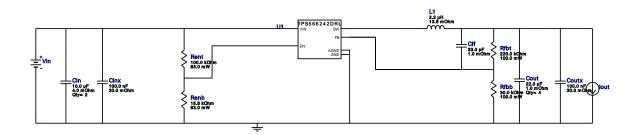
VinMin = 11.0V VinMax = 13.0V Vout = 5.0V Iout = 6.0A Device = TPS566242DRLR Topology = Buck Created = 2024-02-09 22:26:56.806 BOM Cost = \$1.82 BOM Count = 15 Total Pd = 2.36W

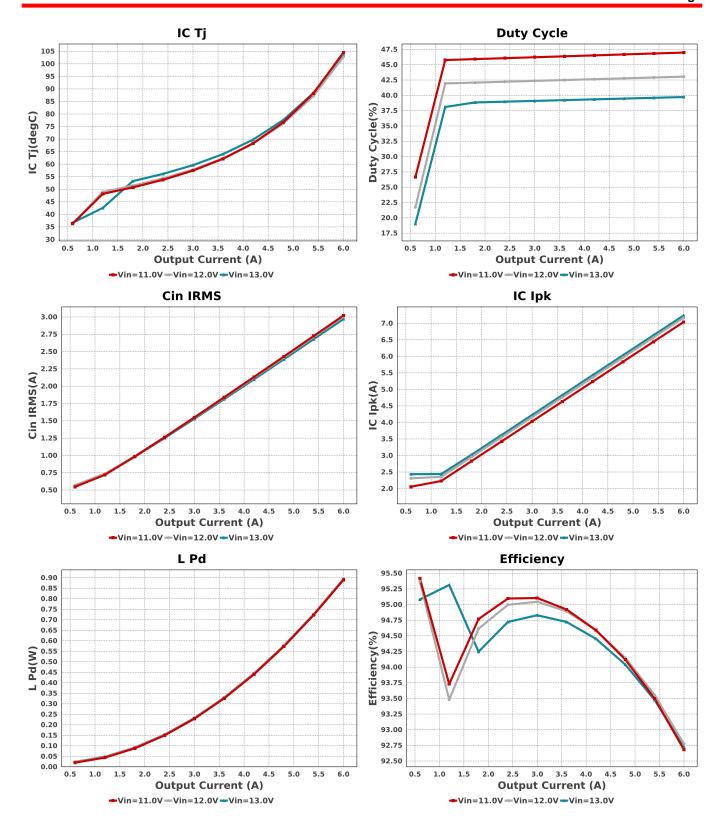
WEBENCH® Design Report

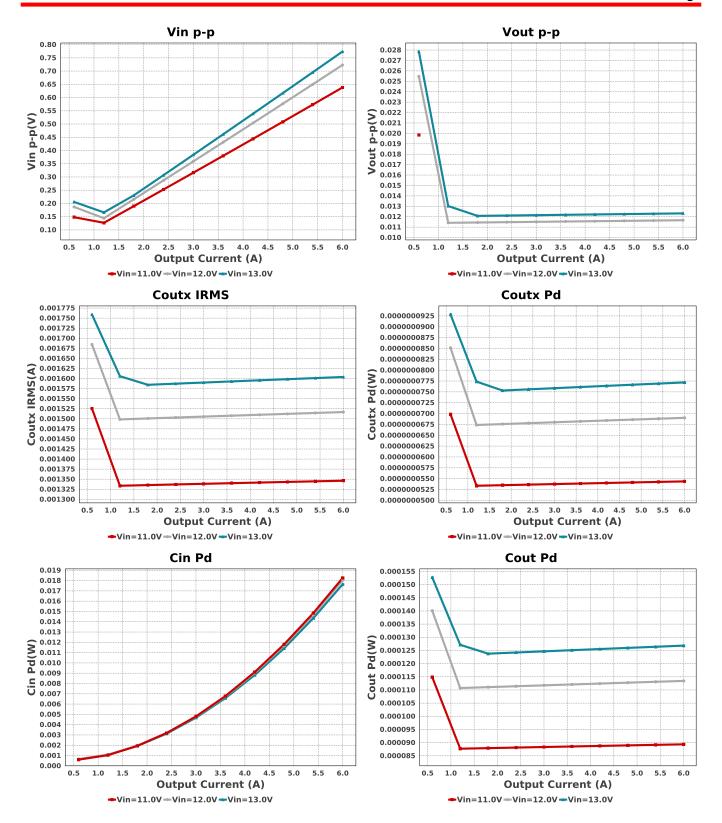
Design: 30 TPS566242DRLR TPS566242DRLR 11V-13V to 5.00V @ 6A

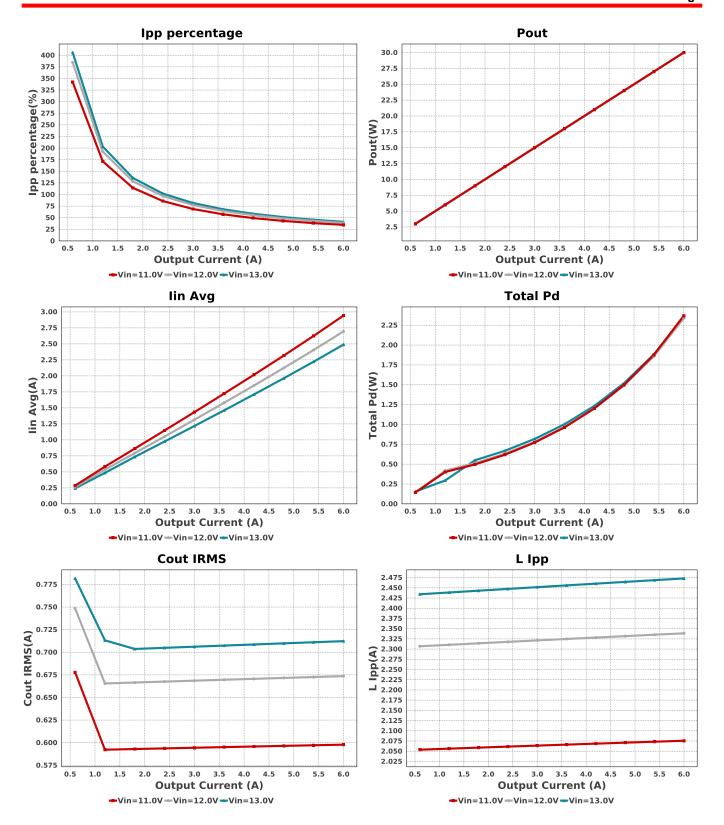


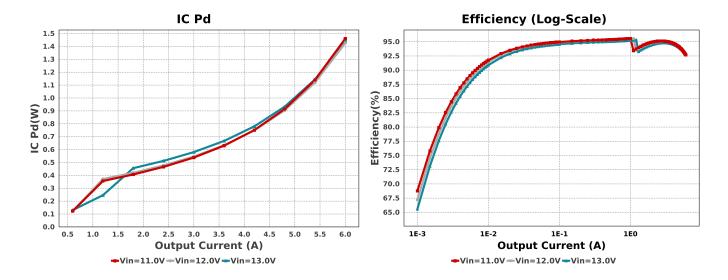
Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cff	MuRata	GRM1555C1E330JA01D Series= C0G/NP0	Cap= 33.0 pF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
Cin	MuRata	GRM21BR61E106MA73L Series= X5R	Cap= 10.0 uF ESR= 4.0 mOhm VDC= 25.0 V IRMS= 2.8 A	2	\$0.04	0805 7 mm ²
Cinx	MuRata	GRM188R71H104KA93D Series= X7R	Cap= 100.0 nF ESR= 20.0 mOhm VDC= 50.0 V IRMS= 3.8 A	1	\$0.02	0603 5 mm ²
Cout	Taiyo Yuden	LMK212BJ226MG-T Series= X5R	Cap= 22.0 uF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 1.6 A	4	\$0.09	0805 7 mm ²
Coutx	MuRata	GRM188R71E104KA01D Series= X7R	Cap= 100.0 nF ESR= 30.0 mOhm VDC= 25.0 V IRMS= 1.51 A	1	\$0.01	0603 5 mm ²
L1	Vishay-Dale	IHLP2525EZER2R2M01	L= 2.2 μH 13.6 mOhm	1	\$1.10	IHLP-2525EZ 75 mm ²
Renb	Vishay-Dale	CRCW040215K8FKED Series= CRCWe3	Res= 15.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
Rent	Vishay-Dale	CRCW0402100KFKED Series= CRCWe3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
Rfbb	Yageo	RC0603FR-0730KL Series= ?	Res= 30.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
Rfbt	Yageo	RC0603FR-07220KL Series= ?	Res= 220.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
U1	Texas Instruments	TPS566242DRLR	Switcher	1	\$0.20	DRL0006A 7 mm²









Operating Values

1. Cin IRMS 2.97 A Capacitor 2. Cin Pd 17.644 mW Capacitor 3. Coul IRMS 712.286 mA Capacitor 4. Coult Pd 12.884 mW Capacitor 5. Coutx IRMS 1.604 mA Capacitor 6. Coutx Pd 77.171 nW Capacitor 7. IC Ipk 7.236 A IC 8. IC Pd 1.444 W IC 9. IC Tj 103.619 degC IC 10. IC Tolerance 11.0 mV IC 11. ICThetaJA Effective 51.0 degC/W IC 12. In Avg 2.489 A IC 13. Ipp percentage 41.216 % Inductor 15. L Pd 893.76 mW Inductor 16. Cin Pd 17.644 mW Power 17. Coult Pd 12.684 µW Power 18. Coutx Pd 77.171 nW Power 19. L Pd 893.76 mW Power 10. L Pd 893.76 mW Power 10. Total Pd 2.258 tw Power 11. Total Pd 2.355 W	.#	Name	Value	Category	Description
3. Cout RMS 712.286 mA Capacitor Cout Pd 126.84 µW Capacitor Cout Pd Cout Pd Capacitor Capacitor Cout Pd Capacitor C	1.	Cin IRMS	2.97 A	Capacitor	Input capacitor RMS ripple current
Cout Pd 128.84 µW Capacitor Coutx RMS 1604 mA Capacitor Coutx RMS 1604 mA Capacitor Capacitor Coutx Pd 77.171 nW Capacitor	2.	Cin Pd	17.644 mW	Capacitor	Input capacitor power dissipation
5. Coutx RMS 1.604 mA Capacitor Output capacitor, x RMS ripple current 6. Coutx Pd 7.7171 nW Capacitor Cuptu capacitor, x power loss 7. IC Ipk 7.236 A IC IC Peak switch current in IC 9. IC Tj 103.619 degC IC IC Income dependent of the current in IC IC Income dependent of the current in IC 10. IC Tolerance 11.0 mV IC IC power dissipation 11. ICThetaJA Effective 51.0 degC/W IC IC junction temperature 12. Il in Avg 2.489 A IC IC junction temperature 12. Il in Avg 2.489 A IC IC victor tolerance 13. Ipp percentage 41.216 % Inductor Inductor or inductor incoment Inductor prover dissipation 15. L Pd 893.76 mW Power Inductor prover dissipation 16. Cin Pd 17.644 mW Power Output capacitor power dissipation 17. Cout Pd 1.268 dt JW Power Output capacitor power dissipation 18. IC Pd 1.344 W Power Output capacitor power dissipation 19. C Pd <td>3.</td> <td>Cout IRMS</td> <td>712.286 mA</td> <td>Capacitor</td> <td>Output capacitor RMS ripple current</td>	3.	Cout IRMS	712.286 mA	Capacitor	Output capacitor RMS ripple current
Coutx Pd	4.	Cout Pd	126.84 μW	Capacitor	Output capacitor power dissipation
C C Peak switch current in IC	5.	Coutx IRMS	1.604 mA	Capacitor	Output capacitor_x RMS ripple current
7. C Dpk	6.	Coutx Pd	77.171 nW	Capacitor	Output capacitor_x power loss
B. C Pd	7.	IC lpk	7.236 A		
9. IC Tj	8.	IC Pd	1.444 W	IC	IC power dissipation
10. C Tolerance	9.	IC Ti	103.619 deaC		·
11. ICThetaJA Effective 12. Iin Avg			•		,
12. In Avg					
13.	12.				
14. L lpp		0			0 1
14. L Ipp 2.473 A Inductor Peak-to-peak inductor ripple current 15. L Pd 893.76 mW Inductor Peak-to-peak inductor ripple current 16. Cin Pd 17.644 mW Power Inductor power dissipation 17. Cout Pd 126.84 µW Power Output capacitor power dissipation 18. Coutx Pd 77.171 nW Power Output capacitor power dissipation 19. IC Pd 1.444 W Power IC power dissipation 10. L Pd 893.76 mW Power IC power dissipation 11. Total Pd 2.355 W Power Total Power Dissipation 12. BOM Count 15 System Information Duty cycle 11. Total Pd 2.355 W Power Total Power Dissipation 23. Duty Cycle 39.721 % System Information System System 1. Efficiency 92.721 % System Information System Information 26. Frequency 569.405 kHz System Information Switching frequency 27. lout 6.0 A System Information System Information 28. Mode		77 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7			
15. L Pd	14.	L lpp	2.473 A	Inductor	,
16. Cin Pd			-		· · · · · · · · · · · · · · · · · · ·
17. Cout Pd 126.84 µW Power Output capacitor power dissipation 18. Coutx Pd 77.171 nW Power Output capacitor x power loss 19. IC Pd 1.444 W Power IC power dissipation 20. L Pd 893.76 mW Power Inductor power dissipation 21. Total Pd 2.355 W Power Total Power Dissipation 22. BOM Count 15 System Information System Duty cycle 23. Duty Cycle 39.721 % System Information System Steady state efficiency 24. Efficiency 92.721 % System Information Total Foot Print Area of BOM components 25. FootPrint 150.0 mm² System Information System Output power Information 26. Frequency 569.405 kHz System Information System Output power Information 27. Iout 6.0 A System Information Total Double power Information 28. Mode CCM System Information Total BOM Cost Information 30. Total BOM \$1.82 System Information 31. Vin 13.0 V System Information System Information					·
18. Coutx Pd 77.171 nW Power 19. Cutput capacitor_x power loss 12. Led 17.444 W Power 10. Led 18.					· · · · · · · · · · · · · · · · · · ·
19. IC Pd			•		
20. L Pd 893.76 mW Power Inductor power dissipation 21. Total Pd 2.355 W Power 22. BOM Count 23. Duty Cycle 39.721 % System Information 24. Efficiency 92.721 % System Information 25. FootPrint 150.0 mm² System Information 26. Frequency 569.405 kHz System Information 27. lout 6.0 A System Information 28. Mode CCM System Information 29. Pout 30.0 W System Information 30. Total BOM \$1.82 System Information 31. Vin 13.0 V System Information 32. Vin p-p 773.832 mV System Information 33. Vout 5.0 V System Information 34. Vout Actual 5.0 V System Information 35. Vout Tolerance 3.644 % System Information 36. Vout p-p 12.32 mV System Power Dissipation Total Power Dissipation Total Power Dissipation Total Design BOM count Total Power Dissipation Total Design BOM count Income Duty cycle Indomation Switching frequency Iout operating point Total Foot Print Area of BOM components Incometion Switching frequency Iout operating point Iout operating point Total output power Total BOM Cost Information Vin operating point	_				• • = •
21.Total Pd 22.2.355 W 15Power System InformationTotal Power Dissipation Total Design BOM count23.Duty Cycle39.721 %System InformationDuty cycle24.Efficiency92.721 %System InformationSystem SystemSteady state efficiency25.FootPrint150.0 mm²System InformationTotal Foot Print Area of BOM components26.Frequency569.405 kHzSystem InformationSwitching frequency27.Iout6.0 ASystem InformationIout operating point28.ModeCCMSystem InformationConduction Mode29.Pout30.0 WSystem InformationTotal output power30.Total BOM\$1.82System InformationTotal BOM Cost31.Vin13.0 VSystem InformationTotal BOM Cost32.Vin p-p773.832 mVSystem InformationPeak-to-peak input voltage33.Vout Actual5.0 VSystem InformationOperational Output Voltage34.Vout Actual5.0 VSystem InformationVout Actual calculated based on selected voltage divider resistors35.Vout Tolerance3.644 %System InformationVout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable36.Vout P-p12.32 mVSystem InformationVout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable					·
22. BOM Count 15 System Information System Information					·
Information System Duty cycle 39.721 % System Information System System System Information System Information System					·
23. Duty Cycle 39.721 % System Information System System Steady state efficiency Information 25. FootPrint 150.0 mm² System Information 26. Frequency 569.405 kHz System Information 27. lout 6.0 A System Information 28. Mode CCM System Information 29. Pout 30.0 W System Information 30. Total BOM \$1.82 System Information 31. Vin 13.0 V System Information 32. Vin p-p 773.832 mV System Information 33. Vout 5.0 V System Information 34. Vout Actual 5.0 V System Information System Information System Information Vout Actual 5.0 V System Vout Actual 5.0 V System Vout Tolerance Information System Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable Peak-to-peak output ripple voltage				•	
Information System Steady state efficiency FrootPrint 150.0 mm² System Information System Information System Information System Information Switching frequency Information Switching frequency Information Switching frequency Information Switching frequency Information Information Switching frequency Information Switching frequency Information Switching frequency Information Information Information System Information Switching frequency Infor	23.	Duty Cycle	39.721 %		Duty cycle
24. Efficiency 92.721 % System Information 25. FootPrint 150.0 mm² System Information 26. Frequency 569.405 kHz System Information 27. lout 6.0 A System Information 28. Mode CCM System Information 29. Pout 30.0 W System Information 30. Total BOM \$1.82 System Information 31. Vin 13.0 V System Information 32. Vin p-p 773.832 mV System Information 33. Vout 5.0 V System Information 34. Vout Actual 5.0 V System Information 35. Vout Tolerance 3.644 % System Information 36. Vout p-p 12.32 mV System Information 37. System Information System Information 38. Vout Tolerance 3.644 % System Information Information System Information System Information System Information System Information Information System Information System Information Information System System Peak-to-peak output ripple voltage		. , . ,		•	- , , , , .
Information System Total Foot Print Area of BOM components Information System Switching frequency Septem System Information Information System Information Information Information System Information Information Information System Information	24.	Efficiency	92.721 %		Steady state efficiency
Information System Switching frequency Information System Information In		•			•
Information System Switching frequency Information System Information In	25.	FootPrint	150.0 mm ²	System	Total Foot Print Area of BOM components
Information System Information System Information				Information	
27. lout 6.0 A System Information 28. Mode CCM System Conduction Mode Information 29. Pout 30.0 W System Information 30. Total BOM \$1.82 System Information 31. Vin 13.0 V System Vin operating point 32. Vin p-p 773.832 mV System Information 33. Vout 5.0 V System Information 34. Vout Actual 5.0 V System Information 35. Vout Tolerance 3.644 % System Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable 36. Vout p-p 12.32 mV System Peak-to-peak output ripple voltage	26.	Frequency	569.405 kHz	System	Switching frequency
Information System Conduction Mode				Information	
28. Mode CCM System Information 29. Pout 30.0 W System Total output power Information 30. Total BOM \$1.82 System Information 31. Vin 13.0 V System Vin operating point Information 32. Vin p-p 773.832 mV System Information 33. Vout 5.0 V System Information 34. Vout Actual 5.0 V System Vout Actual calculated based on selected voltage divider resistors Information 35. Vout Tolerance 3.644 % System Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable 36. Vout p-p 12.32 mV System Peak-to-peak output ripple voltage	27.	lout	6.0 A	System	lout operating point
Information System Total output power				Information	
29. Pout 30.0 W System Information 30. Total BOM \$1.82 System Information 31. Vin 13.0 V System Vin operating point 32. Vin p-p 773.832 mV System Peak-to-peak input voltage Information 33. Vout 5.0 V System Operational Output Voltage 34. Vout Actual 5.0 V System Vout Actual calculated based on selected voltage divider resistors 35. Vout Tolerance 3.644 % System Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable 36. Vout p-p 12.32 mV System Peak-to-peak output ripple voltage	28.	Mode	CCM	System	Conduction Mode
Information 30. Total BOM \$1.82 System Total BOM Cost Information 31. Vin 13.0 V System Vin operating point Information 32. Vin p-p 773.832 mV System Peak-to-peak input voltage Information 33. Vout 5.0 V System Operational Output Voltage Information 34. Vout Actual 5.0 V System Vout Actual calculated based on selected voltage divider resistors Information 35. Vout Tolerance 3.644 % System Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable 36. Vout p-p 12.32 mV System Peak-to-peak output ripple voltage				Information	
30. Total BOM \$1.82 System Information 31. Vin 13.0 V System Vin operating point 32. Vin p-p 773.832 mV System Peak-to-peak input voltage Information 33. Vout 5.0 V System Operational Output Voltage Information 34. Vout Actual 5.0 V System Information 35. Vout Tolerance 3.644 % System Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable 36. Vout p-p 12.32 mV System Peak-to-peak output ripple voltage	29.	Pout	30.0 W	System	Total output power
Information 31. Vin 13.0 V System Vin operating point 32. Vin p-p 773.832 mV System Peak-to-peak input voltage Information 33. Vout 5.0 V System Operational Output Voltage Information 34. Vout Actual 5.0 V System Information 35. Vout Tolerance 3.644 % System Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable 36. Vout p-p 12.32 mV System Peak-to-peak output ripple voltage				Information	
31. Vin 13.0 V System Vin operating point 32. Vin p-p 773.832 mV System Peak-to-peak input voltage Information 33. Vout 5.0 V System Operational Output Voltage Information 34. Vout Actual 5.0 V System Information 35. Vout Tolerance 3.644 % System Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable 36. Vout p-p 12.32 mV System Peak-to-peak output ripple voltage	30.	Total BOM	\$1.82	System	Total BOM Cost
Information System Peak-to-peak input voltage Peak-to-peak input voltage				Information	
32. Vin p-p 773.832 mV System Information 33. Vout 5.0 V System Operational Output Voltage Information 34. Vout Actual 5.0 V System Vout Actual calculated based on selected voltage divider resistors Information 35. Vout Tolerance 3.644 % System Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable 36. Vout p-p 12.32 mV System Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable Peak-to-peak output ripple voltage	31.	Vin	13.0 V	System	Vin operating point
Information 33. Vout 5.0 V System Operational Output Voltage Information 34. Vout Actual 5.0 V System Vout Actual calculated based on selected voltage divider resistors Information 35. Vout Tolerance 3.644 % System Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable 36. Vout p-p 12.32 mV System Peak-to-peak output ripple voltage				Information	
33. Vout 5.0 V System Operational Output Voltage 34. Vout Actual 5.0 V System Vout Actual calculated based on selected voltage divider resistors Information 35. Vout Tolerance 3.644 % System Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable 36. Vout p-p 12.32 mV System Peak-to-peak output ripple voltage	32.	Vin p-p	773.832 mV	System	Peak-to-peak input voltage
Information 34. Vout Actual 5.0 V System Information Vout Actual calculated based on selected voltage divider resistors Vout Tolerance 3.644 % System Vout Tolerance based on IC Tolerance (no load) and voltage divider Vout Tolerance based on IC Tolerance (no load) and voltage divider Vout Tolerance based on IC Tolerance (no load) and voltage divider Vout Tolerance based on IC Tolerance (no load) and voltage Vout Tolerance based on IC Tolerance (no load) and voltage Vout Tolerance based on IC Tolerance (no load) and voltage divider Vout Tolerance based on IC Tolerance (no load) and voltage divider Vout Tolerance based on IC Tolerance (no load) and voltage divider Vout Tolerance based on IC Tolerance (no load) and voltage divider Vout Tolerance based on IC Tolerance (no load) and voltage divider Vout Tolerance based on IC Tolerance (no load) and voltage divider Vout Tolerance based on IC Tolerance (no load) and voltage divider Vout Tolerance based on IC Tolerance (no load) and voltage divider Vout Tolerance based on IC Tolerance (no load) and voltage divider Vout Tolerance based on IC Tolerance (no load) and voltage divider Vout Tolerance based on IC Tolerance (no load) and voltage divider Vout Tolerance based on IC Tolerance (no load) and voltage divider Vout Tolerance based on IC Tolerance (no load) and voltage (no load)				Information	
34. Vout Actual 5.0 V System Vout Actual calculated based on selected voltage divider resistors 35. Vout Tolerance 3.644 % System Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable 36. Vout p-p 12.32 mV System Peak-to-peak output ripple voltage	33.	Vout	5.0 V	System	Operational Output Voltage
Information 35. Vout Tolerance 3.644 % System Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable 36. Vout p-p 12.32 mV System Peak-to-peak output ripple voltage				Information	
35. Vout Tolerance 3.644 % System Vout Tolerance based on IC Tolerance (no load) and voltage divider Information resistors if applicable 36. Vout p-p 12.32 mV System Peak-to-peak output ripple voltage	34.	Vout Actual	5.0 V	System	Vout Actual calculated based on selected voltage divider resistors
Information resistors if applicable 36. Vout p-p 12.32 mV System Peak-to-peak output ripple voltage					
36. Vout p-p 12.32 mV System Peak-to-peak output ripple voltage	35.	Vout Tolerance	3.644 %	,	` ,
, , , , , , , , , , , , , , , , , , , ,					·
Information	36.	Vout p-p	12.32 mV	•	Peak-to-peak output ripple voltage
				Information	

Design Inputs

	Name	Value	Description
_	lout	6.0	Maximum Output Current
	VinMax	13.0	Maximum input voltage
	VinMin	11.0	Minimum input voltage
	Vout	5.0	Output Voltage
	base_pn	TPS566242	Base Product Number
	source	DC	Input Source Type
	Та	30.0	Ambient temperature

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 11.0V 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. Master key: 1CDCE4611E3710EC[v1]
- 2. TPS566242 Product Folder: http://www.ti.com/product/TPS566242: contains the data sheet and other resources.

Important Notice and Disclaimer

TI provides technical and reliability data (including datasheets), design resources (including reference designs), application or other design advice, web tools, safety information, and other resources AS IS and with all faults, and disclaims all warranties. These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

Providing these resources does not expand or otherwise alter TI's applicable Terms of Sale or other applicable terms available either on ti.com or provided in conjunction with TI products.