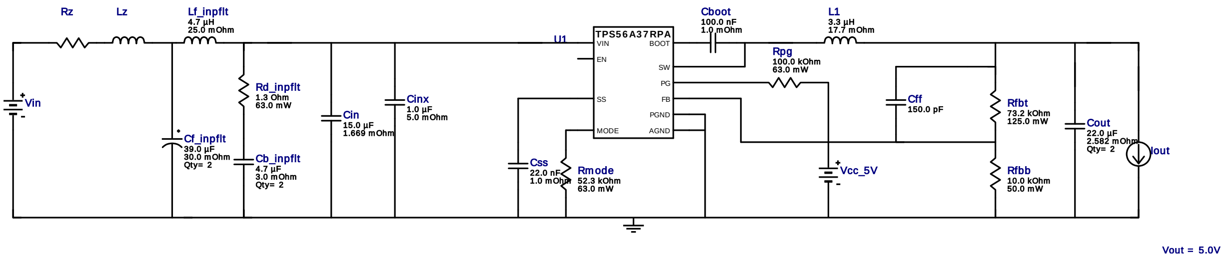
TEXAS INSTRUMENTS

WEBENCH ® Design Report

VinMin = 10.0V
VinMax = 22.0V
Vout = 5.0V
Iout = 7.5A

Device = TPS56A37RPAR
Topology = Buck
Created = 2026-01-18 12:16:16.142
BOM Cost = $4.37
BOM Count = 19
Total Pd = 2.87W

Design : 2 TPS56A37RPAR
TPS56A37RPAR 10V-22V to 5.00V @ 7.5A

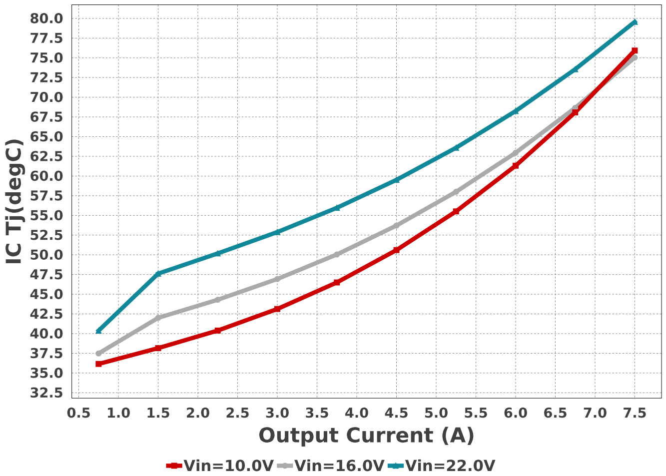


Electrical BOM

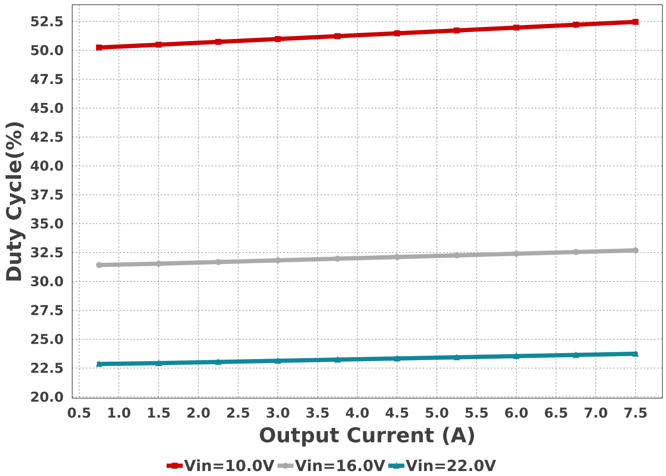
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cb_inpflt	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	2	$0.10	1206 11 mm^2
Cboot	Taiyo Yuden	EMK107B7104KA-T Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm^2
Cf_inpflt	Panasonic	35SVPF39M Series= SVPF	Cap= 39.0 uF ESR= 30.0 mOhm VDC= 35.0 V IRMS= 2.8 A	2	$0.67	CAPSMT_62_E7 106 mm^2
Cff	Kemet	C0603C151K3GACTU Series= C0G/NP0	Cap= 150.0 pF VDC= 25.0 V IRMS= 0.0 A	1	$0.02	0603 5 mm^2
Cin	TDK	C2012X5R1V156M125AC Series= X5R	Cap= 15.0 uF ESR= 1.669 mOhm VDC= 35.0 V IRMS= 5.0498 A	1	$0.20	0805 7 mm^2
Cinx	TDK	C1608X7R1V105K080AC Series= X7R	Cap= 1.0 uF ESR= 5.0 mOhm VDC= 35.0 V IRMS= 0.0 A	1	$0.06	0603 5 mm^2
Cout	TDK	C3225X6S1C226M250AC Series= X6S	Cap= 22.0 uF ESR= 2.582 mOhm VDC= 16.0 V IRMS= 4.5756 A	2	$0.22	1210_280 15 mm^2
Css	MuRata	GRM155R71C223KA01D Series= X7R	Cap= 22.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm^2
L1	Vishay-Dale	IHLP3232DZER3R3M01	L= 3.3 µH 17.7 mOhm	1	$0.71	IHLP-3232DZ 112 mm^2
Lf_inpflt	TDK	VLP8040T-4R7M	L= 4.7 µH 25.0 mOhm	1	$0.22	VLP8040 113 mm^2

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Rd_inpflt	Vishay-Dale	CRCW04021R30FKED Series= CRCW..e3	Res= 1.3 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rfbb	Yageo	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
Rfbt	Panasonic	ERJ-6ENF7322V Series= ERJ-6E	Res= 73.2 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2
Rmode	Vishay-Dale	CRCW040252K3FKED Series= CRCW..e3	Res= 52.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rpg	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
U1	Texas Instruments	TPS56A37RPAR	Switcher	1	$1.11	RPA0010A 16 mm^2

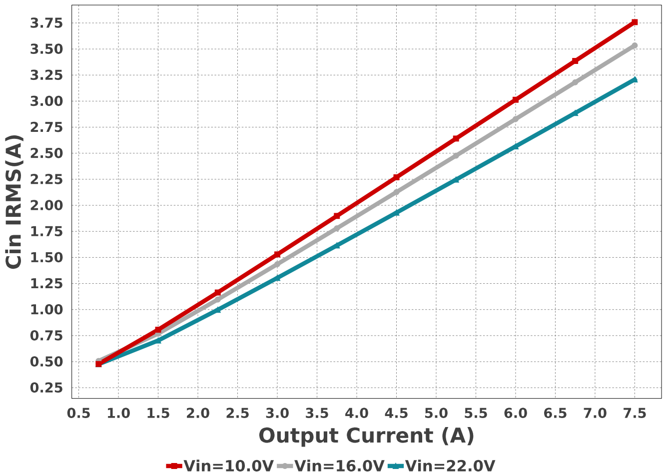
IC Tj



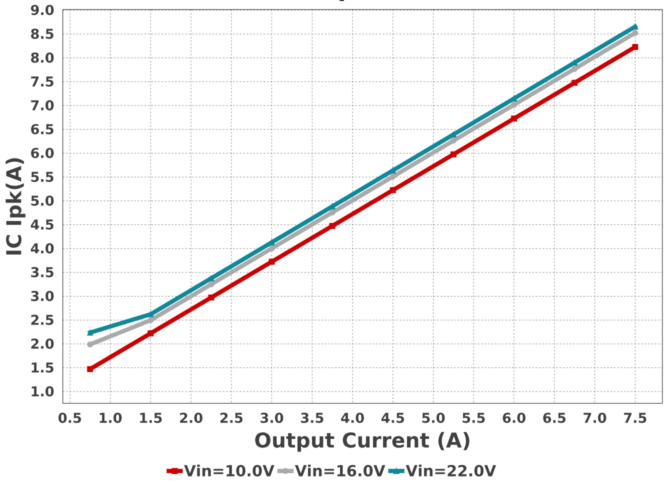
Duty Cycle

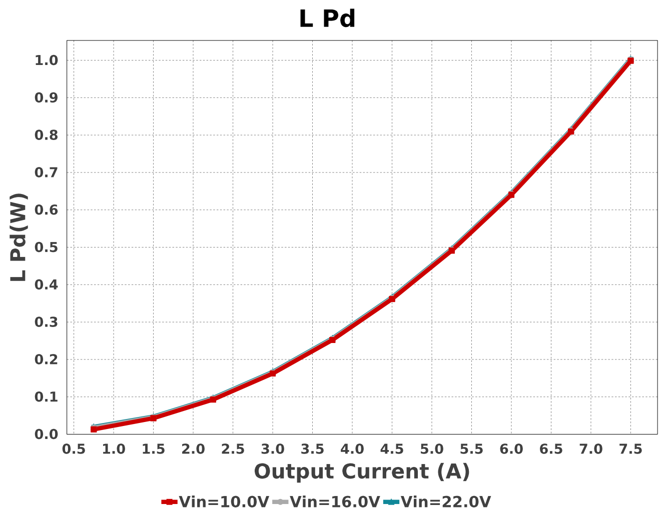


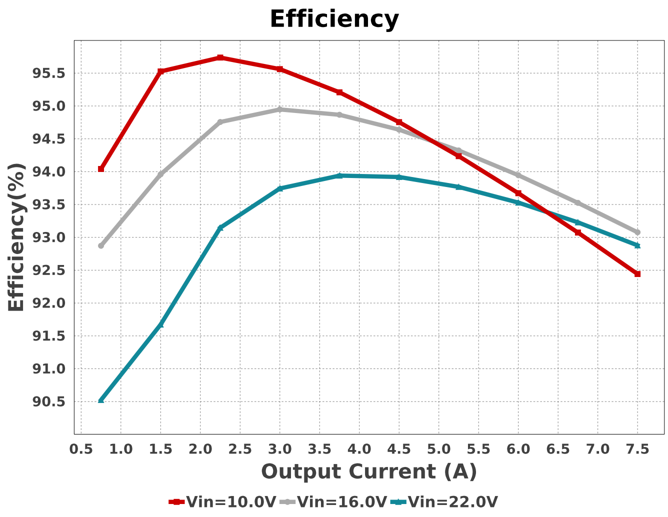
Cin IRMS

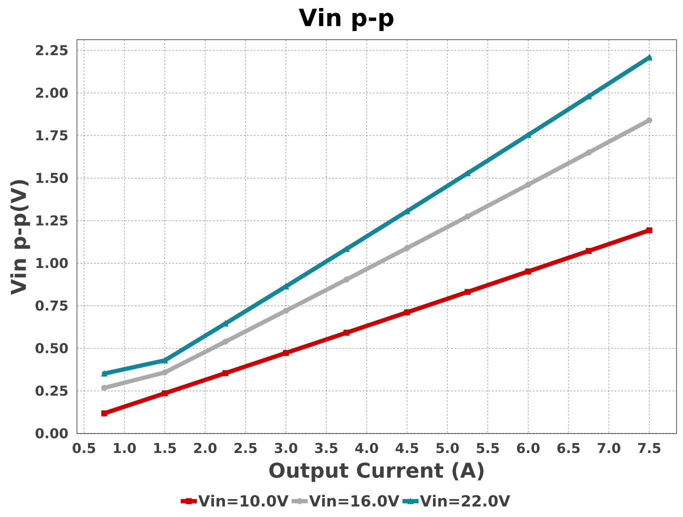


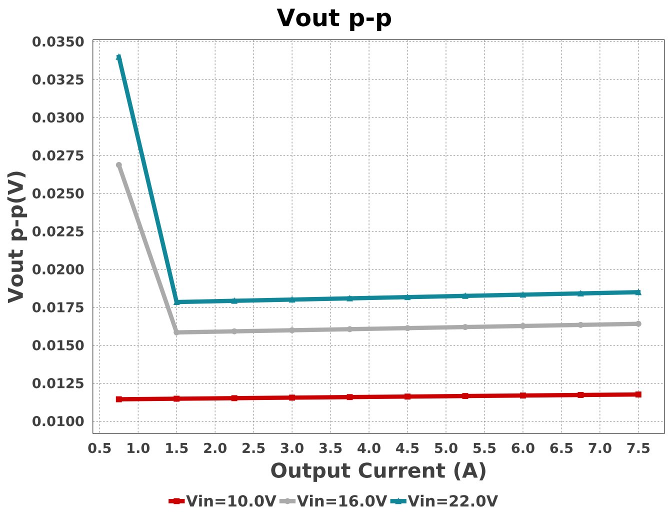
IC Ipk

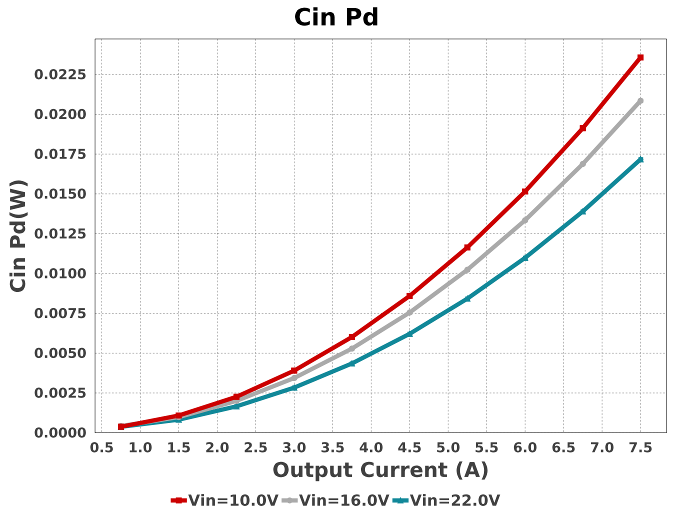


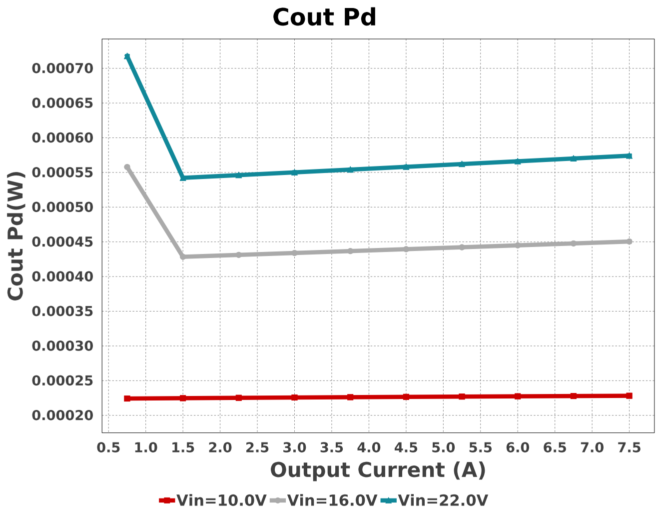

L Pd
L Pd(W)
Output Current (A)
Vin=10.0V Vin=16.0V Vin=22.0V


Efficiency
Efficiency(%)
Output Current (A)
Vin=10.0V Vin=16.0V Vin=22.0V

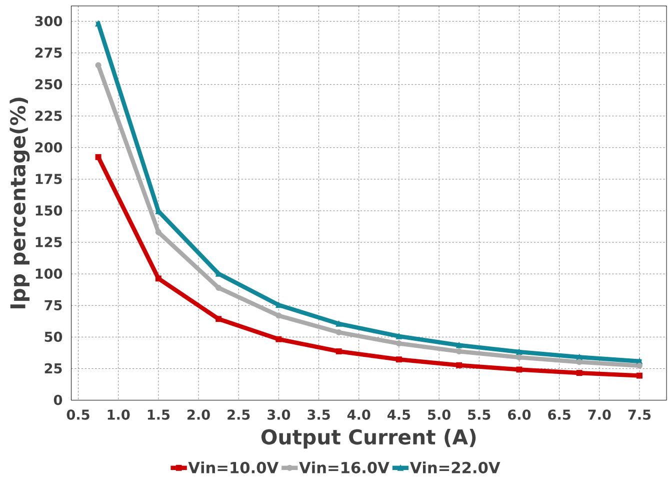

Vin p-p
Vin p-p(V)
Output Current (A)
Vin=10.0V Vin=16.0V Vin=22.0V


Vout p-p
Vout p-p(V)
Output Current (A)
Vin=10.0V Vin=16.0V Vin=22.0V

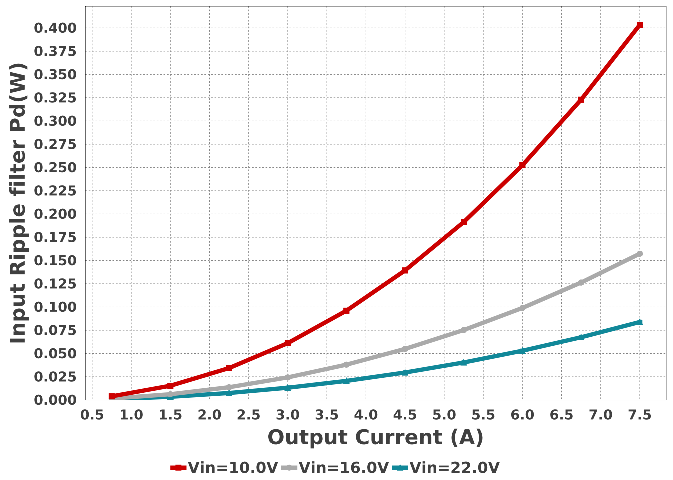

Cin Pd
Cin Pd(W)
Output Current (A)
Vin=10.0V Vin=16.0V Vin=22.0V


Cout Pd
Cout Pd(W)
Output Current (A)
Vin=10.0V Vin=16.0V Vin=22.0V

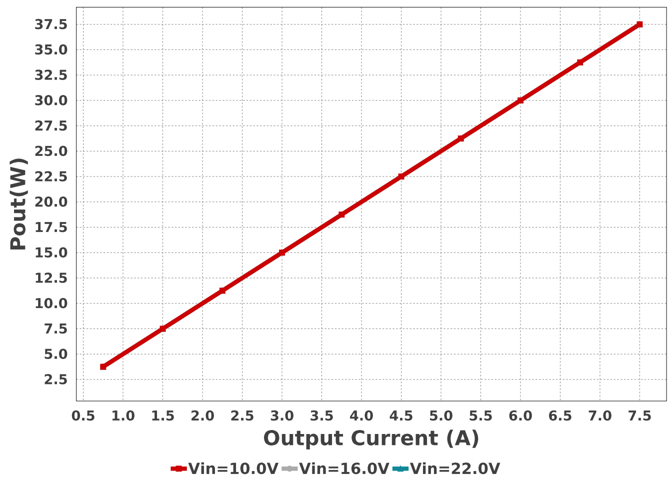
Ipp percentage



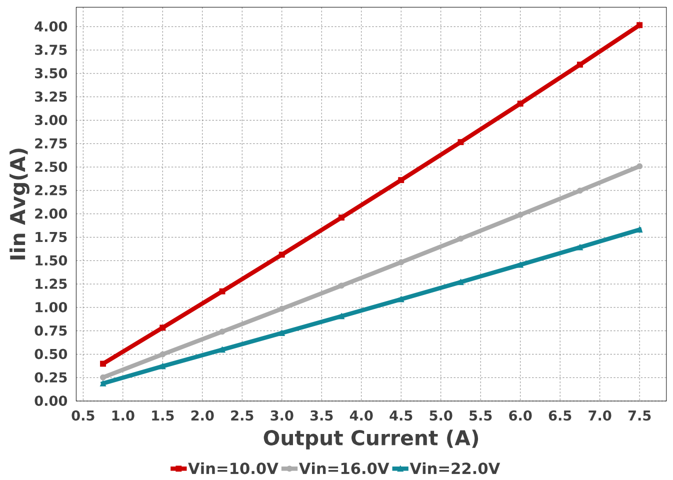
Input Ripple filter Pd



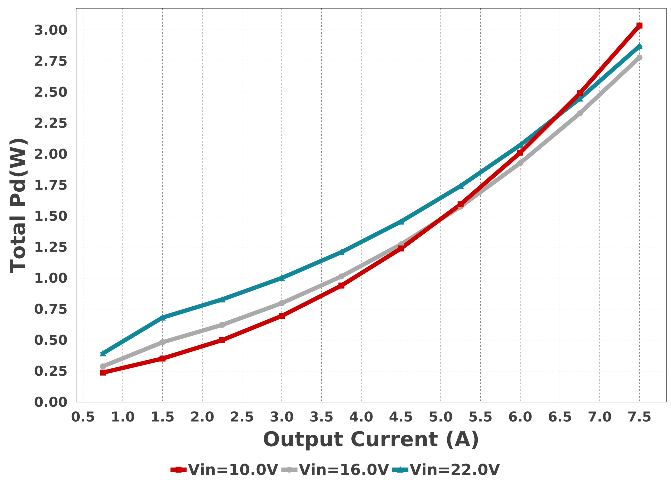
Pout



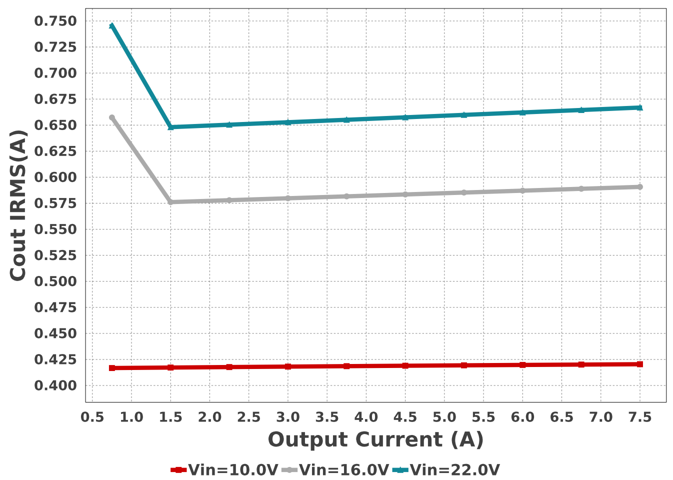
Iin Avg



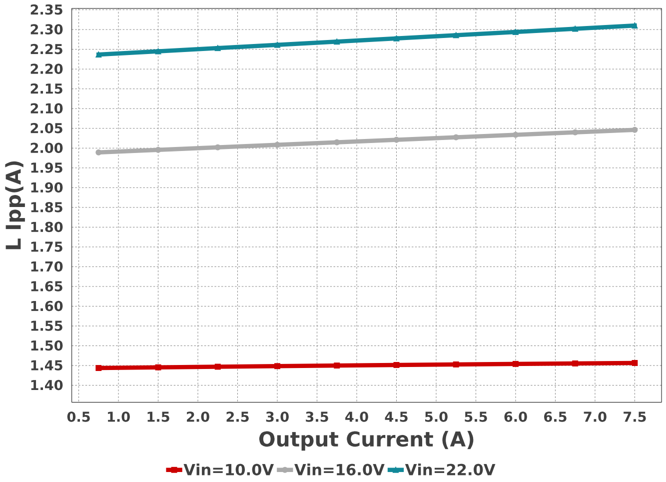
Total Pd



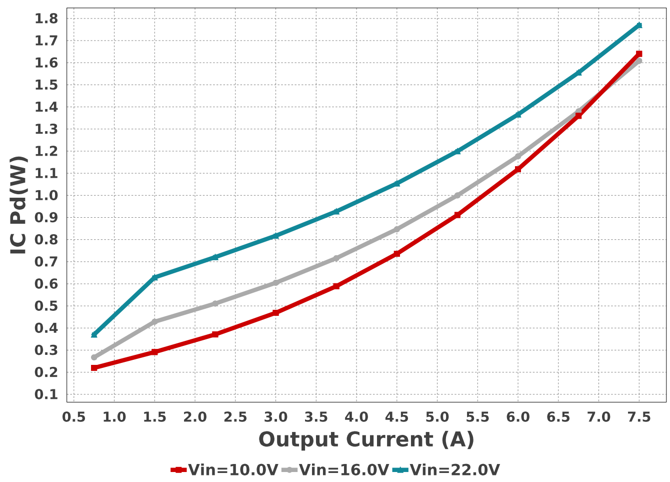
Cout IRMS



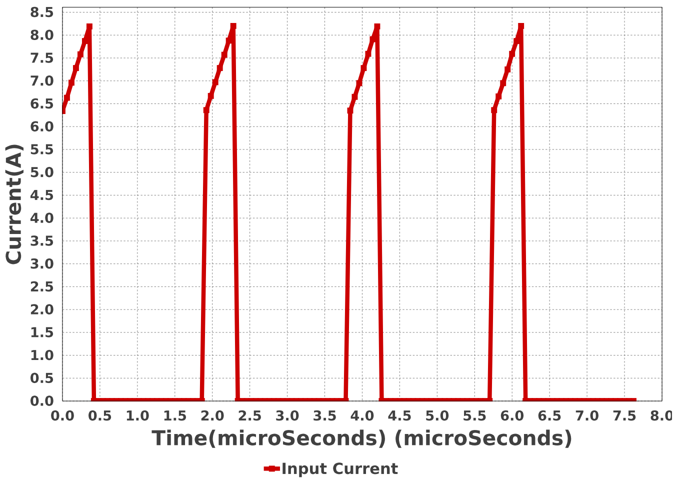
L Ipp



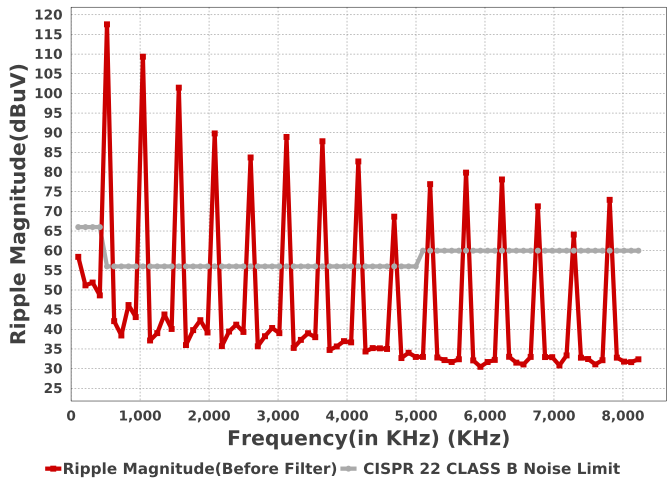
IC Pd



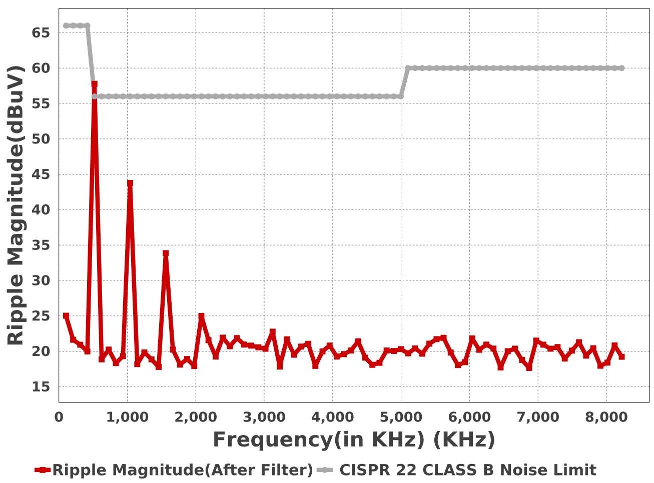
Input Current



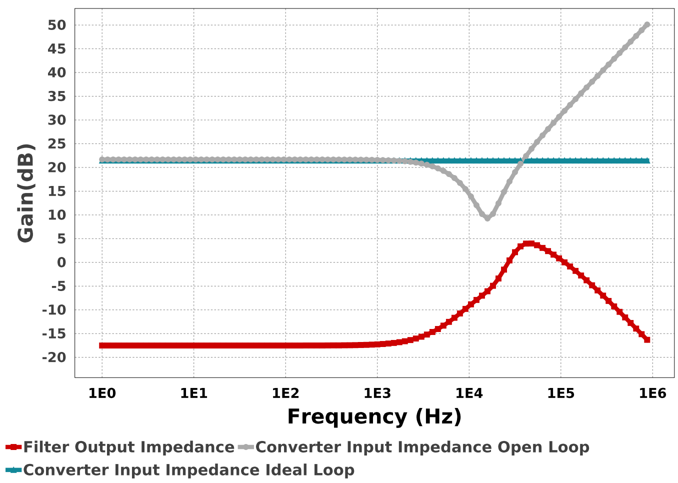
Ripple Freq Spectrum(Before Filter)

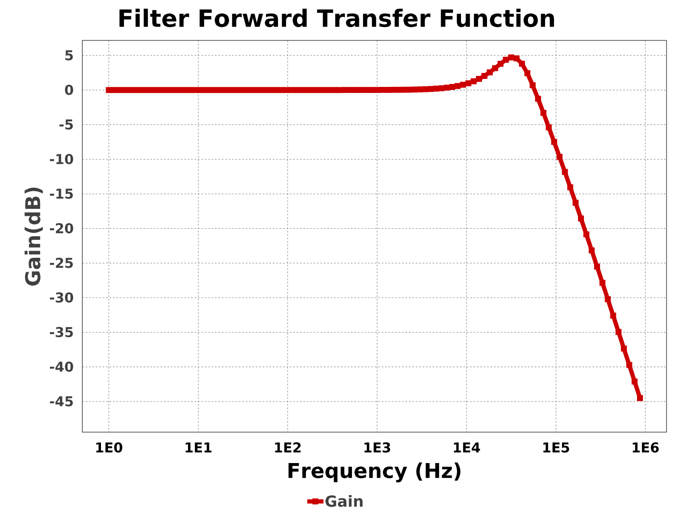


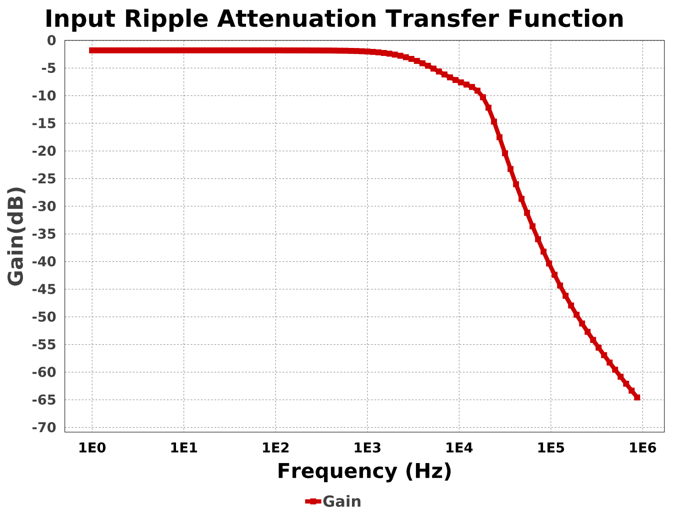
Ripple Freq Spectrum(After Filter)

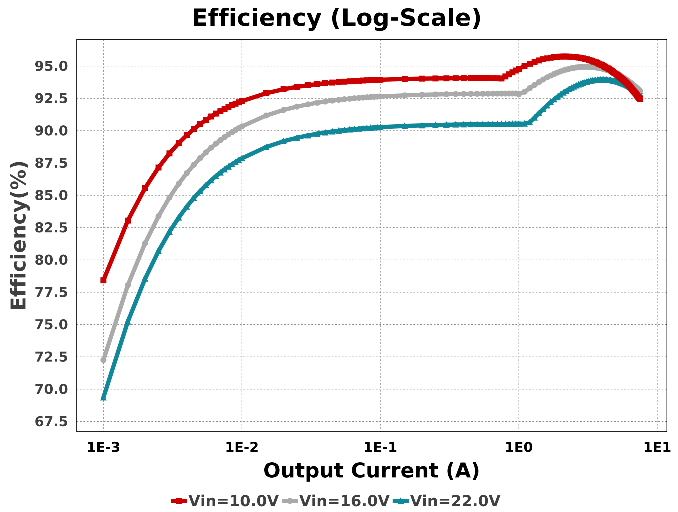


Filter vs Converter Impedance Comparison









Operating Values

#	Name	Value	Category	Description
1.	BOM Count	19		Total Design BOM count
2.	Total BOM	$4.368		Total BOM Cost
3.	Cin IRMS	3.208 A	Capacitor	Input capacitor RMS ripple current
4.	Cin Pd	17.172 mW	Capacitor	Input capacitor power dissipation
5.	Cout IRMS	666.863 mA	Capacitor	Output capacitor RMS ripple current
6.	Cout Pd	574.12 µW	Capacitor	Output capacitor power dissipation
7.	Input Ripple Noise After input filter	57.75 dBuV	EMI Noise	Input Ripple Noise after filter at switching frequency
8.	Input Ripple Noise before input filter	117.57 dBuV	EMI Noise	Input Ripple Noise before filter at switching frequency
9.	Input Ripple filter Pd	83.854 mW	EMI Noise	Input Ripple Filter Power Dissipation
10.	Noise limits defined by CISPR Standards	56.0 dBuV	EMI Noise	Noise limits for CLASS B of CISPR 22 standard
11.	IC Ipk	8.655 A	IC	Peak switch current in IC
12.	IC Pd	1.77 W	IC	IC power dissipation
13.	IC Tj	79.563 degC	IC	IC junction temperature
14.	IC Tolerance	6.0 mV	IC	IC Feedback Tolerance
15.	ICThetaJA Effective	28.0 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance
16.	Iin Avg	1.831 A	IC	Average input current
17.	Ipp percentage	30.801 %	Inductor	Inductor ripple current percentage (with respect to average inductor current)
18.	L Ipp	2.31 A	Inductor	Peak-to-peak inductor ripple current
19.	L Pd	1.004 W	Inductor	Inductor power dissipation
20.	Cin Pd	17.172 mW	Power	Input capacitor power dissipation
21.	Cout Pd	574.12 µW	Power	Output capacitor power dissipation
22.	IC Pd	1.77 W	Power	IC power dissipation
23.	Input Ripple filter Pd	83.854 mW	Power	Input Ripple Filter Power Dissipation
24.	L Pd	1.004 W	Power	Inductor power dissipation
25.	Total Pd	2.87 W	Power	Total Power Dissipation
26.	Duty Cycle	23.74 %	System Information	Duty cycle

#	Name	Value	Category	Description
27.	Efficiency	92.878 %	System Information	Steady state efficiency
28.	FootPrint	546.0 mm^2	System Information	Total Foot Print Area of BOM components
29.	Frequency	520.497 kHz	System Information	Switching frequency
30.	Iout	7.5 A	System Information	Iout operating point
31.	Mode	CCM	System Information	Conduction Mode
32.	Pout	37.5 W	System Information	Total output power
33.	Vin	22.0 V	System Information	Vin operating point
34.	Vin p-p	2.208 V	System Information	Peak-to-peak input voltage
35.	Vout	5.0 V	System Information	Operational Output Voltage
36.	Vout Actual	4.992 V	System Information	Vout Actual calculated based on selected voltage divider resistors
37.	Vout Tolerance	2.795 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
38.	Vout p-p	18.507 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	7.5	Maximum Output Current
VinMax	22.0	Maximum input voltage
VinMin	10.0	Minimum input voltage
Vout	5.0	Output Voltage
base_pn	TPS56A37	Base Product Number
source	DC	Input Source Type
Ta	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

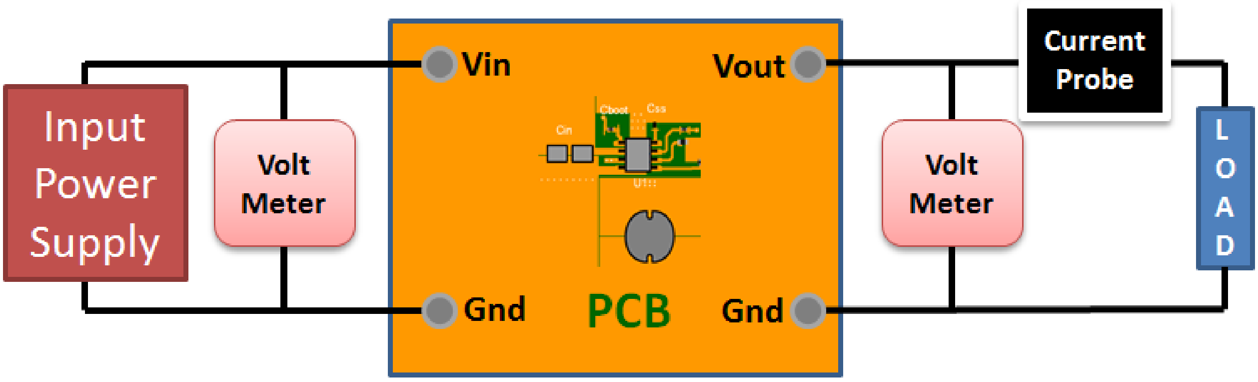
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 10.0V 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 Iout 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 : 23A214825B471F270B085100CB19A706[v1]

2. **TPS56A37** Product Folder : http://www.ti.com/product/TPS56A37 : 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.