National Semiconductor

December 16, 2010

LM113QML

Reference Diode

General Description

The LM113 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.

Features

- Low breakdown voltage: 1.220V
- Dynamic impedance of 0.3Ω from 500 µA to 20 mA
- Temperature stability typically 1% over–55°C to 125°C range
- Tight tolerance: ±5% or ±1%

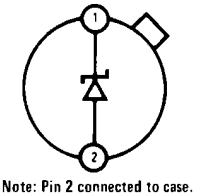
  The characteristics of this reference recommend it for use in bias-regulation circuitry, in low-voltage power supplies or in battery powered equipment. The fact that the breakdown voltage is equal to a physical property of silicon —the energy-band gap voltage—makes it useful for many temperature-compensation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

Ordering Information

NS Part Number	SMD Part Number	NS Package Number	Package Description
LM113H-SMD	5962-8671101XA	H02A	2LD Metal Can
LM113-1H-SMD	5962-8671102XA	H02A	2LD Metal Can
LM113-1H-QMLV	5962-9684302VXA	H02A	2LD Metal Can
LM113WG-QMLV	5962-9684301VZA	WG10A	10LD Ceramic SOIC
LM113-1WG-QMLV	5962-9684302VZA	WG10A	10LD Ceramic SOIC

Connection Diagrams

Metal Can Package (H)



Note: Pin 2 connected to case.
TOP VIEW

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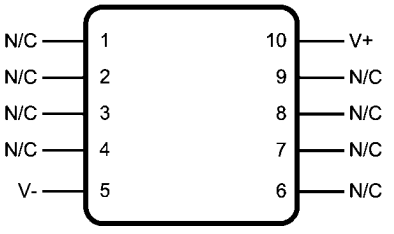
See NS Package Number H02A

Ceramic SOIC Package (WG)



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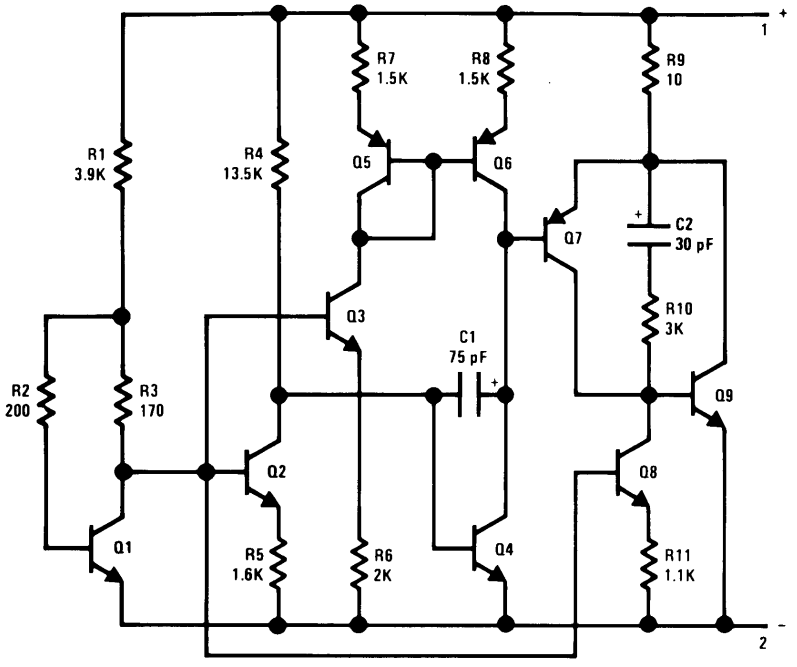
See NS Package Number WG10A

Schematic Diagram



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Absolute Maximum Ratings (*Note 1*)

Power Dissipation (*Note 2*)	100 mW
Reverse Current	50 mA
Forward Current	50 mA
Storage Temperature Range	$-65°C \leq T_A \leq +150°C$
Lead Temperature (Soldering, 10 seconds)	300°C
Maximum Junction Temperature (T_{Jmax})	+150°C
Operating Temperature Range	$-55°C \leq T_A \leq +125°C$
Thermal Resistance	
θ_{JA}	
Metal Can (Still Air)	440°C/W
Metal Can (500LF / Min Air Flow)	TBD
Ceramic SOIC (Still Air)	218°C/W
Ceramic SOIC (500LF / Min Air Flow)	140°C/W
θ_{JC}	
Metal Can	80°C/W
Ceramic SOIC	27°C/W
Package Weight	
Metal Can	275mg
Ceramic SOIC	220mg
ESD Tolerance (*Note 3*)	4000V

Quality Conformance

Mil-Std-883, Method 5005 - Group A

Subgroup	Description	Temp (°C)
1	Static tests at	+25
2	Static tests at	+125
3	Static tests at	-55
4	Dynamic tests at	+25
5	Dynamic tests at	+125
6	Dynamic tests at	-55
7	Functional tests at	+25
8A	Functional tests at	+125
8B	Functional tests at	-55
9	Switching tests at	+25
10	Switching tests at	+125
11	Switching tests at	-55
12	Settling time at	+25
13	Settling time at	+125
14	Settling time at	-55

LM113 Electrical Characteristics

DC Parameters

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
V_{ZR}	Zener Voltage	I_R = 1 mA		1.16	1.28	V	1
				1.157	1.283	V	2, 3
ΔV_{ZR}	Delta Zener Voltage	0.5mA ≤ I_R ≤ 20mA			15	mV	1
		0.5mA ≤ I_R ≤ 10mA			15	mV	2, 3
V_F	Forward Voltage Drop	I_F = 1mA			1.0	V	1, 2, 3
R_R	Reverse Dynamic Impedance	I_R = 1mA	(*Note 4*)		1.0	Ω	4
		I_R = 10mA			0.8	Ω	4

DC Drift Parameters

Delta Calculations performed on QMLV devices at Group B, Subgroup 5, only.

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
V_{ZR}	Zener Voltage	I_R = 1mA		-0.02	0.02	V	1

LM113-1 Electrical Characteristics

DC Parameters

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
V_{ZR}	Zener Voltage	I_R = 1 mA		1.210	1.232	V	1
				1.206	1.234	V	2, 3
ΔV_{ZR}	Delta Zener Voltage	0.5mA ≤ I_R ≤ 20mA			15	mV	1
		0.5mA ≤ I_R ≤ 10mA			15	mV	2, 3
V_F	Forward Voltage Drop	I_F = 1mA			1.0	V	1, 2, 3
R_R	Reverse Dynamic Impedance	I_R = 1mA	(*Note 4*)		1.0	Ω	4
		I_R = 10mA			0.8	Ω	4

DC Drift Parameters

Delta Calculations performed on QMLV devices at Group B, Subgroup 5, only.

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
V_{ZR}	Zener Voltage	I_R = 1mA		-0.02	0.02	V	1

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

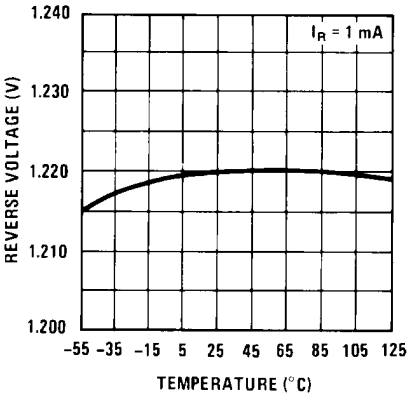
Note 2: The maximum power dissipation must be derated at elevated temperatures and is dictated by T_{Jmax} (maximum junction temperature), θ_{JA} (package junction to ambient thermal resistance), and T_A (ambient temperature). The maximum allowable power dissipation at any temperature is $P_{Dmax} = (T_{Jmax} - T_A)/\theta_{JA}$ or the number given in the Absolute Maximum Ratings, whichever is lower.

Note 3: Human body model, 1.5KΩ in series with 100pF.

Note 4: Guaranteed parameter, not tested.

Typical Performance Characteristics

Temperature Drift



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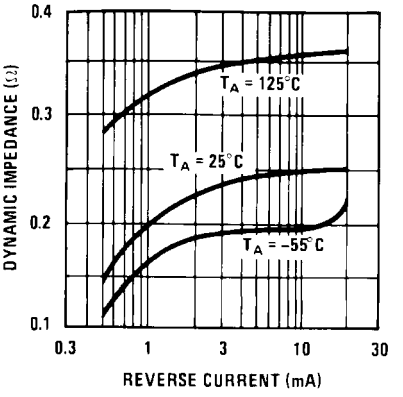
Reverse Dynamic Impedance



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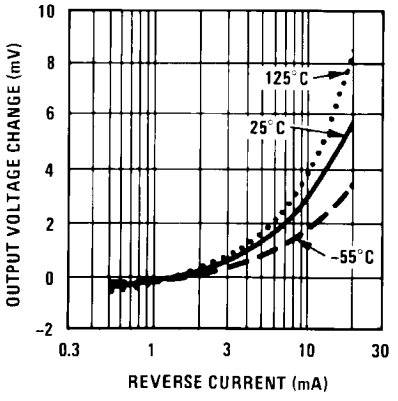
Reverse Characteristics



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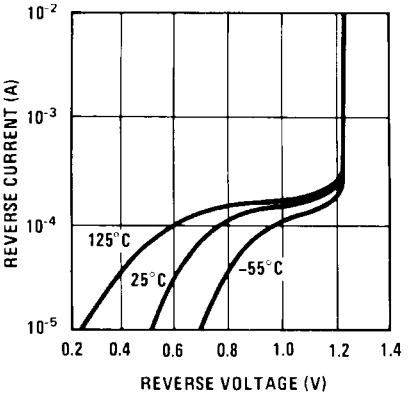
Reverse Characteristics



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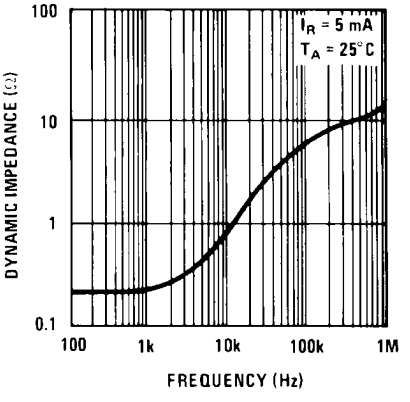
Reverse Dynamic Impedance



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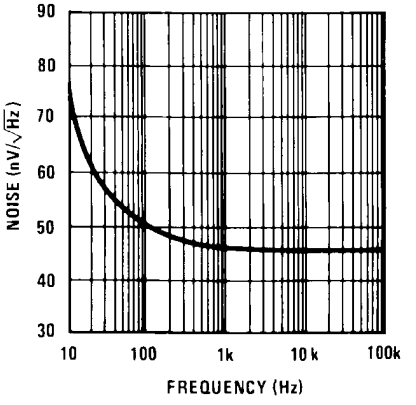
Noise Voltage



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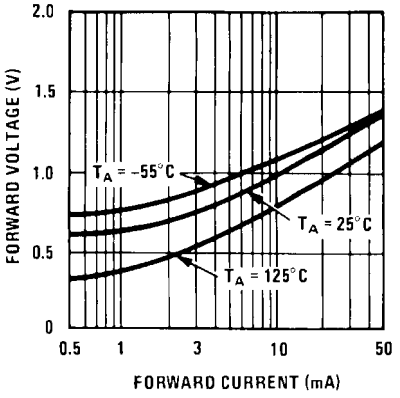
Forward Characteristics



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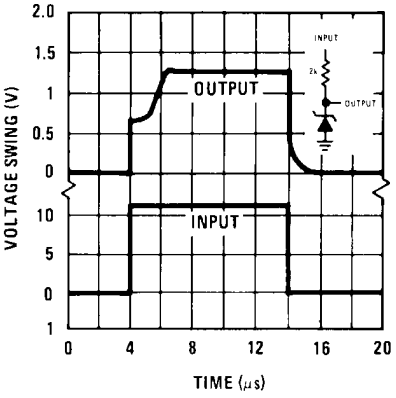
Response Time



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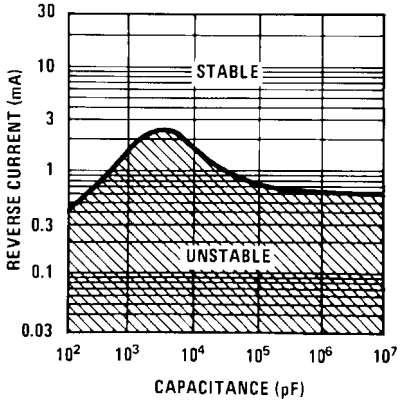
Maximum Shunt Capacitance



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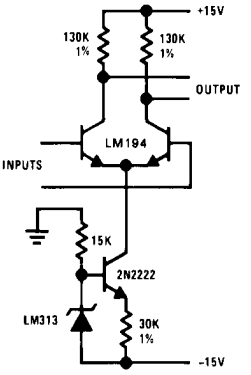
Typical Applications

Amplifier Biasing for Constant Gain with Temperature



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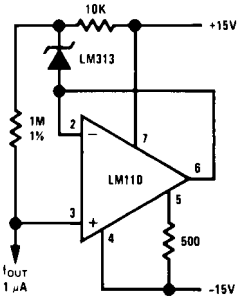
Constant Current Source



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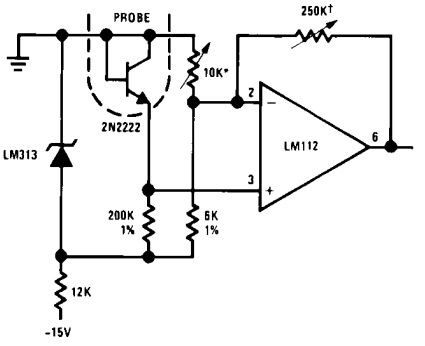
Thermometer



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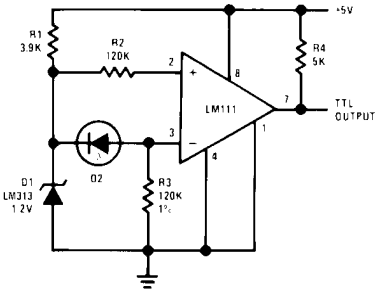
Adjust for 0V at 0°C
Adjust for 100 mV/°C

Level Detector for Photodiode



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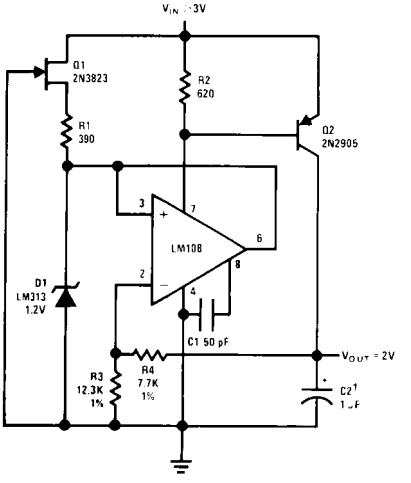
Low Voltage Regulator



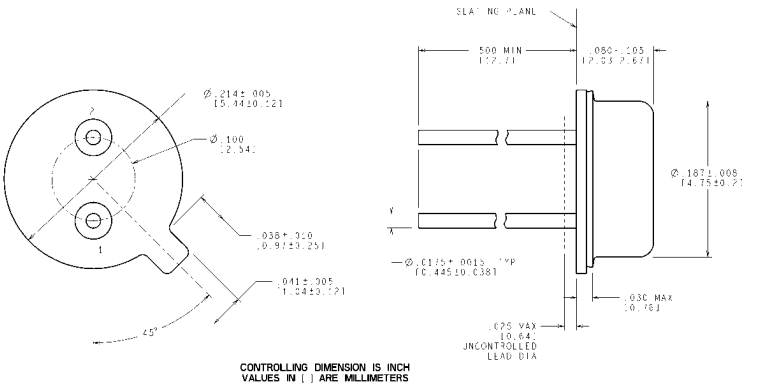
20150016

†Solid tantalum.

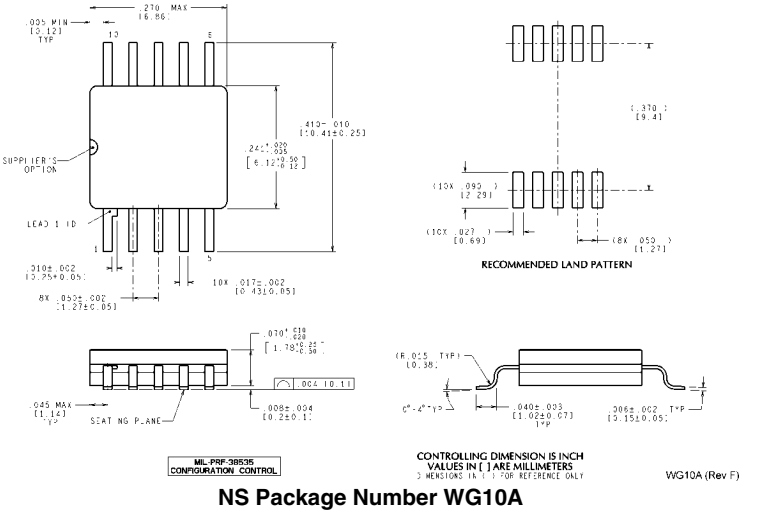
Revision History

Released	Revision	Section	Changes
12/16/2010	A	New release to corporate format	2 MDS data sheets converted into one Corp. data sheet format. MDSs MNLM113-X Rev 1C1 and MNLM113-1-X Rev. 2A1 will be archived.

Physical Dimensions inches (millimeters) unless otherwise noted



NS Package Number H02A



NS Package Number WG10A

Notes

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Switching Regulators	www.national.com/switchers	Distributors	www.national.com/contacts
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LED Lighting	www.national.com/led	Feedback/Support	www.national.com/feedback
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