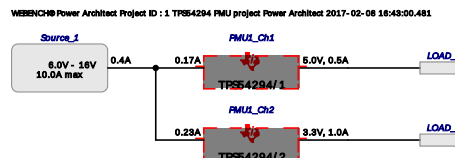


WEBENCH® Power Architect



Project Report

Project : 4167241/1 : TPS54294 PMU project
Created : 2017-02-08 16:43:00.481

Project Summary

1. Total System Efficiency	90.103 %
2. Total System BOM Count	22.0
3. Total System Footprint	231.0 mm ²
4. Total System BOM Cost	\$1.66
5. Total System Power Dissipation	637.1 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

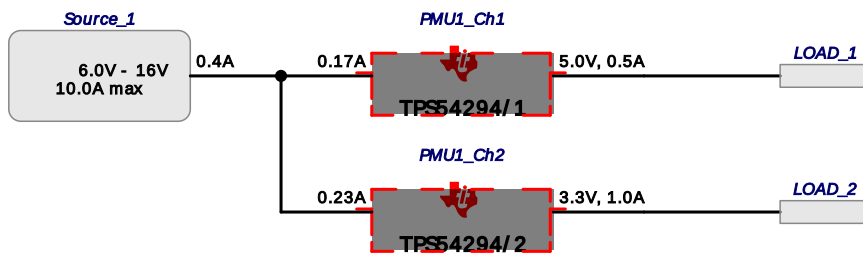
#	Name	NSID	Description	Vout	Iout	Efficiency	Foot-print	Cost	Design	Page
1.	PMU1_Ch1	TPS54294/1	Buck : 2A Dual Channel Synchronous Step-Down Switcher with Integrated FET	5.0 V	0.5 A	91.1%	115	\$1.34	2	8
2.	PMU1_Ch2	TPS54294/2	Buck : 2A Dual Channel Synchronous Step-Down Switcher with Integrated FET	3.3 V	1.0 A	89.3%	169	\$1.31	3	14
3.	PMU1	TPS54294	PMU : NA	V	NaN A	90.1%	231	\$1.66	1	4

Power Loads

#	Name	VLoad	ILoad	Description
1.	LOAD_1	5.0 V	0.5 A	VoutRipple=10%
2.	LOAD_2	3.3 V	1.0 A	VoutRipple=10%

Project Diagram

WEBENCH® Power Architect Project ID : 1 TPS54294 PMU project Power Architect 2017-02-08 16:43:00.481



Electrical Procurement BOM

Manufacturer	Part Number	Description	Quantity	Budgetary Price	Footprint (mm ²)
AVX	08053C104KAT2A	0805	6	\$0.01	40
Vishay-Dale	CRCW0402100KFKED	0402	4	\$0.01	12
Vishay-Dale	CRCW040210K0FKED	0402	4	\$0.01	12
Vishay-Dale	CRCW0402121KFKED	0402	2	\$0.01	6
Vishay-Dale	CRCW040222K1FKED	0402	4	\$0.01	12
Vishay-Dale	CRCW040273K2FKED	0402	2	\$0.01	6
MuRata	GRM155R60J104KA01D	0402	2	\$0.01	6
MuRata	GRM188R60J105KA01D	0603	1	\$0.01	5
MuRata	GRM21BR61C106KE15L	0805	8	\$0.03	27
MuRata	GRM31CC80J476KE18L	1206_190	2	\$0.10	22
MuRata	GRM31CE70G476ME15L	1206_190	2	\$0.10	22
MuRata	LQM2HPN3R3MG0L	1008	2	\$0.12	21
NIC Components	NPI52C3R3MTRF	IND_NPI52C	2	\$0.09	122
Texas Instruments	TPS54294PWPR	PWP0016C	3	\$1.00	176
Total			44	\$4.31	488.76

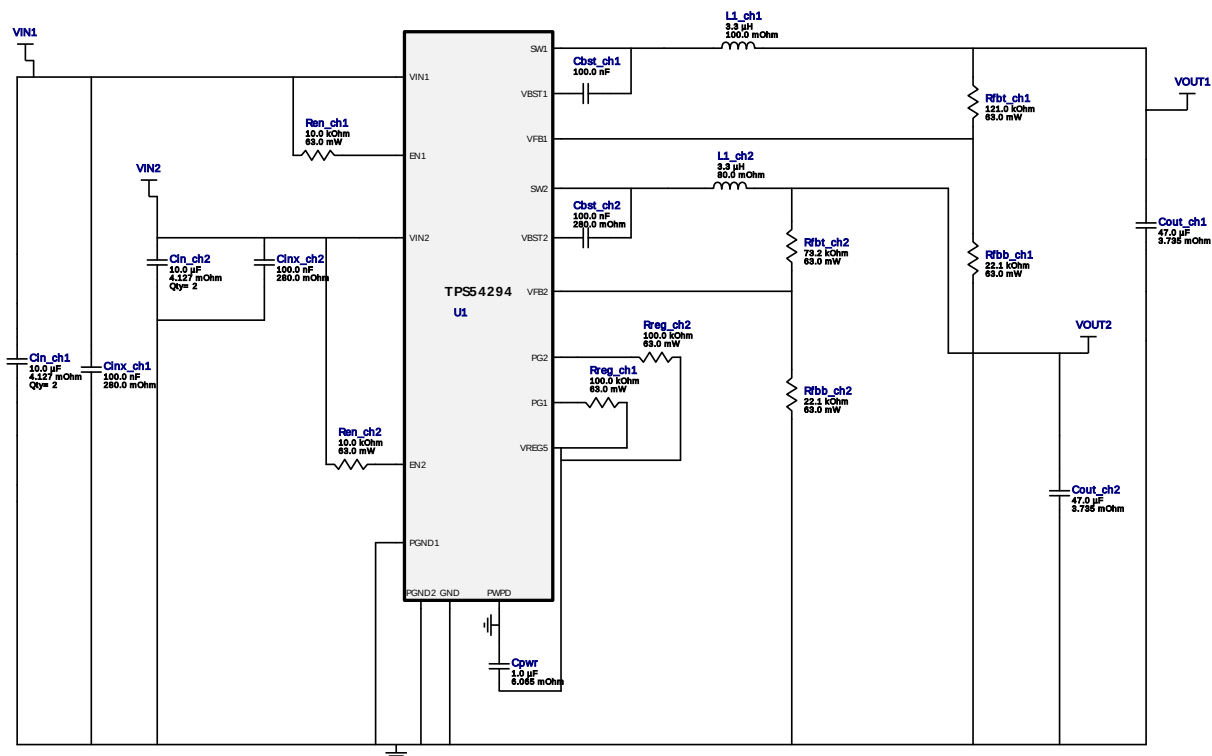


Vout = 5.0V
Iout = 0.5A

Device = TPS54294PWPR
Topology = PMU
Created = 2/8/17 4:42:55 PM
BOM Cost = \$1.66
BOM Count = 22
Total Pd = 0.64W

WEBENCH® Design Report

Design : 4167241/1 TPS54294PWPR
Design 1 - TPS54294PWPR



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.

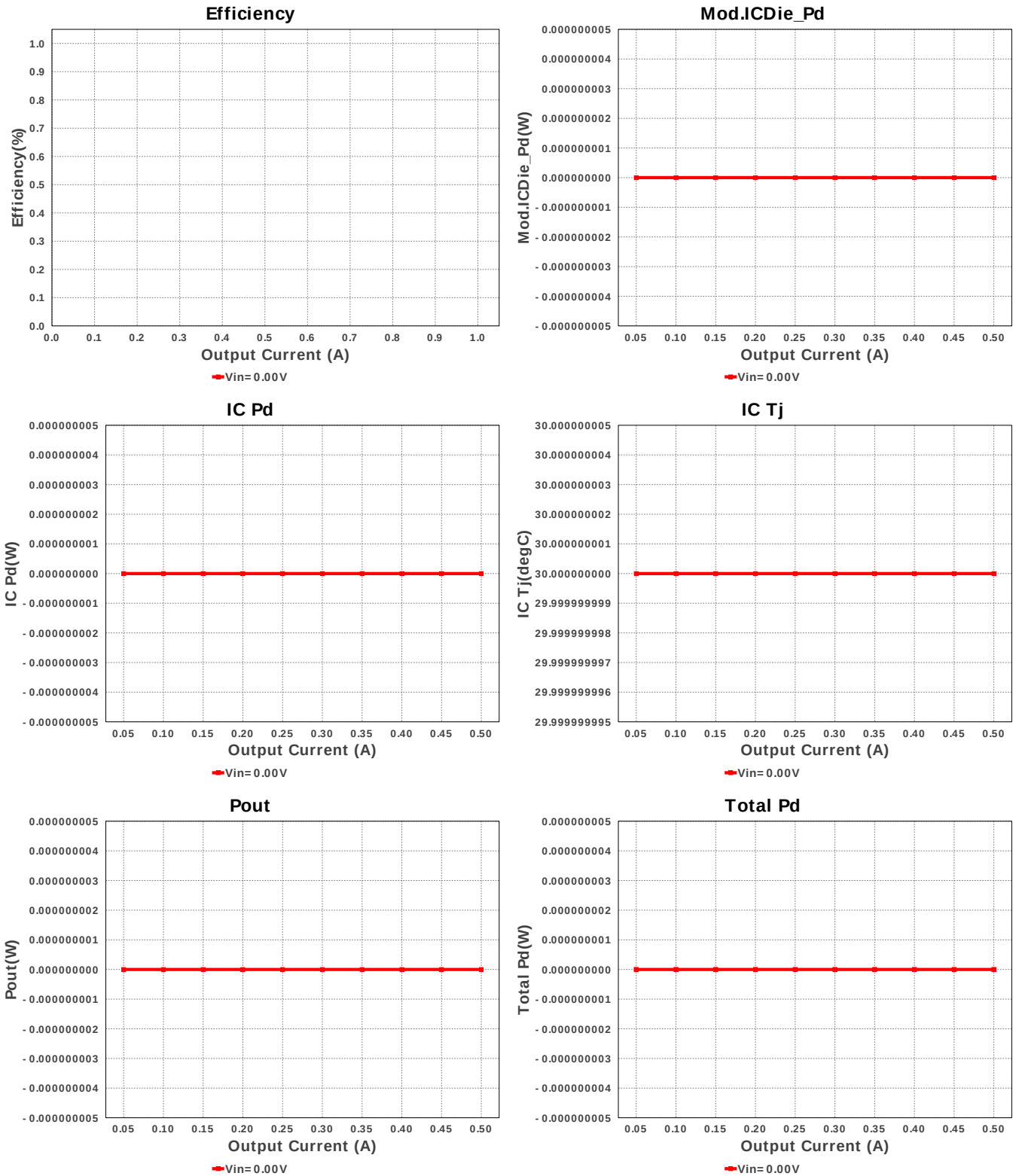
My Comments

No comments

Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst_ch1	MuRata	GRM155R60J104KA01D Series= X5R	Cap= 100.0 nF VDC= 6.3 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
2.	Cbst_ch2	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
3.	Cin_ch1	MuRata	GRM21BR61C106KE15L Series= X5R	Cap= 10.0 uF ESR= 4.127 mOhm VDC= 16.0 V IRMS= 2.46634 A	2	\$0.03	0805 7 mm ²
4.	Cin_ch2	MuRata	GRM21BR61C106KE15L Series= X5R	Cap= 10.0 uF ESR= 4.127 mOhm VDC= 16.0 V IRMS= 2.46634 A	2	\$0.03	0805 7 mm ²
5.	Cinx_ch1	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
6.	Cinx_ch2	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
7.	Cout_ch1	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 mm ²
8.	Cout_ch2	MuRata	GRM31CE70G476ME15L Series= X7U	Cap= 47.0 uF ESR= 3.735 mOhm VDC= 4.0 V IRMS= 4.1841 A	1	\$0.10	 1206_190 11 mm ²
9.	Cpwr	MuRata	GRM188R60J105KA01D Series= X5R	Cap= 1.0 uF ESR= 6.065 mOhm VDC= 6.3 V IRMS= 1.36934 A	1	\$0.01	 0603 5 mm ²
10.	L1_ch1	MuRata	LQM2HPN3R3MG0L	L= 3.3 uH DCR= 100.0 mOhm	1	\$0.12	 1008 10 mm ²
11.	L1_ch2	NIC Components	NPI52C3R3MTRF	L= 3.3 uH DCR= 80.0 mOhm	1	\$0.09	 IND_NPI52C 61 mm ²
12.	Ren_ch1	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
13.	Ren_ch2	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
14.	Rfbb_ch1	Vishay-Dale	CRCW040222K1FKED Series= CRCW..e3	Res= 22.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
15.	Rfbb_ch2	Vishay-Dale	CRCW040222K1FKED Series= CRCW..e3	Res= 22.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
16.	Rfbt_ch1	Vishay-Dale	CRCW0402121KFKED Series= CRCW..e3	Res= 121.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
17.	Rfbt_ch2	Vishay-Dale	CRCW040273K2FKED Series= CRCW..e3	Res= 73.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
18.	Rreg_ch1	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
19.	Rreg_ch2	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
20.	U1	Texas Instruments	TPS54294PWPR	Switcher	1	\$1.00	 PWP0016C 59 mm ²



Operating Values

#	Name	Value	Category	Description
1.	BOM Count	22	General	Total Design BOM count
2.	FootPrint	231.0 mm ²	General	Total PMU footprint area of BOM components
3.	Pout	5.8 W	General	Total PMU output power
4.	Total BOM	\$1.66	General	Total BOM Cost
5.	Efficiency	90.103 %	Op_point	PMU steady state efficiency
6.	IC Tj	49.242 degC	Op_point	PMU IC junction temperature
7.	ICThetaJA	41.4 degC/W	Op_point	IC junction-to-ambient thermal resistance
8.	Cin_ch1 Pd	905.289 μ W	Power	Input capacitor power dissipation
9.	Cin_ch2 Pd	355.237 μ W	Power	Input capacitor power dissipation
10.	Cout_ch1 Pd	867.782 μ W	Power	Output capacitor power dissipation
11.	Cout_ch2 Pd	601.585 μ W	Power	Output capacitor power dissipation

#	Name	Value	Category	Description
12.	IC Pd	464.787 mW	Power	IC Pd
13.	L1_ch1 Pd	69.573 mW	Power	Inductor power dissipation
14.	L1_ch2 Pd	100.0 mW	Power	Inductor power dissipation
15.	Module ICPd	464.787 mW	Power	IC Pd
16.	Total Pd	637.095 mW	Power	PMU total power dissipation
17.	Total Pd	637.095 mW	Power	PMU total power dissipation

Design Inputs

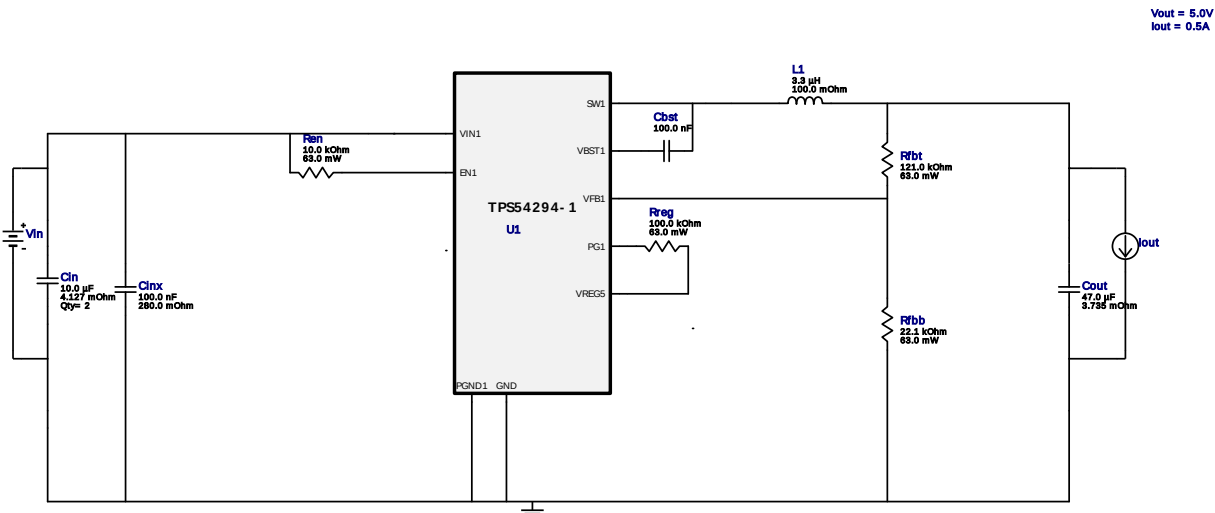
#	Name	Value	Description
1.	Iout	500.0 m	Maximum Output Current
2.	Iout1	500.0 m	Output Current #1
3.	Iout2	1.0	Output Current #2
4.	Vin1Max	16.0	Maximum Input Voltage #1
5.	Vin1Min	6.0	Minimum Input Voltage #1
6.	Vin2Max	16.0	Maximum Input Voltage #2
7.	Vin2Min	6.0	Minimum Input Voltage #2
8.	Vout	5.0	Output Voltage
9.	Vout1	5.0	Output Voltage #1
10.	Vout2	3.3	Output Voltage #2
11.	base_pn	TPS54294	Base Product Number
12.	source	DC	Input Source Type
13.	Ta	30.0	Ambient temperature

Design Assistance

1. **TPS54294** Product Folder : <http://www.ti.com/product/tps54294> : contains the data sheet and other resources.

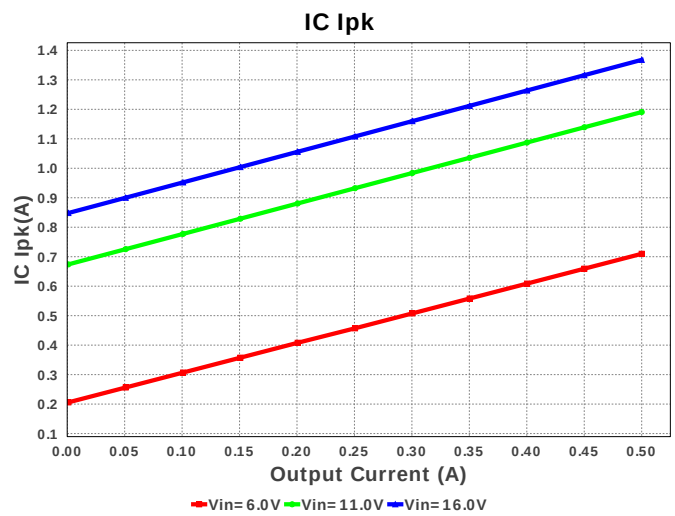
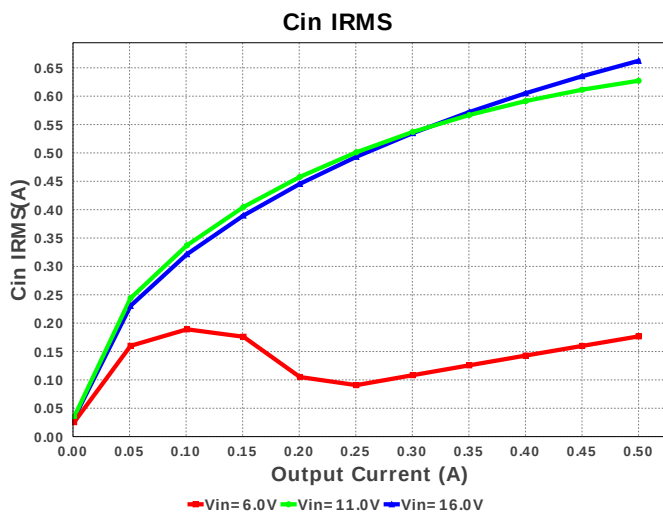
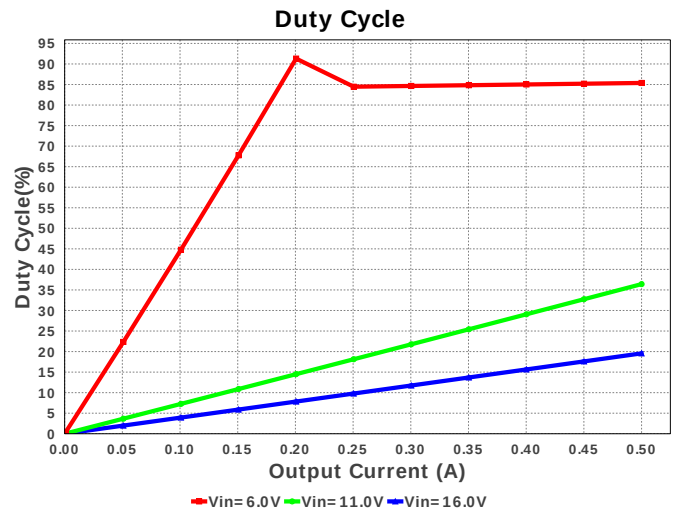
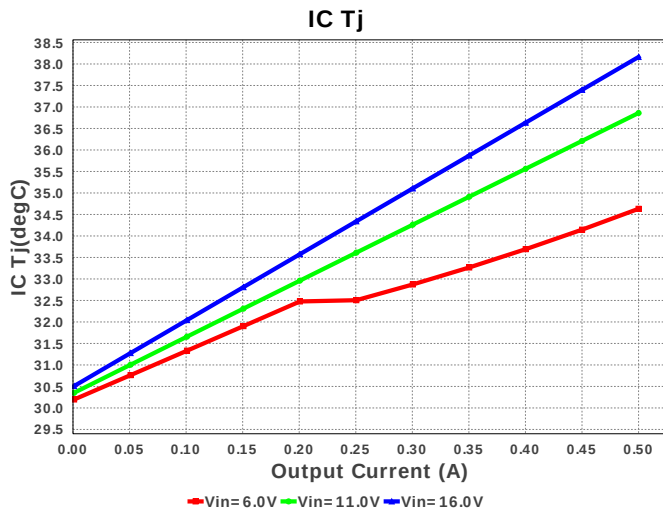
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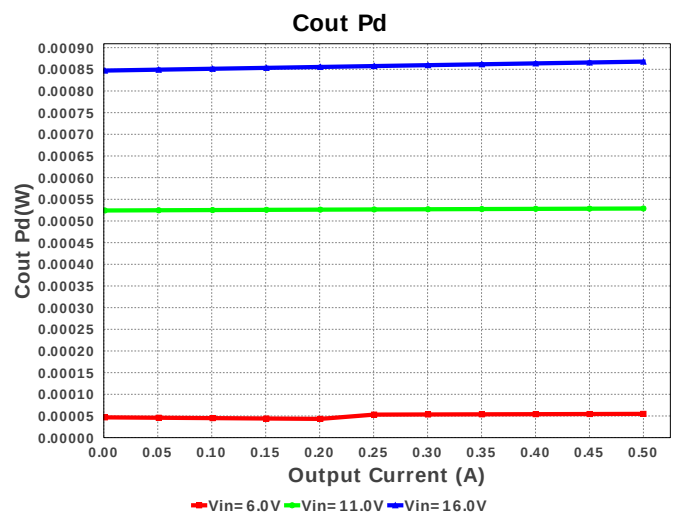
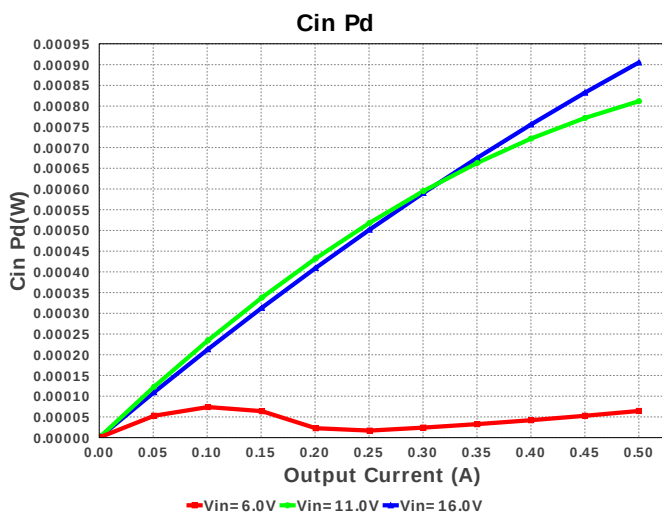
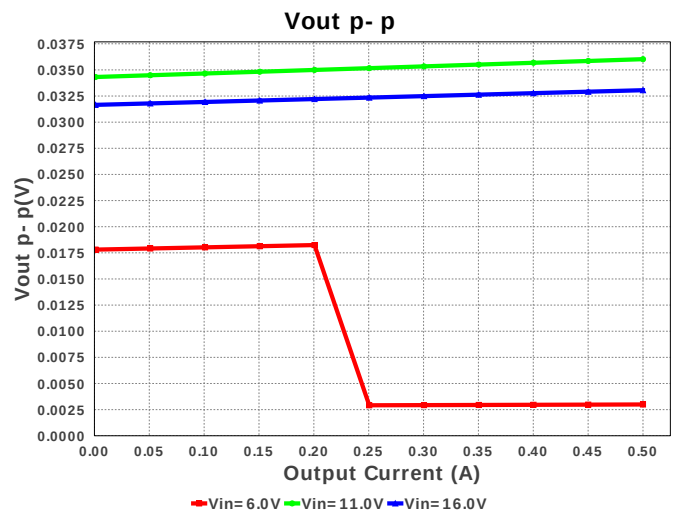
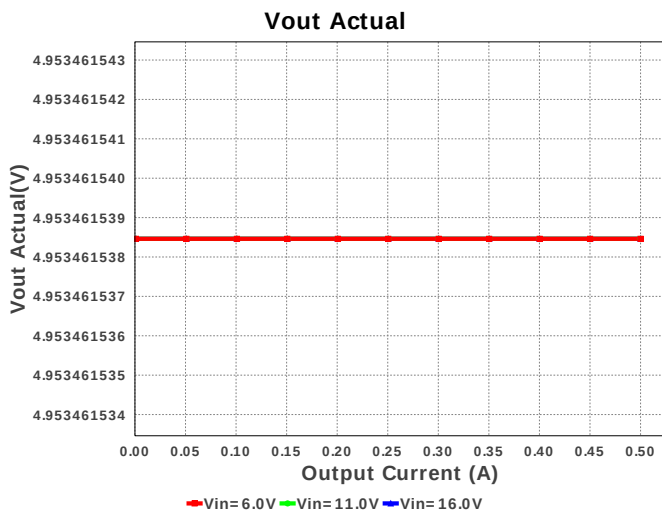
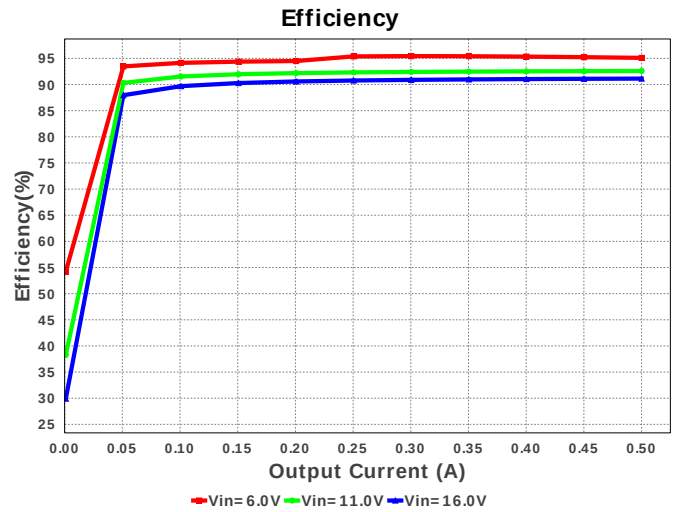
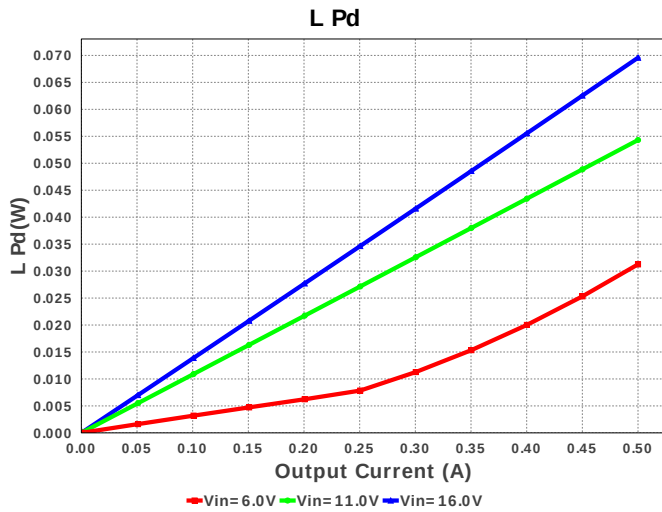
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TPS54294PWPR 6.0V-16.0V to 5.00V @ 0.5A

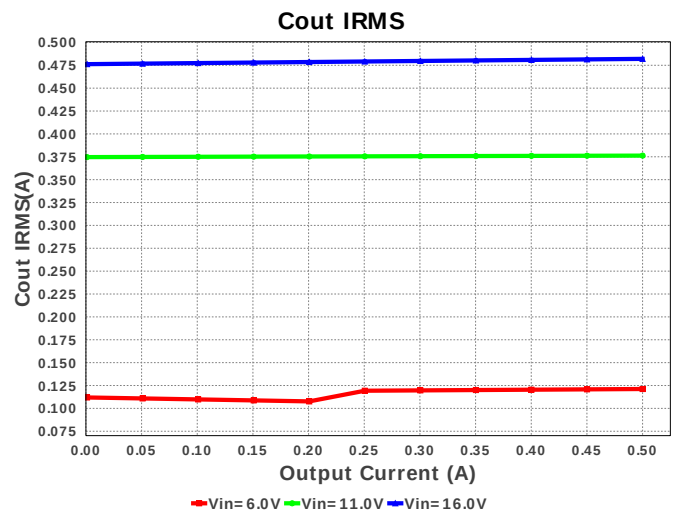
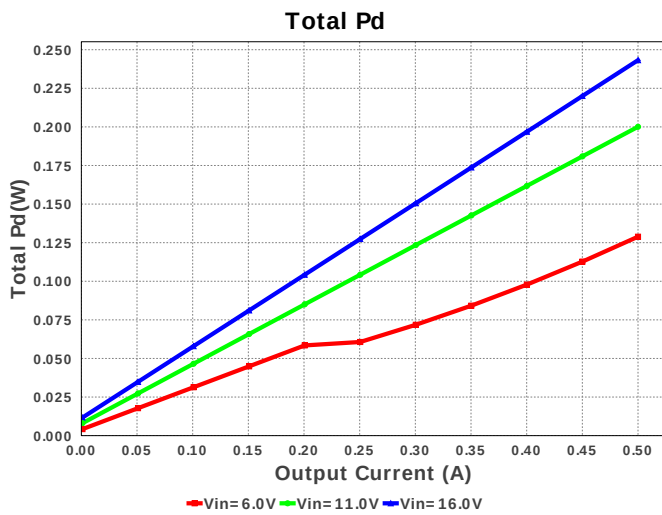
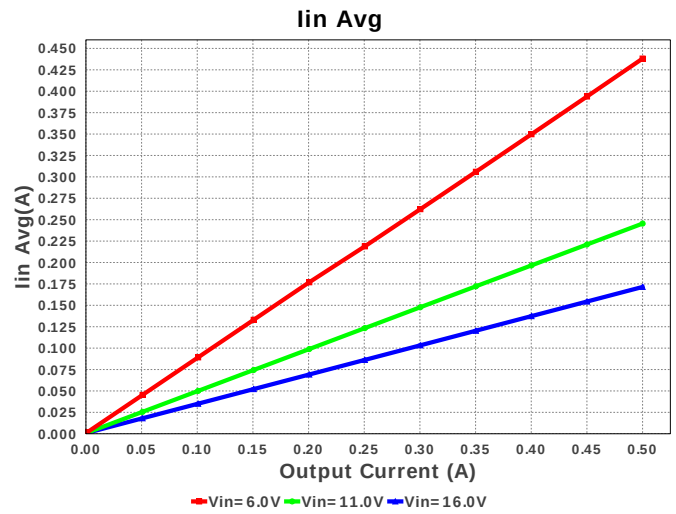
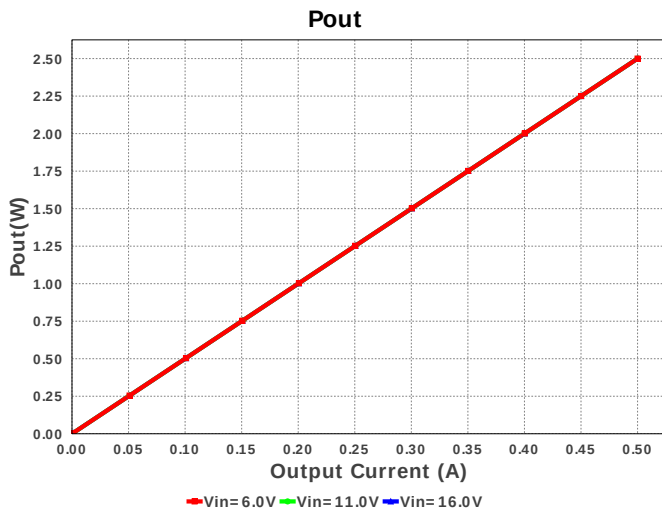
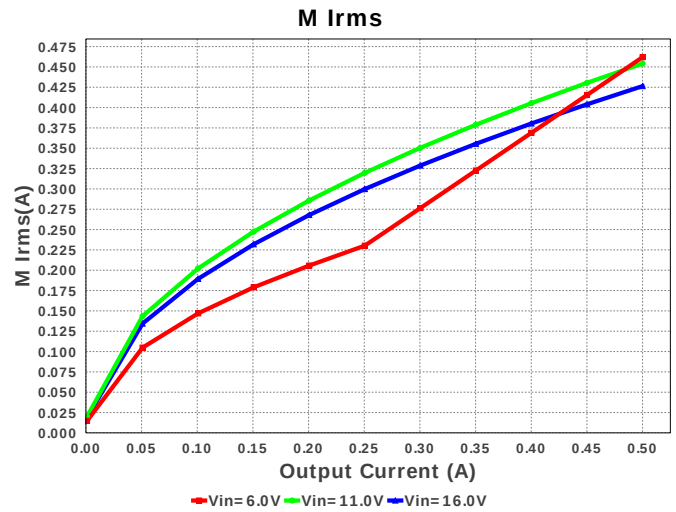
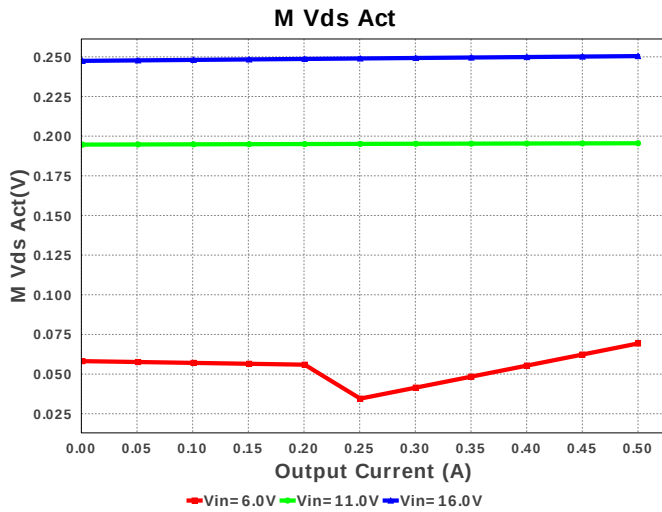


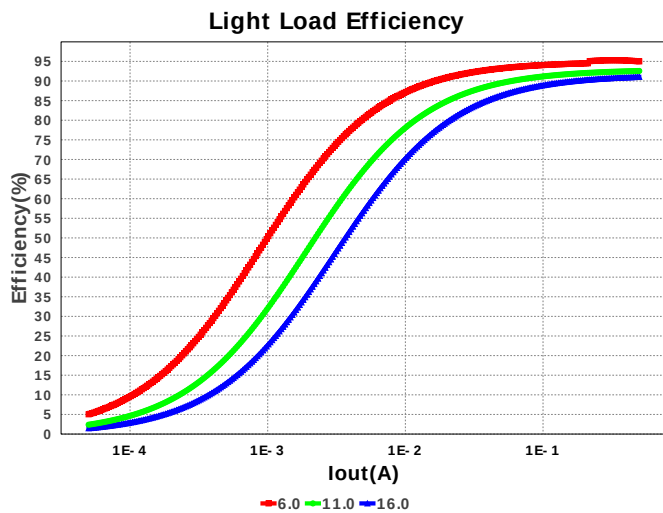
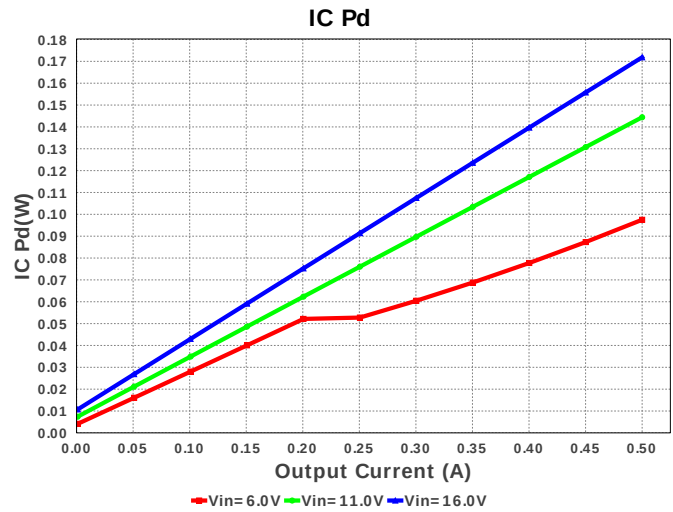
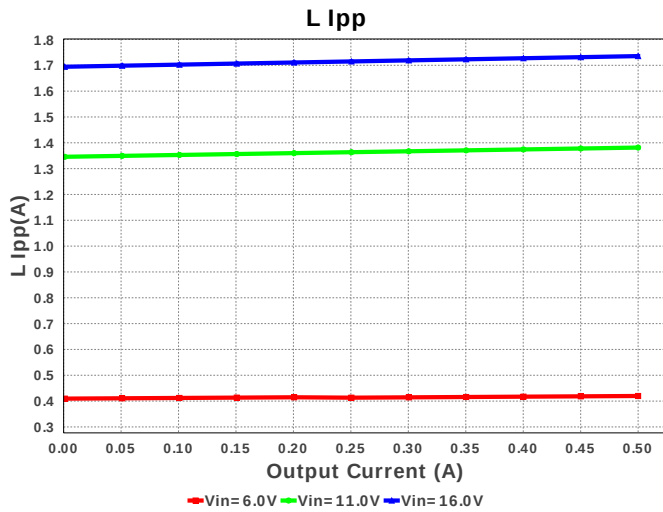
tj.com/webench

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	U1	Texas Instruments	TPS54294PWPR	Switcher	0	\$1.00	 PWP0016C 59 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	662.356 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	482.014 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	1.368 A	Current	Peak switch current in IC
4.	Iin Avg	171.45 mA	Current	Average input current
5.	L Ipp	1.736 A	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	426.385 mA	Current	Q Iavg
7.	Frequency	375.701 kHz	General	Switching frequency
8.	IC Tolerance	7.6 mV	General	IC Feedback Tolerance
9.	M Vds Act	250.462 mV	General	Voltage drop across the MosFET
10.	Mode	DCM	General	Conduction Mode
11.	Pout	2.5 W	General	Total output power
12.	Vout Actual	4.953 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
13.	Vout OP	5.0 V	Op_Point	Operational Output Voltage
14.	Duty Cycle	19.562 %	Op_point	Duty cycle
15.	Efficiency	91.134 %	Op_point	PMU channel steady state efficiency
16.	ICThetaJA	47.5 degC/W	Op_point	IC junction-to-ambient thermal resistance
17.	IOUT_OP	500.0 mA	Op_point	Iout operating point
18.	VIN_OP	16.0 V	Op_point	Vin operating point
19.	Vout p-p	18.769 mV	Op_point	Peak-to-peak output ripple voltage
20.	Cin Pd	905.289 μW	Power	Input capacitor power dissipation
21.	Cout Pd	867.782 μW	Power	Output capacitor power dissipation
22.	IC Iq Pd	10.4 mW	Power	IC Iq Pd
23.	IC Pd	171.854 mW	Power	IC power dissipation
24.	L Pd	69.573 mW	Power	Inductor power dissipation
25.	M1 PdCond	27.271 mW	Power	M1 MOSFET switching losses
26.	M1 PdSw	14.6 mW	Power	M1 MOSFET switching losses
27.	M1 PdCond	37.478 mW	Power	M2 MOSFET switching losses
28.	M2 Pdbody	47.049 mW	Power	Power dissipation through lower FET
29.	Total Pd	243.212 mW	Power	PMU channel power dissipation
30.	Vout Tolerance	2.719 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	500.0 m	Maximum Output Current
2.	VinMax	16.0	Maximum input voltage
3.	VinMin	6.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	TPS54294/1	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **TPS54294/1** Product Folder : <http://www.ti.com/product/TPS54294> : contains the data sheet and other resources.

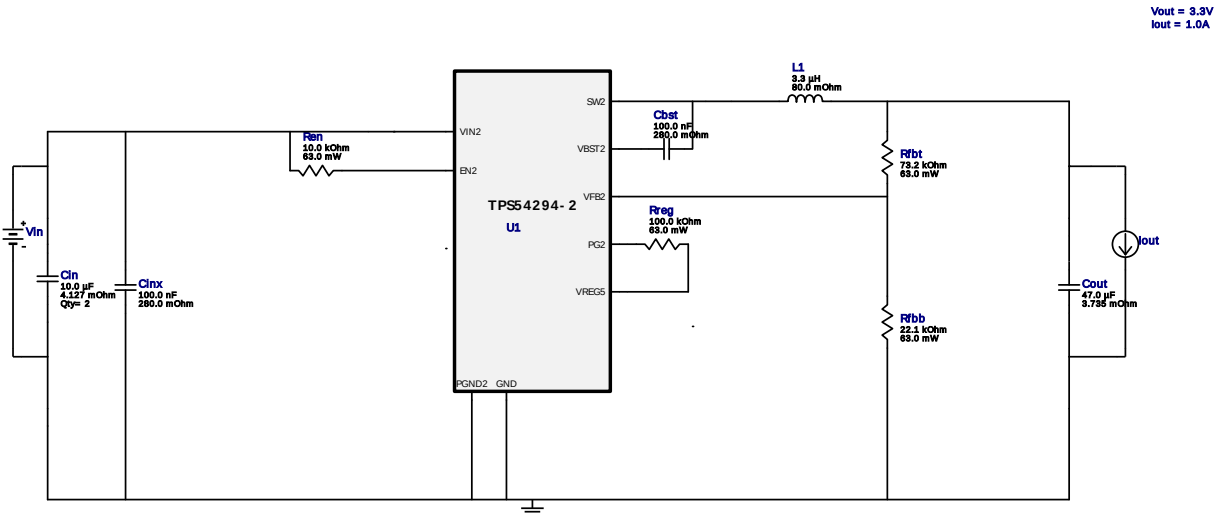


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Iout = 1.0A

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WEBENCH® Design Report

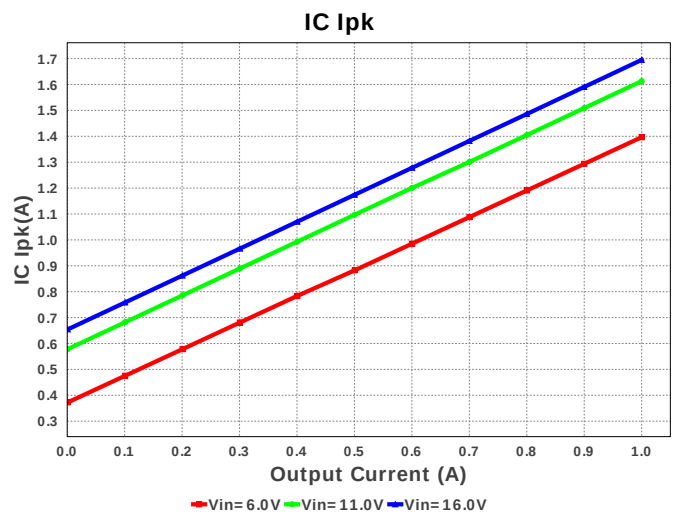
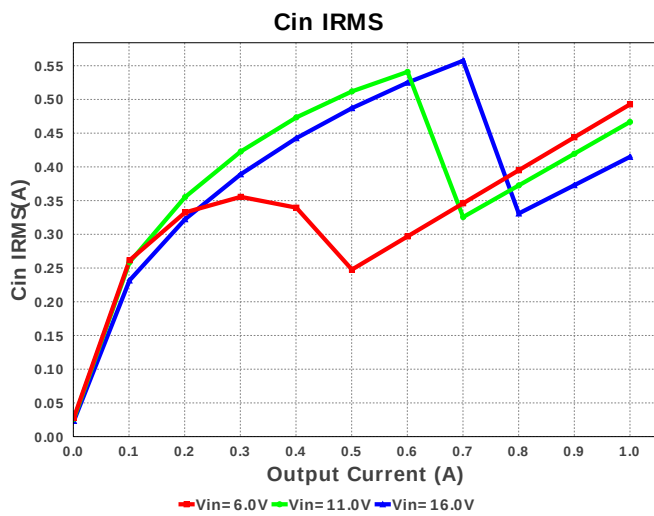
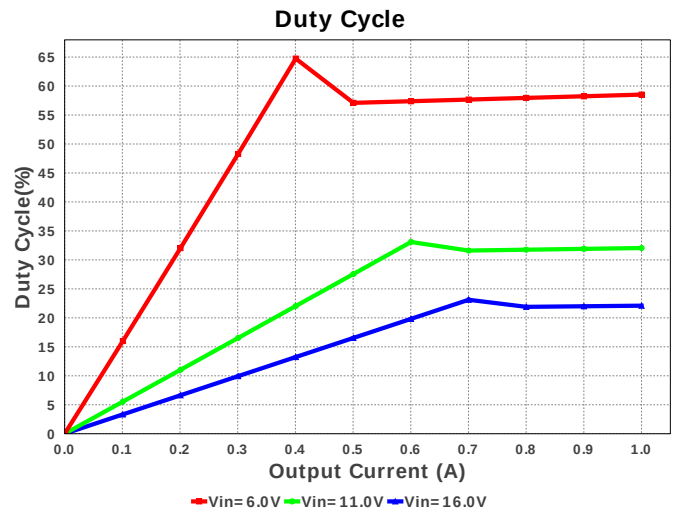
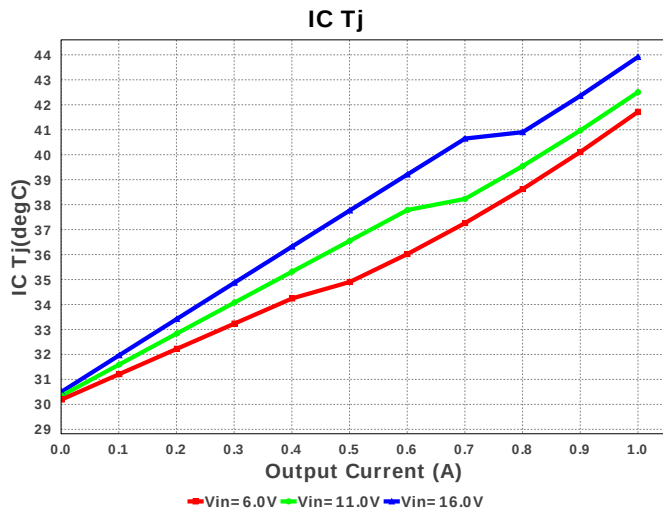
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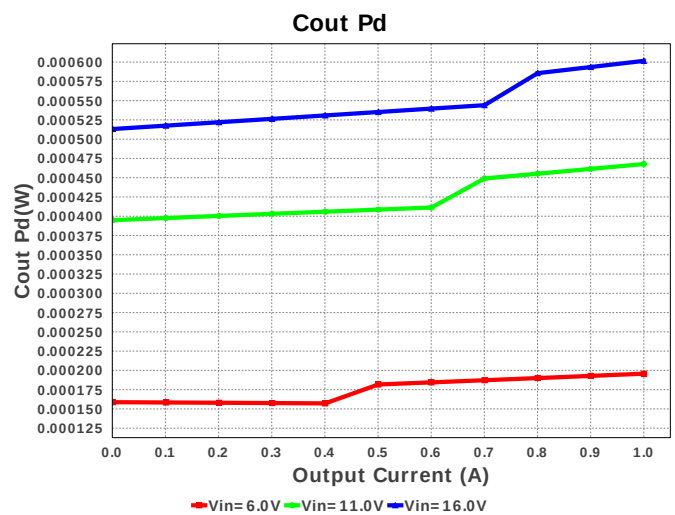
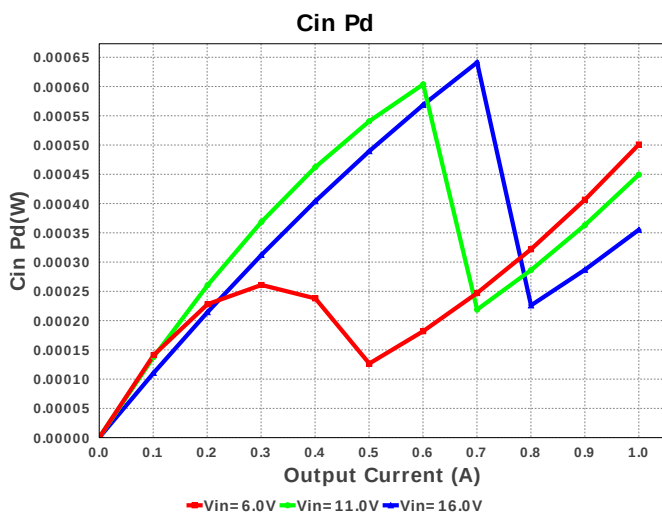
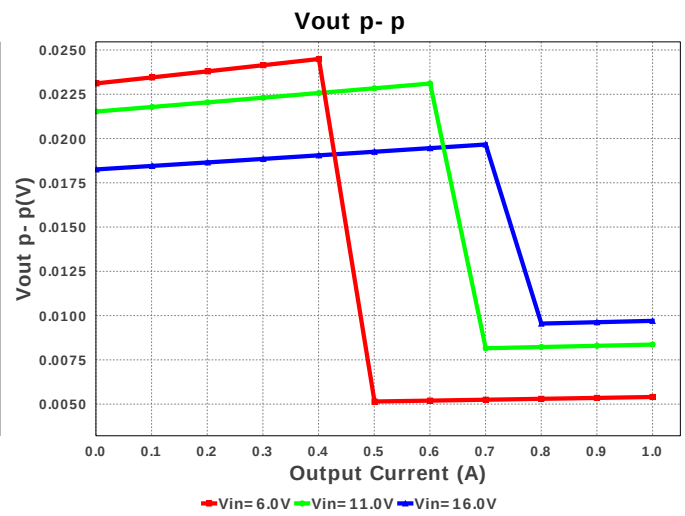
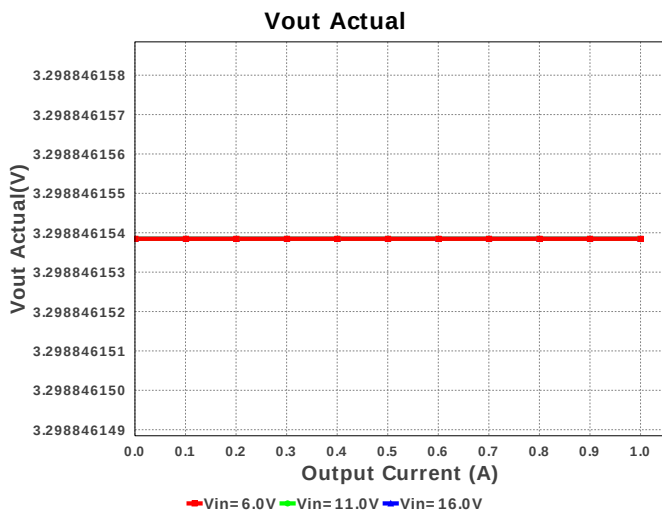
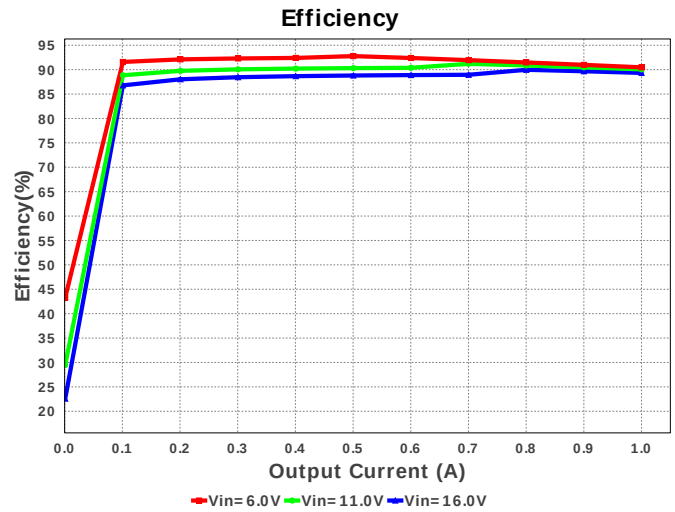
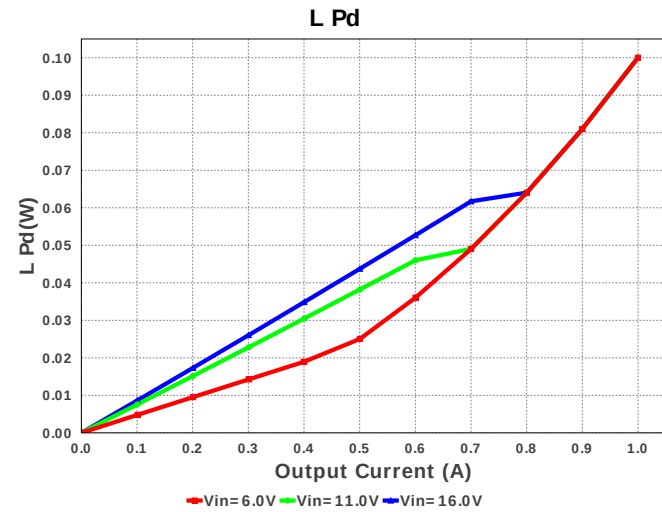


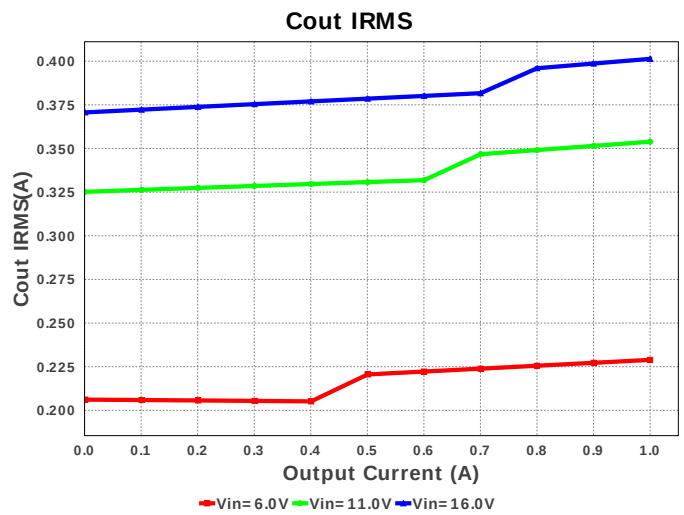
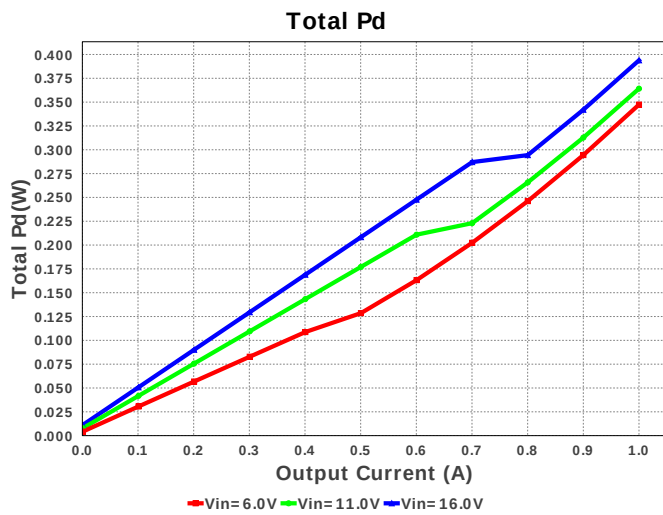
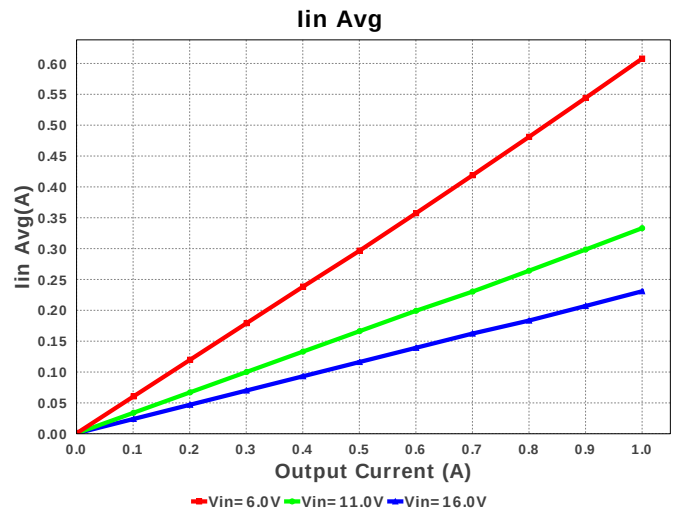
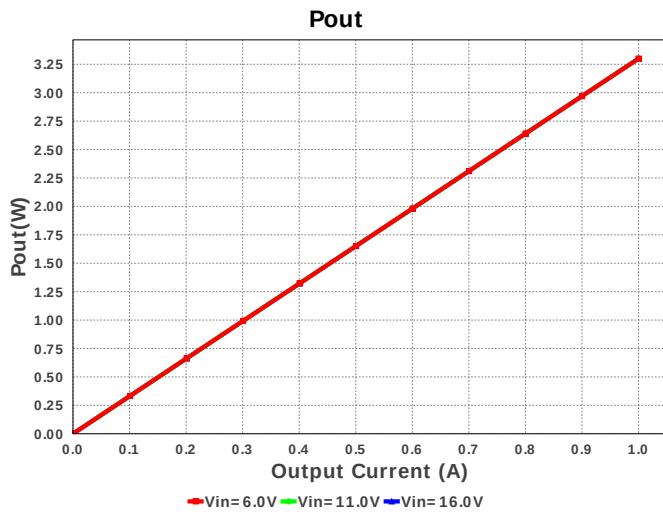
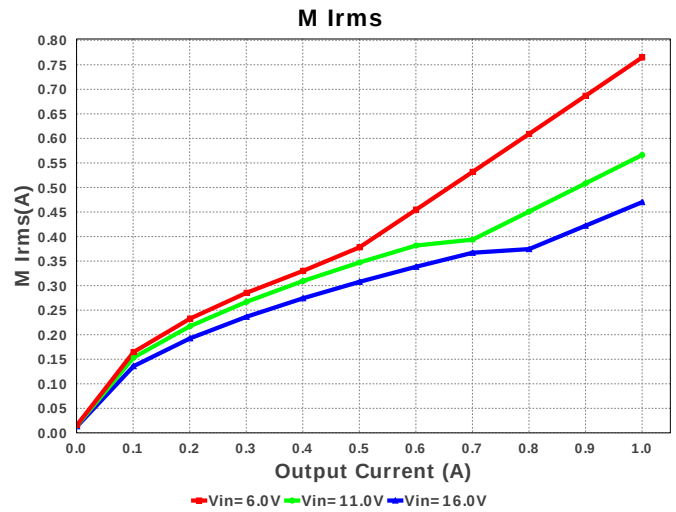
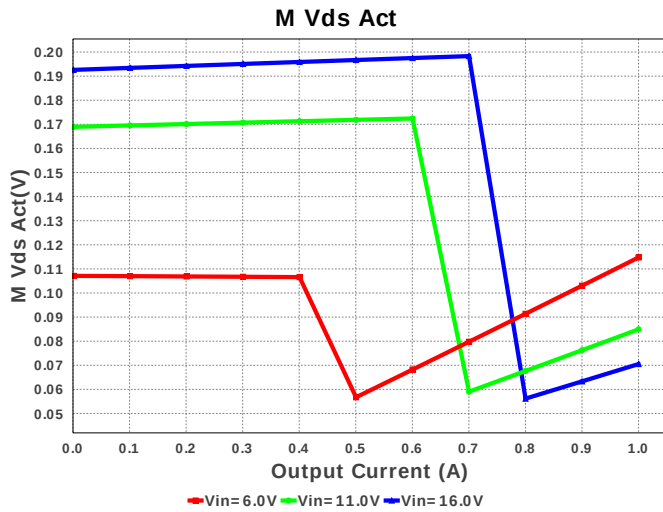
Electrical BOM

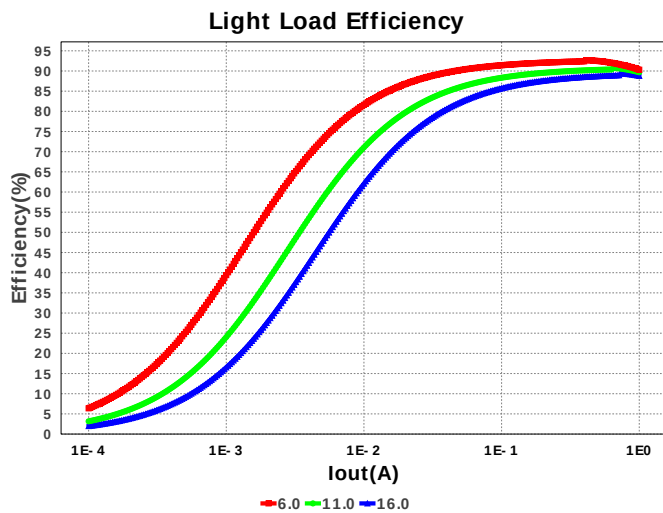
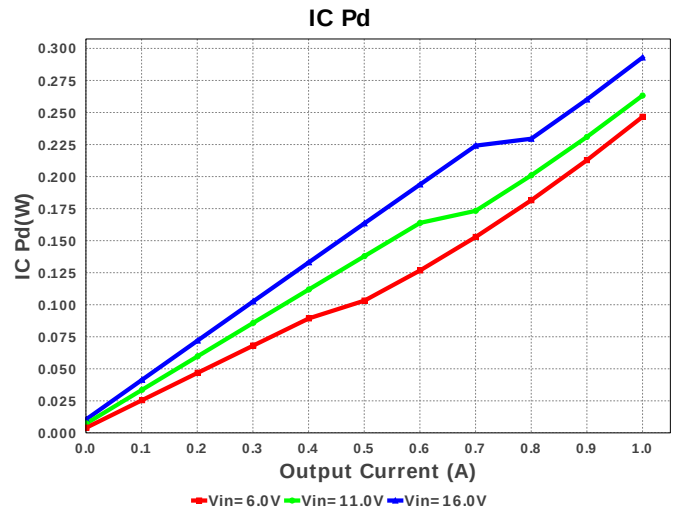
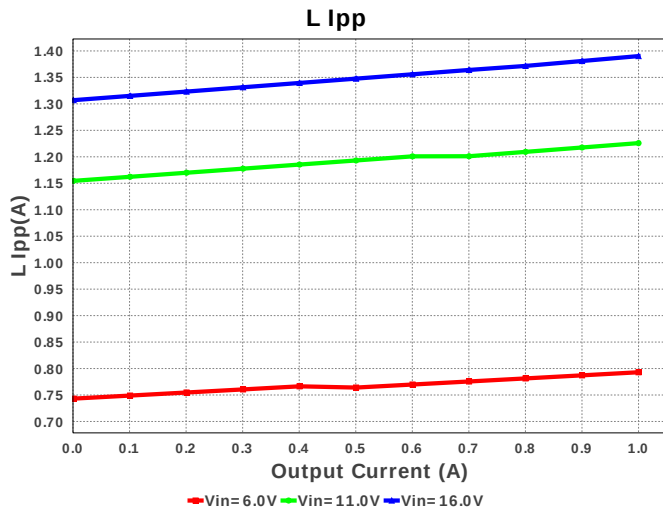
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbst	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
2.	Cin	MuRata	GRM21BR61C106KE15L Series= X5R	Cap= 10.0 uF ESR= 4.127 mOhm VDC= 16.0 V IRMS= 2.46634 A	2	\$0.03	0805 7 mm ²
3.	Cinx	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
4.	Cout	MuRata	GRM31CE70G476ME15L Series= X7U	Cap= 47.0 uF ESR= 3.735 mOhm VDC= 4.0 V IRMS= 4.1841 A	1	\$0.10	1206_190 11 mm ²
5.	L1	NIC Components	NPI52C3R3MTRF	L= 3.3 uH DCR= 80.0 mOhm	1	\$0.09	IND_NPI52C 61 mm ²
6.	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
7.	Rfbb	Vishay-Dale	CRCW040222K1FKED Series= CRCW..e3	Res= 22.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
8.	Rfbt	Vishay-Dale	CRCW040273K2FKED Series= CRCW..e3	Res= 73.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
9.	Rreg	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	U1	Texas Instruments	TPS54294PWPR	Switcher	0	\$1.00	 PWP0016C 59 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	414.913 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	401.331 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	1.695 A	Current	Peak switch current in IC
4.	Iin Avg	230.87 mA	Current	Average input current
5.	L Ipp	1.39 A	Current	Peak-to-peak inductor ripple current
6.	M1 Irms	470.095 mA	Current	Q lavg
7.	Frequency	611.739 kHz	General	Switching frequency
8.	IC Tolerance	7.6 mV	General	IC Feedback Tolerance
9.	M Vds Act	70.514 mV	General	Voltage drop across the MosFET
10.	Mode	CCM	General	Conduction Mode
11.	Pout	3.3 W	General	Total output power
12.	Vout Actual	3.299 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
13.	Vout OP	3.3 V	Op_Point	Operational Output Voltage
14.	Duty Cycle	22.099 %	Op_point	Duty cycle
15.	Efficiency	89.337 %	Op_point	PMU channel steady state efficiency
16.	ICThetaJA	47.5 degC/W	Op_point	IC junction-to-ambient thermal resistance
17.	IOUT_OP	1.0 A	Op_point	Iout operating point
18.	VIN_OP	16.0 V	Op_point	Vin operating point
19.	Vout p-p	11.237 mV	Op_point	Peak-to-peak output ripple voltage
20.	Cin Pd	355.237 μ W	Power	Input capacitor power dissipation
21.	Cout Pd	601.585 μ W	Power	Output capacitor power dissipation
22.	IC Iq Pd	10.4 mW	Power	IC Iq Pd
23.	IC Pd	292.933 mW	Power	IC power dissipation
24.	L Pd	100.0 mW	Power	Inductor power dissipation
25.	M1 PdCond	33.148 mW	Power	M1 MOSFET switching losses
26.	M1 PdSw	28.474 mW	Power	M1 MOSFET switching losses
27.	M1 PdCond	77.901 mW	Power	M2 MOSFET switching losses
28.	M2 Pdbody	91.761 mW	Power	Power dissipation through lower FET
29.	Total Pd	393.883 mW	Power	PMU channel power dissipation
30.	Vout Tolerance	2.561 %		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	16.0	Maximum input voltage
3.	VinMin	6.0	Minimum input voltage
4.	Vout	3.3	Output Voltage
5.	base_pn	TPS54294/2	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **TPS54294/2** Product Folder : <http://www.ti.com/product/TPS54294> : contains the data sheet and other resources.

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