ACE736E

42V Input Standoff Voltage, 0.4A Step-Down Converter

Description

The ACE736E is a wide input range, high-efficiency, and high frequency DC-to-DC step-down switching regulator, capable of delivering up to 0.4A of output current. With a fixed switching frequency of 750KHz, this current mode PWM controlled converter allows the use of small external components, such as ceramic input and output caps, as well as small inductors.ACE736E also employs a proprietary control scheme that switches the device into a power save mode during light load, thereby extending the range of high efficiency operation. An OVP function protects the IC itself and its downstream system against input voltage surges. With this OVP function, the IC can stand off input voltage as high as 42V, making it an ideal solution for industrial applications such as smart meters as well as automotive applications.

In automotive systems, power comes from the battery, with its voltage typically between 9V and 24V. Including cold crank and double battery jump-starts, the minimum input voltage may be as low as 4V and the maximum up to 36V, with even higher transient voltages. With these high input voltages, linear regulators cannot be used for high supply currents without overheating the regulator. Instead, high efficiency switching regulators such as ACE736E must be used to minimize thermal dissipation.

Features

- Wide Input Operating Range from 4V to 38V
- Standoff Input Voltage: 42V
- High Efficiency at 20V In 12V Out: Up to 95%
- High Efficiency PFM mode at light load
- Capable of Delivering 0.4A
- No External Compensation Needed
- Current Mode control
- Logic Control Shutdown
- Thermal shutdown and UVLO
- Available in SOT23-6 Package

Application

- Smart Meters
- Industrial Applications
- Automotive Applications

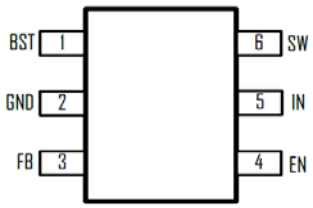
Absolute Maximum Rating

Parameter		Value
IN Voltage		–0.3V to 42V
SW ,EN Voltage		–0.3V to VIN+0.3
BST Voltage		–0.3V to SW+6V
FB Voltage		–0.3V to 6V
SW to ground current		Internally limited
Operating Temperature Range		–40°C to 85°C
Storage Temperature Range		–55°C to 150°C
Thermal Resistance	θ_{JA}	220 °C/W
	θ_{JC}	110 °C/W

(Note: Exceeding these limits may damage the device. Exposure to absolute maximum rating conditions for long periods may affect device reliability.)

Packaging Type

SOT-23-6



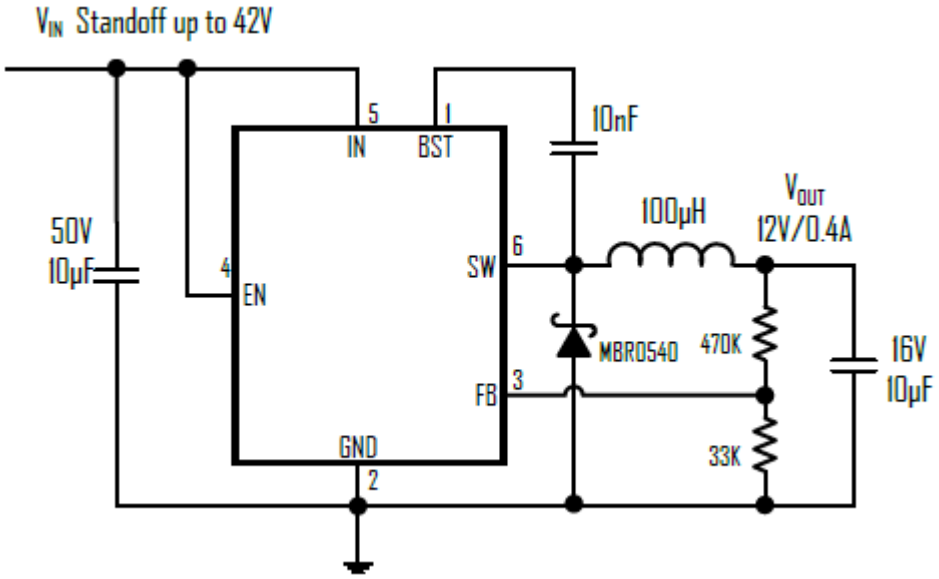
SOT-23-6	Description	Function
1	BST	Bootstrap pin. Connect a 10nF capacitor from this pin to SW.
2	GND	Ground
3	FB	Feedback Input. Connect an external resistor divider from the output to FB and GND to set V_{OUT}
4	EN	Enable pin for the IC. Drive this pin high to enable the part, low to disable.
5	IN	Supply Voltage. Bypass with a 10μF ceramic capacitor to GND.
6	SW	Inductor Connection. Connect an inductor between SW and the regulator output.

Ordering information

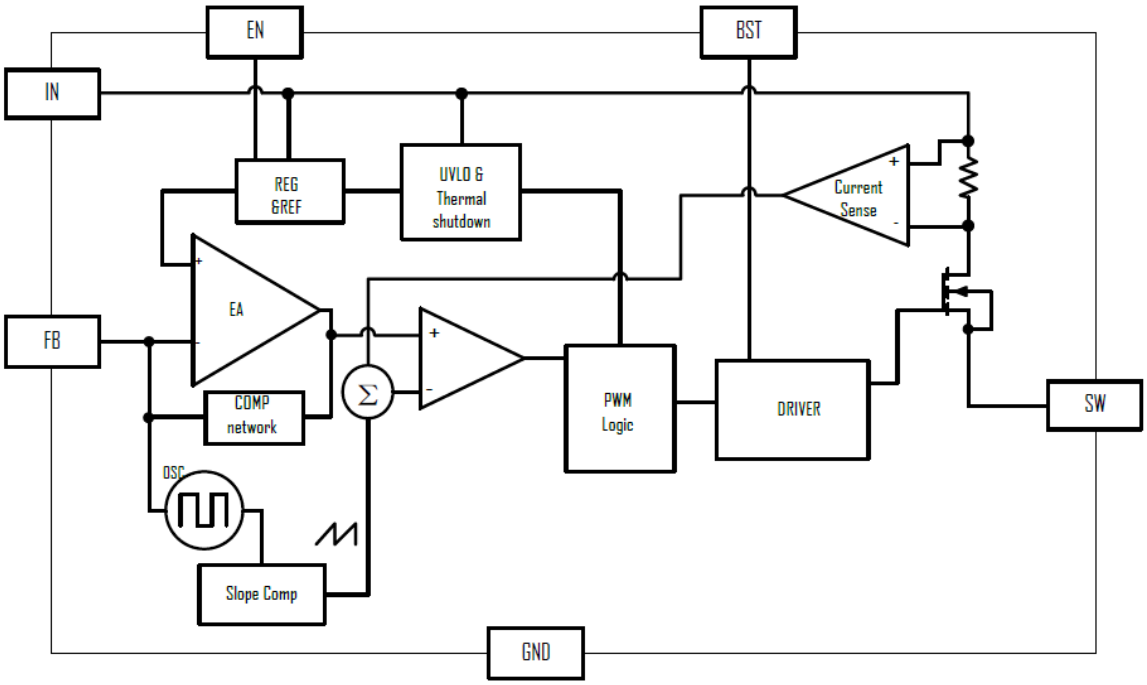
ACE736E XX + H

- Halogen - free
- Pb - free
- GM: SOT-23-6

Typical Application



Block Diagram



Electrical Characteristics

V_{IN}=V_{EN}=5, T_A=25℃

Parameter	Conditions	Min	Typ	Max	Unit
Input Standoff Voltage		42			V
Input Voltage Range		4		38	V
Input UVLO	Rising, Hysteresis=140mV		3.80		V
Input OVP	Rising, Hysteresis=1.3V		38		V
Input Supply Current	V_{FB}=0.85V		0.6		mA
Input Shutdown Current			6		μA
FB Feedback Voltage		0.78	0.80	0.82	V
FB Input Current			0.01		μA
Switching Frequency			75		KHz
Maximum Duty Cycle		90			%
Fold-Back Frequency	V_{FB}=0 V		95		KHz
High side Switch On Resistance	I_{SW} =200mA		550		mΩ
High side Switch Current Limit			0.7		A
SW Leakage Current	V_{IN}=12V,V_{SW}=0,EN=GND			10	μA
EN Input Current	V_{IN}=12V,V_{EN}=5V		1	5	μA
EN Input Low Voltage	Rising, Hysteresis=100mV	0.8	1.1	1.4	V
Thermal Shutdown	Hysteresis=40℃		150		℃

Functional Descriptions

Loop Operation

The ACE736E is a wide input range, high-efficiency, DC-to-DC step-down switching regulator, capable of delivering up to 0.4A of output current, integrated with a 550mΩ high side MOSFET. It uses a PWM current-mode control scheme. An error amplifier integrates error between the FB signal and the internal reference voltage. The output of the integrator is then compared to the sum of a current-sense signal and the slope compensation ramp. This operation generates a PWM signal that modulates the duty cycle of the power MOSFETs to achieve regulation for output voltage.

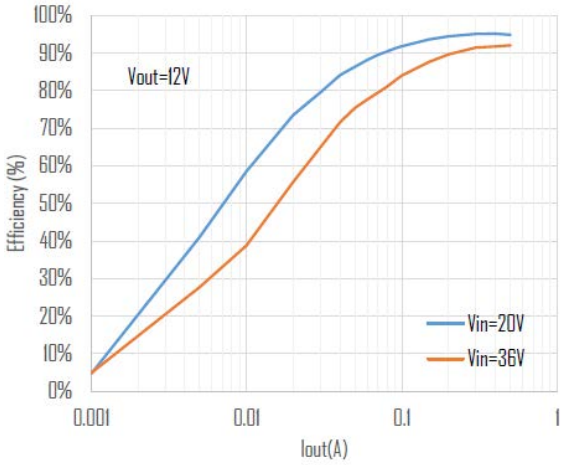
Light Load Operation

Traditionally, a fixed constant frequency PWM DC-DC regulator always switches even when the output load is small. When energy is shuffling back and forth through the power MOSFETs, power is lost due to the finite RDSONs of the MOSFETs and parasitic capacitances. At light load, this loss is prominent and efficiency is therefore very low. ACE735E employs a proprietary control scheme that improves efficiency in this situation by enabling the device into a power save mode during light load,thereby extending the range of high efficiency operation.

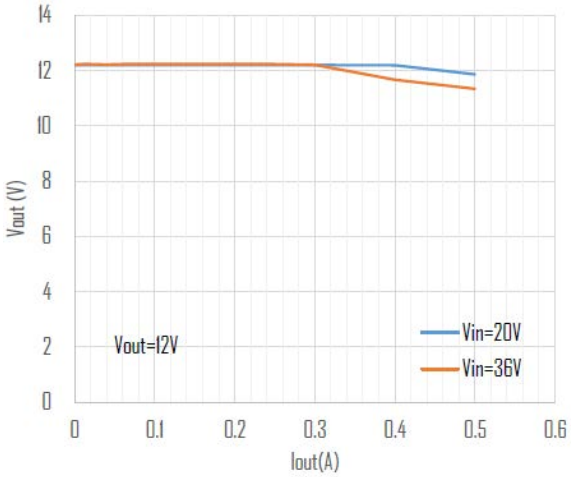
Typical Characteristics

(Typical values are at T_A = 25℃, L=100uH, Cout=10uF unless otherwise specified.)

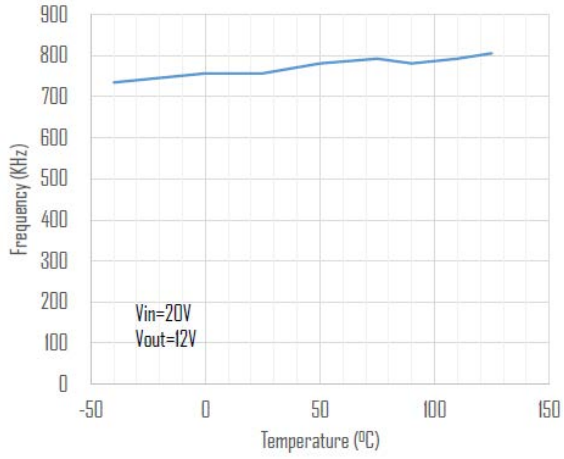
Efficiency Vs Iout



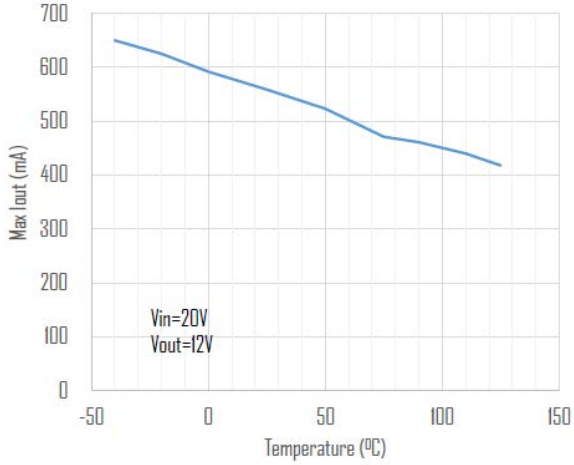
Output Voltage Vs Iout



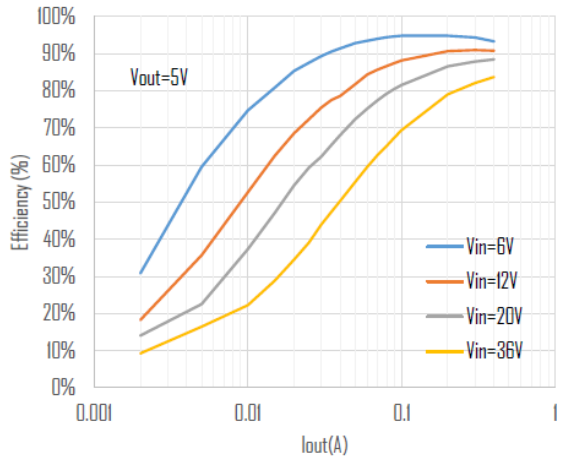
Frequency Vs Temperature



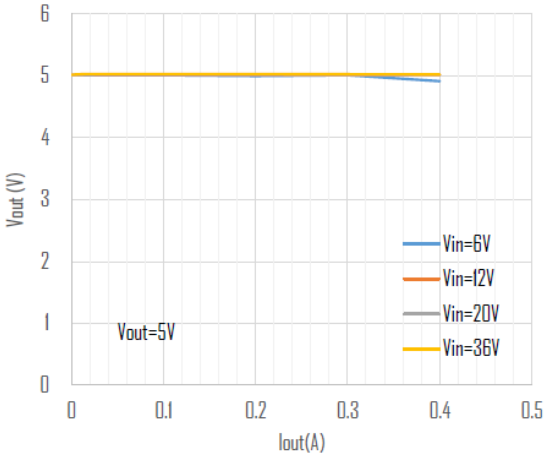
Maximum Iout Vs Temperature



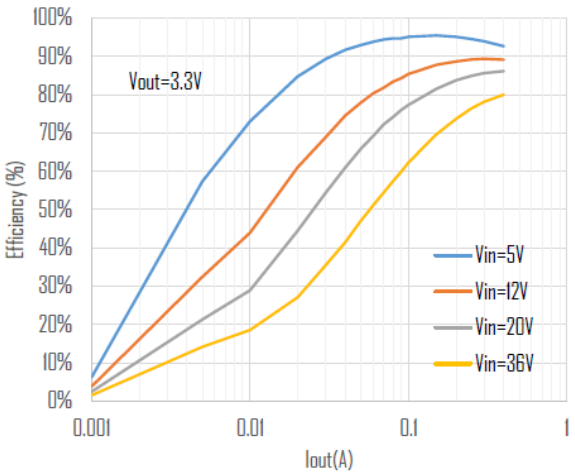
Efficiency Vs Iout



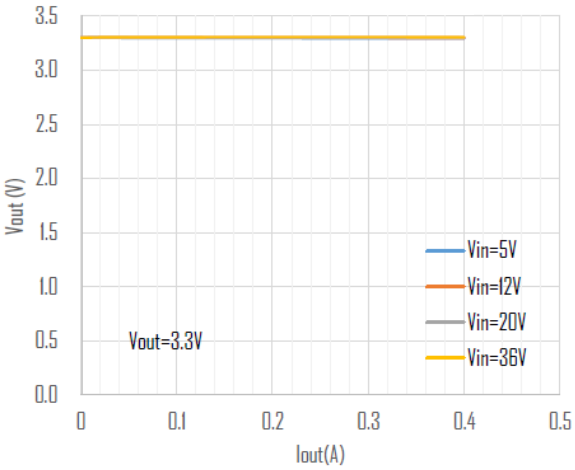
Output Voltage Vs Iout



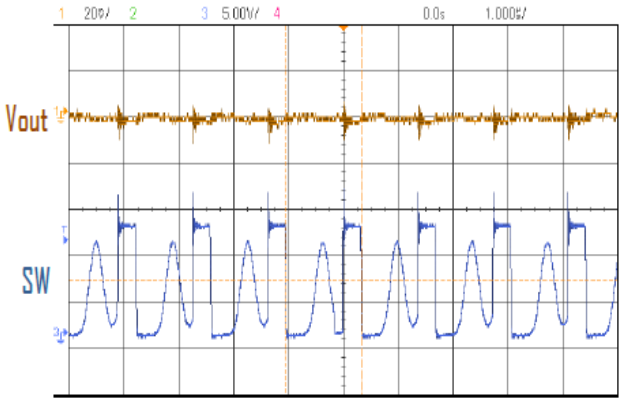
Efficiency Vs Iout



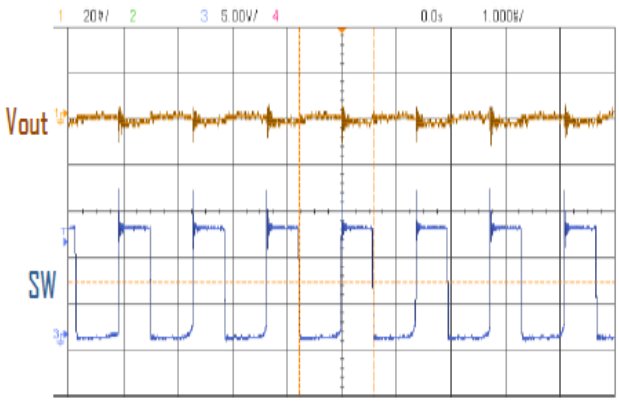
Output Voltage Vs Iout



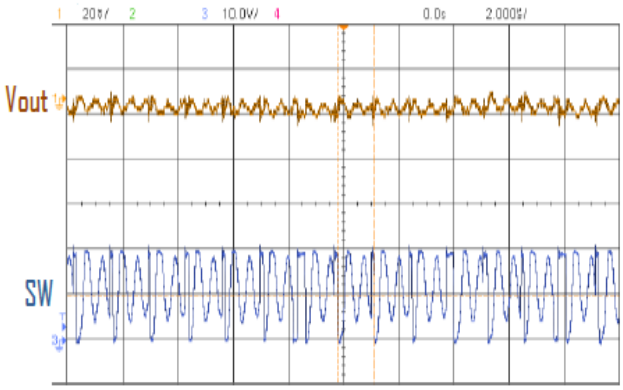
Switching Forms: Vin=12V, Vout=5V, Iout=10mA



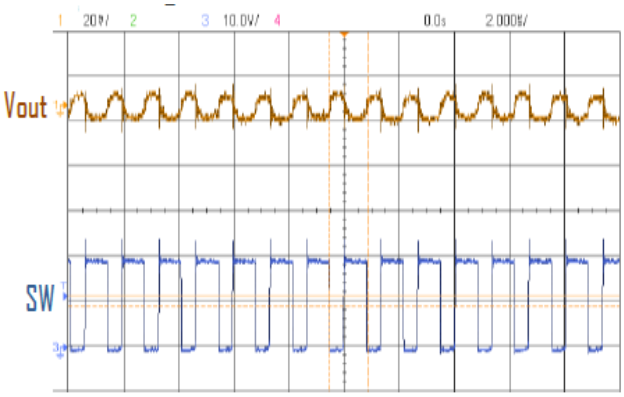
Switching Forms: Vin=12V, Vout=5V, Iout=25mA



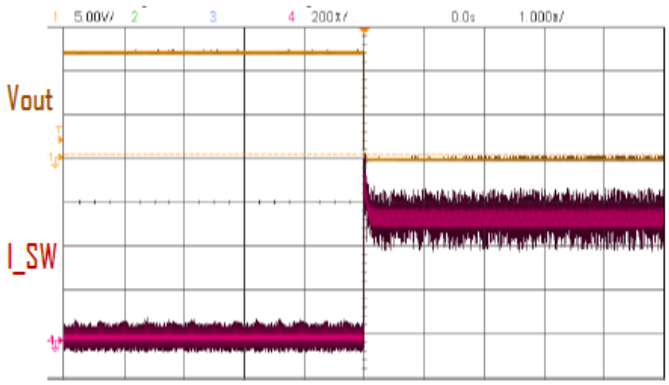
Switching Forms: Vin=20V, Vout=12V, Iout=5mA



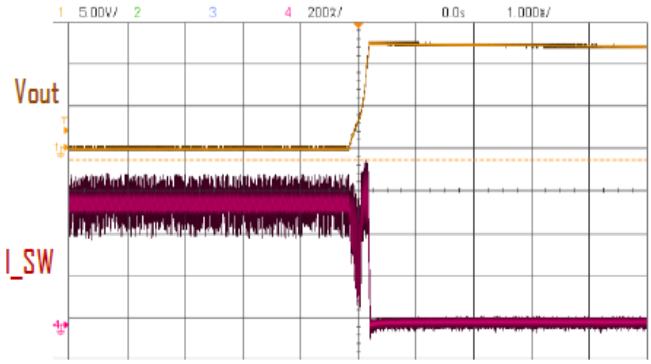
Switching Forms: Vin=20V, Vout=12V, Iout=30mA



Output Short Response: Vin=36V, Vout=12V

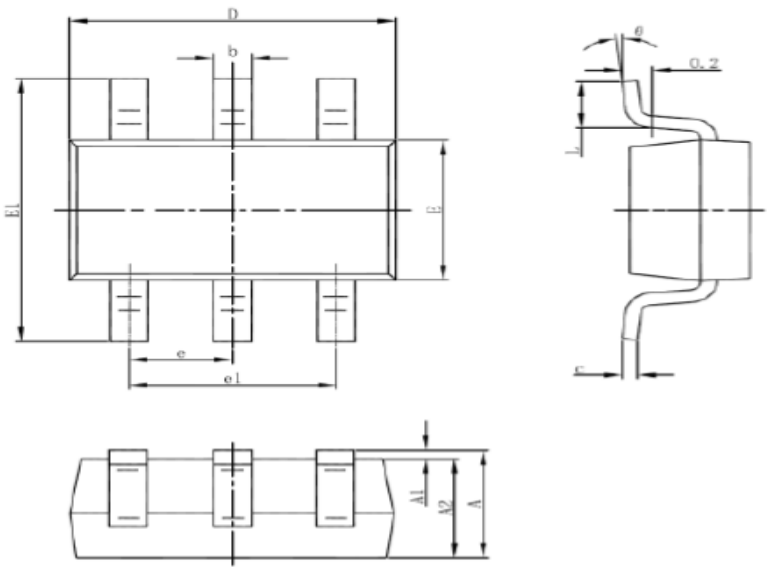


Output Short Response: Vin=36V, Vout=12V



Packing Information

SOT-23-6



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

Notes

ACE does not assume any responsibility for use as critical components in life support devices or systems without the express written approval of the president and general counsel of ACE Electronics Co., LTD. As sued herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and shoes failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.