LM311 - Voltage Comparator

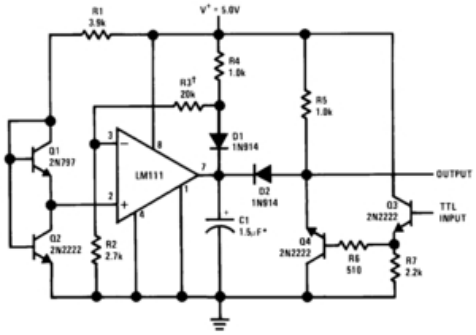
RoHS Compliant

Features

- Operates from single 5V supply
- Input current: 150 nA max. over temperature
- Offset current: 20 nA max. over temperature
- Differential input voltage range: ±30V
- Power consumption: 135 mW at ±15V

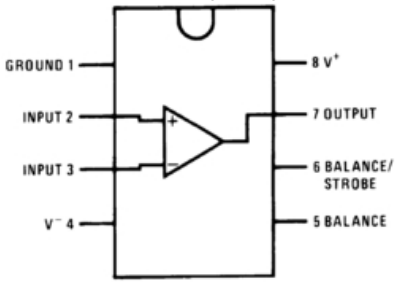
Typical Application

*click for larger image



Connection Diagram

*click for larger image



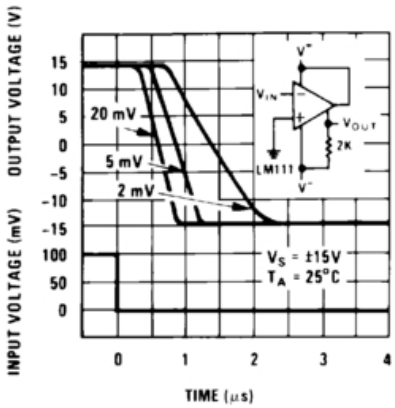
Parametric Table

Response Time	0.1 us
Output Bus	Open Drain
Supply Min	5 Volt
Supply Max	36 Volt
Channels	1 Channels
Offset Voltage max, 25C	7.5 mV
Output Current	50 mA
Input Range	Not R-R
Supply Current Per Channel	5.1 mA
PowerWise Rating 3	510 uA x us
Max Input Bias Current	300 nA
Special Features	Offset Adjust, Strobe
Temperature Min	0 deg C
Temperature Max	70 deg C
Function	Comparator

i

Typical Performance

*click for larger image



Datasheet

RoHS Compliance Information

LM111/LM211/LM311 Voltage Comparator

Package Availability, Models

Part Number	Package Type	Pins	Spec.	MSL Rating	Peak Reflow	RoHS Report		Factory Lead Time Weeks	Factory Lead Time Qty	Models				Std Pack Size	Package Marking Format
LM311M	SOIC NARROW	8	STD	1	235	RoHS		Full production		N/A				rail of 95	NSZXTT LM 311M
			NOPB	1	260			6 weeks	3000						
LM311MX	SOIC NARROW	8	STD	1	235	RoHS		Full production		N/A				reel of 2500	NSZXTT LM 311M
			NOPB	1	260			6 weeks	5000						
LM311N	MDIP	8	STD	1	NA	RoHS		Full production		N/A				rail of 40	NSUZXYTT LM 311N
			NOPB	1	NA			6 weeks	2000						
LM311H	TO-99	8	STD	1	NA	RoHS		Full production		N/A				box of 500	NSZXYTTE# LM311H
			NOPB	1	NA			10 weeks	1000						
LM311 MDA	Unpackaged Die							Lifetime buy		N/A				tray of N/A	-
								N/A	150000						
LM311 MWA	Wafer							Obsolete		N/A				wafer jar of N/A	-
								N/A	N/A						

Obsolete Versions

Obsolete Part	Alternate Part or Supplier	Source	Last Time Buy Date
LM311J	LM311N	NATIONAL SEMICONDUCTOR	12/07/93
LM311J-8	LM311N	NATIONAL SEMICONDUCTOR	04/04/95
LM311N-14	NONE	NATIONAL SEMICONDUCTOR	12/07/93

General Description

The LM111, LM211 and LM311 are voltage comparators that have input currents nearly a thousand times lower than devices like the LM106 or LM710. They are also designed to operate over a wider range of supply voltages: from standard ±15V op amp supplies down to the single 5V supply used for IC logic. Their output is compatible with RTL, DTL and TTL as well as MOS circuits. Further, they can drive lamps or relays, switching voltages up to 50V at currents as high as 50 mA.

Both the inputs and the outputs of the LM111, LM211 or the LM311 can be isolated from system ground, and the output can drive loads referred to ground, the positive supply or the negative supply. Offset balancing and strobe capability are provided and outputs can be wire OR'ed. Although slower than the LM106 and LM710 (200 ns response time vs 40 ns) the devices are also much less prone to spurious oscillations. The LM111 has the same pin configuration as the LM106 and LM710.

The LM211 is identical to the LM111, except that its performance is specified over a -25°C to +85°C temperature range instead of -55°C to +125°C. The LM311 has a temperature range of 0°C to +70°C.

Reliability Metrics

Part Number	Process	EFR Reject	EFR Sample Size	PPM *	LTA Rejects	LTA Device Hours	FITS	MTTF (Hours)
LM311M	SLM	0	42786	0	0	3352500	2	951281028
LM311MX	SLM	0	42786	0	0	3352500	2	951281028
LM311N	SLM	0	42786	0	0	3352500	2	951281028

Note: The Early Failure Rates were calculated as point estimates. The Long Term Failure Rates were calculated at 60% confidence using the Arrhenius equation at 0.7eV activation energy and derating the assumed stress temperature of 150°C to an application temperature of 55°C.

National Semiconductor

LM111/LM211/LM311 Voltage Comparator

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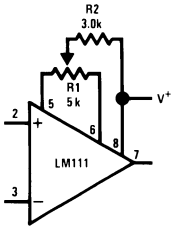
3.0 Typical Applications (Note 3)

Offset Balancing



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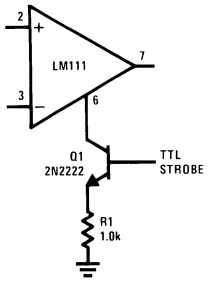
Strobing



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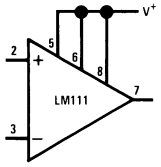
Note: Do Not Ground Strobe Pin. Output is turned off when current is pulled from Strobe Pin.

Increasing Input Stage Current (Note 1)



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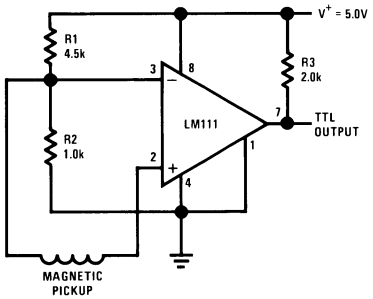
Note 1: Increases typical common mode slew from 7.0V/µs to 18V/µs.

Detector for Magnetic Transducer



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5.0 Absolute Maximum Ratings for the LM311 (Note 12)

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

Total Supply Voltage (V_{84})	36V
Output to Negative Supply Voltage (V_{74})	40V
Ground to Negative Supply Voltage (V_{14})	30V
Differential Input Voltage	±30V
Input Voltage (Note 13)	±15V
Power Dissipation (Note 14)	500 mW
ESD Rating (Note 19)	300V
Output Short Circuit Duration	10 sec
Operating Temperature Range	0˚ to 70˚C
Storage Temperature Range	−65˚C to 150˚C
Lead Temperature (soldering, 10 sec)	260˚C
Voltage at Strobe Pin	V^+−5V
Soldering Information	
Dual-In-Line Package	
Soldering (10 seconds)	260˚C
Small Outline Package	
Vapor Phase (60 seconds)	215˚C
Infrared (15 seconds)	220˚C

See AN-450 “Surface Mounting Methods and Their Effect on Product Reliability” for other methods of soldering surface mount devices.

Electrical Characteristics (Note 15) for the LM311

Parameter	Conditions	Min	Typ	Max	Units
Input Offset Voltage (Note 16)	T_A=25˚C, R_S≤50k		2.0	7.5	mV
Input Offset Current(Note 16)	T_A=25˚C		6.0	50	nA
Input Bias Current	T_A=25˚C		100	250	nA
Voltage Gain	T_A=25˚C	40	200		V/mV
Response Time (Note 17)	T_A=25˚C		200		ns
Saturation Voltage	V_{IN}≤−10 mV, I_{OUT}=50 mA T_A=25˚C		0.75	1.5	V
Strobe ON Current (Note 18)	T_A=25˚C		2.0	5.0	mA
Output Leakage Current	V_{IN}≥10 mV, V_{OUT}=35V T_A=25˚C, I_{STROBE}=3 mA V^- = Pin 1 = −5V		0.2	50	nA
Input Offset Voltage (Note 16)	R_S≤50K			10	mV
Input Offset Current (Note 16)				70	nA
Input Bias Current				300	nA
Input Voltage Range		−14.5	13.8,−14.7	13.0	V
Saturation Voltage	V^+≥4.5V, V^-=0 V_{IN}≤−10 mV, I_{OUT}≤8 mA		0.23	0.4	V
Positive Supply Current	T_A=25˚C		5.1	7.5	mA
Negative Supply Current	T_A=25˚C		4.1	5.0	mA

Note 12: “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.”

Note 13: This rating applies for ±15V supplies. The positive input voltage limit is 30V above the negative supply. The negative input voltage limit is equal to the negative supply voltage or 30V below the positive supply, whichever is less.

Note 14: The maximum junction temperature of the LM311 is 110˚C. For operating at elevated temperature, devices in the H08 package must be derated based on a thermal resistance of 165˚C/W, junction to ambient, or 20˚C/W, junction to case. The thermal resistance of the dual-in-line package is 100˚C/W, junction to ambient.

Note 15: These specifications apply for V_S=±15V and Pin 1 at ground, and 0˚C < T_A < +70˚C, unless otherwise specified. The offset voltage, offset current and bias current specifications apply for any supply voltage from a single 5V supply up to ±15V supplies.

Note 16: The offset voltages and offset currents given are the maximum values required to drive the output within a volt of either supply with 1 mA load. Thus, these parameters define an error band and take into account the worst-case effects of voltage gain and R_S.

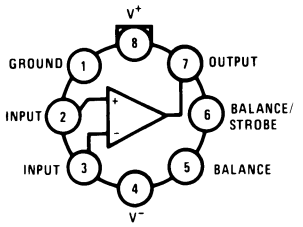
Note 17: The response time specified (see definitions) is for a 100 mV input step with 5 mV overdrive.

Note 18: This specification gives the range of current which must be drawn from the strobe pin to ensure the output is properly disabled. Do not short the strobe pin to ground; it should be current driven at 3 to 5 mA.

Note 19: Human body model, 1.5 kΩ in series with 100 pF.

11.0 Connection Diagrams

Metal Can Package



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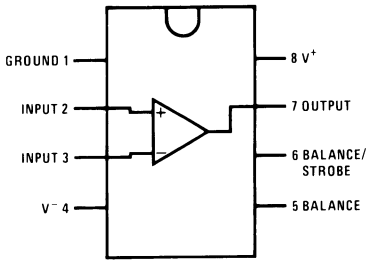
Note: Pin 4 connected to case

Top View
Order Number LM111H, LM111H/883(Note 21) **, LM211H or LM311H**
See NS Package Number H08C

Dual-In-Line Package



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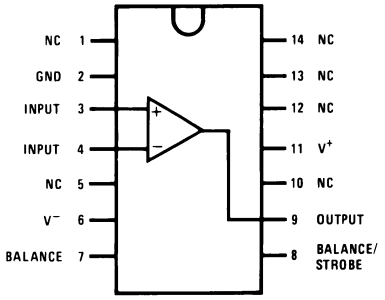
Top View
Order Number LM111J-8, LM111J-8/883(Note 21)**,**
LM311M, LM311MX or LM311N
See NS Package Number J08A, M08A or N08E

Dual-In-Line Package



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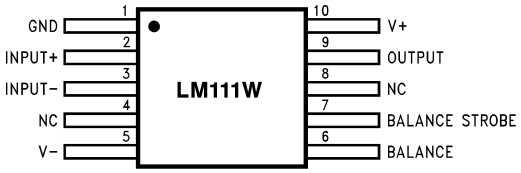
Top View
Order Number LM111J/883(Note 21)
See NS Package Number J14A or N14A



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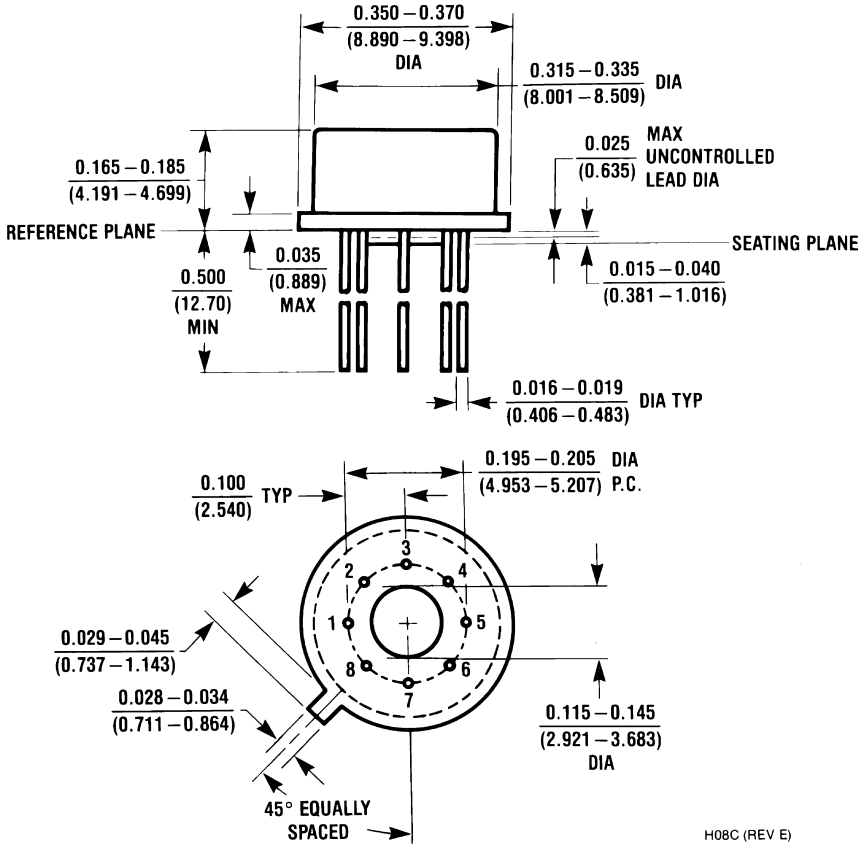
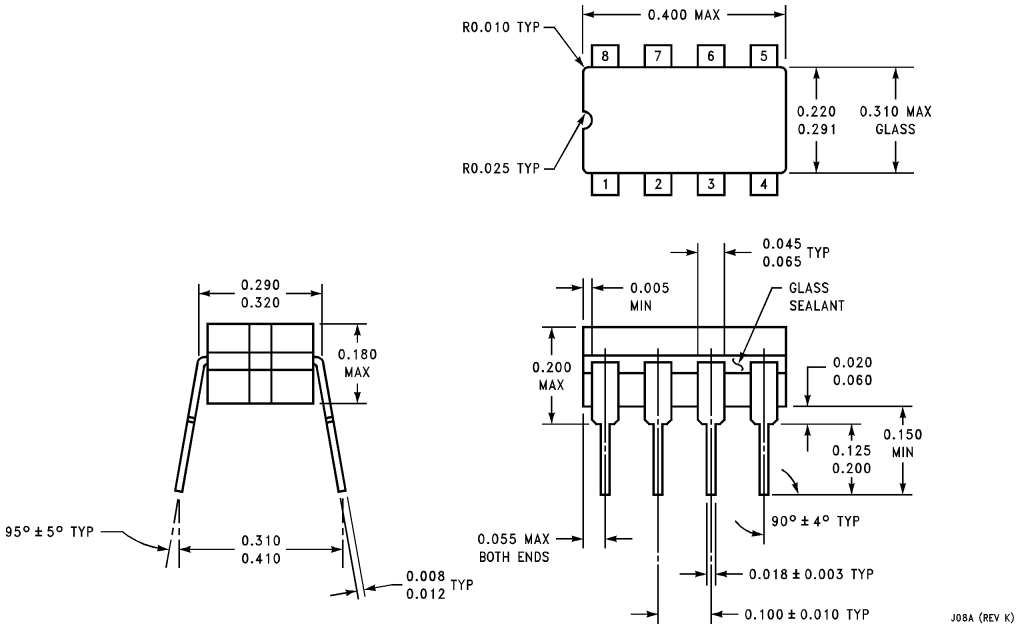
Order Number LM111W/883(Note 21)**, LM111WG/883**
See NS Package Number W10A, WG10A

Note 21: Also available per JM38510/10304

12.0 Physical Dimensions inches (millimeters) unless otherwise noted



Metal Can Package (H)
Order Number LM111H, LM111H/883, LM211H or LM311H
NS Package Number H08C



Cavity Dual-In-Line Package (J)
Order Number LM111J-8, LM111J-8/883
NS Package Number J08A