



## UC3844/45

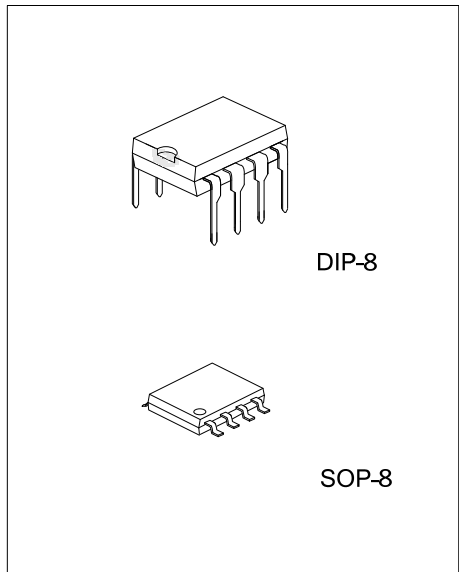
## LINEAR INTEGRATED CIRCUIT

### HIGH PERFORMANCE CURRENT MODE PWM CONTROLLERS

#### DESCRIPTION

The UTC **UC3844/3845** are high performance fixed frequency current mode controllers that specifically designed for Off-Line and DC to DC converter applications with minimal external parts count.

The differences between **UC3844** and **UC3845** are the maximum duty cycle ranges and under-voltage lockout thresholds. The **UC3844** ideally suited to off-line applications with UVLO thresholds of  $16V_{(ON)}$  and  $10V_{(OFF)}$ , and **UC3845** has UVLO thresholds of  $8.5V_{(ON)}$  and  $7.6V_{(OFF)}$  for lower voltage applications.



#### FEATURES

- \* Operation output switching frequency up to 500 kHz
- \* Automatic feed forward compensation
- \* Latching PWM for cycle-by-cycle current limiting
- \* High current totem pole output
- \* Internally trimmed reference with under voltage lockout
- \* UVLO with hysteresis
- \* Low startup and operating current

#### ORDERING INFORMATION

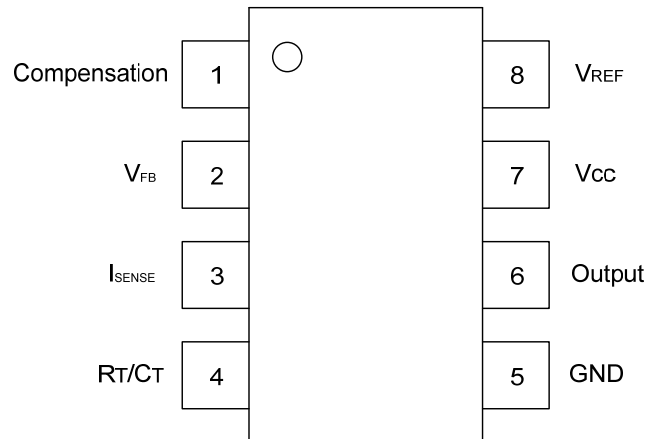
| Ordering Number |               | Package | Packing   |
|-----------------|---------------|---------|-----------|
| Lead Free       | Halogen Free  |         |           |
| UC3844L-D08-T   | UC3844G-D08-T | DIP-8   | Tube      |
| UC3844L-S08-R   | UC3844G-S08-R | SOP-8   | Tape Reel |
| UC3845L-D08-T   | UC3845G-D08-T | DIP-8   | Tube      |
| UC3845L-S08-R   | UC3845G-S08-R | SOP-8   | Tape Reel |

|  |   |
|--|---|
| <p>UC3844G-D08-T</p> <p>(1)Packing Type<br/>(2)Package Type<br/>(3)Green Package</p> | <p>(1) T: Tube, R: Tape Reel<br/>(2) D08: DIP-8, S08: SOP-8<br/>(3) G: Halogen Free and Lead Free, L: Lead Free</p> |
|--|---|

## MARKING

| PACKAGE | UC3844   | UC3845   |
|---------|--|--|
| DIP-8   | <p>             8 7 6 5 → Date Code<br/>             UTC<br/>             UC 3 8 4 4<br/>             L: Lead Free<br/>             G: Halogen Free<br/>             Lot Code         </p> | <p>             8 7 6 5 → Date Code<br/>             UTC<br/>             UC 3 8 4 5<br/>             L: Lead Free<br/>             G: Halogen Free<br/>             Lot Code         </p> |
| SOP-8   | <p>             8 7 6 5 → Date Code<br/>             UTC<br/>             UC3844<br/>             L: Lead Free<br/>             G: Halogen Free<br/>             Lot Code         </p>     | <p>             8 7 6 5 → Date Code<br/>             UTC<br/>             UC3845<br/>             L: Lead Free<br/>             G: Halogen Free<br/>             Lot Code         </p>     |

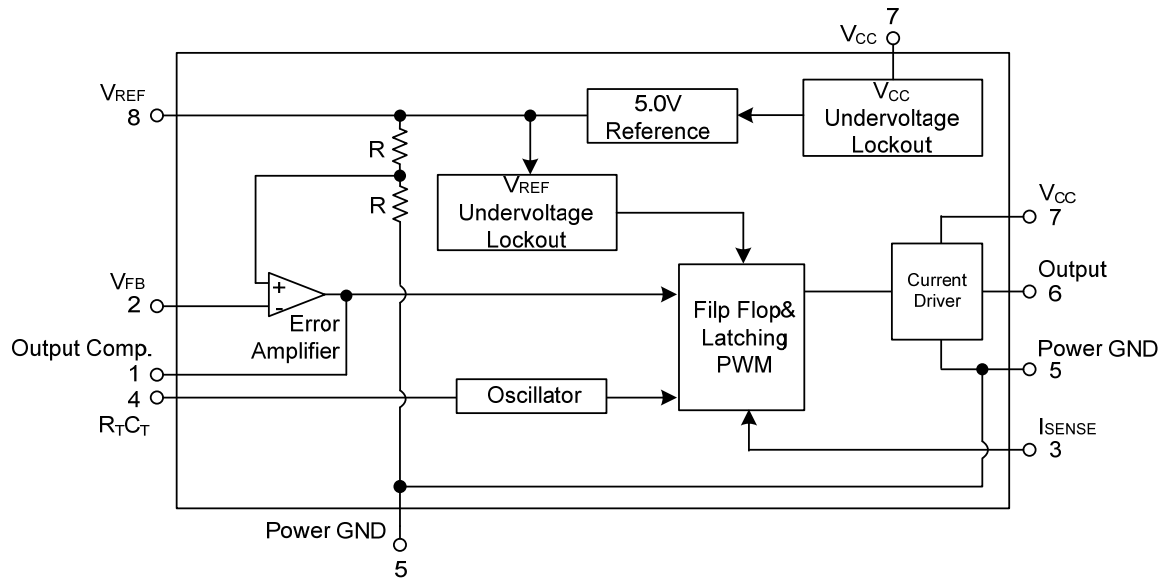
## PIN CONFIGURATION



## PIN DESCRIPTION

| PIN NO | PIN NAME                       | FUNCTION  |
|--------|--------------------------------|---|
| 1      | Compensation                   | Error amplifier output, this pin is made available for loop compensation.   |
| 2      | V <sub>FB</sub>                | Voltage Feedback, the inverting input of the Error Amplifier. It is normally connected to the switching power supply output through a resistor divider.   |
| 3      | I <sub>SENSE</sub>             | A voltage proportional to inductor current is connected to this input. The PWM uses this information to terminate the output switch conduction.   |
| 4      | R <sub>T</sub> /C <sub>T</sub> | The Oscillator frequency and maximum output duty cycle are programmed by connecting resistor R <sub>T</sub> to V <sub>ref</sub> and capacitor C <sub>T</sub> to ground. Operation to 1 MHz is possible. |
| 5      | GND                            | Power ground.   |
| 6      | Output                         | This output directly drives the gate of a power MOSFET. Peak currents up to 1A are sourced and sunk by this pin. The output switches at one-half the oscillator frequency.                              |
| 7      | V <sub>CC</sub>                | Positive supply.  |
| 8      | V <sub>REF</sub>               | Reference output, provides charging current for capacitor C <sub>T</sub> through resistor R <sub>T</sub> .  |

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub>=25°C)

| PARAMETER                                 | SYMBOL                             | RATINGS     | UNIT |    |
|---|------------------------------------|-------------|------|----|
| Current Sense and Voltage feedback Inputs | V <sub>IN</sub>                    | -0.3 ~ +5.5 | V    |    |
| Total Power Supply and Zener Current      | (I <sub>CC</sub> +I <sub>Z</sub> ) | 30          | mA   |    |
| Error Amp Output Sink Current             | I <sub>SINK</sub>                  | 10          | mA   |    |
| Output Current, Source or Sink (Note 2)   | I <sub>OUT</sub>                   | 1.0         | A    |    |
| Output Energy (Capacitive Load per cycle) | W                                  | 5.0         | μJ   |    |
| Power Dissipation                         | P <sub>D</sub>                     | DIP-8       | 1250 | mW |
|   |                                    | SOP-8       | 800  |    |
| Junction Temperature                      | T <sub>J</sub>                     | +150        | °C   |    |
| Operation Temperature                     | T <sub>OPR</sub>                   | 0 ~ 70      | °C   |    |
| Storage Temperature                       | T <sub>STG</sub>                   | -65 ~ +150  | °C   |    |

Note: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Maximum package power dissipation limits must be observed.

■ THERMAL DATA

| PARAMETER           | SYMBOL          | RATINGS | UNIT |      |
|---------------------|-----------------|---------|------|------|
| Junction to Ambient | θ <sub>JA</sub> | SOP-8   | 156  | °C/W |
|                     |                 | DIP-8   | 100  |      |

■ ELECTRICAL CHARACTERISTICS

(T<sub>A</sub>=25°C, V<sub>CC</sub>=15V, R<sub>T</sub>=10k, C<sub>T</sub>=3.3nF, 0°C ≤ T<sub>A</sub> ≤ 70°C, unless otherwise specified)

| PARAMETER   | SYMBOL                | TEST CONDITIONS                               | MIN   | TYP  | MAX  | UNIT  |
|---|-----------------------|---|---|------|------|-------|
| <b>REFERENCE SECTION</b>                            |                       |   |   |      |      |       |
| Reference Output Voltage                            | V <sub>REF</sub>      | I <sub>OUT</sub> =1.0mA, T <sub>J</sub> =25°C | 4.9   | 5.0  | 5.1  | V     |
| Line Regulation                                     | ΔV <sub>OUT</sub>     | V <sub>CC</sub> =12V ~ 25V                    |   | 2.0  | 20   | mV    |
| Load Regulation                                     | ΔV <sub>OUT</sub>     | I <sub>OUT</sub> =1.0mA ~ 20mA                |   | 3.0  | 25   | mV    |
| Temperature Stability                               | t <sub>s</sub>        |   |   | 0.2  |      | mV/°C |
| Total Output Variation over Line, Load, Temperature | V <sub>REF</sub>      |   | 4.82  |      | 5.18 | V     |
| Output Noise Voltage                                | e <sub>N</sub>        | f=10Hz ~ kHz, T <sub>J</sub> =25°C            |   | 50   |      | μV    |
| Long Term Stability                                 | S                     | T <sub>A</sub> =125°C for 1000 Hours          |   | 5    |      | mV    |
| Output Short Circuit Current                        | I <sub>SC</sub>       |   | -30   | -85  | -180 | mA    |
| <b>OSCILLATOR SECTION</b>                           |                       |   |   |      |      |       |
| Oscillator Voltage Swing                            | V <sub>OSC</sub>      |   |   | 1.6  |      | V     |
| Discharge Current                                   | I <sub>DSG</sub>      | V <sub>OSC</sub> =2.0V, T <sub>J</sub> =25°C  |   | 10.8 |      | mA    |
| Frequency   | f <sub>OSC</sub>      | T <sub>J</sub> =25°C                          | 47  | 52   | 57   | kHz   |
|   |                       | 0°C ≤ T <sub>A</sub> ≤ 70°C                   | 46  |      | 60   |       |
| Frequency Change with Voltage                       | Δf <sub>OSC</sub> /ΔV | V <sub>CC</sub> =12V ~ 25V                    |   | 0.2  | 1.0  | %     |
| Frequency Change with Temperature                   | Δf <sub>OSC</sub> /ΔT | 0°C ≤ T <sub>A</sub> ≤ 70°C                   |   | 5.0  |      | %     |
| <b>ERROR AMPLIFIER SECTION</b>                      |                       |   |   |      |      |       |
| Voltage Feedback Input                              | V <sub>FB</sub>       | V <sub>OUT</sub> =2.5V                        | 2.42  | 2.50 | 2.58 | V     |
| Output Voltage Swing                                | High                  | V <sub>OH</sub>                               | R <sub>L</sub> =15k to ground, V <sub>FB</sub> =2.3V            | 5.0  | 6.2  | V     |
|   | Low                   | V <sub>OL</sub>                               | R <sub>L</sub> =15k to V <sub>REF</sub> , V <sub>FB</sub> =2.7V |      | 0.8  |       |
| Output Current                                      | Sink                  | I <sub>SINK</sub>                             | V <sub>OUT</sub> =1.1V, V <sub>FB</sub> =2.7V                   | 2.0  | 12   | mA    |
|   | Source                | I <sub>SOURCE</sub>                           | V <sub>OUT</sub> =5.0V, V <sub>FB</sub> =2.3V                   | -0.5 | -1.0 |       |
| Input Bias Current                                  | I <sub>(BIAS)</sub>   | V <sub>FB</sub> =2.7V                         |   | -0.1 | -2.0 | μA    |
| Open Loop Voltage Gain                              | G <sub>VO</sub>       | V <sub>OUT</sub> =2.0V ~ 4.0V                 | 65  | 90   |      | dB    |
| Power Supply Rejection Ratio                        | PSRR                  | V <sub>CC</sub> =12V ~ 25V                    | 60  | 70   |      | dB    |
| Unity Gain Bandwidth                                | GB <sub>W</sub>       | T <sub>J</sub> =25°C                          | 0.7   | 1.0  |      | MHz   |

## ■ ELECTRICAL CHARACTERISTICS(Cont.)

| PARAMETER   | SYMBOL            | TEST CONDITIONS                | MIN              | TYP  | MAX  | UNIT    |   |
|---|-------------------|--------------------------------|------------------|------|------|---------|---|
| <b>CURRENT SENSE SECTION</b>                      |                   |                                |                  |      |      |         |   |
| Current Sense Input Voltage Gain<br>(Note 2, 3)   | $G_V$             |                                | 2.85             | 3.0  | 3.15 | V/V     |   |
| Maximum Current Sense Input<br>Threshold (Note 2) | $V_{I(THR)}$      |                                | 0.9              | 1.0  | 1.1  | V       |   |
| Input Bias Current                                | $I_{I(BIAS)}$     |                                |                  | -2.0 | -10  | $\mu$ A |   |
| Power Supply Rejection Ratio                      | PSRR              | $V_{CC}=12V \sim 25V$ (Note 4) |                  | 70   |      | dB      |   |
| Propagation Delay                                 | $t_{PLH(IN/OUT)}$ |                                |                  | 150  | 300  | ns      |   |
| <b>OUTPUT SECTION</b>                             |                   |                                |                  |      |      |         |   |
| Output Voltage                                    | Low               | $V_{OL}$                       | $I_{SINK}=20mA$  |      | 0.2  | 0.8     | V |
|   |                   |                                | $I_{SINK}=200mA$ |      | 1.6  | 2.2     |   |
|   | High              | $V_{OH}$                       | $I_{SINK}=20mA$  | 11   | 13.5 |         | V |
|   |                   |                                | $I_{SINK}=200mA$ | 11   | 13.4 |         |   |
| Output Voltage with $U_{VLO}$ Activated           | $V_{OL(UVLO)}$    | $V_{CC}=6.0V, I_{SINK}=1.0mA$  |                  | 0.7  | 1.2  | V       |   |
| Output Voltage Rise Time                          | $t_R$             | $C_L=1.0nF, T_J=25^\circ C$    |                  | 50   | 150  | ns      |   |
| Output Voltage Fall Time                          | $t_F$             | $C_L=1.0nF, T_J=25^\circ C$    |                  | 50   | 150  | ns      |   |
| <b>UNDERVOLTAGE LOCKOUT SECTION</b>               |                   |                                |                  |      |      |         |   |
| Startup Threshold                                 | UC3844            | $V_{THR}$                      |                  | 14.5 | 16.0 | 17.5    | V |
|   | UC3845            |                                |                  | 7.8  | 8.4  | 9.0     |   |
| Minimum Operating<br>Voltage After Turn-On        | UC3844            | $V_{CC(MIN)}$                  |                  | 8.5  | 10.0 | 11.5    | V |
|   | UC3845            |                                |                  | 7.0  | 7.6  | 8.2     |   |
| <b>PWM SECTION</b>                                |                   |                                |                  |      |      |         |   |
| Duty Cycle  | MAX               | $DC_{MAX}$                     |                  | 47   | 48   | 50      | % |
|   | MIN               | $DC_{MIN}$                     |                  |      |      | 0       | % |
| <b>TOTAL DEVICE</b>                               |                   |                                |                  |      |      |         |   |
| Power Supply Zener Voltage                        | $V_Z$             | $I_{CC}=25mA$                  | 30               | 36   |      | V       |   |
| Power Supply Current<br>(Note 4)                  | $I_{CC}$          | Start Up                       |                  | 0.3  | 0.5  | mA      |   |
|   |                   | Operating                      |                  | 12   | 17   |         |   |
| Startup Current                                   | $I_{START-UP}$    | $V_{CC}=14V, UVLO$ Active      |                  | 0.3  | 0.5  | mA      |   |

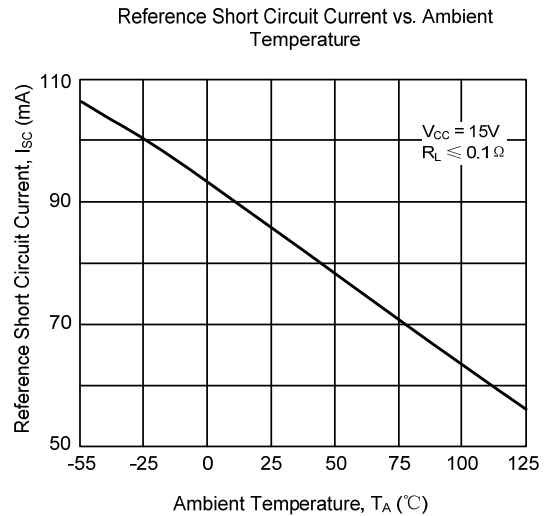
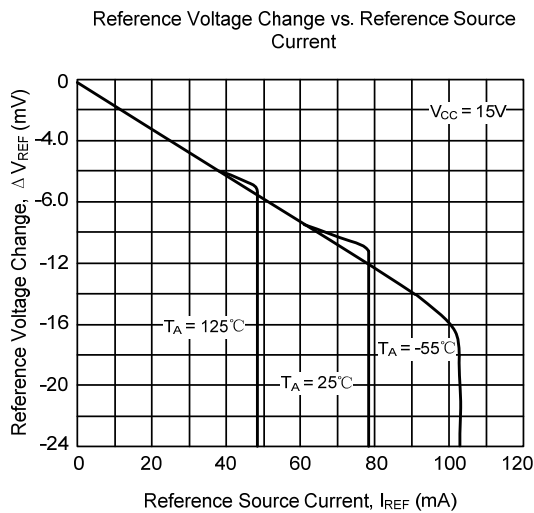
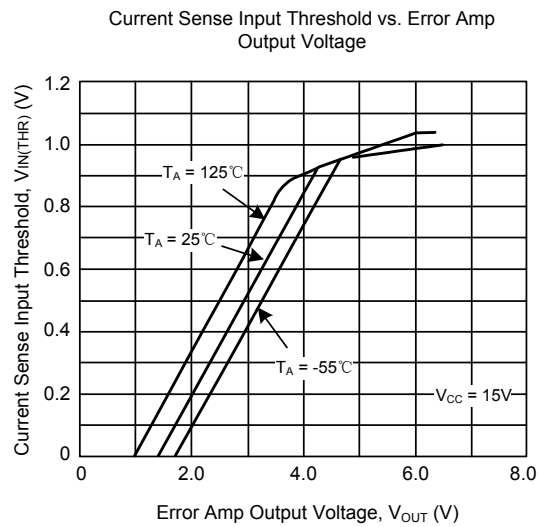
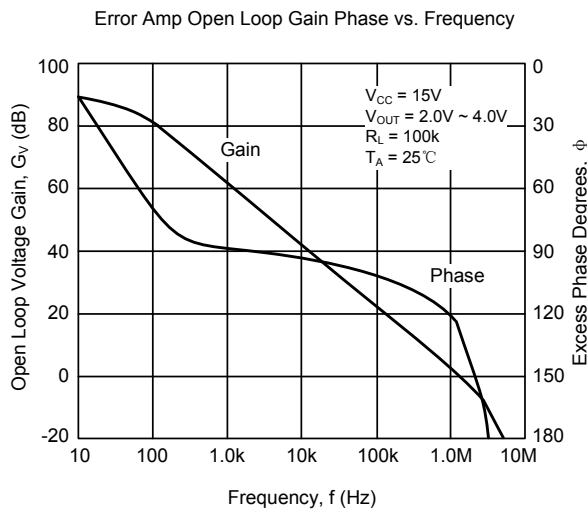
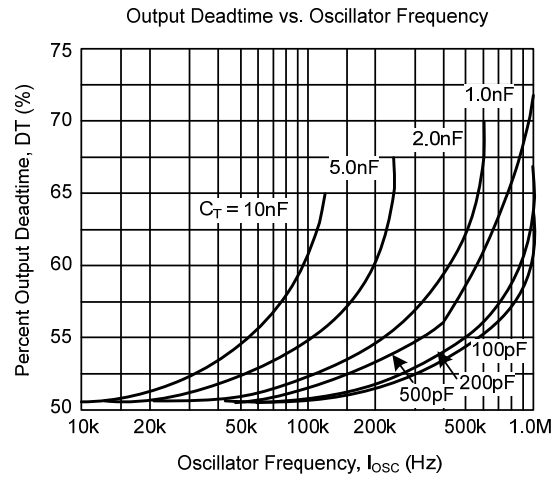
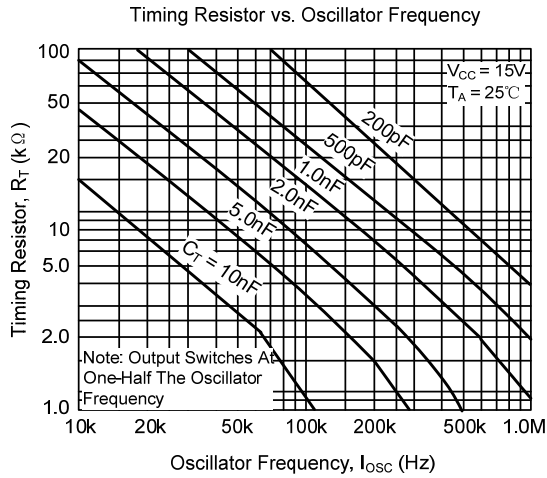
Notes: 1. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient as possible.

2. This parameter is measured at the latch trip point with  $V_{FB}=0V$ .

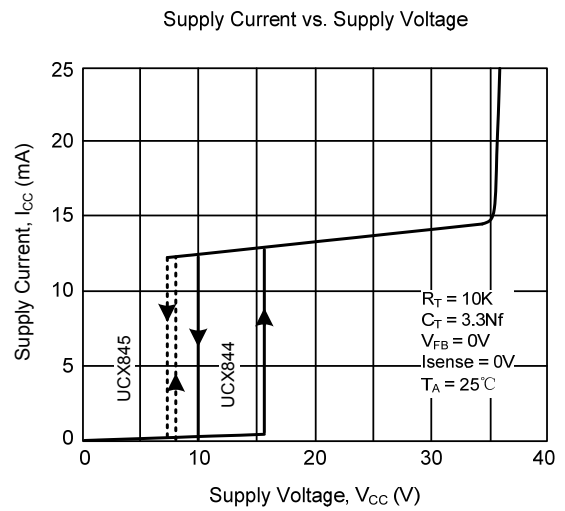
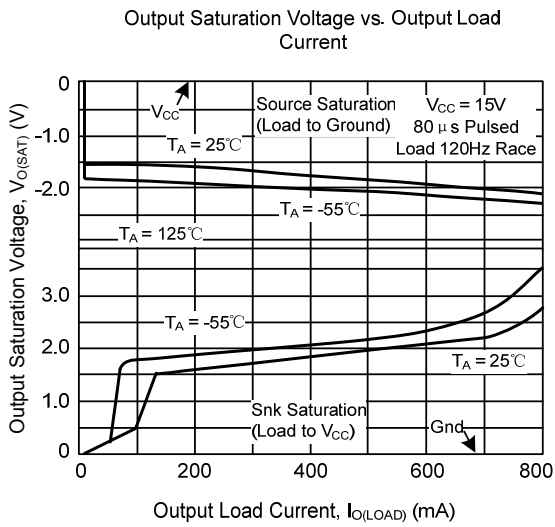
3. Comparator gain is defined as:  $A_V = \frac{\Delta V \text{ Output Compensation}}{\Delta V \text{ Current Sense Input}}$

4. Adjust  $V_{CC}$  above the startup threshold before setting to 15V.

## TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. UTC reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.