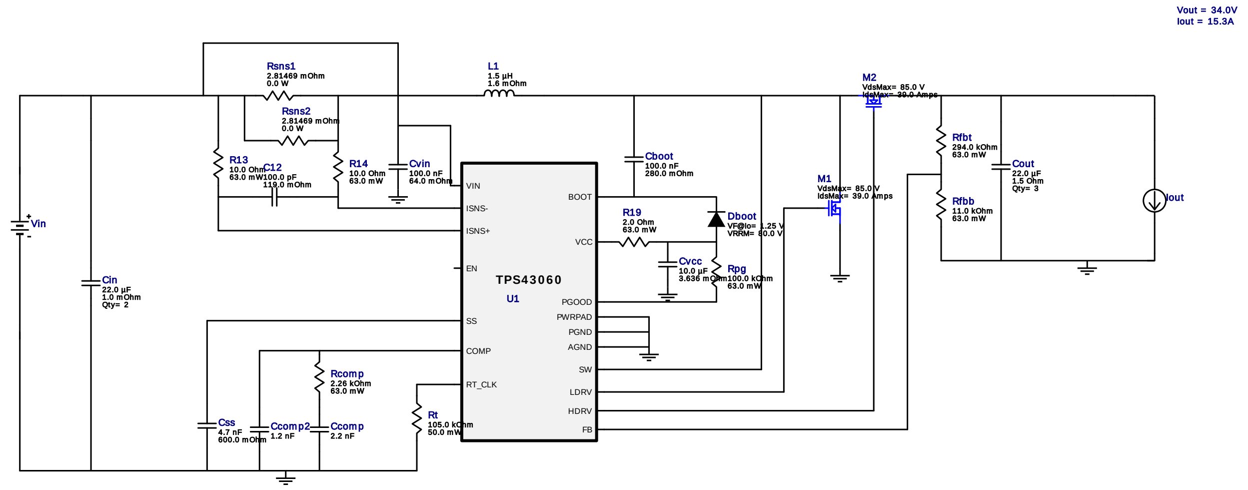
VinMin = 22.0V
VinMax = 26.0V
Vout = 34.0V
Iout = 15.3A

Device = TPS43060RTER
Topology = Boost
Created = 2023-09-06 01:17:40.930
BOM Cost = NA
BOM Count = 27
Total Pd =

WEBENCH ® Design Report

Design : 142 TPS43060RTER
TPS43060RTER 22V-26V to 34.00V @ 15.3A



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.

Design Alerts

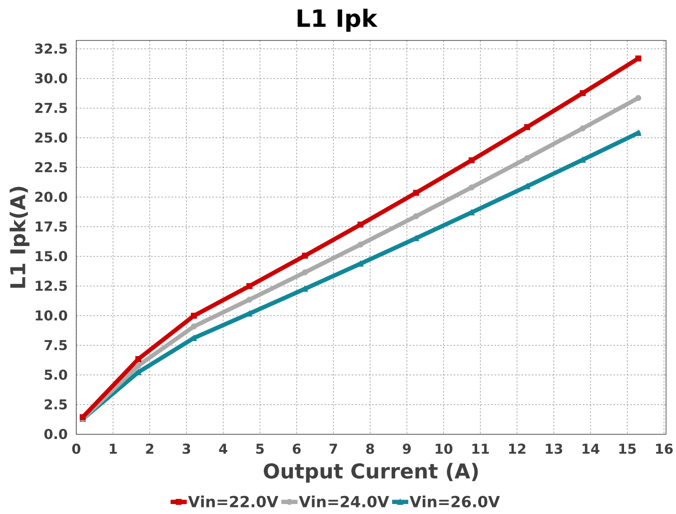
TPS43060 Design

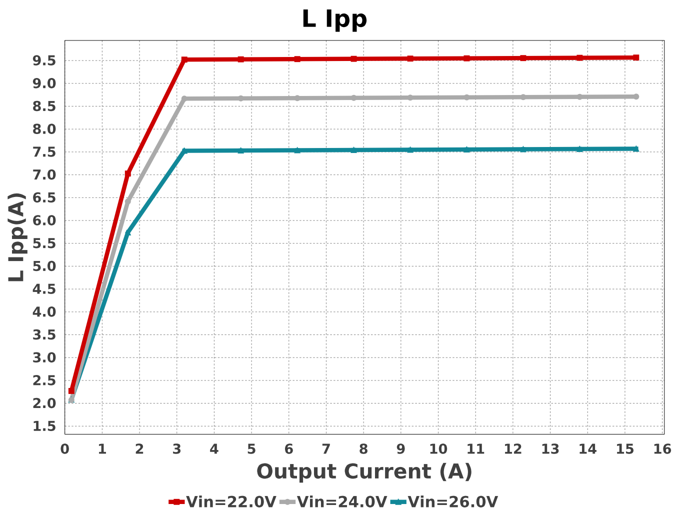
With the current design condition, suitable FET components M1 and M2 could not be found in the current database. Hence, this design is created using ideal FETs. Please note that the resulting FET parameters are ideal, so the efficiency and loss values (related to FET) have been disabled. Also, schematic/PCB export and thermal simulations will not work with ideal FET.

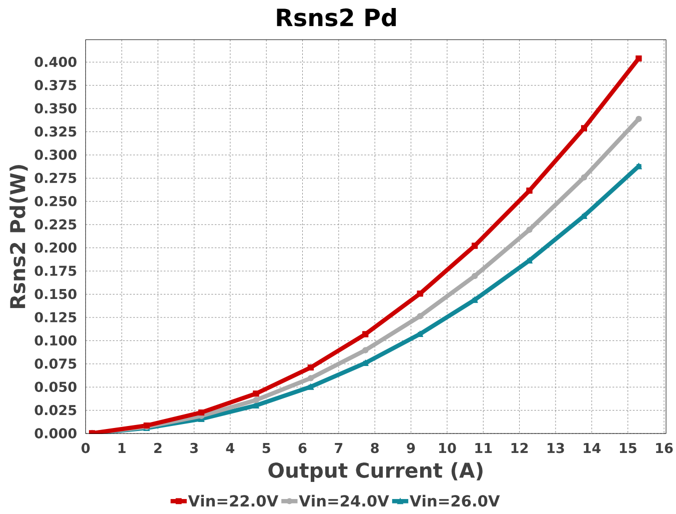
Electrical BOM

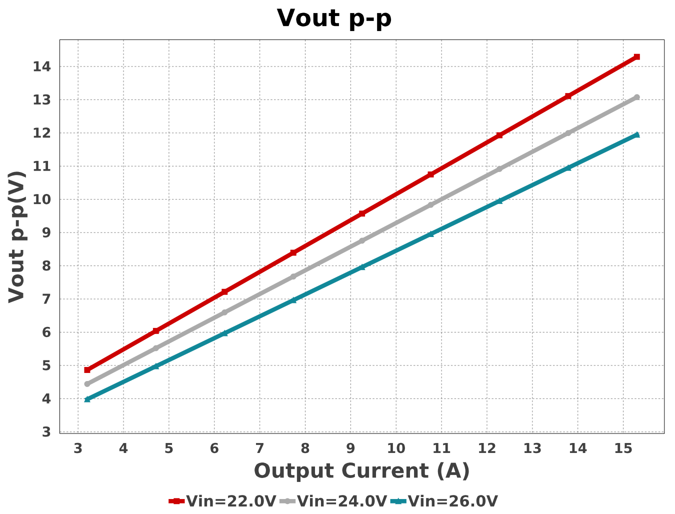
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
C12	AVX	06035A101JAT2A Series= C0G/NP0	Cap= 100.0 pF ESR= 119.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm^2
Cboot	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
Ccomp	Samsung Electro-Mechanics	CL21C222JBFNNNE Series= C0G/NP0	Cap= 2.2 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm^2
Ccomp2	TDK	C2012C0G1H122J060AA Series= C0G/NP0	Cap= 1.2 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm^2
Cin	TDK	CKG57NX7S2A226M500JH Series= X7S	Cap= 22.0 uF ESR= 1.0 mOhm VDC= 100.0 V IRMS= 0.0 A	2	$2.17	CKG57N 56 mm^2
Cout	MuRata	KRM55WR71J226MH01K Series= X7R	Cap= 22.0 uF ESR= 1.5 Ohm VDC= 63.0 V IRMS= 0.0 A	3	$2.11	KRM55_670 59 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

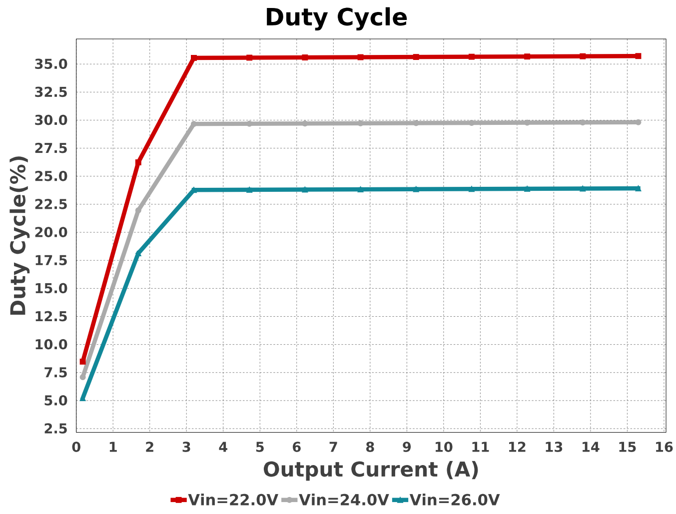
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cvcc	MuRata	GRM188R61C106MA73D Series= X5R	Cap= 10.0 uF ESR= 3.636 mOhm VDC= 16.0 V IRMS= 2.8889 A	1	$0.05	0603 5 mm^2
Cvin	Kemet	C0805C104M5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	$0.01	0805 7 mm^2
Dboot	Infineon Technologies	BAS1602VH6327XTSA1	VF@Io= 1.25 V VRRM= 80.0 V	1	$0.06	SOD-523 5 mm^2
L1	Coilcraft	XAL1010-152MEB	L= 1.5 µH 1.6 mOhm	1	$1.71	XAL1010 160 mm^2
M1	NA	IdealFET	VdsMax= 85.0 V IdsMax= 39.0 Amps	1	NA	KCS0003B 80 mm^2
M2	NA	IdealFET	VdsMax= 85.0 V IdsMax= 39.0 Amps	1	NA	KCS0003B 80 mm^2
R13	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
R14	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
R19	Vishay-Dale	CRCW04022R00FKED Series= CRCW..e3	Res= 2.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rcomp	Vishay-Dale	CRCW04022K26FKED Series= CRCW..e3	Res= 2.26 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rfbb	Vishay-Dale	CRCW040211K0FKED Series= CRCW..e3	Res= 11.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rfbt	Vishay-Dale	CRCW0402294KFKED Series= CRCW..e3	Res= 294.0 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
Rsns1	CUSTOM	CUSTOM Series= ?	Res= 2.81469 mOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm^2
Rsns2	CUSTOM	CUSTOM Series= ?	Res= 2.81469 mOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm^2
Rt	Yageo	RC0201FR-07105KL Series= ?	Res= 105.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
U1	Texas Instruments	TPS43060RTER	Switcher	1	$0.94	S-PVQFN-N16 17 mm^2

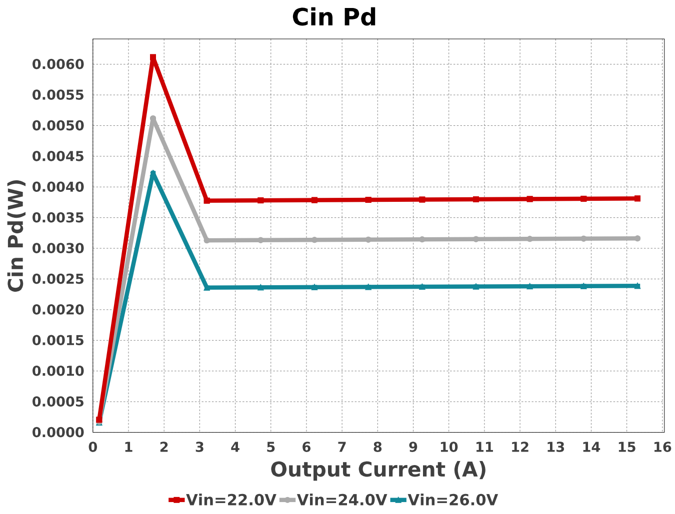

L1 Ipk
L1 Ipk(A)
Output Current (A)
Vin=22.0V Vin=24.0V Vin=26.0V

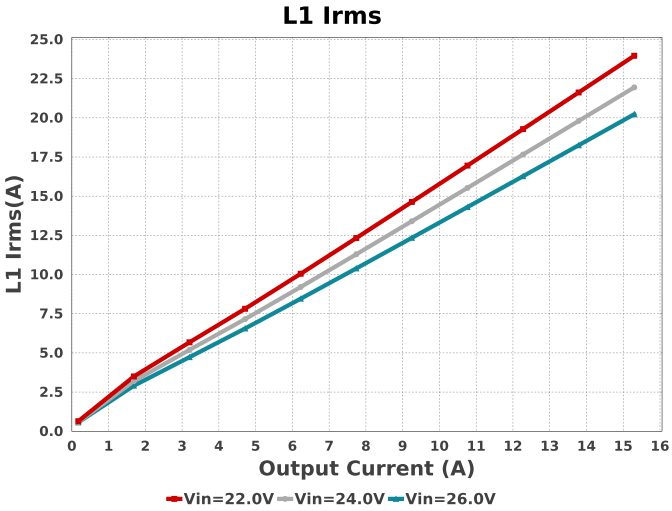

L Ipp
L Ipp(A)
Output Current (A)
Vin=22.0V Vin=24.0V Vin=26.0V

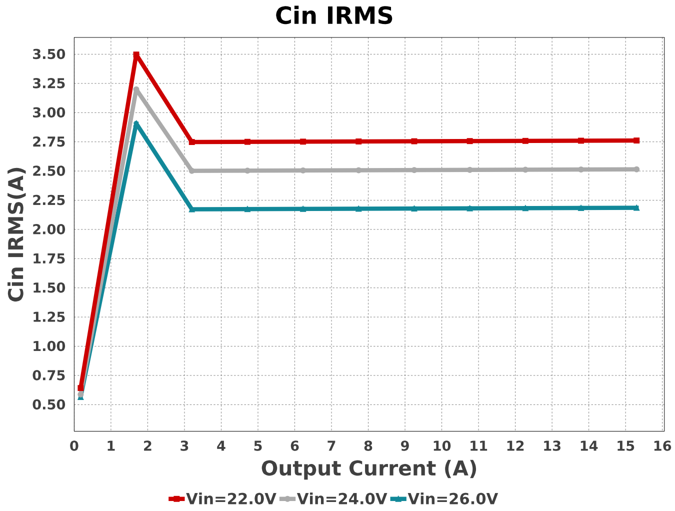

Rsns2 Pd
Rsns2 Pd(W)
Output Current (A)
Vin=22.0V Vin=24.0V Vin=26.0V

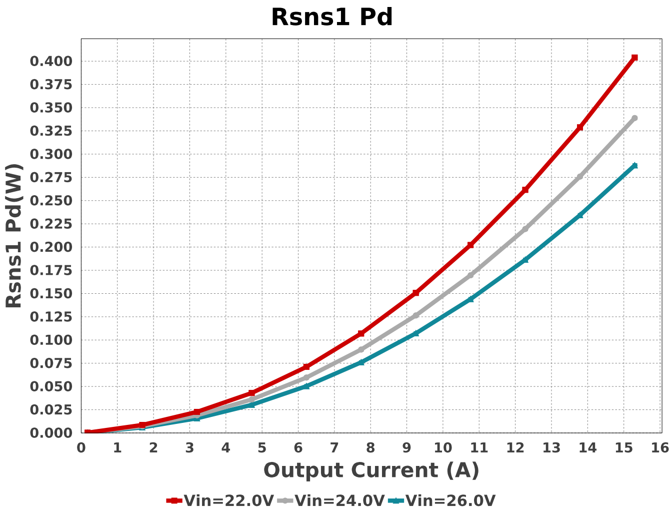

Vout p-p
Vout p-p(V)
Output Current (A)
Vin=22.0V Vin=24.0V Vin=26.0V

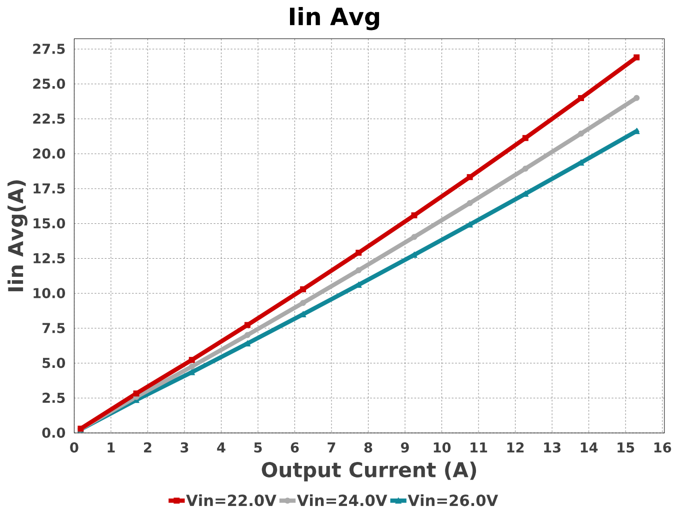

Duty Cycle
Duty Cycle(%)
Output Current (A)
Vin=22.0V Vin=24.0V Vin=26.0V

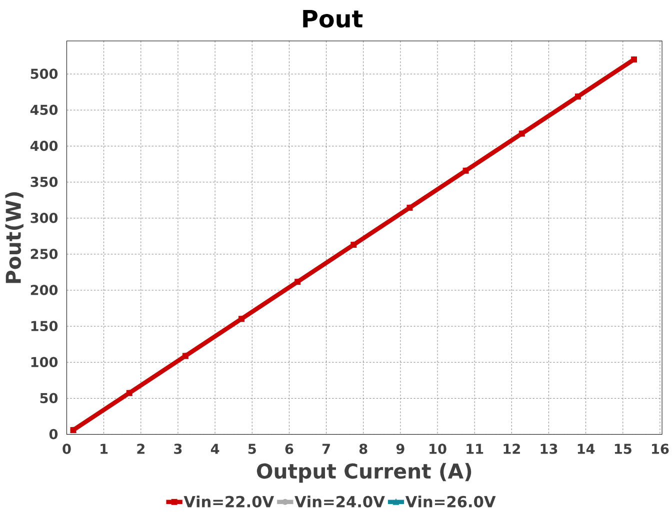

Cin Pd
Cin Pd(W)
Output Current (A)
Vin=22.0V Vin=24.0V Vin=26.0V

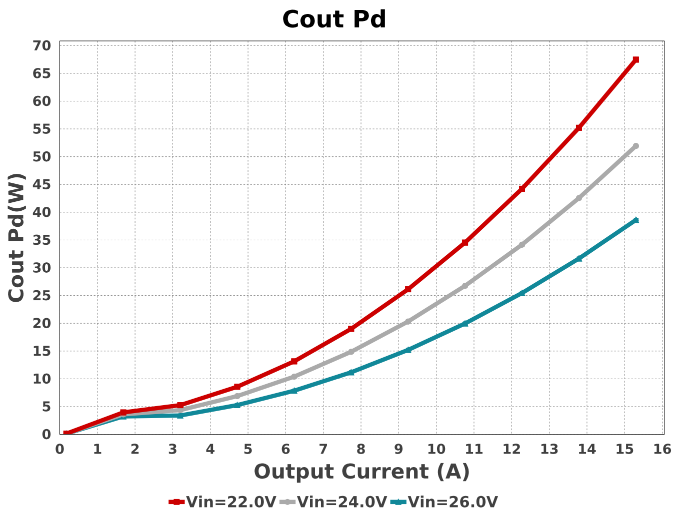

L1 Irms
L1 Irms(A)
Output Current (A)
Vin=22.0V Vin=24.0V Vin=26.0V

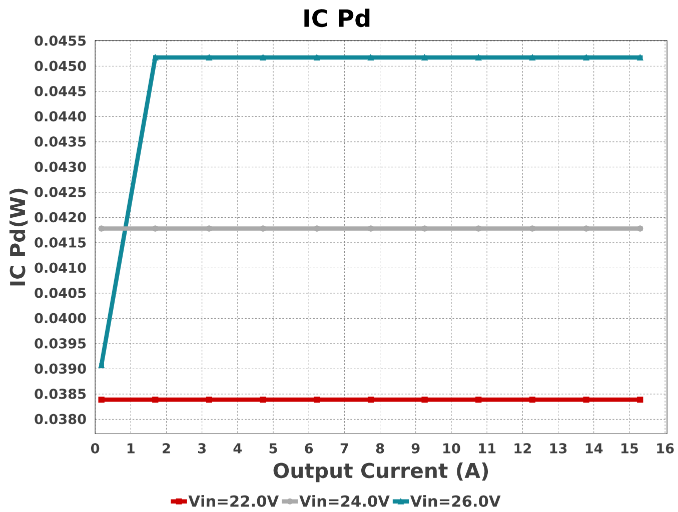

Cin IRMS
Cin IRMS(A)
Output Current (A)
Vin=22.0V Vin=24.0V Vin=26.0V

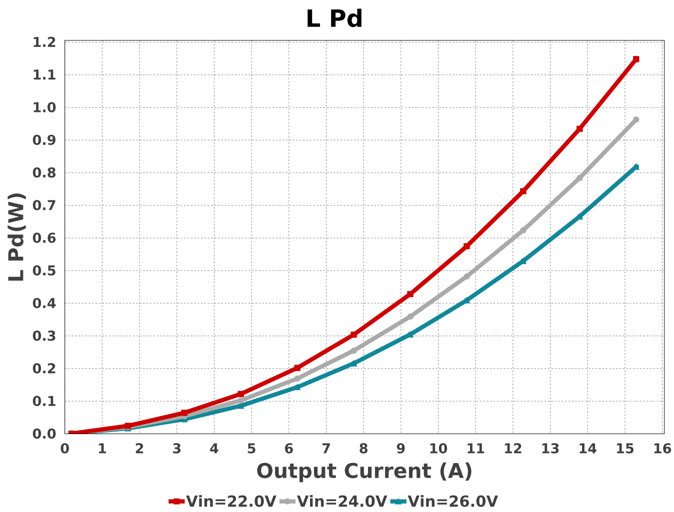

Rsns1 Pd
Rsns1 Pd(W)
Output Current (A)
Vin=22.0V Vin=24.0V Vin=26.0V

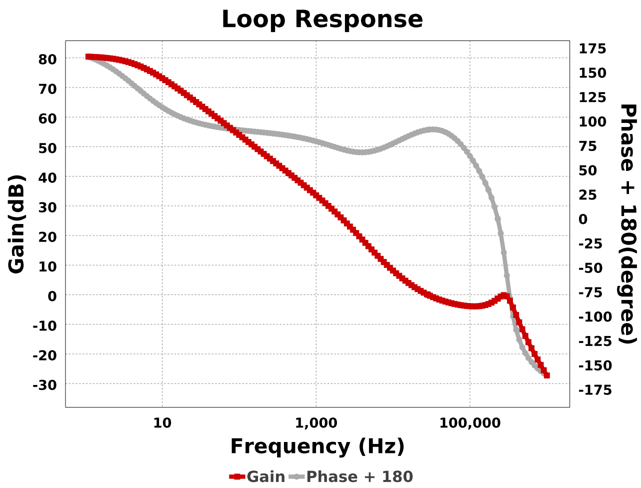

Iin Avg
Iin Avg(A)
Output Current (A)
Vin=22.0V Vin=24.0V Vin=26.0V


Pout
Pout(W)
Output Current (A)
Vin=22.0V Vin=24.0V Vin=26.0V


Cout Pd
Cout Pd(W)
Output Current (A)
Vin=22.0V Vin=24.0V Vin=26.0V







Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	2.761 A	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	3.812 mW	Capacitor	Input capacitor power dissipation
3.	Cout Pd	67.472 W	Capacitor	Output capacitor power dissipation
4.	IC Pd	13.2 mW	IC	IC power dissipation
5.	ICThetaJA	65.7 degC/W	IC	IC junction-to-ambient thermal resistance
6.	Iin Avg	26.907 A	IC	Average input current
7.	L Ipp	9.565 A	Inductor	Peak-to-peak inductor ripple current
8.	L Pd	1.148 W	Inductor	Inductor power dissipation
9.	L1 Ipk	31.69 A	Inductor	Inductor peak current
10.	L1 Irms	23.96 A	Inductor	Inductor ripple current
11.	Cin Pd	3.812 mW	Power	Input capacitor power dissipation
12.	Cout Pd	67.472 W	Power	Output capacitor power dissipation
13.	IC Pd	13.2 mW	Power	IC power dissipation
14.	L Pd	1.148 W	Power	Inductor power dissipation
15.	Rsns1 Pd	403.95 mW	Power	Rsns1 Power Dissipation
16.	Rsns2 Pd	403.95 mW	Power	Rsns2 Power Dissipation
17.	Rsns1 Pd	403.95 mW	Resistor	Rsns1 Power Dissipation
18.	Rsns2 Pd	403.95 mW	Resistor	Rsns2 Power Dissipation
19.	BOM Count	27	System Information	Total Design BOM count
20.	Cross Freq	24.828 kHz	System Information	Bode plot crossover frequency
21.	Duty Cycle	35.714 %	System Information	Duty cycle
22.	FootPrint	704.0 mm^2	System Information	Total Foot Print Area of BOM components
23.	Frequency	547.619 kHz	System Information	Switching frequency
24.	Gain Marg	4.468 dB	System Information	Bode Plot Gain Margin
25.	Iout	15.3 A	System Information	Iout operating point

#	Name	Value	Category	Description
26.	Low Freq Gain	80.319 dB	System Information	Gain at 1Hz
27.	Mode	CCM	System Information	Conduction Mode
28.	Phase Marg	87.454 deg	System Information	Bode Plot Phase Margin
29.	Pout	520.2 W	System Information	Total output power
30.	Total BOM	NA	System Information	Total BOM Cost
31.	Vin	22.0 V	System Information	Vin operating point
32.	Vout	34.0 V	System Information	Operational Output Voltage
33.	Vout Actual	33.827 V	System Information	Vout Actual calculated based on selected voltage divider resistors
34.	Vout Tolerance	4.036 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
35.	Vout p-p	14.291 V	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	15.3	Maximum Output Current
VinMax	26.0	Maximum input voltage
VinMin	22.0	Minimum input voltage
Vout	34.0	Output Voltage
base_pn	TPS43060	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

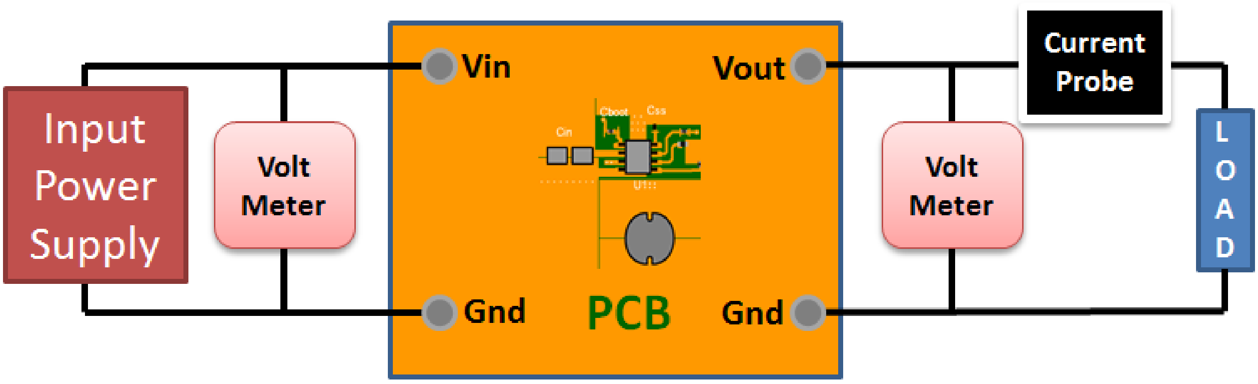
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 22.0V 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. Feature Highlights: Low Quiescent Current Boost Controller, Wide Vin Range 4.5V to 38V Vin, 58V Vout, 7.5V Gate Drive optimized for standard MOSFET Thresholds Thermal Shutdown

2. Master key : F20DB821062544F1[v1]

3. **TPS43060** Product Folder : http://www.ti.com/product/TPS43060 : contains the data sheet and other resources.

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