ACE709

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

Description

ACE709, 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 ACE709 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 ACE709 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.

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

Application

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

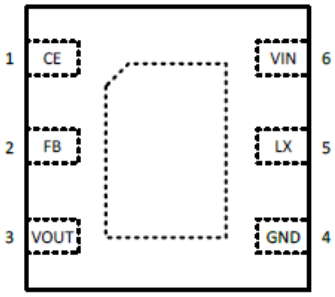
Absolute Maximum Ratings

Parameter	Max	Unit
Max Input Voltage	5.5	V
Max Operating Junction Temperature(T_J)	125	^{O}C
Ambient Temperature(T_A)	-40~85	^{O}C
Maximum Power Dissipation	800	mW
Storage Temperature(Ts)	-55~150	^{O}C
ESD (HBM)	>2000	V

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

Packaging Type

DFN2*2-6



Top View

DFN2*2-6	Description	Function
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 Vin
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

Ordering information

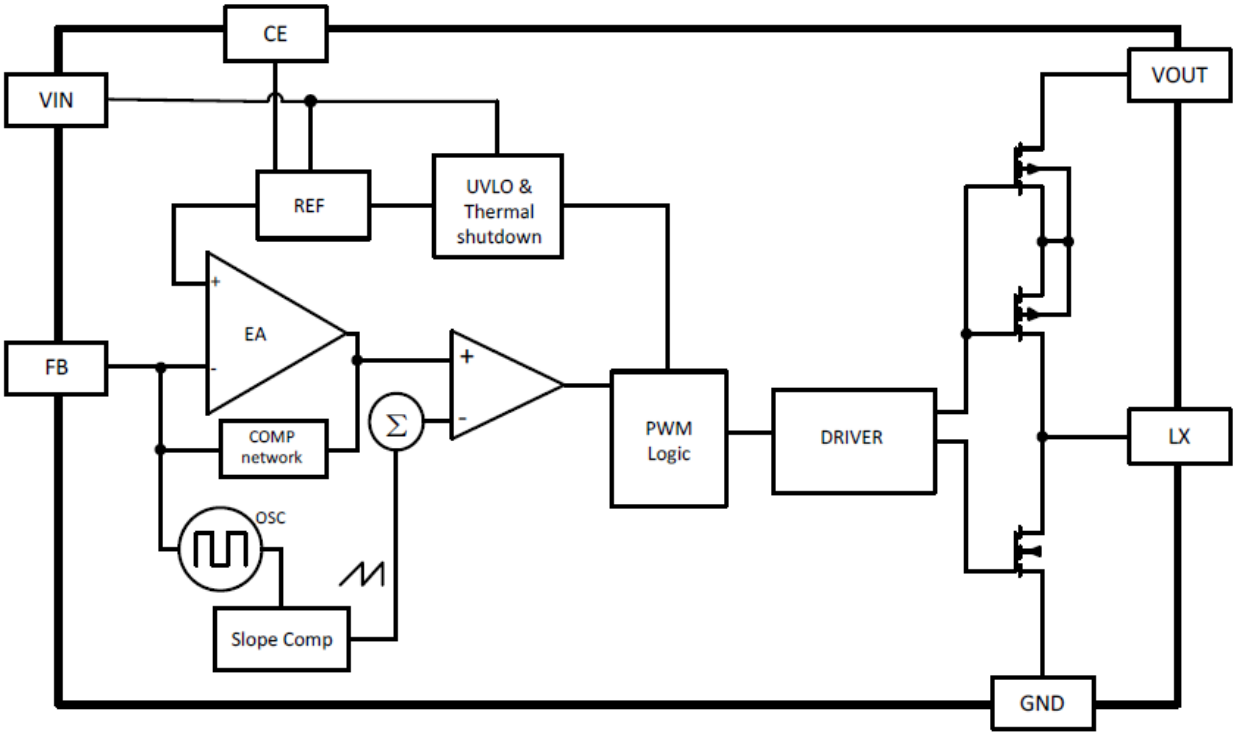
ACE709 XX + H

- Halogen - free
- Pb - free
- KN : DFN2*2-6

Recommended work conditions

Parameter	Max	Unit
Input Voltage Range	5	V
Operating Junction Temperature(T_J)	-40~85	^{o}C

Block Diagram

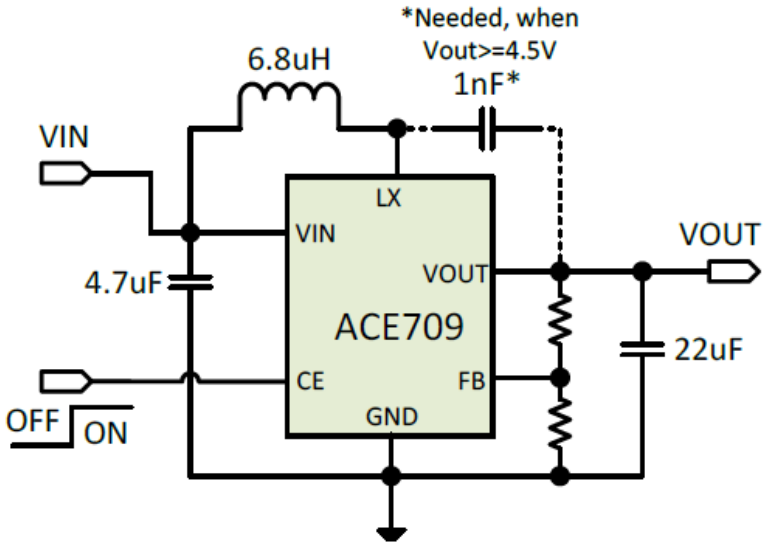


Electrical Characteristics

V_{DD}=5V, T_A=25°C

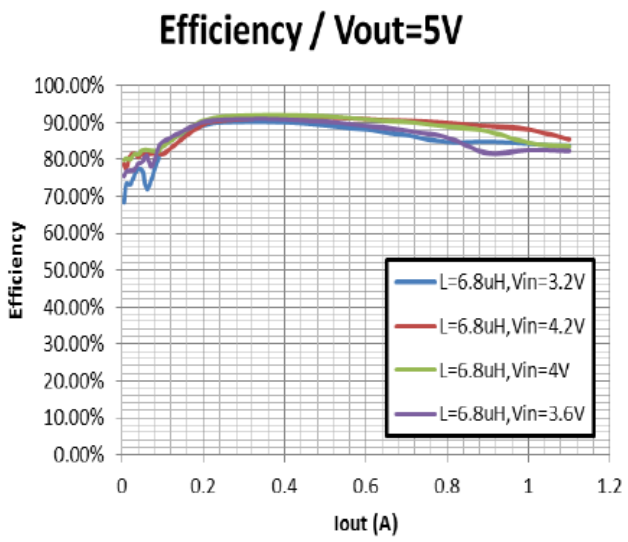
Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{DD}	Input Voltage Range		0.9		5	V
Vstart	Startup Voltage	Iout = 0 A		0.9	1.0	V
Vref	Feedback Voltage	Vout = 2.5 to 5V	0.585	0.6	0.615	
Ifb	Feedback Leakage current			0.1	0.4	
Vout	Output Voltage Range		2.1		5	V
Iq	Quiescent Current	Active, Vfb=0.7, No Switching		40	60	uA
		Shutdown		1	10	uA
Irev	Reverse current, Vout to Vin	CE=0			5	uA
Fsoc	Switching Frequency			1.8		MHz
$R_{DS(ON)}$ P	PMOS $R_{DS(ON)}$			150	300	mΩ
$R_{DS(ON)}$ N	NMOS $R_{DS(ON)}$			150	300	mΩ
Llimit	Peak Current Limit		1.2	1.5	2	A
Ilxlk	LX Leakage Current	LX=5V, CE=0			10	uA
Icelk	CE Leakage Current				1	uA
Vh_en	EN Input High Voltage		0.6			V
Vl_en	EN Input Low Voltage				0.3	V
TSD	Thermal Shut Down			150		°C

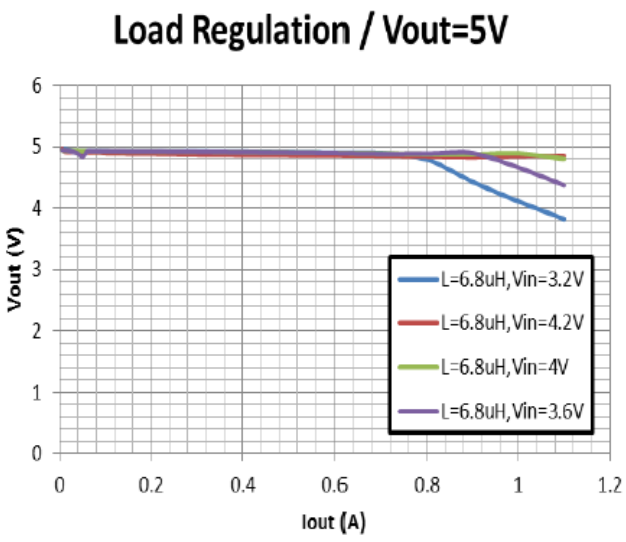
Typical Application Circuit



Typical Performance Characteristics

Tested under T_A=25 °C, L=6.8uH, unless otherwise specified

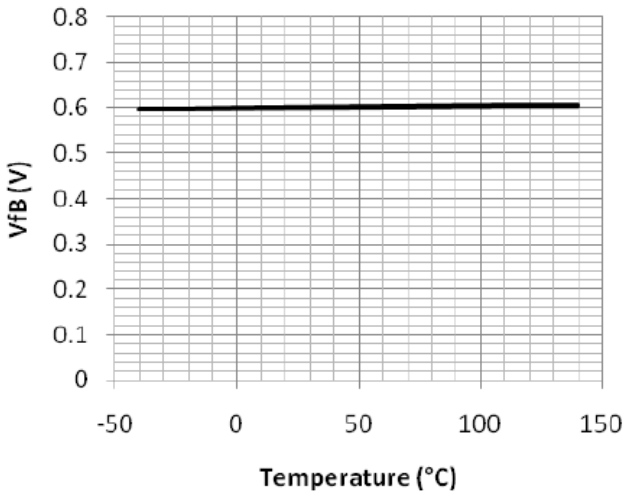




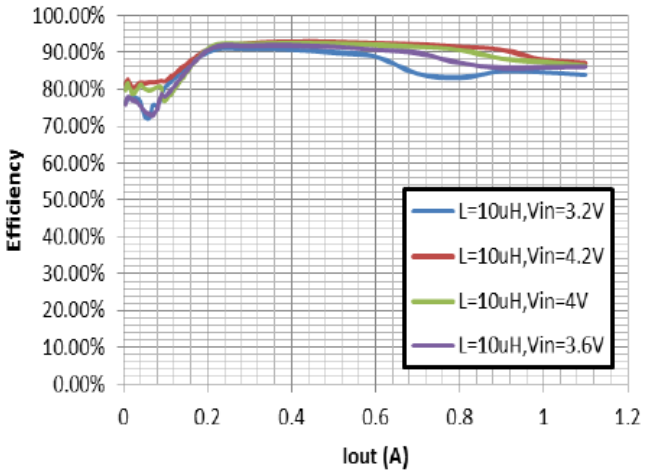
Typical Performance Characteristics

Tested under T_A=25 °C, L=6.8uH, unless otherwise specified

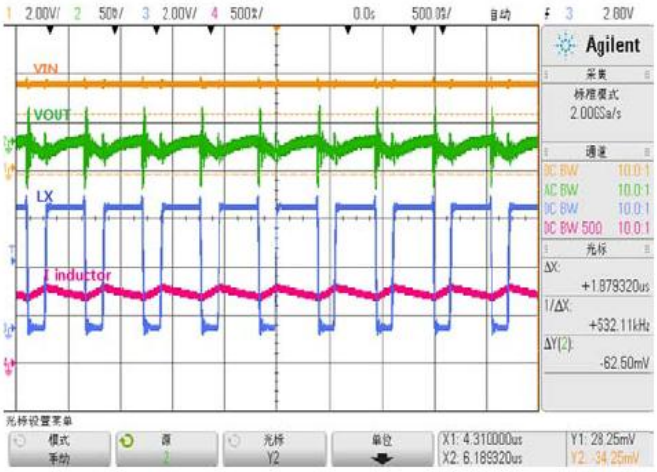
Vfb Vs. Temperature



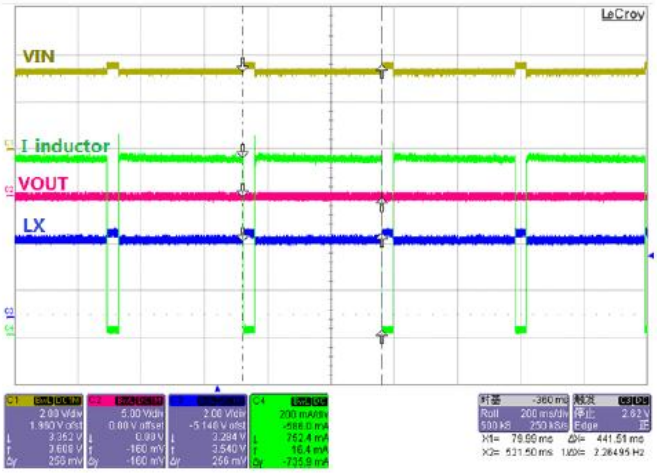
L=10uH Efficiency / Vout=5V



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



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



Detailed description

General description

The ACE709 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

ACE709 employs a “Hiccup” mode of short-circuit protection, which enables output voltage auto recover when short-circuit is removed.

True shut off function

ACE709 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. ACE709, 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.

RTOP = RBOTTOM[(VOUT / 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.

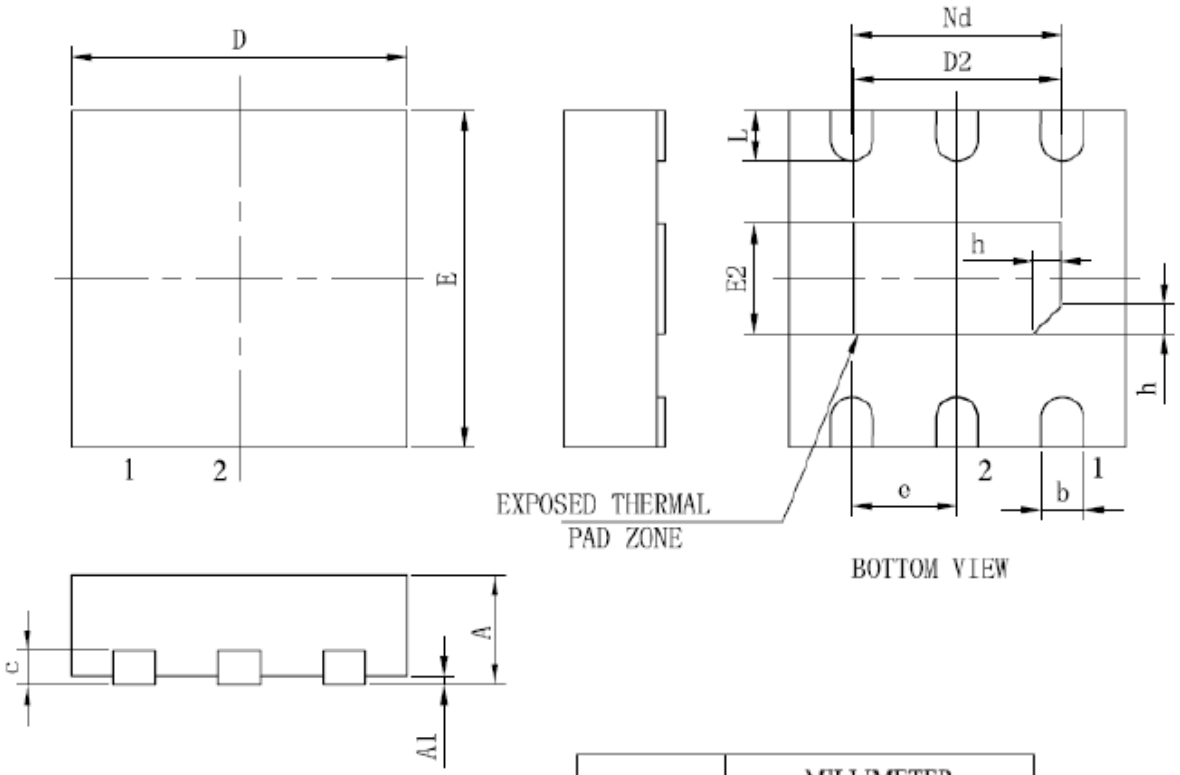
Application Information

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, SW, 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

Packing Information

DFN2*2-6



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

Notes

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