DESCRIPTION

The A7131A is a monolithic step-down DC/DC converter capable of delivering up to 3A of output current without requiring an external transistor, saving board space. The device features a low EMI signature and can operate at 100% duty cycle for low-dropout operation.

The internal soft-start function limits inrush current, helping to extend battery life in portable systems. Protection features include cycle-by-cycle peak current limiting, short-circuit protection, thermal shutdown, and UVLO.

The device is available in SOT-26 package.

FEATURES

- Wide input voltage Range: 2.5V~5.5V
- Adjustable Output Voltage from 0.6V to V_{IN}
- Low $R_{DS(ON)}$ Switches 80mΩ / 55mΩ
- Output Discharge Resistance: 20Ω
- 1MHzTypical Switching Frequency
- Duty Cycle up to 100%
- Short Circuit Protection
- Over Current Protection
- Internal Soft Startup
- Thermal Shutdown Protection

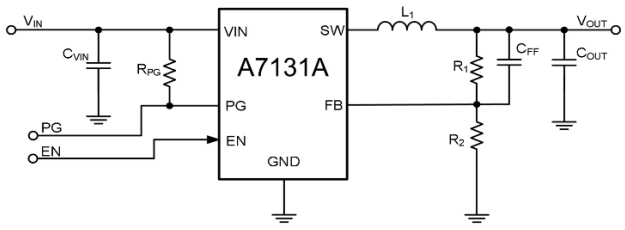
APPLICATION

- LCD Monitor and LCD TV
- Battery-powered Equipment
- Entertainment Devices
- Digital Home Appliances: Digital TVs

ORDERING INFORMATION

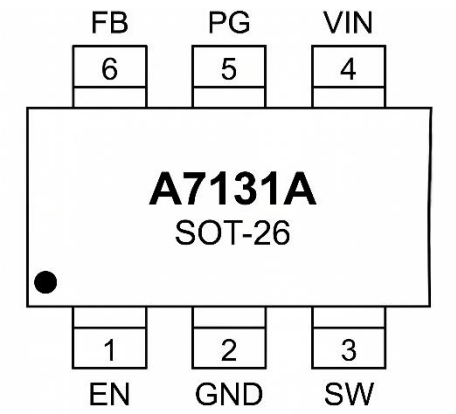
Package Type	Part Number	
SOT-26 SPQ:3,000pcs/Reel	E6	A7131AE6R
		A7131AE6VR
Note	V: Halogen free Package R: Tape & Reel	
AiT provides all RoHS products		

TYPICAL APPLICATION



L1: PIA4030-1R0N or PIA5040-1R5N

PIN DESCRIPTION



SOT-26, E6

Top View

PIN#	Symbol	Function
1	EN	Device enable logic input. Logic high enables the device, logic low disables the device and turns it into shutdown. Do not leave floating.
2	GND	Ground pin.
3	SW	Switch pin connected to the internal FET switches and inductor terminal. Connect the inductor of the output filter to this pin.
4	VIN	Power supply voltage input.
5	PG	Power Good Indicator Pin. The open-drain output is high-impedance when the output voltage is within ±10% of the regulation voltage and is pulled low otherwise.
6	FB	Feedback pin for the internal control loop. Connect this pin to an external feedback divider.

ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range, unless otherwise noted

V_{IN}, and EN Voltage	-0.3V ~ 6V
SW, Voltage	-0.3V ~ V_{IN} +0.3V
FB, Voltage	- 0.3V ~ 6V
T_J, Operating Junction Temperature	-40°C ~ +150°C
T_{STG}, Storage Temperature	-65°C ~ +150°C
$R_{\theta JA}$, Junction-to-Ambient Thermal Resistance	240°C/W
$R_{\theta JC}$(top), Junction-to-Case (Top) Thermal Resistance	140°C/W

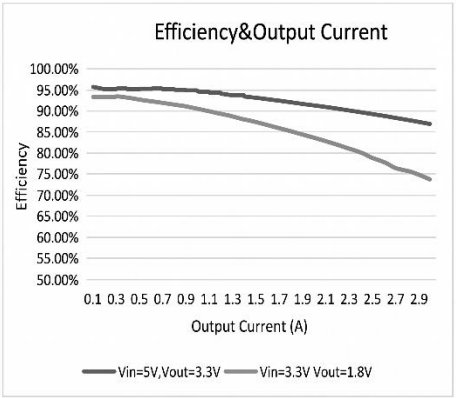
Stresses above may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONFITIONS

T_C= 25°C, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating Junction Temperature	-	-	-40	-	125	°C
Operating temperature range	-	-	-40	-	85	°C
Input Voltage	V_{IN}	-	2.5	-	5.5	V
Output Current	-	-	0	-	3.0	A

EFFICIENCY

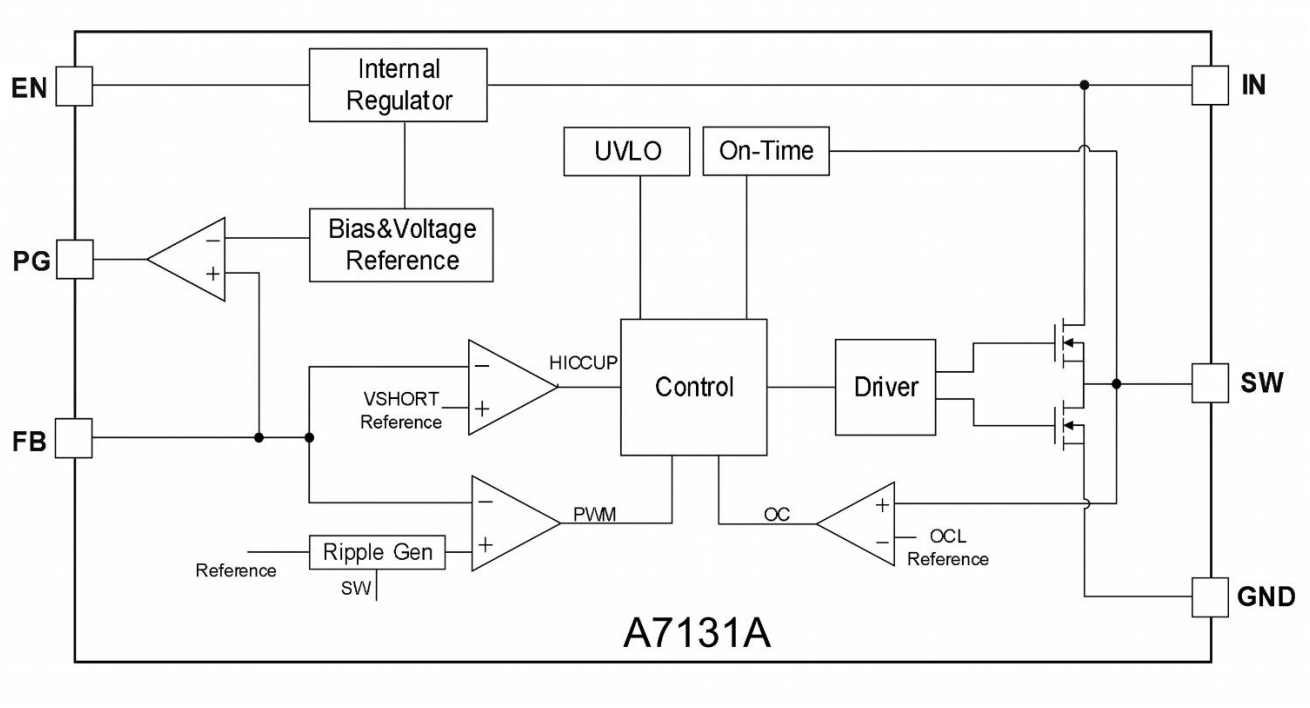


ELECTRICAL CHARACTERISTICS

T_A = 25℃, V_{IN} =5V, unless otherwise specified.

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Units
Input voltage range	V_{IN}	-	2.5	-	5.5	V
Non switching quiescent current	I_Q	OUT=1.8V, I_{load}=0A	-	40	75	μA
Shutdown current	I_{OFF}	EN = GND	-	-	1	μA
Regulated Feedback Voltage	V_{FB}	-	588	600	612	mV
V_{IN} under voltage lockout	$V_{IN(UVLO)}$	-	-	2.2	-	V
V_{IN} under voltage lockout Hysteresis		-	-	300	-	mV
ENABLE (EN PIN)						
Enable threshold	$V_{(EN\_RISING)}$	Rising	1.2	-	-	V
	$V_{(EN\_FALLING)}$	Falling	-	-	0.4	V
Threshold Hysteresis	$V_{(EN\_HYS)}$	-	-	270	-	mV
POWER STAGE						
High-side FET on resistance	$R_{(HSD)}$	I_{SW}=100mA	-	80	-	mΩ
Low-side FET on resistance	$R_{(LSD)}$	I_{SW}=-100mA	-	55	-	mΩ
Output Discharge Resistance	-	-	-	20	-	Ω
CURRENT LIMIT						
High-side FET current limit	$I_{(LIM\_HS)}$	FB=90%	-	4	-	A
Low side FET current limit	$I_{(LIM\_LS)}$	FB=90%	-	3	-	A
OSCILLATOR						
Centre switching frequency	F_{SW}	OUT=1.8V, I_{load}=1A	-	1.0	-	MHz
OVER TEMPERATURE PROTECTION						
Rising temperature	Thermal Shutdown	-	-	160	-	°C
Hysteresis		-	-	30	-	°C
Soft start	-	-	0.5	1	1.5	ms

BLOCK DIAGRAM



DETAILED INFORMATION

Overview

The A7131A is a high-output-current, monolithic step-down DC/DC converter designed to deliver up to 3A of output current from an input voltage ranging from 2.5V to 5.5V. The device operates at a fixed 1MHz switching frequency and utilizes a slope-compensated current-mode control architecture.

The external shutdown function can be controlled by a logic-level signal to place the device into standby mode. Internal compensation simplifies the design and provides good line and load regulation without requiring external compensation components. For protection, the A7131A incorporates thermal shutdown to prevent damage caused by excessive operating temperature and cycle-by-cycle current limiting to protect the internal power switch from overcurrent conditions. When the current-limit condition occurs and V_{FB} falls below 0.6V, the switching frequency is reduced to provide additional protection under severe load conditions.

Application information

The A7131A is a high-performance, monolithic step-down converter with a wide 2.5V to 5.5V input voltage range and up to 3A output current. The device operates at a fixed 1MHz switching frequency and requires only a few external power components, including C_{IN}, C_{OUT}, and L1. The output voltage can be programmed using an external feedback network to any voltage from 0.6V up to the input voltage.

$$V_{OUT} = 0.6 \times \frac{R_1 + R_2}{R_2}$$

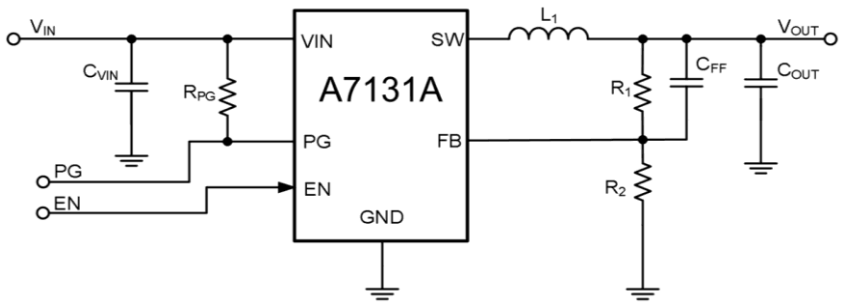


Table 1. Recommended Component Values

V_{OUT} (V)	L1 (µH)	C_{IN}(µF)	C_{OUT}(µF)	C_{FF} Opt.(pF)	R_{PG} (kΩ)	R1 (kΩ)	R2 (kΩ)
1	1	10	22	10~100	100	6.67	10
1.5	1	10	22	10~100	100	15	10
1.8	1	10	22	10~100	100	20	10
3.3	1	10	22	10~100	100	45	10

Table 2 . Reference inductor model

Input Voltage (V)	Output Voltage	Output Current	Inductance	Inductor model
5	1	3	0.899	PIA4030-1R0N (1µH)
5	1.5	3	1.167	PIA5040-1R5N(1.5µH)
5	1.8	3	1.280	PIA5040-1R5N (1.5µH)
5	3.3	3	1.247	PIA5040-1R5N (1.5µH)

Note: The inductor values provided are for reference only. The required inductance should be recalculated based on the actual application conditions, including input voltage, output voltage, load current, switching frequency, and other relevant parameters.

Power Supply Recommendations

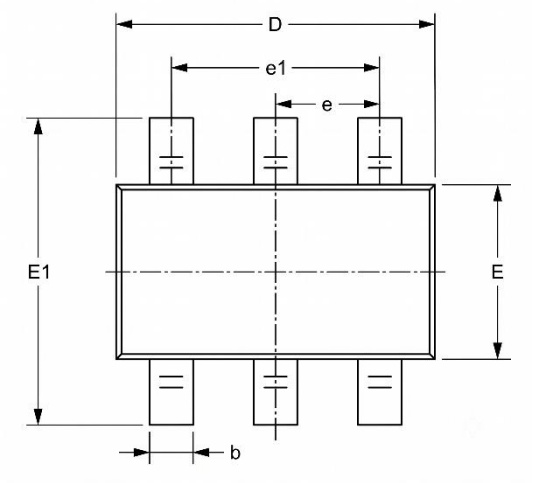
The devices are designed to operate from an input voltage supply range between 2.5V and 5.5V. This input supply must be well regulated. If the input supply is located more than a few inches from the device or converter, additional bulk capacitance may be required in addition to the ceramic bypass capacitors. An electrolytic capacitor with a value of 47 µF is a typical choice.

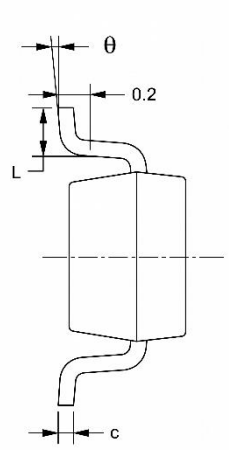
Layout Guidelines

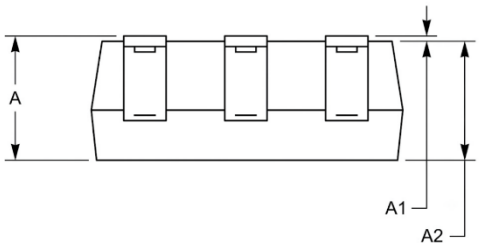
- VIN and GND traces should be as wide as possible to reduce trace impedance. The wide areas are also of advantage from the viewpoint of heat dissipation.
- The input capacitor and output capacitor should be placed as close to the device as possible to minimize trace impedance.
- Provide sufficient vias for the input capacitor and output capacitor.
- Keep the SW trace as physically short and wide as practical to minimize radiated emissions.
- Do not allow switching current to flow under the device.
- A separate VOUT path should be connected to the upper feedback resistor.
- Make a Kelvin connection to the GND pin for the feedback path.
- Voltage feedback loop should be placed away from the high-voltage switching trace, and preferably has ground shield.
- The trace of the VFB node should be as small as possible to avoid noise coupling.
- The GND trace between the output capacitor and the GND pin should be as wide as possible to minimize its trace impedance.

PACKAGE INFORMATION

Dimension in SOT-26 (Unit: mm):







Symbol	MILLIMETERS	
	Min.	Max.
A	1.050	1.250
A1	0.000	0.100
A2	1.050	1.150
b	0.300	0.500
c	0.100	0.200
D	2.820	3.020
E	1.500	1.700
E1	2.650	2.950
e	0.950 BSC	
e1	1.900 BSC	
L	0.300	0.600
θ	0°	8°

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