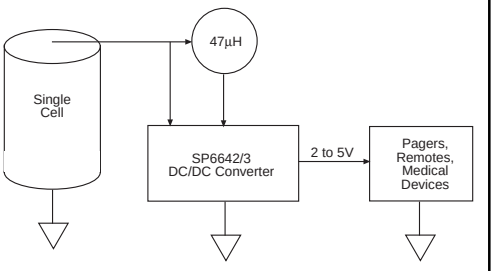
SP6642/3
Application Note:
High Current Output

- 40mA Output Current for the SP6642/3 Single Cell to 2V to 5V Converter
- High Efficiency: 81%
- Twice the Output Current as the Pin-to-Pin Compatible MAX1642/3
- 0.75V Start-up Voltage

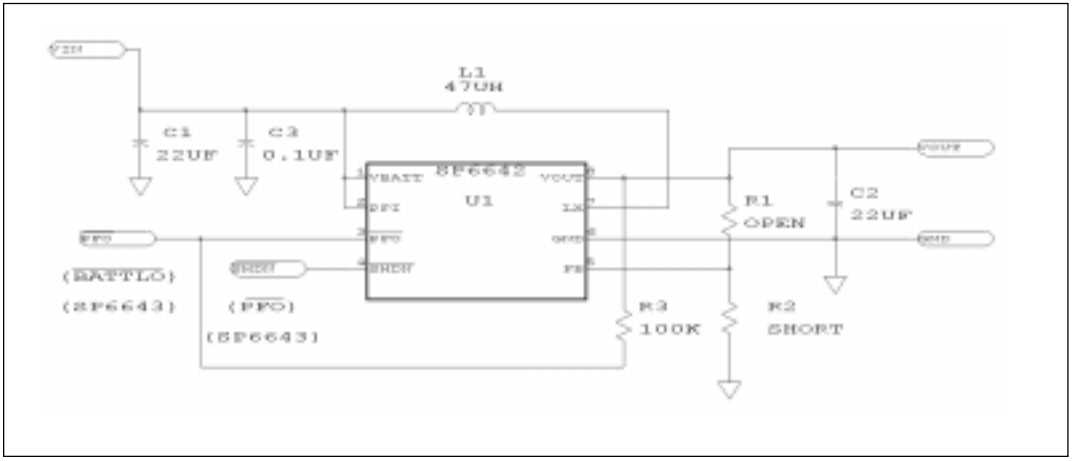
SP6642/3 40mA Output Application: Block Diagram



Description

The **SP6642/6643** devices are high-efficiency, low-power step-up DC-DC converters for +1V inputs ideal for single alkaline cell applications such as pagers, remote controls, pointing devices and other low-power portable products. This application note is for users like medical devices, emergency lighting and others who need twice the output current than the datasheet specified values for the SP6642/6643. Typically specified at 20mA for 3.3V out with a 1.2V input, the SP6642 can actually output double the current if a lower value of inductor is selected.

SP6642/6643 Applications Schematic – 47µH Inductor



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High Current Application

Changing the inductor on the **SP6642/3** from 100µH to 47µH will increase the peak inductor current by 2 times from about 250mA to about 500mA. This can be seen from the relationship of inductor current in the equation

$$V_L = Ldi/dt$$

where V_L is set by Vin and Vout, dt is the charge time set by the On-Time Constant, K as specified in the **SP6642/3** datasheet. Since L is the only factor changing, for a decrease of L by 1/2, the peak current, di, will double. With a doubling of peak current, the output current the **SP6642/3** can provide will double. The saturation current specified for the inductor needs to be greater then the peak current to avoid saturating the inductor, which would result in a loss in efficiency and could damage the inductor. *Table 1* below lists the inductors recommended for their low DC resistance and sufficient saturation current rating.

INDUCTANCE (µH)	VENDOR/PART NO.	INDUCTOR SPECIFICATION	
		RESISTANCE	Isat (mA)
47	Sumida CD54-470	0.37	720
100	Sumida CD54-101	0.7	520

Table 1. Recommended Surface Mount Inductors

High Current Performance

The curves in figures 1-6 illustrate **SP6642** efficiency Vs output current using the Sumida 47uH inductor CD54-470 and the Sumida 100uH inductor CD54-101 for 3 different output voltages (2.4V, 3.3V, 5.0V) and 4 different input voltages (0.85V, 1.0V, 1.2V, 1.6V). These figures cover the full range of input and output voltages and currents for a single cell step-up converter for 2-5V output. Comparing figures 1,3,5 for the 47uH inductor to figures 2,4,6 for the 100µH inductor and you will see about double the output current for the 47µH Vs the 100µH. For example, for 5V out for Vin of 1.0 to 1.6V (typical single cell voltages), the 47µH maximum output current is 30 to 50mA, while the 100µH maximum output is 15 to 25mA.

Comparing efficiencies, the 47µH is less efficient than the 100uH at the maximum output current by about 4%. This difference can be attributed to the difference in time constant of charge for the inductor (L/R) in the equation for charging current:

$$Ich = Imax*(1-e^{-t/(L/R)})$$

where Imax is the peak inductor current, t is the charging time, L/R is the time constant for charge in the inductor. Since L changes by 1/2 from 100µH to 47µH, the DC series resistance R needs to decrease by 1/2 for L/R to remain the same. But, the DC resistance is composed of **SP6642/3** switch resistance and the DC resistance of the inductor. Even though inductor resistance reduces by about 1/2 (table 1) the **SP6642/3** switch resistance remains the same and the total DC resistance R will not reduce by 1/2. From this you can see that to decrease inductor values to be even less than 47µH, the efficiency will continue to decrease and peak current could rise to unacceptable levels.

In summary, the **SP6642/3** can obtain higher output currents by using a properly selected inductor value. The efficiency curves show double the output current allowing the **SP6642/3** to be used in a wider variety of portable products including medical devices and emergency lighting.

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SP6642 Efficiency vs. Output Current

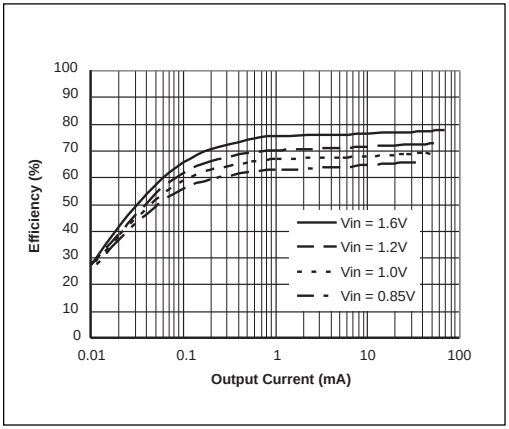


Figure 1. 2.4V_{OUT} Sumida 47µH

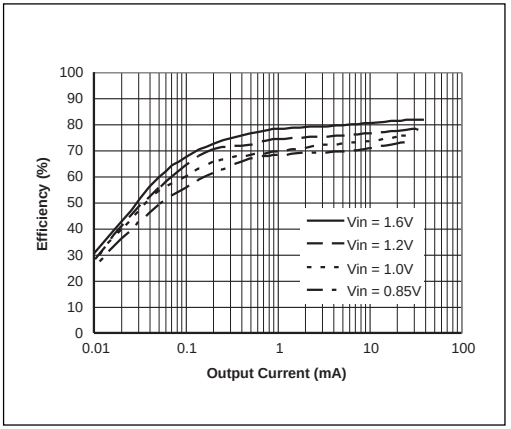


Figure 2. 2.4V_{OUT} Sumida 100µH

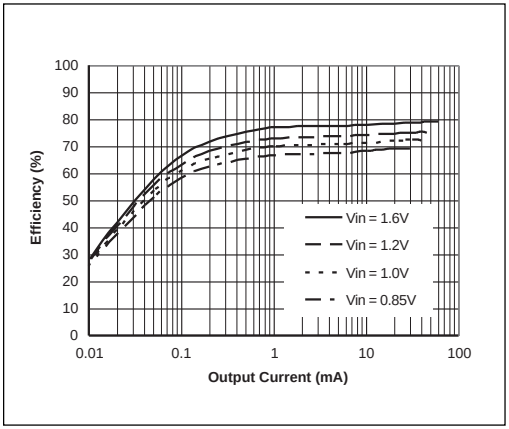


Figure 3. 3.3V_{OUT} Sumida 47µH

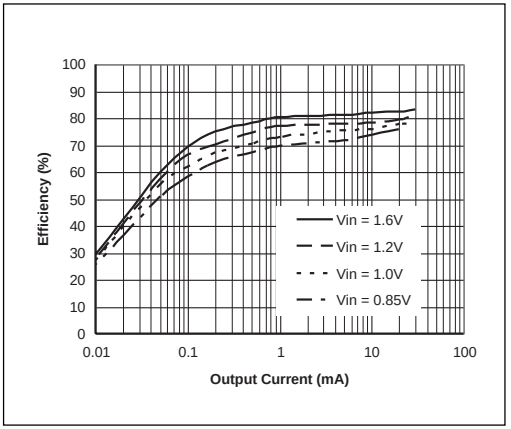


Figure 4. 3.3V_{OUT} Sumida 100µH

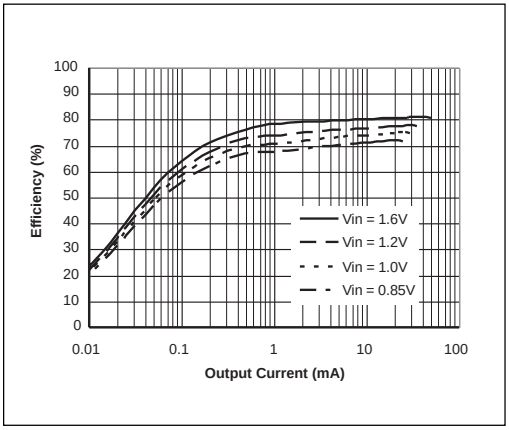


Figure 5. 5V_{OUT} Sumida 47µH

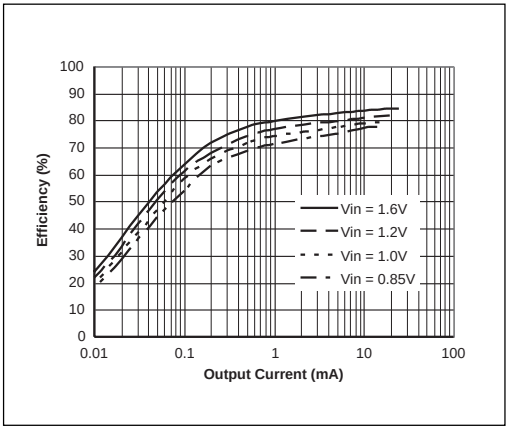


Figure 6. 5.0V_{OUT} Sumida 100µH

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ORDERING INFORMATION

Model	Temperature Range	Package Types
SP6642EU	-40°C to +85°C	8-pin µSOIC
SP6643EU	-40°C to +85°C	8-pin µSOIC
SP6642UEB		SP6642 Evaluation Board

Please consult the factory for pricing and availability on a Tape-On-Reel option.

Sipex Corporation

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