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NTE953
Linear Integrated Circuit
4−Terminal Positive Adjustable Voltage Regulator

Description:

The NTE953 4−Terminal adjustable voltage regulator is designed to deliver continuous load currents of up to 1.0A with a maximum input voltage of +40V. Output current capability can be increased to greater than 1.0A through the use of one or more external transistors. The output voltage range is 5V to 30V. For systems requiring both a positive and negative, the NTE953 and NTE954 are excellent for use as a dual tracking regulator with appropriate external circuitry.

Features:

- Output Current in Excess of 1A
- Positive Output 5V to 30V
- Internal Thermal Overload Protection
- Internal Short Circuit Protection
- Output Transistor Safe−Area Protection
- Power Watt Package

Absolute Maximum Ratings:

Input Voltage 40V
Control Pin Voltage . . . . $0 \leq V \leq V_{OUT}$
Power Dissipation . . . . Internally Limited
Operating Junction Temperature Range . . . . 0°C to 150°C
Storage Temperature Range . . . . –55°C to +150°C
Lead Temperature (During soldering, 10s) . . . . +230°C

Electrical Characteristics: ($-0°C \le T_J \le 125°C$, V_{IN} = 10V, I_{OUT} = 500mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, unless otherwise specified.)

Parameter	Test Conditions (Note 1, Note 3)		Min	Typ	Max	Unit
Input Voltage Range	T_J = 25°C		7.5	–	40	V
Output Voltage Range	$V_{IN} = V_{OUT}$ +5V		5.0	–	30	V
Output Voltage Tolerance	$V_{OUT} +3V \le V_{IN} \le V_{OUT}$ +15V, 5mA $\le I_{OUT} \le$ 1.0A, $P_D \le$ 15W, $V_{IN\ (max)}$ = 38V	T_J = 25°C	–	–	4.0	%(V_{OUT})
			–	–	5.0	%(V_{OUT})
Line Regulation	T_J = 25°C, $V_{OUT} \le$ 10V, (V_{OUT} 2.5V) $\le V_{IN} \le$ (V_{OUT} +20V)		–	–	1.0	%(V_{OUT})
	T_J = 25°C, $V_{OUT} \ge$ 10V, (V_{OUT} +3V) $\le V_{IN} \le$ (V_{OUT} +15V) (V_{OUT} +3V) $\le V_{IN} \le$ (V_{OUT} +7V)		– –	– –	0.75 0.67	%(V_{OUT})
Load Regulation	T_J = 25°C, $V_{IN} = V_{OUT}$ +5V	250mA $\le I_{OUT} \le$ 750mA	–	–	1.0	%(V_{OUT})
		5mA $\le I_{OUT} \le$ 1.5A	–	–	2.0	%(V_{OUT})
Control Pin Current	T_J = 25°C		–	1.0	5.0	μA
			–	–	8.0	μA
Quiescent Current	T_J = 25°C		–	3.2	5.0	μA
			–	–	6.0	μA
Ripple Rejection	8V $\le V_{IN} \le$ 18V, V_{OUT} = 5V, f = 120Hz		62	78	–	dB
Output Noise Voltage	T_J = 25°C, 10Hz $\le$ f $\le$ 100kHz, V_{OUT} = 5V, I_{OUT} = 5mA		–	8	40	μV/V_{OUT}
Dropout Voltage	Note 2		–	–	2.5	V
Short Circuit Current	T_J = 25°C, V_{IN} = 30V		–	0.75	1.2	A
Peak Output Current	T_J = 25°C		1.3	2.2	3.3	A
Average Temperature Coefficient of Output Voltage	V_{OUT} = 5V, I_{OUT} = 5mA	T_J = –55°C to +25°C	–	–	0.4	mV/°C/V_{OUT}
		T_J = +25°C to +150°C	–	–	0.3	
Control Pin Voltage (Reference)	T_J = 25°C		4.8	5.0	5.2	V
			4.75	–	5.25	V

Note 1. V_{OUT} is defined as: $V_{OUT} = \frac{R1 + R2}{R2}(5.0)$

Note 2. Dropout Voltage is defined as that input–output voltage differential which causes the output voltage to decrease by 5% of its initial value.

Note 3. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ($t_W \le$ 10ms, duty cycle $\le$ 5%). Output voltage changes due to changes in internal temperature must be taken into account separately.

Design Considerations:

The NTE953 adjustable voltage regulator has an output voltage which varies from $V_{CONTROL}$ to typically

$$V_{IN} -2V \text{ by } V_{OUT} = V_{CONTROL} \frac{(R1 + R2)}{R2}$$

The nominal reference in the NTE953 is 5.0V. If we allow 1.0mA to flow in the control string to eliminate bias current effects, we can make R2 = 2.2kΩ. The output voltage is then:

$$V_{OUT} = (R1 + R2)V, \text{ where R1 and R2 are in k}\Omega\text{s.}$$

Example: If R2 = 5kΩ and R1 = 10kΩ then
V_{OUT} = 15V nominal

By proper wiring of the feedback resistors, load regulation of the device can be improved significantly.

The NTE953 voltage regulator contains thermal−overload protection from excessive power, internal short−circuit protection which limits each circuit's maximum current, and output transistor safe−area protection for reducing the output current as the voltage across each pass transistor is increased.

Although the internal power dissipation is limited, the junction temperature must be kept below the maximum specified temperature in order to meet data sheet specifications. To calculate the maximum junction temperature or heat sink required, the following thermal resistance values should be used:

Typ °C/W	**Max °C/W**	**Typ °C/W**	**Max °C/W**
Θ_{JC}	Θ_{JC}	Θ_{JA}	Θ_{JA}
7.5	11	75	80

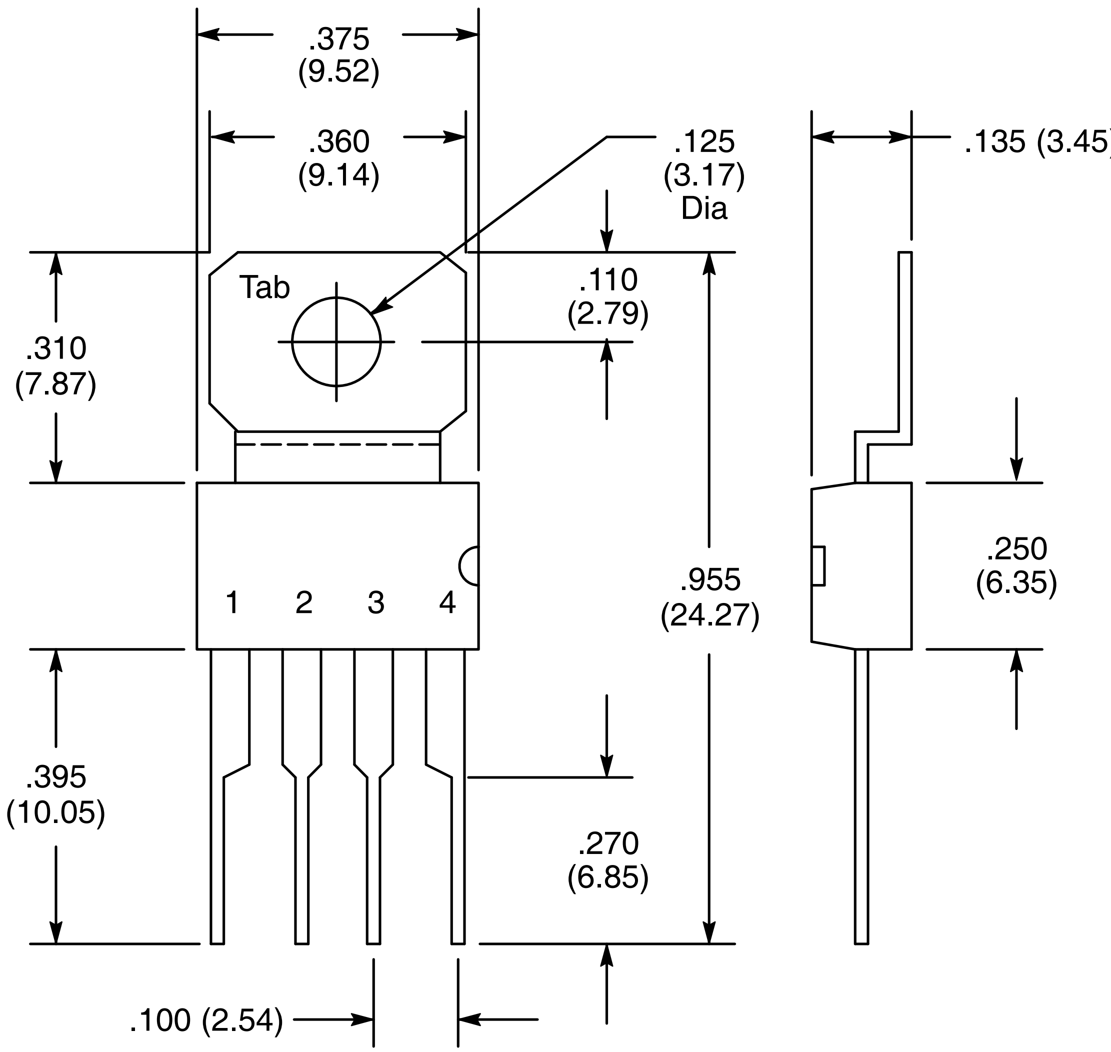
$$P_{D(max)} = \frac{T_{J(max)} - T_A}{\Theta_{JC} + \Theta_{CA}} \quad \text{or} \quad \frac{T_{J(max)} - T_A}{\Theta_{JA}}$$

(Without a heat sink)

$$\Theta_{CA} = \Theta_{CS} + \Theta_{SA}$$

Solving for T_J: $T_J = T_A + P_D (\Theta_{JC} + \Theta_{CA})$ or
$T_A + P_D \Theta_{JA}$ (Without heat sink)

Where:
- T_J = Junction Temperature
- T_A = Ambient Temperature
- P_D = Power Dissipation
- Θ_{JA} = Junction to Ambient Thermal Resistance
- Θ_{JC} = Junction to Case Thermal Resistance
- Θ_{CA} = Case to Ambient Thermal Resistance
- Θ_{CS} = Case to Heat Sink Resistance
- Θ_{SA} = Heat Sink to Ambient Thermal Resistance



Pin 1. GND
2. V_{IN}
3. V_{OUT}
4. Adjust
Tab GND