

# XL336-5.0 SOP-8/XT336-5.0 TO-92

### **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 Drift
- Fast Turn-on
- Three Lead Transistor Package

### **Connection Diagrams**

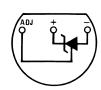


Figure 1. TO-92 Plastic Package (Bottom View)

### DESCRIPTION

The XL336-5.0 and XT336-5.0 integrated circuits are precision 5.0V shunt regulator diodes. These monolithic IC voltage references operate as a low temperature coefficient 5.0V zener with 0.6 $\Omega$  dynamic impedance. A third terminal on the XL336-5.0 allows the reference voltage and temperature coefficient to be trimmed easily.

The XL336-5.0 series is useful as a precision 5.0V low voltage reference for digital voltmeters, power supplies or op amp circuitry. The 5.0V makes it convenient to obtain a stable reference from low voltage supplies. Further, since the XL336-5.0 operates as a shunt regulator, it can be used as either a positive or negative voltage reference.

The XL336-5.0 is rated for operation over −55°C to +125°C while the XT336-5.0 is rated over a −25°C to +85°C temperature range. The XT336-5.0 is rated for operation over a 0°C to +70°C temperature range. See the Connection Diagrams for available packages. For applications requiring 2.5V see XL336-5.0.

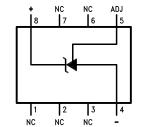


Figure 2. SOIC Package

## **Typical Applications**

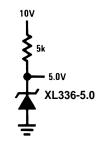


Figure 4. 5.0V Reference

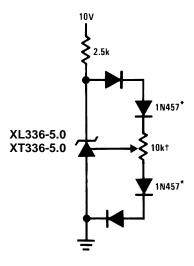
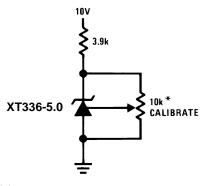


Figure 5. 5.0V Reference with Minimum **Temperature Coefficient** 



<sup>\*</sup> Does not affect temperature coefficient

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

<sup>†</sup> Adjust to 5.00V \* Any silicon signal diode

### **ABSOLUTE MAXIMUM RATINGS (1)**

Reverse Current	15	mA		
Forward Current	10	mA		
Storage Temperature	-60 to +150	°C		
Operating Temperature Range (2)				
	−55 to +150	°C		
XL336-5.0 / XT336-5.0	-25 to +85	°C		
	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		

<sup>(1)</sup> 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.

### THERMAL CHARACTERISTICS

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

		150°C	
	XL336-5.0 / XT336-5.0	125°C	
		100°C	
Thermal Resistance	TO-92	то	SOIC-8
$\theta_{ja}$ (Junction to Ambient)	180°C/W (0.4" Leads)	440°C/W	165°C/W
	170°C/W (0.125" Leads)		
θ <sub>ja</sub> (Junction to Case)	N/A	80°C/W	N/A

#### **ELECTRICAL CHARACTERISTICS**

Parameter	Conditions		XL336-5.0			XT336-5.0		
		Min	Тур	Max	Min	Тур	Max	
Reverse Breakdown Voltage	T <sub>A</sub> =25°C, I <sub>R</sub> =1 mA							
		4.9	5.00	5.1	4.8	5.00	5.2	V
	XL336-5.0 / XT336-5.0	4.95	5.00	5.05	4.90	5.00	5.1	V
Reverse Breakdown Change	T <sub>A</sub> =25°C,		6	12		6	20	mV
With Current	600 μA≤I <sub>R</sub> ≤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	V <sub>R</sub> Adjusted 5.00V							
(2)	I <sub>R</sub> =1 mA, (Figure 15)							
	0°C≤T <sub>A</sub> ≤70°C XL336-5.0)					4	12	mV

<sup>(1)</sup> Unless otherwise specified, the XL336-5.0 is specified from −55°C≤T<sub>A</sub>≤+125°C, the XT336-5.0 from −25°C≤T<sub>A</sub>≤+85°C and the XL336-5.0 from 0°C≤T<sub>A</sub>≤+70°C.

<sup>(2)</sup> For elevated temperature operation, Ti max see THERMAL CHARACTERISTICS

<sup>(2)</sup> Temperature stability for the XL336 and XT336 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<sub>REF</sub> from 25°C to T<sub>A</sub>(min) or T<sub>A</sub>(max).

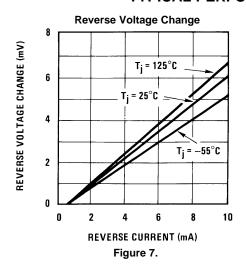
# XL336-5.0 SOP-8 XT336-5.0 TO-92

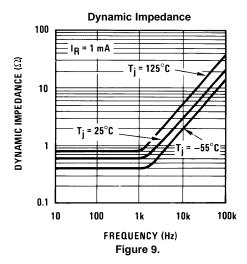
# **ELECTRICAL CHARACTERISTICS (continued)**

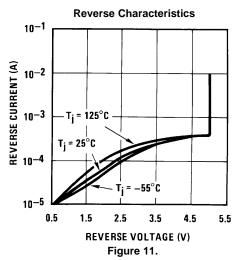
(1)

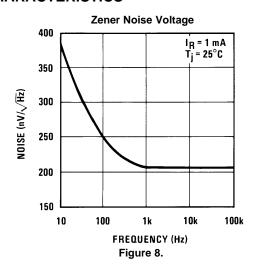
Parameter	Conditions	XL336-5.0			XT336-5.0			Units
			-25°C≤T <sub>A</sub> ≤+85°C (XL336-5.0)		7	18		
	-55°C≤T <sub>A</sub> ≤+125°C (XT336-5.0)		20	36				mV
Reverse Breakdown Change	600 μA≤I <sub>R</sub> ≤10 mA		6	17		6	24	mV
With Current								
Adjustment Range	Circuit of Figure 14		±1			±1		V
Reverse Dynamic Impedance	I <sub>R</sub> = 1 mA		0.8	1.6		0.8	2.5	Ω
Long Term Stability	$T_A=25^{\circ}C\pm0.1^{\circ}C$ , $I_R=1$ mA, $t=1000$ hrs		20			20		ppm

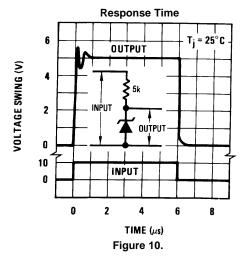
## TYPICAL PERFORMANCE CHARACTERISTICS

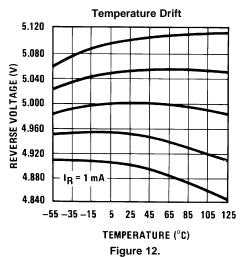




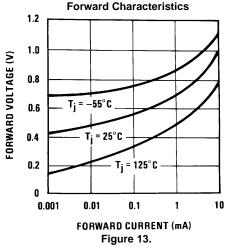








# TYPICAL PERFORMANCE CHARACTERISTICS (continued) Forward Characteristics



#### **APPLICATION HINTS**

The XL336-5.0 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 XL336-5.0 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 XL336-5.0. It is usually sufficient to mount the diodes near the XL336-5.0 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.

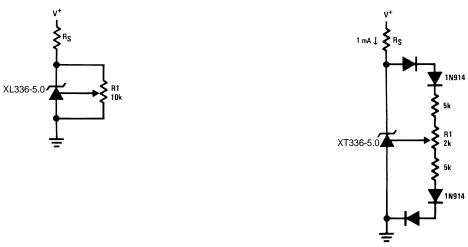
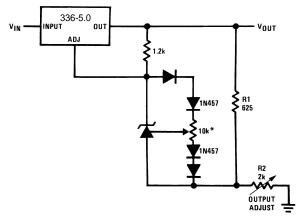


Figure 14. XL336-5.0 with Pot for Adjustment of Breakdown Voltage (Trim Range = ±1.0V Typical)

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

### **Typical Applications**



<sup>\*</sup> Adjust for 6.25V across R1

Figure 16. Precision Power Regulator with Low Temperature Coefficient

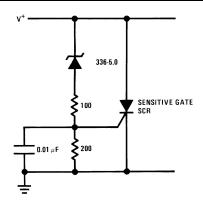


Figure 17. 5V Crowbar

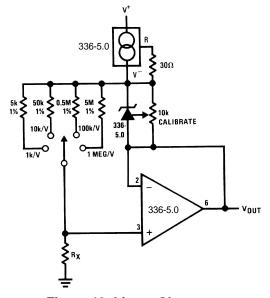


Figure 19. Linear Ohmmeter

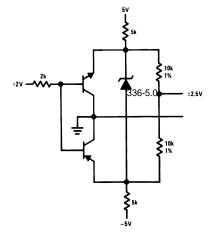


Figure 21. Bipolar Output Reference

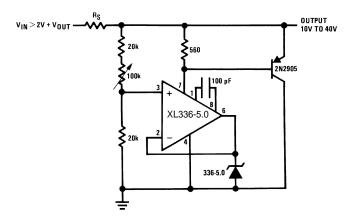


Figure 18. Adjustable Shunt Regulator

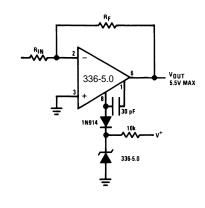


Figure 20. Op Amp with Output Clamped

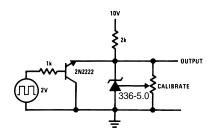
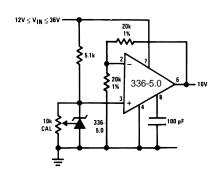


Figure 22. 5.0V Square Wave Calibrator



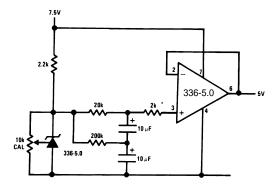


Figure 23. 10V Buffered Reference

Figure 24. Low Noise Buffered Reference

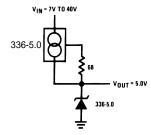
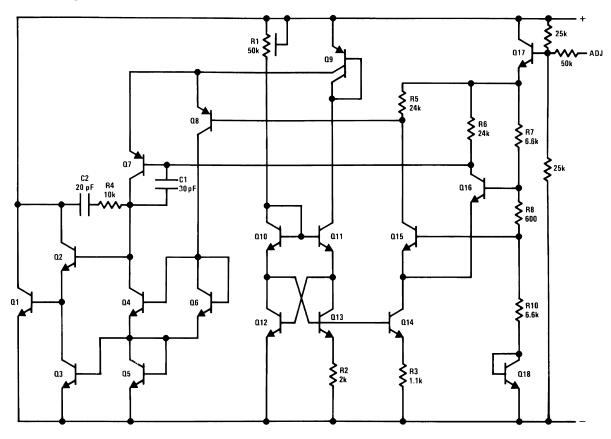


Figure 25. Wide Input Range Reference

# **Schematic Diagram**



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