



UR233

LINEAR INTEGRATED CIRCUIT

LOW DROP FIXED AND ADJUSTABLE POSITIVE VOLTAGE REGULATORS

DESCRIPTION

The UTC **UR233** is a LOW DROP Voltage Regulator able to provide up to 0.8A of Output Current, available even in adjustable version ($V_{REF}=1.25V$). High efficiency is assured by NPN pass transistor. In fact in the case, unlike than PNP one, the Quiescent Current flows mostly into the load. Only a very common $10\mu F$ minimum capacitor is needed for stability. On chip trimming allows the regulator to reach a very tight output voltage tolerance, within $\pm 1\%$ at $25^\circ C$. The ADJUSTABLE **UR233** is pin to pin compatible with the other standard Adjustable voltage regulators maintaining the better performances in terms of Drop and Tolerance.

FEATURES

- *Low dropout voltage (1.5V Typ.)
- *Output current up to 0.8A
- *Fixed output voltage of: 1.7V, 1.8V, 2.5V, 2.85V, 3.0V, 3.3V, 5.0V
- *Adjustable version availability ($V_{REF}=1.25V$)
- *Internal current and thermal limit
- *Available in $\pm 1\%$ (at $25^\circ C$) and 2% in all temperature range
- *Supply voltage rejection: 75dB (TYP)

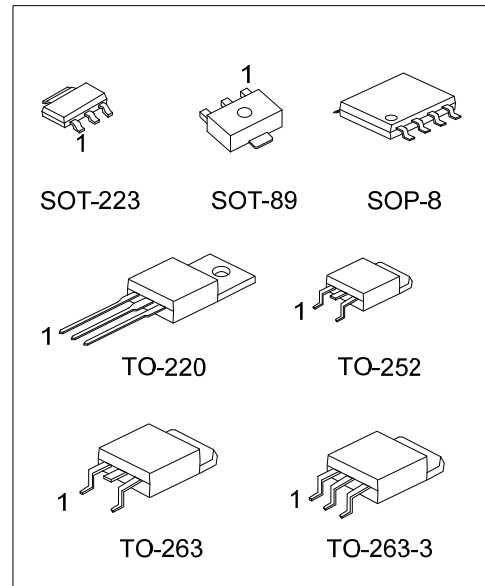
ORDERING INFORMATION

| Ordering Number | | Package | ① Pin Assignment | ② Packing |
|------------------|-------------------|----------|--------------------------------------|-------------------------|
| Normal | Lead Free Plating | | | |
| UR233-xx-AA3-①-② | UR233L-xx-AA3-①-② | SOT-223 | A: GOI B: OGI C: GIO D: IGO | R: Tape Reel T: Tube |
| UR233-xx-AB3-①-② | UR233L-xx-AB3-①-② | SOT-89 | | |
| UR233-xx-TA3-①-② | UR233L-xx-TA3-①-② | TO-220 | | |
| UR233-xx-TN3-①-② | UR233L-xx-TN3-①-② | TO-252 | | |
| UR233-xx-TQ2-①-② | UR233L-xx-TQ2-①-② | TO-263 | | |
| UR233-xx-TQ3-①-② | UR233L-xx-TQ3-①-② | TO-263-3 | | |
| UR233-xx-S08-①-② | UR233L-xx-S08-①-② | SOP-8 | GOOIxOOx | |

Note: Pin Assignment: I: V_{IN} O: V_{OUT} G: GND

ORDERING INFORMATION(Cont.)

| | |
|---|--|
| <p>UR233L-xx-AA3-①-②</p> <p>(1) Packing Type (2) Pin Assignment (3) Package Type (4) Output Voltage Code (5) Lead Plating</p> | <p>(1) R: Tape Reel, T: Tube (2) refer to Pin Assignment (3) AA3: SOT-223, AB3: SOT-89, TA3: TO-220, TN3: TO-252, TQ2: TO-263, TQ3: TO-263-3, S08: SOP-8 (4) xx: refer to Marking Information (5) L: Lead Free Plating, Blank: Pb/Sn</p> |
|---|--|



*Pb-free plating product number: UR233L

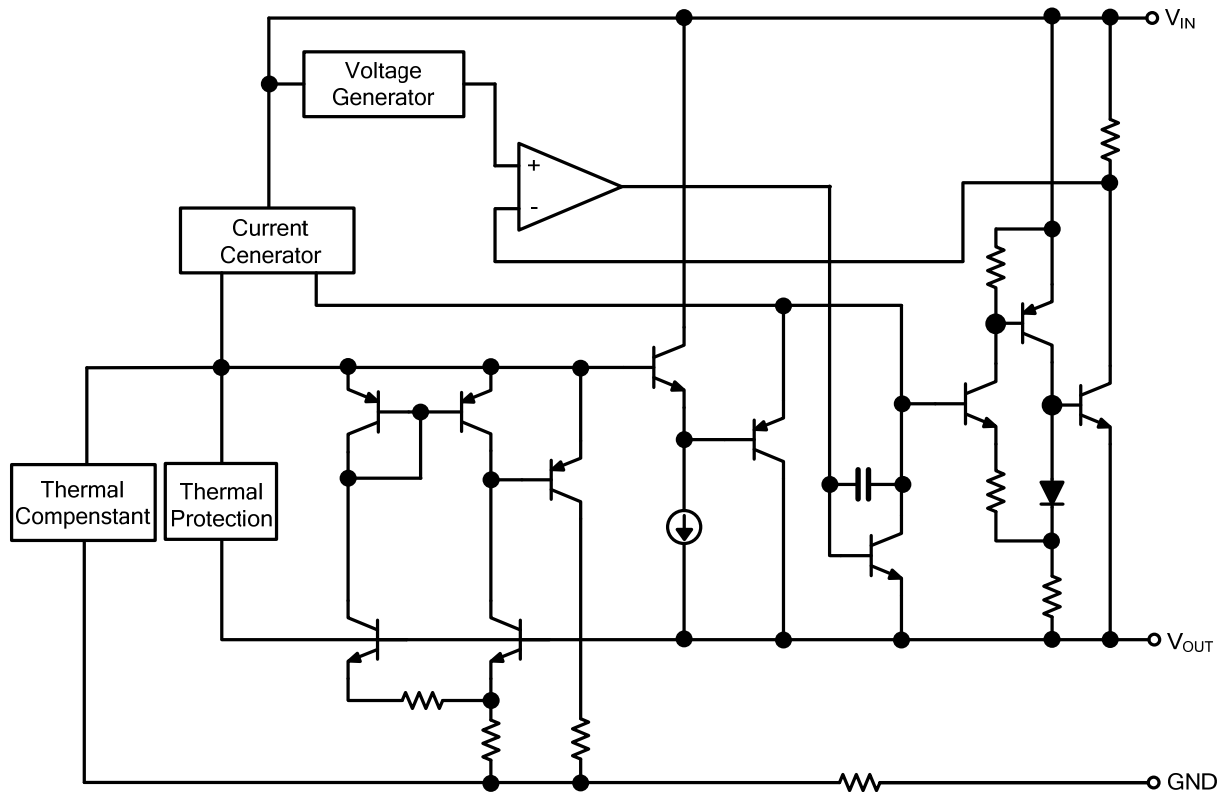
UR233

LINEAR INTEGRATED CIRCUIT

MARKING INFORMATION

| PACKAGE | VOLTAGE CODE | PIN CODE | PIN 1 | PIN 2 | PIN 3 | MARKING |
|--|--|----------|-------|-------|-------|---------|
| SOT-223 | | A | GND | OUT | IN | |
| | | B | OUT | GND | IN | |
| | | C | GND | IN | OUT | |
| | | D | IN | GND | OUT | |
| SOT-89 | 17:1.7V 18:1.8V 25:2.5V 2J:2.85V 30:3.0V 33:3.3V 50:5.0V AD:ADJ | A | GND | OUT | IN | |
| | | B | OUT | GND | IN | |
| | | C | GND | IN | OUT | |
| | | D | IN | GND | OUT | |
| TO-220 TO-252 TO-263 TO-263-3 | | A | GND | OUT | IN | |
| | | B | OUT | GND | IN | |
| | | C | GND | IN | OUT | |
| | | D | IN | GND | OUT | |

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

| PARAMETER | | SYMBOL | VALUE | UNIT |
|--------------------------------|---------|-----------|------------|------|
| DC Input Voltage | | V_{IN} | 12 | V |
| Power Dissipation | SOT-223 | P_D | 0.740 | W |
| | SOT-89 | | 0.571 | |
| | SOP-8 | | 0.625 | |
| | TO-252 | | 1.471 | |
| | TO-220 | | 1.820 | |
| | TO-263 | | 2.222 | |
| Operating Junction Temperature | | T_{OPR} | -40 ~ +85 | °C |
| Storage Temperature | | T_{STG} | -65 ~ +150 | °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 | SOT-223 | θ_{JA} | 135 | °C/W |
| | SOT-89 | | 175 | |
| | SOP-8 | | 160 | |
| | TO-252 | | 68 | |
| | TO-220 | | 55 | |
| | TO-263 | | 45 | |
| Junction-to-Case | SOT-223 | θ_{JC} | 19 | °C/W |
| | SOT-89 | | 48 | |
| | SOP-8 | | 45 | |
| | TO-252 | | 7.5 | |
| | TO-220 | | 15 | |
| | TO-263 | | 7.8 | |

■ ELECTRICAL CHARACTERISTICS ($T_J=0 \sim 125^\circ\text{C}$, unless otherwise specified)

For UR233-1.7

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT | |
|--------------------------|------------------|--|------|-------|-------|-------|---|
| Output Voltage | V_{OUT} | $V_{IN}=3.7\text{V}$, $I_{OUT}=10\text{mA}$, $T_J=25^\circ\text{C}$ | ±1% | 1.683 | 1.700 | 1.717 | V |
| Output Voltage | V_{OUT} | $V_{IN}=3.1 \sim 10\text{V}$, $I_{OUT}=2 \sim 800\text{mA}$ | ±2% | 1.666 | | 1.734 | V |
| Line Regulation | ΔV_{OUT} | $V_{IN}=3.1 \sim 10\text{V}$, $I_{OUT}=2\text{mA}$ | | 1 | 6 | mV | |
| Load Regulation | ΔV_{OUT} | $V_{IN}=3.1\text{V}$, $I_{OUT}=2 \sim 800\text{mA}$ | | 1 | 10 | mV | |
| Temperature Stability | ΔV_{OUT} | | | 0.5 | | % | |
| Long Term Stability | ΔV_{OUT} | 1000 hrs, $T_J=125^\circ\text{C}$ | | 0.3 | | % | |
| Operating Input Voltage | V_{IN} | $I_{OUT}=100\text{mA}$ | | | 12 | V | |
| Quiescent Current | I_Q | $V_{IN}=10\text{V}$ | | 5 | 10 | mA | |
| Output Current | I_{OUT} | $V_{IN}=6.7\text{V}$, $T_J=25^\circ\text{C}$ | 800 | 950 | 1200 | mA | |
| Output Noise Voltage | eN | $B=10\text{Hz} \sim 10\text{KHz}$, $T_J=25^\circ\text{C}$ | | 100 | | μV | |
| Supply Voltage Rejection | SVR | $I_{OUT}=40\text{mA}$, $f=120\text{Hz}$, $T_J=25^\circ\text{C}$, $V_{IN}=4.7\text{V}$, $V_{RIPPLE}=1\text{Vpp}$ | 60 | 75 | | dB | |
| Dropout Voltage | V_D | | | | 1.50 | V | |
| Thermal Regulation | | $T_A=25^\circ\text{C}$, 30ms Pulse | | 0.01 | 0.10 | %/W | |

■ ELECTRICAL CHARACTERISTICS(Cont.)

For UR233-1.8

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT | |
|--------------------------|------------------|---|-----------|-------|-------|-------|---------|
| Output Voltage | V_{OUT} | $V_{IN}=3.8V, I_{OUT}=10mA, T_J=25^{\circ}C$ | $\pm 1\%$ | 1.782 | 1.800 | 1.818 | V |
| Output Voltage | V_{OUT} | $V_{IN}=3.2 \sim 10V, I_{OUT}=2 \sim 800mA$ | $\pm 2\%$ | 1.764 | | 1.836 | V |
| Line Regulation | ΔV_{OUT} | $V_{IN}=3.2 \sim 10V, I_{OUT}=2mA$ | | 1 | 6 | | mV |
| Load Regulation | ΔV_{OUT} | $V_{IN}=3.2V, I_{OUT}=2 \sim 800mA$ | | 1 | 10 | | mV |
| Temperature Stability | ΔV_{OUT} | | | 0.5 | | | % |
| Long Term Stability | ΔV_{OUT} | 1000 hrs, $T_J=125^{\circ}C$ | | 0.3 | | | % |
| Operating Input Voltage | V_{IN} | $I_O=100mA$ | | | 12 | | V |
| Quiescent Current | I_Q | $V_{IN}=10V$ | | 5 | 10 | | mA |
| Output Current | I_{OUT} | $V_{IN}=6.8V, T_J=25^{\circ}C$ | 800 | 950 | 1200 | | mA |
| Output Noise Voltage | eN | $B=10Hz \sim 10KHz, T_J=25^{\circ}C$ | | 100 | | | μV |
| Supply Voltage Rejection | SVR | $I_O=40mA, f=120Hz, T_J=25^{\circ}C, V_{IN}=4.8V, V_{RIPPLE}=1V_{pp}$ | 60 | 75 | | | dB |
| Dropout Voltage | V_D | | | | 1.50 | | V |
| Thermal Regulation | | $T_A=25^{\circ}C, 30ms$ Pulse | | 0.01 | 0.10 | | %/W |

For UR233-2.5

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT | |
|--------------------------|------------------|---|-----------|-------|-------|-------|---------|
| Output Voltage | V_{OUT} | $V_{IN}=4.5V, I_{OUT}=10mA, T_J=25^{\circ}C$ | $\pm 1\%$ | 2.475 | 2.500 | 2.525 | V |
| Output Voltage | V_{OUT} | $V_{IN}=3.9 \sim 10V, I_{OUT}=2 \sim 800mA$ | $\pm 2\%$ | 2.450 | | 2.550 | V |
| Line Regulation | ΔV_{OUT} | $V_{IN}=3.9 \sim 10V, I_{OUT}=2mA$ | | 1 | 6 | | mV |
| Load Regulation | ΔV_{OUT} | $V_{IN}=3.9V, I_{OUT}=2 \sim 800mA$ | | 1 | 10 | | mV |
| Temperature Stability | ΔV_{OUT} | | | 0.5 | | | % |
| Long Term Stability | ΔV_{OUT} | 1000 hrs, $T_J=125^{\circ}C$ | | 0.3 | | | % |
| Operating Input Voltage | V_{IN} | $I_{OUT}=100mA$ | | | 12 | | V |
| Quiescent Current | I_Q | $V_{IN}=10V$ | | 5 | 10 | | mA |
| Output Current | I_{OUT} | $V_{IN}=7.5V, T_J=25^{\circ}C$ | 800 | 950 | 1200 | | mA |
| Output Noise Voltage | eN | $B=10Hz \sim 10KHz, T_J=25^{\circ}C$ | | 100 | | | μV |
| Supply Voltage Rejection | SVR | $I_{OUT}=40mA, f=120Hz, T_J=25^{\circ}C, V_{IN}=5.5V, V_{RIPPLE}=1V_{pp}$ | 60 | 75 | | | dB |
| Dropout Voltage | V_D | | | | 1.50 | | V |
| Thermal Regulation | | $T_A=25^{\circ}C, 30ms$ Pulse | | 0.01 | 0.10 | | %/W |

■ ELECTRICAL CHARACTERISTICS(Cont.)

For UR233-2.85

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT | |
|--------------------------|------------------|--|-----------|-------|------|-------|---------|
| Output Voltage | V_{OUT} | $V_{IN}=4.85V, I_{OUT}=10mA, T_J=25^{\circ}C$ | $\pm 1\%$ | 2.822 | 2.85 | 2.878 | V |
| Output Voltage | V_{OUT} | $V_{IN}=4.25 \sim 10V, I_{OUT}=2 \sim 800mA$ | $\pm 2\%$ | 2.793 | | 2.907 | V |
| Line Regulation | ΔV_{OUT} | $V_{IN}=4.25 \sim 10V, I_{OUT}=2mA$ | | 1 | 6 | | mV |
| Load Regulation | ΔV_{OUT} | $V_{IN}=4.25V, I_{OUT}=2 \sim 800mA$ | | 1 | 10 | | mV |
| Temperature Stability | ΔV_{OUT} | | | 0.5 | | | % |
| Long Term Stability | ΔV_{OUT} | 1000 hrs, $T_J=125^{\circ}C$ | | 0.3 | | | % |
| Operating Input Voltage | V_{IN} | $I_{OUT}=100mA$ | | | 12 | | V |
| Quiescent Current | I_Q | $V_{IN}=10V$ | | 5 | 10 | | mA |
| Output Current | I_{OUT} | $V_{IN}=7.85V, T_J=25^{\circ}C$ | 800 | 950 | 1200 | | mA |
| Output Noise Voltage | eN | $B=10Hz \sim 10KHz, T_J=25^{\circ}C$ | | 100 | | | μV |
| Supply Voltage Rejection | SVR | $I_{OUT}=40mA, f=120Hz, T_J=25^{\circ}C, V_{IN}=5.85V, V_{RIPPLE}=1V_{pp}$ | 60 | 75 | | | dB |
| Dropout Voltage | V_D | | | | 1.50 | | V |
| Thermal Regulation | | $T_A=25^{\circ}C, 30ms$ Pulse | | 0.01 | 0.10 | | %/W |

For UR233-3.0

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT | |
|--------------------------|------------------|---|-----------|------|------|------|---------|
| Output Voltage | V_{OUT} | $V_{IN}=5V, I_{OUT}=10mA, T_J=25^{\circ}C$ | $\pm 1\%$ | 2.97 | 3.00 | 3.03 | V |
| Output Voltage | V_{OUT} | $V_{IN}=4.5 \sim 12V, I_{OUT}=2 \sim 800mA$ | $\pm 2\%$ | 2.94 | | 3.06 | V |
| Line Regulation | ΔV_{OUT} | $V_{IN}=4.5 \sim 12V, I_{OUT}=2mA$ | | 1 | 6 | | mV |
| Load Regulation | ΔV_{OUT} | $V_{IN}=4.5V, I_{OUT}=2 \sim 800mA$ | | 1 | 10 | | mV |
| Temperature Stability | ΔV_{OUT} | | | 0.5 | | | % |
| Long Term Stability | ΔV_{OUT} | 1000 hrs, $T_J=125^{\circ}C$ | | 0.3 | | | % |
| Operating Input Voltage | V_{IN} | $I_{OUT}=100mA$ | | | 12 | | V |
| Quiescent Current | I_Q | $V_{IN}=12V$ | | 5 | 10 | | mA |
| Output Current | I_{OUT} | $V_{IN}=8V, T_J=25^{\circ}C$ | 800 | 950 | 1200 | | mA |
| Output Noise Voltage | eN | $B=10Hz \sim 10KHz, T_J=25^{\circ}C$ | | 100 | | | μV |
| Supply Voltage Rejection | SVR | $I_{OUT}=40mA, f=120Hz, T_J=25^{\circ}C, V_{IN}=6V, V_{RIPPLE}=1V_{pp}$ | 60 | 75 | | | dB |
| Dropout Voltage | V_D | | | | 1.50 | | V |
| Thermal Regulation | | $T_A=25^{\circ}C, 30ms$ Pulse | | 0.01 | 0.10 | | %/W |

■ ELECTRICAL CHARACTERISTICS(Cont.)

For UR233-3.3

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT | |
|--------------------------|------------------|---|-----------|-------|-------|-------|---------|
| Output Voltage | V_{OUT} | $V_{IN}=5.3V, I_{OUT}=10mA, T_J=25^{\circ}C$ | $\pm 1\%$ | 3.267 | 3.300 | 3.333 | V |
| Output Voltage | V_{OUT} | $V_{IN}=4.8 \sim 12V, I_{OUT}=2 \sim 800mA$ | $\pm 2\%$ | 3.234 | | 3.366 | V |
| Line Regulation | ΔV_{OUT} | $V_{IN}=4.8 \sim 12V, I_{OUT}=2mA$ | | 1 | 6 | | mV |
| Load Regulation | ΔV_{OUT} | $V_{IN}=4.8V, I_{OUT}=2 \sim 800mA$ | | 1 | 10 | | mV |
| Temperature Stability | ΔV_{OUT} | | | 0.5 | | | % |
| Long Term Stability | ΔV_{OUT} | 1000 hrs, $T_J=125^{\circ}C$ | | 0.3 | | | % |
| Operating Input Voltage | V_{IN} | $I_{OUT}=100mA$ | | | 12 | | V |
| Quiescent Current | I_Q | $V_{IN}=12V$ | | 5 | 10 | | mA |
| Output Current | I_{OUT} | $V_{IN}=8.3V, T_J=25^{\circ}C$ | 800 | 950 | 1200 | | mA |
| Output Noise Voltage | eN | $B=10Hz \sim 10KHz, T_J=25^{\circ}C$ | | 100 | | | μV |
| Supply Voltage Rejection | SVR | $I_{OUT}=40mA, f=120Hz, T_J=25^{\circ}C, V_{IN}=6.3V, V_{RIPPLE}=1V_{pp}$ | 60 | 75 | | | dB |
| Dropout Voltage | V_D | | | | 1.50 | | V |
| Thermal Regulation | | $T_A=25^{\circ}C, 30ms$ Pulse | | 0.01 | 0.10 | | %/W |

For UR233-5.0

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT | |
|--------------------------|------------------|---|-----------|------|------|------|---------|
| Output Voltage | V_{OUT} | $V_{IN}=7V, I_{OUT}=10mA, T_J=25^{\circ}C$ | $\pm 1\%$ | 4.95 | 5.00 | 5.05 | V |
| Output Voltage | V_{OUT} | $V_{IN}=6.5 \sim 12V, I_{OUT}=2 \sim 800mA$ | $\pm 2\%$ | 4.90 | | 5.10 | V |
| Line Regulation | ΔV_{OUT} | $V_{IN}=6.5 \sim 12V, I_{OUT}=2mA$ | | 1 | 10 | | mV |
| Load Regulation | ΔV_{OUT} | $V_{IN}=6.5V, I_{OUT}=2 \sim 800mA$ | | 1 | 15 | | mV |
| Temperature Stability | ΔV_{OUT} | | | 0.5 | | | % |
| Long Term Stability | ΔV_{OUT} | 1000 hrs, $T_J=125^{\circ}C$ | | 0.3 | | | % |
| Operating Input Voltage | V_{IN} | $I_{OUT}=100mA$ | | | 12 | | V |
| Quiescent Current | I_Q | $V_{IN}=12V$ | | 5 | 10 | | mA |
| Output Current | I_{OUT} | $V_{IN}=10V, T_J=25^{\circ}C$ | 800 | 950 | 1200 | | mA |
| Output Noise Voltage | eN | $B=10Hz \sim 10KHz, T_J=25^{\circ}C$ | | 100 | | | μV |
| Supply Voltage Rejection | SVR | $I_{OUT}=40mA, f=120Hz, T_J=25^{\circ}C, V_{IN}=8V, V_{RIPPLE}=1V_{pp}$ | 60 | 75 | | | dB |
| Dropout Voltage | V_D | | | | 1.50 | | V |
| Thermal Regulation | | $T_A=25^{\circ}C, 30ms$ Pulse | | 0.01 | 0.10 | | %/W |

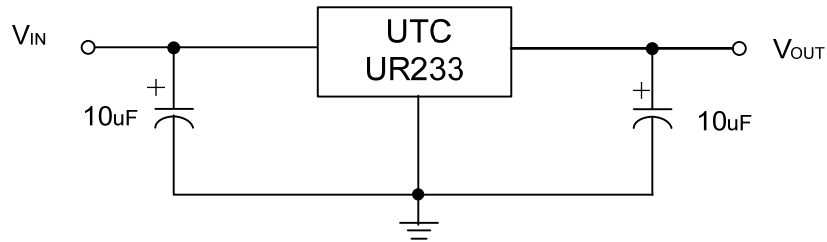
■ ELECTRICAL CHARACTERISTICS(Cont.)

UR233-ADJ

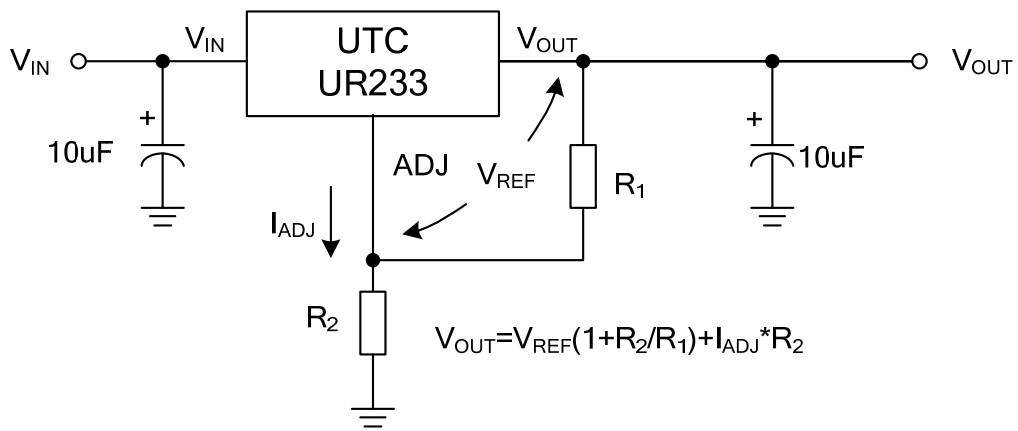
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT | |
|-------------------------------|------------------|--|-----------|-------|-------|-------|---------|
| Reference Voltage | V_{REF} | $V_{IN} - V_{OUT} = 2V, I_{OUT} = 10mA, T_J = 25^\circ C$ | $\pm 1\%$ | 1.238 | 1.25 | 1.262 | V |
| Reference Voltage | V_{REF} | $V_{IN} = V_{OUT} + 1.5V \sim 10V, I_{OUT} = 10 \sim 800mA$ | $\pm 2\%$ | 1.225 | | 1.275 | V |
| Line Regulation | ΔV_{OUT} | $V_{IN} = V_{OUT} + 1.5V \sim 10V, I_{OUT} = 10mA$ | | 0.035 | 0.200 | | % |
| Load Regulation | ΔV_{OUT} | $V_{IN} - V_{OUT} = 3V, I_{OUT} = 10 \sim 800mA$ | | 0.10 | 0.400 | | % |
| Temperature Stability | ΔV_{OUT} | | | 0.50 | | | % |
| Long Term Stability | ΔV_{OUT} | 1000 hrs, $T_J = 125^\circ C$ | | 0.3 | | | % |
| Operating Input Voltage | V_{IN} | | | | 12 | | V |
| Adjustment Pin Current | I_{ADJ} | $V_{IN} \leq 12V$ | | 60 | 120 | | μA |
| Adjustment Pin Current Change | ΔI_{ADJ} | $V_{IN} = V_{OUT} + 1.5V \sim 10V, I_{OUT} = 10 \sim 800mA$ | | 1 | 5 | | μA |
| Minimum Load Current | $I_{OUT(MIN)}$ | $V_{IN} = 12V$ | | 2 | 5 | | mA |
| Output Current | I_{OUT} | $V_{IN} - V_{OUT} = 5V, T_J = 25^\circ C$ | 800 | 950 | 1200 | | mA |
| Output Noise (%Vo) | eN | $B = 10Hz \sim 10KHz, T_J = 25^\circ C$ | | 0.003 | | | % |
| Supply Voltage Rejection | SVR | $I_{OUT} = 40mA, f = 120Hz, T_J = 25^\circ C, V_{IN} - V_{OUT} = 3V, V_{RIPPLE} = 1V_{pp}$ | 60 | 75 | | | dB |
| Dropout Voltage | V_D | | | | 1.50 | | V |
| Thermal Regulation | | $T_A = 25^\circ C, 30ms$ Pulse | | 0.01 | 0.10 | | %/W |

■ APPLICATION CIRCUITS

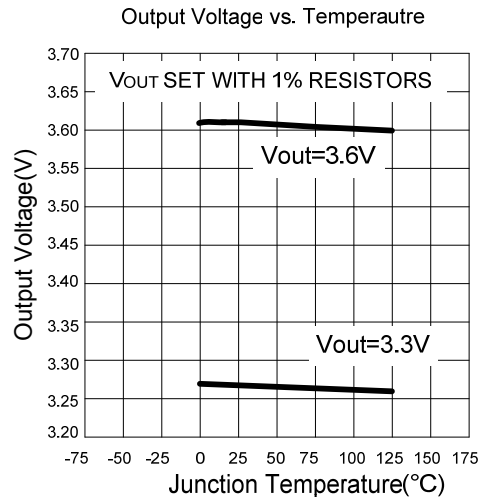
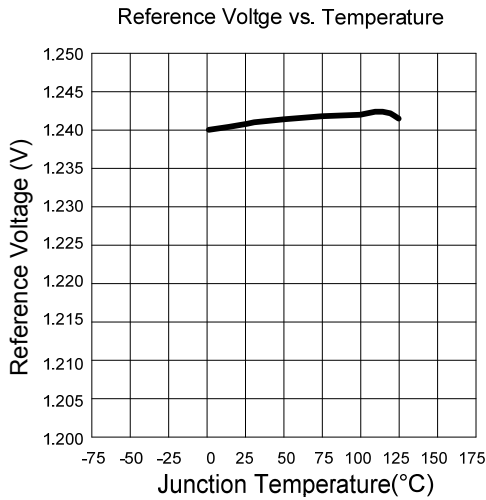
FIXED VOLTAGE



ADJUSTABLE



■ TYPICAL CHARACTERISTICS



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