深圳市诚芯微科技有限公司
SHENZHEN CHENGXINWEI TECHNOLOGY CO.,LTD

CX8518

产品说明书

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DESCRIPTION

The CX8518 is a monolithic synchronous buck regulator. The device integrates 100mΩ MOSFETS that provide 4A of continuous load current over a wide operating input voltage of 4.75V to 32V. Current mode control provides fast transient response and cycle-by-cycle current limit.

An adjustable soft-start prevents inrush current at turn-on and in shutdown mode, the supply current drops below 1μA.

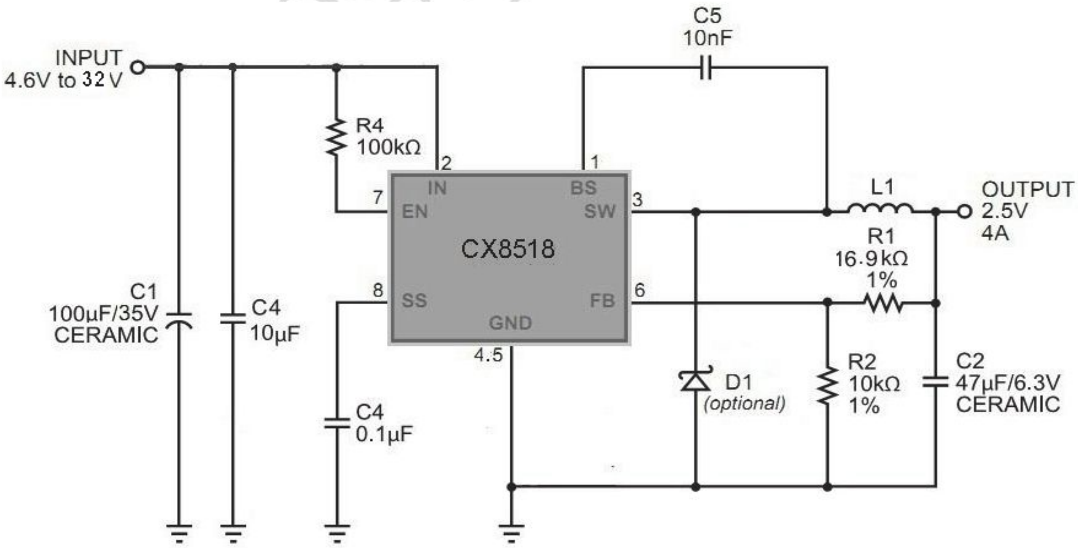
FEATURES

- 4A Continuous Output Current
- Wide 4.75V to 32V Operating Input Range
- Integrated 100mΩ Power MOSFET Switches
- Output Adjustable from 0.925V to 20V
- Up to 93% Efficiency
- Programmable Soft-Start
- Stable with Low ESR Ceramic Output Capacitors
- Fixed 320KHz Frequency
- Cycle-by-Cycle Over Current Protection
- Input Under Voltage Lockout
- Thermally Enhanced 8-Pin SOIC Package

APPLICATIONS

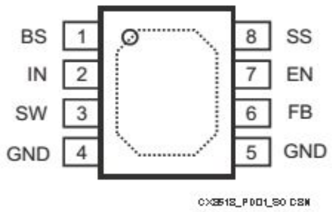
- Distributed Power Systems
- Networking Systems
- FPGA, DSP, ASIC Power Supplies
- Green Electronics/Appliances
- Notebook Computers

TYPICAL APPLICATION



PACKAGE REFERENCE

TOP VIEW



Part Number*	Package	Temperature
CX8518DN	SOP8EP (Exposed Pad)	–40° to +85°C

ABSOLUTE MAXIMUM RATINGS [1]

Supply Voltage V_{IN}......................–0.3V to +32V
Switch Voltage V_{SW}................ –1V to V_{IN} + 0.3V
Boost Voltage V_{BS}..........V_{SW} – 0.3V to V_{SW} + 6V
All Other Pins...............................–0.3V to +6V
Junction Temperature..............................150°C
Lead Temperature.................................260°C
Storage Temperature ....–65°C to +150°C

Recommended Operating Conditions [2]

Input Voltage V_{IN}...........................4.75V to 32V
Output Voltage V_{OUT} .... 0.925V to 20V
Ambient Operating Temp .... –40°C to +85°C

Thermal Resistance [3] θ_{JA} θ_{JC}

SOIC8N .... 50 ...... 10... °C/W

Maximum Power Dissipation Operating

(*TA*=25°C)
SOIC8N[4], P_{OUT} 2W

Notes:
1) Exceeding these ratings may damage the device.
2) The device is not guaranteed to function outside of its operating conditions.
3) Measured on approximately 1" square of 1 oz copper.
4) Derating 20mW/°C at TA > 25°C

ELECTRICAL CHARACTERISTICS

V_{IN} = 12V, T_A = +25°C, unless otherwise noted.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Shutdown Supply Current		V_{EN} = 0V		0.3	3.0	μA
Supply Current		V_{EN} = 2.0V, V_{FB} = 1.0V		1.3	1.5	mA
Feedback Voltage	V_{FB}	4.75V ≤ V_{IN} ≤ 32V	0.890	0.910	0.930	V
Feedback Overvoltage Threshold				1.1		V
Error Amplifier Voltage Gain [5]	A_{EA}			480		V/V
Error Amplifier Transconductance	G_{EA}	ΔI_C = ±10μA		920		μA/V
High-Side Switch On-Resistance [5]	$R_{DS(ON)1}$			100		mΩ
Low-Side Switch On-Resistance [5]	$R_{DS(ON)2}$			100		mΩ
High-Side Switch Leakage Current		V_{EN} = 0V, V_{SW} = 0V		0	10	μA
Upper Switch Current Limit		Minimum Duty Cycle	4.0	5.8		A
Lower Switch Current Limit		From Drain to Source		0.9		A
Oscillation Frequency	F_{osc1}		280	310	370	KHz
Short Circuit Oscillation Frequency	F_{osc2}	V_{FB} = 0V		110		KHz
Maximum Duty Cycle	D_{MAX}	V_{FB} = 1.0V		90		%
Minimum On Time [5]	T_{ON}			220		ns
EN Shutdown Threshold Voltage		V_{EN} Rising	1.1	1.5	2.0	V
EN Shutdown Threshold Voltage Hysterisis				220		mV

ELECTRICAL CHARACTERISTICS *(continued)*

V_{IN} = 12V, T_A = +25°C, unless otherwise noted.

Parameter	Symbol	Condition	Min	Typ	Max	Units
EN Lockout Threshold Voltage			2.2	2.5	2.7	V
EN Lockout Hysterisis				210		mV
Input Under Voltage Lockout Threshold		V_{IN} Rising	3.80	4.05	4.40	V
Input Under Voltage Lockout Threshold Hysteresis				210		mV
Soft-Start Current		V_{SS} = 0V		6		μA
Soft-Start Period		C_{SS} = 0.1μF		15		ms
Thermal Shutdown [5]				160		°C

PIN FUNCTIONS

Pin #	Name	Description
1	BS	High-Side Gate Drive Boost Input. BS supplies the drive for the high-side N-Channel MOSFET switch. Connect a 0.01μF or greater capacitor from SW to BS to power the high side switch.
2	IN	Power Input. IN supplies the power to the IC, as well as the step-down converter switches. Drive IN with a 4.75V to 32V power source. Bypass IN to GND with a suitably large capacitor to eliminate noise on the input to the IC. See *Input Capacitor*.
3	SW	Power Switching Output. SW is the switching node that supplies power to the output. Connect the output LC filter from SW to the output load. Note that a capacitor is required from SW to BS to power the high-side switch.
4.5	GND	Ground
6	FB	Feedback Input. FB senses the output voltage and regulates it. Drive FB with a resistive voltage divider connected to it from the output voltage. The feedback threshold is 0.925V. See *Setting the Output Voltage*.
7	EN	Enable Input. EN is a digital input that turns the regulator on or off. Drive EN high to turn on the regulator; low to turn it off. Attach to IN with a 100kΩ pull up resistor for automatic startup.
8	SS	Soft-Start Control Input. SS controls the soft-start period. Connect a capacitor from SS to GND to set the soft-start period. A 0.1μF capacitor sets the soft-start period to 15ms. To disable the soft-start feature, leave SS unconnected.

APPLICATIONS INFORMATION

COMPONENT SELECTION

Setting the Output Voltage

The output voltage is set using a resistive voltage divider connected from the output voltage to FB. The voltage divider divides the output voltage down to the feedback voltage by the ratio:

$$V_{FB} = V_{OUT}\frac{R2}{R1+R2}$$

Thus the output voltage is:

$$V_{OUT} = 0.910\times\frac{R1+R2}{R2}$$

R2 can be as high as 100kΩ, but a typical value is 10kΩ. Using the typical value for R2, R1 is determined by:

$$R1 = 10.81\times(V_{OUT}-0.910)\ (k\Omega)$$

For example, for a 3.3V output voltage, R2 is 10kΩ, and R1 is 26.1kΩ. Table 1 lists recommended resistance values of R1 and R2 for standard output voltages.

Table 1—Recommended Resistance Values

VOUT	R1	R2
1.8V	9.53kΩ	10kΩ
2.5V	16.9kΩ	10kΩ
3.3V	26.1kΩ	10kΩ
5V	44.2kΩ	10kΩ
12V	121kΩ	10kΩ

Inductor

The inductor is required to supply constant current to the load while being driven by the switched input voltage. A larger value inductor will result in less ripple current that will in turn result in lower output ripple voltage. However, the larger value inductor will have a larger physical size, higher series resistance, and/or lower saturation current. A good rule for determining inductance is to allow the peak-to-peak ripple current to be approximately 30% of the maximum switch current limit. Also, make sure that the peak inductor current is below the maximum switch current limit.

The inductance value can be calculated by:

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

Where V_{OUT} is the output voltage, V_{IN} is the input voltage, f_S is the switching frequency, and ΔI_L is the peak-to-peak inductor ripple current.

Choose an inductor that will not saturate under the maximum inductor peak current, calculated by:

$$I_{LP} = I_{LOAD}+\frac{V_{OUT}}{2\times f_S\times L}\times\left(1-\frac{V_{OUT}}{V_{IN}}\right)$$

Where I_{LOAD} is the load current.

The choice of which style inductor to use mainly depends on the price vs. size requirements and any EMI constraints.

Optional Schottky Diode

During the transition between the high-side switch and low-side switch, the body diode of the low-side power MOSFET conducts the inductor current. The forward voltage of this body diode is high. An optional Schottky diode may be paralleled between the SW pin and GND pin to improve overall efficiency. Table 2 lists example Schottky diodes and their Manufacturers.

Table 2—Diode Selection Guide

Part Number	Voltage/Current Rating	Vendor
B130	40V, 3A	Diodes, Inc.
SK13	40V, 3A	Diodes, Inc.
MBRS130	40V, 3A	International Rectifier

Input Capacitor

The input current to the step-down converter is discontinuous, therefore a capacitor is required to supply the AC current while maintaining the DC input voltage. Use low ESR capacitors for the best performance. Ceramic capacitors are preferred, but tantalum or low-ESR electrolytic capacitors will also suffice. Choose X5R or X7R dielectrics when using ceramic capacitors.

Since the input capacitor (C1) absorbs the input switching current, it requires an adequate ripple current rating. The RMS current in the input capacitor can be estimated by:

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

The worst-case condition occurs at $V_{IN} = 2V_{OUT}$, where $I_{C1} = I_{LOAD}/2$. For simplification, use an input capacitor with a RMS current rating greater than half of the maximum load current.

The input capacitor can be electrolytic, tantalum or ceramic. When using electrolytic or tantalum capacitors, a small, high quality ceramic capacitor, i.e. 0.1μF, should be placed as close to the IC as possible. When using ceramic capacitors, make sure that they have enough capacitance to provide sufficient charge to prevent excessive voltage ripple at input. The input voltage ripple for low ESR capacitors can be estimated by:

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

Where C1 is the input capacitance value.

Output Capacitor

The output capacitor (C2) is required to maintain the DC output voltage. Ceramic, tantalum, or low ESR electrolytic capacitors are recommended. Low ESR capacitors are preferred to keep the output voltage ripple low. The output voltage ripple can be estimated by:

$$\Delta V_{OUT} = \frac{V_{OUT}}{f_S \times L} \times \left(1 - \frac{V_{OUT}}{V_{IN}}\right) \times \left(R_{ESR} + \frac{1}{8 \times f_S \times C2}\right)$$

Where C2 is the output capacitance value and R_{ESR} is the equivalent series resistance (ESR) value of the output capacitor.

When using ceramic capacitors, the impedance at the switching frequency is dominated by the capacitance which is the main cause for the output voltage ripple. For simplification, the output voltage ripple can be estimated by:

$$\Delta V_{OUT} = \frac{V_{OUT}}{8 \times f_S{}^2 \times L \times C2} \times \left(1 - \frac{V_{OUT}}{V_{IN}}\right)$$

When using tantalum or electrolytic capacitors, the ESR dominates the impedance at the switching frequency. For simplification, the output ripple can be approximated to:

$$\Delta V_{OUT} = \frac{V_{OUT}}{f_S \times L} \times \left(1 - \frac{V_{OUT}}{V_{IN}}\right) \times R_{ESR}$$

The characteristics of the output capacitor also affect the stability of the regulation system. The CX8518 can be optimized for a wide range of capacitance and ESR values.

External Bootstrap Diode

An external bootstrap diode may enhance the efficiency of the regulator, the applicable conditions of external BS diode are:

- V_{OUT} is 5V or 3.3V; and
- Duty cycle is high: D= $\frac{V_{OUT}}{V_{IN}}$ >65%

In these cases, an external BS diode is recommended from the output of the voltage regulator to BS pin, as shown in Figure3

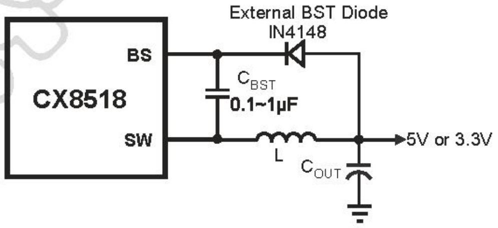
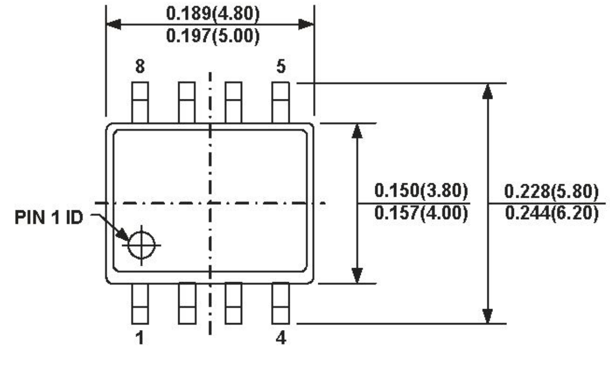


Figure 3—Add Optional External Bootstrap Diode to Enhance Efficiency

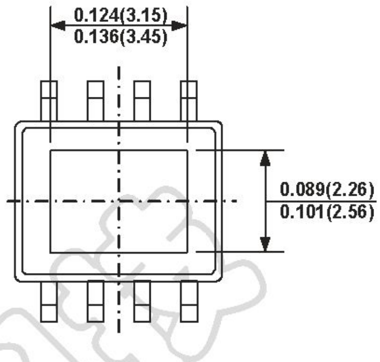
The recommended external BS diode is IN4148, and the BS cap is 0.1~1μF.

PACKAGE INFORMATION

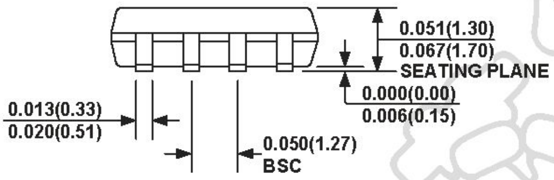
SOIC8EP (EXPOSED PAD)



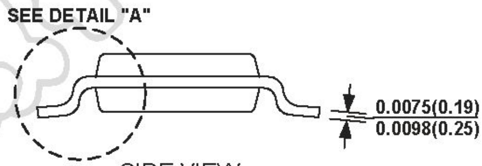
TOP VIEW



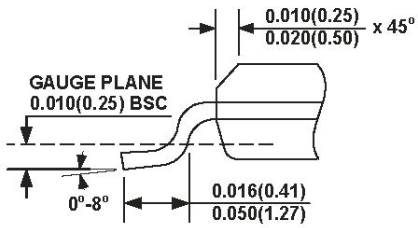
BOTTOM VIEW



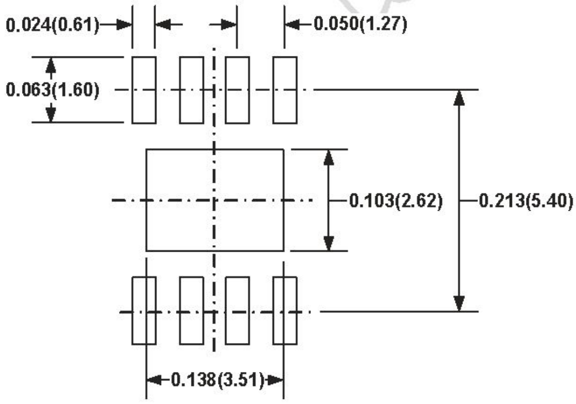
FRONT VIEW



SIDE VIEW



DETAIL "A"



RECOMMENDED LAND PATTERN