LITIX™ Power TLD5098EL

Application Boards with IO Filter

V3_LITIX

10.02.2014

ATV BP LI

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LITIX™ Power
TLD5098EL - Application Boards Overview

- LITIX™ Power – General Overview
- LITIX™ Power – TLD5098EL Appboards with IO Filter Description
  - Boost to GND configuration + short to GND protection (B2G + S2G) – Topology “BOOST”
  - Boost to Battery (B2B) – Topology “BUCK / BOOST”
  - SEPIC configuration – Topology “BUCK / BOOST”
- LITIX™ Power - Support Material Overview

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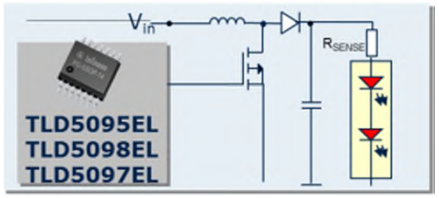
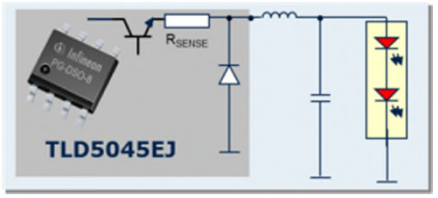
Our TLD50xx DCDC Family is well established in Automotive LED Lighting Applications

TLD50xx Family

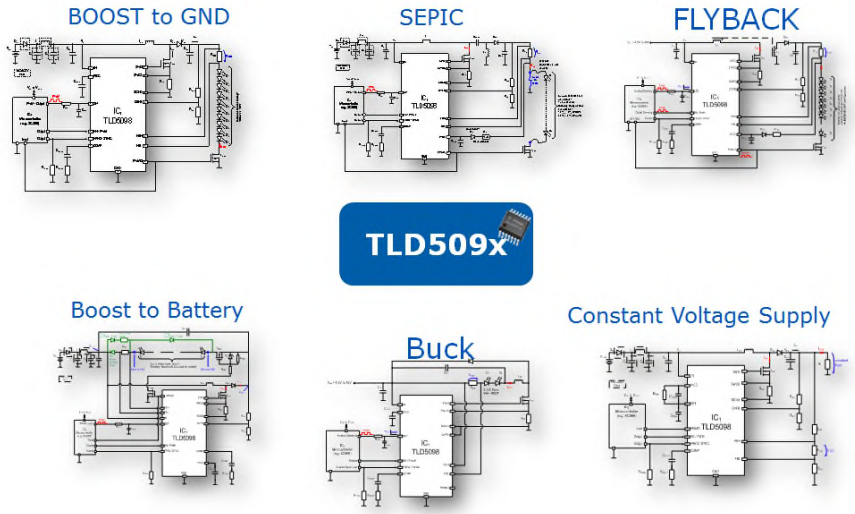


DC/DC Controller IC
Boost, Buck, Buck-Boost, SEPIC and Flyback, PWM dimming, switching frequency (100-500kHz)



DC/DC Driver IC
Buck, integrated power stage (700mA), freewheeling diode, sense resistor PWM dimming,

The Topology "allrounder"



Well established in the Market

Key Features & Benefits

- TLD509xEL: Multitopology 1ch DC/DC controller Family
- wide LED current range via simple adaptation of external components
- good EMC performance
- built in protection and diagnostic features
- constant Current or Constant Voltage Regulation
- PWM dimming
- analog dimming for TLD5097EL and TLD5098EL
- TLD5045EJ: High integrated (power stage, free wheeling diode, current sense resistor) Buck converter for up to 700mA

LITIX™ Power
Automotive Target Applications

Rear Light & Side Marker

Headlights Low Beam

LED

DRL

Interior Lighting

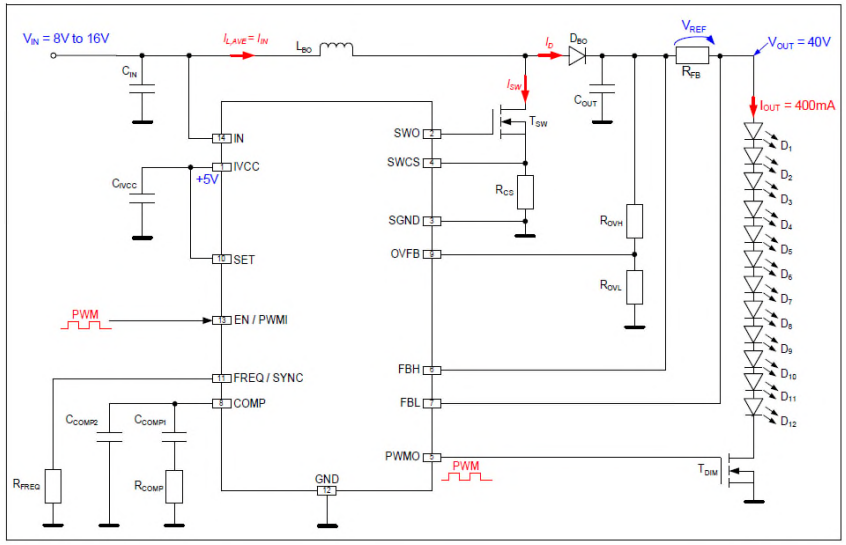
Picture source: Internet

Infineon® Power LED Driver - TLD5098EL
LED Boost, Buck-Boost, Sepic Controller

Key Features

- Wide input voltage range from 4.5 V to 45 V
- Drives LEDs in Boost (B2G), Buck-Boost (B2B) and SEPIC Topology (max. 61V - TLD5098), Buck, Flyback
- Flexible Switching Frequency Range: 100 kHz to 500 kHz (for EMC optimization)
- Analog Dimming feature to adjust average LED current
- Integrated Gate Driver for PWM Dimming (TLD5098)
- Open Circuit Detection and Shutdown
- Short to GND Detection and Shutdown
- Output Overvoltage Protection
- Device Over Temperature Protection
- Synchronization with external clock
- Very Low Shutdown Current: IQ< 10 µA

TLD5098EL



Target Applications

Specially designed for Automotive exterior lighting

- High & Low Beam
- DTRL
- Fog
- …

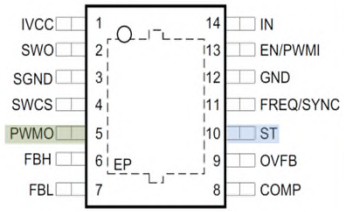
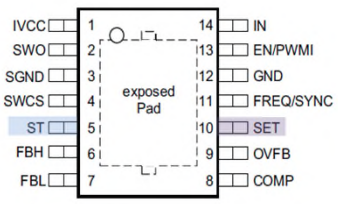
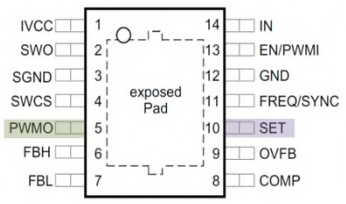
Package

- PG-SSOP-14

RoHS

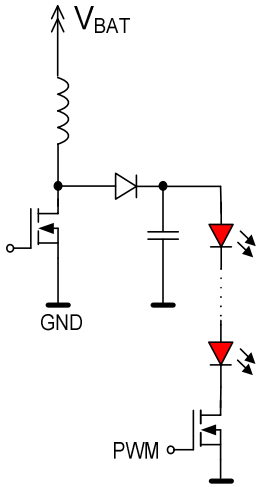
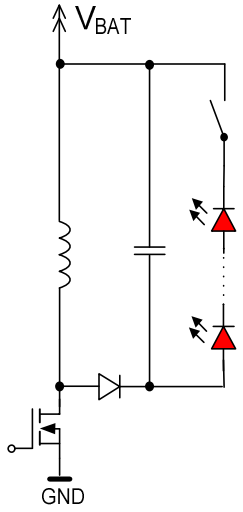
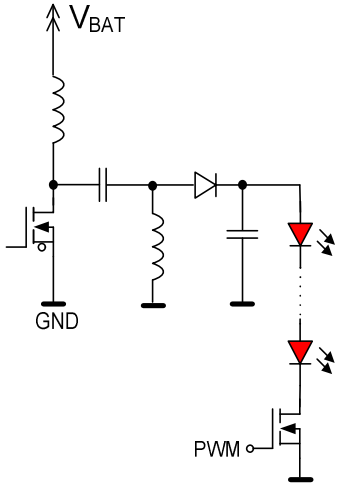
AEC Qualified

Infineon® Power LED Driver
Overview Multitopology DCDC Controller TLD509x

		TLD5095	TLD5097 NEW	TLD5098
Topolgy	BOOST	YES	YES	YES
	BUCK	YES	YES	YES
	BUCK-BOOST	YES	YES	YES
Operating Voltage	MIN	4.75V	4.5V	4.5V
	MAX	45V	45V	45V
Integration		Controller (2 Gate Driver)	Controller (1 Gate Driver)	Controller (2 Gate Driver)
MAX LED Current		scaleable	scaleable	scaleable
MAX Output Voltage		45V	61V	61V
LED current accuracy		±3.3%	±3.3%	±3.3%
Operating Temperature	MIN	-40°C	-40°C	-40°C
	MAX	150°C	150°C	150°C
LED current Dimming	Digital (PWM)	YES, with dedicated PWM Gatedriver	YES	YES, with dedicated PWM Gatedriver
	Analog	NO	YES	YES
Switching Frequency	MIN	100kHz	100kHz	100kHz
	MAX	500kHz	500kHz	500kHz
	OPEN / VOUTOV	YES	YES	YES
Protection	SHORT of OUT	NO	NO	YES
	IC Overtemperature	YES	YES	YES
STATUS PIN		YES	YES	NO, but µC can monitor alternative Pins
ATV Grade / AEC Qualified		AEC Qualified RoHS	AEC Qualified RoHS	AEC Qualified RoHS
Package		PG-SSOP-14 ePad (Body: 5mm x 4mm)	PG-SSOP-14 ePad (Body: 5mm x 4mm)	PG-SSOP-14 ePad (Body: 5mm x 4mm)
Pinning				

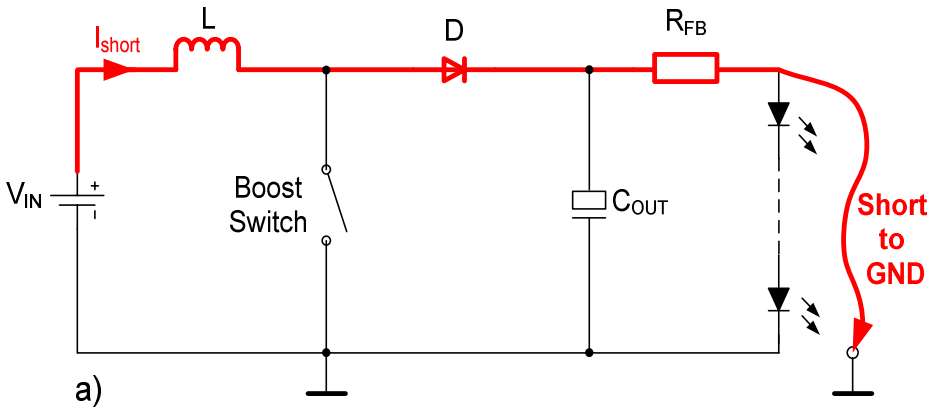
TLD5098EL in different configurations Summary

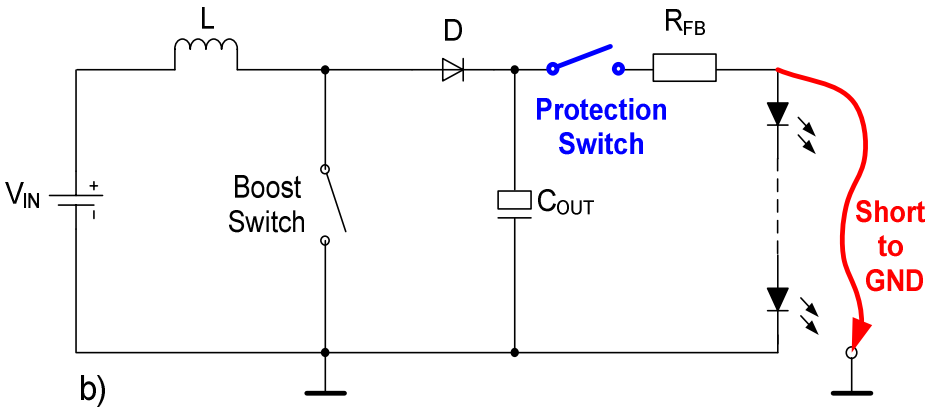
- **Boost to GND Configuration**
  - Boost to GND
  - SEPIC
  - Constant Voltage Mode
- **Boost to V_{BAT} Configuration**
  - Boost to V_{BAT}
  - Constant Voltage Mode

	Boost to Ground	Boost to Battery	SEPIC
			
Flexibility: Buck / Boost	Boost	Buck / Boost	Buck / Boost
Maximum VOUT	max. 45V (→ TLD5095) max. 60V (→ TLD5098)	Independent from maximum ratings of the DC/DC	max. 45V (→ TLD5095) max. 60V (→ TLD5098)
Short Circuit Protection	YES, with additional highside dimming concept	YES, with additional external components	YES, configuration itself is short circuit protected
Efficiency and Component Count	+	O	-
EMC on: **Input** **Output**	 + O	 - O	 + O

Short circuit detection for Boost converters in general

- Short circuit in every boost circuit is difficult to handle!
  - After a short circuit applied we have direct current flow over the external components.
- One countermeasure could be a fuse in the supply line. But this is what customers usually don't want to have.
- TLD5098 features a short circuit protection feature.
  - The digital dimming circuit controls a switch and opens the circuit in case an short circuit event





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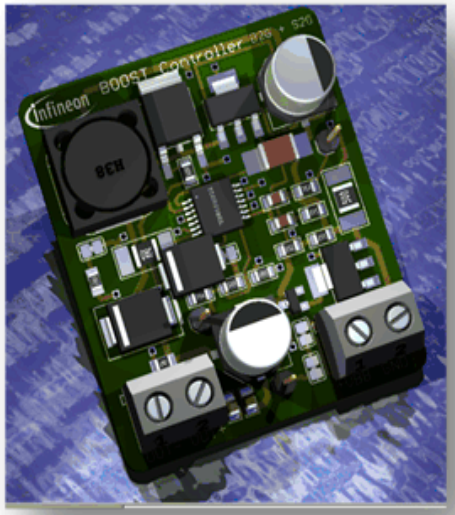
LITIX™ Power
TLD5098EL – Application Boards with I/O filter

- **Application Boards** with filters:

Sales Name of Demoboard	SP Number	Description
APPBOARD TLD5098EL V5	SP000984908	Boost to Ground Configuration w/ short to ground protection & EMC filter
APPBOARD TLD5098EL V6	SP000984910	Boost to Battery Configuration with EMC filter
APPBOARD TLD5098EL V7	SP000984912	SEPIC Configuration with EMC filter



- The size of the application boards is 5.5 cm x 5 cm and the connections to the power supply and external load can be established with cables.
- The application boards in combination with real loads enable fast and realistic application prototyping and could be very beneficial for constructing initial system demonstrators.
- The layout of these boards is optimized for EMC and can be reused for customer applications.

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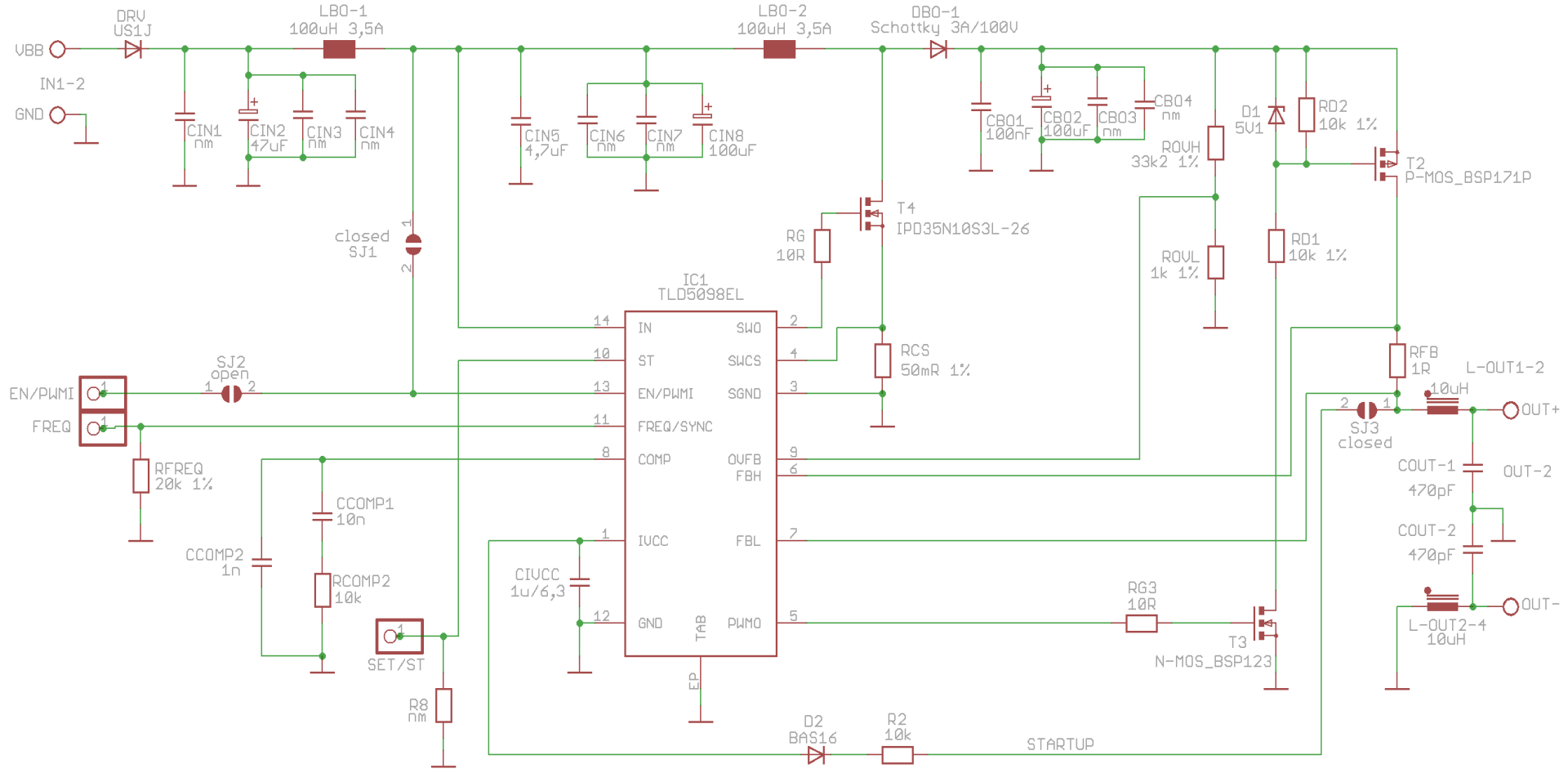
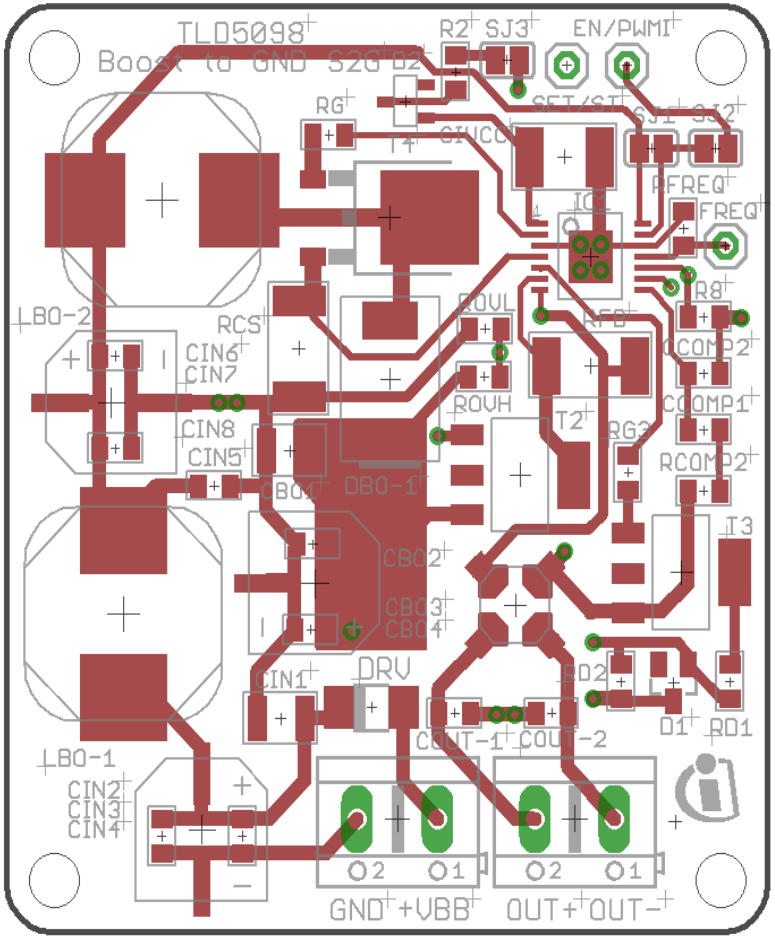
Boost to GND configuration + short to GND protection (**B2G + S2G**) – Topology "**BOOST**"

Schematic



Boost to GND configuration + short to GND protection (**B2G + S2G**) – Topology "**BOOST**"

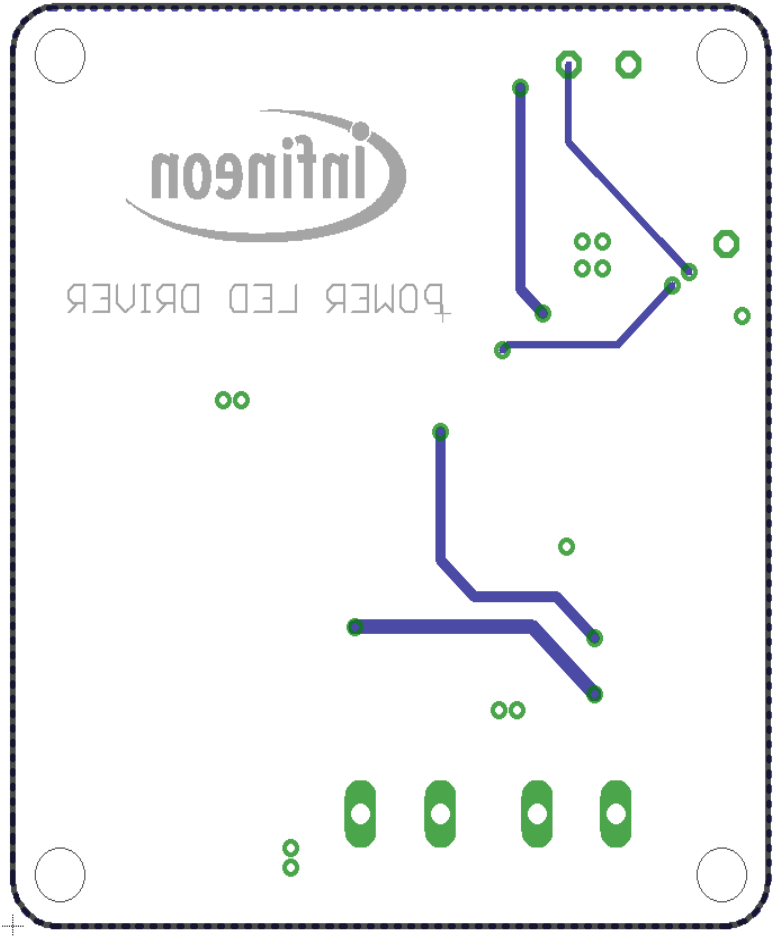
Board (TOP)

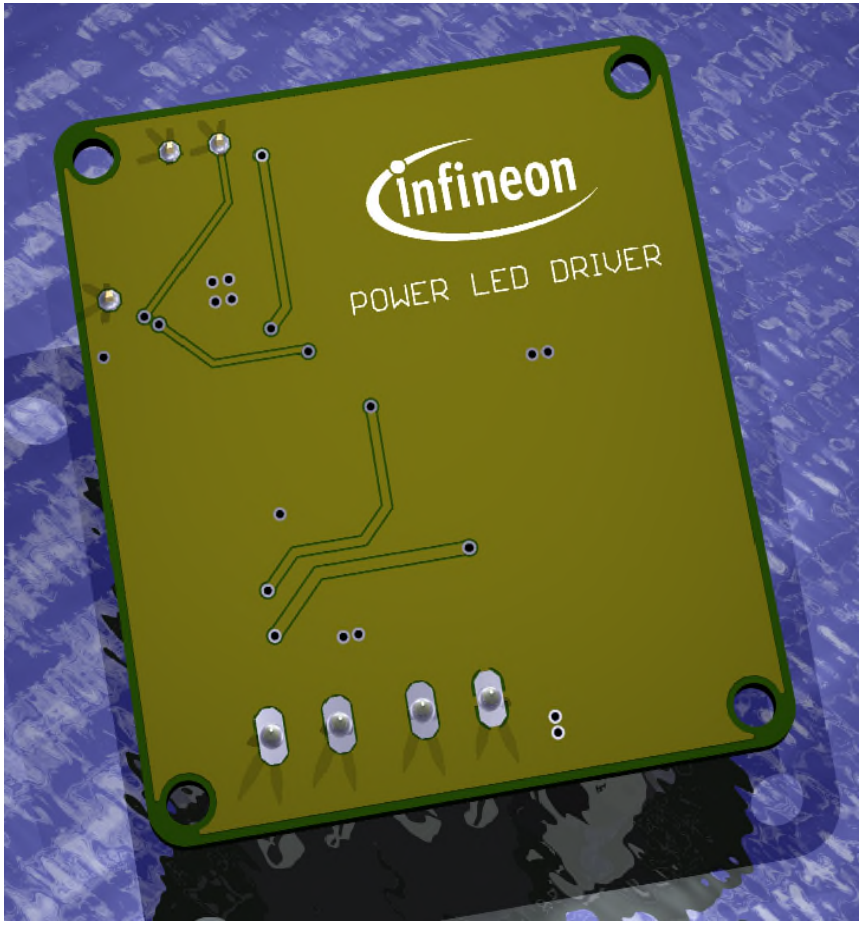


54mm

48mm

Board (BOTTOM)





Bill of Material (BOM)

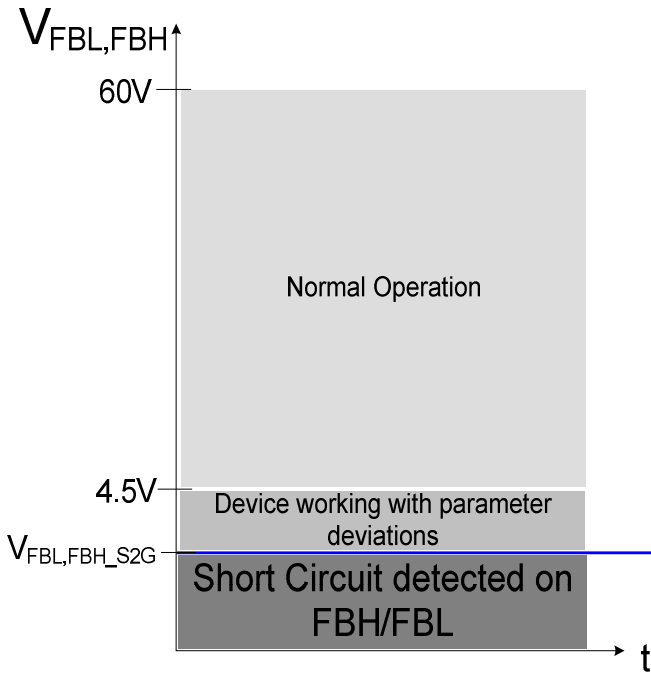
Part	Value	Package	Device	Quantity
IN1, OUT		AK500/2	Connector	2
EN/PWMI, FREQ, SET/ST		Meassurement - Point		3
RG3	10R	0805	Resistor	1
RFB	1R	2512	Resistor	1
ROVL	1k 1%	0805	Resistor	1
RG	10R	0805	Resistor	1
R2, RCOMP2	10k	0805	Resistor	2
RD1, RD2	10k 1%	0805	Resistor	2
R8	nm	0805	Resistor	1
RCS	50mR 1%	2512	Resistor	1
RFREQ	20k 1%	0805	Resistor	1
ROVH	33k2 1%	0805	Resistor	1
RCS	50mR 1%	2512	Resistor	1
SJ2	open	Solderjumper	Jumper	1
SJ1, SJ3	closed	Solderjumper	Jumper	2
IC1	TLD5098EL	PG-SSOP-14-1-EP	Chip	1
DBO-1	Schottky 3A/100V	DO214AB	Diode	1
DRV	US1J	DO-214AC	Diode	1
D2	BAS16	SOT23	Diode	1
D1	Zener 5,1V	SOT23	Dioide	1
LBO-1, LBO-2	100uH 3,5A	MSS1278	Coil	2
L-OUT	10uH	LPD4012	Coil	1

Bill of Material (BOM)

T4	IPG20N06S3L-23	TO252-3-11	Transistor	1
T3	N-MOS_BSP123	SOT222	Transistor	1
T2	P-MOS_BSP171P	SOT223	Transistor	1
CCOMP2	1n	0805	Capacitor	1
CIVCC	1u/6,3	1812	Capacitor	1
CCOMP1	10n	0805	Capacitor	1
CIN1	nm	1210	Capacitor	1
CIN2	47uF	PANASONIK_FK_SIZE-F	Capacitor	1
CIN3, CIN4, CIN6, CIN7, CBO3, CBO4	nm	0805	Capacitor	6
CIN5	4,7uF	0805	Capacitor	1
CIN8	100uF	PANASONIK_FK_SIZE-F	Capacitor	1
CBO1	100nF	1210	Capacitor	1
CBO2	100uF	PANASONIK_FK_SIZE-F	Capacitor	1
COUT-1, COUT-2	470pF	0805	Capacitor	2
Distance		M3x15mm	Distance	4
Bolt		M3x6mm		4

TLD5098 - Short circuit detection implementation

- A defined short circuit voltage threshold (V_{FBL,FBH_S2G}) is implemented at the current sensing pins FBH and FBL.
- If the voltage level on this pins are lower than max. 2V a short circuit is detected.



Short Circuit Protection			min.	typ.	max.	
9.2.1	FBH and FBL Short-Circuit fault sensing common mode range	V_{FBL,FBH_S2G}	1.5	–	2	V

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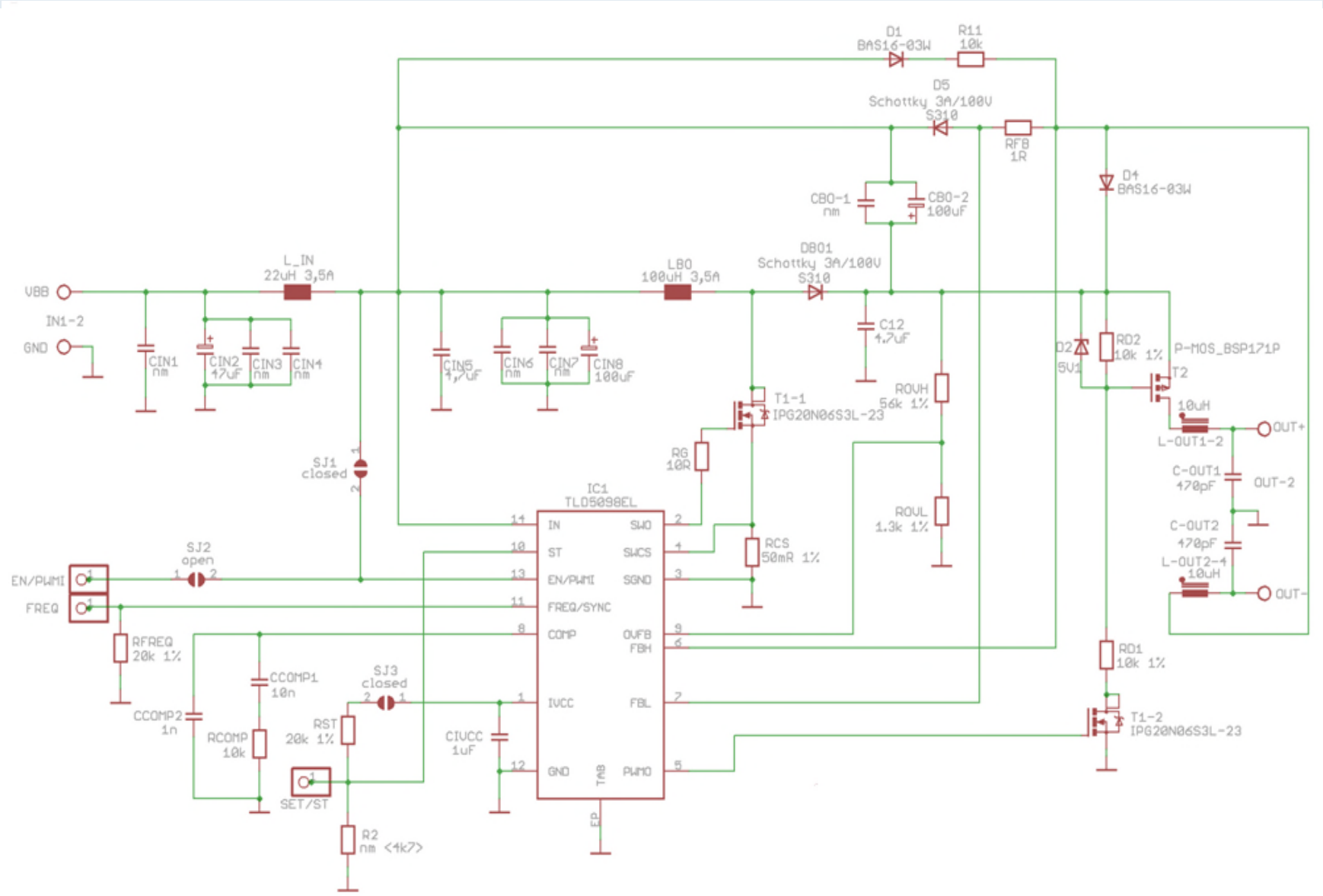
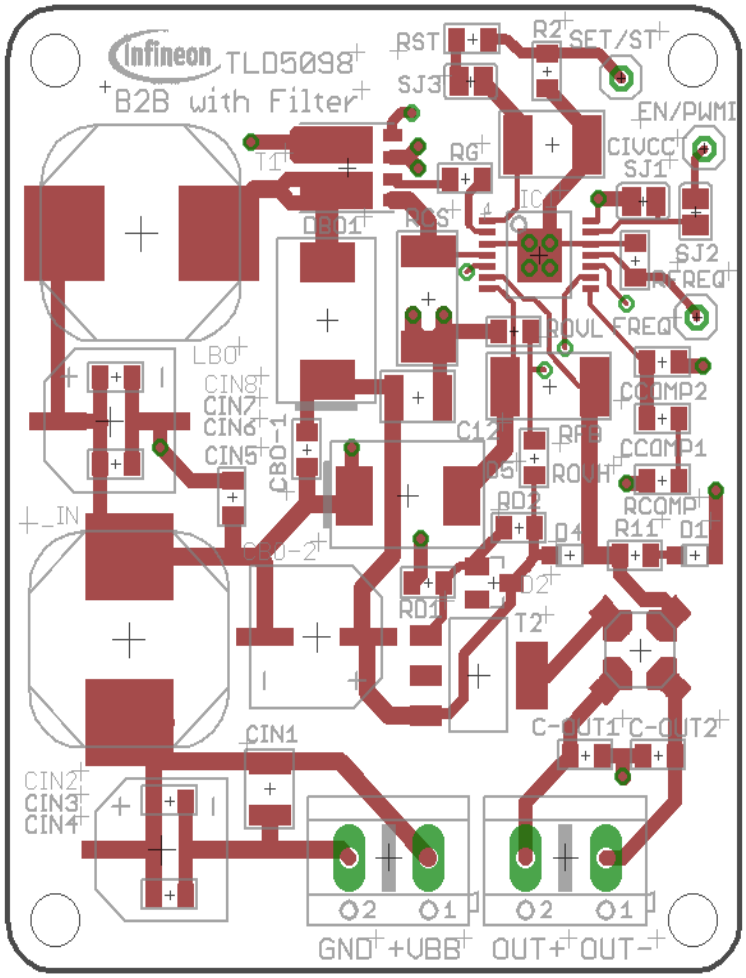
Boost to Battery (**B2B**) – Topology "**BUCK / BOOST**" Schematic



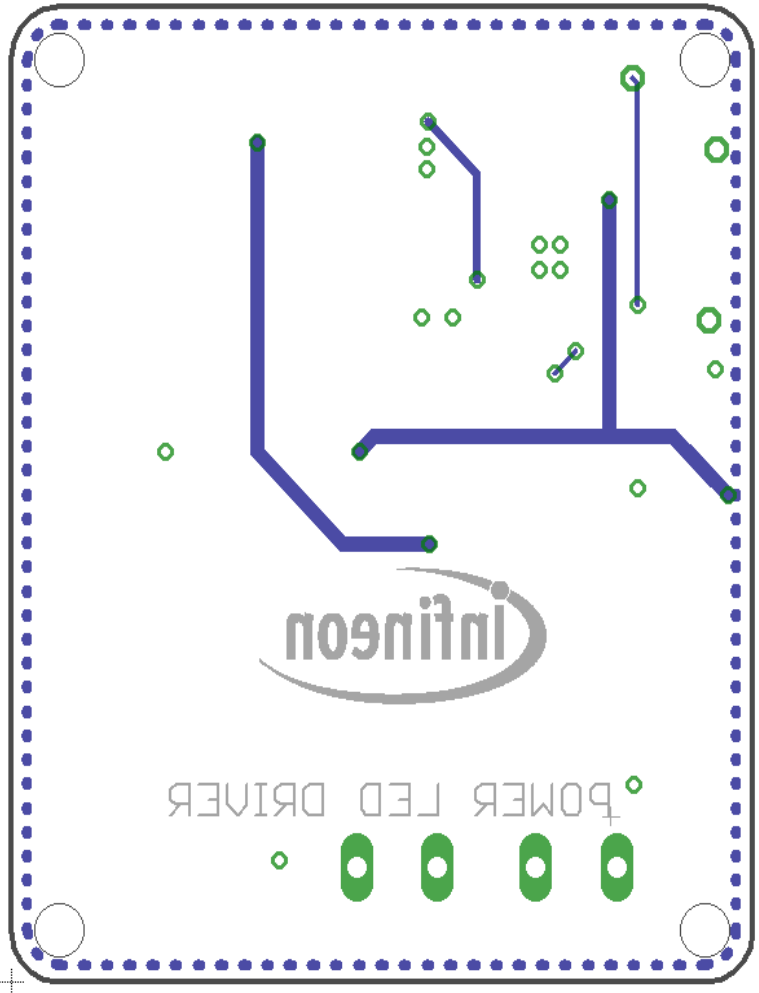
Boost to Battery (**B2B**) – Topology "**BUCK / BOOST**"
Board (TOP)

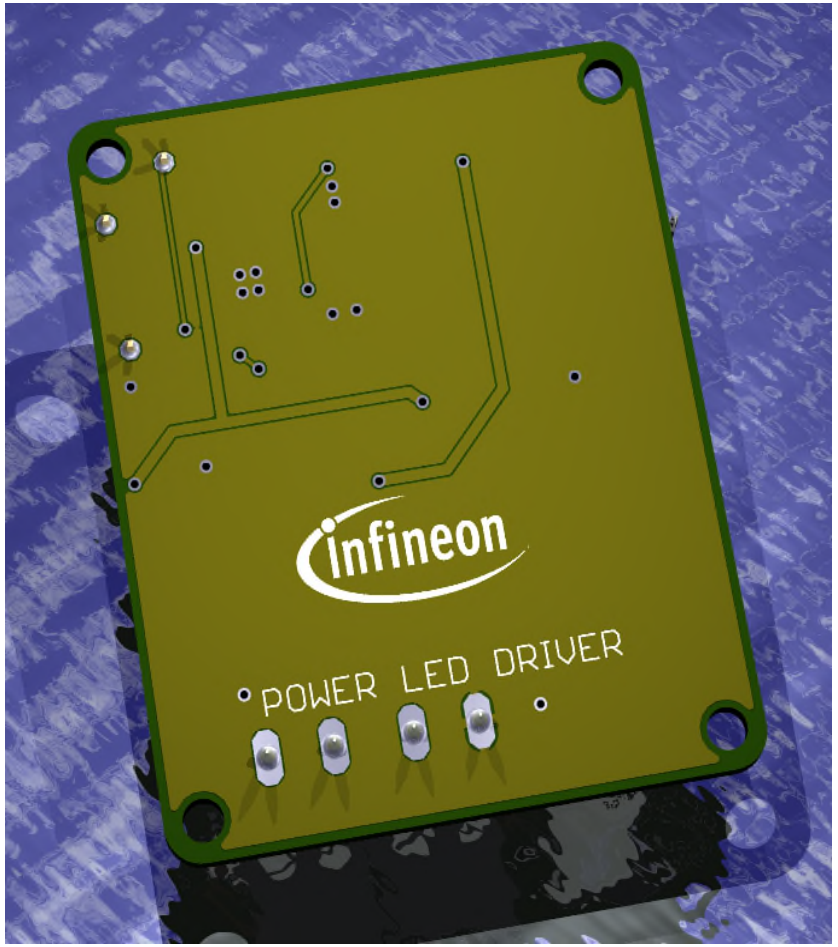


56mm

46mm

Boost to Battery (**B2B**) – Topology "**BUCK / BOOST**" Board (BOTTOM)





Boost to Battery (**B2B**) – Topology "**BUCK / BOOST**" Bill of Material (BOM)

Part	Value	Package	Device	Quantity
T1	IPG20N06S3L-23	PG-TDSON-8-4	Transistor	1
T2	P-MOS_BSP171P	SOT223	Transistor	1
SJ1, SJ3	closed	Solderjumper	Jumper	2
SJ2	open	Solderjumper	Jumper	1
IC1	TLD5098EL	PG-SSOP-14-1-EP	Chip	1
EN/PWMI , FREQ, SET/ST		Meassurement - Point		3
L-OUT	10uH	LPD4012	Coil	1
LBO	100uH 3,5A	MSS1278	Coil	1
L_IN	22uH 3,5A	MSS1278	Coil	1
IN1, OUT		AK500/2	Connection	2
D1, D4	BAS16-03W	SOD323	Diode	2
D5, DBO1	Schottky 3A/100V	DO214AB	Diode	2
D2	Zener Diodem 5,1V	SOT23	Diode	1
C-OUT1, C-OUT2	470pF	0805	Capacitor	2
C12	4.7uF	1210	Capacitor	1
CIN1	nm	1210	Capacitor	1
CIN3, CIN4, CIN6, CIN7	nm	0805	Capacitor	4
CIN5	4,7uF	0805	Capacitor	1
CIN2	47uF	PANASONIK_FK_SIZE-F	Capacitor	1
CIN8	100uF	PANASONIK_FK_SIZE-F	Capacitor	1

Boost to Battery (**B2B**) – Topology "**BUCK / BOOST**" Bill of Material (BOM)

CCOMP1	10n	0805	Capacitor	1
CCOMP2	1n	0805	Capacitor	1
CBO-1	nm	0805	Capacitor	1
CBO-2	100uF	PANASONIK_FK_SIZE-F	Capacitor	1
CIVCC	1uF	1812	Capacitor	1
R2	nm	0805	Resistor	1
R11, RCOMP, RD1, RD2	10k	0805	Resistor	4
RCS	50mR 1%	2512	Resistor	1
RFB	1R	2512	Resistor	1
RFREQ	20k 1%	0805	Resistor	1
RG	10R	0805	Resistor	1
ROVH	56k 1%	0805	Resistor	1
ROVL	1.3k 1%	0805	Resistor	1
RST	20k 1%	0805	Resistor	1
Distance		M3x15mm	Distance	4
Bolt		M3x6mm		4

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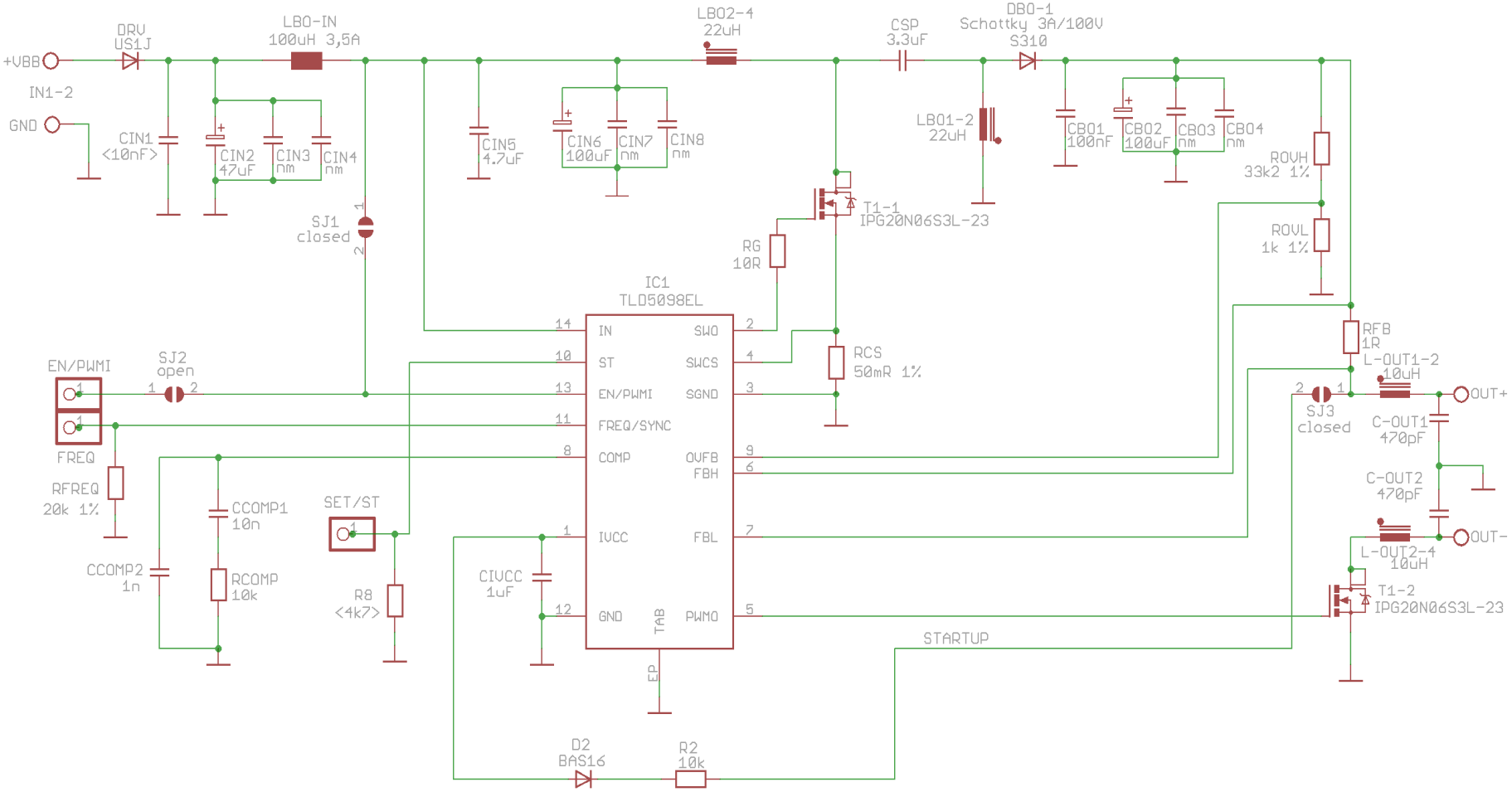
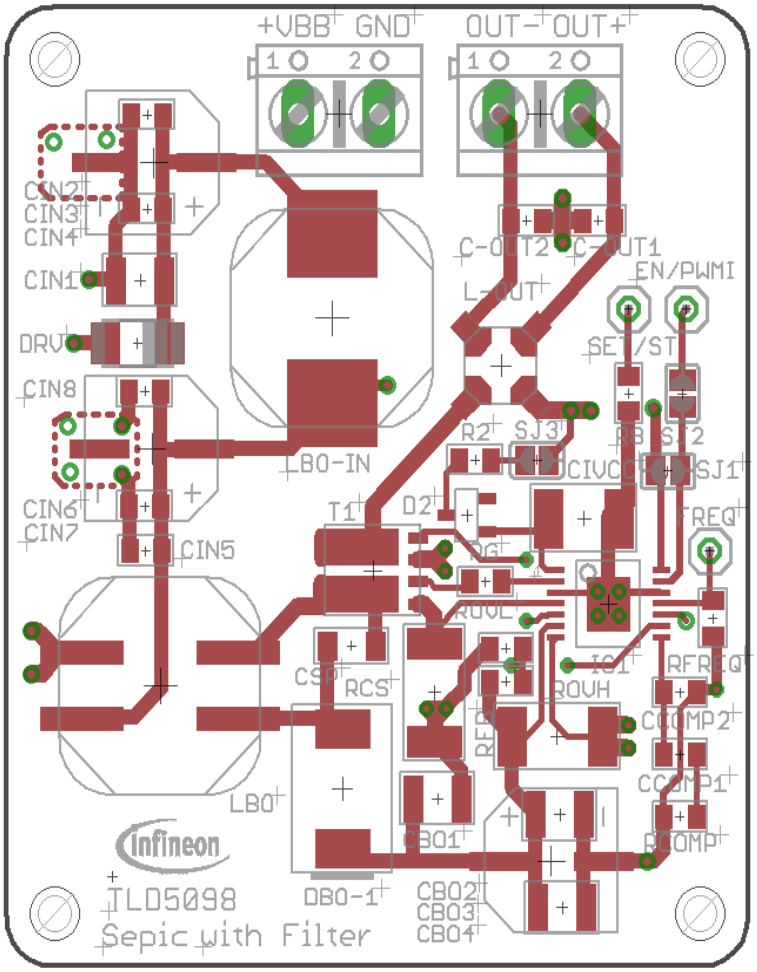
SEPIC configuration – Topology "**BUCK / BOOST**"

Schematic



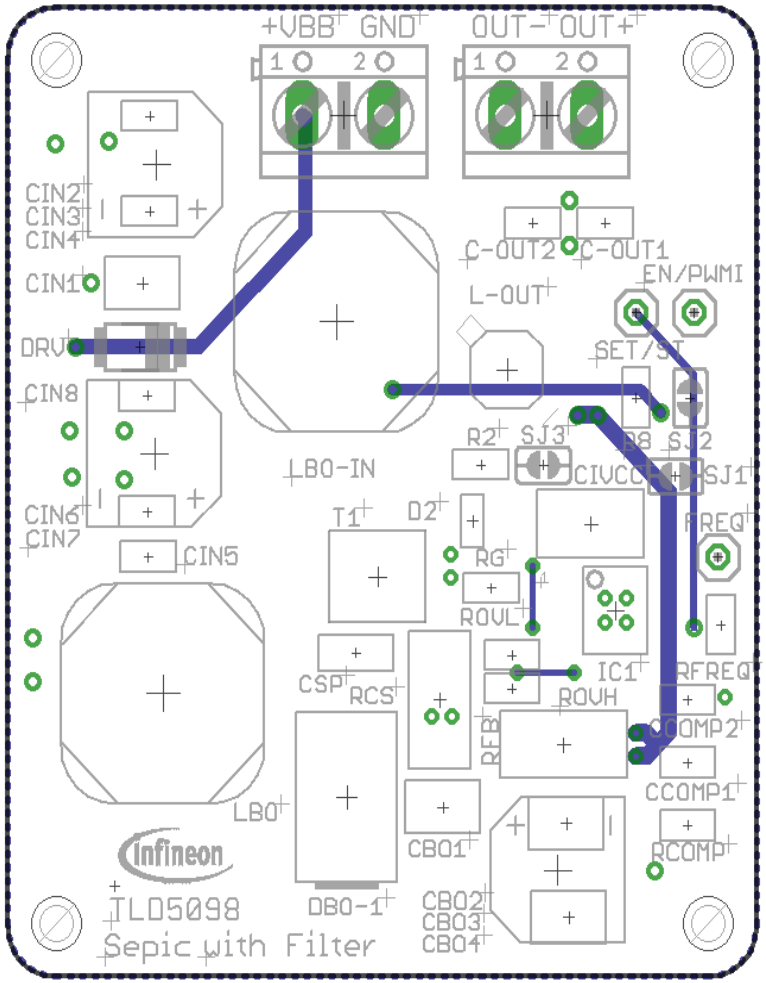
SEPIC configuration – Topology "**BUCK / BOOST**"
Board (TOP)

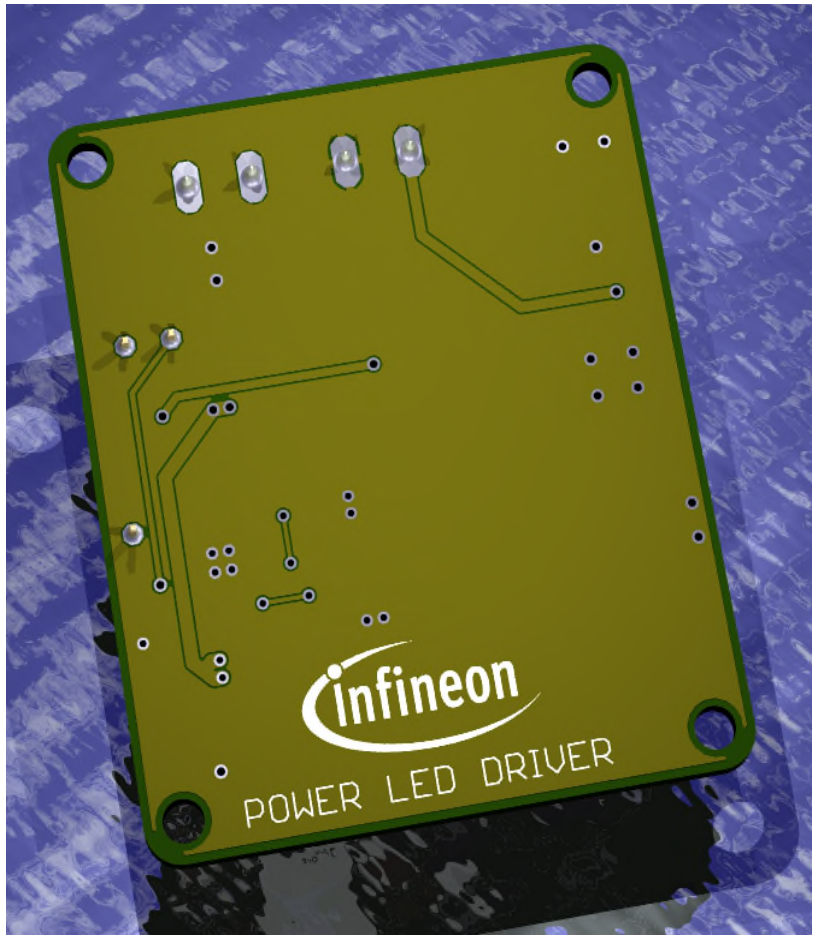


55mm

46mm

SEPIC configuration – Topology "**BUCK / BOOST**"
Board (BOTTOM)





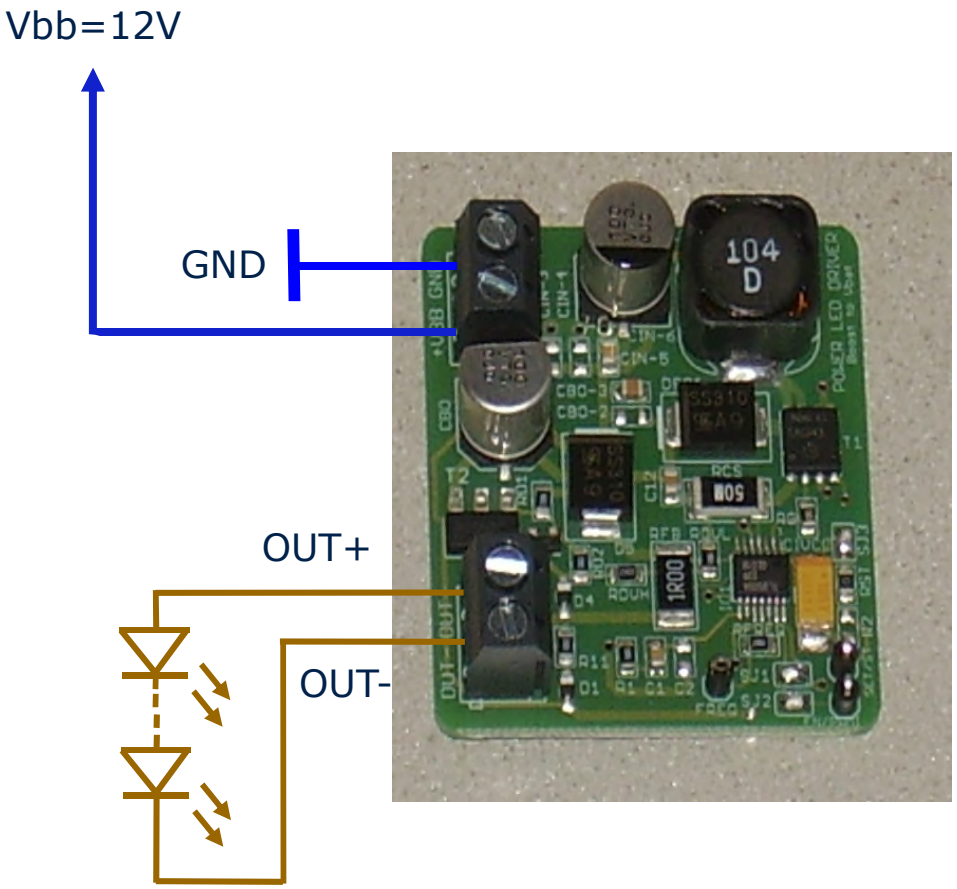
SEPIC configuration – Topology "**BUCK / BOOST**"
Bill of Material (BOM)

Part	Value	Package	Device	Quantity
T1	IPG20N06S3L-23	PG-TDSON-8-4	Transistor	1
SJ1, SJ3	closed	Solderjumper	Jumper	2
SJ2	open	Solderjumper	Jumper	1
EN/PWMI , FREQ , SET/ST		Meassurement - Point		3
R2, RCOMP	10k	0808	Resistor	2
R8	nm <4,7k>	0805	Resistor	1
RFB	1R	2510	Resistor	1
RCS	50mR 1%	2512	Resistor	1
RFREQ	20k 1%	0808	Resistor	1
RG	10R	0805	Resistor	1
ROVH	33k2 1%	0805	Resistor	1
ROVL	1k 1%	0805	Resistor	1
OUT+, IN1		AK500/2	Connection	2
L-OUT	10uH	LPD4012	Coil	1
LBO	22uH	MSD1278	Coil	1
LBO-IN	100uH / 3,5A	MSS1278	Coil	1
IC1	TLD5098EL	PG-SSOP-14-1-EP	Chip	1
DRV	US1J	DO-214AC	Diode	1
DBO-1	SCHOTTKY 3A 100V	DO-214AB	Diode	1
D2	BAS16	SOT23	Diode	1

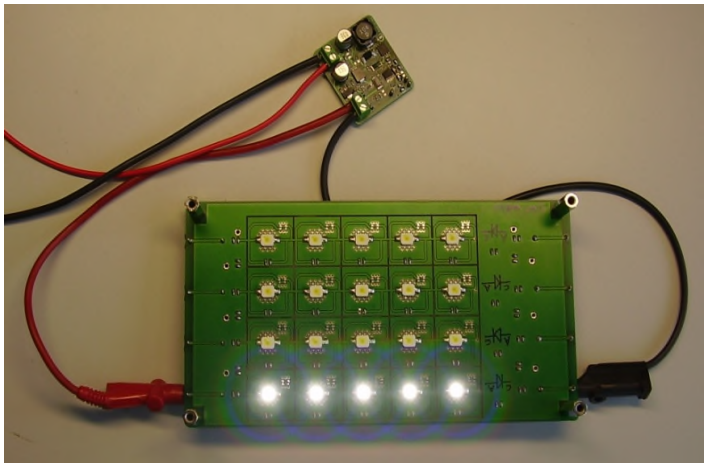
SEPIC configuration – Topology "**BUCK / BOOST**"
Bill of Material (BOM)

C-OUT1, C-OUT2	470pF	0805	Capacitor	2
CBO1	100nF	1210	Capacitor	1
CBO2	100uF	PANASONIK_FK_SIZE-F	Capacitor	1
CBO3, CBO4	nm	1210	Capacitor	2
CCOMP1	10nF	0805	Capacitor	1
CCOMP2	1nF	0805	Capacitor	1
CIN1	nm <10n>	1210	Capacitor	1
CIN2	47uF	PANASONIK_FK_SIZE-F	Capacitor	1
CIN3, CIN4, CIN6, CIN7	nm	0805	Capacitor	4
CIN5	4.7uF	0805	Capacitor	1
CIN8	100uF	PANASONIK_FK_SIZE-F	Capacitor	1
CIVCC	1uF	1812	Capacitor	1
CSP	3,3uF	1206	Capacitor	1
Distance		M3x15mm	Distance	4
Bolt		M3x6mm		4

Getting started – Example on **B2B without Filter**



Example: 5097/98
Application Board in combination with a general purpose loadboard!



LITIX™ Power
TLD5098EL - Application Boards Overview

- LITIX™ Power – General Overview
- LITIX™ Power – TLD5098EL Appboard Description
  - Boost to GND configuration + short to GND protection (B2G + S2G) – Topology “BOOST”
  - Boost to Battery (B2B) – Topology “BUCK / BOOST”
  - SEPIC configuration – Topology “BUCK / BOOST”
- LITIX™ Power - Support Material Overview

Available Appboards

Sales Name of Demoboard	SP Number	Description
APPBOARD TLD5098EL VER1	SP000954242	Constant Voltage Mode
APPBOARD TLD5098EL VER2	SP000954244	Boost to Ground Configuration w/ short to ground protection
APPBOARD TLD5098EL VER3	SP000954246	Boost to Battery Configuration
APPBOARD TLD5098EL VER4	SP000954248	SEPIC Configuration
APPBOARD TLD5098EL V5	SP000984908	Boost to Ground Configuration w/ short to ground protection & EMC filter
APPBOARD TLD5098EL V6	SP000984910	Boost to Battery Configuration with EMC filter
APPBOARD TLD5098EL V7	SP000984912	SEPIC Configuration with EMC filter
BOARD TLD5097 B2B	SP001157588	Boost to Battery Configuration
BOARD TLD5097 B2G	SP001157586	Boost to Ground Configuration
BOARD TLD5097 SEPIC	SP001157590	SEPIC Configuration

http://www.infineon.com/LITIX-power-appboards

Available Demoboards

Sales Name of Demoboard	SP Number	Description
Demoboard TLD5045EJ	SP000924382	Buck mode
Demoboard TLD5095EL Ver1	SP000760364	Boost to GND (default), Sepic & Constant Voltage Mode possible
Demoboard TLD5095EL Ver2	SP000845642	Boost to Battery (default), Constant Voltage Mode possible

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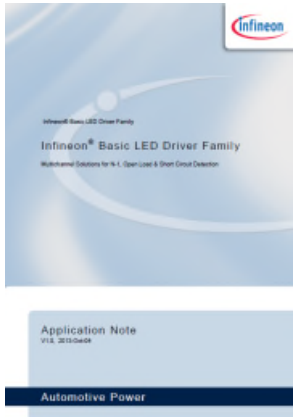
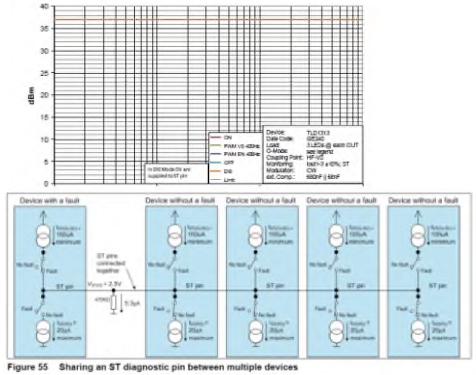
Other design in support material

- Data Sheets & Application Note
- Simulation Models
- EMC Test Reports
- Excel Calculation Tool for TLD509xEL available on request





Thank you very much for your attention

For more information, please visit:

http://www.infineon.com/LITIX

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