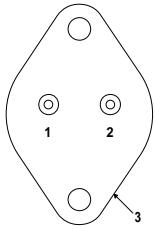
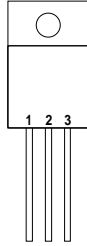


## 3 AMP POSITIVE VOLTAGE REGULATORS



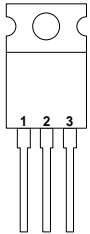
Pin 1 –  $V_{IN}$   
 Pin 2 –  $V_{OUT}$   
 Case – Ground

**K Package – TO-3**



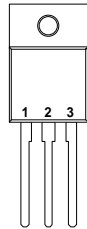
Pin 1 –  $V_{IN}$   
 Pin 2 – Ground  
 Pin 3 –  $V_{OUT}$   
 Case – Ground

**G Package – TO-257**



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

**T Package – TO-220**

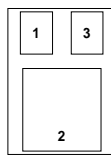


Pin 1 –  $V_{IN}$   
 Pin 2 – Ground  
 Pin 3 –  $V_{OUT}$   
 Case – Ground

**V Package – TO-218**

### 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



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

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

### 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 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
$\Delta V_O$ 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
$\Delta V_O$ 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
$\Delta I_Q$ 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			$\mu\text{Vrms}$
$\frac{\Delta V_{IN}}{\Delta V_O}$ 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**

- 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-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
$\Delta V_O$ 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
$\Delta V_O$ 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
$\Delta I_Q$ 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			$\mu\text{V}_{\text{rms}}$
$\frac{\Delta V_{IN}}{\Delta V_O}$ 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)

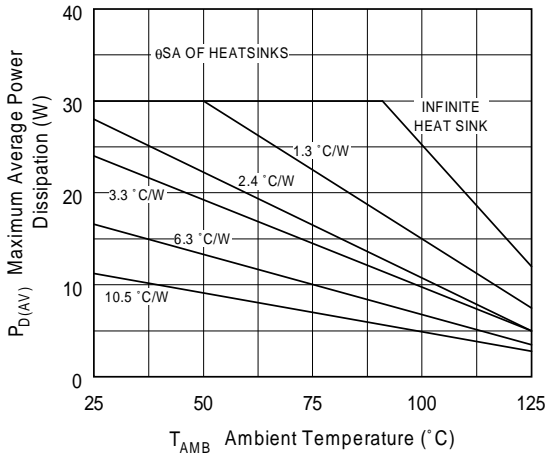
Parameter	Test Conditions	IP123A-15 IP323A-15			IP123-15 LM123-15			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
$V_O$ Output Voltage	$I_O = 1\text{A}$ $V_{IN} = 17.9\text{V}$	14.85	15	15.15	14.4	15	15.6	V
	$P_{OUT} \leq P_{MAX}^2$ $V_{IN} = 18.5\text{V to } 25\text{V}$ $I_O = 5\text{mA to } 3\text{A}$ $T_J = \text{Over Temp. Range } ^1$	14.55		15.45	14.25		15.75	V
$\Delta V_O$ 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
$\Delta V_O$ 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
$\Delta I_Q$ 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			$\mu\text{V}_{\text{rms}}$
$\frac{\Delta V_{IN}}{\Delta V_O}$ 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**

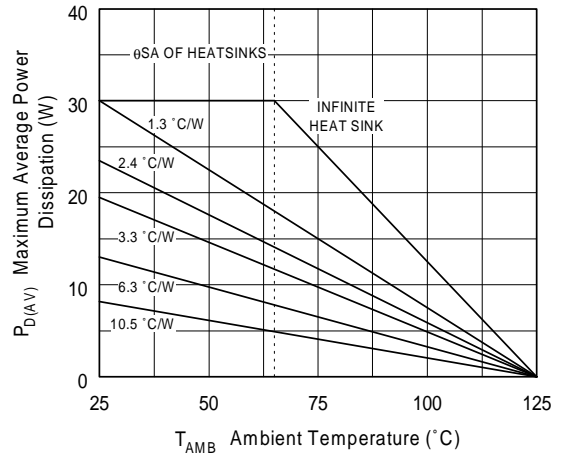
- 1) Applies over full temperature range:-  
 $T_J = -55$  to  $+150^\circ\text{C}$  for IP123A / IP123 / LM123  
 $T_J = 0$  to  $+125^\circ\text{C}$  for IP323A  
All other specifications apply at  $T_J = 25^\circ\text{C}$  unless otherwise stated.
- 2)  $P_{MAX} = 30\text{W}$  for K-Pack (TO-3) , 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**

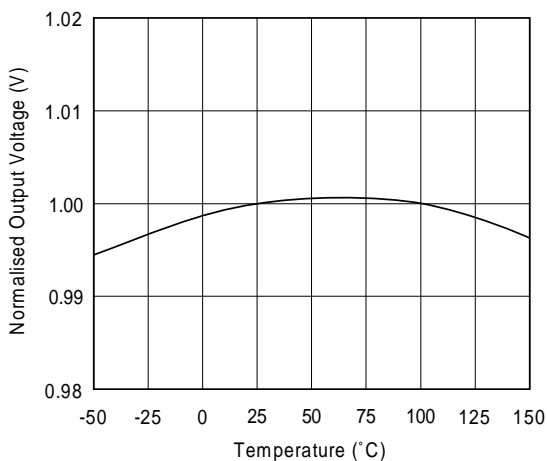
**MAXIMUM AVERAGE POWER DISSIPATION**  
( For IP123AK, IP123K, IP123AG, IP123G )



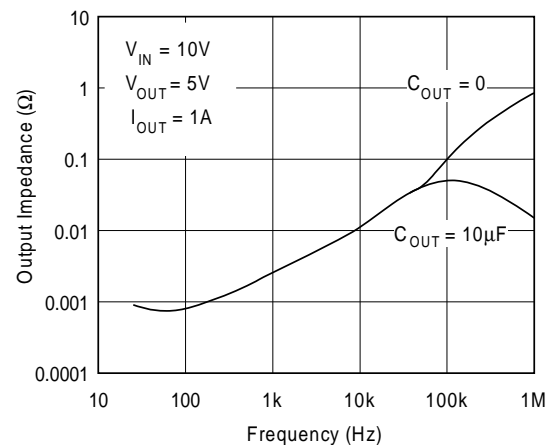
**MAXIMUM AVERAGE POWER DISSIPATION**  
( For IP323AK, IP323K, IP323AV, IP323V )



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

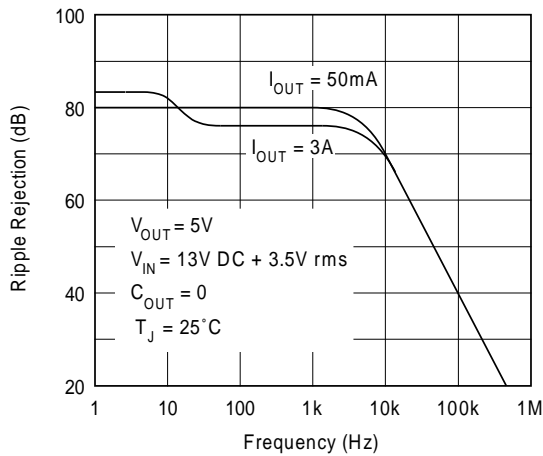


**OUTPUT IMPEDANCE**

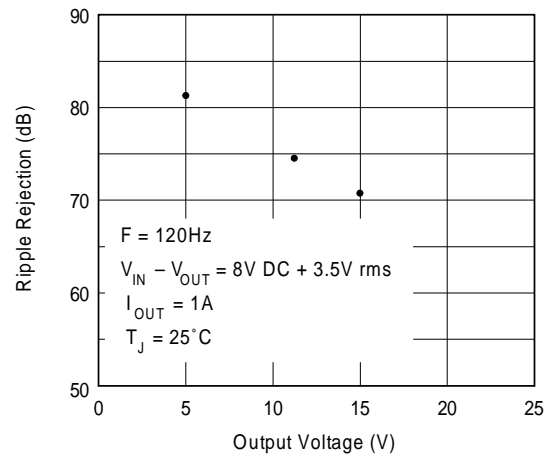


TYPICAL PERFORMANCE CHARACTERISTICS

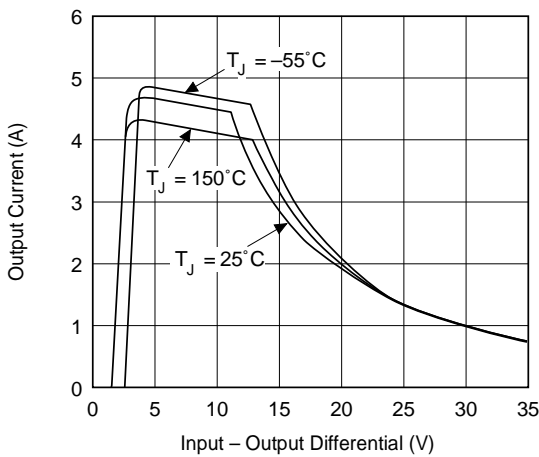
RIPPLE REJECTION



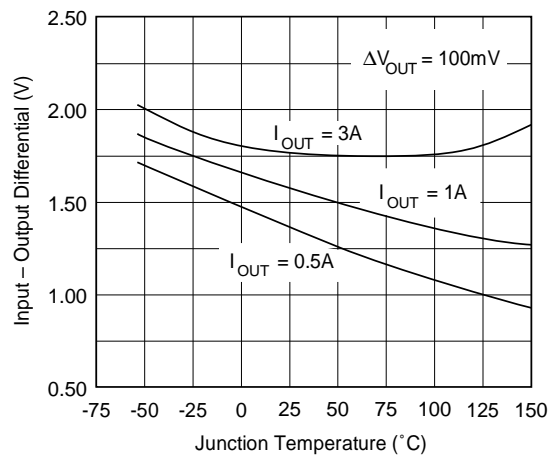
RIPPLE REJECTION



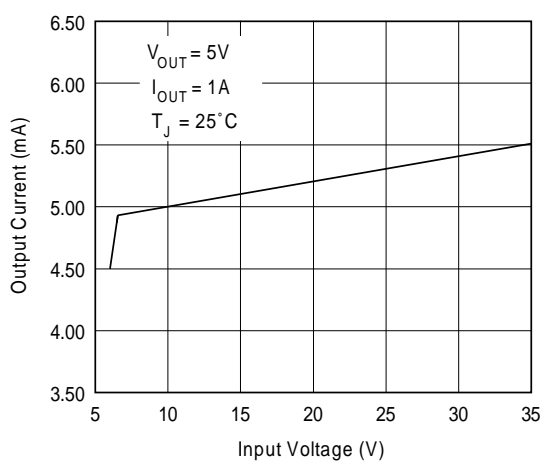
CURRENT LIMIT



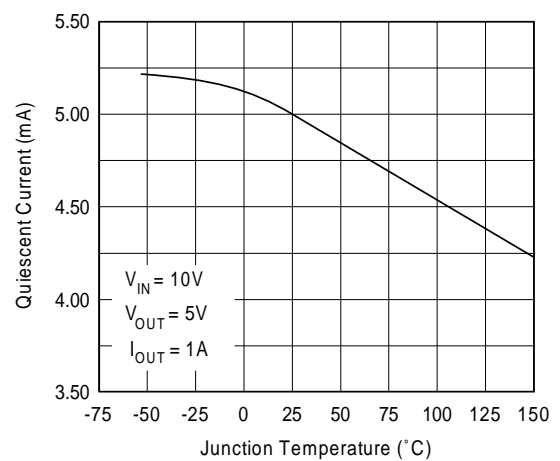
DROPOUT VOLTAGE



QUIESCENT CURRENT

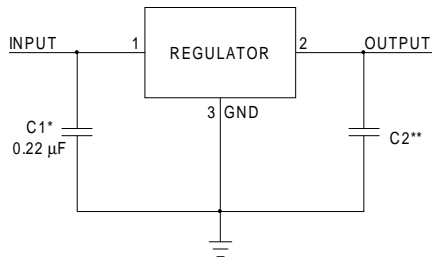


QUIESCENT CURRENT



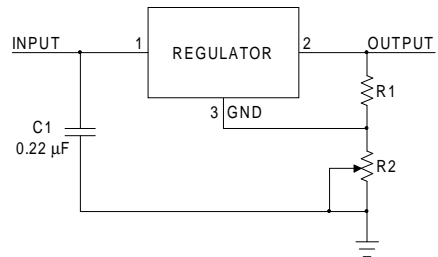
### APPLICATIONS INFORMATION

#### 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

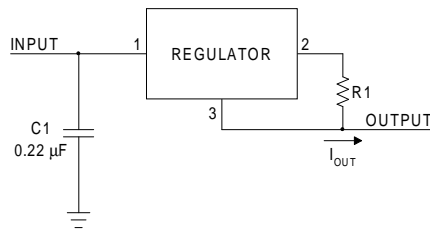


$$V_{OUT} = V_{REG} + (V_{REG} / R1 + I_Q) R2$$

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

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

#### 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)

zz = Voltage Code  
 (05, 12, 15)

eg.

IP123AK-15

IP123ASG-05