National Semiconductor

June 1999

LM325 Dual Voltage Regulator

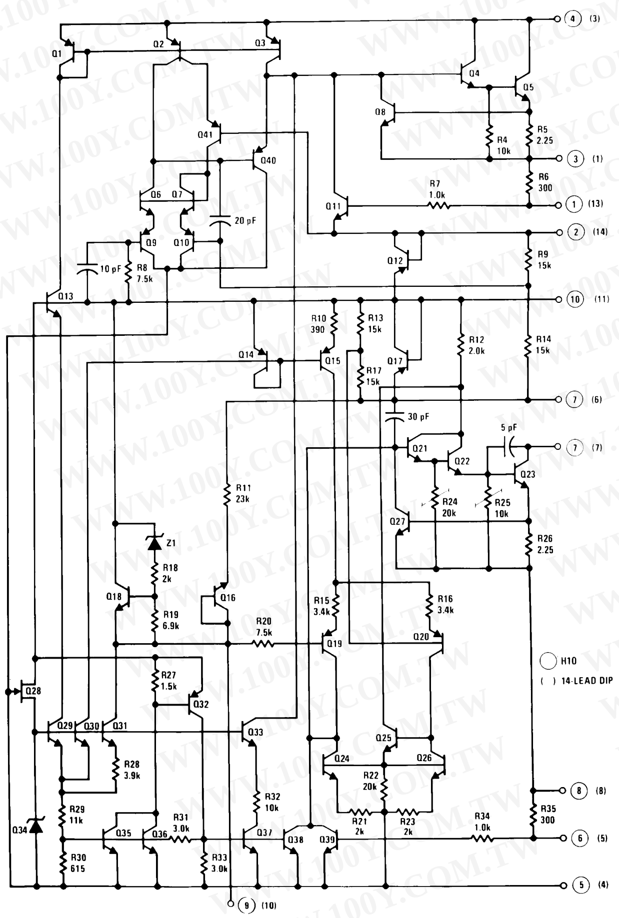
General Description

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



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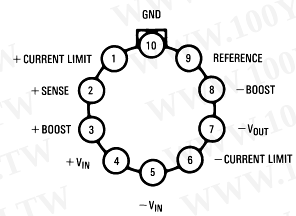
Metal Can Package



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Case connected to $-V_{IN}$

Top View
Order Number LM325H
See NS Package Number H10C

 DS007776 www.national.com

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 V_O^+ V_O^-	I_L = 0 mA to 50 mA, V_{IN} = ±30V, T = $_j$ 25˚C		3.0 5.0	10 10	mV mV
Load Regulation Over Temperature Range V_O^+ V_O^-	I_L = 0 mA to 50 mA, V_{IN} = ±30V		4.0 7.0	20 20	mV mV
Output Voltage Balance	T_j = 25˚C			±300	mV
Output Voltage Over Temperature Range	$P \leq P_{MAX}$, $0 \leq I_O \leq 50$ mA, $18V \leq \|V_{IN}\| \leq 30$	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 Junction to Ambient Junction to Ambient	 (Still Air) (400 Lf/min Air Flow)		 20 215 82		 ˚C/W ˚C/W ˚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.

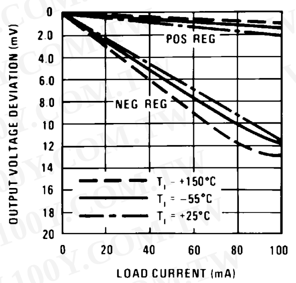
Note 3: Unless otherwise specified these specifications apply for T_j = 0˚C to +125˚C on LM325, V_{IN} = ±20V, I_L = 0 mA, I_{MAX} = 100 mA, P_{MAX} = 2.0W for the H10 Package.

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



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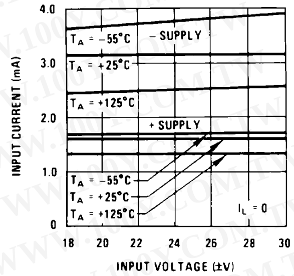
Standby Current Drain



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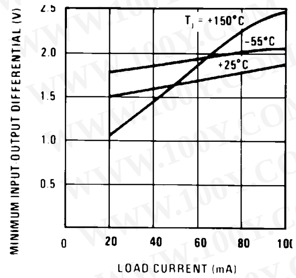
Regulator Dropout Voltage for Positive Regulator



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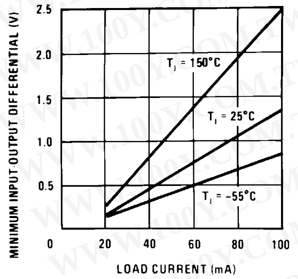
Regulator Dropout Voltage for Negative Regulator



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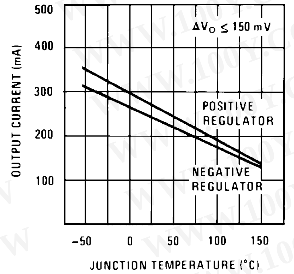
Peak Output Current vs Junction Temperature



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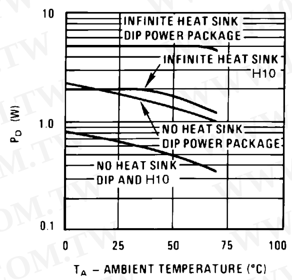
LM325 Maximum Average Power Dissipation vs Ambient Temperature



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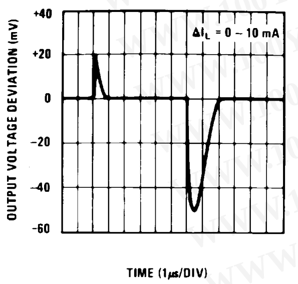
Load Transient Response for Positive Regulator



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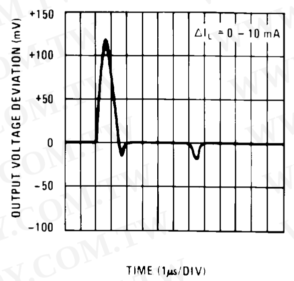
Load Transient Response for Negative Regulator



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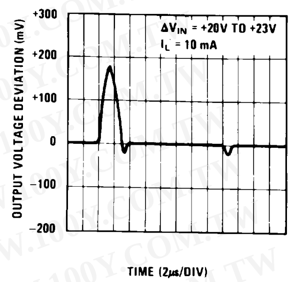
Line Transient Response for Positive Regulator



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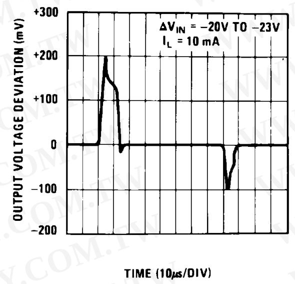
Typical Performance Characteristics (Continued)

Line Transient Response for Negative Regulator



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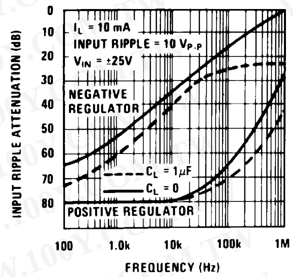
Ripple Rejection



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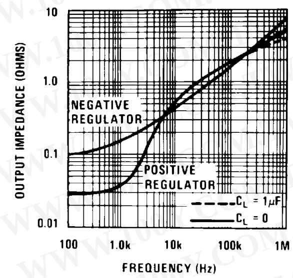
Output Impedance vs Frequency



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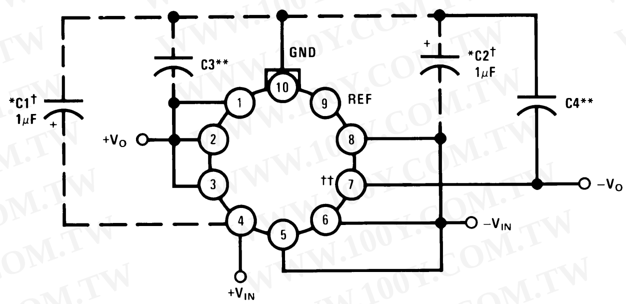
Typical Applications

Basic Regulator†††



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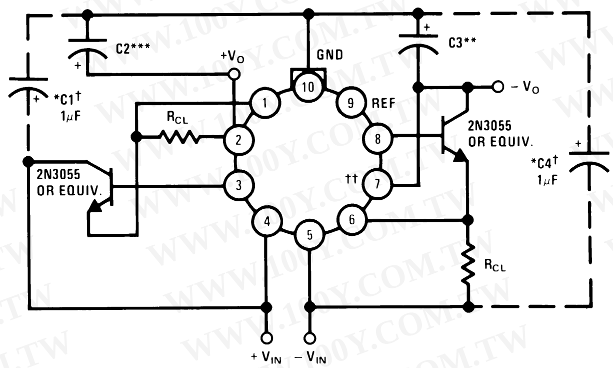
Typical Applications (Continued)

2.0 Amp Boosted Regulator with Current Limit



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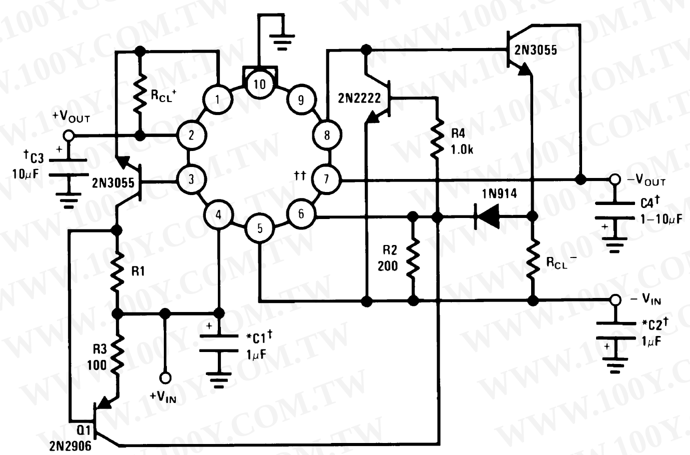
Note: Metal can (H) packages shown.

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

†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



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

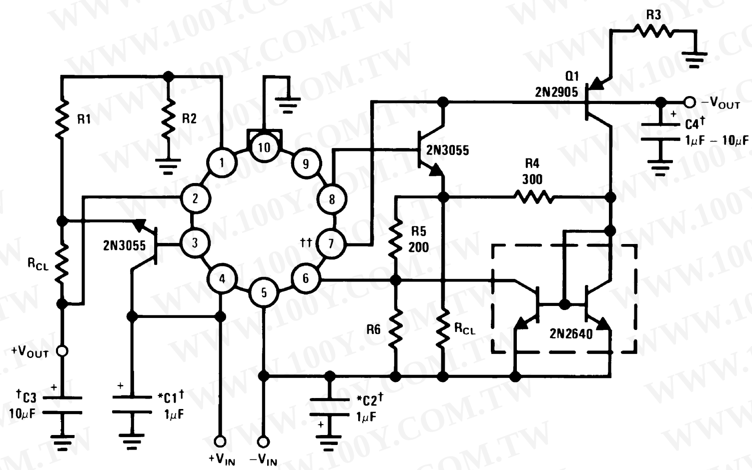
$$I_{CL}{}^{+} = \frac{V_{SENSE\ NEG} + V_{DIODE}}{R_{CL}{}^{-}}$$

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

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

Typical Applications (Continued)

Boosted Regulator With Foldback Current Limit



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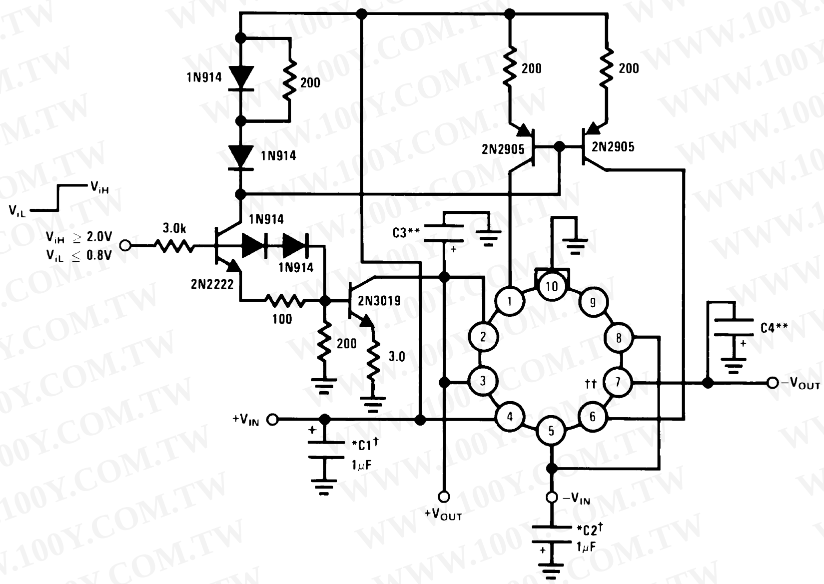
Positive Reg.
I_{MAX} = 2.0A
I_{SC}^{+} = 750 mA
@T_A = 25˚C
$+V_{IN}$ = +25V
Negative Reg.
I_{MAX} = 2.0A
I_{SC} = 750 mA
@T_A = 25˚C
$-V_{IN}$ = −25V

Resistor Values

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

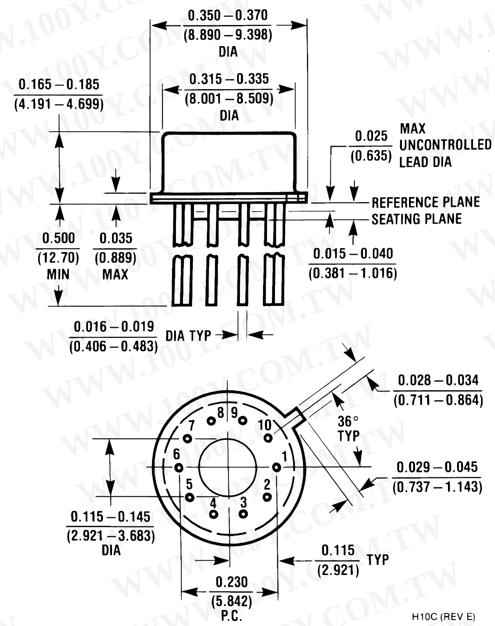
Typical Applications (Continued)

Electric Shutdown



†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