Eliminating the 12V Battery with the use of a Sine Amplitude Converter to create a 12V power from the high Voltage Vehicle Battery

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SAE Paper # (if applicable, delete text box if Oral Only (no paper))

The 12V Lead-Acid Battery will be Banned!

The 12V Lead Acid Battery in Countries like Norway and Netherlands have expressed bans for ICE vehicles from 2025, even Germany vowing to wean itself off its ICE addiction by 2030.

The battery is a warranty issue

The lead acid battery is heavy and has no intelligence on its cycle time or health

The 12V Battery Benefits

Alternate reservoir of energy not dependent on upstream electronics status

Not dependent on the High Voltage Battery

Why not replace the Battery with a Sine Amplitude Converter?

Important Perimeters

Dynamic Response

Redundancy

Vibration

Feedback or Communication to component

BCM under Test

Outputs and Type	1, Isolated
Voltage - Output	47.5V
Current - Output	25.7A
Voltage - Input	260V ~ 410V
Regulator Topology	Buck
Frequency - Switching	1.18MHz
Board Type	Fully Populated
Supplied Contents	Board(s)
Utilized IC / Part	BCM380y475x1K2A30
Power - Output	1.2 kW

https://www.digikey.com/en/products/detail/vicor-corporation/BCD380P475T1K2A30/4740999

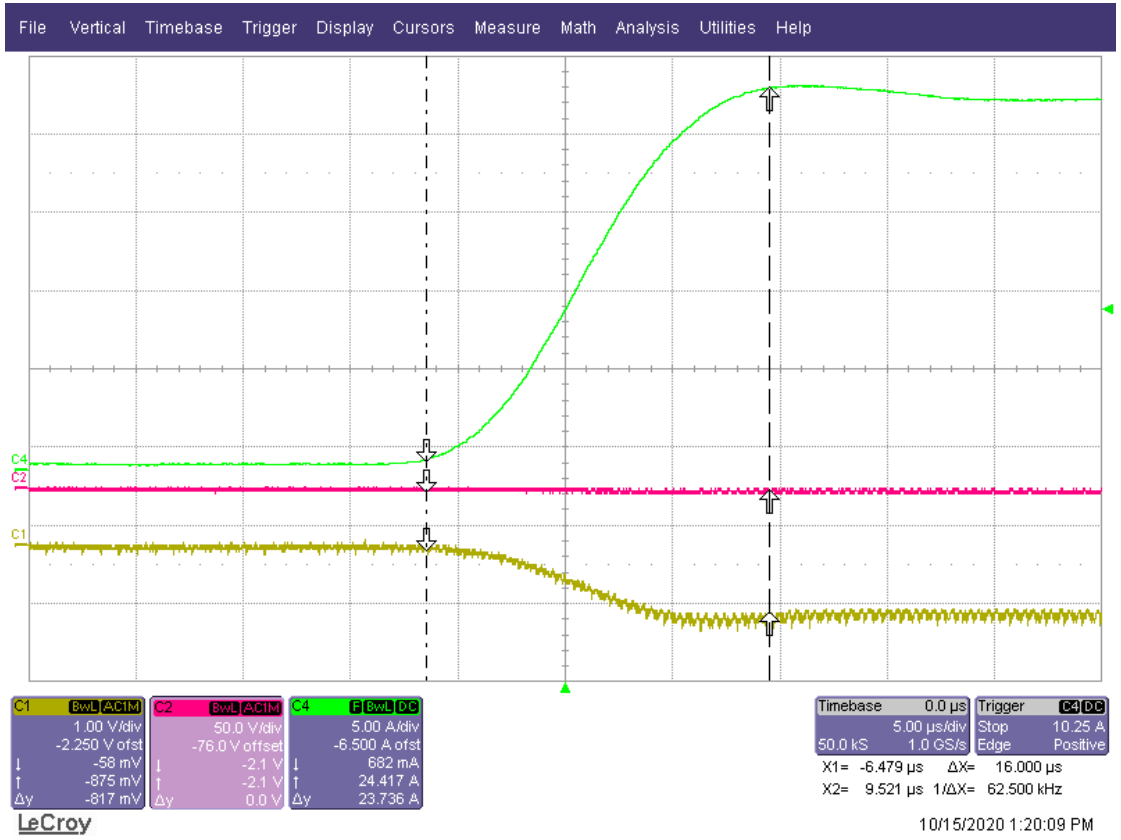
BCM6123 Transient Response

Load Bank limits the di/dt

Δ Iout = 24.4A – 0.68A = 23.72A

Δ Time = 16usec = 0.016msec

di/dt = 1,424A/msec



Vin at 50V/div and Vout at 1V/div

BCM6123 with load switching 0.68A to 24.4A

Load Bank limits the di/dt

Δ Vin = 1.063V

Δ Vout = 0.843V

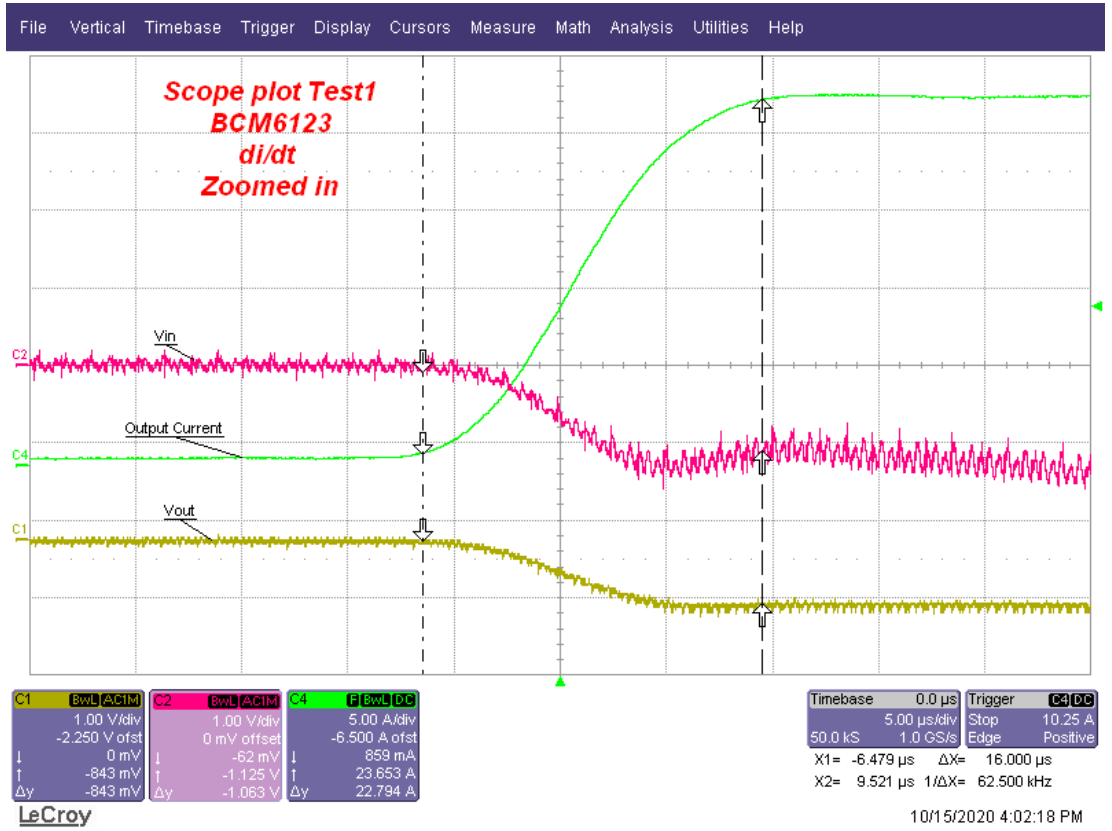
K = 1/8

Input reflected to Vout

- 1.063V/8 = 0.133V

Voltage Drop

- 0.843V – 0.133V = **0.710V**
- Voltage Drop is the BCM + Cables



Vin and Vout at same scale of 1V/div

NBM2317
48V to 12V Bus Converter at 1kW

NBM2317 in Boost Mode 12V →48V

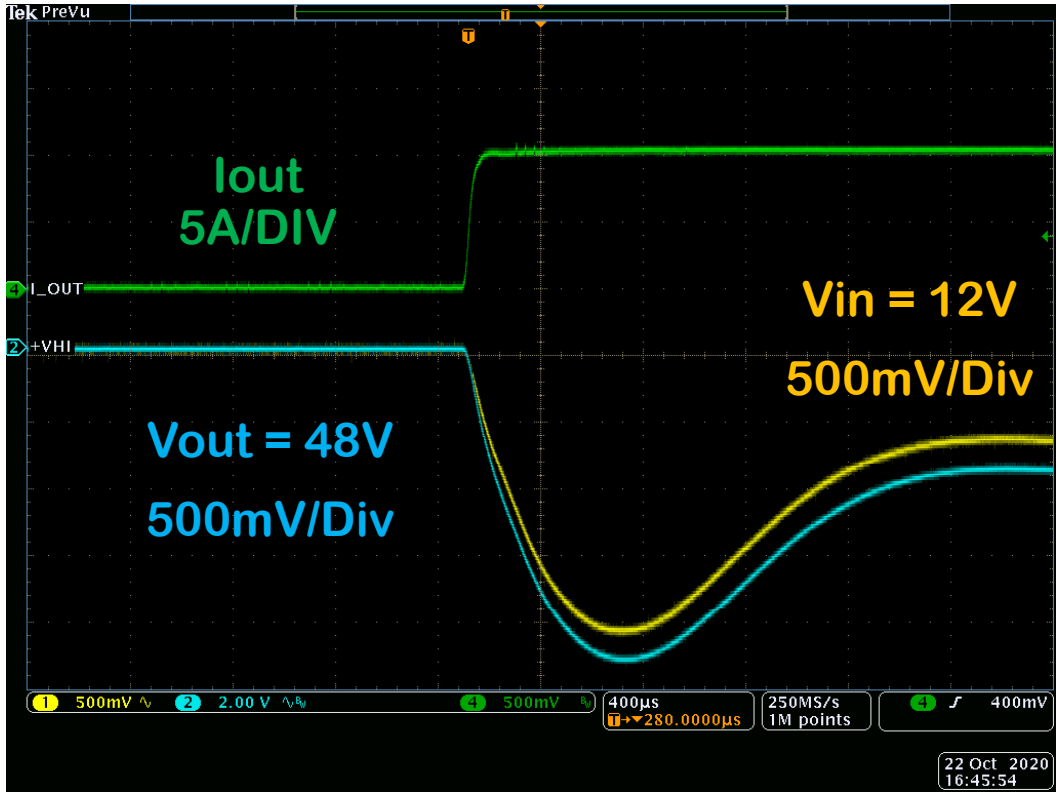
Vin =12V

Vout = 48V

Vin and Vout is superimposed

Load Step 0 to 12A

Voltage is AC Coupled to see the dip



The Next Slides are
Vin = 48V
Vout = 12V
48V → 12V

Step Down or Buck

Transient Testing with Electronic Load Bank

NBM2317 in Buck Mode 48V →12V

Vin is 48V

Vout is 12V

Load 0 to 60A

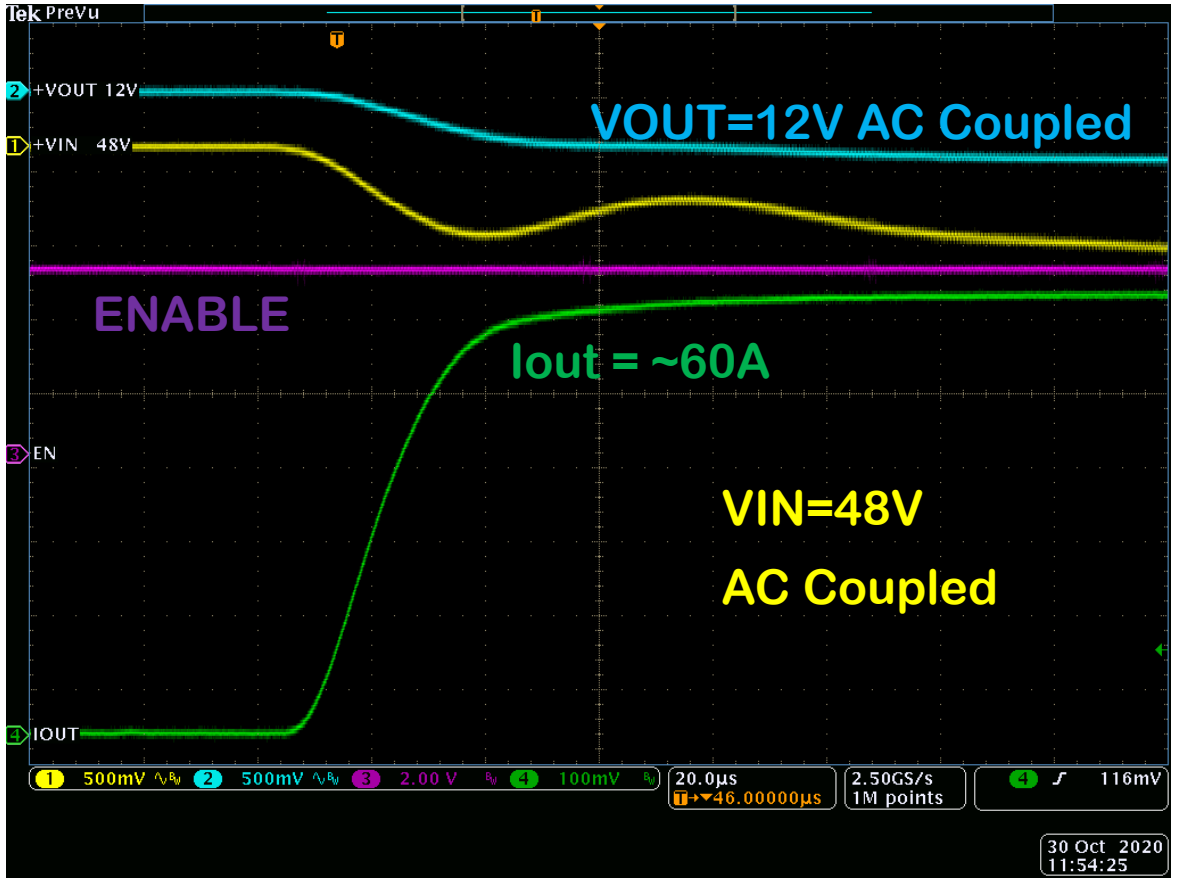
Electronic Load

Yellow = 48V = Vin

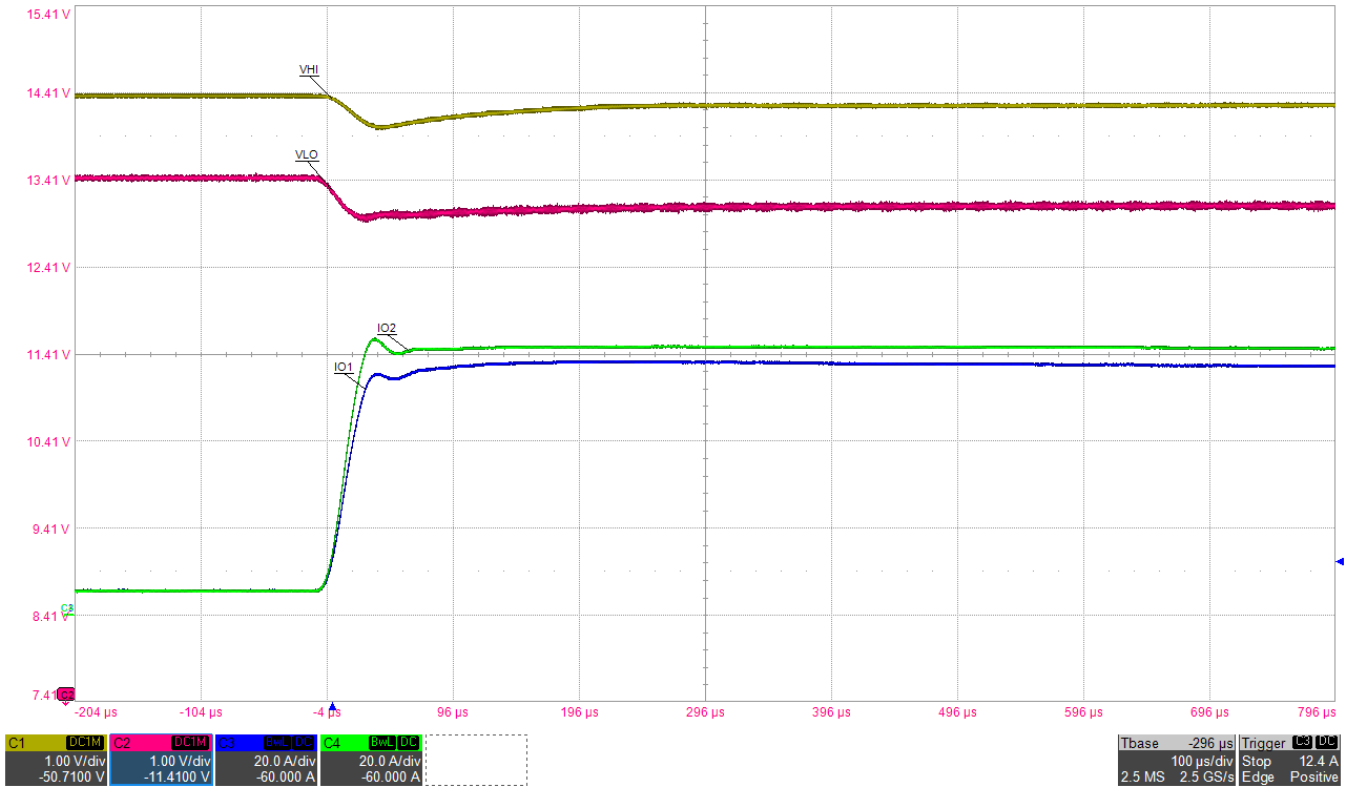
Blue = 12V = Vout

Purple = Enable

Green = Iout at 10A/div.



Load transient test 12A to 120V 54V Bus Load Applied



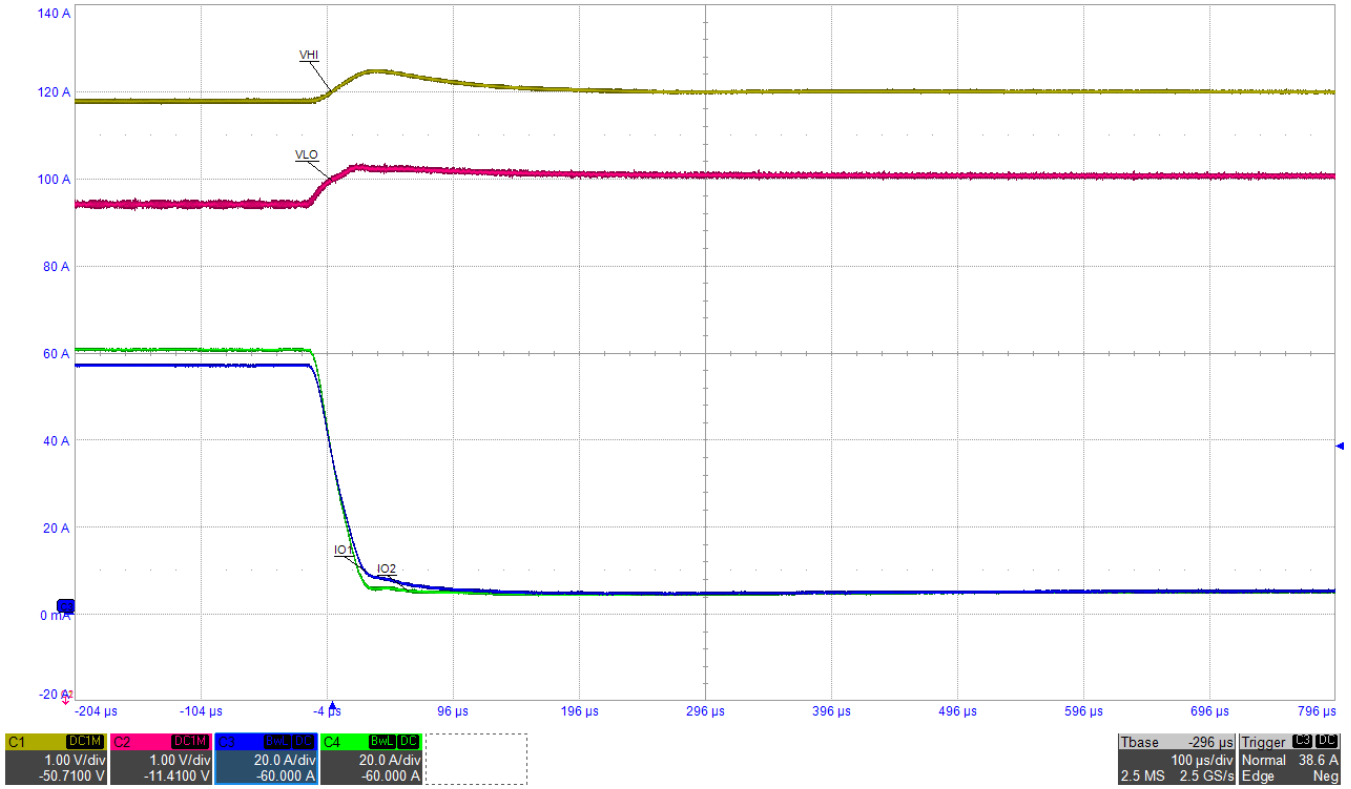
- Slew rate≈3A/us
- NBM2317
- Vin = 12V
- Vout = 54V
- 2UP Array Step transient test
- (DC coupled voltage probes)

CH1 – V_{HI}: 1V/div (DC)
CH2 – V_{LO}: 1V/div (DC)

CH3 – I_{O1}: 20A/div (DC)
CH4 – I_{O2}: 20A/div (DC)

Timebase
100µs/div

Load transient test 12A to 120V 54V Bus Load Removed



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Timebase
100µs/div

Redundancy

Provide three separate channels of power from the High Voltage Battery

- 1. Power for the typical non-critical loads that can be turned off during an accident
- 2. Steering and Braking – Always are on
- 3. Can bus and Communication – Always are on

Speaker information

Thank you

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Patrick is the lead Automotive Principal Field Applications Engineer, helping power engineers architect new Automotive power delivery systems. He has a BS in Electrical Engineering from Illinois Institute of Technology.

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