Testing of 200 W Medium Voltage Point-of-Load with XDPP1100 digital controller

About this document

Scope and purpose

This is a design verification test of 200W Medium Voltage Point-of-Load P100109B.

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1 Test setup

Figure 1, Figure 2 and Figure 3 show pictures of the test setup.

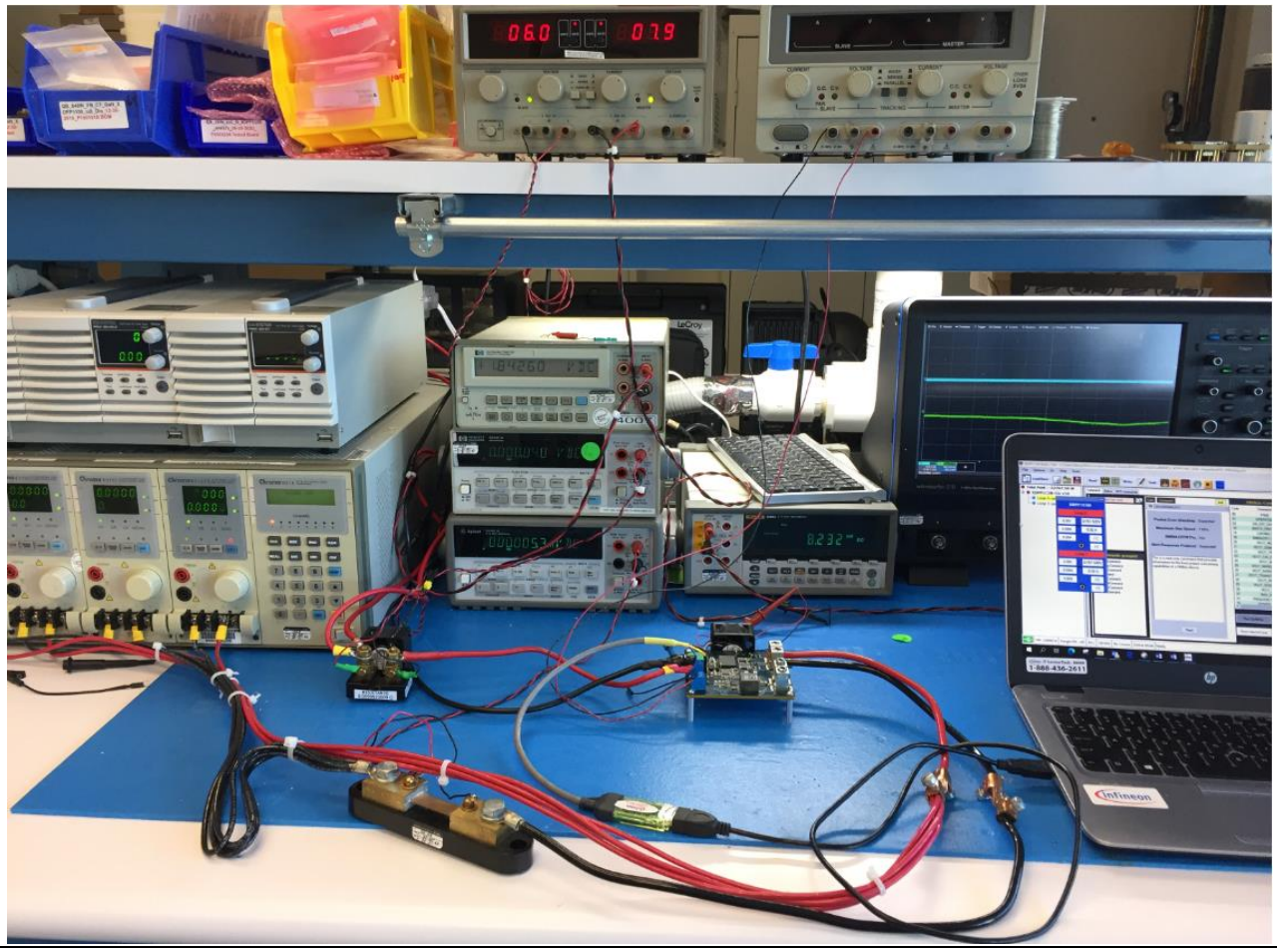


Figure 1 Test bench setup

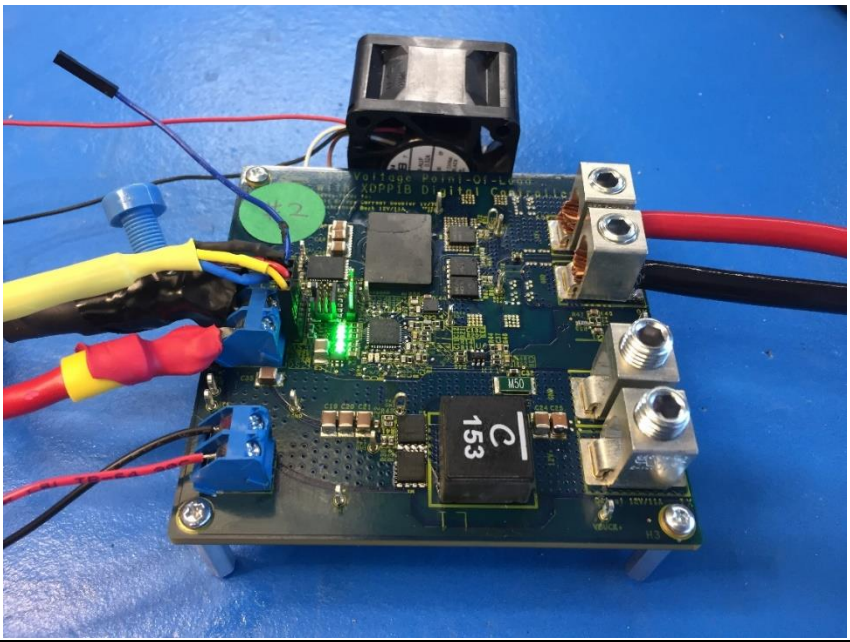


Figure 2 Connections

Test setup

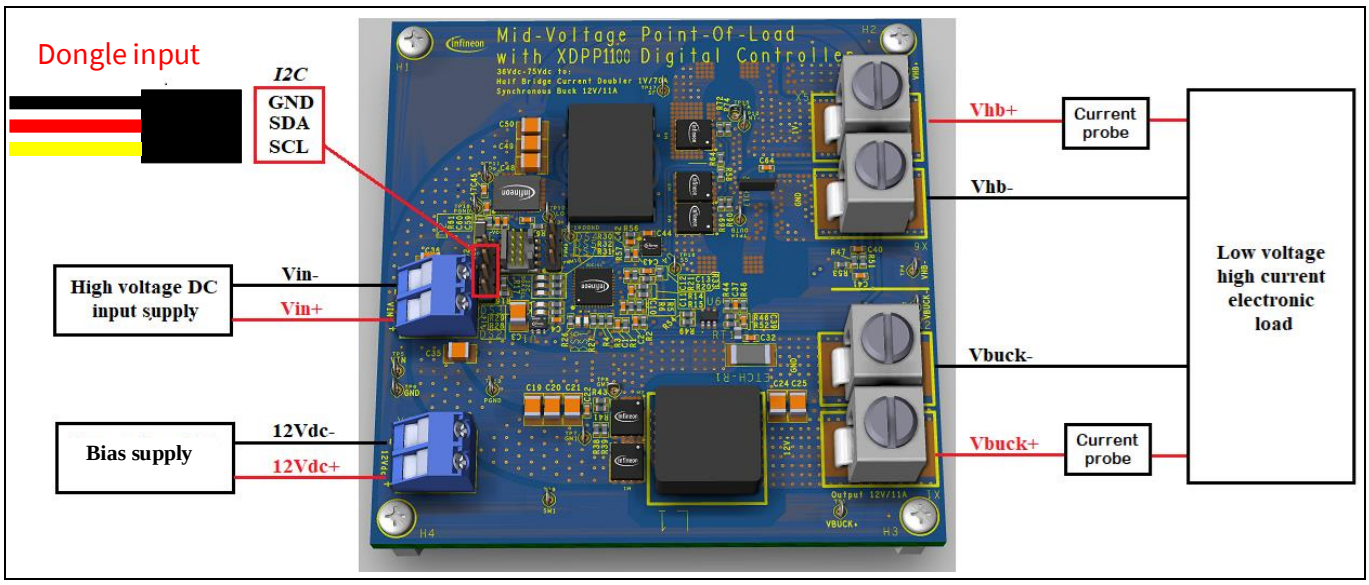


Figure 3 Connections (continued)

2 Schematic and board layout

Figure 4, Figure 5 and Figure 6 show the schematics of the MVPOL.

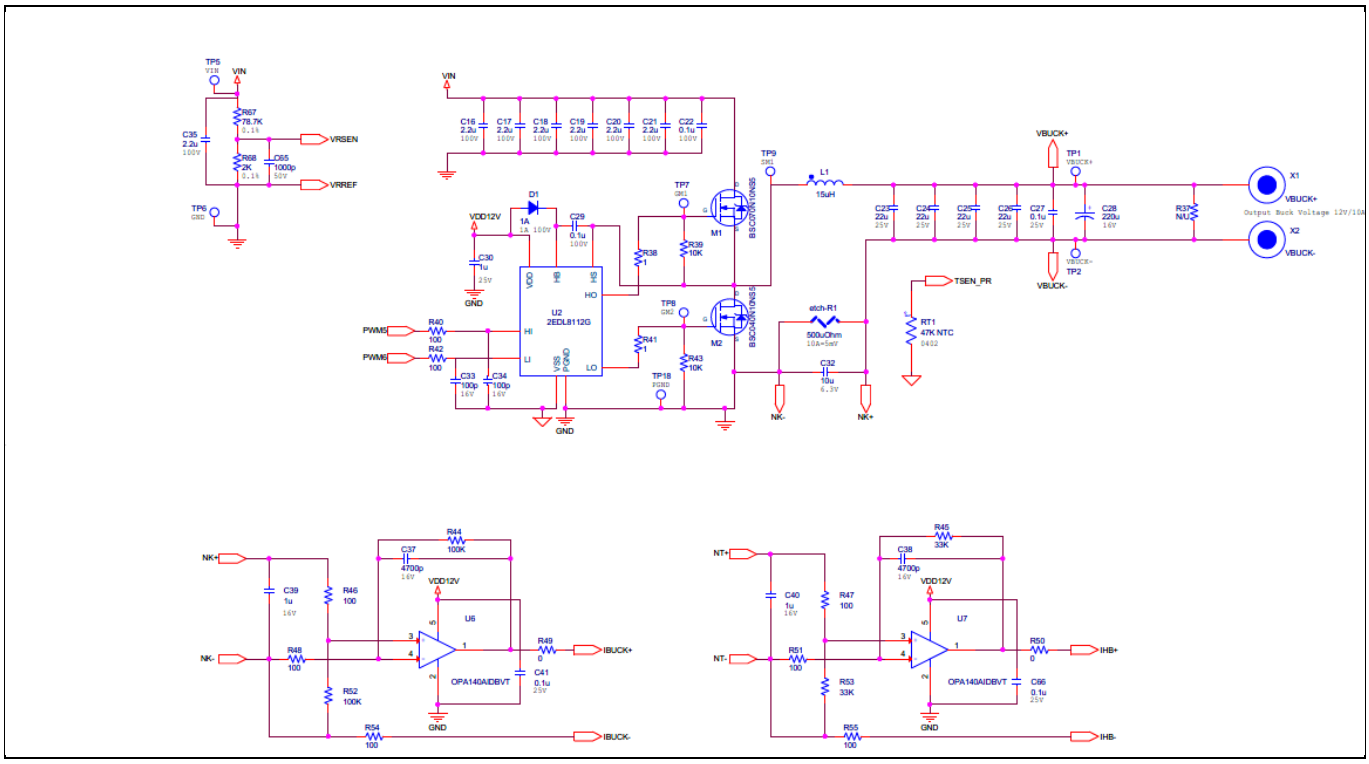


Figure 4 Power stage schematics of the buck

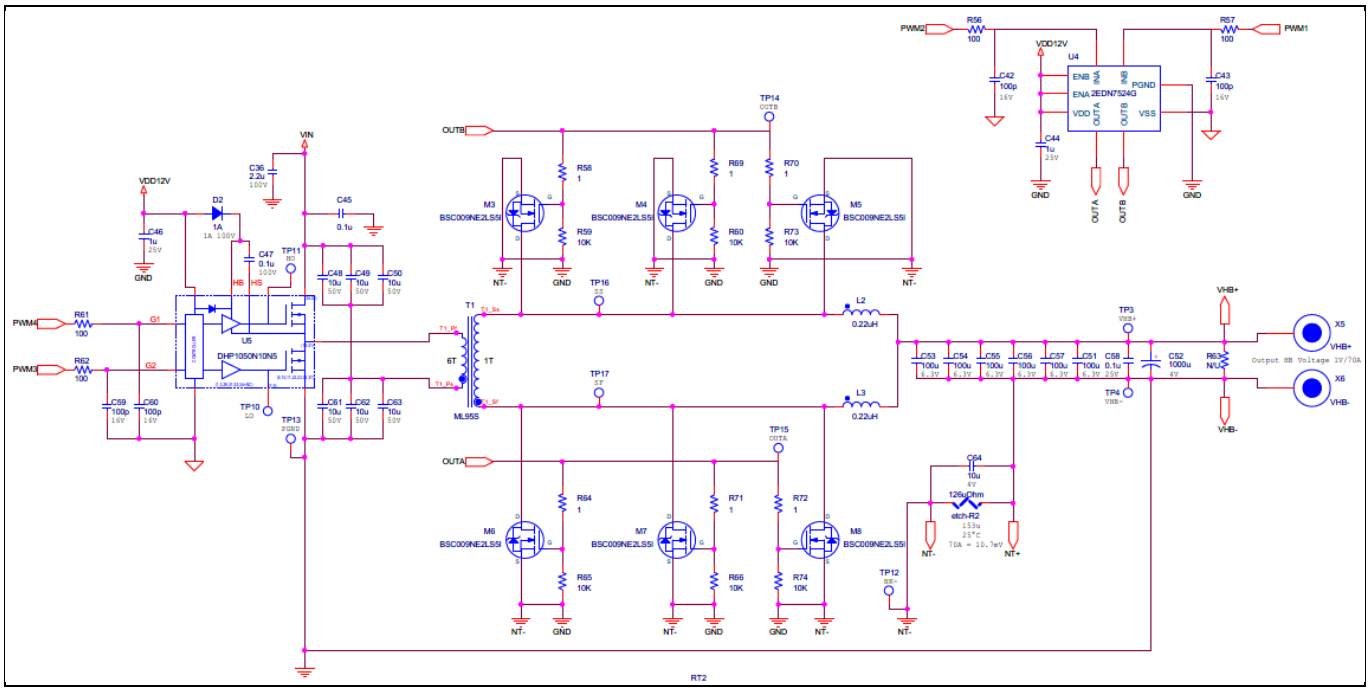


Figure 5 Power stage schematics of the half bridge current doubler

Schematic and board layout

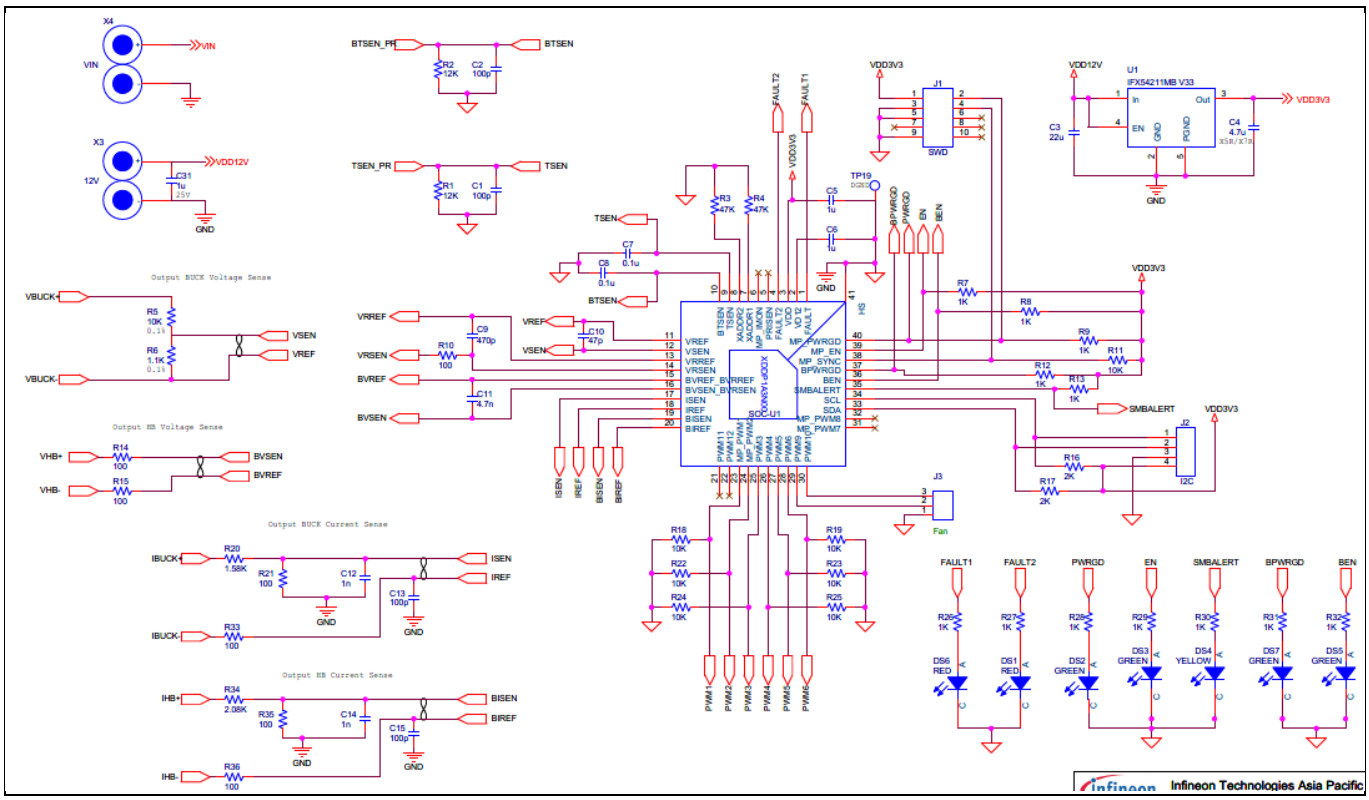


Figure 6 Schematics of the control circuit

3 Efficiency and regulation

The following efficiency is measured on unit 2 with external bias voltage = 10.8V and Fan voltage = 6V.

3.1 Efficiency and regulation of the 48V-12V buck

Vin=36V						
Vin	**Iin**	**Pin**	**Vout**	**Iout**	**Pout**	**Eff**
36.009	0.0289	1.041	11.9883	0.000	0.000	/
35.996	0.7014	25.248	11.9914	2.008	24.078	95.37
35.998	2.0635	74.282	11.9916	6.000	71.948	96.86
36.004	3.7874	136.362	11.9924	10.994	131.849	96.69

Vin=48V						
Vin (V)	**Iin (A)**	**Pin (W)**	**Vout (V)**	**Iout (A)**	**Pout (W)**	**Eff (%)**
48.006	0.0277	1.330	11.9944	0.000	0.000	/
48.006	0.5384	25.846	12.0036	2.006	24.082	93.17
48.006	1.5688	75.312	12.0044	5.998	72.007	95.61
48.000	2.8709	137.803	12.0040	10.994	131.968	95.77

Vin=75V						
Vin (V)	**Iin (A)**	**Pin (W)**	**Vout (V)**	**Iout (A)**	**Pout (W)**	**Eff (%)**
74.999	0.0281	2.107	11.9979	0.000	0.000	/
75.002	0.3662	27.466	12.0055	2.006	24.087	87.70
74.999	1.0341	77.556	12.0092	5.998	72.030	92.87
75.002	1.8791	140.936	12.0098	10.992	132.011	93.67

3.2 Efficiency and regulation of the 48V-1V half bridge current doubler

Vin=36V						
Vin	**Iin**	**Pin**	**Vout**	**Iout**	**Pout**	**Eff**
36.000	0.0111	0.400	0.9963	0.000	0.000	/
36.005	0.2947	10.611	0.9961	9.993	9.954	93.81
36.002	0.8942	32.193	0.9983	30.006	29.956	93.05
36.001	1.5363	55.308	0.9994	50.007	49.976	90.36
36.007	2.2124	79.662	1.0009	70.027	70.087	87.98

Vin=48V						
Vin (V)	**Iin (A)**	**Pin (W)**	**Vout (V)**	**Iout (A)**	**Pout (W)**	**Eff (%)**
47.997	0.0111	0.533	0.9976	0.000	0.000	/
48.003	0.2233	10.719	0.9968	10.001	9.969	93.01
48.004	0.6757	32.436	0.9999	30.000	29.998	92.48
48.006	1.1504	55.226	1.0005	50.006	50.033	90.60
48.006	1.6500	79.210	1.0026	70.008	70.189	88.61

Efficiency and regulation

Vin=75V						
Vin (V)	**Iin (A)**	**Pin (W)**	**Vout (V)**	**Iout (A)**	**Pout (W)**	**Eff (%)**
75.004	0.0139	1.043	1.0007	0.000	0.000	/
75.000	0.1500	11.250	0.9995	10.000	9.995	88.84
75.004	0.4392	32.942	1.0016	30.002	30.051	91.23
74.998	0.7441	55.806	1.0061	50.001	50.307	90.15
74.992	1.0695	80.204	1.0146	70.015	71.039	88.57

4 Thermal

Figure 7 and Figure 8 show the thermal images of the buck on unit 2 under different fan voltages.

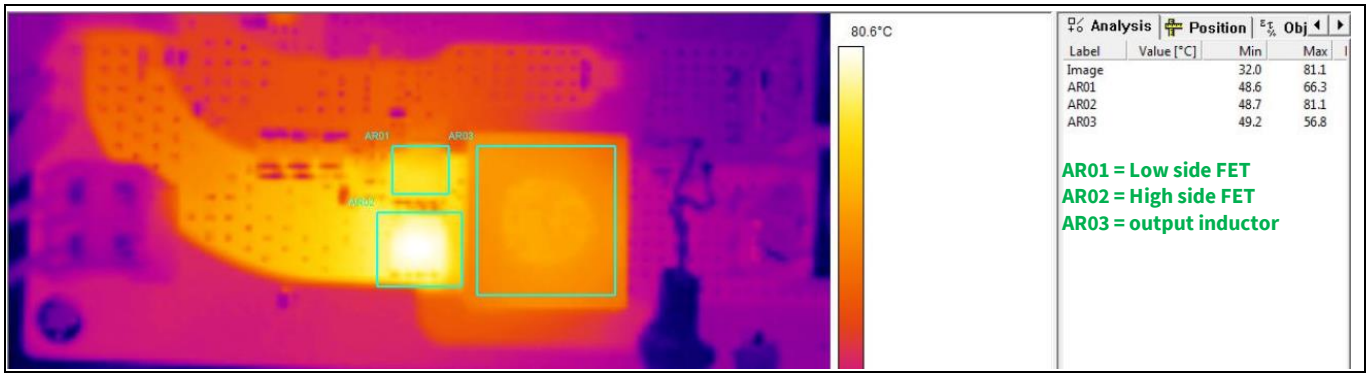


Figure 7 Thermal of buck at Vin=75V Iout=11A Fan voltage=6V

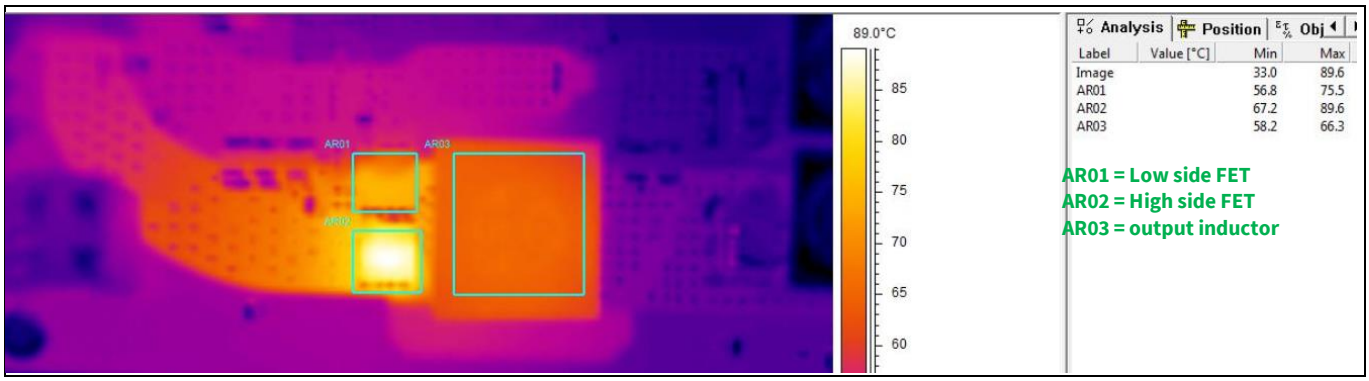


Figure 8 Thermal of buck at Vin=75V Iout=11A Fan voltage=4.8V

Figure 9**Error! Reference source not found.** and Figure 10 show the thermal images of the half bridge current doubler on unit 2 under different fan voltages.

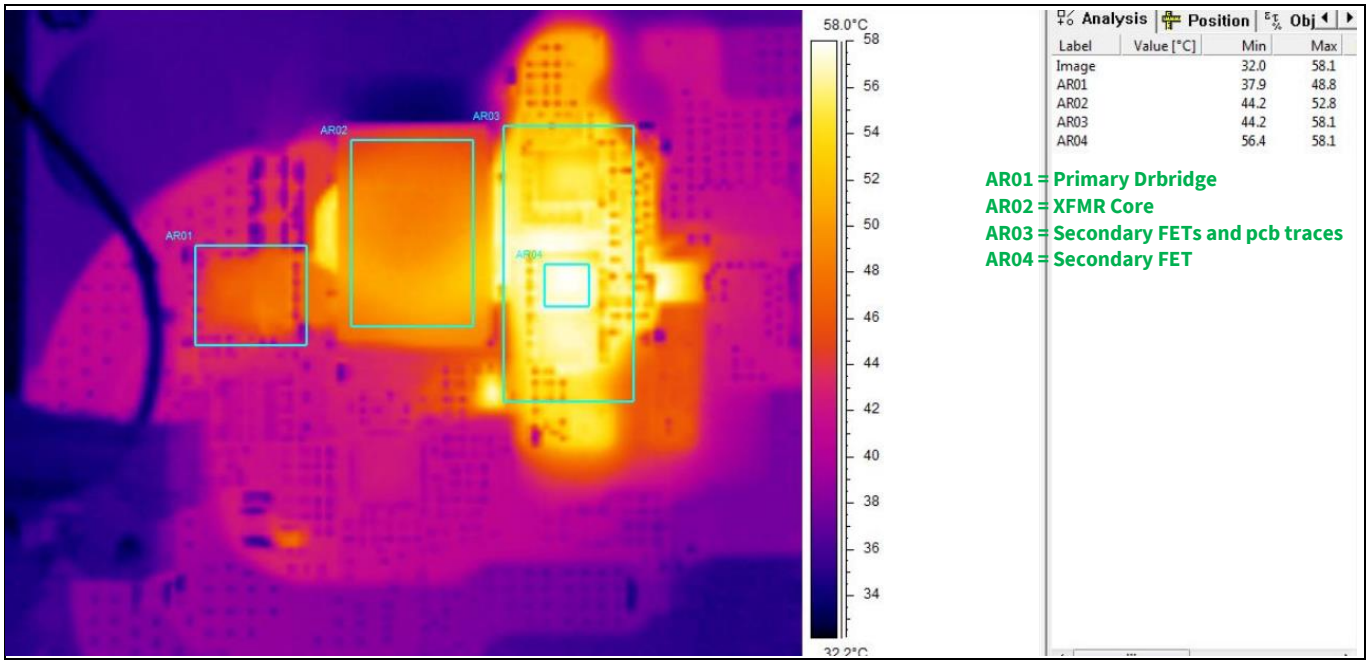


Figure 9 Thermal of Half Bridge Current Doubler at Vin=75V Iout=70A Fan voltage=6V

Thermal

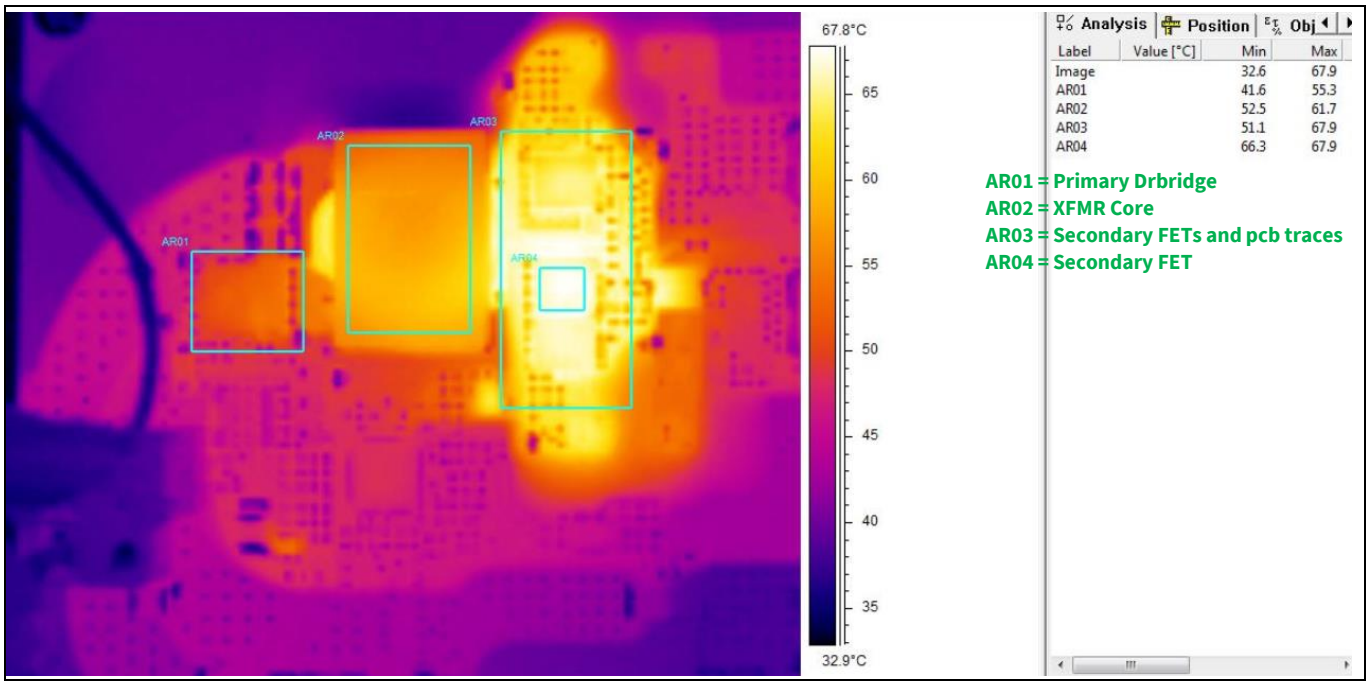
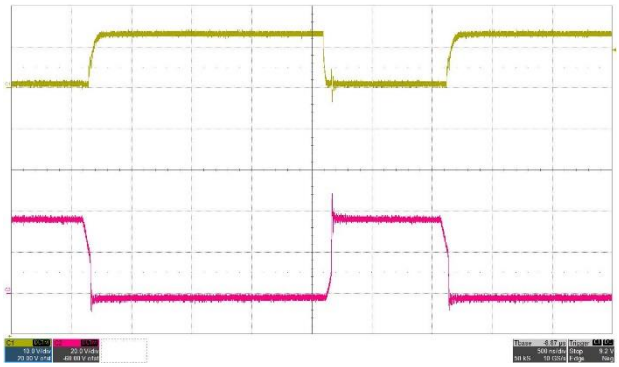


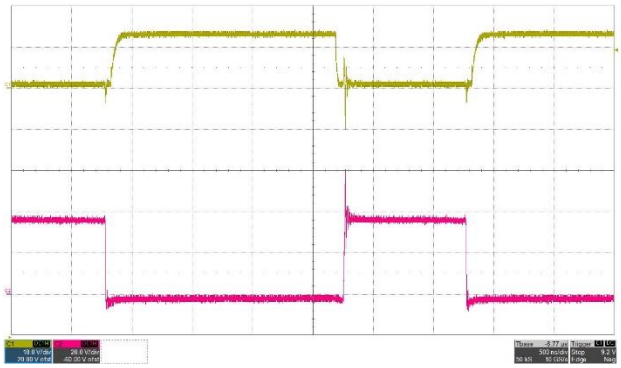
Figure 10 Thermal of Half Bridge Current Doubler at Vin=75V Iout=70A Fan voltage=4.8V

5 Switching waveforms

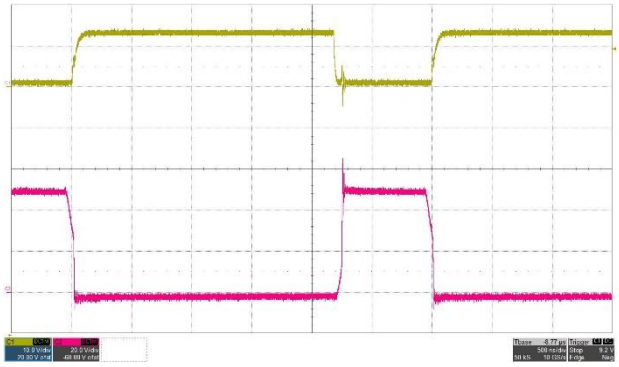
Figure 11 shows the switching waveforms of the buck over line and load range.



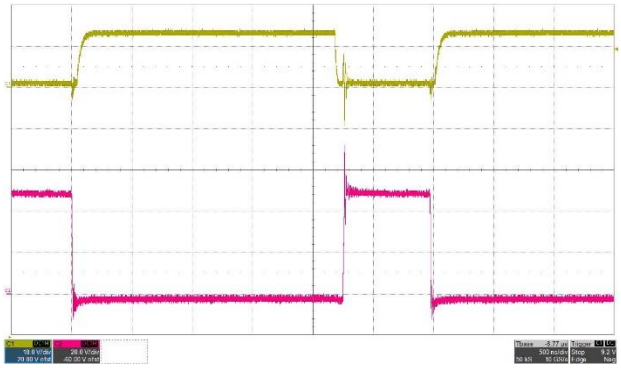
Vin=36V & Iout=0A
Ch.1= low Vgs
Ch.2= low Vds



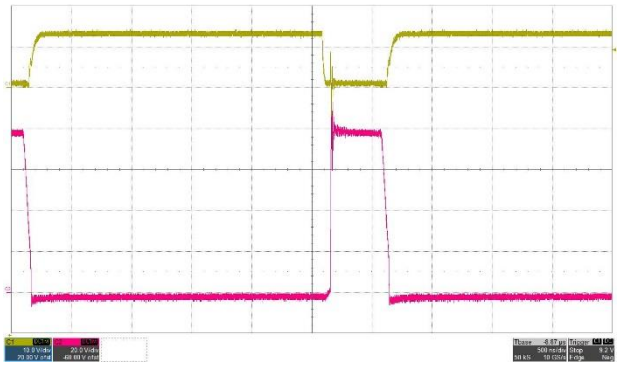
Vin=36V & Iout=11A
Ch.1= low Vgs
Ch.2= low Vds



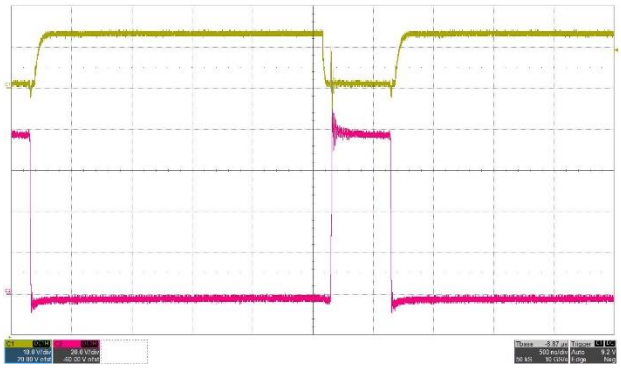
Vin=48V & Iout=0A
Ch.1= low Vgs
Ch.2= low Vds



Vin=48V & Iout=11A
Ch.1= low Vgs
Ch.2= low Vds



Vin=75V & Iout=0A
Ch.1= low Vgs
Ch.2= low Vds

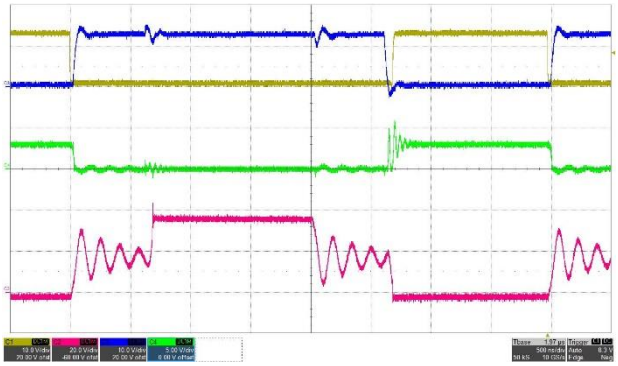


Vin=75V & Iout=0A
Ch.1= low Vgs
Ch.2= low Vds

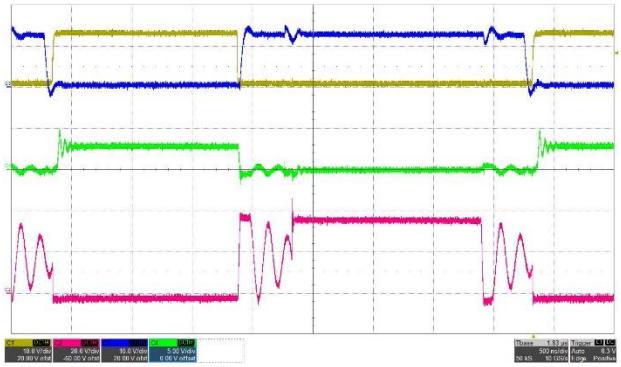
Figure 11 Switching waveforms of the buck

Switching waveforms

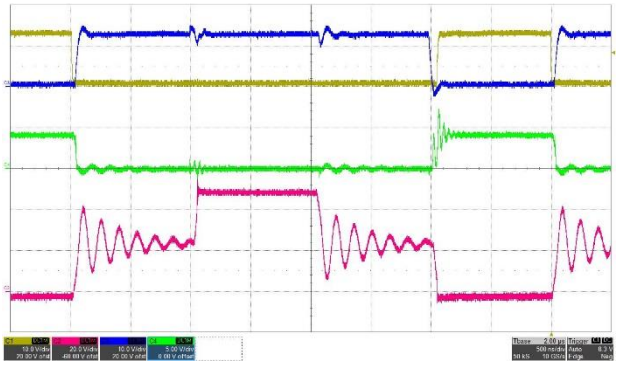
Figure 12 shows the switching waveforms of the half bridge current doubler over line and load range.



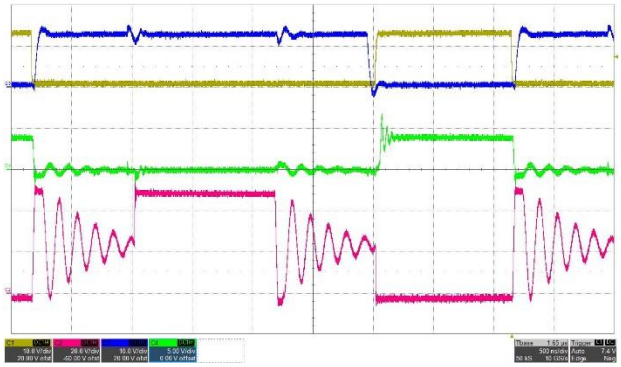
Vin=36V & Iout=0A
Ch.1= primary low Vgs
Ch.2= primary low Vds
Ch.3= secondary low Vgs
Ch.4= secondary low Vds



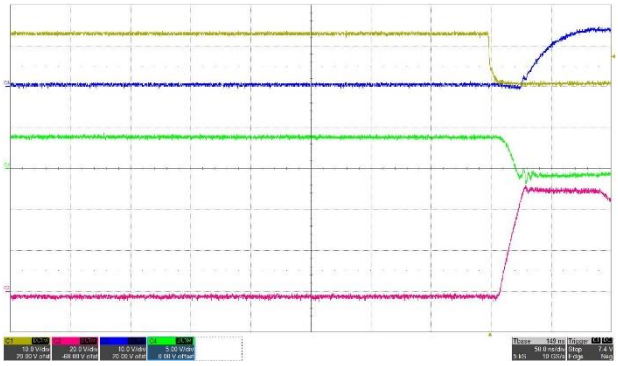
Vin=36V & Iout=70A
Ch.1= primary low Vgs
Ch.2= primary low Vds
Ch.3= secondary low Vgs
Ch.4= secondary low Vds



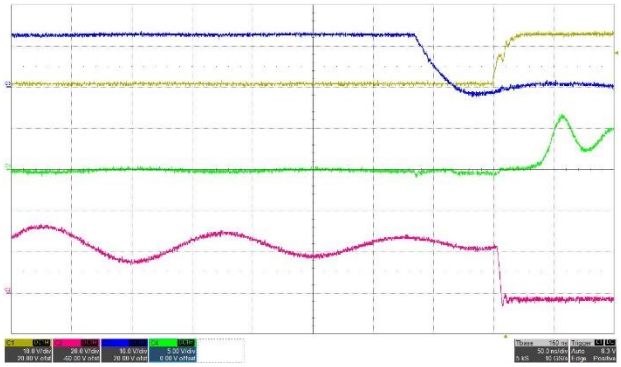
Vin=48V & Iout=0A
Ch.1= primary low Vgs
Ch.2= primary low Vds
Ch.3= secondary low Vgs
Ch.4= secondary low Vds



Vin=48V & Iout=70A
Ch.1= primary low Vgs
Ch.2= primary low Vds
Ch.3= secondary low Vgs
Ch.4= secondary low Vds

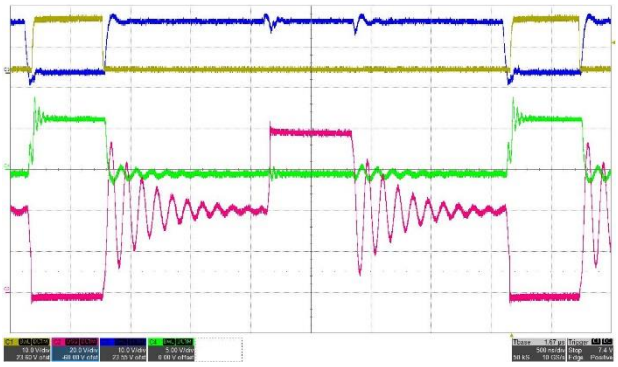


Vin=48V & Iout=70A
Ch.1= primary low Vgs
Ch.2= primary low Vds
Ch.3= secondary low Vgs
Ch.4= secondary low Vds

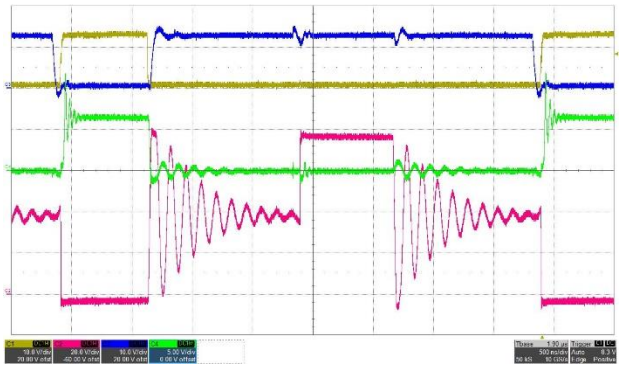


Vin=48V & Iout=70A
Ch.1= primary low Vgs
Ch.2= primary low Vds
Ch.3= secondary low Vgs
Ch.4= secondary low Vds

Switching waveforms



Vin=75V & Iout=0A
Ch.1= primary low Vgs
Ch.2= primary low Vds
Ch.3= secondary low Vgs
Ch.4= secondary low Vds

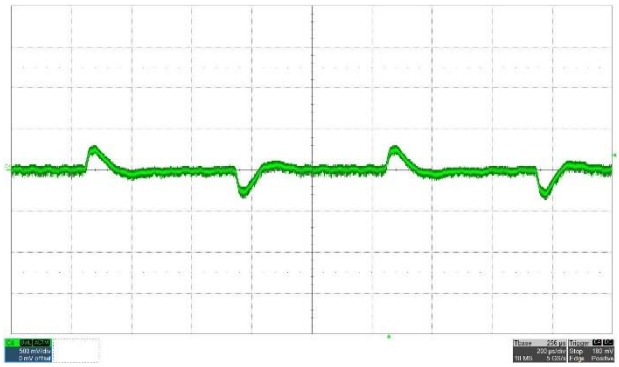


Vin=75V & Iout=70A
Ch.1= primary low Vgs
Ch.2= primary low Vds
Ch.3= secondary low Vgs
Ch.4= secondary low Vds

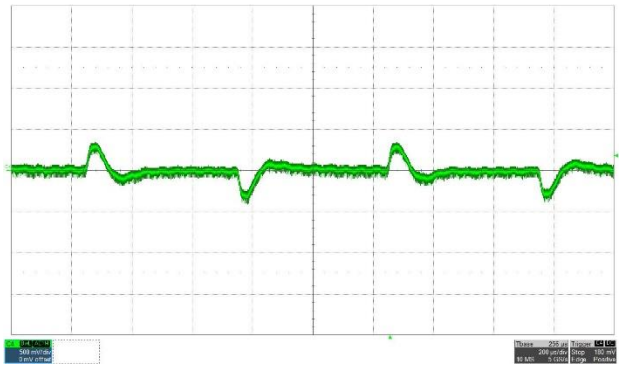
Figure 12 Switching waveforms of the half bridge current doubler

6 Transient waveforms

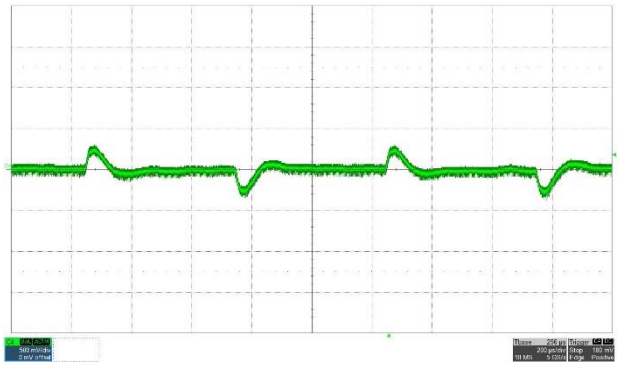
Figure 13 shows the transient of the buck.



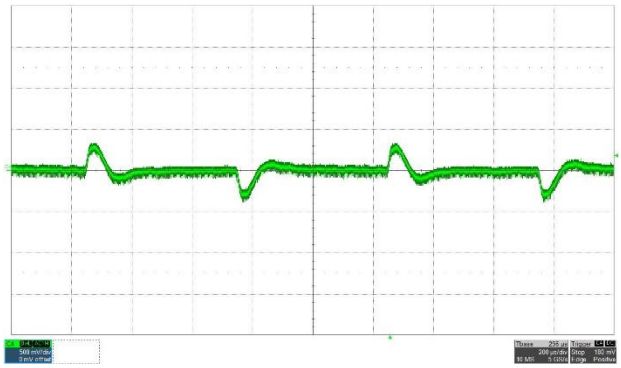
Buck
Vin=36V transient 10% load to 50% load @1A/us
Ch.4= Vout (AC)



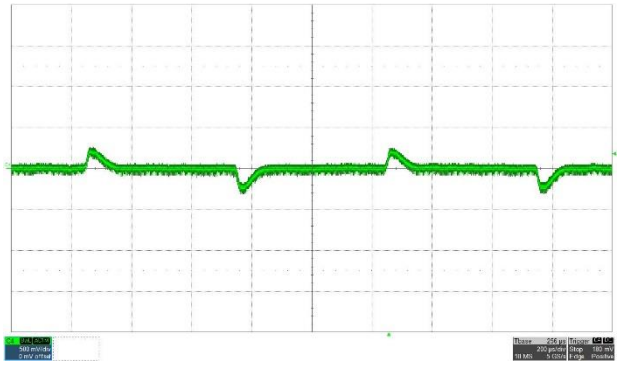
Buck
Vin=36V transient 10% load to 50% load @1A/us
Ch.4= Vout (AC)



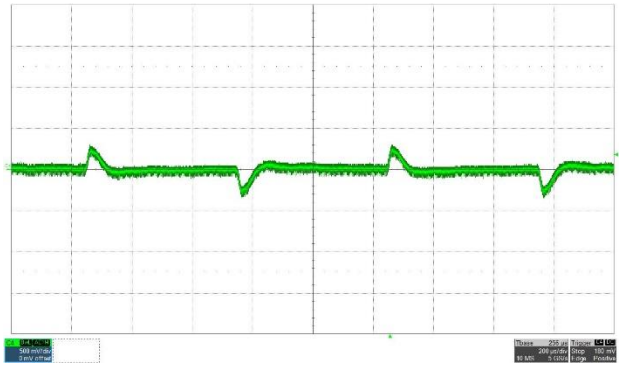
Buck
Vin=48V transient 10% load to 50% load @1A/us
Ch.4= Vout (AC)



Buck
Vin=48V transient 10% load to 50% load @1A/us
Ch.4= Vout (AC)



Buck
Vin=75V transient 10% load to 50% load @1A/us
Ch.4= Vout (AC)

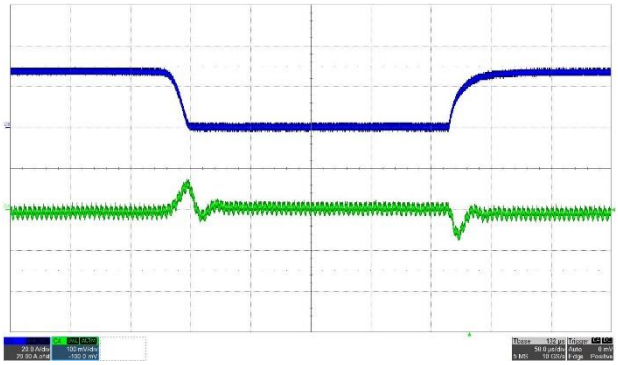


Buck
Vin=75V transient 10% load to 50% load @1A/us
Ch.4= Vout (AC)

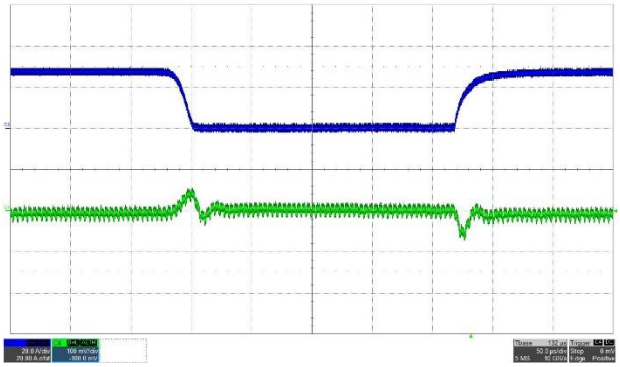
Figure 13 Transient waveforms of the buck

Transient waveforms

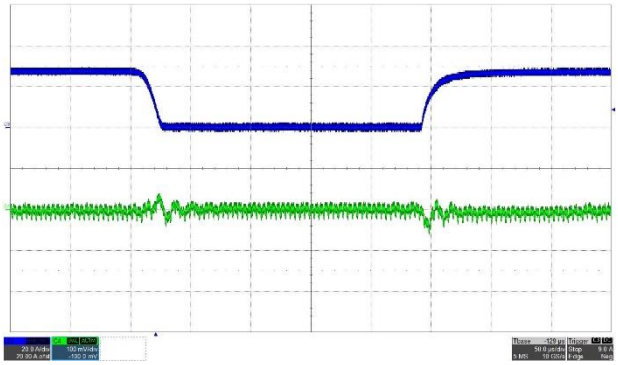
Figure 14 shows the transient of the half bridge current doubler. The transient waveforms are taken with resistor load (0.033 ohm, for 30A at 1V), not electronic load, and due to limited equipment.



half bridge current doubler
Vin=36V transient at 1V from no load to 30A
Ch.3= Output current
Ch.4= Vout (AC)



half bridge current doubler
Vin=48V transient at 1V from no load to 30A
Ch.3= Output current
Ch.4= Vout (AC)



half bridge current doubler
Vin=75V transient at 1V from no load to 30A
Ch.3= Output current
Ch.4= Vout (AC)

Figure 14 Transient waveforms of the half bridge current doubler

Revision history

Document version	Date of release	Description of changes
1.0	11/16/2020	

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