TEXAS INSTRUMENTS

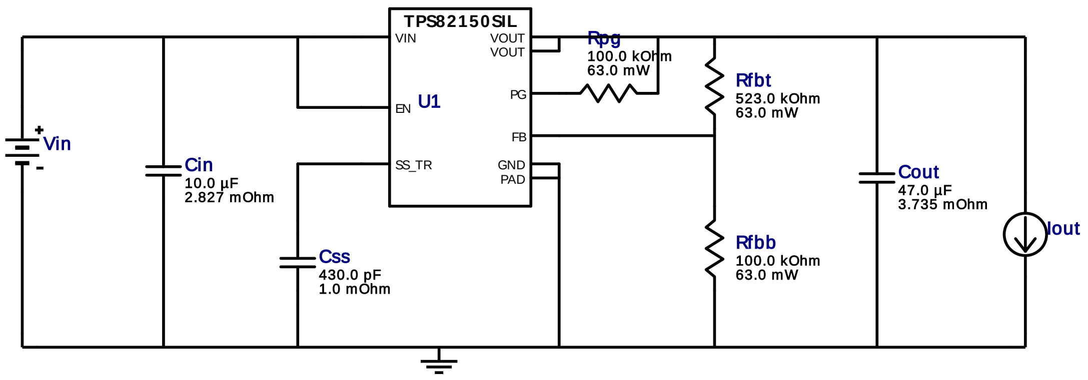
WEBENCH ® Design Report

VinMin = 8.0V
VinMax = 17.0V
Vout = 5.0V
Iout = 1.0A

Device = TPS82150SILR
Topology = Buck
Created = 2019-07-19 09:06:20.125
BOM Cost = $1.96
BOM Count = 7
Total Pd = 0.63W

Design : 3 TPS82150SILR
TPS82150SILR 8V-17V to 5.00V @ 1A

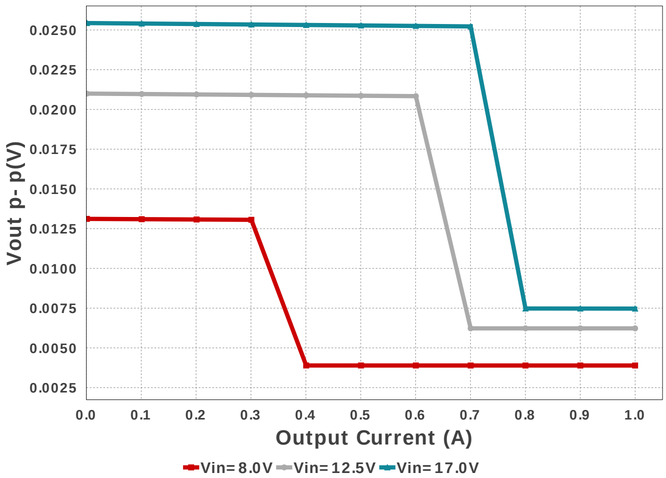
Vout = 5.0V
Iout = 1.0A



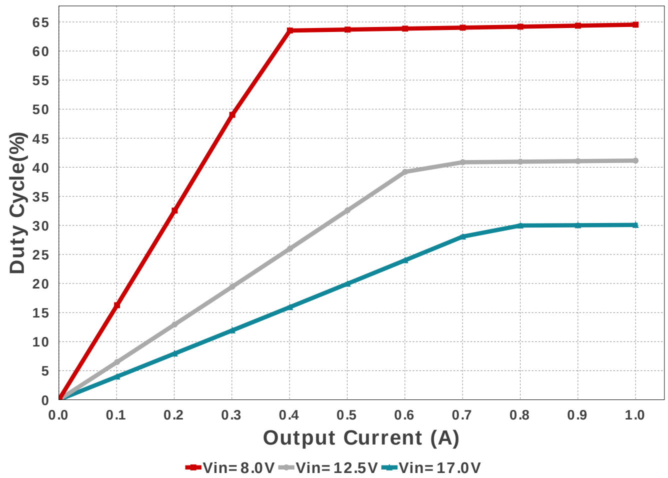
Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cin	TDK	C3225X7S1H106K250AB Series= X7S	Cap= 10.0 uF ESR= 2.827 mOhm VDC= 50.0 V IRMS= 4.3729 A	1	$0.41	1210_280 15 mm^2
Cout	MuRata	GRM31CC80J476KE18L Series= X6S	Cap= 47.0 uF ESR= 3.735 mOhm VDC= 6.3 V IRMS= 4.0522 A	1	$0.20	1206_190 11 mm^2
Css	MuRata	GRM1555C1E431JA01D Series= C0G/NP0	Cap= 430.0 pF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.02	0402 3 mm^2
Rfbb	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rfbt	Vishay-Dale	CRCW0402523KFKED Series= CRCW..e3	Res= 523.0 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
U1	Texas Instruments	TPS82150SILR	Switcher	1	$1.30	SIL0008D_SMD 15 mm^2

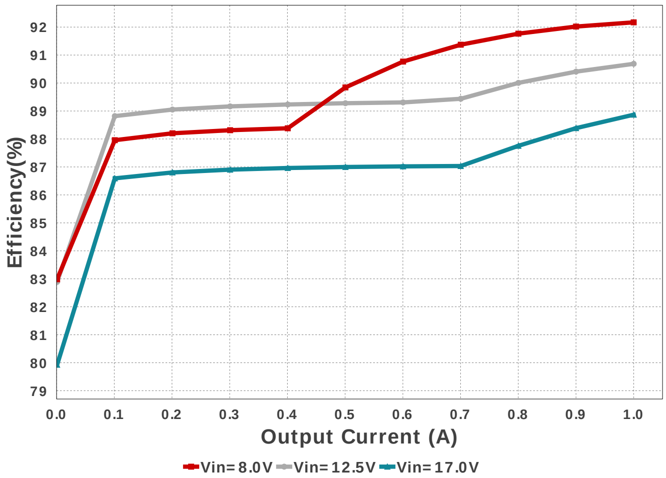
Vout p- p



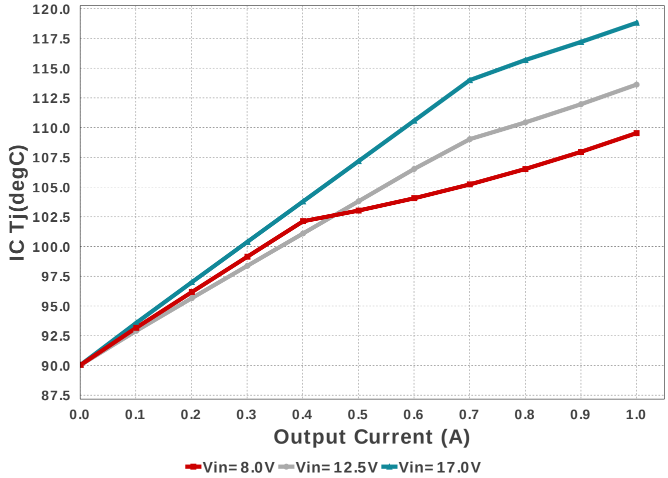
Duty Cycle



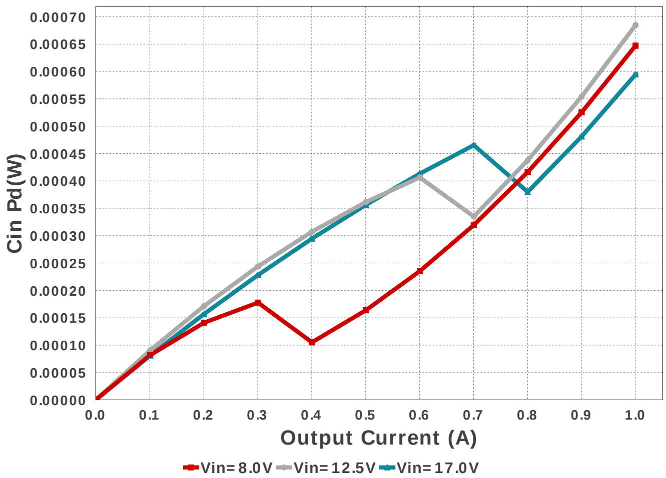
Efficiency



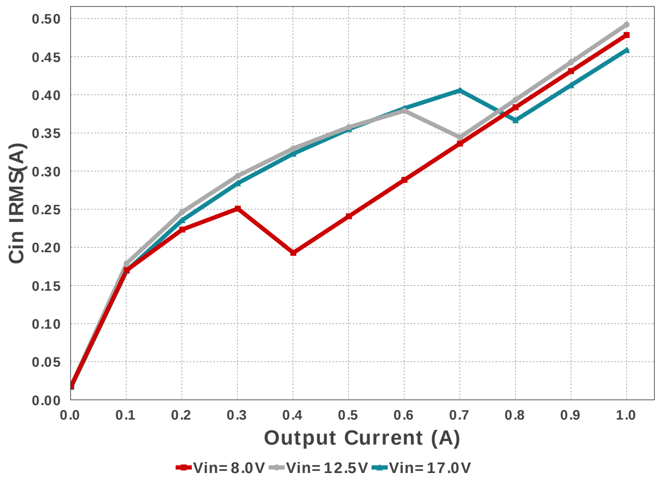
IC Tj

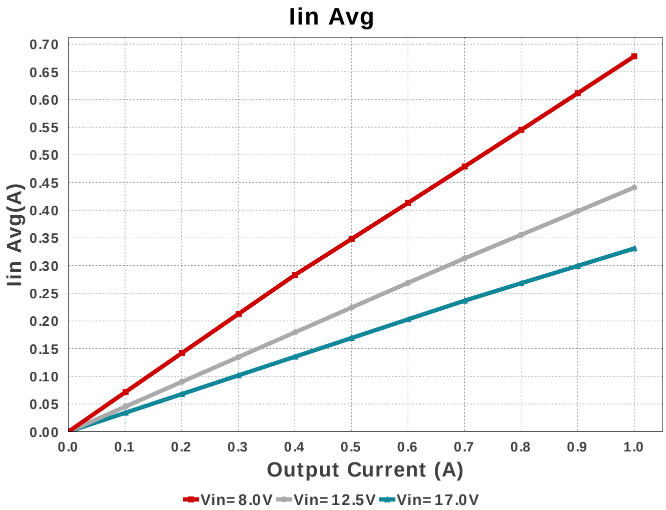


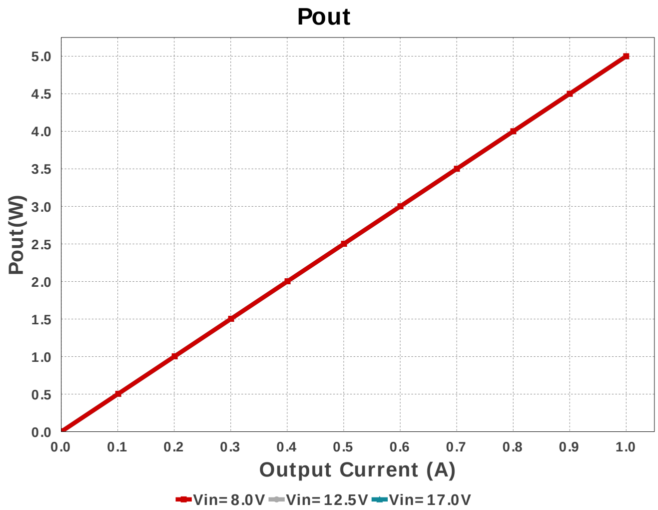
Cin Pd

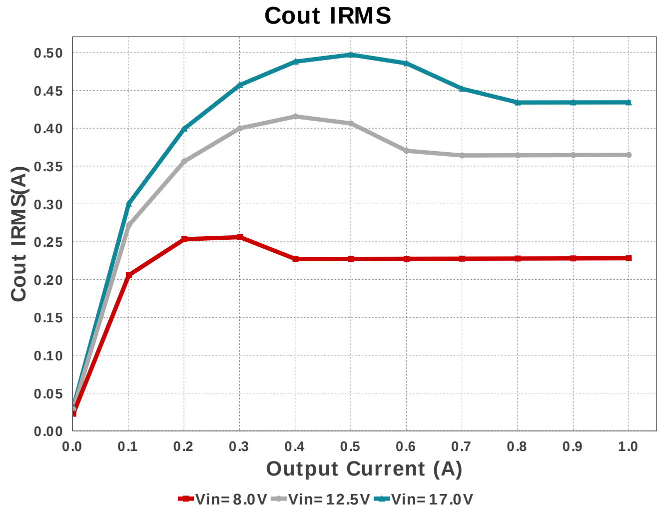


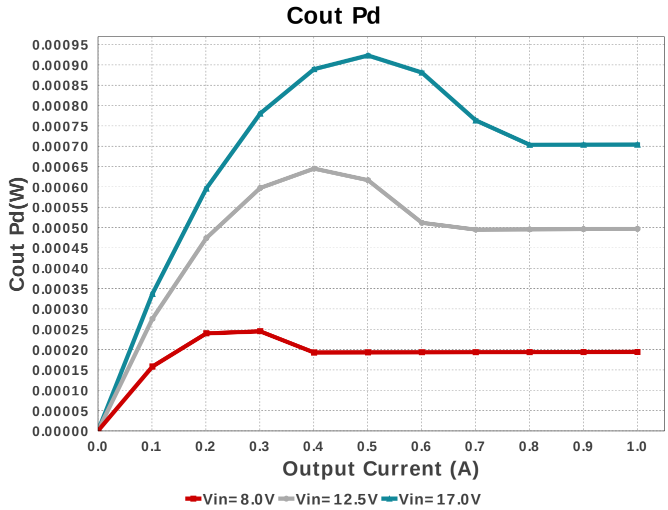
Cin IRMS

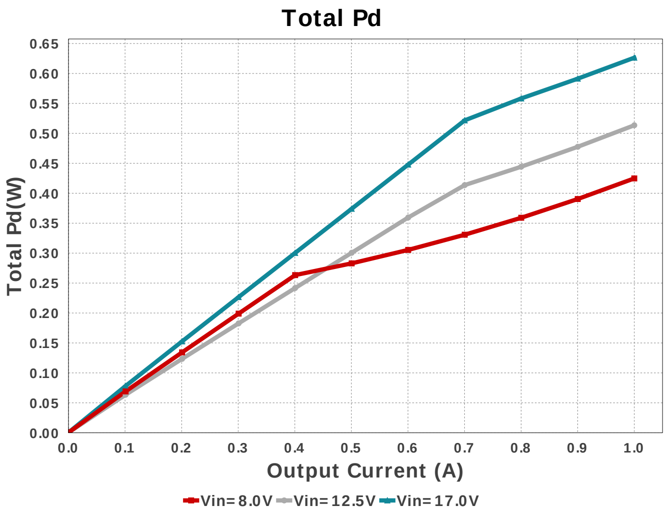


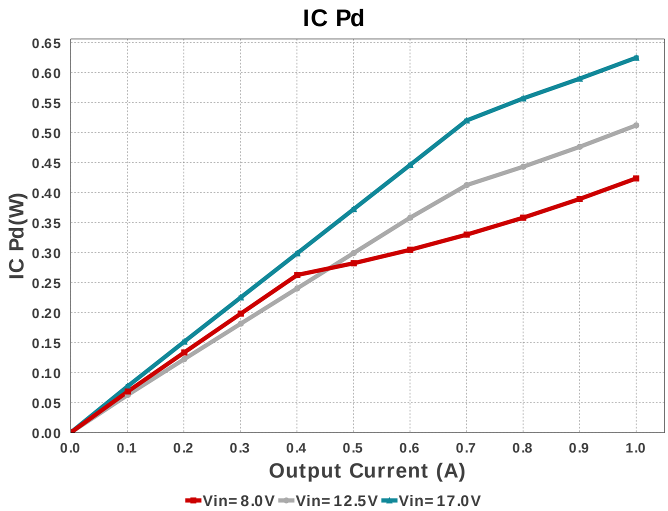

Iin Avg
Iin Avg(A)
Output Current (A)
Vin= 8.0V Vin= 12.5V Vin= 17.0V

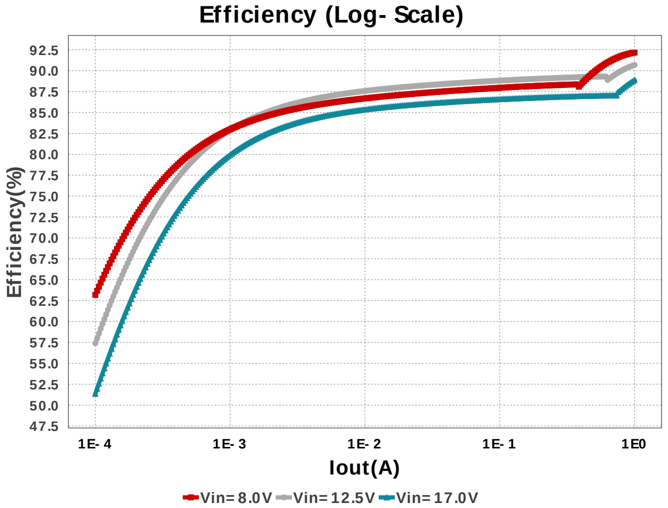

Pout
Pout(W)
Output Current (A)
Vin= 8.0V Vin= 12.5V Vin= 17.0V


Cout IRMS
Cout IRMS(A)
Output Current (A)
Vin= 8.0V Vin= 12.5V Vin= 17.0V


Cout Pd
Cout Pd(W)
Output Current (A)
Vin= 8.0V Vin= 12.5V Vin= 17.0V


Total Pd
Total Pd(W)
Output Current (A)
Vin= 8.0V Vin= 12.5V Vin= 17.0V


IC Pd
IC Pd(W)
Output Current (A)
Vin= 8.0V Vin= 12.5V Vin= 17.0V



Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	458.599 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	594.55 µW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	434.209 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	704.19 µW	Capacitor	Output capacitor power dissipation
5.	IC Pd	625.04 mW	IC	IC power dissipation
6.	IC Tj	118.815 degC	IC	IC junction temperature
7.	ICThetaJA Effective	46.1 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance
8.	Iin Avg	330.96 mA	IC	Average input current
9.	Cin Pd	594.55 µW	Power	Input capacitor power dissipation
10.	Cout Pd	704.19 µW	Power	Output capacitor power dissipation
11.	IC Pd	625.04 mW	Power	IC power dissipation
12.	Total Pd	626.322 mW	Power	Total Power Dissipation
13.	BOM Count	7	System Information	Total Design BOM count
14.	Duty Cycle	30.078 %	System Information	Duty cycle
15.	Efficiency	88.868 %	System Information	Steady state efficiency
16.	FootPrint	53.0 mm^2	System Information	Total Foot Print Area of BOM components
17.	Frequency	2.181 MHz	System Information	Switching frequency
18.	Iout	1.0 A	System Information	Iout operating point
19.	Mode	CCM	System Information	Conduction Mode
20.	Pout	5.0 W	System Information	Total output power
21.	Total BOM	$1.96	System Information	Total BOM Cost
22.	Vin	17.0 V	System Information	Vin operating point
23.	Vout	5.0 V	System Information	Operational Output Voltage
24.	Vout Actual	4.984 V	System Information	Vout Actual calculated based on selected voltage divider resistors
25.	Vout Tolerance	3.603 %	System Information	Vout Tolerance based on IC Tolerance (full load) and voltage divider resistors if applicable
26.	Vout p-p	7.471 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	1.0	Maximum Output Current
VinMax	17.0	Maximum input voltage
VinMin	8.0	Minimum input voltage
Vout	5.0	Output Voltage
base_pn	TPS82150	Base Product Number
source	DC	Input Source Type
Ta	90.0	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

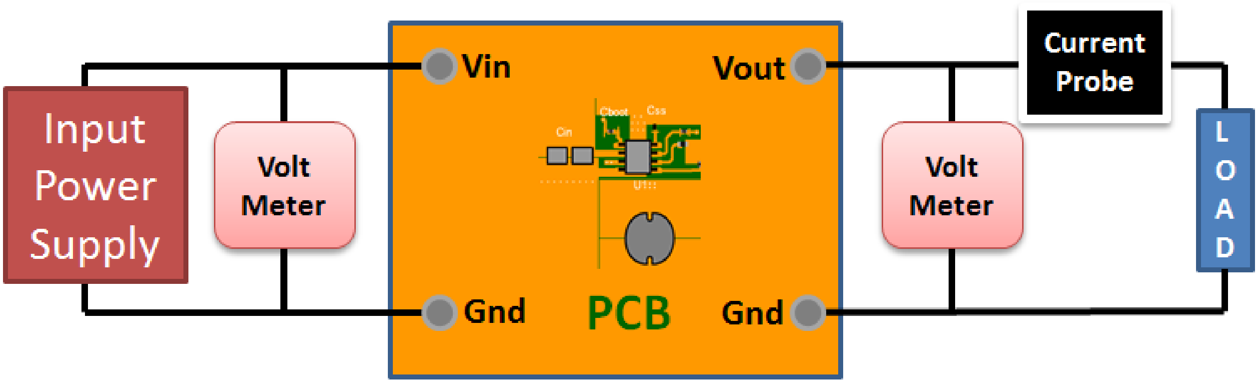
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 8.0V 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: DCS-Control(TM) Architecture with up to 3A output current, Power module with integrated inductor, 3V to 17V Input Voltage Range, Adjustable output voltage from 0.9V to 5V, Optional softstart capacitor for slow startup, Power Save Mode for light load efficiency, 100% duty cycle for lowest dropout, PG=Low when device is in shutdown through EN or Thermal Shutdown

2. Master key : 6CCD1BA7C78FEA40[v1]

3. **TPS82150** Product Folder : http://www.ti.com/product/TPS82150 : contains the data sheet and other resources.

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