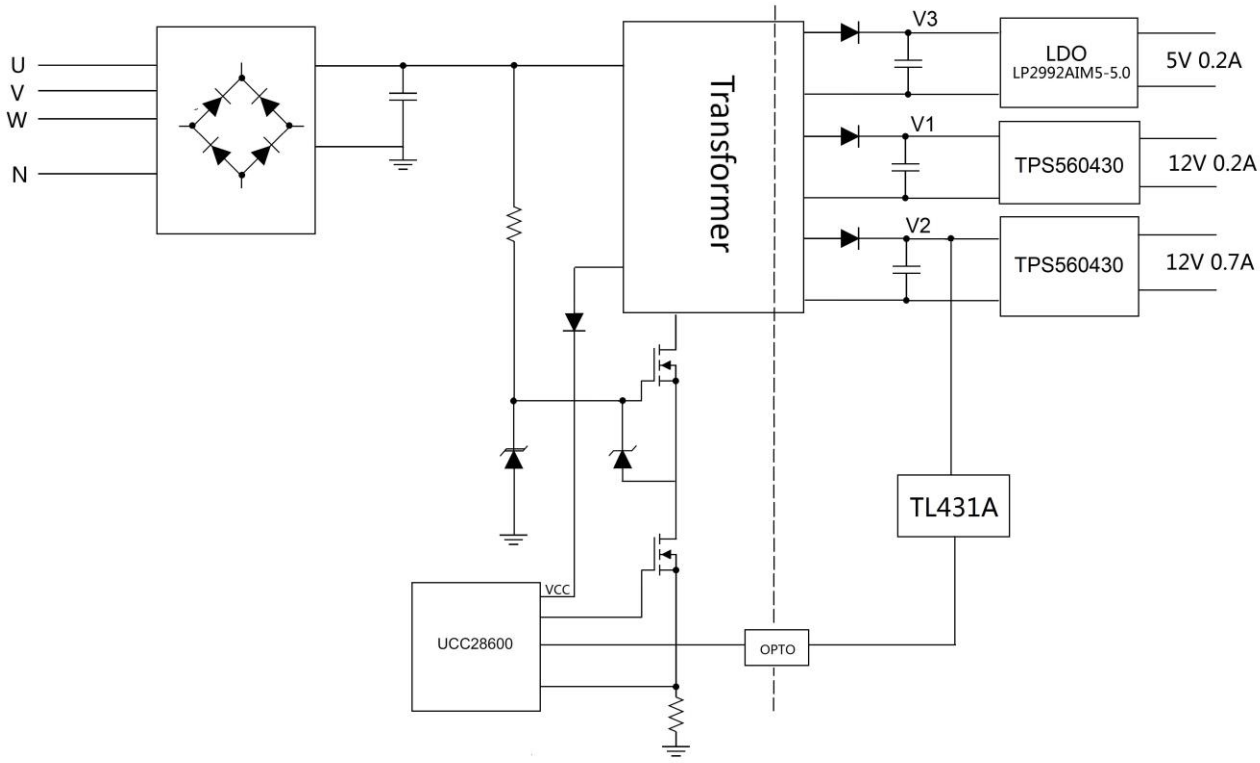
Test Report: PMP40347
3 phase AC input, 12W output reference design for smart meter

Description

- The reference design was designed for the 3phase smart meter application. It uses the UCC28600 quasi-resonant flyback controller to generate three isolated 12W rails from an extremely wide input from 110VAC to 420VAC. The design has good line and load regulation, and perfect protection feature.



1 Test Prerequisites

1.1 Voltage and Current Requirements

Table 1. Voltage and Current Requirements

PARAMETER	SPECIFICATIONS
Input votage range	110Vac-420Vac
Output voltage VO1	12V
Output current IO1	0.2A

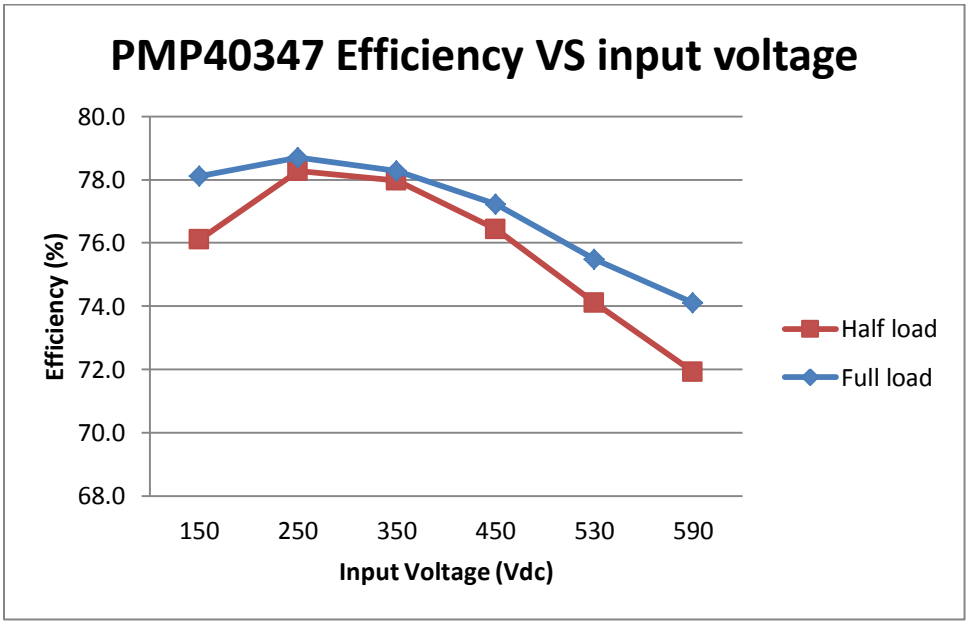
Output voltage VO2	12V
Output current IO2	0.7A
Output voltage VO3	5V
Output current IO3	0.2A

1.2 Required Equipment

- Chroma programmable AC source 61503
- Tektronix digital phosphor oscilloscope DPO3054
- Chroma Programmable DC power supply model 62012P-600-8
- Chroma DC electronic load 6314A

2 Testing and Results

2.1 Efficiency Graphs

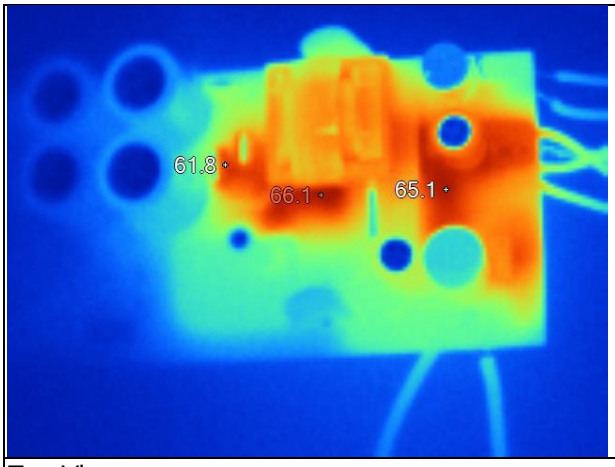


2.2 Efficiency Data

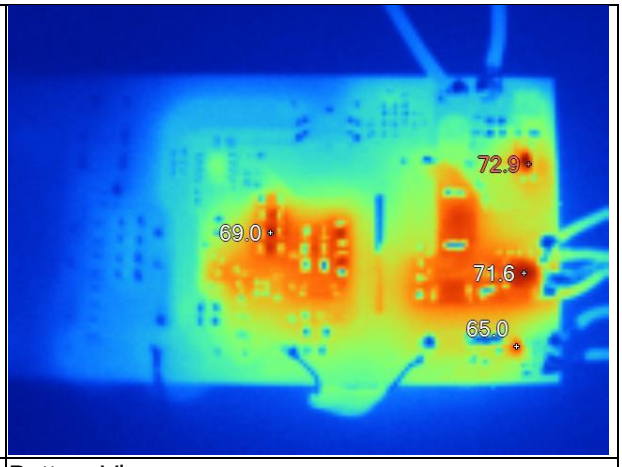
Vin (Vdc)	Iin (A)	Pin (W)	V1 (V)	Io_V1 (A)	V2 (V)	Io_V2 (A)	V3 (V)	Io_V3 (A)	Effi (%)
150	0.099	14.910	11.953	0.198	12.003	0.692	4.969	0.198	78.1
250	0.059	14.800	11.953	0.198	12.003	0.692	4.961	0.198	78.7
350	0.043	14.875	11.953	0.197	12.001	0.692	4.961	0.198	78.3
450	0.034	15.075	11.945	0.197	12.001	0.692	4.961	0.198	77.2
530	0.029	15.423	11.945	0.197	12.000	0.692	4.961	0.198	75.5
590	0.027	15.694	11.945	0.197	12.000	0.691	4.969	0.198	74.1

Vin (Vdc)	Iin (A)	Pin (W)	V1 (V)	Io_V1 (A)	V2 (V)	Io_V2 (A)	V3 (V)	Io_V3 (A)	Effi (%)
150	0.051	7.635	11.945	0.098	12.000	0.346	4.969	0.099	76.1
250	0.030	7.425	11.953	0.098	12.000	0.346	4.969	0.099	78.3
350	0.021	7.455	11.953	0.098	12.000	0.346	4.969	0.099	78.0
450	0.017	7.605	11.953	0.098	12.000	0.346	4.969	0.099	76.4
530	0.015	7.844	11.953	0.098	12.000	0.346	4.969	0.099	74.1
590	0.014	8.083	11.953	0.098	12.000	0.346	4.969	0.099	71.9

2.3 Thermal Images

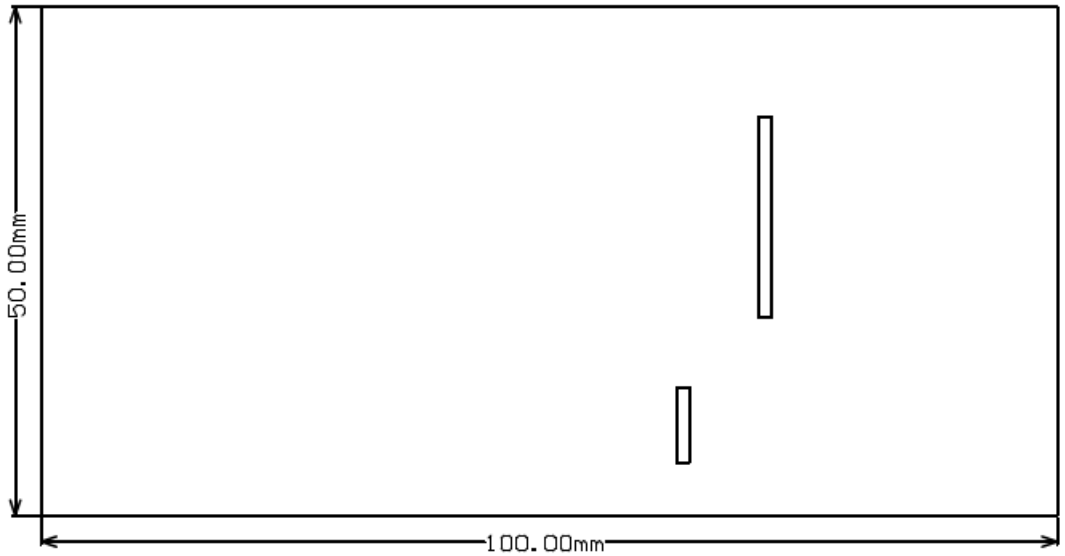


Top View
Vin: 530V DC
Io_V1=0.2A, Io_V2=0.7A, Io_V3=0.1A



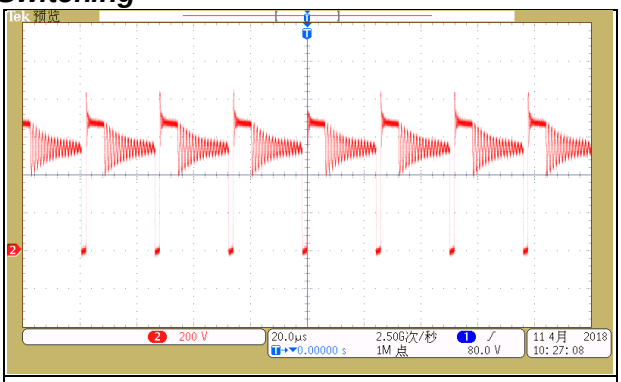
Bottom View
Vin: 530V DC
Io_V1=0.2A, Io_V2=0.7A, Io_V3=0.1A

2.4 Dimensions



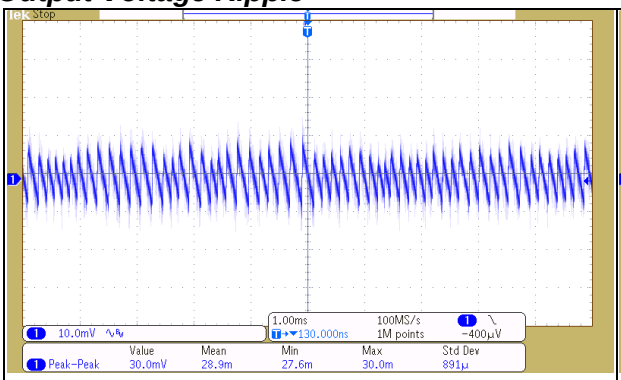
3 Waveforms

3.1 Switching

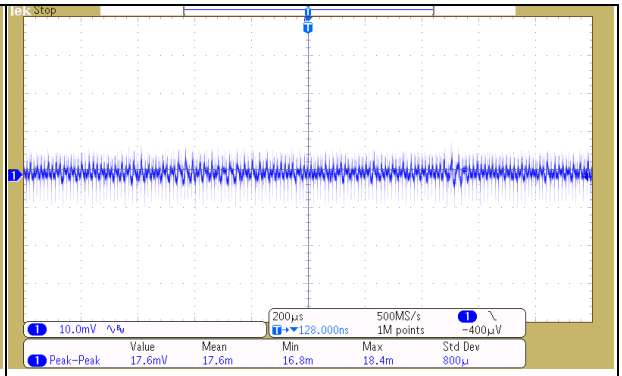


Vin: 530V DC
Io1=0.2A, Io2=0.7A, I3=0.2A

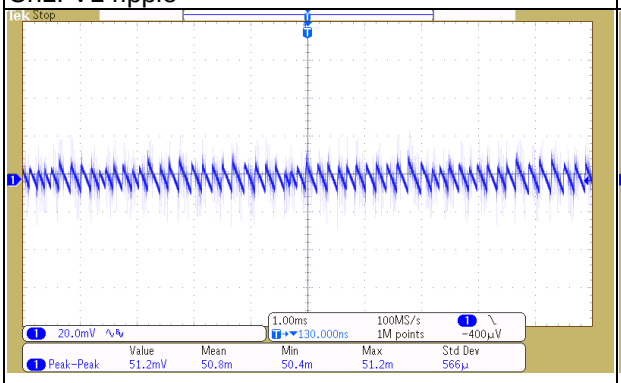
3.2 Output Voltage Ripple



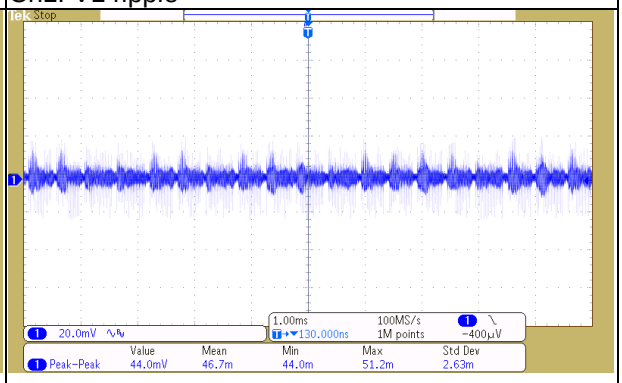
Vin:150V DC, V1 no load, V2 V3 full load
Ch1: V1 ripple



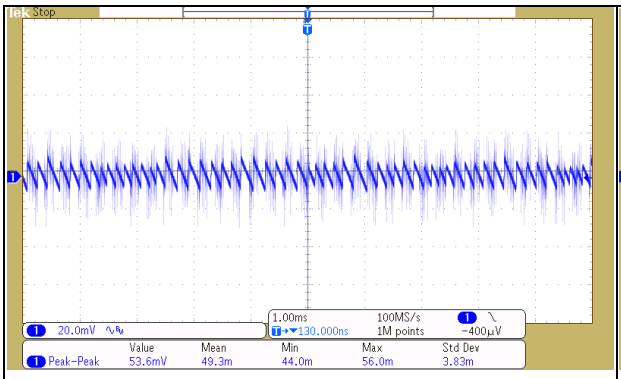
Vin:150V DC, V1 V2 V3 full load
Ch1: V1 ripple



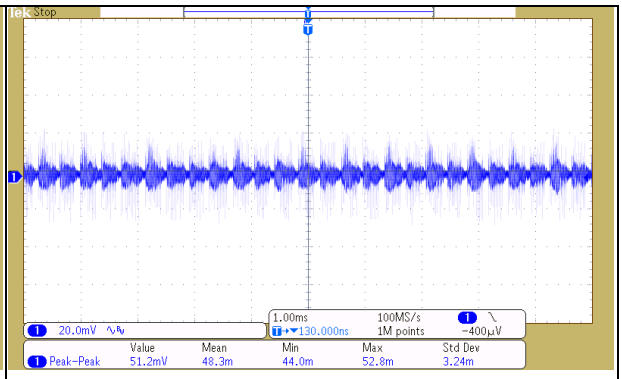
Vin:530V DC, V1 no load, V2 V3 full load
Ch1: V1 ripple



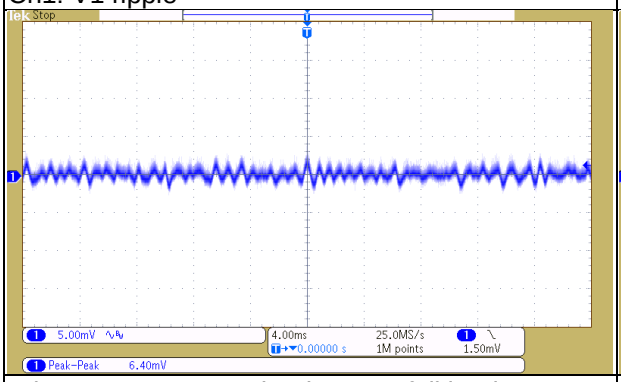
Vin:530V DC, V1 V2 V3 full load
Ch1: V1 ripple



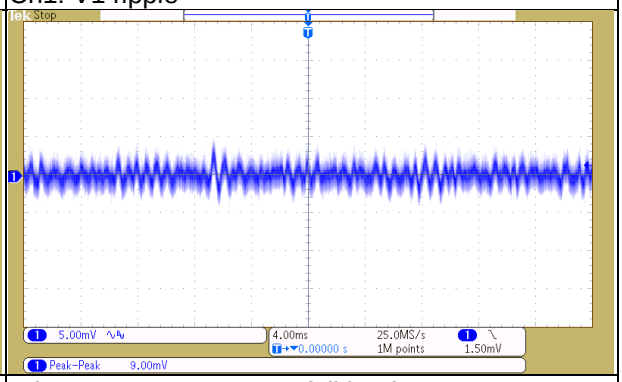
Vin:590V DC, V1 no load, V2 V3 full load
Ch1: V1 ripple



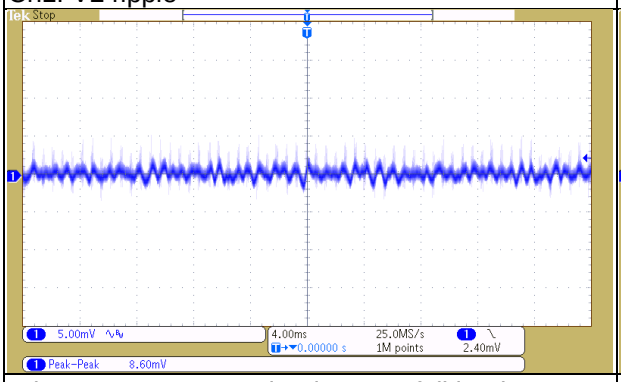
Vin:590V DC, V1 V2 V3 full load
Ch1: V1 ripple



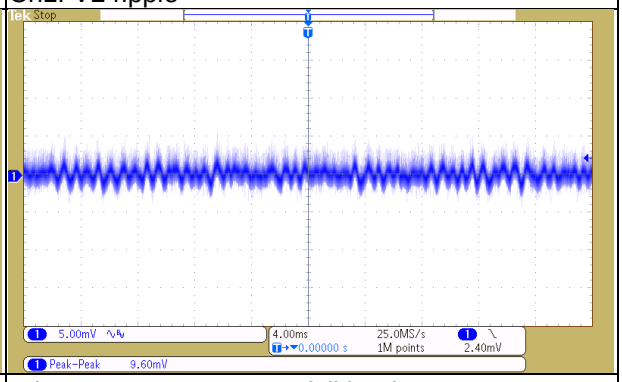
Vin:150V DC, V2 no load, V1 V3 full load
Ch1: V2 ripple



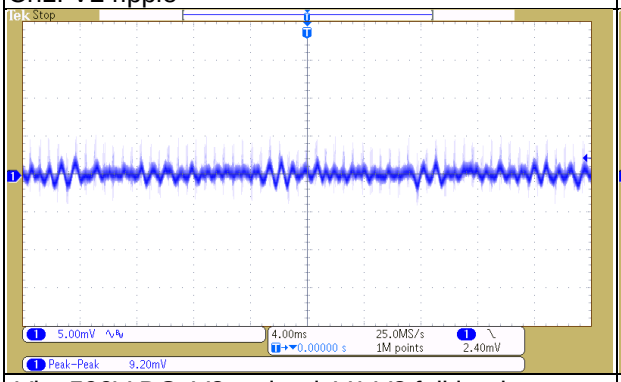
Vin:150V DC, V1 V2 V3 full load
Ch1: V2 ripple



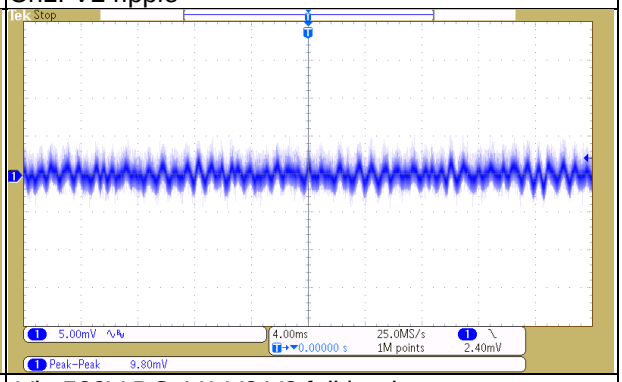
Vin: 530V DC, V2 no load, V1 V3 full load
Ch1: V2 ripple



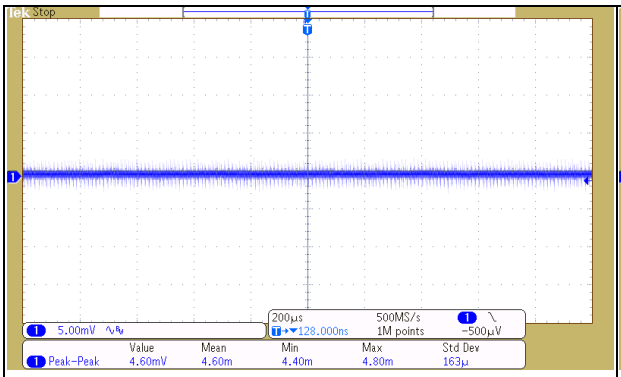
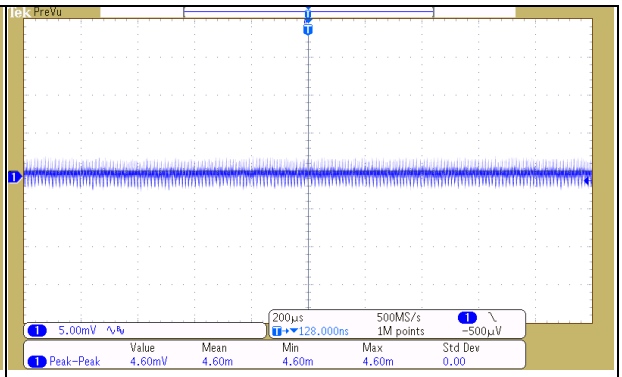
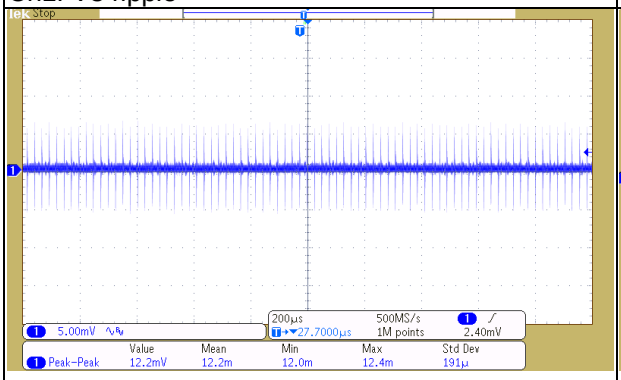
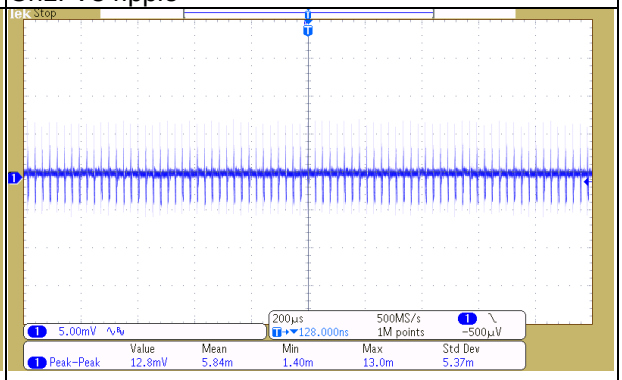
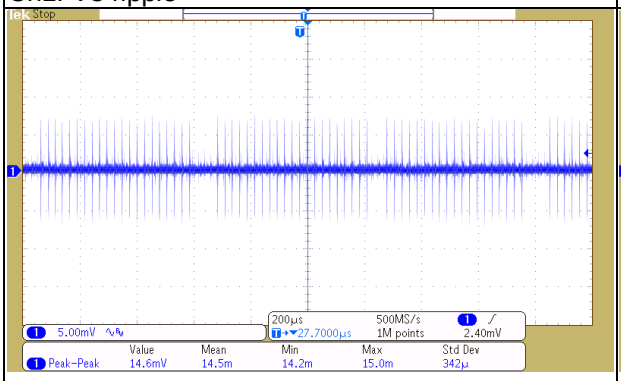
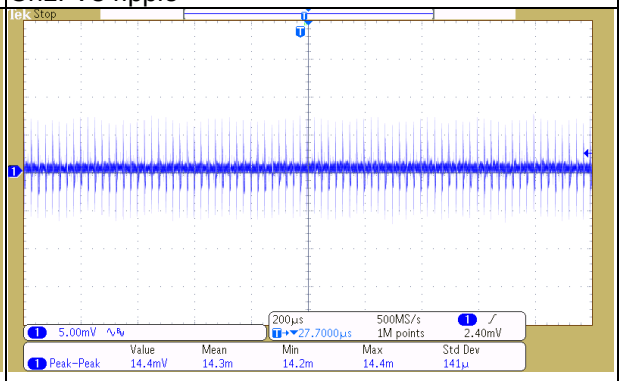
Vin:530V DC, V1 V2 V3 full load
Ch1: V2 ripple



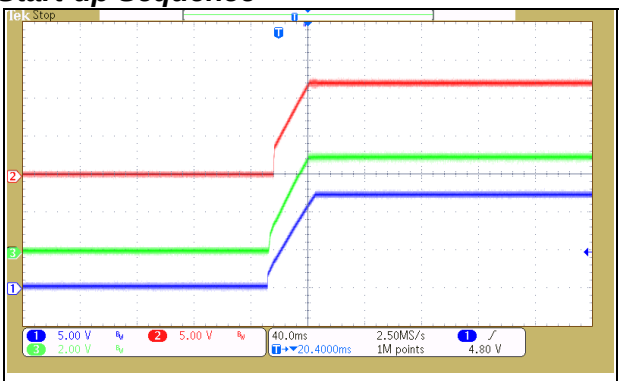
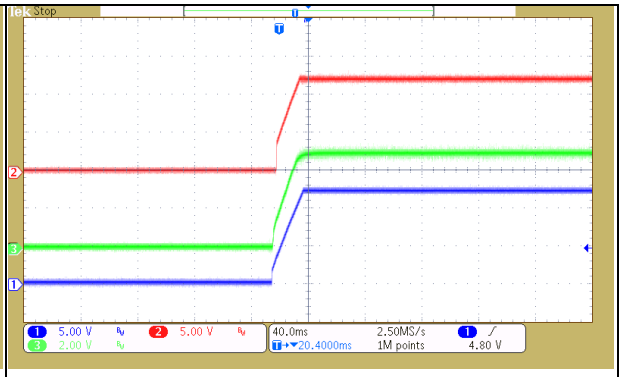
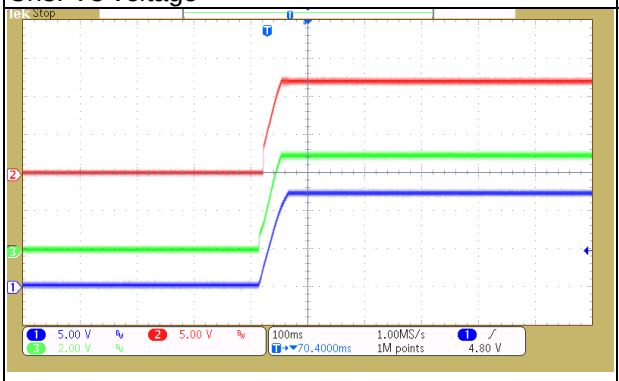
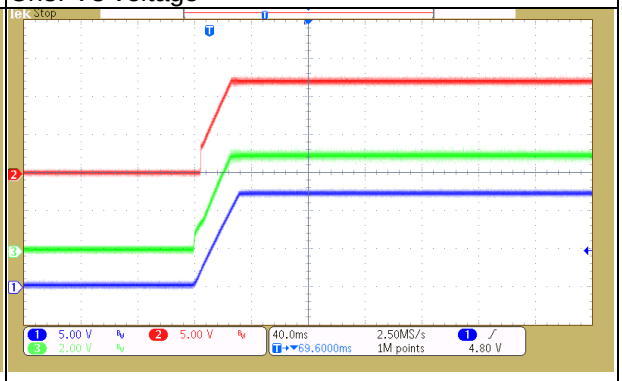
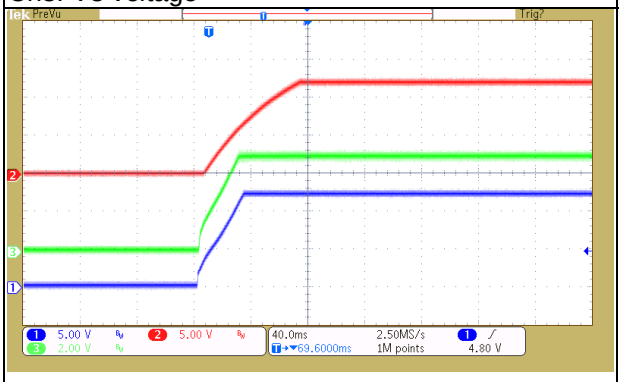
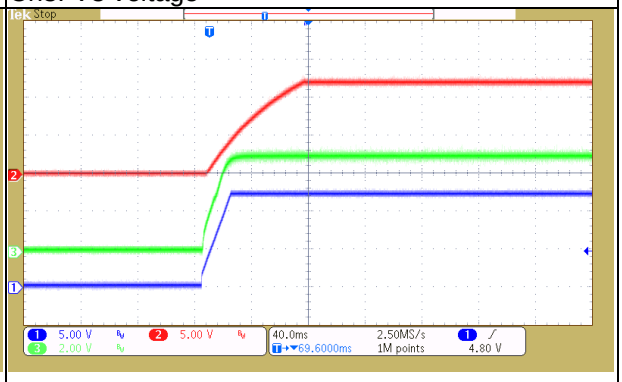
Vin: 590V DC, V2 no load, V1 V3 full load
Ch1: V2 ripple

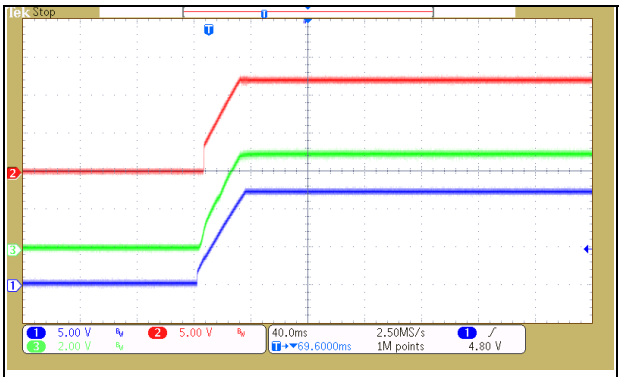
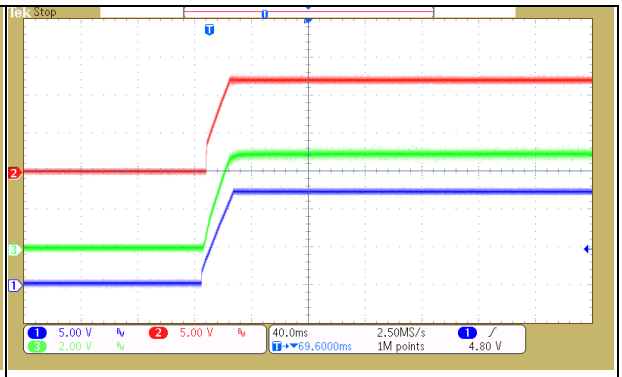


Vin:590V DC, V1 V2 V3 full load
Ch1: V2 ripple

	
Vin:150V DC, V3 no load, V1 V2 full load Ch1: V3 ripple	Vin:150V DC, V1 V2 V3 full load Ch1: V3 ripple
	
Vin: 530V DC, V3 no load, V1 V2 full load Ch1: V3 ripple	Vin:530V DC, V1 V2 V3 full load Ch1: V3 ripple
	
Vin: 590V DC, V3 no load, V1 V2 full load Ch1: V3 ripple	Vin: 590V DC, V1 V2 V3 full load Ch1: V3 ripple

3.3 Start-up Sequence

	
Vin: 150V DC, V1 V2 V3 full load start up Ch1: V1 voltage Ch2: V2 voltage Ch3: V3 voltage	Vin: 530V DC, V1 V2 V3 full load start up Ch1: V1 voltage Ch2: V2 voltage Ch3: V3 voltage
	
Vin: 150V DC, V1 V2 V3 full load start up Ch1: V1 voltage, with 2200uF cap load Ch2: V2 voltage Ch3: V3 voltage	Vin: 530V DC, V1 V2 V3 full load start up Ch1: V1 voltage, with 2200uF cap load Ch2: V2 voltage Ch3: V3 voltage
	
Vin: 150V DC, V1 V2 V3 full load start up Ch1: V1 voltage Ch2: V2 voltage, with 3300uF cap load Ch3: V3 voltage	Vin: 530V DC, V1 V2 V3 full load start up Ch1: V1 voltage Ch2: V2 voltage, with 3300uF cap load Ch3: V3 voltage

	
Vin: 150V DC, V1 V2 V3 full load start up Ch1: V1 voltage Ch2: V2 voltage Ch3: V3 voltage, with 470uF cap load	Vin: 530V DC, V1 V2 V3 full load start up Ch1: V1 voltage Ch2: V2 voltage Ch3: V3 voltage, with 470uF cap load

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