LM(2)5148/-Q1 Synchronous Buck Controller Design Tool

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

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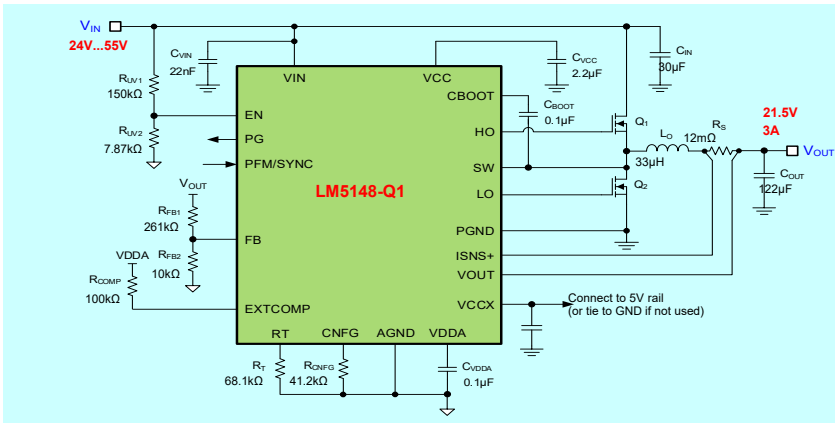
Step 1: Operating Specifications

LM5148-Q1

Input Voltage – Min, $V_{IN(min)}$	**24**	**V**
Input Voltage – Nom, $V_{IN(nom)}$	**48**	**V**
Input Voltage – Max, $V_{IN(max)}$	**55**	**V**
Output Voltage, V_{OUT}	**21.5**	**V**
Full Load Output Current, I_{OUT}	**3**	**A**
Switching Frequency, F_{SW}	**320**	**kHz**
Frequency Set Resistor, R_T	68.1	kΩ
Ambient Temperature, T_A	**40**	**°C**



Step 2: Current Sense Resistor

Required I_{OCP} Setpoint at $V_{IN(nom)}$	**4.5**	**A**
Recommended Shunt Resistance	11.8	mΩ
Shunt Resistance, R_S	**12**	**mΩ**
Min Inductor Sat Current, $I_{LO(SAT)}$	5.0	A
Max Power Loss in Shunt	0.29	W
$I_{OUT(typ)}$ at OCP Inception: $V_{IN(min)}$	4.9	A
$V_{IN(nom)}$	4.4	A
$V_{IN(max)}$	4.4	A

Step 3: Buck Inductance

Inductance for Ideal Slope Comp	35.49	µH
Inductance, L_O	**33**	**µH**
Inductor DCR	**40**	**mΩ**
ΔI_L as a % at $V_{IN(nom)}$	38	%
Estimate Core Loss at $V_{IN(nom)}$	**0.2**	**W**

Step 4: Output Capacitors

Output Voltage Ripple Spec	**50**	**mV_{PK-PK}**
Minimum Output Capacitance	8.8	µF
Output Capacitance (derated), C_{OUT}	**122**	**µF**
Maximum Permitted ESR	44	mΩ
Output Capacitor ESR	**1**	**mΩ**
Resulting Output Voltage Ripple (max)	4	mV_{PK-PK}
Output Capacitor RMS Current (max)	0.36	A_{RMS}

Step 5: Input Capacitors

Input Voltage Ripple Spec	**200**	**mV_{PK-PK}**
Minimum Input Capacitance	12	µF
Input Capacitance (derated), C_{IN}	**30**	**µF**
Maximum Permitted ESR	33.6	mΩ
Input Capacitor ESR	**1**	**mΩ**
Resulting Input Voltage Ripple (max)	82	mV_{PK-PK}
Input Capacitor RMS Current (max)	1.5	A_{RMS}

Step 6: Precision Enable, DRSS, FPWM / PFM

UVLO Divider | DRSS Enabled | FPWM

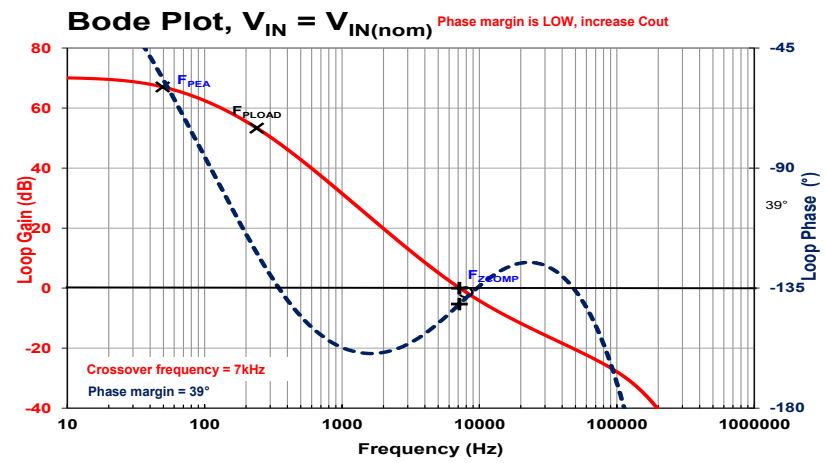
Input Voltage UVLO Turn On	**20**	**V**
Input Voltage UVLO Turn Off	**18.5**	**V**
Upper Enable Resistor, R_{UV1}	150	kΩ
Lower Enable Resistor, R_{UV2}	7.9	kΩ
Configuration Resistor, R_{CNFG}	41.2	kΩ

* Tie PFM to GND

Step 7: Compensation Design

Internal Compensation

Upper Feedback Resistor	**261**	**kΩ**
Lower Feedback Resistor	10	kΩ
Actual Output Voltage Setpoint	21.680	V



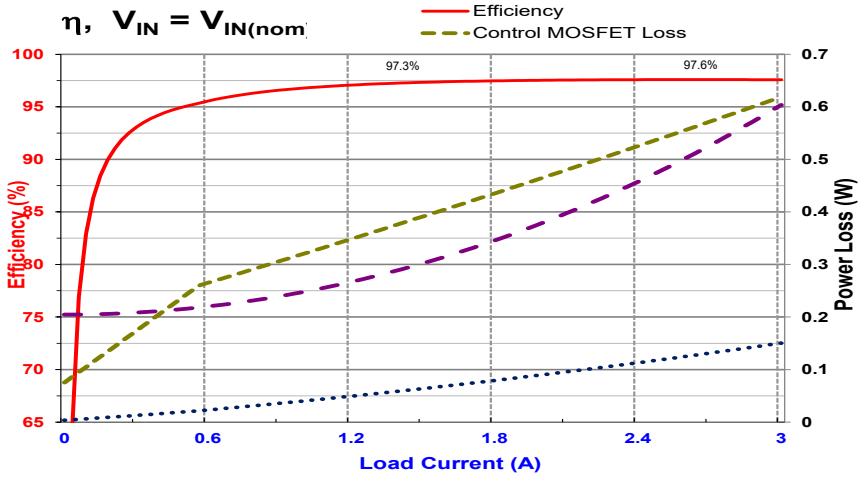
Efficiency / Power Loss Analyzer

Step 8: Efficiency

	Power MOSFETs (Q_1, Q_2) '852, '824 High-side	Low-side	
On-State Resistance, $R_{DS(on)}$	**8.8**	**8.8**	mΩ
Total Gate Charge, Q_G	**25**	**25**	nC
Gate-Drain Charge, Q_{GD}	**4.3**	**4.3**	nC
Gate-Source Charge, Q_{GS}	**4.6**	**4.6**	nC
Output Charge, Q_{OSS}		**12**	nC
Output Capacitance, C_{OSS}	**192**	**192**	pF
Gate Resistance, R_G	**1.2**	**1.2**	Ω
Transconductance, g_{FS}	**84**	**84**	S
Gate-Source Threshold Voltage, V_{TH}	**1.7**	**1.7**	V
Body Diode Forward Voltage, V_{BD}	**1.2**	**1.2**	V
Body Diode Rev Recovery Charge, Q_{RR}		**14**	nC
Thermal Resistance, θ_{JA}	**41**	**41**	°C/W

External Schottky Diode (if applicable)

Schottky Fwd Voltage, V_{FWDsch}	**0**	V
Schottky Rev Recovery Charge, Q_{RRsch}	**0**	nC



Step 9: IC Power Loss

VCCX Connected

IC Power Dissipation	0.08	W
IC Junction Temperature (estimate)	42.7	°C