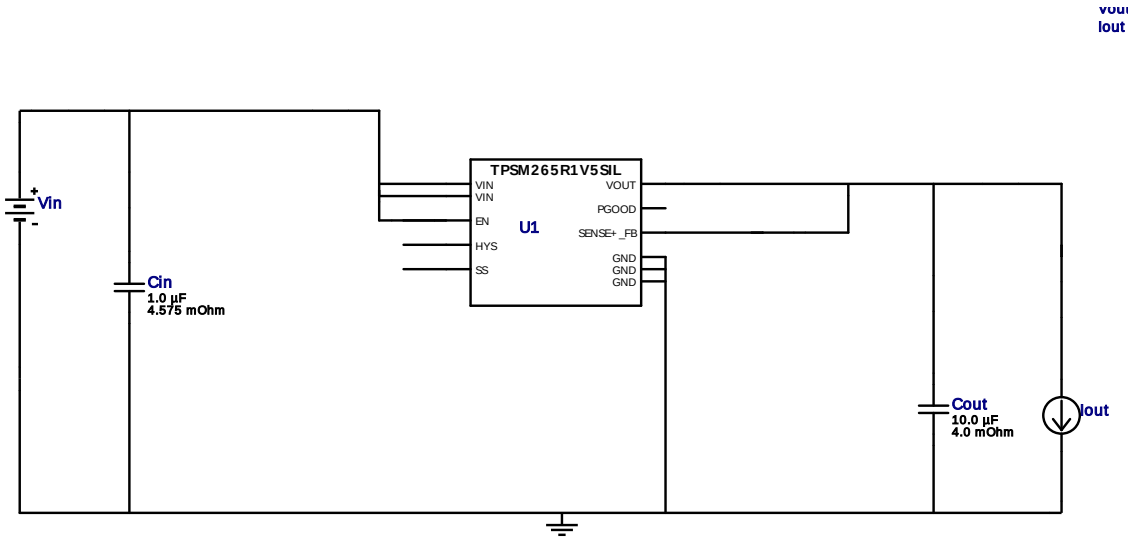
WEBENCH® Design Report

VinMin = 46.0V
VinMax = 48.0V
Vout = 5.0V
Iout = 0.1A

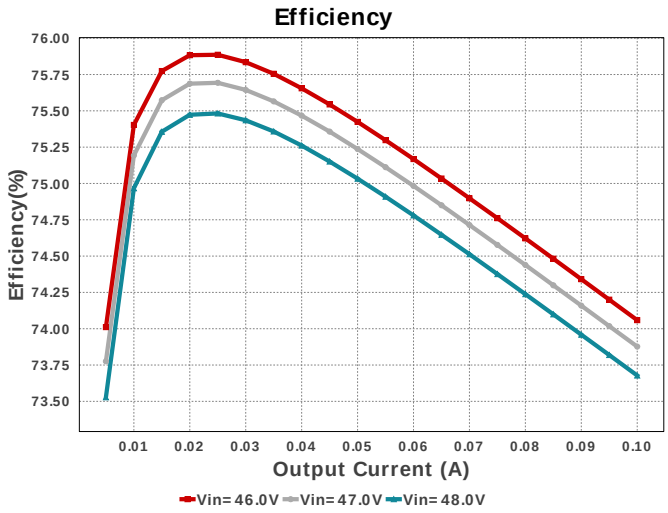
Device = TPSM265R1V5SILR
Topology = Buck
Created = 2020-11-03 02:32:08.896
BOM Cost = $2.19
BOM Count = 3
Total Pd = 0.18W

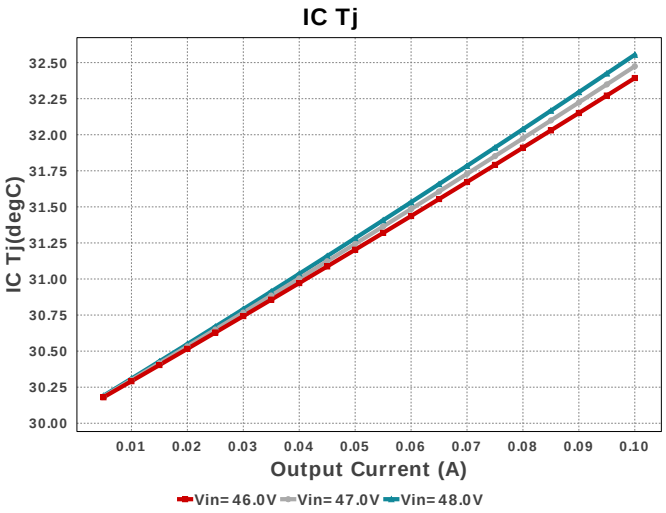
Design : 6 TPSM265R1V5SILR
TPSM265R1V5SILR 46V-48V to 5.00V @ 0.1A

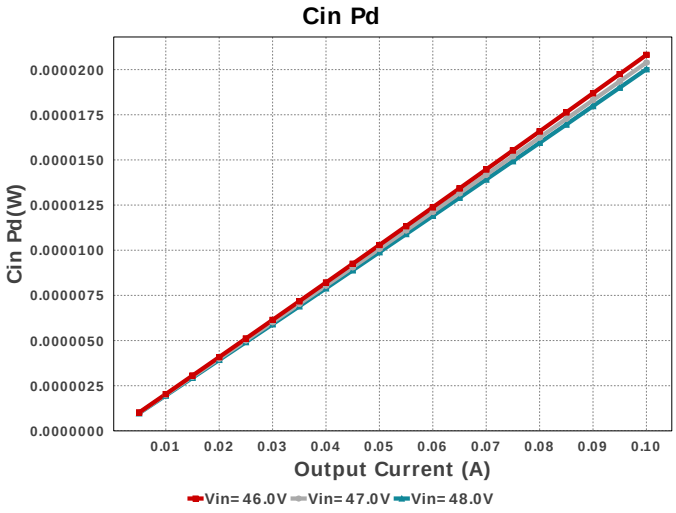


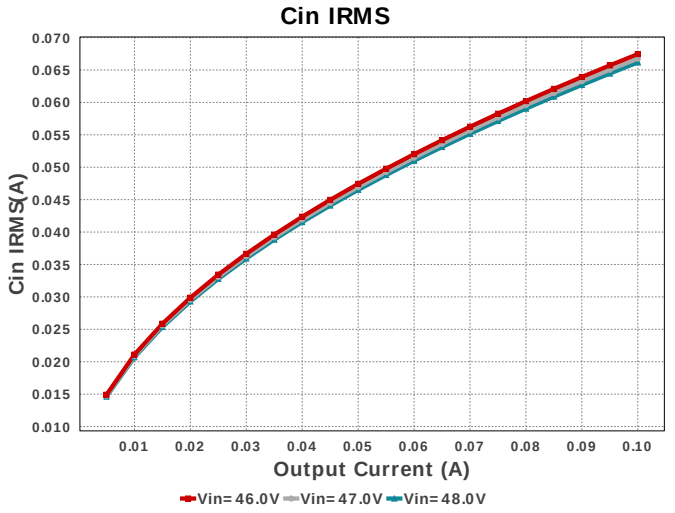
Electrical BOM

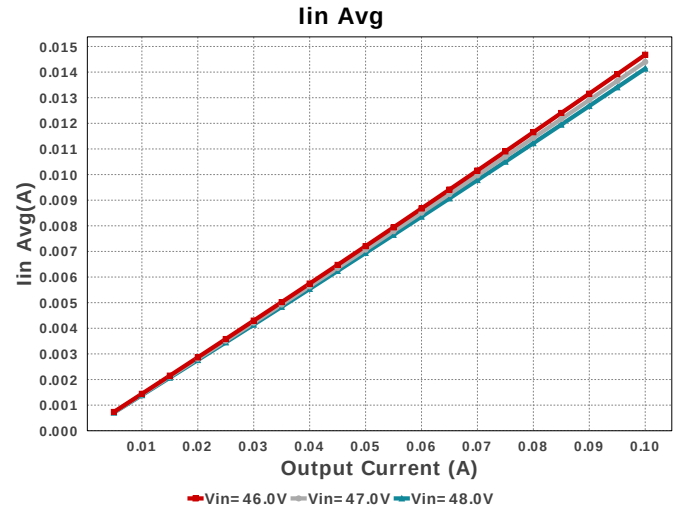
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cin	TDK	C3216X7R2A105K160AA Series= X7R	Cap= 1.0 uF ESR= 4.575 mOhm VDC= 100.0 V IRMS= 3.39639 A	1	$0.12	1206_180 11 mm^2
Cout	MuRata	GRM31CR71E106KA12L Series= X7R	Cap= 10.0 uF ESR= 4.0 mOhm VDC= 25.0 V IRMS= 6.0 A	1	$0.22	1206_180 11 mm^2
U1	Texas Instruments	TPSM265R1V5SILR	Switcher	1	$1.85	SIL0010C 18 mm^2

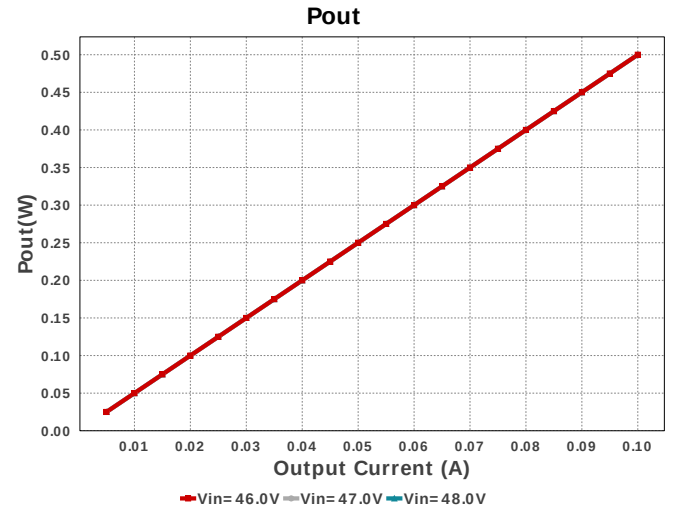


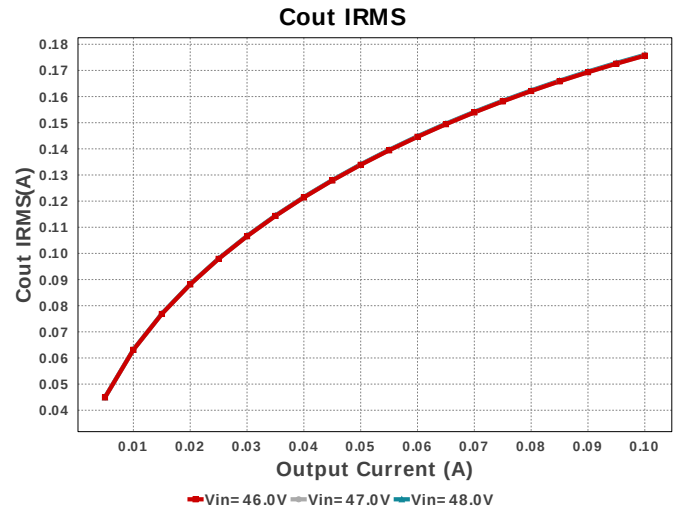


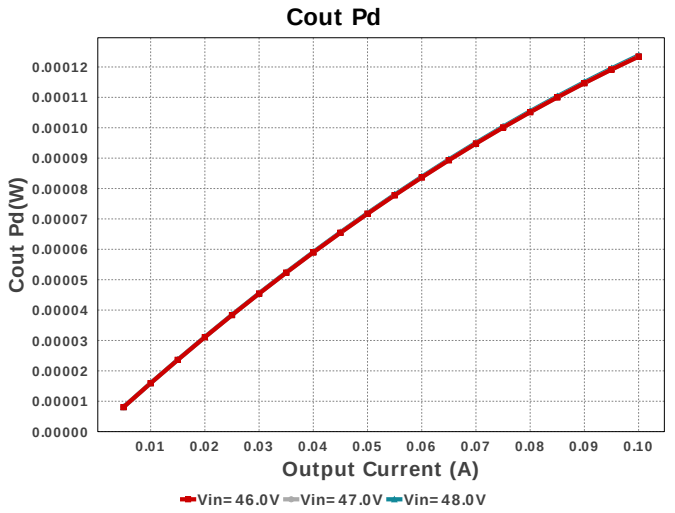


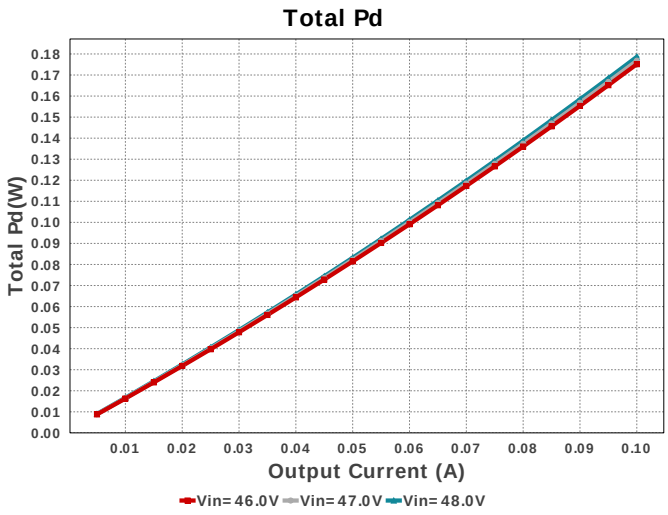


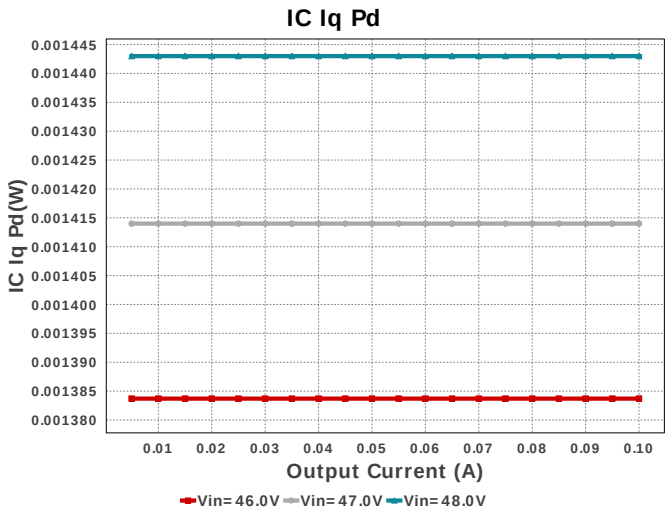


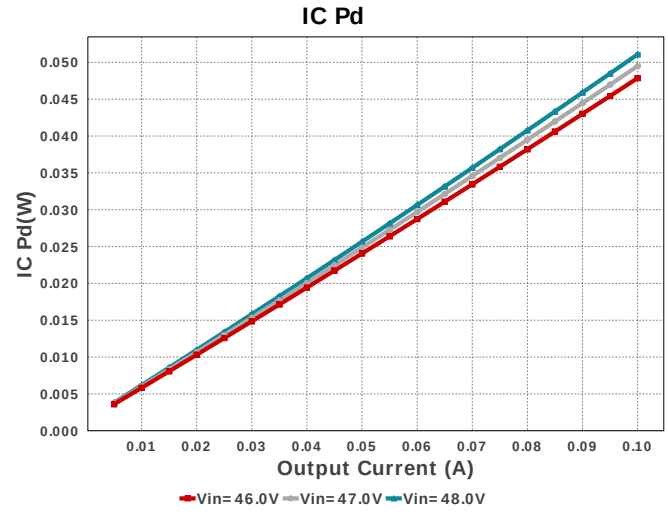


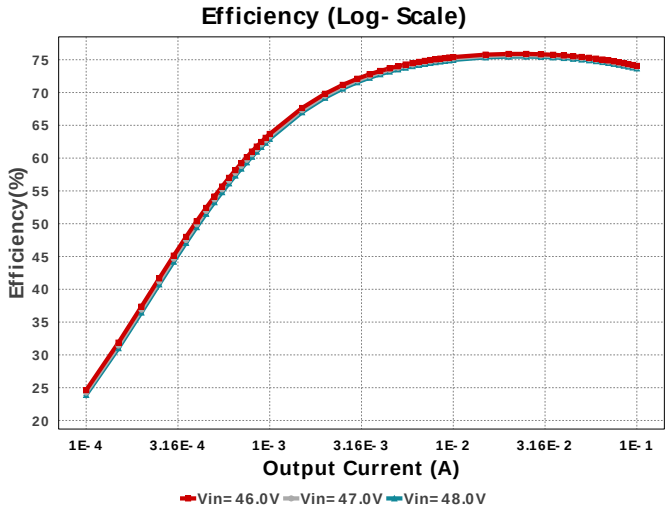












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	66.156 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	20.023 µW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	175.951 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	123.83 µW	Capacitor	Output capacitor power dissipation
5.	IC Iq Pd	1.443 mW	IC	IC Quiescent Power Dissipation
6.	IC Pd	51.088 mW	IC	IC power dissipation
7.	IC Tj	32.554 degC	IC	IC junction temperature
8.	ICThetaJA	50.0 degC/W	IC	IC junction-to-ambient thermal resistance
9.	Iin Avg	14.138 mA	IC	Average input current
10.	Cin Pd	20.023 µW	Power	Input capacitor power dissipation
11.	Cout Pd	123.83 µW	Power	Output capacitor power dissipation
12.	IC Iq Pd	1.443 mW	Power	IC Quiescent Power Dissipation
13.	IC Pd	51.088 mW	Power	IC power dissipation
14.	Total Pd	178.627 mW	Power	Total Power Dissipation
15.	BOM Count	3	System Information	Total Design BOM count
16.	Efficiency	73.678 %	System Information	Steady state efficiency
17.	FootPrint	40.0 mm^2	System Information	Total Foot Print Area of BOM components
18.	Frequency	52.873 kHz	System Information	Switching frequency
19.	Iout	100.0 mA	System Information	Iout operating point
20.	Mode	PFM	System Information	Conduction Mode
21.	Pout	500.0 mW	System Information	Total output power
22.	Total BOM	$2.19	System Information	Total BOM Cost
23.	Vin	48.0 V	System Information	Vin operating point

#	Name	Value	Category	Description
24.	Vout	5.0 V	System Information	Operational Output Voltage
25.	Vout Tolerance	2.0 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

Name	Value	Description
Iout	100.0 m	Maximum Output Current
VinMax	48.0	Maximum input voltage
VinMin	46.0	Minimum input voltage
Vout	5.0	Output Voltage
base_pn	TPSM265R1V5	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

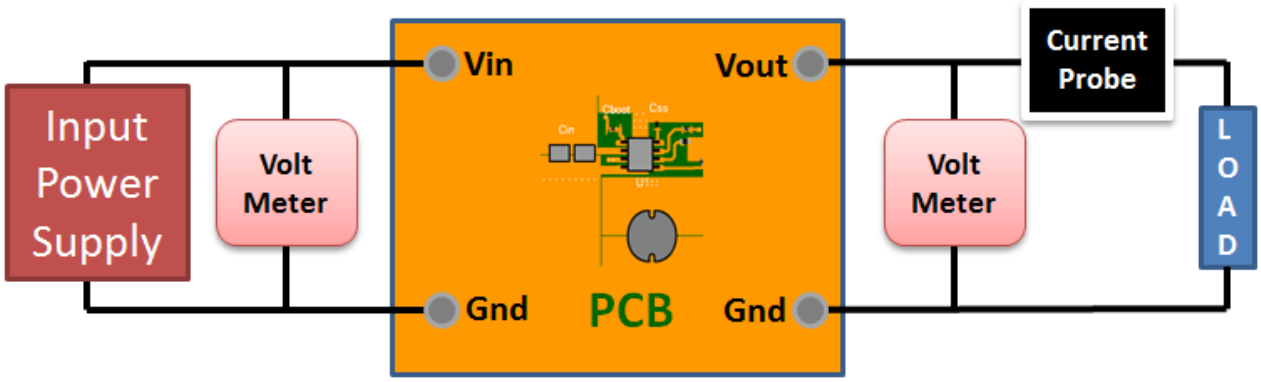
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 46.0V 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.

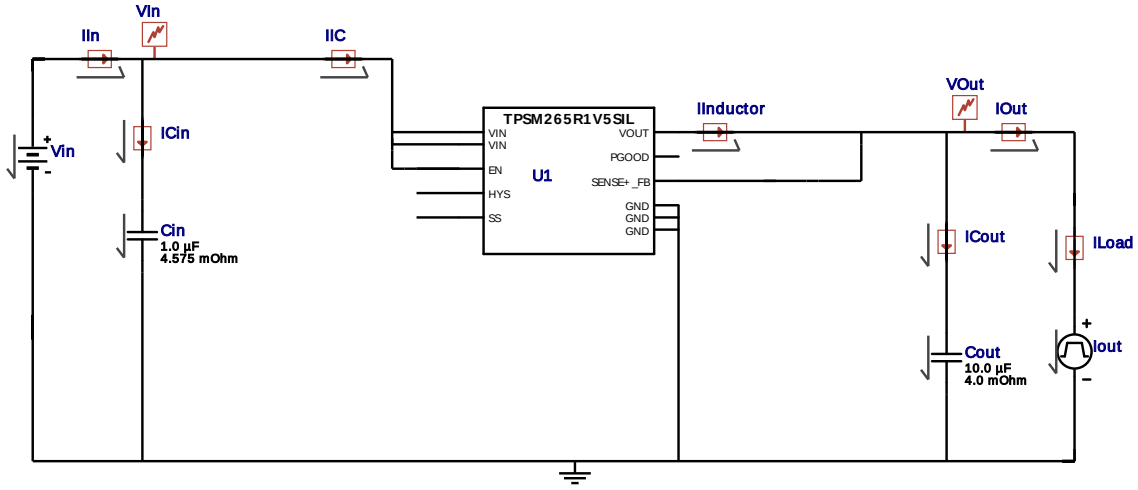


WEBENCH® Electrical Simulation Report

Design Id = 6

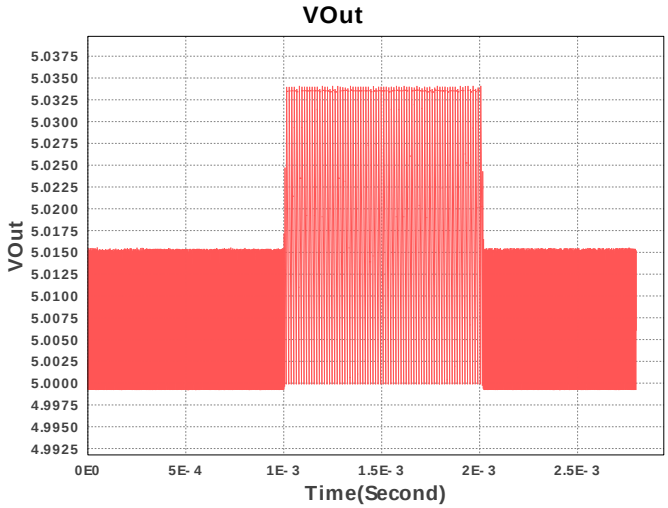
sim_id = 1

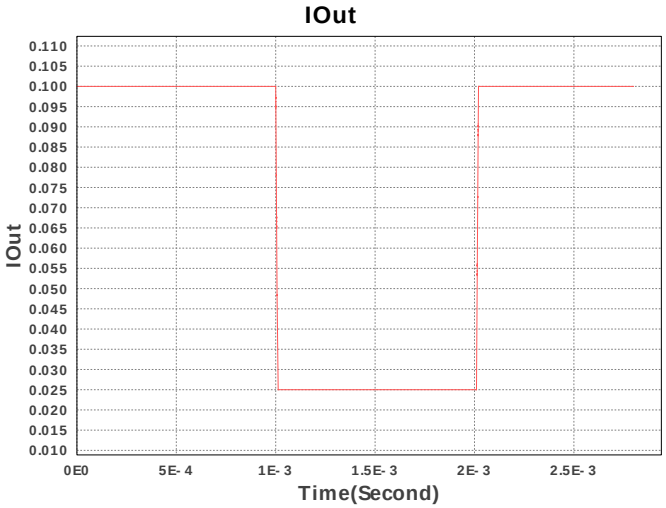
Simulation Type = Load Transient



Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	Cout	IC	Initial Voltage	5.0 V
2.	Iout	signal_type	Signal Type	PULSE
		I1	Initial Load Current	0.1 A
		I2	Minimum Load Current	0.025 A
		Td	Initial Time Delay	0.001 s
		Tf	Fall Time	10u s
		Tr	Rise Time	10u s
		Pw	Pulse Width	0.001 s

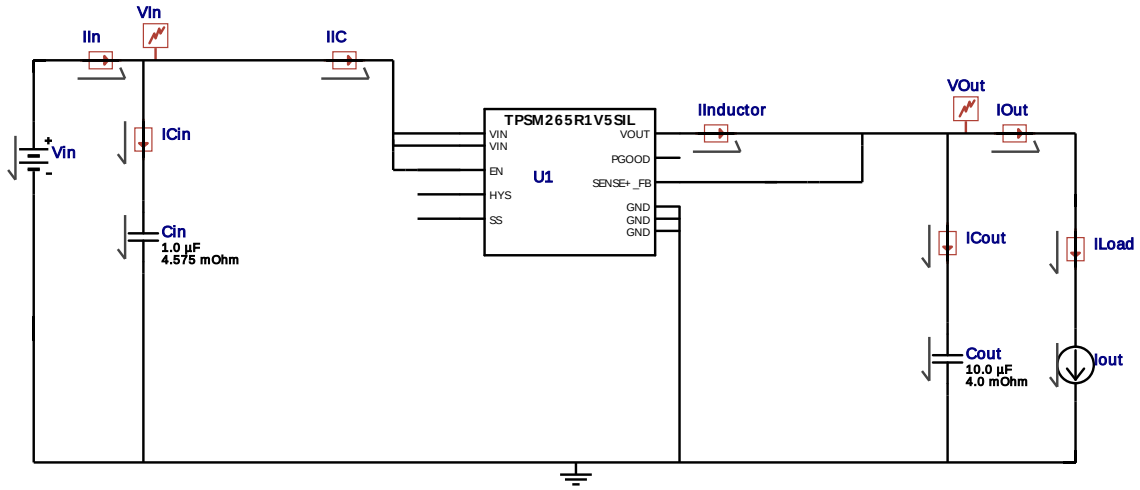




Design Id = 6

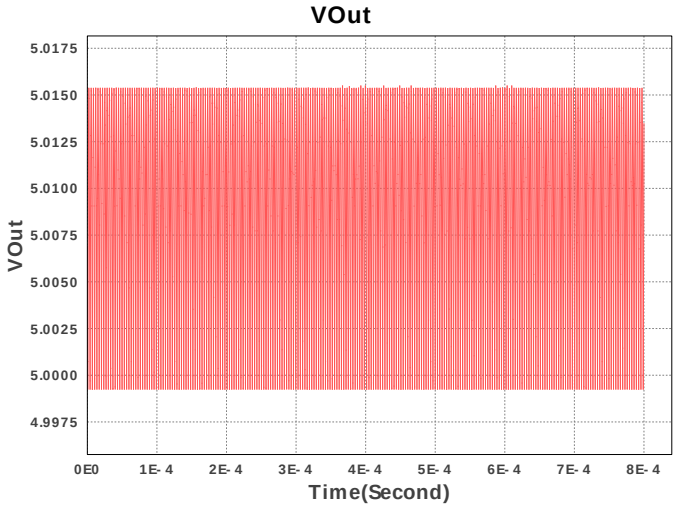
sim_id = 2

Simulation Type = Steady State



Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	Cout	IC	Initial Voltage	5.0 V
2.	Iout	I	Load Current	0.1 A



Design Assistance

1. Master key : 6306BADE0F5211DD[v1]
2. **TPSM265R1V5** Product Folder : http://www.ti.com/product/TPSM265R1 : contains the data sheet and other resources.