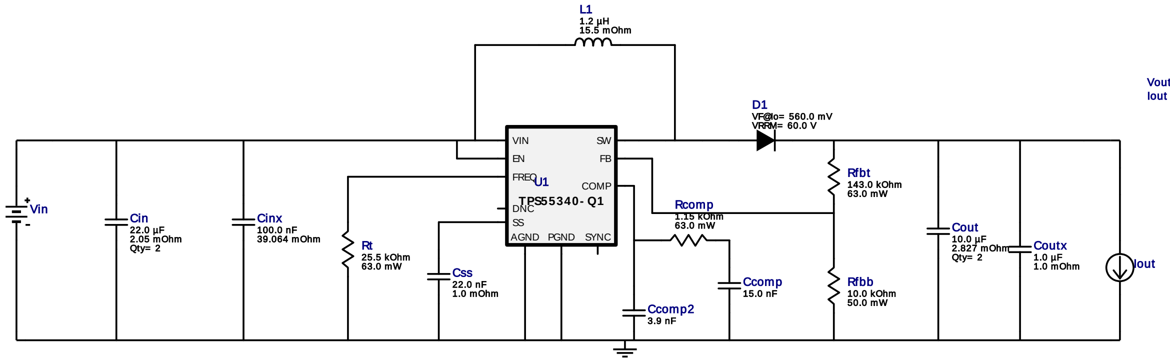
VinMin = 14.8V
VinMax = 16.8V
Vout = 19.0V
Iout = 3.0A

Device = TPS55340QRTERQ1
Topology = Boost
Created = 2020-04-29 08:35:07.948
BOM Cost = $4.90
BOM Count = 16
Total Pd = 2.51W

WEBENCH ® Design Report

Design : 2 TPS55340QRTERQ1
TPS55340QRTERQ1 14.8V-16.8V to 19.00V @ 3A



1. For frequency > 1.6 MHz, the user is required to make sure load current is always greater than "Iout Min" value shown in the Op Vals.

Design Alerts

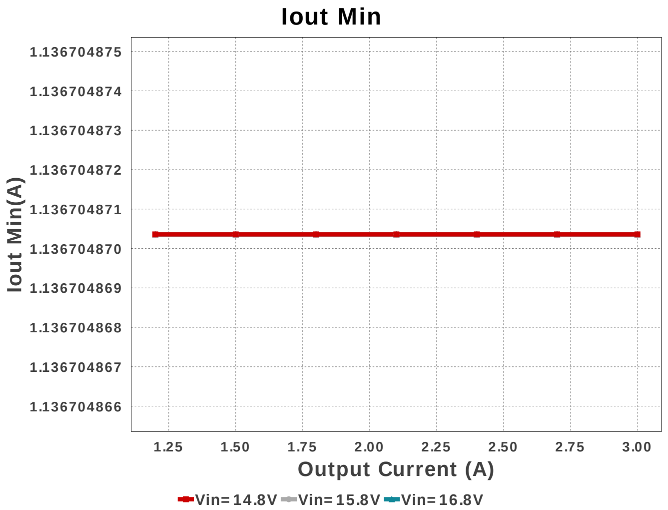
Component Selection Information

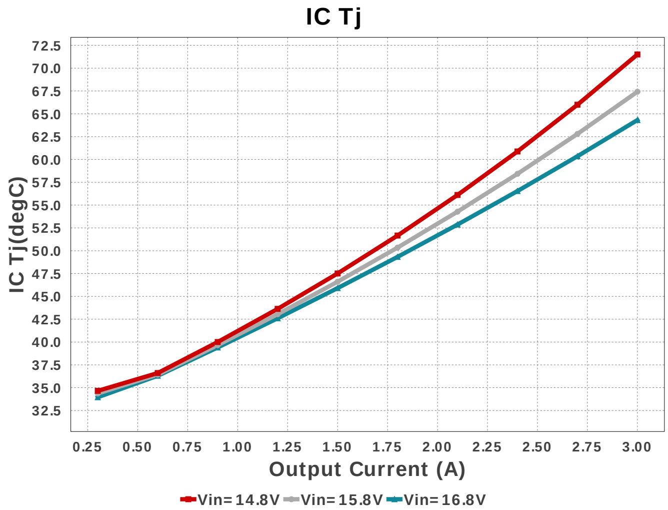
The TPS55340-Q1 is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application.

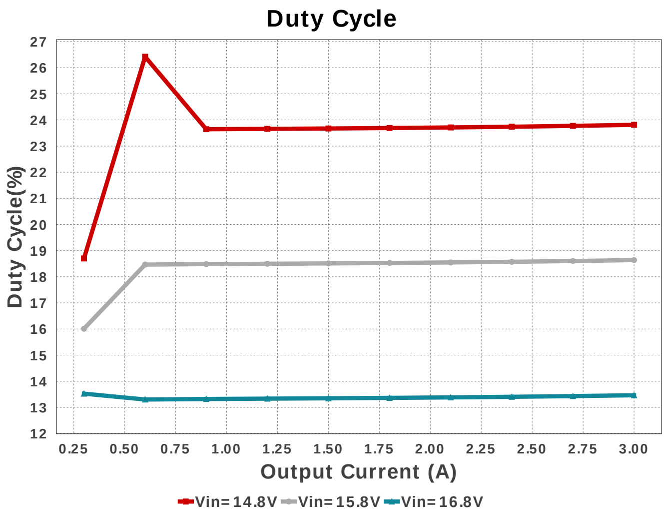
Electrical BOM

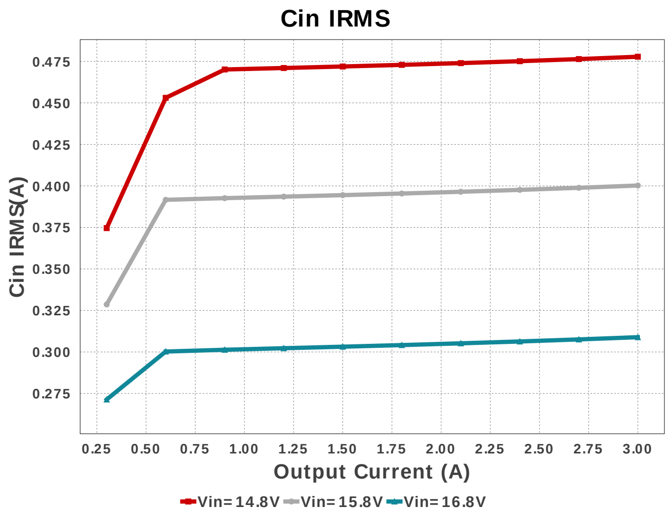
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Ccomp	Kemet	C0603C153J3GACTU Series= C0G/NP0	Cap= 15.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.10	0603 5 mm²
Ccomp2	TDK	CGJ3E2C0G1H392J080AA Series= C0G/NP0	Cap= 3.9 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.07	0603 5 mm²
Cin	TDK	C2012X5R1V226M125AC Series= X5R	Cap= 22.0 uF ESR= 2.05 mOhm VDC= 35.0 V IRMS= 4.5559 A	2	$0.33	0805 7 mm²
Cinx	TDK	CGA2B3X7R1H104K050BB Series= X7R	Cap= 100.0 nF ESR= 39.064 mOhm VDC= 50.0 V IRMS= 814.67 mA	1	$0.02	0402 3 mm²
Cout	TDK	CGA6P3X7S1H106K250AB Series= X7S	Cap= 10.0 uF ESR= 2.827 mOhm VDC= 50.0 V IRMS= 4.3729 A	2	$0.33	1210_280 15 mm²
Coutx	Taiyo Yuden	GMK212B7105KG-T Series= X7R	Cap= 1.0 uF ESR= 1.0 mOhm VDC= 35.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm²
Css	MuRata	GRM155R71C223KA01D Series= X7R	Cap= 22.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
D1	Diodes Inc.	PDS760-13	VF@Io= 560.0 mV VRRM= 60.0 V	1	$0.63	PowerDI5 50 mm²
L1	Wurth Elektronik	74438357012	L= 1.2 µH 15.5 mOhm	1	$1.14	WE-MAPI_4030 26 mm²

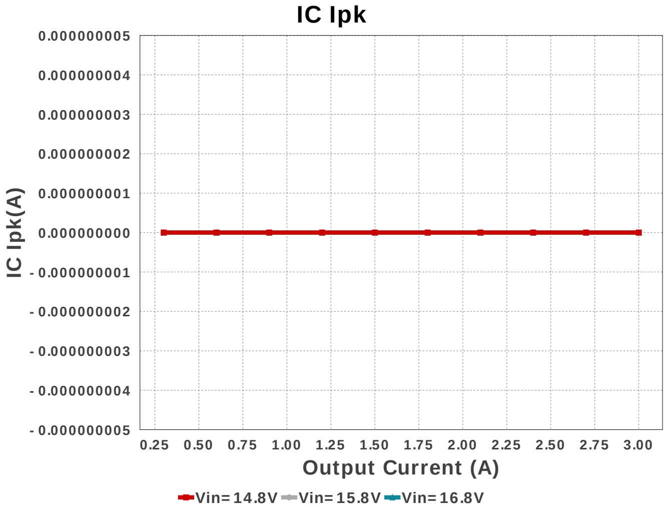
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Rcomp	Vishay-Dale	CRCW04021K15FKED Series= CRCW..e3	Res= 1.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rfbb	Yageo	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
Rfbt	Vishay-Dale	CRCW0402143KFKED Series= CRCW..e3	Res= 143.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rt	Vishay-Dale	CRCW040225K5FKED Series= CRCW..e3	Res= 25.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
U1	Texas Instruments	TPS55340QRTERQ1	Switcher	1	$1.54	S-PWQFN-N16 17 mm^2

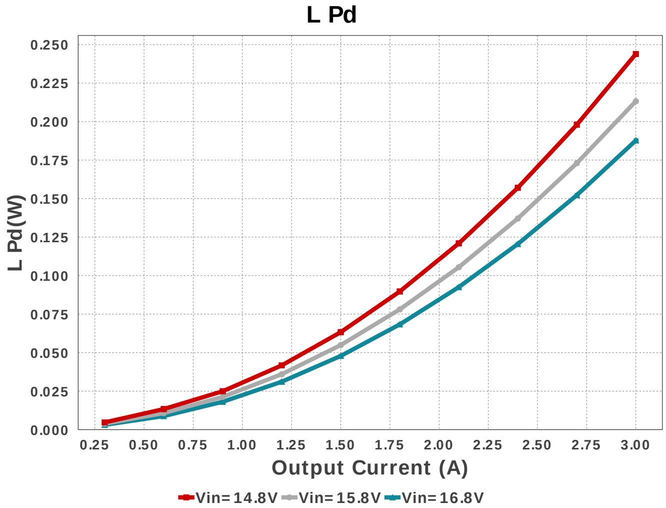


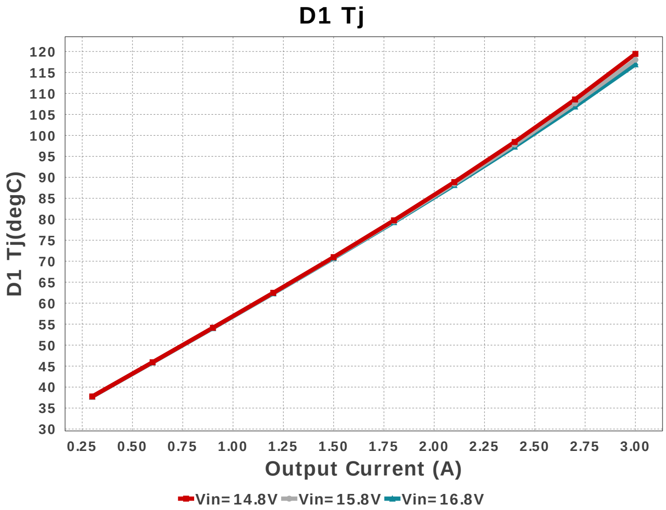


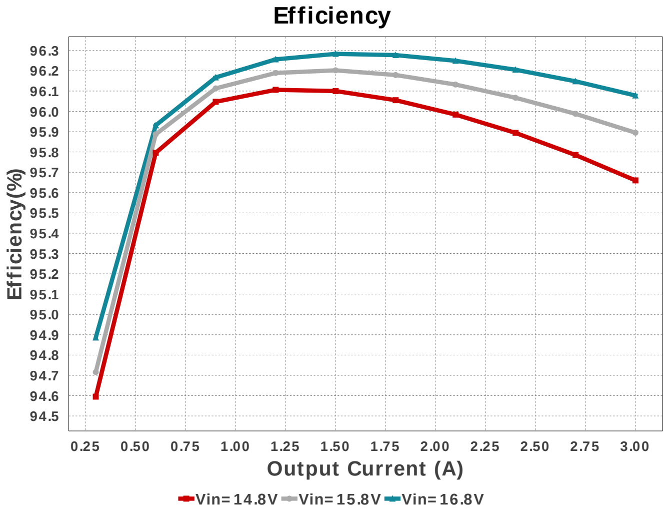


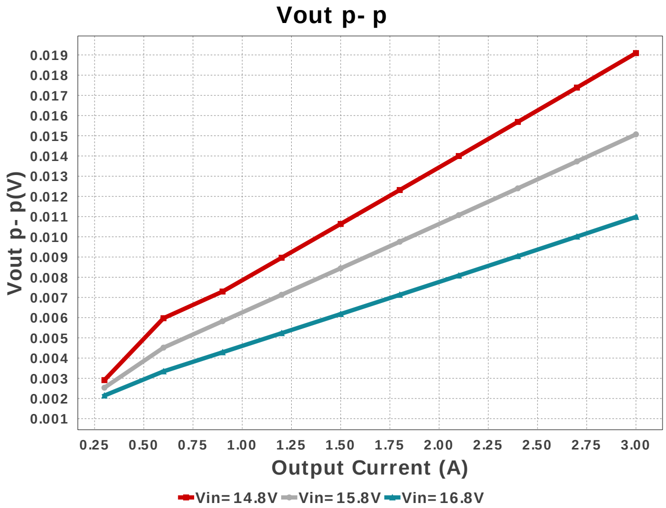


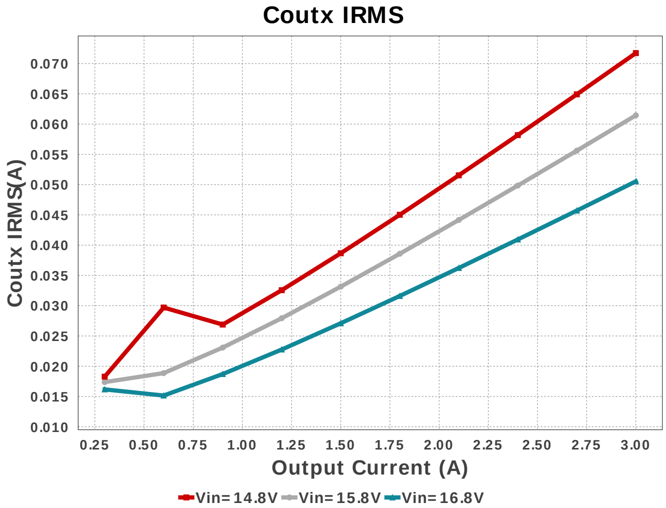

IC Ipk
IC Ipk(A)
Output Current (A)
Vin=14.8V Vin=15.8V Vin=16.8V


L Pd
L Pd(W)
Output Current (A)
Vin=14.8V Vin=15.8V Vin=16.8V

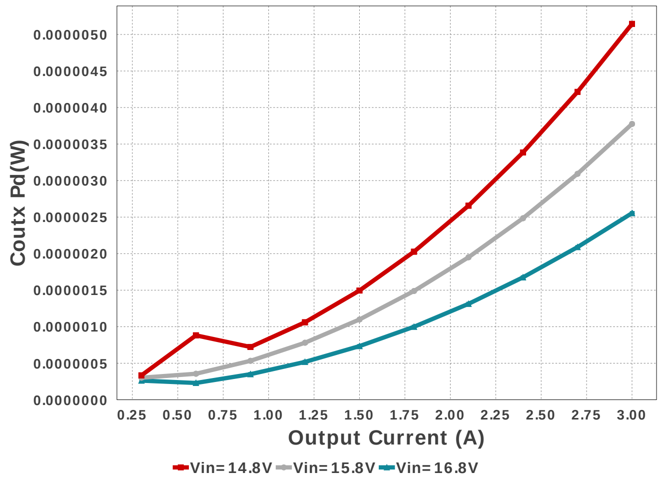

D1 Tj
D1 Tj(degC)
Output Current (A)
Vin=14.8V Vin=15.8V Vin=16.8V


Efficiency
Efficiency(%)
Output Current (A)
Vin=14.8V Vin=15.8V Vin=16.8V

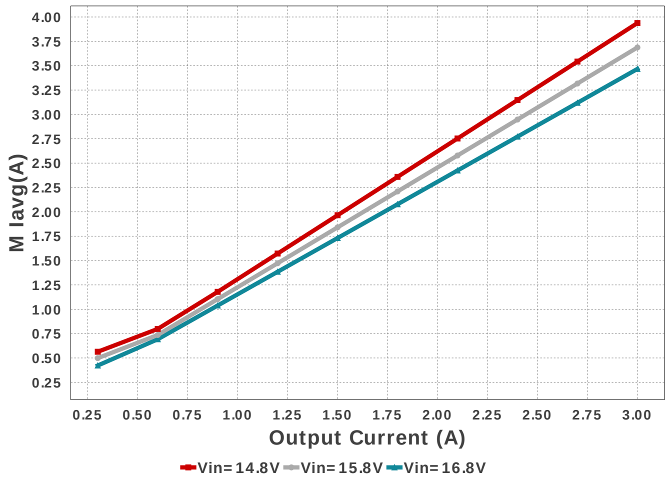

Vout p- p
Vout p- p(V)
Output Current (A)
Vin=14.8V Vin=15.8V Vin=16.8V


Coutx IRMS
Coutx IRMS(A)
Output Current (A)
Vin=14.8V Vin=15.8V Vin=16.8V

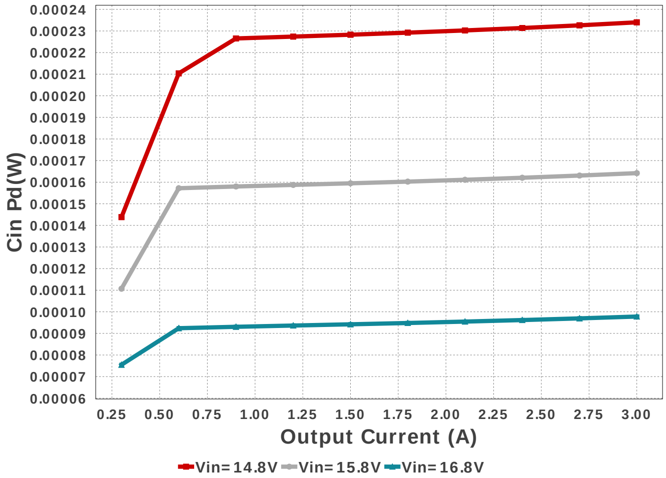
Coutx Pd



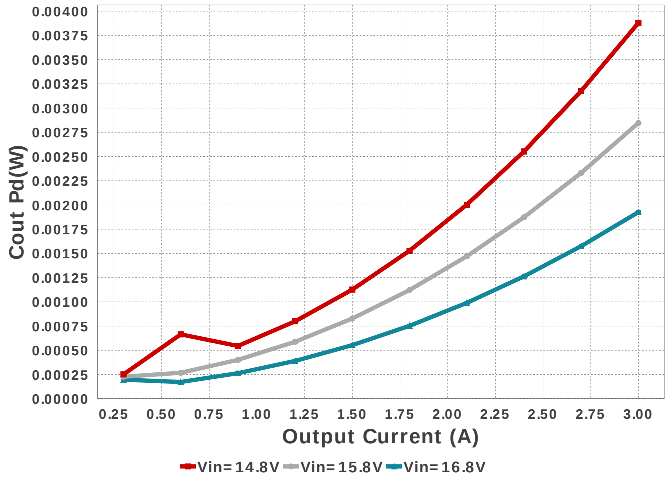
M Iavg



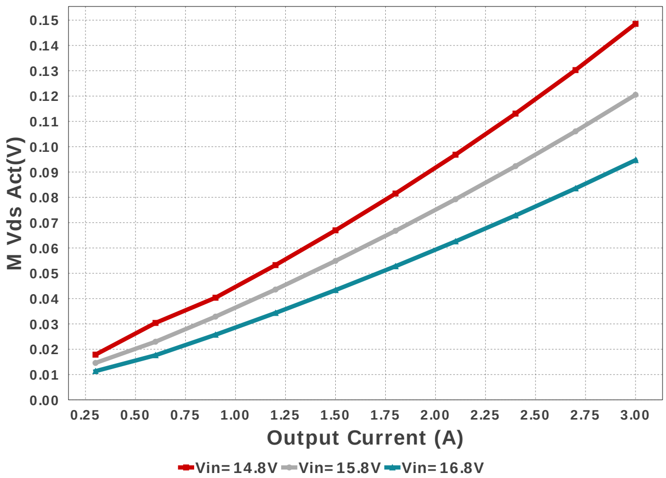
Cin Pd



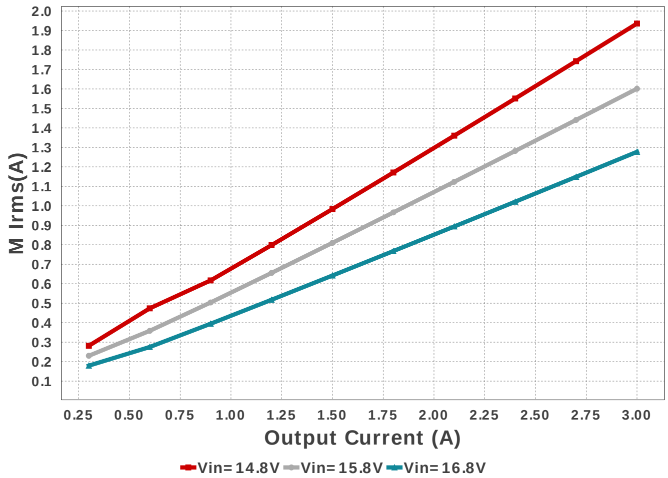
Cout Pd

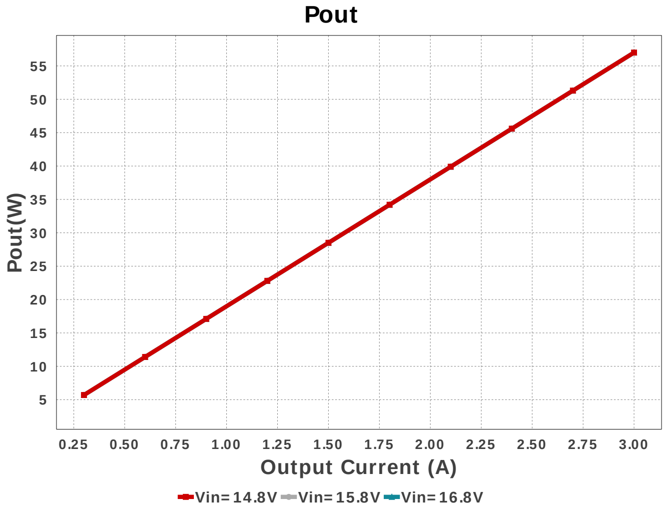


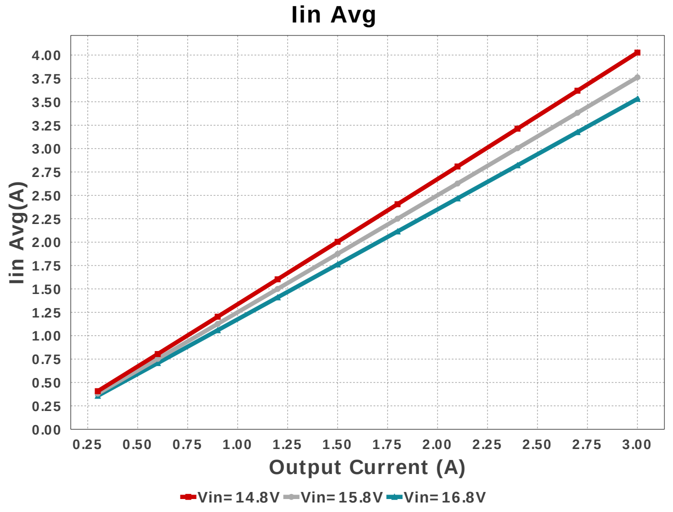
M Vds Act

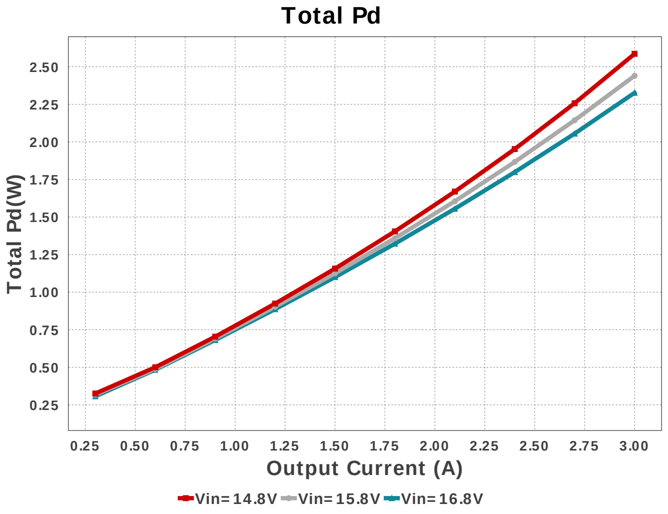


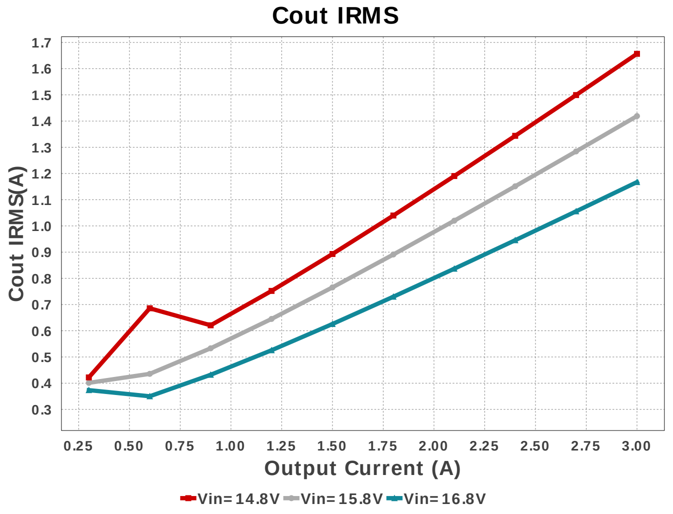
M Irms

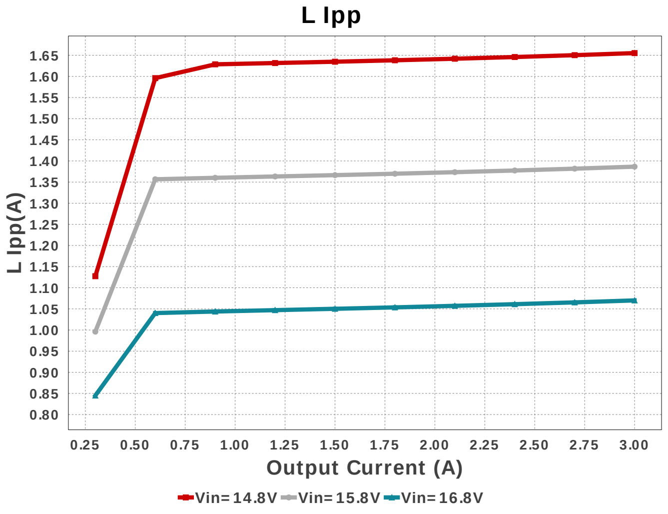


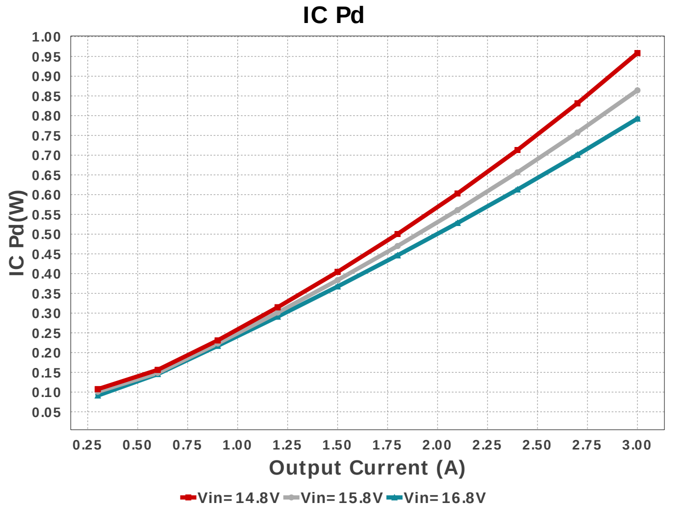

Pout
Pout(W)
Output Current (A)
Vin=14.8V
Vin=15.8V
Vin=16.8V

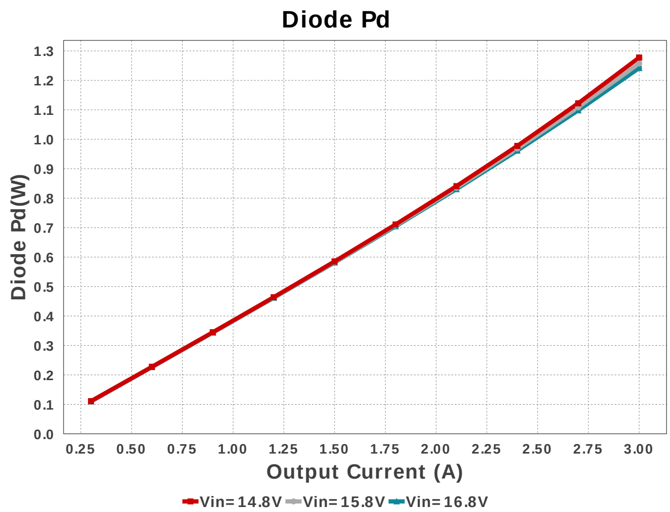

Iin Avg
Iin Avg(A)
Output Current (A)
Vin=14.8V
Vin=15.8V
Vin=16.8V

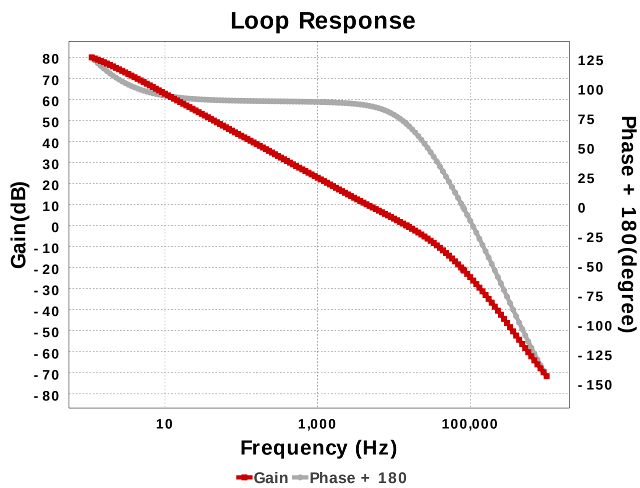

Total Pd
Total Pd(W)
Output Current (A)
Vin=14.8V
Vin=15.8V
Vin=16.8V


Cout IRMS
Cout IRMS(A)
Output Current (A)
Vin=14.8V
Vin=15.8V
Vin=16.8V


L Ipp
L Ipp(A)
Output Current (A)
Vin=14.8V
Vin=15.8V
Vin=16.8V


IC Pd
IC Pd(W)
Output Current (A)
Vin=14.8V
Vin=15.8V
Vin=16.8V





Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	475.823 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	232.07 µW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	1.652 A	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	3.857 mW	Capacitor	Output capacitor power dissipation
5.	Coutx IRMS	71.528 mA	Capacitor	Output capacitor_x RMS ripple current
6.	Coutx Pd	5.116 µW	Capacitor	Output capacitor_x power loss
7.	Iout Min	1.137 A	Current	Minimum output current because Frequency is greater than 1.6 MHz.
8.	D1 Tj	114.09 degC	Diode	D1 junction temperature
9.	Diode Pd	1.201 W	Diode	Diode power dissipation
10.	IC Ipk	0.0 A	IC	Peak switch current in IC
11.	IC Pd	955.46 mW	IC	IC power dissipation
12.	IC Tj	71.371 degC	IC	IC junction temperature
13.	IC Tolerance	9.0 mV	IC	IC Feedback Tolerance
14.	ICThetaJA	43.3 degC/W	IC	IC junction-to-ambient thermal resistance
15.	Iin Avg	4.021 A	IC	Average input current
16.	L Ipp	1.648 A	Inductor	Peak-to-peak inductor ripple current
17.	L Pd	243.21 mW	Inductor	Inductor power dissipation
18.	M Iavg	3.933 A	Mosfet	MOSFET Average current
19.	M Irms	1.929 A	Mosfet	MOSFET RMS ripple current
20.	M Vds Act	147.938 mV	Mosfet	Voltage drop across the MosFET
21.	Cin Pd	232.07 µW	Power	Input capacitor power dissipation
22.	Cout Pd	3.857 mW	Power	Output capacitor power dissipation
23.	Coutx Pd	5.116 µW	Power	Output capacitor_x power loss
24.	Diode Pd	1.201 W	Power	Diode power dissipation
25.	IC Pd	955.46 mW	Power	IC power dissipation
26.	L Pd	243.21 mW	Power	Inductor power dissipation
27.	Total Pd	2.506 W	Power	Total Power Dissipation
28.	BOM Count	16	System Information	Total Design BOM count
29.	Cross Freq	13.567 kHz	System Information	Bode plot crossover frequency
30.	Duty Cycle	23.713 %	System Information	Duty cycle
31.	Efficiency	95.788 %	System Information	Steady state efficiency
32.	FootPrint	169.0 mm^2	System Information	Total Foot Print Area of BOM components
33.	Frequency	1.798 MHz	System Information	Switching frequency
34.	Gain Marg	-21.183 dB	System Information	Bode Plot Gain Margin
35.	Iout	3.0 A	System Information	Iout operating point
36.	Low Freq Gain	80.011 dB	System Information	Gain at 1Hz
37.	Mode	CCM	System Information	Conduction Mode
38.	Phase Marg	68.374 deg	System Information	Bode Plot Phase Margin
39.	Pout	57.0 W	System Information	Total output power

#	Name	Value	Category	Description
40.	Total BOM	$4.9	System Information	Total BOM Cost
41.	Vin	14.8 V	System Information	Vin operating point
42.	Vout	19.0 V	System Information	Operational Output Voltage
43.	Vout Actual	18.804 V	System Information	Vout Actual calculated based on selected voltage divider resistors
44.	Vout Tolerance	2.634 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
45.	Vout p-p	19.011 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	3.0	Maximum Output Current
VinMax	16.8	Maximum input voltage
VinMin	14.8	Minimum input voltage
Vout	19.0	Output Voltage
base_pn	TPS55340-Q1	Base Product Number
source	DC	Input Source Type
Ta	30.0	Ambient temperature

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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 Cin and Cout, 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

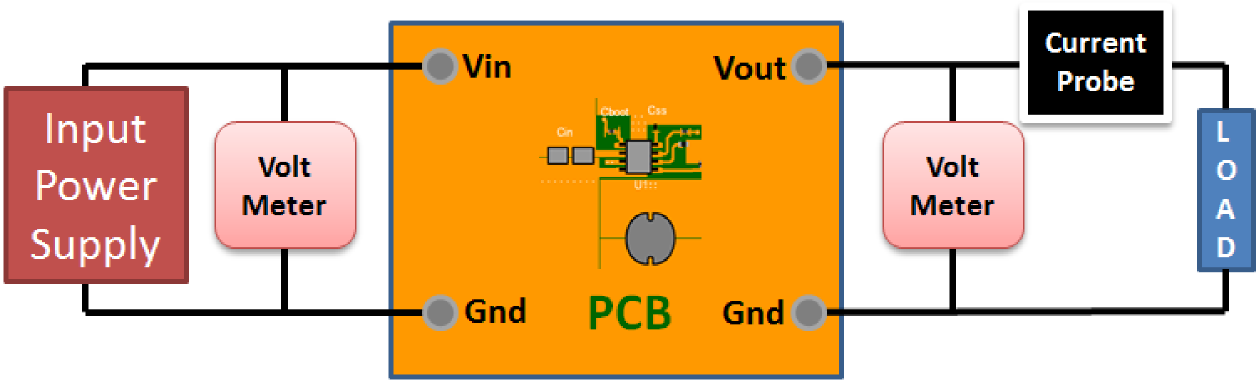
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab town 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 14.8V and set the input supply's current limit to zero. With the input supply off connect up the input supply to Vin and GND. Connect a digital volt meter and a load if needed to set the minimum Iout of the design from Vout 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 Vin and GND, a load is connected between Vout and GND and a current meter is connected in series between Vout 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.

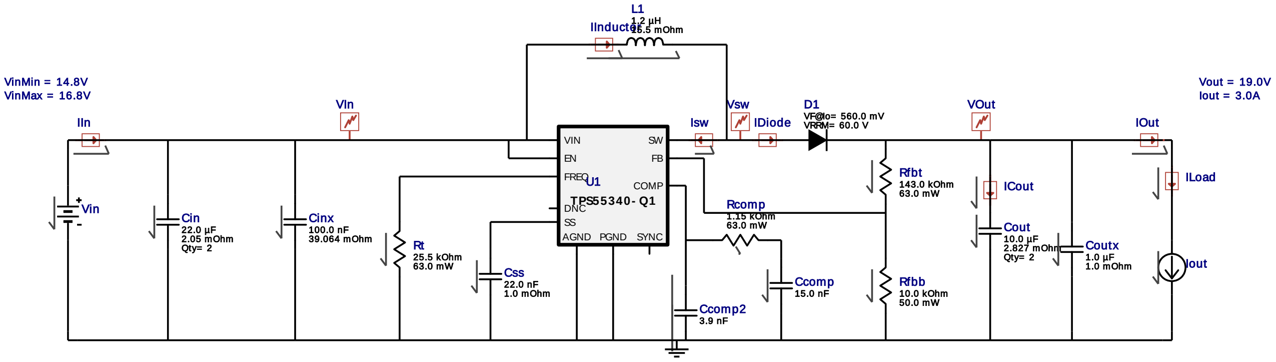


WEBENCH® Electrical Simulation Report

Design Id = 2

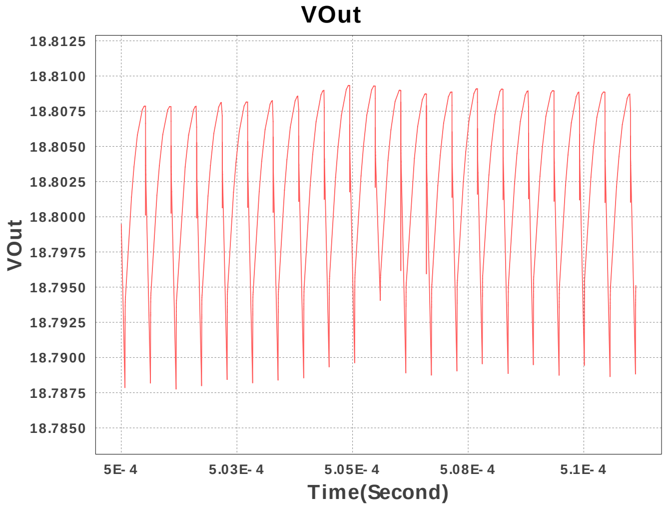
sim_id = 4

Simulation Type = Steady State



Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	Iout	I	Load Current	3.0 A



Design Assistance

1. The TPS55340-Q1 is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application

2. Master key : 540DA9CC30766418[v1]

3. **TPS55340-Q1** Product Folder : http://www.ti.com/product/TPS55340%2DQ1 : contains the data sheet and other resources.

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