

TPS65219(-Q1) Thermal- & Efficiency Calculator

Disclaimer

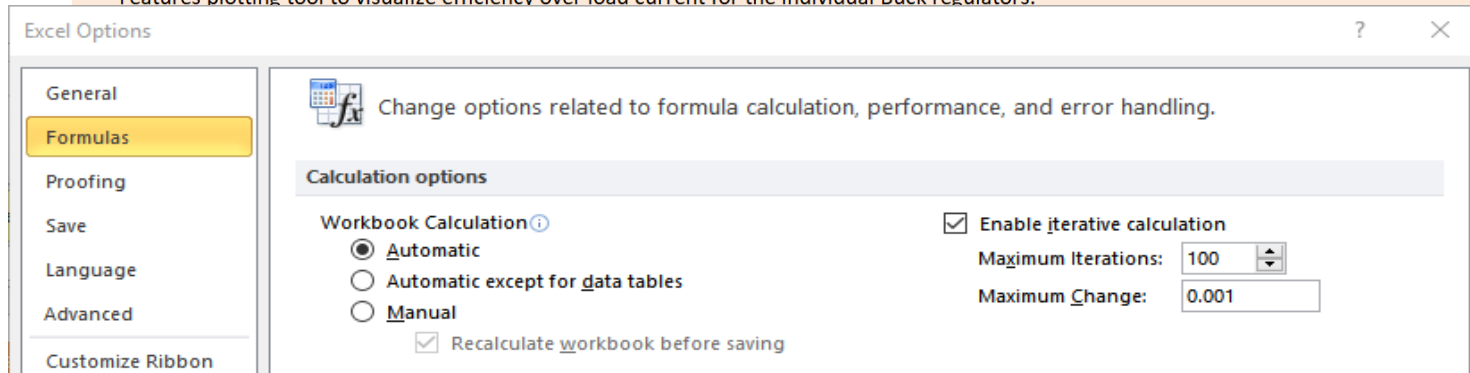
- This calculator is intended to be used as efficiency estimator for the TPS65219(-Q1) device. The efficiency is modelled using equations which will consider various real circuit impacts and should provide a reasonable proxy to the measured device efficiency. The modelled accuracy is expected to match device efficiency within $\pm 3\%$ but does not replace "real world" measurements.
- Important Legal Notice: All information in this calculator and in any related correspondence is provided "AS IS" and "with all faults", and is subject to TI's Important Notice (<http://www.ti.com/corp/docs/legal/important-notice.shtml>).

How to use the tool? (1/3)

Follow the instructions in the Readme worksheet:

Efficiency Calculator Usage

- 1 Turn on File->Options->Formulas-> Enable Iterative Calculation (100 should suffice)
- 2 Use light yellow cells to set your Buck parameters
- 3 Overall efficiency is calculated based on sum of individual losses
- 4 Effective DC is computed using the iterative feature
- 5 Efficiency curve can be generated using the "Update Curve" button. Iload numbers are being used from column R
- 6 **Tab 1: Efficiency&Thermal Estimator**
The tab Efficiency&Thermal Estimator allows to test different scenarios of voltage and load conditions and estimate its impact on efficiency and overall System power.
- 7 **Tab 2-4: Buck1, Buck2, Buck3**
Calculates individual Buck efficiencies and input currents based on the inputs on Tab1. Allows for customization of inductor value and DCR. Features plotting tool to visualize efficiency over load current for the individual Buck regulators.



How to use the tool? (2/3)

Enter the System /PMIC Supply voltage

Update the supply voltage per rail as needed
(here using Buck2-output as LDO- supply)

Enter the output voltage per rail as needed

Switching frequency

Thermal resistance Junction to board, here value for 4x4mm² RSM-package

Expected maximum board temperature: $T_{\text{Ambient}} + \text{Self-heating}$

Calculated efficiency at operating point

Enter the load current per rail as needed
(consider SoC + peripherals, if Buck is supplying LDO, add LDO-load currents)


Powerdissipation in PMIC per rail and total

Selfheating of PMIC
(total dissipation x Θ_{tjamb})

Calculated PMIC junction temperature for entered use-case

TPS65219(-Q1) - Efficiency and Thermal Estimator							
Regulator	Vin [V]	Vout [V]	Efficiency	Iload [A]	Iin [A]	Pdiss [mW]	
System Voltage	5					0	
Buck 1	5	0.75	73.6%	2.12	0.43	433	
Buck 2	5	3.30	95.4%	0.34	0.24		
Buck 3	5	1.10	89.1%	0.19	0.05		
LDO 1 (NMOS)	3.3	1.80	54.5%	0.10	0.10	150	
LDO 2 (NMOS)	1.8	0.85	47.2%	0.13	0.13	124	
LDO 3 (PMOS)	3.3	1.80	54.5%	0.06	0.06	90	
LDO 4 (PMOS)	3.3	1.80	NA	0.00	0.00	0	
PMIC	5			0.00	0.00		
total dissipation of the PMIC:						882	
Θ_{tjamb}			10.7	°C/W	T_{delta}	9.4	
f(SW) [MHz]	2.30		T_{board}	100	°C	T_{junction}	109.4
Input Field	Calculated Field	Info	<p>This calculator is intended to be used as an efficiency estimator for the TPS65219(-Q1) device. The efficiency is modeled using various equations which will consider various reasonable proxy to the measured device efficiency. The modelled accuracy is intended to match device efficiency within ±3% but does not replace actual measurements.</p> <p>Important Legal Notice: All information is provided "AS IS" and is subject to change without notice. See the TI E2E forum for more information.</p>				

TPS65219 Example Use-Case

		TPS65219(-Q1) - Efficiency and Thermal Estimator					
TPS65219(-Q1) Simulator	Regulator	Vin [V]	Vout [V]	Efficiency	Iload [A]	Iin [A]	Pdiss [mW]
	System Voltage	5					0
	Buck 1	5	0.75	73.6%	2.12	0.43	433
	Buck 2	5	3.30	95.4%	0.34	0.24	54
	Buck 3	5	1.10	89.1%	0.19	0.05	31
	LDO 1 (NMOS)	3.3	1.80	54.5%	0.10	0.10	150
	LDO 2 (NMOS)	1.8	0.85	47.2%	0.13	0.13	124
	LDO 3 (PMOS)	3.3	1.80	54.5%	0.06	0.06	90
	LDO 4 (PMOS)	3.3	1.80	NA	0.00	0.00	0
	Misc	5			0.00	0.00	
				total dissipation of the PMIC:			882
			Thetajb	10.7 °C/W		Tdelta	9.4
	f(SW) [MHz]	2.30	Tboard	100 °C		Tjunction	109.4
Input Field	Calculated Field	Info only	<p>This calculator is intended to be used as efficiency estimator for the TPS65219(-Q1) device. The efficiency is modelled using equations which will consider various real circuit impacts and should provide a reasonable proxy to the measured device efficiency. The modelled accuracy is expected to match device efficiency within $\pm 3\%$ but does not replace "real world" measurements.</p> <p>Important Legal Notice: All information in this calculator and in any related correspondence is provided "AS IS" and "with all faults", and is subject to TI's Important Notice (http://www.ti.com/corp/docs/legal/important-notice.shtml).</p>				

How to use the tool? (2/2)

Data taken from sheet 'Efficiency & Thermal Estimator' or pre-set

Inductor value. 470nH required, but can be modified to calculate for corner-case due to tolerances

Inductor DC-resistance. Update with value for chosen inductor

Efficiency considering PMIC-losses only

Efficiency considering PMIC- and passive-losses

Contributors to losses

Press to update Efficiency plot below after updating parameters.

Note: Sheet 'Efficiency & Thermal Estimator' will auto-update for the operating point without pressing this button.

Efficiency plot for conditions per Sheet 'Efficiency & Thermal Estimator' and inductor settings on this sheet

