32,768 WORD x 8 BIT CMOS STATIC RAM

DESCRIPTION
The TC5532BPJ is a 262,144 bits high speed static random access memory organized as 32,768 words by 8 bits using CMOS technology, and operated from a single 5-volt supply. Toshiba's CMOS technology and advanced circuit form provide high speed feature.
The TC5532BPJ has low power feature with device control using Chip Enable (CE), and has Output Enable Input (OE) for fast memory access. Also the device power at memory access is reduced by automatic power down circuit form.
The TC5532BPJ is suitable for use in cache memory where high speed is required. All Inputs and Outputs are directly TTL compatible.
The TC5532BPJ is packaged in a 28 pin standard DIP and SOJ with 300 mil width for high density surface assembly.

FEATURES
- Fast access time:
  TC5532BPJ-17  17ns(MAX.)
  TC5532BPJ-20  20ns(MAX.)
  TC5532BPJ-25  25ns(MAX.)
  TC5532BPJ-35  35ns(MAX.)
- Low power dissipation
  Operation:  TC5532BPJ-17  140mA(MAX.)
  TC5532BPJ-20  140mA(MAX.)
  TC5532BPJ-25  140mA(MAX.)
  TC5532BPJ-35  120mA(MAX.)
  Standby:  1mA(MAX.)
- 5V single power supply:
  -17:  5V±5%
  20/25/35:  5V±10%
- Fully static operation
- All Inputs and Outputs: TTL compatible
- Output buffer control: OE
- Package:  TC5532BP: DIP28-P-300B
  TC5533B: SOJ28-P-300A

PIN CONNECTION
TC5532BP  TC5532B
A14  1  28VDD  A14  1  28VDD
A12  2  27WE  A12  2  27WE
A13  3  26A14  A13  3  26A14
A15  4  25A16  A15  4  25A16
A16  5  24A9  A16  5  24A9
A17  6  23A11  A17  6  23A11
A18  7  22OE  A18  7  22OE
A19  8  21AE  A19  8  21AE
A20  9  20CE  A10  9  20CE
A21  10  19WE  A10  10  19WE
A22  11  18WE  A11  11  18WE
A23  12  17WE  A12  12  17WE
A24  13  16WE  A13  13  16WE
GND  14  15VDD  GND  14  15VDD

PIN NAMES
A0-A14  Address Inputs
W01-W08  Data Inputs/Outputs
CE  Chip Enable Input
WE  Write Enable Input
OE  Output Enable Input
VDD  Power (+5V)
GND  Ground

BLOCK DIAGRAM

C-81
### MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ITEM</th>
<th>RATING</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDD</td>
<td>Power Supply Voltage</td>
<td>-0.5–7.0</td>
<td>V</td>
</tr>
<tr>
<td>VIN</td>
<td>Input Voltage</td>
<td>-2.0–7.0</td>
<td>V</td>
</tr>
<tr>
<td>VIO</td>
<td>Input/Output Voltage</td>
<td>-0.5–VDD + 0.5</td>
<td>V</td>
</tr>
<tr>
<td>PD</td>
<td>Power Dissipation</td>
<td>1.0</td>
<td>W</td>
</tr>
<tr>
<td>Tsold</td>
<td>Soldering Temperature × Time</td>
<td>260 · 10</td>
<td>°C · sec</td>
</tr>
<tr>
<td>Tstg</td>
<td>Storage Temperature</td>
<td>-65–150</td>
<td>°C</td>
</tr>
<tr>
<td>Toper</td>
<td>Operating Temperature</td>
<td>-10–85</td>
<td>°C</td>
</tr>
</tbody>
</table>

### DC RECOMMENDED OPERATING CONDITIONS \( (Ta = 0–70°C) \)

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDD</td>
<td>Power Supply Voltage</td>
<td>-17</td>
<td>4.75</td>
<td>5.0</td>
<td>5.25</td>
</tr>
<tr>
<td></td>
<td>-20/25/35</td>
<td>4.5</td>
<td>5.0</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>VIN</td>
<td>Input High Voltage</td>
<td>-4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>VL</td>
<td>Input Low Voltage</td>
<td>-0.5*</td>
<td>-</td>
<td>0.8</td>
<td></td>
</tr>
</tbody>
</table>

* - 3V Pulse Width : 10ns

### DC and OPERATING CHARACTERISTICS \( (Ta = 0–70°C, -17 : VDD = 5V ± 5%, -20/25/35 : VDD = 5V ± 10%) \)

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>TEST CONDITION</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>tIL</td>
<td>Input Leakage Current</td>
<td>( V_{IH} = 0)–VDD</td>
<td>-</td>
<td>-</td>
<td>±1</td>
<td>μA</td>
</tr>
<tr>
<td>tOH</td>
<td>Output High Current</td>
<td>( V_{OH} = 2.4V )</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>tOL</td>
<td>Output Low Current</td>
<td>( V_{OL} = 0.4V )</td>
<td>8</td>
<td>-</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>tLO</td>
<td>Output Leakage Current</td>
<td>( CE = VIH ) or ( CE = VIH ) or ( WE = VIL ), ( VOUT = 0)–VDD</td>
<td>-</td>
<td>-</td>
<td>±1</td>
<td>μA</td>
</tr>
<tr>
<td>tDQO</td>
<td>Operating Current</td>
<td>( cycle = Min cycle )</td>
<td>( VDD = 5.25V )</td>
<td>-17</td>
<td>-</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td>( CE = VIL )</td>
<td>( VDD = 5.5V )</td>
<td>-20</td>
<td>-</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Input = ( VIH/VIL )</td>
<td>( VDD = 5.25V )</td>
<td>-25</td>
<td>-</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( VDD = 5.5V )</td>
<td>-35</td>
<td>-</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>tDQ1</td>
<td>Standby Current</td>
<td>( cycle = Min cycle )</td>
<td>( VDD = 5.25V )</td>
<td>-17</td>
<td>-</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>( CE = VIH )</td>
<td>( VDD = 5.5V )</td>
<td>-20</td>
<td>-</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Input = ( VIH/VIL )</td>
<td>( VDD = 5.25V )</td>
<td>-25</td>
<td>-</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>( VDD = 5.5V )</td>
<td>-35</td>
<td>-</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>tDQ2</td>
<td>Standby Current</td>
<td>( CE = VDD – 0.2V )</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Input = ( VDD – 0.2V or 0.2V )</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CAPACITANCE \( (Ta = 25°C, f = 1.0MHz) \)

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>TEST CONDITION</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIN</td>
<td>Input Capacitance</td>
<td>( VIN = GND )</td>
<td>6</td>
<td>pF</td>
</tr>
<tr>
<td>COUT</td>
<td>Output Capacitance</td>
<td>( VOUT = GND )</td>
<td>8</td>
<td>pF</td>
</tr>
</tbody>
</table>

Note: This parameter is periodically sampled and is not 100% tested.
### AC CHARACTERISTICS

**(Ta = 0~70°C)**

- 17: $V_{DD} = 5V ± 5\%$
- 20/25/35: $V_{DD} = 5V ± 10\%$

#### READ CYCLE

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>TC55328PJ - 17</th>
<th>TC55328PJ - 20</th>
<th>TC55328PJ - 25</th>
<th>TC55328PJ - 35</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t_{AC}$</td>
<td>Read Cycle Time</td>
<td>17 - 20</td>
<td>17 - 20</td>
<td>17 - 20</td>
<td>17 - 20</td>
<td>ns</td>
</tr>
<tr>
<td>$t_{ACC}$</td>
<td>Address Access Time</td>
<td>- 17 - 20</td>
<td>- 25 - 25</td>
<td>- 25 - 25</td>
<td>- 25 - 25</td>
<td></td>
</tr>
<tr>
<td>$t_{CO}$</td>
<td>CE Access Time</td>
<td>- 17 - 20</td>
<td>- 25 - 25</td>
<td>- 25 - 25</td>
<td>- 25 - 25</td>
<td></td>
</tr>
<tr>
<td>$t_{OE}$</td>
<td>OE Access Time</td>
<td>- 9 - 10</td>
<td>- 12 - 15</td>
<td>- 12 - 15</td>
<td>- 12 - 15</td>
<td></td>
</tr>
<tr>
<td>$t_{OH}$</td>
<td>Output Data Hold Time from Address Change</td>
<td>5 - 5</td>
<td>5 - 5</td>
<td>5 - 5</td>
<td>5 - 5</td>
<td></td>
</tr>
<tr>
<td>$t_{ODD}$</td>
<td>Output Disable Time from CE</td>
<td>0 - 8</td>
<td>0 - 10</td>
<td>0 - 10</td>
<td>0 - 10</td>
<td></td>
</tr>
<tr>
<td>$t_{ODD}$</td>
<td>Output Enable Time from OE</td>
<td>0 - 10</td>
<td>0 - 12</td>
<td>0 - 12</td>
<td>0 - 12</td>
<td></td>
</tr>
<tr>
<td>$t_{ODD}$</td>
<td>Output Disable Time from OE</td>
<td>- 8 - 8</td>
<td>- 10 - 15</td>
<td>- 10 - 15</td>
<td>- 10 - 15</td>
<td></td>
</tr>
<tr>
<td>$t_{PU}$</td>
<td>Chip Selection to Power Up Time</td>
<td>0 - 0</td>
<td>0 - 0</td>
<td>0 - 0</td>
<td>0 - 0</td>
<td></td>
</tr>
<tr>
<td>$t_{PD}$</td>
<td>Chip Deselection to Power Down Time</td>
<td>17 - 20</td>
<td>25 - 35</td>
<td>25 - 35</td>
<td>25 - 35</td>
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</tr>
</tbody>
</table>

#### WRITE CYCLE

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>TC55328PJ - 17</th>
<th>TC55328PJ - 20</th>
<th>TC55328PJ - 25</th>
<th>TC55328PJ - 35</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t_{WC}$</td>
<td>Write Cycle Time</td>
<td>17 - 20</td>
<td>17 - 20</td>
<td>17 - 20</td>
<td>17 - 20</td>
<td>ns</td>
</tr>
<tr>
<td>$t_{CE}$</td>
<td>Chip Enable to End of Write</td>
<td>13 - 13</td>
<td>15 - 20</td>
<td>15 - 20</td>
<td>15 - 20</td>
<td></td>
</tr>
<tr>
<td>$t_{AS}$</td>
<td>Address Set Up Time</td>
<td>0 - 0</td>
<td>0 - 0</td>
<td>0 - 0</td>
<td>0 - 0</td>
<td></td>
</tr>
<tr>
<td>$t_{WP}$</td>
<td>Write Pulse Width</td>
<td>13 - 13</td>
<td>15 - 20</td>
<td>15 - 20</td>
<td>15 - 20</td>
<td></td>
</tr>
<tr>
<td>$t_{WR}$</td>
<td>Write Recovery Time</td>
<td>0 - 0</td>
<td>0 - 0</td>
<td>0 - 0</td>
<td>0 - 0</td>
<td></td>
</tr>
<tr>
<td>$t_{DS}$</td>
<td>Data Set Up Time</td>
<td>10 - 10</td>
<td>12 - 15</td>
<td>12 - 15</td>
<td>12 - 15</td>
<td></td>
</tr>
<tr>
<td>$t_{DH}$</td>
<td>Data Hold Time</td>
<td>0 - 0</td>
<td>0 - 0</td>
<td>0 - 0</td>
<td>0 - 0</td>
<td></td>
</tr>
<tr>
<td>$t_{OE}$</td>
<td>Output Enable Time from WE</td>
<td>0 - 0</td>
<td>0 - 0</td>
<td>0 - 0</td>
<td>0 - 0</td>
<td></td>
</tr>
<tr>
<td>$t_{OD}$</td>
<td>Output Disable Time from WE</td>
<td>- 8 - 8</td>
<td>- 10 - 15</td>
<td>- 10 - 15</td>
<td>- 10 - 15</td>
<td></td>
</tr>
</tbody>
</table>

#### AC TEST CONDITIONS

<table>
<thead>
<tr>
<th>Input Pulse Levels</th>
<th>3.0V/0.0V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Pulse Rise and Fall Time</td>
<td>3ns</td>
</tr>
<tr>
<td>Input Timing Measurement Reference Levels</td>
<td>2.2V/0.8V</td>
</tr>
<tr>
<td>Output Timing Measurement Reference Levels</td>
<td>2.0V/0.8V</td>
</tr>
<tr>
<td>Output Load</td>
<td>Fig.1</td>
</tr>
</tbody>
</table>
TIMING WAVEFORMS
READ CYCLE (2)

WRITE CYCLE1 (9) (WE Controlled Write)
WRITE CYCLE2 (CE Controlled Write)

- Addresses
- WE
- CE
- DOUT: UNKNOWN
- DIN: DATA IN STABLE
- High Impedance

 timelines:
- tWC
- tAS
- twp
- tWS
- tCOE
- tDQW
- tQs
- tDH

Date: 46.23.14
NOTE: 1. The operating temperature ($T_a$) is guaranteed with transverse air flow exceeding 400 linear feet per minute.

2. $WE$ is High for Read Cycle.

3. Assuming that $OE$ Low transition occurs coincident with or after $WE$ Low transition, Outputs remain in a high impedance state.

4. Assuming that $OE$ High transition occurs coincident with or prior to $WE$ High transition, Outputs remain in a high impedance state.

5. Assuming that $OE$ is High for Write Cycle, Outputs are in a high impedance state during this period.

6. These parameters are specified as follows and measured by using the load shown in Fig.1.

(A) $t_{C_{OE}, t_{OE}, t_{OEW}}$ ............... Output Enable Time

(B) $t_{C_{OD}, t_{OD}, t_{ODW}}$ ............... Output Disable Time

---

Diagram:

- $OE, OE$
- $WE$
- $D_{OUT}$
- $0.2V$
- $0.2V$
- $0.2V$
- $0.2V$
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- $0.2V$
OUTLINE DRAWINGS

Plastic DIP (DIP28 - P = 3008)

UNIT in mm

WEIGHT : 2.03g (Typ.)
OUTLINE DRAWINGS

Plastic SOJ (SOJ28 – P – 300A)

UNIT in mm

WEIGHT : 0.83g (Typ.)