100V Input,1.5A Current Limit, Step-down Converter

Features

- 1.5A current limit
- ESOP-8 package
- 95% Peak Efficiency
- Up to 92% duty cycle
- 1μA shutdown current
- 0.8V voltage reference
- 150 kHz Fixed Frequency
- Peak Current mode control
- 1A continuous load current
- Thermal shutdown Function
- 9V to 100V input voltage range
- 400μA operating quiescent current
- 120V 400-mΩ high-side MOSFET
- 150ms Hiccup mode short circuit protection Function

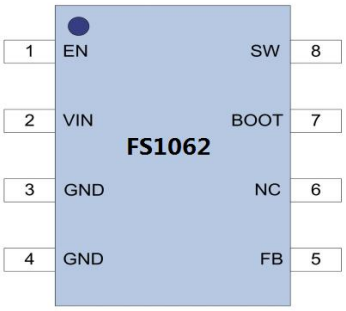
Applications

- Charger in vehicle
- Battery Chargers
- Charger in vehicle

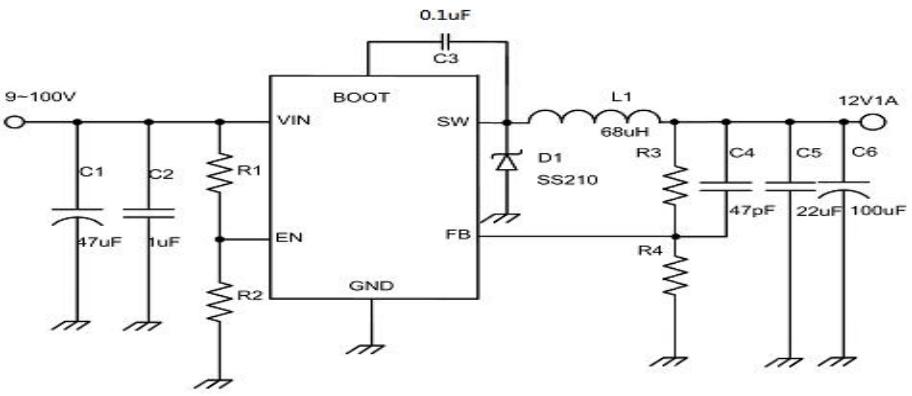
General Description

The FS1062 is a high voltage, non-synchronous step-down converter operates over a wide range input voltage 9V to 100V. The FS1062 integrates a 120V 400mΩ high-side mosfet. The FS1062 delivers 1A continuous load current with up to 95% efficiency. The FS1062 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 FS1062 exhibits protection features that protect the load from faults like under-voltage, over-current and over-temperature. The FS1062 is available in an ESOP-8 package.

Pin Configuration



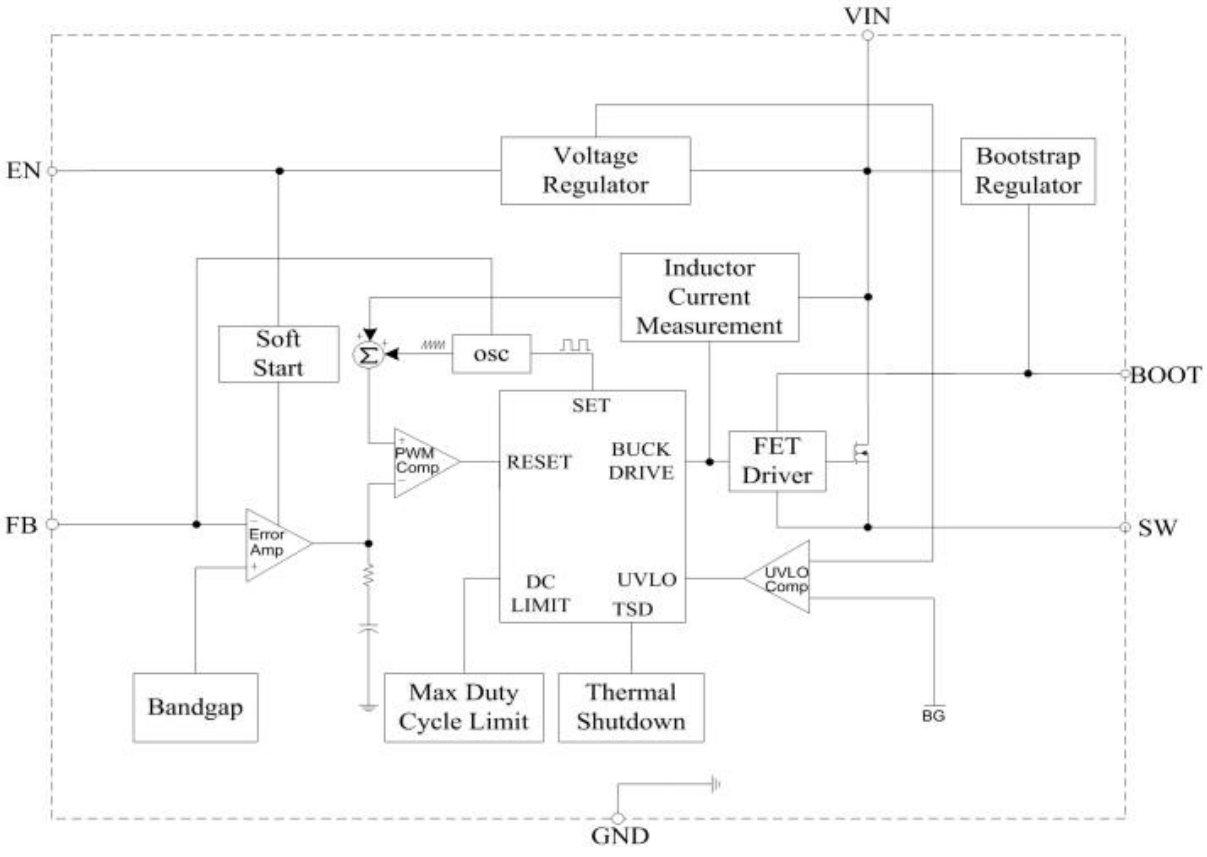
Typical Application



- **Pin Configuration**

Pin (ESOP-8L)	Symbol	Description
1	EN	Enable input. Pull EN below the specified threshold to shut down the FS1062. Pull EN above the specified threshold to enable the FS1062.
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.

- **Block Diagram**



Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
SW，EN，VIN Voltage	V_{SW},V_{EN},V_{IN}	-0.3 to 120	V
FB Voltage	V_{FB}	-0.3 to 7	
BOOT Voltage	V_{BOOT}	V_{SW} -0.3 to V_{SW} +7	
Junction Temperature	T_J	150	℃
Storage Temperature Range	T_{stg}	-55 to + 150	
Lead Temperature (Soldering 10 sec.)	T_{solder}	260	
Human Body Model	ESD	2	kV

Electrical Characteristics

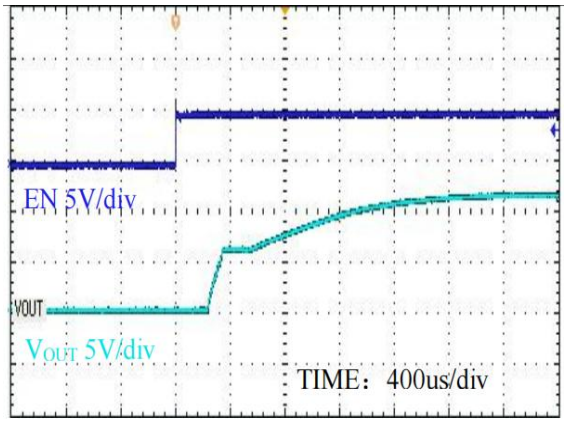
At T_A=25℃, V_{IN}=48V, V_{OUT}=12V, Unless Otherwise Noted.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}		9		100	V
UVLO	V_{START}			8		
UVLO Hysteresis	V_{UVLO1}			0.3		
Shutdown supply current	I_{SHUT}	EN=0V		9		uA
Input Quiescent Current	I_Q	V_{FB}=1V		500		
Enable threshold voltage	V_{EN}			2.2		V
Enable threshold voltage Hysteresis	V_{UVLO2}			0.2		
FB Reference Threshold	V_{FB}			0.8		
Feedback short voltage	$V_{FB(short)}$			0.35		
Feedback short voltage Hysteresis	V_{FB2}			0.42		
Switching frequency	F	I_{OUT}=500mA		150		KHz
Maximum Duty Cycle	D_{MAX}	V_{IN}=12V		92		%
Current Limit Threshold	I_{PEAK}			1.5		A
On-resistance	R_{DSON}	V_{IN}=18V		400		mΩ
Thermal shutdown Temp	T_{SD}			150		℃
Thermal shutdown Temp Hysteresis	T_{SH}			30		℃

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.

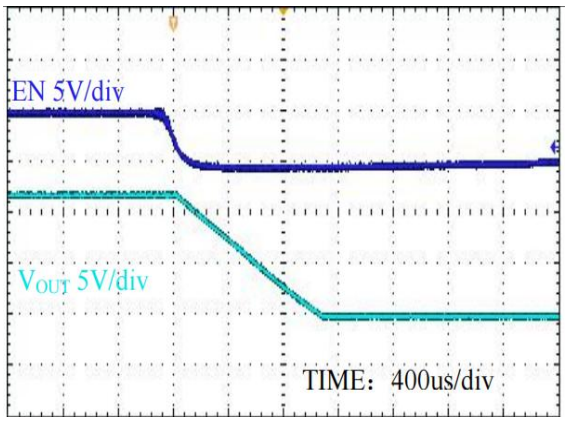
- **Typical Characteristics** (At T_A=25℃, V_{IN}=48V, V_{OUT}=12V, Unless Otherwise Noted)

Figure1 EN Start up



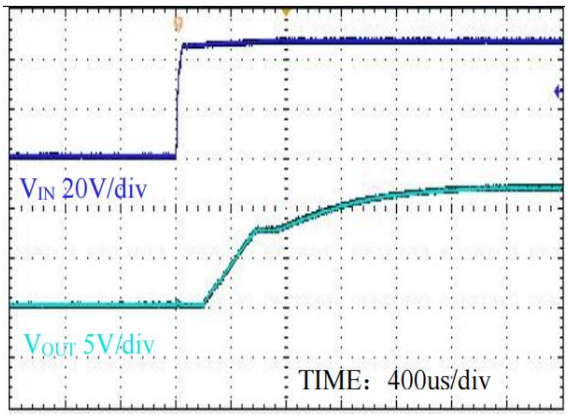
V_{IN}=48V EN=5V

Figure2 EN Turn off



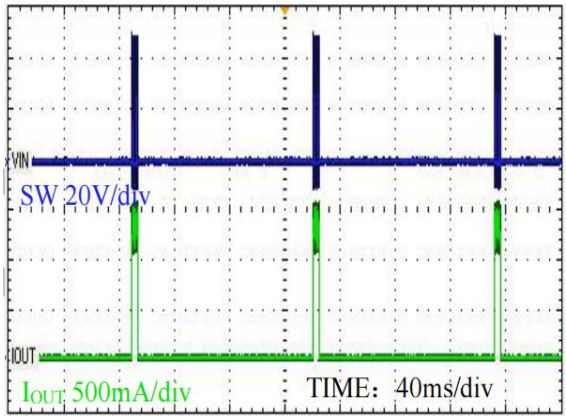
V_{IN}=48V EN=5V

Figure3 Start up



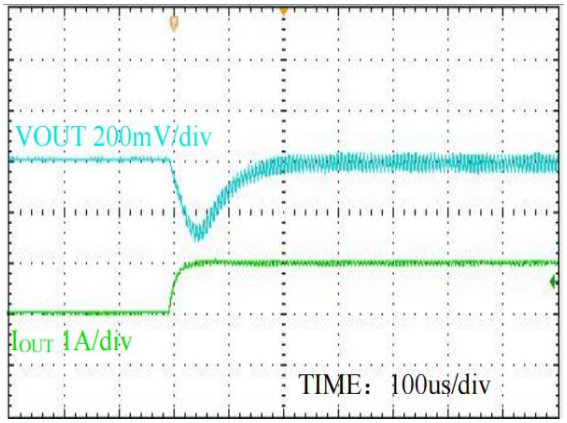
V_{IN}=48V I_{OUT}=0A

Figure4 Start up



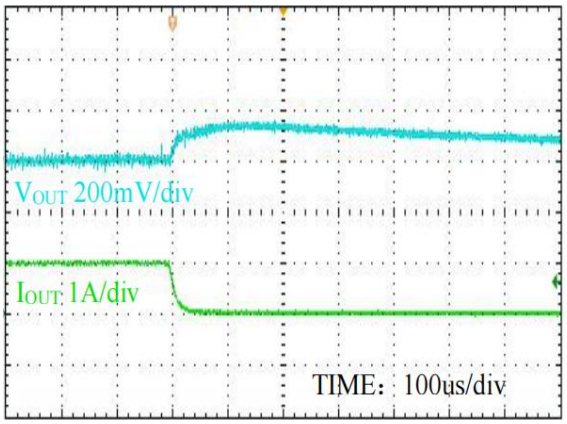
V_{IN}=48V

Figure5 Load Transient



I_{OUT}=10mA~1A V_{IN}=48V

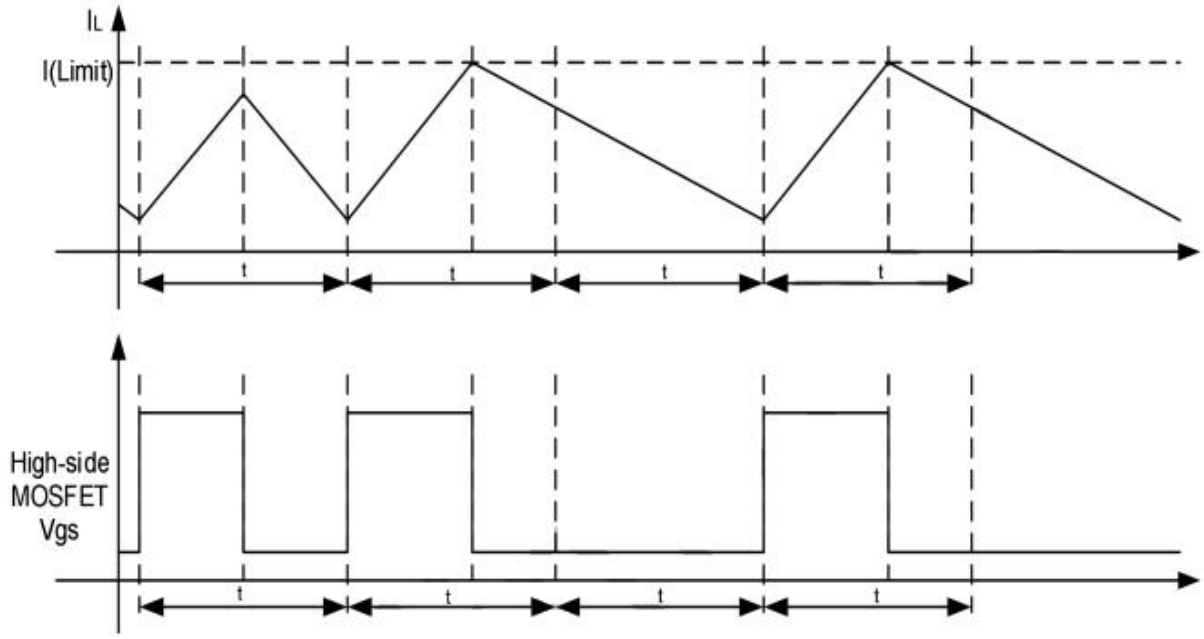
Figure6 Load Transient



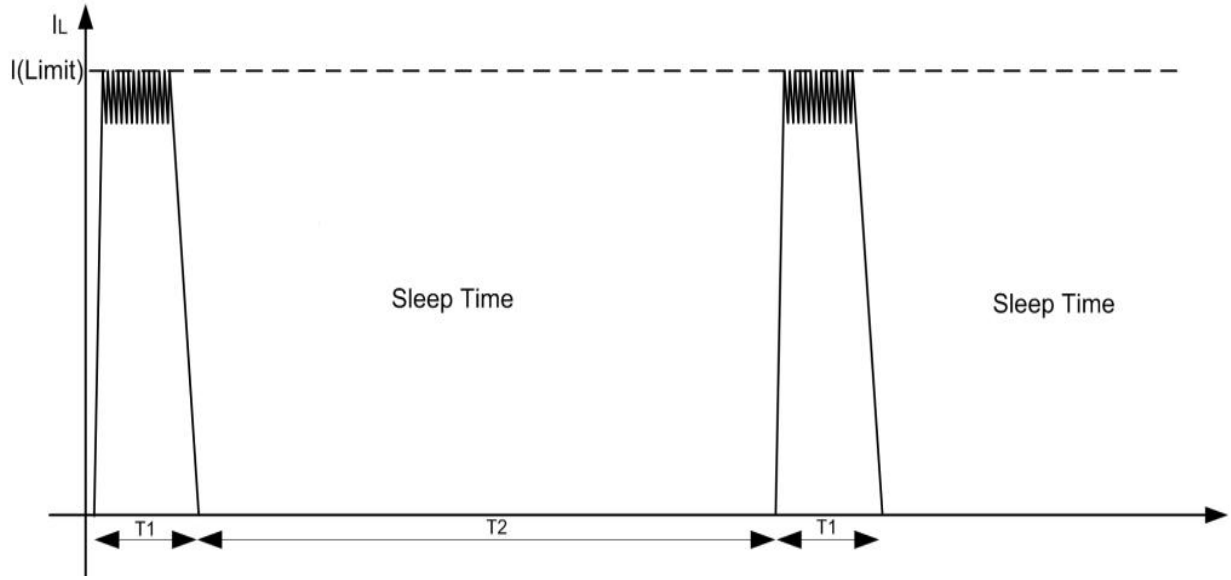
I_{OUT}=10mA~1A V_{IN}=48V

Applications Information

Over-current Protection: TheFS1062 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 47 μF, 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 theFS1062.

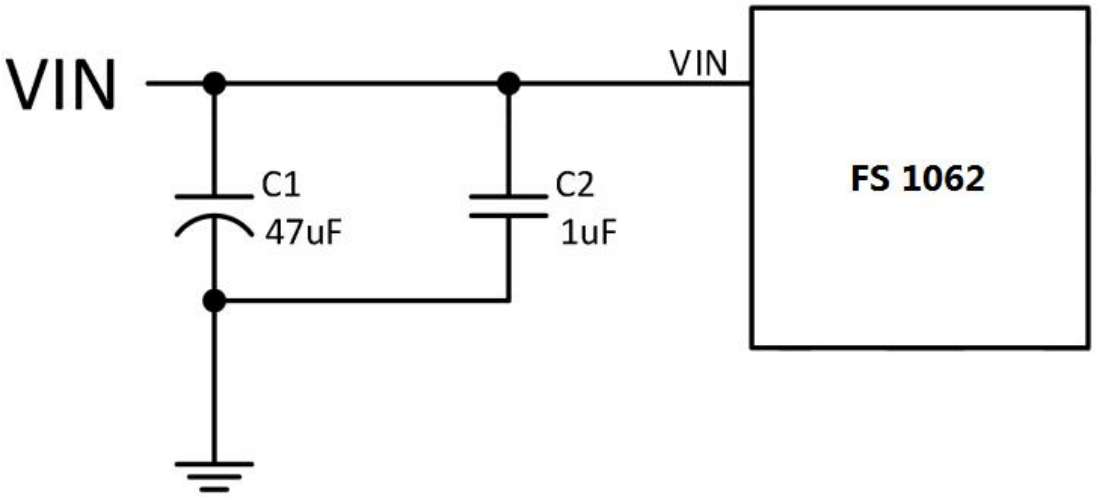


Figure7 The capacitor on the VIN

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 3 A nominal.Use the value of 68μH,5A to prevent saturation.

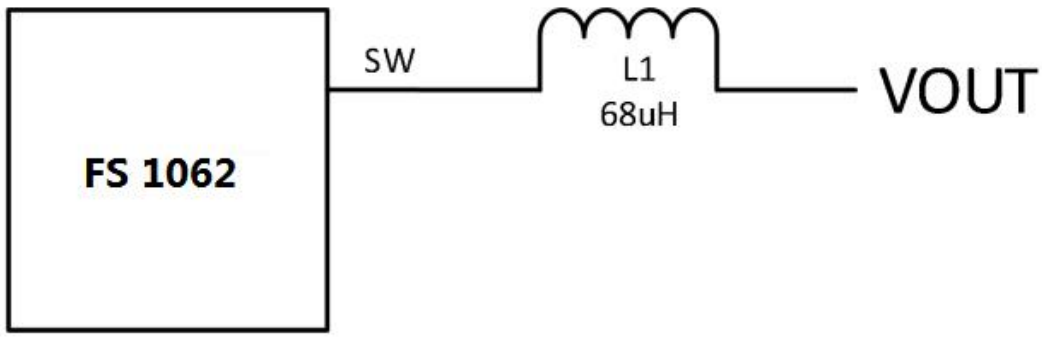


Figure8 The inductor on the choice

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 Figure15. The regulation point can be calculated as follows:

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

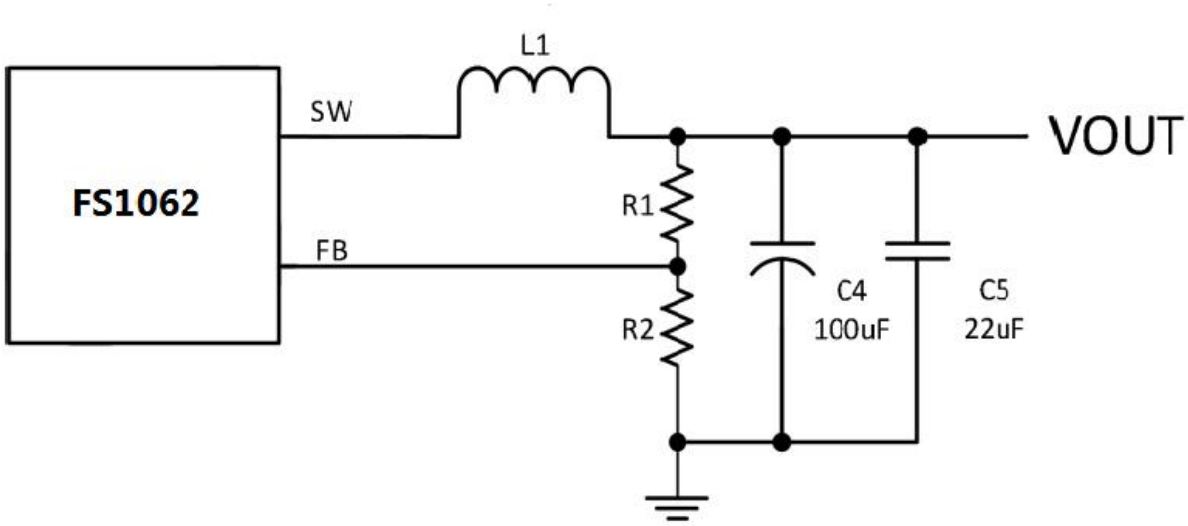
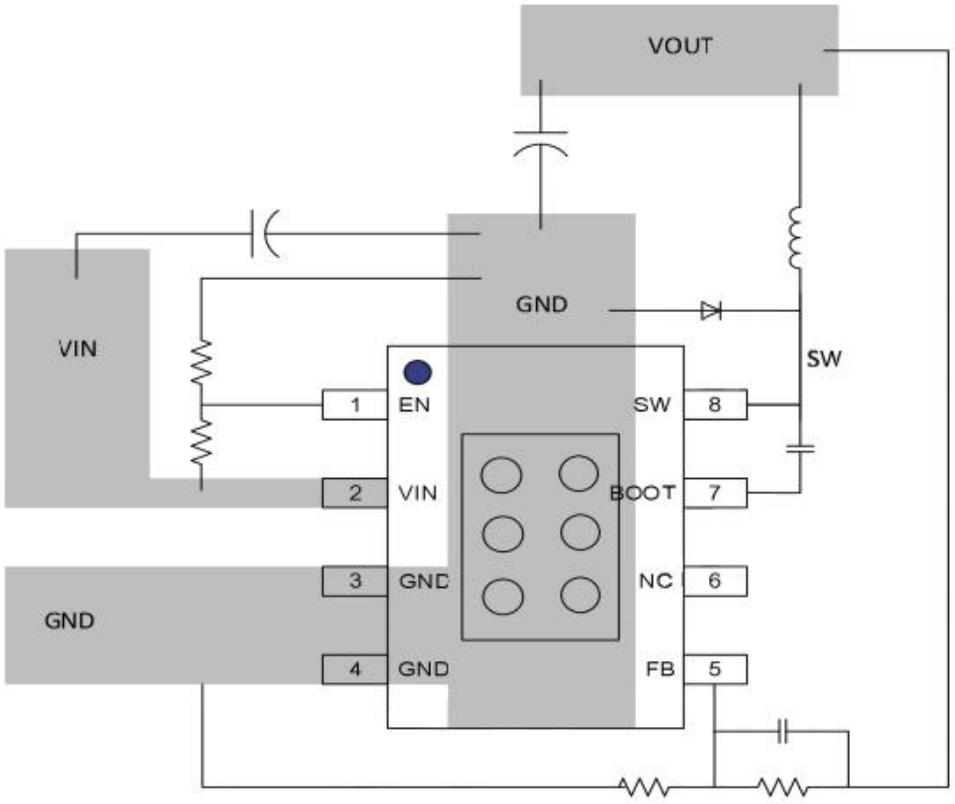


Figure9 Output Capacitors and Output Configuration

- **Layout**



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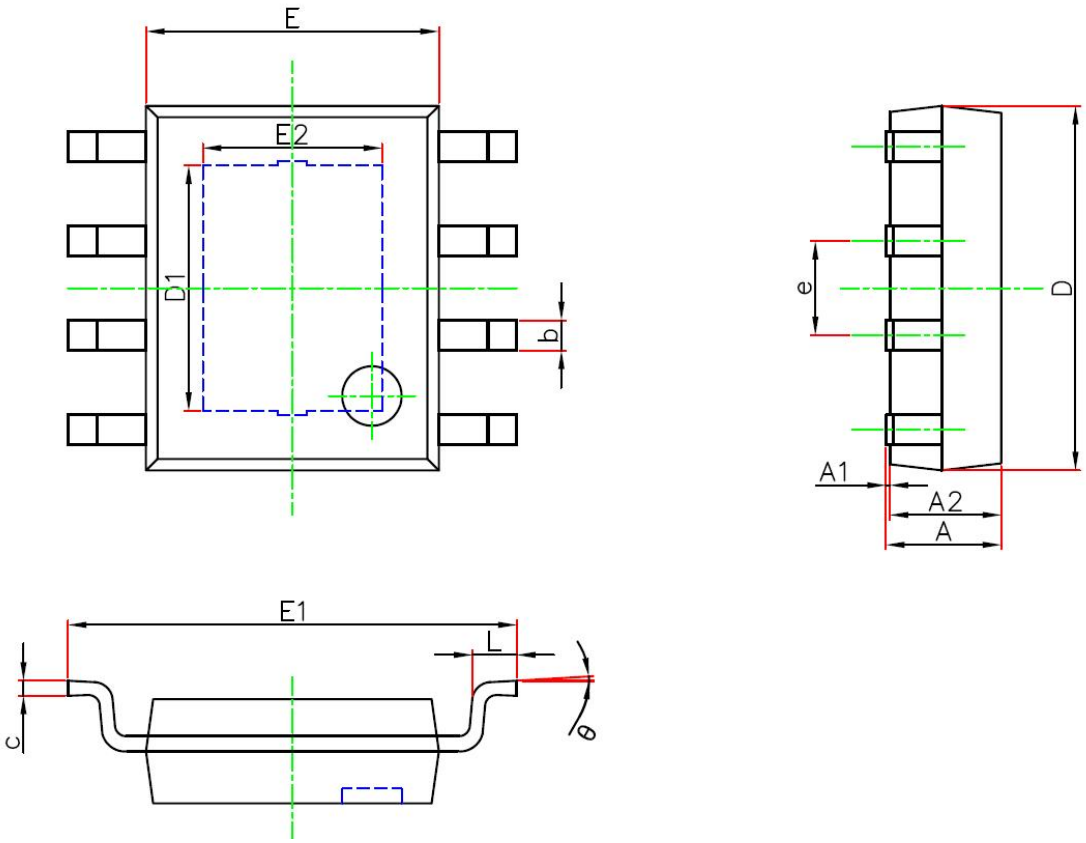
- Package Information

E-SOP8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.300	1.700	0.051	0.067
A1	0.000	0.100	0.000	0.004
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
D1	3.202	3.402	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.313	2.513	0.091	0.099
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°