



UM603A

LINEAR INTEGRATED CIRCUIT

DUAL OPERATIONAL AMPLIFIER AND CURRENT CONTROLLER

DESCRIPTION

The UTC **UM603A** is a monolithic IC that includes one independent op-amp and another op-amp for which the non inverting input is wired to a 2.5V fixed voltage reference. This device is offering space and cost saving in many applications like power supply management or data acquisition systems.

FEATURES

OPERATIONAL AMPLIFIER

- *Low input offset voltage: 0.5mV typ. for UTC **UM603A**
- *Low supply current: 350uA/op.(@ $V_{CC}= 5V$)
- *Medium bandwidth(unity gain): 0.9MHz
- *Large output voltage swing: 0V ~ ($V_{CC}-1.5V$)
- *Input common mode voltage range includes ground
- *Wide power supply range: 3V ~ 32V $\pm 1.5 \sim \pm 16V$

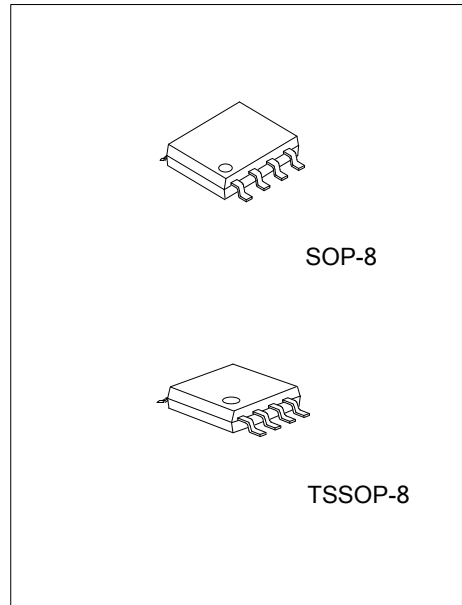
VOLTAGE REFERENCE

- *Fixed output voltage reference 2.5V
- * Reference voltage tolerance
 - UM603A-1: $\pm 0.4\%$
 - UM603A-2: $\pm 1\%$
- *Sink current capability : 1 ~ 100mA
- *Typical output impedance : 0.2 Ω

ORDERING INFORMATION

| Ordering Number | | Package | Packing |
|-----------------|---------------|---------|-----------|
| Lead Free | Halogen Free | | |
| UM603AL-S08-R | UM603AG-S08-R | SOP-8 | Tape Reel |
| UM603AL-P08-R | UM603AG-P08-R | TSSOP-8 | Tape Reel |

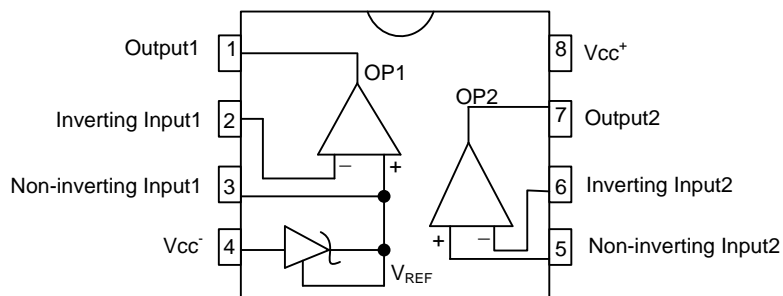
| | |
|---|--|
| <p>UM603AG-S08-R</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Green Package</p> | <p>(1) R: Tape Reel</p> <p>(2) S08: SOP-8, P08: TSSOP-8</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p> |
|---|--|



MARKING

| SOP-8 | TSSOP-8 |
|---|---|
| <p>UTC → Date Code L: Lead Free G: Halogen Free Lot Code</p> | <p>UTC → Date Code L: Lead Free G: Halogen Free Lot Code</p> |

PIN CONFIGURATION



PIN DESCRIPTION

| PIN NO | PIN NAME | I/O | PIN DESCRIPTION |
|--------|----------------------|-----|---|
| 1 | Output 1 | O | OP1 output |
| 2 | Inverting Input1 | I | OP1 inverting input |
| 3 | Non-Inverting Input1 | O | A 2.5V fixed voltage reference output, wired to OP1 non-inverting input |
| 4 | V _{cc-} | | |
| 5 | Non-Inverting Input2 | I | OP2 non-inverting input |
| 6 | Inverting Input2 | I | OP2 inverting input |
| 7 | Output 2 | O | OP2 output |
| 8 | V _{cc+} | | |

■ ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | RATING | UNIT |
|----------------------------|---------------|------------|------|
| Supply Voltage | V_{CC} | 36 | V |
| Differential Input Voltage | $V_{I(DIFF)}$ | 36 | V |
| Input Voltage | V_{IN} | -0.3 ~ +36 | V |
| Junction Temperature | T_J | +125 | °C |
| Operating Temperature | T_{OPR} | -55 ~ +125 | °C |

Note: 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.

■ THERMAL DATA

| PARAMETER | SYMBOL | RATING | UNIT |
|---------------------|---------|--------|------|
| Junction to Ambient | SOP-8 | 175 | °C/W |
| | TSSOP-8 | 120 | |

■ ELECTRICAL CHARACTERISTICS

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP. | MAX | UNIT |
|--|----------|---|-----|------|-----|------|
| Total Supply Current, excluding Current in the Voltage Reference | I_{CC} | $V_{CC}^+=5V$, no load, $T_{MIN} \leq T_A \leq T_{MAX}$ | 0.7 | | 1.2 | mA |
| | | $V_{CC}^+=30V$, no load, $T_{MIN} \leq T_A \leq T_{MAX}$ | | | 2 | |

$V_{CC}^+=+5V$, $V_{CC}=\text{Ground}$, $T_A=25^\circ\text{C}$ (unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT | |
|---|---------------|--|------------------------------------|---------------------------------|-----|------------------------------|----|
| OPERATOR1 (op-amp with non-inverting input connected to the internal V_{REF}) | | | | | | | |
| Input Offset Voltage | UM603A-1 | $V_{I(OFF)}$ | $V_{I(CM)}=0V$ | $T_A=25^\circ\text{C}$ | 0.5 | 2 | mV |
| | | | | $T_{MIN} \leq T_A \leq T_{MAX}$ | | 3 | |
| | UM603A-2 | $V_{I(OFF)}$ | $V_{I(CM)}=0V$ | $T_A=25^\circ\text{C}$ | 1 | 4 | mV |
| | | | | $T_{MIN} \leq T_A \leq T_{MAX}$ | | 5 | |
| Input Offset Voltage Drift | $DV_{I(OFF)}$ | | | 7 | | $\mu\text{V}/^\circ\text{C}$ | |
| Input Bias Current | $I_{I(BIAS)}$ | negative input | | 20 | | nA | |
| Large Signal Voltage Gain | A_{VD} | $V_{I(CM)}=0V$, $V_{CC}=15V$, $R_L=2k$ | | 100 | | V/mV | |
| Supply Voltage Rejection Ratio | SVR | $V_{I(CM)}=0V$, $V_{CC}=5V \sim 30V$ | 65 | 100 | | dB | |
| Output Current Source | I_{SOURCE} | $V_{OUT}=2V$, $V_{CC}=+15V$, $V_{ID}=+1V$ | 20 | 40 | | mA | |
| Short Circuit to Ground | I_{SC} | $V_{CC}=+15V$ | | 40 | 60 | mA | |
| Output Current Sink | I_{SINK} | $V_{ID}=-1V$, $V_{CC}=+15V$, $V_{OUT}=2V$ | 10 | 20 | | mA | |
| High Level Output Voltage | V_{OH} | $V_{CC}^+=30V$ | $T_A=25^\circ\text{C}$, $R_L=10k$ | 27 | | V | |
| | | | $T_{MIN} \leq T_A \leq T_{MAX}$ | 27 | 28 | | |
| Low Level Output Voltage | V_{OL} | $R_L=10k$ | | 5 | 20 | mV | |
| | | $T_{MIN} \leq T_A \leq T_{MAX}$ | | 5 | 20 | | |
| Slew Rate at Unity Gain | SR | $V_{IN}=0.5 \sim 3V$, $V_{CC}=15V$ $R_L=2k$, $C_L=100pF$, unity gain | 0.2 | 0.4 | | V/ μs | |
| Gain Bandwidth Product | G_{BP} | $V_{CC}=30V$, $R_L=2K$, $C_L=100pF$ $f=100kHz$, $V_{IN}=10mV$ | 0.5 | 0.9 | | MHz | |
| Total Harmonic Distortion | THD | $f=1kHz$, $C_L=100pF$, $V_{OUT}=2V_{PP}$ $A_v=20dB$, $R_L=2k$, $V_{CC}=30V$ | | 0.02 | | % | |

■ ELECTRICAL CHARACTERISTICS (Cont.)

$V_{CC}=\pm 5V$, $V_{CC}=\text{Ground}$, $V_{OUT}=1.4V$, $T_A=25^\circ\text{C}$ (unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|-----------------|--|------------------------------------|------|------------------------------|------------------|
| OPERATOR2 (independent op-amp)(Note 1) | | | | | | |
| Input Offset Voltage | UM603A-1 | $V_{I(OFF)}$ | $T_A=25^\circ\text{C}$ | 0.5 | 2 | mV |
| | | | $T_{MIN}\leq T_A\leq T_{MAX}$ | | 3 | |
| | UM603A-2 | | $T_A=25^\circ\text{C}$ | 1 | 4 | mV |
| | | | $T_{MIN}\leq T_A\leq T_{MAX}$ | | 5 | |
| Input Offset Voltage Drift | $DV_{I(OFF)}$ | | 7 | | $\mu\text{V}/^\circ\text{C}$ | |
| Input Offset Current | $I_{I(OFF)}$ | $T_A=25^\circ\text{C}$ | | 2 | 30 | nA |
| | | $T_{MIN}\leq T_A\leq T_{MAX}$ | | | 50 | |
| Input Bias Current | $I_{I(BIAS)}$ | $T_A=25^\circ\text{C}$ | | 20 | 150 | nA |
| | | $T_{MIN}\leq T_A\leq T_{MAX}$ | | | 200 | |
| Large Signal Voltage Gain | A_{VD} | $V_{CC}=15V$, $R_L=2k$, $V_{OUT}=1.4V\sim 11.4V$ | 50 | 100 | | V/mV |
| | | $T_{MIN}\leq T_A\leq T_{MAX}$ | 25 | | | |
| Supply Voltage Rejection Ratio | SVRR | $V_{CC}=5V\sim 30V$ | 65 | 100 | | dB |
| Input Common Mode Voltage Range | $V_{I(CM)}$ | $V_{CC}=\pm 30V$ (Note 1) | 0 | | $(V_{CC+})-1.5$ | V |
| | | $T_{MIN}\leq T_A\leq T_{MAX}$ | 0 | | $(V_{CC+})-2$ | |
| Common Mode Rejection Ratio | CMRR | | 70 | 85 | | dB |
| | | $T_{MIN}\leq T_A\leq T_{MAX}$ | 60 | | | |
| Output Current Source | $I_{O(SOURCE)}$ | $V_{CC}=\pm 15V$, $V_{OUT}=2V$, $V_{JD}=\pm 1V$ | 20 | 40 | | mA |
| Short Circuit to Ground | I_{SC} | $V_{CC}=\pm 15V$ | | 40 | 60 | mA |
| Output Current Sink | $I_{O(SINK)}$ | $V_{ID}=-1V$, $V_{CC}=\pm 15V$, $V_{OUT}=2V$ | 10 | 20 | | mA |
| High Level Output Voltage | V_{OH} | $V_{CC+}=30V$ | $T_A=25^\circ\text{C}$, $R_L=10k$ | 27 | 28 | V |
| | | | $T_{MIN}\leq T_A\leq T_{MAX}$ | 27 | | |
| Low Level Output Voltage | V_{OL} | $R_L=10k$ | | 5 | 20 | mV |
| | | $T_{MIN}\leq T_A\leq T_{MAX}$ | | 5 | 20 | |
| Slew Rate at Unity Gain | SR | $V_{IN}=0.5\sim 3V$, $V_{CC}=15V$ $R_L=2k$, $C_L=100pF$, unity gain | 0.2 | 0.4 | | V/ μs |
| Gain Bandwidth Product | GBP | $V_{CC}=30V$, $R_L=2K$, $C_L=100pF$ $f=100kHz$, $V_{IN}=10mV$ | 0.5 | 0.9 | | MHz |
| Total Harmonic Distortion | THD | $f=1kHz$, $C_L=100pF$, $V_{OUT}=2V_{PP}$ $A_V=20dB$, $R_L=2k$, $V_{CC}=30V$, | | 0.02 | | % |

■ VOLTAGE REFERENCE

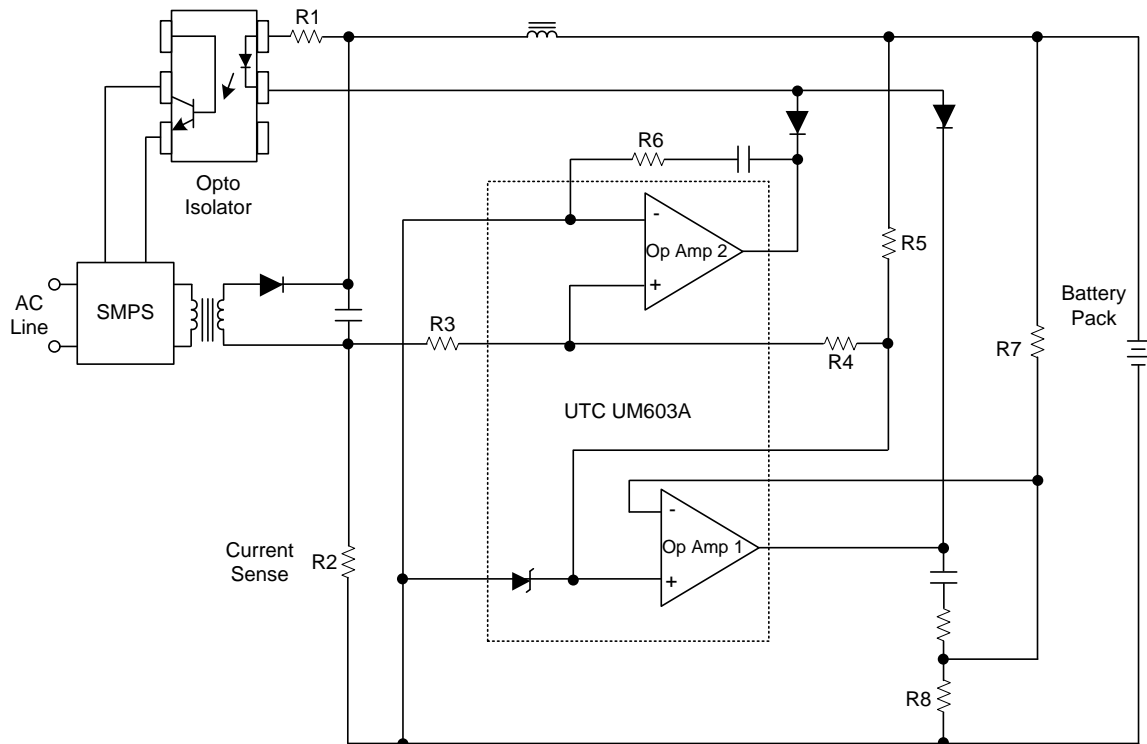
| PARAMETER | SYMBOL | Value | UNIT |
|-----------------|--------|---------|------|
| Cathode Current | I_K | 1 ~ 100 | mA |

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT | |
|--|------------------|---|--|-------|-----|----------|---|
| Reference Input Voltage | UM603A-1 | V_{REF} | $\pm 0.4\%$, $T_A=25^\circ\text{C}$ | 2.49 | 2.5 | 2.51 | V |
| | | | $T_{MIN}\leq T_A\leq T_{MAX}$, $V_{KA}=V_{REF}$, $I_{KA}=10mA$ | 2.48 | | 2.52 | |
| | UM603A-2 | | $\pm 1\%$, $T_A=25^\circ\text{C}$ | 2.475 | 2.5 | 2.525 | |
| | | | $T_{MIN}\leq T_A\leq T_{MAX}$, $V_{KA}=V_{REF}$, $I_{KA}=10mA$ | 2.45 | | 2.55 | |
| Reference Input Voltage Deviation Over Temperature Range | ΔV_{REF} | $V_{KA}=V_{REF}$, $I_K=10mA$, $T_{MIN}\leq T_A\leq T_{MAX}$ | | 7 | 30 | mV | |
| Minimum Cathode Current for Regulation | I_{MIN} | $V_{KA}=V_{REF}$ | | 0.5 | 1 | mA | |
| Dynamic Impedance(Note 2) | Z_{KA} | $V_{KA}=V_{REF}$, $\Delta I_K=1\sim 100mA$, $f<1kHz$ | | 0.2 | 0.5 | Ω | |

Notes: 1. The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is $V_{CC+} - 1.5V$. But either of both inputs can go to +36V without damage.

2. The dynamic impedance is defined as $Z_{KA} = \frac{\Delta V_{KA}}{\Delta I_K}$.

■ TYPICAL APPLICATION CIRCUIT



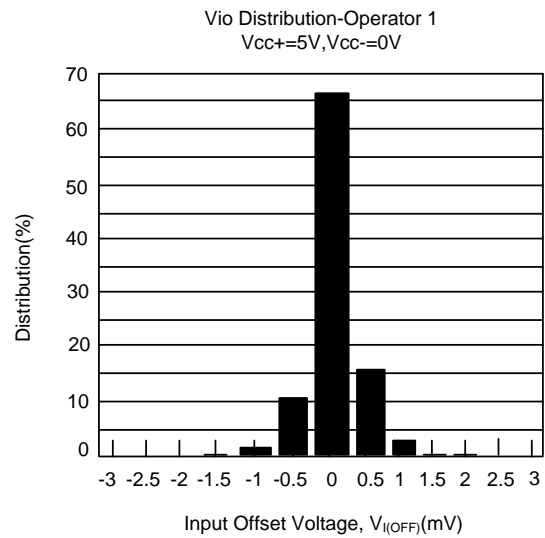
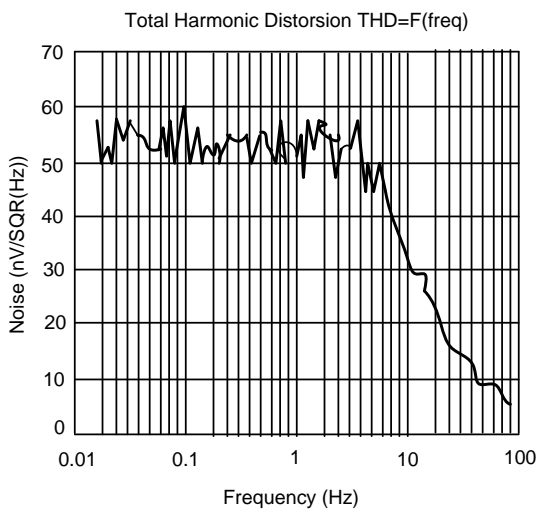
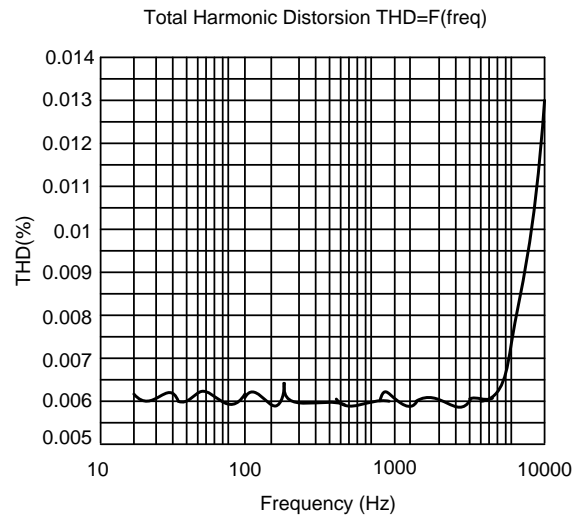
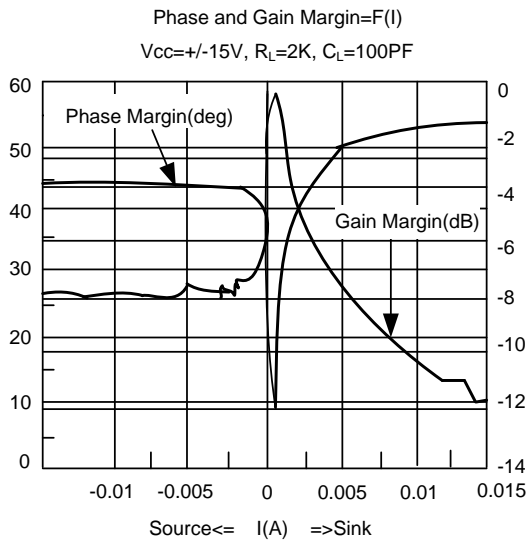
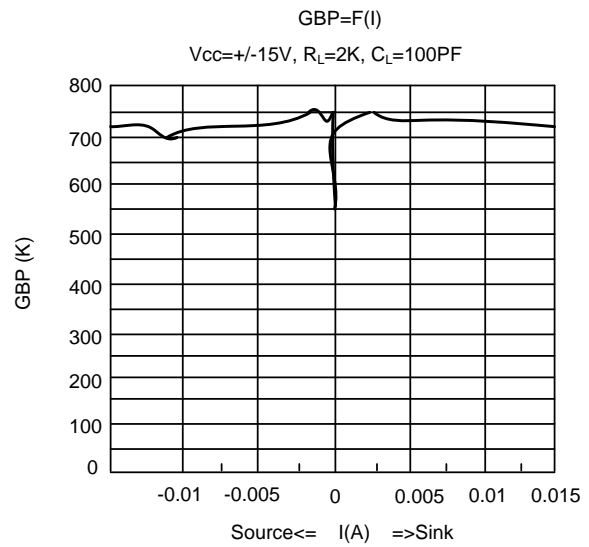
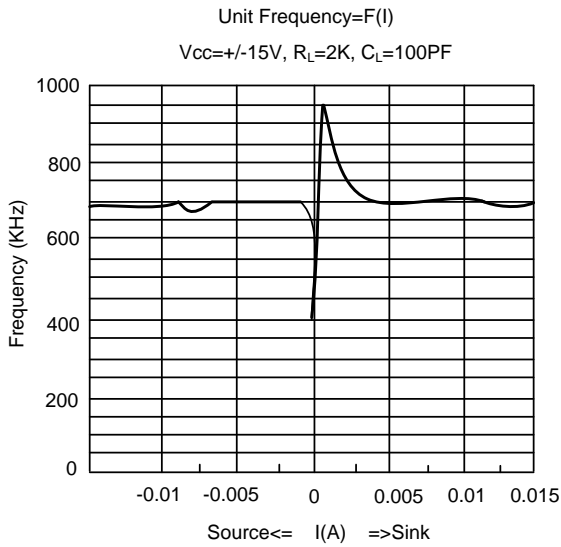
$$V_{OUT} = V_{REF} \times \frac{R_7 + R_8}{R_8}$$

$$V_{SENSE} = V_{REF} \times \frac{R_3}{R_3 + R_4} \text{ (Pin 5)}$$

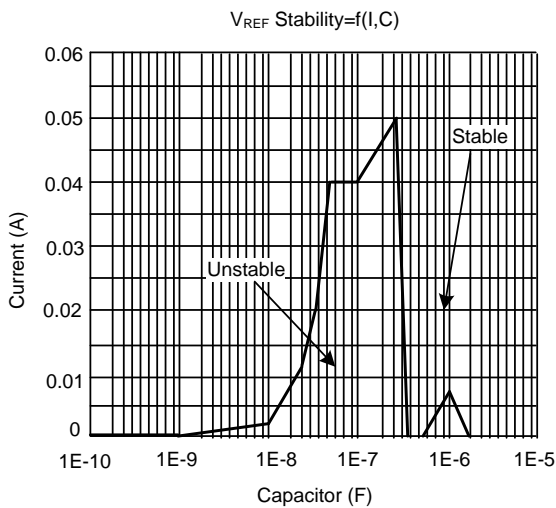
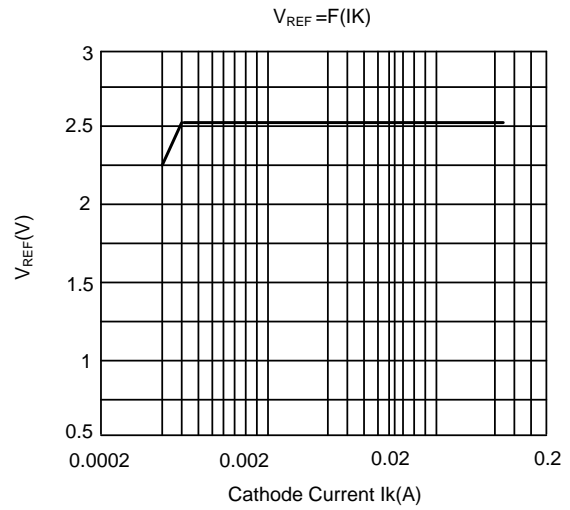
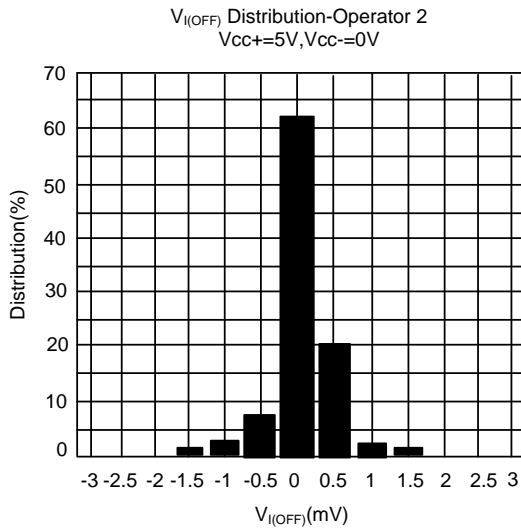
$$\text{Current Limie} = \frac{V_{SENSE}}{R_2}$$

Application of UTC UM603A in a Constant Current and Constant Voltage Charger

TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS(Cont.)



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[E1-A](#) [UPC4742G2-E1-A](#) [UPC832G2-E2-A](#) [UPC842G2-E1-A](#) [UPC802G2-E1-A](#) [UPC4741G2-E2-A](#) [UPC4572G2-E2-A](#) [UPC844GR-9LG-](#)
[E2-A](#) [UPC259G2-E1-A](#) [UPC4741G2-E1-A](#) [UPC4558G2-E1-A](#) [UPC1251GR-9LG-E1-A](#) [UPC4744G2-E1-A](#) [UPC4092G2-E1-A](#)
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