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: ±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 over-drive variations of 5 mV to 500 mV. It may be operated from op amp supplies (±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

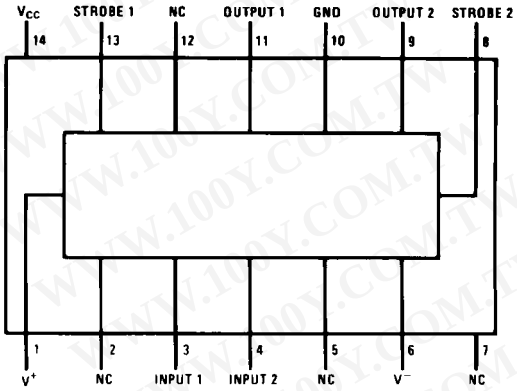


Figure 1. Top View
Dual-In-Line Package

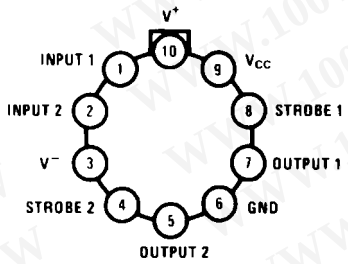
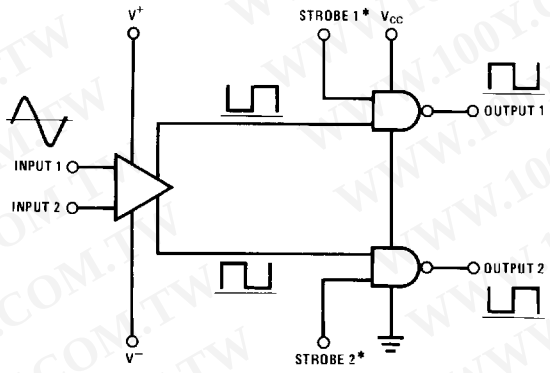


Figure 2. Metal Can Package

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, $T_{MIN} \le T_A \le T_{MAX}$, 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°C		5	20		10	30	µA µA
Input Offset Current	T_A=25°C		2	3		2	5	µA µA
Voltage Gain	T_A=25°C		3			3		V/mV
Input Resistance	T_A=25°C, f=1 kHz		20			20		kΩ
Logical “1” Output Voltage	V_{CC}=4.75V, I_{SOURCE}=−0.5 mA	2.4	3.3		2.4	3.3		V
Logical “0” Output Voltage	V_{CC}=4.75V, I_{SINK}=6.4 mA			0.4			0.4	V
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°C≤T_A≤125°C			4.5				mA
Supply Current I^+	V^+=10V, V^-=−10V, V_{CC}=5.25V, 0°C≤T_A≤70°C						5	mA
Supply Current I^-	V^+=10V, V^-=−10V, V_{CC}=5.25V, −55°C≤T_A≤125°C			10				mA
Supply Current I^-	V^+=10V, V^-=−10V,V_{CC}=5.25V, 0°C≤T_A≤70°C						10	mA
Supply Current I_{CC}	V^+=10V, V^-=−10V, V_{CC}=5.25V, −55°C≤T_A≤125°C			18				mA
Supply Current I_{CC}	V^+=10V, V^-=−10V, V_{CC}=5.25V, 0°C≤T_A≤70°C						20	mA
Transient Response	V_{IN} = 50 mV overdrive (3)							
Propagation Delay Time ($t_{pd(0)}$)	T_A=25°C		14	20		14	20	ns
Propagation Delay Time ($t_{pd(1)}$)	T_A=25°C		14	20		14	20	ns
Delay Between Output A and B	T_A=25°C		2	5		2	5	ns
Strobe Delay Time ($t_{pd(0)}$)	T_A=25°C		8			8		ns
Strobe Delay Time ($t_{pd(1)}$)	T_A=25°C		8			8		ns

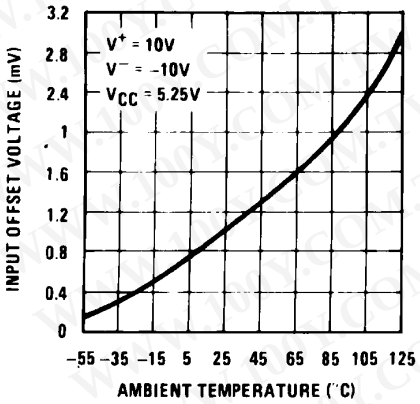
(1) Typical thermal impedances are as follows:

	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		

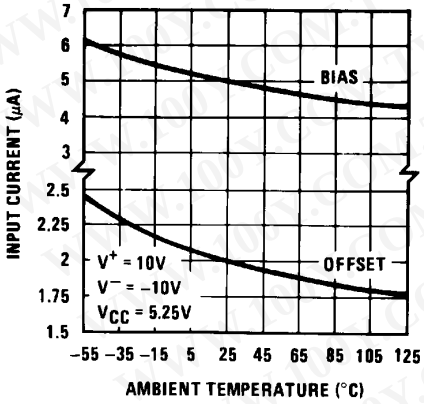
(2) Refer to RETS161X for LM161H and LM161J military specifications.
(3) Measurements using AC Test circuit, Fanout = 1. The devices are faster at low supply voltages.

Typical Performance Characteristics

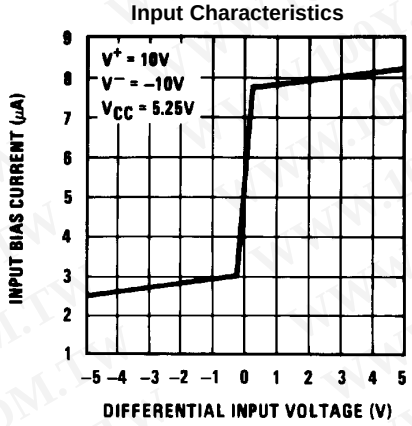
Offset Voltage



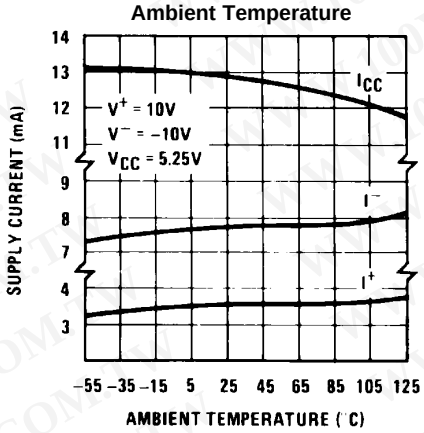
Input Currents vs Ambient Temperature



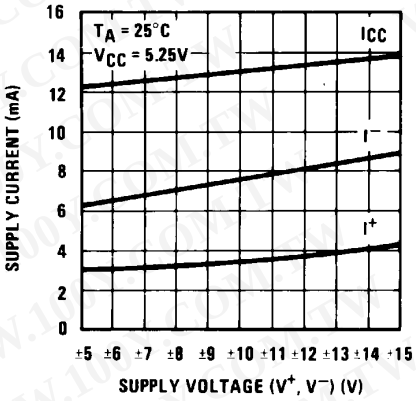
Input Characteristics



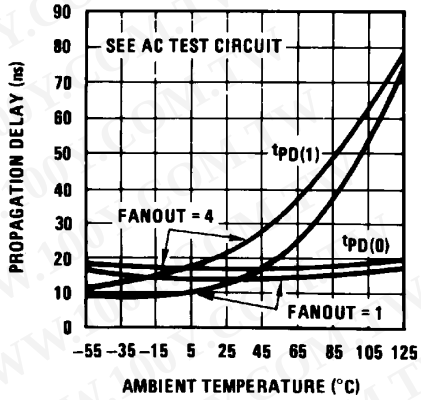
Supply Current vs Ambient Temperature



Supply Current vs Supply Voltage

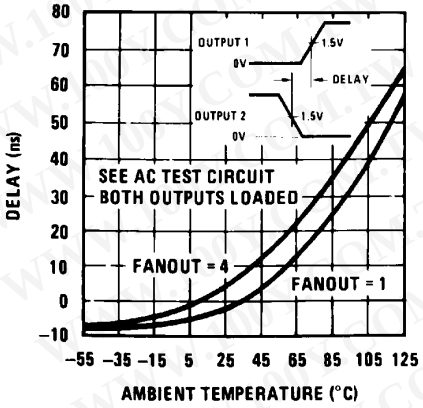


Propagation Delay vs Ambient Temperature

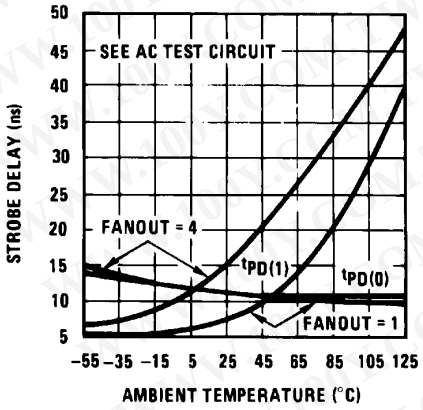


Typical Performance Characteristics (continued)

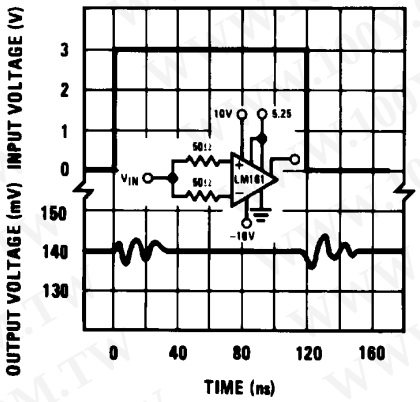
Delay of Output 1 With Respect to Output 2 vs Ambient Temperature



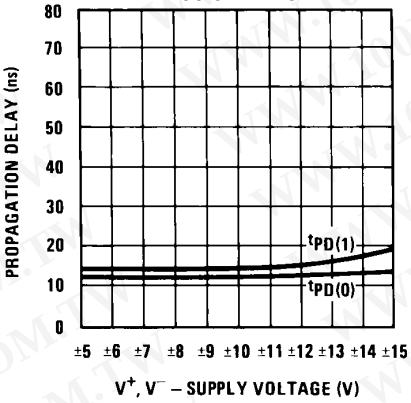
Strobe Delay vs Ambient Temperature



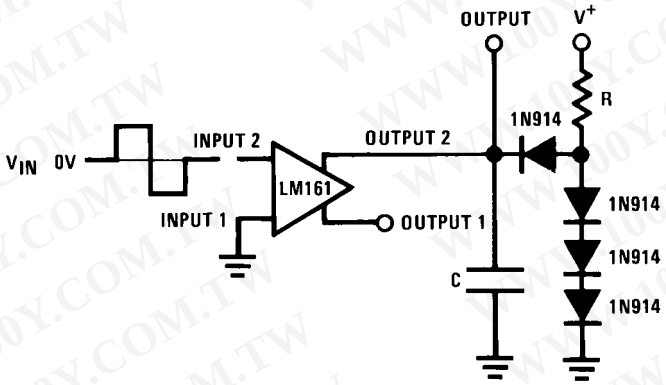
Common-Mode Pulse Response



Propagation Delay vs Supply Voltage



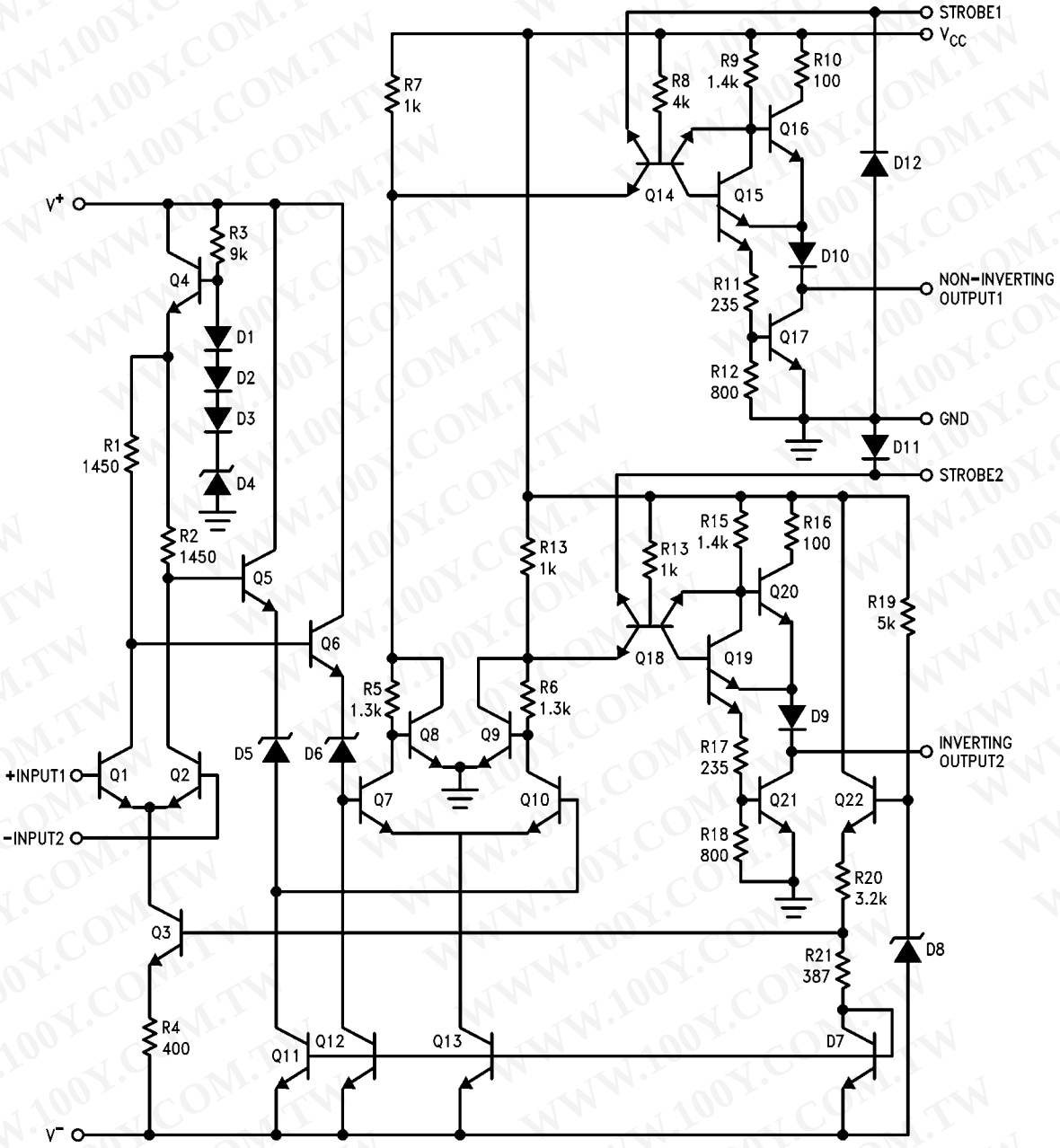
AC TEST CIRCUIT



V_{IN} = ±50 mV	FANOUT = 1	FANOUT = 4	V^- = −10V	C=15 pF	C = 30 pF
V^+ = +10V	R = 2.4k	R = 680Ω	V_{CC} = 5.25V		

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	

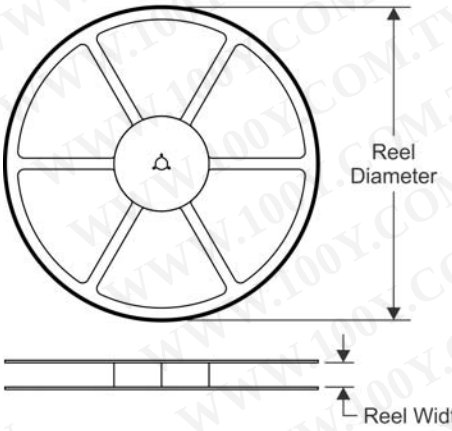
(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, 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)

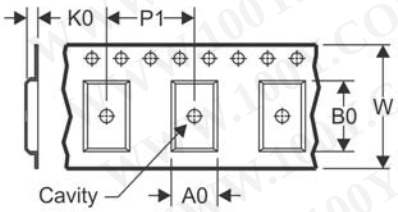
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

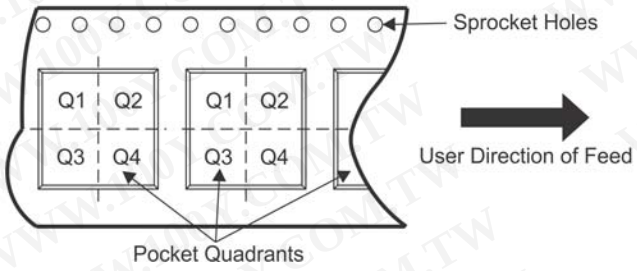


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

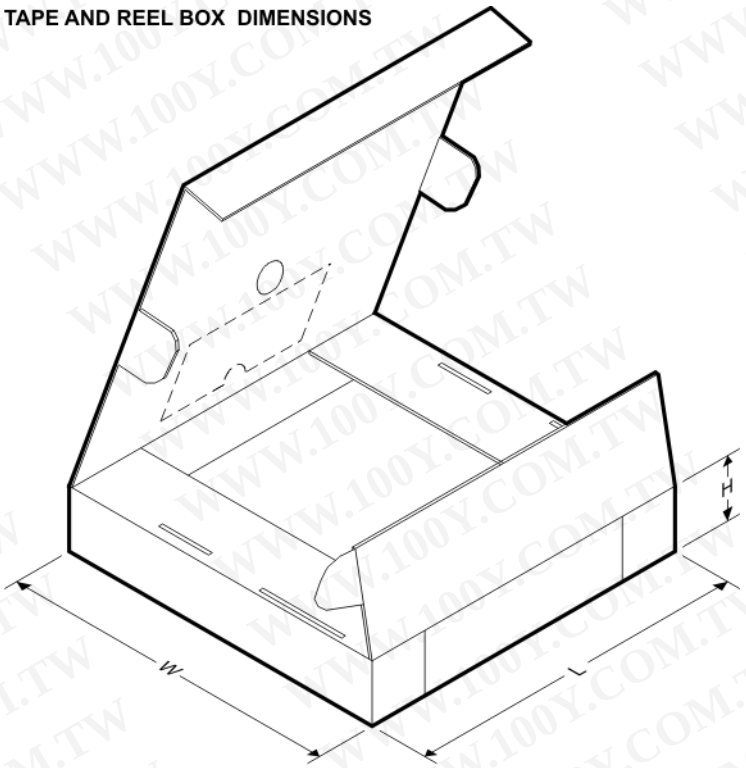
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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

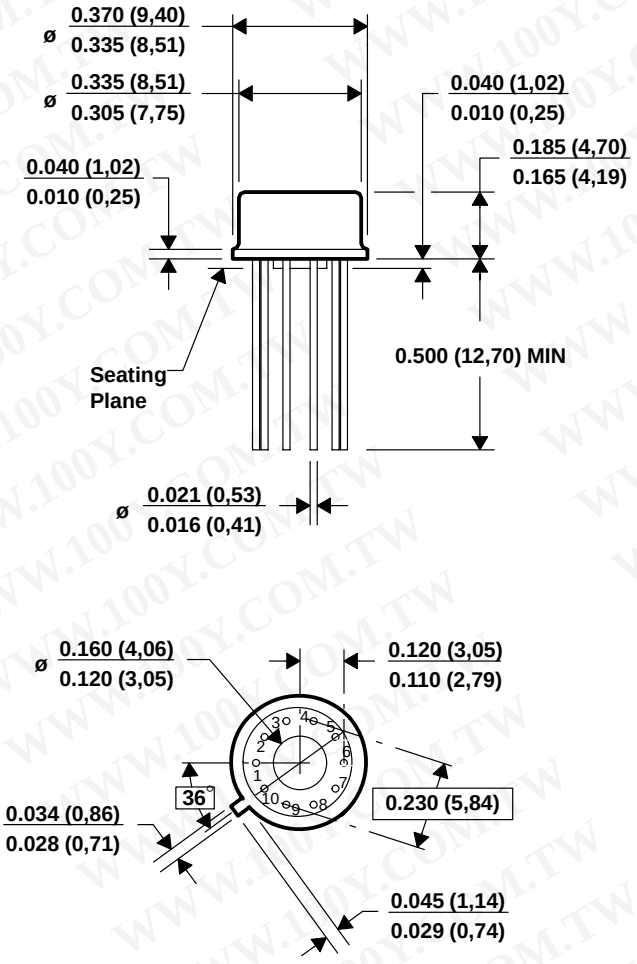
TAPE AND REEL BOX DIMENSIONS



*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

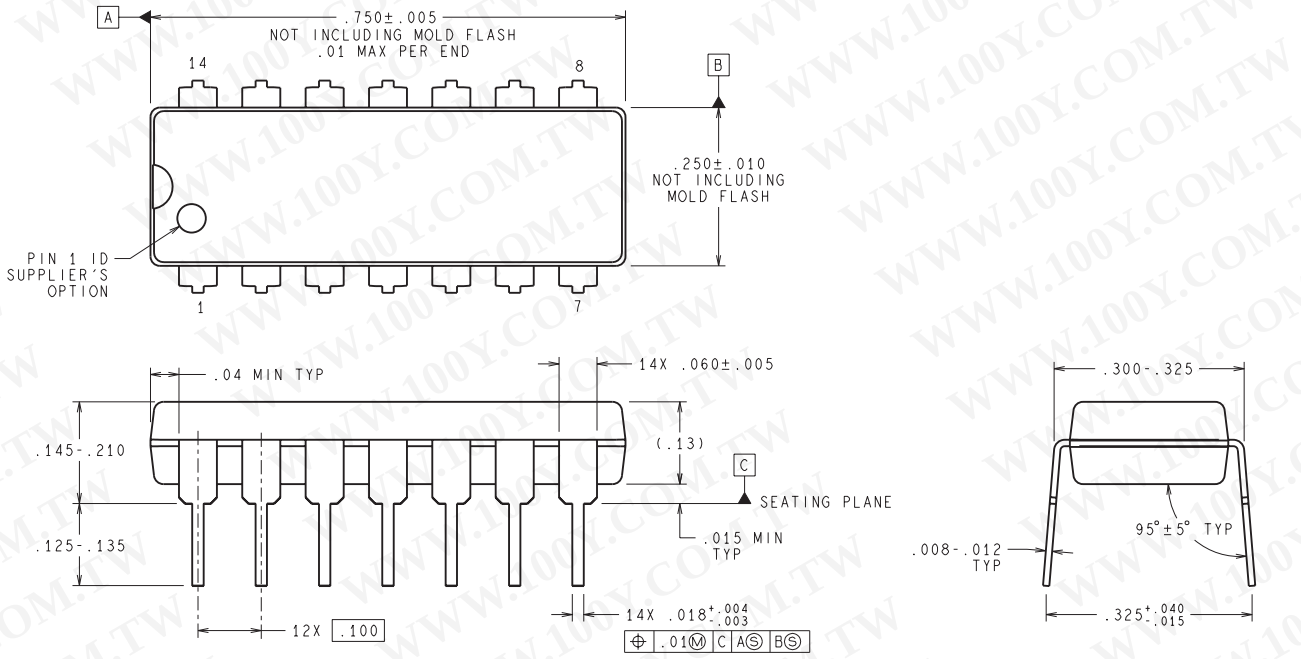
LME (O–MBCY–W10) **METAL CYLINDRICAL PACKAGE**



4202488/A 03/01

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.

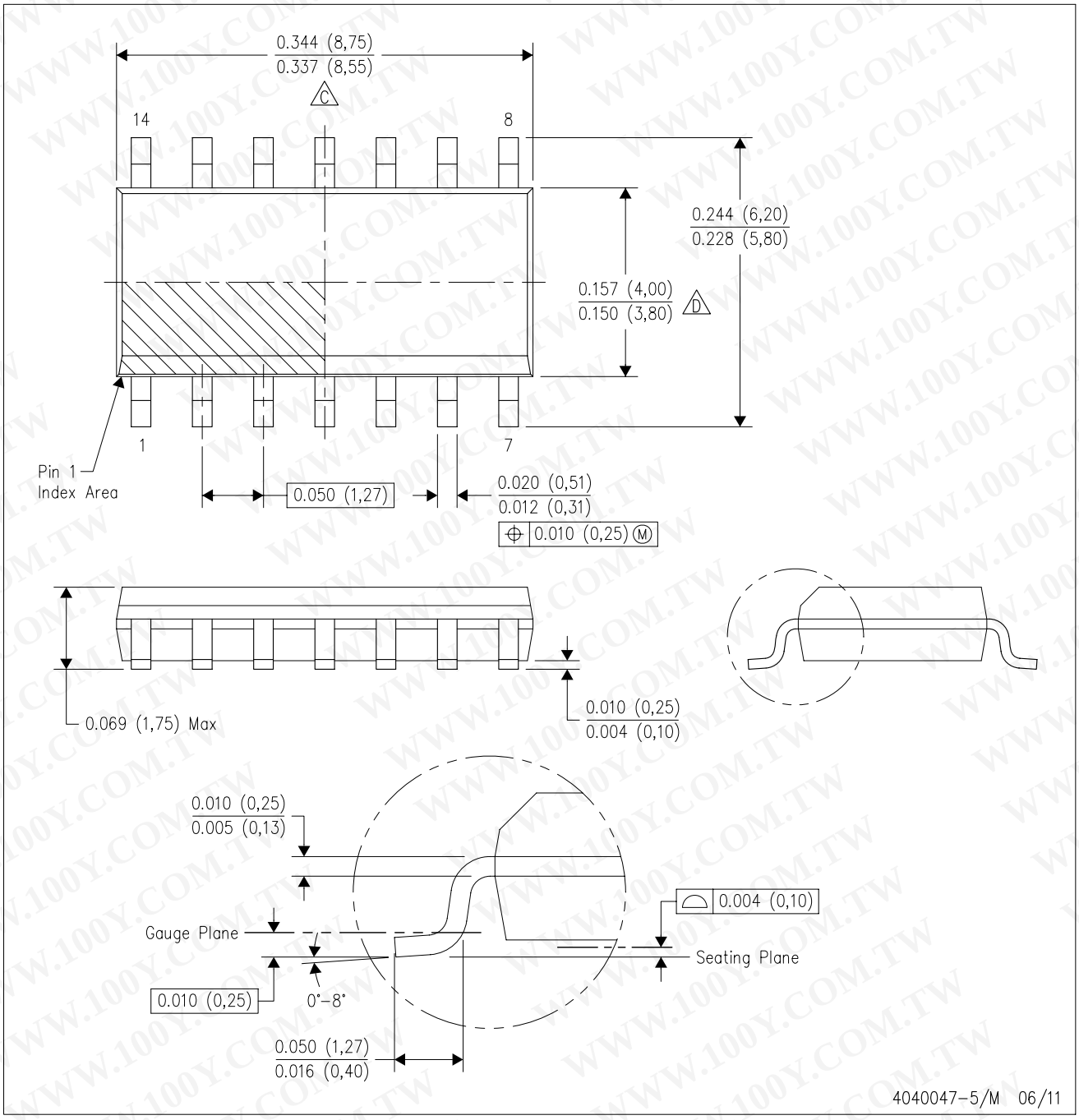
NFF0014A



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.
C. 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.
D. 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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