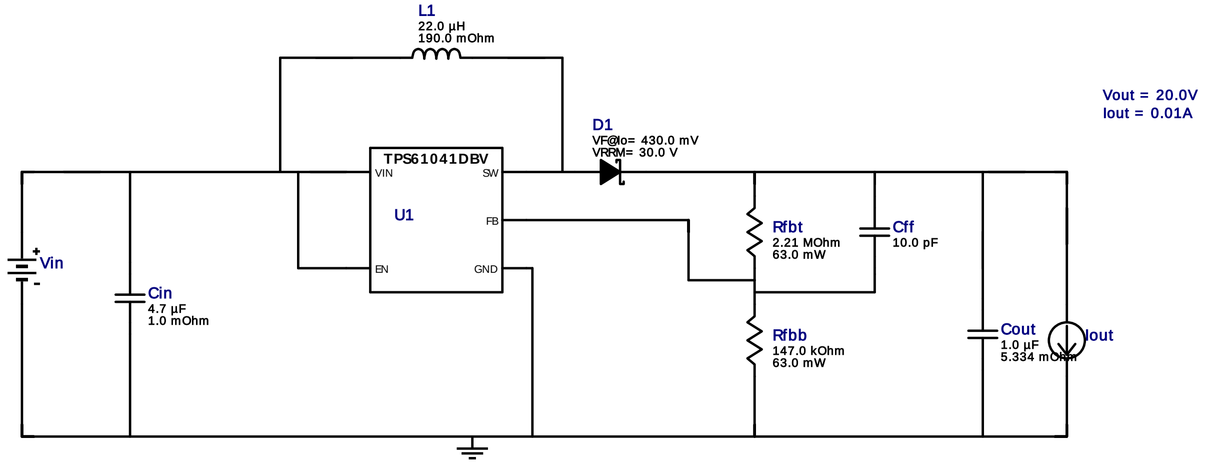
VinMin = 2.8V
VinMax = 4.6V
Vout = 20.0V
Iout = 0.01A

Device = TPS61041DBVR
Topology = Boost
Created = 2021-06-30 03:15:35.209
BOM Cost = $2.13
BOM Count = 8
Total Pd = 0.03W

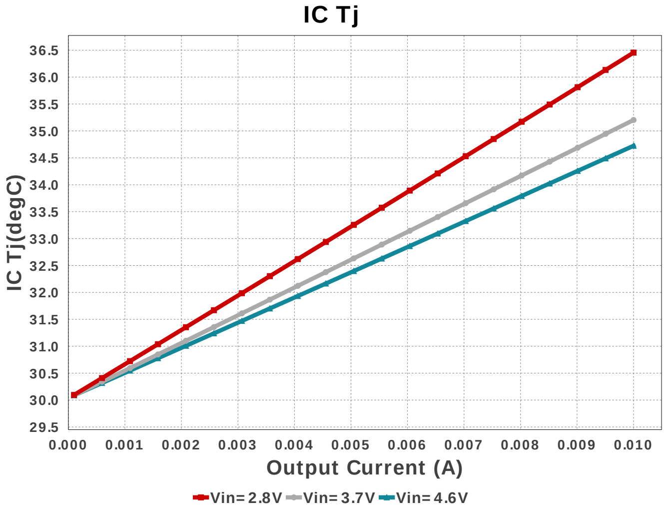
WEBENCH ® Design Report

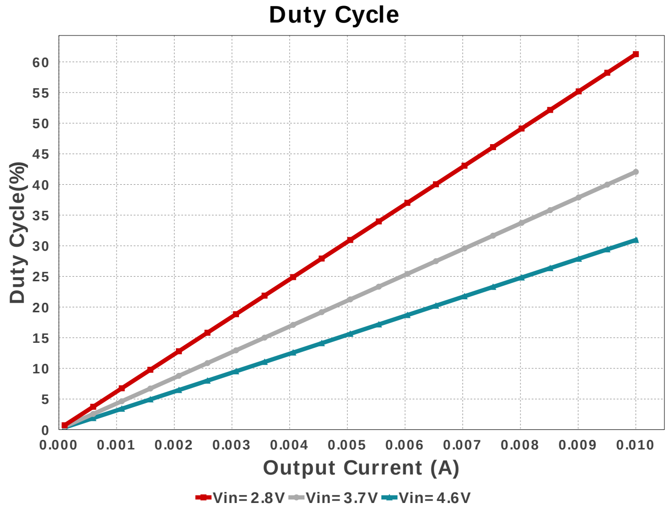
Design : 320 TPS61041DBVR
TPS61041DBVR 2.8V-4.6V to 20.00V @ 0.01A

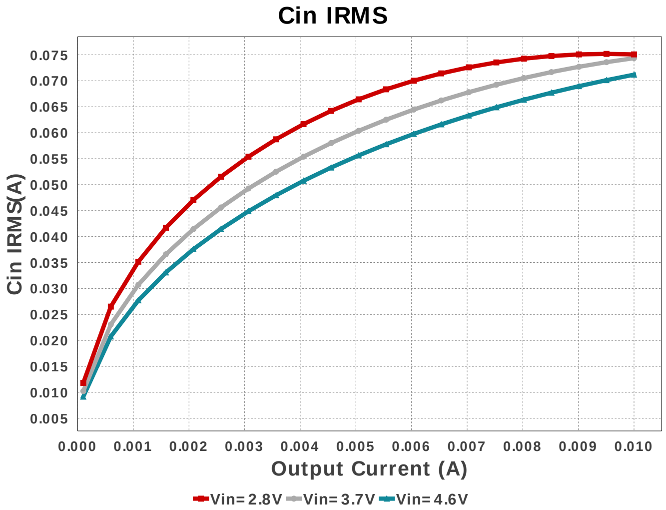


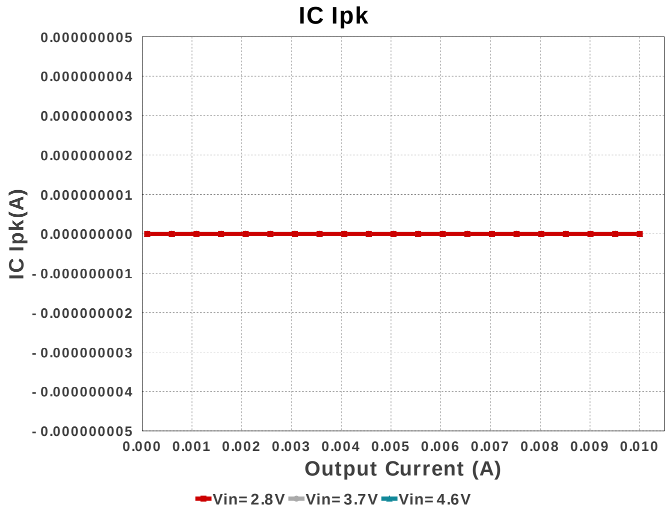
Electrical BOM

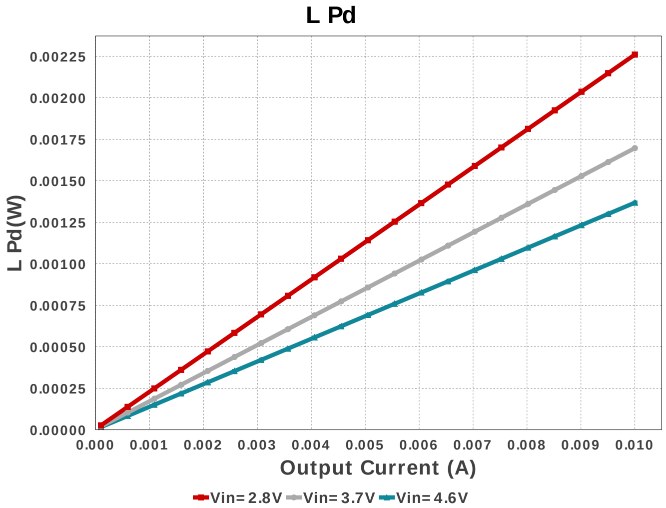
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cff	Samsung Electro-Mechanics	CL10C100JB8NNNC Series= C0G/NP0	Cap= 10.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm²
Cin	MuRata	GRM155R61A475MEAAD Series= X5R	Cap= 4.7 uF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.03	0402_065 3 mm²
Cout	MuRata	GRM31CR72A105KA01L Series= X7R	Cap= 1.0 uF ESR= 5.334 mOhm VDC= 100.0 V IRMS= 1.55432 A	1	$0.24	1206_190 11 mm²
D1	ON Semiconductor	MBR0530T1G	VF@Io= 430.0 mV VRRM= 30.0 V	1	$0.05	SOD-123 13 mm²
L1	Wurth Elektronik	74437346220	L= 22.0 µH 190.0 mOhm	1	$1.30	WE-LHMI_7030 74 mm²
Rfbb	Vishay-Dale	CRCW0402147KFKED Series= CRCW..e3	Res= 147.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rfbt	Vishay-Dale	CRCW04022M21FKED Series= CRCW..e3	Res= 2.21 MOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
U1	Texas Instruments	TPS61041DBVR	Switcher	1	$0.48	DBV0005A 15 mm²

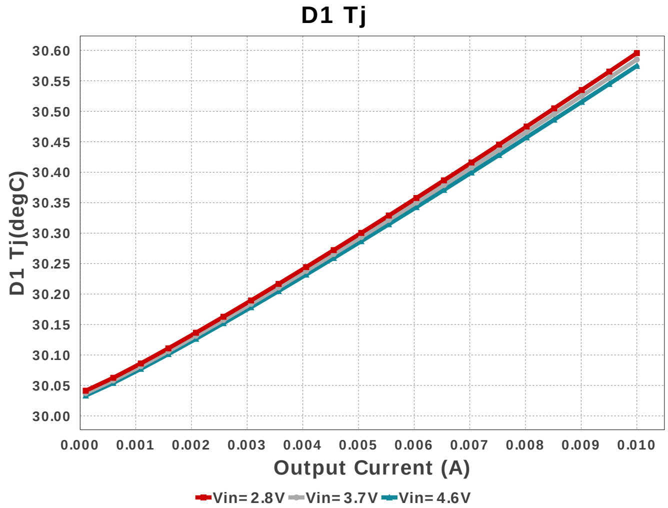

IC Tj
IC Tj(degC)
Output Current (A)
Vin= 2.8V Vin= 3.7V Vin= 4.6V

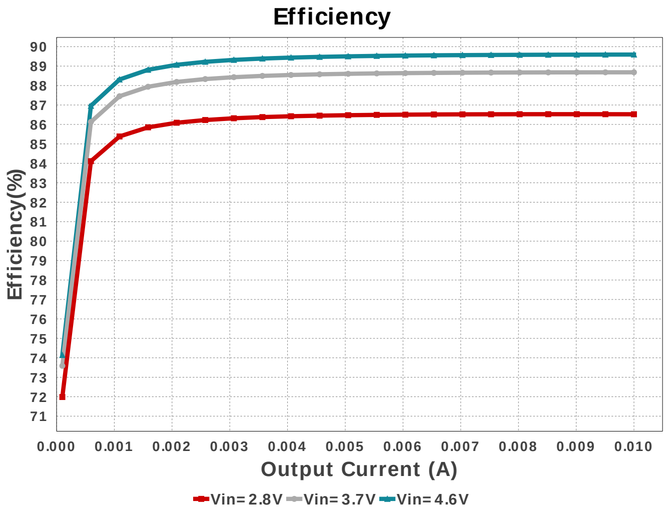

Duty Cycle
Duty Cycle(%)
Output Current (A)
Vin= 2.8V Vin= 3.7V Vin= 4.6V

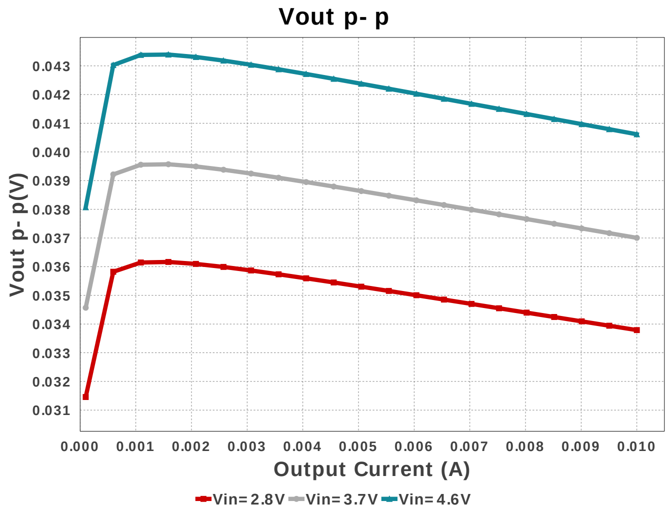

Cin IRMS
Cin IRMS(A)
Output Current (A)
Vin= 2.8V Vin= 3.7V Vin= 4.6V

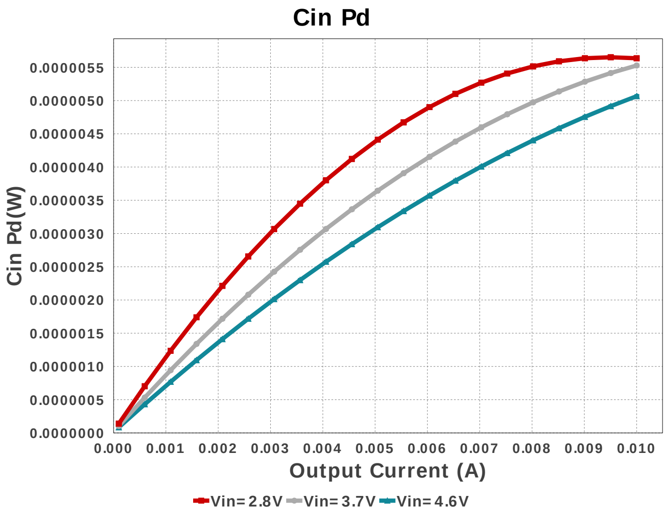

IC Ipk
IC Ipk(A)
Output Current (A)
Vin= 2.8V Vin= 3.7V Vin= 4.6V

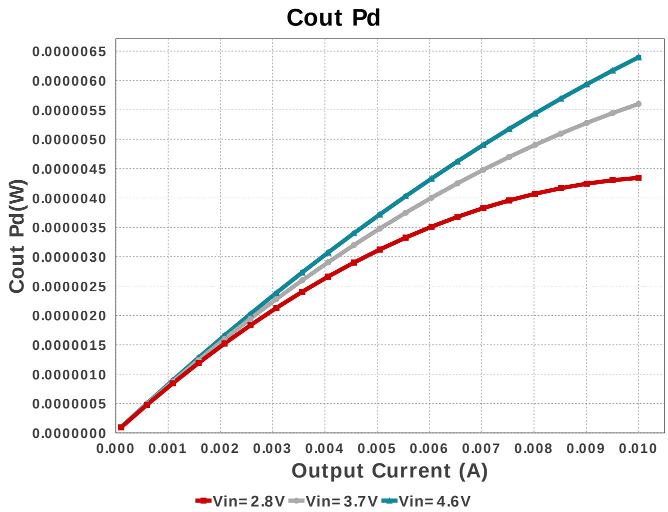

L Pd
L Pd(W)
Output Current (A)
Vin= 2.8V Vin= 3.7V Vin= 4.6V

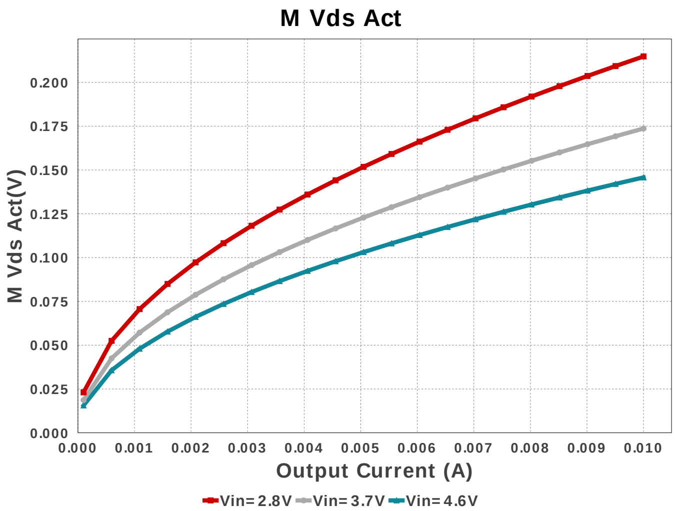

D1 Tj
D1 Tj(degC)
Output Current (A)
Vin= 2.8V Vin= 3.7V Vin= 4.6V

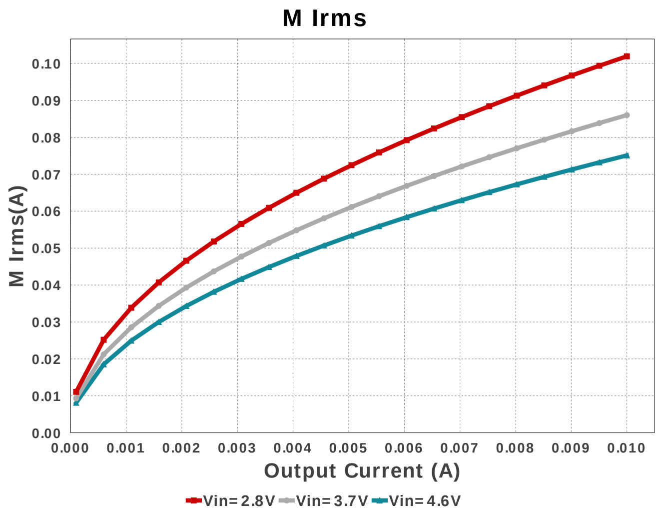

Efficiency
Efficiency(%)
Output Current (A)
Vin= 2.8V
Vin= 3.7V
Vin= 4.6V

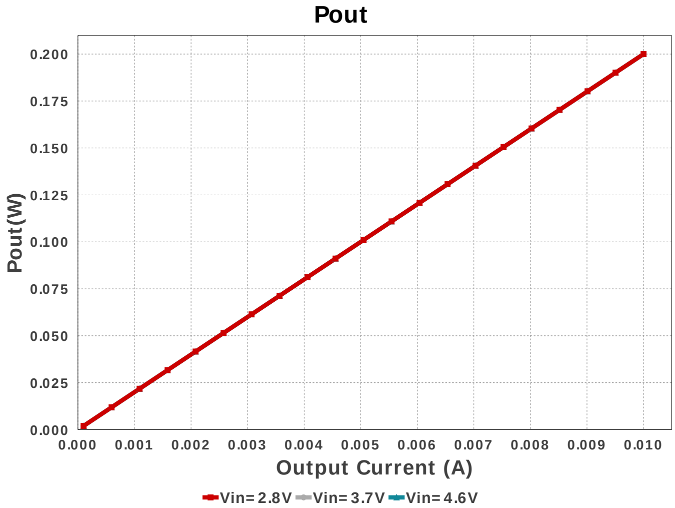

Vout p- p
Vout p- p(V)
Output Current (A)
Vin= 2.8V
Vin= 3.7V
Vin= 4.6V

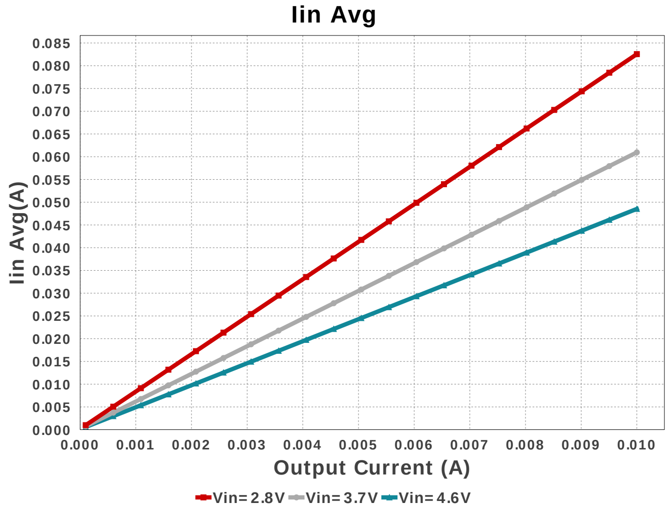

Cin Pd
Cin Pd(W)
Output Current (A)
Vin= 2.8V
Vin= 3.7V
Vin= 4.6V

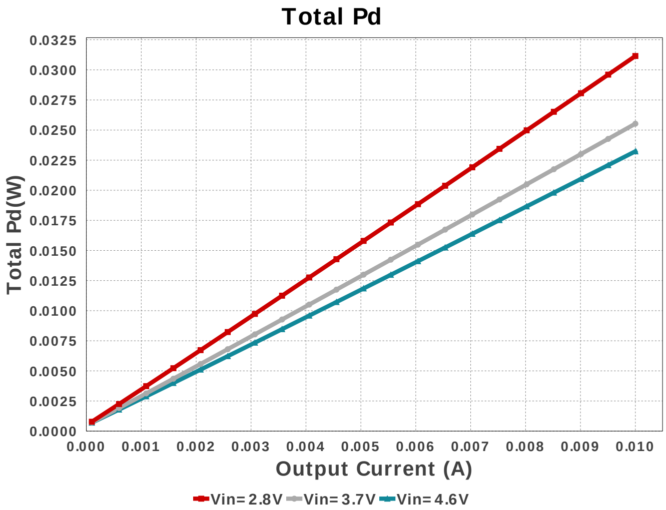

Cout Pd
Cout Pd(W)
Output Current (A)
Vin= 2.8V
Vin= 3.7V
Vin= 4.6V

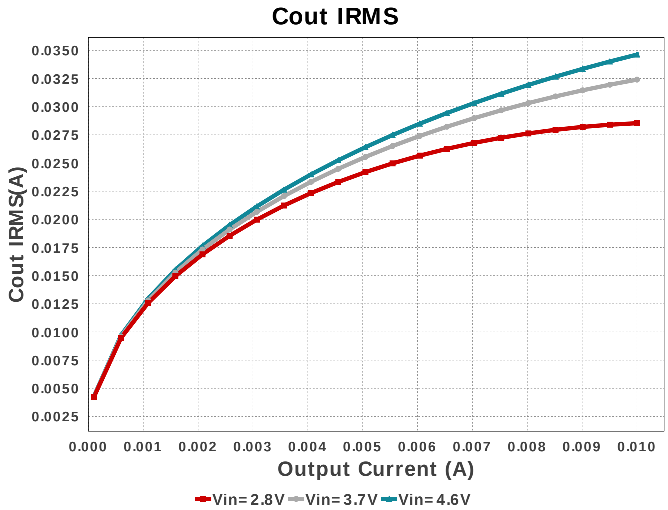

M Vds Act
M Vds Act(V)
Output Current (A)
Vin= 2.8V
Vin= 3.7V
Vin= 4.6V

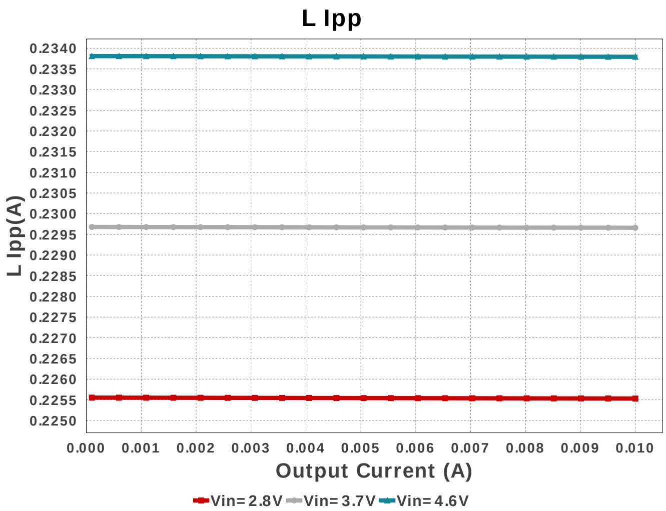

M Irms
M Irms(A)
Output Current (A)
Vin= 2.8V
Vin= 3.7V
Vin= 4.6V

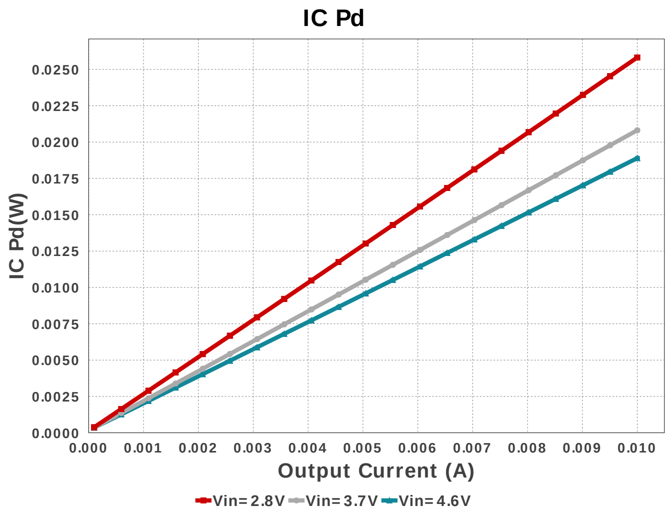

Pout
Pout(W)
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
0.000 0.001 0.002 0.003 0.004 0.005 0.006 0.007 0.008 0.009 0.010
Output Current (A)
Vin= 2.8V Vin= 3.7V Vin= 4.6V

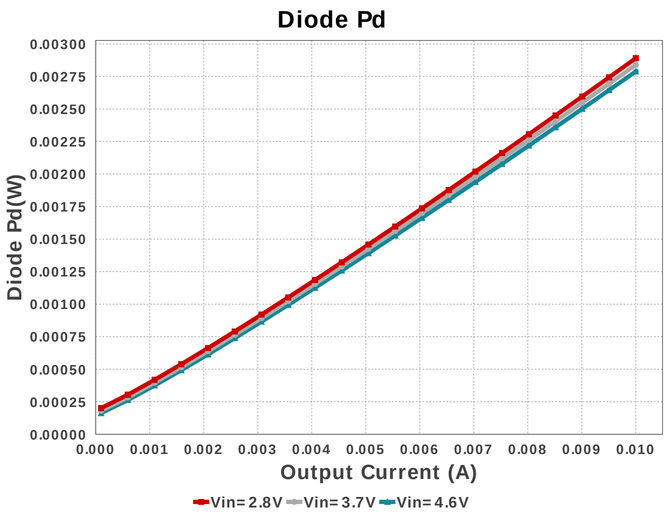

Iin Avg
Iin Avg(A)
0.085
0.080
0.075
0.070
0.065
0.060
0.055
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0.000 0.001 0.002 0.003 0.004 0.005 0.006 0.007 0.008 0.009 0.010
Output Current (A)
Vin= 2.8V Vin= 3.7V Vin= 4.6V

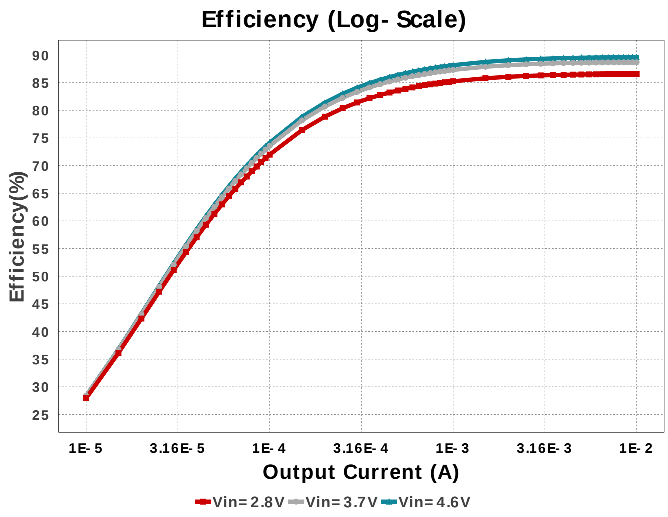

Total Pd
Total Pd(W)
0.0325
0.0300
0.0275
0.0250
0.0225
0.0200
0.0175
0.0150
0.0125
0.0100
0.0075
0.0050
0.0025
0.0000
0.000 0.001 0.002 0.003 0.004 0.005 0.006 0.007 0.008 0.009 0.010
Output Current (A)
Vin= 2.8V Vin= 3.7V Vin= 4.6V


Cout IRMS
Cout IRMS(A)
0.0350
0.0325
0.0300
0.0275
0.0250
0.0225
0.0200
0.0175
0.0150
0.0125
0.0100
0.0075
0.0050
0.0025
0.000 0.001 0.002 0.003 0.004 0.005 0.006 0.007 0.008 0.009 0.010
Output Current (A)
Vin= 2.8V Vin= 3.7V Vin= 4.6V


L Ipp
L Ipp(A)
0.2340
0.2335
0.2330
0.2325
0.2320
0.2315
0.2310
0.2305
0.2300
0.2295
0.2290
0.2285
0.2280
0.2275
0.2270
0.2265
0.2260
0.2255
0.2250
0.000 0.001 0.002 0.003 0.004 0.005 0.006 0.007 0.008 0.009 0.010
Output Current (A)
Vin= 2.8V Vin= 3.7V Vin= 4.6V


IC Pd
IC Pd(W)
0.0250
0.0225
0.0200
0.0175
0.0150
0.0125
0.0100
0.0075
0.0050
0.0025
0.0000
0.000 0.001 0.002 0.003 0.004 0.005 0.006 0.007 0.008 0.009 0.010
Output Current (A)
Vin= 2.8V Vin= 3.7V Vin= 4.6V





Operating Values

#	Name	Value	Category	Description
1.	BOM Count	8		Total Design BOM count
2.	Total BOM	$2.134		Total BOM Cost
3.	Cin IRMS	75.074 mA	Capacitor	Input capacitor RMS ripple current
4.	Cin Pd	5.636 µW	Capacitor	Input capacitor power dissipation
5.	Cout IRMS	28.534 mA	Capacitor	Output capacitor RMS ripple current
6.	Cout Pd	4.343 µW	Capacitor	Output capacitor power dissipation
7.	D1 Tj	30.595 degC	Diode	D1 junction temperature
8.	Diode Pd	2.891 mW	Diode	Diode power dissipation
9.	IC Ipk	0.0 A	IC	Peak switch current in IC
10.	IC Pd	25.82 mW	IC	IC power dissipation
11.	IC Tj	36.455 degC	IC	IC junction temperature
12.	IC Tolerance	25.0 mV	IC	IC Feedback Tolerance
13.	ICThetaJA	250.0 degC/W	IC	IC junction-to-ambient thermal resistance
14.	Iin Avg	82.554 mA	IC	Average input current
15.	L Ipp	225.531 mA	Inductor	Peak-to-peak inductor ripple current
16.	L Pd	2.26 mW	Inductor	Inductor power dissipation
17.	M Irms	101.918 mA	Mosfet	MOSFET RMS ripple current
18.	M Vds Act	214.8 mV	Mosfet	Voltage drop across the MosFET
19.	Cin Pd	5.636 µW	Power	Input capacitor power dissipation
20.	Cout Pd	4.343 µW	Power	Output capacitor power dissipation
21.	Diode Pd	2.891 mW	Power	Diode power dissipation
22.	IC Pd	25.82 mW	Power	IC power dissipation
23.	L Pd	2.26 mW	Power	Inductor power dissipation
24.	Total Pd	31.15 mW	Power	Total Power Dissipation
25.	Duty Cycle	61.265 %	System Information	Duty cycle
26.	Efficiency	86.524 %	System Information	Steady state efficiency
27.	FootPrint	126.0 mm^2	System Information	Total Foot Print Area of BOM components
28.	Frequency	313.74 kHz	System Information	Switching frequency
29.	Iout	10.0 mA	System Information	Iout operating point
30.	Mode	DCM	System Information	Conduction Mode
31.	Mode	DCM	System Information	PWM/PFM Mode
32.	Pout	200.0 mW	System Information	Total output power
33.	Vin	2.8 V	System Information	Vin operating point
34.	Vout	20.0 V	System Information	Operational Output Voltage
35.	Vout Actual	19.77 V	System Information	Vout Actual calculated based on selected voltage divider resistors
36.	Vout Tolerance	3.96 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
37.	Vout p-p	33.79 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	10.0 m	Maximum Output Current
VinMax	4.6	Maximum input voltage
VinMin	2.8	Minimum input voltage
Vout	20.0	Output Voltage
base_pn	TPS61041	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

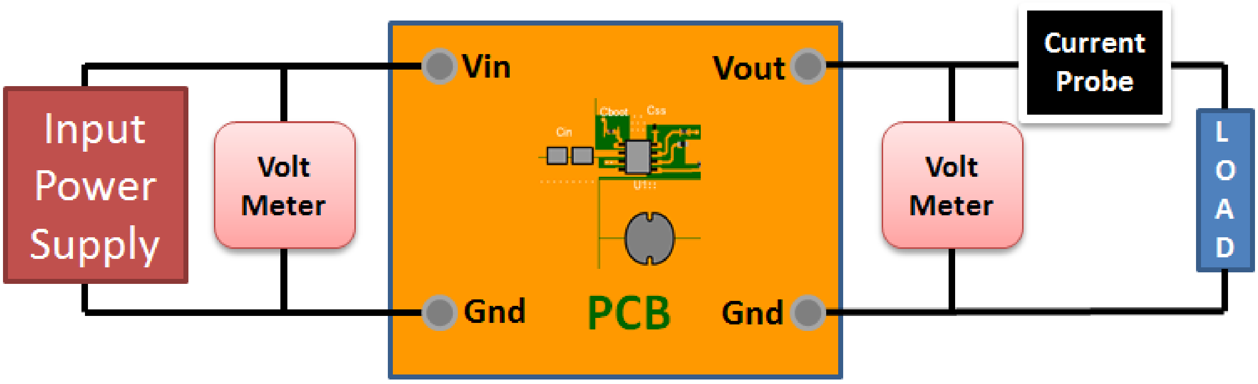
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 2.8V 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 : D9CED8BEE5623EB1[v1]

2. **TPS61041** Product Folder : http://www.ti.com/product/TPS61041 : contains the data sheet and other resources.