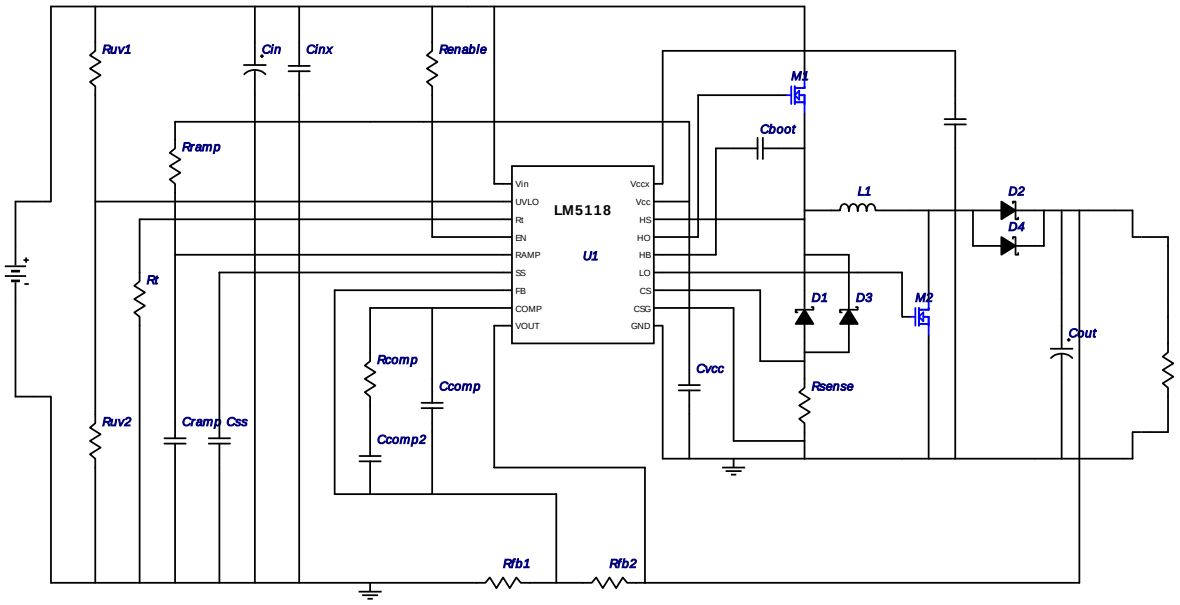
WEBENCH® Design Report

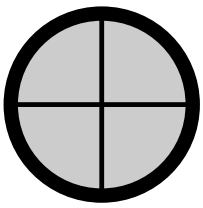
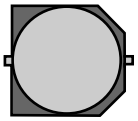
VinMin = 23.0V
VinMax = 34.0V
Vout = 28.0V
Iout = 5.0A

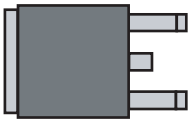
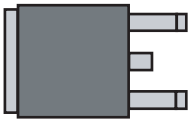
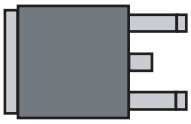
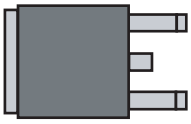
Device = LM5118MH/NOPB
Topology = Buck_Boost
Created = 12/23/12 9:41:25 PM
BOM Cost = $0.00
Total Pd = 9.18 W
Footprint = 4,895.0 mm2
BOM Count = 41

Design : 3595001/19 LM5118MH/NOPB
LM5118MH/NOPB 23.0V-34.0V to 28.0V @ 5.0A



Electrical BOM

#	Name	Manufacturer	Part Number	Quantity	Price	Properties	Footprint
1.	Cboot	MuRata	GRM21BR71E104KA01L Series= X7R	1	$0.01	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	0805 13mm2
2.	Ccomp	Yageo America	CC0805KRX7R9BB271 Series= X7R	1	$0.01	Cap= 270.0 pF VDC= 50.0 V IRMS= 0.0 A	0805 13mm2
3.	Ccomp2	Yageo America	CC0805KRX7R9BB272 Series= X7R	1	$0.01	Cap= 2.7 nF VDC= 50.0 V IRMS= 0.0 A	0805 13mm2
4.	Cin	Panasonic	EEUED2D221 Series= 286	3	$1.28	Cap= 220.0 µF ESR= 110.775 mOhm VDC= 200.0 V IRMS= 2.0 A	 CAPPR7.5-18X31.5 400mm2
5.	Cinx	Kemet	C0805C104K5RACTU Series= X7R	1	$0.01	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	0805 13mm2
6.	Cout	Panasonic	EEE-FC1H470P Series= FC	14	$0.24	Cap= 47.0 µF ESR= 300.0 mOhm VDC= 50.0 V IRMS= 500.0 mA	 SM_RADIAL_G 172mm2
7.	Cramp	Yageo America	CC0805KRX7R9BB272 Series= X7R	1	$0.01	Cap= 2.7 nF VDC= 50.0 V IRMS= 0.0 A	0805 13mm2

#	Name	Manufacturer	Part Number	Quantity	Price	Properties	Footprint
8.	Css	Yageo America	CC0805KRX7R9BB223 Series= X7R	1	$0.01	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	 0805 13mm2
9.	Cvcc	MuRata	GRM155R61A105KE15D Series= X5R	1	$0.01	Cap= 1.0 µF VDC= 10.0 V IRMS= 0.0 A	 0402 8mm2
10.	D1	Vishay-Semiconductor	MBRB745PBF	1	$0.67	VF@Io= 700.0 mV VRRM= 45.0 V	 DDPAK 210mm2
11.	D2	Vishay-Semiconductor	MBRB745PBF	1	$0.67	VF@Io= 700.0 mV VRRM= 45.0 V	 DDPAK 210mm2
12.	D3	Vishay-Semiconductor	MBRB745PBF	1	$0.67	VF@Io= 700.0 mV VRRM= 45.0 V	 DDPAK 210mm2
13.	D4	Vishay-Semiconductor	MBRB745PBF	1	$0.67	VF@Io= 700.0 mV VRRM= 45.0 V	 DDPAK 210mm2
14.	L1	CUSTOM	CUSTOM	1	$0.00	L= 50.664 µH DCR= 28.0 mOhm	CUSTOM 0mm2
15.	M1	NXP Semiconductor	PSMN5R5-60YS	1	$0.63	VdsMax= 60.0 V IdsMax= 74.0 Amps	 LFPAK 56mm2
16.	M2	AOS	AON7242	1	$0.49	VdsMax= 40.0 V IdsMax= 30.0 Amps	 TRANS_AOS_DFN3.3X3.3 28mm2
17.	Rcomp	Vishay-Dale	CRCW040286K6FKED Series= CRCW..e3	1	$0.01	Res= 86.6 kOhm Power= 63.0 mW Tolerance= 1.0%	 0402 8mm2
18.	Renable	Vishay-Dale	CRCW04021M00FKED Series= CRCW..e3	1	$0.01	Res= 1000.0 kOhm Power= 63.0 mW Tolerance= 1.0%	 0402 8mm2
19.	Rfb1	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	1	$0.01	Res= 1,000 Ohm Power= 63.0 mW Tolerance= 1.0%	 0402 8mm2
20.	Rfb2	Vishay-Dale	CRCW040221K5FKED Series= CRCW..e3	1	$0.01	Res= 21.5 kOhm Power= 63.0 mW Tolerance= 1.0%	 0402 8mm2
21.	Rramp	Vishay-Dale	CRCW040276K8FKED Series= CRCW..e3	1	$0.01	Res= 76.8 kOhm Power= 63.0 mW Tolerance= 1.0%	 0402 8mm2
22.	Rsense	Bourns	CRA2512-FZ-R010ELF Series= 385	1	$0.17	Res= 10.0 mOhm Power= 3.0 W Tolerance= 1.0%	 2512 43mm2
23.	Rt	Vishay-Dale	CRCW040261K9FKED Series= CRCW..e3	1	$0.01	Res= 61.9 kOhm Power= 63.0 mW Tolerance= 1.0%	 0402 8mm2
24.	Ruv1	Vishay-Dale	CRCW040237K4FKED Series= CRCW..e3	1	$0.01	Res= 37.4 kOhm Power= 63.0 mW Tolerance= 1.0%	 0402 8mm2

#	Name	Manufacturer	Part Number	Quantity	Price	Properties	Footprint
25.	Ruv2	Vishay-Dale	CRCW04022K67FKED Series= CRCW..e3	1	$0.01	Res= 2.67 kOhm Power= 63.0 mW Tolerance= 1.0%	0402 8mm2
26.	U1	Texas Instruments	LM5118MH/NOPB	1	$2.38	Switcher	 MXA20A 71mm2

Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	2.465 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	713.008 m A	Current	Output capacitor RMS ripple current
3.	HS Ipk	8.375 A	Current	Peak switch current in IC
4.	Iin Avg	4.388 A	Current	Average input current
5.	L Ipp	2.47 A	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	7.569 A	Current	Inductor ripple current
7.	LS Ipk	8.065 A	Current	Peak switch current in IC
8.	M1 Irms	5.79 A	Current	MOSFET RMS ripple current
9.	M2 Irms	3.978 A	Current	MOSFET RMS ripple current
10.	BOM Count	41.0	General	Total Design BOM count
11.	FootPrint	4.895 k mm2	General	Total Foot Print Area of BOM components
12.	Frequency	100.0 k Hz	General	Switching frequency
13.	IC Tolerance	18.0 m V	General	IC Feedback Tolerance
14.	M1 ThetaJA	40.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
15.	M2 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
16.	Pout	140.0 W	General	Total output power
17.	Total BOM	$0.0	General	Total BOM Cost
18.	Boost Duty Cycle	32.183 %	Op_point	Boost Duty cycle
19.	Buck Duty Cycle	58.371 %	Op_point	Buck Duty cycle
20.	Cross Freq	4.543 k Hz	Op_point	Bode plot crossover frequency
21.	Efficiency	93.844 %	Op_point	Steady state efficiency
22.	IC Tj	57.059 degC	Op_point	IC junction temperature
23.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
24.	IOUT_OP	5.0 A	Op_point	Iout operating point
25.	M1 TjOP	39.216 degC	Op_point	MOSFET junction temperature
26.	M2 TjOP	33.319 degC	Op_point	MOSFET junction temperature
27.	Operating Topology	Transition	Op_point	The current operating topology of the device
28.	Phase Marg	30.946 deg	Op_point	Bode Plot Phase Margin
29.	VIN_OP	34.0 V	Op_point	Vin operating point
30.	Vout p-p	53.135 m V	Op_point	Peak-to-peak output ripple voltage
31.	Cin Pd	224.312 m W	Power	Input capacitor power dissipation
32.	Cout Pd	10.894 m W	Power	Output capacitor power dissipation
33.	IC Pd	926.472 m W	Power	IC power dissipation
34.	L Pd	1.764 W	Power	Inductor power dissipation
35.	M1 Pd	848.699 m W	Power	MOSFET power dissipation
36.	M1 PdCond	820.129 m W	Power	M1 MOSFET conduction losses
37.	M1 PdSw	28.569 m W	Power	M1 MOSFET switching losses
38.	M2 Pd	262.977 m W	Power	MOSFET power dissipation
39.	M2 PdCond	116.879 m W	Power	M2 MOSFET conduction losses
40.	M2 PdSw	146.098 m W	Power	M2 MOSFET switching losses
41.	Total Pd	9.184 W	Power	Total Power Dissipation
42.	Diode 1 Power Dissipation	728.503 m OpvalUnits.PD	Unknown	Power dissipation in the diode
43.	Diode 2 Power Dissipation	1.823 OpvalUnits.PD	Unknown	Power dissipation in the diode
44.	Diode 3 Power Dissipation	728.503 m OpvalUnits.PD	Unknown	Power dissipation in the diode
45.	Diode 4 Power Dissipation	1.823 OpvalUnits.PD	Unknown	Power dissipation in the diode

Design Inputs

#	Name	Value	Description
1.	Iout	5.0 A	Maximum Output Current
2.	Iout1	5.0 Amps	Output Current #1
3.	VinMax	34.0 V	Maximum input voltage
4.	VinMin	23.0 V	Minimum input voltage
5.	Vout	28.0 V	Output Voltage
6.	Vout1	28.0 Volt	Output Voltage #1
7.	base_pn	LM5118	National Based Product Number
8.	source	DC	Input Source Type
9.	Ta	20.0 degC	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.