

■ DESCRIPTION

SP3406 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 8.5V to 36V.

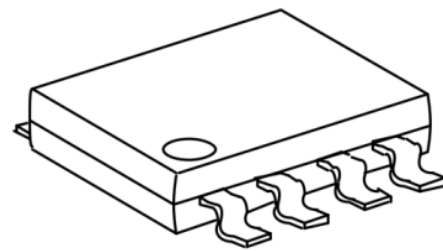
MOSFET, what build in 15mΩ High-Side, could deliver up to 5.5A of continuous output current and the output current accurate to within $\pm 7\%$.

External compensation is not needed. It consists of inside line compensation function with 95mV at $V_{IN}=12V@I_O=5.5A$.

In conclusion, SP3406 is a full function and high performance, high reliability buck DC-DC converter.

■ FEATURES

- Build in High-Side MOSFET
- Max Output Current: 5.5A
- Constant Output Voltage: 5.05V
- Excellent Constant Current Accuracy: $\pm 7\%$
- Constant Voltage Accuracy: $\pm 2\%$
- No External Compensation Needed
- Jitter Function
- Efficiency: Up to 96%
- Line Compensation: Typ.95mV@ $I_O=5.5A$
- Short Circuit Protection
- Over Voltage Protection
- Thermal shutdown Protection
- Under Voltage Lock-Out
- ESD HBM >5KV
- Available in SOP-8L Package

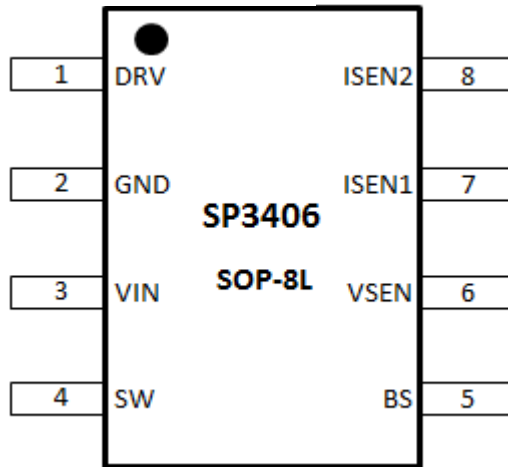


SOP-8L

■ APPLICATIONS

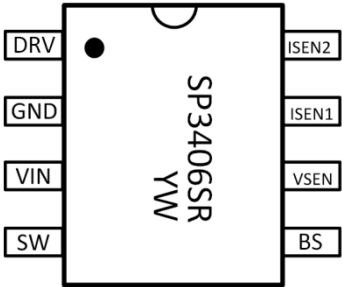
- Car Charger
- Power Strip/Hub
- Car DVD
- Black Box
- Industry Application
- Other

TYPICAL APPLICATION



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

ORDER/MARKING INFORMATION

Order Information	Top Marking
<p>SP3406 - X - X</p> <p>Product Number</p> <p>Package S: SOP-8</p> <p>Packing R: Tape Reel</p>	 <p>Y: Year (15=2015,16=2016,...) W: Weekly (01-54)</p>

■ ABSOLUTE MAXIMUM RATINGS (at TA = 25°C)

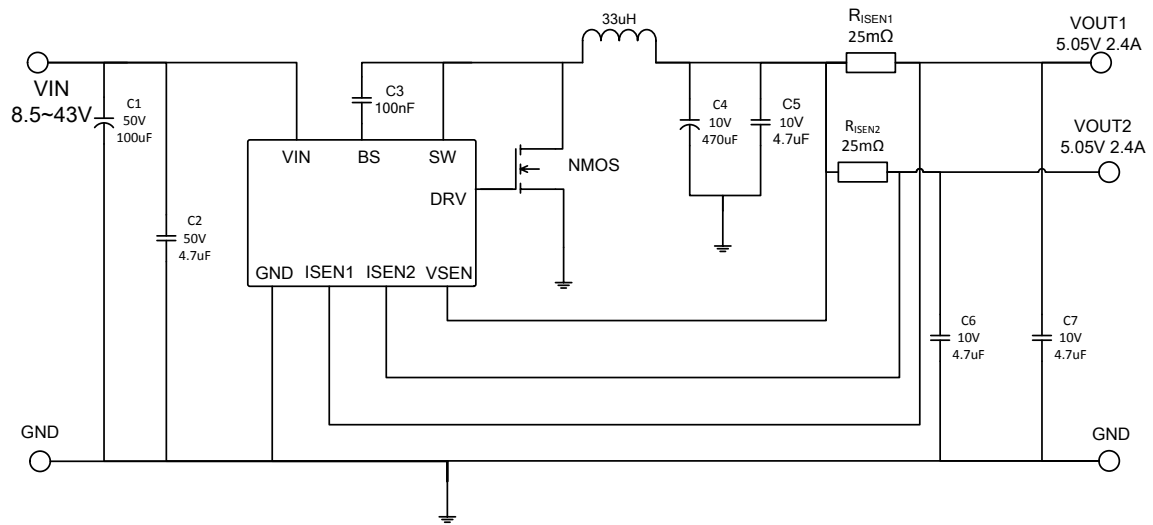
Parameter	Symbol	Rating	Units
VIN to GND		-0.3 to 43	V
SW to GND		-0.3 to VIN	V
BS to GND		V _{SW} -0.3 to V _{SW} +6	V
ISEN1, ISEN2, DRV, V _{SEN} to GND		-0.3 to 6	V
Max Operating Junction Temperature	T _j	125	°C
Ambient Temperature	T _a	-55 to 85	°C
Storage Temperature	T _s	-40 – 150	°C
Lead Temperature (Soldering 10 sec.)		260	°C
Package Thermal Resistance	θ _{jc}	45	°C/W
ESD (HBM)		>5000	V

Note: Exceed these limits to damage to the device. Exposure absolute maximum rating conditions may affect device reliability.

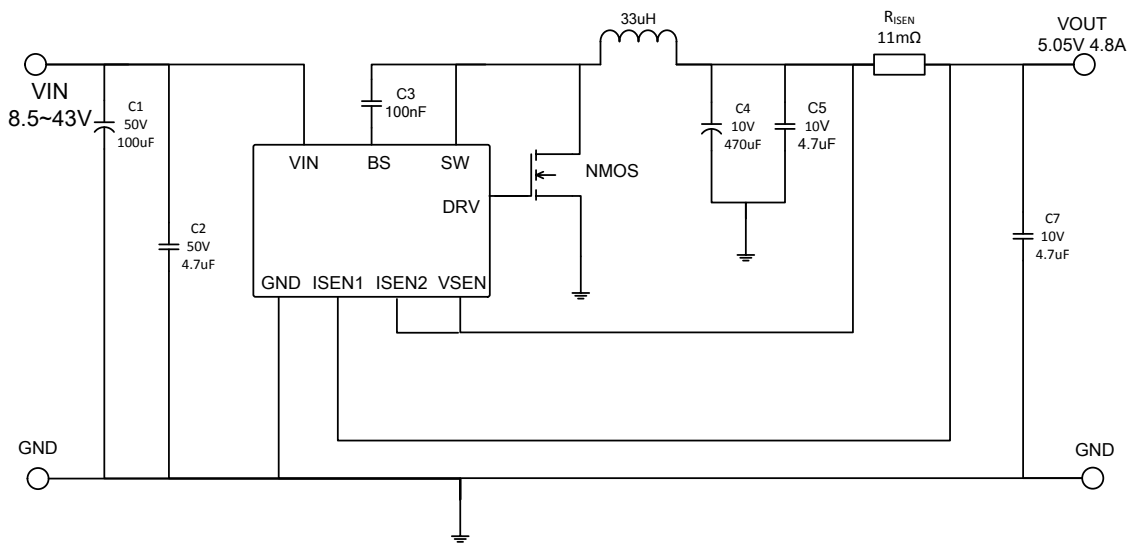
■ ELECTRICAL CHARACTERISTICS (VIN=12V, TA = 25°C, unless otherwise stated)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Input Voltage	V _{IN}		8.5	-	43	V
Input OVP Threshold	V _{OVP-VIN}		34	36	38	V
UVLO Voltage	V _{UVLO}		-	8	9	V
UVLO Hysteresis			-	1	-	V
Quiescent Current	I _{CCQ}	V _{SENSE} =5.8V	-	1.6	2.5-	mA
Standby Current	I _{SB}	No Load, Vin>8.5V	-	1.6	-	mA
Output Voltage	V _{OUT}	I _O =1A	4.95	5.05	5.15	V
Output OVP detect Voltage	V _{SEN}	Internal define	-	6.2	-	V
Switching Frequency	F _{SW}	I _{OUT} =1A	-	130	-	KHz
Reference Voltage Of Constant Current	Reference Of VSEN-ISEN	2.4V<V _{OUT} <4.5V	55.8	60	64.2	mV
High-Side Switch On Resistance	High-side	VIN=12V, I _{OUT} =1A, 50°C		15		mΩ
Low-Side Switch On Resistance	Low-side	VIN=12V, I _{OUT} =1A		10		Ω
Maximum Duty Cycle	D _{MAX}		90	95	-	%
Minimum On-Time			-	120	-	ns
Line Compensation		V _{IN} =12V, I _{OUT} =5.5A		95		mV
Secondary Cycle-by-Cycle Current Limit	I _{LIMIT}	Minimum Duty Cycle, no CC		8.5		A
DRV MAX Current	I _{MAX} _{SINK}				1.2	A
	I _{MAX} _{PULL}				0.7	A
Thermal shutdown Temp	T _{SD}		-	155	-	°C
Thermal Shutdown Hysteresis	T _{SH}		-	30	-	°C

TYPICAL APPLICATION CIRCUIT



Dual Channel Application

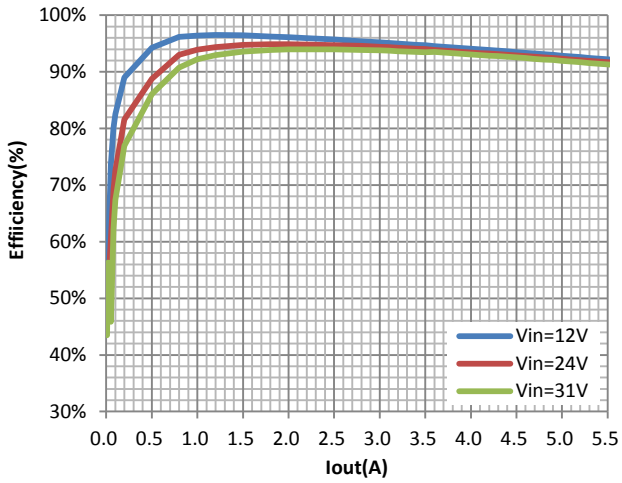


Single Channel Application

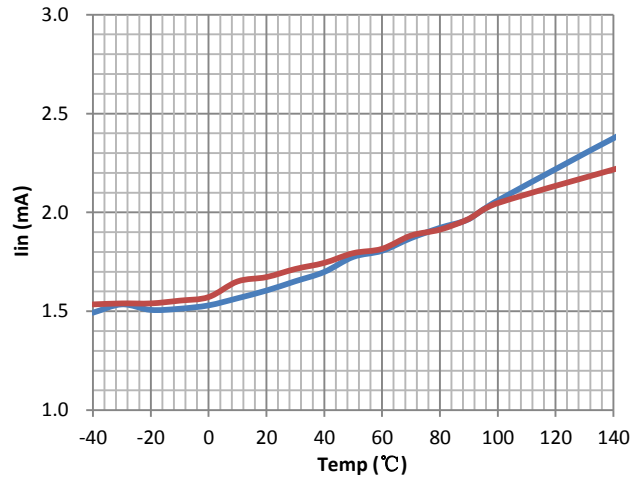
- Note:**
- 1) It is recommended to use C1 and C4 as high-frequency low-ESR capacitors for Rubycon and Wurth.
 - 2) The inductor core is recommended for the iron silicone Aluminum ring.
 - 3) Pin VSEN is shorted to pin ISEN2 in single channel application.

TYPICAL PERFORMANCE CHARACTERISTICS

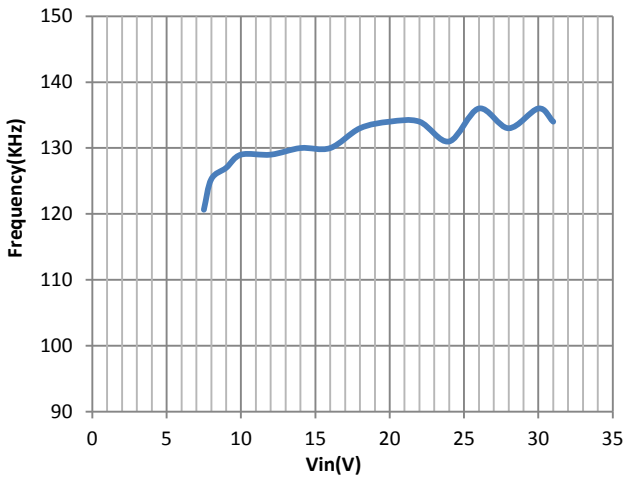
Efficiency&Iout(%)



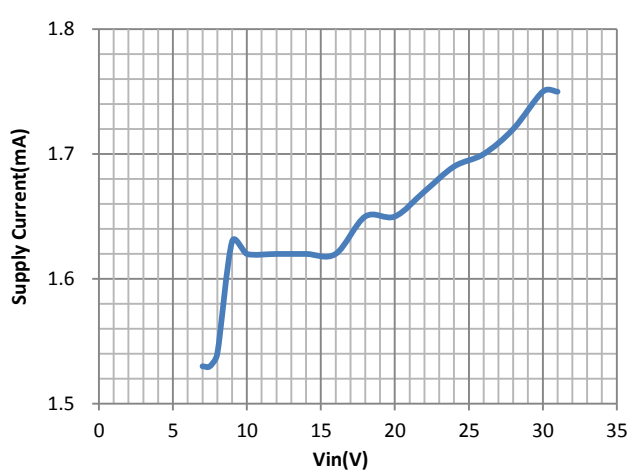
Temp vs. Iin



Switch Frequency vs. Input Voltage

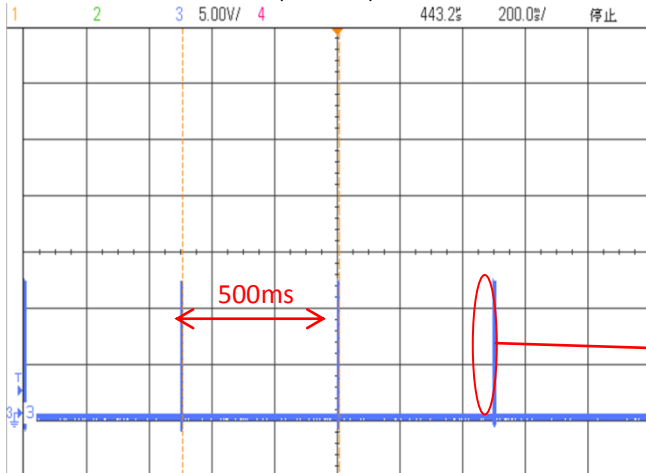


Supply Current vs. Input Voltage



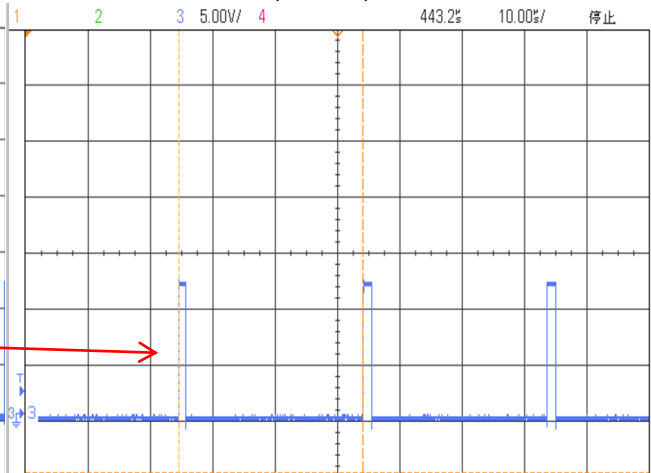
Short Circuit

Vin=12V, Freq=2Hz
(CH3=SW)



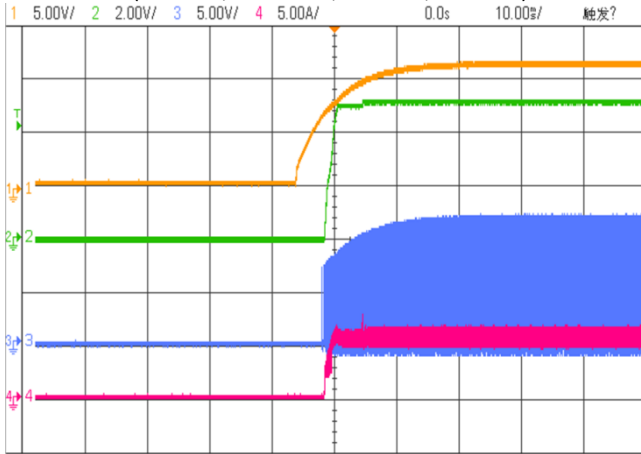
Short Circuit

Vin=12V, Freq=34kHz
(CH3=SW)



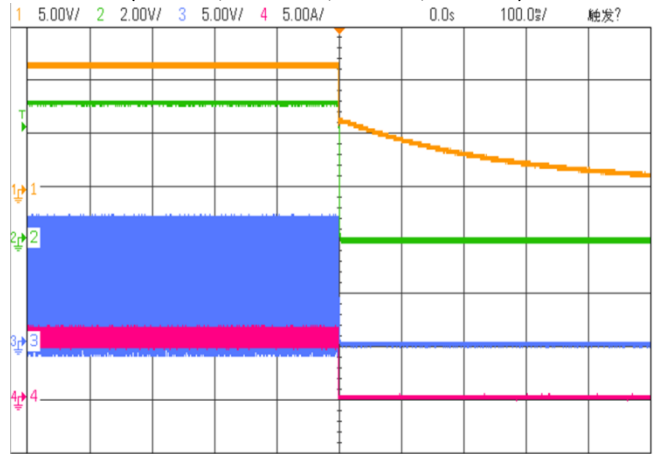
Power On

Vin=12V, Vout=5.05V, Iout=5.5A
(CH1=Vin, CH2=Vout, CH3=SW, CH4=Isw)



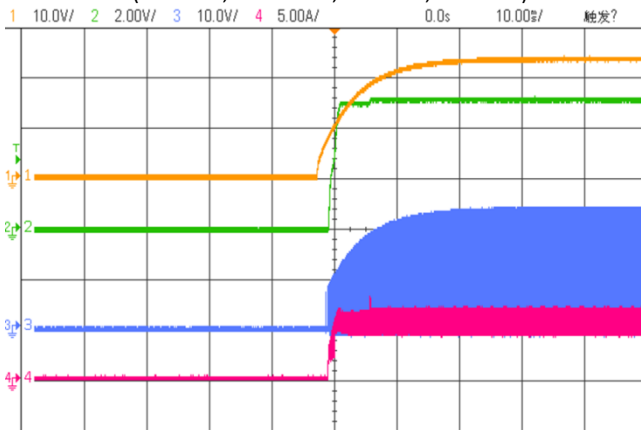
Power Off

Vin=12V, Vout=5.05V, Iout=5.5A
(CH1=Vin, CH2=Vout, CH3=SW, CH4=Isw)



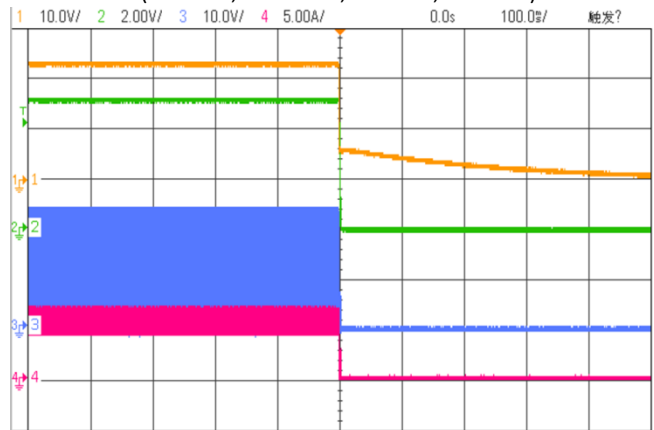
Power On

Vin=24V, Vout=5.05V, Iout=5.5A
(CH1=Vin, CH2=Vout, CH3=SW, CH4=Isw)



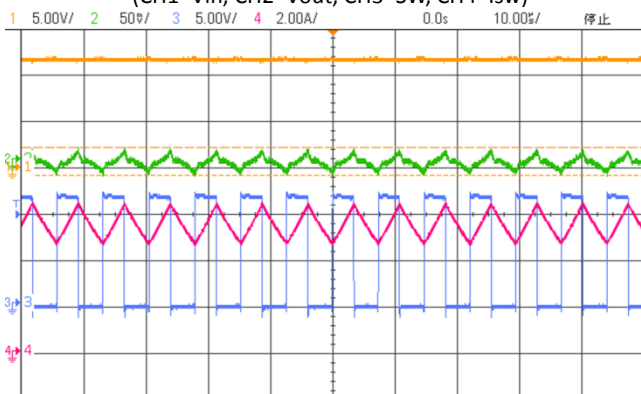
Power Off

Vin=24V, Vout=5.05V, Iout=5.5A
(CH1=Vin, CH2=Vout, CH3=SW, CH4=Isw)



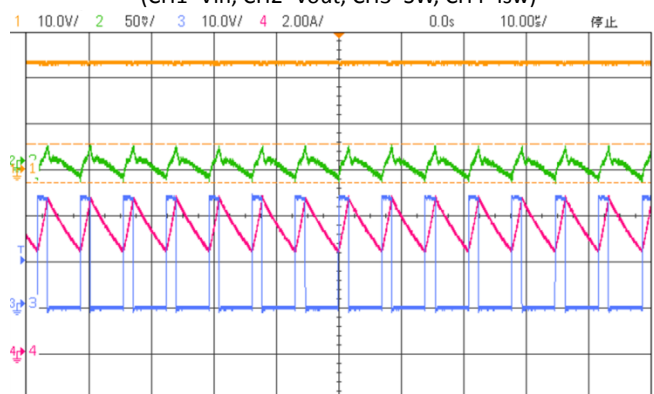
Output Voltage Ripple

Vin=12V, Vout=5.05V, Iout=5.5A
(CH1=Vin, CH2=Vout, CH3=SW, CH4=Isw)



Output Voltage Ripple

Vin=24V, Vout=5.05V, Iout=5.5A
(CH1=Vin, CH2=Vout, CH3=SW, CH4=Isw)



■ FUNCTIONAL DESCRIPTION

Input Under Voltage Protection

SP3406 provides an input voltage up to 43V and operates from an input voltage range of 8.5V to 36V. If V_{IN} drops below 7V, the UVLO circuit inhibits switching. Once V_{IN} rises above 8V, the UVLO clears, and the soft-start sequence activates.

Input Over Voltage Protection

If V_{IN} rises above 36V, the UVLO circuit inhibits switching. SP3406 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

SP3406 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

SP3406 presets the output voltage to 5.05V.

Output Over Voltage Protection

Once V_{SEN} rises above 6.2V, SP3406 shuts down to avoid damage caused by abnormal use of electrical equipment.

Constant Current Output

SP3406 senses the current by sampling the voltage difference between I_{SEN1} and I_{SEN2} , and adjusts the output current to the default value by the loop.

$$I_{OUT1} = \frac{60mV}{R_{ISEN1}} \quad I_{OUT2} = \frac{60mV}{R_{ISEN2}}$$

Constant current operates normally when V_{SEN} is higher than 2V. When V_{SEN} is below 1.9V causing by overload, SP3406 will enter short circuit protection mode.

Short Circuit Protection

When V_{SEN} drops below 1.9V since too heavy load, SP3406 will enter short circuit protection function, and the system will enter hit-cup mode, and frequency drop to 34KHz per cycle and stop switching for 500mS.

Line Compensation

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

Thermal Shutdown

The junction temperature of the IC is monitored internally. If the junction temperature exceeds the threshold value (typically 155°C), the converter shuts off. This is non-latch protection. There is about 30°C hysteresis. Once the junction temperature drops around 125°C, it initiates a Soft-start.

■ 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 2.2 μF 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

SP3406 selection are amount at 22 μH ~51 μH inductance, if the demand is higher, the output ripple is advised to choose a larger inductance sense of values, such as 33 μH or 47 μH .

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.

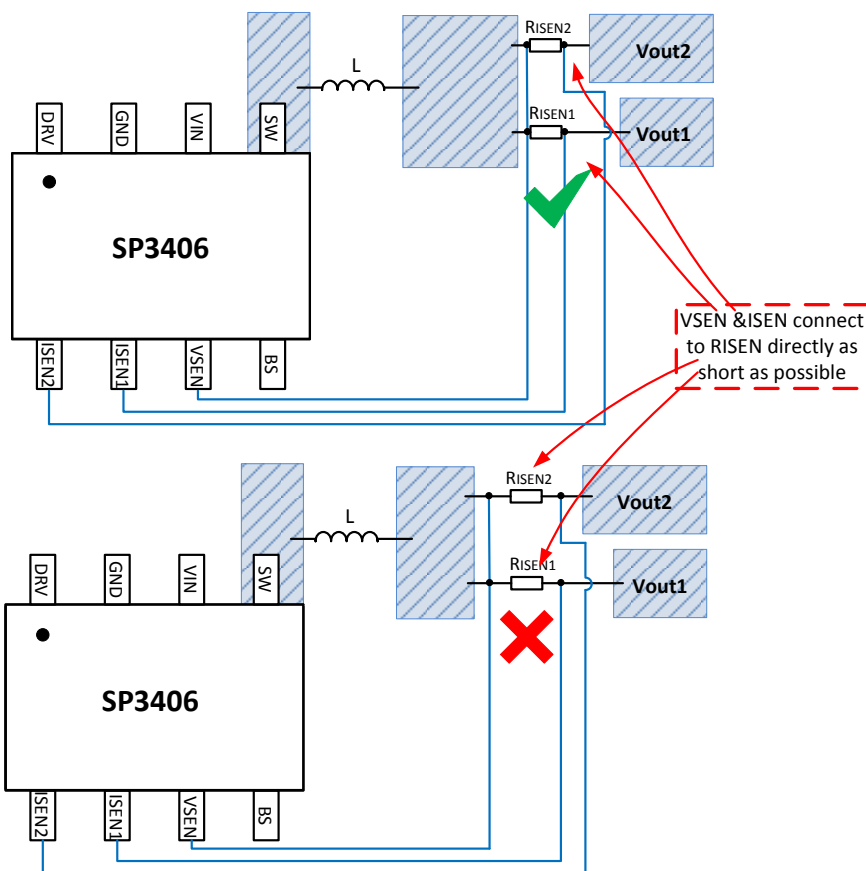
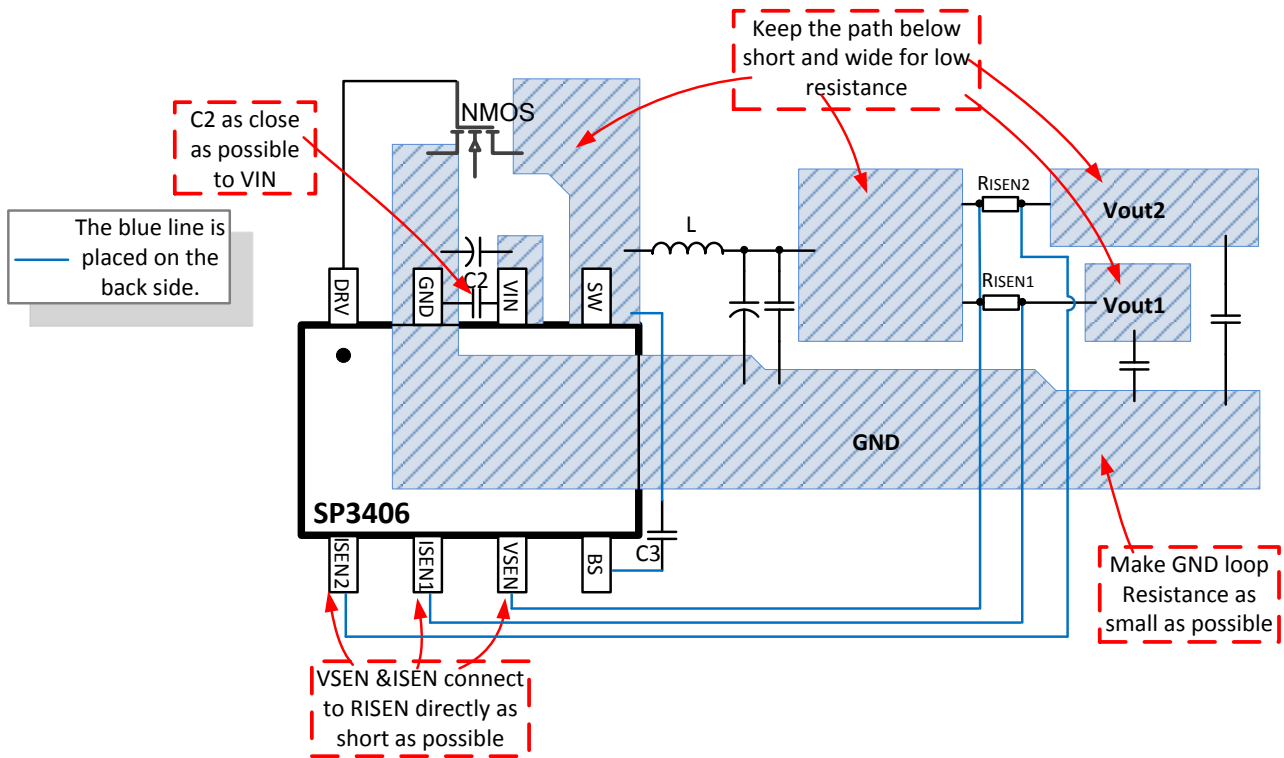
BS capacitance selection

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

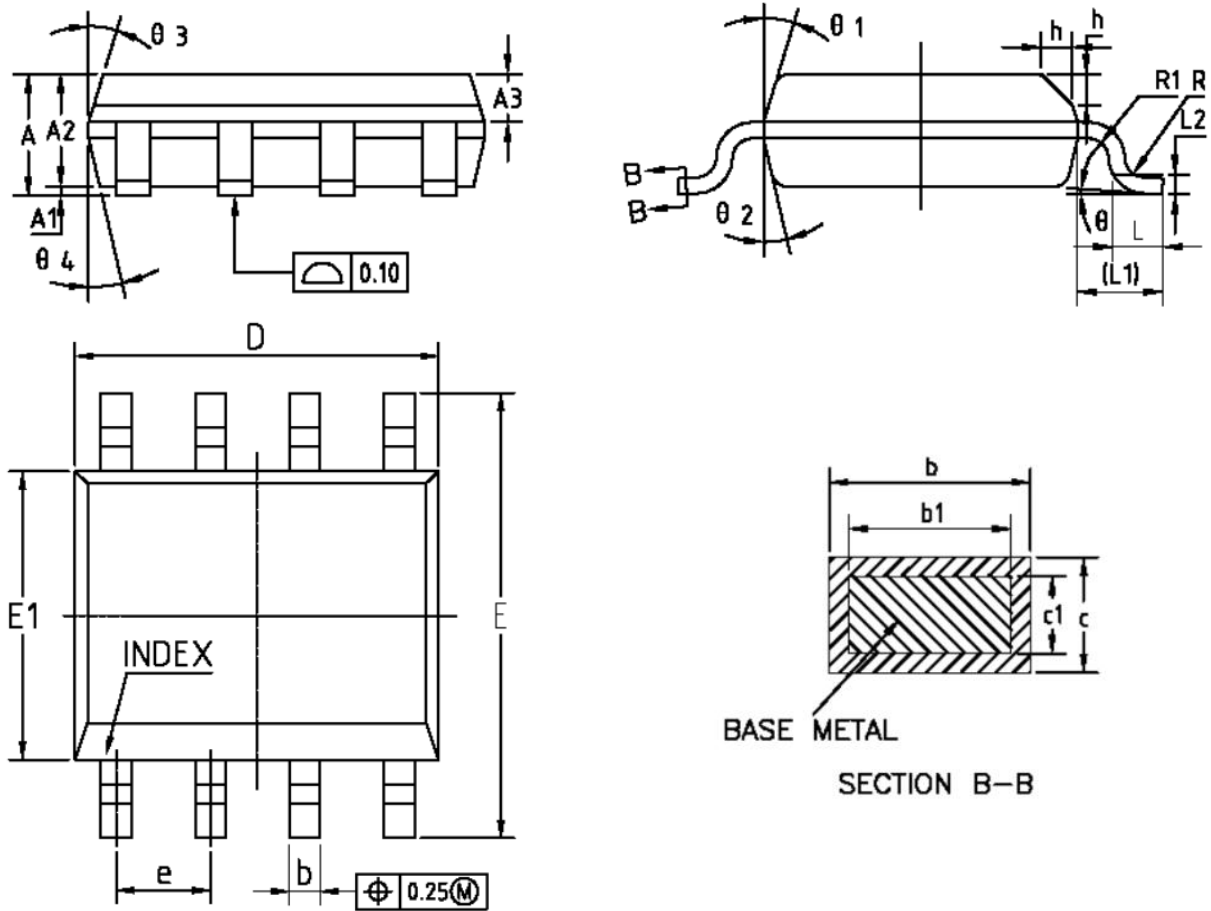
EMI/EMC

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 4.7 Ω and C4 1nF; BS pin reserved R1 5.1 Ω string C3 100nF.

Layout Guide



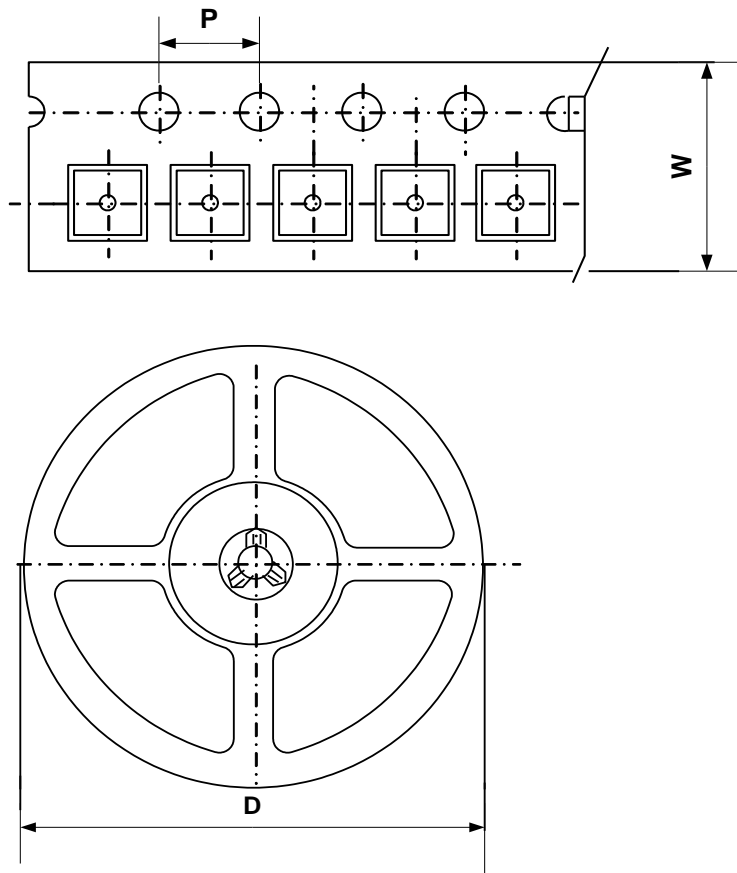
PACKAGE INFORMATION



COMMON DIMENSIONS (UNITS OF MEASURE=MILLIMETER)

Symbol	Min	Nom	Max	Symbol	Min	Nom	Max
A	1.35	1.55	1.75	L	0.45	0.60	0.80
A1	0.10	0.15	0.25	L1	1.04REF		
A2	1.25	1.40	1.65	L2	0.25BSC		
A3	0.50	0.60	0.70	R	0.07	--	--
b	0.38	--	0.51	R1	0.07	--	--
b1	0.37	0.42	0.47	θ	0°	--	8°
c	0.17	--	0.25	$\theta 1$	15°	17°	19°
c1	0.17	0.20	0.23	$\theta 2$	11°	13°	15°
D	4.80	4.90	5.00	$\theta 3$	15°	17°	19°
E	5.80	6.00	6.20	$\theta 4$	11°	13°	15°
E1	3.80	3.90	4.00				
e	1.27BSC						
h	0.30	0.40	0.50				

■ TAPE AND REEL INFORMATION



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

Note: Carrier Tape Dimension, Reel Size and Packing Minimum