Negative Output Flyback Pulse Width Modulator

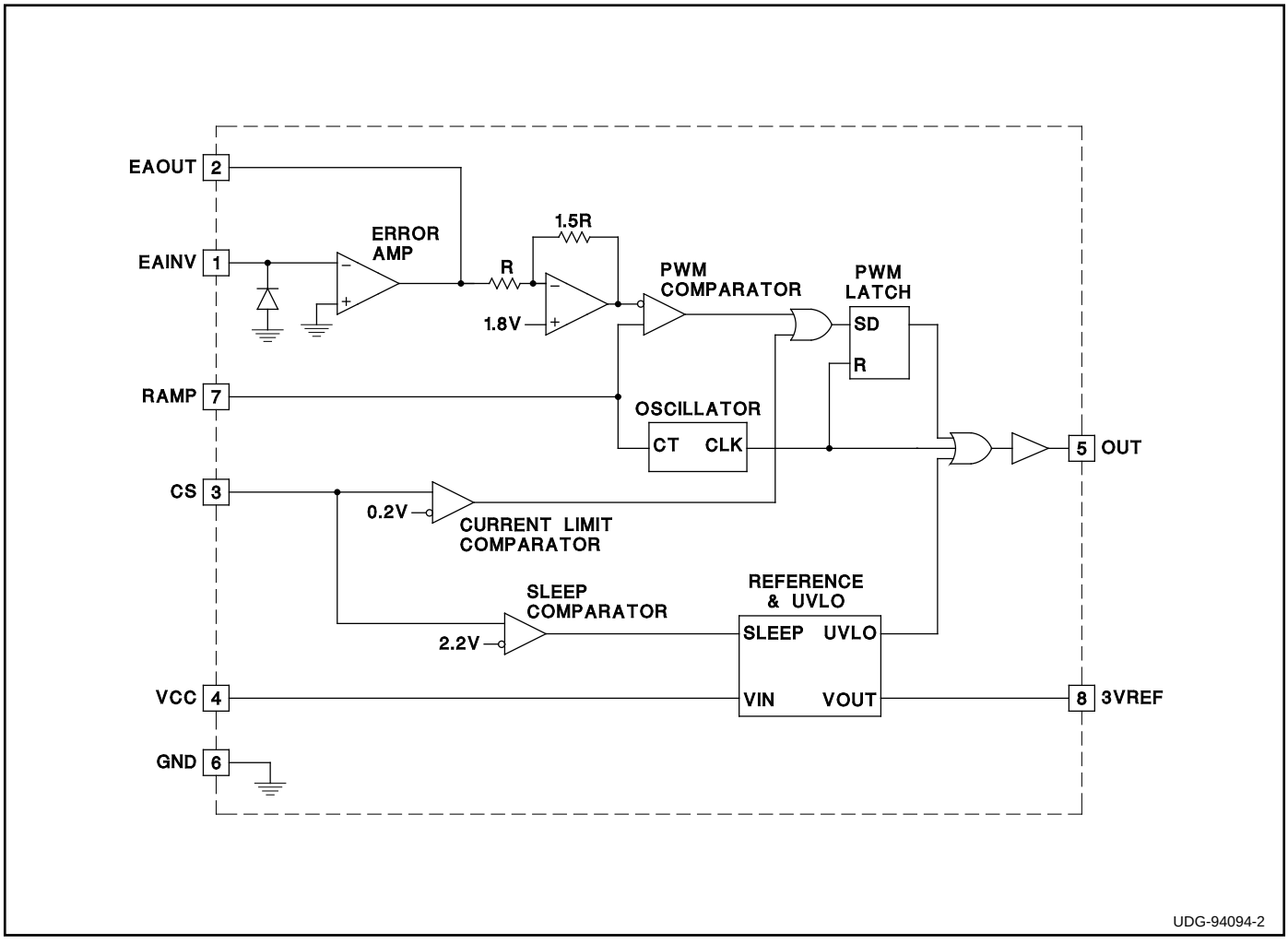
FEATURES

- Simple Single Inductor Flyback PWM for Negative Voltage Generation
- Drives External PMOS Switch
- Contains UVLO Circuit
- Includes Pulse-by-Pulse Current Limit
- Low 50µA 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 50µA, making the UC3572 ideal for battery powered applications.

BLOCK DIAGRAM

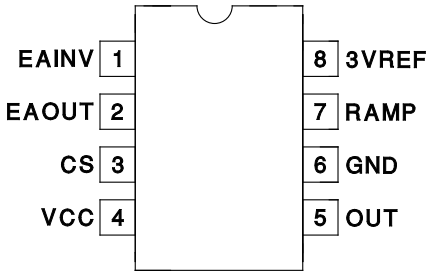


ABSOLUTE MAXIMUM RATINGS

VCC 35V
EAINV . . . . . .–0.6V to VCC
I_{EAOUT} 25mA
RAMP . . . . . .–0.3V to 4V
CS . . . . . .–0.3V to VCC
I_{OUT} . . . . . .–0.7A to 0.7A
I_{3VREF} . . . . . .–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 DIAGRAMS

DIL-8, SOIC-8 (TOP VIEW)
J or N, D Packages



ELECTRICAL CHARACTERISTICS

Unless otherwise stated, these parameters apply for T_A = – 55°C to +125°C for the UC1572, – 40°C to +85°C for the UC2572, and 0°C to +70°C for the UC3572, VCC = 5V, CT = 680pF, $T_A = T_J$.

PARAMETER	TEST CONDITION	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	I_{3VREF} = 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
	I_{EAINV} = –1mA		–0.2	–0.9	V
I_{EAINV}	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
I_{EAOUT}	EAINV = –100mV, EAOUT = 2V	–350	–500		µA
	EAINV = 100mV, EAOUT = 2V	7	20		mA
Unity Gain Bandwidth	T_J = 25°C, F = 10kHz	0.6	1		MHz
Current Sense Comparator Section					
Threshold		0.195	0.215	0.235	V
Input Bias Current	CS = 0		–0.4	–1	µA
CS Propagation Delay			300		ns
Gate Drive Output Section					
OUT High Saturation	I_{OUT} = 0		0	0.3	V
	I_{OUT} = –10mA		0.7	1.5	V
	I_{OUT} = –100mA		1.5	2.5	V
OUT Low Saturation	I_{OUT} = 10mA		0.1	0.4	V
	I_{OUT} = 100mA		1.5	2.2	V
Rise Time	T_J = 25°C, C_{LOAD} = 1nF + 3.3 Ohms		30	80	ns
Fall Time	T_J = 25°C, C_{LOAD} = 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

ELECTRICAL CHARACTERISTICS (cont.) Unless otherwise stated, these parameters apply for T_A = – 55°C to +125°C for the UC1572, – 40°C to +85°C for the UC2572, and 0°C to +70°C for the UC3572, VCC = 5V, CT = 680pF, $T_A = T_J$.

PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNITS
Undervoltage Lockout Section					
Start Threshold		3.5	4.2	4.7	V
Hysteresis		100	200	300	mV
Sleep Mode Section					
Threshold		1.8	2.2	2.6	V
Supply Current Section					
I_{VCC}	VCC = 5V, 30V		9	12	mA
	VCC = 30, CS = 3V		50	150	µA

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.

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

GND: Circuit Ground.

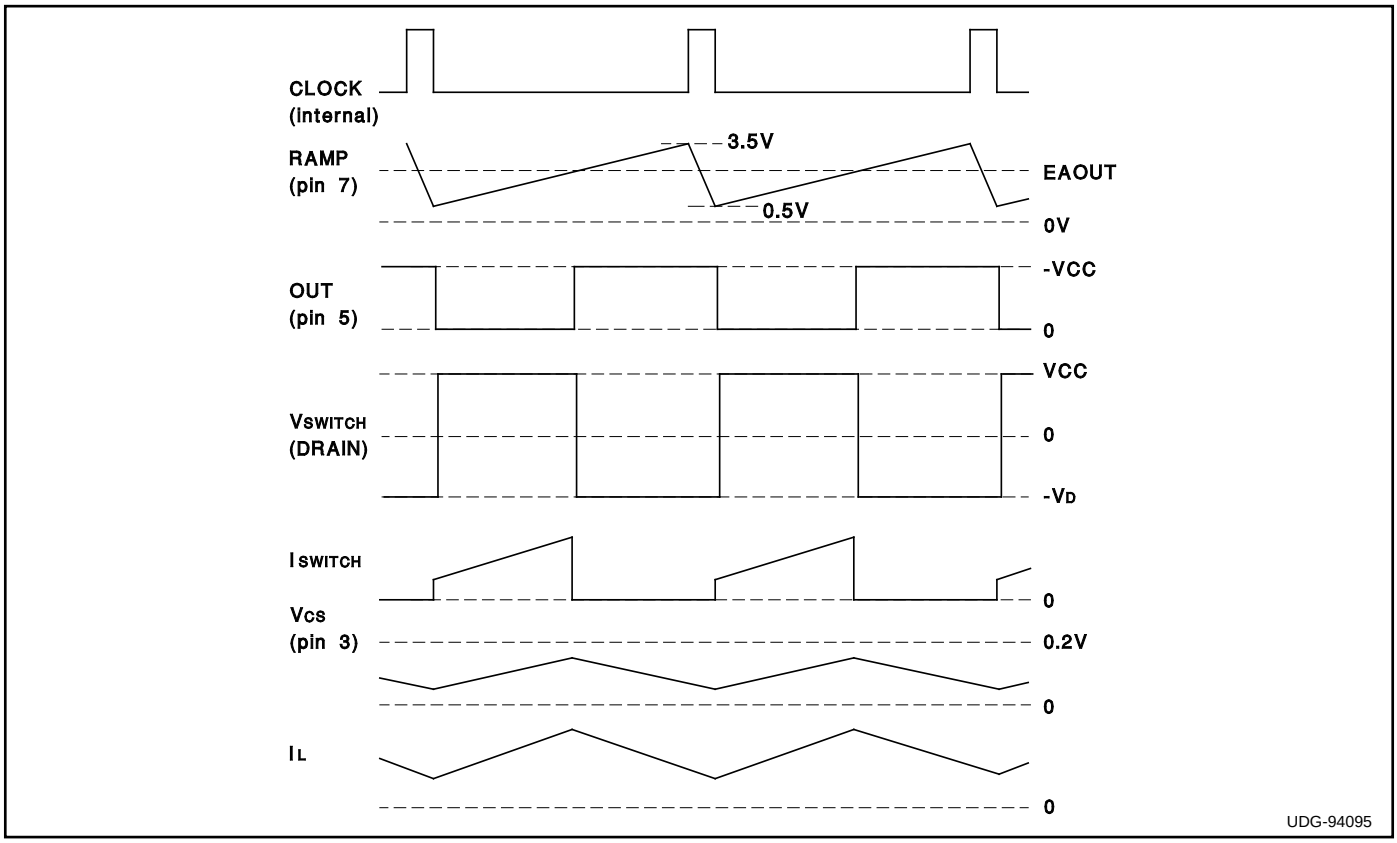
OUT: Gate drive for external PMOS switch connected between VCC and the flyback inductor. OUT drives the gate of the PMOS switch between VCC and GND.

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

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

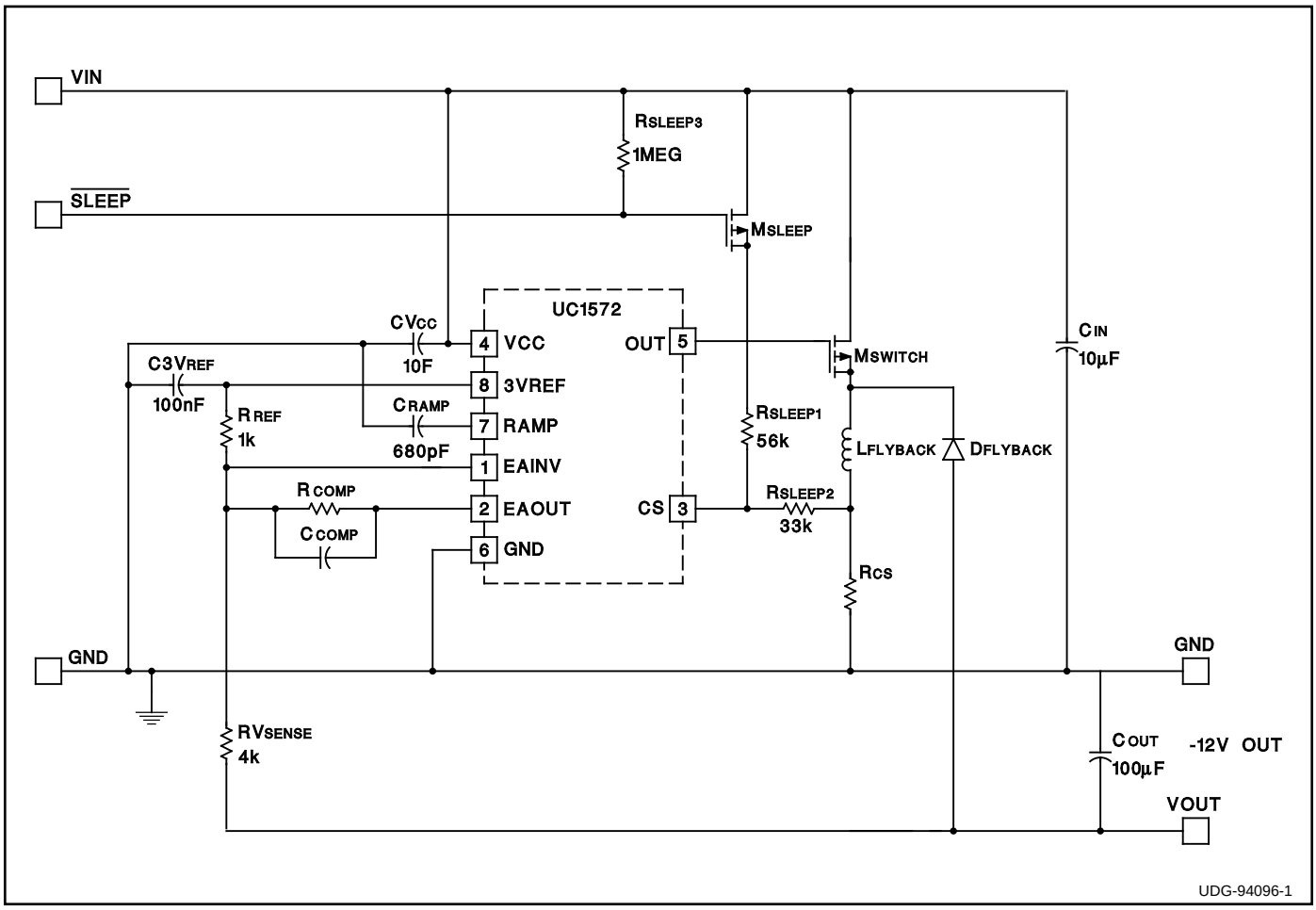
Recommended operating frequency range is 10kHz to 200kHz.

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



Typical Waveforms

TYPICAL APPLICATION : +5V TO -12V FLYBACK CONVERTER



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