

## LM325 Dual Voltage Regulator

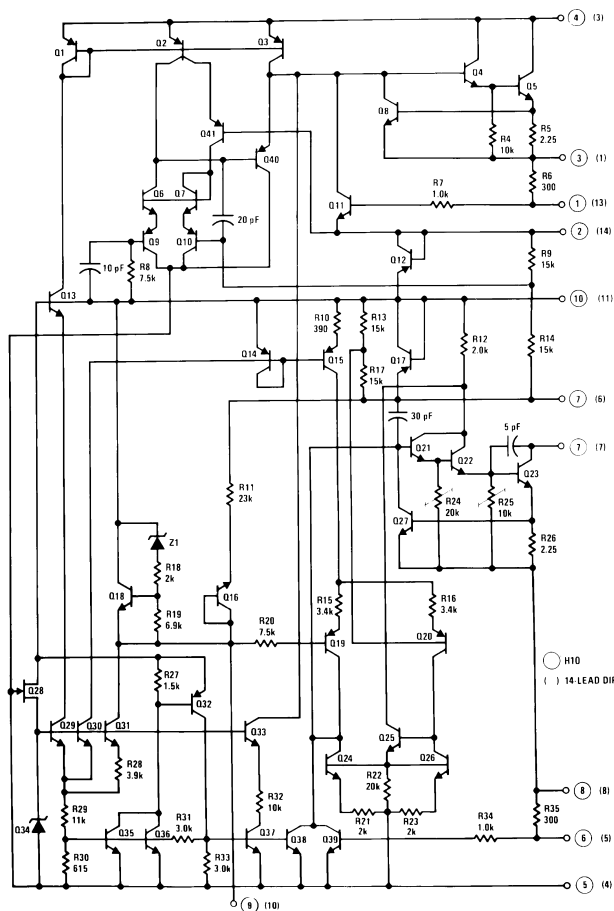
### General Description

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

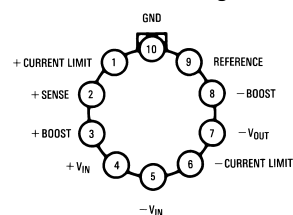
### Features

- $\pm 15\text{V}$  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



### Metal Can Package



Case connected to  $-V_{IN}$

**Top View**  
Order Number LM325H  
See NS Package Number H10C

**Absolute Maximum Ratings** (Note 1)

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

Input Voltage	±30V
Forced $V_{O+}$ (Min) (Note 2)	-0.5V
Forced $V_{O-}$ (Max) (Note 2)	+0.5V
Power Dissipation (Note 3)	$P_{MAX}$

Output Short-Circuit Duration (Note 4)

Continuous

**Operating Conditions**

Operating Free Temperature Range	0°C to +70°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10 sec.)	300°C

**Electrical Characteristics**

Parameter	Conditions	Min	Typ	Max	Units
Output Voltage	$T_j = 25^\circ\text{C}$	14.5	15	15.5	V
Input-Output Differential		2.0			V
Line Regulation	$V_{IN} = 18\text{V to } 30\text{V}$ , $I_L = 20\text{ mA}$ , $T_j = 25^\circ\text{C}$		2.0	10	mV
Line Regulation Over Temperature Range	$V_{IN} = 18\text{V to } 30\text{V}$ , $I_L = 20\text{ mA}$ ,		20	20	mV
Load Regulation $V_{O+}$ $V_{O-}$	$I_L = 0\text{ mA to } 50\text{ mA}$ , $V_{IN} = \pm 30\text{V}$ , $T_j = 25^\circ\text{C}$		3.0 5.0	10 10	mV mV
Load Regulation Over Temperature Range $V_{O+}$ $V_{O-}$	$I_L = 0\text{ mA to } 50\text{ mA}$ , $V_{IN} = \pm 30\text{V}$		4.0 7.0	20 20	mV mV
Output Voltage Balance	$T_j = 25^\circ\text{C}$			±300	mV
Output Voltage Over Temperature Range	$P \leq P_{MAX}$ , $0 \leq I_O \leq 50\text{ mA}$ , $18\text{V} \leq  V_{IN}  \leq 30$	14.27		15.73	V
Temperature Stability of $V_O$			±0.3		%
Short Circuit Current Limit	$T_j = 25^\circ\text{C}$		260		mA
Output Noise Voltage	$T_j = 25^\circ\text{C}$ , BW = 100 – 10 kHz		150		µVrms
Positive Standby Current	$T_j = 25^\circ\text{C}$		1.75	3.0	mA
Negative Standby Current	$T_j = 25^\circ\text{C}$		3.1	5.0	mA
Long Term Stability			0.2		%/kHr
Thermal Resistance Junction to Case (Note 5) LM325H			20		°C/W
Junction to Ambient	(Still Air)		215		°C/W
Junction to Ambient	(400 Lf/min Air Flow)		82		°C/W
Junction to Ambient LM325N	(Still Air)		90		°C/W

**Note 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 guarantee specific performance limits.

**Note 2:** That voltage to which the output may be forced without damage to the device.

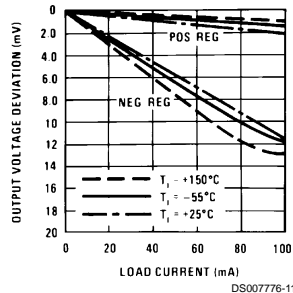
**Note 3:** Unless otherwise specified these specifications apply for  $T_j = 0^\circ\text{C to } +125^\circ\text{C}$  on LM325,  $V_{IN} = \pm 20\text{V}$ ,  $I_L = 0\text{ mA}$ ,  $I_{MAX} = 100\text{ mA}$ ,  $P_{MAX} = 2.0\text{W}$  for the H10 Package.

**Note 4:** If the junction temperature exceeds  $150^\circ\text{C}$ , the output short circuit duration is 60 seconds.

**Note 5:** Without a heat sink, the thermal resistance junction to ambient of the H10 Package is about  $155^\circ\text{C/W}$ . With a heat sink, the effective thermal resistance can only approach the junction to case values specified, depending on the efficiency of the sink.

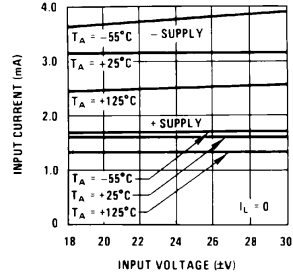
## Typical Performance Characteristics

Load Regulation



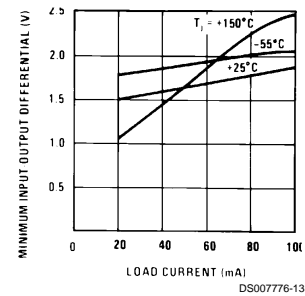
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Standby Current Drain



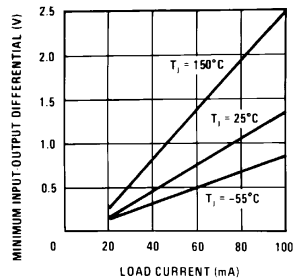
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Regulator Dropout Voltage for Positive Regulator



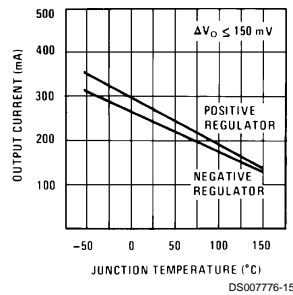
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Regulator Dropout Voltage for Negative Regulator



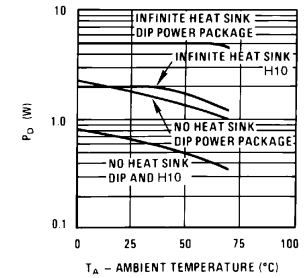
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Peak Output Current vs Junction Temperature



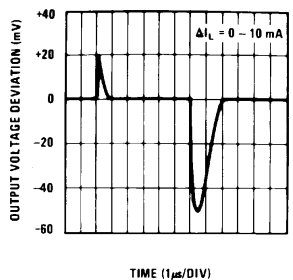
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LM325 Maximum Average Power Dissipation vs Ambient Temperature



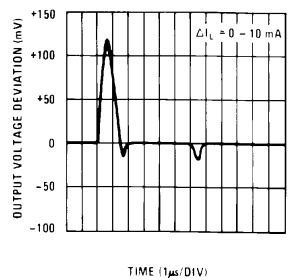
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Load Transient Response for Positive Regulator



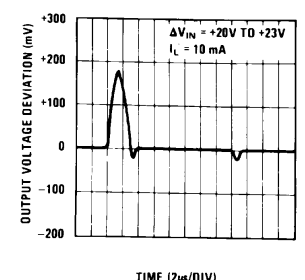
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Load Transient Response for Negative Regulator



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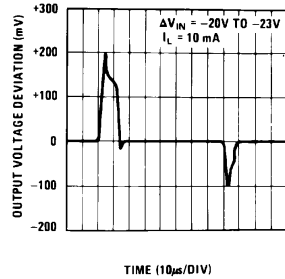
Line Transient Response for Positive Regulator



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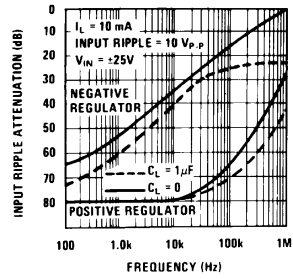
## Typical Performance Characteristics (Continued)

Line Transient Response  
for Negative Regulator



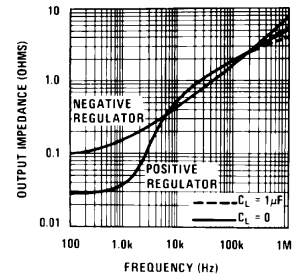
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Ripple Rejection



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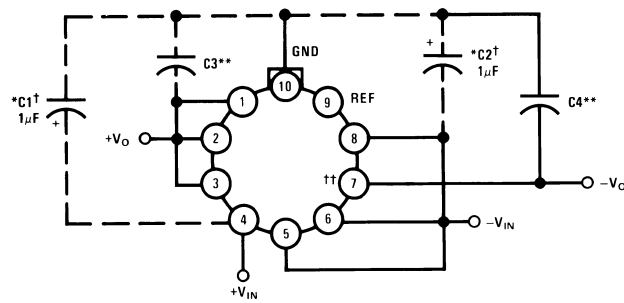
Output Impedance  
vs Frequency



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## Typical Applications

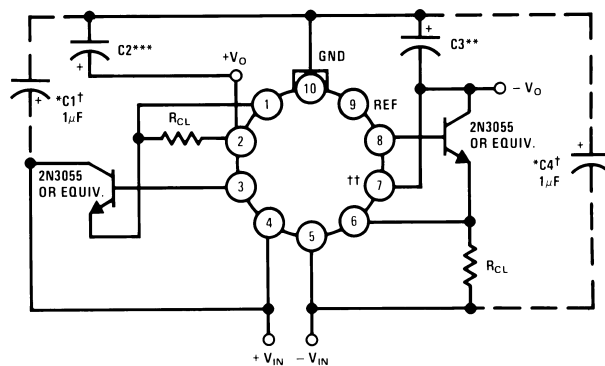
Basic Regulator†††



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## Typical Applications (Continued)

### 2.0 Amp Boosted Regulator with Current Limit



**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

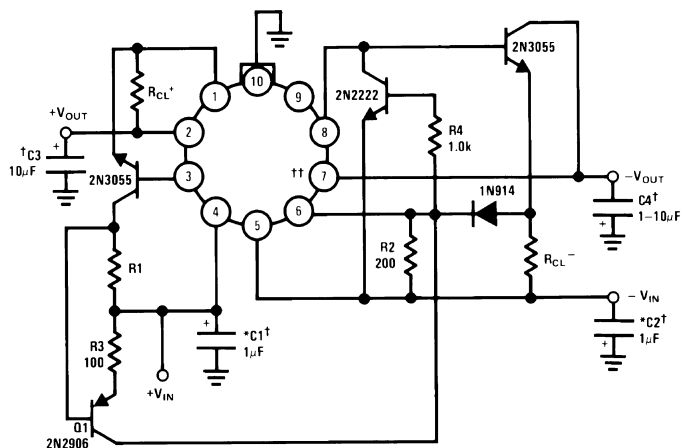
†††R<sub>CL</sub> can be added to the basic regulator between pins 6 and 5, 1 and 2 to reduce current limit.

\*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 μF electrolytic.)

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

### Positive Current Dependent Simultaneous Current Limiting



$$I_{CL}^{+} = \frac{\frac{V_{SENSE NEG}}{2} + V_{BEQ1}}{R1}$$

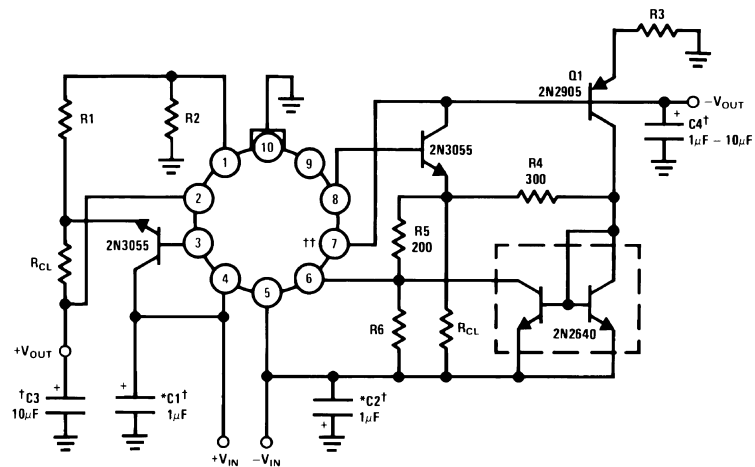
$$I_{CL}^{-} = \frac{V_{SENSE NEG} + V_{DIODE}}{R_{CL}^{-}}$$

I<sub>CL</sub><sup>+</sup> Controls Both Sides of the Regulator.

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

## Typical Applications (Continued)

### Boosted Regulator With Foldback Current Limit



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Positive Reg.

$I_{MAX} = 2.0A$

$I_{SC} = 750\text{ mA}$

@ $T_A = 25^\circ C$

$+V_{IN} = +25V$

Negative Reg.

$I_{MAX} = 2.0A$

$I_{SC} = 750\text{ mA}$

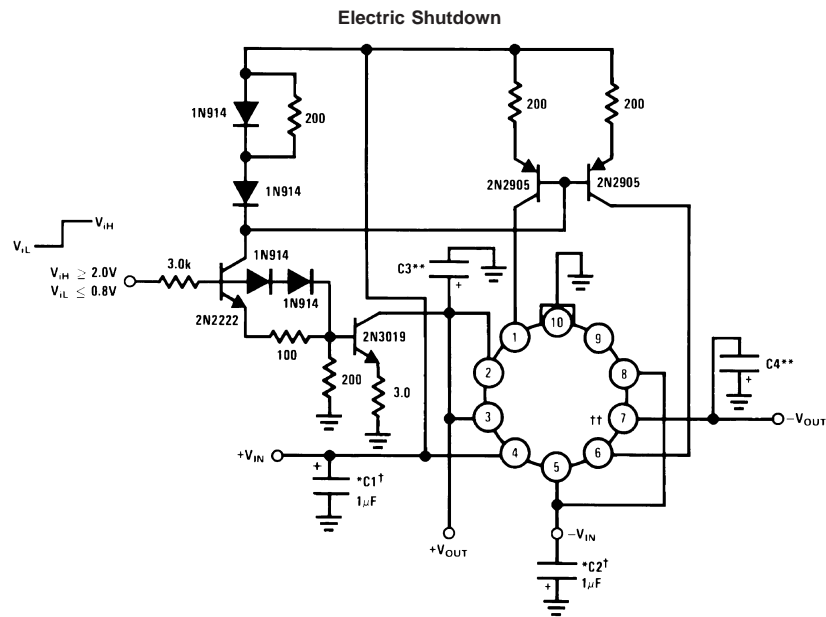
@ $T_A = 25^\circ C$

$-V_{IN} = -25V$

#### Resistor Values

	125	126
R1	18	20
R2	310	180
R3	2.4k	1.35k
R6	300	290
R <sub>CL</sub>	0.7	0.9

## Typical Applications (Continued)



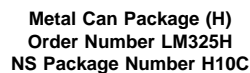
DS007776-10

†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 μF electrolytic.)



1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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