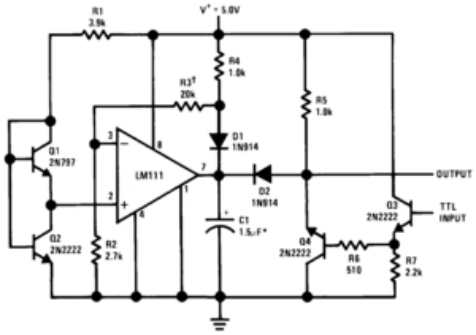
LM111 - Voltage Comparator

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

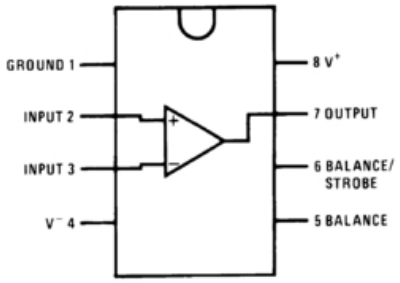
Typical Application

*click for larger image



Connection Diagram

*click for larger image

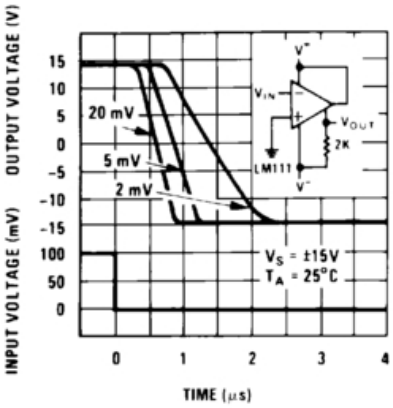


Parametric Table

Response Time	0.2, 0.1 us
Output Bus	Open Drain
Supply Min	5 Volt
Supply Max	36 Volt
Channels	1 Channels
Offset Voltage max, 25C	3 mV
Output Current	50 mA
Input Range	Not R-R
Supply Current Per Channel	5.1 mA
PowerWise Rating 3	1020, 510 uA x us
Max Input Bias Current	150 nA
Special Features	Offset Adjust, Strobe
Temperature Min	-55 deg C
Temperature Max	125 deg C
Function	Comparator
AEC Q-100 Automotive Grade	0

Typical Performance

*click for larger image



Datasheet

RoHS Compliance Information

LM111/LM211/LM311 Voltage Comparator

LM111JAN Voltage Comparator

LM111QML Voltage Comparator

Package Availability, Models

Part Number	Package							Factory Lead Time		Models				Std Pack Size	Package Marking Format
	Type	Pins	Spec.	MSL Rating	Peak Reflow	RoHS Report		Weeks	Qty						
LM111J-8	CERDIP	8	STD	1	NA	RoHS		Full production 6 weeks	500	LM111.MOD				rail of 40	NSUZXYTT LM111J -8
LM111H	TO-99	8	STD NOPB	1 1	NA NA	RoHS		Full production 6 weeks	2000	LM111.MOD				box of 500	NSZXYTTE# LM111H
LM111 MD8	Unpackaged Die							Full production N/A	5000	LM111.MOD				tray of N/A	-
LM111 MW8	Wafer							Full production N/A	10000	LM111.MOD				wafer jar of N/A	-
5962-8687701Q2A (LM111E-SMD)	LCC	20				RoHS		Obsolete 10 weeks	100	LM111.MOD				rail of 50	NSZSSXXYYA Q 5962-8687701Q2A
LM111E/883	LCC	20	STD	1	NA	RoHS		Obsolete 8 weeks	500	LM111.MOD				rail of 50	NSZSSXXYYA LM111E /883 Q
5962-8687701QGA (LM111H-SMD)	TO-99	8				RoHS		Obsolete 8 weeks	100	LM111.MOD				tray of 20	NSZSSXXYYA Q 5962-8687701QGA
LM111H/883	TO-99	8	STD	1	NA	RoHS		Full production 15 weeks	1000	LM111.MOD				tray of 20	NSZSSXXYYA LM111H/883 Q
5962-8687701QPA (LM111J-8-SMD)	CERDIP	8				RoHS		Obsolete 8 weeks	2000	LM111.MOD				rail of 40	NSZSSXXYYA Q 5962 8687701QPA
LM111J-8/883	CERDIP	8	STD	1	NA	RoHS		Full production 7 weeks	1000	LM111.MOD				rail of 40	NSZSSXXYYA LM111J-8 /883 Q
LM111J/883	CERDIP	14	STD	1	NA	RoHS		Full production 6 weeks	1000	LM111.MOD				rail of 25	NSZSSXXYYA LM111J/883 Q
LM111W/883	CERPACK	10	STD	1	NA	RoHS		Obsolete 10 weeks	100	LM111.MOD				rail of 19	NS LM111W /883 Q ZSSXXYYA
5962-8687701QZA (LM111WG-SMD)	CERPACK	10				RoHS		Obsolete 10 weeks	500	LM111.MOD				tray of 54	NSZSS XXYYA 5962-868770 1QZA Q
LM111WG/883	CERPACK	10	STD	1	NA	RoHS		Full production 10 weeks	500	LM111.MOD				tray of 54	NS LM111WG /883 Q ZSSXXYYA
JM38510/10304BGA (JL111BGA)	TO-99	8				RoHS		Full production 8 weeks	500	N/A				tray of 20	NS ZSSXXYYA 27014 Q JM38510/10304BGA
JM38510/10304BPA (JL111BPA)	CERDIP	8				RoHS		Obsolete 8 weeks	100	N/A				rail of 40	NS JM38510 /10304BPA 27014 Q ZSSXXYYA
JM38510/10304BCA (JL111BCA)	CERDIP	14				RoHS		Obsolete 6 weeks	500	N/A				rail of 25	NS ZSSXXYYA JM38510/10304BCA 27014 Q
JM38510/10304BHA (JL111BHA)	CERPACK	10				RoHS		Obsolete 13 weeks	500	N/A				rail of 19	NS JM38510/ 10304BHA 27014 Q ZSSXXYYA
JL111SGA	TO-99	8	STD	1	NA	RoHSc		Obsolete N/A	100	N/A				tray of N/A	NS ZSSXXYYA JM38510/10304SGA
														tray	NSZSSXXYYA

LM111HPQMLV	TO-99	8	STD	1	NA	RoHS		Obsolete N/A	N/A	LM111.MOD				of N/A	LM111HPQV Q 5962P0052401VGA
5962L0052401VGA (LM111HLQMLV)	TO-99	8				RoHS		Full production N/A	500	LM111.MOD				tray of 20	NSZSSXXYYA LM111HLQV Q 5962L0052401VGA
5962R0052402VGA (LM111HRLQMLV)	TO-99	8				RoHS		Full production 6 weeks	100	LM111.MOD				tray of 20	NSZSSXXYYA LM111HRLQV Q 5962R0052402VGA
JL111SPA	CERDIP	8	STD	1	NA	RoHS		Obsolete N/A	N/A	N/A				rail of N/A	NSZSSXXYYA JM38510 /10304SPA 27014 Q
5962L0052401VPA (LM111J-8LQMLV)	CERDIP	8				RoHS		Full production N/A	100	LM111.MOD				rail of 40	NSZSSXXYYA LM111J-8L QV Q 5962L 0052401VPA
5962R0052402VPA (LM111J-8RLQMLV)	CERDIP	8				RoHS	D	Full production N/A	N/A	LM111.MOD				rail of 40	NSZSSXXYYA LM111J-8RL QV Q 5962R 0052402VPA
JL111SHA	CERPACK	10	STD	1	NA	RoHS		Obsolete N/A	50	N/A				rail of N/A	NS JM38510 /10304SHA 27014 Q ZSSXXYYA
5962L0052401VHA (LM111WLQMLV)	CERPACK	10				RoHS		Full production N/A	50	LM111.MOD				rail of 19	NSLM111W LQV Q ZSSXXYYA 5962L005 2401VHA
5962R0052402VHA (LM111WRLQMLV)	CERPACK	10				RoHS		Full production N/A	N/A	LM111.MOD				rail of 19	NSLM111W RLQV Q ZSSXXYYA 5962R005 2402VHA
JL111SZA	CERPACK	10	STD	1	NA	RoHS		Obsolete N/A	N/A	N/A				tray of N/A	NS JM38510 \10304SZA 27014 Q ZSSXXYYA
LM111WGPQMLV	CERPACK	10	STD	1	NA	RoHS		Obsolete N/A	N/A	LM111.MOD				tray of N/A	NSLM111W GPQV Q 5962P005 2401VZA ZSSXXYYA
5962L0052401VZA (LM111WGLQMLV)	CERPACK	10				RoHS		Full production N/A	50	LM111.MOD				tray of 54	NSLM111W GLQV Q 5962L005 2401VZA ZSSXXYYA
5962R0052402VZA (LM111WGRLQMLV)	CERPACK	10				RoHS		Full production N/A	100	LM111.MOD				tray of 54	NSLM111W GRLQV Q 5962R005 2402VZA ZSSXXYYA

Obsolete Versions

Obsolete Part	Alternate Part or Supplier	Source	Last Time Buy Date
LM111E-MLS	JL111SZA	National Semiconductor	12/06/2005
LM111E-SMD	LM111WG/883	NATIONAL SEMICONDUCTOR CORP	12/03/2008
LM111E-SMD	UA111	NATIONAL SEMICONDUCTOR CORP	12/03/2008
LM111E/883	LM111WG/883	NATIONAL SEMICONDUCTOR CORP	12/03/2008
LM111E/883	UA111	NATIONAL SEMICONDUCTOR CORP	12/03/2008
LM111H-MLS	JL111SGA	NATIONAL SEMICONDUCTOR	09/08/99
LM111H-MLS	NONE	NONE	02/21/2006
LM111H-SMD	UA111	NATIONAL SEMICONDUCTOR CORP	12/03/2008
LM111HPQMLV	None	None	09/06/2005
LM111J	NONE	NATIONAL SEMICONDUCTOR	12/07/93
LM111J-8-SMD	LM111J-8/883	NATIONAL SEMICONDUCTOR CORP	12/03/2008
LM111J-8PQMLV	JL111SPA	NATIONAL SEMI.	12/06/2005
LM111W-MLS	JL111SHA	NSC	03/05/2008
LM111WG-SMD	UA111	NATIONAL SEMICONDUCTOR CORP	11/16/2008
LM111WGPQMLV	A111	NATIONAL SEMICONDUCTOR	09/06/2005
LM111WPQMLV	None	None	09/06/2005
LM111W/883	UA111	NATIONAL SEMICONDUCTOR CORP	12/03/2008

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.

National Semiconductor

LM111/LM211/LM311 Voltage Comparator

1.0 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.

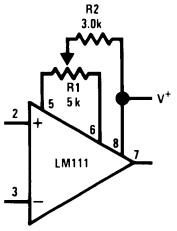
The LM211 is identical to the LM111, except that its performance is specified over a –25˚C to +85˚C temperature range instead of –55˚C to +125˚C. The LM311 has a temperature range of 0˚C to +70˚C.

2.0 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

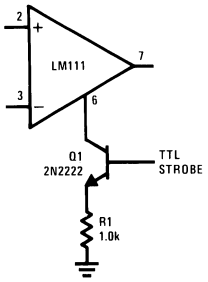
3.0 Typical Applications (Note 3)

Offset Balancing



00570436

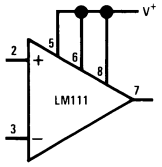
Strobing



00570437

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

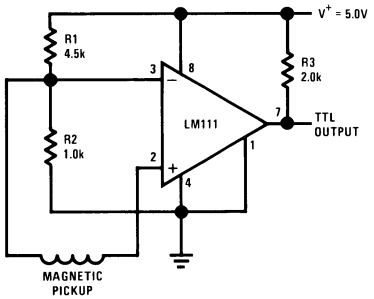
Increasing Input Stage Current (Note 1)



00570438

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

Detector for Magnetic Transducer



00570439

4.0 Absolute Maximum Ratings for the LM111/LM211 (Note 10)

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})	50V
Ground to Negative Supply Voltage (V_{14})	30V
Differential Input Voltage	±30V
Input Voltage (Note 4)	±15V
Output Short Circuit Duration	10 sec
Operating Temperature Range	
LM111	−55˚C to 125˚C
LM211	−25˚C to 85˚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.

ESD Rating (Note 11)	300V

Electrical Characteristics (Note 6) for the LM111 and LM211

Parameter	Conditions	Min	Typ	Max	Units
Input Offset Voltage (Note 7)	T_A=25˚C, R_S≤50k		0.7	3.0	mV
Input Offset Current	T_A=25˚C		4.0	10	nA
Input Bias Current	T_A=25˚C		60	100	nA
Voltage Gain	T_A=25˚C	40	200		V/mV
Response Time (Note 8)	T_A=25˚C		200		ns
Saturation Voltage	V_{IN}≤−5 mV, I_{OUT}=50 mA T_A=25˚C		0.75	1.5	V
Strobe ON Current (Note 9)	T_A=25˚C		2.0	5.0	mA
Output Leakage Current	V_{IN}≥5 mV, V_{OUT}=35V T_A=25˚C, I_{STROBE}=3 mA		0.2	10	nA
Input Offset Voltage (Note 7)	R_S≤50 k			4.0	mV
Input Offset Current (Note 7)				20	nA
Input Bias Current				150	nA
Input Voltage Range	V^+=15V, V^-=−15V, Pin 7 Pull-Up May Go To 5V	−14.5	13.8,-14.7	13.0	V
Saturation Voltage	V^+≥4.5V, V^-=0 V_{IN}≤−6 mV, I_{OUT}≤8 mA		0.23	0.4	V
Output Leakage Current	V_{IN}≥5 mV, V_{OUT}=35V		0.1	0.5	µA
Positive Supply Current	T_A=25˚C		5.1	6.0	mA
Negative Supply Current	T_A=25˚C		4.1	5.0	mA

Note 4: This rating applies for ±15 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 5: The maximum junction temperature of the LM111 is 150˚C, while that of the LM211 is 110˚C. For operating at elevated temperatures, 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 110˚C/W, junction to ambient.

Note 6: These specifications apply for V_S=±15V and Ground pin at ground, and −55˚C≤T_A≤+125˚C, unless otherwise stated. With the LM211, however, all temperature specifications are limited to −25˚C≤T_A≤+85˚C. The offset voltage, offset current and bias current specifications apply for any supply voltage from a single 5V supply up to ±15V supplies.

Note 7: The offset voltages and offset currents given are the maximum values required to drive the output within a volt of either supply with a 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 8: The response time specified (see definitions) is for a 100 mV input step with 5 mV overdrive.

Note 9: 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 10: Refer to RETS111X for the LM111H, LM111J and LM111J-8 military specifications.

Note 11: Human body model, 1.5 kΩ in series with 100 pF.

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.

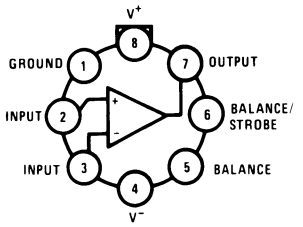
Note 17: The response time specified (see definitions) is for a 100 mV input step with 5 mV overdrive.

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

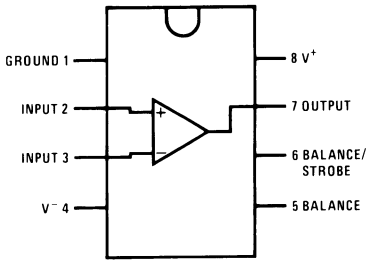


00570406

Note: Pin 4 connected to case

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

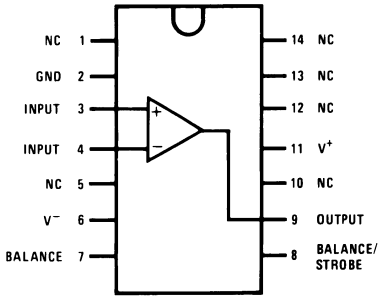
Dual-In-Line Package



00570434

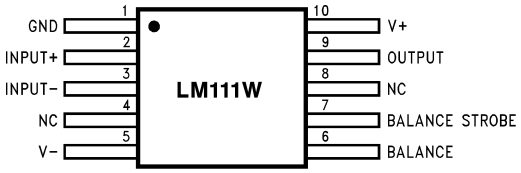
Top View
Order Number LM111J-8, LM111J-8/883(Note 21)**,**
LM311M, LM311MX or LM311N
See NS Package Number J08A, M08A or N08E

Dual-In-Line Package



00570435

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

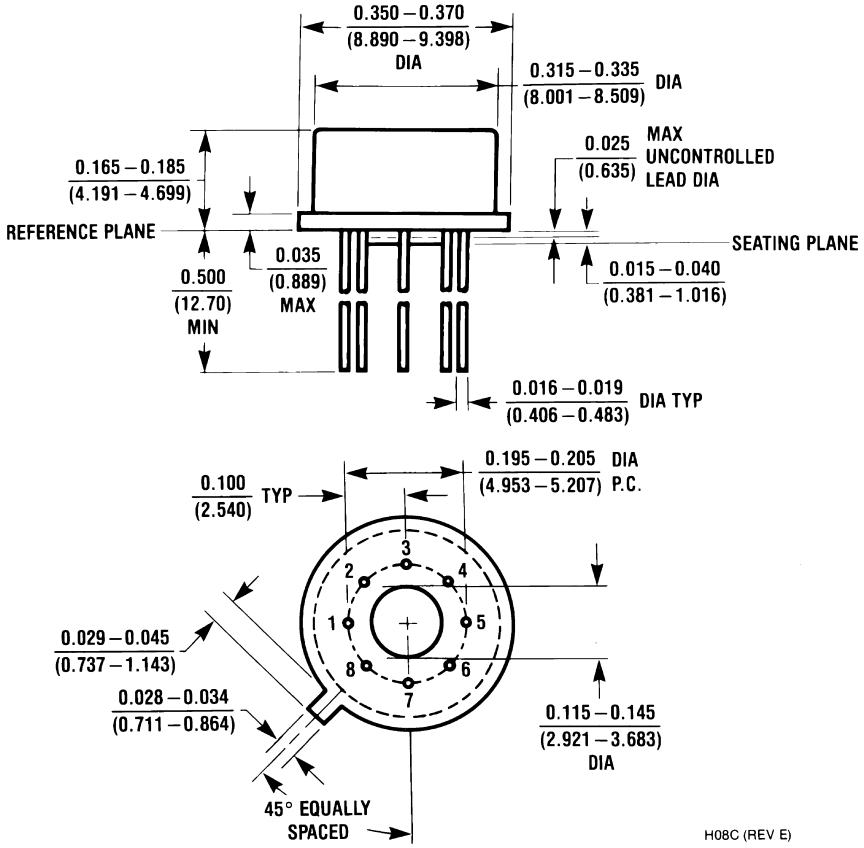


00570433

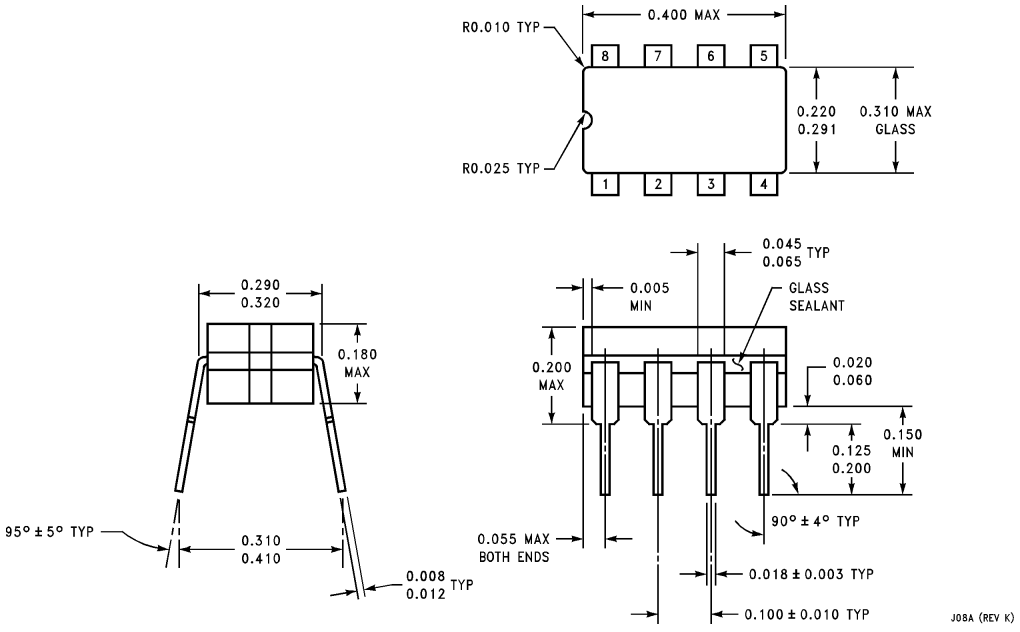
Order Number LM111W/883(Note 21)**, LM111WG/883**
See NS Package Number W10A, WG10A

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