

## 200mA Step-Up DC/DC Converter

### FEATURES

- High Efficiency Up To 87%.
- Adjustable Output Voltage with Two Resistors (SS6633A)
- Power-Saving Shutdown Mode (7 $\mu$ A 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.

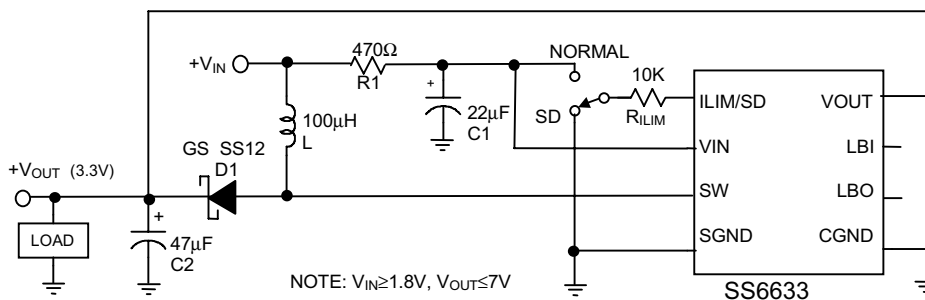
### DESCRIPTION

The SS6633 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 SS6633A. 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.

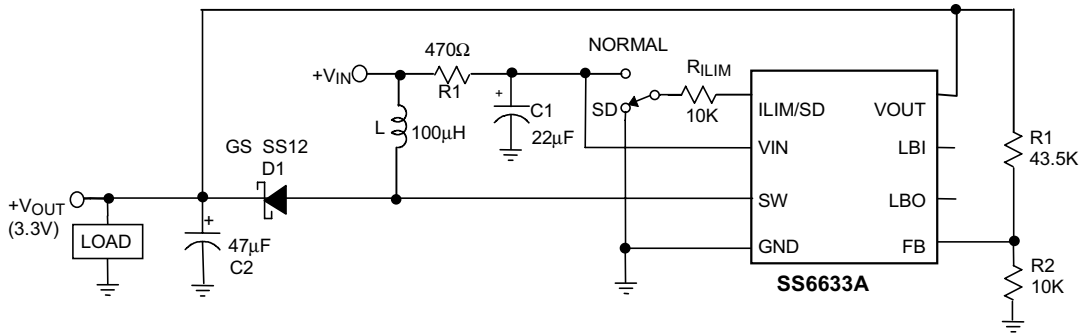
120KHz switching rate reduces the inductor size. Inductors of 47 $\mu$ H to 150 $\mu$ H inductance are recommended for most applications.

### TYPICAL APPLICATION CIRCUIT



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

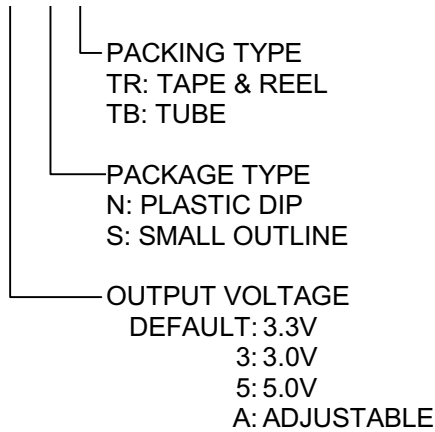
## TYPICAL APPLICATION CIRCUIT (Continued)



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

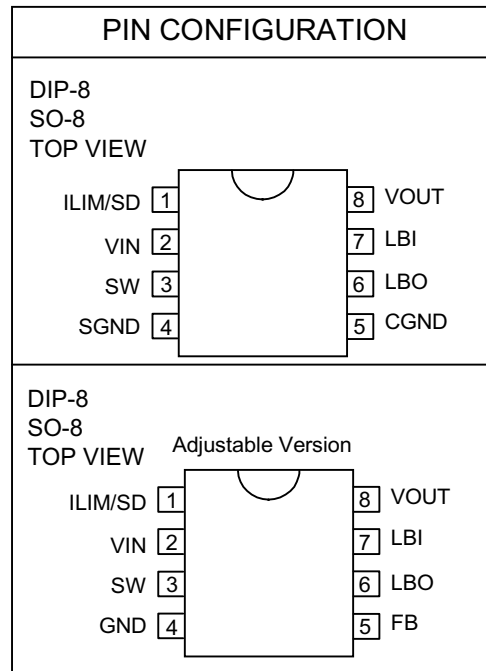
## ORDERING INFORMATION

SS6633-XCXXX



EX: SS6633-3CSTR

→ 3.0V Version, in SO8 Package & Tape & Reel Packing Type  
(CN is not available in TR 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		1.8		7	V
Output Voltage	$I_{LOAD} = 70mA$ SS6633 SS6633-3 SS6633-5	3.16 2.88 4.80	3.3 3 5	3.44 3.12 5.20	V
Switch off Current			105	140	$\mu A$
No Load Current	SS6633/SS6633-3 SS6633-5		160 250		$\mu A$
Shutdown Mode Current			7	15	$\mu A$
Shutdown Recovery Time	$V_{IN}=2.5V$ , $I_{LOAD} = 70mA$		1.8		mS
Efficiency	$I_{LOAD} = 70mA$ SS6633/SS6633-3 SS6633-5		87 86		%
Line Regulation	$I_{LOAD} = 40mA$ SS6633, V <sub>IN</sub> = 2.0~3.3V SS6633-3, V <sub>IN</sub> = 2.0~3.0V SS-6633-5, V <sub>IN</sub> = 2.2~4.5V		0.6 0.6 0.5		%V <sub>OUT</sub>
Load Regulation	$I_{LOAD} = 170mA$ SS6633/SS6633-3 SS6633-5		0.6 0.5		%V <sub>OUT</sub>
Oscillator Frequency		90	120	150	KHz
LBI Pin Trip Point		1.17	1.22	1.27	V
FB Reference Voltage	SS6633A	0.598	0.617	0.636	V
SW "ON Resistance"	SS6633/SS6633-3 SS6633-5		1.75 1.25		$\Omega$
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

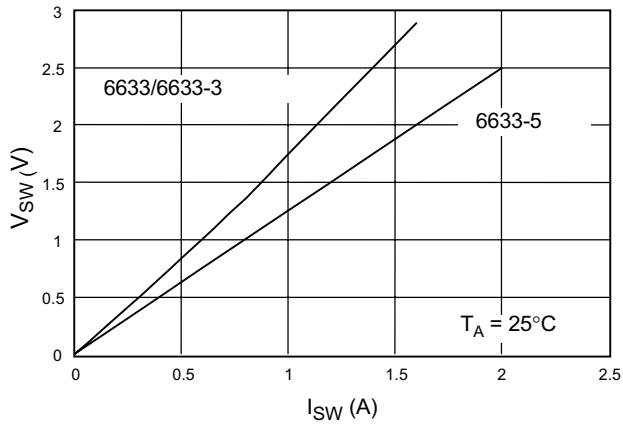


Fig. 1 Switch Voltage vs. Current

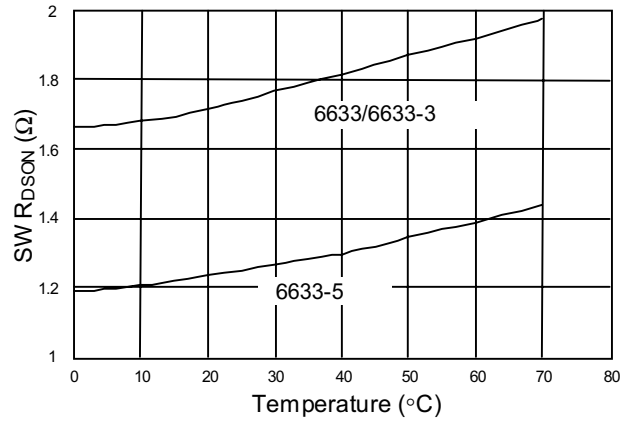


Fig. 2 SW ON Resistance vs. Temperature

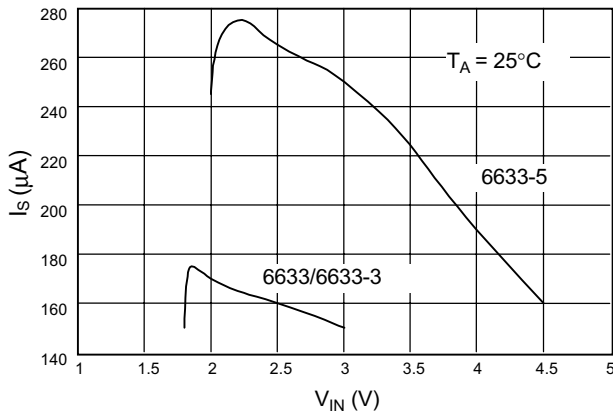


Fig. 3 No Load Supply Current vs. Input Voltage

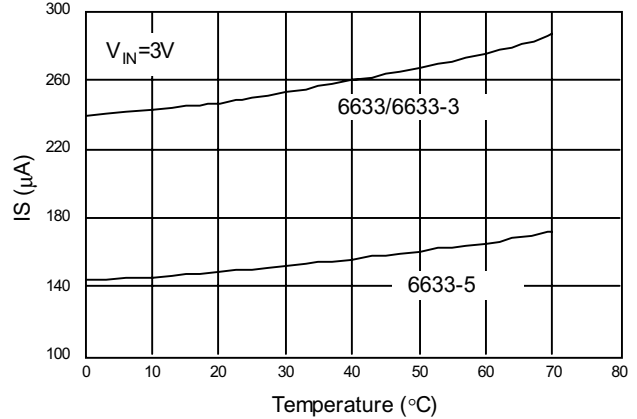


Fig. 4 No Load Supply Current vs. Temperature

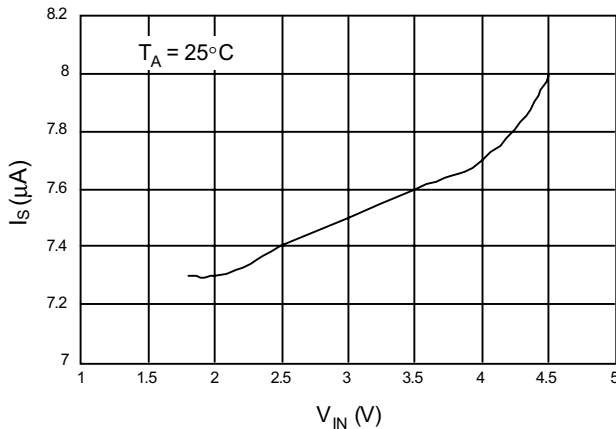


Fig. 5 Shutdown Mode Supply Current vs. Input Voltage

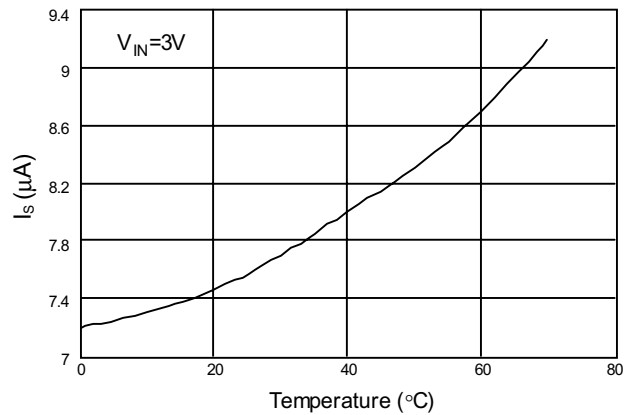


Fig. 6 Shutdown Mode Supply Current vs. Temperature

**TYPICAL PERFORMANCE CHARACTERISTICS (Continued)**

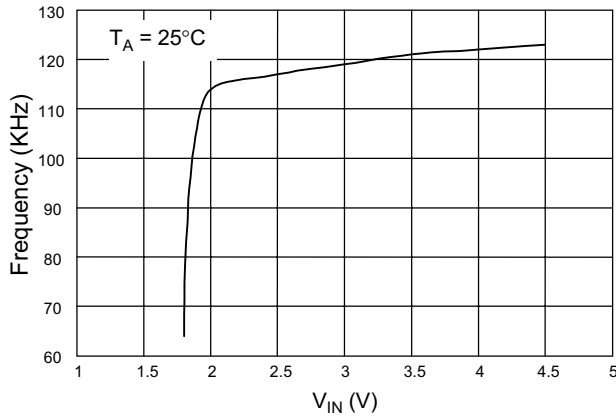


Fig. 7 Oscillator Frequency vs. Input Voltage

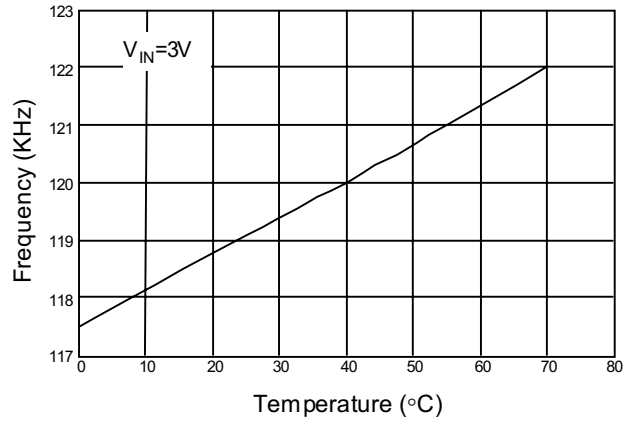


Fig. 8 Oscillator Frequency vs. Temperature

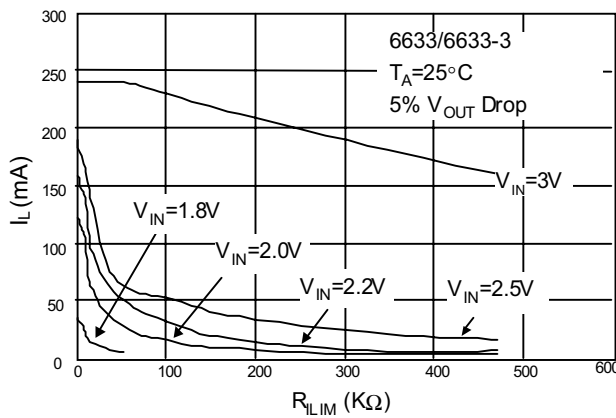


Fig. 9 Maximum Load Current vs. Switch Current Limit Resistance

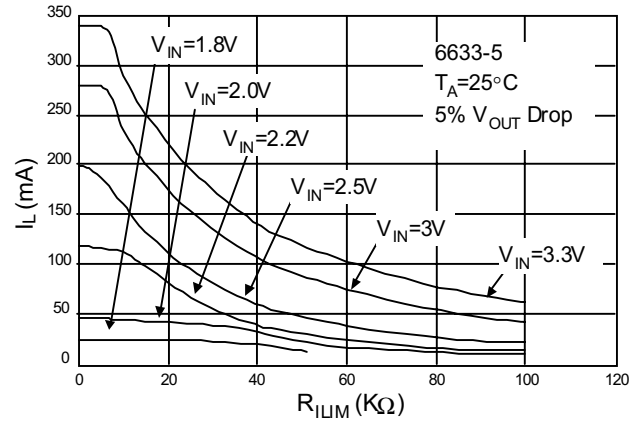
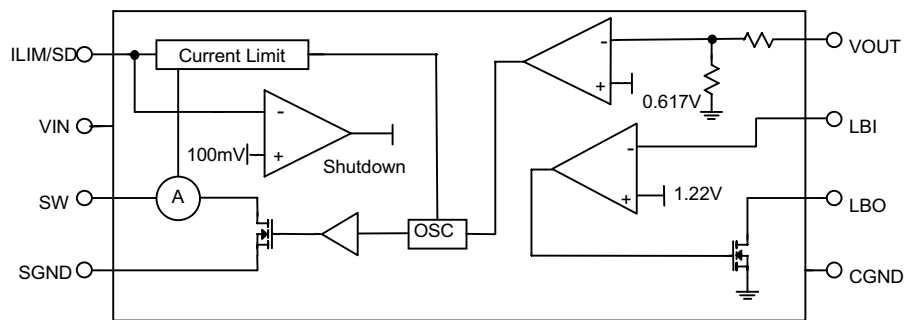


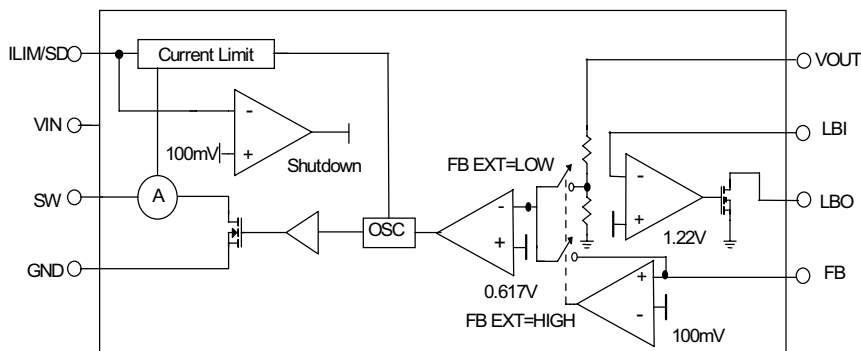
Fig. 10 Maximum Load Current vs. Switch Current Limit Resistance

**BLOCK DIAGRAM**



SS6633-3 / SS6633 / SS6633-5

## ■ BLOCK DIAGRAM (Continued)



The driver and reference (0.617V and 1.22V) for 6633A are based on VOUT pin. And VOUT must be  $\geq 2.2V$  then system can operate normally.

SS6633A

## ■ PIN DESCRIPTIONS

### SS6633-30/ SS6633-33 / SS6633-50

- |   |  |
|---|--|
| <p>PIN 1: ILIM/SD-</p> <ol style="list-style-type: none"> <li>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 SS6633. (See typical performance characteristics). The ILIM/SD pin should be shorted to VIN pin if limiting on switch peak current is not intended.</li> <li>2. The SS6633 goes in shutdown mode and consumes less than <math>10\mu A</math> when ILIM/SD pin is pulled to ground.</li> </ol> | <p>PIN 3: SW - Drain of the power switch, to be connected to inductor/ diode.</p> <p>PIN 4: SGND - Ground connected to source of power switch.</p> <p>PIN 5: CGND - Ground for control circuits of the IC. It should be separated from SGND to avoid the interference.</p> <p>PIN 6: LBO - Open drain output of the battery low detector, with <math>45\Omega</math> "ON resistance" at <math>V_{IN}=2V</math>. It is pulled low when the voltage on LBI pin is below 1.22V.</p> <p>PIN 7: LBI - The noninverting input of the battery low detector, of which the inverting input is internally connects to 1.22V voltage reference.</p> <p>PIN 8: VOUT - The output voltage feedbacks to the IC through this pin.</p> |
| <p>PIN 2: VIN - Input supply.</p>   |  |

**SS6633A**

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 SS6633A. (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 SS6633A 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<sub>OUT</sub> voltage is given by the following equation:

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

where R1 = Resistor connected between FB pin and V<sub>OUT</sub> pin.

R2 = Resistor connected between FB pin and ground.

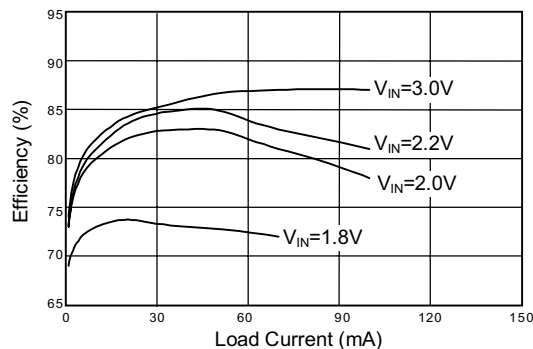
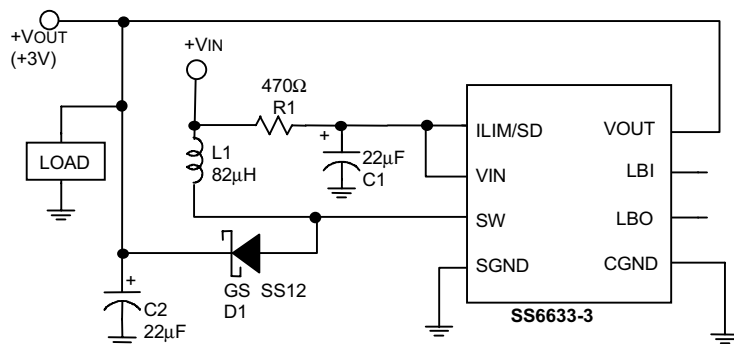
V<sub>OUT</sub>=Output voltage to be set.

PIN 6: LBO - Open drain output of the battery low detector, with 45 Ω “ON resistance” at V<sub>IN</sub>=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)

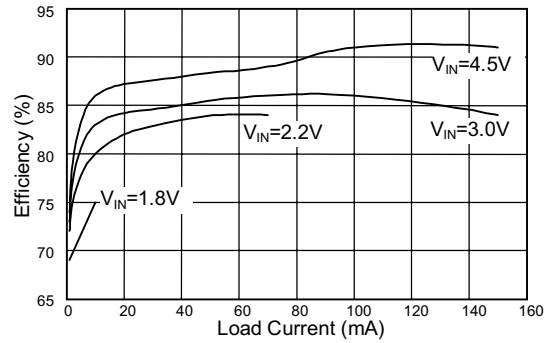
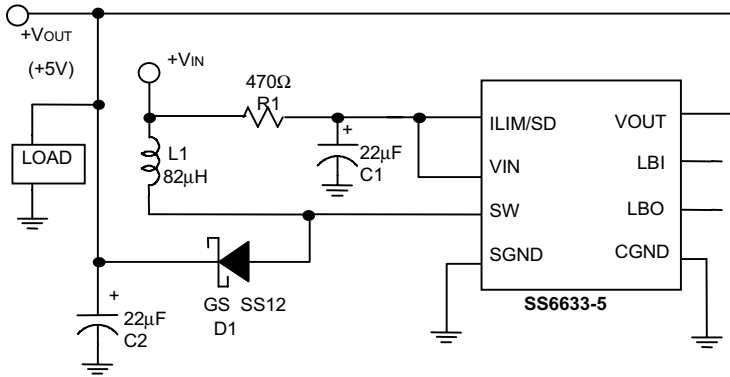
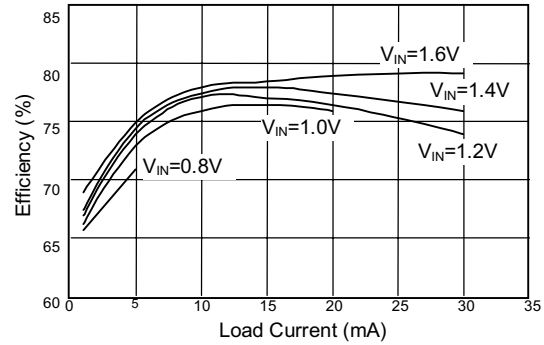
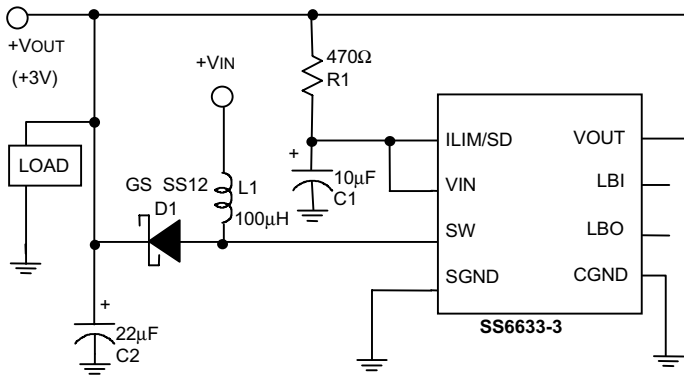
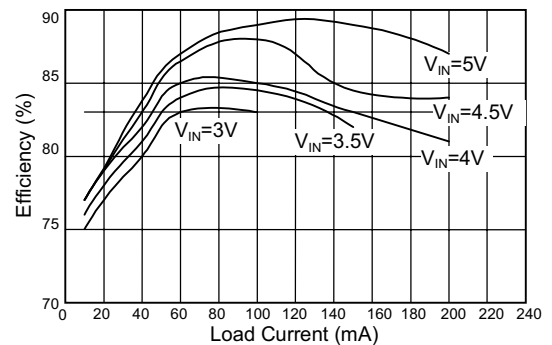
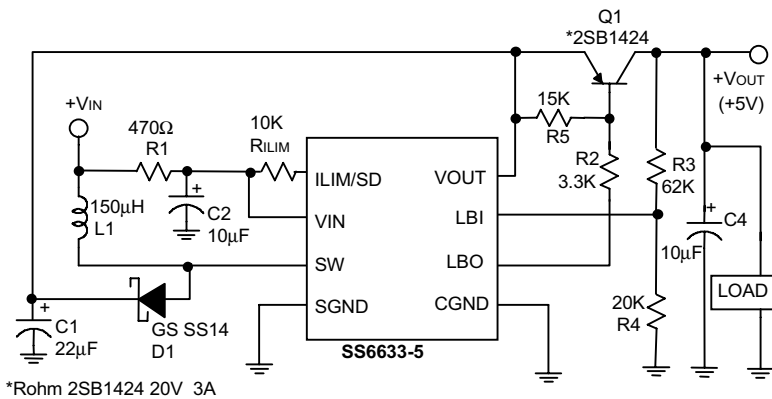


Fig. 12 5V Output Step-Up Converter



Start-Up VIN Voltage = 1.4V

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



\*Rohm 2SB1424 20V 3A

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



APPLICATION EXAMPLES (Continued)

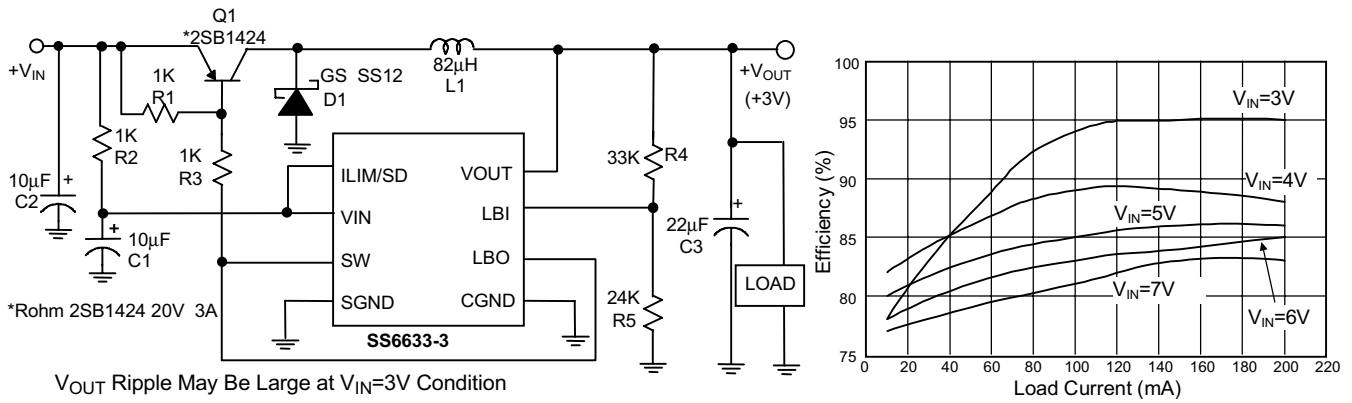


Fig. 15 3-Cell Input 3V Output Step-Down Converter

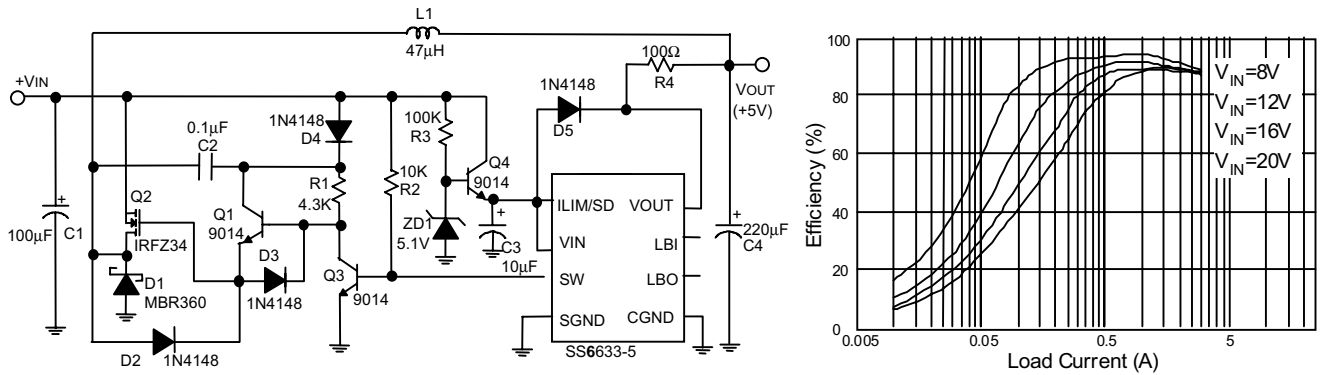


Fig. 16 Boost-Driven 5V Output Step-Down Converter

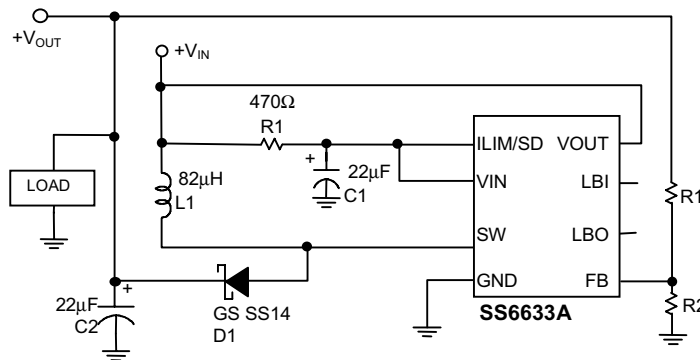
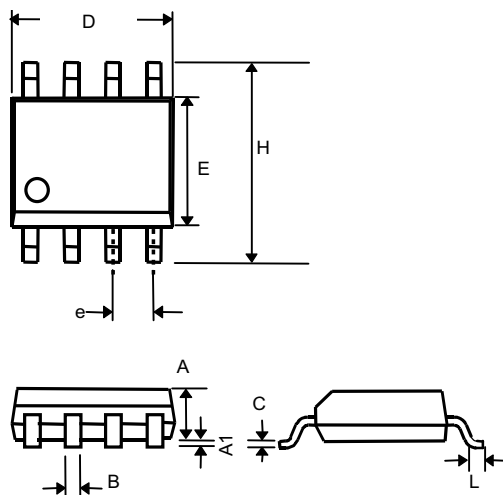


Fig. 17 Adjustable Output Voltage Step-Up Converter

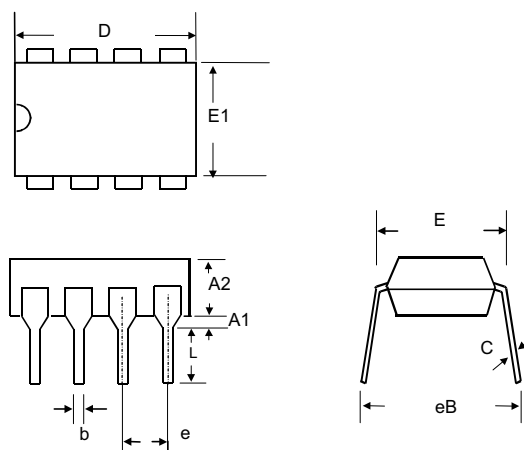
## ■ PHYSICAL DIMENSION

### ● 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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