Step-Up DC/DC Controller

■ FEATURES

- Adjustable Output Voltage with Two Resistors (AIC1630A).
- Power-Saving Shutdown Mode (7µA typical).
- 120KHz Switching Rate.
- On-Chip Low Battery Detector.

■ APPLICATIONS

- Palmtop & Notebook Computers.
- Battery Charger Supply.
- Cellular Telephone.
- LCD Contrast Supply.
- Flash Memory Programmer.
- Battery Backup Supplies.
- Portable Instruments.

■ DESCRIPTION

The AIC1630 is a DC-DC controller designed to drive an external power switch for more flexibility, especially in higher voltage and larger power applications. Typically six components are required to set up a step-up configuration easily achieving efficiency beyond 80%. A few more components are required to set up a step-down configuration delivering 4A load current with 83% typical efficiency, 86% at 2A load, and 300µA quiescent current.

The output voltage is internally set to 3V, 3.3V, 5V or externally set to an arbitrary value below breakdown voltage of the power switch. Logic-controlled shutdown mode is provided for power saving. The low battery detector can be also configured as a linear regulator.
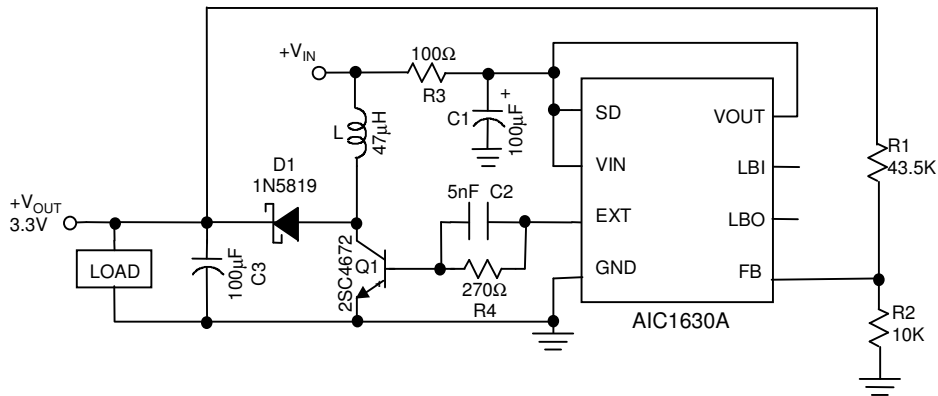
120KHz switching rate reduces the inductor size. Inductors of 22µH to 47µH inductance are recommended for most applications.

■ TYPICAL APPLICATION CIRCUIT
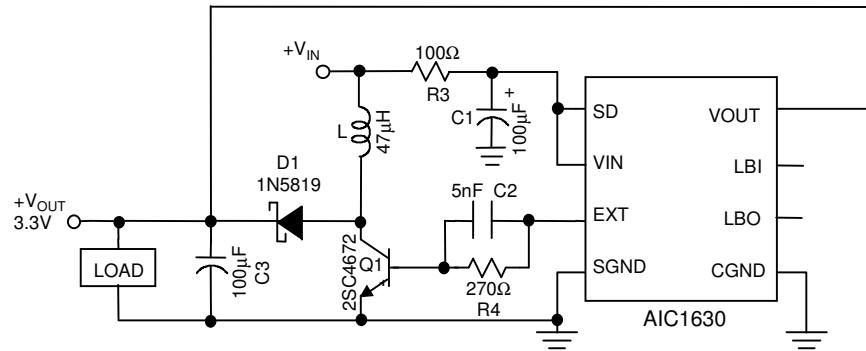
Note : $V_{IN} \geq$ 1.8V , $V_{OUT} \leq$ 7V

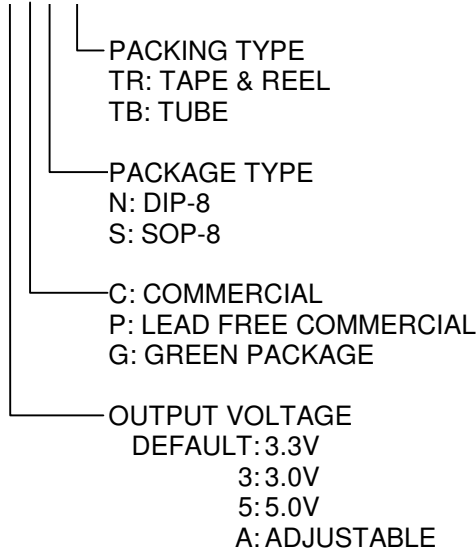**High Efficiency Step-Up DC/DC Converter**
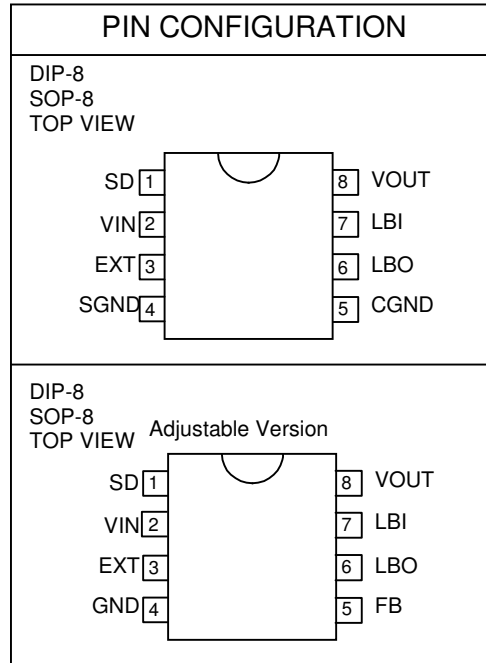

Note : $V_{IN} \geq$ 2.2V

High Efficiency Step-Up DC/DC Converter

■ ORDERING INFORMATION

AIC1630-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: AIC1630-3CSTR
  → 3.0V Version, in SOP-8 Package & Tape & Reel Packing Type

PIN CONFIGURATION

DIP-8
SOP-8
TOP VIEW

SD	1	8	VOUT
VIN	2	7	LBI
EXT	3	6	LBO
SGND	4	5	CGND

DIP-8
SOP-8
TOP VIEW   Adjustable Version

SD	1	8	VOUT
VIN	2	7	LBI
EXT	3	6	LBO
GND	4	5	FB

■ ABSOLUTE MAXIMUM RATINGS

Supply Voltage 7.0V

DC Voltage Applied On All Other Pins 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		1.8		7	V
Output Voltage	I_L=200mA AIC1630 AIC1630-3 AIC1630-5	 3.16 2.88 4.80	 3.3 3.0 5.0	 3.44 3.12 5.20	V
Switch Off Current			105	140	μA
Shutdown Mode Current			7	15	μA
Recovery Time from Shutdown	V_{IN}=2.5V, I_L=200mA		0.4		mS
Efficiency	I_L=300mA Fig. 1 in Appl. Examples		85		%
Line Regulation	V_{IN}=2.2~3.3V V_{OUT}=5V, I_L=100mA		0.6		%V_{OUT}
Load Regulation	I_L=10mA~500mA V_{OUT}=5V		2.5		%V_{OUT}
Oscillator Frequency		90	120	150	KHz
LBI Pin Trip Point		1.17	1.22	1.27	V
FB Threshold Voltage	AIC1630A	0.598	0.617	0.636	V
EXT Pin Driving Capability	Pin 8=5V Sourcing, Pin 3= 0.85V Sinking, Pin 3= 4.15V		 80 50		 mA mA
LBO "ON Resistance"	V_{IN}=2V		45		Ω
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
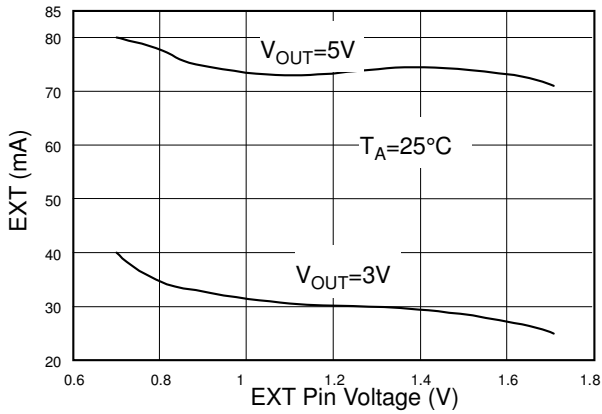
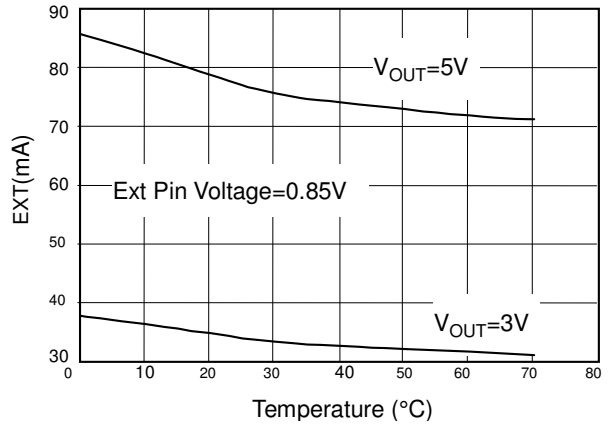Fig. 1   Ext Pin Sourcing Capability

Fig. 2   Ext Pin Sourcing Capability vs. Temperature
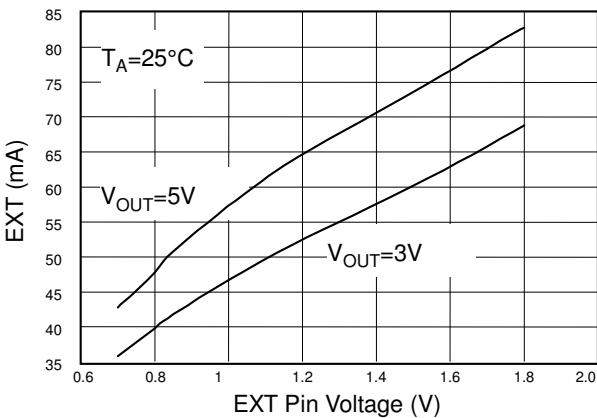

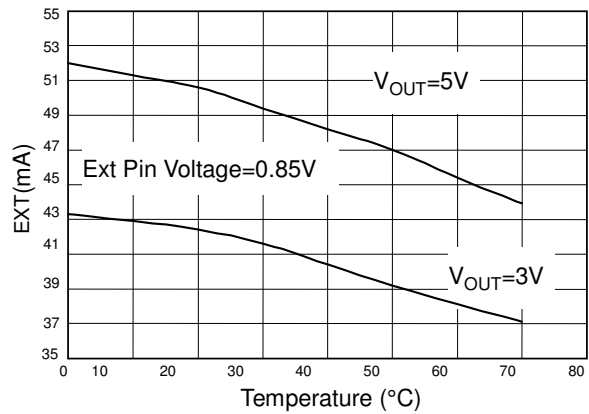Fig. 3   Ext Pin Sinking Capability

Fig. 4   Ext Pin Sinking Capability vs. Temperature
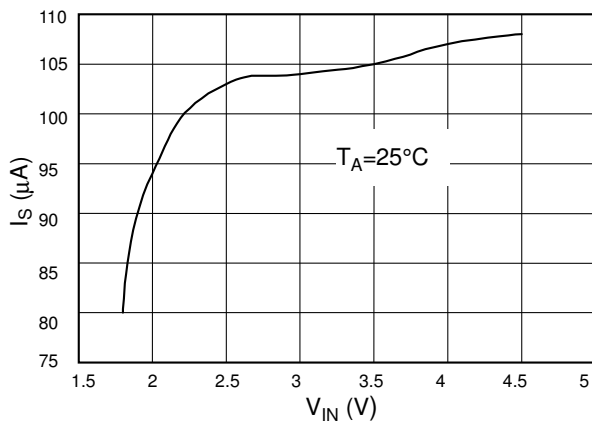

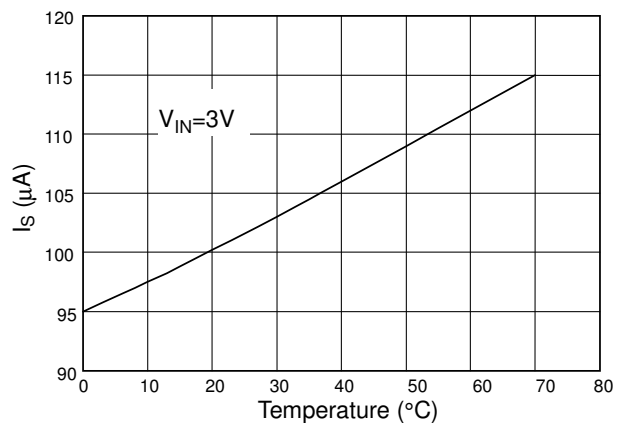Fig. 5   Switch off Supply Current vs. Input Voltage

Fig. 6   Switch Off Supply Current vs. Temperature
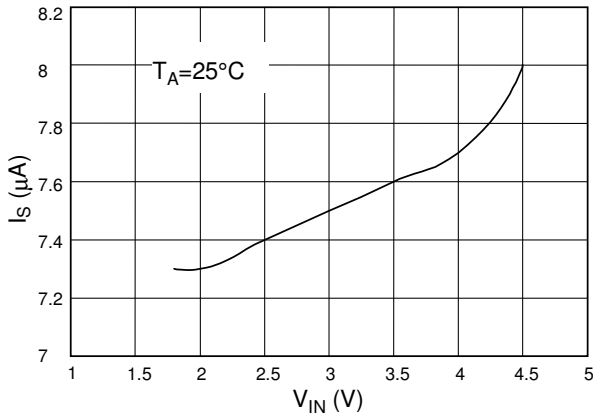
■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)
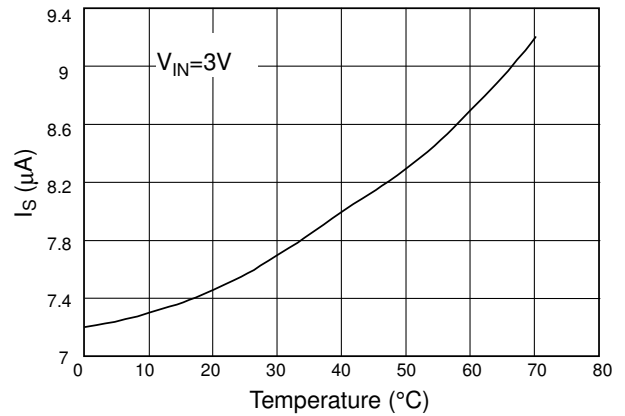
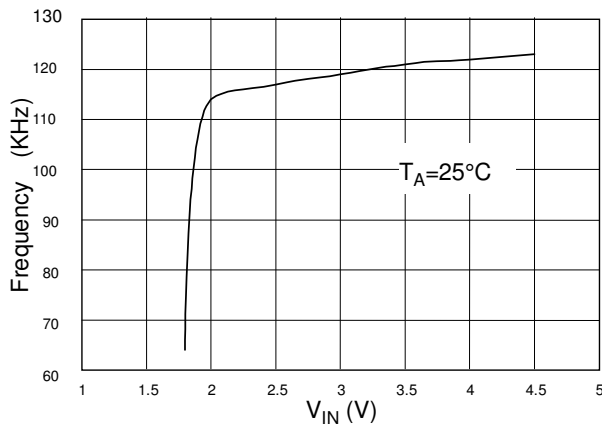Fig. 7 Shutdown Mode Supply Current vs. Input Voltage

Fig. 8 Shutdown Mode Supply Current vs. Temperature
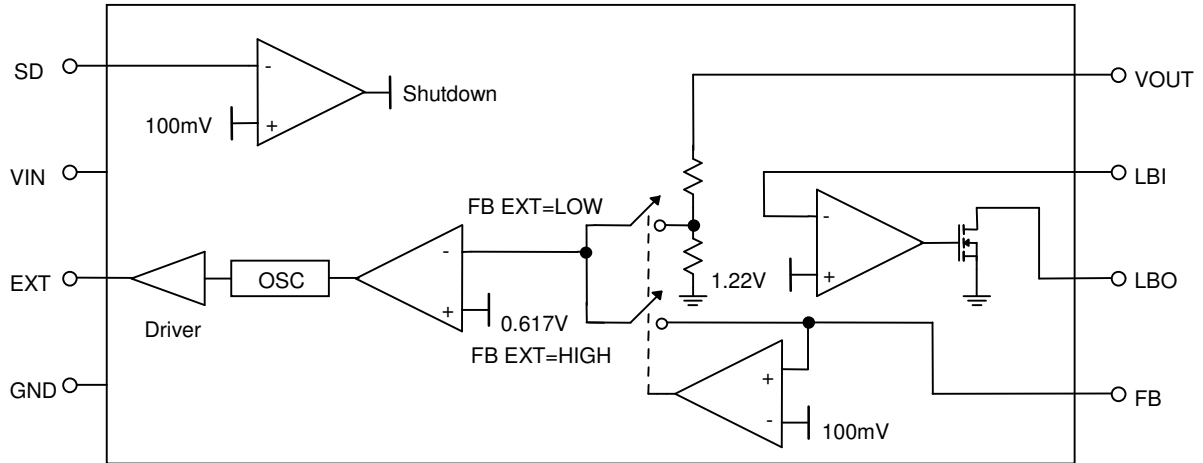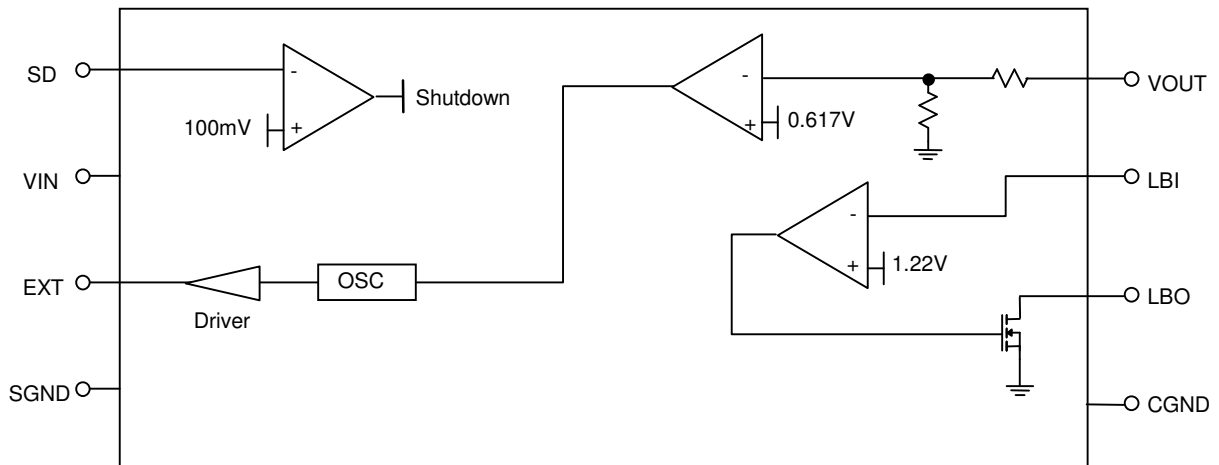
Fig. 9 Oscillator Frequency vs. Input Voltage
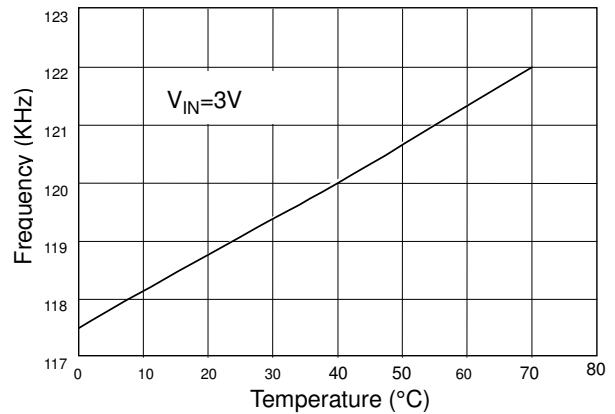
Fig. 10 Oscillator Frequency vs. Temperature

BLOCK DIAGRAM

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

AIC1630A

AIC1630-3/AIC1630/AIC1630-5

■ PIN DESCRIPTIONS

AIC1630-3/ AIC1630 / AIC1630-5

PIN 1: SD   - The AIC1630 goes in shutdown mode and consumes less than 10 μA when SD pin is pulled to ground and it goes in normal operating mode when the SD pin is pulled to a positive voltage above 100mV.

PIN 2: VIN   - Input supply.

PIN 3: EXT   - Push-pull drive output to drive external power switch.

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.

AIC1630A

PIN 1: SD   - The AIC1630A goes in shutdown mode and consumes less than 10μA when SD pin is pulled to ground and it goes in normal operating mode when the SD pin is pulled to a positive voltage above 100mV.

PIN 2: VIN   - Input supply.

PIN 3: EXT   - Push-pull drive output to drive external power switch.

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:

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

    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 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. 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.
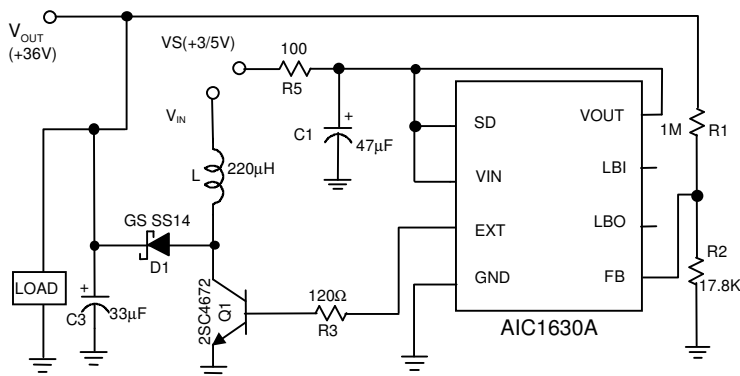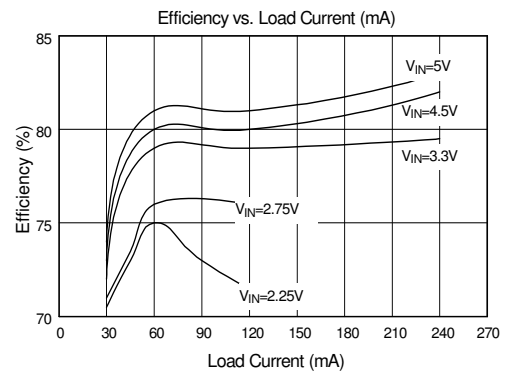
APPLICATION EXAMPLES
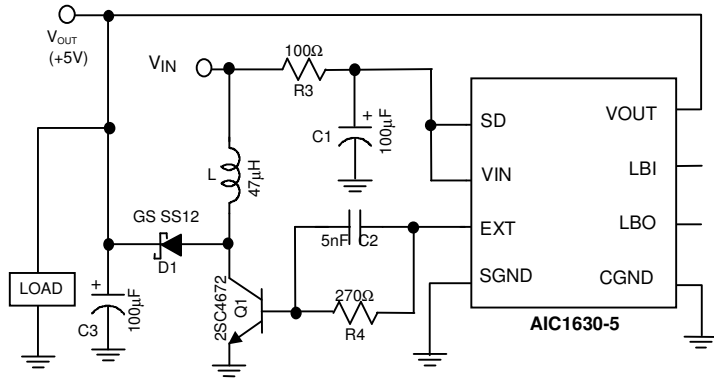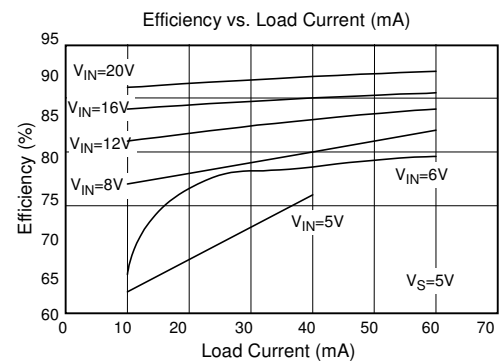

Fig. 11   5V Output Step-Up Converter
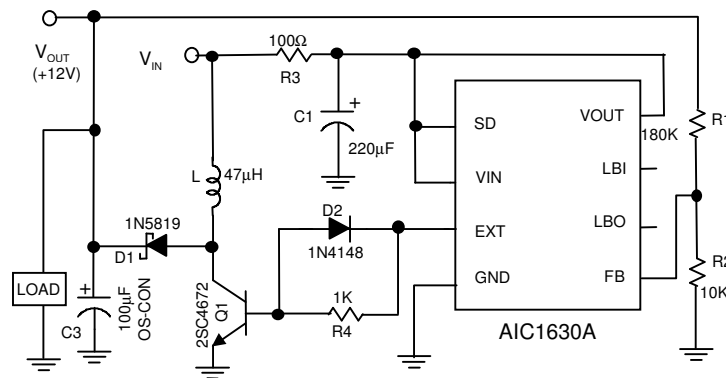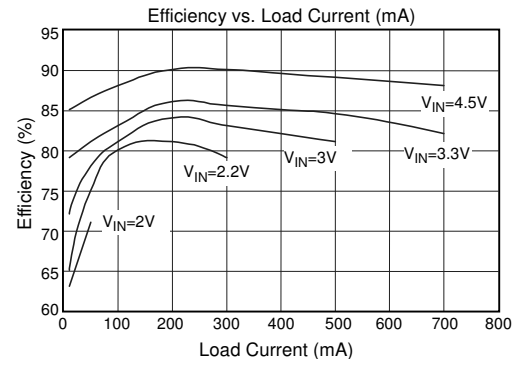
Note : V_{IN} ≥ 2.2V

Fig. 12   12V Output Step-Up Converter for Flash Memory

Fig. 13   36V Output Step-Up Converter for Color LCD
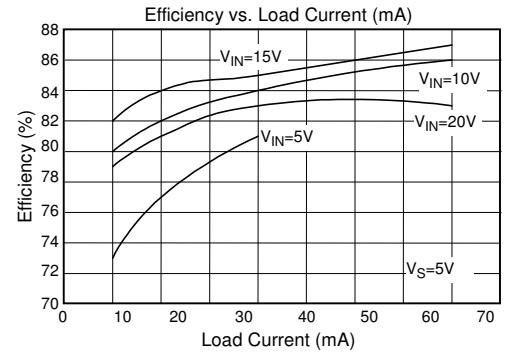
AIC1630

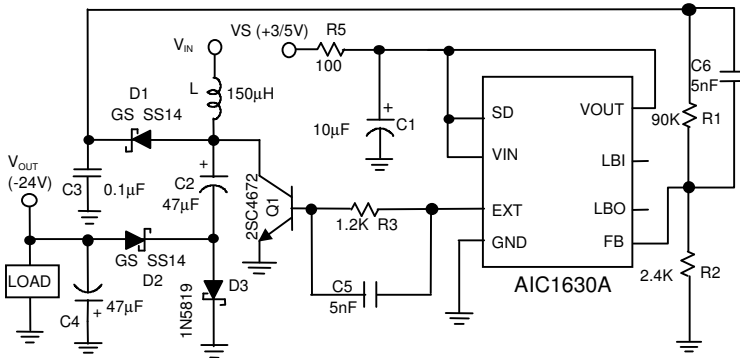## ■ APPLICATION EXAMPLES (Continued)

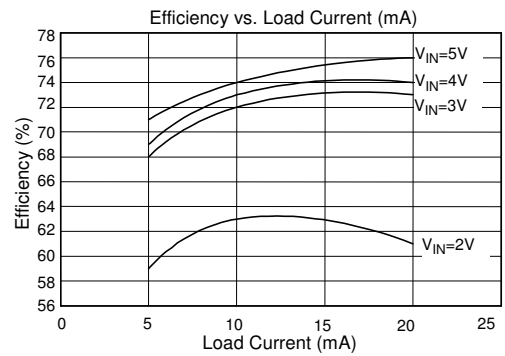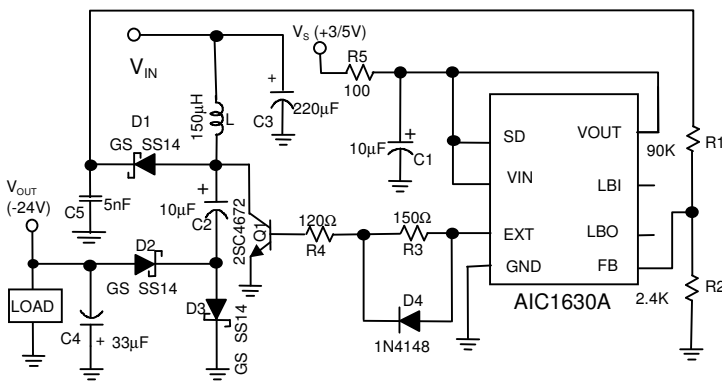**Fig. 14   -24V Output Inverting Converter for LCD**

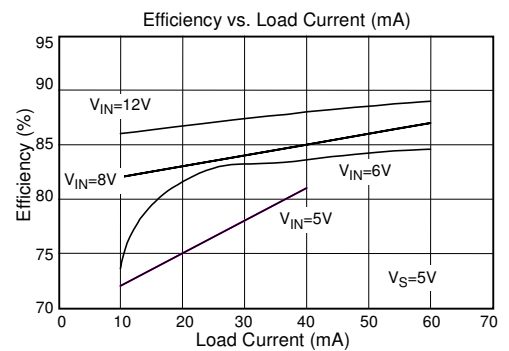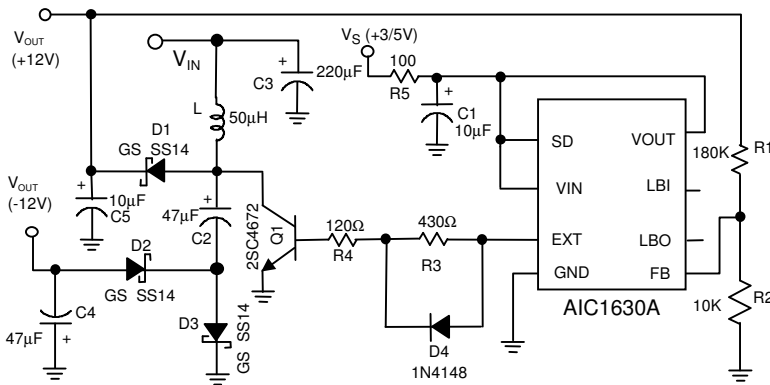**Fig. 15   2V Input 20mA Load -24V Output Inverting Converter for LCD**

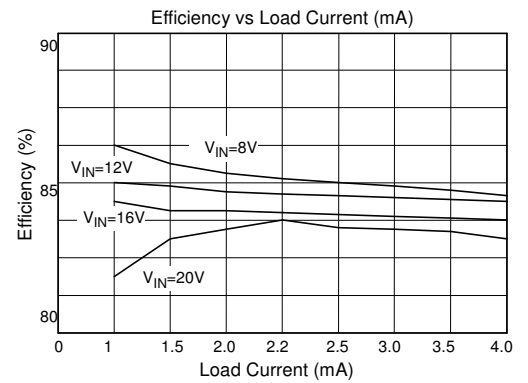**Fig. 16   12V Dual Output Converter for computer for computer Interfacing**
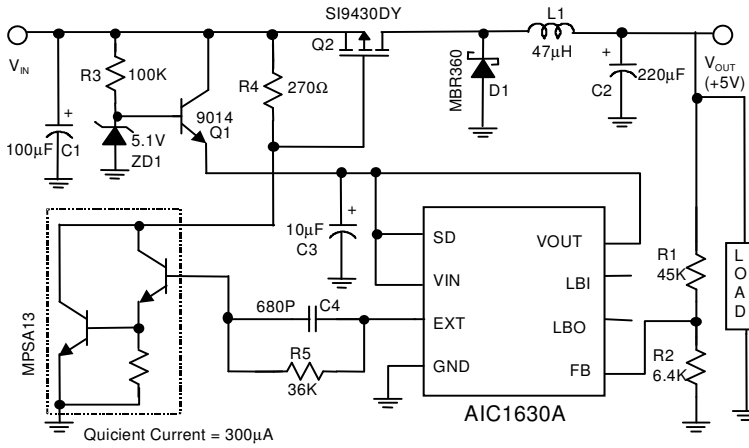
10

APPLICATION EXAMPLES (Continued)

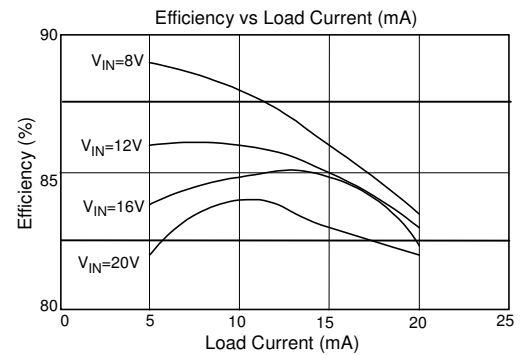**Fig. 17   5V Output Step-Down Converter -1**
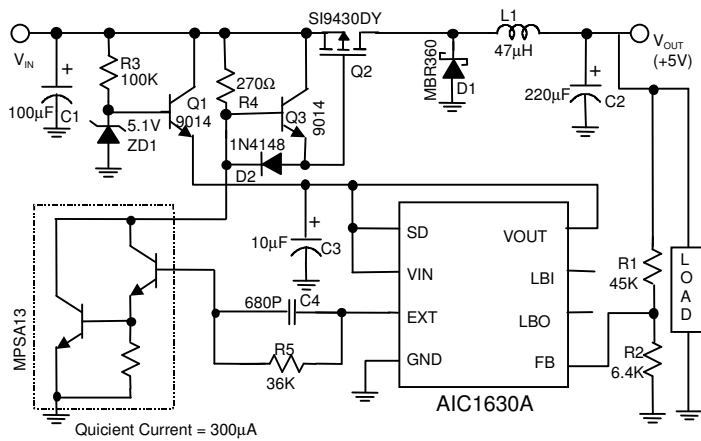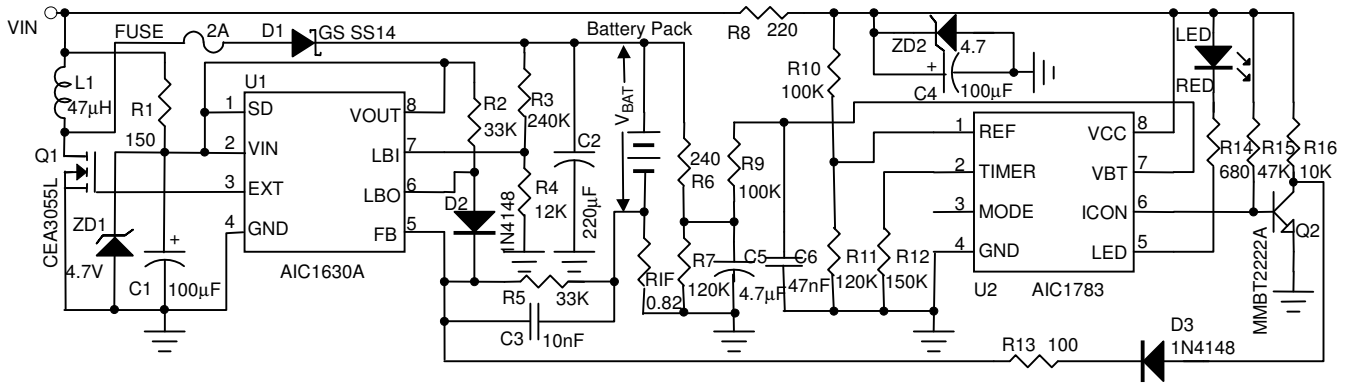

Fig. 18   5V Output Step-Down Converter -2

APPLICATION EXAMPLES (Continued)

Note: V_{IN} must be lower than V_{BAT}.

R_{IF} sets the Charging Current, $I_{CHARGE} = 0.617V/R_{IF}$

Short Circuit Condition is protected with a 2A Fuse.

Fig. 19 Step-Up Rechargeable Battery Charger
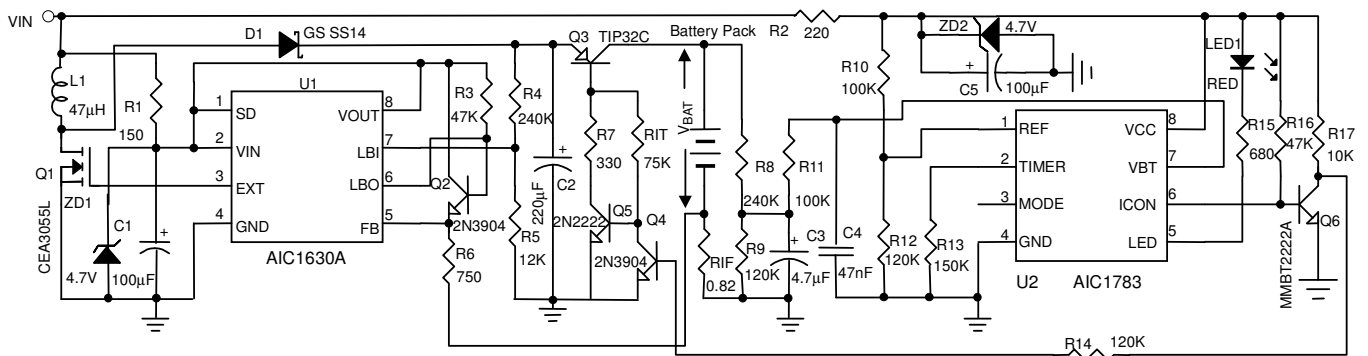
Note: Fast Charge Current $= 0.8A$ @$V_{IN} < VBAT$

$= (V_{IN} - V_{BAT} - 0.5)/0.82$ @$V_{IN} > V_{BAT}$

Trickle charge Current $= 30mA$.

R_{IF} sets Fast Charge Current, R_{IT} sets Trickle Charge Current

Fig. 20   Step-Up/Down Rechargeable Battery Charger

$\mathbb{Q}\mathbb{I}\mathbb{D}$ **aic**

■ **APPLICATION EXAMPLES** (Continued)

Fig. 21   SEPIC Circuit of the DC-DC Converter

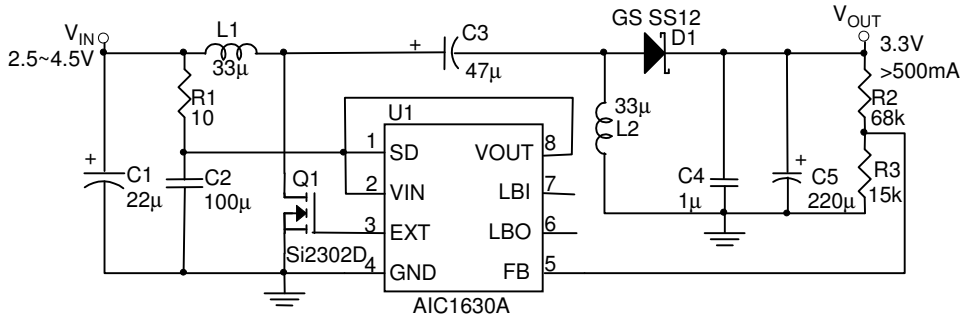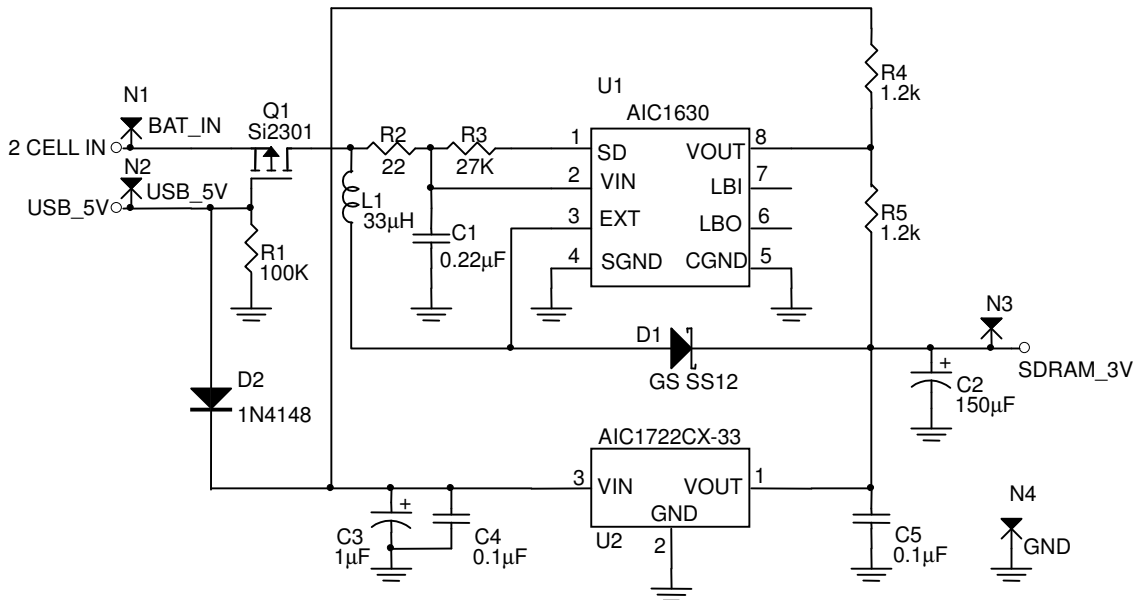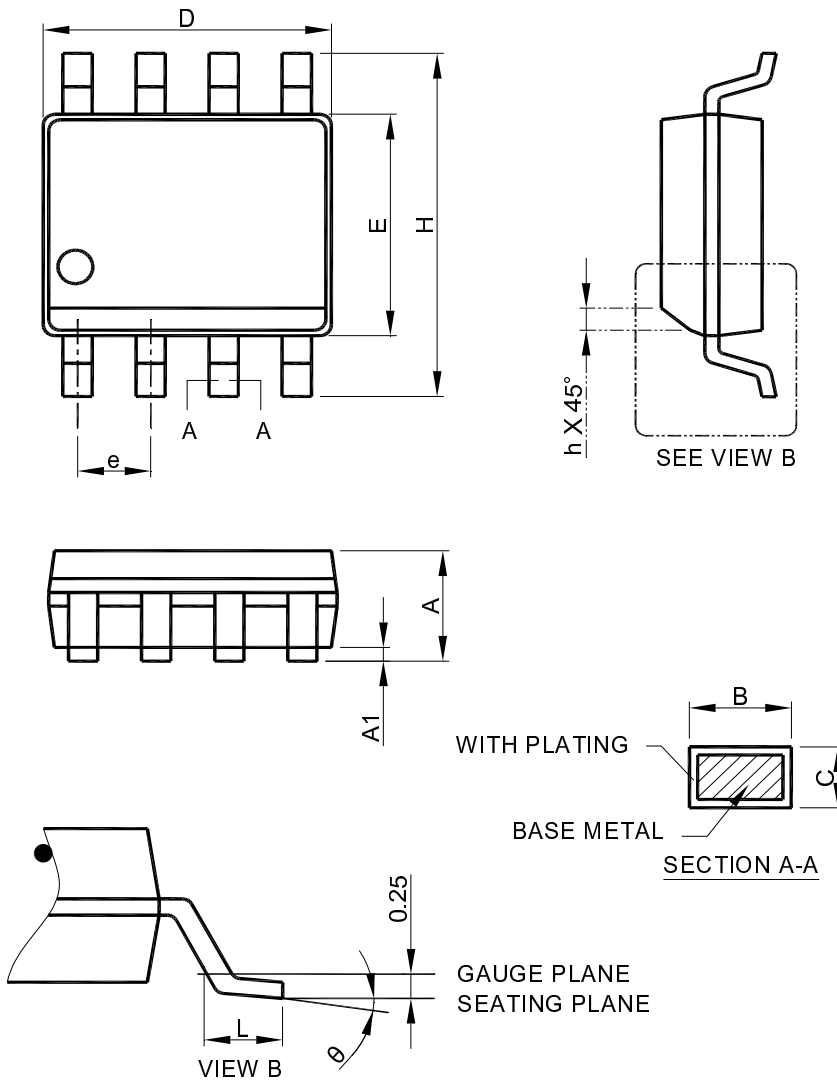**Fig. 22   USB dual Input Application of SDRAM**

■ PHYSICAL DIMENSION (unit: mm)

● **SOP-8**

SEE VIEW B

WITH PLATING

BASE METAL

SECTION A-A

GAUGE PLANE
SEATING PLANE

VIEW B

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.
4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

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°
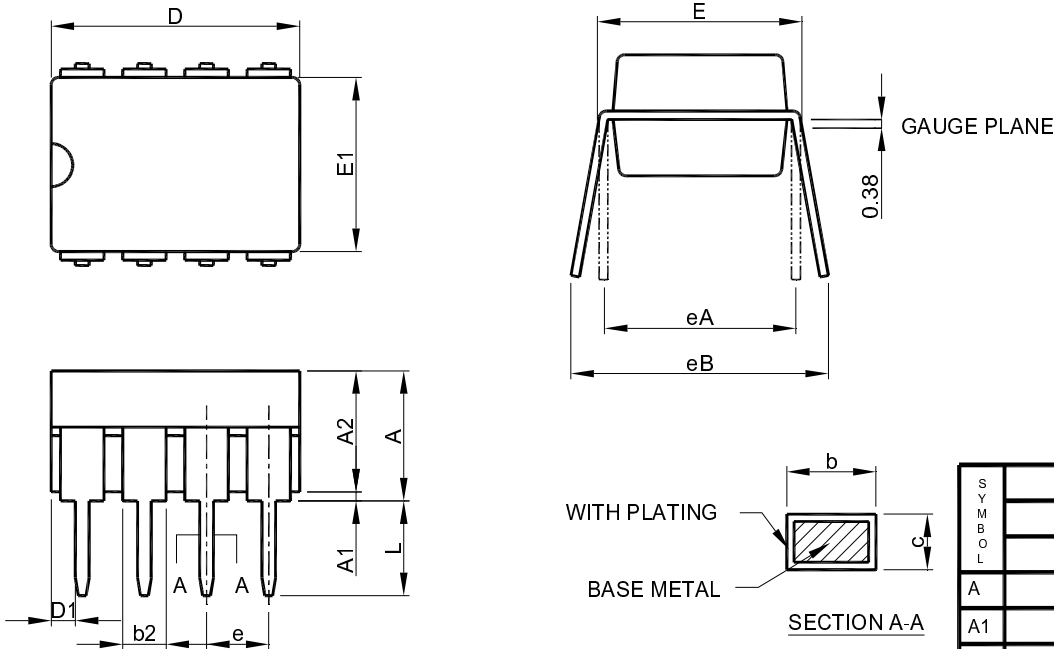
DIP-8

S Y M B O L	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" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 10 mil per side .
3. Dimension "D1"and "E1" do not include inter-lead flash or protrusions.
4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

Note:

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Life Support Policy: AIC does not authorize any AIC product for use in life support devices and/or systems. Life support devices or systems are devices or systems which, (I) are intended for surgical implant into the body or (ii) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.