PRELIMINARY

Low Dropout 1 Ampere Linear Regulator Family

FEATURES

- Precision Positive Linear Voltage Regulation
- 0.5V Dropout at 1A
- Guaranteed Reverse Input/ Output Voltage Isolation with Low Leakage
- Low Quiescent Current Irrespective of Load
- Adjustable Output Voltage Version
- Fixed Versions for 3.3V and 5V Outputs
- Logic Shutdown Capability
- Short Circuit Power Limit of 3% • VIN • Current Limit
- Remote Load Voltage for Accurate Load Regulation

DESCRIPTION

The UCC381-3/-5/-ADJ family of positive linear series pass regulators is tailored for low drop out applications where low quiescent power is important. Fabricated with a BiCMOS technology ideally suited for low input to output differential applications, the UCC381 will pass 1A while requiring only 0.5V of input voltage headroom. Dropout voltage decreases linearly with output current, so that dropout at 200mA is less than 100mV. Quiescent current is always less than 450µA. To prevent reverse current conduction, on-chip circuitry limits the minimum forward voltage to typically 50mV. Once the forward voltage limit is reached, the input-output differential voltage is maintained as the input voltage drops until undervoltage lockout disables the regulator.

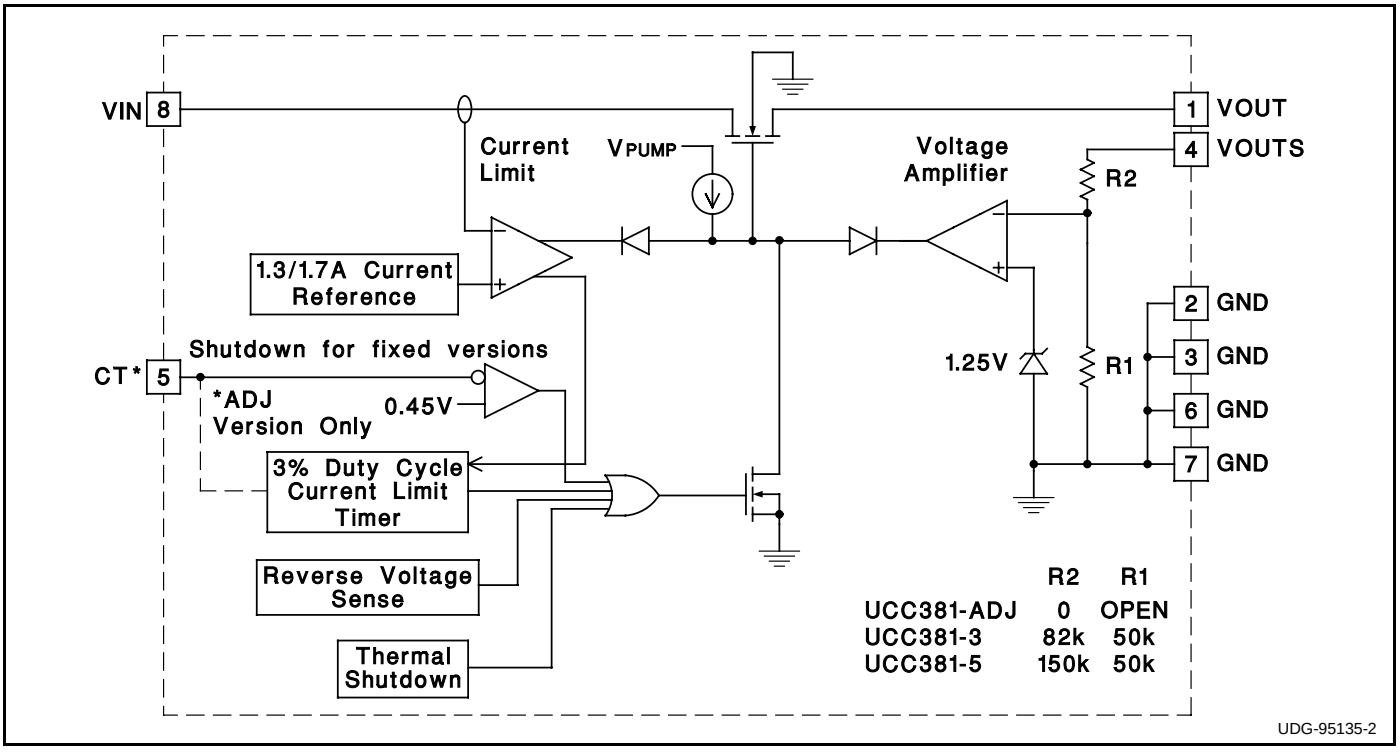
UCC381-3 and UCC381-5 versions have on-chip resistor networks preset to regulate either 3.3V or 5.0V, respectively. Furthermore, remote sensing of the load voltage is possible by connecting the VOUTS pin directly at the load. The output voltage is then regulated to 1.5% at room temperature and better than 2.5% over temperature. The UCC381-ADJ version has a regulated output voltage programmed by an external user-definable resistor ratio.

Short circuit current is internally limited. The device responds to a sustained overcurrent condition by turning off after a TON delay. The device then stays off for a period, TOFF, that is 32 times the TON delay. The device then begins pulsing on and off at the TON/(TON+TOFF) duty cycle of 3%. This drastically reduces the power dissipation during short circuit such that heat sinking, if at all required, must only accommodate normal operation. On the fixed output versions of the device TON is fixed at 400µs – a guaranteed minimum. On the adjustable version an external capacitor sets the on time. The off time is always 32 times TON.

The UCC381 can be shutdown to 25µA (max) by pulling the CT pin low.

continued

BLOCK DIAGRAM



DESCRIPTION (cont.)

Internal power dissipation is further controlled with thermal overload protection circuitry. Thermal shutdown occurs if the junction temperature exceeds 165°C. The chip will remain off until the temperature has dropped 20°C.

The UCC281 series is specified for operation over the industrial range of –40°C to +85°C, and the UCC383 series is specified from 0°C to +70°C. These devices are available in the 8 pin DP surface mount power package. For other packaging options consult the factory.

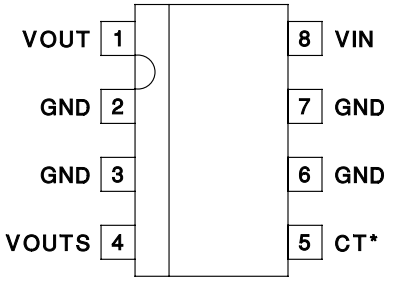
ABSOLUTE MAXIMUM RATINGS

VIN 9V
CT . . . . . –0.3 to 3V
Storage Temperature . . . . . –65°C to +150°C
Junction Temperature . . . . . –55°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. All voltages are referenced to GND.

CONNECTION DIAGRAMS

SOIC-8 (Top View)
DP Package



* ADJ version only

ELECTRICAL CHARACTERISTICS: Unless otherwise stated, these specifications hold for T_A = 0°C to 70°C for the UCC381-X series and –40°C to +85°C for the UCC283-X series, VIN = VOUT + 1.5V, I_{OUT} = 0mA, C_{OUT} = 2.2µF. CT = 1500pF for the UCC381-ADJ version and VOUT set to 5V. $T_J = T_A$.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
UCC381-5 Fixed 5V, 1A Family					
Output Voltage	T_J = 25°C	4.925	5	5.075	V
	Over Temperature	4.875		5.125	V
Line Regulation	VIN = 5.15V to 9V		1	3	mV
Load Regulation	I_{OUT} = 0mA to 1A		2	5	mV
Output Noise Voltage	T_J = 25°C, BW = 10Hz to 10kHz		200		µVrms
Drop Out Voltage, VIN - VOUT	I_{OUT} = 1A, VOUT = 4.85V, TA < 85°C		0.5	0.6	V
	I_{OUT} = 200mA, VOUT = 4.85V, TA < 85°C		100	200	mV
Peak Current Limit	VOUT = 0V		2	3.5	A
Overcurrent Threshold		1		1.6	A
Current Limit Duty Cycle	VOUT = 0V		3	5	%
Overcurrent Time Out, T_{ON}	VOUT = 0V	400	750		µs
Quiescent Current			400	650	µA
Quiescent Current in Shutdown	VIN = 9V		10	25	µA
Shutdown Threshold	At CT Input	0.25	0.45		V
Reverse Leakage Current	0V < VIN < VOUT, VOUT < 5.1V, at VIN		350	650	µA
	0V < VIN < VOUT, VOUT < 5.1V, at VOUT	50			mA

ELECTRICAL CHARACTERISTICS (cont.): Unless otherwise stated, these specifications hold for T_A = 0°C to 70°C for the UCC381-X series and –40°C to +85°C for the UCC283-X series, VIN = VOUT + 1.5V, I_{OUT} = 0mA, C_{OUT} = 2.2µF. CT = 1500pF for the UCC381-ADJ version and VOUT set to 5V. $T_J = T_A$.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
UCC381-3 Fixed 3.3V, 1A Family					
Output Voltage	T_J = 25°C	3.25	3.3	3.35	V
	Over Temperature	3.22		3.38	V
Line Regulation	VIN = 3.45V to 9V		1	3	mV
Load Regulation	I_{OUT} = 0mA to 1A		2	5	mV
Output Noise Voltage	T_J = 25°C, BW = 10Hz to 10kHz		200		µVrms
Dropout Voltage, VIN - VOUT	I_{OUT} = 1A, VOUT = 3.15V, T_A < 85°C		0.6	0.8	V
	I_{OUT} = 200mA, VOUT = 3.15V, TA < 85°C		100	200	mV
Peak Current Limit	VOUT = 0V		2	3.5	A
Overcurrent Threshold		1		1.6	A
Current Limit Duty Cycle	VOUT = 0V		3	5	%
Overcurrent Time Out, T_{ON}	VOUT = 0V	400	750		µs
Quiescent Current			400	650	µA
Quiescent Current in Shutdown	VIN = 9V		10	25	µA
Shutdown Threshold	At CT Input	0.25	0.45		V
Reverse Leakage Current	0V < VIN < VOUT, VOUT < 3.35V, at VIN		350	650	µA
	0V < VIN < VOUT, VOUT < 3.35V, at VOUT	50			µA
UCC381-ADJ Adjustable Output, 1A Family					
Regulating Voltage at ADJ Input	T_J = 25°C	1.23	1.25	1.27	V
	Over Temperature	1.22		1.28	V
Line Regulation, at ADJ Input	VIN = VOUT + 150mV to 9V		1	3	mV
Load Regulation, at ADJ Input	IOUT = 0mA to 1A		2	5	mV
Output Noise Voltage	T_J = 25°C, BW = 10Hz to 10kHz		200		µVrms
Dropout Voltage, VIN - VOUT	IOUT = 1A, VOUT = 4.85V		0.5	0.6	V
	IOUT = 200mA, VOUT = 4.85V		100	200	mV
Peak Current Limit	VOUT = 0V		2	3.5	A
Overcurrent Threshold		1		1.6	A
Current Limit Duty Cycle	VOUT = 0V		3	5	%
Overcurrent Time Out, TON	VOUT = 0V, CT = 1500pF	400	1000		µs
Quiescent Current			400	650	µA
Quiescent Current in Shutdown	VIN = 9V		10	25	µA
Shutdown Threshold	At CT Input	0.25	0.45		V
Reverse Leakage Current	0V < VIN < VOUT, VOUT < 5.1V, at VIN		350	650	µA
	0V < VIN < VOUT, VOUT < 5.1V, at VOUT	50			µA
Bias Current at ADJ Input			100	250	nA

PIN DESCRIPTIONS

CT: For UCC381-3 and UCC381-5 versions, this is the shutdown pin which, when pulled low, turns off the regulator output and puts the device in a low current state. For the UCC381-ADJ version, a capacitor is required between the CT pin and GND to set the T_{ON} time during overcurrent according to the following (typical) equation:

$$T_{ON} = 660{,}000 \bullet C_{CT}.$$

GND: All voltages are measured with respect to this pin. This is the low noise ground reference input for regulation. The output decoupling capacitor should be tied to Pin 7.

VIN: Positive supply input for the regulator. Bypass this pin to GND with at least 1µF of low ESR, ESL capacitance if the source is located further than 1 inch from the device.

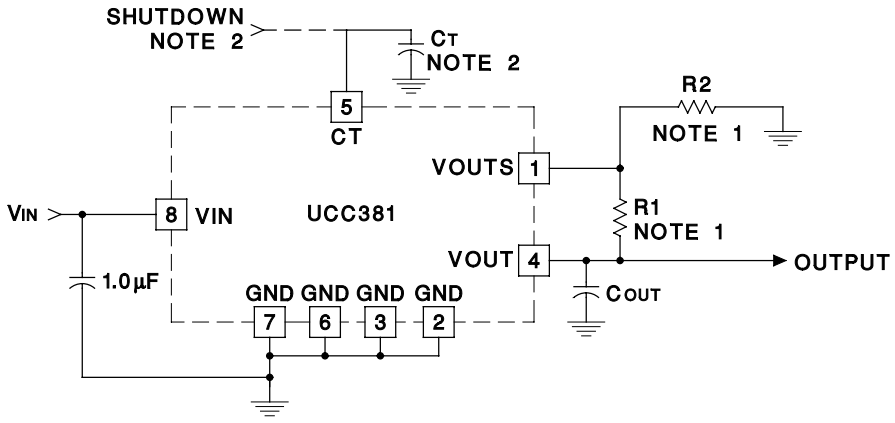
VOUT: Output for regulator. Regulator does not require a minimum output capacitor for stability. Choose the appropriate size capacitor for the application with respect to the required transient loading. For example, if the load is very dynamic, a large capacitor will smooth out the response to load steps.

VOUTS: Feedback for regulator sensing of the output voltage. For loads which are a considerable resistive distance from the VOUT pin, the VOUTS pin can be used to move the resistance into the control loop of the regulator, thereby effectively canceling the IR drop associated with the load path. For local regulation, merely connect this pin directly to the VOUT pin. For the UCC381-ADJ version, the output voltage can be set by two external resistors according to the following relationship:

$$V_{OUT} = 1.25 \bullet \left(1 + \frac{R1}{R2}\right)$$

where R1 is a resistor connected between VOUT and VOUTS and R2 is a resistor connected between VOUTS and GND.

TYPICAL APPLICATION CIRCUIT



Note 1: R1 and R2 for adjustable version only.
For 3.3V and 5V versions connect VOUT to VOUTS. See Pin Descriptions.
Note 2: C_T timing capacitor is for adjustable version only.
For 3.3V and 5V versions, the CT pin is used to enable or shutdown the part. See Pin Descriptions.

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