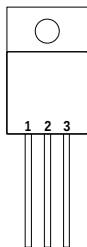


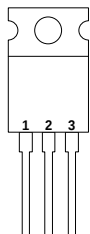
Pin 1 –  $V_{IN}$   
Pin 2 –  $V_{OUT}$   
Case – Ground

**K Package – TO-3**



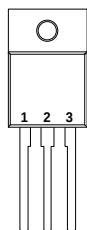
Pin 1 –  $V_{IN}$   
Pin 2 – Ground  
Pin 3 –  $V_{OUT}$   
Case – Ground

**G Package – TO-257**



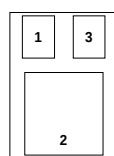
Pin 1 –  $V_{IN}$   
Pin 2 – Ground  
Pin 3 –  $V_{OUT}$   
Case – Ground

**T Package – TO-220**



Pin 1 –  $V_{IN}$   
Pin 2 – Ground  
Pin 3 –  $V_{OUT}$   
Case – Ground

**V Package – TO-218**



Pin 1 –  $V_{IN}$   
Pin 2 – Ground  
Pin 3 –  $V_{OUT}$

**SG Package – TO-220SM**  
**CERAMIC SURFACE MOUNT**

## 3 AMP POSITIVE VOLTAGE REGULATORS

### FEATURES

- 0.04%/V LINE REGULATION
- 0.3%/A LOAD REGULATION
- THERMAL OVERLOAD PROTECTION
- SHORT CIRCUIT PROTECTION
- SAFE OPERATING AREA PROTECTION
- 1% TOLERANCE
- START-UP WITH NEGATIVE VOLTAGE ( $\pm$  SUPPLIES) ON OUTPUT
- AVAILABLE IN 5V, 12V AND 15V OPTIONS

### ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ unless otherwise stated)

|           |                                      |                                             |
|-----------|--------------------------------------|---------------------------------------------|
| $V_I$     | DC Input Voltage                     | 35V                                         |
| $P_D$     | Power Dissipation                    | Internally limited                          |
| $T_J$     | Operating Junction Temperature Range | See Ordering Information                    |
| $T_{STG}$ | Storage Temperature Range            | $-65^\circ\text{C}$ to $+150^\circ\text{C}$ |
| $T_L$     | Lead Temperature (Soldering, 10 sec) | $300^\circ\text{C}$                         |

**ELECTRICAL CHARACTERISTICS** ( $T_J = 25^\circ\text{C}$  unless otherwise stated)

| Parameter                                           | Test Conditions                                                                                                                        | IP123A-05<br>IP323A-05 |      |      | IP123-05<br>LM123-05 |      |      | Units              |
|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|------------------------|------|------|----------------------|------|------|--------------------|
|                                                     |                                                                                                                                        | Min.                   | Typ. | Max. | Min.                 | Typ. | Max. |                    |
| $V_O$ Output Voltage                                | $I_O = 1\text{A}$ $V_{IN} = 7.5\text{V}$                                                                                               | 4.95                   | 5    | 5.05 | 4.8                  | 5    | 5.2  | V                  |
|                                                     | $P_{OUT} \leq P_{MAX}^2$ $V_{IN} = 8\text{V to } 15\text{V}$<br>$I_O = 5\text{mA to } 3\text{A}$<br>$T_J = \text{Over Temp. Range }^1$ | 4.85                   |      | 5.15 | 4.75                 |      | 5.25 | V                  |
|                                                     |                                                                                                                                        |                        |      |      |                      |      |      |                    |
| $\Delta V_O$ Line Regulation                        | $I_O = 1\text{A}$ $V_{IN} = 7.5\text{V to } 15\text{V}$<br>$T_J = \text{Over Temp. Range }^1$                                          |                        |      | 15   |                      |      | 25   | mV                 |
| $\Delta V_O$ Load Regulation                        | $V_{IN} = 8\text{V}$ $I_O = 5\text{mA to } 3\text{A}$<br>$T_J = \text{Over Temp. Range }^1$                                            |                        |      | 50   |                      |      | 100  | mV                 |
| $I_Q$ Quiescent Current                             | $V_{IN} = 8\text{V}$ $I_O = 5\text{mA to } 3\text{A}$<br>$T_J = \text{Over Temp. Range }^1$                                            |                        |      | 10   |                      |      | 14   | mA                 |
| $\Delta I_Q$ Quiescent Current Change               | $V_{IN} = 8\text{V}$ $I_O = 5\text{mA to } 3\text{A}$<br>$T_J = \text{Over Temp. Range }^1$                                            |                        |      | 1.5  |                      |      | 3.0  | mA                 |
|                                                     | $I_O = 1\text{A}$ $V_{IN} = 7.5\text{V to } 15\text{V}$<br>$T_J = \text{Over Temp. Range }^1$                                          |                        |      | 1.5  |                      |      | 3.0  | mA                 |
| $V_N$ Output Noise Voltage                          | $f = 10\text{Hz to } 100\text{kHz}$                                                                                                    |                        | 40   |      |                      | 40   |      | $\mu\text{Vrms}$   |
| $\frac{\Delta V_{IN}}{\Delta V_O}$ Ripple Rejection | $f = 120\text{Hz}$ $V_{IN} = 8\text{V to } 18\text{V}$                                                                                 | 66                     | 80   |      | 60                   | 80   |      | dB                 |
|                                                     | $I_O = 1\text{A}$ $T_J = \text{Over Temp. Range }^1$                                                                                   | 60                     |      |      | 56                   |      |      |                    |
| $I_{SC}$ Short Circuit Current                      | $V_{IN} = 15\text{V}$                                                                                                                  |                        | 3    |      |                      | 3    |      | A                  |
|                                                     | $V_{IN} = 7.5\text{V}$                                                                                                                 |                        | 4    |      |                      | 4    |      |                    |
| Long Term Stability                                 |                                                                                                                                        |                        |      | 35   |                      |      | 35   | mV                 |
| $R_{\theta JC}$ Thermal Resistance Junction to Case | K Package , V Package                                                                                                                  |                        | 1.5  | 2.5  |                      | 2    |      | $^\circ\text{C/W}$ |
|                                                     | G Package , T Package                                                                                                                  |                        | 3    | 4    |                      | 4    |      |                    |
|                                                     | SG Package                                                                                                                             |                        | TBA  |      |                      | TBA  |      |                    |

**Notes**

- 1) Applies over full temperature range:–  
 $T_J = -55$  to  $+150^\circ\text{C}$  for IP123A / IP123 / LM123  
 $T_J = 0$  to  $+125^\circ\text{C}$  for IP323A  
All other specifications apply at  $T_J = 25^\circ\text{C}$  unless otherwise stated.
- 2)  $P_{MAX} = 30\text{W}$  for K-Pack (TO-3) , V-Pack (TO-218) and G-Pack (TO-257) Packages.  
 $P_{MAX} = 25\text{W}$  for T-Pack (TO-220) Package.  
 $P_{MAX} = 15\text{W}$  for SG-Pack (TO-220SM) Package.
- 3) All characteristics are measured with a capacitor across the input of  $0.22\mu\text{F}$  and a capacitor across the output of  $0.1\mu\text{F}$ .
- 4) All characteristics except noise voltage and ripple rejection ratios are measured using pulse techniques ( $t_p \leq 10\text{ms}$  ,  $\delta \leq 5\%$ ).
- 5) Output voltage changes due to changes into internal temperature must be taken into account separately.

**ELECTRICAL CHARACTERISTICS** ( $T_J = 25^\circ\text{C}$  unless otherwise stated)

| Parameter                                           | Test Conditions                                                                                                                            | IP123A-12<br>IP323A-12 |      |       | IP123-12<br>LM123-12 |      |      | Units                      |
|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------|-------|----------------------|------|------|----------------------------|
|                                                     |                                                                                                                                            | Min.                   | Typ. | Max.  | Min.                 | Typ. | Max. |                            |
| $V_O$ Output Voltage                                | $I_O = 1\text{A}$ $V_{IN} = 14.8\text{V}$                                                                                                  | 11.88                  | 12   | 12.12 | 11.5                 | 12   | 12.5 | V                          |
|                                                     | $P_{OUT} \leq P_{MAX}^2$ $V_{IN} = 15.4\text{V to } 22\text{V}$<br>$I_O = 5\text{mA to } 3\text{A}$<br>$T_J = \text{Over Temp. Range } ^1$ | 11.64                  |      | 12.36 | 11.4                 |      | 12.6 | V                          |
|                                                     |                                                                                                                                            |                        |      |       |                      |      |      |                            |
| $\Delta V_O$ Line Regulation                        | $I_O = 1\text{A}$ $V_{IN} = 14.8\text{V to } 22\text{V}$<br>$T_J = \text{Over Temp. Range } ^1$                                            |                        |      | 36    |                      |      | 60   | mV                         |
| $\Delta V_O$ Load Regulation                        | $V_{IN} = 15.4\text{V}$ $I_O = 5\text{mA to } 3\text{A}$<br>$T_J = \text{Over Temp. Range } ^1$                                            |                        |      | 75    |                      |      | 150  | mV                         |
| $I_Q$ Quiescent Current                             | $V_{IN} = 15.4\text{V}$ $I_O = 5\text{mA to } 3\text{A}$<br>$T_J = \text{Over Temp. Range } ^1$                                            |                        |      | 10    |                      |      | 14   | mA                         |
| $\Delta I_Q$ Quiescent Current Change               | $V_{IN} = 15.4\text{V}$ $I_O = 5\text{mA to } 3\text{A}$<br>$T_J = \text{Over Temp. Range } ^1$                                            |                        |      | 1.5   |                      |      | 3.0  | mA                         |
|                                                     | $I_O = 1\text{A}$ $V_{IN} = 14.8\text{V to } 22\text{V}$<br>$T_J = \text{Over Temp. Range } ^1$                                            |                        |      | 1.5   |                      |      | 3.0  | mA                         |
| $V_N$ Output Noise Voltage                          | $f = 10\text{Hz to } 100\text{kHz}$                                                                                                        |                        | 75   |       |                      | 75   |      | $\mu\text{V}_{\text{rms}}$ |
| $\frac{\Delta V_{IN}}{\Delta V_O}$ Ripple Rejection | $f = 120\text{Hz}$ $V_{IN} = 15.4\text{V to } 25.4\text{V}$                                                                                | 58                     | 72   |       | 52                   | 72   |      | dB                         |
|                                                     | $I_O = 1\text{A}$ $T_J = \text{Over Temp. Range } ^1$                                                                                      | 52                     |      |       | 48                   |      |      |                            |
| $I_{SC}$ Short Circuit Current                      | $V_{IN} = 15.4\text{V}$                                                                                                                    |                        | 3    |       |                      | 3    |      | A                          |
| $I_{pk}$ Peak Output Current                        | $V_{IN} = 15.4\text{V}$                                                                                                                    |                        | 4    |       |                      | 4    |      | A                          |
| Long Term Stability                                 |                                                                                                                                            |                        |      | 84    |                      |      | 84   | mV                         |
| $R_{\theta JC}$ Thermal Resistance Junction to Case | K Package , V Package                                                                                                                      |                        | 1.5  | 2.5   |                      | 2    |      | $^\circ\text{C/W}$         |
|                                                     | G Package , T Package                                                                                                                      |                        | 3    | 4     |                      | 4    |      |                            |
|                                                     | SG Package                                                                                                                                 |                        | TBA  |       |                      | TBA  |      |                            |

**Notes**

- 1) Applies over full temperature range:–  
 $T_J = -55$  to  $+150^\circ\text{C}$  for IP123A / IP123 / LM123  
 $T_J = 0$  to  $+125^\circ\text{C}$  for IP323A  
All other specifications apply at  $T_J = 25^\circ\text{C}$  unless otherwise stated.
- 2)  $P_{MAX} = 30\text{W}$  for K-Pack (TO-3) , V-Pack (TO-218) and G-Pack (TO-257) Packages.  
 $P_{MAX} = 25\text{W}$  for T-Pack (TO-220) Package.  
 $P_{MAX} = 15\text{W}$  for SG-Pack (TO-220SM) Package.
- 3) All characteristics are measured with a capacitor across the input of  $0.22\mu\text{F}$  and a capacitor across the output of  $0.1\mu\text{F}$ .
- 4) All characteristics except noise voltage and ripple rejection ratios are measured using pulse techniques ( $t_p \leq 10\text{ms}$  ,  $\delta \leq 5\%$ ).
- 5) Output voltage changes due to changes into internal temperature must be taken into account separately.

**ELECTRICAL CHARACTERISTICS** ( $T_J = 25^\circ\text{C}$  unless otherwise stated)

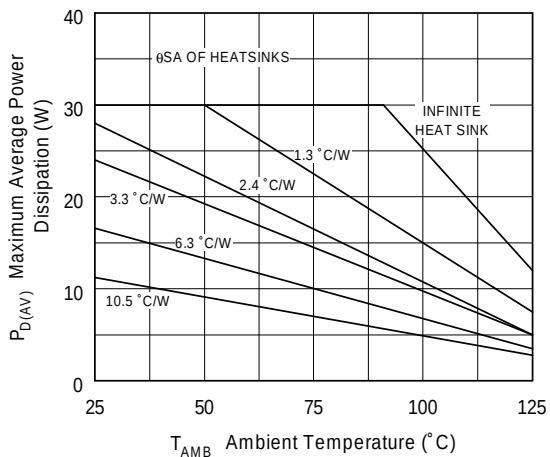
| Parameter                                           | Test Conditions                                                                                                                            | IP123A-15<br>IP323A-15 |      |       | IP123-15<br>LM123-15 |      |       | Units                      |
|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------|-------|----------------------|------|-------|----------------------------|
|                                                     |                                                                                                                                            | Min.                   | Typ. | Max.  | Min.                 | Typ. | Max.  |                            |
| $V_O$ Output Voltage                                | $I_O = 1\text{A}$ $V_{IN} = 17.9\text{V}$                                                                                                  | 14.85                  | 15   | 15.15 | 14.4                 | 15   | 15.6  | V                          |
|                                                     | $P_{OUT} \leq P_{MAX}^2$ $V_{IN} = 18.5\text{V to } 25\text{V}$<br>$I_O = 5\text{mA to } 3\text{A}$<br>$T_J = \text{Over Temp. Range } ^1$ | 14.55                  |      | 15.45 | 14.25                |      | 15.75 | V                          |
|                                                     |                                                                                                                                            |                        |      |       |                      |      |       |                            |
| $\Delta V_O$ Line Regulation                        | $I_O = 1\text{A}$ $V_{IN} = 17.9\text{V to } 25\text{V}$<br>$T_J = \text{Over Temp. Range } ^1$                                            |                        |      | 45    |                      |      | 75    | mV                         |
| $\Delta V_O$ Load Regulation                        | $V_{IN} = 18.5\text{V}$ $I_O = 5\text{mA to } 3\text{A}$<br>$T_J = \text{Over Temp. Range } ^1$                                            |                        |      | 75    |                      |      | 150   | mV                         |
| $I_Q$ Quiescent Current                             | $V_{IN} = 18.5\text{V}$ $I_O = 5\text{mA to } 3\text{A}$<br>$T_J = \text{Over Temp. Range } ^1$                                            |                        |      | 10    |                      |      | 14    | mA                         |
| $\Delta I_Q$ Quiescent Current Change               | $V_{IN} = 18.5\text{V}$ $I_O = 5\text{mA to } 3\text{A}$<br>$T_J = \text{Over Temp. Range } ^1$                                            |                        |      | 1.5   |                      |      | 3.0   | mA                         |
|                                                     | $I_O = 1\text{A}$ $V_{IN} = 17.9\text{V to } 25\text{V}$<br>$T_J = \text{Over Temp. Range } ^1$                                            |                        |      | 1.5   |                      |      | 3.0   | mA                         |
| $V_N$ Output Noise Voltage                          | $f = 10\text{Hz to } 100\text{kHz}$                                                                                                        |                        | 90   |       |                      | 90   |       | $\mu\text{V}_{\text{rms}}$ |
| $\frac{\Delta V_{IN}}{\Delta V_O}$ Ripple Rejection | $f = 120\text{Hz}$ $V_{IN} = 18.5\text{V to } 28.5\text{V}$                                                                                | 56                     | 70   |       | 50                   | 70   |       | dB                         |
|                                                     | $I_O = 1\text{A}$ $T_J = \text{Over Temp. Range } ^1$                                                                                      | 50                     |      |       | 46                   |      |       |                            |
| $I_{SC}$ Short Circuit Current                      | $V_{IN} = 18.5\text{V}$                                                                                                                    |                        | 2.5  |       |                      | 2.5  |       | A                          |
| $I_{pk}$ Peak Output Current                        | $V_{IN} = 18.5\text{V}$                                                                                                                    |                        | 4    |       |                      | 4    |       | A                          |
| Long Term Stability                                 |                                                                                                                                            |                        |      | 105   |                      |      | 105   | mV                         |
| $R_{\theta JC}$ Thermal Resistance Junction to Case | K Package , V Package                                                                                                                      |                        | 1.5  | 2.5   |                      | 2    |       | $^\circ\text{C/W}$         |
|                                                     | G Package , T Package                                                                                                                      |                        | 3    | 4     |                      | 4    |       |                            |
|                                                     | SG Package                                                                                                                                 |                        | TBA  |       |                      | TBA  |       |                            |

**Notes**

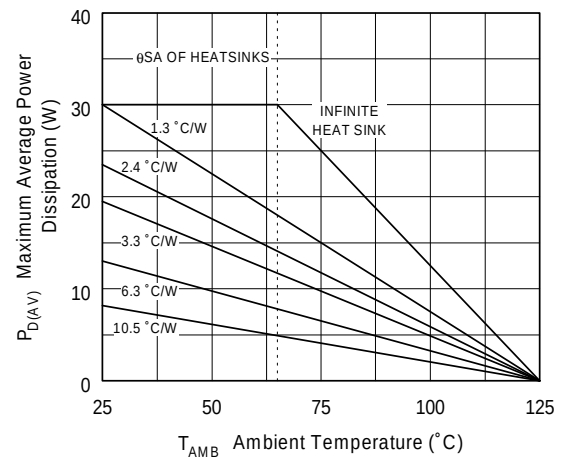
- 1) Applies over full temperature range:–  
 $T_J = -55$  to  $+150^\circ\text{C}$  for IP123A / IP123 / LM123  
 $T_J = 0$  to  $+125^\circ\text{C}$  for IP323A  
All other specifications apply at  $T_J = 25^\circ\text{C}$  unless otherwise stated.
- 2)  $P_{MAX} = 30\text{W}$  for K-Pack (TO-3) , V-Pack (TO-218) and G-Pack (TO-257) Packages.  
 $P_{MAX} = 25\text{W}$  for T-Pack (TO-220) Package.  
 $P_{MAX} = 15\text{W}$  for SG-Pack (TO-220SM) Package.
- 3) All characteristics are measured with a capacitor across the input of  $0.22\mu\text{F}$  and a capacitor across the output of  $0.1\mu\text{F}$ .
- 4) All characteristics except noise voltage and ripple rejection ratios are measured using pulse techniques ( $t_p \leq 10\text{ms}$  ,  $\delta \leq 5\%$ ).
- 5) Output voltage changes due to changes into internal temperature must be taken into account separately.

## TYPICAL PERFORMANCE CHARACTERISTICS

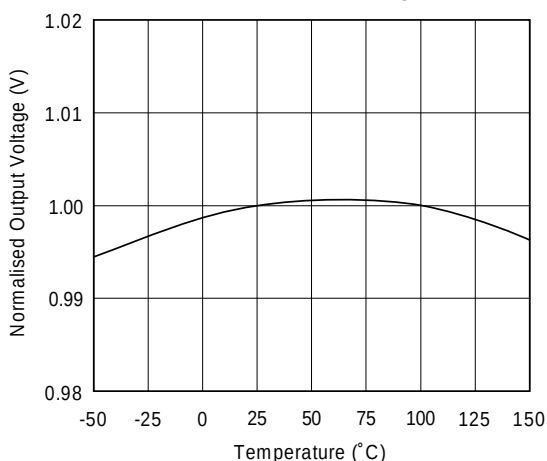
**MAXIMUM AVERAGE POWER DISSIPATION**  
( For IP123AK, IP123K, IP123AG, IP123G )



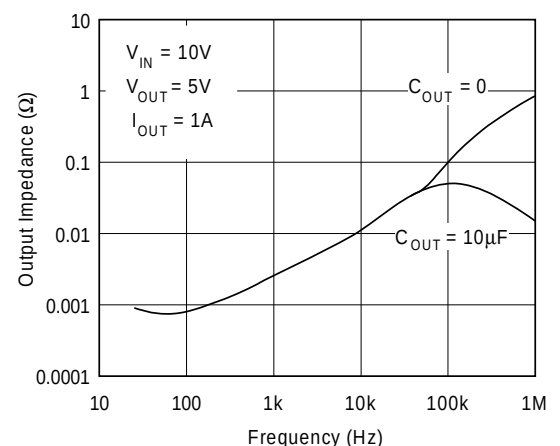
**MAXIMUM AVERAGE POWER DISSIPATION**  
( For IP323AK, IP323K, IP323AV, IP323V )



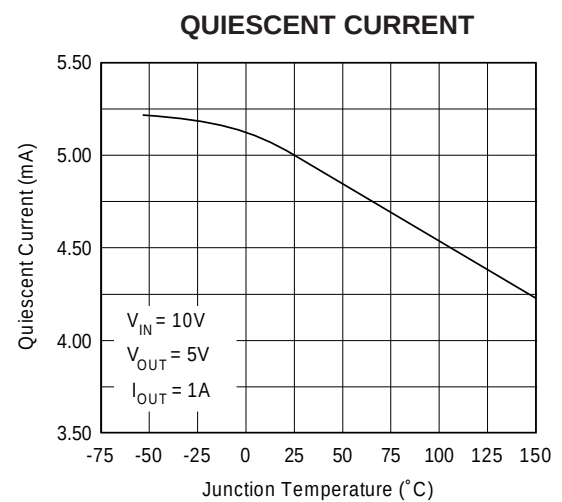
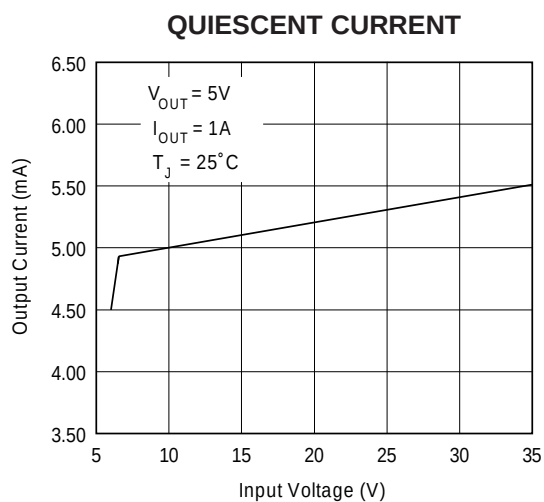
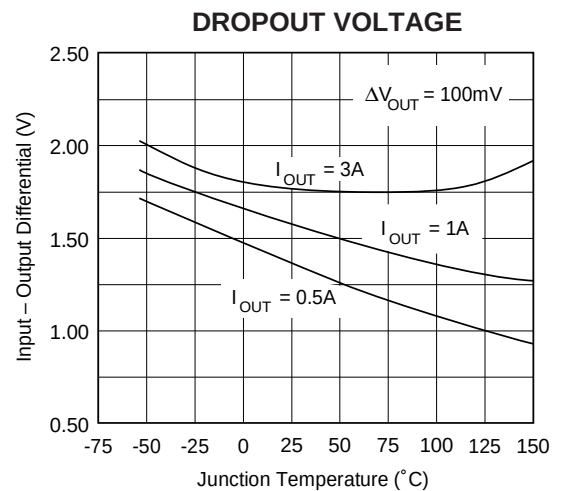
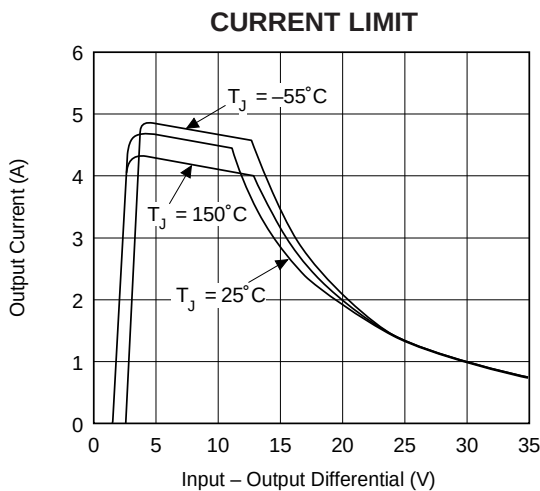
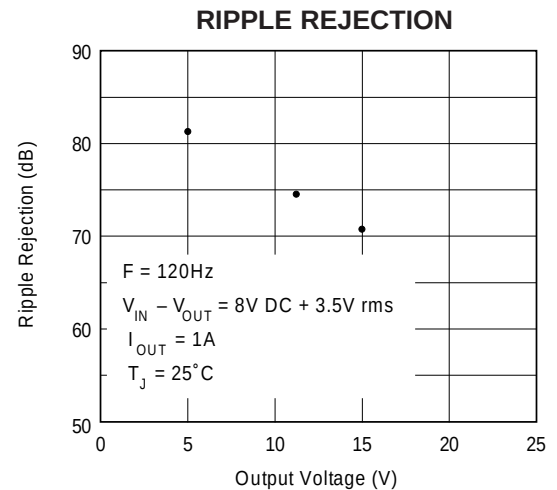
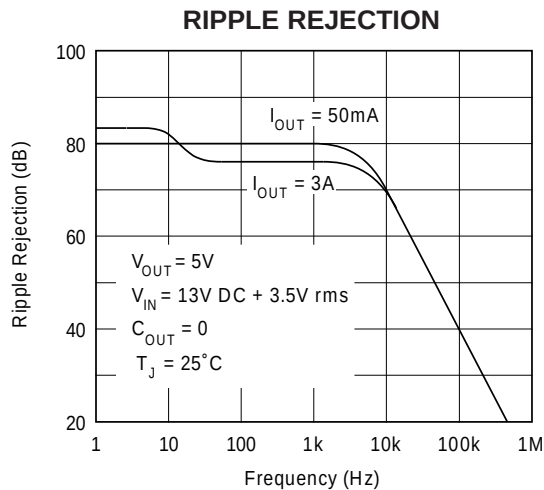
**OUTPUT VOLTAGE**  
(Normalised to 1V at  $T_J = 25^\circ\text{C}$ )



**OUTPUT IMPEDANCE**

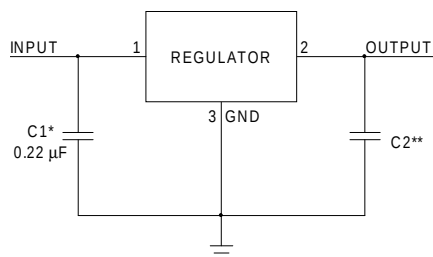


## TYPICAL PERFORMANCE CHARACTERISTICS



## APPLICATIONS INFORMATION

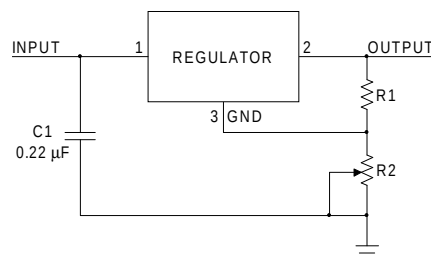
### FIXED OUTPUT REGULATOR



\* Required if the regulator is located far from the power supply filter.

\*\* Although no output capacitor is needed for stability, it does help transient response. If needed, use a 0.1µF ceramic disk.

### ADJUSTABLE OUTPUT REGULATOR

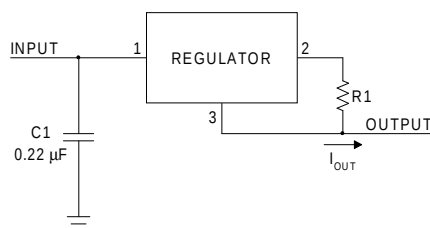


$$V_{OUT} = V_{REG} + (V_{REG} / R1 + I_Q) R2$$

$$V_{REG} / R1 > 3 I_Q$$

$$\text{Load Regulation (L}_r\text{)} \approx \left[ \frac{(R1 + R2)}{R1} \right] (L_R \text{ of regulator})$$

### CURRENT REGULATOR



$$I_{OUT} = \frac{V_{REG}}{R1} + I_Q$$

$$\Delta I_Q = 3.0\text{mA over line and load changes.}$$

## Order Information

| Part Number | K-Pack (TO-3) | G-Pack (TO-257) | T-Pack (TO-220) | V-Pack (TO-218) | SG-Pack TO-220SM | Temp. Range   |
|-------------|---------------|-----------------|-----------------|-----------------|------------------|---------------|
| IP123Axx-zz | ✓             | ✓               |                 |                 | ✓                | -55 to +150°C |
| IP123xx-zz  | ✓             | ✓               |                 |                 | ✓                | "             |
| LM123xx-zz  | ✓             |                 |                 |                 | ✓                | "             |
| IP323Axx-zz | ✓             |                 | ✓               | ✓               |                  | 0 to +125°C   |

#### Note:

xx = Package Code  
(K, G, T, V, SM)

eg.

IP123AK-15

zz = Voltage Code  
(05, 12, 15)

IP123ASG-05