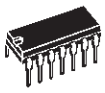
TS3704C,I,M

MICROPOWER QUAD CMOS VOLTAGE COMPARATORS

- PUSH-PULL CMOS OUTPUT (NO EXTERNAL PULL-UP RESISTOR REQUIRED)
- EXTREMELY LOW SUPPLY CURRENT : **9µA typ / comparator**
- WIDE SINGLE SUPPLY RANGE **3V TO 16V** OR DUAL SUPPLIES (±1.5V TO ±8V)
- EXTREMELY LOW INPUT BIAS CURRENT : **1pA typ**
- EXTREMELY LOW INPUT OFFSET CURRENTS : **1pA typ**
- INPUT COMMON-MODE VOLTAGE RANGE INCLUDES GND
- HIGH INPUT IMPEDANCE : $10^{12}\Omega$ typ
- FAST RESPONSE TIME : 2µs typ for 5mV overdrive
- PIN-TO-PIN AND FUNCTIONALLY COMPATIBLE WITH BIPOLAR LM339



N
DIP14
(Plastic Package)

D
SO14
(Plastic Micropackage)

P
TSSOP14
(Thin Shrink Small Outline Package)

DESCRIPTION

The TS3704 is a micropower CMOS quad voltage comparator with extremely low consumption of 9mA 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.

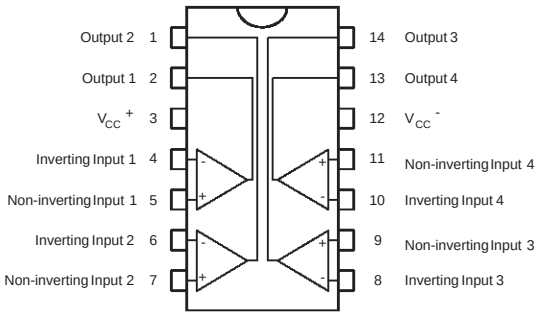
Thus response times remain similar to the LM339.

ORDER CODE

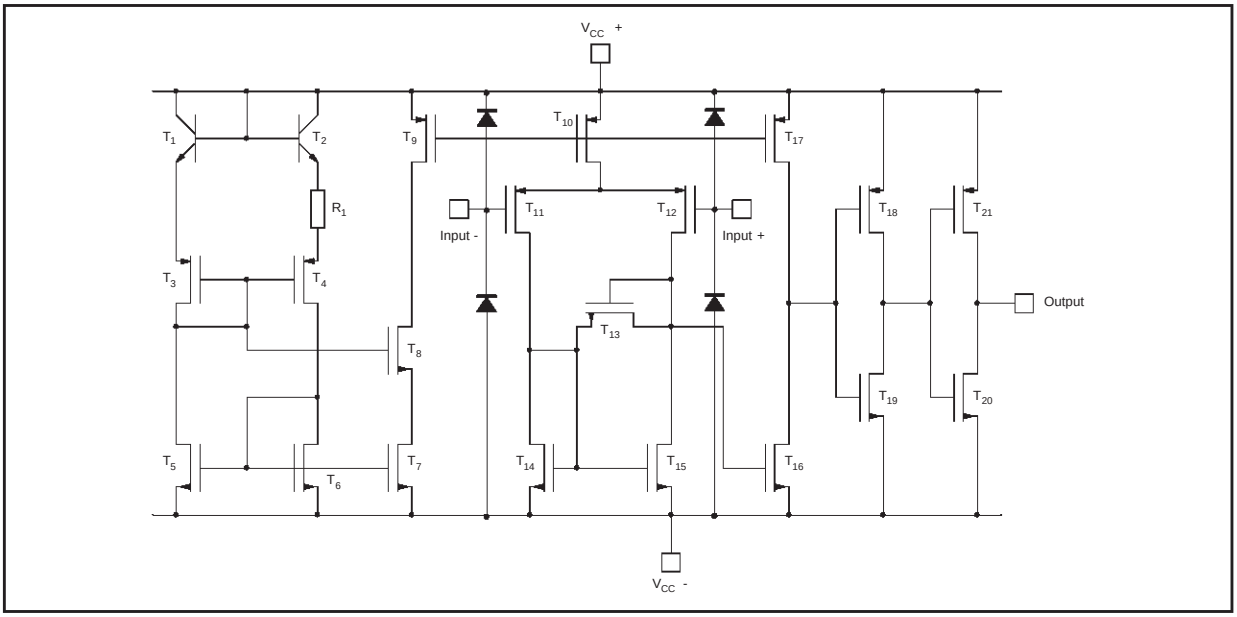
Part Number	Temperature Range	Package		
		N	D	P
TS3704C	0°C, +70°C	•	•	•
TS3704I	-40°C, +125°C	•	•	•
TS3704M	-55°C, +125°C	•	•	•

N = Dual in Line Package (DIP)
D = Small Outline Package (SO) - also available in Tape & Reel (DT)
P = Thin Shrink Small Outline Package (TSSOP) - only available in Tape & Reel (PT)

PIN CONNECTIONS (top view)



SCHEMATIC DIAGRAM (for 1/4 TS3704)



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	
T_{stg}	Storage Temperature Range	-65 to +150	°C

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 possitive supply voltage.
4. Guaranteed by design.
5. Pd is calculated with T_{amb} = +25°C, T_j = +150°C and R_{thja} = 80°C/W for DIP14 package
   = 150°C/W for SO14 package
   = 175°C/W for TSSOP14 package

OPERATING CONDITIONS

Symbol	Parameter		Value	Unit
V_{CC}^+	Supply Voltage	TS3704C,I TS3704M	3 to 16 4 to 16	V
V_{icm}	Common Mode Input Voltage Range		0 to V_{CC}^+ -1.5	V
T_{oper}	Operating Free-Air Temperature range	TS3704C TS3704I TS3704M	0 to +70 -40 to +125 -55 to +125	°C

ELECTRICAL CHARACTERISTICS

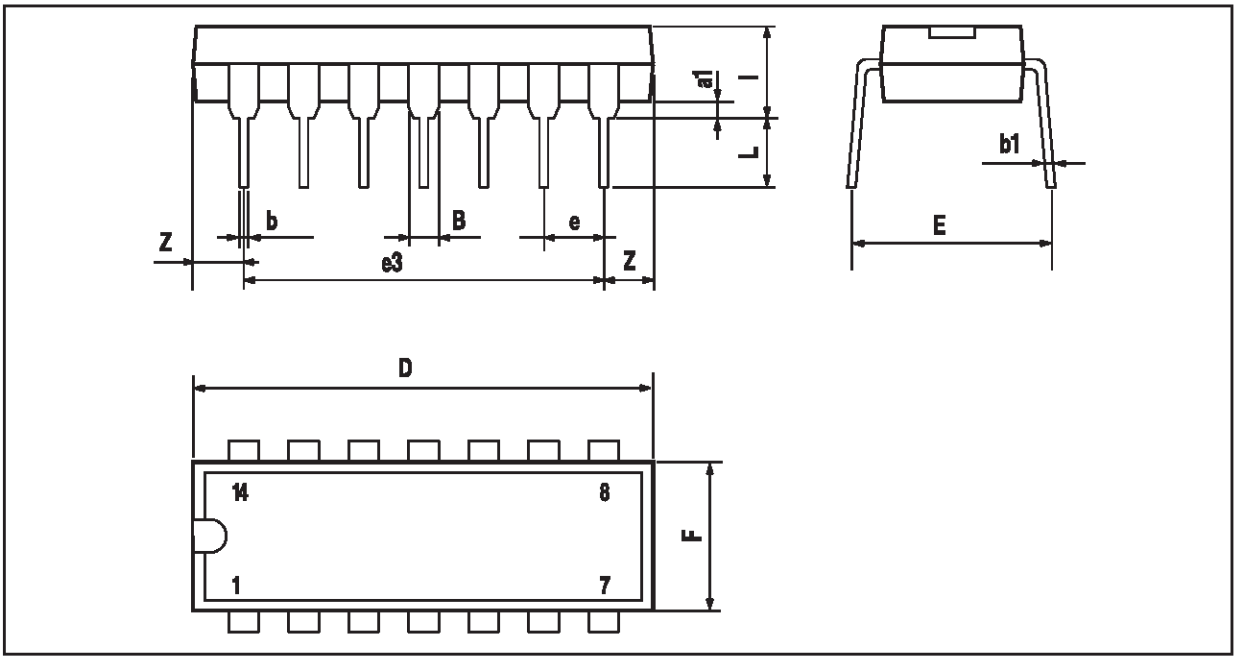
V_{CC}^+ = 5V, V_{CC}^- = 0V, T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage $V_{ic} = V_{icm\ min.}$, V_{cc}^+ = 5V to 10V - note 1) $T_{min.} \le T_{amb} \le T_{max.}$		1.2	5 6.5	mV
I_{io}	Input Offset Voltage - note 2) V_{ic} = 2.5V $T_{min.} \le T_{amb} \le T_{max.}$		1	 300	pA
I_{ib}	Input Bias Current (see note 2) V_{ic} = 2.5V $T_{min.} \le T_{amb} \le T_{max.}$		1	 600	pA
V_{icm}	Input Common Mode Voltage Range $T_{min.} \le T_{amb} \le T_{max}$	0 0		V_{CC}^+-1.2 V_{CC}^+ -1.5	V
CMR	Common-mode Rejection Ratio $V_{ic} = V_{icm\ min.}$		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 $T_{min.} \le T_{amb} \le T_{max.}$	4.5 4.3	4.7		V
V_{OL}	Low Level Output Voltage V_{id} = -1V, I_{OL} = 4mA $T_{min.} \le T_{amb} \le T_{max.}$		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 maximun 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.

PACKAGE MECHANICAL DATA

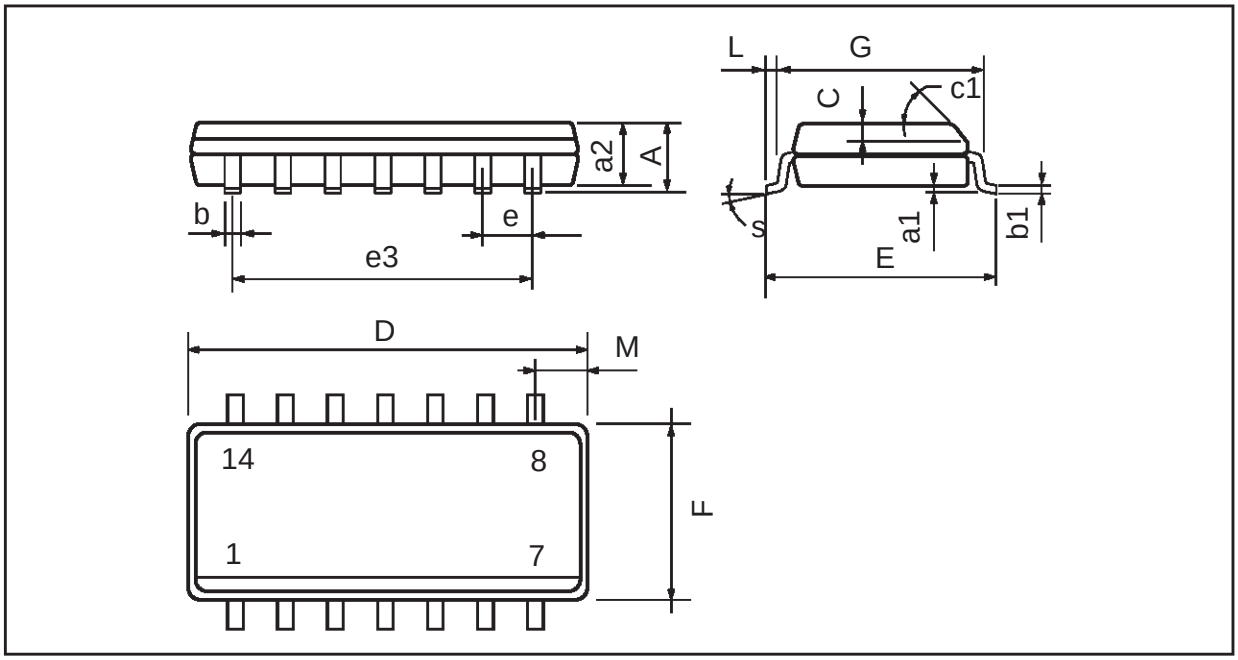
14 PINS - PLASTIC DIP



Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
i			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100

PACKAGE MECHANICAL DATA

14 PINS - PLASTIC MICROPACKAGE (SO)

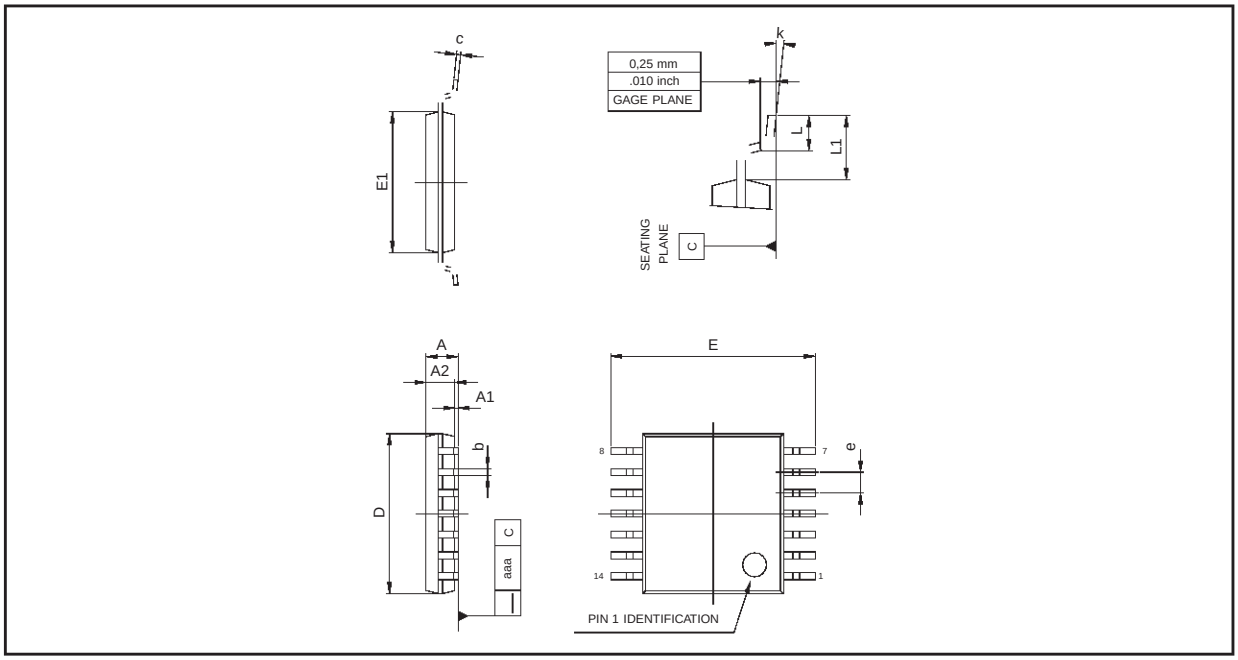


Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.2	0.004		0.008
a2			1.6			0.063
b	0.35		0.46	0.014		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.020	
c1	45° (typ.)					
D (1)	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
F (1)	3.8		4.0	0.150		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.020		0.050
M			0.68			0.027
S	8° (max.)					

Note : (1) D and F do not include mold flash or protrusions - Mold flash or protrusions shall not exceed 0.15mm (.066 inc) ONLY FOR DATA BOOK.

PACKAGE MECHANICAL DATA

14 PINS - THIN SHRINK SMALL OUTLINE PACKAGE (TSSOP)



Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.20			0.05
A1	0.05		0.15	0.01		0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.15
c	0.09		0.20	0.003		0.012
D	4.90	5.00	5.10	0.192	0.196	0.20
E		6.40			0.252	
E1	4.30	4.40	4.50	0.169	0.173	0.177
e		0.65			0.025	
k	0°		8°	0°		8°
L	0.450	0.600	0.750	0.018	0.024	0.030
L1		1.00			0.039	
aaa			0.100			0.004