

**AUTOMOTIVE COMPLIANT LOW KNEE CURRENT 3.3V VOLTAGE REFERENCE**

**Description**

The ZRC330Q uses a bandgap circuit design to achieve a precision micropower voltage reference of 3.3 volts. The device is available in a small outline surface mount package, ideal for applications where space saving is important.

The ZRC330Q design provides a stable voltage without an external capacitor and is stable with capacitive loads. The ZRC330Q is recommended for operation between 20µA and 5mA, and so is ideally suited to low power and battery powered applications.

Excellent performance is maintained to an absolute maximum of 25mA, however the rugged design and 20 volt processing allows the reference to withstand transient effects and currents up to 200mA. Superior switching capability allows the device to reach stable operating conditions in only a few microseconds.

The ZRC330Q has been qualified to AEC-Q100 Grade 1 and is Automotive Compliant supporting PPAPs.

**Features**

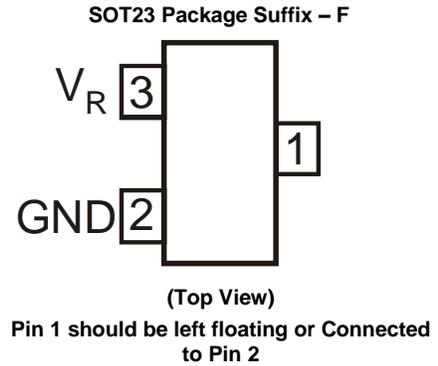
- Temperature Range: -40°C to +125°C
- Low Knee Current, 15µA Typical
- Reference Voltage Tolerance at +25°C
  - 1%: ZRC330QF01
  - 2%: ZRC330QF02
- No Stabilizing Capacitor Required
- Typical Slope Resistance: 0.6Ω
- ±1% Tolerance
- Operating Current 20µA to 5mA
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q100 Standards for High Reliability**
  - **AEC-Q100 Grade 1**
  - **PPAP Capable (Note 4)**

**Applications**

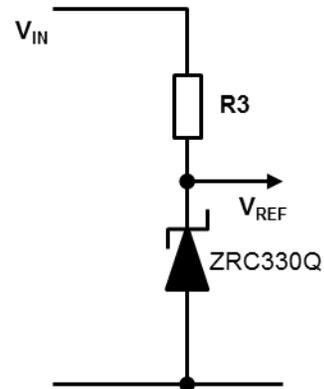
- Automotive Measurement Systems
- Automotive Instrumentation
- Automotive Reference
- Automotive Data Acquisition Systems
- Precision Power Supplies

- 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](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.
  4. Automotive products are AEC-Q100 qualified and are PPAP capable. Refer to [http://www.diodes.com/quality/product\\_compliance\\_definitions/](http://www.diodes.com/quality/product_compliance_definitions/).

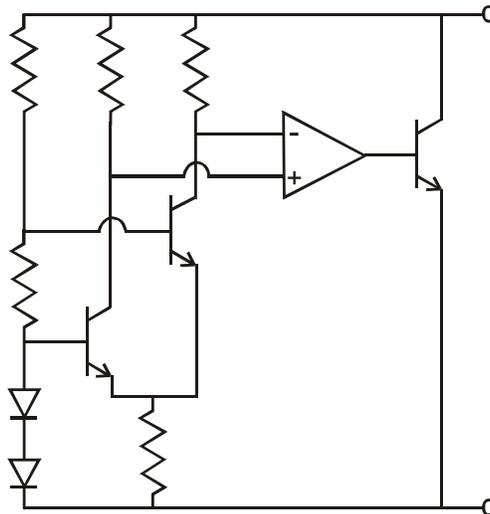
**Pin Assignments**



**Typical Application Circuit**



## Functional Block Diagram



## Absolute Maximum Ratings

Parameter		Rating	Unit
Reverse Current		25	mA
Forward Current		25	mA
Junction Temperature		+150	°C
Storage Temperature		-55 to +125	°C
ESD Susceptibility			
HBM	Human Body Model	4	kV
MM	Machine Model	100	V
CDM	Charged Device Model	1	kV

Caution: Stresses greater than the 'Absolute Maximum Ratings' specified above, may cause permanent damage to the device. These are stress ratings only; functional operation of the device at conditions between maximum recommended operating conditions and absolute maximum ratings is not implied. Device reliability may be affected by exposure to absolute maximum rating conditions for extended periods of time.

(Semiconductor devices are ESD sensitive and may be damaged by exposure to ESD events. Suitable ESD precautions should be taken when handling and transporting these devices.)

## Package Thermal Data

Package	$\theta_{JA}$	$P_{DIS}$
SOT23 ( $T_A = +25^\circ\text{C}$ , $T_J = +125^\circ\text{C}$ )	380°C/W	260mW

## Recommended Operating Conditions

Parameter	Rating	Unit
Reverse Current	5	mA
Ambient Temperature	-40 to +125	°C
Junction Temperature	-40 to +125	°C

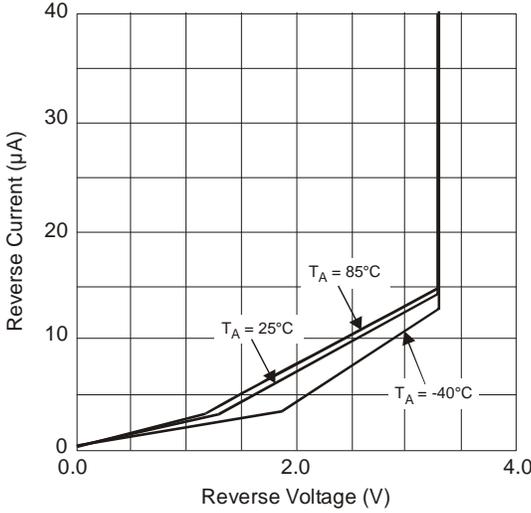
**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit	
V <sub>R</sub>	Reverse Breakdown Voltage	I <sub>R</sub> = 150μA	ZRC330QF01	3.27	3.3	3.33	V
			ZRC330QF02	3.234	—	3.366	
I <sub>MIN</sub>	Minimum Operating Current	—	—	15	20	μA	
I <sub>R</sub>	Recommended Operating Current	—	0.02	—	5	mA	
T <sub>C</sub>	Average Reverse Breakdown Voltage Temperature Coefficient (Note 5)	I <sub>R(MIN)</sub> to I <sub>R(MAX)</sub>	—	15	50	ppm/°C	
			—	0.6	2		
R <sub>S</sub>	Slope resistance (Note 6)	—	—	0.6	2	Ω	
Z <sub>R</sub>	Reverse Dynamic Impedance	I <sub>R</sub> = 1mA, f = 100Hz I <sub>AC</sub> = 0.1I <sub>R</sub>	—	0.5	1.2	Ω	
E <sub>N</sub>	Wideband Noise Voltage	I <sub>R</sub> = 150μA, f = 10Hz to 10kHz	—	75	—	μV(rms)	

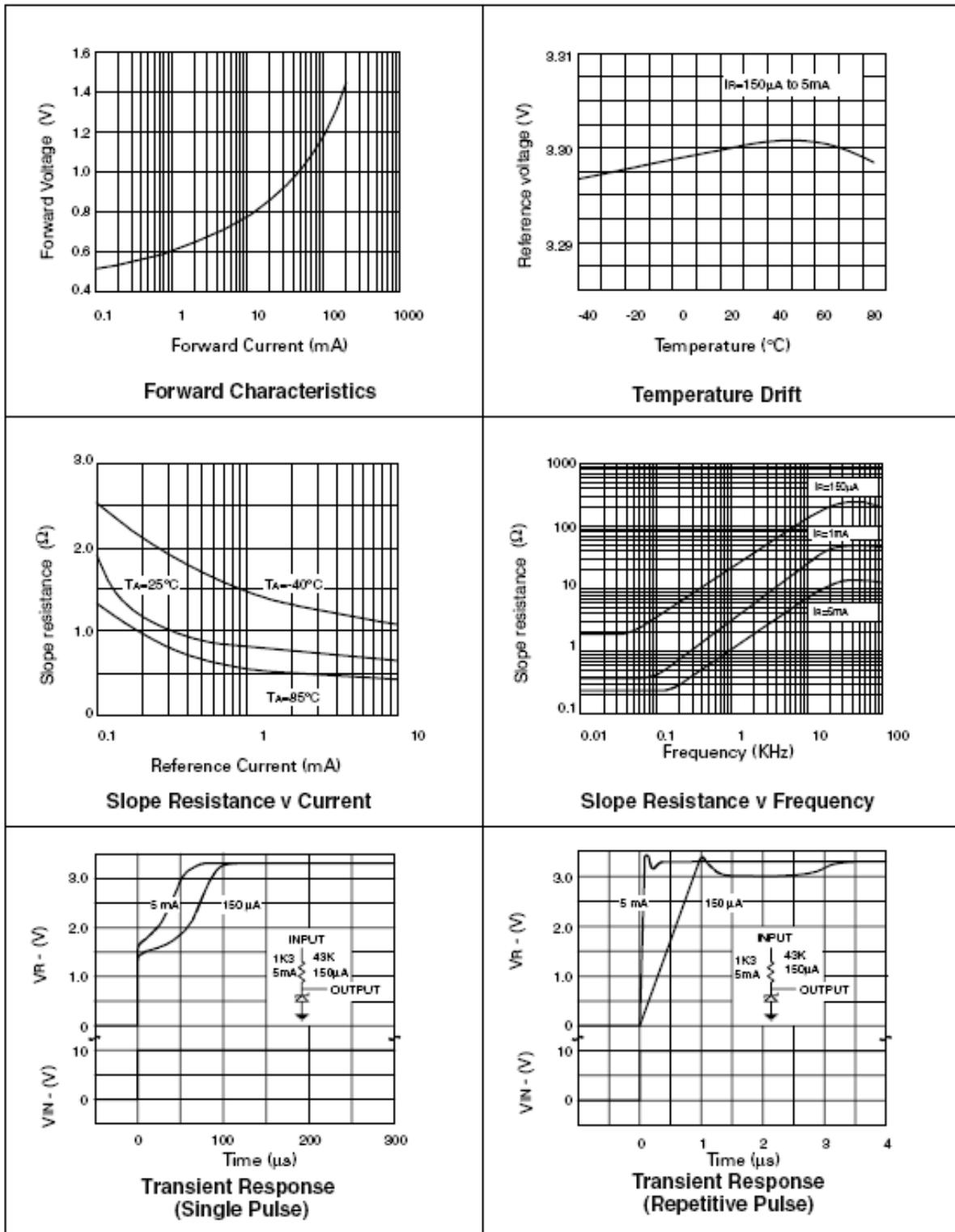
Notes: 5.  $T_C = \frac{(V_{R(MAX)} - V_{R(MIN)}) \times 1000000}{V_R \times (T_{(MAX)} - T_{(MIN)})}$

where: V<sub>R(MAX)</sub> – V<sub>R(MIN)</sub> is the maximum deviation in reference voltage measured over the full operating temperature range

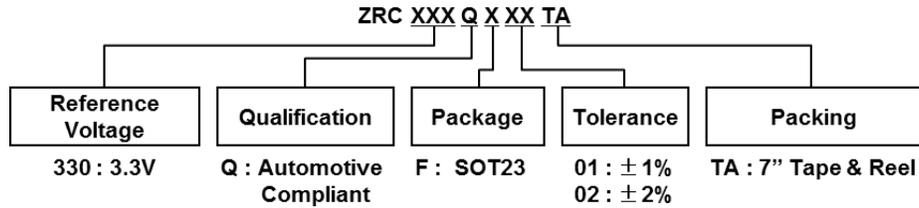
6.  $R_S = \frac{V_R \text{ Change}(I_{R(MIN)} \text{ to } I_{R(MAX)})}{I_{R(MAX)} - I_{R(MIN)}}$



**Typical Characteristics**



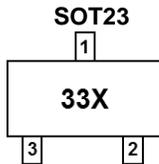
**Ordering Information** (Note 7)



Part Number	Tol (%)	Package (Note 7)	Package Code	Identification Code	Reel Size (inches)	Quantity per Reel	Tape Width (mm)	Qualification Grade (Note 8)
ZRC330QF01TA	1	SOT23	F	33C	7", 180mm	3,000	8	Automotive Compliant
ZRC330QF02TA	2	SOT23	F	33B	7", 180mm	3,000	8	Automotive Compliant

- Notes: 7. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.  
 8. ZRC330Q has been qualified to AEC-Q100 grade 1 and is classified as "Automotive Compliant" supporting PPAP documentation. Automotive, AEC-Q100 and standard products are electrically and thermally the same, except where specified. For more information, please refer to [http://www.diodes.com/quality/product\\_compliance\\_definitions/](http://www.diodes.com/quality/product_compliance_definitions/). See ZRC330 datasheet for commercial qualified versions.

**Marking Information**

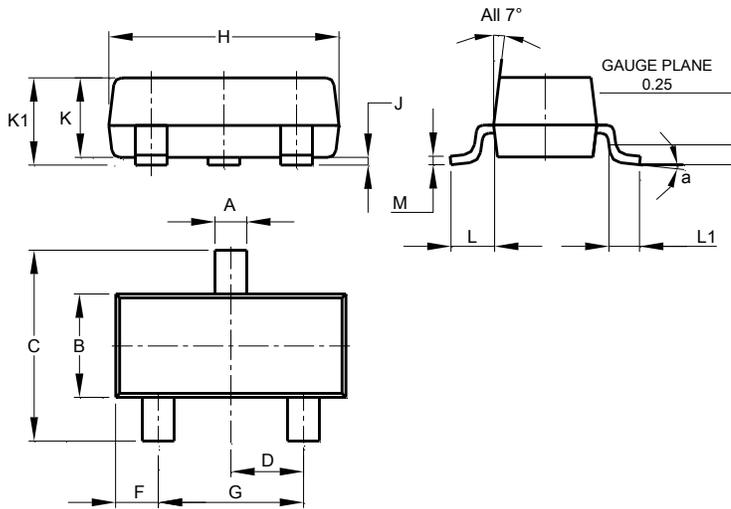


Part Number	XXX : Identification Code
ZRC330QF01TA	33C
ZRC330QF02TA	33B

**Package Outline Dimensions**

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

**SOT23**

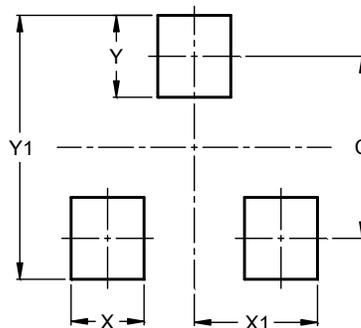


SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	0°	8°	—
All Dimensions in mm			

**Suggested Pad Layout**

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

**SOT23**



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

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