DESCRIPTION

The CN2201P is a current mode monolithic buck switching regulator.Operating with an input range of 4.7-40V,the CN2201P delivers 1A of continuous output current with two integrated N-Channel MOSFETS. The internal synchronous power switches provide high efficiency without the use of an external Schottky diode. CN2201P also employs a proprietary control scheme that switches the device into a power save mode during light load, thereby extending the range of high efficiency operation. An OVP function protects the IC itself and Thermal shutdown provides reliable,fault-tolerant operation. With this OVP function, the IC can stand off input voltage as 42V, making it an ideal solution for industrial applications such as smart meters as well as automotive applications.A 3uA shutdown mode quiescent current allows use in a battery-powered applications.

FEATURES

- Wide Input Operating Range from 4.7V to 40V
- Capable of Delivering 1A
- No External Compensation Needed
- Current Mode control
- Up to 93% efficiency
- Internet Soft-Start
- 700KHz switching frequency
- Short circuit protection
- 3uA low shutdown supply current
- Stable with ceramic output capacitors
- Thermal protection and UVLO
- Available in SOT23-6 package

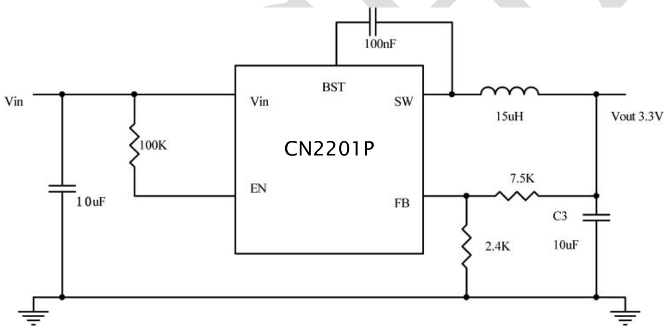
ORDERING INFORMATION

PART#	PACKAGE IN	MPQ
CN2201P	SOT23-6	3,000PCS

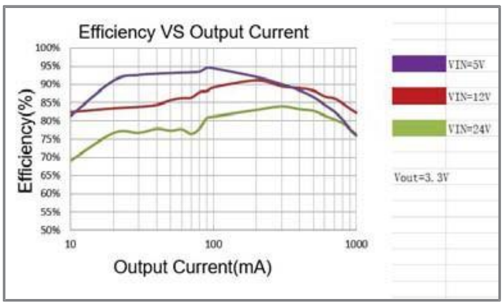
APPLICATIONS

- Smart Meters
- Industrial Applications
- Automotive Applications

TYPICAL APPLICATION



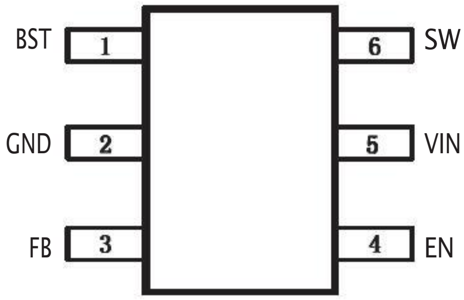
3.3V/1A Step Down Regulators



Efficiency vs Load Current (Vout=3.3V)

PIN CONFIGURATION

TOP VIEW



SOT23-6

ABSOLUTE MAXIMUM RATINGS

(Note: Exceeding these limits may damage the device. Exposure to absolute maximum rating conditions for long periods may affect device reliability.)

IN Voltage...-0.3V to 44V

SW,EN Voltage..............................-0.3V to VIN+0.36V

BST Voltage..-0.3V to SW+5V

FB Voltage...-0.3V to 6V

SW to ground current...................Internally limited

Operating Temperature Range.............-40℃to150℃

Thermal Resistance ΘJA ΘJC

SOT23-6.................................220............130℃/W

ELECTRICAL CHACRACTERISTICS

(V_{IN}=12V,unless otherwise specified.Typical values are at T_A=25℃)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Standoff Voltage			42		V
Input Voltage Range		4.7		42	V
Input UVLO	Rising,Hysteresis=300mV		4.5		V
Input OVP	Rising,Hysteresis=1.5V		42		V
Input Supply Current	VFB=0.90V		0.35		mA
Input Shutdown Current			3		μA
FB Feedback Voltage		0.784	0.800	0.816	V
FB Input Current			0.1		μA
Switch Frequency		630	700	770	KH_z
Maximum Duty Cycle			98		%
FoldBack Frequency	VFB=OV		60		KHZ
High side Switch On Resistance	I_{SW}=100mA		550		mΩ
Low side Switch On Resistance			300		mΩ
High side Switch Current Limit			1.2		A
SW Leakage Current	V_{IN}=12V,V_{SW}=0,EN=GND		3		μA
EN Input Current	VIN=12V,VEN=5V		1	5	μA
EN Input Low Voltage	Rising,Hysteresis=200mV		1.5		V
Thermal Shutdown	Hysteresis=40℃		150		℃

PIN DESCRIPTION

PIN#	NAME	DESCRIPTION
1	BST	Bootstrap pin. Connect a 100nF capacitor from this pin to SW
2	GND	Ground
3	FB	Feedback Input.Connect an external resistor divider from the output to FB and GND to set V_{OUT}

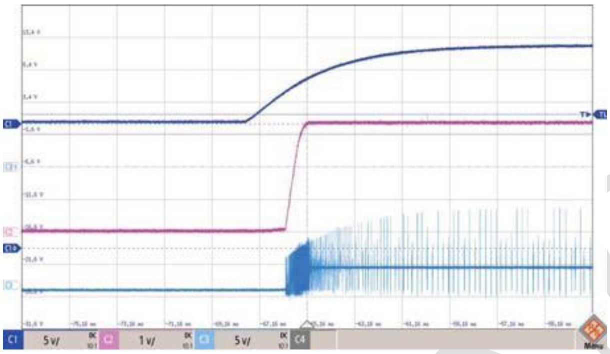
PIN#	NAME	DESCRIPTION
4	EN	Enable pin for the IC.Drive this pin high to enable the part,Low to disable
5	IN	Supply Voltage.Bypass with a 10μF ceramic capacitor to GND
6	SW	Inductor Connection.Connect an inductor Between SW and the regulator output

TYPICAL CHARACTERISTICS

(Typical values are at TA=25℃ unless otherwise specified.)

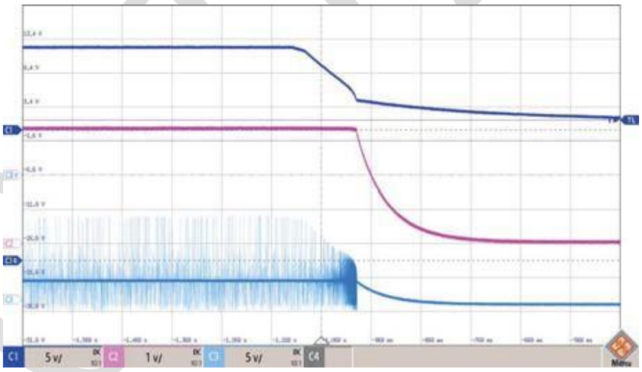
Start -up Waveform with

V_{IN}=12V V_{OUT}=3.3V I_{OUT}=0A



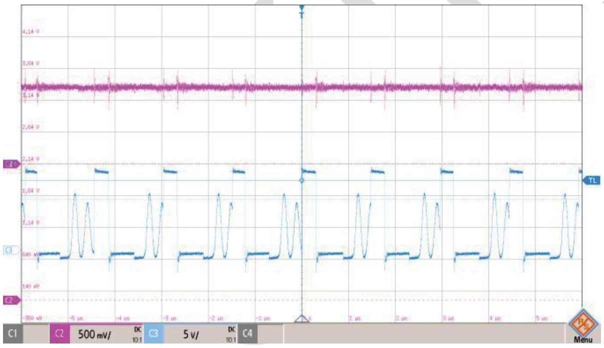
Shutdown Waveform with

V_{IN}=12V V_{OUT}=3.3V I_{OUT}=0A



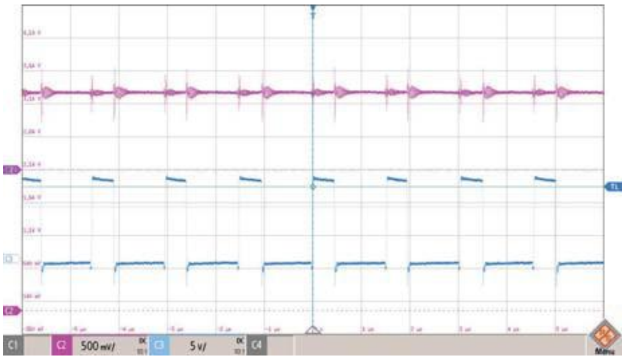
Switching Waveform with

VIN=12V VOUT=3.3V IOUT=0.06A



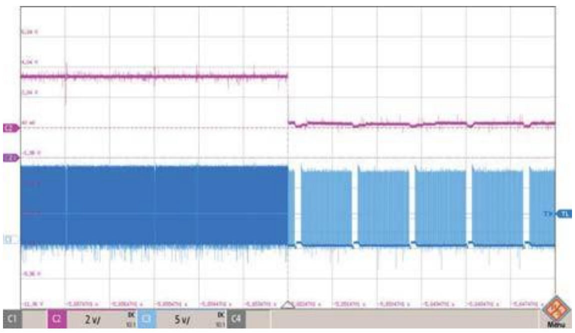
Switching Waveform with

V_{IN}=12V V_{OUT}=3.3V I_{OUT}=0.6A



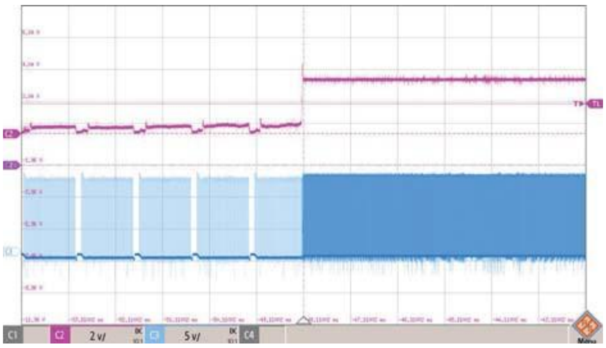
Short Circuit Protection

V_{IN}=12V V_{OUT}=3.3V I_{OUT}=0.6A to Short

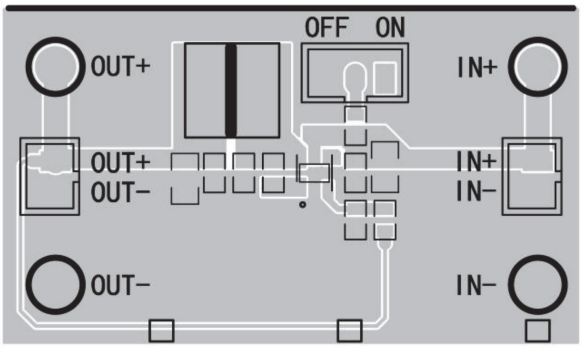


Short Circuit Recovery

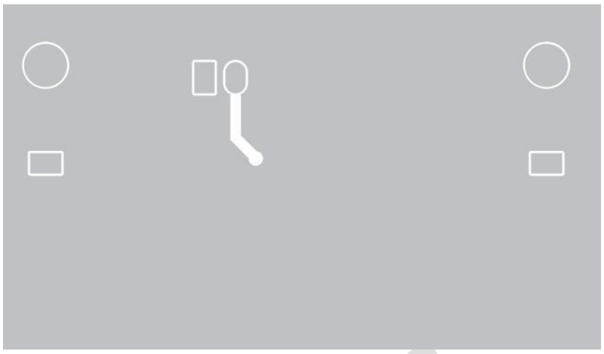
VIN=12V VOUT=3.3V IOUT=Short to



PCB GUIDELINE



Top Layer



Bottom Layer

FUNCTIONAL DESCRIPTION

The CN2201P is a synchronous,current-mode,step-down regulator It regulates input voltages from 4.7V to 40V down to an output voltage as low as 0.8V,and is capable of supplying up to 1A of load current.

Current-Mode Control

The CN2201P utilizes current-mode control to regulate the output voltage.The output voltage is measured at the FB pin through a resistive voltage divider and the error is amplified by the internal transconductance error amplifier.

Output of the internal error amplifier is compared with the switch current measured internally to control the output current.

Shut-Down Mode

The CN2201P shuts down when voltage at EN pin is below 0.7V.The entire regulator is off and the supply current consumed by the CN2201P drops below 3uA.

Power Switch

N-Channel MOSFET switches are integrated on the CN2201P to down convert the input voltage to the regulated output voltage.Since the top MOSFET needs a gate voltage great than the input voltage ,a boostrap capacitor connected between BST and SW pins is required to drive the gate if the top switch.The boostrap capacitor is charged by the internal 5V rail when SW is low.

Vin Under-Voltage Protection

A resistive divider can be connected between Vin and ground,with the central tap connected to EN,so that when Vin drops to the pre-set value,EN drops below 1.5V to tigger input under voltage lockout protection.

Thermal Protection

When the temperature of the CN2201P rises above 150℃,it is forced into thermal shut-down.

Only when core temperature drop below 110℃ can the regulator becomes active again.

PPLICATION INFORMATION

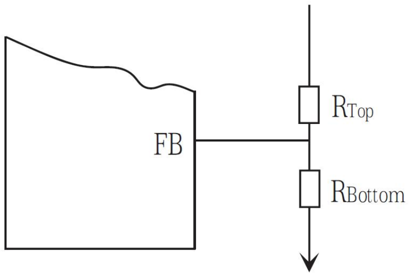
Output Voltage Set

Out voltage are set by external resistors.The FB threshold is 0.8V.

$R_{TOP}=R_{BOTTOM}$ x[(VOUT/0.8)-1]

The following table lists the recommended values.

VOUT(V)	RBOTTOM(kΩ)	R_{TOP}(kΩ)
2.5	4.99	11
3.3	2.4	7.5
5	2.1	11.2



Input Capacitor

The input capacitor is used to supply the AC input current tothe step-down converter and maintaining the DC input voltage.

The ripple current through the input capacitor can be calculated by:

$$I_{C1} = I_{LOAD} \bullet \sqrt{\frac{V_{OUT}}{V_{IN}} \bullet \left(1 - \frac{V_{OUT}}{V_{IN}}\right)}$$

Where ILOAD is the load current,VOUT is the output voltage,VIN is input voltage.

Thus the input capacitor can be calculated by the following equatio the input ripple voltage is determined.

$$C1 = \frac{I_{LOND}}{f_S \bullet \Delta V_{IN}} \bullet \frac{V_{OUT}}{V_{IN}} \bullet \left(1 - \frac{V_{OUT}}{V_{IN}}\right)$$

Where C1 is the input capacitance value,fs is the switching frequency,ΔV_{IN} is the input ripple current.

The input capacitor can be electrolytic,tantalum or ceramic.To minir the potential noise,a small X5R or X7R ceramic capacitor,i.e.0.1uF,: be placed as close to the IC as possible when using electrolytic capacitors.

A 10uF ceramic capacitor is recommended in typical application,an extra 47uF electrolytic capacitor is needed if hot-plug is required.

Output Capacitor

The output capacitor is required to maintain the DC output voltage,and the capacitance value determines the output ripple voltage.The output voltage ripple can be calculated by:

$$\Delta V_{OUT} = \frac{V_{OUT}}{F_S \bullet L} \bullet \left(1 - \frac{V_{OUT}}{V_{IN}}\right) \bullet \left(R_{ESR} + \frac{1}{8 \bullet f_S \bullet C_2}\right)$$

Where C2 is the output capacitance value and RESR is the equivalent series resistance value of the output capacitor.

The output capacitor can be low ESR electrolytic,tantalum or ceramic,which lower ESR capacitors get lower output ripple voltage.

The output capacitors also affect the system stability and transient response, and a 10uF ceramic capacitor is recommended in typical application.

Inductor

The inductor is used to supply constant current to the output load,and the value determines the ripple current which affect the efficiency and the output voltage ripple.The ripple current is typically allowed to be 30% of the maximum switch current limit,thus the inductance value can be calculated by:

Where VIN is the input voltage,VOUT is the output voltage,fs is the switch frequency,and ΔIL is the peak-to-peak inductor ripple current.

$$L = \frac{V_{OUT}}{f_S \bullet \Delta I_L} \bullet \left(1 - \frac{V_{OUT}}{V_{IN}}\right)$$

External Boostrap Capacitor

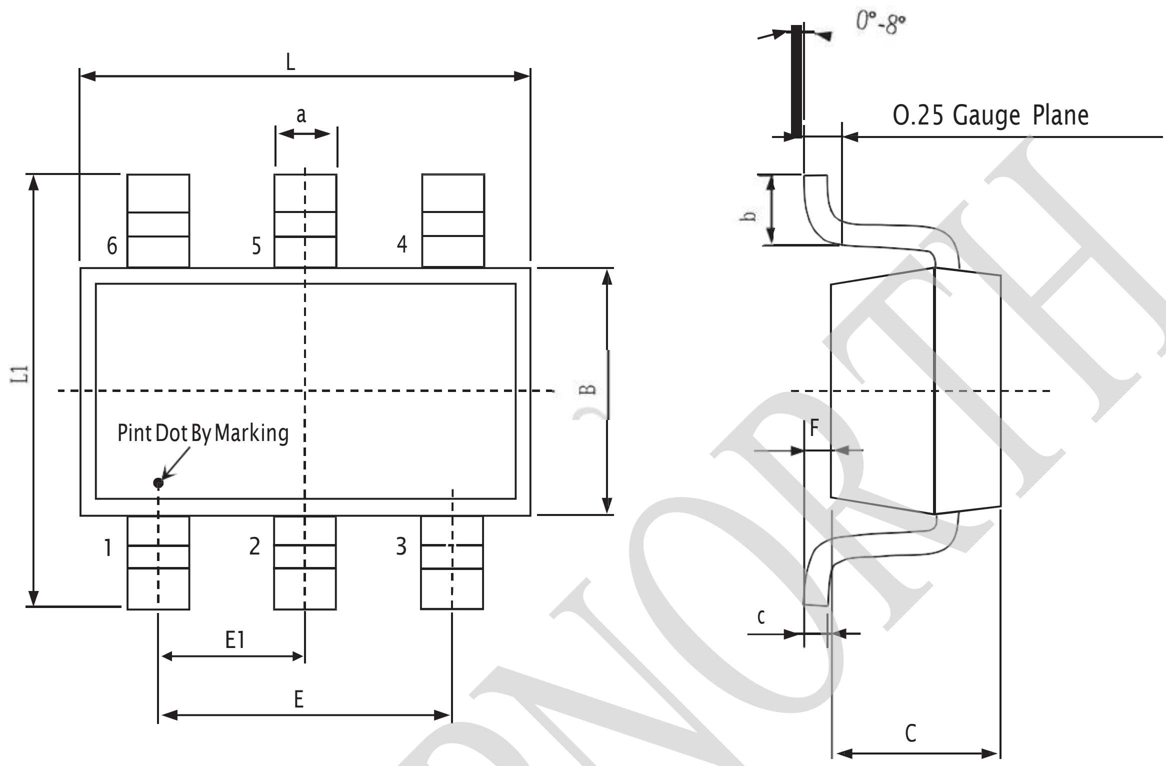
A boostrap capacitor is required to supply voltage to the top switch diver. A 0.1uF low ESR ceramic capacitor is recommended to connected to the BST pin and SW pin.

Other Components Selection

V_{OUT}(V)	C_{OUT}(μF)	L(μH)
8	22	15 to 22
5	22	10 to 15
3.3	22	6.8 to 10

PACKAGE OUTLINE

CN2201P **UNIT:mm**



Symbol	Dimensions In Millimeters		Symbol	Dimensions In Millimeters	
	Min	Max		Min	Max
L	2.82	3.02	E1	0.85	1.05
B	1.5	1.70	a	0.35	0.50
C	0.90	1.30	c	0.10	0.20
L1	2.60	3.00	b	0.35	0.55
E	1.80	2.00	f	0	0.15