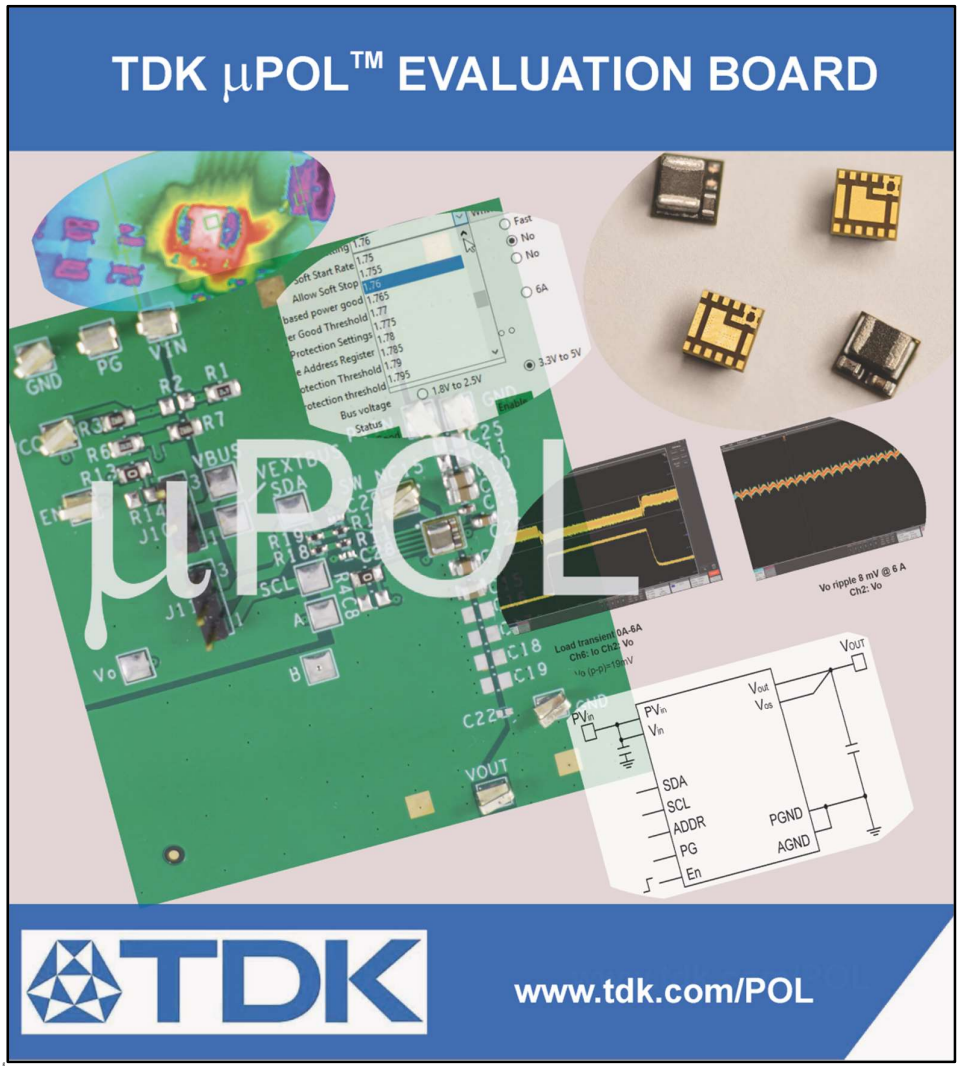

EV1603A-5000-A
EVALUATION BOARD
USER GUIDE

Introduction

This user guide describes the evaluation board provided for the FS1603A-5000 µPOL™ product.

The board generates an output voltage (V_{OUT}) of 5V for loads of 0–3A from an input voltage (PV_{IN}) of 12V.

Specifications

- Input voltage (PV_{IN}) = +12V
- Output voltage (V_{OUT}) = +5V
- Output load (I_O) = 0–3A
- Switching frequency (F_{SW}) = 1.45MHz
- Output capacitance (C_O) = 2x22µF (MLCC)
- Input capacitance (C_{IN}) = 2x22µF (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 (+5V)
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 0–3A 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). FS1603A, is mounted on the top side of the board.

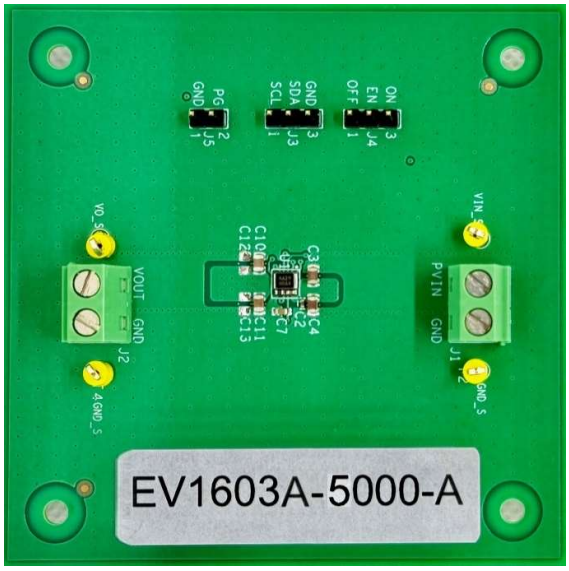

Figure 1 ***View of Board (Top)***

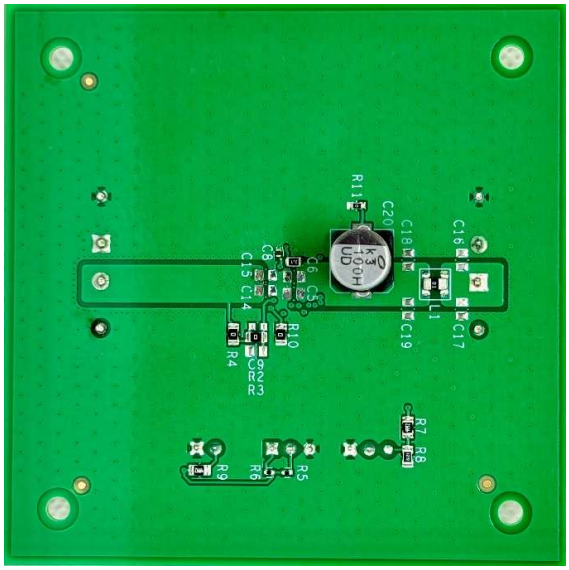

Figure 2 ***View of Board (Bottom)***

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

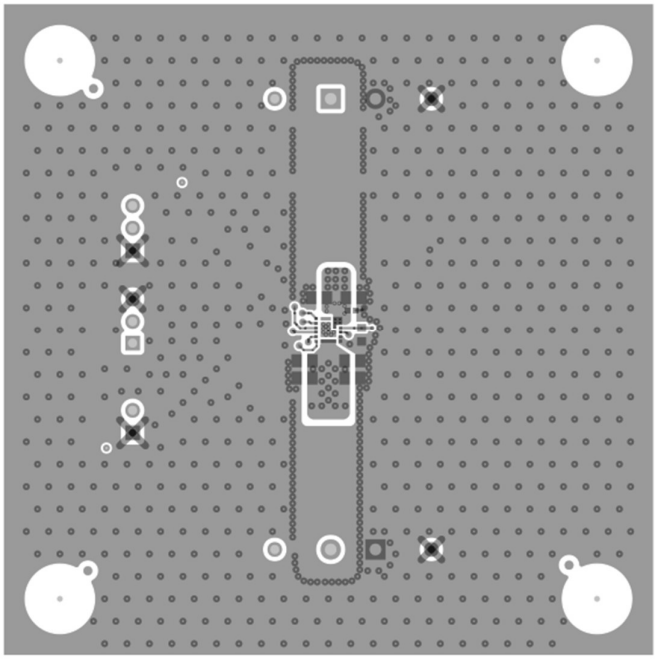

Figure 3 Board layout – layer 1

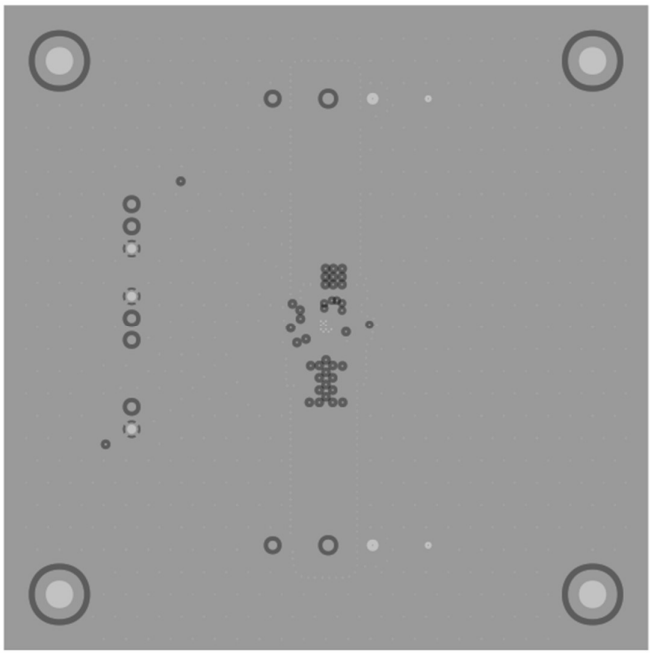

Figure 4 Board layout – layer 2

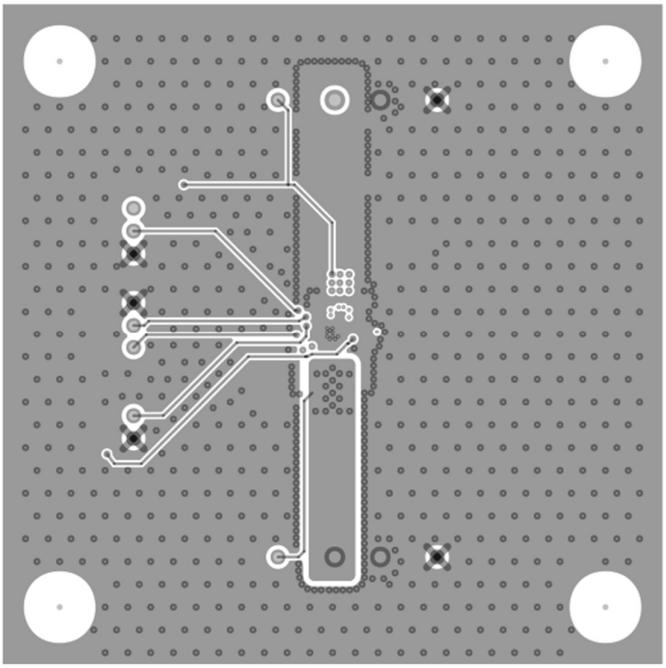

Figure 5 ***Board layout – layer 3***

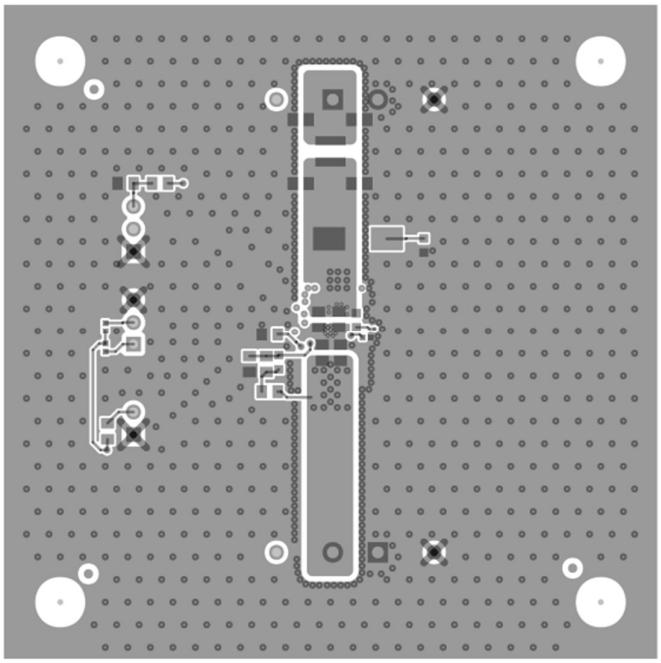

Figure 6 ***Board layout – layer 4***

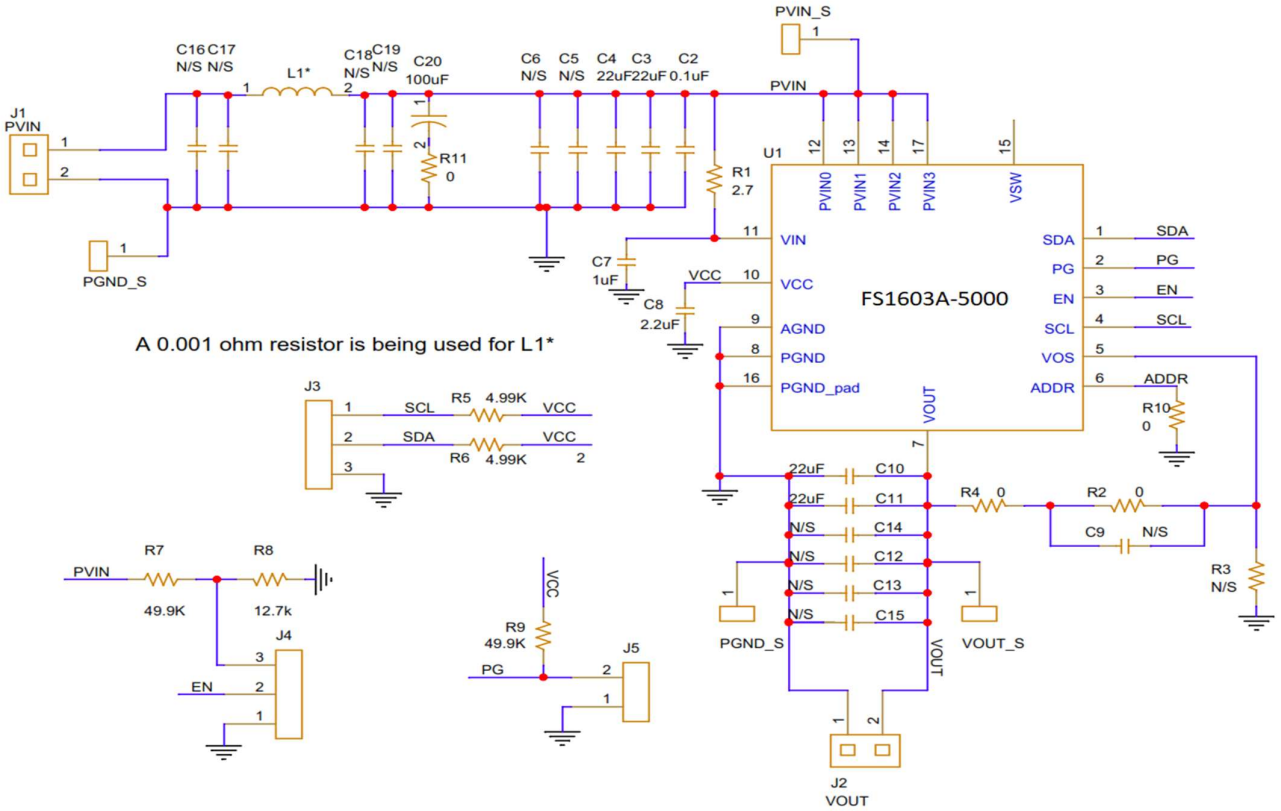

Figure 7 Schematic

Part reference	Quantity	Type	Description
FS1603A µPOL	1	–	FS1603A 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 5V and I_O is 0–3A.

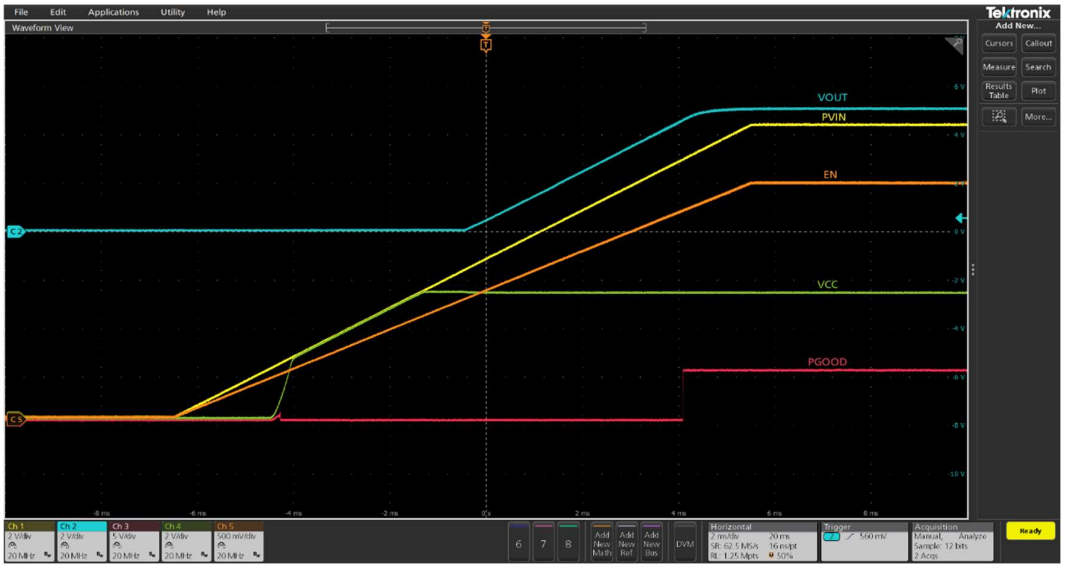

Figure 8 ***Startup with no load (Ch1 :PV_{IN}, Ch2: V_{OUT}, Ch3: PG, Ch4:V_{CC}, Ch5: Enable)***

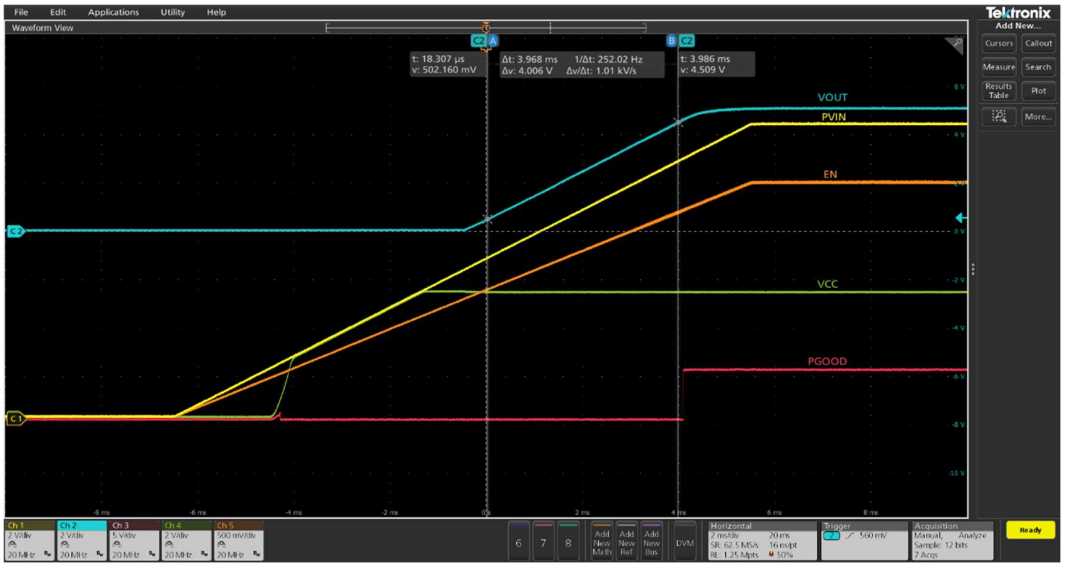

Figure 9 ***Startup with 3A load (Ch1:PV_{IN}, Ch2: V_{OUT}, Ch3: PG, Ch4:V_{CC}, Ch5: Enable)***

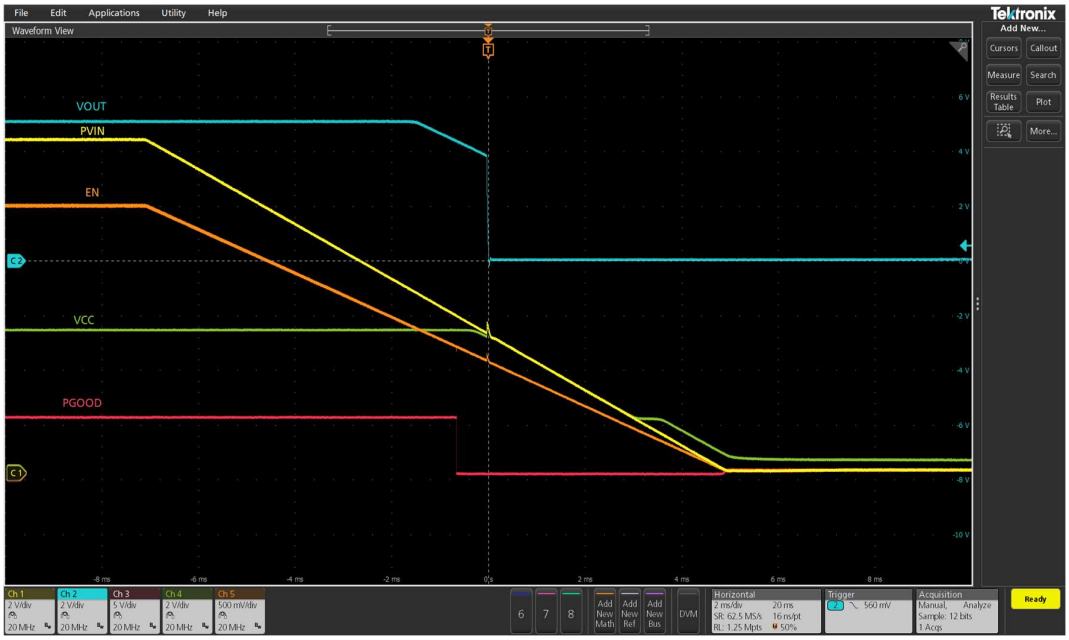

Figure 10 ***Shutdown with Enable de-assertion at 3A load (Ch1:PV_{IN}, Ch2: V_{OUT}, Ch3: PG, Ch4:V_{CC}, Ch5: Enable)***

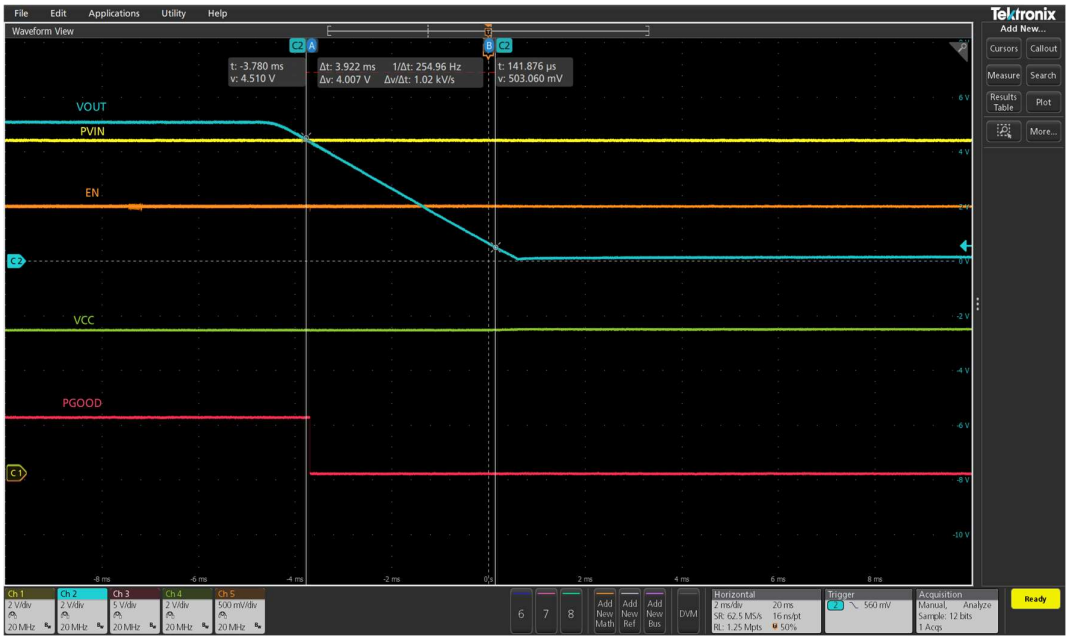

Figure 11 ***Soft turn off at 0A (Ch1:PV_{IN}, Ch2: V_{OUT}, Ch3: PG, Ch4:V_{CC}, Ch5: Enable)***

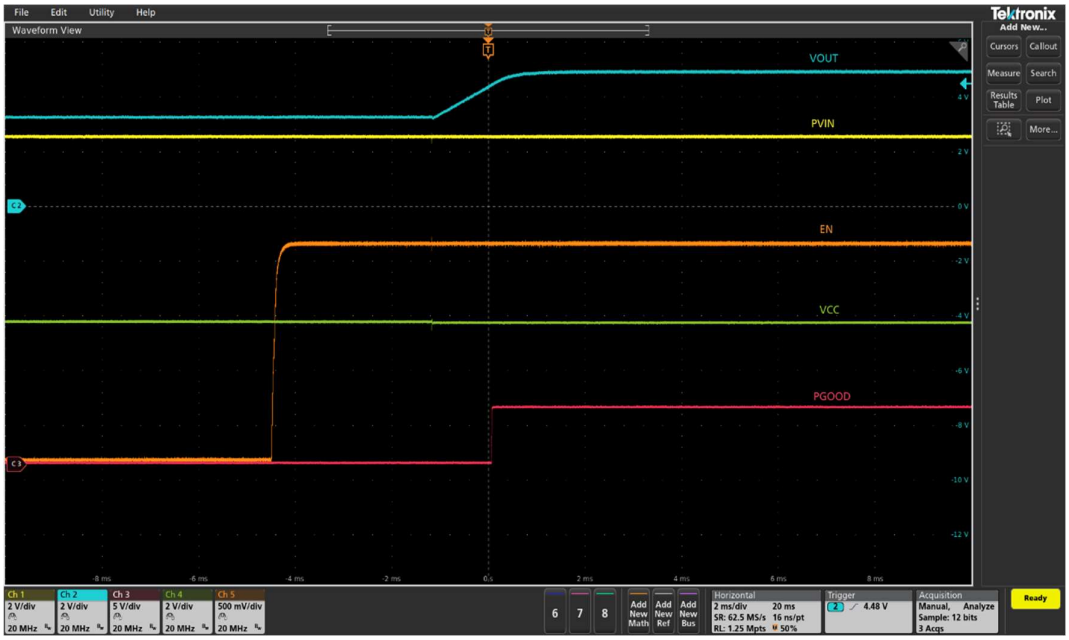

Figure 12 ***Startup into pre-bias. Max 70% of Vout. (Ch1:PV_{IN}, Ch2: V_{OUT}, Ch3: PG, Ch4:V_{CC}, Ch5: Enable)***

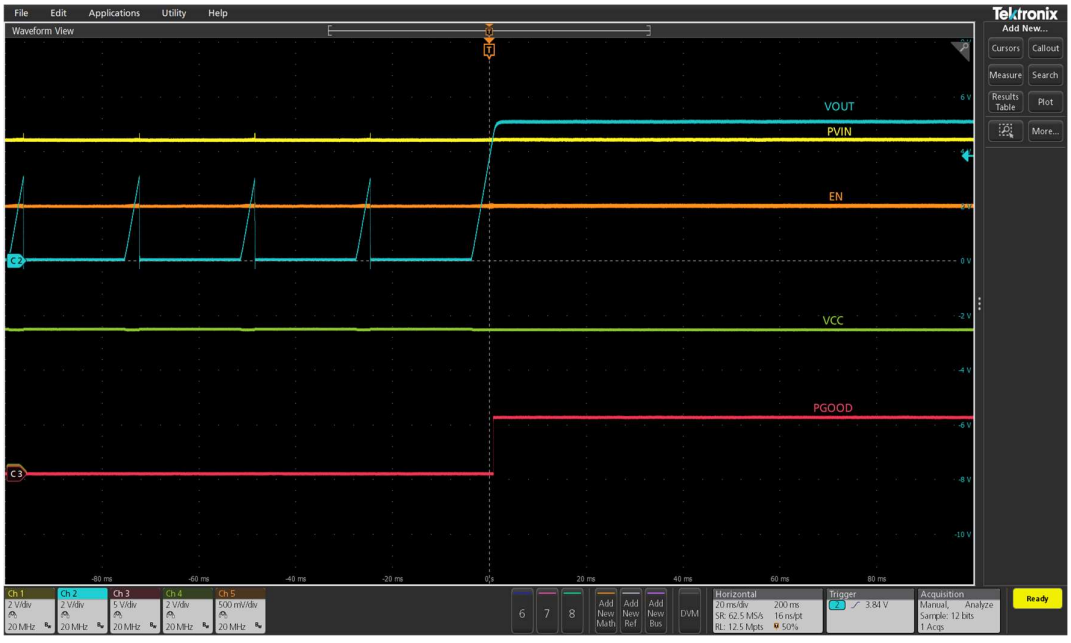

Figure 13 ***Over-current protection and auto-recover to 3A (Ch1:PV_{IN}, Ch2: V_{OUT}, Ch3: PG, Ch4:V_{CC}, Ch5: Enable)***

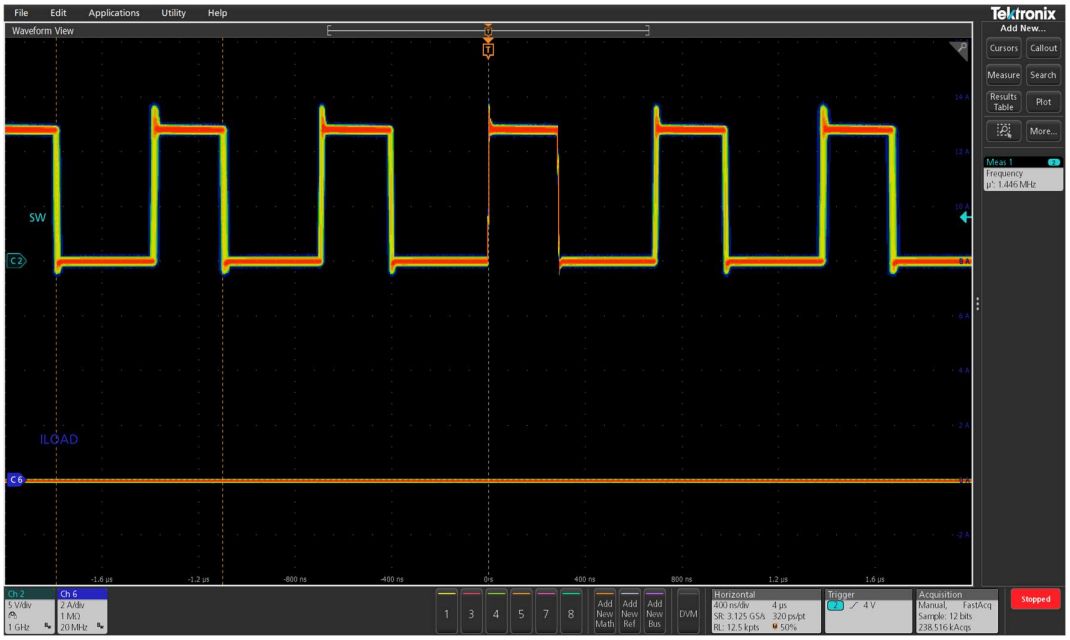

Figure 14 ***Sw at 0A (Ch2: Sw, Ch6: I_O), F_{SW} = 1.45 MHz***

Figure 15 ***Sw at 3A (Ch2: Sw, Ch6: I_O), F_{SW} = 1.53 MHz***

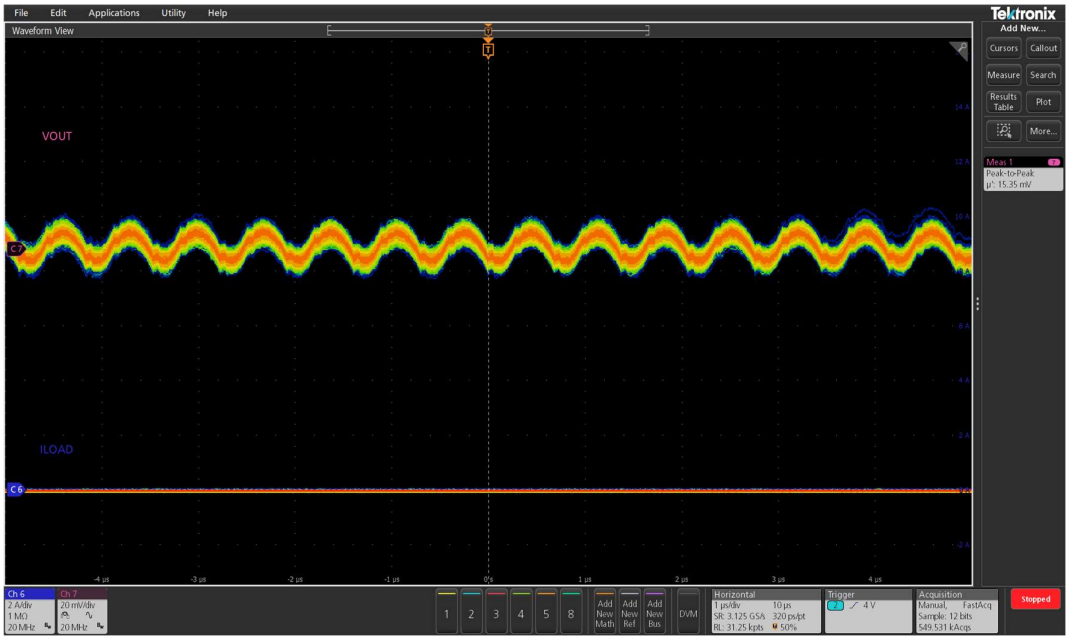

Figure 16 *V_{OUT} ripple at 0A (Ch6:I_O , Ch7:V_{OUT}), Peak-Peak V_{OUT} ripple = 15.4 mV*

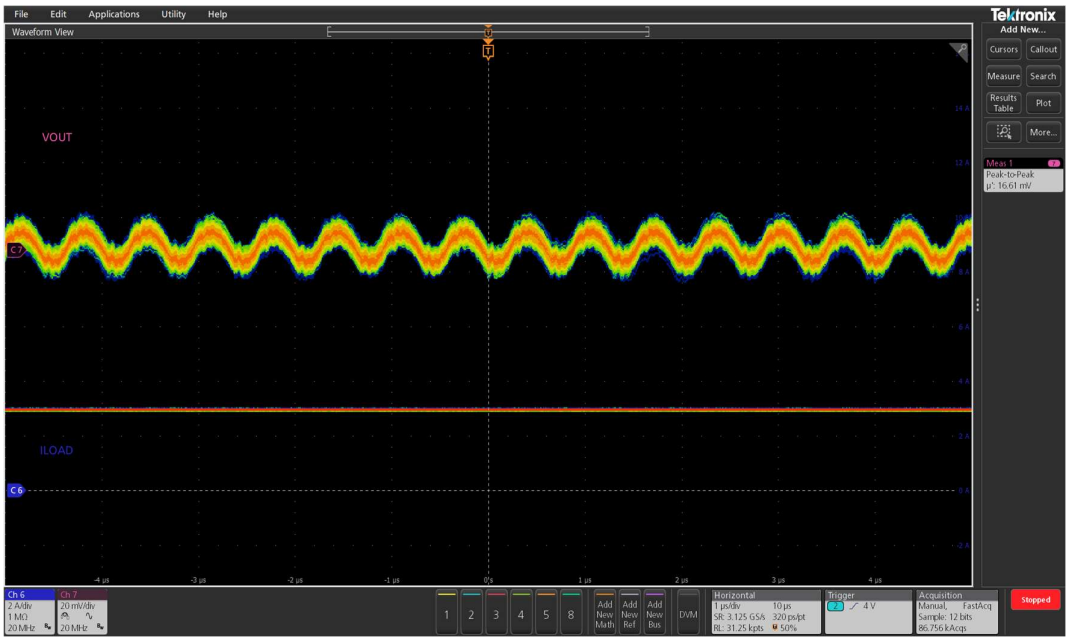

Figure 17 *V_{OUT} ripple at 3A (Ch6:I_O , Ch7:V_{OUT}), Peak-Peak V_{OUT} ripple = 16.6 mV*

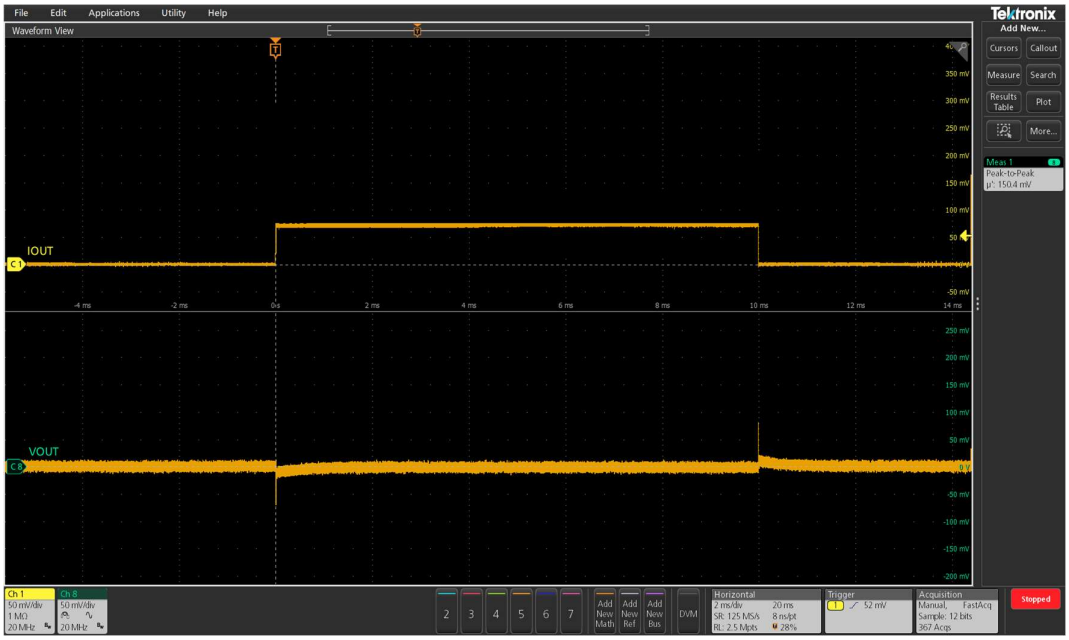

Figure 18 ***Transient response 0A to 1.5A @ 3A/us (Ch1:I_O, Ch8: V_{OUT}), peak-peak deviation = 150.4 mV***

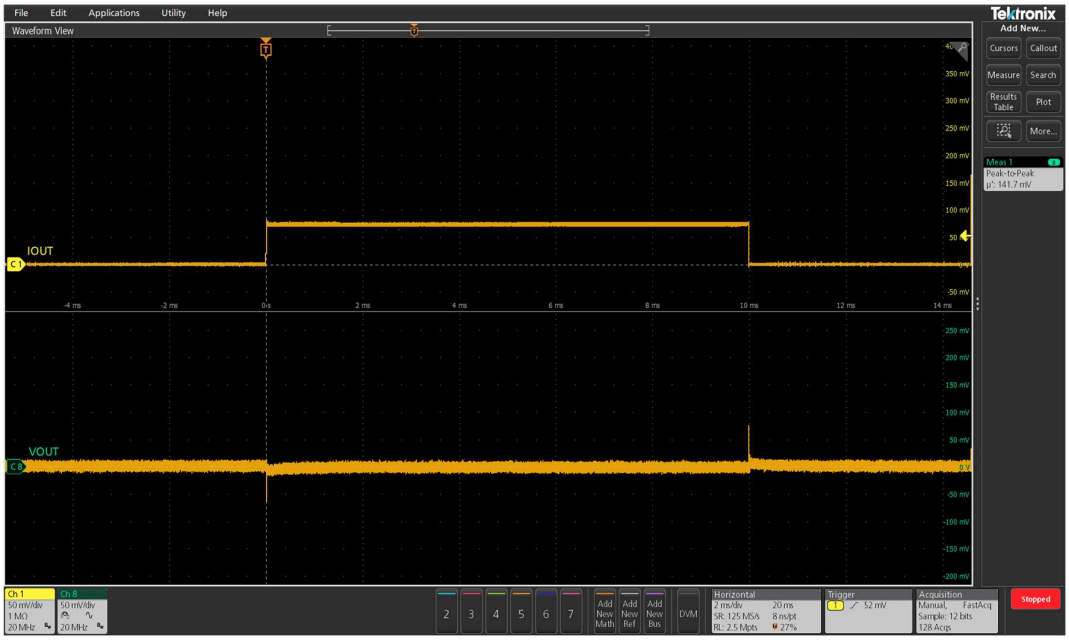

Figure 19 ***Transient response 1.5A to 3A @ 3A/us (Ch1:I_O, Ch8: V_{OUT}), peak-peak deviation = 141.7 mV***

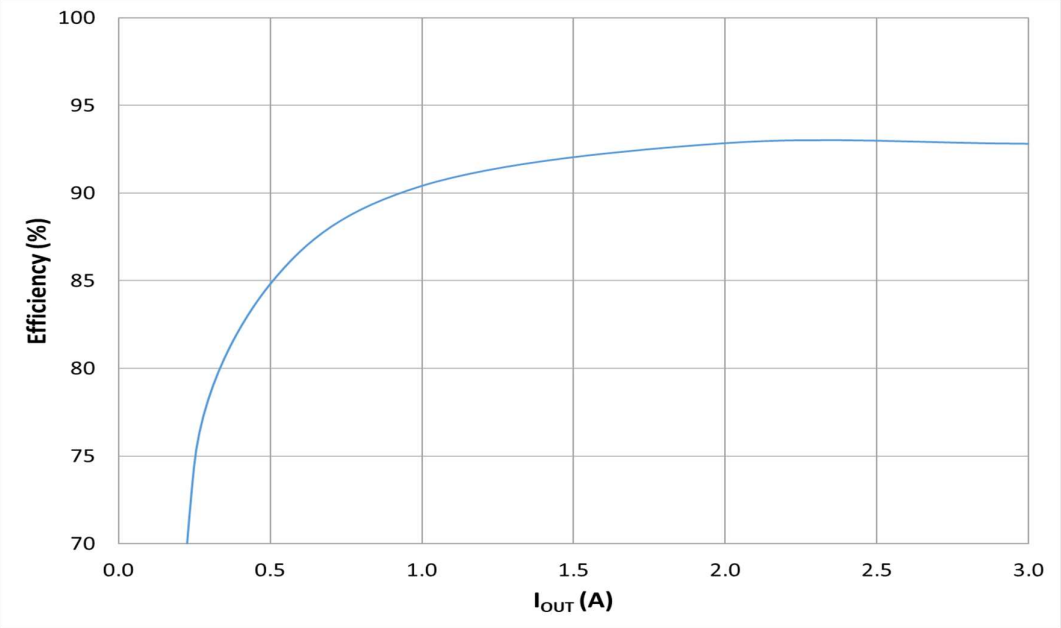

Figure 20 ***Efficiency***

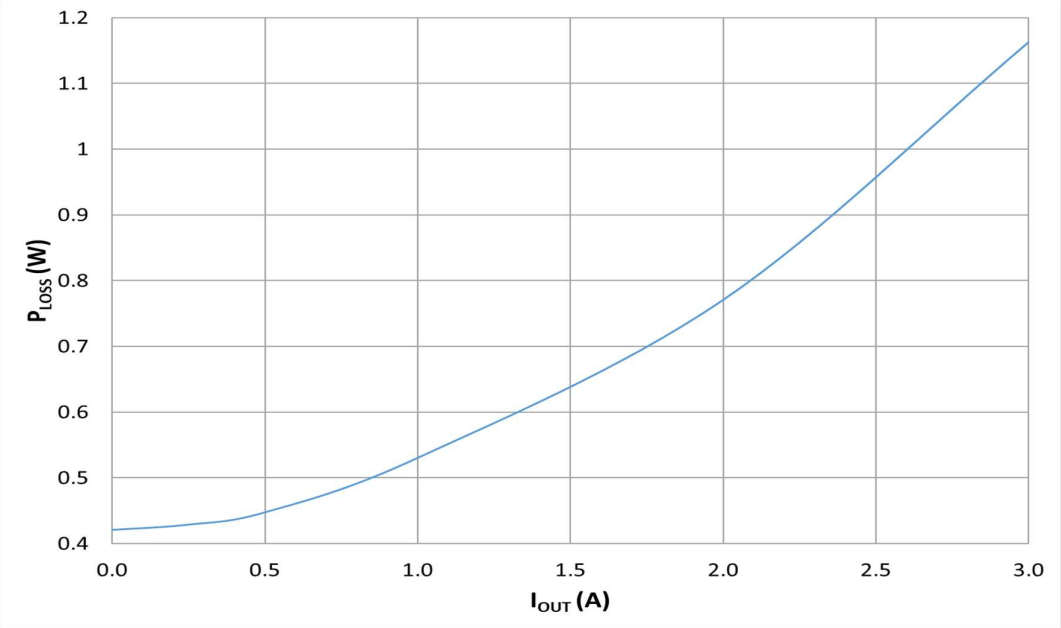

Figure 21 ***Power loss***

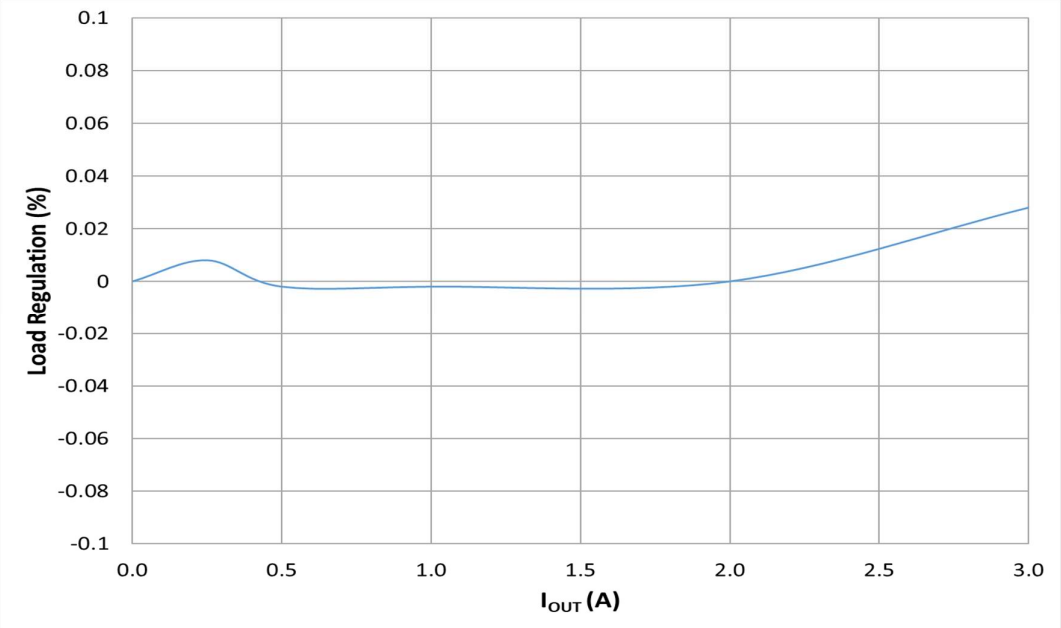

Figure 22 ***Load regulation – <±0.1% (I_O = 0–3A)***

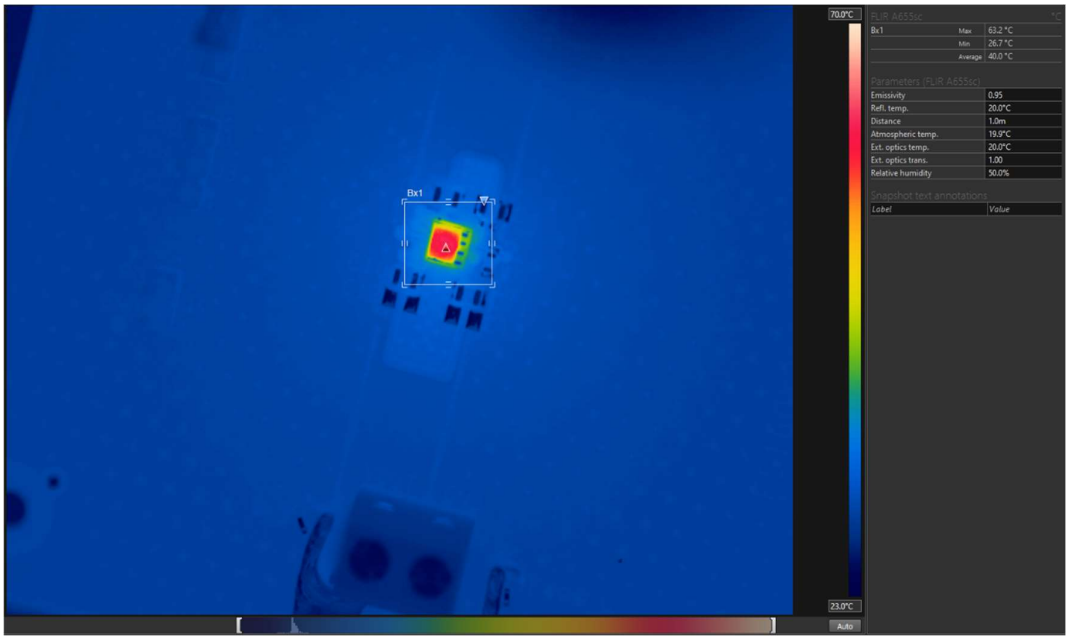

Figure 23 ***Thermal image(PVIN=12V, I_{OUT}=3A) – maximum temperature rise = 41°C***

Disclaimer

IMPORTANT NOTICE AND DISCLAIMER

TDK PROVIDES THIS POWER DESIGN USER GUIDE (“Resources”) “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS. ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These Resources are intended for skilled developers designing with TDK products. You are solely responsible for (1) selecting the appropriate TDK products for your application, (2) designing, validating and testing your application, (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements, and (4) ensuring your application complies with all applicable laws and regulations. These Resources are subject to change without notice and TDK assumes no responsibility for any notices or lack thereof. TDK grants you permission to use these Resources solely for development of an application that uses the TDK products described in the Resource.

This permission may be revoked at any time by TDK or any of its affiliates. Your use of these Resources shall be in compliance with all applicable laws and regulations including applicable export/import controls. Reproduction and display of these Resources is prohibited. No license is granted to any other TDK intellectual property right or to any third party intellectual property right. TDK disclaims responsibility for, and you agree to fully indemnify TDK, its affiliates and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these Resources.

REMINDERS FOR USING THESE PRODUCTS

Before using these products, be sure to request the delivery specifications.

SAFETY REMINDERS

Please pay sufficient attention to the warnings for safe designing when using these products.

The products listed on this specification sheet are intended for use in general electric equipment (AV equipment, telecommunication equipment,

REMINDER

home appliances, amusement equipment, computer equipment, personal equipment, office equipment, measurement equipment, industrial robots) under a normal condition and use condition.

The products are not designed or warranted to meet the requirements of the applications listed below, whose performance and/or quality require a more stringent level of safety or reliability, or whose failure, malfunction or trouble could cause serious damage to sociality, person or property. Please understand that we are not responsible for any damage or liability caused by use of the products in any of the applications below or for any other use exceeding the range or conditions set forth in this specification sheet.

1. Aerospace/Aviation equipment
2. Transportation equipment (cars, electric trains, ships, etc.)
3. Medical equipment
4. Power-generation control equipment
5. Atomic energy related equipment
6. Seabed equipment
7. Transportation control equipment
8. Public Information-processing equipment
9. Military equipment
10. Electric heating apparatus, burning equipment
11. Disaster prevention/crime prevention equipment
12. Safety equipment
13. Other applications that are not considered general-purpose applications

When using this product in general-purpose application, you are kindly requested to take into consideration securing protection circuit/ equipment or providing backup circuits, etc., to ensure higher safety.