

0.9V startup, 1A True Shut-Off Synchronous Boost DC/DC converter

DESCRIPTION

The BL8541, is a high-efficiency, synchronous step-up switching regulators optimized for battery-powered applications. It supports up to 1A load current and allows the use of small, low cost inductors and MLCC capacitors.

The BL8541 starts up as low as 0.9V input voltage and it has true-shutoff function (shut off output to zero voltage when CE pulled low) and real output short-circuit protection. These features make it ideal for USB interface power supply.

Given its high efficiency, the BL8541 device is ideal for small portable applications powered by battery. It consumes as low as 40uA (3V input /3.3V output) at zero load. And its current consumption is less than 1uA in shutdown mode.

BL8541 is available in DFN2x2-6 package.

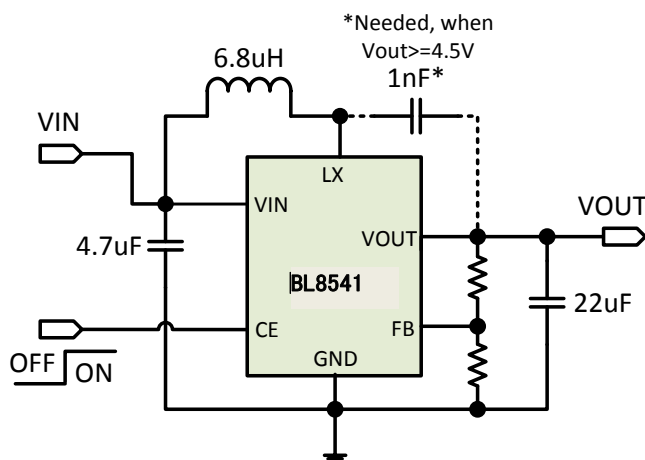
FEATURES

- Capable of Delivering 1A
- High Efficiency: Up to 92%
- Compatible with MLCC capacitor
- 1.8MHz Switching Frequency
- Low dropout 100% Duty operation
- 0.6V Reference for Low Output voltages
- True Shutoff and Short-Circuit Protection
- Logic Control Shutdown (IQ<1uA)
- Thermal shutdown and UVLO
- Available in DFN2x2-6

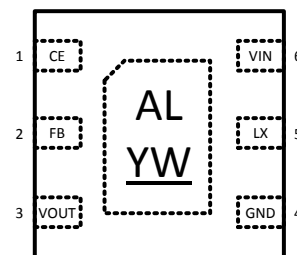
APPLICATIONS

- MID / Tablet PC
- Portable Power Bank
- Smartphone OTG
- Toy
- Other portable device

TYPICAL APPLICATION



PIN OUT & MARKING



DFN2x2-6
Top View

AL: Product Code
YW: Date code (Year & Week)

ORDERING INFORMATION

PART No.	PACKAGE	Tape&Reel
BL8541CKCTR	DFN2x2-6	3000/Reel

ABSOLUTE MAXIMUM RATING

Parameter		Value
Max Input Voltage		5.5V
Max Operating Junction Temperature(Tj)		125°C
Ambient Temperature(Ta)		-40°C – 85°C
Maximum Power Dissipation	DFN2x2-6	800mW
Storage Temperature(Ts)		-55°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. 5V
Operating Junction Temperature(Tj)		-40°C – 85°C

ELECTRICAL CHARACTERISTICS

(VDD=5V, TA=25°C)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VDD	Input Voltage Range		0.9		5	V
Vstart	Startup Voltage	Iout = 0 A		0.9	1.0	V
Vref	Feedback Voltage	Vout = 2.5 to 5V	0.585	0.6	0.615	V
I _{fb}	Feedback Leakage current			0.1	0.4	uA
Vout	Output Voltage Range		2.1		5	V
I _q	Quiescent Current	Active, V _{fb} =0.7, No Switching		40	60	uA
		Shutdown		1	10	uA
I _{rev}	Reverse current, Vout to Vin	CE=0			5	uA
F _{soc}	Switching Frequency			1.8		MHz
R _{dsonP}	PMOS R _{dson}			150	300	mohm
R _{dsonN}	NMOS R _{dson}			150	300	mohm
I _{limit}	Peak Current Limit		1.2	1.5	2	A
I _{lxlk}	LX Leakage Current	LX=5V, CE=0			10	uA
I _{celk}	CE Leakage Current				1	uA
V _{h_en}	EN Input High Voltage		0.6			V
V _{l_en}	EN Input Low Voltage				0.3	V
TSD	Thermal Shut Down			150		°C

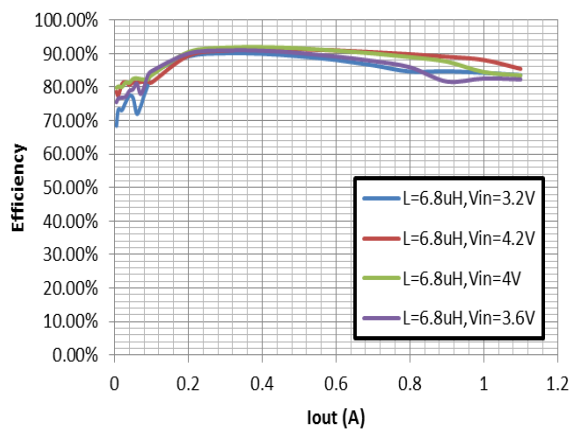
PIN DESCRIPTION

PIN #	NAME	DESCRIPTION
1	CE	Enable pin for the IC. Drive the pin to high to enable the part, and low to disable
2	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 V_{in}
3	VOUT	Output voltage pin, with 22uF ceramic capacitor closely connected to GND
4	GND	Ground
5	LX	To connect inductor to VIN
6	VIN	Supply voltage, with 4.7uF ceramic capacitor connected to GND

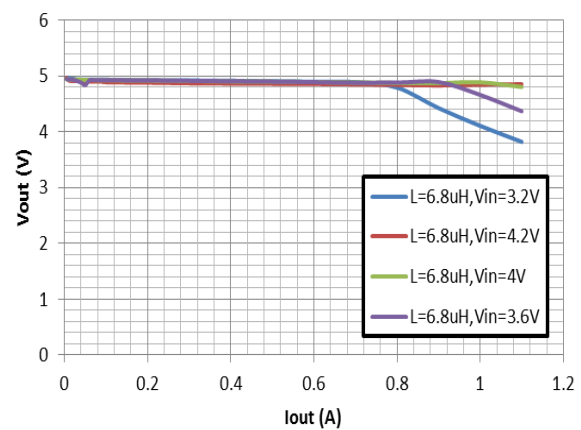
ELECTRICAL PERFORMANCE

Tested under $T_A=25^{\circ}\text{C}$, $L=6.8\mu\text{H}$, unless otherwise specified

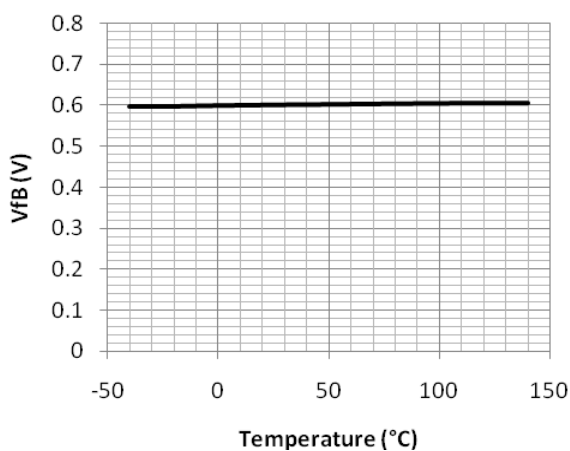
Efficiency / $V_{out}=5\text{V}$



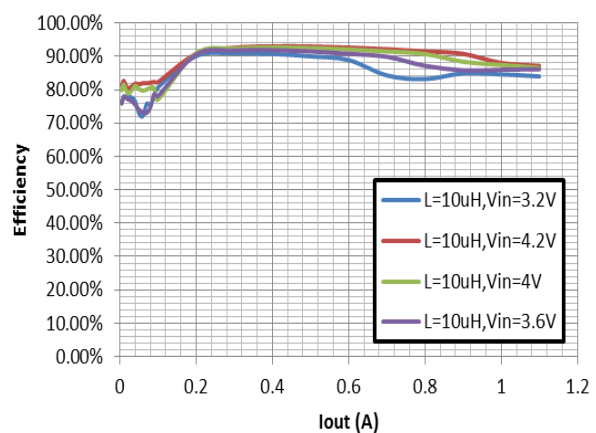
Load Regulation / $V_{out}=5\text{V}$



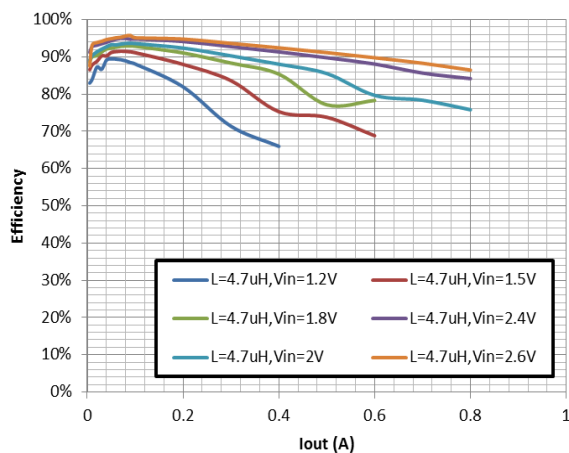
Vfb Vs. Temperature



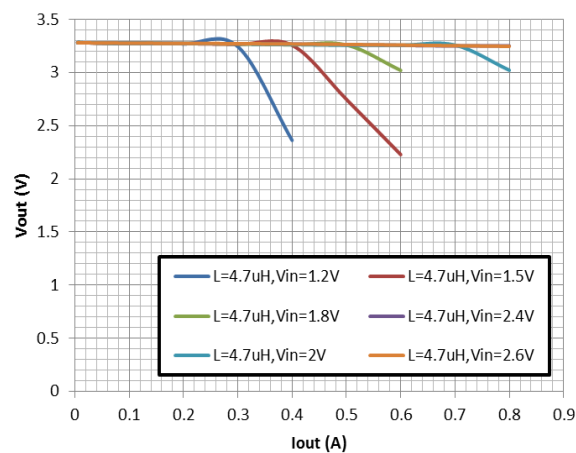
L=10uH Efficiency / $V_{out}=5\text{V}$



Efficiency / Vout=3.3V / L=4.7uH



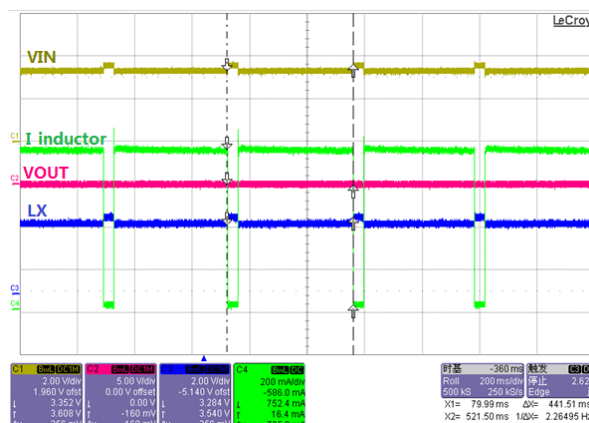
Load Regulation / Vout=3.3 / L=4.7uH



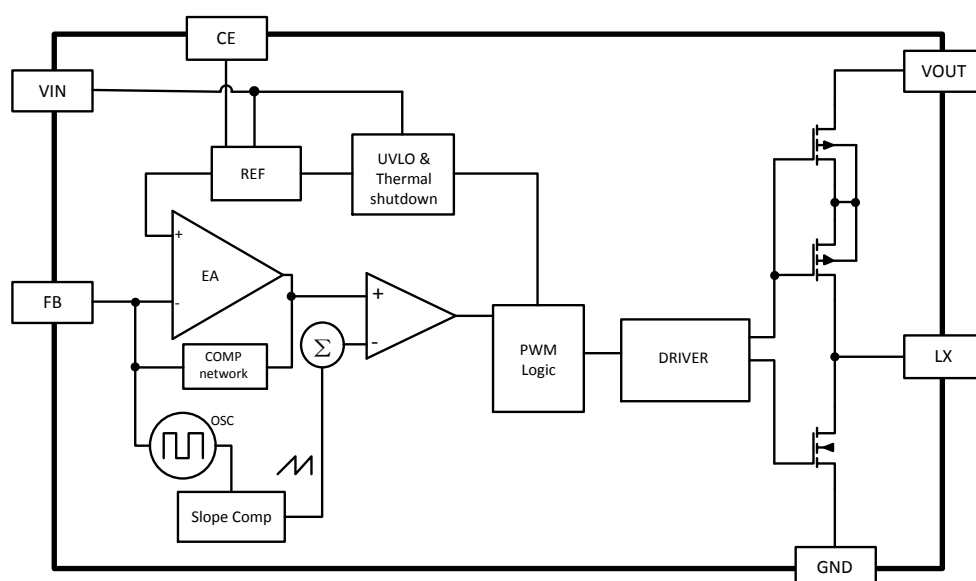
Output Ripple / LX / Inductor Current
Vin=3.6V, Vout=5V, Iout=0.5A



Output Short Circuit Protection
Vin=3.6V / Vout set to 5V



BLOCK DIAGRAM



DETAILED DESCRIPTION

General description

The BL8541 is a high-efficiency, Boost DC/DC converter, with input current limit at 1.5A. It integrates an 150mΩ high side MOSFET and an 150 mΩ low side MOSFET. It employs PWM/PFM auto-switch control mode.

Short circuit protection

BL8541 employs a “Hiccup” mode of short-circuit protection, which enables output voltage auto recover when short-circuit is removed.

True shut off function

BL8541 offers a true shut off function, which means it can really shut off output (make output voltage to zero) when CE is pull low (chip turns off). Normally, there is a schottky diode (or MOSFET body diode) existed between LX and Vout for a normal boost converter, and thus, when CE is pull low, though the chip is turned off, the Vin is connected to Vout thru inductor and schottky diode. So we still can detect a voltage at Vout terminal. BL8541, with its proprietary design skill, can truly shut down the output when chip is turned off.

Design Procedure

Setting Output Voltages

Output voltages are set by external resistors. The FB_ threshold is 0.6V.

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

Capacitor Selection

A 22uF ceramic capacitor is demanded on output terminal, while 4.7uF is good enough for input.

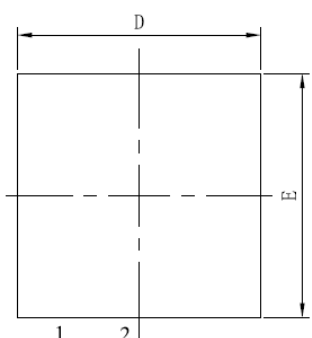
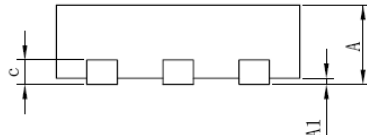
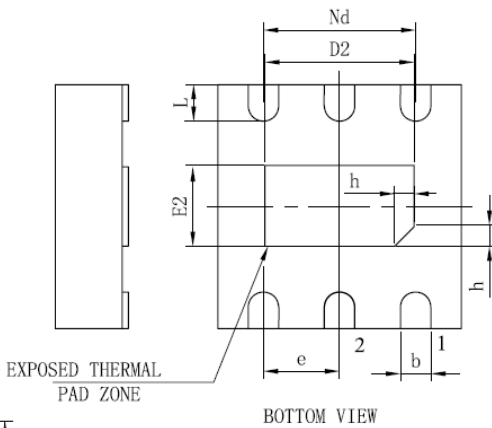
Higher values, lower cost ceramic capacitors are now becoming available in smaller case sizes. Their high ripple current, high voltage rating and low ESR make them ideal for switching regulator applications. Using ceramic capacitors can achieve very low output ripple and small circuit size. When choosing the input and output ceramic capacitors, choose the X5R or X7R dielectric formulations. These dielectrics have the best temperature and voltage characteristics of all the ceramics for a given value and size.

Application Information

Layout is critical to achieve clean and stable operation. The switching power stage requires particular attention. Follow these guidelines for good PC board layout:

- 1) Place 22uF output capacitors as close to the IC VOUT and GND pins as possible
- 2) Connect input and output capacitors to the same power ground node with a star ground configuration then to IC ground.
- 3) Keep the high-current paths as short and wide as possible. Keep the path of switching current short. Avoid vias in the switching paths.
- 4) If possible, connect VIN, LX, and GND separately to a large copper area to help cool the IC to further improve efficiency and long-term reliability.
- 5) Ensure all feedback connections are short and direct. Place the feedback resistors as close to the IC as possible.
- 6) Route high-speed switching nodes away from sensitive analog areas

PACKAGE OUTLINE

Package	DFN2x2-6	Devices per reel	3000	Unit	mm																																																							
Package specification:																																																												
   <table><tr><th rowspan="2">SYMBOL</th><th colspan="3">MILLIMETER</th></tr><tr><th>MIN</th><th>NOM</th><th>MAX</th></tr><tr><td>A</td><td>0.70</td><td>0.75</td><td>0.80</td></tr><tr><td>A1</td><td>—</td><td>0.02</td><td>0.05</td></tr><tr><td>b</td><td>0.25</td><td>0.30</td><td>0.35</td></tr><tr><td>c</td><td>0.18</td><td>0.20</td><td>0.25</td></tr><tr><td>D</td><td>1.95</td><td>2.00</td><td>2.05</td></tr><tr><td>D2</td><td>1.00</td><td>—</td><td>1.45</td></tr><tr><td>e</td><td colspan="3">0.65BSC</td></tr><tr><td>Nd</td><td colspan="3">1.30BSC</td></tr><tr><td>E</td><td>1.95</td><td>2.00</td><td>2.05</td></tr><tr><td>E2</td><td>0.50</td><td>—</td><td>0.85</td></tr><tr><td>L</td><td>0.25</td><td>0.30</td><td>0.40</td></tr><tr><td>h</td><td>0.10</td><td>0.15</td><td>0.20</td></tr></table>						SYMBOL	MILLIMETER			MIN	NOM	MAX	A	0.70	0.75	0.80	A1	—	0.02	0.05	b	0.25	0.30	0.35	c	0.18	0.20	0.25	D	1.95	2.00	2.05	D2	1.00	—	1.45	e	0.65BSC			Nd	1.30BSC			E	1.95	2.00	2.05	E2	0.50	—	0.85	L	0.25	0.30	0.40	h	0.10	0.15	0.20
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