SGM6614 Demo Board Test Report

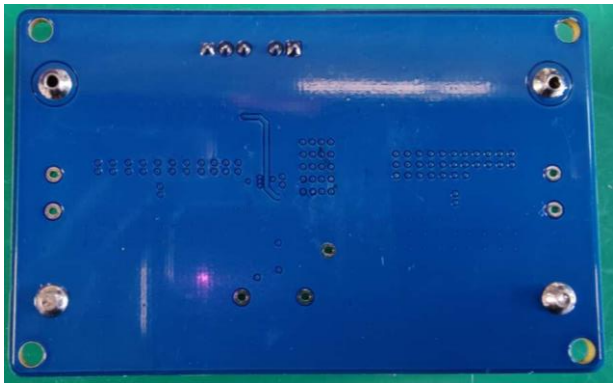
18V Output, 15A, Fully Integrated

Synchronous Boost Converter

Demo Board Picture:

Top

Bottom



Contents

1 INTRODUCTION

The SGM6614 is a 15A switch current, fully integrated synchronous Boost converter. The integrated switch FET and rectifier switch with an 8.8mΩ and a 12.2mΩ on-resistance respectively provide high conversion efficiency for portable applications. The wide input voltage range of 2.17V to 18V offers flexibility to various input supplies such as single-cell to multi-cell lithium batteries. The device can support up to 18V output. The SGM6614 operates in PWM mode at medium and heavy loads and automatically switches to PFM mode at light loads to keep high conversion efficiency. The SGM6614 is available in a Green TQFN-3×2.5-11L package. And this test report, as a support document for the EVB respectively, contains the schematic diagram, BOM, PCB Layout, test data and waveforms. Please refer to SGM6614 datasheet for the details.

2 PACKAGE AND EVB PHOTO

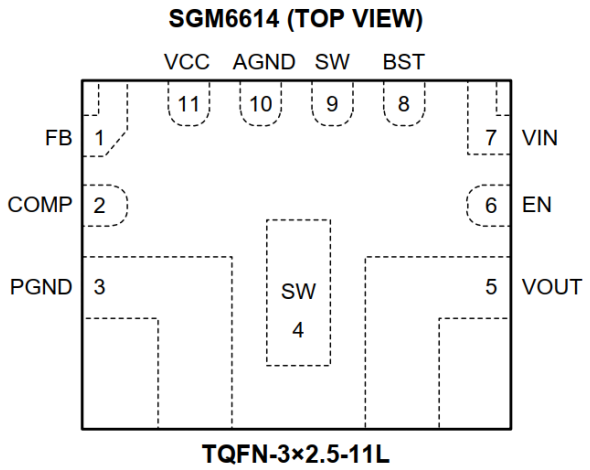


Figure 1 SGM6614 Pin Configuration

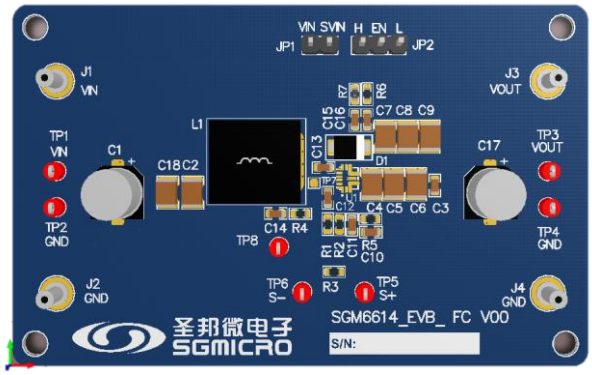


Figure 2 Evaluation Board

3 EVB ELECTRICAL SPECIFICATION

Table 1 Electrical Characteristic Summary

Parameters	Conditions	Min	Typ	Max	Unit
Input Characteristics					
Input Operating Voltage Range		2.17	3.6		V
Shutdown Current	V_{IN}=3.6 V, V_{OUT}=16 V, EN Low			1.5	μA
Quiescent Current	V_{IN}=3.6 V, V_{OUT}=16 V, EN High		0.34	1.4	μA
Output Characteristics					
Output Voltage	V_{IN} = 3.0 – 15 V, V_{OUT} = 16 V, Iout=0.1A	16.024	16	16.026	V
Output Current	V_{IN} = 3.6 V, V_{OUT} = 16 V	0		2.3	A
Efficiency	V_{IN} = 3.6 V, V_{OUT} = 16 V, I_{OUT} = 2.0 A		93.28		%
Environment					
Ambient Temperature	Free Air Flow	0	25	45	°C

4 SCHEMATIC DIAGRAM

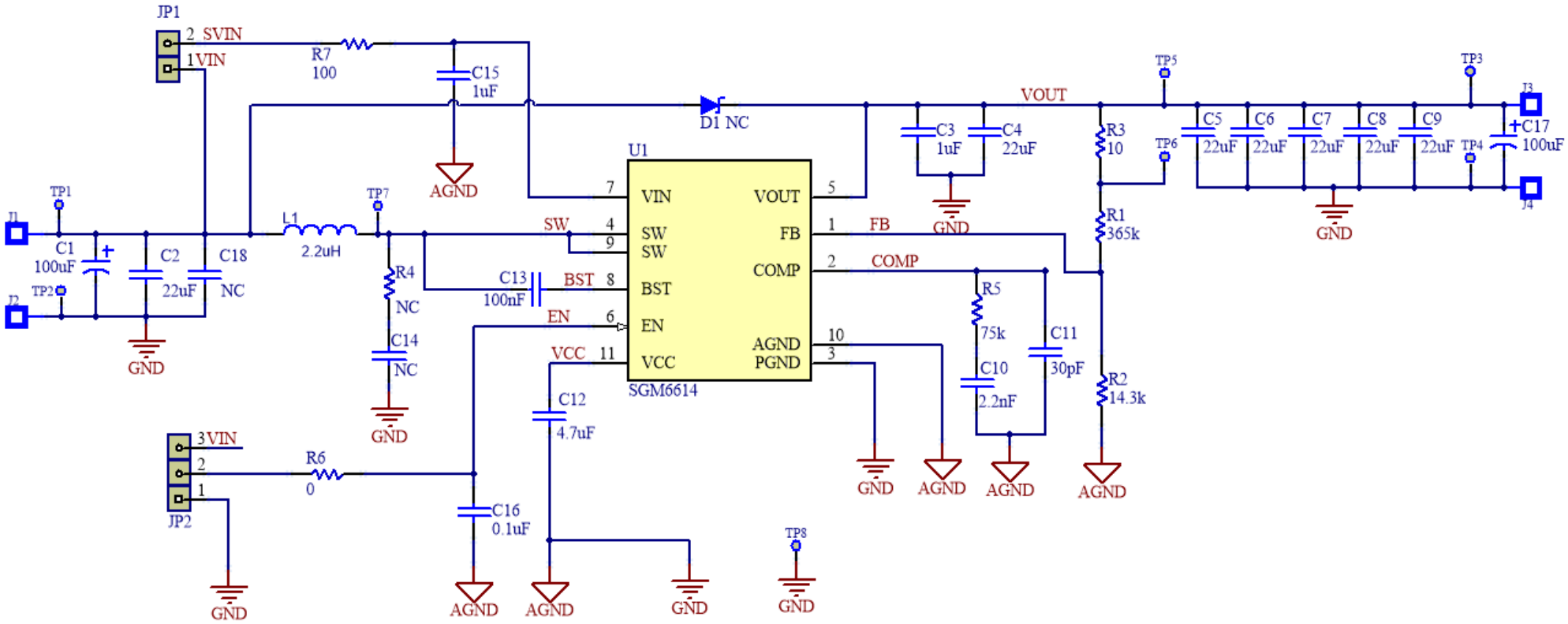


Figure 3 Schematic Diagram

5 BILL OF MATERIALS

Table 2 SGM6614 (Vout = 16V) BOM

Designator	Comment	Quantity	Description	package	PN	
C1	100uF	1	VZT 系列, 50V			
C2, C4, C5, C6, C7, C8, C9	22uF	7	CAP, CERM, 22 uF, 25 V, ±10%, X7R,1210	C1210SM	GRM32ER71E226KE15L	MURATA
C3	1uF	1	CAP, CERM, 1 µF, 25V, ±10%, X5R, 0603	C0603SM	GRM188R61E105KAADD	MURATA
C10	2.2nF	1	CAP, CERM, 2.2 nF, 50 V, ±10%, X7R, 0603	C0603SM		
C11	30pF	1	CAP, CERM, 30 pF, 50 V, ±5%, C0G/NP0, 0603	C0603SM	GQM1875C2E300GB12	MURATA
C12	4.7uF	1	CAP, CERM, 4.7 µF, 25 V, ± 10%, X5R, 0603	C0603SM	GRM188R61E475KE11D	MURATA
C13, C16	100nF	3	CAP, CERM, 0.1 µF, 100 V, ± 20%, X7R, 0603	C0603SM	GRM188R72A104KA35D	MURATA
C15	1uF	1	CAP, CERM, 1 µF, 100 V, ± 20%, X7R, 0603	C0603SM		
C14	NC	1		C0603SM		
C17	100uF(NC)	1				
C18	NC	1		C1210SM		
J1, J2, J3, J4	CONN/2.45mm	4		I/O-1PIN-D2.45mm		
JP1		1	Connector	CN254SP02M		
JP2		1	Connector	CN254SP03M		
L1	2.2uH	1	2.2 µH ±20% 16A 2.2mΩ	1090	78439369022	WURTH
R1	365k	1	RES, 365 k, 1%, 0.063 W, 0603	R0603SM		
R2	14.3k	1	RES, 14.3 k, 1%, 0.063 W,0603	R0603SM		
R3	10ohm	1	RES, 10ohm, 1%	R0603SM		
R4	NC	1		R0603SM		
R5	75k	1	RES, 75 k, 1%, 0603	R0603SM		
R6	0	2	RES, 0, 5%, 0.063 W, 0603	R0603SM		
R7	100	1	RES, 0, 5%, 0.063 W,0603	R0603SM		
TP1,TP2,TP3,TP4,TP5,TP6,TP7		4		TP		
U1	SGM6614	1				
D1	NC	1	3 A, 30V low VF MEGA Schottky barrier rectifier	SOD128	PMEG3030EP	Nexperia

6 EVALUATION BOARD LAYOUT

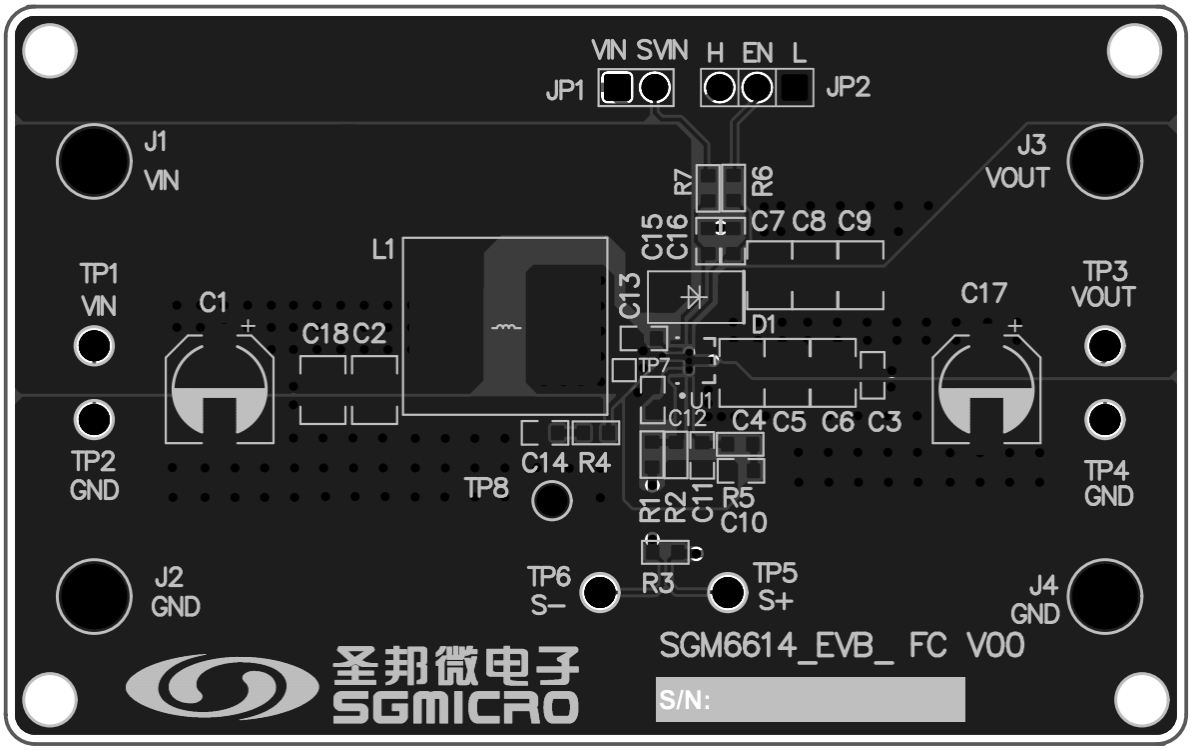


Figure 4 PCB TOP

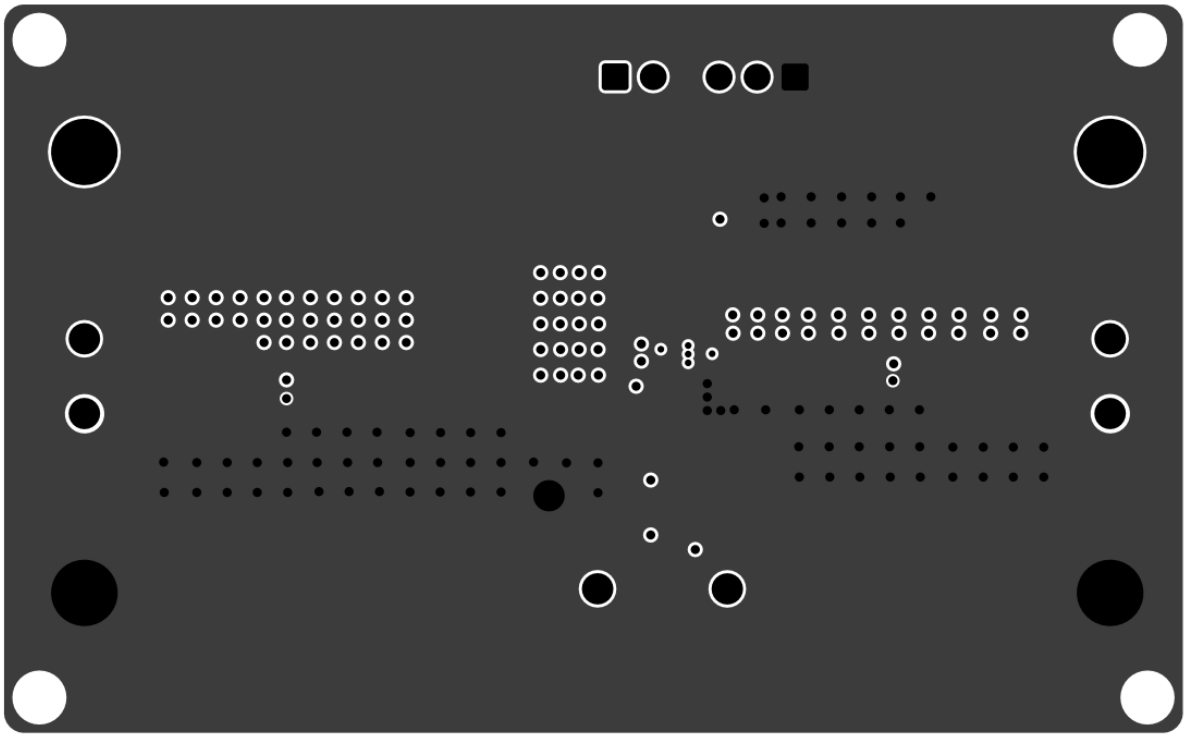


Figure 5 PCB Mid-layer 1

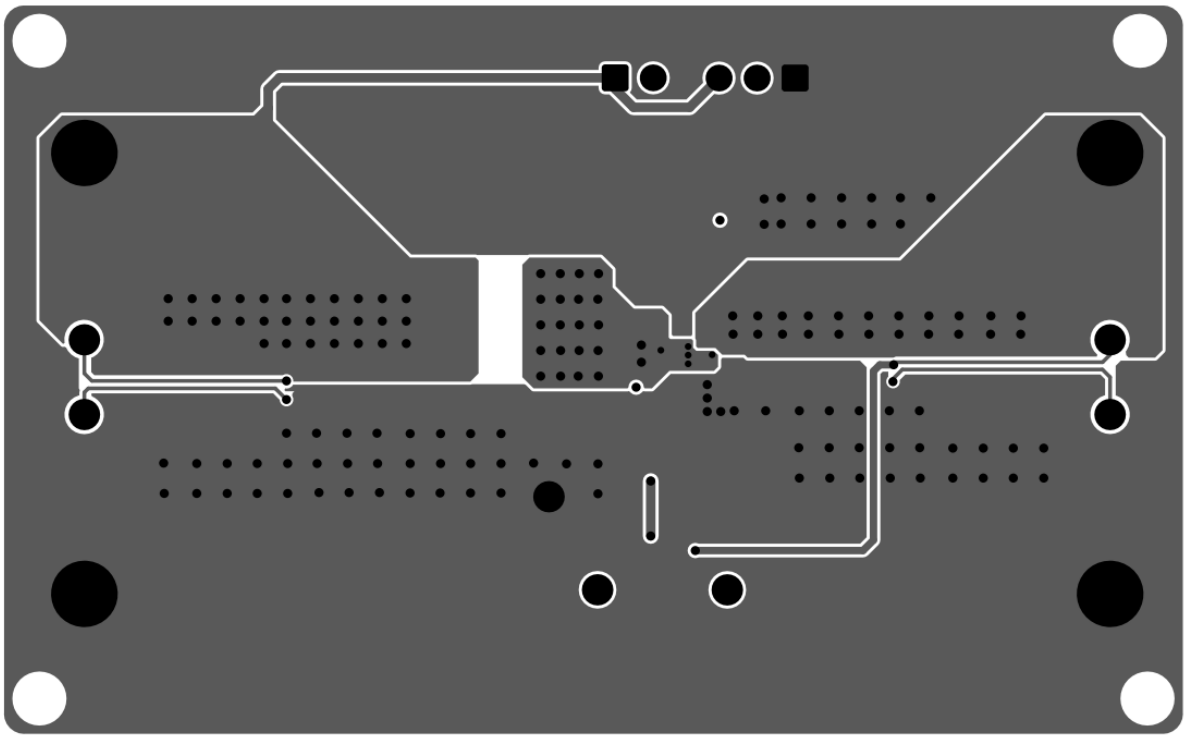


Figure 6 PCB Mid-layer 2

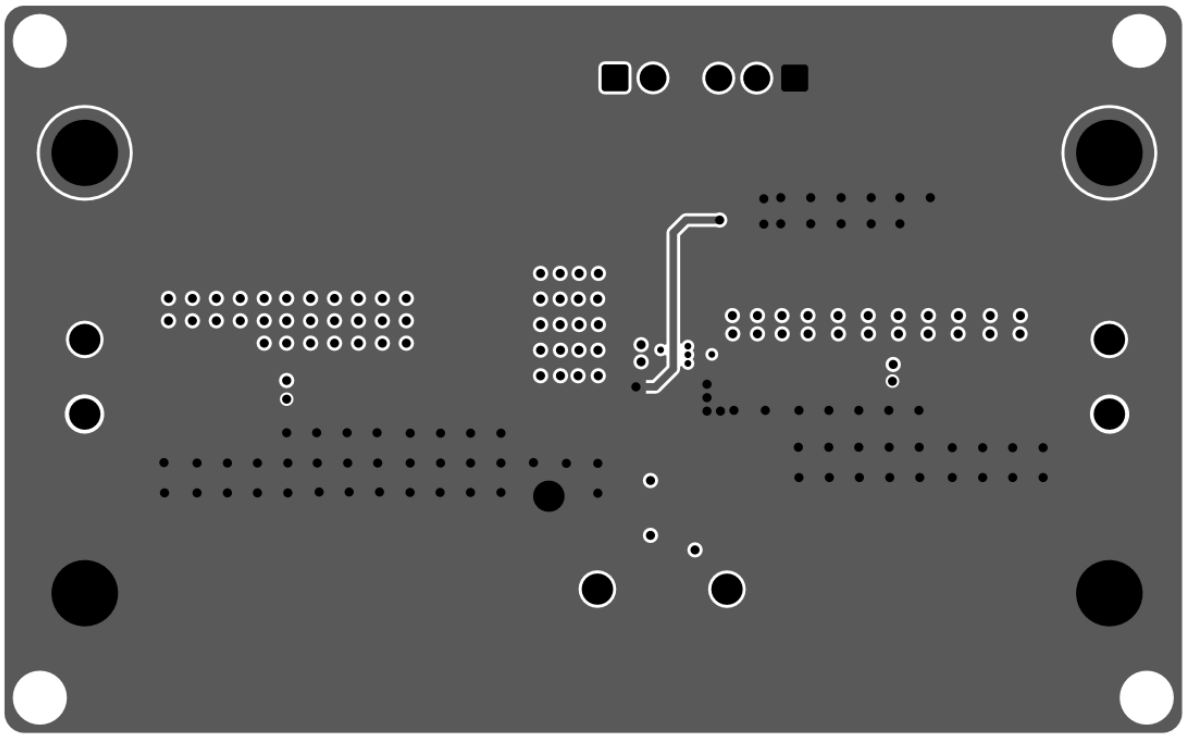


Figure 7 PCB Bottom

7 SETUP NOTES

7.1 Output Voltage

The output voltage of the EVB depends on R1 and R2. The user can change the external components based on Table 3 to configure the output voltage for your desired application, and the compensation parameter is also recommended on Table.

Table 3 Selecting the different Resistors for Output Voltage Setting

Output Voltage Setting V_{OUT} (V)	Feedback Resistance		Recommended compensation parameter		
	R_1 (kΩ)	R_2 (kΩ)	R_5 (kΩ)	C_{10} (nF)	C_{11} (pF)
5	105	14.3	36.5	3.3	30
13	294		75	2.2	30
16	365				
18	412				

7.2 JP1-(VIN Control)

The JP1 jumper connects the control VIN with power VIN. By default, this jumper is set to the ON position. Take off the jumper for a user-defined voltage.

7.3 JP2-(Enable)

Placing a jumper across EN and H (VIN) pins of JP2 enable the output. Placing a jumper across EN and L (GND) pins of JP2 disable the output.

8 TEST DATA AND WAVEFORMS

8.1 Input Shutdown Current

Test Condition: EN Low, SGM6614 disabled

Table 4 Shutdown Current

Vin(V)	2.5	3.6	5.0	7.2	9.0	12	14
Iin(μA)	0.128	0.186	0.259	0.375	0.471	0.629	0.735

8.2 Input Quiescent Current

Test Condition: EN High, SGM6614 no switching

Table 5 Input Quiescent Current

Vin(V)	2.5	3.6	5.0	7.2	9.0	12	14
Iin(μA)	0.119	0.174	0.243	0.351	0.441	0.589	0.689

8.3 Efficiency

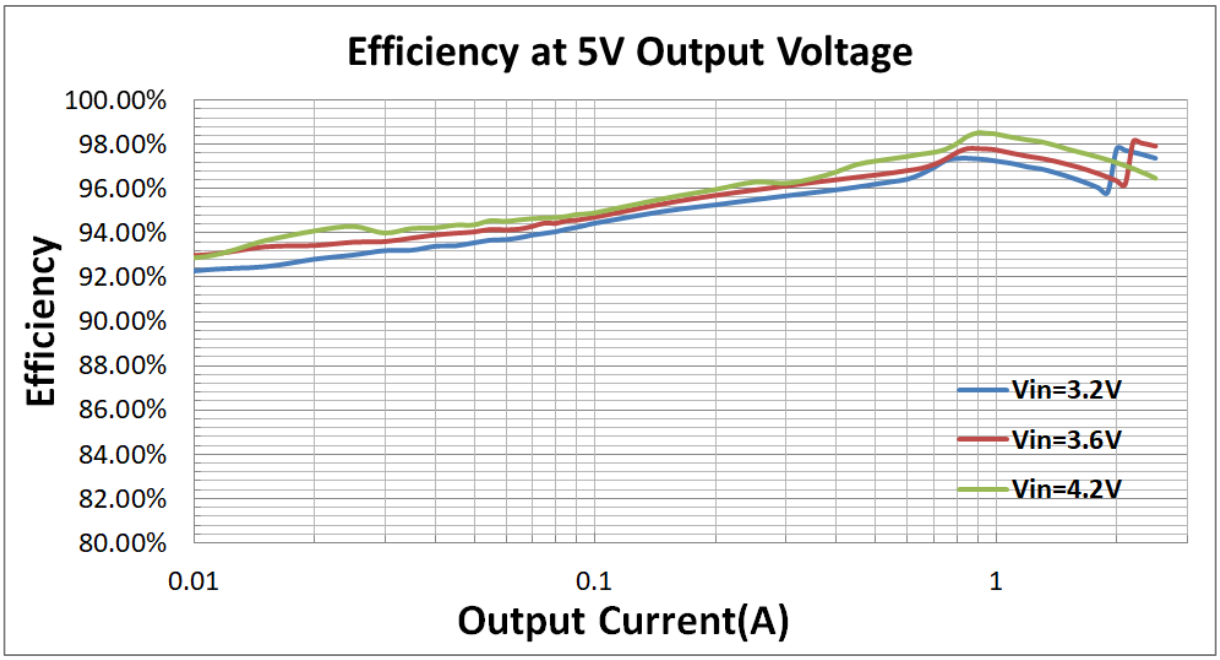


Figure 8 Efficiency vs Iout at 5.0V output

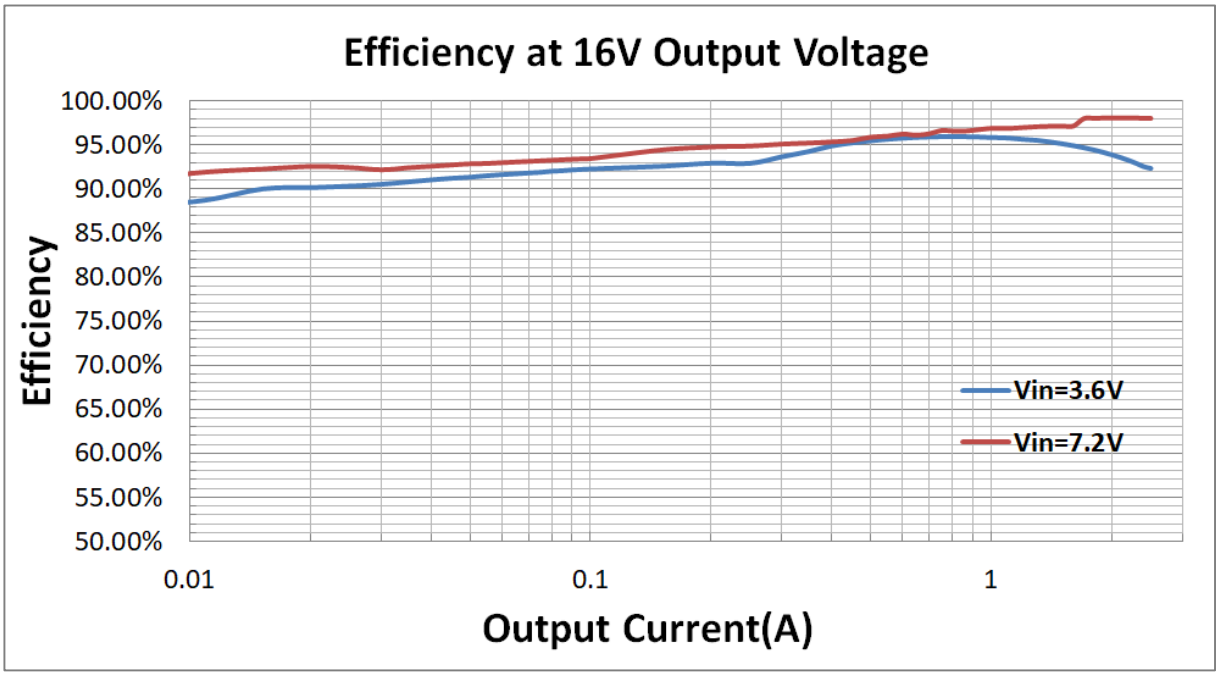


Figure 9 Efficiency vs Iout at 16V output

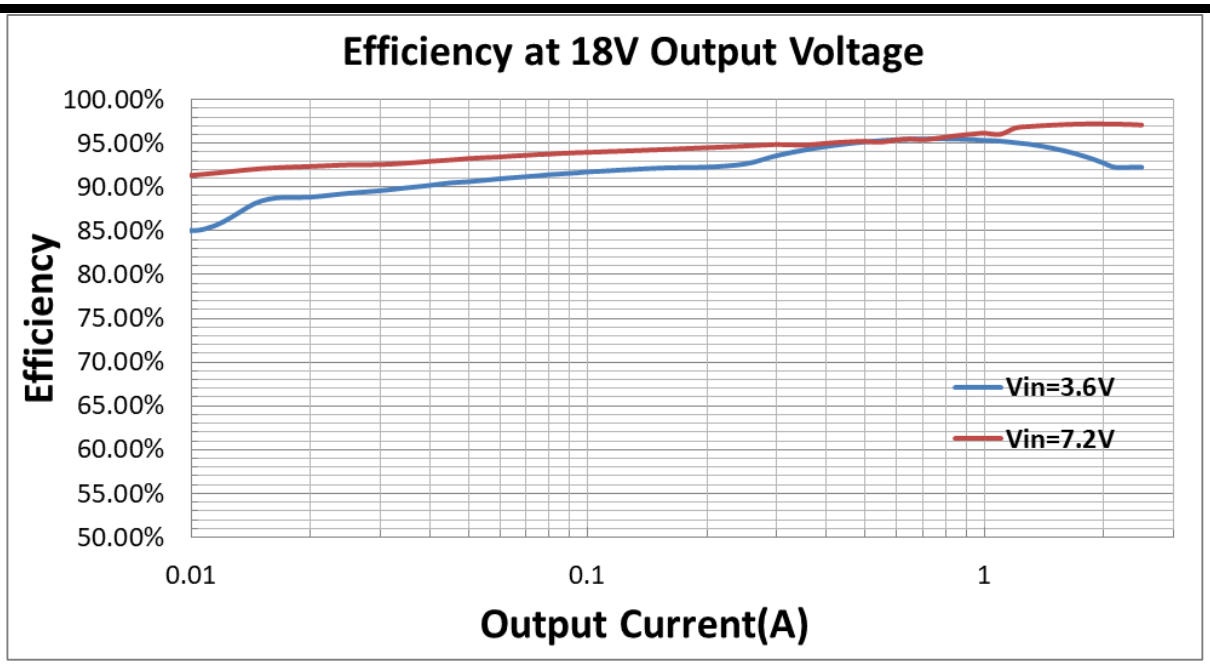


Figure 10 Efficiency vs Iout at 18V output

8.4 Turn-on

Note: C1: Vout; C2: SW; C3: Vin; C4: IL for turn-on waveform

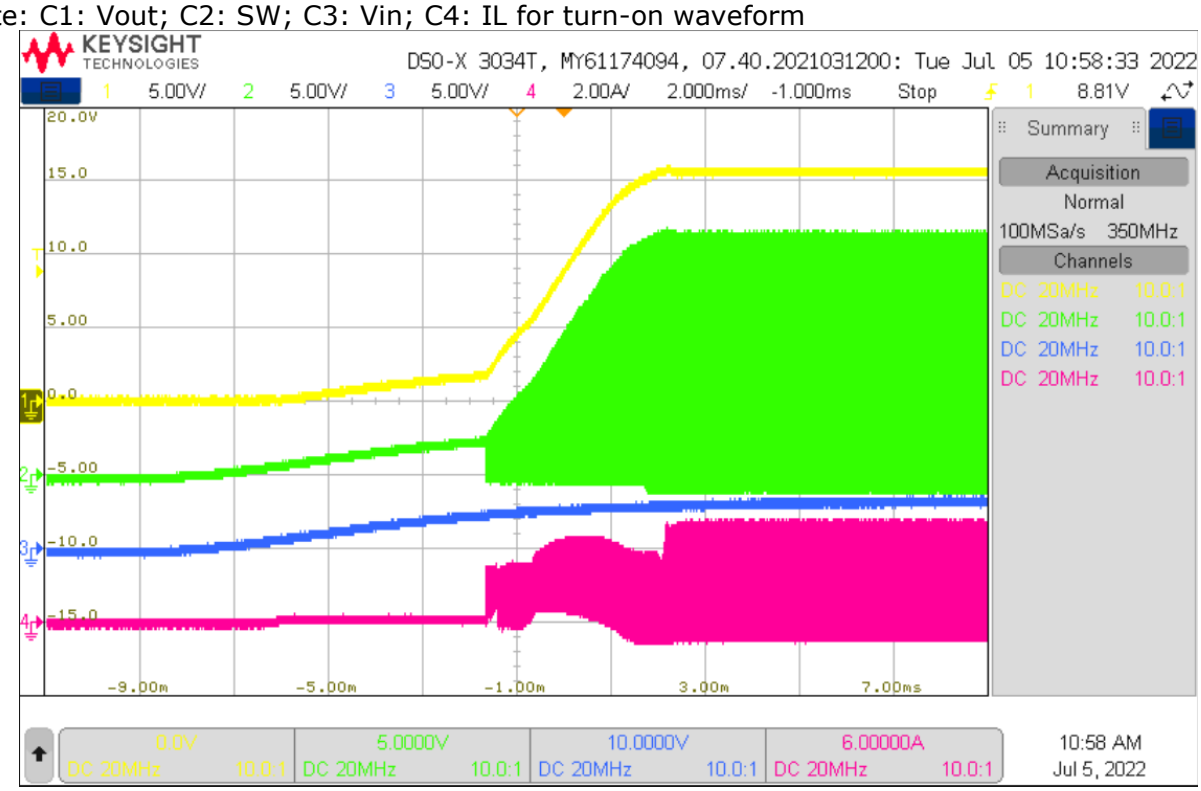


Figure 11 Turn-on at 3.6Vin, 16Vout/0.1A

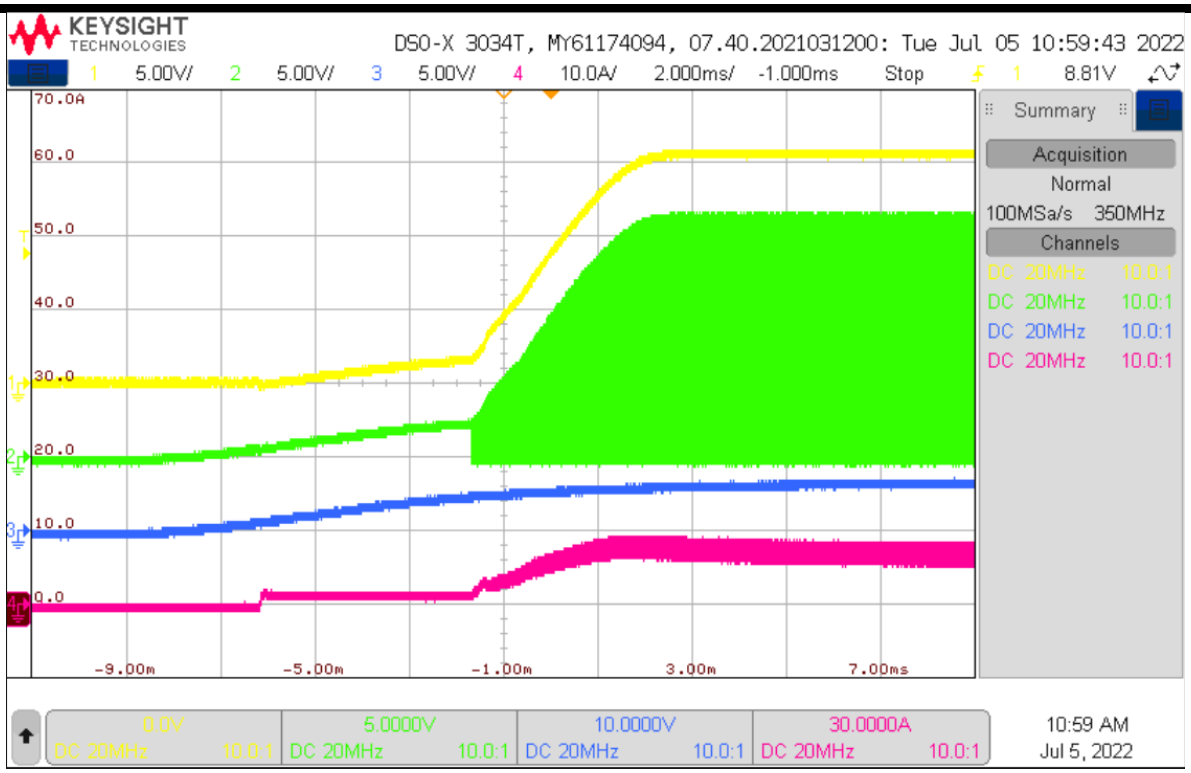


Figure 12 Turn-on at 3.6Vin, 16Vout/2.0A

8.5 Turn-off

Note: C1: Vout; C2: SW; C3: Vin; C4: IL for turn-on waveform

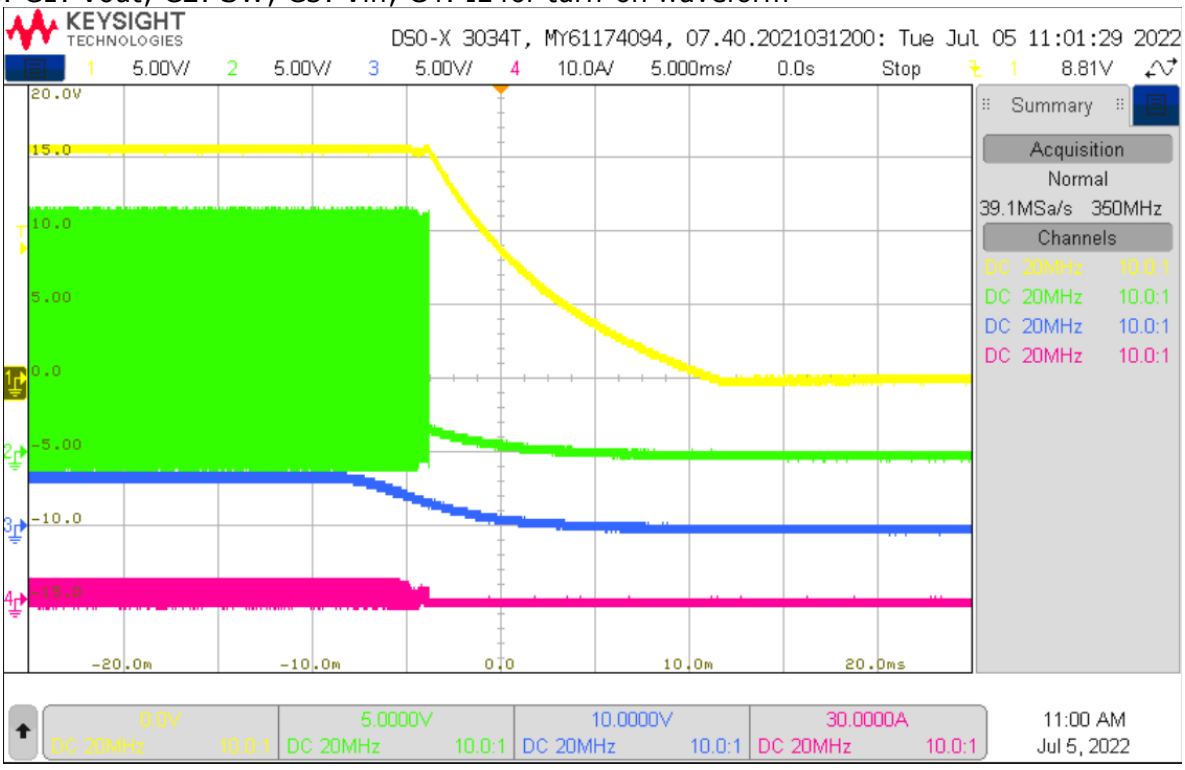


Figure 13 Turn-off at 3.6Vin, 16Vout/0.1A

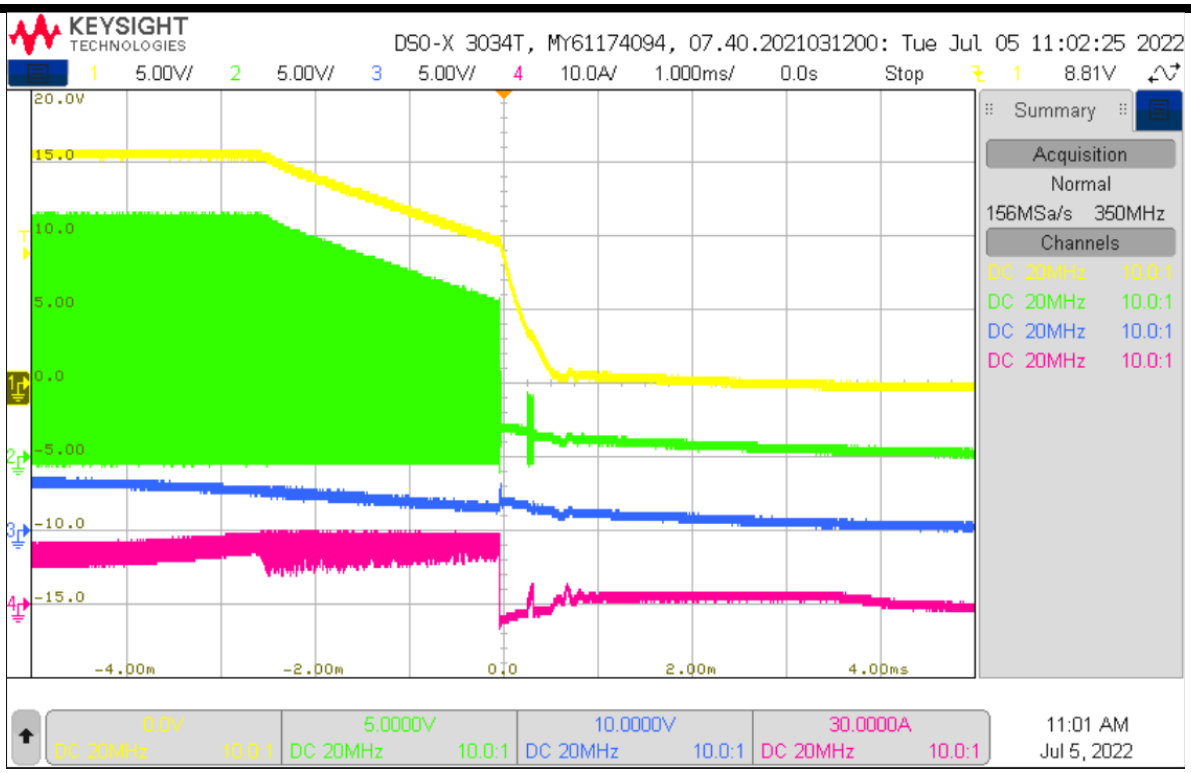


Figure 14 Turn-off at 3.6Vin, 16Vout/2.0A

8.6 Ripple and Noise

Note: C1: Vout (AC Coupled); C2: SW; C3: Vin; C4: IL for ripple & noise waveforms

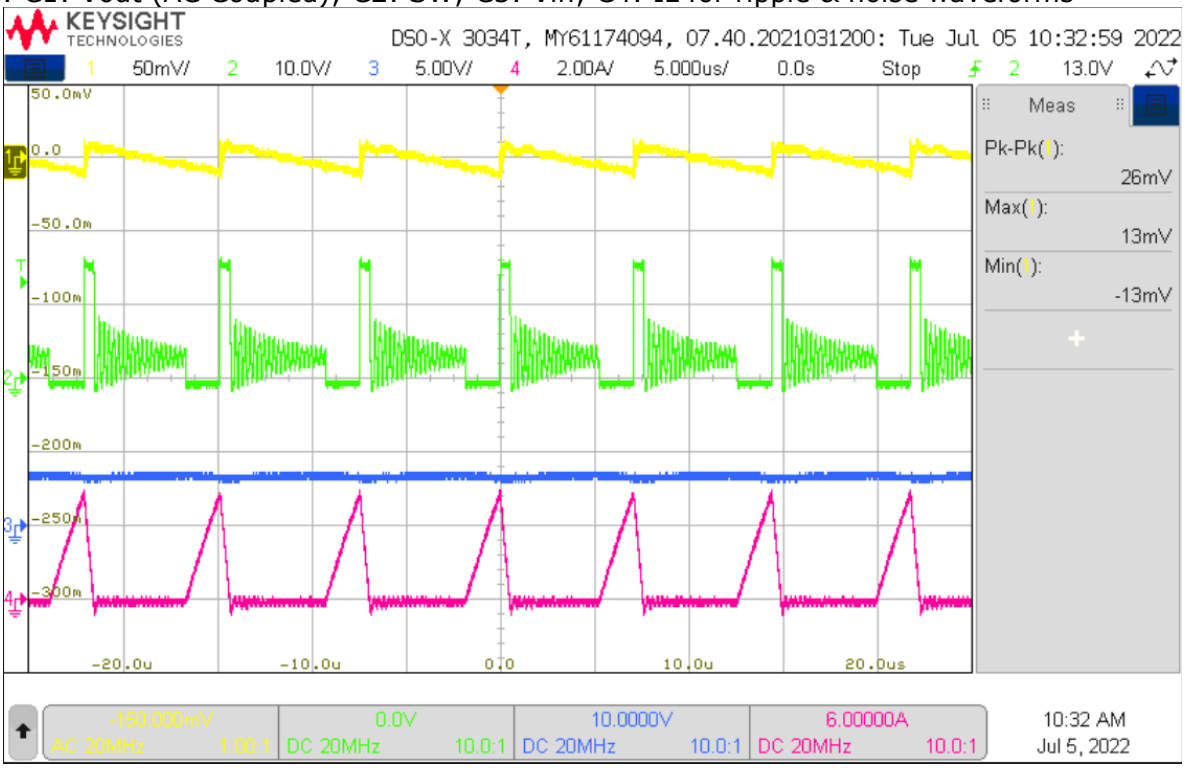


Figure 15 Ripple & Noise at 3.6Vin and 16Vout/0.1A

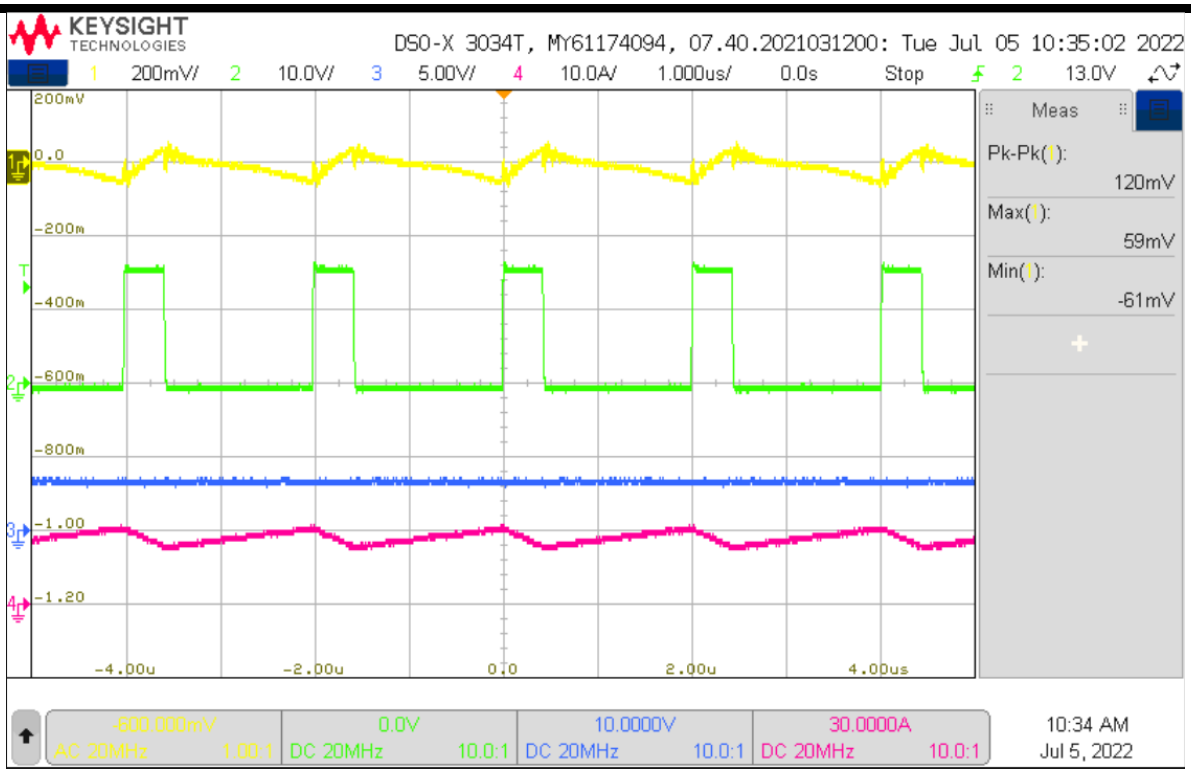


Figure 16 Ripple & Noise at 3.6Vin and 16Vout/2.0A

8.7 Load Transient Response

Test Condition: Vin=3.6V; Vout=16V; Load from 0.1A to 2.0A. C1 is Vout (AC) and C4 is Iout

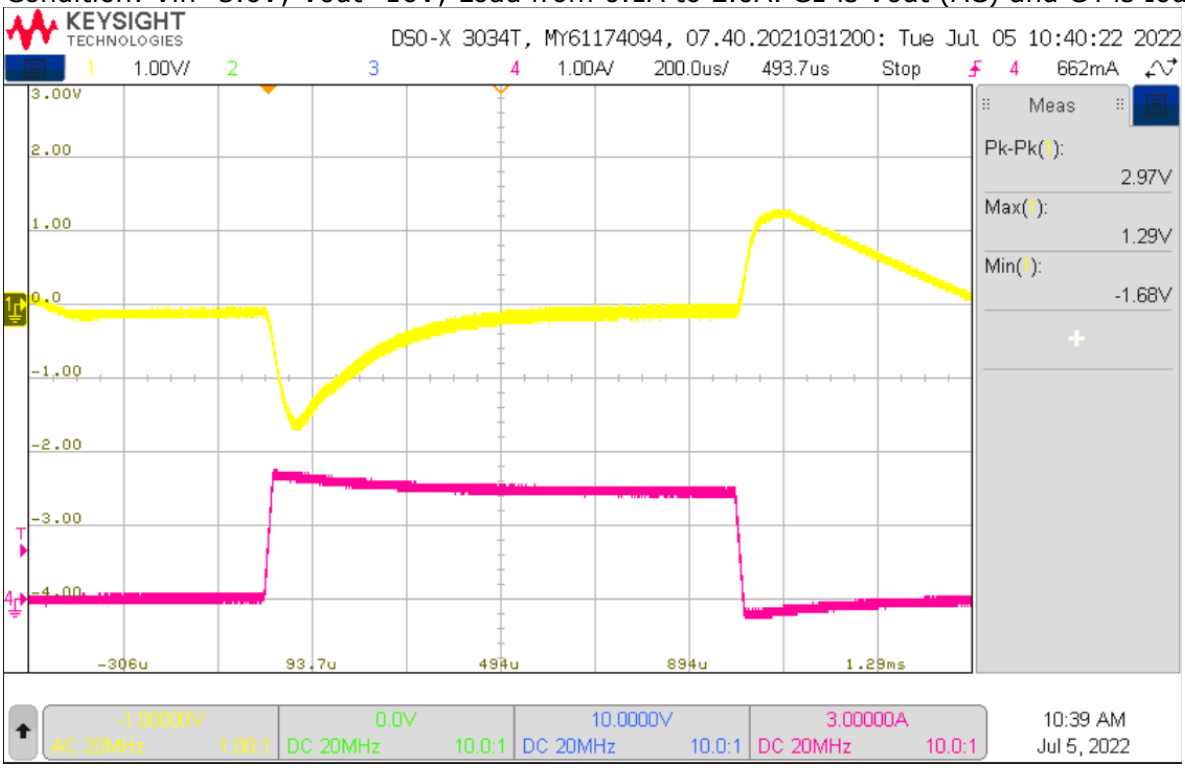


Figure 17 3.6Vin Load Transient

8.8 Over Current Protection (OCP)

Test Condition: Vin=3.6V, Vout=16V, Iout: 0.1-2.5A. C1: Vout; C4: IL

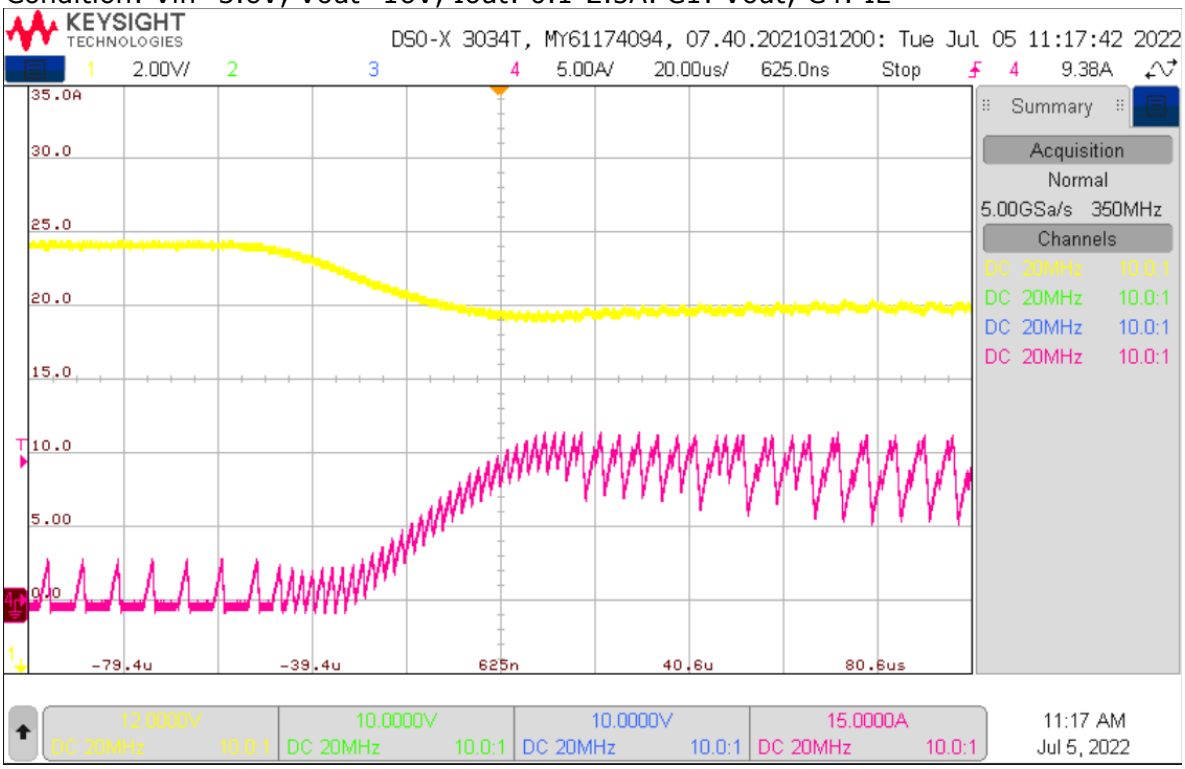


Figure 18 OCP at 3.6Vin and 16Vout

8.9 Over Voltage Protection (OVP)

Test Condition: Vin=3.6V, Vout=16V, Iout=0.1A. C1: Vout; C2: SW; C4: IL

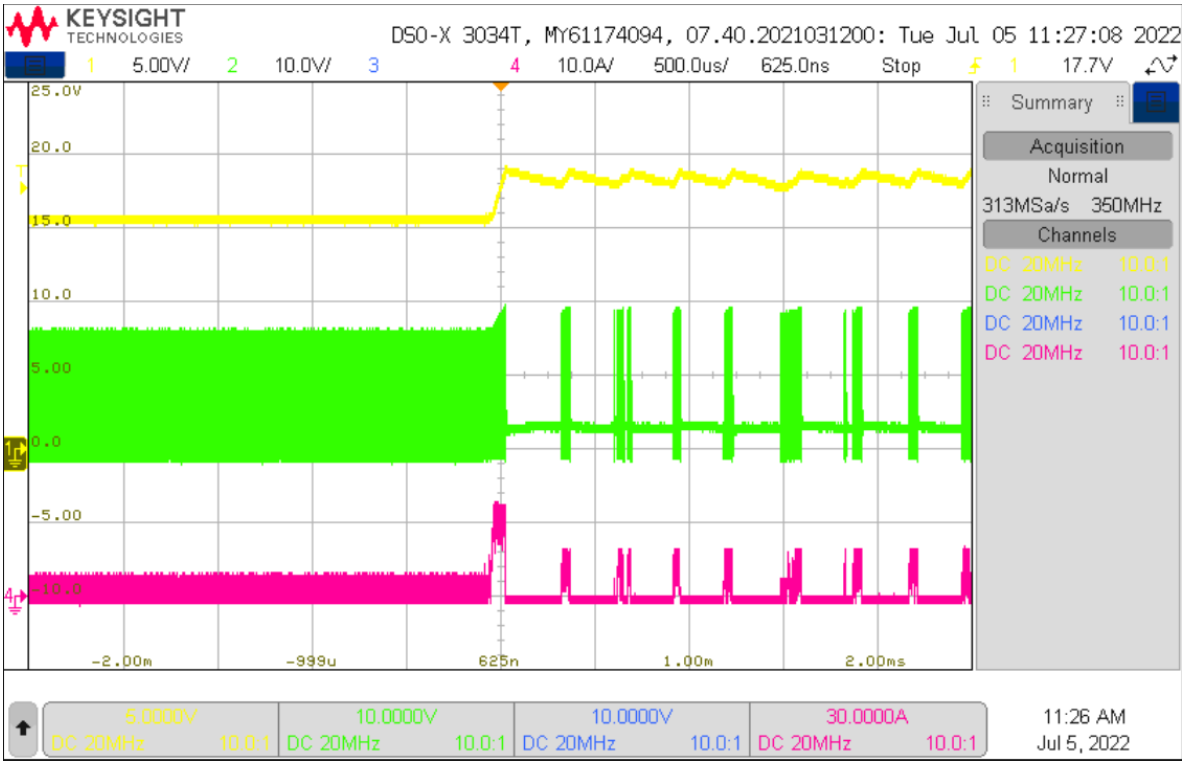


Figure 19 OVP at 3.6Vin and 16Vout

8.10 Over Temperature Protection (OTP)

Test Condition: Vin=3.6V, Vout=16V, Iout=2.0A. C1: Vout; C2: SW; C4: IL

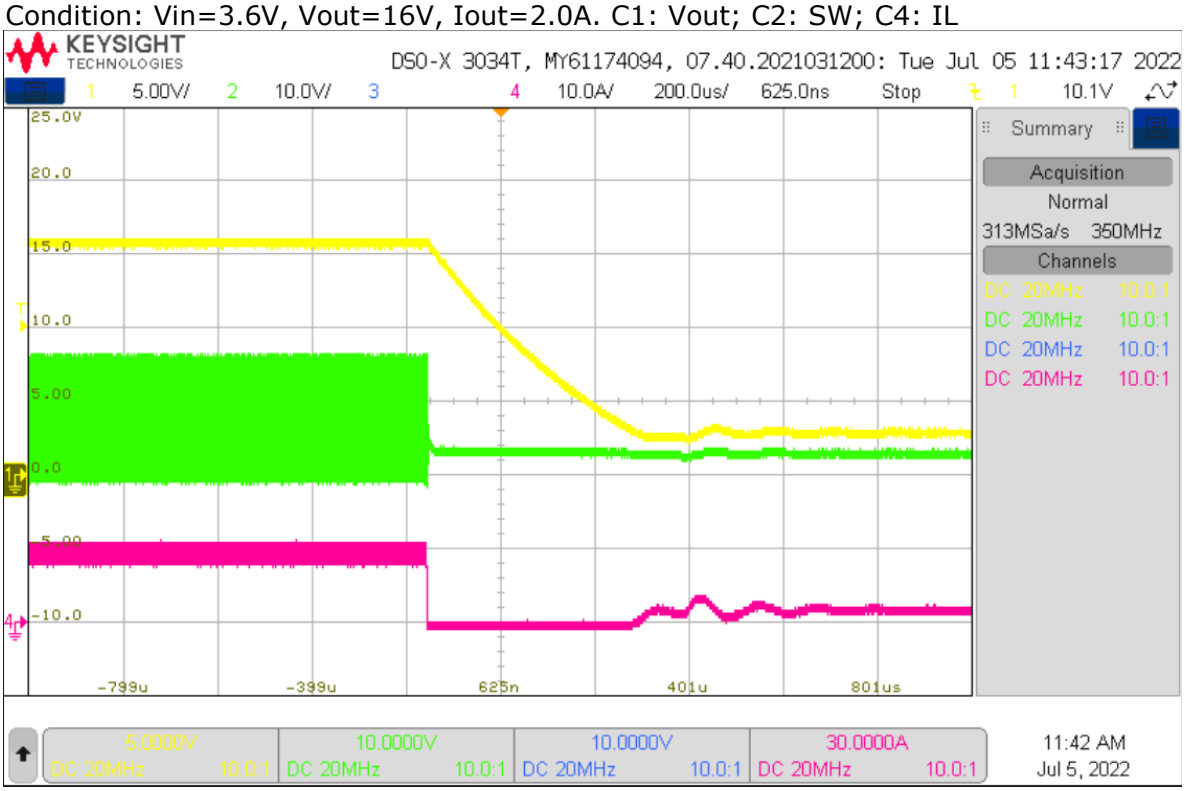


Figure 20 OTP at 3.6Vin and 16Vout