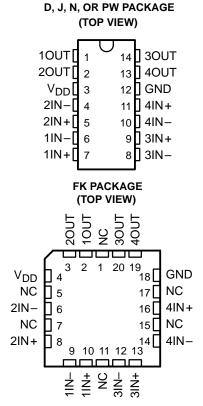
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- Single- or Dual-Supply Operation
- Wide Range of Supply Voltages 2 V to 18 V
- Very Low Supply Current Drain 0.3 mA Typ
- Fast Response Time . . . 200 ns Typ for **TTL-Level Input Step**
- **Built-In ESD Protection**
- High Input Impedance . . .  $10^{12} \Omega$  Typ
- **Extremely Low Input Bias Current 5 pA Typ**
- Ultrastable Low Input Offset Voltage
- **Input Offset Voltage Change at Worst-Case** Input Conditions Typically 0.23 µV/Month. Including the First 30 Days
- **Common-Mode Input Voltage Range Includes Ground**
- Outputs Compatible With TTL, MOS, and **CMOS**
- **Pin-Compatible With LM339**

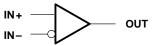
## description

These quadruple differential comparators are fabricated using LinCMOS™ technology and consist of four independent voltage comparators designed to operate from a single power supply. Operation from dual supplies is also possible if the difference between the two supplies is 2 V to 18 V. Each device features extremely high input impedance (typically greater than  $10^{12} \Omega$ ), allowing direct interfacing with high-impedance sources. The outputs are n-channel open-drain configurations and can be connected to achieve positive-logic wired-AND relationships.



NC - No internal connection

## symbol (each comparator)



The TLC374 has internal electrostatic discharge (ESD) protection circuits and has been classified with a 1000-V ESD rating using human body model testing. However, care should be exercised in handling this device as exposure to ESD may result in degradation of the device parametric performance.

The TLC374C is characterized for operation from 0°C to 70°C. The TLC374I is characterized for operation from -40° to 85°C. The TLC374M is characterized for operation over full military temperature range of −55°C to 125°C. The TLC374Q is characterized for operation from −40°C to 125°C.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

LinCMOS is a trademark of Texas Instruments Incorporated.



# TLC374, TLC374Q, TLC374Y LinCMOS™ QUADRUPLE DIFFERENTIAL COMPARATORS

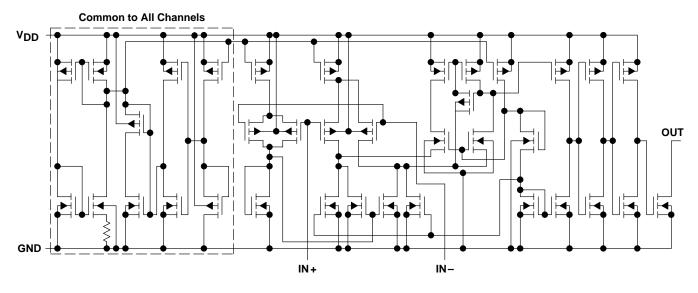
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## **AVAILABLE OPTIONS**

	Via may		PACKAGED DEVICES									
TA	V <sub>IO</sub> max AT 25°C	SMALL OUTLINE   CHIP CARRIER   CERAMIC DIP   (FK) (J)		PLASTIC DIP (N)	TSSOP (PW)	FORM (Y)						
0°C to 70°C	5 mV	TLC374CD	_	_	TLC374CN	TLC374CPW	TLC374Y					
-40°C to 85°C	5 mV	TLC374ID	_		TLC374IN		_					
−55°C to 125°C	5 mV	TLC374MD	TLC374MFK	TLC374MJ	TLC374MN	_	_					
-40°C to 125°C	5 mV	TLC374QD	_	_	TLC374QN		_					

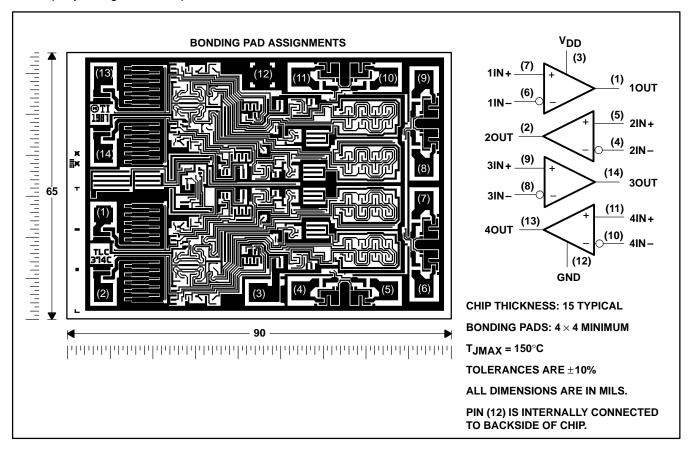
The D packages are available taped and reeled. Add R suffix to device type (e.g., TLC374CDR).

## equivalent schematic (each comparator)



## **TLC374Y chip information**

This chip, when properly assembled, displays characteristics similar to the TLC374C. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.



# **TLC374, TLC374Q, TLC374Y** LinCMOS™ QUADRUPLE DIFFERENTIAL COMPARATORS

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## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage V (con Note 1)	10.1/
Supply voltage, V <sub>DD</sub> (see Note 1)	
Differential input voltage, V <sub>ID</sub> (see Note 2)	±18 V
Input voltage, V <sub>I</sub>	V <sub>DD</sub>
Input voltage range, V <sub>I</sub>	
Output voltage, VO	
Input current, I <sub>1</sub>	±5 mA
Output current, IO	20 mA
Duration of output short circuit to ground (see Note 3)	
Continuous total power dissipation	See Dissipation Rating Table
Operating free-air temperature range, T <sub>A</sub> : TLC374C	0°C to 70°C
TLC374I	40°C to 85°C
TLC374M	–55°C to 125°C
TLC374Q	40°C to 125°C
Storage temperature range, T <sub>stq</sub>	65°C to 150°C
Case temperature range for 60 seconds: FK package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: D, N, or PW p	package 260°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: J package .	300°C

<sup>†</sup> Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. All voltage values except differential voltages are with respect to network ground.
  - 2. Differential voltages are at IN+ with respect to IN -.
  - 3. Short circuits from outputs to V<sub>DD</sub> can cause excessive heating and eventual device destruction.

#### **DISSIPATION RATING TABLE**

PACKAGE	T <sub>A</sub> ≤ 25°C POWER RATING	DERATING FACTOR	DERATE ABOVE T <sub>A</sub>	T <sub>A</sub> = 70°C POWER RATING	T <sub>A</sub> = 85°C POWER RATING	T <sub>A</sub> = 125°C POWER RATING
D	500 mW	7.6 mW/°C	84°C	500 mW	494 mW	190 mW
FK	500 mW	11.0 mW/°C	104°C	500 mW	500 mW	269 mW
J	500 mW	11.0 mW/°C	104°C	500 mW	500 mW	269 mW
N	500 mW	9.2 mW/°C	95°C	500 mW	500 mW	224 mW
PW	700 mW	5.6 mW/°C	_	448 mW	_	_

## recommended operating conditions

		TLC	374C	TLC	3741	TLC3	74M	TLC3	74Q	UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	UNIT
Supply voltage, V <sub>DD</sub>		3	16	3	16	4	16	3	16	V
Common made input valtage V. a	V <sub>DD</sub> = 5 V	0	3.5	0	3.5	0	3.5	0	3.5	V
Common-mode input voltage, V <sub>IC</sub>	V <sub>DD</sub> = 10 V	0	8.5	0	8.5	0	8.5	0	8.5	V
Operating free-air temperature, TA		0	70	-40	85	-55	125	-40	125	°C



# electrical characteristics at specified free-air temperature, $V_{DD} = 5 \text{ V}$

	PARAMETER	TEST CON	DITIONS	<b>.</b>	TLC	374C		TLC	C374I		TLC	374M		UNIT
	PARAMETER	TEST CON	DITIONS	T <sub>A</sub> †	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	UNIT
\/:a	Input offset voltage	\/.o = \/.o = min	Soo Noto 4	25°C		1	5		1	5		1	5	mV
VIO	input onset voltage	$V_{IC} = V_{ICR}min,$	See Note 4	Full range			6.5			7			10	IIIV
lio	Input offset current			25°C		1			1			1		pA
lio	input onset current			MAX			0.3			1			10	nA
	Input bias current			25°C		5			5			5		pA
İΙΒ	input bias current			MAX			0.6			2			20	nA
\/.o.	Common-mode input			25°C	0 to V <sub>DD</sub> -1			0 to V <sub>DD</sub> -1			0 to V <sub>DD</sub> -1			V
VICR	voltage range			Full range	0 to V <sub>DD</sub> -1.5			0 to V <sub>DD</sub> -1.5			0 to V <sub>DD</sub> -1.5			v
la	High-level output current	V <sub>ID</sub> = 1 V	V <sub>OH</sub> = 5 V	25°C		0.1			0.1			0.1		nA
ЮН	r ligit-level output current	AID = 1 A	V <sub>OH</sub> = 15 V	Full range			1			1			1	μΑ
V/01	Low-level output voltage	V <sub>ID</sub> = −1 V,	I <sub>OL</sub> = 4 mA	25°C		150	400		150	400		150	400	mV
VOL	Low-level output voltage	ν <sub>ID</sub> = - ι ν,	IOL = 4 IIIA	Full range			700			700			700	IIIV
$I_{OL}$	Low-level output current	$V_{ID} = -1 V$ ,	V <sub>OL</sub> = 1.5 V	25°C	6	16	·	6	16		6	16	·	mA
Inn	Supply current	VID = 1 V	No load	25°C		300	600		300	600		300	600	μА
IDD	(four comparators)	$V_{ID} = 1 V$	No loau	Full range			800		•	800			800	μΑ

<sup>†</sup> All characteristics are measured with zero common-mode input voltage unless otherwise noted. Full range is 0°C to 70°C for TLC374C, -40°C to 85°C for TLC374I, and -55°C to 125°C for the TLC374M, and -40°C to 125°C for TLC374Q. MAX is 70°C for TLC374C, 85°C TLC374I, and 125°C for the TLC374M, and 125°C for TLC374Q. IMPORTANT: See Parameter Measurement Information.

NOTE 4: The offset voltage limits given are the maximum values required to drive the output above 4 V or below 400 mV with a 10-kΩ resistor between the output and V<sub>DD</sub>. They can be verified by applying the limit value to the input and checking for the appropriate output state.

# switching characteristics, V<sub>DD</sub> = 5 V, T<sub>A</sub> = 25°C

PARAMETER	TEST C	TLC37	UNIT			
		MIN TYP MAX				
Response time	R <sub>L</sub> connected to 5 V through 5.1 k $\Omega$ ,	100-mV input step with 5-mV overdrive		650		nc
Response time	$C_L = 15 \text{ pF}^{\ddagger}$ , See Note 5	TTL-level input step		200		ns

‡C<sub>L</sub> includes probe and jig capacitance.

NOTE 5: The response time specified is the interval between the input step function and the instant when the output crosses 1.4 V.

LinCMOS™ QUADRUPLE DIFFERENTIAL COMPARATORS

# TLC374, TLC374Q, TLC374Y LinCMOS™ QUADRUPLE DIFFERENTIAL COMPARATORS

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# electrical characteristics at specified free-air temperature, $V_{DD}$ = 5 V, $T_A$ = 25°C (unless otherwise noted)

	PARAMETER	TEST CON	IDITIONS	TLC	374Y		UNIT
	PARAMETER	I EST CON	IDITIONS	MIN	TYP	MAX	UNII
VIO	Input offset voltage	$V_{IC} = V_{ICR}min,$	See Note 4		1	5	mV
IIO	Input offset current				1		pA
I <sub>IB</sub>	Input bias current				5		pA
VICR	Common-mode input voltage range			0 to V <sub>DD</sub> -1			V
ІОН	High-level output current	V <sub>ID</sub> = 1 V,	V <sub>OH</sub> = 5 V		0.1		nA
VOL	Low-level output voltage	$V_{ID} = -1 V$ ,	$I_{OL} = 4 \text{ mA}$		150	400	mV
lOL	Low-level output current	$V_{ID} = -1 V$ ,	$V_{OL} = 1.5 \text{ mV}$	6	16		mA
$I_{DD}$	Supply current (four comparators)	V <sub>ID</sub> =1 V,	No load		300	600	μΑ

NOTE 4: The offset voltage limits given are the maximum values required to drive the output above 4 V or below 400 mV with a 10-kΩ resistor between the output and V<sub>DD</sub>. They can be verified by applying the limit value to the input and checking for the appropriate output state.

# switching characteristics, $V_{DD} = 5 \text{ V}$ , $T_A = 25^{\circ}\text{C}$

PARAMETER	TEST CO	ONDITIONS	Т	LC374Y		UNIT
PARAMETER	lesi co	CHOITIGHS	MIN	TYP	MAX	UNII
Response time	R <sub>L</sub> connected to 5 V through 5.1 k $\Omega$ ,	100-mV input step with 5-mV overdrive		650		no
Response time	$C_L = 15 \text{ pF}^{\dagger}$ , See Note 5	TTL-level input step		200		ns

<sup>†</sup>C<sub>L</sub> includes probe and jig capacitance.

NOTE 4: The response time specified is the interval between the input step function and the instant when the output crosses 1.4 V.



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#### PARAMETER MEASUREMENT INFORMATION

The digital output stage of the TLC374 can be damaged if it is held in the linear region of the transfer curve. Conventional operational amplifier/comparator testing incorporates the use of a servo loop that is designed to force the device output to a level within this linear region. Since the servo-loop method of testing cannot be used, the following alternative for measuring parameters such as input offset voltage, common-mode rejection, etc., are offered.

To verify that the input offset voltage falls within the limits specified, the limit value is applied to the input as shown in Figure 1(a). With the noninverting input positive with respect to the inverting input, the output should be high. With the input polarity reversed, the output should be low.

A similar test can be made to verify the input offset voltage at the common-mode extremes. The supply voltages can be slewed as shown in Figure 1(b) for the V<sub>ICR</sub> test, rather than changing the input voltages, to provide greater accuracy.

A close approximation of the input offset voltage can be obtained by using a binary search method to vary the differential input voltage while monitoring the output state. When the applied input voltage differential is equal, but opposite in polarity to the input offset voltage, the output changes state.

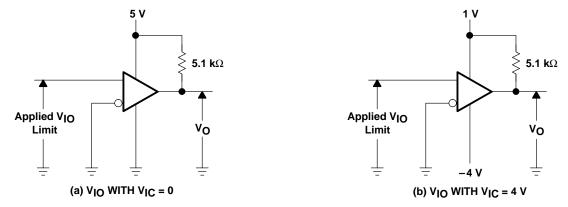


Figure 1. Method for Verifying That Input Offset Voltage is Within Specified Limits

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#### PARAMETER MEASUREMENT INFORMATION

Figure 2 illustrates a practical circuit for direct dc measurement of input offset voltage that does not bias the comparator into the linear region. The circuit consists of a switching-mode servo loop in which U1a generates a triangular waveform of approximately 20-mV amplitude. U1b acts as a buffer with C2 and R4 removing any residual dc offset. The signal is then applied to the inverting input of the comparator under test, while the noninverting input is driven by the output of the integrator formed by U1c through the voltage divider formed by R9 and R10. The loop reaches a stable operating point when the output of the comparator under test has a duty cycle of exactly 50%, which can only occur when the incoming triangle wave is sliced symmetrically or when the voltage at the noninverting input exactly equals the input offset voltage.

Voltage divider R9 and R10 provide a step up of the input offset voltage by a factor of 100 to make measurement easier. The values of R5, R8, R9, and R10 can significantly influence the accuracy of the reading; therefore, it is suggested that their tolerance level be 1% or lower.

Measuring the extremely low values of input current requires isolation from all other sources of leakage current and compensation for the leakage of the test socket and board. With a good picoammeter, the socket and board leakage can be measured with no device in the socket. Subsequently, this open-socket leakage value can be subtracted from the measurement obtained with a device in the socket to obtain the actual input current of the device.

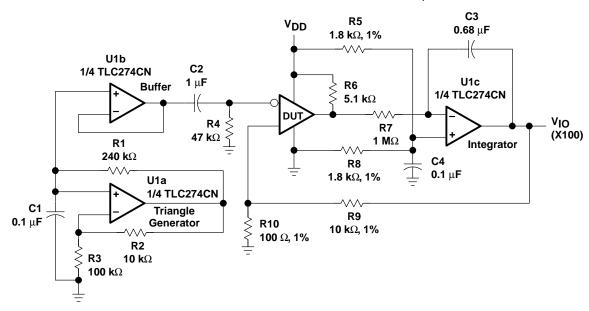
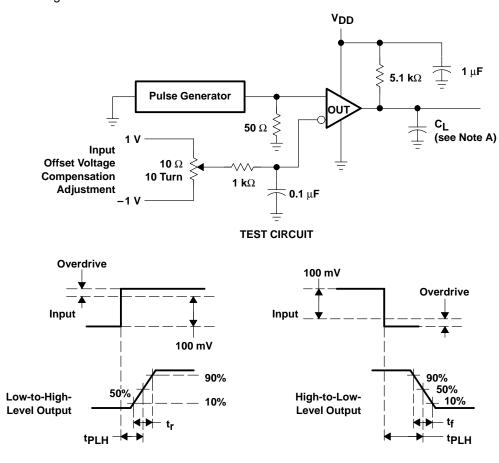


Figure 2. Test Circuit for Input Offset Voltage Measurement



#### PARAMETER MEASUREMENT INFORMATION

Response time is defined as the interval between the application of an input step function and the instant when the output reaches 50% of its maximum value. Response time, low-to-high-level output, is measured from the trailing edge of the input pulse. Response-time measurement at low input signal levels can be greatly affected by the input offset voltage. The offset voltage should be balanced by the adjustment at the inverting input (as shown in Figure 3) so that the circuit is just at the transition point. Then a low signal, for example, 105-mV or 5-mV overdrive, causes the output to change state.



**VOLTAGE WAVEFORMS** 

NOTE A:  $C_L$  includes probe and jig capacitance.

Figure 3. Response, Rise, and Fall Times Test Circuit and Voltage Waveforms

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#### PRINCIPLES OF OPERATION

## LinCMOS process

LinCMOS process is a linear polysilicon-gate complimentary-MOS process. Primarily designed for single-supply applications, LinCMOS products facilitate the design of a wide range of high-performance analog functions from operational amplifiers to complex mixed-mode converters.

While digital designers are experienced with CMOS, MOS technologies are relatively new for analog designers. This short guide is intended to answer the most frequently asked questions related to the quality and reliability of LinCMOS products. Further questions should be directed to the nearest TI field sales office.

#### electrostatic discharge

CMOS circuits are prone to gate oxide breakdown when exposed to high voltages even if the exposure is only for very short periods of time. Electrostatic discharge (ESD) is one of the most common causes of damage to CMOS devices. It can occur when a device is handled without proper consideration for environmental electrostatic charges, e.g. during board assembly. If a circuit in which one amplifier from a dual operational amplifier is being used and the unused pins are left open, high voltages tends to develop. If there is no provision for ESD protection, these voltages may eventually punch through the gate oxide and cause the device to fail. To prevent voltage buildup, each pin is protected by internal circuitry.

Standard ESD-protection circuits safely shunt the ESD current by providing a mechanism whereby one or more transistors break down at voltages higher than normal operating voltages but lower than the breakdown voltage of the input gate. This type of protection scheme is limited by leakage currents which flow through the shunting transistors during normal operation after an ESD voltage has occurred. Although these currents are small, on the order of tens of nanoamps, CMOS amplifiers are often specified to draw input currents as low as tens of picoamps.

To overcome this limitation, TI design engineers developed the patented ESD-protection circuit shown in Figure 4. This circuit can withstand several successive 1-kV ESD pulses, while reducing or eliminating leakage currents that may be drawn through the input pins. A more detailed discussion of the operation of TI's ESD-protection circuit is presented on the next page.

All input an output pins of LinCMOS and Advanced LinCMOS products have associated ESD-protection circuitry that undergoes qualification testing to withstand 1000 V discharged from a 100-pF capacitor through a 1500- $\Omega$  resistor (human body model) and 200 V from a 100-pF capacitor with no current-limiting resistor (charged device model). These tests simulate both operator and machine handling of devices during normal test and assembly operations.

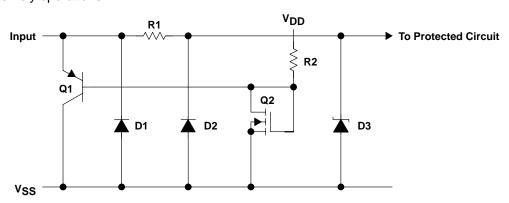


Figure 4. LinCMOS ESD-Protection Schematic



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#### PRINCIPLES OF OPERATION

## Input protection circuit operation

Texas Instruments patented protection circuitry allows for both positive- and negative-going ESD transients. These transients are characterized by extremely fast rise times and usually low energies, and can occur both when the device has all pins open and when it is installed in a circuit.

## positive ESD transients

Initial positive charged energy is shunted through Q1 to  $V_{SS}$ . Q1 turns on when the voltage at the input rises above the voltage on  $V_{DD}$  by a value equal to the  $V_{EB}$  of Q1. The base current increases through R2 with input current as Q1 saturates. The base current through R2 as Q1 saturates forces the voltage at the drain and gate of Q2 to exceed its threshold level ( $V_T \sim$  22 to 26 V) and turn on Q2. The shunted input current through Q1 to  $V_{SS}$  is now shunted through the n-channel enhancement-type MOSFET Q2 to  $V_{SS}$ . If the voltage on the input pin continues to rise, the breakdown voltage of d3 is exceeded and all remaining energy is dissipated in R1 and D3. The breakdown voltage of D3 is designed to be 24 V to 27 V, which is well below the gate oxide voltage of the circuit to be protected.

#### negative ESD transients

The negative charged ESD transients are shunted directly through D1. Additional energy is dissipated in R1 and D2 as D2 becomes forward-biased. The voltage seen by the protected circuit is -0.3 V to -1 V (the forward voltage of D1 and D2).

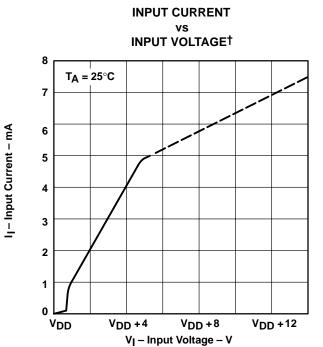
## circuit-design considerations

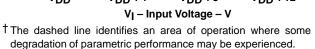
LinCMOS products are being used in actual circuits environments that have input voltages that exceed the recommended common-mode input voltage range and activate the input protection circuit. Even under normal operation, these conditions occur during circuit power up or power down, and in many cases, when the device is being used for a signal conditioning function. The input voltages can exceed  $V_{ICR}$  and not damage the device only if the inputs are current limited. The recommended current limit shown on most product data sheets is  $\pm 5$  mA. Figures 5 and 6 show typical characteristics for input voltage vs input current.

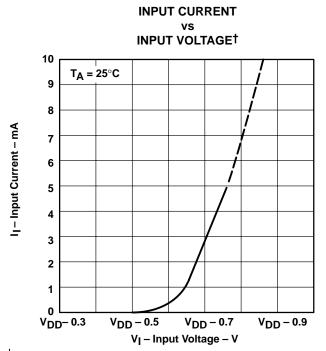
Normal operation and correct output state can be expected even when the input voltage exceeds the positive supply voltage. The input current should be externally limited even through internal positive current limiting is achieved in the input protection circuit by the action of Q1. When Q1 is on, it saturates and limits the current to approximately 5-mA collector current by design. When saturated, Q1 base current increases with input current. This current is forced into the  $V_{DD}$  pin and into the device  $I_{DD}$  or the  $V_{DD}$  supply through R2 producing the current limiting effects shown in Figure 5. This internal limiting lasts only as long as the input voltage is below the  $V_{T}$  of Q2.

When the input voltage exceeds the negative supply voltage, normal operation is affected and output voltage states may not be correct. Also, the isolation between channels of multiple devices (duals and quads) can be severely affected. External current limiting must be used since this current is directly shunted by D1 and D2, and no internal limiting is achieved. If normal output voltage states are required, an external input voltage clamp is required (see Figure 7).

#### PRINCIPLES OF OPERATION

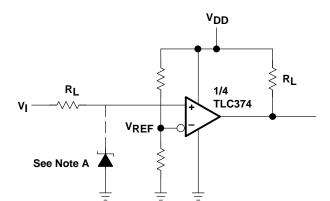






† The dashed line identifies an area of operation where some degradation of parametric performance may be experienced.

Figure 5 Figure 6



**Positive Voltage Input Current Limit:** 

$$R_{I} = \frac{+V_{I} - V_{DD} - 0.3 V}{5 \text{ mA}}$$

**Negative Voltage Input Current Limit:** 

$$R_{I} = \frac{-V_{I} - V_{DD} - (0.3 \text{ V})}{5 \text{ mA}}$$

NOTE A: If the correct output state is required when the negative input exceeds VSS, a Schotty clamp is required.

Figure 7. Typical Input Current-Limiting Configuration for a LinCMOS Comparator

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## **PACKAGING INFORMATION**

Orderable part number	Status	Material type	Package   Pins	Package qty   Carrier	<b>RoHS</b> (3)	Lead finish/ Ball material	MSL rating/ Peak reflow	Op temp (°C)	Part marking (6)
5962-87659012A	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 87659012A TLC374MFKB
5962-8765901CA	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8765901CA TLC374MJB
TLC374CD	Obsolete	Production	SOIC (D)   14	-	-	Call TI	Call TI	0 to 70	TLC374C
TLC374CDR	Active	Production	SOIC (D)   14	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	TLC374C
TLC374CDR.A	Active	Production	SOIC (D)   14	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	TLC374C
TLC374CN	Active	Production	PDIP (N)   14	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	TLC374CN
TLC374CN-A	Active	Production	PDIP (N)   14	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	TLC374CN_A
TLC374CN-A.A	Active	Production	PDIP (N)   14	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	TLC374CN_A
TLC374CN.A	Active	Production	PDIP (N)   14	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	TLC374CN
TLC374CNS	Active	Production	SOP (NS)   14	50   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	TLC374
TLC374CNS.A	Active	Production	SOP (NS)   14	50   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	TLC374
TLC374CPW	Active	Production	TSSOP (PW)   14	90   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	P374
TLC374CPW.A	Active	Production	TSSOP (PW)   14	90   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	P374
TLC374CPWR	Active	Production	TSSOP (PW)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	P374
TLC374CPWR.A	Active	Production	TSSOP (PW)   14	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	P374
TLC374ID	Obsolete	Production	SOIC (D)   14	-	-	Call TI	Call TI	-40 to 85	TLC374I
TLC374IDR	Active	Production	SOIC (D)   14	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TLC374I
TLC374IDR.A	Active	Production	SOIC (D)   14	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TLC374I
TLC374IN	Active	Production	PDIP (N)   14	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	TLC374IN
TLC374IN.A	Active	Production	PDIP (N)   14	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	TLC374IN
TLC374MD	Obsolete	Production	SOIC (D)   14	-	-	Call TI	Call TI	-55 to 125	TLC374M
TLC374MFKB	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 87659012A TLC374MFKB
TLC374MFKB.A	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 87659012A TLC374MFKB
TLC374MJ	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	TLC374MJ

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Orderable part number	Status	Material type (2)	Package   Pins	Package qty   Carrier	RoHS	Lead finish/ Ball material	MSL rating/ Peak reflow	Op temp (°C)	Part marking (6)
TLC374MJ.A	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	TLC374MJ
TLC374MJB	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8765901CA TLC374MJB
TLC374MJB.A	Active	Production	CDIP (J)   14	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8765901CA TLC374MJB

<sup>(1)</sup> Status: For more details on status, see our product life cycle.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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#### OTHER QUALIFIED VERSIONS OF TLC374, TLC374M:

Catalog: TLC374

<sup>(2)</sup> Material type: When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> RoHS values: Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

<sup>(4)</sup> Lead finish/Ball material: Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

<sup>(5)</sup> MSL rating/Peak reflow: The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> Part marking: There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

## PACKAGE OPTION ADDENDUM

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Military : TLC374M

NOTE: Qualified Version Definitions:

- Catalog TI's standard catalog product
- Military QML certified for Military and Defense Applications

# **PACKAGE MATERIALS INFORMATION**

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## TAPE AND REEL INFORMATION





A0	Dimension designed to accommodate the component width
В0	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		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TLC374CDR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
TLC374CDR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
TLC374CPWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
TLC374IDR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1



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#### \*All dimensions are nominal

	7 III dilliotto di e trettimat										
	Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)			
	TLC374CDR	SOIC	D	14	2500	356.0	356.0	35.0			
ı	TLC374CDR	SOIC	D	14	2500	353.0	353.0	32.0			
ı	TLC374CPWR	TSSOP	PW	14	2000	353.0	353.0	32.0			
	TLC374IDR	SOIC	D	14	2500	353.0	353.0	32.0			

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## **TUBE**



\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
5962-87659012A	FK	LCCC	20	55	506.98	12.06	2030	NA
TLC374CN	N	PDIP	14	25	506	13.97	11230	4.32
TLC374CN-A	N	PDIP	14	25	506	13.97	11230	4.32
TLC374CN-A.A	N	PDIP	14	25	506	13.97	11230	4.32
TLC374CN.A	N	PDIP	14	25	506	13.97	11230	4.32
TLC374CNS	NS	SOP	14	50	530	10.5	4000	4.1
TLC374CNS.A	NS	SOP	14	50	530	10.5	4000	4.1
TLC374CPW	PW	TSSOP	14	90	530	10.2	3600	3.5
TLC374CPW.A	PW	TSSOP	14	90	530	10.2	3600	3.5
TLC374IN	N	PDIP	14	25	506	13.97	11230	4.32
TLC374IN.A	N	PDIP	14	25	506	13.97	11230	4.32
TLC374MFKB	FK	LCCC	20	55	506.98	12.06	2030	NA
TLC374MFKB.A	FK	LCCC	20	55	506.98	12.06	2030	NA



SMALL OUTLINE INTEGRATED CIRCUIT



#### NOTES:

- 1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.

  2. This drawing is subject to change without notice.

  3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not
- exceed 0.15 mm, per side.
- 4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm, per side.
- 5. Reference JEDEC registration MS-012, variation AB.



SMALL OUTLINE INTEGRATED CIRCUIT



NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SMALL OUTLINE INTEGRATED CIRCUIT



NOTES: (continued)

- 8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
- 9. Board assembly site may have different recommendations for stencil design.



## **MECHANICAL DATA**

# NS (R-PDSO-G\*\*)

# 14-PINS SHOWN

## PLASTIC SMALL-OUTLINE PACKAGE



NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.



8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

This image is a representation of the package family, actual package may vary. Refer to the product data sheet for package details.



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CERAMIC DUAL IN LINE PACKAGE



Images above are just a representation of the package family, actual package may vary. Refer to the product data sheet for package details.

4040083-5/G





CERAMIC DUAL IN LINE PACKAGE



#### NOTES:

- 1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- 2. This drawing is subject to change without notice.
- 3. This package is hermitically sealed with a ceramic lid using glass frit.
- His package is remitted by sealed with a ceramic its using glass mit.
   Index point is provided on cap for terminal identification only and on press ceramic glass frit seal only.
   Falls within MIL-STD-1835 and GDIP1-T14.



CERAMIC DUAL IN LINE PACKAGE



# N (R-PDIP-T\*\*)

# PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
- The 20 pin end lead shoulder width is a vendor option, either half or full width.





SMALL OUTLINE PACKAGE



#### NOTES:

- 1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.

  2. This drawing is subject to change without notice.

  3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not
- exceed 0.15 mm per side.
- 4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
- 5. Reference JEDEC registration MO-153.



SMALL OUTLINE PACKAGE



NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SMALL OUTLINE PACKAGE



NOTES: (continued)

- 8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
- 9. Board assembly site may have different recommendations for stencil design.



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