

# High Efficiency Regulator Controller

## FEATURES

- Complete Control for a High Current, Low Dropout, Linear Regulator
- Fixed 5V or Adjustable Output Voltage
- Accurate 2.5A Current Limiting with Foldback
- Internal Current Sense Resistor
- Remote Sense for Improved Load Regulation
- External Shutdown
- Under-Voltage Lockout and Reverse Voltage Protection
- Thermal Shutdown Protection
- 8 Pin Mini-Dip Package  
(Surface Mount also Available)

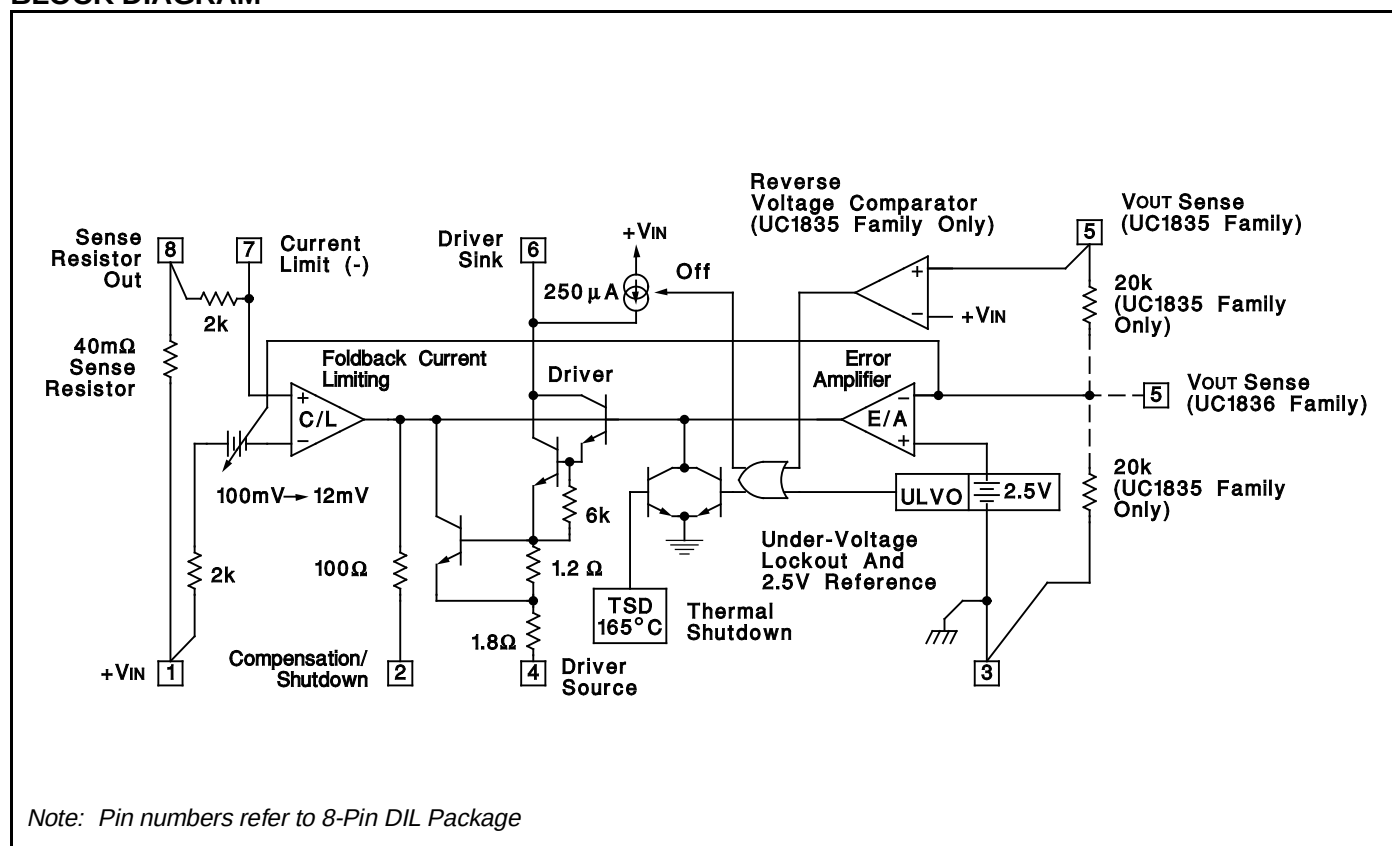
## DESCRIPTION

The UC1835/6 families of linear controllers are optimized for the design of low cost, low dropout, linear regulators. Using an external pass element, dropout voltages of less than 0.5V are readily obtained. These devices contain a high gain error amplifier, a 250mA output driver, and a precision reference. In addition, current sense with foldback provides for a 2.5A peak output current dropping to less than 0.5A at short circuit.

These devices are available in fixed, 5V, (UC1835), or adjustable, (UC1836), versions. In the fixed 5 volt version, the only external parts required are an external pass element, an output capacitor, and a compensation capacitor. On the adjustable version the output voltage can be set anywhere from 2.5V to 35V with two external resistors.

Additional features of these devices include under-voltage lockout for predictable start-up, thermal shutdown and short circuit current limiting to protect the driver device. On the fixed voltage version, a reverse voltage comparator minimizes reverse load current in the event of a negative input to output differential.

## BLOCK DIAGRAM



## ABSOLUTE MAXIMUM RATINGS (Note 1)

Input Supply Voltage (+VIN) . . . . . -1.0V to +40V  
Driver Output Current (Sink or Source) . . . . . 600mA  
Driver Source to Sink Voltage . . . . . +40V  
Maximum Current Through Sense Resistor. . . . . 4A  
VOUT Sense Input Voltage . . . . . -3V to +40V  
Power Dissipation at TA = 25°C (Note 2) . . . . . 1000mW  
Power Dissipation at Tc = 25°C (Note 2) . . . . . 2000mW

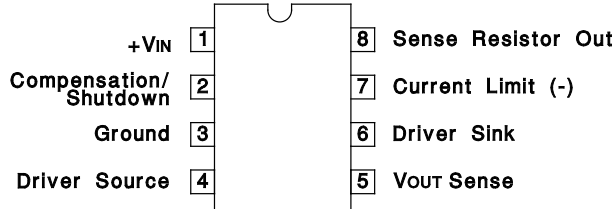
Operating Junction Temperature . . . . . -55°C to +150°C  
Storage Temperature . . . . . -65°C to +150°C  
Lead Temperature (Soldering, 10 Seconds) . . . . . 300°C

Note 1: Voltages are referenced to ground, (Pin 3). Currents are positive into, negative out of, the specified terminals.

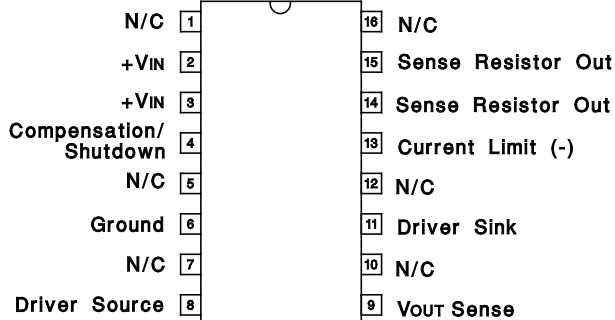
Consult Packaging Section of Databook for thermal considerations and limitations of packages.

## CONNECTION DIAGRAMS

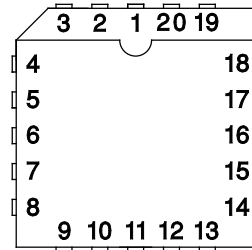
### DIL-8, SOIC-8 (TOP VIEW) N or J Package, D Package



### SOIC-16 (TOP VIEW) DW Package



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



| PACKAGE PIN FUNCTION      |     |
|---------------------------|-----|
| FUNCTION                  | PIN |
| N/C                       | 1   |
| +VIN                      | 2   |
| +VIN                      | 3   |
| N/C                       | 4   |
| Compensation/<br>Shutdown | 5   |
| N/C                       | 6   |
| Ground                    | 7   |
| N/C                       | 8   |
| N/C                       | 9   |
| Driver Source             | 10  |
| N/C                       | 11  |
| VOUT Sense                | 12  |
| N/C                       | 13  |
| N/C                       | 14  |
| Driver Sink               | 15  |
| N/C                       | 16  |
| Current Limit (-)         | 17  |
| N/C                       | 18  |
| Sense Resistor Out        | 19  |
| Sense Resistor Out        | 20  |

**ELECTRICAL CHARACTERISTICS:** Unless otherwise stated, specifications hold for TA = 0°C to +70°C for the UC3835/6, -25°C to +85°C for the UC2835/6, and -55°C to +125°C for the UC1835/6, +VIN = 6V, Driver Source= 0V, Driver Sink = 5V, TA = TJ.

| PARAMETER                                                          | TEST CONDITIONS                     | MIN. | TYP. | MAX. | UNITS |
|--------------------------------------------------------------------|-------------------------------------|------|------|------|-------|
| <b>Input Supply</b>                                                |                                     |      |      |      |       |
| Supply Current                                                     | +VIN = 6V                           |      | 2.75 | 4.0  | mA    |
|                                                                    | +VIN = 40V                          |      | 3.75 | 6.0  | mA    |
| UVLO Threshold                                                     | +VIN Low to High, VOUT Sense = 0V   | 3.9  | 4.4  | 4.9  | V     |
| Threshold Hysteresis                                               |                                     |      | 0.1  | 0.35 | V     |
| Reverse Current                                                    | +VIN = -1.0V, Driver Sink Open      |      | 6.0  | 20   | mA    |
| <b>Regulating Voltage and Error Amplifier (UC1835 Family Only)</b> |                                     |      |      |      |       |
| Regulating Level at VOUT Sense (VREG)                              | Driver Current = 10mA, TJ = 25°C    | 4.94 | 5.0  | 5.06 | V     |
|                                                                    | Over Temperature                    | 4.9  |      | 5.1  | V     |
| Line Regulation                                                    | +VIN = 5.2V + 35V                   |      | 15   | 40   | mV    |
| Load Regulation                                                    | Driver Current = 0 to 250mA         |      | 6.0  | 25   | mV    |
| Bias Current at VOUT Sense                                         | VOUT Sense = 5.0V                   | 75   | 125  | 210  | μA    |
| Error Amp Transconductance                                         | ±100μA at Compensation/Shutdown Pin | 0.8  | 1.3  | 2.0  | mS    |
| Maximum Compensation Output Current                                | Sink or Source, Driver Source Open  | 90   | 200  | 260  | μA    |

**ELECTRICAL CHARACTERISTICS:** Unless otherwise stated, specifications hold for  $T_A = 0^\circ\text{C}$  to  $+70^\circ\text{C}$  for the UC3835/6,  $-25^\circ\text{C}$  to  $+85^\circ\text{C}$  for the UC2835/6, and  $-55^\circ\text{C}$  to  $+125^\circ\text{C}$  for the UC1835/6,  $+V_{IN} = 6\text{V}$ , Driver Source =  $0\text{V}$ , Driver Sink =  $5\text{V}$ ,  $T_A = T_J$ .

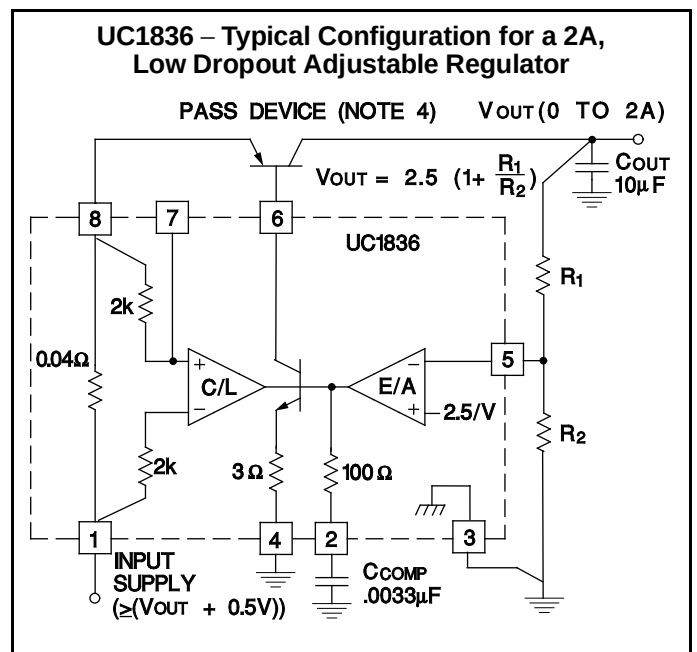
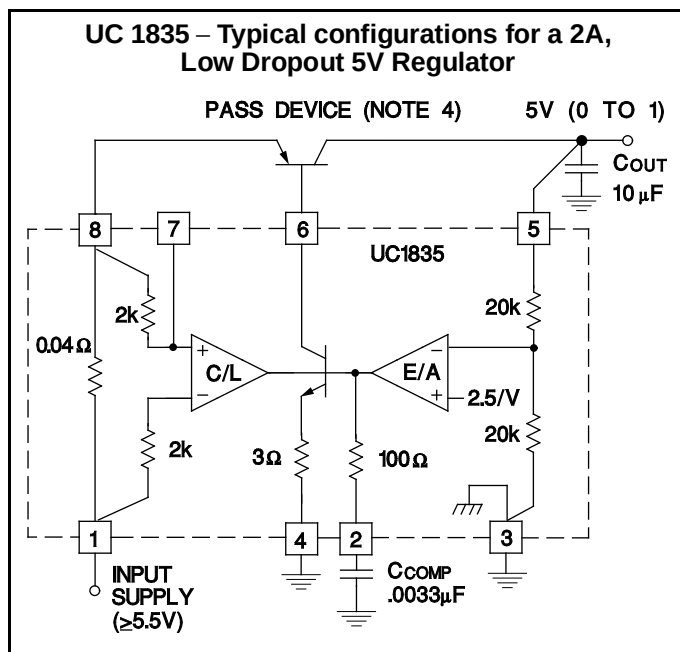
| PARAMETER                                                          | TEST CONDITIONS                                                                       | MIN. | TYP. | MAX. | UNITS            |
|--------------------------------------------------------------------|---------------------------------------------------------------------------------------|------|------|------|------------------|
| <b>Regulating Voltage and Error Amplifier (UC1836 Family Only)</b> |                                                                                       |      |      |      |                  |
| Regulating Level at $V_{OUT}$ Sense ( $V_{REG}$ )                  | Driver Current = $10\text{mA}$ , $T_J = 25^\circ\text{C}$                             | 2.47 | 2.5  | 2.53 | V                |
|                                                                    | Over Temperature                                                                      | 2.45 |      | 2.55 | V                |
| Line Regulation                                                    | $+V_{IN} = 5.2\text{V}$ to $35\text{V}$                                               |      | 6.0  | 20   | mV               |
| Load Regulation                                                    | Driver Current = $0$ to $250\text{mA}$                                                |      | 3.0  | 15   | mV               |
| Bias Current at $V_{OUT}$ Sense                                    | $V_{OUT}$ Sense = $2.5\text{V}$                                                       | -1.0 | -0.2 |      | $\mu\text{A}$    |
| Error Amp Transconductance                                         | $\pm 100\mu\text{A}$ at Compensation/Shutdown Pin                                     | 0.8  | 1.3  | 2.0  | mS               |
| Maximum Compensation Output Current                                | Sink or Source, Driver Source Open                                                    | 90   | 200  | 260  | $\mu\text{A}$    |
| <b>Driver</b>                                                      |                                                                                       |      |      |      |                  |
| Maximum Current                                                    |                                                                                       | 250  | 500  |      | mA               |
| Saturation Voltage                                                 | Driver Current = $250\text{mA}$ , Driver Sink                                         |      | 2.0  | 2.8  | V                |
| Pull-Up Current at Driver Sink                                     | Compensation/Shutdown = $0.45\text{V}$                                                | 140  | 250  | 300  | $\mu\text{A}$    |
| Driver Sink Leakage                                                | In UVLO                                                                               |      |      | 10   | $\mu\text{A}$    |
|                                                                    | In Reverse Voltage (UC1835 Family Only)                                               |      |      | 10   | $\mu\text{A}$    |
| Thermal Shutdown                                                   |                                                                                       |      | 165  |      | $^\circ\text{C}$ |
| <b>Foldback Current Limit</b>                                      |                                                                                       |      |      |      |                  |
| Current Limit Levels at Sense Resistor Out                         | $V_{OUT}$ Sense = $(0.99) V_{REG}$                                                    | 2.2  | 2.5  | 2.8  | A                |
|                                                                    | $V_{OUT}$ Sense = $(0.5) V_{REG}$                                                     | 1.3  | 1.5  | 1.7  | A                |
|                                                                    | $V_{OUT}$ Sense = $0\text{V}$                                                         | 0.25 | 0.4  | 0.55 | A                |
| Current Limit Amp Transconductance                                 | $\pm 100\mu\text{A}$ at Compensation/Shutdown, $V_{OUT}$ Sense = $(0.9) V_{REG}$      | 12   | 24   | 42   | mS               |
| Limiting Voltage at Current Limit (-)<br>(Note 2)                  | $V_{OUT}$ Sense = $(0.9) V_{REG}$<br>Volts Below $+V_{IN}$ , $T_J = 25^\circ\text{C}$ | 80   | 100  | 140  | mV               |
| Sense Resistor Value (Note 3)                                      | $V_{OUT}$ Sense = $(0.9) V_{REG}$ ,<br>$I_{OUT} = I_A$ , $T_J = 25^\circ\text{C}$     |      | 40   |      | $\text{m}\Omega$ |

Note 2: This voltage has a positive temperature coefficient of approximately  $3500\text{ppm}/^\circ\text{C}$ .

Note 3: This resistance has a positive temperature coefficient of approximately  $3500\text{ppm}/^\circ\text{C}$ .

The total resistance from Pin 1 to Pin 8 will include an additional  $60$  to  $100\text{m}\Omega$  of package resistance.

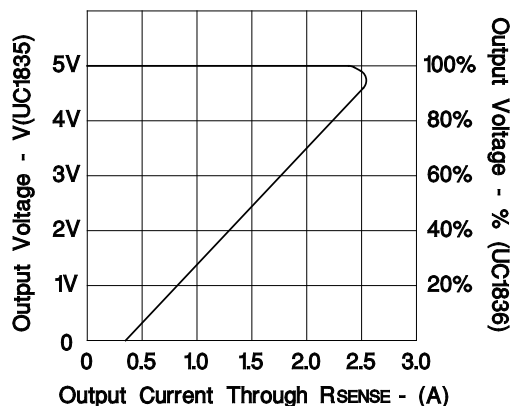
## APPLICATION AND OPERATION INFORMATION



Note 4: Suggested Pass devices are TIP 32B. (Dropout Voltage  $\leq 0.75\text{V}$ ) or, D45H, (Dropout Voltage  $\leq 0.5\text{V}$ ), or equivalents.

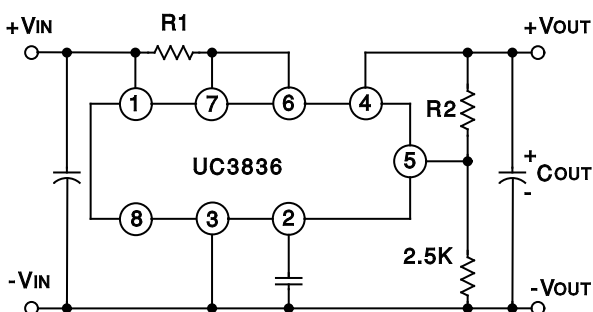
## APPLICATION AND OPERATION INFORMATION (cont.)

UC1835/6 Foldback Current Limiting



## UC3835/36 TYPICAL APPLICATIONS

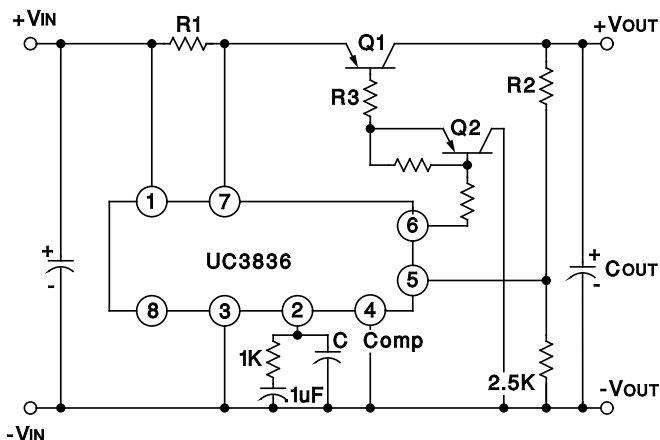
**Low Current Application**  
using the UC3836 internal drive transistor



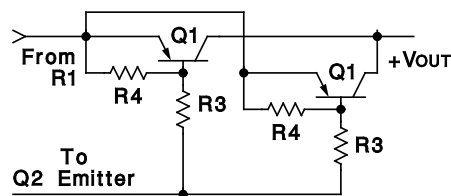
**Typical Output Current vs VIN and VOUT**  
of the UC3836 internal drive transistor  
for PDISS = 0.5W (approx.)

|      |       | VIN |     |     |     |     |    |
|------|-------|-----|-----|-----|-----|-----|----|
| VOUT | Volts | 5   | 9   | 12  | 15  | 18  | 24 |
|      | 2     | 150 | 60  | 40  | 30  | 20  | 12 |
|      | 5     |     | 105 | 55  | 35  | 25  | 15 |
|      | 9     |     |     | 130 | 60  | 35  | 20 |
|      | 12    |     |     |     | 120 | 55  | 25 |
|      | 15    |     |     |     |     | 110 | 30 |

**High Current Application**  
using drive transistor Q2 to increase Q1 base drive  
and reduce UC3836 power dissipation



**Parallel Pass Transistors**  
can be added for high current or  
high power dissipation applications



### EQUATIONS:

$$R1 = 0.100 \text{ V}/I_{OUT} (\text{MAX})$$

$$R2 = (V_{OUT} - 2.5\text{V})/1\text{mA}$$

$$R3 = ((V_{IN} - V_{BE} - V_{SAT}) \cdot \beta_{\text{min}}) / I_{OUT} (\text{max})$$

**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup>    | Lead/<br>Ball Finish | MSL Peak Temp <sup>(3)</sup> | Samples<br>(Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|----------------------------|----------------------|------------------------------|-----------------------------|
| 5962-9065002PA   | ACTIVE                | CDIP         | JG              | 8    | 1           | TBD                        | Call TI              | Call TI                      |                             |
| UC1835J          | OBSOLETE              | CDIP         | JG              | 8    |             | TBD                        | Call TI              | Call TI                      |                             |
| UC1835J883B      | OBSOLETE              | CDIP         | JG              | 8    |             | TBD                        | Call TI              | Call TI                      |                             |
| UC1835L883B      | OBSOLETE              | LCCC         | FK              | 20   |             | TBD                        | Call TI              | Call TI                      |                             |
| UC1836J          | ACTIVE                | CDIP         | JG              | 8    | 1           | TBD                        | A42                  | N / A for Pkg Type           |                             |
| UC1836J883B      | ACTIVE                | CDIP         | JG              | 8    | 1           | TBD                        | A42                  | N / A for Pkg Type           |                             |
| UC1836L          | OBSOLETE              | TO/SOT       | L               | 20   |             | TBD                        | Call TI              | Call TI                      |                             |
| UC1836L883B      | OBSOLETE              | TO/SOT       | L               | 20   |             | TBD                        | Call TI              | Call TI                      |                             |
| UC2835D          | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UC2835DG4        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UC2835J          | OBSOLETE              | CDIP         | JG              | 8    |             | TBD                        | Call TI              | Call TI                      |                             |
| UC2835N          | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UC2835NG4        | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UC2836D          | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UC2836DG4        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UC2836DW         | OBSOLETE              | SOIC         | DW              | 16   |             | TBD                        | Call TI              | Call TI                      |                             |
| UC3835N          | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UC3835NG4        | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UC3836D          | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UC3836DG4        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UC3836DTR        | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/<br>Ball Finish | MSL Peak Temp <sup>(3)</sup> | Samples<br>(Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|----------------------|------------------------------|-----------------------------|
| UC3836DTRG4      | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UC3836N          | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UC3836NG4        | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |

<sup>(1)</sup> 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.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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#### OTHER QUALIFIED VERSIONS OF UC1835, UC1836, UC3835, UC3836 :

● Catalog: [UC3835](#), [UC3836](#)

● Military: [UC1835](#), [UC1836](#)

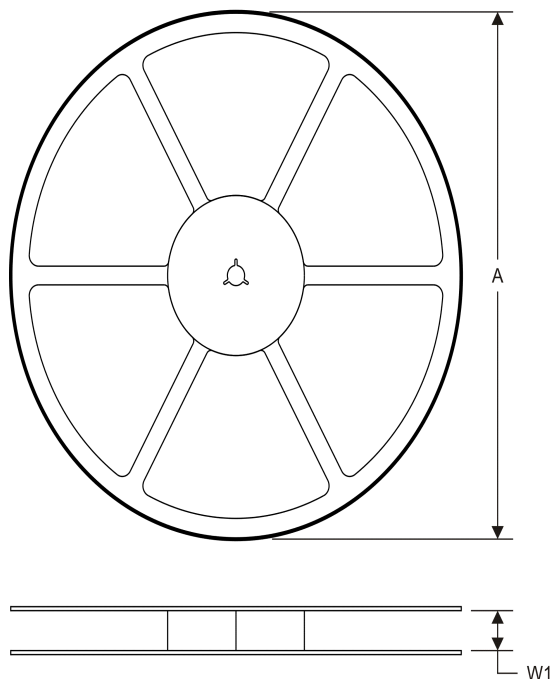
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NOTE: Qualified Version Definitions:

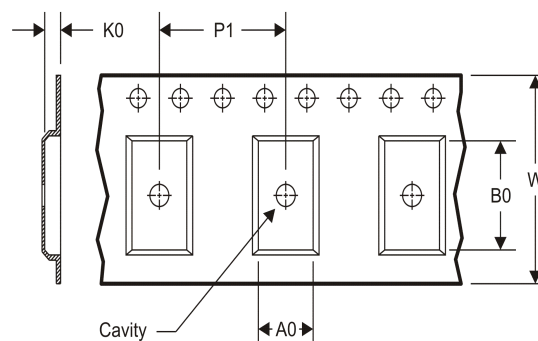
- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

## 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                   |

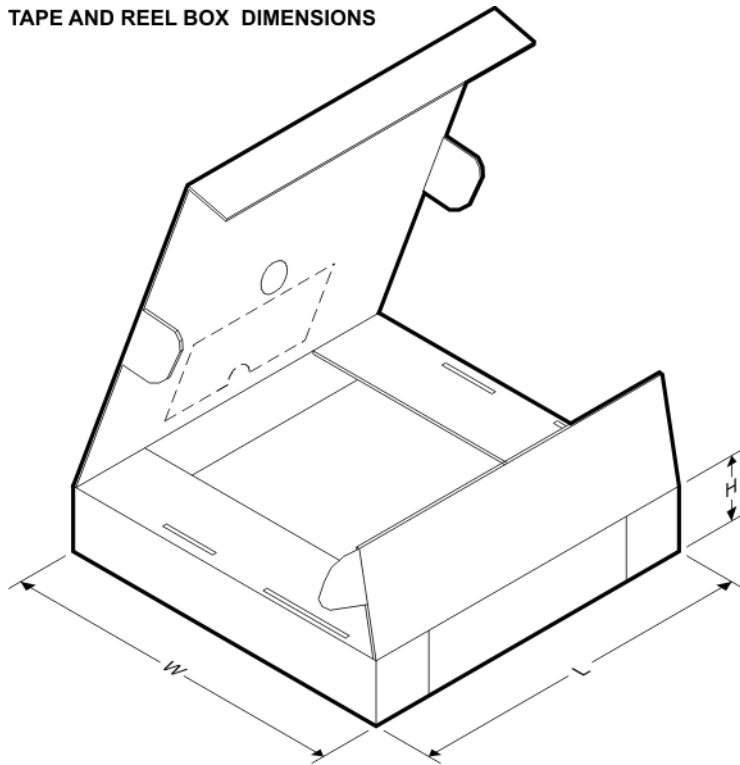
### TAPE AND REEL INFORMATION

\*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 |
|-----------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| UC3836DTR | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |



## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device    | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-----------|--------------|-----------------|------|------|-------------|------------|-------------|
| UC3836DTR | SOIC         | D               | 8    | 2500 | 367.0       | 367.0      | 35.0        |

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### Products

|                        |                                                                                      |
|------------------------|--------------------------------------------------------------------------------------|
| Audio                  | <a href="http://www.ti.com/audio">www.ti.com/audio</a>                               |
| Amplifiers             | <a href="http://amplifier.ti.com">amplifier.ti.com</a>                               |
| Data Converters        | <a href="http://dataconverter.ti.com">dataconverter.ti.com</a>                       |
| DLP® Products          | <a href="http://www.dlp.com">www.dlp.com</a>                                         |
| DSP                    | <a href="http://dsp.ti.com">dsp.ti.com</a>                                           |
| Clocks and Timers      | <a href="http://www.ti.com/clocks">www.ti.com/clocks</a>                             |
| Interface              | <a href="http://interface.ti.com">interface.ti.com</a>                               |
| Logic                  | <a href="http://logic.ti.com">logic.ti.com</a>                                       |
| Power Mgmt             | <a href="http://power.ti.com">power.ti.com</a>                                       |
| Microcontrollers       | <a href="http://microcontroller.ti.com">microcontroller.ti.com</a>                   |
| RFID                   | <a href="http://www.ti-rfid.com">www.ti-rfid.com</a>                                 |
| OMAP Mobile Processors | <a href="http://www.ti.com/omap">www.ti.com/omap</a>                                 |
| Wireless Connectivity  | <a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a> |

### Applications

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