

# Welcome!

## Texas Instruments New Product Update

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- Phone lines will be muted
- Please post questions in the chat or contact your sales person or field applications engineer

# **New Product Update: Low ripple & Low Iq DC/DC point-of-load buck converters**

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**April 1, 2021**

# Agenda

- 7-30V, <6A, Buck Converter Portfolio
- Introducing TPS62912/3
  - Industry's first low-noise buck converters with integrated ferrite-bead compensation
  - Customer Benefit: Low 20  $\mu$ VRMS noise performance (from 100 Hz to 100 kHz) and ultra-low output-voltage ripple of 10  $\mu$ VRMS, enables engineers the ability to remove one or more low-dropout regulators (LDOs) from their designs, reduce power losses by up to 76%, and save 36% of board space.
  - Target Applications: Telecom infrastructure, Test & Measurement, Aerospace & Defense, Medical
- Introducing TPS62901/2/3
  - 3-V to 17-V, high efficiency and low IQ buck converter in 1.5-mm  $\times$  2-mm QFN package
  - Customer Benefit: Power savings from a 4-uA Iq combined with high efficiency across all load conditions
  - Target Applications: Battery operated end equipment, motor drives and Enterprise applications

# BSR-MV LC Buck Converter Portfolio



Automotive

Released

Newly Released

Preview

Mid Voltage >20V

## TPS62175

4.75 - 28V, 0.5A, 5µA Iq, DCS  
1MHz, 2x3mm SON

## TPS54334/5A/6A

4.5V - 28V 3A, CM,  
0.2-1.5MHz, QFN/SOIC

## TPS54202/302/308

4.5V - 28V 2A/3A, CM,  
500/400/340KHz, SOT23-6

## TPS54531

3.5V - 28V, 2/3/5A, CM,  
570k, Non-Sync, SOIC-8

## TPS5402/3/5

6V - 28V 1.8A, CM,  
0.2-1.5MHz, non-Sync, QFN/SOIC

## TPS56339

4.5V - 24V, 3A, AECM  
500KHz SOT23-6

## TPS54231/2

3.5V - 28V, 2/3/5A, CM,  
0.57/1MHz, Non-Sync, SOIC-8

## TPS54339/E

4.5V - 23V, 2A/3A, D-CAP2  
600KHz SOIC-8

## TPS54239/E

4.5V - 23V, 2A/3A, D-CAP2  
600KHz SOIC-8

## TPS54331/2

3.5V - 28V, 2/3/5A, CM,  
0.57/1MHz, Non-Sync, SOIC-8

Mid Voltage <20V

## TPS62745/1

3.3- 10V , 300mA, 400nA Iq  
2.5MHz, 2x3mm SON

## TPS62150/1/2/3

3 -17V, 1A, 17µA Iq, DCS  
1.25MHz / 2.5MHz, 3x3QFN



## TPS62140/1/2/3

3 -17V, 2A, 17µA Iq, DCS  
1.25MHz / 2.5MHz, 3x3QFN

## TPS62130/1/2/3

3 -17V, 3A 17µA Iq, DCS  
1.25MHz / 2.5MHz, 3x3 QFN



## TPS62901/2/3

2.9 - 17V, 1A- 3A , 4µA Iq DCS  
2.5MHz , 1.5x2 QFN HR

## TPS62135/6

3 -17V, 4A, 18µA Iq, DCS  
1MHz, 2.5MHz, 2x3QFN

## TPS62125

2 -15Vin, 300mA, 11µA Iq, DCS  
1MHz, 2x2QFN

## TPS62160/1/2/3

3 -17V, 1A, 17µA Iq, DCS  
2.25MHz, 2x2QFN



## TPS62147/8

3 -17V, 2A, 18µA Iq, DCS  
1.25MHz / 2.5MHz, 2x3QFN

## TPS54320

17V, 3A, CM  
1.2MHz, Sync, 3.5x3.5QFN

## TPS62912/3

3 - 17V, 2A -3A , 2.2MHz CM  
Low Noise 20uVRMS , 2x2 QFN HR

## TPS54424

17V, 4A, CM  
1.6MHz, Sync, 3.5x3.5QFN

## TPS62120/122

2 -15Vin, 750mA, 11µA Iq, DCS  
800kHz, SOT-23/ 2x2QFN

## TPS62170/1/2/3

3 -17V, 0.5A, 17µA Iq, DCS  
2.25MHz, 2x2QFN



## TPS54x27/8

4.5V - 18V, 2A-3A D-CAP2  
650kHz, SOIC-8



## TPS56x200/9

4.5 - 17V, 2A-3A, DCAP2,  
650K, SOT23-6

## TPS562/3202/7

2-3A, SOT563 packaging, DCAP2  
Low cost solution

## TPS54x27/8

4.5V - 18V, 4A-6A D-CAP2  
650kHz, SOIC-8

## TPS560200

4.5 - 17V, 0.5A, DCAP2,  
650K, SOT23-5 / MSOP8



## TPS561201/8

4.5 - 17V, 1A D-CAP2,  
580KHz ,SOT23-6

## TPS562201/8

4.5 - 17V, 2A D-CAP2,  
580KHz ,SOT23-6

## TPS563201/8

4.5 - 17V, 3A D-CAP2,  
580KHz ,SOT23-6

## TPS562/311

17V, 2-3A, AECM,  
600kHz, SOT583  
Samples Available, RTM 3Q21

## TPS56x28

4.5V - 18V, 4A-6A, D-CAP2  
Power good , 650kHz, SOIC-8

## TPS563240/9

4.5 - 17V, 3A D-CAP3,  
1.4MHz ,SOT23-6

## TPS563x31

4.5 - 17V, 2A-3A D-CAP3,  
600kHz / 850kHz, SOT563

## TPS56x201/8

4.5 - 17V, 4/5A D-CAP2,  
560KHz ,SOT23-6

≤ 1A

≤ 3A

>3A

4

# Introducing the TPS62912/3

Industry's 1st low-noise buck converters w/ integrated ferrite-bead compensation

# Problem Statement & Common Solutions

## Problem statement

Powering noise sensitive (meaning low ripple & low noise) point-of-load rails in high precision systems such as **high speed ADCs/DACs, AFEs** or clocks and minimizing interference with sensitive signal chain components.

## Common solutions today

Using a DC/DC from VIN and filter output of DC/DC

- With a secondary LDO – **thermal rise, system efficiency performance, solution size**
- With an external LC filter – **may have problems due to stability issues**

# TPS62912/13 2A/3A low noise and low ripple buck converter with integrated ferrite bead compensation

RELEASED

## FEATURES

- 3.0V to 17V input voltage range
- 0.8V to 5.5V output voltage
- 57mΩ/20mΩ RDSon
- 1% output voltage accuracy
- 2.2MHz/1MHz switching frequency
- **Low noise <math>20\mu\text{V}\_{\text{RMS}}</math> 100Hz to 100kHz**
- **Low voltage ripple <math>10\mu\text{V}\_{\text{RMS}}</math> after ferrite bead**
- **Integrated 2<sup>nd</sup> stage filter compensation**
- **PSRR >65dB (up to 100kHz)**
- Spread spectrum modulation (optional)
- - 40°C to 150°C junction temperature range
- 2.0mmx2.0mm Hotrod QFN

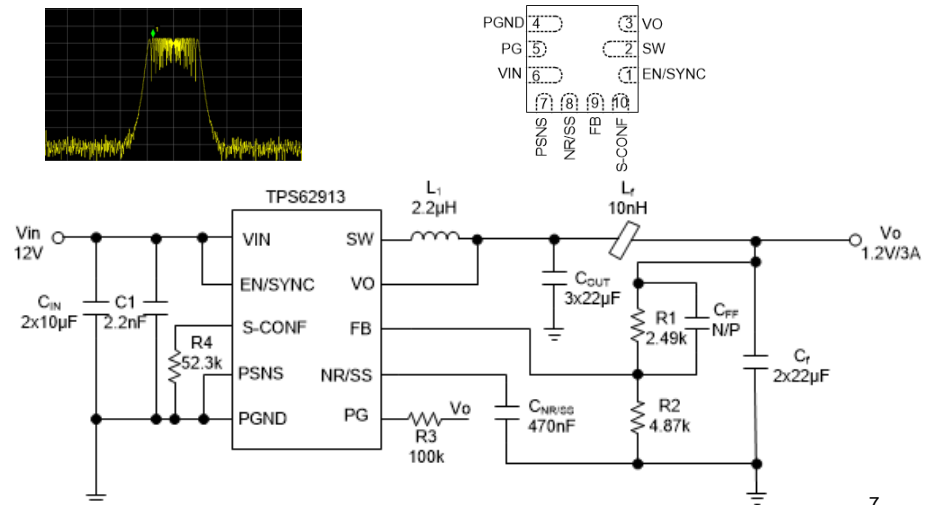
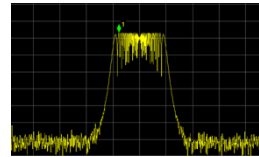
## APPLICATIONS

- Telecom infrastructure
- Test & Measurement
- Radar, Avionics
- Medical

Configuration	Function
S-CONFIG	2.2MHz/1MHz
S-CONFIG	Spread Spectrum
S-CONFIG	Output discharge

## BENEFITS

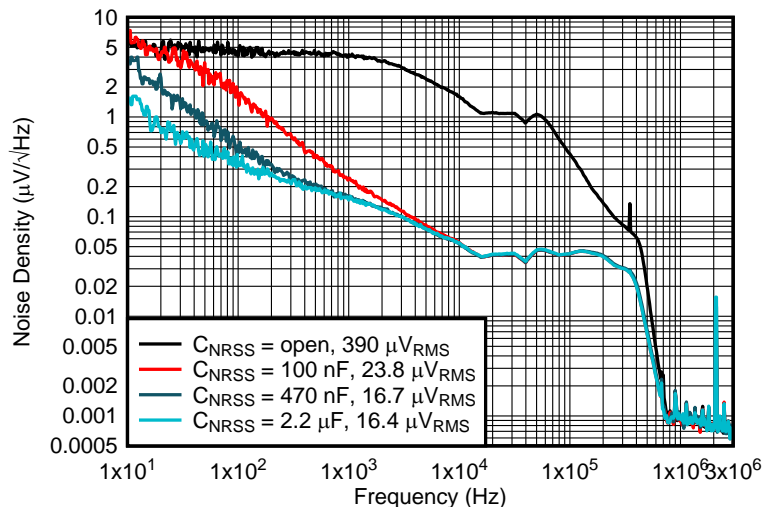
- Eliminates LDO and passive post filtering
- Remote sense FB improves load regulation
- 1% output voltage regulation reduces bulk capacitance
- Low output voltage ripple minimizes RF spurs.
- Low 1/f noise for optimum phase noise
- Spread spectrum reduces spurious noise and EMI



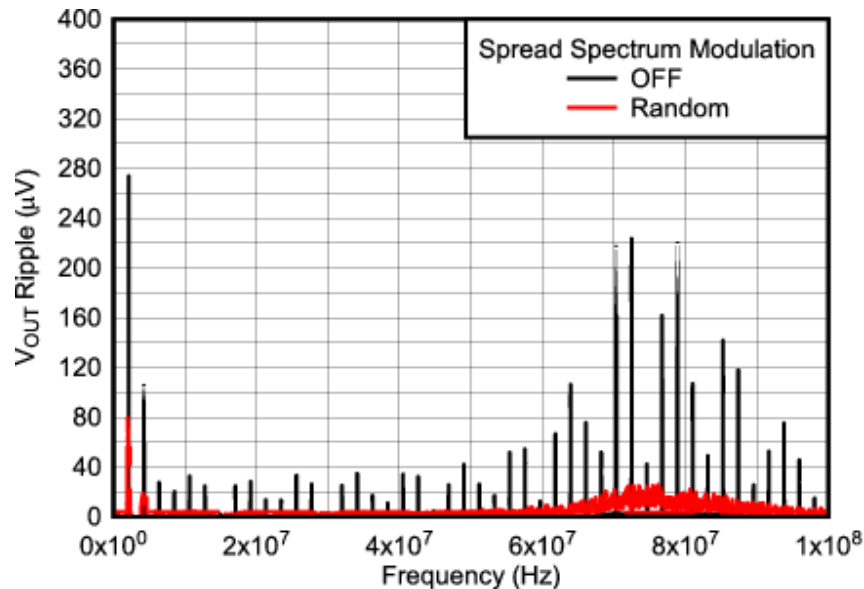
# Defining Low Noise & Ripple

## Example with 12Vin to 3.3Vout, 2.2MHz

### Noise (less than 100kHz)



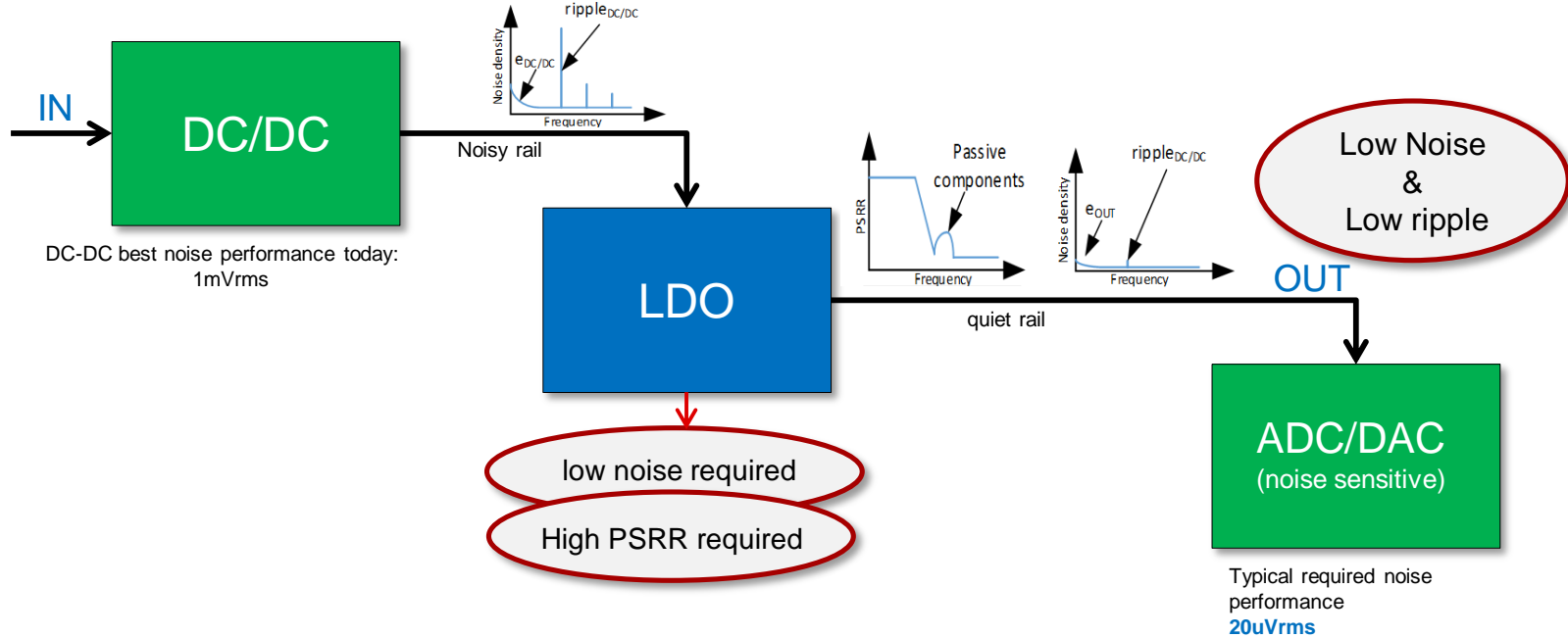
### Ripple (DC-DC $f_{SW}$ and above)





# Typical solution for low-noise systems

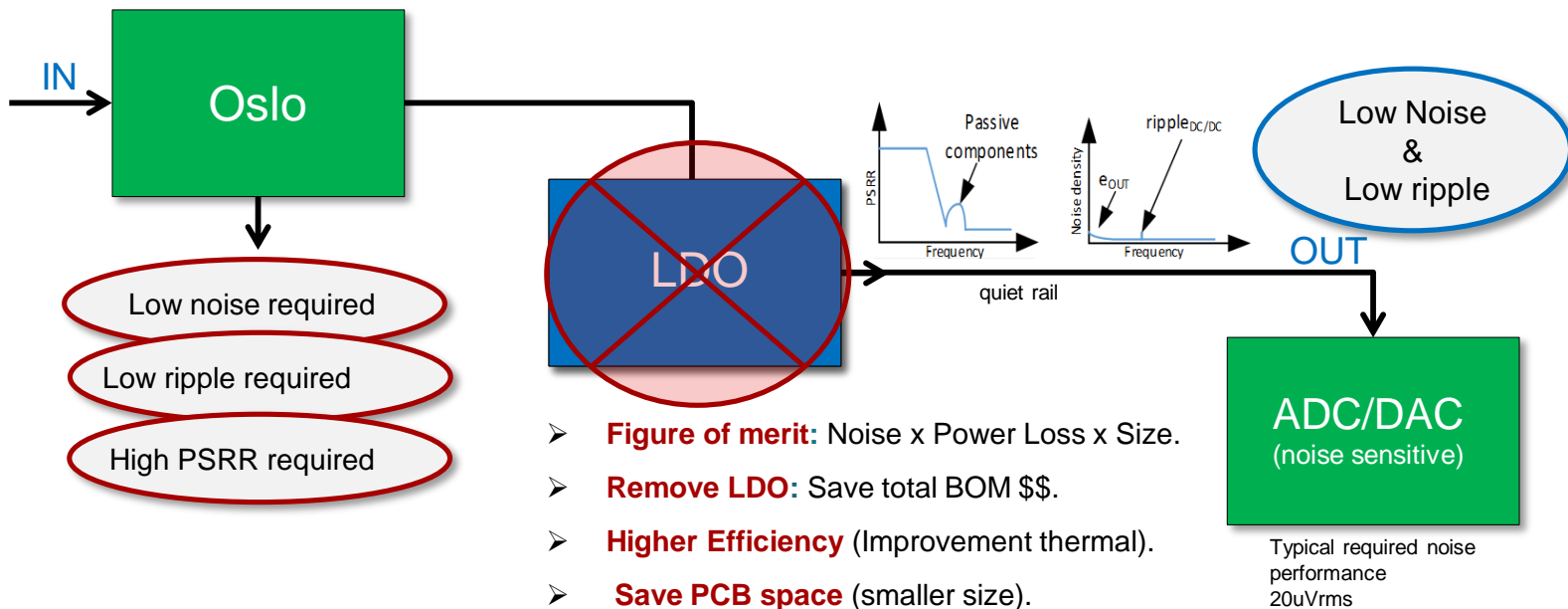
## Low Noise, High PSRR, LDO



- **LDO is the most critical element in a high performance system**
- **Low noise and High PSRR is a must to achieve a low noise power supply**

# The TPS62912/3 Answer

## No LDO



- LDO is not required anymore
- Allows system cost reduction, reduced LDOs power losses and heat dissipation

# Available Marketing Collateral

## As of March 2020

Collateral	Content Type	Link
TPS62912EVM-077: 17-V, 2-A low noise/low ripple buck converter with integrated ferrite bead filter compensation	EVM	<a href="https://www.ti.com/tool/TPS62912EVM-077">https://www.ti.com/tool/TPS62912EVM-077</a>
TPS62913EVM-077: 17-V, 3-A low noise/low ripple buck converter with integrated ferrite bead filter compensation	EVM	<a href="https://www.ti.com/tool/TPS62913EVM-077">https://www.ti.com/tool/TPS62913EVM-077</a>
TPS6291xEVM-077 Evaluation Modules User's Guide	EVM User's Guide	<a href="https://www.ti.com/lit/ug/slvubx2/slvubx2.pdf">https://www.ti.com/lit/ug/slvubx2/slvubx2.pdf</a>
TPS6291x 3-V to 17-V, 2-A/3-A Low Noise and Low Ripple Buck Converter with Integrated Ferrite Bead Filter Compensation (SLVSFP4A)	Datasheet	<a href="https://www.ti.com/lit/ds/symlink/tps62913.pdf">https://www.ti.com/lit/ds/symlink/tps62913.pdf</a>
WEBENCH Designs	Webench Model	<a href="https://www.ti.com/product/TPS62912#design-development">https://www.ti.com/product/TPS62912#design-development</a> <a href="https://www.ti.com/product/TPS62913#design-development">https://www.ti.com/product/TPS62913#design-development</a>
Product Folder Live, Pricing set-up, Device visible parametric search, EVM Tool Folder Live, Set-up maximum units samples order/price, Customer initial sample requirement	APL setup	<a href="https://www.ti.com/product/TPS62912">https://www.ti.com/product/TPS62912</a> <a href="https://www.ti.com/product/TPS62913">https://www.ti.com/product/TPS62913</a>
"Powering Sensitive ADC Designs with the TPS62913 Low-Ripple and Low-Noise Buck Converter"	App Note	<a href="https://www.ti.com/lit/an/slvaw7/slvaw7.pdf">https://www.ti.com/lit/an/slvaw7/slvaw7.pdf</a>
News Release	Campaign Kick-off	<a href="https://news.ti.com/industries-first-low-noise-buck-converters-with-integrated-ferrite-bead-compensation-simplify-high-precision-designs">https://news.ti.com/industries-first-low-noise-buck-converters-with-integrated-ferrite-bead-compensation-simplify-high-precision-designs</a>
"Minimize noise and ripple with a low-noise buck converter" Blog	Technical Article	<a href="https://e2e.ti.com/blogs_/b/powerhouse/archive/2020/10/21/minimize-noise-and-ripple-with-a-low-noise-buck-converter">https://e2e.ti.com/blogs_/b/powerhouse/archive/2020/10/21/minimize-noise-and-ripple-with-a-low-noise-buck-converter</a>
Virtual Electronica: "Powering Sensitive ADC Designs with TPS62913 Low-Ripple and Low-Noise Buck Converter" (promotional)	Video	<a href="https://training.ti.com/powering-sensitive-adcs-low-noise-low-ripple-dcdc-buck-converter">https://training.ti.com/powering-sensitive-adcs-low-noise-low-ripple-dcdc-buck-converter</a>
Low Noise and low ripple buck converter with integrated ferrite bead compensation (training)	Video	<a href="https://training.ti.com/achieve-low-noise-and-low-output-ripple-high-efficiency-dcdc-converter">https://training.ti.com/achieve-low-noise-and-low-output-ripple-high-efficiency-dcdc-converter</a>
"Powering the AFE7920 with the TPS62913 Low Ripple & Low Noise Buck Converter"	App Note	<a href="https://www.ti.com/lit/an/slvaf16/slvaf16.pdf">https://www.ti.com/lit/an/slvaf16/slvaf16.pdf</a>
New Product Update (NPU) - Introducing Oslo and Vespa	Webinar	<a href="https://training.ti.com/node/1147267">https://training.ti.com/node/1147267</a>

# Introducing the TPS62901/2/3

High efficiency and low IQ buck converter in 1.5-mm × 2-mm QFN package

# Problem Statement & Common Solutions

## Problem statement

This highly flexible family leverages features to cover a wide variety of applications with just one part, such as: lower iQ to extend the lifetime of battery operated systems, increased efficiency across all load conditions to decrease power loss and thermal constraints, and finally a smaller solution size for power density.

## Common solutions today

Using a different DC/DC optimized for size, solution cost or performance for each unique application

# Vespa (TPS6290x)

3-V to 17-V, 1-3A, High Efficiency and Low IQ Buck Converter in 1.5-mm × 2-mm QFN Package

RELEASED

## FEATURES

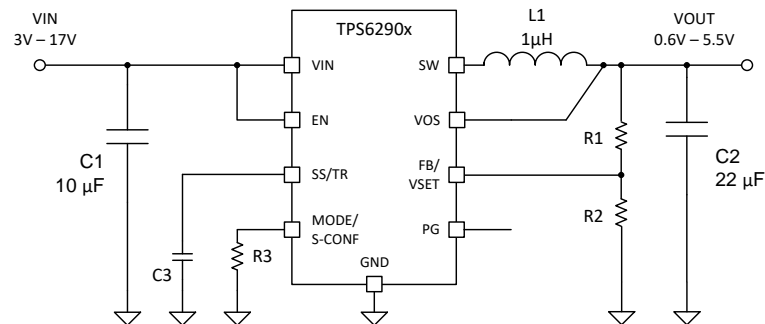
- Input Voltage: 3V – 17V
- Output Voltage: 0.4V – 5.5V
  - Adj. via external divider, 0.6V to 5.5V
  - Internal Divider: 16 options from 0.4 to 5.5
- 3A/2A/1A pin-to-pin family
- 1% Output Accuracy with selectable Forced-PWM operation
- $T_J$  up to 150°C
- Precise-Enable, CONFIG-Pin, Window-PG Comparator
- 1uH Inductor, 22uF Cout, no external Bootstrap
- Small QFN package (1.5mm x 2.0 mm) with 0.5mm pitch
- DCS-Control™ with AEE
- 4μA Quiescent Current
- Selectable output discharge
- Highly Flexible- & Easy-to-Use
  - Optimized Pinout for Single-Layer Routing
  - Precise Enable Input
  - Optional Forced PWM- or Auto-Power-Save-Mode
  - Power Good Output and active output discharge

## APPLICATIONS

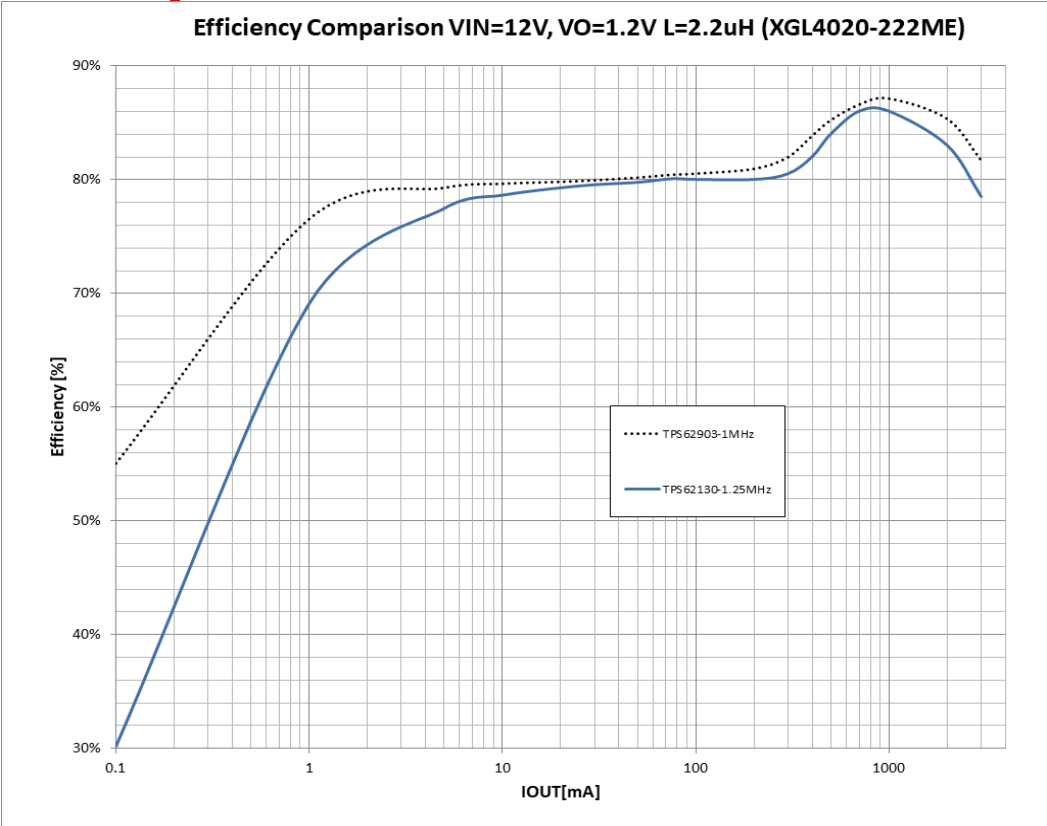
- Industrial PC & FPGA Supply
- SSD
- Factory, Building Automation
- Portable Electronics
- Point-of-Load regulation

## BENEFITS

- **Saves PCB Area by Smallest Solution size**
  - No Bootstrap-C, fixed  $V_O$  options, 1uH, 22uF Co
  - Small QFN package with flexible single layer routing
- **Output Monitoring by Window-PG comparator**
- **Input Monitoring by precise EN-Threshold and Hysteresis (POC-Filter)**
- **1% Accurate and Low Ripple Output in Forced-PWM configuration**
- **Optimizes Battery Lifetime & Energy Budget**
- **High efficiency at light load**



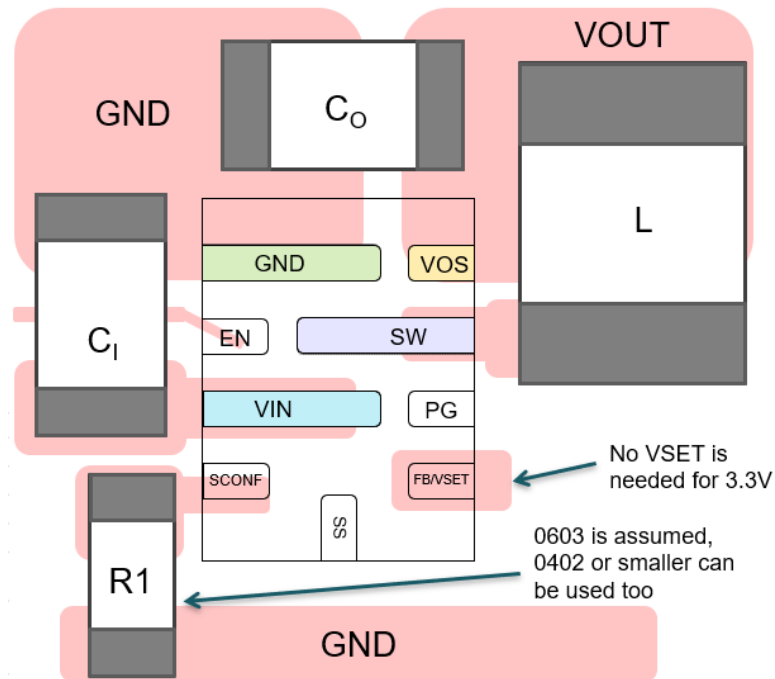
# Efficiency comparison TPS6290x vs. TPS6213x



# Smallest Solution size

- 1.5mm x 2.0mm HotRod package
- Single-Layer PCB layout  
saves cost, space & easy layout  
optimized layout for lower noise / EMI
- Total solution size is: **23.71mm<sup>2</sup>**

Size		
Inductor (mm <sup>2</sup> )	3.2	DFE201612E
Input cap (mm <sup>2</sup> )	2.5	10uH (805)
Output cap (mm <sup>2</sup> )	2.5	22uH (805)
Package (mm <sup>2</sup> )	3	QFN (2.0mmx1.5mm)
other components (mm <sup>2</sup> )	1.28	no VSET Res, 1 S-CONFIG Res (603 size each)
Routing estimates (mm <sup>2</sup> )	11.232	Estimated 90% of components size for routing
Total size (mm <sup>2</sup> )	23.712	Total comp size + 90% for routing





# Flexibility by SCON: Smart-Config-Pin

- User can choose device setting via Resistor

- FB/VSEL: select between  $V_O$  Version (Adj or fixed)
- MODE: select Auto-Mode or Forced-PWM
- Discharge: Active Discharge YES/NO
- FSW: Choose one of two frequencies

- Apply High or Low level to get PFM/PWM behavior like in the past

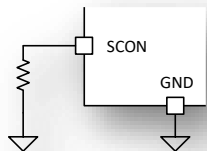
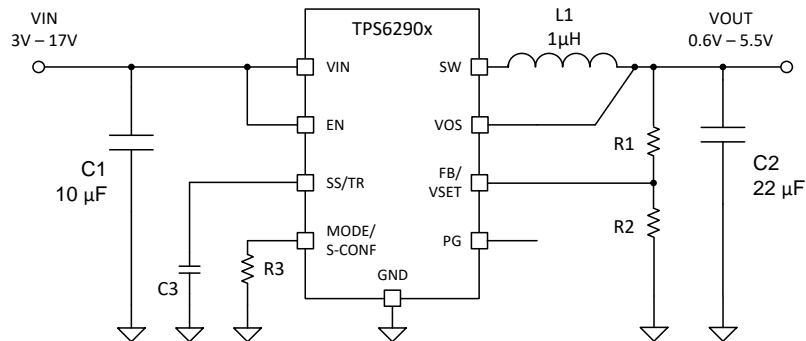


Table 7-1. SmartConfig Setting Table

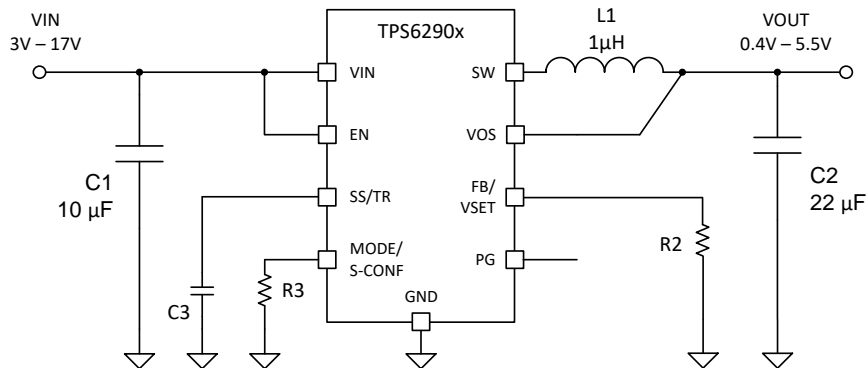
#	LEVEL OR RESISTOR VALUE [Ω] (1)	FB/VSET-PIN	F <sub>SW</sub> (MHz)	OUTPUT DISCHARGE	MODE (AUTO OR FORCED PWM)	DYNAMIC MODE CHANGE
Setting Options by Level						
1	GND	external FB	2.5	yes	Auto PFM/PWM with AEE	active
2	HIGH (>V <sub>IH_MODE</sub> )	external FB	2.5	yes	Forced PWM	
Setting Options by Resistor						
3	7.15 k	external FB	2.5	no	Auto PFM/PWM with AEE	not active
4	8.87 k	external FB	2.5	no	Forced PWM	
5	11.0 k	external FB	1	yes	Auto PFM/PWM	
6	13.7 k	external FB	1	yes	Forced PWM	
7	16.9 k	external FB	1	no	Auto PFM/PWM	
8	21.0 k	external FB	1	no	Forced PWM	
9	26.1 k	VSET	2.5	yes	Auto PFM/PWM with AEE	
10	32.4 k	VSET	2.5	yes	Forced PWM	
11	40.2 k	VSET	2.5	no	Auto PFM/PWM with AEE	
12	49.9 k	VSET	2.5	no	Forced PWM	
13	61.9 k	VSET	1	yes	Auto PFM/PWM	
14	76.8 k	VSET	1	yes	Forced PWM	
15	95.3 k	VSET	1	no	Auto PFM/PWM	
16	118 k	VSET	1	no	Forced PWM	

(1) E96 Resistor Series, 1% Accuracy, Temperature Coefficient better or equal than ±200 ppm/°C

# FB (Adj) & VSEL device setting



- Adjustable Version for
  - High flexibility (Vout)
  - LED Application
  - Customers are familiar



- VSEL option for
  - higher accuracy  
**1% VOUT directly**
  - lower System  $I_Q$   
**~3 $\mu$ A saving at 3.3V $_O$**
  - Smaller & cheaper solution  
**up to 2 components less**

Visit [www.ti.com/npu](http://www.ti.com/npu)

For more information on the New Product Update series, calendar and archived recordings



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