National Semiconductor

June 1999

LM325
Dual Voltage Regulator

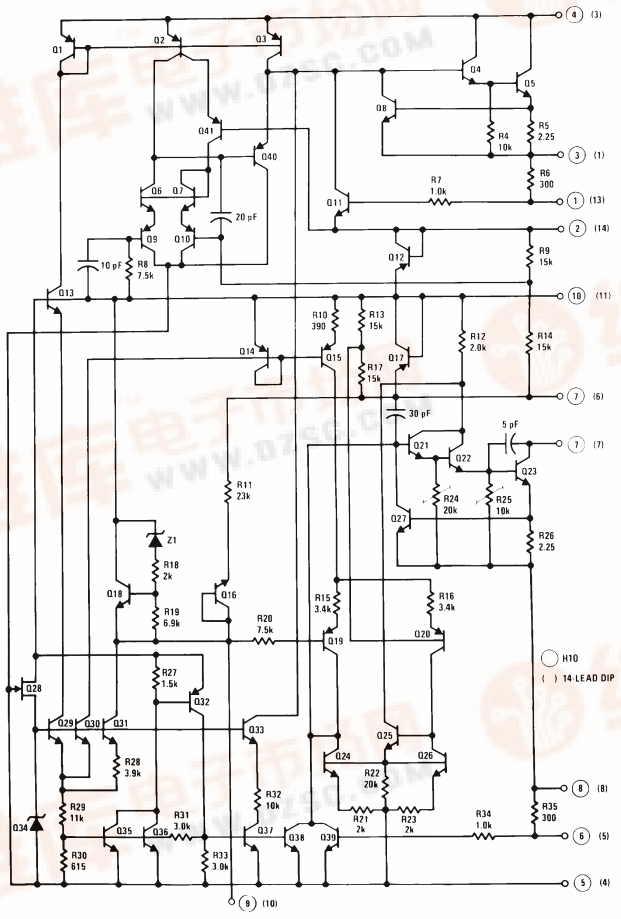
General Description

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 ±15V outputs. Input voltages up to ±30V 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

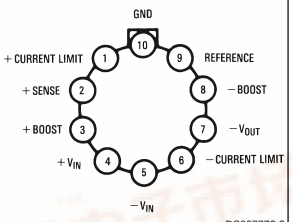
- ±15V tracking outputs
- Output current to 100 mA
- Output voltage balanced to within 2%
- Line and load regulation of 0.06%
- Internal thermal overload protection
- Standby current drain of 3 mA
- Externally adjustable current limit
- Internal current limit

Schematic and Connection Diagrams



DS007776-1

Metal Can Package



DS007776-3

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˚C	14.5	15	15.5	V
Input-Output Differential		2.0			V
Line Regulation	V_{IN} = 18V to 30V, I_L = 20 mA, T_j = 25˚C		2.0	10	mV
Line Regulation Over Temperature Range	V_{IN} = 18V to 30V, I_L = 20 mA,		20	20	mV
Load Regulation	I_L = 0 mA to 50 mA, V_{IN} = ±30V,				
V_O^+	$T = _j$ 25˚C		3.0	10	mV
V_O^-			5.0	10	mV
Load Regulation Over Temperature Range	I_L = 0 mA to 50 mA, V_{IN} = ±30V				
V_O^+			4.0	20	mV
V_O^-			7.0	20	mV
Output Voltage Balance	T_j = 25˚C			±300	mV
Output Voltage Over Temperature Range	$P \le P_{MAX}$, $0 \le I_O \le 50$ mA, $18V \le \lvert V_{IN} \rvert \le 30$	14.27		15.73	V
Temperature Stability of V_O			±0.3		%
Short Circuit Current Limit	T_j = 25˚C		260		mA
Output Noise Voltage	T_j = 25˚C, BW = 100 − 10 kHz		150		µVrms
Positive Standby Current	T_j = 25˚C		1.75	3.0	mA
Negative Standby Current	T_j = 25˚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.

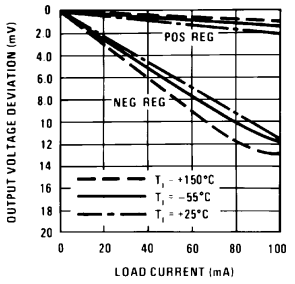
Note 3: Unless otherwise specified these specifications apply for T_j = 0˚C to +125˚C on LM325, V_{IN} = ±20V, I_L = 0 mA, I_{MAX} = 100 mA, P_{MAX} = 2.0W for the H10 Package.

Note 4: If the junction temperature exceeds 150˚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˚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.

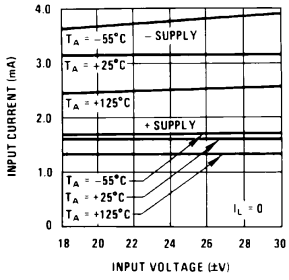
Typical Performance Characteristics

Load Regulation



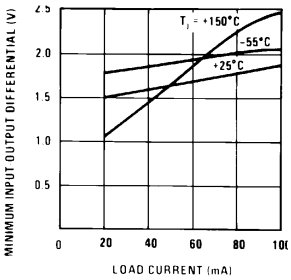
DS007776-11

Standby Current Drain



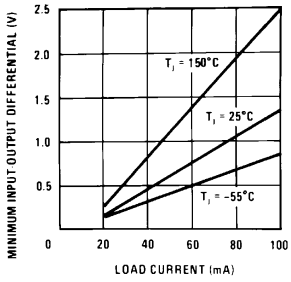
DS007776-12

Regulator Dropout Voltage for Positive Regulator



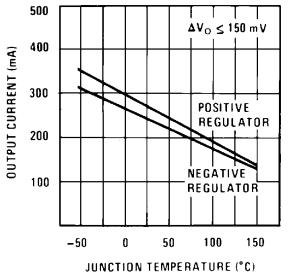
DS007776-13

Regulator Dropout Voltage for Negative Regulator



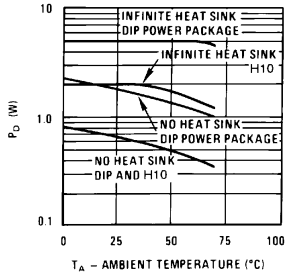
DS007776-14

Peak Output Current vs Junction Temperature



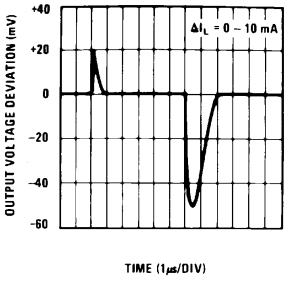
DS007776-15

LM325 Maximum Average Power Dissipation vs Ambient Temperature



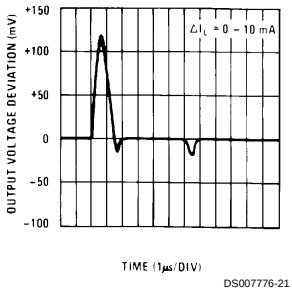
DS007776-17

Load Transient Response for Positive Regulator



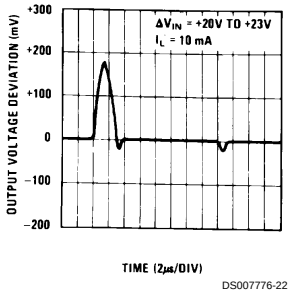
DS007776-20

Load Transient Response for Negative Regulator



DS007776-21

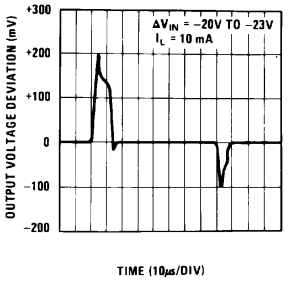
Line Transient Response for Positive Regulator



DS007776-22

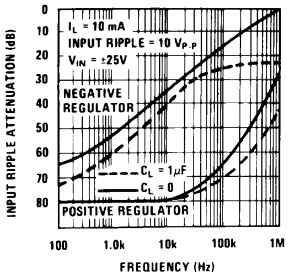
Typical Performance Characteristics (Continued)

Line Transient Response for Negative Regulator



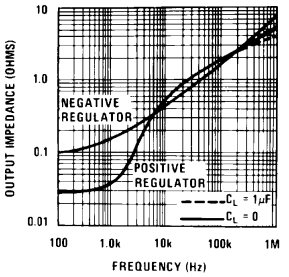
DS007776-23

Ripple Rejection



DS007776-24

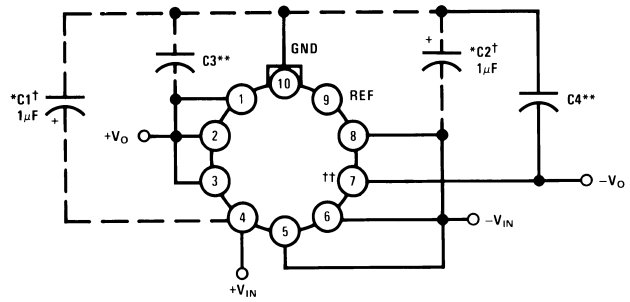
Output Impedance vs Frequency



DS007776-25

Typical Applications

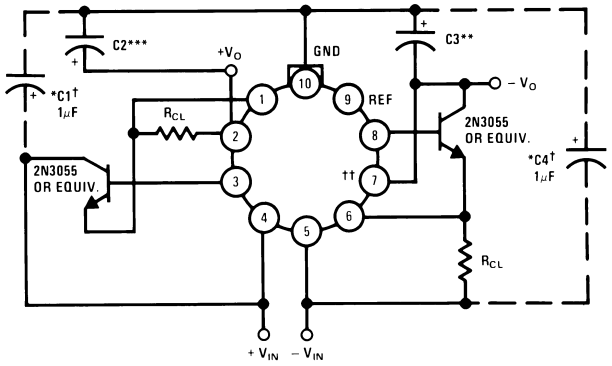
Basic Regulator†††



DS007776-6

Typical Applications (Continued)

2.0 Amp Boosted Regulator with Current Limit



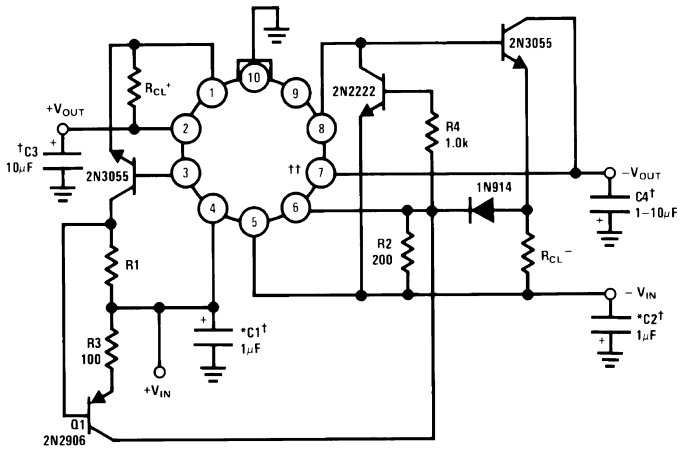
DS007776-7

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 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



DS007776-8

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

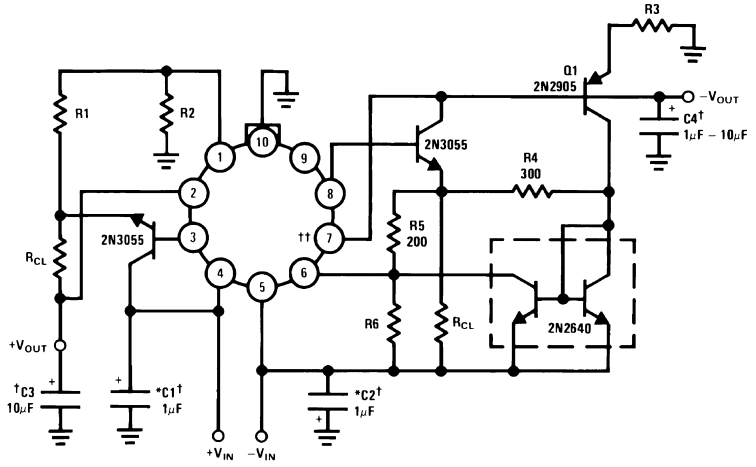
$$I_{CL}^{+} = \frac{V_{SENSE\ NEG} + V_{DIODE}}{R_{CL}^{-}}$$

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

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

Typical Applications (Continued)

Boosted Regulator With Foldback Current Limit



DS007776-9

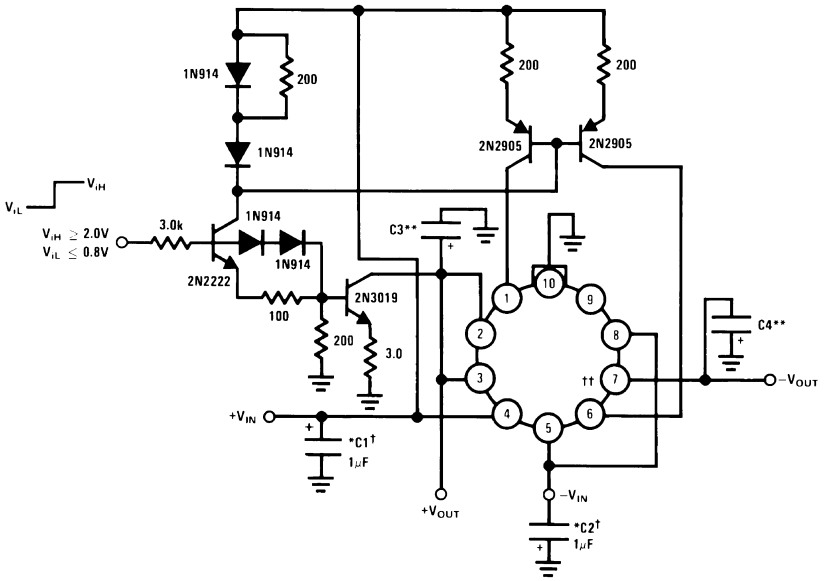
Positive Reg.
I_{MAX} = 2.0A
I_{SC}^{+} = 750 mA
@T_A = 25˚C
$+V_{IN}$ = +25V
Negative Reg.
I_{MAX} = 2.0A
I_{SC} = 750 mA
@T_A = 25˚C
$-V_{IN}$ = −25V

Resistor Values

	125	126
R1	18	20
R2	310	180
R3	2.4k	1.35k
R6	300	290
R_{CL}	0.7	0.9

Typical Applications (Continued)

Electric Shutdown



DS007776-10

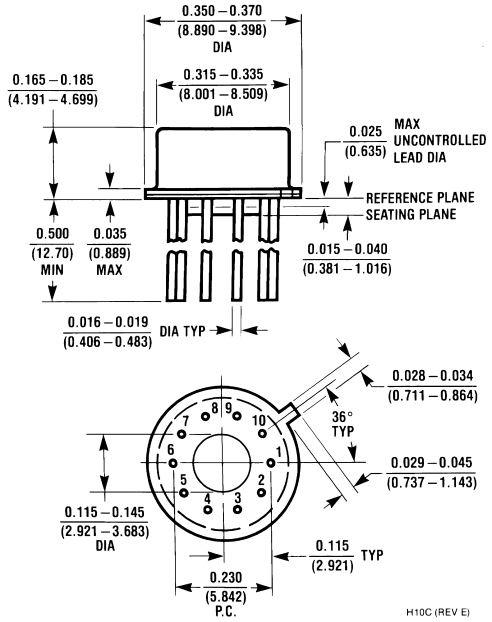
†Solid tantalum

††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.)

Physical Dimensions inches (millimeters) unless otherwise noted



Metal Can Package (H)
Order Number LM325H
NS Package Number H10C

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT AND GENERAL COUNSEL OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

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.

National Semiconductor Corporation
Americas
Tel: 1-800-272-9959
Fax: 1-800-737-7018
Email: support@nsc.com

www.national.com

National Semiconductor Europe
Fax: +49 (0) 1 80-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 1 80-530 85 85
English Tel: +49 (0) 1 80-532 78 32
Français Tel: +49 (0) 1 80-532 93 58
Italiano Tel: +49 (0) 1 80-534 16 80

National Semiconductor Asia Pacific Customer Response Group
Tel: 65-2544466
Fax: 65-2504466
Email: sea.support@nsc.com

National Semiconductor Japan Ltd.
Tel: 81-3-5639-7560
Fax: 81-3-5639-7507