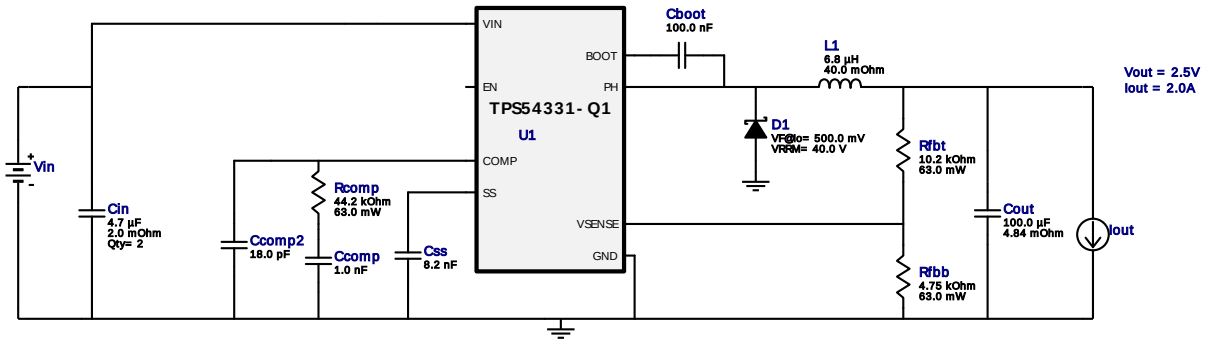
WEBENCH® Design Report

VinMin = 21.0V
VinMax = 25.0V
Vout = 2.5V
Iout = 2.0A

Device = TPS54331QDRQ1
Topology = Buck
Created = 7/21/16 12:28:42 AM
BOM Cost = $2.27
BOM Count = 13
Total Pd = 1.56W

Design : 4742013/199 TPS54331QDRQ1
TPS54331QDRQ1 21.0V-25.0V to 2.50V @ 2.0A

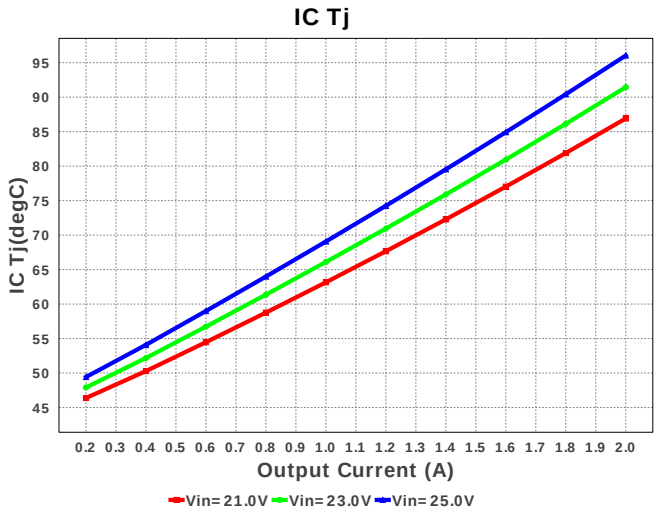


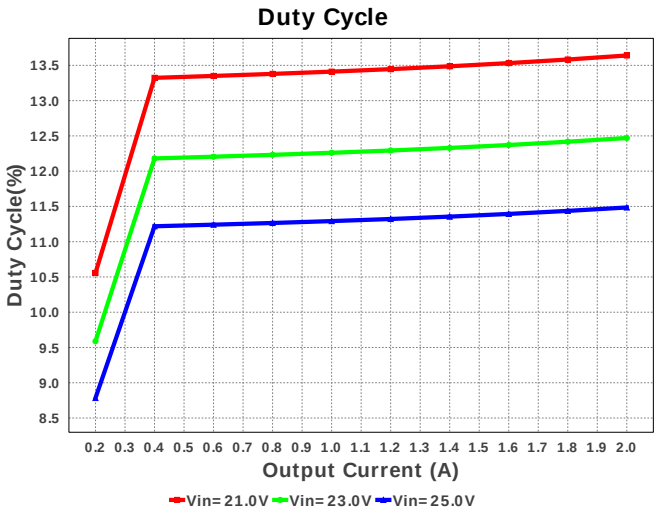
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application.View WEBENCH(R) Disclaimer.

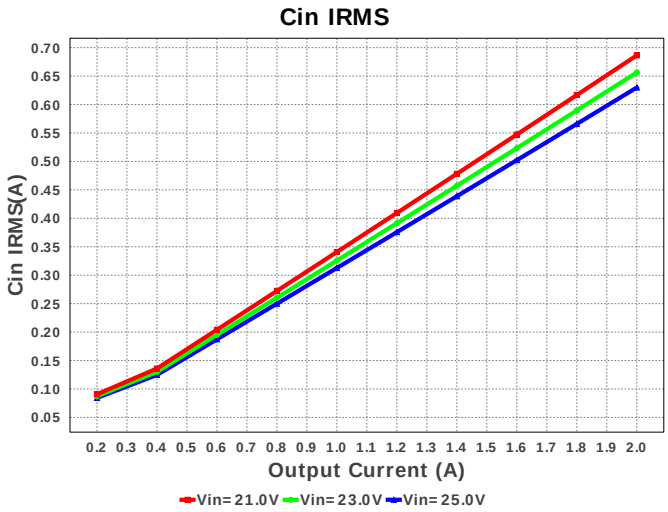
Electrical BOM

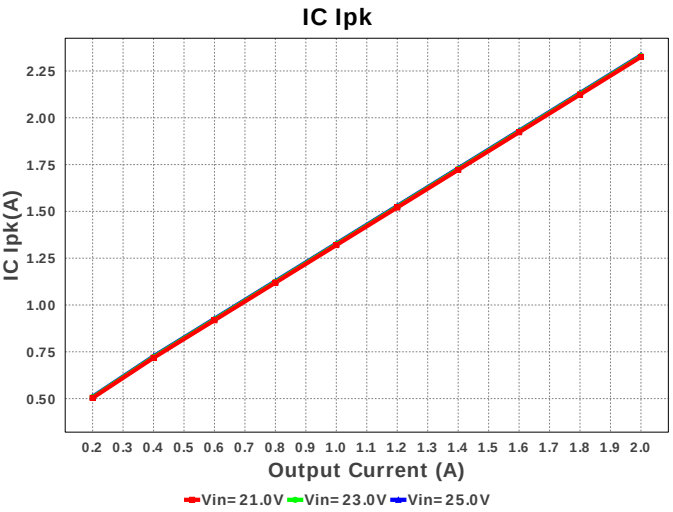
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Ccomp	Samsung Electro-Mechanics	CL21C102JBCNFNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Ccomp2	Kemet	C0805C180K5GACTU Series= C0G/NP0	Cap= 18.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Cin	MuRata	GRM32ER71H475KA88L Series= X7R	Cap= 4.7 uF ESR= 2.0 mOhm VDC= 50.0 V IRMS= 5.35 A	2	$0.19	1210 15 mm²
5.	Cout	MuRata	GRM31CD80G107ME39L Series= X6T	Cap= 100.0 uF ESR= 4.84 mOhm VDC= 4.0 V IRMS= 4.3381 A	1	$0.14	1206_190 11 mm²
6.	Css	MuRata	GRM033R61A822KA01D Series= X5R	Cap= 8.2 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
7.	D1	Diodes Inc.	B340A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.11	SMA 37 mm²
8.	L1	Bourns	SDR0805-6R8ML	L= 6.8 µH DCR= 40.0 mOhm	1	$0.22	SDR0805 96 mm²
9.	Rcomp	Vishay-Dale	CRCW040244K2FKED Series= CRCW..e3	Res= 44.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
10.	Rfbb	Vishay-Dale	CRCW04024K75FKED Series= CRCW..e3	Res= 4.75 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

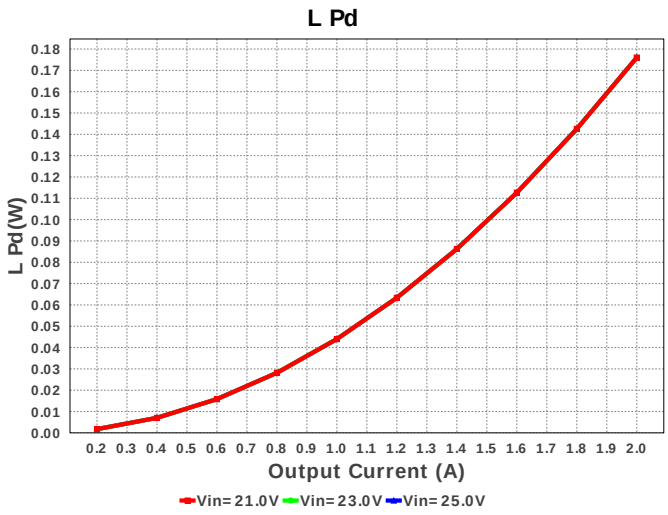
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	Rfbt	Vishay-Dale	CRCW040210K2FKED Series= CRCW..e3	Res= 10.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
12.	U1	Texas Instruments	TPS54331QDRQ1	Switcher	1	$1.35	D0008A 57 mm^2

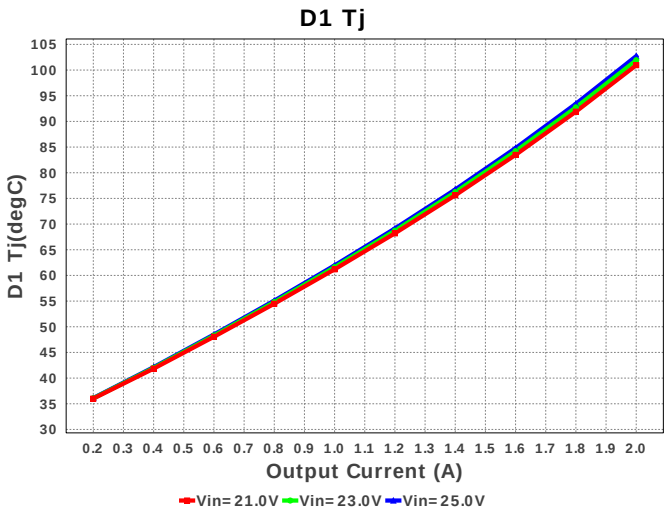


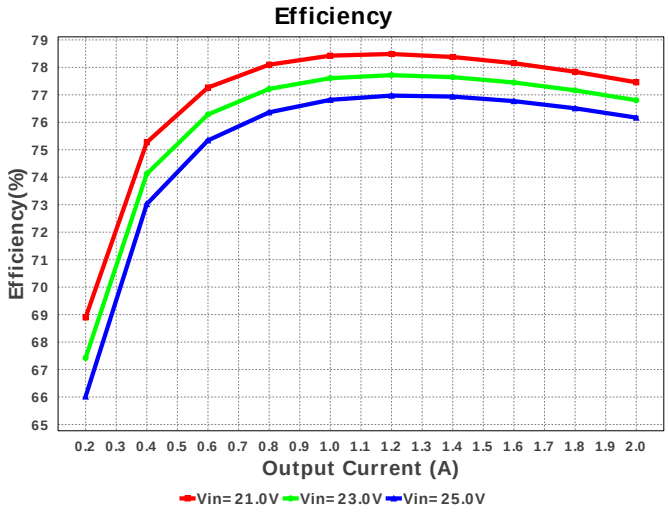


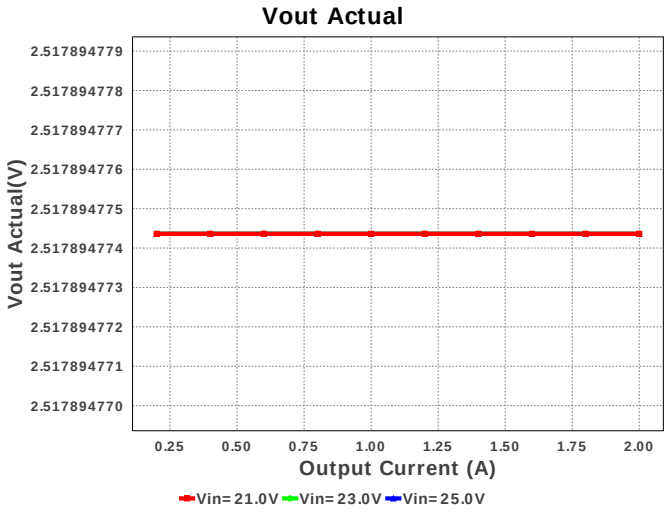


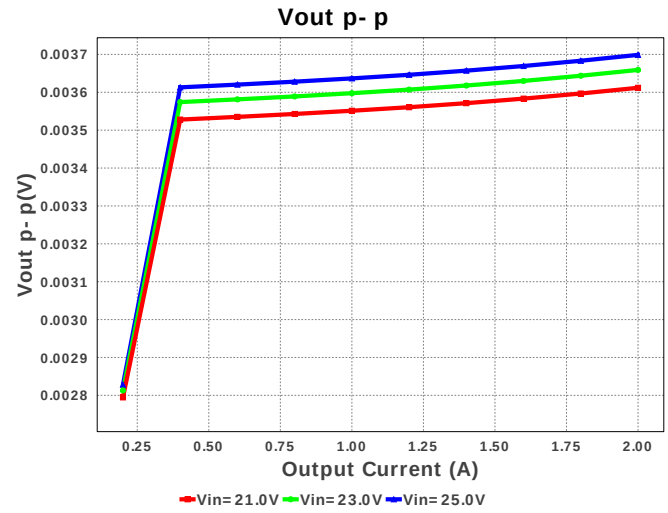


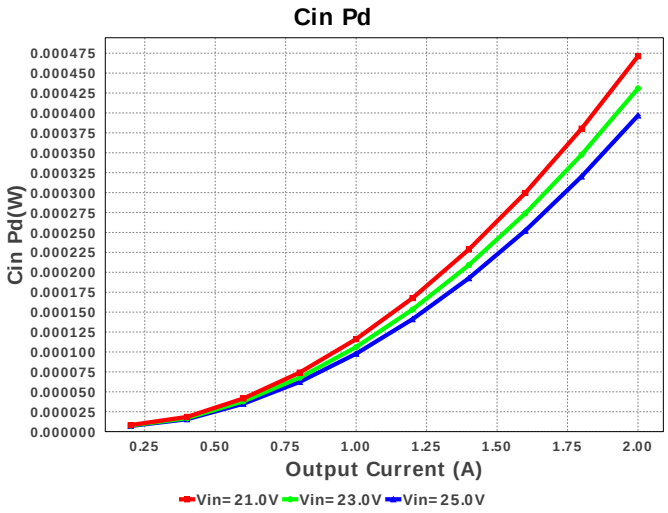


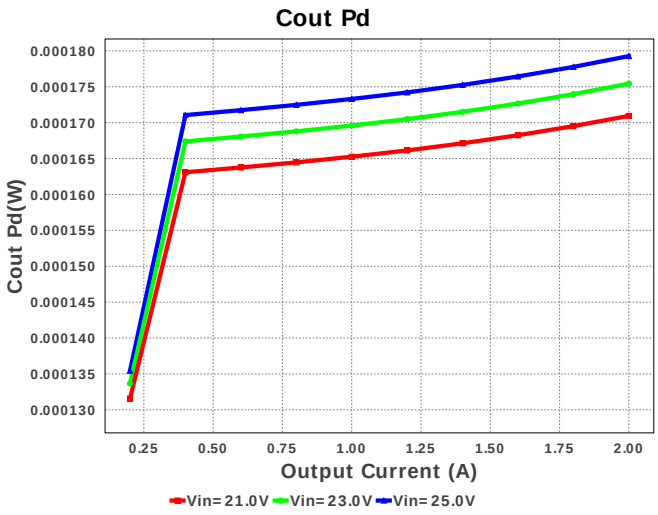


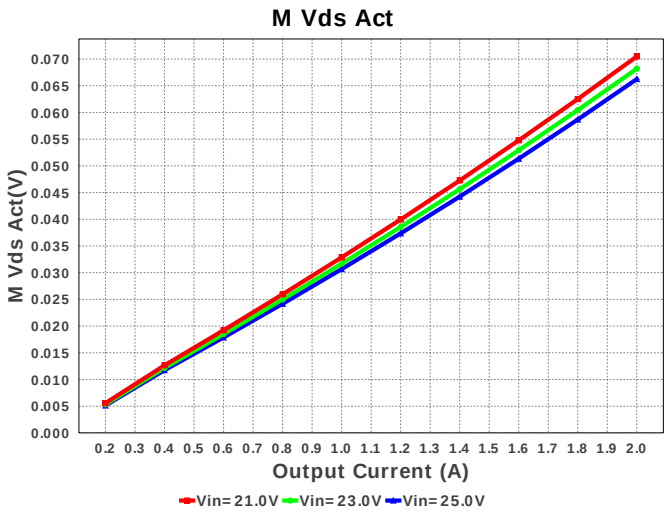


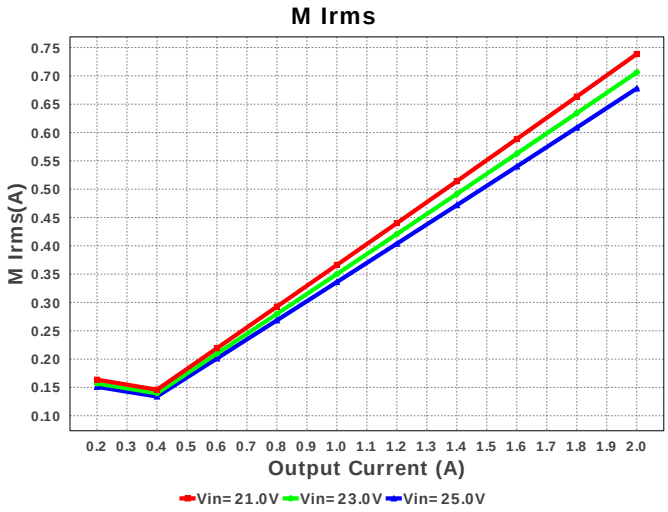


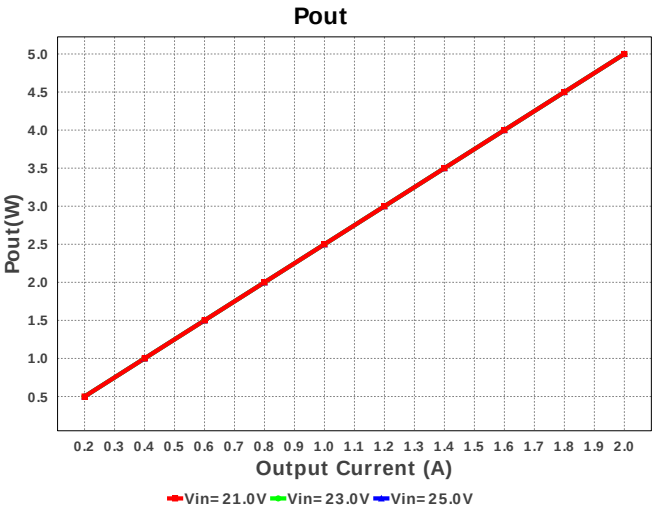


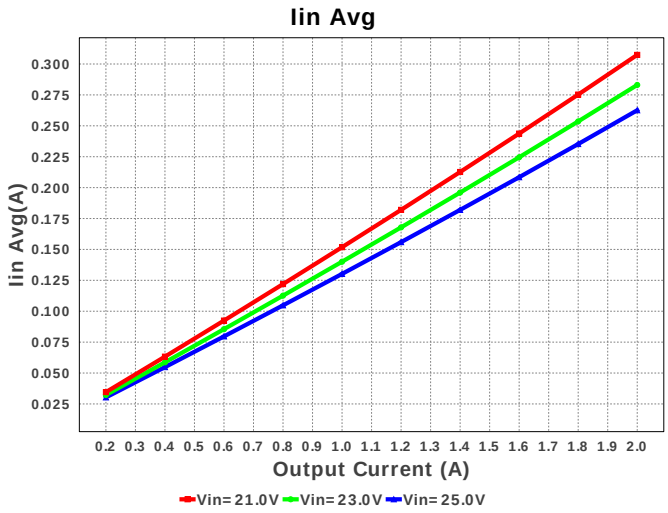


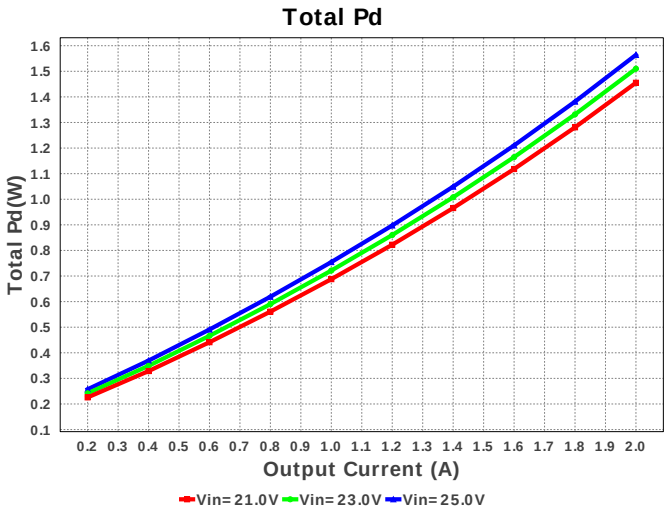


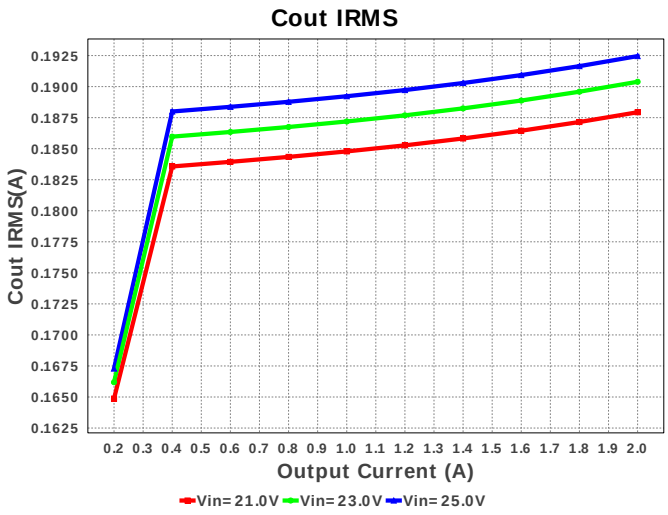


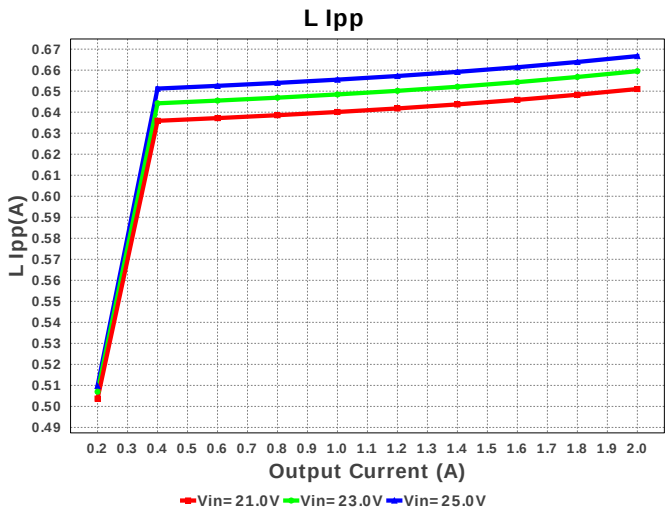


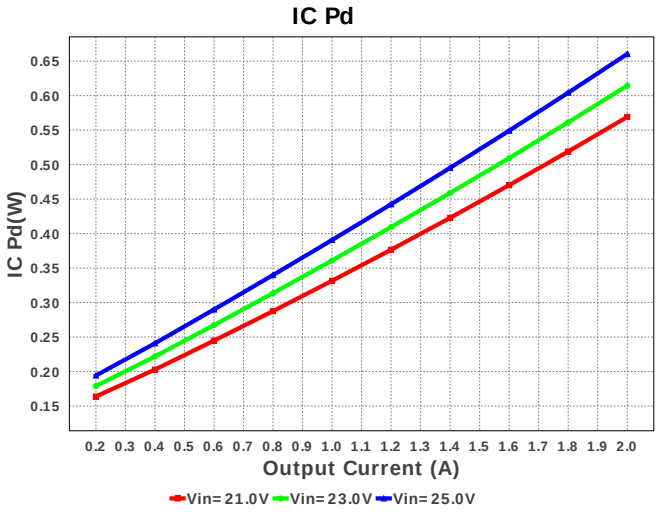


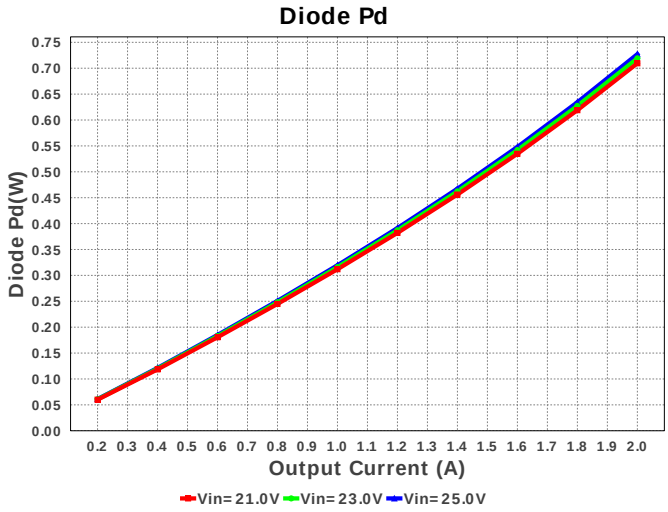


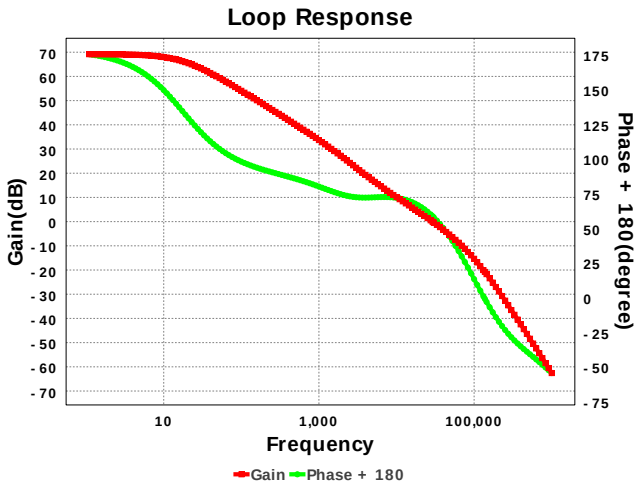












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	629.877 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	192.457 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	2.333 A	Current	Peak switch current in IC
4.	Iin Avg	262.57 mA	Current	Average input current
5.	L Ipp	666.69 mA	Current	Peak-to-peak inductor ripple current
6.	M Irms	677.785 mA	Current	MOSFET RMS current
7.	BOM Count	13	General	Total Design BOM count
8.	FootPrint	258.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	570.0 kHz	General	Switching frequency
10.	M Vds Act	66.242 mV	General	Voltage drop across the MosFET
11.	Pout	5.0 W	General	Total output power

#	Name	Value	Category	Description
12.	Total BOM	$2.27	General	Total BOM Cost
13.	D1 Tj	102.72 degC	Op_Point	D1 junction temperature
14.	Low Freq Gain	69.176 dB	Op_Point	Gain at 10Hz
15.	Vout Actual	2.518 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
16.	Vout OP	2.5 V	Op_Point	Operational Output Voltage
17.	Cross Freq	29.097 kHz	Op_point	Bode plot crossover frequency
18.	Duty Cycle	11.485 %	Op_point	Duty cycle
19.	Efficiency	76.171 %	Op_point	Steady state efficiency
20.	Gain Marg	-20.797 dB	Op_point	Bode Plot Gain Margin
21.	IC Tj	96.04 degC	Op_point	IC junction temperature
22.	ICThetaJA	100.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
23.	IOUT_OP	2.0 A	Op_point	Iout operating point
24.	Phase Marg	59.66 deg	Op_point	Bode Plot Phase Margin
25.	VIN_OP	25.0 V	Op_point	Vin operating point
26.	Vout p-p	3.699 mV	Op_point	Peak-to-peak output ripple voltage
27.	Cin Pd	396.745 µW	Power	Input capacitor power dissipation
28.	Cout Pd	179.271 µW	Power	Output capacitor power dissipation
29.	Diode Pd	727.198 mW	Power	Diode power dissipation
30.	IC Pd	660.398 mW	Power	IC power dissipation
31.	L Pd	176.0 mW	Power	Inductor power dissipation
32.	Total Pd	1.564 W	Power	Total Power Dissipation
33.	Vout Tolerance	4.927 %		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	25.0	Maximum input voltage
3.	VinMin	21.0	Minimum input voltage
4.	Vout	2.5	Output Voltage
5.	base_pn	TPS54331-Q1	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. The TPS54331-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. TPS54331-Q1 Product Folder : http://www.ti.com/product/TPS54331%2DQ1 : contains the data sheet and other resources.