

LM123/LM323A/LM323-N 3-Amp, 5-Volt Positive Regulator

Check for Samples: [LM123](#), [LM323-N](#), [LM323A](#)

FEATURES

- Ensured 1% Initial Accuracy (A Version)
- 3 Amp Output Current
- Internal Current and Thermal Limiting
- 0.01Ω Typical Output Impedance
- 7.5V Minimum Input Voltage
- 30W Power Dissipation
- P⁺ Product Enhancement tested

DESCRIPTION

The LM123 is a three-terminal positive regulator with a preset 5V output and a load driving capability of 3 amps. New circuit design and processing techniques are used to provide the high output current without sacrificing the regulation characteristics of lower current devices.

The LM323A offers improved precision over the standard LM323-N. Parameters with tightened specifications include output voltage tolerance, line regulation, and load regulation.

The 3 amp regulator is virtually blowout proof. Current limiting, power limiting, and thermal shutdown provide the same high level of reliability obtained with these techniques in the LM109 1 amp regulator.

No external components are required for operation of the LM123. If the device is more than 4 inches from the filter capacitor, however, a 1 μF solid tantalum capacitor should be used on the input. A 0.1 μF or larger capacitor may be used on the output to reduce load transient spikes created by fast switching digital logic, or to swamp out stray load capacitance.

An overall worst case specification for the combined effects of input voltage, load currents, ambient temperature, and power dissipation ensure that the LM123 will perform satisfactorily as a system element.

For applications requiring other voltages, see LM150 series adjustable regulator data sheet.

Operation is specified over the junction temperature range –55°C to +150°C for LM123, –40°C to +125°C for LM323A, and 0°C to +125°C for LM323-N. A hermetic TO-3 package is used for high reliability and low thermal resistance.

Connection Diagram

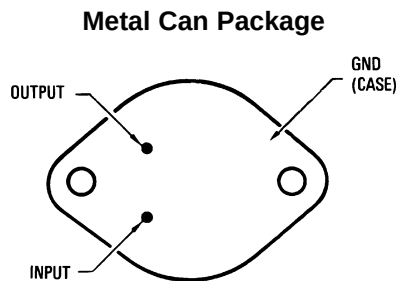


Figure 1. See Package Number NDS



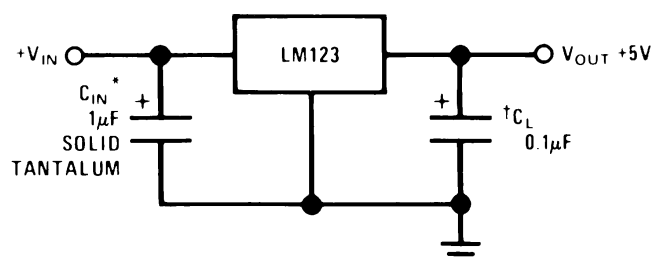
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Typical Applications



*Required if LM123 is more than 4" from filter capacitor.

†Regulator is stable with no load capacitor into resistive loads.

Figure 2. Basic 3 Amp Regulator



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings^{(1) (2)(3)}

Input Voltage		20V
Power Dissipation		Internally Limited
Operating Junction Temperature Range	LM123	–55°C to +150°C
	LM323A	–40°C to +125°C
	LM323-N	0°C to +125°C
Storage Temperature Range		–65°C to +150°C
Lead Temperature (Soldering, 10 sec.)		300°C
ESD Tolerance ⁽⁴⁾		2000V

- (1) "Absolute Maximum Ratings" indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not ensure specific performance limits.
- (2) Refer to RETS123K drawing for LM123K military specifications.
- (3) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/Distributors for availability and specifications.
- (4) Human body model, 1.5 kΩ in series with 100 pF.

LM123 Electrical Characteristics⁽¹⁾

Parameter	Conditions	LM123			Units
		Min	Typ	Max	
Output Voltage	$T_j = 25^\circ\text{C}$ $V_{IN} = 7.5\text{V}$, $I_{OUT} = 0\text{A}$	4.7	5	5.3	V
	$7.5\text{V} \leq V_{IN} \leq 15\text{V}$ $0\text{A} \leq I_{OUT} \leq 3\text{A}$, $P \leq 30\text{W}$	4.6		5.4	V
Line Regulation ⁽²⁾	$T_j = 25^\circ\text{C}$ $7.5\text{V} \leq V_{IN} \leq 15\text{V}$		5	25	mV
Load Regulation ⁽²⁾	$T_j = 25^\circ\text{C}$, $V_{IN} = 7.5\text{V}$, $0\text{A} \leq I_{OUT} \leq 3\text{A}$		25	100	mV
Quiescent Current	$7.5\text{V} \leq V_{IN} \leq 15\text{V}$, $0\text{A} \leq I_{OUT} \leq 3\text{A}$		12	20	mA
Output Noise Voltage	$T_j = 25^\circ\text{C}$ $10\text{ Hz} \leq f \leq 100\text{ kHz}$		40		μVrms
Short Circuit Current Limit	$T_j = 25^\circ\text{C}$	$V_{IN} = 15\text{V}$	3	4.5	A
		$V_{IN} = 7.5\text{V}$	4	5	A
Long Term Stability				35	mV
Thermal Resistance Junction to Case ⁽³⁾			2		°C/W

- (1) Unless otherwise noted, specifications apply for $-55^\circ\text{C} \leq T_j \leq +150^\circ\text{C}$ for the LM123, $-40^\circ\text{C} \leq T_j \leq +125^\circ\text{C}$ for the LM323A, and $0^\circ\text{C} \leq T_j \leq +125^\circ\text{C}$ for the LM323-N. Although power dissipation is internally limited, specifications apply only for $P \leq 30\text{W}$.
- (2) Load and line regulation are specified at constant junction temperature. Pulse testing is required with a pulse width $\leq 1\text{ ms}$ and a duty cycle $\leq 5\%$.
- (3) Without a heat sink, the thermal resistance of the TO-3 package is about 35°C/W . With a heat sink, the effective thermal resistance can only approach the specified values of 2°C/W , depending on the efficiency of the heat sink.

LM323A/LM323-N Electrical Characteristics ⁽¹⁾

Parameter	Conditions	LM323A			LM323-N			Units
		Min	Typ	Max	Min	Typ	Max	
Output Voltage	$T_J = 25^\circ\text{C}$ $V_{IN} = 7.5\text{V}$, $I_{OUT} = 0\text{A}$	4.95	5	5.05	4.8	5	5.2	V
	$7.5\text{V} \leq V_{IN} \leq 15\text{V}$ $0\text{A} \leq I_{OUT} \leq 3\text{A}$, $P \leq 30\text{W}$	4.85		5.15	4.75		5.25	V
Line Regulation ⁽²⁾	$T_J = 25^\circ\text{C}$ $7.5\text{V} \leq V_{IN} \leq 15\text{V}$		5	10		5	25	mV
Load Regulation ⁽²⁾	$T_J = 25^\circ\text{C}$, $V_{IN} = 7.5\text{V}$, $0\text{A} \leq I_{OUT} \leq 3\text{A}$		25	50		25	100	mV
Quiescent Current	$7.5\text{V} \leq V_{IN} \leq 15\text{V}$, $0\text{A} \leq I_{OUT} \leq 3\text{A}$		12	20		12	20	mA
Output Noise Voltage	$T_J = 25^\circ\text{C}$ $10\text{ Hz} \leq f \leq 100\text{ kHz}$		40			40		μV_{rms}
Short Circuit Current Limit	$T_J = 25^\circ\text{C}$ $V_{IN} = 15\text{V}$		3	4.5		3	4.5	A
	$V_{IN} = 7.5\text{V}$		4	6		4	5	A
Long Term Stability				35			35	mV
Thermal Resistance Junction to Case ⁽³⁾			2			2		$^\circ\text{C/W}$

- (1) Unless otherwise noted, specifications apply for $-55^\circ\text{C} \leq T_J \leq +150^\circ\text{C}$ for the LM123, $-40^\circ\text{C} \leq T_J \leq +125^\circ\text{C}$ for the LM323A, and $0^\circ\text{C} \leq T_J \leq +125^\circ\text{C}$ for the LM323-N. Although power dissipation is internally limited, specifications apply only for $P \leq 30\text{W}$.
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- (3) Without a heat sink, the thermal resistance of the TO-3 package is about 35°C/W . With a heat sink, the effective thermal resistance can only approach the specified values of 2°C/W , depending on the efficiency of the heat sink.

Typical Performance Characteristics

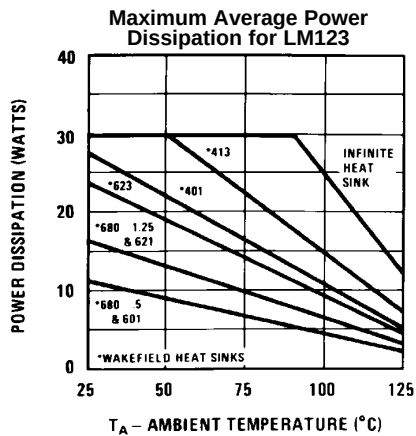


Figure 3.

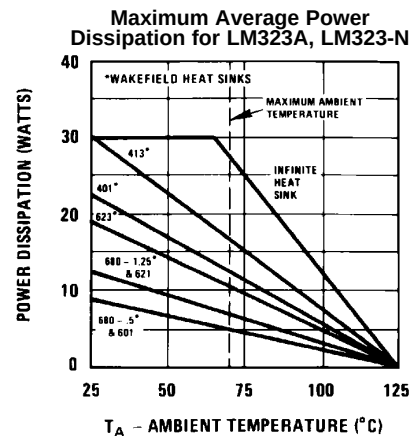


Figure 4.

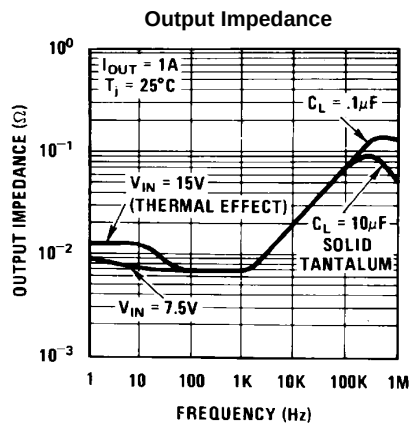


Figure 5.

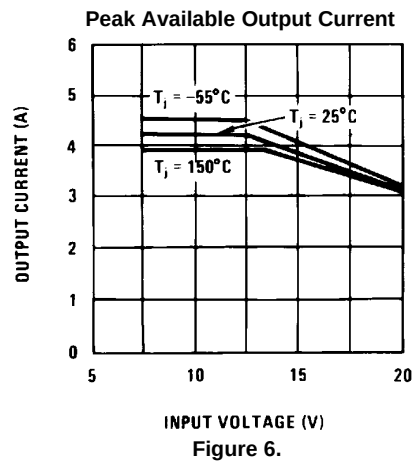


Figure 6.

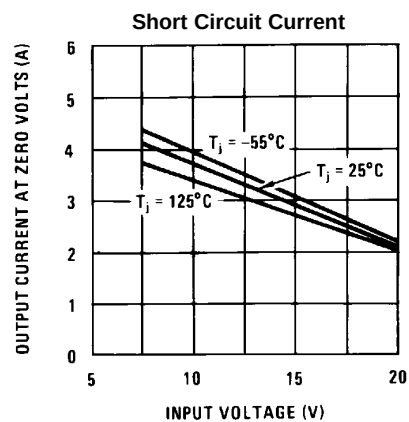


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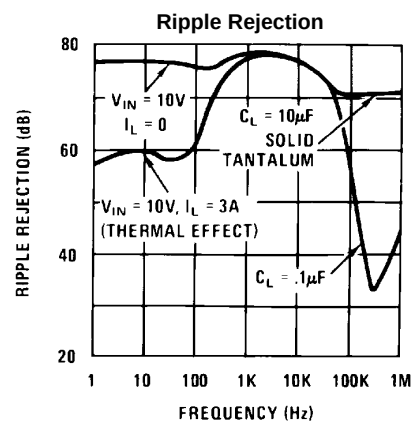


Figure 8.

Typical Performance Characteristics (continued)

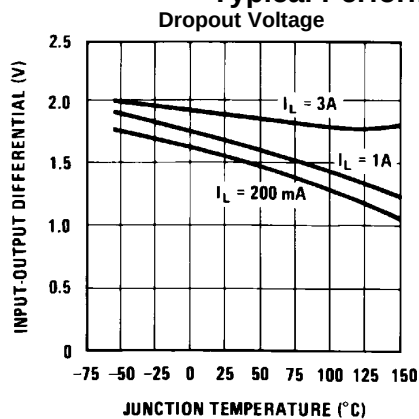


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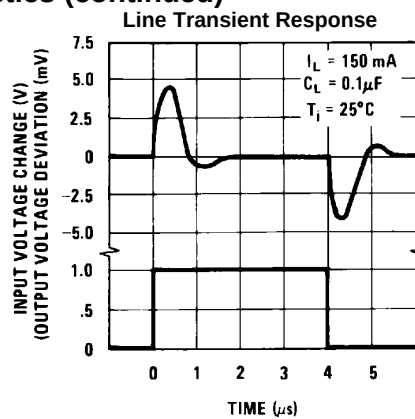


Figure 10.

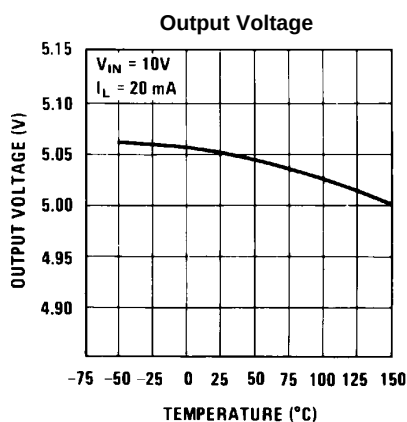


Figure 11.

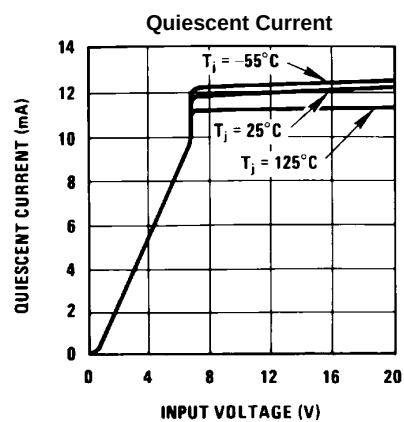


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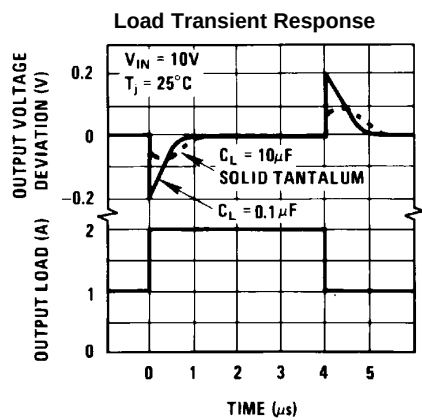


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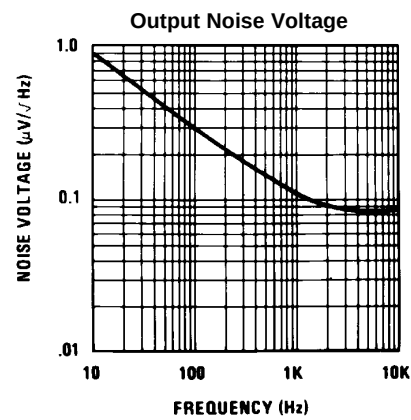
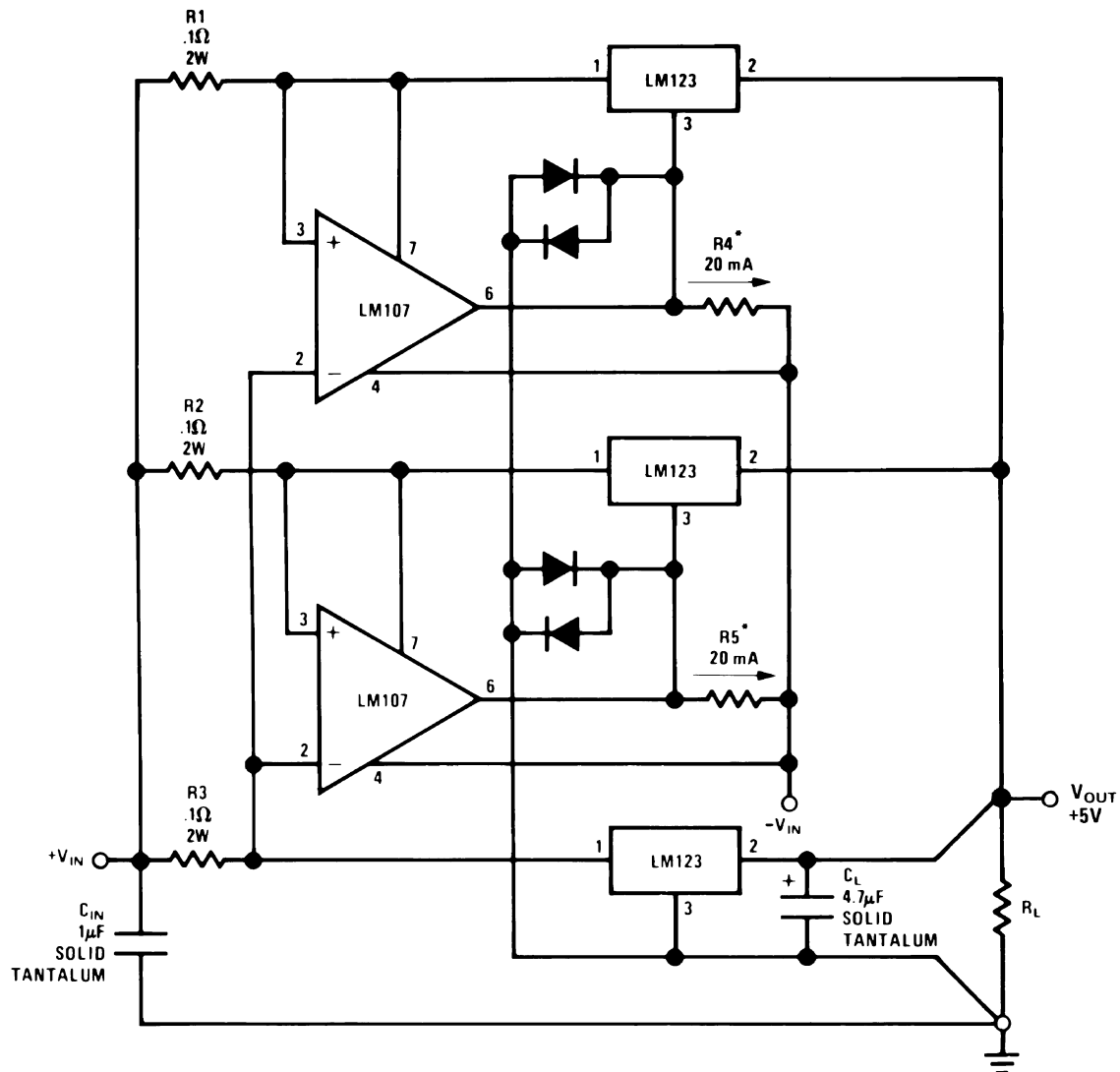


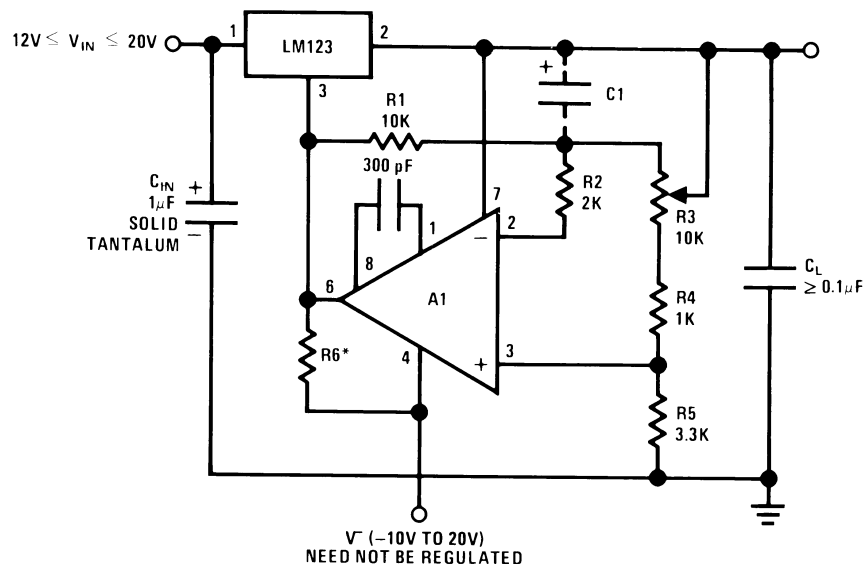
Figure 14.

TYPICAL APPLICATIONS



*Select for 20 mA Current from Unregulated Negative Supply

Figure 15. 10 Amp Regulator with Complete Overload Protection



$$*R6 = \frac{V^-}{12 \text{ mA}}$$

A₁—LM101A

C₁—2 μF Optional—Improves Ripple Rejection, Noise, and Transient Response

Figure 16. Adjustable Regulator 0V–10V @ 3A

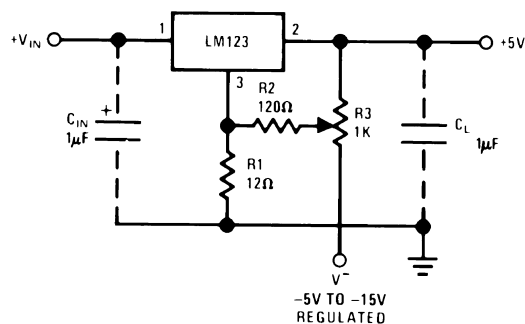
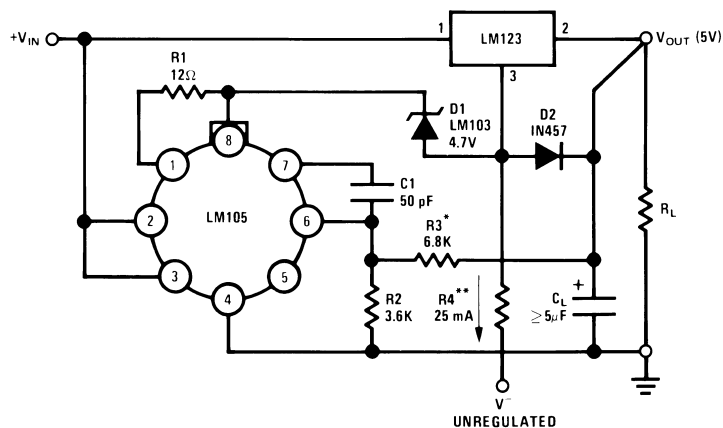


Figure 17. Trimming Output to 5V

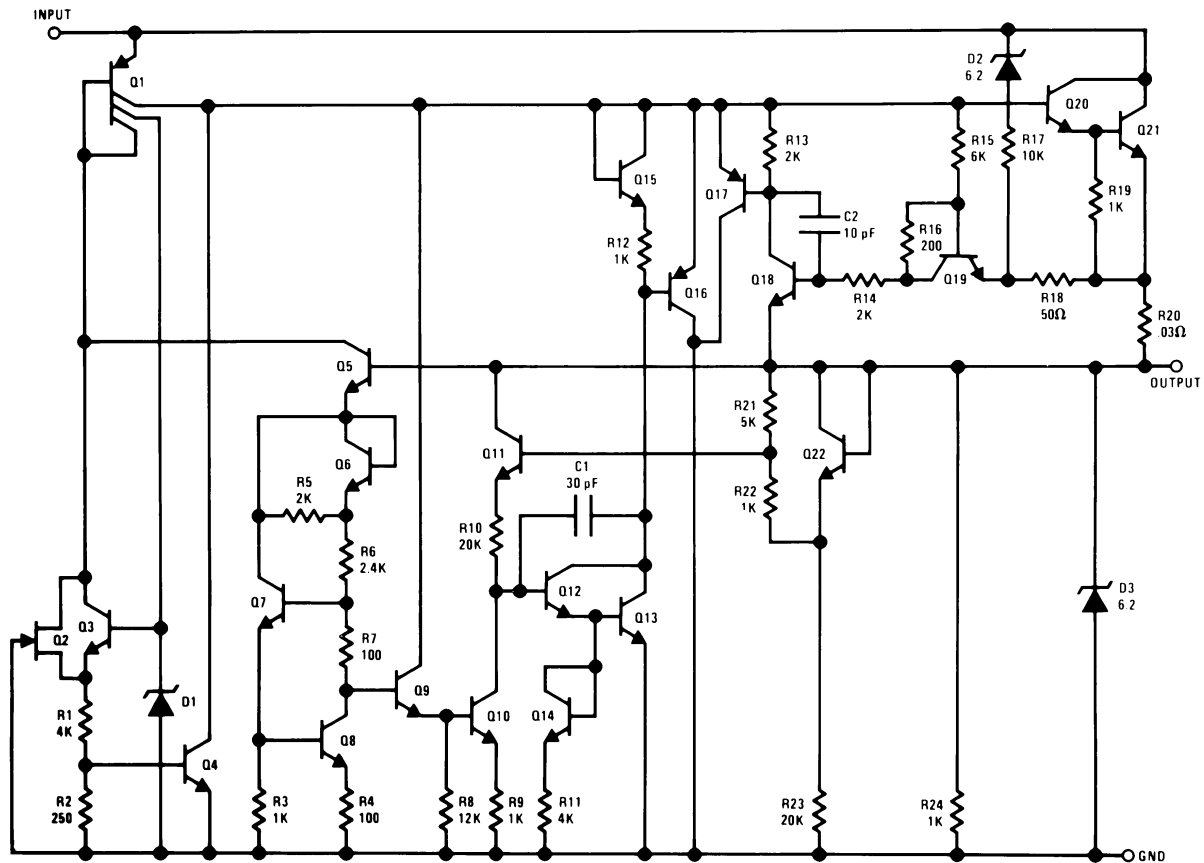


*Select to Set Output Voltage

**Select to Draw 25 mA from V⁻

Figure 18. Adjustable Output 5V–10V 0.1% Regulation

Schematic Diagram



PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
LM323K STEEL	Active	Production	TO-3 (NDS) 2	50 TRAY NON-STD	No	Call TI	Call TI	0 to 125	LM323K STEEL
LM323K STEEL/NOPB	Active	Production	TO-3 (NDS) 2	50 TRAY NON-STD	Yes	Call TI	Level-1-NA-UNLIM	0 to 125	LM323K STEEL

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

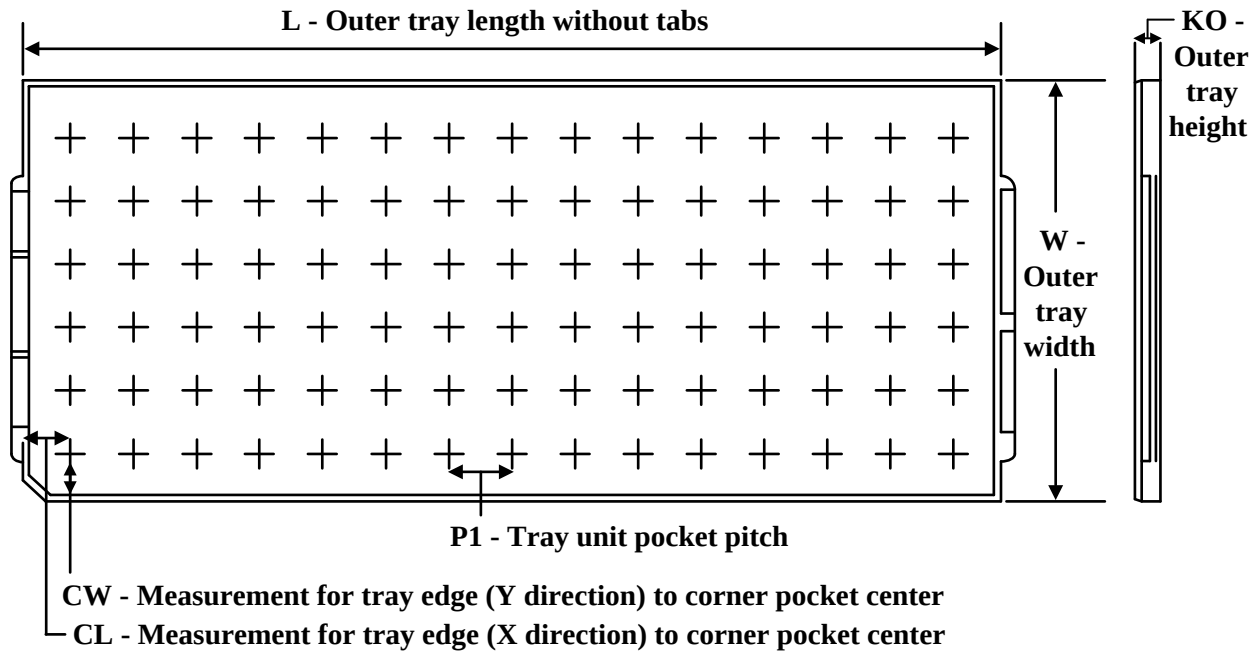
⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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TRAY



Chamfer on Tray corner indicates Pin 1 orientation of packed units.

*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	Unit array matrix	Max temperature (°C)	L (mm)	W (mm)	K0 (μm)	P1 (mm)	CL (mm)	CW (mm)
LM323K STEEL	NDS	TO-CAN	2	50	9 X 6	NA	292.1	215.9	25654	3.87	22.3	25.4
LM323K STEEL/NOPB	NDS	TO-CAN	2	50	9 X 6	NA	292.1	215.9	25654	3.87	22.3	25.4

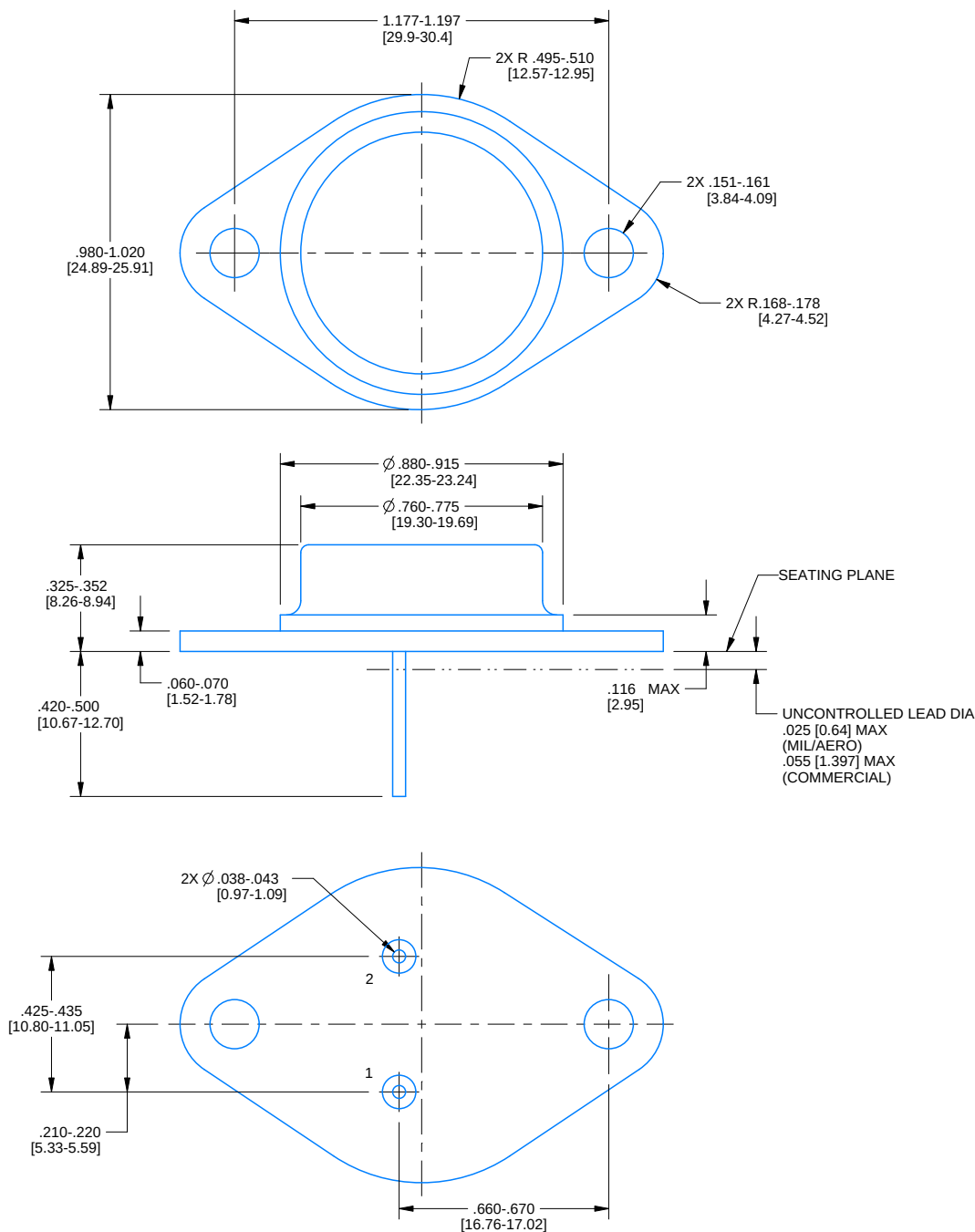
NDS0002A



PACKAGE OUTLINE

TO-CAN - 8.94 mm max height

TRANSISTOR OUTLINE



4214773/B 09/2024

NOTES:

1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.

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