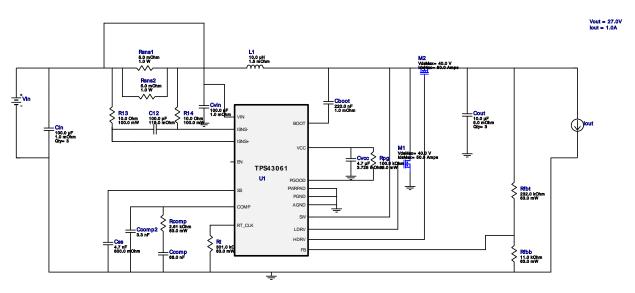


WEBENCH® Design Report

VinMin = 4.5V VinMax = 5.5V Vout = 27.0V Iout = 1.0A Device = TPS43061RTER
Topology = Boost
Created = 2019-06-20 11:03:58.272
BOM Cost = \$6.22
BOM Count = 26
Total Pd = 1.29W

Design: 9 TPS43061RTER TPS43061RTER 4.5V-5.5V to 27.00V @ 1A

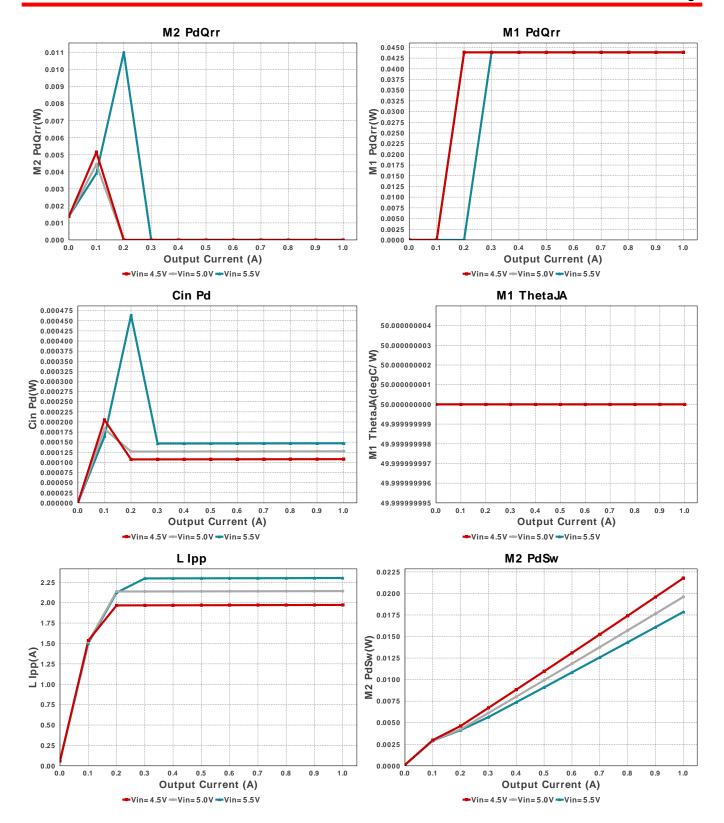


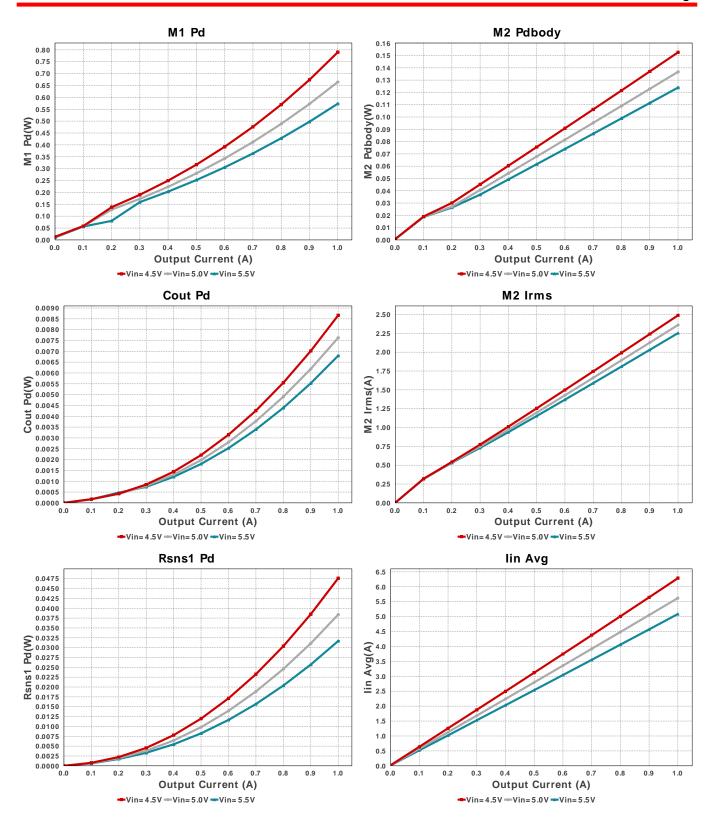
1. The pulse skip mode in the device has not been modeled. Efficiency and operational parameters of the model in pulse skip mode is not valid.

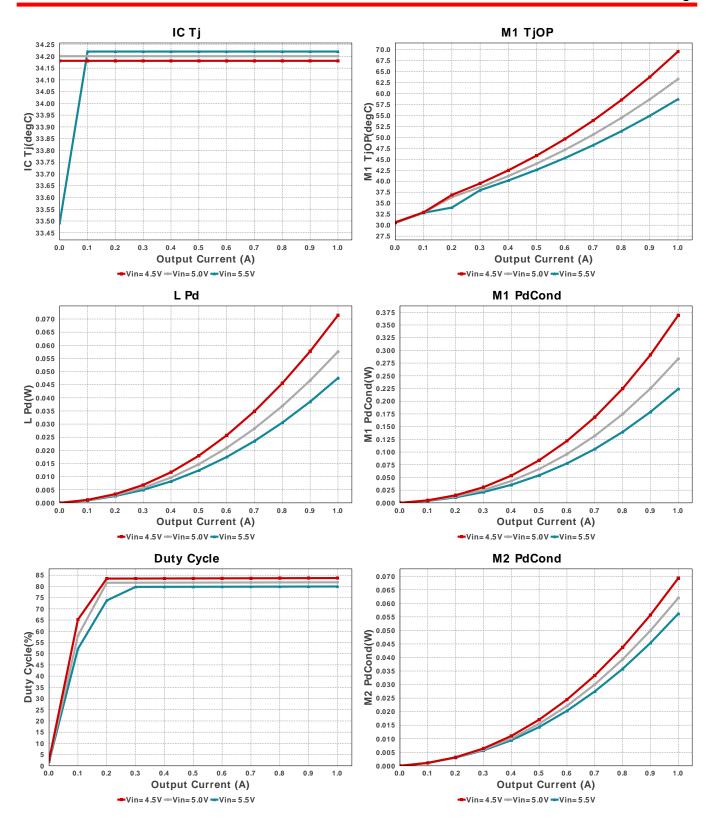
Electrical BOM

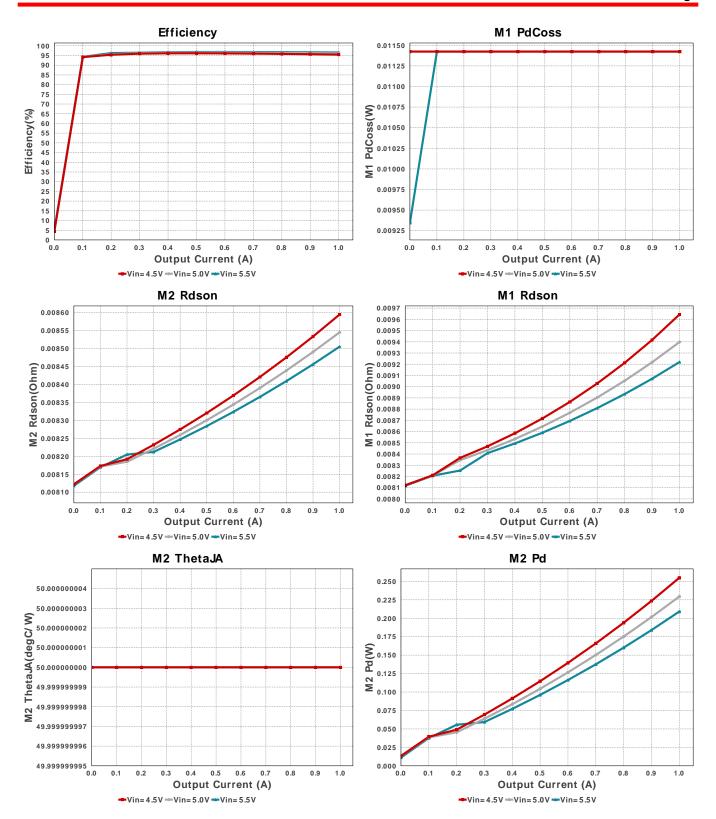
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
C12	AVX	06035A101JAT2A Series= C0G/NP0	Cap= 100.0 pF ESR= 119.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0603 5 mm ²
Cboot	Kemet	C0603C224Z4VACTU Series= Y5V	Cap= 220.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	0603 5 mm ²
Ccomp	TDK	C3216C0G1H683J160AA Series= C0G/NP0	Cap= 68.0 nF VDC= 5.0 V IRMS= 0.0 A	1	\$0.15	1206 11 mm ²
Ccomp2	Samsung Electro- Mechanics	CL21C332JBFNNNE Series= C0G/NP0	Cap= 3.3 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.04	0805 7 mm ²
Cin	MuRata	GRM32ER61A107ME20L Series= X5R	Cap= 100.0 uF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	3	\$0.41	1210_270 15 mm ²
Cout	Samsung Electro- Mechanics	CL32B106KBJNNWE Series= X7R	Cap= 10.0 uF ESR= 5.0 mOhm VDC= 50.0 V IRMS= 0.0 A	3	\$0.18	1210_270 15 mm ²
Css	MuRata	GRM188R71E472KA01D Series= X7R	Cap= 4.7 nF ESR= 600.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0603 5 mm ²
Cvcc	TDK	C1608X6S1C475K080AC Series= X6S	Cap= 4.7 uF ESR= 3.728 mOhm VDC= 16.0 V IRMS= 2.69359 A	1	\$0.08	0603 5 mm ²

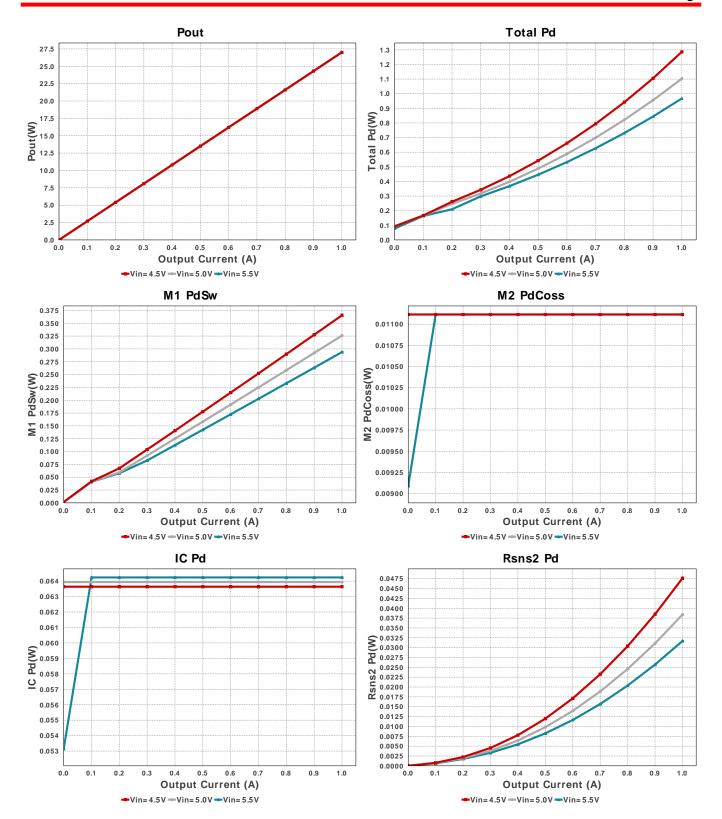
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cvin	MuRata	GRM155R71C104KA88D Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
L1	Coilcraft	SER2915L-103KL	L= 10.0 μH 1.5 mOhm	1	\$1.88	SER2915L 652 mm ²
M1	Texas Instruments	CSD18514Q5A	VdsMax= 40.0 V IdsMax= 50.0 Amps	1	\$0.27	TRANS_NexFET_Q5A 55 mm²
M2	Texas Instruments	CSD18514Q5A	VdsMax= 40.0 V IdsMax= 50.0 Amps	1	\$0.27	TRANS_NexFET_Q5A 55 mm²
R13	Yageo	RC0603FR-0710RL Series=?	Res= 10.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
R14	Yageo	RC0603FR-0710RL Series= ?	Res= 10.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
Rcomp	Vishay-Dale	CRCW04022K61FKED Series= CRCWe3	Res= 2.61 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
Rfbb	Vishay-Dale	CRCW040211K0FKED Series= CRCWe3	Res= 11.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
Rfbt	Vishay-Dale	CRCW0402232KFKED Series= CRCWe3	Res= 232.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
Rpg	Vishay-Dale	CRCW0402100KFKED Series= CRCWe3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
Rsns1	Susumu Co Ltd	PRL1632-R005-F-T1 Series= PRL1632	Res= 5.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	\$0.20	0612 11 mm ²
Rsns2	Susumu Co Ltd	PRL1632-R005-F-T1 Series= PRL1632	Res= 5.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	\$0.20	0612 11 mm ²
Rt	Vishay-Dale	CRCW0402301KFKED Series= CRCWe3	Res= 301.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
U1	Texas Instruments	TPS43061RTER	Switcher	1	\$1.25	•
						S-PVQFN-N16 17 mm ²

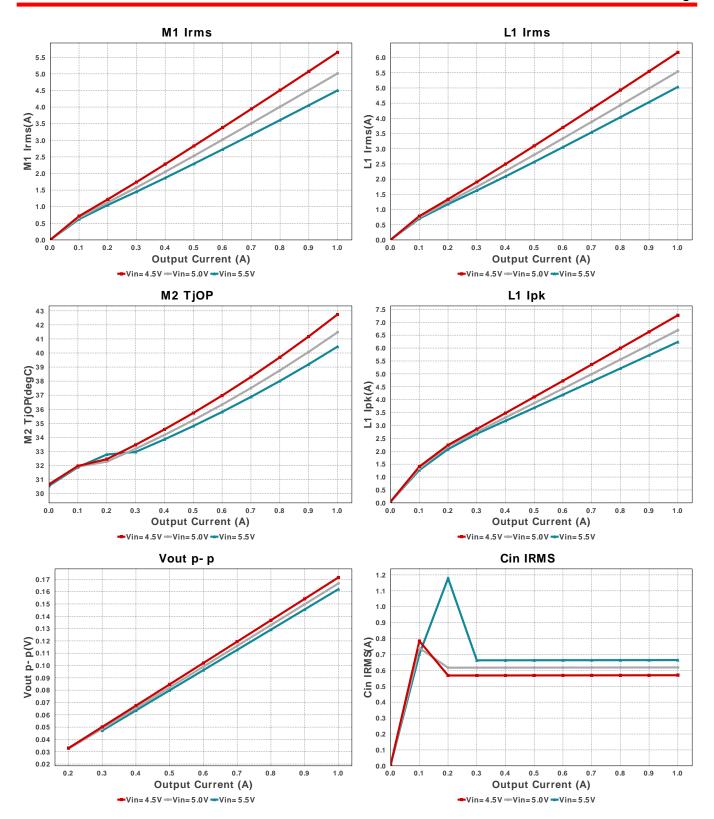


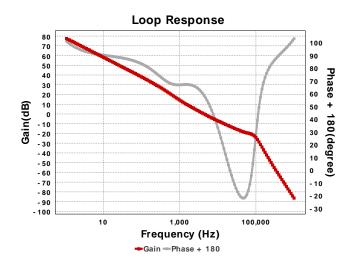












Operating Values

2. Cin Pd 108.06 µW Capacitor Input capacitor power dissipation 3. Cout Pd 8.662 mW Capacitor Output capacitor power dissipation 4. IC Pd 63.638 mW IC IC power dissipation 5. IC Tj 34.181 degC IC IC junction-to-ambient thermal resistance 6. ICThetaJA 65.7 degC/W IC IC junction-to-ambient thermal resistance 8. Lipp 1.972 A Inductor Average input current 1. Lipp 1.972 A Inductor Inductor power dissipation 1. Lipk 7.273 A Inductor Inductor peak current 1. Lipk 7.273 A Inductor Inductor peak current 1. Mill Mr PdCond 69.17 mW Mosfet MOSFET RMS ripple current 1. Mill Mr PdCond 369.17 mW Mosfet MISFET switching losses 1. Mill Mr PdCond 369.17 mW Mosfet MI MOSFET switching losses 1. Mill Mr PdCond 369.17 mW Mosfet MI MOSFET switching losses 1. Mill Mr PdCond 369.02 degC <td< th=""><th>#</th><th>Name</th><th>Value</th><th>Category</th><th>Description</th></td<>	#	Name	Value	Category	Description
3. Cout Pd					Input capacitor RMS ripple current
1. C Pd	2.	Cin Pd	108.06 μW	Capacitor	Input capacitor power dissipation
5. IC Tj 34.181 degC IC Li junction temperature 6. ICThetaJA 6.57 degCW IC Ui junction temperature 7. Iin Avg 6.286 A IC Average input current 8. Lipp 1.972 A Inductor 9. L Pd 71.415 mW Inductor 10. L I Ipk 7.273 A Inductor 11. L I Irms 6.172 A Inductor 12. MI Irms 5.647 A Mostet M1 Pd 792.04 mW Mosfet M1 Pd 792.04 mW Mosfet M1 PdCoss 369.17 mW Mosfet M1 PdCoss 11.424 mW Mosfet M1 PdGv 45.9 mW Mosfet M1 PdGv 36.55 mW Mosfet M1 MOSFET switching losses M1 MR dson 9.648 mOhm Mosfet M1 MOSFET switching losses M1 MT IDP 69.602 degC Mosfet M1 MOSFET junction temperature M2 Ims 2.49 A Mosfet MOSFET junction temperature M2 PdCods 36.55 mW Mosfet MOSFET junction temperature M2 P	3.	Cout Pd	8.662 mW	Capacitor	Output capacitor power dissipation
6. ICThetaJA 65.7 degC/W IC IC junction-to-ambient thermal resistance 7. In Avg 6.286 A IC Average input current 8. L Ipp 1.972 A Inductor Peak-to-peak inductor ripple current 10. L I Ipk 7.273 A Inductor Inductor peak current 11. L I Irms 6.172 A Inductor Inductor peak current 12. M I Irms 5.647 A Mosfet MOSFET RMS ripple current 13. M Pd 792.04 mW Mosfet MOSFET power dissipation 14. M PdCond 369.17 mW Mosfet MOSFET power dissipation 15. M PdCoss 11.424 mW Mosfet MI MOSFET cost Losses 16. M PdGr 4.59 mW Mosfet MI MOSFET switching losses 17. M PdSw 365.55 mW Mosfet MI MOSFET switching losses 18. MI Rtson 9.648 mOhm Mosfet MI MOSFET junction-to-ambient thermal resistance 19. M T ThetaJA 50.0 degC/W Mosfet MOSFET junction temperature 11. M Z Irms 2.49 A Mosfet MOSFET jower dissipation 22. M PdCos	4.	IC Pd	63.639 mW		IC power dissipation
7. Ilin Avg 6.286 A IC Average input current 8. Lipp 1.972 A Inductor Peak-to-peak inductor rinductor piple current 10. Li I pk 7.273 A Inductor Inductor power dissipation 11. Li lims 6.172 A Inductor Inductor power dissipation 12. Mi Irms 5.647 A Mosfet MOSFET power dissipation 14. Mi Pd Gods 369.17 mW Mosfet MOSFET power dissipation 14. Mi PdCods 369.17 mW Mosfet MI MOSFET conduction losses 16. Mi PdCors 45.9 mW Mosfet MI MOSFET switching losses 16. Mi PdCor 45.9 mW Mosfet MI MOSFET switching losses 18. Mi Rdson 9.648 mOhm Mosfet MI MOSFET switching losses 19. Mi ThetaJA 50.0 degC/W Mosfet MOSFET switching losses 11. Mi Irms 2.49 A Mosfet MOSFET switching losses 12. M2 Pd 254.74 mW Mosfet MOSFET switching losses 22. M2 Pd 254.74 mW Mosfet MOSFET power dissipation 23. M2 PdCood <t< td=""><td>5.</td><td>IC Tj</td><td>34.181 degC</td><td>IC</td><td>IC junction temperature</td></t<>	5.	IC Tj	34.181 degC	IC	IC junction temperature
1. 1. 1. 1. 1. 1. 1. 1.	6.	ICThetaJA	65.7 degC/W	IC	IC junction-to-ambient thermal resistance
1. Pq	7.	lin Avg	6.286 A	IC	Average input current
1. LPd	8.	L lpp	1.972 A	Inductor	Peak-to-peak inductor ripple current
10. L Ipk	9.		71.415 mW	Inductor	Inductor power dissipation
11. Lt rims			7.273 A	Inductor	·
12 M1 Ims		•	6.172 A		·
13. M1 Pd	12.				• •
14. MI PdCond 369.17 mW Mosfet M1 MOSFET conduction losses 15. MI PdCors 11.424 mW Mosfet M1 MOSFET cost Losses 16. MI PdQrr 45.9 mW Mosfet M1 MOSFET switching losses 17. MI PdSw 365.55 mW Mosfet M1 MOSFET switching losses 18. MI Rdson 9.648 mOhm Mosfet Drain-Source On-resistance 19. MI ThetaJA 50.0 degC/W Mosfet M1 MOSFET junction-to-ambient thermal resistance 19. MI TiOP 69.602 degC Mosfet M1 MOSFET junction temperature 19. MI TiOP 69.602 degC Mosfet M1 MOSFET junction temperature 19. MI TiOP 69.602 degC Mosfet M1 MOSFET junction temperature 10. MI TiOP 69.602 degC Mosfet M2 PdCond 69.253 mW Mosfet M2 PdCond 69.253 mW Mosfet M2 PdCond 69.253 mW Mosfet M2 MOSFET conduction losses 17. M2 PdCos 11.114 mW Mosfet M2 MOSFET switching losses 18. M2 PdCos 11.114 mW Mosfet M2 MOSFET switching losses 18. M2 PdSw 21.767 mW Mosfet M2 MOSFET switching losses 18. M2 PdSw 21.767 mW Mosfet M2 MOSFET switching losses 18. M3 PdSw 21.767 mW Mosfet M2 MOSFET switching losses M2 M2 PdSw M2 PdGvr M2 PdGvr M3 PdSw	13.				• •
15. M1 PdCoss					·
M1 PdOrr					
17. M1 PdSw 365.55 mW Mosfet M1 MOSFET switching losses Drain-Source On-resistance Drain-Source On-resistance Drain-Source On-resistance Drain-Source On-resistance Drain-Source On-resistance MOSFET junction-to-ambient thermal resistance MOSFET junction-to-ambient thermal resistance MOSFET proper dissipation MOSFET power dissipation MOSFET pow					
18. M1 Rdson					· · · · · · · · · · · · · · · · · · ·
19. M1 ThetaJA 50.0 degCW Mosfet MOSFET junction-to-ambient thermal resistance 20. M1 TjOP 69.602 degC Mosfet M1 MOSFET junction temperature 21. M2 Irms 2.49 A Mosfet MOSFET RMS ripple current 22. M2 Pd 254.74 mW Mosfet MOSFET power dissipation 23. M2 PdCond 69.253 mW Mosfet M2 MOSFET conduction losses 24. M2 PdCoss 11.114 mW Mosfet M2 MOSFET conduction losses 25. M2 PdSw 21.767 mW Mosfet M2 MOSFET switching losses 26. M2 PdSw 21.767 mW Mosfet M2 MOSFET switching losses 27. M2 Rdson 8.595 mOhm Mosfet Mosfet MOSFET junction-to-ambient of the power FET 27. M2 Rdson 8.595 mOhm Mosfet MOSFET junction-to-ambient of the power FET 27. M2 Rdson 8.595 mOhm Mosfet MOSFET junction-to-ambient thermal resistance 28. M2 ThetaJA 50.0 degC/W Mosfet MOSFET junction-to-ambient thermal resistance					· · · · · · · · · · · · · · · · · · ·
20. M1 TjOP 69.602 degC Mosfet M1 MOSFET junction temperature 21. M2 Irms 2.49 A Mosfet MOSFET fower dissipation 22. M2 Pd 254.74 mW Mosfet MOSFET power dissipation 23. M2 PdCond 69.253 mW Mosfet M2 MOSFET conduction losses 24. M2 PdCoss 11.114 mW Mosfet M2 MOSFET switching losses 25. M2 PdSw 21.767 mW Mosfet M2 SFET switching losses 26. M2 Pdbody 152.61 mW Mosfet Power dissipation through lower FET 27. M2 Rdson 8.595 mOhm Mosfet MOSFET junction temperature 28. M2 ThetaJA 50.0 degC/W Mosfet MOSFET junction temperature 29. M2 TjOP 42.737 degC Mosfet MOSFET junction temperature 30. Cin Pd 108.06 μW Power Input capacitor power dissipation 31. Cout Pd 8.662 mW Power Input capacitor power dissipation 32. IC Pd 63.639 mW <t< td=""><td></td><td></td><td></td><td></td><td></td></t<>					
21. M2 Irms 2.49 A Mosfet MOSFET RMS ripple current 22. M2 Pd 254.74 mW Mosfet MCSFET power dissipation 23. M2 PdCond 69.253 mW Mosfet M2 MOSFET conduction losses 24. M2 PdCoss 11.114 mW Mosfet M2 MOSFET conduction losses 25. M2 PdSw 21.767 mW Mosfet M2 MOSFET switching losses 26. M2 PdSw 21.767 mW Mosfet M2 MOSFET switching losses 27. M2 Rdson 8.595 mOhm Mosfet Power dissipation lower FET 28. M2 ThetaJA 50.0 degC/W Mosfet MOSFET junction-to-ambient thermal resistance 29. M2 TjOP 42.737 degC Mosfet MOSFET junction temperature 30. Cin Pd 108.06 µW Power Input capacitor power dissipation 31. Cout Pd 8.662 mW Power Output capacitor power dissipation 32. LC Pd 63.639 mW Power Inductor power dissipation 33. LP d 71.415 mW <			· ·		•
22. M2 Pd 254.74 mW Mosfet MOSFET power dissipation 23. M2 PdCond 69.253 mW Mosfet M2 MOSFET conduction losses 24. M2 PdCoss 11.114 mW Mosfet M2 MOSFET Coss Losses 25. M2 PdSw 21.767 mW Mosfet M2 MOSFET switching losses 26. M2 Pdbody 152.61 mW Mosfet Power dissipation through lower FET 27. M2 Rdson 8.595 mOhm Mosfet Drain-Source On-resistance 28. M2 ThetaJA 50.0 degC/W Mosfet MOSFET junction-to-ambient thermal resistance 29. M2 TjOP 42.737 degC Mosfet MOSFET junction temperature 30. Cin Pd 108.06 µW Power Input capacitor power dissipation 31. Cout Pd 8.662 mW Power Utput capacitor power dissipation 32. IC Pd 63.639 mW Power IC power dissipation 33. L Pd 71.415 mW Power Inductor power dissipation 34. M1 Pd 792.04 mW <td< td=""><td></td><td>•</td><td>•</td><td></td><td>·</td></td<>		•	•		·
23. M2 PdCond 69.253 mW Mosfet M2 MOSFET conduction losses 24. M2 PdCoss 11.114 mW Mosfet M2 MOSFET Coss Losses 25. M2 PdSw 21.767 mW Mosfet M2 MOSFET switching losses 26. M2 Pdbody 152.61 mW Mosfet Power dissipation through lower FET 27. M2 Rdson 8.595 mOhm Mosfet Drain-Source On-resistance 28. M2 ThetaJA 50.0 degC/W Mosfet MOSFET junction-to-ambient thermal resistance 29. M2 TjOP 42.737 degC Mosfet MOSFET junction temperature 30. Cin Pd 108.06 μW Power Input capacitor power dissipation 31. Cout Pd 8.662 mW Power Input capacitor power dissipation 32. L Pd 71.415 mW Power Inductor power dissipation 33. L Pd 71.415 mW Power MOSFET power dissipation 34. M1 PdCond 369.17 mW Power MOSFET power dissipation 35. M1 PdCoss 11.424 mW					• •
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25. M2 PdSw 21.767 mW Mosfet M2 MOSFET switching losses 26. M2 Pdbody 152.61 mW Mosfet Power dissipation through lower FET 27. M2 Rdson 8.595 mOhm Mosfet Power dissipation through lower FET 28. M2 ThetaJA 50.0 degC/W Mosfet MOSFET junction-to-ambient thermal resistance 29. M2 TjOP 42.737 degC Mosfet MOSFET junction temperature 30. Cin Pd 108.06 µW Power Input capacitor power dissipation 31. Cout Pd 8.662 mW Power Output capacitor power dissipation 32. IC Pd 63.639 mW Power IC power dissipation 33. L Pd 71.415 mW Power MOSFET power dissipation 34. M1 Pd 792.04 mW Power MOSFET power dissipation 35. M1 PdCond 369.17 mW Power M1 MOSFET conduction losses 36. M1 PdCors 11.424 mW Power M1 MOSFET switching losses 37. M1 PdSw 365.55 mW					
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Design Inputs

Name	Value	Description	
lout	1.0	Maximum Output Current	
SoftStart	1.01 ms	Soft Start Time (ms)	
VinMax	5.5	Maximum input voltage	
VinMin	4.5	Minimum input voltage	
VinTyp	5.0	Typical input voltage	
Vout	27.0	Output Voltage	
base_pn	TPS43061	Base Product Number	
source	DC	Input Source Type	
Та	30.0	Ambient temperature	
UserFsw	301.047 k	Customer Selected Frequency	

WEBENCH® Assembly

Component Testing

Some published data on components in datasheets such as Capacitor ESR and Inductor DC resistance is based on conservative values that will guarantee that the components always exceed the specification. For design purposes it is usually better to work with typical values. Since this data is not always available it is a good practice to measure the Capacitance and ESR values of Cin and Cout, and the inductance and DC resistance of L1 before assembly of the board. Any large discrepancies in values should be electrically simulated in WEBENCH to check for instabilities and thermally simulated in WebTHERM to make sure critical temperatures are not exceeded.

Soldering Component to Board

If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab town to the board place the iron down on the board while resting against the tab, heating both surfaces simultaneously. Apply light pressure to the top of the plastic case until the solder flows around the part and the part is flush with the PCB. If the solder is not flowing around the board you may need a higher wattage iron (generally 25W to 30W is enough).

Initial Startup of Circuit

It is best to initially power up the board by setting the input supply voltage to the lowest operating input voltage 4.5V and set the input supply's current limit to zero. With the input supply off connect up the input supply to Vin and GND. Connect a digital volt meter and a load if needed to set the minimum lout of the design from Vout and GND. Turn on the input supply and slowly turn up the current limit on the input supply. If the voltage starts to rise on the input supply continue increasing the input supply current limit while watching the output voltage. If the current increases on the input supply, but the voltage remains near zero, then there may be a short or a component misplaced on the board. Power down the board and visually inspect for solder bridges and recheck the diode and capacitor polarities. Once the power supply circuit is operational then more extensive testing may include full load testing, transient load and line tests to compare with simulation results.

Load Testing

The setup is the same as the initial startup, except that an additional digital voltmeter is connected between Vin and GND, a load is connected between Vout and GND and a current meter is connected in series between Vout and the load. The load must be able to handle at least rated output power + 50% (7.5 watts for this design). Ideally the load is supplied in the form of a variable load test unit. It can also be done in the form of suitably large power resistors. When using an oscilloscope to measure waveforms on the prototype board, the ground leads of the oscilloscope probes should be as short as possible and the area of the loop formed by the ground lead should be kept to a minimum. This will help reduce ground lead inductance and eliminate EMI noise that is not actually present in the circuit.



Design Assistance

- 1. Feature Highlights: Low Quiescent Current Boost Controller, Wide Vin Range 4.5V to 38V Vin, 58V Vout, 5.5V Gate Drive optimized for Low Qg NexFETs Thermal Shutdown
- 2. Master key: E56AD4253327D321[v1]
- 3. TPS43061 Product Folder: http://www.ti.com/product/TPS43061: contains the data sheet and other resources.

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