TPS61042 Dual Li-Ion and Higher Input Voltages

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ABSTRACT

This document shows how to operate the TPS61042 from input voltages greater than 6 V. The ability to operate from input voltages greater than 6 V allows the TPS61042 to operate from dual Li-Ion or higher input voltages.

The TPS61042 is a highly integrated constant-current LED driver that is designed to operate from input voltages between 1.8 V and 6.0 V. For portable systems, this input voltage range covers 2-, and 3-cell alkaline as well as single Li-Ion sources. In order to provide longer battery life, many systems are migrating to 4-cell alkaline (3.6-V to 7.2-V) or dual Li-Ion (6.0-V to 8.4-V). A slight modification to the typical application circuit shown in the data sheet allows the TPS61042 to be operated from these higher input voltages. The 6-V input voltage limitation to the TPS61042 comes from the maximum voltage rating of the VIN pin. The TPS61042 can be used with higher input voltages as long as the control circuitry is kept separate from the power stage so that VIN can be kept below 6 V. Figure 1 shows a typical LED driver application that is powered from a dual Li-Ion input. The bias voltage to the IC is disconnected from the power stage. In this application, the TPS61042, which is powered through VIN, receives its input bias voltage from an available system voltage of 3.3 V. VIN can be connected to any available system voltage between 1.8 V and 6.0 V. The input current into VIN is typically less than 500 µA. If a lower system voltage is not available, then a resistor and a zener diode can be used to provide a local bias voltage to the IC. The power stage is connected directly to the dual Li-Ion input. In general, the power stage can be powered from any voltage that is less than the required output voltage.
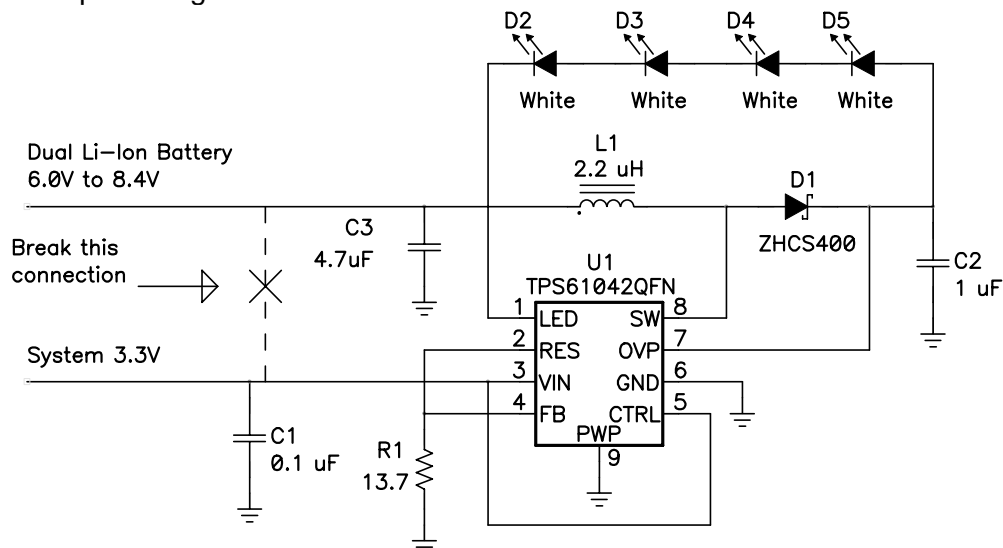

Figure 1.   Typical Dual Li-Ion Powered LED Driver

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INSTRUMENTS

In addition to extending the useful operating range of the TPS61042, this technique provides two additional benefits: increased efficiency and higher available power output. Efficiency is increased due to the reduced conversion factor of the supply. Figure 2 shows the increase in efficiency with rising input voltage for a typical four-white-LED application.
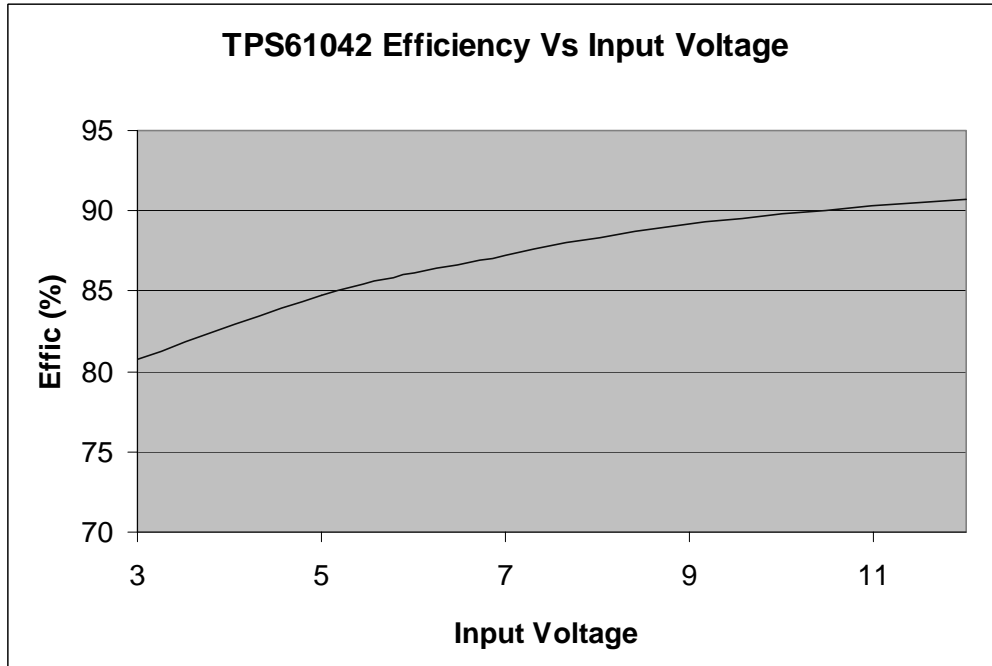
TPS61042 Efficiency Vs Input Voltage

Figure 2.   TPS61042 Efficiency vs Input Voltage

The increase in output power with increased input voltage is a function of the TPS61042 operating topology. The TPS61042 is a hysteretic, discontinuous boost converter. For more information on this subject, refer to the TPS61041 data sheet, TI literature number SLVS441. Figure 3 shows the TPS61042 maximum drive current versus input voltage for a typical four-white-LED load drive circuit.
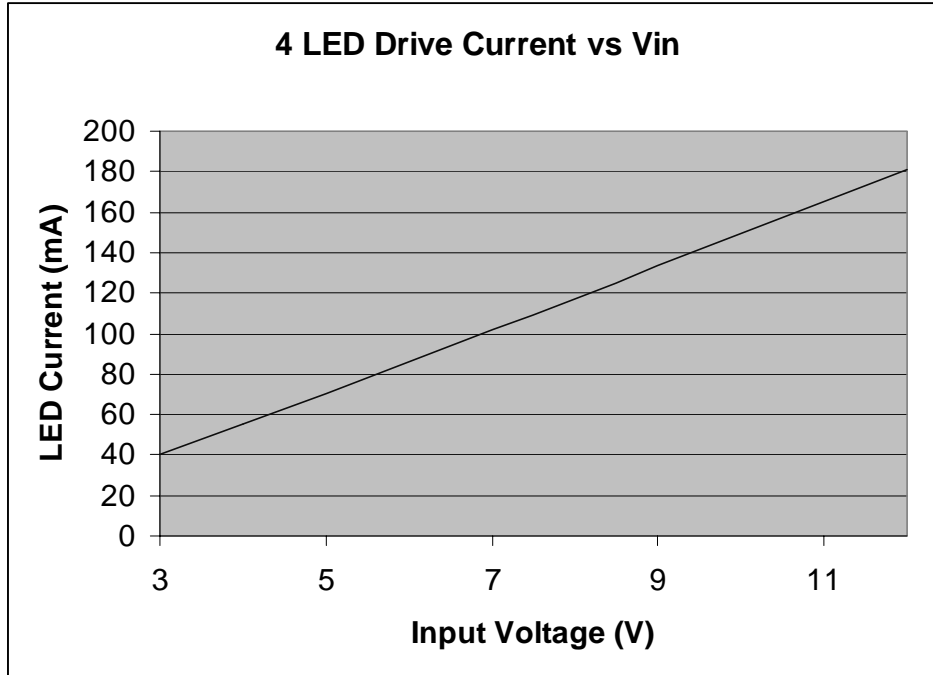
4 LED Drive Current vs Vin

LED Current (mA) — Input Voltage (V)

Figure 3.   TPS61042 Four LED Drive Current vs Input Voltage

To summarize, the TPS61042 may be configured to operate from input voltages greater than 6 V. Operating from higher input voltages extends the operating range of the IC, increases operating efficiency, and increases available output power. This technique is also applicable to TI's TPS61040, TPS61041, and TPS61045 boost converters as well.

Table 1.   Other Boost Converters Available From Texas Instruments

Device	Type	Iout mA	Switch Limit mA (max)	Vin V	Vout V	Switching Frequency KHz (max)	Shutdown	LDO (mA)	Low Battery	PG	Power Sequencing	UVLO	Current Limit	Thermal Limit
TPS61000	Boost	100/250	1100	0.8-3.3	1.5-3.3	840	x		x			x	x	
TPS61010	Boost	100/250	1130	0.8-3.3	1.5-3.3	840	x		x			x	x	
TPS61030	Boost	1000	4500	1.8-5.5	1.8-5.5	700	x		x			x	x	x
TPS61040	Boost	20 @ 18V	400	1.8-6.0	Vin - 28	1000	x					x	x	
TPS61041	Boost	20 @ 18V	250	1.8-6.0	Vin - 28	1000	x					x	x	
TPS61042	Boost	6 white LEDs	500	1.8-6.0	28	1000	x					x		x
TPS61045	Boost	LCD drive	450	1.8-6.0	30	1000	x				x	x		x
TPS61100	Boost + LDO	200	1500	0.8-3.3	1.5-5.5	800	x	120	x	x			x	x
TPS61120	Boost + LDO	500	1600	1.8-5.5	2.5-5.5	600	x	200	x	x			x	x

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