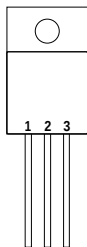


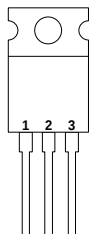
Pin 1 – V_{IN}
Pin 2 – V_{OUT}
Case – Ground

K Package – TO-3



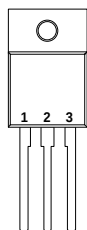
Pin 1 – V_{IN}
Pin 2 – Ground
Pin 3 – V_{OUT}
Case – Ground

G Package – TO-257



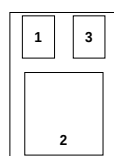
Pin 1 – V_{IN}
Pin 2 – Ground
Pin 3 – V_{OUT}
Case – Ground

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°C to $+150^\circ\text{C}$
T_L	Lead Temperature (Soldering, 10 sec)	300°C

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

Parameter	Test Conditions	IP123A-05 IP323A-05			IP123-05 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
	$P_{OUT} \leq P_{MAX}^2$ $V_{IN} = 8\text{V to } 15\text{V}$ $I_O = 5\text{mA to } 3\text{A}$ $T_J = \text{Over Temp. Range }^1$	4.85		5.15	4.75		5.25	V
ΔV_O Line Regulation	$I_O = 1\text{A}$ $V_{IN} = 7.5\text{V to } 15\text{V}$ $T_J = \text{Over Temp. Range }^1$			15			25	mV
ΔV_O Load Regulation	$V_{IN} = 8\text{V}$ $I_O = 5\text{mA to } 3\text{A}$ $T_J = \text{Over Temp. Range }^1$			50			100	mV
I_Q Quiescent Current	$V_{IN} = 8\text{V}$ $I_O = 5\text{mA to } 3\text{A}$ $T_J = \text{Over Temp. Range }^1$			10			14	mA
ΔI_Q Quiescent Current Change	$V_{IN} = 8\text{V}$ $I_O = 5\text{mA to } 3\text{A}$ $T_J = \text{Over Temp. Range }^1$			1.5			3.0	mA
	$I_O = 1\text{A}$ $V_{IN} = 7.5\text{V to } 15\text{V}$ $T_J = \text{Over Temp. Range }^1$			1.5			3.0	mA
V_N Output Noise Voltage	$f = 10\text{Hz to } 100\text{kHz}$		40			40		μVrms
$\frac{\Delta V_{IN}}{\Delta V_O}$ 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 IP323A-12			IP123-12 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
	$P_{OUT} \leq P_{MAX}^2$ $V_{IN} = 15.4\text{V to } 22\text{V}$ $I_O = 5\text{mA to } 3\text{A}$ $T_J = \text{Over Temp. Range } ^1$	11.64		12.36	11.4		12.6	V
ΔV_O Line Regulation	$I_O = 1\text{A}$ $V_{IN} = 14.8\text{V to } 22\text{V}$ $T_J = \text{Over Temp. Range } ^1$			36			60	mV
ΔV_O Load Regulation	$V_{IN} = 15.4\text{V}$ $I_O = 5\text{mA to } 3\text{A}$ $T_J = \text{Over Temp. Range } ^1$			75			150	mV
I_Q Quiescent Current	$V_{IN} = 15.4\text{V}$ $I_O = 5\text{mA to } 3\text{A}$ $T_J = \text{Over Temp. Range } ^1$			10			14	mA
ΔI_Q Quiescent Current Change	$V_{IN} = 15.4\text{V}$ $I_O = 5\text{mA to } 3\text{A}$ $T_J = \text{Over Temp. Range } ^1$			1.5			3.0	mA
	$I_O = 1\text{A}$ $V_{IN} = 14.8\text{V to } 22\text{V}$ $T_J = \text{Over Temp. Range } ^1$			1.5			3.0	mA
V_N Output Noise Voltage	$f = 10\text{Hz to } 100\text{kHz}$		75			75		μV_{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

- 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.
- $P_{MAX} = 30\text{W}$ 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.
- All characteristics are measured with a capacitor across the input of $0.22\mu\text{F}$ and a capacitor across the output of $0.1\mu\text{F}$.
- All characteristics except noise voltage and ripple rejection ratios are measured using pulse techniques ($t_p \leq 10\text{ms}$, $\delta \leq 5\%$).
- 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)

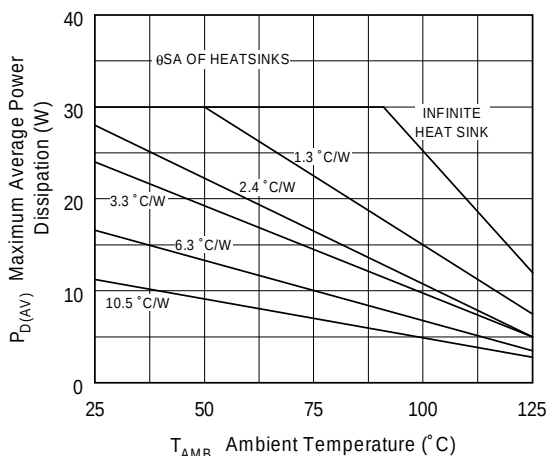
Parameter	Test Conditions	IP123A-15 IP323A-15			IP123-15 LM123-15			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_O Output Voltage	$I_O = 1\text{A}$ $V_{IN} = 17.9\text{V}$	14.85	15	15.15	14.4	15	15.6	V
	$P_{OUT} \leq P_{MAX}^2$ $V_{IN} = 18.5\text{V to } 25\text{V}$ $I_O = 5\text{mA to } 3\text{A}$ $T_J = \text{Over Temp. Range } ^1$	14.55		15.45	14.25		15.75	V
ΔV_O Line Regulation	$I_O = 1\text{A}$ $V_{IN} = 17.9\text{V to } 25\text{V}$ $T_J = \text{Over Temp. Range } ^1$			45			75	mV
ΔV_O Load Regulation	$V_{IN} = 18.5\text{V}$ $I_O = 5\text{mA to } 3\text{A}$ $T_J = \text{Over Temp. Range } ^1$			75			150	mV
I_Q Quiescent Current	$V_{IN} = 18.5\text{V}$ $I_O = 5\text{mA to } 3\text{A}$ $T_J = \text{Over Temp. Range } ^1$			10			14	mA
ΔI_Q Quiescent Current Change	$V_{IN} = 18.5\text{V}$ $I_O = 5\text{mA to } 3\text{A}$ $T_J = \text{Over Temp. Range } ^1$			1.5			3.0	mA
	$I_O = 1\text{A}$ $V_{IN} = 17.9\text{V to } 25\text{V}$ $T_J = \text{Over Temp. Range } ^1$			1.5			3.0	mA
V_N Output Noise Voltage	$f = 10\text{Hz to } 100\text{kHz}$		90			90		μV_{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

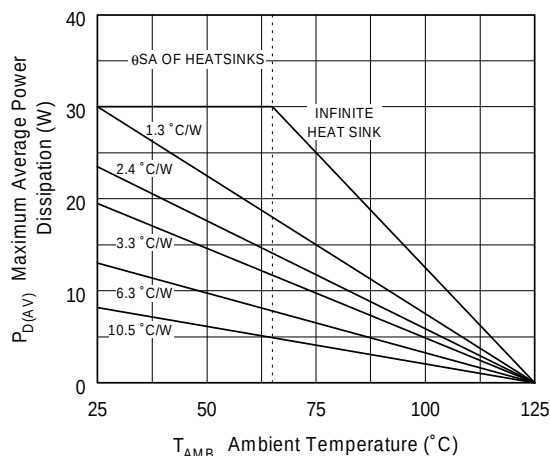
- Applies over full temperature range:–
 $T_J = -55$ to $+150^\circ\text{C}$ for IP123A / IP123 / LM123
 $T_J = 0$ to $+125^\circ\text{C}$ for IP323A
All other specifications apply at $T_J = 25^\circ\text{C}$ unless otherwise stated.
- $P_{MAX} = 30\text{W}$ for K-Pack (TO-3) , V-Pack (TO-218) and G-Pack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

TYPICAL PERFORMANCE CHARACTERISTICS

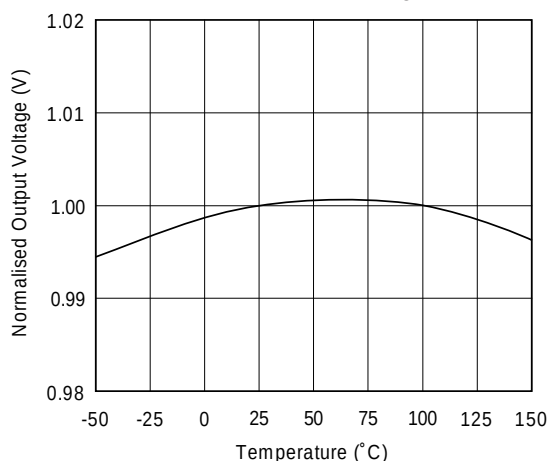
MAXIMUM AVERAGE POWER DISSIPATION
(For IP123AK, IP123K, IP123AG, IP123G)



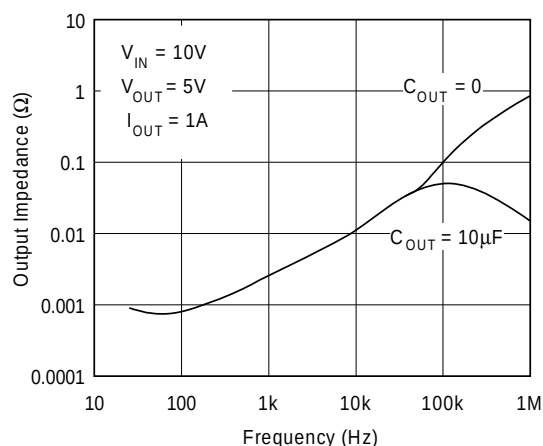
MAXIMUM AVERAGE POWER DISSIPATION
(For IP323AK, IP323K, IP323AV, IP323V)



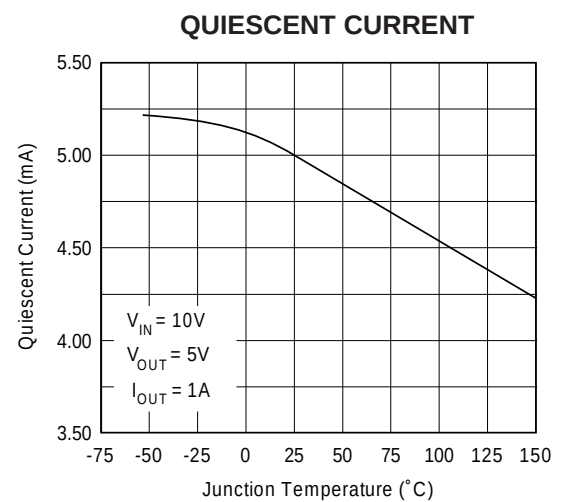
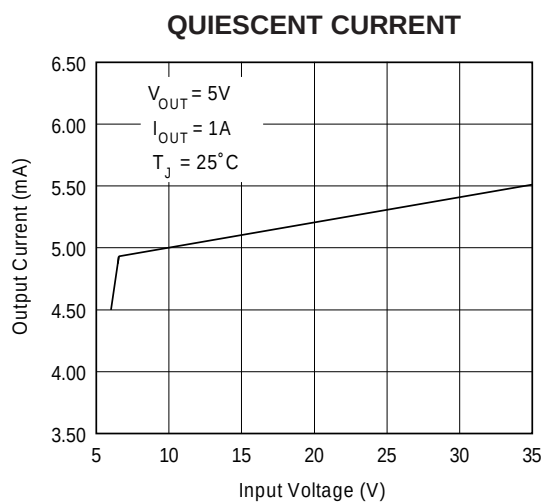
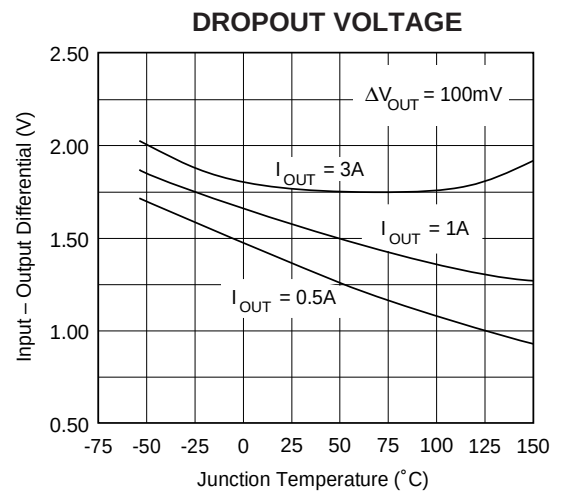
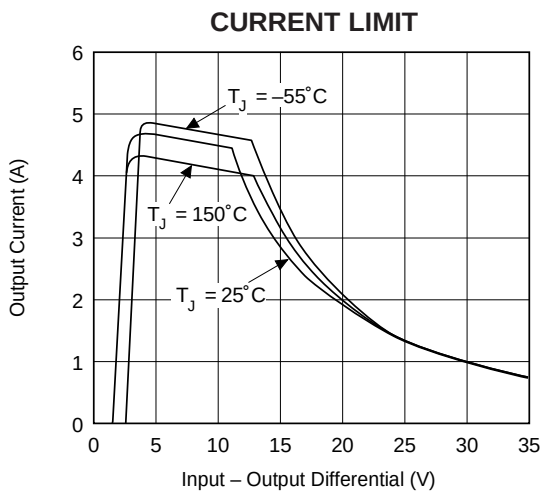
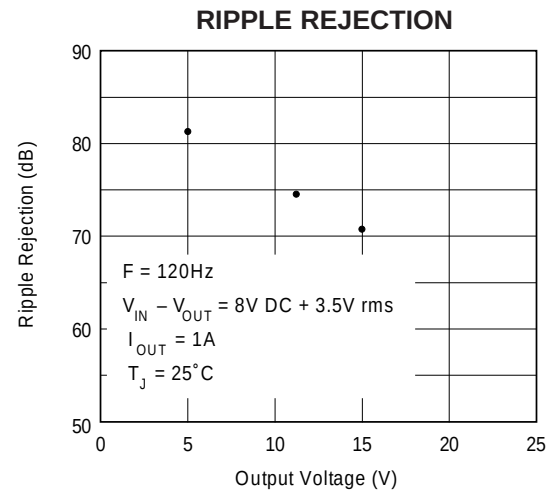
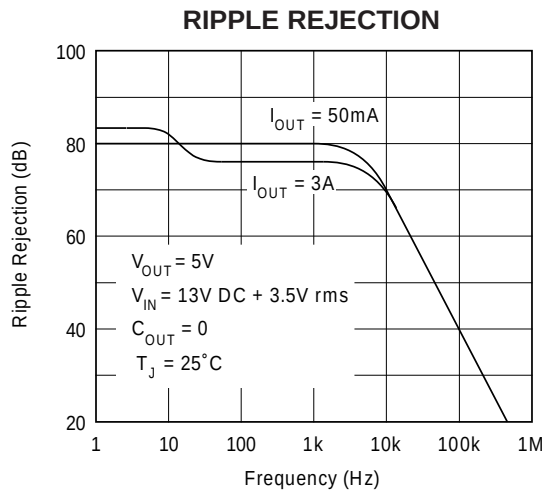
OUTPUT VOLTAGE
(Normalised to 1V at $T_J = 25^\circ\text{C}$)



OUTPUT IMPEDANCE

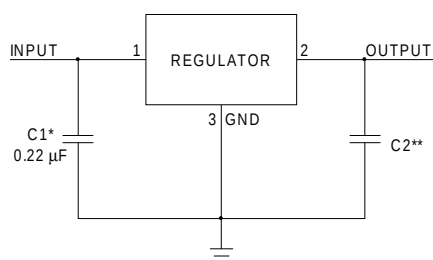


TYPICAL PERFORMANCE CHARACTERISTICS



APPLICATIONS INFORMATION

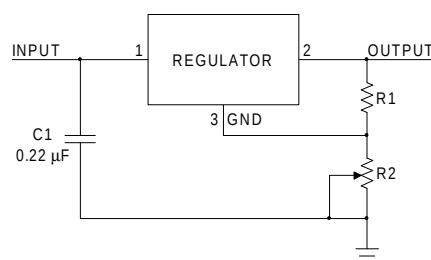
FIXED OUTPUT REGULATOR



* 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

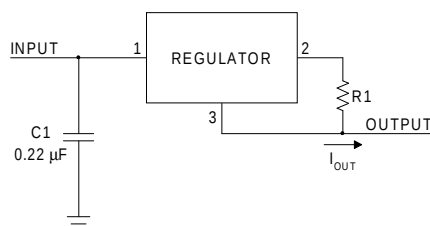


$$V_{OUT} = V_{REG} + (V_{REG} / R1 + I_Q) R2$$

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

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

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