UCC28742 High-Efficiency Flyback Controller with Optocoupler Feedback

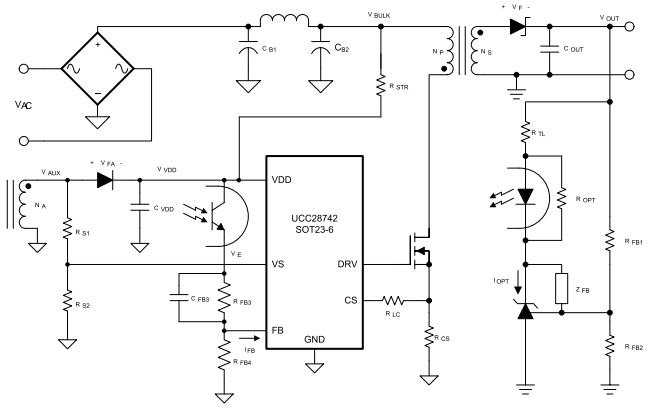
1 Features

- Opto-Coupled Feedback Enables up to 1% Regulation
- Accurate Current Limit with Overload Timeout Protection and Delayed Hiccup Response
- Resonant-Ring Valley-Switching Operation for Highest Overall Efficiency
- 80-kHz Maximum Switching Frequency
- Frequency Dithering to Ease EMI Compliance
- Clamped Gate-Drive Output for MOSFET
- Ultra-Low Start-Up Current and Large VDD Hysteresis
  - High Value Start-Up Resistor
  - Low Bias Capacitance
- Fault Protections
  - Input Low Line
  - Output Over-Voltage
  - Over-Current
  - Short-Circuit
- SOT23-6 Package
- Create a Custom Design Using the UCC28742 with the WEBENCH® Power Designer

2 Applications

- Industrial and Medical AC-to-DC Power Supplies
- Smart Electricity Meters
- Bias Supply for UPS, Server PSU, etc.
- Power Supply for Cable Modem, Television, Set-Top Box, and Wireless Routers
- AC-to-DC Power Supply for Appliances

Simplified Schematic



3 Description

The UCC28742 off-line flyback controller is a highly integrated, 6-pin secondary-side regulated PWM controller for efficient AC-to-DC power supplies. It is an isolated-flyback power-supply controller that provides Constant-Voltage (CV) using an optical coupler to improve transient response to large-load steps. This device processes information from opto-coupled feedback and an auxiliary flyback winding for high-performance control of output voltage and current.

The UCC28742 employs advanced control algorithms to achieve high operating efficiency and performance. The drive output interfaces to a MOSFET power switch. Discontinuous conduction mode (DCM) with valley-switching reduces switching losses. Modulation of switching frequency and primary current-peak amplitude (FM and AM) keeps the conversion efficiency high across the entire load and line ranges.

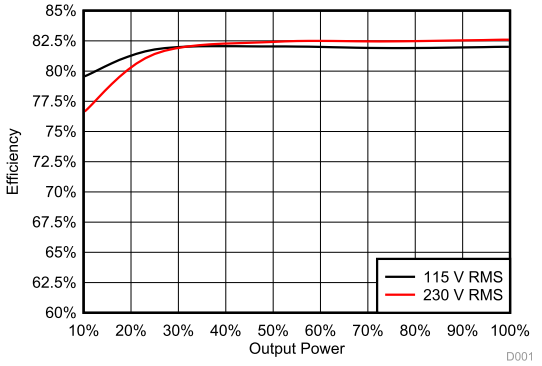
The controller has a maximum switching frequency of 80 kHz and always maintains control of the peak-primary current in the transformer. A minimum switching frequency of 200 Hz facilitates the achievement of low no-load input power.

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
UCC28742	SOT23-6	2.90 mm × 1.60 mm

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

Typical Efficiency of a 10-W, 5-V AC-to-DC Converter



6 Specifications

6.1 Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) (1)

		MIN	MAX	UNIT
V_{VDD}	Bias supply voltage		38	V
VS	Voltage range	–0.75	7	V
FB	Voltage range	–0.5	7	V
CS	Voltage range	–0.5	5	V
V_{DRV}	Gate-drive voltage at DRV	–0.5	Self-limiting	V
I_{DRV}	DRV continuous sink current		50	mA
I_{DRV}	DRV continuous source current		15	mA
I_{DRV}	DRV peak sourcing current, V_{DRV} = 10 V to 0 V		Self-limiting	mA
I_{DRV}	DRV peak sink current, V_{DRV} = 0 V to 10 V		Self-limiting	mA
I_{FB}	FB, peak current		1.0	mA
I_{VS}	VS, peak, 1% duty-cycle, when detecting line voltage		1.2	mA
T_J	Operating junction temperature range	–55	150	°C
T_{STG}	Storage temperature	–65	150	°C
T_{LEAD}	Lead temperature 0.6 mm from case for 10 seconds		260	°C

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 (1)	±2000	V
$V_{(ESD)}$	Electrostatic discharge	Charged-device model (CDM) ESD stress voltage (2)	±500	V

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
VDD	Bias supply operating voltage	9	35	V
C_{DD}	VDD bypass capacitor	0.047	no limit	µF
I_{FB}	Feedback current, continuous		50	µA
I_{VS}	VS pin sourcing current when detecting line voltage		1.0	mA
T_J	Operating junction temperature	–40	125	°C

6.6 Typical Characteristics

VDD = 25 V, unless otherwise noted.

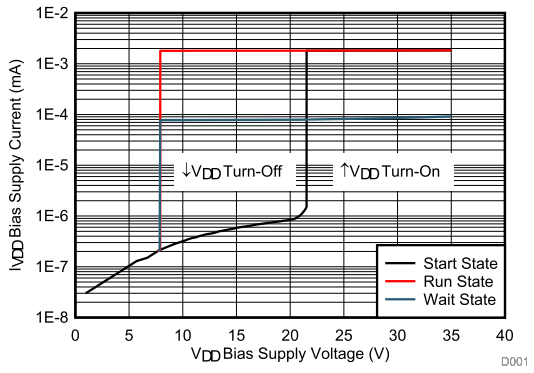


Figure 1. Bias Supply Current vs. Bias Supply Voltage

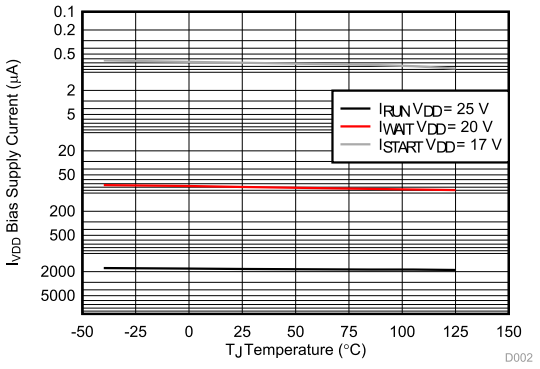


Figure 2. Bias Supply Current vs. Temperature

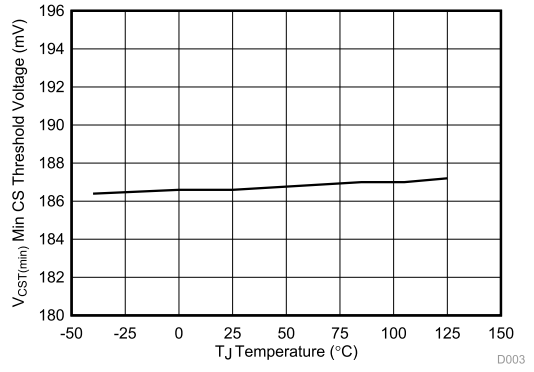


Figure 3. Minimum CS Threshold vs. Temperature

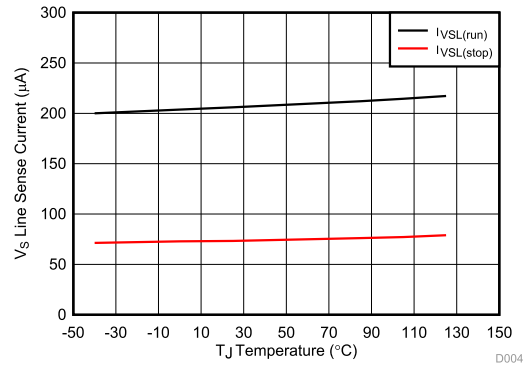


Figure 4. VS Line-Sense Current vs. Temperature

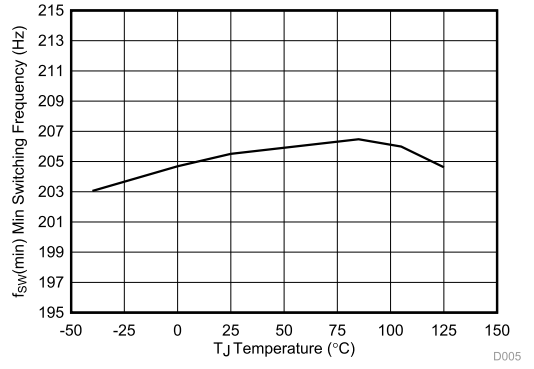


Figure 5. Minimum Switching Frequency vs. Temperature

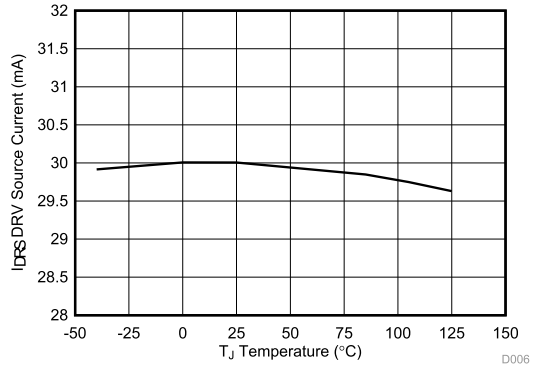


Figure 6. DRV Source Current vs. Temperature

10.2 Layout Example

Figure 26 demonstrates a layout of 10-W, 5-V/2-A converter with trade-offs to minimize the loops while effectively placing components and tracks for low noise operation on a single-layer printed circuit board. In addition to the consideration of minimal loops, one another layout guideline is always to use the device GND as reference point. This applies to both power and signal to return to the device GND pin (pin 5).

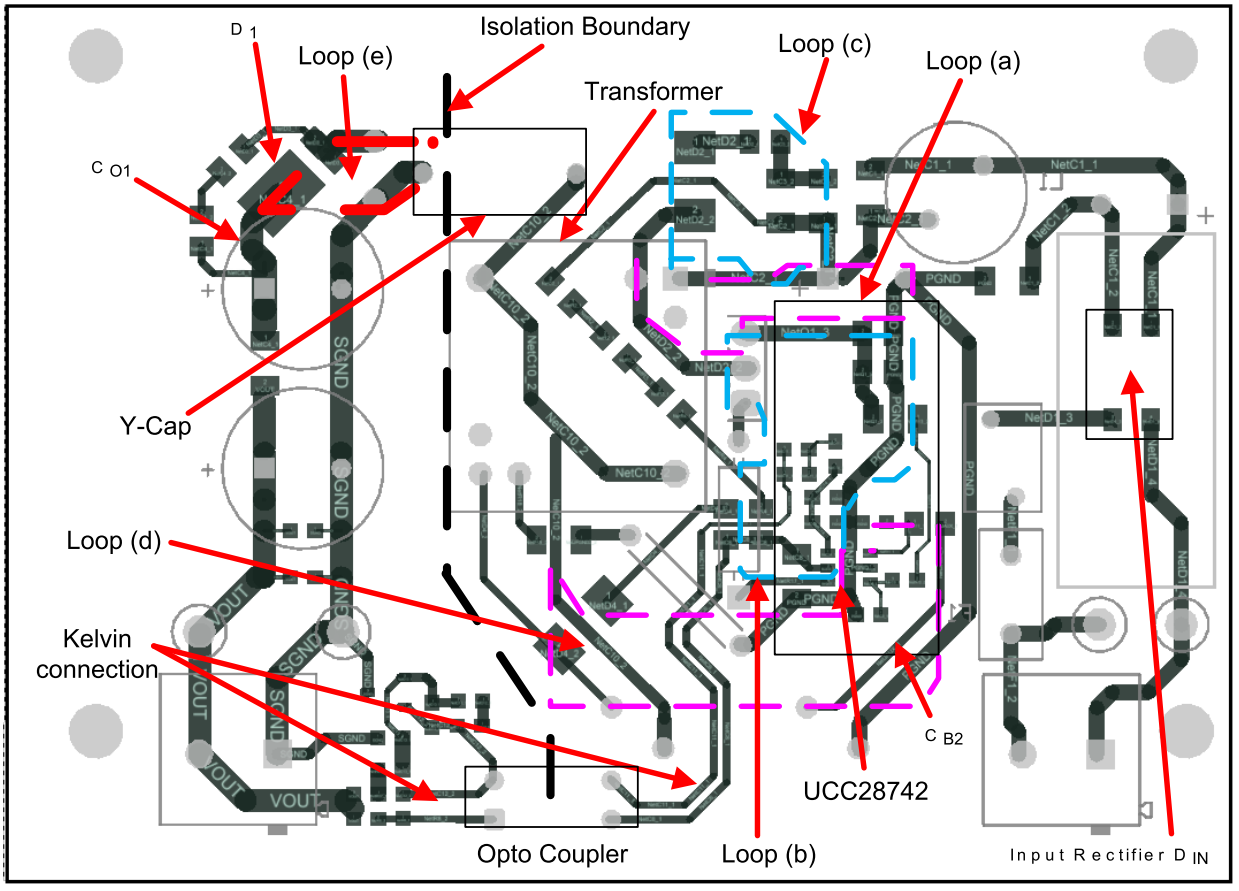


Figure 26. Layout Example