Memory FRAM

256K (32 K × 8) Bit SPI

MB85RS256TY (AEC-Q100 Compliant)

**DESCRIPTION**

MB85RS256TY is a FRAM (Ferroelectric Random Access Memory) chip in a configuration of 32,768 words × 8 bits, using the ferroelectric process and silicon gate CMOS process technologies for forming the nonvolatile memory cells. This product is specifically targeted for high-temperature environment such as automotive applications.

MB85RS256TY adopts the Serial Peripheral Interface (SPI). The MB85RS256TY is able to retain data without using a back-up battery, as is needed for SRAM. The memory cells used in the MB85RS256TY can be used for $10^{13}$ read/write operations, which is a significant improvement over the number of read and write operations supported by Flash memory and E²PROM. As MB85RS256TY does not need any waiting time in writing process, the write cycle time of MB85RS256TY is much shorter than that of Flash memories or E²PROM.

**FEATURES**

- **Bit configuration**: 32,768 words × 8 bits
- **Serial Peripheral Interface**: SPI (Serial Peripheral Interface) Correspondent to SPI mode 0 (0, 0) and mode 3 (1, 1)
- **Operating frequency**: 40 MHz (Max)
- **High endurance**: $10^{13}$ times / byte
- **Data retention**: 40.2 years (+85 °C)
  - 10.9 years (+105 °C)
  - 3.38 years (+125 °C) or more
  - Under evaluation for more than 3.38 years (+125 °C)
- **Operating power supply voltage**: 1.8 V to 3.6 V
- **Low power consumption**: Operating power supply current 2.5 mA (Max@40 MHz)
  - Standby current 50 μA (Max)
  - Sleep current 12 μA (Max)
- **Operation ambient temperature range**: −40 °C to +125 °C
- **Package**: 8-pin plastic SOP
  - AEC-Q100 Grade 1 compliant
  - RoHS compliant
### PIN ASSIGNMENT

![TOP VIEW]

### PIN FUNCTIONAL DESCRIPTIONS

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Pin Name</th>
<th>Functional description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CS</td>
<td>Chip Select pin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>This is an input pin to make chips select. When CS is “H” level, device is in deselect (standby) status and SO becomes High-Z. Inputs from other pins are ignored for this time. When CS is “L” level, device is in select (active) status. CS has to be “L” level before inputting op-code. The Chip Select pin is pulled up internally to the VDD pin.</td>
</tr>
<tr>
<td>3</td>
<td>WP</td>
<td>Write Protect pin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>This is a pin to control writing to a status register. The writing of status register (see “STATUS REGISTER”) is protected in related with WP and WPEN. See “WRITING PROTECT” for detail.</td>
</tr>
<tr>
<td>7</td>
<td>HOLD</td>
<td>Hold pin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>This pin is used to interrupt serial input/output without making chips deselect. When HOLD is “L” level, hold operation is activated, SO becomes High-Z, SCK and SI become do not care. See “HOLD OPERATION” for detail.</td>
</tr>
<tr>
<td>6</td>
<td>SCK</td>
<td>Serial Clock pin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>This is a clock input pin to input/output serial data. SI is loaded synchronously to a rising edge, SO is output synchronously to a falling edge.</td>
</tr>
<tr>
<td>5</td>
<td>SI</td>
<td>Serial Data Input pin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>This is an input pin of serial data. This inputs op-code, address, and writing data.</td>
</tr>
<tr>
<td>2</td>
<td>SO</td>
<td>Serial Data Output pin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>This is an output pin of serial data. Reading data of FRAM memory cell array and status register data are output. This is High-Z during standby.</td>
</tr>
<tr>
<td>8</td>
<td>VDD</td>
<td>Supply Voltage pin</td>
</tr>
<tr>
<td>4</td>
<td>VSS</td>
<td>Ground pin</td>
</tr>
</tbody>
</table>
**BLOCK DIAGRAM**

Serial-Parallel Converter

Control Circuit

Address Counter

Row Decoder

FRAM Cell Array 32,768 x 8

FRAM Status Register

Column Decoder/Sense Amp/Write Amp

Data Register

Parallel-Serial Converter

SI

CS

SCK

HOLD

WP

SO
MB85RS256TY corresponds to the SPI mode 0 (CPOL = 0, CPHA = 0), and SPI mode 3 (CPOL = 1, CPHA = 1).

**SPI MODE**

- **SPI Mode 0**
  - CS
  - SCK
  - SI
  - MSB: 7 6 5 4 3 2 1 0
  - LSB: 7 6 5 4 3 2 1 0

- **SPI Mode 3**
  - CS
  - SCK
  - SI
  - MSB: 7 6 5 4 3 2 1 0
  - LSB: 7 6 5 4 3 2 1 0
SERIAL PERIPHERAL INTERFACE (SPI)

MB85RS256TY works as a slave of SPI. More than 2 devices can be connected by using microcontroller equipped with SPI port. By using a microcontroller not equipped with SPI port, SI and SO can be bus connected to use.

System Configuration with SPI Port

System Configuration without SPI Port

MOSI : Master Out Slave In
MISO : Master In Slave Out
SS  : Slave Select

Microcontroller

MB85RS256TY

CS  HOLD

SO  SI  SCK

MB85RS256TY

SS1

SISO

SCK

CS

SCK

HOLD

HOLD1

SS2

HOLD2
## STATUS REGISTER

<table>
<thead>
<tr>
<th>Bit No.</th>
<th>Bit Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>WPEN</td>
<td>Status Register Write Protect&lt;br&gt;This is a bit composed of nonvolatile memories (FRAM). WPEN protects writing to a status register (refer to “WRITING PROTECT”) relating with WP input. Writing with the WRSR command and reading with the RDSR command are possible.</td>
</tr>
<tr>
<td>6 to 4</td>
<td>—</td>
<td>Not Used Bits&lt;br&gt;These are bits composed of nonvolatile memories, writing with the WRSR command is possible. These bits are not used but they are read with the RDSR command.</td>
</tr>
<tr>
<td>3</td>
<td>BP1</td>
<td>Block Protect&lt;br&gt;This is a bit composed of nonvolatile memory. This defines size of write protect block for the WRITE command (refer to “BLOCK PROTECT”). Writing with the WRSR command and reading with the RDSR command are possible.</td>
</tr>
<tr>
<td>2</td>
<td>BP0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>WEL</td>
<td>Write Enable Latch&lt;br&gt;This indicates FRAM Array and status register are writable. The WREN command is for setting, and the WRDI command is for resetting. With the RDSR command, reading is possible but writing is not possible with the WRSR command. WEL is reset after the following operations.&lt;br&gt;After power ON.&lt;br&gt;After WRDI command recognition.&lt;br&gt;The rising edge of CS after WRSR command recognition.&lt;br&gt;The rising edge of CS after WRITE command recognition.&lt;br&gt;After returning from SLEEP mode.</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>This is a bit fixed to “0”.</td>
</tr>
</tbody>
</table>

## OP-CODE

MB85RS256TY accepts 8 kinds of command specified in op-code. Op-code is a code composed of 8 bits shown in the table below. Do not input invalid codes other than those codes. If CS is risen while inputting op-code, the command are not performed.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Op-code</th>
</tr>
</thead>
<tbody>
<tr>
<td>WREN</td>
<td>Set Write Enable Latch</td>
<td>0000 0110B</td>
</tr>
<tr>
<td>WRDI</td>
<td>Reset Write Enable Latch</td>
<td>0000 0100B</td>
</tr>
<tr>
<td>RDSR</td>
<td>Read Status Register</td>
<td>0000 0101B</td>
</tr>
<tr>
<td>WRSR</td>
<td>Write Status Register</td>
<td>0000 0001B</td>
</tr>
<tr>
<td>READ</td>
<td>Read Memory Code</td>
<td>0000 0011B</td>
</tr>
<tr>
<td>WRITE</td>
<td>Write Memory Code</td>
<td>0000 0010B</td>
</tr>
<tr>
<td>RDID</td>
<td>Read Device ID</td>
<td>1001 1111B</td>
</tr>
<tr>
<td>SLEEP</td>
<td>Sleep Mode</td>
<td>1011 1001B</td>
</tr>
</tbody>
</table>
### COMMAND

#### WREN

The WREN command sets WEL (Write Enable Latch) bit to 1. WEL has to be set with the WREN command before writing operation (WR SR command and WRITE command).

![Diagram showing the WREN command sequence]

#### WRDI

The WRDI command resets WEL (Write Enable Latch) bit to 0. Writing operation (WR SR command and WRITE command) are not performed when WEL is reset.

![Diagram showing the WRDI command sequence]
**RDSR**

The RDSR command reads status register data. After op-code of RDSR is input to SI, 8-cycle clock is input to SCK. The SI value is invalid for this time. SO is output synchronously to a falling edge of SCK. In the RDSR command, repeated reading of status register is enabled by sending SCK continuously before rising of CS.

**WRSR**

The WRSR command writes data to the nonvolatile memory bit of status register. After performing WRSR op-code to a SI pin, 8 bits writing data is input. WEL (Write Enable Latch) is not able to be written with WRSR command. A SI value correspondent to bit 1 is ignored. Bit 0 of the status register is fixed to “0” and cannot be written. The SI value corresponding to bit 0 is ignored. WP signal level shall be fixed before performing WRSR command, and do not change the WP signal level until the end of command sequence.
• READ

The READ command reads FRAM memory cell array data. Arbitrary 16 bits address and op-code of READ are input to SI. The most significant address bit is invalid. Then, 8-cycle clock is input to SCK. SO is output synchronously to the falling edge of SCK. While reading, the SI value is invalid. When CS is risen, the READ command is completed, but keeps on reading with automatic address increment which is enabled by continuously sending clocks to SCK in unit of 8 cycles before CS rising. When it reaches the most significant address, it rolls over to the starting address, and reading cycle keeps on infinitely.

• WRITE

The WRITE command writes data to FRAM memory cell array. WRITE op-code, arbitrary 16 bits of address and 8 bits of writing data are input to SI. The most significant address bit is invalid. When 8 bits of writing data is input, data is written to FRAM memory cell array. Risen CS will terminate the WRITE command, but if you continue sending the writing data for 8 bits each before CS rising, it is possible to continue writing with automatic address increment. When it reaches the most significant address, it rolls over to the starting address, and writing cycle can be continued infinitely.
• RDID

The RDID command reads fixed Device ID. After performing RDID op-code to SI, 32-cycle clock is input to SCK. The SI value is invalid for this time. SO is output synchronously to a falling edge of SCK. The output is in order of Manufacturer ID (8bit)/Continuation code (8bit)/Product ID (1st Byte)/Product ID (2nd Byte).

In the RDID command, 32-bit Device ID is output by continuously sending SCK clock, and SO holds the output state of the last bit until CS is risen.

![Diagram of RDID command](attachment)
**SLEEP**

The SLEEP command shifts the LSI to a low power mode called “SLEEP mode”. The transition to the SLEEP mode is carried out at the rising edge of $\overline{CS}$ after operation code in the SLEEP command. However, when at least one SCK clock is inputted before the rising edge of $\overline{CS}$ after operation code in the SLEEP command, this SLEEP command is canceled.

After the SLEEP mode transition, SCK and SI inputs are ignored and SO changes to a High-Z state. If input pin(s) other than $\overline{CS}$ pin is (are) not fixed to VSS or VDD, flow-throw current may flow.

![Diagram of SLEEP mode entry](image)

Returning to a normal operation from the SLEEP mode is carried out after $t_{REC}$ (Max 400 $\mu$s) time from the falling edge of CS (see the figure below). It is possible to return CS to H level before $t_{REC}$ time. However, it is prohibited to bring down CS to L level again during $t_{REC}$ period.

![Diagram of SLEEP mode exit](image)
**BLOCK PROTECT**

Writing protect block for WRITE command is configured by the value of BP0 and BP1 in the status register.

<table>
<thead>
<tr>
<th>BP1</th>
<th>BP0</th>
<th>Protected Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>6000H to 7FFFH (upper 1/4)</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>4000H to 7FFFH (upper 1/2)</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0000H to 7FFFH (all)</td>
</tr>
</tbody>
</table>

**WRITING PROTECT**

Writing operation of the WRITE command and the WRSR command are protected with the value of WEL, WPEN, WP as shown in the table.

<table>
<thead>
<tr>
<th>WEL</th>
<th>WPEN</th>
<th>WP</th>
<th>Protected Blocks</th>
<th>Unprotected Blocks</th>
<th>Status Register</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>X</td>
<td>X</td>
<td>Protected</td>
<td>Protected</td>
<td>Protected</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>X</td>
<td>Protected</td>
<td>Unprotected</td>
<td>Unprotected</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Protected</td>
<td>Unprotected</td>
<td>Protected</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Protected</td>
<td>Unprotected</td>
<td>Unprotected</td>
</tr>
</tbody>
</table>

**HOLD OPERATION**

Hold status is retained without aborting a command if HOLD is “L” level while CS is “L” level. The timing for starting and ending hold status depends on the SCK to be “H” level or “L” level when a HOLD pin input is transited to the hold condition as shown in the diagram below. In case the HOLD pin transited to “L” level when SCK is “L” level, return the HOLD pin to “H” level at SCK being “L” level. In the same manner, in case the HOLD pin transited to “L” level when SCK is “H” level, return the HOLD pin to “H” level at SCK being “H” level. Arbitrary command operation is interrupted in hold status. SCK and SI inputs become do not care. And, SO becomes High-Z while reading command (RDSR, READ). If CS is rising during hold status, a command is aborted. In case the command is aborted before its recognition, WEL holds the value before transition to hold status.
### ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply voltage*</td>
<td>VDD</td>
<td>– 0.5 to + 4.0</td>
<td>V</td>
</tr>
<tr>
<td>Input voltage*</td>
<td>V_IN</td>
<td>– 0.5 to V_DD + 0.5( ≤ 4.0)</td>
<td>V</td>
</tr>
<tr>
<td>Output voltage*</td>
<td>V_OUT</td>
<td>– 0.5 to V_DD + 0.5( ≤ 4.0)</td>
<td>V</td>
</tr>
<tr>
<td>Operation ambient temperature</td>
<td>T_A</td>
<td>– 40 to + 125</td>
<td>℃</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>T_stg</td>
<td>– 55 to + 150</td>
<td>℃</td>
</tr>
</tbody>
</table>

*: These parameters are based on the condition that V_S is 0 V.

WARNING: Semiconductor devices may be permanently damaged by application of stress (including, without limitation, voltage, current or temperature) in excess of absolute maximum ratings. Do not exceed any of these ratings.

### RECOMMENDED OPERATING CONDITIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply voltage*1</td>
<td>V_DD</td>
<td>1.8 to 3.6</td>
<td>V</td>
</tr>
<tr>
<td>Operation ambient temperature*2</td>
<td>T_A</td>
<td>– 40 to + 125</td>
<td>℃</td>
</tr>
</tbody>
</table>

*1: These parameters are based on the condition that V_S is 0 V.

*2: Ambient temperature when only this device is working. Please consider it to be the almost same as the package surface temperature.

WARNING: The recommended operating conditions are required in order to ensure the normal operation of the semiconductor device. All of the device's electrical characteristics are warranted when the device is operated under these conditions. Any use of semiconductor devices will be under their recommended operating condition. Operation under any conditions other than these conditions may adversely affect reliability of device and could result in device failure. No warranty is made with respect to any use, operating conditions or combinations not represented on this data sheet. If you are considering application under any conditions other than listed herein, please contact sales representatives beforehand.
### ELECTRICAL CHARACTERISTICS

#### 1. DC Characteristics

(within recommended operating conditions)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>(0 \leq V_{\text{CS}} &lt; V_{\text{DD}})</th>
<th>(V_{\text{CS}} = V_{\text{DD}})</th>
<th>(25 , ^\circ\text{C})</th>
<th>(125 , ^\circ\text{C})</th>
<th>(\mu\text{A})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input leakage current*1</td>
<td>(</td>
<td>I_{\text{IL}}</td>
<td>)</td>
<td>(0 \leq V_{\text{CS}} &lt; V_{\text{DD}})</td>
<td>(V_{\text{DD}} \leq 200)</td>
<td>(V_{\text{DD}} \leq 25)</td>
<td>(V_{\text{DD}} \leq 125)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(V_{\text{CS}} = V_{\text{DD}})</td>
<td>(25 , ^\circ\text{C})</td>
<td>(1)</td>
<td>(2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(V_{\text{CS}} = V_{\text{SS}})</td>
<td>(125 , ^\circ\text{C})</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output leakage current*2</td>
<td>(</td>
<td>I_{\text{OL}}</td>
<td>)</td>
<td>(V_{\text{SS}} = 0 \text{ V to } V_{\text{DD}})</td>
<td>(25 , ^\circ\text{C})</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(V_{\text{SS}} = 125 , ^\circ\text{C})</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating power supply current*3</td>
<td>(I_{\text{DD}})</td>
<td>(SCK = 40\text{MHz})</td>
<td></td>
<td>2.1</td>
<td>2.5</td>
<td></td>
<td>(\text{mA})</td>
</tr>
<tr>
<td>Standby current</td>
<td>(I_{\text{SB}})</td>
<td>(SCK = SI = CS = WP = HOLD = V_{\text{DD}})</td>
<td></td>
<td>20</td>
<td>50</td>
<td></td>
<td>(\mu\text{A})</td>
</tr>
<tr>
<td>Sleep current</td>
<td>(I_{\text{ZZ}})</td>
<td>(CS = V_{\text{DD}})</td>
<td>(\text{All inputs } V_{\text{SS}} \text{ or } V_{\text{DD}})</td>
<td></td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Input high voltage</td>
<td>(V_{\text{IH}})</td>
<td>(V_{\text{DD}} = 1.8 \text{ V to } 3.6 \text{ V})</td>
<td></td>
<td></td>
<td>(V_{\text{DD}} \times 0.8)</td>
<td>(V_{\text{DD}} + 0.5)</td>
<td></td>
</tr>
<tr>
<td>Input low voltage</td>
<td>(V_{\text{IL}})</td>
<td>(V_{\text{DD}} = 1.8 \text{ V to } 3.6 \text{ V})</td>
<td></td>
<td></td>
<td>(V_{\text{DD}} - 0.5)</td>
<td>(V_{\text{DD}} \times 0.2)</td>
<td></td>
</tr>
<tr>
<td>Output high voltage</td>
<td>(V_{\text{OH}})</td>
<td>(I_{\text{OH}} = -2 \text{ mA})</td>
<td>(V_{\text{DD}} - 0.5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output low voltage</td>
<td>(V_{\text{OL}})</td>
<td>(I_{\text{OL}} = 2 \text{ mA})</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pull up resistance for CS</td>
<td>(R_{P})</td>
<td></td>
<td>18</td>
<td>33</td>
<td>80</td>
<td></td>
<td>(\text{k}\Omega)</td>
</tr>
</tbody>
</table>

*1 : Applicable pin : CS, WP, HOLD, SCK, SI

*2 : Applicable pin : SO

*3 : Input voltage magnitude : VDD – 0.2 V or VSS
2. AC Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min</td>
<td>Max</td>
<td></td>
</tr>
<tr>
<td>SCK clock frequency</td>
<td>$f_{CK}$</td>
<td>0</td>
<td>33</td>
<td>MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>40</td>
<td>1.8V to 2.7V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.7V</td>
<td>3.6V</td>
<td>2.7V to 3.6V</td>
</tr>
<tr>
<td>Clock high time</td>
<td>$t_{CH}$</td>
<td>13</td>
<td>—</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>—</td>
<td>1.8V to 2.7V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.7V</td>
<td>3.6V</td>
<td>2.7V to 3.6V</td>
</tr>
<tr>
<td>Clock low time</td>
<td>$t_{CL}$</td>
<td>13</td>
<td>—</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>—</td>
<td>1.8V to 2.7V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.7V</td>
<td>3.6V</td>
<td>2.7V to 3.6V</td>
</tr>
<tr>
<td>Chip select set up time</td>
<td>$t_{CSU}$</td>
<td>10</td>
<td>—</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.7V</td>
<td>3.6V</td>
<td>—</td>
</tr>
<tr>
<td>Chip select hold time</td>
<td>$t_{CSH}$</td>
<td>10</td>
<td>—</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.7V</td>
<td>3.6V</td>
<td>—</td>
</tr>
<tr>
<td>Output disable time</td>
<td>$t_{OD}$</td>
<td>—</td>
<td>16</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.7V</td>
<td>3.6V</td>
<td>—</td>
</tr>
<tr>
<td>Output data valid time</td>
<td>$t_{ODV}$</td>
<td>—</td>
<td>13</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>—</td>
<td>9</td>
<td>2.7V to 3.6V</td>
</tr>
<tr>
<td>Output hold time</td>
<td>$t_{OH}$</td>
<td>0</td>
<td>—</td>
<td>ns</td>
</tr>
<tr>
<td>Deselect time</td>
<td>$t_{D}$</td>
<td>40</td>
<td>—</td>
<td>ns</td>
</tr>
<tr>
<td>Data in rising time</td>
<td>$t_{R}$</td>
<td>—</td>
<td>50</td>
<td>ns</td>
</tr>
<tr>
<td>Data falling time</td>
<td>$t_{F}$</td>
<td>—</td>
<td>50</td>
<td>ns</td>
</tr>
<tr>
<td>Data set up time</td>
<td>$t_{SU}$</td>
<td>5</td>
<td>—</td>
<td>ns</td>
</tr>
<tr>
<td>Data hold time</td>
<td>$t_{H}$</td>
<td>5</td>
<td>—</td>
<td>ns</td>
</tr>
<tr>
<td>HOLD set uptime</td>
<td>$t_{HS}$</td>
<td>10</td>
<td>—</td>
<td>ns</td>
</tr>
<tr>
<td>HOLD hold time</td>
<td>$t_{HH}$</td>
<td>10</td>
<td>—</td>
<td>ns</td>
</tr>
<tr>
<td>HOLD output floating time</td>
<td>$t_{HZ}$</td>
<td>—</td>
<td>20</td>
<td>ns</td>
</tr>
<tr>
<td>HOLD output active time</td>
<td>$t_{LZ}$</td>
<td>—</td>
<td>20</td>
<td>ns</td>
</tr>
<tr>
<td>SLEEP recovery time</td>
<td>$t_{REC}$</td>
<td>—</td>
<td>400</td>
<td>µs</td>
</tr>
</tbody>
</table>

AC Test Condition

- Power supply voltage: 1.8 V to 3.6 V Operation
- Operation ambient temperature: −40 °C to +125 °C
- Input voltage magnitude: $V_{DD} \times 0.8 \leq V_{IL} \leq V_{DD}$
  $0 \leq V_{IH} \leq V_{DD} \times 0.2$
- Input rising time: 5 ns
- Input falling time: 5 ns
- Input judge level: $V_{DD}/2$
- Output judge level: $V_{DD}/2$
AC Load Equivalent Circuit

![Diagram of AC Load Equivalent Circuit]

3. Pin Capacitance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output capacitance</td>
<td>$C_O$</td>
<td>$V_{DD} = 3.3 \text{ V}$, $V_{IN} = V_{OUT} = 0 \text{ V to } V_{DD}$, $f = 1 \text{ MHz}$, $T_A = +25 \degree \text{ C}$</td>
<td>—</td>
<td>8 pF</td>
</tr>
<tr>
<td>Input capacitance</td>
<td>$C_I$</td>
<td>$f = 1 \text{ MHz}$, $T_A = +25 \degree \text{ C}$</td>
<td>—</td>
<td>6 pF</td>
</tr>
</tbody>
</table>
■ TIMING DIAGRAM

- **Serial Data Timing**

- **Hold Timing**
**POWER ON/OFF SEQUENCE**

If the device does not operate within the specified conditions of read cycle, write cycle or power on/off sequence, memory data can not be guaranteed.

**FRAM CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
<td></td>
</tr>
<tr>
<td>Read/Write Endurance(^1)</td>
<td>10(^{13})</td>
<td>—</td>
<td>Times/byte</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Endurance of the sum of read counts and write counts. Operation Ambient Temperature (T_A = + 125\ ^\circ) C</td>
</tr>
<tr>
<td>Data Retention(^2)</td>
<td>3.38 or more(^3)</td>
<td>—</td>
<td>Years</td>
</tr>
<tr>
<td></td>
<td>10.9</td>
<td>—</td>
<td>Operation Ambient Temperature (T_A = + 105\ ^\circ) C</td>
</tr>
<tr>
<td></td>
<td>40.2</td>
<td>—</td>
<td>Operation Ambient Temperature (T_A = + 85\ ^\circ) C</td>
</tr>
</tbody>
</table>

\(^1\): Total number of reading and writing defines the minimum value of endurance, as an FRAM memory operates with destructive readout mechanism.

\(^2\): Minimum values define retention time of the first reading/writing data right after shipment, and these values are calculated by qualification results.

\(^3\): Under evaluation for more than 3.38 years (+125 °C).
NOTE ON USE

We recommend programming of the device after reflow. Data written before reflow cannot be guaranteed.

ESD AND LATCH-UP

<table>
<thead>
<tr>
<th>Test</th>
<th>DUT</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESD HBM (Human Body Model)</td>
<td>MB85RS256TYPNF-GS-AWE2</td>
<td>≥ 2000 V</td>
</tr>
<tr>
<td>JESD22-A114 compliant</td>
<td>MB85RS256TYPNF-GS-BCE1</td>
<td>≥ 1000 V</td>
</tr>
<tr>
<td>ESD CDM (Charged Device Model)</td>
<td>MB85RS256TYPNF-GS-AWERE2</td>
<td>≥ 125mA</td>
</tr>
<tr>
<td>JESD22-C101 compliant</td>
<td>MB85RS256TYPNF-GS-BCERE1</td>
<td></td>
</tr>
<tr>
<td>Latch-Up (I-test)</td>
<td></td>
<td>≥ 5.4V</td>
</tr>
<tr>
<td>JESD78 compliant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latch-Up (V_supply overvoltage test)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JESD78 compliant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

REFLOW CONDITIONS AND FLOOR LIFE


Current status on Contained Restricted Substances

This product complies with the regulations of REACH Regulations, EU RoHS Directive and China RoHS.
# ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Part number</th>
<th>Package</th>
<th>Shipping form</th>
<th>Minimum shipping quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>MB85RS256TYPNF-GS-AWE2</td>
<td>8-pin plastic SOP</td>
<td>Tube</td>
<td>■*</td>
</tr>
<tr>
<td>MB85RS256TYPNF-GS-BCE1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MB85RS256TYPNF-GS-AWERE2</td>
<td>8-pin plastic SOP</td>
<td>Embossed Carrier tape</td>
<td>1500</td>
</tr>
<tr>
<td>MB85RS256TYPNF-GS-BCERE1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* : Please contact our sales office about minimum shipping quantity.

Note: MB85RS256TYPNF-GS has two basic part numbers, “-AW” and “-BC”, corresponding to each assembly site.
**PACKAGE DIMENSION**

(1) MB85RS256TYPNF-GS-AWE2/MB85RS256TYPNF-GS-AWERE2

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-pin plastic SOP</td>
<td></td>
</tr>
<tr>
<td>Lead pitch</td>
<td>1.27 mm</td>
</tr>
<tr>
<td>Package width x package length</td>
<td>3.9 mm x 4.9 mm</td>
</tr>
<tr>
<td>Lead shape</td>
<td>Gullwing</td>
</tr>
<tr>
<td>Sealing method</td>
<td>Plastic mold</td>
</tr>
<tr>
<td>Mounting height</td>
<td>1.75 mm MAX</td>
</tr>
</tbody>
</table>

Note *: These dimensions do not include resin protrusion.

Dimensions in mm

Details of "A" part

- 0.10 ± 0.05
- 0.4 (Min)

Pins width not do not include tie bar cutting remainder.
# MB85RS256TY (AEC-Q100 Compliant)

## (2) MB85RS256TYPNF-GS-BCE1/MB85RS256TYPNF-GS-BCERE1

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead pitch</td>
<td>1.27 mm</td>
</tr>
<tr>
<td>Package width × package length</td>
<td>3.9 mm × 4.89 mm</td>
</tr>
<tr>
<td>Lead shape</td>
<td>Gullwing</td>
</tr>
<tr>
<td>Sealing method</td>
<td>Plastic mold</td>
</tr>
<tr>
<td>Mounting heigth</td>
<td>1.73 mm MAX</td>
</tr>
</tbody>
</table>

8-pin plastic SOP

Note: These dimensions do not include resin protrusion. Pins width do not include tie bar cutting remainder.

Dimensions in mm
MARKING (Example)

(1) MB85RS256TYPNF-GS-AWE2/MB85RS256TYPNF-GS-AWERE2

S25TY: Product name
A1907 : A(CS code) + 1907(Year and Week code)
R01 : Trace code
(2) MB85RS256TYPNF-GS-BCE1/MB85RS256TYPNF-GS-BCERE1

[S25TY]
[A1907]
[V01]

S25TY : Product name
A1907 : A(CS code) + 1907(Year + Week code)
V01 : Trace code
PACKING INFORMATION

(1) MB85RS256TYPNF-GS-AWE2/MB85RS256TYPNF-GS-AWERE2

1. Tube (MB85RS256TYPNF-GS-AWE2)

1.1 Tube Dimensions

- Tube/stopper shape (example)

![Diagram of tube and stopper]

- Tube cross-sections and Maximum quantity

<table>
<thead>
<tr>
<th></th>
<th>Maximum quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>pcs/tube</td>
<td>pcs/inner box</td>
</tr>
<tr>
<td>85</td>
<td>4,250</td>
</tr>
</tbody>
</table>

No heat resistance.
Package should not be baked by using tube.

(Dimensions in mm)

- Direction of index in tube

![Diagram showing index mark]
1.2 Product label indicators (example)

Label I: Label on Inner box/Moisture Barrier Bag/ (It sticks it on the reel for the emboss taping)
[C-3 Label (50mm × 100mm) Supplemental Label (20mm × 100mm)]

<table>
<thead>
<tr>
<th>C-3 Label</th>
<th>Perforated line</th>
<th>Supplemental Label</th>
</tr>
</thead>
</table>

- XXXXXXXXXXXXXXXX (Customer part number or FJ part number)
- (3N)1 XXXXXXXXXXXXXXXX XXX (LEAD FREE mark)
- (Part number and quantity)
- QC PASS
- (3N)2 XXXXXXXXXXXXXXXX XXXXX
- XXX pcs (Quantity)
- XXXXXXXXXXXXXXXX (Customer part number or FI part number)
- (FJ control number)
- XXX/XX/XX (Packed years/month/day) ASSEMBLED IN xxxx
- XXXXXXXXXXXXXXXX (Customer part number or FI part number)
- (FJ control number bar code)
- XXXXXXXXXXXXXXXX (Customer part number or FI part number)
- (Lot Number and quantity)
- XXXXXXXXXXXXXXXX (Comment)
- XXXXXXXXXXXXXXXX (Part number and quantity)
- (FJ control number)
1.3 Dimensions for Containers

(1) Dimensions for inner box

<table>
<thead>
<tr>
<th>L</th>
<th>W</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>549</td>
<td>125</td>
<td>81</td>
</tr>
</tbody>
</table>

(Dimensions in mm)

(2) Dimensions for outer box

<table>
<thead>
<tr>
<th>L</th>
<th>W</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>567</td>
<td>272</td>
<td>269</td>
</tr>
</tbody>
</table>

(Dimensions in mm)
2. **Emboss Tape** (MB85RS256TYPNF-GS-AWERE2)

2.1 **Tape Dimensions** (not drawn to scale) (8-pin plastic SOP)

<table>
<thead>
<tr>
<th>Maximum storage capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>pcs/reel(Φ330mm)</td>
</tr>
<tr>
<td>1500</td>
</tr>
<tr>
<td>(1 pack/inner box)</td>
</tr>
</tbody>
</table>

(Dimension in mm)

Heat proof temperature: No heat resistance.

Package should not be baked by using tape and reel.
2.2 IC orientation

- example

(User Direction of Feed)

(Feed Side)

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2.4 Product label indicators (examples)

Label I: Label on Inner box/Moisture Barrier Bag/ (It sticks it on the reel for the emboss taping)
[C-3 Label (50mm × 100mm) Supplemental Label (20mm × 100mm)]

<table>
<thead>
<tr>
<th>C-3 Label</th>
<th>Perforated line</th>
<th>Supplemental Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>XXXXXXXXXXXXX (Customer part number or FJ part number)</td>
<td>(Part number and quantity)</td>
<td></td>
</tr>
<tr>
<td>(3N1) X XXXXXXXXXX XXX</td>
<td>QC PASS</td>
<td></td>
</tr>
<tr>
<td>(3N2) X XXXXXXXXXX XXX</td>
<td>(FJ control number)</td>
<td></td>
</tr>
<tr>
<td>XXXX pcs</td>
<td>(Quantity)</td>
<td></td>
</tr>
<tr>
<td>XXXXXXXXXX XXX</td>
<td>(Customer part number or FJ part number)</td>
<td></td>
</tr>
<tr>
<td>XXXXX/XX/XX (Packed years/month/day)</td>
<td>ASSEMBLED IN xxxx</td>
<td></td>
</tr>
<tr>
<td>XXXXXXXXXXXXX (Customer part number or FJ part number)</td>
<td>(Package count)</td>
<td></td>
</tr>
<tr>
<td>XXXXX-XXX XX</td>
<td>XXX-XX XX</td>
<td></td>
</tr>
<tr>
<td>XXXXXXXXXX (FJ control number)</td>
<td>(Lot Number and quantity)</td>
<td></td>
</tr>
<tr>
<td>XXXXXXXXXXXXX (Comment)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Label II: Moisture Barrier Bag (It sticks it on the Aluminum laminated bag)
[MSL Label (100mm × 70mm)]

---

MOISTURE-SENSITIVE DEVICES

注意
1. ドライバック包装の保管期限は、24ヶ月（25℃/80%RH未満）です。
2. 本製品の保存温度は、-20℃です。
3. 製造後、下図の状態で、ご使用ください。
   a) 168時間以内（30℃/60%RH以下）
   b) J-STO-033条件
4. 以下の条件の場合は、実装前にベークしてください。
   a) 23±5℃の環境下でインジケータカードの10%を超えた場合
   b) 3a、3bの条件に該当しない場合
5. ベーク必要性は、IPC/JEDEC J-STD-033 参照してください。

CAUTION
1. Calculated shelf life in sealed bag: 24 months at ≤25°C / ≤60% RH
2. Peak package body temperature: 260°C
3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must
   a) Mounted within: 168 hours of factory conditions ≤30°C/60%RH
   b) Stored on J-STO-033
4. Devices require bake, before mounting, if
   a) Humidity Indicator Card is >10% when read at 23±5°C
   b) 3a or 3b not met
5. If baking is required, refer to IPC/JEDEC J-STD-020 for bake procedure.

包装日・品名ラベルをご確認下さい
Bag Seal Date: See adjacent bar code label

注意 Marr and body temperature defined by IPC/JEDEC J-STD-020

---

LEAD FREE mark

---

MSL label
2.5 Dimensions for Containers

(1) Dimensions for inner box

<table>
<thead>
<tr>
<th>Tape width</th>
<th>L</th>
<th>W</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>350</td>
<td>335</td>
<td>35</td>
</tr>
</tbody>
</table>

(Dimensions in mm)

(2) Dimensions for outer box

<table>
<thead>
<tr>
<th>L</th>
<th>W</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>384</td>
<td>368</td>
<td>225</td>
</tr>
</tbody>
</table>

(Dimensions in mm)
(2) MB85RS256TPNF-GS-BCE1/MB85RS256TPNF-GS-BCERE1

1. Tube (MB85RS256TPNF-GS-BCE1)

1.1 Tube Dimensions
- Tube/stopper shape (example)

![](image)

- Tube cross-sections and Maximum quantity

<table>
<thead>
<tr>
<th>Maximum quantity</th>
<th>pcs/tube(500mm)</th>
<th>pcs/inner box</th>
<th>pcs/outer box</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>4,250</td>
<td>17,000</td>
<td></td>
</tr>
</tbody>
</table>

No heat resistance.
Package should not be baked by using tube.

(Dimensions in mm)

- Direction of index in tube

![](image)
1.2 Product label indicators (example)
Label I: Label on Inner box/Moisture Barrier Bag/ (It sticks it on the reel for the emboss taping)  
[C-3 Label (50mm × 100mm) Supplemental Label (20mm × 100mm)]

<table>
<thead>
<tr>
<th>C-3 Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>XXXXXXXXXXXXXXXXXXXX (Customer part number or FJ part number)</td>
</tr>
<tr>
<td>QC PASS</td>
</tr>
<tr>
<td>(3N)1 XXXXXXXXXXXXXXXXXXX XXX (LEAD FREE mark)</td>
</tr>
<tr>
<td>(Part number and quantity)</td>
</tr>
<tr>
<td>XXXX pcs (Quantity)</td>
</tr>
<tr>
<td>XXXXXXXXXXXXXXXXXXXX (Customer part number or FJ part number)</td>
</tr>
<tr>
<td>XXX/XX/XX (Packed years/month/day) ASSEMBLED IN xxxx</td>
</tr>
<tr>
<td>XXXXXXXXXXXX (Comment)</td>
</tr>
<tr>
<td>FJ control number</td>
</tr>
<tr>
<td>(Lot Number and quantity)</td>
</tr>
<tr>
<td>(Quantity)</td>
</tr>
<tr>
<td>(Package count)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supplemental Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>XXXXXXXXXXXXXXXXXXXX (Customer part number or FJ part number)</td>
</tr>
<tr>
<td>XXX/XX/XX (Packed years/month/day)</td>
</tr>
<tr>
<td>XXXXXXXXXXXX (FJ control number)</td>
</tr>
<tr>
<td>XXXXXXXXXXXXXXXXXXXX (Comment)</td>
</tr>
</tbody>
</table>
1.3 Dimensions for Containers

(1) Dimensions for inner box

<table>
<thead>
<tr>
<th>L</th>
<th>W</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>533</td>
<td>124</td>
<td>73</td>
</tr>
</tbody>
</table>

(Dimensions in mm)

(2) Dimensions for outer box

<table>
<thead>
<tr>
<th>L</th>
<th>W</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>549</td>
<td>277</td>
<td>180</td>
</tr>
</tbody>
</table>

(Dimensions in mm)
2. **Emboss Tape (MB85RS256TYPNF-GS-BCERE1)**

2.1 **Tape Dimensions** (not drawn to scale) (8-pin plastic SOP)

<table>
<thead>
<tr>
<th>Maximum storage capacity</th>
<th>pcs/reel(Φ330mm)</th>
<th>pcs/inner box</th>
<th>pcs/outer box</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500</td>
<td>1500</td>
<td>9000</td>
<td>(6 inner boxes/outer box: Max)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(Dimensions in mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat proof temperature : No heat resistance. Package should not be baked by using tape and reel.</td>
</tr>
</tbody>
</table>
2.2 IC orientation

- example

(User Direction of Feed) (Feed Side) (User Direction of Feed)

2.3 Reel dimensions

Dimensions in mm

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>W1</th>
<th>W2</th>
</tr>
</thead>
<tbody>
<tr>
<td>254</td>
<td>100</td>
<td>13</td>
<td>13.5</td>
<td>17.5</td>
</tr>
</tbody>
</table>
2.4 Product label indicators (examples)

Label I: Label on Inner box/Moisture Barrier Bag/ (It sticks it on the reel for the emboss taping)
[C-3 Label (50mm × 100mm) Supplemental Label (20mm × 100mm)]

<table>
<thead>
<tr>
<th>Label I: Label on Inner box/Moisture Barrier Bag/ (It sticks it on the reel for the emboss taping)</th>
<th>C-3 Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>XXXXXXXXXXXXXXXXXX (Customer part number or FJ part number)</td>
<td>C-3 Label</td>
</tr>
<tr>
<td>(3N1) XXXXXXXXXXXXXXX XX (LEAD-FREE mark) (Part number and quantity)</td>
<td>QC PASS</td>
</tr>
<tr>
<td>(3N2) XXXXXXXXXXXXXXX XX (FJ control number)</td>
<td></td>
</tr>
<tr>
<td>XXXX pcs (Quantity)</td>
<td></td>
</tr>
<tr>
<td>XXXXXXXXXXXXXXXXX (Customer part number or FJ part number)</td>
<td></td>
</tr>
<tr>
<td>XXXXX/XX/XX (Packed years/month/day) ASSEMBLED IN xxxx</td>
<td></td>
</tr>
<tr>
<td>XXXXXXXXXXXXXXXXX (Customer part number or FJ part number)</td>
<td></td>
</tr>
<tr>
<td>XXXXX-XXX XX (Lot Number and quantity)</td>
<td></td>
</tr>
<tr>
<td>XXXXXXXXXXXXX (FJ control number)</td>
<td></td>
</tr>
<tr>
<td>XXXXXXXXXXXX (Comment)</td>
<td></td>
</tr>
</tbody>
</table>

Label II: Moisture Barrier Bag (It sticks it on the Aluminum laminated bag)
[MSL Label (100mm × 70mm)]

<table>
<thead>
<tr>
<th>Label II: Moisture Barrier Bag (It sticks it on the Aluminum laminated bag)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caution</td>
</tr>
<tr>
<td>This bag contains MOISTURE-SENSITIVE DEVICES</td>
</tr>
<tr>
<td><strong>LEVEL 3</strong></td>
</tr>
<tr>
<td>1. Calculated shelf life in sealed bag: 24 months at &lt;40°C and &lt;90% relative humidity (RH)</td>
</tr>
<tr>
<td>2. Peak package body temperature: 260°C</td>
</tr>
<tr>
<td>3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must be</td>
</tr>
<tr>
<td>a) Mounted within: 168 hours of factory conditions</td>
</tr>
<tr>
<td>&lt;30°C/60% RH, or</td>
</tr>
<tr>
<td>b) Stored per J-STD-033</td>
</tr>
<tr>
<td>4. Devices require bake, before mounting, if:</td>
</tr>
<tr>
<td>a) Humidity Indicator Card reads &gt;10% for level 2a ~ 5a</td>
</tr>
<tr>
<td>devices or &gt;60% for level 2 devices when read at 23 ± 5°C</td>
</tr>
<tr>
<td>b) 3a or 3b are not met</td>
</tr>
<tr>
<td>5. If baking is required, refer to IPC/JEDEC J-STD-033 for bake procedure</td>
</tr>
<tr>
<td>Bag Seal Date: see adjacent bar code label.</td>
</tr>
<tr>
<td>Note: Level and body temperature defined by IPC/JEDEC J-STD-020</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>MSL label</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.5 Dimensions for Containers

(1) Dimensions for inner box

<table>
<thead>
<tr>
<th>Tape width</th>
<th>L</th>
<th>W</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>265</td>
<td>262</td>
<td>51</td>
</tr>
</tbody>
</table>

(Dimensions in mm)

(2) Dimensions for outer box

<table>
<thead>
<tr>
<th>L</th>
<th>W</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>549</td>
<td>277</td>
<td>180</td>
</tr>
</tbody>
</table>

(Dimensions in mm)
### MAJOR CHANGES IN THIS EDITION

A change on a page is indicated by a vertical line drawn left side of that page.

<table>
<thead>
<tr>
<th>Page</th>
<th>Section</th>
<th>Change Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>PACKIN INFORMATION</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.4 Product Label indicators</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Label II</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>MSL Label is revised.</td>
</tr>
</tbody>
</table>
Mouser Electronics

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MB85RS256TPNF-GS-BCERE1