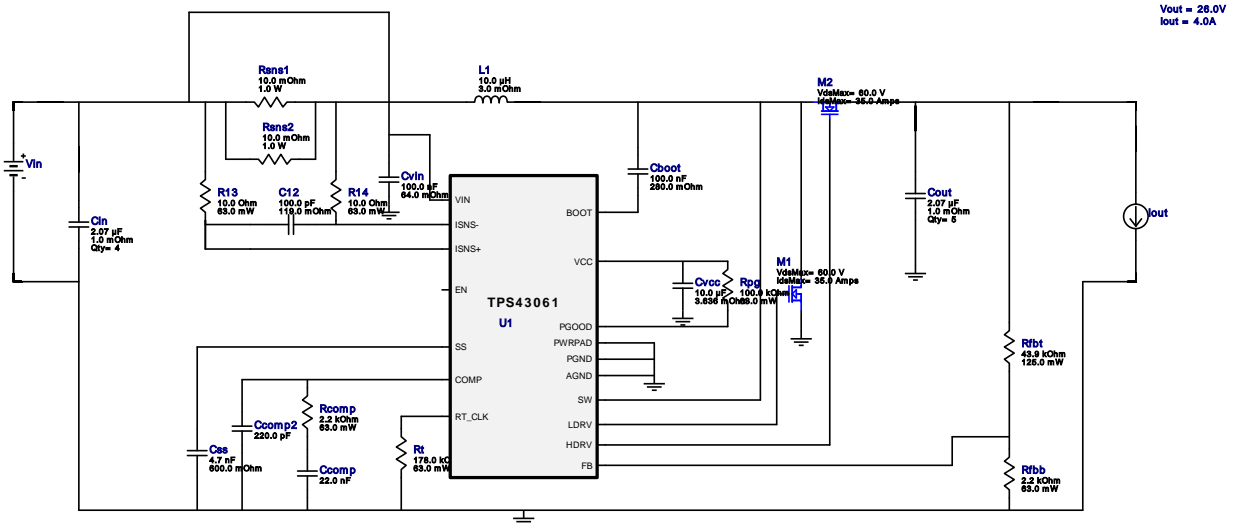


WEBENCH® Design Report

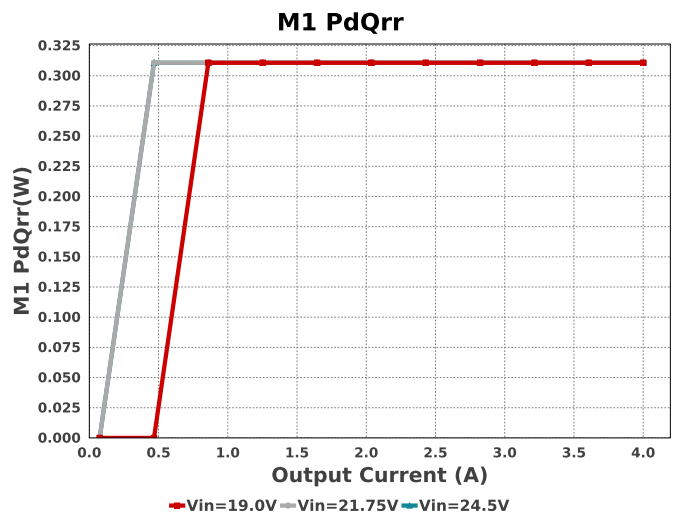
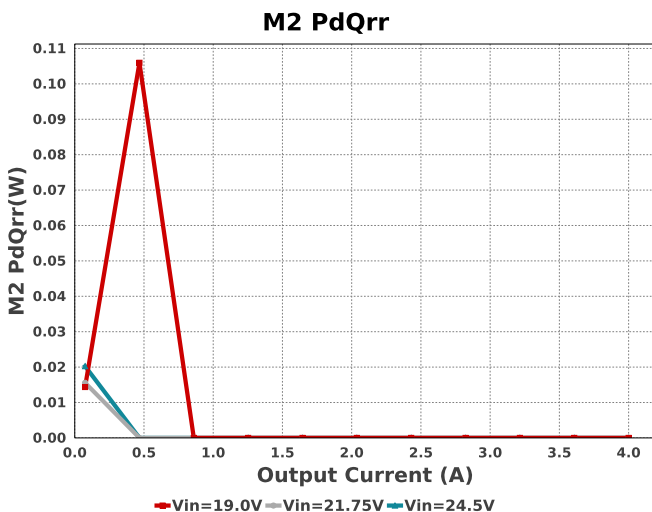
 Design : 10 TPS43061RTER
 TPS43061RTER 17V-24V to 26.00V @ 3.8A


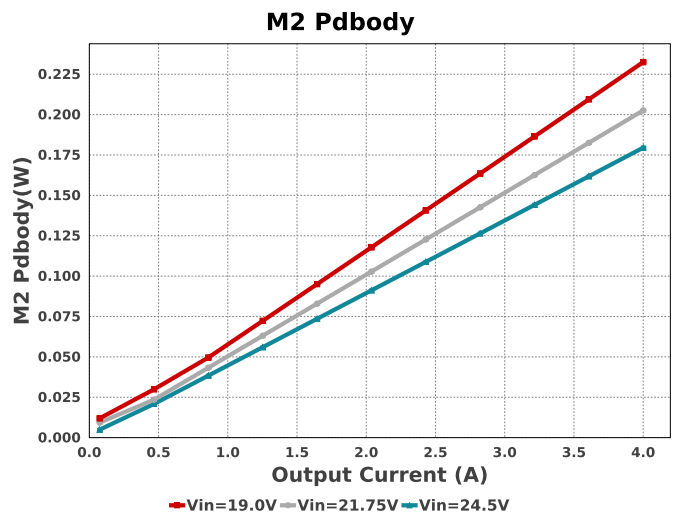
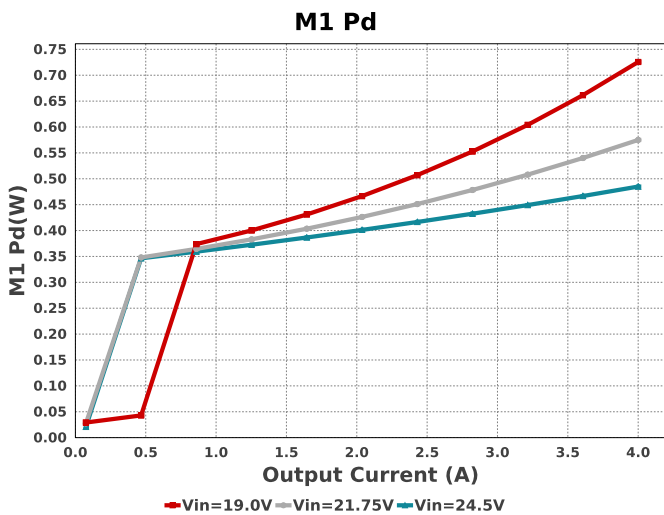
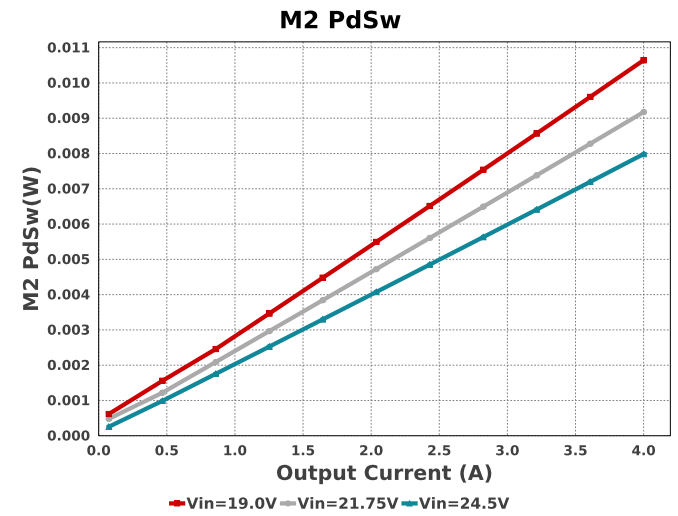
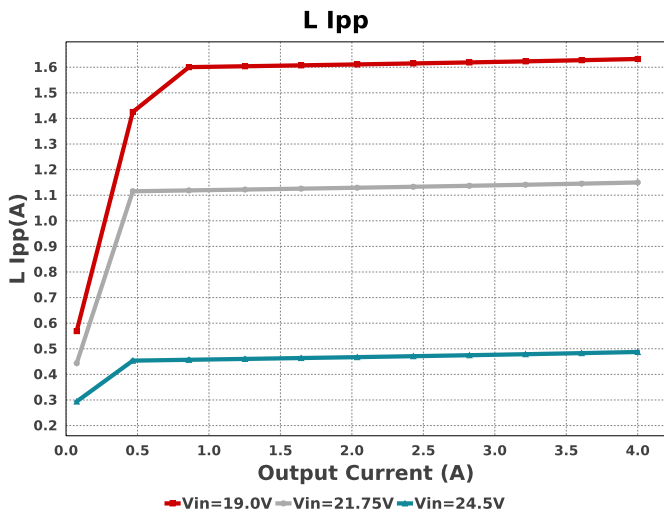
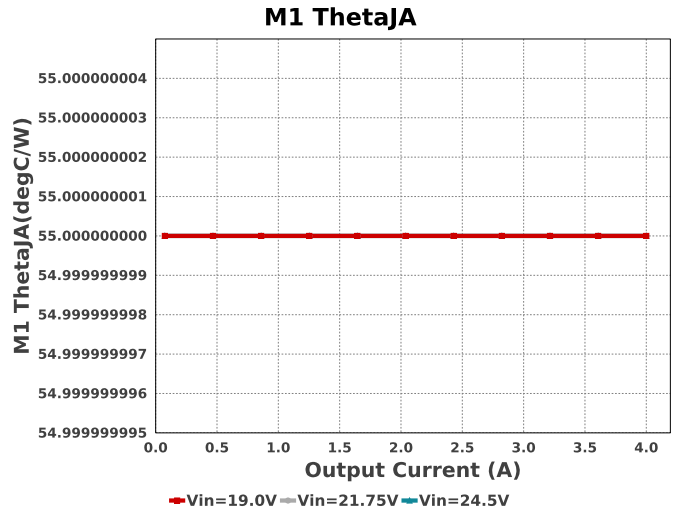
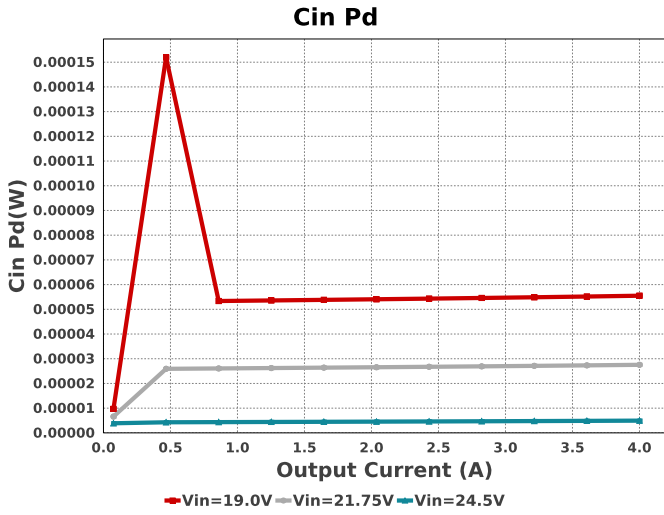
1. The pulse skip mode in the device has not been modeled. Efficiency and operational parameters of the model in pulse skip mode is not valid.

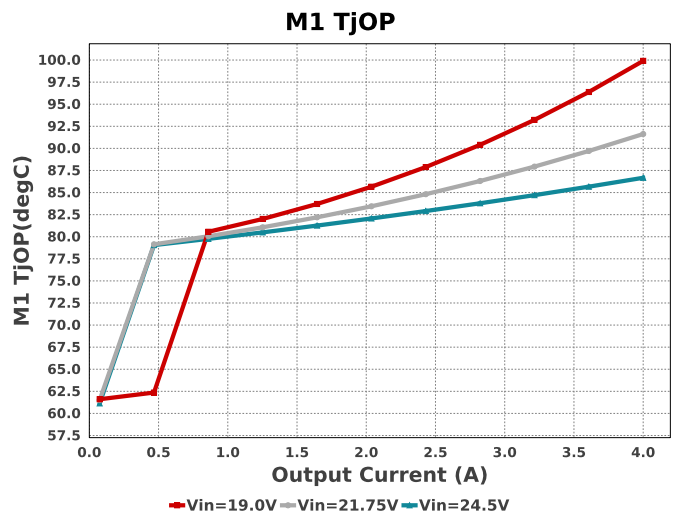
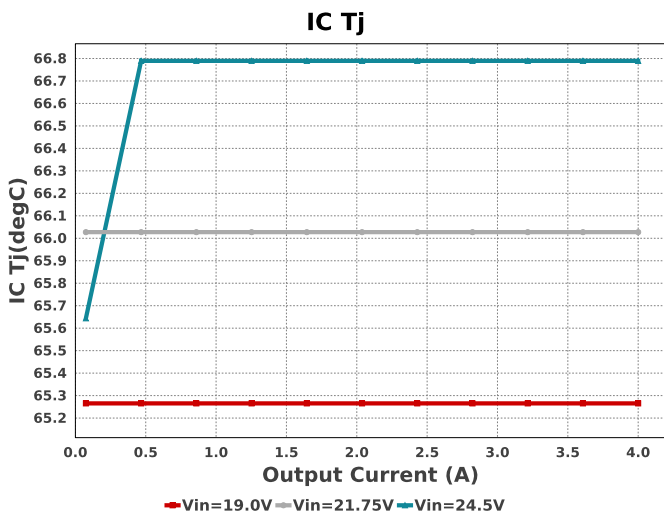
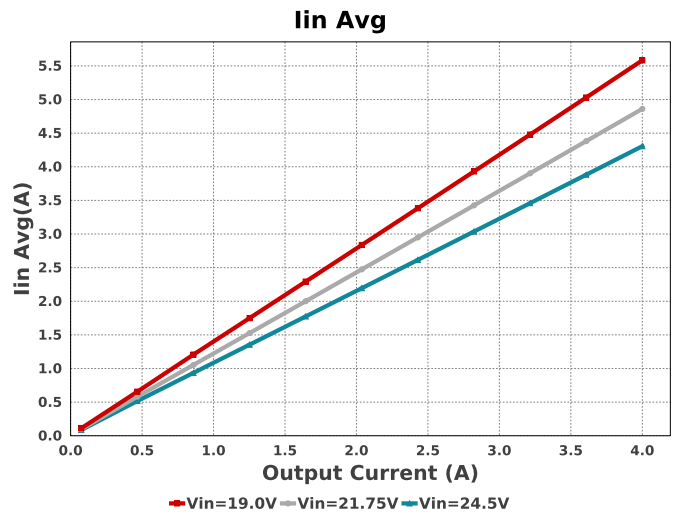
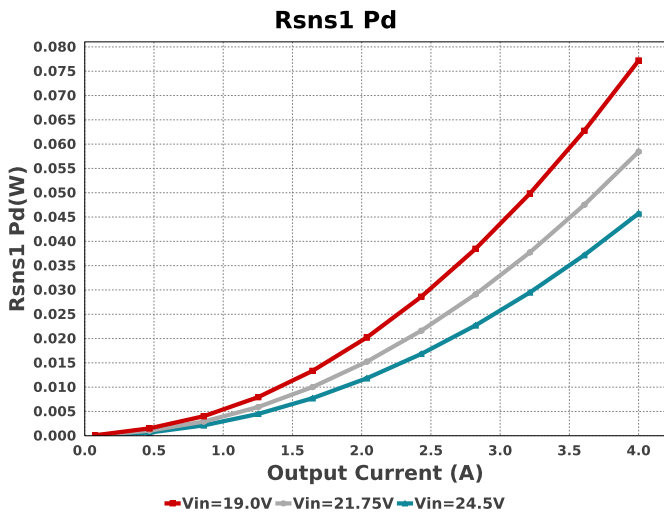
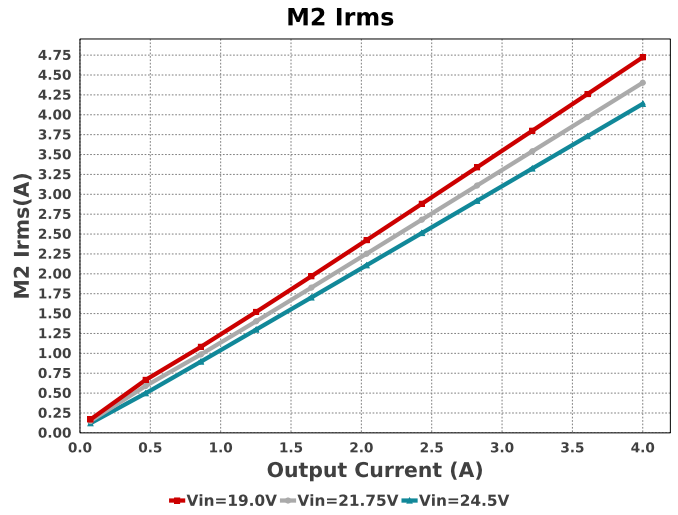
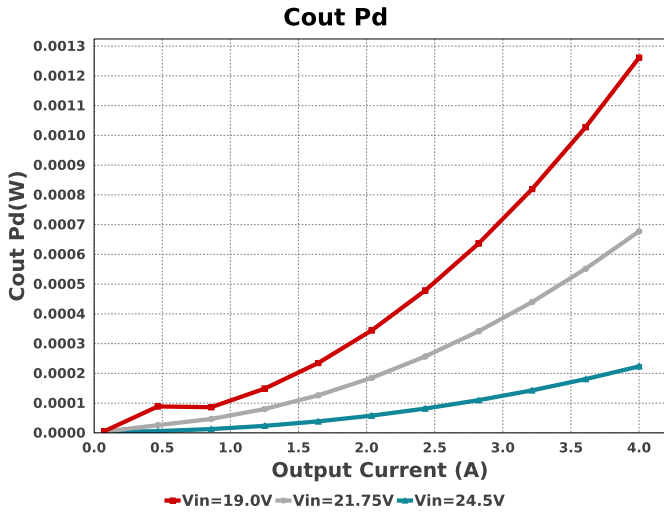
Electrical BOM

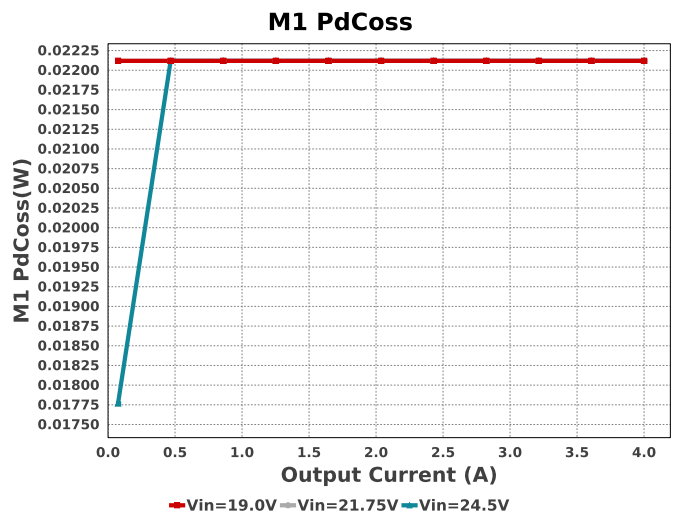
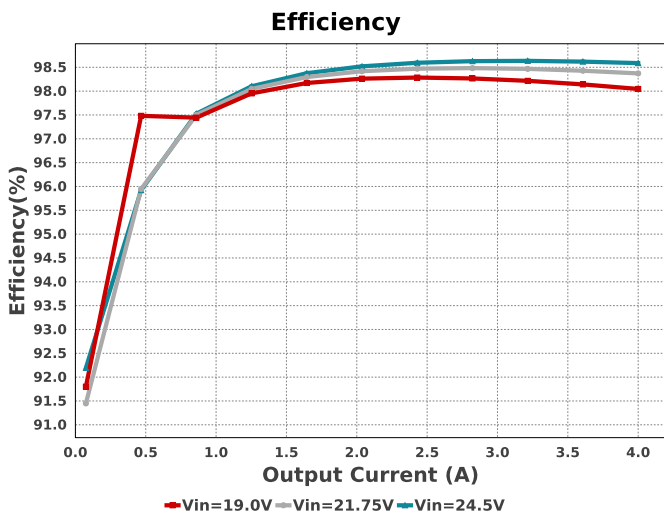
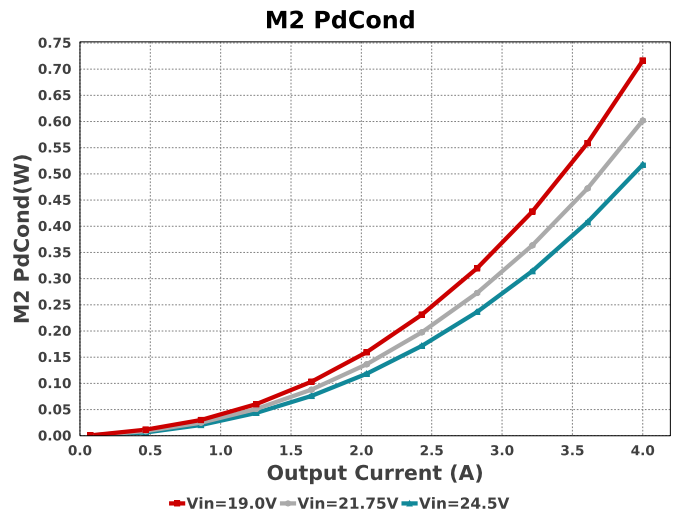
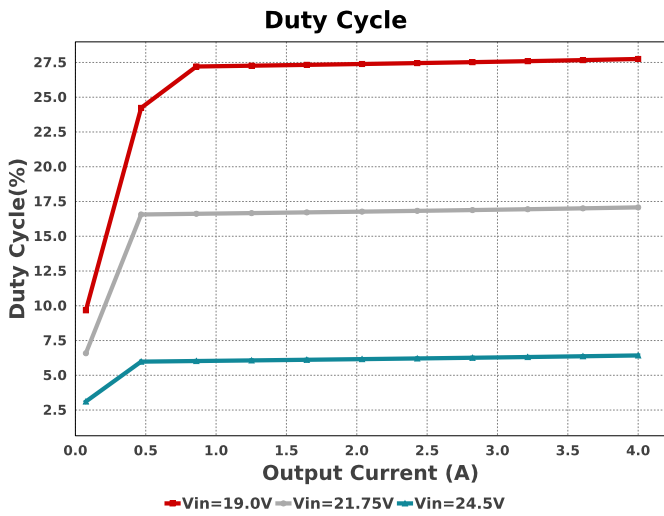
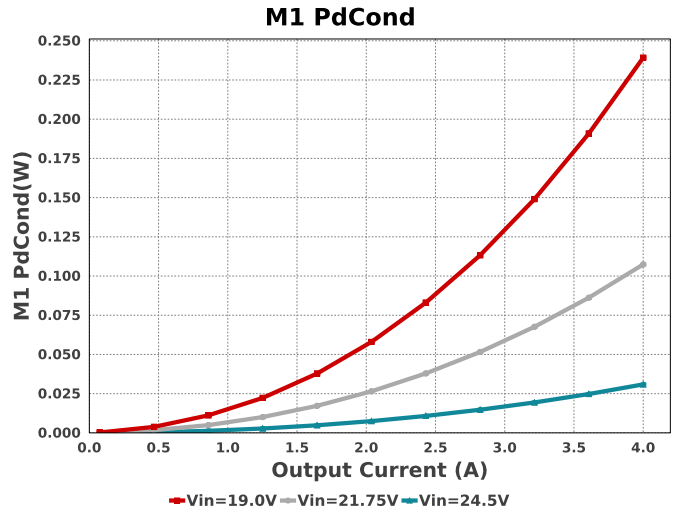
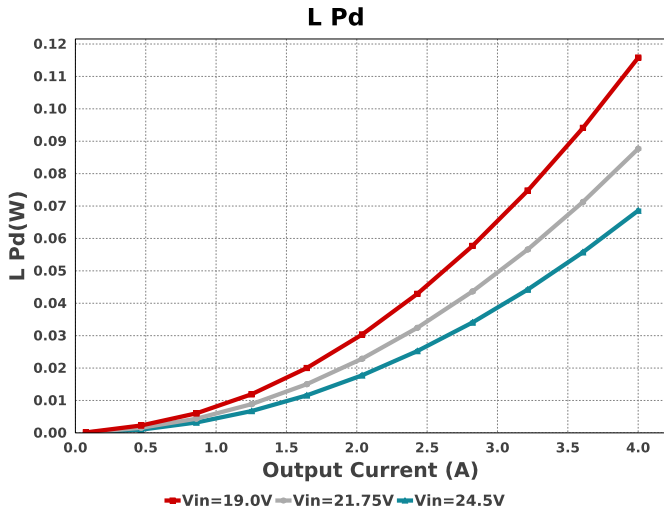
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C12	AVX	06035A101JAT2A Series= C0G/NP0	Cap= 100.0 pF ESR= 119.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0603 5 mm ²
Cboot	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
Ccomp	CUSTOM	CUSTOM Series= C0G/NP0	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	1	NA	0805 0 mm ²
Ccomp2	CUSTOM	CUSTOM Series= C0G/NP0	Cap= 220.0 pF VDC= 50.0 V IRMS= 0.0 A	1	NA	0805 0 mm ²
Cin	CUSTOM	CUSTOM Series= X7R	Cap= 2.07 uF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 0.0 A	4	NA	1210_270 0 mm ²
Cout	CUSTOM	CUSTOM Series= X7R	Cap= 2.07 uF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 0.0 A	5	NA	1210_270 0 mm ²
Css	MuRata	GRM188R71E472KA01D Series= X7R	Cap= 4.7 nF ESR= 600.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0603 5 mm ²
Cvcc	MuRata	GRM188R61C106MA73D Series= X5R	Cap= 10.0 uF ESR= 3.636 mOhm VDC= 16.0 V IRMS= 2.8889 A	1	\$0.05	0603 5 mm ²

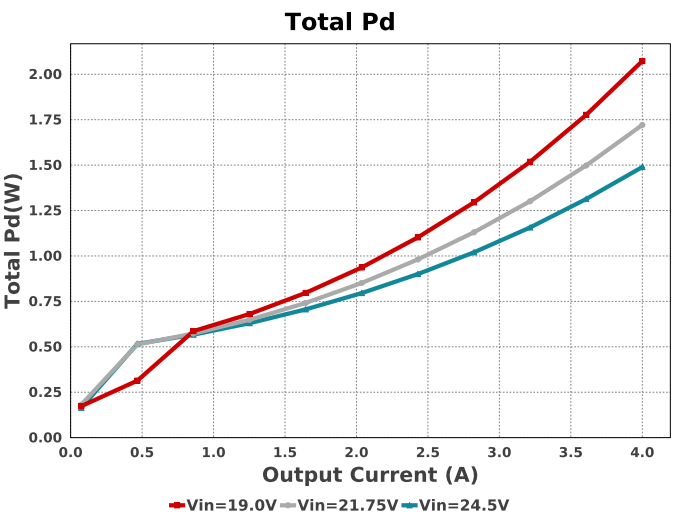
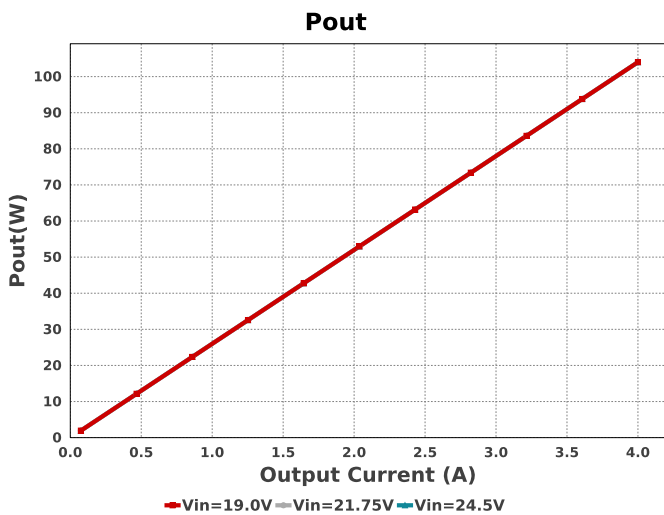
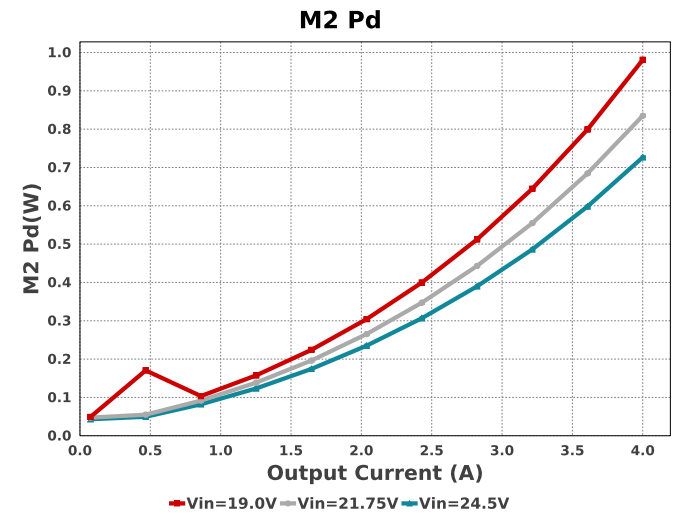
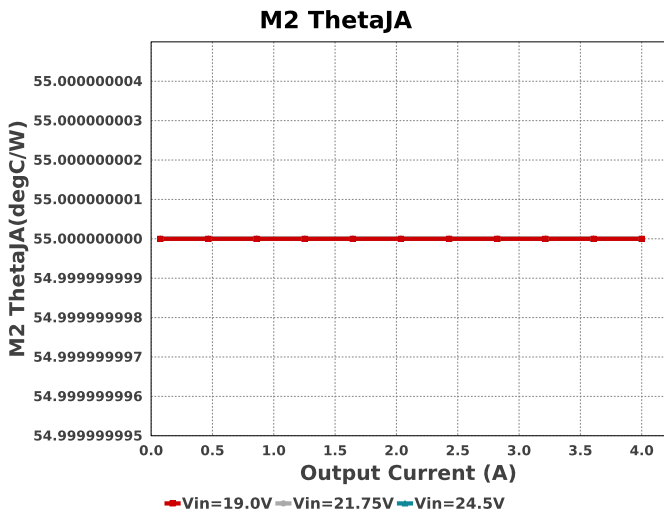
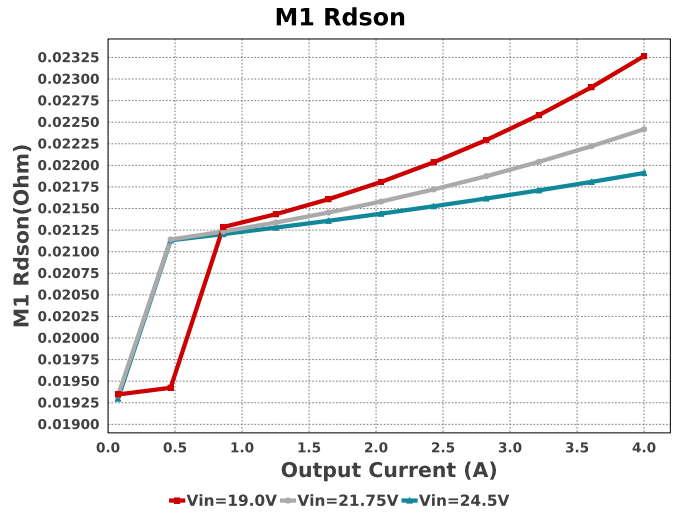
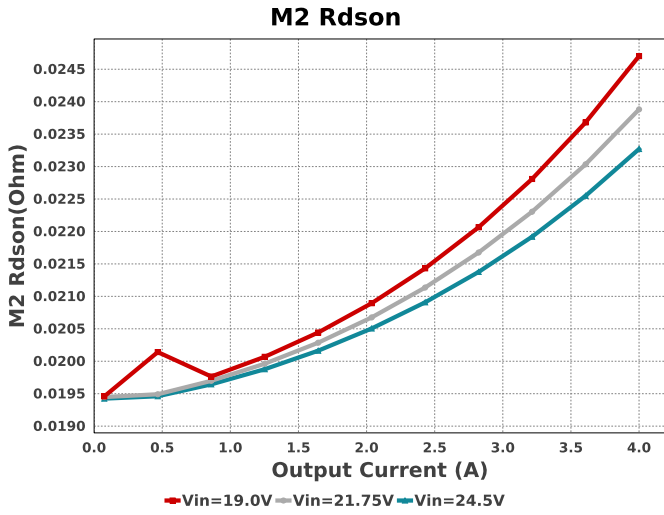
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cvin	Kemet	C0805C104M5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	\$0.01	0805 7 mm ²
L1	CUSTOM	CUSTOM	L= 10.0 µH 3.0 mOhm	1	NA	XAL6060 0 mm ²
M1	Texas Instruments	CSD18543Q3A	VdsMax= 60.0 V IdsMax= 35.0 Amps	1	\$0.21	DNH0008A 18 mm ²
M2	Texas Instruments	CSD18543Q3A	VdsMax= 60.0 V IdsMax= 35.0 Amps	1	\$0.21	DNH0008A 18 mm ²
R13	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
R14	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
Rcomp	CUSTOM	CUSTOM Series= CRCW..e3	Res= 2.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	NA	0402 0 mm ²
Rfbb	CUSTOM	CUSTOM Series= CRCW..e3	Res= 2.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	NA	0402 0 mm ²
Rfbt	CUSTOM	CUSTOM Series= RT0805	Res= 43.9 kOhm Power= 125.0 mW Tolerance= 0.1%	1	NA	0805 0 mm ²
Rpg	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
Rsns1	Susumu Co Ltd	PRL1632-R010-F-T1 Series= PRL1632	Res= 10.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	\$0.20	0612 11 mm ²
Rsns2	Susumu Co Ltd	PRL1632-R010-F-T1 Series= PRL1632	Res= 10.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	\$0.20	0612 11 mm ²
Rt	Vishay-Dale	CRCW0402178KFKED Series= CRCW..e3	Res= 178.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
U1	Texas Instruments	TPS43061RTER	Switcher	1	\$0.94	S-PVQFN-N16 17 mm ²

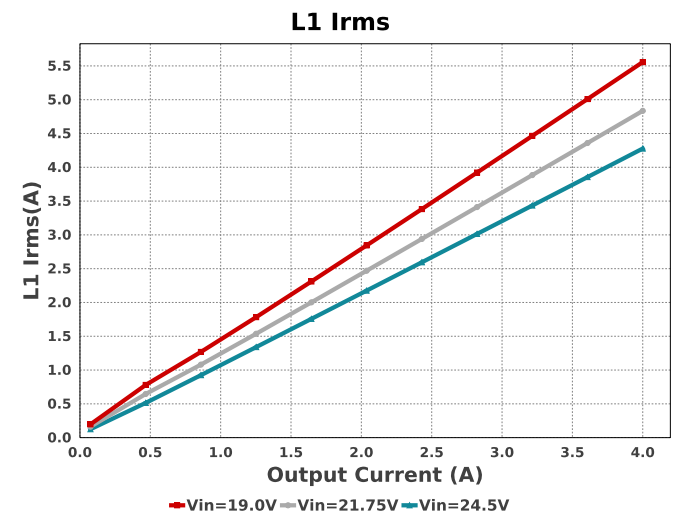
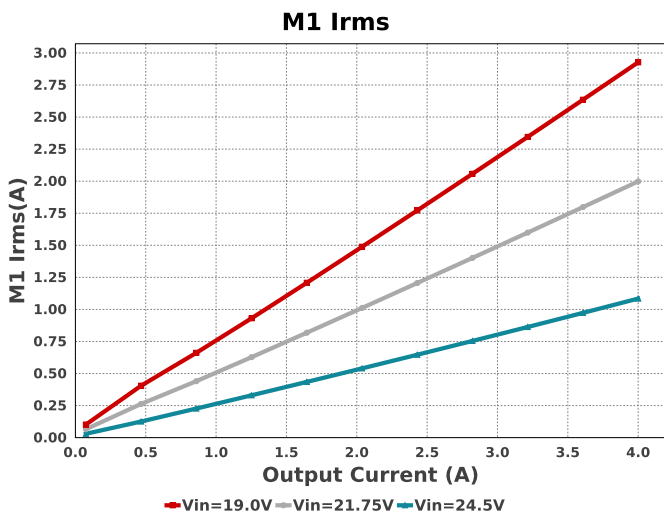
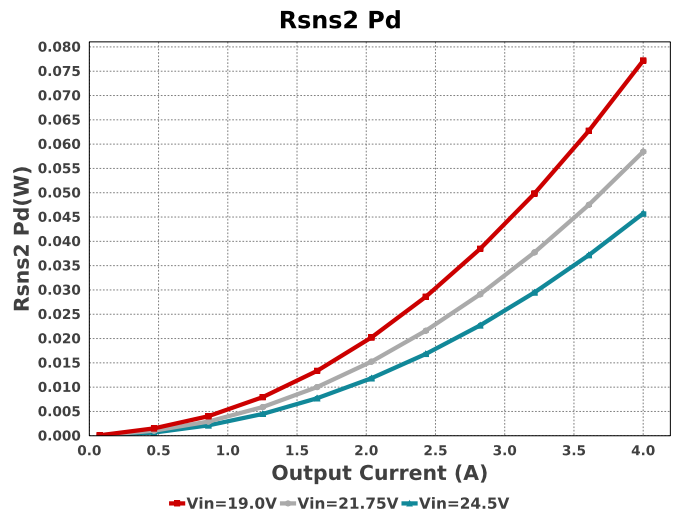
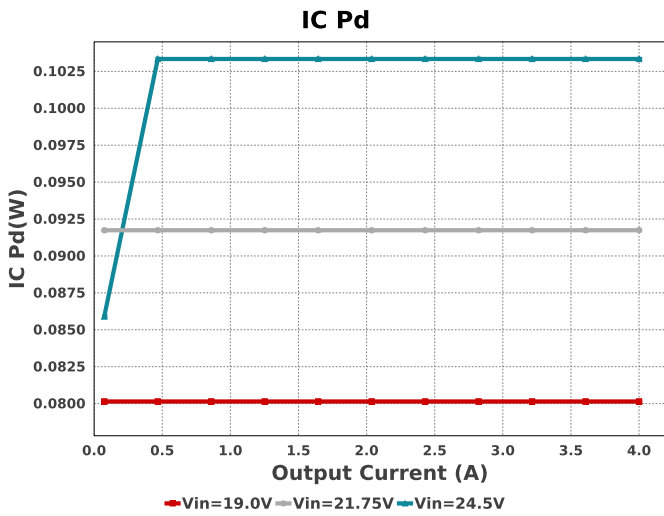
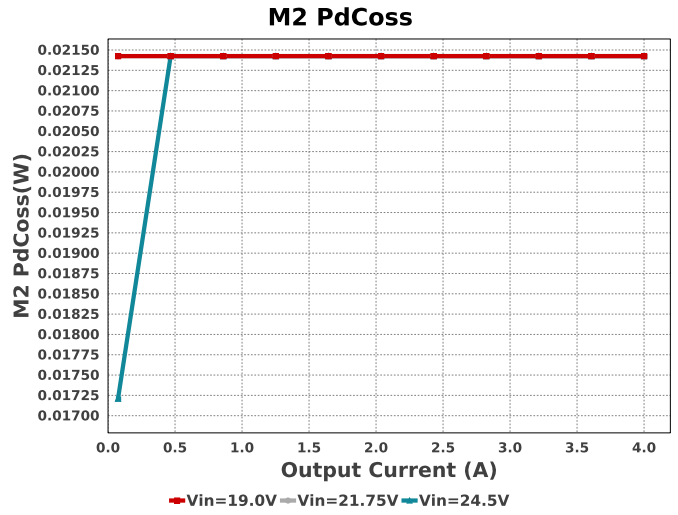
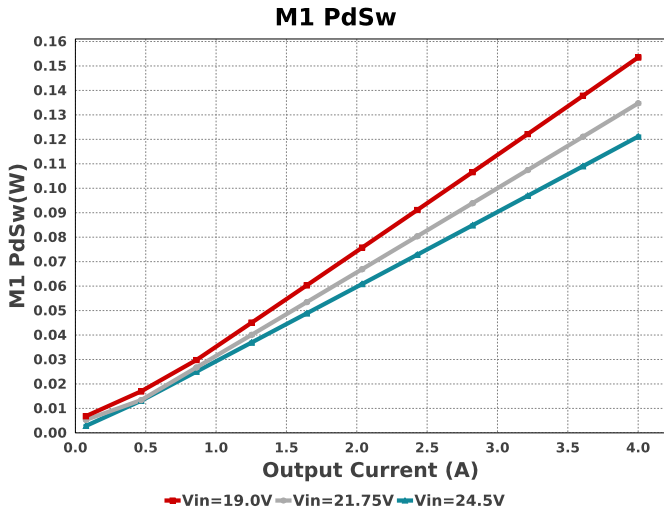


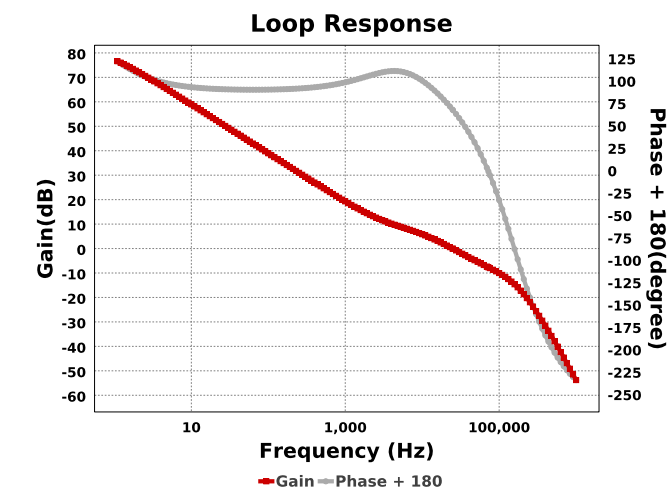
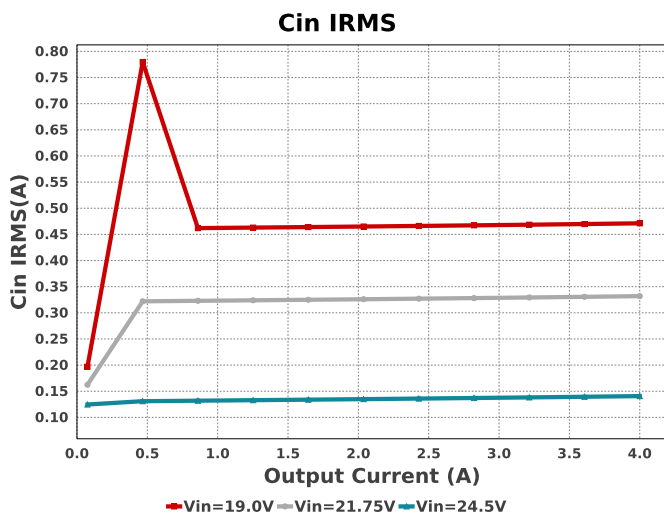
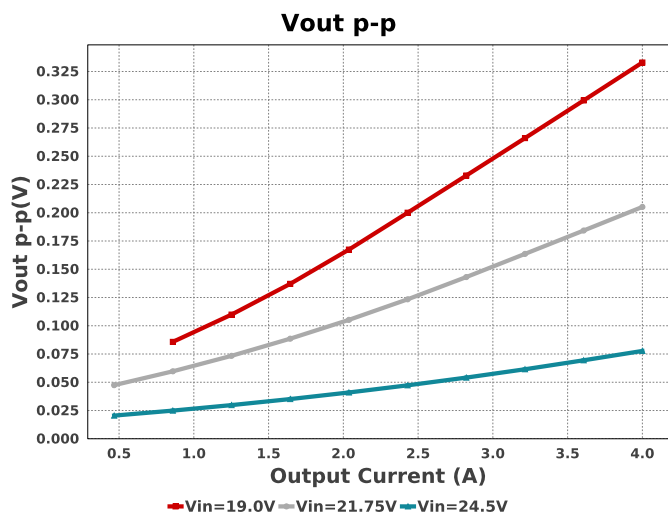
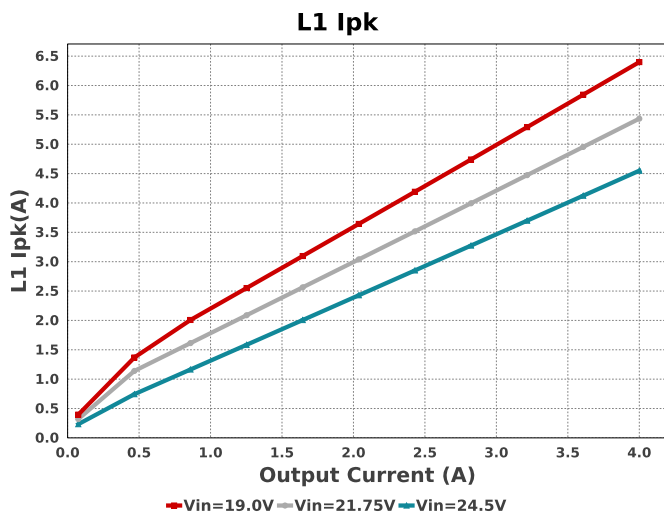
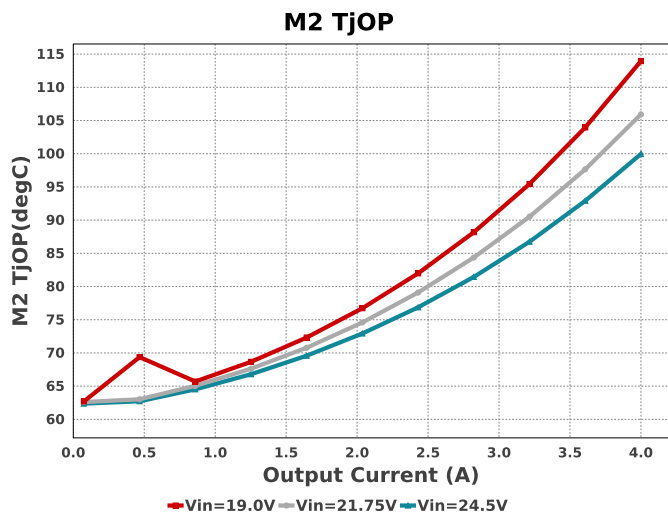












Operating Values

#	Name	Value	Category	Description
1.	BOM Count	29		Total Design BOM count
2.	Total BOM	NA		Total BOM Cost
3.	Cin IRMS	471.177 mA	Capacitor	Input capacitor RMS ripple current
4.	Cin Pd	55.502 μW	Capacitor	Input capacitor power dissipation
5.	Cout Pd	1.261 mW	Capacitor	Output capacitor power dissipation
6.	IC Pd	80.142 mW	IC	IC power dissipation
7.	IC Tj	65.265 degC	IC	IC junction temperature
8.	ICThetaJA	65.7 degC/W	IC	IC junction-to-ambient thermal resistance
9.	Iin Avg	5.583 A	IC	Average input current
10.	L Ipp	1.632 A	Inductor	Peak-to-peak inductor ripple current
11.	L Pd	115.77 mW	Inductor	Inductor power dissipation

#	Name	Value	Category	Description
12.	L1 Ipk	6.399 A	Inductor	Inductor peak current
13.	L1 Irms	5.556 A	Inductor	Inductor ripple current
14.	M1 Irms	2.927 A	Mosfet	MOSFET RMS ripple current
15.	M1 Pd	725.57 mW	Mosfet	MOSFET power dissipation
16.	M1 PdCond	239.19 mW	Mosfet	M1 MOSFET conduction losses
17.	M1 PdCoss	22.119 mW	Mosfet	M1 MOSFET Coss Losses
18.	M1 PdQrr	310.76 mW	Mosfet	M1 MOSFET switching losses
19.	M1 PdSw	153.5 mW	Mosfet	M1 MOSFET switching losses
20.	M1 Rdson	23.266 mOhm	Mosfet	Drain-Source On-resistance
21.	M1 ThetaJA	55.0 degC/W	Mosfet	MOSFET junction-to-ambient thermal resistance
22.	M1 TjOP	99.907 degC	Mosfet	M1 MOSFET junction temperature
23.	M2 Irms	4.723 A	Mosfet	MOSFET RMS ripple current
24.	M2 Pd	980.85 mW	Mosfet	MOSFET power dissipation
25.	M2 PdCond	716.29 mW	Mosfet	M2 MOSFET conduction losses
26.	M2 PdCoss	21.425 mW	Mosfet	M2 MOSFET Coss Losses
27.	M2 PdSw	10.645 mW	Mosfet	M2 MOSFET switching losses
28.	M2 Pdbody	232.5 mW	Mosfet	Power dissipation through lower FET
29.	M2 Rdson	24.702 mOhm	Mosfet	Drain-Source On-resistance
30.	M2 ThetaJA	55.0 degC/W	Mosfet	MOSFET junction-to-ambient thermal resistance
31.	M2 TjOP	113.947 degC	Mosfet	MOSFET junction temperature
32.	Cin Pd	55.502 μW	Power	Input capacitor power dissipation
33.	Cout Pd	1.261 mW	Power	Output capacitor power dissipation
34.	IC Pd	80.142 mW	Power	IC power dissipation
35.	L Pd	115.77 mW	Power	Inductor power dissipation
36.	M1 Pd	725.57 mW	Power	MOSFET power dissipation
37.	M1 PdCond	239.19 mW	Power	M1 MOSFET conduction losses
38.	M1 PdCoss	22.119 mW	Power	M1 MOSFET Coss Losses
39.	M1 PdQrr	310.76 mW	Power	M1 MOSFET switching losses
40.	M1 PdSw	153.5 mW	Power	M1 MOSFET switching losses
41.	M2 Pd	980.85 mW	Power	MOSFET power dissipation
42.	M2 PdCond	716.29 mW	Power	M2 MOSFET conduction losses
43.	M2 PdCoss	21.425 mW	Power	M2 MOSFET Coss Losses
44.	M2 PdQrr	0.0 W	Power	Synchronous Boost High Side Reverse Recovery
45.	M2 PdSw	10.645 mW	Power	M2 MOSFET switching losses
46.	M2 Pdbody	232.5 mW	Power	Power dissipation through lower FET
47.	Rsns1 Pd	77.183 mW	Power	Rsns1 Power Dissipation
48.	Rsns2 Pd	77.183 mW	Power	Rsns2 Power Dissipation
49.	Total Pd	2.073 W	Power	Total Power Dissipation
50.	Rsns1 Pd	77.183 mW	Resistor	Rsns1 Power Dissipation
51.	Rsns2 Pd	77.183 mW	Resistor	Rsns2 Power Dissipation
52.	Cross Freq	19.373 kHz	System	Bode plot crossover frequency
53.	Duty Cycle	27.75 %	System	Duty cycle
54.	Efficiency	98.046 %	System	Steady state efficiency
55.	FootPrint	345.0 mm ²	System	Total Foot Print Area of BOM components
56.	Frequency	323.034 kHz	System	Switching frequency
57.	Gain Marg	-6.252 dB	System	Bode Plot Gain Margin
58.	Iout	4.0 A	System	Iout operating point
59.	Low Freq Gain	76.765 dB	System	Gain at 1Hz
60.	Mode	CCM	System	Conduction Mode
61.	Phase Marg	69.976 deg	System	Bode Plot Phase Margin
62.	Pout	104.0 W	System	Total output power
63.	Vin	19.0 V	System	Vin operating point
64.	Vout	26.0 V	System	Operational Output Voltage
65.	Vout Actual	25.565 V	System	Vout Actual calculated based on selected voltage divider resistors
66.	Vout Tolerance	3.129 %	System	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
67.	Vout p-p	332.946 mV	System	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	4.0	Maximum Output Current
SoftStart	1.01 ms	Soft Start Time (ms)
VinMax	24.5	Maximum input voltage
VinMin	19.0	Minimum input voltage
Vout	26.0	Output Voltage
base_pn	TPS43061	Base Product Number
source	DC	Input Source Type
Ta	60.0	Ambient temperature
UserFsw	320.0 k	Customer Selected Frequency

WEBENCH® Assembly

Component Testing

Some published data on components in datasheets such as Capacitor ESR and Inductor DC resistance is based on conservative values that will guarantee that the components always exceed the specification. For design purposes it is usually better to work with typical values. Since this data is not always available it is a good practice to measure the Capacitance and ESR values of C_{in} and C_{out} , and the inductance and DC resistance of L1 before assembly of the board. Any large discrepancies in values should be electrically simulated in WEBENCH to check for instabilities and thermally simulated in WebTHERM to make sure critical temperatures are not exceeded.

Soldering Component to Board

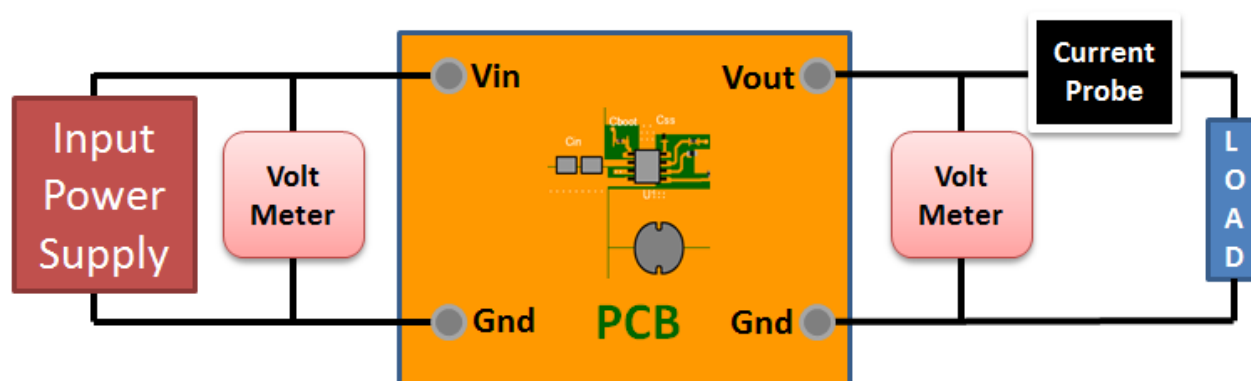
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab down to the board place the iron down on the board while resting against the tab, heating both surfaces simultaneously. Apply light pressure to the top of the plastic case until the solder flows around the part and the part is flush with the PCB. If the solder is not flowing around the board you may need a higher wattage iron (generally 25W to 30W is enough).

Initial Startup of Circuit

It is best to initially power up the board by setting the input supply voltage to the lowest operating input voltage 19.0V and set the input supply's current limit to zero. With the input supply off connect up the input supply to V_{in} and GND. Connect a digital volt meter and a load if needed to set the minimum load of the design from V_{out} and GND. Turn on the input supply and slowly turn up the current limit on the input supply. If the voltage starts to rise on the input supply continue increasing the input supply current limit while watching the output voltage. If the current increases on the input supply, but the voltage remains near zero, then there may be a short or a component misplaced on the board. Power down the board and visually inspect for solder bridges and recheck the diode and capacitor polarities. Once the power supply circuit is operational then more extensive testing may include full load testing, transient load and line tests to compare with simulation results.

Load Testing

The setup is the same as the initial startup, except that an additional digital voltmeter is connected between V_{in} and GND, a load is connected between V_{out} and GND and a current meter is connected in series between V_{out} and the load. The load must be able to handle at least rated output power + 50% (7.5 watts for this design). Ideally the load is supplied in the form of a variable load test unit. It can also be done in the form of suitably large power resistors. When using an oscilloscope to measure waveforms on the prototype board, the ground leads of the oscilloscope probes should be as short as possible and the area of the loop formed by the ground lead should be kept to a minimum. This will help reduce ground lead inductance and eliminate EMI noise that is not actually present in the circuit.



Design Assistance

1. Feature Highlights: Low Quiescent Current Boost Controller, Wide V_{in} Range 4.5V to 38V V_{in} , 58V V_{out} , 5.5V Gate Drive optimized for Low Q_g NexFETs Thermal Shutdown
2. Master key : 4507709AB5719FFA17DB9FDA61D8E6FB[v1]
3. **TPS43061** Product Folder : <http://www.ti.com/product/TPS43061> : contains the data sheet and other resources.

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