■ DESCRIPTION

SP3414 has an optimum input voltage, step-down converter that operates in either CV (Constant Output Voltage) mode or CC (Constant Output Current) mode. The maximum input voltage is up to 43V and the operation input voltage from 7V to 36V.
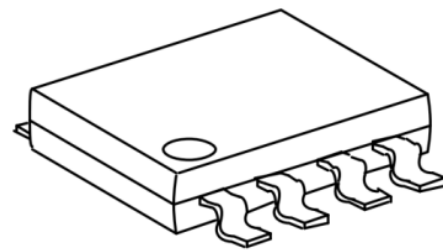
MOSFET, what build in 75mΩ High-Side, could deliver up to 4A of continuous output current and the output current accurate to within ±7%.

External compensation is not need. It consists of inside line compensation function with 95mV at VIN (12V), and the constant current value can be set by an external resistance.

In conclusion, SP3414 is a full function and high performance, high reliability buck DC-DC converter.

■ FEATURES

- Build in High-Side MOSFET
- Max Output Current: 4A
- Constant Output Voltage: 5.1V
- Excellent Constant Current Accuracy: ±7%
- Constant Voltage Accuracy: ±2%
- Jitter Function
- Efficiency: Up to 95%
- Line Compensation: Typ.95mV@I_{OUT}=3.4A
- Short Circuit Protection
- Over Voltage Protection
- Thermal shutdown Protection
- Under Voltage Lock Output
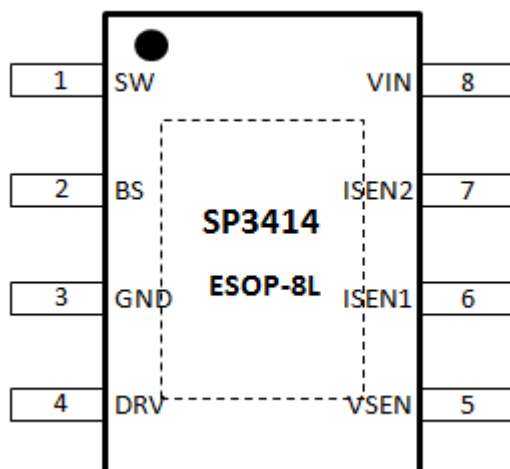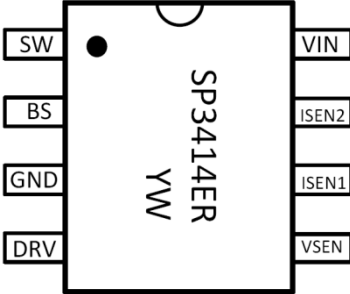- Available in ESOP-8L Package

ESOP-8L

■ APPLICATIONS

- Car Charger
- Power Strip/Hub
- Car DVD
- Black Box
- Industry Application
- Other

■ TYPICAL APPLICATION

PIN	NAME	DESCRIPTION
1	SW	Power switching output connect to external inductor
2	BS	Power to the internal high-side MOSFET gate driver. Connect a 100nF capacitor from BS to VIN
3	GND	Ground
4	DRV	Driver of low-side NMOS, connect to the gate of NMOS
5	VSEN	Sense of output voltage
6	ISEN1	Current Sense Input 1
7	ISEN2	Current Sense Input 2
8	VIN	Power Supply Input. Bypass this pin with a 2.2µF ceramic capacitor to GND, placed as close to the IC as possible.

■ ORDER/MARKING INFORMATION

Order Information	Top Marking
SP3414 - X - X Packing R: Tape Reel Package E: ESOP-8 Product Number	SP3414ER YW Y: Year (15=2015,16=2016,…) W: Weekly (01-54)

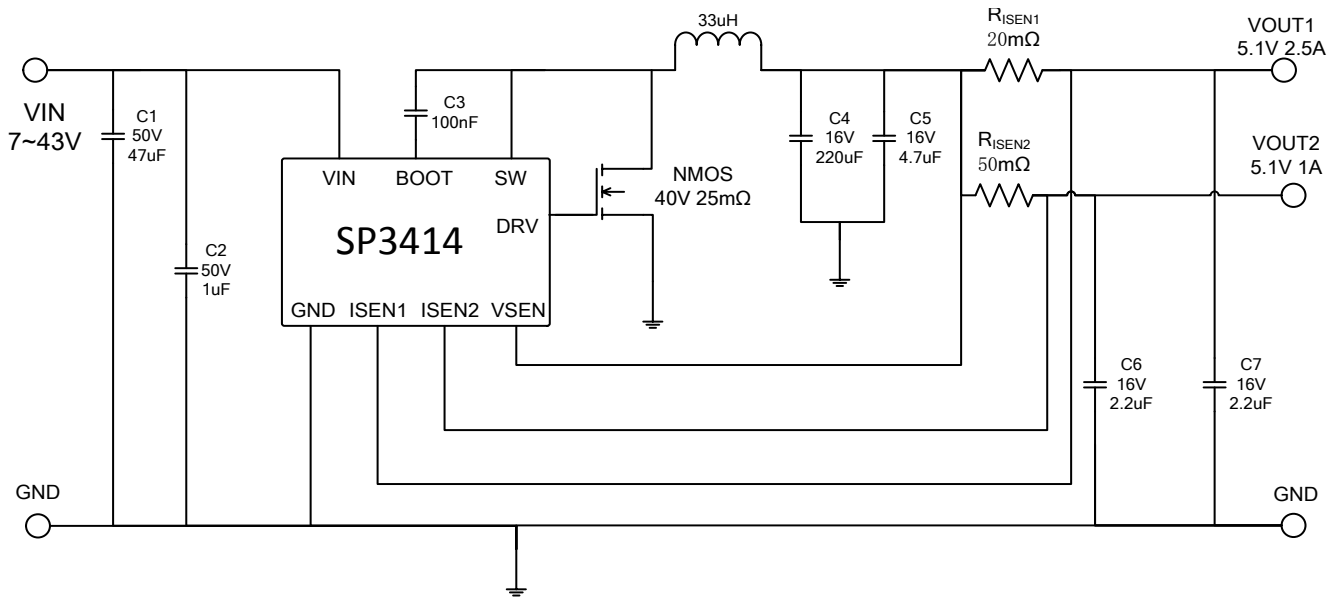## ABSOLUTE MAXIMUM RATINGS (at T_A = 25°C)

Parameter	Symbol	Rating	Units
VIN to GND		-0.3 to 43	V
SW to GND		-0.3 to VIN	V
BS to GND		V_{SW}-0.3 to V_{SW}+6	V
ISEN, VSEN		-0.3 to 25	V
Junction to Ambient Thermal Resistance		105	°C/W
Operating Junction Temperature		-40 to 150	°C
Storage Junction Temperature		-55 to 150	°C
Lead Temperature (Soldering 10 sec.)		300	°C
Thermal Resistance from Junction to case	θ_{JC}	15	°C/W
Thermal Resistance from Junction to ambient	θ_{JA}	40	°C/W
ESD (HBM)		>2000	V

Note: Exceed these limits to damage to the device. Exposure absolute maximum rating conditions may affect device reliability.
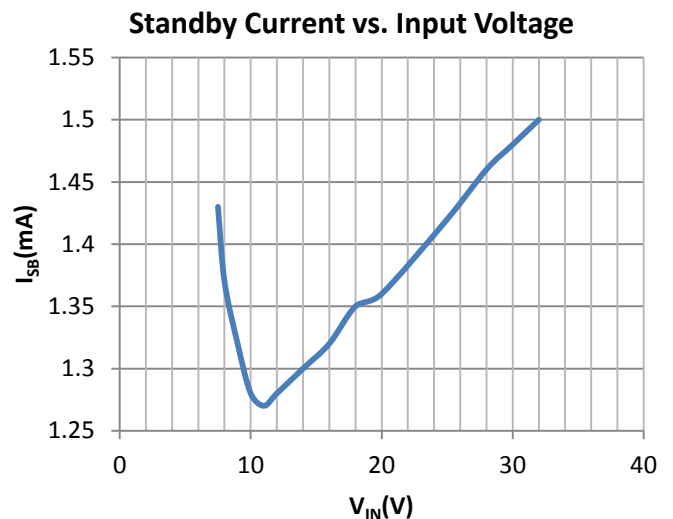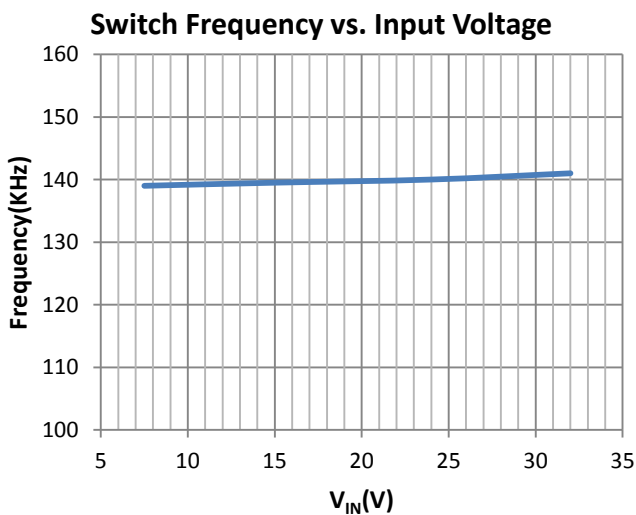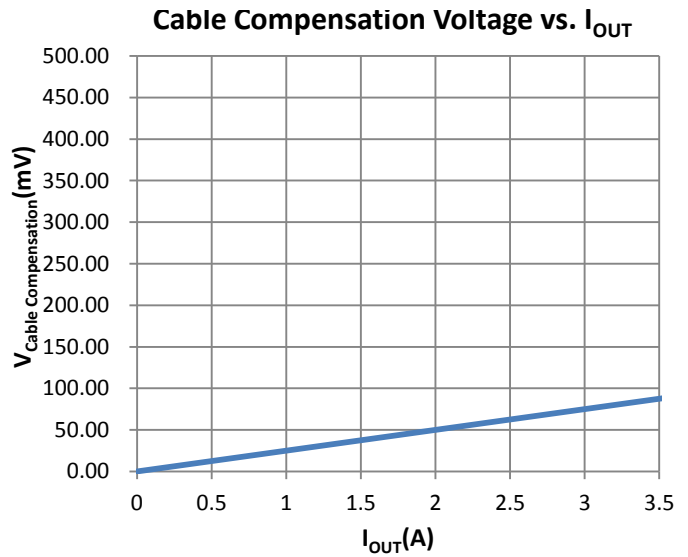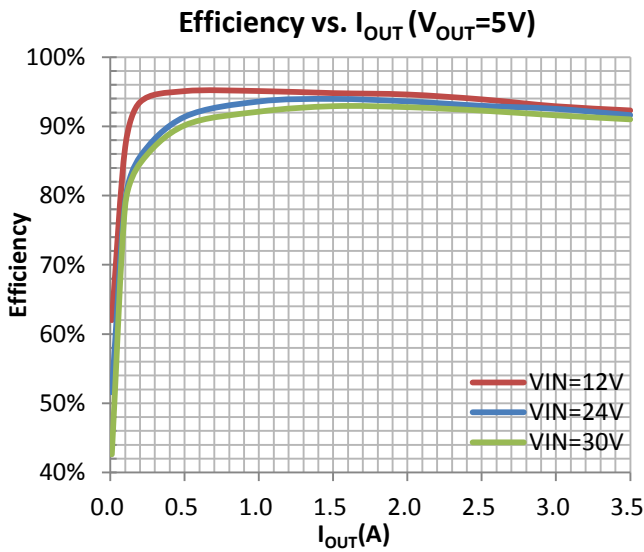
ELECTRICAL CHARACTERISTICS(V_{IN}=12V, T_A = 25°C,unless otherwise stated)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Input Voltage	V_{IN}		7	-	43	V
Input OVP Threshold	$V_{OVP-VIN}$		34	36	38	V
UVLO Voltage	V_{UVLO}		6	6.5	7	V
UVLO Hysteresis			0.3	0.5	0.8	V
Quiescent Current	I_{CCQ}	V_{FB}=1.5V, force driver off.	-	1.5	-	mA
Standby Current	I_{SB}	No Load	-	1.6	5	mA
Output Voltage	V_{OUT}		5.0	5.1	5.2	V
Output OVP detect Voltage	V_{OVP}	Internal define	-	6.3	-	V
Switching Frequency	F_{SW}	I_{OUT}=1A	120	145	170	KHz
Reference Voltage Of Constant Current	Reference Of V_{ISEN}-V_{VSEN}	0.4V<VFB<0.95V	46.5	50	53.5	mV
V_{OUT}-Short	V_{SEN}		1	1.2	1.5	V
High-Side Switch On Resistance	High-side	VIN=12V,I_{OUT}=1A,50°C		75		mΩ
Low-Side Switch On Resistance	Low-side	VIN=12V		10		Ω
Maximum Duty Cycle	D_{MAX}		90	95	-	%
Minimum On-Time			-	120	-	ns
Line Compensation		I_{OUT}=3.4A	90	95	100	mV
DRV MAX Current	$IMAX_{SINK}$				1.2	A
	$IMAX_{PULL}$				0.7	A
Thermal shutdown Temp	T_{SD}		-	140	-	°C
Thermal Shutdown Hysteresis	T_{SH}		-	30	-	°C

■ TYPICAL APPLICATION CIRCUIT

■ TYPICAL PERFORMANCE CHARACTERISTICS

Efficiency vs. I_{OUT} (V_{OUT}=5V)

VIN=12V
VIN=24V
VIN=30V

Cable Compensation Voltage vs. I_{OUT}

Switch Frequency vs. Input Voltage

Standby Current vs. Input Voltage

■ FUNCTIONAL DESCRIPTION

Input Under Voltage Protection

SP3414 provides an input voltage up to 43V and operates from an input voltage range of 7V to 36V. If V_{IN} drops below 6.3V, the UVLO circuit inhibits switching. Once V_{IN} rises above 7V, the UVLO clears, and the soft-start sequence activates.

Input Over Voltage Protection

If V_{IN} rises above 36V, the UVLO circuit inhibits switching. SP3414 will not be damaged until the voltage exceeds 43V. Once V_{IN} drops below 33V, the UVLO clears, and the soft-start sequence activates.

Soft-start

SP3414 has an internal soft-start circuitry to reduce supply inrush current during startup conditions. When the device exits under-voltage lockout (UVLO), shutdown mode, or restarts following a thermal-overload event, the soft-start circuitry slowly ramps up current available after 300us.

Constant Voltage Output

SP3414 presets the output voltage to 5.1V.

Output Over Voltage Protection

Once VSEN rises above 6.3V, SP3414 shuts down to avoid damage caused by abnormal use of electrical equipment.

Constant Current Output

SP3414 senses the current by sampling the voltage difference between ISEN and VSEN, and adjusts the output current to the default value by the loop.

$$I_{OUTPUT} = \frac{50mV}{R_{ISEN1}} \qquad I_{OUTPUT} = \frac{50mV}{R_{ISEN2}}$$

Constant current operates normally when

VSEN is higher than 2V. When VSEN is below 2V causing by overload, SP3414 will enter short circuit protection mode.

Short Circuit Protection

When VSEN drops below 1.9V since too heavy load, SP3414 will enter short circuit protection function, and the system will enter hit-cup mode, and frequency drop to 50KHz per cycle and stop switching for 83mS.

Line Compensation

When output current from 0mA to full load, output voltage will be increased 95mV (Max) for line compensation.

Thermal Shutdown

Thermal-overload protection limits total power dissipation in the device. When the junction temperature exceeds T_J= +150°C, a thermal sensor forces the device into shutdown, allowing the die to cool. The thermal sensor turns the device on again after the junction temperature cools by

25°C, resulting in a pulsed output during continuous overload conditions. Following a thermal-shutdown condition, the soft-start sequence begins.

■ APPLICATION GUIDELINES

Input capacitance selection

Input capacitance selection pressure 50V, the total capacity of 40 µF ceramic capacitor, of course, if considering the cost factor, can also choose a more than 50V voltage, capacity of more than 100 µF electrolytic capacitor, parallel a 50V voltage, capacity of 2.2µF ceramic capacitors.

The location of the input capacitance, try to close to the chip VIN PIN position, if it is electrolytic capacitors and ceramic capacitors in parallel, ceramic capacitor is more close to the chip.

Inductance selection

SP3414 selection are amount at 22µH~51µH inductance, if the demand is higher, the output ripple is advised to choose a larger inductance sense of values, such as 33µH or 47µH.

Require inductor saturation current must be not less than 1.5 times of the preset constant current value.

Output capacitance selection

Generally recommended to use a 470 µF electrolytic capacitor and a 4.7 µF ceramic capacitors in parallel as the output capacitance, the demand is higher, if the output ripple is proposed to 4.7 µF ceramic capacitor replacement for one or two ESR lower 22 µF ceramic capacitors, ceramic capacitors capacitance value, the greater the output ripple is smaller.
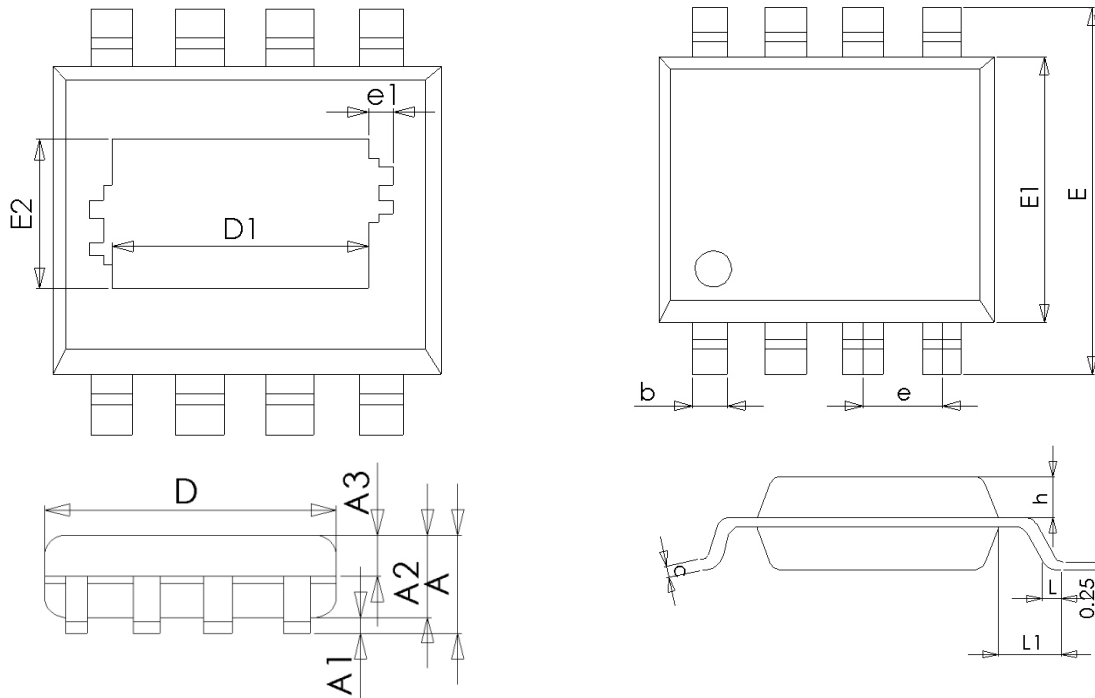
BS capacitance selection

BS and select let SW proposal in 22nF~100nF ceramic capacitor, withstand voltage value of not less than 50V.
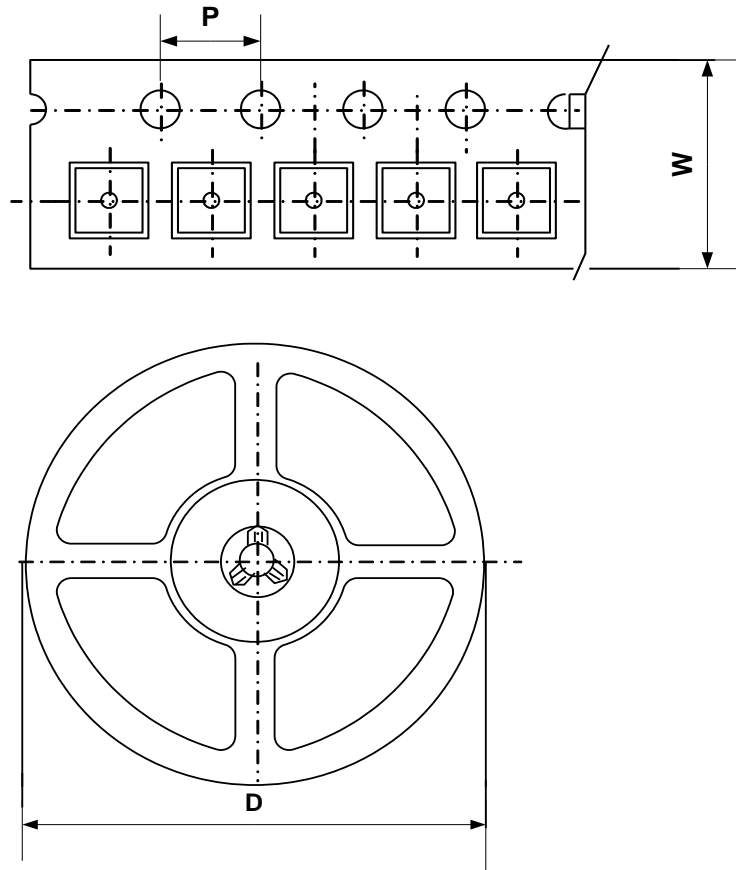
EMI/EMC

SW reserved RC circuit, resistance to choose 4.7R, 2.2nF capacitance advice; If the application version enough volume, can be reserved at input end type π circuit. SW pin reserved RC circuit of R2 4.7Ω and C4 1nF; BS pin reserved R1 5.1Ω string C3 100nF.

■ PACKAGE INFORMATION

Symbol	Dimensions In Millimeters		
	Min	**NOM**	**Max**
A	--	--	1.65
A1	0.05	--	0.15
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.38	--	0.51
c	0.25BSC		
D	4.80	4.90	5.00
D1	3.10	3.30	3.50
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
E2	2.20	2.40	2.60
e	1.27BSC		
h	0.25	--	0.50
L	0.50	0.60	0.80
L1	1.05BSC		

■ TAPE AND REEL INFORMATION

Package Type	Carrier Width (W)	Pitch (P)	Reel Size(D)	Packing Minimum
ESOP-8L	12.0±0.1 mm	8.0±0.1 mm	330±1 mm	4000pcs

Note: Carrier Tape Dimension, Reel Size and Packing Minimum