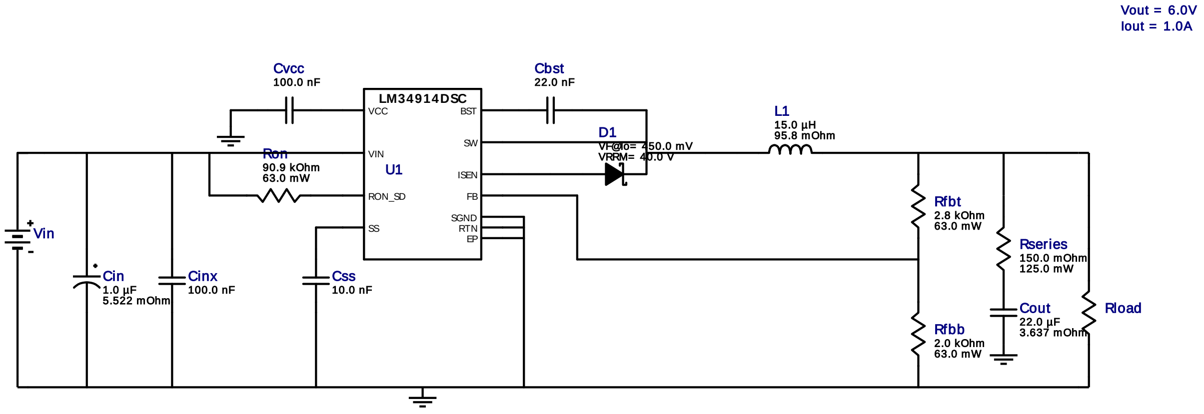
TEXAS INSTRUMENTS

WEBENCH ® Design Report

VinMin = 12.0V
VinMax = 24.0V
Vout = 6.0V
Iout = 1.0A

Device = LM34914SD/NOPB
Topology = Buck
Created = 8/12/16 7:42:00 AM
BOM Cost = $1.84
BOM Count = 13
Total Pd = 0.75W

Design : 4412135/17 LM34914SD/NOPB
LM34914SD/NOPB 12.0V-24.0V to 6.00V @ 1.0A

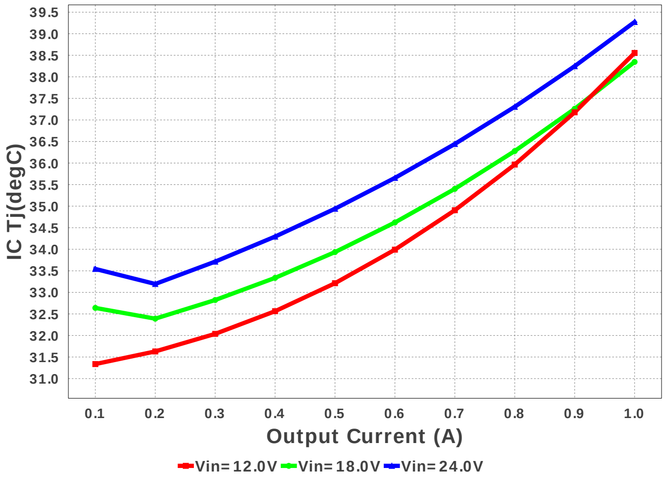


Electrical BOM

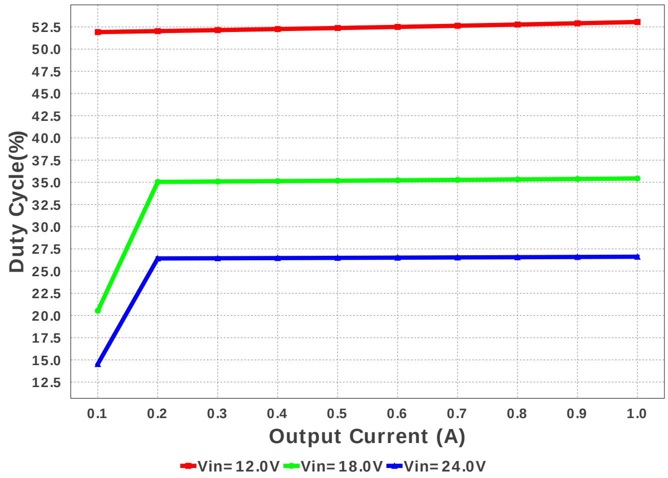
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	MuRata	GRM033C80J223KE01D Series= X6S	Cap= 22.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0201 2 mm^2
2.	Cin	TDK	C1608X7R1V105K080AC Series= X7R	Cap= 1.0 uF ESR= 5.522 mOhm VDC= 35.0 V IRMS= 2.2162 A	1	$0.05	0603 5 mm^2
3.	Cinx	MuRata	GRM21BR71E104KA01L Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
4.	Cout	MuRata	GRM31CR61A226KE19L Series= X5R	Cap= 22.0 uF ESR= 3.637 mOhm VDC= 10.0 V IRMS= 3.56456 A	1	$0.07	1206_190 11 mm^2
5.	Css	MuRata	GRM155R61C103KA01D Series= X5R	Cap= 10.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm^2
6.	Cvcc	MuRata	GRM21BR71E104KA01L Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
7.	D1	Diodes Inc.	1N5819HW-7-F	VF@Io= 450.0 mV VRRM= 40.0 V	1	$0.08	SOD-123 13 mm^2
8.	L1	Bourns	SRN6045-150M	L= 15.0 µH DCR= 95.8 mOhm	1	$0.16	SRN6045 64 mm^2
9.	Rfbb	Vishay-Dale	CRCW04022K00FKED Series= CRCW..e3	Res= 2.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
10.	Rfbt	Vishay-Dale	CRCW04022K80FKED Series= CRCW..e3	Res= 2.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
11.	Ron	Vishay-Dale	CRCW040290K9FKED Series= CRCW..e3	Res= 90.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
12.	Rseries	Panasonic	ERJ-2BSFR15X Series= ERJ-2B	Res= 150.0 mOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.06	0402 3 mm^2
13.	U1	Texas Instruments	LM34914SD/NOPB	Switcher	1	$1.35	DSC0010B 16 mm^2

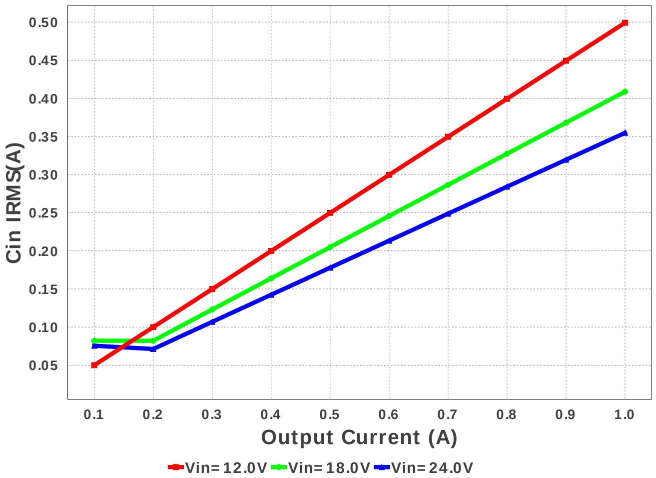
IC Tj



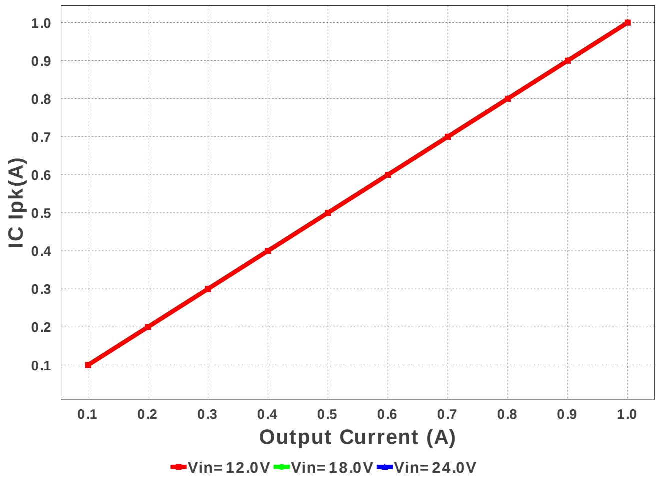
Duty Cycle

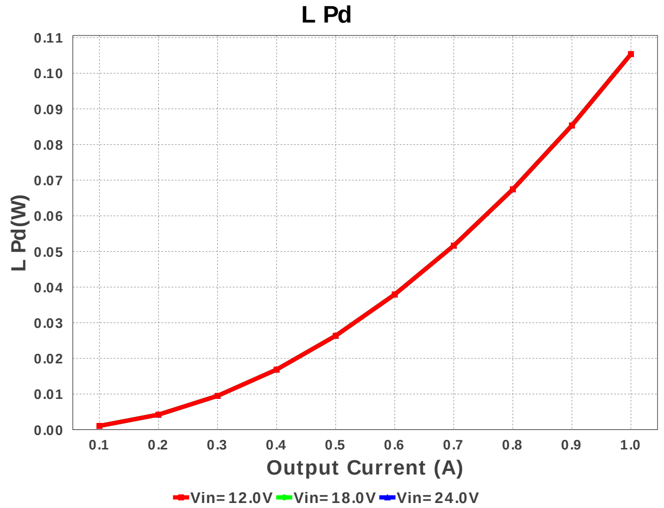


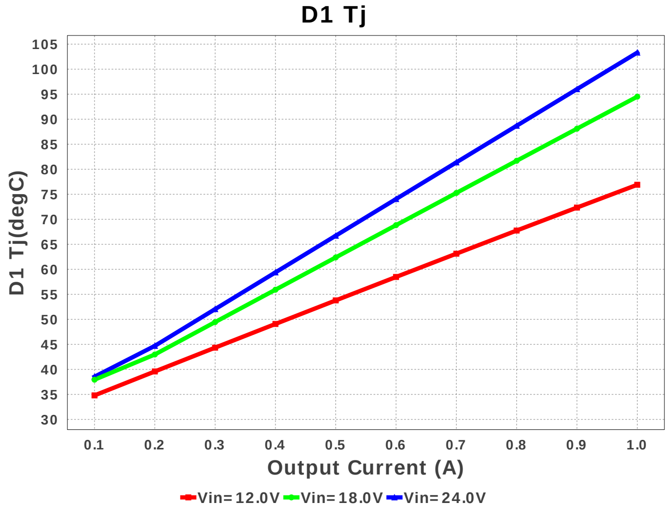
Cin IRMS

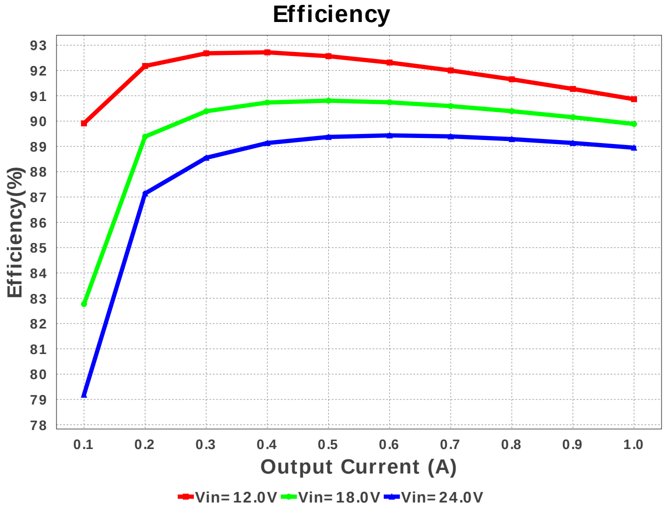


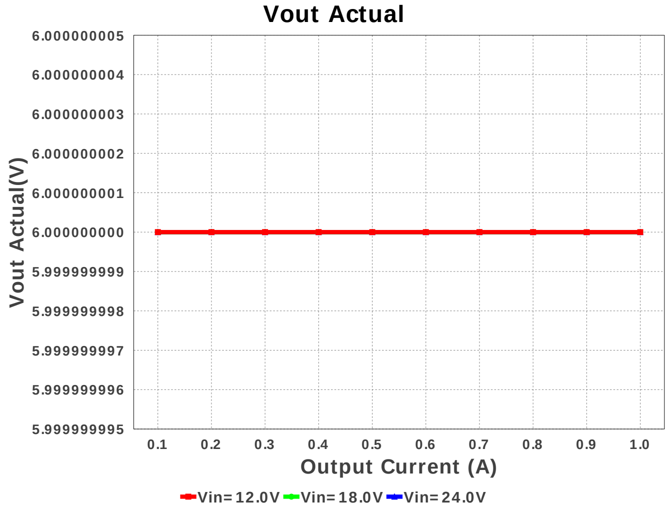
IC Ipk

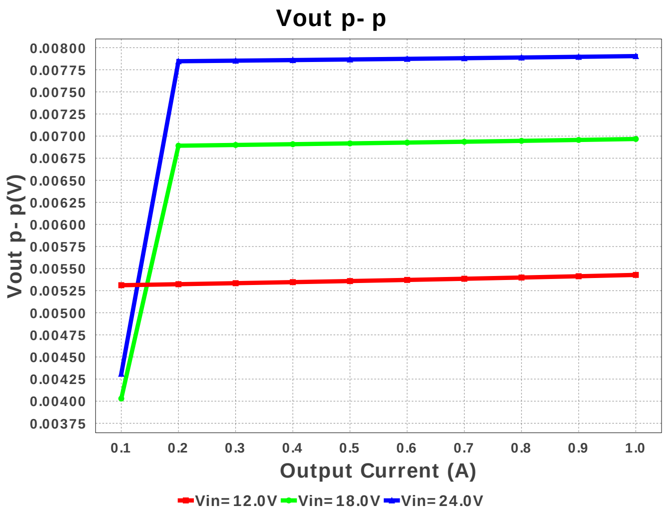


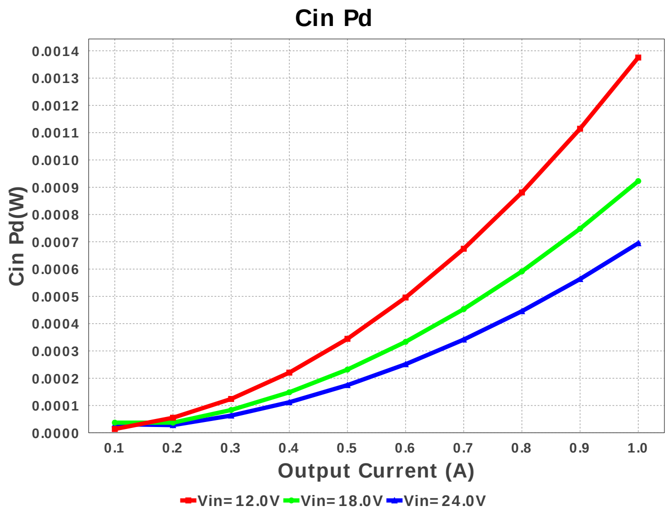

L Pd
L Pd(W)
Output Current (A)
Vin=12.0V Vin=18.0V Vin=24.0V

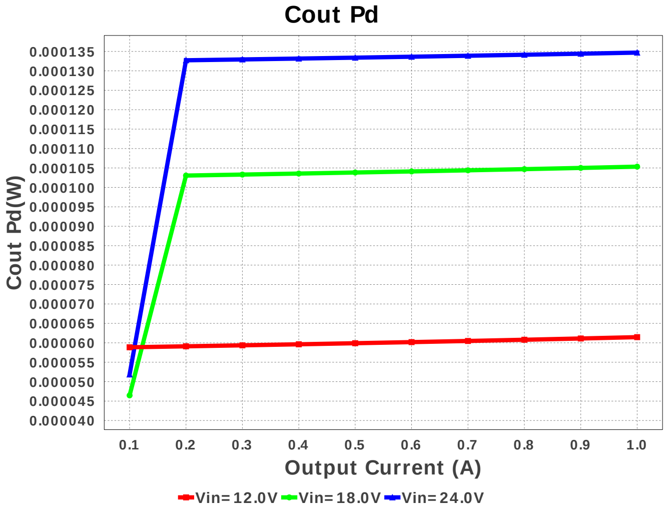

D1 Tj
D1 Tj(degC)
Output Current (A)
Vin=12.0V Vin=18.0V Vin=24.0V

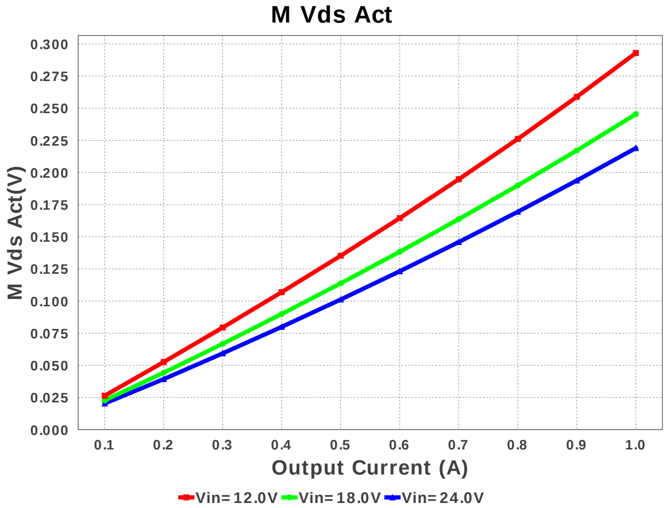

Efficiency
Efficiency(%)
Output Current (A)
Vin=12.0V Vin=18.0V Vin=24.0V

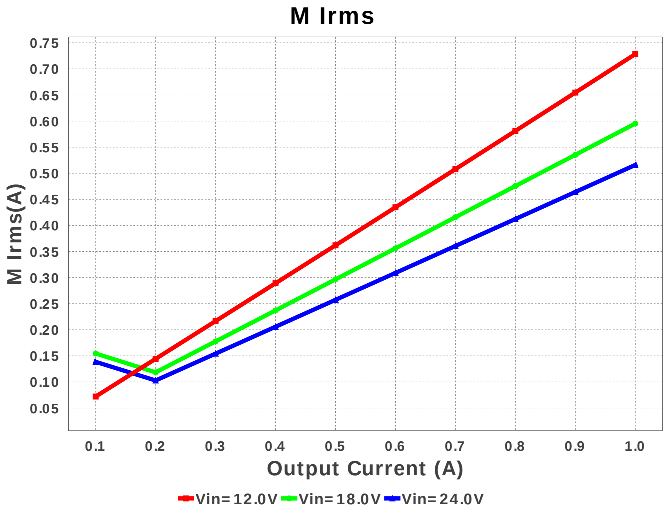

Vout Actual
Vout Actual(V)
Output Current (A)
Vin=12.0V Vin=18.0V Vin=24.0V

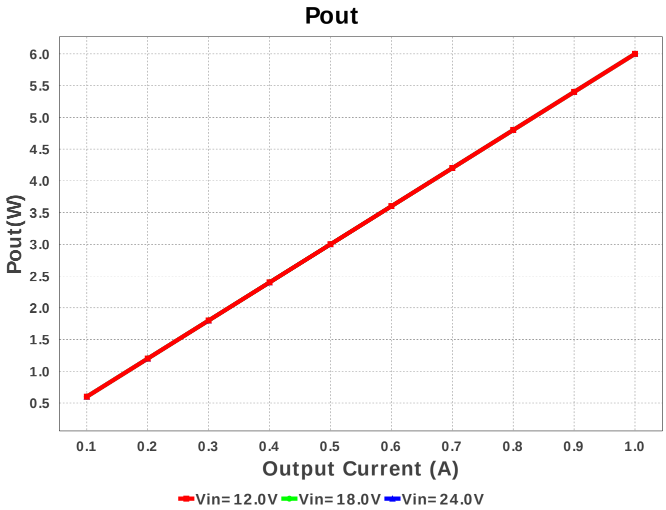

Vout p- p
Vout p- p(V)
Output Current (A)
Vin=12.0V Vin=18.0V Vin=24.0V

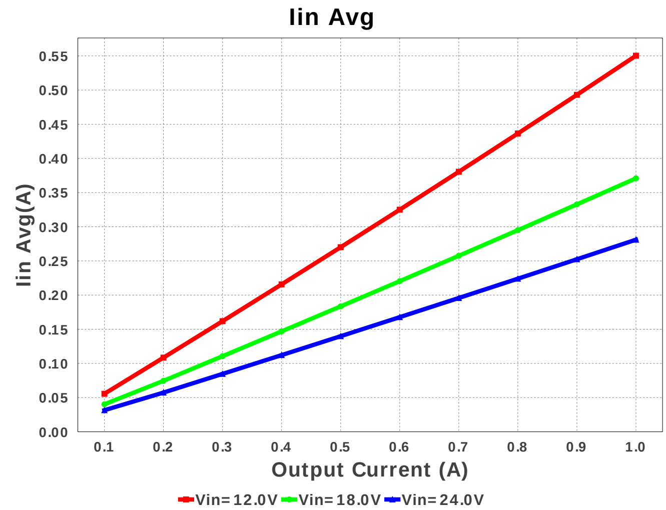

Cin Pd
Cin Pd(W)
Output Current (A)
Vin=12.0V Vin=18.0V Vin=24.0V

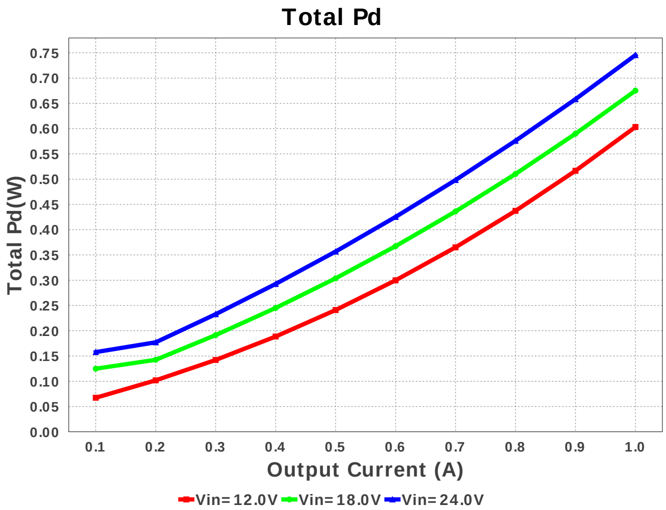

Cout Pd
Cout Pd(W)
Output Current (A)
Vin= 12.0V Vin= 18.0V Vin= 24.0V

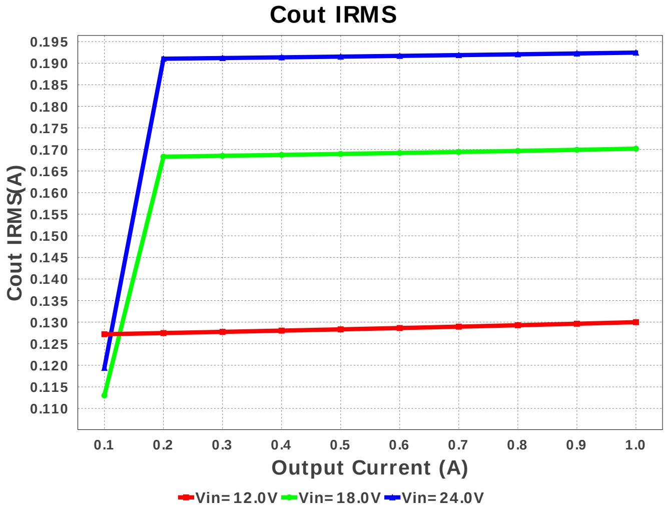

M Vds Act
M Vds Act(V)
Output Current (A)
Vin= 12.0V Vin= 18.0V Vin= 24.0V

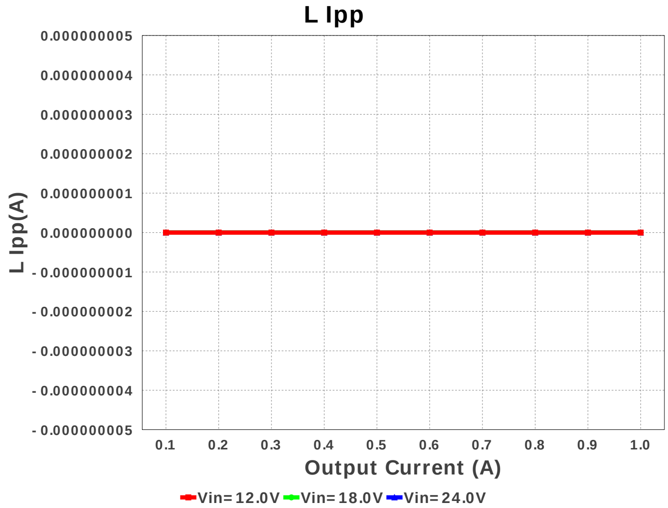

M Irms
M Irms(A)
Output Current (A)
Vin= 12.0V Vin= 18.0V Vin= 24.0V

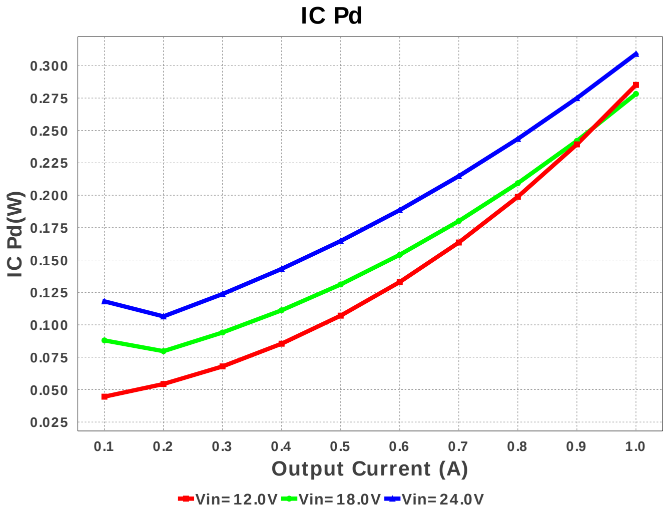

Pout
Pout(W)
Output Current (A)
Vin= 12.0V Vin= 18.0V Vin= 24.0V

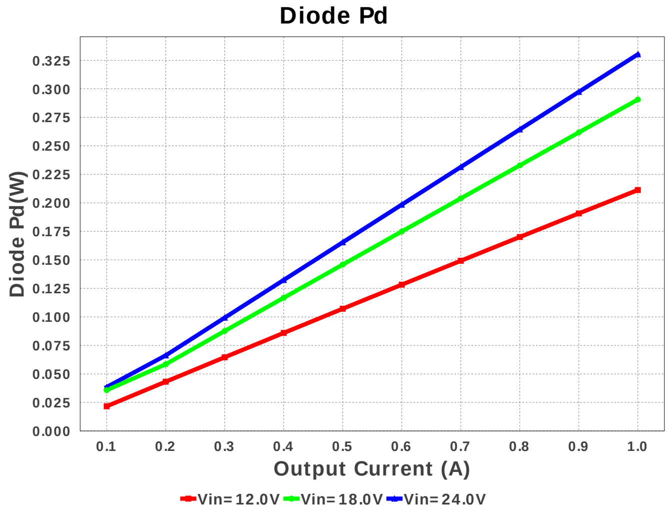

Iin Avg
Iin Avg(A)
Output Current (A)
Vin= 12.0V Vin= 18.0V Vin= 24.0V


Total Pd
Total Pd(W)
Output Current (A)
Vin= 12.0V Vin= 18.0V Vin= 24.0V









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	354.703 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	192.445 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	1.308 A	Current	Peak switch current in IC
4.	Iin Avg	281.06 mA	Current	Average input current
5.	L Ipp	615.93 mA	Current	Peak-to-peak inductor ripple current
6.	M Irms	515.934 mA	Current	MOSFET RMS current
7.	BOM Count	13	General	Total Design BOM count
8.	FootPrint	139.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	479.152 kHz	General	Switching frequency
10.	IC Tolerance	5.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	218.998 mV	General	Voltage drop across the MosFET
12.	Mode	CCM	General	Conduction Mode
13.	Pout	6.0 W	General	Total output power
14.	Total BOM	$1.84	General	Total BOM Cost
15.	D1 Tj	103.308 degC	Op_Point	D1 junction temperature
16.	Vout Actual	6.0 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
17.	Vout OP	6.0 V	Op_Point	Operational Output Voltage
18.	Duty Cycle	26.619 %	Op_point	Duty cycle
19.	Efficiency	88.948 %	Op_point	Steady state efficiency
20.	IC Tj	39.273 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	24.0 V	Op_point	Vin operating point
24.	Vout p-p	100.294 mV	Op_point	Peak-to-peak output ripple voltage
25.	Cin Pd	694.746 µW	Power	Input capacitor power dissipation
26.	Cout Pd	134.696 µW	Power	Output capacitor power dissipation
27.	Diode Pd	330.215 mW	Power	Diode power dissipation
28.	IC Pd	309.088 mW	Power	IC power dissipation
29.	L Pd	105.38 mW	Power	Inductor power dissipation
30.	Total Pd	745.506 mW	Power	Total Power Dissipation

#	Name	Value	Category	Description
31.	Vout Tolerance	1.381 %		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	24.0	Maximum input voltage
3.	VinMin	12.0	Minimum input voltage
4.	Vout	6.0	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.