WIDE VIN DC/DC Power Solutions
Reliable Power for Demanding Systems

LM5146-Q1 DC-DC Controller Design Tool

About | = Input Box | TERMS OF USE

Step 1: Operating Specifications

Input Voltage – Min, $V_{IN(min)}$	**30**	**V**
Input Voltage – Nom, $V_{IN(nom)}$	**48**	**V**
Input Voltage – Max, $V_{IN(max)}$	**60**	**V**
Output Voltage, V_{OUT}	**15**	**V**
Maximum Output Current, I_{OUT}	**15**	**A**
Free-running Switching Frequency, F_{SW}	**215**	**kHz**
SYNC Frequency (if used), $F_{SW-SYNC}$		**kHz**
Frequency Set Resistor, R_{RT}	46.4	kΩ

Step 2: Filter Inductor

Recommended Filter Inductance	9.6	µH
Inductance, L_F	**10**	**µH**
Inductor DCR	**2.86**	**mΩ**
Pk-to-Pk Ripple Current at $V_{IN(nom)}$, ΔI_L	4.8	A_{pk-pk}
Inductor Ripple Current as a % of Max I_{OUT}	32	%

Step 3: $R_{DS(on)}$ or Shunt-Based Current Limit

RDS(on) sensing

Required Current Limit Setpoint	**15**	**A**
Current Limit Set Resistor, R_{ILIM}	402	Ω
Min Inductor Sat Current, $I_{L(SAT)}$	20.4	A

Step 4: Output Capacitance

Output Voltage Ripple Specification	**10**	**mV_{pk-pk}**
Minimum Ideal Output Capacitance	281	µF
Total Output Capacitance (Derated), C_{OUT}	**330**	**µF**
Maximum Permitted ESR	1	mΩ
Output Capacitor ESR	**20**	**mΩ**
Resulting Output Voltage Ripple	97	mV_{pk-pk}
Output Capacitor Ripple Current	1.4	A (rms)

Step 5: Input Capacitance

Input Voltage Ripple Specification	**500**	**mV_{pk-pk}**
Minimum Ideal Input Capacitance	30	µF
Total Input Capacitance (Derated), C_{IN}	**47**	**µF**
Maximum Permitted ESR	10	mΩ
Input Capacitor ESR	**100**	**mΩ**
Resulting Input Voltage Ripple	2063	mV_{pk-pk}
Input Capacitor Ripple Current	7.0	A (rms)

Step 6: Soft-start, UVLO

Soft-Start Time, t_{SS}	**4**	**ms**
Soft-Start Capacitance, C_{SS}	47	nF
Input Voltage UVLO Turn-On	**14**	**V**
Input Voltage UVLO Turn-Off	**13**	**V**
UVLO Upper Resistor, R_{UV1}	100	kΩ
UVLO Lower Resistor, R_{UV2}	9.31	kΩ

If the SYNC feature is not required, connect SYNCIN to GND or VCC for DCM or CCM operation, respectively

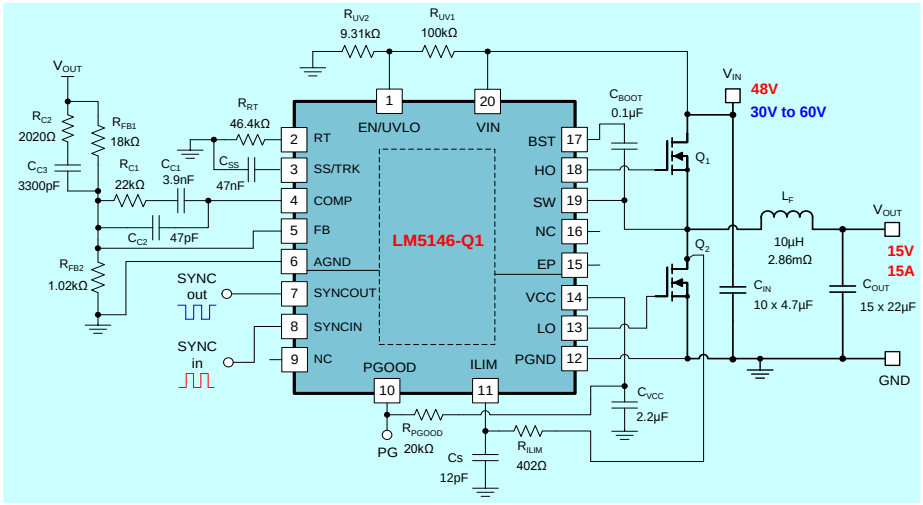
Step 7: Compensation Design

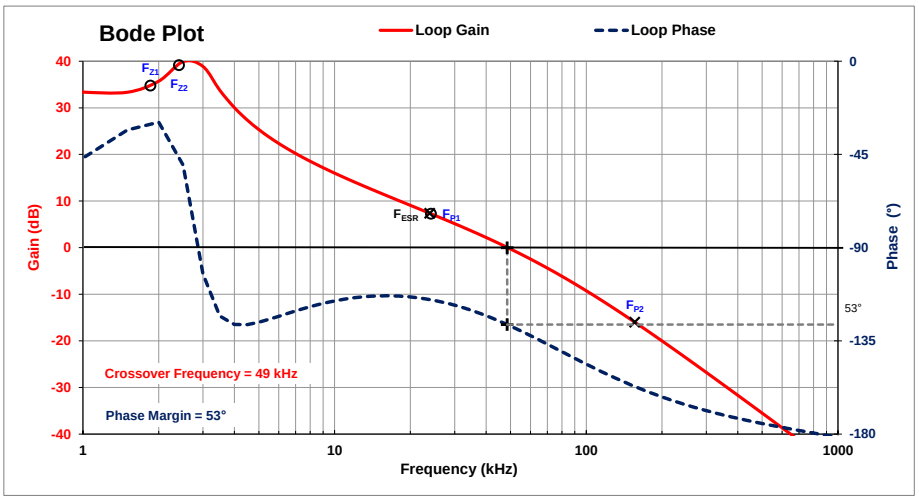
LC Complex Pole Frequency	2.7	kHz
ESR Zero Frequency	24	kHz
Desired Crossover Frequency	**50**	kHz
Appropriate Midband Gain	1.21	V/V
Upper Feedback Resistor, R_{FB1}	**18**	**kΩ**
Lower Feedback Resistor, R_{FB2}	1.02	kΩ
Actual Output Voltage, V_{OUT}	14.918	V

Pole & Zero Placement		
Baseline P/Z Frequencies:		
F_{Z1}	**1.9**	**kHz**
F_{Z2}	**2.5**	**kHz**
F_{P1}	**24**	**kHz**
F_{P2}	**108**	**kHz**

Compensation Components

	Calculated /	Std Values	Selected		Actual P/Z Frequencies
R_{C1}	21.8	22.1	**22**	**kΩ**	**1.9 kHz (F_{Z1})**
C_{C1}	3789	3900	**3900**	**pF**	**2.4 kHz (F_{Z2})**
C_{C2}	69	68	**47**	**pF**	**24 kHz (F_{P1})**
R_{C2}	2056	2050	**2020**	**Ω**	**156 kHz (F_{P2})**
C_{C3}	3210	3300	**3300**	**pF**	





** Specify Inductor Core Loss ** 0.4 W

Efficiency / Power Loss Analyzer

Step 8: Efficiency

High-Side MOSFET (Q_1) Specifications	NVMFS6B25NL	
On-State Resistance, $R_{DS(on)}$	**6.5**	mΩ
Total Gate Charge, Q_G	**37**	nC
Gate-Drain Charge, Q_{GD}	**6.7**	nC
Gate-Source Charge, Q_{GS}	**10.5**	nC
Output Capacitance, C_{OSS}	**738**	pF
Gate Resistance, R_G	**2**	Ω
Transconductance, g_{FS}	**82**	S
Gate-Source Threshold Voltage, $V_{GS(TH)}$	**2.7**	V
Body Diode Forward Voltage, V_{BD1}	**0.8**	V
Thermal Resistance, θ_{JA}	**50**	°C/W

Low-Side MOSFET (Q_2) Specifications	NVMFS6B14NL	
On-State Resistance, $R_{DS(on)}$	**6.4**	mΩ
Total Gate Charge, Q_G	**31**	nC
Output Charge, Q_{OSS}	**43**	nC
Output Capacitance, C_{OSS}	**1350**	pF
Body Diode Forward Voltage, V_{BD2}	**1.2**	V
Body Diode Recovery Charge, Q_{RR}	**84**	nC
Thermal Resistance, θ_{JA}	**50**	°C/W
Antiparallel Schottky Diode (if applicable)		
Schottky Diode Forward Voltage, V_{SD}	**0**	V
Schottky Diode Recovery Charge, Q_{RR2}	**0**	nC