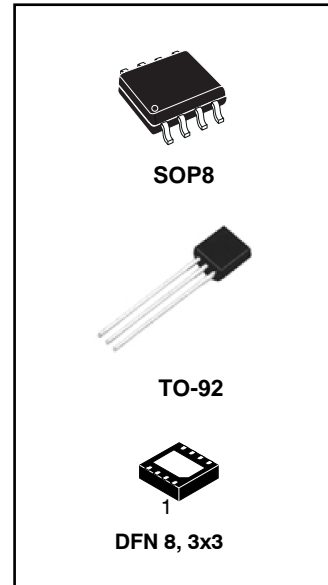


**DESCRIPTION**

The LM236 and LM336 are precision 5.0V regulator diodes. These voltage reference monolithic ICs operate like 5.0V zener diodes with a low temperature coefficient and a dynamic impedance of 0.6Ω. A third pin enables adjusting the reference voltage and the temperature coefficient.

**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
- Guaranteed temperature stability
- Easily trimmed for minimum temperature drift
- Fast turn-on
- Three lead transistor package

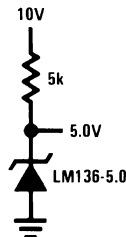


**ORDERING INFORMATION**

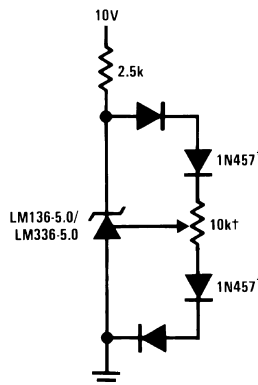
| DEVICE         | Package Type | MARKING | Packing | Packing Qty  |
|----------------|--------------|---------|---------|--------------|
| LM236M-5.0/TR  | SOP8L        | LM236-5 | Reel    | 2500pcs/reel |
| LM336M-5.0/TR  | SOP8L        | LM336-5 | Reel    | 2500pcs/reel |
| LM236Z-5.0     | TO-92        | LM236-5 | Tape    | 1000pcs/box  |
| LM336Z-5.0     | TO-92        | LM336-5 | Tape    | 1000pcs/box  |
| LM236DQ-5.0/TR | DFN-8        | LM236-5 | Reel    | 2500pcs/reel |
| LM336DQ-5.0/TR | DFN-8        | LM336-5 | Reel    | 2500pcs/reel |

**Typical Applications**

5.0V Reference

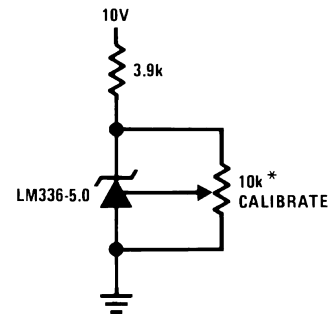


5.0V Reference with Minimum Temperature Coefficient



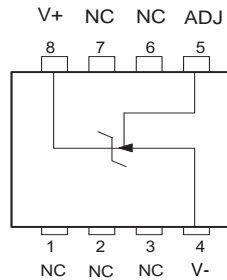
† Adjust to 5.00V  
\* Any silicon signal diode

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

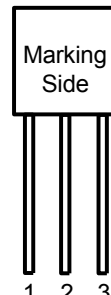


\* Does not affect temperature coefficient

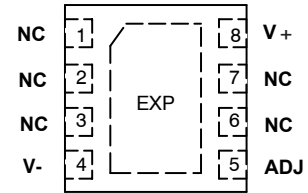
**PIN CONNECTIONS**



**S08**  
(Top view)



**TO-92 PKG**



**DFN-8 3\*3**  
(Top view)

**ABSOLUTE MAXIMUM RATINGS**

| Symbol         | Parameter                            | LM336  | Unit |
|----------------|--------------------------------------|--|------|
| $I_R$<br>$I_F$ | Current<br>Reverse<br>Forward        | 15<br>10                                     | mA   |
| $T_{oper}$     | Operating Free-air Temperature Range | LM336-5.0: 0 to +70<br>LM236-5.0: -40 to +85 | °C   |
| $T_{Stg}$      | Storage Temperature Range            | -65 to +150                                  | °C   |

SOP Package

Vapor Phase (60 sec.)

215°C

Infrared (15 sec.)

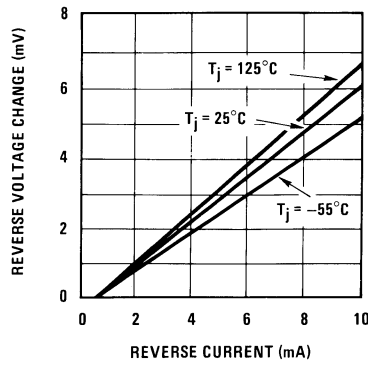
220°C

**ELECTRICAL CHARACTERISTICS**

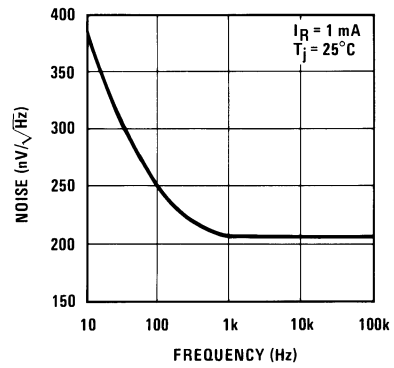
| Symbol       | Parameter   | LM236/LM336 |      |      | Unit     |
|--------------|---|-------------|------|------|----------|
|              |   | Min.        | Typ. | Max. |          |
| $V_R$        | Reference Breakdown Voltage<br>$T_{amb} = +25^\circ\text{C}$ , $I_R = 1\text{mA}$   | 4.9         | 5.0  | 5.1  | V        |
| $\Delta V_R$ | Reverse Breakdown Voltage Change with Current<br>$600\mu\text{A} \leq I_R \leq 10\text{mA}$<br>$T_{amb} = +25^\circ\text{C}$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$ | -           | 6    | 20   | mV       |
| $Z_D$        | Reverse Dynamic Impedance ( $I_R = 1\text{mA}$ )<br>$T_{amb} = +25^\circ\text{C}$ $f=100\text{Hz}$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                           | -           | 0.6  | 2.0  | $\Omega$ |
| $K_{VT}$     | Temperature Stability ( $V_R = 5.0\text{V}$ , $I_R = 1\text{mA}$ )  | -           | 4    | 12   | mV       |
| $K_{VH}$     | Long Term Stability ( $T_{amb} = +25^\circ\text{C} \pm 0.1^\circ\text{C}$ , $I_R = 1\text{mA}$ )  | -           | 20   | -    | ppm      |

## Typical Performance Characteristics

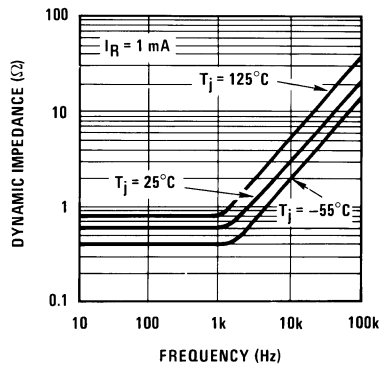
Reverse Voltage Change



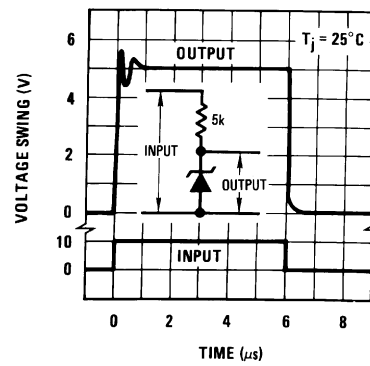
Zener Noise Voltage



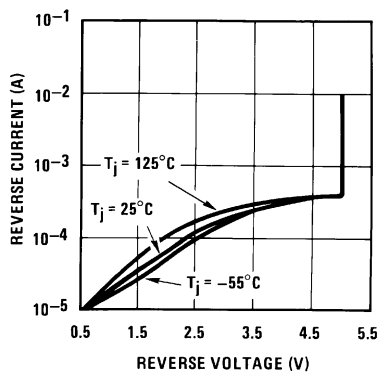
Dynamic Impedance



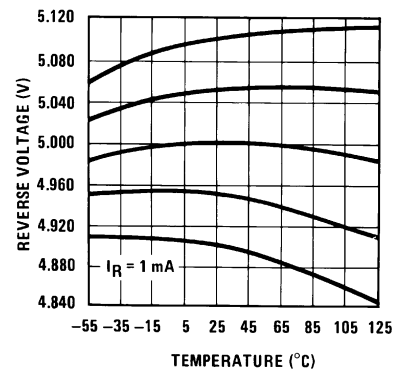
Response Time



Reverse Characteristics



Temperature Drift



Typical Performance Characteristics (Continued)

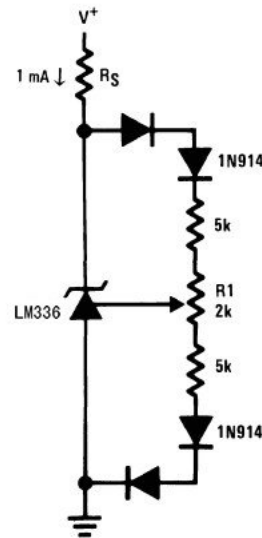
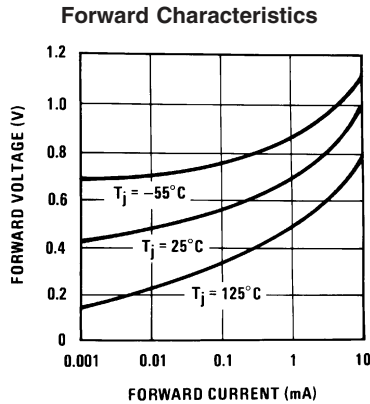


FIGURE 2. Temperature Coefficient Adjustment (Trim Range = ±0.5V Typical)

Application Hints

The LMx36-5.0 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 1 shows an LM336-5.0 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 2. 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 LM336-5.0. It is usually sufficient to mount the diodes near the LM336-5.0 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.

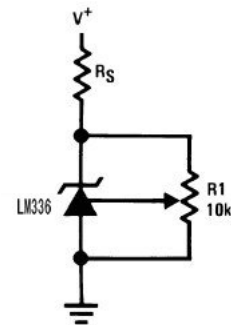
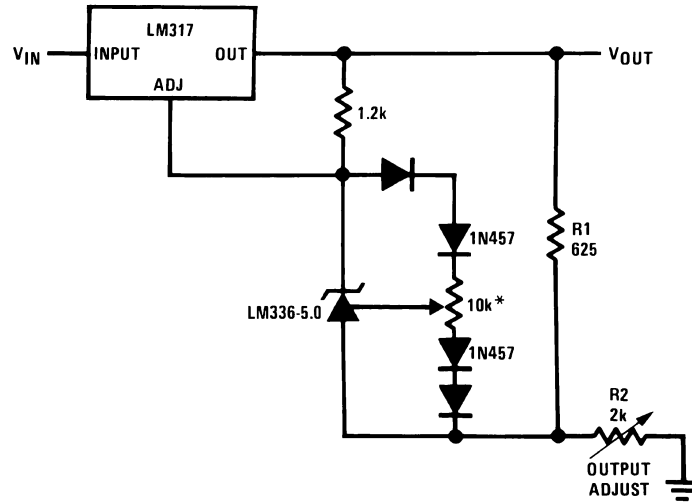


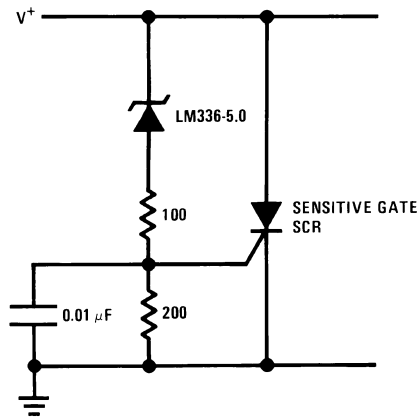
FIGURE 1. LM336-5.0 with Pot for Adjustment of Breakdown Voltage (Trim Range = ±1.0V Typical)

Typical Applications

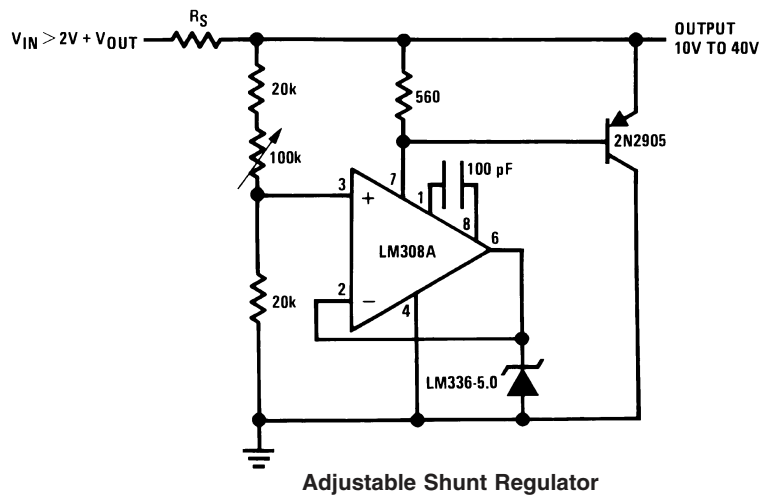


Precision Power Regulator with Low Temperature Coefficient

\* Adjust for 6.25V across R1

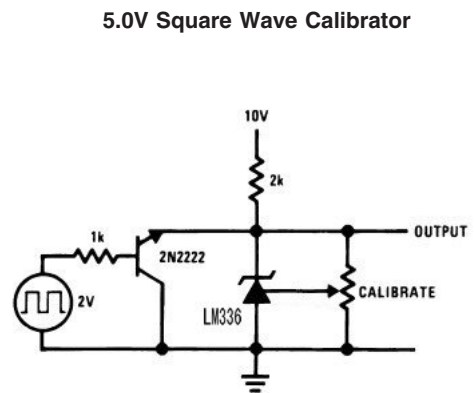
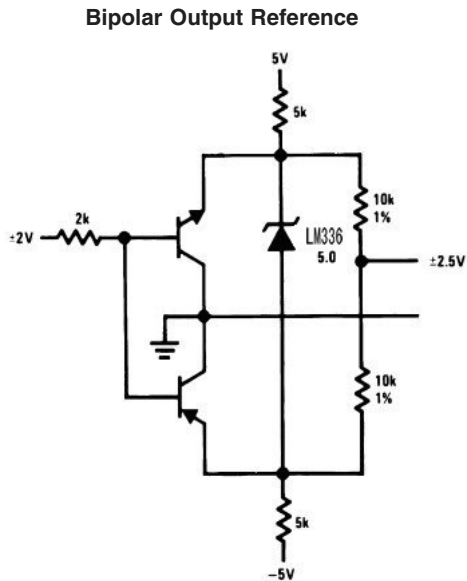
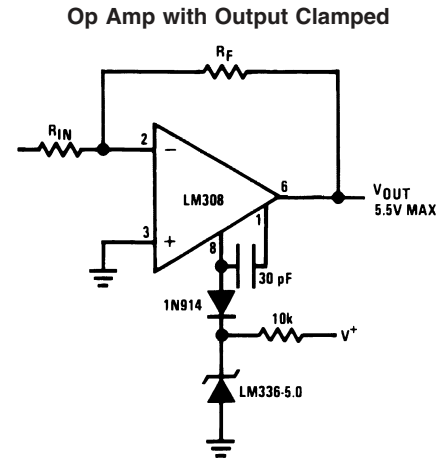
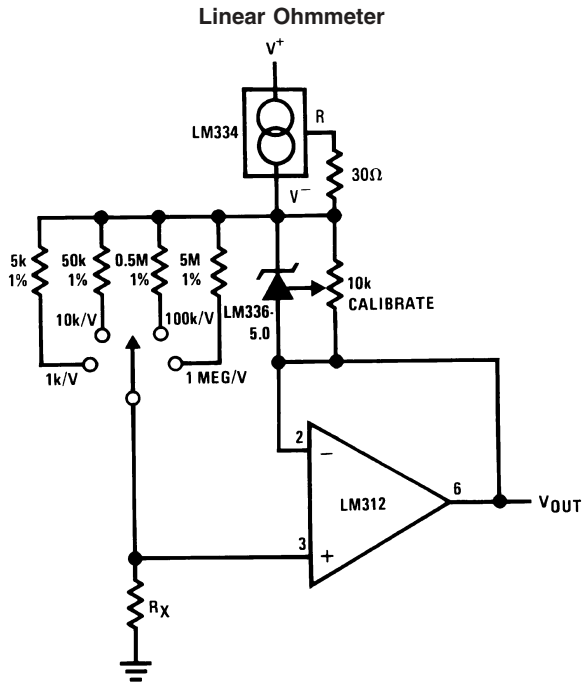


5V Crowbar



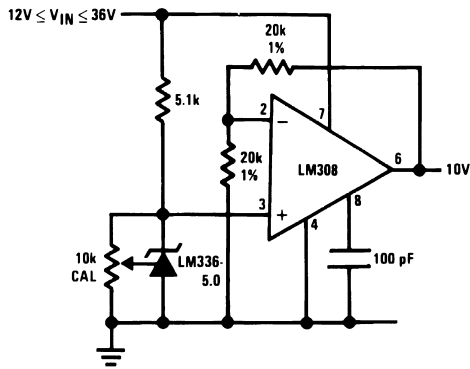
Adjustable Shunt Regulator

Typical Applications (Continued)

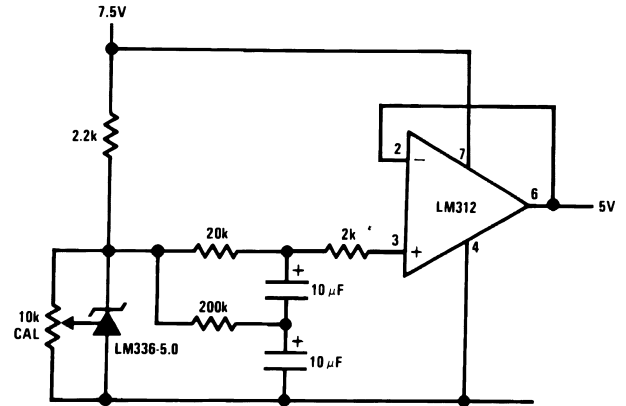


Typical Applications (Continued)

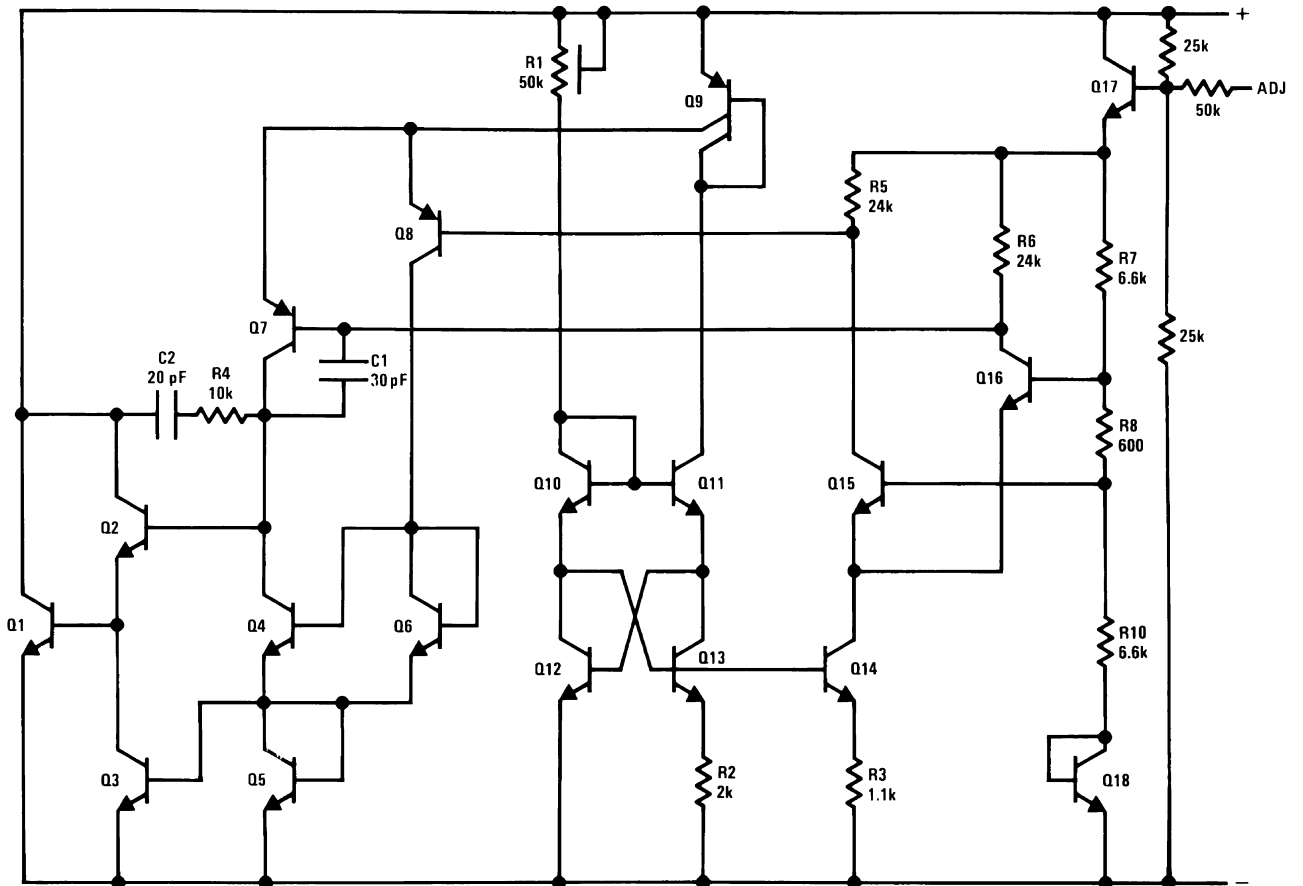
10V Buffered Reference



Low Noise Buffered Reference

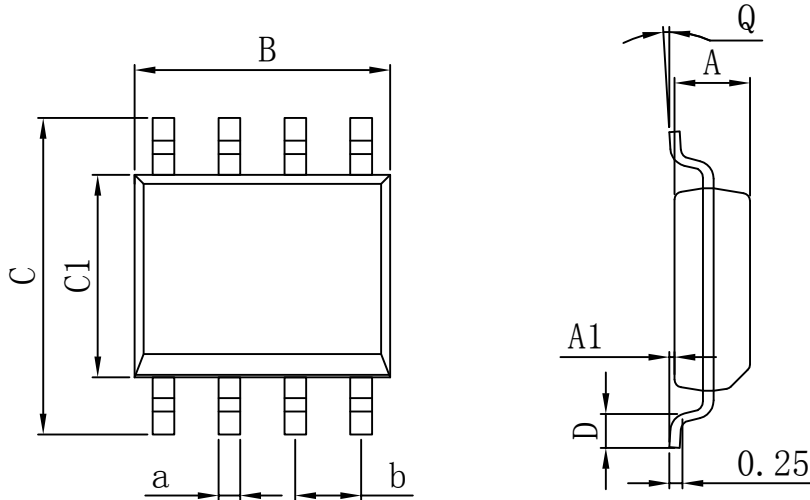


Schematic Diagram



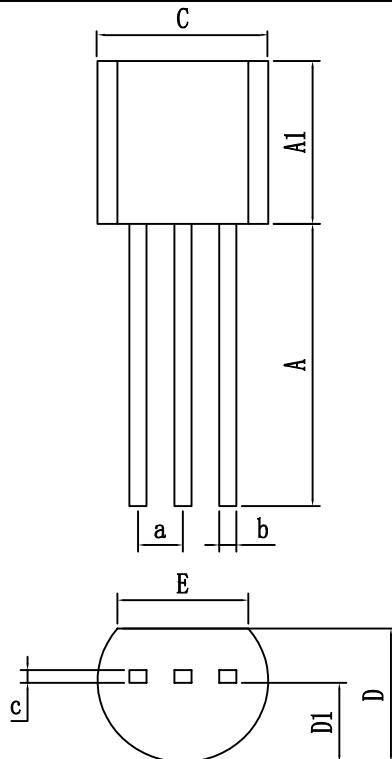
PACKAGE

SOP8



| Dimensions In Millimeters |       |       |          |           |       |
|---------------------------|-------|-------|----------|-----------|-------|
| Symbol :                  | Min : | Max : | Symbol : | Min :     | Max : |
| A                         | 1.225 | 1.570 | D        | 0.400     | 0.950 |
| A1                        | 0.100 | 0.250 | Q        | 0°        | 8°    |
| B                         | 4.800 | 5.100 | a        | 0.420 TYP |       |
| C                         | 5.800 | 6.250 | b        | 1.270 TYP |       |
| C1                        | 3.800 | 4.000 |          |           |       |

TO-92

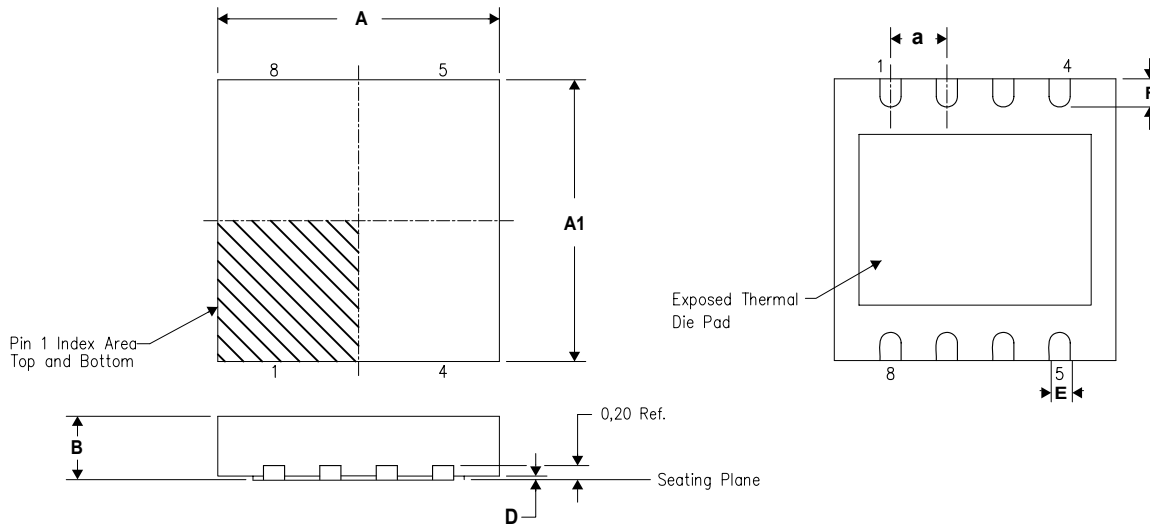


| Dimensions In Millimeters |        |        |          |           |       |
|---------------------------|--------|--------|----------|-----------|-------|
| Symbol :                  | Min :  | Max :  | Symbol : | Min :     | Max : |
| A                         | 11.200 | 12.700 | E        | 3.430     | 3.830 |
| A1                        | 4.320  | 5.340  | a        | 1.270 TYP |       |
| C                         | 4.440  | 5.210  | b        | 0.485 TYP |       |
| D                         | 3.170  | 4.190  | c        | 0.380 TYP |       |
| D1                        | 2.030  | 2.670  |          |           |       |



PACKAGE

DFN-8(3\*3)



| Dimensions In Millimeters |       |       |          |          |       |
|---------------------------|-------|-------|----------|----------|-------|
| Symbol :                  | Min : | Max : | Symbol : | Min :    | Max : |
| A                         | 2.900 | 3.100 | E        | 0.200    | 0.340 |
| A1                        | 2.900 | 3.100 | F        | 0.300    | 0.500 |
| B                         | 0.800 | 1.000 | a        | 0.65 TYP |       |
| D                         | 0.000 | 0.050 |          |          |       |

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