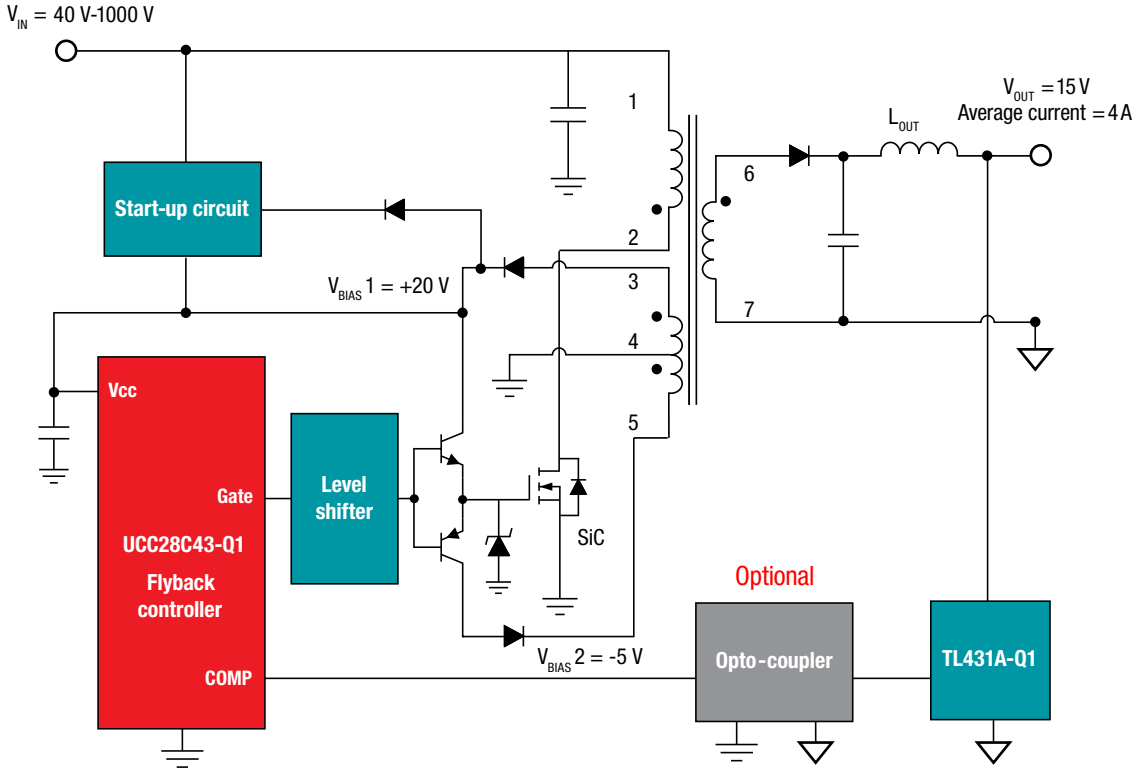
UCC28C4X-Q1 Selection Guide for Automotive Isolated DC/DC Auxiliary Power Applications

Introduction

Automotive powertrain systems require numerous isolated DC/DC bias supplies to power a variety of electronics including gate drivers, controllers, and MCU's. The flyback topology is the most popular solution due to its low-cost, wide-input voltage range, and ability to provide multiple outputs. Flyback controllers are typically operated either directly off the 12 V, 48 V or HV battery or off a regulated voltage rail. Below is an example block diagram from TI design, TIDA-01505, for a backup flyback power supply. The high-voltage to low-voltage backup supply powers the low-voltage side of the traction inverter system in case the 12 V battery was to fail.

When selecting a flyback controller, there are a number of things to consider such as the control scheme, operating input voltage range, and duty cycle. The **UCC28C4X-Q1** family supports a fixed-frequency, peak current-mode flyback implementation with UVLO and maximum duty-cycle limit options. **UCC28C4X-Q1** can be configured with either primary-side regulation using an auxiliary winding or secondary-side regulation with the use of an optocoupler. This family of devices features high frequency operation up to 1 MHz with low start up and operating currents, thus minimizing start up loss and operating power consumption for improved efficiency. The devices also feature a fast current sense to output delay time of 35 ns, and a ±1-A peak output current capability for driving large external MOSFETs directly.



Feature differentiation and system considerations

The table below provides a concise description of the feature differences between the **UCC28C4X-Q1** family.

Maximum duty cycle limit

For the flyback converter, a nominal operating point around 50% maximum duty cycle maximizes the conduction interval for both primary and secondary and minimizes RMS currents. A 50% maximum duty cycle limit also provides a known max volt-second product which can be applied to the transformer, reducing the risk of saturation and may eliminate the need for slope compensation. Alternatively, a wide-input voltage flyback converter may require a PWM that can operate up to nearly 100% duty cycle. For applications that have a wide-input voltage range requirement, such as the backup supply in the traction inverter system, a controller with 100% max duty cycle limit should be selected.

UVLO turn-on

Three sets of UVLO thresholds are available with the following turn-on and turn-off thresholds: 14.5 V/9.0 V, 8.4 V/7.6 V, and 7.0 V/6.6 V.

The 14.5 V/9.0 V UVLO option is primarily intended for off-line or medium to high volt battery or rail power applications, where the wider hysteresis allows for longer soft-starting time of the converter while the VCC cap discharges and the auxiliary winding comes up into regulation. The 8.4 V/7.6 V UVLO option is ideal for high frequency DC/DC converters and is optimized to run off a 12-VDC rail allowing up to 25% voltage tolerance. The 7.0 V/6.6 V UVLO option is designed to support operation from a 12V battery and supports ISO 16750-2: Level 1 operation. A TVS diode and RC filter or simple linear regulator is recommended for protection of VCC pin. For an even lower turn-on voltage, UCC2813-3-Q1 and UCC2813-5-Q1 feature a maximum turn on voltage of 4.5 V enabling operation during cold cranking from 12 V battery systems and support ISO 16750-2: Level 4 operation.

UCC28C4X-Q1 Feature Differentiation

	UCC28C40-Q1	UCC28C41-Q1	UCC28C42-Q1	UCC28C43-Q1	UCC28C44-Q1	UCC28C45-Q1
Maximum duty cycle limit	100%	50%	100%	100%	50%	50%
UVLO ON/OFF	7 V/6.6 V	7 V/6.6 V	14.5 V/9 V	8.4 V/7.6 V	14.5 V/9 V	8.4 V/7.6 V

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