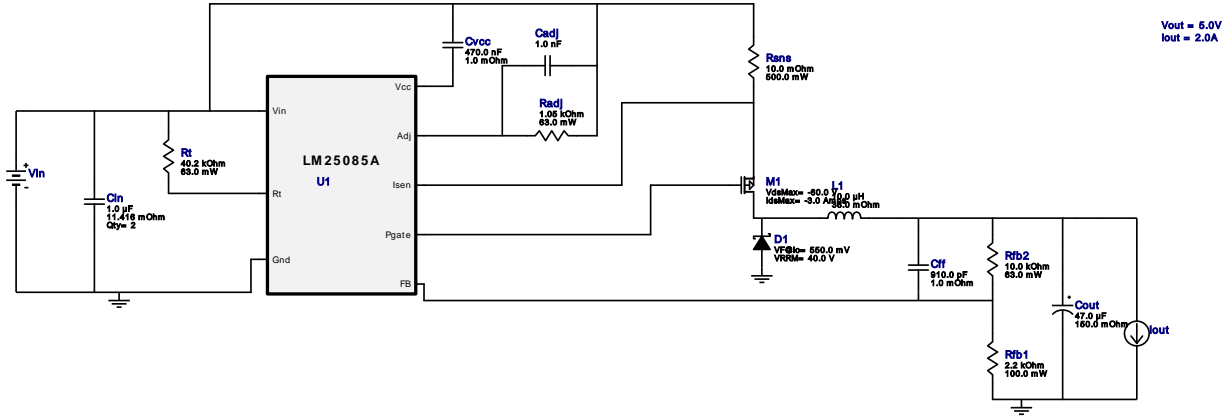


WEBENCH® Design Report

Design : 24 LM25085AMY/NOPB
LM25085AMY/NOPB 17V-20V to 5.00V @ 2A





VinMin = 17.0V
VinMax = 20.0V
Vout = 5.0V
Iout = 2.0A

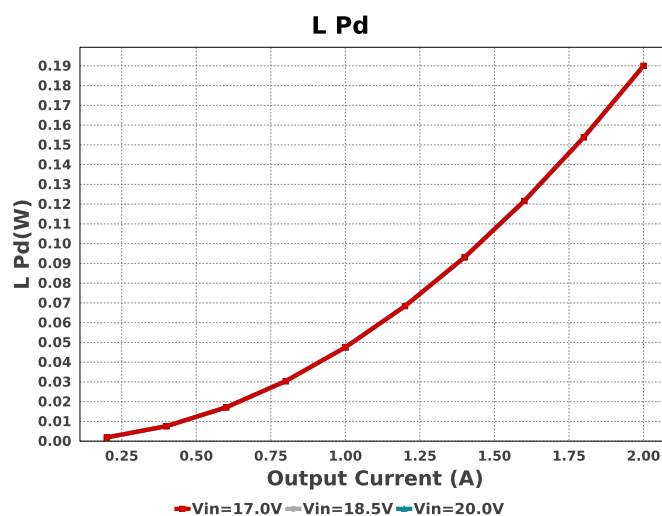
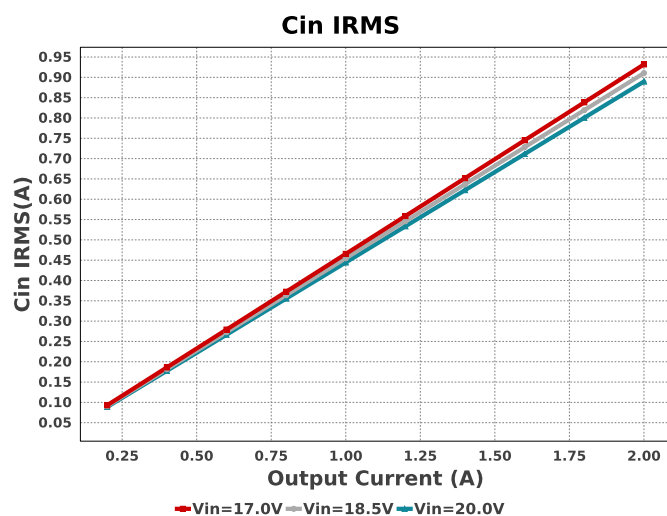
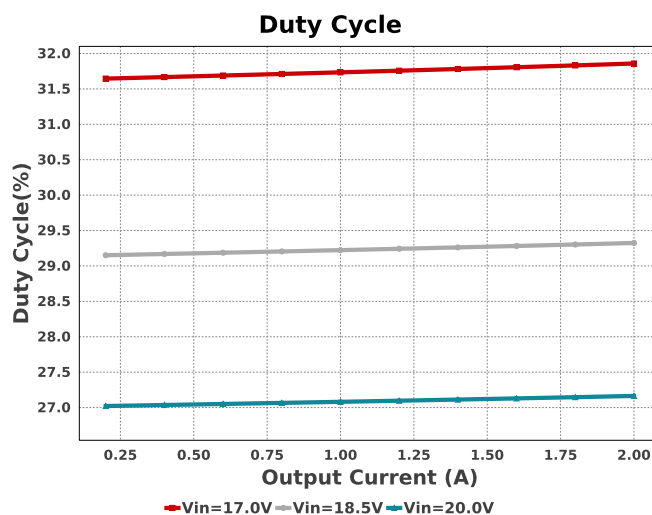
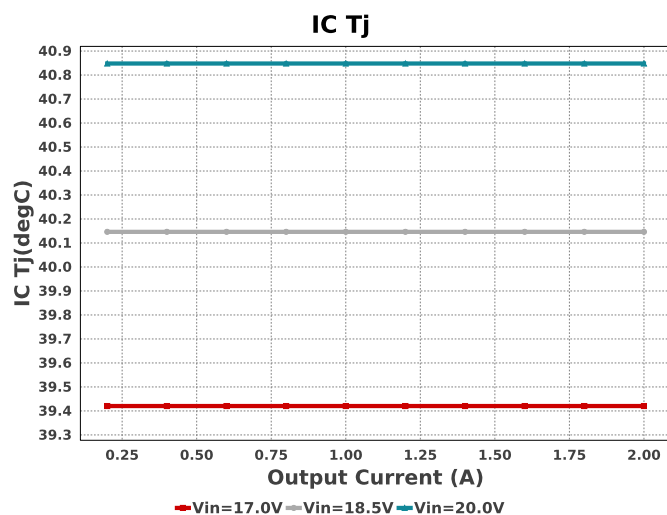
Device = LM25085AMY/NOPB
Topology = Buck
Created = 2023-03-22 05:54:32.317
BOM Cost = \$2.19
BOM Count = 15
Total Pd = 1.46W

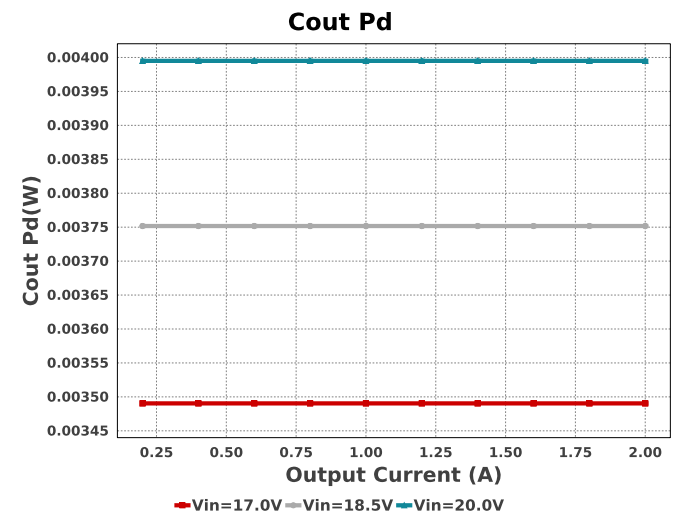
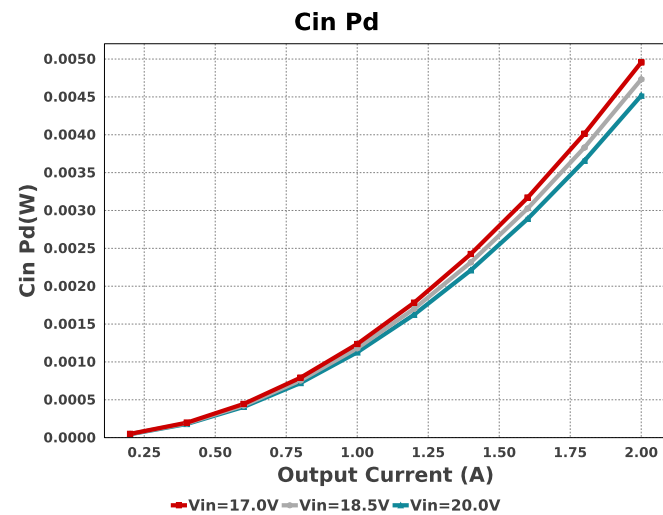
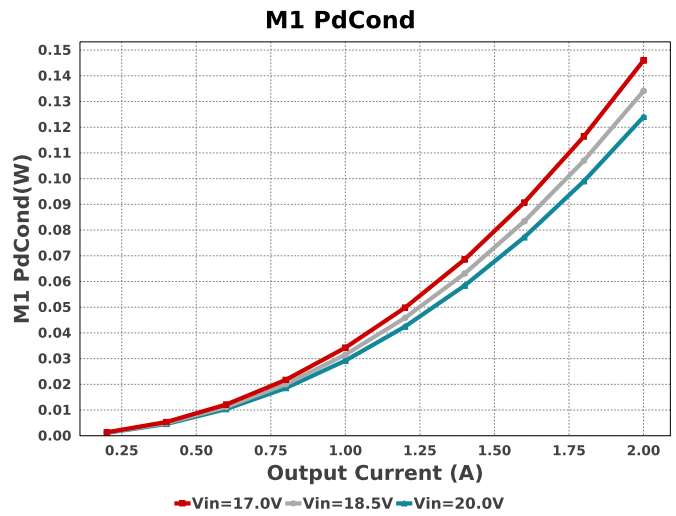
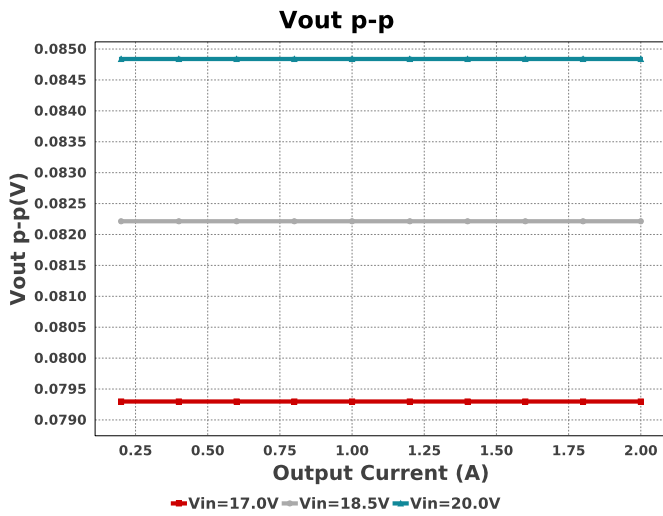
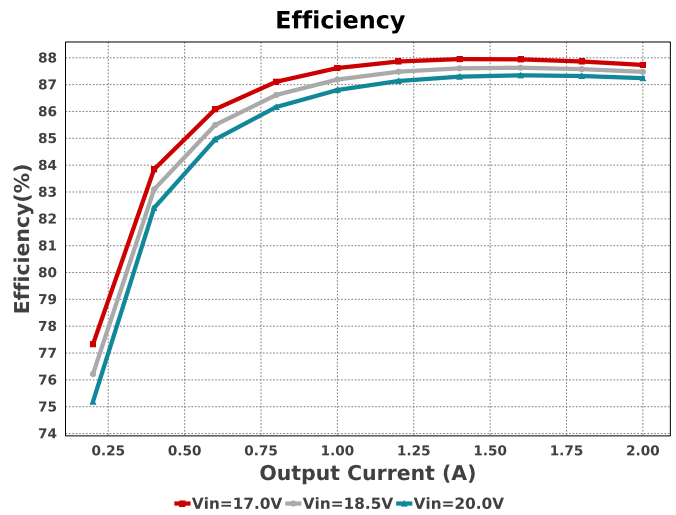
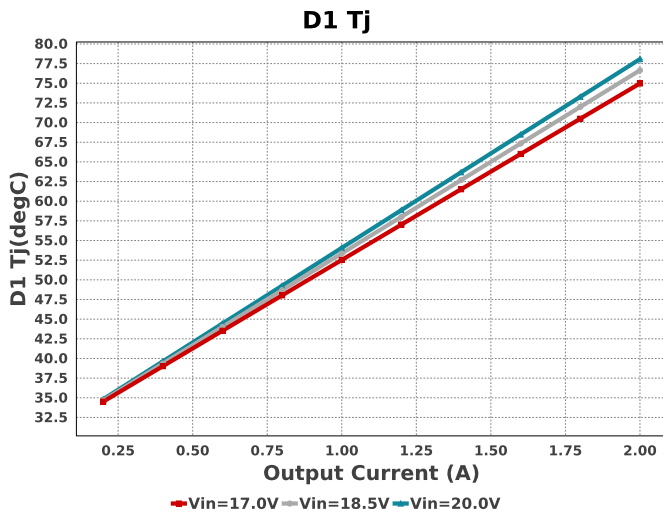


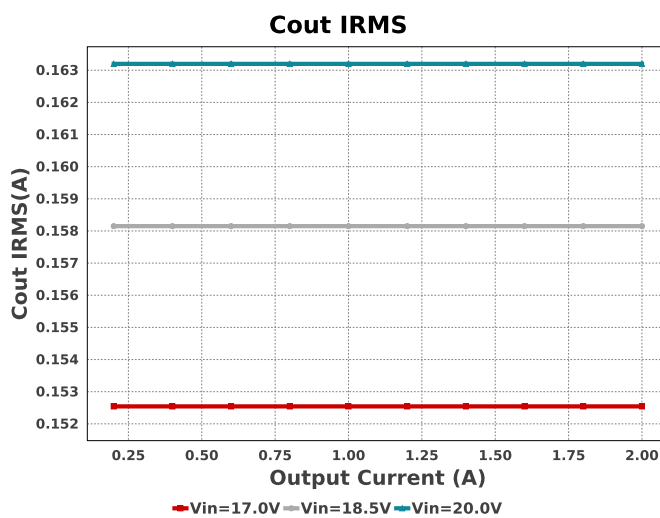
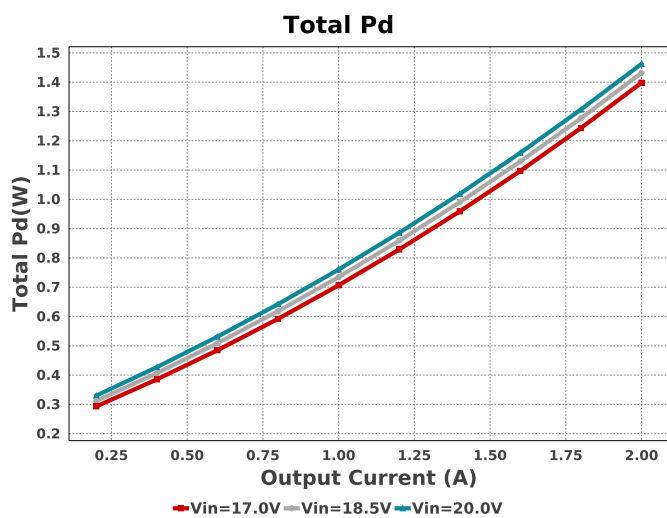
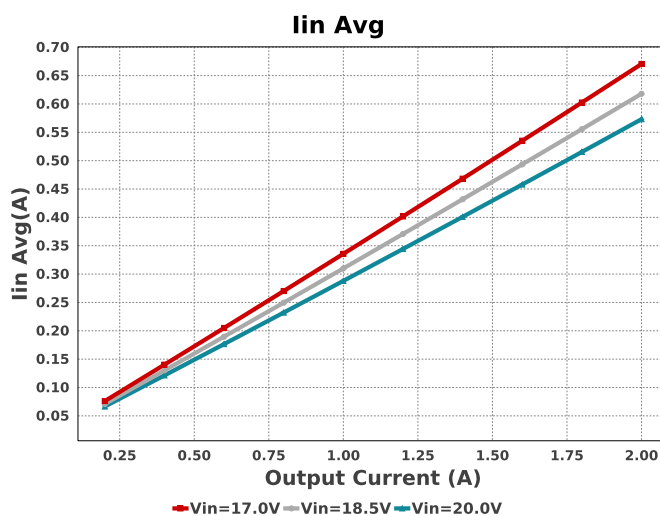
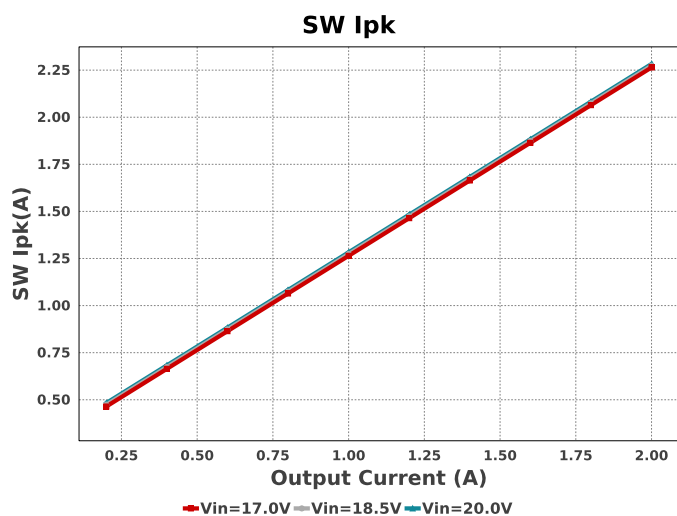
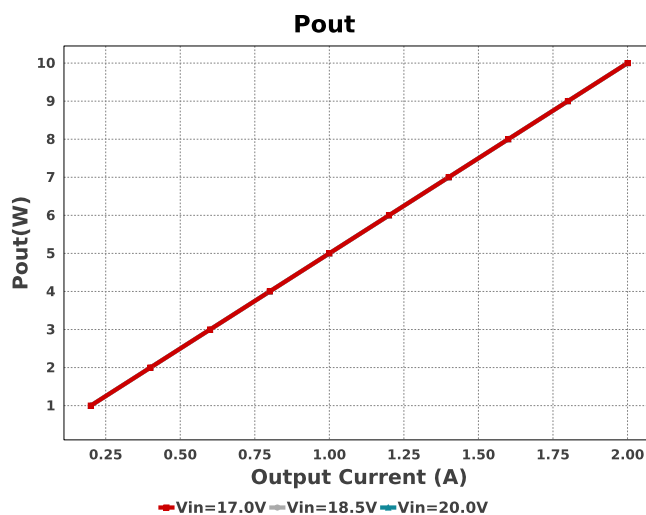
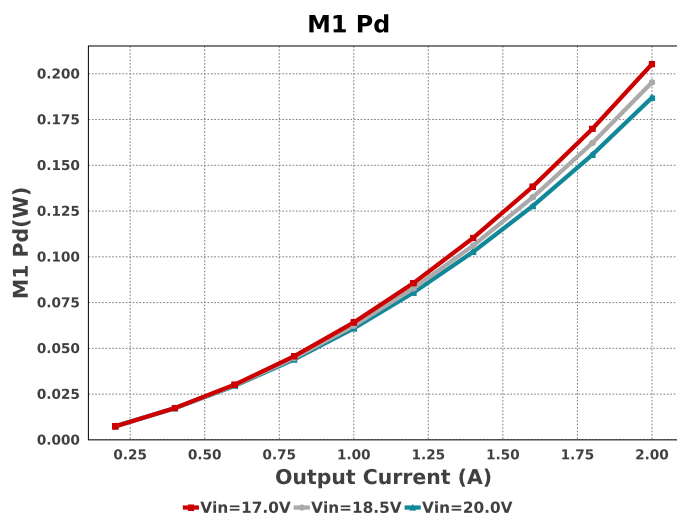
Electrical BOM

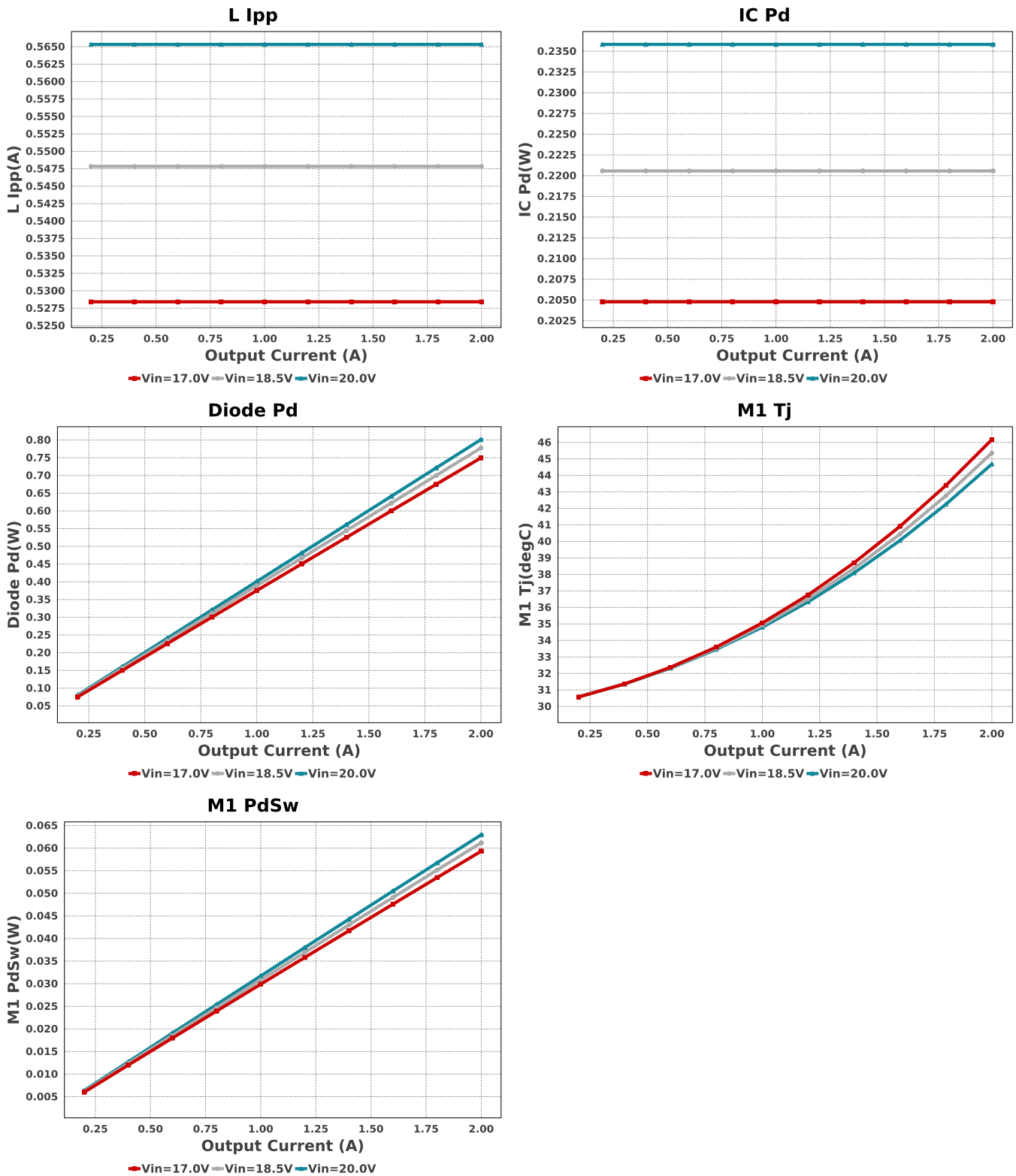
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cadj	Samsung Electro-Mechanics	CL21C102JBCNNNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
Cff	Kemet	C0603C911J5GACTU Series= C0G/NP0	Cap= 910.0 pF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	\$0.08	0603 5 mm ²
Cin	TDK	C1005X5R1V105K050BC Series= X5R	Cap= 1.0 uF ESR= 11.416 mOhm VDC= 35.0 V IRMS= 1.483 A	2	\$0.03	0402 3 mm ²
Cout	Panasonic	6TPU47MSI Series= TPU	Cap= 47.0 uF ESR= 150.0 mOhm VDC= 6.3 V IRMS= 510.0 mA	1	\$0.44	CAPSMT_6_S09 7 mm ²
Cvcc	Taiyo Yuden	TMK212BJ474KD-T Series= X5R	Cap= 470.0 nF ESR= 1.0 mOhm VDC= 20.0 V IRMS= 0.0 A	1	\$0.02	0805 7 mm ²
D1	Fairchild Semiconductor	SS24FL	VF@Io= 550.0 mV VRRM= 40.0 V	1	\$0.09	SOD-123F 12 mm ²
L1	TDK	VLP8040T-100M	L= 10.0 uH 38.0 mOhm	1	\$0.22	VLP8040 113 mm ²
M1	Fairchild Semiconductor	FDC5614P	VdsMax= -60.0 V IdsMax= -3.0 Amps	1	\$0.25	SOT-23-6 15 mm ²
Radj	Vishay-Dale	CRCW04021K05FKED Series= CRCW..e3	Res= 1.05 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
Rfb1	Yageo	RC0603FR-072K2L Series= ?	Res= 2.2 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Rfb2	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
Rsns	Stackpole Electronics Inc	CSR1206FK10L0 Series= ?	Res= 10.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	\$0.11	 1206 11 mm ²
Rt	Vishay-Dale	CRCW040240K2FKED Series= CRCW..e3	Res= 40.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
U1	Texas Instruments	LM25085AMY/NOPB	Switcher	1	\$0.87	 MUY08A 24 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	889.622 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	4.518 mW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	163.198 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	3.995 mW	Capacitor	Output capacitor power dissipation
5.	D1 Tj	78.071 degC	Diode	D1 junction temperature
6.	Diode Pd	801.18 mW	Diode	Diode power dissipation
7.	IC Pd	235.83 mW	IC	IC power dissipation
8.	IC Tj	40.848 degC	IC	IC junction temperature
9.	IC Tolerance	18.0 mV	IC	IC Feedback Tolerance
10.	ICThetaJA	46.0 degC/W	IC	IC junction-to-ambient thermal resistance
11.	Iin Avg	572.95 mA	IC	Average input current

#	Name	Value	Category	Description
12.	L Ipp	565.33 mA	Inductor	Peak-to-peak inductor ripple current
13.	L Pd	190.0 mW	Inductor	Inductor power dissipation
14.	M1 Pd	183.58 mW	Mosfet	M1 MOSFET total power dissipation
15.	M1 PdCond	124.45 mW	Mosfet	M1 MOSFET conduction losses
16.	M1 PdSw	59.128 mW	Mosfet	M1 MOSFET switching losses
17.	M1 Tj	44.373 degC	Mosfet	M1 MOSFET junction temperature
18.	Cin Pd	4.518 mW	Power	Input capacitor power dissipation
19.	Cout Pd	3.995 mW	Power	Output capacitor power dissipation
20.	Diode Pd	801.18 mW	Power	Diode power dissipation
21.	IC Pd	235.83 mW	Power	IC power dissipation
22.	L Pd	190.0 mW	Power	Inductor power dissipation
23.	M1 Pd	183.58 mW	Power	M1 MOSFET total power dissipation
24.	M1 PdCond	124.45 mW	Power	M1 MOSFET conduction losses
25.	M1 PdSw	59.128 mW	Power	M1 MOSFET switching losses
26.	Total Pd	1.459 W	Power	Total Power Dissipation
27.	BOM Count	15	System	Total Design BOM count
			Information	
28.	Duty Cycle	27.165 %	System	Duty cycle
			Information	
29.	Efficiency	87.267 %	System	Steady state efficiency
			Information	
30.	FootPrint	219.0 mm ²	System	Total Foot Print Area of BOM components
			Information	
31.	Frequency	585.631 kHz	System	Switching frequency
			Information	
32.	Iout	2.0 A	System	Iout operating point
			Information	
33.	Mode	CCM	System	Conduction Mode
			Information	
34.	Pout	10.0 W	System	Total output power
			Information	
35.	SW Ipk	2.283 A	System	Peak switch current
			Information	
36.	Total BOM	\$2.19	System	Total BOM Cost
			Information	
37.	Vin	20.0 V	System	Vin operating point
			Information	
38.	Vout	5.0 V	System	Operational Output Voltage
			Information	
39.	Vout Actual	4.991 V	System	Vout Actual calculated based on selected voltage divider resistors
			Information	
40.	Vout Tolerance	3.689 %	System	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
			Information	
41.	Vout p-p	84.839 mV	System	Peak-to-peak output ripple voltage
			Information	

Design Inputs

Name	Value	Description
Iout	2.0	Maximum Output Current
VinMax	20.0	Maximum input voltage
VinMin	17.0	Minimum input voltage
VinTyp	18.0	Typical input voltage
Vout	5.0	Output Voltage
base_pn	LM25085A	Base Product Number
source	DC	Input Source Type
Ta	30.0	Ambient temperature

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 17.0V 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.

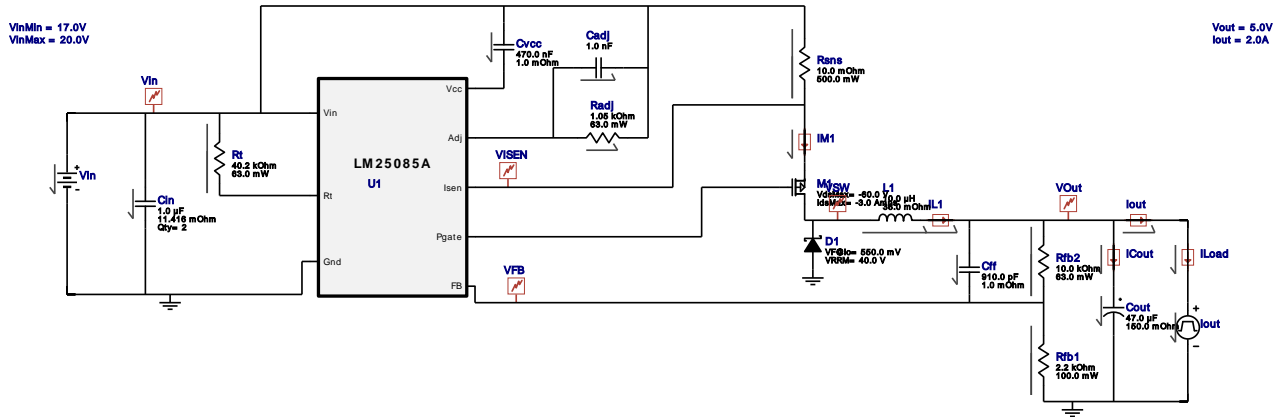


WEBENCH® Electrical Simulation Report

Design Id = 24

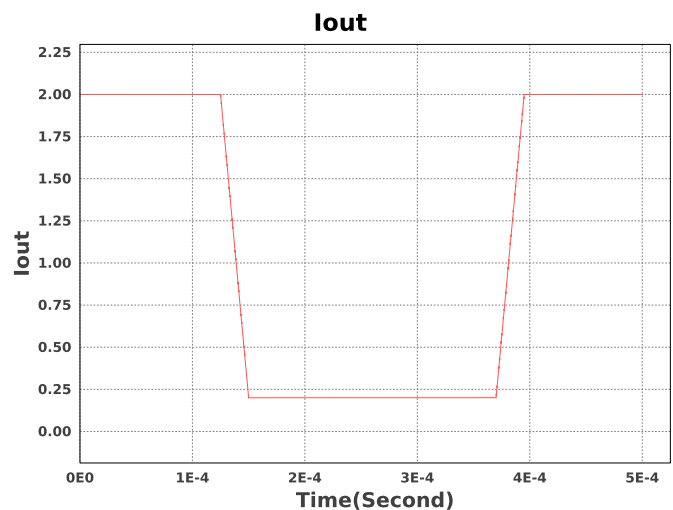
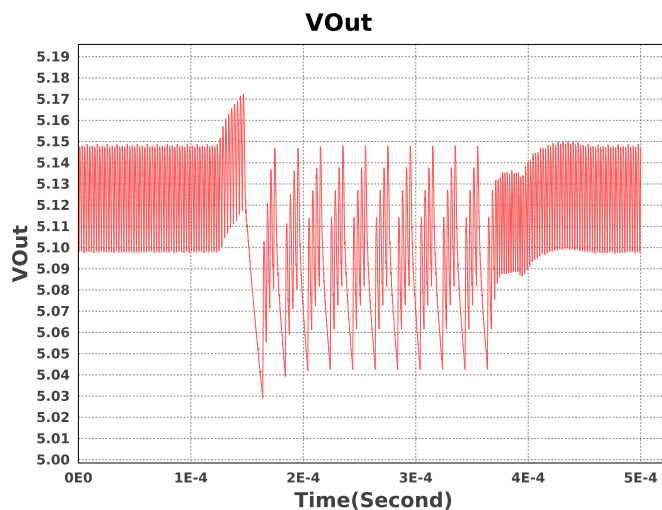
sim_id = 2

Simulation Type = Load Transient



Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	Iout	signal_type	Signal Type	PULSE
		I1	Initial Current	2.0 A
		I2	Peak Current	0.2 A
		Td	Initial Delay Time	125u Sec
		Tr	Rise Time	25u Sec
		Tf	Fall Time	25u Sec
		Pw	Pulse Width	220u Sec



Design Assistance

1. For a Constant On Time device to be stable, we need to provide a ripple at the feedback comparator. There are various methods to implement the ripple. Depending on the circuit complexity vs. the allowable ripple, we have three options to choose from. The simplest option, 'Low Complexity', would require only a high ESR cap at the output. This means that the BOM count will be small, but the output voltage ripple will be quite large. The 'optimal solution' would require a feed-forward cap in parallel with the upper feedback resistor to AC couple the ripple to the feedback node. This increases the BOM count slightly, but now we have more control over the output voltage ripple. If the output voltage requirement is very tight, then the best option is to go for the 'Low Output Ripple' solution. In this option we can go with very low ESR output caps and have very good control over the output voltage ripple

2. Master key : B9BB535380F6DCECC9D62E6CF388EC6F[v1]

3. **LM25085A** Product Folder : <http://www.ti.com/product/LM25085A> : contains the data sheet and other resources.

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