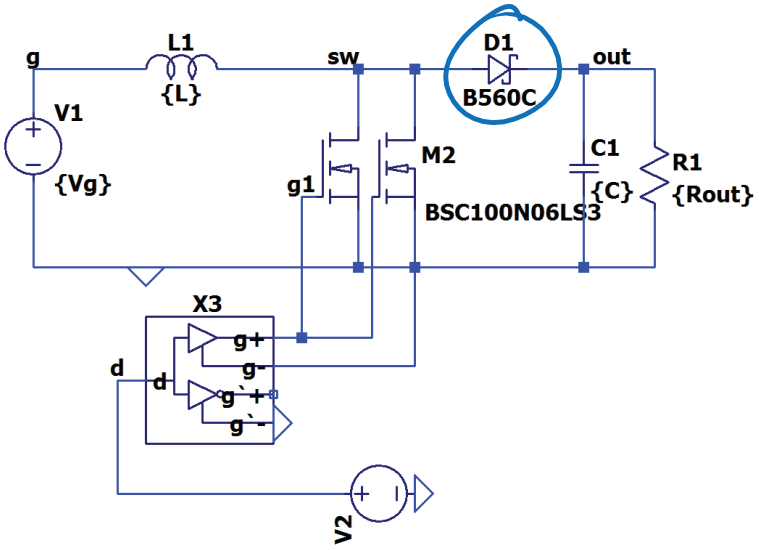
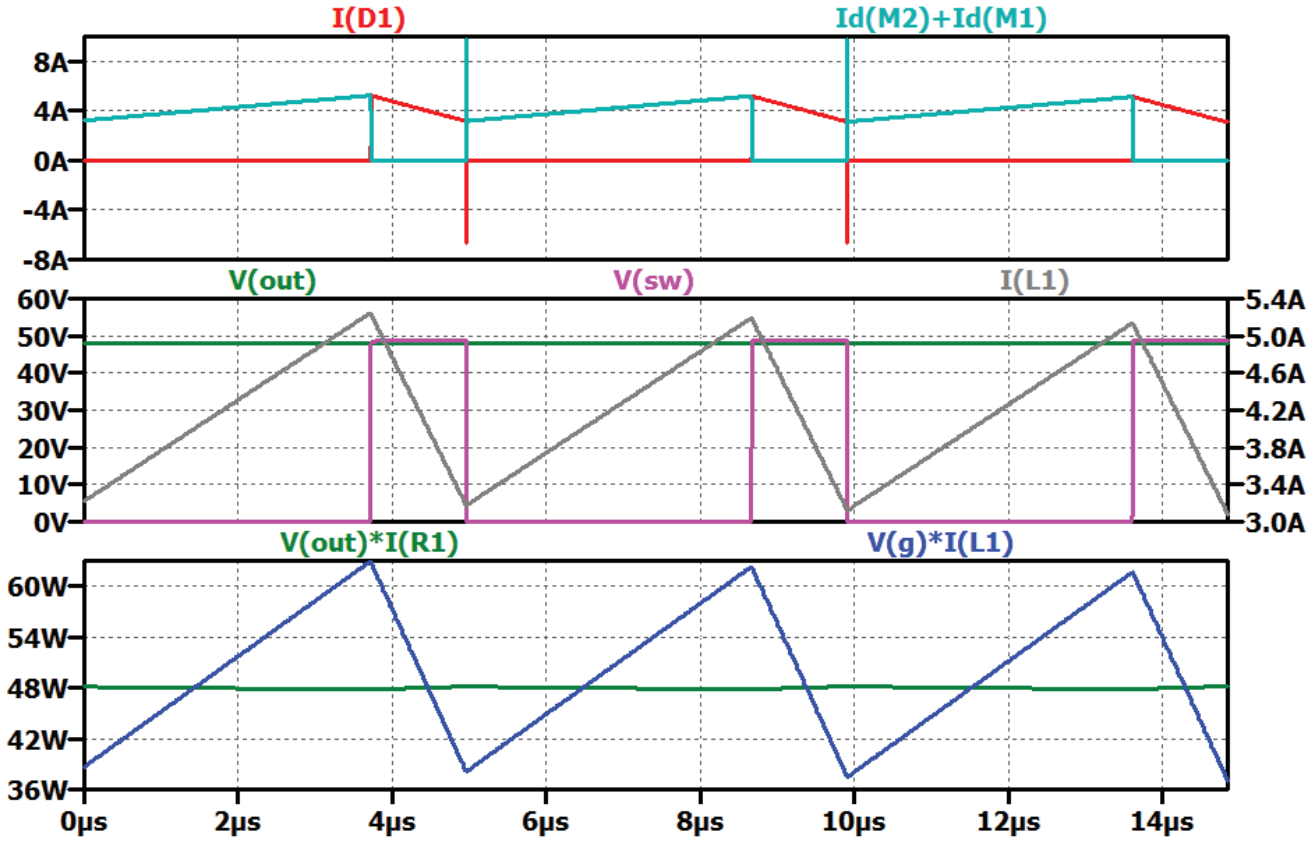
Schottky Diode



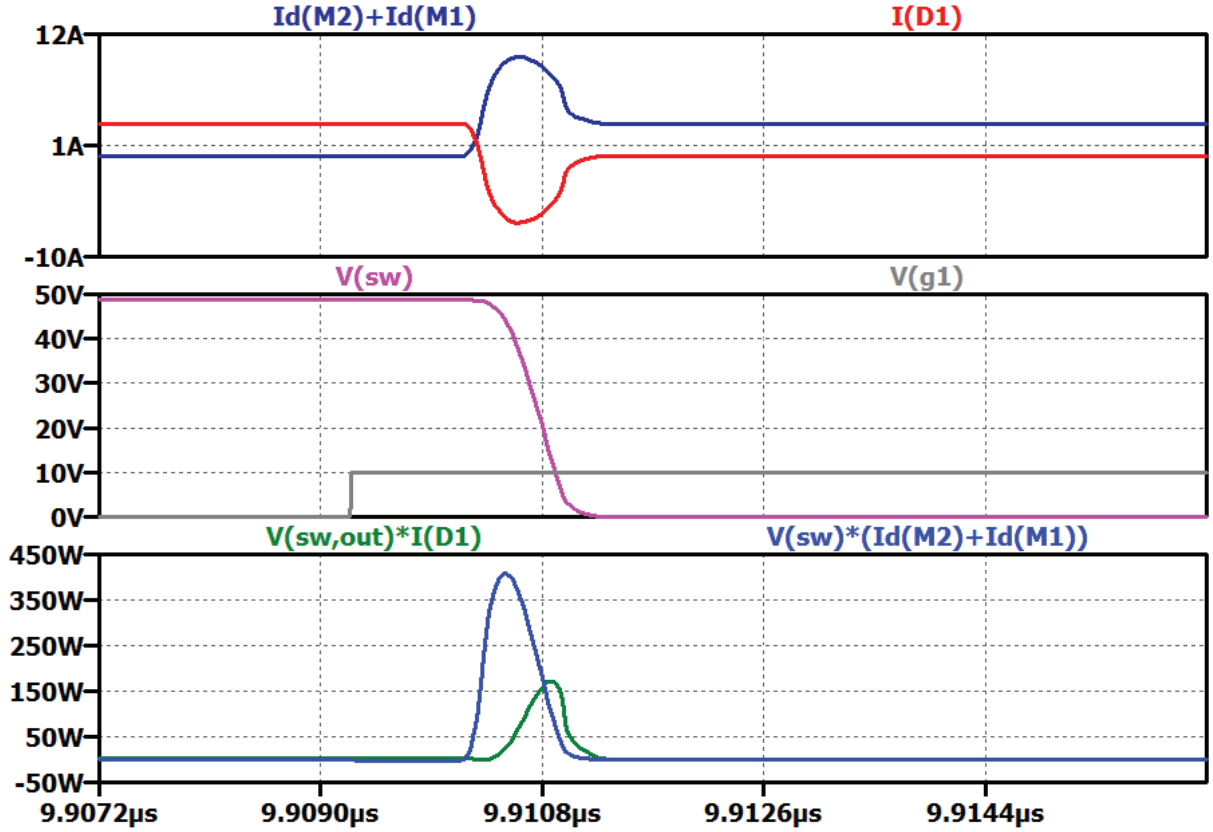
L	C_{out}	f_s	Diode	η (Sim)
22uH	22uF	202k	Si (FR)	93.9%
22uH	22uF	202k	Si Schottky	95.8%

only 2% increase!

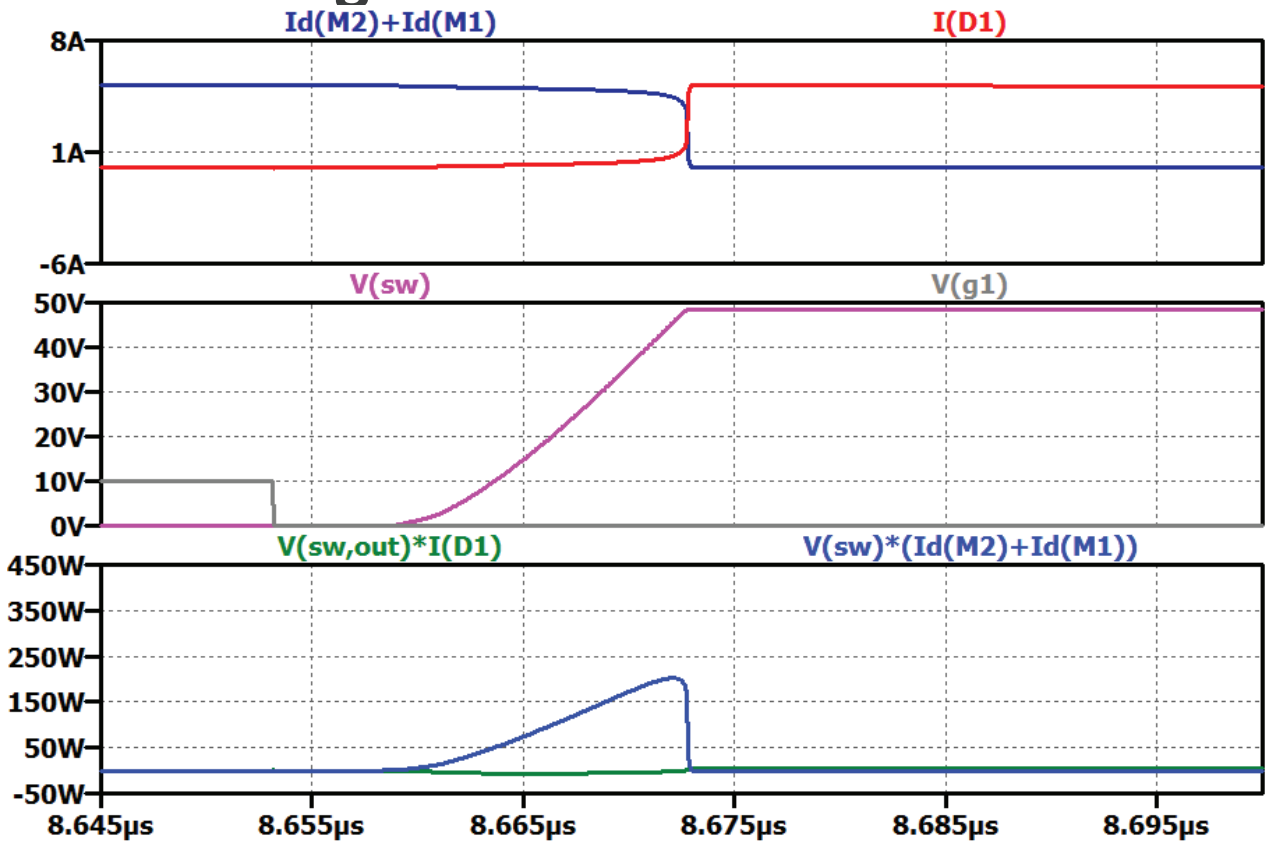
Simulation Waveforms



Switching Transition – FET turn ON



Switching Transition – FET turn OFF

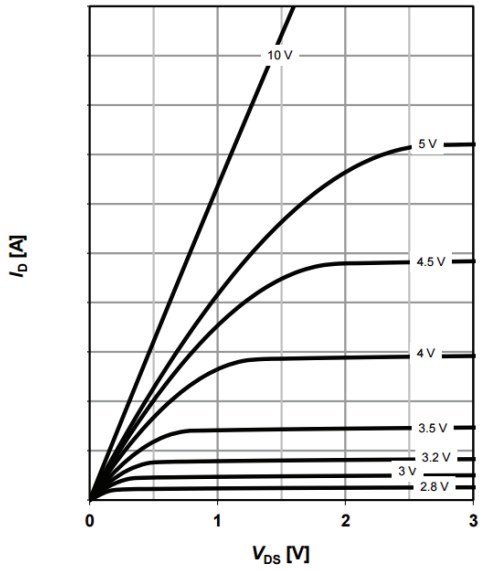


MOSFET Switching Behaviors

5 Typ. output characteristics

$I_D=f(V_{DS})$; $T_j=25$ °C

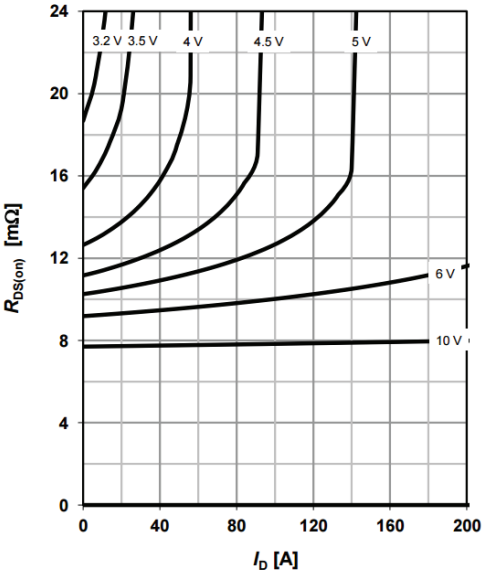
parameter: V_{GS}



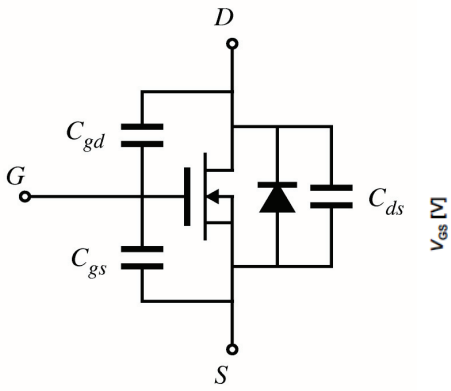
6 Typ. drain-source on resistance

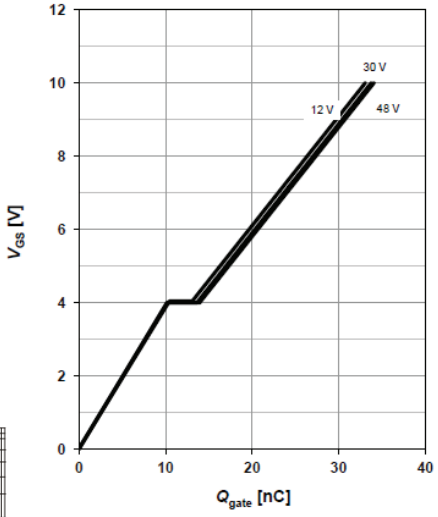
$R_{DS(on)}=f(I_D)$; $T_j=25$ °C

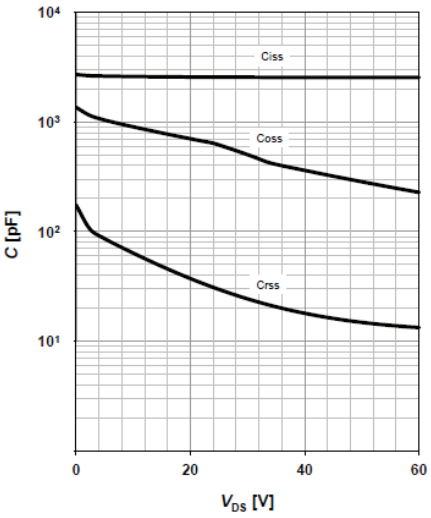
parameter: V_{GS}

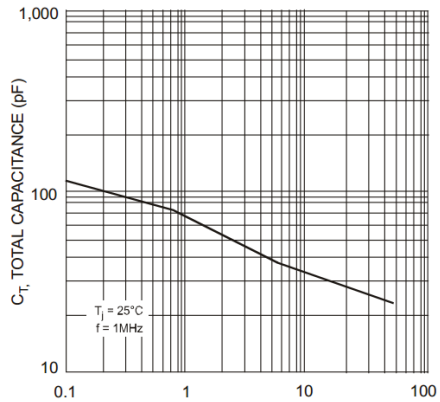


MOSFET Stored Charge

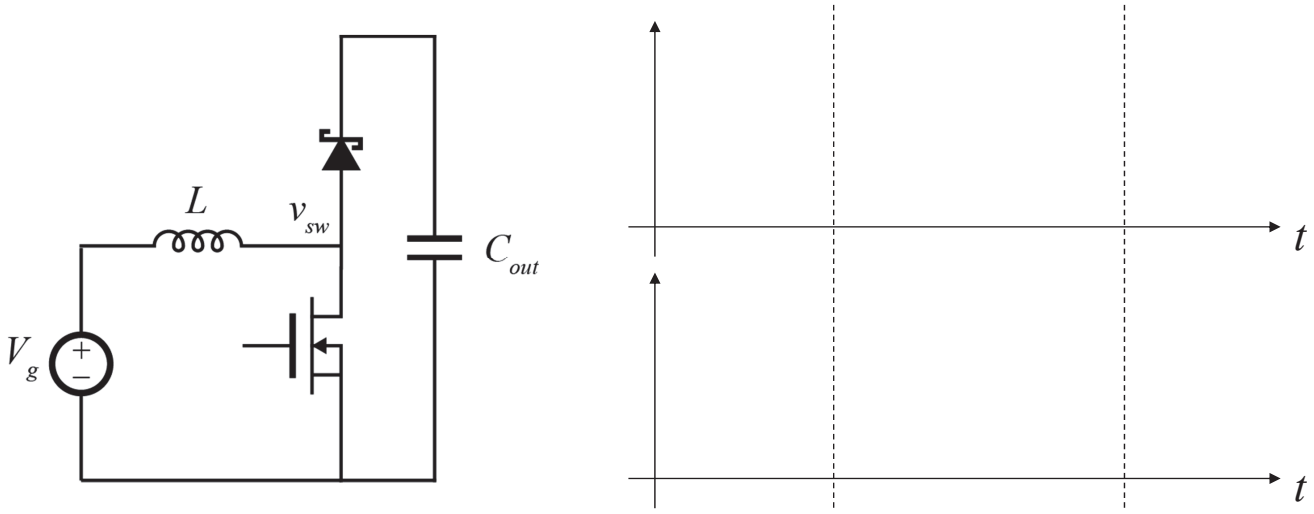




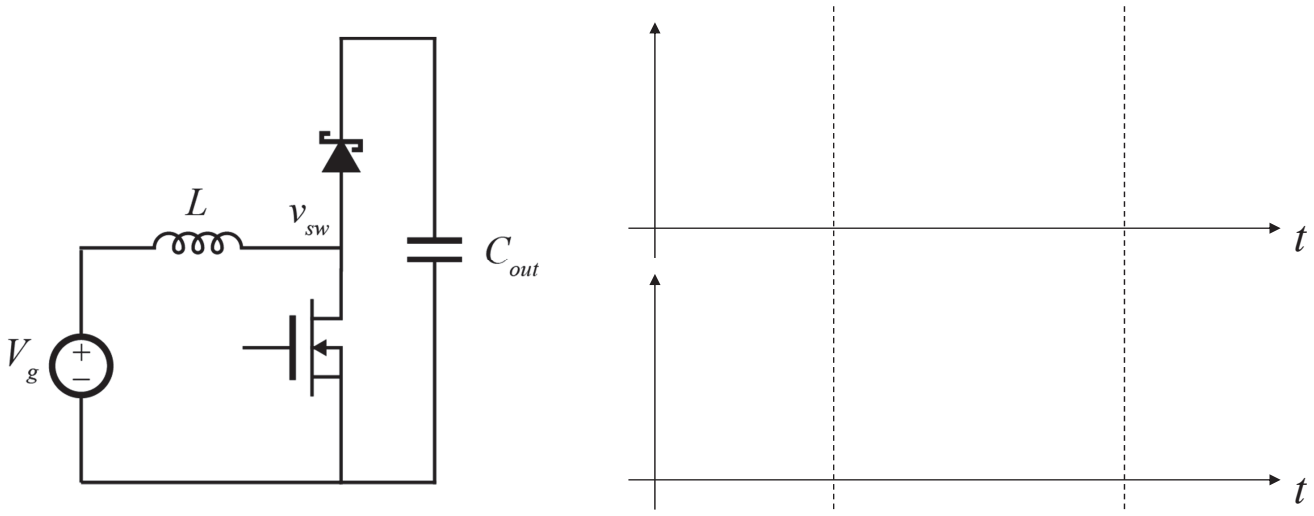




Device Capacitances



Device Capacitances



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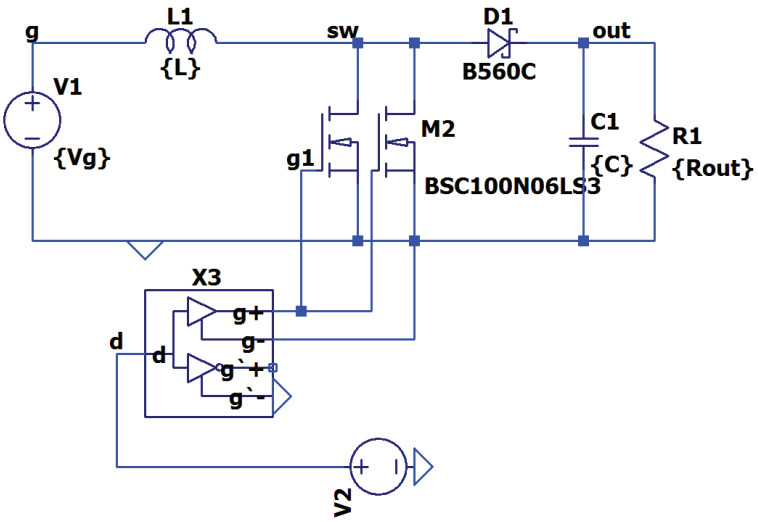
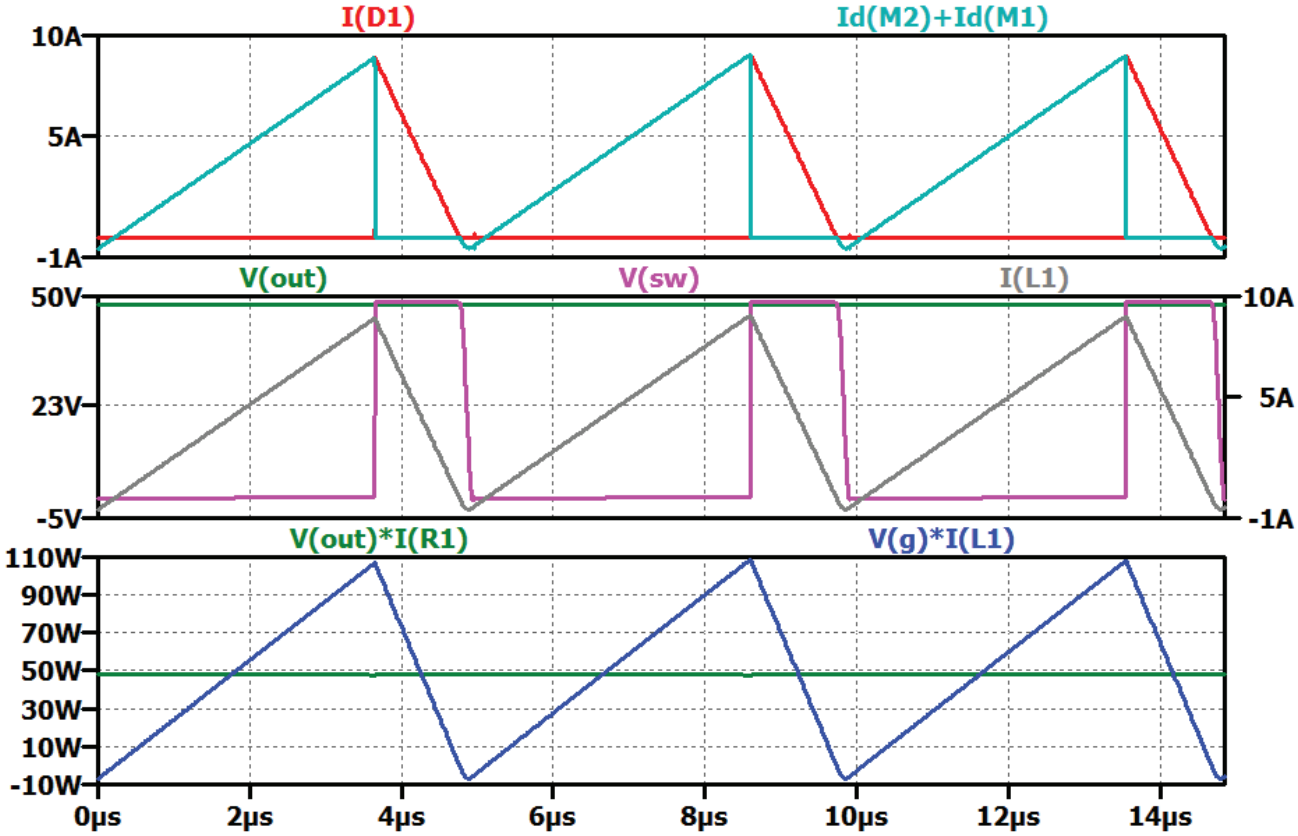
DCM: Soft Switching

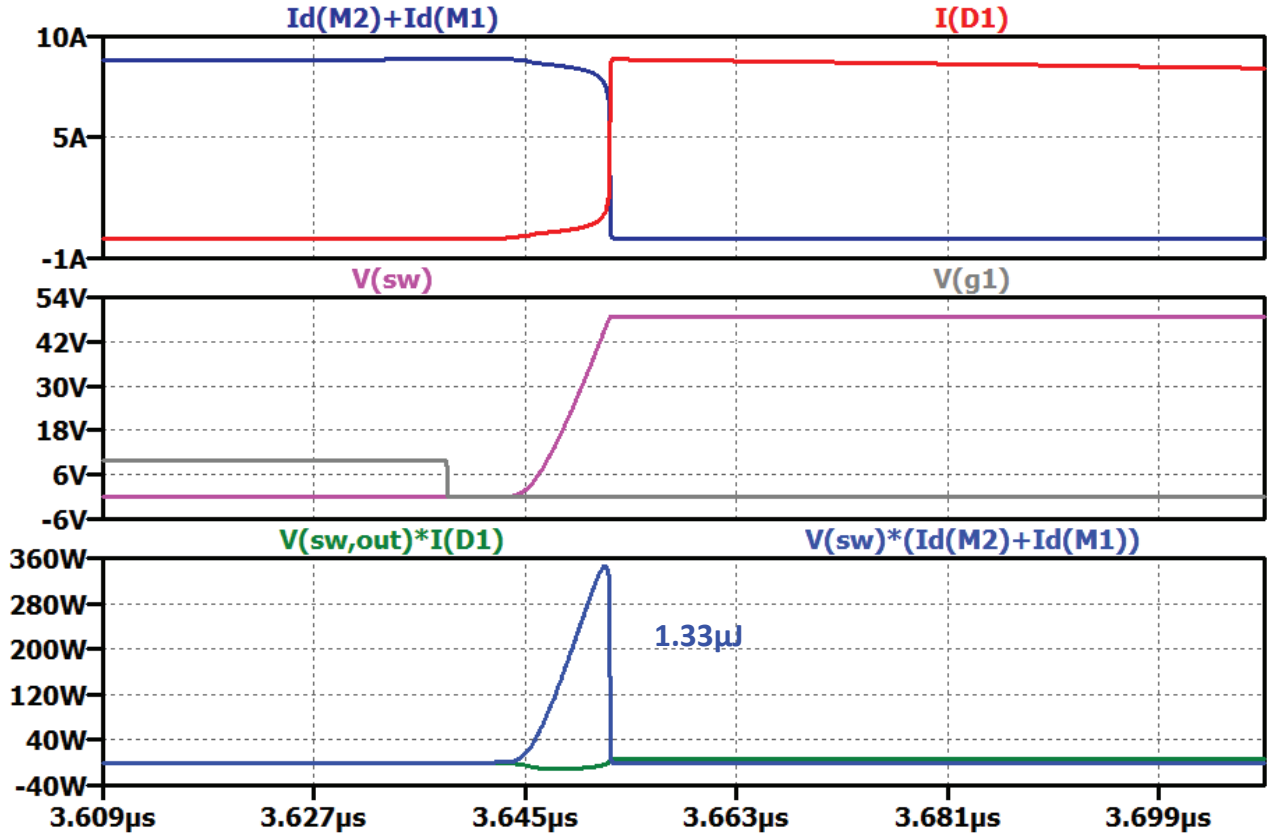


L	C_{out}	f_s	Diode	η (Sim)
22uH	22uF	202k	Si (FR)	93.9%
22uH	22uF	202k	Si Schottky	95.8%
4.6uH	22uF	202k	Si Schottky	98.2%

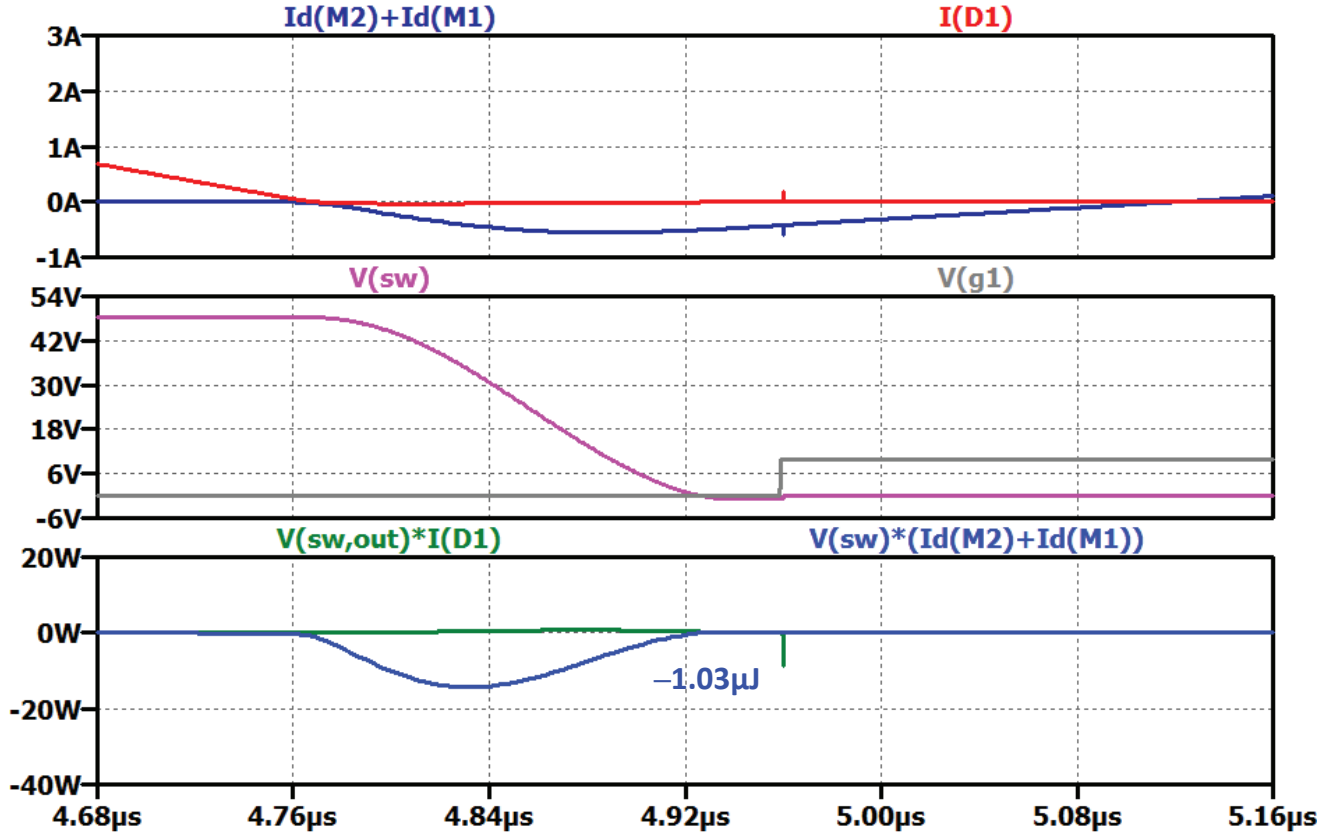
DCM Simulation



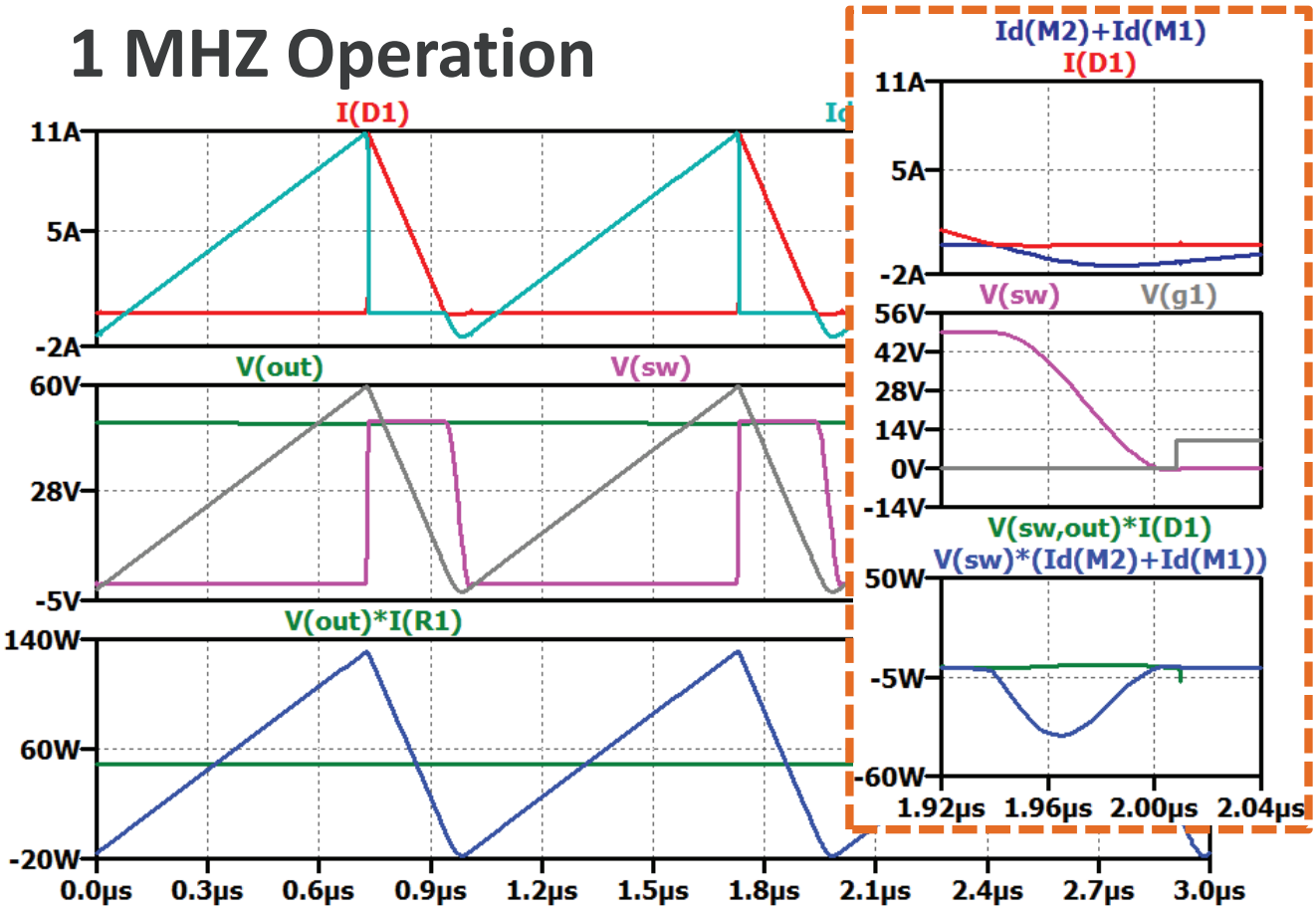
MOSFET Turn-Off



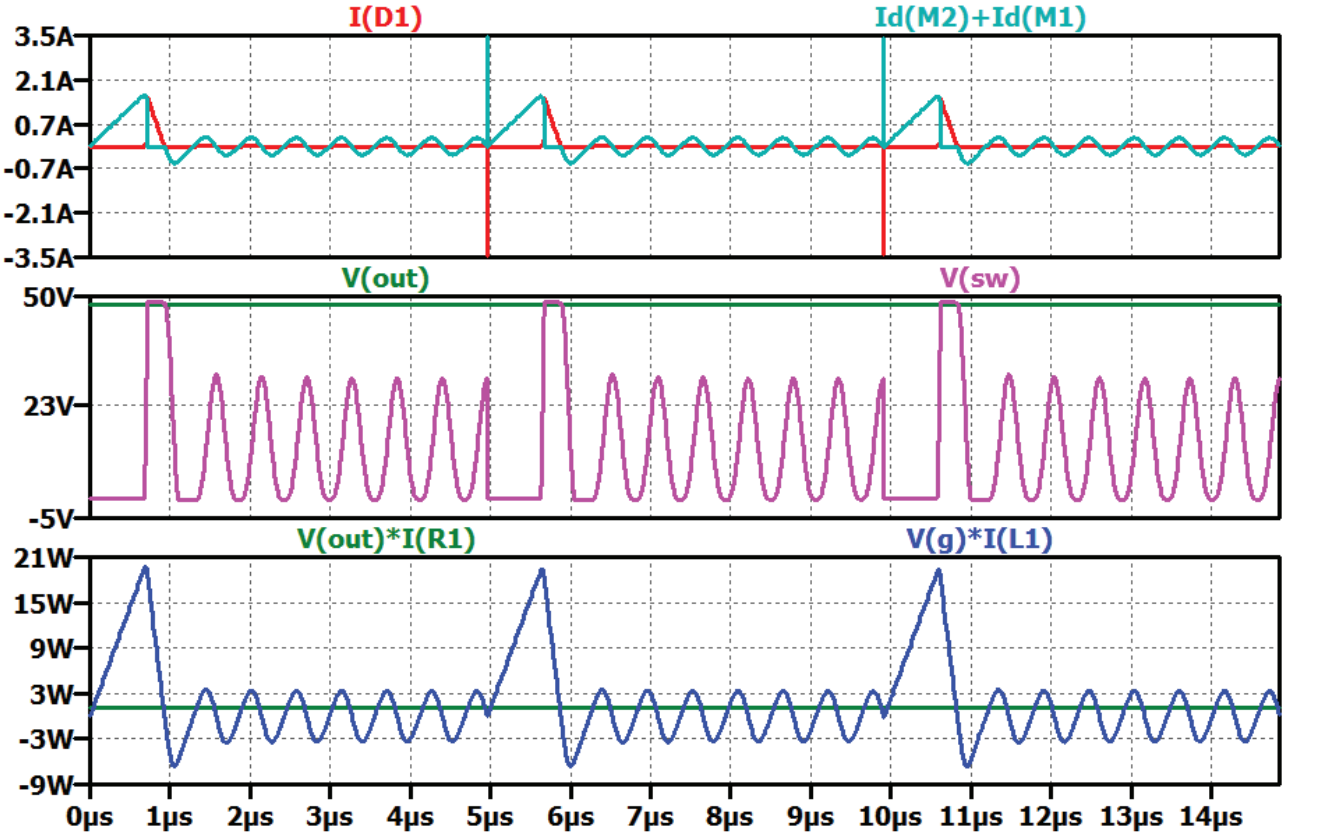
MOSFET Turn-On



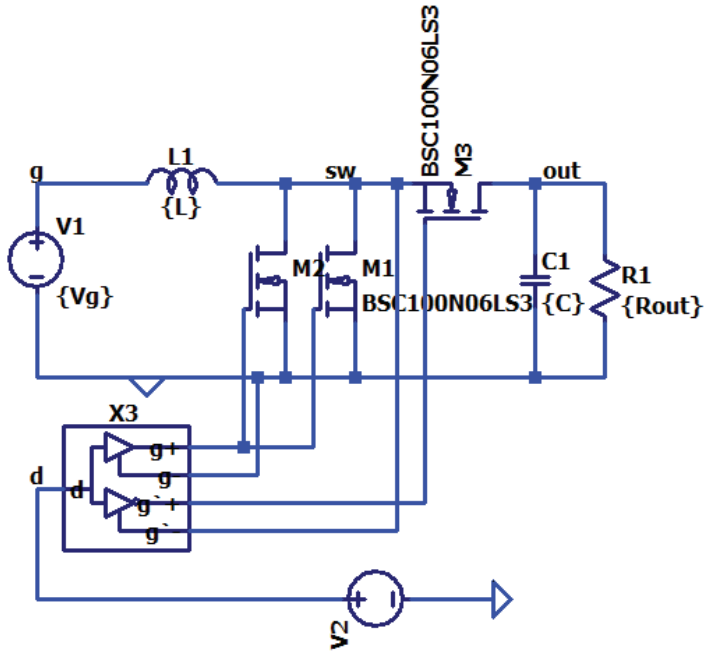
1 MHZ Operation



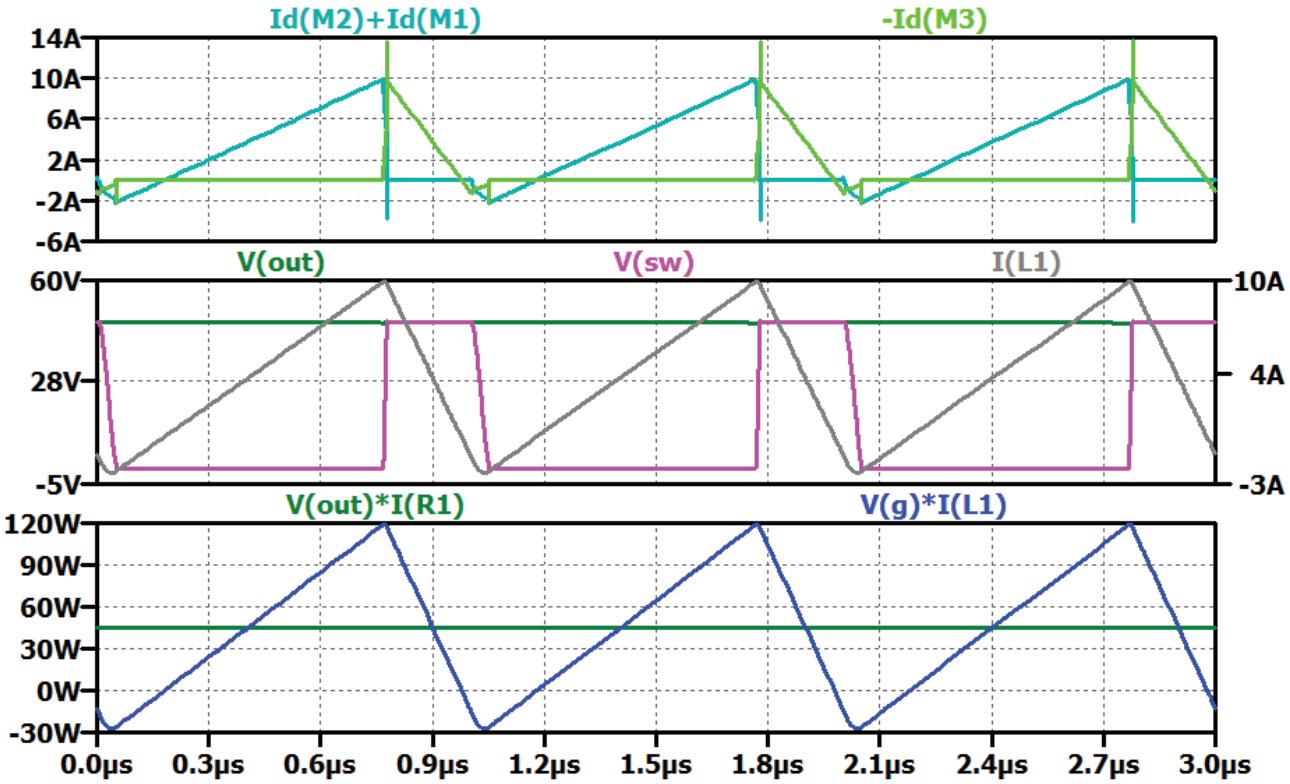
Low Power Operation



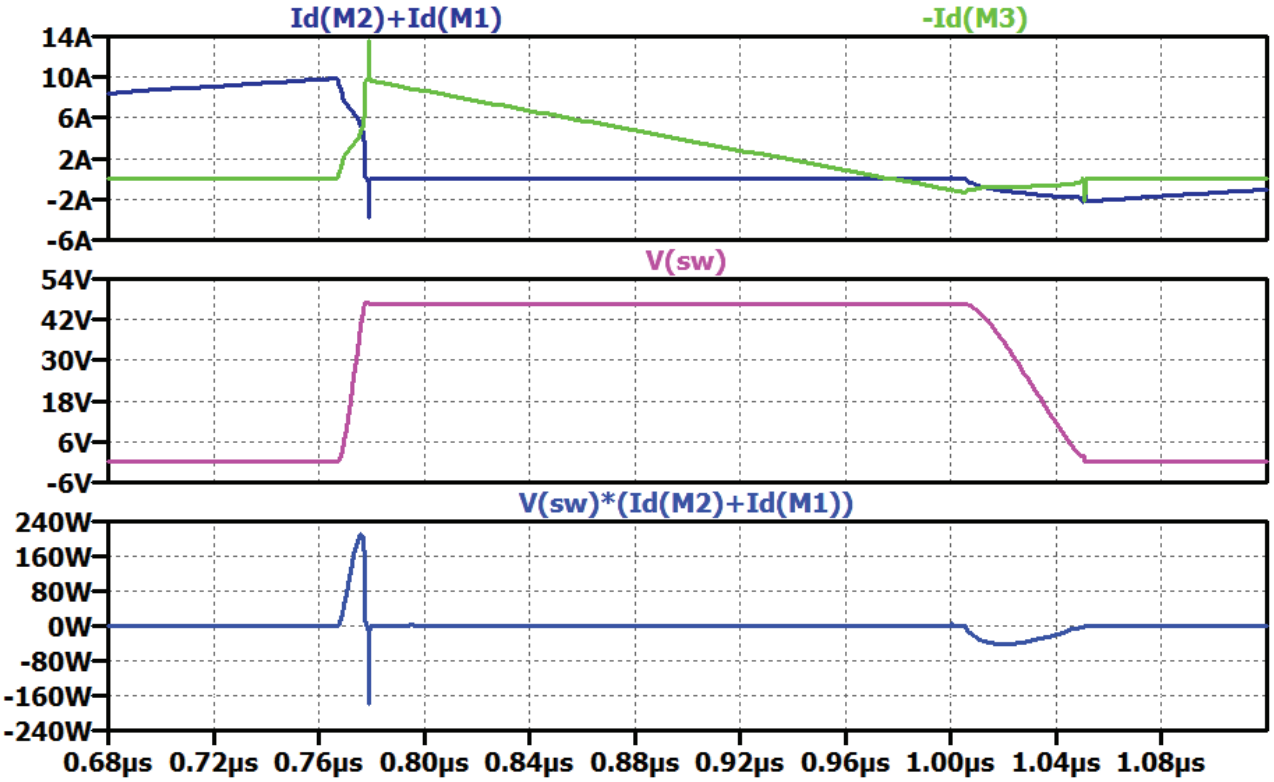
Synchronous Operation



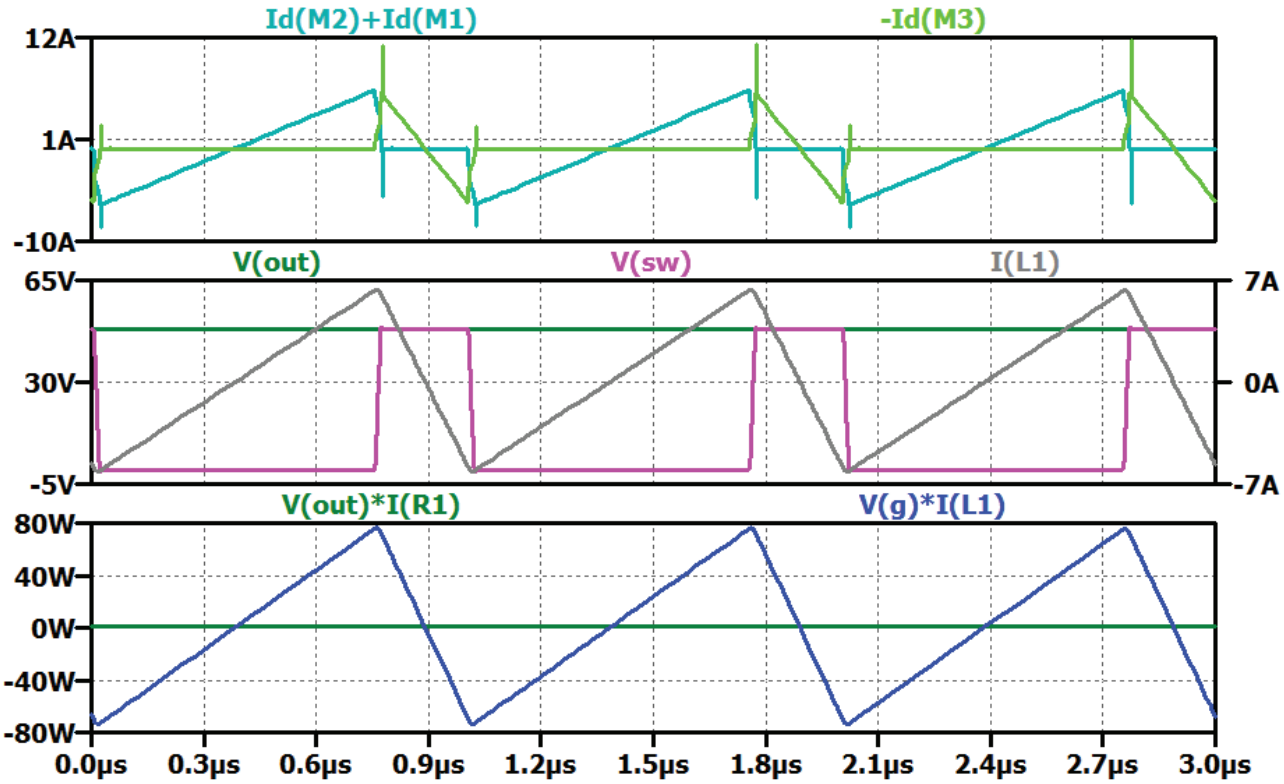
Synchronous Simulation



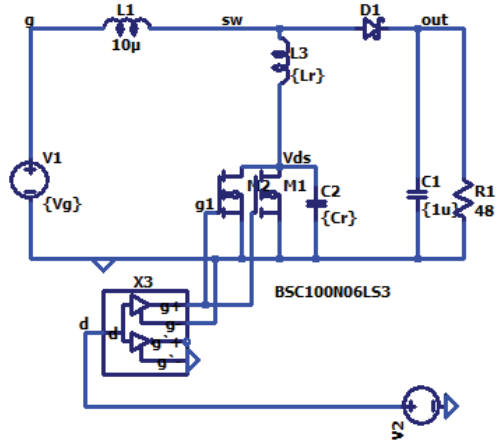
Switching Transitions



Low Power Operation

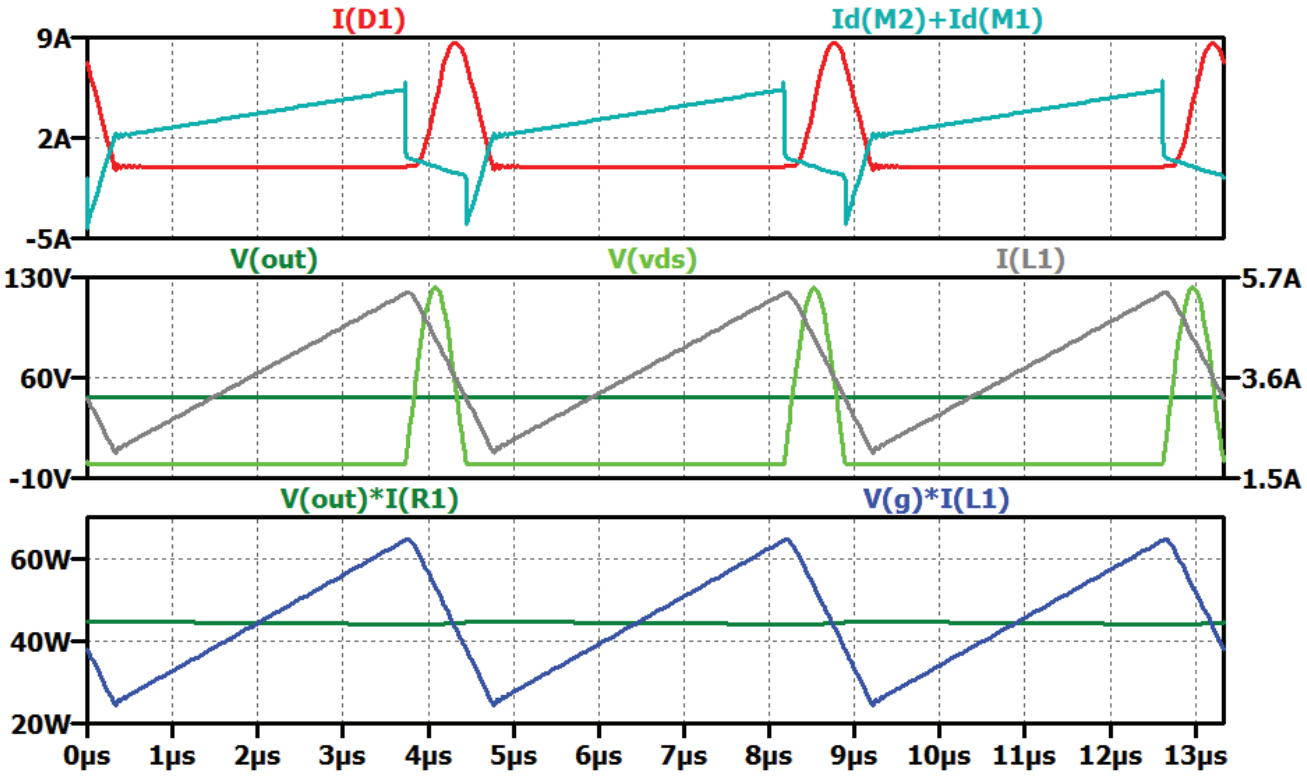


Resonant Operation

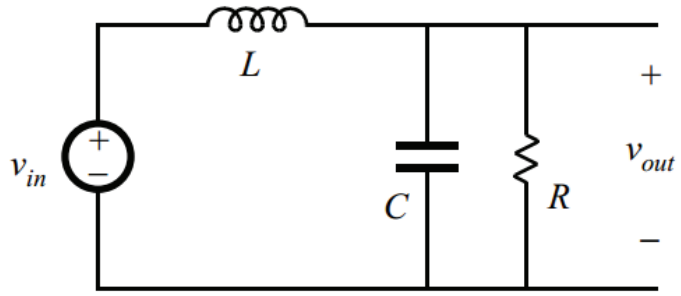


Switching	*L*	C_{out}	f_s	Diode	η (Sim)
Hard	22uH	22uF	202k	Si (FR)	93.9%
Hard	22uH	22uF	202k	Si Schottky	95.8%
Soft	4.65uH	22uF	202k	Si Schottky	98.4%
Soft	710nH	4.4uF	1 MHz	Si Schottky	98.2%
Soft	710nH	4.4uF	1 MHz	MOSFET	99.6%
Resonant	10uH + 2.4uH	1uF + 10nF	225 kHz	Si Schottky	98.6%
Resonant	10uH + 2.4uH	1uF + 10nF	225 kHz	MOSFET	99.96%

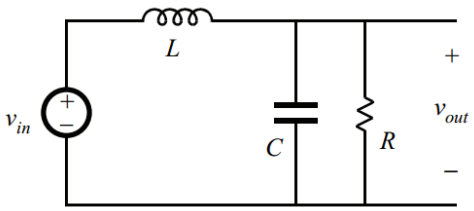
Resonant Boost Converter



Resonant Circuits



Resonant Circuit Analysis



Soft Switching

- Advantages
  - Reduced switching loss
  - Possible operation at higher switching frequency
  - Lower EMI
- Disadvantages
  - Increased current and/or voltage stresses due to circulating current
  - Higher peak and rms current values
  - Complexity of analysis and modeling