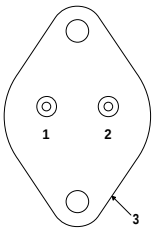
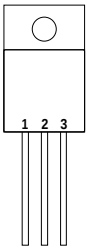
IP123A SERIES
IP123 SERIES
IP323A SERIES
LM123 SERIES



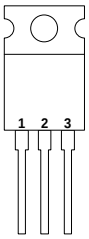
Pin 1 – V_{IN}
Pin 2 – V_{OUT}
Case – Ground

K Package – TO–3



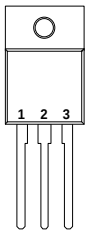
Pin 1 – V_{IN}
Pin 2 – Ground
Pin 3 – V_{OUT}
Case – Ground

G Package – TO–257



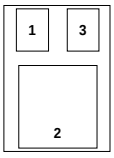
Pin 1 – V_{IN}
Pin 2 – Ground
Pin 3 – V_{OUT}
Case – Ground

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 (± SUPPLIES) ON OUTPUT**
- **AVAILABLE IN 5V, 12V AND 15V OPTIONS**

ABSOLUTE MAXIMUM RATINGS (T_C = 25°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°C
T_L	Lead Temperature (Soldering, 10 sec)	300°C

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise stated)

Parameter	Test Conditions	IP123A–05 IP323A–05 Min.	IP123A–05 IP323A–05 Typ.	IP123A–05 IP323A–05 Max.	IP123–05 LM123–05 Min.	IP123–05 LM123–05 Typ.	IP123–05 LM123–05 Max.	Units
V_O Output Voltage	I_O = 1A V_{IN} = 7.5V	4.95	5	5.05	4.8	5	5.2	V
	$P_{OUT} \le P_{MAX}$ [2] V_{IN} = 8V to 15V I_O = 5mA to 3A T_J = Over Temp. Range [1]	4.85		5.15	4.75		5.25	V
ΔV_O Line Regulation	I_O = 1A V_{IN} = 7.5V to 15V T_J = Over Temp. Range [1]			15			25	mV
ΔV_O Load Regulation	V_{IN} = 8V I_O = 5mA to 3A T_J = Over Temp. Range [1]			50			100	mV
I_Q Quiescent Current	V_{IN} = 8V I_O = 5mA to 3A T_J = Over Temp. Range [1]			10			14	mA
ΔI_Q Quiescent Current Change	V_{IN} = 8V I_O = 5mA to 3A T_J = Over Temp. Range [1]			1.5			3.0	mA
	I_O = 1A V_{IN} = 7.5V to 15V T_J = Over Temp. Range [1]			1.5			3.0	mA
V_N Output Noise Voltage	f = 10Hz to 100kHz		40			40		µVrms
$\frac{\Delta V_{IN}}{\Delta V_O}$ Ripple Rejection	f = 120Hz V_{IN} = 8V to 18V	66	80		60	80		dB
	I_O = 1A T_J = Over Temp. Range [1]	60			56			
I_{SC} Short Circuit Current	V_{IN} = 15V		3			3		A
	V_{IN} = 7.5V		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		°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°C for IP123A / IP123 / LM123
   T_J = 0 to +125°C for IP323A
   All other specifications apply at T_J = 25°C unless otherwise stated.
2) P_{MAX} = 30W for K–Pack (TO–3) , V–Pack (TO–218) and G–Pack (TO–257) Packages.
   P_{MAX} = 25W for T–Pack (TO–220) Package.
   P_{MAX} = 15W for SG–Pack (TO–220SM) Package.
3) All characteristics are measured with a capacitor across the input of 0.22µF and a capacitor across the output of 0.1µF.
4) All characteristics except noise voltage and ripple rejection ratios are measured using pulse techniques ($t_p \le$ 10ms , $\delta \le$ 5%).
5) Output voltage changes due to changes into internal temperature must be taken into account separately.

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise stated)

Parameter	Test Conditions	IP123A–12 IP323A–12 Min.	Typ.	Max.	IP123–12 LM123–12 Min.	Typ.	Max.	Units
V_O Output Voltage	I_O = 1A V_{IN} = 14.8V	11.88	12	12.12	11.5	12	12.5	V
	$P_{OUT} \le P_{MAX}$ [2] V_{IN} = 15.4V to 22V I_O = 5mA to 3A T_J = Over Temp. Range [1]	11.64		12.36	11.4		12.6	V
ΔV_O Line Regulation	I_O = 1A V_{IN} = 14.8V to 22V T_J = Over Temp. Range [1]			36			60	mV
ΔV_O Load Regulation	V_{IN} = 15.4V I_O = 5mA to 3A T_J = Over Temp. Range [1]			75			150	mV
I_Q Quiescent Current	V_{IN} = 15.4V I_O = 5mA to 3A T_J = Over Temp. Range [1]			10			14	mA
ΔI_Q Quiescent Current Change	V_{IN} = 15.4V I_O = 5mA to 3A T_J = Over Temp. Range [1]			1.5			3.0	mA
	I_O = 1A V_{IN} = 14.8V to 22V T_J = Over Temp. Range [1]			1.5			3.0	mA
V_N Output Noise Voltage	f = 10Hz to 100kHz		75			75		µVrm
$\frac{\Delta V_{IN}}{\Delta V_O}$ Ripple Rejection	f = 120Hz V_{IN} = 15.4V to 25.4V	58	72		52	72		dB
	I_O = 1A T_J = Over Temp. Range [1]	52			48			
I_{SC} Short Circuit Current	V_{IN} = 15.4V		3			3		A
I_{pk} Peak Output Current	V_{IN} = 15.4V		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		°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°C for IP123A / IP123 / LM123
   T_J = 0 to +125°C for IP323A
   All other specifications apply at T_J = 25°C unless otherwise stated.
2) P_{MAX} = 30W for K–Pack (TO–3) , V–Pack (TO–218) and G–Pack (TO–257) Packages.
   P_{MAX} = 25W for T–Pack (TO–220) Package.
   P_{MAX} = 15W for SG–Pack (TO–220SM) Package.
3) All characteristics are measured with a capacitor across the input of 0.22µF and a capacitor across the output of 0.1µF.
4) All characteristics except noise voltage and ripple rejection ratios are measured using pulse techniques ($t_p \le$ 10ms , $\delta \le$ 5%).
5) Output voltage changes due to changes into internal temperature must be taken into account separately.

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise stated)

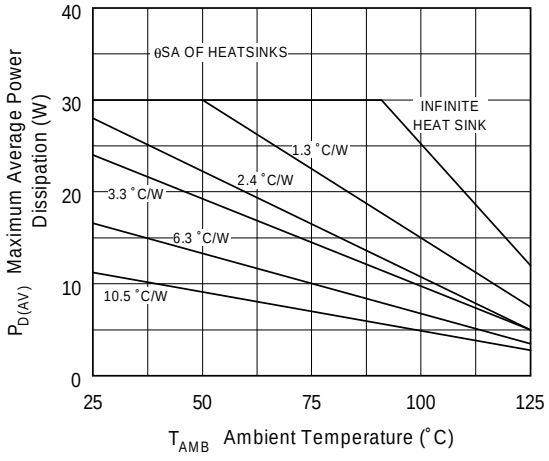
Parameter	Test Conditions	IP123A–15 IP323A–15 Min.	Typ.	Max.	IP123–15 LM123–15 Min.	Typ.	Max.	Units
V_O Output Voltage	I_O = 1A V_{IN} = 17.9V	14.85	15	15.15	14.4	15	15.6	V
	$P_{OUT} \le P_{MAX}$ [2] V_{IN} = 18.5V to 25V, I_O = 5mA to 3A, T_J = Over Temp. Range [1]	14.55		15.45	14.25		15.75	V
ΔV_O Line Regulation	I_O = 1A V_{IN} = 17.9V to 25V, T_J = Over Temp. Range [1]			45			75	mV
ΔV_O Load Regulation	V_{IN} = 18.5V I_O = 5mA to 3A, T_J = Over Temp. Range [1]			75			150	mV
I_Q Quiescent Current	V_{IN} = 18.5V I_O = 5mA to 3A, T_J = Over Temp. Range [1]			10			14	mA
ΔI_Q Quiescent Current Change	V_{IN} = 18.5V I_O = 5mA to 3A, T_J = Over Temp. Range [1]			1.5			3.0	mA
	I_O = 1A V_{IN} = 17.9V to 25V, T_J = Over Temp. Range [1]			1.5			3.0	mA
V_N Output Noise Voltage	f = 10Hz to 100kHz		90			90		µVrm
$\frac{\Delta V_{IN}}{\Delta V_O}$ Ripple Rejection	f = 120Hz V_{IN} = 18.5V to 28.5V	56	70		50	70		dB
	I_O = 1A T_J = Over Temp. Range [1]	50			46			
I_{SC} Short Circuit Current	V_{IN} = 18.5V		2.5			2.5		A
I_{pk} Peak Output Current	V_{IN} = 18.5V		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		°C/W
	G Package , T Package		3	4		4		
	SG Package		TBA			TBA		

Notes

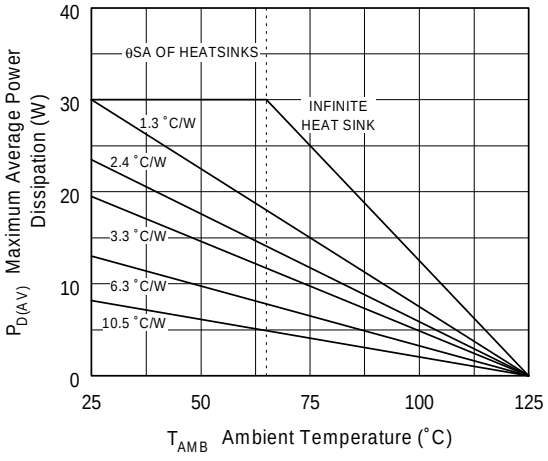
1) Applies over full temperature range:–
   T_J = –55 to +150°C for IP123A / IP123 / LM123
   T_J = 0 to +125°C for IP323A
   All other specifications apply at T_J = 25°C unless otherwise stated.
2) P_{MAX} = 30W for K–Pack (TO–3) , V–Pack (TO–218) and G–Pack (TO–257) Packages.
   P_{MAX} = 25W for T–Pack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

TYPICAL PERFORMANCE CHARACTERISTICS

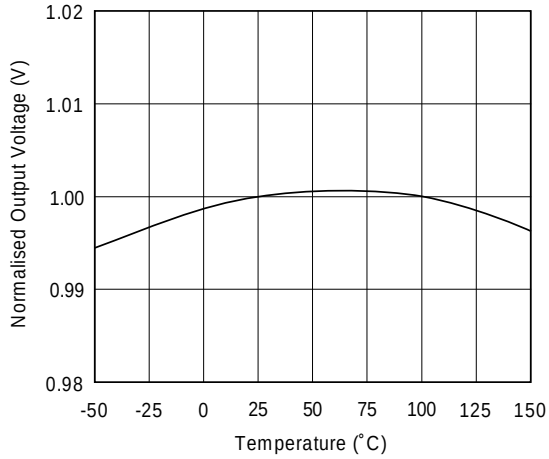
MAXIMUM AVERAGE POWER DISSIPATION (For IP123AK, IP123K, IP123AG, IP123G)



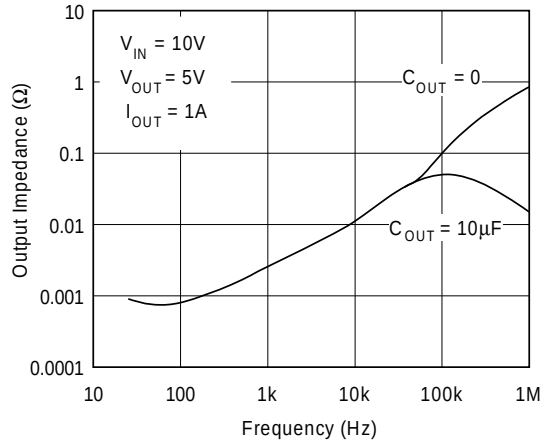
MAXIMUM AVERAGE POWER DISSIPATION (For IP323AK, IP323K, IP323AV, IP323V)



OUTPUT VOLTAGE (Normalised to 1V at T_J = 25°C)

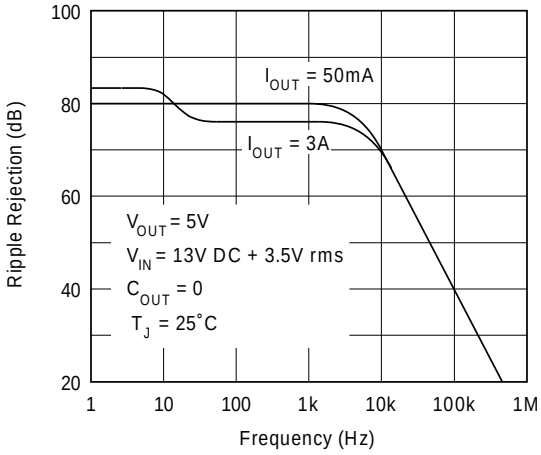


OUTPUT IMPEDANCE

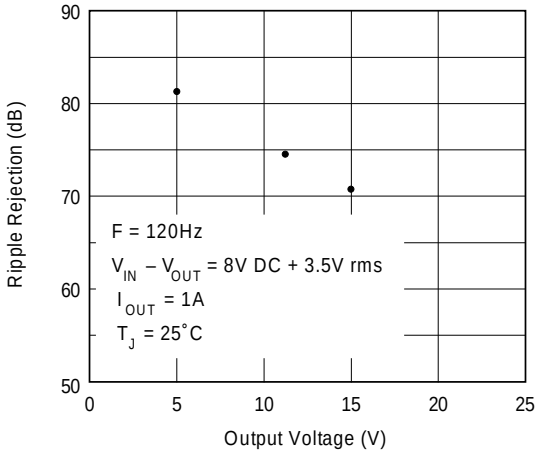


TYPICAL PERFORMANCE CHARACTERISTICS

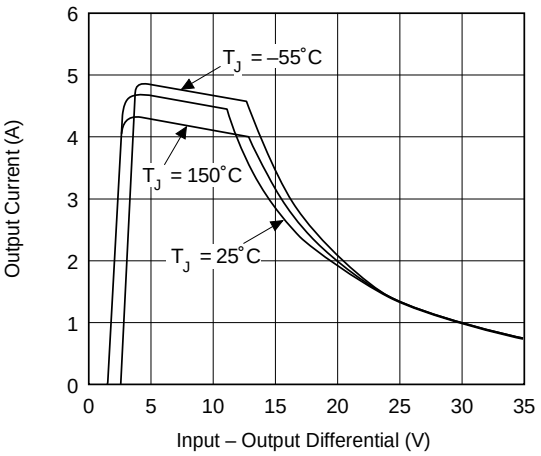
RIPPLE REJECTION



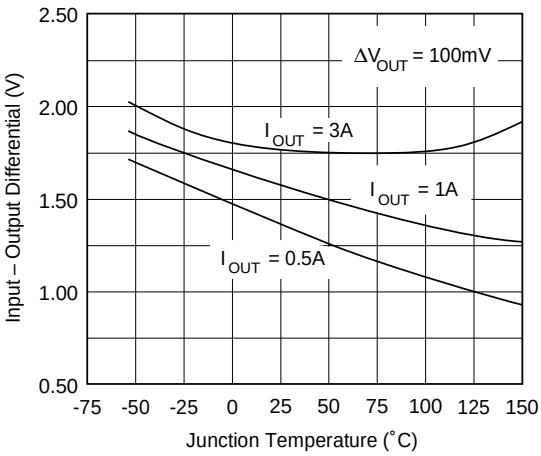
RIPPLE REJECTION



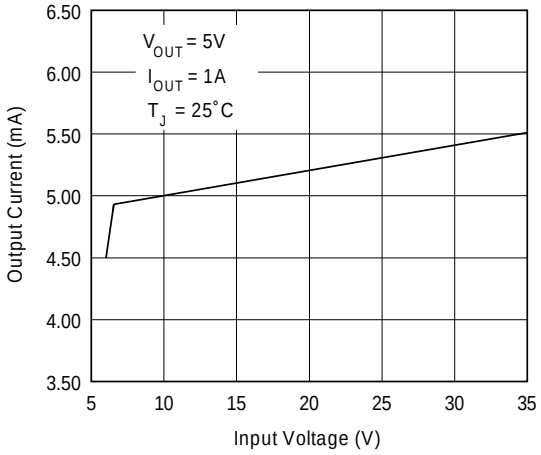
CURRENT LIMIT



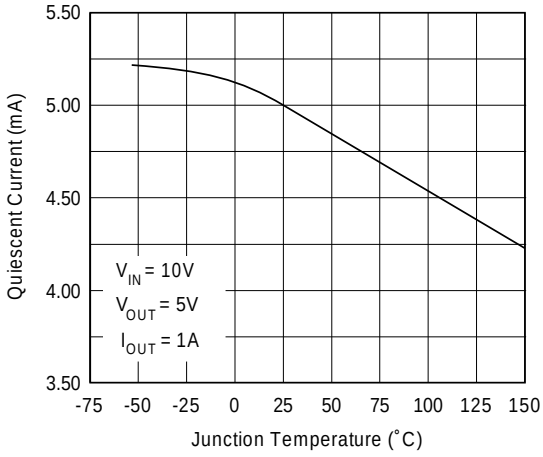
DROPOUT VOLTAGE



QUIESCENT CURRENT



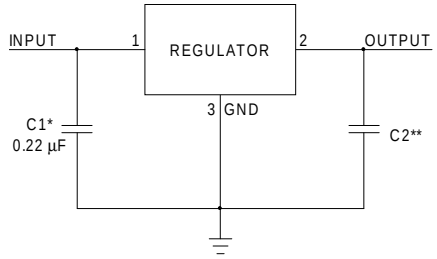
QUIESCENT CURRENT



IP123A SERIES
IP123 SERIES
IP323A SERIES
LM123 SERIES

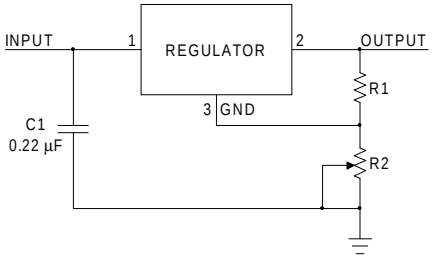
APPLICATIONS INFORMATION

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

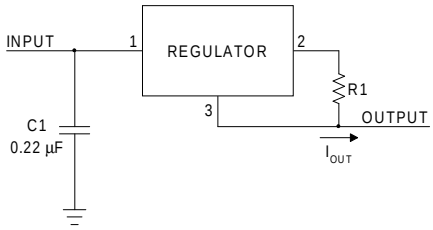


$V_{OUT} = V_{REG} + (V_{REG} / R1 + I_Q) R2$

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

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

CURRENT REGULATOR



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

ΔI_Q = 3.0mA 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)
zz = Voltage Code (05, 12, 15)

eg.

IP123AK–15
IP123ASG–05