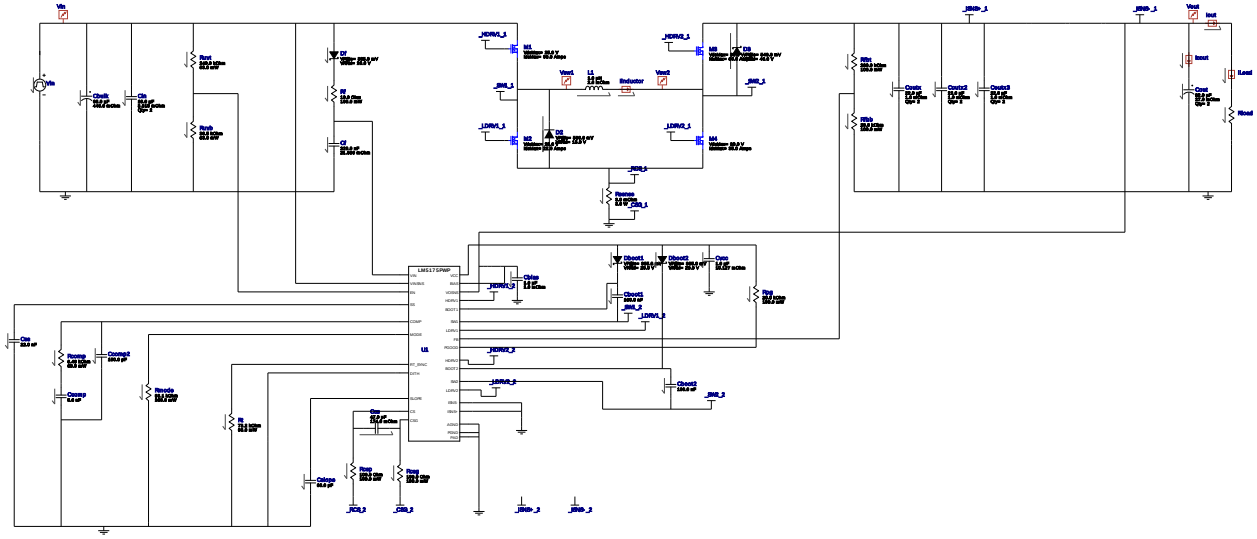
VinMin = 10.0V
VinMax = 12.0V
Vout = 12.0V
Iout = 12.0A

Device = LM5175PWPR
Topology = Buck_Boost
Created = 2018-04-12 03:00:39.291
User ID = 5297731
Design Id = 27
eSim Id = 1
Simulation Type = Input Transient

WEBENCH® Electrical Simulation Report



My Comments

No comments

Electrical BOM

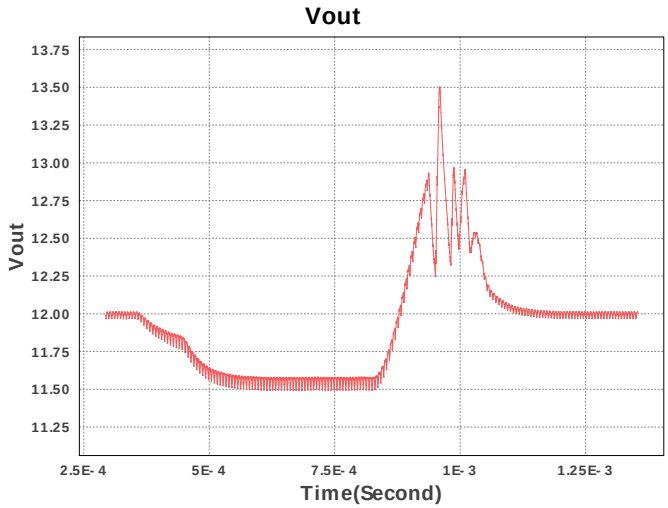
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbias	Taiyo Yuden	TMK212BJ105KG-T Series= X5R	Cap= 1.0 µF ESR= 1.0 mOhm VDC= 20.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm²
2.	Cboot1	TDK	C3216C0G1H104J160AA Series= C0G/NP0	Cap= 100.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.20	1206 11 mm²
3.	Cboot2	TDK	C3216C0G1H104J160AA Series= C0G/NP0	Cap= 100.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.20	1206 11 mm²
4.	Cbulk	Nichicon	UUD1C680MCL1GS Series= uD	Cap= 68.0 µF ESR= 440.0 mOhm VDC= 16.0 V IRMS= 230.0 mA	1	$0.11	SM_RADIAL_6.3AMM 80 mm²
5.	Ccomp	TDK	CGA4C2C0G1H562J060AA Series= C0G/NP0	Cap= 5.6 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.05	0805 7 mm²
6.	Ccomp2	Samsung Electro-Mechanics	CL21C151JBANNNC Series= C0G/NP0	Cap= 150.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
7.	Ccs	AVX	06035A470JAT2A Series= C0G/NP0	Cap= 47.0 pF ESR= 174.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm²
8.	Cf	TDK	C1608X5R1H224K080AB Series= X5R	Cap= 220.0 nF ESR= 21.699 mOhm VDC= 50.0 V IRMS= 1.125 A	1	$0.04	0603 5 mm²
9.	Cin	MuRata	GRM31CR61C106KA88L Series= X5R	Cap= 10.0 µF ESR= 3.615 mOhm VDC= 16.0 V IRMS= 3.828 A	2	$0.10	1206_190 11 mm²

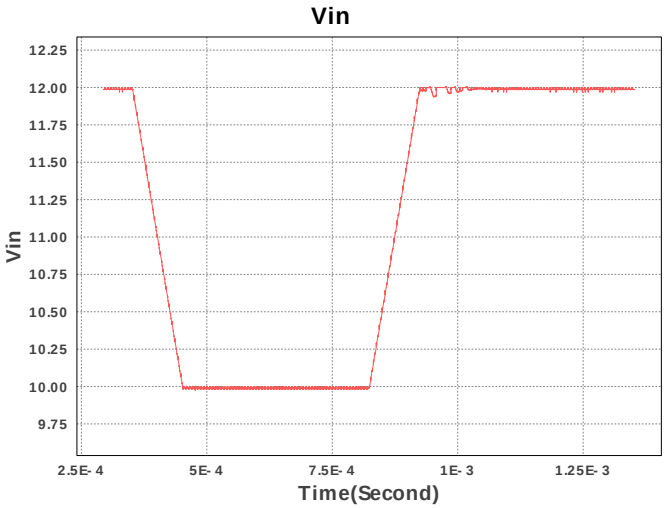
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Cout	Panasonic	16SVPF82M Series= SVPF	Cap= 82.0 µF ESR= 27.0 mOhm VDC= 16.0 V IRMS= 3.0 A	2	$0.37	 CAPSMT_62_E61 53 mm²
11.	Coutx	AVX	12103D226MAT2A Series= X5R	Cap= 22.0 µF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	2	$0.26	 1210 15 mm²
12.	Coutx2	AVX	12103D226MAT2A Series= X5R	Cap= 22.0 µF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	2	$0.26	 1210 15 mm²
13.	Coutx3	AVX	12103D226MAT2A Series= X5R	Cap= 22.0 µF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	2	$0.26	 1210 15 mm²
14.	Cslope	Yageo America	CC0603JRNP09BN680 Series= C0G/NP0	Cap= 68.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0603 5 mm²
15.	Css	MuRata	GCM21B5C1H223JA16L Series= C0G/NP0	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.07	 0805 7 mm²
16.	Cvcc	MuRata	GRM188R61C105KA93D Series= X5R	Cap= 1.0 µF ESR= 10.127 mOhm VDC= 16.0 V IRMS= 994.631 mA	1	$0.02	 0603 5 mm²
17.	D2	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 15.0 V	1	NA	CUSTOM 0 mm²
18.	D3	Torex USA Corporation	XBS104S13R-G	VF@Io= 540.0 mV VRRM= 40.0 V	1	$0.13	 SOD-323 9 mm²
19.	Dboot1	Comchip Technology	CDBK0520L	VF@Io= 385.0 mV VRRM= 20.0 V	1	$0.08	 SOD-123F 12 mm²
20.	Dboot2	Comchip Technology	CDBK0520L	VF@Io= 385.0 mV VRRM= 20.0 V	1	$0.08	 SOD-123F 12 mm²
21.	Df	Comchip Technology	CDBK0520L	VF@Io= 385.0 mV VRRM= 20.0 V	1	$0.08	 SOD-123F 12 mm²
22.	L1	Coilcraft	XAL7070-102MEB	L= 1.0 µH DCR= 2.6 mOhm	1	$1.19	 XAL7070 87 mm²
23.	M1	Texas Instruments	CSD16340Q3	VdsMax= 25.0 V IdsMax= 60.0 Amps	1	$0.37	 DQG0008A 18 mm²
24.	M2	Texas Instruments	CSD16327Q3	VdsMax= 25.0 V IdsMax= 22.0 Amps	1	$0.36	 DQG0008A 18 mm²
25.	M3	Texas Instruments	CSD17575Q3	VdsMax= 30.0 V IdsMax= 60.0 Amps	1	$0.35	 DQG0008A 18 mm²
26.	M4	Texas Instruments	CSD17577Q3A	VdsMax= 30.0 V IdsMax= 35.0 Amps	1	$0.21	 DNH0008A 18 mm²
27.	Rcomp	Vishay-Dale	CRCW04026K49FKED Series= CRCW..e3	Res= 6.49 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
28.	Rcsg	Yageo America	RC0603FR-07100RL Series= ?	Res= 100.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm²
29.	Rcsp	Yageo America	RC0603FR-07100RL Series= ?	Res= 100.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
30.	Rf	Vishay-Dale	CRCW060310R0FKEA Series= CRCW..e3	Res= 10.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
31.	Rfbb	Yageo America	RC0603FR-0720KL Series= ?	Res= 20.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
32.	Rfbt	Yageo America	RC0603FR-07280KL Series= ?	Res= 280.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
33.	Rmode	Vishay-Dale	CRCW060393K1FKEA Series= CRCW..e3	Res= 93.1 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
34.	Rpg	Yageo America	RC0603FR-0720KL Series= ?	Res= 20.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
35.	Rsense	Vishay-Dale	WSR33L000FEA Series= WSR	Res= 3.0 mOhm Power= 3.0 W Tolerance= 1.0%	1	$0.68	4527 122 mm²
36.	Rt	Vishay-Dale	CRCW040273K2FKED Series= CRCW..e3	Res= 73.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
37.	Ruvb	Vishay-Dale	CRCW040236K5FKED Series= CRCW..e3	Res= 36.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
38.	Ruvt	Yageo America	RC0402FR-07249KL Series= ?	Res= 249.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
39.	U1	Texas Instruments	LM5175PWPR	Switcher	1	$3.10	PWP0028F_N 98 mm²

Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	Cout	IC	Initial Condition	12.0 V
2.	Coutx	IC	Initial Condition	12.0 V
3.	Coutx2	IC	Initial Condition	12.0 V
4.	Coutx3	IC	Initial Condition	12.0 V
5.	Cslope	IC	Initial Condition	0 V
6.	Css	IC	Initial Voltage	1.195 V
7.	L1	IC	Initial Current	-16.134453781512608 A
8.	Rload	R	Load Resistance	1.0 Ohm





Design Inputs

#	Name	Value	Description
1.	Iout	12.0 A	Maximum Output Current
2.	VinMax	12.0 V	Maximum input voltage
3.	VinMin	10.0 V	Minimum input voltage
4.	Vout	12.0 V	Output Voltage
5.	base_pn	LM5175	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0 degC	Ambient temperature

Operating Values

#	Name	Value	Category	Description
1.	Total BOM	$0.0		Total BOM Cost
2.	Cin IRMS	0.0 A	Current	Input capacitor RMS ripple current
3.	Cout IRMS	0.0 A	Current	Output capacitor RMS ripple current
4.	Coutx IRMS	0.0 A	Current	Output capacitor_x RMS ripple current
5.	Iin Avg	12.173 A	Current	Average input current
6.	L Ipp	0.0 A	Current	Peak-to-peak inductor ripple current
7.	L1 Irms	12.0 A	Current	Inductor ripple current
8.	M1 Irms	12.0 A	Current	MOSFET RMS ripple current
9.	M2 Irms	0.0 A	Current	MOSFET RMS ripple current
10.	SW Ipk	0.0 A	Current	Peak switch current
11.	BOM Count	4	General	Total Design BOM count
12.	FootPrint	934.0 mm^2	General	Total Foot Print Area of BOM components
13.	Frequency	343.832 kHz	General	Switching frequency
14.	IC Tolerance	0.0 V	General	IC Feedback Tolerance
15.	M1 Rdson	4.3 mOhm	General	Drain-Source On-resistance
16.	M1 ThetaJA	42.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
17.	M2 Rdson	4.8 mOhm	General	Drain-Source On-resistance
18.	M2 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
19.	Mode	CCM	General	Conduction Mode
20.	Pout	144.0 W	General	Total output power
21.	Cross Freq	19.162 kHz	Op Point	Bode plot crossover frequency
22.	Duty Cycle	100.0 %	Op Point	Duty cycle
23.	Efficiency	98.581 %	Op Point	Steady state efficiency
24.	Gain Marg	-15.58 dB	Op Point	Bode Plot Gain Margin
25.	IC Tj	33.016 degC	Op Point	IC junction temperature
26.	ICThetaJA	30.5 degC/W	Op Point	IC junction-to-ambient thermal resistance
27.	IOUT_OP	12.0 A	Op Point	Iout operating point
28.	Low Freq Gain	68.31 dB	Op Point	Gain at 1Hz
29.	M1 TjOP	66.162 degC	Op Point	MOSFET junction temperature
30.	M2 TjOP	32.162 degC	Op Point	MOSFET junction temperature
31.	Operating Topology	Buck	Op Point	The current operating topology of the device
32.	Phase Marg	57.164 deg	Op Point	Bode Plot Phase Margin
33.	VIN_OP	12.0 V	Op Point	Vin operating point
34.	Vout Actual	12.0 V	Op Point	Vout Actual calculated based on selected voltage divider resistors
35.	Vout OP	12.0 V	Op Point	Operational Output Voltage
36.	Vout Tolerance	1.886 %	Op Point	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
37.	Vout p-p	0.0 V	Op Point	Peak-to-peak output ripple voltage
38.	Cin Pd	0.0 W	Power	Input capacitor power dissipation
39.	Cout Pd	0.0 W	Power	Output capacitor power dissipation

#	Name	Value	Category	Description
40.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
41.	D2 Pd	0.0 W	Power	Diode power dissipation
42.	D3 Pd	0.0 W	Power	Diode power dissipation
43.	IC Pd	98.88 mW	Power	IC power dissipation
44.	L Pd	468.0 mW	Power	Inductor power dissipation
45.	M1 Pd	848.065 mW	Power	MOSFET power dissipation
46.	M1 PdCond	671.515 mW	Power	M1 MOSFET conduction losses
47.	M1 PdSw	176.551 mW	Power	M1 MOSFET switching losses
48.	M2 Pd	39.3 mW	Power	MOSFET power dissipation
49.	M2 PdCond	0.0 W	Power	M2 MOSFET conduction losses
50.	M2 PdSw	39.3 mW	Power	M2 MOSFET switching losses
51.	M3 Pd	619.2 mW	Power	M3 MOSFET total power dissipation
52.	M3 PdCond	619.2 mW	Power	M3 MOSFET conduction losses
53.	M4 Pd	0.0 W	Power	M4 MOSFET total power dissipation
54.	Rsense Pd	0.0 W	Power	Rsense Power Dissipation
55.	Total Pd	2.073 W	Power	Total Power Dissipation

Design Assistance

1. Tip: Snubbers and/or gate resistors may be required to limit the SW1,2 node switching spikes below the IC and FET abs max ratings.

2. Tip: Slope Capacitor: smaller slope capacitors provide better transition region behavior.

3. LM5175 Product Folder : http://www.ti.com/product/LM5175 : contains the data sheet and other resources.