



# LC2126B

## 2A 6V Synchronous Buck Converter with Fixed frequency 3MHz

### DESCRIPTION

The LC2126B is a high efficiency synchronous, buck DC/DC converter. Its input voltage range is from 2.6V to 6V and provides an adjustable regulated output voltage from 0.6V to  $V_{in}$  while delivering up to 2A of output current.

The internal synchronous switches increase efficiency and eliminate the need for an external Schottky diode. It runs at a fixed 3MHz frequency, which allows the use of small inductor with  $L < 1\mu H$  while maintaining a high efficiency and small output voltage ripple.

The LC2126B is always operating in PWM mode .

The LC2126B is available in SOT23-5 package.

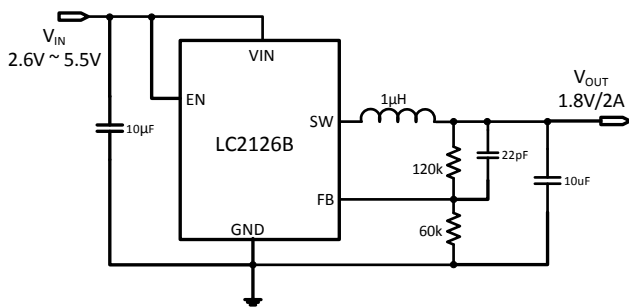
### FEATURES

- Adjustable Output Voltage,  $V_{fb}=0.6V$
- Maximum output current is 2A
- Range of operation input voltage: Max 6V
- No Load current:  $10mA@V_{in}=5V, V_{out}=3.3V$
- Line regulation:  $0.1\%/V$  (typ.)
- Load regulation:  $10mV$  (typ.)
- High efficiency, up to 96%
- Environment Temperature:  $-20^{\circ}C \sim 85^{\circ}$

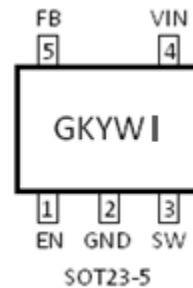
### APPLICATIONS

- Power Management for 3G modem
- Smart Phone
- Tablet PC
- Set Top Box
- Other Battery Powered Device

### TYPICAL APPLICATION



### PIN OUT & MARKING



**Note:** GK: Product Code  
 YW: Date code

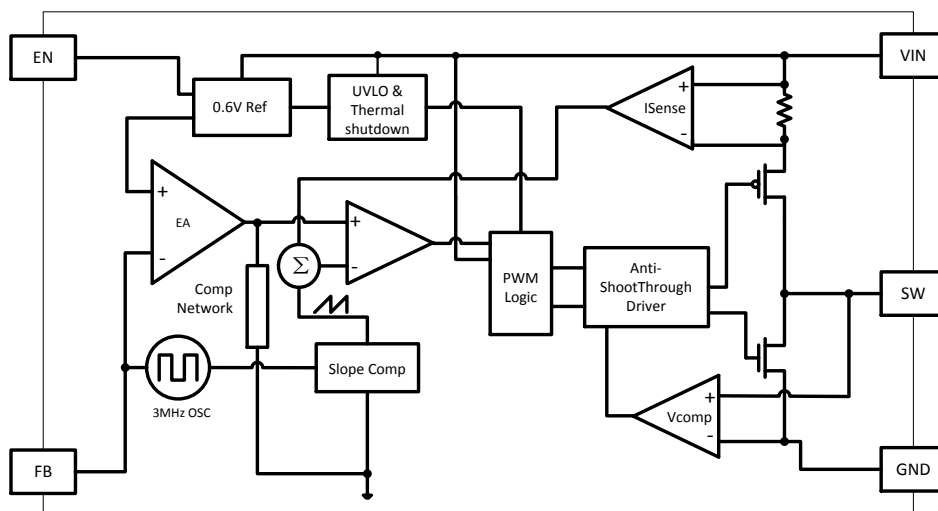
### ORDERING INFORMATION

PART No.	PACKAGE	Tape&Reel
LC2126BCB5TR	SOT23-5	3000pcs/Reel

## PINOUT DESCRIPTION

PIN #	NAME	DESCRIPTION
1	EN	Enable pin for the IC. Drive this pin to high to enable the part, low to disable.
2	GND	Ground.
3	SW	Inductor Connection. Connect an inductor Between SW and the regulator output.
4	VIN	Supply Voltage.
5	FB	Feedback Input. Connect an external resistor divider from the output to FB and GND to set the output to a voltage between 0.6V and VIN

## BLOCK DIAGRAM



## ABSOLUTE MAXIMUM RATING

Parameter	Value
Max Input Voltage	6V
Max Operating Junction Temperature(Tj)	125°C
Ambient Temperature(Ta)	-20°C – 85°C
Power Dissipation	SOT-23-5 250mW
Storage Temperature(Ts)	-40°C - 150°C
Lead Temperature & Time	260°C, 10S
ESD (HBM)	>2000V

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

## RECOMMENDED WORK CONDITIONS

Parameter	Value
Input Voltage Range	Max. 6V
Operating Junction Temperature(Tj)	-20°C –125°C

## ELECTRICAL CHARACTERISTICS

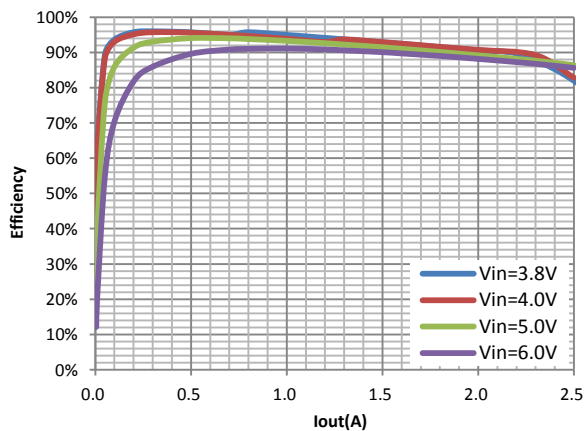
(Vin=5V, TA=25°C)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Vin	Input Voltage Range		2.6		6.0	V
UVLO	Input Under Voltage Lockout	Increase Vin	2.1	2.2		V
Vref	Feedback Voltage	Vin=5V, VEN=5V	0.588	0.6	0.612	V
Iblk	Feedback Leakage current			0.01	0.1	uA
Iq	Quiescent Current	Active, Vfb=0.65V, No Switching		250		uA
		Shutdown		0.1	1	uA
LnReg	Line Regulation	Vin=2.7V to 5.5V		0.04		%/V
LdReg	Load Regulation	Iout=0.1 to 2A		0.15		%/A
Fsoc	Switching Frequency		2.4	3	3.6	MHz
RdsonP	PMOS Rdson	Isw=200mA		100	120	mohm
RdsonN	NMOS Rdson	Isw=200mA		80	100	mohm
Ilimit	Peak Current Limit		2.5	3		A
Iswlk	SW Leakage Current	Vout=5.5V, EN=GND			10	uA
Venh, Vmdh	EN/MODE High Threshold				1.5	V
Venl, Vmdl	EN/MODE Low Threshold		0.4			V
Ienlk, Imdlk	EN/MODE Leakage Current	EN=GND			1	uA

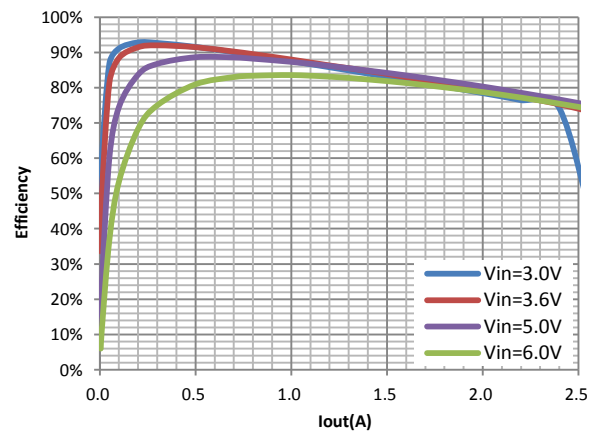
## TYPICAL PERFORMANCE CHARACTERISTICS

(Vin=3.6V, L=1uH, Cin=10uF, Cout=10uF, TA=25°C, unless otherwise stated)

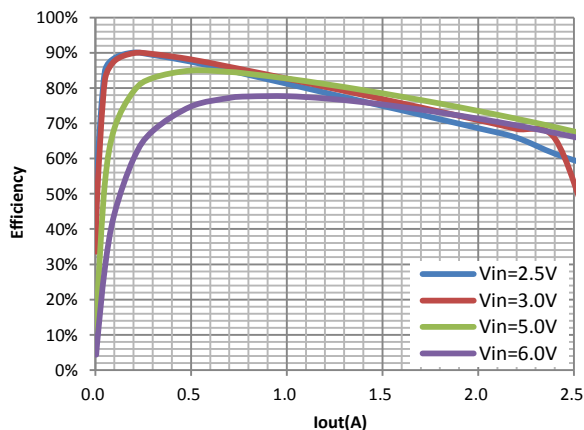
Efficiency at Vout=3.3V



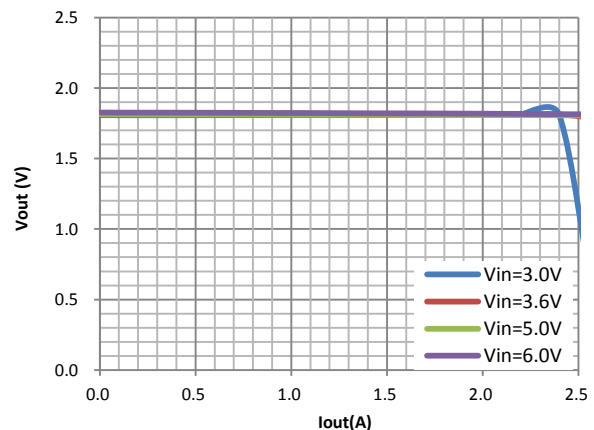
Efficiency at Vout=1.8V



Efficiency at Vout=1.2V

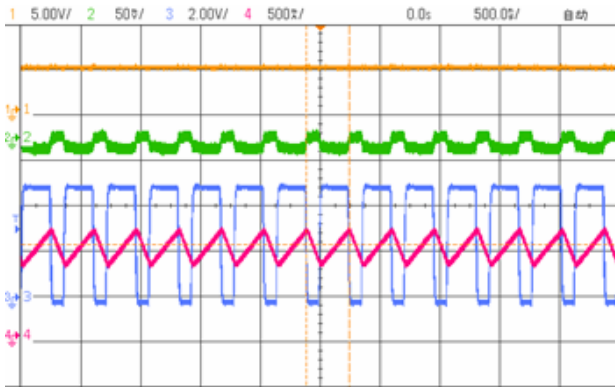


Load Regulation at Vout=1.8V



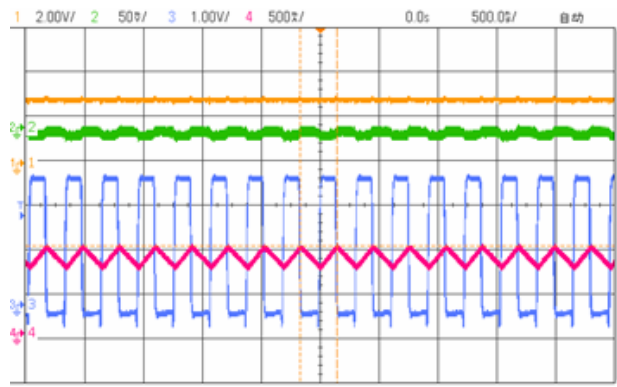
## Switching waveform

Vin=5.0V, Vout=3.3V, Iout=1A  
Ch1—Vin, Ch2—Vout, Ch3—SW, Ch4—IL



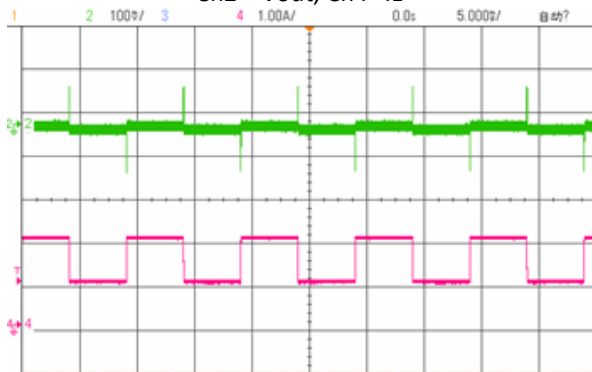
## Switching waveform

Vin=3.0V, Vout=1.2V, Iout=1A  
Ch1—Vin, Ch2—Vout, Ch3—SW, Ch4—IL



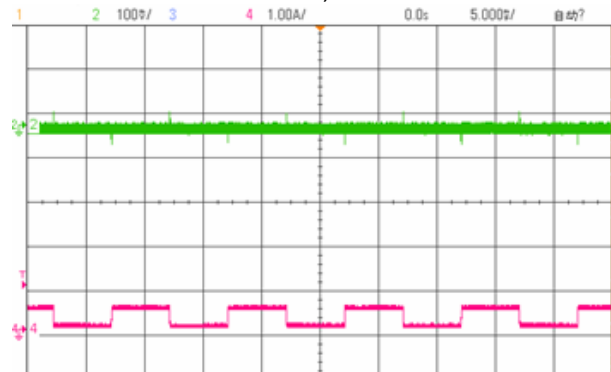
## Load Transient

Vin=5.0V, Vout=3.3V, Iout=1A~2A  
Ch2—Vout, Ch4—IL



## Load Transient

Vin=5.0V, Vout=3.3V, Iout=0.1~0.5A  
Ch2—Vout, Ch4—IL



## FUNCTIONAL DESCRIPTIONS

The LC2126B high efficiency switching regulator is a small, simple, DC-to-DC step-down converter capable of delivering up to 2A of output current. The device operates in pulse-width modulation (PWM) at 3MHz from a 2.6V to 5.5V input voltage and provides an output voltage from 0.6V to VIN, making the LC2126B ideal for on-board post-regulation applications. An internal synchronous rectifier improves efficiency and eliminates the typical Schottky free-wheeling diode. Using the on resistance of the internal high-side MOSFET to sense switching currents eliminates current-sense resistors, further improving efficiency and cost.

### Loop Operation

LC2126B uses a PWM current-mode control scheme. An open-loop comparator compares the integrated voltage-

feedback signal against the sum of the amplified current-sense signal and the slope compensation ramp. At each rising edge of the internal clock, the internal high-side MOSFET turns on until the PWM comparator terminates the on cycle. During this on-time, current ramps up through the inductor, sourcing current to the output and storing energy in the inductor. The current mode feedback system regulates the peak inductor current as a function of the output voltage error signal. During the off cycle, the internal high-side P-channel MOSFET turns off, and the internal low-side N-channel MOSFET turns on. The inductor releases the stored energy as its current ramps down while still providing current to the output.

## Current Sense

An internal current-sense amplifier senses the current through the high-side MOSFET during on time and produces a proportional current signal, which is used to sum with the slope compensation signal. The summed signal then is compared with the error amplifier output by the PWM comparator to terminate the on cycle.

## Current Limit

There is a cycle-by-cycle current limit on the high-side MOSFET. When the current flowing out of SW exceeds this limit, the high-side MOSFET turns off and the synchronous rectifier turns on. LC2126B utilizes a frequency fold-back mode to prevent overheating during short-circuit output conditions. The device enters frequency fold-back mode when the FB voltage drops below 200mV, limiting the current to IPEAK and reducing power dissipation. Normal operation resumes upon removal of the short-circuit condition.

## DESIGN PROCEDURE

### Inductor Selection

The peak-to-peak ripple is limited to 30% of the maximum output current. This places the peak current far enough from the minimum overcurrent trip level to ensure reliable operation while providing enough current ripples for the current mode converter to operate stably. In this case, for 2A maximum output current, the maximum inductor ripple current is 667 mA. The inductor size is estimated as following equation:

$$L_{IDEAL} = (V_{IN(MAX)} - V_{OUT}) / I_{RIPPLE} * D_{MIN} * (1 / F_{OSC})$$

Therefore,

for  $V_{OUT} = 1.8V$ ,

The inductor values is calculated to be  $L = 0.60\mu H$ .  
Choose  $1\mu H$

And for  $V_{OUT} = 1.2V$ ,

The inductor values is calculated to be  $L = 0.469\mu H$ .  
Choose  $0.47\mu H$

The resulting ripple is

$$I_{RIPPLE} = (V_{IN(MAX)} - V_{OUT}) / L_{ACTUAL} * D_{MIN} * (1 / F_{OSC})$$

When,

$V_{OUT} = 1.8V$ ,  $I_{RIPPLE} = 403mA$

$V_{OUT} = 1.2V$ ,  $I_{RIPPLE} = 665mA$

### Output Capacitor Selection

For most applications a nominal  $10\mu F$  or  $22\mu F$  capacitor is suitable. The LC2126B internal compensation is designed for a fixed corner frequency that is equal to

## Soft Start

LC2126B has a 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 I soft-start circuitry slowly ramps up current available at SW.

## UVLO and Thermal Shutdown

If  $V_{IN}$  drops below 2V, the UVLO circuit inhibits switching. Once  $V_{IN}$  rises above 2.1V, the UVLO clears, and the soft-start sequence activates. Thermal-overload protection limits total power dissipation in the device. When the junction temperature exceeds  $T_J = +160^{\circ}C$ , 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  $15^{\circ}C$ , resulting in a pulsed output during continuous overload conditions. Following a thermal-shutdown condition, the soft-start sequence begins.

$$FC = \frac{1}{2 * \pi * \sqrt{C_{OUT} * L}} = 50Khz$$

For example, for  $V_{OUT} = 1.8V$ ,  $L = 1\mu H$ ,  $C_{OUT} = 10\mu F$ , for  $V_{OUT} = 1.2V$ ,  $L = 0.47\mu H$ ,  $C_{OUT} = 22\mu F$

## Setting Output Voltage

Output voltages are set by external resistors. The FB\_ threshold is 0.6V.

$$R_{TOP} = R_{BOTTOM} * [(V_{OUT} / 0.6) - 1]$$

## Guidelines for Input Capacitor and Output Capacitor

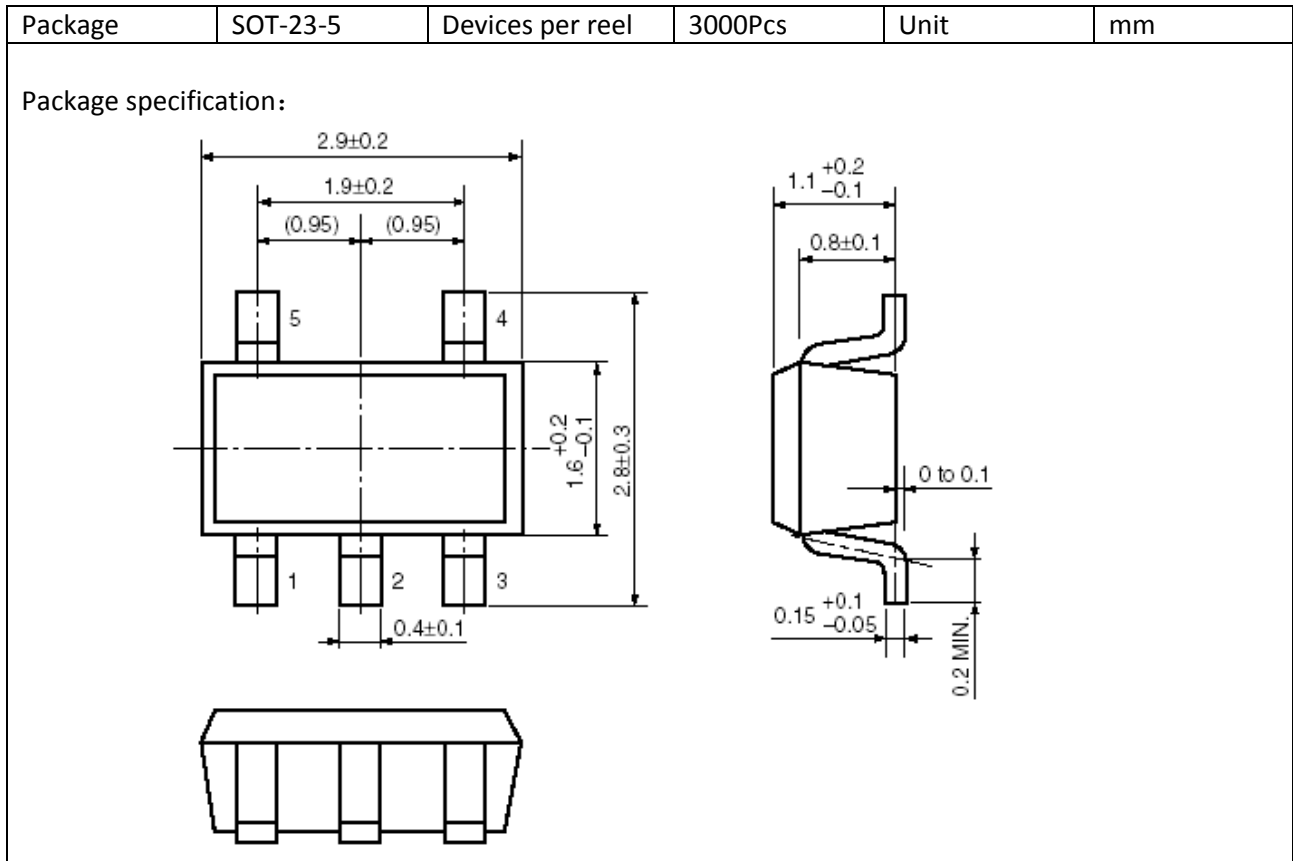
The input capacitor in a DC-to-DC converter reduces current peaks drawn from the battery or other input power source and reduces switching noise in the controller. The impedance of the input capacitor at the switching frequency should be less than that of the input source so high-frequency switching currents do not pass through the input source. The output capacitor keeps output ripple small and ensures control-loop stability. The output capacitor must also have low impedance at the switching frequency. Ceramic, polymer, and tantalum capacitors are suitable, with ceramic exhibiting the lowest ESR and high-frequency impedance. Output ripple with a ceramic output capacitor is approximately as follows:

$$V_{RIPPLE} = I_{L(PEAK)} [1 / (2\pi * f_{OSC} * C_{OUT})]$$

If the capacitor has significant ESR, the output ripple component due to capacitor ESR is as follows:

$$V_{RIPPLE(ESR)} = I_{L(PEAK)} * ESR$$

## PACKAGE OUTLINE




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