Getting started with STEVAL-0608Y1V8 evaluation board based on DCP0608Y, automotive 6 V / 8 A step-down converter

Introduction

The STEVAL-0608Y1V8 is a step-down switching power supply based on the DCP0608Y regulator.

The target application is the conversion from 5 input to 1.8 V output with up to 8 A continuous load, 2.25 MHz programmed switching frequency, and 3 ms soft-start.

With minor BOM changes, the programmed output voltage, switching frequency and soft-start can be arranged to meet different requirements.

The DCP0608Y is a high efficiency monolithic step-down synchronous switching regulator designed to deliver up to 8 A continuous current, operating from 2.9 to 6 V input voltage.

The DCP0608Y features low-resistance integrated N-channel MOSFETs (11 mΩ typ.) and diode emulation working mode for optimum efficiency over all the loading range.

The integrated 0.6 V reference allows the regulation of output voltages with ±1.5 % accuracy over temperature variations. The switching frequency with ±5 % dithering is externally selectable between 1.8 and 4 MHz.

The high-power conversion efficiency over all the load range is guaranteed when the low consumption mode (LCM) is selected.

The constant frequency operation with minimum output voltage noise is achieved when the low noise mode (LNM) is chosen.

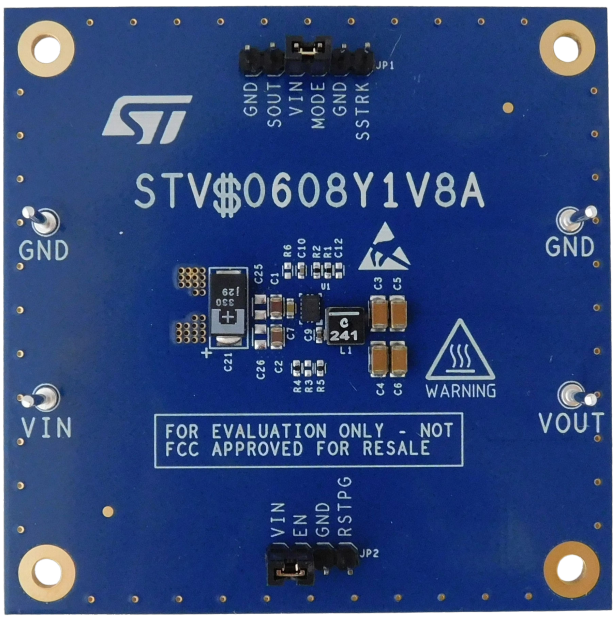
The MODE/SIN input pin can be exploited to implement dynamic transitions between LCM–LNM during the regulator operation or to synchronize the DCP0608Y to an external clock.

The soft-start duration can be adjusted with an external capacitor, or the same SS/TRK pin can be used for output voltage sequencing while the RST/PGOOD pin provides real-time information on the output voltage.

On the SOUT pin the clock-out signal is available to synchronize up to three DCP0608Y slaves, with selectable phase shifting, to minimize the RMS input current and improve EMC.

The DCP0608Y is available in QFN11 2x3 mm with wettable flanks.

Figure 1. STEVAL-0608Y1V8 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

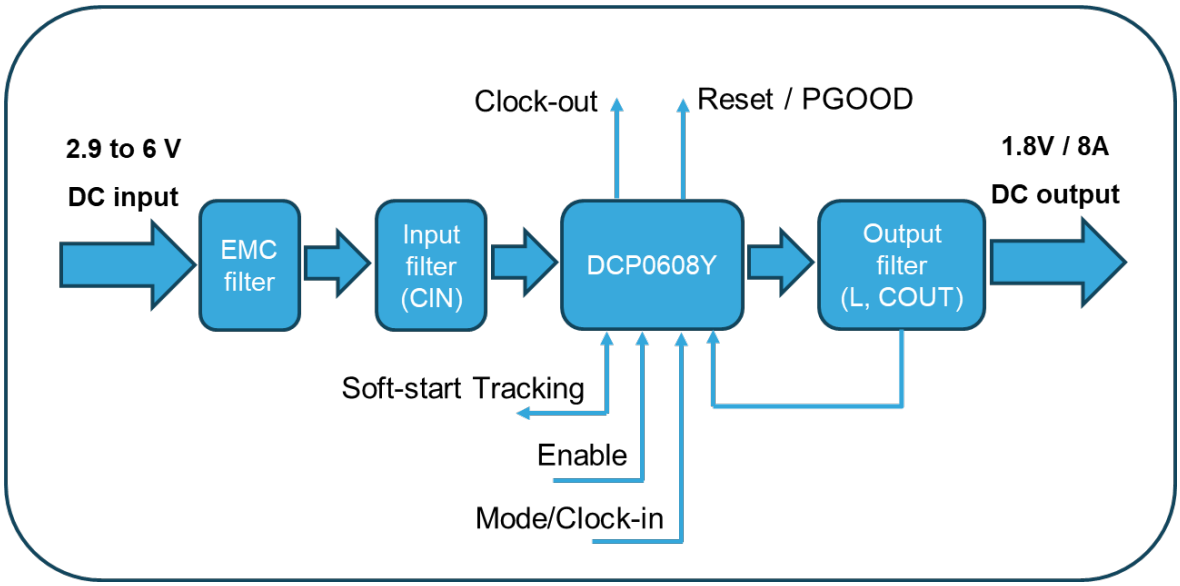
This board is intended for use by skilled technical personnel who are suitably qualified and familiar with the installation, use and maintenance of power electronic systems.

The same personnel must be aware of and must apply national accident prevention rules.

The electrical installation shall be completed in accordance with the appropriate requirements (e.g., cross-sectional areas of conductors, fusing, and GND connections).

1.2 Functional block diagram

Figure 2. STEVAL-0608Y1V8 block diagram



1.3 Features

- Step-down DC-DC switching converter
- AEC-Q100 Grade 1 qualified
- Operating junction temperature range: -40 to +150°C
- 1.8 V output, up to 8 A load
- 2.25 MHz switching frequency with dithering
- Programmed 3 ms soft-start
- Up to 6 V DC input voltage
- 3µA typ. shutdown current
- 50 µA typ. operating quiescent current (LCM, SOUT=GND)
- Peak current mode architecture with integrated compensation
- Dynamically selectable low noise mode or low consumption mode operation
- Autorecovery overvoltage / overcurrent / overtemperature protection
- Reset / power-good with 2 ms typ. assertion delay
- Synchronizable to external clock
- QFN11 2x3 mm package

2 How to use the board

To properly evaluate the STEVAL-0608Y1V8 board, the below listed steps should be followed.

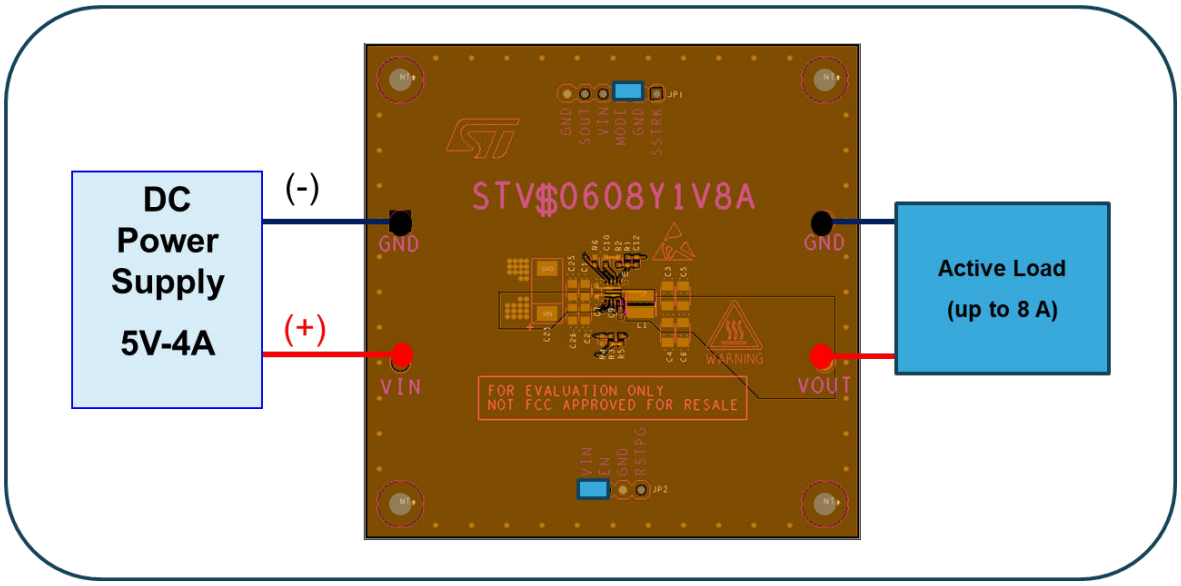
Step 1. Connect the power supply to the terminal pin of VIN and GND

Step 2. Connect the load to the terminal pin of VOUT and GND

Step 3. Set the supply voltage VIN to 5V and switch the power supply on

Step 4. Vary the active load in the range 0 – 8 A

Figure 3. STEVAL-0608Y1V8 testing setup



3 Connectors and test points

3.1 Connectors

VIN

The input voltage is provided, through the EMC filter, to the pin VIN of the device.

A power supply ranging from 2.9 to 6 V should be connected to this test point, setting a proper current limit depending on the expected maximum load.

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

GND

Return of the terminal of the input and output capacitors.

VOUT

Regulated output voltage, 1.8 V programmed.

3.2 Test points

EN

The ENABLE input must be forced above 1.2 V to turn on the DCP0608Y. This can be achieved by shorting to VIN through a jumper, as shown in figure 3.

RSTPG

This test point is directly connected to the RESET/PGOOD output pin. A 100 k Ω pull-up resistor to VIN is already mounted in the board.

SSTRK

This test point is directly connected to the SS/TRK pin. A 10 nF capacitor mounted between the pin and GND programs 3 ms soft-start.

MODE

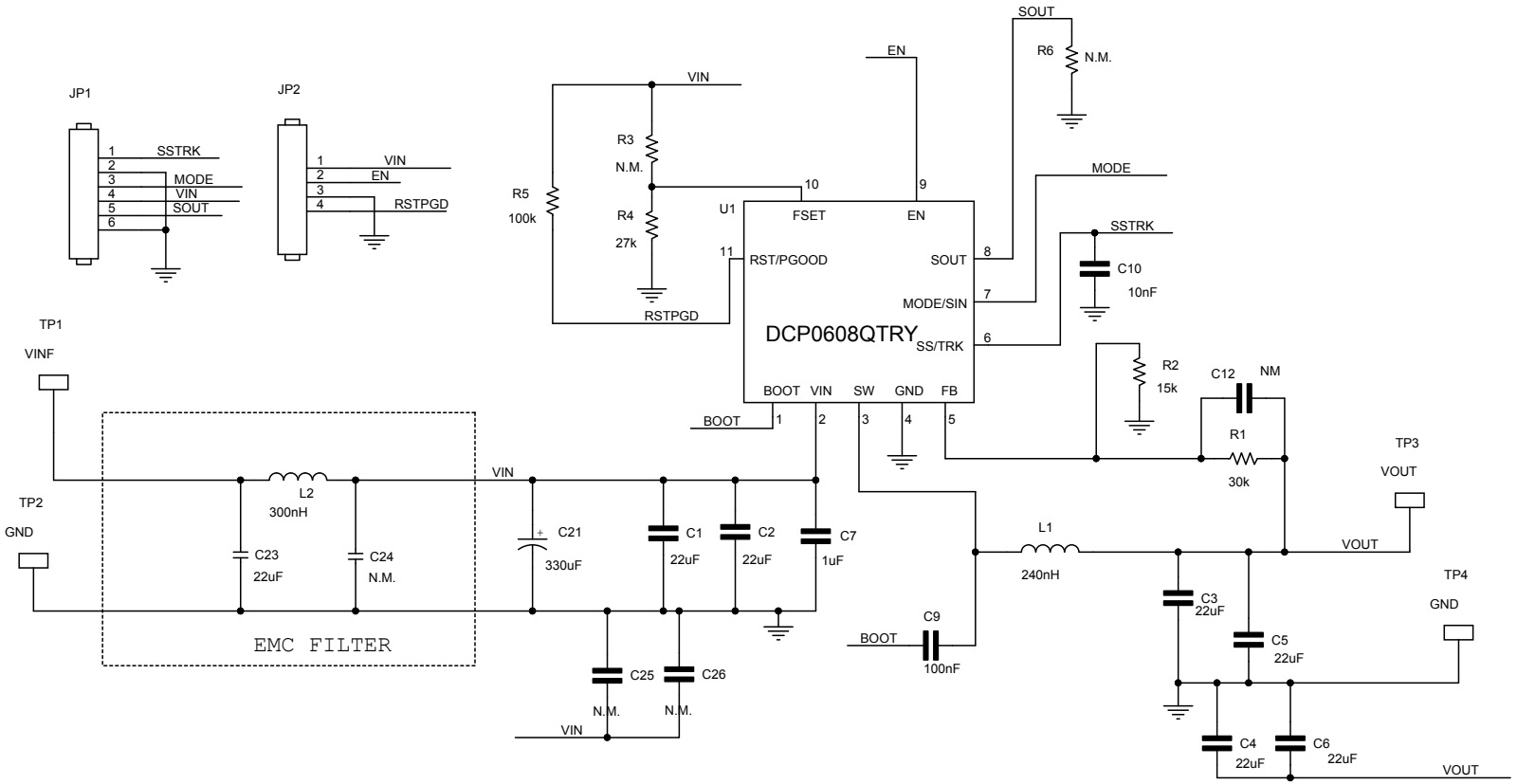
Directly connected to MODE/SIN pin to enable the LCM working mode (when forced to GND) or the LNM working mode (when forced to VIN) or to synchronize to an external clock. MODE can be toggled during DCP0608Y operation to implement a dynamic transition between LCM–LNM.

SOUT

Clock-out signal with programmable phase shift to synchronize up to three additional DCP0608Y. If not required, it can be shorted to GND through a jumper before powering up the regulator.

4 Schematic diagrams

Figure 4. **STEVAL-0608Y1V8 circuit schematic**



5 Bill of materials

Table 1. **STEVAL-0608Y1V8 bill of materials**

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
1	3	C1, C2, C23	22 uF	Ceramic capacitor X7T/10V/20%	Murata	GRT21BD71A226ME13
2	4	C3, C4, C5, C6	22 uF	Ceramic capacitor X7R/10V/10%	Murata	GCM31CR71A226KE
3	1	C7	1 uF	Ceramic capacitor X7R/25V/10%	Murata	GCM188R71E105KA
4	1	C9	100 nF	Ceramic capacitor X7R/16V/10%	Murata	GRT155R71C104KE
5	1	C10	10 nF	Ceramic capacitor X7R/25V/5%	KEMET YAGEO	C0402C103J3RACAUTO
6	1	C21	330 uF	Polymer Tantalum Capacitor	Panasonic	6TAE330ML
7	3	C12, C25, C26		(not mounted)		
8	1	L1	240 nH	Shielded Power Inductor	Coilcraft	XGL4025-241ME
9	1	L2	300 nH	Shielded Power Inductor	Coilcraft	XGL3020-301ME
10	1	R1	30 k	Thick film resistor	MULTICOMP PRO	MP003488
11	1	R2	15 k	Thick film resistor	MULTICOMP PRO	MP003483
12	1	R4	27 k	Thick film resistor	MULTICOMP PRO	MP003487
13	1	R5	100 k	Thick film resistor	MULTICOMP PRO	MP003498
14	2	R3, R6		(not mounted)		
15	1	JP1	header	6 Way, 1 Row, Straight Pin Header, 2,54 mm pitch, 6mm height	TE Connectivity	826936-6
16	1	JP2	header	4 Way, 1 Row, Straight Pin Header, 2,54 mm pitch, 6mm height	TE Connectivity	826936-4
17	4	TP1, TP2, TP3, TP4	terminal pin	Brass terminal pin	Ettinger	013.14.239
18	1	U1	DCP0608QTRY, QFN 2x3 11 Leads	Automotive 6V / 8A step-down DC/DC regulator	STMicroelectronics	DCP0608QTRY
19	2	Jumpers		Female Straight Black Open 2 Way 1 Row 2.54mm Pitch	RS PRO	251-8682

6 Board versions

Table 2. **STEVAL-0608Y1V8 versions**

Finished good	Schematic diagrams	Bill of materials
STV$0608Y1V8A(1)	STV$0608Y1V8A schematic diagrams	STV$0608Y1V8A bill of materials

1. *This code identifies the STEVAL-0608Y1V8 evaluation board first version.*

7 STEVAL-0608Y1V8 layout

The STEVAL-0608Y1V8 is a 4-layer PCB, 70 x 70 mm with 1oz copper thickness.

Figure 5. PCB layout (top)

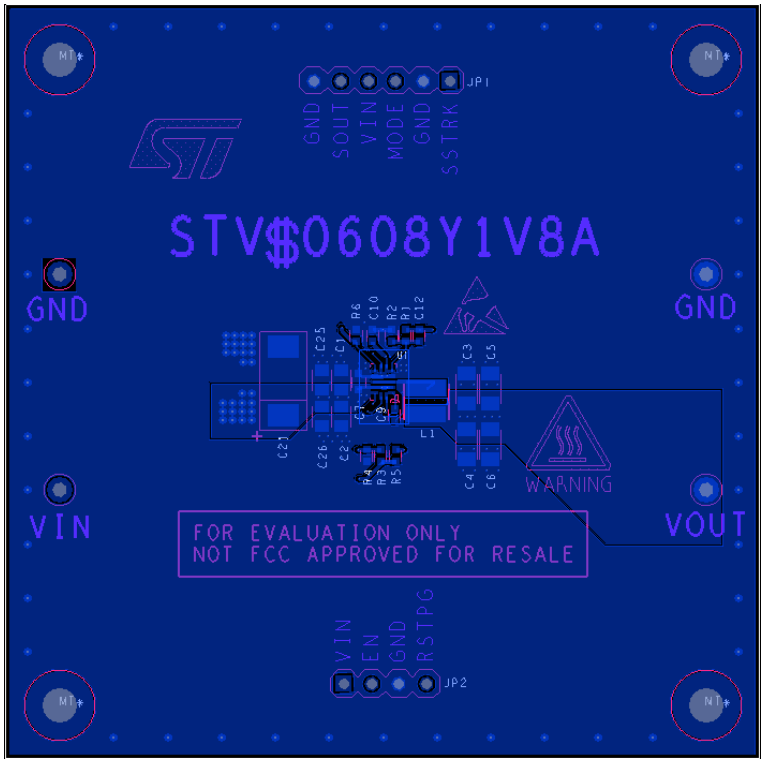


Figure 6. PCB layout (internal layer 1)

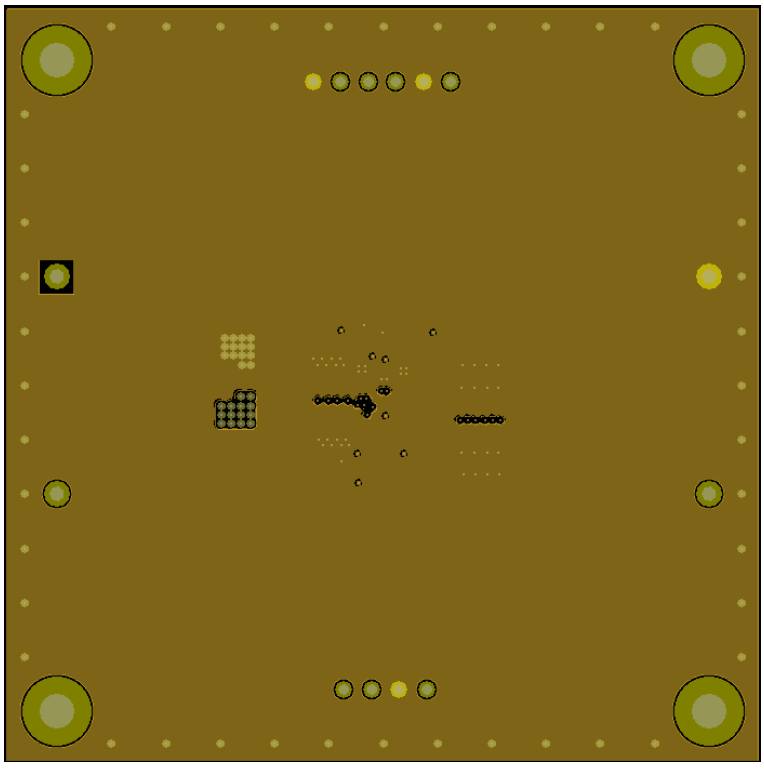


Figure 7. **PCB layout (internal layer 2)**

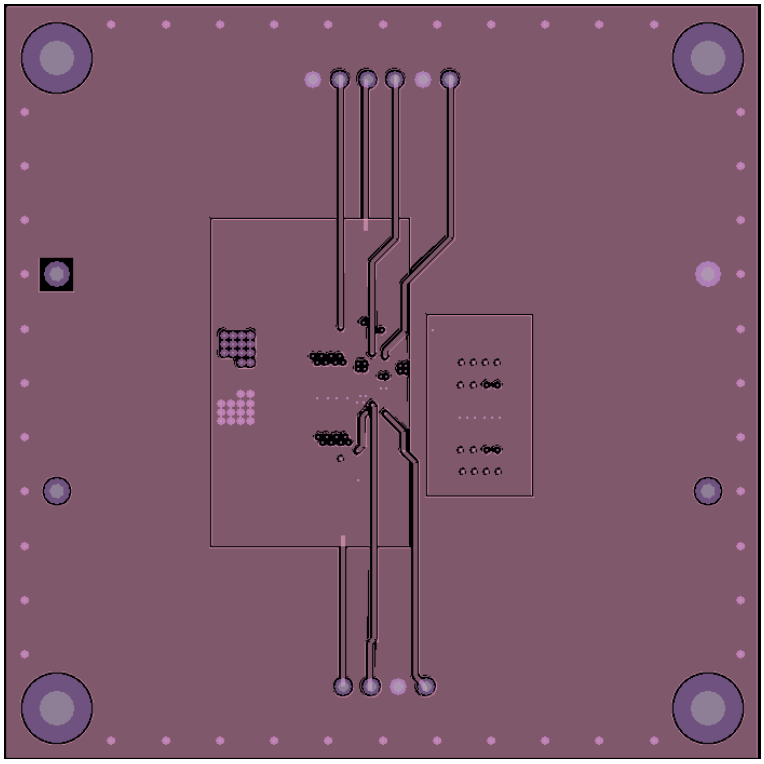
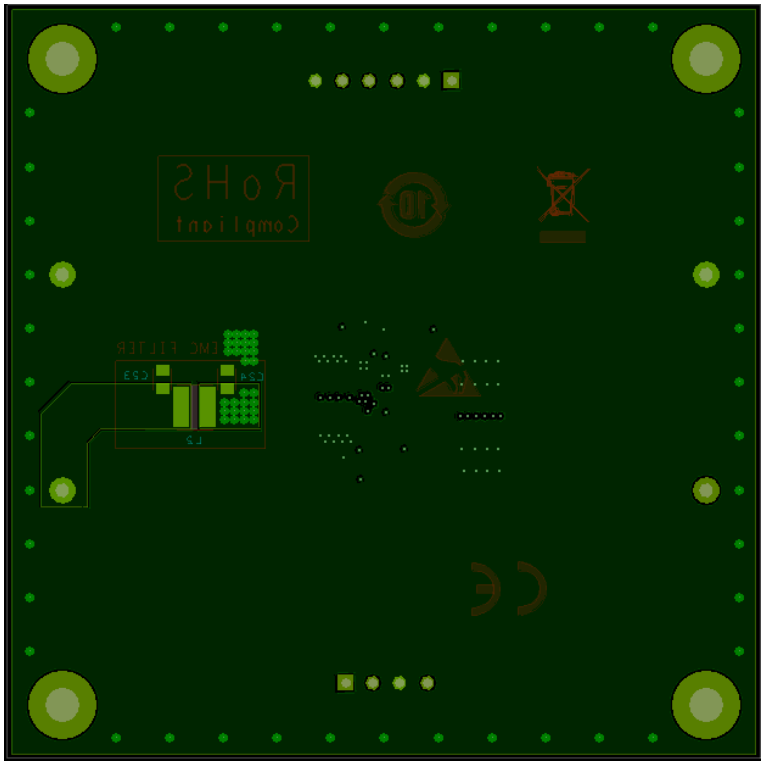


Figure 8. **PCB layout (bottom)**



8 STEVAL-0608Y1V8 performance and waveforms

Figure 9. **Efficiency (log.scale, EMC filter excluded, VIN = 5 V)**

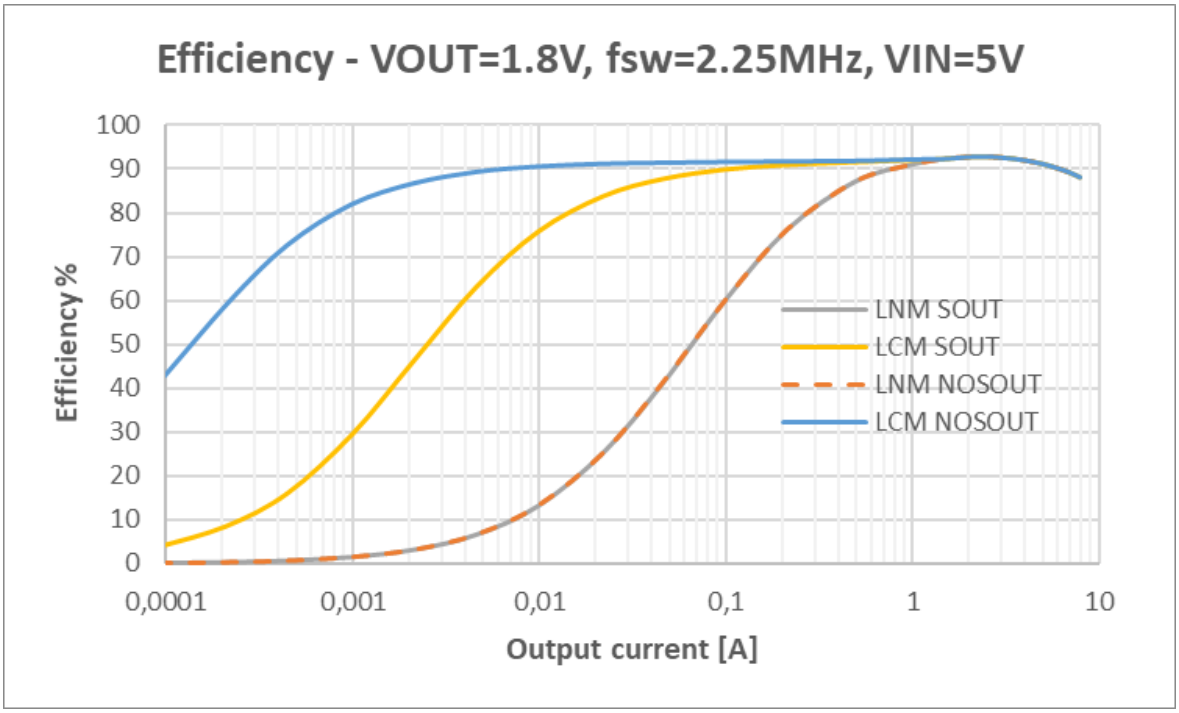


Figure 10. **Efficiency (log.scale, EMC filter excluded, VIN = 3.3 V)**

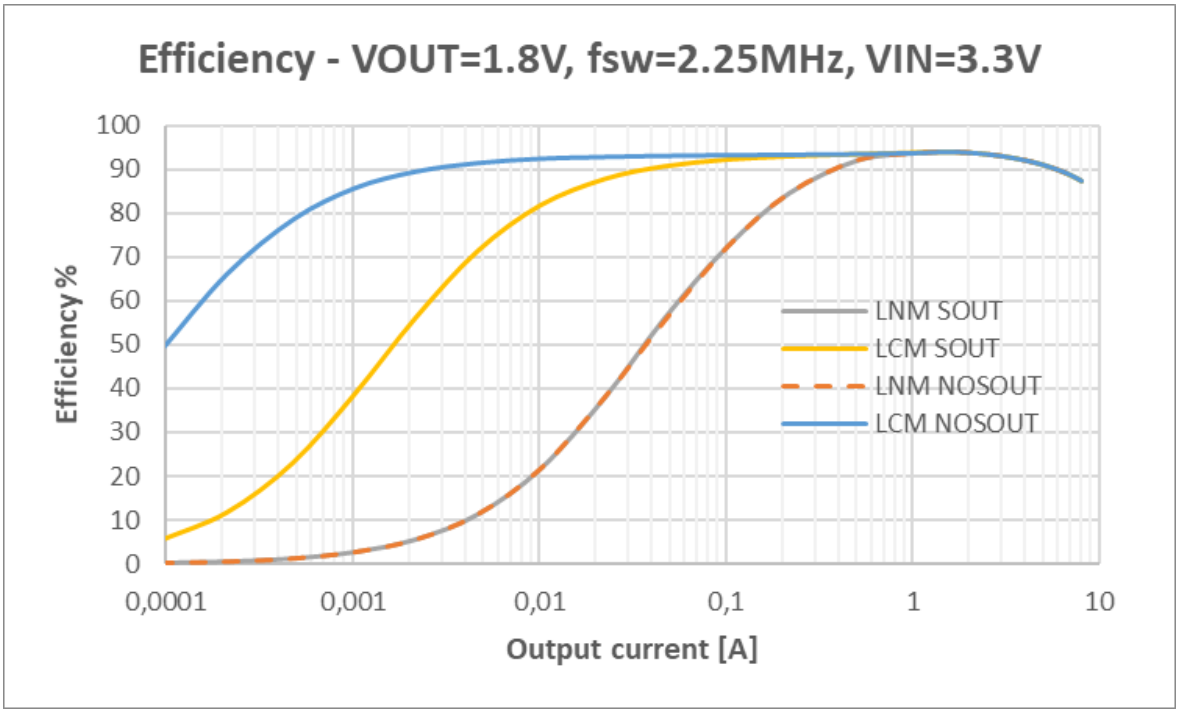


Figure 11. **Efficiency (linear scale, EMC filter excluded)**

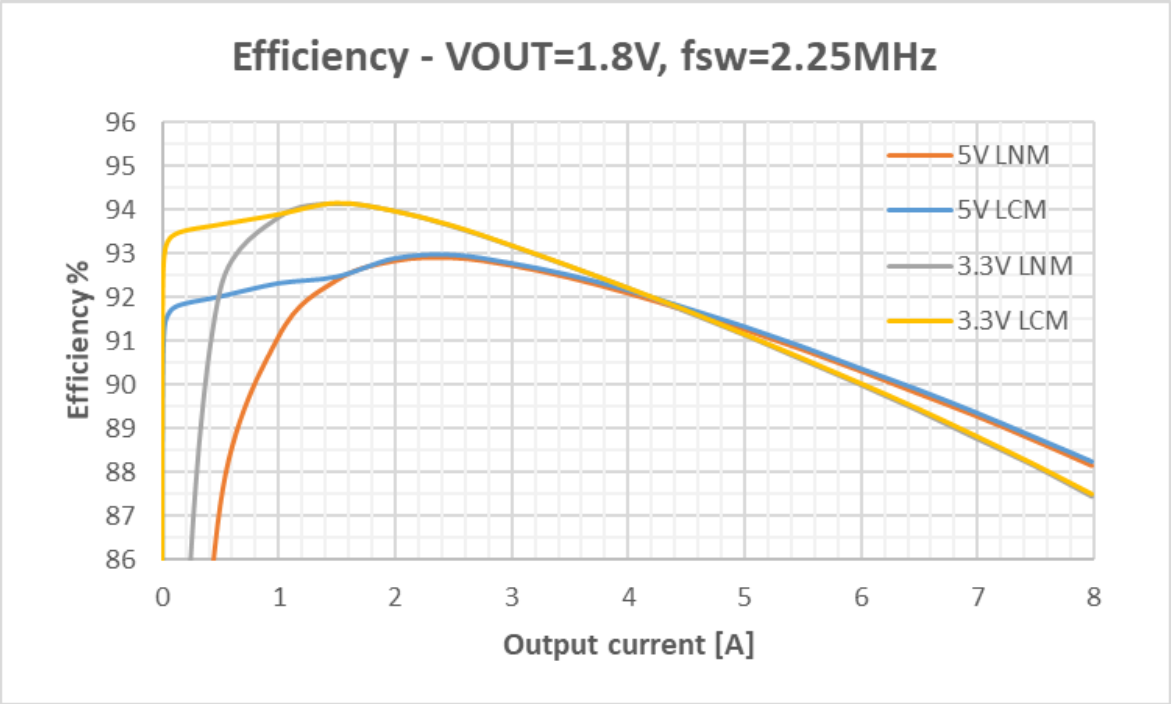


Figure 12. **Load regulation**

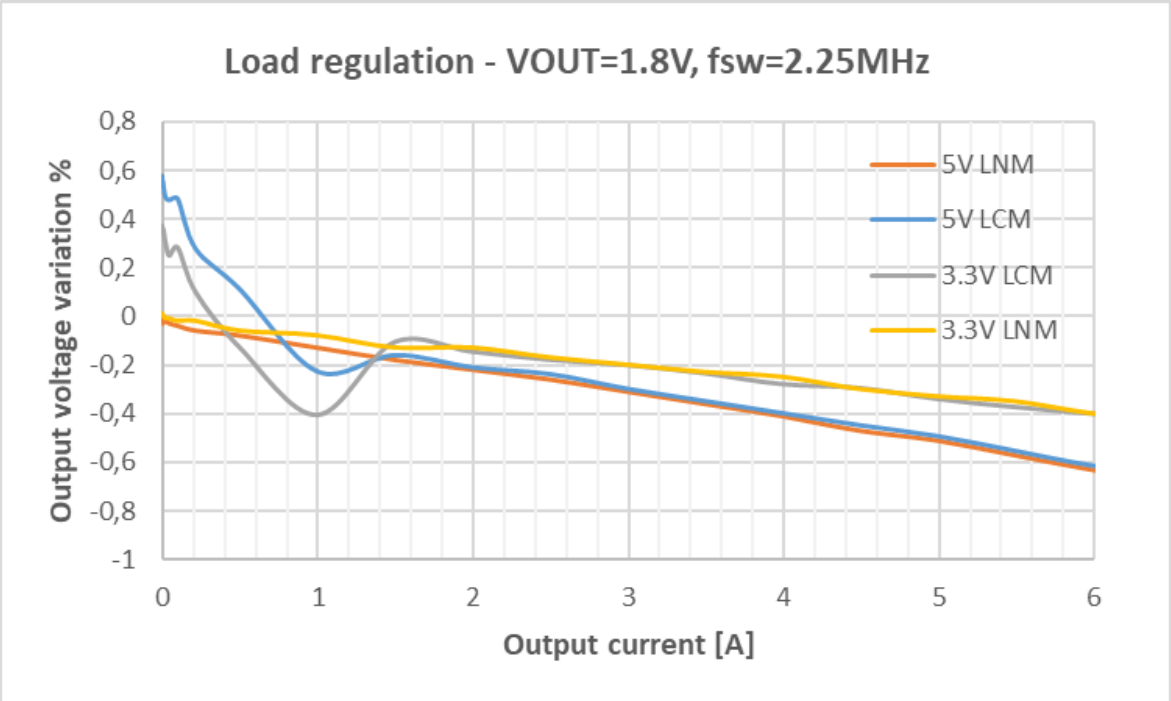


Figure 13. **Total losses (linear scale, EMC filter excluded)**

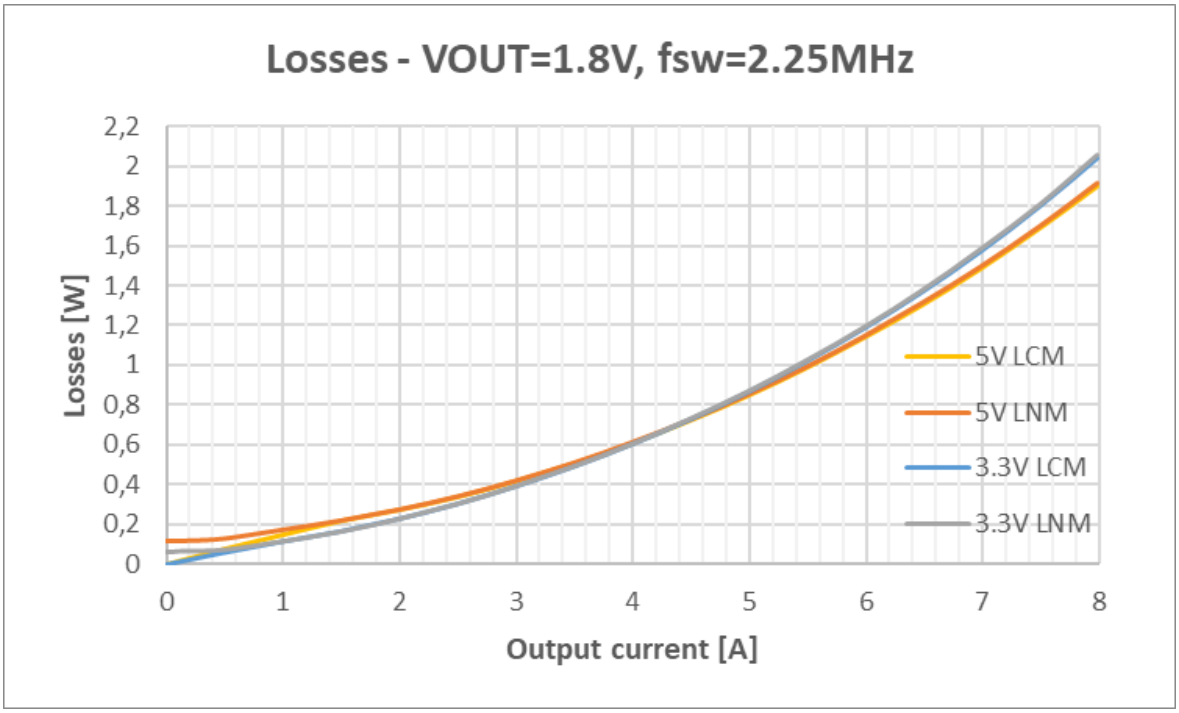


Figure 14. **Total losses (log. scale, EMC filter excluded)**

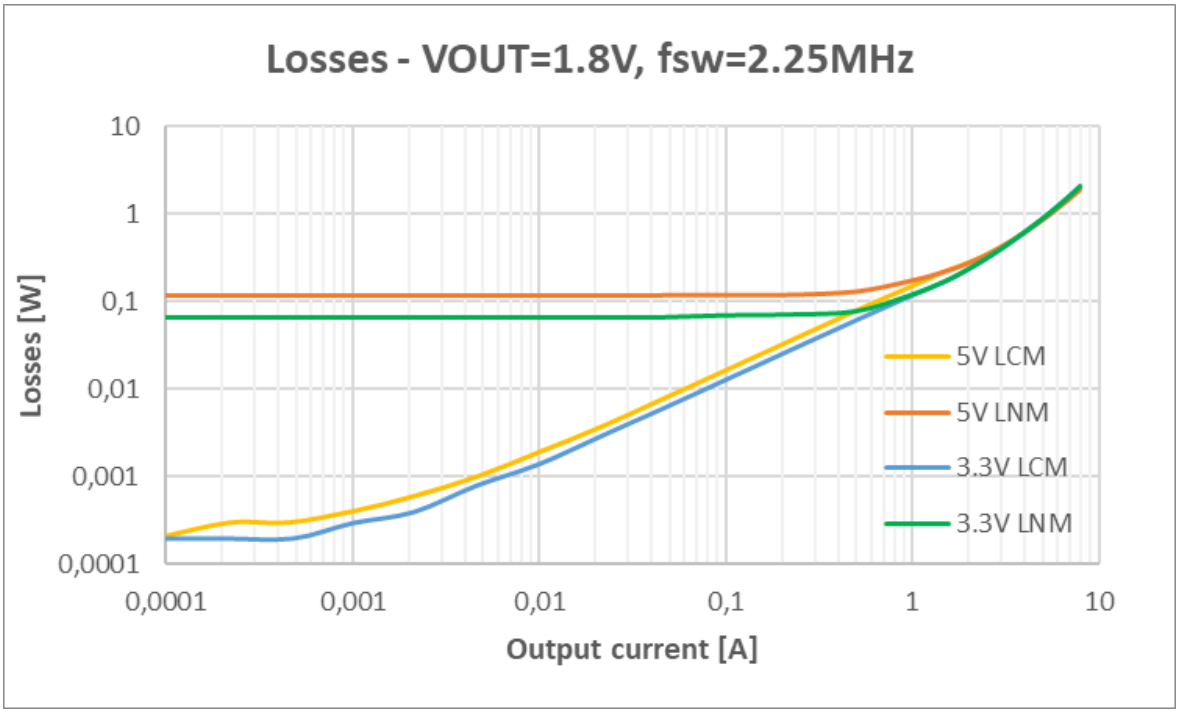


Figure 15. **Thermal behavior – VIN = 5 V, IOUT = 8 A, 5 minutes settlement time. Tamb = 25° C**

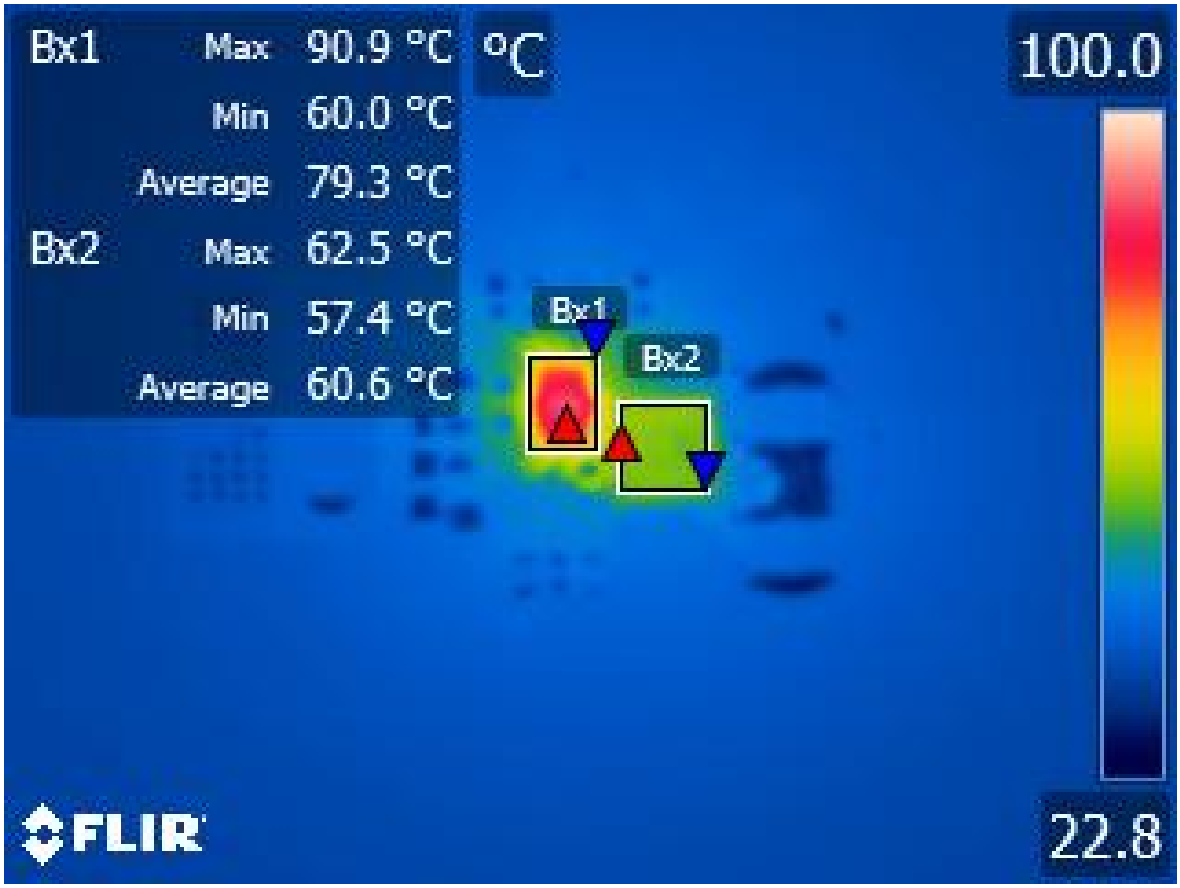


Figure 16. **Oscilloscope waveform – LCM, no load**

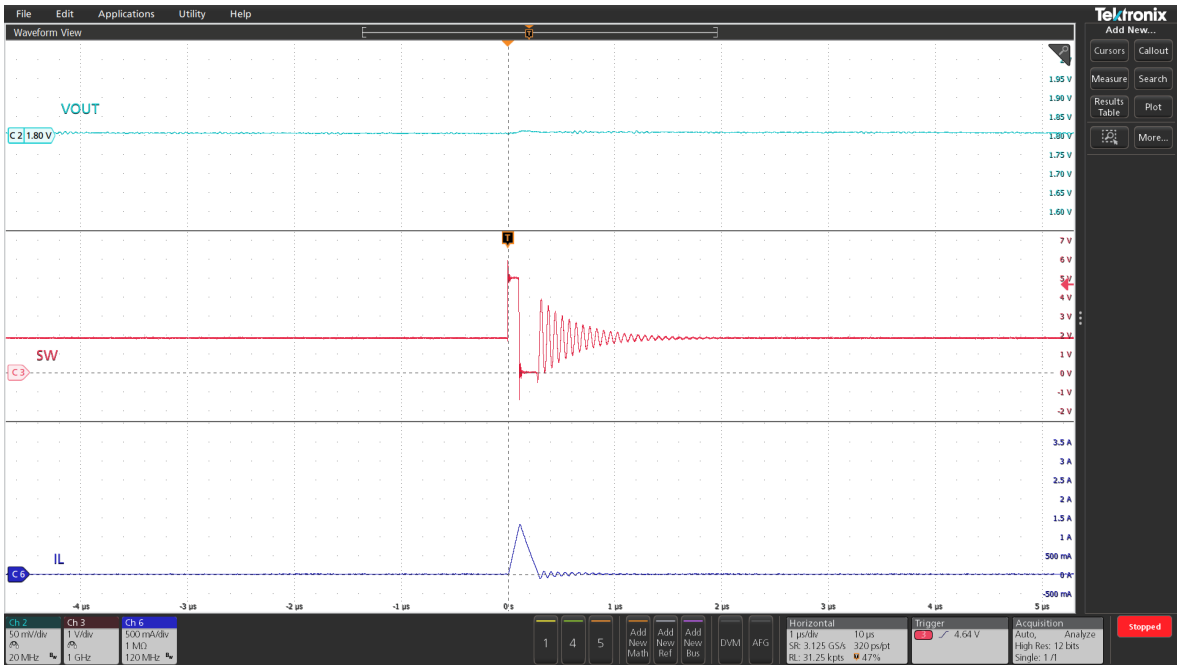


Figure 17. **Oscilloscope waveform – LCM, 100mA load**

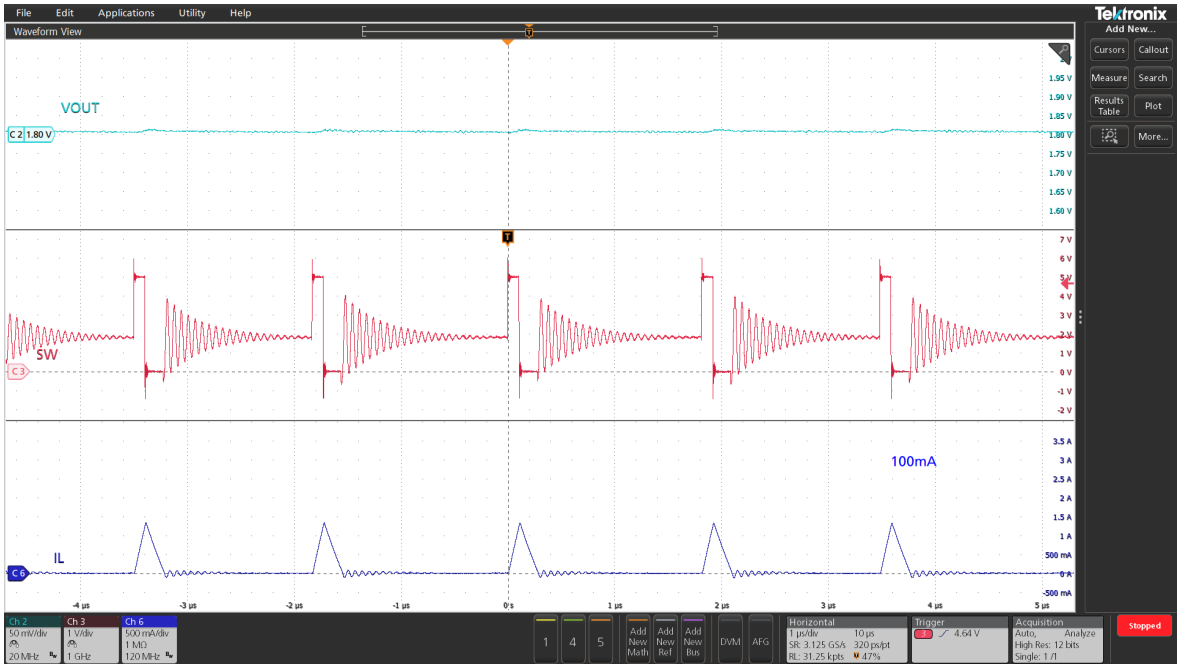


Figure 18. **Oscilloscope waveform – LCM, 0.5 A load**

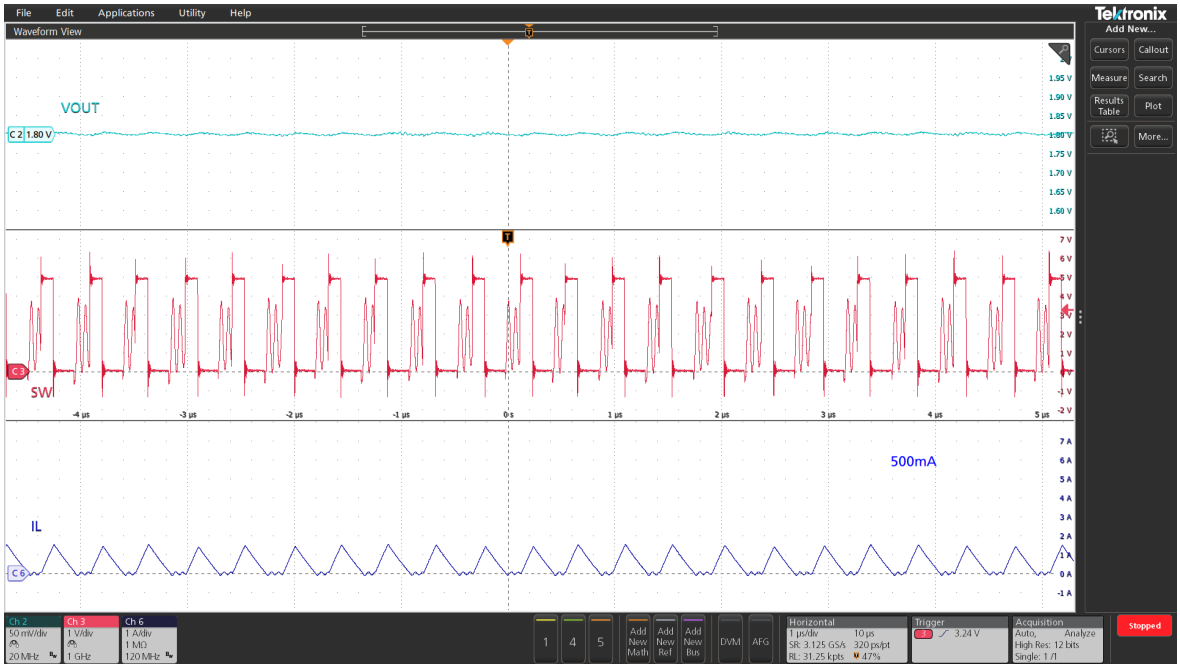


Figure 19. **Oscilloscope waveform – LCM, 8 A load**

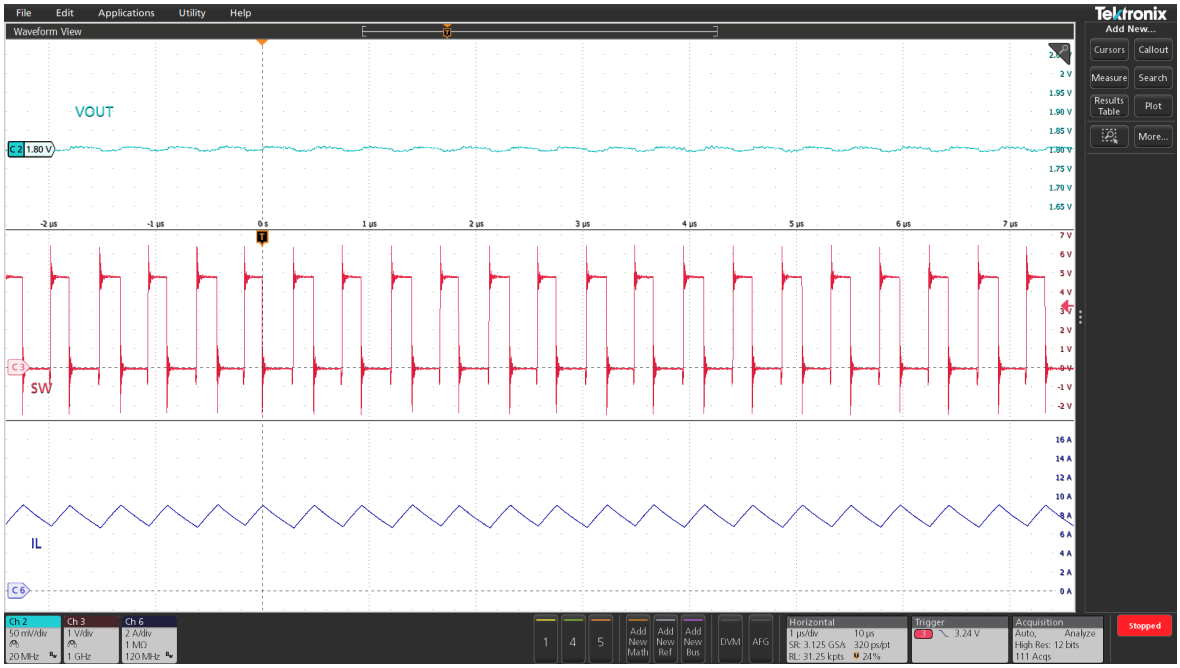


Figure 20. **Oscilloscope waveform – LNM, NO load**

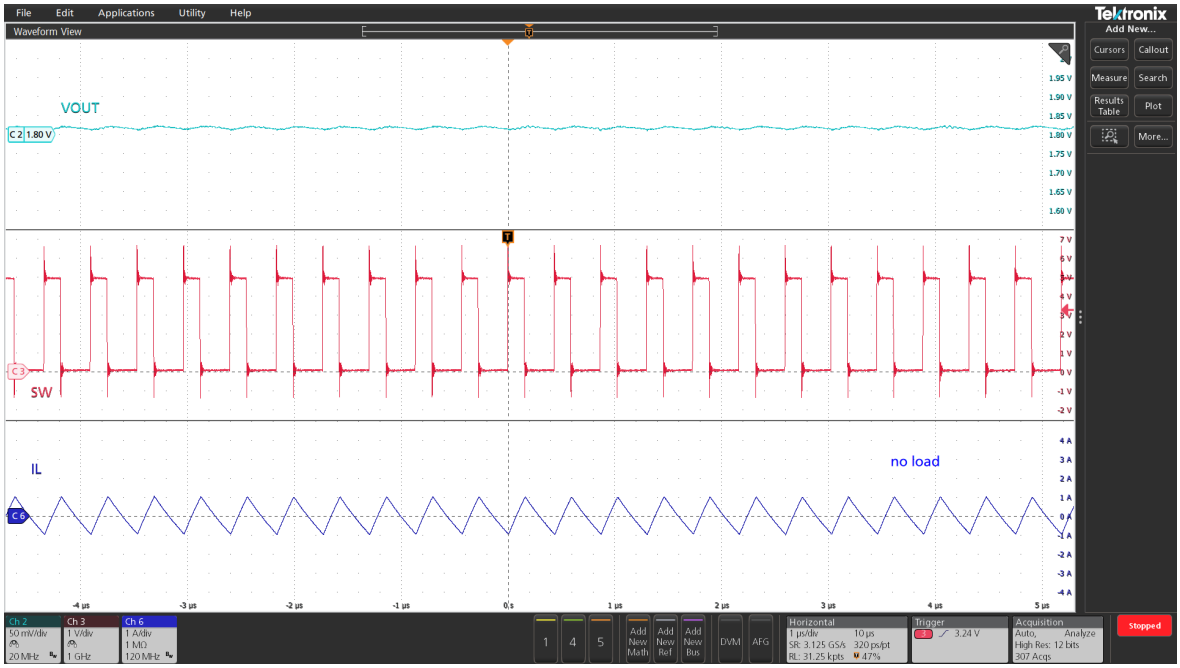


Figure 21. **Oscilloscope waveform – LNM, 4 A load step**

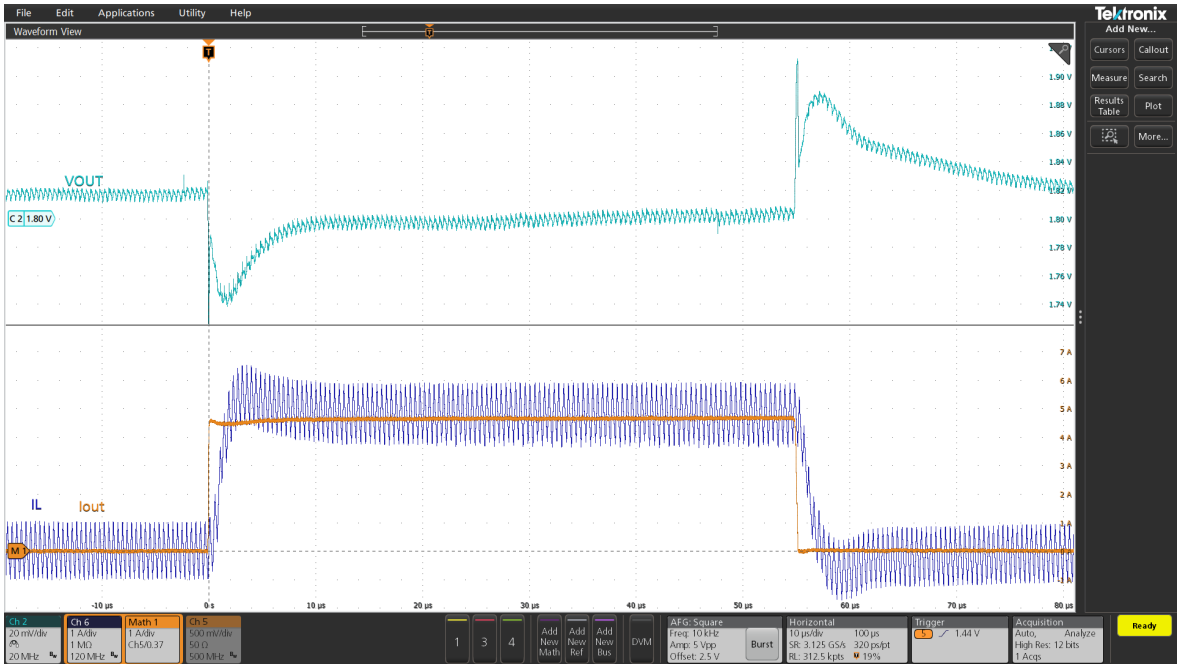


Figure 22. **Oscilloscope waveform – LNM, 8 A load step**

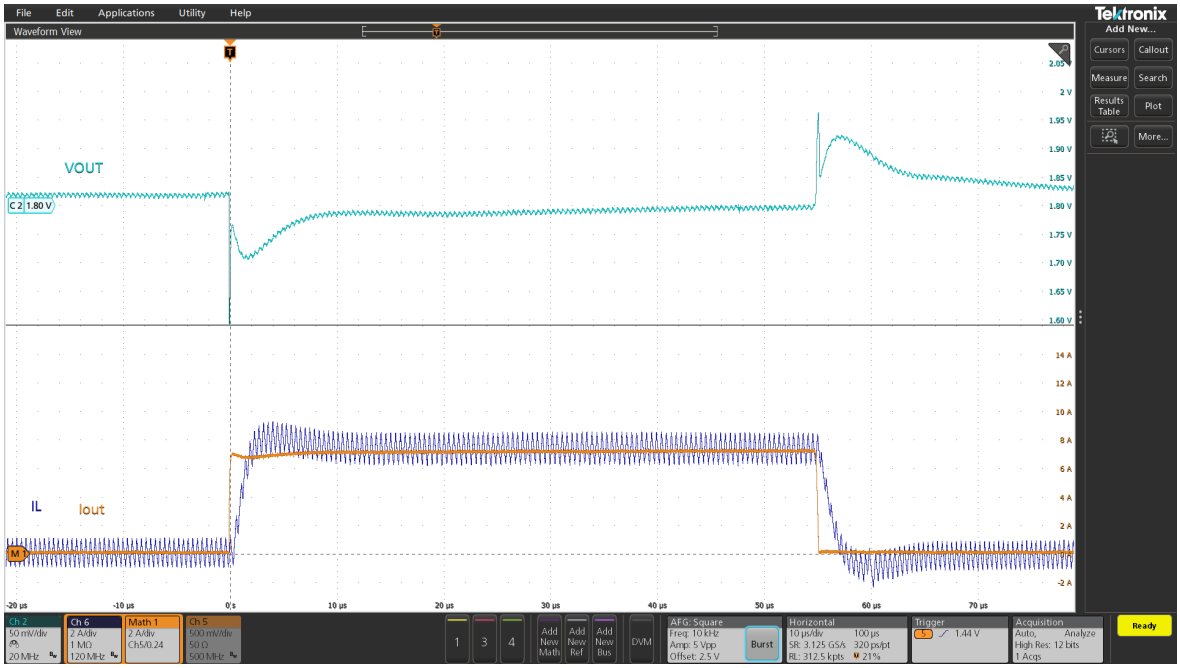


Figure 23. **Oscilloscope waveform – LCM to LNM to LCM**

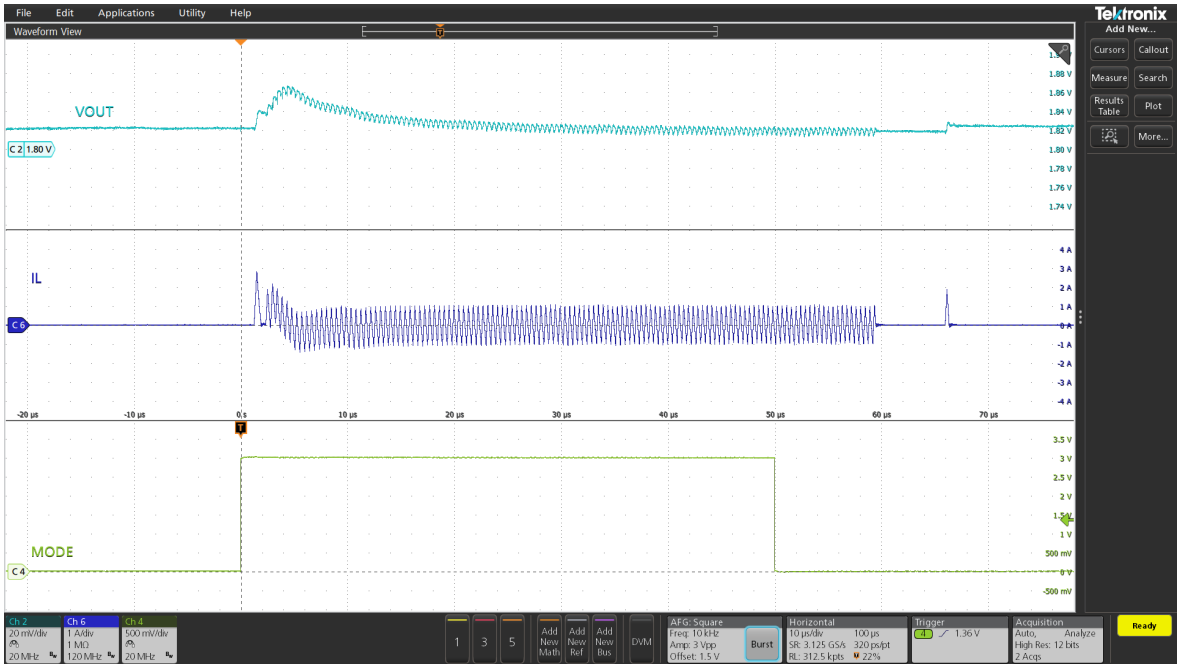
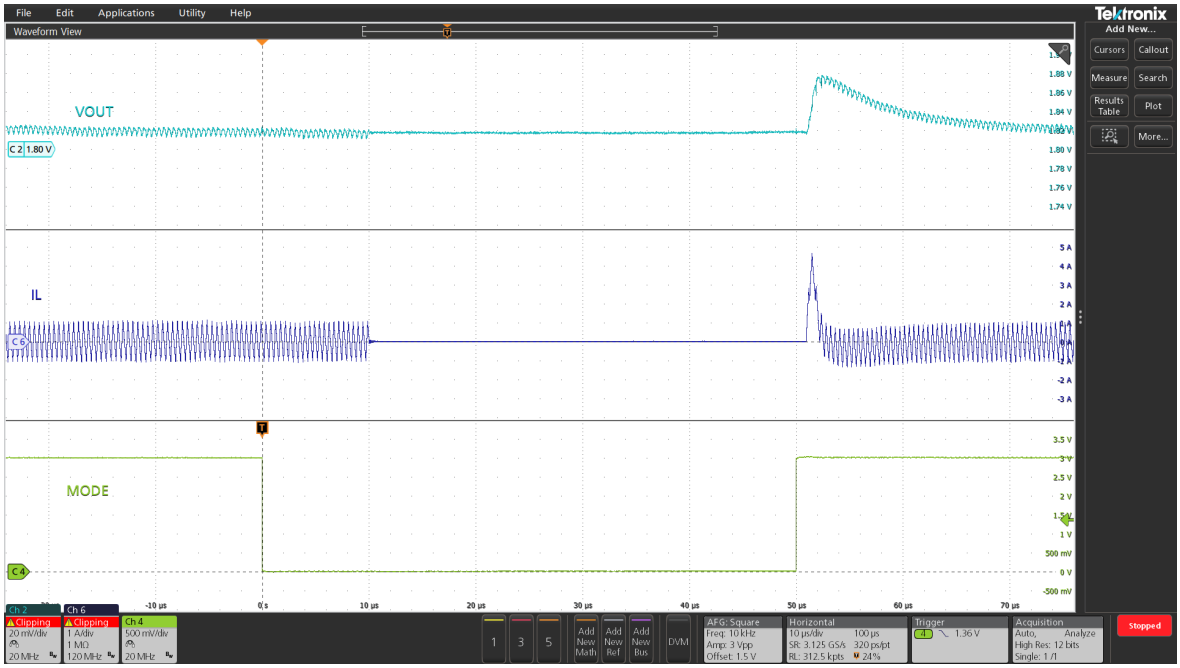


Figure 24. **Oscilloscope waveform – LNM to LCM to LNM**



9 STEVAL-0608Y1V8 EMC compliance

The STEVAL-0608Y1V8 is certified by an external supervisor company and is Class A compliant with the following standards, for industrial use only:

Table 3. List of standards, which the STEVAL-0608Y1V8 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 input EMC filter made of C23 and L2, mounted in the bottom side of the board, has the main purpose of reducing the EMI noise to guarantee the STEVAL-0608Y1V8 compliance with CISPR16-4-2 test standard and the other specifications listed above.

10 Disclaimer

The certification of the STEVAL-0608Y1V8 is fulfilled with the schematic, the layout and the BOM indicated in the sections Section 4: 4, Section 5: 5, Section 7: 7.

Any drift from the schematic, the layout, and the BOM described in the sections Section 4: 4, Section 5: 5, Section 7: 7, invalidates the certification and the EMC compliance of the STEVAL-0608Y1V8 is no longer ensured.

Any change in the schematic, layout, and BOM implemented by the user of the STEVAL-0608Y1V8 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 wishes to adapt the board to other typical application requirements.

Although the recommended modifications can be considered as minor changes, the certification of the STEVAL-0608Y1V8 remains valid only under the conditions mentioned in the sections Section 4: 4, Section 5: 5, Section 7: 7.

11 Board setting capability

The STEVAL-0608Y1V8 provides the possibility to change some setting in accordance with the application conditions.

Output voltage

The regulated output voltage is set to 1.8 V. If a different voltage is desired, the output resistor divider should be adjusted according to the following equation:

$$V_{OUT} = 0.6 \cdot \left(1 + \frac{R_1}{R_2}\right)$$

Switching frequency and COUT

The switching frequency can be changed by selecting the appropriate resistor value, R4=RFSET, as described in the table below:

Table 4. Switching frequency and COUT configuration

RFSET [kΩ] 1%	FSW [MHz]	KC [µF*V]
FSET=VIN	2.25 (No dithering)	100
100	1.8	200
82	2.25	200
68	3.5	200
47	4	200
33	1.8	100
27	2.25	100
22	3.5	100
15	4	100
10	1.8	50
8.2	2.25	50
6.8	3.5	50
4.7	4	50
FSET=GND	2.25 (No dithering)	50

The spread spectrum feature (dithering) is always implemented unless FSET is shorted to VIN or GND.

RFSET value is also impacting on the integrated compensation network, summarized in the KC parameter (third column).

KC is providing the minimum suggested output capacitance value to guarantee a stable operation: $C_{OUT} \geq \frac{K_C}{V_{OUT}}$

To optimize the DCP0608Y dynamic behavior, choose the RFSET resistor that selects the required switching frequency and program the KC value closer to the actual output capacitance value (considering the expected derating due to the working voltage).

Soft start

The soft start interval is 3 ms. It can be modified by selecting a different C10=CSS capacitor, following the equation below, considering ISS=2uA and VREF=VFB=0.6 V: $C_{SS} = \frac{T_{SS} \cdot I_{SS}}{V_{REF}}$

Until the SS pin is kept lower than VFB (0.6 V typ.) the tracking function is enabled. This feature can be exploited to program a proportional power-up and ramp-up sequence. As soon as SS voltage is higher than 0.6 V, the control loop reference switches to the internal voltage reference and SS pin is left in high impedance.

Clock-out (SOUT)

SOUT pin is providing the clock-out signal, available on SOUT test point. Based on the R6=RSOUT resistor, the following phase shifting can be programmed on the clock-out:

Table 5. **SOUT phase shifting programming**

RSOUT [kΩ]	Phase shift [°]	Devices
N.M.	180	Master + 1
100	120	Master + 2
75	90	Master + 3

In this way, up to four DCP0608Y can be synchronized with proportional phase shift.

If the clock-out feature is not required, SOUT test point must be shorted to GND before powering up the regulator, to improve light load efficiency above all in LCM mode.

12 eDesignSuite

The eDesignSuite software helps in the selection of the devices as well as in the design of the external components suitable for a certain application.

After inserting the application conditions, the device can be selected and the design of the external components is automatically carried out.

13 Application idea

13.1 Typical applications

With minor changes in the BOM, the most used voltage conversions are easily achieved, as summarized in table below.

Table 6. Typical applications (fsw = 2.25MHz, R4=RFSET=27 kΩ)

VIN [V]	VOUT [V]	Inductor (L1) value / PN	COUT (C3 to C6) value / PN	R1 [kΩ]	R2 [kΩ]
5	3.3	400 nH Coilcraft XGL4030-401 Wurth 78438440200040	3x 22 uF Murata GCM31CR71A226KE	68	15
5	3.0	300 nH Coilcraft XGL4030-301 Wurth 78438440200030	3x 22 uF Murata GCM31CR71A226KE	30	7.5
5	2.5	300 nH Coilcraft XGL4030-301 Wurth 78438440200030	3x 22 uF Murata GCM31CR71A226KE	51	16
3.3 – 5	2.1	240 nH Coilcraft XGL4025-241 Wurth XHMA 220nH 4020	4x 22 uF Murata GCM31CR71A226KE	30	12
3.3 – 5	1.8	240 nH Coilcraft XGL4025-241 Wurth XHMA 220nH 4020	4x 22 uF Murata GCM31CR71A226KE	30	15
3.3 – 5	1.5	240 nH Coilcraft XGL4025-241 Wurth XHMA 220nH 4020	4x 22 uF Murata GCM31CR71A226KE	30	20
3.3 – 5	1.2	200 nH Coilcraft XEL4030-201 Wurth XHMA 220nH 4020	3x 47 uF Murata GCM31CR71A226KE	15	15
3.3 – 5	1.0	200 nH Coilcraft XEL4030-201 Wurth XHMA 220nH 4020	3x 47 uF Murata GCM31CD70G476ME	10	15
3.3	0.8	130 nH Coilcraft XGL4030-131 Wurth 78438440200016	4x 47 uF Murata GCM31CD70G476ME	11	33
3.3	0.6	130 nH Coilcraft XGL4030-131 Wurth 78438440200016	4x 47 uF Murata GCM31CD70G476ME	0	n.m.

The typical measured performance is shown in the curves below.

Figure 25. **Efficiency 2.25MHz – VIN = 5 V - LNM**

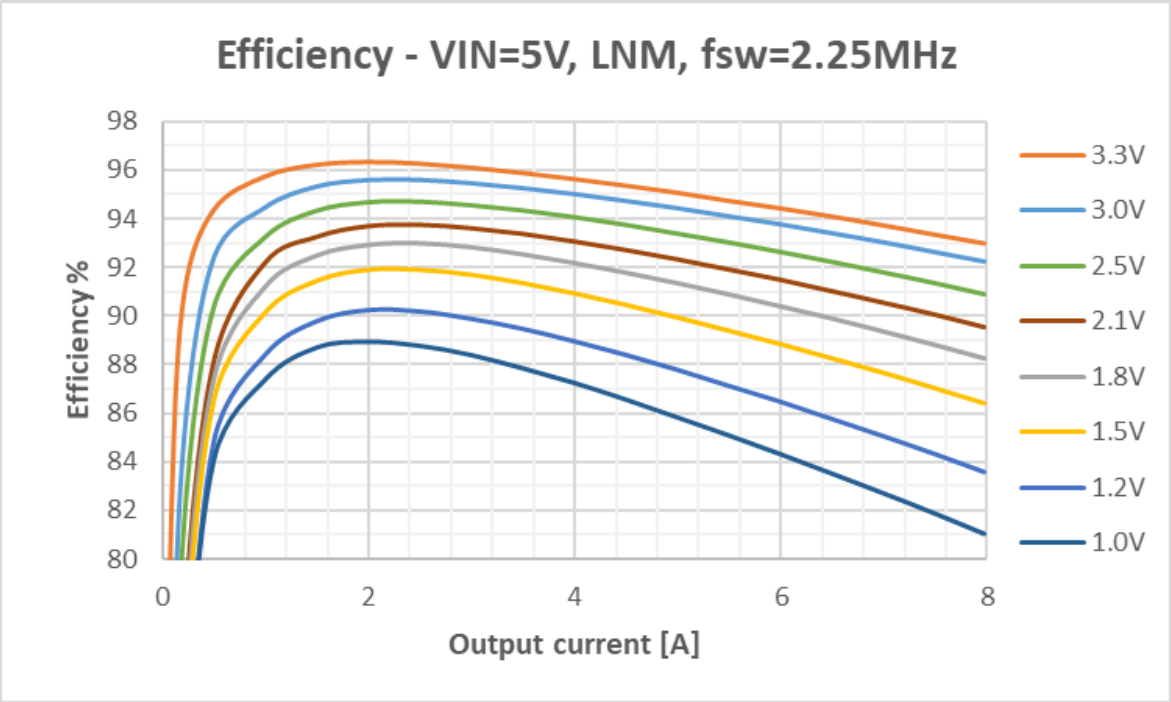


Figure 26. **Efficiency 2.25MHz – VIN = 5 V - LCM (SOUT=GND)**

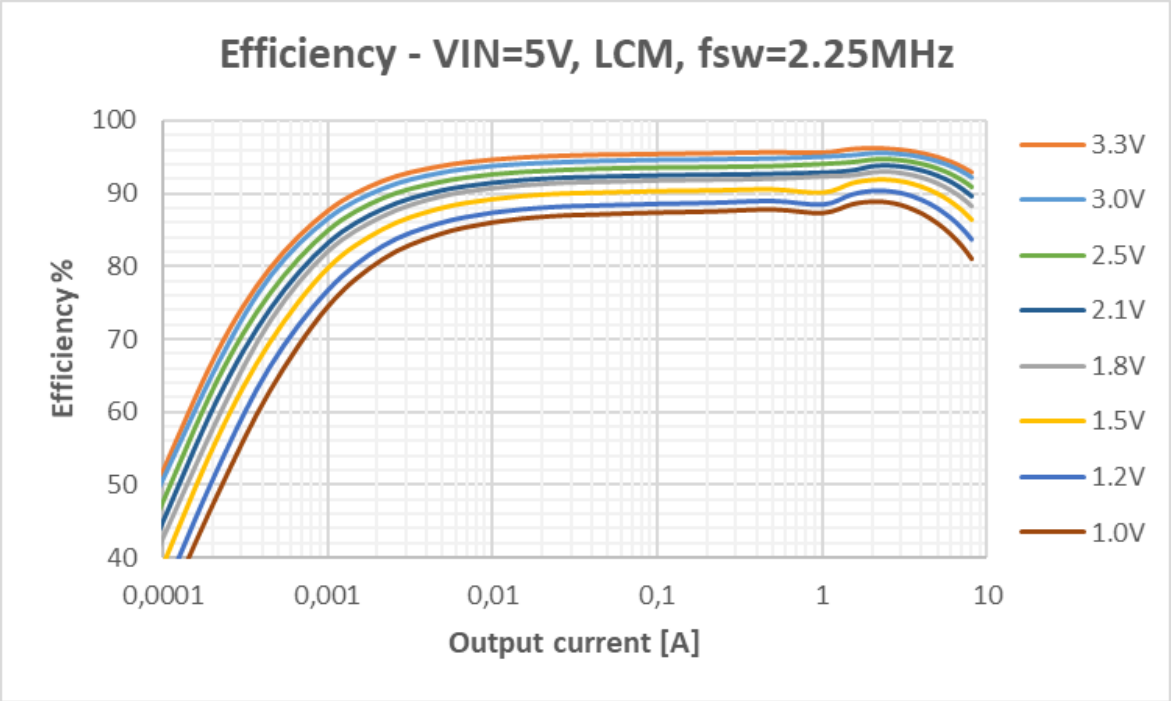


Figure 27. **Efficiency 2.25MHz – VIN = 3,3 V - LNM**

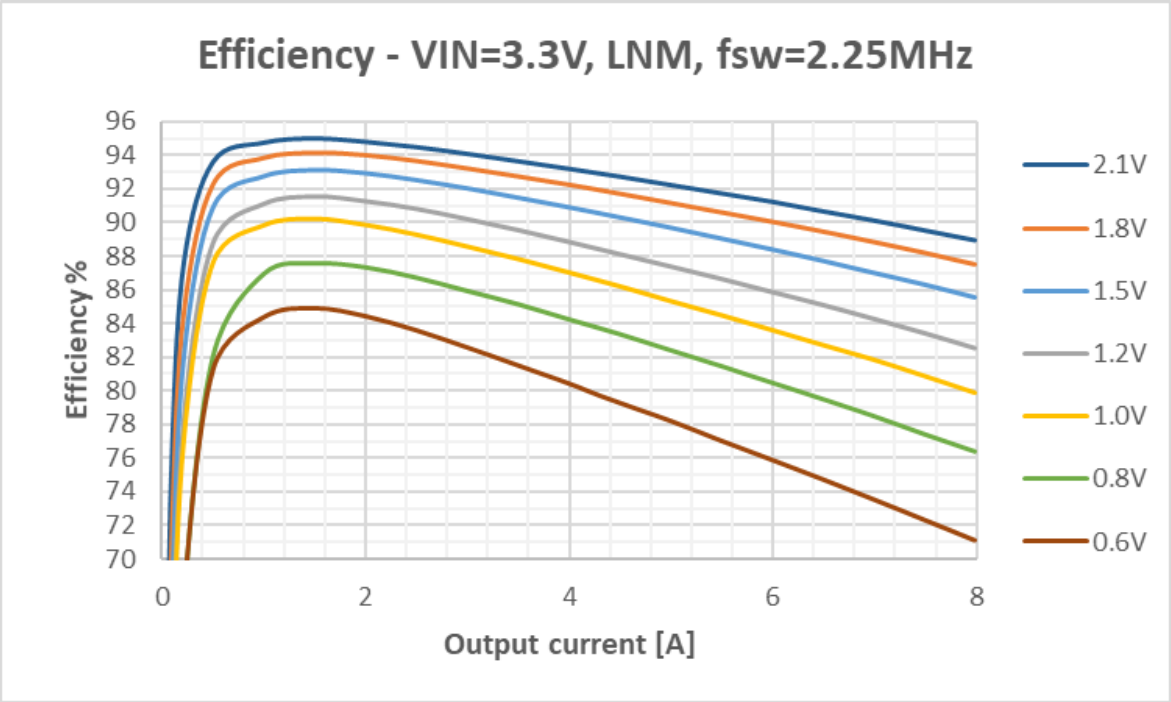


Figure 28. **Efficiency 2.25MHz – VIN = 3,3 V - LCM (SOUT=GND)**

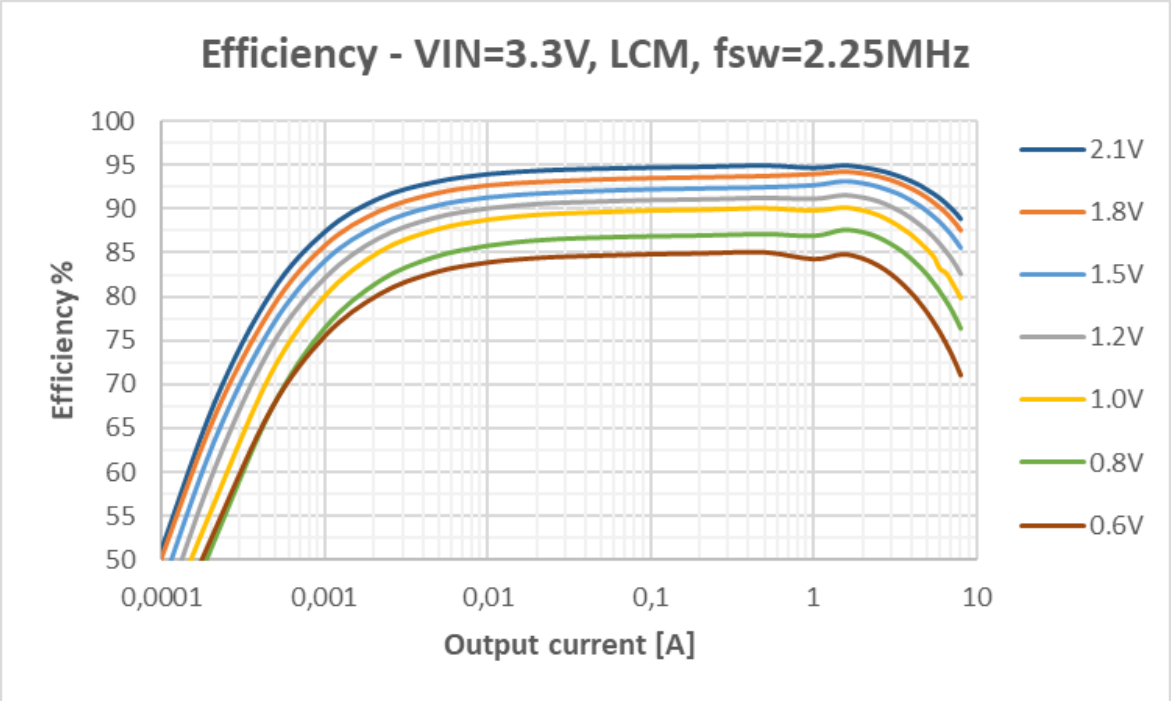


Figure 29. **Total losses 2.25MHz – VIN = 5 V – LNM**

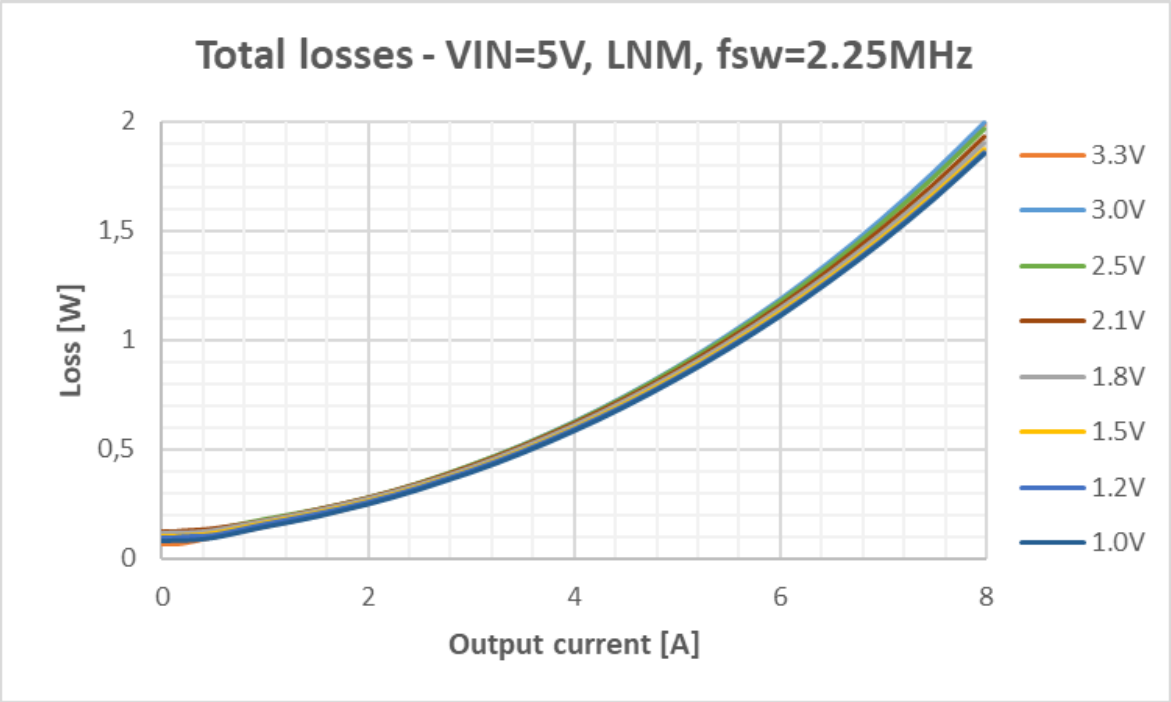


Figure 30. **Total losses 2.25MHz – VIN = 3.3 V – LNM**

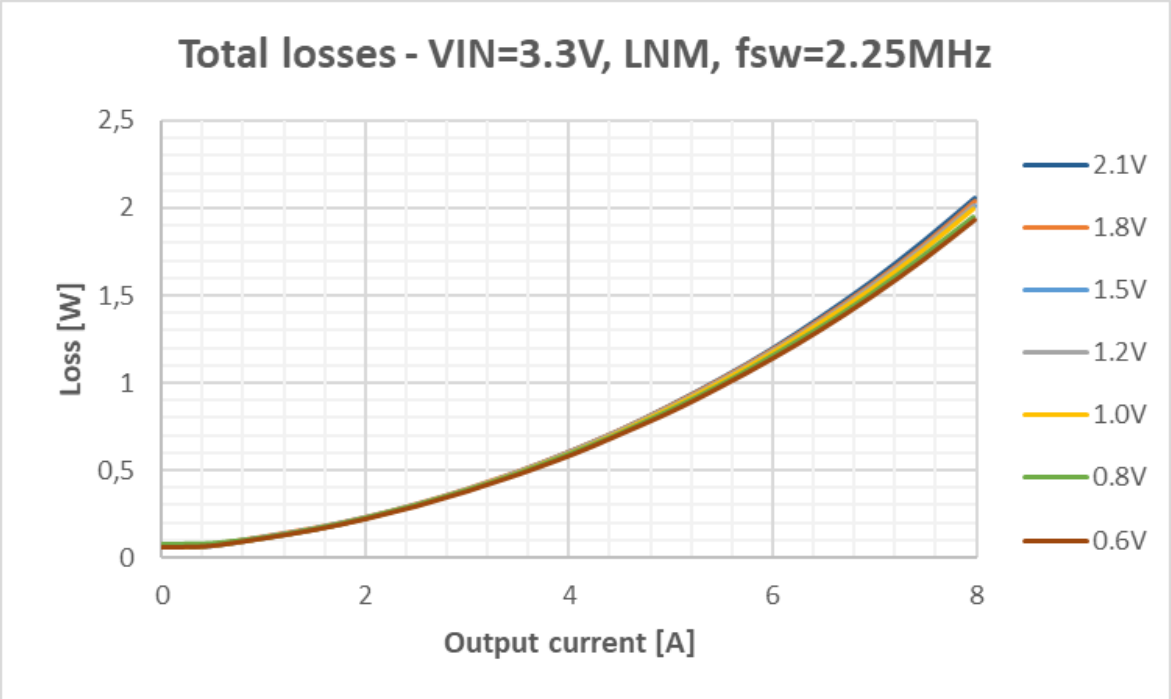


Figure 31. **Load regulation 2.25MHz – VIN = 5 V – LNM**

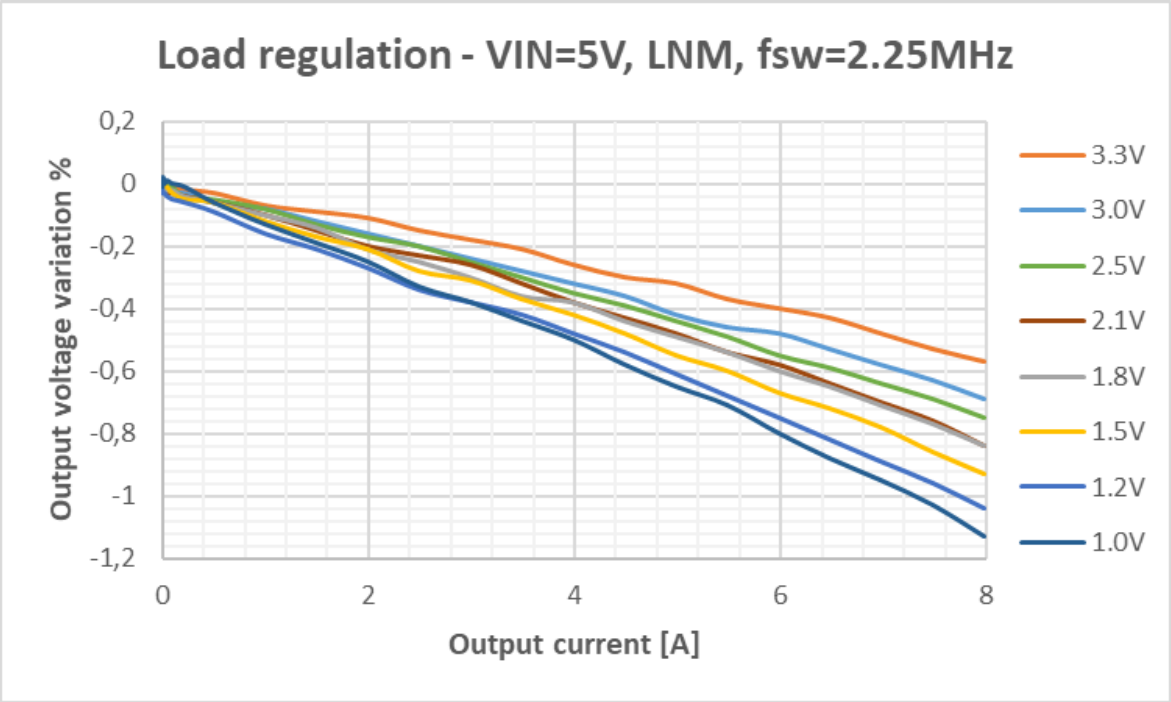


Figure 32. **Load regulation 2.25MHz – VIN = 3.3 V – LNM**

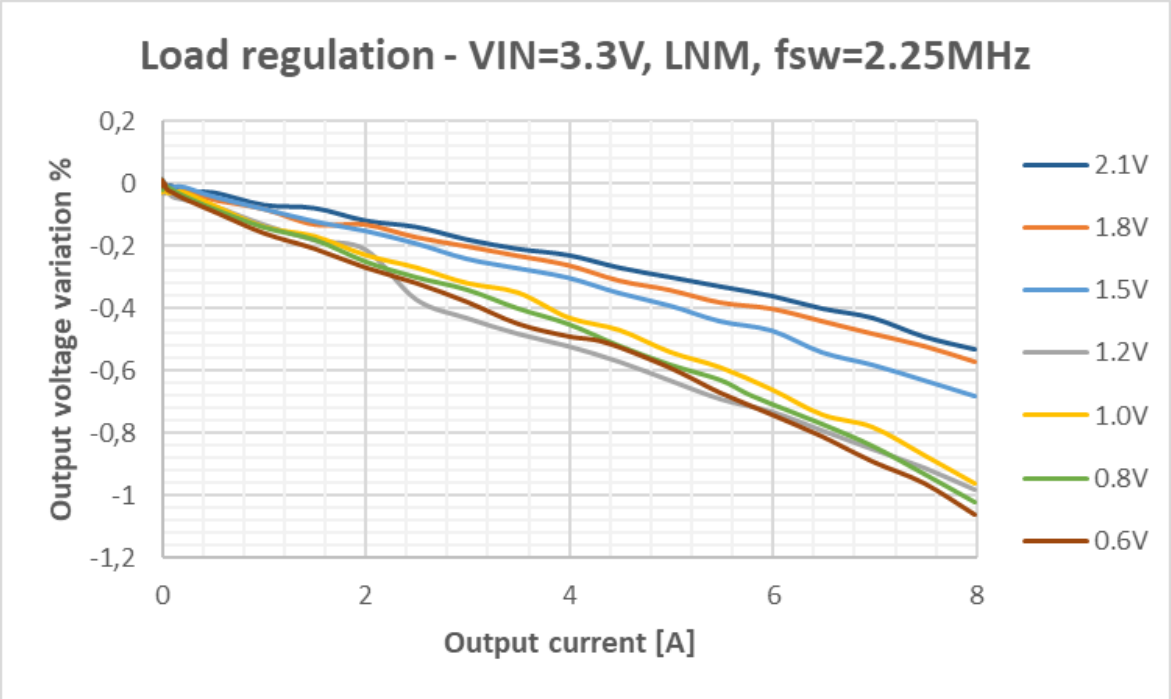


Figure 33. **Load regulation 2.25MHz – VIN = 5 V – LCM**

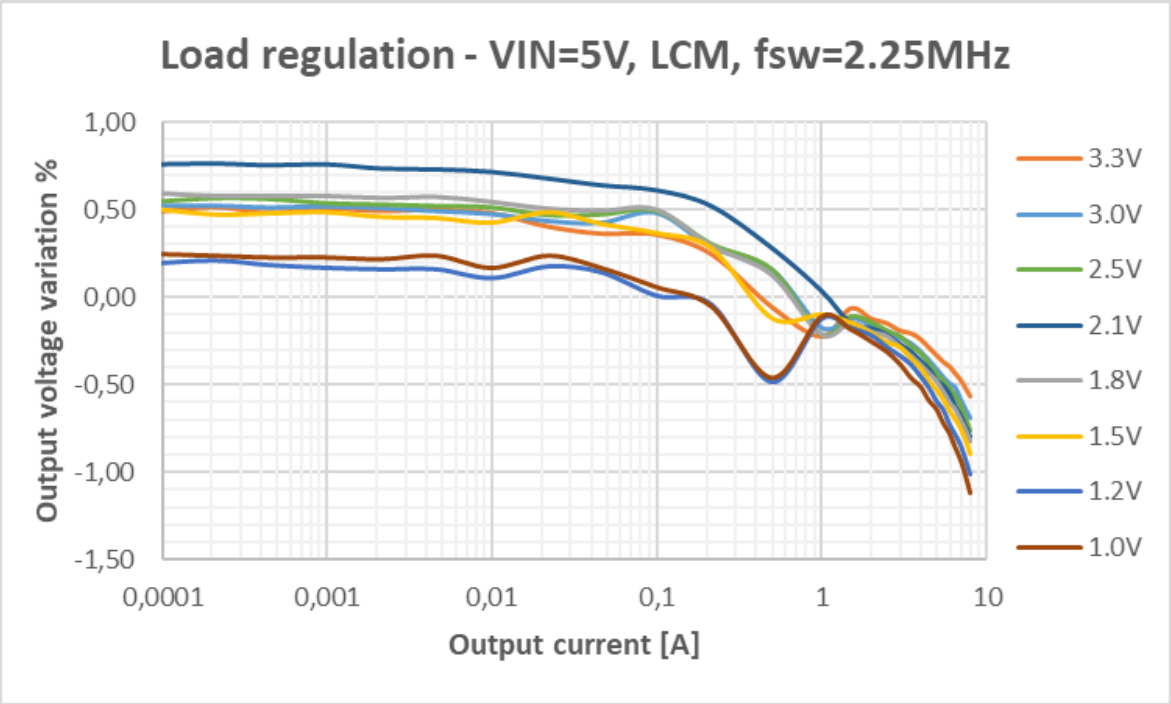
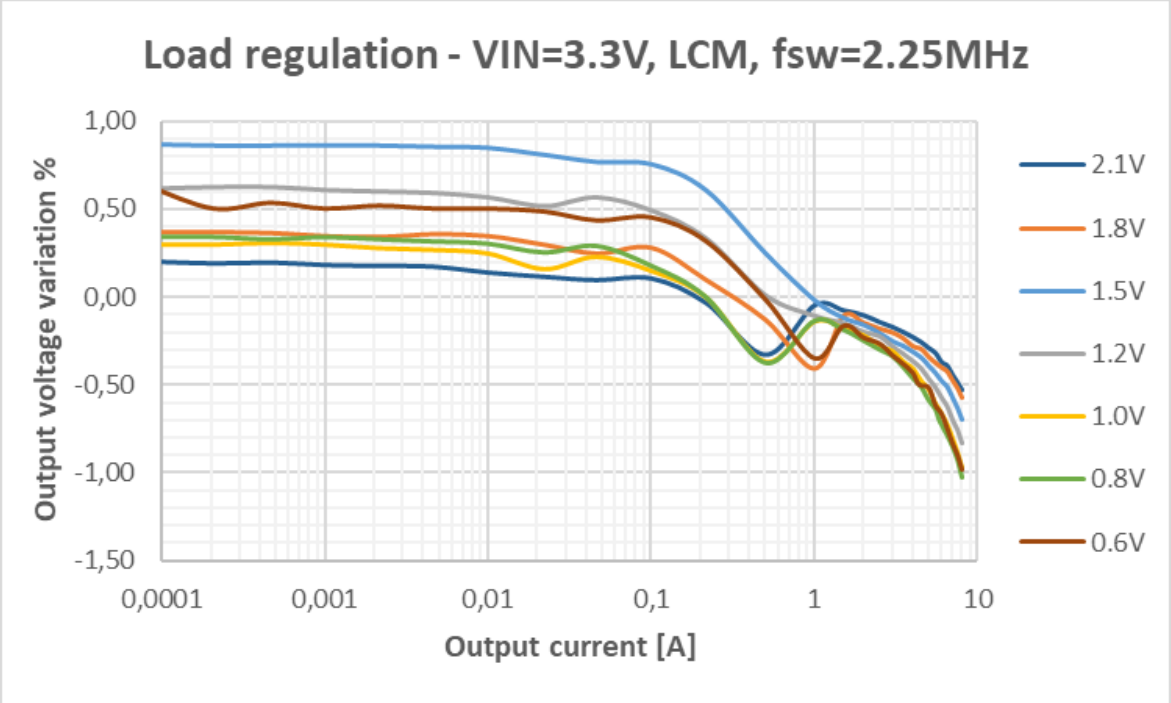


Figure 34. **Load regulation 2.25MHz – VIN = 3.3 V – LCM**



14 Regulatory compliance information

Notice for US Federal Communication Commission (FCC)

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).

Notice for the European Union

This device is in conformity with the essential requirements of the Directive 2014/30/EU (EMC) and of the Directive 2011/65/EU (RoHS II), including subsequent revisions and additions, as well as amended by the Delegated Directive 2015/863/EU (RoHS III). Compliance to EMC standards in Class A (industrial intended use).

Notice for the United Kingdom

This device is in conformity with the relevant provisions of the following EU legislation recognized by the United Kingdom:

• Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091) implementing Directive 2014/30/EU (EMC). Compliance to EMC standards in Class A (industrial intended use).

• The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (RoHS) (S.I. 2012/3032) implementing Directive 2011/65/EU (RoHS II), including subsequent revisions and additions, as well as amended by the Delegated Directive 2015/863/EU (RoHS III).

Revision history

Table 7. **Document revision history**

Date	Revision	Changes
30-Jun-2026	1	Initial release.

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