

LM125/LM325 Dual Voltage Regulators

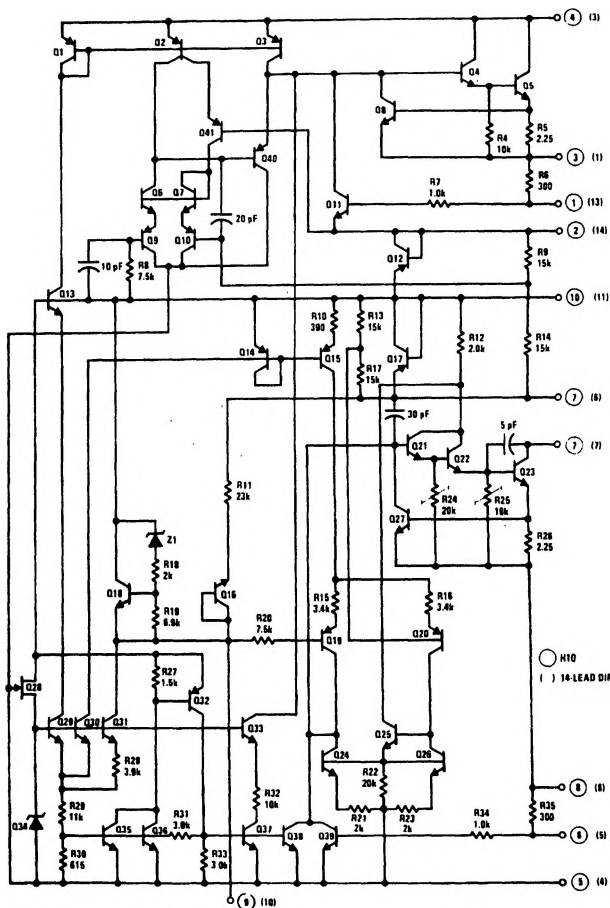
General Description

These dual polarity tracking regulators are designed to provide balanced positive and negative output voltages at current up to 100 mA, and are set for $\pm 15V$ outputs. Input voltages up to $\pm 30V$ can be used and there is provision for adjustable current limiting. These devices are available in two package types to accommodate various power requirements and temperature ranges.

Features

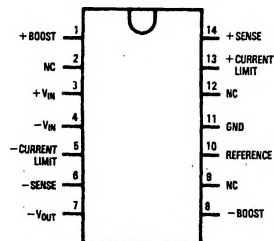
- $\pm 15V$ tracking outputs
- Output current to 100 mA
- Output voltage balanced to within 2%
- Line and load regulation of 0.06%
- Internal thermal overload protection
- Standby current drain of 3 mA
- Externally adjustable current limit
- Internal current limit

Schematic and Connection Diagrams



TL/H/7776-1

Dual-In-Line Package

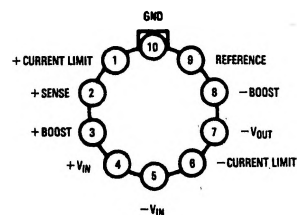


TL/H/7776-2

Top View

Order Number LM325N
See NS Package Number N14A

Metal Can Package



Case connected to $-V_{IN}$ TL/H/7776-3

Top View

Order Number
LM125H/883 or LM325H
See NS Package Number H10C

Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

(Note 5)

Input Voltage	$\pm 30V$
Forced V_O^+ (Min) (Note 1)	$-0.5V$
Forced V_O^- (Max) (Note 1)	$+0.5V$
Power Dissipation (Note 2)	P_{MAX}
Output Short-Circuit Duration (Note 3)	Continuous

Operating Conditions

Operating Free Temperature Range	$-55^\circ C$ to $+125^\circ C$
LM125	$0^\circ C$ to $+70^\circ C$
LM325	$-65^\circ C$ to $+150^\circ C$
Storage Temperature Range	$-65^\circ C$ to $+150^\circ C$
Lead Temperature (Soldering, 10 sec.)	$300^\circ C$

Electrical Characteristics LM125/LM325 (Note 2)

Parameter	Conditions	Min	Typ	Max	Units
Output Voltage LM125 LM325	$T_j = 25^\circ C$	14.8 14.5	15 15	15.2 15.5	V V
Input-Output Differential		2.0			V
Line Regulation	$V_{IN} = 18V$ to $30V$, $I_L = 20$ mA, $T_j = 25^\circ C$		2.0	10	mV
Line Regulation Over Temperature Range	$V_{IN} = 18V$ to $30V$, $I_L = 20$ mA,		2.0	20	mV
Load Regulation V_O^+ V_O^-	$I_L = 0$ to 50 mA, $V_{IN} = \pm 30V$, $T_j = 25^\circ C$		3.0 5.0	10 10	mV mV
Load Regulation Over Temperature Range V_O^+ V_O^-	$I_L = 0$ to 50 mA, $V_{IN} = \pm 30V$		4.0 7.0	20 20	mV mV
Output Voltage Balance LM125 LM325	$T_j = 25^\circ C$			± 150 ± 300	mV mV
Output Voltage Over Temperature Range LM125 LM325	$P \leq P_{MAX}$, $0 \leq I_O \leq 50$ mA; $18V \leq V_{IN} \leq 30$	14.65 14.27		15.35 15.73	V V
Temperature Stability of V_O			± 0.3		%
Short Circuit Current Limit	$T_j = 25^\circ C$		260		mA
Output Noise Voltage	$T_j = 25^\circ C$, BW = 100 – 10 kHz		150		μV_{rms}
Positive Standby Current	$T_j = 25^\circ C$		1.75	3.0	mA
Negative Standby Current	$T_j = 25^\circ C$		3.1	5.0	mA
Long Term Stability			0.2		%/kHr
Thermal Resistance Junction to Case (Note 4) LM125H, LM325H Junction to Ambient Junction to Ambient	(Still Air) (400 Lf/min Air Flow)		20 215 82		$^\circ C/W$ $^\circ C/W$ $^\circ C/W$
Junction to Ambient LM325N	(Still Air)		90		$^\circ C/W$

Note 1: That voltage to which the output may be forced without damage to the device.

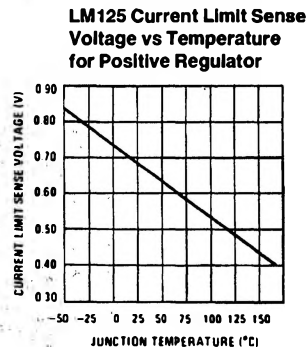
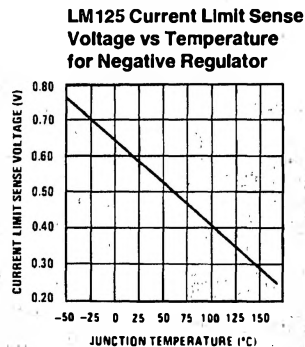
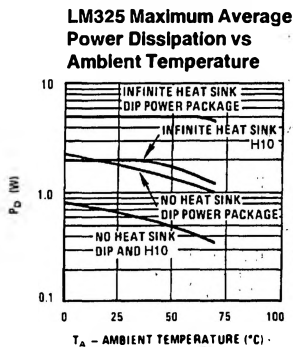
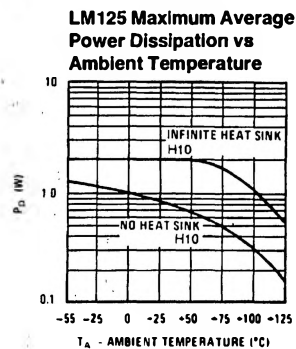
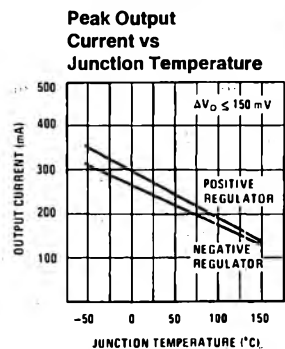
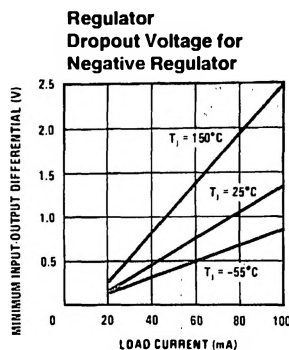
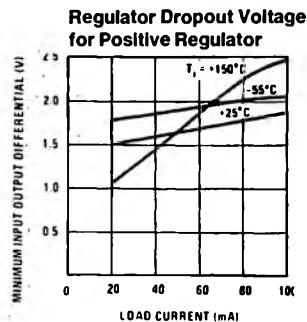
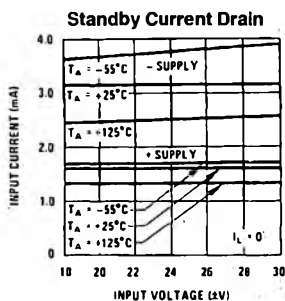
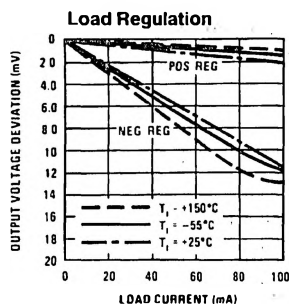
Note 2: Unless otherwise specified these specifications apply for $T_j = 55^\circ C$ to $+150^\circ C$ on LM125, $T_j = 0^\circ C$ to $+125^\circ C$ on LM325A, $T_j = 0^\circ C$ to $+125^\circ C$ on LM325, $V_{IN} = \pm 20V$, $I_L = 0$ mA, $I_{MAX} = 100$ mA, $P_{MAX} = 2.0W$ for the H10 Package, $I_{MAX} = 100$ mA, $P_{MAX} = 1.0W$ for the DIP N Package.

Note 3: If the junction temperature exceeds $150^\circ C$, the output short circuit duration is 60 seconds.

Note 4: Without a heat sink, the thermal resistance junction to ambient of the H10 Package is about $155^\circ C/W$. With a heat sink, the effective thermal resistance can only approach the junction to case values specified, depending on the efficiency of the sink.

Note 5: Refer to RETS125X drawing for military specification of LM125.

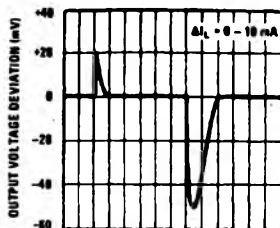
Typical Performance Characteristics



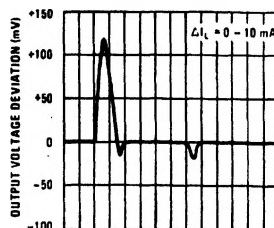
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Typical Performance Characteristics (Continued)

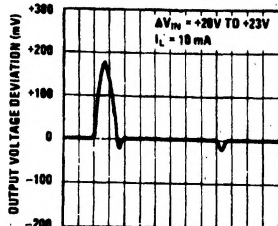
Load Transient Response for Positive Regulator

TIME (1 μ s/DIV)

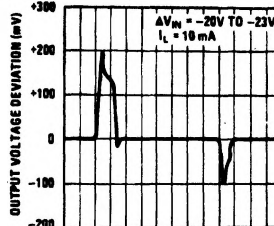
Load Transient Response for Negative Regulator

TIME (1 μ s/DIV)

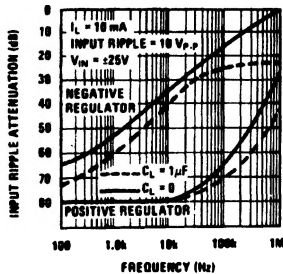
Line Transient Response for Positive Regulator

TIME (2 μ s/DIV)

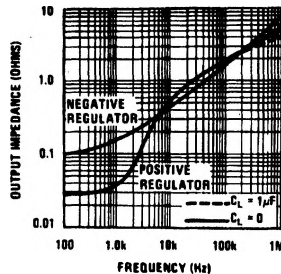
Line Transient Response for Negative Regulator

TIME (10 μ s/DIV)

Ripple Rejection



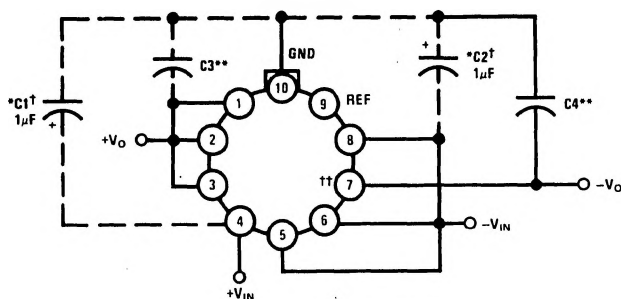
Output Impedance vs Frequency



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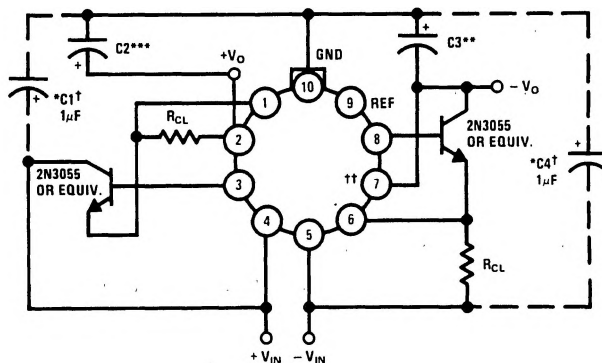
Typical Applications

Basic Regulator†††



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2.0 Amp Boosted Regulator With Current Limit



TL/H/7776-7

Note: Metal can (H) packages shown.

$$I_{CL} = \frac{\text{Current Limit Sense Voltage (See Curve)}}{R_{CL}}$$

†Solid tantalum

††Short pins 6 and 7 on dip

††† R_{CL} can be added to the basic regulator between pins 6 and 5, 1 and 2 to reduce current limit.

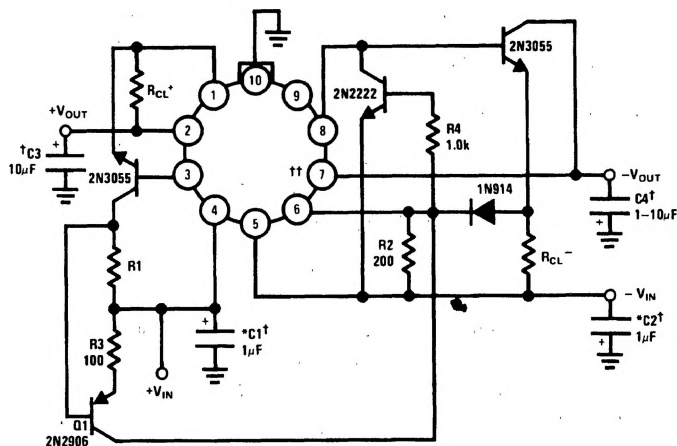
*Required if regulator is located an appreciable distance from power supply filter.

**Although no capacitor is needed for stability, it does help transient response. (If needed use 1 μ F electrolytic).

***Although no capacitor is needed for stability, it does help transient response. (If needed use 10 μ F electrolytic).

Typical Applications (Continued)

Positive Current Dependent Simultaneous Current Limiting



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$$I_{CL}^+ = \frac{V_{SENSE\ NEG}}{2} + V_{BEQ1}$$

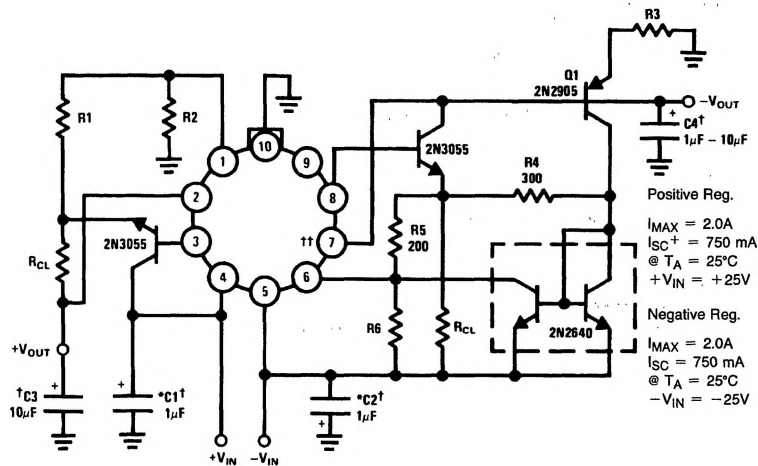
$$I_{CL}^+ = \frac{R1}{R_{CL}^+}$$

$$I_{CL}^+ = \frac{V_{SENSE\ NEG} + V_{DIODE}}{R_{CL}^-}$$

$$R_{CL}^+ = \frac{V_{SENSE}^+}{1.1 I_{CL}^+}$$

I_{CL}^+ Controls Both Sides of the Regulator.

Boosted Regulator With Foldback Current Limit



Resistor Values

	125	126
R1	18	20
R2	310	180
R3	2.4k	1.35k
R6	300	290
RCL	0.7	0.9

Positive Reg.

$I_{MAX} = 2.0A$
 $I_{SC}^+ = 750\text{ mA}$
 $@ T_A = 25^\circ C$
 $+V_{IN} = +25V$

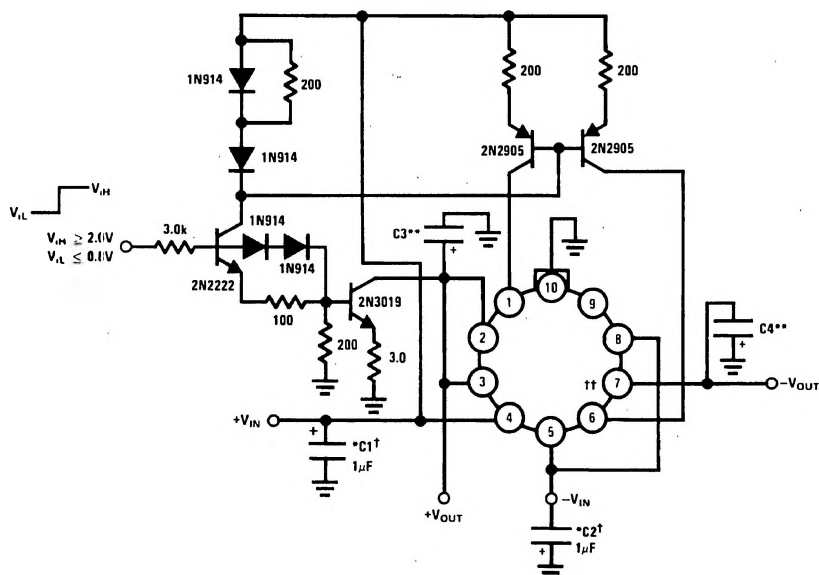
Negative Reg.

$I_{MAX} = 2.0A$
 $I_{SC} = 750\text{ mA}$
 $@ T_A = 25^\circ C$
 $-V_{IN} = -25V$

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Typical Applications (Continued)

Electric Shutdown



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†Solid tantalum

††Short pins 6 and 7 on dip

*Required if regulator is located an appreciable distance from power supply filter.

**Although no capacitor is needed for stability, it does help transient response. (If needed use 1 μ F electrolytic).