5.0V Reference Diode

DESCRIPTION

The HT136-5.0/HT236-5.0/HT336-5.0 integrated circuits are precision 5.0V shunt regulator diodes. These monolithic IC voltage references operate as a low temperature coefficient 5.0V zener with 0.6Ω dynamic impedance. A third terminal on the HT136-5.0 allows the reference voltage and temperature coefficient to be trimmed easily.

The HT136-5.0 series is useful as a precision 5.0V lowvolt-age reference for digital voltmeters, power supplies or op amp circuitry. The 5.0V makes it convenient to obtain a stable ref-erence from low voltage supplies. Further, since the HT136-5.0 operates as a shunt regulator, it can beused as either a positive or negative voltage reference.

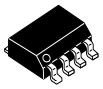
The HT136-5.0 is rated for operation over −55° C to +125° C while the HT236-5.0 is rated over a −25° C to +85° C temper-ature range. The HT336-5.0 is rated for operation over a 0° Cto +70° C temperature range. See the connection diagrams for available packages. For applications requiring 2.5V see HT136-2.5.

FEATURES

- Adjustable 4V to 6V
- Low Temperature Coefficient
- Wide Operating Current of 600 μA to 10 mA
- 0.6Ω Dynamic Impedance
- ± 1% Initial Tolerance Available
- Specified Temperature Stability
- Easily Trimmed for Minimum Temperature • Fast Turn-on
- Three Lead Transistor Package

SOP89-3 D SUFFIX
HT336D-xx

MSOP−8 M SUFFIX
HT336M-xx

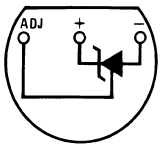


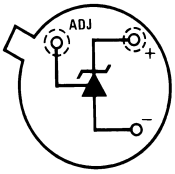
SOP−8 R SUFFIX
HT336R-xx

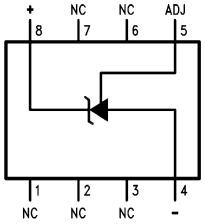
TO92 M SUFFIX
HT336T-xx0

TO-92-3L T SUFFIX
HT336AT-xx

Connection Diagrams







Typical Applications

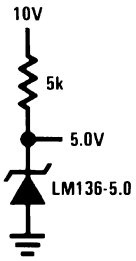
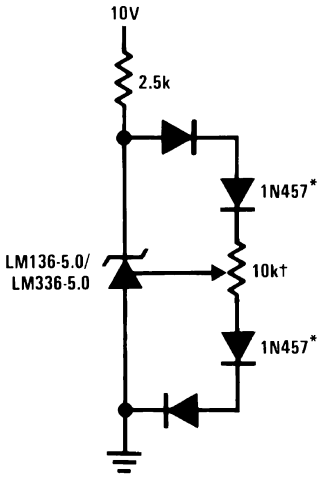
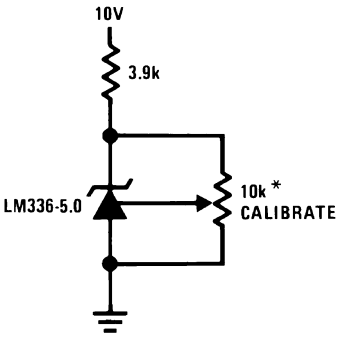


Figure 4. 5.0V Reference



† Adjust to 5.00V
* Any silicon signal diode

Figure 5. 5.0V Reference with Minimum Temperature Coefficient



* Does not affect temperature coefficient

Figure 6. Trimmed 4V to 6V Reference with Temperature Coefficient Independent of Breakdown Voltage

ABSOLUTE MAXIMUM RATINGS (1)

Reverse Current	15	mA
Forward Current	10	mA
Storage Temperature	−60 to +150	°C
Operating Temperature Range (2)		
HT136-5.0	−55 to +150	°C
HT236-5.0	−25 to +85	°C
HT336-5.0	0 to +70	°C
Soldering Information		
TO-92 Package (10 sec.)	260	°C
TO Package (10 sec.)	300	°C
SOIC Package		
Vapor Phase (60 sec.)	215	°C
Infrared (15 sec.)	220	°C

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Electrical specifications do not apply when operating the device beyond its specified operating conditions.
(2) For elevated temperature operation,

THERMAL CHARACTERISTICS

over operating free-air temperature range (unless otherwise noted)

	HT136	**150°C**	
	HT236	**125°C**	
	HT336	**100°C**	
Thermal Resistance	**TO-92**	**TO**	**SOIC-8**
θ_{ja} (Junction to Ambient)	180°C/W (0.4″ Leads)	440°C/W	165°C/W
	170°C/W (0.125″ Leads)		
θ_{ja} (Junction to Case)	N/A	80°C/W	N/A

ELECTRICAL CHARACTERISTICS

		HT136A-5.0/HT236A-5.0			**HT336B-5.0**			
Parameter	**Conditions**	**HT136-5.0/HT236-5.0**			**HT336-5.0**			**Units**
		Min	**Typ**	**Max**	**Min**	**Typ**	**Max**	
Reverse Breakdown Voltage	T_A=25°C, I_R=1 mA							
	HT136-5.0/HT236-5.0/HT336-5.0	4.9	5.00	5.1	4.8	5.00	5.2	V
	HT136A-5.0/HT236A-5.0, HT336B-5.0	4.95	5.00	5.05	4.90	5.00	5.1	V
Reverse Breakdown Change	T_A=25°C,		6	12		6	20	mV
With Current	600 µA≤I_R≤10 mA							
Reverse Dynamic Impedance	T_A=25°C, I_R=1 mA, f = 100 Hz		0.6	1.2		0.6	2	Ω
Temperature Stability (2)	V_R Adjusted 5.00V							
	I_R=1 mA,							
	0°C≤T_A≤70°C (HT336-5.0)					4	12	mV

(1) Unless otherwise specified, the HT136-5.0 is specified from −55°C≤T_A≤+125°C, the HT236-5.0 from −25°C≤T_A≤+85°C and the HT336-5.0 from 0°C≤T_A≤+70°C.
(2) Temperature stability for the HT336 and HT236 family is specified by design. Design limits are specified (but not 100% percent production tested) over the indicated temperature and supply voltage ranges. These limits are not used to calculate outgoing quality levels. Stability is defined as the maximum charge in V_{REF} from 25°C to T_A(min) or T_A(max).

ELECTRICAL CHARACTERISTICS (continued)

(1)

		HT136A-5.0/HT236A-5.0			HT336B-5.0			
Parameter	**Conditions**	**HT136-5.0/HT236-5.0**			**HT336-5.0**			**Units**
		Min	**Typ**	**Max**	**Min**	**Typ**	**Max**	
	−25°C≤T_A≤+85°C (HT236-5.0)		7	18				mV
	−55°C≤T_A≤+125°C (HT136-5.0)		20	36				mV
Reverse Breakdown Change With Current	600 µA≤I_R≤10 mA		6	17		6	24	mV
Adjustment Range	Circuit of Figure 14		±1			±1		V
Reverse Dynamic Impedance	I_R = 1 mA		0.8	1.6		0.8	2.5	Ω
Long Term Stability	T_A=25°C±0.1°C, I_R=1 mA, t = 1000 hrs		20			20		ppm

TYPICAL PERFORMANCE CHARACTERISTICS

Reverse Voltage Change

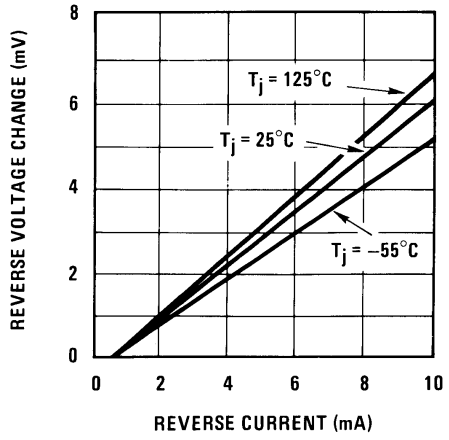


Figure 7.

Zener Noise Voltage

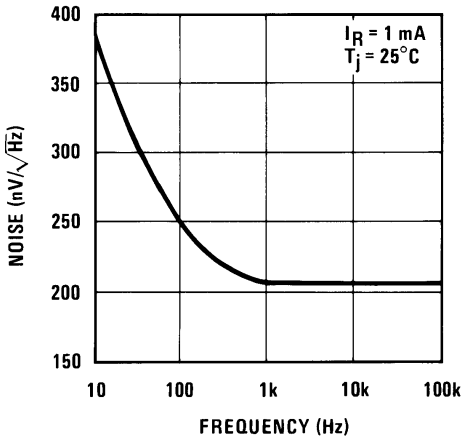


Figure 8.

Dynamic Impedance

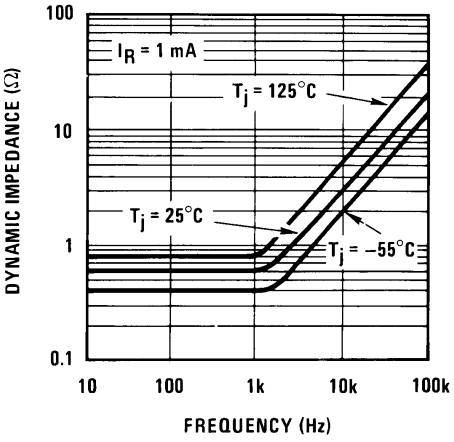


Figure 9.

Response Time

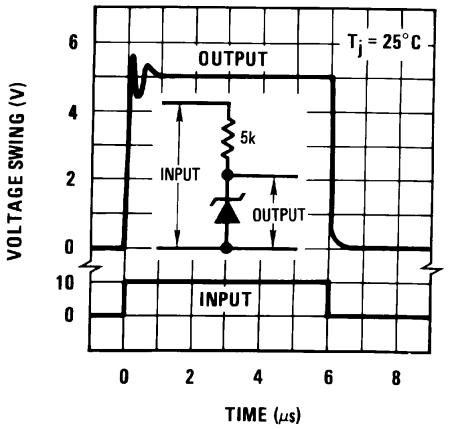


Figure 10.

Reverse Characteristics

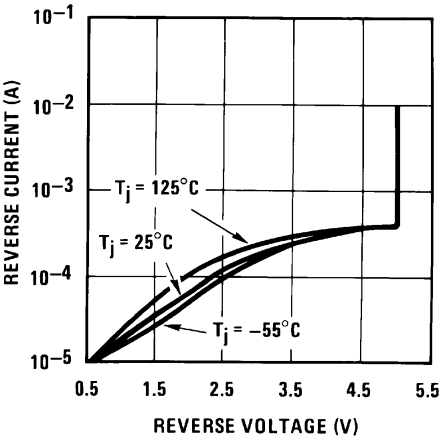


Figure 11.

Temperature Drift

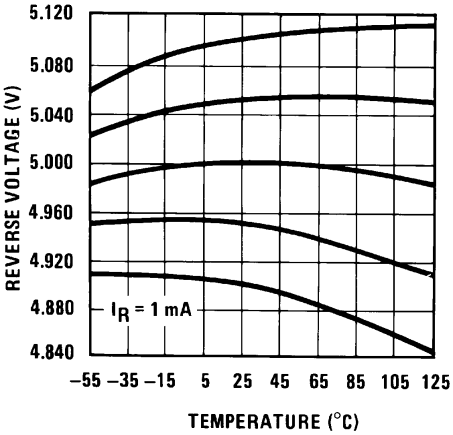


Figure 12.

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

Forward Characteristics

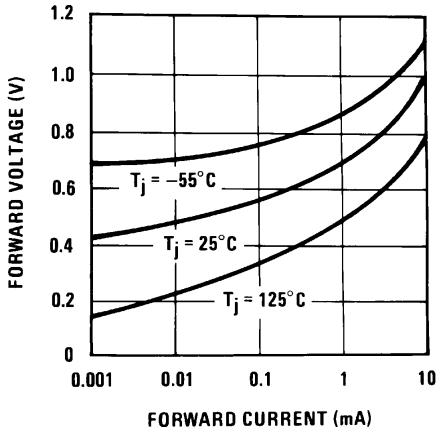


Figure 13.

The HT136-5.0 series voltage references are much easier to use than ordinary zener diodes. Their low impedance and wide operating current range simplify biasing in almost any circuit. Further, either the breakdown voltage or the temperature coefficient can be adjusted to optimize circuit performance.

Figure 14 shows an HT136-5.0 with a 10k potentiometer for adjusting the reverse breakdown voltage. With the addition of R1 the breakdown voltage can be adjusted without affecting the temperature coefficient of the device. The adjustment range is usually sufficient to adjust for both the initial device tolerance and inaccuracies in buffer circuitry.

If minimum temperature coefficient is desired, four diodes can be added in series with the adjustment potentiometer as shown in Figure 15. When the device is adjusted to 5.00V the temperature coefficient is minimized. Almost any silicon signal diode can be used for this purpose such as a 1N914, 1N4148 or a 1N457. For proper temperature compensation the diodes should be in the same thermal environment as the HT136-5.0. It is usually sufficient to mount the diodes near the HT136-5.0 on the printed circuit board. The absolute resistance of the network is not critical and any value from 2k to 20k will work. Because of the wide adjustment range, fixed resistors should be connected in series with the pot to make pot setting less critical.

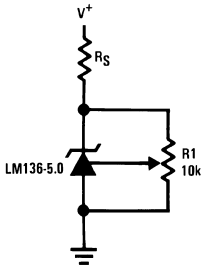


Figure 14. HT136-5.0 with Pot for Adjustment of Breakdown Voltage (Trim Range = ±1.0V Typical)

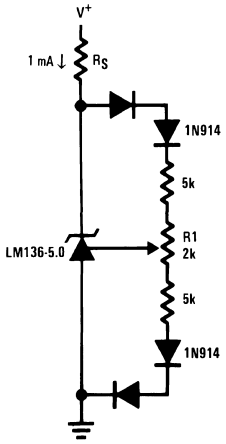
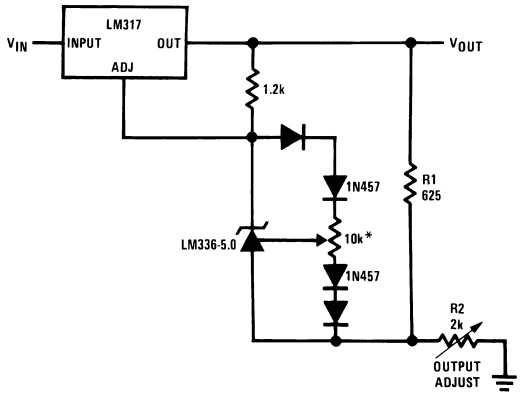


Figure 15. Temperature Coefficient Adjustment (Trim Range = ±0.5V Typical)

Typical Applications



* Adjust for 6.25V across R1

Figure 16. Precision Power Regulator with Low Temperature Coefficient

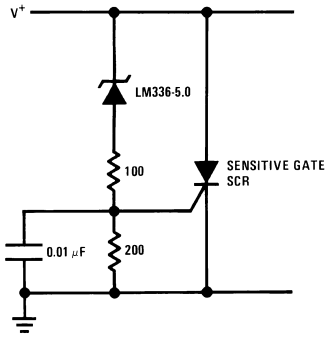


Figure 17. 5V Crowbar

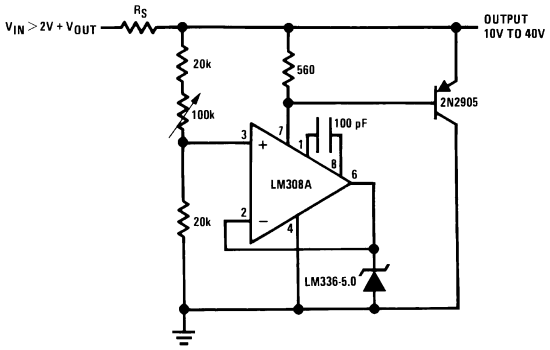


Figure 18. Adjustable Shunt Regulator

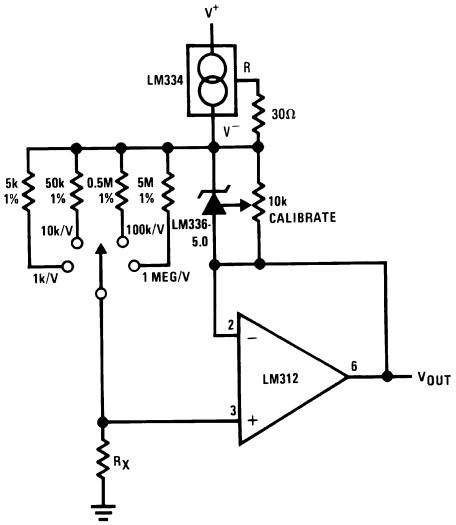


Figure 19. Linear Ohmmeter

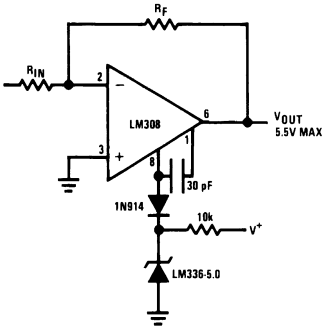


Figure 20. Op Amp with Output Clamped

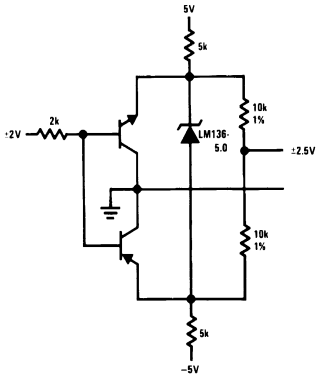


Figure 21. Bipolar Output Reference

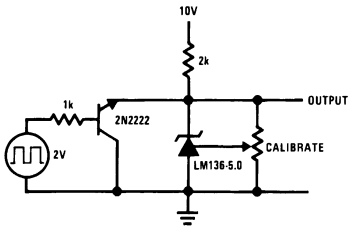


Figure 22. 5.0V Square Wave Calibrator

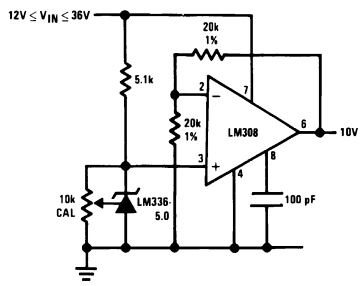


Figure 23. 10V Buffered Reference

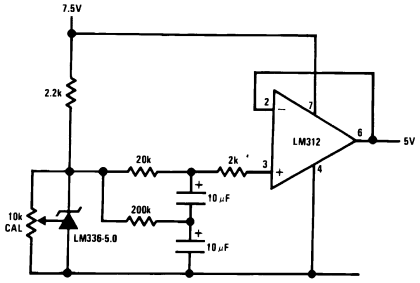


Figure 24. Low Noise Buffered Reference

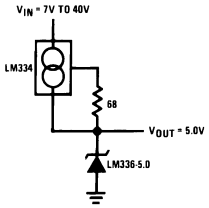
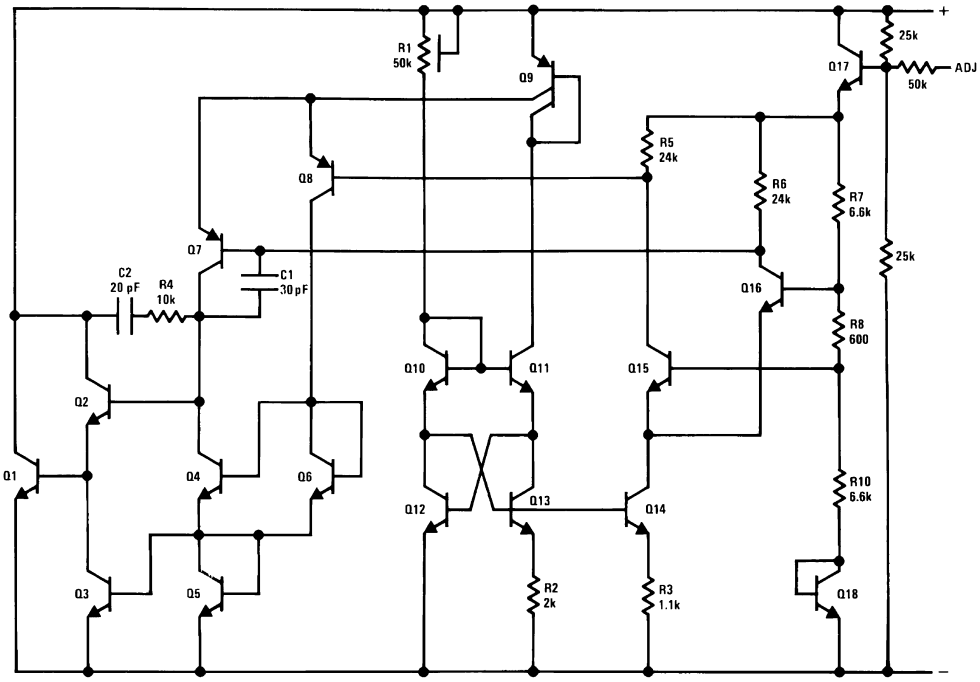
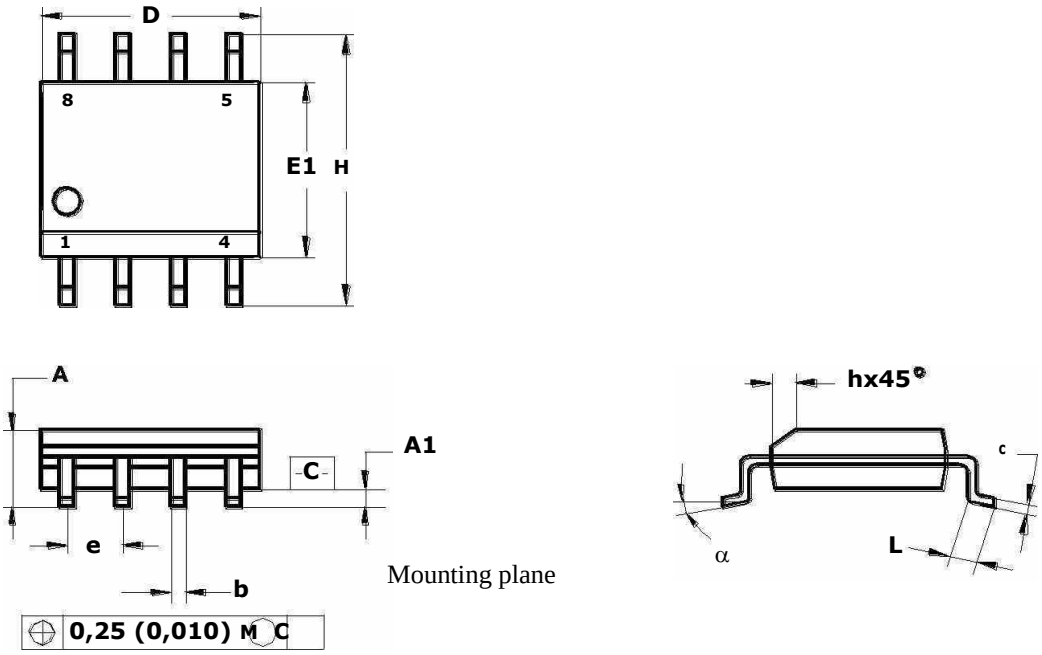


Figure 25. Wide Input Range Reference

Schematic Diagram



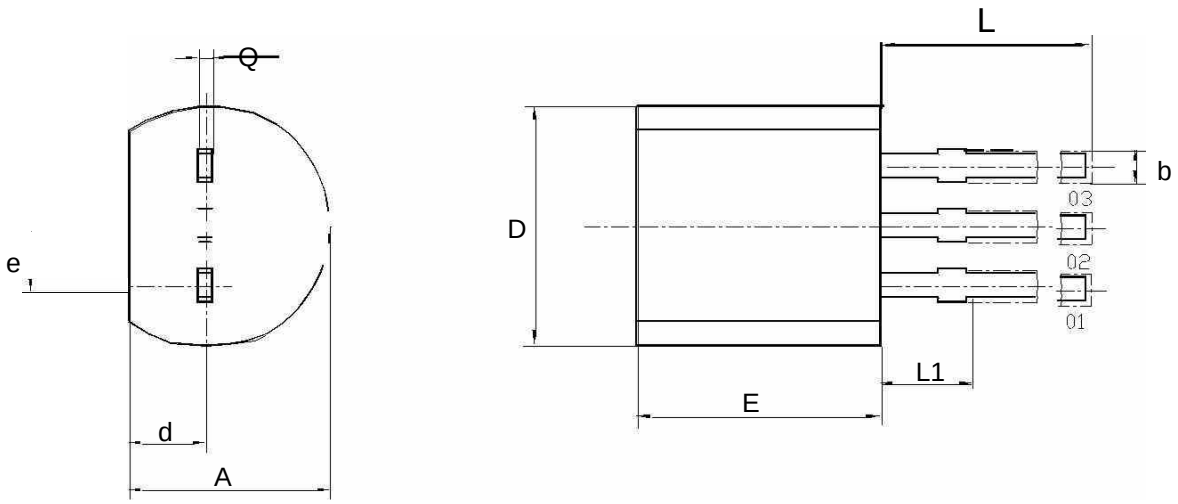
SOP8 150mil



Note – Dimensions D, E1 do not include the value of fin, which should not exceed 0,25 (0,010) per side.

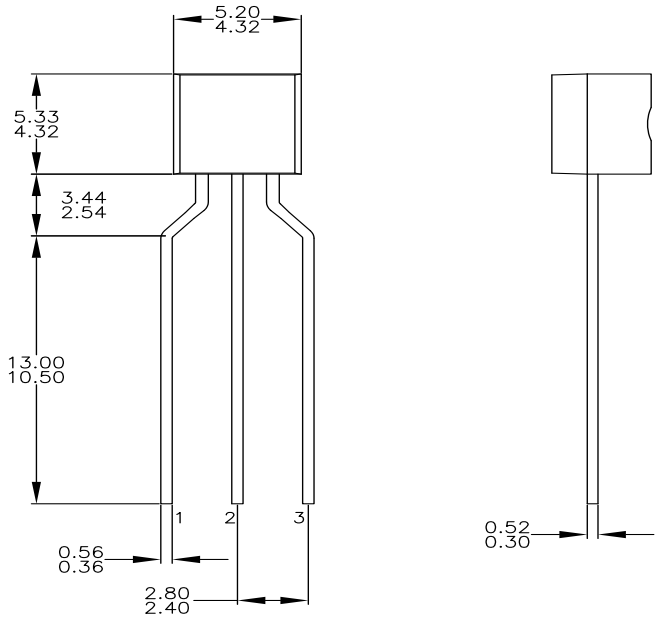
	D	E1	H	b	e	α	A	A1	c	L	h
Millimeters											
min	4.80	3.80	5.80	0.33		0°	1.35	0.10	0.19	0.41	0.25
max	5.00	4.00	6.20	0.51	1.27	8°	1.75	0.25	0.25	1.27	0.50
Inches											
min	0.1890	0.1497	0.2284	0.013		0°	0.0532	0.0040		0.016	0.0099
max	0.1968	0.1574	0.2440	0.020	0.100	8°	0.0688	0.0090		0.050	0.0196

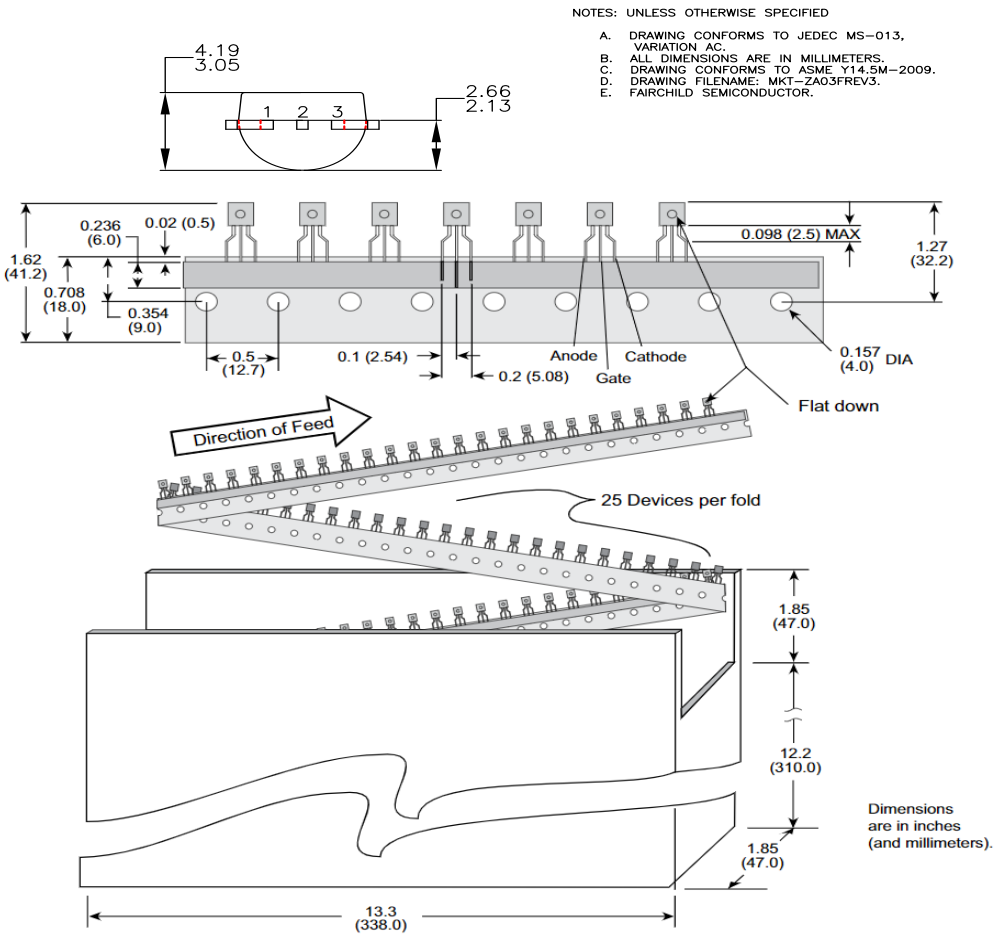
TO92



Dimensions	mm	
	min	max
E	4,6	5,1
b	-	0,5
D	4,6	5
d	1,25	1,65
A	3,5	3,8
e	1,2573	1,2827
L	12,5	14,5
L1	-	2
Q	-	0,5

TO-92-3L


5.20
4.32
5.33
4.32
3.44
2.54
13.00
10.50
1
2
3
0.56
0.36
2.80
2.40
0.52
0.30


NOTES: UNLESS OTHERWISE SPECIFIED
A. DRAWING CONFORMS TO JEDEC MS-013, VARIATION AC.
B. ALL DIMENSIONS ARE IN MILLIMETERS.
C. DRAWING CONFORMS TO ASME Y14.5M-2009.
D. DRAWING FILENAME: MKT-ZA03FREV3.
E. FAIRCHILD SEMICONDUCTOR.
4.19
3.05
2.66
2.13
1
2
3
0.236
(6.0)
0.02 (0.5)
1.62
(41.2)
0.708
(18.0)
0.354
(9.0)
0.098 (2.5) MAX
1.27
(32.2)
0.5
(12.7)
0.1 (2.54)
0.2 (5.08)
Anode
Gate
Cathode
0.157
(4.0)
DIA
Flat down
Direction of Feed
25 Devices per fold
1.85
(47.0)
12.2
(310.0)
1.85
(47.0)
13.3
(338.0)
Dimensions
are in inches
(and millimeters).

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