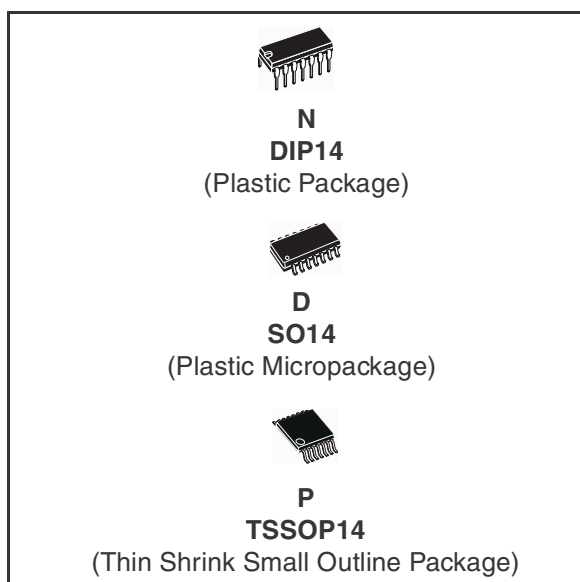


Micropower Quad CMOS Voltage Comparators

- Push-pull cmos output (no external pull-up resistor required)
- Extremely low supply current: **9µA typ/comp.**
- Wide single supply range **2.7V to 16V** or dual supplies ($\pm 1.35V$ to $\pm 8V$)
- Extremely low input bias current: **1pA typ.**
- Extremely low input offset current: **1pA typ.**
- Input common-mode voltage range includes GND
- High input impedance: $10^{12}\Omega$ typ
- Last response time: 2µs typ. for 5mV overdrive
- Pin-to-pin and functionally compatible with bipolar LM339

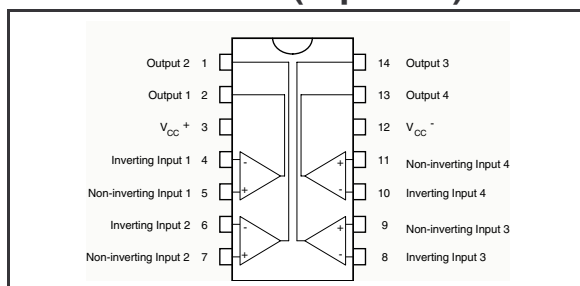


Description

The TS3704 is a micropower CMOS quad voltage comparator with extremely low consumption of 9µA typ / comparator (20 times less than bipolar LM339). The push-pull CMOS output stage allows power and space saving by eliminating the external pull-up resistor required by usual open-collector output comparators.

Thus response times remain similar to the LM339.

Pin Connection (top view)



Order Codes

Part Number	Temperature Range	Package	Packaging	Marking
TS3704CN	0°C, +70°C	DIP14	Tube	TS3704CN
TS3704CD/CDT		SO-14	Tube or Tape & Reel	3704C
TS3704IN	-40°C, +125°C	DIP14	Tube	TS3704IN
TS3704ID/IDT		SO-14	Tube or Tape & Reel	3704I
TS3704IPT		TSSOP14 (Thin Shrink Outline Package)	Tape & Reel	3704I
TS3704IYD		SO-14 (automotive grade level)	Tube or Tape & Reel	3704IY
TS3704IYDT				3704Y

1 Absolute Maximum Ratings

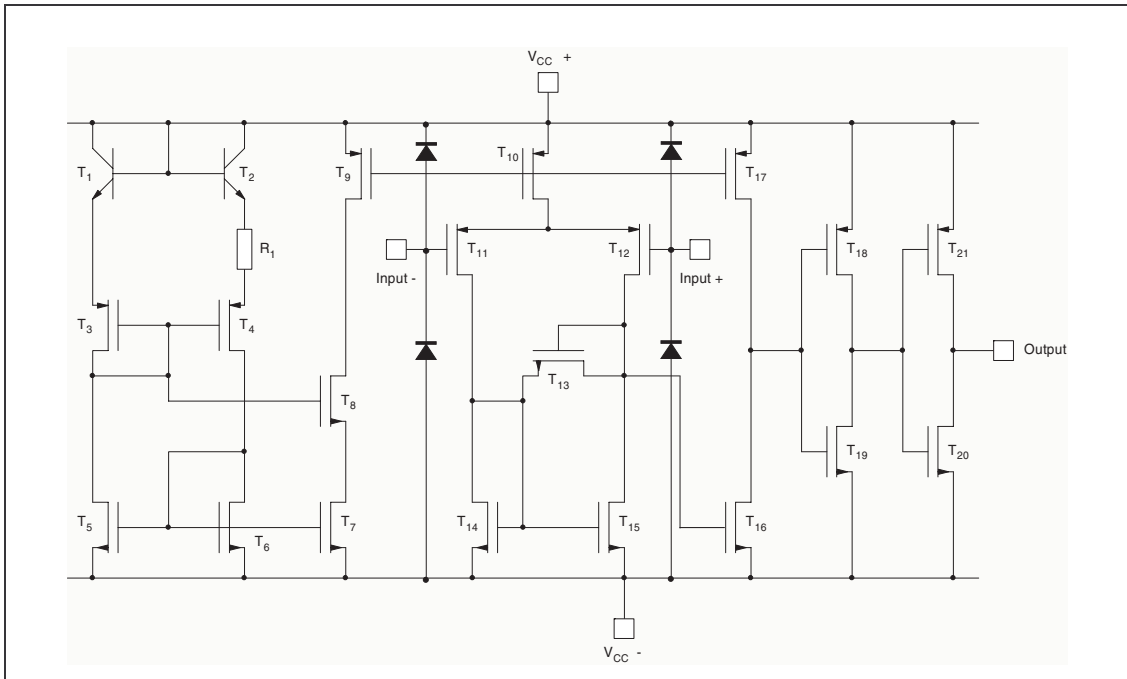
Table 1. Key parameters and their absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}^+	Supply Voltage ⁽¹⁾	18	V
V_{id}	Differential Input Voltage ⁽²⁾	±18	V
V_i	Input Voltage ⁽³⁾	18	V
V_o	Output Voltage	18	V
I_o	Output Current	20	mA
I_F	Forward Current in ESD Protection Diodes on Input ⁽⁴⁾	50	mA
P_d	Power Dissipation ⁽⁵⁾ DIP14 SO14 TSSOP14	1500 830 710	mW
T_{stg}	Storage Temperature Range	-65 to +150	°C
ESD	HBM: Human Body Model ⁽⁶⁾	500	V
	MM: Machine Model ⁽⁷⁾	50	V
	CDM: Charged Device Model	1.5	kV

1. All voltage values, except differential voltage, are with respect to network ground terminal.
2. Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.
3. The magnitude of the input and the output voltages must never exceed the magnitude of the positive and negative supply voltages.
4. Guaranteed by design.
5. P_d is calculated with $T_{amb} = +25^{\circ}C$, $T_j = +150^{\circ}C$ and
 $R_{thja} = 80^{\circ}C/W$ for DIP14 package
 $R_{thja} = 150^{\circ}C/W$ for SO14 package
 $R_{thja} = 175^{\circ}C/W$ for TSSOP14 package
6. Human body model, 100pF discharged through a 1.5kΩ resistor into pin of device.
7. Machine model ESD, a 200pF cap is charged to the specified voltage, then discharged directly into the IC with no external series resistor (internal resistor < 5Ω), into pin to pin of device.

2 Typical Application Schematics

Figure 1. Schematic diagram (for 1/4 TS3704)



3 Electrical Characteristics

Table 2. $V_{CC}^+ = 3V$, $V_{CC}^- = 0V$, $T_{amb} = 25^\circ C$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage ⁽¹⁾ $V_{ic} = 1.5V$ $T_{min.} \leq T_{amb} \leq T_{max.}$			5 6.5	mV
I_{io}	Input Offset Current ⁽²⁾ $V_{ic} = 1.5V$ $T_{min.} \leq T_{amb} \leq T_{max.}$		1	300	pA
I_{ib}	Input Bias Current ⁽²⁾ $V_{ic} = 1.5V$ $T_{min.} \leq T_{amb} \leq T_{max.}$		1	600	pA
V_{icm}	Input Common Mode Voltage Range $T_{min.} \leq T_{amb} \leq T_{max.}$	0 0		$V_{CC}^+ - 1.2$ $V_{CC}^+ - 1.5$	V
CMR	Common-mode Rejection Ratio $V_{ic} = V_{icm \text{ min.}}$		80		dB
SVR	Supply Voltage Rejection Ratio $V_{CC}^+ = 3V \text{ to } 5V$		75		dB
V_{OH}	High Level Output Voltage $V_{id} = 1V$, $I_{OH} = -4mA$ $T_{min.} \leq T_{amb} \leq T_{max.}$	2 1.8	2.4		V
V_{OL}	Low Level Output Voltage $V_{id} = -1V$, $I_{OL} = 4mA$ $T_{min.} \leq T_{amb} \leq T_{max.}$		300	400 575	mV
I_{CC}	Supply Current (each comparator) No load - Outputs low $T_{min.} \leq T_{amb} \leq T_{max.}$		7	20 25	μA
t_{PLH}	Response Time Low to High $V_{ic} = 0V$, $f = 10kHz$, $C_L = 50pF$, Overdrive = 5mV TTL Input		1.2 0.7		μs
t_{PHL}	Response Time High to Low $V_{ic} = 0V$, $f = 10kHz$, $C_L = 50pF$, Overdrive = 5mV TTL Input		2 0.15		μs

1. The specified offset voltage is the maximum value required to drive the output up to 2.5V or down to 0.3V.

2. Maximum values including unavoidable inaccuracies of the industrial test.

Table 3. $V_{CC}^+ = 5V$, $V_{CC}^- = 0V$, $T_{amb} = 25^\circ C$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage ⁽¹⁾ $V_{ic} = 2.5V$, $V_{CC}^+ = 5V$ to $10V$ $T_{min.} \leq T_{amb} \leq T_{max.}$		1.2	5 6.5	mV
I_{io}	Input Offset Current ⁽²⁾ $V_{ic} = 2.5V$ $T_{min.} \leq T_{amb} \leq T_{max.}$		1	300	pA
I_{ib}	Input Bias Current ⁽²⁾ $V_{ic} = 2.5V$ $T_{min.} \leq T_{amb} \leq T_{max.}$		1	600	pA
V_{icm}	Input Common Mode Voltage Range $T_{min.} \leq T_{amb} \leq T_{max.}$	0 0		$V_{CC}^+ - 1.2$ $V_{CC}^+ - 1.5$	V
CMR	Common-mode Rejection Ratio $V_{ic} = V_{icm \text{ min.}}$		80		dB
SVR	Supply Voltage Rejection Ratio $V_{CC}^+ = +5V$ to $+10V$		92		dB
V_{OH}	High Level Output Voltage $V_{id} = 1V$, $I_{OH} = -4mA$ $T_{min.} \leq T_{amb} \leq T_{max.}$	4.5 4.3	4.7		V
V_{OL}	Low Level Output Voltage $V_{id} = -1V$, $I_{OL} = 4mA$ $T_{min.} \leq T_{amb} \leq T_{max.}$		200	300 375	mV
I_{CC}	Supply Current (each comparator) No load - Outputs low		9	20 25	μA
t_{PLH}	Response Time Low to High $V_{ic} = 0V$, $f = 10kHz$, $C_L = 50pF$, Overdrive = $5mV$ Overdrive = $10mV$ Overdrive = $20mV$ Overdrive = $40mV$ TTL Input		1.2 1 0.9 0.8 0.7		μs
t_{PHL}	Response Time High to Low $V_{ic} = 0V$, $f = 10kHz$, $C_L = 50pF$, Overdrive = $5mV$ Overdrive = $10mV$ Overdrive = $20mV$ Overdrive = $40mV$ TTL Input		2 1.5 0.9 0.7 0.15		μs
t_f	Fall time $f = 10kHz$, $C_L = 50pF$, Overdrive $50mV$		30		ns

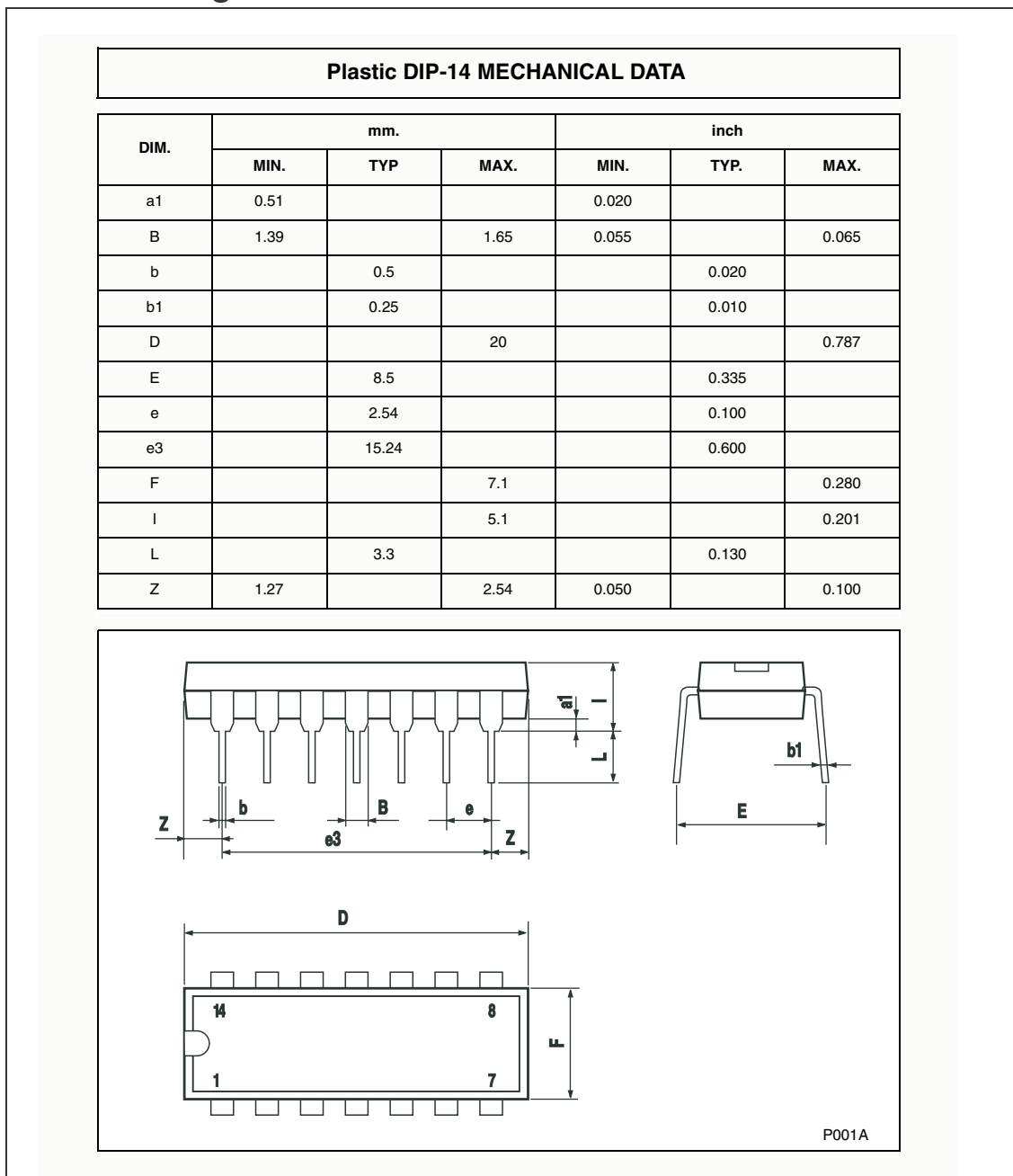
1. The specified offset voltage is the maximum value required to drive the output up to 4.5V or down to 0.3V.

2. Maximum values including unavoidable inaccuracies of the industrial test.

4 Package Mechanical Data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

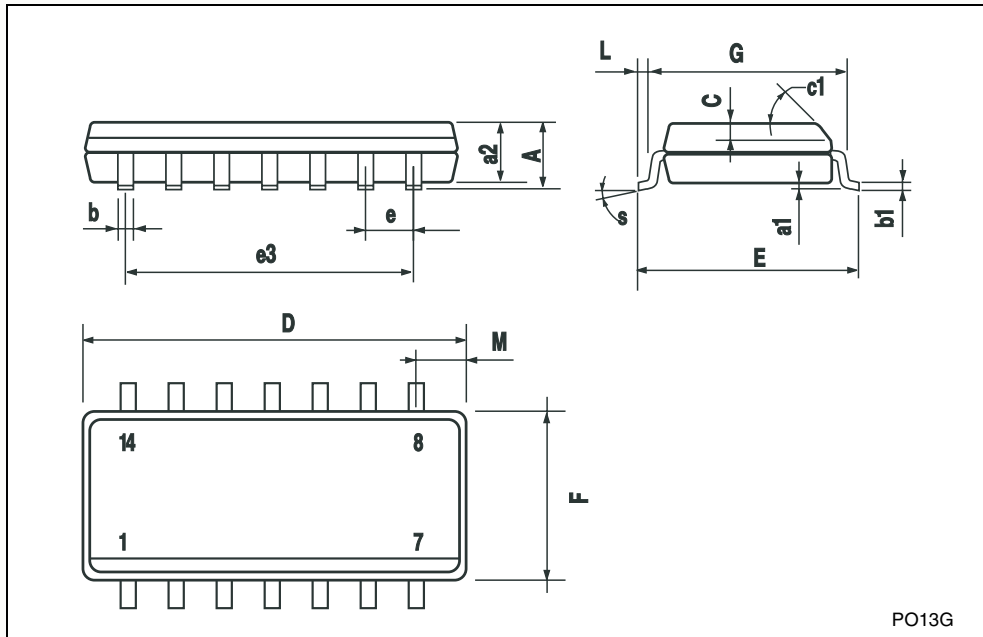
4.1 DIP14 Package



4.2 SO-14 Package

SO-14 MECHANICAL DATA

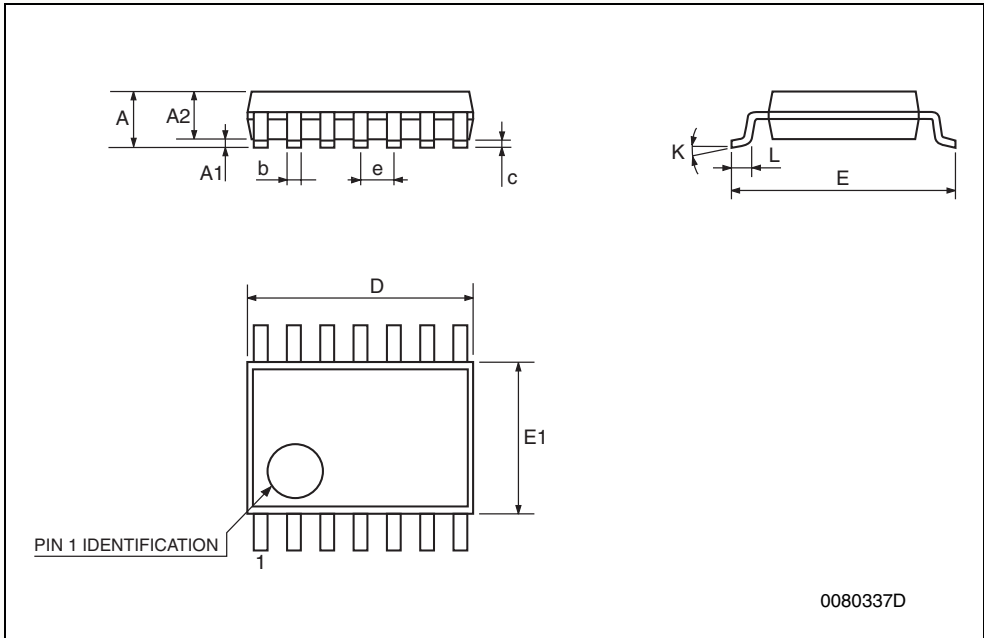
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.2	0.003		0.007
a2			1.65			0.064
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.68			0.026
S	8° (max.)					



4.3 TSSOP14 Package

TSSOP14 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.2			0.047
A1	0.05		0.15	0.002	0.004	0.006
A2	0.8	1	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.0089
D	4.9	5	5.1	0.193	0.197	0.201
E	6.2	6.4	6.6	0.244	0.252	0.260
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65 BSC			0.0256 BSC	
K	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030



5 Revision History

Date	Revision	Changes
Oct. 2004	1	Initial release.
Aug. 2005	2	1 - PPAP references inserted in the datasheet see : <i>Order Codes on page 1.</i> 2 - ESD protection inserted in <i>Table 1. on page 2.</i>

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