



# EV1604A-3300-A EVALUATION BOARD USER GUIDE



## Introduction

This user guide describes the evaluation board provided for the FS1604A-3300  $\mu$ POL™ product.

The board generates an output voltage ( $V_{OUT}$ ) of 3.3V for loads of 0–4A from an input voltage ( $PV_{IN}$ ) of 12V.

## Specifications

- Input voltage ( $PV_{IN}$ ) = +12V
- Output voltage ( $V_{OUT}$ ) = +3.3V
- Output load ( $I_o$ ) = 0–4A
- Switching frequency ( $F_{SW}$ ) = 1.56MHz
- Output capacitance ( $C_o$ ) = 2x22 $\mu$ F (MLCC)
- Input capacitance ( $C_{IN}$ ) = 2x22 $\mu$ F (MLCC)
- Dimensions (width x length x thickness) = 76.2 x 76.2 x 1.6 mm

## Connections

Name	Identifier	Description
$PV_{IN}$	J1	Input voltage (+12V)
Gnd	J1	Ground for input voltage
$V_{OUT}$	J2	Output voltage (+3.3V)
Gnd	J2	Ground for output voltage
En	J4	Enable
PG	J5	Power Good

The board is configured for a single input supply. An internal low drop-out regulator generates the internal supply ( $V_{CC}$ ) from  $PV_{IN}$ . The Enable (En) input is connected to  $PV_{IN}$  through a resistor divider, so that no Enable signal is needed.

## Operation

To use the evaluation board:

1. Connect a well-regulated +12V input supply to  $PV_{IN}$  and Gnd.
2. Connect a load of 0–4A to  $V_{OUT}$  and Gnd.

## Description

The evaluation board consists of a 4-layer PCB made from FR4 glass-reinforced epoxy laminate material. All layers use 2oz copper (equating to a thickness of 0.0694mm). FS1604A is mounted on the top side of the board.

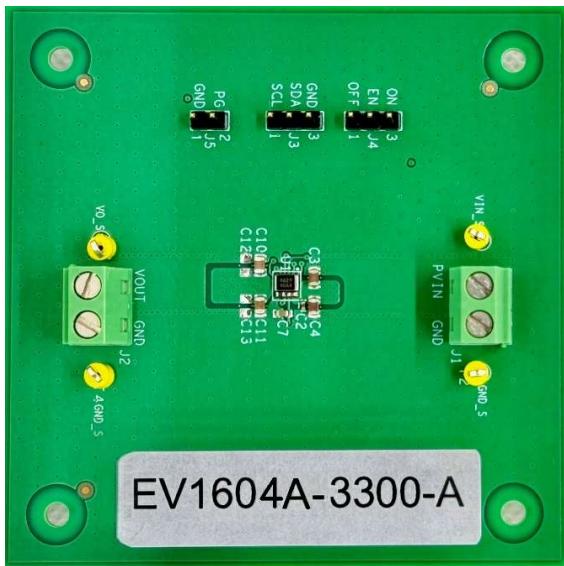


Figure 1 View of Board (Top)

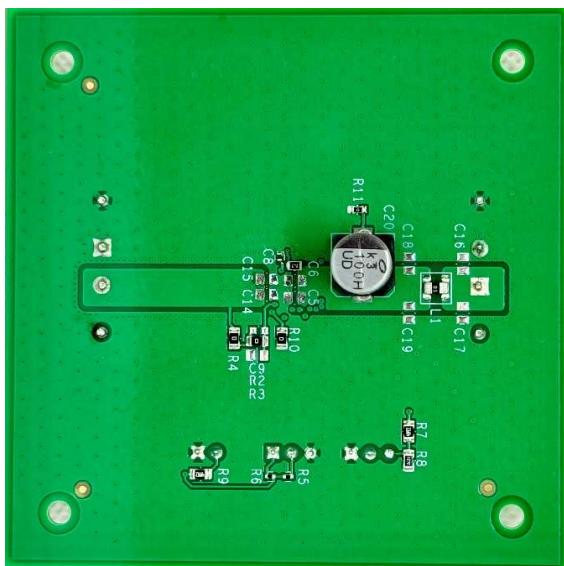
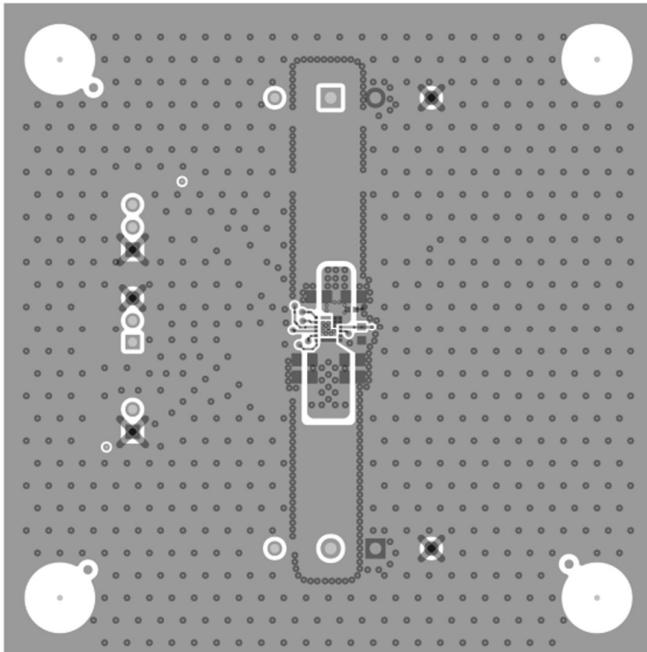
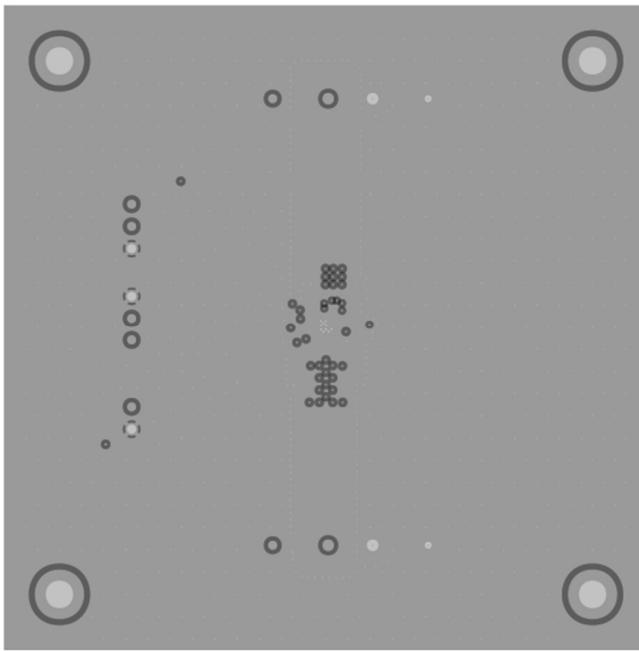


Figure 2 View of Board (Bottom)

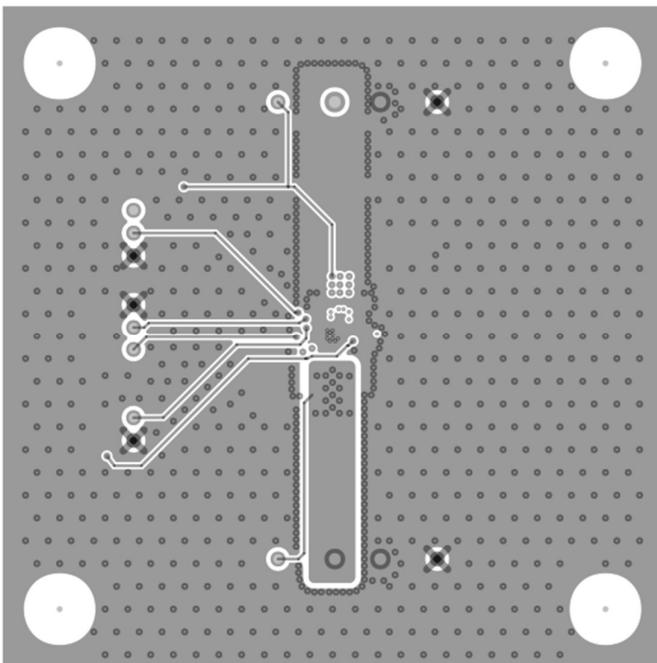
Figure 3 to Figure 6 show the pictures of the board layers and Figure 7 shows a schematic of the electric circuit.



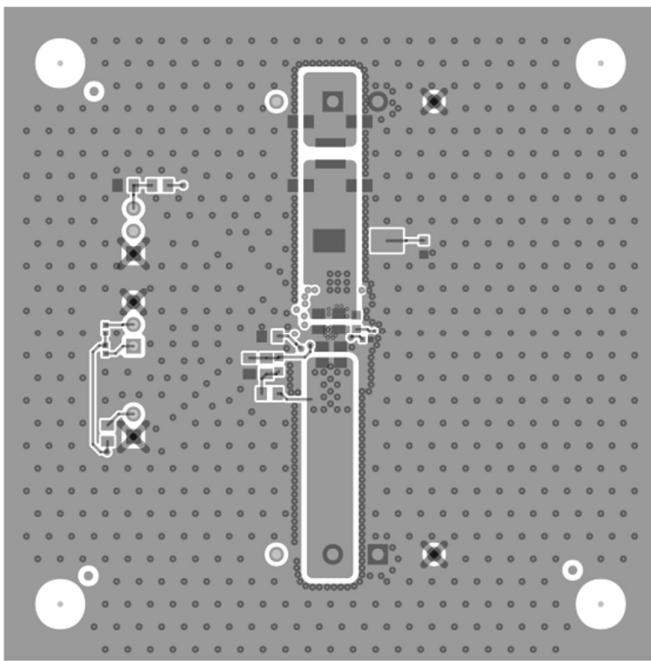
**Figure 3** *Board layout – layer 1*



**Figure 4** *Board layout – layer 2*



**Figure 5** *Board layout – layer 3*



**Figure 6** *Board layout – layer 4*

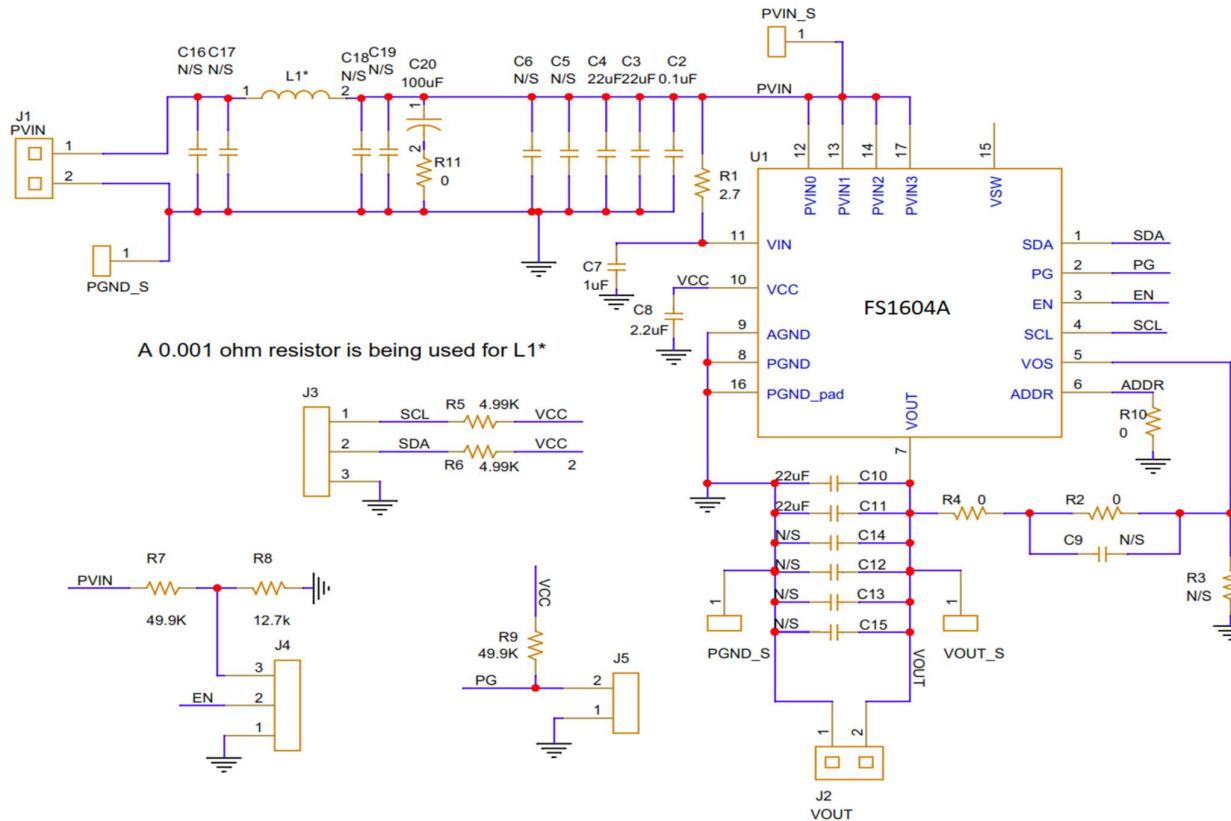


Figure 7 Schematic

Part reference	Quantity	Type	Description
FS1604A $\mu$ POL	1	–	FS1604A Module
C20	1	100uF	Aluminum capacitor
C2	1	0.1uF	0402, 25V, X7R
C3,C4	2	22uF	0805, 25V, X5R, 10%
C10,C11	2	22uF	0805, 6.3V, X5R, 10%
C7	1	1uF	0603, 25V, X5R, 10%
C8	1	2.2uF	0402, 10V, X7S, 10%
R8	1	12.7K	10%, 1/8W, 0805 case size
R1	1	2.7	10%, 1/8W, 0805 case size
R7,R9	2	49.9K	10%, 1/8W, 0805 case size
R2,R4,R10	2	0	0805 case size
R11	1	0	0603 case size
R5,R6	2	4.99K	0402 case size
L1	1	0.001ohm	1206 case size
J1,J2	2		TERM BLOCK 2POS 5mm, TH
J3,J4	2		3-pin Header
J5	1		2-pin Header
T1,T2,T3,T4	4		Test point

## Typical performance

Figure 8 to Figure 22 show typical operating waveforms for the evaluation board, while Figure 23 shows a thermal image of the board in operation. In all cases, the board is operating at room temperature with no airflow;  $PV_{IN}$  is 12V,  $V_{OUT}$  is 3.3V and  $I_o$  is 0–4A.

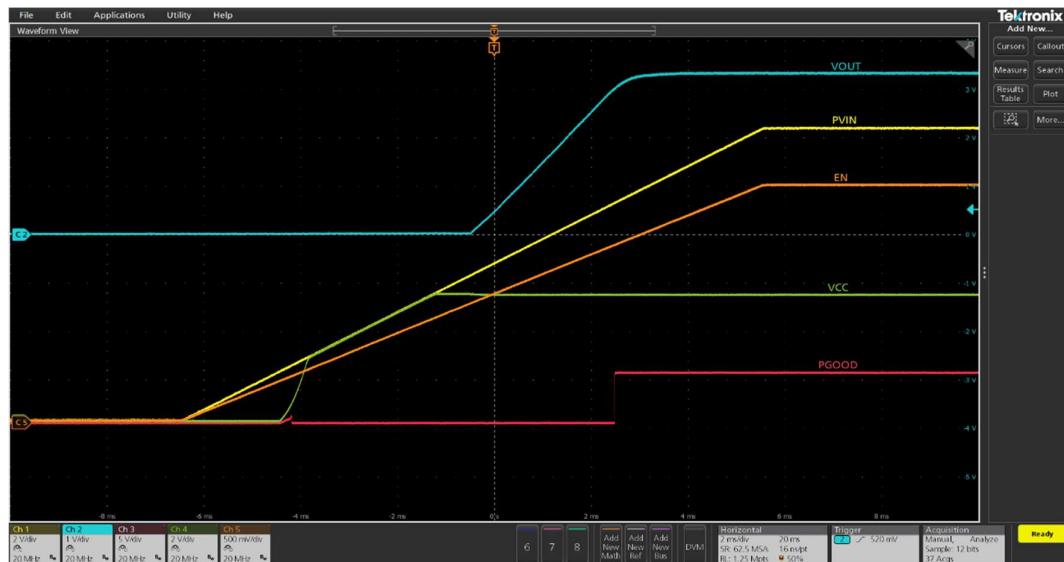


Figure 8 Startup with no load (Ch1 : $PV_{IN}$ , Ch2:  $V_{OUT}$ , Ch3: PG, Ch4:  $V_{CC}$ , Ch5: Enable)

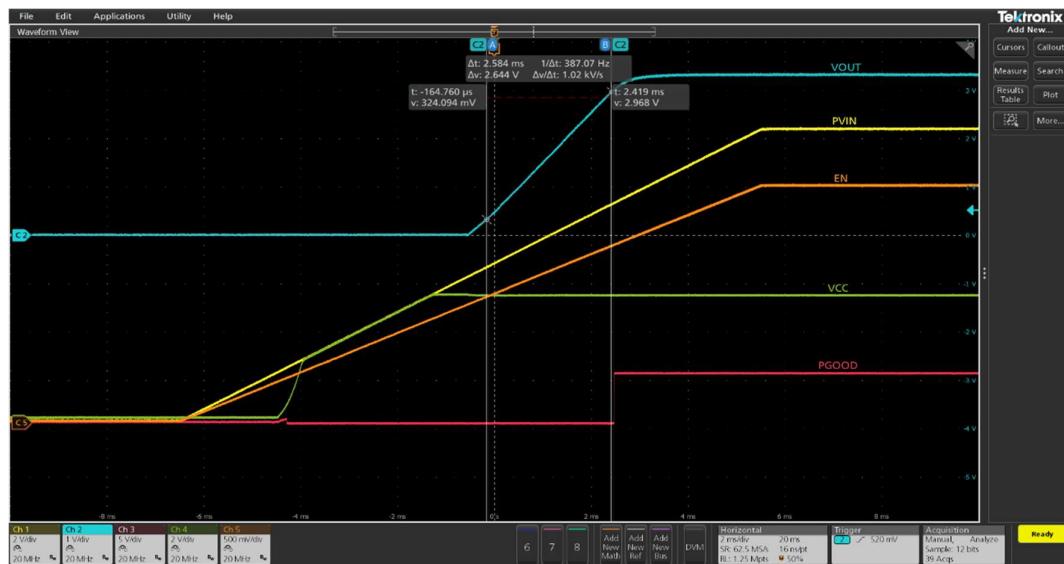


Figure 9 Startup with 4A load (Ch1: $PV_{IN}$ , Ch2:  $V_{OUT}$ , Ch3: PG, Ch4:  $V_{CC}$ , Ch5: Enable)

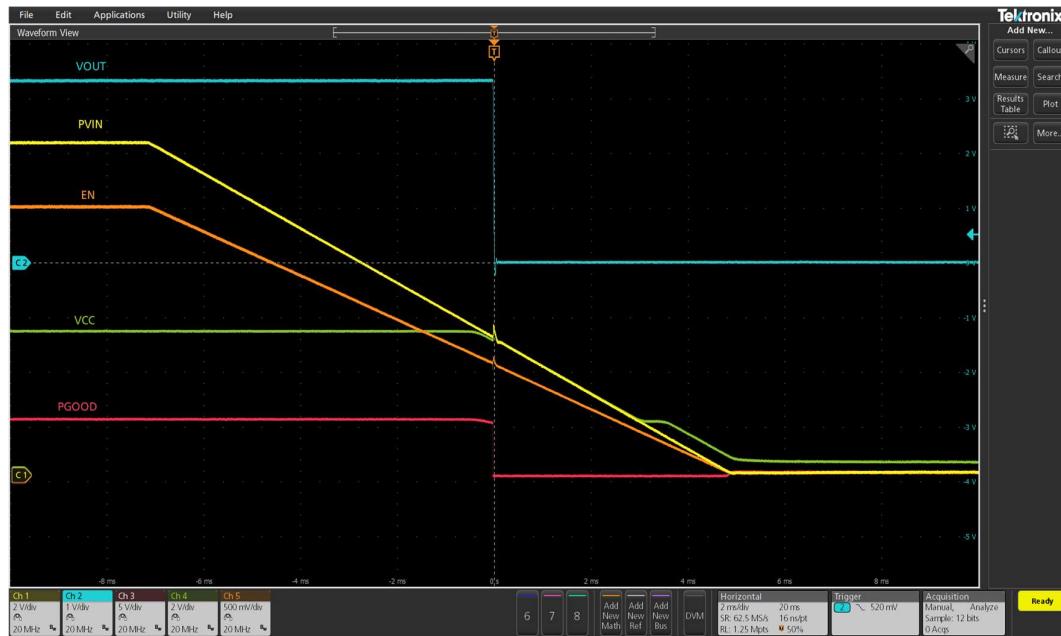


Figure 10 Shutdown with Enable de-assertion at 4A load (Ch1:PV<sub>IN</sub>, Ch2: V<sub>OUT</sub>, Ch3: PG, Ch4:V<sub>CC</sub> Ch5: Enable)

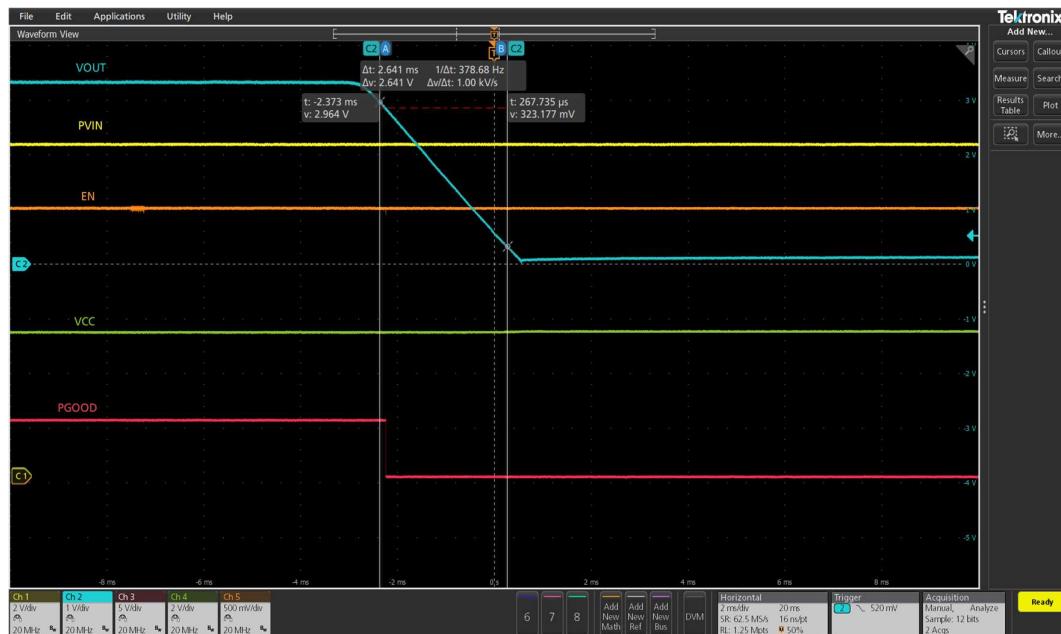


Figure 11 Soft turn off at 0A (Ch1:PV<sub>IN</sub>, Ch2: V<sub>OUT</sub>, Ch3: PG, Ch4:V<sub>CC</sub>, Ch5: Enable)



Figure 12 Startup into pre-bias. (Ch1:PV<sub>IN</sub>, Ch2: V<sub>OUT</sub>, Ch3: PG, Ch4:V<sub>CC</sub>, Ch5: Enable)

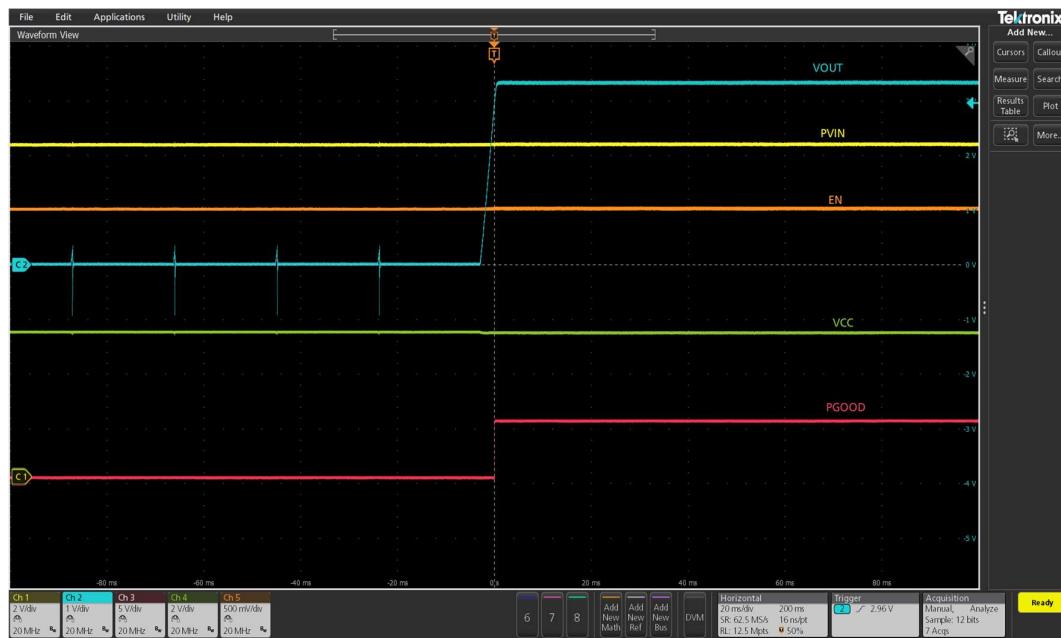


Figure 13 Over-current protection and auto-recover to 4A (Ch1:PV<sub>IN</sub>, Ch2: V<sub>OUT</sub>, Ch3: PG, Ch4:V<sub>CC</sub>, Ch5: Enable)



Figure 14 *Sw at 0A (Ch2: Sw, Ch6: Io),  $F_{SW} = 1.56 \text{ MHz}$*



Figure 15 *Sw at 4A (Ch2: Sw, Ch6: Io),  $F_{SW} = 1.69 \text{ MHz}$*

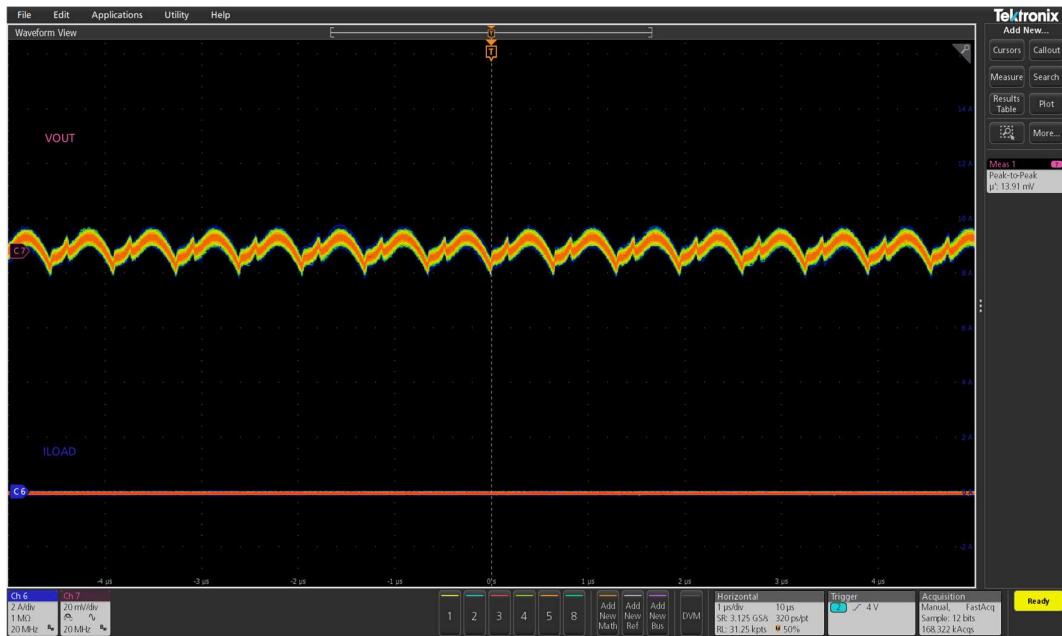


Figure 16  $V_{OUT}$  ripple at 0A (Ch6:I<sub>O</sub>, Ch7:V<sub>OUT</sub>), Peak-to-Peak  $V_{OUT}$  ripple = 13.9 mV

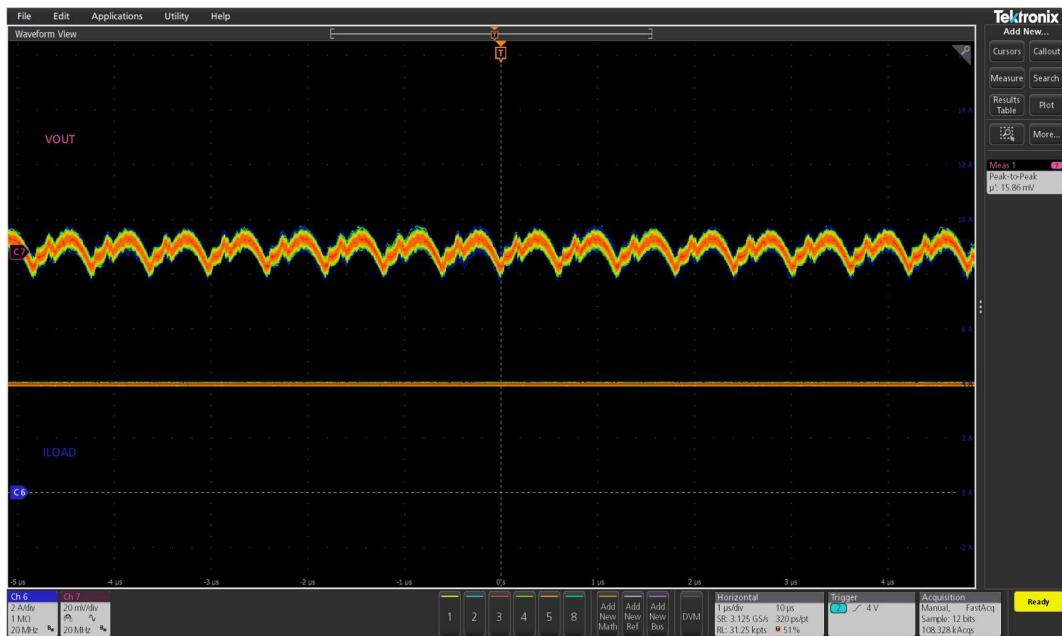


Figure 17  $V_{OUT}$  ripple at 4A (Ch6:I<sub>O</sub>, Ch7:V<sub>OUT</sub>), Peak-to-Peak  $V_{OUT}$  ripple = 15.9 mV

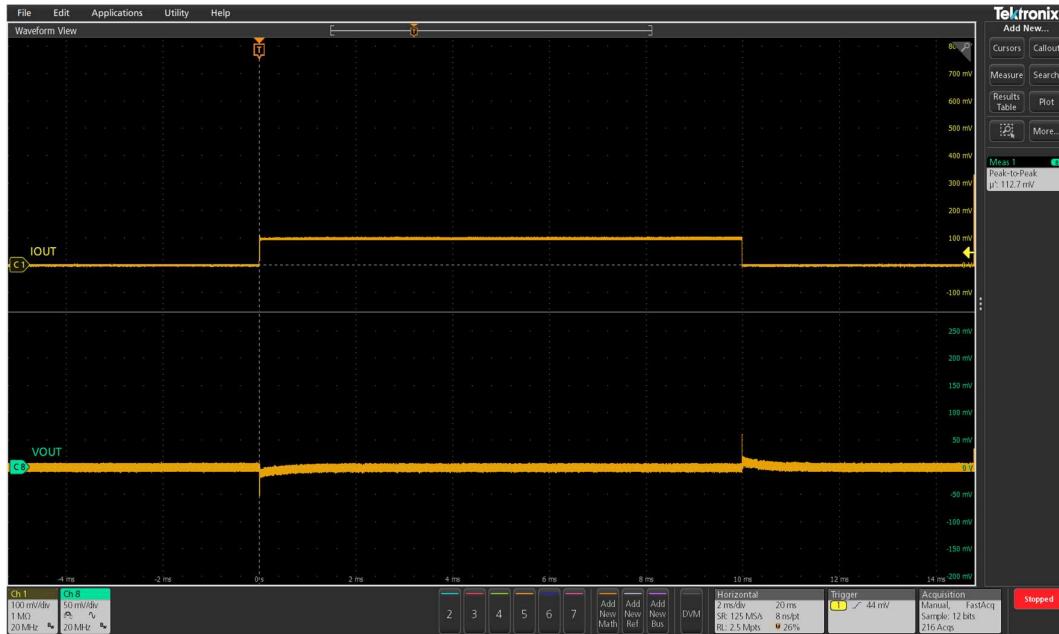


Figure 18 Transient response 0A to 2A @ 3A/us (Ch1: $I_{out}$ , Ch8:  $V_{out}$ ), peak-peak deviation = 112.7 mV

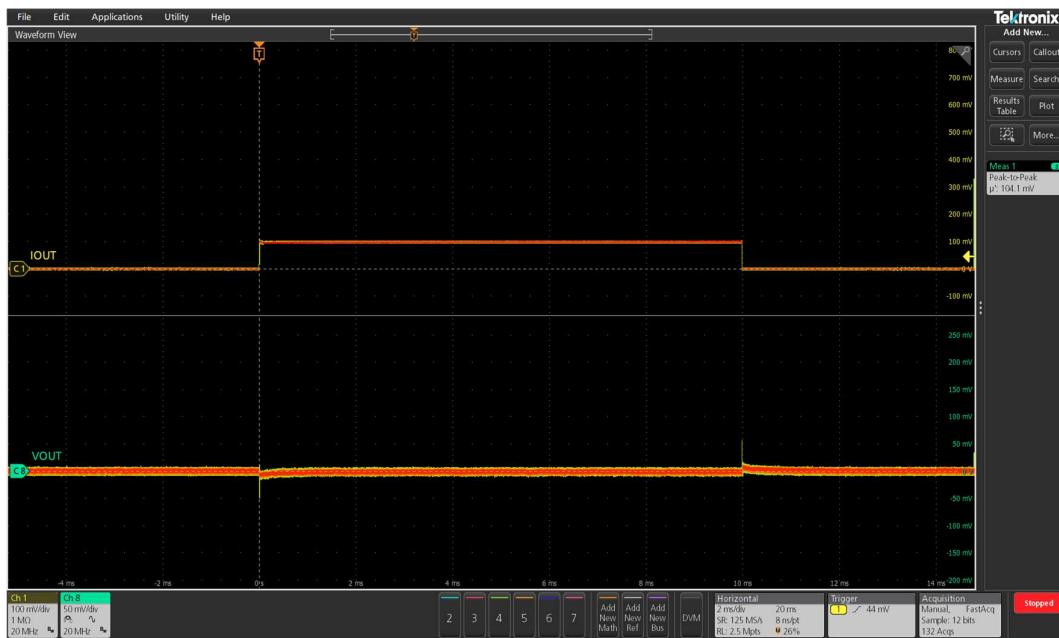


Figure 19 Transient response 2A to 4A @ 3A/us (Ch1: $I_{out}$ , Ch8:  $V_{out}$ ), peak-peak deviation = 104.1 mV

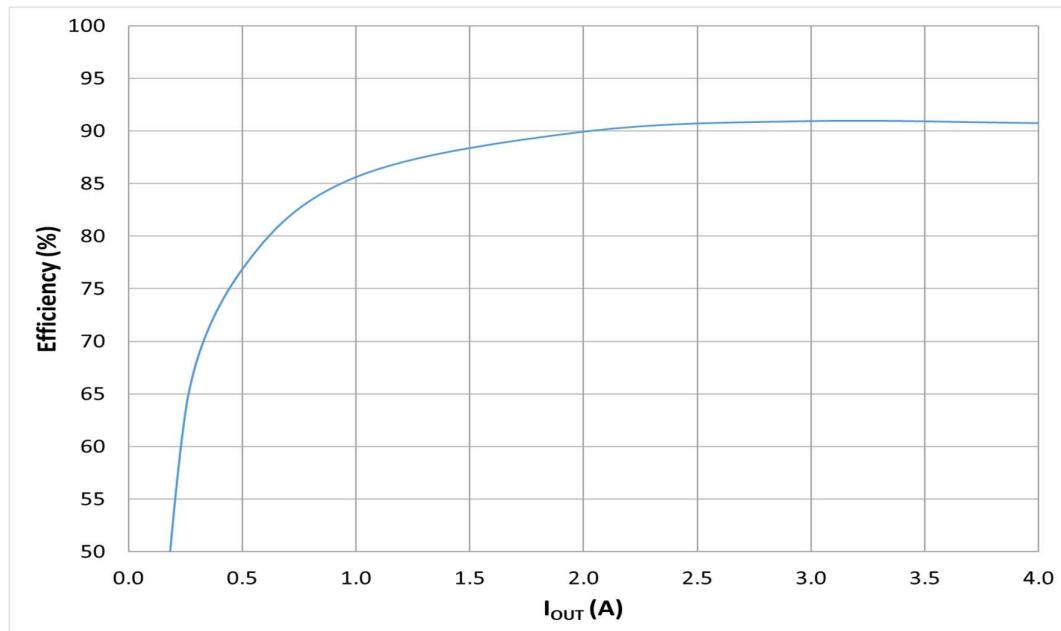


Figure 20 *Efficiency*

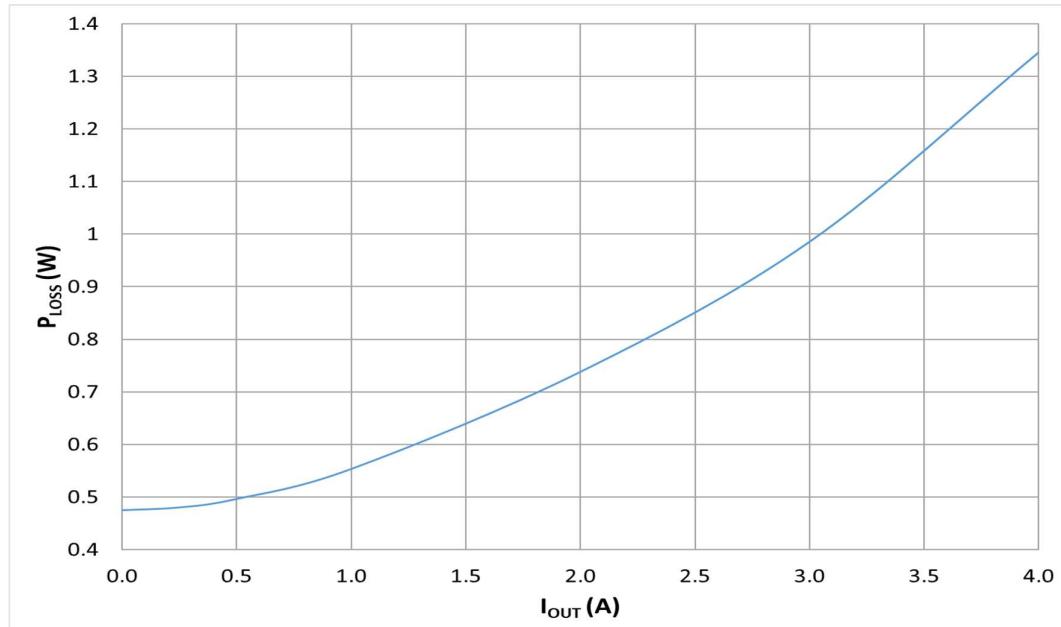


Figure 21 *Power loss*

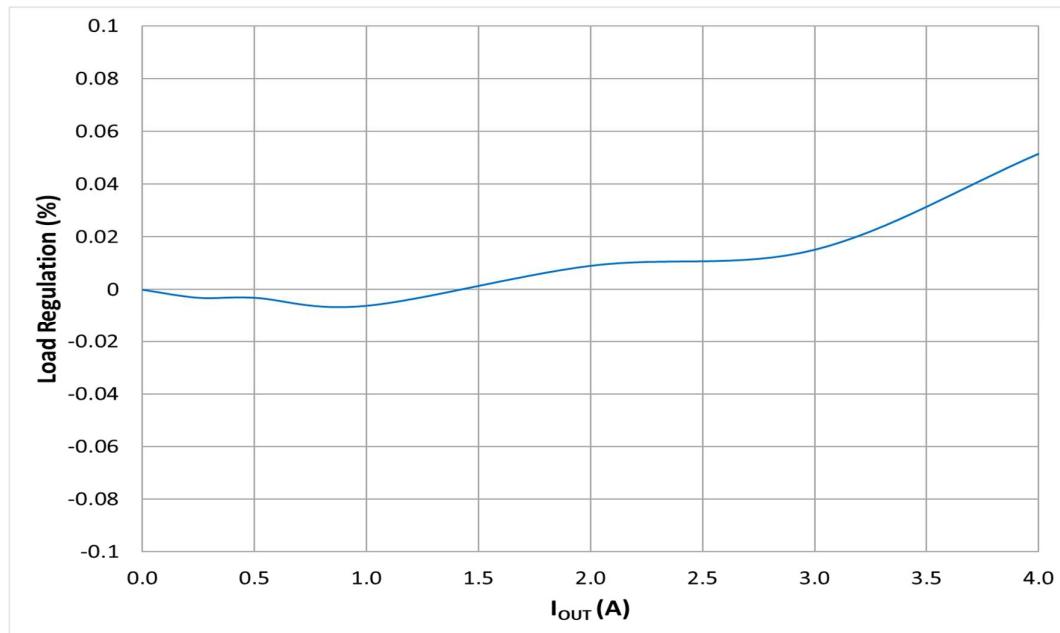


Figure 22 *Load regulation – <±0.1% ( $I_O$  – 0–4A)*

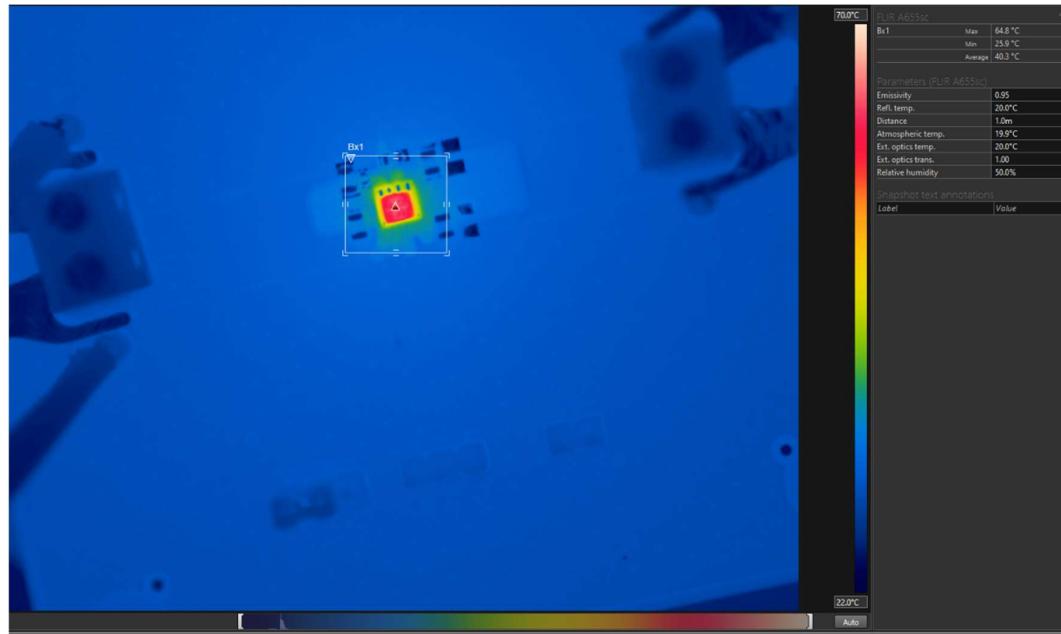


Figure 23 *Thermal image( $P_{VIN}=12V$ ,  $I_{OUT}=4A$ ) – maximum temperature rise = 43°C*

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#### REMINDER

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3. Medical equipment
4. Power-generation control equipment
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6. Seabed equipment
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9. Military equipment
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11. Disaster prevention/crime prevention equipment
12. Safety equipment
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