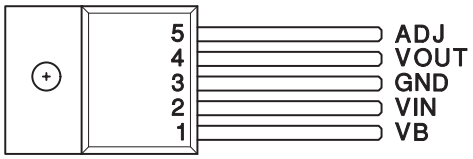
UC285-1, UC285-2, UC285-3, UC285-ADJ, UC385-1, UC385-2, UC385-3, UC385-ADJ
FAST TRANSIENT RESPONSE 5-A LOW-DROPOUT REGULATOR

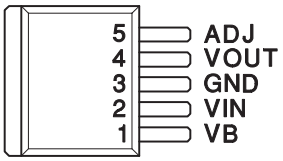
SLUS212B – NOVEMBER 1999 – REVISED APRIL 2000

- **Fast Transient Response**
- **10 mA to 5 A Load Current**
- **Short Circuit Protection**
- **Maximum Dropout of 500 mV at 5-A Load Current**
- **Separate Bias (VB) and VIN Pins**
- **Available in Adjustable or Fixed Output Voltages**
- **5-Pin Package Allows Kelvin Sensing of Load Voltage**
- **Reverse Current Protection**

5-PIN TO-220
T PACKAGE (TOP VIEW)



5-PIN TO-263
TD PACKAGE
(TOP VIEW)



Note: Tab = Ground

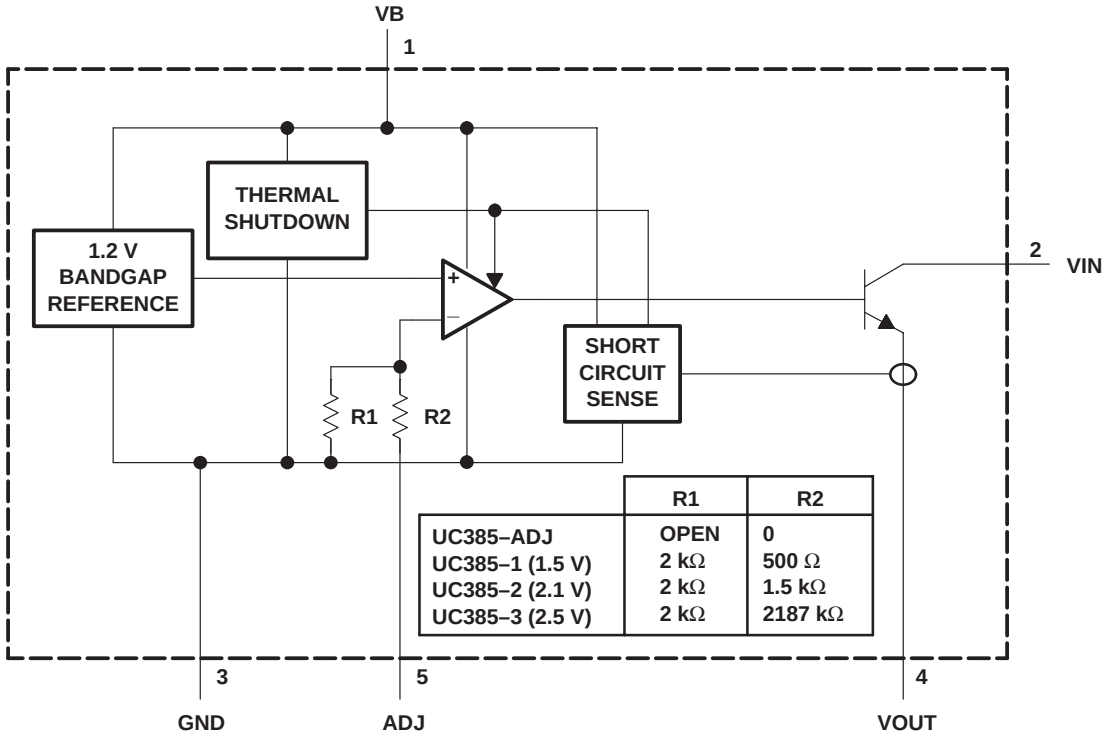
description

The UC385 is a low dropout linear regulator providing a quick response to fast load changes. Combined with its precision on-board reference, the UC385 excels at driving GTL and BTL buses. Due to its fast response to load transients, the total capacitance required to decouple the regulator's output can be significantly decreased when compared to standard LDO linear regulators.

Dropout voltage (VIN to VOUT) is only 490 mV maximum and 350 mV typical at 5-A load (0°C to 100°C).

The on-board bandgap reference is stable with temperature and scaled for a 1.2 V input to the internal power amplifier. The UC385 is available in fixed output voltages of 1.5 V, 2.1 V, or 2.5 V. The output voltage of the adjustable version can be set with two external resistors. If the external resistors are omitted, the output voltage defaults to 1.2 V.

block diagram



	R1	R2
UC385–ADJ	OPEN	0
UC385–1 (1.5 V)	2 kΩ	500 Ω
UC385–2 (2.1 V)	2 kΩ	1.5 kΩ
UC385–3 (2.5 V)	2 kΩ	2187 kΩ

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

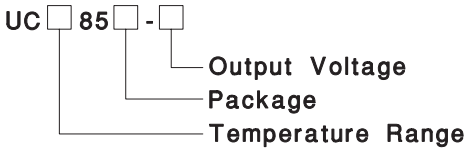
absolute maximum ratings over operating free-air temperature (unless otherwise noted)†

Input voltage, V_I (VIN) . . . . . 7.5 V
Output Voltage, V_I . . . . . 1.2 V to –6.0 V
Storage Temperature, T_{stg} . . . . . –65°C to 150°C
Junction Temperature, T_J . . . . . –55°C to 150°C
Lead Temperature (Soldering, 10 seconds) . . . . . 300°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

ORDERING INFORMATION

Temperature Range	Package	Output Voltage
		1: 1.5 V
2: –40°C to 100°C	TD: TO–263	2: 2.1 V
3: 0°C to 100°C	T: TO-220	3: 2.5 V
		ADJ: 1.2 V or Adjustable



electrical characteristics T_A = –40°C to 100°C for the UC285-x series and 0°C to 100°C for the UC385-x, VB = 5 V, VIN = 3.3 V, VOUT = 2.5 V, $T_A = T_J$ (unless otherwise noted)

PARAMETER		TEST CONDITION	MI0N	TYP	MAX	UNIT
UC385-3 Fixed 2.5 V, 5-A Family						
Output voltage	UC385-3	I_{VOUT} = 100 mA	2.475	2.5	2.525	V
	UC285-3	I_{VOUT} = 100 mA	2.45	2.5	2.525	V
Load regulation		I_{VOUT} = 10 mA to 5 A		0.5	4	mV
VIN PSRR			80	110		dB
VB PSRR			50	65		dB
VIN dropout voltage (VIN - VOUT)		I_{VOUT} = 5 A, T_J = 25°C		350	425	mV
	UC385-3	I_{VOUT} = 5 A		350	490	mV
	UC285-3	I_{VOUT} = 5 A		350	500	mV
VB dropout (VB - VOUT)	UC385-3	I_{VOUT} = 5 A		1.8	2.1	V
	UC285-3	I_{VOUT} = 5 A		1.8	2.2	V
Short circuit current limit			5.1		7.5	A
VB current		I_{VOUT} = 10 mA		8	15	mA
		I_{VOUT} = 5 A		40	100	mA
VIN current		I_{VOUT} = 5 A	4.9	4.96		A
UC385-2 Fixed 2.1 V, 5-A Family						
Output voltage	UC385-2	I_{VOUT} = 100 mA	2.079	2.1	2.121	V
	UC285-2	I_{VOUT} = 100 mA	2.058	2.1	2.121	V
Load regulation		I_{VOUT} = 10 mA to 5 A		0.5	4	mV
VIN PSRR			80	110		dB
VB PSRR			50	67		dB

electrical characteristics T_A = –40°C to 100°C for the UC285-x series and 0°C to 100°C for the UC385-x, VB = 5 V, VIN = 3.3 V, VOUT = 2.5 V, $T_A = T_J$ (unless otherwise noted) (continued)

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
UC385–2 Fixed 2.1 V, 5-A Family (continued)						
VIN dropout voltage (VIN - VOUT)		I_{VOUT} = 5 A, T_J = 25°C		350	425	mV
	UC385-2	I_{VOUT} = 5 A		350	490	mV
	UC285-2	I_{VOUT} = 5 A		350	500	mV
VB dropout (VB - VOUT)	UC385-2	I_{VOUT} = 5 A		1.8	2.1	V
	UC285-2	I_{VOUT} = 5 A		1.8	2.2	V
Short circuit current limit			5.1		7.5	A
VB current		I_{VOUT} = 10 mA		8	15	mA
		I_{VOUT} = 5 A		40	100	mA
VIN current		I_{VOUT} = 5 A	4.9	4.96		A
UC385–1 Fixed 1.5 V, 5-A Family						
Output voltage	UC385-1	I_{VOUT} = 100 mA	1.485	1.5	1.515	V
	UC285-1	I_{VOUT} = 100 mA	1.470	1.5	1.515	V
Load regulation		I_{VOUT} = 10 mA to 5 A		0.5	4	mV
VIN PSRR			80	110		dB
VB PSRR			50	65		dB
VIN dropout voltage (VIN - VOUT)		I_{VOUT} = 5 A, T_J = 25°C		350	425	mV
	UC285-1	I_{VOUT} 5 A		350	490	mV
	UC285-2	I_{VOUT} = 5 A		350	500	mV
VB dropout (VB - VOUT)	UC385-1	I_{VOUT} = 5 A		1.8	2.1	V
	UC285-1	I_{VOUT} = 5 A		1.8	2.2	V
Short circuit current limit			5.1		7.5	A
VB current		I_{VOUT} = 10 mA		8	15	mA
		I_{VOUT} = 5 A		40	100	mA
VIN = current		I_{VOUT} = 5 A	4.9	4.96		A
UC385-ADJ Adjustable, 5-A Family						
ADJ voltage	UC385-ADJ	I_{VOUT} - 100 mA	1.188	1.2	1.212	V
	UC285-ADJ	I_{VOUT} - 100 mA	1.176	1.2	1.212	V
Load regulation		I_{VOUT} = 10 mA to 5 A		0.5	4	mV
VIN PSRR		VOUT programmed for 2.5 V	80	110		dB
VB PSRR VOUT		Programmed for 2.5 V	50	65		dB
VIN dropout voltage (VIN - VOUT)		I_{VOUT} = 5 A, T_J = 25°C		350	425	mV
	UC385-ADJ	I_{VOUT} = 5 A		350	490	mV
	UC285-ADJ	I_{VOUT} = 5 A		350	500	mV
VB dropout (VB - VOUT)	UC385-ADJ	I_{VOUT} = 5 A		1.8	2.1	V
	UC285-ADJ	I_{VOUT} = 5 A		1.8	2.2	V
Short circuit current limit			5.1		7.5	A
VB current		I_{VOUT} = 10 mA		8	15	mA
		I_{VOUT} = 5 A		40	100	mA
VIN current		I_{VOUT} = 5 A	4.9	4.96		A

pin descriptions

ADJ: In the adjustable version, the user programs the output voltage with two external resistors. The resistors should be 0.1% for high accuracy. The output amplifier is configured as a non-inverting operational amplifier. The resistors should meet the criteria of R3 || R4 < 100 Ω. Connect ADJ to VOUT for an output voltage of 1.2 V. Note that the point at which the feedback network is connected to the output is the Kelvin sense point.

GND: For accurate results, the GND pin should be referenced to the load ground.

VB: Supplies power to all circuits of the regulator except the output power transistor. The 2-V headroom from VB to VOUT allows the use of a Darlington output stage for inherently low output impedance and fast response. (Dropout is derated for junction temperatures below 0°C.)

VIN: Supplies the current to the collector of the output power transistor only. The dropout (VIN-VOUT) is under 100 mV for light loads; maximum dropout is 490 mV at 5 A for T_J = 0°C to 100°C. (Dropout is derated for junction temperatures over 100°C.)

VOUT: This pin should be connected to the load via a low-impedance path. Avoid connectors which add significant inductance and resistance. Note that even though a Kelvin sense is available through a 5-pin package, care must be taken since voltage drops along wire traces add to the dropout voltage.

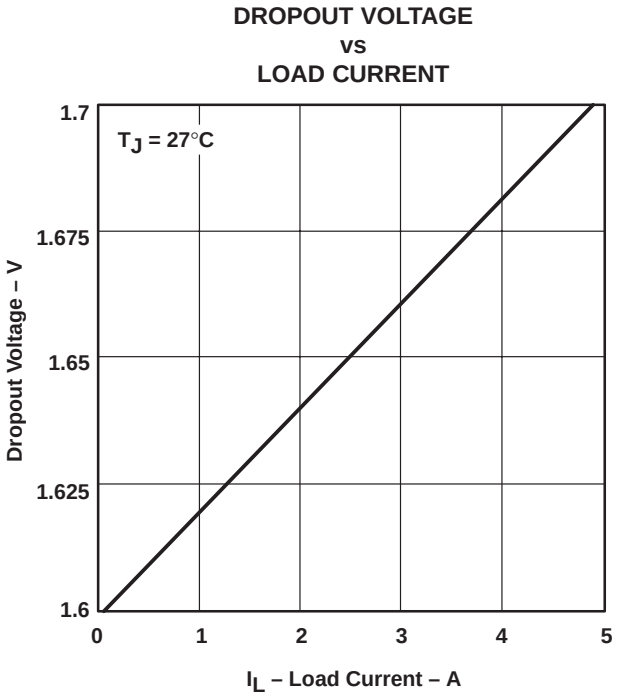


Figure 1

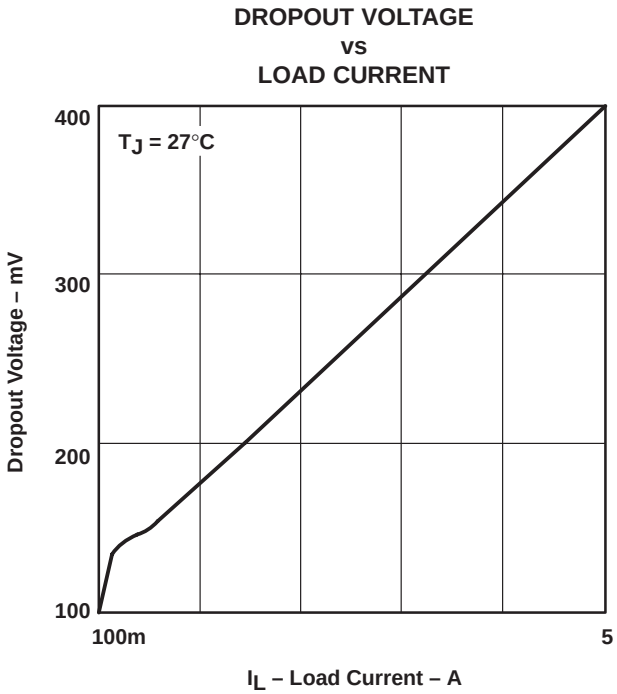


Figure 2

APPLICATION INFORMATION

The UC385 is easy to use. The adjustable version requires two resistors to set the output voltage. The fixed versions of the UC385 require no external resistors. All versions of the UC385 require decoupling capacitors on the input and output. In a typical application, VB and VIN are driven from switching power supplies that may have large filter capacitors at their outputs. If the UC385 is further than 12 inches from the power supply, it is recommended to add local decoupling as close as possible to the linear regulator.

Decouple the output of the UC385 with at least 100 μF of high quality tantalum or Sanyo OSCON capacitors close to the VOUT pin for maximum stability. Many applications involving ultra fast GTL or BTL applications require additional capacitance close to the load. The exact amount will vary according to speed and magnitude of the load transients and the tolerance allowed for transients on VOUT. When specifying the decoupling capacitors, the series resistance of the capacitor bank is an important factor in its ability to filter load transients.

The UC385 allows for Kelvin sensing the voltage at the load. This improves regulation performance and eliminates the voltage drops due to wire trace resistance. This voltage drop must be added to the headroom (VIN to VOUT and VB to VOUT). The dropout of 350 mV is measured at the pins and does not include additional drops due to trace resistance.

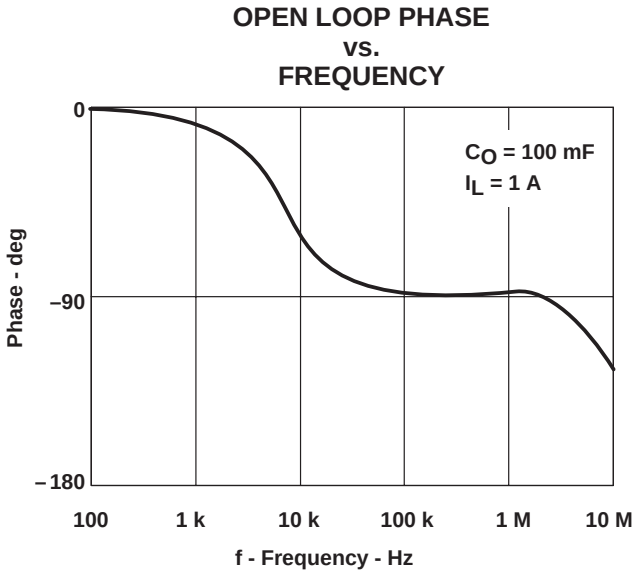


Figure 3

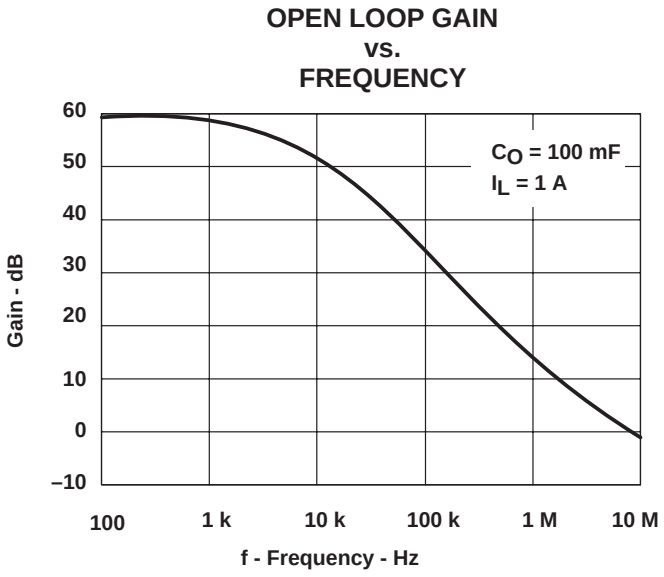


Figure 4

APPLICATION INFORMATION

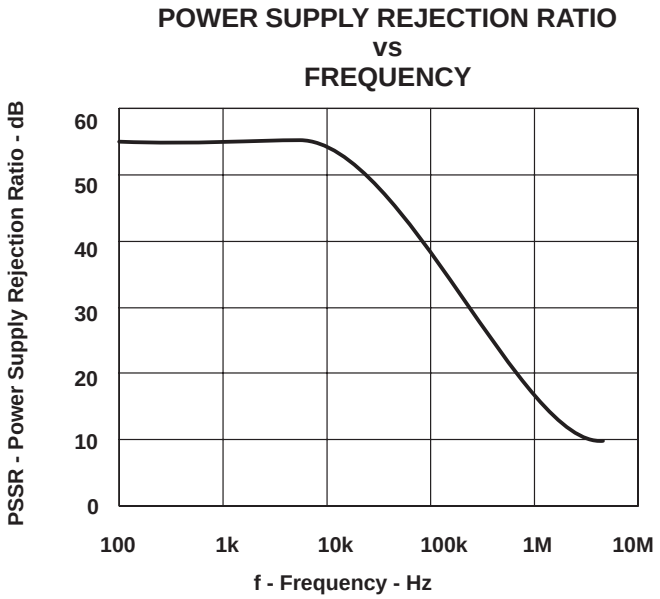


Figure 5

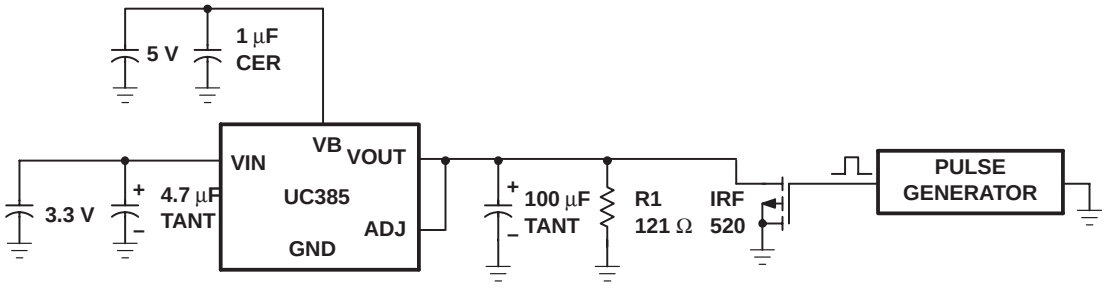


Figure 6. Transient Test Circuit

APPLICATION INFORMATION

10 mA to 3 A/μs Load Transient Response

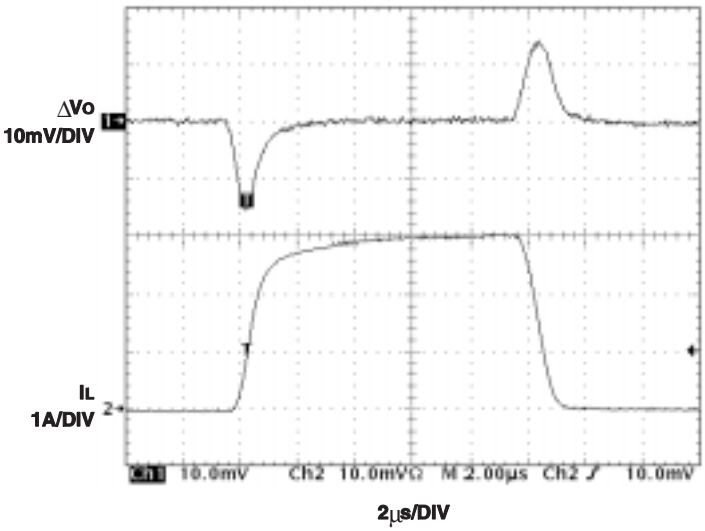


Figure 7

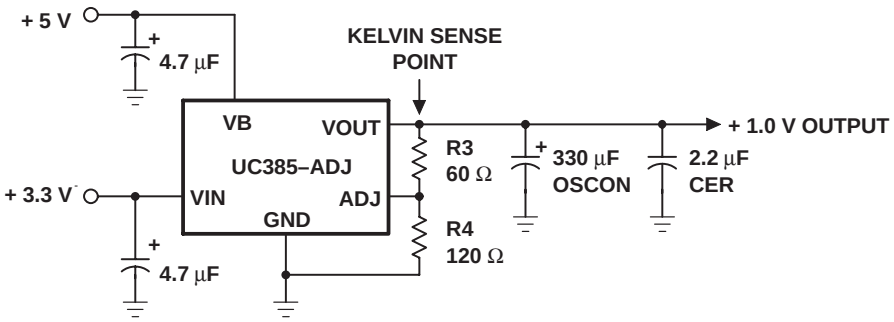


Figure 8. Typical UC385-ADJ Application

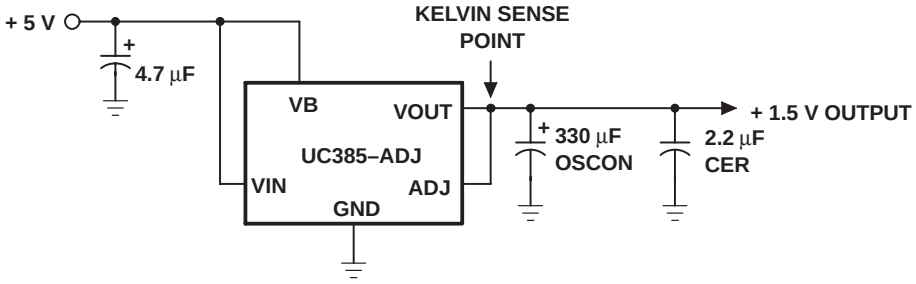


Figure 9. Typical UC385-1, -2, or -3 Application

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