

LM113/LM313 Reference Diode

General Description

The LM113/LM313 are temperature compensated, low voltage reference diodes. They feature extremely-tight regulation over a wide range of operating currents in addition to an unusually-low breakdown voltage and good temperature stability.

The diodes are synthesized using transistors and resistors in a monolithic integrated circuit. As such, they have the same low noise and long term stability as modern IC op amps. Further, output voltage of the reference depends only on highly-predictable properties of components in the IC; so they can be manufactured and supplied to tight tolerances.

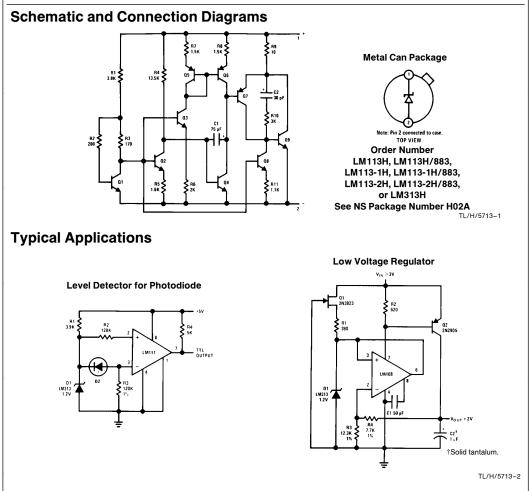
Dynamic impedance of 0.3Ω from 500 μA to 20 mA Temperature stability typically 1% over-55°C to 125°C

- range (LM113), 0°C to 70°C (LM313)
- Tight tolerance: $\pm 5\%$, $\pm 2\%$ or $\pm 1\%$

The characteristics of this reference recommend it for use in bias-regulation circuitry, in low-voltage power supplies or in battery powered equipment. The fact that the breakdown voltage is equal to a physical property of silicon—the energy-band gap voltage—makes it useful for many temperature-compensation and temperature-measurement functions.

Features

■ Low breakdown voltage: 1.220V



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Absolute Maximum Ratin	gs			
If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.		Storage Temperature Range	-65°C to +150°C 300°C	
		Lead Temperature (Soldering, 10 seconds)		
(Note 3)		Operating Temperature Range		
Power Dissipation (Note 1)	100 mW	LM113	-55°C to+125°C	
Reverse Current	50 mA	LM313	0°C to +70°C	
Forward Current	50 mA			

Electrical Characteristics (Note 2)

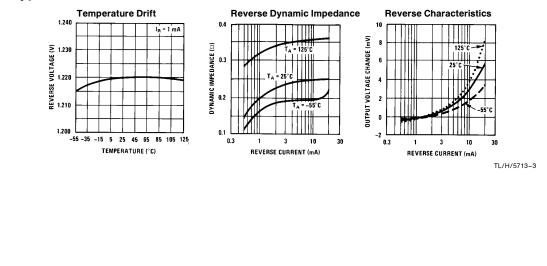
Parameter	Conditions	Min	Тур	Max	Units
Reverse Breakdown Voltage	I _R = 1 mA				
LM113/LM313		1.160	1.220	1.280	V
LM113-1		1.210	1.22	1.232	V
LM113-2		1.195	1.22	1.245	V
Reverse Breakdown Voltage Change	$0.5 \text{ mA} \leq I_R \leq 20 \text{ mA}$		6.0	15	mV
Reverse Dynamic Impedance	$I_{\rm B} = 1 \rm mA$		0.2	1.0	Ω
	$I_{R} = 10 \text{ mA}$		0.25	0.8	Ω
Forward Voltage Drop	$I_{F} = 1.0 \text{ mA}$		0.67	1.0	V
RMS Noise Voltage	$\begin{array}{c} 10 \mbox{ Hz} \leq f \leq 10 \mbox{ kHz} \\ I_{\rm R} = 1 \mbox{ mA} \end{array}$		5		μV
Reverse Breakdown Voltage Change with Current	$\begin{array}{l} 0.5 \text{ mA} \leq I_R \leq 10 \text{ mA} \\ T_{MIN} \leq T_A \leq T_{MAX} \end{array} \end{array} eq:mass_mass_mass_mass_mass_mass_mass_mass$			15	mV
Breakdown Voltage Temperature Coefficient	$1.0 \text{ mA} \leq I_R \leq 10 \text{ mA} \\ T_{MIN} \leq T_A \leq T_{MAX}$		0.01		%/°C

Note 1: For operating at elevated temperatures, the device must be derated based on a 150°C maximum junction and a thermal resistance of 80°C/W junction to case or 440°C/W junction to ambient.

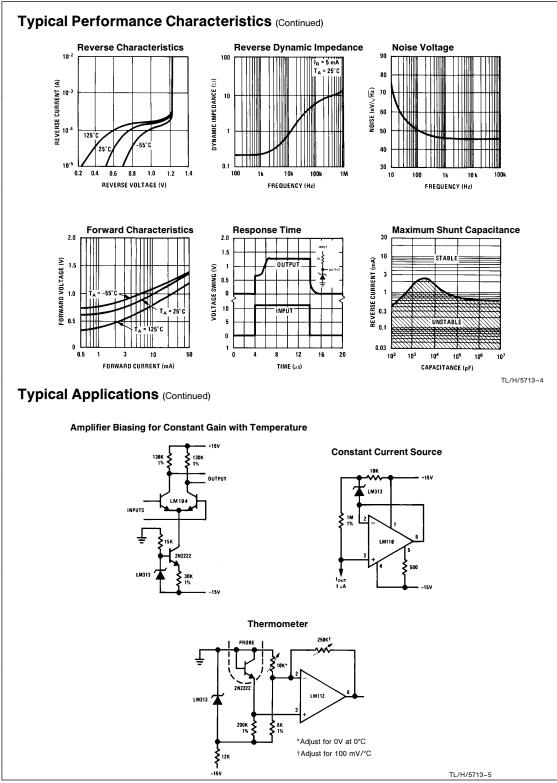
Note 2: These specifications apply for $T_A = 25^{\circ}$ C, unless stated otherwise. At high currents, breakdown voltage should be measured with lead lengths less than $\frac{1}{4}$ inch. Kelvin contact sockets are also recommended. The diode should not be operated with shunt capacitances between 200 pF and 0.1 μ F, unless isolated by at least a 100 Ω resistor, as it may oscillate at some currents.

Note 3: Refer to the following RETS drawings for military specifications: RETS113-1X for LM113-1, RETS113-2X for LM113-2 or RETS113X for LM113.

Typical Performance Characteristics



2



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