LM5360x-Q1 5-V, 3.3-V, and Adjustable Synchronous-Buck 1-A Regulator for Automotive Applications

1 Features

- Automotive Grade Product, AEC Grade 1 Qualified
- 10-lead 3 mm x 3 mm WSON Package
- –40°C to 150°C junction Temperature Range
- Peak Current Mode Control
- 2.1-MHz (±10%) Fixed Switching Frequency
- Pin Selectable Forced PWM Mode
- External Frequency Synchronization With Forced PWM Mode
- Reset Output With Filter and Delayed Release
- Automatic Light Load Mode for Improved Efficiency
- Built-In Compensation, Soft-start, Current Limit, Thermal Shutdown, and UVLO
- Spread Spectrum is Available as a Factory Option
- Electrical Specifications
  - 3.5-V to 36 V Input Voltage With Transients up to 42 V
  - 1000-mA Maximum Load Current (LM53601-Q1)
  - 650-mA Maximum load Current (LM53600-Q1)
  - Output Voltage Options: 5 V, 3.3 V, and Adjustable
  - ±2% Fixed Output Voltage Tolerance (Over Temperature)
  - ±1.75% FB Voltage Tolerance for Adjustable Output Version (Over Temperature)
  - 1.8-µA Current When Shutdown (Typical)
  - 22-µA Quiescent Current at No Load With 3.3-V Output (Typical)

2 Applications

- Automotive Camera Applications
- Automotive Infotainment

3 Description

The LM53600/01 synchronous buck regulator is optimized for automotive applications, providing either an adjustable output or an output voltage of 3.3 V or 5 V. The LM53600-Q1 device supports load currents up to 650 mA and the LM536001-Q1 supports load currents up to 1000 mA.

Advanced high speed circuitry allows the device to regulate from an 18-V input to a 3.3-V output at a fixed frequency of 2.1 MHz. Innovative architecture allows the device to regulate a 3.3-V output from an input voltage of only 3.8 V. Input voltage range up to 36 V, with transient tolerance up to 42 V, eases input surge protection design.

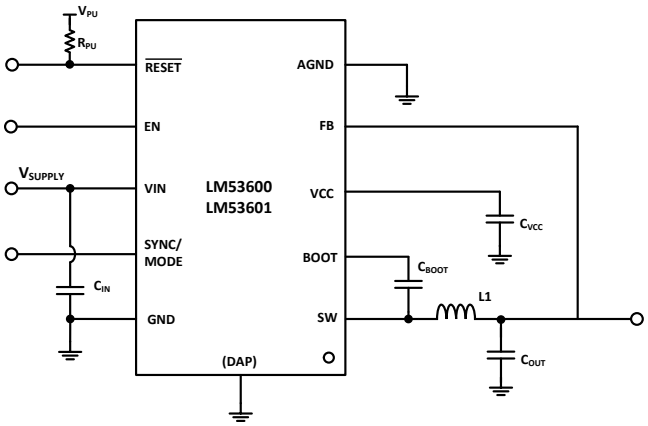
An open drain reset output, with filtering and delayed release, provides a true indication of system status. This feature negates the requirement for an additional supervisory component, saving cost and board space. Seamless transition between PWM and PFM modes, along with a quiescent current of only 22 µA, ensures high efficiency and superior transient response at all loads. Few external components are needed allowing the generation of compact PCB layout. The device characteristics are specified from a junction temperature range of –40°C up to 150°C.

Device Information(1)

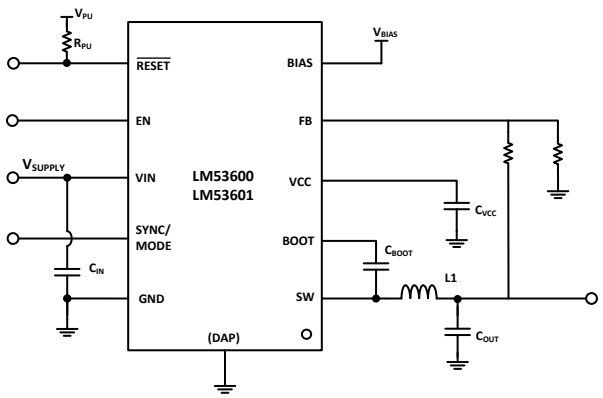
PART NUMBER	PACKAGE	BODY SIZE (NOM)
LM53600-Q1	WSON (10)	3.00mm x 3.00mm
LM53601-Q1		

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

Fixed Version



Adjustable Version



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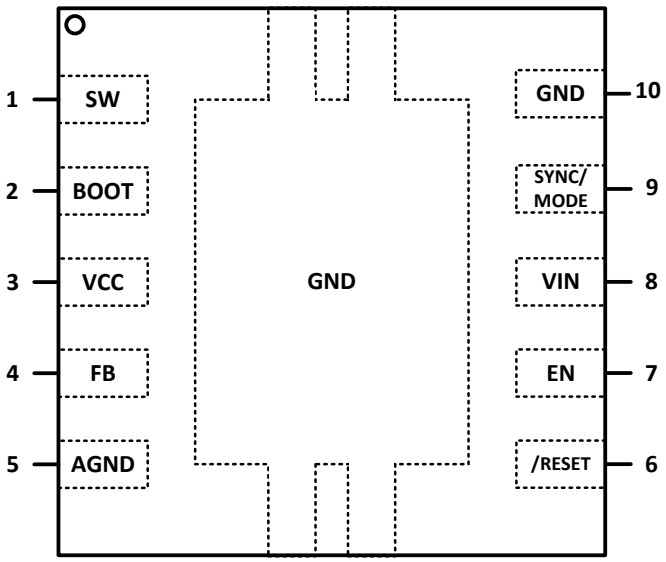
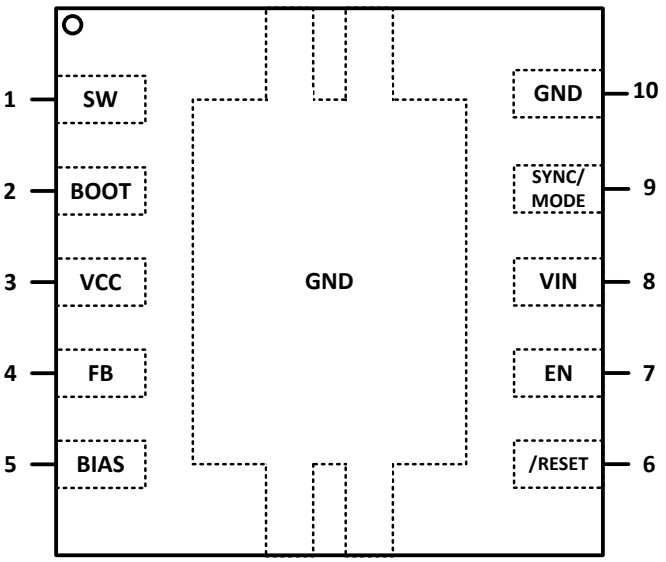
4 Pin Configuration and Functions

DSX Package
10-Pin WSON
Fixed Version Top View



DSX Package
10-Pin WSON
Adjustable Version Top View



Pin Functions

PIN		I/O(1)	DESCRIPTION
NAME	NO.		
1	SW	P	Regulator switch node. Connect to output inductor.
2	BOOT	I	High-gate driver upper supply rail. Connect a 100nF capacitor from SW pin to BOOT. An internal diode charges the capacitor while SW node is low.
3	VCC	P	Internal 3V regulator output. Used as supply to internal control circuits. Connect a high quality 1.0µF capacitor from this pin to AGND for fixed versions or to GND for adjustable versions.
4	FB (Fixed Versions)	I/P	Fixed version only, this pin serves as feedback for output voltage as well as power source for VCC's regulator. Connect to output node. Bypass immediately adjacent to this pin to AGND.
	FB (ADJ Version)	I	ADJ version only, this pin serves as feedback for output voltage only. Connect to output through a voltage divider which determines output voltage set point.
5	AGND (Fixed Version)	G	Fixed versions only, this ground is the ground to which input signals and FB are compared.
	BIAS (ADJ Version)	P	Power source for VCC's regulator. Connect to output node. Bypass immediately adjacent to this pin.
6	$\overline{\text{RESET}}$	O	Open drain reset output. Connect to suitable voltage supply through a current limiting pull up resistor. High = regulator OK, Low = regulator fault. Will go low when EN = low. See detailed description.
7	EN	I	Enable input to regulator. High = on, Low = off. Can be connected to Vin. Do not float.
8	VIN	I	Input supply to regulator. Connect input bypass capacitors directly between this pin and GND.
9	SYNC/MODE	I	This is a multifunction mode control input which is tolerant of voltages up to input voltage. With a valid synchronization signal at this pin, the device will switch in forced PWM mode at the external clock frequency and synchronize with it at the rising edge of the clock. See the "Electrical Characteristics table" for synchronization signal specifications. With this input tied high, the device will switch at the internal clock frequency in forced PWM mode. With this input tied low, the device will switch at the internal clock frequency in AUTO mode with diode emulation at light load. Spread spectrum is disabled if there is a valid synchronization signal. Do not float.
10	GND	G	Bypass to VIN immediately adjacent to this pin.

(1) G = Ground, I = Input, O = Output, P = Power

Pin Functions (continued)

PIN		I/O(1)	DESCRIPTION
NAME	NO.		
EXPOSED PAD	Thermal, GND	Thermal	Connect to ground – isolation of this terminal from ground is not guaranteed. This terminal serves as the LM53601 - Q1's thermal connection to its PCB. Connect to ground plane for adequate heat sinking.

5 Device and Documentation Support

5.1 Community Resource

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.

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5.2 Trademarks

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5.3 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.

5.4 Glossary

SLYZ022 — *TI Glossary*.

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

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.

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