Description

The SE8405 is a high voltage, non-synchronous step-down converter operates over a wide range input voltage 9V to 100V.

The SE8405 delivers 1.5A continuous load current with up to 95% efficiency. The SE8405 operates with fixed frequency peak current control with built-in compensation eliminates the need for external components.

Cycle-by-cycle current limit in high-side MOSFET protects the converter in an overload condition. Hiccup mode protection is triggered if the over-current condition has persisted for longer than the present time.

The SE8405 exhibits protection features that protect the load from faults like under-voltage, over-current and over-temperature.

The SE8405 is available in an ESOP-8 package.

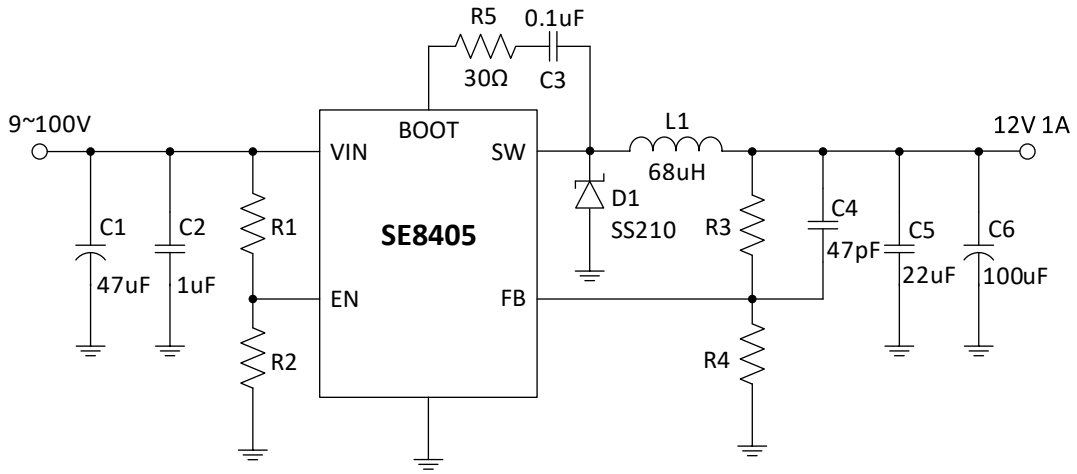
Features

- Wide Input Voltage Range : 9-100V
- output current:1.5A
- Up to 95% Efficiency
- 400mΩ Internal Power MOSFET
- Peak Current mode control
- 300 kHz Fixed Frequency
- Internal compensation for ease of use
- Up to 92% duty cycle
- 1μA shutdown current
- 150ms Hiccup mode short circuit protection Function
- Thermal shutdown Function
- ESOP-8 package

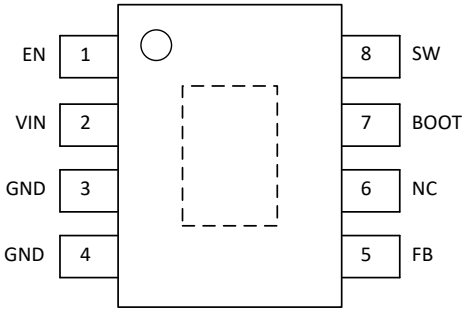
Applications

- Automotive Systemsand Industry Systems
- Distributed Power Systems
- Battery Powered Systems
- GPS tracker,Charger in vehicle
- Motor Drives, Telecom

Typical Application



Pin Configuration



ESOP-8

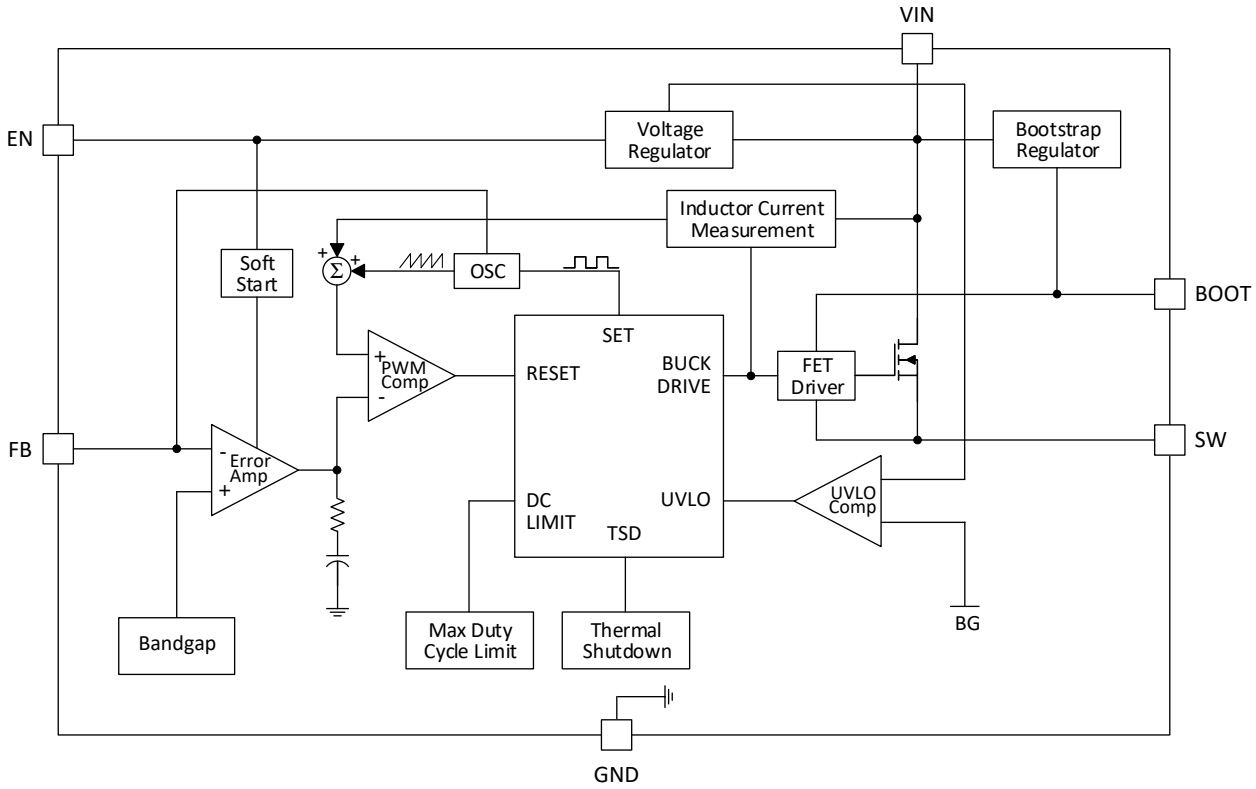
Functional Pin Description

PIN	NAME	Description
1	EN	Enable input. Pull EN below the specified threshold to shut down the SE8405. Pull EN above the specified threshold to enable the SE8405.
2	VIN	Input supply. VIN supplies power to all of the internal control circuitry, both BOOT regulators, and the high-side switch.
3 , 4	GND	Ground. GND should be placed as close to the output capacitor as possible to avoid the high-current switch paths. Connect the exposed pad to GND plane for optimal thermal performance.
5	FB	Feedback. FB is the input to the voltage hysteretic comparator. The average FB voltage is maintained at 800mV by loop regulation.
6	NC	No Connection
7	BOOT	Bootstrap. BOOT is the positive power supply for the internal, floating, high-side MOSFET driver. Connect a bypass capacitor between BOOT and SW.
8	SW	Switch node. SW is the output from the high-side switch. A low forward voltage schottky rectifier to ground is required. The rectifier must be placed close to SW to reduce switching spikes.

Ordering Information

Product model	Packaging form	Smallest packaging	Logo	Output current
SE8405	ESOP8	4000PCS	SE8405	1.5A
SE8405A	ESOP8	4000PCS	SE8405A	1.0A

Block Diagram



Absolute Maximum Ratings

Item	Description	Range	Unit
V_{SW} , V_{EN} , V_{IN}	SW , EN , VIN Voltage	-0.3 ~ +120	V
V_{FB}	FB Voltage	-0.3 ~ +7	V
V_{BOOT}	BOOT Voltage	V_{SW}-0.3 ~ V_{SW}+7	V
T_{stg}	Storage Junction Temperature	-55 ~ 150	°C
T_{solder}	Lead Temperature (Soldering 10 sec.)	260°C	
ESD	Human Body Model	2	kV

Note: exceeding the range specified by the rated parameters will cause damage to the chip, and the working state of the chip beyond the range of rated parameters cannot be guaranteed. Exposure outside the rated parameter range will affect the reliability of the chip.

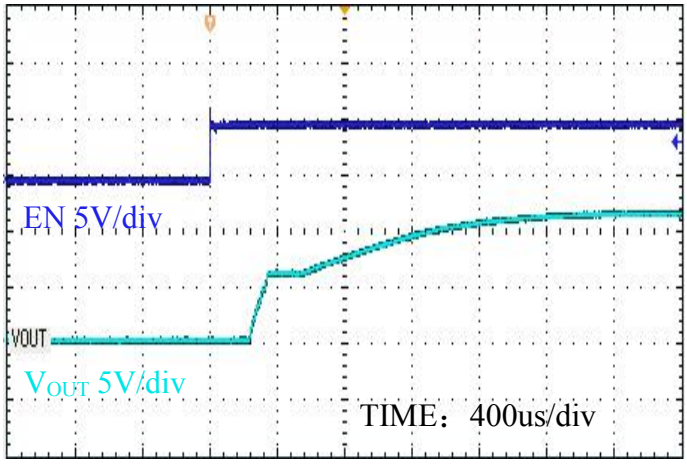
Electrical Characteristics

(At T_A=25°C, V_{IN}=48V, V_{OUT}=12V, Unless Otherwise Noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
VCC SUPPLY VOLTAGE						
Input Voltage	V_{IN}		9	-	100	V
UVLO	V_{STRAT}		-	8	-	V
UVLO Hysteresis	V_{UVLO1}		-	0.3	-	V
Shutdown supply current	I_{SHUT}	EN=0V	-	9	-	uA
Input Quiescent Current	I_Q	V_{FB}=1V	-	400	-	uA
ENABLE						
Enable threshold voltage	V_{EN}		-	2.2	-	V
Enable threshold voltage Hysteresis	V_{UVLO2}		-	0.2	-	V
FEEDBACK						
FB Reference Threshold	V_{FB}		-	0.8	-	V
Feedback short voltage	$V_{FB(short)}$		-	0.35	-	V
Feedback short voltage Hysteresis	V_{FB2}		-	0.42	-	V
OSCILLATOR						
Switching frequency	F	I_{OUT}=500mA	-	300	-	kHz
Maximum Duty Cycle	D_{MAX}	V_{IN}=12V	-	92	-	%
CURRENT LIMIT						
Current Limit Threshold(SE8405)	I_{PEAK}		-	3	-	A
Current Limit Threshold(SE8405A)	I_{PEAK}		-	1.7	-	A
HIGH-SIDE MOSFET						
On-resistance	R_{DSON}	VIN=18V	-	400	-	mΩ
BV(SE8405)	V_{DS}		-	-	100	V
BV(SE8405A)	V_{DS}		-	-	120	V
THERMAL SHUTDOWN						
Thermal shutdown Temp	T_{SD}		-	150	-	°C
Thermal shutdown Temp Hysteresis	T_{SH}		-	30	-	°C

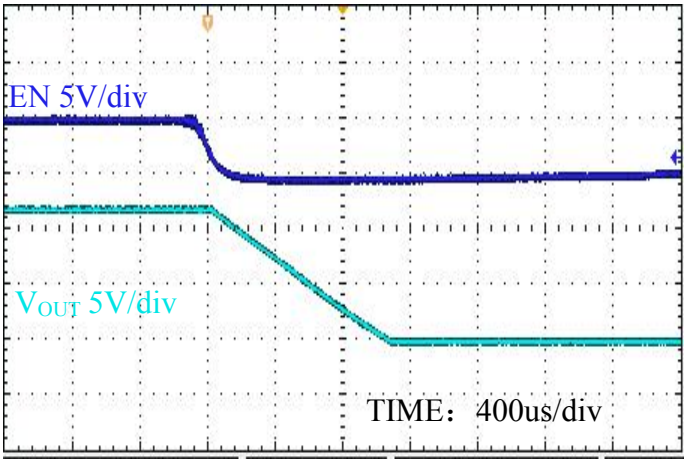
Typical Characteristics

(At T_A=25°C, V_{IN}=48V, V_{OUT}=12V, Unless Otherwise Noted)



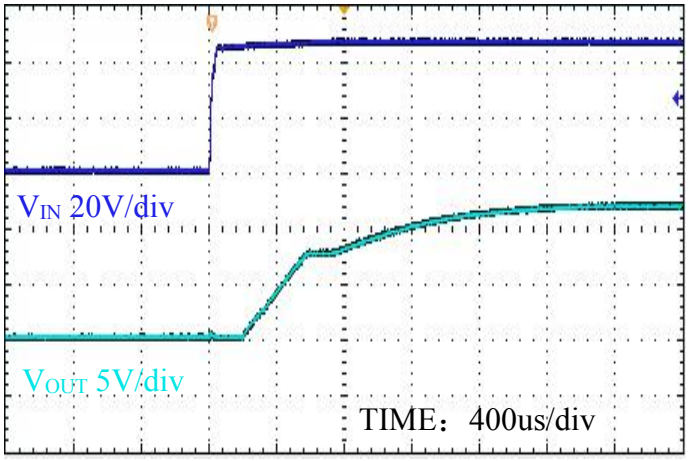
Vin=48V EN=5V

Figure1 EN Start up



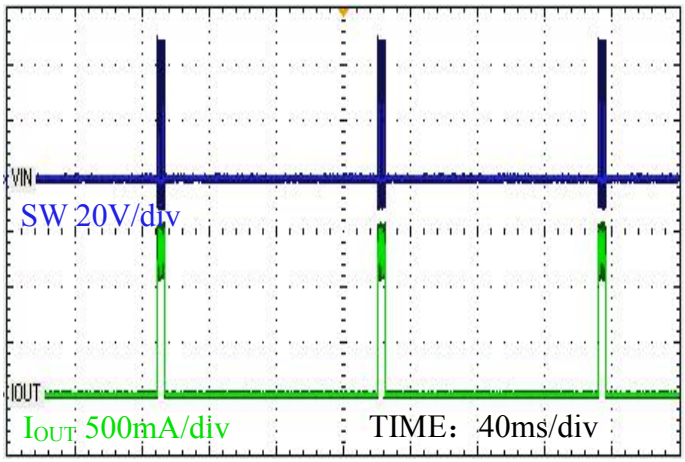
Vin=48V EN=5V

Figure2 EN Turn off



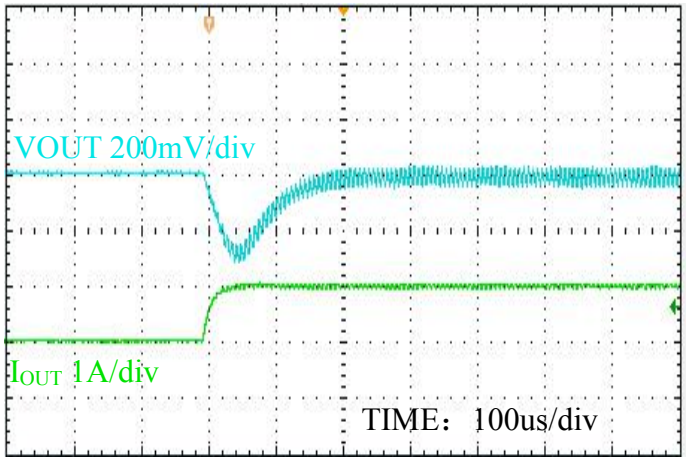
Vin=48V Iout=0A

Figure3 Start up



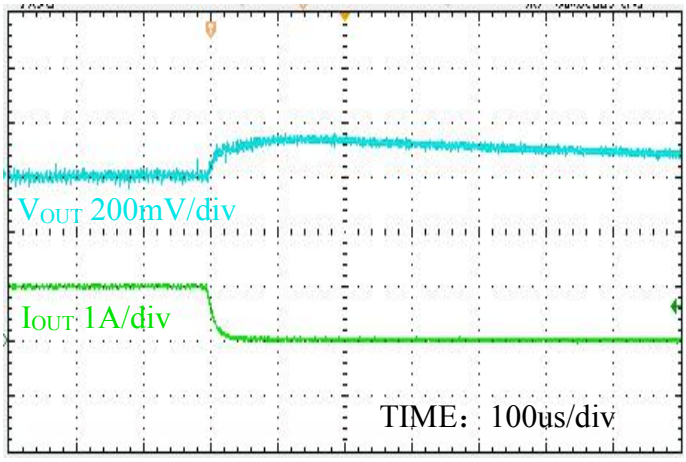
Vin=48V

Figure4 Start up



Iout=10mA~1A Vin=48V

Figure5 Load Transient



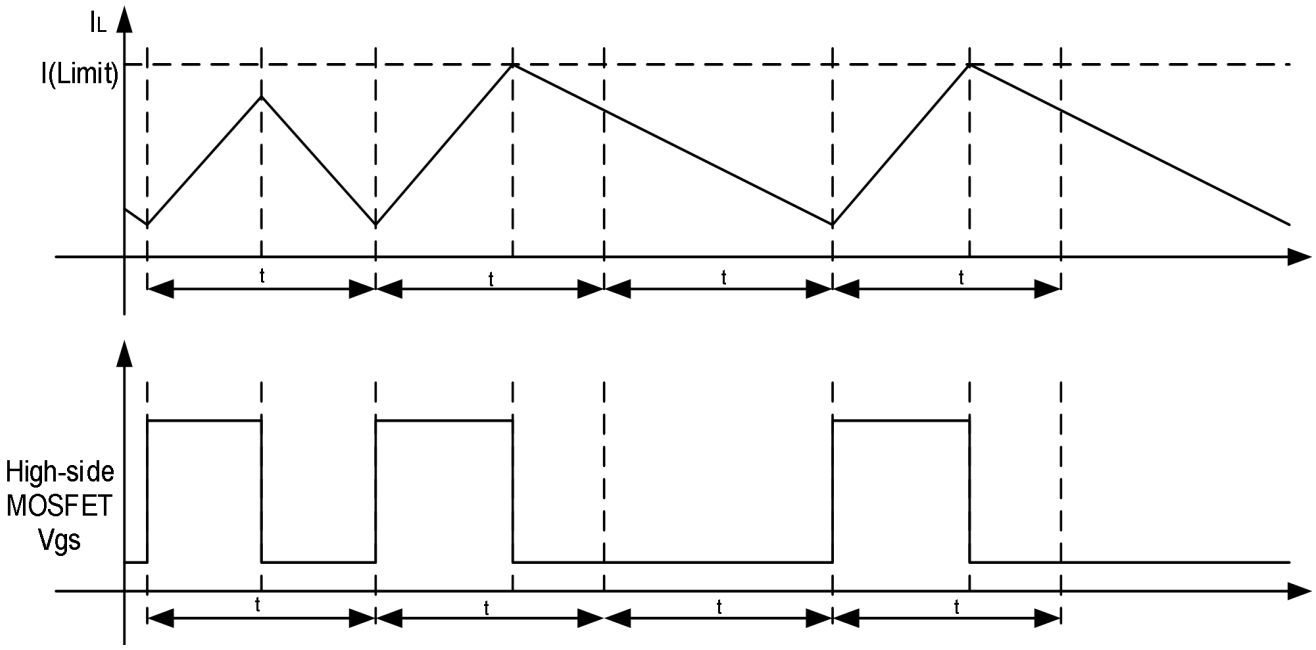
Iout=1A~10mA Vin=48V

Figure6 Load Transient

Applications Information

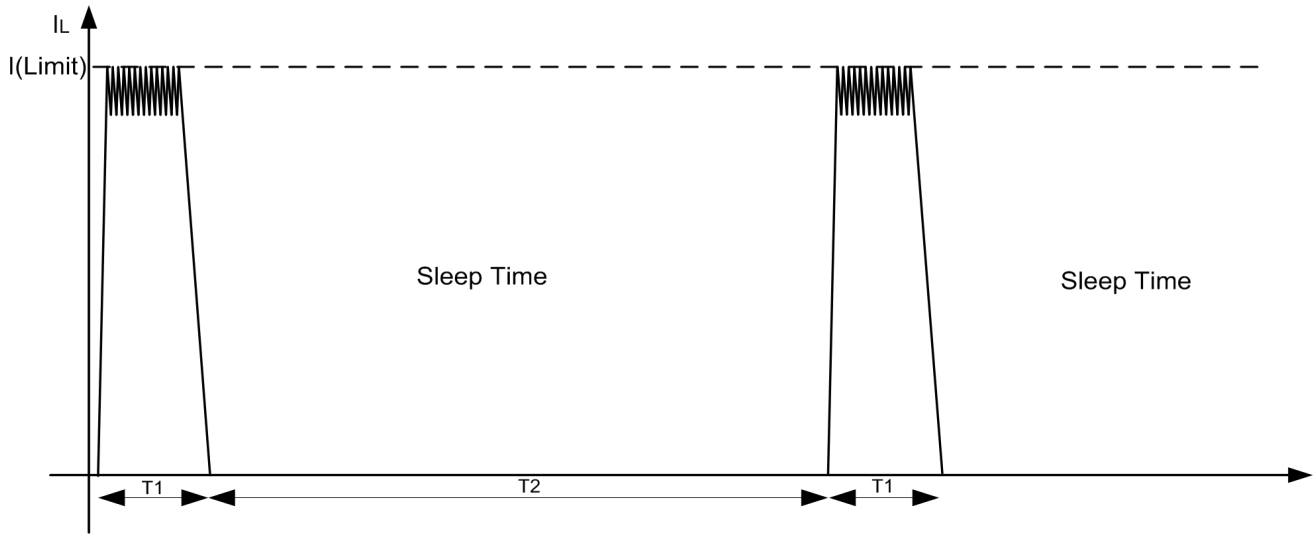
Over-current Protection

The SE8405 implements current-mode control which uses the internal COMP voltage to control the turn on and the turnoff of the high-side MOSFET on a cycle-by-cycle basis. During each cycle,the switch current and the current reference generated by the internal COMP voltage are compared. When the peak switch current intersects the current reference the high-side switch turns off.



Hiccup mode

If an output overload condition occurs for more than the hiccup wait time,which is programmed for 512 switching cycles(T1), the device shuts down and restarts after the hiccup time of 16384 cycles(T2). The hiccup mode helps to reduce the device power dissipation under severe over-current conditions.



C1

This capacitor's purpose is to supply most of the switch current during the on-time, and limit the voltage ripple at VIN. To allow for the capacitor's tolerance, temperature effects, and voltage effects, a 47µF, capacitor is used.

C2

This capacitor helps avoid supply voltage transients and ringing due to long lead inductance at VIN. A low ESR, 1µF ceramic chip capacitor is recommended, located close to the SE8405.

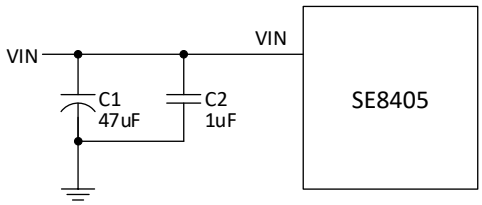


Figure7 The capacitor on the VIN

L1

The inductance is determined based on the switching frequency, load current, inductor ripple current, and the minimum and maximum input voltages designated VIN(min) and VIN(max), respectively. The peak inductor current during an overload condition is limited to 3A nominal. Use the value of 68µH, 5A to prevent saturation.

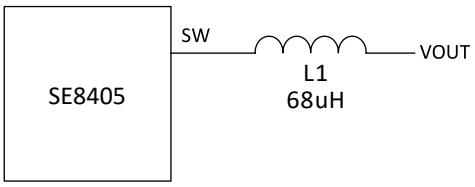


Figure8 The inductor on the choice

D1

A power Schottky diode is recommended. Ultra-fast recovery diodes are not recommended as the high speed transitions at the SW pin may inadvertently affect the IC's operation through external or internal EMI. The important parameters are reverse recovery time and forward voltage. The reverse recovery time determines how long the reverse current surge lasts with each turn-on of the internal buck switch. The forward voltage drop affects efficiency. The diode's reverse voltage rating must be at least as great as the maximum input voltage, plus ripple and transients, and its current rating must be at least as great as the maximum current limit specification.

C4/C5

The output capacitor filters the inductor ripple current and provides a source of charge for transient load conditions. The best performance is typically obtained using ceramic or polymer electrolytic type components. Typical tradeoffs are that the ceramic capacitor provides extremely low ESR to reduce the output ripple voltage and noise spikes. In order to meet output ripple specification, we should choose a ceramic capacitor of 22uF and a polymer electrolytic capacitor of 100uF.

R1/R2

The output voltage (VOUT) is programmed by two external resistors as shown in the Figure9. The regulation point can be calculated as follows:

$$VOUT = 0.8 \times (R1 + R2) / R2$$

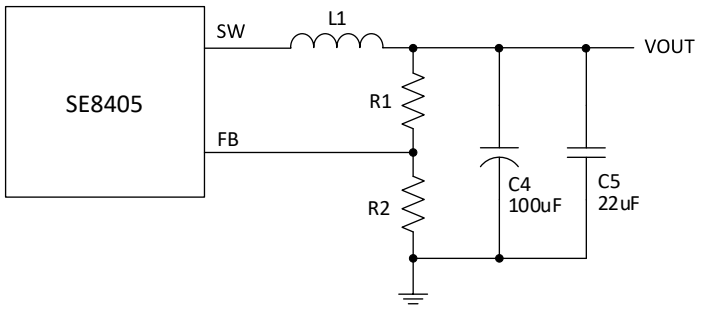
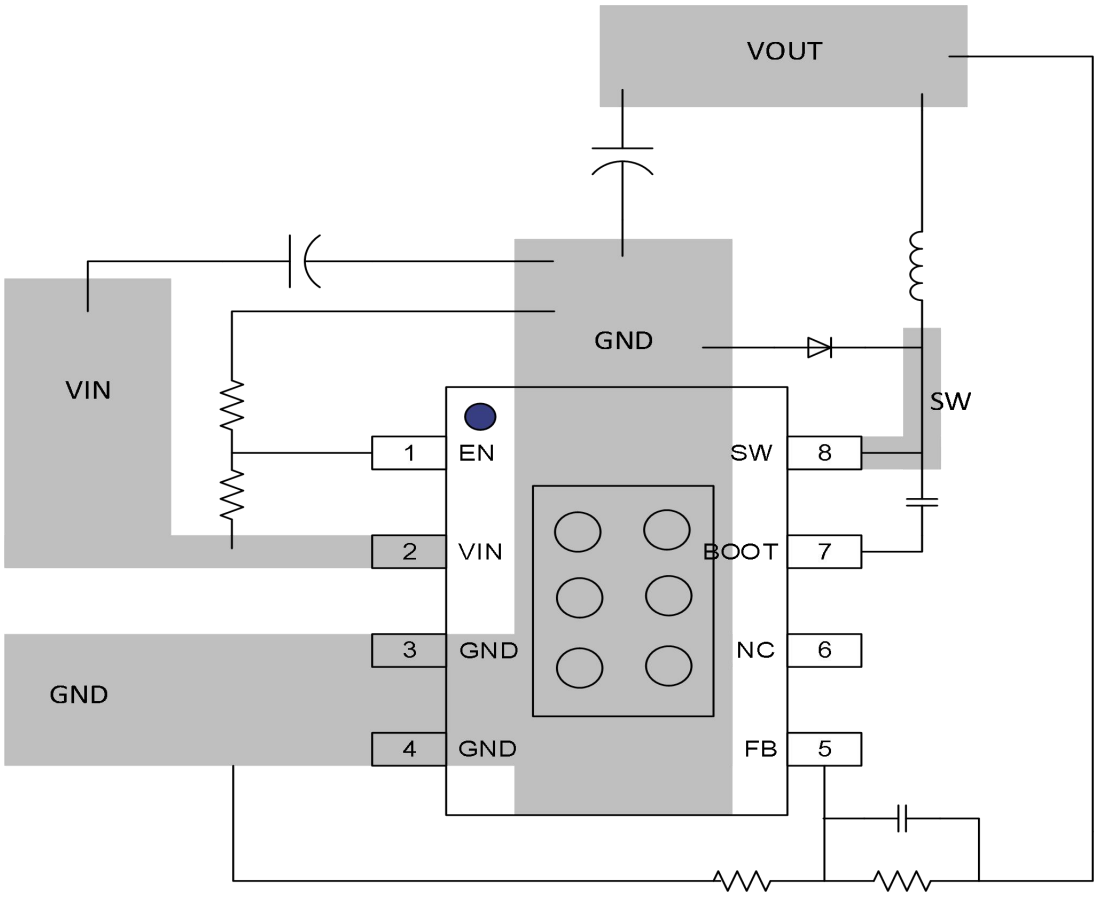


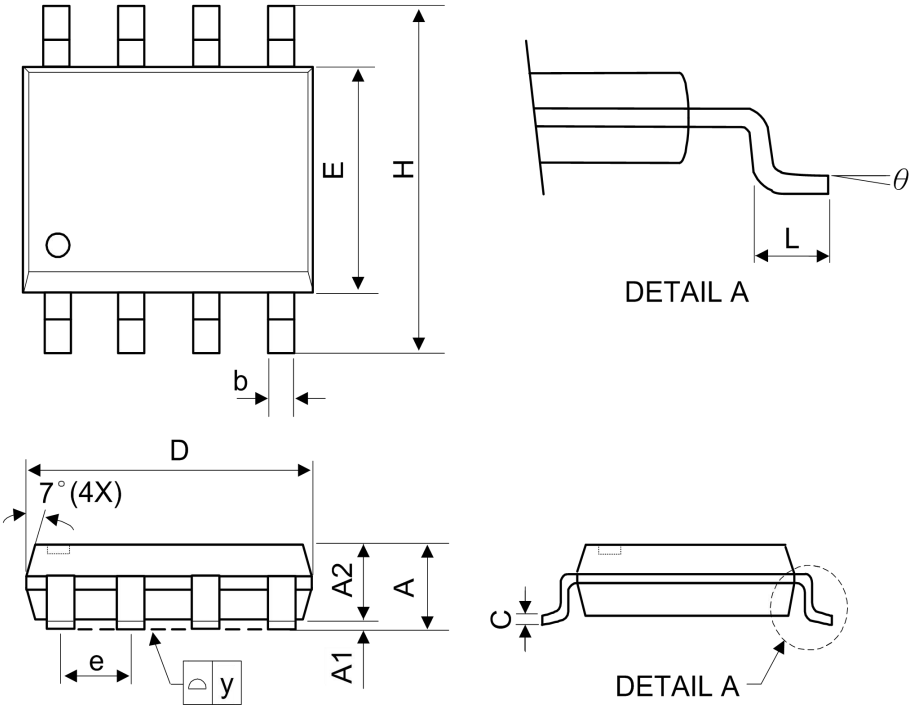
Figure9 Output Capacitors and Output Configuration

Layout



PACKAGE INFORMATION

ESOP8



Symbol	Millimetre			Inch		
	Min	Typ	Max	Min	Typ	Max
A	-	-	1.75	-	-	0.069
A1	0.1	-	0.25	0.04	-	0.1
A2	1.25	-	-	0.049	-	-
C	0.1	0.2	0.25	0.0075	0.008	0.01
D	4.7	4.9	5.1	0.185	0.193	0.2
E	3.7	3.9	4.1	0.146	0.154	0.161
H	5.8	6	6.2	0.228	0.236	0.244
L	0.4	-	1.27	0.015	-	0.05
b	0.31	0.41	0.51	0.012	0.016	0.02
e	1.27 BSC			0.050 BSC		
y	-	-	0.1	-	-	0.004
θ	0°	-	8°	0°	-	8°