

LM161/LM361 High Speed Differential Comparators

Check for Samples: [LM161](#), [LM361](#)

FEATURES

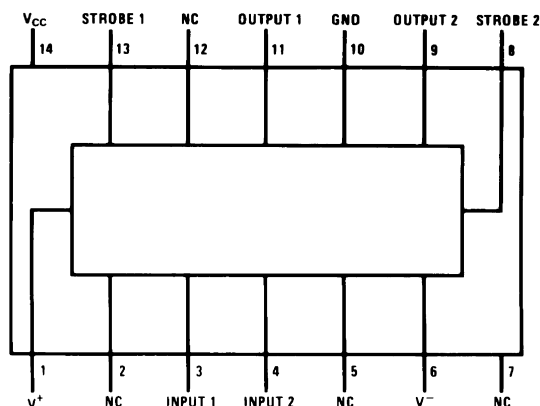
- Independent strobes
- Guaranteed high speed: 20 ns max
- Tight delay matching on both outputs
- Complementary TTL outputs
- Operates from op amp supplies: $\pm 15V$
- Low speed variation with overdrive variation
- Low input offset voltage
- Versatile supply voltage range

DESCRIPTION

The LM161/LM361 is a very high speed differential input, complementary TTL output voltage comparator with improved characteristics over the SE529/NE529 for which it is a pin-for-pin replacement. The device has been optimized for greater speed performance and lower input offset voltage. Typically delay varies only 3 ns for overdrive variations of 5 mV to 500 mV. It may be operated from op amp supplies ($\pm 15V$).

Complementary outputs having maximum skew are provided. Applications involve high speed analog to digital converters and zero-crossing detectors in disk file systems.

Connection Diagrams



**Figure 1. Top View
Dual-In-Line Package**

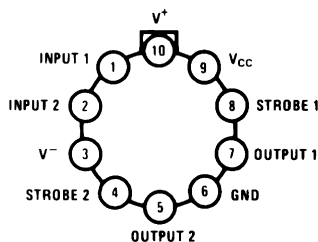


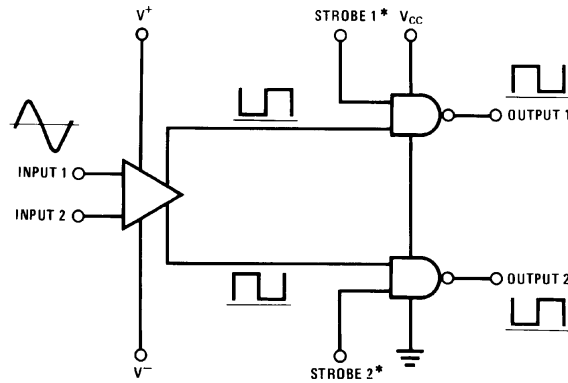
Figure 2. Metal Can Package



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Logic Diagram



*Output is low when current is drawn from strobe pin.



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings ⁽¹⁾

Positive Supply Voltage, V ⁺	+16V
Negative Supply Voltage, V ⁻	-16V
Gate Supply Voltage, V _{CC}	+7V
Output Voltage	+7V
Differential Input Voltage	±5V
Input Common Mode Voltage	±6V
Power Dissipation	600 mW
Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	T_{MIN} T_{MAX}
LM161	-55°C to +125°C
	-25°C to +85°C
LM361	0°C to +70°C
Lead Temp. (Soldering, 10 seconds)	260°C
For Any Device Lead Below V ⁻	0.3V

(1) The device may be damaged by use beyond the maximum ratings.

Operating Conditions

	Min	Typ	Max
Supply Voltage V ⁺			
LM161	5V		15V
LM361	5V		15V
Supply Voltage V ⁻			
LM161	-6V		-15V
LM361	-6V		-15V
Supply Voltage V _{CC}			
LM161	4.5V	5V	5.5V
LM361	4.75V	5V	5.25V

ESD Tolerance ⁽¹⁾	1600V
Soldering Information ⁽²⁾	
Dual-In-Line Package	
Soldering (10 seconds) ⁽²⁾	260°C
Small Outline Package	
Vapor Phase (60 seconds)	215°C
Infrared (15 seconds)	220°C

(1) Human body model, 1.5 kΩ in series with 100 pF.

(2) See AN-450 "Surface Mounting Methods and Their Effect on Product Reliability" for other methods of soldering surface mount devices.

Electrical Characteristics⁽¹⁾⁽²⁾⁽¹⁾
 $(V^+ = +10V, V_{CC} = +5V, V^- = -10V, T_{MIN} \leq T_A \leq T_{MAX}, \text{ unless noted})$

Parameter	Conditions	Limits						Units	
		LM161			LM361				
		Min	Typ	Max	Min	Typ	Max		
Input Offset Voltage			1	3			1	5	mV
Input Bias Current	$T_A = 25^\circ\text{C}$		5				10		μA
				20				30	μA
Input Offset Current	$T_A = 25^\circ\text{C}$		2				2		μA
				3				5	μA
Voltage Gain	$T_A = 25^\circ\text{C}$		3				3		V/mV
Input Resistance	$T_A = 25^\circ\text{C}, f = 1 \text{ kHz}$		20				20		k Ω
Logical "1" Output Voltage	$V_{CC} = 4.75V,$	2.4	3.3		2.4	3.3			V
	$I_{SOURCE} = -0.5 \text{ mA}$								
Logical "0" Output Voltage	$V_{CC} = 4.75V,$			0.4				0.4	V
	$I_{SINK} = 6.4 \text{ mA}$								
Strobe Input "1" Current (Output Enabled)	$V_{CC} = 5.25V,$ $V_{STROBE} = 2.4V$			200				200	μA
Strobe Input "0" Current (Output Disabled)	$V_{CC} = 5.25V,$ $V_{STROBE} = 0.4V$			-1.6				-1.6	mA
Strobe Input "0" Voltage	$V_{CC} = 4.75V$			0.8				0.8	V
Strobe Input "1" Voltage	$V_{CC} = 4.75V$	2			2				V
Output Short Circuit Current	$V_{CC} = 5.25V, V_{OUT} = 0V$	-18		-55	-18			-55	mA
Supply Current I^+	$V^+ = 10V, V^- = -10V,$ $V_{CC} = 5.25V,$ $-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$			4.5					mA
Supply Current I^+	$V^+ = 10V, V^- = -10V,$ $V_{CC} = 5.25V,$ $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$						5		mA
Supply Current I^-	$V^+ = 10V, V^- = -10V,$ $V_{CC} = 5.25V,$ $-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$			10					mA
Supply Current I^-	$V^+ = 10V,$ $V^- = -10V, V_{CC} = 5.25V,$ $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$						10		mA
Supply Current I_{CC}	$V^+ = 10V, V^- = -10V,$								
	$V_{CC} = 5.25V,$			18					mA
	$-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$								
Supply Current I_{CC}	$V^+ = 10V, V^- = -10V,$								
	$V_{CC} = 5.25V,$						20		mA
	$0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$								
Transient Response	$V_{IN} = 50 \text{ mV overdrive}^{(3)}$								
Propagation Delay Time ($t_{pd(0)}$)	$T_A = 25^\circ\text{C}$		14	20		14	20		ns
Propagation Delay Time ($t_{pd(1)}$)	$T_A = 25^\circ\text{C}$		14	20		14	20		ns
Delay Between Output A and B	$T_A = 25^\circ\text{C}$		2	5		2	5		ns
Strobe Delay Time ($t_{pd(0)}$)	$T_A = 25^\circ\text{C}$		8			8			ns

(1) Typical thermal impedances are as follows:

	H Package	J Package	N Package
θ_{JA}	165°C/W (Still Air) 67°C/W (400 LF/Min Air Flow)	112°C/W	105°C/W
θ_{JC}	25°C/W		

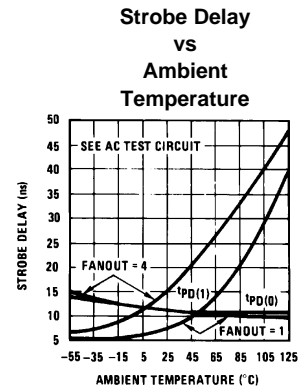
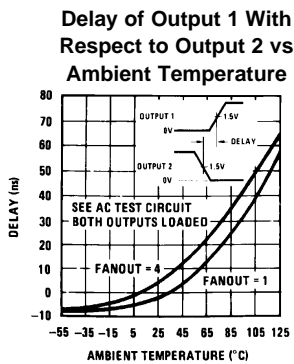
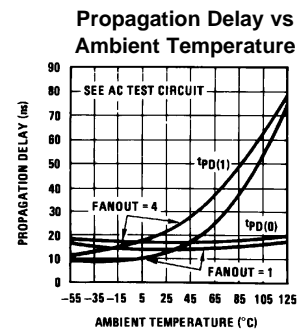
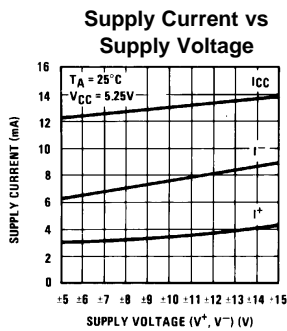
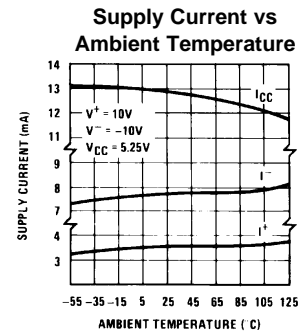
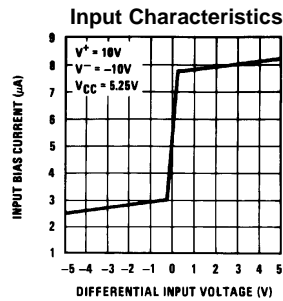
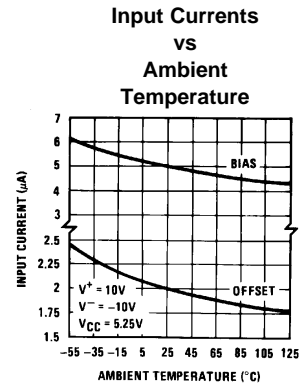
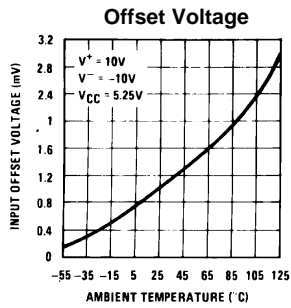
(2) Refer to RETS161X for LM161H and LM161J military specifications.

(3) Measurements using AC Test circuit, Fanout = 1. The devices are faster at low supply voltages.

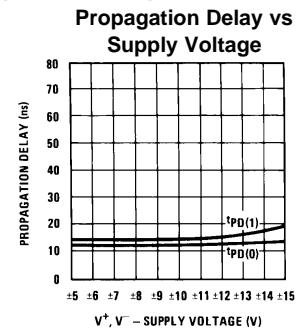
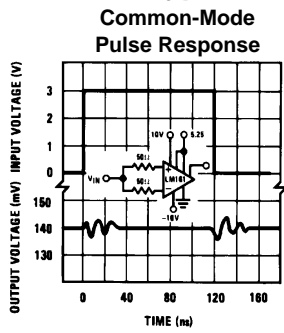
Electrical Characteristics⁽¹⁾⁽²⁾⁽¹⁾ (continued)
 $(V^+ = +10V, V_{CC} = +5V, V^- = -10V, T_{MIN} \leq T_A \leq T_{MAX}, \text{ unless noted})$

Parameter	Conditions	Limits						Units
		LM161			LM361			
		Min	Typ	Max	Min	Typ	Max	
Strobe Delay Time ($t_{pd(1)}$)	$T_A = 25^\circ\text{C}$		8			8		ns

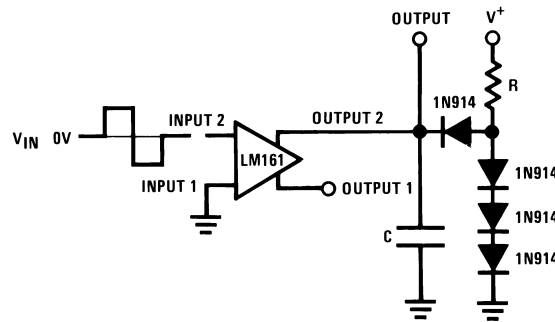
Typical Performance Characteristics



Typical Performance Characteristics (continued)



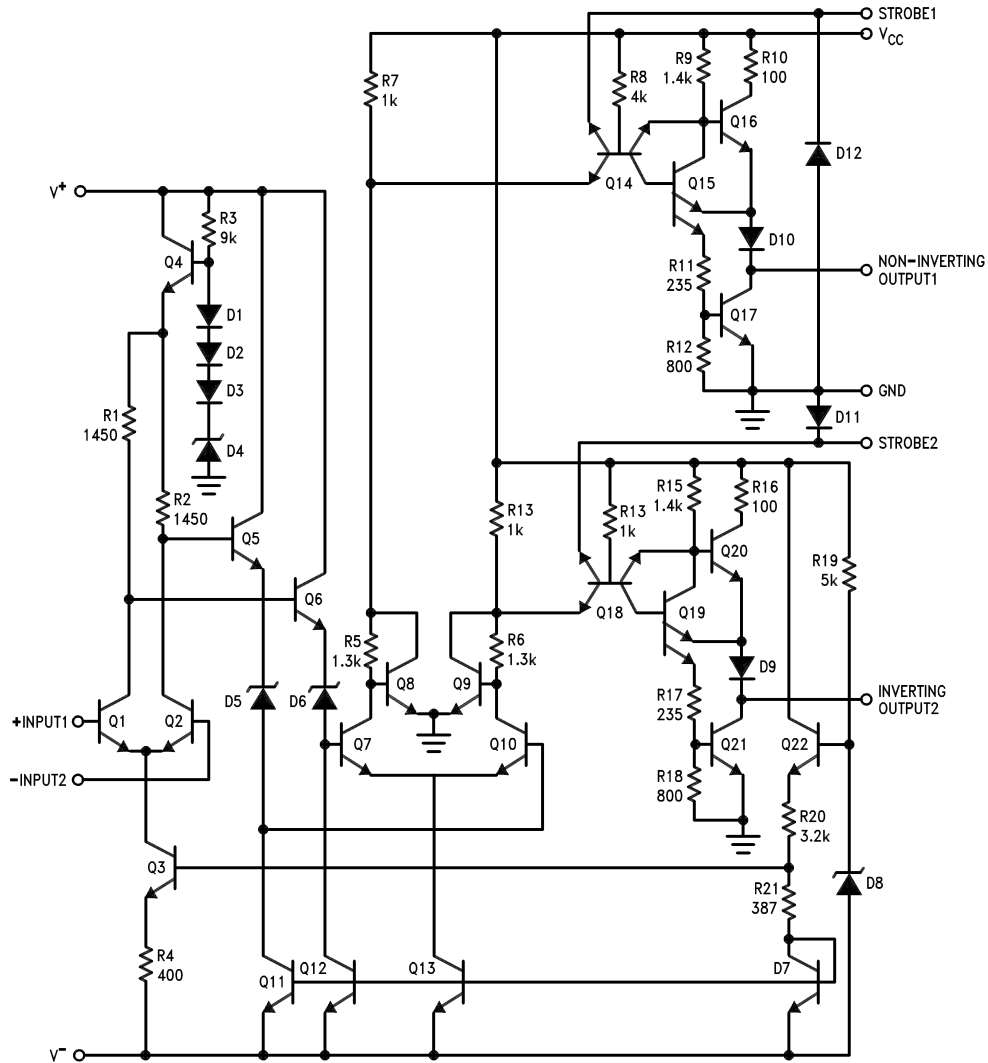
AC Test Circuit



$V_{IN} = \pm 50 \text{ mV}$	FANOUT = 1	FANOUT = 4
$V^+ = +10\text{V}$	$R = 2.4\text{k}$	$R = 680\Omega$
$V^- = -10\text{V}$	$C = 15 \text{ pF}$	$C = 30 \text{ pF}$
$V_{CC} = 5.25\text{V}$		

Schematic Diagram

Figure 3. LM161



R10, R16: 85
R11, R17: 205

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
LM361H	ACTIVE	TO-100	LME	10	500	TBD	POST-PLATE	Level-1-NA-UNLIM	
LM361H/NOPB	ACTIVE	TO-100	LME	10	500	Green (RoHS & no Sb/Br)	POST-PLATE	Level-1-NA-UNLIM	
LM361M	ACTIVE	SOIC	D	14	55	TBD	CU SNPB	Level-1-235C-UNLIM	
LM361M/NOPB	ACTIVE	SOIC	D	14	55	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	
LM361MX	ACTIVE	SOIC	D	14	2500	TBD	CU SNPB	Level-1-235C-UNLIM	
LM361MX/NOPB	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	
LM361N	ACTIVE	PDIP	NFF	14	25	TBD	Call TI	Level-1-NA-UNLIM	
LM361N/NOPB	ACTIVE	PDIP	NFF	14	25	Green (RoHS & no Sb/Br)	Call TI	Level-1-NA-UNLIM	
LM529CH	ACTIVE	TO-100	LME	10	500	TBD	POST-PLATE	Level-1-NA-UNLIM	
LM529CN	ACTIVE	PDIP	NFF	14	25	TBD	Call TI	Level-1-NA-UNLIM	
NE529A	ACTIVE	PDIP	NFF	14	25	TBD	Call TI	Level-1-NA-UNLIM	
NE529K	ACTIVE	TO-100	LME	10	500	TBD	POST-PLATE	Level-1-NA-UNLIM	
SE529K	ACTIVE	TO-100	LME	10	500	TBD	POST-PLATE	Level-1-NA-UNLIM	

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM361MX	SOIC	D	14	2500	330.0	16.4	6.5	9.35	2.3	8.0	16.0	Q1
LM361MX/NOPB	SOIC	D	14	2500	330.0	16.4	6.5	9.35	2.3	8.0	16.0	Q1

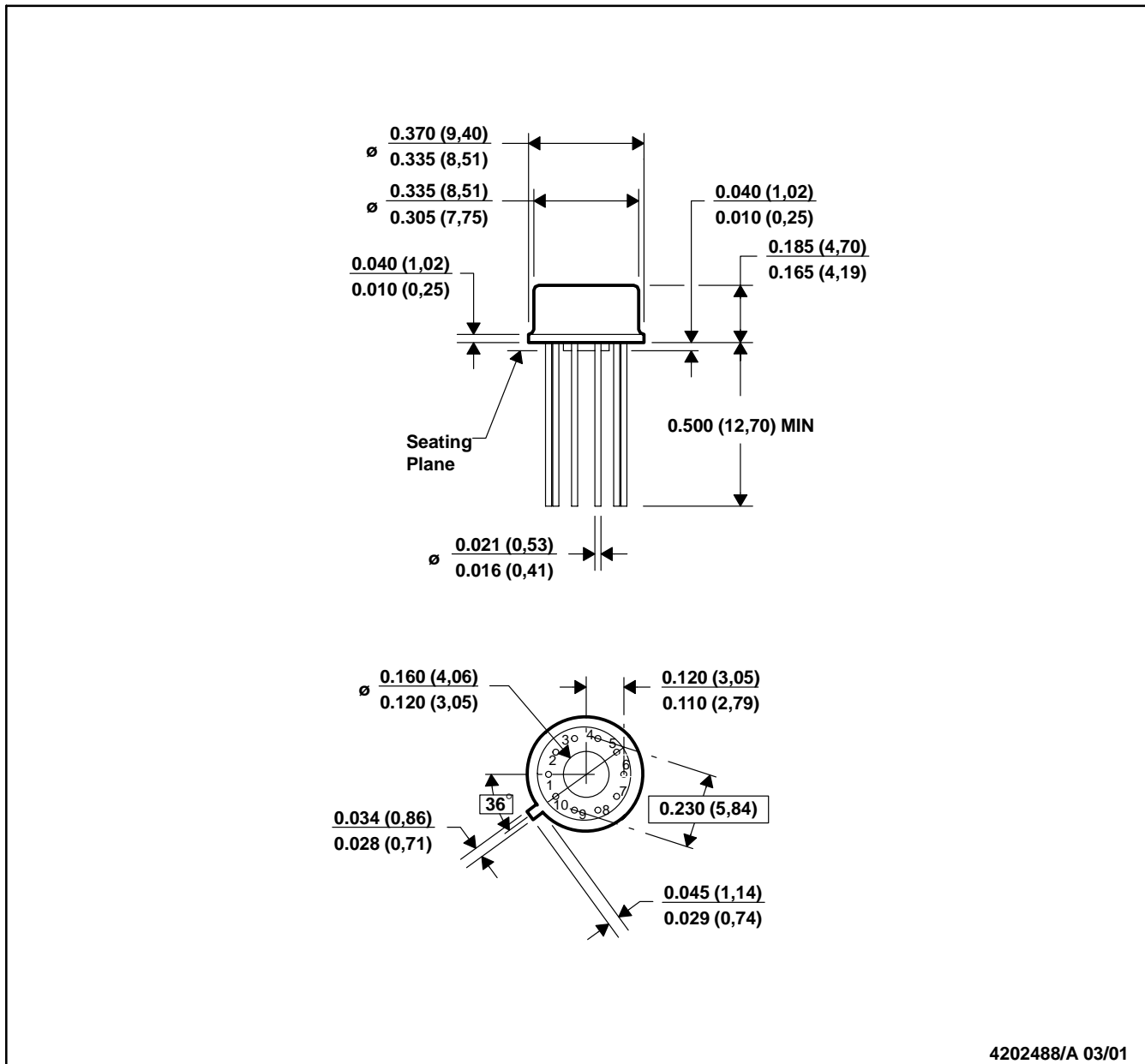
TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM361MX	SOIC	D	14	2500	349.0	337.0	45.0
LM361MX/NOPB	SOIC	D	14	2500	349.0	337.0	45.0

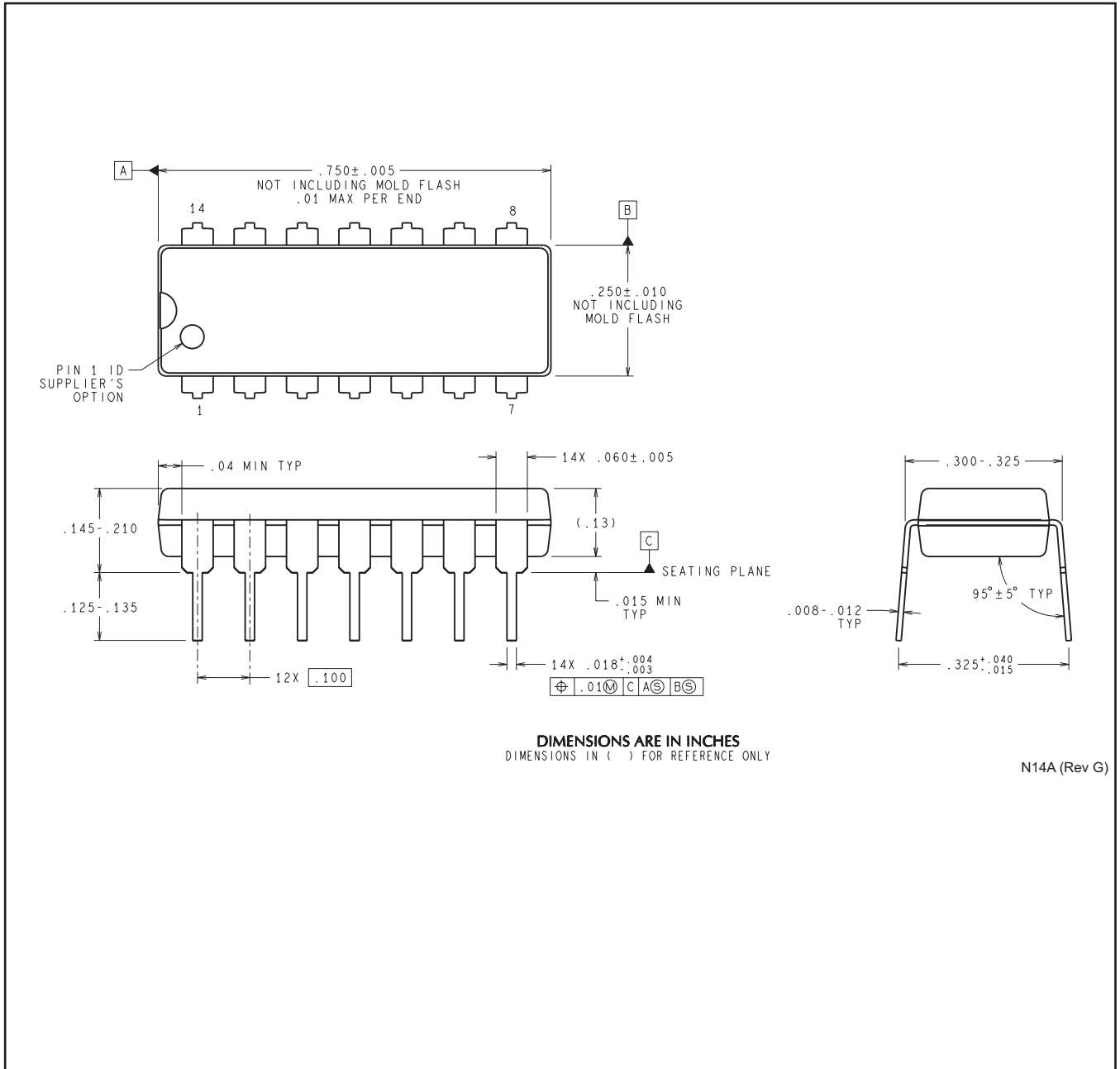
LME (O-MBCY-W10)

METAL CYLINDRICAL PACKAGE



- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Leads in true position within 0.010 (0,25) R @ MMC at seating plane.
 D. Pin numbers shown for reference only. Numbers may not be marked on package.
 E. Falls within JEDEC MO-006/TO-100.

NFF0014A



DIMENSIONS ARE IN INCHES
 DIMENSIONS IN () FOR REFERENCE ONLY

N14A (Rev G)

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 -  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 -  Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AB.

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