Welcome!
Texas Instruments new product update

- **This webinar will be recorded and available at <u>www.ti.com/npu</u>**

- **Phone lines will be muted**

- **Please post questions in the chat or contact your TI sales contact or field applications engineer**

TEXAS INSTRUMENTS

New product update:
TI automotive radar new power solution overview – LP8774x-Q1

Fraser pan

If you have questions, please feel free to submit questions to <u>Krishnamurthy (Murthy) Hegde</u> in the chat window
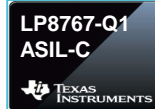
December 2nd, 2021

TEXAS INSTRUMENTS

Agenda

- ADAS overview - partner with TI for ADAS PMIC solutions

- Existing PMIC solutions for AWR

- New power solution for AWR: LP8774x-Q1
  - TI's complete radar solution competitive advantages
  - Key design challenges solved by LP8774x-Q1

- LP8774x-Q1 key performance results
  - LP8774x-Q1 noise performance target
  - AWR2944 FFT plot
  - LP8774x-Q1 load transient result

- LP8774x-Q1 one pager

- Package

- LP8774x-Q1 status update

- Power tree diagrams

- LP87745-Q1 product folder and EVM/tools on TI.com

- Reference design TIDEP-01027 on TI.com

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Partner with TI for ADAS PMIC solutions

Sensors

Camera (front camera, remote camera)
Superior transient performance; low noise imager supply

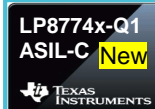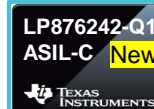| TPS65000-Q1	TPS65033-Q1 ASIL-B	LP8757-Q1	LP8767-Q1 ASIL-C
TEXAS INSTRUMENTS	TEXAS INSTRUMENTS	TEXAS INSTRUMENTS	TEXAS INSTRUMENTS

Value Proposition
- Best in class low noise LDO for imager power (remote cameras)
- +/- 3% DC + AC accuracy across load transients
- High power density up to 20 A in 5.5 x 5mm^2 package
- Integrated monitoring features to meet ASIL targets
- Mid-Vin capability enables single-chip power solution for PoC modules

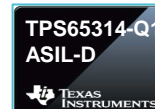### Radar (SRR, MRR, LRR, imaging, in-cabin)
Low noise regulators enabling LDO-free power

| TPS65313-Q1 ASIL-C	LP87524J-Q1	LP87702-Q1 ASIL-B	LP876242-Q1 ASIL-C New	LP8774x-Q1 ASIL-C New
TEXAS INSTRUMENTS	TEXAS INSTRUMENTS	TEXAS INSTRUMENTS	TEXAS INSTRUMENTS	TEXAS INSTRUMENTS

Value Proposition
- Integrated monitoring features to meet ASIL targets
- Low noise regulators + high F_{sw} (4-17 MHz) enable best RF performance without LDOs
- Scalability of application (SRR to LRR, and Vin range)
- Optimized solution size for radar applications

Compute

Sensor fusion, domain controller, LIDAR: *ultimate scalability & flexibility*

| TPS65917-Q1 ASIL-B	LP8752/6-Q1	TPS6594-Q1 ASIL-D	LP8764-Q1 ASIL-D	TPS65314-Q1 ASIL-D
TEXAS INSTRUMENTS	TEXAS INSTRUMENTS	TEXAS INSTRUMENTS	TEXAS INSTRUMENTS	TEXAS INSTRUMENTS

Value Proposition
- Integrated monitoring features to meet ASIL targets
- +/- 3% DC + AC accuracy across load transients
- Scalable, stackable distributed power approach with inter-PMIC communication
- Fully programable state machine & customer programable NVM for ultimate scalability and flexibility across multiple ICs

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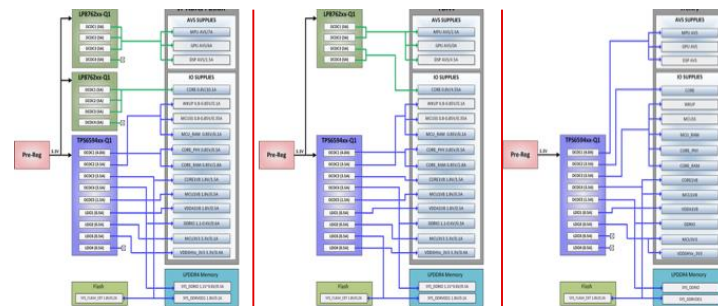
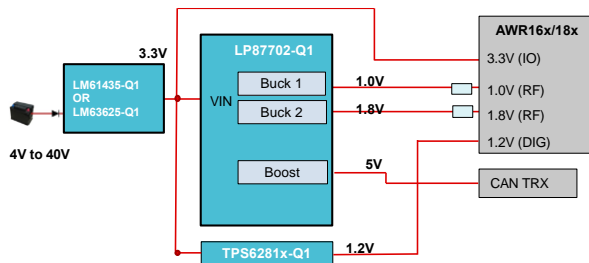# Existing PMIC solutions for AWR

3 architecture options to fit your needs


LP87524J-Q1
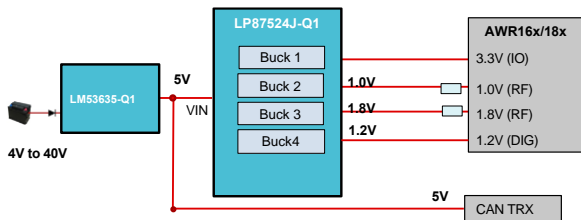
- ✓ Single-chip PMIC from 5-V V_{IN}
- ✓ **Smallest solution size except LP8774x-Q1.**
- ✓ 4.4-MHz switching for LDO-free supply
- ✓ EVMs are available now
- ✓ Scalable external pre-regulator

LP87702-Q1 + TPS62810-Q1

- ✓ **Lowest BOM cost solution except LP8774x-Q1.**
- ✓ Supports cold crank (V_{IN}<5 V)
- ✓ **Integrated watchdog and redundant V_{mon} for ASIL-B support**
- ✓ 4.4-MHz switching for LDO-free supply
- ✓ Scalable external pre-regulator
- ✓ EVMs available now with modified architecture
- ✓ Updated reference design Dec. '20

TPS65313-Q1 + TPS65653-Q1
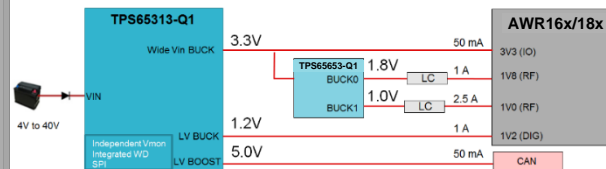
- ✓ **Developed under ISO26262 process for full ASIL-C compliance**
- ✓ Supports cold crank (V_{IN}<5 V)
- ✓ **Integrated watchdog and redundant voltage monitor**
- ✓ **Wide-Vin PMIC supports up to 40 V**
- ✓ **Advanced spread spectrum**
- ✓ 4.4-MHz switching for LDO-free power
- ✓ **Full AWR-attach test report available**

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New power solution for AWR: LP8774x-Q1

Samples 4Q 2021; RTM 4Q 2022
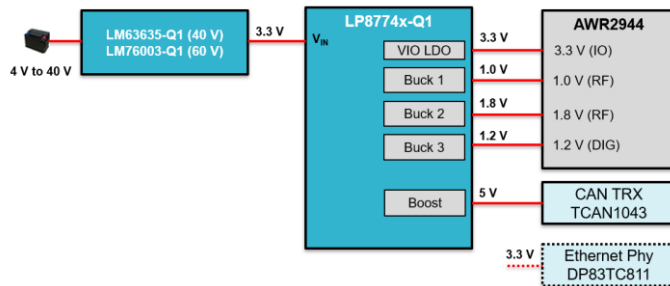
Optimized, best performance PMIC for SRR/MRR applications

- **>20% Solution cost savings from AWR existing power solutions**
- Targeting **15-20%** reduction in solution size over existing solutions
- Next-generation DCDC switching IP increases efficiency, reduces cost, and enables 17.6-MHz F_{sw} → **Lower ripple, reduced noise spurs, no LDOs required, with smaller passive components**
- SafeTI^{TM} system-level ASIL-C support

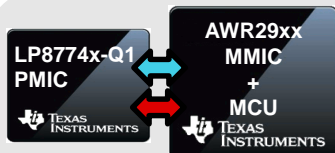*Pricing based on early estimates and assumptions to be verified*

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TI's complete radar solution competitive advantages

Supplier validated chipset

LP8774x-Q1 PMIC ⇄ **AWR29xx MMIC + MCU**

Texas Instruments | Texas Instruments

Low noise RF analog power supply

Watchdog & fault monitoring interface

Superior performance

- **Industry leading** RF Performance with superior output power and noise figure **without LDOs**
- Industry's first "designed for RF" low-noise DCDC regulators that **switch at 17.6 MHz, above IF band**
- Best-in-class low power **signal processing** capabilities with dedicated HWA with memory compression engine

Ultimate scalability

- Vast portfolio of MCUs & MMICs from cost-sensitive short range to high-performance long range
- Pin-to-pin compatibility & software scalability across AWR device family (same SDK)
- Flexibility to select V_{BATT} regulator to match any V_{IN} (5 V to 60 V) and load current requirements
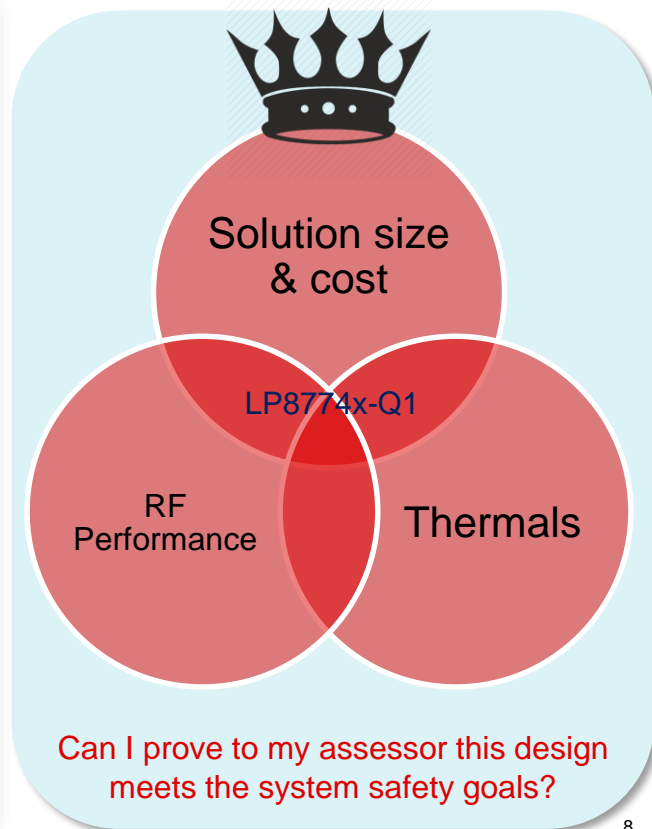
Co-developed chipset with comprehensive spec compliance testing

- PMIC + AWR294x developed in parallel as dedicated, optimized chipset solution with safety concept
- Power supply spec'd and simulated to ensure for full AWR specification compliance
- Comprehensive test report available at device release including noise, thermal, and RF tests

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# Key design challenges solved by LP8774x-Q1

LP8774x-Q1 addresses critical SRR/MRR needs:

1. Lowest solution cost and smallest solution size
   - Targeting >20% cost/size improvement over existing AWR solutions
   - Much higher reduction in cost/size possible with cost optimized BOM (~44 µF changes to ~10 µF per BUCK output) .
   - Further reduction in solution cost/size is achieved by removal of 2nd stage LC filters on each supply rail.

2. Features & documentation to support ASIL-B/C systems
   - System level approach to fault monitoring & protection

3. Noise / ripple performance that meets AWR noise / ripple performance specification
   - First to market to meet spec without external LDO and LC filter.

4. Thermal dissipation that does not affect RF performance
   - External LDO-free helps.

5. Power capability (including transients) to support all corner radar use cases, from USRR to MRR.
   - External LDO-free helps.

Solution size & cost

LP8774x-Q1

RF Performance

Thermals

Can I prove to my assessor this design meets the system safety goals?

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LP8774x-Q1 noise performance target

- AWR22xx and AWR29xx platform performance requires improved performance from PMIC

- The noise specification reaches down to 10 KHz

- Noise specification reaches up to 20 MHz (AWR22xx) or 15 MHz (AWR29xx)

- 4-MHz DCDC as used in legacy generation power supplies does not enable full performance of the AWR22/29xx MMIC

- LP8774x-Q1 meets new RF noise and ripple specification of AWR22/29xx MMIC
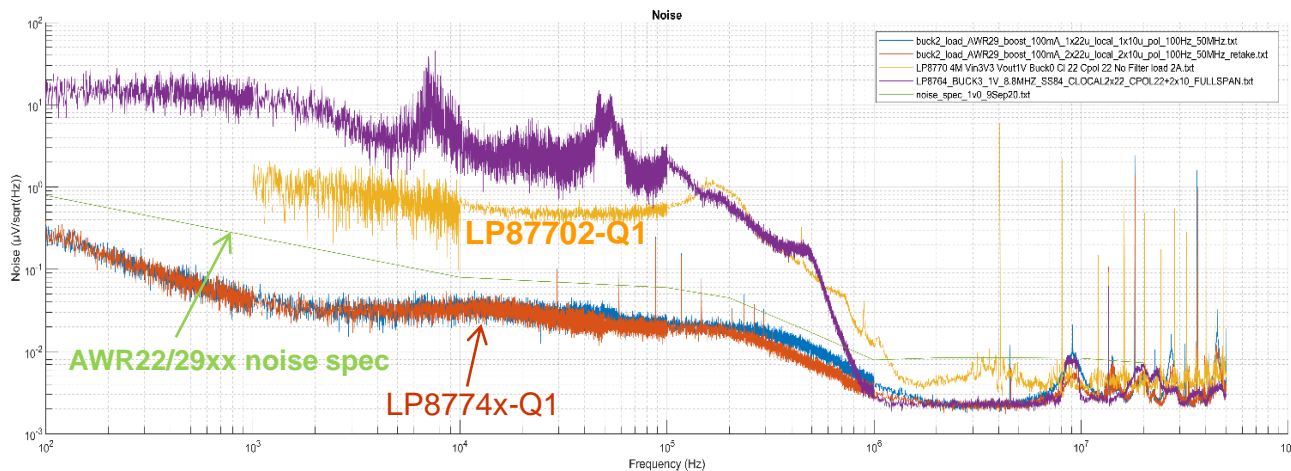
Noise comparison between different PMICs: LP8774x-Q1 BUCK2, 1.0 V, 1.5-A load, 17.6 MHz, 240 nH with 2x22 µF (orange plot) or 1x22 µF (blue).

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AWR2944 FFT plot with metal plate kept in front of antenna for max reflection
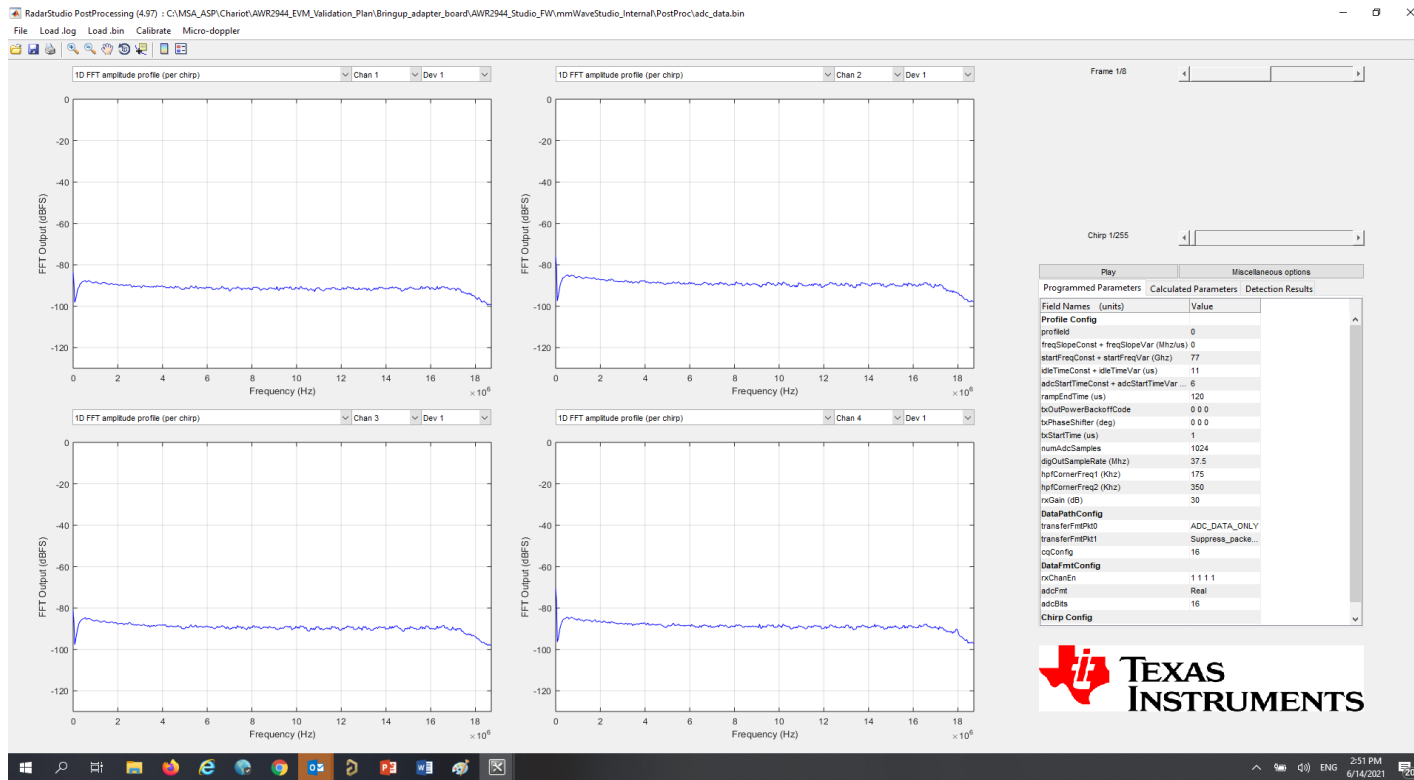
Clean spectrum without any PMIC related spurs

LP8774x-Q1 load transient result on AWR2944 1-V rail (0-2A load step current)
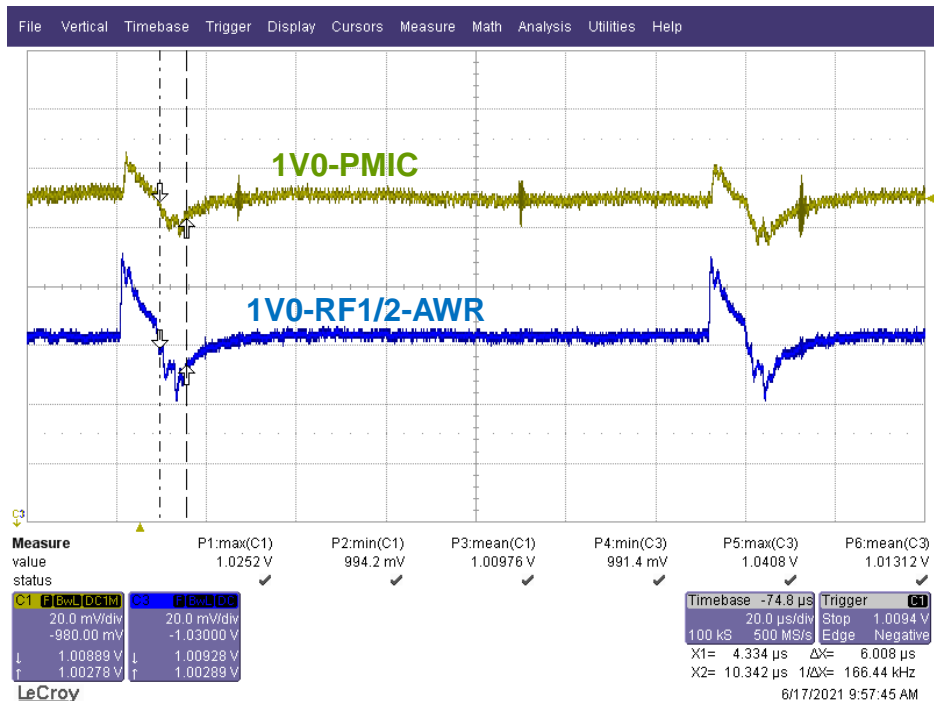
At local output capacitor: around 10-mV undershoot and around 10-mV overshoot

At point of load capacitor: less than 20-mV undershoot and less than 30-mV overshoot

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LP8774x-Q1
ADAS PMIC for Radar

Preview

AEC-Q100 Grade 1
Ambient 125°C
Junction 150°C

4.5 mm x 5 mm
0.5 mm pitch
28 pin HotRod QFN

Features

- 3 Buck regulators with **3.3-V input** (3 V – 4 V) range
  - 3 A, 3 A, and 3 A
  - 0.9-V – 1.9-V output voltage
  - **4.4 / 8.8 / 17.6-MHz switching frequency**; Synchronous
  - **Low noise across full frequency range of interest in radar**
- 300-mA, 5-V boost regulator
  - 4.4-MHz switching frequency; Synchronous
- 150-mA LDO
- Spread spectrum and external sync clock options
- 1 external voltage monitor
- Q&A watchdog, BIST (boot)
- Error signal monitor and reset for AWR/MCU
- Supports SPI or direct EN-control operation
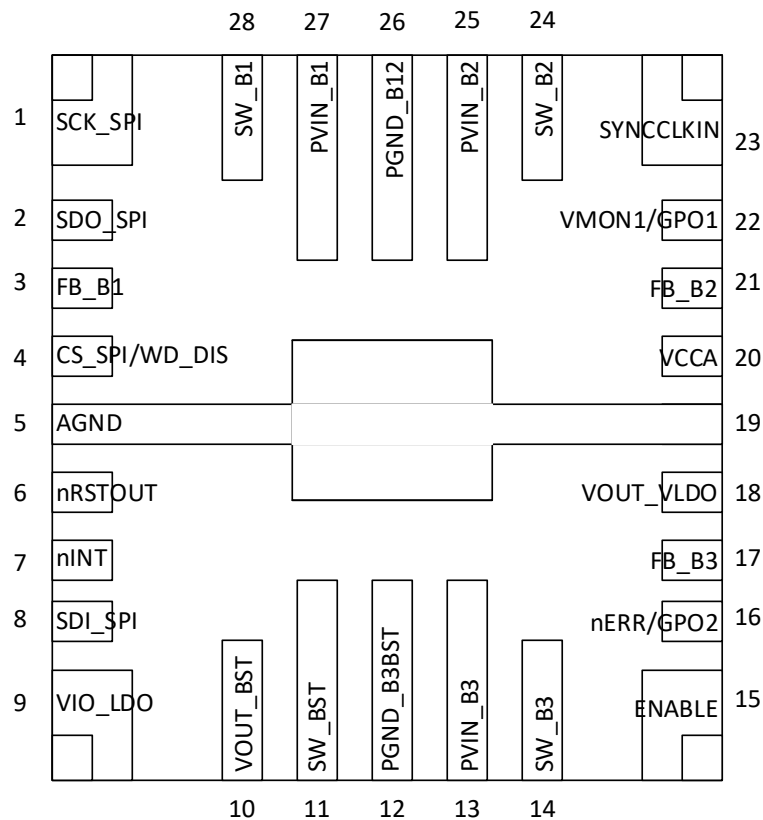
Applications

- Automotive radar module

Benefits

- **Cost optimized** for point of load radar modules power
- **Flexibility** and **efficiency** enabled by factory programmed voltage & sequence
- **ASIL-C / SIL-2 for functional safety systems**

LP8774x-Q1
Diagnostic and fault protection

Voltage regulators	Spread spectrum	External clock sync.
LV BUCK 3 A	ESM (nERR in) and nRES out	Q&A WD
LV BUCK 3 A	UVLO / UVP / OVP / OCP / SCP/ TSD	
LV BUCK 3 A	1 VMON	BISTs
BOOST 5V 300 mA	Power sequencer	
LDO 1.8/3.3 V 150 mA	2 GPO (muxed)	SPI

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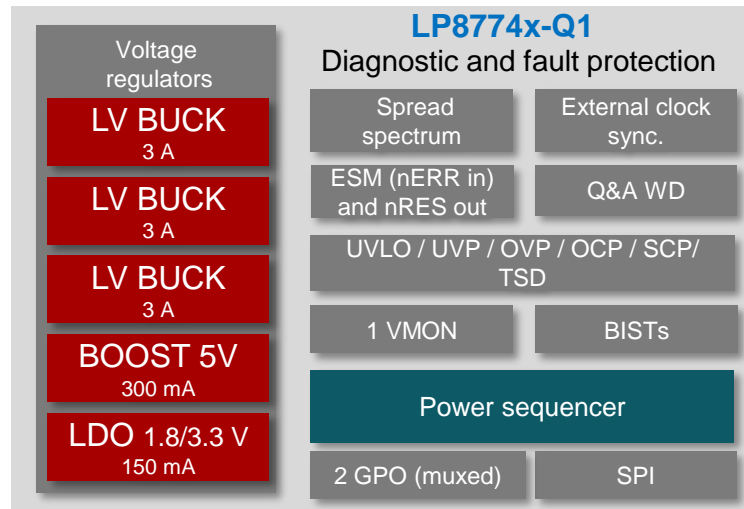
Package

VQFN-HR 1-mm max height

4.5 mm x 5 mm
0.5-mm pitch

TEXAS INSTRUMENTS
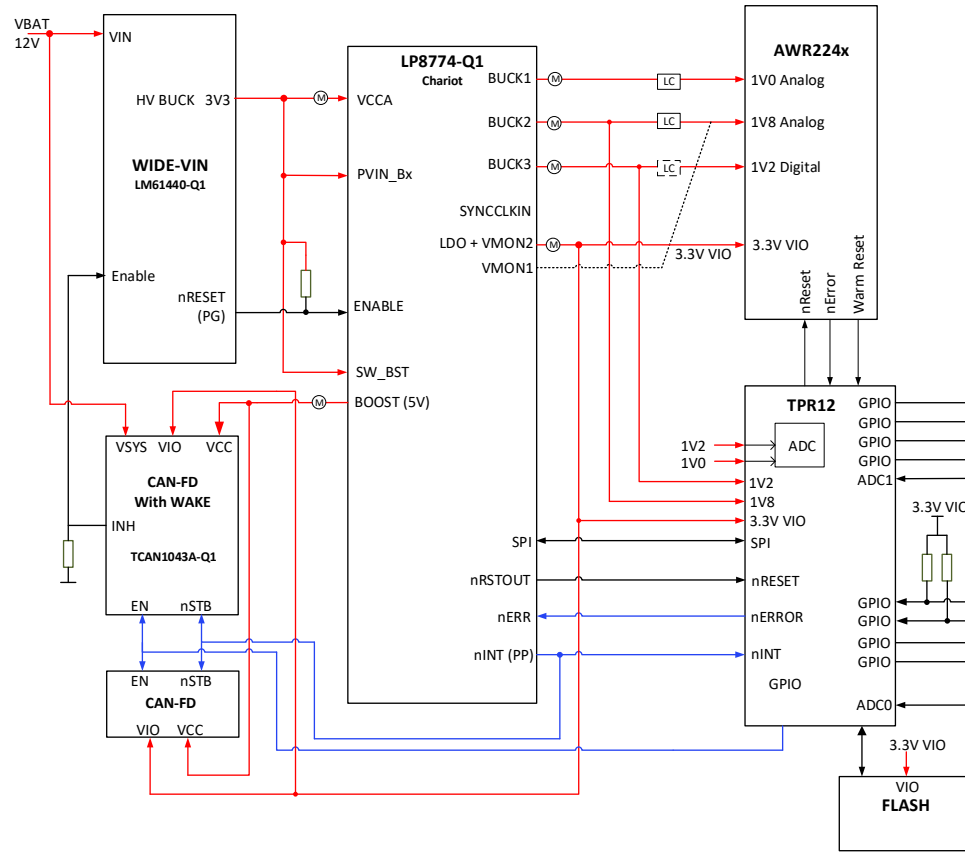
LP8774x-Q1 status update

- Samples are available now. Based on customers' demand, customized samples with different device configurations are possible.

- First samples will be 17.6 MHz and configured to power AWR2943/4.

- AWR2944 EVM with LP87745-Q1 is available now.

- Device RTM: 4Q 2022
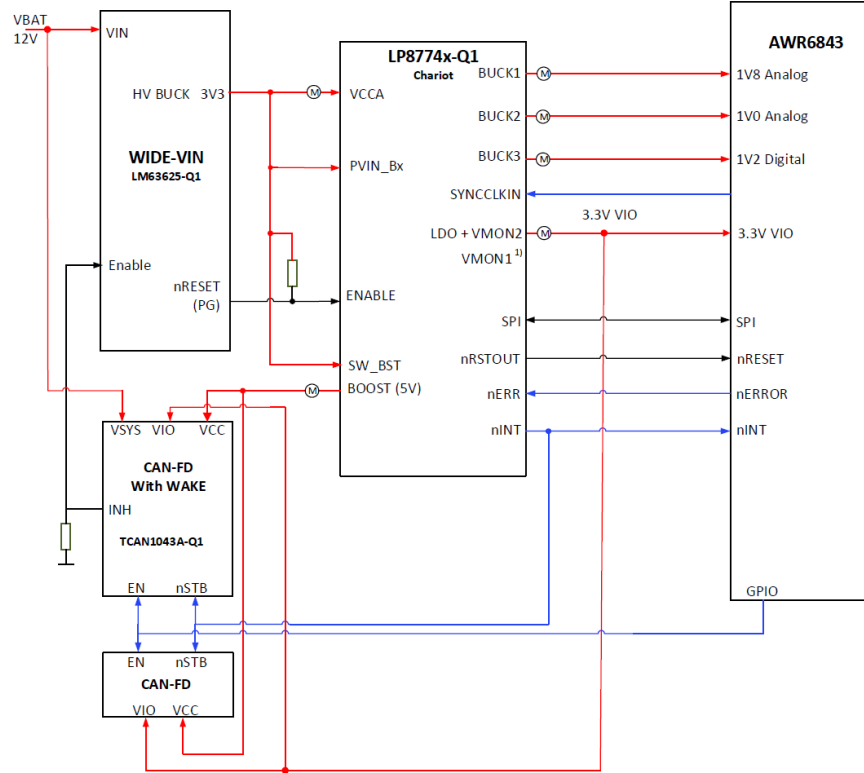
- In-line with AWR2943/4 schedule.

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Radar module solution for AWR2944 with LP8774x-Q1

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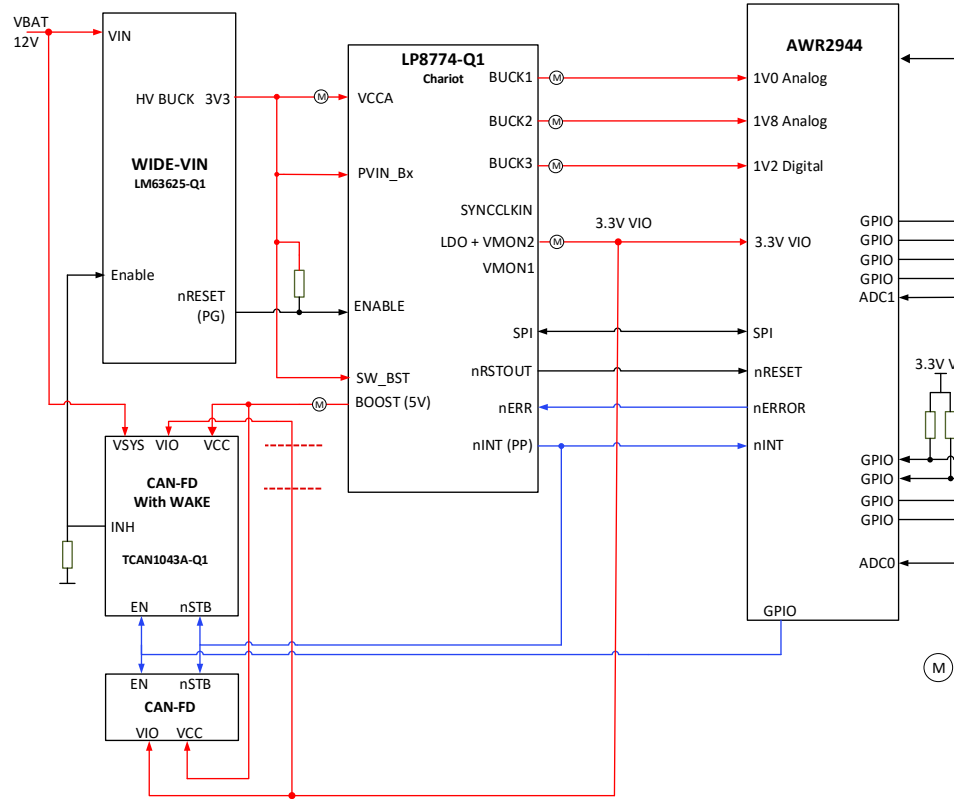
Radar module solution for AWR224x with LP8774x-Q1

Radar module solution for AWR6843 with LP8774x-Q1

LP87745-Q1 product folder on Ti.com

request

Product folder URL: https://www.ti.com/product/LP87745-Q1

Design & development: EVM and tools

Design & development

For additional terms or required resources, click any title below to view the detail page where available.

All   Hardware development   Design tools & simulation   Reference designs   CAD/CAE symbols

Hardware development

EVALUATION BOARD
LP877451Q1EVM — LP8774x-Q1 ADAS PMIC low-noise configuration 3-buck and 5-V boost evaluation module

The LP8774x-Q1 device is designed to meet the power management requirements of the AWR and IWR MMICs in various automotive and industrial radar applications. The device has three step-down DC/DC converters, a 5 V boost converter and a 1.8 V/3.3 V LDO. The LDO is powered from the boost and (...)

View options

📄 User guide

Design tools & simulation

SIMULATION MODEL
LP87745-Q1 Transient and AC SIMPLIS Model

SNVMC81.ZIP (57 KB) - SIMPLIS Model

Download

CALCULATION TOOL
PEET-GUI — PMIC Efficiency Estimator Tool (PEET)

The PMIC Efficiency Estimator Tool (PEET GUI) is a graphical user interface used to easily evaluate PMIC DC/DC regulator efficiency relative to your design conditions. The PEET GUI can be used to configure each DC/DC regulator separately and provides real-time efficiency and power dissipation data (...)

Start evaluation

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Reference design: TIDEP-01027

NEW

TIDEP-01027

High-end corner radar reference design

Design files

Overview | Design files & products | Technical documentation | Support & training

Overview

Description & features | Applications

The TIDA-01027 reference design provides a foundation for corner radar applications to meet NCAP R79 safety requirements using the AWR2944 evaluation module (EVM). The design allows users to estimate and track the position (in the azimuthal plane) and velocity of objects in device field of view (FoV) up to 200 m. This application focuses on corner and front long-range radar systems for multiple functions, such as blind-spot detection, front cross-traffic assist, and lane-change assist. It also demonstrates the usage of the TI compression engine and hardware accelerator (HWA) capabilities.

Features

- Enables carmakers to meet NCAP R79 safety requirements using a single-chip radar sensor
- Provides unmatched corner radar performance with best-in-class RF performance enabled by a fourth transmitter for 33% higher angular resolution than traditional three-transmitter devices
- Detects and tracks objects (such as cars and trucks) up to 200 m away with velocity of ±140 kmph
- Antenna azimuth FoV ±80º with azimuth angular resolution of approximately 9.5º
- Showcases AWR2944 transmit phase shift, data compression, and HWA with Doppler division multiple access (DDMA) processing chain provided by mmWave software development kit (MMWAVE-MCUPLUS-SDK).

A fully assembled board has been developed for testing and performance validation only, and is not available for sale.

Design files & products

Design files

Download ready-to-use system files to speed your design process.

⬇ Schematic — TIDEP-01027	TIDM946.PDF (3000 K)	Detailed schematic diagram for design layout and components
⬇ Bill of materials (BOM) — TIDEP-01027	TIDM947.PDF (245 K)	Complete listing of design components, reference designators, and manufacturers/part numbers
⬇ Assembly drawing — TIDEP-01027	TIDM948.PDF (1308 K)	Detailed overview of design layout for component placement
⬇ Gerber file — TIDEP-01027	TIDCG26.ZIP (2402 K)	Design file that contains information on physical board layer of design PCB

Products

Includes TI products in the design and potential alternatives.
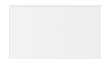
AUTOMOTIVE MMWAVE RADAR SENSORS
AWR2944 — Automotive 2nd-generation, 76-GHz to 81-GHz, high-performance SoC for corner and long-range radar
Data sheet | 📄 PDF | ⬚ HTML

CAN & LIN TRANSCEIVERS & SBCS
TCAN1042HG-Q1 — Automotive 70-V bus-fault-protected CAN transceiver with 5-Mbps flexible data-rate
Data sheet | 📄 PDF | ⬚ HTML

CAN & LIN TRANSCEIVERS & SBCS
TCAN1043A-Q1 — Automotive CAN FD transceiver with wake/inhibit
Data sheet | 📄 PDF | ⬚ HTML

DIGITAL TEMPERATURE SENSORS
TMP112 — ±0.5°C 1.4V to 3.6V digital temperature sensor with I2C/SMBus in 2.56mm2 package ;
Data sheet | 📄 PDF | ⬚ HTML

ETHERNET PHYS
DP83867E — Extended temperature, robust low-latency gigabit Ethernet PHY transceiver with SGMII
Data sheet | 📄 PDF | ⬚ HTML

View all 7 ▾

Reference design URL: https://www.ti.com/tool/TIDEP-01027

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Thank you!

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Visit www.ti.com/npu

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

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