

- ◇ STRUCTURE                    Silicon Monolithic Integrated Circuit
- ◇ PRODUCT                    I<sup>2</sup>C BUS Serial EEPROMs
- ◇ SERIES                      ADVANTAGE SERIES
- ◇ FAMILY                      BR24C□□ family
- ◇ TYPE                        Supply voltage 1.8V~5.5V/Operating temperature -40°C~+85°Ctype
- ◇ PART NUMBER            BR24C□□-10□U-1.8

| PART NUMBER         | PACKAGE              | DENSITY |
|---------------------|----------------------|---------|
| BR24C01A -10SU-1.8  | 8-lead<br>JEDEC SOIC | 1Kbit   |
| BR24C02N -10SU-1.8  |                      | 2Kbit   |
| BR24C04N -10SU-1.8  |                      | 4Kbit   |
| BR24C08AN -10SU-1.8 |                      | 8Kbit   |
| BR24C16AN -10SU-1.8 |                      | 16Kbit  |
| BR24C32AN -10SU-1.8 |                      | 32Kbit  |
| BR24C01A -10TU-1.8  | 8-lead<br>TSSOP      | 1Kbit   |
| BR24C02 -10TU-1.8   |                      | 2Kbit   |
| BR24C04 -10TU-1.8   |                      | 4Kbit   |
| BR24C08A -10TU-1.8  |                      | 8Kbit   |
| BR24C16A -10TU-1.8  |                      | 16Kbit  |
| BR24C32A -10TU-1.8  |                      | 32Kbit  |

- ◇ FEATURE                    Two wire serial interface  
                                   Endurance : 1,000,000 erase/write cycles  
                                   Data retention : 100years  
                                   Initial Data FFh in all address

◇ ABSOLUTE MAXIMUM RATING

| Parameter                                 | Symbol           | Rating                    | Unit |
|---|------------------|---------------------------|------|
| Operating Temperature                     | T <sub>opr</sub> | -40~85                    | °C   |
| Storage Temperature                       | T <sub>stg</sub> | -65~125                   | °C   |
| Voltage on Any Pin with Respect to Ground | -                | -0.3~V <sub>cc</sub> +0.3 | V    |
| Maximum Operating Voltage                 | V <sub>cc</sub>  | -0.3~6.5                  | V    |

◇ POWER DISSIPATION (T<sub>a</sub>=25°C)

| PACKAGE           | Rating | Unit |
|-------------------|--------|------|
| 8-lead JEDEC SOIC | 450 *1 | mW   |
| 8-lead TSSOP      | 330 *2 | mW   |

\* Degradation is done at 4.5mW/°C(\*1), 3.3mW/°C(\*2)for operation above 25°C

◇ DC OPERATING CHARACTERISTICS

BR24C01A/02/04/08A/16A.Unless otherwise specified,V<sub>CC</sub>=1.8V to 5.5V, T<sub>a</sub>=-40°C to 85°C

| Parameter                              | Symbol           | Min                  | Max                  | Unit | Test Conditions                          |
|--|------------------|----------------------|----------------------|------|--|
| Supply Current V <sub>CC</sub> =5.0V   | I <sub>CC1</sub> | -                    | 1.0                  | mA   | READ at 100 kHz                          |
| Supply Current V <sub>CC</sub> =5.0V   | I <sub>CC2</sub> | -                    | 3.0                  | mA   | WRITE at 100 kHz                         |
| Standby Current V <sub>CC</sub> =1.8V  | I <sub>SB1</sub> | -                    | 3.0                  | μA   | V <sub>IN</sub> =V <sub>CC</sub> or GND  |
| Standby Current V <sub>CC</sub> =2.5V  | I <sub>SB2</sub> | -                    | 4.0                  | μA   | V <sub>IN</sub> =V <sub>CC</sub> or GND  |
| Standby Current V <sub>CC</sub> =2.7V  | I <sub>SB3</sub> | -                    | 4.0                  | μA   | V <sub>IN</sub> =V <sub>CC</sub> or GND  |
| Standby Current V <sub>CC</sub> =5.0V  | I <sub>SB4</sub> | -                    | 18.0                 | μA   | V <sub>IN</sub> =V <sub>CC</sub> or GND  |
| Input Leakage Current                  | I <sub>IJ</sub>  | -                    | 3.0                  | μA   | V <sub>IN</sub> =V <sub>CC</sub> or GND  |
| Output Leakage Current                 | I <sub>LO</sub>  | -                    | 3.0                  | μA   | V <sub>OUT</sub> =V <sub>CC</sub> or GND |
| Input Low Level                        | V <sub>IL</sub>  | -                    | V <sub>CC</sub> ×0.3 | V    | 2.5V ≤ V <sub>CC</sub> ≤ 5.5V            |
|  |                  | -                    | V <sub>CC</sub> ×0.2 |      | 1.8V ≤ V <sub>CC</sub> < 2.5V            |
| Input High Level                       | V <sub>IH</sub>  | V <sub>CC</sub> ×0.7 | -                    | V    | 2.5V ≤ V <sub>CC</sub> ≤ 5.5V            |
|  |                  | V <sub>CC</sub> ×0.8 | -                    |      | 1.8V ≤ V <sub>CC</sub> < 2.5V            |
| Output Low Level V <sub>CC</sub> =3.0V | V <sub>OL1</sub> | -                    | 0.4                  | V    | I <sub>OL</sub> =2.1mA                   |
| Output Low Level V <sub>CC</sub> =1.8V | V <sub>OL2</sub> | -                    | 0.2                  | V    | I <sub>OL</sub> =0.15mA                  |

◇ AC OPERATING CHARACTERISTICS

BR24C01A/02/04/08A/16A.Unless otherwise specified,V<sub>CC</sub>=1.8V to 5.5V, T<sub>a</sub>=-40°C to 85°C

| Parameter   | Symbol                 | 1.8V |     | 2.5V,2.7V,5.0V |     | Unit         |
|---|------------------------|------|-----|----------------|-----|--------------|
|   |                        | Min  | Max | Min            | Max |              |
| Clock Frequency, SCL  | f <sub>SCL</sub>       | -    | 100 | -              | 400 | kHz          |
| Clock Pulse Width Low   | t <sub>LOW</sub>       | 4.7  | -   | 1.2            | -   | μs           |
| Clock Pulse Width High  | t <sub>HIGH</sub>      | 4.0  | -   | 0.6            | -   | μs           |
| Noise Suppression Time  | t <sub>N</sub>         | -    | 100 | -              | 50  | ns           |
| Clock Low to Data Out Valid                                   | t <sub>AA</sub>        | 0.1  | 4.5 | 0.1            | 0.9 | μs           |
| Time the bus must be free before a new transmission can start | t <sub>BUF</sub>       | 4.7  | -   | 1.2            | -   | μs           |
| Start Hold Time   | t <sub>HOLD,STA</sub>  | 4.0  | -   | 0.6            | -   | μs           |
| Start Setup Time  | t <sub>SETUP,STA</sub> | 4.7  | -   | 0.6            | -   | μs           |
| Data In Hold Time   | t <sub>HOLD,DAT</sub>  | 0    | -   | 0              | -   | μs           |
| Data In Setup Time  | t <sub>SETUP,DAT</sub> | 200  | -   | 100            | -   | ns           |
| Inputs Rise Time *1   | t <sub>R</sub>         | -    | 1.0 | -              | 0.3 | μs           |
| Inputs Fall Time *1   | t <sub>F</sub>         | -    | 300 | -              | 300 | ns           |
| Stop Setup Time   | t <sub>SETUP,STO</sub> | 4.7  | -   | 0.6            | -   | μs           |
| Data Out Hold Time  | t <sub>OH</sub>        | 100  | -   | 50             | -   | ns           |
| Write Cycle Time  | t <sub>WR</sub>        | -    | 5   | -              | 5   | ms           |
| Endurance *1<br>5.0V, 25°C                                    | Endurance              | 1M   | -   | 1M             | -   | Write Cycles |

\*1 Not 100% TESTED

BR24C32A Unless otherwise specified,V<sub>CC</sub>=1.8V to 5.5V, T<sub>a</sub>=-40°C to 85°C

| Parameter                              | Symbol           | Min                  | Max                  | Unit | Test Conditions                          |
|--|------------------|----------------------|----------------------|------|--|
| Supply Current V <sub>CC</sub> =5.0V   | I <sub>CC1</sub> | -                    | 1.0                  | mA   | READ at 400 kHz                          |
| Supply Current V <sub>CC</sub> =5.0V   | I <sub>CC2</sub> | -                    | 3.0                  | mA   | WRITE at 400 kHz                         |
| Standby Current V <sub>CC</sub> =1.8V  | I <sub>SB1</sub> | -                    | 1.0                  | μA   | V <sub>IN</sub> =V <sub>CC</sub> or GND  |
| Standby Current V <sub>CC</sub> =2.5V  | I <sub>SB2</sub> | -                    | 2.0                  | μA   | V <sub>IN</sub> =V <sub>CC</sub> or GND  |
| Standby Current V <sub>CC</sub> =2.7V  | I <sub>SB3</sub> | -                    | 2.0                  | μA   | V <sub>IN</sub> =V <sub>CC</sub> or GND  |
| Standby Current V <sub>CC</sub> =5.0V  | I <sub>SB4</sub> | -                    | 6.0                  | μA   | V <sub>IN</sub> =V <sub>CC</sub> or GND  |
| Input Leakage Current                  | I <sub>IJ</sub>  | -                    | 3.0                  | μA   | V <sub>IN</sub> =V <sub>CC</sub> or GND  |
| Output Leakage Current                 | I <sub>LO</sub>  | -                    | 3.0                  | μA   | V <sub>OUT</sub> =V <sub>CC</sub> or GND |
| Input Low Level                        | V <sub>IL</sub>  | -                    | V <sub>CC</sub> ×0.3 | V    | 2.5V ≤ V <sub>CC</sub> ≤ 5.5V            |
|  |                  | -                    | V <sub>CC</sub> ×0.2 |      | 1.8V ≤ V <sub>CC</sub> < 2.5V            |
| Input High Level                       | V <sub>IH</sub>  | V <sub>CC</sub> ×0.7 | -                    | V    | 2.5V ≤ V <sub>CC</sub> ≤ 5.5V            |
|  |                  | V <sub>CC</sub> ×0.8 | -                    |      | 1.8V ≤ V <sub>CC</sub> < 2.5V            |
| Output Low Level V <sub>CC</sub> =3.0V | V <sub>OL1</sub> | -                    | 0.4                  | V    | I <sub>OL</sub> =2.1mA                   |
| Output Low Level V <sub>CC</sub> =1.8V | V <sub>OL2</sub> | -                    | 0.2                  | V    | I <sub>OL</sub> =0.15mA                  |

BR24C32A.Unless otherwise specified,V<sub>CC</sub>=1.8V to 5.5V, T<sub>a</sub>=-40°C to 85°C

| Parameter   | Symbol                 | 1.8V |     | 2.5V,2.7V,5.0V |     | Unit         |
|---|------------------------|------|-----|----------------|-----|--------------|
|   |                        | Min  | Max | Min            | Max |              |
| Clock Frequency, SCL  | f <sub>SCL</sub>       | -    | 100 | -              | 400 | kHz          |
| Clock Pulse Width Low   | t <sub>LOW</sub>       | 4.7  | -   | 1.3            | -   | μs           |
| Clock Pulse Width High  | t <sub>HIGH</sub>      | 4.0  | -   | 0.6            | -   | μs           |
| Noise Suppression Time  | t <sub>N</sub>         | -    | 100 | -              | 50  | ns           |
| Clock Low to Data Out Valid                                   | t <sub>AA</sub>        | 0.1  | 4.5 | 0.1            | 0.9 | μs           |
| Time the bus must be free before a new transmission can start | t <sub>BUF</sub>       | 4.7  | -   | 1.3            | -   | μs           |
| Start Hold Time   | t <sub>HOLD,STA</sub>  | 4.0  | -   | 0.6            | -   | μs           |
| Start Setup Time  | t <sub>SETUP,STA</sub> | 4.7  | -   | 0.6            | -   | μs           |
| Data In Hold Time   | t <sub>HOLD,DAT</sub>  | 0    | -   | 0              | -   | μs           |
| Data In Setup Time  | t <sub>SETUP,DAT</sub> | 200  | -   | 100            | -   | ns           |
| Inputs Rise Time *1   | t <sub>R</sub>         | -    | 1.0 | -              | 0.3 | μs           |
| Inputs Fall Time *1   | t <sub>F</sub>         | -    | 300 | -              | 300 | ns           |
| Stop Setup Time   | t <sub>SETUP,STO</sub> | 4.7  | -   | 0.6            | -   | μs           |
| Data Out Hold Time  | t <sub>OH</sub>        | 100  | -   | 50             | -   | ns           |
| Write Cycle Time  | t <sub>WR</sub>        | -    | 5   | -              | 5   | ms           |
| Endurance *1<br>5.0V, 25°C                                    | Endurance              | 1M   | -   | 1M             | -   | Write Cycles |

\*1 Not 100% TESTED

○This product is not designed for protection against radioactive rays.

◇ BLOCK DIAGRAM

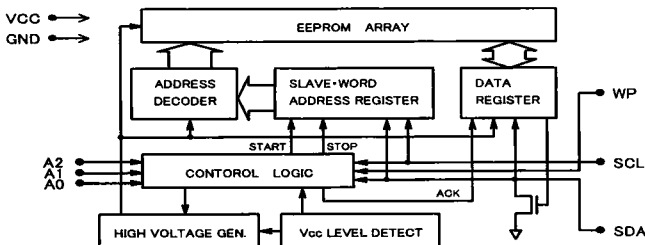


Fig.-1 BLOCK DIAGRAM

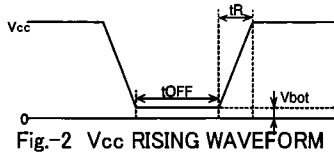
◇ PIN No., PIN NAME

| PIN No. | PIN NAME        |
|---------|-----------------|
| 1       | A0              |
| 2       | A1              |
| 3       | A2              |
| 4       | GND             |
| 5       | SDA             |
| 6       | SCL             |
| 7       | WP              |
| 8       | V <sub>CC</sub> |

◇NOTES FOR POWER SUPPLY

Vcc rises through the low voltage region in which internal circuit of IC and the controller are unstable, so that device may not work properly due to an incomplete reset of internal circuit. To prevent this, the device has the feature of P.O.R. and LVCC. In the case of power up, keep the following conditions to ensure functions of P.O.R. and LVCC.

1. It is necessary to be "SDA='H'" and "SCL='L' or 'H'".
2. Follow the recommended conditions of tR, tOFF, Vbot for the function of P.O.R. during power up.



◇RECOMMENDED CONDITIONS OF tR, tOFF, Vbot

| tR          | tOFF       | Vbot       |
|-------------|------------|------------|
| Below 10ms  | Above 10ms | Below 0.3V |
| Below 100ms | Above 10ms | Below 0.2V |

3. Prevent SDA and SCL from being "High-Z".

In case that condition 1. and/or 2. cannot be met, take following actions.

- A) Unable to keep condition 1.  
( SDA is "LOW" during power up.)  
→ Control SDA ,SCL to be "HIGH" as Fig.-3(a), 3(b).
- B) Unable to keep condition 2.  
→ After power becomes stable, execute software reset.
- C) Unable to keep both conditions 1 and 2.  
→ Follow the instruction A first, then the instruction B.

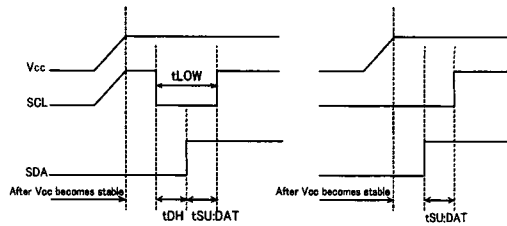
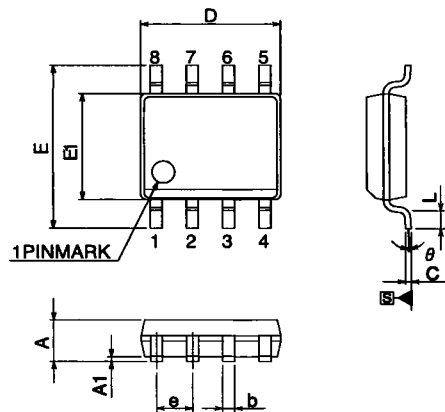


Fig.-3(a) SCL='H' and SDA='L' Fig.-3(b) SCL='L' and SDA='L'

◇CAUTIONS ON USE

- (1) Absolute maximum ratings  
If the absolute maximum ratings such as impressed voltage and action temperature range and so forth are exceeded, LSI may be destructed. Do not impress voltage and temperature exceeding the absolute maximum ratings. In the case of fear exceeding the absolute maximum ratings, take physical safety countermeasures such as fuses, and see to it that conditions exceeding the absolute maximum ratings should not be impressed to LSI.
- (2) GND electric potential  
Set the voltage of GND terminal lowest at any action condition. Make sure that each terminal voltage is lower than that of GND terminal.
- (3) Thermal design  
In consideration of permissible loss in actual use condition, carry out heat design with sufficient margin.
- (4) Terminal to terminal shortcircuit and wrong packaging  
When to package LSI onto a board, pay sufficient attention to LSI direction and displacement. Wrong packaging may destruct LSI. And in the case of shortcircuit between LSI terminals and terminals and power source, terminal and GND owing to foreign matter, LSI may be destructed.
- (5) Use in a strong electromagnetic field may cause malfunction, therefore, evaluated design sufficiently.

◇ PHYSICAL DIMENSION

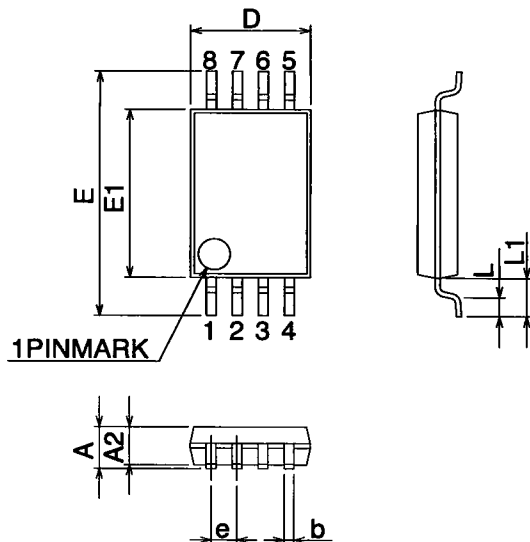


- Notes**
- 1.This drawing is subject to change without notice.
  - 2.Body dimensions do not include mold flash or protrusion, or gate burns.
  - 3.Reference JEDEC MS-012 variation AA.

Fig-4 8-lead JEDEC SOIC Package Outline

◇ 8-lead JEDEC SOIC Package Size Data

| Symbol | mm          |      |      | inches       |       |       |
|--------|-------------|------|------|--------------|-------|-------|
|        | Typ.        | Min. | Max. | Typ.         | Min.  | Max.  |
| A      | -           | 1.35 | 1.75 | -            | 0.053 | 0.069 |
| A1     | -           | 0.10 | 0.25 | -            | 0.004 | 0.010 |
| b      | -           | 0.31 | 0.51 | -            | 0.012 | 0.020 |
| c      | -           | 0.17 | 0.25 | -            | 0.007 | 0.010 |
| D      | -           | 4.80 | 5.00 | -            | 0.189 | 0.197 |
| e      | 1.27<br>BSC | -    | -    | 0.050<br>BSC | -     | -     |
| E      | -           | 5.79 | 6.20 | -            | 0.228 | 0.244 |
| E1     | -           | 3.81 | 3.99 | -            | 0.150 | 0.157 |
| L      | -           | 0.40 | 1.27 | -            | 0.016 | 0.050 |
| θ      | -           | 0°   | 8°   | -            | 0°    | 8°    |



- Notes**
- 1.This drawing is subject to change without notice.
  - 2.Body dimensions do not include mold flash or protrusion, or gate burns.
  - 3.Reference MO-153

Fig-5 8-lead TSSOP Package Outline

◇ 8-lead TSSOP Package Size Data

| Symbol | mm          |      |      | inches |       |       |
|--------|-------------|------|------|--------|-------|-------|
|        | Typ.        | Min. | Max. | Typ.   | Min.  | Max.  |
| A      | -           | -    | 1.20 | -      | -     | 0.047 |
| A2     | 1.00        | 0.80 | 1.05 | 0.039  | 0.031 | 0.041 |
| b      | -           | 0.19 | 0.30 | -      | 0.007 | 0.012 |
| D      | 3.00        | 2.90 | 3.10 | 0.118  | 0.114 | 0.122 |
| e      | 0.65<br>BSC | -    | -    | 0.025  | -     | -     |
| E      | 6.40<br>BSC | -    | -    | 0.252  | -     | -     |
| E1     | 4.40        | 4.30 | 4.50 | 0.173  | 0.169 | 0.177 |
| L      | 0.60        | 0.45 | 0.75 | 0.023  | 0.017 | 0.030 |
| L1     | 1.00<br>REF | -    | -    | 0.039  | -     | -     |

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