PRECISION MICROPOWER SHUNT VOLTAGE REFERENCES

Description

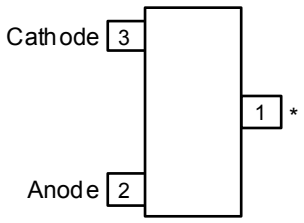
The ZXRE330 is a low knee current 3.3V voltage reference. Offering tight tolerances and sharp knee characteristics – consuming only 1µA when the 3.3V reference voltage can no longer be maintained.

Excellent performance is maintained over the 1µA to 5mA operating current range. The device has been designed to be highly tolerant of capacitive loads so maintaining excellent stability.

It's available in small outline SOT23 and TO92 packages This device offers a pin for pin compatible alternative to industry standard shunt voltage reference.

Pin Assignments

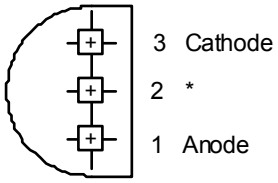
ZXRE330xSA (SOT23)



Top view

* Pin 1 must be left floating or connected to pin 2

ZXRE330xV (TO92)



(Top View)

* Pin 2 must be left floating or connected to pin 1

Features

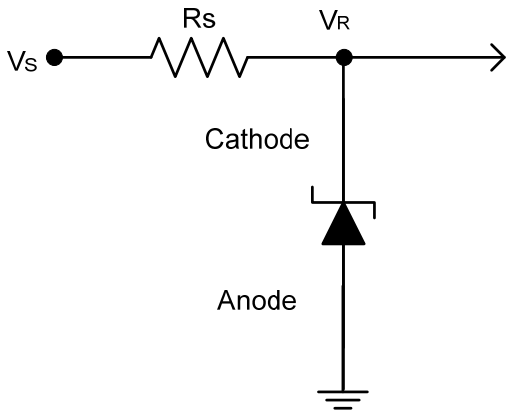
- Small packages: SOT23 & TO92
- No output capacitor required
- Output voltage tolerance
- ZXRE330E ±2% at +25°C
- ZXRE330A ±0.5% at +25°C
- Low output noise
  - (10Hz to 10 kHz)..... 55µV_{RMS}
- Wide operating current range 1µA to 5mA
- Extended temperature range -40°C to +85°C
- Low temperature coefficient 20ppm/°C (Typ)
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Applications

- Battery powered equipment
- Precision power supplies
- Portable instrumentation
- Portable communications devices
- Notebook and palmtop computers
- Data acquisition systems
- Low current voltage clamps

Notes: 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Typical Applications Circuit



Absolute Maximum Ratings (@T_A = +25°C, unless otherwise specified.) (Voltages to GND Unless Otherwise Stated)

Parameter	Rating	Unit
Continuous Reverse Current	10	mA
Continuous Forward Current	10	mA
Operating Junction Temperature	-40 to +150	°C
Storage Temperature	-65 to +150	°C

Note: 4. Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum rating, for extended periods, may reduce device reliability. Unless otherwise stated voltages specified are relative to the ANODE pin.

Package Thermal Data

Package	θ_{JA}	P_{DIS} T_{AMB} = +25°C, T_J = +150°C
SOT23	415°C/W	300mW
TO92	180°C/W	700mW

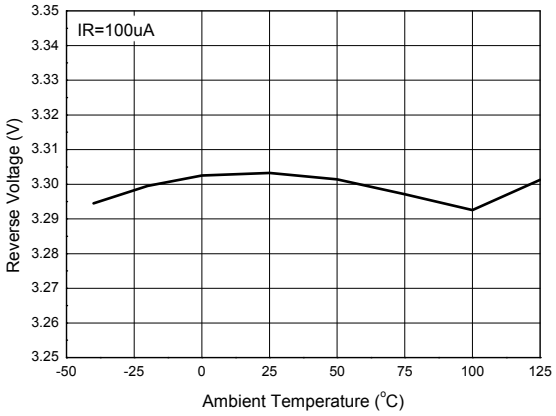
Recommended Operating Conditions (@T_A = +25°C, unless otherwise specified.)

Parameter	Min.	Max.	Units
Reverse Current	0.002	5	mA
Operating Ambient Temperature Range	-40	+85	°C

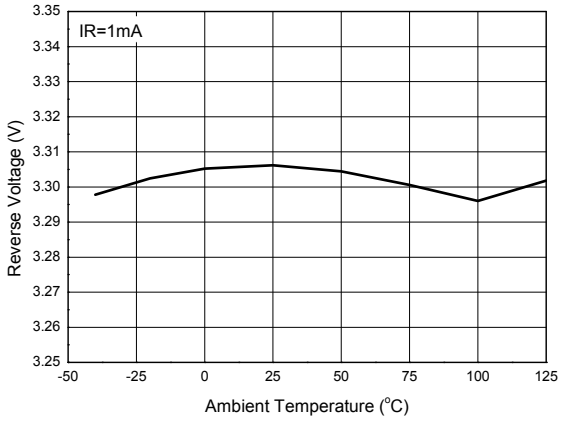
Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Conditions	T_{AMB}		Typ.	E Limits	Units
V_{REF}	Reverse breakdown voltage	I_R = 100µA	+25°C		3.3	—	V
	Reverse breakdown voltage tolerance	I_R = 100µA	+25°C	ZXRE330A	—	±16.5	mV
				ZXRE330E		±66	
			-40 to +85°C			±99	
I_{ROFF}	Off state reverse current	V = V_{REF} *0.9	+25°C		0.5	—	µA
			-40 to +85°C		—	1	
$\Delta V_R/\Delta T$	Average reverse breakdown voltage temperature coefficient	I_R = 5mA	-40 to +85°C		±20	—	—
		I_R = 100µA			±15	±150	ppm/°C
		I_R = 10µA			±15	—	—
ΔV_R	Reverse breakdown change with current	2uA <I_R < 100uA	25°C		0.2	—	mV
			-40 to +85°C		—	0.6	
		100uA < I_R < 5mA	25°C		10	—	
			-40 to +85°C		—	20	
I_{RMIN}	Minimal Operating Current	—			1	2	µA
Z_R	Dynamic output impedance	I_R = 2mA, f = 120Hz, I_{AC} = 0.1I_R			2	—	Ω
e_n	Noise voltage	I_R = 100µA 10Hz < f < 10kHz			55	—	μV_{RMS}
V_R	Long term stability (non cumulative)	t = 1000Hrs, I_R = 100µA			—	—	ppm
V_{HYST}	Thermal hysteresis	ΔT = -40°C to +85°C			0.08	—	%

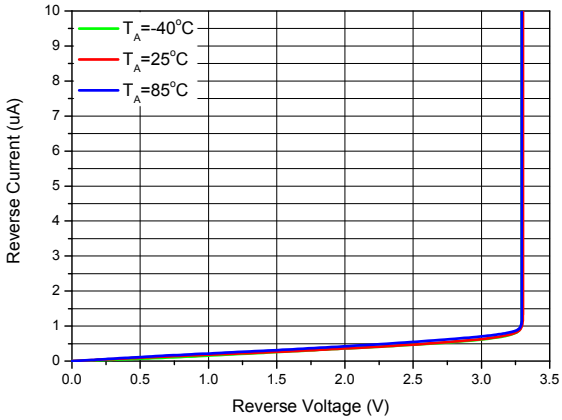
Typical Characteristics



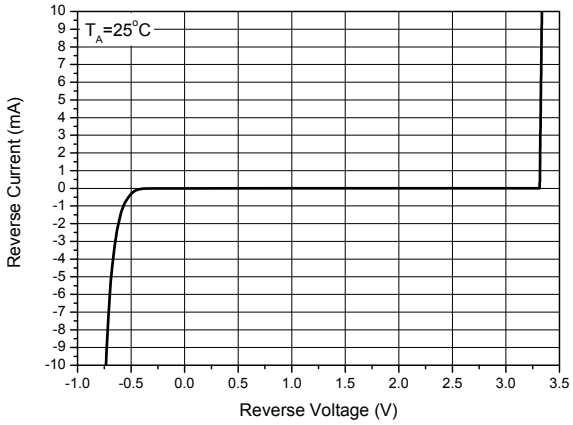
Reverse Breakdown Voltage Temperature Coefficient



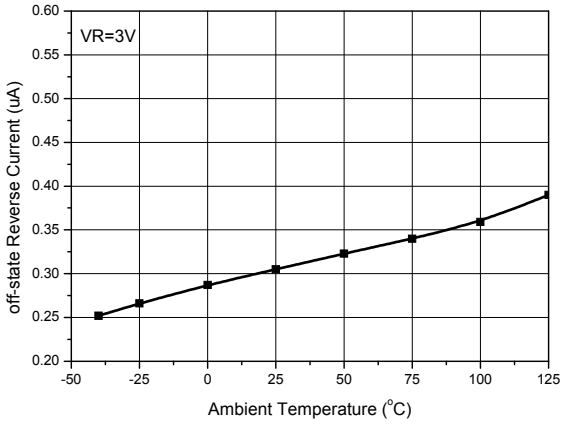
Reverse Breakdown Voltage Temperature Coefficient



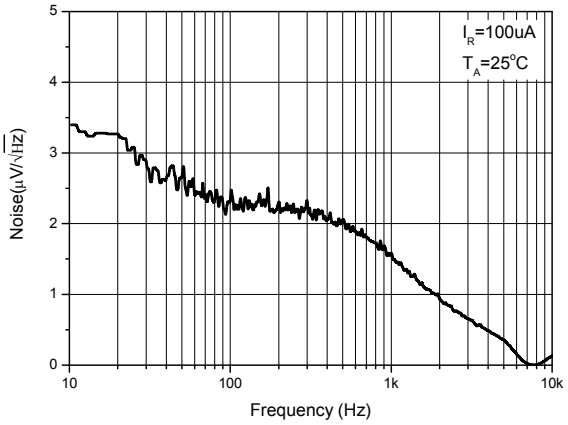
Minimal Operating Current



Reverse Current vs. Reverse Voltage

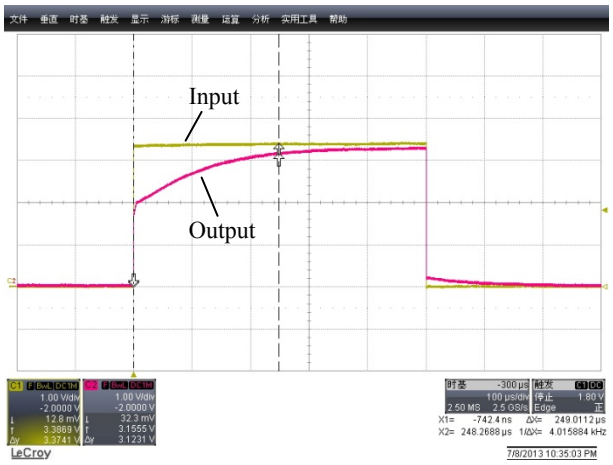


Off-state Reverse Current vs. Temperature

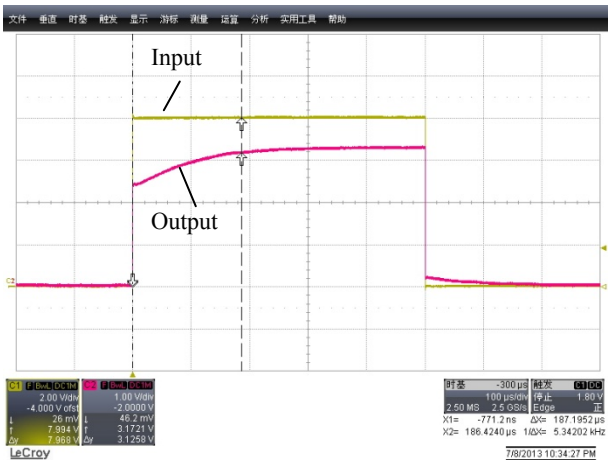


Noise Voltage vs. Frequency

Start Up Characteristics ZXRE330



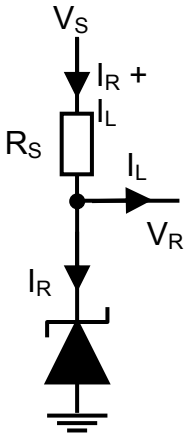
I_R=100µA, No Load Capacitor



I_R=5mA, No Load Capacitor

Application Information

In a conventional shunt regulator application (*Figure 1*), an external series resistor (R_S) is connected between the supply voltage, V_S, and the ZXRE330.



R_S determines the current that flows through the load (I_L) and the ZXRE330 (I_R). Since load current and supply voltage may vary, R_S should be small enough to supply at least the minimum acceptable I_R to the ZXRE330 even when the supply voltage is at its minimum and the load current is at its maximum value. When the supply voltage is at its maximum and I_L is at its minimum, R_S should be large enough so that the current flowing through the ZXRE330 is less than 10 mA.

R_S is determined by the supply voltage, (V_S), the load and operating current, (I_L and I_R), and the ZXRE330's reverse breakdown voltage, V_R.

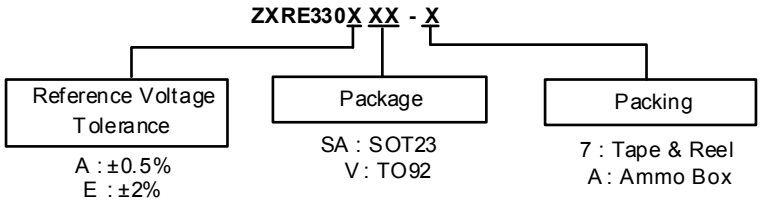
$$R_S = \frac{V_S - V_R}{I_L + I_R}$$

Printed circuit board layout considerations

ZXRE330 in the SOT23 package have the die attached to pin 1, which results in an electrical contact between pin 2 and pin 3. Therefore, pin 1 of the SOT23 package must be left floating or connected to pin 2.

ZXRE330 in the TO92 package have the die attached to pin 2, which results in an electrical contact between pin 2 and pin 1. Therefore, pin 2 must be left floating or connected to pin1.

Ordering Information



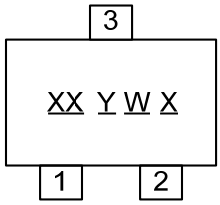
Part Number	Package Code	Packaging	7" Tape and Reel		Ammo Box	
			Quantity	Part Number Suffix	Quantity	Part Number Suffix
ZXRE330ASA-7	SA	SOT23	3000/Tape & Reel	-7	NA	NA
ZXRE330ESA-7	SA	SOT23	3000/Tape & Reel	-7	NA	NA
ZXRE330AV-A	V	TO92	NA	NA	2000/Box	A
ZXRE330EV-A	V	TO92	NA	NA	2000/Box	A

Note: 5. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at http://www.diodes.com/datasheets/ap02001.pdf

Marking Information

(1) SOT23

(Top View)

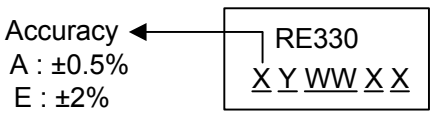


XX : Identification code
Y : Year 0~9
W : Week : A~Z : 1~26 week;
a~z : 27~52 week; z represents 52 and 53 week
X : Internal Code

Part Number	Package	Identification Code
ZXRE330ASA-7	SOT23	DC
ZXRE330ESA-7	SOT23	DD

(2) TO92

(Top View)

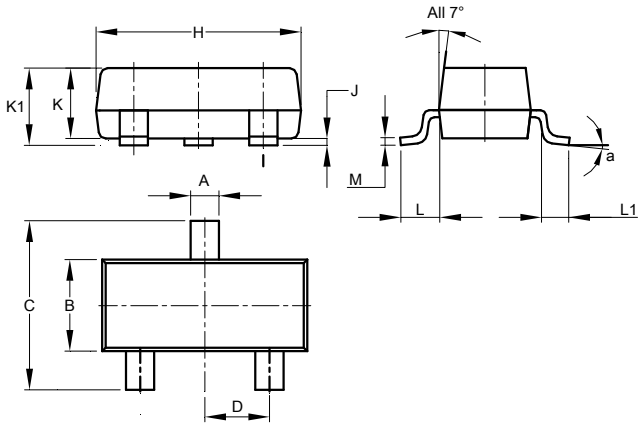


Y : Year : 0~9
WW : Week : 01~52; 52 represents 52 and 53 week
XX : Internal Code

Package Outline Dimensions (All dimensions in mm.)

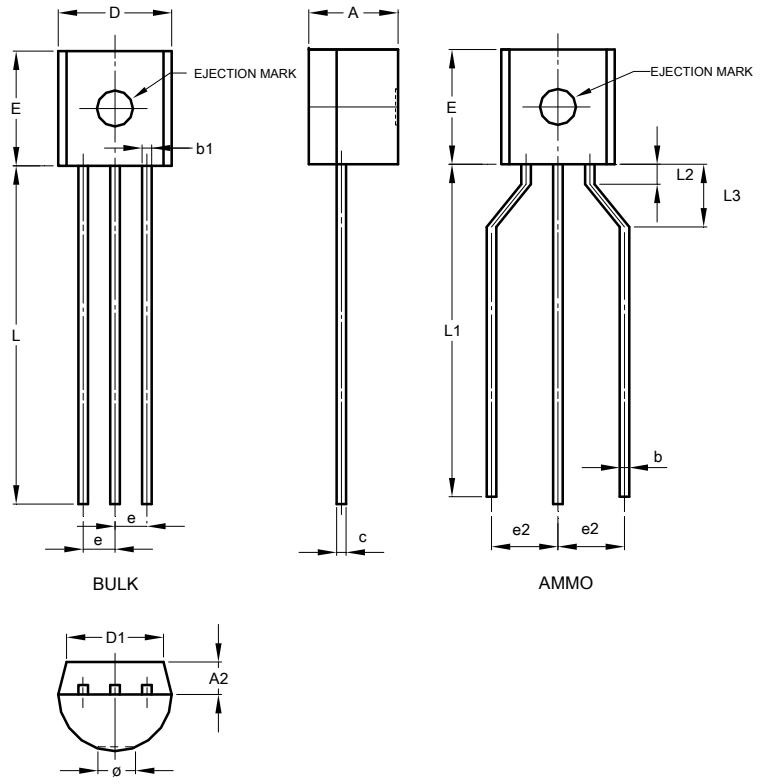
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.

SOT23



SOT23			
Dim	**Min**	**Max**	**Typ**
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	8°		
All Dimensions in mm			

TO92

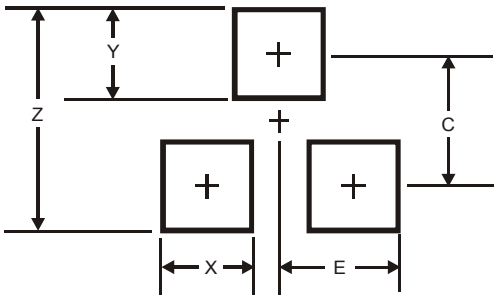


TO92			
Dim	**Min**	**Max**	**Typ**
A	3.45	3.66	-
A2	1.22	1.37	-
b	-	-	0.38
c	-	-	0.38
D	4.27	4.78	-
D1	-	-	3.87
E	4.32	4.83	-
e	-	-	1.27
e2	2.40	2.90	-
L	12.98	15.00	-
L1	12.80	15.00	-
L2	0.80	-	-
L3	2.00	3.00	-
All Dimensions in mm			

Suggested Pad Layout

Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version.

SOT23



Dimensions	Value (in mm)
Z	2.9
X	0.8
Y	0.9
C	2.0
E	1.35

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