



Micropower, Step-Up/Step-Down Switching Regulator Adjustable and Fixed 5 V, 12 V

ADP1110

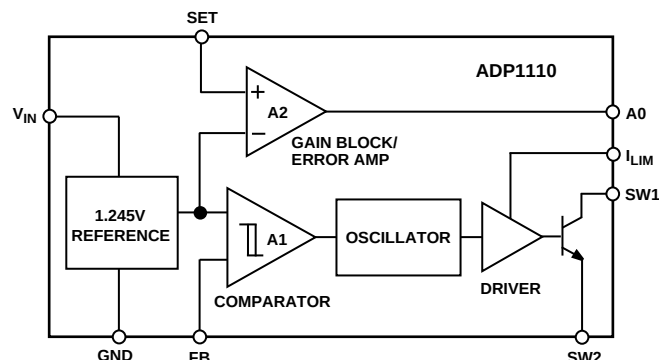
FEATURES

- Operates at Supply Voltages from 1.0 V to 30 V
- Step-Up or Step-Down Mode
- Minimal External Components Required
- Low Battery Detector
- User-Adjustable Current Limiting
- Fixed or Adjustable Output Voltage Versions
- 8-Pin Plastic DIP or SO-8 Package

APPLICATIONS

- Cellular Telephones
- Single-Cell to 5 V Converters
- Laptop and Palmtop Computers
- Pagers
- Cameras
- Battery Backup Supplies
- Portable Instruments
- Laser Diode Drivers
- Hand-Held Inventory Computers

FUNCTIONAL BLOCK DIAGRAM



ORDERING GUIDE

Model	Output Voltage	Package Description	Package Option*
ADP1110AN	ADJ	PDIP	N-8
ADP1110AR	ADJ	SOIC	SO-8
ADP1110AN-5	5 V	PDIP	N-8
ADP1110AR-5	5 V	SOIC	SO-8
ADP1110AN-12	12 V	PDIP	N-8
ADP1110AR-12	12 V	SOIC	SO-8

*For outline information see Package Information section.

GENERAL DESCRIPTION

The ADP1110 is part of a family of step-up/step-down switching regulators that operate from an input voltage supply of as little as 1.0 V. This very low input voltage allows the ADP1110 to be used in applications that use a single cell as the primary power source.

The ADP1110 can be configured to operate in either step-up or step-down mode, but for input voltages greater than 3 V, the ADP1111 would be a more effective solution.

An auxiliary gain amplifier can serve as a low battery detector as well as a linear regulator.

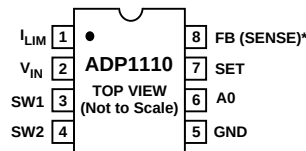
The quiescent current of 300 μ A makes the ADP1110 useful in remote or battery powered applications.

The 70 kHz frequency operation also allows for the use of surface mount external capacitors and inductors.

Battery protection circuitry limits the effect of reverse current to safe levels at reverse voltages up to 1.6 V.

PIN CONFIGURATIONS

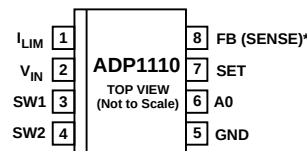
8-Lead Plastic DIP (N-8)



$T_{JMAX} = 90^{\circ}$, $\theta_{JA} = 130^{\circ}$ C/W

*FIXED VERSIONS

8-Lead SOIC (SO-8)



$T_{JMAX} = 90^{\circ}$, $\theta_{JA} = 150^{\circ}$ C/W

*FIXED VERSIONS

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ADP1110—SPECIFICATIONS (@ $T_A = +25^\circ\text{C}$, $V_{IN} = 1.5\text{ V}$, unless otherwise noted)

Parameter	Conditions ¹	V_S	ADP1110			Units
			Min	Typ	Max	
QUIESCENT CURRENT*	Switch Off	I_Q	300			μA
INPUT VOLTAGE*	Step-Up Mode	V_{IN}	1.15		12.6	V
	Step-Down Mode		1.0		12.6 30	V V
COMPARATOR TRIP POINT VOLTAGE*	ADP1110 ¹		210	220	230	mV
OUTPUT SENSE VOLTAGE*	ADP1110-5 ²	V_{OUT}	4.75	5.00	5.25	V
	ADP1110-12 ²		11.4	12.00	12.6	V
COMPARATOR HYSTERESIS*	ADP1110			4	8	mV
OUTPUT HYSTERESIS*	ADP1110-5			90	180	mV
	ADP1110-12			200	400	mV
OSCILLATOR FREQUENCY*		f_{OSC}	52	70	90	kHz
DUTY CYCLE*	Full Load ($V_{FB} < V_{REF}$)	DC	62	69	78	%
SWITCH ON TIME*		t_{ON}	7.5	10	12.5	μs
FEEDBACK PIN BIAS CURRENT*	ADP1110 $V_{FB} = 0\text{ V}$	I_{FB}		70	150	nA
SET PIN BIAS CURRENT*	$V_{SET} = V_{REF}$	I_{SET}		100	300	nA
A0 OUTPUT LOW*	$I_{AO} = 300\text{ }\mu\text{A}$ $V_{SET} = 150\text{ mV}$	V_{AO}		0.15	0.4	V
REFERENCE LINE REGULATION*	$1.0\text{ V} \leq V_{IN} \leq 1.5\text{ V}$			0.35	1.0	%/V
	$1.5\text{ V} \leq V_{IN} \leq 12\text{ V}$			0.05	0.1	%/V
SWITCH SATURATION VOLTAGE* STEP-UP MODE	$V_{IN} = 1.5\text{ V}$, $I_{SW} = 400\text{ mA}$	V_{CESAT}		300	400	mV
	$V_{IN} = 1.5\text{ V}$, $I_{SW} = 500\text{ mA}$				600	mV
	$V_{IN} = 5\text{ V}$, $I_{SW} = 1\text{ A}$			400	550	mV
				700	750	mV
A2 ERROR AMP GAIN*	$R_L = 100\text{ k}\Omega^3$	A_V	1000	5000		V/V
REVERSE BATTERY CURRENT	(Note 4)	I_{REV}		750		mA
CURRENT LIMIT	220 Ω Between I_{LIM} and			400		mA
CURRENT LIMIT TEMPERATURE COEFFICIENT	V_{IN}			-0.3		%/ $^\circ\text{C}$
SWITCH-OFF LEAKAGE CURRENT	Measured at SW1 Pin	I_{LEAK}		1	10	μA
MAXIMUM EXCURSION BELOW GND	$I_{SW1} \leq 10\text{ }\mu\text{A}$, Switch Off	V_{SW2}		-400	-350	mV

NOTES

*Denotes the specifications that apply over the full operating temperature range.

¹This specification guarantees that both the high and low trip point of the comparator fall within the 210 mV to 230 mV range.

²This specification guarantees that the output voltage of the fixed versions will always fall within the specified range. The waveform at the sense pin will exhibit a saw-tooth shape due to the comparator hysteresis.

³100 k Ω resistor connected between a 5 V source and the A0 pin.

⁴The ADP1110 is guaranteed to withstand continuous application of +1.6 V applied to the GND and SW2 pins while V_{IN} , I_{LIM} , and SW1 pins are grounded.

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