

# 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: LM25149/ Q1**

## **Synchronous buck DC/DC controllers with ultra-low IQ & integrated active EMI filter**

**Sharadh Navale**

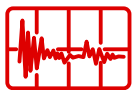
**April 8, 2021**

# Agenda

- Overview of power management challenges
- LM25149/ Q1: New family of synchronous DCDC controllers with ultra-low Iq and integrated Active EMI Filter.
- Overview of EMI mitigation techniques
  - Backgrounder on Active EMI Filter (AEF) – used in LM25149/Q1
  - Dual Random Spread Spectrum (DRSS) – used in LM25149/Q1
- LM25149/Q1 schematics and EMI test results
- LM25149/Q1 support tools
- LM25149/Q1 FAQs

# Addressing power management challenges

## Low EMI



Minimizing interference with other system components and simplifying the engineer's design and qualification processes

## Power density



Increasing power density enables more system functionality at reduced system costs

## Low $I_Q$



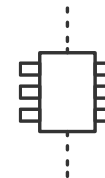
Extending battery and shelf life enables more functionality, improved lifetime and reduced system cost

## Low noise & precision



Reducing or shifting noise simplifies the power chain and improves reliability for precision analog applications

## Isolation



Enabling the highest working voltage and highest reliability in high-voltage and safety-critical applications

# LM25149/ LM5149-Q1

Catalog  
Grade

 AEC-Q100  
Grade 1

## Lowest EMI & lowest $I_Q$ , 42-V/ 80-V current mode synchronous buck controller

### Features

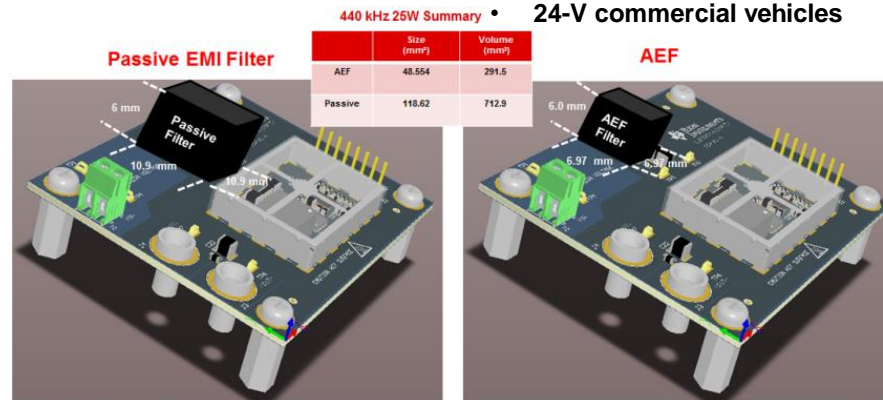
- Operating temperature range  $-40^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$  with  $175^{\circ}\text{C}$  thermal shutdown
- Wide  $V_{\text{IN}}$  3.5 V to 42 V (LM25149) / 80 V (LM5149)
- **Active EMI Filter** (CISPR 25 low frequency 150 kHz to 20 MHz)
- **Dual Random Spread Spectrum (DRSS)**
- **Internal slope compensation, bootstrap diode, current limit hiccup, soft-start**
- **Internal loop compensation, EXTCOMP output when high performance is required**
- **Three fixed  $V_{\text{outs}}$  (3.3 V, 5 V, 12 V) set with a resistor to VDDA, or**
- **Adjustable from 0.8 V- 36 V (LM25149) / 55V (LM5149) with an ext. feedback divider**
- 2- $\mu\text{A}$  shutdown mode  $I_Q$
- 9- $\mu\text{A}$  standby  $I_Q$  (operating, no load), typical
- Advanced drop-out 99% duty cycle
- RT pin to program the oscillator frequency (100 kHz-2.5 MHz)
- Stackable (2X)
- Frequency synchronization to an external clock
- $R_{\text{SENSE}}$  or Inductor DCR current sensing
- $0.8\text{V} \pm 1\%$  feedback reference
- Power good output
- VQFN-24 (3.5 mm by 5.5 mm) wettable flanks

### Benefits

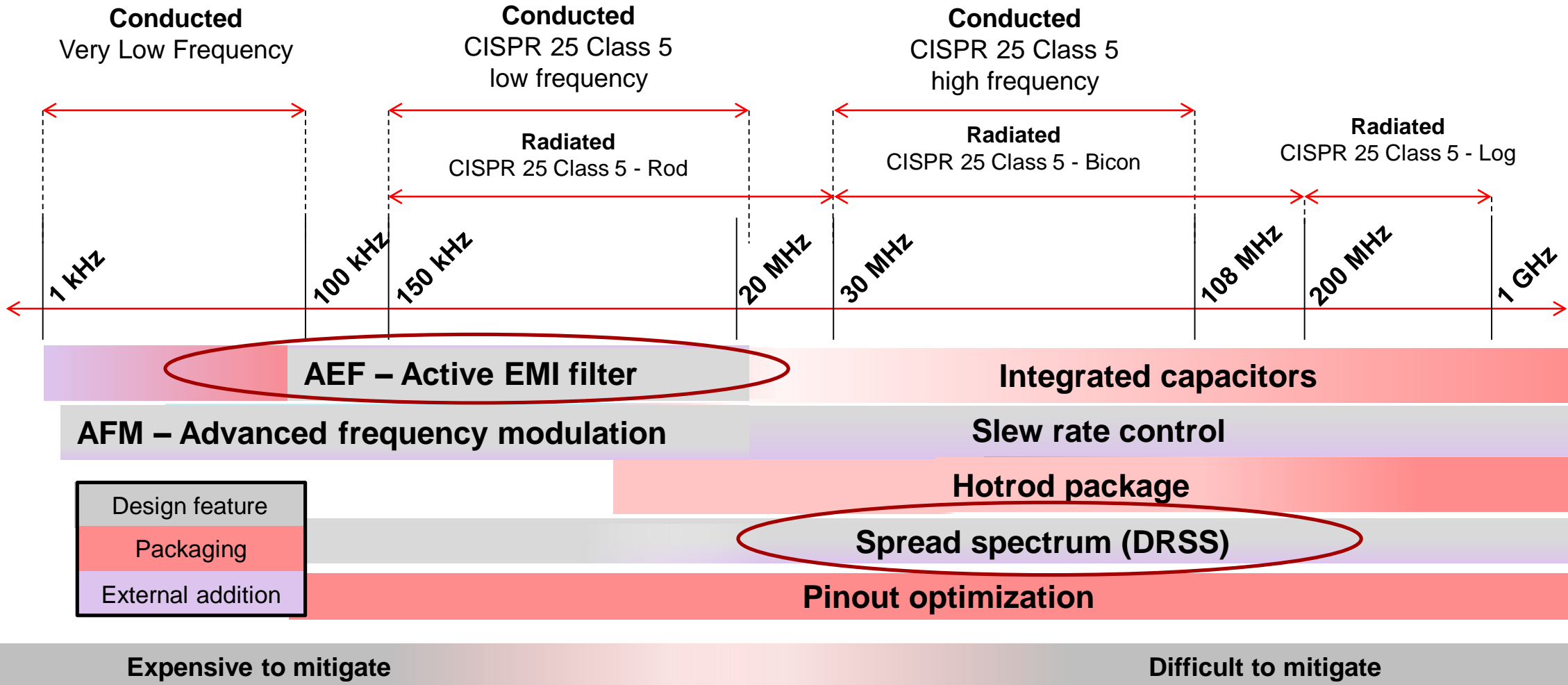
- Reduces the size and cost of the required front-end-filter
- Easy to use - No loop compensation required
- Low BOM cost solution for loads  $< 20\text{A}$

### Applications

- Infotainment and clusters
- Advanced Driver Assistance System (ADAS)
- Industrial transport
- Building automation - Video surveillance
- Wireless infrastructure
- Test & measurement
- 24-V commercial vehicles

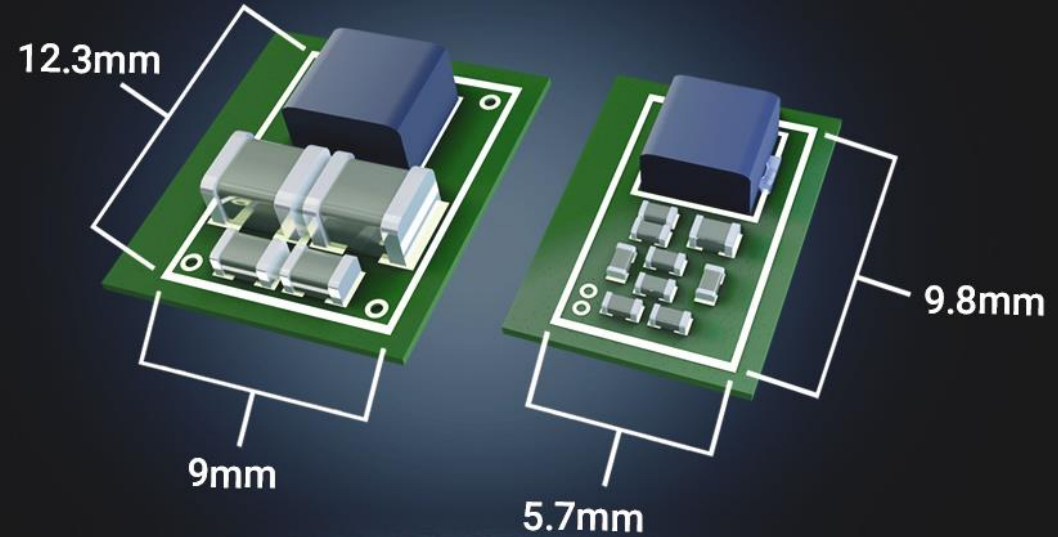


# EMI mitigation: Full spectrum features and limiters



# Benefits of LM25149/Q1

- Integrated active EMI filter and dual-random spread-spectrum (DRSS) technology offers maximum **conducted EMI reduction of 55 dB $\mu$ V** across multiple frequency bands.
- Engineers can shrink the size of the external EMI filter by **nearly 50% in area** and **over 75% in volume**.
- Engineers can also achieve a combination of **reduced filter size** and **low EMI**.



Access the [LM25149-Q1](#) and [LM25149](#) data sheet

# Training video on active EMI filter



AEF.mp4

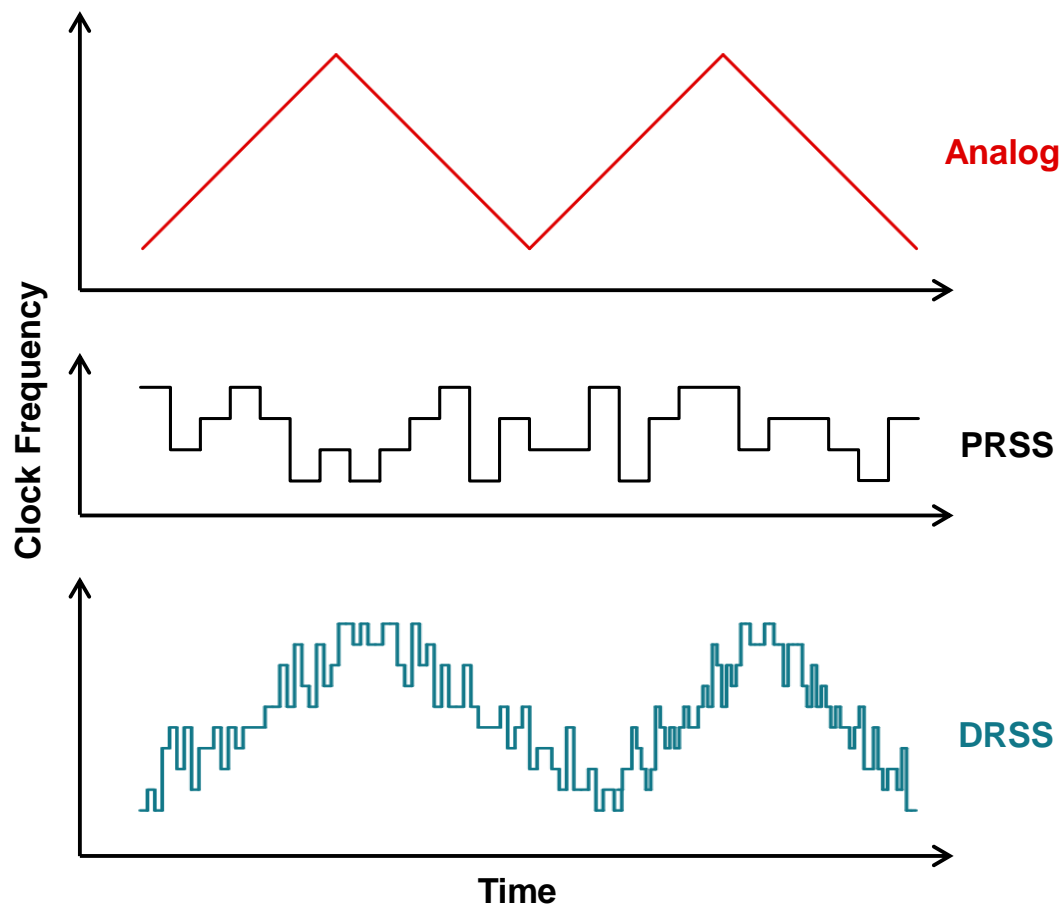
Note: This training video and others like it can be found on [ti.com](http://ti.com)



# What is DRSS?

- **Dual** random spread spectrum is a digital spread spectrum technique that spreads energy in **multiple** bands of interest.
- It is tuned for **industry and automotive standard** EMI tests, which have specific **resolution bandwidth (RBW)** requirements.

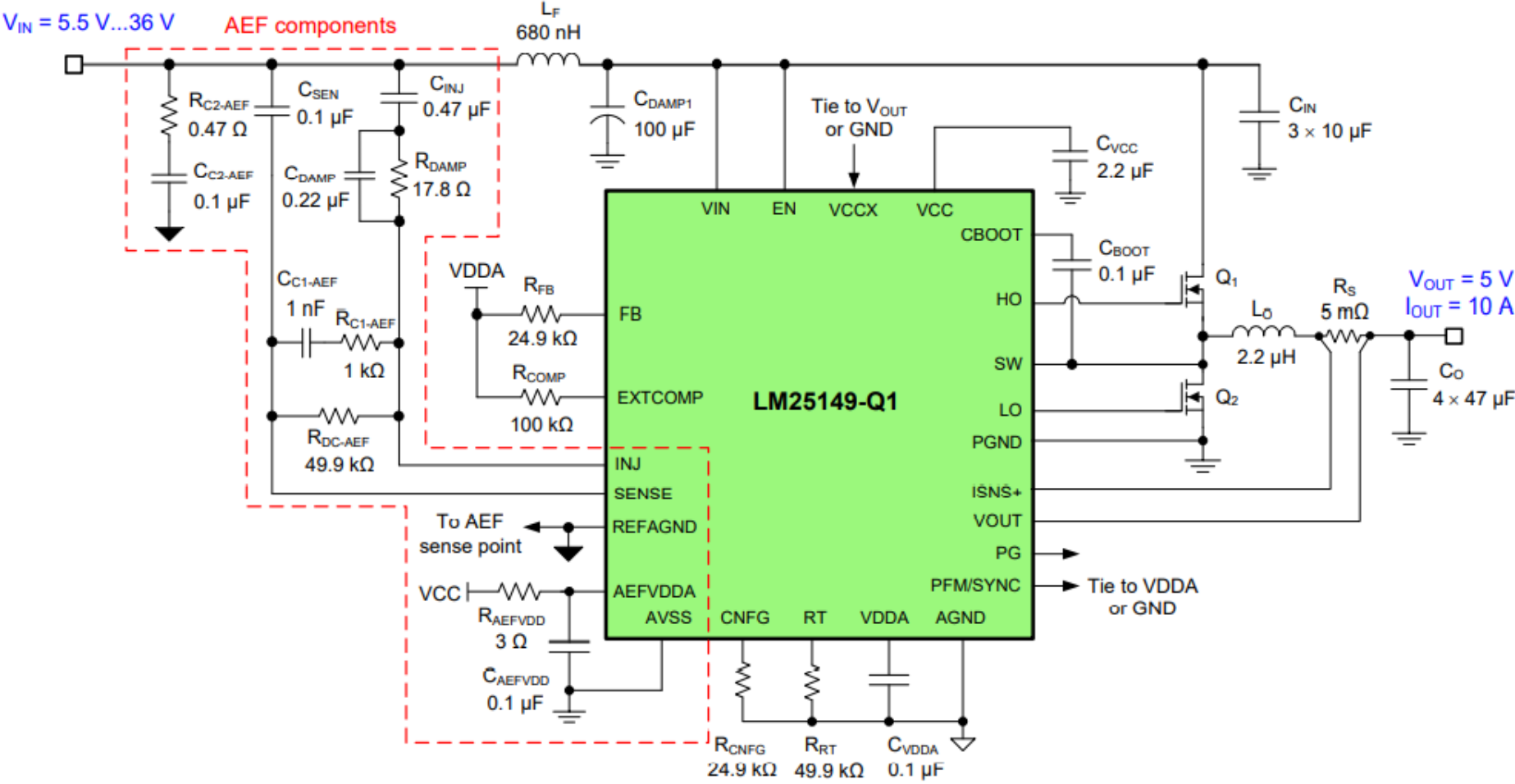
Frequency Band	Analog	PRSS	DRSS
Low	✓	✗	✓
High	✗	✓	✓



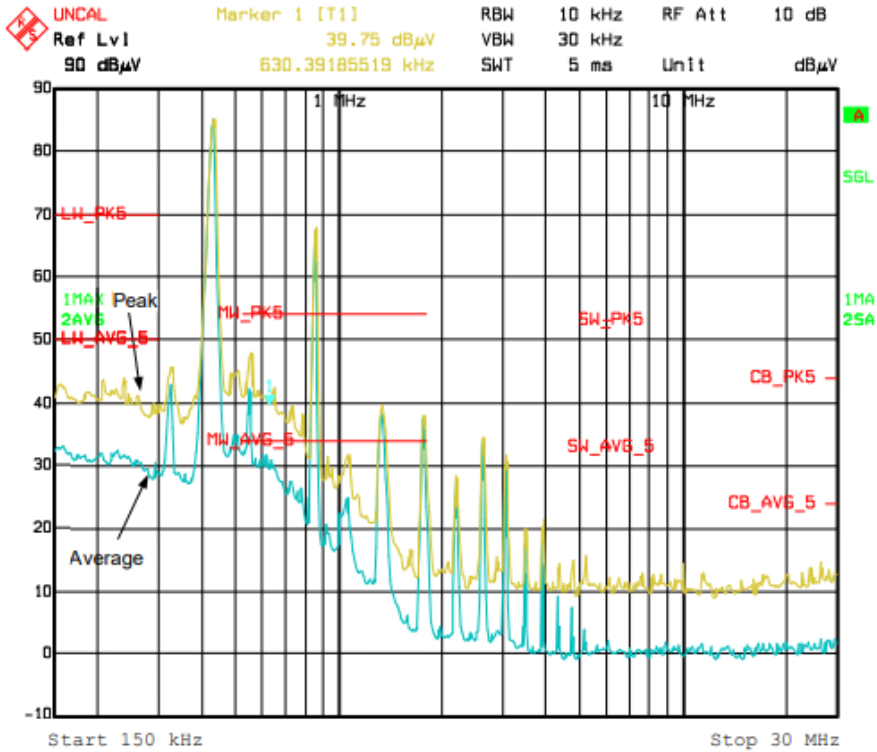
# Comparing spread spectrum implementations

	Analog dither	PRSS	DRSS
Low frequency band 150 kHz – 30 MHz (9 kHz RBW)	~10 dB reduction	~2 dB reduction	~15 dB reduction
High frequency band 30 MHz – 108 MHz (120 kHz RBW)	~2.5 dB reduction	~5 dB peak reduction	~5 dB reduction
Audible range (20 Hz – 20 kHz)	10 kHz $f_m$	Outside of audible range	$f_m$ spread

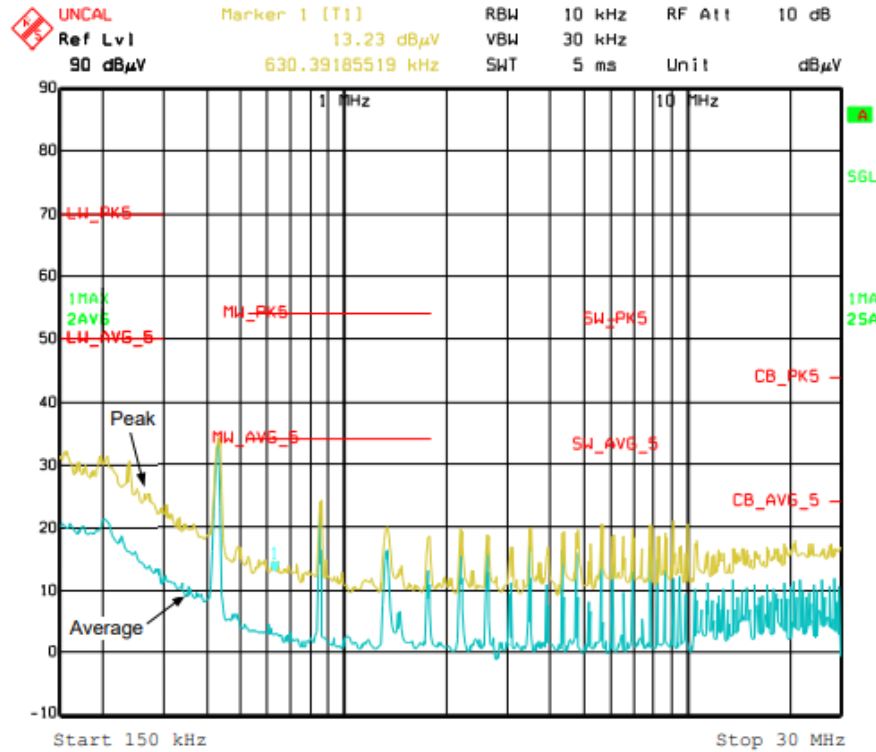
# Schematic of a synchronous buck controller with AEF



# Comparison of circuit performance

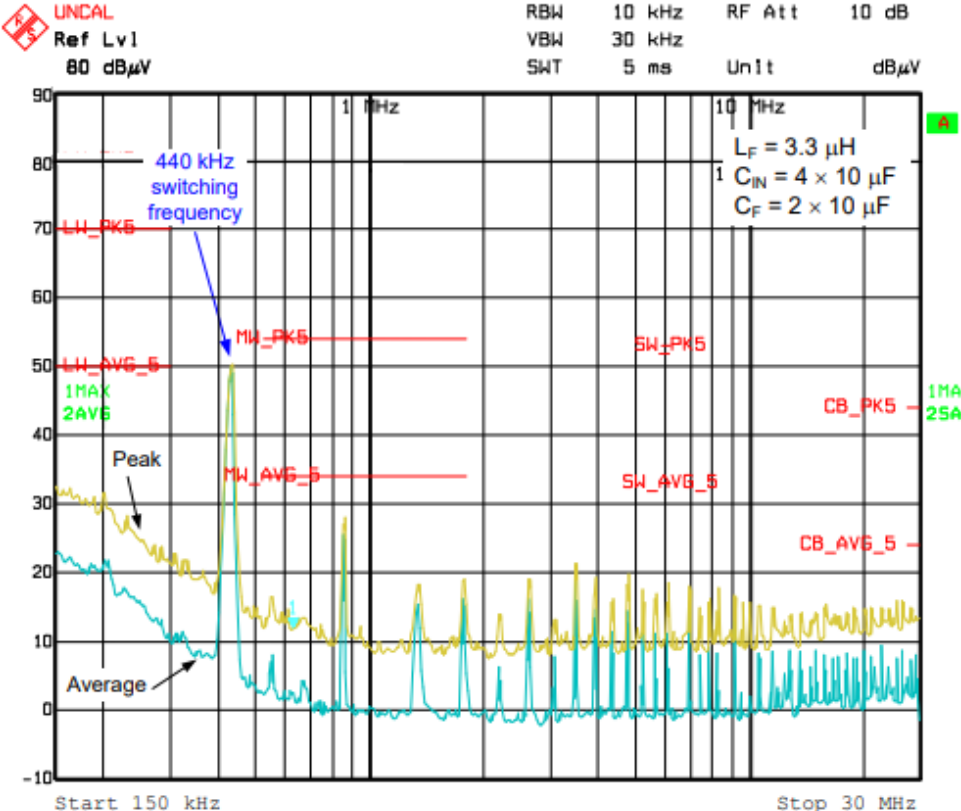


AEF disabled

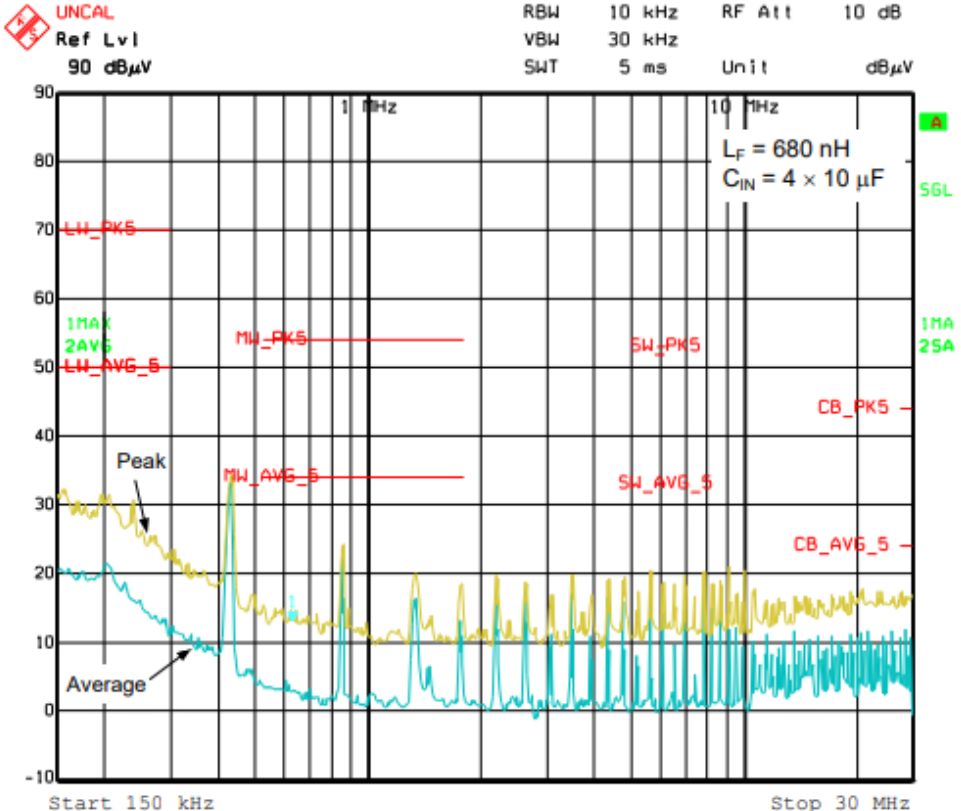


AEF enabled

# Comparison of EMI results



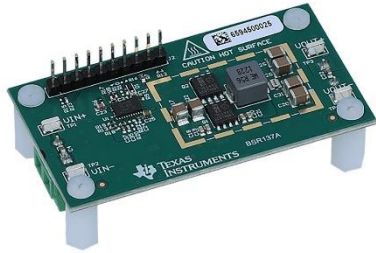
Passive filter solution



Active filter solution

# LM25149/Q1 support tools

EVM



Design quick-start calculator



[P Spice® for TI design and simulation tool](#)

## WEBENCH® Designer LM25149-Q1

	Min		Max		Range
Vin	<input type="text" value="8"/>	-	<input type="text" value="20"/>	V	3.5 to 42 V
Vout			<input type="text" value="5"/>	V	0.8 to 36 V
Iout			<input type="text" value="10"/>	A	0 to 20 A
Ambient Temp			<input type="text" value="30"/>	°C	-40 to 125 °C

[Open design](#)

[What are TI design tools?](#)



# LM25149/Q1 FAQ

- What type of control architecture does the LM25149/Q1 use?
  - LM25149/Q1 controller employs peak current mode control.
- Am I required to design type II compensation to properly use the controller?
  - LM25149/Q1 has optional internal loop compensation and does not require external compensation design. However, option to externally compensate is still available to optimize the design.
- Are there variants of this device family? How are they identified?
  - TI offers a family with two product grades (catalog grade and automotive grade) and two  $V_{IN}$  options (42  $V_{IN}$  and 80  $V_{IN}$ )
    - The 80  $V_{IN}$  options are LM5149 and LM5149-Q1; the 42  $V_{IN}$  options are LM25149 and LM25149-Q1
- Will there be an option to get the device WITHOUT integrated AEF and will it cost less?
  - Yes. LM2518/ LM5148/ Q1 – which are P2P compatible with LM25149/ LM5149/ Q1 – and will be priced ~15% lower. Note: The AEF within LM25149/5149/Q1 may also be disabled.
- What is the availability?
  - LM25149 / Q1 are currently in advanced product launch (APL) and can be seen on ti.com; Release in 4Q2021.
  - Rest of the family will sample in 2H2021

# In summary, use LM25149/Q1 to...





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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