



120V Input, 6A continuous load current Step-down Converter

● Features

- 9V to 120V input voltage range
- 1.25V to 50V Output voltage range
- 6.5A continuous load current
- 93% Peak Efficiency
- 125 kHz Fixed Frequency
- Up to 92% duty cycle
- External current limiting protection
- Short circuit protection Function
- Thermal shutdown Function
- Available in an ESOP-8 package

● Applications

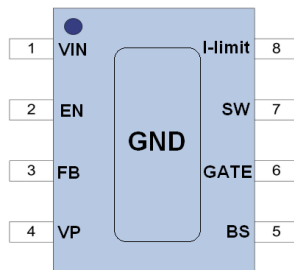
- Electric vehicles, Balanced vehicle
- Solar energy, electric equipment
- Electronic battery charging

● General Description

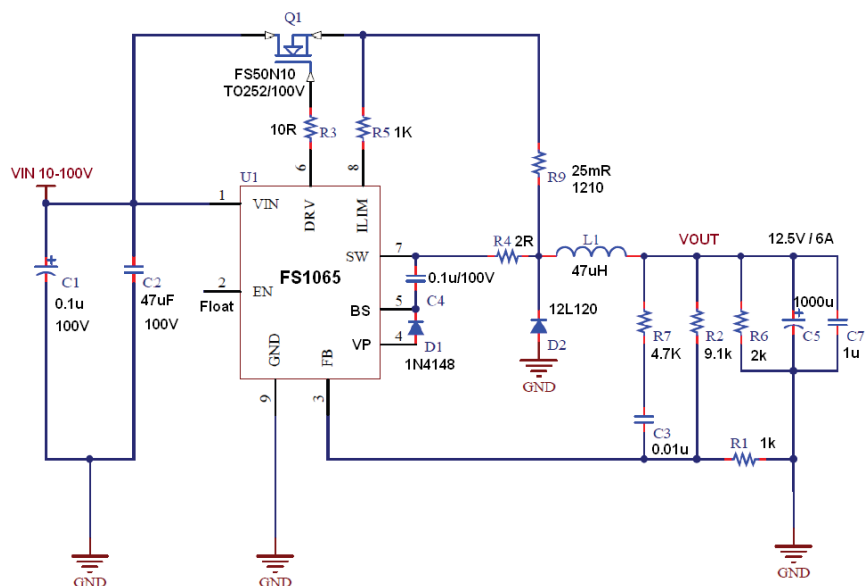
FS1605 is a 120V switch mode step-down constant voltage driver that requires To achieve BUCK DC voltage reduction through external NMOS,It can work on a wide input power range.FS1605 has excellent load and linear adjustment.FS1605 has peak current limiting, soft start, and Overvoltage protection and temperature protection.

FS1605 are packaged in a simple and universal 8-pin ESOP8 package

● Pin Configuration



● Typical Application





● Absolute operating range

V _{IN}	130V
V _{SW}	-0.3V to V _{IN} + 0.3V
V _{BST}	V _{SW} +7.0V
Others	-0.3V to +7.0V
Junction temperature	150°C
Soldering temperature of pin	265°C
Storage temperature	-65°C to +150°C

● Recommended operating conditions

V _{IN}	9V to 120V
V _{OUT}	1.25V to 50V
Ambient temperature	-40°C to +85°C
Thermal resistance	θ_{JA} :140°C/W θ_{JC} :55°C/W

Notes:

- 1、 Exceeding this range may cause permanent damage.
- 2、 Normal operation beyond working conditions cannot be guaranteed
- 3、 Test on 42x45mm² copper clad plate with 35mm copper foil thickness

● Pin Configuration

Pin	Pin Name	Pin Description
7	SW	Switch output
1	VIN	The power supply pin of the IC. An electrolytic capacitor needs to be added to this pin to prevent voltage overshoot at the input terminal. Please place the input capacitor as close as possible to the input pin of the IC.
4	VP	Internal reference voltage
2	EN	Control pin, internally connected to resistor pull-up, suspended ON , grounded OFF
9	GND	Ground. The ground of the internal reference source and the bottom metal solder pad must be grounded
8	I-limit	The current limiting detection pin. sets a constant current value through an external resistor. Range: around 210-250mV
6	GATE	The driver end of MOS, connected through 4.7-10 ohms
3	FB	1.25V voltage reference, no need for external compensation capacitor on resistance
5	BS	Connected to bootstrap capacitor



● Electrical Characteristics

$V_{IN} = 12V, T_A = +25^{\circ}C$, (Unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Feedback voltage	V_{FB}	$12V \leq V_{IN} \leq 120V$	1.23	1.25	1.27	V
Feedback pin bias current	$I_{BIAS(FB)}$	$V_{FB} = 1.25V$		10		nA
Conduction resistance of internal switch	$R_{DS(ON)}$			395		mΩ
Oscillation frequency	f_{SW}	$V_{FB} = 1.25V$	110	125	150	KHz
Protection frequency		$V_{FB} = 0V$		70		KHz
Bootstrap voltage	$V_{BST} - V_{SW}$			10		V
Voltage difference from input to output		2A load	5			V
EN (OFF)		(Turn off current less than 200uA)	0		1	V
EN (ON)			2.8		7	V
Quiescent current		$V_{EN}=2V, V_{FB}=1V$		2	3	mA
Thermal protection				160		°C

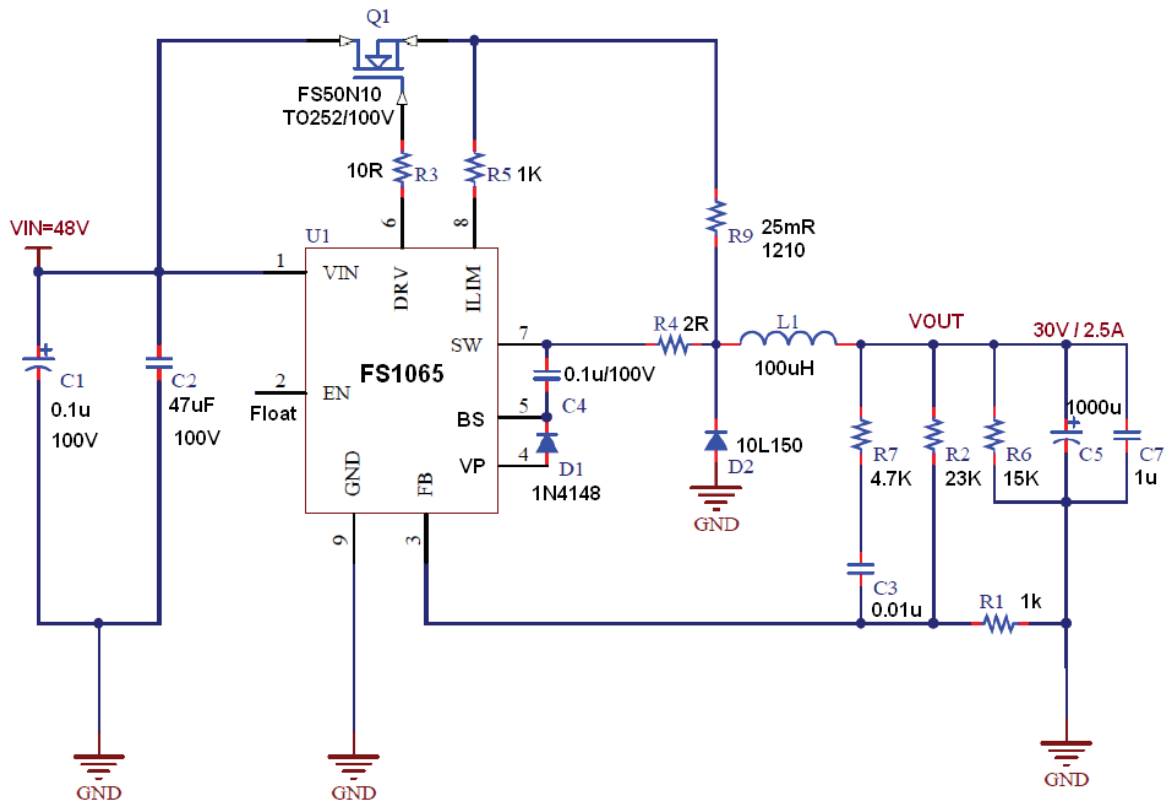
Application Note

- The output voltage is determined by the voltage division of the resistance outside the FB pin.
 $V_{OUT} = 1.25 \times (1 + R1/R2)$
- Output current limiting point $I = 0.18V/R9$, the current limiting is not more than 6A, R9 selects 25 milli ohm, 1210 size for packaging.
- The input of the EN pin does not exceed 7V. There is a pull-up resistance inside the EN pin. The IC works when the pin is suspended, but does not work when the pin is grounded.
- Input/output plus electrolytic capacitor and chip capacitor to ground, as close to the chip as possible.
- Pay attention to heat dissipation for high power boards. Heat dissipation can be achieved through a large number of vias by using the front and back sides of the board. The metal bonding pad at the bottom of the chip must be connected to GND.
- The rated current of Schottky diode should have more margin. The lower the forward voltage drop of the diode, the higher the efficiency of the circuit and the lower the temperature. It is recommended to choose SS10L120 with a larger package size.
- When the output voltage is relatively high, the inductance needs to be larger, 47-68uH is recommended for 12V output, and 100-220uH is recommended for 24V output.
- The withstand voltage of input and output capacitors and freewheeling diodes should have enough margin. When wiring, they need to be close to the chip ground in order to get better EMC. The chip bottom needs to be connected with a large area of GND for stable operation.
- The output can be adjusted to 42V to charge the 37V battery. The higher the voltage, the smaller the current. Increase the inductance appropriately. See the circuit diagram on the next page for details.



- 10、 The output is not completely no-load. It is more stable to add a resistance load (2mA) when no-load. The bootstrap capacitor can be connected with 0-30 ohm resistance in series to obtain better EMC.
- 11、 When input 48V to output 12V/10A, select MOS with low input capacitance (such as 150V super junction process, internal resistance 10 milliohm) for heat dissipation.
- 12、 It is recommended to keep the voltage difference between input and output above 4V, and add a zener such as ZMM13 (12V output) to the ground for protection.
- 13、 For high current applications, auxiliary cooling is required. When the output voltage is above 24V, the inductance is recommended to be 100uH, In LAYOUT, the principle of heat dissipation and ground wire routing should be considered

Typical application circuit



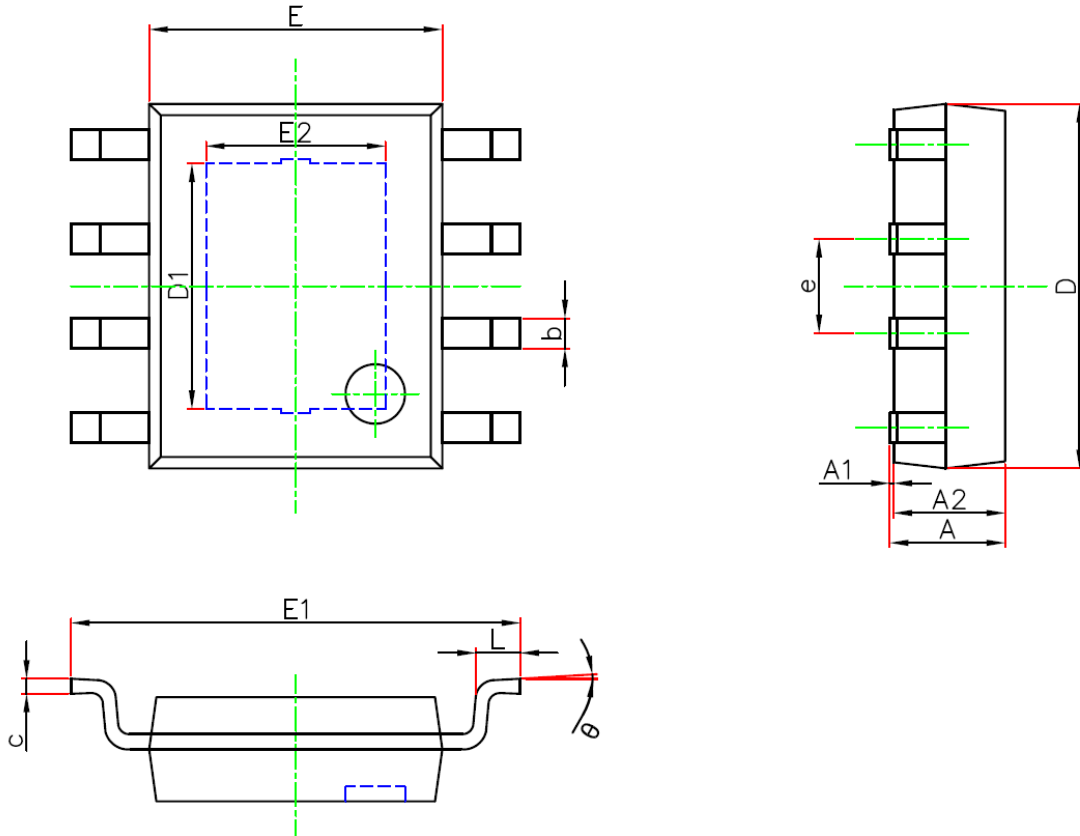
IMPORTANT NOTICE

FORSEMI reserves the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. Forsemi Technology Inc. does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel. Any unauthorized redistribution or copy of this document for any purpose is strictly forbidden.



● 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°