INTEGRATED CIRCUITS
UNITRODE

UC1834
UC2834
UC3834

High Efficiency Linear Regulator

FEATURES

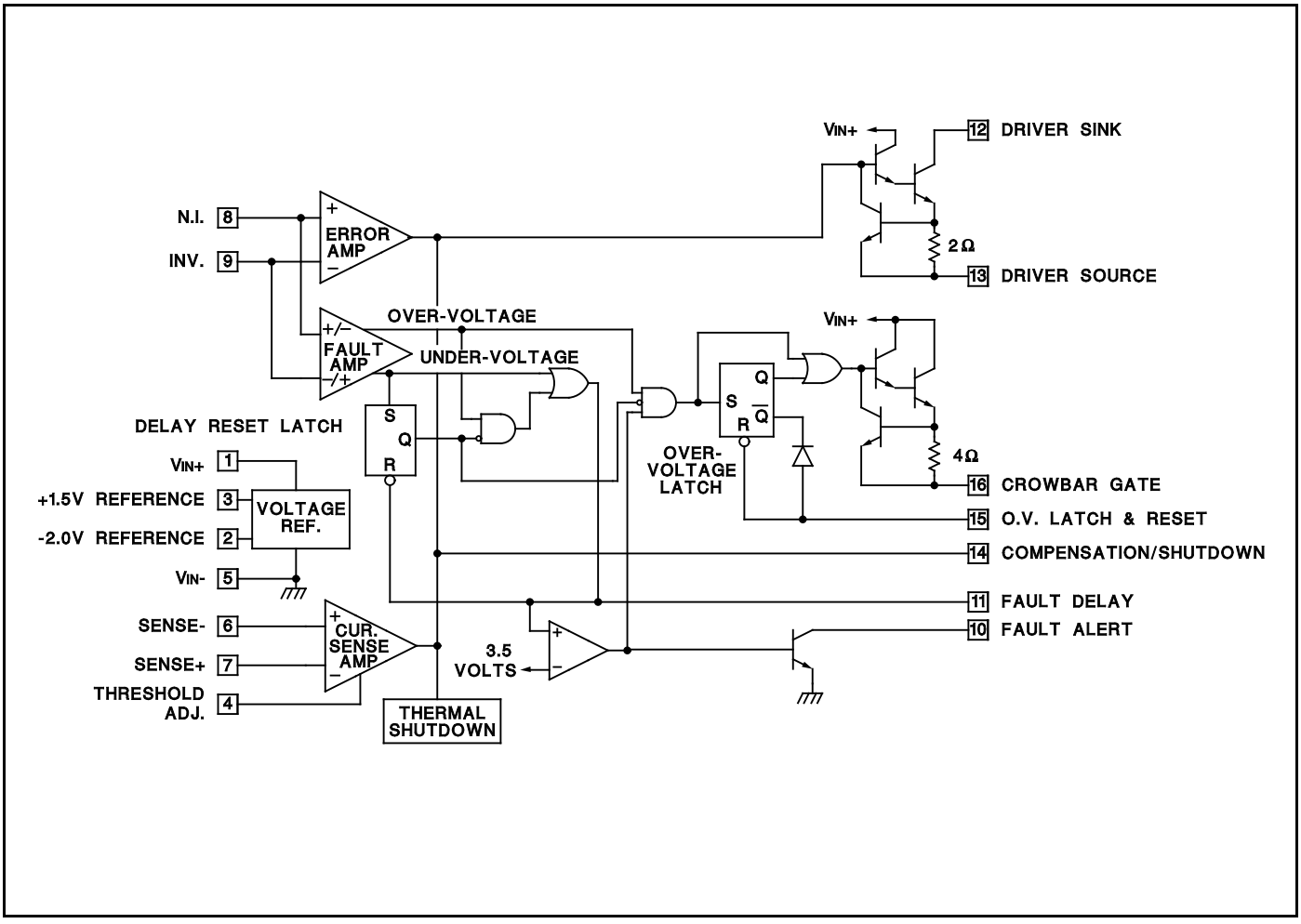
- Minimum V_{IN} - V_{OUT} Less Than 0.5V At 5A Load With External Pass Device
- Equally Usable For Either Positive or Negative Regulator Design
- Adjustable Low Threshold Current Sense Amplifier
- Under And Over-Voltage Fault Alert With Programmable Delay
- Over-Voltage Fault Latch With 100mA Crowbar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

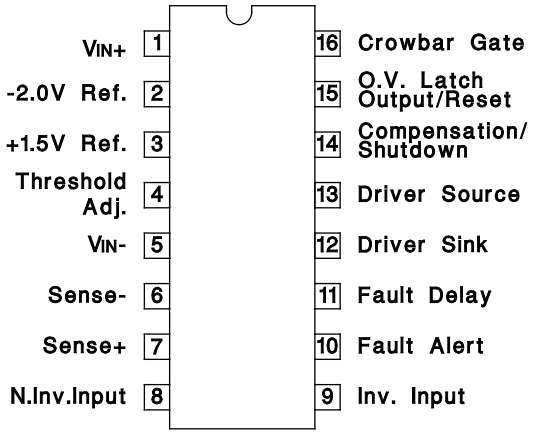
Input Supply Voltage, V_{IN} + ... 40V
Driver Current 400mA
Driver Source to Sink Voltage 40V
Crowbar Current . . . . . –200mA
+1.5V Reference Output Current . . . . . –10mA
Fault Alert Voltage 40V
Fault Alert Current 15mA
Error Amplifier Inputs . . . . . –0.5V to 35V
Current Sense Inputs . . . . . –0.5V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

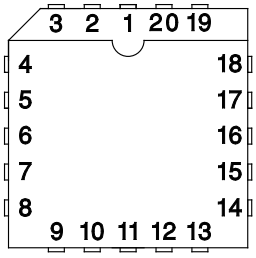
Note 1: Voltages are reference to V_{IN}–, Pin 5.
Currents are positive into, negative out of the specified terminals.
Consult Packaging section of Databook for thermal limitations and considerations of package.

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.

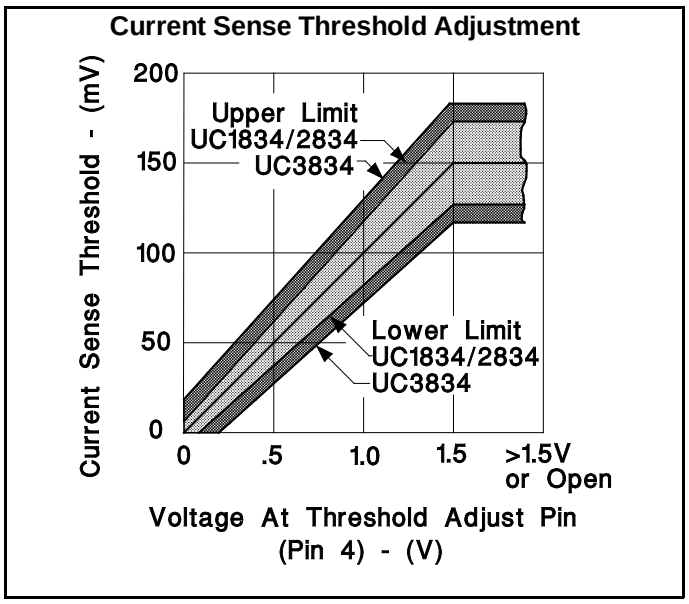
PARAMETER	TEST CONDITIONS	UC1834 UC2834			UC3834			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
Turn-on Characteristics								
Standby Supply Current			5.5	7		5.5	10	mA
+1.5 Volt Reference								
Output Voltage	T_J = 25°C	1.485	1.5	1.515	1.47	1.5	1.53	V
	$T_{J(MIN)} \le T_J \le T_{J(MAX)}$	1.47		1.53	1.455		1.545	
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

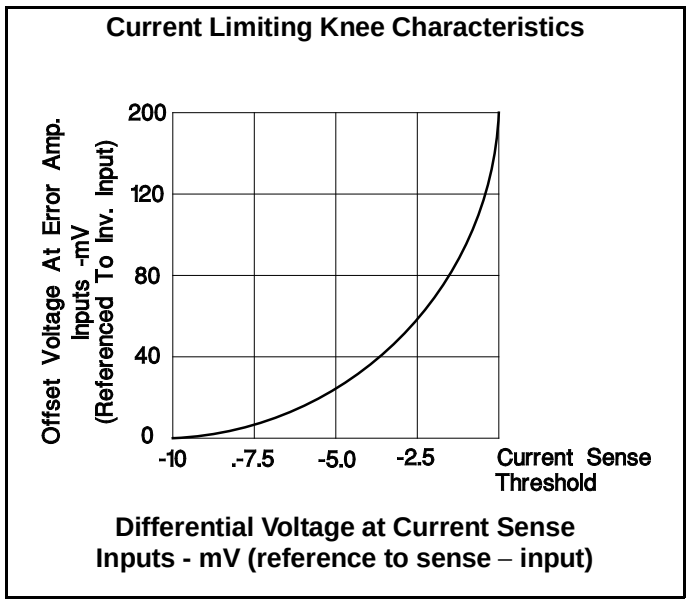
Note 2: When using both the 1.5V and –2.0V references the current out of pin 3 should be balanced by an equivalent current into Pin 2. The –2.0V output will change –2.3mV per µA of imbalance.

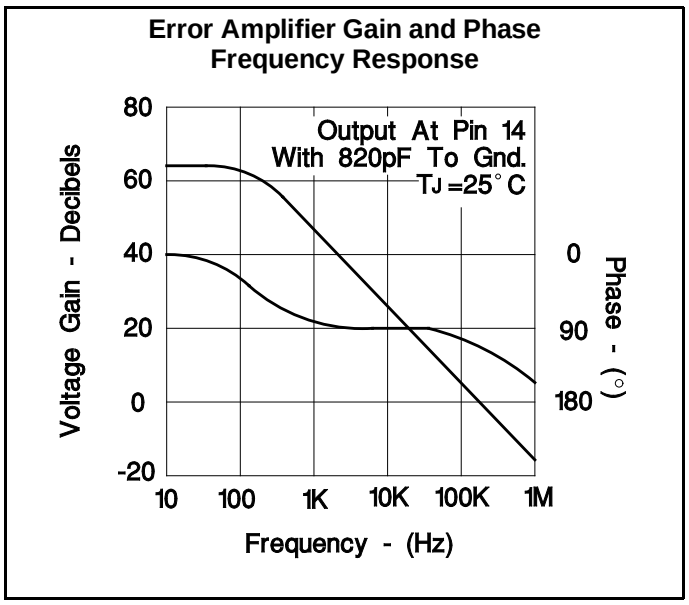
Note 3: Thermal shutdown turns off the driver. If Pin 15 (O.V. Latch Output) is tied to Pin 14 (Compensation/Shutdown) the O.V. Latch will be reset.

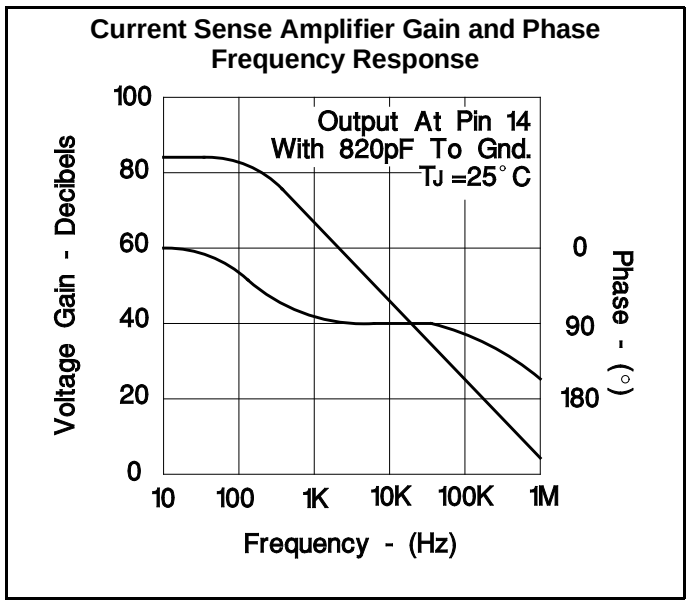
ELECTRICAL CHARACTERISTICS: Unless otherwise stated, these specifications apply for T_A=–55°C to +125°C for the UC1834, –40°C to +85°C for the UC2834, and 0°C to +70°C for the UC3834. V_{IN+} = 15V, V_{IN-} = 0V. $T_A = T_J$

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	



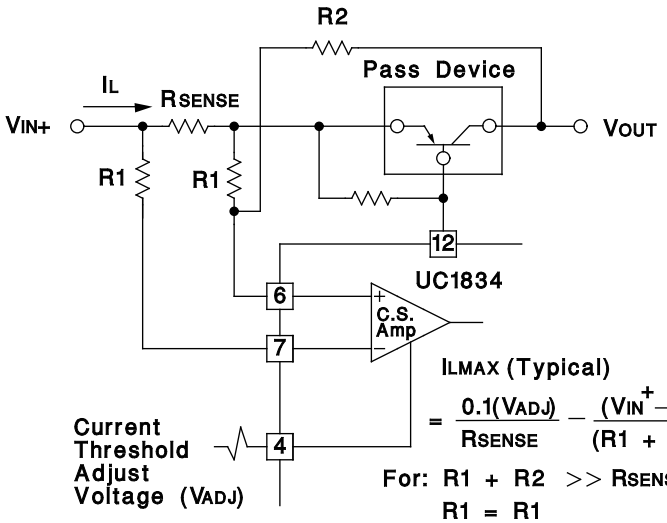






APPLICATION INFORMATION

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:

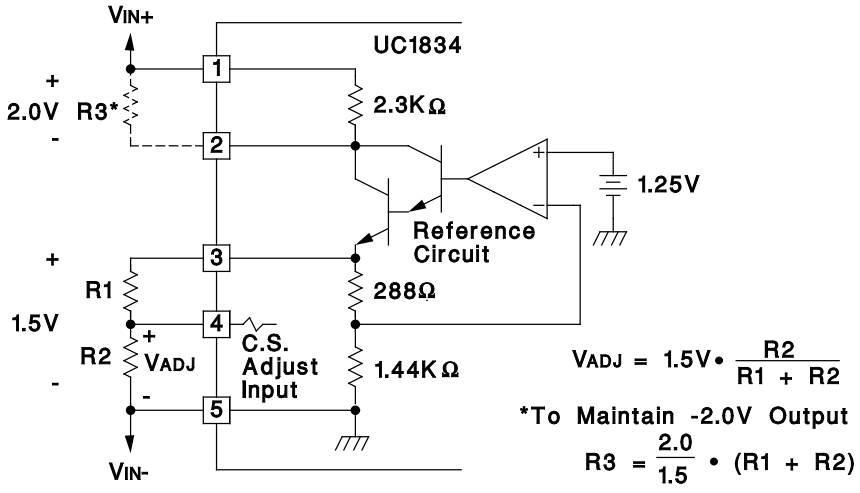
A_V=Small Signal Voltage Gain to pin 14.

$Z_L(f)$ = 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})



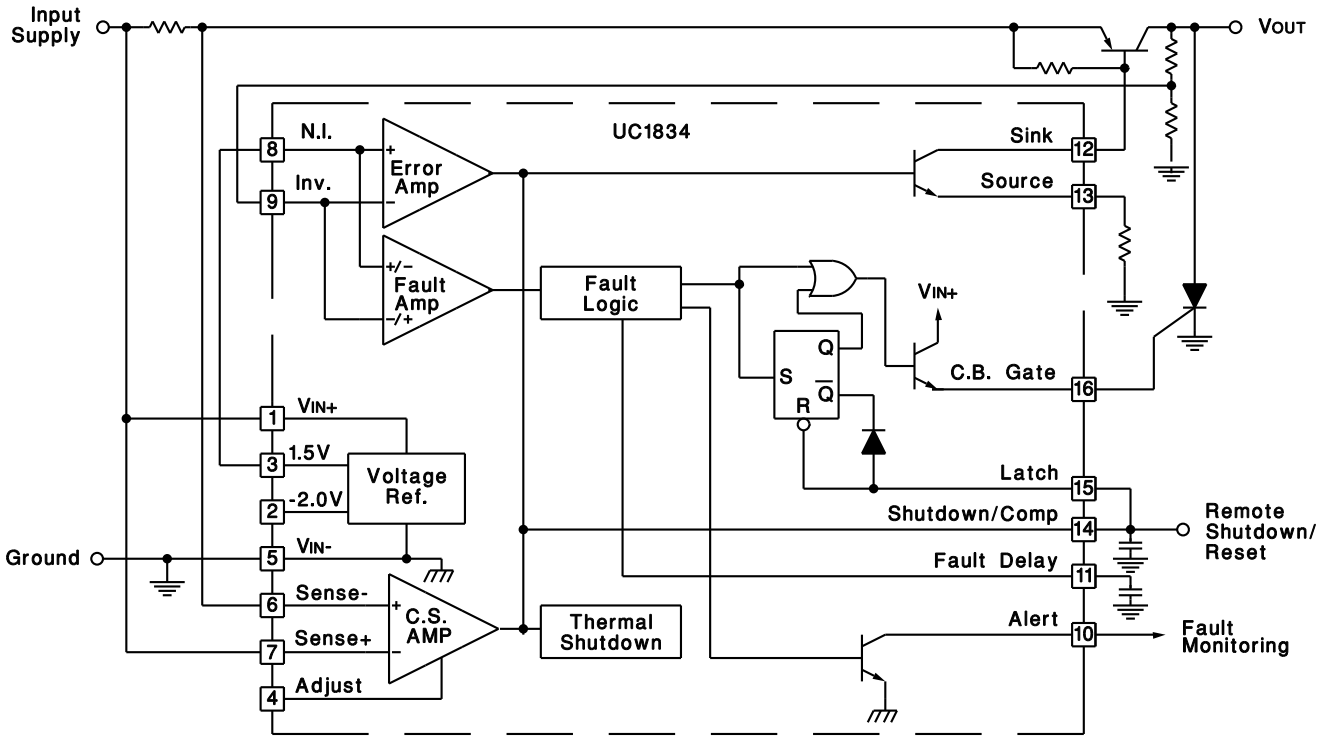
$$V_{ADJ} = 1.5V \bullet \frac{R2}{R1 + R2}$$

*To Maintain -2.0V Output

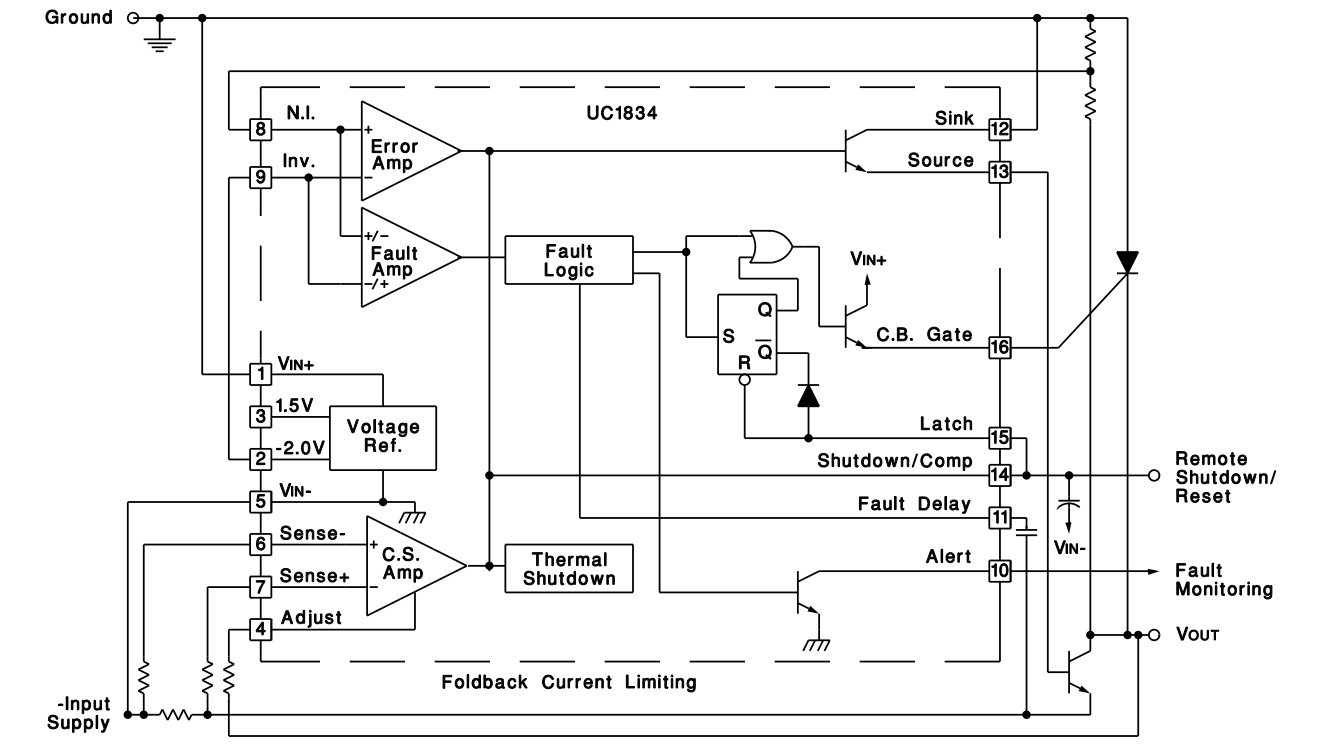
$$R3 = \frac{2.0}{1.5} \bullet (R1 + R2)$$

TYPICAL APPLICATIONS

5-10 Amp Positive Regulator



5-10 Amp Negative Regulator



UNITRODE CORPORATION
7 CONTINENTAL BLVD. • MERRIMACK, NH 03054
TEL. (603) 424-2410 • FAX (603) 424-3460

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-87742012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962-87742012A UC1834L/ 883B	Samples
5962-8774201EA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8774201EA UC1834J/883B	Samples
5962-8774201V2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962-8774201V2A UC1834L QMLV	Samples
5962-8774201VEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8774201VEA UC1834JQMLV	Samples
UC1834J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	UC1834J	Samples
UC1834J883B	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8774201EA UC1834J/883B	Samples
UC1834L	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	UC1834L	Samples
UC1834L883B	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962-87742012A UC1834L/ 883B	Samples
UC2834DW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	UC2834DW	Samples
UC2834DWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	UC2834DW	Samples
UC2834DWTR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	UC2834DW	Samples
UC2834DWTRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	UC2834DW	Samples
UC2834J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-40 to 85	UC2834J	Samples
UC2834Q	ACTIVE	PLCC	FN	20	46	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	-40 to 85	UC2834Q	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
UC2834QG3	ACTIVE	PLCC	FN	20	46	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	-40 to 85	UC2834Q	Samples
UC3834DW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	0 to 70	UC3834DW	Samples
UC3834DWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	0 to 70	UC3834DW	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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

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

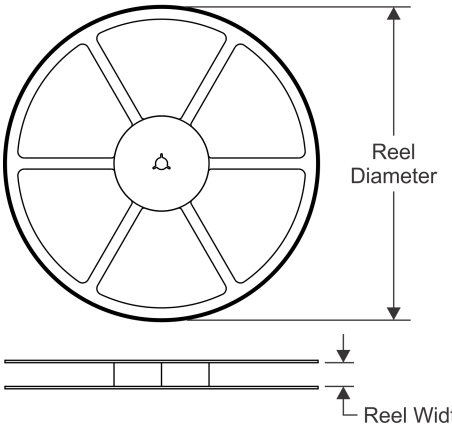
- Catalog: UC3834, UC1834, UC2834
- Military: UC2834M, UC1834
- Space: UC1834-SP

NOTE: Qualified Version Definitions:

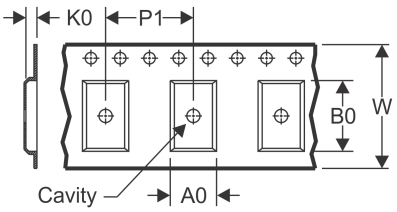
- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

TAPE AND REEL INFORMATION

REEL DIMENSIONS

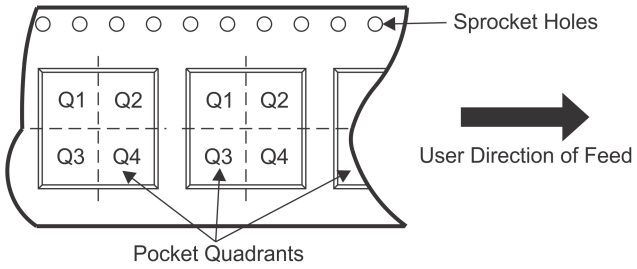


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

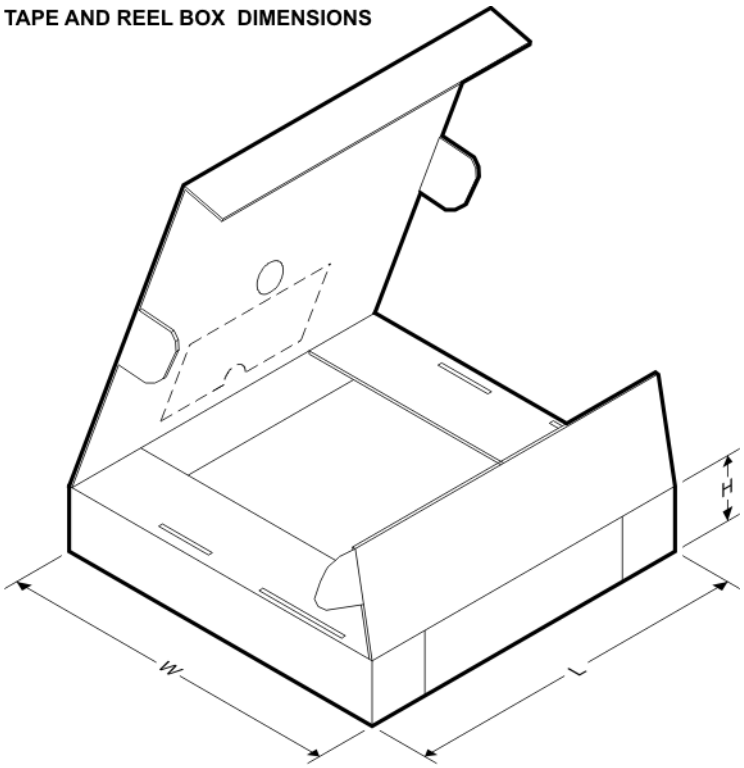
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
UC2834DWTR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
UC2834DWTR	SOIC	DW	16	2000	367.0	367.0	38.0

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265