INTEGRATED CIRCUITS
UNITRODE

UC1834
UC2834
UC3834

High Efficiency Linear Regulator

FEATURES

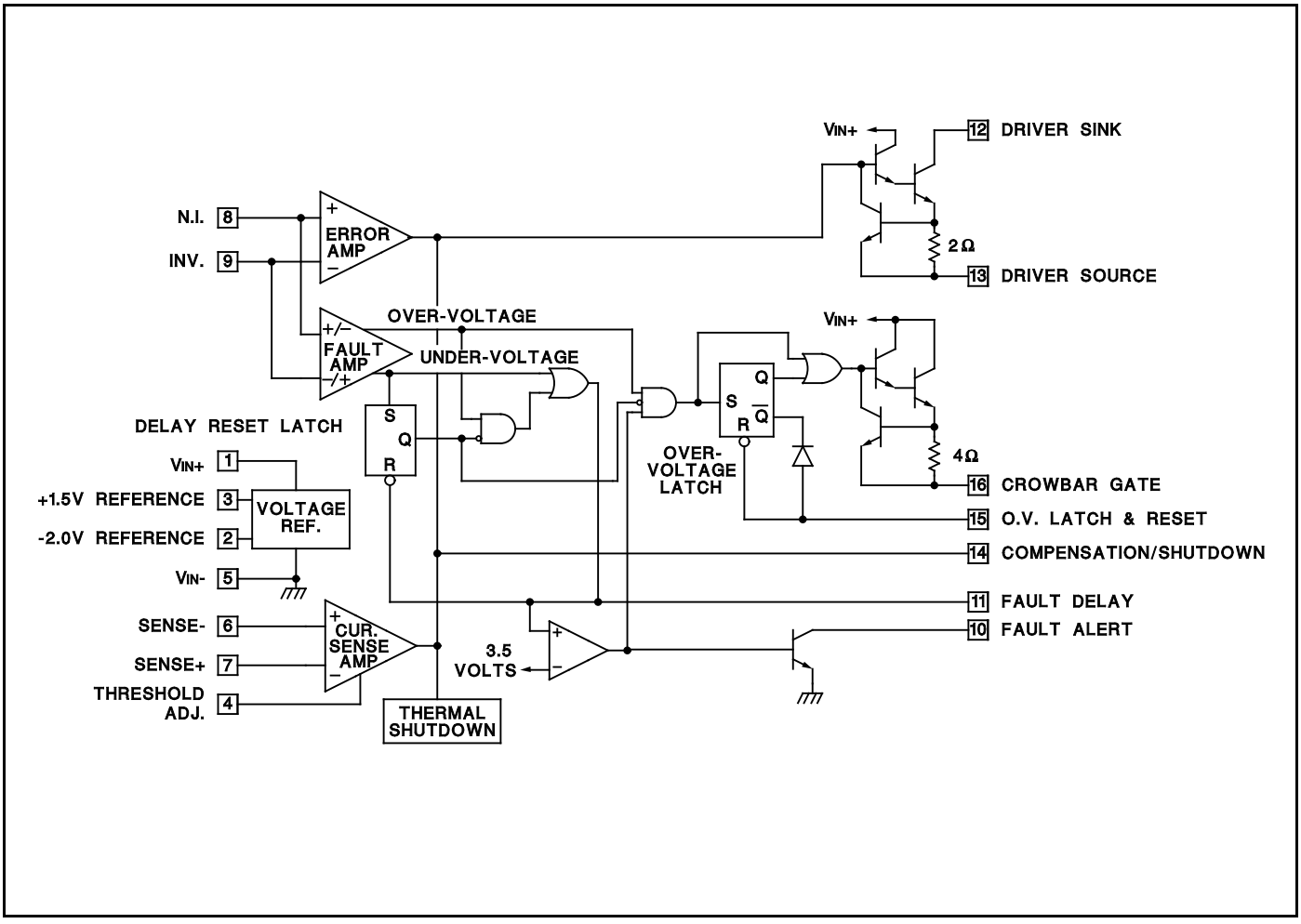
- Minimum V_{IN} - V_{OUT} Less Than 0.5V At 5A Load With External Pass Device
- Equally Usable For Either Positive or Negative Regulator Design
- Adjustable Low Threshold Current Sense Amplifier
- Under And Over-Voltage Fault Alert With Programmable Delay
- Over-Voltage Fault Latch With 100mA Crowbar Drive Output

DESCRIPTION

The UC1834 family of integrated circuits is optimized for the design of low input-output differential linear regulators. A high gain amplifier and 200mA sink or source drive outputs facilitate high output current designs which use an external pass device. With both positive and negative precision references, either polarity of regulator can be implemented. A current sense amplifier with a low, adjustable, threshold can be used to sense and limit currents in either the positive or negative supply lines.

In addition, this series of parts has a fault monitoring circuit which senses both under and over-voltage fault conditions. After a user defined delay for transient rejection, this circuitry provides a fault alert output for either fault condition. In the over-voltage case, a 100mA crowbar output is activated. An over-voltage latch will maintain the crowbar output and can be used to shutdown the driver outputs. System control to the device can be accommodated at a single input which will act as both a supply reset and remote shutdown terminal. These die are protected against excessive power dissipation by an internal thermal shutdown function.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Note 1)

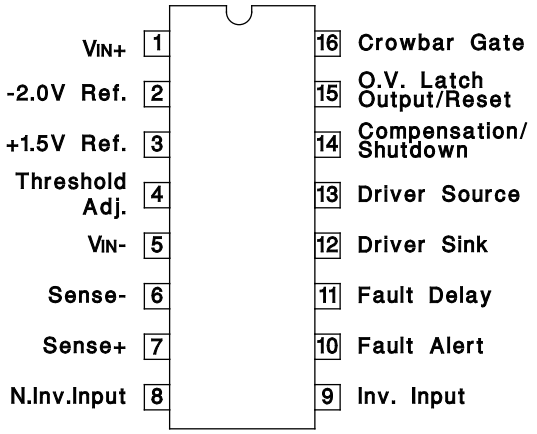
Input Supply Voltage, V_{IN} + ... 40V
Driver Current 400mA
Driver Source to Sink Voltage 40V
Crowbar Current . . . . . –200mA
+1.5V Reference Output Current . . . . . –10mA
Fault Alert Voltage 40V
Fault Alert Current 15mA
Error Amplifier Inputs . . . . . –0.5V to 35V
Current Sense Inputs . . . . . –0.5V to 40V
O.V. Latch Output Voltage . . . . . –0.5V to 40V
O.V. Latch Output Current 15mA

Power Dissipation at T_A = 25°C 1000mW
Power Dissipation at T_C = 25°C 2000mW
Operating Junction Temperature . . . . . –55°C to +150°C
Storage Temperature . . . . . –65°C to +150°C
Lead Temperature (soldering, 10 seconds) . . . . . 300°C

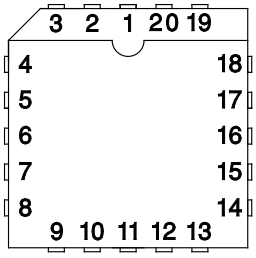
Note 1: Voltages are reference to V_{IN}–, Pin 5.
Currents are positive into, negative out of the specified terminals.
Consult Packaging section of Databook for thermal limitations and considerations of package.

CONNECTION DIAGRAMS

DIL-16, SOIC-16 (TOP VIEW)
J or N Package, DW Package



PLCC-20, LCC-20 (TOP VIEW)
Q, L Packages



PACKAGE PIN FUNCTION	
FUNCTION	**PIN**
N/C	1
V_{IN} +	2
–2.0V REF	3
+1.5V REF	4
Threshold Adjust	5
N/C	6
V_{IN}–	7
Sense–	8
Sense+	9
N.Inv. Input	10
N/C	11
Inv. Input	12
Fault Alert	13
Fault Delay	14
Driver Sink	15
N/C	16
Driver Source	17
Compensation/ Shutdown	18
O.V. Latch Output/Reset	19
Crowbar Gate	20

ELECTRICAL CHARACTERISTICS: Unless otherwise stated, these specifications apply for T_A=–55°C to +125°C for the UC1834, –40°C to +85°C for the UC2834, and 0°C to +70°C for the UC3834. V_{IN+} = 15V, V_{IN-} = 0V, T_A = T_J.

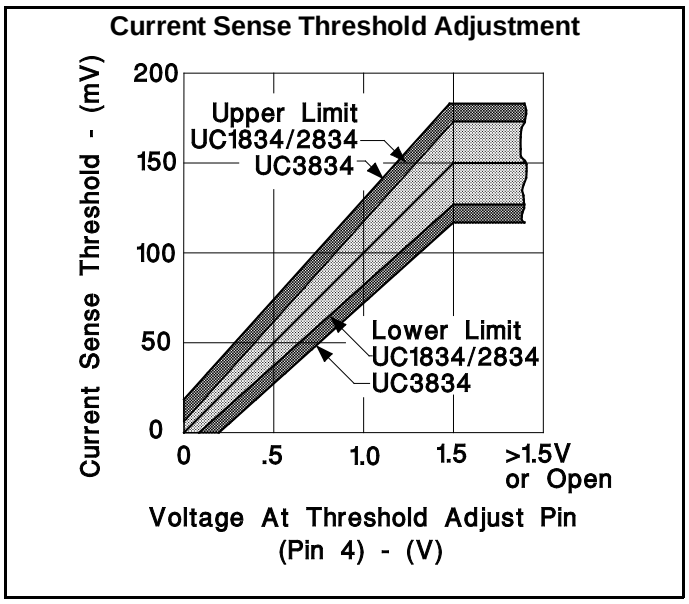
PARAMETER	TEST CONDITIONS	UC1834 UC2834			UC3834			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
Turn-on Characteristics								
Standby Supply Current			5.5	7		5.5	10	mA
+1.5 Volt Reference								
Output Voltage	T_J = 25°C	1.485	1.5	1.515	1.47	1.5	1.53	V
	$T_{J(MIN)} \le T_J \le T_{J(MAX)}$	1.47		1.53	1.455		1.545	
Line Regulation	V_{IN+} = 5 to 35V		1	10		1	15	mV
Load Regulation	I_{OUT} = 0 to 2mA		1	10		1	15	mV
-2.0 Volt Reference (Note 2)								
Output Voltage (Referenced to V_{IN}^+)	T_J = 25°C	–2.04	–2	–1.96	–2.06	–2	–1.94	V
	$T_{J(MIN)} \le T_J \le T_{J(MAX)}$	–2.06		–1.94	–2.08		–1.92	
Line Regulation	V_{IN+} = 5 to 35V		1.5	15		1.5	20	mV
Output Impedance			2.3			2.3		kΩ
Error Amplifier Section								
Input Offset Voltage	V_{CM} = 1.5V		1	6		1	10	mV
Input Bias Current	V_{CM} = 1.5V		–1	–4		–1	–8	µA
Input Offset Current	V_{CM} = 1.5V		0.1	1		0.1	2	µA
Small Signal Open Loop Gain	Output @ Pin 14, Pin 12 = V_{IN+} Pin 13, 20Ω to V_{IN-}	50	65		50	65		dB
CMRR	V_{CM} = 0.5 to 33V, V_{IN+} = 35V	60	80		60	80		dB
PSRR	V_{IN+} = 5 to 35V, V_{CM} = 1.5V	70	100		70	100		dB
Driver Section								
Maximum Output Current		200	350		200	350		mA
Saturation Voltage	I_{OUT} = 100mA		0.5	1.2		0.5	1.5	V
Output Leakage Current	Pin 12 = 35V, Pin 13 = V_{IN-}, Pin 14 = V_{IN-}		0.1	50		0.1	50	µA
Shutdown Input Voltage at Pin 14	$I_{OUT} \le$ 100µA, Pin 13 = V_{IN-}, Pin 12 = V_{IN+}	0.4	1		0.4	1		V
Shutdown Input Current at Pin 14	Pin 14 = V_{IN-}, Pin 12 = V_{IN+} $I_{OUT} \le$ 100µA, Pin 13 = V_{IN-}		–100	–150		–100	–150	µA
Thermal Shutdown (Note 3)			165			165		°C
Fault Amplifier Section								
Under- and Over-Voltage Fault Threshold	V_{CM} = 1.5V, @ E/A Inputs	120	150	180	110	150	190	mV
Common Mode Sensitivity	V_{IN+} = 35V, V_{CM} = 1.5 to 33V		–0.4	–0.8		–0.4	–1.0	%/v
Supply Sensitivity	V_{CM} = 1.5V, V_{IN+} = 5 to 35V		–0.5	–1.0		–0.5	–1.2	%/V
Fault Delay		30	45	60	30	45	60	ms/µF
Fault Alert Output Current		2	5		2	5		mA
Fault Alert Saturation Voltage	I_{OUT} = 1mA		0.2	0.5		0.2	0.5	V
O.V. Latch Output Current		2	4		2	4		mA
O.V. Latch Saturation Voltage	I_{OUT} = 1mA		1.0	1.3		1.0	1.3	V
O.V. Latch Output Reset Voltage		0.3	0.4	0.6	0.3	0.4	0.6	V
Crowbar Gate Current		–100	–175		–100	–175		mA
Crowbar Gate Leakage Current	V_{IN+} = 35V, Pin 16 = V_{IN-}		–0.5	–50		–0.5	–50	µA

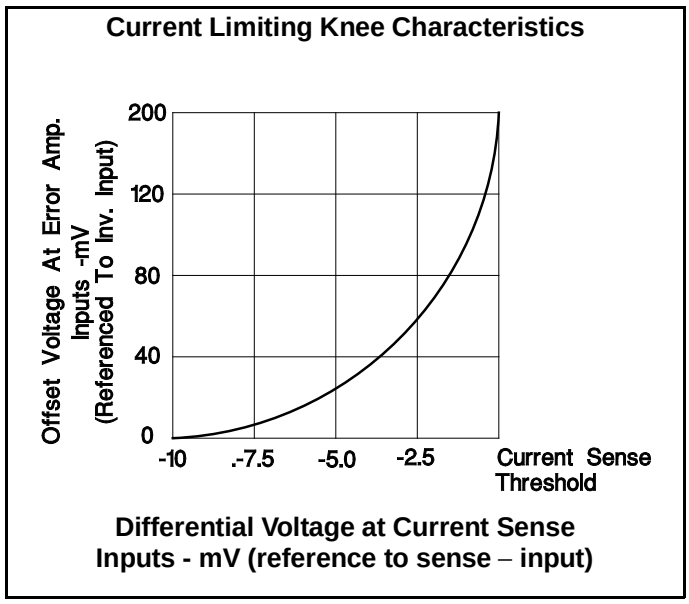
Note 2: When using both the 1.5V and –2.0V references the current out of pin 3 should be balanced by an equivalent current into Pin 2. The –2.0V output will change –2.3mV per µA of imbalance.

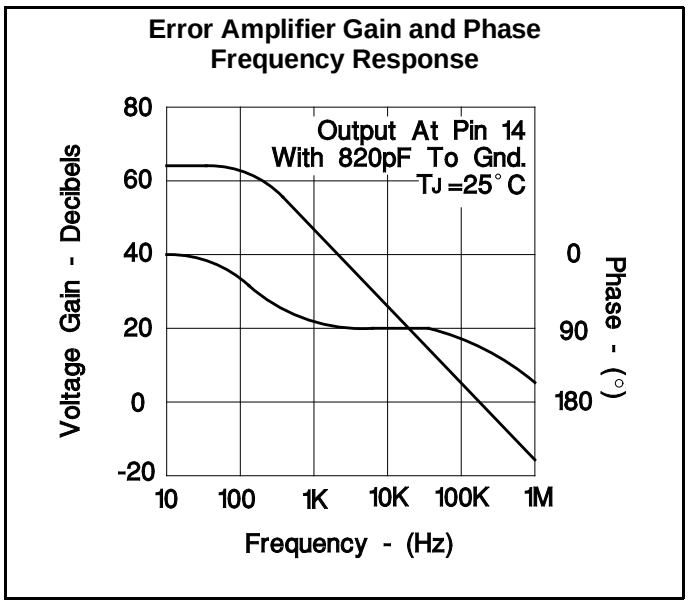
Note 3: Thermal shutdown turns off the driver. If Pin 15 (O.V. Latch Output) is tied to Pin 14 (Compensation/Shutdown) the O.V. Latch will be reset.

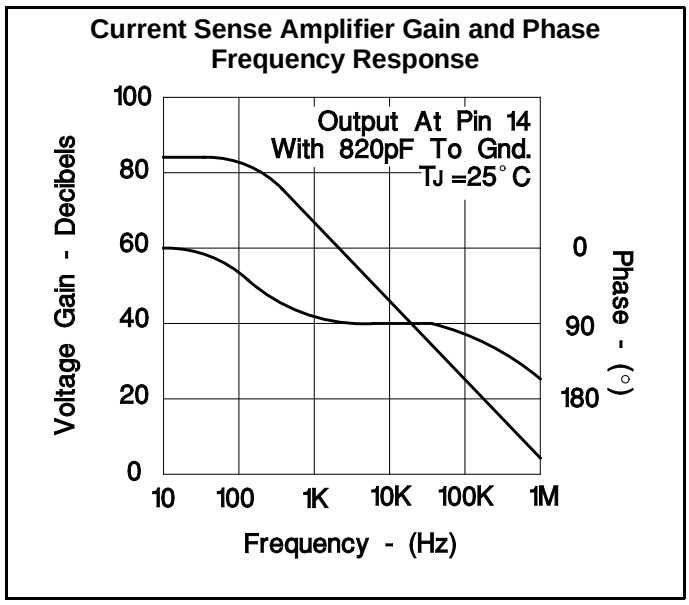
ELECTRICAL CHARACTERISTICS: Unless otherwise stated, these specifications apply for T_A=–55°C to +125°C for the UC1834, –40°C to +85°C for the UC2834, and 0°C to +70°C for the UC3834. V_{IN+} = 15V, V_{IN-} = 0V. $T_A = T_J$

PARAMETER	TEST CONDITIONS	UC1834 UC2834			UC3834			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
Current Sense Amplifier Section								
Threshold Voltage	Pin 4 Open, $V_{CM} = V_{IN+}$ or V_{IN-}	130	150	170	120	150	180	mV
	Pin 4 = 0.5V, $V_{CM} = V_{IN+}$ or V_{IN-}	40	50	60	30	50	70	
Threshold Supply Sensitivity	Pin 4 Open, $V_{CM} = V_{IN-}$, V_{IN+} = 5 to 35V		–0.1	–0.3		–0.1	–0.5	%/V
Adj. Input Current	Pin 4 = 0.5V		–2	–10		–2	–10	µA
Sense Input Bias Current	$V_{CM} = V_{IN+}$		100	200		100	200	µA
	$V_{CM} = V_{IN-}$		–100	–200		–100	–200	



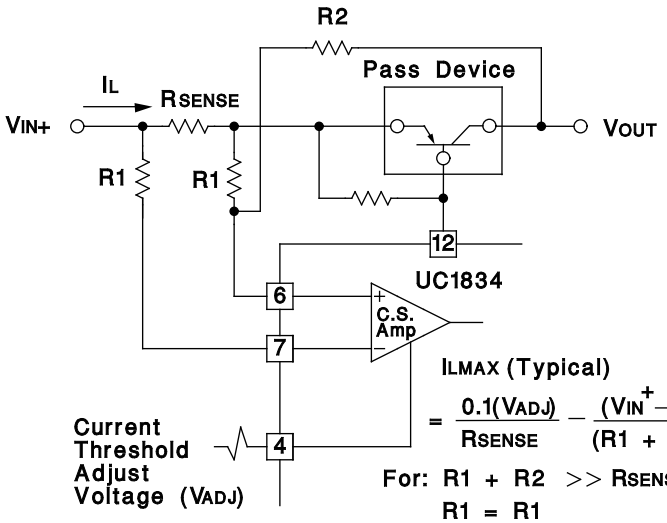






APPLICATION INFORMATION

Foldback Current Limiting



$$I_{LMAX}\ (Typical) = \frac{0.1(V_{ADJ})}{R_{SENSE}} - \frac{(V_{IN}^{+} - V_{OUT})\ R1}{(R1 + R2)\ R_{SENSE}},$$

For: $R1 + R2 >> R_{SENSE}$, $V_{ADJ} \leq 1.5V$, $R1 = R1$

Both the current sense and error amplifiers on the UC1834 are transconductance type amplifiers. As a result, their voltage gain is a direct function of the load impedance at their shared output pin, Pin 14. Their small signal voltage gain as a function of load and frequency is nominally given by;

$$A_{V\ E/A} = \frac{Z_L(f)}{700\Omega} \text{ and } A_{V\ C.S./A} = \frac{Z_L(f)}{70\Omega}$$

for: $f \leq 500kHz$ and $|Z_L(f)| \leq 1\ M\Omega$

Where:

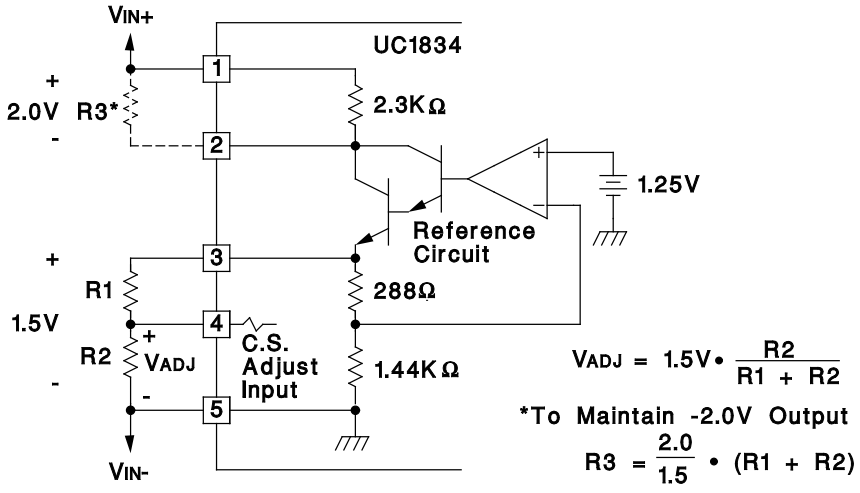
A_V=Small Signal Voltage Gain to pin 14.

$Z_L(f)$ = Load Impedance at Pin 14.

The UC1834 fault delay circuitry prevents the fault outputs from responding to transient fault conditions. The delay reset latch insures that the full, user defined, delay passes before an over-voltage fault response occurs. This prevents unnecessary crowbar, or latched-off conditions, from occurring following sharp under-voltage to over-voltage transients.

The crowbar output on the UC1834 is activated following a sustained over-voltage condition. The crowbar output remains high as long as the fault condition persists, or, as long as the over-voltage latch is set. The latch is set with an over-voltage fault if the voltage at Pin 15 is above the latch reset threshold, typically 0.4V. When the latch is set, its Q– output will pull Pin 15 low through a series diode. As long as a nominal pull-up load exists, the series diode prevents Q– from pulling Pin 15 below the reset threshold. However, Pin 15 is pulled low enough to disable the driver outputs if Pins 15 and 14 are tied together. With Pin 15 and 14 common, the regulator will latch off in response to an over-voltage fault. If the fault condition is cleared and Pins 14 and 15 are momentarily pulled below the latch reset threshold, the driver outputs are re-enabled.

Setting the Threshold Adjust Voltage (V_{ADJ})



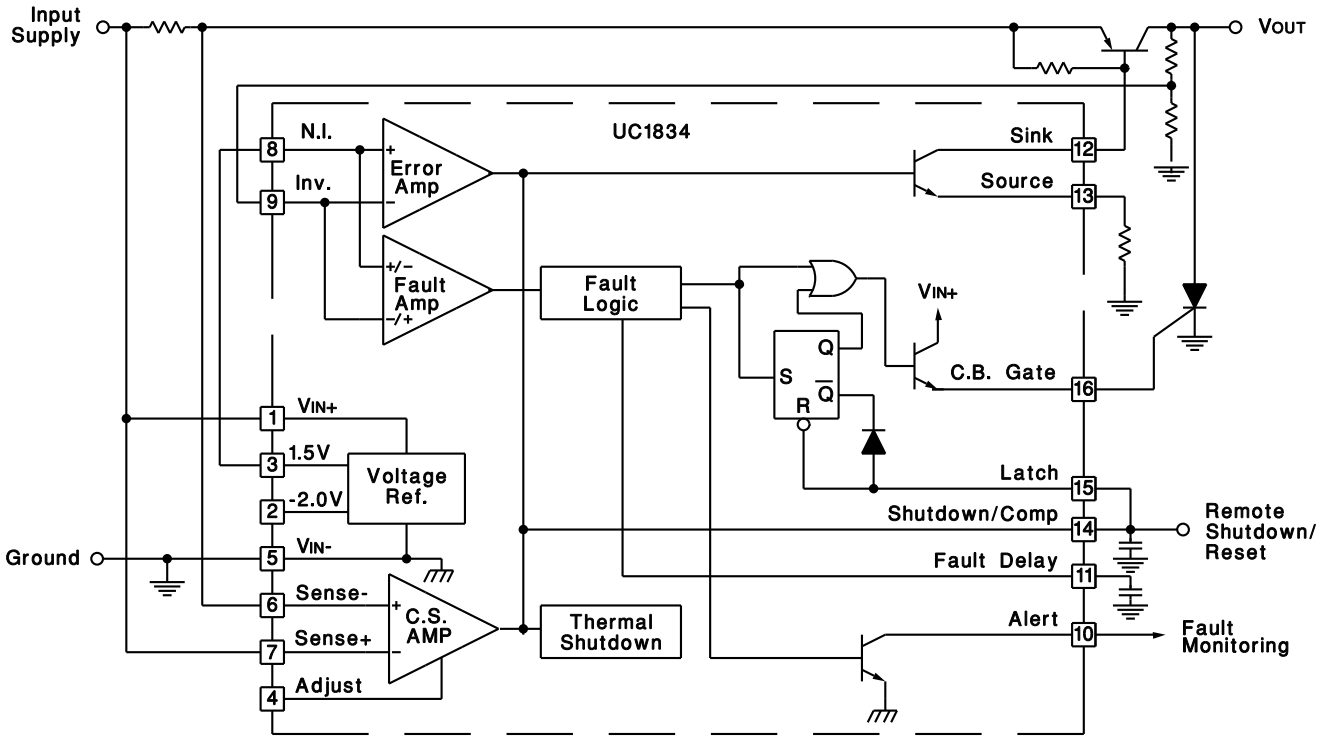
$$V_{ADJ} = 1.5V \bullet \frac{R2}{R1 + R2}$$

*To Maintain -2.0V Output

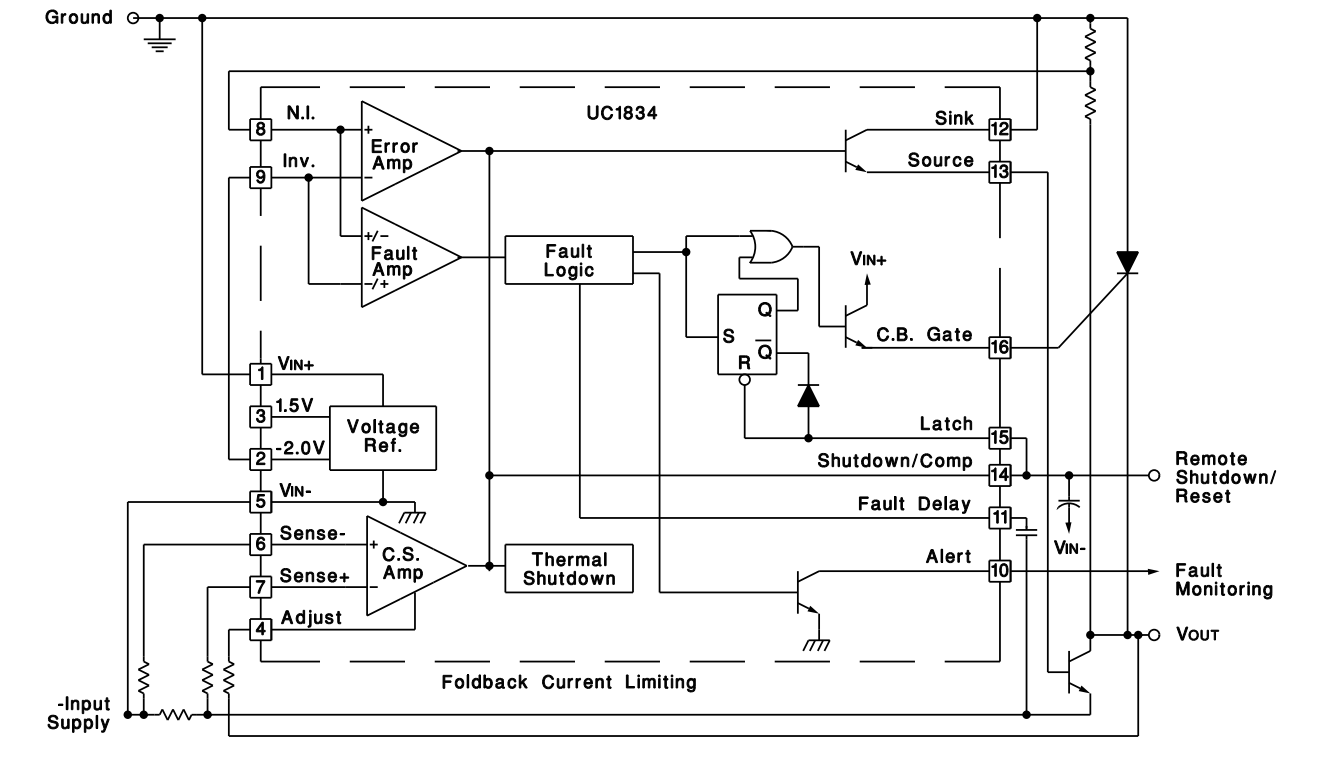
$$R3 = \frac{2.0}{1.5} \bullet (R1 + R2)$$

TYPICAL APPLICATIONS

5-10 Amp Positive Regulator



5-10 Amp Negative Regulator



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PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
5962-87742012A	Active	Production	LCCC (FK) | 20	55 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-87742012A UC1834L/ 883B
5962-8774201EA	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8774201EA UC1834J/883B
5962-8774201V2A	Active	Production	LCCC (FK) | 20	55 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8774201V2A UC1834L QMLV
5962-8774201V2A.A	Active	Production	LCCC (FK) | 20	55 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8774201V2A UC1834L QMLV
5962-8774201VEA	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8774201VEA UC1834JQMLV
5962-8774201VEA.A	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8774201VEA UC1834JQMLV
UC1834J	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	UC1834J
UC1834J.A	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	UC1834J
UC1834J883B	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8774201EA UC1834J/883B
UC1834J883B.A	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8774201EA UC1834J/883B
UC1834L	Active	Production	LCCC (FK) | 20	55 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	UC1834L
UC1834L.A	Active	Production	LCCC (FK) | 20	55 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	UC1834L
UC1834L883B	Active	Production	LCCC (FK) | 20	55 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-87742012A UC1834L/ 883B

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
UC1834L883B.A	Active	Production	LCCC (FK) | 20	55 | TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-87742012A UC1834L/ 883B
UC2834DW	Active	Production	SOIC (DW) | 16	40 | TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	UC2834DW
UC2834DW.A	Active	Production	SOIC (DW) | 16	40 | TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	UC2834DW
UC2834J	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-40 to 85	UC2834J
UC2834J.A	Active	Production	CDIP (J) | 16	25 | TUBE	No	SNPB	N/A for Pkg Type	-40 to 85	UC2834J
UC3834DW	Active	Production	SOIC (DW) | 16	40 | TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	0 to 70	UC3834DW
UC3834DW.A	Active	Production	SOIC (DW) | 16	40 | TUBE	Yes	NIPDAU	Level-2-260C-1 YEAR	0 to 70	UC3834DW

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

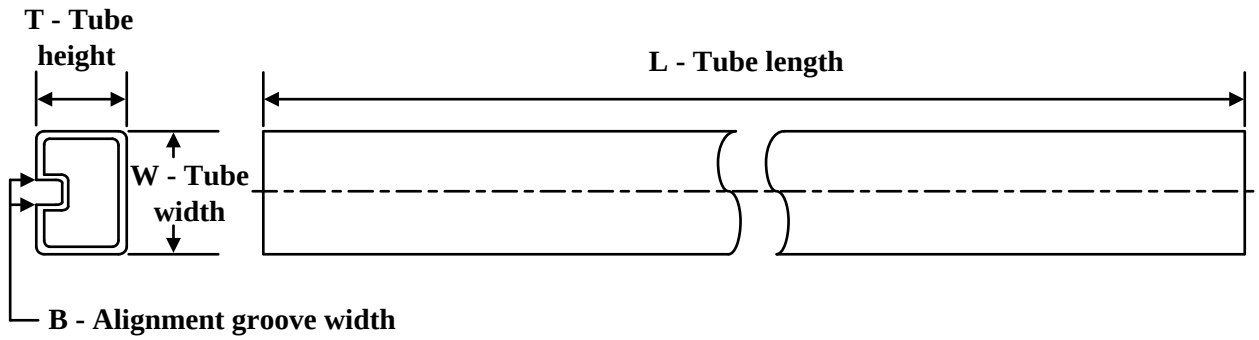
OTHER QUALIFIED VERSIONS OF UC1834, UC1834-SP, UC2834, UC2834M, UC3834 :

- Catalog : UC3834, UC1834, UC2834
- Military : UC2834M, UC1834
- Space : UC1834-SP

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
5962-87742012A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-8774201V2A	FK	LCCC	20	55	506.98	12.06	2030	NA
5962-8774201V2A.A	FK	LCCC	20	55	506.98	12.06	2030	NA
UC1834L	FK	LCCC	20	55	506.98	12.06	2030	NA
UC1834L.A	FK	LCCC	20	55	506.98	12.06	2030	NA
UC1834L883B	FK	LCCC	20	55	506.98	12.06	2030	NA
UC1834L883B.A	FK	LCCC	20	55	506.98	12.06	2030	NA
UC2834DW	DW	SOIC	16	40	507	12.83	5080	6.6
UC2834DW.A	DW	SOIC	16	40	507	12.83	5080	6.6
UC3834DW	DW	SOIC	16	40	507	12.83	5080	6.6
UC3834DW.A	DW	SOIC	16	40	507	12.83	5080	6.6

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