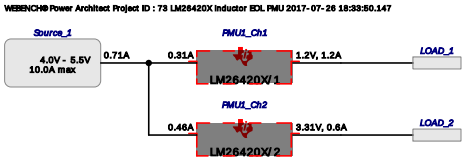
WEBENCH® Power Architect



Project Report

Project : 1240147/73 : LM26420X Inductor EOL
Created : 2017-07-26 18:33:50.147

Project Summary

1.	Total System Efficiency	87.78 %
2.	Total System BOM Count	18.0
3.	Total System Footprint	166.0 mm2
4.	Total System BOM Cost	$4.70
5.	Total System Power Dissipation	476.9 mW

--> Launch WEBENCH Power Architect.

My Comments

No comments

Sequencer Flag Table

Supply	Sequencer Flag	Load	Load Name
PMU1_Ch1	0	LOAD_1	
PMU1_Ch2	0	LOAD_2	
PMU1	NA		

Power Supplies

#	Name	NSID	Description	Vout	Iout	Efficiency	Foot-print	Cost	Design	Page
1.	PMU1_Ch1	LM26420X/1	Buck : Dual High-Frequency Step Down DC-DC regulator	1.2 V	1.2 A	84.7%	86	$2.72	728	7
2.	PMU1_Ch2	LM26420X/2	Buck : Dual High-Frequency Step Down DC-DC regulator	3.31 V	0.6 A	90.2%	70	$2.19	729	12
3.	PMU1	LM26420X	PMU : NA	V	NaN A	87.8%	137	$3.32	727	4

Power Loads

#	Name	VLoad	ILoad	Description
1.	LOAD_1	1.2 V	1.2 A	VoutRipple=10%
2.	LOAD_2	3.31 V	0.6 A	VoutRipple=10%

Project Diagram

Electrical Procurement BOM

Manufacturer	Part Number	Description	Quantity	Budgetary Price	Footprint (mm^2)
Wurth Elektronik	744043003	WE-TPC-M2	2	$0.75	67
TDK	C1608X5R1A226M080AC	0603	6	$0.12	14
Vishay-Dale	CRCW040210K0FKED	0402	4	$0.01	12
Vishay-Dale	CRCW040210K2FKED	0402	4	$0.01	12
Vishay-Dale	CRCW040249K9FKED	0402	3	$0.01	9
Vishay-Dale	CRCW04025R11FKED	0402	1	$0.01	3
Panasonic	ERJ-6ENF4992V	0805	1	$0.01	7
MuRata	GRM155R61A474KE15D	0402	1	$0.01	3
MuRata	GRM188R61C106MA73D	0603	3	$0.08	14
MuRata	GRM21BC80G226ME39L	0805	2	$0.04	7
MuRata	GRM21BR61C106KE15L	0805	1	$0.03	7
Texas Instruments	LM26420XSQ/NOPB	RUM0016A	3	$1.61	75
Yageo America	RC0603FR-075K1L	0603	2	$0.01	9
Yageo America	RT0805BRD0732KL	0805	2	$0.05	14
Bourns	SDR0302-8R2ML	SDR0302	2	$0.18	30
Total			37	$8.03	282.87

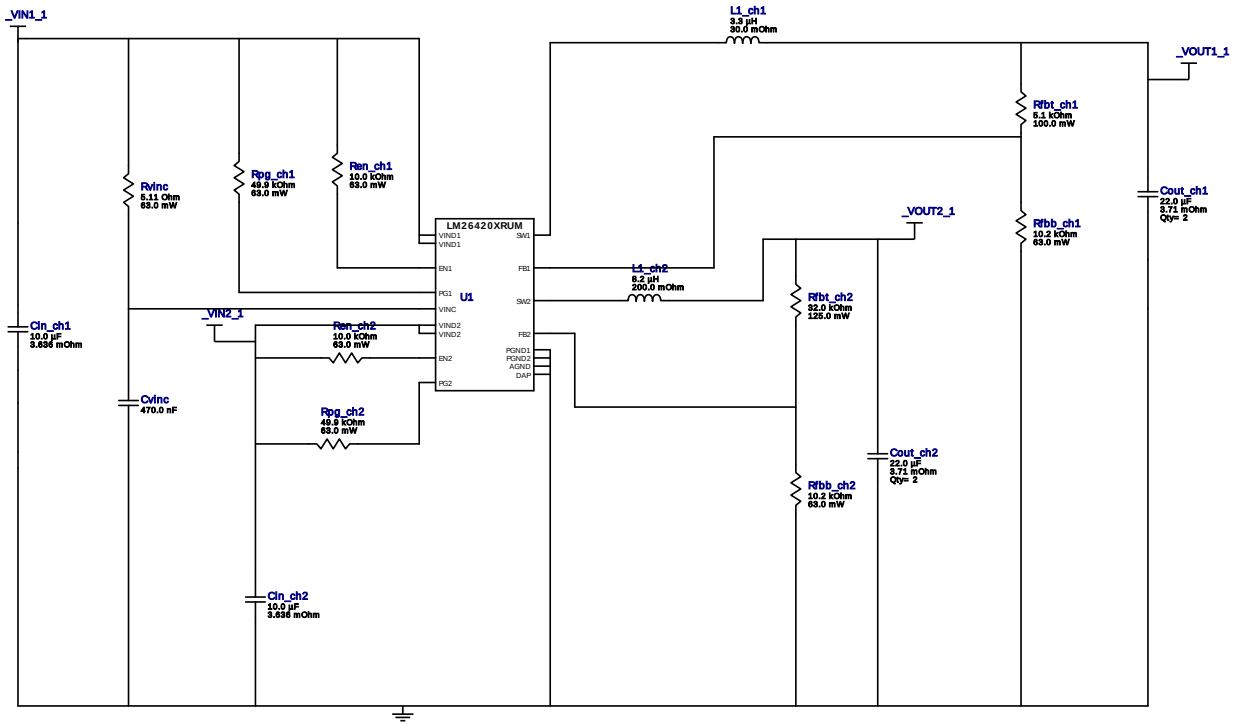
TEXAS INSTRUMENTS

WEBENCH® Design Report

Vout = 1.2V
Iout = 1.2A

Device = LM26420XSQ/NOPB
Topology = PMU
Created = 2017-07-26 18:33:49.209
BOM Cost = $3.32
BOM Count = 19
Total Pd = 0.48W

Design : 1240147/727 LM26420XSQ/NOPB
Design #35 from yuma.kudo@toshiba.co.jp

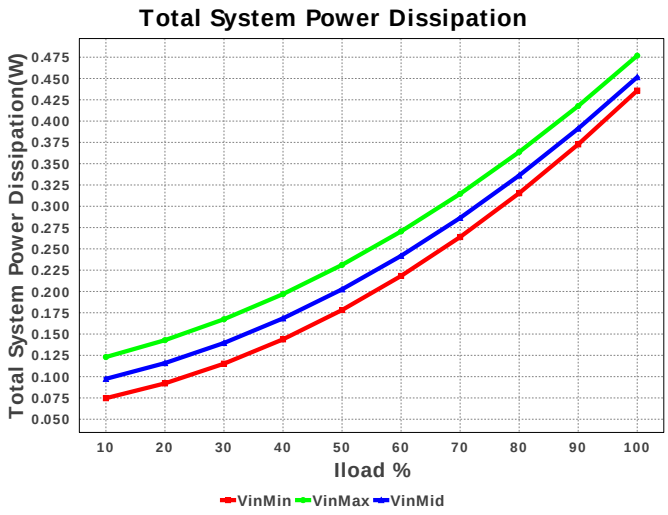


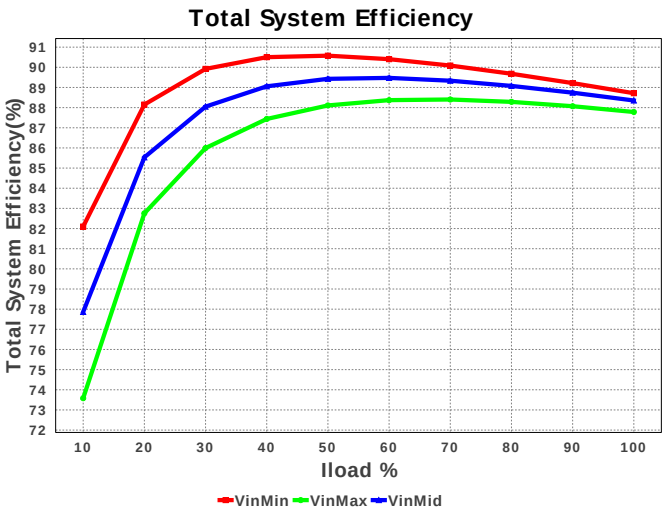
1. This schematic shows all the components for this Power Management Unit. The block diagram on the left shows how the channels are connected. Use the drop down PMU Options selector below the optimization dial on the summary page to get the details for each channel. Or click on the block diagram on the left to select a specific channel.

Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cin_ch1	MuRata	GRM188R61C106MA73D Series= X5R	Cap= 10.0 uF ESR= 3.636 mOhm VDC= 16.0 V IRMS= 2.8889 A	1	$0.08	0603 5 mm^2
2.	Cin_ch2	MuRata	GRM188R61C106MA73D Series= X5R	Cap= 10.0 uF ESR= 3.636 mOhm VDC= 16.0 V IRMS= 2.8889 A	1	$0.08	0603 5 mm^2
3.	Cout_ch1	TDK	C1608X5R1A226M080AC Series= X5R	Cap= 22.0 uF ESR= 3.71 mOhm VDC= 10.0 V IRMS= 2.69936 A	2	$0.12	0603 5 mm^2
4.	Cout_ch2	TDK	C1608X5R1A226M080AC Series= X5R	Cap= 22.0 uF ESR= 3.71 mOhm VDC= 10.0 V IRMS= 2.69936 A	2	$0.12	0603 5 mm^2
5.	Cvinc	MuRata	GRM155R61A474KE15D Series= X5R	Cap= 470.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm^2
6.	L1_ch1	Wurth Elektronik	744043003	L= 3.3 µH DCR= 30.0 mOhm	1	$0.75	WE-TPC-M2 34 mm^2

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
7.	L1_ch2	Bourns	SDR0302-8R2ML	L= 8.2 µH DCR= 200.0 mOhm	1	$0.18	SDR0302 15 mm²
8.	Ren_ch1	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
9.	Ren_ch2	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
10.	Rfbb_ch1	Vishay-Dale	CRCW040210K2FKED Series= CRCW..e3	Res= 10.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
11.	Rfbb_ch2	Vishay-Dale	CRCW040210K2FKED Series= CRCW..e3	Res= 10.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
12.	Rfbt_ch1	Yageo America	RC0603FR-075K1L Series= ?	Res= 5.1 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
13.	Rfbt_ch2	Yageo America	RT0805BRD0732KL Series= ?	Res= 32.0 kOhm Power= 125.0 mW Tolerance= 0.1%	1	$0.05	0805 7 mm²
14.	Rpg_ch1	Vishay-Dale	CRCW040249K9FKED Series= CRCW..e3	Res= 49.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
15.	Rpg_ch2	Vishay-Dale	CRCW040249K9FKED Series= CRCW..e3	Res= 49.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
16.	Rvinc	Vishay-Dale	CRCW04025R11FKED Series= CRCW..e3	Res= 5.11 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
17.	U1	Texas Instruments	LM26420XSQ/NOPB	Switcher	1	$1.61	RUM0016A 25 mm²





Operating Values

#	Name	Value	Category	Description
1.	BOM Count	19	General	Total Design BOM count
2.	FootPrint	137.0 mm^2	General	Total PMU footprint area of BOM components
3.	Pout	3.426 W	General	Total PMU output power
4.	Total BOM	$3.32	General	Total BOM Cost
5.	Efficiency	87.784 %	Op_point	PMU steady state efficiency
6.	IC Tj	43.239 degC	Op_point	PMU IC junction temperature
7.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
8.	Cin_ch1 Pd	907.551 µW	Power	Input capacitor power dissipation
9.	Cin_ch2 Pd	311.802 µW	Power	Input capacitor power dissipation
10.	Cout_ch1 Pd	2.549 µW	Power	Output capacitor power dissipation
11.	Cout_ch2 Pd	796.07 nW	Power	Output capacitor power dissipation
12.	IC Pd	330.969 mW	Power	IC Pd
13.	L1_ch1 Pd	54.059 mW	Power	Inductor power dissipation
14.	L1_ch2 Pd	90.131 mW	Power	Inductor power dissipation
15.	Mod.ICDie_Pd	330.969 mW	Power	IC Pd
16.	Total Pd	476.75 mW	Power	PMU total power dissipation
17.	Total Pd	476.75 mW	Power	PMU total power dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	1.2	Maximum Output Current
2.	Iout1	1.2	Output Current #1
3.	Iout2	600.0 m	Output Current #2
4.	Vin1Max	5.5	Maximum Input Voltage #1
5.	Vin1Min	4.0	Minimum Input Voltage #1
6.	Vin2Max	5.5	Maximum Input Voltage #2
7.	Vin2Min	4.0	Minimum Input Voltage #2
8.	Vout	1.2	Output Voltage
9.	Vout1	1.2	Output Voltage #1
10.	Vout2	3.31	Output Voltage #2
11.	base_pn	LM26420X	Texas Instruments Base Part Number
12.	source	DC	Input Source Type
13.	ta	30.0	Ambient temperature

Design Assistance

1. LM26420X Product Folder : http://www.ti.com/product/lm26420 : contains the data sheet and other resources.

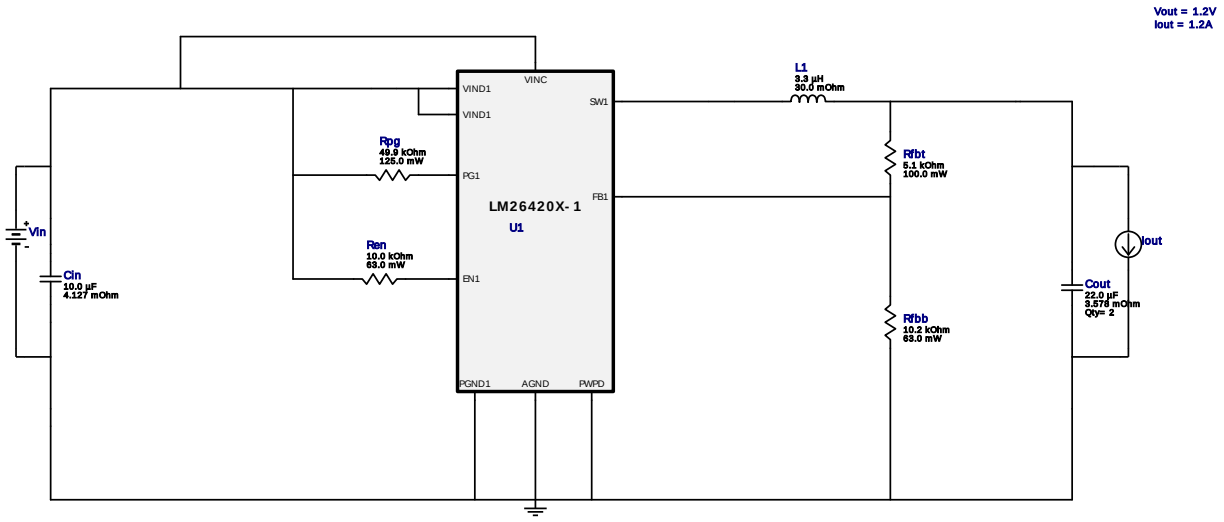
TEXAS INSTRUMENTS

WEBENCH® Design Report

Vout = 1.2V
Iout = 1.2A

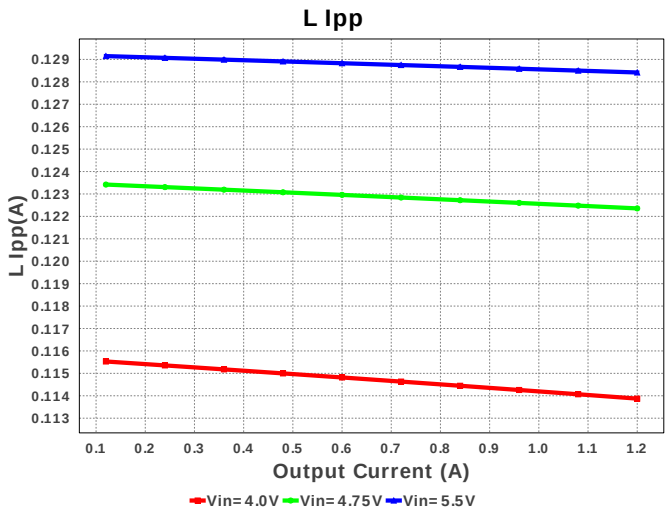
Device = LM26420XSQ/NOPB
Topology = Buck
Created = 2017-07-31 23:37:16.528
BOM Cost = $2.51
BOM Count = 9
Total Pd = 0.26W

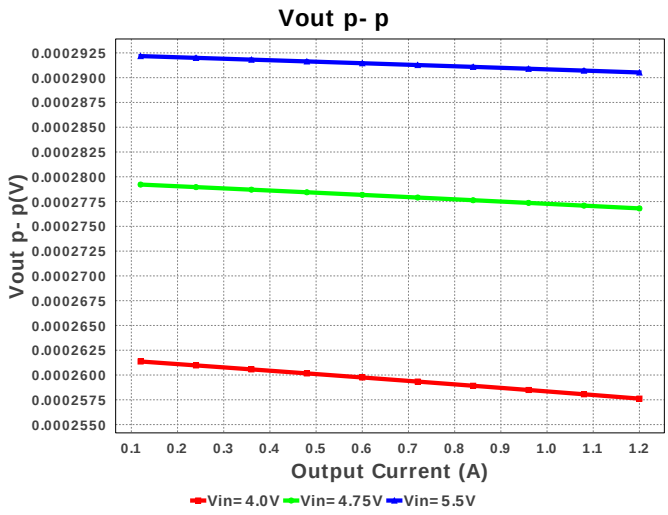
Design : 1240147/728 LM26420XSQ/NOPB
LM26420XSQ/NOPB 4.0V-5.5V to 1.20V @ 1.2A

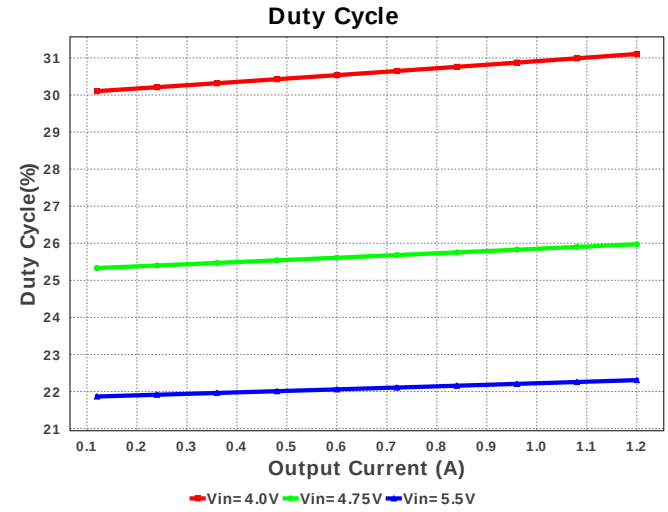


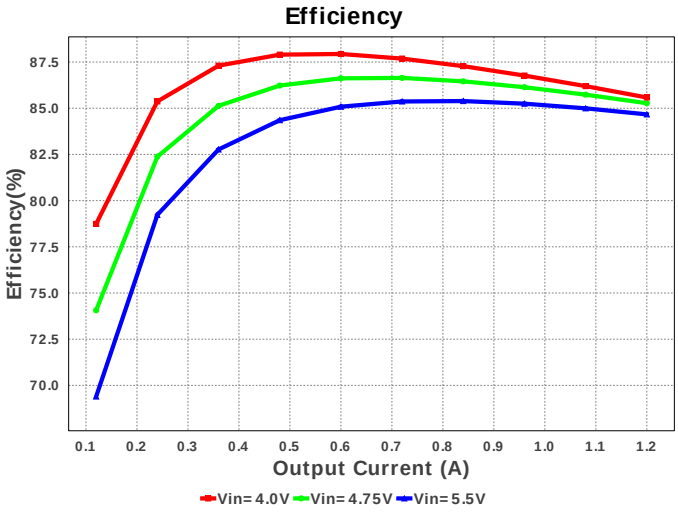
Electrical BOM

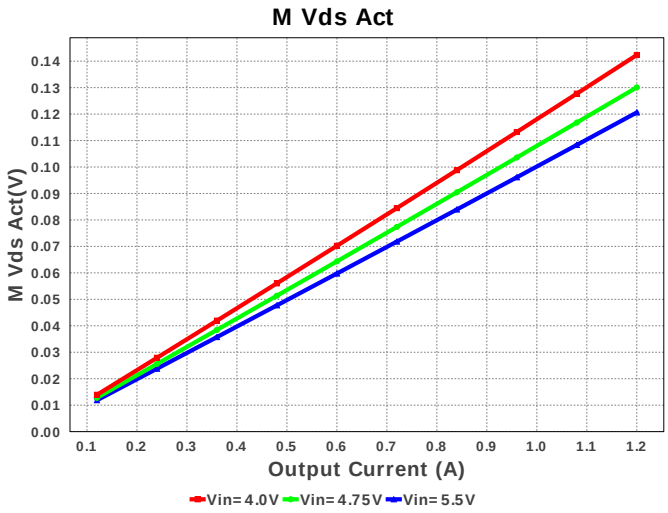
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cin	MuRata	GRM21BR61C106KE15L Series= X5R	Cap= 10.0 uF ESR= 4.127 mOhm VDC= 16.0 V IRMS= 2.46634 A	1	$0.03	0805 7 mm²
2.	Cout	MuRata	GRM21BC80G226ME39L Series= X6S	Cap= 22.0 uF ESR= 3.578 mOhm VDC= 4.0 V IRMS= 3.29633 A	2	$0.04	0805 7 mm²
3.	L1	Wurth Elektronik	744043003	L= 3.3 µH DCR= 30.0 mOhm	1	$0.75	WE-TPC-M2 34 mm²
4.	Ren	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
5.	Rfbb	Vishay-Dale	CRCW040210K2FKED Series= CRCW..e3	Res= 10.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
6.	Rfbt	Yageo America	RC0603FR-075K1L Series= ?	Res= 5.1 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
7.	Rpg	Panasonic	ERJ-6ENF4992V Series= ERJ-6E	Res= 49.9 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
8.	U1	Texas Instruments	LM26420XSQ/NOPB	Switcher	1	$1.61	RUM0016A 25 mm²

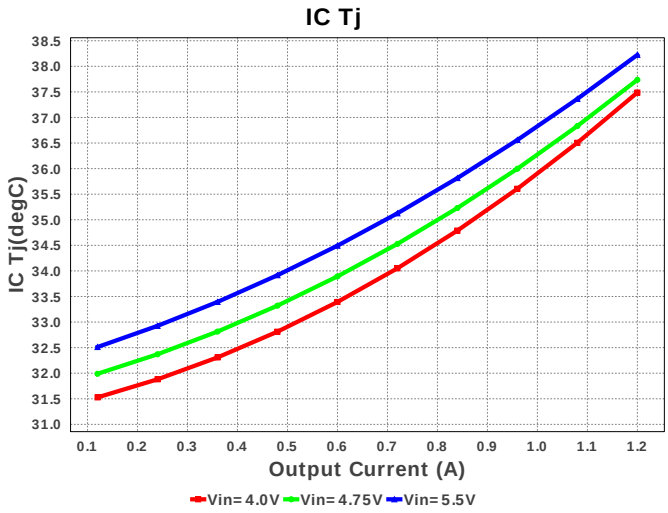


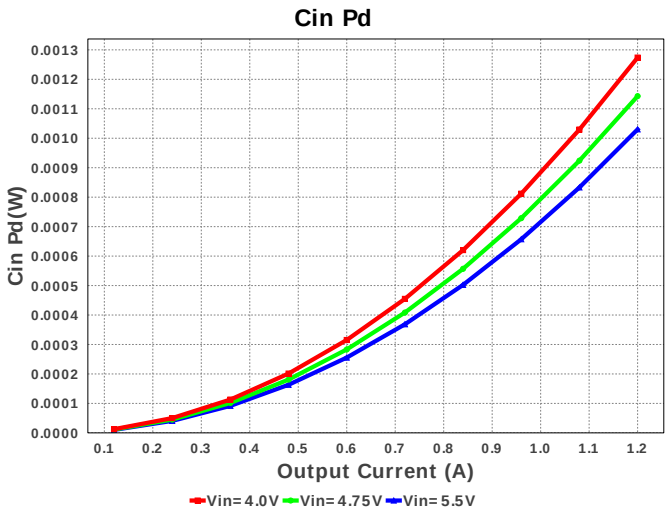


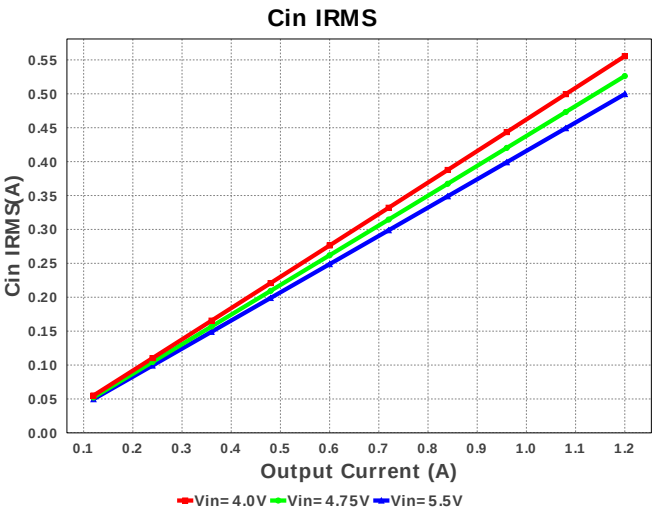


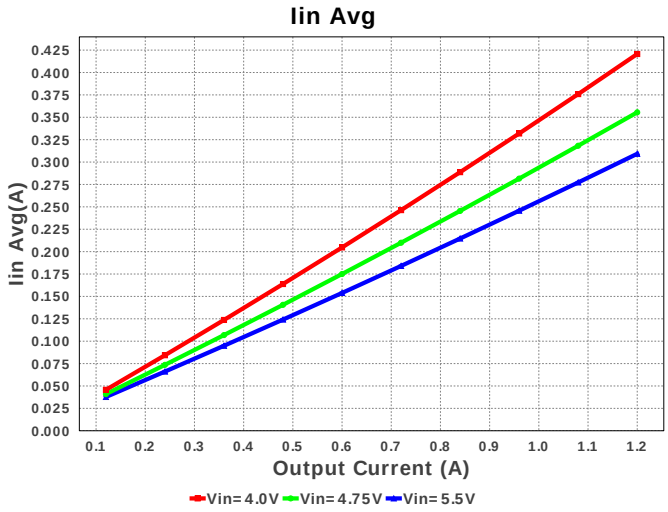


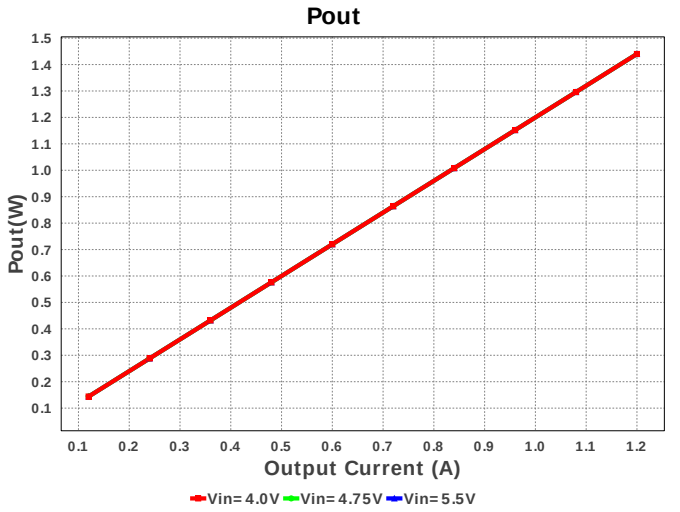


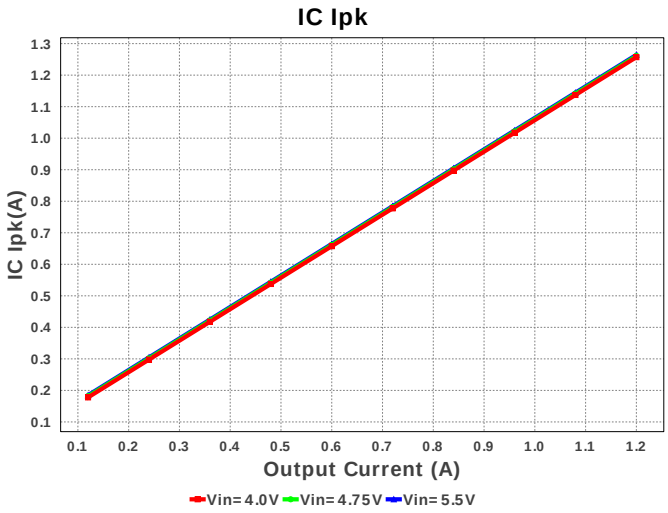


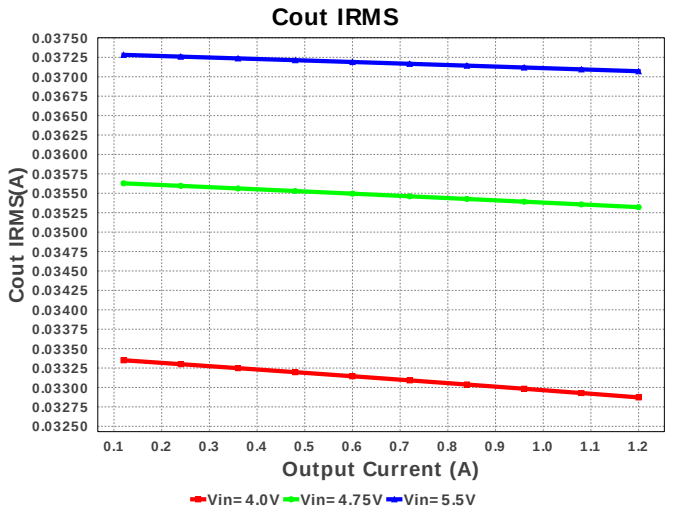


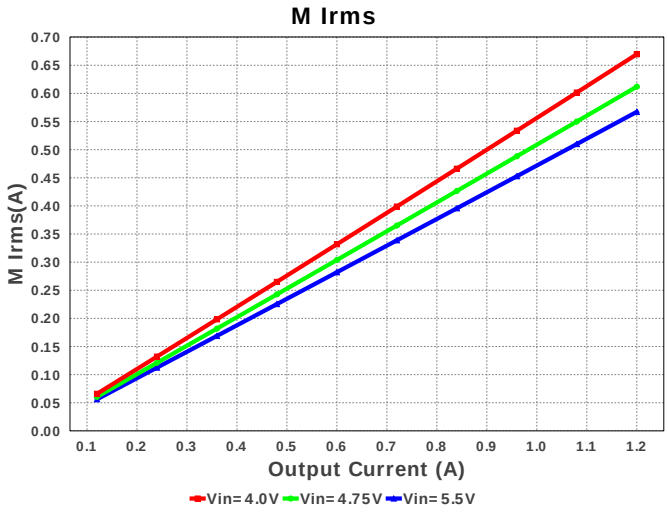


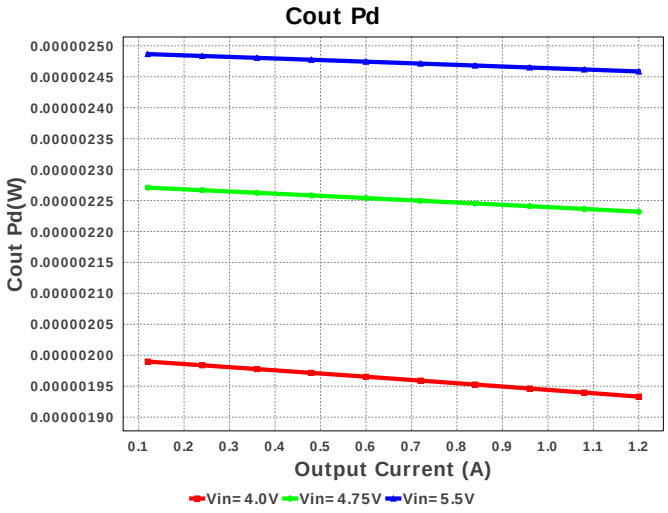


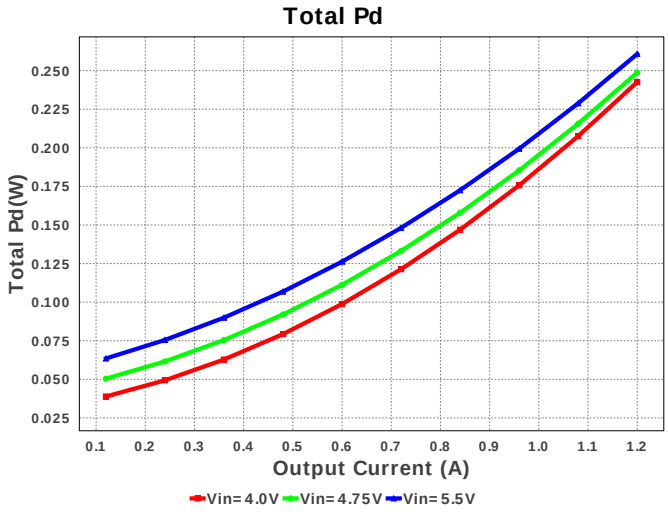


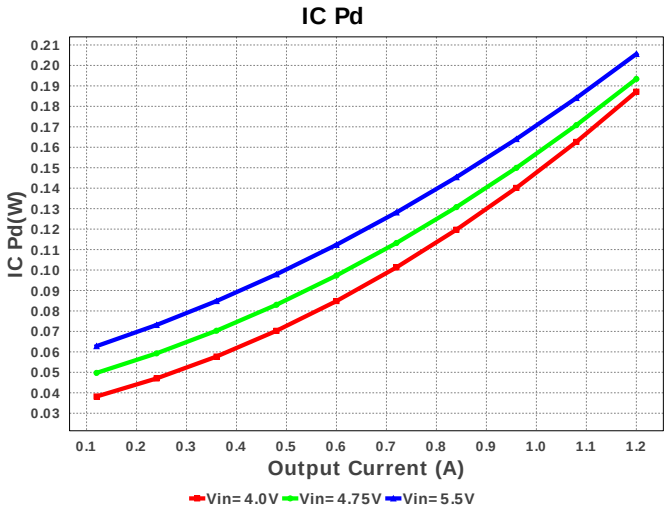


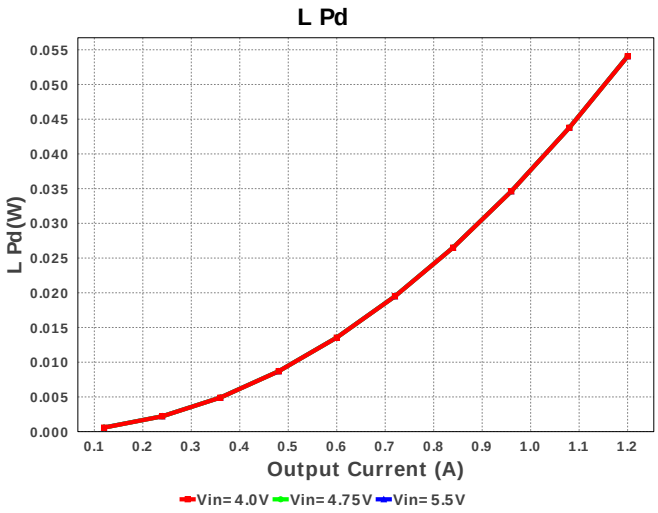


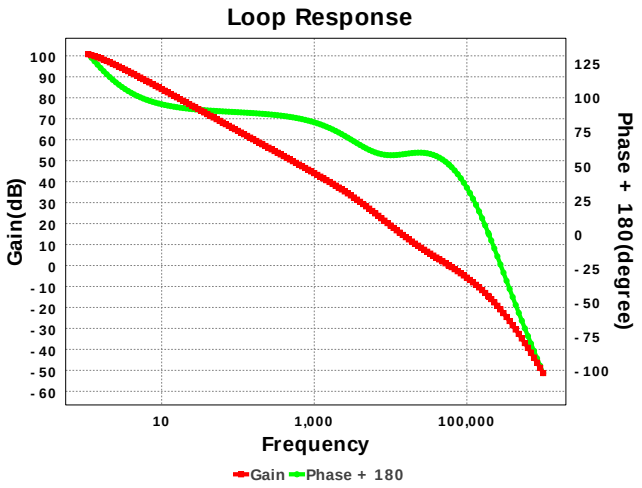












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	499.601 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	37.071 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	1.264 A	Current	Peak switch current in IC
4.	Iin Avg	309.23 mA	Current	Average input current
5.	L Ipp	128.42 mA	Current	Peak-to-peak inductor ripple current
6.	M Irms	567.194 mA	Current	MOSFET RMS current
7.	BOM Count	9	General	Total Design BOM count
8.	FootPrint	96.0 mm^2	General	Total Foot Print Area of BOM components
9.	Frequency	2.2 MHz	General	Switching frequency
10.	IC Tolerance	20.0 mV	General	IC Feedback Tolerance
11.	M Vds Act	120.61 mV	General	Voltage drop across the MosFET

#	Name	Value	Category	Description
12.	Mode	CCM	General	Conduction Mode
13.	Pout	1.44 W	General	Total output power
14.	Total BOM	$2.51	General	Total BOM Cost
15.	Low Freq Gain	100.769 dB	Op_Point	Gain at 1Hz
16.	Low Freq Gain	100.769 dB	Op_Point	Gain at 1Hz
17.	Vout Actual	1.2 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
18.	Vout OP	1.2 V	Op_Point	Operational Output Voltage
19.	Cross Freq	55.033 kHz	Op_point	Bode plot crossover frequency
20.	Cross Freq	58.388 kHz	Op_point	Bode plot crossover frequency
21.	Duty Cycle	22.307 %	Op_point	Duty cycle
22.	Efficiency	84.667 %	Op_point	Steady state efficiency
23.	Gain Marg	-15.444 dB	Op_point	Bode Plot Gain Margin
24.	Gain Marg	-14.864 dB	Op_point	Bode Plot Gain Margin
25.	IC Tj	38.224 degC	Op_point	IC junction temperature
26.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
27.	IOUT_OP	1.2 A	Op_point	Iout operating point
28.	Phase Marg	52.237 deg	Op_point	Bode Plot Phase Margin
29.	Phase Marg	51.319 deg	Op_point	Bode Plot Phase Margin
30.	VIN_OP	5.5 V	Op_point	Vin operating point
31.	Vout p-p	290.523 μV	Op_point	Peak-to-peak output ripple voltage
32.	Cin Pd	1.03 mW	Power	Input capacitor power dissipation
33.	Cout Pd	2.459 μW	Power	Output capacitor power dissipation
34.	IC Pd	205.593 mW	Power	IC power dissipation
35.	L Pd	54.059 mW	Power	Inductor power dissipation
36.	Total Pd	260.778 mW	Power	Total Power Dissipation
37.	Vout Tolerance	3.19 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	1.2	Maximum Output Current
2.	VinMax	5.5	Maximum input voltage
3.	VinMin	4.0	Minimum input voltage
4.	Vout	1.2	Output Voltage
5.	base_pn	LM26420X/1	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. LM26420X/1 Product Folder : http://www.ti.com/product/LM26420X : contains the data sheet and other resources.

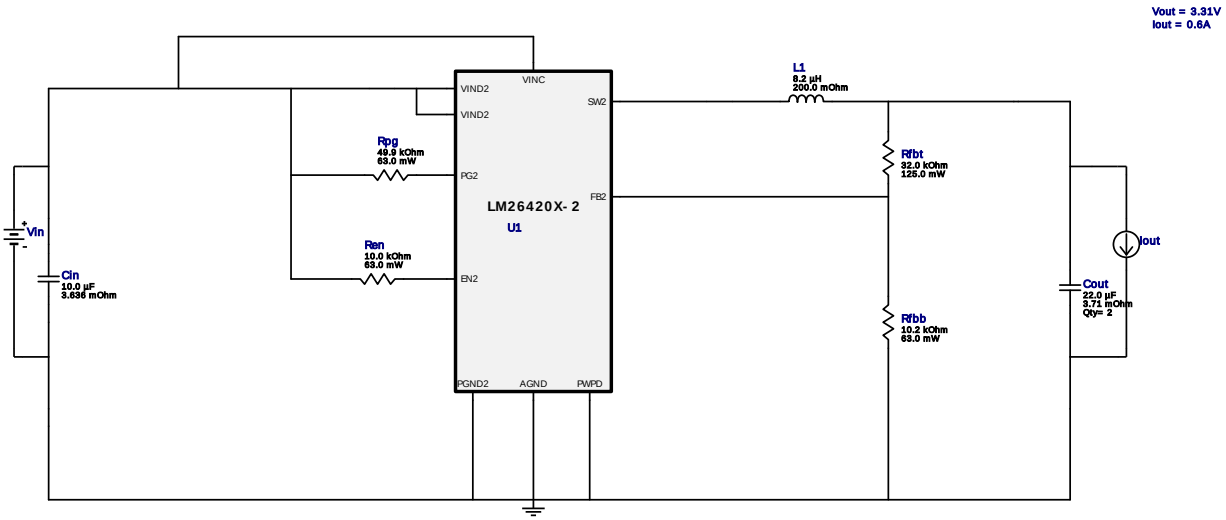
TEXAS INSTRUMENTS

WEBENCH® Design Report

Vout = 3.31V
Iout = 0.6A

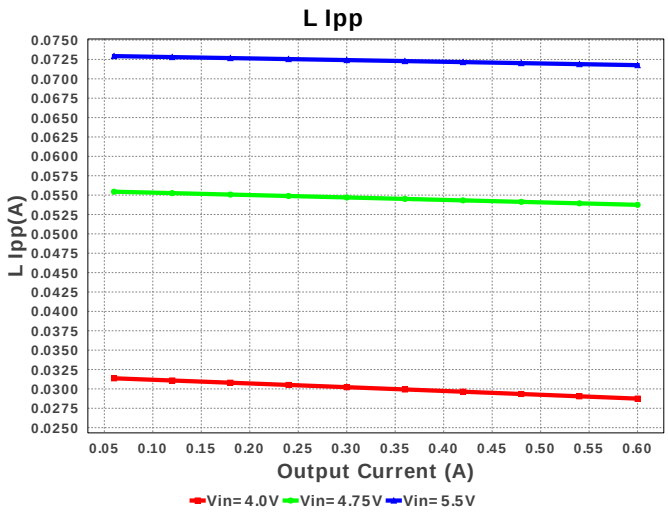
Device = LM26420XSQ/NOPB
Topology = Buck
Created = 2017-07-26 18:33:49.743
BOM Cost = $NaN
BOM Count = NaN
Total Pd = 0.22W

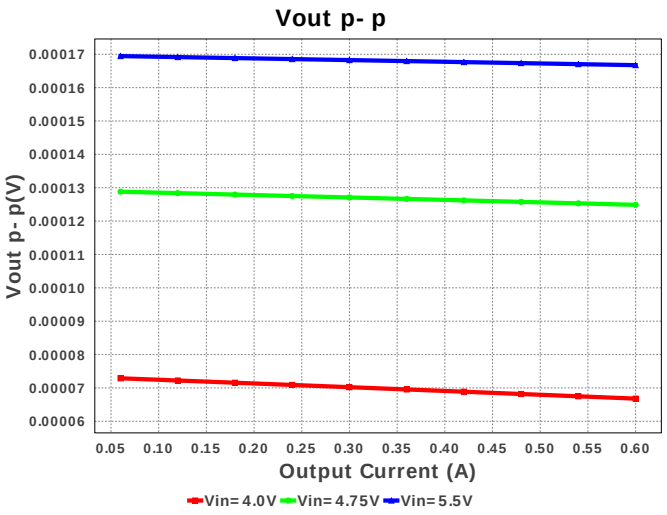
Design : 1240147/729 LM26420XSQ/NOPB
Design #37 from yuma.kudo@toshiba.co.jp

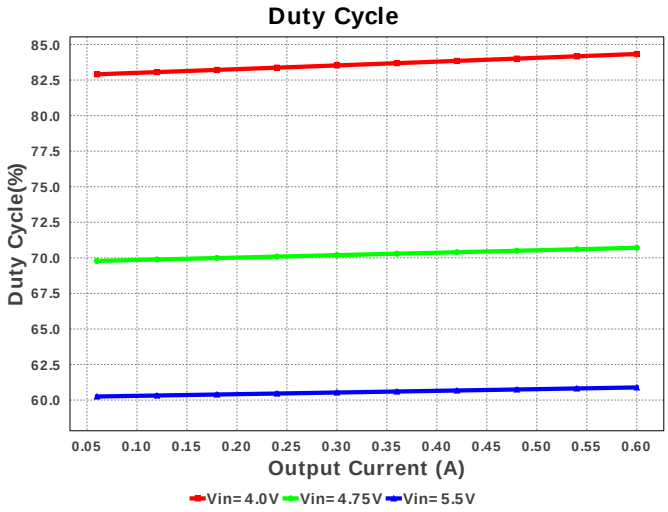


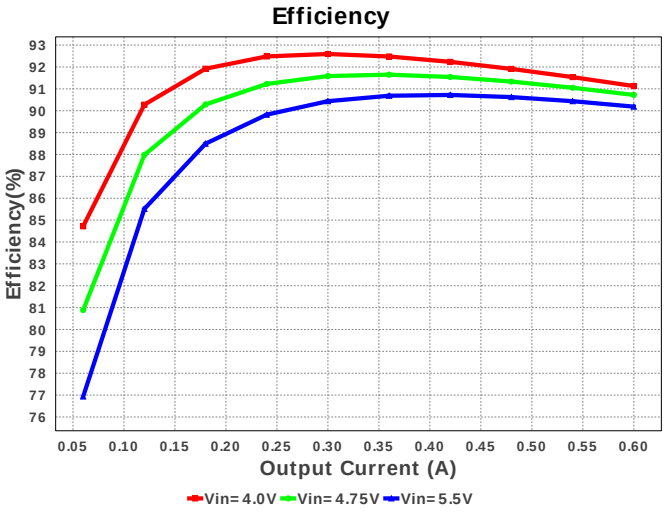
Electrical BOM

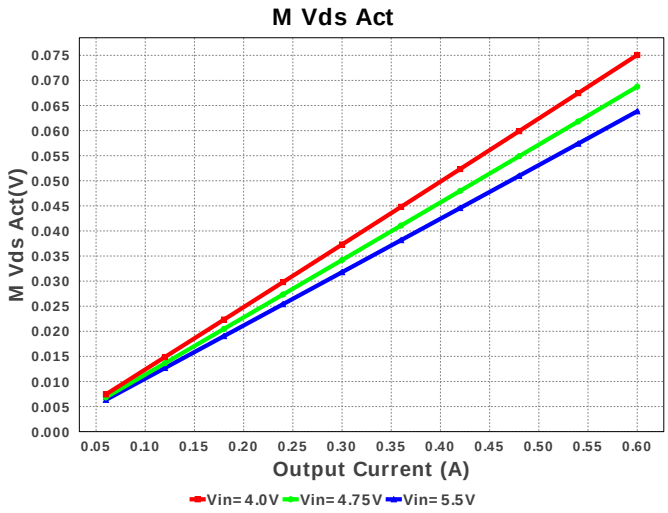
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cin	MuRata	GRM188R61C106MA73D Series= X5R	Cap= 10.0 uF ESR= 3.636 mOhm VDC= 16.0 V IRMS= 2.8889 A	1	$0.08	0603 5 mm^2
2.	Cout	TDK	C1608X5R1A226M080AC Series= X5R	Cap= 22.0 uF ESR= 3.71 mOhm VDC= 10.0 V IRMS= 2.69936 A	2	$0.12	0603 5 mm^2
3.	L1	Bourns	SDR0302-8R2ML	L= 8.2 µH DCR= 200.0 mOhm	1	$0.18	SDR0302 15 mm^2
4.	Ren	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
5.	Rfbb	Vishay-Dale	CRCW040210K2FKED Series= CRCW..e3	Res= 10.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
6.	Rfbt	Yageo America	RT0805BRD0732KL Series= ?	Res= 32.0 kOhm Power= 125.0 mW Tolerance= 0.1%	1	$0.05	0805 7 mm^2
7.	Rpg	Vishay-Dale	CRCW040249K9FKED Series= CRCW..e3	Res= 49.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
8.	U1	Texas Instruments	LM26420XSQ/NOPB	Switcher	0	$1.61	RUM0016A 25 mm^2

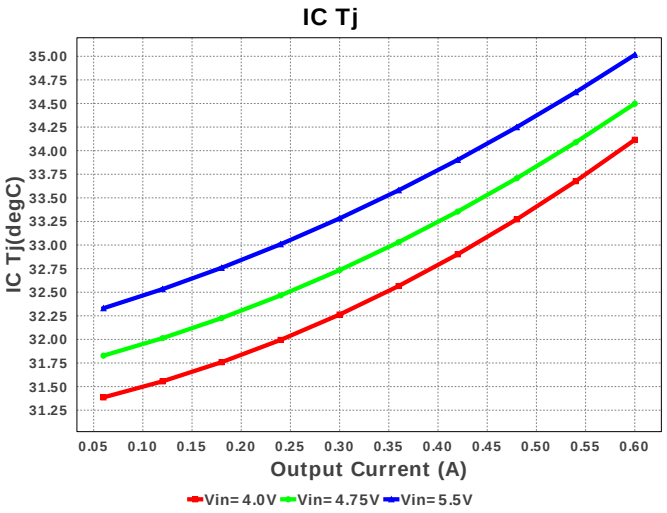


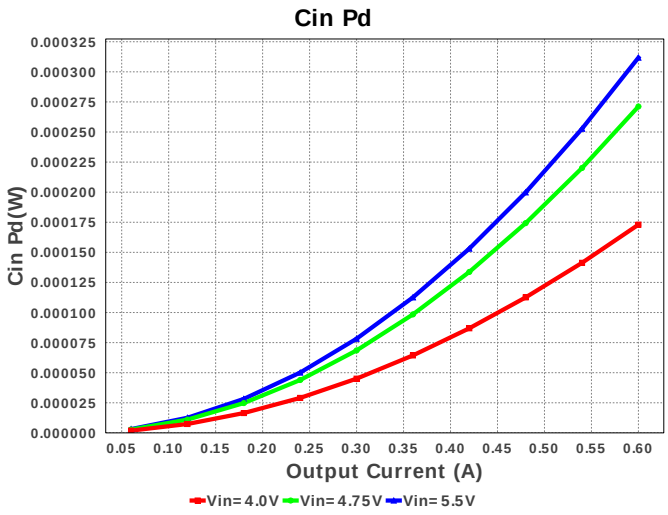


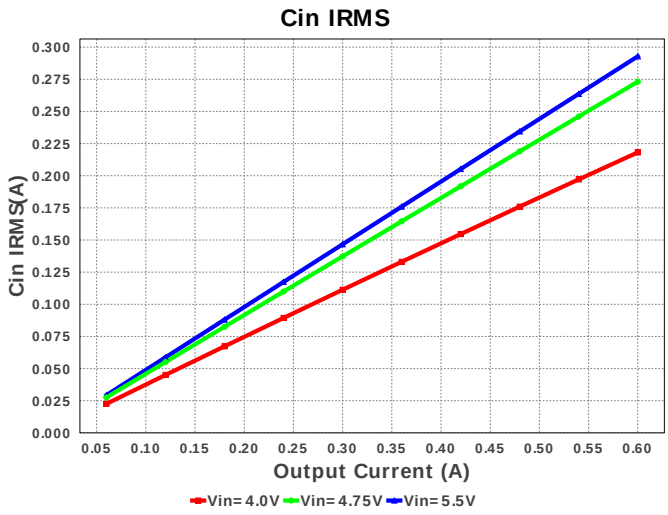


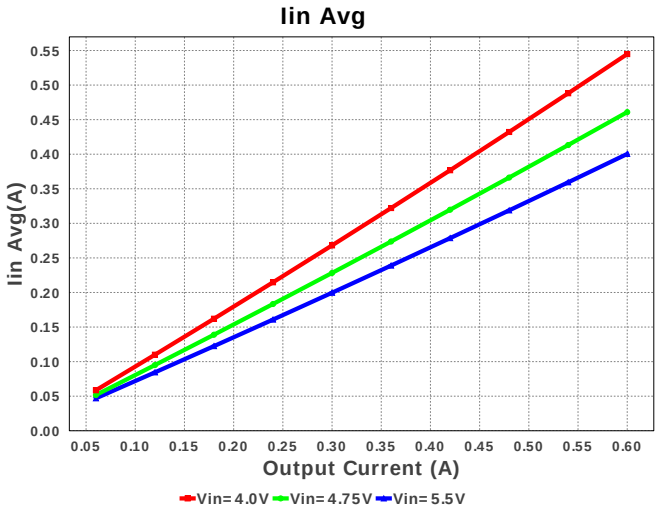


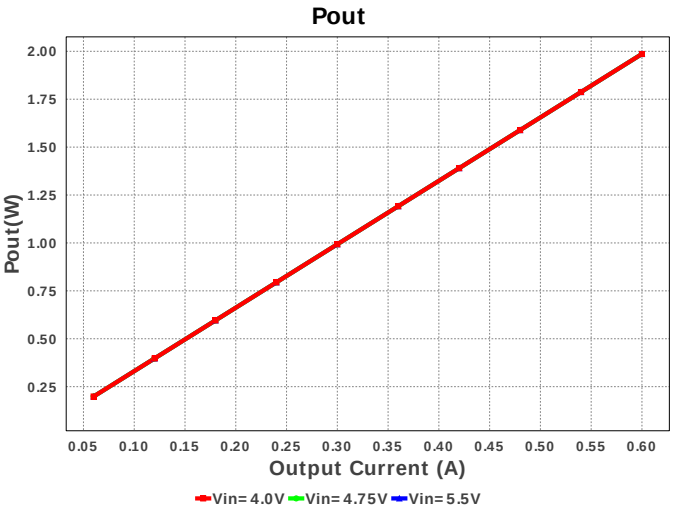


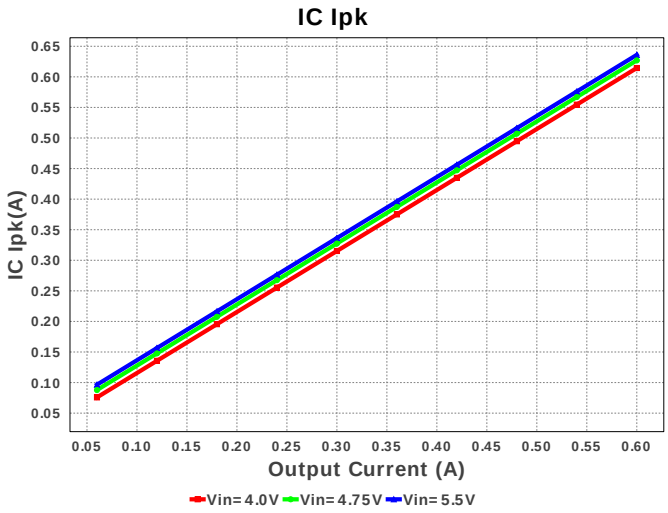


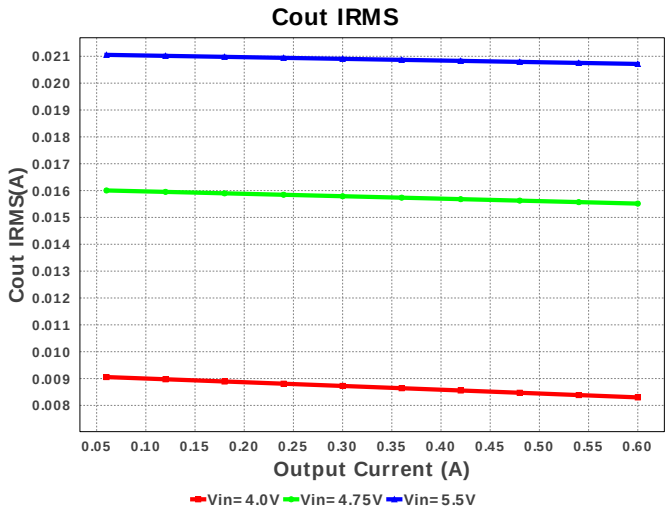


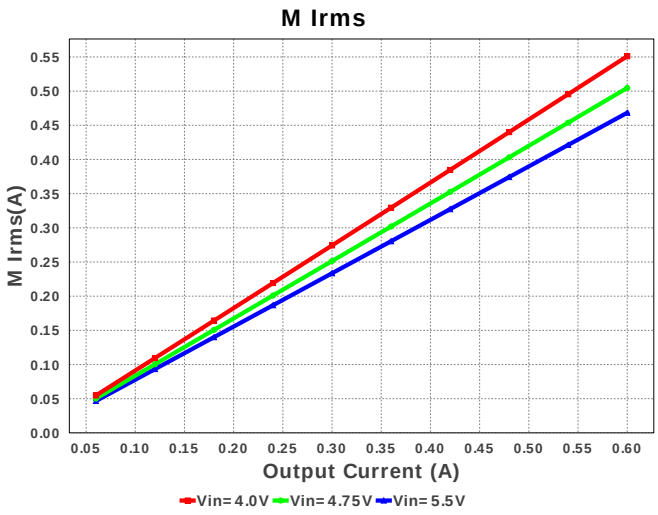


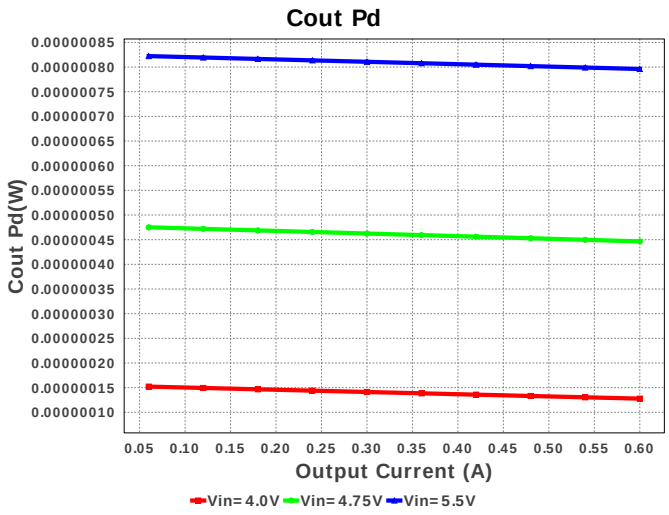


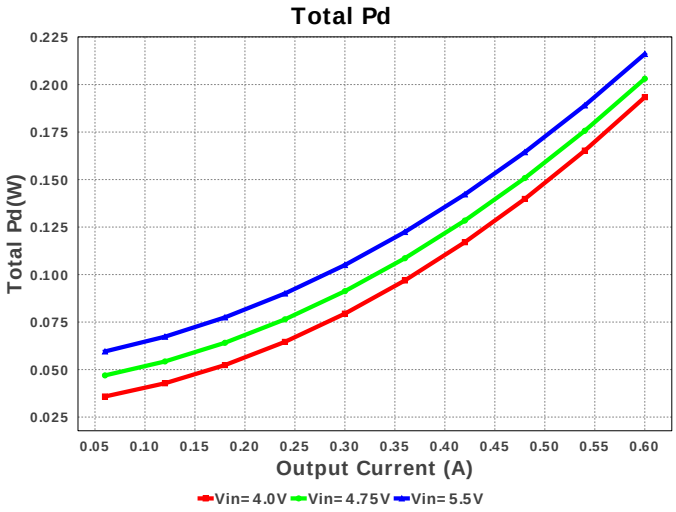


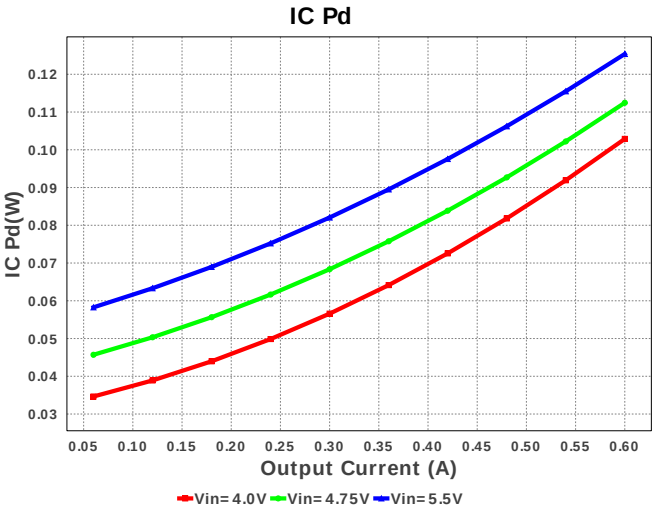


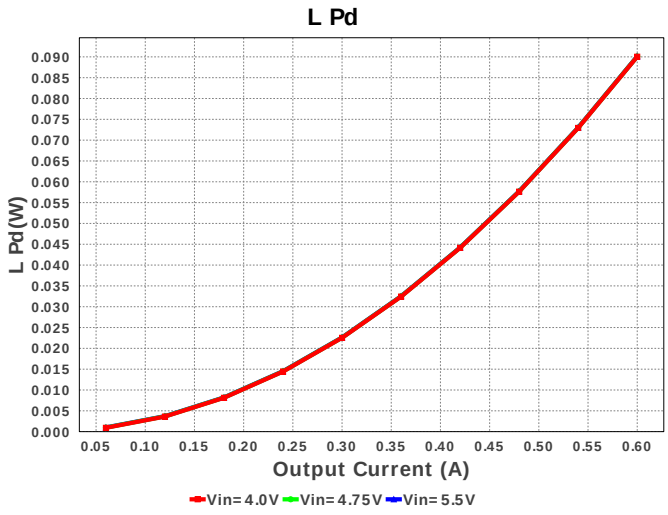


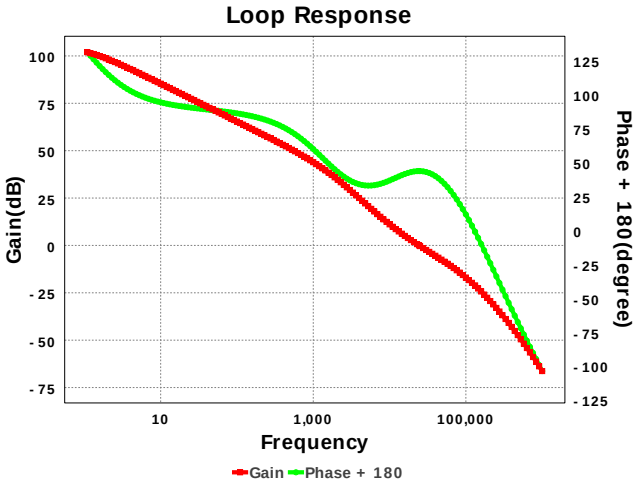












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	292.838 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	20.716 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	635.959 mA	Current	Peak switch current in IC
4.	Iin Avg	400.38 mA	Current	Average input current
5.	L Ipp	71.762 mA	Current	Peak-to-peak inductor ripple current
6.	M Irms	468.349 mA	Current	MOSFET RMS current
7.	Frequency	2.2 MHz	General	Switching frequency
8.	IC Tolerance	20.0 mV	General	IC Feedback Tolerance
9.	M Vds Act	63.846 mV	General	Voltage drop across the MosFET
10.	Mode	CCM	General	Conduction Mode
11.	Pout	1.986 W	General	Total output power

#	Name	Value	Category	Description
12.	Low Freq Gain	101.963 dB	Op_Point	Gain at 1Hz
13.	Low Freq Gain	101.963 dB	Op_Point	Gain at 1Hz
14.	Vout Actual	3.31 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Vout OP	3.31 V	Op_Point	Operational Output Voltage
16.	Cross Freq	22.886 kHz	Op_point	Bode plot crossover frequency
17.	Cross Freq	24.36 kHz	Op_point	Bode plot crossover frequency
18.	Duty Cycle	60.889 %	Op_point	Duty cycle
19.	Efficiency	90.187 %	Op_point	PMU channel steady state efficiency
20.	Gain Marg	-21.896 dB	Op_point	Bode Plot Gain Margin
21.	Gain Marg	-21.218 dB	Op_point	Bode Plot Gain Margin
22.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
23.	IOUT_OP	600.0 mA	Op_point	Iout operating point
24.	Phase Marg	44.365 deg	Op_point	Bode Plot Phase Margin
25.	Phase Marg	44.717 deg	Op_point	Bode Plot Phase Margin
26.	VIN_OP	5.5 V	Op_point	Vin operating point
27.	Vout p-p	166.736 µV	Op_point	Peak-to-peak output ripple voltage
28.	Cin Pd	311.802 µW	Power	Input capacitor power dissipation
29.	Cout Pd	796.07 nW	Power	Output capacitor power dissipation
30.	IC Pd	125.377 mW	Power	IC power dissipation
31.	L Pd	90.131 mW	Power	Inductor power dissipation
32.	Total Pd	216.091 mW	Power	PMU channel power dissipation
33.	Vout Tolerance	3.364 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	600.0 m	Maximum Output Current
2.	VinMax	5.5	Maximum input voltage
3.	VinMin	4.0	Minimum input voltage
4.	Vout	3.31	Output Voltage
5.	base_pn	LM26420X/2	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. LM26420X/2 Product Folder : http://www.ti.com/product/LM26420X : contains the data sheet and other resources.