

0.9V Startup, 1MHz, 300mA Iout, Low Iq, Synchronous Boost Converter

DESCRIPTION

The BL8536 is a step-up converter that provides a boosted output voltage from a low voltage source. Because of its proprietary design, it starts up at a very low input voltage down to 0.9V, and only consumes 15uA at standby, making it an ideal choice for single cell alkaline/NiMH battery operations.

A switching frequency of 1MHz minimizes solution footprint by allowing the use of tiny, low profile inductors and ceramic capacitors. The current mode PWM design is internally compensated, reducing external parts count.

BL8536 is available in SOT23-3, SOT23-5 and SOT89-3 Packages.

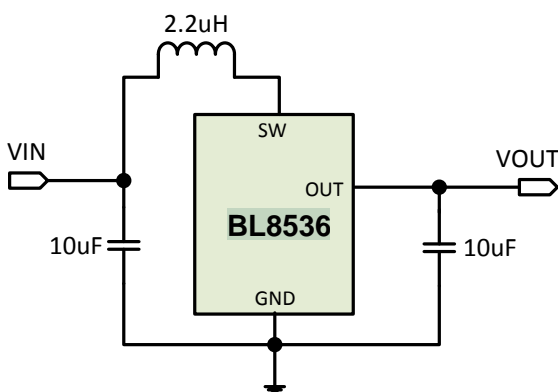
FEATURES

- Efficiency up to 95%@Vin=2.7V, Vout=3.3V
- Typical 15uA standby current
- 1MHz Switching Frequency allows small inductor and output cap
- Input boost-strapping allows using small or no input cap
- Low Vin Start-up Voltage down to 0.9V Ideal for Single Alkaline Cell operations
- Maximum Output Current up to 300mA
- Low Noise PWM control
- Internally Compensated Current Mode Control
- Internal Synchronous Rectifier
- Available in SOT23-3, SOT23-5 and SOT89-3

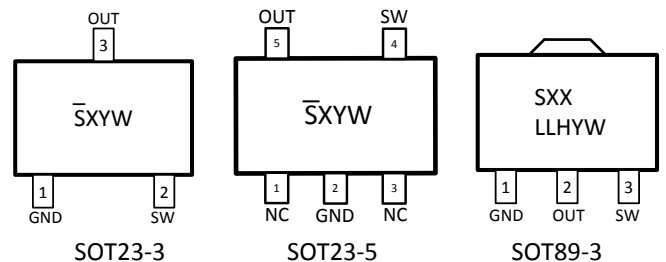
APPLICATIONS

- One to Three Cell Battery Operated Devices
- Medical Instruments
- Bluetooth Headsets
- Flash-Based MP3 Players
- Noise Canceling Headphones

TYPICAL APPLICATION



PIN OUT & MARKING



\bar{S} : Product Code
 X: Output Voltage
 YW: Date code

S: Product Code
 XX: Output Voltage
 LL: LOT No.
 H: FAB Code
 YW: Date code

Output Voltage Code X:

| VOUT | Code | VOUT | Code |
|------|-----------|------|-----------|
| 1.8V | 8 | 2.8V | 8 |
| 2.2V | $\bar{2}$ | 3.0V | $\bar{0}$ |
| 2.5V | $\bar{5}$ | 3.3V | $\bar{3}$ |
| 2.7V | $\bar{7}$ | 3.6V | $\bar{6}$ |

ORDERING INFORMATION

| PART No. | PACKAGE | Tape&Reel |
|---------------|---------|-----------|
| BL8536CB3TR□□ | SOT23-3 | 3000/Reel |
| BL8536CB5TR□□ | SOT23-5 | 3000/Reel |
| BL8536CC3TR□□ | SOT89-3 | 1000/Reel |

Note: □□stands for output voltage.

ABSOLUTE MAXIMUM RATING

| Parameter | Value | |
|--|---------------|-------|
| SW Voltage | -0.3 ~ 6V | |
| OUT Voltage | -0.3 ~ 6V | |
| Max Operating Junction Temperature(Tj) | 125°C | |
| Maximum Power Dissipation | SOT23-3 | 450mW |
| | SOT23-5 | 450mW |
| | SOT89-3 | 500mW |
| Ambient Temperature(Ta) | -40°C – 85°C | |
| Storage Temperature(Ts) | -55°C - 150°C | |
| Lead Temperature & Time | 260°C, 10S | |

Note: Exceed these limits to damage to the device.

Exposure to absolute maximum rating conditions may affect device reliability.

ELECTRICAL CHARACTERISTICS

(T_A=25°C)

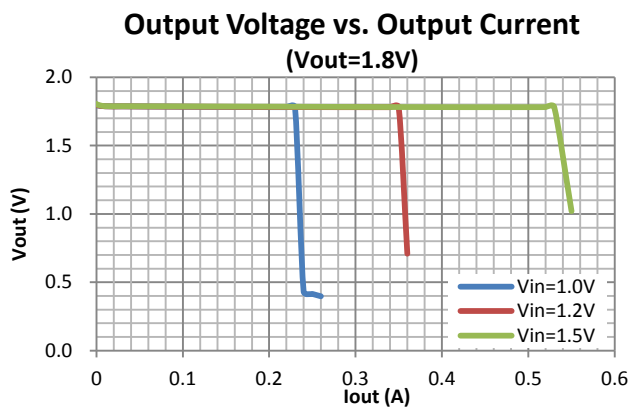
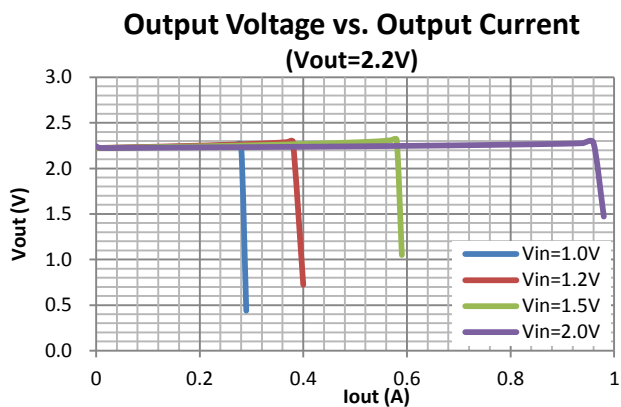
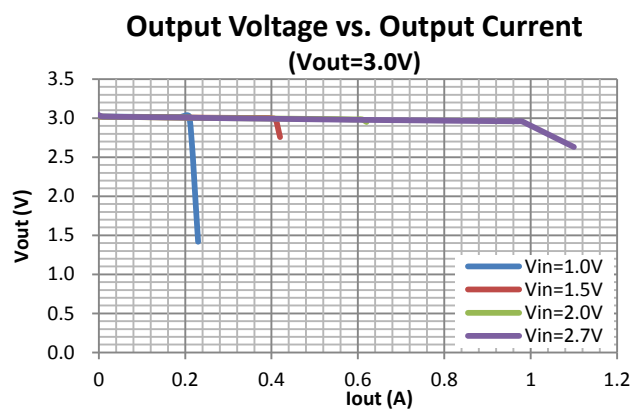
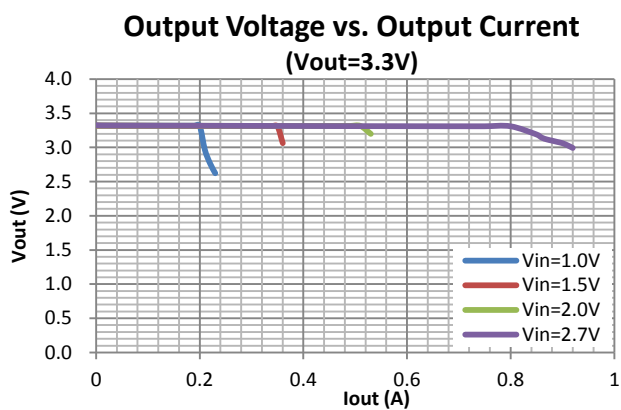
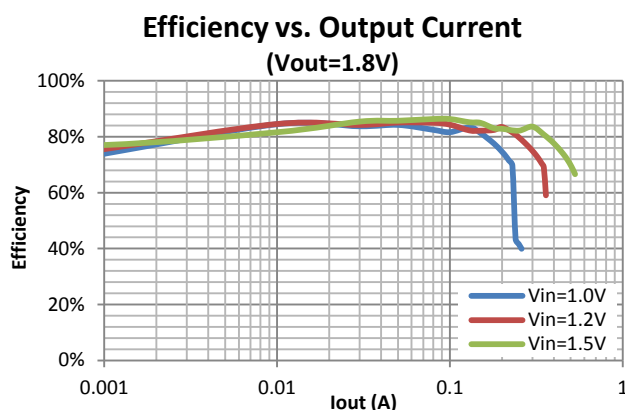
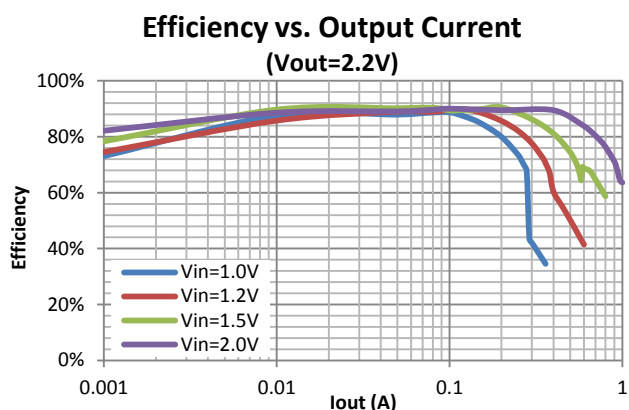
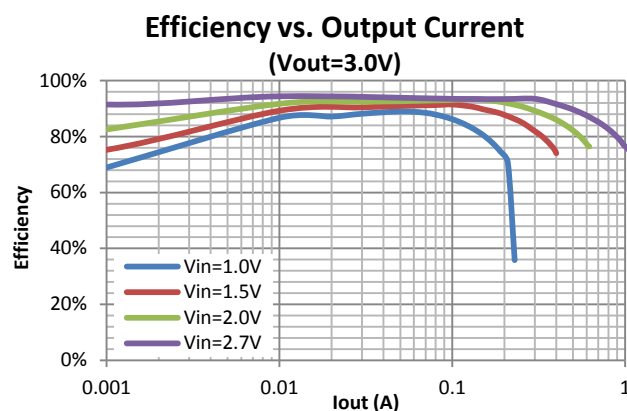
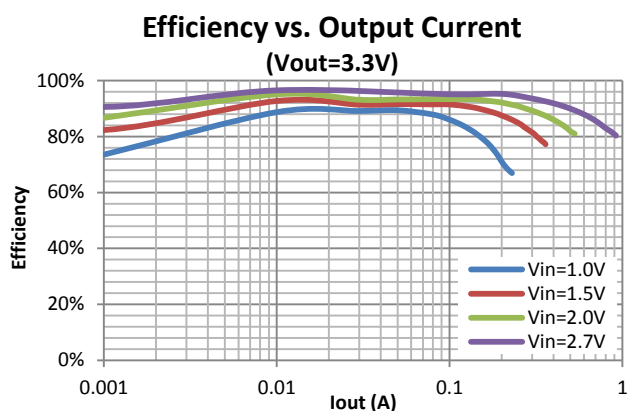
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------|---------------------------------------|--|-----|-----|-----|------|
| V _{in} | Input Voltage Range | | 0.9 | | 5 | V |
| V _{start} | Startup Voltage | I _{out} = 1mA | | 0.9 | | V |
| V _{hold} | Hold Voltage | I _{out} = 50mA | | 0.5 | 0.7 | V |
| V _{out} | Output Voltage Range | | 1.8 | | 3.6 | V |
| | Output voltage accuracy | I _{out} = 0mA | | 2 | | % |
| | Line regulation | I _{out} = 50mA | | 0.1 | 0.2 | %/V |
| | Load regulation | I _{out} = 0~300mA | | 1 | 2 | % |
| F _{soc} | Switching Frequency | V _{out} =0.95V _o , No inductor | 0.7 | 1 | 1.4 | MHz |
| | Max Duty cycle | V _{out} =0.95V _o , No inductor | 85 | 90 | 95 | % |
| I _q | Quiescent Current at V _{out} | V _{out} =1.05*V _o | 5 | 8 | 15 | uA |
| | Supply current at V _{in} | I _{out} = 0mA | | | 20 | uA |
| | Efficiency | I _{out} = 100mA | 85 | | | % |
| R _{dsonP} | PMOS R _{dson} | I _{sw} =100mA | | 400 | 600 | mohm |
| R _{dsonN} | NMOS R _{dson} | I _{sw} =100mA | | 200 | 300 | mohm |
| I _{swlk} | SW Leakage Current | V _{out} =3.6V, V _{sw} =0 or 5.2V | | | 1 | uA |

PIN DESCRIPTION

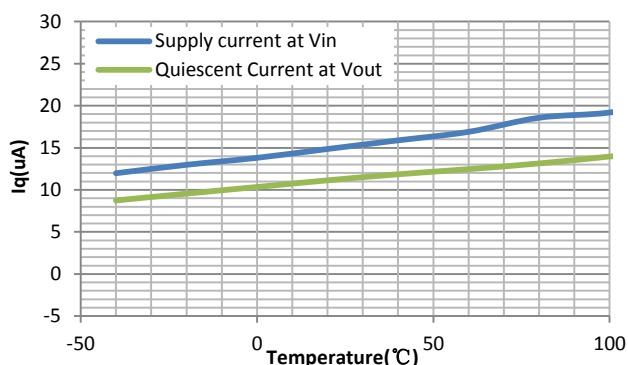
| PIN # | | | NAME | DESCRIPTION |
|---------|---------|---------|------|--|
| SOT23-3 | SOT23-5 | SOT89-3 | | |
| 1 | 2 | 1 | GND | Ground |
| 2 | 4 | 3 | SW | To connect inductor to VIN |
| 3 | 5 | 2 | OUT | Output voltage pin, with 10uF ceramic capacitor closely connected to GND |
| - | 1, 3 | - | NC | No Connection |

ELECTRICAL PERFORMANCE

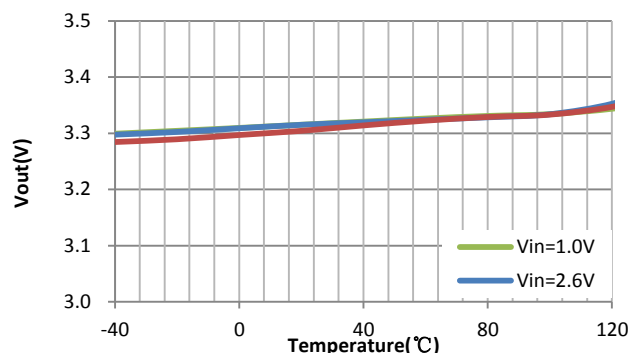
Tested under $C_{in}=C_{out}=10\mu F$, $L=2.2\mu H$, $T_A=25^\circ C$, unless otherwise specified



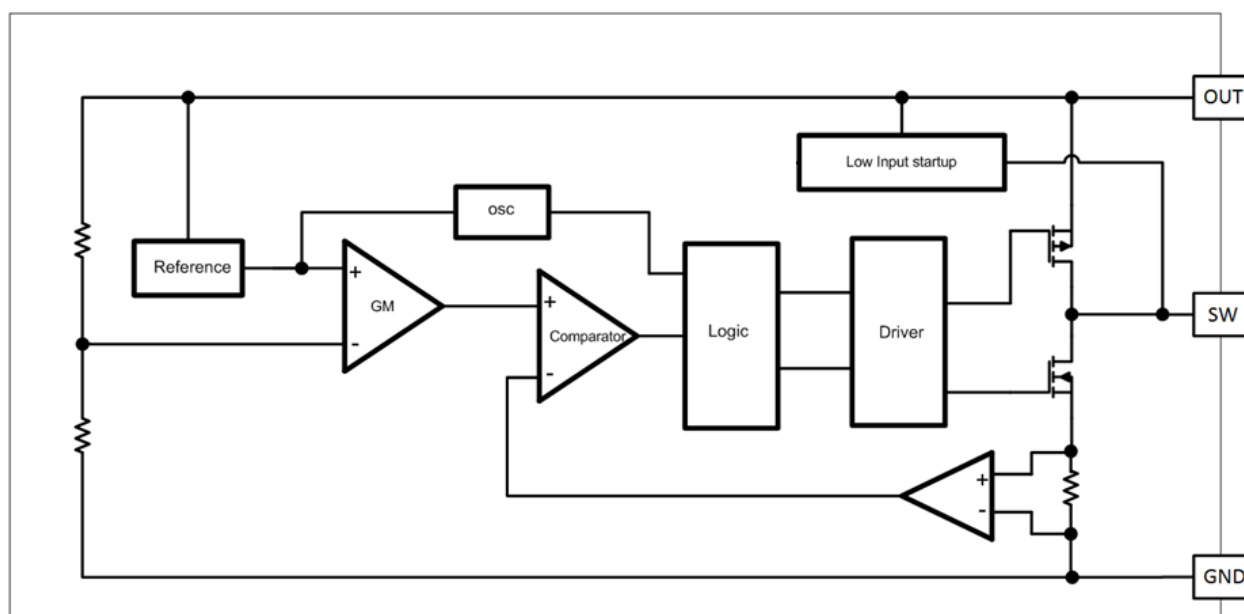
Iq vs. Temperature



Output Voltage vs. Temperature



BLOCK DIAGRAM



DETAILED DESCRIPTION

BL8536 is a low input voltage start up, current mode DC-DC step up converter. It's operation can be best understood by referring to the block diagram. Upon starting up, the low voltage startup circuitry drives SW with on-off cycles, transferring energy from input to OUT by storing energy in the inductor during on-time and releasing it to the output during off-time. When OUT reaches 2V, the startup circuit turns off and the main controller takes over. The main control loop consists of a reference, a GM error amplifier, a PWM controller, a current sense amplifier, an oscillator, a PWM logic control, and it is power stage including its driver. The main control loop is a classic current mode

control loop. The GM stage integrates the error between FB and REF, and its output is used to compare with a triangular wave which the summing result of the current sense amplifier output and a slope compensation voltage. The output of the comparator is used to drive the power stage to reach regulation.

APPLICATION INFORMATION

Inductor selection

With switching frequency up to 1MHz, small surface mount inductors can be used with values from 2.2uH to 4.7uH. For a given chosen inductor value and application conditions make sure the peak

inductor current does not exceed the maximum current rating of the selected vendor's inductor.

Input and output capacitor selection

The BL8536's bootstrap architecture allows the use of very small input capacitor. For applications that only need to drive small output load current, the input capacitor is optional, because once output is started up, the IC's is powered by OUT, a quiet power supply.

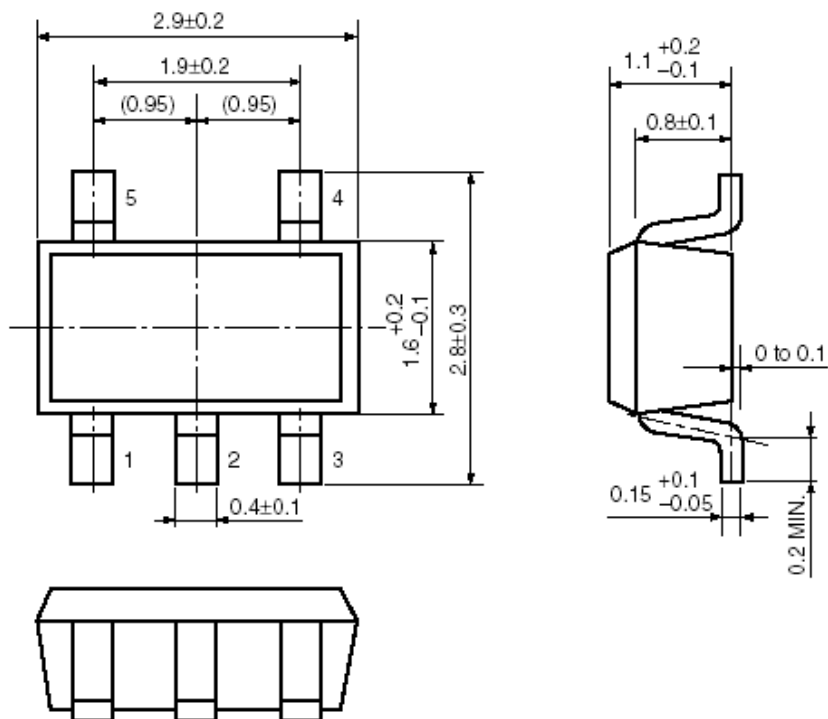
The output capacitor is used to stabilize the loop and provide ac current to the load. A low ESR ceramic cap with values from 2.2uF to 22uF can be used. Smaller value capacitors are generally cheaper with small footprints, while larger capacitor provides lower ripples and better transient load responses. Also, when extreme low startup voltage is needed, larger output capacitors are needed for the part to startup under heavy load condition.

PACKAGE OUTLINE

| Package | SOT-23-3 | Devices per reel | 3000Pcs | Unit | mm |
|---|----------|------------------|---------|------|----|
| Package dimension: | | | | | |
| <p>The drawing shows the mechanical specifications for the SOT-23-3 package. The top view indicates a total width of 2.9 ± 0.2 mm, with a central lead width of 0.4 ± 0.1 mm. The distance between the two side leads is 1.9 ± 0.2 mm, with each lead being 0.95 mm wide. The package height is 2.8 ± 0.3 mm, and the lead height is 1.6 ± 0.2 mm. The side view shows a maximum lead height of 1.4 mm, a lead thickness of 0.16 mm (with a tolerance of $+0.1$ to -0.06), and a lead width of 0.8 mm. The lead angle is specified as 0 to 0.1 degrees. The bottom view shows the package footprint with a total width of 1.9 ± 0.2 mm.</p> | | | | | |

| | | | | | |
|---------|---------|------------------|------|------|----|
| Package | SOT23-5 | Devices per reel | 3000 | Unit | mm |
|---------|---------|------------------|------|------|----|

Package specification:



| | | | | | |
|---------|----------|------------------|---------|------|----|
| Package | SOT-89-3 | Devices per reel | 1000Pcs | Unit | mm |
|---------|----------|------------------|---------|------|----|

Package dimension:

