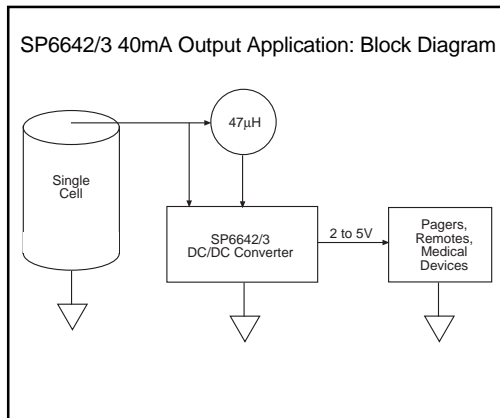




SP6642/3 Application Note: High Current Output

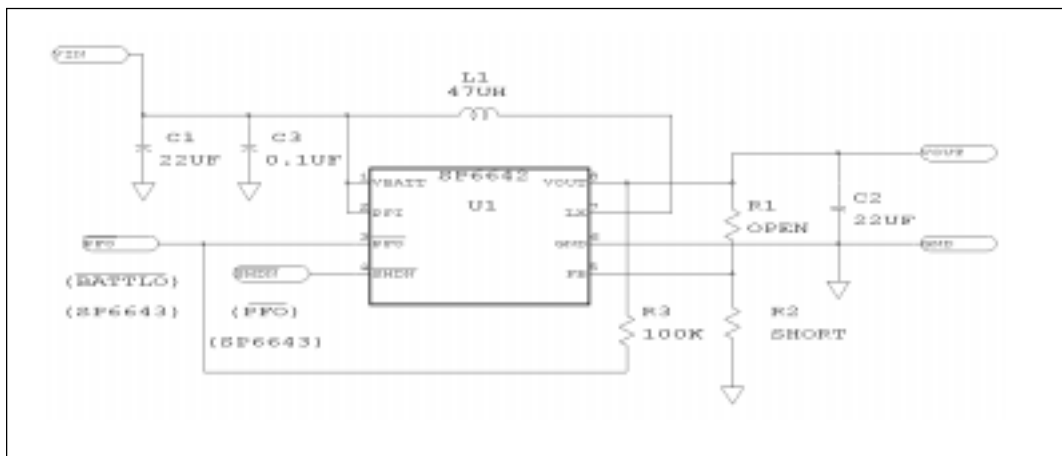
- 40mA Output Current for the SP6642/3 Single Cell to 2V to 5V Converter
- High Efficiency: 81%
- Twice the Output Current as the Pin-to-Pin Compatible MAX1642/3
- 0.75V Start-up Voltage



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



High Current Application

Changing the inductor on the **SP6642/3** from 100 μ H to 47 μ H 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

$$V_L = L di/dt$$

where V_L is set by V_{in} and V_{out} , 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 than 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 (μ H)	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 47 μ H inductor CD54-470 and the Sumida 100 μ H 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 47 μ H inductor to figures 2,4,6 for the 100 μ H inductor and you will see about double the output current for the 47 μ H Vs the 100 μ H. For example, for 5V out for V_{in} of 1.0 to 1.6V (typical single cell voltages), the 47 μ H maximum output current is 30 to 50mA, while the 100 μ H maximum output is 15 to 25mA.

Comparing efficiencies, the 47 μ H is less efficient than the 100 μ H 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:

$$I_{ch} = I_{max} * (1 - e^{-t/(L/R)})$$

where I_{max} 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 100 μ H to 47 μ H, 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 47 μ H, 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.

SP6642 Efficiency vs. Output Current

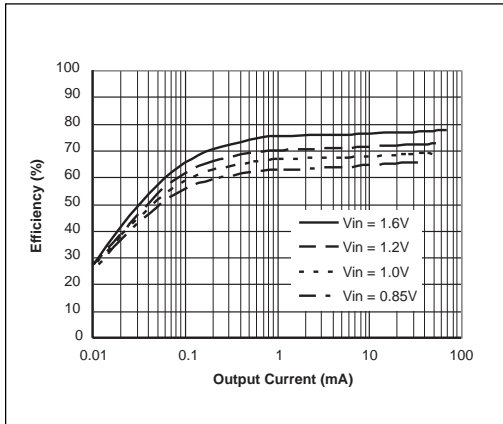


Figure 1. 2.4V_{OUT} Sumida 47µH

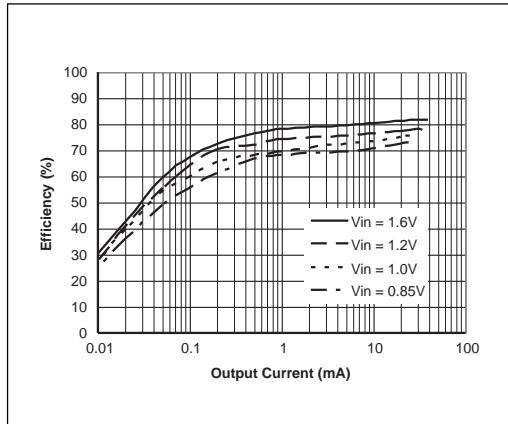


Figure 2. 2.4V_{OUT} Sumida 100µH

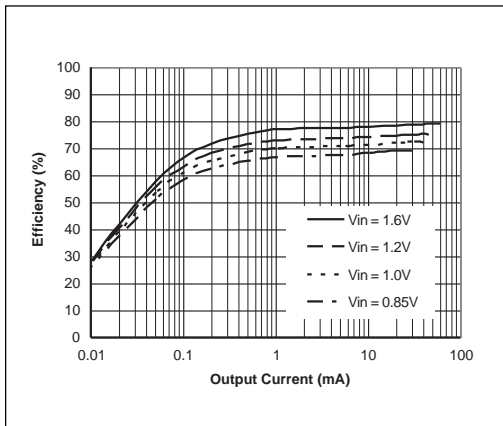


Figure 3. 3.3V_{OUT} Sumida 47µH

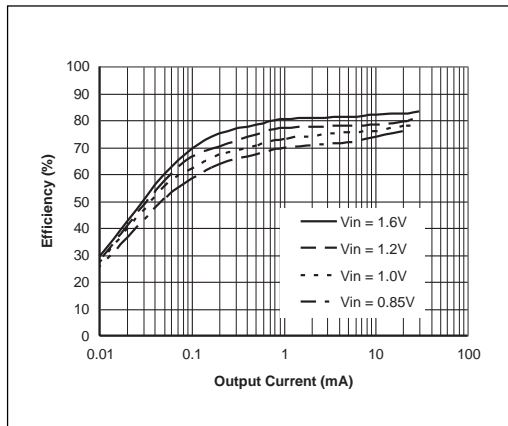


Figure 4. 3.3V_{OUT} Sumida 100µH

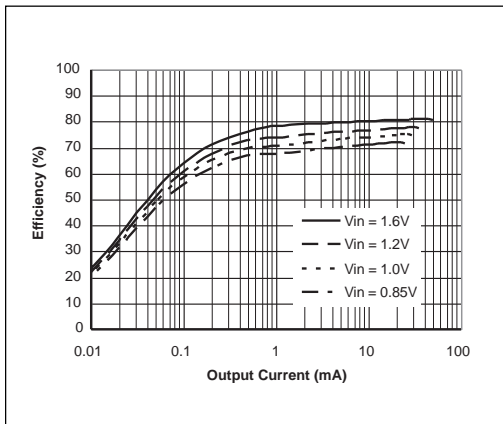


Figure 5. 5V_{OUT} Sumida 47µH

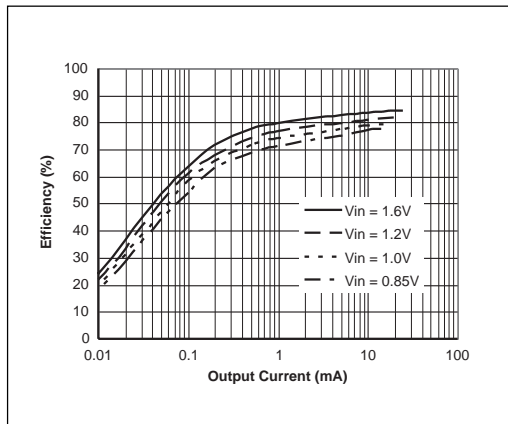


Figure 6. 5V_{OUT} Sumida 100µH

ORDERING INFORMATION

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

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



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