Board user manual

Automotive front light LED reference design with SEPIC topology

Manual overview

This Infineon board user manual serves as guidance for the usage of the automotive front light LED reference design with SEPIC topology based on the flexible multi-topology DC-DC controller TLD5099EP of the LITIX™ Power family. One single DC-DC channel is used to drive the high beam and low beam. The high beam can be activated in conjunction with the low beam or the low beam can be activated standalone. This represents a cost saving approach especially suitable for entry level LED headlamps. A PWM dimming feature enables furthermore control of brightness and enables derating in extreme operating conditions. For information related to the board design, a dedicated reference design document is available.

Highlighted components

- TLD5099EP Multi-topology DC-DC controller from the LITIX™ Power family

- IPD60N10S4L OptiMOS™ -T2 as power stage switching MOSFET

- IPD50P04P4L-11 OptiMOS™ -P2 as reverse battery protection MOSFET

Applications

- Automotive front light

- High beam, low beam

- Daytime running light, turn indicator

- Motorcycle headlamp

Delivery Package

Board user manual
**Automotive front light LED reference design with SEPIC topology**
System Operation
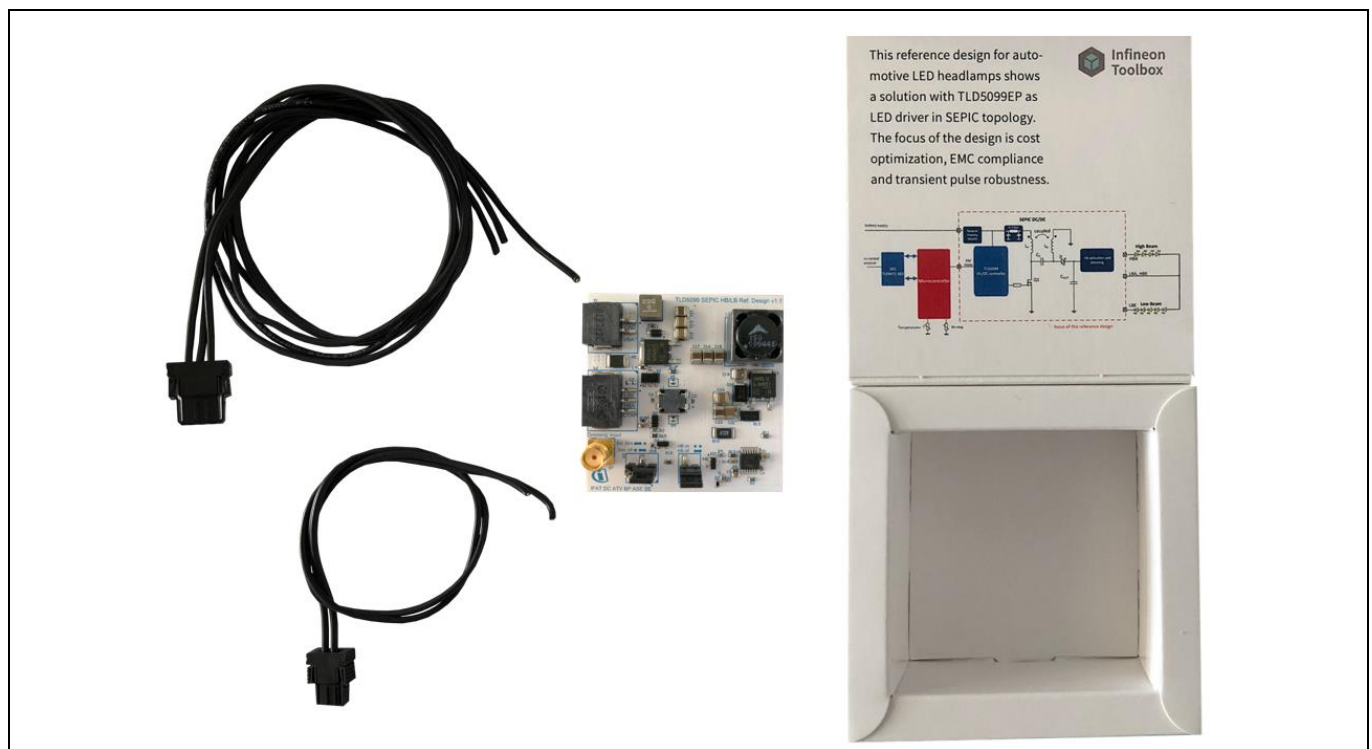
1 System Operation

The following sections will provide a brief overview regarding the start-up and operation modes of the automotive front light LED reference design shown in Figure 1. The circuit board is supplied via the connector X1 in the top left corner, while the LED load is attached to connector X2 below. Within the delivery package, the corresponding cables from the manufacturer ERNI are available.

Table 1 summarizes key parameters related to the operation of the board. Once the nominal supply voltage is applied, the configured constant current is provided to the LEDs. The load condition is dependent on the settings of jumpers X3 and X6 in the lower area of the printed circuit board. In below paragraphs, the different configuration possibilities are introduced.

Table 1   Board main parameters

Parameter	Symbol	Value			Unit
		Min.	**Typ.**	**Max.**	
Nominal supply voltage range	V_{IN}	8	13.5	16	V
Extended supply voltage range	V_{IN}	4.5		35	V
Output voltage	V_{OUT}			38.75	V
Nominal LED current	I_{LED}		900		mA
Input current	I_{IN}			3.57	A
Switching frequency	f_{FREQ}		310		kHz
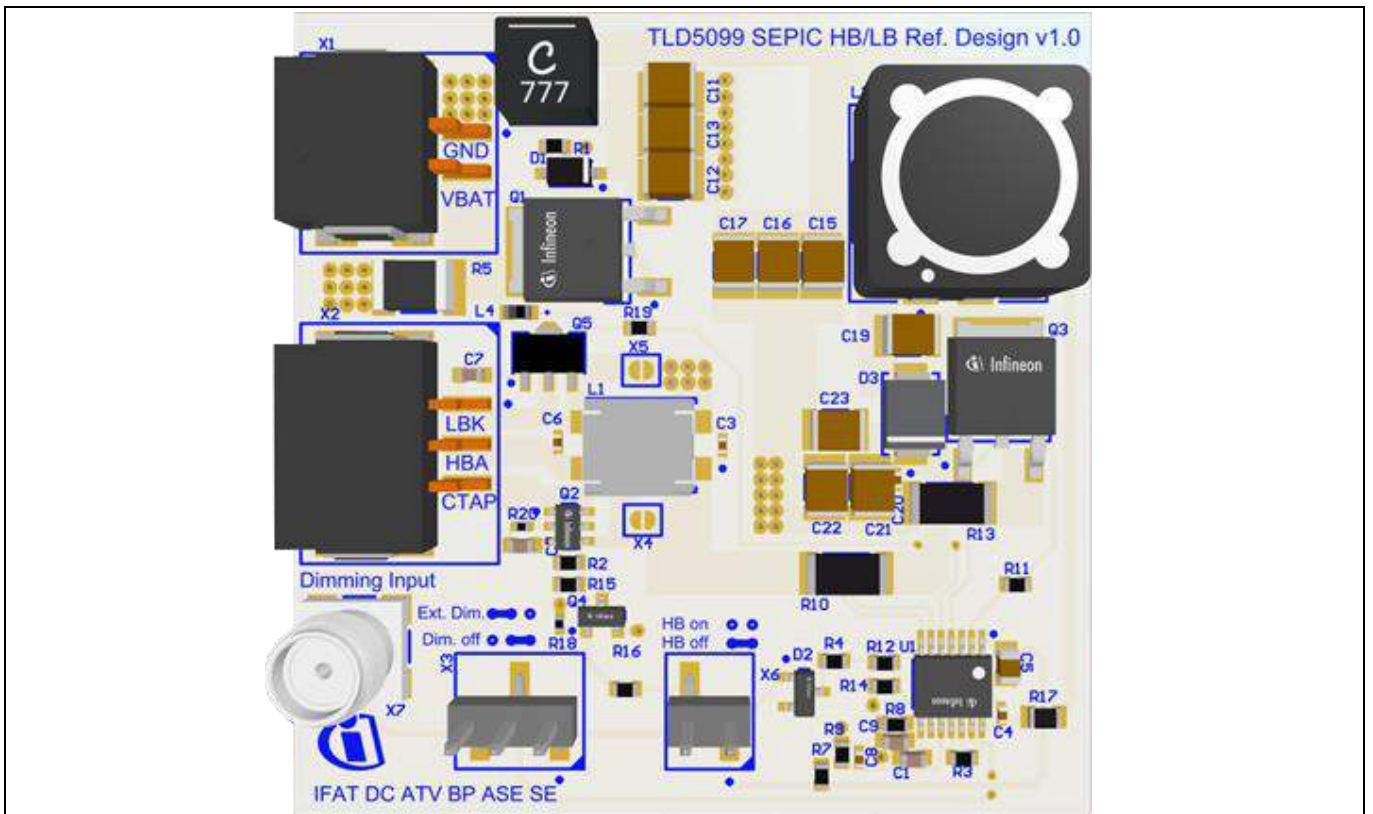
Figure 1   TLD5099EP SEPIC HB/LB reference design PCB

1.1 LED load connection

In case of the given design, the load condition visualized in Figure 2 is considered. The low beam is represented by a string of five LEDs attached between the connector pins CTAP (anode) and LBK (cathode). For the high beam activation, four additional LEDs are foreseen. These need to be wired between the connector pins HBA (anode) and CTAP (cathode). When selecting the LEDs for the high beam and low beam, one must consider the maximum output voltage specified in Table 1.
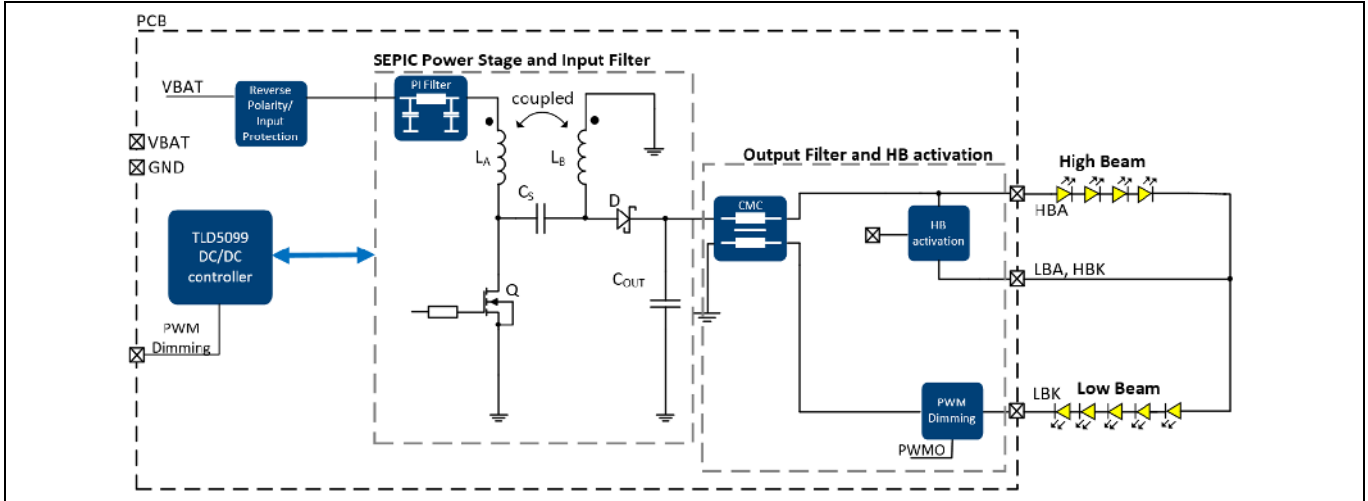

Figure 2   **TLD5099EP SEPIC high beam / low beam reference design block diagram**

1.2 High beam activation

The high beam state depends on the placement of jumper X6, highlighted in Figure 3. As already indicated via the silk screen, shorting the two pins deactivates the high beam. In order to avoid current overshoots during the state transition phases, the reverse transfer capacitance of the switching MOSFET is increased. With this circuitry in place, a rise and fall time in the range of couple of milliseconds is ensured.

1.3 Load PWM dimming

Using jumper X3, the EN/PWMI pin of the TLD5099EP can either be shorted to the input voltage, or connected to the BNC connector X7, as shown in Figure 3. It serves as input for a pulse-width-modulated signal, with a frequency of 100 Hz to 500 Hz, in order to dim the low beam LEDs. For this purpose, the TLD5099EP features a dedicated PWMO pin controlling an external MOSFET. As indicated via the silk screen, the external dimming is activated by placing a jumper at the left position. In case dimming is not required, the jumper has to be placed to the right position.
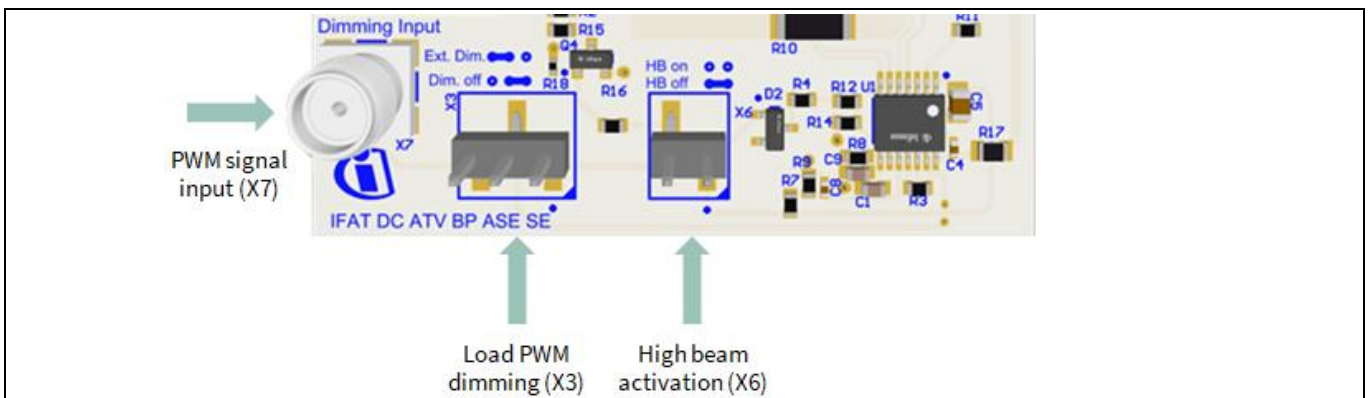

Figure 3   **TLD5099EP SEPIC reference design configuration options**

Revision history

Document version	Date of release	Description of changes
Rev.1.00	August 2020	Initial board user manual

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