Features

- Up to 94% Efficiency
- Truly Shut Down
- Output Over Voltage Protection
- Over Temperature Protection
- Low Shutdown Current: < 1μA
- Low Quiescent Current: 16μA
- Low No-load Input Current (see Typical Performance Characteristics for detail)
- Output Disconnect by Shutdown Function
- Small SOT23-6 Package

Applications

- Wireless Mice
- Medical Instruments
- Smart Phones
- Bluetooth Headsets

General Description

The TX9011 provides a power-supply solution for products powered by either a single-cell, two-cell, or three-cell alkaline, NiCd or NiMH, or one-cell Li-Ion or Li-polymer battery. Possible output currents depend on the input-to-output voltage ratio. The boost converter is based on a hysteretic controller topology using synchronous rectification to obtain maximum efficiency at minimal quiescent currents. The output voltage of the adjustable version can be programmed by an external resistor divider, or is set internally to a fixed output voltage. The converter can be switched off by a featured enable pin. While being switched off, battery drain is minimized. The device is packaged in a 6-pin thin SOT23-6 package.

Typical Application

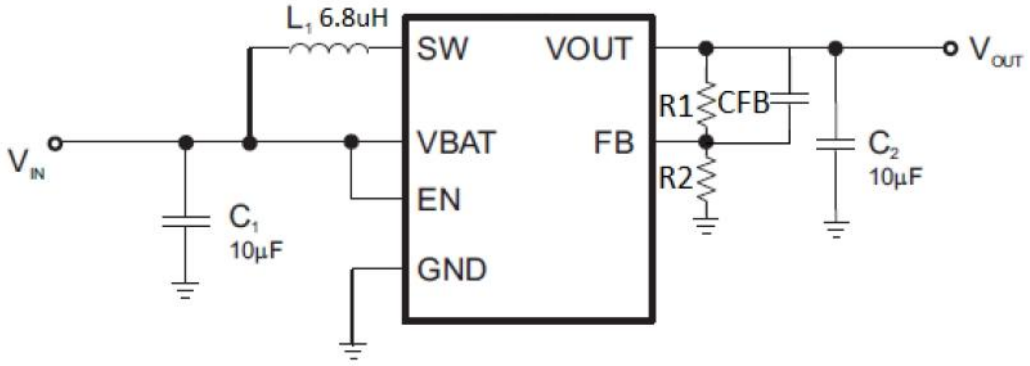
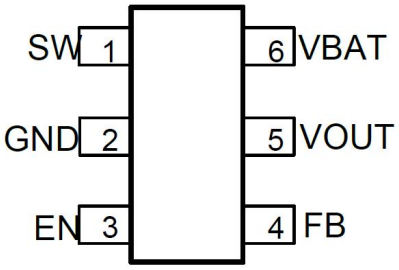


Figure 1 Typical Application Circuit for V_{OUT}=3.3V

Pin Configuration

TOP VIEW



Pin Function Description

Pin NO.	Pin Name	Pin Description
1	SW	Switch Pin. Connect Inductor between VBAT and this pin.
2	GND	IC Ground.
3	EN	Enable input (VBAT enabled, GND disabled).
4	FB	Voltage feedback for programming the output voltage.
5	VOUT	Boost converter output.
6	VBAT	Supply voltage.

Order Information

Part Number	Package	Shipment
TX9011	SOT23-6	Tape & Reel / 3000

Absolute Maximum Ratings (1)

Supply Voltage V_{IN} 6V

V_{SW} .....-0.3V to VIN + 0.3V

All Other Pins .....-0.3V to +6V

Junction Temperature .....150°C

Storage Temperature ..... -65°C ~ 150°C

Lead Temperature .....260°C

ESD Classification(HBM) .....Class 2

Recommended Operating Conditions (2)

Input Supply Voltage V_{IN} ..... 0.9V ~ 5V

Output Voltage V_{OUT} .....1.8V ~ 5.5V

Ambient Temperature T_A .....-40°C ~ 85°C

Thermal Characteristics

SOT23-6, θ_{JA} ..... 220℃/W

SOT23-6, θ_{JC} .....110℃/W

Notes: (1) Stresses exceed those ratings may damage the device.

Notes: (2) If out of its operation conditions, the device is not guaranteed to function.

Electrical Characteristics

(V_{IN}=1.2V, T_A=25℃, unless otherwise specified.)

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage Range		V_{OUT}	---	1.8	---	5	V
Minimum Start Up Voltage		---	---	---	0.9	---	V
Quiescent Current	V_{IN}	I_Q	I_O=0, V_{EN}=V_{IN}=1.2V,V_{OUT}=3.3V	---	0.5	1	uA
	V_{OUT}	I_Q		---	15	30	uA
Shutdown Current		I_{SD}	---	---	0.1	1	uA
Inductor current ripple		---	---	---	350	---	mA
Regulated FB Voltage		---	---	---	0.52	---	V
PFET On Resistance1		$R_{(ON)\_P}$	---	---	0.55	---	Ω
NFET On Resistance1		$R_{(ON)\_N}$	---	---	0.35	---	Ω
SW Leakage Current		---	---	-1	---	1	uA
NFET Current Limit		---	---	---	0.8	---	A
Over Temperature Protection		---	---	---	140	---	℃
Over Temperature Hysteresis		---	---	---	20	---	℃
EN High-Level Input Voltage		---	---	0.8	---	---	V
EN Low-Level Input Voltage		---	---	---	---	0.2	V

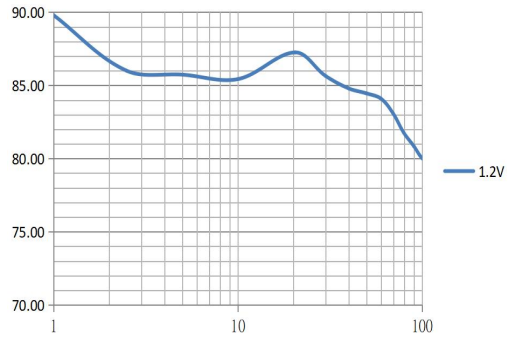
Notes:(1) Guaranteed by design.

Typical Operating Characteristics:

C1 = 10uF, C2 = 10uF, L1 = 6.8uH, C_{FB}=NA, T_A = +25℃, unless otherwise noted.

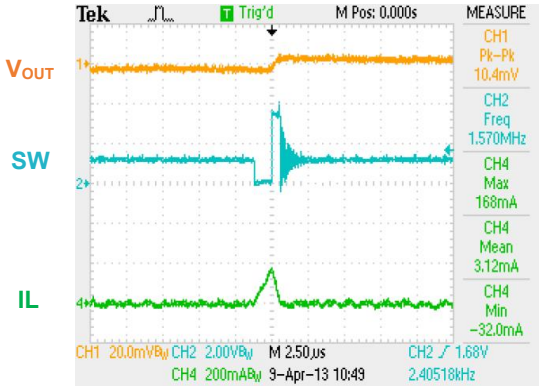
Efficiency Test

Vout=3.3V



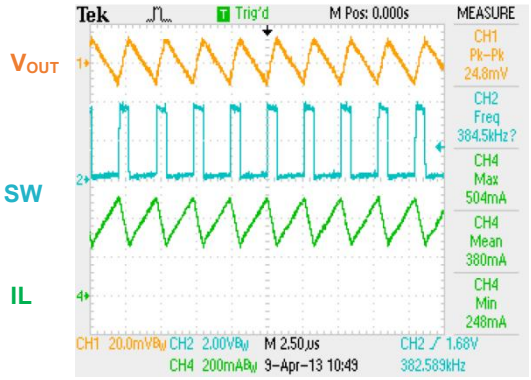
Steady State

Vin=1.2V,Vout=3.3V,Iout=0A



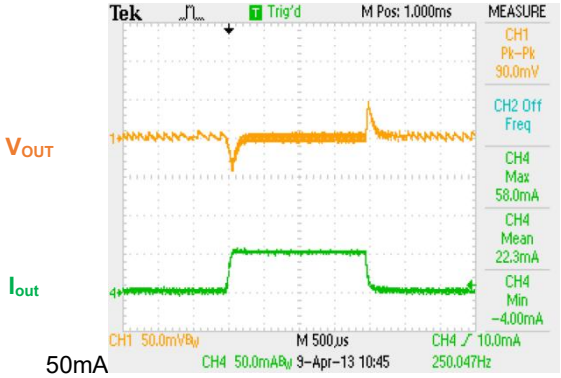
Steady State

Vin=1.2V,Vout=3.3V,Iout=100mA



Dynamic Loading

Vin=1.2V,Vout=3.3V,Iout=0mA to

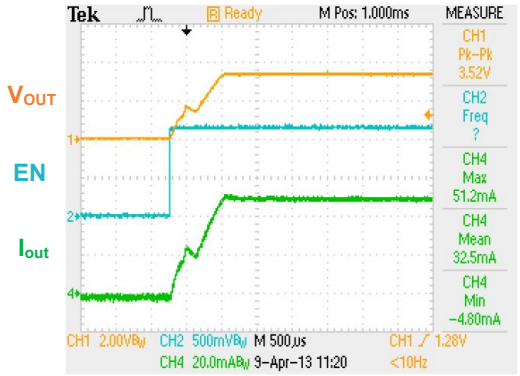


50mA

Power On

Vin=1.2V,Vout=3.3V, R

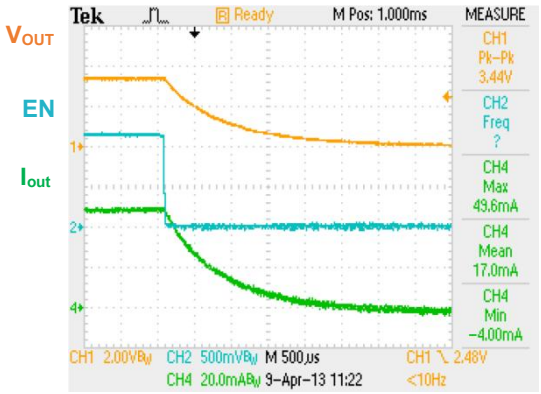
Load=66.5Ω



Shut Down

Vin=1.2V,Vout=3.3V, R

Load=66.5Ω



OPERATION

The TX9011 is a high performance, high efficient boost converter. To achieve high efficiency the power stage is realized as a synchronous boost topology. For the power switching two actively controlled low RDS(on) power MOSFETs are implemented.

The TX9011 is controlled by a hysteretic current mode controller. This controller regulates the output voltage by keeping the inductor ripple current constant and adjusting the offset of this inductor current depending on the output load. In case the required average input current is lower than the average inductor current defined by this constant ripple the inductor current gets discontinuous to keep the efficiency high at low load conditions.

The output voltage VOUT is monitored by the feedback network which is connected to the error amplifier. To regulate the output voltage, the error amplifier compares this feedback voltage with the internal voltage reference and adjusts the required offset of the inductor current accordingly.

Output Voltage Setting

Referring to Typical Application Circuits, the output voltage of the switching regulator (V_{OUT}) can be set with below Equation (1). R1 is typically 1MΩ.

$$V_{OUT}= (1+\frac{R1}{R2}) * 0.52V$$

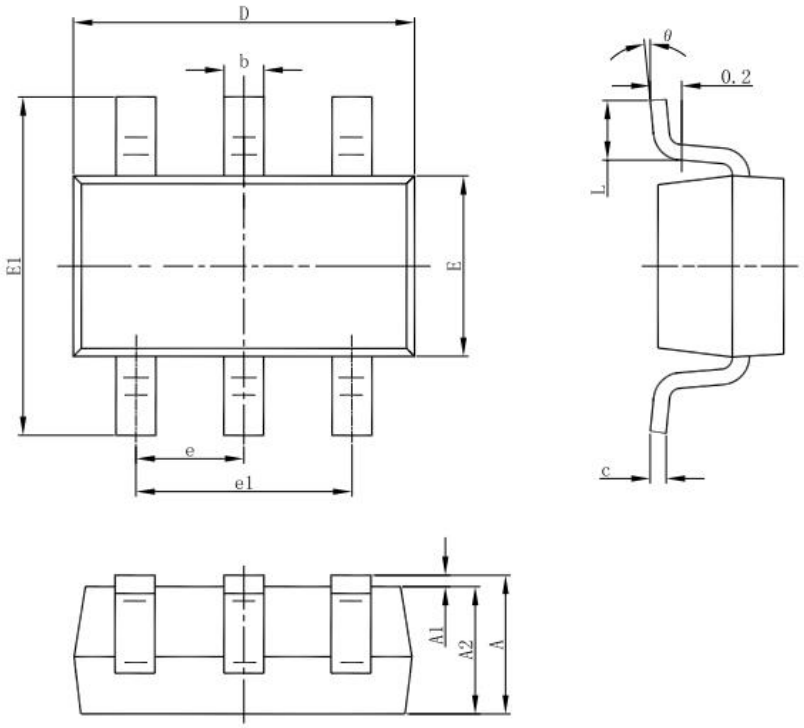
Enable and Shutdown Mode

The device is enabled when EN is set high and shut down when EN is low. During shutdown, the converter stops switching and all internal control circuitry is turned off.

Startup

After the EN pin is tied high, the device starts to operate. In case the input voltage is not high enough to supply the control circuit properly a startup oscillator starts to operate the switches. During this phase the switching frequency is controlled by the oscillator and the maximum switch current is limited. As soon as the device has built up the output voltage to about 1.6 V, high enough for supplying the control circuit, the device switches to its normal hysteretic current mode operation. The startup time depends on input voltage and load current.

SOT23-6 PACKAGE INFORMATION



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°