ACE727Z

18V, 3A, High Efficiency Synchronous Step-Down Converter

Description

ACE727Z is a wide input range, high-efficiency and high frequency DC-to-DC step-down switching regulator, capable of delivering up to 3A of output current. With a fixed switching frequency of 500 KHz, 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. ACE727Z 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 20V, making it an ideal solution for industrial applications such as LCD TV, Set Top Box, Portable TV, etc.

Features

- Wide Input Range: 4.2V-18V
- High Efficiency PFM mode at light load
- Capable of Delivering 3A
- No External Compensation Needed
- Current Mode Control
- Thermal Shutdown and UVLO
- Excellent Load and Line Transient Response
- Available in SOT23-6 Package

Application

- LCD TV
- Set Top Box
- Portable TV

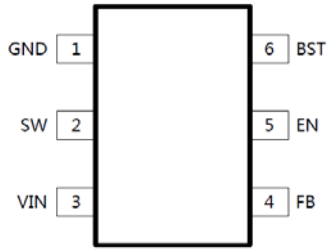
Absolute Maximum Ratings

Parameter		Value
IN,SW,EN Voltage		–0.3V to 19V
BST Voltage		–0.3V to SW+6V
FB Voltage		–0.3V to 6V
Operating Temperature Range		–40°C to 85°C
Storage Temperature Range		–55°C to 150°C
Thermal Resistance	$\square\theta_{JA}$	100°C/W
	$\square\theta_{JC}$	55°C/W
Lead Temperature (Soldering 10ssec)		260°C

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



Ordering information

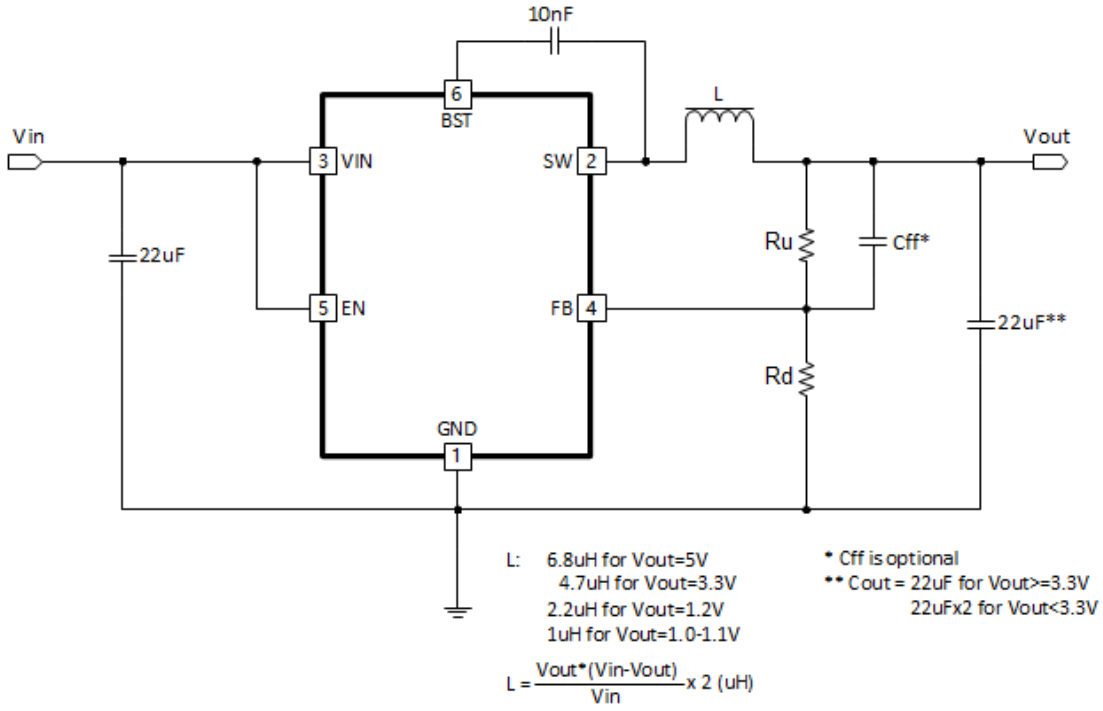
ACE727ZXX+ H

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

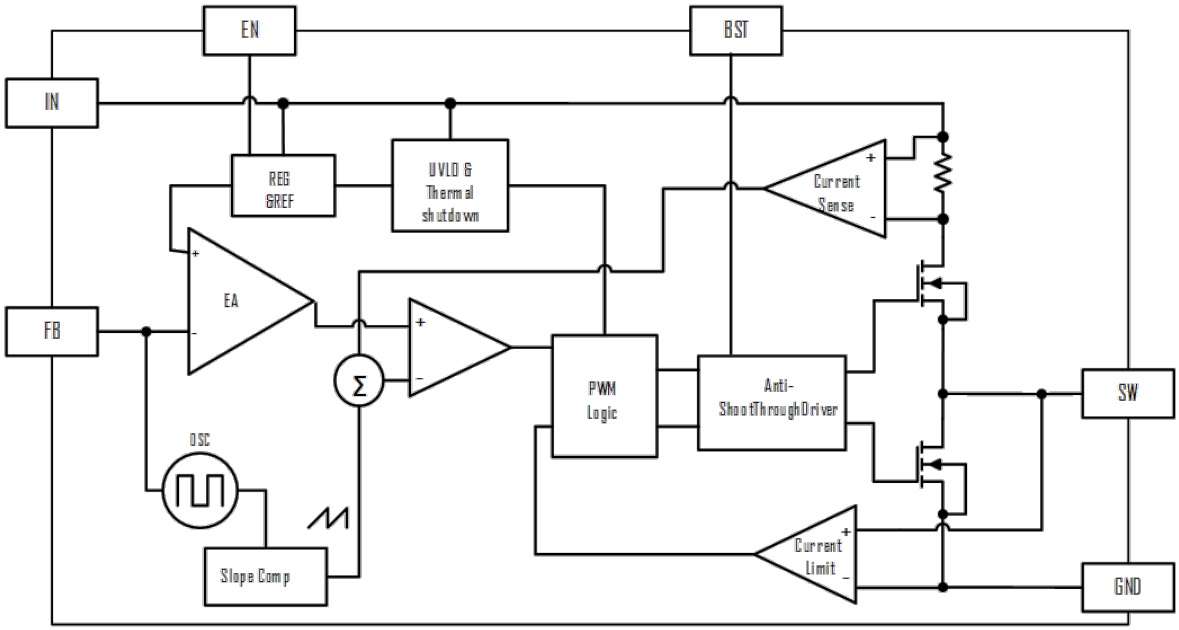
Pin Description

SOT-23-6	Description	Function
1	GND	Ground
2	SW	Inductor Connection. Connect an inductor Between SW and the regulator output.
3	VIN	Supply Voltage. Bypass with a 22μF ceramic capacitor to GND
4	FB	Feedback Input. Connect an external resistor divider from the output to FB and GND to set V_{OUT}
5	EN	Enable pin for the IC. Drive this pin high to enable the part, low or floating to disable.
6	BST	Bootstrap pin. Connect a 10nF capacitor from this pin to SW

Typical Application



Block Diagram



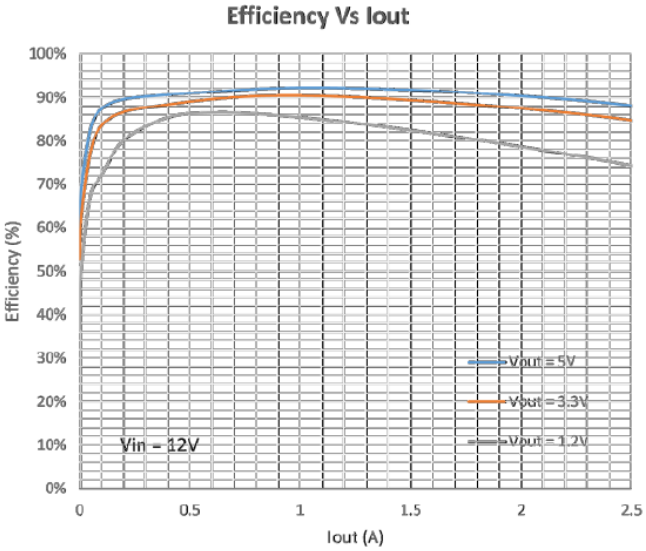
Electrical Characteristics

(V_{IN} = 12V, unless otherwise specified. Typical values are at TA = 25℃.)

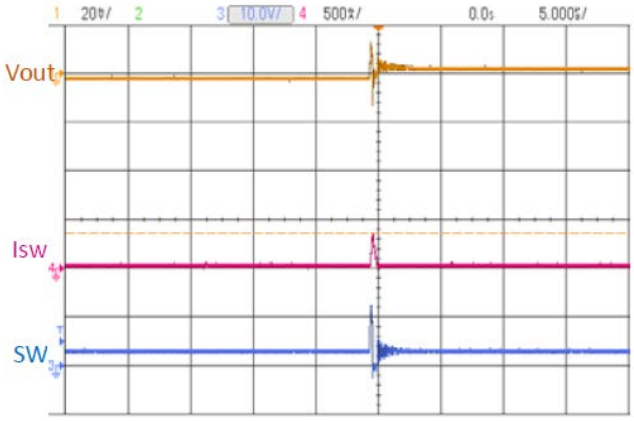
Parameter	Conditions	Min	Typ	Max	Unit
Input Voltage Range		4.2		18	V
Input UVLO	Rising, Hysteresis=340mV	4.2			V
Input OVP	Rising, Hysteresis=1V	19			V
Input Supply Current	V_{FB}=0.65V	700			μA
Input Shutdown Current			7	14	μA
FB Voltage		0.776	0.8	0.824	V
FB Input Current			0	1	μA
Switching Frequency		500			kHz
Maximum Duty Cycle		91			%
Short Circuit Hiccup Time	On Time	2			mS
	Off Time	6			mS
FB Hiccup Threshold		0.2			V
High Side Switch On Resistance		120			mΩ
Low Side Switch On Resistance		75			mΩ
High Side Current Limit		3.5			A
SW Leakage Current	IN=SW=12V	20			μA
EN Rising Threshold		1.5			V
EN Falling Threshold		1.3			V
EN Input Current	V_{EN}=2V	2			uA
Thermal Shutdown	Rising, Hysteresis =40°C	150			°C

Typical performance characteristics

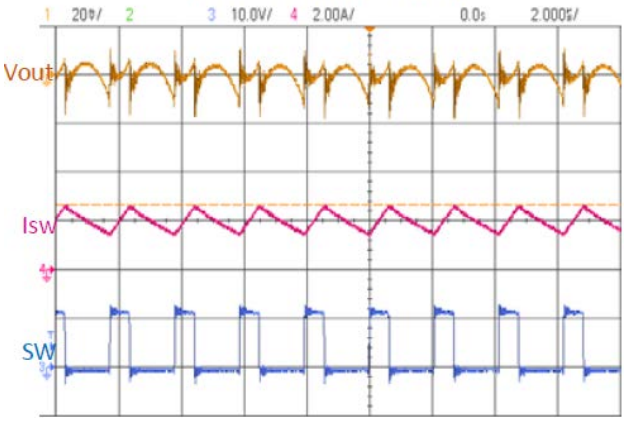
Typical values are at T_A=25°C unless otherwise specified



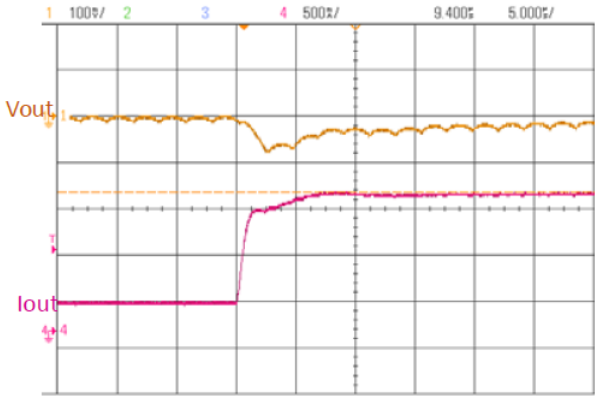
Switching Waveform at Iout = 0A
(Vin=12V, Vout=3.3V)



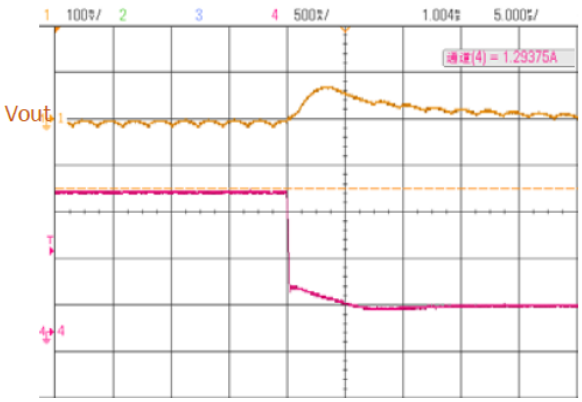
Switching Waveform at Iout = 2A
(Vin=12V, Vout=3.3V)



Load Transient Response –Iout Rising Edge 1A/1us
Vin=12V, Vout=1.1V, L=2.2uH, Cout=22uFx2, Iout 0.3-1.5A



Load Transient Response – Iout Falling Edge 1A/0.2us
Vin=12V, Vout=1.1V, L=2.2uH, Cout=22uFx2, Iout 1.5-0.3A



Functional Description

The ACE727Z is a synchronous buck regulator ICs that integrates the PWM control, top and bottom switches on the same die to minimize the switching transition loss and conduction l

The ACE727Z is a wide input range, high efficiency, DC-to-DC step-down switching regulator, capable of delivering up to 3A of output current, integrated with a 155mΩ high side and 88mΩ low side MOSFET. It uses 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 MOSFET 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 MOSFET, power is lost due to the finite Rdson of the MOSFET and parasitic capacitances. At light load, this loss is prominent and efficiency is therefore very low. ACE727Z employs a proprietary control scheme that improves efficiency in this situation by enabling then device into a power save mode during light load, thereby extending the range of high efficiency operation.

Enable

EN is a digital control pin that turns the ACE727Z on and off. Drive EN High to turn on the regulator, drive it Low to turn it off. An internal 1MΩ resistor from EN pin to GND allows EN to float to shut down the chip. Connecting the EN pin through a pull up resistor or shorted EN to IN will automatically turn on the chip whenever plug in IN.

Over Current Protection and Hiccup

ACE727Zhas a cycle-by-cycle over current limit for when the inductor current peak value is over the set current limit threshold. When the output voltage drop until FB falls below UV threshold (0.2V), the ACE727Z will enter hiccup mode. It will turn off the chip immediately for 6mS. After that, it will try to re-starts as normal for 2mS. After 2mS, if FB is still below UV threshold, then the chip enters hiccup mode again. If FB is higher than UV threshold, it will enter the normal mode.

Over-Temperature Protection

Thermal protection disables the output when the junction temperature rises to approximately 150°C, allowing the device to cool down. When the junction temperature cools to approximately 110°C, the output circuitry is again enabled. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits regulator dissipation, protecting the device from damage as a result of overheating.

Application Information

External Output Voltage Setting

In external Output Voltage Setting Version selected, the ACE727Z regulator is programmed using an external resistor divider. The output voltage is calculated using below equation.

$$V_{OUT} = V_{REF} \times (1 + \frac{R_u}{R_d})$$

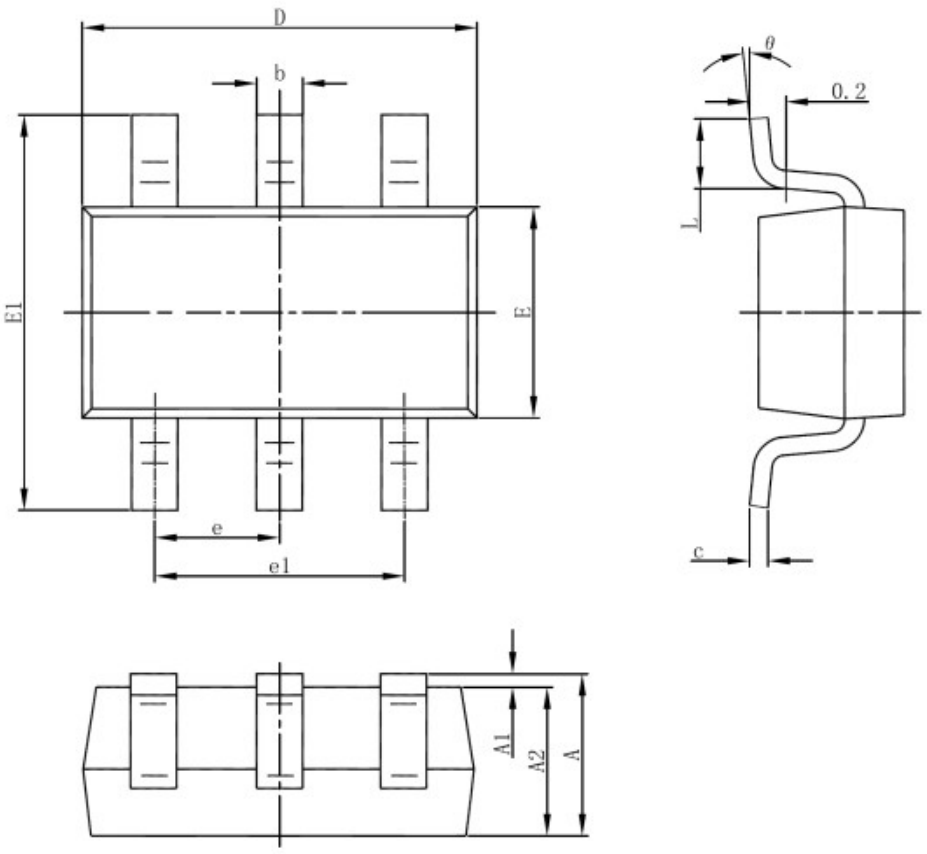
Where: VREF =0.8V typically (the internal reference voltage)

Resistors Rd has to be between 1kOhm to 20KOhm and thus Ru is calculated by following equation.

$$R_u = \left(\frac{V_{OUT}}{V_{REF}} - 1\right) \times R_d$$

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.