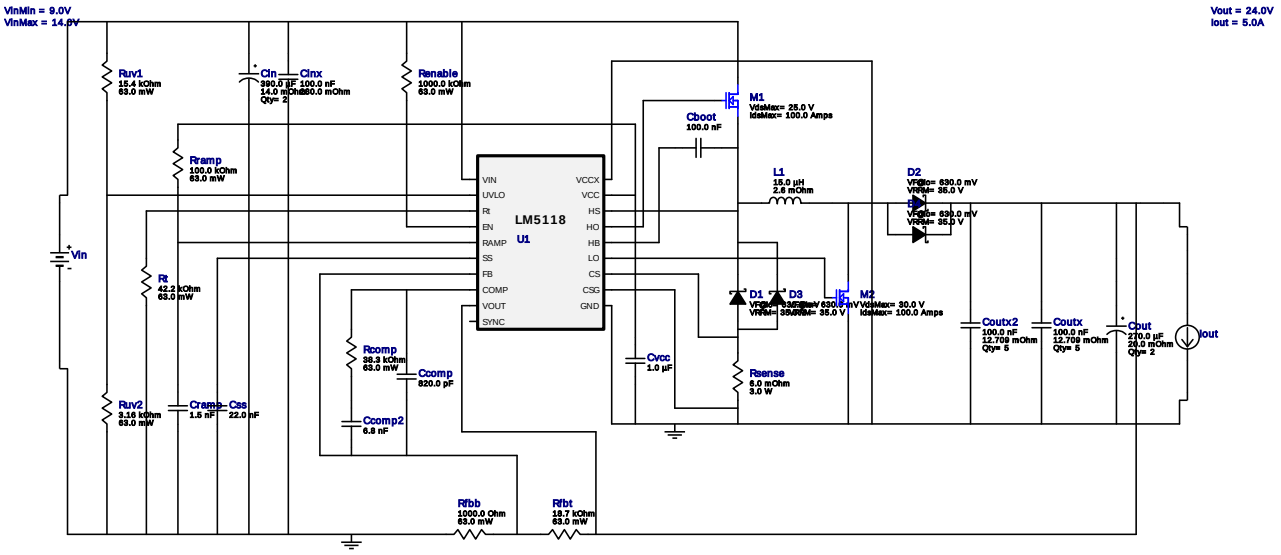
WEBENCH® Design Report

VinMin = 9.0V
VinMax = 14.0V
Vout = 24.0V
Iout = 5.0A

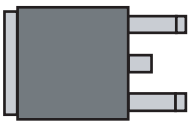
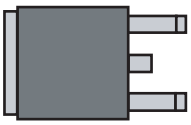
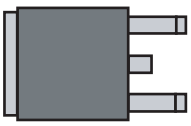
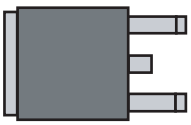
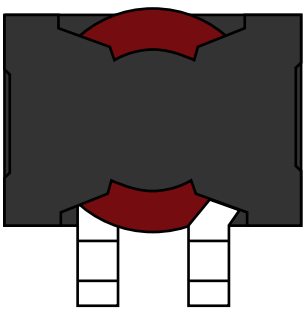
Device = LM5118MH/NOPB
Topology = Buck_Boost
Created = 6/24/15 9:07:28 AM
BOM Cost = $14.77
Footprint = 2,465.0 mm^2
BOM Count = 38
Total Pd = 7.8W

Design : 3562520/16 LM5118MH/NOPB
LM5118MH/NOPB 9.0V-14.0V to 24.00V @ 5.0A

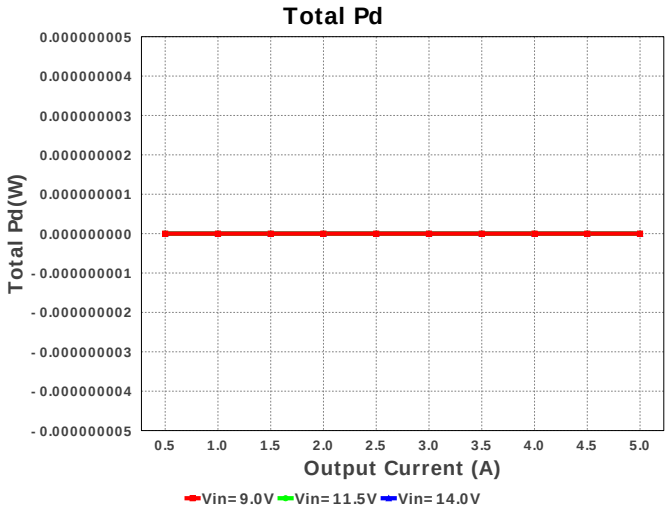


Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM21BR71E104KA01L Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
2.	Ccomp	Yageo America	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
3.	Ccomp2	Yageo America	CC0805KRX7R9BB682 Series= X7R	Cap= 6.8 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
4.	Cin	Panasonic	20SVPF390M Series= 1273	Cap= 390.0 uF ESR= 14.0 mOhm VDC= 20.0 V IRMS= 4.95 A	2	$0.63	CAPSMT_62_E12 106 mm^2
5.	Cinx	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
6.	Cout	Panasonic	EEHZA1V271P Series= 1267	Cap= 270.0 uF ESR= 20.0 mOhm VDC= 35.0 V IRMS= 2.5 A	2	$1.13	SM_RADIAL_10BMM 160 mm^2
7.	Coutx	TDK	C2012X8R1H104K Series= X8R	Cap= 100.0 nF ESR= 12.709 mOhm VDC= 50.0 V IRMS= 0.0 A	5	$0.03	0805 7 mm^2
8.	Coutx2	TDK	C2012X8R1H104K Series= X8R	Cap= 100.0 nF ESR= 12.709 mOhm VDC= 50.0 V IRMS= 0.0 A	5	$0.03	0805 7 mm^2

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Cramp	Yageo America	CC0805KRX7R9BB152 Series= X7R	Cap= 1.5 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0805 7 mm²
10.	Css	Yageo America	CC0805KRX7R9BB223 Series= X7R	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0805 7 mm²
11.	Cvcc	Taiyo Yuden	EMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 16.0 V IRMS= 0.0 A	1	$0.02	 0805 7 mm²
12.	D1	Vishay-Semiconductor	MBRB1635PBF	VF@Io= 630.0 mV VRRM= 35.0 V	1	$0.71	 DDPAK 210 mm²
13.	D2	Vishay-Semiconductor	MBRB1635PBF	VF@Io= 630.0 mV VRRM= 35.0 V	1	$0.71	 DDPAK 210 mm²
14.	D3	Vishay-Semiconductor	MBRB1635PBF	VF@Io= 630.0 mV VRRM= 35.0 V	1	$0.71	 DDPAK 210 mm²
15.	D4	Vishay-Semiconductor	MBRB1635PBF	VF@Io= 630.0 mV VRRM= 35.0 V	1	$0.71	 DDPAK 210 mm²
16.	L1	Coilcraft	SER2918H-153KL	L= 15.0 µH DCR= 2.6 mOhm	1	$2.65	 SER2918H 652 mm²
17.	M1	Texas Instruments	CSD16321Q5	VdsMax= 25.0 V IdsMax= 100.0 Amps	1	$0.73	 TRANS_NexFET_Q5 55 mm²
18.	M2	Texas Instruments	CSD17312Q5	VdsMax= 30.0 V IdsMax= 100.0 Amps	1	$1.07	 TRANS_NexFET_Q5 55 mm²
19.	Rcomp	Vishay-Dale	CRCW040238K3FKED Series= CRCW..e3	Res= 38.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
20.	Renable	Vishay-Dale	CRCW04021M00FKED Series= CRCW..e3	Res= 1000.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
21.	Rfbb	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
22.	Rfbt	Vishay-Dale	CRCW040218K7FKED Series= CRCW..e3	Res= 18.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
23.	Rramp	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
24.	Rsense	Vishay-Dale	WSR36L000FEA Series= 382	Res= 6.0 mOhm Power= 3.0 W Tolerance= 1.0%	1	$0.64	4527 122 mm^2
25.	Rt	Vishay-Dale	CRCW040242K2FKED Series= CRCW..e3	Res= 42.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
26.	Ruv1	Vishay-Dale	CRCW040215K4FKED Series= CRCW..e3	Res= 15.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
27.	Ruv2	Vishay-Dale	CRCW04023K16FKED Series= CRCW..e3	Res= 3.16 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
28.	U1	Texas Instruments	LM5118MH/NOPB	Switcher	1	$2.86	MXA20A 71 mm^2



Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	8.221 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	8.199 A	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	0.0 A	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	9.438 A	Current	Average input current
5.	L Ipp	3.072 A	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	18.424 A	Current	Inductor ripple current
7.	M1 Irms	11.404 A	Current	MOSFET RMS ripple current
8.	M2 Irms	11.404 A	Current	MOSFET RMS ripple current
9.	SW Ipk	19.938 A	Current	Peak switch current
10.	BOM Count	38	General	Total Design BOM count
11.	FootPrint	2.465 k mm^2	General	Total Foot Print Area of BOM components
12.	Frequency	141.53 kHz	General	Switching frequency
13.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
14.	M1 ThetaJA	48.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
15.	M2 ThetaJA	49.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
16.	Pout	120.0 W	General	Total output power
17.	Total BOM	$14.77	General	Total BOM Cost
18.	D1 Tj	50.475 degC	Op_Point	D1 junction temperature
19.	D2 Tj	50.475 degC	Op_Point	D2 junction temperature
20.	D3 Tj	50.475 degC	Op_Point	D3 junction temperature
21.	D4 Tj	50.475 degC	Op_Point	D4 junction temperature

#	Name	Value	Category	Description
22.	Vout OP	24.0 V	Op_Point	Operational Output Voltage
23.	Cross Freq	2.554 kHz	Op_point	Bode plot crossover frequency
24.	Duty Cycle	72.83 %	Op_point	Duty cycle
25.	Efficiency	90.817 %	Op_point	Steady state efficiency
26.	IC Tj	41.009 degC	Op_point	IC junction temperature
27.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
28.	IOUT_OP	5.0 A	Op_point	Iout operating point
29.	M1 TjOP	52.525 degC	Op_point	MOSFET junction temperature
30.	M2 TjOP	176.509 degC	Op_point	MOSFET junction temperature
31.	Phase Marg	27.031 deg	Op_point	Bode Plot Phase Margin
32.	VIN_OP	9.0 V	Op_point	Vin operating point
33.	Vout p-p	31.124 mV	Op_point	Peak-to-peak output ripple voltage
34.	Cin Pd	473.092 mW	Power	Input capacitor power dissipation
35.	Cout Pd	672.256 mW	Power	Output capacitor power dissipation
36.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
37.	D1 Pd	1.575 W	Power	Diode power dissipation
38.	D2 Pd	1.575 W	Power	Diode2 power dissipation
39.	D3 Pd	1.575 W	Power	Diode3 power dissipation
40.	D4 Pd	1.575 W	Power	Diode4 power dissipation
41.	IC Pd	275.234 mW	Power	IC power dissipation
42.	L Pd	970.783 mW	Power	Inductor power dissipation
43.	M1 Pd	517.314 mW	Power	MOSFET power dissipation
44.	M1 PdCond	347.015 mW	Power	M1 MOSFET conduction losses
45.	M1 PdSw	170.299 mW	Power	M1 MOSFET switching losses
46.	M2 Pd	2.887 W	Power	MOSFET power dissipation
47.	M2 PdCond	211.737 mW	Power	M2 MOSFET conduction losses
48.	M2 PdSw	2.676 W	Power	M2 MOSFET switching losses
49.	Total Pd	7.8 W	Power	Total Power Dissipation
50.	Low Freq Gain	81.619 dB	Unknown	Gain at 10Hz

Design Inputs

#	Name	Value	Description
1.	Iout	5.0	Maximum Output Current
2.	Iout1	5.0	Output Current #1
3.	VinMax	14.0	Maximum input voltage
4.	VinMin	9.0	Minimum input voltage
5.	Vout	24.0	Output Voltage
6.	Vout1	24.0	Output Voltage #1
7.	base_pn	LM5118	Texas Instruments Base Part Number
8.	source	DC	Input Source Type
9.	ta	30.0	Ambient temperature

Design Assistance

1. The LM5118 is a wide range buck-boost controller which is operable in an ultra wide input range of 3 to 75V. A buck-boost regulator can maintain regulation for input voltages either higher or lower than the output voltage. The challenge is that buck-boost power converters are not as efficient as buck regulators. The LM5118 has been designed as a dual mode controller whereby the power converter acts as a buck regulator while the input voltage is above the output. As the input voltage approaches the output voltage, a gradual transition to the buck-boost mode occurs. This gradual transition between modes eliminates disturbances at the output during transitions.

2. LM5118 Product Folder : http://www.ti.com/product/lm5118 : contains the data sheet and other resources.