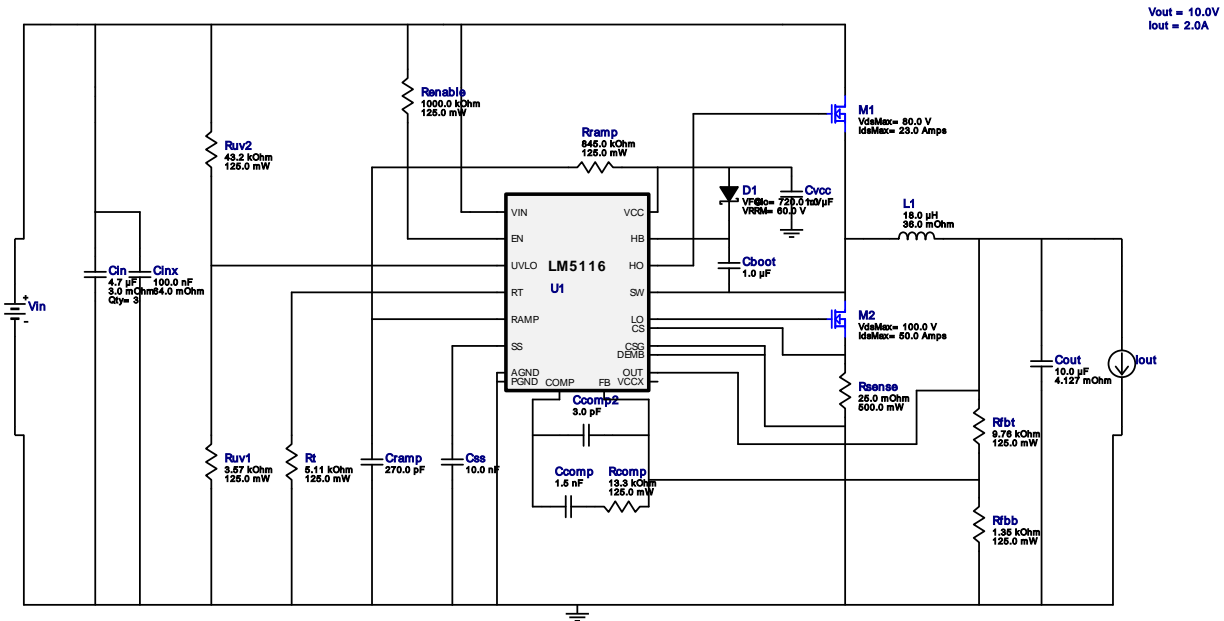




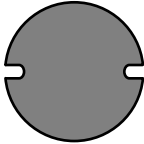












## WEBENCH® Design Report

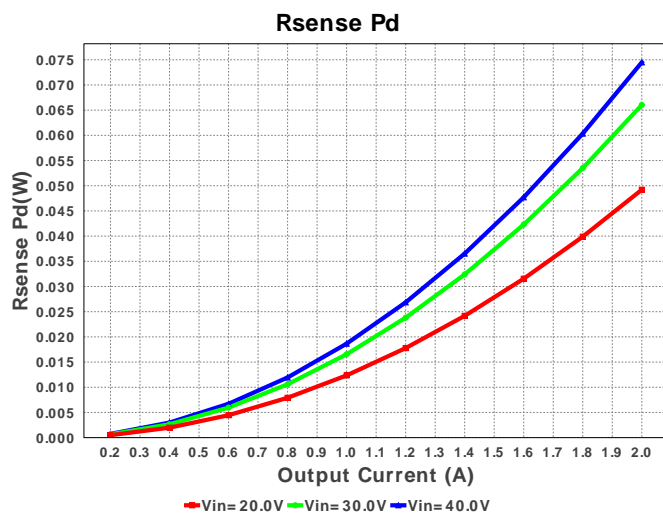
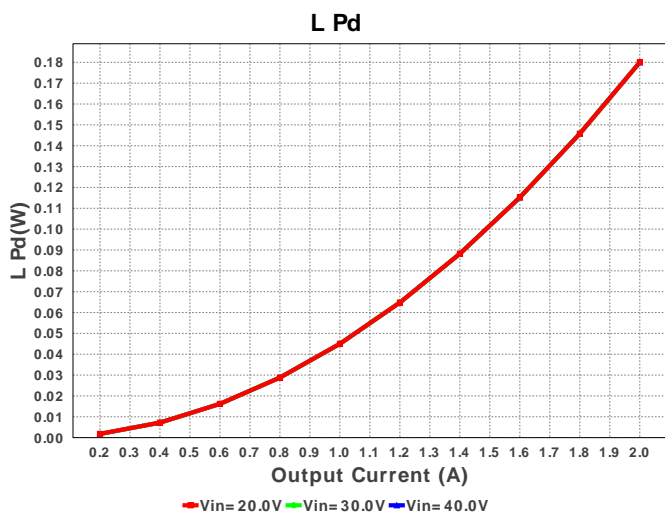
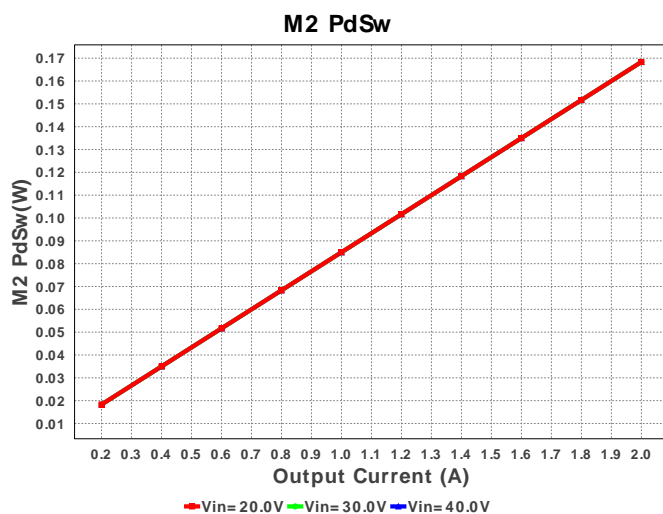
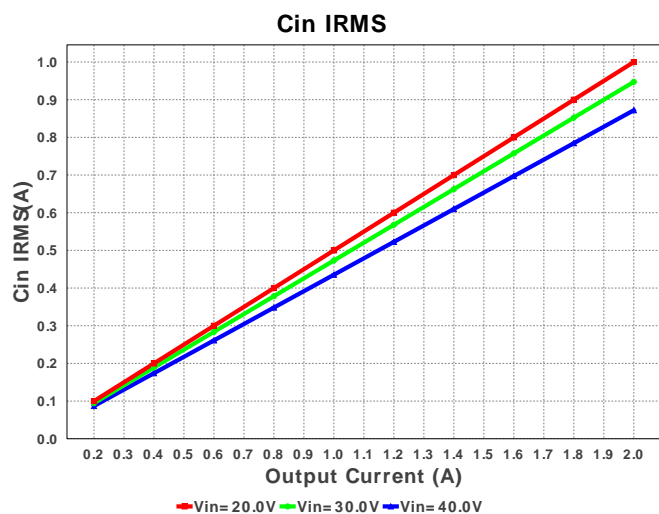
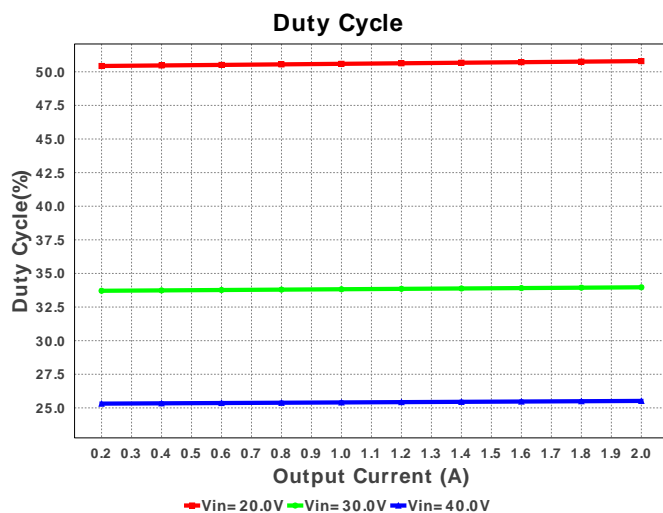
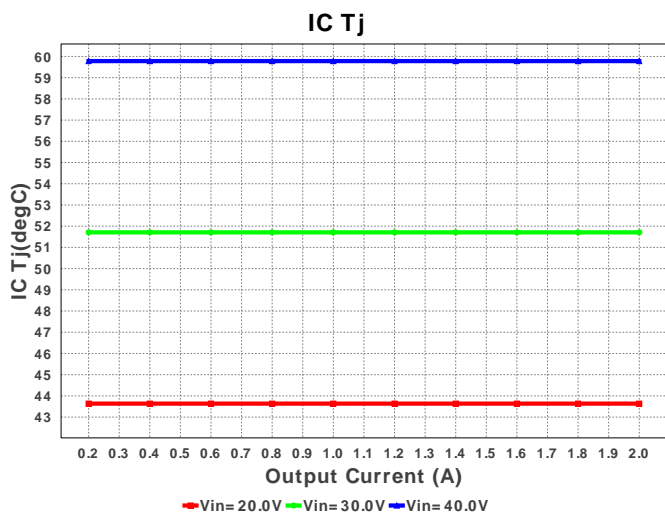
Design : 4352199/69 LM5116MHX/NOPB  
LM5116MHX/NOPB 20.0V-40.0V to 10.00V @ 2.0A

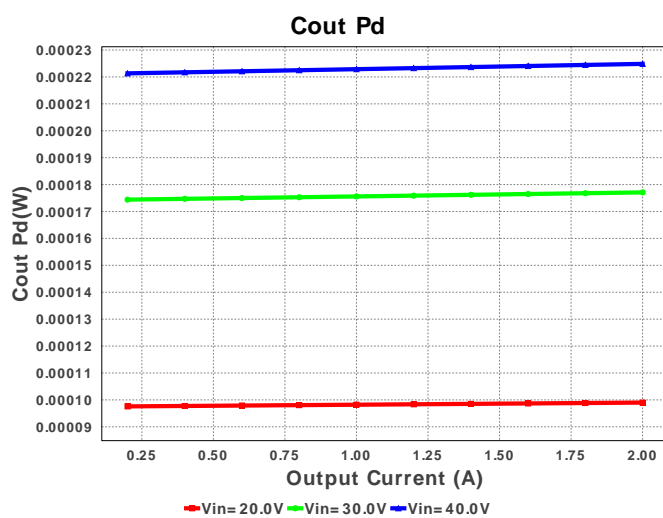
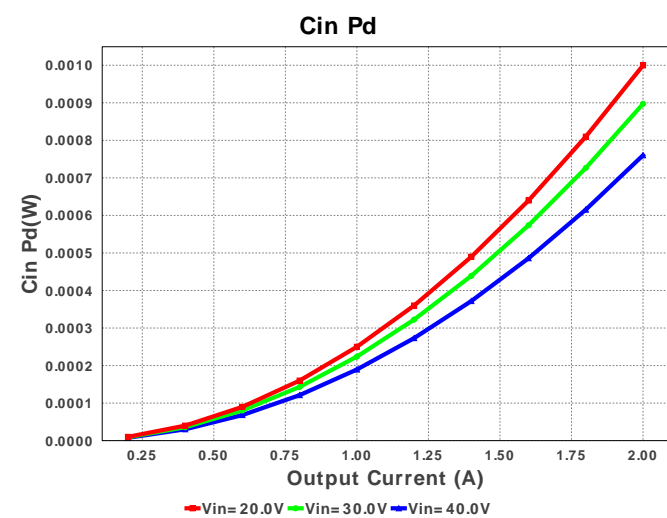
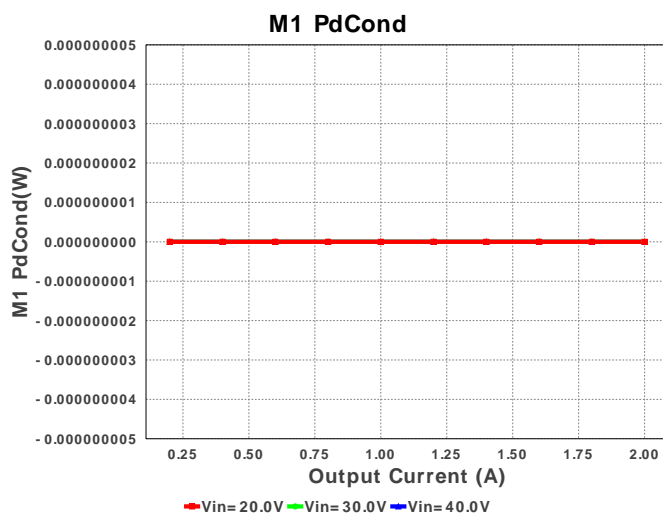
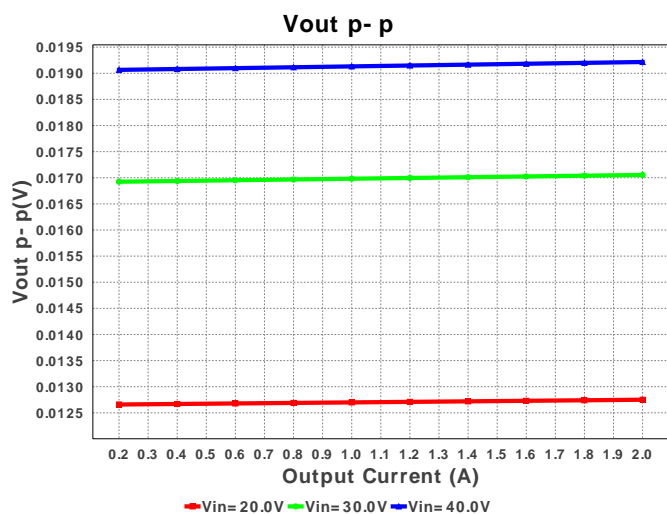
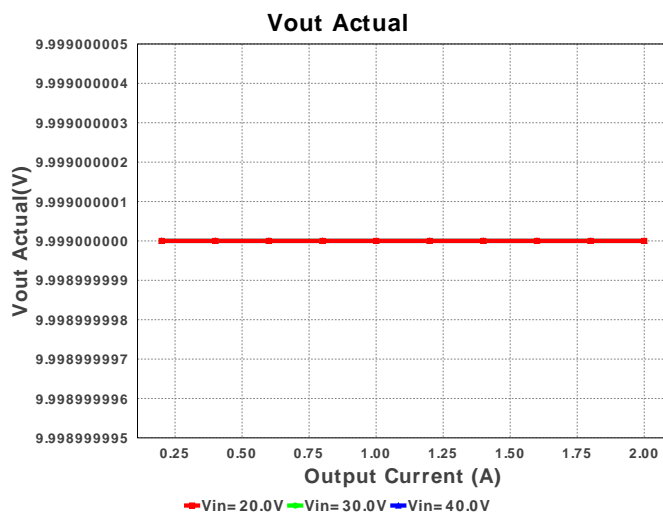
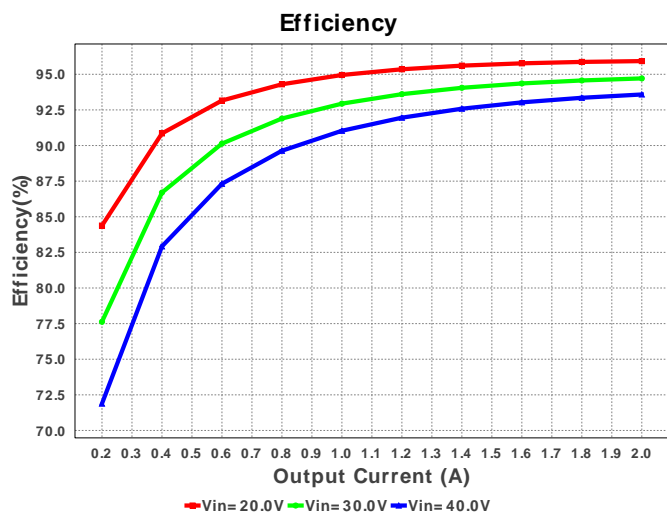


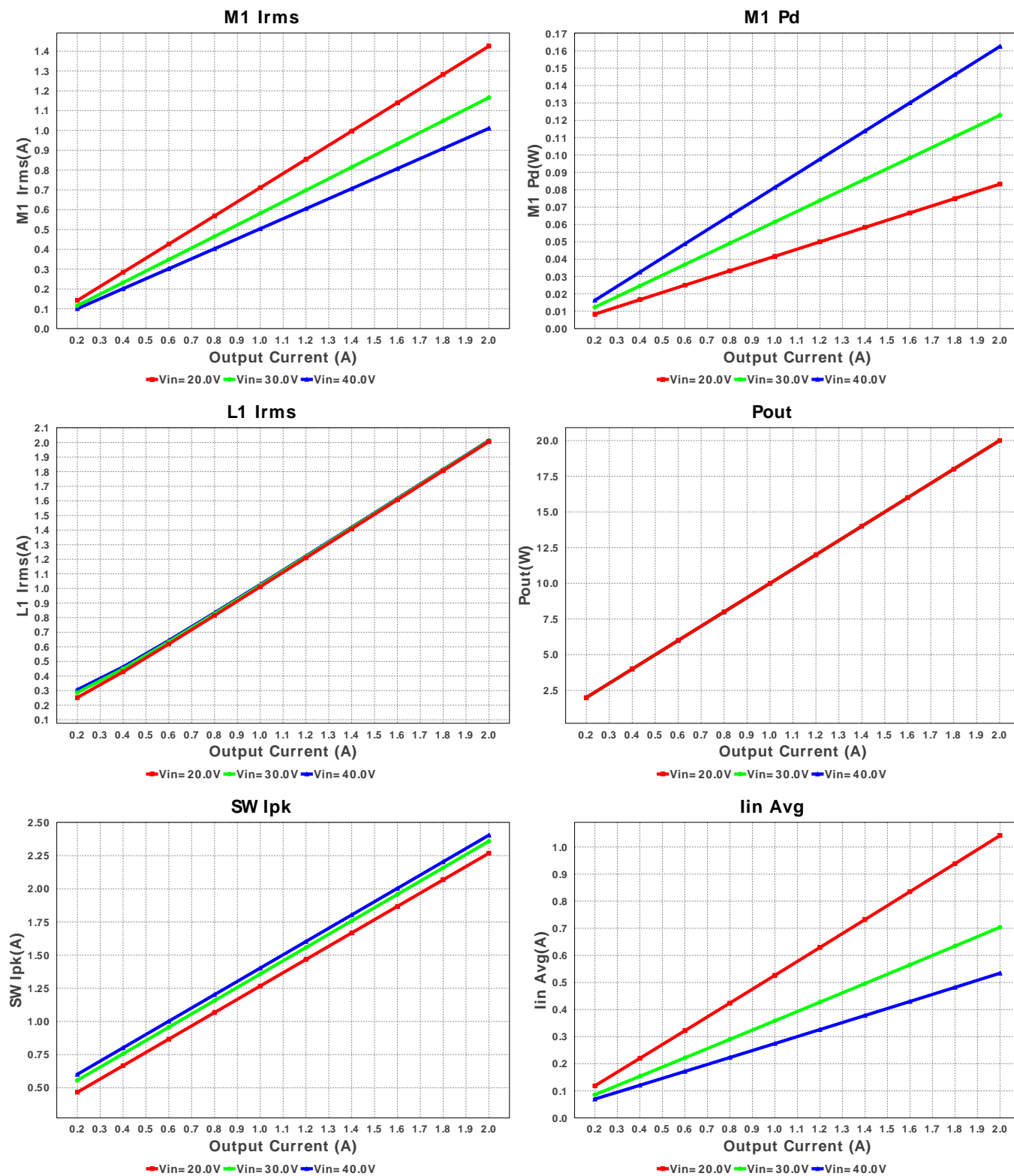
## Electrical BOM

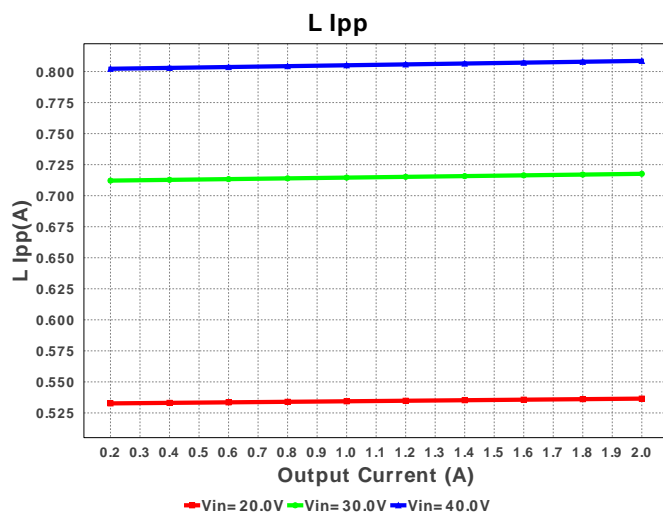
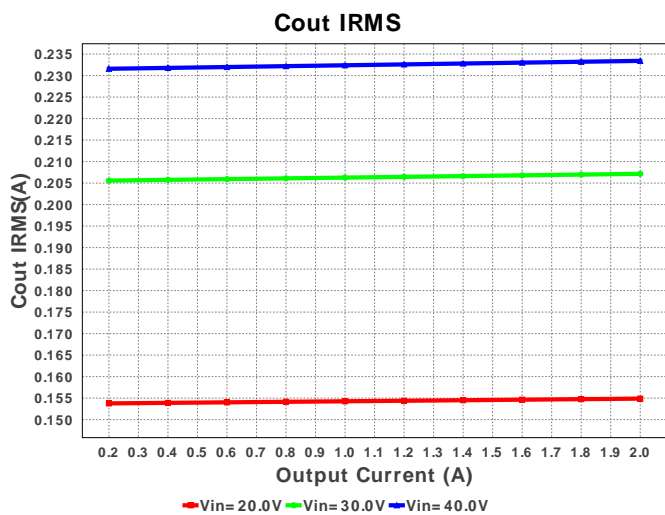
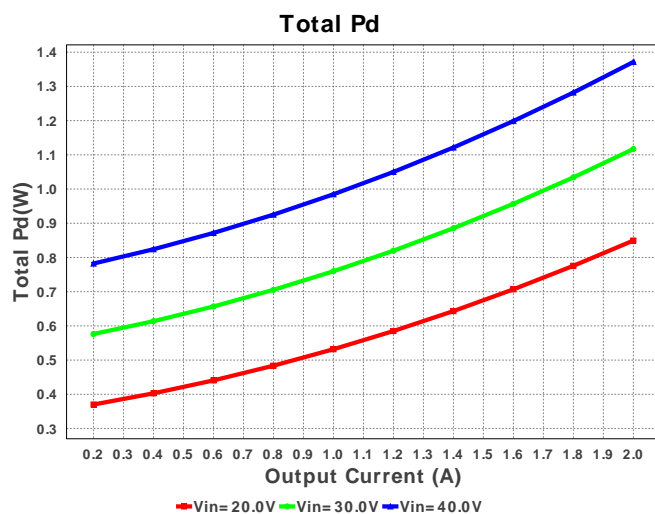
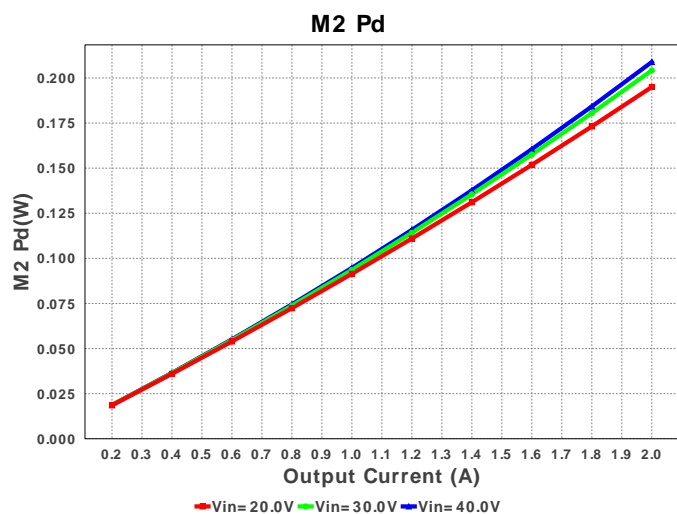
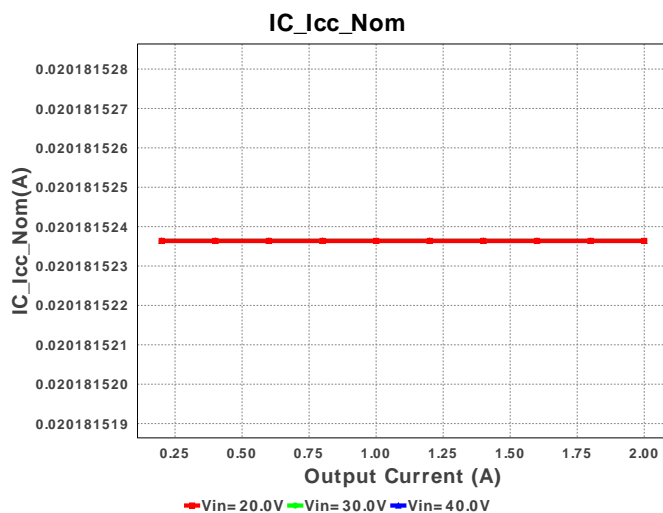
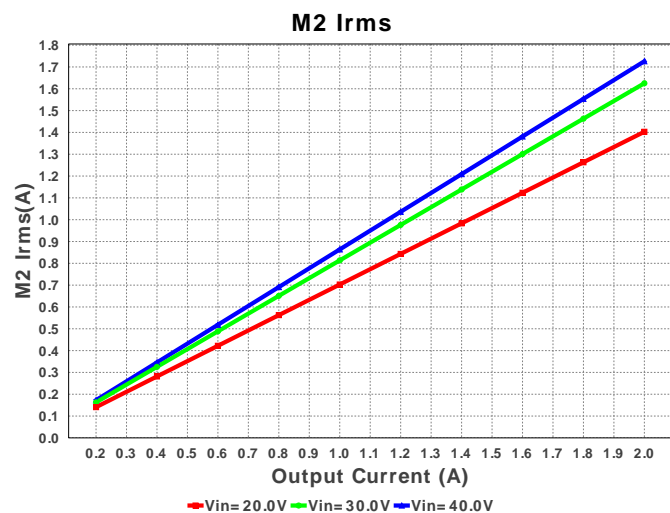
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	Taiyo Yuden	EMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 16.0 V IRMS= 0.0 A	1	\$0.02	0805 7 mm <sup>2</sup>
2.	Ccomp	Yageo America	CC0805KRX7R9BB152 Series= X7R	Cap= 1.5 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm <sup>2</sup>
3.	Ccomp2	Kemet	C0603C309C5GACTU Series= C0G/NP0	Cap= 3.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.02	0603 5 mm <sup>2</sup>
4.	Cin	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	3	\$0.07	1206 11 mm <sup>2</sup>
5.	Cinx	Kemet	C0805C104K5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	\$0.01	0805 7 mm <sup>2</sup>
6.	Cout	MuRata	GRM21BR61C106KE15L Series= X5R	Cap= 10.0 uF ESR= 4.127 mOhm VDC= 16.0 V IRMS= 2.46634 A	1	\$0.03	0805 7 mm <sup>2</sup>
7.	Cramp	Yageo America	CC0805KRX7R9BB271 Series= X7R	Cap= 270.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm <sup>2</sup>
8.	Css	MuRata	GRM216R71H103KA01D Series= X7R	Cap= 10.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm <sup>2</sup>

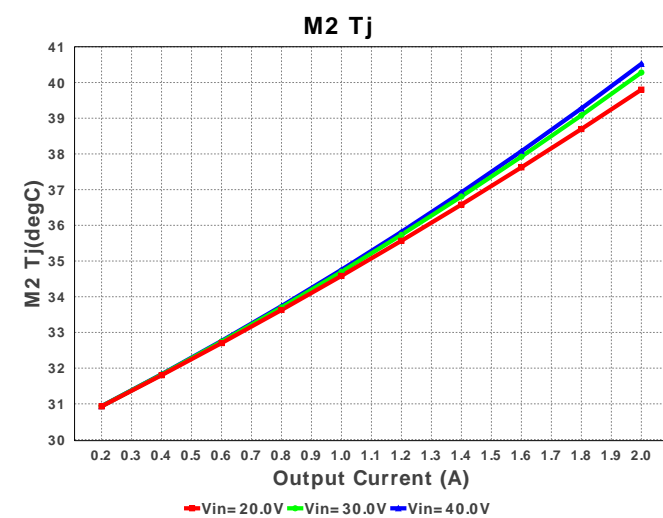
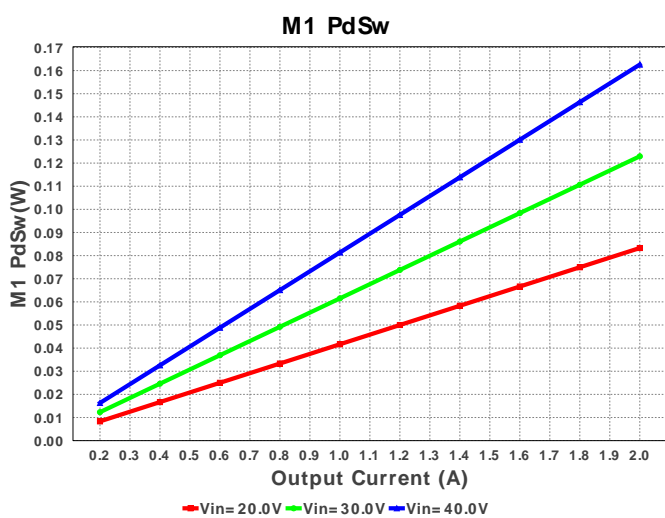
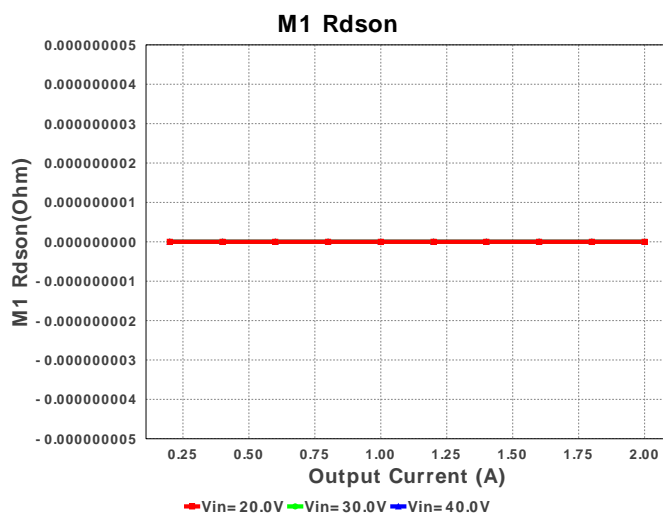
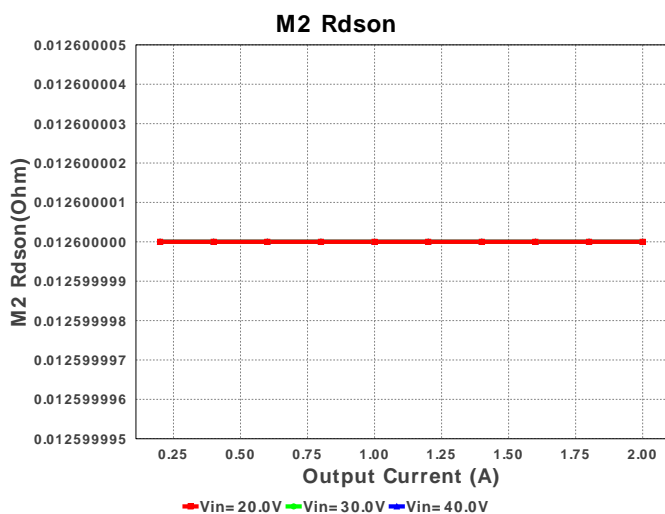
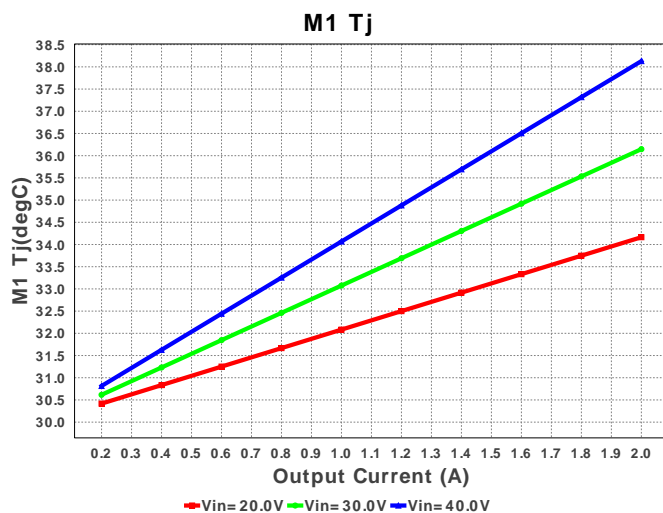
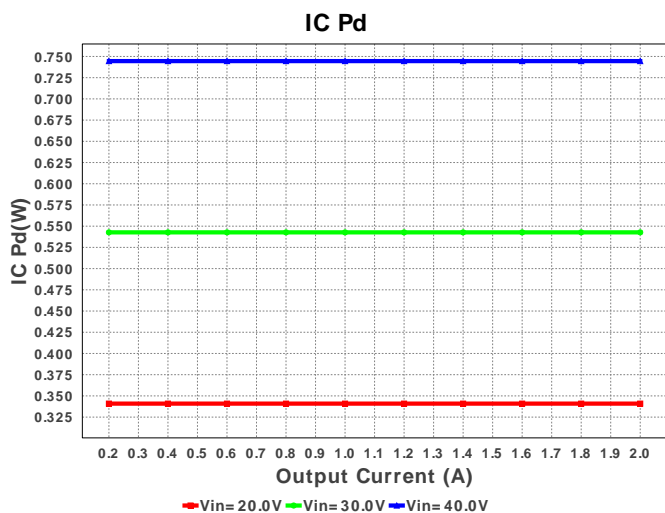
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Cvcc	Taiyo Yuden	EMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 16.0 V IRMS= 0.0 A	1	\$0.02	 0805 7 mm <sup>2</sup>
10.	D1	ON Semiconductor	SS16T3G	VF@Io= 720.0 mV VRRM= 60.0 V	1	\$0.08	 SMA 37 mm <sup>2</sup>
11.	L1	Bourns	SDR1307-180ML	L= 18.0 µH DCR= 36.0 mOhm	1	\$0.35	 SDR1307 227 mm <sup>2</sup>
12.	M1	Infineon Technologies	BSC340N08NS3 G	VdsMax= 80.0 V IdsMax= 23.0 Amps	1	\$0.19	 PG-TDSON-8 55 mm <sup>2</sup>
13.	M2	Texas Instruments	CSD19534Q5A	VdsMax= 100.0 V IdsMax= 50.0 Amps	1	\$0.38	 TRANS_NexFET_Q5A 55 mm <sup>2</sup>
14.	Rcomp	Panasonic	ERJ-6ENF1332V Series= ERJ-6E	Res= 13.3 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm <sup>2</sup>
15.	Renable	Panasonic	ERJ-6ENF1004V Series= ERJ-6E	Res= 1000.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm <sup>2</sup>
16.	Rfbb	Yageo America	RT0805BRD071K35L Series= RT0805	Res= 1.35 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.05	 0805 7 mm <sup>2</sup>
17.	Rfbt	Panasonic	ERJ-6ENF9761V Series= ERJ-6E	Res= 9.76 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm <sup>2</sup>
18.	Rramp	Panasonic	ERJ-6ENF8453V Series= ERJ-6E	Res= 845.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm <sup>2</sup>
19.	Rsense	Stackpole Electronics Inc	CSR1206FK25L0 Series= ?	Res= 25.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	\$0.10	 1206 11 mm <sup>2</sup>
20.	Rt	Panasonic	ERJ-6ENF5111V Series= ERJ-6E	Res= 5.11 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm <sup>2</sup>
21.	Ruv1	Panasonic	ERJ-6ENF3571V Series= ERJ-6E	Res= 3.57 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm <sup>2</sup>
22.	Ruv2	Panasonic	ERJ-6ENF4322V Series= ERJ-6E	Res= 43.2 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	 0805 7 mm <sup>2</sup>
23.	U1	Texas Instruments	LM5116MHX/NOPB	Switcher	1	\$2.42	 MXA20A 71 mm <sup>2</sup>



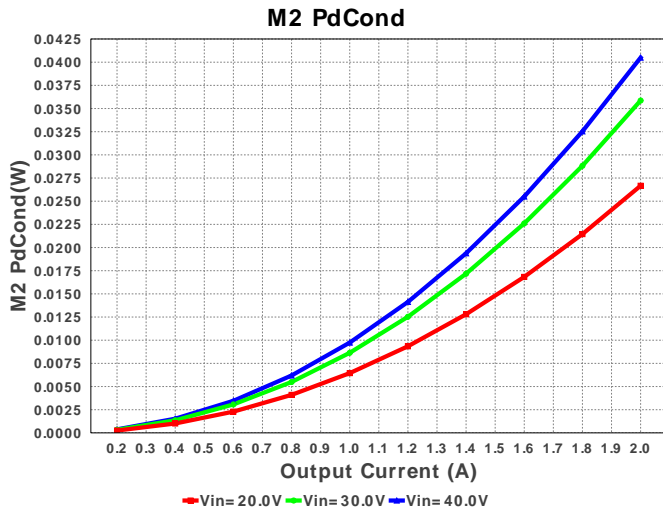












## Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	871.919 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	233.417 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	534.29 mA	Current	Average input current
4.	L Ipp	808.58 mA	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	2.014 A	Current	Inductor ripple current
6.	M1 Irms	1.01 A	Current	MOSFET RMS ripple current
7.	M2 Irms	1.726 A	Current	MOSFET RMS ripple current
8.	SW Ipk	2.404 A	Current	Peak switch current
9.	BOM Count	25	General	Total Design BOM count
10.	FootPrint	595.0 mm <sup>2</sup>	General	Total Foot Print Area of BOM components
11.	Frequency	525.973 kHz	General	Switching frequency
12.	IC Tolerance	16.0 mV	General	IC Feedback Tolerance
13.	M1 Rdson	0.0 Ohm	General	Drain-Source On-resistance
14.	M2 Rdson	12.6 mOhm	General	Drain-Source On-resistance
15.	Pout	20.0 W	General	Total output power
16.	Total BOM	\$3.98	General	Total BOM Cost
17.	Low Freq Gain	102.246 dB	Op_Point	Gain at 10Hz
18.	Vout Actual	9.999 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
19.	Cross Freq	85.105 kHz	Op_point	Bode plot crossover frequency
20.	Duty Cycle	25.517 %	Op_point	Duty cycle
21.	Efficiency	93.582 %	Op_point	Steady state efficiency
22.	Gain Marg	-13.343 dB	Op_point	Bode Plot Gain Margin
23.	IC Tj	59.781 degC	Op_point	IC junction temperature
24.	IOUT_OP	2.0 A	Op_point	Iout operating point
25.	M1 Tj	38.275 degC	Op_point	M1 MOSFET junction temperature
26.	M2 Tj	40.391 degC	Op_point	M2 MOSFET junction temperature
27.	Phase Marg	58.235 deg	Op_point	Bode Plot Phase Margin
28.	VIN_OP	40.0 V	Op_point	Vin operating point
29.	Vout p-p	19.216 mV	Op_point	Peak-to-peak output ripple voltage
30.	Cin Pd	760.243 μW	Power	Input capacitor power dissipation
31.	Cout Pd	224.854 μW	Power	Output capacitor power dissipation
32.	IC Pd	744.526 mW	Power	IC power dissipation
33.	L Pd	180.0 mW	Power	Inductor power dissipation
34.	M1 Pd	165.491 mW	Power	M1 MOSFET total power dissipation
35.	M1 PdCond	0.0 W	Power	M1 MOSFET conduction losses
36.	M1 PdSw	165.491 mW	Power	M1 MOSFET switching losses
37.	M2 Pd	206.247 mW	Power	M2 MOSFET total power dissipation
38.	M2 PdCond	40.489 mW	Power	M2 MOSFET conduction losses
39.	M2 PdSw	165.758 mW	Power	M2 MOSFET switching losses
40.	Rsense Pd	74.483 mW	Power	Rsense Power Dissipation
41.	Total Pd	1.372 W	Power	Total Power Dissipation
42.	IC_licc_Nom	20.182 mA		IC Icc gate driver current
43.	Vout Tolerance	2.297 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

## Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	VinMax	40.0	Maximum input voltage
3.	VinMin	20.0	Minimum input voltage
4.	Vout	10.0	Output Voltage



#	Name	Value	Description
5.	base_pn	LM5116	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

## Design Assistance

1. LM5116 Product Folder : <http://www.ti.com/product/LM5116> : contains the data sheet and other resources.

Texas Instruments' WEBENCH simulation tools attempt to recreate the performance of a substantially equivalent physical implementation of the design. Simulations are created using Texas Instruments' published specifications as well as the published specifications of other device manufacturers. While Texas Instruments does update this information periodically, this information may not be current at the time the simulation is built. Texas Instruments does not warrant the accuracy or completeness of the specifications or any information contained therein. Texas Instruments does not warrant that any designs or recommended parts will meet the specifications you entered, will be suitable for your application or fit for any particular purpose, or will operate as shown in the simulation in a physical implementation. Texas Instruments does not warrant that the designs are production worthy.

**You should completely validate and test your design implementation to confirm the system functionality for your application prior to production.**

Use of Texas Instruments' WEBENCH simulation tools is subject to [Texas Instruments' Site Terms and Conditions of Use](#). Prototype boards based on WEBENCH created designs are provided AS IS without warranty of any kind for evaluation and testing purposes and are subject to the terms of the [Evaluation License Agreement](#).