Getting started with STEVAL-L6983IV1 evaluation board based on L6983I, 38V, 10W synchronous iso-buck converter for isolated applications

Introduction

The STEVAL-L6983IV1 evaluation board is based on the L6983I, 38 V, 10 W synchronous iso-buck converter designed for isolated applications.

The primary output voltage can be accurately adjusted, whereas the isolated secondary output is derived by using a given transformer ratio. No optocoupler is required. The primary sink capability up to -4.5A (even during soft-start) allows transferring a proper energy to the secondary side as well as enabling a tracked soft-start of the secondary output. The control loop is based on a peak current mode architecture and the device operates in forced PWM. The 390 ns blanking time filters oscillations, generated by the transformer leakage inductance, making the solution more robust.

The compact QFN-16 3x3mm package and the internal compensation of the L6983I help minimize the design complexity and size.

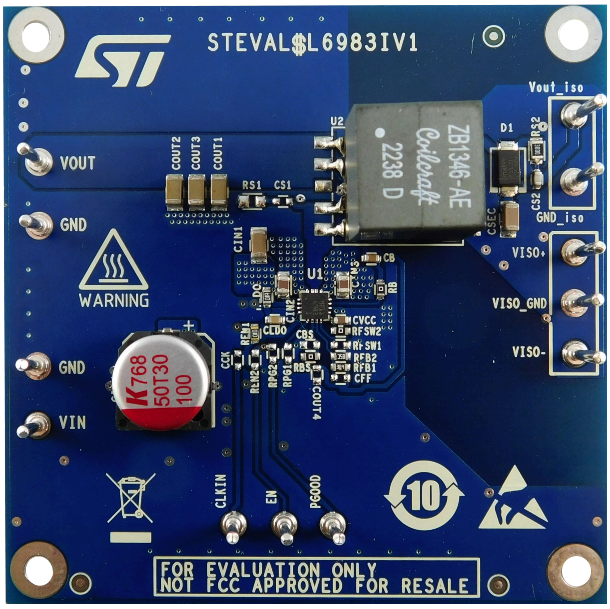
The switching frequency can be programmed in the 200 kHz - 1 MHz range with an optional spread spectrum for improved EMC.

The EN pin provides the enable/disable functionality. The typical shutdown current is 2 µA when disabled. As soon as the EN pin is pulled-up, the device is enabled, and the internal 1.3 ms soft start takes place.

The L6983I features the power good open collector that monitors the FB voltage. Pulse by pulse, the current sensing on both power elements implements an effective constant current protection. The thermal shutdown prevents thermal run-away. Due to the primary reverse current limit, the secondary output is protected against short-circuit events.

The evaluation board generates an isolated unregulated voltage and provides the possibility to use a post-regulation to generate a dual voltage (layout available on the bottom of the PCB, components not mounted).

Figure 1. STEVAL-L6983IV1 evaluation board



Notice: *For dedicated assistance, submit a request through our online support portal at* ***www.st.com/support****.*

1 Getting started

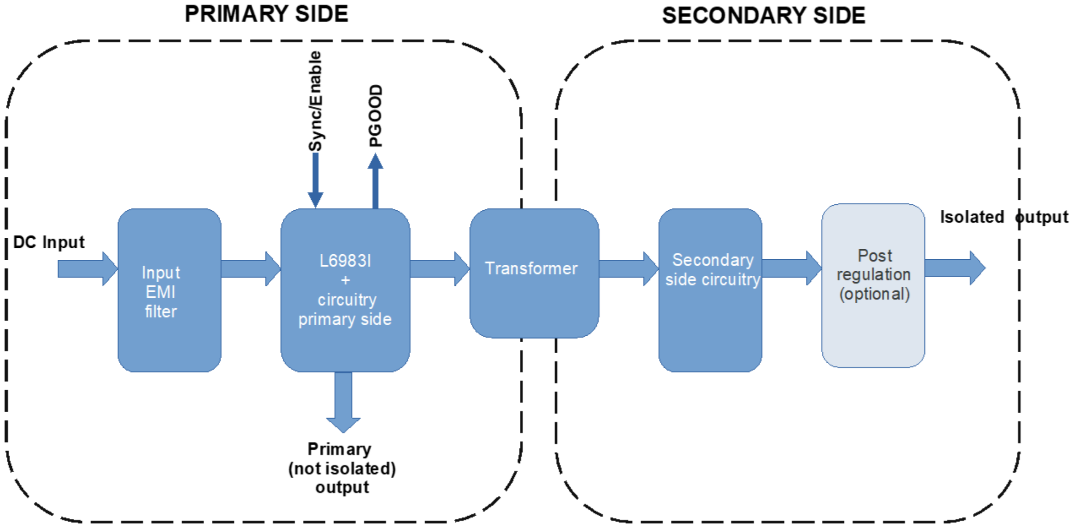
1.1 Safety instructions

This board is intended to be used by skilled technical personnel who are suitably qualified and familiar with the installation, use, and maintenance of power electronic systems. The same personnel must be aware of and must apply national accident prevention rules.

The electrical installation has to be completed in accordance with the appropriate requirements (that is, cross-sectional areas of conductors, fusing, and GND connections).

1.2 Functional block diagram

Figure 2. **STEVAL-L6983IV1 block diagram**



1.3 Features

- Designed for iso-buck topology
- 4 to 38 V input voltage range
- Up to 10 W deliverable power (depending on the application conditions)
- Isolated output voltage unregulated
- Optional postregulation (not mounted, layout foreseen at the bottom)
- Embeds the transformer
- Regulation at the primary side, no optocoupler required
- 200 kHz to 1 MHz programmable switching frequency
- Suitable for external synchronization
- Power-good signal available
- Enable function available
- Input EMI filter embedded
- Selectable spread spectrum function for improved EMC performance

2 How to use the board

The STEVAL-L6983IV1 is configured to deliver 5 V at the primary non-isolated output and an unregulated voltage at the isolated output that varies with the applied load (see load regulation curves in Section 9). The switching frequency is set to 400 kHz.

To use the board, follow the procedure below.

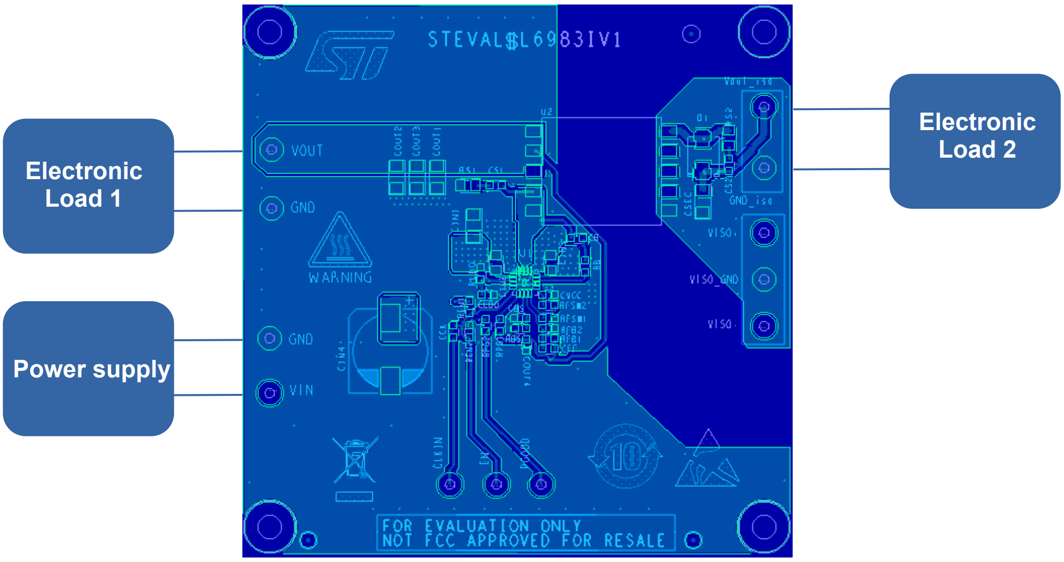
Step 1. Connect the power supply to the test points of VIN and GND.

Step 2. Connect the load to the primary non-isolated output (if any) as well as to the secondary isolated output.

Step 3. Set the supply voltage VIN from 8 V to 38 V and switch the power supply on.

Step 4. Regulate both active loads.

Figure 3. STEVAL-L6983IV1 basic test setup



3 Connectors and test points

3.1 VIN – TPxx

This connector is used for the input supply voltage. This voltage is provided, through the input EMI filter, to the device VIN pin.

A power supply ranging from 4 V to 38 V should be connected to this test point, setting a proper current limit.

The wire connection should be as short as possible to avoid or limit possible oscillations due to the parasitic inductance of the wire and the input capacitor.

3.2 GND1 and GND_{prim} – TPxx and TPxxx

GND1 and GND_{prim} are, respectively, the return path of the input and output capacitors. Wires used for this connection should be as short as possible.

3.3 V_{OUT1} – TPxx

This is the connector for the primary non-isolated output voltage. To load the primary output, connect a resistor or an active load to this test point. Short wires are recommended.

3.4 EN/SYNCH – TPxx

By default, the EN pin is pulled-up to the input voltage through the resistor R_{en1}. This makes the device always enabled. The same test-point can be used to apply an external signal for synchronization.

3.5 PGOOD – TPxx

This test point is directly connected to the PGOOD pin.

3.6 $VOUT_{iso}$ – TPxx

This test point provides the isolated output voltage (unregulated). When completely unloaded, the voltage at this pin could be much higher than the theoretical value (N*VOUT1). Short wire connection from this test point to the load is recommended.

3.7 GND_{iso} – TPxx

The voltage at this test point represents the reference for the isolated voltage. Short connection is recommended.

3.8 VISO+, VISO- and VISO_gnd – TPxx

The isolated output voltage can be post-regulated and used to generate a dual voltage. On the bottom side of the PCB, the layout for post-regulation is available (components to be assembled). If the components of the post regulation circuitry are assembled, the VISO+, VISO- and VISO_gnd test points provide a positive (VISO+) and negative voltage (VISO-), both referred to VISO_gnd.

4 Schematic diagrams

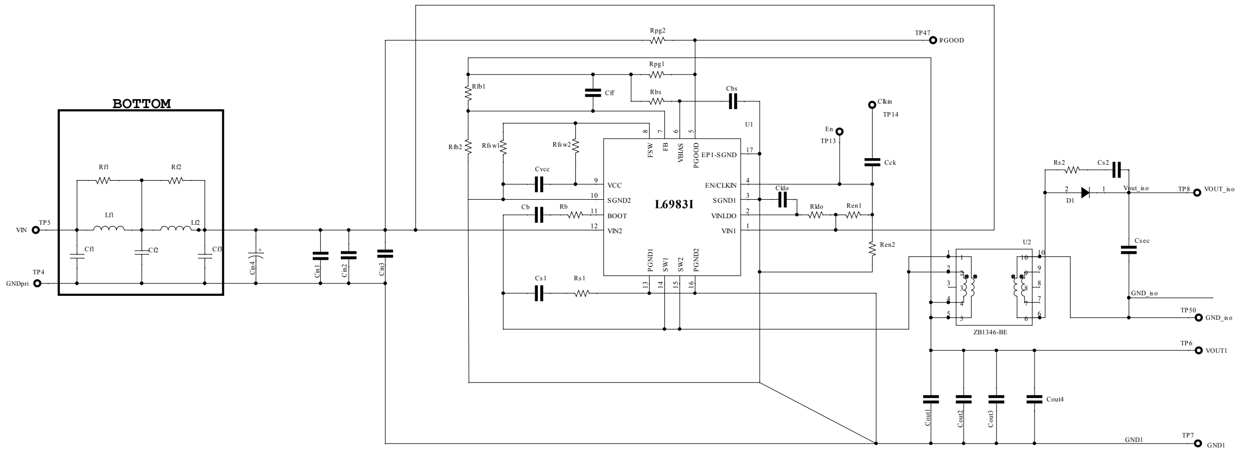


Figure 4. STEVAL-L6983IV1 circuit schematic (1 of 2)

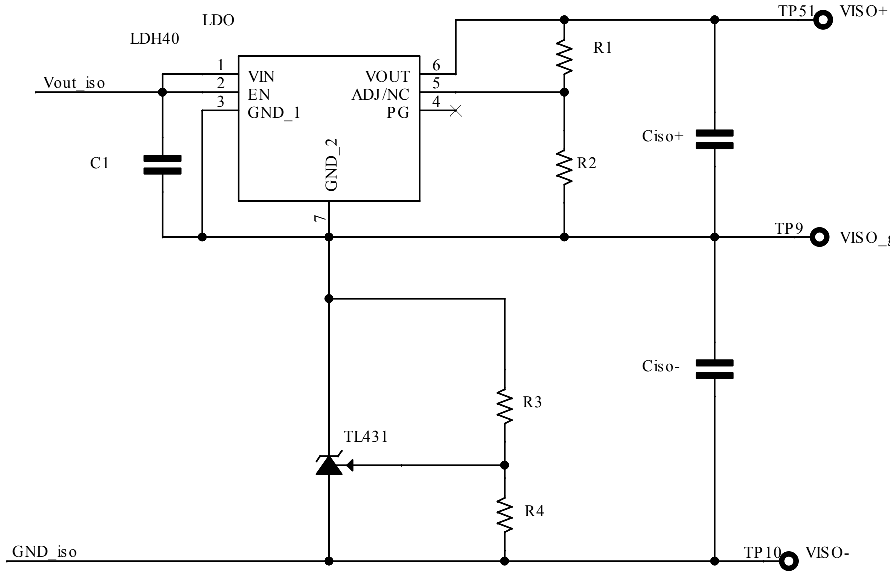


Figure 5. STEVAL-L6983IV1 circuit schematic (2 of 2) - post regulation (not mounted, bottom side)

5 Bill of materials

Table 1. BOM

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
1	1	U1	L6983IQTR QFPN 16L 3x3x0.8mm	38V 10W synchronous iso-buck converter for isolated applications	ST	L6983IQTR
2	1	U2	N = 6, 2kV isolation	Transformer 10pins, EPQ13	Coilcraft	ZB1346-AE
3	1	U3	LDO40LPURY DFN6 3x3mm	400mA, 38V LDO (not mounted)	ST	LDO40LPURY
4	1	R1	-	0603 SMD resistor (not mounted)	-	-
5	1	R2	-	0603 SMD resistor (not mounted)	-	-
6	1	R3	-	0603 SMD resistor (not mounted)	-	-
7	1	Rb	0Ω, 1%, 0.25W	0603 SMD resistor	-	-
8	1	Rbs	0Ω, 1%, 0.25W	0603 SMD resistor	-	-
9	1	Ren1	100kΩ, 1%, 0.25W	0603 SMD resistor	-	-
10	1	Ren2	-	0603 SMD resistor (not mounted)	-	-
11	1	Rf1	-	0603 SMD resistor (not mounted)	-	-
12	1	Rf2	-	0603 SMD resistor (not mounted)	-	-
13	1	Rfb1	360kΩ, 1%, 0.25W	0603 SMD resistor	-	-
14	1	Rfb2	75kΩ, 1%, 0.25W	0603 SMD resistor	-	-
15	1	Rfsw1	-	0603 SMD resistor (not mounted)	-	-
16	1	Rfsw2	0Ω, 1%, 0.25W	0603 SMD resistor	-	-
17	1	Rldo	100Ω, 1%, 0.25W	0603 SMD resistor	-	-
18	1	Rpg1	-	0603 SMD resistor (not mounted)	-	-

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
19	1	Rpg2	-	0603 SMD resistor (not mounted)	-	-
20	1	Rs1	-	0805 SMD resistor (not mounted)	-	-
21	1	Rs2	300Ω, 1%, 0.5W	0805 SMD resistor	-	-
22	1	Cldo	1μF, 50V, 10%	0603 MLCC	Samsung Electro Mechanics	CL10A105KB8NNNC
23	1	C1	-	0603 MLCC (not mounted)	-	-
24	1	Cb	100nF, 50V, 10%	0603 MLCC	TDK	CGA3E2X7R1H104K080AA
25	1	Cbs	-	0603 MLCC (not mounted)	-	-
26	1	Cck	-	0603 MLCC (not mounted)	-	-
27	3	Cf1,Cf2, Cf3	10μF, 50V, 10%	1206 MLCC	Samsung Electro Mechanics	CL31B106KBHNNNE
28	1	Cff	-	0603 MLCC (not mounted)	-	-
29	1	Cin1	10μF, 50V, 10%	1206 MLCC	Samsung Electro Mechanics	CL31B106KBHNNNE
30	2	Cin2 Cin3	1μF, 50V, 20%	0805 MLCC	TDK	CGA4J3X7R1H105M125AB
31	1	Cin4	100μF, 50V, 20%	Aluminum organic polymer capacitror10x10 mm	KEMET	A768MS107M1HLAV024
32	2	Ciso+ Ciso-	-	0805 MLCC (not mounted)	-	-
33	3	Cout1 Cout2 Cout3	22μF, 16V, 20%	1206 MLCC	Taiyo Yuden	EMK316BB7226ML-T
34	1	Cout4	-	0603 MLCC	-	-
35	1	Cs1	-	0603 MLCC	-	-
36	1	Cs2	180pF, 50V, 1%	0603 MLCC	Vishay	VJ0603A181FXAPW1BC
37	1	Csec	10μF, 50V, 10%	1206MLCC	Samsung Electro Mechanics	CL31B106KBHNNNE
38	1	Cvcc	1μF, 16V, 10%	0603 MLCC	TDK	CGA3E1X7R1C105K080AC
39	1	Lf1	220Ω (100MHz), 25%	0805 Ferrite bead	TDK	MPZ2012S221ATD25
40	1	Lf2	6.8μH	4x4mm Inductor	Coilcraft	XGL4030-682MEC

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
41	1	D1	170V, 1A	Power schottky rectifier, SMA Flat	ST	STPS1170AF
42	1	Dz1	SOD123 package	Zener Diode (not mounted)	-	-
43	1	Dz2	SOD123 package	Zener Diode (not mounted)	-	-
44	1	Q1	SOT23 package	NPN BJT (not mounted)	ST	2STR1215
45	12	TP1 to TP12	-	Turret solder/ press mount terminal 1.3mm – 13.5mm – 5mm	ETTINGER	13.14.239

Table 2. Main parameters of the transformer ZB1346-BE

Description	Value
Turn ratio	1:6
Magnetizing inductance	13.5 µH
Leakage inductance	140 nH
Primary winding resistance	60 mΩ
Secondary winding resistance	1.35 Ω

6 STEVAL-L6983IV1 layout

The STEVAL-L6983IV1 is a two-layer PCB with 1 oz copper thickness.

Figure 6. STEVAL-L6983IV1 layout (top)

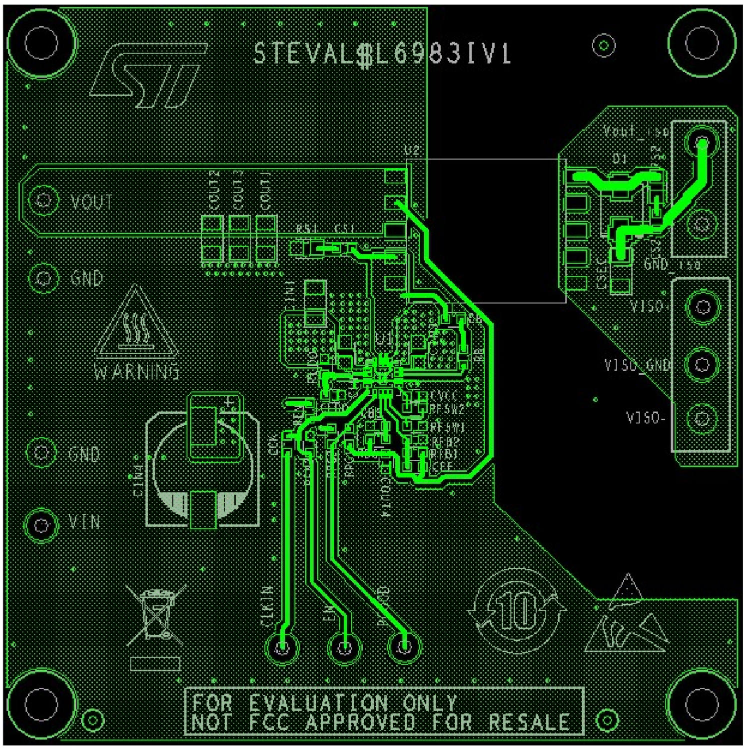
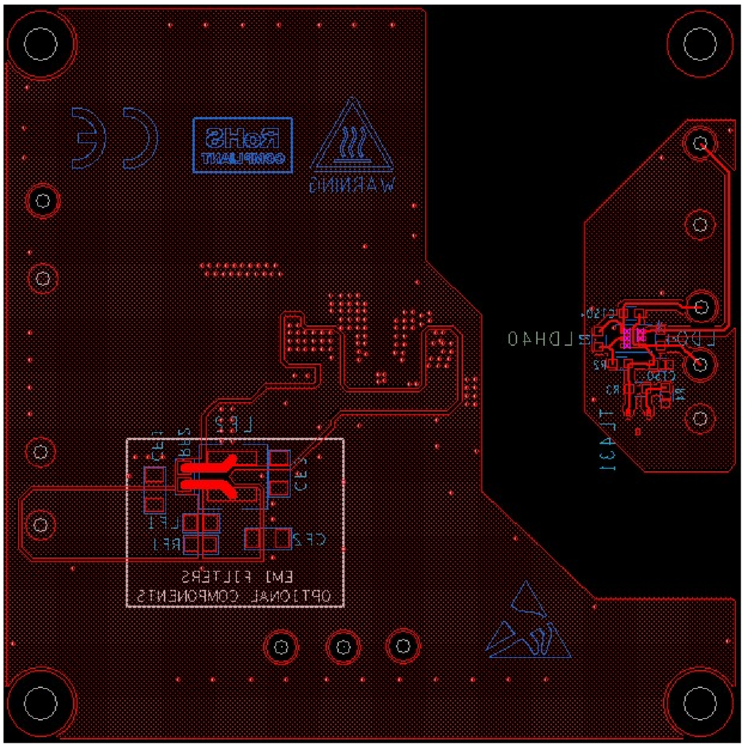


Figure 7. STEVAL-L6983IV1 layout (bottom)



7 STEVAL-L6983IV1 performance and waveforms

7.1 Efficiency

Figure 8. Efficiency at different V_{IN}, f_{SW} = 400 kHz

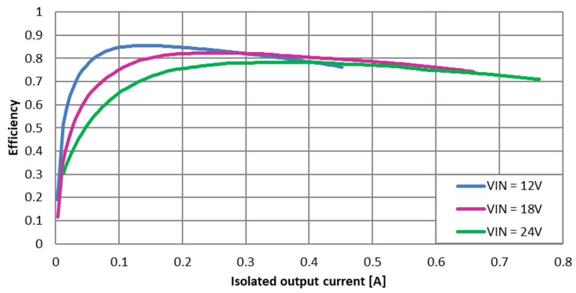


Figure 9. Efficiency vs f_{SW}, V_{IN} = 12 V

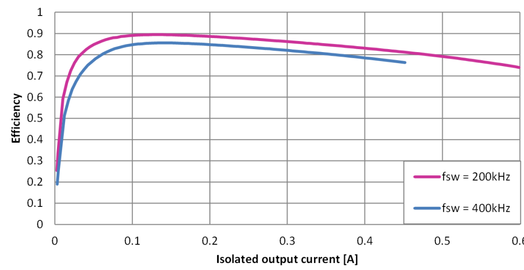


Figure 10. Efficiency vs f_{SW}, V_{IN} = 18 V

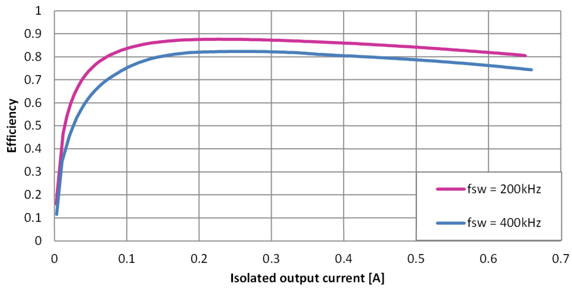
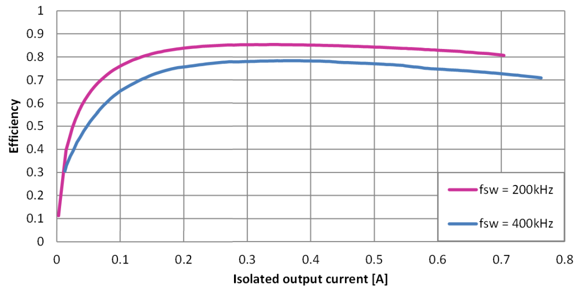


Figure 11. Efficiency vs f_{SW}, V_{IN} = 24 V



7.2 Load regulation

Figure 12. Load regulation at different V_{IN}, f_{SW} = 400 kHz

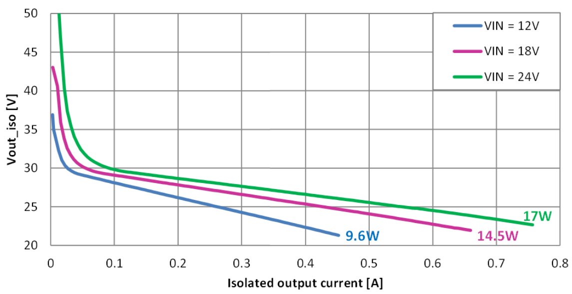


Figure 13. Load regulation vs f_{SW}, V_{IN} = 12 V

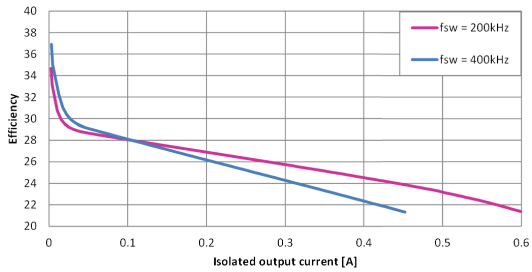


Figure 14. Load regulation vs f_{SW}, V_{IN} = 18 V

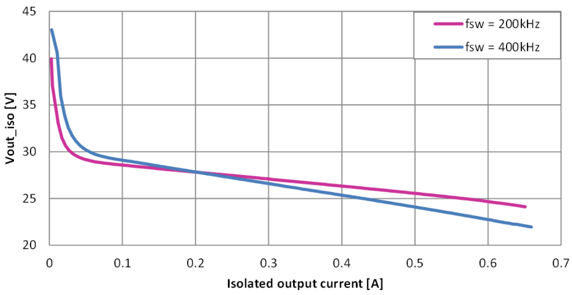
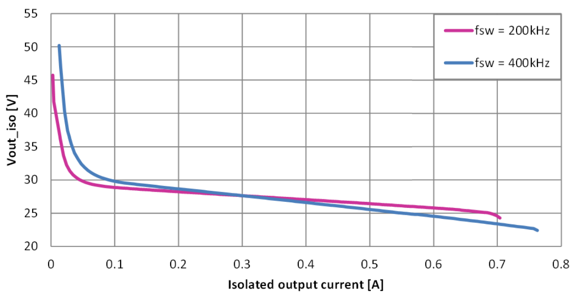


Figure 15. Load regulation vs f_{SW}, V_{IN} = 24 V



7.3 Winding current

Figure 16. V_{IN} = 12 V, f_{SW} = 400 kHz, I_{OUTiso} = 450 mA

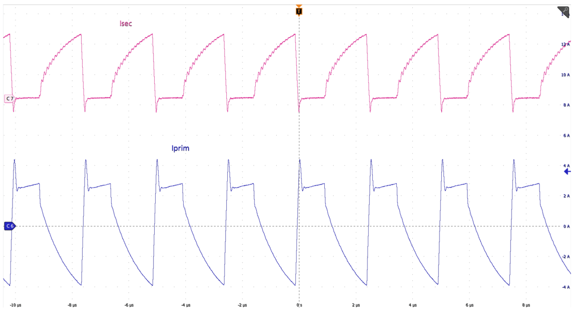


Figure 17. V_{IN} = 12 V, f_{SW} = 200 kHz, I_{OUTiso} = 600 mA

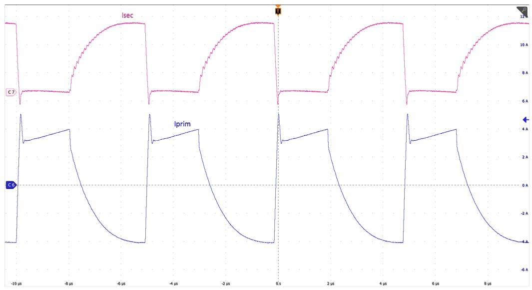


Figure 18. V_{IN} = 24 V, f_{SW} = 400 kHz, I_{OUTiso} = 750 mA

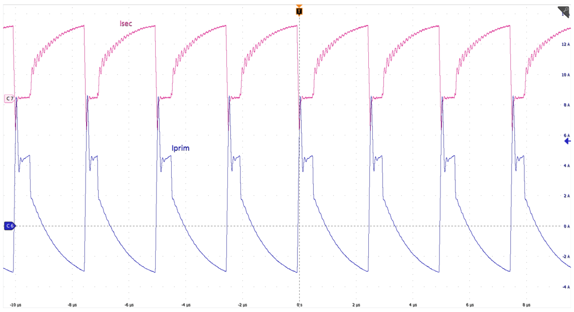
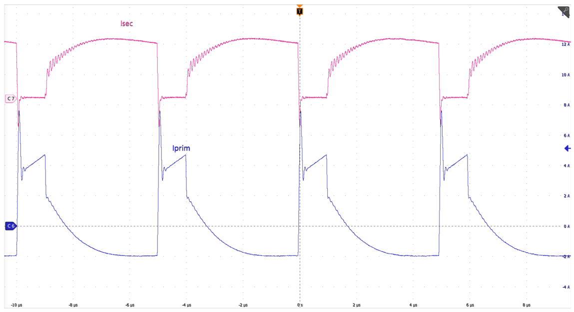


Figure 19. V_{IN} = 24 V, f_{SW} = 200 kHz, I_{OUTiso} = 700 mA



8 Input EMI filter

The STEVAL-L6983IV1 is compliant with CISPR16-4-2 thanks to the embedded EMI filter (bottom side).

The EMI filter consists of:

- A double pi filter with an inductor (Lf2)
- A ferrite bead (Lf1)
- Three MLCC capacitors (Cf1, Cf2, and Cf3)
- An electrolytic bulk capacitor used as bulk energy storage (Cin4)

9 STEVAL-L6983IV1 EMC compliance

The STEVAL-L6983IV1 is certified by an external supervisor company and Class A compliant with the following standards, for industrial use only:

Table 3. List of standards which the STEVAL-L6983IV1 complies with

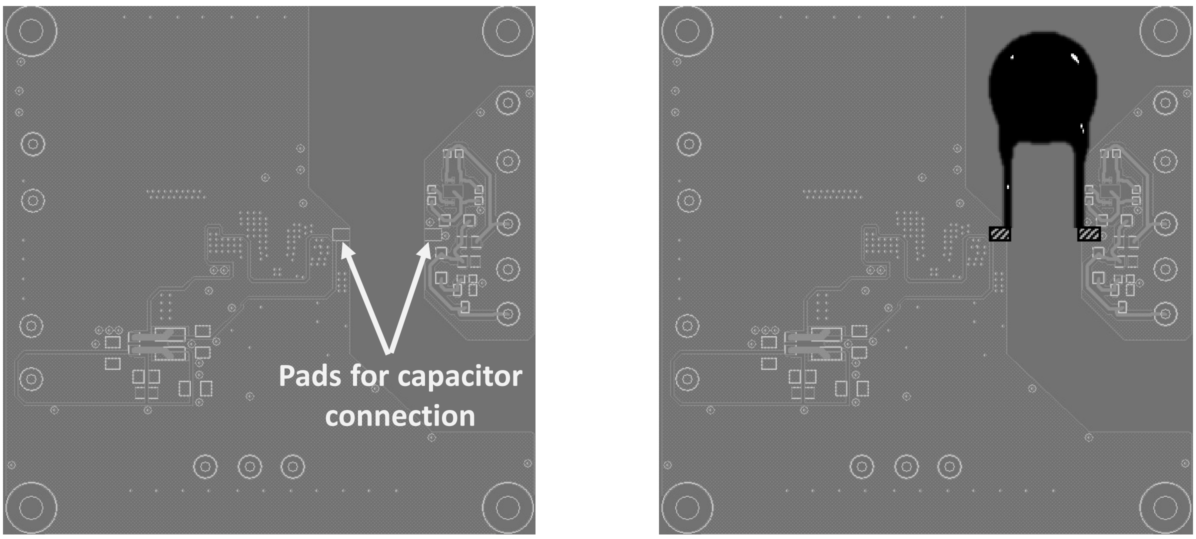
Reference standard	Standard application
CISPR 32:2015 +A1:2019 / EN 55032:2015 + A1:2020 CISPR 35:2016 / EN 55035:2017 + A11:2020 IEC 61000-3-2:2018 + A1:2020 EN IEC 61000-2-3:2019 + A1:2021 IEC 61000-3-3:2013 + A1:2017 + A2:2021 EN 61000-3-3:2013 + A1:2019 + A2:2021	Full
FCC CFR 47 Part 15 Subpart B	Full
ICES-003 Issue 7 (2020)	Full

The compliance is achieved by using a 4.7 nF capacitor (the one specified in the table below), soldered with a very short connection to the provided pads at the bottom of the STEVAL-L6983IV1 (see Figure 20)

Table 4. Capacitor used to achieve the compliance

Part number	Description	Manufacturer
CK45-B3DD472KYVNA	Ceramic Disc Capacitor, 4700 pF, 2 kV, ± 10%, B, 7.5 mm, Radial Leaded	TDK

Figure 20. Capacitor connection at the bottom of STEVAL-L6983IV1 for EMC compliance



The addition of the capacitor mentioned above implies an improvement of the EMC performances, with special reference to the radiated emissions in which a reduction up to 30 dBμV/m is achievable.

The results of the EMC tests are shown in the Figure 21 and Figure 22.

Figure 21. Conducted EMC test results of the STEVAL-L6983IV1

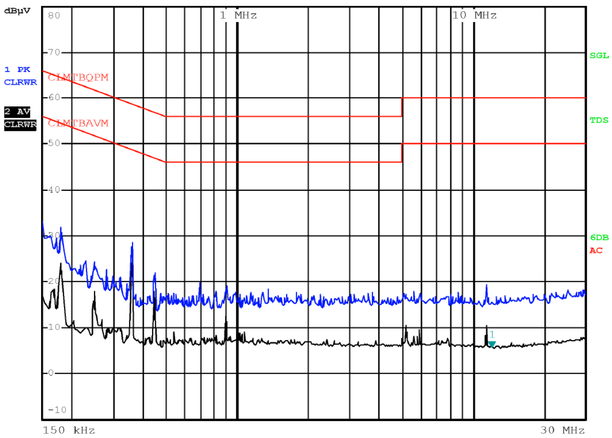
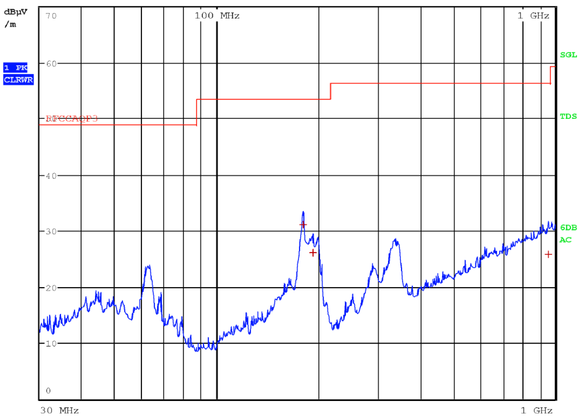
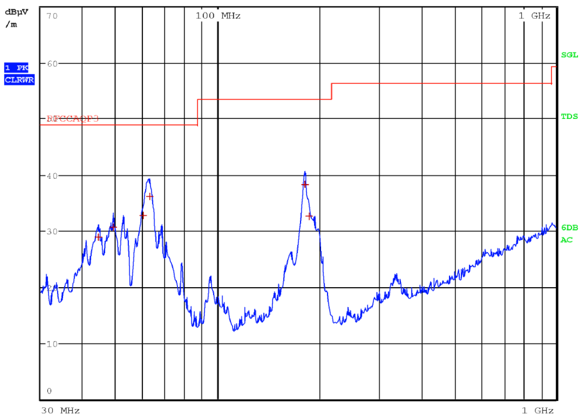


Figure 22. Radiated EMC test results of the STEVAL-L6983IV1 (horizontal on the left, vertical on the right)





10 Disclaimer

The certification of the STEVAL-L6983IV1 is fulfilled with the schematic, the layout and the BOM indicated in the sections 4, 5, 6.

Any drift from the schematic, the layout, and the BOM described in the sections 4, 5, 6, invalidates the certification and the EMC compliance of the STEVAL-L6983IV1 is no longer ensured.

Any change in the schematic, layout, and BOM implemented by the user of the STEVAL-L6983IV1 are under the user's responsibility.

The recommended changes in the BOM described in the next chapters should be considered as possible application ideas in case the user wish to adapt the board to other typical application requirements.

Although the recommended modifications can be considered as minor changes, the certification of the STEVAL-L6983IV1 remains valid only under the conditions mentioned in the sections 4, 5, 6.

11 Board setting capability

The STEVAL-L6983IV1 provides the possibility to change some settings according to the application conditions.

Switching frequency

By default, the Rfsw2 is equal to 0 Ω. It sets the switching frequency to 400 kHz and enables the dithering.

By changing the value of Rfsw1, a different switching frequency is set. Using the Rfsw1 instead of Rfsw2 disables the dithering function (see Table 5. Switching frequency and dithering setting).

Figure 23. Resistors on the PCB used to set the switching frequency and the dithering

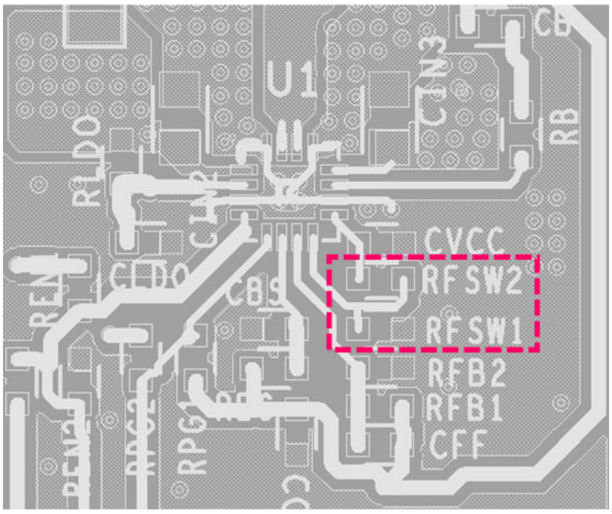


Table 5. Switching frequency and dithering setting

Symbol	Option	Rfsw2(KΩ)	Rfsw1(KΩ)	Min.	Typ.	Max.	Unit
FSW	Dithering	1.8	N.C.		200		kHz
		0	N.C.		400		kHz
		3.3	N.C.		500		kHz
		5.6	N.C.		700		kHz
		10	N.C.		1000		kHz
	No dithering	N.C.	1.8		200		kHz
		N.C.	0	360	400	440	kHz
		N.C.	3.3		500		kHz
		N.C.	5.6	630	700	770	kHz
		N.C.	10	900	1000	1100	kHz

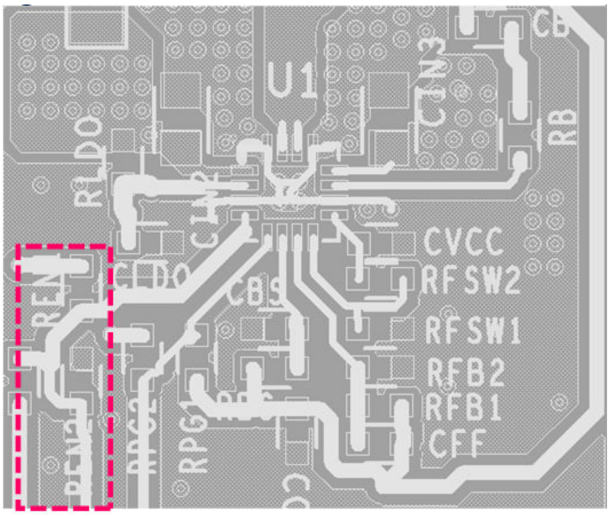
Enable thresholds

The STEVAL-L6983IV1 is equipped with the R_{EN1} = 100 kΩ as pull-up resistor to keep the device always enabled. The power-up threshold can be adjusted by properly selecting the R_{EN1} and R_{EN2}, according to the following equations:

$$V_{PowerUP} = 1.2 \cdot \left(1 + \frac{R_{EN1}}{R_{EN2}}\right)$$

$$V_{PowerDown} = 1.0 \cdot \left(1 + \frac{R_{EN1}}{R_{EN2}}\right)$$

Figure 24. **Resistors to enable thresholds setting**

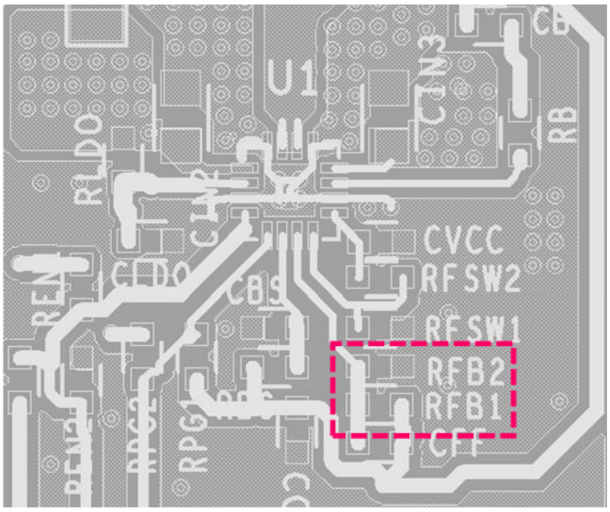


Primary output voltage

The primary (nonisolated) output voltage is set to 5 V. If a different voltage is desired, the output resistor divider should be adjusted according to the following equation:

$$V_{OUT\_prim} = 0.85 \cdot \left(1 + \frac{R_{FB1}}{R_{FB2}}\right)$$

Figure 25. **Resistors of the primary output divider**



Secondary isolated output voltage

The secondary isolated output voltage is not regulated. A post regulation can be implemented by following the guidelines provided in Post regulation circuitry.

The isolated unregulated voltage depends on several parameters. In the case of no current is drawn from the primary output, a good approximation of the secondary isolated output voltage is given by the following formula:

$$V_{OUT\_sec} = N \cdot V_{OUT\_prim} \cdot \frac{L_m}{L_m + L_{LEAK}} - R_{wind\_sec} \cdot I_{OUT\_sec} - V_{FD1}$$

The load regulation performances are depicted in Section 7.2: Load regulation.

Note: Changing the value of the primary output voltage implies the variation of the isolated output voltage too.

12 eDesignSuite

The eDesignSuite software tool developed by STMicroelectronics helps you configure ST products for power conversion applications.

You can use it to customize your board for a specific application. After entering the main specifications for your design, you can generate an automatic design or follow a sequential process to build a highly customized design.

13 Application idea

13.1 Post regulation circuitry

A post regulation circuitry is foreseen in the layout at the bottom of the STEVAL-L6983IV1. No components are embedded.

The table below proposes the possible components that can be mounted according to the desired post-regulated voltage(s).

Table 6. Post regulation options for various applications

Desired isolated voltage(s)	R1	R2	R3	R4	TL431	C1	Ciso+, Ciso-	Other notes
18 V/-5 V	11.5 kΩ	825 Ω	10 kΩ	10 kΩ	TL431BL3T	1 µF	1 µF → 10 µF	-
15 V/-8 V	11.5 kΩ	1 kΩ	22 kΩ	10 kΩ	TL431BL3T	1 µF	1 µF → 10 µF	-
12 V	7.5 kΩ	825 Ω	n.m.	n.m.	n.m.	1 µF	1 µF →à 10 µF (only Ciso+)	• Use a transformer with a lower turn ratio (e.g. ZD2087-AE, see Section 13.2: Transformer optimization example) • Adjust the primary output voltage accordingly (e.g. R_{FB1} = 420 kΩ) • VISO- and GNDiso shorted
6 V/-3 V	3.3 kΩ	825 Ω	2 kΩ	10 kΩ	TL431BL3T	1 µF	1 µF → 10 µF	• Use a transformer with a lower turn ratio (e.g. ZD2087-AE, see Section 13.2: Transformer optimization example) • Adjust the primary output voltage accordingly (e.g. R_{FB1} = 330 kΩ)

The last two solutions foresee a different primary output voltage and a different transformer that better match the reduced voltage required at the secondary side for those applications.

More details about the proposed transformer are provided in the next section.

13.2 Transformer optimization example

The BOM described in Table 1. BOM implies that the primary output voltage is regulated to 5 V and the transformer is optimized for that voltage in order to provide a secondary isolated output voltage (around 30 V) suitable for a possible post-regulation that generates 18 V/-5 V or 15 V/-8 V.

If a different isolated voltage should be regulated or a 24 V bus is used as input voltage, an optimized solution can be derived with some changes in the BOM (e.g. transformer, primary side resistor divider).

The Table 7 shows an example how to change the primary output resistor divider in case a 12 V primary output is regulated from a 24 V input voltage. It is also proposed a different transformer with a lower turn ratio (N = 2.55, see Table 8) that ensures a secondary output voltage around 30 V too.

Table 7. Comparison between STEVAL-L6983IV1 BOM and optimized solution for V_{IN} = 24 V

		Solution of the STEVAL-L6983IV1	Optimized solution for V_{IN} = 24 V regulating 12 V at the primary output
Transformer		ZB1346-BE	ZD2087-AE
Primary output resistor divider	R_{FB1}	360 kΩ	120 kΩ
	R_{FB2}	75 kΩ	9.1 kΩ

Characteristic of the transformer for this solution are summarized in the table below.

Table 8. Main parameters of the transformer ZD2087-AE

Description	Value
Turn ratio	1:2.55
Magnetizing inductance	13.5 µH
Leakage inductance	150 nH
Primary winding resistance	30 mΩ
Secondary winding resistance	293 mΩ

Here below some performance curves and waveforms relative to this application.

Figure 26. Efficiency vs f_{SW}, V_{IN} = 24 V

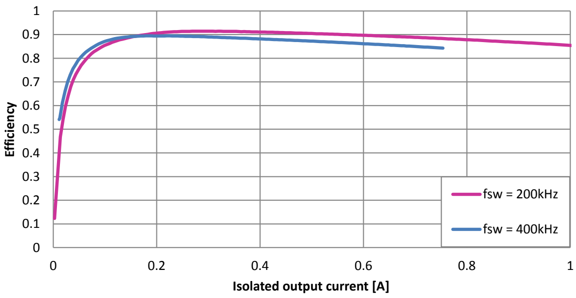


Figure 27. Load regulation vs f_{SW}, V_{IN} = 24 V

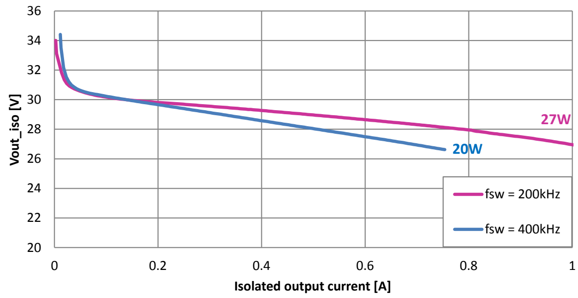


Figure 28. V_{IN} = 24 V, f_{SW} = 400 kHz, I_{OUTiso} = 750 mA

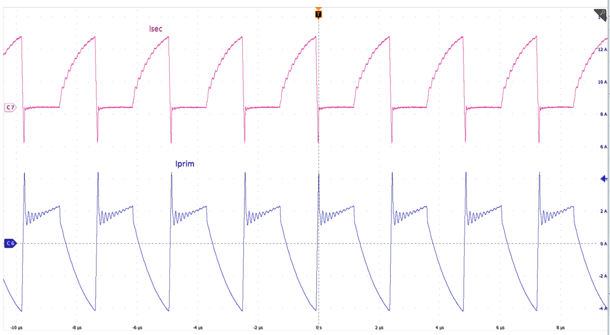
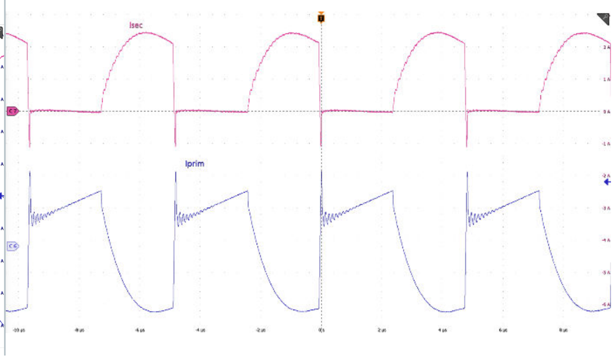


Figure 29. V_{IN} = 24 V, f_{SW} = 200 kHz, I_{OUTiso} = 1 A



14 Thermal performance

The pictures below show the thermal performance of the STEVAL-L6983IV1 detected by an infrared camera under the specific conditions.

Figure 30. V_{IN} = 12 V, f_{SW} = 400 kHz, I_{OUTiso} = 450 mA (hotspot around 74°C)

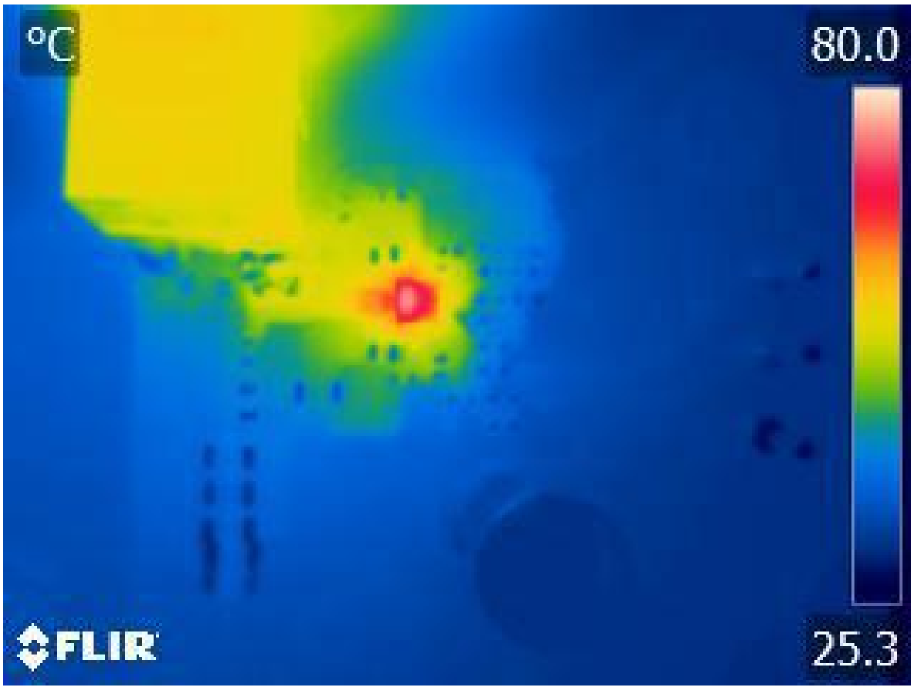
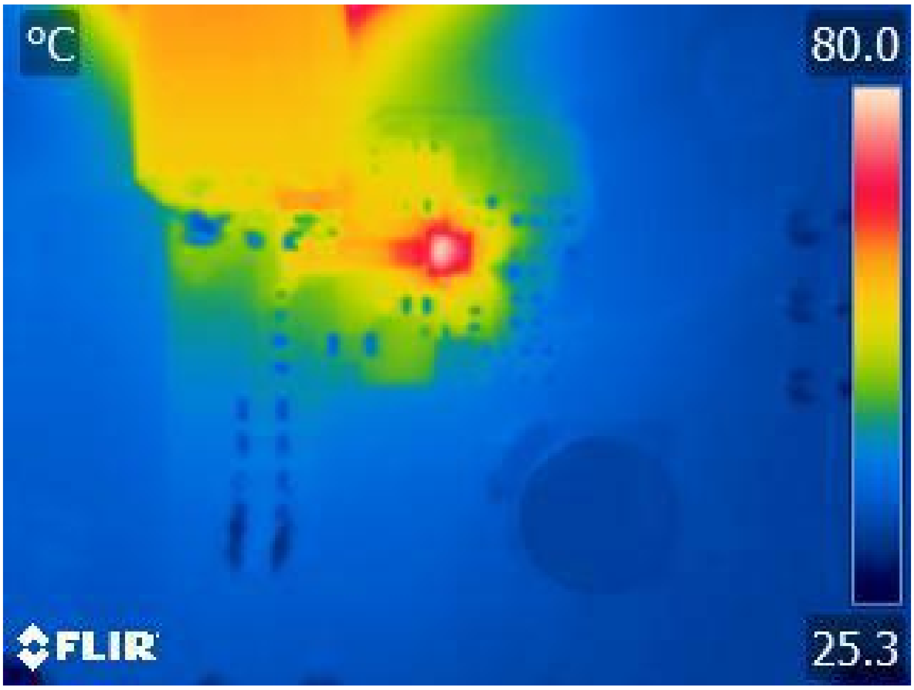


Figure 31. V_{IN} = 24 V, f_{SW} = 400 kHz, I_{OUTiso} = 750 mA - BOM modified as described in section 13 (hotspot around 75°C)



15 Transformer parameters

Table 9. Main parameters of the ZB1346-AE transformer

Parameter	Description
Turn ratio	1:6
Magnetizing inductance	13.5 µH
Leakage inductance	140 nH
Primary winding resistance	60 mΩ
Secondary winding resistance	1.35 Ω

16 Board versions

Table 10. STEVAL-L6983IV1 versions

Finished good	Schematic diagrams	Bill of materials
STEVAL$L6983IV1A (1)	STEVAL$L6983IV1A schematic diagrams	STEVAL$L6983IV1A bill of materials
STV$L6983IV1B (1)	STV$L6983IV1B schematic diagrams	STV$L6983IV1B bill of materials

1. *This code identifies the STEVAL-L6983IV1 evaluation board first version. It is printed on the board PCB.*
2. *This code identifies the STEVAL-L6983IV1 evaluation board second version. It is printed on the board PCB.*

17 Regulatory compliance

Notice for US Federal Communication Commission (FCC)

FCC NOTICE:

For evaluation only; not FCC approved for resale

FCC NOTICE - This kit is designed to allow:

(1) Product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and

(2) Software developers to write software applications for use with the end product.

This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter 3.1.2.

Notice for Innovation, Science and Economic Development Canada (ISED)

For evaluation purposes only. This kit generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to Industry Canada (IC) rules.

À des fins d'évaluation uniquement. Ce kit génère, utilise et peut émettre de l'énergie radiofréquence et n'a pas été testé pour sa conformité aux limites des appareils informatiques conformément aux règles d'Industrie Canada (IC).

Important: *The STEVAL-L6983IV1 layout has some trace sections with no soldered component on them. Thus, the final user might change the board functionality by soldering external components (not included in the blister, such as resistors, capacitors, etc.) on the actual printed traces.*

The board must be tested as sold in the blister, with the empty traces. The soldering of external components on the empty traces is not covered by the CE and UKCA certification.

Notice for European Union

This device is in conformity with the essential requirements of the Directive 2014/30/EU (EMC) and of the Directive 2015/863/EU (RoHS).

Notice for United Kingdom

This device is in compliance with the UK Electromagnetic Compatibility Regulations 2016 (UK S.I. 2016 No. 1091) and with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (UK S.I. 2012 No. 3032).

Revision history

Table 11. Document revision history

Date	Revision	Changes
03-Mar-2023	1	Initial release.
31-Jan-2024	2	Updated *Section 1.3: Features, Section 5: Board setting capability, Section 6: Schematic diagrams, Section 7: Bill of materials* and *Section 10: Post regulation circuitry.*
04-Jul-2025	3	Updated Figure 3. STEVAL-L6983IV1 basic test setup, Section 4: Schematic diagrams and Section 6: STEVAL-L6983IV1 layout. Added Section 10: Disclaimer and Section 13: Application idea. Minor text changes to improve readability.

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