2 terminals. Make sure that the input voltage does not exceed 28V, and supports sufficient current limit. Turn on the power at the input.
3. Check the output voltage at J6 and J7 terminals. 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 JP1.
5. Users can place C1 if input wire is long and C14 for better load transient performance.

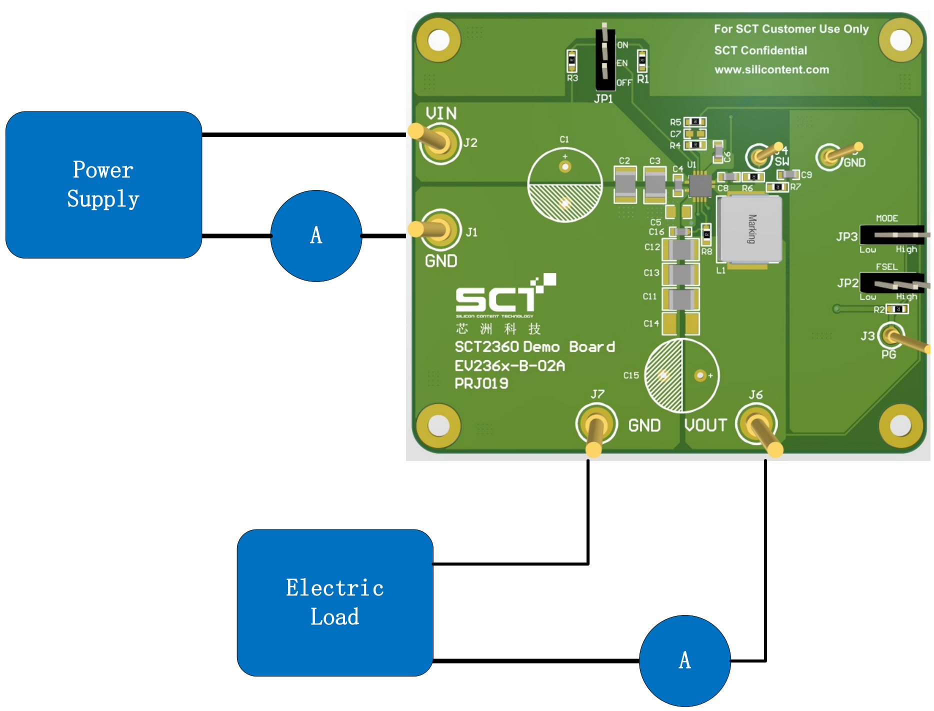


Figure 1. SCT2360EVM Power Supply, Load and Measurement Equipment Setup

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 3 for proper scope probe technique.

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

SCHEMATIC DIAGRAM

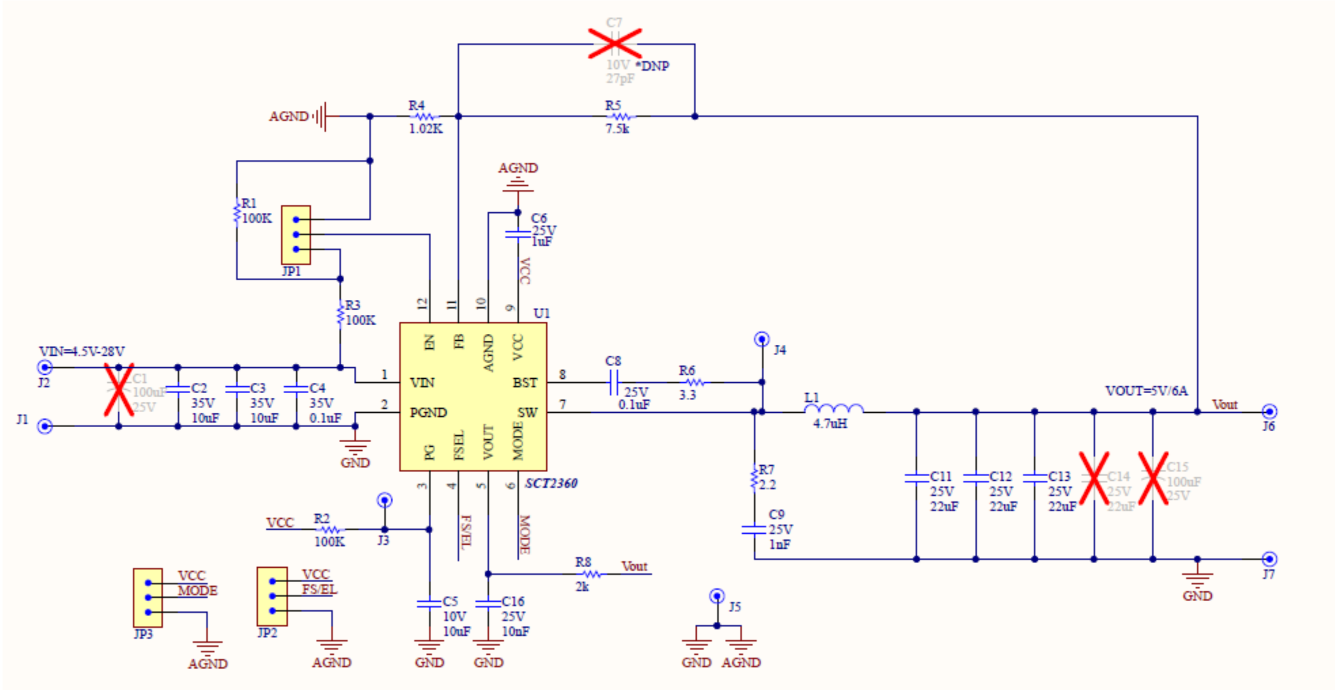


Figure 3. SCT2360EVM Schematic

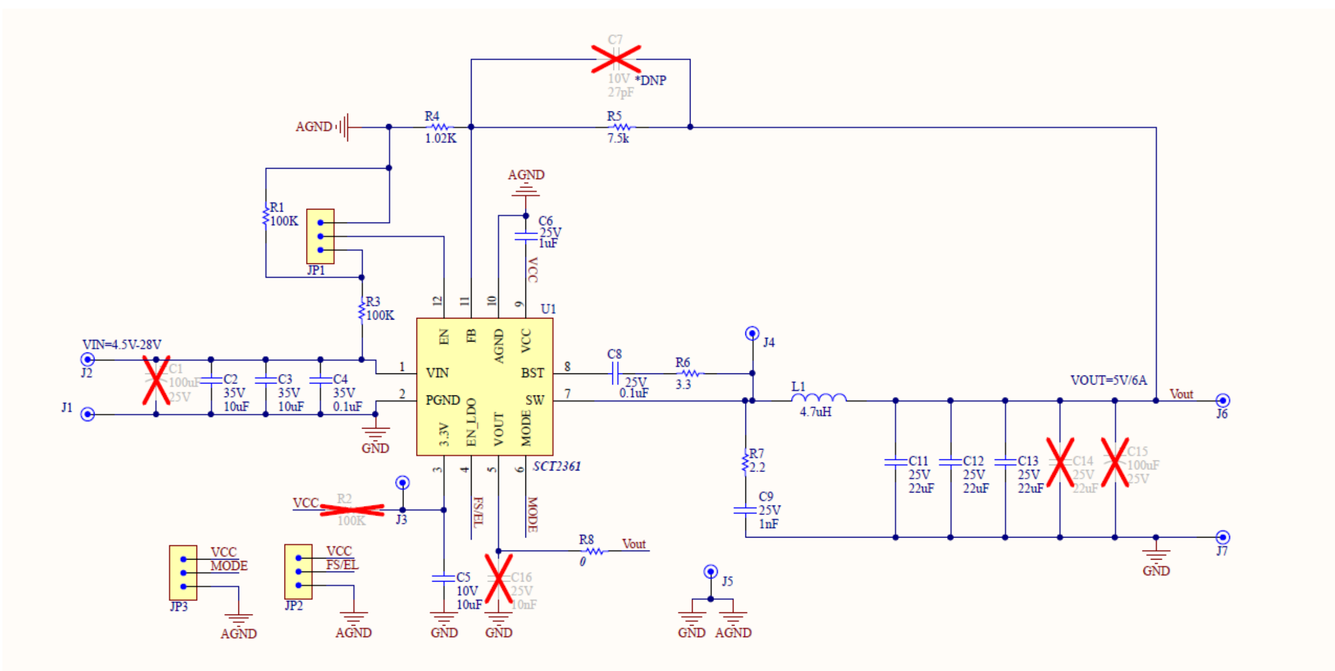


Figure 4. SCT2361EVM Schematic

BILL OF MATERIALS

Table 2. SCT2360EVM Bills of Materials

Footprint	Part Number	Manufacture	Designator	Description	Quantity
C1210	GCM32EC7YA106KA03L	MuRata	C2, C3	10uf, 35V, 1210	2
C0603	885012206095	Wurth Electronic	C4	0.1uF, 35V, 0603	1
C0603	885012106022	Wurth Electronic	C6	1uF, 25V, 0603	1
C0603	885012206071	Wurth Electronic	C8	0.1uF, 25V, 0603	1
C0603	885012206083	Wurth Electronic	C9	1nF, 50V, 0603	1
C1210	885012109014	Wurth Electronic	C11, C12, C13	22uf, 25V, 1210	3
C0603	885012206065	Wurth Electronic	C9	10nF, 25V, 0603	1
Terminal_2.1	-	QJCJ Factory	J1, J2, J6, J7	terminal 2.1	4
Terminal_1.1	-	QJCJ Factory	J3, J4, J5	terminal 1.1	3
Jumper3	61300311121	Wurth Electronic	JP1, JP2, JP3	3 pin jumper, 100mil	3
WE-LHMI SMD	74437356047	Wurth Electronic	L1	Inductor, 4.7 uH, 6.2A, SMD	1
R0603	RS-03K104FT	FH	R1,R2, R3	100k 1% 0603	3
R0603	RS-03K1021FT	FH	R4	1.02k 1% 0603	1
R0603	RS-03K7501FT	FH	R5	7.5k 1% 0603	1

Table 3. SCT2361EVM Bills of Materials

Footprint	PartNumber	Manufacture	Designator	Description	Quantity
C1210	GCM32EC7YA106KA03L	MuRata	C2, C3	10uf, 35V, 1210	2
C0603	885012206095	Wurth Electronic	C4	0.1uF, 35V, 0603	1
C0805	885012207026	Wurth Electronic	C5	10uF, 10V, 0805	1
C0603	885012106022	Wurth Electronic	C6	1uF, 25V, 0603	1
C0603	885012206071	Wurth Electronic	C8	0.1uF, 25V, 0603	1
C0603	885012206083	Wurth Electronic	C9	1nF, 50V, 0603	1
C1210	885012109014	Wurth Electronic	C11, C12, C13	22uf, 25V, 1210	3
Terminal_2.1	-	QJCJ Factory	J1, J2, J6, J7	terminal 2.1	4
Terminal_1.1	-	QJCJ Factory	J3, J4, J5	terminal 1.1	3
Jumper3	61300311121	Wurth Electronic	JP1, JP2, JP3	3 pin jumper, 100mil	3
WE-LHMI SMD	74437356047	Wurth Electronic	L1	Inductor, 4.7 uH, 6.2A, SMD	1
R0603	RS-03K104FT	FH	R1, R3	100k 1% 0603	2
R0603	RS-03K1021FT	FH	R4	1.02k 1% 0603	1
R0603	RS-03K7501FT	FH	R5	7.5k 1% 0603	1
R0603	RS-03L3R30FT	FH	R6	3.3 1% 0603	1

PRINTED CIRCUIT BOARD LAYOUT

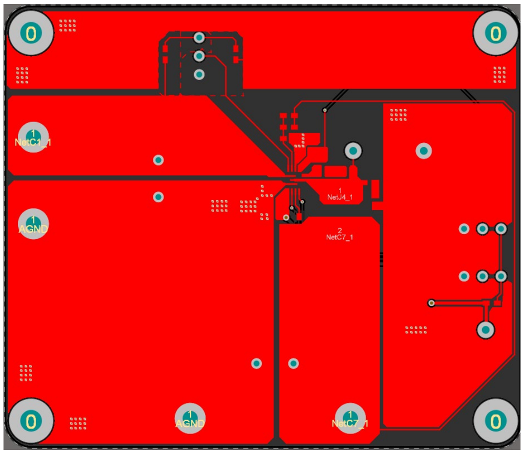


Figure 5. Top Layer

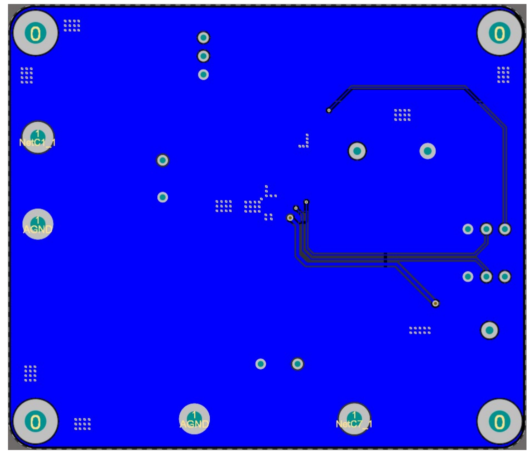


Figure 6. Bottom Layer

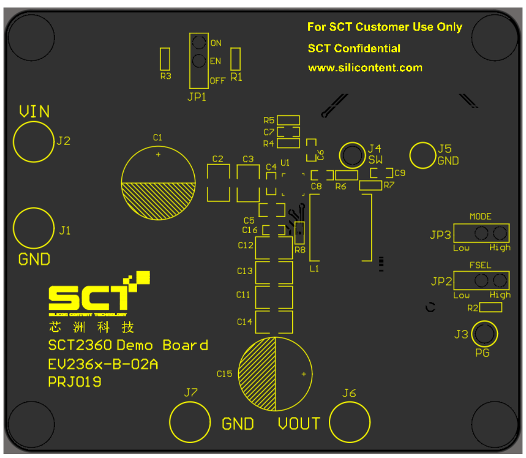


Figure 7. SCT2360EVM Silkscreen Layer

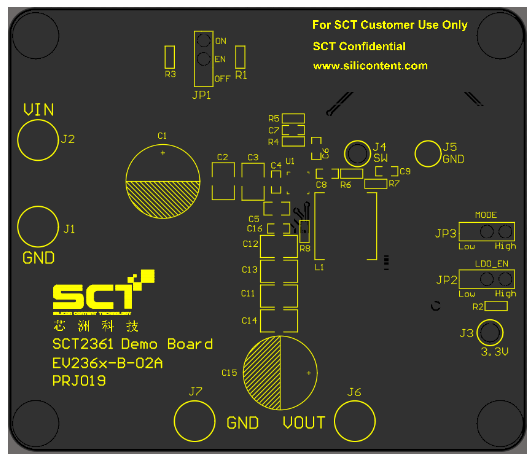


Figure 8. SCT2361EVM Silkscreen Layer

EVM TEST RESULTS

Vin=12V, Vout=5V, unless otherwise noted

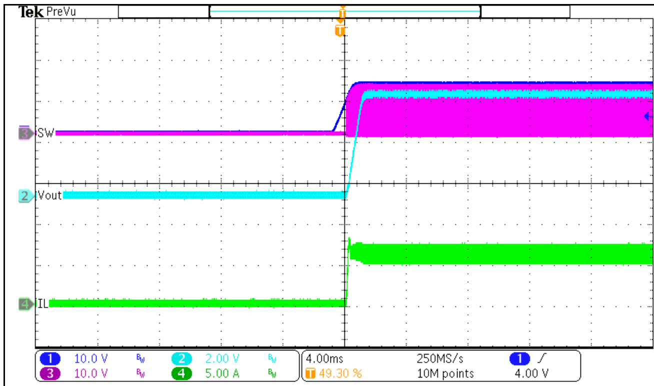


Figure 10. Power Up
(CH-1: Vin, CH-2: Vout, CH-3: SW, CH-4:IL)

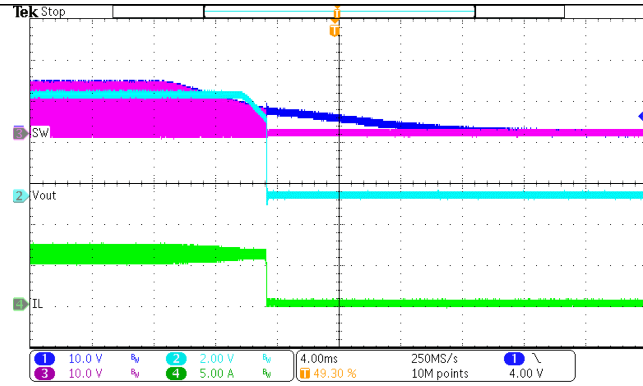


Figure 11. Power Down
(CH-1: Vin, CH-2: Vout, CH-3: SW, CH-4:IL)

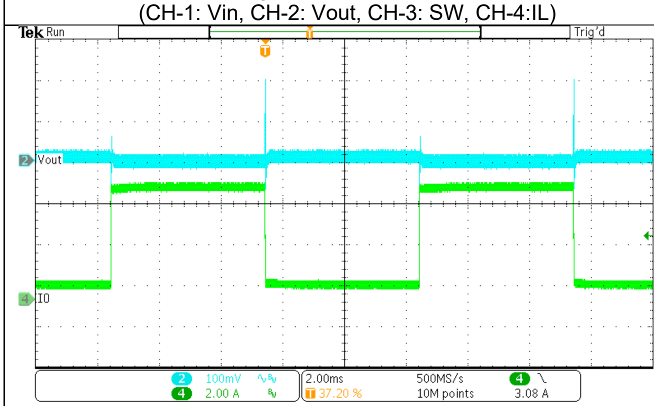


Figure 12. Load Transient
(0.6A-5.4A, SR=2.5A/us, CH-1: Iout, CH-2: Vout)

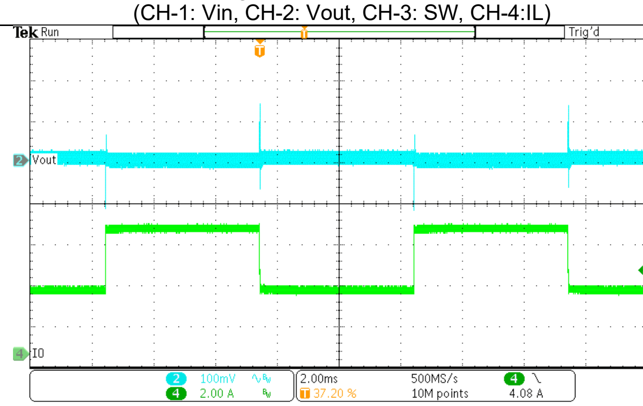


Figure 13. Load Transient
(3A-6A, SR=2.5A/us, CH-1: Iout, CH-2: Vout)

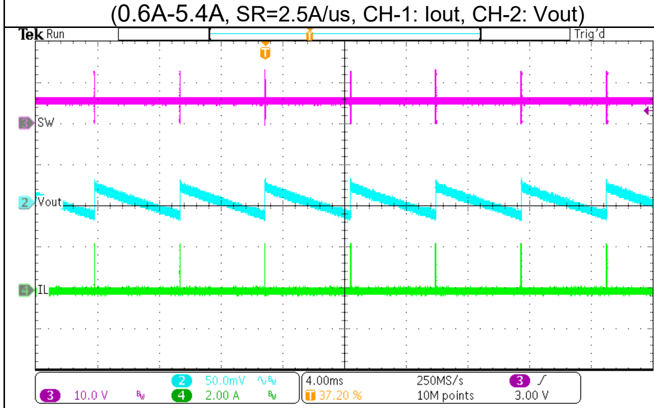


Figure 14. Switching Waveforms and Output Ripple in PSM
(IOUT=0A)

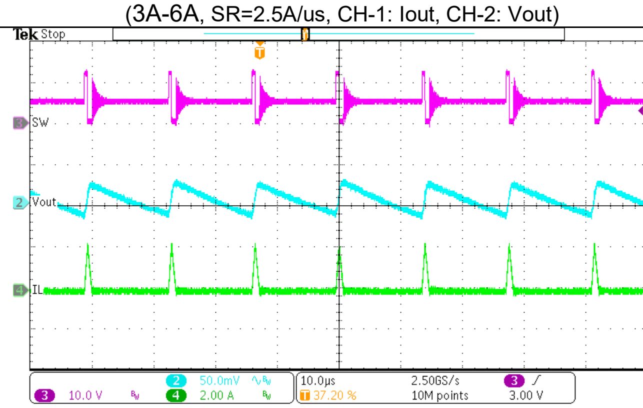


Figure 15. Switching Waveforms and Output Ripple in USM
(IOUT=100mA)

OPTIONAL MODIFICATION

Under Voltage Lockout Threshold

The SCT2360 and SCT2361 is enabled when the VIN pin voltage rises above 3.8V and the EN pin voltage exceeds the enable threshold of 1.18V. The device is disabled when the VIN pin voltage falls below 3.5V or when the EN pin voltage is below 1.1V. An internal 1.5uA pull up current source to EN pin allows the device enable when EN pin floats.

EN pin is a high voltage pin that can be connected to VIN directly to start up the device.

For a higher system UVLO threshold, connect an external resistor divider (R1 and R2) shown in Figure 16 from VIN to EN. The UVLO rising and falling threshold can be calculated by Equation 1 and Equation 2 respectively.

$$V_{rise} = 1.18 * \left(1 + \frac{R1}{R2}\right) - 1.5uA * R1 \qquad (1)$$

$$V_{fall} = 1.1 * \left(1 + \frac{R1}{R2}\right) - 5.5uA * R1 \qquad (2)$$

where:

- V_{rise} is the rising threshold of Vin UVLO.
- V_{fall} is the falling threshold of Vin UVLO

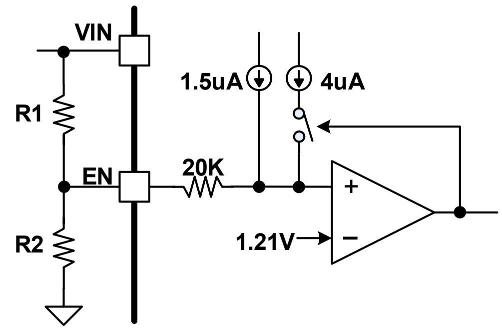


Figure 16. VIN UVLO Programmable by EN Divider

Switching Frequency Selection

The switching frequency of the SCT2360 is selectable to be one of three options: 400KHz, 800KHz and 1200KHz. The switching frequency selection is programmed by FSEL pin. The selection information is shown in following table. The frequency setting is latched in at each power up and is not be able to be modified during operation. Cycling the input power or the EN pin can reselect the switching frequency.

Table 4. FSEL Pin Set-up for Switching Frequency Selection

FSEL Set-up	Connect to GND	Floating	Connect to VCC
Switching Frequency	400KHz	800KHz	1200KHz

Mode Selection

The SCT2360 and SCT2361 features three different operation modes at light load by easily programming the MODE pin. The programming information is listed in following table. The mode setting is latched in at each power up and is not be able to be modified during operation. Cycling the input power or the EN pin can reselect the switching frequency.

Table 5. MODE Pin Set-up for Mode Selection

MODE Set-up	Floating	Connect to GND	Connect to VCC
Switching Frequency	PFM with USM	PFM	FPWM

IMPORTANT NOTICE

This evaluation board kit being sold or provided by Silicon Content Technology is intended for use for ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY and is not provided by SCT for commercial use. As such, the evaluation board herein may not be complete in terms of required design, marketing, and/or manufacturing related protective considerations, including but not limited to product safety measures typically found in finished commercial goods. The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user releases SCT 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 all appropriate precautions regarding electrostatic discharge. Also, be aware that the products herein may not be regulatory compliant or agency certified (FCC, UL, CE, etc.). No License is granted under any patent right or other intellectual property whatsoever. SCT assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or any other intellectual property rights of any kind. Please read the Evaluation Board user's guide prior to handling the product. Persons handling this product must have electronics training and observe good laboratory practice standards. Common sense is encouraged. This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a SCT application engineer.