

## WEBENCH® Design Report

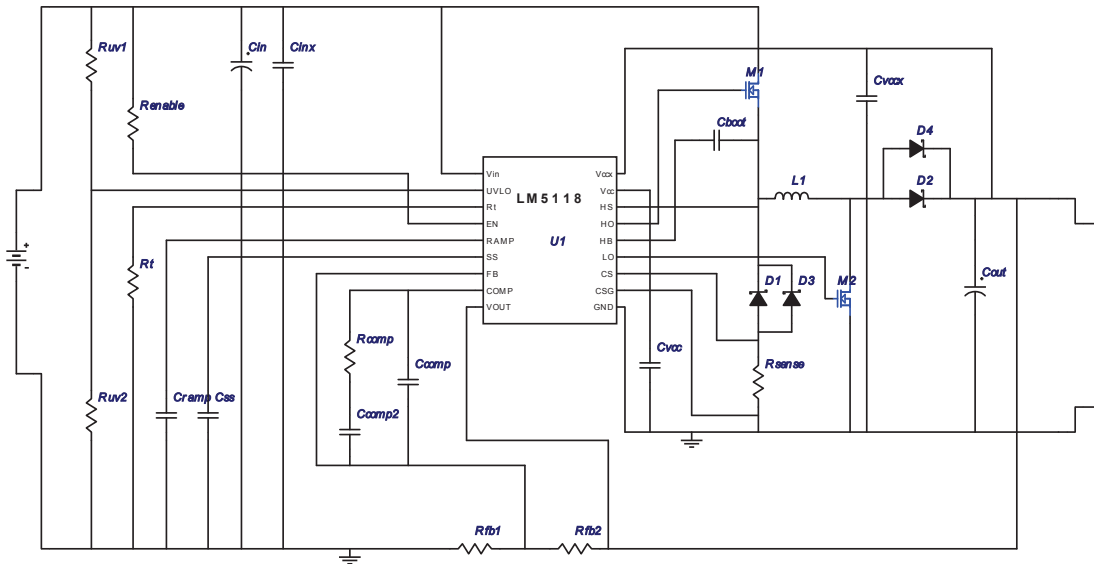
Design : 1151656/5 LM5118MH

Design 5 - LM5118MH

WEBENCH® Design : LM5118MH\_Buck\_Boost\_VTH\_VCCX

VinMin = 6.0V  
VinMax = 30.0V  
Vout = 9.0V  
Iout = 1.0A

Device = LM5118MH  
Topology = Buck\_Boost  
Creation date = 2/11/11 11:12:14 PM  
Total BOM Cost = \$5.31  
Total Pd = 1.26 W  
Footprint = 759.0 mm2  
BOM Count = 26



## Electrical BOM

#	Name	Manufacturer	Part Number	Qty	Price	Properties	Footprint
1.	Cboot	MuRata	GRM219R71C104KA01D Series= X7R	1	\$0.01	Cap= 100.0 nF ESR= 0.0 Ohm VDC= 16.0 V IRMS= 0.0 A	0805 13mm2
2.	Ccomp	Yageo America	CC0805KRX7R9BB561 Series= X7R	1	\$0.01	Cap= 560.0 pF ESR= 0.0 Ohm VDC= 50.0 V IRMS= 0.0 A	0805 13mm2
3.	Ccomp2	Yageo America	CC0805KRX7R9BB103 Series= X7R	1	\$0.01	Cap= 10.0 nF ESR= 0.0 Ohm VDC= 50.0 V IRMS= 0.0 A	0805 13mm2
4.	Cin	TDK	C5750X7R1H106M Series= X7R	1	\$0.63	Cap= 10.0 µF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 5.5 A	2220 60mm2
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	Nippon Chemi-Con	APXE160ARA820MF80G Series= PXE	1	\$0.46	Cap= 82.0 µF ESR= 24.0 mOhm VDC= 16.0 V IRMS= 2.7 A	CAPSMT_62_F80 74mm2
7.	Cramp	Yageo America	CC0805KRX7R9BB271 Series= X7R	1	\$0.01	Cap= 270.0 pF ESR= 0.0 Ohm VDC= 50.0 V IRMS= 0.0 A	0805 13mm2
8.	Css	MuRata	GRM216R71H223KA01D Series= X7R	1	\$0.01	Cap= 22.0 nF ESR= 0.0 Ohm VDC= 50.0 V IRMS= 0.0 A	0805 13mm2

#	Name	Manufacturer	Part Number	Qty	Price	Properties	Footprint
9.	Cvcc	MuRata	GRM155R61A105KE15D Series= X5R	1	\$0.01	Cap= 1.0 $\mu$ F ESR= 0.0 Ohm VDC= 10.0 V IRMS= 0.0 A	 0402 8mm2
10.	Cvccx	TDK	C2012Y5V1C105Z/0.85 Series= Y5V	1	\$0.01	Cap= 1.0 $\mu$ F ESR= 9.0 mOhm VDC= 16.0 V IRMS= 0.0 A	 0805 13mm2
11.	D1	Diodes Inc.	B260A-13-F	1	\$0.11	VF@Io= 700.0 mV VRRM= 60.0 V	 SMA 37mm2
12.	D2	Diodes Inc.	B220A-13-F	1	\$0.09	VF@Io= 500.0 mV VRRM= 20.0 V	 SMA 37mm2
13.	D3	Diodes Inc.	B260A-13-F	1	\$0.11	VF@Io= 700.0 mV VRRM= 60.0 V	 SMA 37mm2
14.	D4	Diodes Inc.	B220A-13-F	1	\$0.09	VF@Io= 500.0 mV VRRM= 20.0 V	 SMA 37mm2
15.	L1	Bourns	SDR1105-220ML	1	\$0.38	L= 22.0 $\mu$ H DCR= 80.0 mOhm	 SDR1105 157mm2
16.	M1	Infineon Technologies	BSC093N04LS G	1	\$0.30	VdsMax= 40.0 V IdsMax= 49.0 Amps	 PG-TDSON-8 55mm2
17.	M2	Vishay-Siliconix	SI2316BDS-T1-E3	1	\$0.23	VdsMax= 30.0 V IdsMax= 4.5 Amps	 SOT-23 22mm2
18.	Rcomp	Vishay-Dale	CRCW040215K8FKED Series= CRCW..e3	1	\$0.01	Res= 15.8 kOhm Power= 63.0 mW Tolerance= 1.0%	 0402 8mm2
19.	Renale	Vishay-Dale	CRCW04021M00FKED Series= CRCW..e3	1	\$0.01	Res= 1000.0 kOhm Power= 63.0 mW Tolerance= 1.0%	 0402 8mm2
20.	Rfb1	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	1	\$0.01	Res= 1,000 Ohm Power= 63.0 mW Tolerance= 1.0%	 0402 8mm2
21.	Rfb2	Vishay-Dale	CRCW04026K34FKED Series= CRCW..e3	1	\$0.01	Res= 6.34 kOhm Power= 63.0 mW Tolerance= 1.0%	 0402 8mm2
22.	Rsense	Stackpole Electronics Inc	CSR 1/2 0.05 1 I Series= ?	1	\$0.08	Res= 50.0 mOhm Power= 500.0 mW Tolerance= 1.0%	 1206 19mm2
23.	Rt	Vishay-Dale	CRCW040218K7FKED Series= CRCW..e3	1	\$0.01	Res= 18.7 kOhm Power= 63.0 mW Tolerance= 1.0%	 0402 8mm2
24.	Ruv1	Vishay-Dale	CRCW040232K4FKED Series= CRCW..e3	1	\$0.01	Res= 32.4 kOhm Power= 63.0 mW Tolerance= 1.0%	 0402 8mm2
25.	Ruv2	Vishay-Dale	CRCW040210K7FKED Series= CRCW..e3	1	\$0.01	Res= 10.7 kOhm Power= 63.0 mW Tolerance= 1.0%	 0402 8mm2
26.	U1	National Semiconductor	LM5118MH	1	\$2.68	Switcher	 MXA20A 71mm2

## Op Vals

#	Name	Value	Category	Description
1.	Cin IRMS	464.93 mA	Current	Input capacitor RMS ripple current

#	Name	Value	Category	Description
2.	Cout IRMS	290.289 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	341.8 mA	Current	Average input current
4.	L Ipp	1.006 A	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	1.041 A	Current	Inductor ripple current
6.	M1 Irms	562.176 mA	Current	MOSFET RMS ripple current
7.	SW Ipk	1.503 A	Current	Peak switch current
8.	BOM Count	26.0	General	Total Design BOM count
9.	FootPrint	759.0 mm2	General	Total Foot Print Area of BOM components
10.	Frequency	300.0 kHz	General	Switching frequency
11.	M1 Rdson	13.7 mOhm	General	Drain-Source On-resistance
12.	M1 ThetaJA	50.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
13.	Mode	CCM	General	Conduction Mode
14.	Pout	9.0 W	General	Total output power
15.	Total BOM	\$5.31	General	Total BOM Cost
16.	Cross Freq	8.481 kHz	Op_point	Bode plot crossover frequency
17.	Duty Cycle	31.604 %	Op_point	Duty cycle
18.	Efficiency	87.76 %	Op_point	Steady state efficiency
19.	IC Tj	36.392 degC	Op_point	IC junction temperature
20.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
21.	IOUT_OP	1.0 A	Op_point	Iout operating point
22.	M1 TjOP	30.406 degC	Op_point	MOSFET junction temperature
23.	Operating Topology	Buck	Op_point	The current operating topology of the device
24.	Phase Marg	63.994 deg	Op_point	Bode Plot Phase Margin
25.	VIN_OP	30.0 V	Op_point	Vin operating point
26.	Vout p-p	24.669 mV	Op_point	Peak-to-peak output ripple voltage
27.	Cin Pd	648.479 µW	Power	Input capacitor power dissipation
28.	Cout Pd	2.022 mW	Power	Output capacitor power dissipation
29.	IC Pd	159.802 mW	Power	IC power dissipation
30.	L Pd	100.0 mW	Power	Inductor power dissipation
31.	M1 Pd	8.12 mW	Power	MOSFET power dissipation
32.	M1 PdCond	4.449 mW	Power	M1 MOSFET conduction losses
33.	M1 PdSw	3.671 mW	Power	M1 MOSFET switching losses
34.	Total Pd	1.255 W	Power	Total Power Dissipation
35.	Diode 1 Power Dissipation	239.385 mOpvalUnits.PD	Unknown	Power dissipation in the diode
36.	Diode 2 Power Dissipation	250.0 mOpvalUnits.PD	Unknown	Power dissipation in the diode
37.	Diode 3 Power Dissipation	239.385 mOpvalUnits.PD	Unknown	Power dissipation in the diode
38.	Diode 4 Power Dissipation	250.0 mOpvalUnits.PD	Unknown	Power dissipation in the diode
39.	IC Tolerance	18.0 mV	Unknown	IC Feedback Tolerance
40.	Vout OP	9.0 V	Unknown	Vin operating point

## Design Inputs

#	Name	Value	Description
1.	ErrorFeature	I	Error feature
2.	Iout	1.0 A	Maximum Output Current
3.	Iout1	1.0 Amps	Output Current #1
4.	SoftStart	0.0 ms	Soft Start Time (ms)
5.	SyncFeature	I	External Sync feature
6.	VinMax	30.0 V	Maximum input voltage
7.	VinMin	6.0 V	Minimum input voltage
8.	Vout	9.0 V	Output Voltage
9.	Vout1	9.0 Volt	Output Voltage #1
10.	base_pn	LM5118	National Based Product Number
11.	customfreq	Y	Use Customer Frequency
12.	onOff	I	On/Off feature
13.	optfactor	3.0	Optimization factor to tune up the design
14.	pricefactor	0.0	Price factor to tune up the design cost
15.	ta	30.0 degC	Ambient temperature

## Design Assist

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.national.com/pf/LM/LM5118.html> : contains the data sheet and other resources.

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