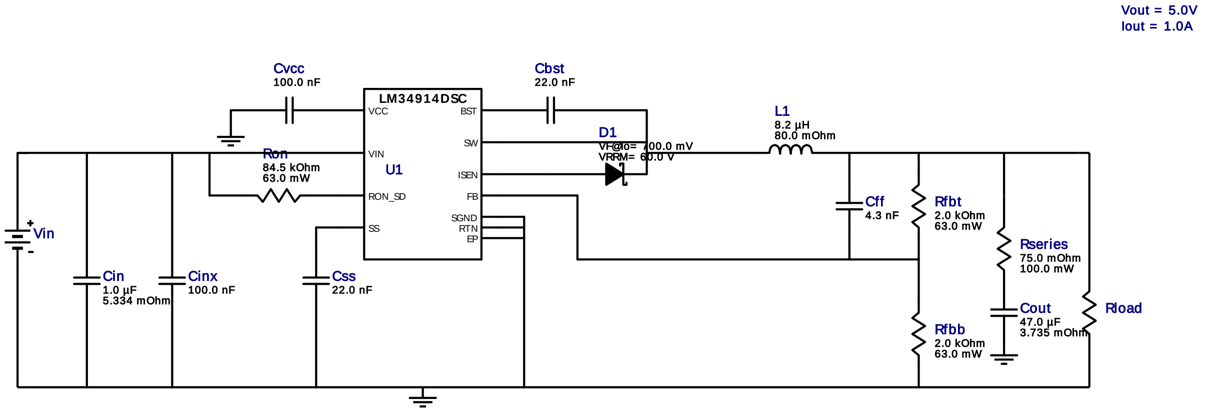
VinMin = 10.0V
VinMax = 40.0V
Vout = 5.0V
Iout = 1.0A

Device = LM34914SD/NOPB
Topology = Buck
Created = 8/24/16 8:28:10 PM
BOM Cost = $1.93
BOM Count = 14
Total Pd = 0.89W

WEBENCH ® Design Report

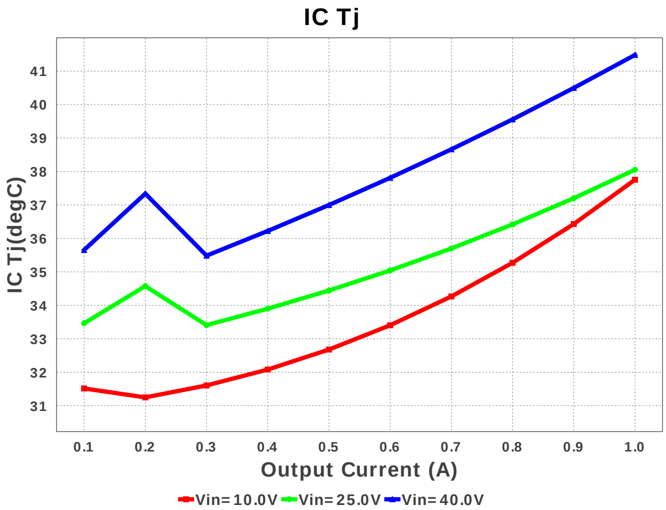
Design : 4755249/5 LM34914SD/NOPB
LM34914SD/NOPB 10.0V-40.0V to 5.00V @ 1.0A

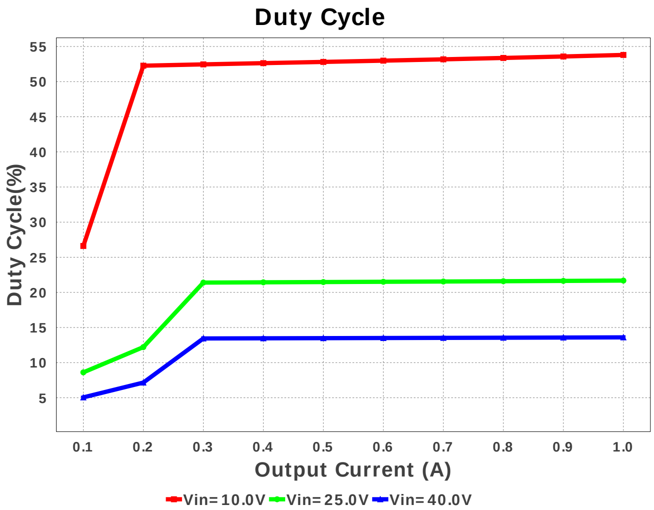


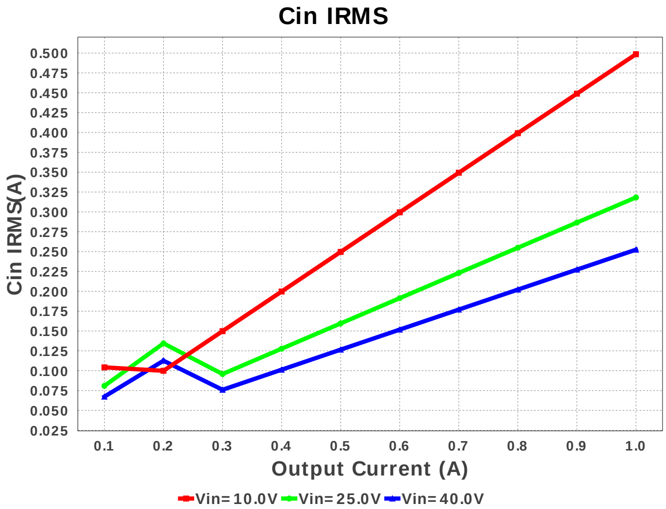
Electrical BOM

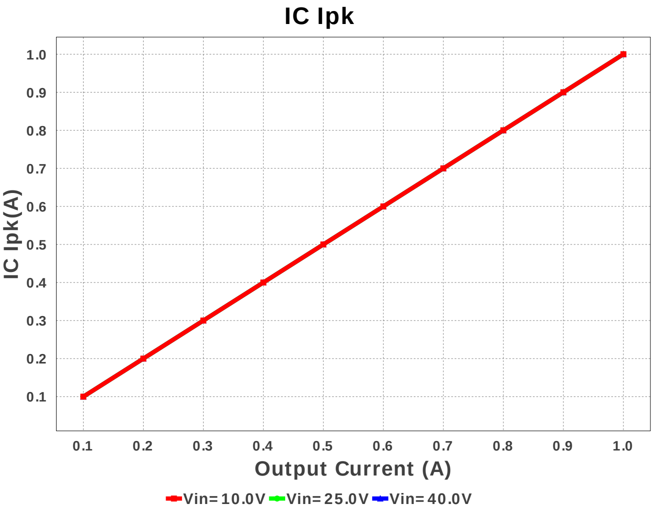
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	MuRata	GRM033C80J223KE01D Series= X6S	Cap= 22.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
2.	Cff	Kemet	C0603C432J5GAC7867 Series= C0G/NP0	Cap= 4.3 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.07	0603 5 mm²
3.	Cin	MuRata	GRM31CR72A105KA01L Series= X7R	Cap= 1.0 uF ESR= 5.334 mOhm VDC= 100.0 V IRMS= 1.55432 A	1	$0.11	1206_190 11 mm²
4.	Cinx	MuRata	GRM21BR71E104KA01L Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
5.	Cout	MuRata	GRM31CC80J476KE18L Series= X6S	Cap= 47.0 uF ESR= 3.735 mOhm VDC= 6.3 V IRMS= 4.0522 A	1	$0.10	1206_190 11 mm²
6.	Css	MuRata	GRM155R61C223KA01D Series= X5R	Cap= 22.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
7.	Cvcc	MuRata	GRM21BR71E104KA01L Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
8.	D1	Diodes Inc.	B160-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	$0.05	SMA 37 mm²
9.	L1	NIC Components	NPI54C8R2MTRF	L= 8.2 µH DCR= 80.0 mOhm	1	$0.09	IND_NPI54C 61 mm²
10.	Rfbb	Vishay-Dale	CRCW04022K00FKED Series= CRCW..e3	Res= 2.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
11.	Rfbt	Vishay-Dale	CRCW04022K00FKED Series= CRCW..e3	Res= 2.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

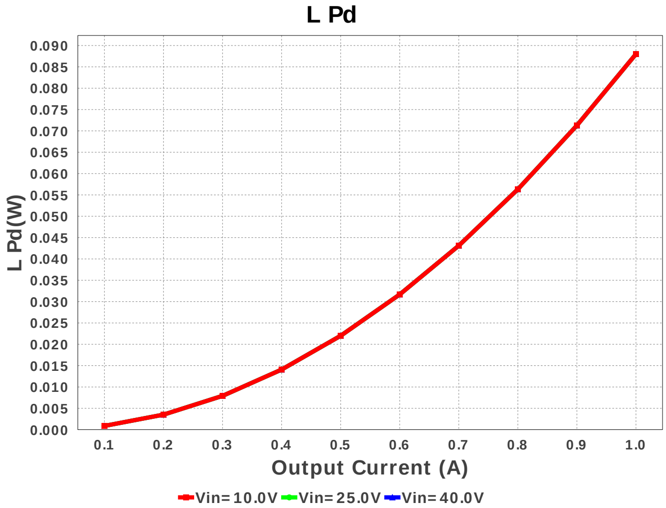
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
12.	Ron	Vishay-Dale	CRCW040284K5FKED Series= CRCW..e3	Res= 84.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
13.	Rseries	Panasonic	ERJ-L03UF75MV Series= ERJ-L03	Res= 75.0 mOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.09	0603 5 mm^2
14.	U1	Texas Instruments	LM34914SD/NOPB	Switcher	1	$1.35	DSC0010B 16 mm^2

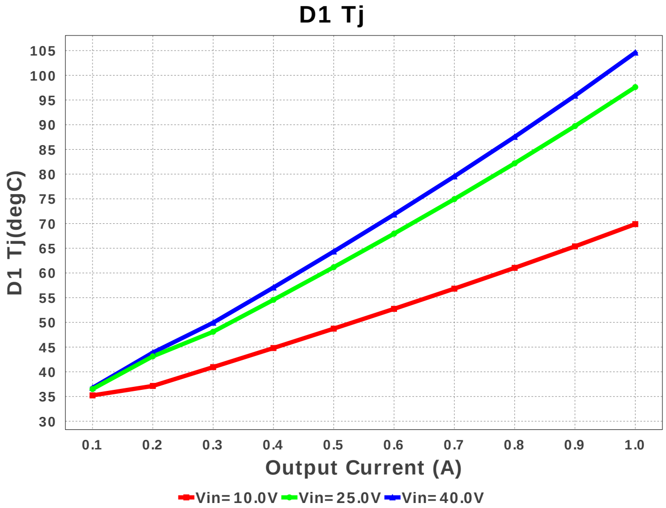


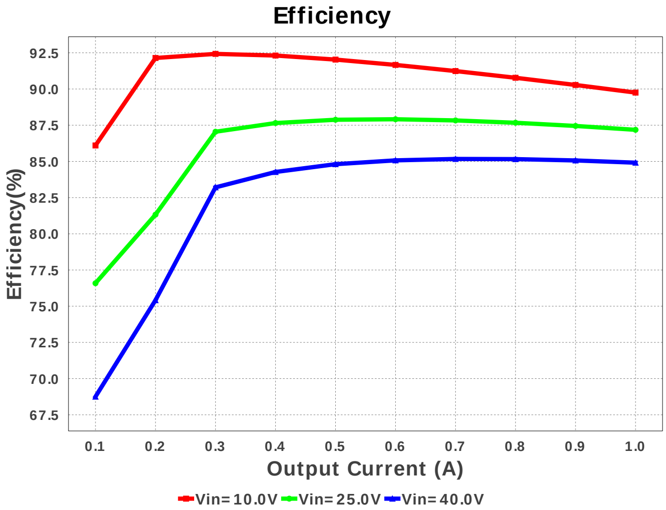


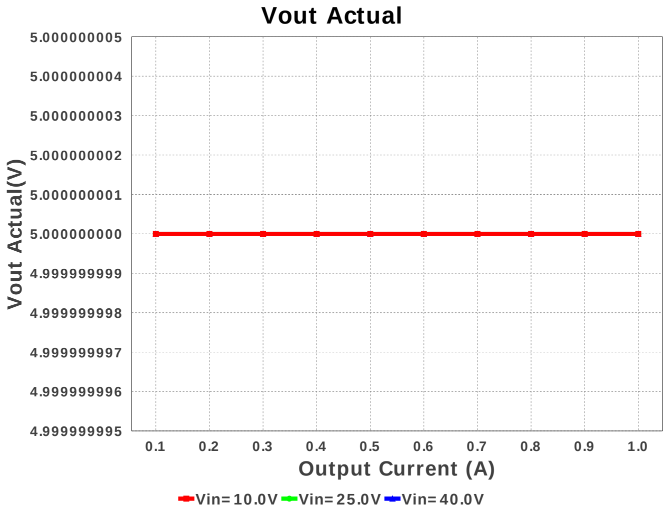


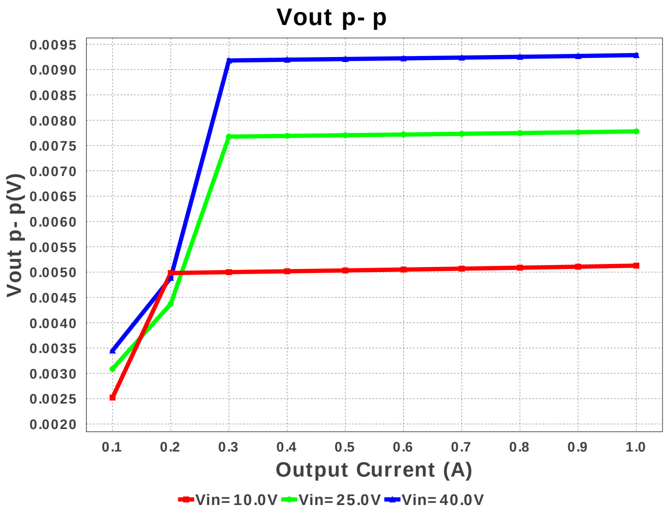


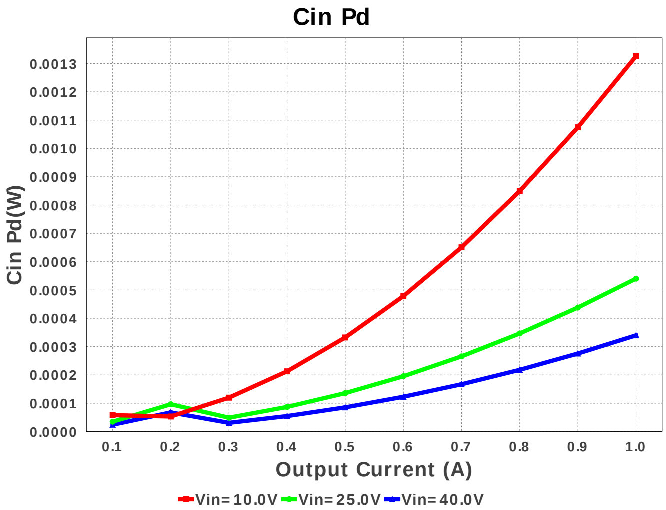

L Pd
L Pd(W)
0.090
0.085
0.080
0.075
0.070
0.065
0.060
0.055
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin= 10.0V Vin= 25.0V Vin= 40.0V

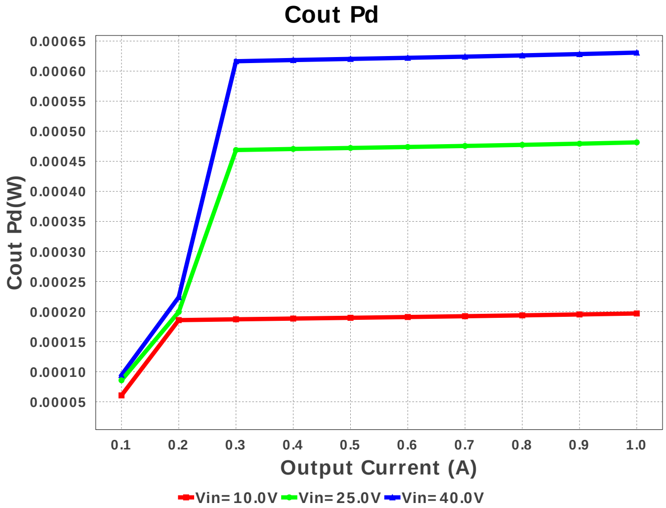

D1 Tj
D1 Tj(degC)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin= 10.0V Vin= 25.0V Vin= 40.0V

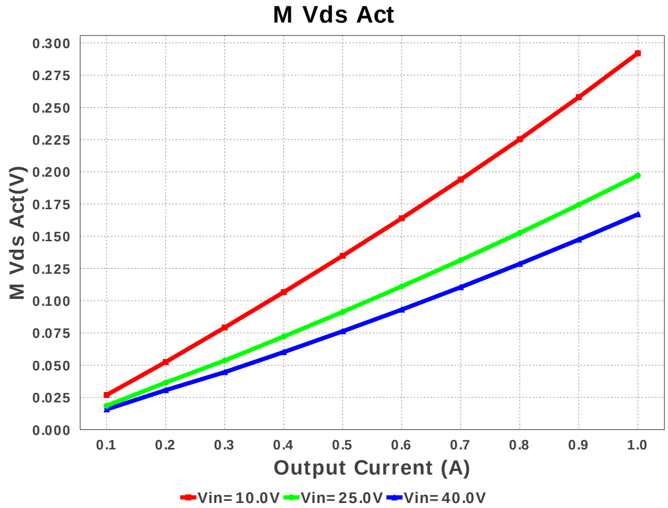

Efficiency
Efficiency(%)
92.5
90.0
87.5
85.0
82.5
80.0
77.5
75.0
72.5
70.0
67.5
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin= 10.0V Vin= 25.0V Vin= 40.0V

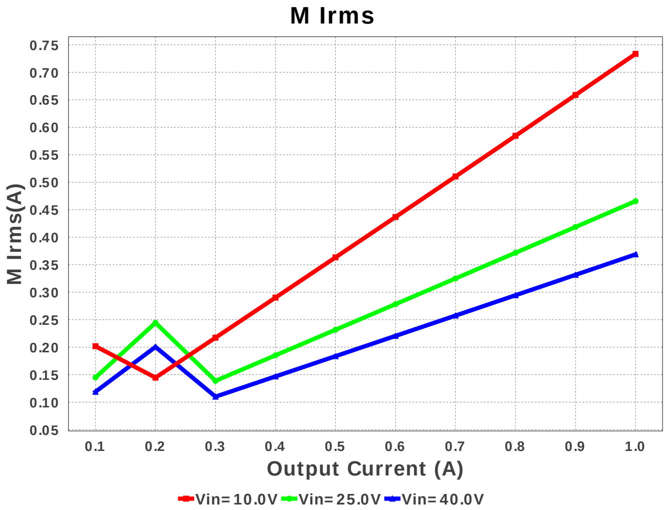

Vout Actual
Vout Actual(V)
5.000000005
5.000000004
5.000000003
5.000000002
5.000000001
5.000000000
4.999999999
4.999999998
4.999999997
4.999999996
4.999999995
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin= 10.0V Vin= 25.0V Vin= 40.0V

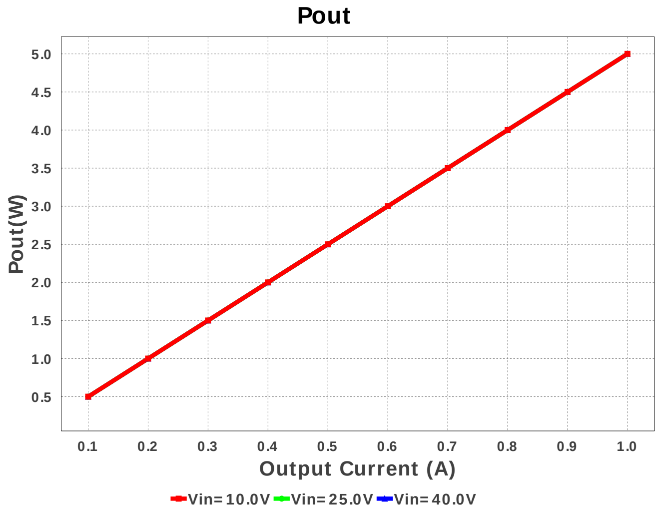

Vout p- p
Vout p- p(V)
0.0095
0.0090
0.0085
0.0080
0.0075
0.0070
0.0065
0.0060
0.0055
0.0050
0.0045
0.0040
0.0035
0.0030
0.0025
0.0020
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin= 10.0V Vin= 25.0V Vin= 40.0V

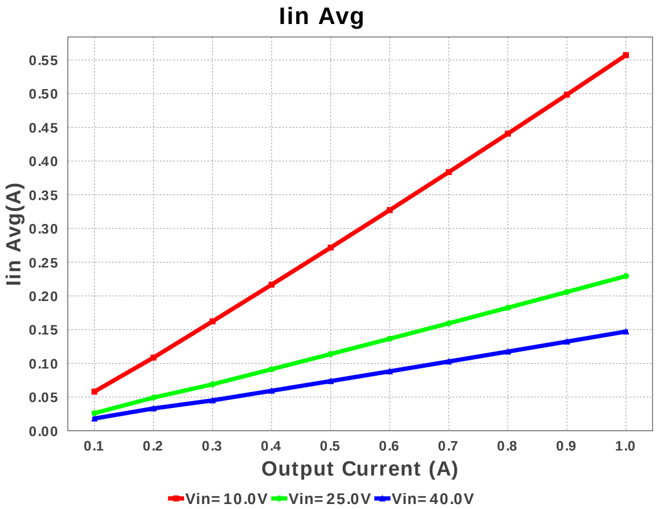

Cin Pd
Cin Pd(W)
0.0013
0.0012
0.0011
0.0010
0.0009
0.0008
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0.0000
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin= 10.0V Vin= 25.0V Vin= 40.0V

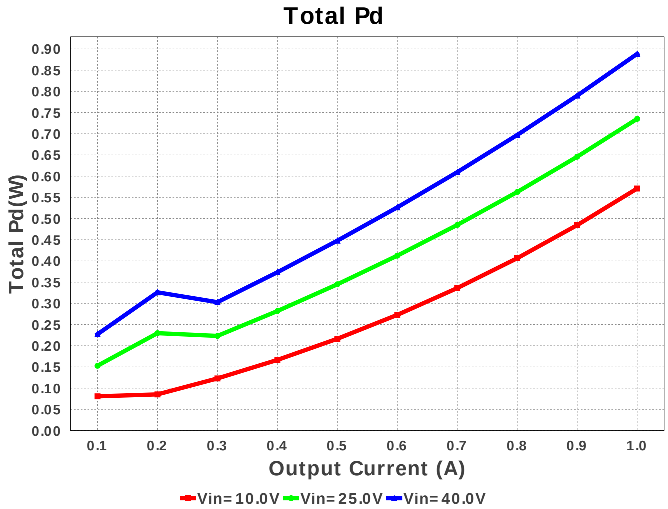

Cout Pd
Cout Pd(W)
0.00065
0.00060
0.00055
0.00050
0.00045
0.00040
0.00035
0.00030
0.00025
0.00020
0.00015
0.00010
0.00005
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=25.0V Vin=40.0V

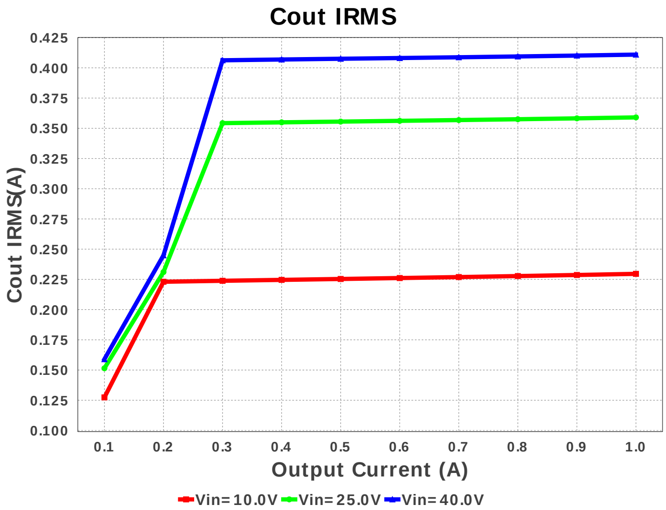

M Vds Act
M Vds Act(V)
0.300
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=25.0V Vin=40.0V

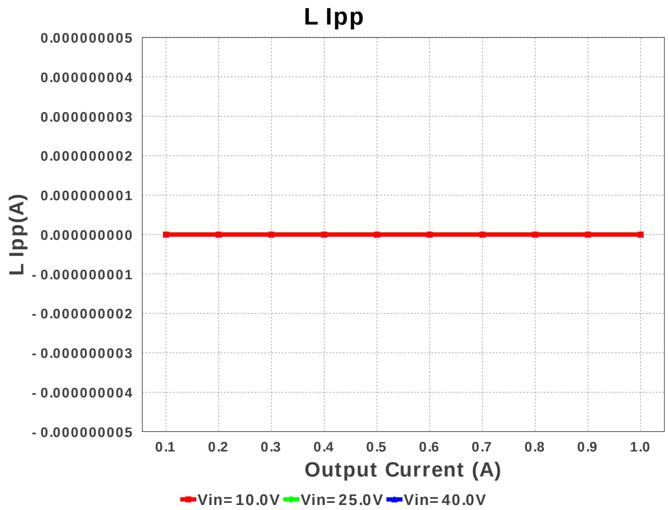

M Irms
M Irms(A)
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=25.0V Vin=40.0V

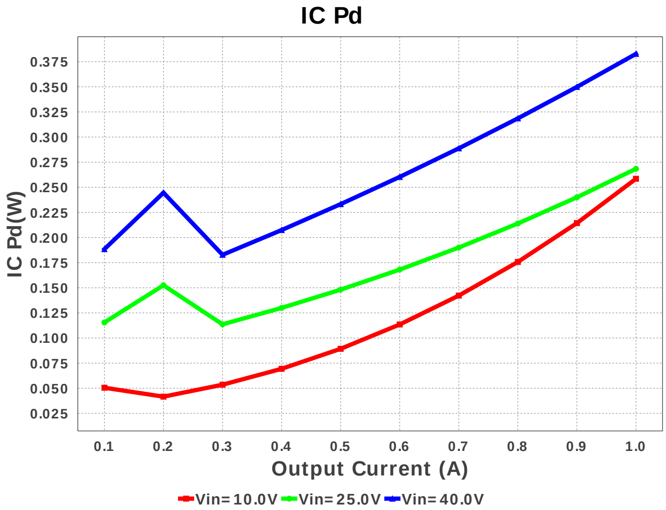

Pout
Pout(W)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=25.0V Vin=40.0V

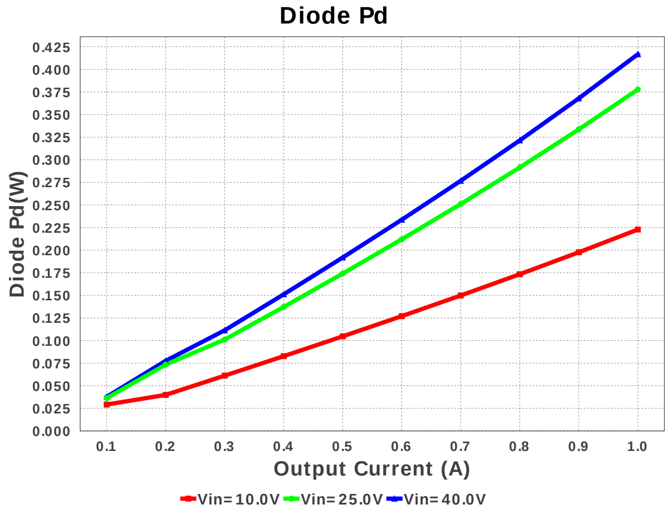

Iin Avg
Iin Avg(A)
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=25.0V Vin=40.0V


Total Pd
Total Pd(W)
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=25.0V Vin=40.0V









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	252.414 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	410.956 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	1.649 A	Current	Peak switch current in IC
4.	Iin Avg	147.21 mA	Current	Average input current
5.	L Ipp	1.298 A	Current	Peak-to-peak inductor ripple current
6.	M Irms	368.762 mA	Current	MOSFET RMS current
7.	BOM Count	14	General	Total Design BOM count
8.	FootPrint	173.0 mm²	General	Total Foot Print Area of BOM components
9.	Frequency	407.718 kHz	General	Switching frequency
10.	IC Tolerance	5.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	166.98 mV	General	Voltage drop across the MosFET
12.	Mode	CCM	General	Conduction Mode
13.	Pout	5.0 W	General	Total output power
14.	Total BOM	$1.93	General	Total BOM Cost
15.	D1 Tj	104.589 degC	Op_Point	D1 junction temperature
16.	Vout Actual	5.0 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
17.	Vout OP	5.0 V	Op_Point	Operational Output Voltage
18.	Duty Cycle	13.599 %	Op_point	Duty cycle
19.	Efficiency	84.912 %	Op_point	Steady state efficiency
20.	IC Tj	41.484 degC	Op_point	IC junction temperature
21.	ICThetaJA	30.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
22.	IOUT_OP	1.0 A	Op_point	Iout operating point
23.	VIN_OP	40.0 V	Op_point	Vin operating point
24.	Vout p-p	106.618 mV	Op_point	Peak-to-peak output ripple voltage
25.	Cin Pd	339.845 µW	Power	Input capacitor power dissipation
26.	Cout Pd	630.784 µW	Power	Output capacitor power dissipation
27.	Diode Pd	416.699 mW	Power	Diode power dissipation
28.	IC Pd	382.786 mW	Power	IC power dissipation
29.	L Pd	88.0 mW	Power	Inductor power dissipation
30.	Total Pd	888.442 mW	Power	Total Power Dissipation

#	Name	Value	Category	Description
31.	Vout Tolerance	1.212 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	1.0	Maximum Output Current
2.	VinMax	40.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	LM34914	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

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. LM34914 Product Folder : http://www.ti.com/product/LM34914 : contains the data sheet and other resources.