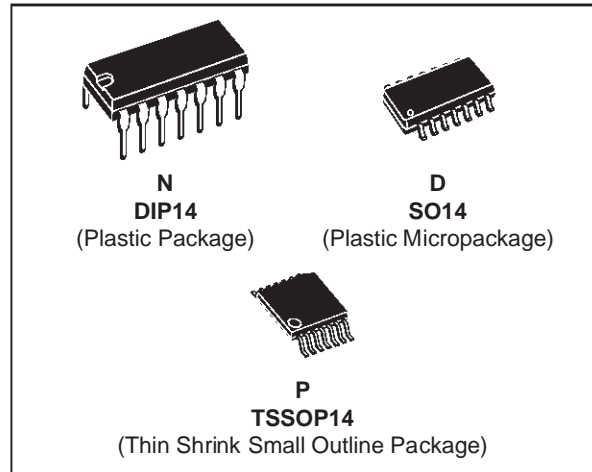




TS3704C,I,M

MICROPOWER QUAD CMOS VOLTAGE COMPARATORS

- PUSH-PULL CMOS OUTPUT (NO EXTERNAL PULL-UP RESISTOR REQUIRED)
- EXTREMELY LOW SUPPLY CURRENT : 9 μ A TYP / COMPARATOR
- WIDE SINGLE SUPPLY RANGE (3V TO 16V) OR DUAL SUPPLIES (± 1.5 V TO ± 8 V)
- EXTREMELY LOW INPUT BIAS CURRENT : 1pA TYP
- EXTREMELY LOW INPUT OFFSET CURRENT : 1pA TYP
- INPUT COMMON-MODE VOLTAGE RANGE INCLUDES GND
- HIGH INPUT IMPEDANCE : 10¹² Ω TYP
- FAST RESPONSE TIME : 2 μ s TYP FOR 5mV OVERDRIVE
- PIN-TO-PIN AND FUNCTIONALLY COMPATIBLE WITH BIPOLAR LM339

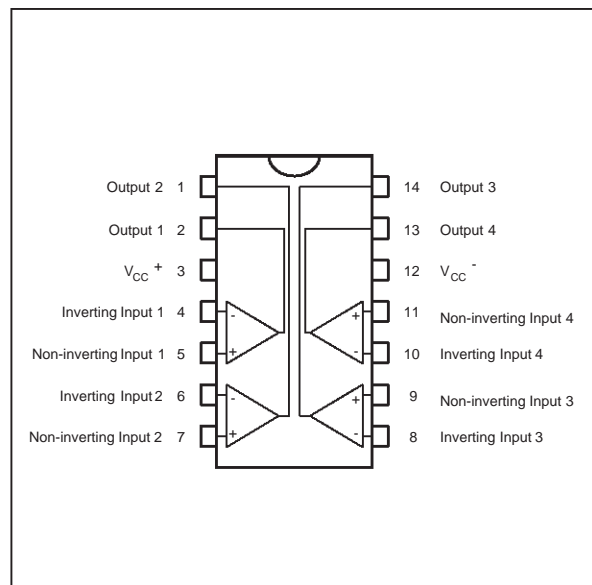


ORDER CODES

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

Example : TS3704CN

PIN CONNECTIONS (top view)

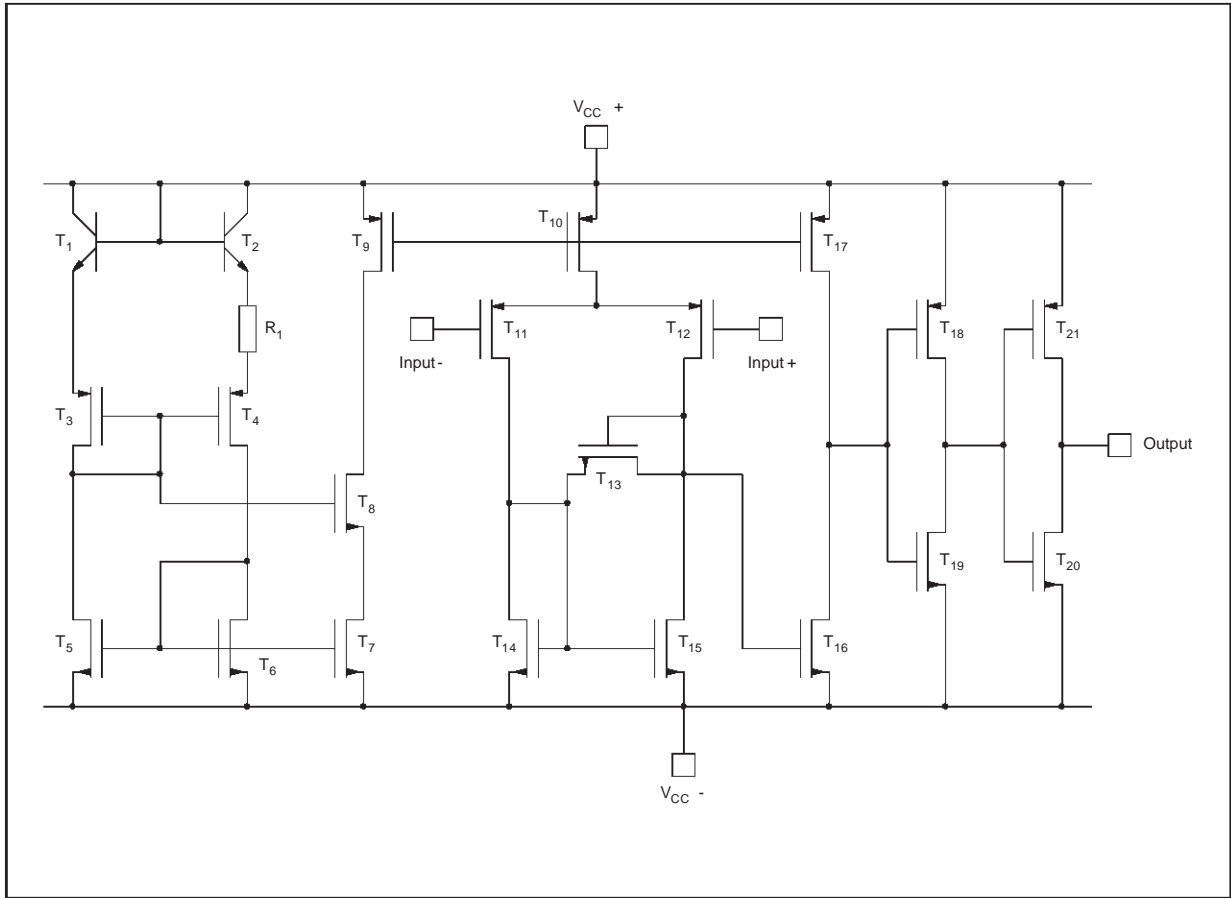


DESCRIPTION

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

SCHEMATIC DIAGRAM (for 1/4 TS3704)



MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|------------|---------------------------------------|---|-------------|
| V_{CC}^+ | Supply Voltage - (note 1) | 18 | V |
| V_{id} | Differential Input Voltage - (note 2) | ± 18 | V |
| V_i | Input Voltage - (note 3) | 18 | V |
| V_o | Output Voltage | 18 | V |
| I_o | Output Current | 20 | mA |
| T_{oper} | Operating Free-Air Temperature Range | TS3704C TS3704I TS3704M 0 to +70 -40 to +125 -55 to +125 | $^{\circ}C$ |
| T_{stg} | Storage Temperature Range | -65 to +150 | $^{\circ}C$ |

- Notes :**
- All voltage values, except differential voltage, are with respect to network ground terminal.
 - Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.
 - The magnitude of the input and the output voltages must never exceed the magnitude of the positive supply voltage.
 - Short circuit from outputs to V_{CC}^+ can cause excessive heating and eventual destruction.

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 |

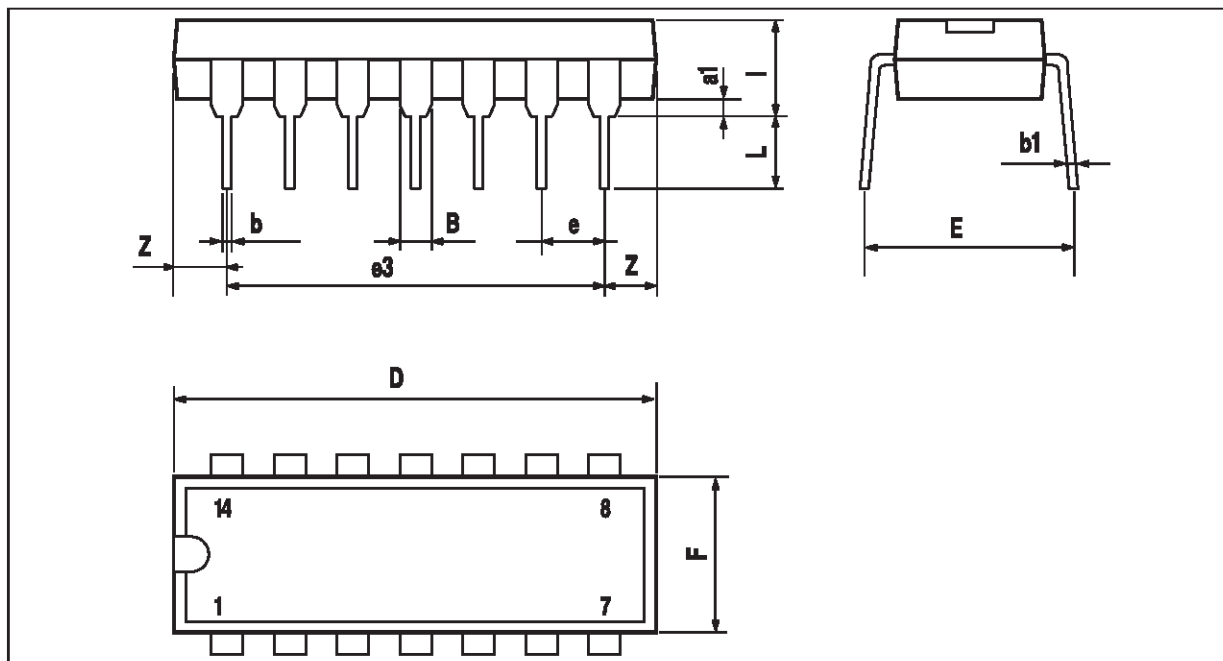
ELECTRICAL CHARACTERISTICS
 $V_{CC}^+ = 5V, V_{CC}^- = 0V, T_{amb} = 25^\circ C$ (unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|-----------|--|--|--------------------------------|------------|---------|
| V_{io} | Input Offset Voltage $V_{ic} = V_{icm\ min.}, V_{CC}^+ = 5V\ to\ 10V$ - (note 1) $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 1.2 | 5 6.5 | mV |
| I_{io} | Input Offset Current - (note 2) $V_{ic} = 2.5\ V$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 1 | 300 | pA |
| I_{ib} | Input Bias Current - (note 2) $V_{ic} = 2.5\ V$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 1 | 600 | pA |
| V_{icm} | Input Common Mode Voltage Range $T_{min.} \leq T_{amb} \leq T_{max.}$ | 0 to $V_{CC}^+ - 1.2$ 0 to $V_{CC}^+ - 1.5$ | | | V |
| CMR | Common-mode Rejection Ratio $V_{ic} = V_{icm\ min.}$ | | 78 | | 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 $V_{id} = -1V, I_{OL} = 4mA$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 234 | 300 375 | mV |
| I_{CC} | Supply Current (4 comparators) No load - Outputs low $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 36 | 80 100 | 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 |

Note : 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.

PACKAGE MECHANICAL DATA

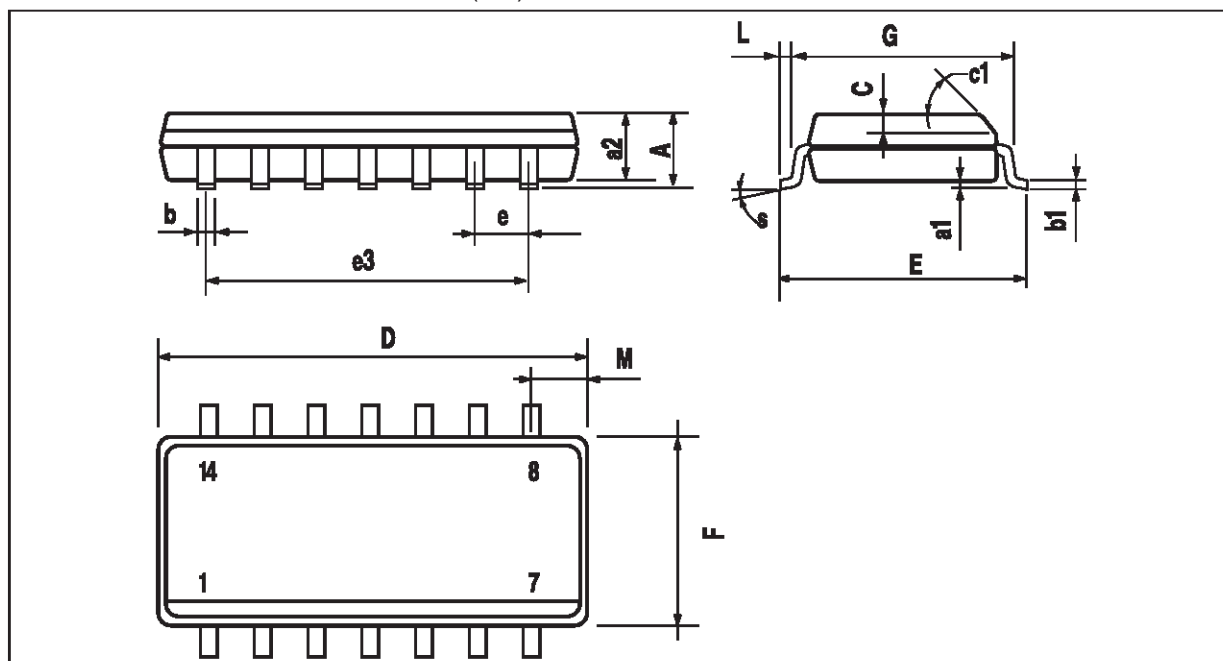
14 PINS - PLASTIC DIP



| 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 |

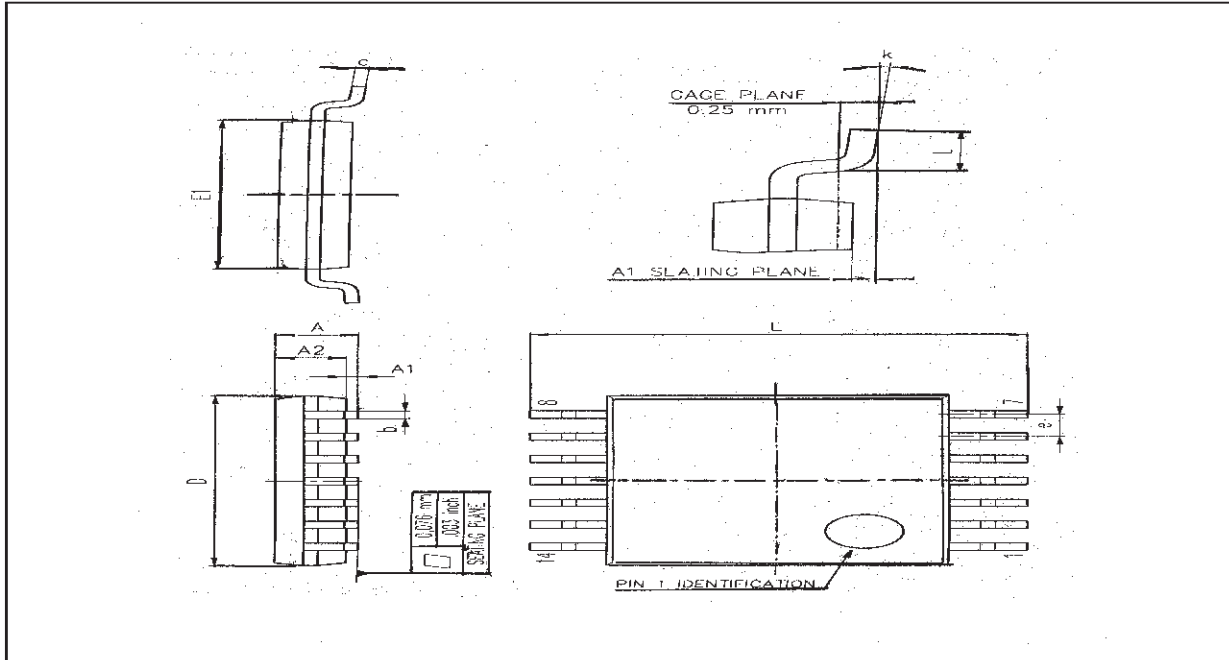
PACKAGE MECHANICAL DATA

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 | 8.55 | | 8.75 | 0.336 | | 0.334 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 7.62 | | | 0.300 | |
| F | 3.8 | | 4.0 | 0.150 | | 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.) | | | | | |

PACKAGE MECHANICAL DATA
 14 PINS - THIN SHRINK SMALL OUTLINE PACKAGE



| Dim. | 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 | 0.50 | 0.60 | 0.75 | 0.09 | 0.0236 | 0.030 |

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