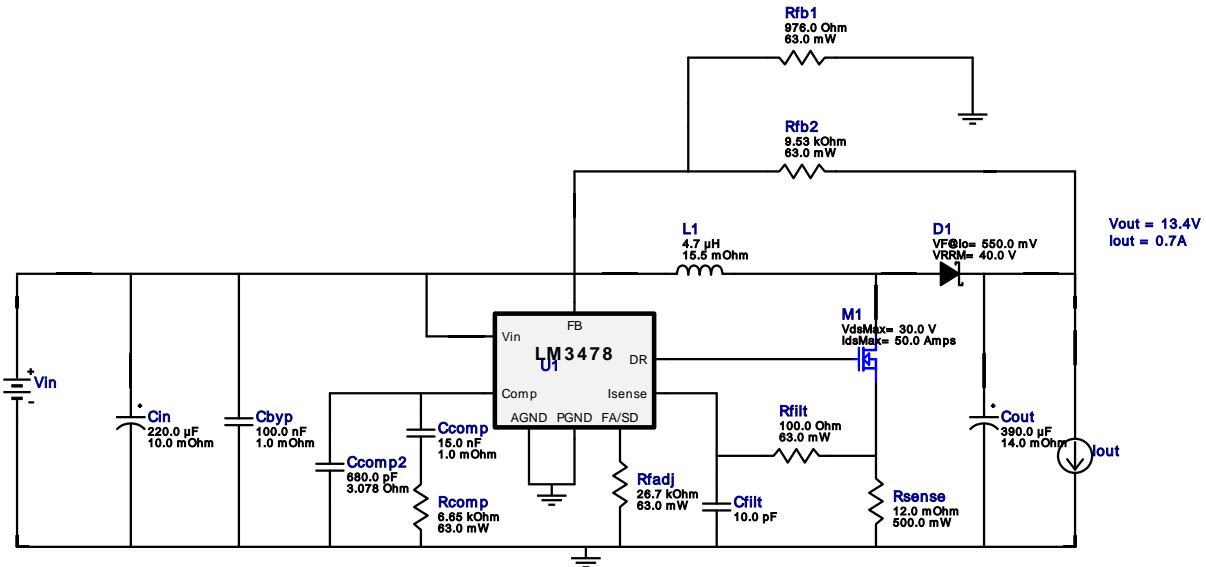


VinMin = 3.0V
VinMax = 4.2V
Vout = 13.4V
Iout = 0.7A

Device = LM3478MM/NOPB
Topology = Boost
Created = 2022-12-23 13:14:08.065
BOM Cost = \$3.55
BOM Count = 16
Total Pd = 1.43W

WEBENCH[®] Design Report

Design : 51 LM3478MM/NOPB
LM3478MM/NOPB 3V-4.2V to 13.40V @ 0.7A

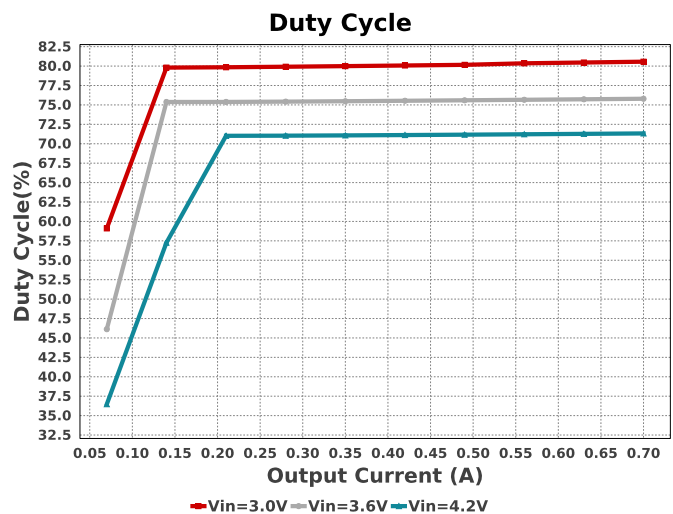
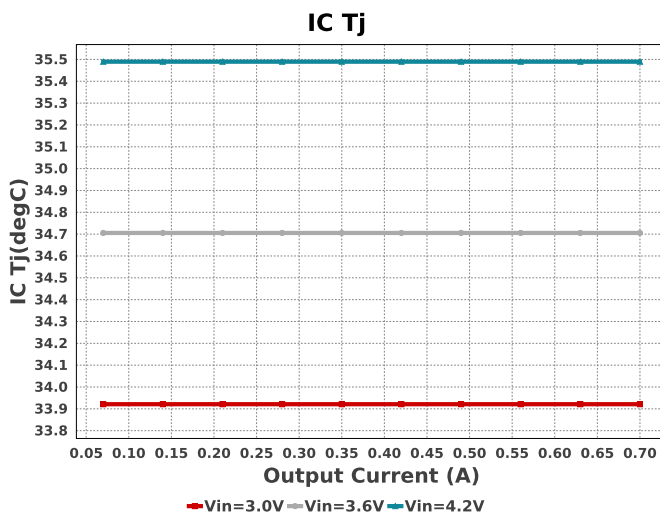


1. With the low turn of voltage of the LM34x8 your power supply may current limit before you reach your working input voltage. If this happens, or to preempt this from happening, you can include a low pass RC filter from input voltage to Vin on the IC. Make sure the rise time on the RC network is slower than your supply's rise time.

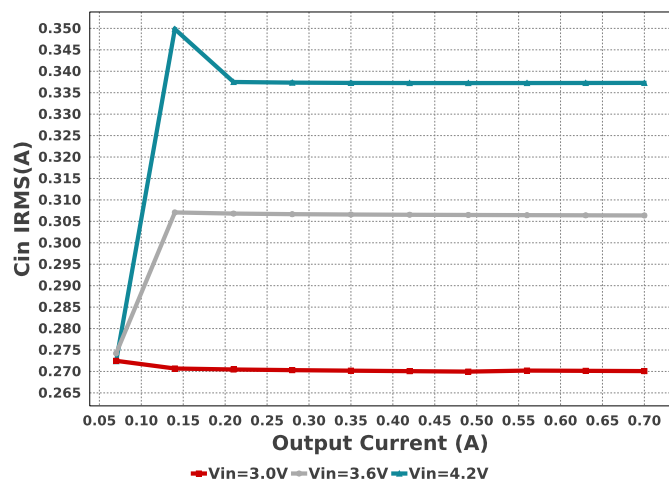
Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cbyp	MuRata	GRM155R70J104KA01D Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 6.3 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
Ccomp	MuRata	GRM155R71C153KA01D Series= X7R	Cap= 15.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
Ccomp2	TDK	CGA2B2X7R1H681K050BA Series= X7R	Cap= 680.0 pF ESR= 3.0778 Ohm VDC= 50.0 V IRMS= 257.63 mA	1	\$0.01	0402 3 mm ²
Cfilt	Yageo	CC0805JRNPO9BN100 Series= C0G/NP0	Cap= 10.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
Cin	Chemi-Con	APXF6R3ARA221MF61G Series= PXF	Cap= 220.0 uF ESR= 10.0 mOhm VDC= 6.3 V IRMS= 3.9 A	1	\$0.26	CAPSMT_62_F61 74 mm ²
Cout	Panasonic	20SVPF390M Series= SVPF	Cap= 390.0 uF ESR= 14.0 mOhm VDC= 20.0 V IRMS= 4.95 A	1	\$1.11	CAPSMT_62_E12 106 mm ²
D1	Fairchild Semiconductor	SS24FL	VF@Io= 550.0 mV VRRM= 40.0 V	1	\$0.09	SOD-123F 12 mm ²

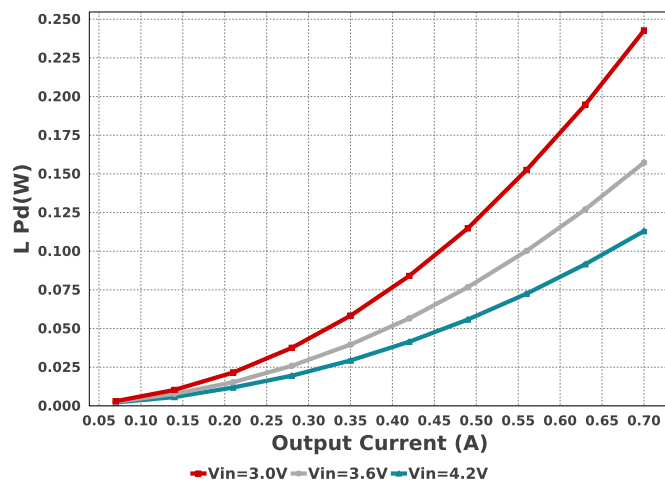
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
L1	Bourns	SRR1280-4R7Y	L= 4.7 μ H 15.5 mOhm	1	\$0.60	 SRR1280 210 mm ²
M1	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 50.0 Amps	1	\$0.24	 DQG0008A 18 mm ²
Rcomp	Vishay-Dale	CRCW04026K65FKED Series= CRCW..e3	Res= 6.65 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
Rfadj	Vishay-Dale	CRCW040226K7FKED Series= CRCW..e3	Res= 26.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
Rfb1	Vishay-Dale	CRCW0402976RFKED Series= CRCW..e3	Res= 976.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
Rfb2	Vishay-Dale	CRCW04029K53FKED Series= CRCW..e3	Res= 9.53 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
Rfilt	Vishay-Dale	CRCW0402100RFKED Series= CRCW..e3	Res= 100.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
Rsense	Stackpole Electronics Inc	CSR1206FK12L0 Series= ?	Res= 12.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	\$0.11	 1206 11 mm ²
U1	Texas Instruments	LM3478MM/NOPB	Switcher	1	\$1.05	 MUA08A 24 mm ²



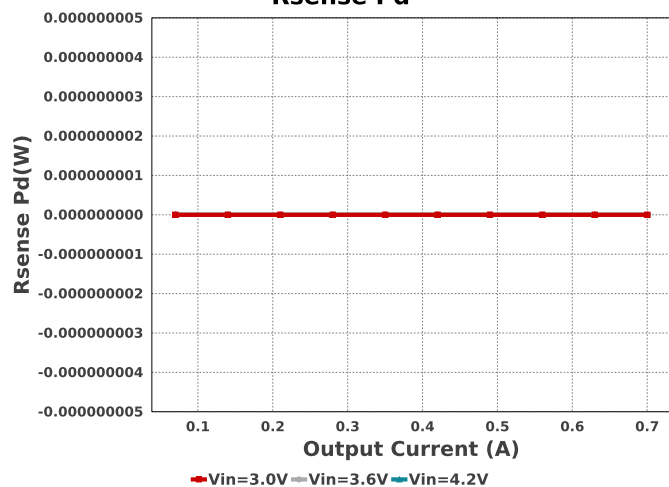
Cin IRMS



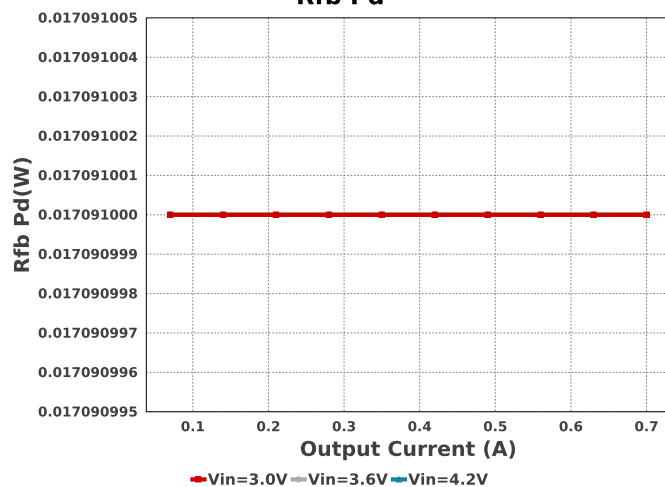
L Pd



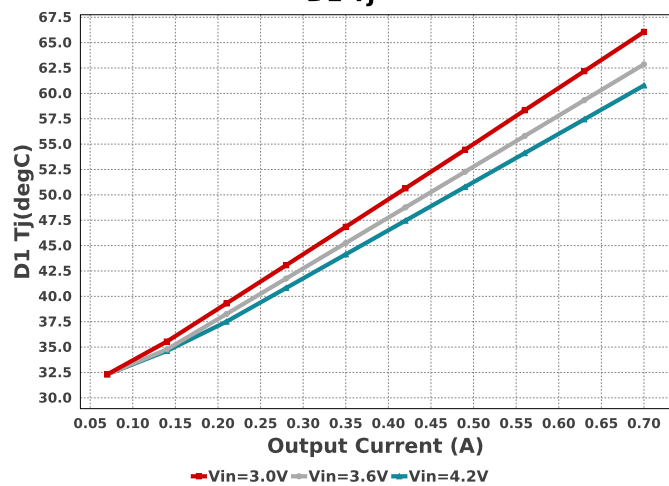
Rsense Pd



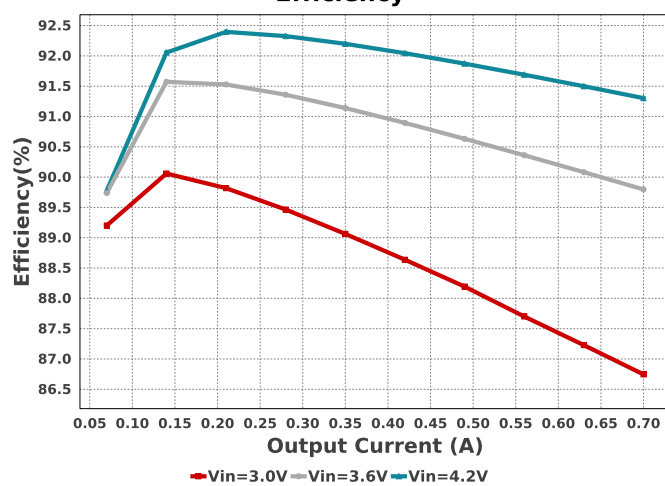
Rfb Pd

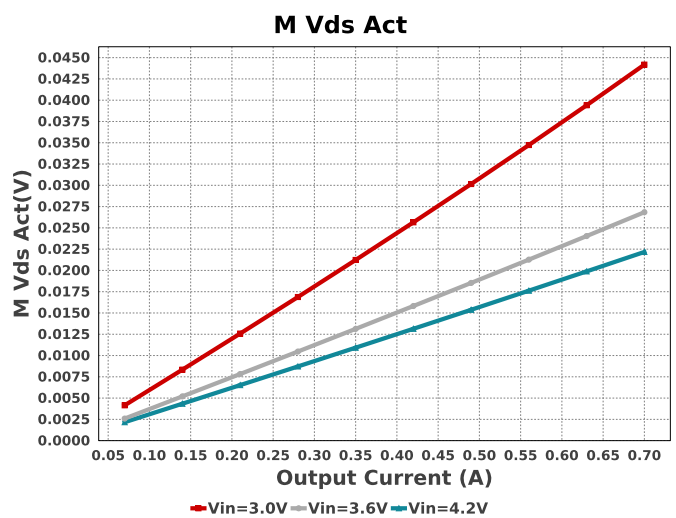
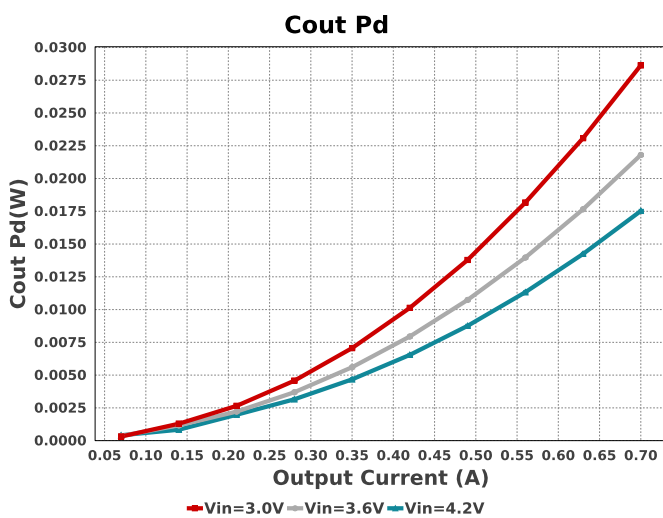
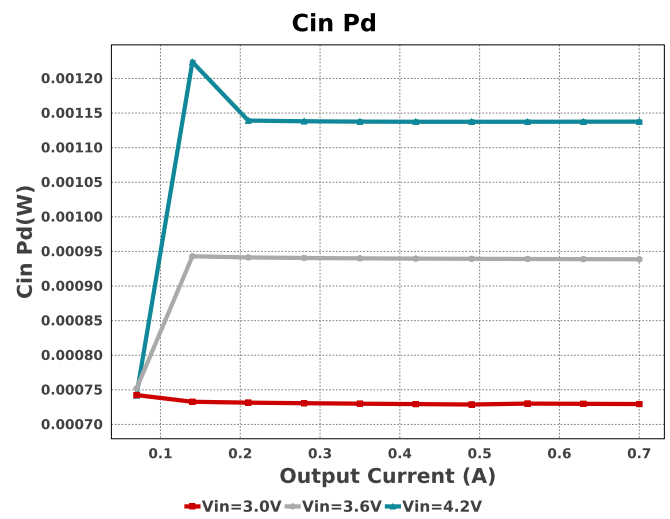
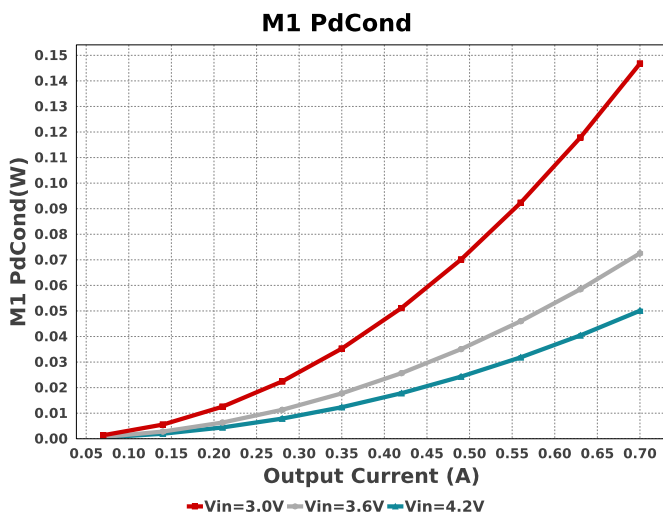
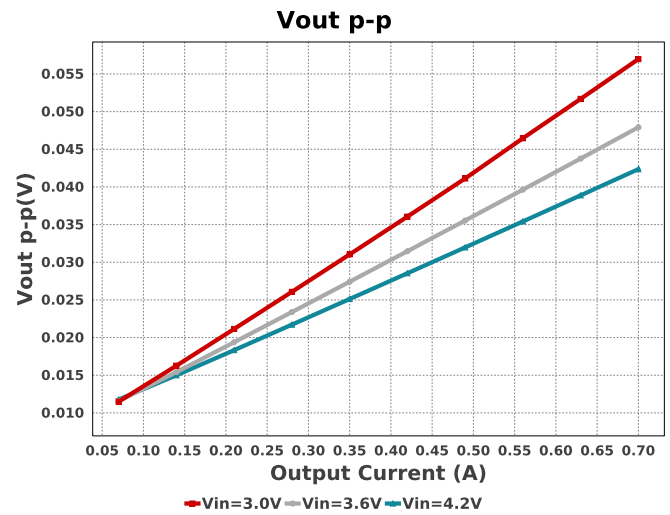
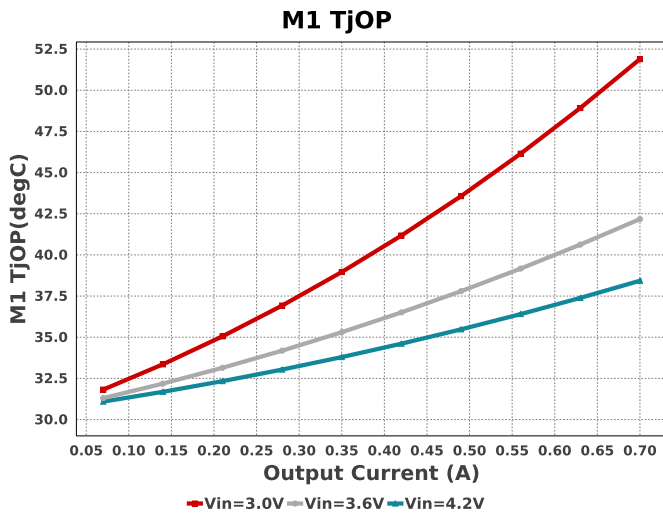


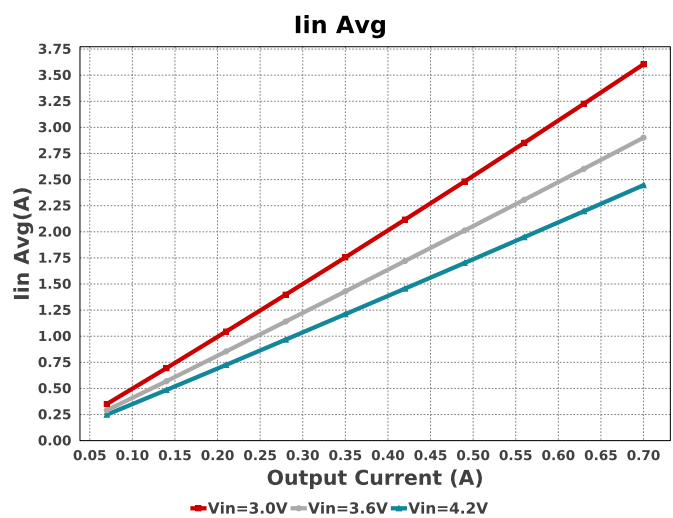
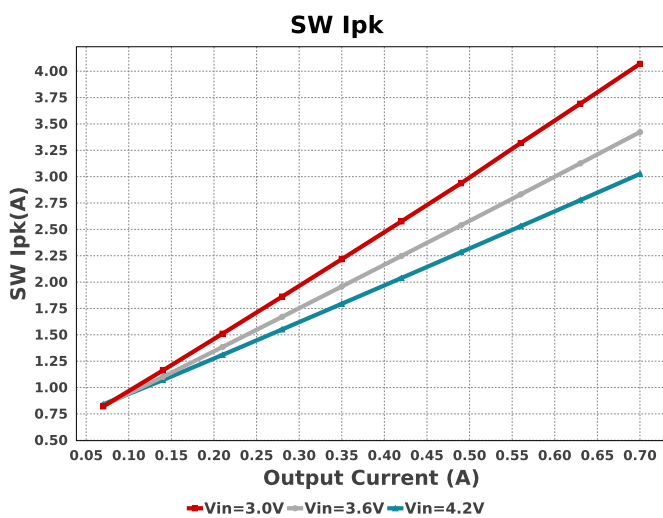
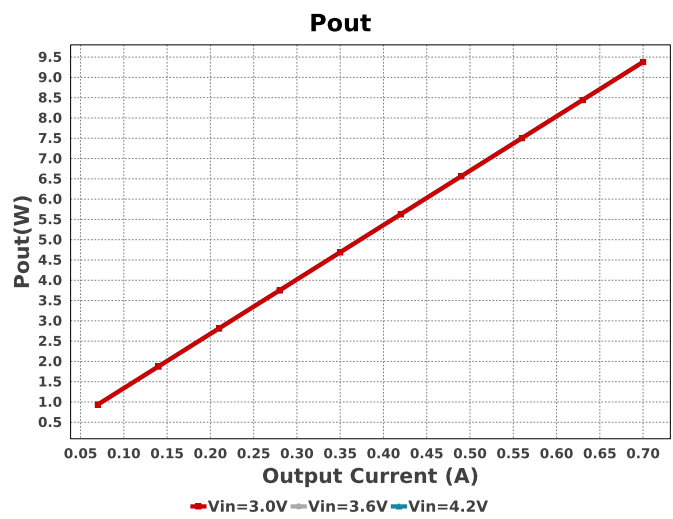
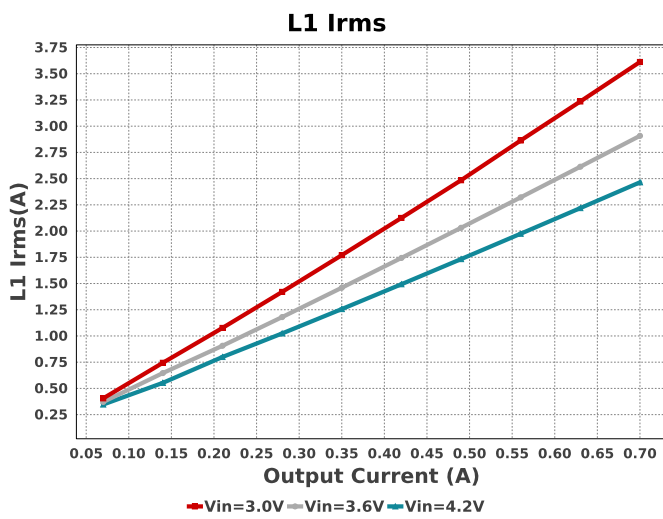
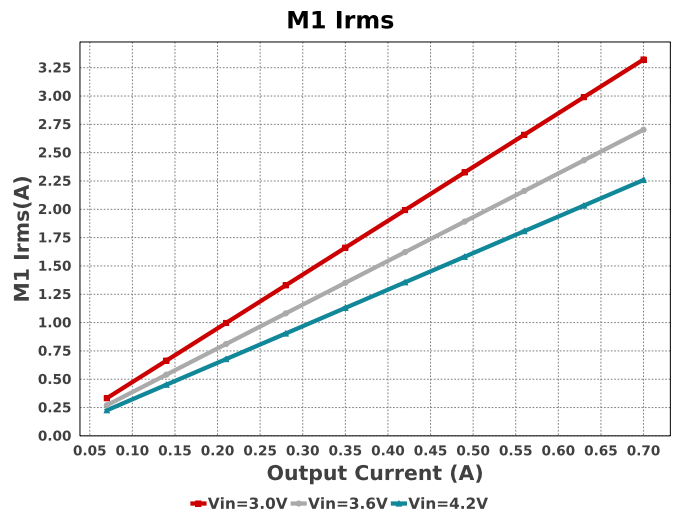
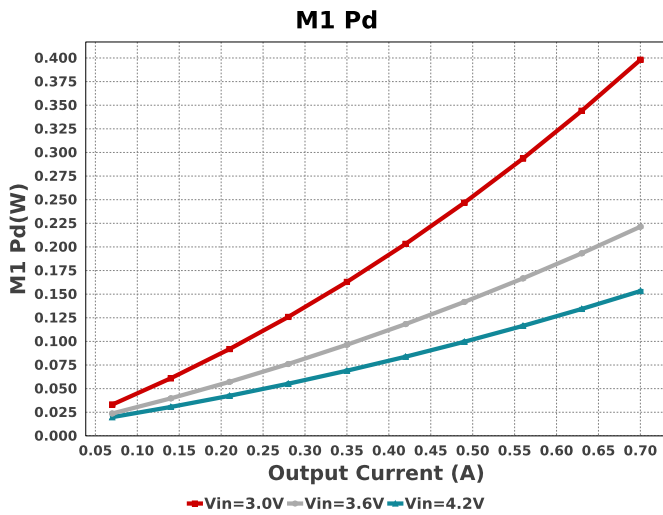
D1 Tj

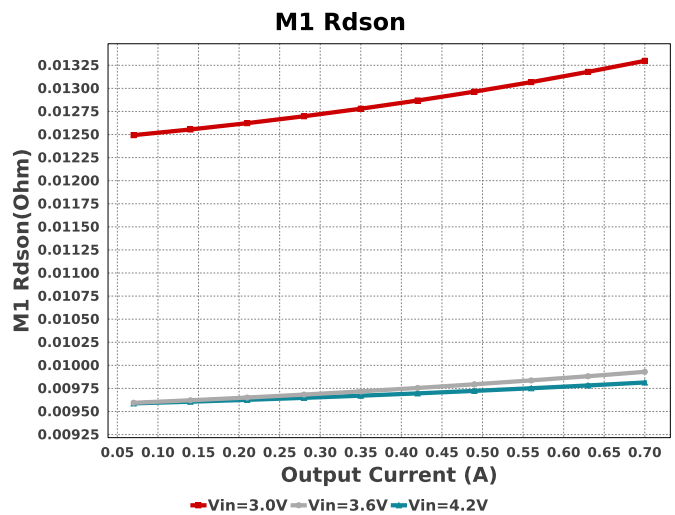
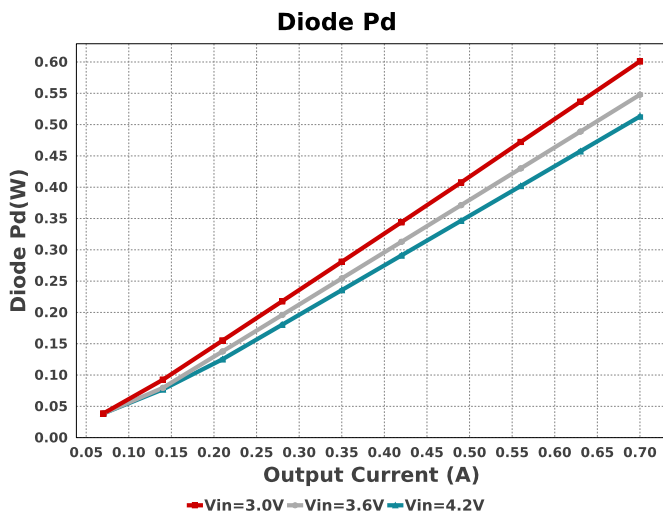
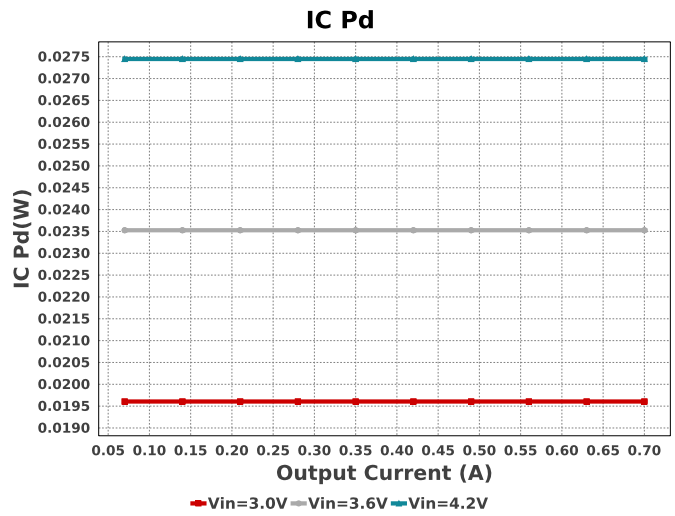
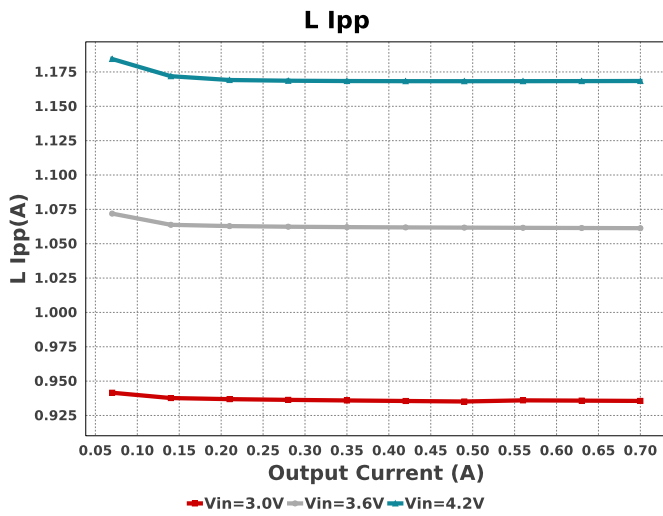
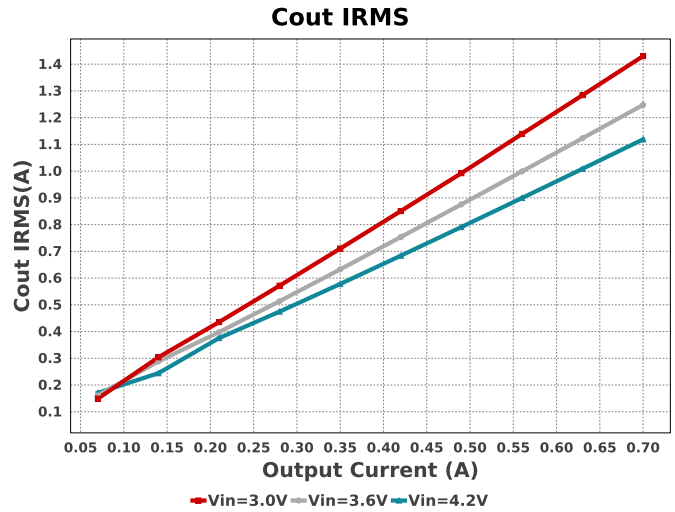
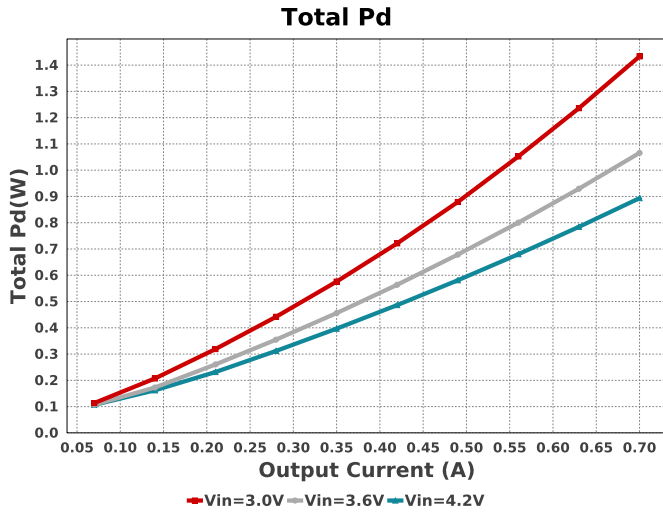


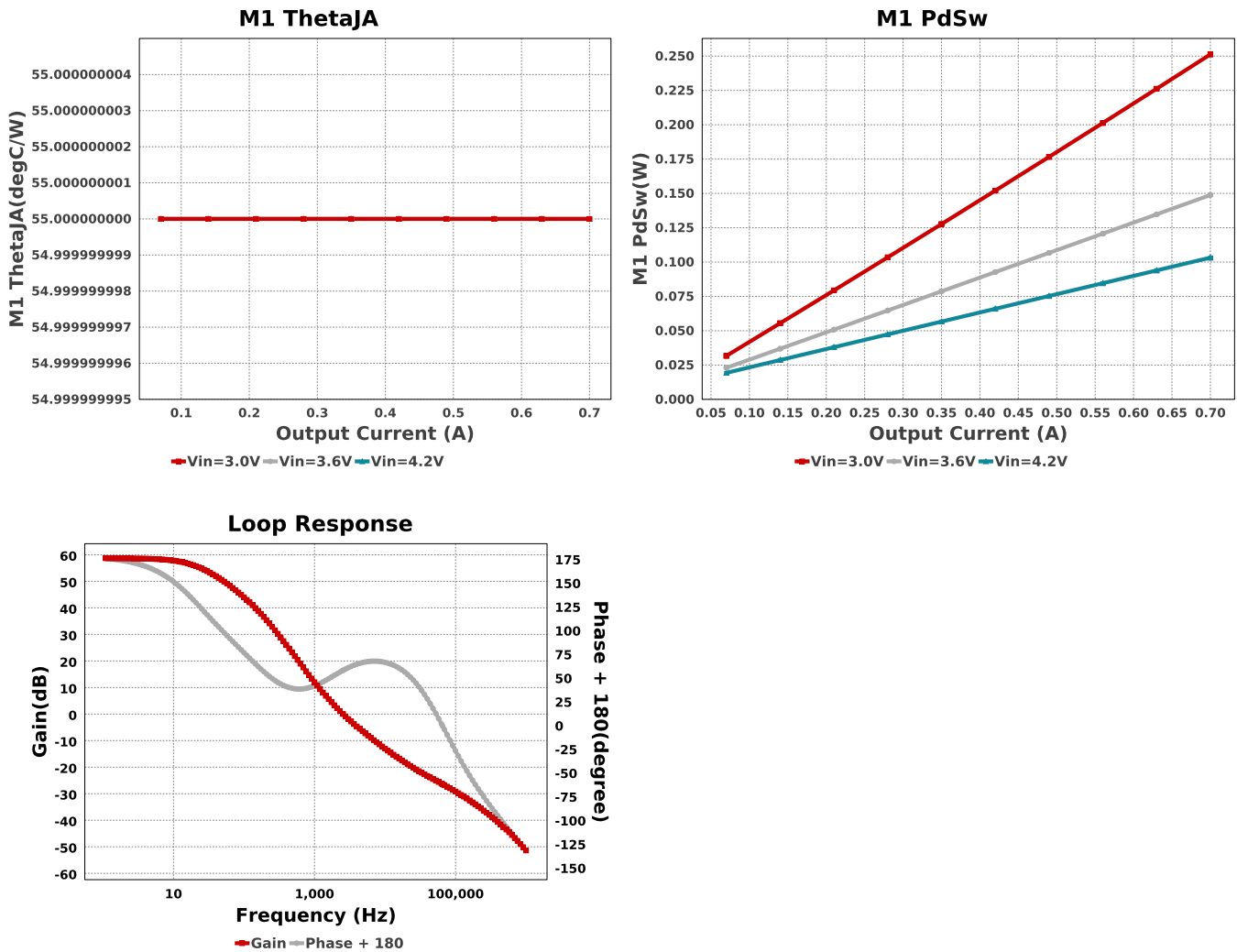
Efficiency











Operating Values

#	Name	Value	Category	Description
1.	BOM Count	16		Total Design BOM count
2.	Total BOM	\$3.551		Total BOM Cost
3.	Cin IRMS	270.081 mA	Capacitor	Input capacitor RMS ripple current
4.	Cin Pd	729.44 μ W	Capacitor	Input capacitor power dissipation
5.	Cout IRMS	1.43 A	Capacitor	Output capacitor RMS ripple current
6.	Cout Pd	28.637 mW	Capacitor	Output capacitor power dissipation
7.	D1 Tj	66.061 degC	Diode	D1 junction temperature
8.	Diode Pd	601.02 mW	Diode	Diode power dissipation
9.	IC Pd	19.606 mW	IC	IC power dissipation
10.	IC Tj	33.921 degC	IC	IC junction temperature
11.	IC Tolerance	24.3 mV	IC	IC Feedback Tolerance
12.	ICThetaJA	200.0 degC/W	IC	IC junction-to-ambient thermal resistance
13.	Iin Avg	3.604 A	IC	Average input current
14.	L Ipp	935.588 mA	Inductor	Peak-to-peak inductor ripple current
15.	L Pd	242.66 mW	Inductor	Inductor power dissipation
16.	L1 Irms	3.612 A	Inductor	Inductor ripple current
17.	M Vds Act	44.18 mV	Mosfet	M Vds
18.	M1 Irms	3.322 A	Mosfet	M1 MOSFET Irms
19.	M1 Pd	398.03 mW	Mosfet	M1 MOSFET total power dissipation
20.	M1 PdCond	146.78 mW	Mosfet	M1 MOSFET conduction losses
21.	M1 PdSw	251.25 mW	Mosfet	M1 MOSFET switching losses
22.	M1 Rdson	13.298 mOhm	Mosfet	Drain-Source On-resistance
23.	M1 ThetaJA	55.0 degC/W	Mosfet	MOSFET junction-to-ambient thermal resistance
24.	M1 TjOP	51.892 degC	Mosfet	M1 MOSFET junction temperature
25.	Cin Pd	729.44 μ W	Power	Input capacitor power dissipation
26.	Cout Pd	28.637 mW	Power	Output capacitor power dissipation
27.	Diode Pd	601.02 mW	Power	Diode power dissipation
28.	IC Pd	19.606 mW	Power	IC power dissipation
29.	L Pd	242.66 mW	Power	Inductor power dissipation
30.	M1 Pd	398.03 mW	Power	M1 MOSFET total power dissipation
31.	M1 PdCond	146.78 mW	Power	M1 MOSFET conduction losses
32.	M1 PdSw	251.25 mW	Power	M1 MOSFET switching losses

#	Name	Value	Category	Description
33.	Rfb Pd	17.091 mW	Power	Rfb Power Dissipation
34.	Rsense Pd	0.0 W	Power	LED Current Rsns Power Dissipation
35.	Total Pd	1.433 W	Power	Total Power Dissipation
36.	Rfb Pd	17.091 mW	Resistor	Rfb Power Dissipation
37.	Rsense Pd	0.0 W	Resistor	LED Current Rsns Power Dissipation
38.	Cross Freq	1.902 kHz	System	Bode plot crossover frequency
39.	Duty Cycle	80.566 %	Information	
			System	Duty cycle
40.	Efficiency	86.746 %	Information	
			System	Steady state efficiency
41.	FootPrint	486.0 mm ²	Information	
			System	Total Foot Print Area of BOM components
42.	Frequency	541.734 kHz	Information	
			System	Switching frequency
43.	Gain Marg	-23.314 dB	Information	
			System	Bode Plot Gain Margin
44.	Iout	700.0 mA	Information	
			System	Iout operating point
45.	Low Freq Gain	55.302 dB	Information	
			System	Gain at 1Hz
46.	Mode	CCM	Information	
			System	Conduction Mode
47.	Phase Marg	51.26 deg	Information	
			System	Bode Plot Phase Margin
48.	Pout	9.38 W	Information	
			System	Total output power
49.	SW Ipk	4.07 A	Information	
			System	Peak switch current
50.	Vin	3.0 V	Information	
			System	Vin operating point
51.	Vout	13.4 V	Information	
			System	Operational Output Voltage
52.	Vout Actual	13.563 V	Information	
			System	Vout Actual calculated based on selected voltage divider resistors
53.	Vout Tolerance	3.796 %	Information	
			System	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
54.	Vout p-p	56.975 mV	Information	
			System	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	700.0 m	Maximum Output Current
VinMax	4.2	Maximum input voltage
VinMin	3.0	Minimum input voltage
Vout	13.4	Output Voltage
base_pn	LM3478	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

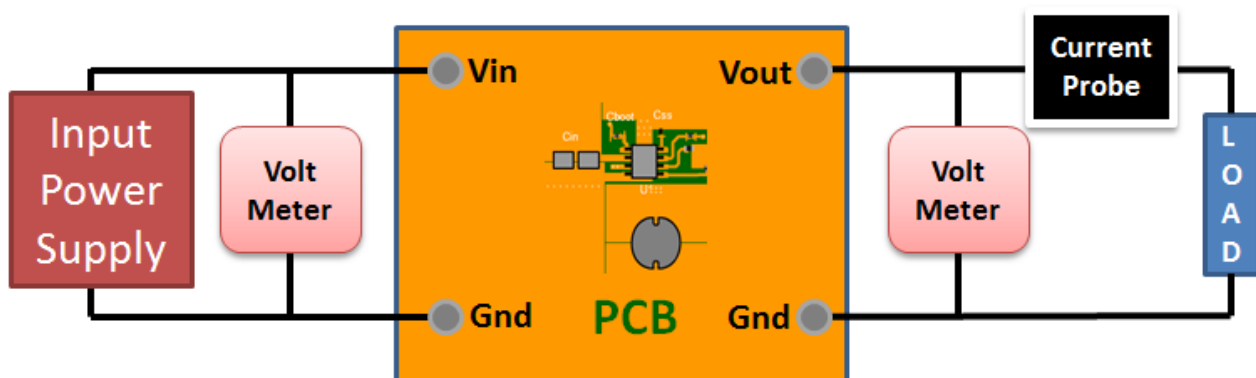
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 3.0V 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. Master key : 1955E47119554D04[v1]
2. **LM3478** Product Folder : <http://www.ti.com/product/LM3478> : contains the data sheet and other resources.

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