

30W Fully Integrated Synchronous Boost Converter Evaluation Board

FEATURES

- Wide 2.7V-14V Input Voltage Range
- Wide 4.5V-14.6V Output Voltage Range
- 13mΩ/11mΩ $R_{ds(on)}$ Internal Power MOSFETs
- Up to 12A Switch Current and Programmable Peak Current Limit
- Adjustable 200K-2.2MHz Switching Frequency
- Selectable PFM or Forced PWM Mode
- Programmable Soft Start
- Output and Feedback Overvoltage Protection
- Thermal Shutdown Protection at 150°C
- DFN-20 3.5mmx4.5mm Package

APPLICATIONS

- Bluetooth Audio
- Power Banks
- POS System
- E-Cigarette
- USB Power Delivery

DESCRIPTION

The EV12A0-B-01A Evaluation Board is designed to demonstrate the capabilities of SCT12A0, a high efficiency fully integrated synchronous boost converter. It offers a very compact solution to achieve up to 30W continuous output power over a wide input supply range. The constant off-time peak current-mode operation provides fast transient response and eases loop stabilization. The device features include over-current protection, output over voltage protection and thermal shutdown. The SCT12A0 is available in a space-saving 20-pin DFN 3.5mmx4.5mm package.

This user's guide describes the characteristics, operation and the use of the EV12A0-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
EV12A0-B-01A	SCT12A0

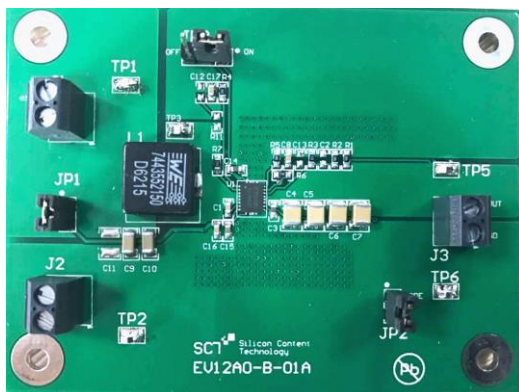
PERFORMANCE SUMMARY

Specifications are at $T_A = 25^\circ\text{C}$

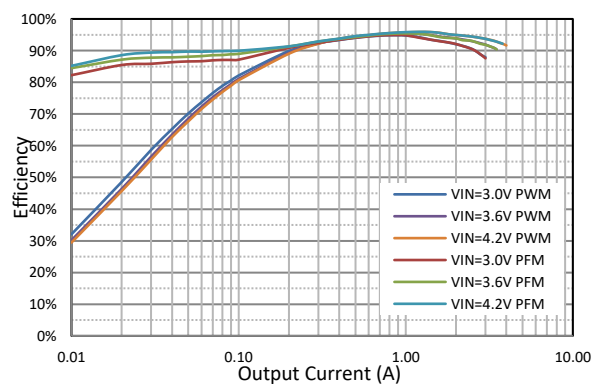
Table 1. Performance

Parameter	Condition	Value
Input Voltage	DC up to 14V	2.7V-8.4V
Output Voltage	JP2: ON PWM	9V \pm 2.5%
Output Current	Continuous DC current	3A
Frequency	Default	560KHz

EV12A0-B-01A Evaluation Board Top View



Efficiency



QUICK START PROCEDURE

Evaluation board EV12A0-B-01A is easy to set up to evaluate the performance of the SCT12A0. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

- Place jumpers in the following positions:
 - JP1: ON Connect V_{IN} supply to V_{IN} pin of IC.
 - JP2: ON Select Forced PWM mode. OFF Select PFM mode.
 - JP3: ON Connect EN pin to V_{CC} to enable IC.
- With power off, connect the input power supply to J1 V_{IN} connector and J2 GND connector. Turn on the power at the input. Make sure that the input voltage does not exceed 14V, and supports sufficient current limit.
- Check the output voltage. The output voltage should be 9V 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.
- To use the enable function, apply a digital input to the EN pin of JP3.

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 V_{IN} or V_{OUT} . See Figure 2 for proper scope probe technique.

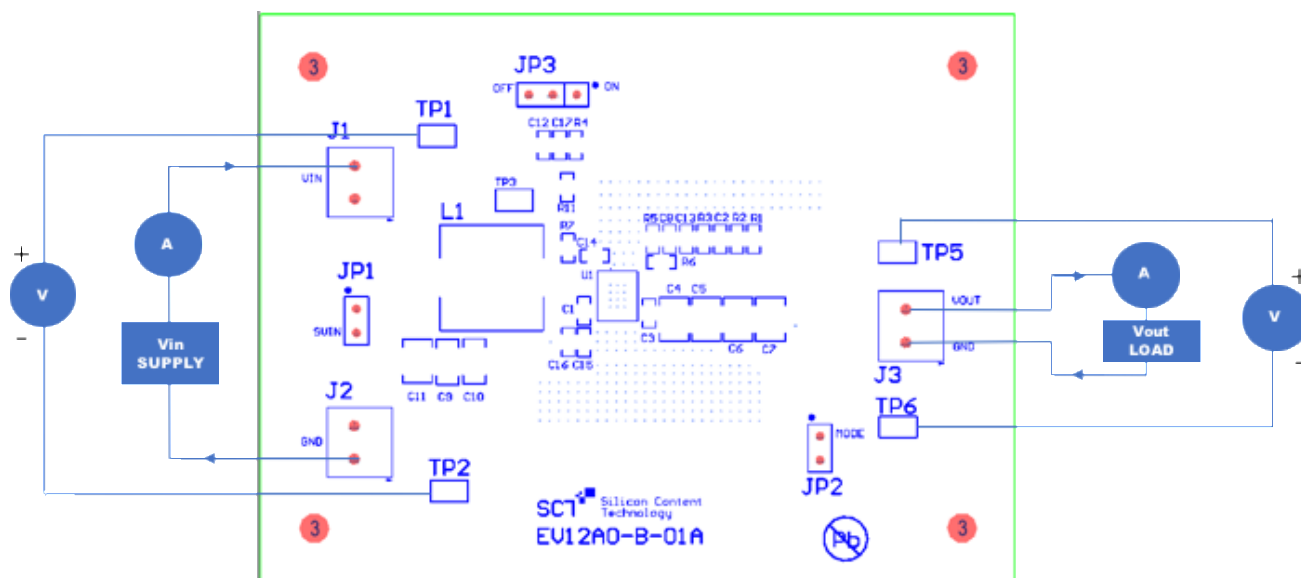


Figure 1. Proper Supply, Load and Measurement Equipment Setup

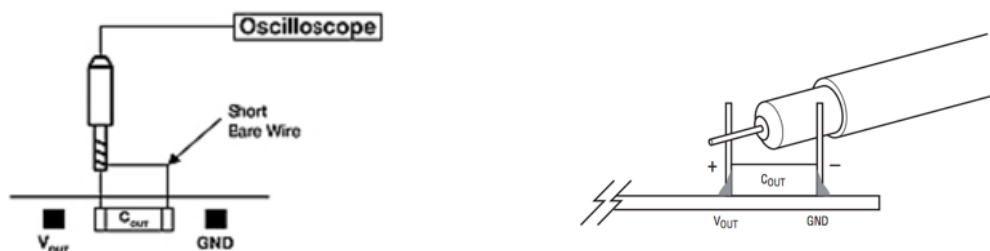


Figure 2. Measuring Voltage Ripple Across Terminals or Directly Across Ceramic Capacitor

SCHEMATIC DIAGRAM

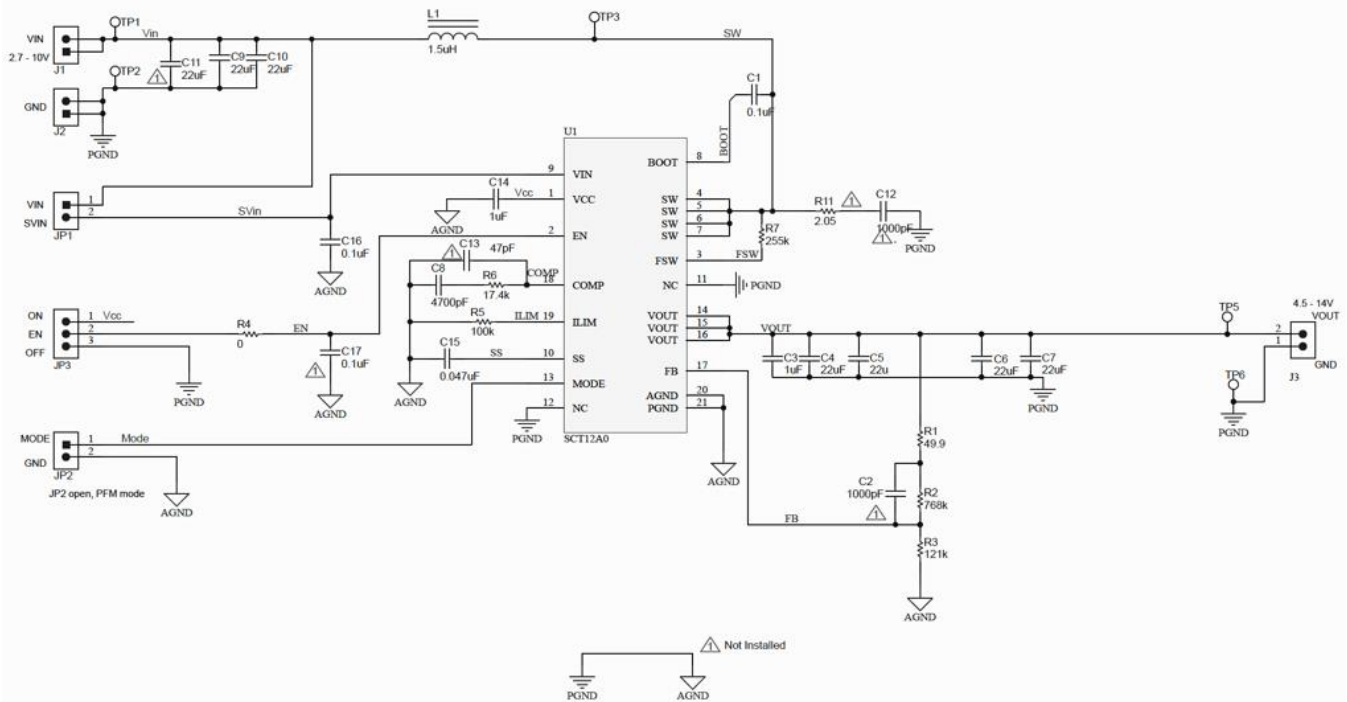


Figure 3. Evaluation Board Schematic

BILL OF MATERIALS

Table 2. Bills of Materials

Manufacture	Comment	Designator	Description	Quantity
Silicon Content Technology	SCT12A0	U1	SCT12A0, 30W Synchronous Boost Converter DFN-20L 3.5mmX4.5mm with thermal pad	1
Würth Elektronik	61300211121	JP1, JP2, JP3	Header, 100mil, 2x1, Tin, TH	3
Würth Elektronik	691 214 110 002S	J1, J2, J3	Terminal Block, 6A, 3.5mm Pitch, 2-Pos, TH	3
Murata	GRM1885C1H470JA01D	C13	CAP, CERM, 47 pF, 50 V, +/- 5%, C0G/NP0, 0603	Not Installed
Murata	GRM188R61E105KA12D	C3	CAP, CERM, 1 uF, 25 V, +/- 10%, X5R, 0603	1
Murata	GRM188R71H102KA01D	C11,	CAP, CERM, 22uF, 16 V, +/- 10%, X5R, 1206	Not Installed
Murata	GRM188R71H102KA01D	C2, C12	CAP, CERM, 1000 pF, 50 V, +/- 10%, X7R, 0603	Not Installed
Murata	GRM188R71H473KA61D	C15	CAP, CERM, 0.047u, 50 V, +/- 10%, X7R, 0603	1
Murata	06033D04KATA	C1, C16, C17	CAP, CERM, 0.1 uF, 25 V, +/- 10%, X5R, 0603	3
Murata	GRM188R61H472KA01D	C8	CAP, CERM, 4700 pF, 50 V, +/- 10%, X5R, 0603	1
Murata	0603ZD475KAT2A	C14	CAP, CERM, 1uF, 10V, +/-10%, X5R, 0603	1
Würth Elektronik	885012109014	C4, C5, C6, C7	CAP, CERM, 22 uF, 25 V, +/- 10%, X5R, 1210	4
Würth Elektronik	885012108018	C9, C10	CAP, CERM, 22uF, 16 V, +/- 10%, X5R, 1206	2
Würth Elektronik	7443552150	L1	Inductor, Shielded Drum Core, WE-Perm, 1.5 uH, Rate current 14 A, DCR 0.0051 ohm, SMD	1
Vishay	CRCW0603768KFKEA	R2	RES, 768 k, 1%, 0.1 W, 0603	1
Vishay	CRCW0603255KFKEA	R7	RES, 255 k, 1%, 0.1 W, 0603	1
Vishay	CRCW0603121KFKEA	R3	RES, 121 k, 1%, 0.1 W, 0603	1
Vishay	CRCW0603100KFKEA	R5	RES, 100 k, 1%, 0.1 W, 0603	1
Vishay	CRCW060349R9FKEA	R1	RES, 49.9, 1%, 0.1 W, 0603	1
Vishay	CRCW060317K4FKEA	R6	RES, 17.4 k, 1%, 0.1 W, 0603	1
Vishay	CRCW06032R05FKEA	R11	RES, 2.05, 1%, 0.1 W, 0603	Not Installed
Vishay	CRCW06030000Z0EA	R4	RES, 0, 5%, 0.1 W, 0603	1
Keystone	5015	TP1, TP2, TP3, TP5, TP6	Test Point, Miniature, SMT	5

PRINTED CIRCUIT BOARD LAYOUT

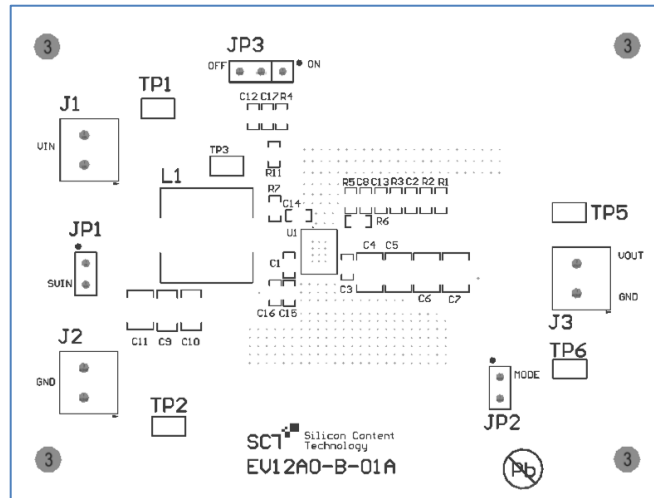


Figure 4. Top Silkscreen Layer

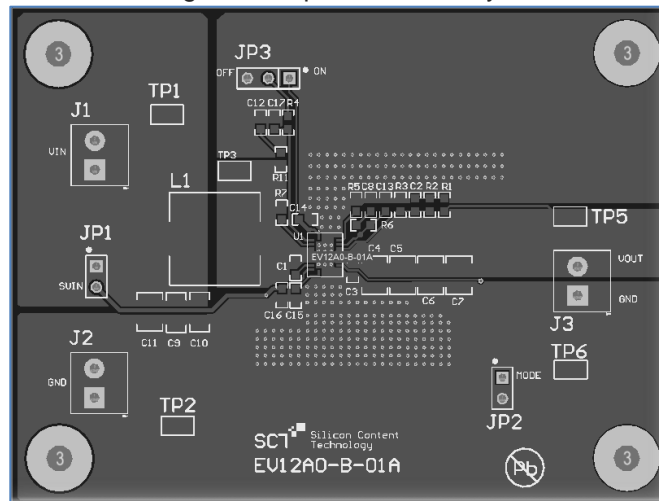


Figure 5. Top Layer

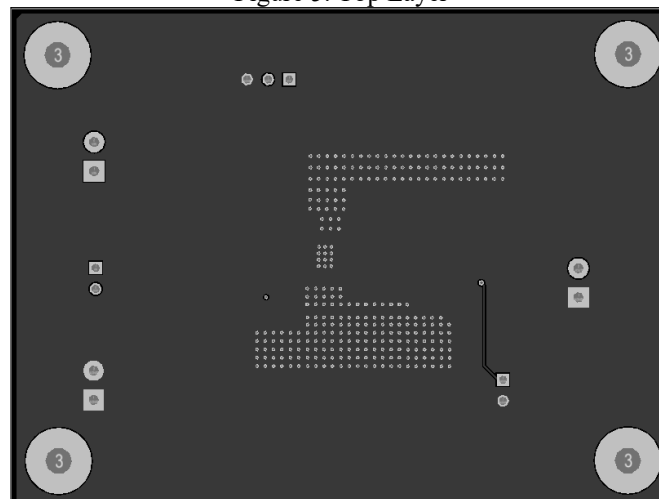


Figure 6. Bottom Layer

EVB TEST RESULTS

$V_{in}=3.6V$ unless otherwise noted

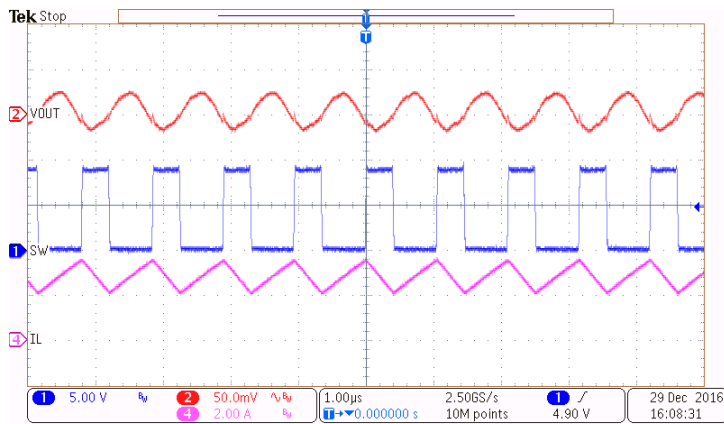


Figure 6. Output Ripple in PWM

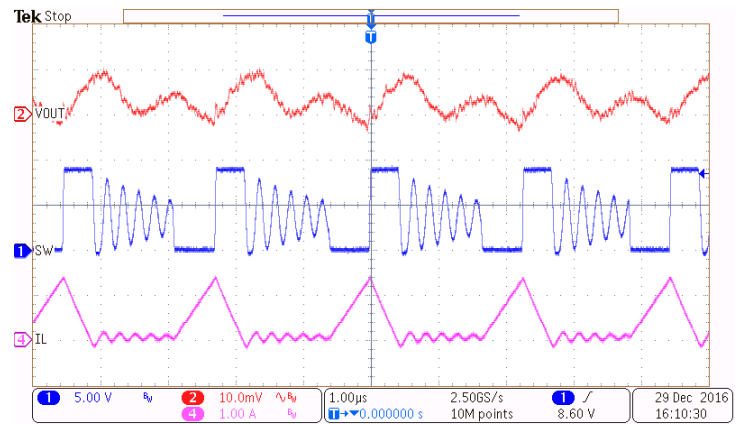


Figure 7. Output Ripple in DCM

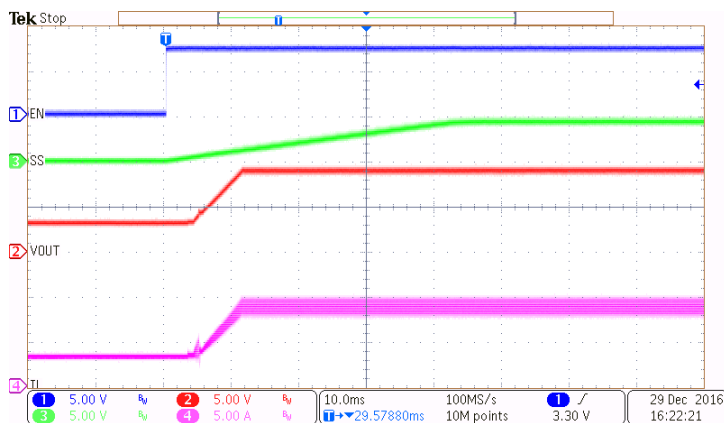


Figure 8. Power Up

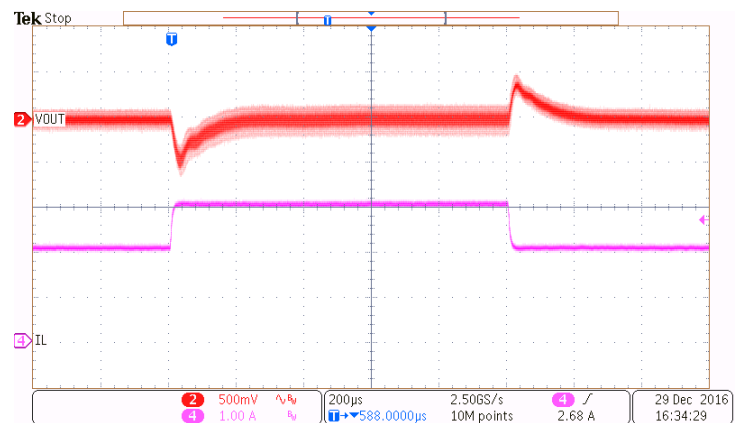


Figure 9. Load Transient ($I_{out}=2A$ to $3A$, $SR=250mA/us$)

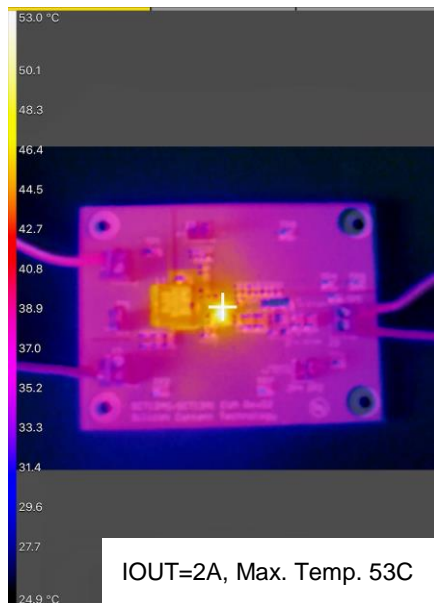


Figure 10. Infrared Thermal Image, $I_{out}=2A$

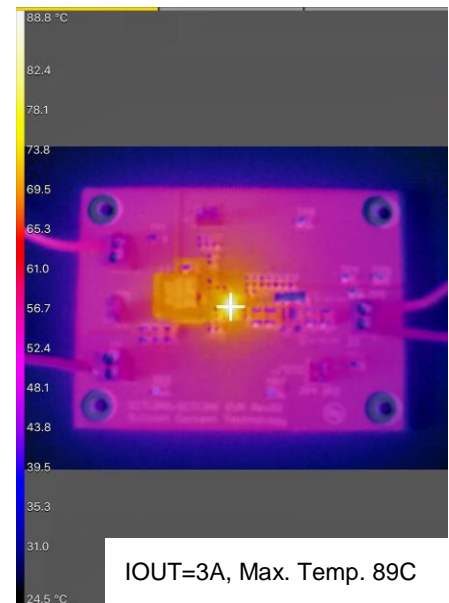


Figure 11. Infrared Thermal Image, $I_{out}=3A$

OPTIONAL MODIFICATION

Switching Frequency

The resistor connected from FSW to SW R7 (Default 255KΩ) sets switching frequency of the converter. Use equation 1 to set a desired frequency.

$$R_{FREQ} = \frac{6 * (\frac{1}{f_{SW}} - T_{DELAY} * \frac{V_{OUT}}{V_{IN}})}{C_{FREQ}} \quad (1)$$

where:

- f_{SW} is the desired switching frequency
- $T_{DELAY} = 90$ ns
- $C_{FREQ} = 34$ pF
- V_{IN} is the input voltage
- V_{OUT} is the output voltage

Table 3. R_{FSW} Value for Common Switching Frequencies
(Vin=3.6V, Vout=9V, Room Temperature)

Fsw	R _{FSW} (R7)
200 KHz	768 KΩ
350 KHz	422 KΩ
520 KHz	287 KΩ
730 KHz	196 KΩ
1000 KHz	130 KΩ
2000 KHz	48.7 KΩ

Peak Current Limit

The resistor R5 at ILIM pin sets default peak input current limit at 13A typical. Use equation 2 to set inductor peak current limit

$$I_{LIM} = \frac{12000}{R_{LIM}} \quad (2)$$

where:

- I_{LIM} is the peak current limit
- R_{LIM} is the resistance of ILIM pin to ground

Table 4. R_{LIM} Value for Inductor Peak Current
(Vin=3.6V, Vout=9V, L=1.5uH, Room Temperature)

I _{LIM}	R _{LIM} (R5)
13.4 A	100 KΩ
9.4 A	150 KΩ
7.2 A	200 KΩ
5.2 A	301 KΩ

Output Voltage

The output voltage is set by an external resistor divider R2 and R3 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.

$$R_2 = \frac{(V_{OUT} - V_{REF}) \times R_3}{V_{REF}} \quad (3)$$

where:

- V_{REF} is the feedback reference voltage, typical 1.2V

Table 5. Feedback Resistor R₃ R₄ Value for Output Voltage
(Room Temperature)

V _{OUT}	R ₂	R ₃
5 V	187 KΩ	59 KΩ
9 V	768 KΩ	121 KΩ
12.1 V	536 KΩ	59 KΩ

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