**Unitrode Products from Texas Instruments**

**UCC2819, UCC3819**
**PROGRAMMABLE OUTPUT**
**POWER FACTOR PREREGULATOR**
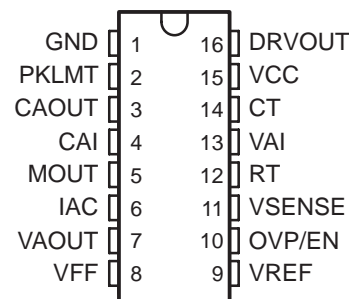SLUS482B - APRIL 2001 – REVISED DECEMBER 2004

- **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-μA Typical Start-Up Current**
- **Low-Power BiCMOS Operation**
- **10.8-V to 17-V Operation**
- **Programmable Output Voltage (Tracking Boost Topology)**

**D, DW, N, and PW PACKAGES**
**(TOP VIEW)**

| | | | |
|---|---|---|---|
| GND | 1 | 16 | DRVOUT |
| PKLMT | 2 | 15 | VCC |
| CAOUT | 3 | 14 | CT |
| CAI | 4 | 13 | VAI |
| MOUT | 5 | 12 | RT |
| IAC | 6 | 11 | VSENSE |
| VAOUT | 7 | 10 | OVP/EN |
| VFF | 8 | 9 | VREF |

## description

The UCC2819/UCC3819 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 UCC3819 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 UCC3819 allows the output voltage to be programmed by bringing out the error amplifier noninverting input.

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

## block diagram
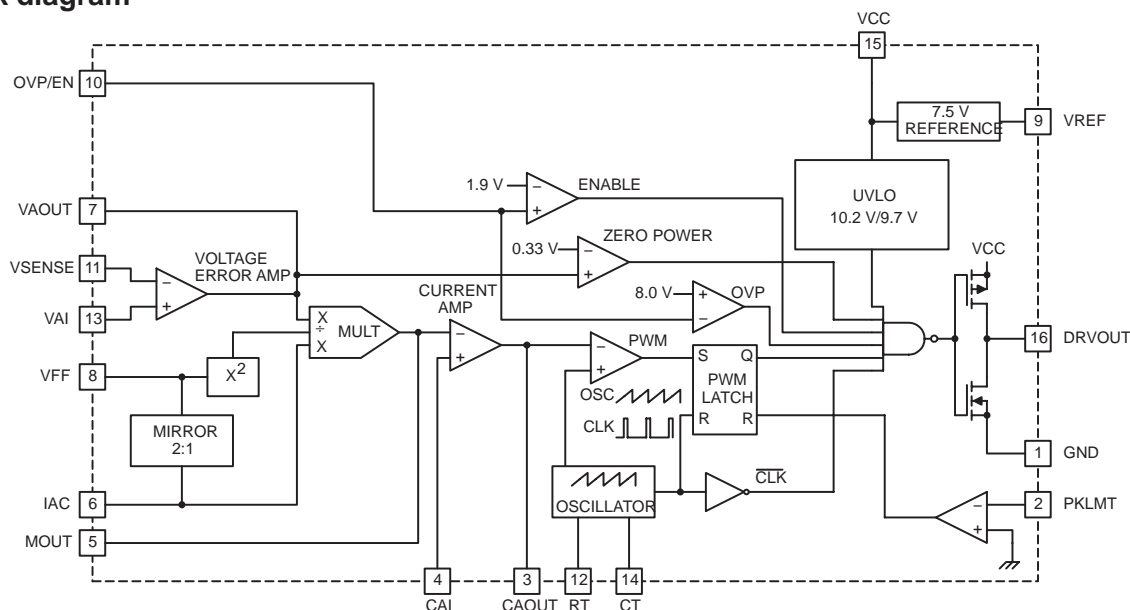


UDG-01009

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

| | |
|---|---|
| Supply voltage, VCC . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 18 V |
| Gate drive current, continuous . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 0.2 A |
| Gate drive current . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 1.2 A |
| Input voltage, CAI, MOUT . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 8 V |
| Input voltage, PKLMT . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 5 V |
| Input voltage, VSENSE, OVP/EN, VAI . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 10 V |
| Input current, RT, IAC, PKLMT . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 10 mA |
| Maximum negative voltage, DRVOUT, PKLMT, MOUT . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | −0.5 V |
| Power dissipation . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | 1 W |

† 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.

**AVAILABLE OPTIONS**

| $T_J$ | PACKAGE DEVICES | | | |
|---|---|---|---|---|
| | D PACKAGE | DW PACKAGE | N PACKAGE | PW PACKAGE |
| 0°C to 70°C | UCC3819D | UCC3819DW | UCC3819N | UCC3819PW |
| −40°C to 85°C | UCC2819D | UCC2819DW | UCC2819N | UCC2819PW |

† The D, DW, and PW packages are available taped and reeled. Add TR suffix to device type (e.g. UCC3819DTR) to order quantities of 2500 devices per reel.

## electrical characteristics, $T_A$ = 0°C to 70°C for the UCC3819, −40°C to 85°C for the UCC2819, VCC = 12 V, $R_T$ = 22 kΩ, $C_T$ = 270 pF, (unless otherwise noted)

### supply current

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| 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 |

### UVLO

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| VCC turnon threshold | | 9.7 | 10.2 | 10.8 | V |
| VCC turnoff threshold | | 9.4 | 9.7 | | V |
| UVLO hysteresis | | 0.3 | 0.5 | | V |

### voltage amplifier

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| 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 |
| $V_{SENSE}$ bias current | VSENSE = VREF,　　　　VAOUT = 2.5 V | | 50 | 200 | nA |
| CMRR | VCM = 1 V to 7.5 V | 50 | 70 | | dB |
| Open loop gain | VAOUT = 2 V to 5 V | 50 | 90 | | dB |
| High-level output voltage | $I_L$ = −150 μA | 5.3 | 5.5 | 5.6 | V |
| Low-level output voltage | $I_L$ = 150 μA | 0 | 50 | 150 | mV |

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**electrical characteristics, $T_A$ = 0°C to 70°C for the UCC3819, –40°C to 85°C for the UCC2819, VCC = 12 V, $R_T$ = 22 kΩ, $C_T$ = 270 pF, (unless otherwise noted)**

### over voltage protection and enable

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| Over voltage reference | | VREF +0.48 | VREF +0.50 | VREF +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 | V |

### current amplifier

| PARAMETER | TEST CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Input offset voltage | $V_{CM}$ = 0 V, | $V_{CAOUT}$ = 3 V | –3.5 | 0 | 2.5 | mV |
| Input bias current | $V_{CM}$ = 0 V, | $V_{CAOUT}$ = 3 V | | –50 | –100 | nA |
| Input offset current | $V_{CM}$ = 0 V, | $V_{CAOUT}$ = 3 V | | 25 | 100 | nA |
| Open loop gain | $V_{CM}$ = 0 V, | $V_{CAOUT}$ = 2 V to 5 V | 90 | | | dB |
| Common-mode rejection ratio | $V_{CM}$ = 0 V to 1.5 V, | $V_{CAOUT}$ = 3 V | 60 | 80 | | dB |
| High-level output voltage | $I_L$ = –120 µA | | 5.6 | 6.5 | 6.8 | V |
| Low-level output voltage | $I_L$ = 1 mA | | 0.1 | 0.2 | 0.5 | V |
| Gain bandwidth product | See Note 1 | | | 2.5 | | MHz |

### voltage reference

| PARAMETER | TEST CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Input voltage, (UCC3819) | $T_A$ = 0°C to 70°C | | 7.387 | 7.5 | 7.613 | V |
| Input voltage, (UCC2819) | $T_A$ = –40°C to 85°C | | 7.369 | 7.5 | 7.631 | V |
| Load regulation | $I_{REF}$ = 1 mA to 2 mA | | 0 | | 10 | mV |
| Line regulation | VCC = 10.8 V to 15 V, | See Note 2 | 0 | | 10 | mV |
| Short-circuit current | $V_{REF}$ = 0 V | | –20 | –25 | –50 | mA |

### oscillator

| PARAMETER | TEST CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Initial accuracy | $T_A$ = 25°C | | 85 | 100 | 115 | kHz |
| Voltage stability | VCC = 10.8 V to 15 V | | –1 | | 1 | % |
| Total variation | Line, temp, | See Note 1 | 80 | | 120 | kHz |
| Ramp peak voltage | | | 4.5 | 5 | 5.5 | V |
| Ramp amplitude voltage (peak to peak) | | | 3.5 | 4 | 4.5 | V |

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

**electrical characteristics, $T_A$ = 0°C to 70°C for the UCC3819, –40°C to 85°C for the UCC2819, VCC = 12 V, $R_T$ = 22 kΩ, $C_T$ = 270 pF, (unless otherwise noted)**

## peak current limit

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| PKLMT reference voltage | | –15 | | 15 | mV |
| PKLMT propagation delay | | 150 | 350 | 500 | ns |

## multiplier

| PARAMETER | TEST CONDITIONS | | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| $I_{MOUT}$, high line, low power output current, (0°C to 85°C) | $I_{AC}$ = 500 µA, | $V_{FF}$ = 4.7 V, | VAOUT = 1.25 V | 0 | –6 | –20 | µA |
| $I_{MOUT}$, high line, low power output current, (–40°C to 85°C) | $I_{AC}$ = 500 µA, | $V_{FF}$ = 4.7 V, | VAOUT = 1.25 V | 0 | | –23 | µA |
| $I_{MOUT}$, high line, high power output current | $I_{AC}$ = 500 µA, | $V_{FF}$ = 4.7 V, | VAOUT = 5 V | –70 | –90 | –105 | µA |
| $I_{MOUT}$, low line, low power output current | $I_{AC}$ = 150 µA, | $V_{FF}$ = 1.4 V, | VAOUT = 1.25 V | –10 | –19 | –50 | µA |
| $I_{MOUT}$, low line, high power output current | $I_{AC}$ = 150 µA, | $V_{FF}$ = 1.4 V, | VAOUT = 5 V | –268 | –300 | –346 | µA |
| $I_{MOUT}$, IAC limited | $I_{AC}$ = 150 µA, | $V_{FF}$ = 1.3 V, | VAOUT = 5 V | –250 | –300 | –400 | µA |
| Gain constant (K) | $I_{AC}$ = 300 µA, | $V_{FF}$ = 3 V, | VAOUT = 2.5 V | 0.5 | 1 | 1.5 | 1/V |
| $I_{MOUT}$, zero current | $I_{AC}$ = 150 µA, | $V_{FF}$ = 1.4 V, | VAOUT = 0.25 V | | 0 | –2 | µA |
| | $I_{AC}$ = 500 µA, | $V_{FF}$ = 4.7 V, | VAOUT = 0.25 V | | 0 | –2 | µA |
| $I_{MOUT}$, zero current, (0°C to 85°C) | $I_{AC}$ = 500 µA, | $V_{FF}$ = 4.7 V, | VAOUT = 0.5 V | | 0 | –3 | µA |
| $I_{MOUT}$, zero current, (–40°C to 85°C) | $I_{AC}$ = 500 µA, | $V_{FF}$ = 4.7 V, | VAOUT = 0.5 V | | 0 | –3.5 | µA |
| Power limit ($I_{MOUT}$ x $V_{FF}$) | $I_{AC}$ = 150 µA, | $V_{FF}$ = 1.4 V, | VAOUT = 5 V | –375 | –420 | –485 | µW |

## feed-forward

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| VFF output current | $I_{AC}$ = 300 µA | –140 | –150 | –160 | µA |

## gate driver

| PARAMETER | TEST CONDITIONS | | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| Pullup resistance | $I_O$ = –100 mA to –200 mA | | | | 5 | 12 | Ω |
| Pulldown resistance | $I_O$ = 100 mA | | | | 2 | 10 | Ω |
| Output rise time | $C_L$ = 1 nF, | $R_L$ = 10 Ω, | $V_{DRVOUT}$ = 0.7 V to 9 V | | 25 | 50 | ns |
| Output fall time | $C_L$ = 1 nF, | $R_L$ = 10 Ω, | $V_{DRVOUT}$ = 9 V to 0.7 V | | 10 | 50 | ns |
| Maximum duty cycle | | | | 93 | 95 | 100 | % |
| Minimum controlled duty cycle | At 100 kHz | | | | | 2 | % |

## zero power

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| Zero power comparator threshold | Measured on VAOUT | 0.20 | 0.33 | 0.50 | V |

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## pin descriptions

**CAI:** (current amplifier noninverting input) 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:** (current amplifier output) 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:** (oscillator timing capacitor) 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:** (gate drive) The output drive for the boost switch is a totem-pole MOSFET gate driver on DRVOUT. Use a series gate resistor to prevent interaction between the gate impedance and the output driver that might cause the DRVOUT to overshoot excessively. See characteristic curve (Figure 13) to determine minimum required gate resister value. Some overshoot of the DRVOUT output is always expected when driving a capacitive load.

**GND:** (ground) 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.

**IAC:** (current proportional to input voltage) 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 µA.

**MOUT:** (multiplier output and current amplifier inverting input) 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 $\left( 2 \times I_{IAC} \right)$. 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:** (over-voltage/enable) 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:** (PFC peak current limit) 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:** (oscillator charging current) A resistor from RT to GND is used to program oscillator charging current. A resistor between 10 kΩ and 100 kΩ is recommended. Nominal voltage on this pin is 3 V.

## pin descriptions (continued)

**VAI:** (voltage amplifier non-inverting input) This input can be tied to the VREF or any other voltage reference (≤7.5 V) to set the boost regulator output voltage.

**VAOUT:** (voltage amplifier output) 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:** (positive supply voltage) 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:** (feed-forward voltage) 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:** (voltage amplifier inverting input) This is normally connected to a compensation network and to the boost converter output through a divider network.

**VREF:** (voltage reference output) 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-μF or larger ceramic capacitor for best stability. Please refer to Figures 8 and 9 for VREF line and load regulation characteristics.

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## APPLICATION INFORMATION

The UCC3819 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 UCC3819 is that the non-inverting input of the voltage error amplifier is made available to the user through an external pin (VAI) in the UCC3819. 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.

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## APPLICATION INFORMATION
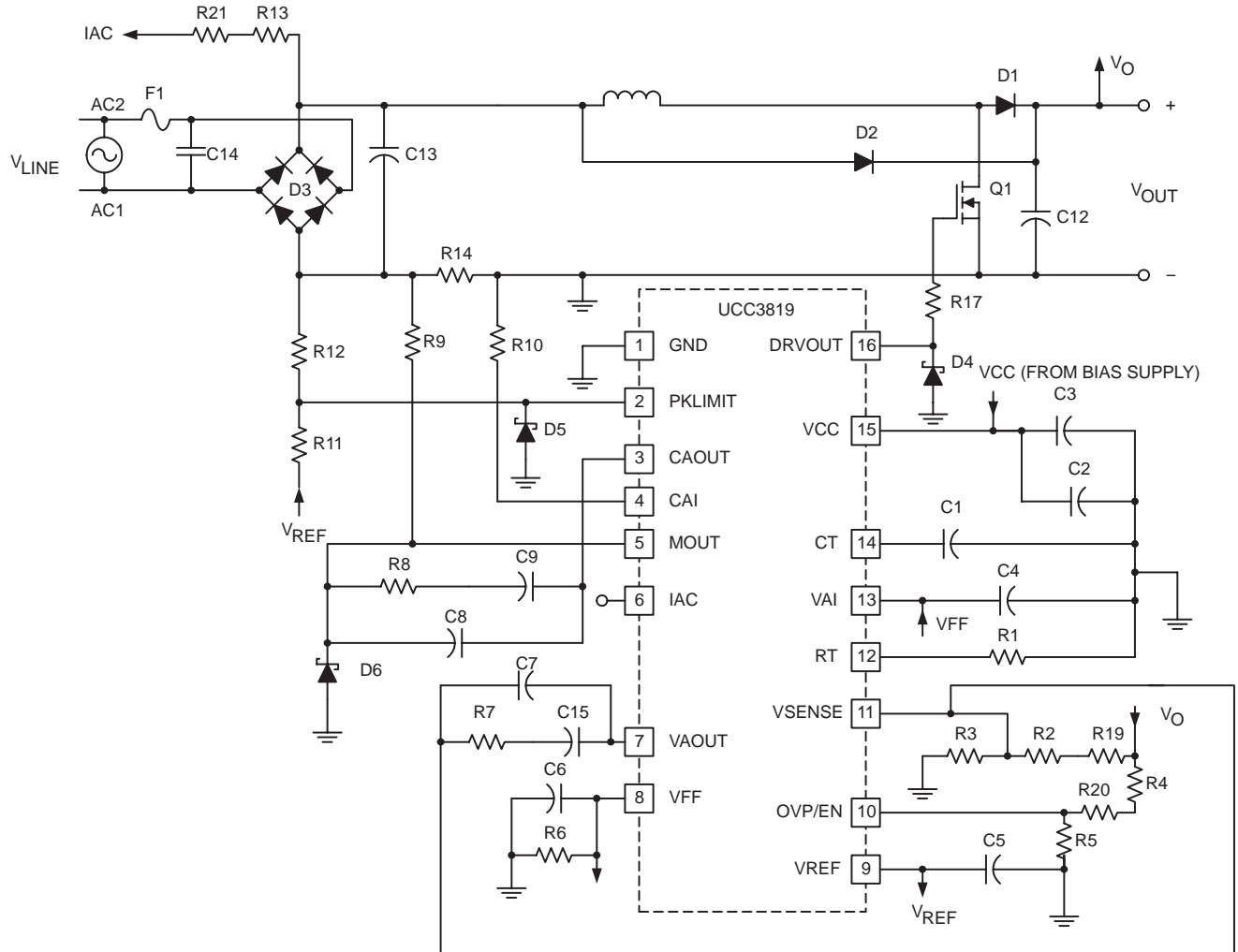


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**Figure 1. Suggested Implementation of UCC3819 in a Tracking Boost PFC Preregulator**

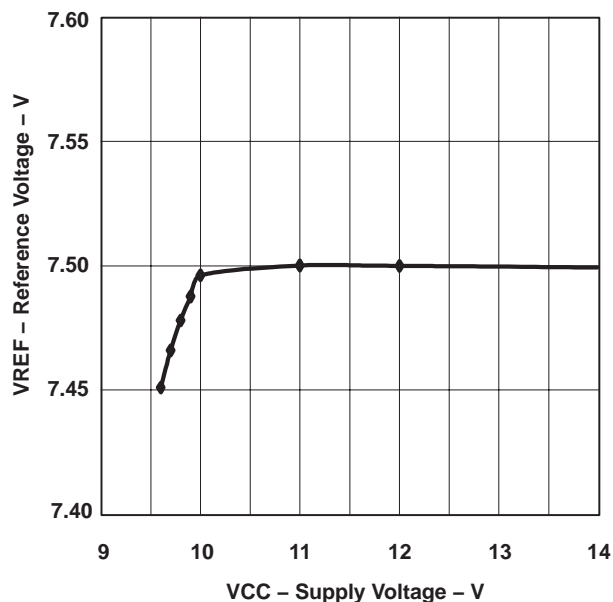## APPLICATION INFORMATION

**REFERENCE VOLTAGE
vs
SUPPLY VOLTAGE**



Figure 2

**REFERENCE VOLTAGE
vs
REFERENCE CURRENT**
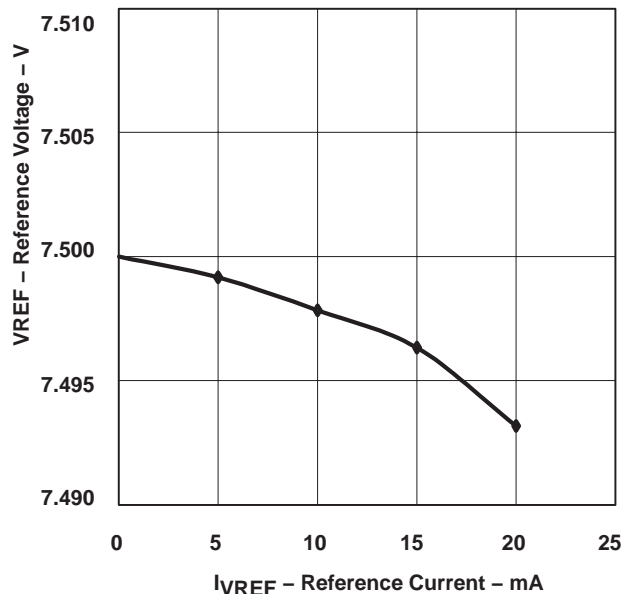


Figure 3

**MULTIPLIER OUTPUT CURRENT
vs
VOLTAGE ERROR AMPLIFIER OUTPUT**
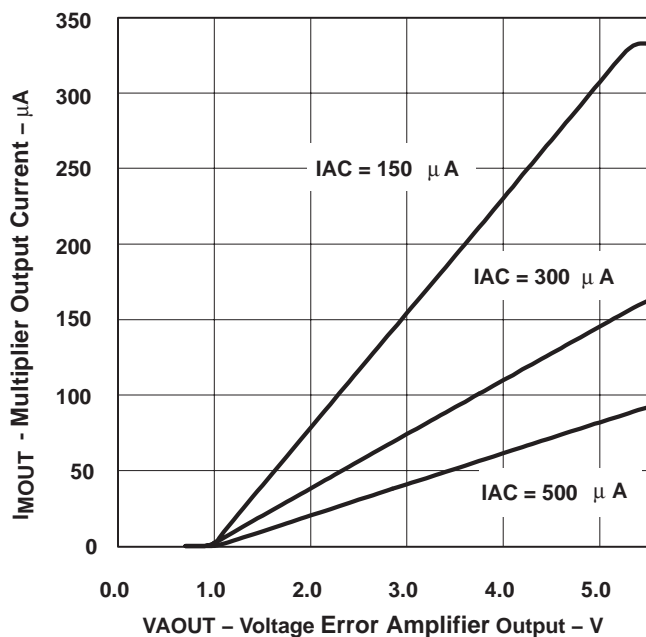


Figure 4

**MULTIPLIER GAIN
vs
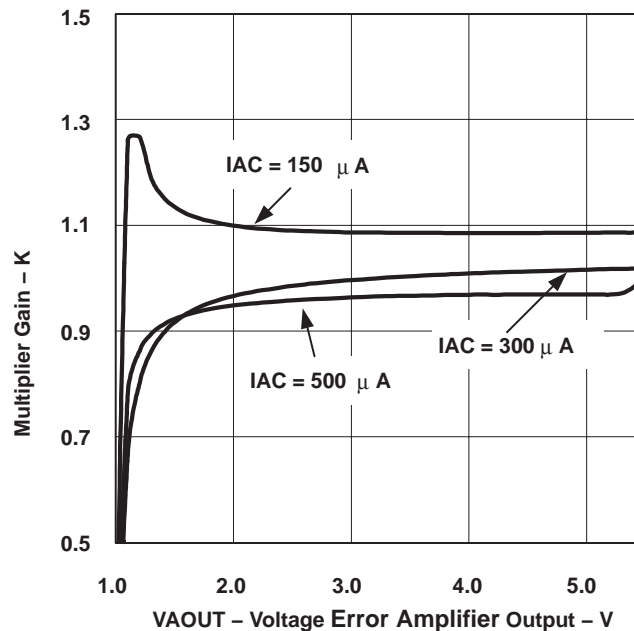VOLTAGE ERROR AMPLIFIER OUTPUT**



Figure 5

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## APPLICATION INFORMATION

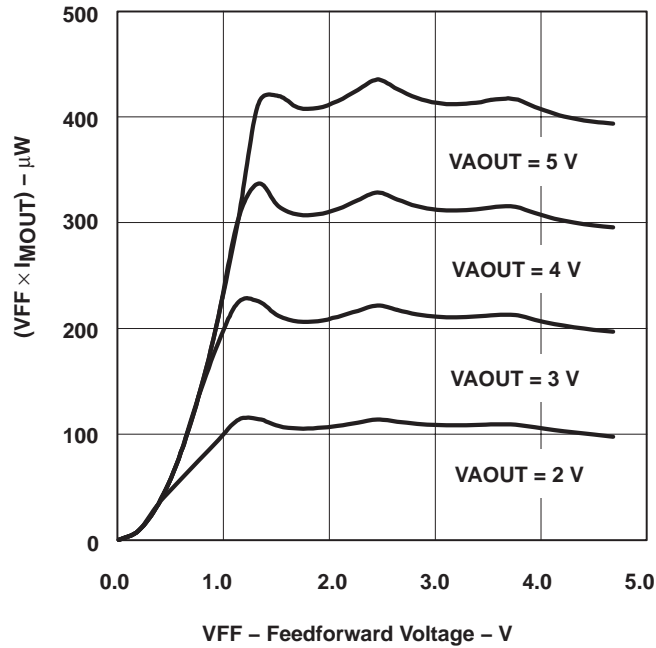**MULTIPLIER CONSTANT POWER PERFORMANCE**



**Figure 6**

**RECOMMENDED MINIMUM GATE RESISTANCE**
**vs**
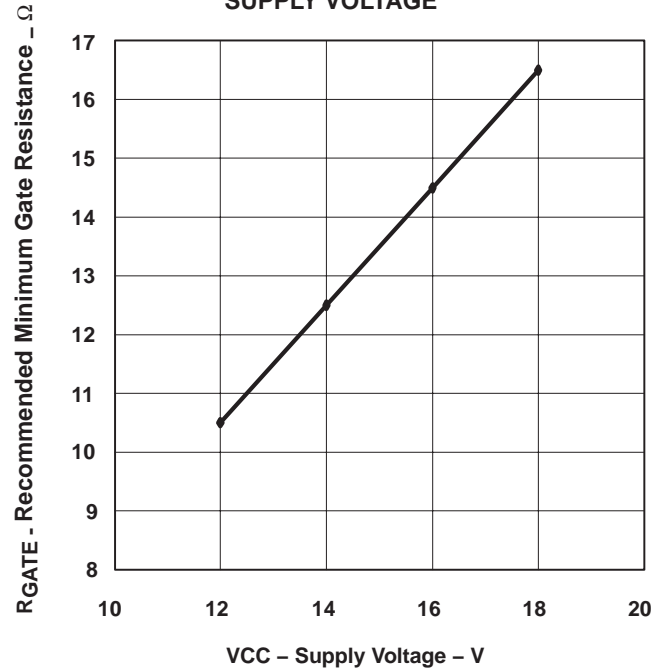**SUPPLY VOLTAGE**



**Figure 7**

## 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| UCC2819D | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | UCC2819D | Samples |
| UCC2819DG4 | ACTIVE | SOIC | D | 16 | | TBD | Call TI | Call TI | -40 to 85 | | Samples |
| UCC2819DTR | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | UCC2819D | Samples |
| UCC2819DTRG4 | ACTIVE | SOIC | D | 16 | | TBD | Call TI | Call TI | -40 to 85 | | Samples |
| UCC2819N | ACTIVE | PDIP | N | 16 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | N / A for Pkg Type | -40 to 85 | UCC2819N | Samples |
| UCC2819NG4 | ACTIVE | PDIP | N | 16 | | TBD | Call TI | Call TI | -40 to 85 | | Samples |
| UCC3819N | ACTIVE | PDIP | N | 16 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | N / A for Pkg Type | 0 to 70 | UCC3819N | Samples |
| UCC3819NG4 | ACTIVE | PDIP | N | 16 | | TBD | Call TI | Call TI | 0 to 70 | | 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)** 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)

**(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.

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## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

Reel Diameter

Reel Width (W1)

**TAPE DIMENSIONS**

Cavity

| 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**

Sprocket Holes

| Q1 | Q2 |
| Q3 | Q4 |

User Direction of Feed

Pocket Quadrants

*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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UCC2819DTR | SOIC | D | 16 | 2500 | 330.0 | 16.4 | 6.5 | 10.3 | 2.1 | 8.0 | 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) |
|---|---|---|---|---|---|---|---|
| UCC2819DTR | SOIC | D | 16 | 2500 | 333.2 | 345.9 | 28.6 |

## N (R−PDIP−T**)          PLASTIC DUAL−IN−LINE PACKAGE

16 PINS SHOWN

| PINS ** DIM | 14 | 16 | 18 | 20 |
|---|---|---|---|---|
| A   MAX | 0.775 (19,69) | 0.775 (19,69) | 0.920 (23,37) | 1.060 (26,92) |
| A   MIN | 0.745 (18,92) | 0.745 (18,92) | 0.850 (21,59) | 0.940 (23,88) |
| ⚠C  MS−001 VARIATION | AA | BB | AC | AD |

0.260 (6,60) / 0.240 (6,10)

0.070 (1,78) / 0.045 (1,14) ⚠D

0.045 (1,14) / 0.030 (0,76) ⚠D

0.020 (0,51) MIN

0.200 (5,08) MAX

Seating Plane

0.125 (3,18) MIN

0.100 (2,54)

0.021 (0,53) / 0.015 (0,38)

⊕ 0.010 (0,25) Ⓜ

14/18 Pin Only
20 Pin vendor option ⚠D

0.325 (8,26) / 0.300 (7,62)

0.015 (0,38)

Gauge Plane

0.010 (0,25) NOM

0.430 (10,92) MAX

4040049/E   12/2002

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

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D (R−PDSO−G16)                                    PLASTIC SMALL OUTLINE

0.394 (10,00)
0.386 (9,80)
⟨C⟩

16                                                9

0.244 (6,20)
0.228 (5,80)

0.157 (4,00)
0.150 (3,80) ⟨D⟩

1                                                8

Pin 1
Index Area

0.050 (1,27)

0.020 (0,51)
0.012 (0,31)

⊕ 0.010 (0,25) Ⓜ

0.069 (1,75) Max

0.010 (0,25)
0.004 (0,10)

0.010 (0,25)
0.005 (0,13)

0.004 (0,10)

Gauge Plane

Seating Plane

0.010 (0,25)          0°−8°

0.050 (1,27)
0.016 (0,40)

4040047−6/M   06/11

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 0.006 (0,15) each side.
        ⟨D⟩  Body width does not include interlead flash.  Interlead flash shall not exceed 0.017 (0,43) each side.
         E.  Reference JEDEC MS−012 variation AC.

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D (R−PDSO−G16)                          PLASTIC  SMALL  OUTLINE

Example Board Layout
(Note C)

Stencil Openings
(Note D)

←14x1,27

16x0,55

←14x1,27

16x1,50

5,40

5.40

Example
Non Soldermask Defined Pad

Example
Pad Geometry
(See Note C)

←0,60

1,55

Example
Solder Mask Opening
(See Note E)

←0,07

All Around

4211283−4/E  08/12

NOTES:   A.  All linear dimensions are in millimeters.
         B.  This drawing is subject to change without notice.
         C.  Publication IPC−7351 is recommended for alternate designs.
         D.  Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release.  Customers should
             contact their board assembly site for stencil design recommendations. Refer to IPC−7525 for other stencil recommendations.
         E.  Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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