UHF RFID tag IC, 224-bit memory

SPECIFICATION

1 FEATURES

- SMIC EEPROM CMOS 180 nm
- Operating temperature range -40…+65 °C
- EPC Class 1 Generation 2 compliant
- Operating frequency 860 - 960 MHz
- 224 bit memory organized in 3 banks: EPC, TID and RESERVED
- Two pads with combined on-wafer testing and RF operation functionality
- Small area (0.185 mm²)

2 APPLICATIONS

- Supply chain management and logistics
- Airline baggage handling
- Mail and parcel delivery
- Automobile billing systems
- Asset tagging

3 FUNCTIONAL DESCRIPTION

The chip is intended for use in passive UHF transponder applications. IC derives its operating power from an RF electromagnetic field generated by a reader, which is received and rectified by the chip. The chip sends the answer back to the reader using a backscatter modulation technique. Chip can be connected to external dipole-like antenna. NT1025A provides a fast and flexible anti-collision protocol based on internal random number generator according to EPC standard. NT1025A supports all EPC C1G2 mandatory command as well as optional Access command. NT1025A has a 224 bit EEPROM organized in 3 banks as shown in Table 1.

Table 1: NT1025A EEPROM map.

<table>
<thead>
<tr>
<th>Bank address</th>
<th>Bank name</th>
<th>Bank size</th>
</tr>
</thead>
<tbody>
<tr>
<td>“01”</td>
<td>EPC</td>
<td>128 bit</td>
</tr>
<tr>
<td>“10”</td>
<td>TID</td>
<td>32 bit</td>
</tr>
<tr>
<td>“00”</td>
<td>RESERVED</td>
<td>64 bit</td>
</tr>
</tbody>
</table>

Short-time memory block provides 4-bit storage with persistence values according to EPC C1G2 standard.
IC is designed on SMIC EEPROM CMOS 180 nm technology.
4 STRUCTURE

Figure 1: UHF RFID tag IC structure.
## PIN DESCRIPTION

<table>
<thead>
<tr>
<th>Name</th>
<th>Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF1</td>
<td>IO</td>
<td>Test pad 1 / antenna port 1</td>
</tr>
<tr>
<td>RF2</td>
<td>IO</td>
<td>Test pad 2 / antenna port 2</td>
</tr>
</tbody>
</table>
6 LAYOUT DESCRIPTION

The IC dimensions are given in the table 2.

Table 2: IC dimensions.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>420</td>
<td>µm</td>
</tr>
<tr>
<td>Width</td>
<td>440</td>
<td>µm</td>
</tr>
</tbody>
</table>

Figure 2: Device layout view.

1. Digital part
2. EEPROM
3. Rectifier
4. Reference voltage source
5. Demodulator
6. Clock oscillator
7. Random number generator
8. Short-time memory
9. Energy-storage capacitance
10. Pad RF1
11. Pad RF2
7 OPERATION CHARACTERISTICS

7.1 TECHNICAL CHARACTERISTICS

Technology: SMIC EEPROM CMOS 180 nm
Status: silicon proven
Area: 0.185 mm$^2$

7.2 ELECTRICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>$T_A$</td>
<td></td>
<td>-40 25 +65</td>
<td>°C</td>
</tr>
<tr>
<td>Operating carrier frequency</td>
<td>$F_c$</td>
<td></td>
<td>860 - 960 MHz</td>
<td></td>
</tr>
<tr>
<td>Read sensitivity</td>
<td>$P_{rd, min}$</td>
<td>$T_A = 25 °C$</td>
<td>- 30 -</td>
<td>µW</td>
</tr>
<tr>
<td>Write sensitivity</td>
<td>$P_{w1, min}$</td>
<td>$T_A = 25 °C$</td>
<td>- 50 -</td>
<td>µW</td>
</tr>
<tr>
<td>Impedance$^1$</td>
<td>$Z$</td>
<td>$F_c = 867 MHz$</td>
<td>- 16-j350 -</td>
<td>Ω</td>
</tr>
</tbody>
</table>

Note: 1 Measured for QFN32 package.

8 DELIVERABLES

IP contents:
- Datasheet
- Layout View (GDSII)
- Evaluation kit based on packaged IC
- Characterization Report
- Behavioral Model
- SPICE netlist (.cdl)
- Integration Support