LM53625/35-Q1, 2.5/3.5A, 36 V Wide-V_{IN} Synchronous, 2.1MHz, Automotive Step Down DC-DC Converter

1 Features

- Qualified for Automotive Applications
- AEC-Q100 Qualified With the Following Results:
  - Device Temperature Grade 1: –40°C to 125°C Ambient Operating Temperature Range
  - Device HBM Classification Level 2
  - Device CDM Classification Level C5
- 4 mm x 5 mm, 0.5 mm Pitch SON Package with Wettable Flanks and 0.6 mm VIN Spacing
- -40°C to 150°C Junction Temperature Range
- Current Mode Control with Internal Compensation
- 2.1MHz (±10%) Fixed Switching Frequency
- Low EMI
- Spread Spectrum as a Factory Option
- Min OFF Time-80ns (maximum)
- Min ON Time-60ns (maximum)
- External Frequency Synchronization
- $\overline{\text{RESET}}$ Output with Filter and 3ms Release Timer
- Automatic Light Load Mode for Improved Efficiency
- Pin Selectable Forced PWM Mode
- Built in Compensation, Soft-start, Current Limit, Thermal Shutdown and UVLO
- 3.5 V to 36 V Input Voltage with Transients up to 42 V
- LM53625-Q1 = 2.5 A Maximum Load Current
- LM53635-Q1 = 3.5 A Maximum Load Current
- 91% Efficiency while Converting 13.5 V to 5 V, 3.5 A
- 0.6 V Dropout at 3.5 A Load, 1.4 V @ 1.85MHz @ 105ºC TA
- Output Voltage Options: 5 V, 3.3 V and Adjustable
- ±1.5% Output Voltage Tolerance (over temperature)
- 2-µA Shutdown Current (typical)
- 15-µA Iq - Quiescent Current at no Load (Typical) with 3.3 V Typical

2 Applications

- Automotive Telematics
- Navigation Systems
- In-Dash Instrumentation
- Battery-Powered Applications

3 Description

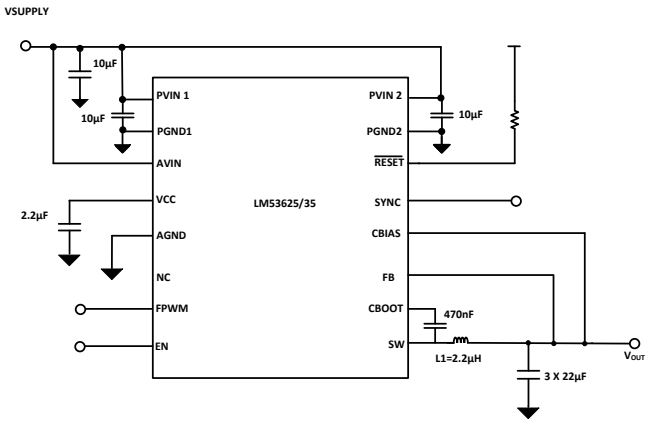
The LM53625-Q1/LM53635-Q1 synchronous buck regulator is optimized for automotive applications, providing an output voltage of 5 V, 3.3 V, or an adjustable output. Advanced high speed circuitry allows the LM53625-Q1/LM53635-Q1 to regulate from an input of 13.5 V to an output 3.3 V at a fixed frequency of 2.1MHz. Innovative architecture allows the device to regulate a 3.3 V output from an input voltage of only 3.5 V. All aspects of the LM53625-Q1/LM53635-Q1 are optimized for automotive and performance driven industrial customers. An input voltage range up to 36 V, with transient tolerance up to 42 V, eases input surge protection design. An open drain reset output, with filtering and delay, provides a true indication of system status. This feature negates the requirement for an additional supervisory component, saving cost and board space. Seamless transition between PWM and PFM modes, along with a quiescent current of only 15-µA for 3.3 V option, ensures high efficiency and superior transient response at all loads.

Device Information(1)

DEVICE NAME	PACKAGE	BODY SIZE
LM53625-Q1	SON (22)	4 mm x 5 mm
LM53635-Q1		

(1) For all available packages, see the orderable addendum at the end of the datasheet.

Typical Application Circuit



Automotive Wide-VIN Buck Convertor, 3.5-V to 36 V input, available in 3.3 V, 5.0 V and Adjustable output.

PRODUCT PREVIEW

Table of Contents

4 Revision History

DATE	REVISION	NOTES
December 2015	*	Initial release.

PRODUCT PREVIEW

5 Device and Documentation Support

5.1 Documentation Support

5.1.1 Related Documentation

Table 1. Resources for Thermal PCB Design

TITLE	LINK
AN-2020 *Thermal Design By Insight, Not Hindsight*	SNVA419
AN-1520 *A Guide to Board Layout for Best Thermal Resistance for Exposed Pad Packages*	SNVA183
SPRA953B *Semiconductor and IC Package Thermal Metrics*	SPRA953
SNVA719 *Thermal Design made Simple with LM43603 and LM43602*	SNVA719
SLMA002 *PowerPAD™ Thermally Enhanced Package*	SLMA002
SLMA004 *PowerPAD Made Easy*	SLMA004

5.2 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

Table 2. Related Links

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
LM53625-Q1	Click here	Click here	Click here	Click here	Click here
LM53635-Q1	Click here	Click here	Click here	Click here	Click here

5.3 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

TI E2E™ Online Community ***TI's Engineer-to-Engineer (E2E) Community.*** Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support ***TI's Design Support*** Quickly find helpful E2E forums along with design support tools and contact information for technical support.

5.4 Trademarks

PowerPAD, E2E are trademarks of Texas Instruments.

5.5 Electrostatic Discharge Caution

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

5.6 Glossary

SLYZ022 — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

PRODUCT PREVIEW

6 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM536253QRNLRQ1	PREVIEW	VQFN	RNL	22	4500	TBD	Call TI	Call TI	-40 to 150		
LM536253QRNLTQ1	PREVIEW	VQFN	RNL	22	250	TBD	Call TI	Call TI	-40 to 150		
LM536255QRNLRQ1	PREVIEW	VQFN	RNL	22	4500	TBD	Call TI	Call TI	-40 to 150		
LM536255QRNLTQ1	PREVIEW	VQFN	RNL	22	250	TBD	Call TI	Call TI	-40 to 150		
LM53625AQRNLRQ1	PREVIEW	VQFN	RNL	22	4500	TBD	Call TI	Call TI	-40 to 150		
LM53625AQRNLTQ1	PREVIEW	VQFN	RNL	22	250	TBD	Call TI	Call TI	-40 to 150		
LM53625LQRNLRQ1	PREVIEW	VQFN	RNL	22	4500	TBD	Call TI	Call TI	-40 to 150		
LM53625LQRNLTQ1	PREVIEW	VQFN	RNL	22	250	TBD	Call TI	Call TI	-40 to 150		
LM53625MQRNLRQ1	PREVIEW	VQFN	RNL	22	4500	TBD	Call TI	Call TI	-40 to 150		
LM53625MQRNLTQ1	PREVIEW	VQFN	RNL	22	250	TBD	Call TI	Call TI	-40 to 150		
LM53625NQRNLRQ1	PREVIEW	VQFN	RNL	22	4500	TBD	Call TI	Call TI	-40 to 150		
LM53625NQRNLTQ1	PREVIEW	VQFN	RNL	22	250	TBD	Call TI	Call TI	-40 to 150		
LM536353QRNLRQ1	PREVIEW	VQFN	RNL	22	4500	TBD	Call TI	Call TI	-40 to 150		
LM536353QRNLTQ1	PREVIEW	VQFN	RNL	22	250	TBD	Call TI	Call TI	-40 to 150		
LM536355QRNLRQ1	PREVIEW	VQFN	RNL	22	4500	TBD	Call TI	Call TI	-40 to 150		
LM536355QRNLTQ1	PREVIEW	VQFN	RNL	22	250	TBD	Call TI	Call TI	-40 to 150		
LM53635AQRNLRQ1	PREVIEW	VQFN	RNL	22	4500	TBD	Call TI	Call TI	-40 to 150		
LM53635AQRNLTQ1	PREVIEW	VQFN	RNL	22	250	TBD	Call TI	Call TI	-40 to 150		
LM53635LQRNLRQ1	PREVIEW	VQFN	RNL	22	4500	TBD	Call TI	Call TI	-40 to 150		
LM53635LQRNLTQ1	PREVIEW	VQFN	RNL	22	250	TBD	Call TI	Call TI	-40 to 150		
LM53635MQRNLRQ1	PREVIEW	VQFN	RNL	22	4500	TBD	Call TI	Call TI	-40 to 150		
LM53635MQRNLTQ1	PREVIEW	VQFN	RNL	22	250	TBD	Call TI	Call TI	-40 to 150		
LM53635NQRNLRQ1	PREVIEW	VQFN	RNL	22	4500	TBD	Call TI	Call TI	-40 to 150		
LM53635NQRNLTQ1	PREVIEW	VQFN	RNL	22	250	TBD	Call TI	Call TI	-40 to 150		

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
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Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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