

General Description

The HS317L is an adjustable 3-terminal positive voltage regulator capable of supplying 100mA over a 1.2V to 37V output range. It is exceptionally easy to use and requires only two external resistors to set the output voltage. Further, it employs internal current limiting, thermal shutdown and safe area compensation, making it essentially blow-out proof. Also, the HS317L is available packaged in a standard TO92、SOP8、SOT89-3 transistor package which is easy to use.

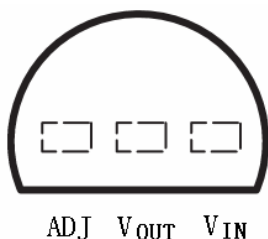
The HS317L serves a wide variety of applications including local, on card regulation. This device can also be used to make a programmable output regulator, or by connecting a fixed resistor between the adjustment and output, the HS317L can be used as a precision current regulator.



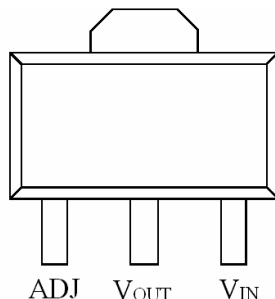
Features

- ▣ Adjustable output down to 1.2V
- ▣ Guaranteed 100 mA output current
- ▣ Line regulation typically 0.01%V
- ▣ Load regulation typically 0.1%
- ▣ Current limit constant with temperature
- ▣ Eliminates the need to stock many voltages
- ▣ 80 dB ripple rejection
- ▣ Output is short circuit protected

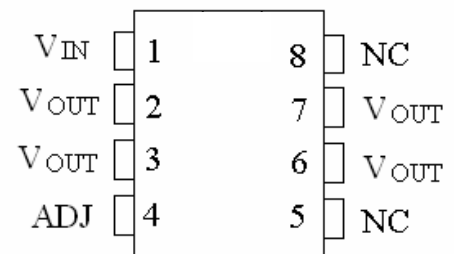
Pin Connection



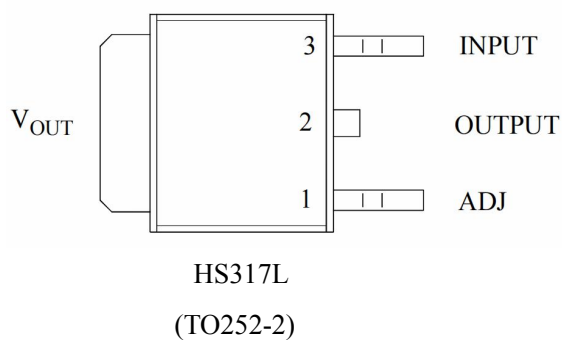
HS317L
(TO92)



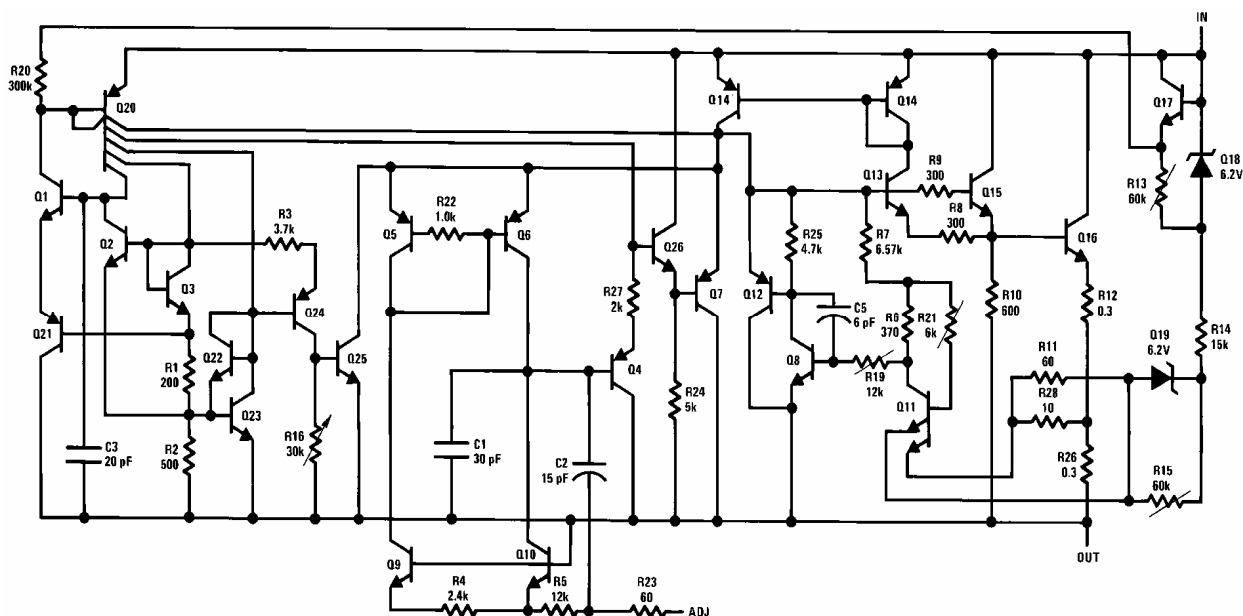
HS317L
(SOT89-3)



HS317L
(SOP8)



Block Diagram



Absolute Maximum Ratings (T_{amb}=25°C)

Characteristic	Symbol	Value	Unit
Input-Output Voltage Differential	V _i -V _o	40	V
Power Dissipation	P _D	Internally Limited	W
Operating Junction Temperature Range	T _j	-40~125	°C
Lead Temperature (Soldering, 4 seconds)	T _L	250	°C
Storage Temperature Range	T _{stg}	-55~150	°C

Electrical Characteristics

(unless otherwise specified: $V_i - V_o = 5.0V$; $I_o = 40mA$; $T_j = 0 \sim 125^\circ C$; $I_{max} = 100mA$ and $P_{max} = 625mW$)

Characteristics	Test conditions	Symbol	Min.	Typ.	Max.	Unit
Line Regulation	$T_j = 25^\circ C$, $I_L \leq 20mA$ $3V \leq (V_{IN} - V_{OUT}) \leq 40V$	Regline	-	0.01	0.05	%/V
Load Regulation	$T_j = 25^\circ C$, $5mA \leq I_{OUT} \leq I_{MAX}$	Regload	-	0.1	0.5	%
Thermal Regulation	$T_j = 25^\circ C$, 10ms Pulse	Regther	-	0.04	0.2	%/W
Adjustment Pin Current	-	I_{adj}	-	50	100	μA
Adjustment Pin Current Change	$5mA \leq I_L \leq 100mA$ $3V \leq (V_{IN} - V_{OUT}) \leq 40V$, $P \leq 625mW$	$\square I_{adj}$	-	0.2	6	μA
Reference Voltage	$3V \leq (V_{IN} - V_{OUT}) \leq 40V$, $5mA \leq I_{OUT} \leq 100mA$, $P \leq 625mW$	V_{ref}	1.15	1.25	1.35	V
Line Regulation	$3V \leq (V_{IN} - V_{OUT}) \leq 40V$, $I_L \leq 20mA$	Regline	-	0.02	0.05	%/V
Load Regulation	$5mA \leq I_{OUT} \leq 100mA$	Regload	-	0.3	1.2	%
Temperature Stability	$T_{MIN} \leq T_j \leq T_{MAX}$	T_s	-	0.65	-	%
Minimum Load Current	$(V_{IN} - V_{OUT}) \leq 40V$	I_{Lmin}	-	3.5	17	mA
	$3V \leq (V_{IN} - V_{OUT}) \leq 15V$		-	1.5	6	
Current Limit	$3V \leq (V_{IN} - V_{OUT}) \leq 13V$	I_{max}	40	200	260	mA
	$(V_{IN} - V_{OUT}) = 40V$		25	50	70	mA
Rms Noise % of V_o	$T_j = 25^\circ C$, $10Hz \leq f \leq 10KHz$	N	-	0.003	0.008	%
Ripple Rejection	$V_{OUT} = 10V$, $f = 120Hz$, $C_{ADJ} = 0$	RR	-	65	80	dB
	$C_{ADJ} = 10 \mu F$		66	80	-	
Long-Term Stability	$T_j = 125^\circ C$, 1000Hours	S	-	0.3	1	%

Application Summary

1. Basic circuit operation

In operation, the HS317L develops a nominal 1.25V reference voltage, V_{ref} , between the output and adjustment terminal. The reference voltage is impressed across program resistor $R1$ and, since the voltage is constant, a constant current $I1$ then flows through the output set resistor $R2$, giving an output voltage of

$$V_{out} = V_{ref}(1 + R2/R1) + I_{adj} * (R2)$$

Since the 100µA current from the adjustment terminal represents an error term, the HS317L was designed to minimize I_{adj} and make it very constant with line and load changes. To do this, all quiescent operating current is returned to the output establishing a minimum load current requirement. If there is insufficient load on the output, the output will rise.

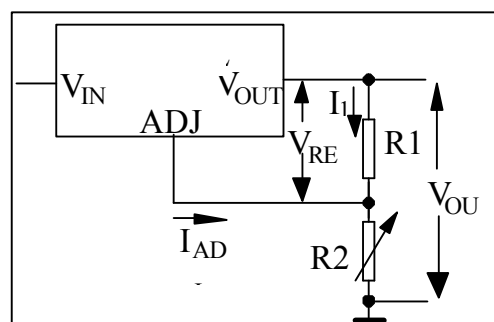
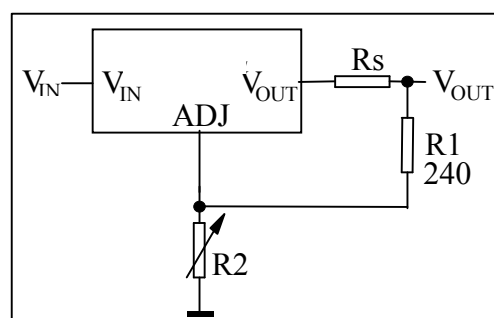


Figure: Basic circuit configuration

2. Load Regulation

The HS317L is capable of providing extremely good load regulation, but a few precautions are needed to obtain maximum performance. For best performance, the programming resistor ($R1$) should be connected as close to the regulator as possible to minimize line drops which effectively appear in series with the reference, thereby degrading regulation. The ground end of $R2$ can be returned near the load ground to provide remote ground sensing and improve load regulation



Regulator with line resistance in output lead

3. External capacitors

A 0.1µF disc or 1.0µF tantalum input bypass capacitor (C_{in}) is recommended to reduce the sensitivity to input line impedance.

The adjustment terminal may be bypassed to ground to improve ripple rejection.

This capacitor (C_{adj}) prevents ripple from being amplified as the output voltage is increased. A 10µF capacitor should improve ripple rejection about 15dB at 120Hz in a 10V application.

Although the HS317L is stable with no output capacitance, like any feedback circuit, certain values of external capacitance can cause excessive ringing. An output capacitance (C_o) in the form of a 1.0µF tantalum or 25µF aluminum electrolytic capacitor on the output swamps this effect and insures stability.

4. Protection Diodes

When external capacitors are used with any IC regulator it is sometimes necessary to add protection diodes to

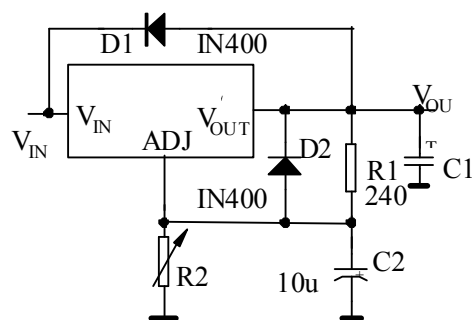
prevent the capacitors from discharging through low current points into the regulator. Most 10 μ F capacitors have low enough internal series resistance to deliver 20A spikes when shorted. Although the surge is short, there is enough energy to damage parts of the IC.

When an output capacitor is connected to a regulator and the input is shorted, the output capacitor will discharge into the output of the regulator. The discharge current depends on the value of the capacitor, the output voltage of the regulator, and the rate of decrease of V_{in} . In the HS317L, this discharge path is through a large junction that is able to sustain a 2A surge with no problem. This is not true of other types of positive regulators. For output capacitors of 25 μ F or less, the HS317L's ballast resistors and output structure limit the peak current to a low enough level so that there is no need to use a protection diode.

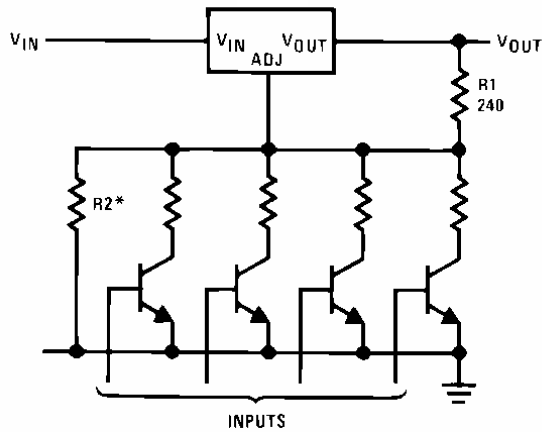
The bypass capacitor on the adjustment terminal can discharge through a low current junction. Discharge occurs when either the input or output is shorted. Internal to the HS317L is a 50 Ω resistor which limits the peak discharge current. No protection is needed for output voltages of 25V or less and 10 μ F capacitance. Figure in right shows an HS317L with protection diodes

Regulator with protection diodes

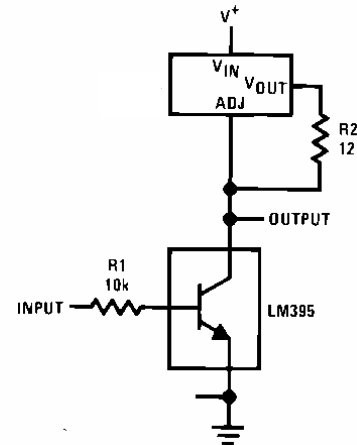
included for use with outputs greater than 25V and high values of output capacitance.



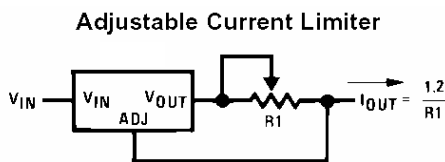
Application Circuit



*Sets maximum Vout
Digitally Selected Outputs



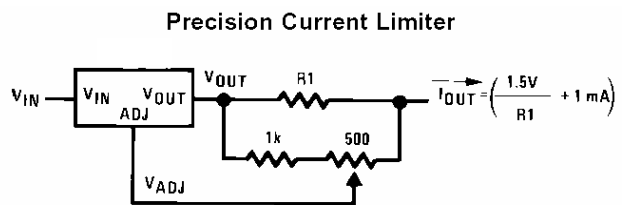
High Gain Amplifier



Adjustable Current Limiter

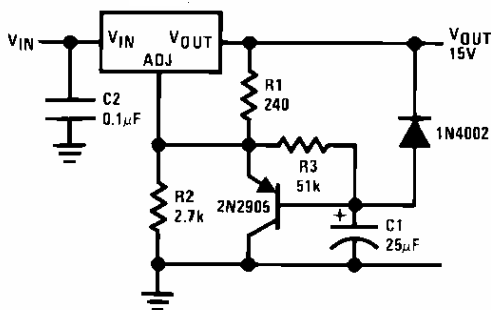
$$12 \square R1 \square 240$$

Adjustable Current Limiter



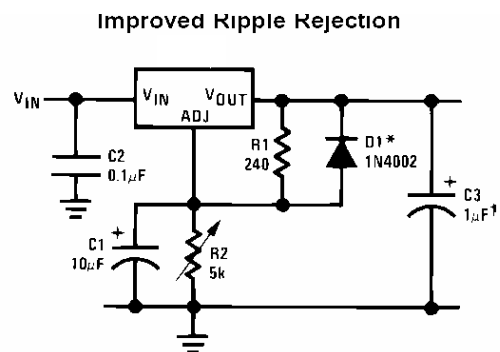
Precision Current Limiter

Precision Current Limiter



Slow Turn-on 15V Regulator

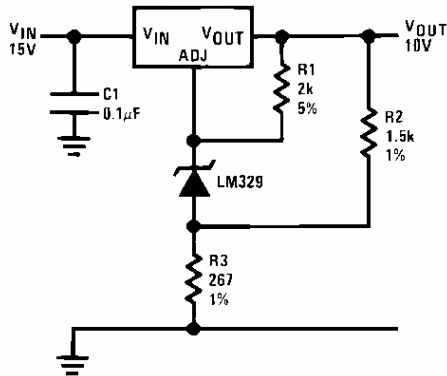
Improved Ripple Rejection



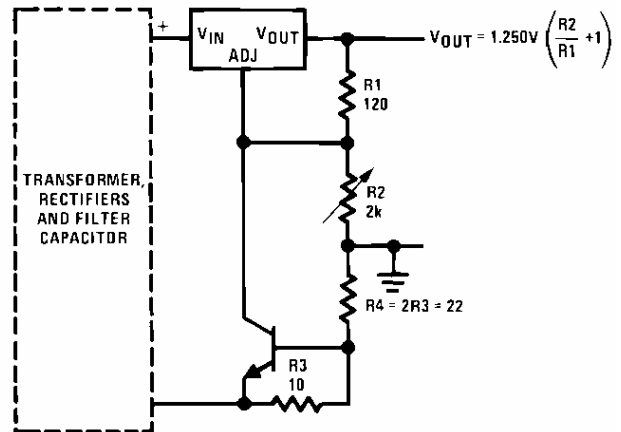
+Sold tantalum

*Discharges C1 if output is shorted to ground

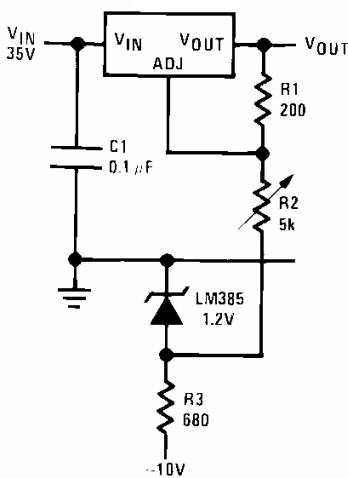
Adjustable Regulator with



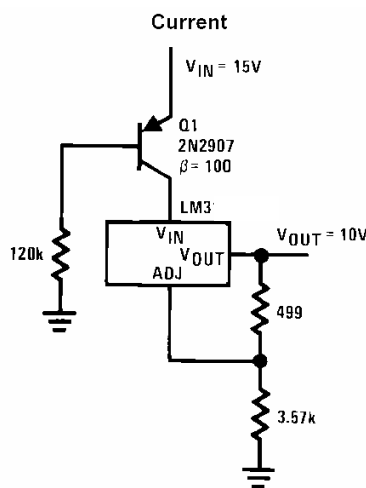
High Stability 10V Regulator



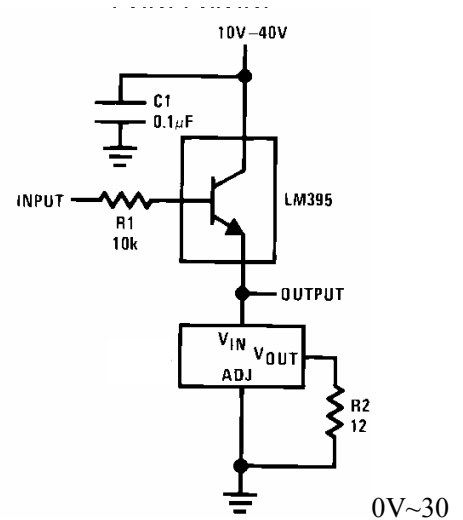
Short circuit current is approximately $600\text{mV}/R_3$,
At 25mA output only 3/4V of drop occurs in R3 and R4
Adjustable Regulator with Current Limiter



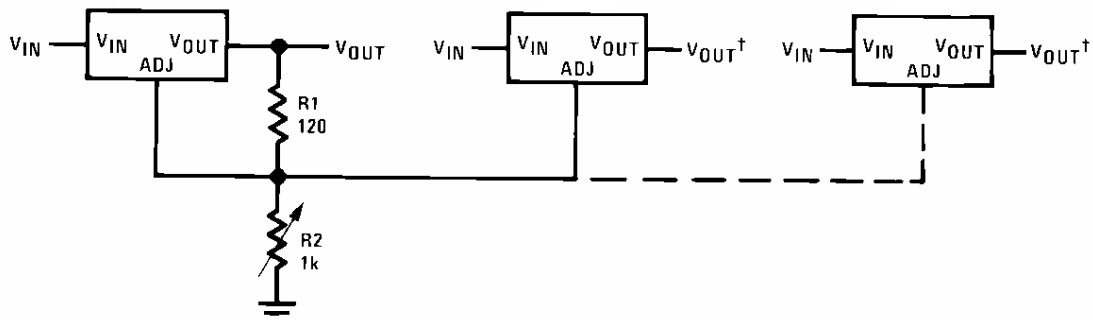
V Regulator



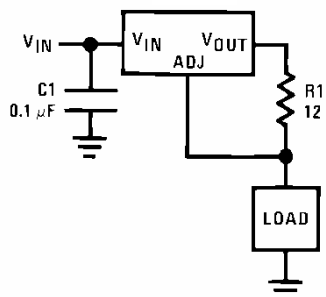
Current



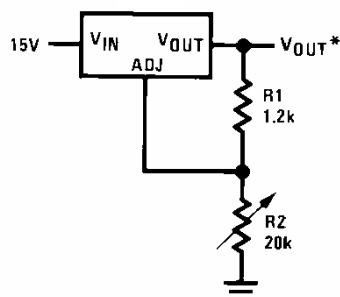
Power Follower



Adjusting Multiple on-Card Regulators with Single Control

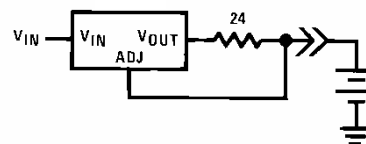


100mA Current Regulator

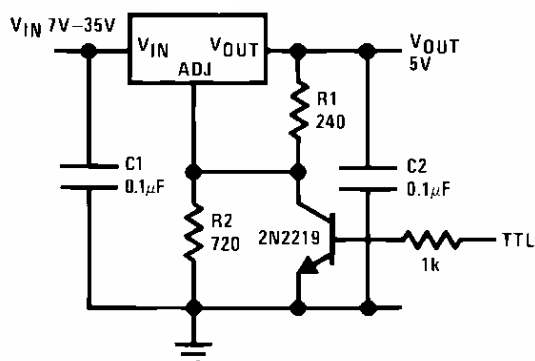


*Minimum load current=2mA

1.2V~12V Regulator with
Minimum Program Current

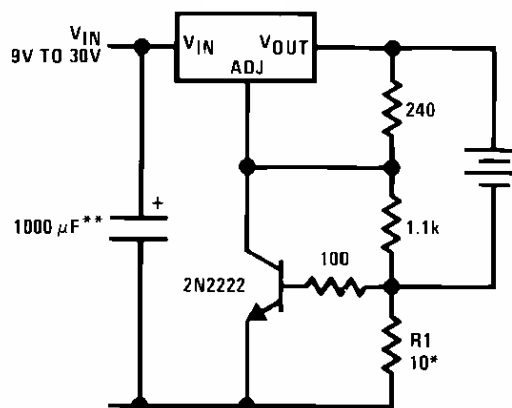


50mA constant Current
Battery Charger for
Nickel-Cadmium Batteries



*Minimum output=1.2V

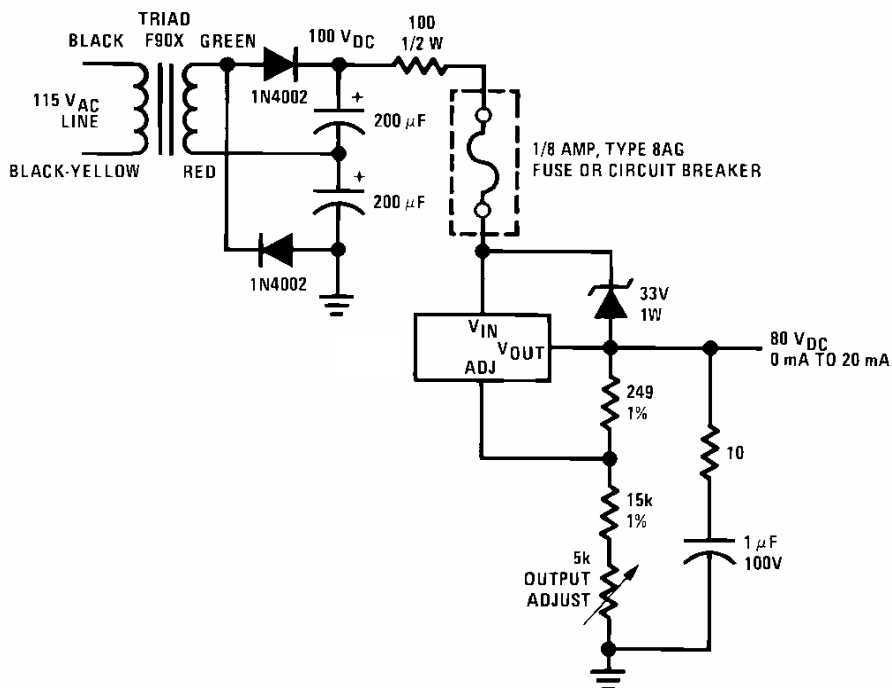
5V Logic Regulator with Electronic Shutdown



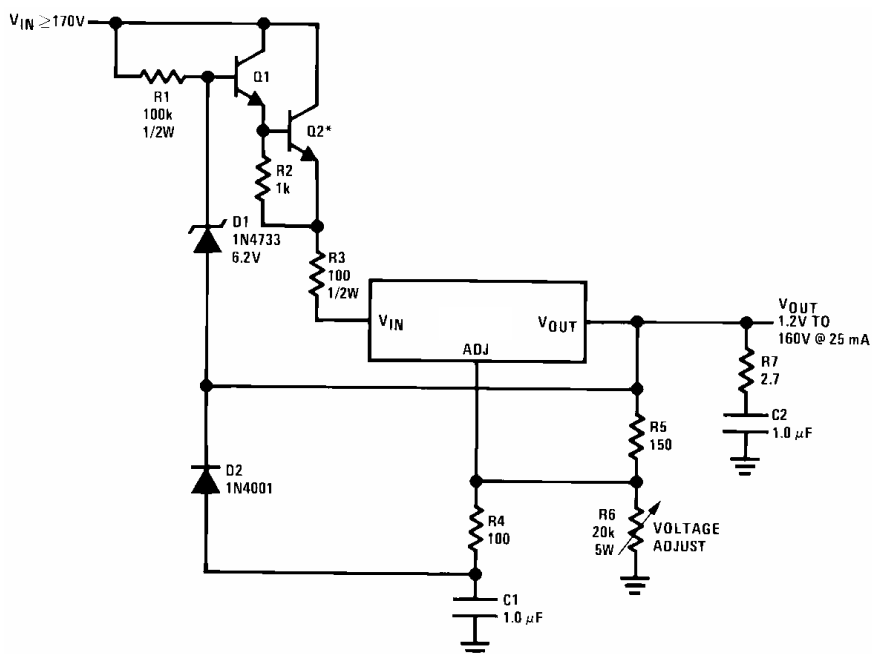
*Sets peak current, $I_{peak} = 0.6V/R1$

**1000 μF is recommended to filter out any input transients

Current Limited 6V Charger



Short Circuit Protected 80V Supply



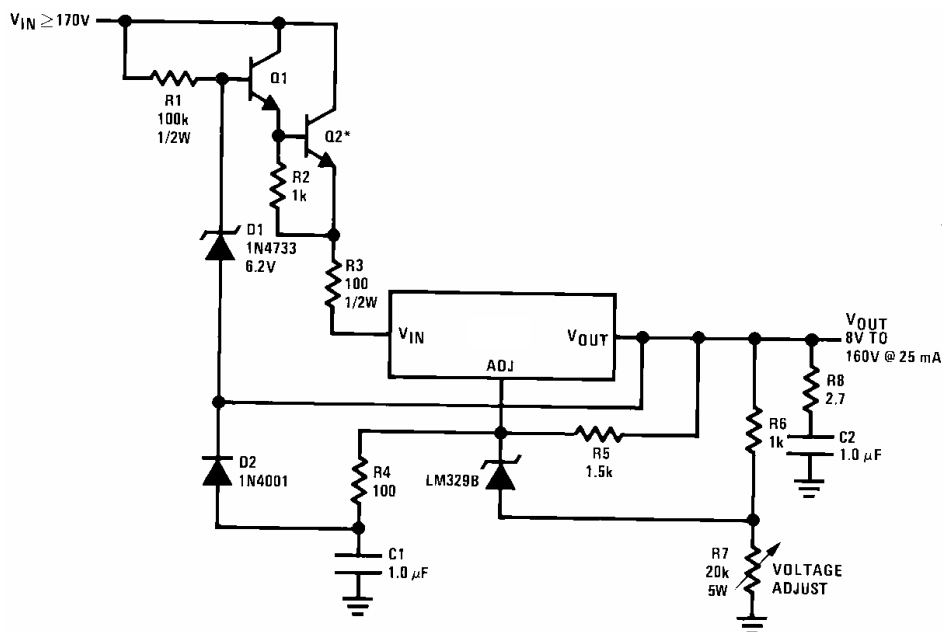
Q1,Q2: NSD134 or similar

C1,C2: 1μF, 200V mylar**

*Heat sink

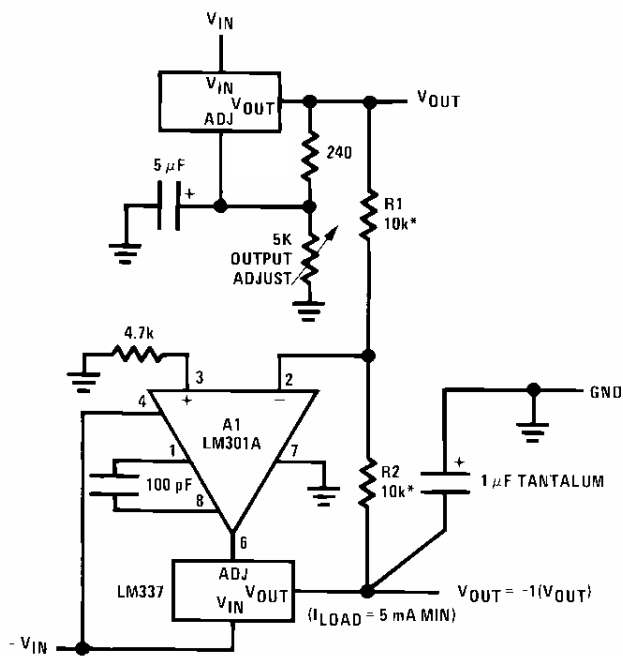
Basic High Voltage Regulator

Dec. 2023 Rev. 2.3

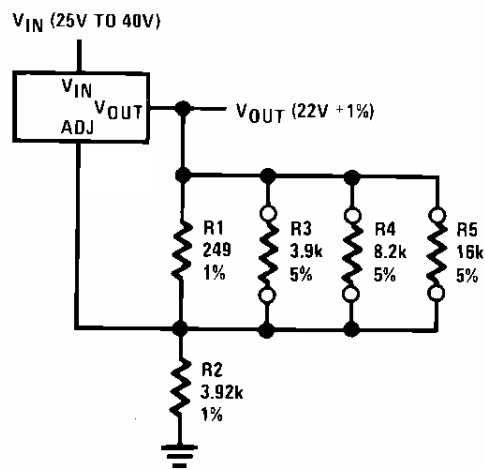


Q1,Q2: NSD134 or similar C1,C2: 1μF, 200V mylar** *Heat sink ** Mylar is a registered trademark of DuPont Co.

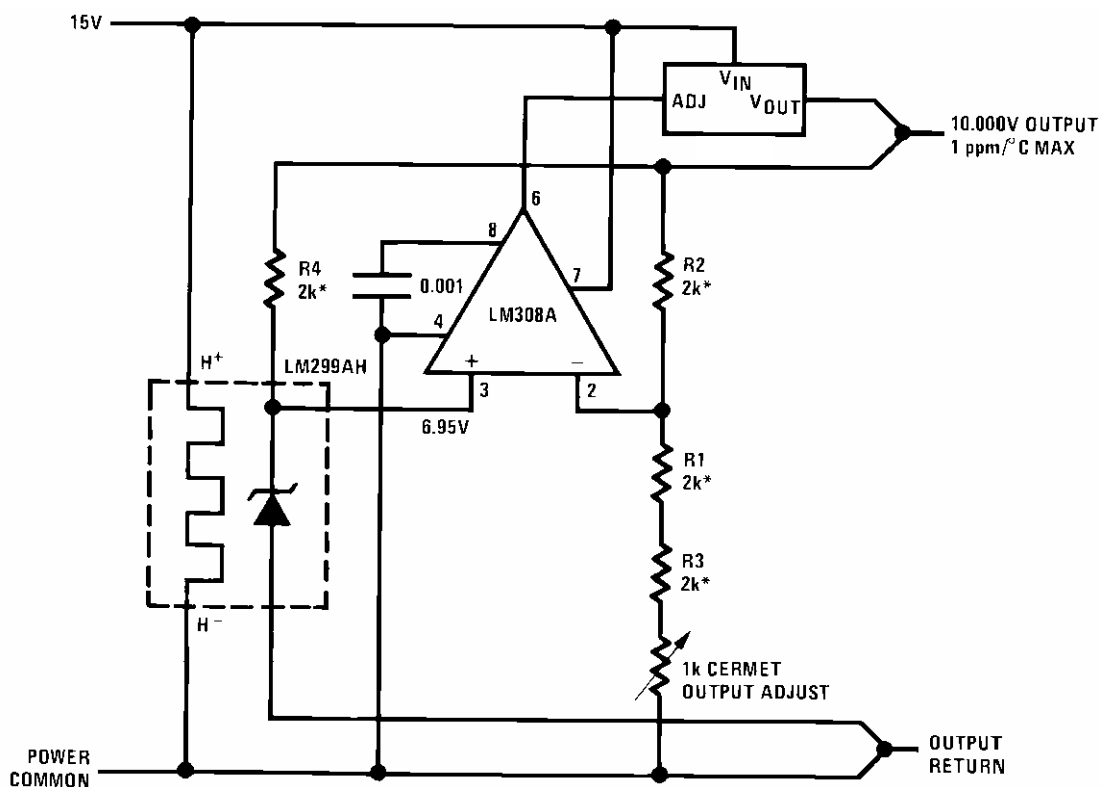
Precision High Voltage Regulator



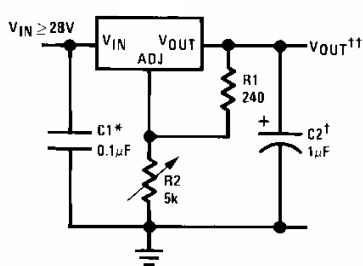
Tracking Regulator



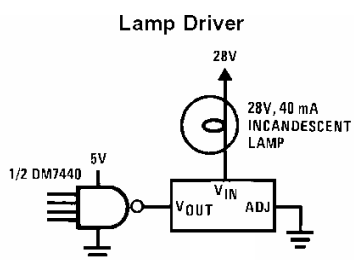
Regulator with Trimmable output Voltage



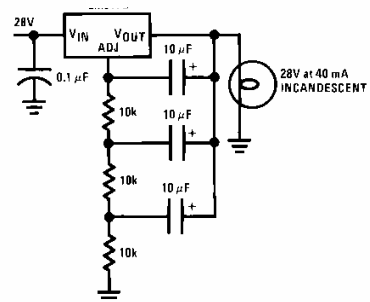
Precision Reference with Short-Circuit Proof Output



Adjustable Regulator



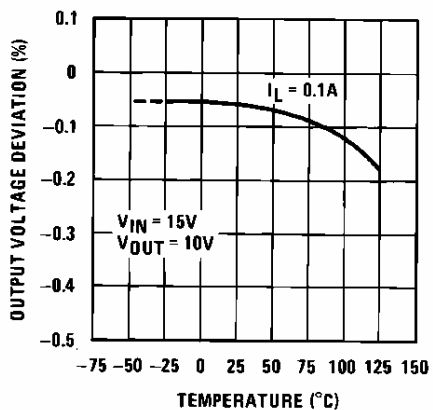
Protected (Bulletproof)
Lamp Driver



Lamp Flasher

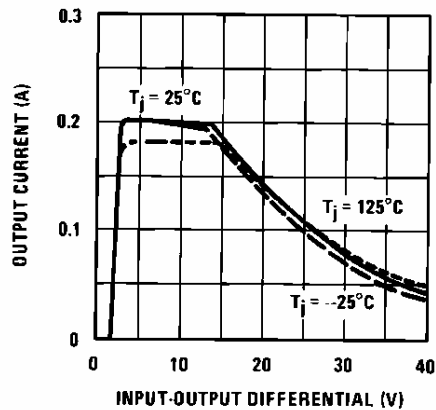
Characteristics Curves

Load Regulation



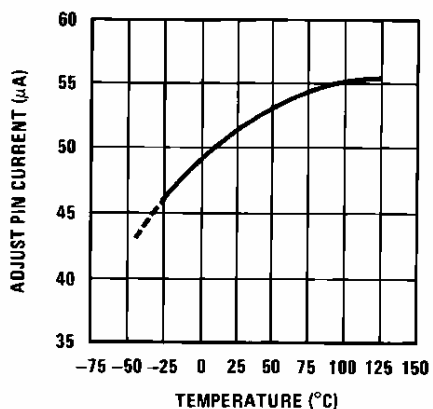
DS009064-34

Current Limit



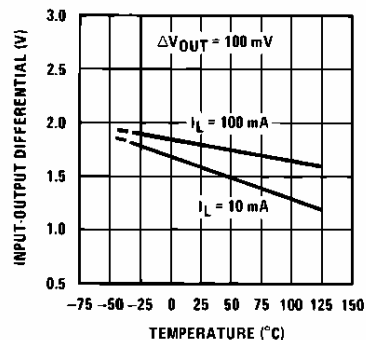
DS009064-35

Adjustment Current



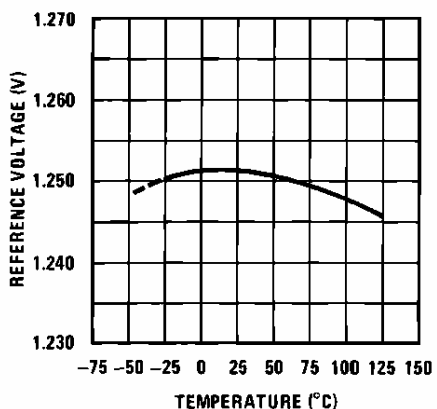
DS009064-36

Dropout Voltage



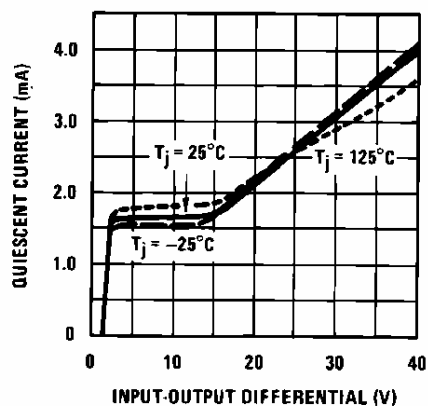
DS009064-37

Reference Voltage Temperature Stability



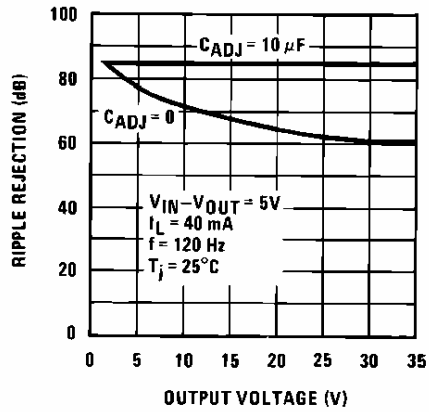
DS009064-38

Minimum Operating Current



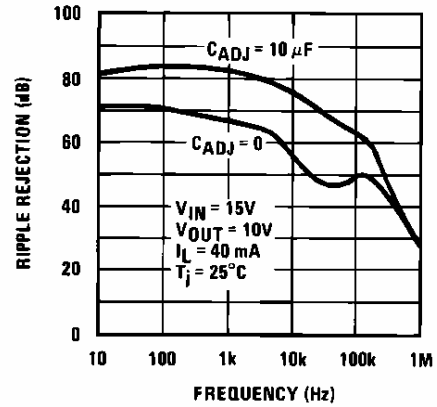
DS009064-39

Ripple Rejection



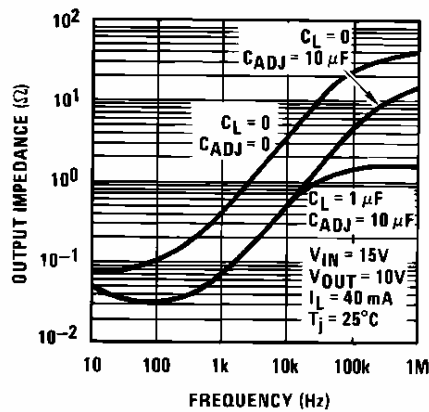
DS009064-40

Ripple Rejection



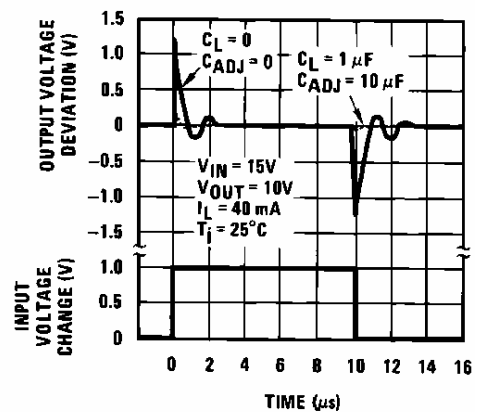
DS009064-41

Output Impedance



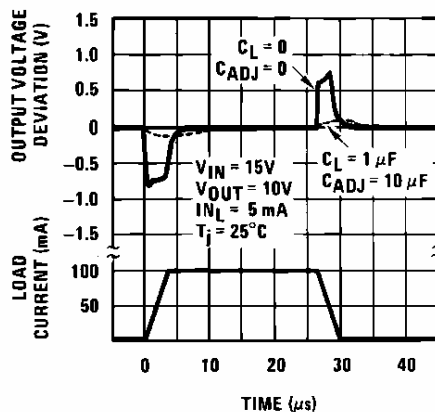
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Line Transient Response



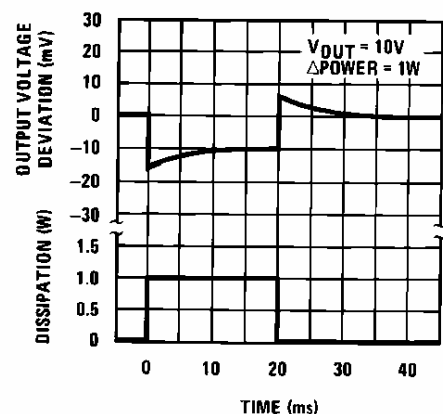
DS009064-43

Load Transient Response



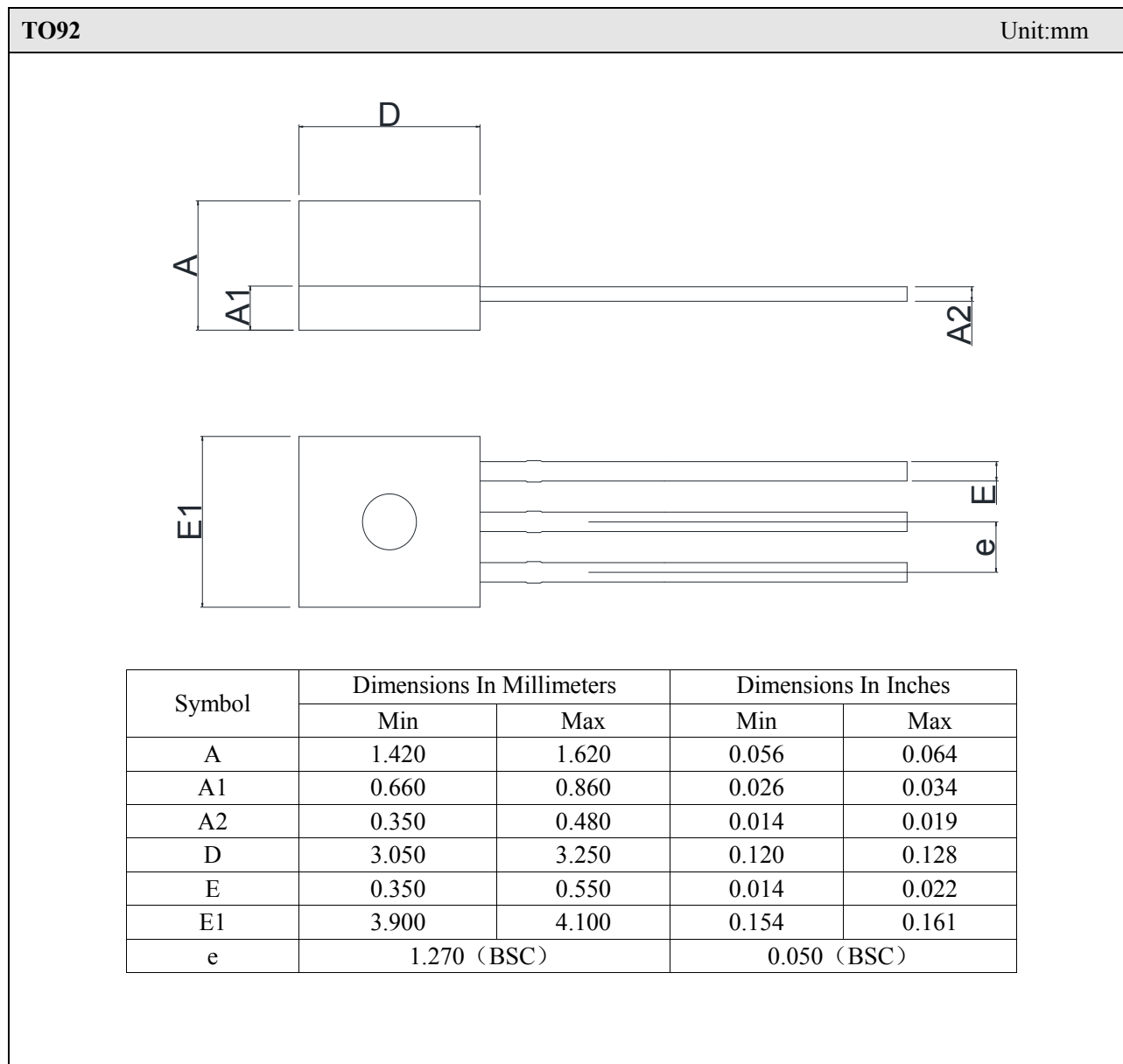
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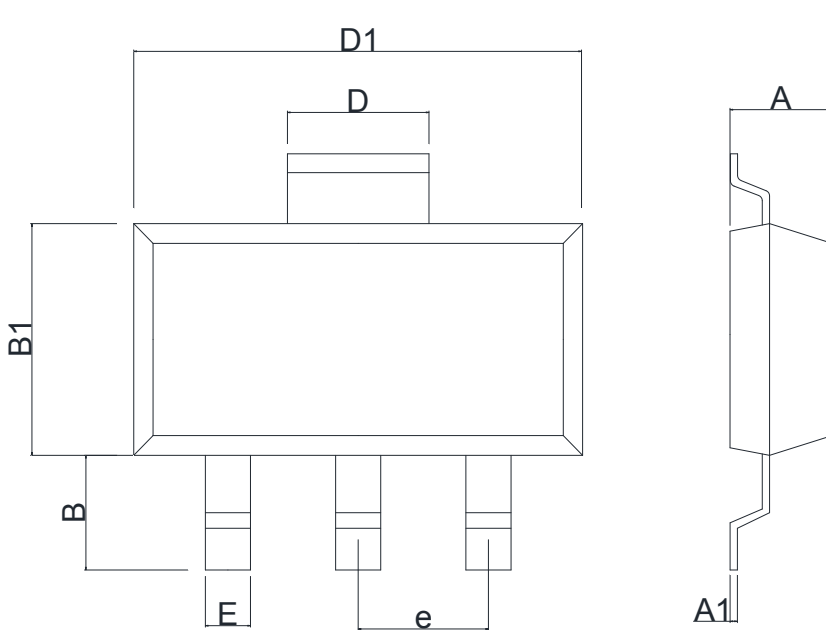
Thermal Regulation



DS009064-45

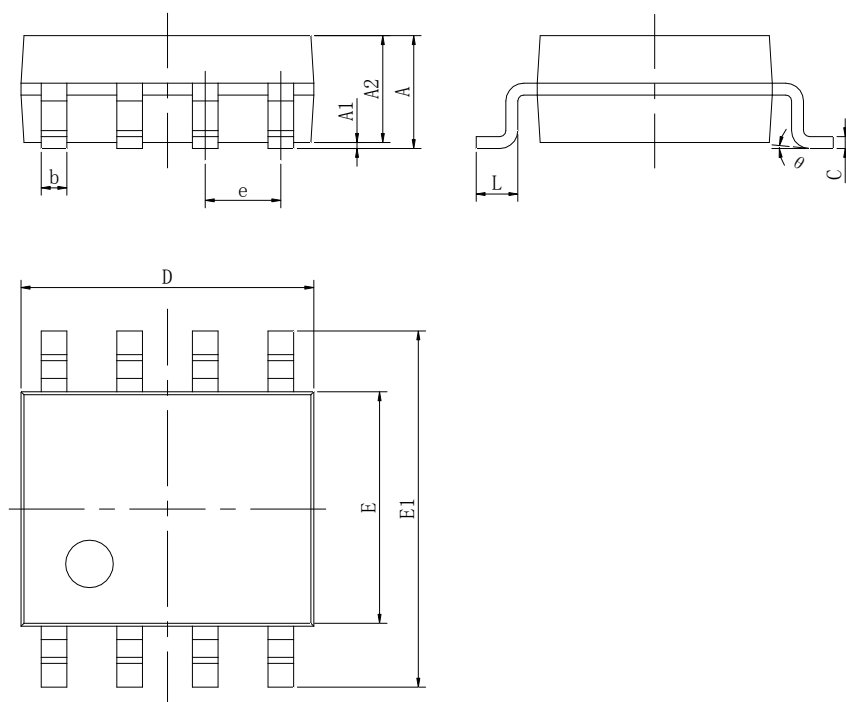
Outline Dimensions



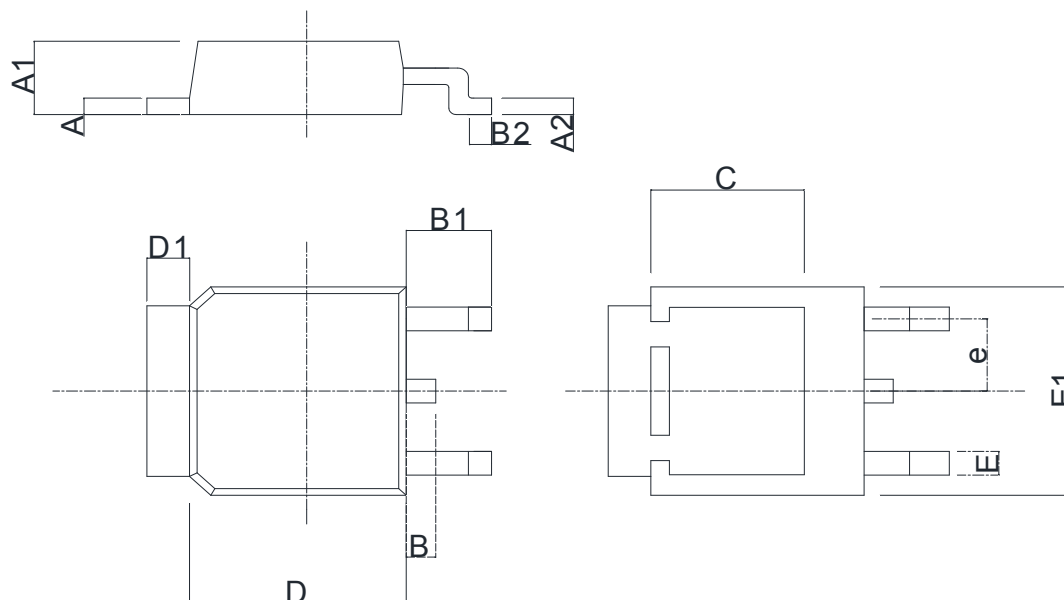
SOT89-3		Unit:mm		
				
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.450	1.550	0.057	0.061
A1	0.390	0.410	0.015	0.016
B	0.950	1.050	0.037	0.041
B1	2.350	2.550	0.092	0.100
E	0.350	0.450	0.013	0.017
D1	4.400	4.600	0.173	0.181
D	1.550 REF		0.061 REF	
e	1.500 (BSC)		0.059 (BSC)	

SOP8

Unit:mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.800	0.053	0.071
A1	0.000	0.250	0.000	0.010
A2	1.250	1.550	0.053	0.061
b	0.300	0.510	0.011	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.201
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.470	0.570	0.018	0.023
A1	2.220	2.380	0.087	0.094
A2	0.470	0.570	0.018	0.023
B	0.820	0.840	0.032	0.033
B1	2.380	2.480	0.093	0.098
B2	0.500	0.520	0.019	0.021
C	4.250	4.450	0.167	0.176
D	6.000	6.200	0.236	0.245
D1	1.150	1.250	0.045	0.050
E	0.650	0.850	0.025	0.034
E1	6.450	6.750	0.253	0.266
e	2.285 (BSC)		0.090 (BSC)	

Statements

- Silicore Technology reserves the right to make changes without further notice to any products or specifications herein. Before customers place an order, customers need to confirm whether datasheet obtained is the latest version, and to verify the integrity of the relevant information.

- Failure or malfunction of any semiconductor products may occur under particular conditions, customers shall have obligation to comply with safety standards when customers use Silicore Technology products to do their system design and machine manufacturing, and take corresponding safety measures in order to avoid potential risk of failure that may cause personal injury or property damage.

- The product upgrades without end, Silicore Technology will wholeheartedly provide customers integrated circuits that have better performance and better quality.