A 200 Amp Current Source with 12 V Input for Automotive Applications

by

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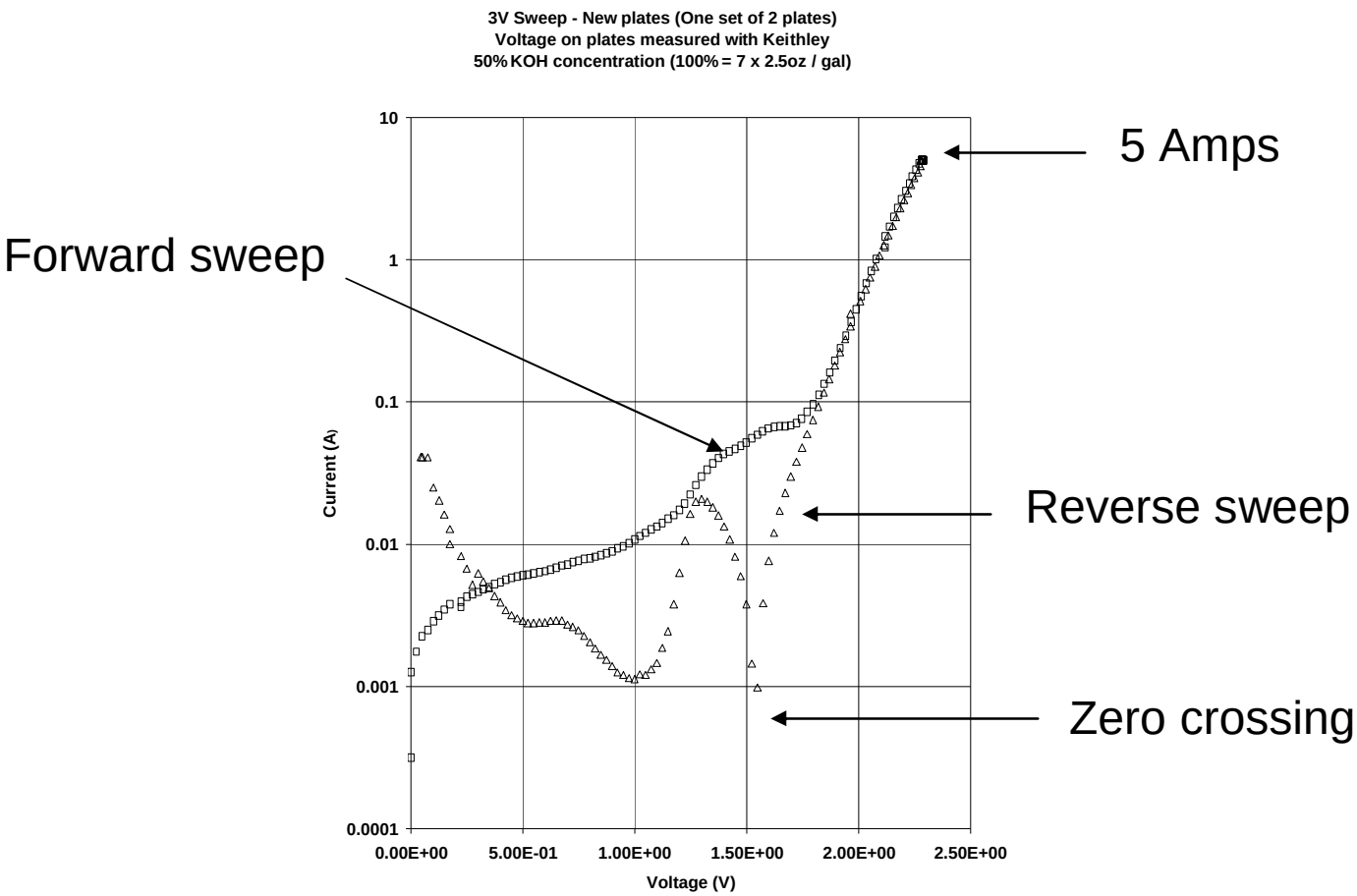
Introduction

- Automotive need for HHO gas
  - Emissions
  - Fuel efficiency
- HHO generator design needs
  - Volume produce
  - Volume control
  - Temperature stability
- Demo

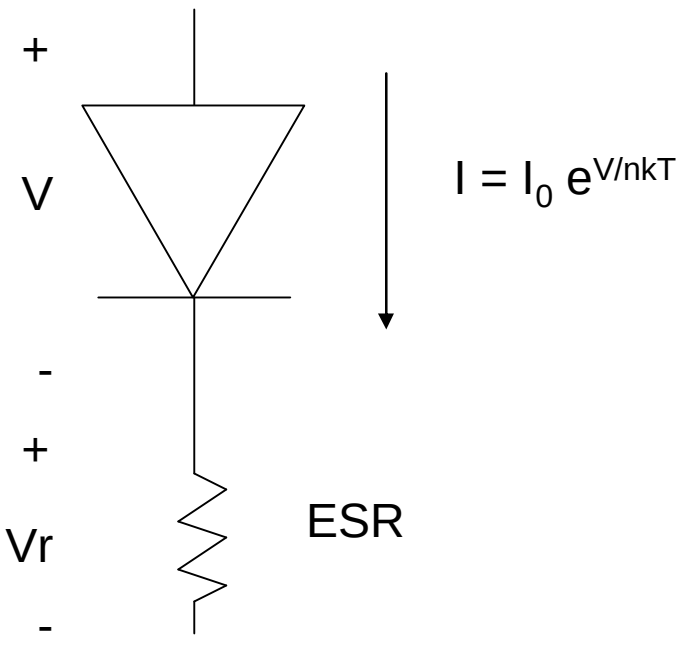
Objective of Presentation

- Understanding an HHO generator as an electrical device (i.e. I-V characteristics)
- Provide pertinent information for generator design and powering

Two plate I-V Characteristic Feb 4, 2010



Model Equation



Transport Equations

Continuity equation

$$\begin{cases} \nabla J_n - q\dfrac{\partial n}{\partial t} = q(R-G) \\ \nabla J_p + q\dfrac{\partial p}{\partial t} = q(G-R) \end{cases}$$

Neg. drift + diffusion $$J_n = \sigma_n E + qD_n \nabla n$$

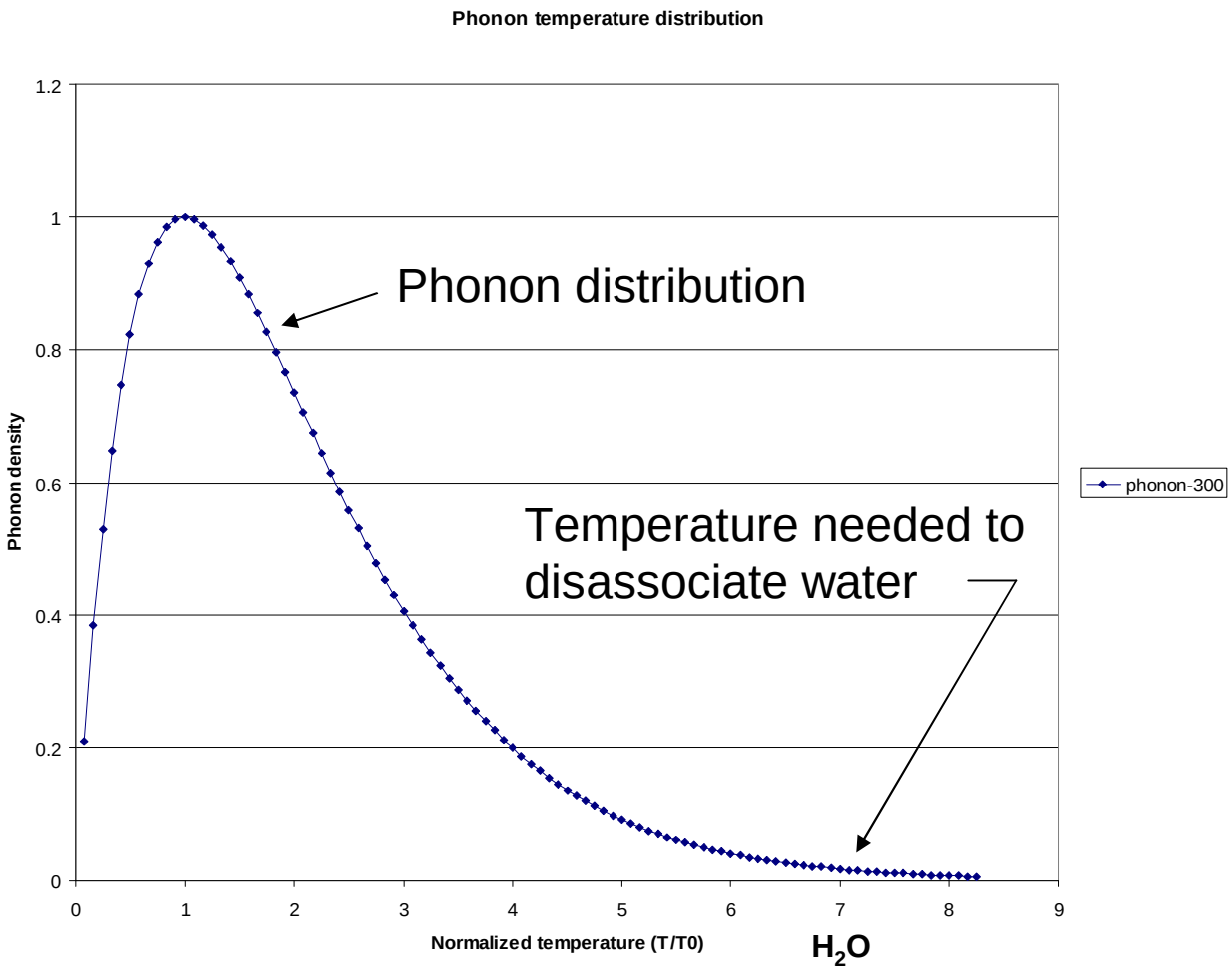
Pos. drift + diffusion $$J_p = \sigma_p E - qD_p \nabla p$$

Section 3, QRM, Wiley and Sons, 1985.

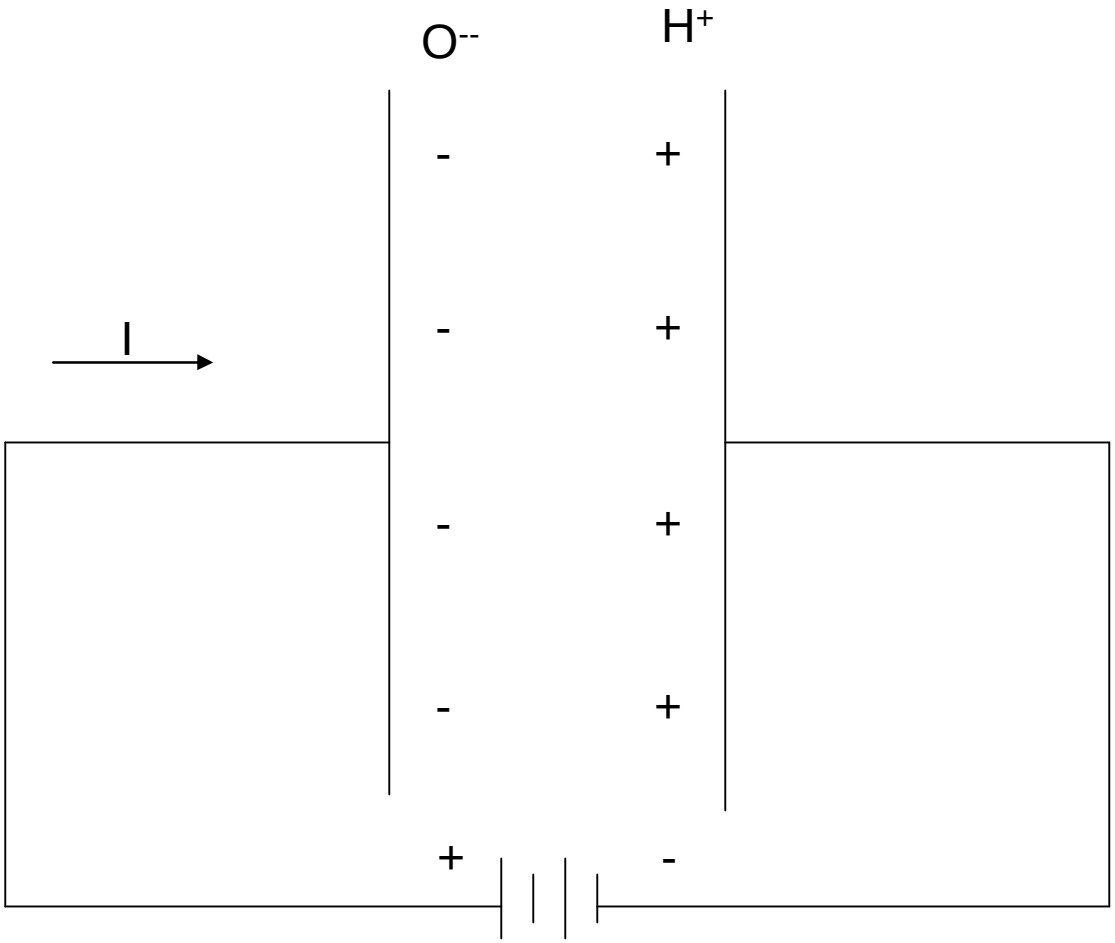
Hydrolysis Equilibrium
R-G =0

- $H_2O \underset{R}{\overset{G}{\rightleftharpoons}} 2H^+ + O^{--}$

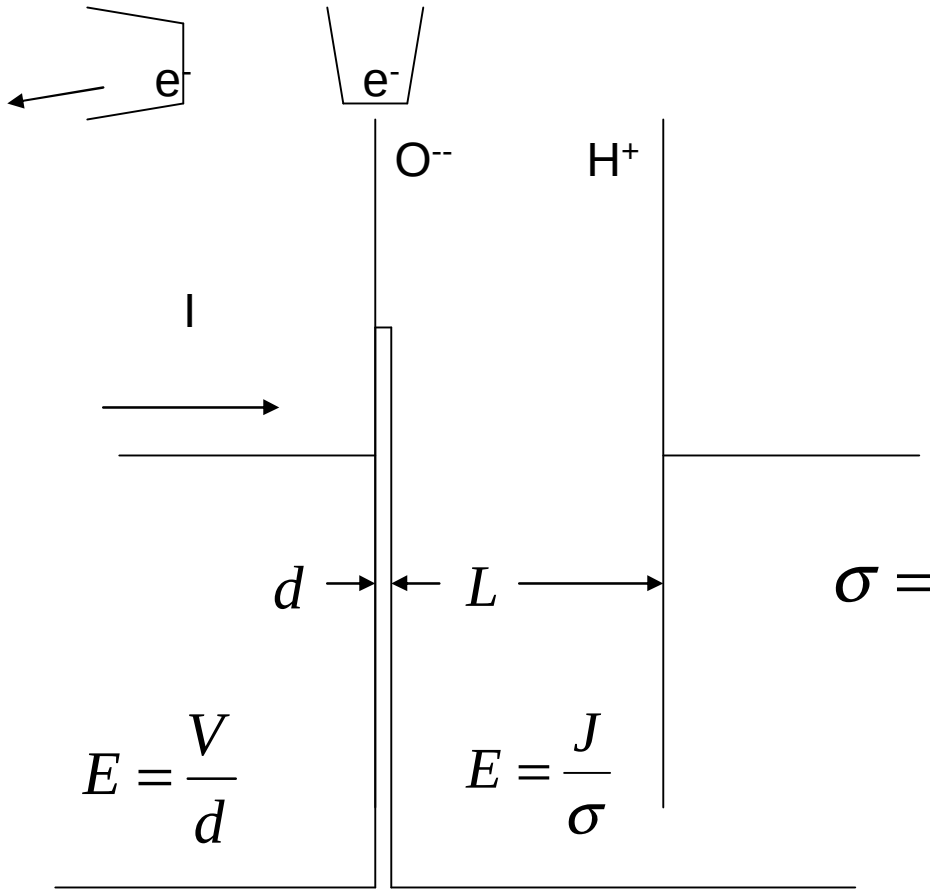
Equilibrium R-G=0



Stopping Recombination by Seperation R=0



Overcoming Electrical Barriers



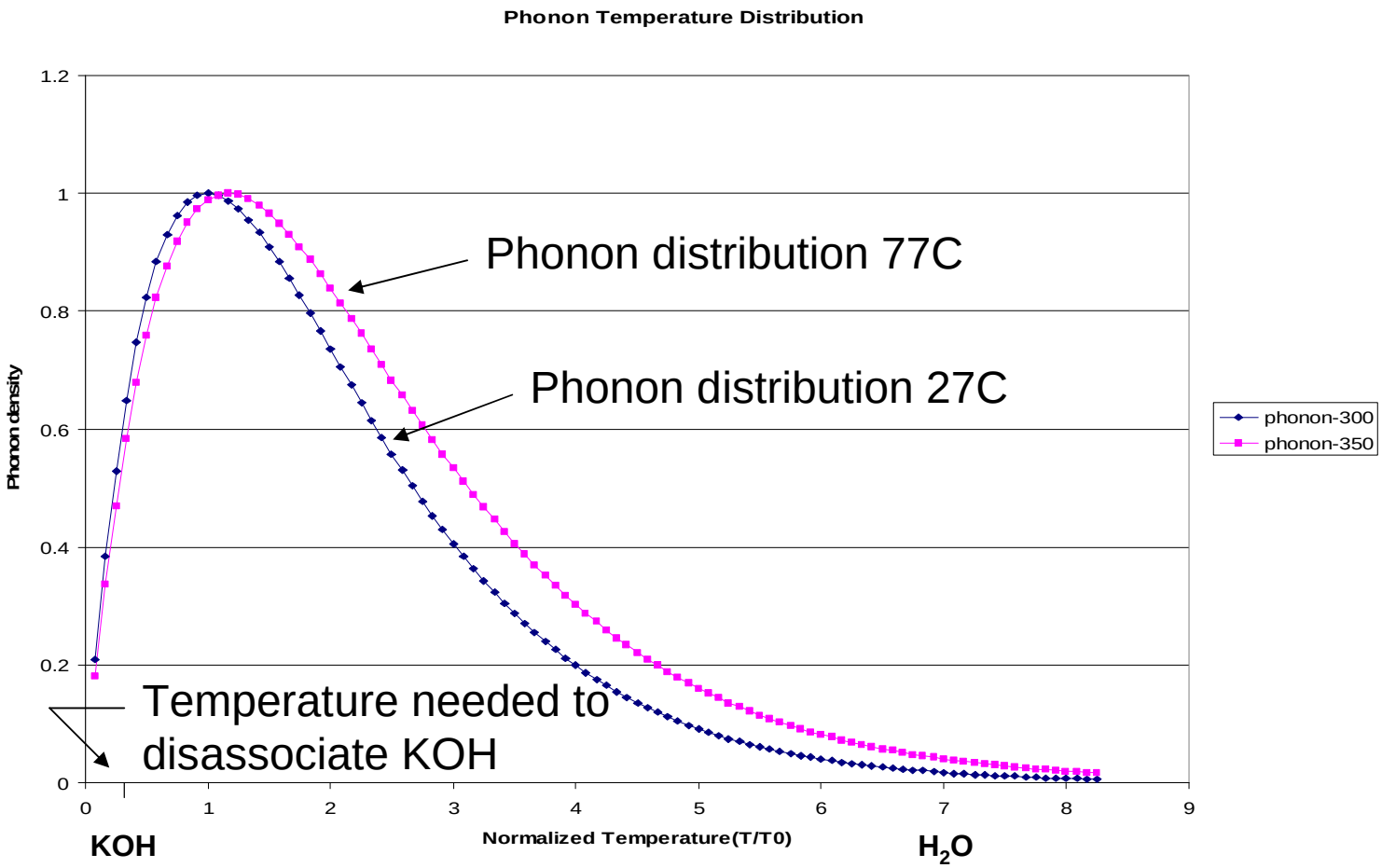
$$\sigma = q\mu_n n = \frac{1}{\rho}$$

$$R = \rho \frac{L}{A}$$

$$E = \frac{V}{d}$$

$$E = \frac{J}{\sigma}$$

Phonon distribution at T=300 and T=350



Exponential junction behavior

$$J_n = \sigma_n E + qD_n \nabla n = 0$$

$$qu_n n \nabla \psi = qD_n \nabla n$$

$$\frac{d\psi}{dx} = V_T \frac{1}{n}\frac{dn}{dx} = V_T \frac{d\ln(n)}{dx}$$

$$n_1 - n_2 = e^{\frac{\psi_1 - \psi_2}{V_T}}$$

$$I_n = AqD_n e^{V/V_T}$$

HHO production rate

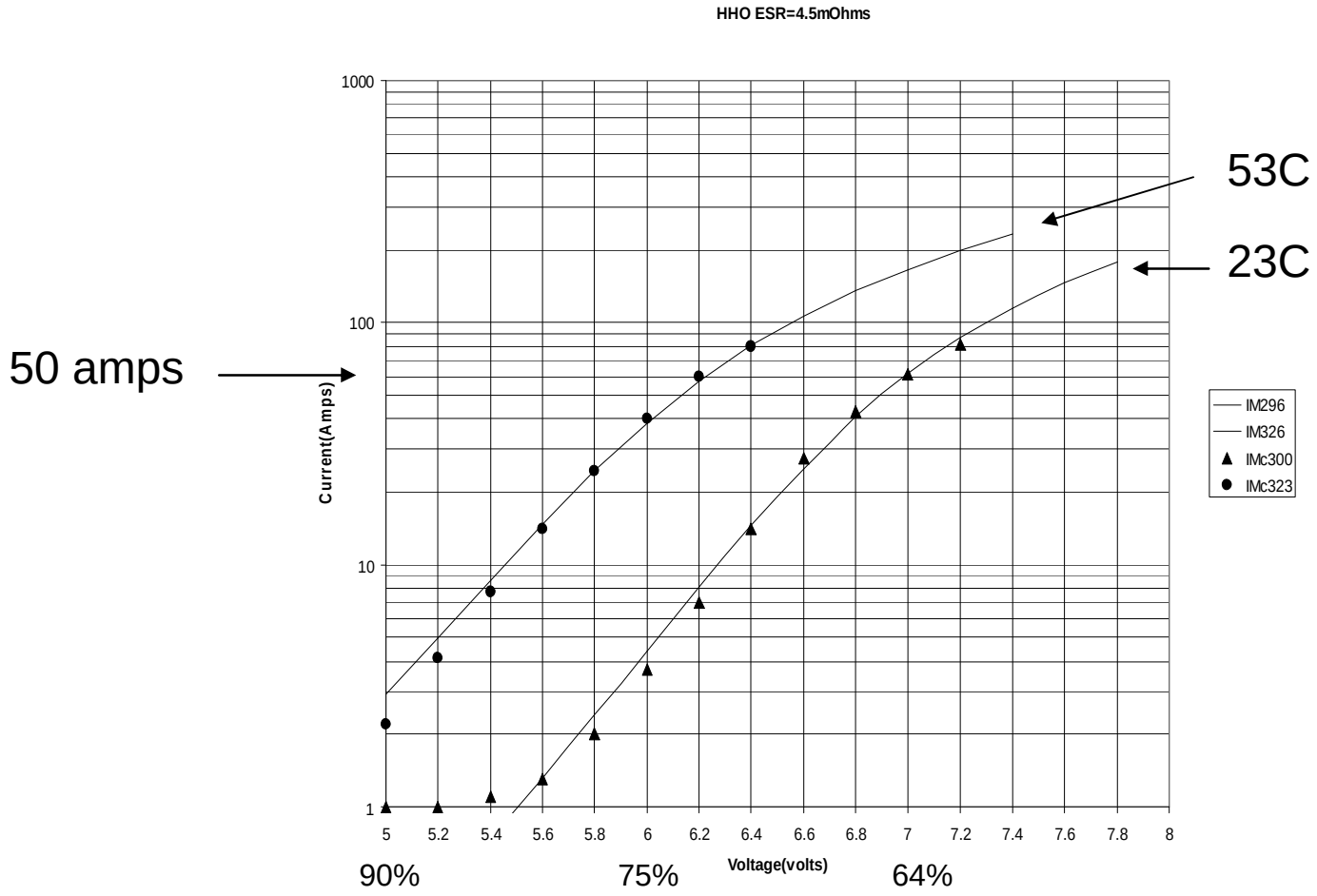
- 2 electrons per molecule of water
  - Amp = 6e18 electrons/sec
  - Mole = 6e23 molecules=22.4 liters(gas state)
  - One mole of H_2O makes 1.5 moles of HHO
- single HHO(Liters/min)= 0.011 x Amps
- 3-series HHO(Liters/min)=0.033 x Amps

Efficiency

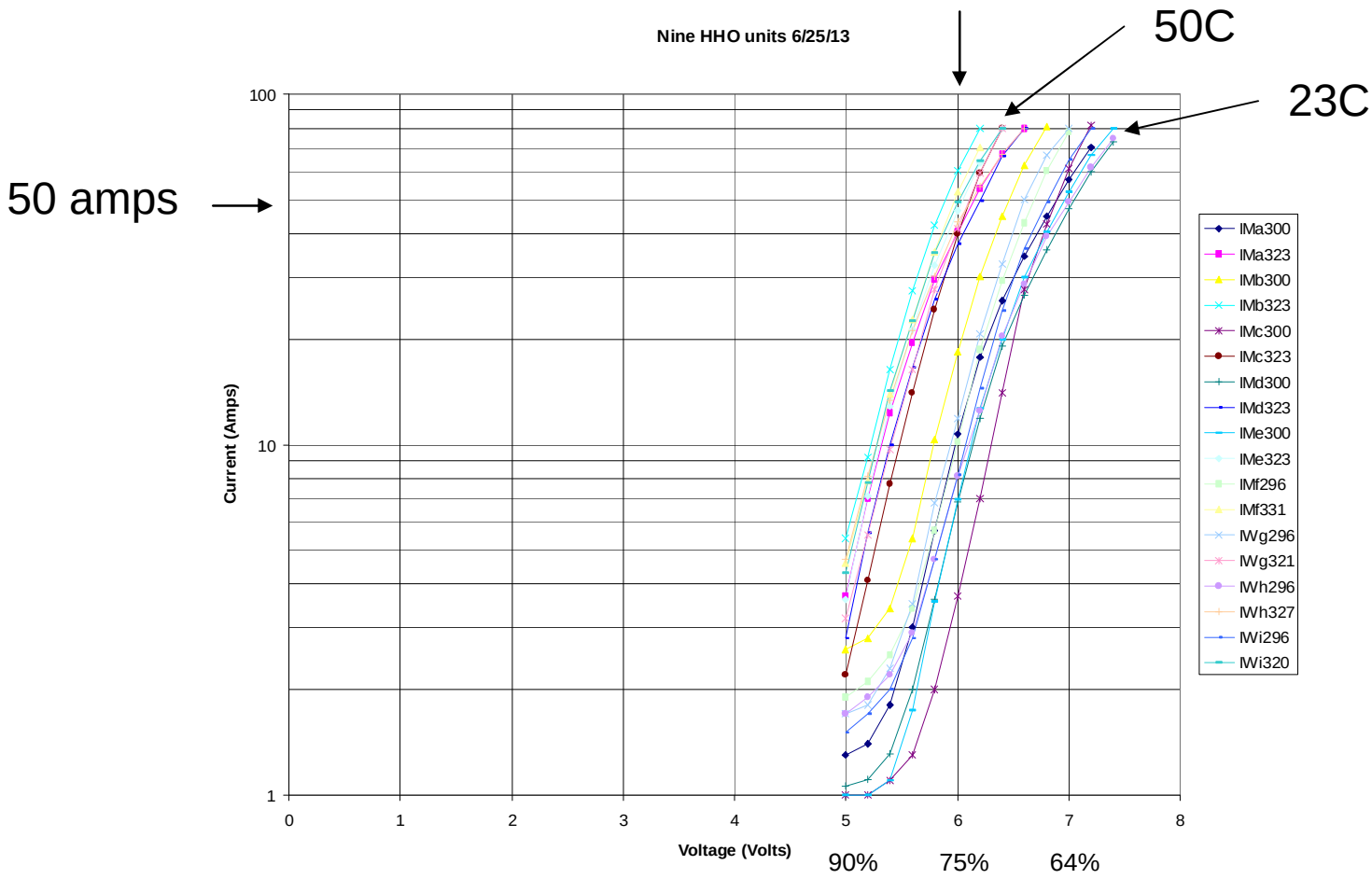
Enthalpy of: $2H_2 + O_2 \rightarrow 2H_2O$

$$Eff = \frac{PowerofHHO}{PowerIN} = \frac{1.5xI}{VxI} = \frac{1.5}{V}$$

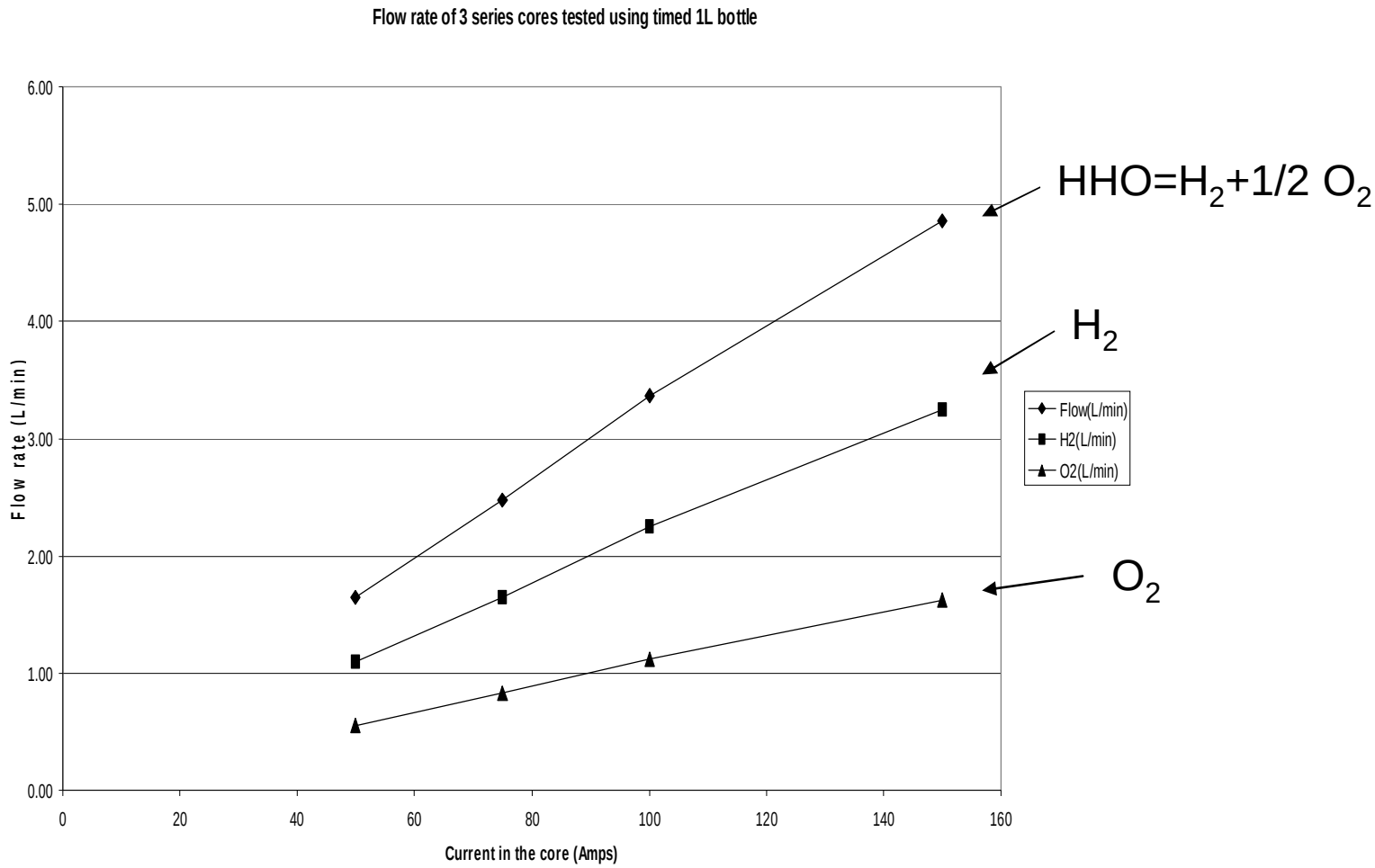
3 cores at T=296 and T=326 with overlaid model curves resulting in ESR=4.5mOhms



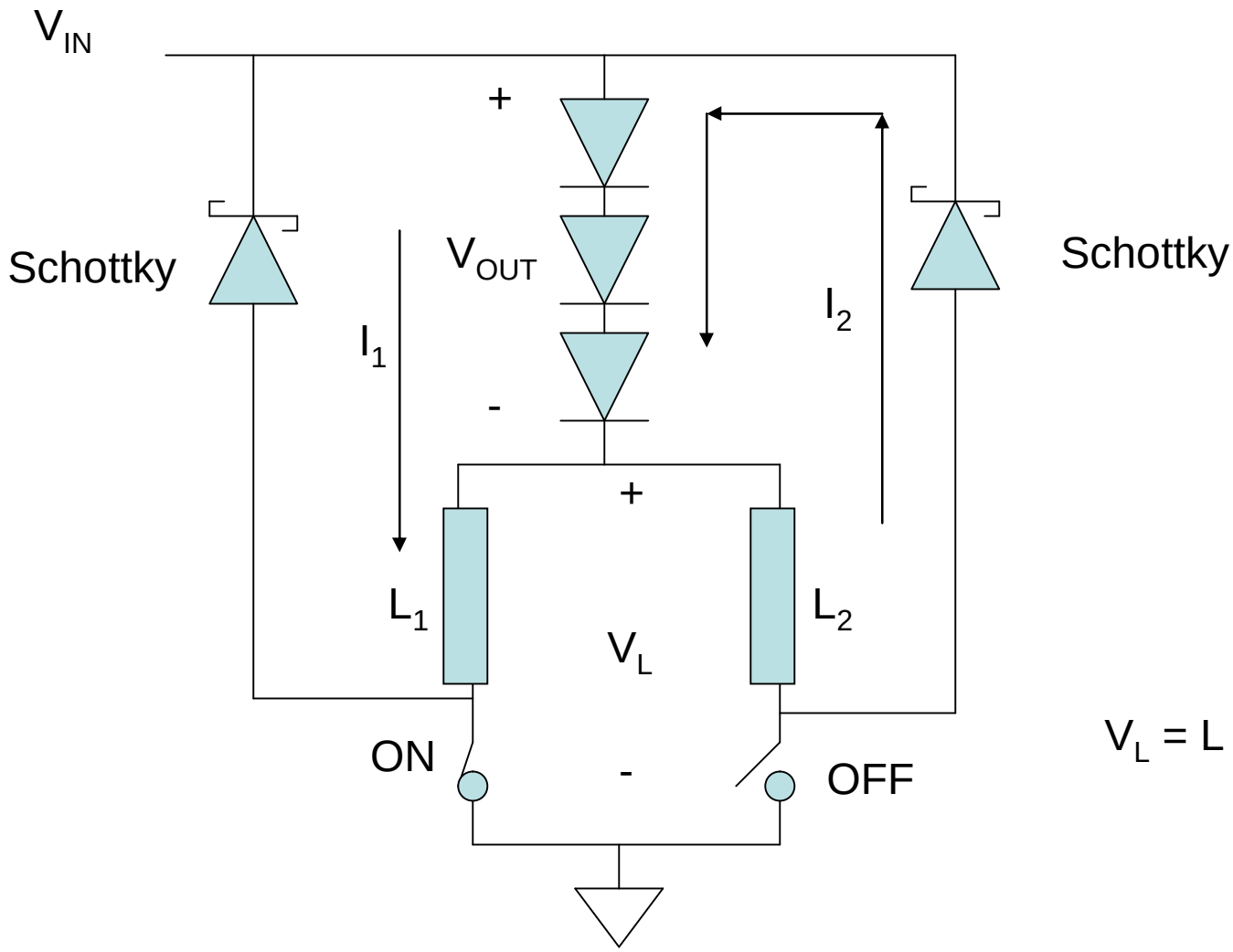
Nine 3-core HHO generators at T=300 and T=320



Measured flow rate of 3 series cores using 1 liter bottle

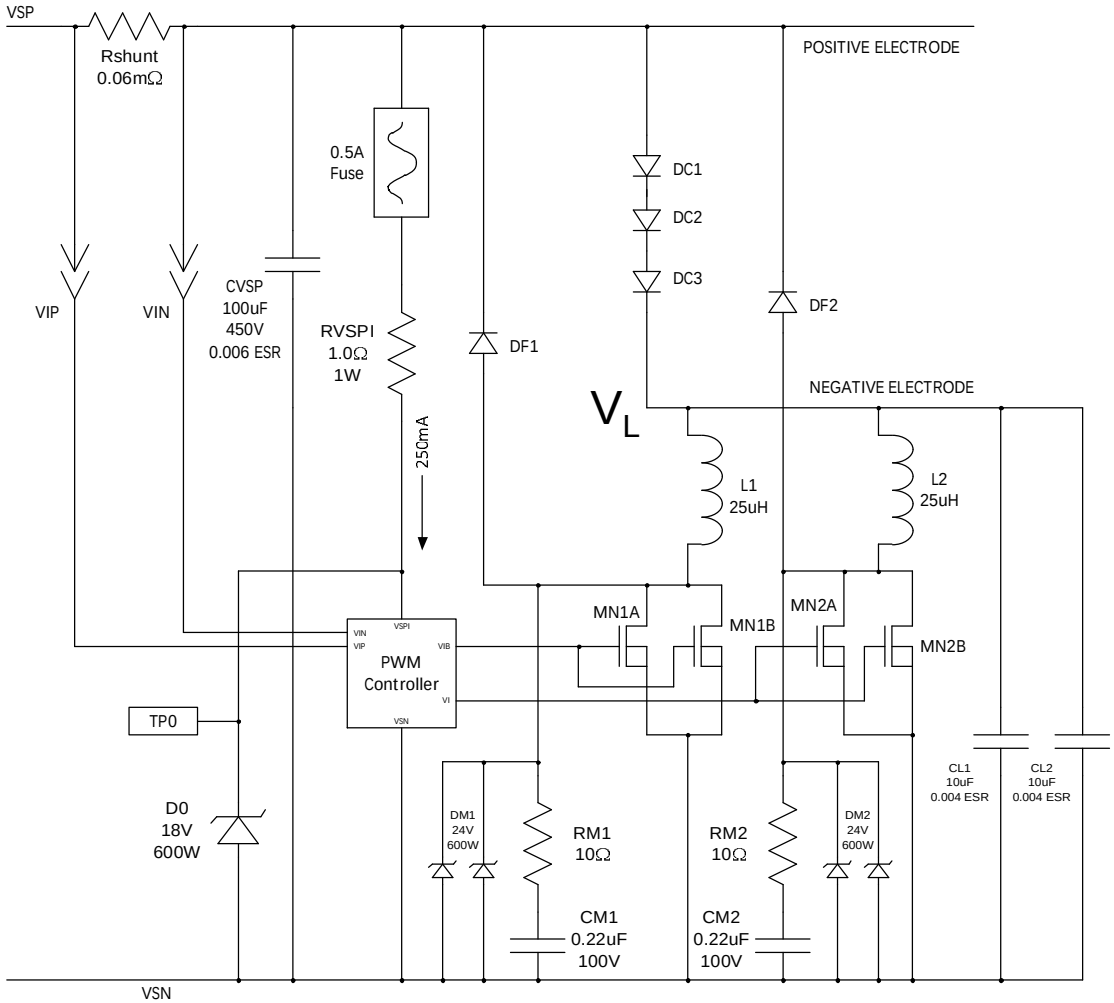


Two phase current source

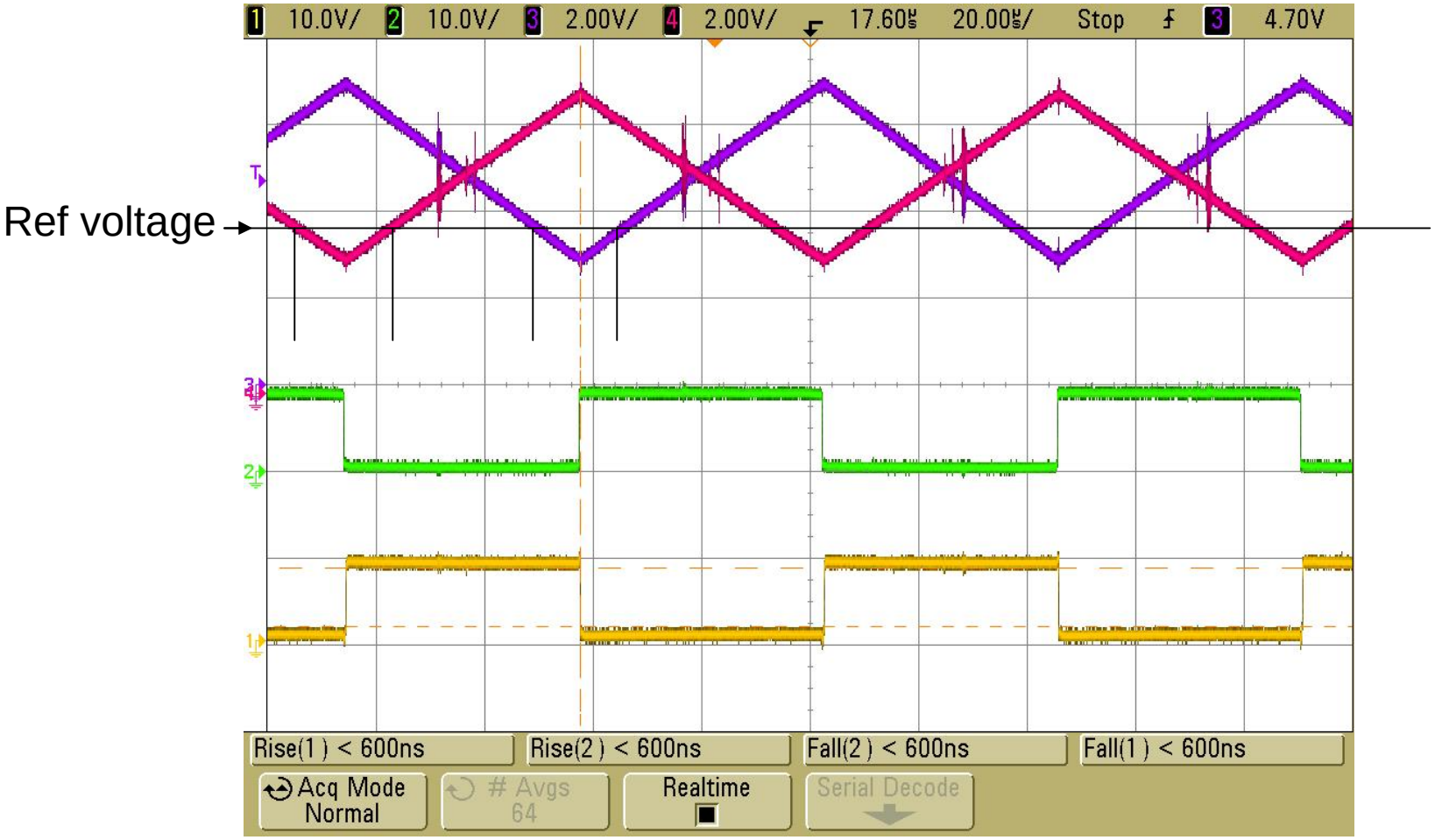


$V_L = L\ di/dt$

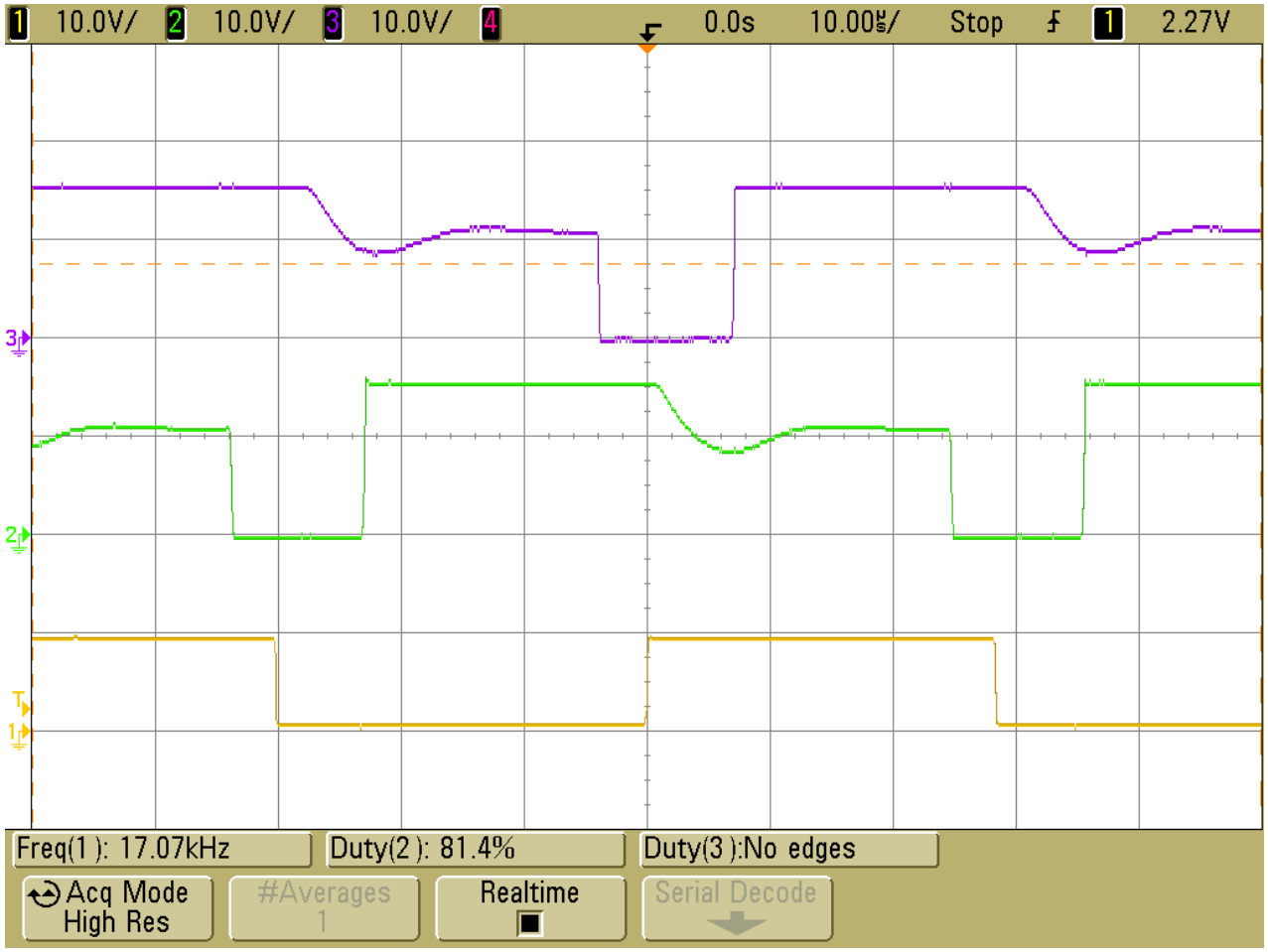
dc voltage to dc current source $I_{out}=V_{in}/V_{out}\ I_{in}$



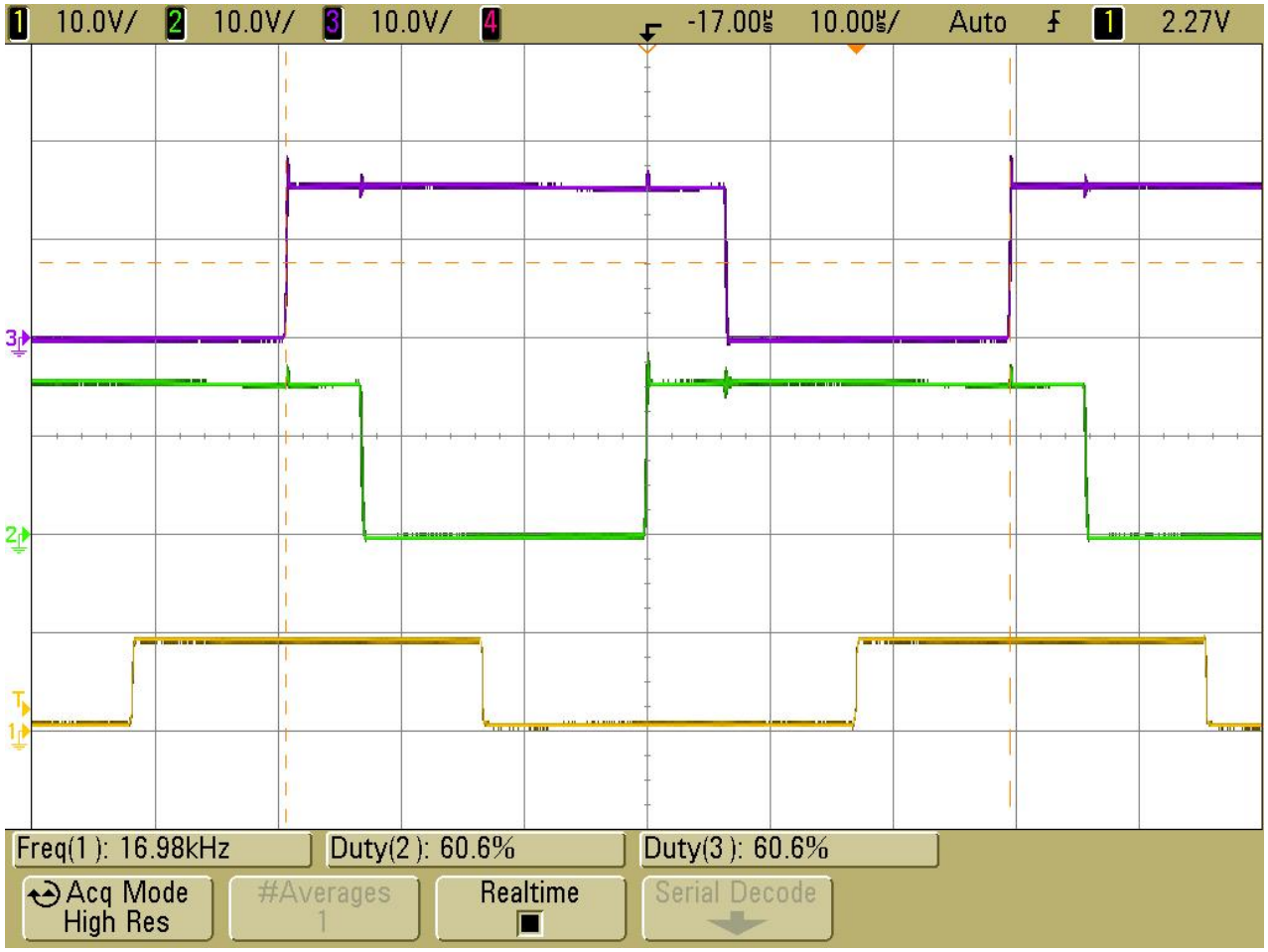
2-phase clock and gate pulses



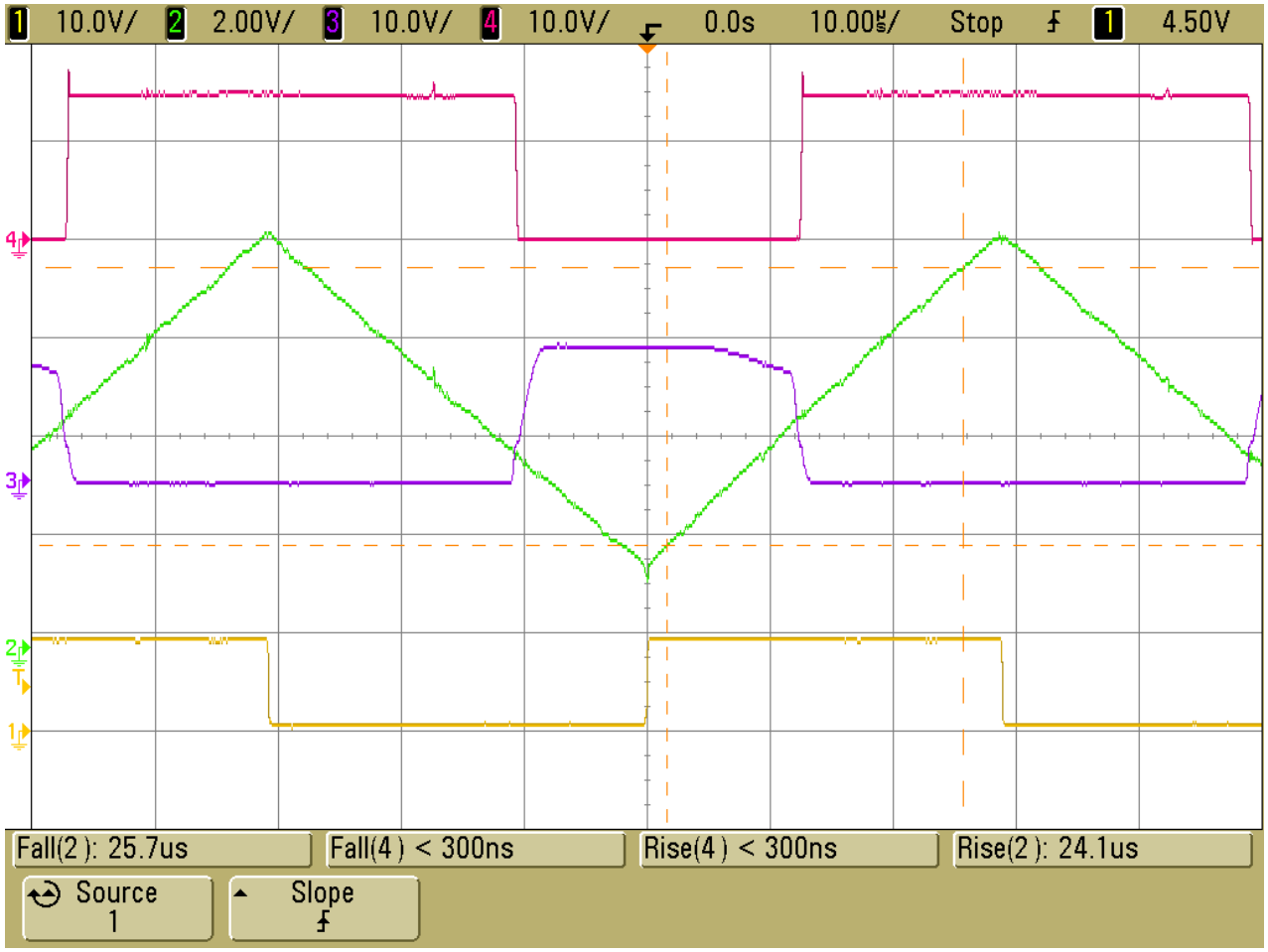
I_{IN} = 1.3A, I_{OUT}=2.3A, HHO =0.07 L/min



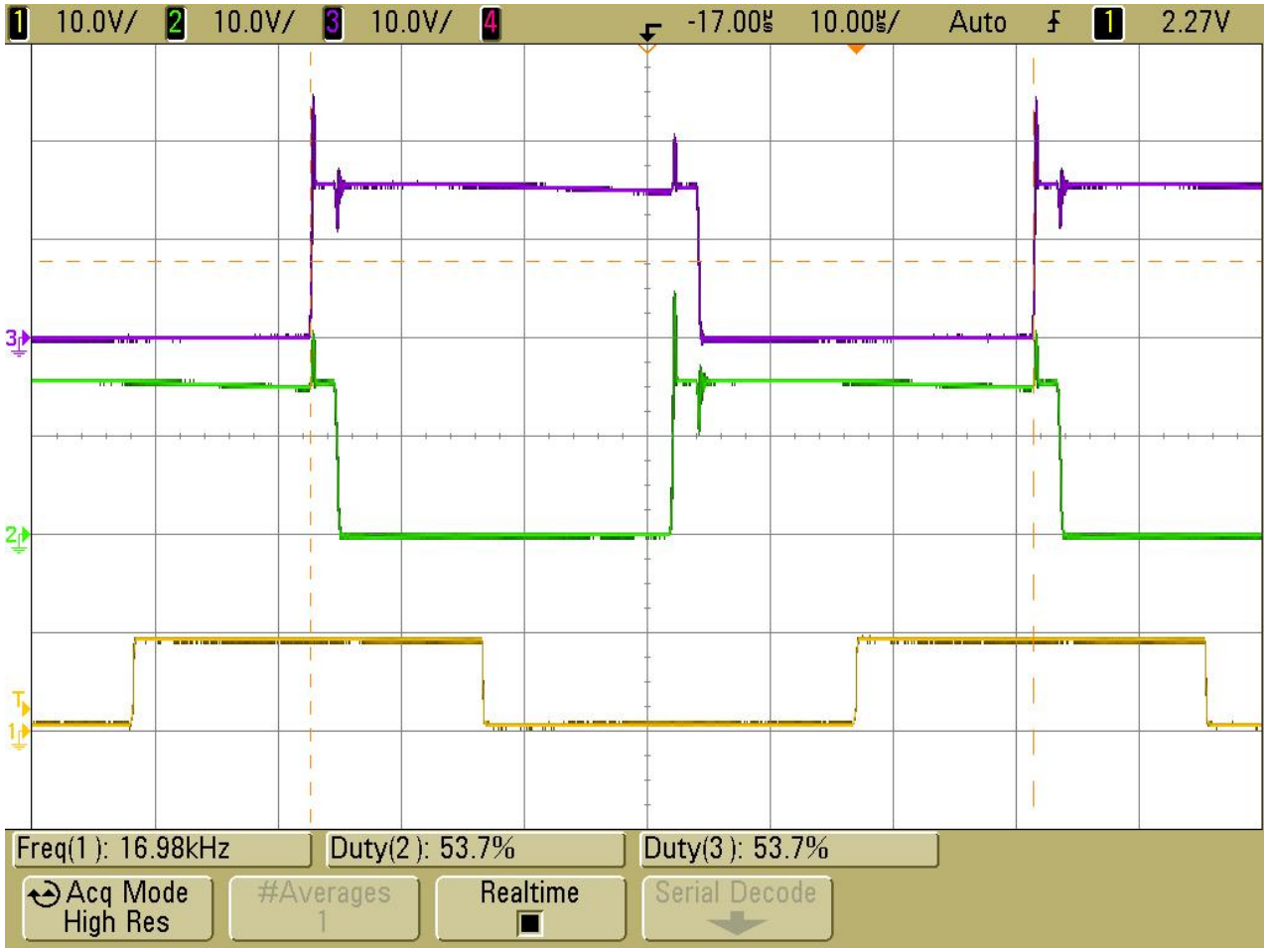
I_{IN} = 13.4A, I_{OUT}=31.2A, HHO =1 L/min



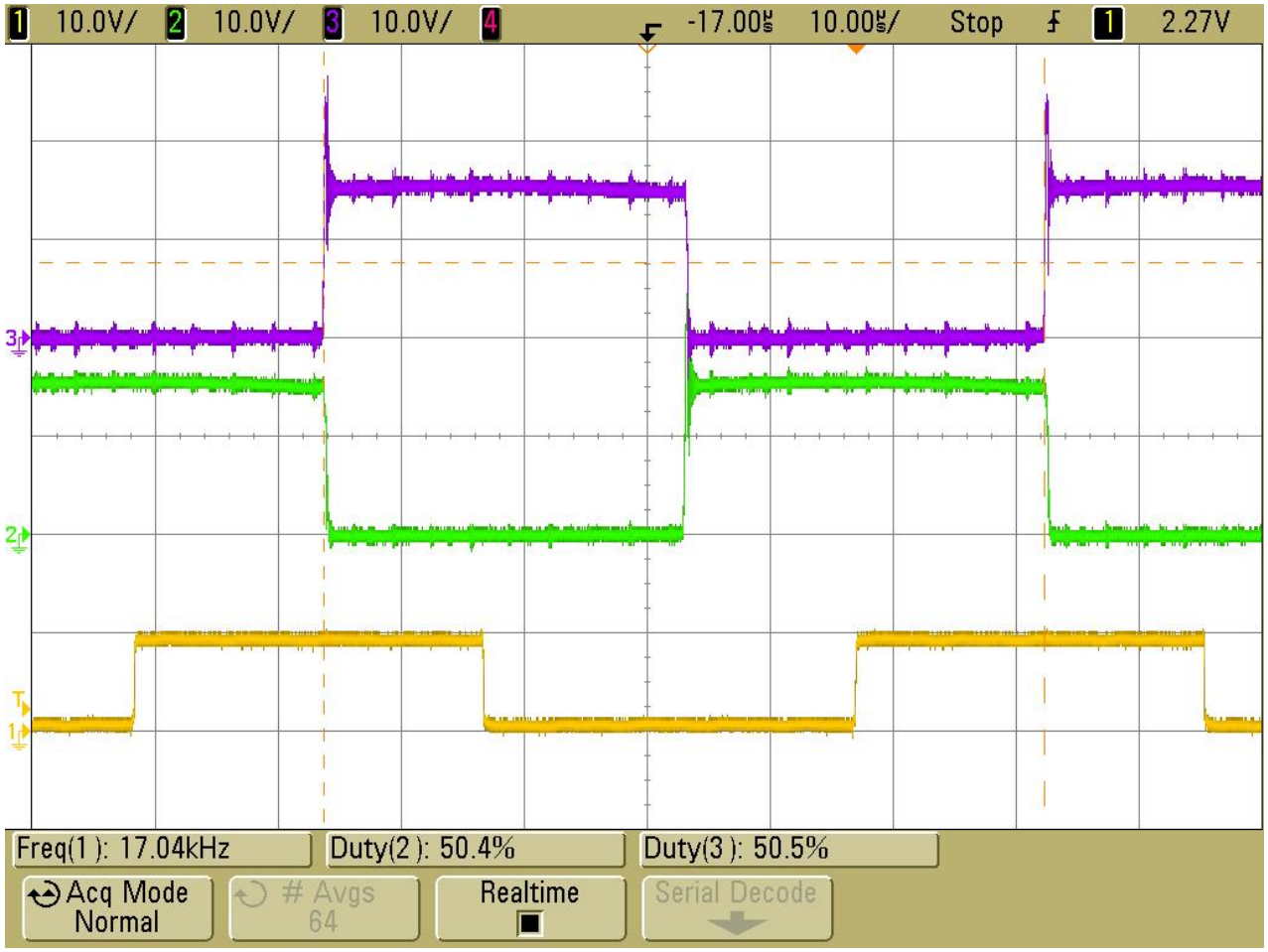
clock(1),comp(2),gate(3),coil(4)



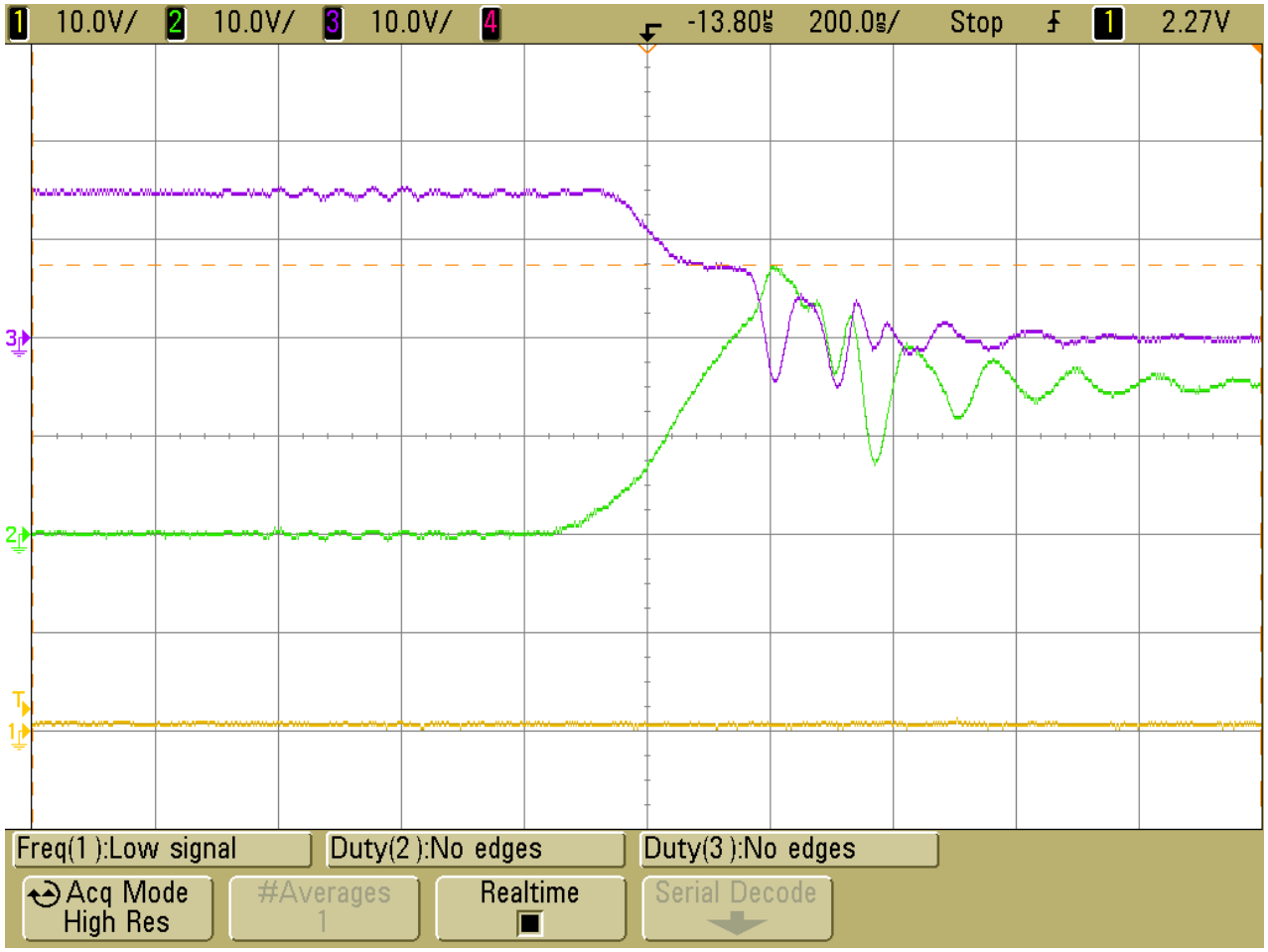
I_{IN}=27A, I_{OUT}=60A, HHO=2 L/min



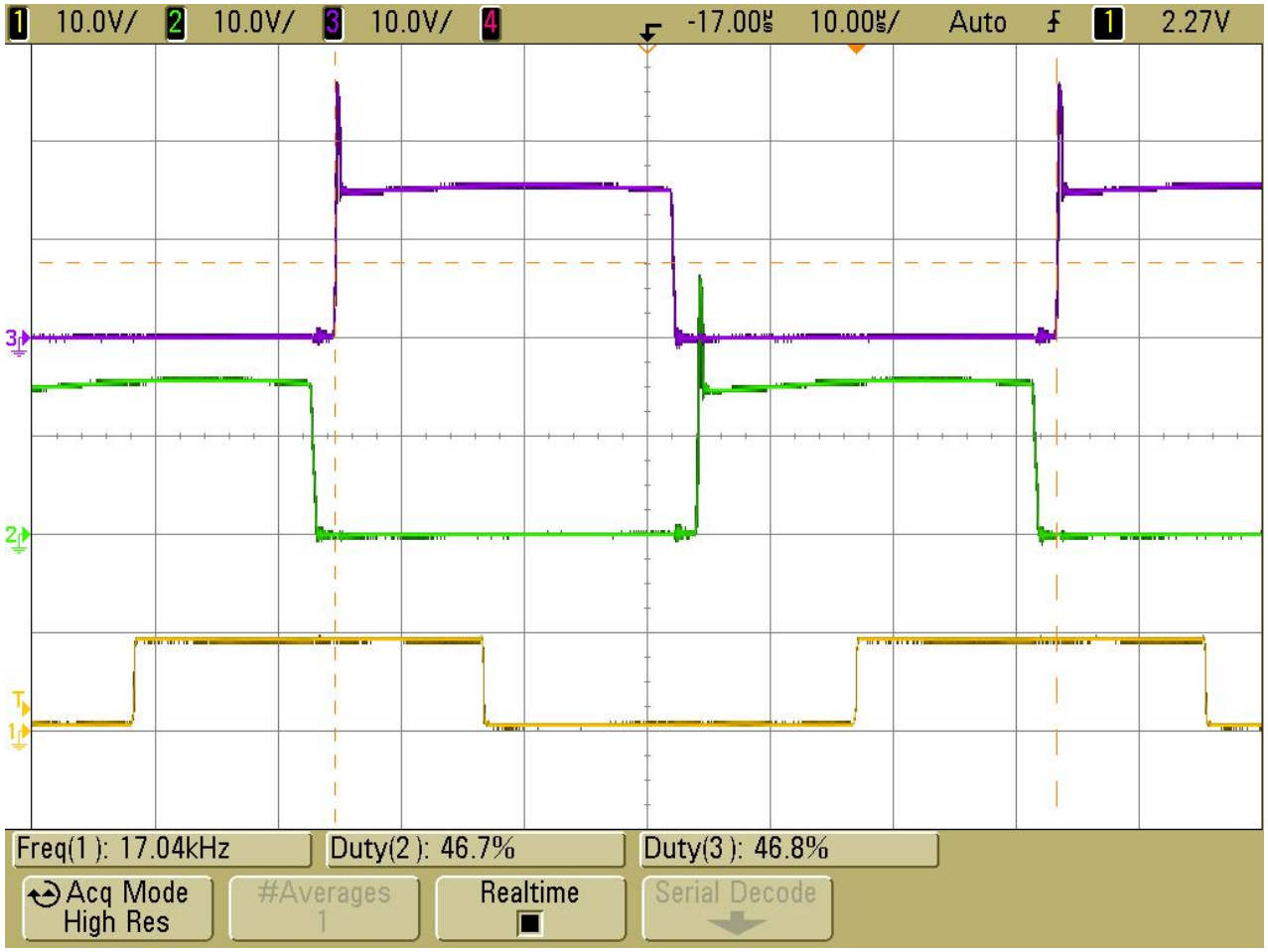
I_{IN}=43A, I_{OUT}=90A, HHO=3 L/min

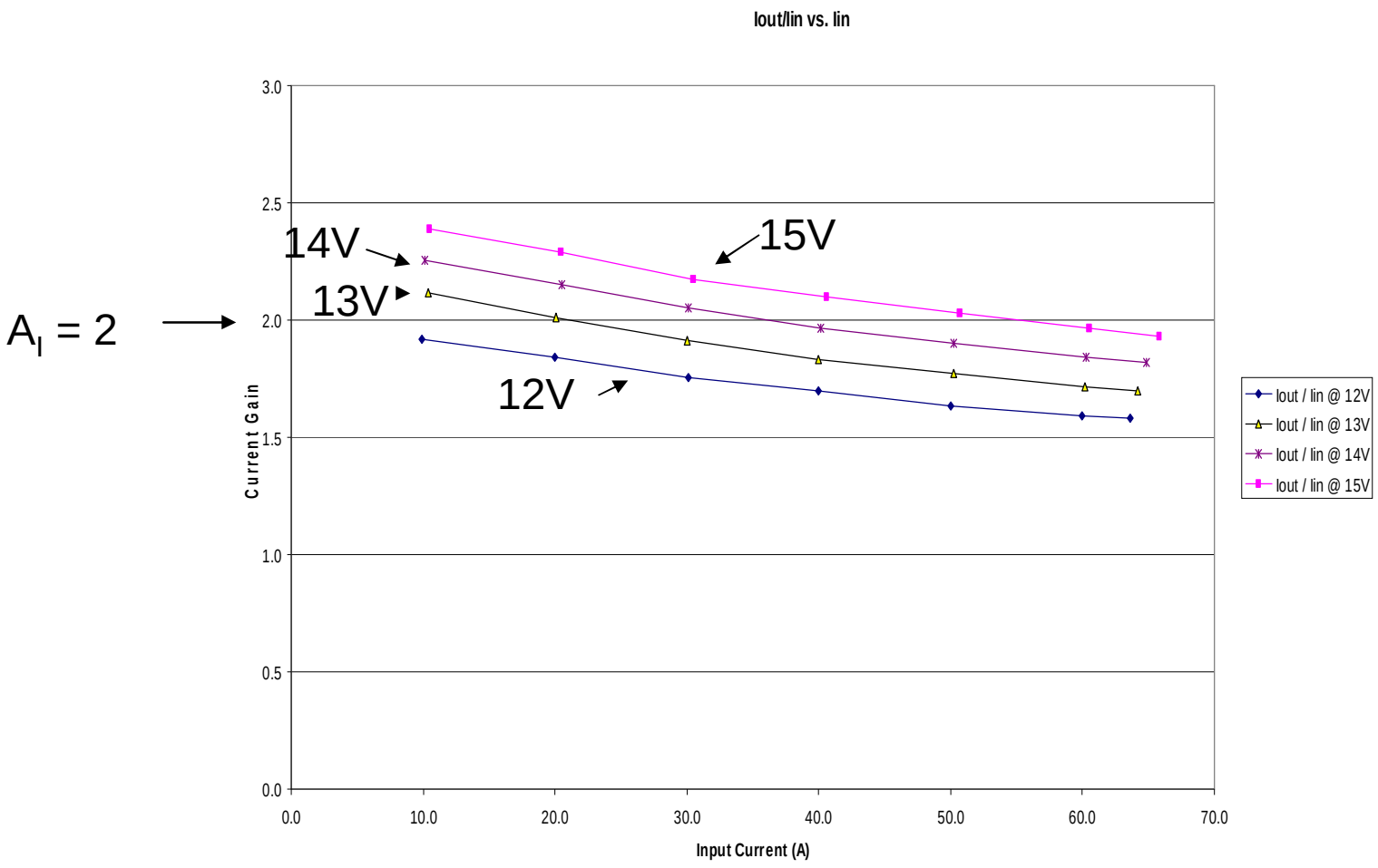


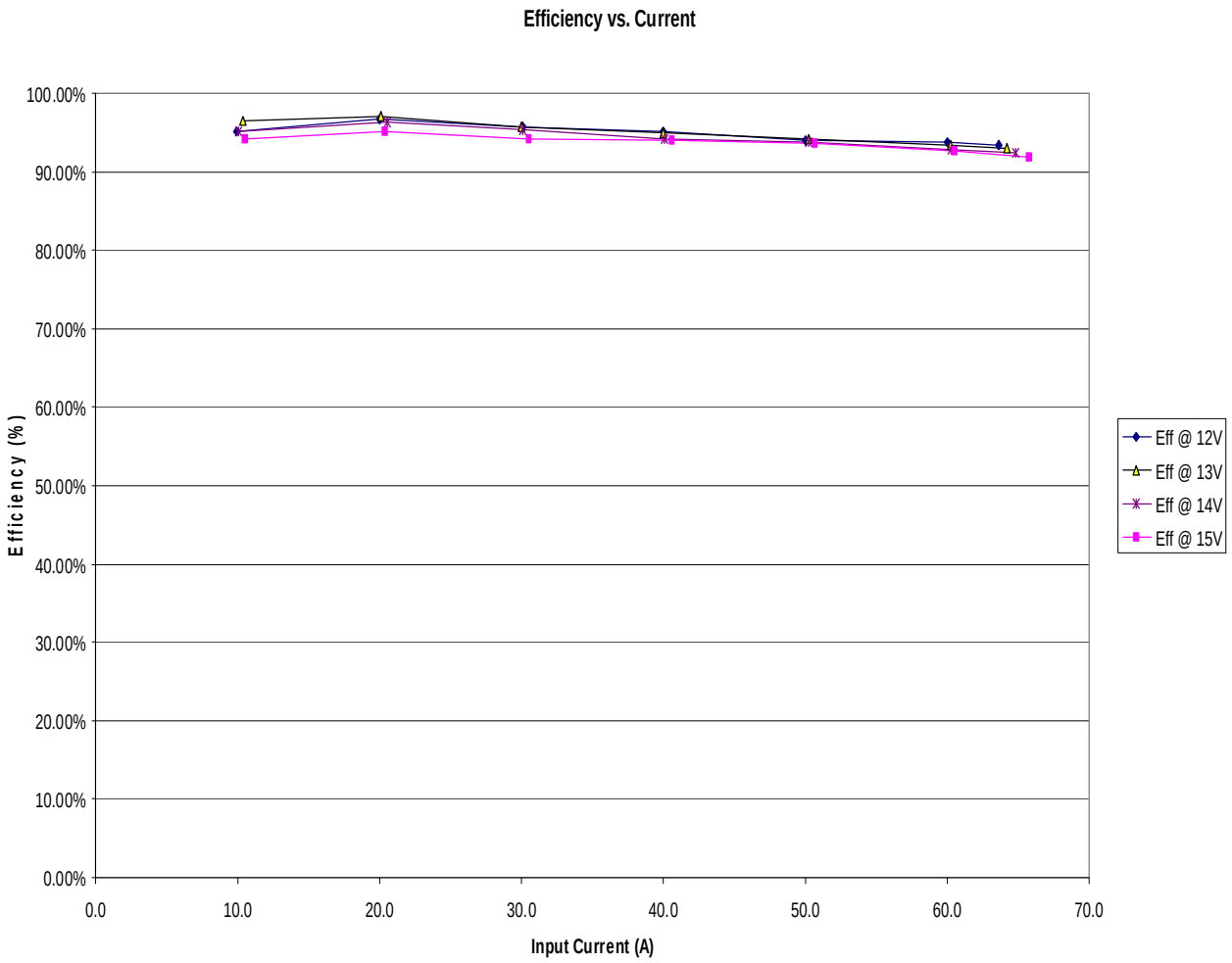
Turn-OFF response



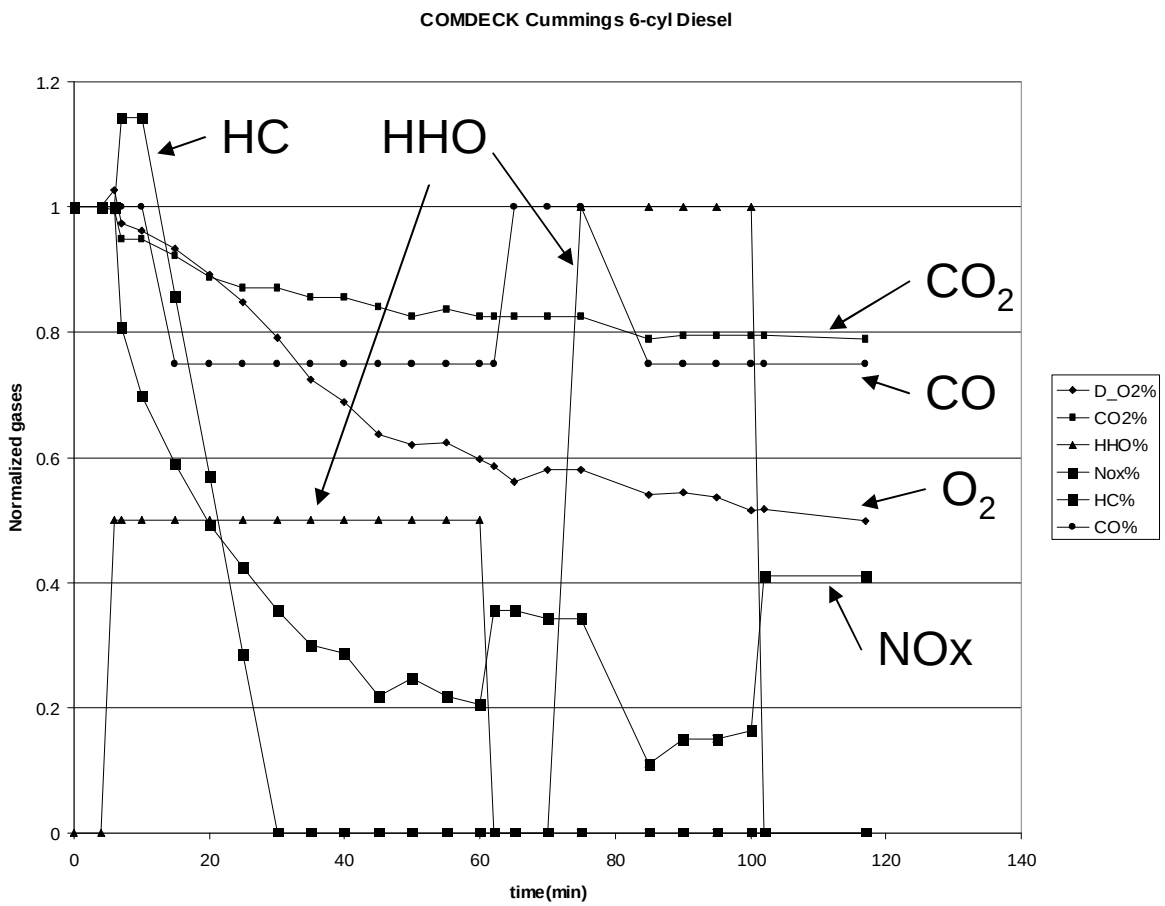
I_{IN}=60.5A, I_{OUT}=118.8A, HHO=4 L/min







Exhaust with 3L/min HHO into air intake



Future possibilities

- Possible use of HHO for engine cleaning and better ignition
- Valid for most liquids, liquid state technology (LST)
- Maybe useful for energy storage by converting other liquids
- Water as fuel if can fuse H + H -> He