



LX9610 EVALUATION BOARD USER GUIDE

Lx9610 12A, 22V, 600kHz Synchronous Power Module

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Introduction to Product

The LX9610 is a 22V, 12A Power Module designed for step down point of load applications. This device includes a voltage mode synchronous controller including the compensation network, internal power MOSFETs and the output inductor all in a 15mm x15mm QFN package. It can operate with an input voltage from 8V to 22V. The output voltage is adjustable from 0.8V to 5V using a single external resistor. It has an internal 5V regulator. The only other components needed to make a complete 12A DC to DC converter are a 4.7uF decoupling capacitor for the 5V regulator, and the bulk input and output capacitors.

Other features of this device are internal digital soft start, thermal shutdown and hiccup mode current limit. The unit can be enabled or shut down through the COMP/EN pin. Over current sensing is accomplished by measuring the voltage across the Rds-on of the low-side MOSFET. Current of the OCP pin of the IC multiplied by resistance of the OCP resistor (residing on the pcb inside the module) sets the OCP threshold. An external resistor can be used to reduce the OCP threshold.

The package of the power module contains five sections,

- a) the controller that sits on a PCB, which contains the controller and the external resistor and caps that are needed for the controller to operate,
- b) the upper MOSFET placed in a cavity,
- c) the lower MOSFET placed in a cavity,
- d) the inductor placed between the output cavity and the lower MOSFET cavity,
- e) the PGND cavity.

The LX9610 is package in a thermal enhanced, compact over-molded module with a length, width and height of the power module are 15mm, 15mm and 3.7mm, respectively. This package is suitable for assembly by standard automated surface mount equipment.

Key Features

- Fully integrated 12A Power Module Requiring Only Input/output Caps and Few External Components.
- Operational Input Supply Voltage Range: 8V to 22V
- Adjustable Output from 0.8V to 5V Using One External Resistor
- Integrated Upper and Lower N-Ch MOSFET's.
- Preset 600Khz Switching Frequency (can go up to 1MHz)
- Voltage Mode Control
- Can be Enabled or Shut Down Through the COMP/EN pin
- Internal Digital Soft Start
- Cycle-by-cycle Over Current Monitoring with Hiccup mode protection
- Available in QFN 15mm x 5mm x 3.5mm
- RoHS Compliant

Applications

- Set-top box
- Servers
- Industrial Equipments
- Telecom and Datacom Applications
- Point of Load Regulator applications

Part Specific Information

IC Part Number	Description
LX9610ILQ	Plastic QFN 15mm x 15mm Exposed Pad

Evaluation Board Part Number	Description
LX9610 EVALUATION BOARD	Evaluation PCB for LX9610

Schematic of Evaluation Board

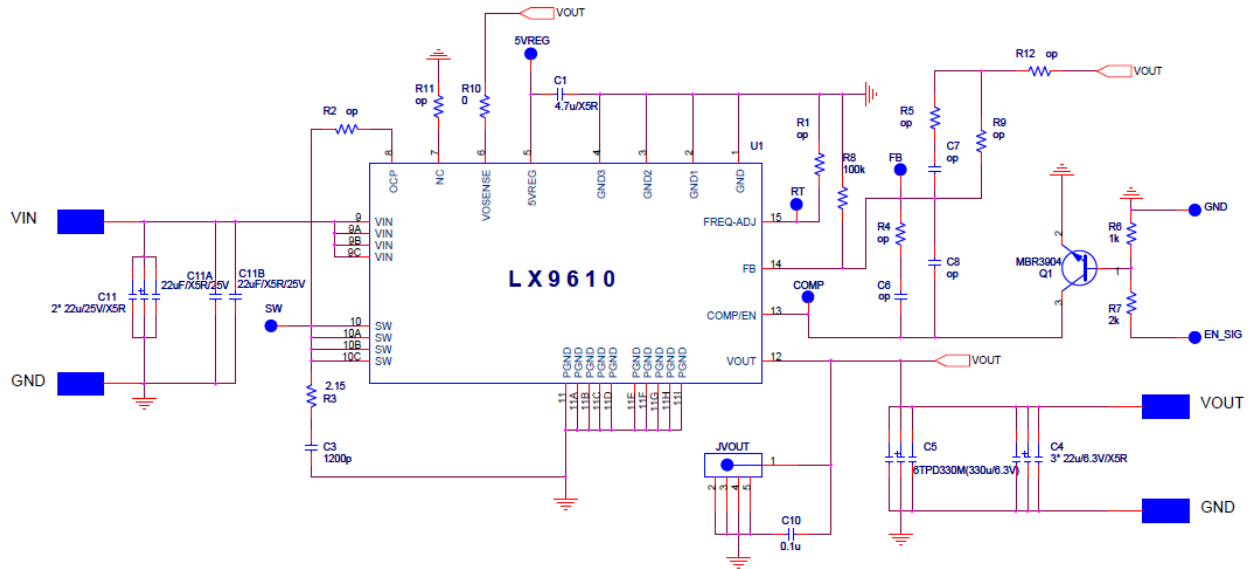


Figure 1 Schematic of Evaluation Board

Layout of Evaluation Board

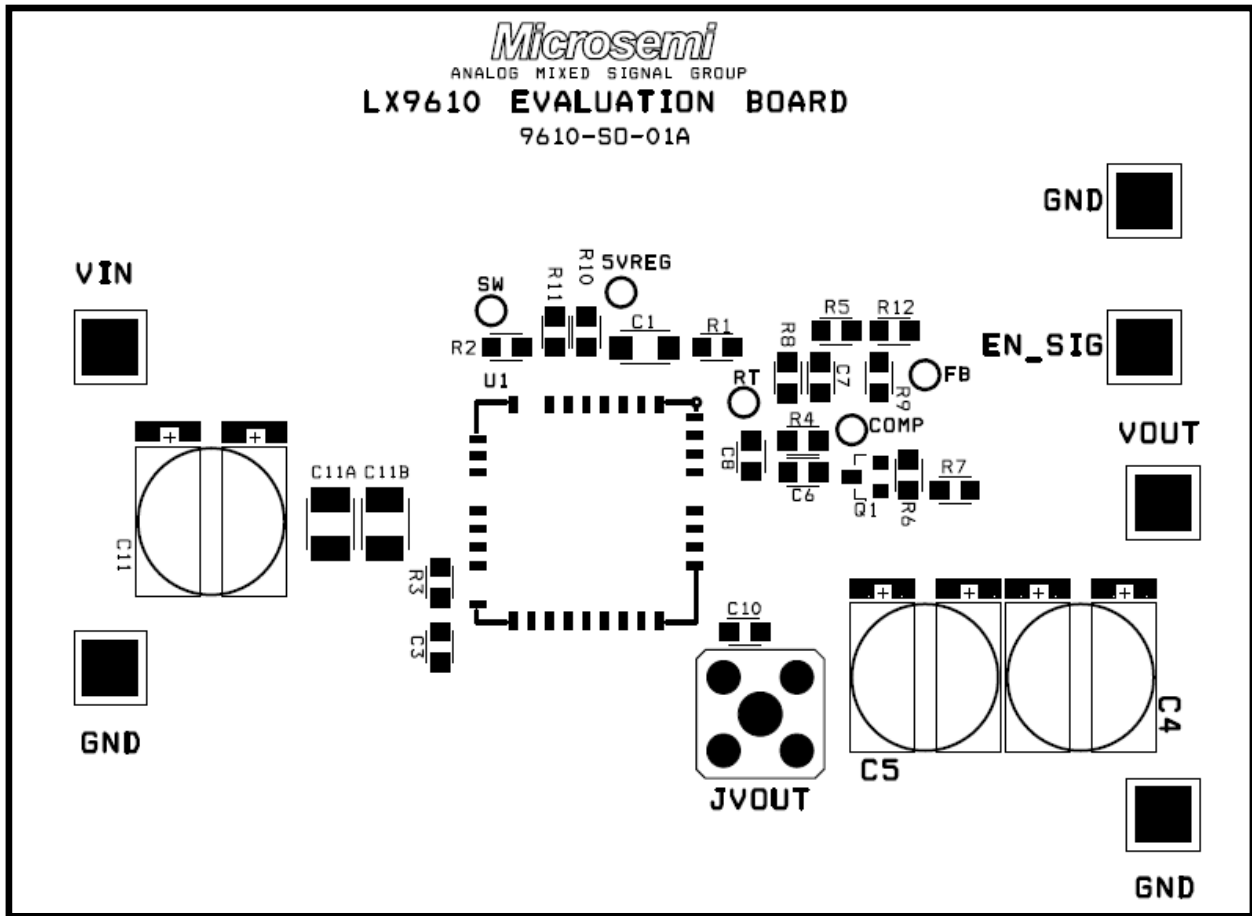


Figure 2 Top Solderpaste
Top Silkscreen

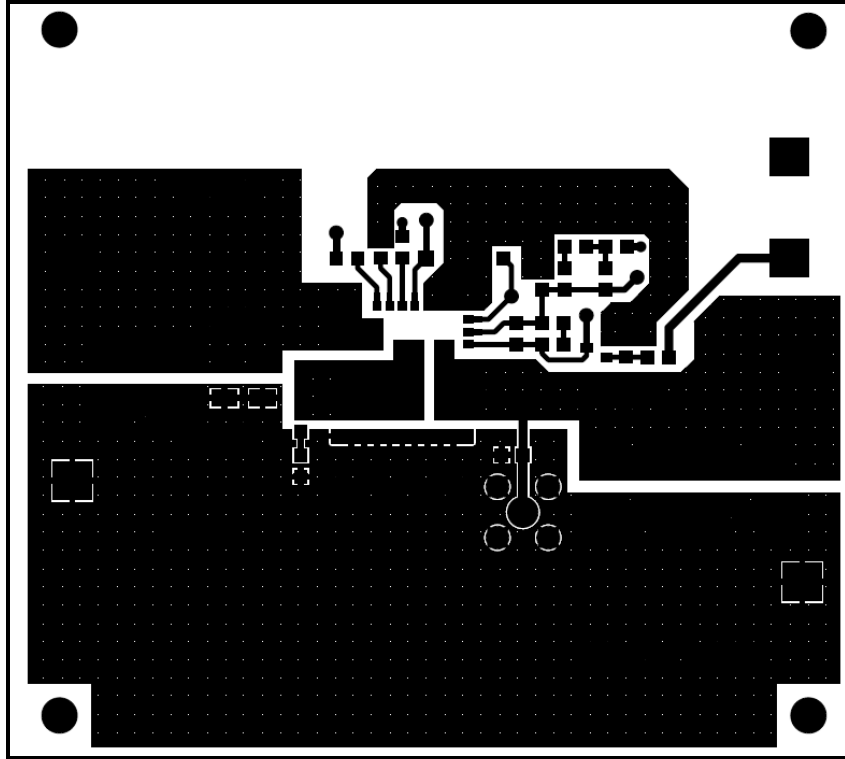


Figure 3 Top Layer 1

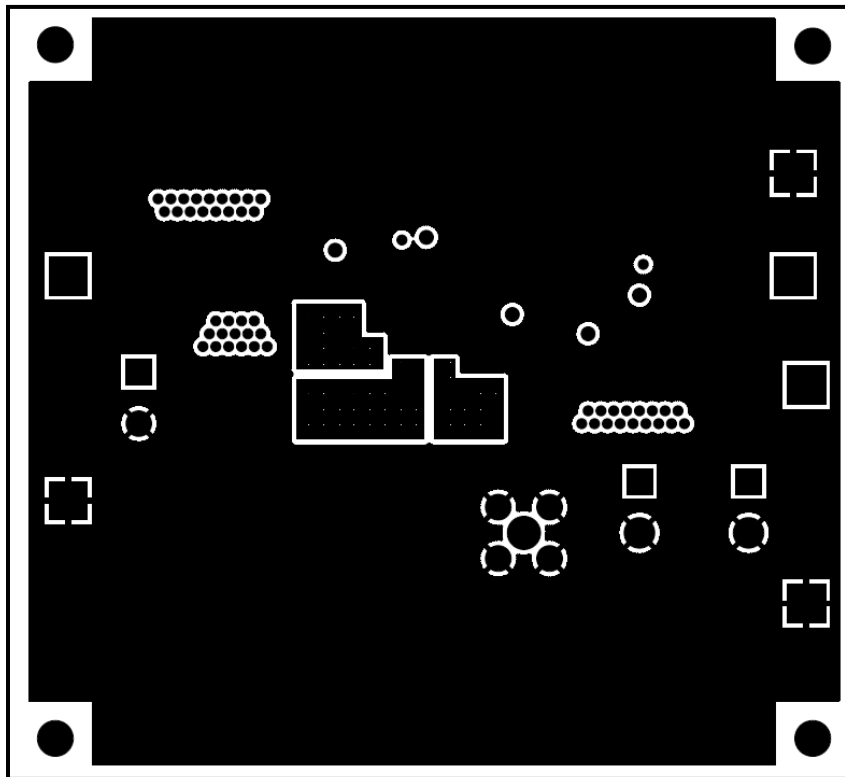


Figure 4 Inner Layer 2

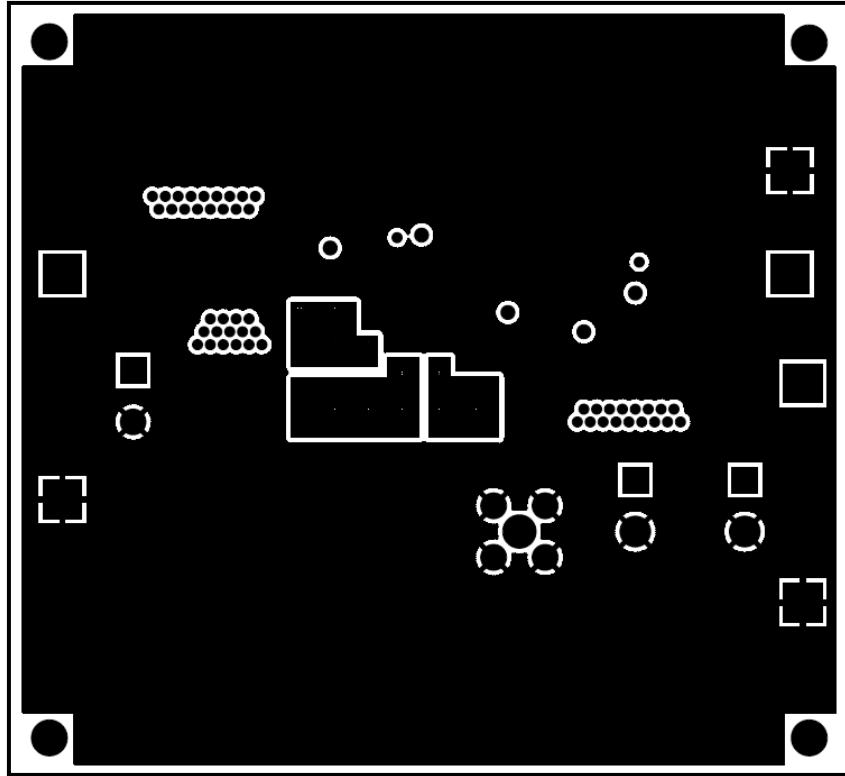


Figure 5 Inner Layer 3

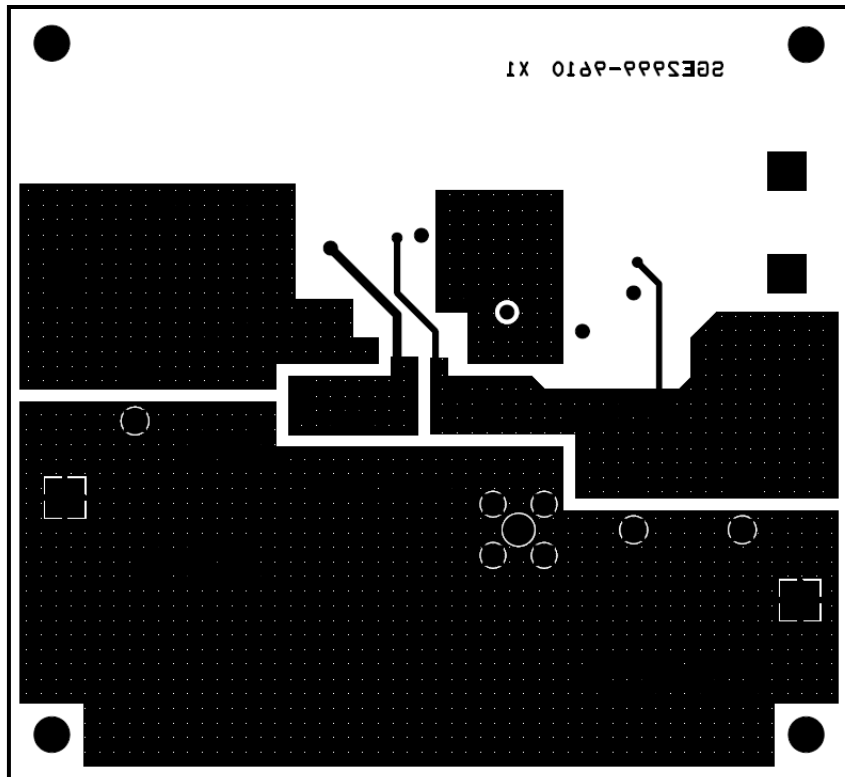


Figure 6 Bottom Layer 4

Bill of Material

MISCELLANEOUS COMPONENTS

Item	Part Description	Reference	Qty
1	Microsemi IC – 12A, 22V, 600 kHz Synchronous Power Module	U1	1
2	Test Point	5VREG, SW, RT, FB, COMP	5
3	Terminal	VIN, VOUT, EN_SIG, GND, GND, GND	6
4	Scope Test Point	JVOUT	1

CAPACITORS

Item	Part Description	Reference	Qty
5	4.7uF/X5R	C1	1
6	1200pF	C3	1
7	3*22uF/6.3V/X5R	C4	1
8	6TPD330M(330uF/6.3V)	C5	1
9	0.1uF	C10	1
10	2*22uF/25V/X5R	C11	1
11	22uF/25V/X5R	C11A, C11B	2

RESISTORS

Item	Part Description	Reference	Qty
12	2.15Ohm	R3	1
13	1kOhm	R6	1
14	2kOhm	R7	1
15	100kOhm	R8	1
16	0Ohm	R10	1

MOSFET

Item	Part Description	Reference	Qty
17	MBR3904	Q1	1

Recommended Operating Condition

Description	Symbol	Min	Max	Unit
Input Voltage	V_{IN}	8	22	V
Output Current	I_{OUT}	0	12	A
Operating Ambient Temperature	T_A	-40	85	°C
Enable Chip	EN_SIG	Float	Float	
Shut Down Chip	EN_SIG	Pull to GND	Pull to GND	

V_{OUT} is Set by The Following Equation

$$V_{OUT} = V_{FB} * (1 + 49.9k / R_{FB}) \quad V_{FB}=0.8V \quad (R_{FB} = R_8)$$

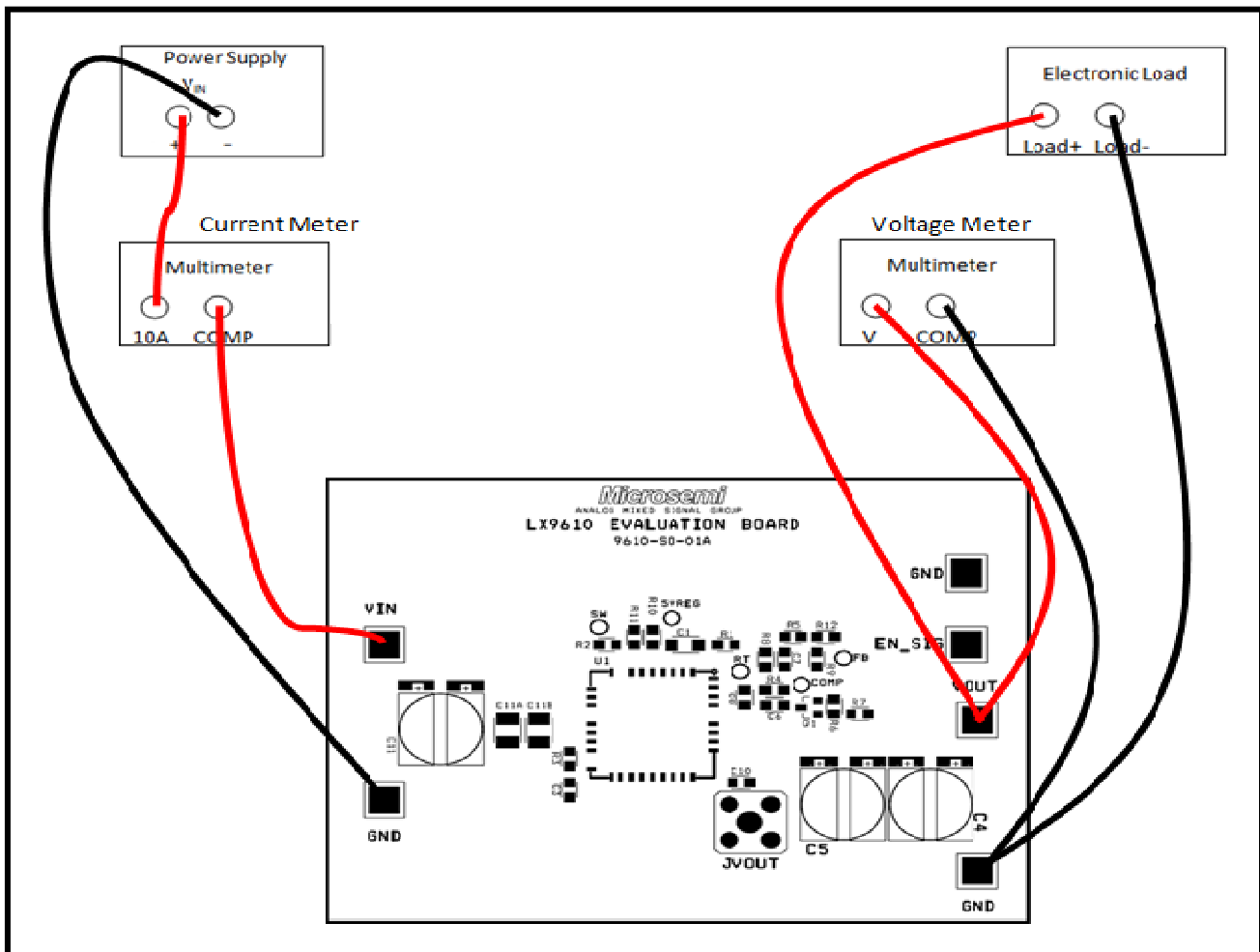


Figure 7 Power Supply and Load Connection

12V Input Efficiency

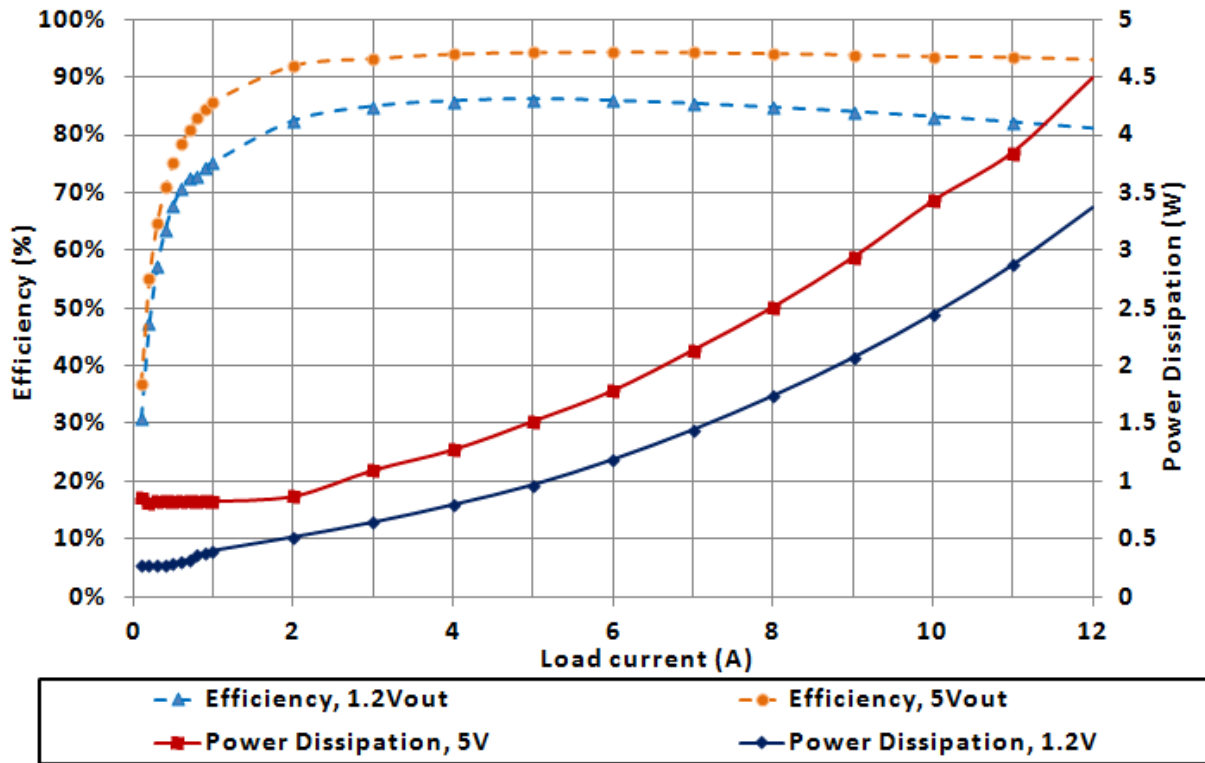
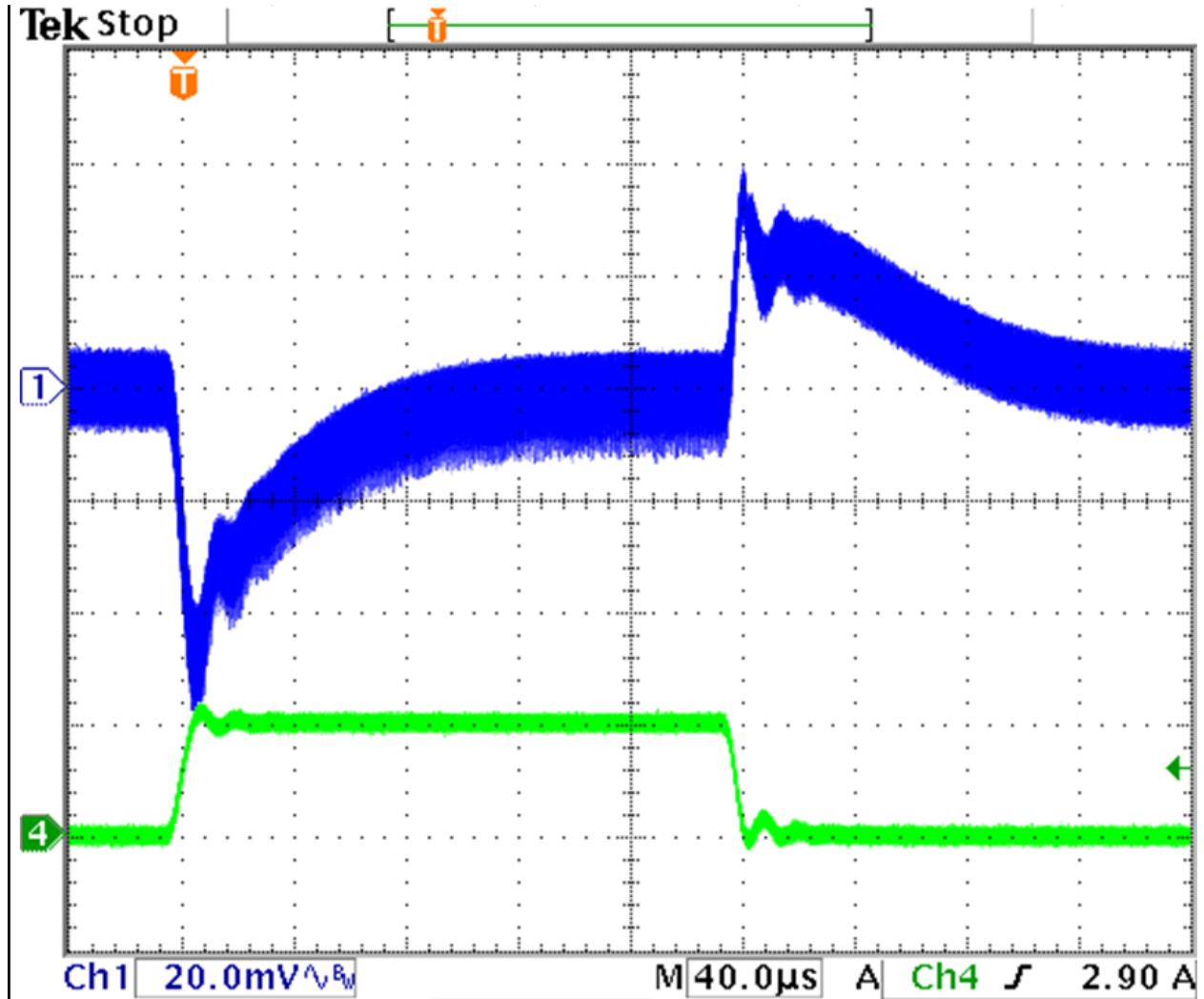


Figure 7 Efficiency Plot of LX9610

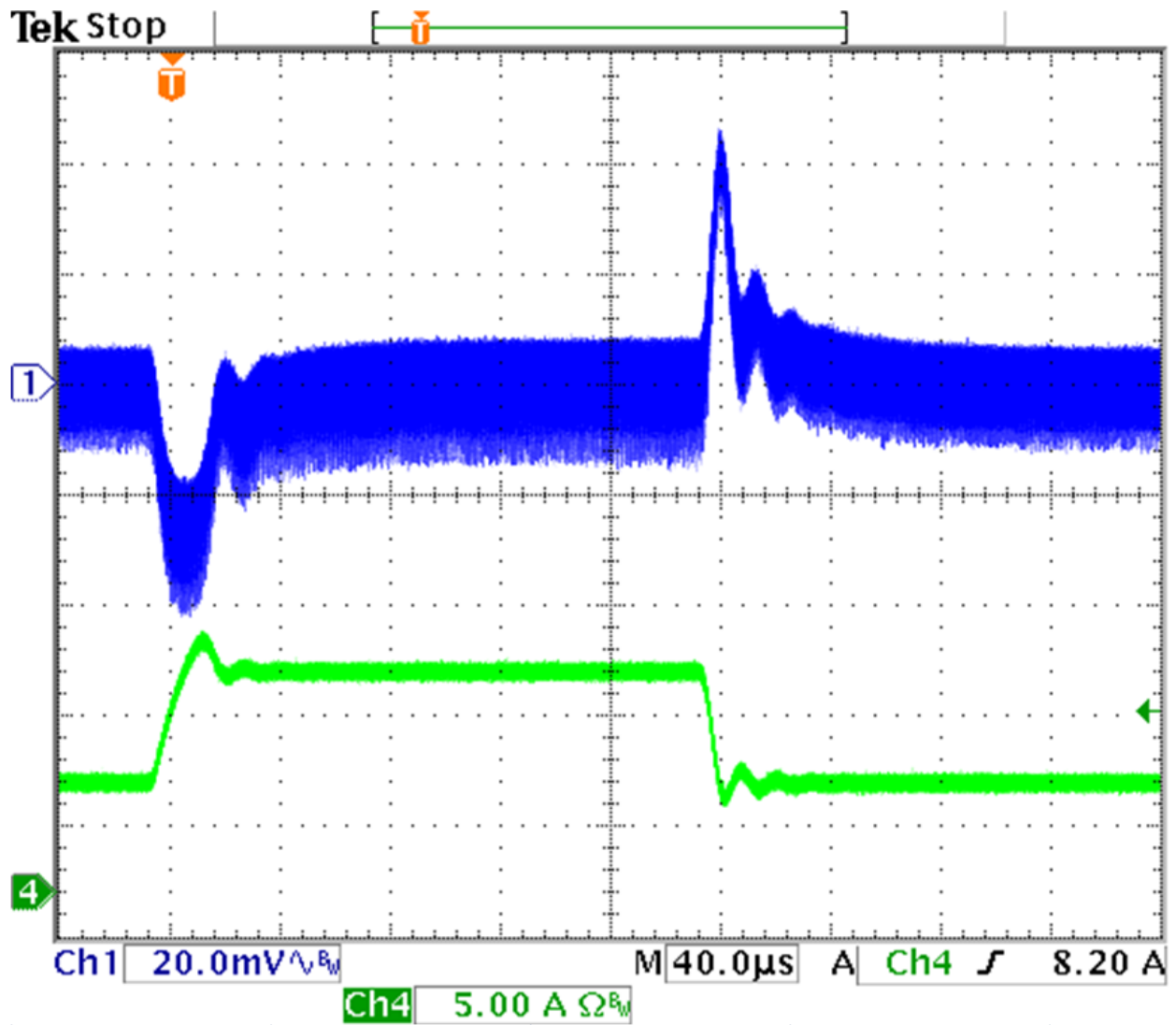
Dynamic Load Response

Dynamic load response with 12V V_{IN} , 1.2V V_{OUT} , 0↔5A load



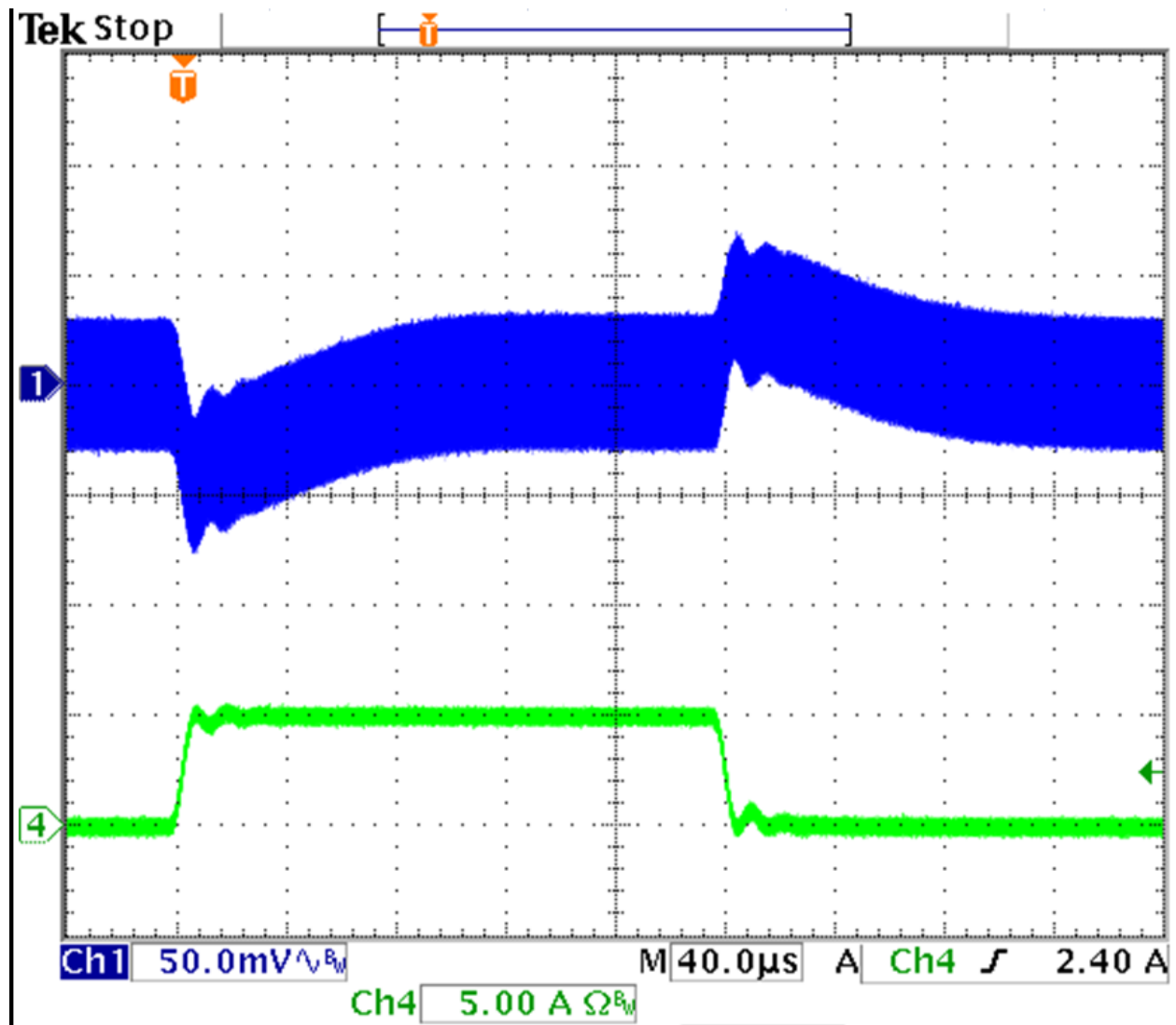
Ch1: 1.2V_{OUT} (across ceramic output caps) Ch4: Load current

Figure 8 $V_{IN}=12V$, $V_{OUT}=1.2V$, Load 0↔5A (2.5A/us)

Dynamic load response with 12V V_{IN} , 1.2V V_{OUT} , 5 \leftrightarrow 10A load


Ch1: 1.2V_{OUT} (across ceramic output caps) Ch4: Load current

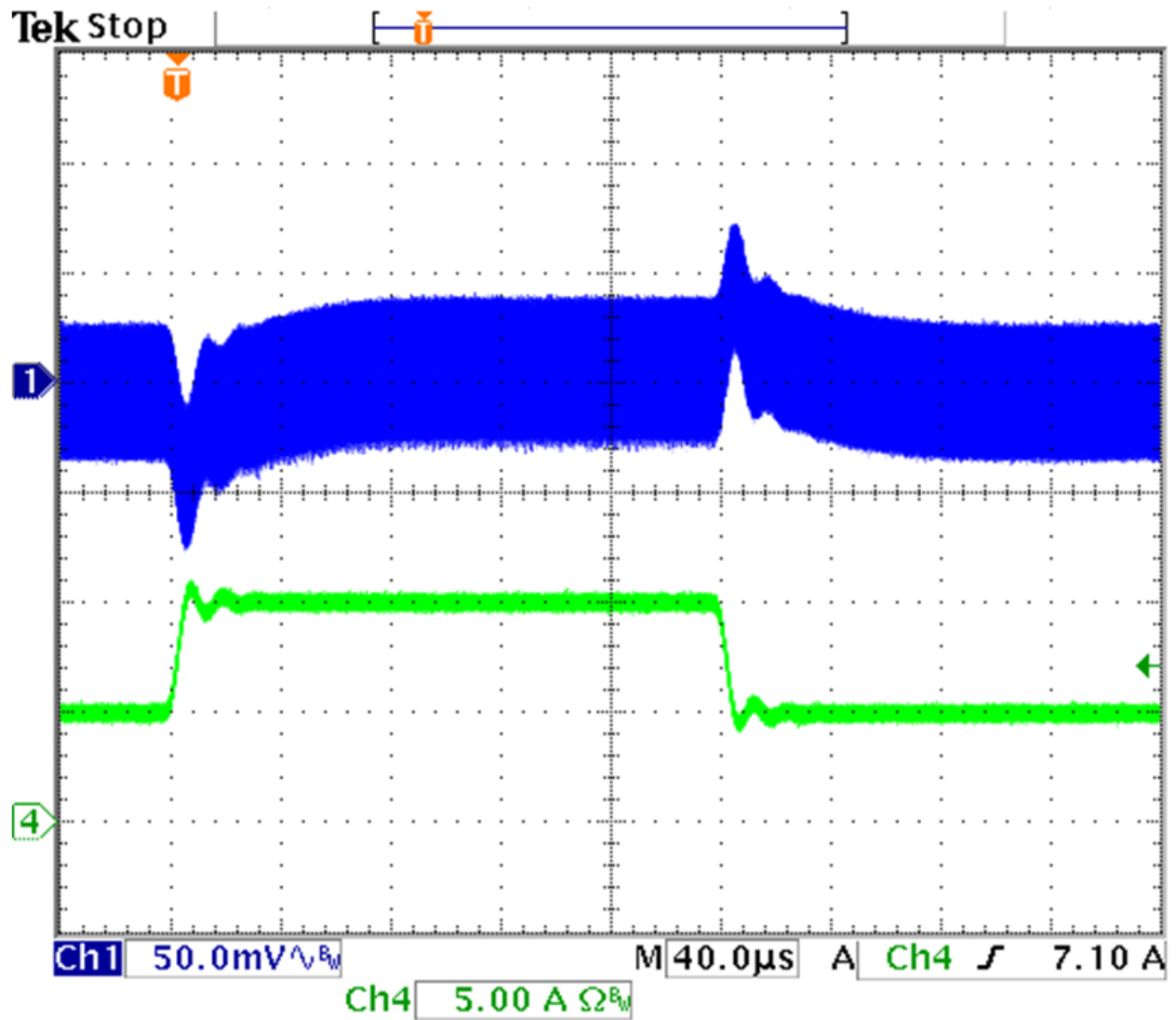
Figure 9 V_{IN} =12V, V_{OUT} =1.2V, Load 5 \leftrightarrow 10A (2.5A/us)

Dynamic load response with 12V V_{IN} , 5V V_{OUT} , 0↔5A load

Ch1: 5V_{OUT} (across ceramic output caps) Ch4: Load current

Figure 10 $V_{IN}=12V$, $V_{OUT}=5V$, Load 0↔5A (2.5A/us)

Dynamic load response with 12V V_{IN} , 5V V_{OUT} , 5 \leftrightarrow 10A load

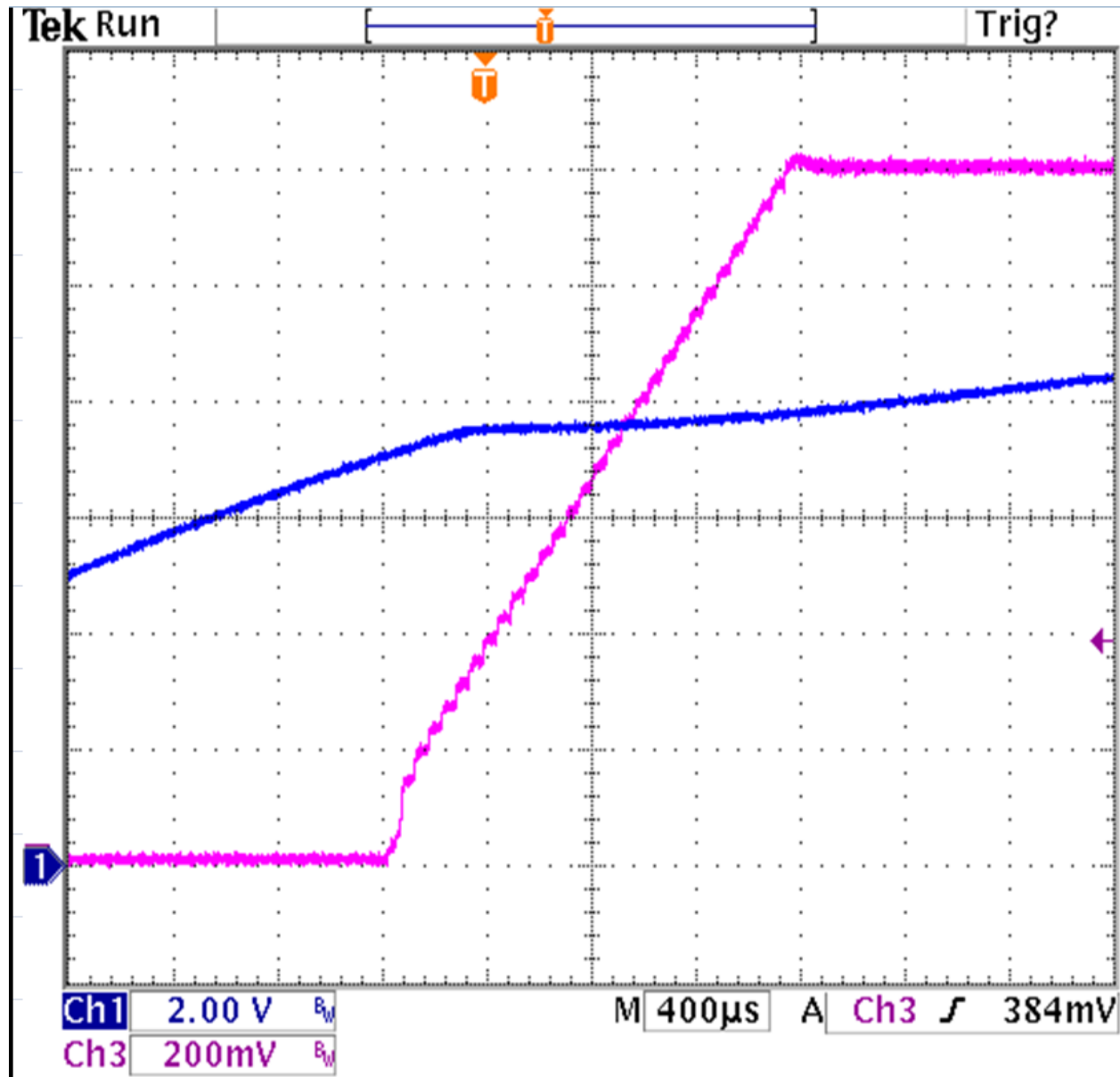


Ch1: 5V_{OUT} (across ceramic output caps) Ch4: Load current

Figure 11 $V_{IN}=12V$, $V_{OUT}=5V$, Load 5 \leftrightarrow 10A (2.5A/us)

Start up

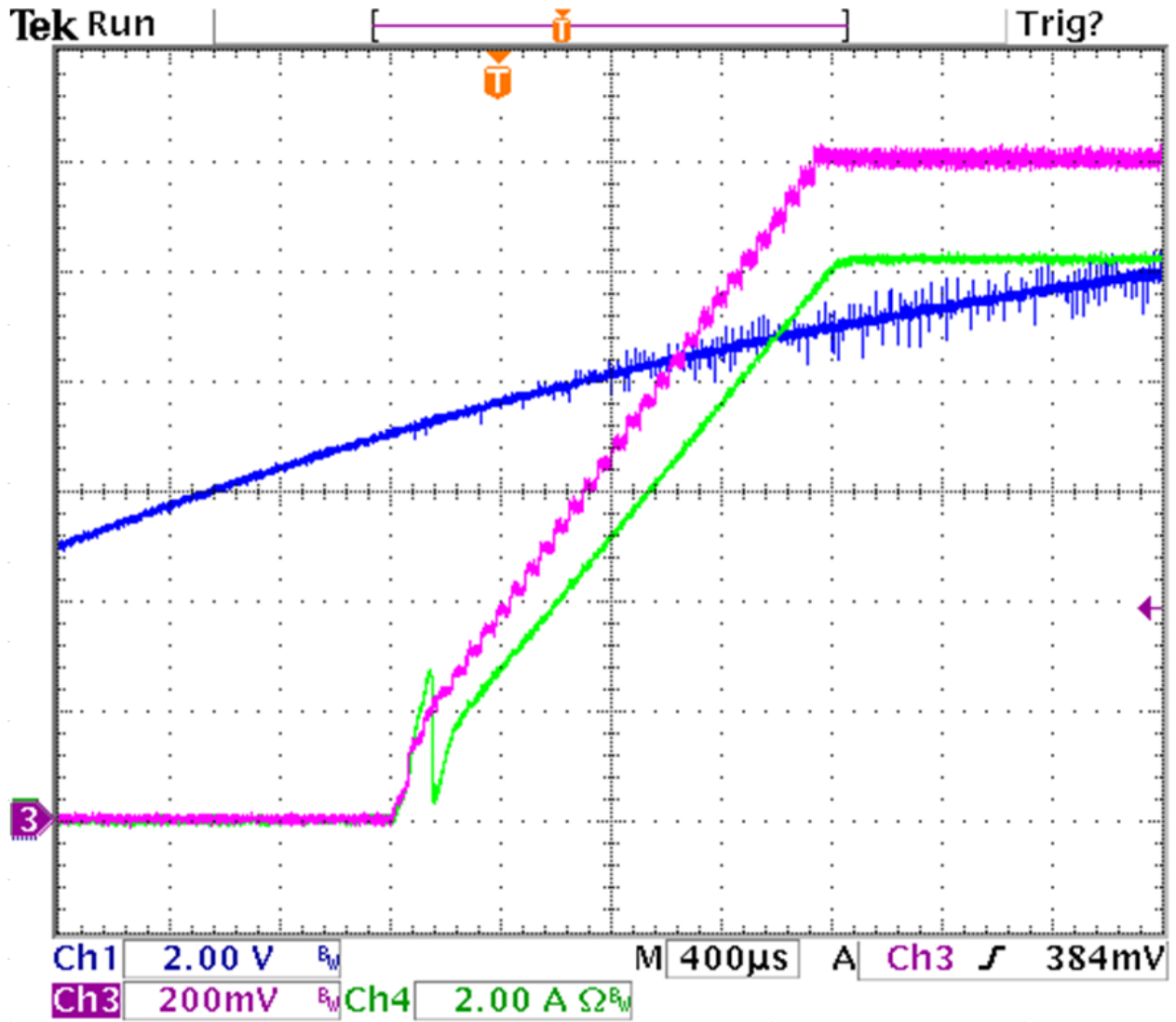
Start up with no load, 12V V_{IN} , 1.2V V_{OUT}



Ch1: 12V V_{IN} Ch3: 1.2V V_{OUT}

Figure 12 $V_{IN}=12V$, $V_{OUT}=1.2V$, No Load

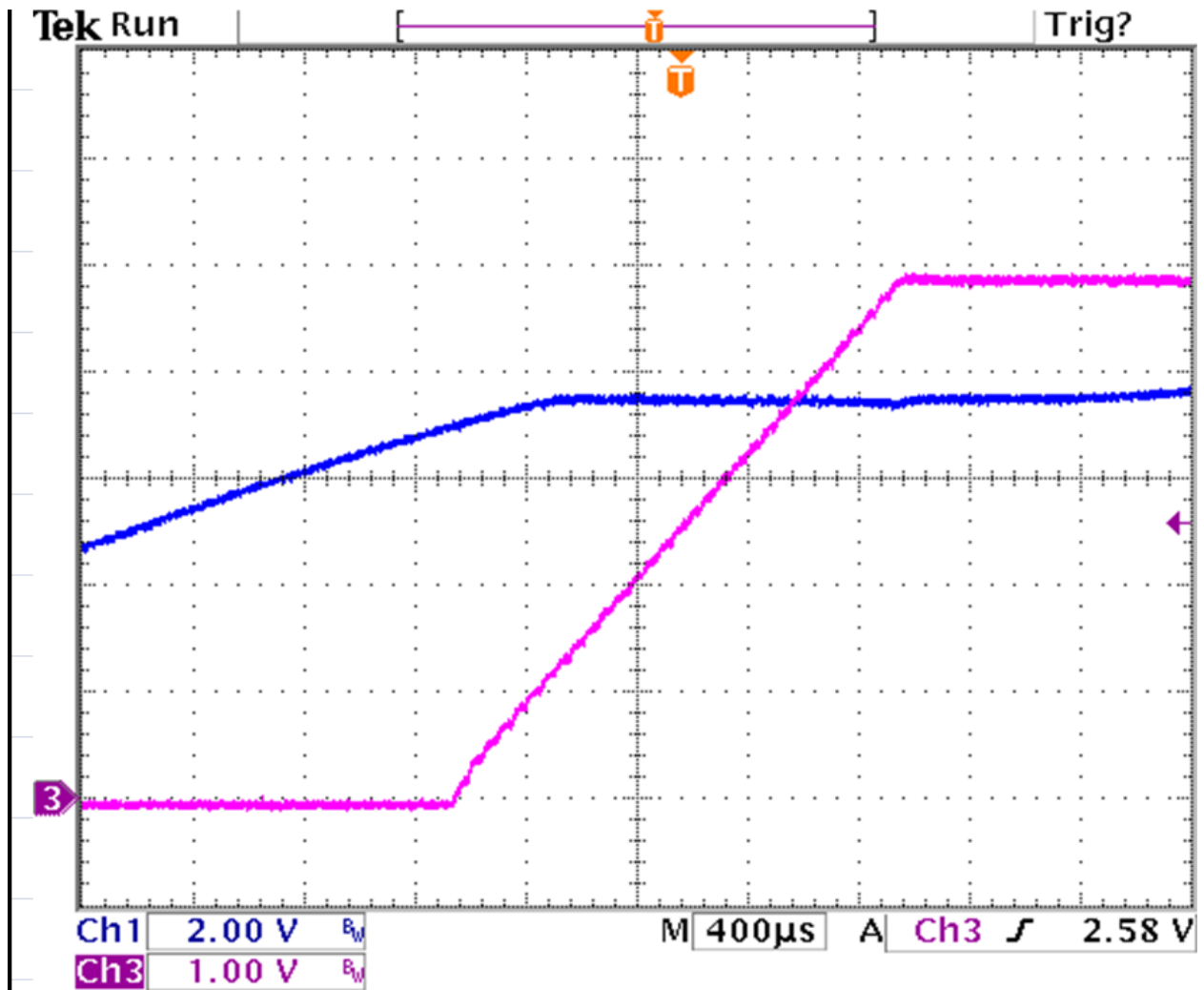
Start up with 10A load (constant resistance mode), 12V V_{IN} , 1.2V V_{OUT}



Ch1: 12V V_{IN} Ch3: 1.2V V_{OUT} Ch4: 10A Load

Figure 13 $V_{IN}=12V$, $V_{OUT}=1.2V$, 10A Load

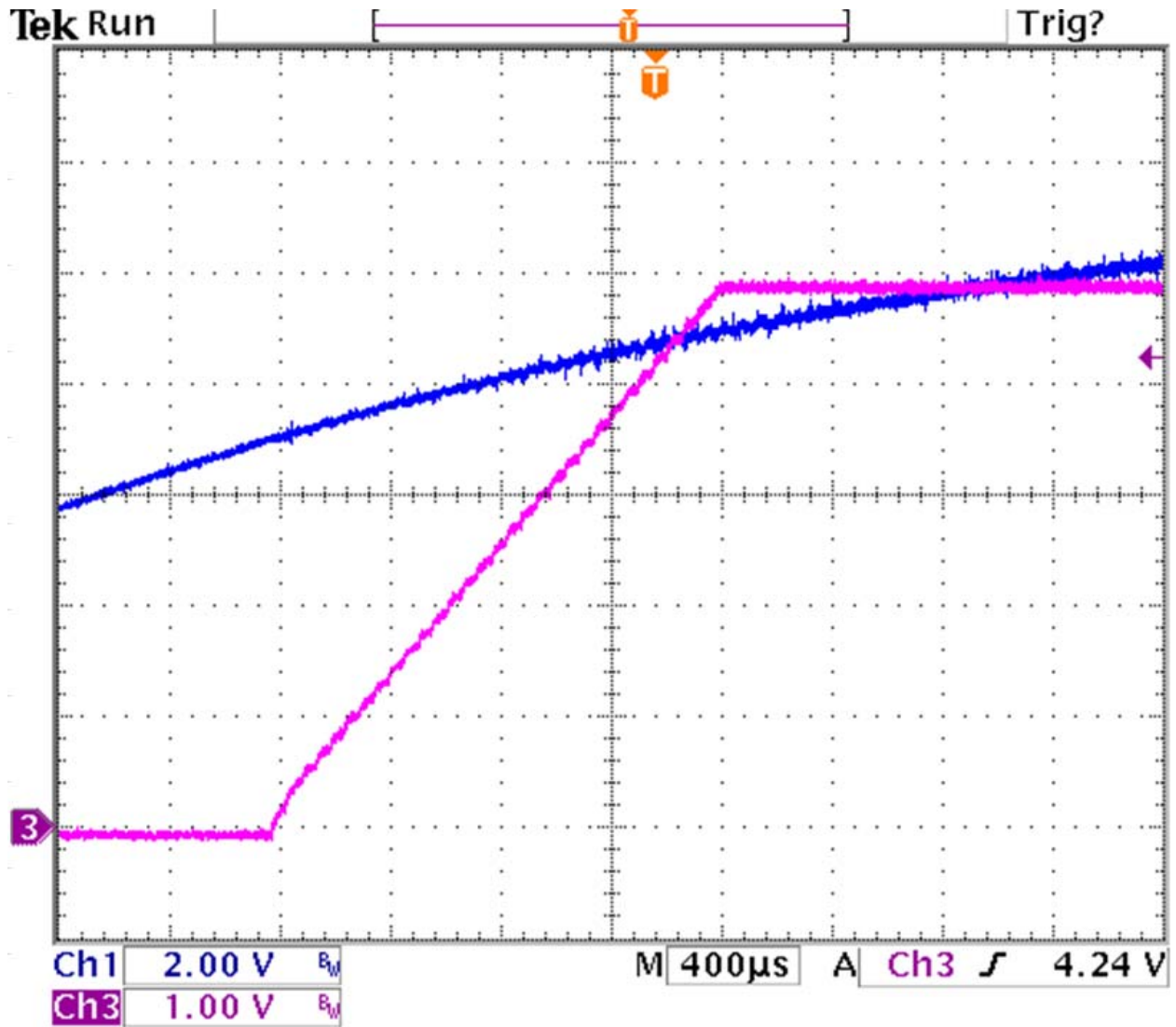
Start up with no load, 12V V_{IN} , 5V V_{OUT}



Ch1: 12V V_{IN} Ch3: 5V V_{OUT}

Figure 13 $V_{IN}=12V$, $V_{OUT}=5V$, No Load

Start up with 10A load (constant resistance mode), 12V V_{IN} , 5V V_{OUT}



Ch1: 12V V_{IN} Ch3: 5V V_{OUT}

Figure 13 $V_{IN}=12V$, $V_{OUT}=5V$, 10A Load