

## PROGRAMMABLE OUTPUT POWER FACTOR PREREGULATOR

### FEATURES

- Controls Boost Preregulator to Near-Unity Power Factor
- World Wide Line Operation
- Over-Voltage Protection
- Accurate Power Limiting
- Average Current Mode Control
- Improved Noise Immunity
- Improved Feed-Forward Line Regulation
- Leading Edge Modulation
- 150- $\mu$ A Typical Start-Up Current
- Low-Power BiCMOS Operation
- 10.8-V to 17-V Operation
- Programmable Output Voltage (Tracking Boost Topology)

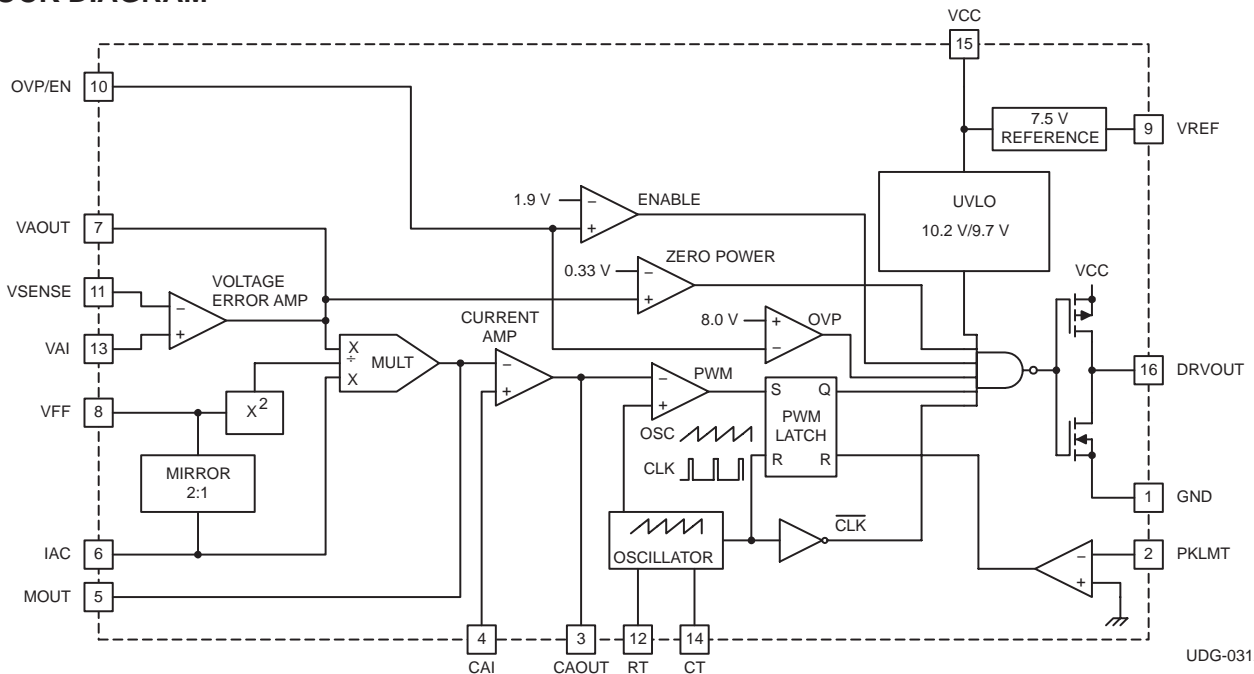
### DESCRIPTION

The UCC2819A/UCC3819A provides all the functions necessary for active power factor corrected preregulators. The controller achieves near unity power factor by shaping the ac-input line current waveform to correspond to that of the ac-input line voltage. Average current mode control maintains stable, low distortion sinusoidal line current.

Designed in Texas Instrument's BiCMOS process, the UCC3819A offers new features such as lower start-up current, lower power dissipation, overvoltage protection, a shunt UVLO detect circuitry and a leading-edge modulation technique to reduce ripple current in the bulk capacitor.

The UCC3819A allows the output voltage to be programmed by bringing out the error amplifier noninverting input.

### BLOCK DIAGRAM



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.

# UCC2819A UCC3819A

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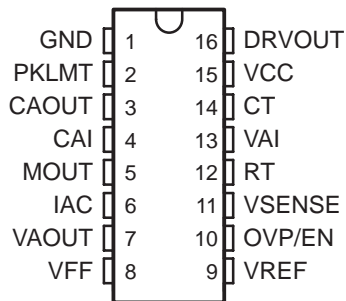
## DESCRIPTION (CONTINUED)

The UCC3819A is directly pin for pin compatible with the UCC3819. Only the output stage of UCC3819A has been modified to allow use of a smaller external gate drive resistor values. For some power supply designs where an adequately high enough gate drive resistor can not be used, the UCC3819A offers a more robust output stage at the cost of increasing the internal gate resistances. The gate drive of the UCC3819A remains strong at  $\pm 1.2$  A of peak current capability.

Available in the 16-pin D, N, and PW packages.

## PIN CONNECTION DIAGRAM

**D, N, AND PW PACKAGES  
(TOP VIEW)**



**AVAILABLE OPTIONS TABLE**

| $T_A = T_J$   | PACKAGE DEVICES     |                  |                       |
|---------------|---------------------|------------------|-----------------------|
|               | SOIC (D) PACKAGE(1) | PDIP (N) PACKAGE | TSSOP (PW) PACKAGE(1) |
| 0°C to 70°C   | UCC3819AD           | UCC3819AN        | UCC3819APW            |
| -40°C to 85°C | UCC2819AD           | UCC2819AN        | UCC2819APW            |

NOTES: (1) The D and PW packages are available taped and reeled. Add R suffix to the device type (e.g. UCC3819ADR) to order quantities of 2,500 devices per reel (D package) and 2,000 devices per reel (for PW package). Bulk quantities are 40 units (D package) and 90 units (PW package) per tube.

**THERMAL RESISTANCE TABLE**

| PACKAGE       | $\theta_{jc} (^{\circ}\text{C}/\text{W})$ | $\theta_{ja} (^{\circ}\text{C}/\text{W})$ |
|---------------|---|---|
| SOIC-16 (D)   | 22  | 40 to 70 (1)                              |
| PDIP-16 (N)   | 12  | 25 to 50 (1)                              |
| TSSOP-16 (PW) | 14 (2)                                    | 123 to 147 (2)                            |

NOTES: (1) Specified  $\theta_{ja}$  (junction to ambient) is for devices mounted to 5-inch<sup>2</sup> FR4 PC board with one ounce copper where noted. When resistance range is given, lower values are for 5 inch<sup>2</sup> aluminum PC board. Test PWB was 0.062 inch thick and typically used 0.635-mm trace widths for power packages and 1.3-mm trace widths for non-power packages with a 100-mil x 100-mil probe land area at the end of each trace.

(2) Modeled data. If value range given for  $\theta_{ja}$ , lower value is for 3x3 inch, 1 oz internal copper ground plane, higher value is for 1x1-inch, ground plane. All model data assumes only one trace for each non-fused lead.

## ABSOLUTE MAXIMUM RATINGS

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

|  | UCCx81xA   | UNIT |
|--|------------|------|
| Supply voltage VCC   | 18         | V    |
| Gate drive current, continuous                             | 0.2        | A    |
| Gate drive current   | 1.2        |      |
| Input voltage, CAI, MOUT, SS                               | 8          | V    |
| Input voltage, PKLMT                                       | 5          |      |
| Input voltage, VSENSE, OVP/EN, VAI                         | 10         |      |
| Input current, RT, IAC, PKLMT                              | 10         | mA   |
| Maximum negative voltage, DRVOUT, PKLMT, MOUT              | -0.5       | V    |
| Power dissipation  | 1          | W    |
| Junction temperature, T <sub>J</sub>                       | -55 to 150 | °C   |
| Storage temperature, T <sub>stg</sub>                      | -65 to 150 |      |
| Lead temperature, T <sub>sol</sub> (soldering, 10 seconds) | 300        |      |

† 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.

## ELECTRICAL CHARACTERISTICS

T<sub>A</sub> = 0°C to 70°C for the UCC3819A, -40°C to 85°C for the UCC2819A, VCC = 12 V, R<sub>T</sub> = 22 kΩ, C<sub>T</sub> = 270 pF, (unless otherwise noted)

| PARAMETER                 | TEST CONDITIONS                      | MIN | TYP  | MAX  | UNITS |
|---------------------------|--------------------------------------|-----|------|------|-------|
| <b>Supply Current</b>     |                                      |     |      |      |       |
| Supply current, off       | VCC = (VCC turnon threshold - 0.3 V) |     | 150  | 300  | μA    |
| Supply current, on        | VCC = 12 V, No load on DRVOUT        | 2   | 4    | 6    | mA    |
| <b>UVLO</b>               |                                      |     |      |      |       |
| VCC turnon threshold      |                                      | 9.7 | 10.2 | 10.8 | V     |
| VCC turnoff threshold     |                                      | 9.4 | 9.7  |      |       |
| UVLO hysteresis           |                                      | 0.3 | 0.5  |      |       |
| <b>Voltage Amplifier</b>  |                                      |     |      |      |       |
| VIO                       | VAOUT = 2.75 V, VCM = 3.75 V         | -15 |      | 15   | mV    |
| VAI bias current          | VAOUT = 2.75 V, VCM = 3.75 V         |     | 50   | 200  | nA    |
| VSENSE bias current       | VSENSE = VREF, VAOUT = 2.5 V         |     | 50   | 200  |       |
| CMRR                      | VCM = 1 V to 7.5 V                   | 50  | 70   |      | dB    |
| Open loop gain            | VAOUT = 2 V to 5 V                   | 50  | 90   |      |       |
| High-level output voltage | I <sub>L</sub> = -150 μA             | 5.3 | 5.5  | 5.6  | V     |
| Low-level output voltage  | I <sub>L</sub> = 150 μA              | 0   | 50   | 150  | mV    |

- NOTES: 1. Ensured by design, Not production tested.  
2. Reference variation for V<sub>CC</sub> < 10.8 V is shown in Figure 2.

# UCC2819A UCC3819A

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## ELECTRICAL CHARACTERISTICS

$T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$  for the UCC3819A,  $-40^\circ\text{C}$  to  $85^\circ\text{C}$  for the UCC2819A,  $V_{CC} = 12\text{ V}$ ,  $R_T = 22\text{ k}\Omega$ ,  $C_T = 270\text{ pF}$ , (unless otherwise noted)

| PARAMETER                                 | TEST CONDITIONS  | MIN           | TYP           | MAX           | UNITS |
|---|--|---------------|---------------|---------------|-------|
| <b>Over Voltage Protection and Enable</b> |  |               |               |               |       |
| Over voltage reference                    |  | VREF<br>+0.48 | VREF<br>+0.50 | VREF<br>+0.52 | V     |
| Hysteresis                                |  | 300           | 500           | 600           | mV    |
| Enable threshold                          |  | 1.7           | 1.9           | 2.1           | V     |
| Enable hysteresis                         |  | 0.1           | 0.2           | 0.3           |       |
| <b>Current Amplifier</b>                  |  |               |               |               |       |
| Input offset voltage                      | $V_{CM} = 0\text{ V}$ ,<br>$V_{CAOUT} = 3\text{ V}$                  | -3.5          | 0             | 2.5           | mV    |
| Input bias current                        | $V_{CM} = 0\text{ V}$ ,<br>$V_{CAOUT} = 3\text{ V}$                  |               | -50           | -100          | nA    |
| Input offset current                      | $V_{CM} = 0\text{ V}$ ,<br>$V_{CAOUT} = 3\text{ V}$                  |               | 25            | 100           |       |
| Open loop gain                            | $V_{CM} = 0\text{ V}$ ,<br>$V_{CAOUT} = 2\text{ V to } 5\text{ V}$   | 90            |               |               | dB    |
| Common-mode rejection ratio               | $V_{CM} = 0\text{ V to } 1.5\text{ V}$ ,<br>$V_{CAOUT} = 3\text{ V}$ | 60            | 80            |               |       |
| High-level output voltage                 | $I_L = -120\text{ }\mu\text{A}$                                      | 5.6           | 6.5           | 6.8           | V     |
| Low-level output voltage                  | $I_L = 1\text{ mA}$  | 0.1           | 0.2           | 0.5           |       |
| Gain bandwidth product                    | See Note 1   |               | 2.5           |               | MHz   |
| <b>Voltage Reference</b>                  |  |               |               |               |       |
| Input voltage, (UCC3819A)                 | $T_A = 0^\circ\text{C to } 70^\circ\text{C}$                         | 7.387         | 7.5           | 7.613         | V     |
| Input voltage, (UCC2819A)                 | $T_A = -40^\circ\text{C to } 85^\circ\text{C}$                       | 7.369         | 7.5           | 7.631         |       |
| Load regulation                           | $I_{REF} = 1\text{ mA to } 2\text{ mA}$                              | 0             |               | 10            | mV    |
| Line regulation                           | $V_{CC} = 10.8\text{ V to } 15\text{ V}$ ,<br>See Note 2             | 0             |               | 10            |       |
| Short-circuit current                     | $V_{REF} = 0\text{ V}$   | -20           | -25           | -50           | mA    |
| <b>Oscillator</b>                         |  |               |               |               |       |
| Initial accuracy                          | $T_A = 25^\circ\text{C}$   | 85            | 100           | 115           | kHz   |
| Voltage stability                         | $V_{CC} = 10.8\text{ V to } 15\text{ V}$                             | -1%           |               | 1%            |       |
| Total variation                           | Line, temp,<br>See Note 1  | 80            |               | 120           | kHz   |
| Ramp peak voltage                         |  | 4.5           | 5             | 5.5           |       |
| Ramp amplitude voltage<br>(peak to peak)  |  | 3.5           | 4             | 4.5           | V     |
| <b>Peak Current Limit</b>                 |  |               |               |               |       |
| PKLMT reference voltage                   |  | -15           |               | 15            | mV    |
| PKLMT propagation delay                   |  | 150           | 350           | 500           | ns    |

NOTES: (1) Ensured by design, Not production tested.  
(2) Reference variation for  $V_{CC} < 10.8\text{ V}$  is shown in Figure 2.

**ELECTRICAL CHARACTERISTICS**

T<sub>A</sub> = 0°C to 70°C for the UCC3819A, -40°C to 85°C for the UCC2819A, V<sub>CC</sub> = 12 V, R<sub>T</sub> = 22 kΩ, C<sub>T</sub> = 270 pF, (unless otherwise noted)

| PARAMETER  | TEST CONDITIONS  | MIN  | TYP  | MAX  | UNITS |
|--|--|------|------|------|-------|
| <b>Multiplier</b>  |  |      |      |      |       |
| I <sub>MOUT</sub> , high line, low power output current, (0°C to 85°C)   | I <sub>AC</sub> = 500 μA, V <sub>FF</sub> = 4.7 V, VAOUT = 1.25 V                | 0    | -6   | -20  | μA    |
| I <sub>MOUT</sub> , high line, low power output current, (-40°C to 85°C) | I <sub>AC</sub> = 500 μA, V <sub>FF</sub> = 4.7 V, VAOUT = 1.25 V                | 0    |      | -23  |       |
| I <sub>MOUT</sub> , high line, high power output current                 | I <sub>AC</sub> = 500 μA, V <sub>FF</sub> = 4.7 V, VAOUT = 5 V                   | -70  | -90  | -105 |       |
| I <sub>MOUT</sub> , low line, low power output current                   | I <sub>AC</sub> = 150 μA, V <sub>FF</sub> = 1.4 V, VAOUT = 1.25 V                | -10  | -19  | -50  |       |
| I <sub>MOUT</sub> , low line, high power output current                  | I <sub>AC</sub> = 150 μA, V <sub>FF</sub> = 1.4 V, VAOUT = 5 V                   | -268 | -300 | -346 |       |
| I <sub>MOUT</sub> , IAC limited  | I <sub>AC</sub> = 150 μA, V <sub>FF</sub> = 1.3 V, VAOUT = 5 V                   | -250 | -300 | -400 |       |
| Gain constant (K)  | I <sub>AC</sub> = 300 μA, V <sub>FF</sub> = 3 V, VAOUT = 2.5 V                   | 0.5  | 1    | 1.5  | 1/V   |
| I <sub>MOUT</sub> , zero current   | I <sub>AC</sub> = 150 μA, V <sub>FF</sub> = 1.4 V, VAOUT = 0.25 V                |      | 0    | -2   | μA    |
|  | I <sub>AC</sub> = 500 μA, V <sub>FF</sub> = 4.7 V, VAOUT = 0.25 V                |      | 0    | -2   |       |
| I <sub>MOUT</sub> , zero current, (0°C to 85°C)                          | I <sub>AC</sub> = 500 μA, V <sub>FF</sub> = 4.7 V, VAOUT = 0.5 V                 |      | 0    | -3   |       |
| I <sub>MOUT</sub> , zero current, (-40°C to 85°C)                        | I <sub>AC</sub> = 500 μA, V <sub>FF</sub> = 4.7 V, VAOUT = 0.5 V                 |      | 0    | -3.5 |       |
| Power limit (I <sub>MOUT</sub> x V <sub>FF</sub> )                       | I <sub>AC</sub> = 150 μA, V <sub>FF</sub> = 1.4 V, VAOUT = 5 V                   | -375 | -420 | -485 | μW    |
| <b>Feed-Forward</b>  |  |      |      |      |       |
| V <sub>FF</sub> output current   | I <sub>AC</sub> = 300 μA   | -140 | -150 | -160 | μA    |
| <b>Gate Driver</b>   |  |      |      |      |       |
| Pullup resistance  | I <sub>O</sub> = -100 mA to -200 mA  |      | 9    | 12   | Ω     |
| Pulldown resistance  | I <sub>O</sub> = 100 mA  |      | 4    | 10   |       |
| Output rise time   | C <sub>L</sub> = 1 nF, R <sub>L</sub> = 10 Ω, V <sub>DRVOUT</sub> = 0.7 V to 9 V |      | 25   | 50   | ns    |
| Output fall time   | C <sub>L</sub> = 1 nF, R <sub>L</sub> = 10 Ω, V <sub>DRVOUT</sub> = 9 V to 0.7 V |      | 10   | 50   |       |
| Maximum duty cycle   |  | 93%  | 95%  | 100% |       |
| Minimum controlled duty cycle  | At 100 kHz   |      |      | 2%   |       |
| <b>Zero Power</b>  |  |      |      |      |       |
| Zero power comparator threshold  | Measured on VAOUT  | 0.20 | 0.33 | 0.50 | V     |

NOTES: (1) Ensured by design, Not production tested.  
(2) Reference variation for V<sub>CC</sub> < 10.8 V is shown in Figure 2.

**PIN ASSIGNMENTS**

| TERMINAL |     | I/O | DESCRIPTION   |
|----------|-----|-----|---|
| NAME     | NO. |     |   |
| CAI      | 4   | I   | Current amplifier noninverting input                    |
| CAOUT    | 3   | O   | Current amplifier output                                |
| CT       | 14  | I   | Oscillator timing capacitor                             |
| DRVOUT   | 16  | O   | Gate drive  |
| GND      | 1   | –   | Ground  |
| IAC      | 6   | I   | Current proportional to input voltage                   |
| MOUT     | 5   | I/O | Multiplier output and current amplifier inverting input |
| OVP/EN   | 10  | I   | Over-voltage/enable                                     |
| PKLMT    | 2   | I   | PFC peak current limit                                  |
| RT       | 12  | I   | Oscillator charging current                             |
| VAI      | 13  | I   | Voltage amplifier non-inverting input                   |
| VAOUT    | 7   | O   | Voltage amplifier output                                |
| VCC      | 15  | I   | Positive supply voltage                                 |
| VFF      | 8   | I   | Feed-forward voltage                                    |
| VSENSE   | 11  | I   | Voltage amplifier inverting input                       |
| VREF     | 9   | O   | Voltage reference output                                |

**Pin Descriptions**

**CAI:** Place a resistor between this pin and the GND side of current-sense resistor. This input and the inverting input (MOUT) remain functional down to and below GND.

**CAOUT:** This is the output of a wide bandwidth operational amplifier that senses line current and commands the PFC pulse-width modulator (PWM) to force the correct duty cycle. Compensation components are placed between CAOUT and MOUT.

**CT:** A capacitor from CT to GND sets the PWM oscillator frequency according to:

$$f \approx \left( \frac{0.6}{RT \times CT} \right)$$

The lead from the oscillator timing capacitor to GND should be as short and direct as possible.

**DRVOUT:** The output drive for the boost switch is a totem-pole MOSFET gate driver on DRVOUT. To avoid the excessive overshoot of the DRVOUT while driving a capacitive load, a series gate current-limiting/damping resistor is recommended to prevent interaction between the gate impedance and the output driver. The value of the series gate resistor is based on the pulldown resistance ( $R_{pull\,down}$  which is 4-Ω typical), the maximum VCC voltage (VCC), and the required maximum gate drive current ( $I_{max}$ ). Using the equation below, a series gate resistance of resistance 11 Ω would be required for a maximum VCC voltage of 18 V and for 1.2 A of maximum sink current. The source current will be limited to approximately 900 mA (based on the  $R_{pull\,up}$  of 9-Ω typical).

$$R_{GATE} = \frac{VCC - (I_{MAX} \times R_{pull\,down})}{I_{MAX}}$$

**GND:** All voltages measured with respect to ground. VCC and REF should be bypassed directly to GND with a 0.1-μF or larger ceramic capacitor.

**Pin Descriptions (continued)**

**IAC:** This input to the analog multiplier is a current proportional to instantaneous line voltage. The multiplier is tailored for very low distortion from this current input ( $I_{IAC}$ ) to multiplier output. The recommended maximum  $I_{IAC}$  is 500  $\mu$ A.

**MOUT:** The output of the analog multiplier and the inverting input of the current amplifier are connected together at MOUT. As the multiplier output is a current, this is a high-impedance input so the amplifier can be configured as a differential amplifier. This configuration improves noise immunity and allows for the leading-edge modulation operation. The multiplier output current is limited to  $(2 \times I_{IAC})$ . The multiplier output current is given by the equation:

$$I_{MOUT} = \frac{I_{IAC} \times (V_{VAOUT} - 1)}{V_{VFF}^2 \times K}$$

where  $K = \frac{1}{V}$  is the multiplier gain constant.

**OVP/EN:** A window comparator input that disables the output driver if the boost output voltage is a programmed level above the nominal or disables both the PFC output driver and resets SS if pulled below 1.9 V (typ).

**PKLMT:** The threshold for peak limit is 0 V. Use a resistor divider from the negative side of the current sense resistor to VREF to level shift this signal to a voltage level defined by the value of the sense resistor and the peak current limit. Peak current limit is reached when PKLMT voltage falls below 0 V.

**RT:** A resistor from RT to GND is used to program oscillator charging current. A resistor between 10 k $\Omega$  and 100 k $\Omega$  is recommended. Nominal voltage on this pin is 3 V.

**VAI:** This input can be tied to the VREF or any other voltage reference ( $\leq 7.5$  V) to set the boost regulator output voltage.

**VAOUT:** This is the output of the operational amplifier that regulates output voltage. The voltage amplifier output is internally limited to approximately 5.5 V to prevent overshoot.

**VCC:** Connect to a stable source of at least 20 mA between 10 V and 17 V for normal operation. Bypass VCC directly to GND to absorb supply current spikes required to charge external MOSFET gate capacitances. To prevent inadequate gate drive signals, the output devices are inhibited unless  $V_{VCC}$  exceeds the upper under-voltage lockout voltage threshold and remains above the lower threshold.

**VFF:** The RMS voltage signal generated at this pin by mirroring 1/2 of the  $I_{IAC}$  into a single pole external filter. At low line, the VFF roll should be 14 V.

**VSENSE:** This is normally connected to a compensation network and to the boost converter output through a divider network.

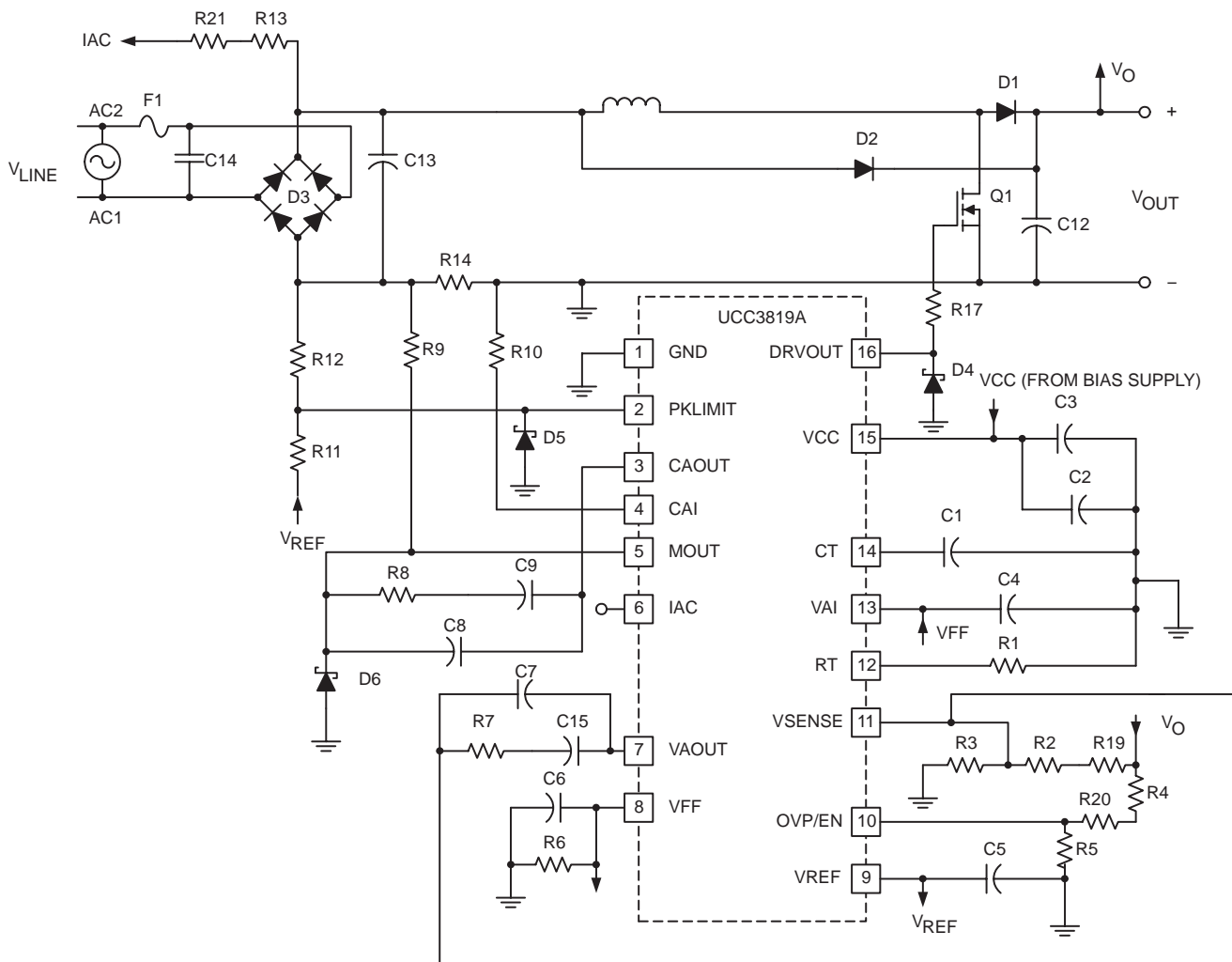
**VREF:** VREF is the output of an accurate 7.5-V voltage reference. This output is capable of delivering 20 mA to peripheral circuitry and is internally short-circuit current limited. VREF is disabled and remains at 0 V when  $V_{VCC}$  is below the UVLO threshold. Bypass VREF to GND with a 0.1- $\mu$ F or larger ceramic capacitor for best stability. Please refer to Figures 8 and 9 for VREF line and load regulation characteristics.

**APPLICATION INFORMATION**

The UCC3819A is based on the UCC3818 PFC preregulator. For a more detailed application information for this part, please refer to the UCC3818 datasheet product folder.

The main difference between the UCC3818 and the UCC3819A is that the non-inverting input of the voltage error amplifier is made available to the user through an external pin (VAI) in the UCC3819A. The SS pin and function were eliminated to accommodate this change.

The benefit of VAI pin is that it can be used to dynamically change the PFC output voltage based on the line voltage (RMS) level or other conditions. Figure 1 shows one suggested implementation of the tracking boost PFC converter as this approach is sometimes referred to. The VAI pin is tied to the VFF pin and hence output voltage scales up with the line voltage. The benefit of this approach is that at lower line voltages the output voltage is lower and that leads to smaller boost inductor value, lower MOSFET conduction losses and reduced component stresses. In order for this feature to work, the downstream converter has to operate over a wider input range.



UDG-01008

**Figure 1. Suggested Implementation of UCC3819A in a Tracking Boost PFC Preregulator**



APPLICATION INFORMATION

REFERENCE VOLTAGE  
vs  
SUPPLY VOLTAGE

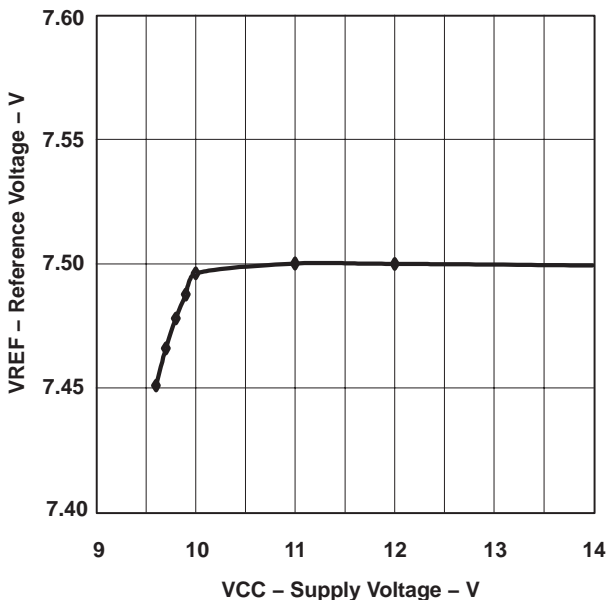


Figure 2

REFERENCE VOLTAGE  
vs  
REFERENCE CURRENT

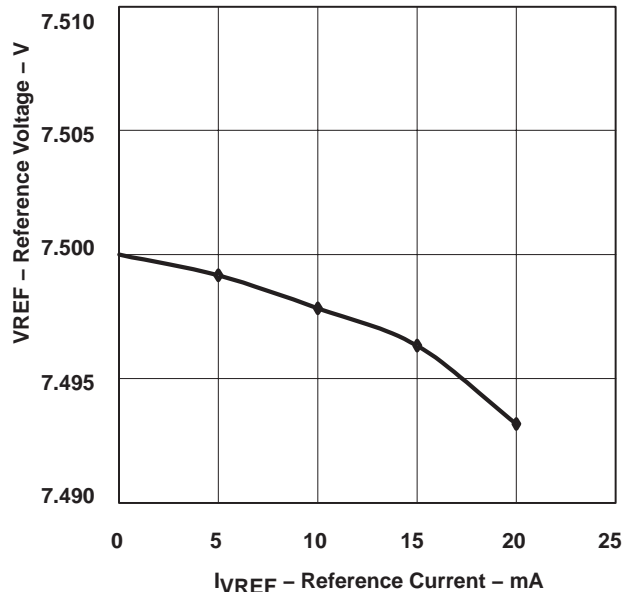


Figure 3

MULTIPLIER OUTPUT CURRENT  
vs  
VOLTAGE ERROR AMPLIFIER OUTPUT

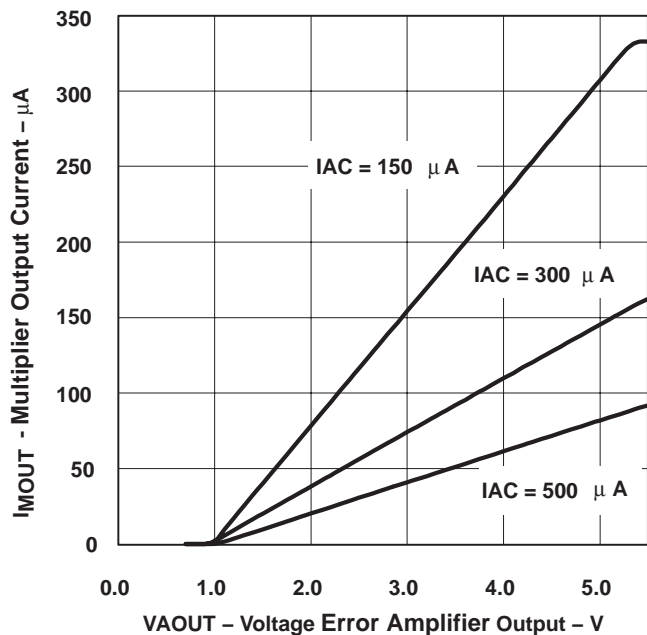


Figure 4

MULTIPLIER GAIN  
vs  
VOLTAGE ERROR AMPLIFIER OUTPUT

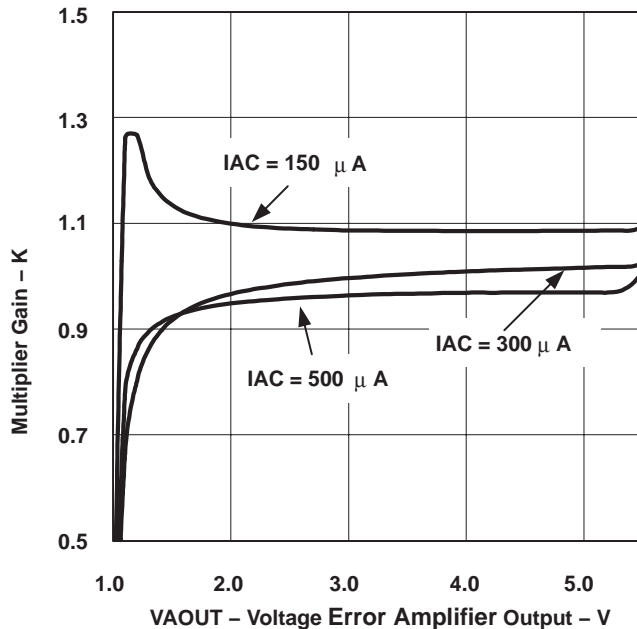
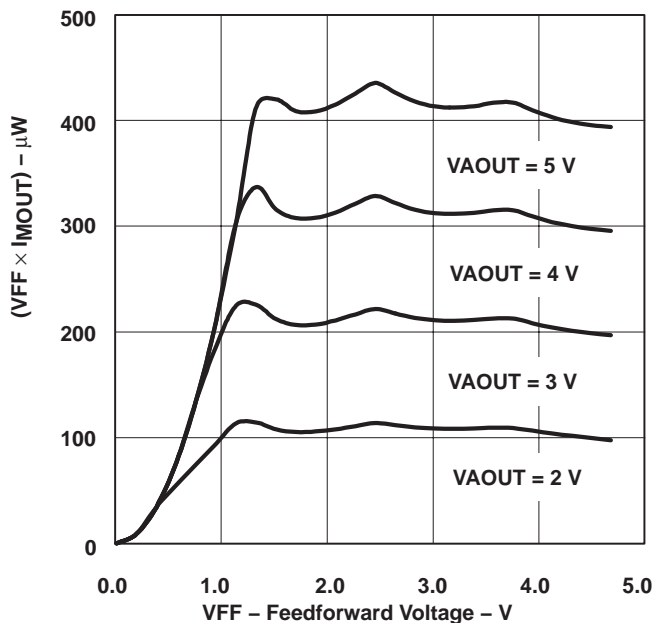


Figure 5

**APPLICATION INFORMATION**

**MULTIPLIER CONSTANT POWER PERFORMANCE**



**Figure 6**

**References and Resources:**

Application Note: *Differences Between UCC3817A/18A/19A and UCC3817/18/19*, Texas Instruments Literature Number SLUA294

User's Guide: *UCC3817 BiCMOS Power Factor Preregulator Evaluation Board*, Texas Instruments Literature Number SLUU077

Application Note: *Synchronizing a PFC Controller from a Down Stream Controller Gate Drive*, Texas Instruments Literature Number SLUA245

Seminar topic: *High Power Factor Switching Preregulator Design Optimization*, L.H. Dixon, SEM-700, 1990.

Seminar topic: *High Power Factor Preregulator for Off-line Supplies*, L.H. Dixon, SEM-600, 1988.

**Related Products**

| DEVICE            | DESCRIPTION                                    | CONTROL METHOD     | TYPICAL POWER LEVEL |
|-------------------|--|--------------------|---------------------|
| UCC3817/A,18/A    | BiCMOS PFC controller                          | ACM <sup>(2)</sup> | 75 W to 2 kW+       |
| UC3854            | PFC controller                                 | ACM <sup>(2)</sup> | 200 W to 2 kW+      |
| UC3854A/B         | Improved PFC controller                        | ACM <sup>(2)</sup> | 200 W to 2 kW+      |
| UC3855A/B         | High performance soft switching PFC controller | ACM <sup>(2)</sup> | 400 W to 2 kW+      |
| UCC38050/1        | Transition mode PFC controller                 | CRM <sup>(1)</sup> | 50 W to 400 W       |
| UCC28510/11/12/13 | Advanced PFC+PWM combo controller              | ACM <sup>(2)</sup> | 75 W to 1kW+        |
| UCC28514/15/16/17 | Advanced PFC+PWM combo controller              | ACM <sup>(2)</sup> | 75 W to 1kW+        |

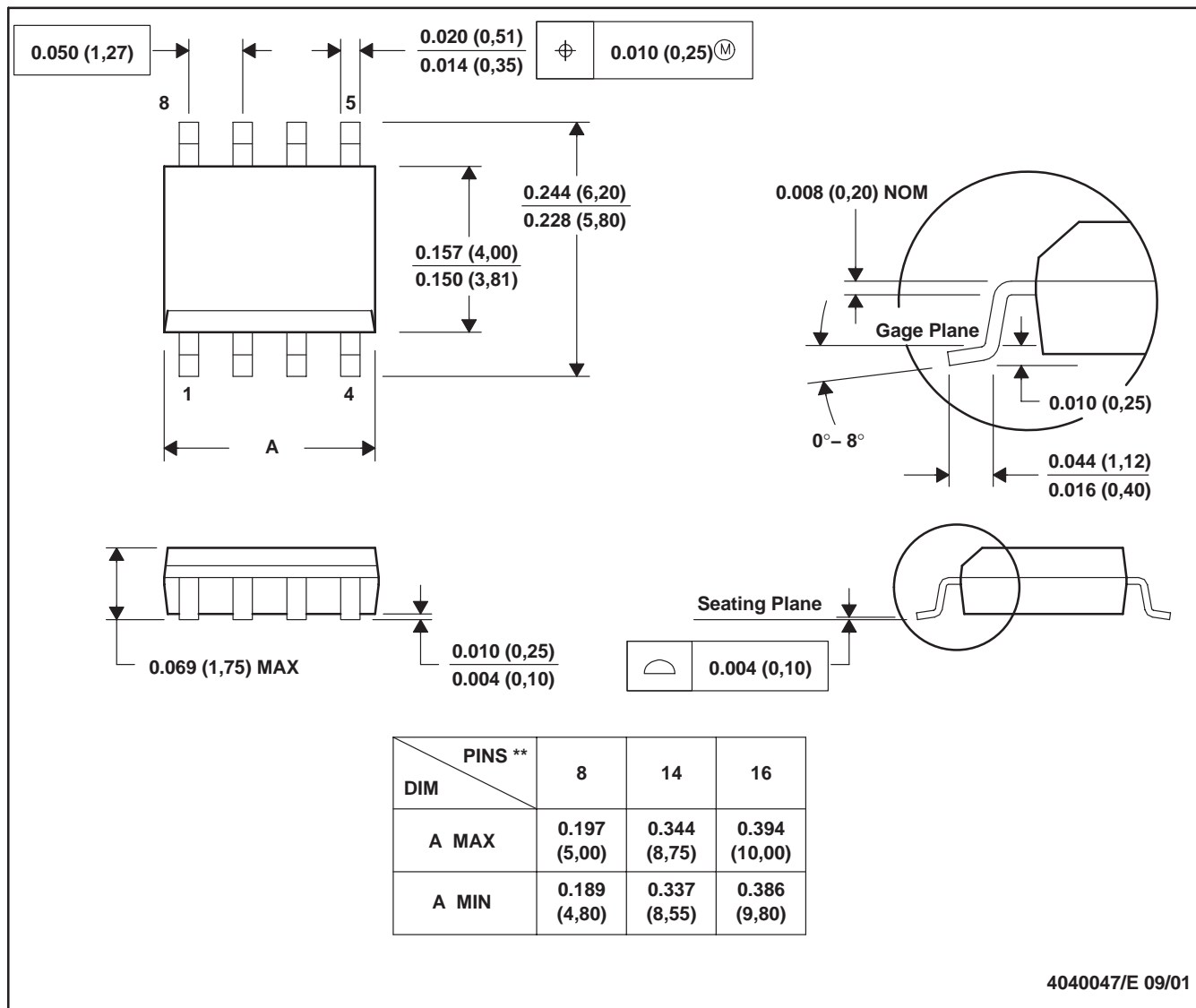
NOTES: (1). Critical conduction mode  
(2). Average current mode

**MECHANICAL DATA**

**D (R-PDSO-G\*\*)**

**PLASTIC SMALL-OUTLINE PACKAGE**

**8 PINS SHOWN**

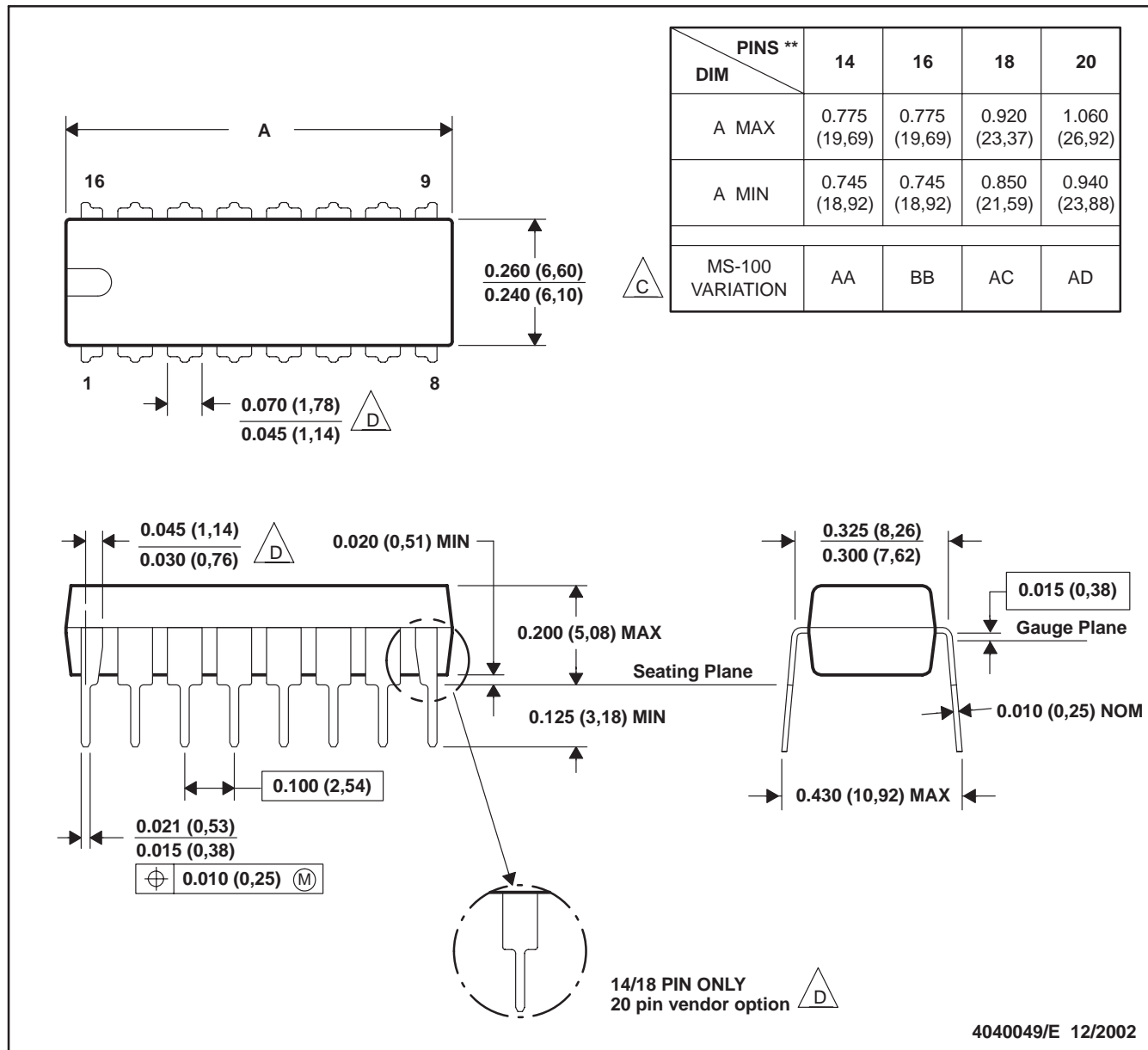


- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).

**MECHANICAL DATA**

**N (R-PDIP-T\*\*)**  
**16 PINS SHOWN**

**PLASTIC DUAL-IN-LINE PACKAGE**



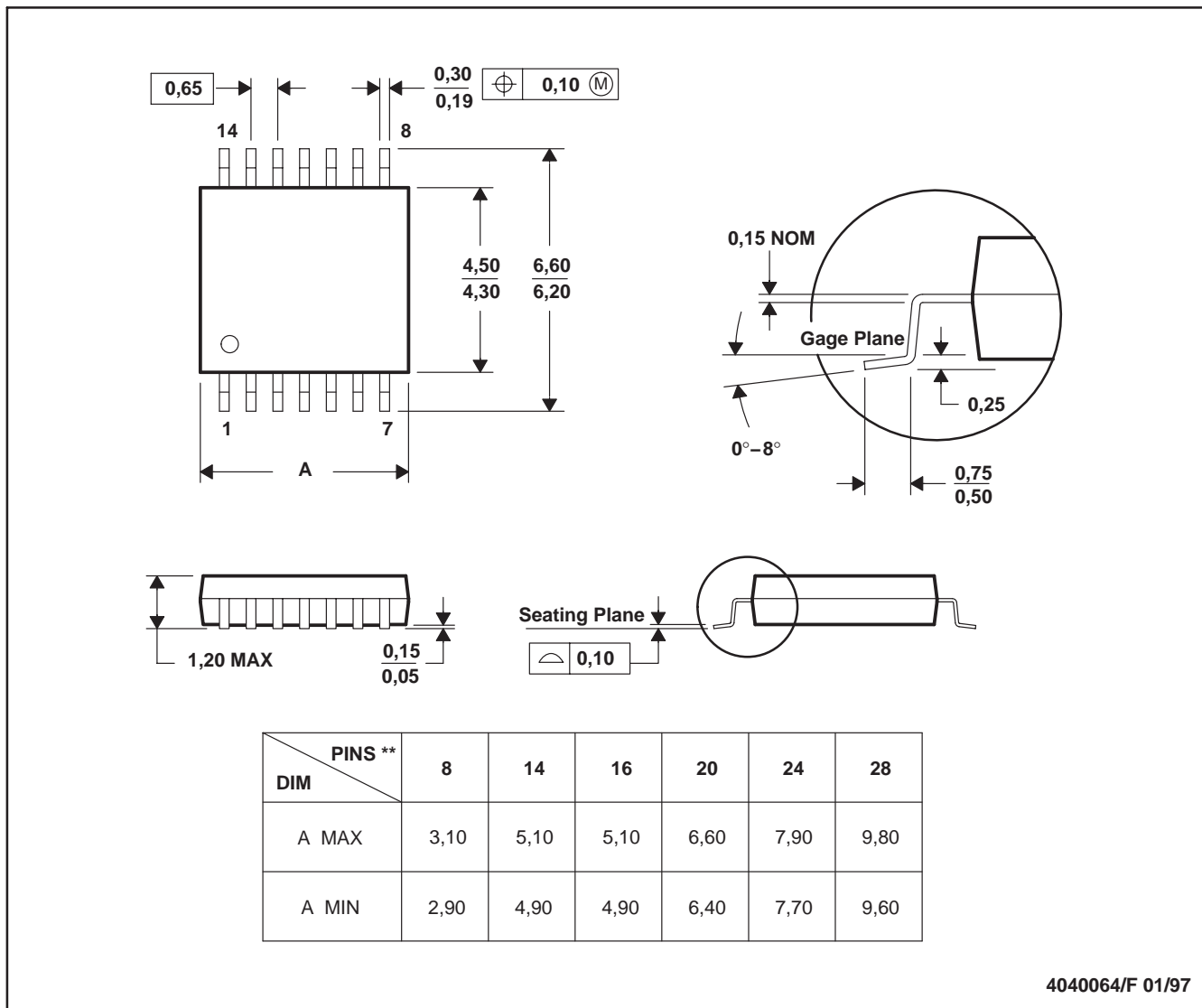
- NOTES: D. All linear dimensions are in inches (millimeters).  
 E. This drawing is subject to change without notice.  
 F. Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).  
 G. The 20 pin end lead shoulder width is a vendor option, either half or full width.

**MECHANICAL DATA**

**PW (R-PDSO-G\*\*)**

**PLASTIC SMALL-OUTLINE PACKAGE**

14 PINS SHOWN



- NOTES: H. All linear dimensions are in millimeters.  
 I. This drawing is subject to change without notice.  
 J. Body dimensions do not include mold flash or protrusion not to exceed 0,15.

PACKAGING INFORMATION

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| UCC2819AD        | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| UCC2819ADG4      | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| UCC2819ADR       | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| UCC2819ADRG4     | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| UCC2819AN        | ACTIVE                | PDIP         | N               | 16   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | N / A for Pkg Type           |
| UCC2819ANG4      | ACTIVE                | PDIP         | N               | 16   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | N / A for Pkg Type           |
| UCC2819APW       | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR          |
| UCC2819APWG4     | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR          |
| UCC2819APWR      | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR          |
| UCC2819APWRG4    | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR          |
| UCC3819AD        | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| UCC3819ADG4      | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| UCC3819ADR       | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| UCC3819ADRG4     | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| UCC3819AN        | ACTIVE                | PDIP         | N               | 16   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | N / A for Pkg Type           |
| UCC3819ANG4      | ACTIVE                | PDIP         | N               | 16   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | N / A for Pkg Type           |
| UCC3819APW       | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR          |
| UCC3819APWG4     | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR          |
| UCC3819APWR      | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR          |
| UCC3819APWRG4    | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR          |

<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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**TAPE AND REEL INFORMATION**



**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 |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| UCC2819ADR  | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| UCC2819APWR | TSSOP        | PW              | 16   | 2000 | 330.0              | 12.4               | 7.0     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| UCC3819ADR  | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| UCC3819APWR | TSSOP        | PW              | 16   | 2000 | 330.0              | 12.4               | 7.0     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |



**TAPE AND REEL BOX DIMENSIONS**



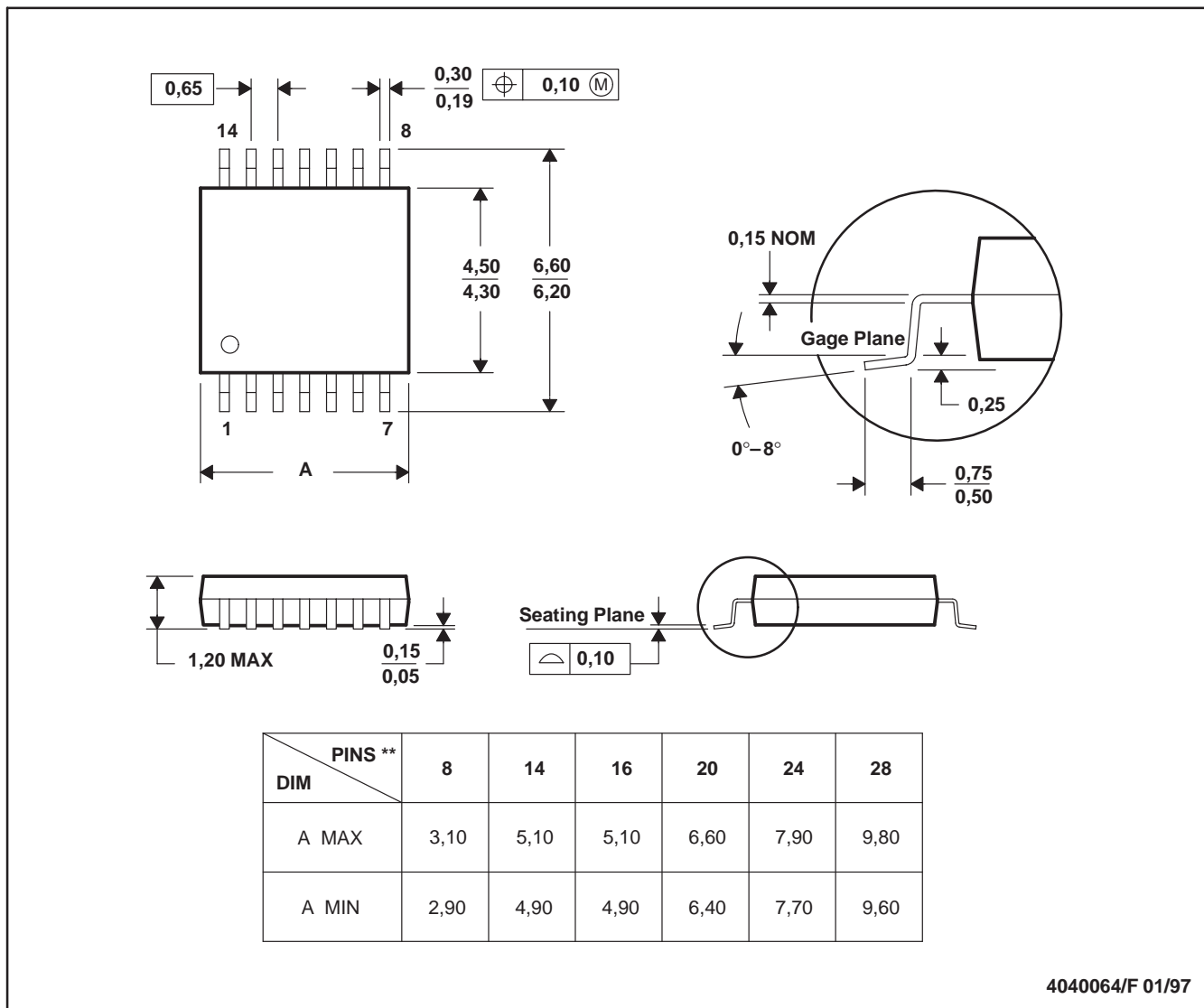
\*All dimensions are nominal

| Device      | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| UCC2819ADR  | SOIC         | D               | 16   | 2500 | 333.2       | 345.9      | 28.6        |
| UCC2819APWR | TSSOP        | PW              | 16   | 2000 | 346.0       | 346.0      | 29.0        |
| UCC3819ADR  | SOIC         | D               | 16   | 2500 | 333.2       | 345.9      | 28.6        |
| UCC3819APWR | TSSOP        | PW              | 16   | 2000 | 346.0       | 346.0      | 29.0        |

PW (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



4040047-4/H 11/2006

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
  - E. Reference JEDEC MS-012 variation AC.

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

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| Military           | <a href="http://www.ti.com/military">www.ti.com/military</a>             |
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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
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