

Negative Output Flyback Pulse Width Modulator

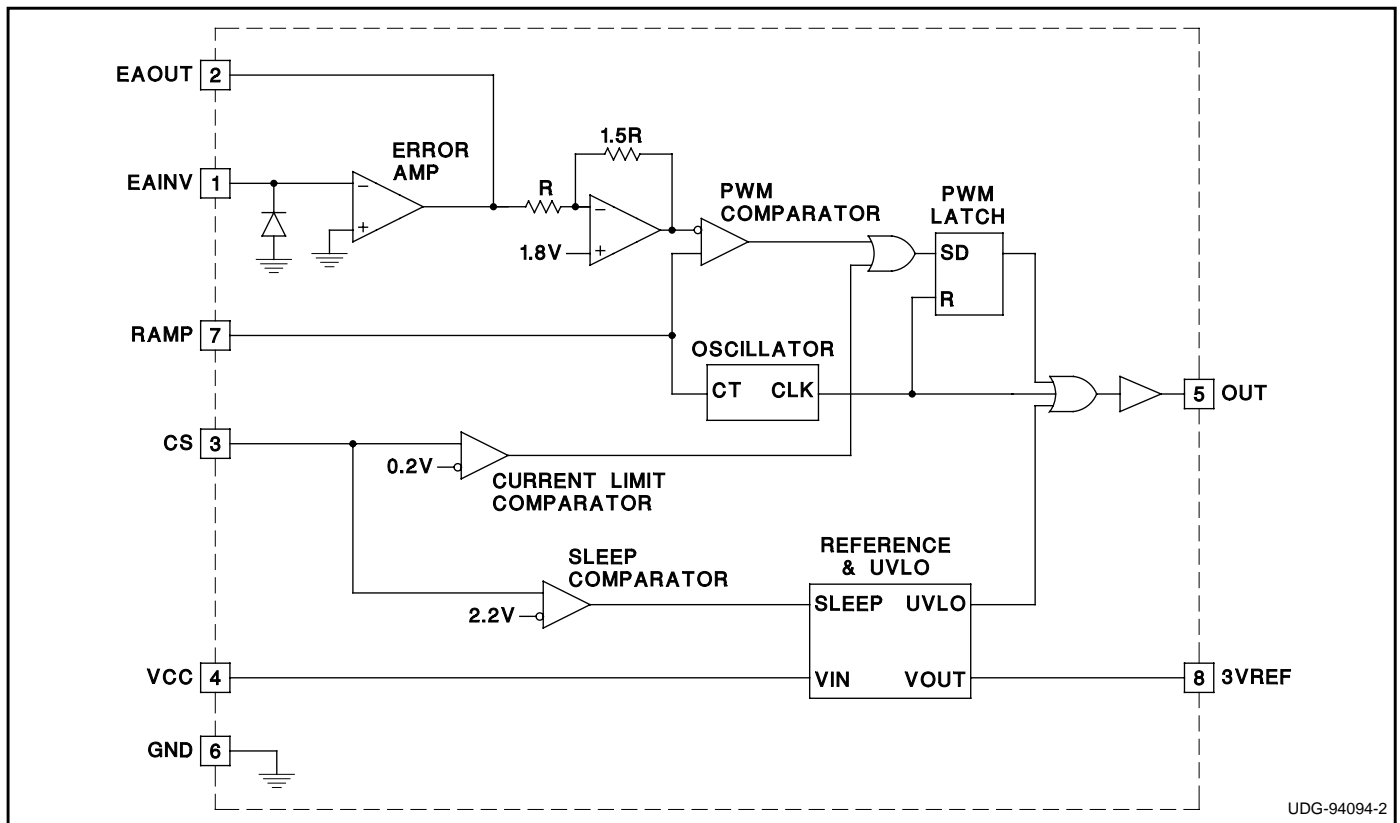
FEATURES

- Simple Single Inductor Flyback PWM for Negative Voltage Generation
- Drives External PMOS Switch
- Contains UVLO Circuit
- Includes Pulse-by-Pulse Current Limit
- Low 50 μ A Sleep Mode Current

DESCRIPTION

The UC3572 is a negative output flyback pulse width modulator which converts a positive input voltage to a regulated negative output voltage. The chip is optimized for use in a single inductor negative flyback switching converter employing an external PMOS switch. The block diagram consists of a precision reference, an error amplifier configured for voltage mode operation, an oscillator, a PWM comparator with latching logic, and a 0.5A peak gate driver. The UC3572 includes an undervoltage lockout circuit to insure sufficient input supply voltage is present before any switching activity can occur, and a pulse-by-pulse current limit. Output current can be sensed and limited to a user determined maximum value. The UVLO circuit turns the chip off when the input voltage is below the UVLO threshold. In addition, a sleep comparator interfaces to the UVLO circuit to turn the chip off. This reduces the supply current to only 50 μ A, making the UC3572 ideal for battery powered applications.

BLOCK DIAGRAM



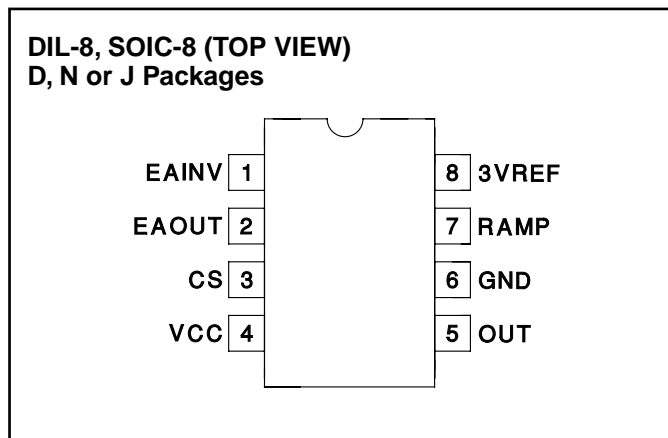
UDG-94094-2

ABSOLUTE MAXIMUM RATINGS

VCC	35V
EAINV	-0.6V to VCC
IEAOUT	25mA
RAMP	-0.3V to 4V
CS	-0.3V to VCC
Iout	-0.7A to 0.7A
I3VREF	-15mA
Storage Temperature	-65°C to +150°C
Junction Temperature	-65°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C

Currents are positive into, negative out of the specified terminal. Consult Packaging Section of Databook for thermal limitations and considerations of packages.

CONNECTION DIAGRAM



ORDERING INFORMATION

	TEMPERATURE RANGE	PACKAGE
UC1572	-55°C to +125°C	J
UC2572	-40°C to +85°C	D, N or J
UC3572	0°C to +70°C	D or N

ELECTRICAL CHARACTERISTICS: Unless otherwise specified, VCC = 5V, CT = 680pF, TA = TJ.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Reference Section					
3VREF		2.94	3	3.06	V
Line Regulation	VCC = 4.75 to 30V		1	10	mV
Load Regulation	I3VREF = 0V to -5mA		1	10	mV
Oscillator Section					
Frequency	VCC = 5V to 30V	85	100	115	kHz
Error Amp Section					
EAINV	EAOUT = 2V	-10	0	10	mV
	IEANV = -1mA		-0.2	-0.9	V
IEAINV	EAOUT = 2V		-0.2	-1.0	μA
AVOL	EAOUT = 0.5V to 3V	65	90		dB
EAOUT High	EAINV = -100mV	3.6	4	4.4	V
EAOUT Low	EAINV = 100mV		0.1	0.2	V
IEAOUT	EAINV = -100mV, EAOUT = 2V	-350	-500		μA
	EAINV = 100mV, EAOUT = 2V	7	20		mA
Unity Gain Bandwidth	TJ = 25°C, F = 10kHz	0.6	1		MHz
Current Sense Comparator Section					
Threshold		0.185	0.205	0.225	V
Input Bias Current	CS = 0		-0.4	-1	μA
CS Propagation Delay			300		nS

ELECTRICAL CHARACTERISTICS: Unless otherwise specified, VCC = 5V, CT = 680pF, TA = TJ.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Gate Drive Output Section					
OUT High Saturation	IOUT = 0		0	0.3	V
	IOUT = -10mA		0.7	1.5	V
	IOUT = -100mA		1.5	2.5	V
OUT Low Saturation	IOUT = 10mA		0.1	0.4	V
	IOUT = 100mA		1.5	2.2	V
Rise Time	TJ = 25°C, CLOAD = 1nF + 3.3 Ohms		30	80	nS
Fall Time	TJ = 25°C, CLOAD = 1nF + 3.3 Ohms		30	80	nS
Pulse Width Modulator Section					
Maximum Duty Cycle	EAINV = +100mV, VCC = 5V to 30V		92	96	%
Minimum Duty Cycle	EAINV = -100mV, VCC = 5V to 30V			0	%
Modulator Gain	EAOUT = 1.5V to 2.5V	45	55	65	%/V
Undervoltage Lockout Section					
Start Threshold		3.5	4.2	4.5	V
Hysteresis		100	200	300	mV
Sleep Mode Section					
Threshold		1.8	2.2	2.6	V
Supply Current Section					
IVCC	VCC = 5V, 30V		9	15	mA
	VCC = 30, CS = 3V		50	150	μA

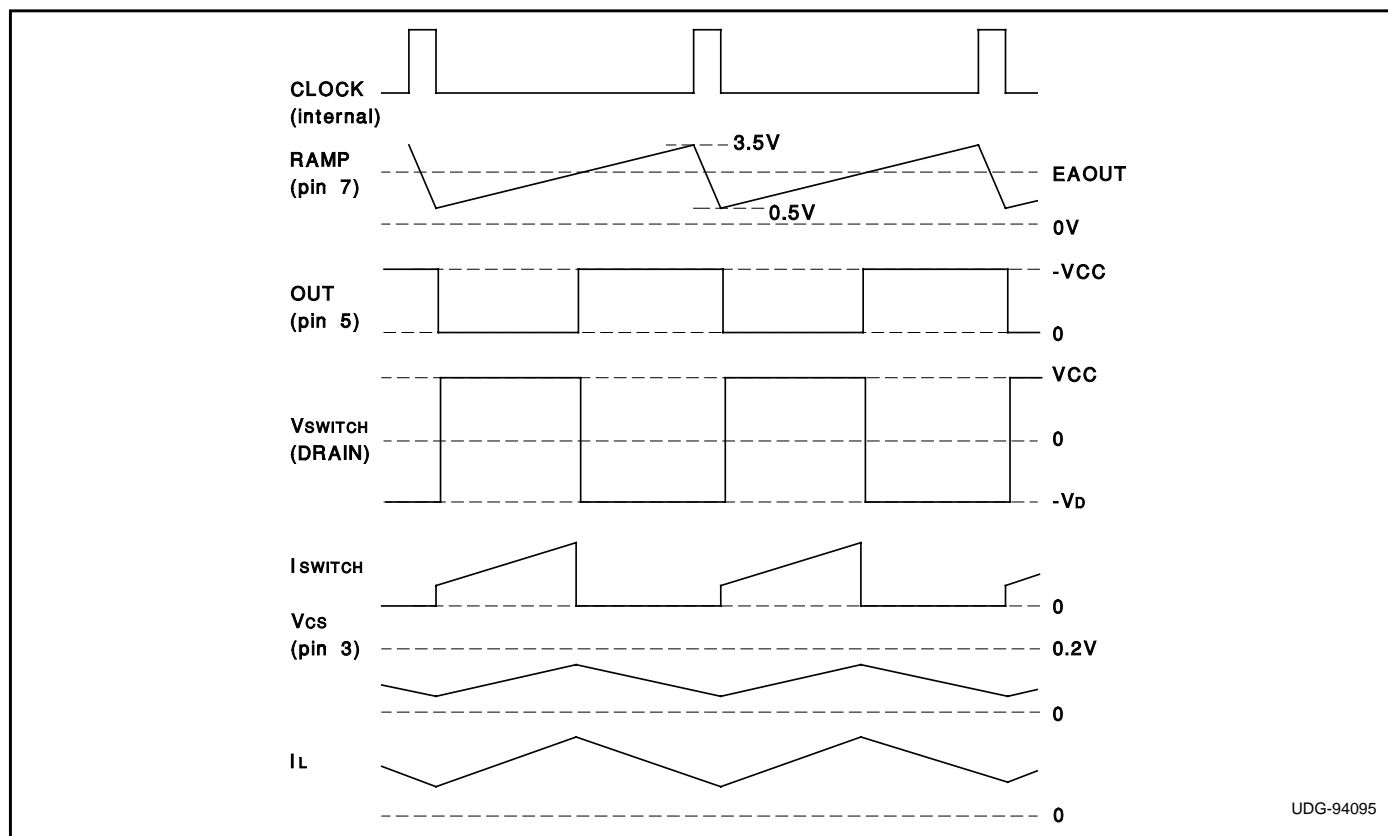


Figure 1. Typical waveforms.

PIN DESCRIPTIONS

3VREF: Precision 3V reference. Bypass with 100nF capacitor to GND.

CS: Current limit sense pin. Connect to a ground referenced current sense resistor in series with the flyback inductor. OUT will be held high (PMOS switch off) if CS exceeds 0.2V.

EAINV: Inverting input to error amplifier. Summing junction for 3VREF and VOUT sense. The non-inverting input of the error amplifier is internally connected to GND. This pin will source a maximum of 1mA.

EAOUT: Output of error amplifier. Use EAOUT and EAINV for loop compensation components.

GND: Circuit Ground.

OUT: Gate drive for external PMOS switch connected between VCC and the flyback inductor. OUT drives the gate of the PMOS switch between VCC and GND.

RAMP: Oscillator and ramp for pulse width modulator. Frequency is set by a capacitor to GND by the equation

$$F = \frac{1}{15k \cdot C_{RAMP}}$$

Recommended operating frequency range is 10kHz to 200kHz.

VCC: Input voltage supply to chip. Range is 4.75 to 30V. Bypass with a 1μF capacitor.

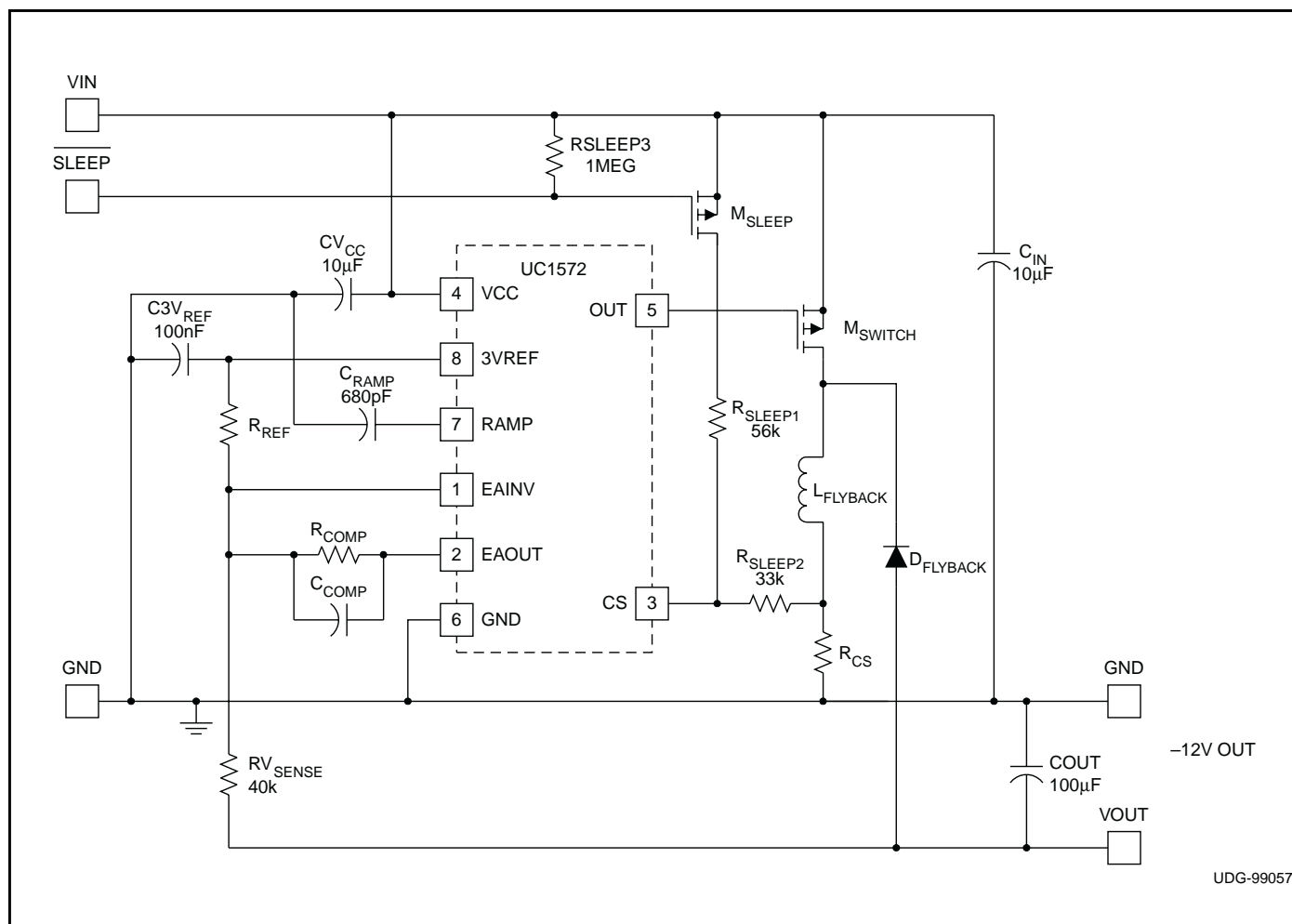


Figure 2. Typical application: +5V to -12V flyback converter.

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgment, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Customers are responsible for their applications using TI components.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, license, warranty or endorsement thereof.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations and notices. Representation or reproduction of this information with alteration voids all warranties provided for an associated TI product or service, is an unfair and deceptive business practice, and TI is not responsible nor liable for any such use.

Resale of TI's products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service, is an unfair and deceptive business practice, and TI is not responsible nor liable for any such use.

Also see: [Standard Terms and Conditions of Sale for Semiconductor Products](http://www.ti.com/sc/docs/stdterms.htm). www.ti.com/sc/docs/stdterms.htm

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265