WIDE V_{IN} DC/DC Power Solutions
Reliable Power for Demanding Systems

LM5175 DC/DC Controller Design Tool

About | = Input Box | TERMS OF USE

Step 1: Operating Specifications

Input Voltage - Min, $V_{IN(min)}$	**9**	V
Input Voltage - Nom, $V_{IN(nom)}$	**14**	V
Input Voltage - Max, $V_{IN(max)}$	**42**	V
Output Voltage, V_{OUT}	**28**	V
Full Load Output Current, $I_{OUT(max)}$	**13**	A
Switching Frequency	**105**	kHz
Frequency Set Resistor, R_T	249	kΩ

Step 2: Filter Inductor

Recommended Filter Inductance	6,6	µH
Inductance, L_F	**4**	**µH**
Inductor DCR	**6**	**mΩ**
Pk-to-Pk Ripple Current at $V_{IN(min)}$, ΔI_{L1}	14,9	A_{pk-pk}
Pk-to-Pk Ripple Current at $V_{IN(nom)}$, ΔI_{L2}	17,0	A_{pk-pk}
Pk-to-Pk Ripple Current at $V_{IN(max)}$, ΔI_{L3}	22,3	A_{pk-pk}
ΔI_L as a % at $V_{IN(min)}$	35	%
ΔI_L as a % at $V_{IN(nom)}$	63	%
ΔI_L as a % at $V_{IN(max)}$	172	%

Step 3: OCP, Sense Resistors, Slope Comp

Required $I_{OCP(MIN)}$ Setpoint at $V_{IN(nom)}$	**12**	**A**
Recommended Sense Resistance	3,4	mΩ
Sense Resistance, R_S	**6**	**mΩ**
Peak Inductor Current, I_{LPK}	35,6	A
Power Loss in Rs at Full Load (Min VIN)	7,47	W
Recommended SLOPE Capacitance	180	pF
SLOPE Capacitance, C_{SLOPE}	**120**	**pF**
$V_{IN(min)}$	5,9	A
$I_{OUT(typ)}$ at OCP Inception: $V_{IN(nom)}$	8,9	A
$V_{IN(max)}$	24,5	A
Required Const Current Loop Setpoint	**N/A**	**A**
Output Leg Shunt Resistance, $R_{CS(out)}$	0	mΩ

Step 4: Output Capacitor

Output Voltage Ripple Spec	**50**	mV_{pk-pk}
Minimum Output Capacitance	1718,1	µF
Output Capacitance, C_{OUT}	**360**	**µF**
Maximum Permitted ESR	N/A	mΩ
Output Capacitor ESR	**2**	**mΩ**
Resulting Output Voltage Ripple (max)	265	mV_{pk-pk}
Output Capacitor RMS Current (max)	18,9	A (rms)

Step 5: Input Capacitor

Input Voltage Ripple Spec	**180**	mV_{pk-pk}
Minimum Input Capacitance	152,3	µF
Input Capacitance, C_{IN}	**180**	**µF**
Maximum Permitted ESR	1,1	mΩ
Input Capacitor ESR	**2**	**mΩ**
Resulting Input Voltage Ripple (max)	201	mV_{pk-pk}
Input Capacitor RMS Current (max)	6,1	A (rms)

Step 6: Soft-start, Dither, UVLO

Soft-Start Time, t_{SS}	**16**	**ms**
Soft-Start Capacitance, C_{SS}	100	nF
DITHER Enabled	**Modulating Frequency**	**1**	**kHz**
DITH Capacitance, Cd	39	nF
Required Input Voltage UVLO On	**5,5**	**V**
Input Voltage UVLO Off	4,84	V
Upper UVLO Resistor, R_{UV1}	**200**	kΩ
Lower UVLO Resistor, R_{UV2}	52,3	kΩ

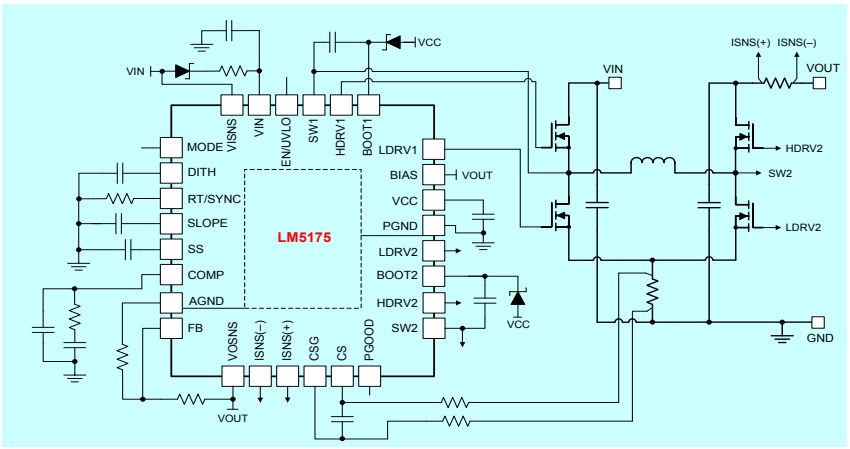
Step 7: Compensation Design

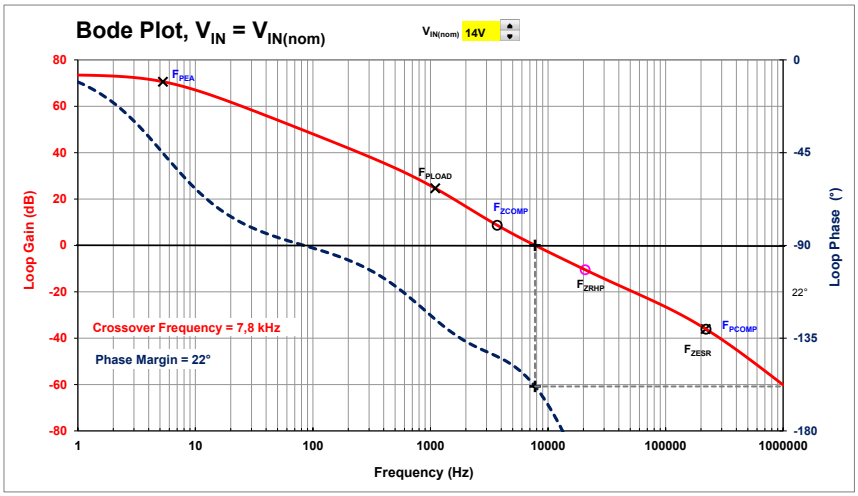
Load Pole Frequency	1098	Hz
C_{OUT} ESR Zero Frequency	221	kHz
Boost RHP Zero Frequency	21	kHz
Desired Crossover Frequency	**8**	**kHz**
Error Amp Pole Frequency	5	Hz
Upper Feedback Resistor, R_{FB1}	**100**	**kΩ**
Lower Feedback Resistor, R_{FB2}	2,94	kΩ

Compensation Components

	Calculated / Std Values	Selected	Actual P/Z Frequencies
R_C	28,4 / 28,7	**28,7 kΩ**	5 Hz (F_{PEA})
C_{C1}	1,4 / 1,5	**1,5 nF**	3,7 kHz (F_{ZCOMP})
C_{C2}	0 / 0	**0 pF**	219 kHz (F_{PCOMP})

Min COMP Voltage **0,43V**
Max COMP Voltage **5,4V**





Efficiency / Power Loss Analyzer

Step 8: Efficiency

Buck-Leg Power MOSFETs (Q_1, Q_2) CSD18563Q5A	Hi-side	Low-side	
On-State Resistance, $R_{DS(on)}$	**5,7**	**5,7**	mΩ
Total Gate Charge, Q_G	**11**	**11**	nC
Gate-Drain Charge, Q_{GD}	**2,9**	**2,9**	nC
Gate-Source Charge, Q_{GS}	**3,3**	**3,3**	nC
Gate Resistance, R_G	**1,5**	**1,5**	Ω
Transconductance, g_{FS}	**60**	**60**	S
Gate-Source Threshold Voltage, V_{TH}	**4**	**4**	V
Body Diode Forward Voltage, V_{BD}	**0,8**	**0,8**	V
Body Diode Rev Recovery Charge, Q_{RR}		**63**	nC
Thermal Resistance, θ_{JA}	**50**	**50**	°C/W

Boost-Leg Power MOSFETs (Q_3, Q_4) CSD16321Q5	Hi-side	Low-side	
On-State Resistance, $R_{DS(on)}$	**1,9**	**1,9**	mΩ
Total Gate Charge, Q_G	**22**	**22**	nC
Gate-Drain Charge, Q_{GD}	**2,5**	**2,5**	nC
Gate-Source Charge, Q_{GS}	**4**	**4**	nC
Gate Resistance, R_G	**1,5**	**1,5**	Ω
Transconductance, g_{FS}	**150**	**150**	S
Gate-Source Threshold Voltage, V_{TH}	**2**	**2**	V
Body Diode Forward Voltage, V_{BD}	**0,8**	**0,8**	V
Body Diode Rev Recovery Charge, Q_{RR}	**33**		nC
Thermal Resistance, θ_{JA}	**50**	**50**	°C/W

External Schottky Diode (if applicable)	*Buck* Leg	*Boost* Leg	
Schottky Fwd Voltage, V_{FWDsch}	**0**	**0**	V
Schottky Rev Recovery Charge, Q_{RRsch}	**0**	**0**	nC