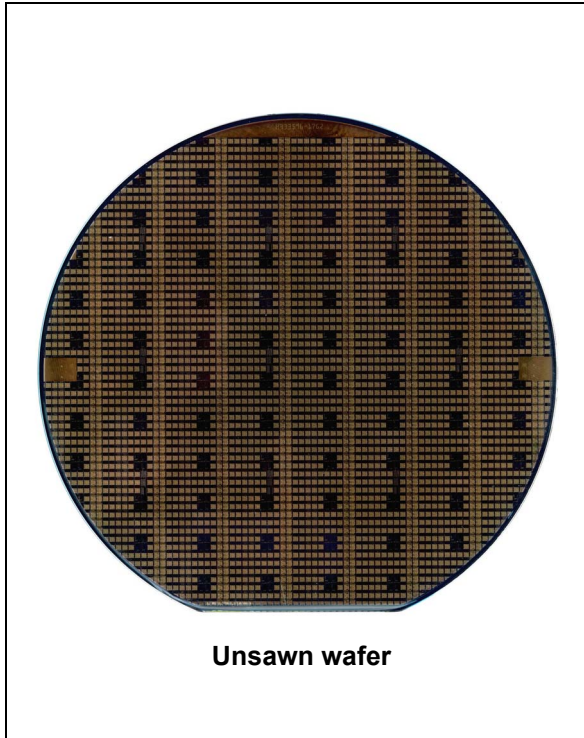


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**Micropower dual CMOS voltage comparator: unsawn wafer**

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Datasheet - production data

**Related products**

- See TS3702 for plastic packaged version

**Description**

The JTS3702 is a micro power CMOS dual voltage comparator with an extremely low consumption of 9  $\mu\text{A}$  typical per comparator (20 times less than the bipolar LM393). 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 LM393.

**Features**

- Push-pull CMOS output (no external pull-up resistor required)
- Extremely low supply current: 9  $\mu\text{A}$  typ per comparator
- Wide single supply range: 2.7 V to 16 V or dual supplies ( $\pm 1.35$  V to  $\pm 8$  V)
- Extremely low input bias current: 1 pA typ
- Extremely low input offset current: 1 pA typ
- Input common-mode voltage range includes GND
- High input impedance:  $10^{12}$   $\Omega$  typ
- Fast response time: 2  $\mu\text{s}$  typ for 5 mV overdrive
- Functionally compatible with bipolar LM393

# Contents

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# 1 Schematic diagram and pad configuration

Figure 1. Schematic diagram (for one channel of JTS3702)

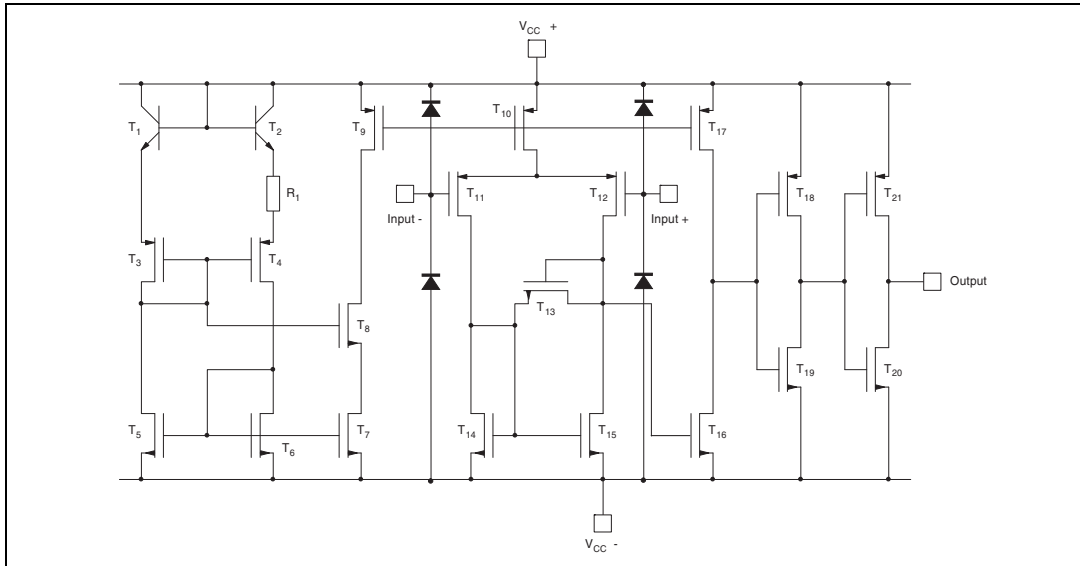
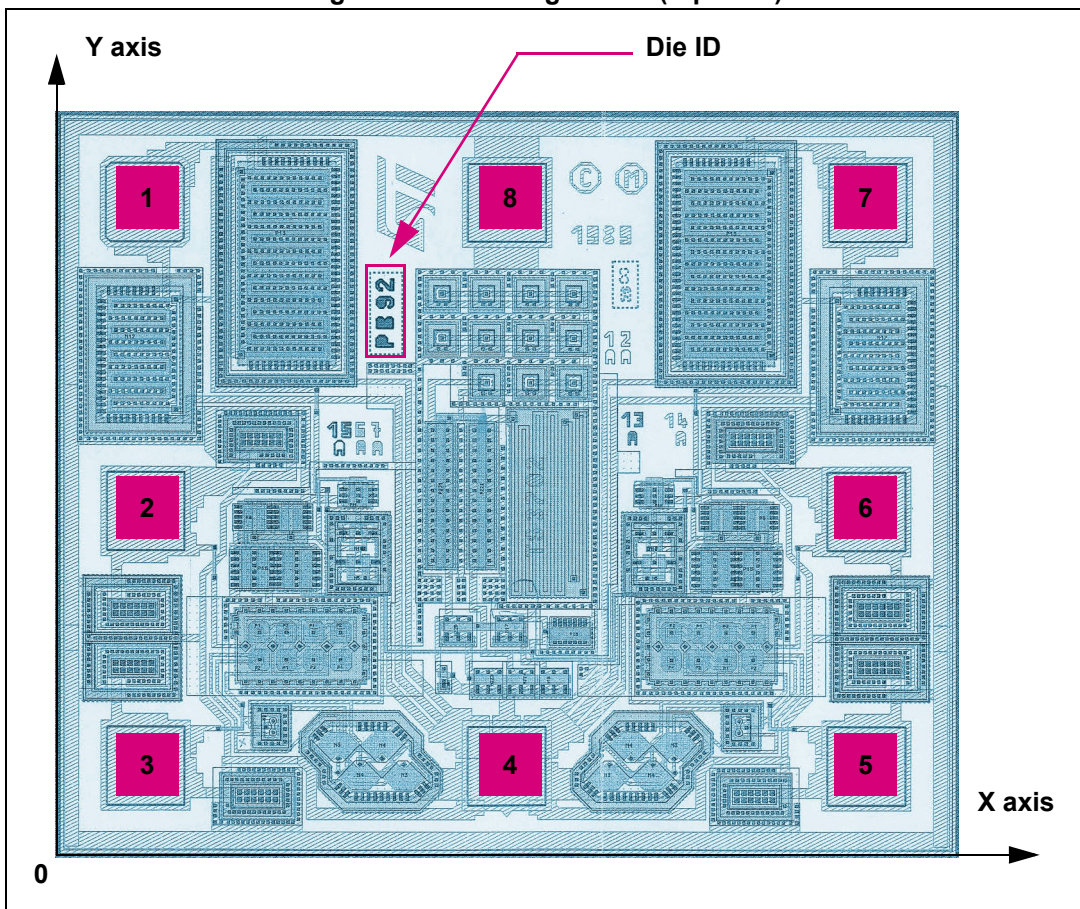


Figure 2. Pad configuration (top view)



**Table 1. Pad coordinates (pad placement origin is the lower left corner of the die)**

| Pad number | Pad description       | Center pad coordinates |                     |
|------------|-----------------------|------------------------|---------------------|
|            |                       | X ( $\mu\text{m}$ )    | Y ( $\mu\text{m}$ ) |
| 1          | Output 1              | 140                    | 1065.3              |
| 2          | Inverting input 1     | 140                    | 565.3               |
| 3          | Non-inverting input 1 | 140                    | 165.3               |
| 4          | Vcc-                  | 665                    | 165.3               |
| 5          | Non-inverting input 2 | 1190                   | 165.3               |
| 6          | Inverting input 2     | 1190                   | 565.3               |
| 7          | Output 2              | 1190                   | 1065.3              |
| 8          | Vcc+                  | 665                    | 1065.3              |

Wafer dimension: 6 inches

Die size without scribe line:

- X = 1306.0  $\mu\text{m}$
- Y = 1076.0  $\mu\text{m}$

Scribe line: 60  $\mu\text{m}$

Bond pad opening 109 x 109  $\mu\text{m}$

## 2 Absolute maximum ratings and operating conditions

**Table 2. Absolute maximum ratings (AMR)**

| Symbol     | Parameter  | Value       | Unit |
|------------|--|-------------|------|
| $V_{CC}^+$ | Supply voltage <sup>(1)</sup>                                    | 18          | V    |
| $V_{id}$   | Differential input voltage <sup>(2)</sup>                        | ±18         |      |
| $V_i$      | Input voltage <sup>(3)</sup>                                     | 18          |      |
| $V_o$      | Output voltage   | 18          |      |
| $I_o$      | Output current   | 20          | mA   |
| $I_F$      | Forward current in ESD protection diodes on Input <sup>(4)</sup> | 50          |      |
| $T_{stg}$  | Storage temperature range  | -65 to +150 | °C   |
| ESD        | HBM: human body model <sup>(5)</sup>                             | 400         | V    |
|            | MM: machine model <sup>(6)</sup>                                 | 50          |      |

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. Human body model: 100 pF discharged through a 1.5 kΩ resistor between two pins of the device, done for all couples of pin combinations with other pins floating.
6. Machine model: a 200 pF cap is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5 Ω), done for all couples of pin combinations with other pins floating.

**Table 3. Operating conditions**

| Symbol     | Parameter  | Value  | Unit |
|------------|--|--|------|
| $V_{CC}^+$ | Supply voltage   | 2.7 to 16                                      | V    |
| $V_{icm}$  | Common mode input voltage range<br>$T_{min} \leq T_{amb} \leq T_{max}$ | 0 to $V_{CC}^+ - 1.2$<br>0 to $V_{CC}^+ - 1.5$ |      |
| $T_{oper}$ | Operating free-air temperature range - JTS3702C                        | 0 to +70                                       | °C   |

### 3 Electrical characteristics

**Table 4. Electrical characteristics at  $V_{CC+} = 3\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $T = 25\text{ °C}$  (unless otherwise specified)**

| Symbol    | Parameter                           | Conditions  | Min.     | Typ.        | Max.       | Unit          |
|-----------|-------------------------------------|---|----------|-------------|------------|---------------|
| $V_{io}$  | Input offset voltage <sup>(1)</sup> | $V_{ic} = 1.5\text{ V}$<br>$T_{min} \leq T_{amb} \leq T_{max}$  |          |             | 5<br>6.5   | mV            |
| $I_{io}$  | Input offset current <sup>(2)</sup> | $V_{ic} = 1.5\text{ V}$<br>$T_{min} \leq T_{amb} \leq T_{max}$  |          | 1           | 300        | pA            |
| $I_{ib}$  | Input bias current <sup>(2)</sup>   | $V_{ic} = 1.5\text{ V}$<br>$T_{min} \leq T_{amb} \leq T_{max}$  |          | 1           | 600        |               |
| CMR       | Common-mode rejection ratio         | $V_{ic} = V_{icm\ min.}$  |          | 80          |            | dB            |
| SVR       | Supply voltage rejection ratio      | $V_{CC+} = 3\text{ V to }5\text{ V}$  |          | 75          |            |               |
| $V_{OH}$  | High level output voltage           | $V_{id} = 1\text{ V}$ , $I_{OH} = -4\text{ mA}$<br>$T_{min} \leq T_{amb} \leq T_{max}$                | 2<br>1.8 | 2.4         |            | V             |
| $V_{OL}$  | Low level output voltage            | $V_{id} = -1\text{ V}$ , $I_{OL} = 4\text{ mA}$<br>$T_{min} \leq T_{amb} \leq T_{max}$                |          | 300         | 400<br>575 | mV            |
| $I_{CC}$  | Supply current<br>(each comparator) | No load - outputs low<br>$T_{min} \leq T_{amb} \leq T_{max}$  |          | 7           | 20<br>25   | $\mu\text{A}$ |
| $t_{PLH}$ | Response time low to high           | $V_{ic} = 0\text{ V}$ , $f = 10\text{ kHz}$ , $C_L = 50\text{ pF}$ ,<br>Overdrive = 5 mV<br>TTL input |          | 1.5<br>0.7  |            | $\mu\text{s}$ |
| $t_{PHL}$ | Response time high to low           | $V_{ic} = 0\text{ V}$ , $f = 10\text{ kHz}$ , $C_L = 50\text{ pF}$ ,<br>Overdrive = 5 mV<br>TTL input |          | 2.2<br>0.15 |            |               |

1. The specified offset voltage is the maximum value required to drive the output up to 2.5 V or down to 0.3 V.
2. Maximum values including unavoidable inaccuracies of the industrial test.

**Table 5. Electrical characteristics at  $V_{CC+} = 5\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $T = 25\text{ }^\circ\text{C}$  (unless otherwise specified)**

| Symbol    | Parameter                           | Conditions   | Min.       | Typ.                              | Max.       | Unit          |
|-----------|-------------------------------------|--|------------|-----------------------------------|------------|---------------|
| $V_{io}$  | Input offset voltage <sup>(1)</sup> | $V_{ic} = V_{icm\ min.}$ , $V_{cc+} = 5\text{ V to }10\text{ V}$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$  |            | 1.2                               | 5<br>6.5   | mV            |
| $I_{io}$  | Input offset current <sup>(2)</sup> | $V_{ic} = 2.5\text{ V}$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$   |            | 1                                 | 300        | pA            |
| $I_{ib}$  | Input bias current <sup>(2)</sup>   | $V_{ic} = 2.5\text{ V}$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$   |            | 1                                 | 600        |               |
| CMR       | Common-mode rejection ratio         | $V_{ic} = V_{icm\ min.}$   |            | 82                                |            | dB            |
| SVR       | Supply voltage rejection ratio      | $V_{cc+} = +5\text{ V to }+10\text{ V}$  |            | 90                                |            |               |
| $V_{OH}$  | High level output voltage           | $V_{id} = 1\text{ V}$ , $I_{OH} = -4\text{ mA}$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$   | 4.5<br>4.3 | 4.7                               |            | V             |
| $V_{OL}$  | Low level output voltage            | $V_{id} = -1\text{ V}$ , $I_{OL} = 4\text{ mA}$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$   |            | 200                               | 300<br>375 | mV            |
| $I_{CC}$  | Supply current<br>(each comparator) | No load - outputs low<br>$T_{min.} \leq T_{amb} \leq T_{max.}$   |            | 9                                 | 20<br>25   | $\mu\text{A}$ |
| $t_{PLH}$ | Response time low to high           | $V_{ic} = 0\text{ V}$ , $f = 10\text{ kHz}$ , $C_L = 50\text{ pF}$ ,<br>Overdrive = 5 mV<br>Overdrive = 10 mV<br>Overdrive = 20 mV<br>Overdrive = 40 mV<br>TTL input |            | 1.5<br>1.1<br>0.9<br>0.7<br>0.6   |            | $\mu\text{s}$ |
| $t_{PHL}$ | Response time high to low           | $V_{ic} = 0\text{ V}$ , $f = 10\text{ kHz}$ , $C_L = 50\text{ pF}$ ,<br>Overdrive = 5 mV<br>Overdrive = 10 mV<br>Overdrive = 20 mV<br>Overdrive = 40 mV<br>TTL input |            | 2.2<br>1.6<br>1.1<br>0.75<br>0.17 |            |               |
| $t_f$     | Fall time                           | $f = 10\text{ kHz}$ , $C_L = 50\text{ pF}$ ,<br>overdrive 50 mV  |            | 30                                |            | ns            |

1. The specified offset voltage is the maximum value required to drive the output up to 4.5 V or down to 0.3 V.
2. Maximum values including unavoidable inaccuracies of the industrial test.

## 4 Packing description

Collective packing is used as STMicroelectronics qualified system for shipment of finished wafers.

The following parts of the collective packing are used in the clean room (see [Figure 3](#) for detailed view):

- Canister (composed of a base and a cover, maximum content is 25 wafers)
- Pink foam discs (lodged below and over the stack, minimum content is 2 discs)
- White interleaves (separators between wafers, maximum content is 26 or more for best fit)
- CMB bag (to protect canister under moderate vacuum)

Figure 3. Canister composition overview

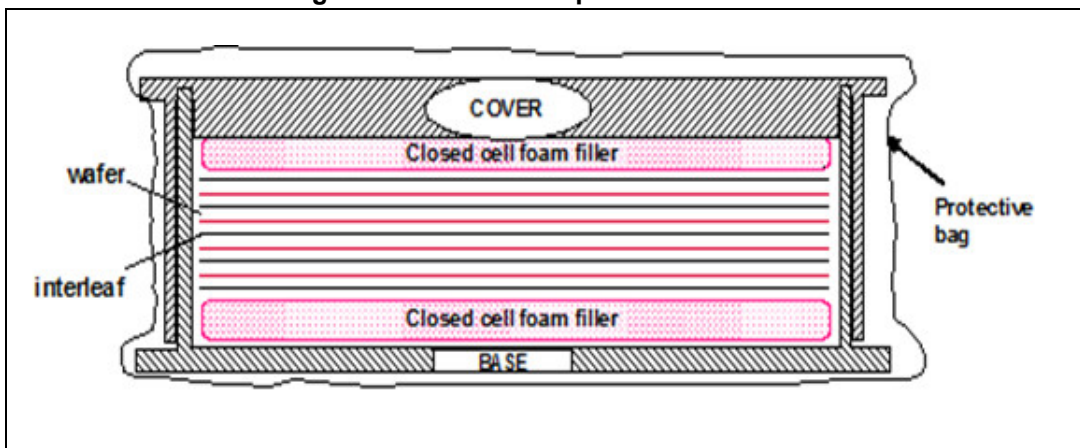


Figure 4. Packed canister picture





## 5 Ordering information

Table 6. Order codes

| Order code    | Temperature range | Package      | Packaging          |
|---------------|-------------------|--------------|--------------------|
| JTS3702C-1AA5 | 0 to +70 °C       | Unsawn wafer | Collective packing |

## 6 Revision history

Table 7. Document revision history

| Date        | Revision | Changes          |
|-------------|----------|------------------|
| 06-Dec-2013 | 1        | Initial release. |

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