

## 500mA Step-Up DC/DC Converter

### FEATURES

- High Efficiency 90%.
- Adjustable Output Voltage with Two Resistors (SS6631A)
- Power-Saving Shutdown Mode (7 $\mu$ A 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.

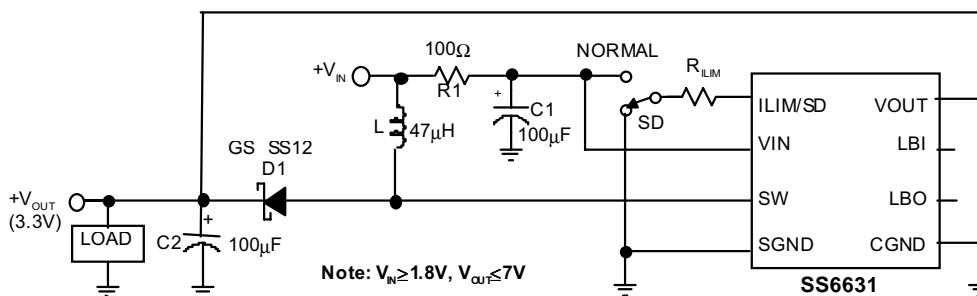
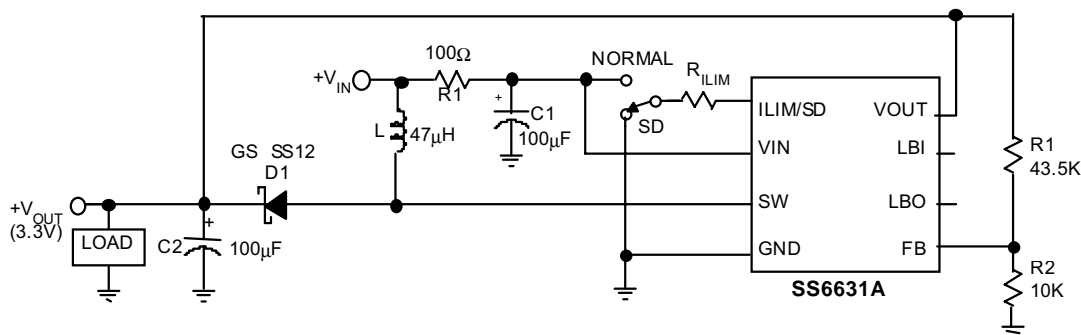
### DESCRIPTION

The SS6631 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 SS6631A. 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 25 $\mu$ H to 50 $\mu$ H inductance are recommended for most applications.

### TYPICAL APPLICATION CIRCUIT



High Efficiency Step-Up DC/DC Converter

## ORDERING INFORMATION

SS6631-XCXXX

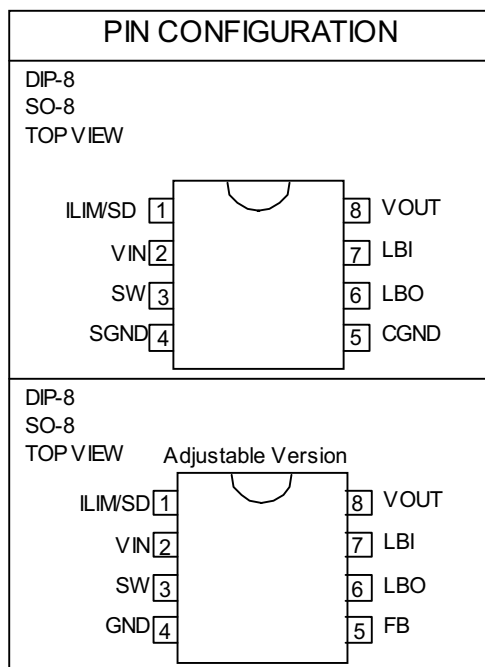
PACKING TYPE  
TR: TAPE & REEL  
TB: TUBE

PACKAGE TYPE  
N: PLASTIC DIP  
S: SMALL OUTLINE

OUTPUT VOLTAGE  
DEFAULT: 3.3V  
3: 3.0V  
5: 5.0V  
A: ADJUSTABLE

EX: SS6631-3CSTR

→ 3.0V Version, in SO8 Package & Tape & Reel Packing Type



## 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 ( $V_{IN}=3.0V$ , $T_A=25^\circ C$ , unless otherwise specified.)

PARAMETER	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Input Voltage	Fig. 14 in Appl. Examples	1.5		7	V
Output Voltage	$I_{LOAD} = 200mA$ SS6631	3.16	3.3	3.44	V
	SS6631-3	2.88	3	3.12	
	SS6631-5	4.80	5	5.20	
Switch off Current			105	140	$\mu A$
No Load Current	SS6631/6631-3		160		$\mu A$
	SS6631-5		180		
Shutdown Mode Current			7	15	$\mu A$

**ELECTRICAL CHARACTERISTICS (Continued)**

PARAMETER	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Shutdown Recovery Time	$V_{IN}=2.5V$ , $I_{LOAD}=200mA$		0.4		mS
Efficiency	$I_{LOAD}=200mA$ SS6631/6631-3 SS6631-5		87 90		%
Line Regulation	$I_{LOAD}=100mA$ SS6631, $V_{IN}=1.8 \sim 3.3V$ SS6631-3, $V_{IN}=1.8 \sim 3V$ SS6631-5, $V_{IN}=2.2 \sim 3.3V$		0.6 0.5 0.8		% $V_{OUT}$
Load Regulation	$I_{LOAD}=10\sim 300mA$ SS6631/6631-3 SS6631-5		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	SS6631A	0.598	0.617	0.636	V
SW "ON Resistance"	SS6631/6631-3 SS6631-5		0.5 0.4		$\Omega$
LBO "ON Resistance"	$V_{IN}=2V$		45		$\Omega$
SW Off Leakage				1	$\mu A$
Input Pin Bias Current				10	nA/Pin
Output Pin Leakage				10	nA/Pin

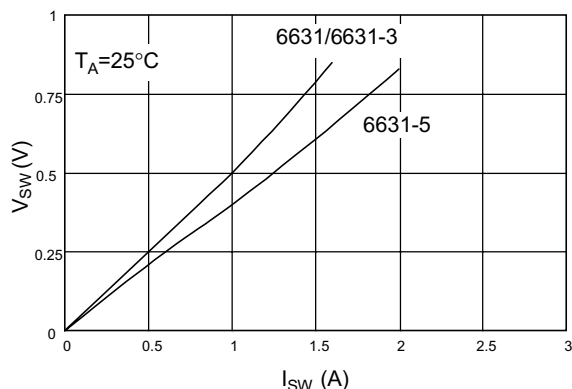
**TYPICAL PERFORMANCE CHARACTERISTICS**


Fig. 1 Switch Voltage vs. Current

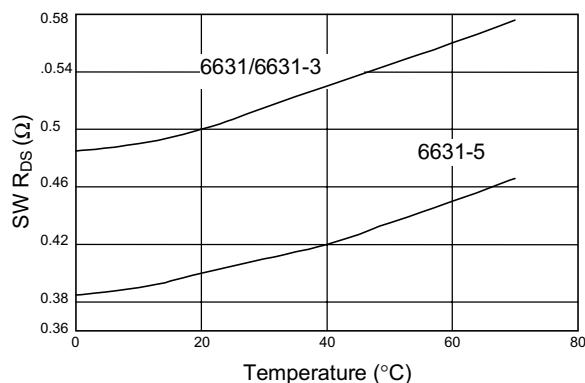


Fig. 2 SW ON Resistance vs. Temperature

**TYPICAL PERFORMANCE CHARACTERISTICS (Continued)**

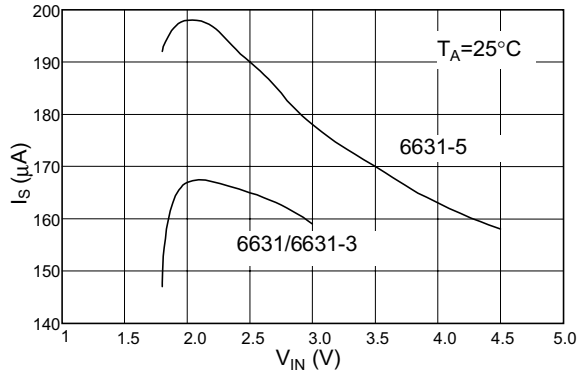


Fig. 3 No Load Supply Current vs. Input Voltage

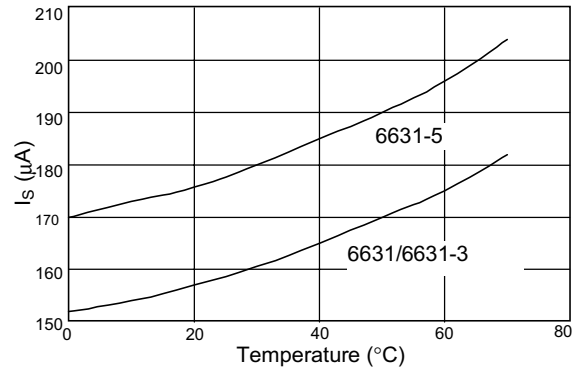


Fig. 4 No Load Supply Current vs. Temperature

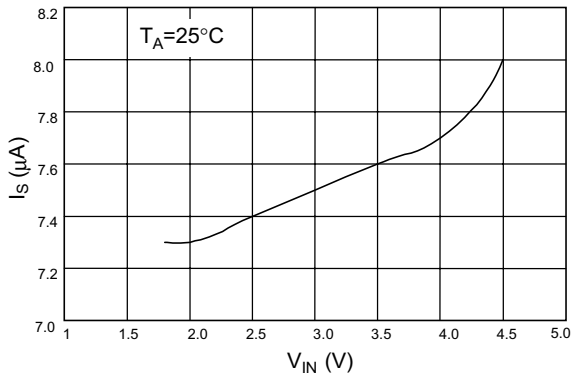


Fig. 5 Shutdown Mode Supply Current vs. Input Voltage

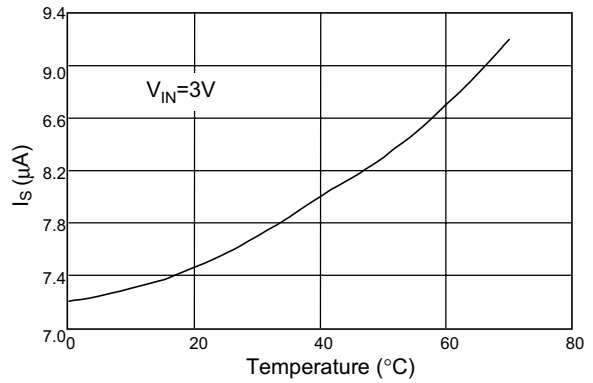


Fig. 6 Shutdown Mode Supply Current vs. Temperature

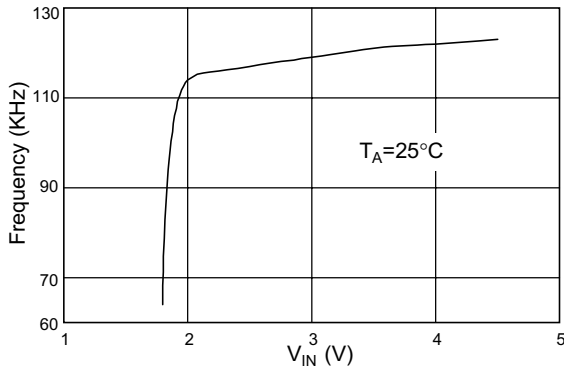


Fig. 7 Oscillator Frequency vs. Input Voltage

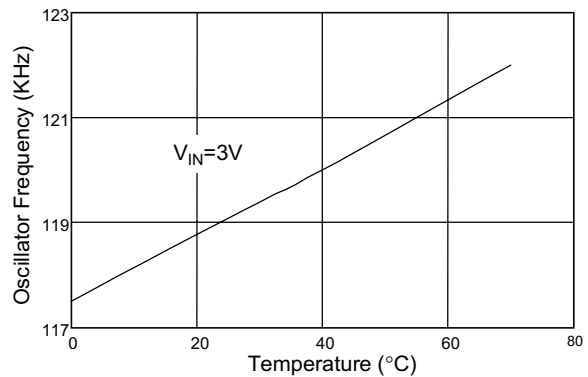


Fig. 8 Oscillator Frequency vs. Temperature

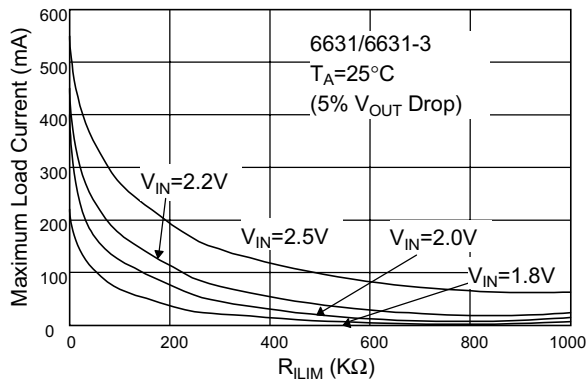
**■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)**


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

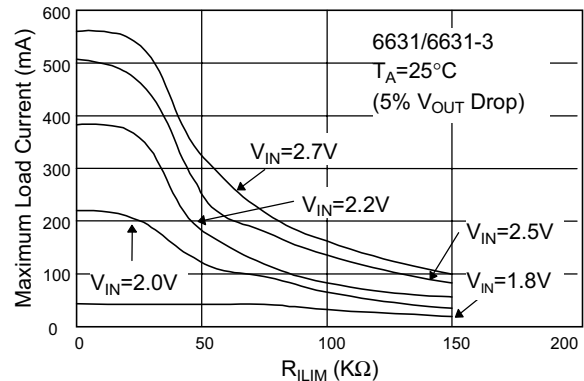
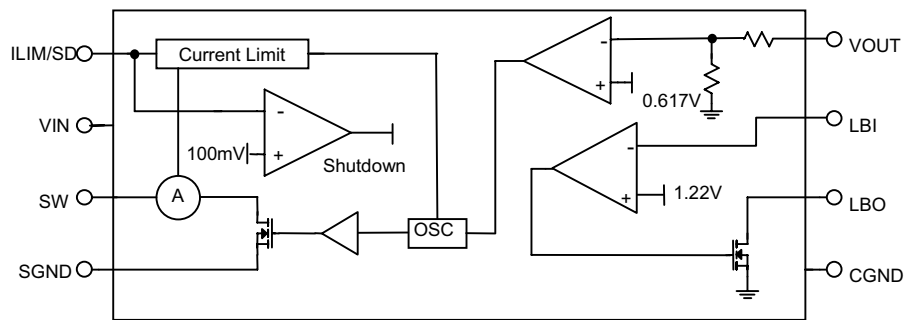
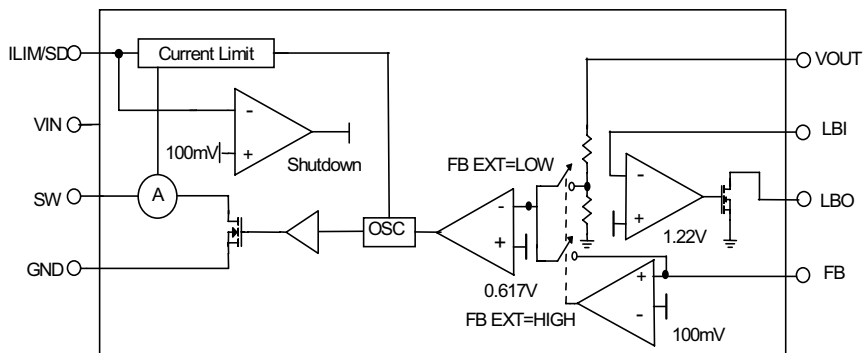


Fig. 10 Maximum Load Current vs. Switch Current Limit Resistance

**■ BLOCK DIAGRAM**


SS6631/6631-3/6631-5



The driver and reference (0.617V and 1.22V) for SS6631A are based on VOUT pin. And VOUT must be  $\geq 2.2\text{V}$  then system can operate normally.

SS6631A

## ■ PIN DESCRIPTIONS

### SS6631/-3/-5

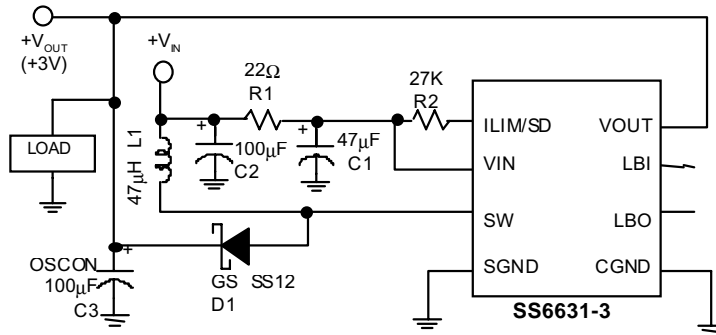
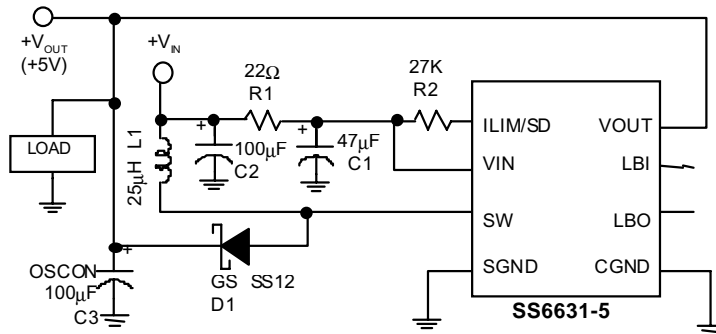
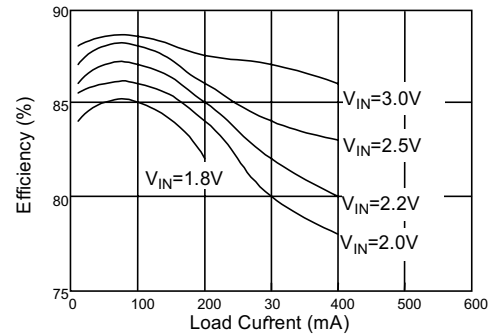
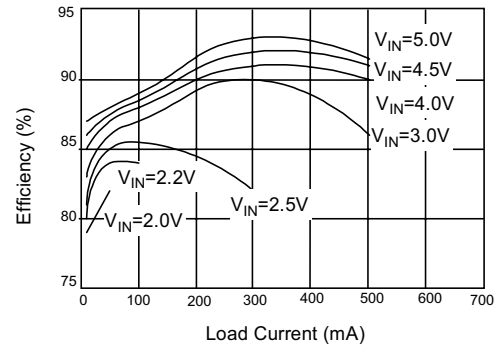
- PIN 1: ILIM/SD- 1. Connected to VIN pin through a resistor to set the switch peak current. It serves to protect IC and inductor, as well as to improve efficiency and output ripples. However, supply capability of the SS6631 is limited by the current limit resistor. (See typical performance characteristics). The ILIM/SD pin should be shorted to VIN pin if limiting on switch peak current is not intended.
2. The SS6631 goes in shut-down mode and consumes less than 10 $\mu$ A 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 45 $\Omega$  "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.

### SS6631A

- 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 SS6631A 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 SS6631A goes in shut-down mode and consumes less than 10 $\mu$ A 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:
- $$\frac{R1}{R2} = \frac{VOUT}{0.617} - 1$$
- 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 45 $\Omega$  "ON resistance" at  $V_{IN}=2V$ . It is pulled low when the voltage on LBI pin is below 1.22V.

**SS6631A (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)

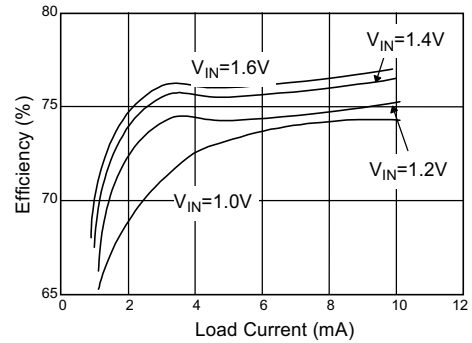
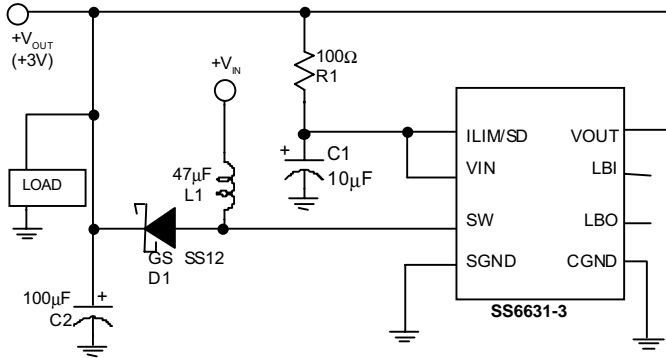


Fig. 13 1-Cell Input 3V Output Step-Up Converter

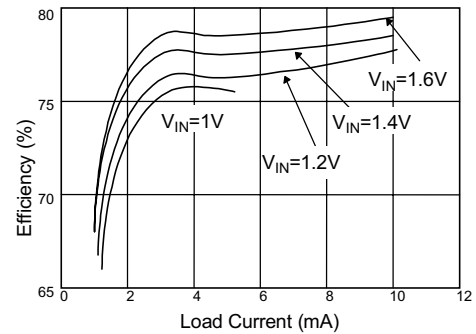
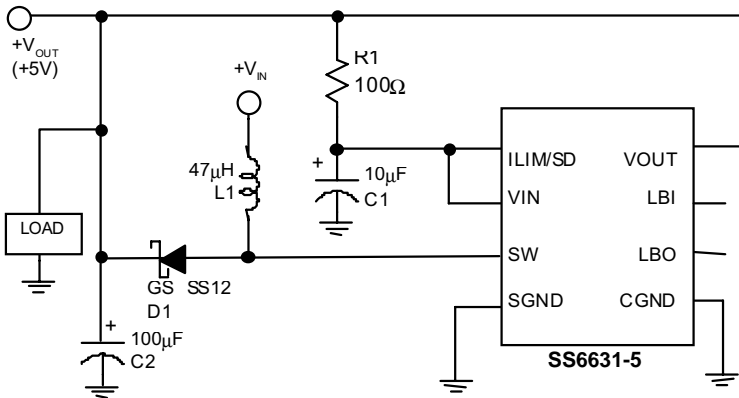
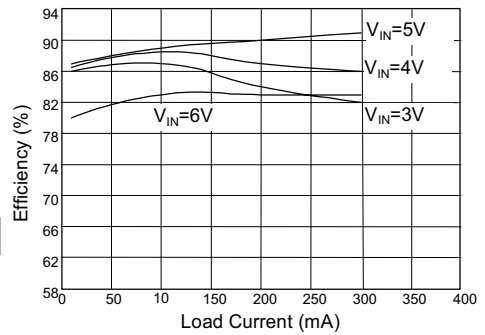
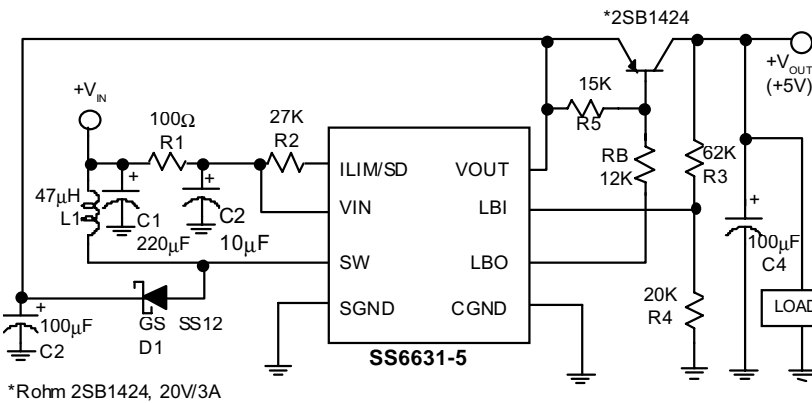


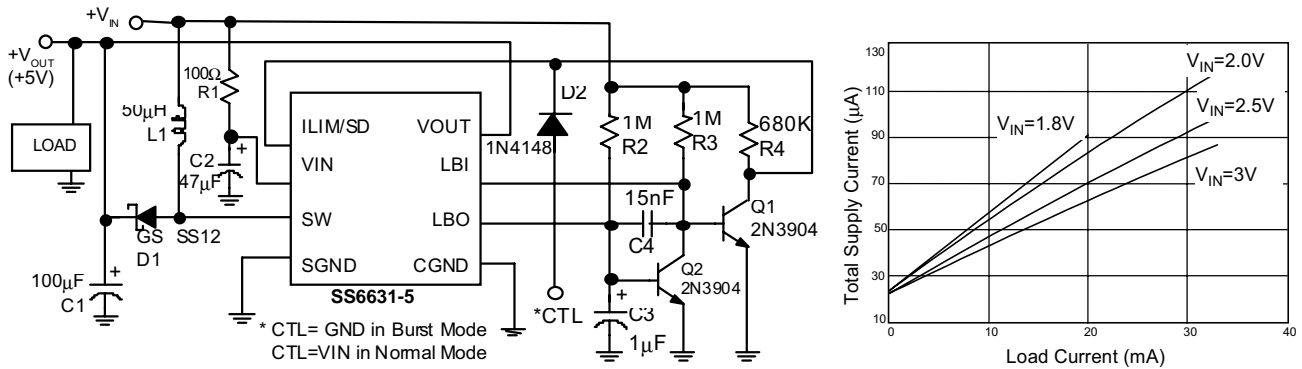
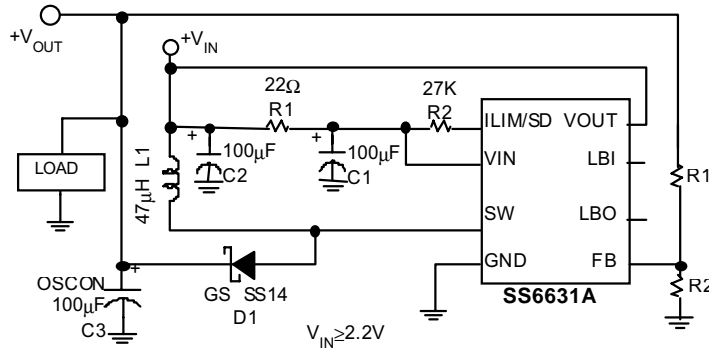
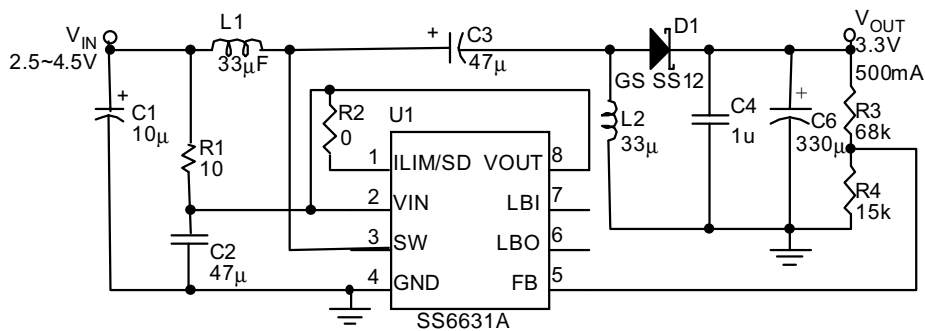
Fig. 14 1-Cell Input 5V Output Step-Up Converter

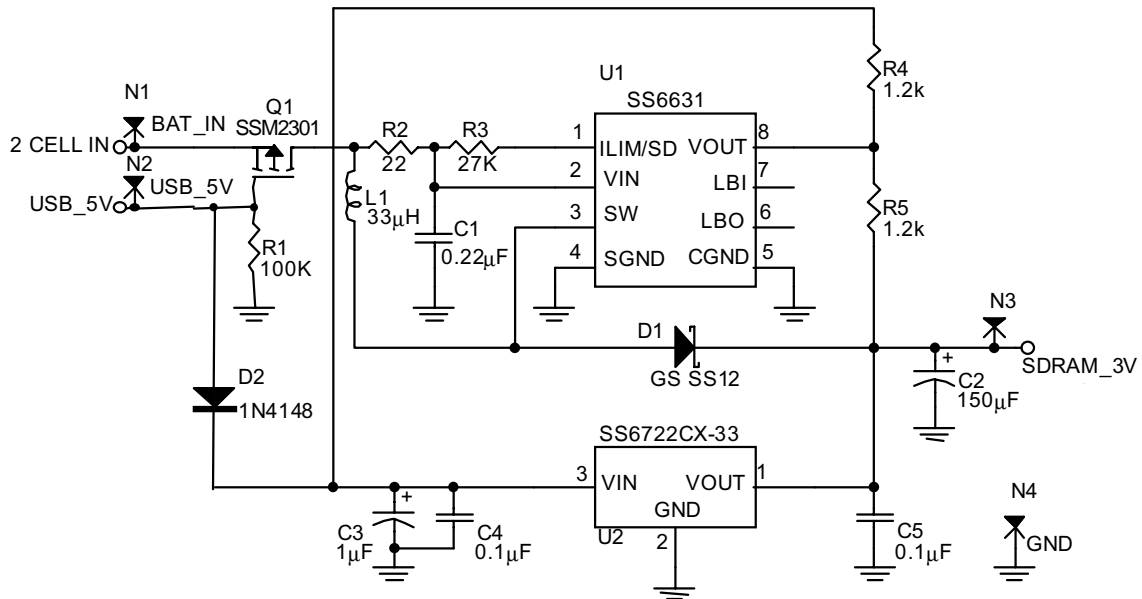


\*Rohm 2SB1424, 20V/3A

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

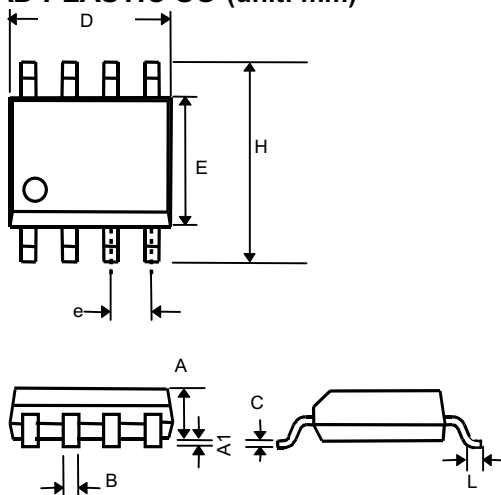


**APPLICATION EXAMPLES (Continued)**

**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**

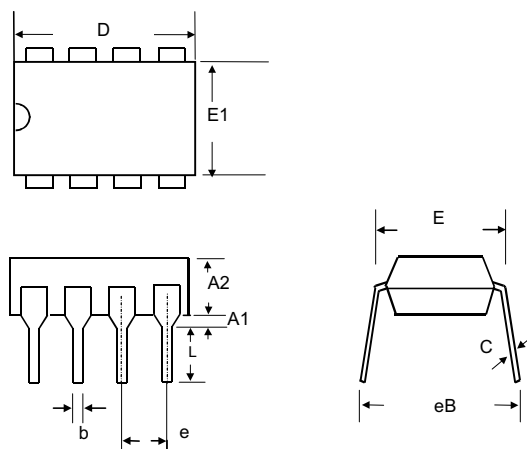
## ■ PHYSICAL DIMENSION

### ● 8 LEAD PLASTIC SO (unit: mm)



SYMBOL	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(TYP)	
H	5.80	6.20
L	0.40	1.27

### ● 8 LEAD PLASTIC DIP (unit: mm)



SYMBOL	MIN	MAX
A1	0.381	—
A2	2.92	4.96
b	0.35	0.56
C	0.20	0.36
D	9.01	10.16
E	7.62	8.26
E1	6.09	7.12
e	2.54 (TYP)	
eB	—	10.92
L	2.92	3.81

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