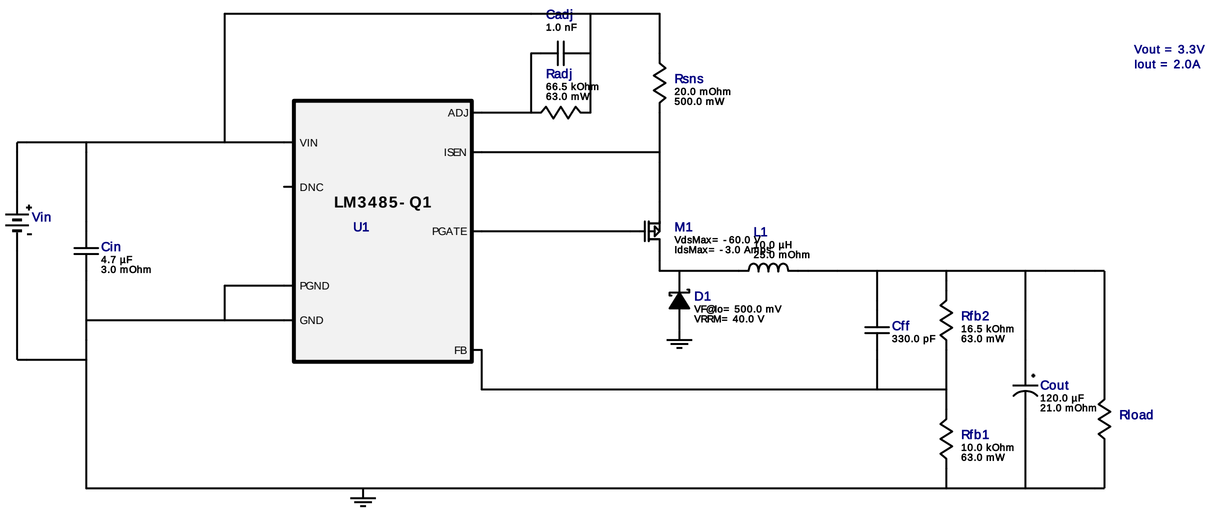
![Texas Instruments]

WEBENCH® Design Report

VinMin = 14.0V
VinMax = 22.0V
Vout = 3.3V
Iout = 2.0A

Device = LM3485Q1MM/NOPB
Topology = Buck
Created = 7/12/16 1:26:27 AM
BOM Cost = $1.70
BOM Count = 12
Total Pd = 1.14W

Design : 4737567/23 LM3485Q1MM/NOPB
LM3485Q1MM/NOPB 14.0V-22.0V to 3.30V @ 2.0A

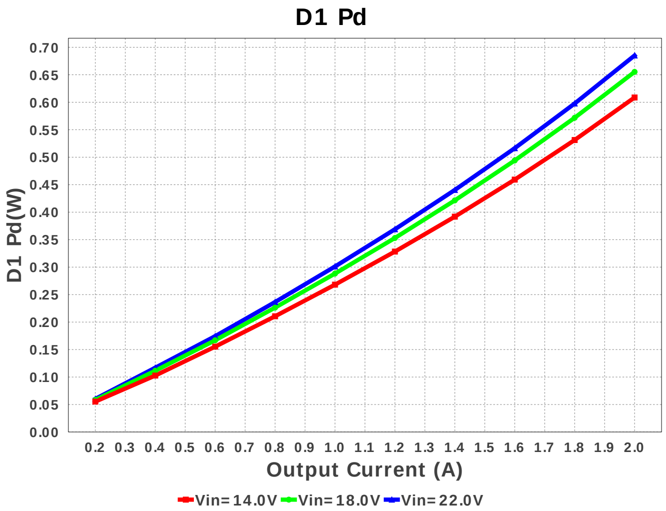


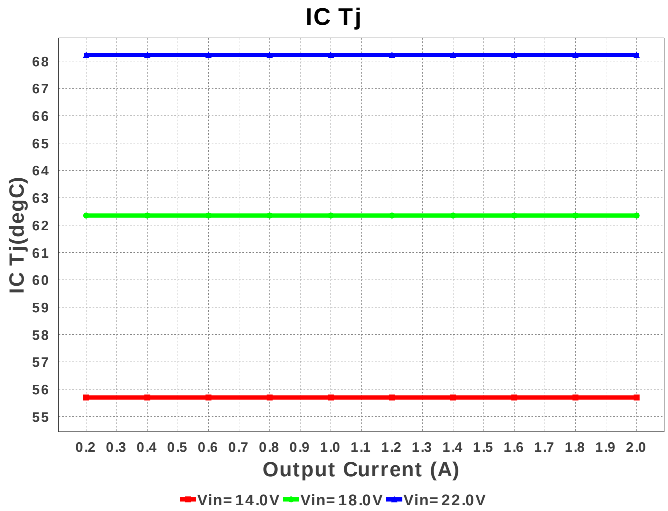
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific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

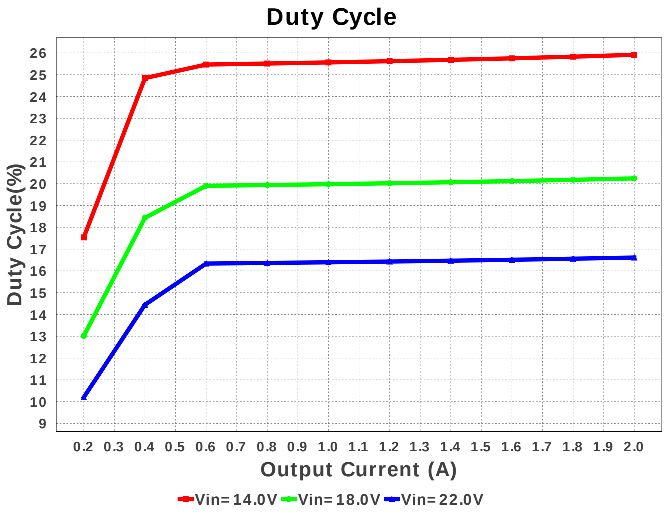
Electrical BOM

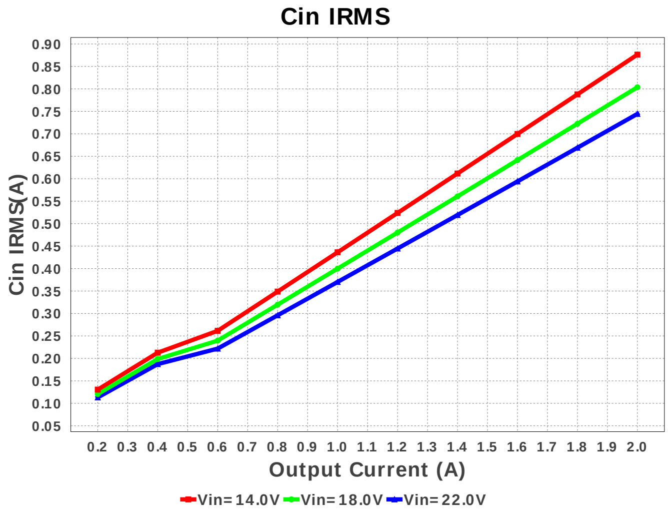
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cadj	Samsung Electro-Mechanics	CL21C102JBCNFNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Cff	Samsung Electro-Mechanics	CL21C331JBANFNC Series= C0G/NP0	Cap= 330.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Cin	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	1	$0.07	1206 11 mm²
4.	Cout	Panasonic	6SVPC120MV Series= SVPC	Cap= 120.0 uF ESR= 21.0 mOhm VDC= 6.3 V IRMS= 2.66 A	1	$0.28	SM_RADIAL_5MM 58 mm²
5.	D1	Diodes Inc.	B340A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.11	SMA 37 mm²
6.	L1	Bourns	SRU1038-100Y	L= 10.0 µH DCR= 25.0 mOhm	1	$0.33	SRU1038 144 mm²
7.	M1	Fairchild Semiconductor	FDC5614P	VdsMax= -60.0 V IdsMax= -3.0 Amps	1	$0.23	SOT-23-6 15 mm²
8.	Radj	Vishay-Dale	CRCW040266K5FKED Series= CRCW..e3	Res= 66.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

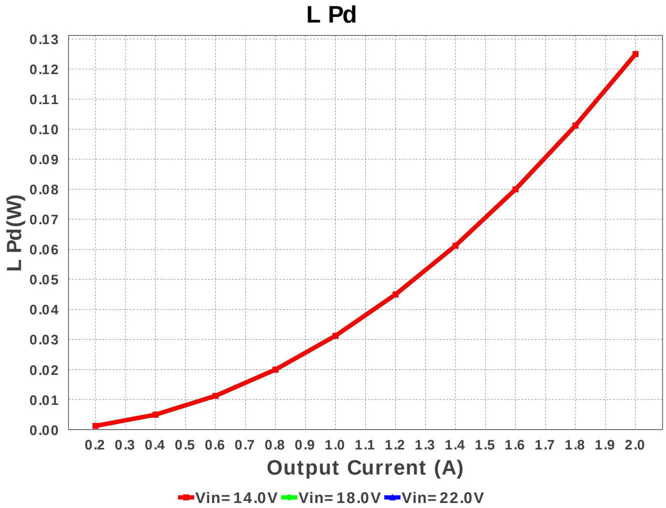
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Rfb1	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
10.	Rfb2	Vishay-Dale	CRCW040216K5FKED Series= CRCW..e3	Res= 16.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
11.	Rsns	Stackpole Electronics Inc	CSR1206FK20L0 Series= ?	Res= 20.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.10	1206 11 mm^2
12.	U1	Texas Instruments	LM3485Q1MM/NOPB	Switcher	1	$0.53	MUA08A 24 mm^2

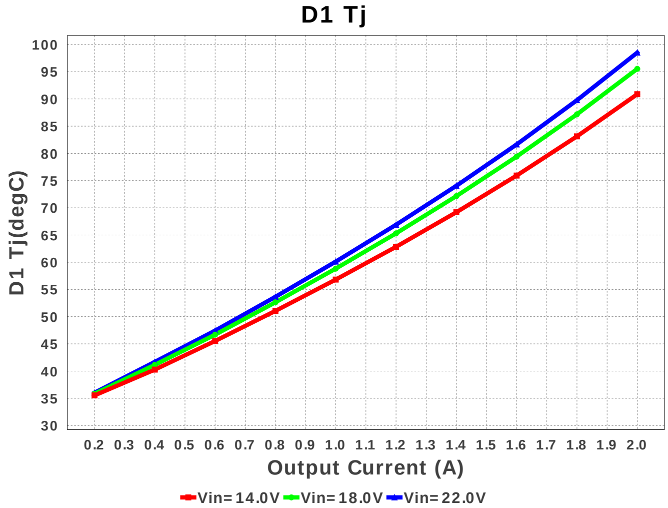


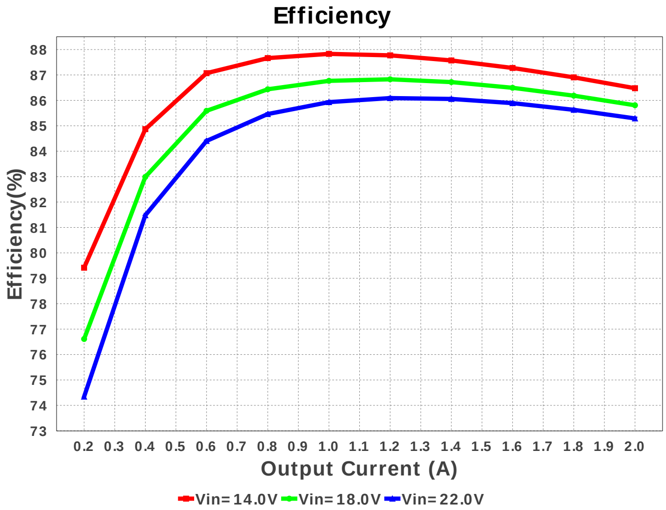


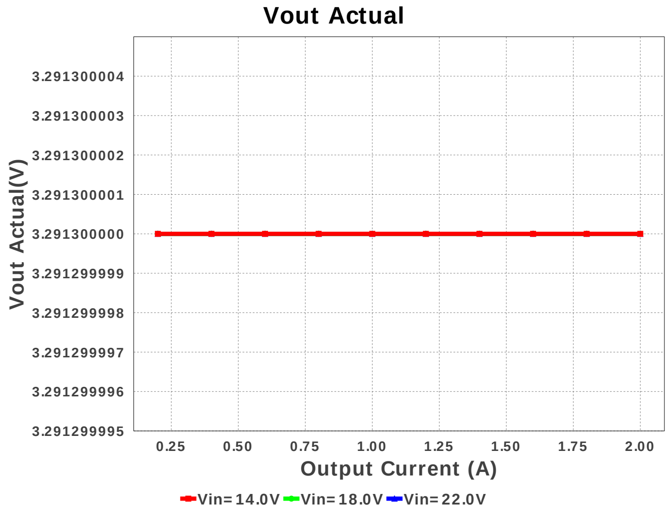


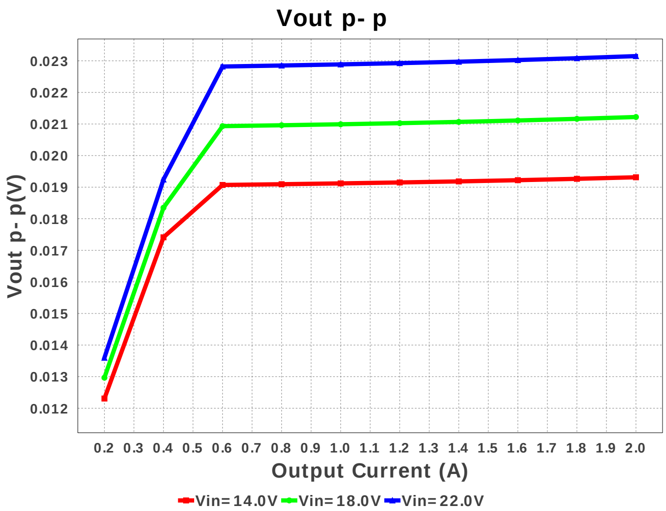


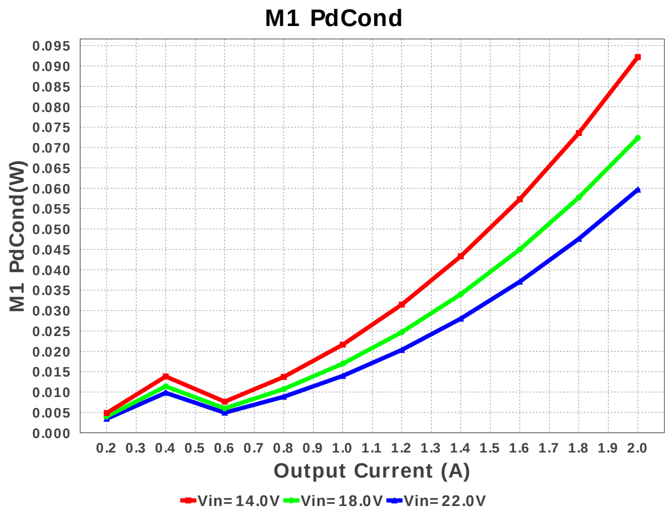

L Pd
L Pd(W)
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Output Current (A)
Vin= 14.0V Vin= 18.0V Vin= 22.0V


D1 Tj
D1 Tj(degC)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Output Current (A)
Vin= 14.0V Vin= 18.0V Vin= 22.0V

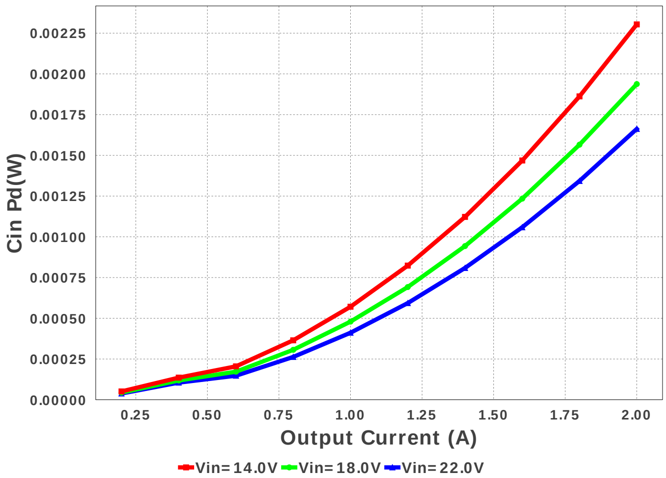

Efficiency
Efficiency(%)
88
87
86
85
84
83
82
81
80
79
78
77
76
75
74
73
0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Output Current (A)
Vin= 14.0V Vin= 18.0V Vin= 22.0V


Vout Actual
Vout Actual(V)
3.291300004
3.291300003
3.291300002
3.291300001
3.291300000
3.291299999
3.291299998
3.291299997
3.291299996
3.291299995
0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00
Output Current (A)
Vin= 14.0V Vin= 18.0V Vin= 22.0V

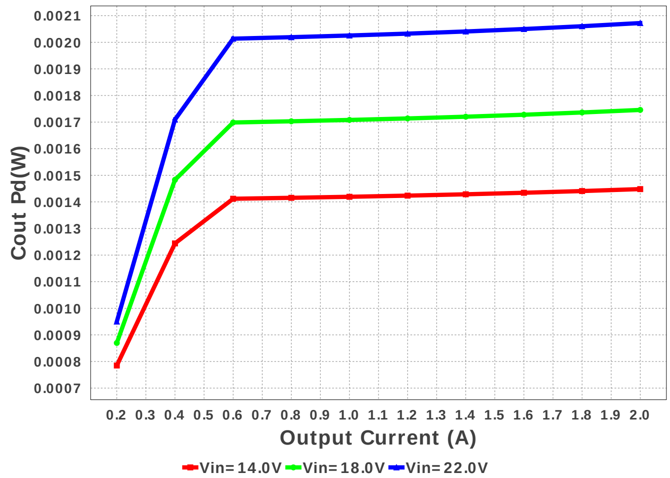

Vout p- p
Vout p- p(V)
0.023
0.022
0.021
0.020
0.019
0.018
0.017
0.016
0.015
0.014
0.013
0.012
0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Output Current (A)
Vin= 14.0V Vin= 18.0V Vin= 22.0V


M1 PdCond
M1 PdCond(W)
0.095
0.090
0.085
0.080
0.075
0.070
0.065
0.060
0.055
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0
Output Current (A)
Vin= 14.0V Vin= 18.0V Vin= 22.0V

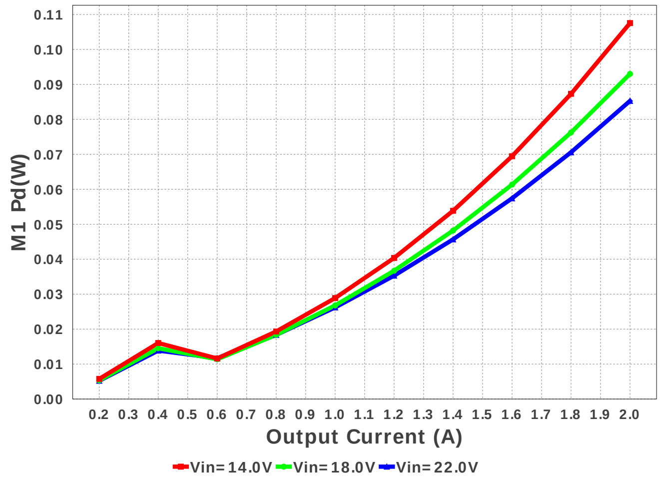
Cin Pd



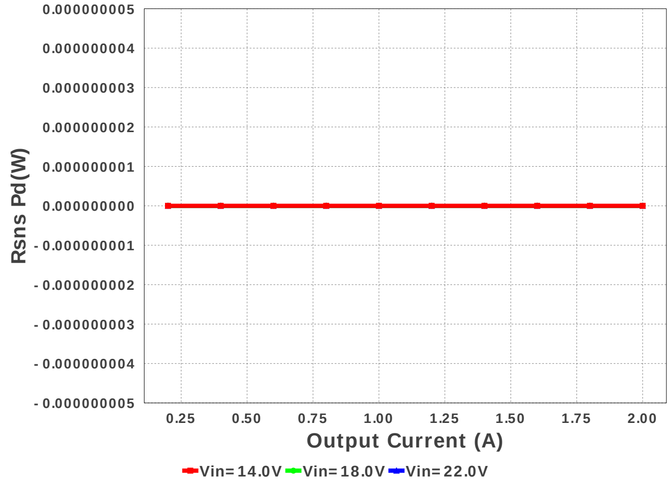
Cout Pd



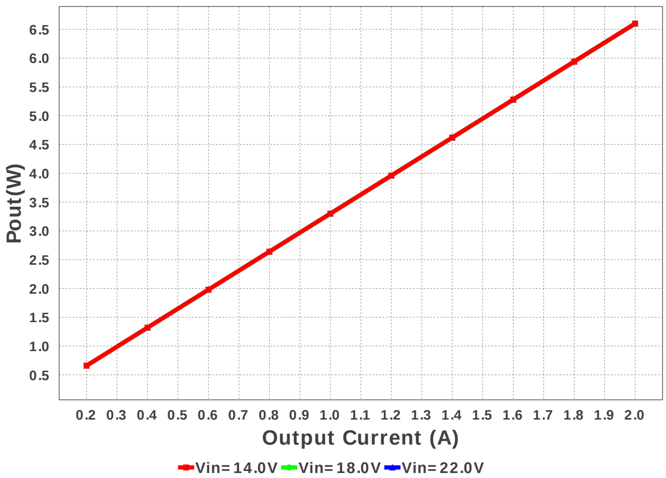
M1 Pd



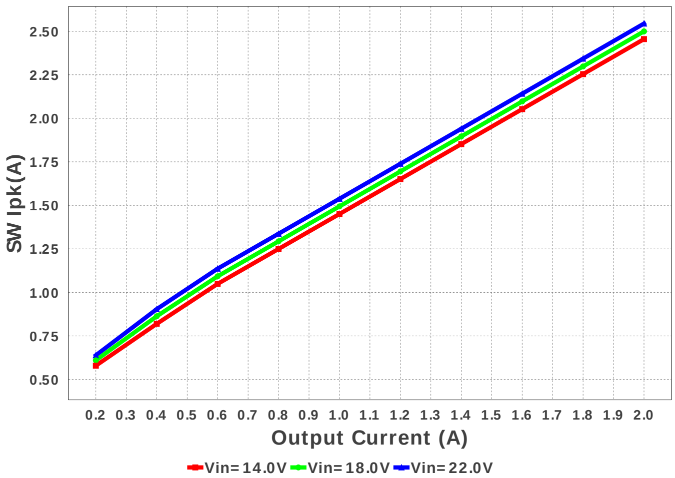
Rsns Pd



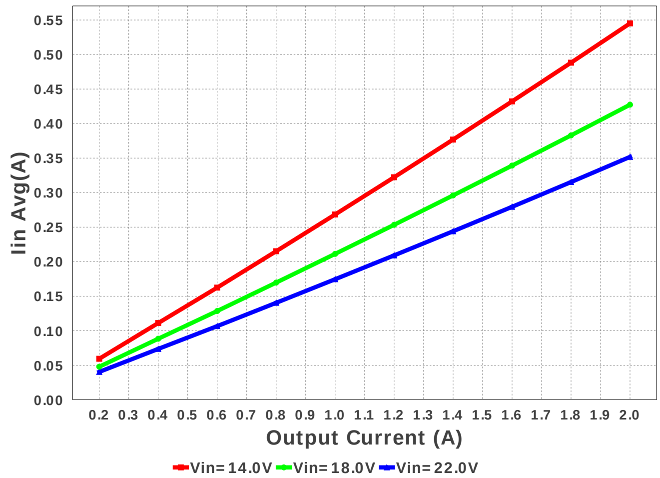
Pout



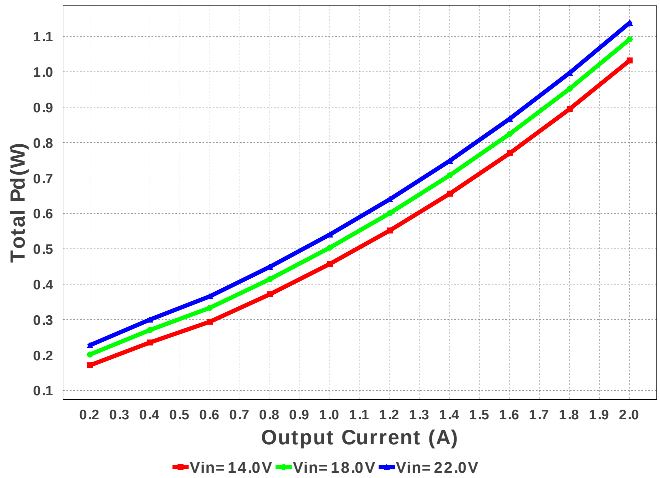
SW Ipk



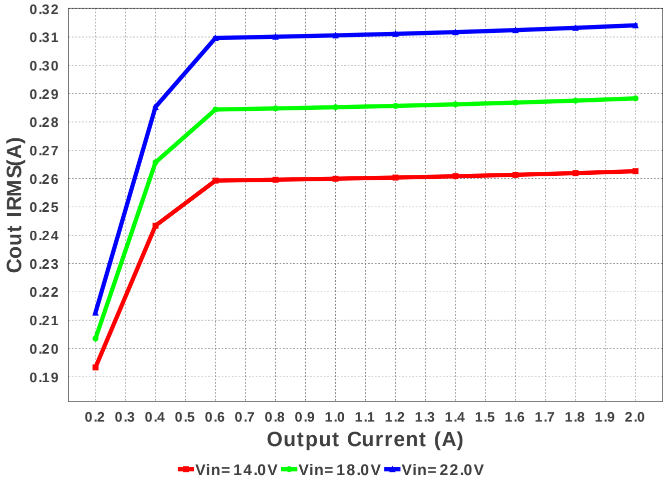
Iin Avg



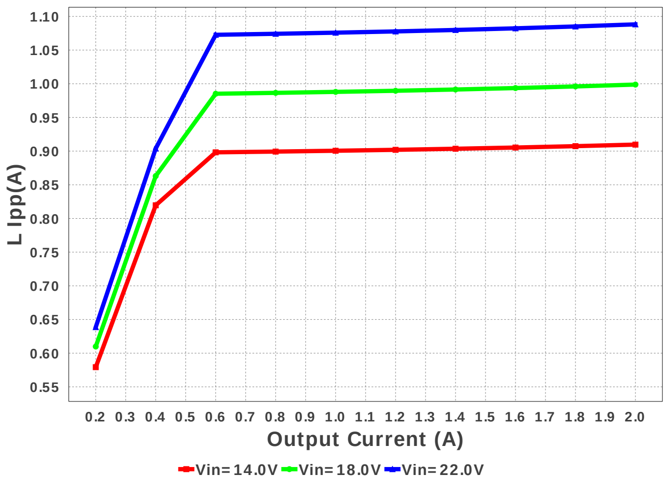
Total Pd



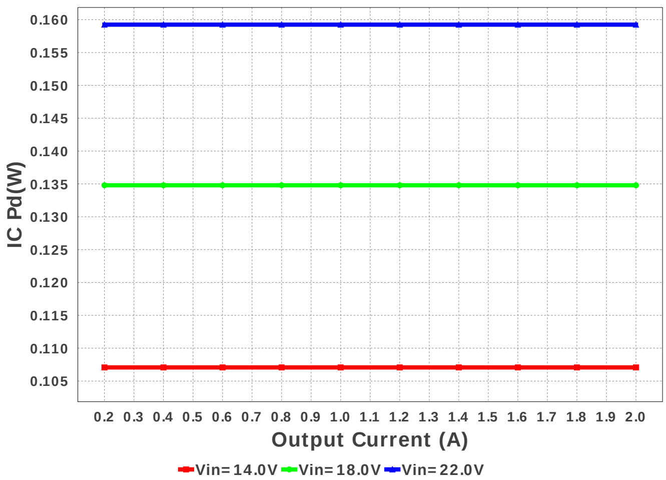
Cout IRMS



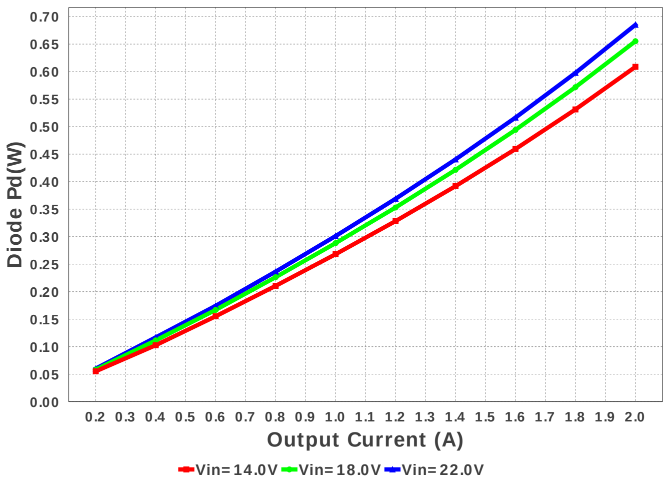
L Ipp

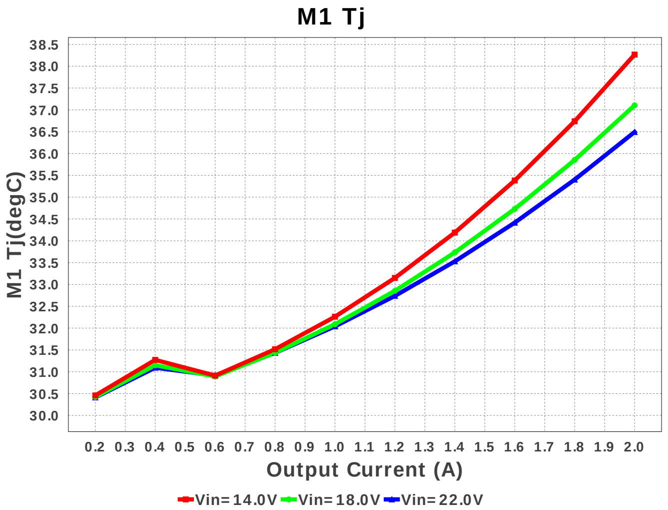


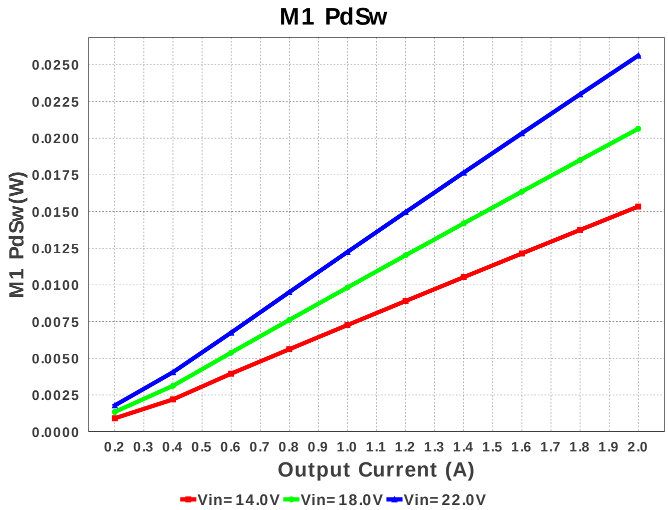
IC Pd



Diode Pd







Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	744.392 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	307.126 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	351.77 mA	Current	Average input current
4.	L Ipp	1.064 A	Current	Peak-to-peak inductor ripple current
5.	SW Ipk	2.532 A	Current	Peak switch current
6.	BOM Count	12	General	Total Design BOM count
7.	FootPrint	323.0 mm^2	General	Total Foot Print Area of BOM components
8.	Frequency	306.159 kHz	General	Switching frequency
9.	IC Tolerance	0.0 V	General	IC Feedback Tolerance
10.	Pout	6.6 W	General	Total output power
11.	Total BOM	$1.7	General	Total BOM Cost
12.	D1 Tj	98.507 degC	Op_Point	D1 junction temperature
13.	Vout Actual	3.291 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
14.	Vout OP	3.3 V	Op_Point	Operational Output Voltage
15.	Duty Cycle	16.613 %	Op_point	Duty cycle
16.	Efficiency	85.283 %	Op_point	Steady state efficiency
17.	IC Tj	61.85 degC	Op_point	IC junction temperature
18.	ICThetaJA	200.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
19.	IOUT_OP	2.0 A	Op_point	Iout operating point
20.	M1 Tj	36.493 degC	Op_point	M1 MOSFET junction temperature
21.	VIN_OP	22.0 V	Op_point	Vin operating point
22.	Vout p-p	22.634 mV	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	1.662 mW	Power	Input capacitor power dissipation
24.	Cout Pd	1.981 mW	Power	Output capacitor power dissipation
25.	D1 Pd	685.068 mW	Power	Output Diode Power Dissipation
26.	Diode Pd	685.068 mW	Power	Diode power dissipation
27.	IC Pd	159.249 mW	Power	IC power dissipation
28.	L Pd	125.0 mW	Power	Inductor power dissipation
29.	M1 Pd	85.984 mW	Power	M1 MOSFET total power dissipation
30.	M1 PdCond	60.362 mW	Power	M1 MOSFET conduction losses
31.	M1 PdSw	25.623 mW	Power	M1 MOSFET switching losses
32.	Rsns Pd	0.0 W	Power	Rsense Power Dissipation
33.	Total Pd	1.139 W	Power	Total Power Dissipation
34.	Vout Tolerance	1.258 %		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	22.0	Maximum input voltage
3.	VinMin	14.0	Minimum input voltage
4.	Vout	3.3	Output Voltage
5.	base_pn	LM3485-Q1	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. The LM3485-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. Outline The LM3485-Q1 is a hysteretic PFET controller. The hysteretic control architecture provides for a stable design without the use of a control loop. The switching frequency depends on the inductance value, output capacitor ESR, and the input voltage. Therefore depending on the chosen BOM, the frequency at different input voltages would vary.

3. Feature Highlights: Automotive Qualified 75V Wide Vin Constant On-Time PFET Buck Switching Controller

4. The LM3485-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

5. Outline The LM3485-Q1 is a hysteretic PFET controller. The hysteretic control architecture provides for a stable design without the use of a control loop. The switching frequency depends on the inductance value, output capacitor ESR, and the input voltage. Therefore depending on the chosen BOM, the frequency at different input voltages would vary.

6. LM3485-Q1 Product Folder : http://www.ti.com/product/LM3485%2DQ1 : contains the data sheet and other resources.