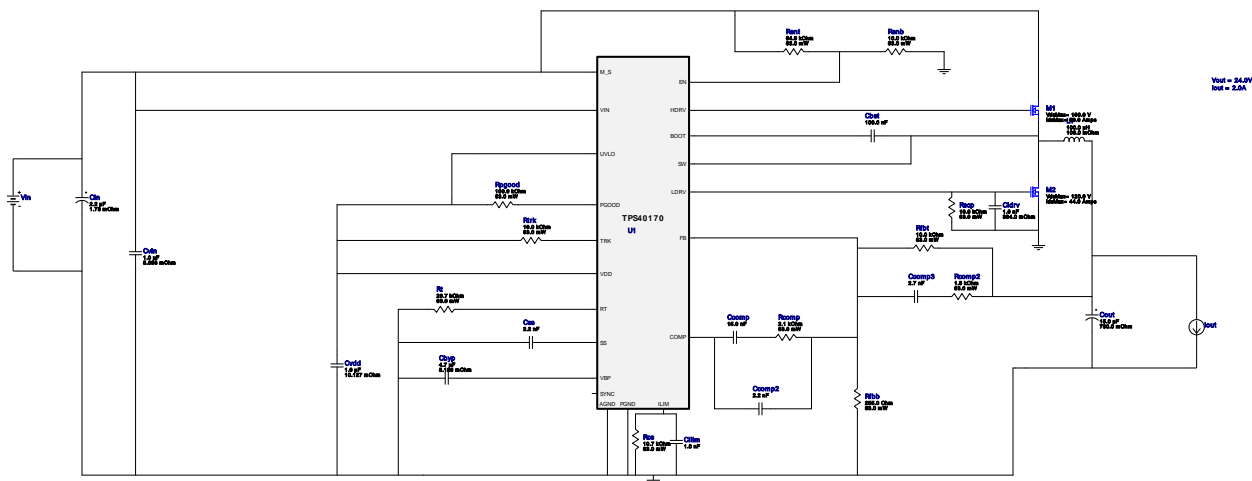


## WEBENCH® Design Report

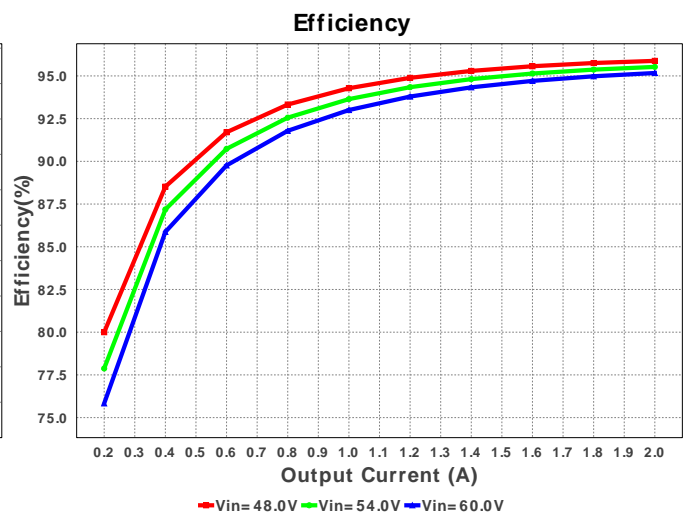
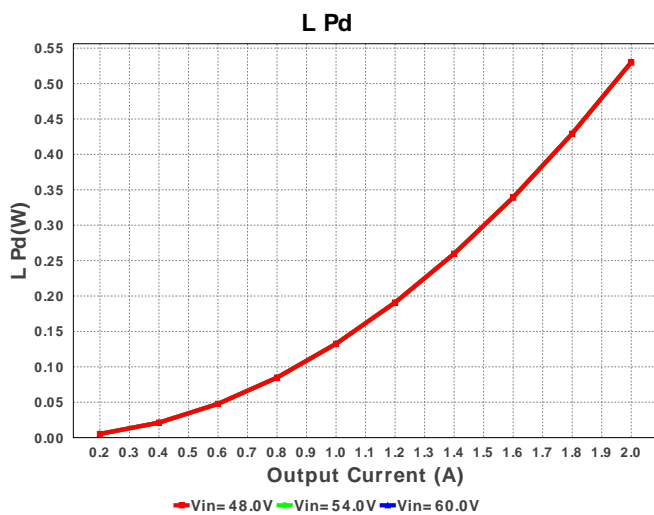
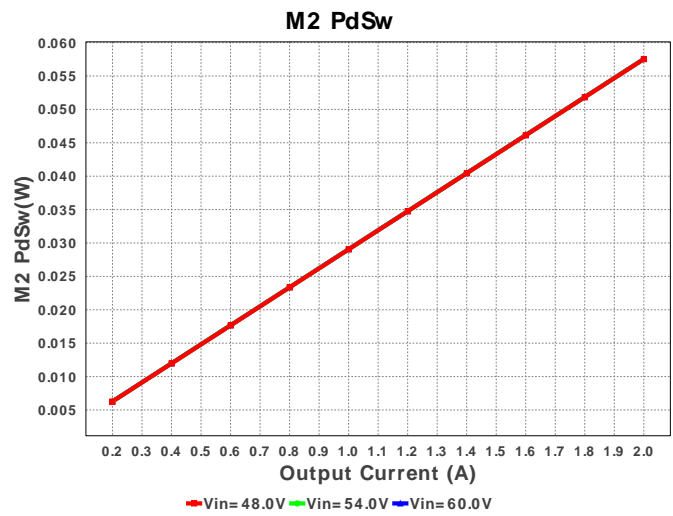
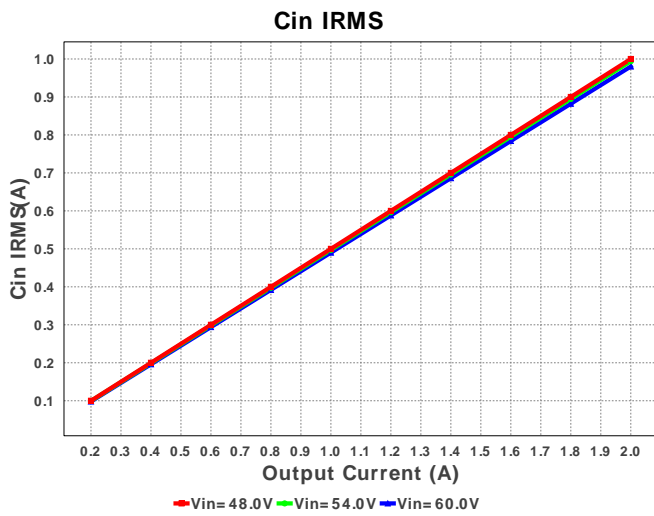
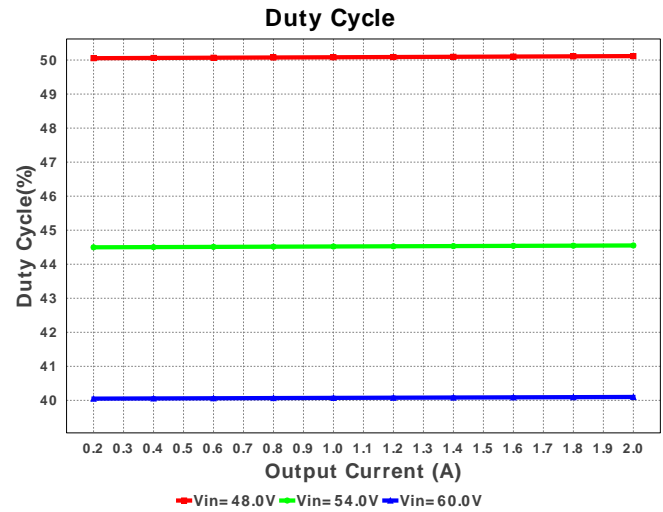
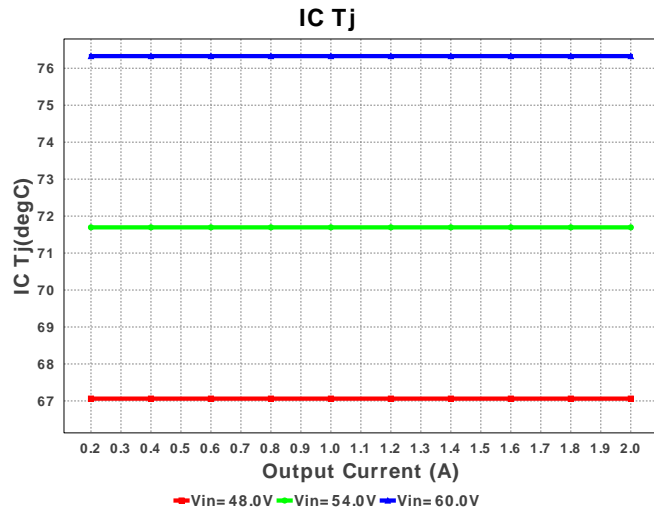
Design : 4466246/59 TPS40170RGYR  
TPS40170RGYR 48.0V-60.0V to 24.00V @ 2.0A

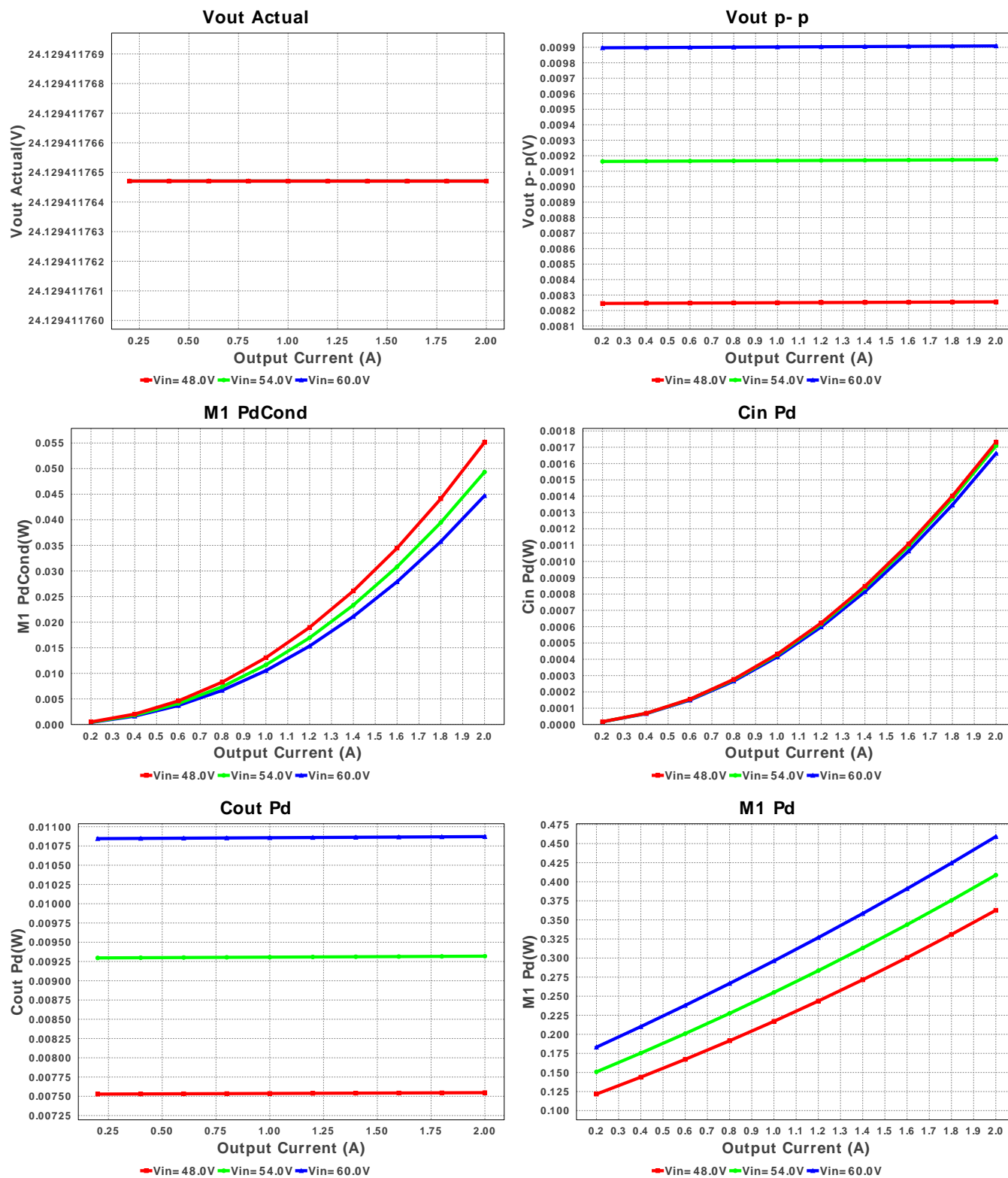


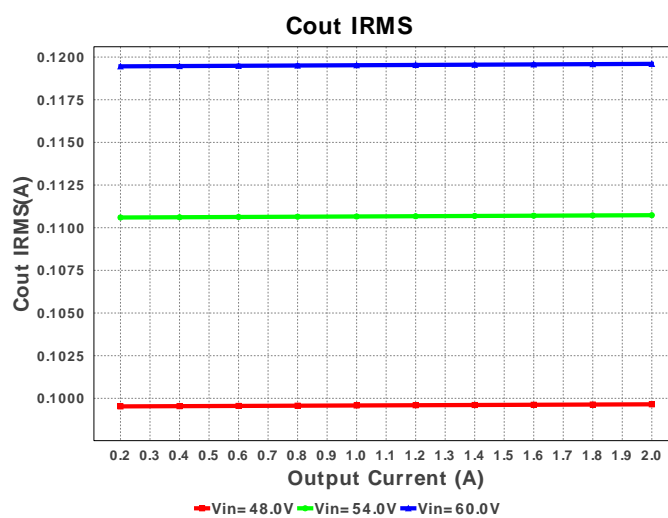
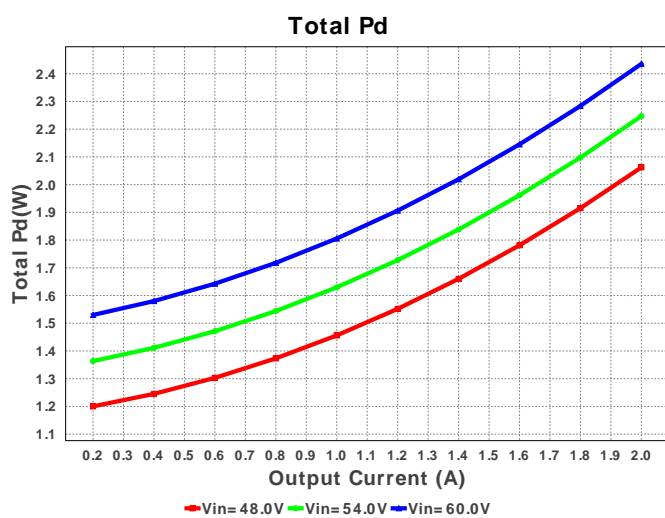
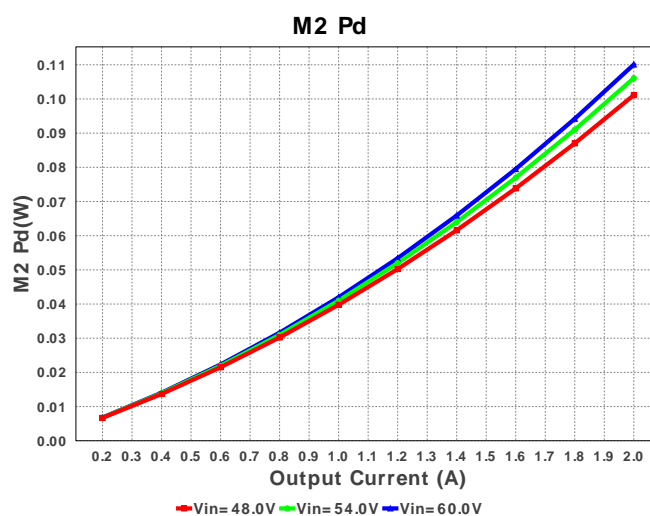
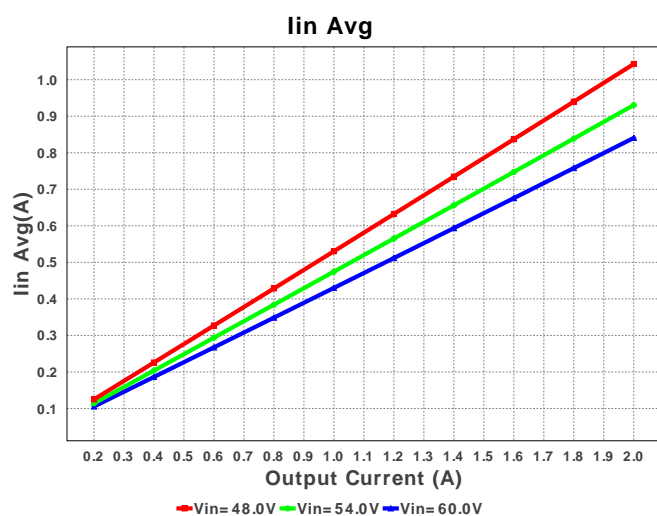
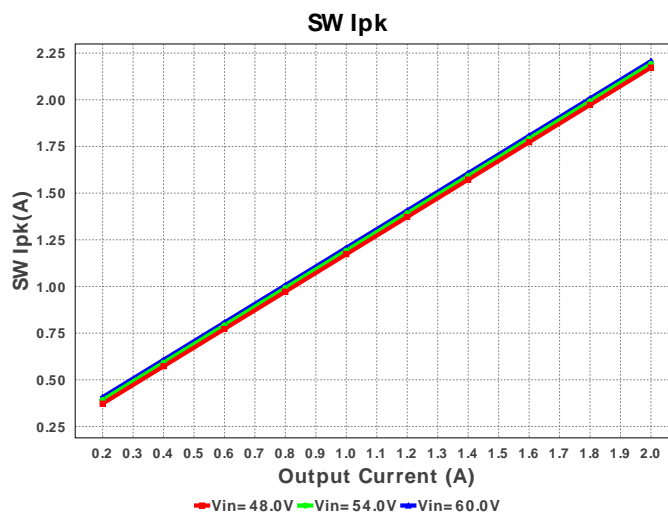
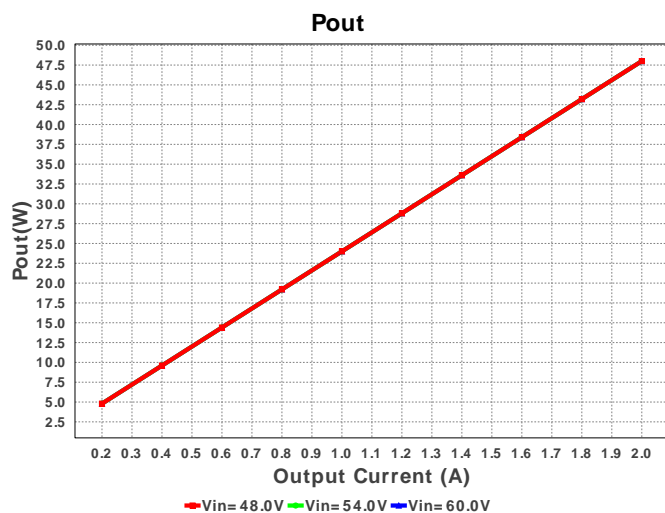
## Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	Taiyo Yuden	HMK212B7104KG-T Series= X7R	Cap= 100.0 nF VDC= 100.0 V IRMS= 0.0 A	1	\$0.03	0805 7 mm <sup>2</sup>
2.	Cbyp	MuRata	GRM21BR61E475KA12L Series= X5R	Cap= 4.7 uF ESR= 5.189 mOhm VDC= 25.0 V IRMS= 2.03531 A	1	\$0.02	0805 7 mm <sup>2</sup>
3.	Ccomp	Yageo America	CC0805KRX7R9BB153 Series= X7R	Cap= 15.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm <sup>2</sup>
4.	Ccomp2	Yageo America	CC0805KRX7R9BB222 Series= X7R	Cap= 2.2 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm <sup>2</sup>
5.	Ccomp3	Yageo America	CC0805KRX7R9BB272 Series= X7R	Cap= 2.7 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm <sup>2</sup>
6.	Cilim	MuRata	GRM216R71E102KA01D Series= X7R	Cap= 1.0 nF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm <sup>2</sup>
7.	Cin	TDK	C3225X7R2A225K230AB Series= X7R	Cap= 2.2 uF ESR= 1.73 mOhm VDC= 100.0 V IRMS= 5.5932 A	1	\$0.19	1210_250 15 mm <sup>2</sup>
8.	Cldrv	Kemet	C0805C102K5RACTU Series= X7R	Cap= 1.0 nF ESR= 384.0 mOhm VDC= 50.0 V IRMS= 214.0 mA	1	\$0.01	0805 7 mm <sup>2</sup>
9.	Cout	Nichicon	UUD1E150MCL1GS Series= uD	Cap= 15.0 uF ESR= 760.0 mOhm VDC= 25.0 V IRMS= 150.0 mA	1	\$0.10	SM_RADIAL_5MM 58 mm <sup>2</sup>
10.	Css	MuRata	GRM033R70J222KA01D Series= X7R	Cap= 2.2 nF VDC= 6.3 V IRMS= 0.0 A	1	\$0.01	0201 2 mm <sup>2</sup>

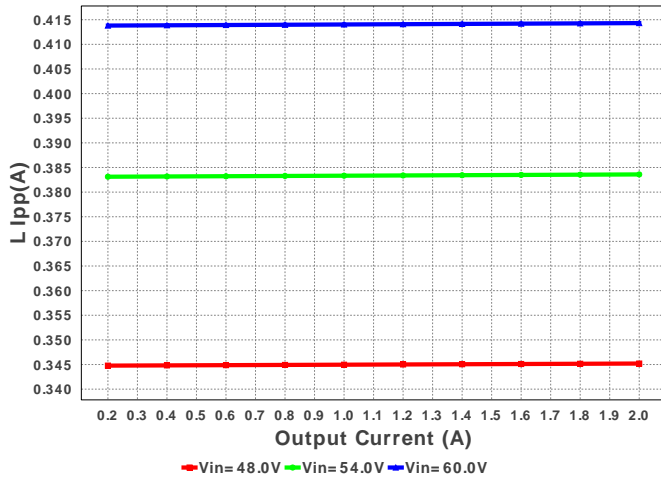
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11.	Cvdd	MuRata	GRM188R61C105KA93D Series= X5R	Cap= 1.0 uF ESR= 10.127 mOhm VDC= 16.0 V IRMS= 994.63 mA	1	\$0.01	 0603 5 mm²
12.	Cvin	TDK	C3216X5R2A105K Series= X5R	Cap= 1.0 uF ESR= 5.698 mOhm VDC= 100.0 V IRMS= 0.0 A	1	\$0.07	 1206 11 mm²
13.	L1	Coilcraft	MSS1210-104KEB	L= 100.0 µH DCR= 106.0 mOhm	1	\$0.81	 MSS1210 204 mm²
14.	M1	Texas Instruments	CSD19537Q3	VdsMax= 100.0 V IdsMax= 50.0 Amps	1	\$0.75	 TRANS_NexFET_Q3 18 mm²
15.	M2	Infineon Technologies	BSC190N12NS3 G	VdsMax= 120.0 V IdsMax= 44.0 Amps	1	\$0.64	 PG-TDSON-8 55 mm²
16.	Rcomp	Vishay-Dale	CRCW04022K10FKED Series= CRCW..e3	Res= 2.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
17.	Rcomp2	Vishay-Dale	CRCW04021K50FKED Series= CRCW..e3	Res= 1.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
18.	Rcs	Vishay-Dale	CRCW040210K7FKED Series= CRCW..e3	Res= 10.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
19.	Renb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
20.	Rent	Vishay-Dale	CRCW040264K9FKED Series= CRCW..e3	Res= 64.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
21.	Rfbb	Vishay-Dale	CRCW0402255RFKED Series= CRCW..e3	Res= 255.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
22.	Rfbt	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
23.	Rpgood	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
24.	Rscp	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
25.	Rt	Vishay-Dale	CRCW040226K7FKED Series= CRCW..e3	Res= 26.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
26.	Rtrk	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
27.	U1	Texas Instruments	TPS40170RGYR	Switcher	1	\$2.10	 RGY0020A 25 mm²



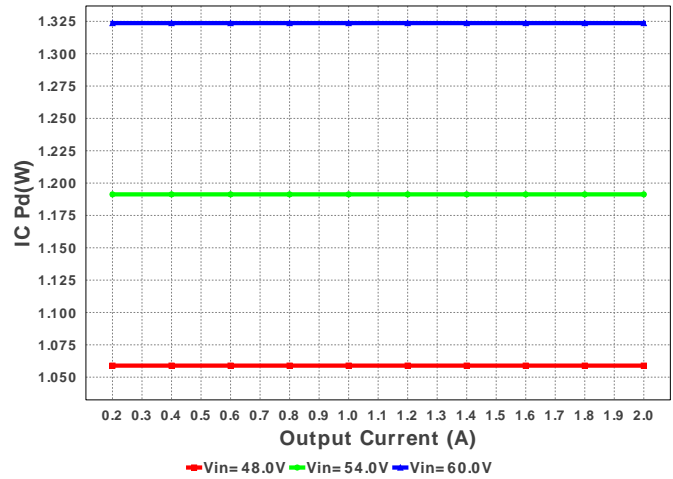




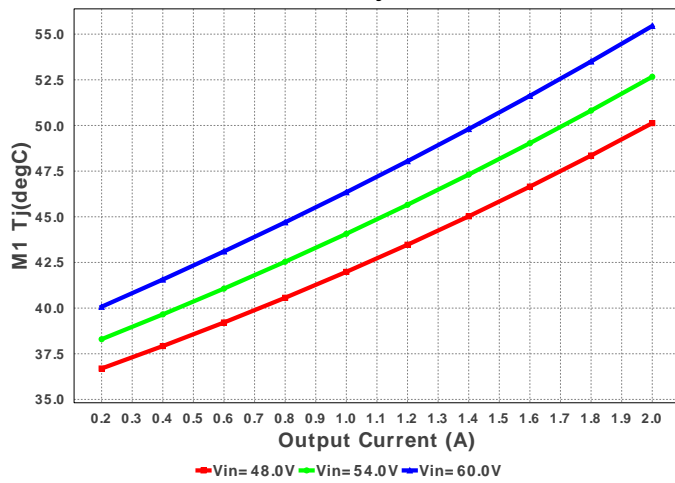
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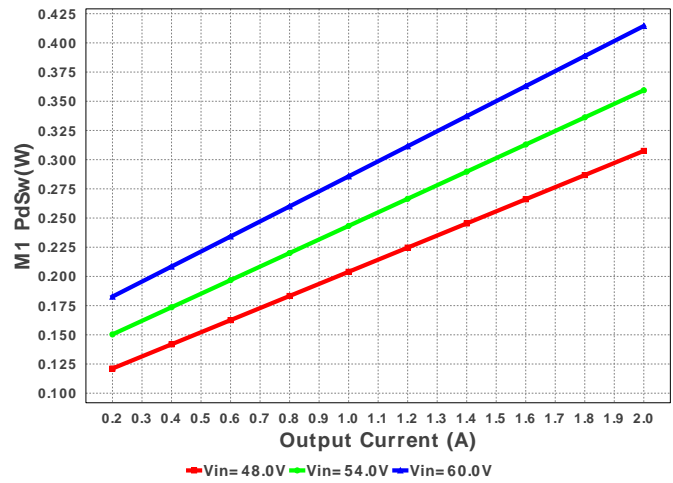
IC Pd



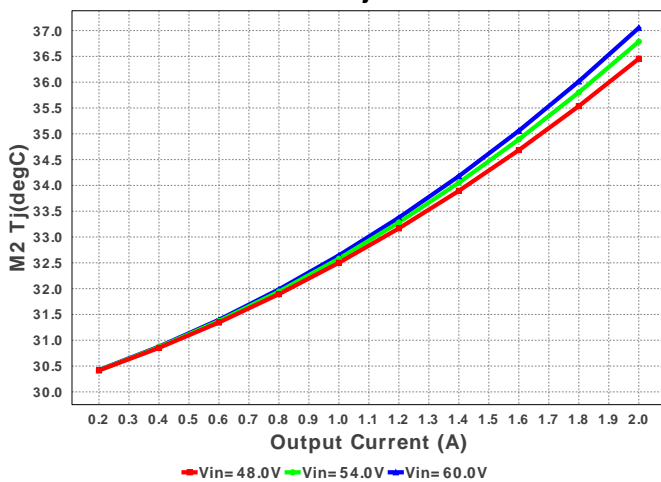
M1 Tj



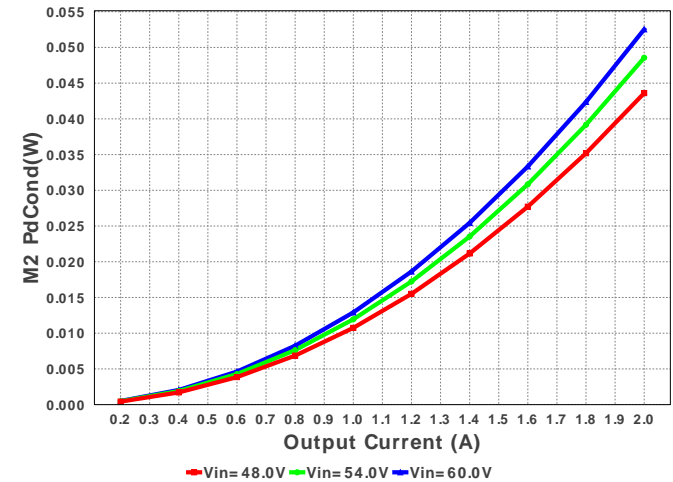
M1 PdSw

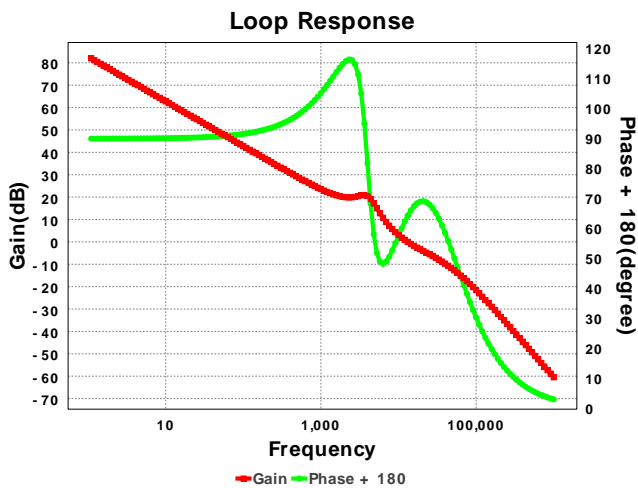


M2 Tj



M2 PdCond





## Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	980.202 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	119.602 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	840.59 mA	Current	Average input current
4.	L Ipp	414.31 mA	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	2.207 A	Current	Peak switch current
6.	BOM Count	27	General	Total Design BOM count
7.	FootPrint	474.0 mm <sup>2</sup>	General	Total Foot Print Area of BOM components
8.	Frequency	348.432 kHz	General	Switching frequency
9.	IC Tolerance	6.0 $\mu$ V	General	IC Feedback Tolerance
10.	Pout	48.0 W	General	Total output power
11.	Total BOM	\$4.89	General	Total BOM Cost
12.	Low Freq Gain	81.953 dB	Op_Point	Gain at 10Hz
13.	Vout Actual	24.129 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
14.	Cross Freq	13.127 kHz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	40.1 %	Op_point	Duty cycle
16.	Efficiency	95.171 %	Op_point	Steady state efficiency
17.	Gain Marg	-71.755 dB	Op_point	Bode Plot Gain Margin
18.	IC Tj	76.328 degC	Op_point	IC junction temperature
19.	IOUT_OP	2.0 A	Op_point	Iout operating point
20.	M1 Tj	55.447 degC	Op_point	M1 MOSFET junction temperature
21.	M2 Tj	37.052 degC	Op_point	M2 MOSFET junction temperature
22.	Phase Marg	64.367 deg	Op_point	Bode Plot Phase Margin
23.	VIN_OP	60.0 V	Op_point	Vin operating point
24.	Vout p-p	9.909 mV	Op_point	Peak-to-peak output ripple voltage
25.	Cin Pd	1.662 mW	Power	Input capacitor power dissipation
26.	Cout Pd	10.871 mW	Power	Output capacitor power dissipation
27.	IC Pd	1.324 W	Power	IC power dissipation
28.	L Pd	530.0 mW	Power	Inductor power dissipation
29.	M1 Pd	459.07 mW	Power	M1 MOSFET total power dissipation
30.	M1 PdCond	44.605 mW	Power	M1 MOSFET conduction losses
31.	M1 PdSw	414.465 mW	Power	M1 MOSFET switching losses
32.	M2 Pd	110.251 mW	Power	M2 MOSFET total power dissipation
33.	M2 PdCond	52.702 mW	Power	M2 MOSFET conduction losses
34.	M2 PdSw	57.548 mW	Power	M2 MOSFET switching losses
35.	Total Pd	2.436 W	Power	Total Power Dissipation
36.	Vout Tolerance	1.971 %		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	60.0	Maximum input voltage
3.	VinMin	48.0	Minimum input voltage
4.	Vout	24.0	Output Voltage
5.	base_pn	TPS40170	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

## Design Assistance



1. **TPS40170** Product Folder : <http://www.ti.com/product/TPS40170> : contains the data sheet and other resources.

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