

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.

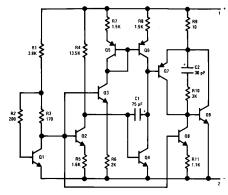
- \blacksquare Dynamic impedance of 0.3 $\!\Omega$ from 500 μA to 20 mA
- Temperature stability typically 1% over 55°C to 125°C range (LM113), 0°C to 70°C (LM313)
- Tight tolerance: $\pm 5\%$, $\pm 2\%$ or $\pm 1\%$

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

Schematic and Connection Diagrams



Metal Can Package

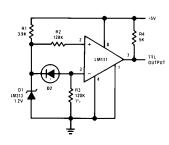


Order Number LM113H, LM113H/883, LM113-1H, LM113-1H/883, LM113-2H, LM113-2H/883, or LM313H

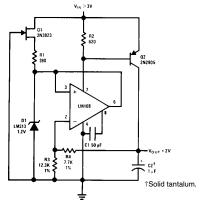
See NS Package Number H02A
TL/H/5713-1

Typical Applications

Level Detector for Photodiode



Low Voltage Regulator



TL/H/5713-2

Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications. (Note 3)

Power Dissipation (Note 1) 100 mW
Reverse Current 50 mA
Forward Current 50 mA

Storage Temperature Range Lead Temperature (Soldering, 10 seconds)

Operating Temperature Range LM113

-65°C to +150°C

300°C

Electrical Characteristics (Note 2)

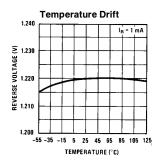
Parameter	Conditions	Min	Тур	Max	Units
Reverse Breakdown Voltage LM113/LM313	I _R = 1 mA	1.160	1.220	1.280	V
LM113-1 LM113-2	IR - TIIIA	1.210 1.195	1.22 1.22	1.232 1.245	V V
Reverse Breakdown Voltage Change	$0.5~\text{mA} \leq I_{ ext{R}} \leq 20~\text{mA}$		6.0	15	mV
Reverse Dynamic Impedance	$I_R = 1 \text{ mA}$ $I_R = 10 \text{ mA}$		0.2 0.25	1.0 0.8	Ω
Forward Voltage Drop	I _F = 1.0 mA		0.67	1.0	V
RMS Noise Voltage	$10 \text{ Hz} \le f \le 10 \text{ kHz}$ $I_{\text{R}} = 1 \text{ mA}$		5		μV
Reverse Breakdown Voltage Change with Current	$0.5 \text{ mA} \leq I_{\hbox{\scriptsize R}} \leq 10 \text{ mA}$ $T_{\hbox{\scriptsize MIN}} \leq T_{\hbox{\scriptsize A}} \leq T_{\hbox{\scriptsize MAX}}$			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

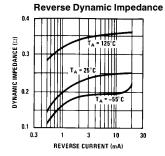
Note 1: For operating at elevated temperatures, the device must be derated based on a 150°C maximum junction and a thermal resistance of 80°C/W junction to case or 440°C/W junction to ambient.

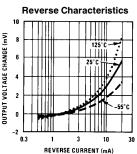
Note 2: These specifications apply for $T_A = 25^{\circ}$ C, unless stated otherwise. At high currents, breakdown voltage should be measured with lead lengths less than $\frac{1}{4}$ inch. Kelvin contact sockets are also recommended. The diode should not be operated with shunt capacitances between 200 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

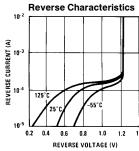


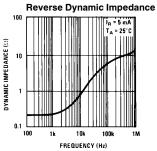


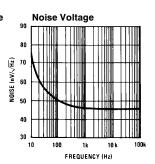


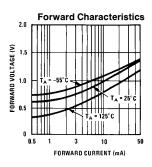
TL/H/5713-3

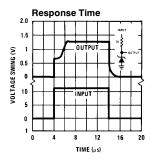
Typical Performance Characteristics (Continued) Reverse Characteristics

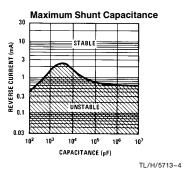






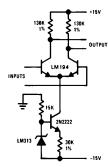


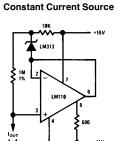




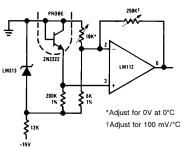
Typical Applications (Continued)

Amplifier Biasing for Constant Gain with Temperature



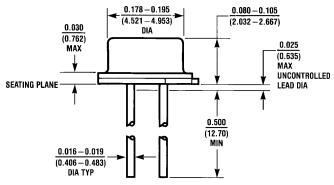


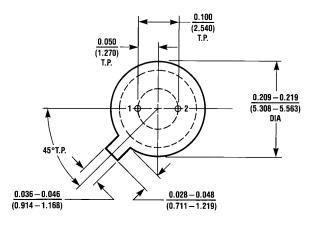
Thermometer



TL/H/5713-5

Physical Dimensions inches (millimeters)





Order Number LM113H, LM113H/883, LM113-1H, LM113-1H/883, LM113-2H, LM113-2H/883 or LM313H NS Package Number H02A

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National Semiconductor National Semiconducto Corporation 1111 West Bardin Road Arlington, TX 76017 Tel: 1(800) 272-9959 Fax: 1(800) 737-7018

National Semiconductor

Europe Fax: (+49) 0-180-530 85 86 Fax: (+49) U-18U-35U oo oo Email: onjwge@tevm2.nsc.com Deutsch Tel: (+49) 0-180-530 85 85 English Tel: (+49) 0-180-532 78 32 Français Tel: (+49) 0-180-532 93 58 Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor National Semiconductor Hong Kong Ltd. 13th Floor, Straight Block, Ocean Centre, 5 Canton Rd. Tsimshatsui, Kowloon Hong Kong Tel: (852) 2737-1600 Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
Tel: 81-043-299-2309
Fax: 81-043-299-2408