PRECISION MICROPOWER SHUNT VOLTAGE REFERENCES

Description

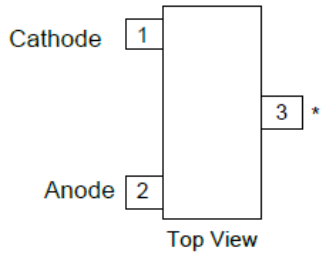
The ZXRE330 is a low knee current 3.3V voltage reference. Offering tight tolerances and sharp knee characteristics, it consumes only 1µA when the 3.3V reference voltage can no longer be maintained.

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 is 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

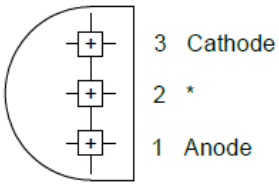
ZXRE330xSA (SOT23)



Top View

* Pin 3 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

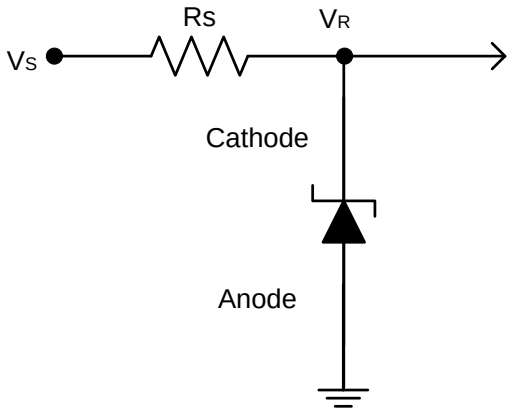
- Small Packages: SOT23 & TO92
- No Output Capacitor Required
- Output Voltage Tolerance
  - ZXRE330E: ±2% at +25°C
  - ZXRE330A: ±0.5% at +25°C
- Low Output Noise
  - 55µV_{RMS} (10Hz to 10kHz)
- Wide Operating Current Range 1µA to 5mA
- Extended Temperature Range -40°C to +85°C
- Low Temperature Coefficient 20ppm/°C (typ)
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

Applications

- Battery-powered equipment
- Precision power supplies
- Portable instrumentation
- Portable communications devices
- Notebooks 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) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ 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 (Note 4) (@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. Stresses greater than those listed under *Absolute Maximum Ratings* can cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to *Absolute Maximum Ratings* for extended periods can affect 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

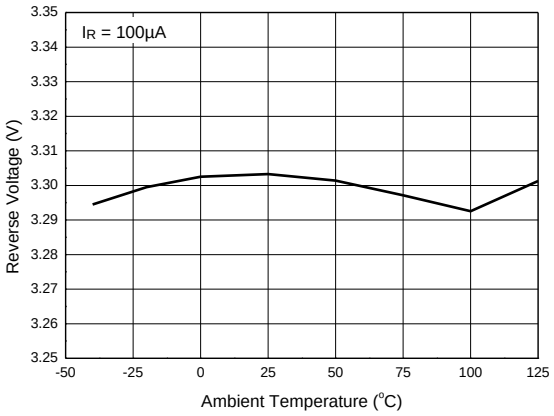
Recommended Operating Conditions (@T_A = +25°C, unless otherwise specified.)

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

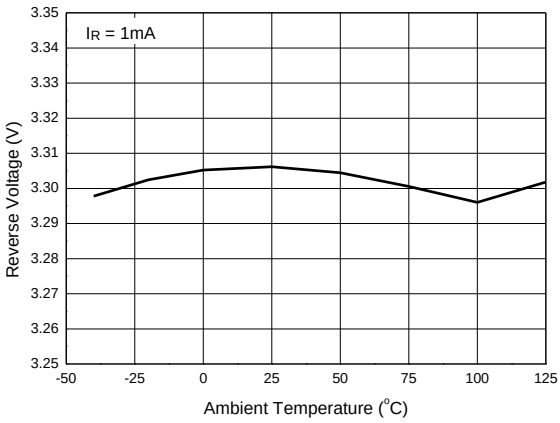
Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Conditions			Typ	E Limits	Units
		—	T_{AMB}				
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} x 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	2µA < I_R < 100µA	+25°C		0.2	—	mV
			-40 to +85°C		—	0.6	
		100µA < 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	—	%

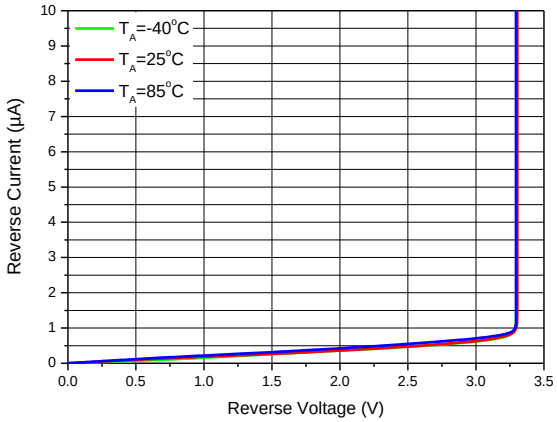
Typical Characteristics



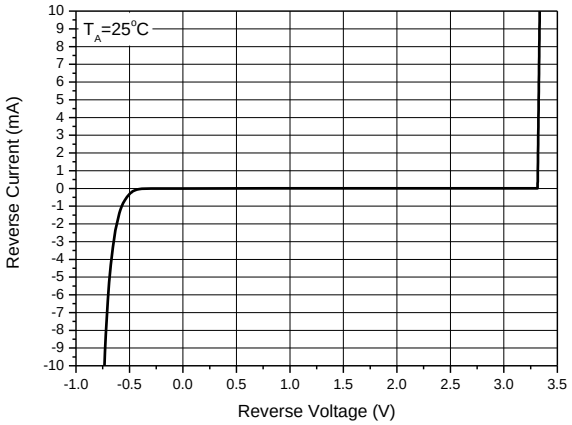
Reverse Breakdown Voltage Temperature Coefficient



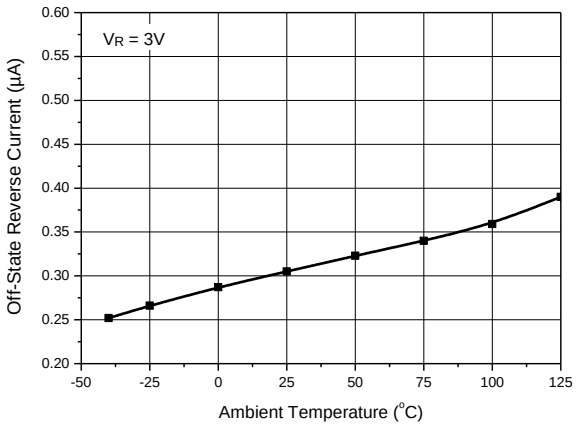
Reverse Breakdown Voltage Temperature Coefficient



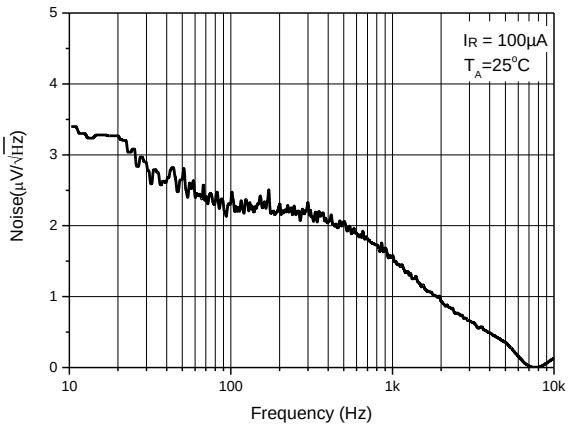
Minimal Operating Current



Reverse Current vs. Reverse Voltage

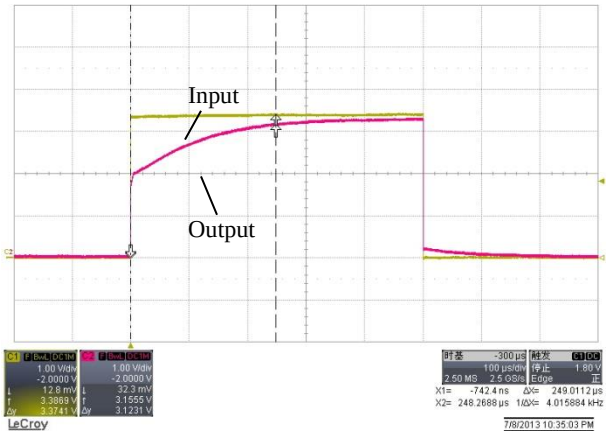


Off-State Reverse Current vs. Temperature

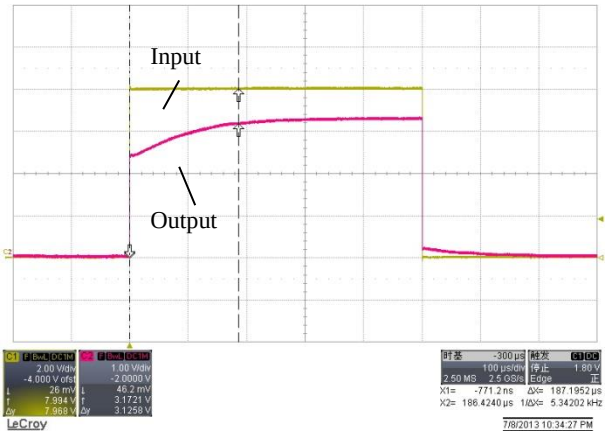


Noise Voltage vs. Frequency

Startup 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.

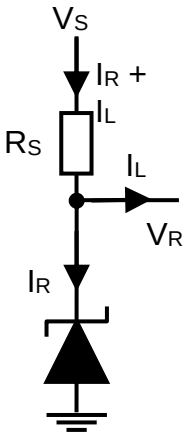


Figure 1

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 10mA.

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.

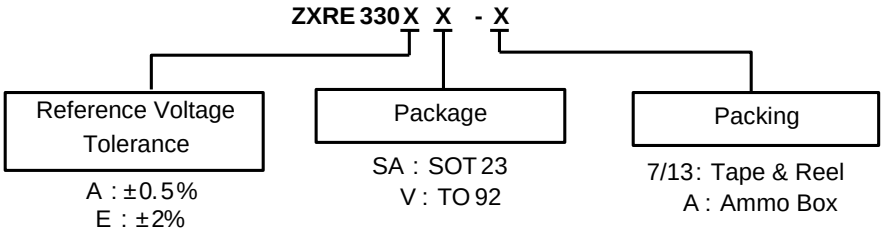
$$R_S = \frac{V_S - V_R}{I_L + I_R}$$

Printed Circuit Board Layout Considerations

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

ZXRE330 in the TO92 package has 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



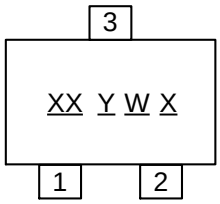
Part Number	Part Number Suffix	Package Code	Status	Package	Packing	
					Qty.	Carrier
ZXRE330ASA-7	-7	SA	Production	SOT23	3,000	Tape & Reel
ZXRE330ESA-7	-7	SA	Production	SOT23	3,000	Tape & Reel
ZXRE330ASA-13	-13	SA	Production	SOT23	10,000	Tape & Reel
ZXRE330ESA-13	-13	SA	Production	SOT23	10,000	Tape & Reel
ZXRE330AV-A	-A	V	NRND*	TO92	2,000	Ammo Box
ZXRE330EV-A	-A	V	NRND*	TO92	2,000	Ammo Box

* NRND = Not Recommended for New Design.

Marking Information

(1) SOT23

(Top View)

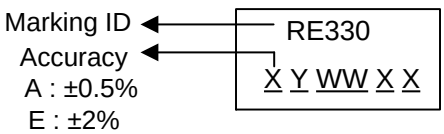


XX : Identification Code
Y : Year 0 to 9 (ex: 3 = 2023)
W : Week : A to Z : week 1 to 26;
a to z : week 27 to 52; z represents week 52 and 53
X : Internal Code

Part Number	Package	Identification Code
ZXRE330ASA-7	SOT23	DC
ZXRE330ASA-13		
ZXRE330ESA-7	SOT23	DD
ZXRE330ESA-13		

(2) TO92

(Top View)

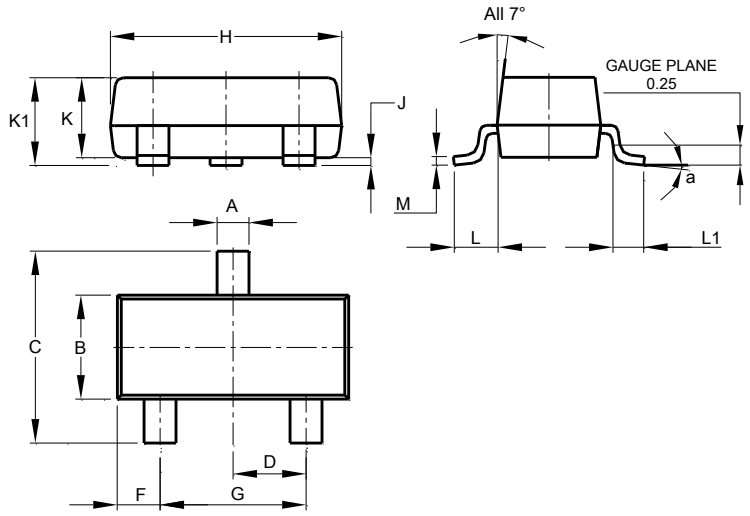


Y : Year : 0 to 9 (ex: 3 = 2023)
WW : Week : 01 to 52; 52 represents week 52 and 53
XX : Internal Code

Package Outline Dimensions

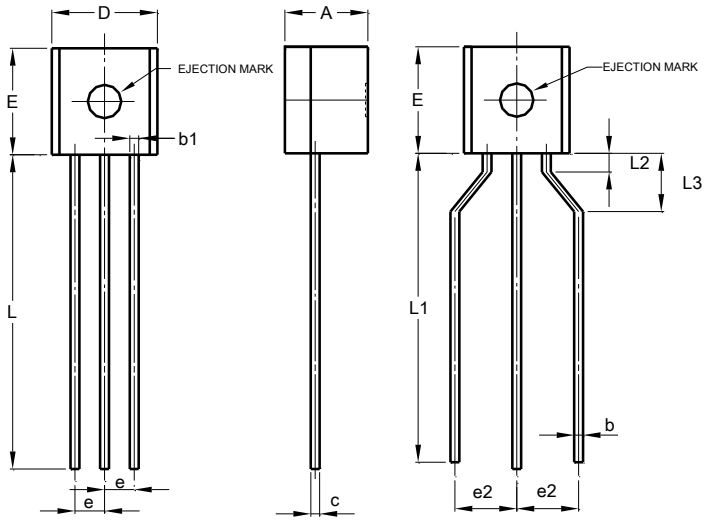
Please see http://www.diodes.com/package-outlines.html for the latest version.

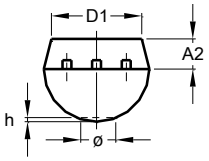
SOT23



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	0°	8°	--
All Dimensions in mm			

TO92



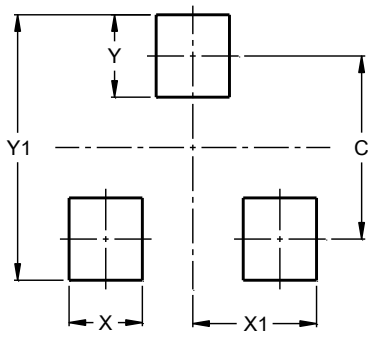


TO92			
Dim	**Min**	**Max**	**Typ**
A	3.45	3.66	-
A2	1.22	1.37	-
b	-	-	0.38
c	-	-	0.38
D	4.27	4.78	-
D1	-	-	3.87
E	4.32	4.83	-
e	-	-	1.27
e2	2.40	2.90	-
L	12.98	15.00	-
L1	12.80	15.00	-
L2	0.80	-	-
L3	2.00	3.00	-
All Dimensions in mm			

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

SOT23



Dimensions	Value (in mm)
C	2.0
X	0.8
X1	1.35
Y	0.9
Y1	2.9

Mechanical Data

- Moisture Sensitivity: SOT23, Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 e3
- Weight: SOT23, 0.009 grams (Approximate)
  TO92, 0.157 grams (Approximate)

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