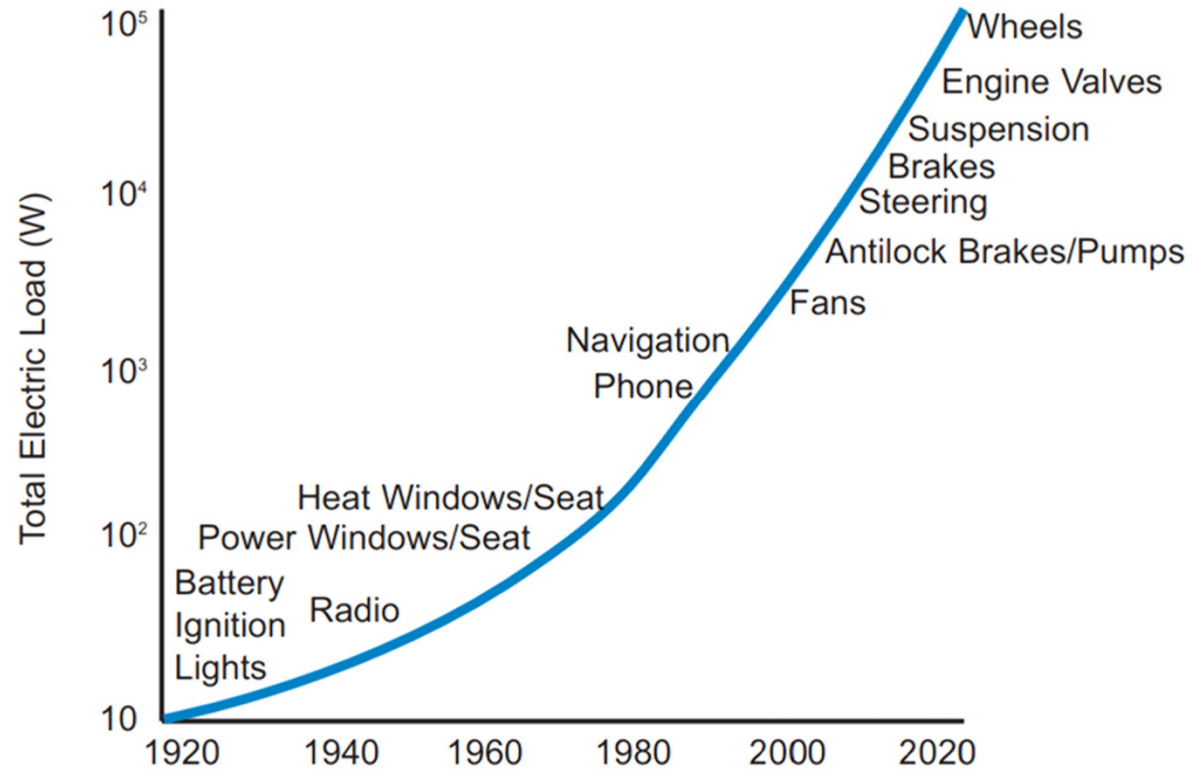


Automobile 12V Power

Figure 3. Electrification of the Auto

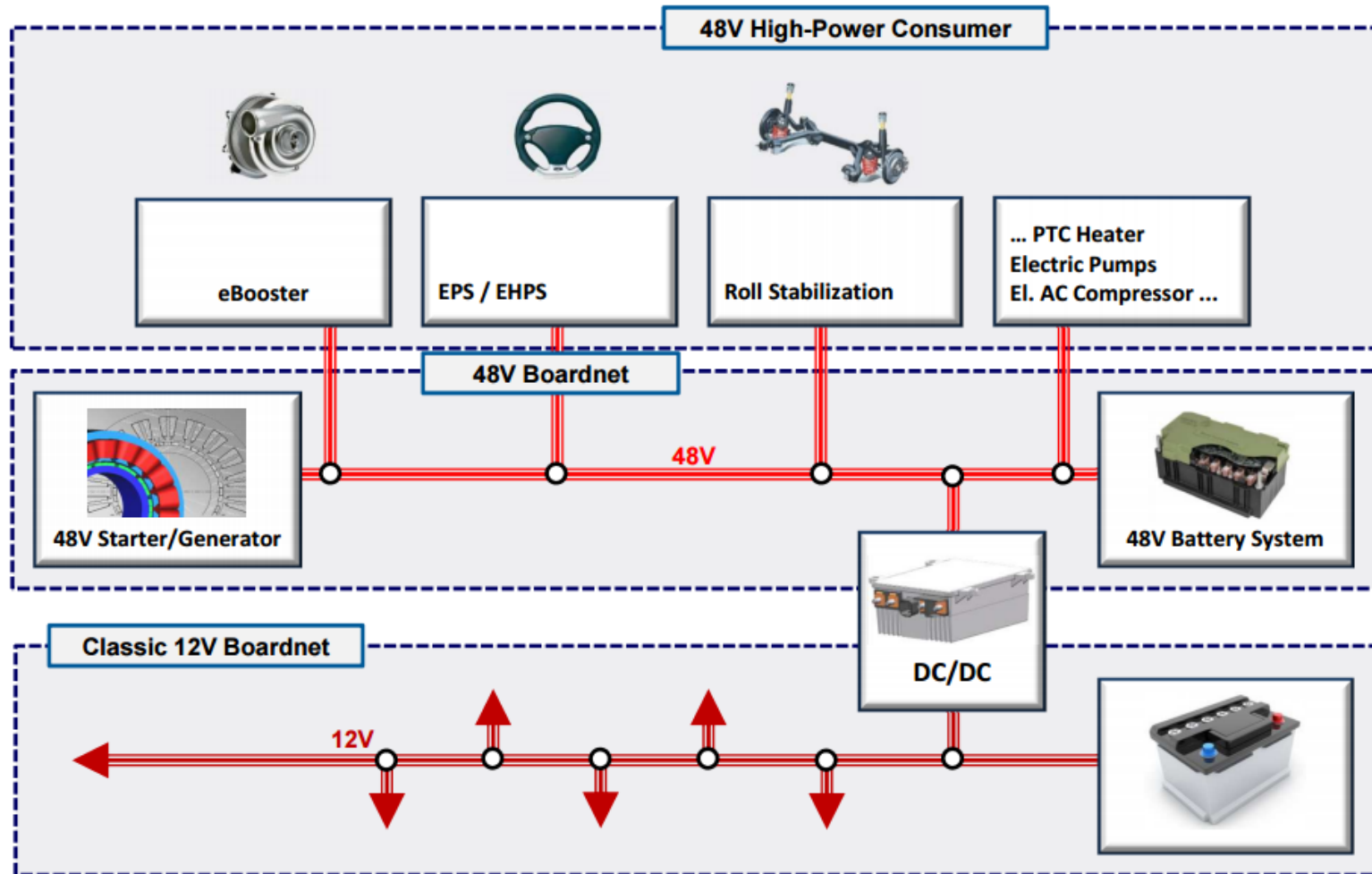


Source: Kasakian, Miller, and Traub, "Automotive Electronics Power Up," *IEEE Spectrum* (May 2000).

48V Electrical System



12V/48V Electrical Architecture



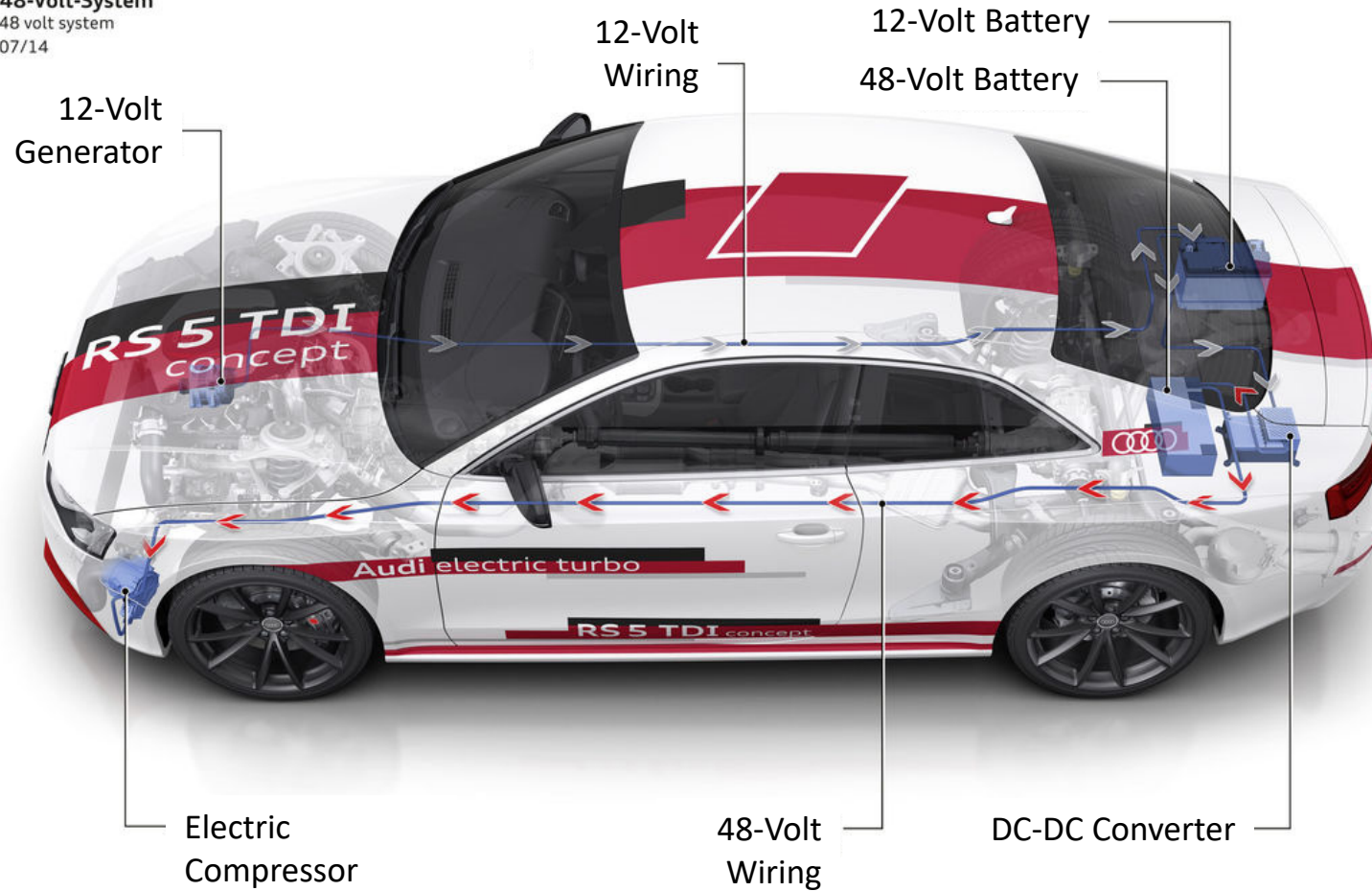
AVL UK Expo 2014 / Ulf Stenzel

12

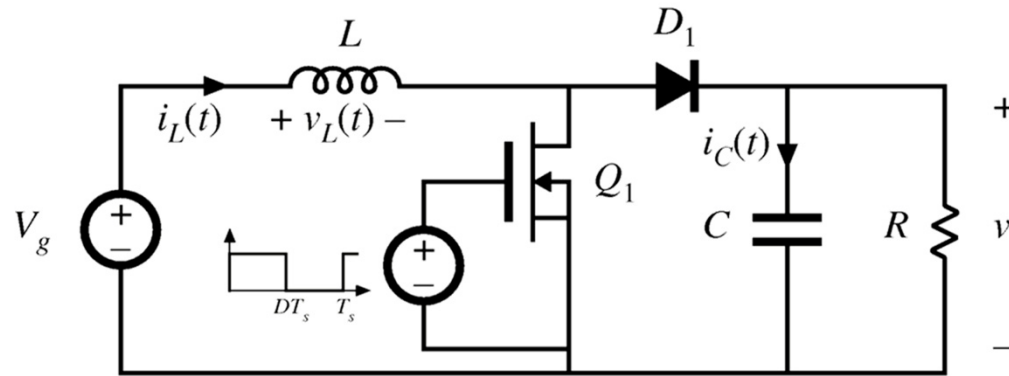
Example 12/48 V Vehicle

Audi RS 5 TDI concept

48-Volt-System
48 volt system
07/14



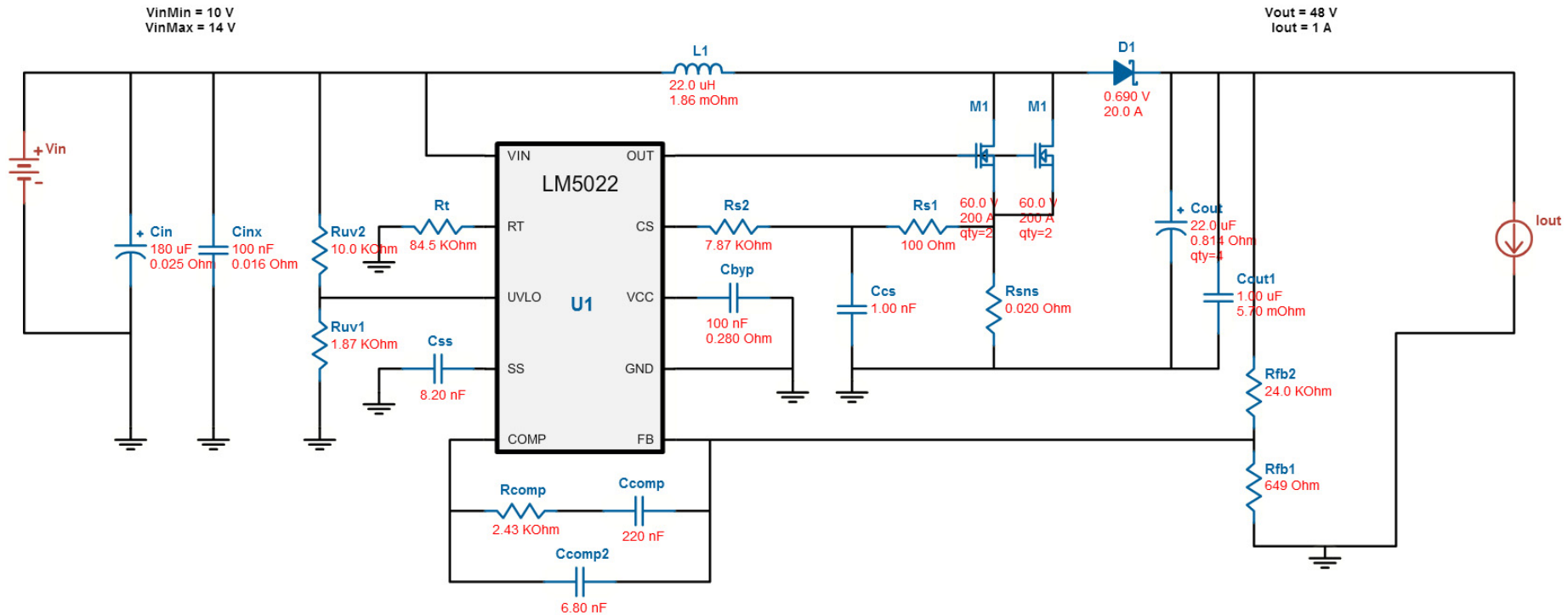
System to Design



Param	Value
V_g	12 V
V_{out}	48 V
R_{out}	48 Ω
ΔV_{out}	0.1 V

Baseline Design

- Use TI WebBench (webench.ti.com) to get a baseline design



Device Parameters

Diode

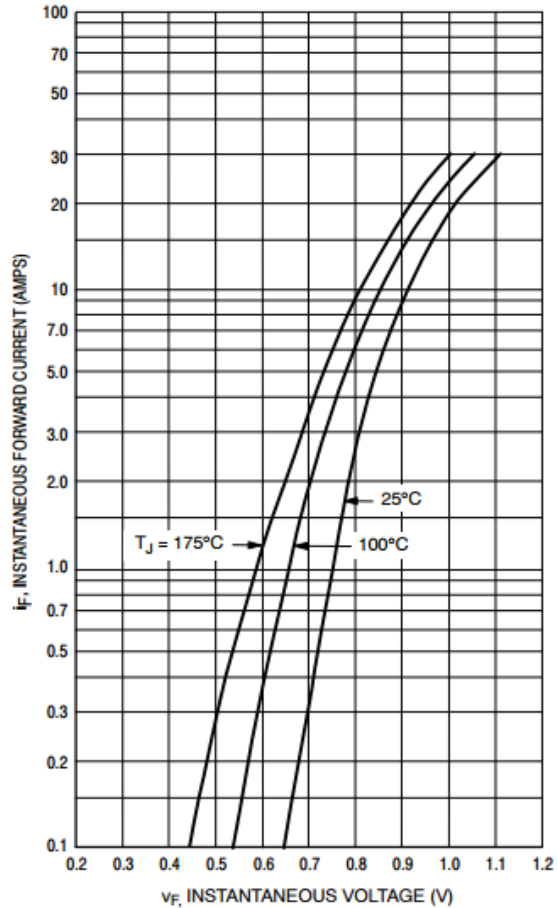
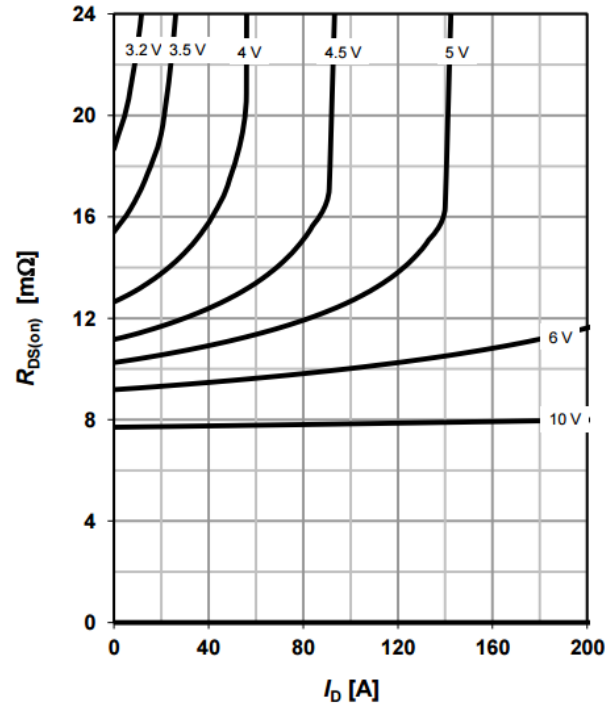


Figure 1. Typical Forward Voltage

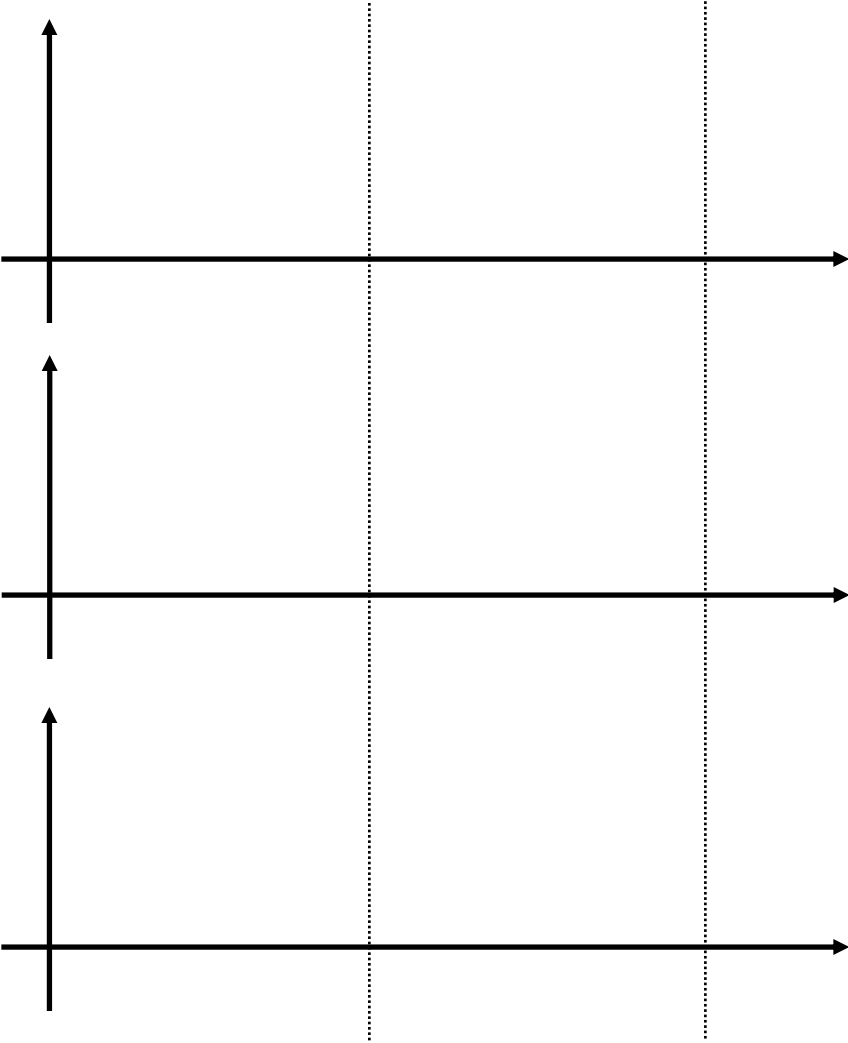
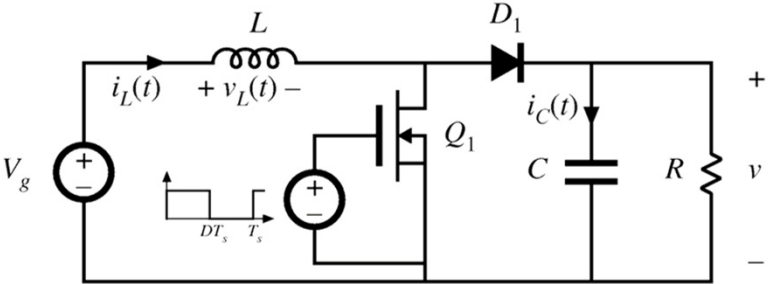
MOSFET



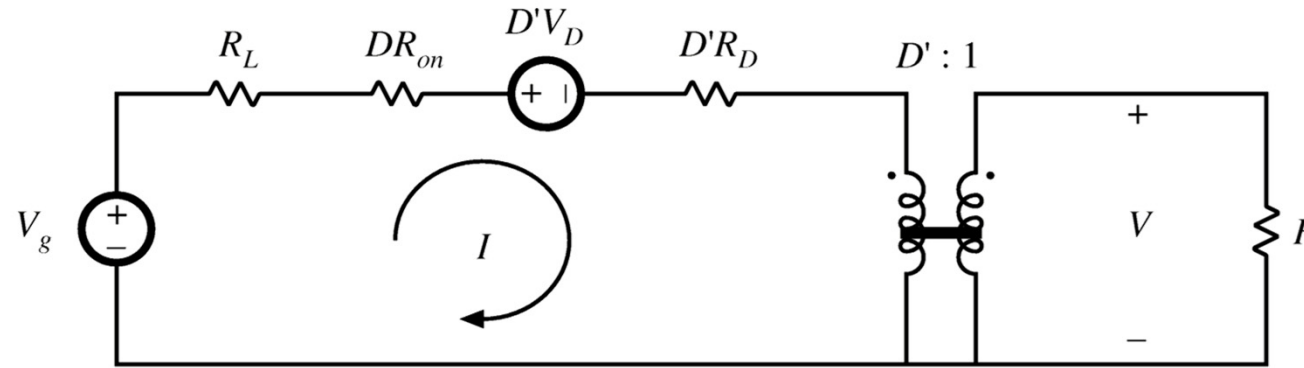
Inductor

Part number ¹	Inductance ² ±10% (μH)	DCR ³ (mOhms)		SRF typ ⁴ (MHz)
		nom	max	
SER2915L-152KL	1.5	1.50	1.65	60
SER2915H-222KL	2.2	1.86	2.05	40
SER2915L-222KL	2.2	1.50	1.65	50
SER2918H-332KL	3.3	2.60	2.86	40
SER2915H-332KL	3.3	1.86	2.05	30
SER2915L-332KL	3.3	1.50	1.65	40
SER2918H-472KL	4.7	2.60	2.86	30
SER2915H-472KL	4.7	1.86	2.05	25
SER2915L-472KL	4.7	1.50	1.65	30
SER2918H-682KL	6.8	2.60	2.86	25
SER2915H-682KL	6.8	1.86	2.05	20
SER2915L-682KL	6.8	1.50	1.65	25
SER2918H-103KL	10	2.60	2.86	20
SER2915H-103KL	10	1.86	2.05	15
SER2915L-103KL	10	1.50	1.65	20
SER2918H-153KL	15	2.60	2.86	16
SER2915H-153KL	15	1.86	2.05	12
SER2915L-153KL	15	1.50	1.65	15
SER2918H-223KL	22	2.60	2.86	15
SER2915H-223KL	22	1.86	2.05	10
SER2915L-223KL	22	1.50	1.65	10
SER2918H-333KL	33	2.60	2.86	10
SER2915H-333KL	33	1.86	2.05	8
SER2915L-333KL	33	1.50	1.65	7

Expected Behavior



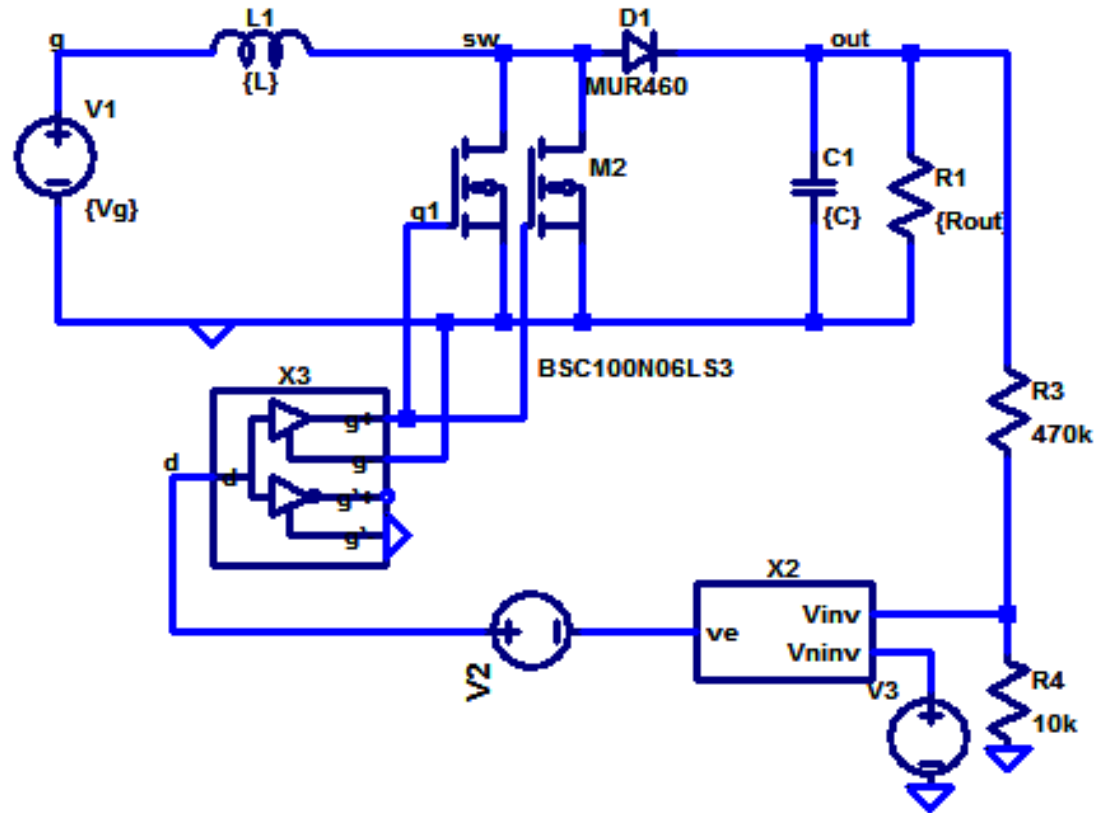
Equivalent Circuit Model



$$V = \left(\frac{1}{D'}\right) (V_g - D'V_D) \left(\frac{D'^2 R}{D'^2 R + R_L + DR_{on} + D'R_D}\right)$$

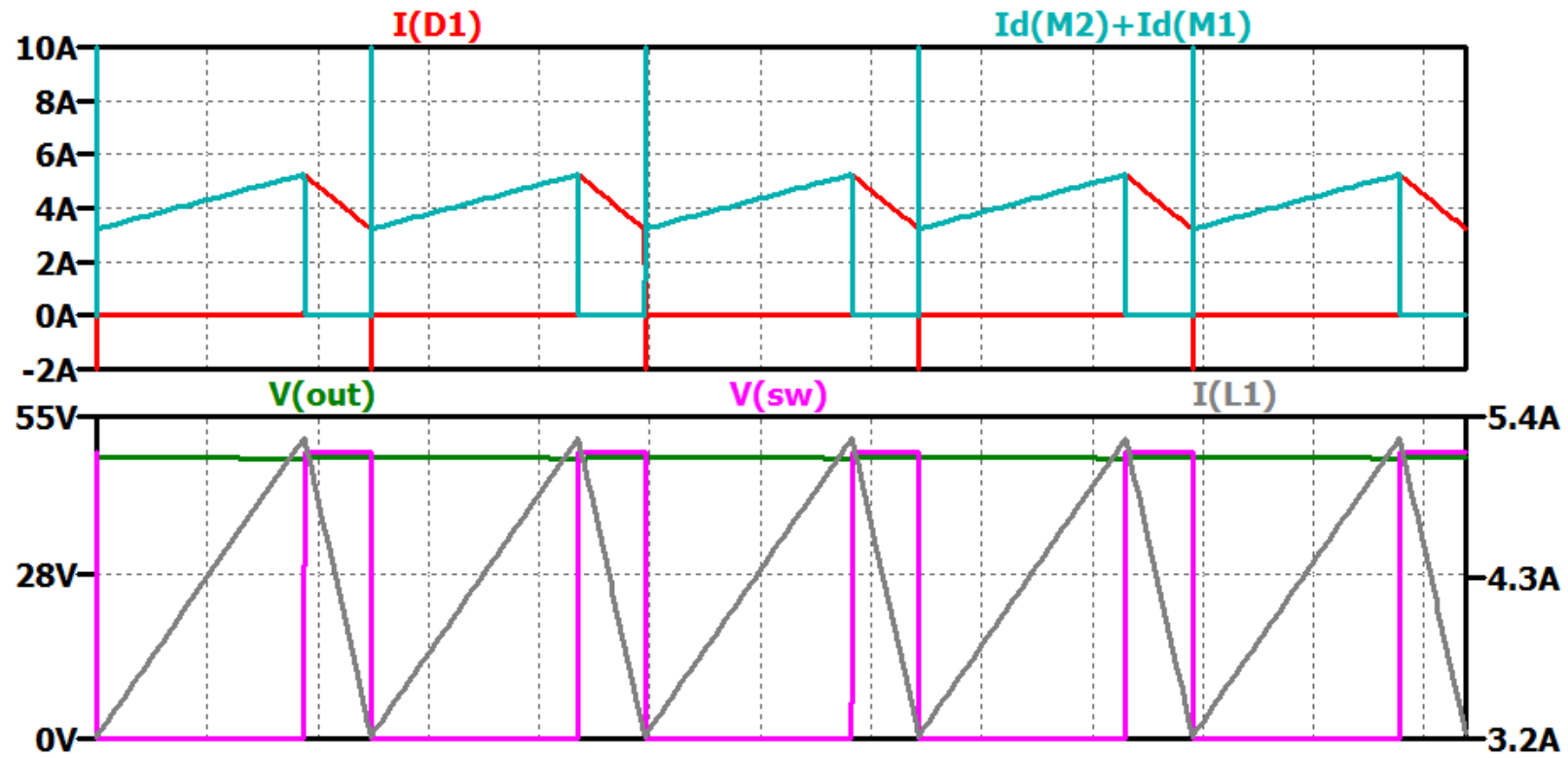
$$\frac{V}{V_g} = \left(\frac{1}{D'}\right) \left(1 - \frac{D'V_D}{V_g}\right) \left(\frac{1}{1 + \frac{R_L + DR_{on} + D'R_D}{D'^2 R}}\right)$$

LTSpice Simulation

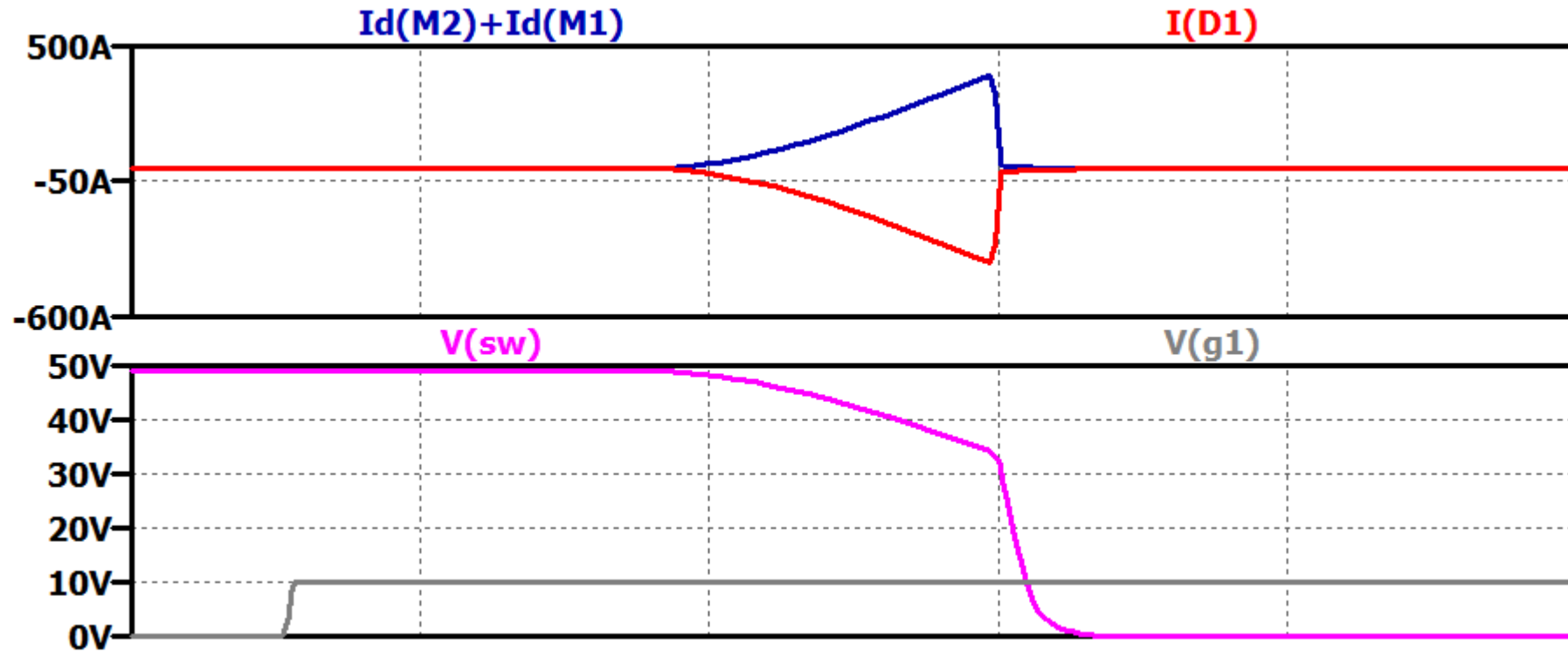


L	C_{out}	f_s	η (Sim)
22uH	22uF	200k	93.9%

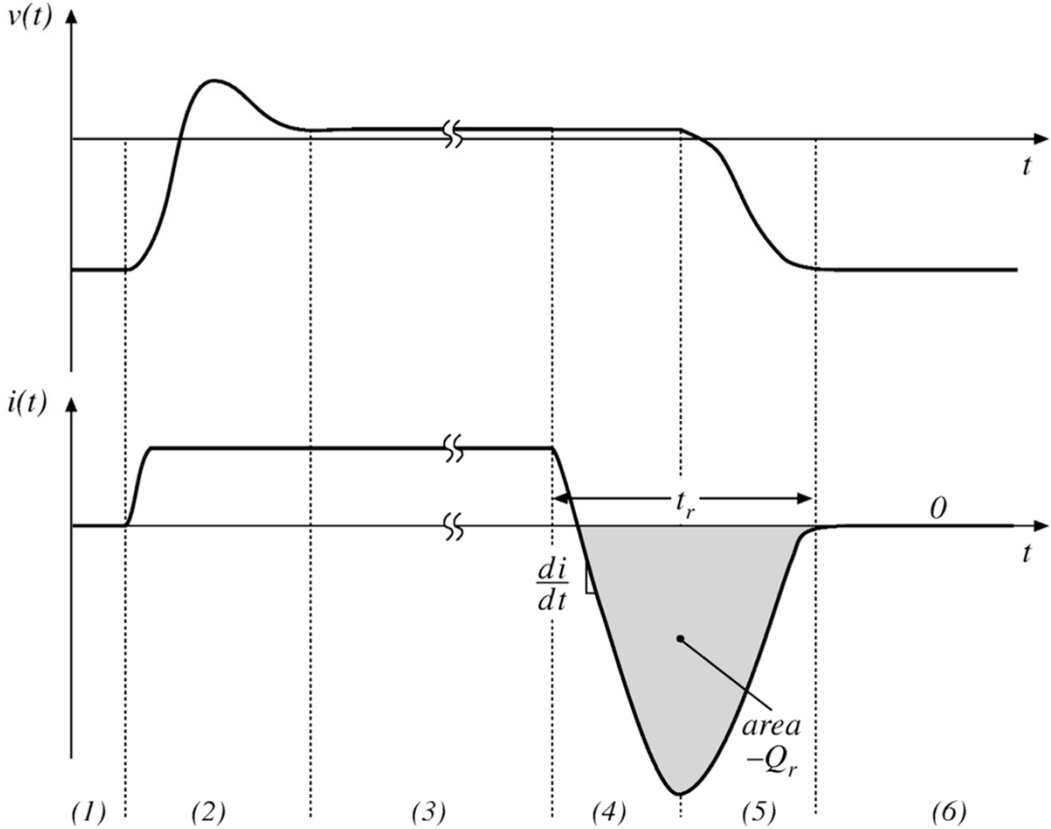
LTSpice Simulation



Switching Transition



Diode Switching Waveforms



Power Diodes

