AIC1631

500mA, Step-Up DC/DC Converter

FEATURES

- High Efficiency 90%.
- Adjustable Output Voltage with Two Resistors (AIC1631A)
- Power-Saving Shutdown Mode (7μA typical).
- Internal 2A Switch.
- 120KHz Switching Rate.
- Adjustable Switch Current Limit.
- On-Chip Low Battery Detector.

APPLICATIONS

- Palmtop & Notebook Computers.
- Pocket Organizers.
- Cameras.
- Pagers.
- Battery Backup Supplies.
- Portable Instruments.

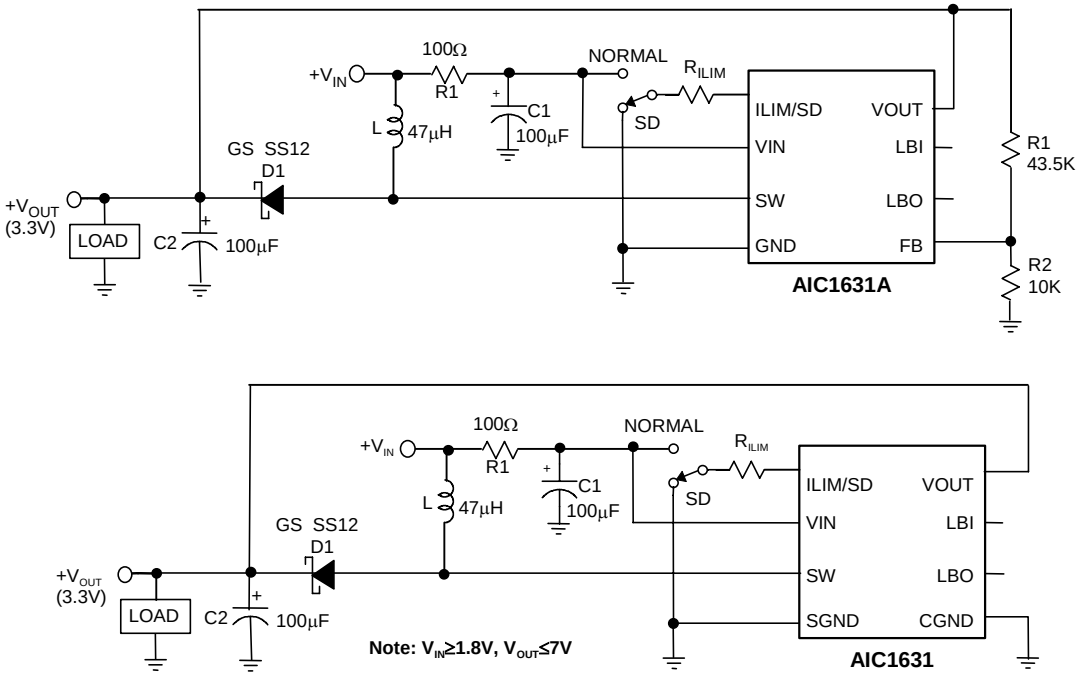
DESCRIPTION

The AIC1631 is a high efficiency step up DC-DC converter. Only four external components are required to deliver a fixed voltage of 3V, 3.3V, or 5V. The output voltage can be externally set to an arbitrary value below breakdown voltage of the power switch for AIC1631A. Efficiency beyond 87% can be easily achieved at 100mA load with 2.2V to 3V input voltages.

Logic-controlled shutdown mode is provided for power saving. Switch current limit can be programmed with a resistor. The low battery detector can be configured as a linear regulator or a burst mode controller performing an extremely low supply current operation.

120KHz switching rate reduces the inductor size. Inductors of 25μH to 50μH inductance are recommended for most applications.

TYPICAL APPLICATION CIRCUIT



High Efficiency Step-Up DC/DC Converter

ORDERING INFORMATION

AIC1631-XXXXX

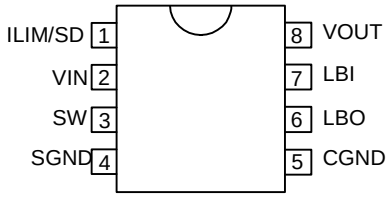
- PACKING TYPE
  - TR: TAPE & REEL
  - TB: TUBE
- PACKAGE TYPE
  - N: DIP-8
  - S: SOP-8
- C: Commercial
  - P: Lead Free Commercial
  - G: Green Package
- OUTPUT VOLTAGE
  - DEFAULT: 3.3V
  - 3: 3.0V
  - 5: 5.0V
  - A: Adjustable

EX: AIC1631-3CSTR

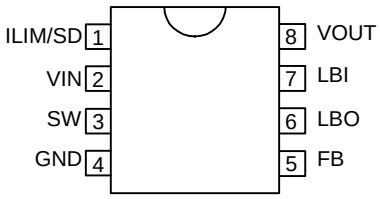
→ 3.0V Version, in SOP-8 Package & Tape & Reel Packing Type

PIN CONFIGURATION

DIP-8
SOP-8
TOP VIEW



DIP-8
SOP-8
TOP VIEW
Adjustable Version



ABSOLUTE MAXIMUM RATINGS

Supply Voltage 7.0V

Operating Temperature Range ..... -40°C to 85°C

Maximum Junction Temperature ..... 125°C

Storage Temperature Range ..... -65°C to 150°C

Lead Temperature (Soldering, 10 sec) ..... 260°C

Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

TEST CIRCUIT

Refer to Typical Application Circuit.

ELECTRICAL CHARACTERISTICS

(V_{IN}=3.0V, T_A=25°C, unless otherwise specified.) (Note1)

PARAMETER	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Input Voltage	Fig. 14 in Appl. Examples	1.5		7	V
Output Voltage	I_{LOAD} =200mA AIC1631 AIC1631-3 AIC1631-5	 3.16 2.88 4.80	 3.3 3 5	 3.44 3.12 5.20	V
Switch off Current			105	140	μA
No Load Current	AIC1631/AIC1631-3 AIC1631-5		160 180		μA
Shutdown Mode Current			7	15	μA
Shutdown Recovery Time	V_{IN}=2.5V, I_{LOAD} =200mA		0.4		mS
Efficiency	I_{LOAD} =200mA AIC1631/AIC1631-3 AIC1631-5		87 90		%
Line Regulation	I_{LOAD} =100mA AIC1631, V_{IN}=1.8 ~ 3.3V AIC1631-3, V_{IN}=1.8 ~ 3V AIC1631-5, V_{IN}=2.2 ~ 3.3V		0.6 0.5 0.8		$\%V_{OUT}$
Load Regulation	I_{LOAD} =10~300mA AIC1631/AIC1631-3 AIC1631-5		0.3 0.8		$\%V_{OUT}$
Oscillator Frequency		90	120	150	KHz
LBI Pin Trip Point		1.17	1.22	1.27	V
FB Threshold Voltage	AIC1631A	0.598	0.617	0.636	V
SW “ON Resistance”	AIC1631/AIC1631-3 AIC1631-5		0.5 0.4		Ω
LBO “ON Resistance”	V_{IN}=2V		45		Ω
SW Off Leakage				1	μA
Input Pin Bias Current				10	nA/Pin
Output Pin Leakage				10	nA/Pin

Note 1: Specifications are production tested at TA=25°C. Specifications over the -40°C to 85°C operating temperature range are assured by design, characterization and correlation with Statistical Quality Controls (SQC).

TYPICAL PERFORMANCE CHARACTERISTICS

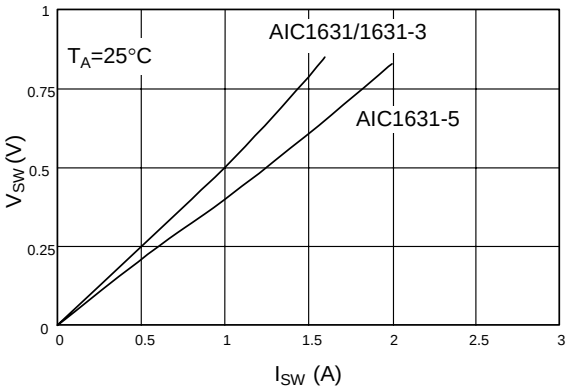


Fig. 1 Switch Voltage vs. Current

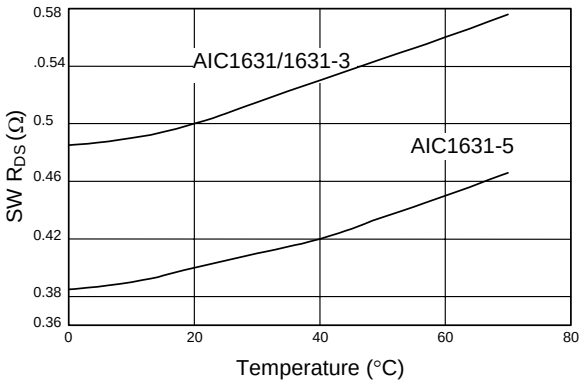


Fig. 2 SW ON Resistance vs. Temperature

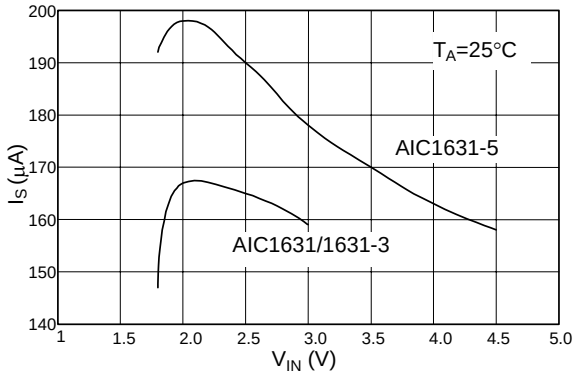


Fig. 3 No Load Supply Current vs. Input Voltage

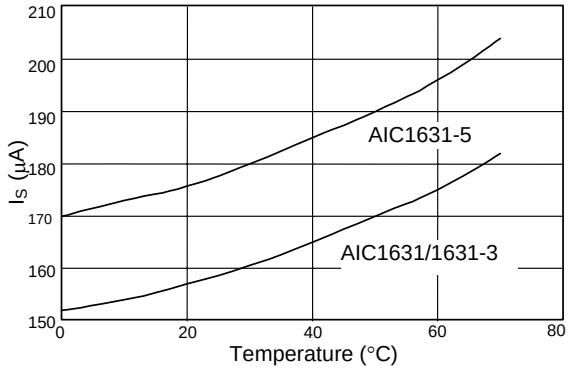


Fig. 4 No Load Supply Current vs. Temperature

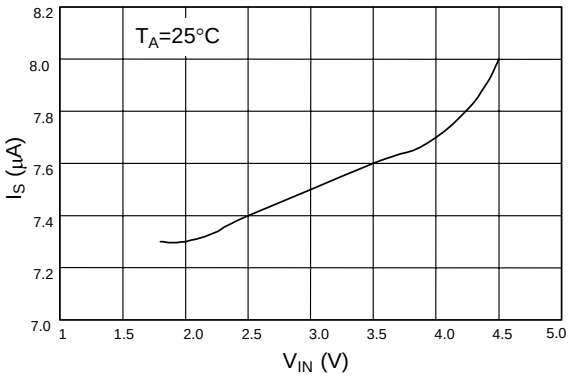


Fig. 5 Shutdown Mode Supply Current vs. Input Voltage

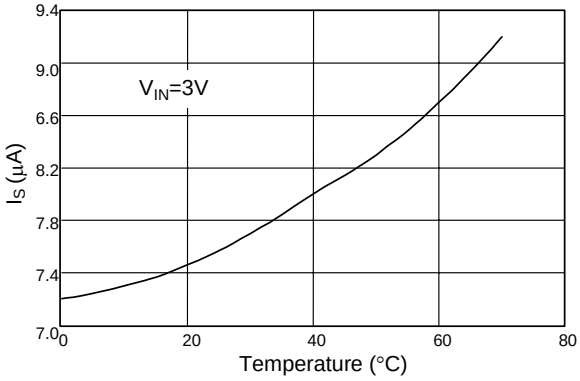


Fig. 6 Shutdown Mode Supply Current vs. Temperature

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

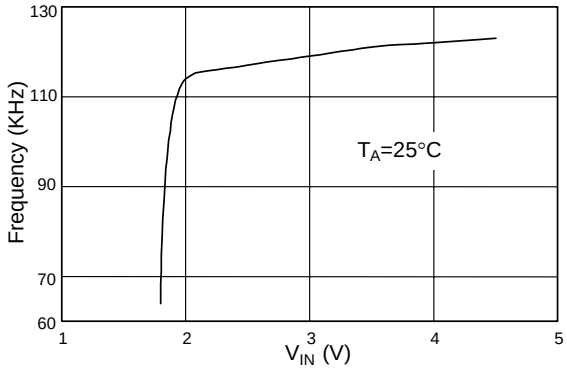


Fig. 7 Oscillator Frequency vs. Input Voltage

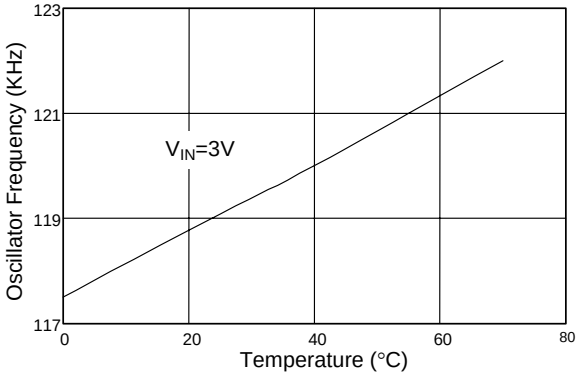


Fig. 8 Oscillator Frequency vs. Temperature

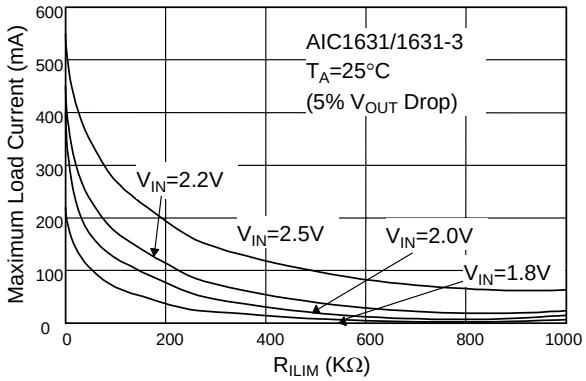


Fig. 9 Maximum Load Current vs. Switch Current Limit Resistance

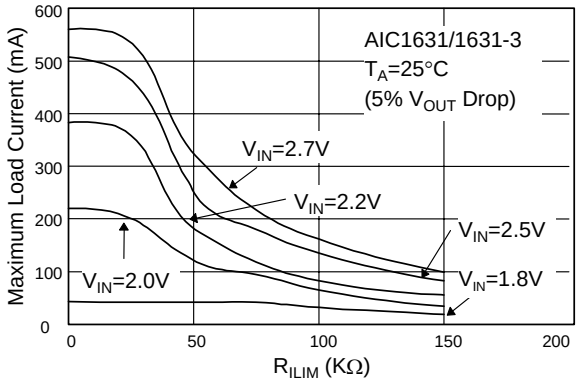
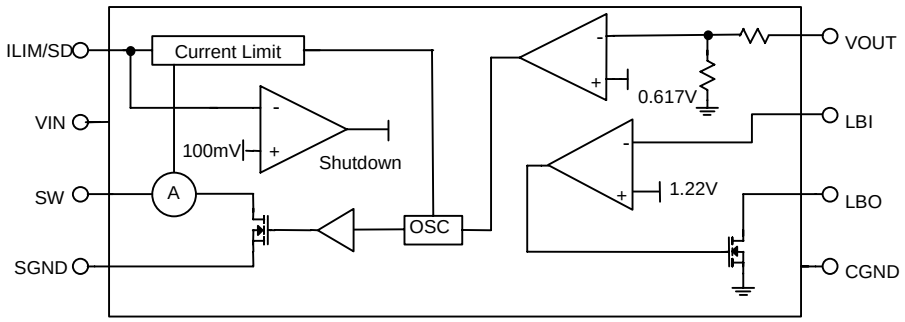
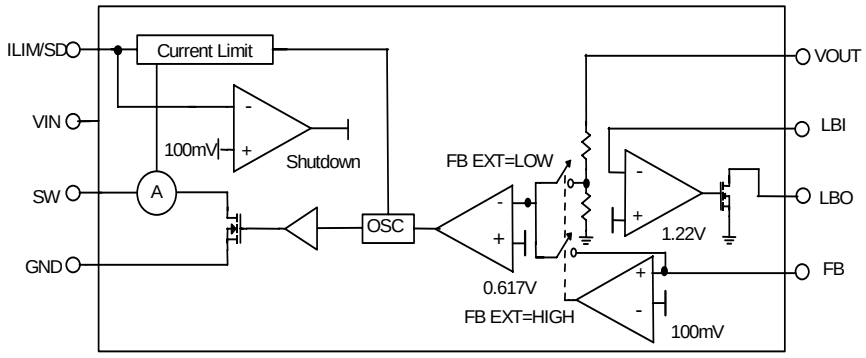


Fig. 10 Maximum Load Current vs. Switch Current Limit Resistance

BLOCK DIAGRAM



AIC1631-3 / AIC1631 / AIC1631-5



The driver and reference (0.617V and 1.22V) for AIC1630A are based on VOUT pin. And VOUT must be ≥2.2V then system can operate normally.

AIC1631A

PIN DESCRIPTIONS

AIC1631-3/ AIC1631/ AIC1631-5

PIN 1: ILIM/SD- 1. Connected to VIN pin through a resistor to set the switch peak current. It serves to protect IC and inductor, as well as to improve efficiency and output ripples. However, supply capability of the AIC1631 is limited by the current limit resistor. (See typical performance characteristics). The ILIM/SD pin should be shorted to VIN pin if limiting on switch peak current is not intended.

2. The AIC1631 goes in shutdown mode and consumes less than 10μA when ILIM/SD pin is pulled to ground.

PIN 2: VIN - Input supply.

PIN 3: SW - Drain of the power switch, to be connected to inductor/ diode.

PIN 4:SGND - Ground connected to source of power switch.

PIN 5:CGND - Ground for control circuits of the IC. It should be separated from SGND to avoid the interference.

PIN 6:LBO - Open drain output of the battery low detector, with 45Ω "ON resistance" at V_{IN}=2V. It is pulled low when the voltage on LBI pin is below 1.22V.

PIN 7:LBI - The noninverting input of the battery low detector, of which the inverting input is internally connects to 1.22V voltage reference.

PIN 8:VOUT - The output voltage feedbacks to the IC through this pin.

AIC1631A

PIN 1: ILIM/SD- 1. Connected to VIN pin through a resistor to set the switch peak current. It serves to protect IC and inductor, as well as to improve efficiency and output ripples. However, supply capability of the AIC1631A is limited by the current limit resistor. (See typical performance characteristics). The ILIM/SD pin should be shorted to VIN pin if limiting on switch peak current is not intended.

2. The AIC1631A goes in shutdown mode and consumes less than 10μA when ILIM/SD pin is pulled to ground.

PIN 2: VIN - Input supply.

PIN 3: SW - Drain of the power switch, to be connected to inductor/ diode.

PIN 4: GND - Ground.

PIN 5: FB - Output voltage can either be internally set to 5 volt by grounding FB pin, or be externally set to an arbitrary voltage by applying to FB pin the divider voltage of two divider resistors.

VOUT voltage is given by the following equation:

$$\frac{R1}{R2} = \frac{V_{OUT}}{0.617} - 1$$

where R1 = Resistor connected

between FB pin and VOUT pin.

R2= Resistor connected between FB pin and ground.

VOUT=Output voltage to be set.

PIN 6: LBO - Open drain output of the battery low detector, with 45Ω "ON resistance" at V_{IN}=2V. It is pulled low when the voltage on LBI pin is below 1.22V.

AIC1631A (continued)

PIN 7: LBI - The noninverting input of the battery low detector, of which the inverting input is internally connects to 1.22V voltage reference.

PIN 8: VOUT- The output voltage feedbacks to the IC through this pin. If output voltage was externally set, the VOUT pin can be tied to any low impedance node with voltage between the external power switch threshold and 7V.

APPLICATION EXAMPLES

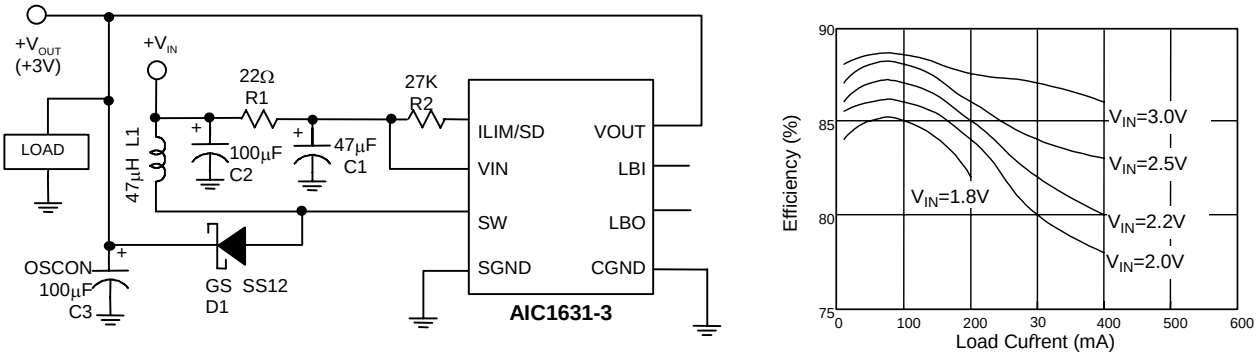


Fig. 11 3V Output Step-Up Converter

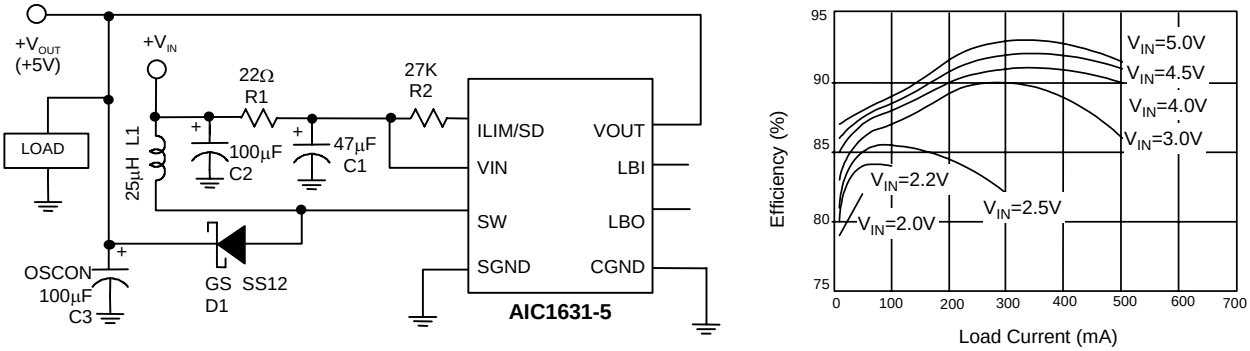
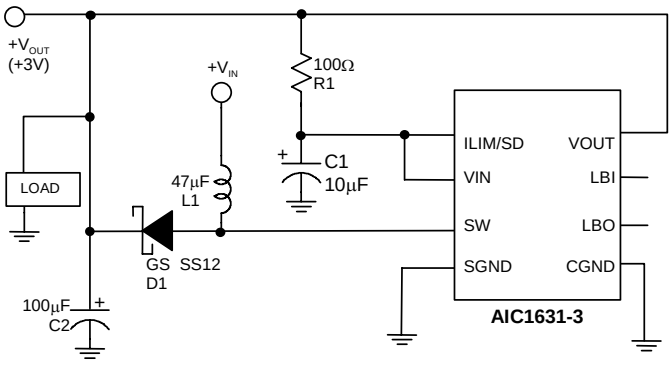


Fig. 12 5V Output Step-Up Converter

APPLICATION EXAMPLES (Continued)



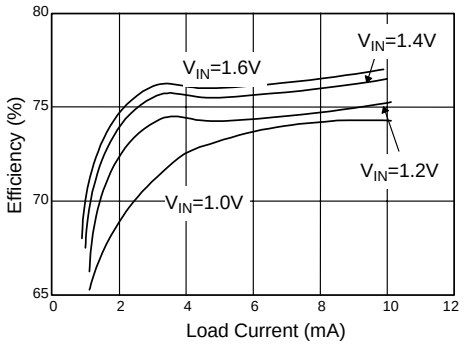
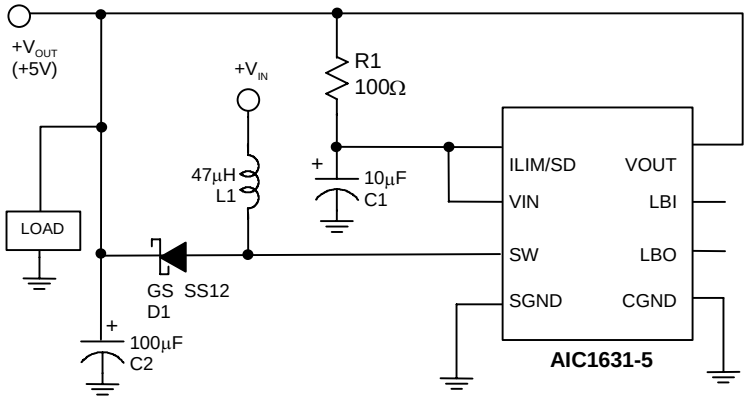


Fig. 13 1-Cell Input 3V Output Step-Up Converter



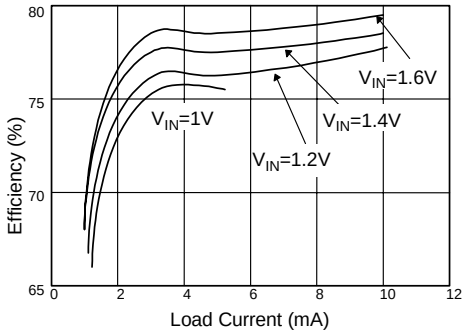
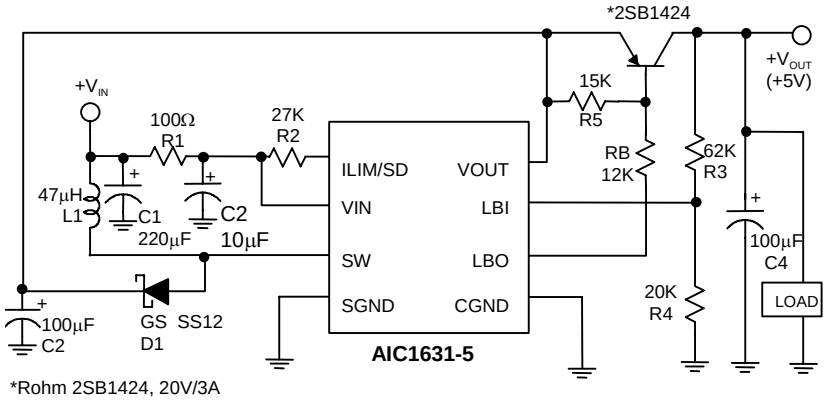


Fig. 14 1-Cell Input 5V Output Step-Up Converter



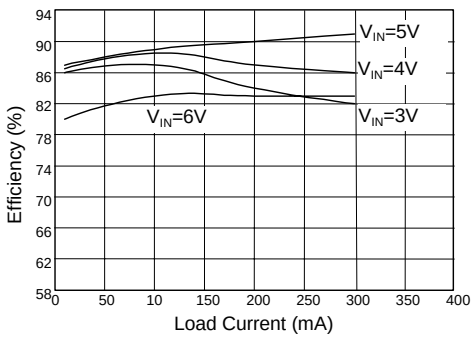


Fig. 15 4-Cell Input Step-Up / Step-Down Converter

APPLICATION EXAMPLES (Continued)

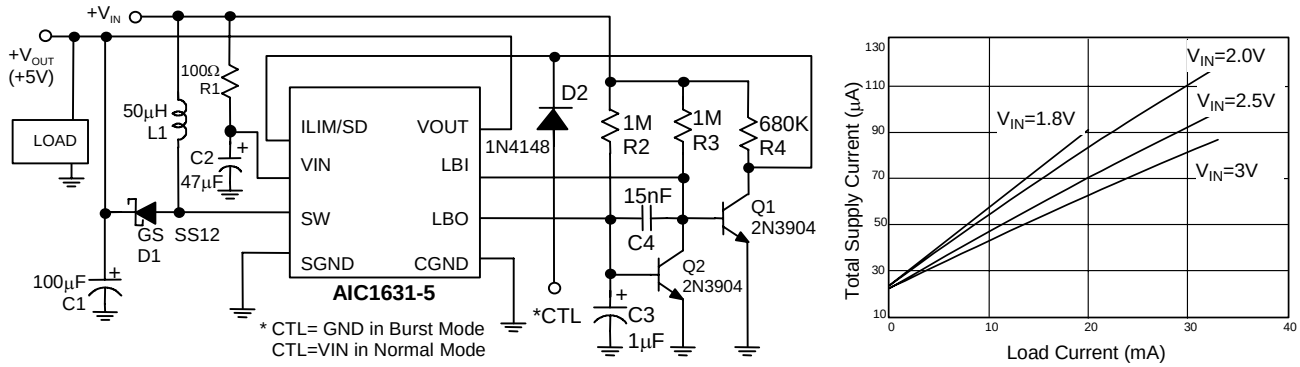


Fig. 16 Low Supply Current Burst Mode Step-Up Converter

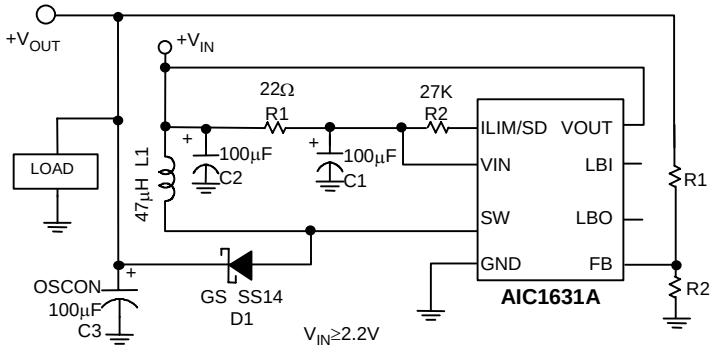


Fig. 17 Adjustable Output Voltage Step-Up Converter

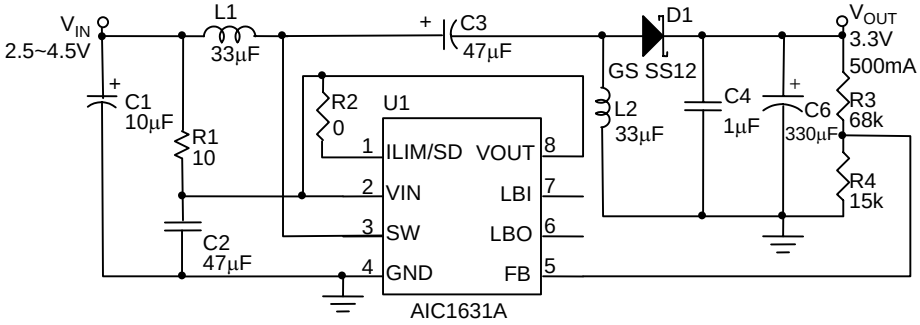


Fig. 18 SEPIC Circuit of the DC-DC Converter

APPLICATION EXAMPLES (Continued)

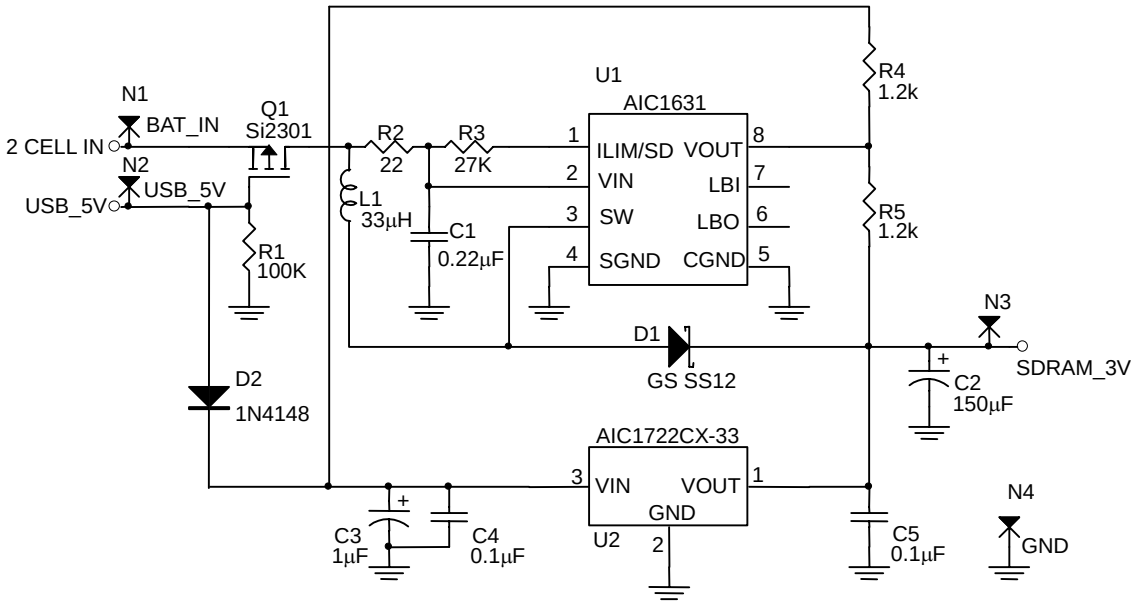
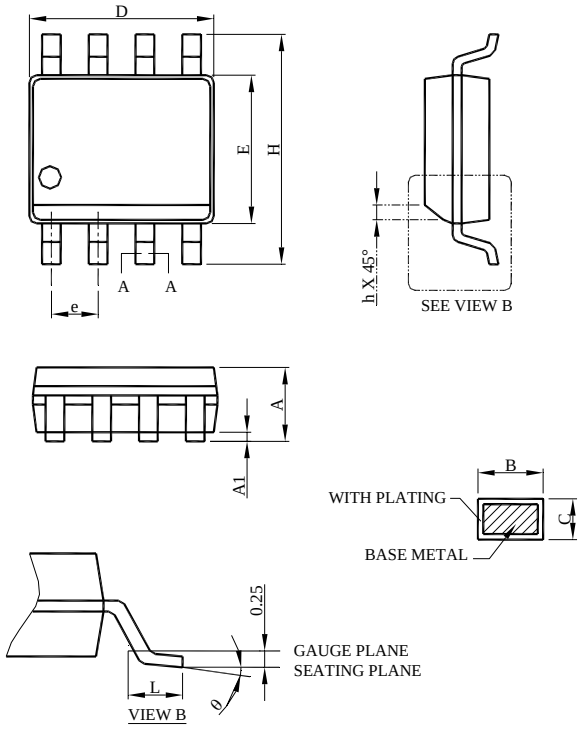


Fig. 19 USB Dual Input Application of SDRAM

PHYSICAL DIMENSION (unit: mm)

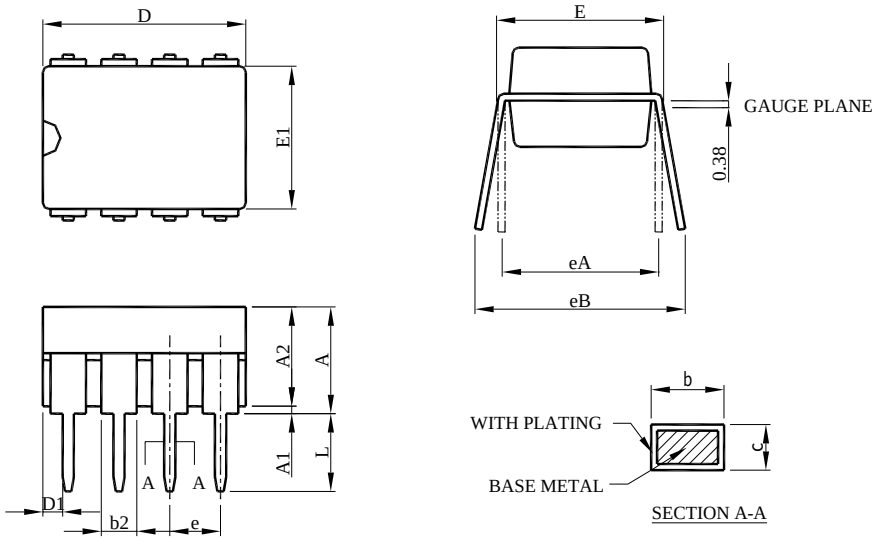
- **SOP-8**



SYMBOL	SOP-8	
	MILLIMETERS	
	MIN.	MAX.
A	1.35	1.75
A1	0.10	0.25
B	0.33	0.51
C	0.19	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27 BSC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.27
θ	0°	8°

Note:
1.Refer to JEDEC MS-012AA.
2.Dimension “D” does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side.
3.Dimension “E” does not include inter-lead flash or protrusions. Inter-lead flash or protrusion shall not exceed 10 mil per side.
4.Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

- **DIP-8**



SYMBOL	DIP-8	
	MILLIMETERS	
	MIN.	MAX.
A		5.33
A1	0.38	
A2	2.92	4.95
b	0.36	0.56
b2	1.14	1.78
c	0.20	0.35
D	9.01	10.16
D1	0.13	
E	7.62	8.26
E1	6.10	7.11
e	2.54 BSC	
eA	7.62 BSC	
eB		10.92
L	2.92	3.81

Note:
1.Refer to JEDEC MS-001BA.
2.Dimension D, D1 and E1 do not include mold flash or protrusions. Mold flash or protrusion shall not exceed 10 mil.
3.Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.