200mA, Step-Up DC/DC Converter

FEATURES

- High Efficiency Up To 87%.
- Adjustable Output Voltage with Two Resistors (AIC1633A)
- Power-Saving Shutdown Mode (7μA typical).
- Internal 0.8A Switch.
- 120KHz Switching Rate.
- Adjustable Switch Current Limit.
- On-Chip Low Battery Detector.

APPLICATIONS

- Pocket Organizers.
- Electronic Dictionaries.
- Cameras.
- Pagers.
- Bar-Code Scanners.
- LCD Displays.
- Battery Backup Supplies.
- Portable Instruments.

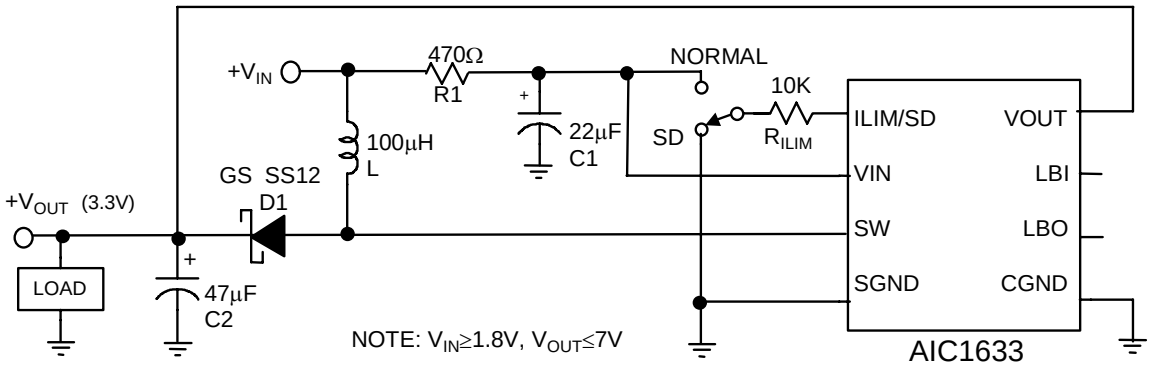
DESCRIPTION

The AIC1633 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 AIC1633A. Efficiency beyond 83% can be easily achieved at 70mA 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 converter or a burst mode controller performing an extremely low supply current operation.

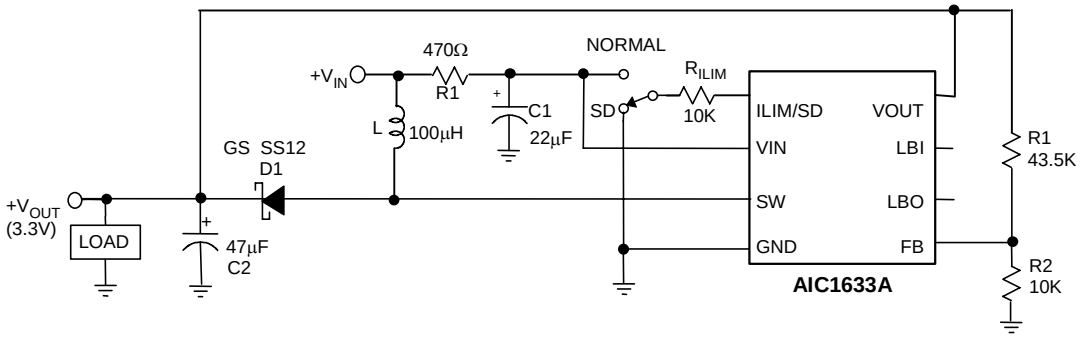
120KHz switching rate reduces the inductor size. Inductors of 47μH to 150μH inductance are recommended for most applications.

TYPICAL APPLICATION CIRCUIT



High-Efficiency Step-Up DC/DC Converter

TYPICAL APPLICATION CIRCUIT (Continued)



High-Efficiency Step-Up DC/DC Converter

ORDERING INFORMATION

AIC1633-XXXXX

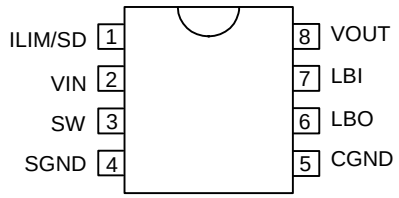
- PACKING TYPE
  - TR: TAPE & REEL
  - TB: TUBE
- PACKAGE TYPE
  - N: DIP-8
  - S: SOP-8
- C: COMMERCIAL
  P: LEAD FREE COMMERCIAL
  G: GREEN PACKAGE
- OUTPUT VOLTAGE
  - DEFAULT: 3.3V
  - 3: 3.0V
  - 5: 5.0V

EX: AIC1633-3CSTR

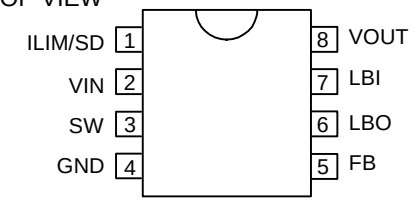
→ 3.0V Version, in SOP-8 Package & Tape & Reel Packing Type
(CN is not available in TR packing type.)

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 ..... -20°C ~ 80°C

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

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		1.8		7	V
Output Voltage	I_{LOAD} =70mA AIC1633 AIC1633-3 AIC1633-5	 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	AIC1633/AIC1633-3 AIC1633-5		160 250		μA
Shutdown Mode Current			7	15	μA
Shutdown Recovery Time	V_{IN}=2.5V, I_{LOAD} =70mA		1.8		mS
Efficiency	I_{LOAD} =70mA AIC1633/AIC1633-3 AIC1633-5		 87 86		%
Line Regulation	I_{LOAD} =40mA AIC1633, V_{IN} =2.0~3.3V AIC1633-3, V_{IN} =2.0~3.0V AIC1633-5, V_{IN} =2.2~4.5V		 0.6 0.6 0.5		$\%V_{OUT}$
Load Regulation	I_{LOAD} =170mA AIC1633/AIC1633-3 AIC1633-5		 0.6 0.5		$\%V_{OUT}$
Oscillator Frequency		90	120	150	KHz
LBI Pin Trip Point		1.17	1.22	1.27	V
FB Reference Voltage	AIC1633A	0.598	0.617	0.636	V
SW "ON Resistance"	AIC1633/AIC1633-3 AIC1633-5		1.75 1.25		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

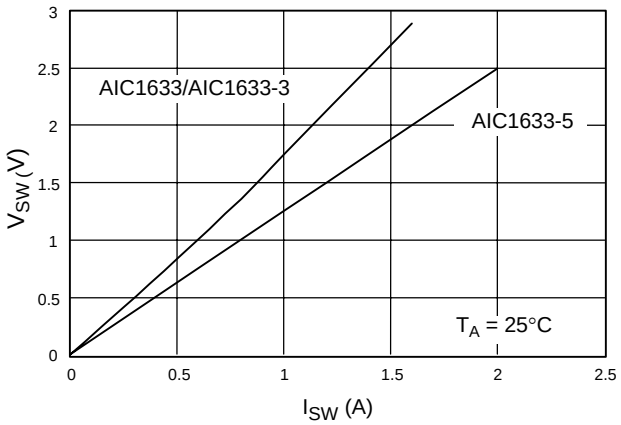


Fig. 1 Switch Voltage vs. Current

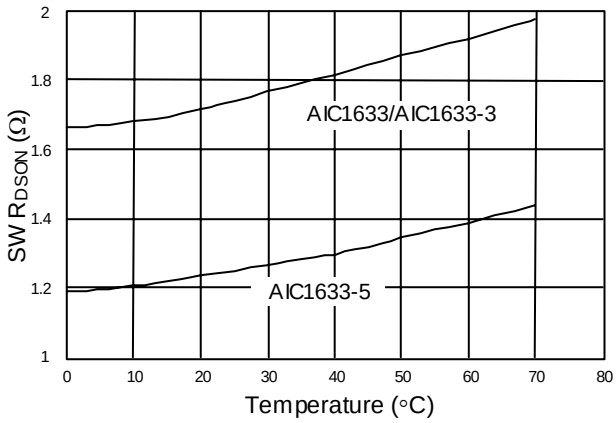


Fig. 2 SW ON Resistance vs. Temperature

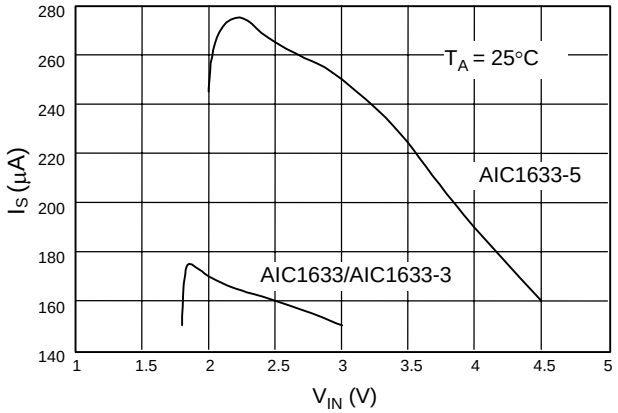


Fig. 3 No Load Supply Current vs. Input Voltage

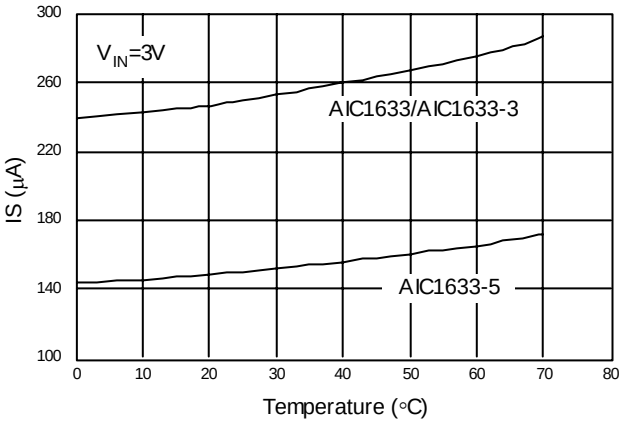


Fig. 4 No Load Supply Current vs. Temperature

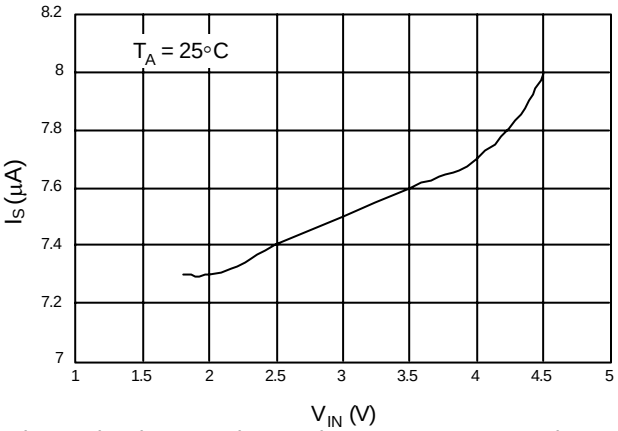


Fig. 5 Shutdown Mode Supply Current vs. Input Voltage

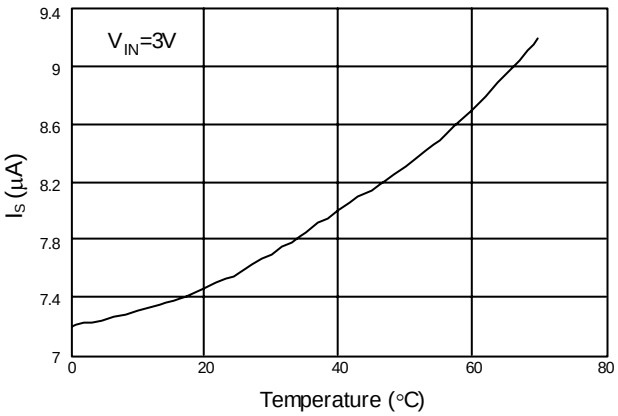


Fig. 6 Shutdown Mode Supply Current vs. Temperature

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

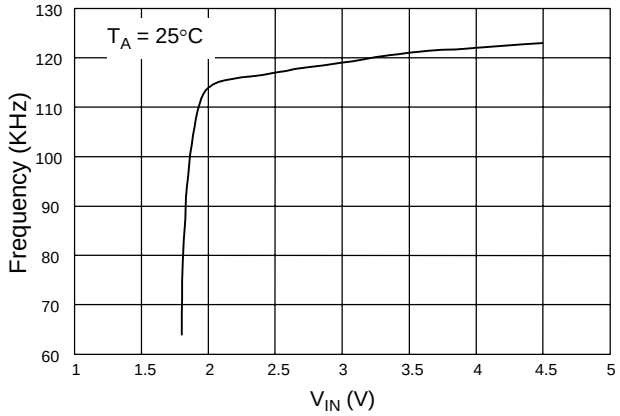


Fig. 7 Oscillator Frequency vs. Input Voltage

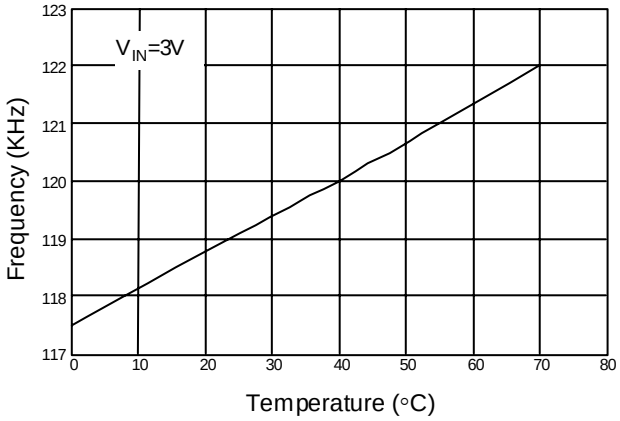


Fig. 8 Oscillator Frequency vs. Temperature

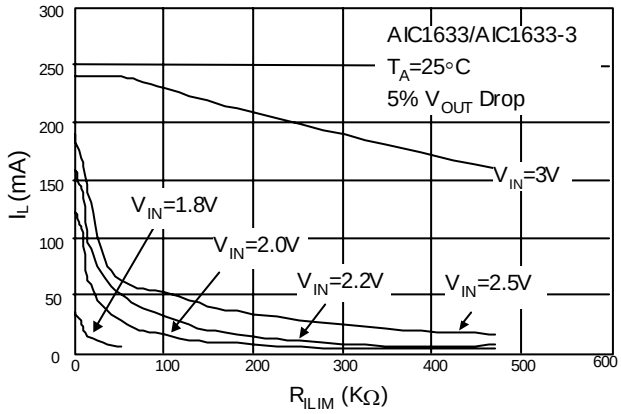


Fig. 9 Maximum Load Current vs. Switch Current Limit Resistance

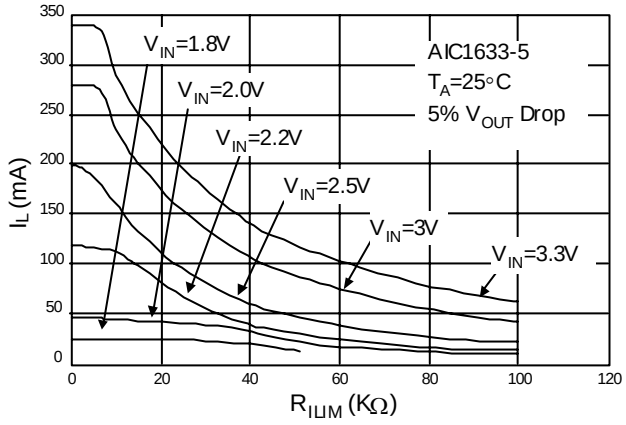
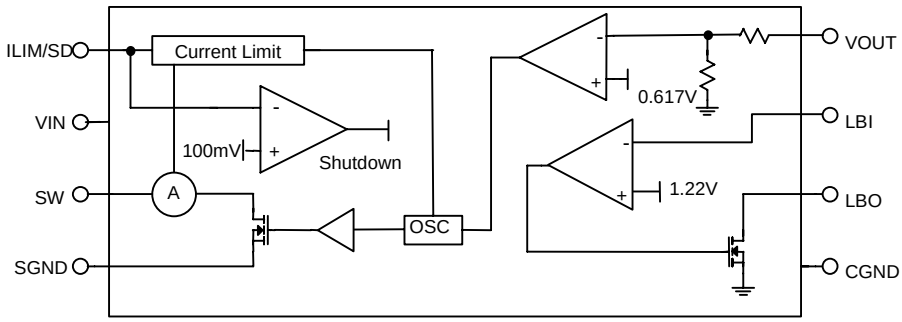


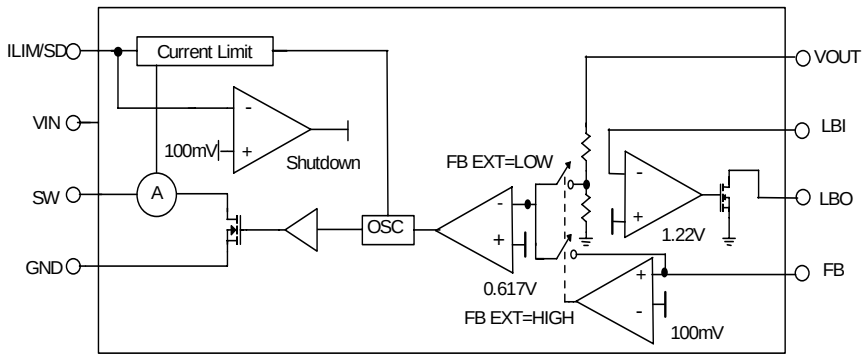
Fig. 10 Maximum Load Current vs. Switch Current Limit Resistance

BLOCK DIAGRAM



AIC1633-3 / AIC1633 / AIC1633-5

BLOCK DIAGRAM (Continued)



The driver and reference (0.617V and 1.22V) for AIC1633A are based on VOUT pin. And VOUT must be ≥2.2V then system can operate normally.

AIC1633A

PIN DESCRIPTIONS

AIC1633-3/ AIC1633 / AIC1633-5

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, the current limit resistor limits supply capability of the AIC1633. (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 AIC1633 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.

AIC1633A

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, the current limit resistor limits supply capability of the AIC1633A. (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 AIC1633A 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.

V_{OUT} 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.

V_{OUT}=Output voltage to be set.

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

PIN 7: LBI - The non-inverting 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

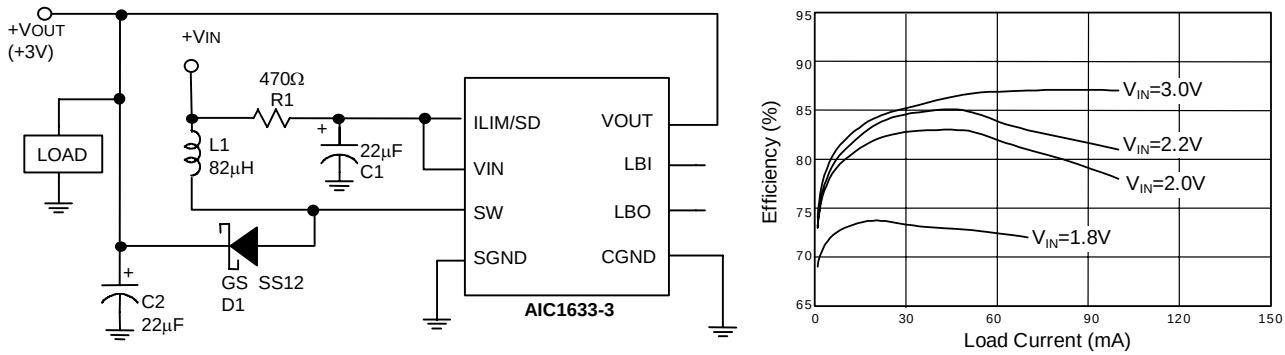


Fig. 11 3V Output Step-Up Converter

APPLICATION EXAMPLES (Continued)

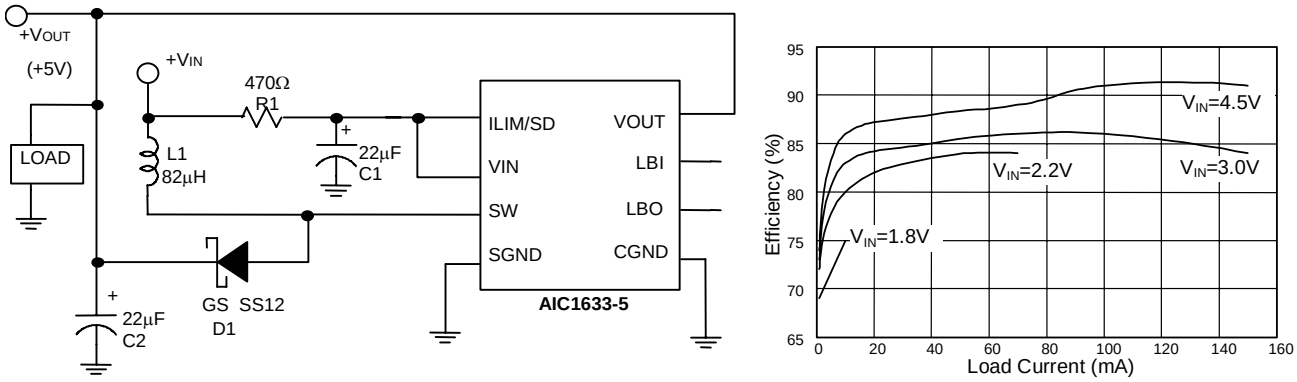
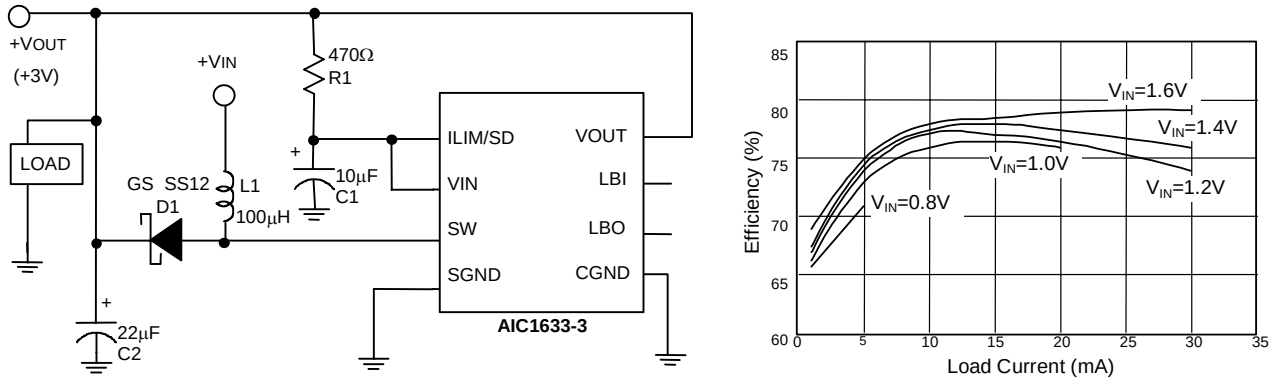


Fig. 12 5V Output Step-Up Converter



Start-Up V_{IN} Voltage = 1.4V

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

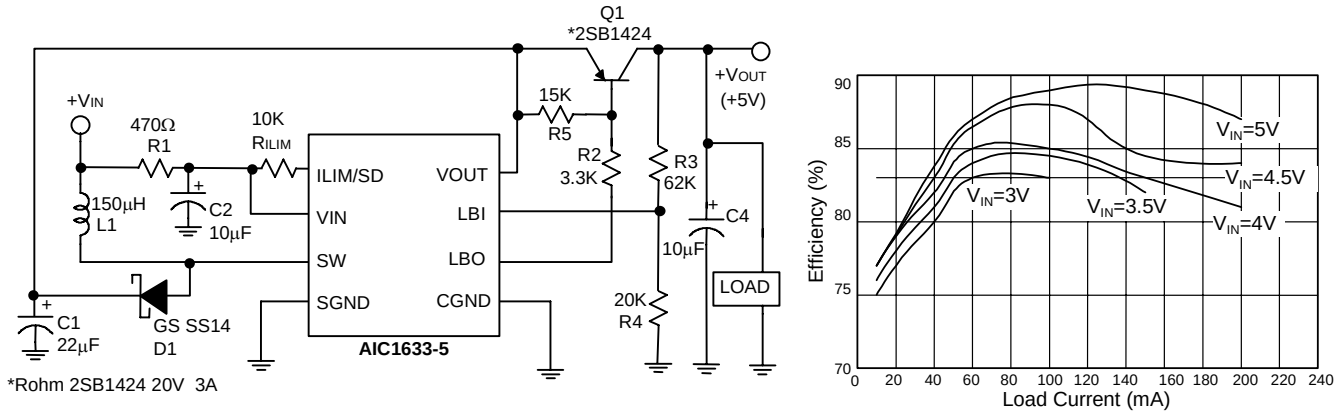


Fig. 14 4-Cell Input Step-Up/ Step-Down Converter

APPLICATION EXAMPLES (Continued)

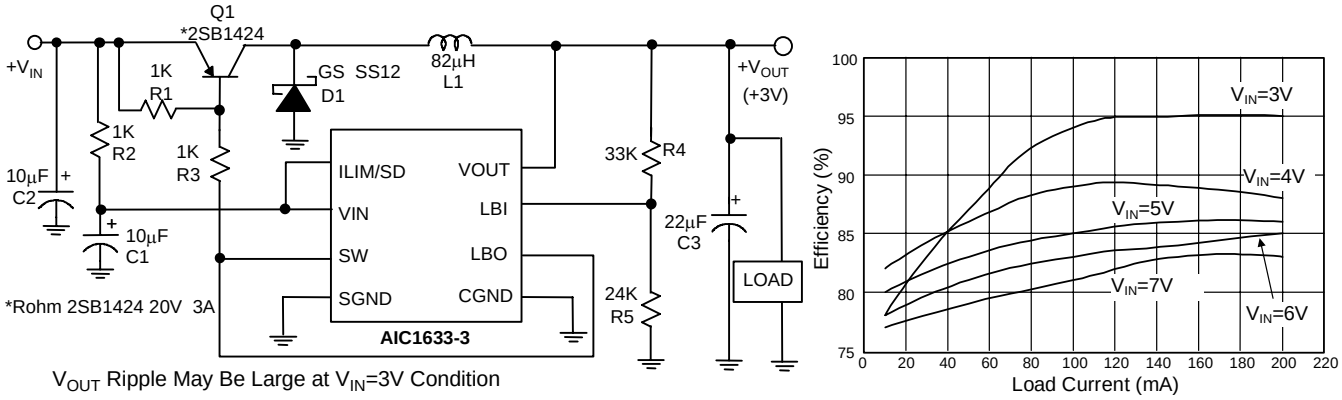


Fig. 15 3-Cell Input 3V Output Step-Down Converter

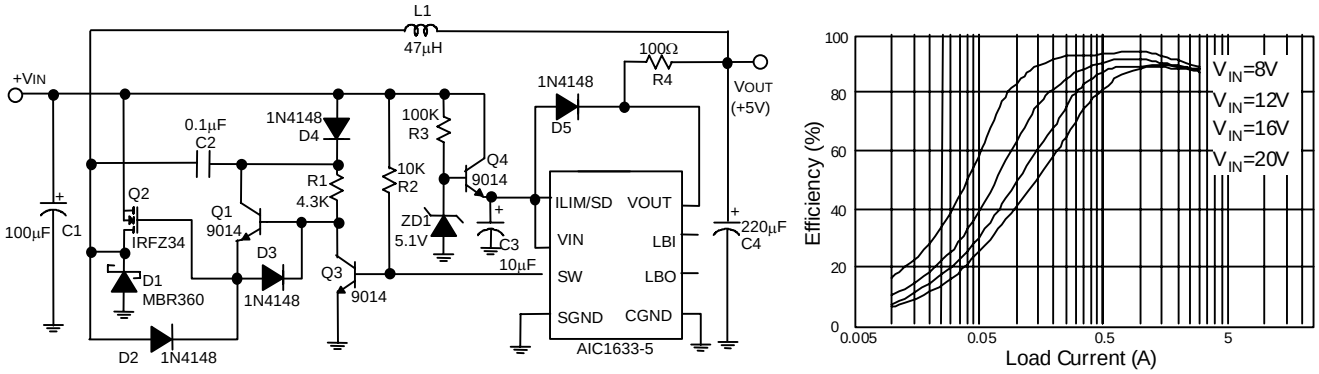


Fig. 16 Boost-Driven 5V Output Step-Down Converter

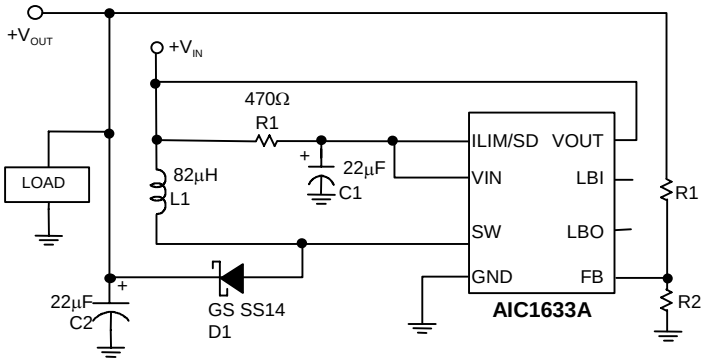
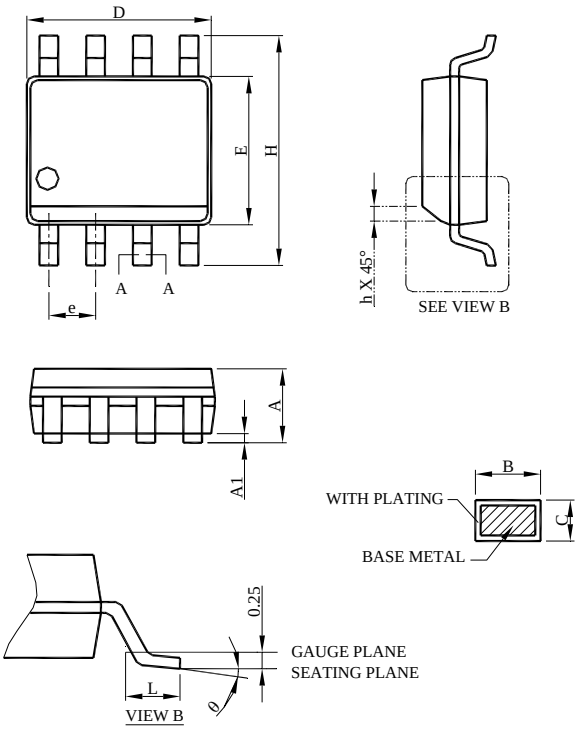


Fig. 17 Adjustable Output Voltage Step-Up Converter

PHYSICAL DIMENSION (unit: mm)

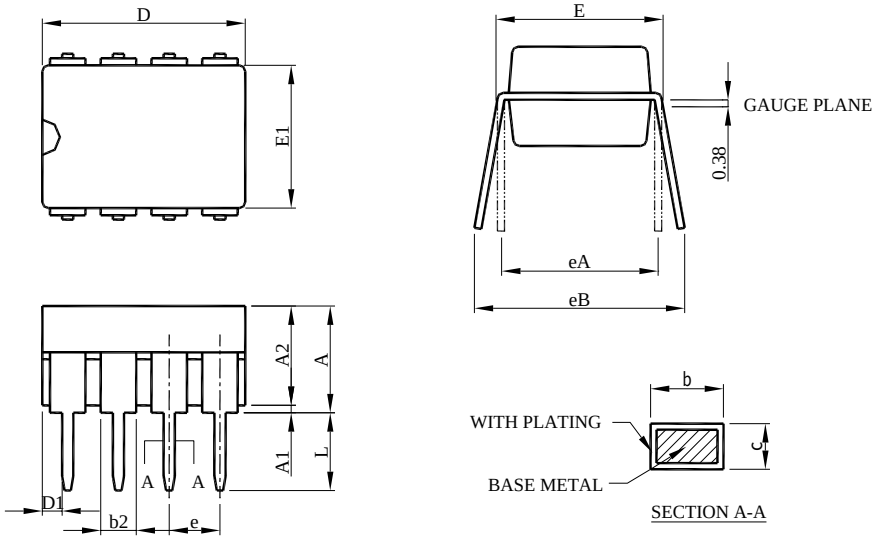
- **SOP-8**



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.